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## **TECHNICAL SPECIFICATION AND REQUIREMENTS**

### **PSR/Mode-S Radar System, No 285-57**

Prepared by CNS/ATM Systems division

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## 1 Introduction

### 1.1 In General

Slovenian Air Navigations Service Slovenia Control Ltd. (hereinafter referred to as the 'Contracting Authority') intends to replace the existing 33-year-old combined PSR/MSSR radar with a new and modern PSR/Mode-S radar. Existing radar is PSR Watchman and MSSR (CMSSR-401 Cardion).

The call for tender includes the supply of a **collocated PSR/Mode-S radar**, a **30 m radar tower** for the installation of radar antennas and **Radome** for protecting the radar antennas. A new PSR/Mode-S radar will be installed at the Mount Nanos location.

### 1.2 Current Surveillance Infrastructure

The Contracting Authority. surveillance infrastructure includes primary (PSR) and secondary (SSR) radars, a Wide area multilateration system (WAM/ADS-B), a surveillance data distribution system (SDDS), surveillance data processing systems – trackers (ARTAS), and tools for data quality monitoring and radar performance verification.

#### 1.2.1 Primary radars (PSR) are installed at sites as follow:

- PSR STAR-2000 (THALES) at Ljubljana Airport;
- PSR Watchman at Oljska gora site.

Both primary radars operate in the S-band frequency range (2.7 to 3.05 GHz).

#### 1.2.2 Secondary radars (SSR) are installed at sites as follow:

- Mode S secondary radars (MSSR) type RSM970S (THALES) is installed at Ljubljana Airport. (Collocated with PSR STAR-2000;
- Indra IRS 20 MP/S is located at Ljubljanski vrh;
- MSSR Cardion CMSSR 401 is located at Oljska gora site. (collocated with PSR Watchman).

#### 1.2.3 Multilateration systems

- (WAM/ADS-B) type MAGS (THALES) are installed at several sites in Slovenia covering FIR Ljubljana + 40NM.

Surveillance infrastructure of Contracting Authority. is completed by resources of SUR data from neighboring countries:

- SSR Mode S – Koralpe (ACG Austria)
- PSR/SSR Mode S – Ronchi (ENAV Italy)

### 1.3 Surveillance Strategy of Contracting Authority for the period 2026 to 2040

The new PSR located at Nanos and existing PSR at Ljubljana Airport will create a duplicated continuous primary coverage within the Ljubljana FIR from at least 8000ft AMSL to 42000ft MSL for aircraft with RCS 2m<sup>2</sup> or greater.

This primary surveillance coverage will be classified as "substitute coverage" to mitigate target losses depending on cooperative surveillance sources /technology.

The new Mode-S radar at the Nanos site, together with the existing Mode-S radars at Ljubljanski vrh and Ljubljana Airport, will create continuous secondary surveillance coverage for cooperative targets. This coverage will be complemented by WAM and ADS-B systems to enhance system redundancy.



#### 1.4 Location introduction Mount Nanos

Contracting Authority has acquired site Mount Nanos for installation of the new PSR/Mode S radar.

Radar at Mount Nanos (hereinafter referred to as 'Nanos') – geographical coordinates: 45°46'18" N, 14°03'10" E; elevation: 1,260 m AMSL. The proposed radar tower at this location shall have a height of 30 metres. Currently, no radar equipment is installed at this site. At the Nanos location there is also a TV tower, on which the antennas of various transmitters are installed.

##### 1.4.1 Transmitted frequencies at Mount Nanos TV Tower

The following broadcasting frequencies are in use at the TV tower on Nanos:

Type of Transmitter	Frequency
DAB R1	10D – 215.072 MHz
DVB-T	27 – 522 MHz
DAB R2	12C – 227.360 MHz
FM - Radio ARS	105.7 MHz
FM - Radio VAL 202	95.3 MHz
FM - Radio KP	88.6 MHz
FM - RADIO CAPODISTRIA	103.1 MHz
FM - PROGRAM PRVI	92.9 MHz
Fixed MW Link	14.683 MHz
Fixed MW Link	14.711 MHz
Fixed MW Link	8.147,97 MHz
Fixed MW Link	8.207,27 MHz
Fixed MW Link	8.088,67 MHz
Fixed MW Link	8.147,97 MHz
Fixed MW Link	8.207,27 MHz
Fixed MW Link	8.266,57 MHz
Fixed MW Link	6.019,325 MHz
Fixed MW Link	25.375 MHz
Fixed MW Link	18.030 MHz
Fixed MW Link	4.037,5 MHz
Fixed MW Link	4.066,5 MHz
Fixed MW Link	23.548 MHz
Fixed MW Link	5.945,2 MHz
WAM (Tx & Rx)	1.030 MHz
WAM (Tx & Rx)	1.090 MHz
Fixed MW Link	17.947,5 MHz
Fixed MW Link	13.115 MHz
Fixed MW Link	13.115 MHz
Fixed MW Link	4.124,5 MHz
Fixed MW Link	4.182,5 MHz
Fixed MW Link	8.088,67 MHz
Fixed MW Link	8.266,57 MHz
Fixed MW Link	13.024 MHz
Fixed MW Link	7.198 MHz
Fixed MW Link	7.142 MHz
Fixed MW Link	7.442 MHz
Fixed MW Link	7.470 MHz
Fixed MW Link	7.254 MHz
Fixed MW Link	13.101 MHz
Fixed MW Link	8.088,67 MHz
Fixed MW Link	8.266,57 MHz
Fixed MW Link	7.254 MHz

Fixed MW Link	7.226 MHz
Fixed MW Link	7.226 MHz
Fixed MW Link	7.254 MHz
Fixed MW Link	7.226 MHz
Fixed MW Link	7.254 MHz
Fixed MW Link	18.525 MHz
Fixed MW Link	18.580 MHz
Fixed MW Link	11.631 MHz
Fixed MW Link	13.213 MHz
Fixed MW Link	23.534 MHz
Fixed MW Link	13.157 MHz
Mobile Connection	469,9125 MHz
Mobile Connection	462,0875 MHz
Mobile Connection	154,98125 MHz
Mobile Connection	154,88125 MHz
Mobile Connection	150,38125 MHz
Mobile Connection	150,38125 MHz
Mobile Connection	459,9125 MHz
Mobile Connection	457,375 MHz
Mobile Connection	458,4125 MHz
Mobile Connection	458,5125 MHz
Mobile Connection	452,0875 MHz
Mobile Connection	467,375 MHz
Mobile Connection	468,4125 MHz
Mobile Connection	468,5125 MHz

WAM transmitter (1030/1090 MHz) are used by Contracting Authority as part of WAM system. Antennas are currently on the TV tower, and it is planned during the new radar installation to place them on the new radar tower below the level of the radar antennas.

## **1.4.2 Nanos Installation Environment**

### **1.4.2.1 Radar electronics**

Indoor installation in building. Electronic parts of the radar will be installed inside the building, where we have necessary electricity connections and controlled climate environment. The space for electronic radar equipment is on the first floor of the building. For the installation of larger and heavier parts, there is a 2x2 meter vertical shaft through which it is possible to lift the electronic radar equipment to the first floor.

### **1.4.2.2 Radar Tower Location**

The location of the new radar tower is situated to the west of the building where the radar electronic equipment will be installed.

The new radar tower will be approximately 80 meters away from the new TV tower. The planned tower configuration is shown in Figures 1 and 2.

#### 1.4.2.2.1 Radar and new TV Tower Location

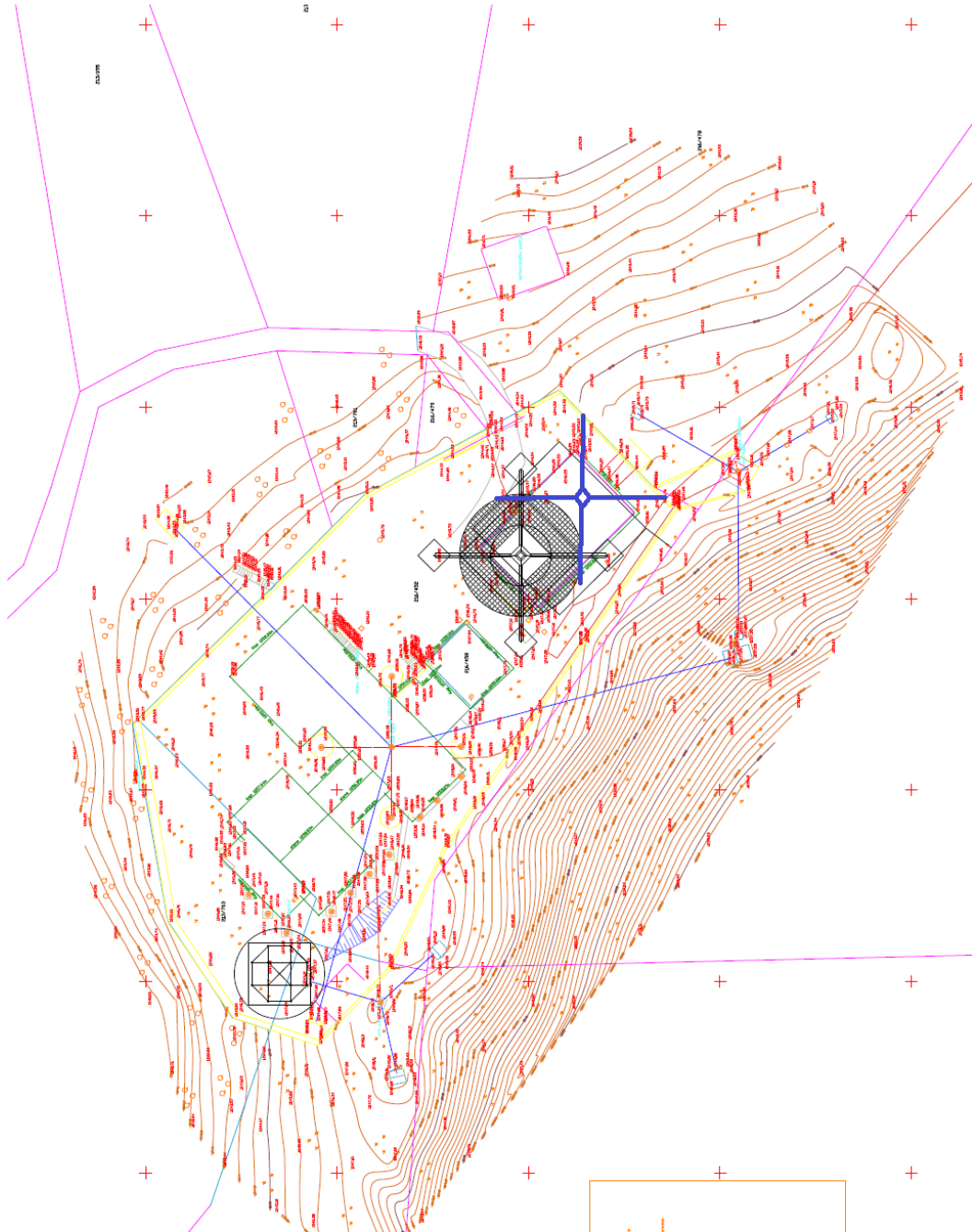


Figure 1: Radar and New TV tower location

#### 1.4.2.2.2 Foundation for Radar tower

The construction of the foundation for the radar tower is not part of the Tender and is entirely the responsibility of the Contracting Authority. The Contracting Authority will construct the foundation in accordance with the plans prepared by the selected Contractor for radar delivery and within mutually agreed timeframes. The Selected Contractor will prepare all the plans for the construction of the radar tower foundations.

1.4.2.3 Access Road

The Nanos radar site is 12 km from the main road. A steep road leads to the site, which is partly asphalted and partly gravel. Entry permit is required, and the vehicle must be accompanied by Slovenia Control staff. The road is passable by a small truck. Contracting Authority can organize a site visit and access inspection upon prior arrangement with the bidders.

1.4.2.4 Transport of the Equipment

The equipment can be transported from the factory to the village below the hill, then reloaded in parts to a smaller truck and driven to the top of the hill to the radar building. It is necessary to consider that large truck cannot be driven up to the top of the hill, as there is limited space for long vehicles to turn. The drivers must make the route inspection in advance before driving.

1.4.2.5 Material Storage

Material stored in boxes up to a size of approximately 100x100x100 cm can be stored in the radar building. The larger equipment will remain in front of the building with a temporary cover to protect it from the rain.

1.4.2.6 Watch Service

For the duration of the mechanical assembly of the equipment, the hired guard duty at site in the vicinity of the radar will be authorized to watch all assembly material.

1.4.2.7 Supporting Machines for Installation

It is assumed that the mechanical installation will take place entirely under the direction and responsibility of the Contractor. The Contracting Authority does not provide any heavy machinery or lifting devices needed for the installation of the radar system. Contracting Authority. ATSEP can be present and can help, but without personal responsibility for the method of the assembly are carried out.

For operations requiring a larger number of people, such as the installation of cables and waveguides, Contracting Authority. can arrange for unqualified part-timers. In that case, the responsibility for management and the quality of the work performed is fully the responsibility of the selected Contractor.

1.4.2.8 Mount Nanos Weather Conditions

1.4.2.8.1 Average Temperature at Nanos by month

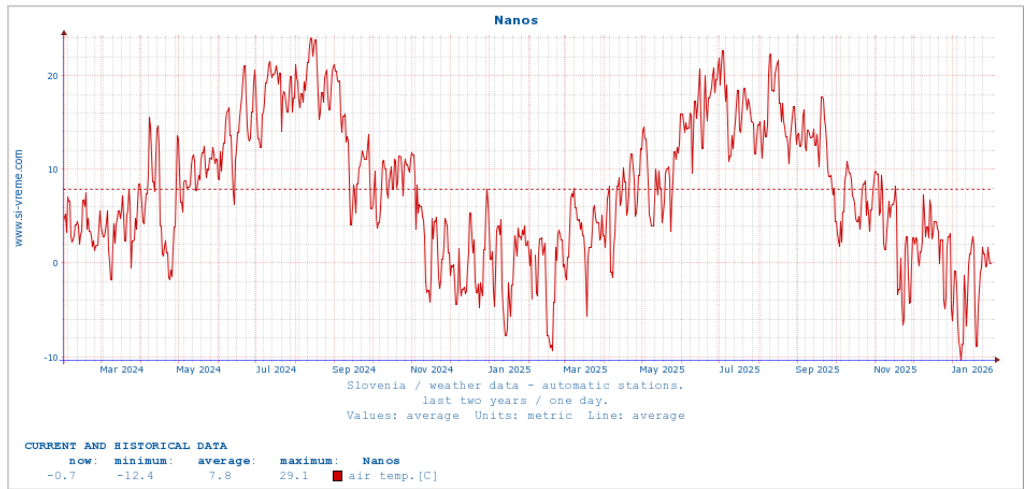


Figure 2: Average Temperature at Nanos

1.4.2.8.2 Average Wind Speed at Nanos by month

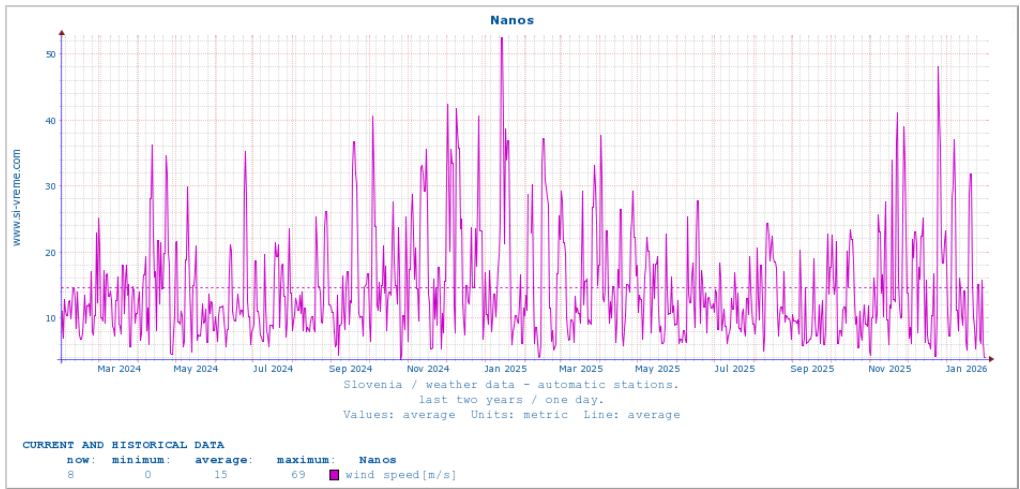


Figure 3: Average Wind Speed at Nanos

1.4.2.8.3 Average Wind Gusts Speed at Nanos by month

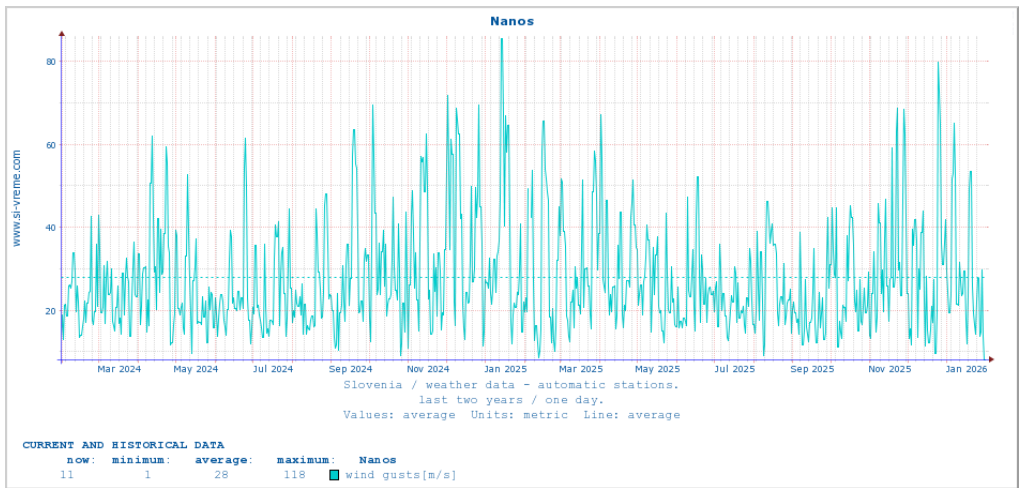


Figure 4: Average Wind Gusts Speed at Nanos

1.4.2.8.4 Maximum Wind Gusts at Nanos by month

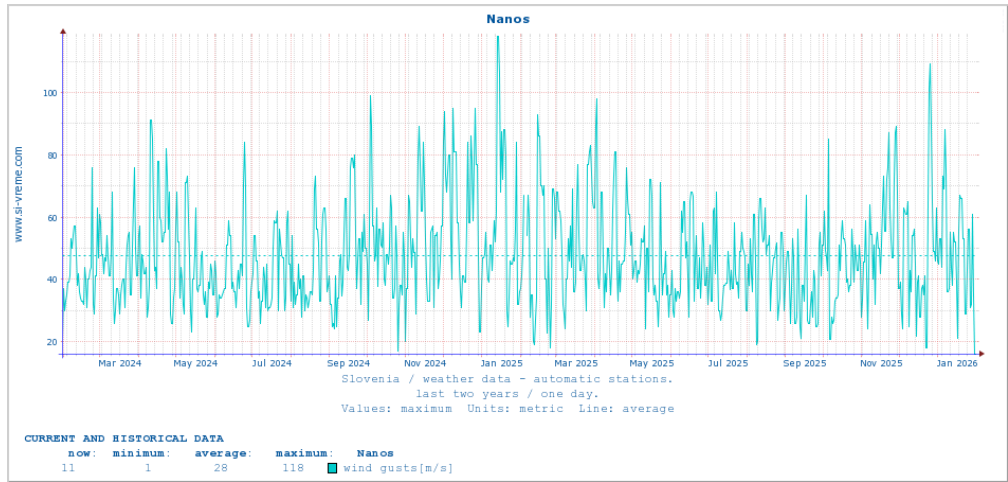


Figure 5: Maximum Wind Gusts at Nanos

### **1.5 Technical Operating Staff and Maintenance**

The experience of Contracting Authority. ATSEP staff is based on the operation of several radar types. The engineers and technicians who will operate the new radars and will also be present during the installation are specialists in the field of surveillance systems. All of them are ATSEP qualified in accordance with Regulation (EU) 2017/373, i.e. have successfully passed the following training cycles:

- Basic Training,
- Qualification Training,
- System/Equipment Rating Training and regularly maintain their competence in continuing training.
- Technical maintenance and operation of radars is organized centrally at Slovenia Control ATCC premises in Surveillance Division (SUR)
- Technical Supervision (24/7) of operating equipment is organized centrally at Slovenia Control ATCC premises in Central Monitoring System (CMS)

The Air Traffic Control Center and at the same time the headquarters of Slovenia Control is located at the Airport Jože Pučnik Ljubljana. The Air Traffic Control Center and the technical support and supervision workplace are located in the ATCC building.

### **1.6 Radar Performance Verification**

The performance of each element of the surveillance infrastructure is verified after installation, after each repair, and periodic revisions. In the time between revisions, the basic parameters are verified daily using the SASS-C tool.

#### **1.6.1 Surveillance Data Chain**

The PSR and SSR output data from Nanos shall be in ASTERIX format connected via SDDS (Surveillance Data Distribution System) to SDPS (Surveillance Data Processing System), ARTAS (ATM surveillance Tracker and Server)

#### **1.6.2 Communication Infrastructure**

The PSR and SSR data will be transferred from the site Nanos to ATCC via third party infrastructure using MPLS terrestrial data network.

#### **1.6.3 CMS (cTNC)**

The Central Monitoring System (CMS – cTNC) is the main tool of technical supervision, which records and presents the current technical status of all ATM systems, including radars, navigation and radio communication devices, through the SNMP protocol. The technical status is long-term archived. The CMS is located in the technical room at ATCC.

### **1.7 Purpose of this Document**

The purpose of this document is to present the Technical Specifications and Requirements for PSR/Mode-S Radar System which is subject of this call for tender.

### **1.8 Technical Specification Content**

Technical Specification for PSR/Mode-S radar System are in Chapter 2 and divided into subchapters:

- **Subchapter A** – Mode-S Specification (Part A)
- **Subchapter B** – Mode-S Specification (Part B)
- **Subchapter C** – PSR Specification
- **Subchapter D** – System Elements Specification
- **Subchapter E** – System Specification (Part A)
- **Subchapter F** – System Specification (Part B)



#### **Subchapters A and B - Mode-S Specification (Part A & Part B)**

- This subchapter specifies the requirements for the Secondary Mode-S radar. The division into groups of requirements, Part A and Part B, is only for the reason of the large number of items.
- All requirements are taken without modification from the document "EUROCONTROL Specification for European Mode S Station (EMS)", Edition: 4.0, Edition date: 17/09/2021, Reference Nr: EUROCONTROL-SPEC-189.
- All annexes, list of abbreviations and other references cited in EMS version 4.0 apply to the specifications.
- Requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted in color.

#### **Subchapter C – PSR Specification**

- This subchapter specifies the requirements for the PSR radar.

#### **Subchapter D – System Elements**

- This subchapter specifies System Elements requirements for collocated PSR/Mode-S Radar System.
- Requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted in color.

#### **Subchapter E and F - System Specification (Part A & Part B)**

- This subchapter specifies Common System Specification requirements for collocated PSR/Mode-S Radar System. The division into groups of requirements, Part A and Part B, is only for the reason of the large number of items.
- Requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted in color.

#### **1.8.1 Reference Material**

[RD 1]	EUROCONTROL Specification for European Mode S Station (EMS) Edition 4.0 Reference nr: EUROCONTROL-SPEC-189
[RD 2]	ETSI EN 303 363-1 (V1.1.1) (2022-02) Air Traffic Control Surveillance Radar Sensors; Secondary Surveillance Radar (SSR); Harmonized Standard for access to radio spectrum; Part 1: SSR Interrogator.
[RD 3]	Detailed Specifications and Acceptable Means of Compliance & Guidance Material for certification or declaration of design compliance of ATM/ANS ground equipment (DS-GE.CER/DEC)

#### **1.8.2 Terms Used in the Technical Specification**

##### **The Tenderer**

The Tenderer means the company submitting the Tender. The Tenderer will process the offer in the form of answers to each requirement listed in the technical specifications.

##### **The Contractor**

The Contractor means the successful Tenderer to whom the contract arising from the Tender has been awarded. Where the technical specification requires some documents or additional information to be handed over, a date will be set for the progress meeting

##### **The Contracting Authority**

The Contracting authority is responsible for procurement. In this case, it is Slovenian Air Navigations Service Contracting Authority.

##### **The Radar or Radar System**

The term "Radar" means primary (PSR) or secondary radar (SSR). The term "Radar System" means collocated PSR and SSR with mechanically coupled antennas.

### 1.8.3 Specification Language

Throughout this document, the use of the word '**Shall**' indicates a mandated criterion, i.e. compliance with the procedure or specification is mandatory and no alternative can be applied.

The use of the word '**Should**' indicates that though the procedure or criterion is regarded as the preferred option, alternative procedures, specifications or criteria can be applied, provided that the manufacturer, installer or tester can provide information or data to adequately support and justify the alternative.

The use of the word '**May**' indicates an optional requirement and the use of '**Will**' a statement of intent.

#### NOTE 1:

Only tenders that fail to meet the technical specification requirements marked as '**Shall**' will be excluded from the public procurement procedure. Failure to comply with requirements marked as '**Should**', '**May**', or '**Will**' will not result in exclusion.

#### NOTE 2:

If a radar system functionality is requested as **MAY**, and the Tenderer does not offer it and marks the requirement of this functionality as **NC (Not Compliant)** and any further requirements for that radar system functionality is marked as **NC (Not Compliant)**, this is not a reason for exclusion.

The leftmost column of the specification contains the requirement identification number. Two patterns of identification are used:

- The first pattern is taken without change from the document "EUROCONTROL Specification for European Mode S Station (EMS)"
  - o Example: **EMS-C04-SYS-SHO-00000**, where:
    - "EMS" is reference to EUROCONTROL document
    - "C04" is number of a chapter in the EMS,
    - "SYS" is the chapter name (Functional Requirements)
    - "SHA" – shall, or "SHO" – "should" or "MAY"- may
    - "00000" is a serial number within the respective chapter
- The second pattern is marked as Contracting Authority. requirements
  - o Example: **ANSP-xxx-xxx-xxxxx**, where:
    - "ANSP" is an indication of originator
    - "xxx" is the Requirements
    - "SHA" – shall, or "SHO" – should or "MAY" - may
    - "0000" is a serial number within the respective Annex



### 1.9 Compliance Matrix Fill Instruction

The Tenderer compliance status shall be indicated against each requirement of this specification in the 'Compliance' column with:

- (a) For **'SHA'** mandatory requirements (i.e. formulated with a **"shall"**):
  - a. A **'C'** for Compliance. This response indicates that the requirement is fully met in all respects, exactly as stated in this specification.
  - b. A **'NC'** for Not Compliant.
  - c. A **'NO'** for requirements related to options Not Offered.
- (b) For **'SHO'** preferable requirements (i.e. formulated with a **"should"**):
  - a. A **'C'** for Compliance. This response indicates that the requirement is fully met in all respects, exactly as stated in this specification.
  - b. An **'AC'** for Alternative Compliance. This response indicates that the Tenderer, despite the preferred option, presents an alternative that can be supported and justified as an equal or better substitute. The alternative shall be detailed in the tender response.
  - c. A **'NC'** for Not Compliant.
- (c) For **'MAY'** optional requirements (i.e. formulated with a **"may"**):
  - a. A **'C'** for Compliance. This response indicates that the option is offered, it will meet the requirements in all respects, exactly as stated in the specification, and is itemized and priced separately in the commercial response.
  - b. An **'AC'** for Alternative Compliance. This response indicates that the Tenderer, despite the preferred option, presents an alternative that can be supported and justified as an equal or better substitute. The response shall be separately in the commercial response.
  - c. A **'C ST'** for Compliance when an option is offered as a Standard without additional cost and is fully compliant with the requirement as specified. The response shall be itemized as a zero-cost option in the commercial response.
  - d. A **'NC'** for Not Compliant.

When a **'C'** response is present for a requirement for the Tenderer, this indicates that the required information is supplied complete as requested in the specification and the information shall become contractual after the signature of the contract.

No other responses will be recognized during the evaluation and absence of **'C'**, **'C ST'**, **'AC'**, **'NO'** or **'NC'** will be counted as non-compliant, as well as statements such as 'Read and understood'.

	C	NC	NO	For 'SHA' mandatory requirements
	C	AC	NC	For 'SHO' preferable requirements
C ST	C	AC	NC	For 'MAY' optional requirements

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted in color.

The Contracting Authority, together with the Contractor, must submit the evidence from these requirements to the Slovenia Civil Aviation Authority (CAA) as proof that the radar system meets the requirements for certification under EASA regulations and for obtaining a permit to use operational radar system for air traffic management and control.

Req. Ident. Code	Compliance	Proposal Ref.
<b>EMS/ANSP-xxx-xxx-xxxx</b>	Expected answer "C", "NC", "NO" or "C ST". Additional information as required under this item.	Statement, description or Reference to Tenderer response documentation.
<b>EMS/ANSP-xxx-SYS-SHA-xxxxx</b>	<b>Requirement identified in DS-GE.CER/DEC</b> Expected answer "C", "NC" or "NO".	<p>The Tenderer as potential Contractor must prove with evidences that the proposed radar system complies with these requirements.</p> <p>These requirements are required by EASA in the document "<b>Detailed Specifications and Acceptable Means of Compliance &amp; Guidance Material for certification or declaration of design compliance of ATM/ANS ground equipment (DS-GE.CER/DEC)</b>" Issue 1 26 October 2023"</p> <p>Evidences that radar system meets these requirements from EMS 4.0 for the certification shall be submitted to the Slovenian Civil Aviation Authority (CAA) to obtain a permit for the operational use of the installed radar system.</p>

**NOTE 3:**

**All requirements from the Compliance Matrix in Field "Proposal Ref." must be fulfilled with evidence or statements provided by the Tenderer. Empty fields "Proposal Ref." in Tenderer response will be considered as NC (Not Compliant).**

<b>EMS-C01-TEN-SHA-00020</b>	<p>The information and the data provided in the proposal descriptions and specifications pertinent to each of the paragraphs of this specification shall be cross referenced via the Proposal Ref. column in the Compliance summary.</p> <p><i>RATIONALE: It can be noted that compliance information not included, or included but in error, in the compliance status summary will be counted as a Non-Compliant statement.</i></p>
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## 2 Subchapter A – Mode-S Specification (Part A)

The Compliance Matrix for Mode S Specification (Part A) is based on Eurocontrol EMS 4.0 and is an integral part of the tender and is in Annex no.1, **Compliance Matrix tab A – Mode S (Part A)**

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted the in color.

### 2.1 Scope of the document

<b>EMS-C01-CON-SHA-000100</b>	The Contractor shall develop, supply, install and commission a working system that is complete in every respect, provides specified outputs and meets the performance requirements to the full specification detailed in this document and referenced documents.
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#### Tenderer response

<b>EMS-C01-TEN-SHA-00020</b>	<p>The information and the data provided in the proposal descriptions and specifications pertinent to each of the paragraphs of this specification shall be cross referenced via the Proposal Ref. column in the Compliance summary.</p> <p><b>RATIONALE:</b> It can be noted that compliance information not included, or included but in error, in the compliance status summary will be counted as a Non-Compliant statement.</p>
<b>EMS-C01-TEN-SHA-00030</b>	All reference to cost implications and specific cost details shall not appear in the Technical response.
<b>EMS-C01-TEN-SHA-00040</b>	All reference to cost implications and specific cost details shall be confined to the Commercial response, i.e. a separate document.
<b>EMS-C01-TEN-SHA-00050</b>	The operational and technical facilities defined by this Specification shall be regarded as essential. Within the defined limits of the specification the Contractor has the freedom of design on the condition that the System meets the requirements.
<b>EMS-C01-TEN-SHA-00060</b>	In the event of conflict between any of the requirements expressed for the Mode S ground station in any reference documents, the requirements expressed in ICAO ANNEX 10 ([RD 1]) and STANAG 4193 ([RD 2]) shall take priority, followed by the requirement in this Specification.

<b>EMS-C01-TEN-SHA-00070</b>	In the event of conflict between any of the requirements expressed in ICAO ANNEX 10 ([RD 1]) and STANAG 4193 ([RD 2]), the first one shall take priority.
<b>EMS-C01-TEN-SHA-00080</b>	Where conflict occurs between this specification and any other specification or document, the Contracting Authority shall be notified.
<b>EMS-C01-TEN-SHA-00090</b>	As part of their Tender response, the Tenderer shall advise the Agency of any amendments to any of the interface specification material included in this document which is either considered desirable or necessary.
<b>EMS-C01-TEN-SHA-00100</b>	The Contractor shall develop, supply, install and commission a working system that is complete in every respect, provides specified outputs and meets the performance requirements to the full specification detailed in this document and referenced documents.
<b>EMS-C01-TEN-SHA-00110</b>	The Tenderer shall provide all proposal material in electronic format.

## 2.2 General

<b>EMS-C02-SYS-SHA-00120</b>	The performance requirements specified in this chapter are the minimum operational performance requirements. They <b>shall</b> be met with all site-dependant and operational parameters set following commissioning including antenna tilt, sensitivity time control, MIP and any other variable thresholds.
<b>EMS-C02-CON-SHA-00130</b>	The Contractor <b>shall</b> fund all costs associated with the provision and use of whichever test tool is selected for the verification of the performance requirements.
<b>EMS-C02-SYS-SHA-00140</b>	The performance requirements specified in the following paragraphs are expected to be achieved globally and for each target trajectory. In case of behaviours out of specifications, an investigation <b>shall</b> be open to find the cause and define, if needed, any necessary corrective action before the acceptance of the System.
<b>EMS-C02-CON-SHA-00150</b>	The procedure and scope for the investigation of targets out of performance <b>shall</b> be agreed between the Contracting Authority and the Contractor.
<b>EMS-C02-TEN-SHA-00160</b>	Full coverage analysis and performance details compliant with this specification <b>shall</b> be supplied with the proposal.

<b>EMS-C02-SYS-SHA-00170</b>	In addition to the general operating model of ANNEX A and ANNEX B, [RD 1] the performance requirements <b>shall</b> be met for the specific operational configurations of the sites to be commissioned.
<b>ANSP-MSSR-SHA-00010</b>	<p>The Tenderer <b>shall</b> provide in its Bid the result of SASS-C tool-based performance measurements done on some previously installed SSR of an identical or similar configuration.</p> <p>The measurement results <b>shall</b> come with the following information:</p> <ul style="list-style-type: none"> <li>a) The location and time of measurement;</li> <li>b) Recording time (the number of samples);</li> <li>c) Configuration and parameters of the measured radar;</li> <li>d) Set of SASS-C parameters;</li> <li>e) SASS-C software version;</li> <li>f) Measurement results <ul style="list-style-type: none"> <li>a. probability of detection of SSR</li> <li>b. accuracy in range and azimuth</li> <li>c. false target rate</li> </ul> </li> </ul>
<b>ANSP-MSSR-SHA-00020</b>	Mode C <b>shall not</b> be extrapolated for the ATC data output.

### 2.3 Scope

<b>EMS-C02-SYS-SHA-00180</b>	The Mode S ground station <b>shall</b> process transponders compliant with ICAO ANNEX 10, Amendments 69 to 91, and with the transponder, MOPS specified in ED-73F ([RD 11]) and previous versions.
<b>EMS-C02-SYS-SHA-00190</b>	The Mode S ground station <b>shall</b> process transponder registers compliant with the corresponding section of ICAO document 9871 ([RD 4]).
<b>EMS-C02-TEN-SHA-00200</b>	The Tenderer <b>shall</b> clearly describe how he intends to fulfil the previous requirement, and more specifically the determination of transponder's communication capability (e.g. CA field in DF = 11 and BDS 1016).

<b>EMS-C02-TEN-SHA-00210</b>	The Tenderer <b>shall</b> in particular indicate the effects of transponders being compliant with different versions of ICAO standards and transponder MOPS on the acquisition processing, GICB Internal Application, DLF, the use of the continuation subfield/flag, on RAs, and on ASTERIX reporting.
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## 2.4 Coverage

<b>EMS-C02-SYS-SHA-00220</b>	The Mode S Radar <b>shall</b> be capable of providing continuous, gap-free cover through 360° of azimuth and over a range of 0.5 NM to at least 256 NM, with an upper limit of at least 66 000 ft and a cone of silence not extending an elevation angle of 45° above the horizontal
<b>EMS-C02-TEN-SHA-00230</b>	The Tenderer <b>shall</b> state the lower limit of coverage in elevation and under what conditions this lower limit is achieved.
<b>EMS-C02-TEN-SHA-00240</b>	The Tenderer <b>shall</b> provide horizontal and vertical polar diagrams for the ICAO defined transponder frequency bands to achieve the accuracy and detection performance described in this chapter.
<b>EMS-C02-TEN-SHA-00250</b>	The Tenderer <b>shall</b> state in their proposals any non-compliance with the performance requirements due to radiation nulls above the horizontal.
<b>EMS-C02-CON-SHA-00260</b>	The Mode S equipment provided by the Contractor <b>shall</b> meet the requirements detailed in the polar diagrams as agreed by the Contracting Authority and the Contractor prior to the award of the Contract.
<b>EMS-C02-CON-SHA-00270</b>	The Mode S Conformity Assessment Volume (Mode S CAV) definition <b>shall</b> be agreed between the Contracting Authority and the Contractor
<b>EMS-C02-SYS-SHA-00280</b>	The radar performance analysis <b>shall</b> be performed considering targets detected inside the Mode S CAV.
<b>EMS-C02-CON-SHA-00290</b>	During the commissioning phase, the Contractor <b>shall</b> analyse the radar performance in the Mode S CAV with Opportunity traffic and/or Flight trials.
<b>EMS-C02-SYS-SHA-00300</b>	The on-site ADS-B <b>shall</b> be capable of providing ADS-B information in at least the full Surveillance Volume.
<b>EMS-C02-CON-SHA-00310</b>	The ADS-B Conformity Assessment Volume (ADS-B CAV) and the ADS-B Update Interval <b>shall</b> be agreed between the Contracting Authority and the Contractor.

<b>EMS-C02-SYS-SHA-00320</b>	The ADS-B performance analysis <b>shall</b> be done considering targets detected inside the ADS-B CAV.
<b>EMS-C02-CON-SHA-00330</b>	During the commissioning phase, the Contractor <b>shall</b> analyse the ADS-B performance in the ADS-B CAV with Opportunity traffic and/or Flight trials.

## 2.5 Data Collection

<b>EMS-C02-SYS-SHO-00340</b>	In order to provide an adequate sample size for global performance verification, the data collected <b>should</b> include at least 50 000 reports, i.e., the target reports belongs to several target trajectories.
<b>EMS-C02-SYS-SHO-00350</b>	In order to provide an adequate sample size for individual trajectories performance verification, the data collected <b>should</b> include at least 100 scans, i.e. per target trajectory.
<b>EMS-C02-SYS-SHO-00360</b>	In order to provide an adequate diversity in the traffic conditions, data for performance verification <b>should</b> be collected at different times, e.g. day and night, peak and valley hours, etc.
<b>EMS-C02-TEN-SHA-00370</b>	To avoid wrong conclusions from non-meaningful samplings, the Tenderer <b>shall</b> provide information on the proposed methodology to analyse the SSR performance (i.e. of targets Mode A/C-only capable) when a low amount of reports is present. This information includes all assumptions and considerations (e.g. discard results below certain number of SSR-only reports, individual analysis, filtering options, etc.).
<b>EMS-C02-SYS-SHA-00380</b>	The data collected ("recordings") for the System performance analysis <b>shall</b> contain multisensor data, including at least the Mode S and the ADS-B data from the Surveillance Data output of the System.

## 2.6 Mode S Performance

<b>EMS-C02-TEN-SHA-00390</b>	The Tenderer <b>shall</b> provide evidence that their proposed system can fully meet the Mode S performance requirements and state under what conditions (e.g. site, garbling, FRUIT rate, etc.).
<b>EMS-C02-CON-SHA-00400</b>	The Mode S performance requirements shall be verified at FAT and SAT.

### 2.6.1 Position Detection

<b>EMS-C02-SYS-SHA-00410</b>	The Probability of Detection (Pd) <b>shall</b> be determined globally and for each target trajectory.
<b>EMS-C02-TEN-SHA-00420</b>	<p>The Tenderer <b>shall</b> provide detection analysis, including uplink and downlink power budgets for 80, 150, 200 and 256 NM ranges, for the conditions of ANNEX A and for each of the following reply frequencies: For SSR transponders:</p> <ul style="list-style-type: none"> <li>a) 1 090 MHz;</li> <li>b) 1 087 MHz;</li> <li>c) 1 093 MHz</li> </ul> <p>For Mode S transponders:</p> <ul style="list-style-type: none"> <li>a) 1 090 MHz;</li> <li>b) 1 089 MHz;</li> <li>c) 1 091 MHz</li> </ul>
<b>EMS-C02-TEN-SHA-00430</b>	The Tenderer <b>shall</b> state, for each performance justification, the values for All-Call and Selective period durations and SSR/Mode S All-Call IRF using the values for antenna rotation speed given in the ANNEX A.
<b>EMS-C02-SYS-SHA-00440</b>	The System <b>shall</b> support a mean FRUIT rate as described in ANNEX A.3.1. [RD 1]
<b>EMS-C02-TEN-SHA-00450</b>	The Tenderer <b>shall</b> detail in their proposal the effect on the Pd of an increase within the 3dB beamwidth of the FRUIT rate (peak) to double of the mean values described in ANNEX A.3.1.
<b>EMS-C02-TEN-SHA-00460</b>	The Tenderer <b>shall</b> state the achievable plot detection figures for each transmitted and received Mode for the conditions stated in the previous requirement.
<b>EMS-C02-TEN-SHA-00470</b>	The Tenderer <b>shall</b> provide a downlink power budget for transponders having a power output of 18.5 dBW, stating the maximum detectable range at 15 000 ft.
<b>EMS-C02-TEN-SHA-00480</b>	The Tenderer <b>shall</b> state any deviation from the detection performance for transponders having power outputs of 18.5 dBW.



### 2.6.1.1 SSR Detection

EMS-C02-TEN-SHA-00490	<p>The Tenderer <b>shall</b> include in their proposal details of the minimum number of replies required at the receivers' inputs to detect a target and output a report when interrogating on the following:</p> <ul style="list-style-type: none"> <li>a) Mode A;</li> <li>b) Mode C;</li> <li>c) Modes A/C interlace;</li> <li>d) Mode A only all-call (intermode);</li> <li>e) Mode C only all-call (intermode);</li> <li>f) Mode A/C only all-call (intermode) interlace.</li> </ul>
EMS-C02-TEN-SHA-00500	<p>The Tenderer <b>shall</b> provide in their proposal an analysis of how the System will achieve a theoretical SSR Pd better than 99% for targets which are not in close proximity (slant range &gt; 2 NM, azimuth &gt; 2 times the nominal 3 dB interrogation beamwidth), with the following hypotheses:</p> <ul style="list-style-type: none"> <li>a) 4 interrogations within the 3 dB beam (2 mode A and 2 mode C);</li> <li>b) A transponder probability of reply equal to 90%;</li> <li>c) A target and mean FRUIT rate as defined in ANNEX A; [RD 1]</li> <li>d) Mode A/C transponder</li> </ul>
EMS-C02-TEN-SHA-00510	<p>The Tenderer <b>shall</b> detail in the theoretical SSR Pd analysis how this Pd will be verified in FAT.</p>
EMS-C02-SYS-SHA-00520	<p>For SAT (on site) with opportunity traffic and with all the parameters used for the commissioning of the System, the SSR Pd <b>shall</b> be at least 97% for the set of targets:</p> <ul style="list-style-type: none"> <li>a) Which are in the Mode S Conformity Assessment Volume;</li> <li>b) Which are not in the cone of silence (elevation angle below 45°);</li> <li>c) Which are not in close proximity (slant range &gt; 2 NM, azimuth &gt; 2 times the nominal 3 dB interrogation beamwidth).</li> </ul>
EMS-C02-SYS-SHA-00530	<p>The Mode S ground station <b>shall not</b> use an SSR-only MIP with the purpose of testing the SSR performance.</p>

### 2.6.1.2 Mode S Detection

<b>EMS-C02-TEN-SHA-00540</b>	The Tenderer <b>shall</b> provide in their proposal an analysis of how the System will achieve a theoretical Mode S Pd better than 99%, with the following hypotheses:  (a) A transponder probability of reply equal to 90%; (b) A target and a mean FRUIT rate as defined in ANNEX A; [RD 1] (c) Mode S transponder.
<b>EMS-C02-TEN-SHA-00550</b>	The Tenderer <b>shall</b> detail in their proposal how the Pd and the number of reinterrogations will be tested in FAT.
<b>EMS-C02-SYS-SHA-00560</b>	For SAT (on site) with opportunity traffic and with all the parameters used for the commissioning of the System, the Mode S Pd <b>shall</b> be at least 99% (using selective interrogations with, on average, 2 GICB requests per target) for the set of targets: a) Which are in the Mode S Conformity Assessment Volume; b) Which are not in the cone of silence (elevation angle below 45°).
<b>EMS-C02-CON-SHA-00570</b>	With the Pd measured in the volume described above, the Contractor <b>shall</b> provide the average number of interrogations per target during one antenna scan.

### 2.6.2 Code Detection

<b>EMS-C02-SYS-SHA-00580</b>	The Probability of Code Detection <b>shall</b> be determined globally and for each target trajectory.
<b>EMS-C02-SYS-SHA-00590</b>	The special civil codes 7500, 7600 and 7700 <b>shall</b> be detected and recognised, as defined in [RD 1].
<b>EMS-C02-TEN-SHA-00600</b>	The Tenderer <b>shall</b> describe in detail how non-discrete Mode A codes are handled by the System.
<b>EMS-C02-SYS-SHA-00610</b>	Target reports including special civil codes <b>shall</b> be sent upon detection, during the same scan, to the Surveillance Data output.
<b>EMS-C02-SYS-SHA-00620</b>	The appropriate alert bits, as specified in ASTERIX Cat. 048 ([RD 26]), <b>shall</b> be set in the Surveillance Data output of target reports with special civil codes.

#### 2.6.2.1 SSR code detection and validation

<b>EMS-C02-SYS-SHA-00630</b>	The System <b>shall</b> perform a credibility check to all Mode A and Mode C replies to remove the possibility of delivering erroneous data to the surveillance users.
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<b>EMS-C02-SYS-SHA-00640</b>	All of the pressure-altitude codes defined in Appendix 1 of [RD 1] <b>shall</b> be translated from the corresponding mode C responses.
<b>EMS-C02-SYS-SHA-00650</b>	Any pressure-altitude codes outside the range of values defined in Appendix 1 of [RD 1] <b>shall not</b> be translated from mode C responses.
<b>EMS-C02-SYS-SHA-00660</b>	Pressure-altitude information <b>shall</b> be sent to the Surveillance Data output when Mode C is present and decodable.
<b>EMS-C02-SYS-SHA-00670</b>	If there are only non-decodable Mode C replies available for a target, the System <b>shall</b> report this situation in item I048/030 of ASTERIX Cat. 048 ([RD 26]).
<b>EMS-C02-SYS-SHA-00680</b>	The special Military Emergency reply train, as defined in [RD 2], <b>shall</b> be detected, recognised and the appropriate fields set in the target report.
<b>EMS-C02-SYS-SHA-00690</b>	The special Military Identity reply train, as defined in [RD 2], <b>shall</b> be detected, recognised and the appropriate fields set in the target report.
<b>EMS-C02-SYS-SHA-00700</b>	The target reports including Military Emergency or Military Identity status <b>shall</b> be sent immediately, not subject to any delay, upon detection to the Surveillance Data output.
<b>EMS-C02-SYS-SHA-00710</b>	The appropriate identifier bits as specified in [RD 26] <b>shall</b> be set in the output message of target reports with Military Emergency or Military Identity status.
<b>EMS-C02-SYS-SHA-00720</b>	The System <b>shall not</b> reject a reply when the X pulse is present.
<b>EMS-C02-SYS-SHA-00730</b>	The System <b>shall</b> identify replies with the X pulse present in item I048/020 of the ASTERIX Cat. 048 target reports ([RD 26]).
<b>EMS-C02-SYS-SHA-00740</b>	The Mode A probability of correct and valid code detection <b>shall</b> be better than 98% for opportunity traffic.
<b>EMS-C02-SYS-SHA-00750</b>	The Mode C probability of correct and valid code detection <b>shall</b> be better than 96% for opportunity traffic.
<b>EMS-C02-SYS-SHA-00760</b>	The maximum of incorrect but validated Mode A codes <b>shall</b> be lower than 0.1%.
<b>EMS-C02-SYS-SHA-00770</b>	The maximum of incorrect but validated Mode C codes <b>shall</b> be lower than 0.1%.
<b>EMS-C02-TEN-SHA-00780</b>	The Tenderer <b>shall</b> provide in their proposal details of the SSR code detection performance which the equipment is able to meet and state under what conditions.

#### 2.6.2.2 Mode S code detection and validation

EMS-C02-SYS-SHA-00790	The ratio of the number of times a target is detected and output with all reply data correctly decoded compared to the number of times a target is detected and output <b>shall</b> be at least 99% for all targets replying in Mode S.
EMS-C02-SYS-SHA-00800	The ratio of the number of times a target is detected and output with incorrectly decoded pressure-altitude or aircraft identification compared to the number of times a target is detected and output <b>shall</b> be lower than 0.1% for all targets replying in Mode S.
EMS-C02-TEN-SHA-00810	The Tenderer <b>shall</b> provide in their proposal details of the Mode S code detection performance, which the equipment is able to meet and state under what conditions.

#### 2.6.3 Long gaps

EMS-C02-SYS-SHA-00820	The probability of long gap <b>shall</b> be determined globally.
EMS-C02-SYS-SHA-00830	The probability of long gap <b>shall</b> be determined by the ratio between the misses inside long gaps, i.e. with length of 3 or more scans, and the number of expected reports inside the Mode S CAV.
EMS-C02-SYS-SHA-00840	The overall probability of long gap for Mode S and SSR position detection <b>shall</b> be smaller than 0.5 %.
EMS-C02-SYS-SHA-00850	The overall probability of long gap for the correct and valid pressure-altitude code detection <b>shall</b> be smaller than 0.5 %.

#### 2.6.4 Resolution

EMS-C02-TEN-SHA-00860	The Tenderer <b>shall</b> include in their proposal a detailed analysis of the resolution and degarbling performance of the System (including Mode A/C and Mode S replies), and state any conditions for which the performance will not be achieved, including the limits of relative amplitudes and relative off boresight angles of interfering replies.
EMS-C02-TEN-SHA-00870	The Tenderer <b>shall</b> detail in their proposal how the azimuth accuracy of the reply is determined under garble conditions.

#### 2.6.4.1 SSR Position

EMS-C02-SYS-SHA-00880	Within a separation window area of 0 NM to less than 0.05 NM in range and 0° to 0.6° in azimuth, the overall probability of detecting two SSR targets <b>shall</b> be at least 60%.
EMS-C02-SYS-SHA-00890	Within a separation window area of greater than 0.05 NM to less than 2 NM in range and by less than 0.6° in azimuth, the overall probability of detecting two SSR targets <b>shall</b> be at least 98%.
EMS-C02-SYS-SHA-00900	Within a separation window area less than 2 NM in range and by more than 0.6° and by less than 4.8° in azimuth, the overall probability of detecting two SSR targets <b>shall</b> be at least 98%.
EMS-C02-SYS-SHA-00910	Outside the separation window areas as defined in 2.6.4.1 the Pd <b>shall</b> be the same as described in 2.6.1.1.
EMS-C02-TEN-SHA-00920	The Tenderer <b>shall</b> provide guaranteed values for the probability of detecting an SSR target for each of the separation window areas defined in 2.6.4.1 for the MIPs available as standard in the System.

#### 2.6.4.2 SSR Decoding

EMS-C02-SYS-SHA-00930	Within a separation window area of 0 NM to less than 0.05 NM in range and 0° to 0.6° in azimuth, the overall probability of detecting two SSR targets with correct and valid Mode A, Mode C codes <b>shall</b> be at least 30%.
EMS-C02-SYS-SHA-00940	Within a separation window area of greater than 0.05 NM to less than 2 NM in range and by less than 0.6° in azimuth, the overall probability of detecting two SSR targets with correct and valid Mode A, Mode C codes <b>shall</b> be at least 90%.
EMS-C02-SYS-SHA-00950	Within a separation window area less than 2 NM in range and by more than 0.6° and by less than 4.8° in azimuth, the overall probability of detecting two SSR targets with correct and valid Mode A, Mode C codes <b>shall</b> be at least 98%.

#### 2.6.4.3 SSR Phantoms

EMS-C02-SYS-SHA-00960	The System <b>shall</b> be capable of processing up to four discrete and mutually overlapping replies simultaneously rejecting all possible phantoms produced by them, including C2/SPI phantoms.
EMS-C02-SYS-SHA-00970	Genuine targets, including relative targets with C2/SPI spacing, <b>shall not</b> be rejected as phantoms.
EMS-C02-TEN-SHA-00980	The Tenderer <b>shall</b> provide details in the response on their proposed method of handling phantoms replies.

#### 2.6.4.4 Mode S Position

<b>EMS-C02-SYS-SHA-00990</b>	At any relative position of two Mode S targets, the System <b>shall</b> maintain the Pd specified in 2.6.1.2 when using selective surveillance interrogations.
<b>EMS-C02-TEN-SHA-01000</b>	The Tenderer <b>shall</b> state in their proposal the expected acquisition performance for two targets in close proximity at any relative position when using stochastic acquisition.
<b>EMS-C02-TEN-SHA-01010</b>	<p>The Tenderer <b>shall</b> provide in their proposal details of the Pd for a Mode S short and long reply garbled over an overlapping time 'T' as listed below with an SSR or Mode S reply:</p> <ul style="list-style-type: none"><li>a) <math>T \leq 20</math> microseconds;</li><li>b) <math>20 &lt; T \leq 32</math> microseconds;</li><li>c) <math>32 &lt; T &lt; 64</math> microseconds;</li><li>d) <math>T \geq 64</math> microseconds.</li></ul>

#### 2.6.4.5 Mode S Decoding

<b>EMS-C02-SYS-SHA-01020</b>	At any relative position of both targets, the System <b>shall</b> maintain the decoding probability and reply integrity specified in 2.6.1.2 for all Mode S selective interrogations.
<b>EMS-C02-TEN-SHA-01030</b>	<p>The Tenderer <b>shall</b> provide in their proposal details of the decoding probability for a Mode S short and long reply garbled over an overlapping time 'T' as listed below with an SSR or Mode S reply:</p> <ul style="list-style-type: none"><li>a) <math>T \leq 20</math> microseconds;</li><li>b) <math>20 &lt; T \leq 32</math> microseconds;</li><li>c) <math>32 &lt; T &lt; 64</math> microseconds;</li><li>d) <math>T \geq 64</math> microseconds.</li></ul>

### 2.6.5 Position Accuracy

<b>EMS-C02-TEN-SHA-01040</b>	<p>The Tenderer <b>shall</b> provide as part of their proposal:</p> <ul style="list-style-type: none"> <li>a) Detailed accuracy performance characteristics of the proposed equipment;</li> <li>b) Any conditions which impact the proposed performance characteristic;</li> <li>c) Detailed system level accuracy error budget analysis as described in ANNEX E.</li> </ul>
<b>EMS-C02-SYS-SHA-01050</b>	<p>The conditions, under which the random errors (azimuth and slant range) and systematic errors (azimuth and slant range) will be measured, <b>shall</b> be:</p> <ul style="list-style-type: none"> <li>a) Plot position data measured at the output interface to the Surveillance users;</li> <li>b) Non-garbled pulse reply conditions;</li> <li>c) Targets within the Mode S Conformity Assessment Volume;</li> <li>d) Interrogation conditions, received power and frequency levels as stated in ANNEX A;</li> <li>e) Separate measurements for: <ul style="list-style-type: none"> <li>a. Modes A/C reports;</li> <li>b. Mode S all-call reports (if included in the Surveillance data output);</li> <li>c. Mode S Selective reports.</li> </ul> </li> <li>f) Long term effects (i.e. stability with time).</li> <li>g) Any combination of units/subsystems which are configured to meet redundancy requirements.</li> <li>h) Measurements using the conditions for accuracy test requirements stated elsewhere in this document and as stated by the Tenderer in their proposal.</li> </ul>
<b>EMS-C02-SYS-SHA-01060</b>	<p>The range and azimuth errors <b>shall</b> be determined globally and for each target trajectory;</p>

### 2.6.5.1 Slant Range Errors

EMS-C02-SYS-SHA-01070	<p>All detected targets within the Mode S Conformity Assessment Volume for any interrogation mode (Mode A/C, Mode A/C only all-call or Mode S) measured using live traffic or controlled test transponders <b>shall</b> be within the following limits:</p> <ul style="list-style-type: none"> <li>a) Slant range systematic error: <ul style="list-style-type: none"> <li>a. The bias error <b>shall</b> be <math>&lt; +1/128</math> NM (+14 metres).</li> </ul> </li> <li>b) Slant range random error: <ul style="list-style-type: none"> <li>a. All SSR random errors <b>shall</b> be less than 30 m SD (1 sigma)</li> <li>b. All Mode S random errors <b>shall</b> be less than 15 m SD (1 sigma).</li> </ul> </li> </ul>
EMS-C02-SYS-SHA-01080	<p>The speed of light value <b>shall</b> be a programmable site-dependant parameter, providing at least 2 values:</p> <ul style="list-style-type: none"> <li>a) The value in vacuum: <math>c = 299,792,458</math> m/s;</li> <li>b) Another speed of light value (to be agreed with the Contracting Authority).</li> </ul>
EMS-C02-TEN-SHA-01090	<p>The Tenderer <b>shall</b> clearly describe the effects of speed of light value on the Systematic and random range errors.</p>

### 2.6.5.2 Azimuth Errors

EMS-C02-SYS-SHA-01100	<p>All detected targets within the Mode S Conformity Assessment Volume for any interrogation mode (Mode A/C, Mode A/C only all-call or Mode S) measured using live traffic or controlled test transponders <b>shall</b> be within the following limits:</p> <ul style="list-style-type: none"> <li>a) Azimuth systematic errors: <ul style="list-style-type: none"> <li>a. The bias error for elevation angles between 0 and <math>+6^\circ</math> <b>shall</b> be less than 1 AU (<math>0.022^\circ</math>);</li> <li>b. The bias error for elevation angle values between 6 and <math>+10^\circ</math> <b>shall</b> be lower than <math>0.033^\circ</math> (excluding ice and wind effects on the antenna).</li> </ul> </li> <li>b) Azimuth random errors: <ul style="list-style-type: none"> <li>a. All random errors <b>shall</b> be less than <math>0.068^\circ</math> SD (1 sigma).</li> </ul> </li> </ul>
EMS-C02-SYS-SHA-01110	<p>The azimuth systematic error <b>shall not</b> increase at elevation angles higher than <math>10^\circ</math> by an amount attributable to the antenna (e.g. beam widening effects, normally the inverse cosine of the elevation angle).</p>



<b>EMS-C02-TEN-SHA-01120</b>	The Tenderer in their proposal shall state the azimuth systematic error changes attributable to the antenna beam widening at large elevation angles.
<b>EMS-C02-CON-SHA-01130</b>	The azimuth systematic error changes at large elevation angles <b>shall</b> be verified by tests of the antenna as part of the overall system test.

#### 2.6.5.3 Systematic Error Adjustment

<b>EMS-C02-SYS-SHA-01140</b>	The System <b>shall</b> provide site-dependent parameters to adjust the bias errors in range and azimuth.
<b>EMS-C02-SYS-SHA-01150</b>	The bias adjustments for the redundant channels <b>shall</b> be capable of being applied separately and independently such that the System bias requirements are met irrespective of the channel in use (i.e. the data from either channel must meet the System requirement).
<b>EMS-C02-SYS-SHA-01160</b>	Operationally compatible calibration procedures <b>shall</b> be developed and used as part of accuracy tests in each redundant channels.
<b>EMS-C02-SYS-SHA-01170</b>	Once the System bias values are nulled, the measured bias value (systematic error) during normal operation of the System <b>shall</b> remain within the specified limits, irrespective of the channel in use.
<b>EMS-C02-SYS-SHA-01180</b>	The angular offset <b>shall</b> be adjusted in order to calibrate the angular measurement of the System to within 1 AU (0.022°).

#### 2.6.5.4 Range and Azimuth Precision

<b>EMS-C02-SYS-SHA-01190</b>	Target range <b>shall</b> be reported to a precision of at least 1/128 NM (14 m) at all ranges.
<b>EMS-C02-SYS-SHA-01200</b>	Target azimuth <b>shall</b> be reported to a precision of at least 360° / 16 384 degrees (0.022°) at all ranges and azimuths.

#### 2.6.5.5 Jumps

<b>EMS-C02-SYS-SHA-01210</b>	The overall jump rate, i.e. the number of jumps divided by the number of detected reports, <b>shall</b> be less than 0.05%.
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### 2.6.6 False and Multiple Targets

<b>EMS-C02-SYS-SHA-01220</b>	The overall Mode S and SSR false target report ratio <b>shall</b> be less than 0.1%.
<b>EMS-C02-SYS-SHA-01230</b>	SSR target reports generated by one or more of the following <b>shall</b> be classified as false target reports: a) FRUIT; b) Second time around echoes.
<b>EMS-C02-TEN-SHA-01240</b>	The Tenderer <b>shall</b> provide full analysis of the false target processing subject to the mean FRUIT rates and distribution of ANNEX A and state the maximum False Target Rate likely to be incurred under the operating conditions described.
<b>EMS-C02-SYS-SHA-01250</b>	The overall Multiple Mode S and SSR Target Rate, measured over one hour, <b>shall</b> be less than one target per scan on average
<b>EMS-C02-SYS-SHA-01260</b>	Multiple Mode S and SSR target reports <b>shall</b> include all those target reports generated by: Replies from a target interrogated by the System via an indirect path (reflection); a) Replies from a target interrogated through a sidelobe of the directional antenna pattern and which are not inhibited by the sidelobe suppression antenna pattern (sidelobes); b) Target split in several sequences either in azimuth or in distance (splits).
<b>EMS-C02-SYS-SHA-01270</b>	The multiple target processing <b>shall</b> discriminate between false and real nonunique addressed Mode S targets and flag this situation in the ASTERIX Cat. 048 ([RD 26]) data item I048/030 Warning Error/Conditions (code 16 for "Duplicated or Illegal Mode S Aircraft Address").
<b>EMS-C02-SYS-SHA-01280</b>	If a Mode S address 000000 or FFFFFFFF is detected, the System <b>shall</b> label its corresponding ASTERIX Cat. 048 ([RD 26]) target report within the field I048/030 "Warning/Error Conditions" (code 16 for "Duplicated or Illegal Mode S Aircraft Address").
<b>EMS-C02-TEN-SHA-01290</b>	The Tenderer <b>shall</b> provide details in their proposal of how will execute the discrimination between false and real non-unique addressed Mode S targets when targets are detected in the same beam-dwell.
<b>EMS-C02-TEN-SHA-01300</b>	The Tenderer <b>shall</b> provide full analysis of the multiple target processing subject to the mean FRUIT rates and distribution of ANNEX A and state the maximum Multiple Target Rate likely to be incurred under the operating conditions described.

### 2.6.7 Target Velocity Limits

EMS-C02-SYS-SHA-01310	<p>The targets population to be controlled includes rotary winged and high-performance fixed wing targets. Therefore, the System <b>shall</b> be capable of detecting and processing targets operating to the following motion parameters, in any combination:</p> <ul style="list-style-type: none"><li>a) A steady state speed from 0 to 2 000 kts;</li><li>b) A vertical rate of climb or descent, as reported by the received Mode C data from 0 to 25000 ft/min;</li><li>c) A vertical rate of climb as in (b) above with no horizontal displacement;</li><li>d) A straight-line acceleration/deceleration from any initial velocity in the range [0, 2 000] kts, from 0.01 g to 5 g, to achieve a steady state speed of between [0, 2 000] kts, e.g. from 300 kts steady state, accelerating at 2 g to 2 000 kts.</li></ul>
EMS-C02-TEN-SHA-01320	The Tenderer <b>shall</b> advise what impact a combination of these motion parameters will have on the surveillance performance, particularly for targets at less than 25 NM range.
EMS-C02-SYS-SHA-01330	Provision <b>shall</b> be made for the values of the above motion parameters to be set to any value within the ranges specified.
EMS-C02-SYS-SHA-01340	By default, all performance verifications <b>shall</b> be performed with the System configured to track at least civil traffic.
EMS-C02-CON-SHA-01350	The Contractor <b>shall</b> demonstrate, when configured for military traffic, that the System is capable of meeting the Pd and the accuracy requirements for trajectories covering the military traffic velocity limits.
EMS-C02-TEN-SHA-01360	The Tenderer <b>shall</b> describe in their proposal how this range of targets performance will be accommodated and how the values of the above motion parameters are pressed.

### 2.6.8 Target Load

#### 2.6.8.1 Peak target models

EMS-C02-SYS-SHA-01370	<p>The System <b>shall</b> be able to support a target load that follows at least the next models (ANNEX A.2.1):</p> <ul style="list-style-type: none"><li>a) Target load model A: 900 targets, distribution of targets from 0.5 NM to 150 NM and antenna scan rate of 15 RPM;</li><li>b) Target load model B: 1 200 targets, distribution of targets from 0.5 NM to 256 NM and antenna scan rate of 10 RPM.</li></ul>
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EMS-C02-SYS-SHA-01380	In both target load models, the System <b>shall</b> be able to request at least 2 GICB extractions for each Mode S target per scan.
EMS-C02-SYS-SHA-01390	<p>The System <b>shall</b> be capable of processing the following targets azimuth distribution for the target load models:</p> <ul style="list-style-type: none"> <li>a) 4 large sector peak of 45°. Each one contains 25% of the total number of targets. Only one large sector peak shall be present in each 90° quadrant;</li> <li>b) 4 small sector peak of 3.5°. Each one contains 43 targets, for Model A, or 64 targets, for Model B. Two small sector peaks <b>shall</b> be centrally located within a large sector and the other two small sector <b>shall</b> be centrally located in another large sector separated by 180° from the first one.</li> </ul> <p><i>Please see Figure 2-A: Target load azimuth distribution in original EUROCONTROL document – EMS ver. 4.0 page 59</i></p>
EMS-C02-SYS-SHA-01400	The targets in the target load models <b>shall</b> follow a random distribution on azimuth and pressure-altitude within the azimuth and range intervals defined in ANNEX A.2.1.2.
EMS-C02-SYS-SHA-01410	Both target load models <b>shall</b> include, randomly distributed, FRUIT and reflection false targets as specified in ANNEX A.3.1 and A.3.3.
EMS-C02-TEN-SHA-01420	<p>The Tenderer <b>shall</b> state in their proposal details of the minimum processing capabilities, for the defined azimuth and range distributions of the target load models, for each of the following cases (ANNEX A.2.1.1):</p> <ul style="list-style-type: none"> <li>a) Case 1: All transponders are Mode S;</li> <li>b) Case 2: 50% of transponders are Modes A/C and 50% are Mode S;</li> <li>c) Case 3: 5% of transponders are Modes A/C and 95% are Mode S.</li> </ul>
EMS-C02-CON-SHA-01430	The Contractor <b>shall</b> test all Cases for each target load test model at least 2 times, with a test duration of at least 150 scans and with different targets random azimuth and pressure-altitude distribution for each test run.
EMS-C02-SYS-SHA-01440	The minimum probability of success to complete all scheduled BDS register extractions in one scan for the target models and each test run <b>shall</b> be at least 90%.

### 2.6.8.2 RTCC target models

EMS-C02-SYS-SHA-01450	<p>The System <b>shall</b> be capable of processing the following RTCC target models (ANNEX A.2.2):</p> <ul style="list-style-type: none"> <li>a) RTCC target model C: <ul style="list-style-type: none"> <li>a. Distribution of targets from 0.5 NM to 150 NM with an antenna scan rate of 15 RPM;</li> <li>b. A background density (out of the peak sectors) of 6 targets per 3.6° sector;</li> <li>c. small peak sectors of 3.6° separated by 180° and containing 28 targets per sector (i.e. 56 targets in total).</li> </ul> </li> <li>b) RTCC target model D: <ul style="list-style-type: none"> <li>a. Distribution of targets from 0.5 NM to 256 NM with an antenna scan rate of 10 RPM;</li> <li>b. A Background density (out of the peak sectors) of 8 targets per 3.6° sector;</li> <li>c. small peak sectors of 3.6° separated by 180° and containing 43 targets per sector (i.e. 86 targets in total).</li> </ul> </li> </ul>
EMS-C02-SYS-SHA-01460	In both RTCC target models, the System <b>shall</b> be able to request at least 3 GICB extractions for each target per scan.
EMS-C02-SYS-SHA-01470	Both RTCC target models <b>shall</b> include, randomly distributed, FRUIT and reflection false targets as specified in ANNEX A.3.1 and A.3.3.
EMS-C02-TEN-SHA-01480	The Tenderer <b>shall</b> state in their proposal details of the minimum processing capabilities, for the defined azimuth and range distributions of the RTCC target models, considering that all transponders are Mode S (ANNEX A.2.2.1).
EMS-C02-CON-SHA-01490	The Contractor <b>shall</b> test each RTCC target model at least 3 times, with a test duration of at least 150 scans and with different targets random range, azimuth and pressure-altitude distributions for each test run.
EMS-C02-SYS-SHA-01500	The minimum probability of success to complete all scheduled BDS register extractions in one scan for the RTCC target models and each test run <b>shall</b> be at least 90%.

### 2.6.8.3 Applicability of Models for Other Scan Rates

<b>EMS-C02-SYS-SHA-01510</b>	The Peak target (2.6.8.1) and RTCC target (2.6.8.2) models are defined for antenna scan rates of 10 and 15 RPM. In case of different antenna scan rates, as indicated in ANNEX A.4.6, the performance <b>shall</b> achieve at least the required for the closest and faster scan rate defined in their respective sections.
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### 2.6.9 Processing delays and overload

<b>EMS-C02-SYS-SHA-01520</b>	The total system delay from illumination of the target by the antenna boresight to transmission of the target report in the Surveillance Data output under full load conditions <b>shall not</b> exceed a time equivalent to 120° of an LVA antenna rotation and not more than 2 seconds independently of the turning rate.
<b>EMS-C02-TEN-SHA-01530</b>	The Tenderer <b>shall</b> provide in their proposal a budget of the delays incurred by each part of the processing for the load conditions described in 2.6.8.
<b>EMS-C02-TEN-SHA-01540</b>	The Tenderer <b>shall</b> detail the effects of overload, in particular on the performance of the System, and state the conditions under which data can be lost.
<b>EMS-C02-SYS-SHO-01550</b>	The System <b>should</b> identify an overload affecting the surveillance performance through item I034/050 of the ASTERIX Cat. 034 Service Messages ([RD 25]).
<b>EMS-C02-SYS-SHA-01560</b>	The System <b>shall</b> include a function to perform a controlled degradation when the target load excess the conditions specified in 2.6.8.
<b>EMS-C02-SYS-SHA-01570</b>	The System <b>shall</b> provide site-dependant parameters to define volumes of interest for the controlled degradation function.
<b>EMS-C02-TEN-SHA-01580</b>	<p>The Tenderer <b>shall</b> describe in their proposal the dynamic threshold or limit employed for the controlled degradation function by reducing the detection and output of pulses, replies or target reports including:</p> <ul style="list-style-type: none"> <li>a) The point of application of the threshold (e.g. receiver output, reply output, etc.);</li> <li>b) The conditions under which the threshold is activated;</li> <li>c) The effect of the threshold on target detection;</li> <li>d) The indications that are provided to show that the threshold is in operation;</li> <li>e) The effect on any surveillance cooperation function.</li> </ul>

<b>EMS-C02-SYS-SHA-01590</b>	The System <b>shall</b> recover from an overload condition and start again the normal operation without the need for any manual intervention.
<b>EMS-C02-SYS-SHA-01600</b>	Each logical block of the processing system, as described on chapter 5, <b>shall</b> be monitored for overload conditions and reported in the BITE.
<b>EMS-C02-SYS-SHA-01610</b>	After completion of overload conditions of any part of the processing system, this situation <b>shall</b> also be reported in the BITE.

#### 2.6.10 System Expansion

<b>EMS-C02-SYS-SHA-01620</b>	The System target load capabilities (2.6.8) <b>shall</b> be expandable to accommodate further growth in air traffic movements.
<b>EMS-C02-SYS-SHA-01630</b>	Traffic growth to 120% of the SSR and Mode S target figures specified in the target load models defined in 2.6.8 <b>shall</b> be attainable without extension of the system delays described in 2.6.9. The traffic growth is considered for all targets azimuth distribution except the peak sectors.
<b>EMS-C02-SYS-SHA-01640</b>	The design architecture <b>shall</b> be capable of supporting the expansion requirements.
<b>EMS-C02-TEN-SHA-01650</b>	The Tenderer <b>shall</b> advise how the expansion can be achieved.
<b>EMS-C02-TEN-SHA-01660</b>	The Tenderer <b>shall</b> state in their proposal the possible additional sub-units or LRU that are required to achieve a safety margin to cover the traffic growth.
<b>EMS-C02-TEN-SHA-01670</b>	The Tenderer <b>shall</b> indicated in their Commercial Response the cost of the possible additional sub-units or LRU to achieve a safety margin to cover the traffic growth.

#### 2.7 ADS-B Performance

<b>EMS-C02-TEN-SHA-01680</b>	The Tenderer <b>shall</b> provide evidence that their proposed system can fully meet the ADS-B performance requirements and state under what conditions (e.g. site, garbling, targets load, etc.).
<b>EMS-C02-CON-SHA-01690</b>	The ADS-B performance requirements <b>shall</b> be verified at FAT and SAT.

<b>EMS-C02-TEN-SHA-01700</b>	The Tenderer <b>shall</b> state any deviation in the ADS-B performance figures for transponders having power outputs of 18.5 dBW.
<b>EMS-C02-TEN-SHA-01710</b>	The Tenderer <b>shall</b> include in their proposal a detailed analysis of the ADS-B degarbling performance, including degarbling figures for ADS-B squitter messages depending on their relative power and relative arrival time with respect to other ADS-B squitter messages, to Mode A/C replies and to Mode S replies.

### 2.7.1 Probability of Update

<b>EMS-C02-SYS-SHA-01720</b>	The ADS-B Probability of Update (PU) <b>shall</b> be determined globally and for each target trajectory.
<b>EMS-C02-TEN-SHA-01730</b>	<p>The Tenderer <b>shall</b> provide ADS-B update analysis, including downlink power budgets for 80, 120, 150 and 256 NM ranges, for the conditions of ANNEX B and for each of the following update intervals for the surveillance data output:</p> <ul style="list-style-type: none"> <li>a) 1 second;</li> <li>b) 2 seconds;</li> <li>c) 4 seconds;</li> <li>d) 5 seconds.</li> </ul>
<b>EMS-C02-SYS-SHA-01740</b>	The System <b>shall</b> be able to detect and track all ADS-B targets, including targets with duplicated addresses.
<b>EMS-C02-TEN-SHA-01750</b>	<p>The Tenderer <b>shall</b> provide in their proposal an analysis of how the System will achieve a theoretical ADS-B PU better than 99%, with the following hypotheses:</p> <ul style="list-style-type: none"> <li>a) Update interval equal to the Mode S scan rate;</li> <li>b) A target and a mean FRUIT rate as defined in ANNEX B;</li> <li>c) ADS-B MOPS versions 0, 1, 2 and 3 ([RD 12], [RD 13], [RD 14] and [RD 15]).</li> </ul>
<b>EMS-C02-TEN-SHA-01760</b>	The Tenderer <b>shall</b> detail in their proposal how the ADS-B PU will be tested in FAT.
<b>EMS-C02-SYS-SHA-01770</b>	For SAT (on site) with opportunity traffic and with all the parameters used for the commissioning of the ground station, the ADS-B PU, considering an update interval equal to the Mode S scan rate, <b>shall</b> be at least 99% for the set of targets which are in the ADS-B Conformity Assessment Volume.



### 2.7.2 Code Detection

EMS-C02-SYS-SHA-01780	The Probability of ADS-B Code Detection <b>shall</b> be determined globally and for each target trajectory.
EMS-C02-SYS-SHA-01790	The ratio of the number of times a target is detected and output with all data correctly decoded compared to the number of times a target is detected and output <b>shall</b> be at least 99% for all ADS-B targets.
EMS-C02-SYS-SHA-01800	The ratio of the number of times a target is detected and output with incorrectly decoded horizontal position, altitude or aircraft identification compared to the number of times a target is detected and output <b>shall</b> be lower than 0.1% for all ADS-B targets.

### 2.7.3 Probability of Long Gap

EMS-C02-SYS-SHA-01810	The probability of ADS-B long gap <b>shall</b> be determined globally.
EMS-C02-SYS-SHA-01820	The overall probability of long gap in the update of ADS-B target reports, including horizontal position and altitude, <b>shall</b> be smaller than 0.5%.

### 2.7.4 Targets Load

EMS-C02-SYS-SHA-01830	The System <b>shall</b> support a target load as described in ANNEX B.2.1 (i.e. similar to the Mode S peak target load models A and B), with each target transmitting at a rate of 6.7 ADSB messages per second ([RD 15]) and under a FRUIT rate as indicated in ANNEX B.3.1.
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### 2.7.5 Processing Delays and Overload

EMS-C02-SYS-SHA-01840	The total system delay from the time of reception of an ADS-B position message until the target report is ready for transmission in the Surveillance Data output under full load conditions <b>shall not</b> exceed 1.5 seconds.
EMS-C02-TEN-SHA-01850	The Tenderer <b>shall</b> provide in their proposal a budget of the delays incurred by each part of the ADS-B processing for the load conditions described in 2.7.4.

<b>EMS-C02-TEN-SHA-01860</b>	The Tenderer <b>shall</b> detail the effects of ADS-B overload, in particular on the performance of the System, and state the conditions under which data can be lost.
<b>EMS-C02-SYS-SHA-01870</b>	The System <b>shall</b> include a function to perform a controlled degradation when the ADS-B target load excess the conditions specified in 2.7.4.
<b>EMS-C02-SYS-SHA-01880</b>	Without the need for any manual intervention, the System <b>shall</b> recover from an ADS-B overload condition and start again the normal operation.
<b>EMS-C02-SYS-SHA-01890</b>	The ADS-B processing system <b>shall</b> be monitored for overload conditions and reported in the BITE, including completion of overload conditions.

#### 2.7.6 System Expansion

<b>EMS-C02-SYS-SHA-01900</b>	Traffic growth to 120% of the ADS-B target figures specified in the target load defined in 2.7.4 <b>shall</b> be attainable without extension of the system delays described in 2.7.5.
<b>EMS-C02-SYS-SHA-01910</b>	The on-site ADS-B design <b>shall</b> be capable of supporting the expansion requirements.
<b>EMS-C02-TEN-SHA-01920</b>	The Tenderer <b>shall</b> advise how the expansion can be achieved and state in their proposal the possible additional sub-units or LRU that are required to achieve a safety margin to cover the ADS-B traffic growth.
<b>EMS-C02-TEN-SHA-01930</b>	The Tenderer <b>shall</b> indicated in their Commercial Response the cost of the possible additional sub-units or LRU to achieve a safety margin to cover the ADS-B traffic growth.

### 3 Functional Requirement

#### 3.1 Description of the System

EMS-C03-SYS-SHA-01940	The Mode S ground station <b>shall</b> meet all the requirements of ICAO ANNEX 10 [RD 1], followed by the requirements as detailed in this document.
EMS-C03-SYS-SHA-01950	The Mode S ground station <b>shall</b> meet the requirements of Military SPI, Military Emergency train and Mode 3 as defined in STANAG 4193 [RD 2].
EMS-C03-TEN-MAY-01960	The Tenderer <b>may</b> provide equipment as described in STANAG 4193 ([RD 2]) which includes Mode 1 and 2.
EMS-C03-SYS-SHA-01970	<p>The Mode S ground station <b>shall</b> support the following modes:</p> <ul style="list-style-type: none"><li>a) Mode A, interrogation and reply, for identity and surveillance;</li><li>b) Mode C, interrogation and reply, for pressure-altitude and surveillance;</li><li>c) Intermode:<ul style="list-style-type: none"><li>a. Mode A/C only all-call (intermode P4 short), interrogation and reply.</li></ul></li><li>d) Mode S:<ul style="list-style-type: none"><li>a. Mode S-only all-call, interrogation (UF = 11) and reply (DF = 11);</li><li>b. Selective addressed surveillance with Standard Length Communication (SLM):<ul style="list-style-type: none"><li>i. Surveillance protocol with pressure-altitude request, interrogation (UF = 4) and reply (DF = 4);</li><li>ii. Surveillance protocol with identity request, interrogation (UF = 5) and reply (DF = 5);</li><li>iii. Ground Initiated Comm-B (GICB) with pressure-altitude reply (DF = 20);</li><li>iv. Ground Initiated Comm-B (GICB) with identity reply (DF = 21).</li></ul></li><li>c. Comm-B broadcast.</li></ul></li></ul>

#### 3.2 Surveillance Mode Interlace Pattern (MIP)

EMS-C03-SYS-SHA-01980	The System <b>shall</b> allow the configuration of All-Call periods and Selective periods in the configuration of the MIPs.
EMS-C03-SYS-SHA-01990	The All-Call period <b>shall</b> be used for the surveillance of Mode A/C transponder equipped targets and the acquisition of Mode S transponder equipped targets.

EMS-C03-SYS-SHA-02000	The Selective period <b>shall</b> be used only for the selective surveillance of Mode S transponder equipped targets.
EMS-C03-SYS-SHA-02010	When the periods adopt static values, the internal IRF for the All-call period <b>shall</b> be adjustable from 50 Hz to 250 Hz with increments no greater than 1 Hz.
EMS-C03-SYS-SHA-02020	The internal IRF for the All-call period <b>shall</b> apply to the paired Mode S-only and Mode A/C-only all-call interrogations used for acquisition in the multisite mode.
EMS-C03-SYS-SHA-02030	For a target that is not locked out, the System <b>shall not</b> trigger, on average, more than 6 Mode S all-call replies per period of 200 ms (i.e. per scan) and no more than 26 Mode S all-call replies counted over a period of 18 s, as described in as defined in [RD 1].
EMS-C03-SYS-SHA-02040	For all Mode S selective interrogations, the System <b>shall</b> transmit less than 2 400 interrogations per second, averaged over a 40 milliseconds interval, and less than 480 interrogations into any 3° sector, averaged over a 1 second interval, as described in as defined in [RD 1].
EMS-C03-SYS-SHA-02050	The System <b>shall</b> comply with the Mode S interrogation limitations (i.e. transmitted interrogations per second and replies triggered for a target that is not locked out) during operation and during any maintenance activity that implies transmissions to the air.
EMS-C03-SYS-SHA-02060	The System <b>shall</b> provide an operational parameter to select between constant or staggered All-Call periods.
EMS-C03-SYS-SHA-02070	The stagger <b>shall</b> be a fixed sequence, random or pseudo random (e.g. 64 stagger periods which are selectable and a deviation of 0% up to +10% in 0.5% steps from the mean IRF).
EMS-C03-TEN-SHA-02080	The Tenderer <b>shall</b> describe the method of stagger generation.
EMS-C03-SYS-SHA-02090	The illumination period for a target in the beam <b>shall</b> be divided into a defined number of intervals that represents one All-Call or one Selective period
EMS-C03-SYS-SHA-02100	The duration and type of each illumination interval for a target in the beam <b>shall</b> be defined separately, but consistently, and considering the IRF, interrogations and triggered replies limits defined within this section (3.2).
EMS-C03-SYS-SHA-02110	The System <b>shall</b> provide operational parameters to configure the MIPs.

EMS-C03-SYS-SHA-02120	<p>The minimum number of All-Call periods within the total illumination intervals <b>shall</b> be configurable in the MIPs, including at least:</p> <ul style="list-style-type: none"> <li>a) Single mode: two All-Call periods;</li> <li>b) Dual mode: four All-Call periods;</li> <li>c) Triple mode interlace: six All-Call periods.</li> </ul>
EMS-C03-SYS-SHA-02130	<p>Different interlaces for the All-Call periods <b>shall</b> be selectable on an antenna scan basis, including at least:</p> <ul style="list-style-type: none"> <li>a) Single Mode Interlace (e.g. Mode A);</li> <li>b) Dual Mode Interlace (e.g. Mode A, Mode C);</li> <li>c) Triple Mode Interlace (e.g. Mode A only all-call, Mode C only all-call and another Mode C only all-call).</li> </ul>
EMS-C03-SYS-SHA-02140	<p>In addition to the Mode A/C and Mode A/C only all-call interrogations, a Mode S only all-call interrogation <b>shall</b> occur once every 'M' All-Call periods, where 'M' is a configurable parameter in the MIP, with a value between 1 and 9 and with steps of 1.</p>
EMS-C03-SYS-SHA-02150	<p>It <b>shall</b> be possible to configure up to three different interlaces to be applied during three consecutive antenna scans.</p>
EMS-C03-SYS-SHA-02160	<p>Changes in interlaces <b>shall</b> be applied on the North crossing.</p>
EMS-C03-TEN-MAY-02170	<p>The Tenderer <b>may</b> offer in their Tender Response, always respecting the limits on IRF, interrogations and triggered replies specified within this section (3.2), additional alternative methods to manage the illumination periods, MIPs and interlaces.</p>
EMS-C03-SYS-SHA-02180	<p>Stochastic lockout over-ride <b>shall</b> be selectable to acquire targets.</p> <p><i>Please see Figure 3-A: Stochastic All-Call example in EUROCONTROL EMS document.</i></p>
EMS-C03-TEN-SHA-02190	<p>The Tenderer <b>shall</b> provide details on how stochastic lockout override is implemented in their proposal.</p>
EMS-C03-SYS-SHA-02200	<p>Provision for intermittent lockout <b>shall</b> be made for the areas where the lockout coverage map applies.</p>
EMS-C03-SYS-SHA-02210	<p>Provision for stochastic lockout override <b>shall</b> be made for the areas where the lockout coverage map applies.</p>
EMS-C03-SYS-SHA-02220	<p>When operating with stochastic lockout override, the System <b>shall</b> interrogate the Mode S targets during the All-Call period with a PR value smaller than 1.</p>

<b>EMS-C03-TEN-SHA-02230</b>	The Tenderer <b>shall</b> detail which operational parameters will be use to configure the MIPs (e.g. modes, interlace, probability of reply, 'M' All-Call periods, etc.) and how these parameters will be accessed.
<b>EMS-C03-TEN-SHA-02240</b>	The Tenderer <b>shall</b> state in their proposal all the characteristics of the MIPs available as standard in the System.

### 3.3 Mode S Data Extraction

#### 3.3.1 Elementary Surveillance

<b>EMS-C03-SYS-SHA-02250</b>	The System <b>shall</b> be able to extract Elementary Surveillance (ELS) data, i.e. BDS registers 10 <sub>16</sub> , 17 <sub>16</sub> , 20 <sub>16</sub> , 30 <sub>16</sub> , 31 <sub>16</sub> and downlink broadcasts from all targets in the Surveillance Volume of the ground station.
<b>EMS-C03-SYS-SHA-02260</b>	When their extraction will be needed, BDS registers containing Mode S specific services GICB capability reports, i.e. 18 <sub>16</sub> to 1C <sub>16</sub> , <b>shall</b> be considered as well as part of the Elementary Surveillance Data (ELS).
<b>EMS-C03-SYS-SHA-02270</b>	As part of the acquisition process, the System <b>shall</b> extract for all the targets in all the Surveillance Volume: <ul style="list-style-type: none"> <li>a) BDS register 10<sub>16</sub> (Data link capability report);</li> <li>b) If bit 33 of BDS register 10<sub>16</sub> is set to 1, BDS register 20<sub>16</sub> (Aircraft identification);</li> <li>c) If bit 25 of BDS register 10<sub>16</sub> is set to 1, BDS register 17<sub>16</sub> (Common usage GICB capability report).</li> </ul>
<b>EMS-C03-SYS-SHA-02280</b>	A parameter <b>shall</b> be available to override the check of bit 33 of BDS register 10 <sub>16</sub> for the extraction of BDS register 20 <sub>16</sub> during the acquisition process.
<b>EMS-C03-SYS-SHA-02290</b>	A parameter <b>shall</b> be available to override the check of bit 25 of BDS register 10 <sub>16</sub> for the extraction of BDS register 17 <sub>16</sub> during the acquisition process.
<b>EMS-C03-SYS-SHA-02300</b>	The System <b>shall</b> re-extract BDS register 17 <sub>16</sub> when bit 36 of BDS register 10 <sub>16</sub> is toggled.
<b>EMS-C03-TEN-SHA-02310</b>	The Tenderer <b>shall</b> provide detailed information on the Acquisition Processing of new Mode S targets (in particular the delay in completing the acquisition process, algorithms used in the form of pseudo-code, extraction of CA field, BDS registers 10 <sub>16</sub> , 17 <sub>16</sub> and 20 <sub>16</sub> , impact on the Surveillance Data output, etc.)
<b>EMS-C03-SYS-SHA-02320</b>	For Mode S targets, the System <b>shall</b> extract the Mode A code and BDS register 20 <sub>16</sub> on acquisition and on change.

<b>EMS-C03-SYS-SHA-02330</b>	Mode A code and BDS register 20 <sub>16</sub> <b>shall</b> automatically be extracted by the station when the last measured position of the track is older than 18 seconds.
<b>EMS-C03-SYS-SHA-02340</b>	The System <b>shall</b> be able to define a periodic extraction of the Mode A code and BDS register 20 <sub>16</sub> for Mode S targets through independently configurable operational parameters.
<b>EMS-C03-SYS-SHA-02350</b>	The System <b>shall</b> provide independently configurable operational parameters to enable and disable the periodic extraction of the Mode A code and BDS register 20 <sub>16</sub> for Mode S targets.
<b>EMS-C03-SYS-SHA-02360</b>	The System <b>shall</b> be capable of retrieving the Mode A code not later than one antenna revolution after detecting the alert flag, subject to the probability of detection described in 2.6.1.
<b>EMS-C03-SYS-SHA-02370</b>	The System <b>shall</b> be able to extract the pressure-altitude information on every scan, subject to the probability of detection described in 2.6.1.
<b>EMS-C03-SYS-SHA-02380</b>	The Mode S ground station <b>shall</b> be capable of performing the extraction of the aircraft identification (i.e. BDS register 20 <sub>16</sub> ) not later than one antenna revolution after its announcement and subject to the probability of detection described in 2.6.1.
<b>EMS-C03-SYS-SHA-02390</b>	The Mode S ground station <b>shall</b> be capable of performing the extraction of the ACAS Resolution Advisory Report broadcast (i.e. BDS register 30 <sub>16</sub> ) not later than one antenna revolution after its announcement and subject to the probability of detection described in 2.6.1.
<b>EMS-C03-SYS-SHA-02400</b>	When the data link capability report (i.e. BDS register 10 <sub>16</sub> ) has reported that the target is equipped with ACAS Xu ([RD 11]), the System <b>shall</b> be capable of performing the extraction of the second part of the ACAS Resolution Advisory Report broadcast (i.e. BDS register 31 <sub>16</sub> ), not later than one antenna revolution after its announcement and subject to the probability of detection described in 2.6.1.
<b>EMS-C03-SYS-SHA-02410</b>	Upon reception of a Mode S reply with a Flight Status field (FS) equal to 4 or 5 (i.e. SPI), the System <b>shall</b> for the corresponding target restart the acquisition process in order to re-acquire airborne information only acquired at track initialisation or on change (target capabilities, Mode A code, Aircraft Identification).

### 3.3.2 Enhanced Surveillance

EMS-C03-SYS-SHA-02420	The System <b>shall</b> be capable to request automatically the periodic extraction of at least 4 Enhanced Surveillance (EHS) BDS registers, i.e. different than the ELS BDS registers defined in 3.3.1, for each target per scan.
EMS-C03-SYS-SHA-02430	The automatic periodic GICB extraction of EHS BDS registers <b>shall</b> be done only in the volume defined in the Datalink map.
EMS-C03-SYS-SHA-02440	The System <b>shall</b> adapt the extraction of EHS BDS registers to the updated content of BDS register 17 <sub>16</sub> (common usage GICB capability report) and, if necessary, BDS registers 18 <sub>16</sub> to 1C <sub>16</sub> (Mode S specific services GICB capability report).
EMS-C03-SYS-SHA-02450	If an EHS BDS register is not listed in the GICB capability report (e.g. BDS register 17 <sub>16</sub> ), it <b>shall not</b> be extracted.
EMS-C03-SYS-SHA-02460	No GICB extraction request received from the DAP Extraction interface <b>shall</b> be accepted by the System if the programmed EHS BDS register is not supported by the target installation according to the GICB capability report (e.g. BDS register 17 <sub>16</sub> ).
EMS-C03-SYS-SHA-02470	An operational parameter <b>shall</b> be available to force the extraction of EHS BDS registers not listed in the GICB capability report (e.g. BDS register 17 <sub>16</sub> ).
EMS-C03-SYS-SHO-02480	The System <b>should</b> be able to extract on acquisition at least four BDS registers with information about the target transponder from all targets in the Surveillance Volume of the ground station.
EMS-C03-SYS-SHA-02490	When the Data link capability report (i.e. BDS register 10 <sub>16</sub> ) has reported that the target is equipped with ACAS X ([RD 11]), the System <b>shall</b> extract BDS registers E5 <sub>16</sub> (TCAS/ACAS Unit Part Number) and E6 <sub>16</sub> (TCAS/ACAS Unit Software Revision) on acquisition from all targets in the Surveillance Volume of the ground station.

### 3.3.3 Re-interrogations

EMS-C03-SYS-SHA-02500	The System <b>shall</b> discard replies containing BDS registers 10 <sub>16</sub> , 20 <sub>16</sub> and 30 <sub>16</sub> when the decoded BDS number field (first byte) is not corresponding to the requested BDS and reschedule a new interrogation.
EMS-C03-SYS-SHA-02510	The System <b>shall</b> discard replies with a DF format not corresponding to the reply format requested by the interrogation, i.e. a DF not equal to 4 or 20 for a UF = 4, a DF not equal to 5 or 21 for a UF = 5, and a DF not equal to 11 for a UF = 11, and re-schedule a new interrogation



<b>EMS-C03-SYS-SHA-02520</b>	The System <b>shall not</b> re-interrogate requesting the same BDS register extraction more than 1 time (i.e. a second interrogation) for the same target during the same antenna scan.
<b>EMS-C03-SYS-SHA-02530</b>	The System <b>shall not</b> re-interrogate more than 2 BDS registers for the same target during the same antenna scan.
<b>EMS-C03-SYS-SHA-02540</b>	If the BDS re-interrogation limit is achieved and the System still needs to perform more interrogations for surveillance purposes, the System <b>shall</b> use only surveillance interrogations requesting short replies (DF = 4 or 5) and identify this situation in item I048/030 of the ASTERIX Cat. 048 target reports ([RD 26]).
<b>EMS-C03-SYS-SHA-02550</b>	When the System is operating in forced extraction of BDS registers not listed in the GICB capability report (e.g. BDS register 17 <sub>16</sub> ), the following limits <b>shall</b> apply to those interrogations until the first successful extraction: <ul style="list-style-type: none"> <li>a) No re-interrogations are allowed;</li> <li>b) Maximum of 5 attempts to be extracted. After that, the System <b>shall not</b> try to extract a non-listed BDS register until new track initialization.</li> </ul>
<b>EMS-C03-SYS-SHA-02560</b>	The System <b>shall</b> provide an operational parameter to define the maximum number of surveillance re-interrogations to the same target in the same scan for situations where the BDS re-interrogation limit is achieved.
<b>EMS-C03-SYS-SHA-02570</b>	If the number of surveillance re-interrogations to the same target in the same scan is reached, the System <b>shall</b> identify this situation in item I048/030 of the ASTERIX Cat. 048 target reports ([RD 26]).
<b>EMS-C03-TEN-SHA-02580</b>	The Tenderer <b>shall</b> define, and support by field data, how many re-interrogations, in function of range, are assumed to achieve the Mode S performance requirements for all configurations given in ANNEX A and target velocity limits specified in 2.6.7.

### 3.3.4 BDS Overlay

<b>EMS-C03-SYS-SHA-02590</b>	The System <b>shall</b> check bit 15 of BDS register 10 <sub>16</sub> (Overlay Command Capability - OCC as described in [RD 1]) to establish and memorize the BDS overlay capability of each target.
<b>EMS-C03-SYS-SHA-02600</b>	BDS overlay operation <b>shall</b> be selectable through an operational parameter.

<b>EMS-C03-SYS-SHA-02610</b>	If a target is with BDS overlay capability and the BDS operation is enable in the operational parameters, the System <b>shall</b> use DI = 0, 3 or 7 format with OVC bit set to 1 to request the transponder to overlay the BDS number on the parity in the associated reply.
<b>EMS-C03-SYS-SHA-02620</b>	When BDS overlay is requested, the System <b>shall</b> discard the reply with a decoded BDS number not corresponding to the requested BDS, re-schedule a new interrogation and report this situation in item I048/030 of the ASTERIX Cat. 048 target reports ([RD 24]).
<b>EMS-C03-SYS-SHA-02630</b>	The System <b>shall</b> provide an operational parameter to enable and disable the BDS overlay request in the interrogations when the message to be extracted is a Comm-B broadcast.

### 3.3.5 Basic Dataflash

<b>EMS-C03-SYS-MAY-02640</b>	The System <b>may</b> provide a Basic Dataflash function to extract EHS BDS registers that are not changing very often (e.g. register 40 <sub>16</sub> ) and for which a change is announced by the Basic Dataflash protocol, implemented in the target transponder, within the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-02650</b>	When the Basic Dataflash function is included, the System <b>shall</b> consider a target as Basic Dataflash capable when BDS register 10 <sub>16</sub> (Data link capability report), bit 42 is set to "1".
<b>EMS-C03-SYS-SHA-02660</b>	When the Basic Dataflash function is included, the System <b>shall</b> provide an operational parameter to enable or disable the Basic Dataflash function.
<b>EMS-C03-SYS-SHA-02670</b>	When the Basic Dataflash function is enabled and as part of the acquisition process, the System <b>shall</b> extract BDS register 11 <sub>16</sub> (Data link capability report continuation) and store its initial status for all the Basic Dataflash capable targets that are inside the Surveillance Volume.
<b>EMS-C03-SYS-SHA-02680</b>	When the Basic Dataflash function is included, the System <b>shall</b> provide an operational parameter to select the mode of Basic Dataflash operation between: <ul style="list-style-type: none"> <li>a) Simple extraction, with a direct extraction of BDS register(s);</li> <li>b) Complete extractions, with extraction of multiple BDS registers after checking their status in BDS register 11<sub>16</sub> (Data link capability report continuation).</li> </ul>
<b>EMS-C03-SYS-SHA-02690</b>	When the Basic Dataflash function is included, the System <b>shall</b> provide operational parameters to define a Dataflash Extraction List with the EHS BDS registers to be extracted when announced through the Basic Dataflash protocol.

<b>EMS-C03-SYS-SHA-02700</b>	When the Basic Dataflash function is enabled and the Simple extraction mode is selected, the System <b>shall</b> directly extract the BDS registers defined in the Dataflash Extraction List when bit 51 of BDS register 10 <sub>16</sub> is toggled for targets which are within the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-02710</b>	When the Basic Dataflash function is enabled and the Complete extraction mode is selected, the System <b>shall</b> re-extract BDS register 11 <sub>16</sub> when bit 51 of BDS register 10 <sub>16</sub> is toggled.
<b>EMS-C03-SYS-SHA-02720</b>	When the Basic Dataflash function is enabled and the Complete extraction mode is selected, after the extraction of BDS register 11 <sub>16</sub> , the System <b>shall</b> compare the status of each BDS register contained in the Dataflash Extraction List and extract those which present a monitored change for targets which are within the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-02730</b>	When the Basic Dataflash function is included, the System <b>shall</b> provide operational parameters to define an extraction periodicity for BDS registers contained in the Dataflash Extraction List over a specific configurable period of time after a change announcement through the Basic Dataflash protocol.
<b>EMS-C03-SYS-SHA-02740</b>	When the Basic Dataflash function is included, the System <b>shall</b> provide an operational parameter to keep the extraction of the EHS BDS registers included in the Dataflash Extraction List by the Basic Dataflash function while the rest of the EHS automatic extractions are disable due the DAP Extraction Function (3.7.2).

### 3.4 Interrogator Code operation

<b>EMS-C03-SYS-SHA-02750</b>	The capability to interrogate and set lockout for an SI code and decode and process replies from an SI capable transponder <b>shall</b> be provided in the ground station.
<b>EMS-C03-SYS-SHA-02760</b>	The System, when operating with an SI code, <b>shall</b> also acquire targets through All-Call replies which are encoded using the "matching" II code.
<b>EMS-C03-SYS-SHA-02770</b>	Even if the content of BDS register 10 <sub>16</sub> states that the transponder has the SI capability, if this transponder is detected as using the "matching" II code to encode the parity sequence of the replies, it <b>shall</b> be considered by the System as a non-SI equipped transponder.

EMS-C03-SYS-SHA-02780	Non-SI equipped transponders reporting incorrectly their SI capability on BDS register 10 <sub>16</sub> <b>shall</b> be reported on the corresponding ASTERIX Cat. 048 target report ([RD 26]) with the code "Transponder Anomaly" set within the field I048/030 "Warning/Error Conditions".
EMS-C03-SYS-SHA-02790	The System, if operating with an SI code, <b>shall</b> interrogate targets equipped with non-SI transponders using the Mode S selective protocols foreseen for II code operation and the corresponding "matching" II code.
EMS-C03-SYS-SHA-02800	The System, if operating with an SI code, <b>shall</b> not lockout SI non-capable transponders on the "matching" II code.
EMS-C03-SYS-SHA-02810	The System, if operating with an II code, <b>shall</b> not lockout Mode S transponders which do not report the SI capability in BDS register 10 <sub>16</sub> (i.e., non-SI capable transponders).
EMS-C03-SYS-SHA-02820	The lockout maps <b>shall not</b> be taken into account for SI non-capable equipped targets.

### 3.5 On-site ADS-B

#### 3.5.1 Implementation

EMS-C03-SYS-SHA-02830	The System <b>shall</b> receive, decode and process ADS-B Extended Squitter messages (DF = 17 and 18) with MOPS version 0, 1, 2 and 3 ([RD 12], [RD 13], [RD 14] and [RD 15] respectively).
EMS-C03-TEN-SHA-02840	The Tenderer <b>shall</b> provide implementation details regarding reception, decoding and processing of ADSB Extended Squitter messages.
EMS-C03-SYS-SHA-02850	In the case of an "independent" implementation of the on-site ADS-B, the ADS-B target reports <b>shall</b> be injected to the Mode S system through the Passive Acquisition Interface (3.7.1).
EMS-C03-TEN-SHA-02860	In the case of an "integrated" implementation of the on-site ADS-B, the Tenderer <b>shall</b> describe how the ADS-B information will be handed inside the Processing system.
EMS-C03-TEN-SHA-02870	The control and monitoring of the on-site ADS-B, either integrated or independent implementation, <b>shall</b> be performed through the CMS.

<b>EMS-C03-TEN-SHA-02880</b>	The Tenderer <b>shall</b> describe, considering the ADS-B performance requirements indicated in 2.7, the configuration of antennas that will use to receive the ADS-B Extended Squitter messages (e.g. Control channel of Mode S LVA antenna, one or more independent omnidirectional antennas, directional antennas, etc.).
<b>EMS-C03-SYS-SHO-02890</b>	The on-site ADS-B <b>should</b> be compliant with the functional and minimum performance requirements indicated in [RD 16].
<b>EMS-C03-TEN-SHA-02900</b>	In the event of conflict between any of the requirements expressed in [RD 16], the requirements expressed in this Specification <b>shall</b> take priority
<b>EMS-C03-SYS-SHA-02910</b>	In the case of an “independent” implementation of the on-site ADS-B, the ADS-B system <b>shall</b> be compliant with the phase overlay capability requirements defined in 6.3.2 for the Mode S Interrogator.

### 3.5.2 ADS-B Functionalities

<b>EMS-C03-SYS-SHA-02920</b>	The targets reports produced by the on-site ADS-B <b>shall</b> be used at least for: <ul style="list-style-type: none"> <li>a) Provision of ADS-B service to ATC with a minimum performance (2.7);</li> <li>b) Provision of ADS-B information for Passive Acquisition in the Mode S system (3.7.1);</li> <li>c) Performance improvements in the Mode S system (e.g. anti-reflection processing).</li> </ul>
<b>EMS-C03-SYS-SHA-02930</b>	The on-site ADS-B <b>shall</b> use the NTP messages available in the internal LAN network for time synchronization and time-stamping (4.3).
<b>EMS-C03-TEN-SHA-02940</b>	The Tenderer <b>shall</b> state in their proposal at which level and how the time stamping information is effectively derived and output in ADS-B target reports
<b>EMS-C03-SYS-SHA-02950</b>	The System <b>shall</b> provide operational parameters to configure separately the maximum validity periods for MOPS version and the Quality Indicators NIC supplements (A, B and C), SDA and GVA.
<b>EMS-C03-SYS-SHA-02960</b>	The System <b>shall</b> provide a filtering functionality to use only the ADS-B information containing MOPS Version and Quality Indicators (e.g. NIC/NUCp, NACp, NACv/NUCr, etc.) above certain pre-defined configurable levels for Passive Acquisition and the Performance improvements.

<b>EMS-C03-SYS-SHA-02970</b>	The System <b>shall</b> be able to use ADS-B information, if enabled by an operational parameter, to improve the anti-reflection processing.
<b>EMS-C03-TEN-SHA-02980</b>	The Tenderer <b>shall</b> provide information on how the ADS-B information is use to improve the anti-reflection Processing.
<b>EMS-C03-SYS-MAY-02990</b>	The System <b>may</b> be able to use ADS-B information, if enabled by an operational parameter, to keep internal tracking of targets inside the cone of silence (CoS).
<b>EMS-C03-TEN-SHA-03000</b>	When ADS-B information is used for a function to keep internal tracking of targets inside the CoS, the Tenderer <b>shall</b> provide information on how the ADS-B information is use to keep internal tracking of targets inside the cone of silence.
<b>EMS-C03-SYS-MAY-03010</b>	The System <b>may</b> be able to use ADS-B information, if enabled by an operational parameter, to detect Interrogator Code conflicts.
<b>EMS-C03-TEN-SHA-03020</b>	When ADS-B information is used to detect Interrogator Code conflicts, the Tenderer <b>shall</b> provide information on how the ADS-B information is use to detect Interrogator Code conflicts.
<b>EMS-C03-SYS-MAY-03030</b>	The System <b>may</b> be able to use ADS-B information, if enabled by an operational parameter, to detect if the errors in range and azimuth are out of specifications
<b>EMS-C03-TEN-SHA-03040</b>	When ADS-B information is used to detect if the errors in range and azimuth, the Tenderer <b>shall</b> provide information on how the ADS-B information is used to detect if the errors are out of specifications. In particular, the Tenderer details how the ADS-B information is extrapolated and compared with the Mode S detected positions to provide position error statistics.
<b>EMS-C03-SYS-SHA-03050</b>	The System <b>shall</b> be able to output the on-site ADS-B data on the Surveillance Data output.

### 3.6 Phase Overlay

<b>EMS-C03-SYS-SHA-03060</b>	The System <b>shall</b> support, without the need of any HW upgrade, an efficient phase data extraction for Mode S and ADS-B messages received with phase overlay.
<b>EMS-C03-SYS-SHA-03070</b>	The System <b>shall</b> support, without the need of any HW upgrade, an efficient Reed-Solomon ParityCorrection decoder for Mode S and ADS-B messages received with phase overlay.

<b>EMS-C03-TEN-SHA-03080</b>	The Tenderer <b>shall</b> indicate on their proposal the capability of the System, or the necessary changes, to support an efficient Low-Density Parity-Check (LDPC) decoder for ADS-B messages received with phase overlay.
<b>EMS-C03-SYS-MAY-03090</b>	The Tenderer <b>may</b> offer a Mode S phase overlay function to extract information contained in the phase of long Mode S replies (DF = 20 or 21) from phase overlay capable targets ([RD 11]).
<b>EMS-C03-SYS-SHA-03100</b>	When the Mode S phase overlay function is included, the System <b>shall</b> provide an operational parameter to enable or disable it.
<b>EMS-C03-SYS-SHA-03110</b>	When the Mode S phase overlay function is included, the System <b>shall</b> consider a target as Mode S phase overlay capable when BDS register 10 <sub>16</sub> (Data link capability report), bit 44 is set to “1”.
<b>EMS-C03-SYS-SHA-03120</b>	When the Mode S phase overlay function is included, the System <b>shall</b> be able to define a list of EHS BDS registers to be automatically and periodically extracted (different than indicated in 3.3.2) for phase overlay capable targets when the phase overlay function is enabled.
<b>EMS-C03-SYS-SHA-03130</b>	When the Mode S phase overlay function is included and enabled, the System <b>shall</b> extract the phase overlay information, from Mode S phase overlay capable targets, and include it in the corresponding Mode S target report sent to the Surveillance Data output.
<b>EMS-C03-SYS-MAY-03140</b>	The Tenderer <b>may</b> offer an ADS-B phase overlay function to extract information contained in the phase of ADS-B Extended Squitter messages from phase overlay capable targets ([RD 15])
<b>EMS-C03-SYS-SHA-03150</b>	When the ADS-B phase overlay function is included, the System <b>shall</b> provide an operational parameter to enable or disable it.
<b>EMS-C03-SYS-SHA-03160</b>	When the ADS-B phase overlay function is included and enabled, the System <b>shall</b> extract the phase overlay information, whenever available from ADS-B version 3 capable targets ([RD 15]), and include it in the corresponding ADS-B target report sent to the Surveillance Data output.

### 3.7 Cooperation Functions

#### 3.7.1 Passive Acquisition

EMS-C03-SYS-SHA-03170	The System <b>shall</b> include an interface (PAI) to perform Passive Acquisition of targets.
EMS-C03-SYS-SHA-03180	The PAI <b>shall</b> be able to receive track data messages in ASTERIX Cat. 017 format ([RD 21]).
EMS-C03-SYS-SHA-03190	The System <b>shall</b> be able to output target information as ASTERIX Cat. 017 ([RD 21]) track data messages to the external WAN network.
EMS-C03-SYS-SHA-03200	When an independent implementation of the on-site ADS-B is performed, the PAI <b>shall</b> be able to receive target report messages in ASTERIX Cat. 021 format ([RD 23]).
EMS-C03-SYS-MAY-03210	The PAI <b>may</b> be able to receive target report messages in ASTERIX Cat. 021 format ([RD 23])
EMS-C03-SYS-SHA-03220	The System <b>shall</b> provide site-dependant parameters to configure the data sources details of the target reports coming through the Passive Acquisition interface.
EMS-C03-TEN-SHA-03230	The Tenderer <b>shall</b> indicate how many external data sources can send target reports and track data messages at the same time to the PAI.
EMS-C03-SYS-SHA-03240	The PAI <b>shall</b> include a Volumetric Filtering function to limit the targets received from each data source.
EMS-C03-SYS-SHA-03250	The PAI <b>shall</b> include a function to discard the targets received if they are older than a configurable time value.
EMS-C03-TEN-SHA-03260	The Tenderer <b>shall</b> detail how the function to limit the targets received from each data source will work and which site-dependant and/or operational parameters will be used.
EMS-C03-SYS-SHA-03270	The System <b>shall</b> include a Passive Acquisition function to perform selective interrogations to new targets acquired from the PAI.
EMS-C03-SYS-SHA-03280	The System <b>shall</b> provide operational parameters, configurable separately for each cooperation data source, to enable and disable the Passive Acquisition for targets on-ground, on-air or both.



<b>EMS-C03-TEN-SHA-03290</b>	<p>The Tenderer <b>shall</b> provide a comparison on the minimum necessary Mode S all-call interrogations when using passive acquisition to acquire new targets, including at least the following situations:</p> <p>No passive acquisition cooperation;</p> <ul style="list-style-type: none"> <li>a) Passive acquisition with on-site ADS-B;</li> <li>b) Passive acquisition with track data messages from Mode S radars (complete coverage);</li> <li>c) Passive acquisition with on-site ADS-B and track data messages from Mode S radars (complete coverage)</li> </ul>
<b>EMS-C03-SYS-SHA-03300</b>	The System <b>shall</b> create the Mode S target reports with the information collected from its own interrogations.

### 3.7.2 DAP Extraction Interface

<b>EMS-C03-SYS-SHA-03310</b>	The System <b>shall</b> include a DAP Extraction Interface to receive and reply GICB requests to extract BDS registers.
<b>EMS-C03-SYS-SHA-03320</b>	The DAP Extraction Interface <b>shall</b> be able to handle GICB service messages in ASTERIX Cat. 018 format ([RD 22]).
<b>EMS-C03-SYS-SHA-03330</b>	The DAP Extraction Interface <b>shall</b> be able to handle Link Management messages in ASTERIX Cat. 018 format ([RD 22]).
<b>EMS-C03-SYS-SHA-03340</b>	The System <b>shall</b> provide a DAP Extraction Function to stop the automatic extraction of EHS BDS registers in the volume defined in the Datalink map and perform only the GICB requested through the DAP Extraction Interface.
<b>EMS-C03-SYS-SHA-03350</b>	After the DAP Extraction Function is disabled, the System <b>shall</b> go back immediately to the automatic selfextraction of EHS BDS registers in the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-03360</b>	The System <b>shall</b> provide an operational parameter to enable and disable the DAP Extraction Function.
<b>EMS-C03-SYS-SHA-03370</b>	The DAP Extraction Function <b>shall</b> be able to extract EHS BDS registers beyond the volume defined in the Datalink map, but always within the limits defined in the surveillance map.
<b>EMS-C03-SYS-SHA-03380</b>	The DAP Extraction Function <b>shall</b> be able to handle single and periodic GICB extraction requests.

<b>EMS-C03-SYS-SHA-03390</b>	Even when the ELS BDS registers are extracted automatically by the System, the DAP Extraction Function <b>shall</b> be able to force their extraction under demand.
<b>EMS-C03-SYS-SHA-03400</b>	When the DAP Extraction Function is activated but the connection with the DAP Extraction Controller is interrupted, i.e. the System doesn't receive GICB requests or keep alive messages during a defined Link Management timer, the System <b>shall</b> disable temporally the DAP Extraction Function (unavailable status) and go back to the automatic self-extraction of EHS BDS registers in the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-03410</b>	When the DAP Extraction Function is activated but temporally unavailable, and the connection with the DAP Extraction Controller is re-established, i.e. the System receives again GICB requests or keep alive messages, the System <b>shall</b> resume the DAP Extraction Function and stop the automatic extraction of EHS BDS registers in the volume defined in the Datalink map.
<b>EMS-C03-SYS-SHA-03420</b>	The System <b>shall</b> include the BDS register data obtained after performing the GICB interrogation, requested through the DAP Extraction Interface, in the Surveillance Data output in ASTERIX Cat. 048 ([RD 26]).

### 3.8 Test Targets

#### 3.8.1 Real Time Quality Control (RTQC)

<b>EMS-C03-SYS-SHA-03430</b>	The System <b>shall</b> be able to generate at least one internal test target (RTQC) to verify the correct behaviour of Receiver and the SMF.
<b>EMS-C03-TEN-SHA-03440</b>	The Tenderer <b>shall</b> indicate how many simultaneous RTQC will be available on their System.
<b>EMS-C03-TEN-SHA-03450</b>	The Tenderer <b>shall</b> indicate where the RTQC will be injected and which subsystem will cross during the receiving, decoding and processing path.
<b>EMS-C03-TEN-SHA-03460</b>	The Tenderer <b>shall</b> describe which parameters will be possible to configure for the RTQC, e.g. range/azimuth, Mode A, Mode S address, Mode C, etc.
<b>EMS-C03-SYS-SHA-03470</b>	The System <b>shall</b> be provide site-dependant parameters to enable or disable the inclusion of the RTQC data in the Surveillance Data output.

<b>EMS-C03-SYS-SHA-03480</b>	When the RTQC data is sent to the Surveillance Data output, the corresponding ASTERIX Cat. 048 ([RD 26]) target reports <b>shall</b> be labelled accordingly with the bit "TST" set to 1 within the field I048/020 (Target Report Descriptor).
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### 3.8.2 Far Field Monitor (FFM)

<b>EMS-C03-SYS-SHA-03490</b>	The Far Field Monitor (FFM) <b>shall</b> be a self-contained unit acting as a Mode S transponder with at least level 2 (as defined in [RD 1]) and located externally to the Mode S ground station site.
<b>EMS-C03-SYS-SHA-03500</b>	The FFM <b>shall</b> be a dual channel system with redundant capacity in the event of a single channel failure.
<b>EMS-C03-SYS-SHA-03510</b>	The radar processing <b>shall</b> enable the definition of multiple FFMs and provide the capability to suppress their reports from delivery to the Surveillance Data output.
<b>EMS-C03-SYS-SHA-03520</b>	<p>The FFM <b>shall</b> include the following features:</p> <ul style="list-style-type: none"> <li>a) Operation on Modes A/C, Mode A/C only all-call (intermode) and Mode S (II and SI codes);</li> <li>b) Simulated range and flight level reporting;</li> <li>c) Robustness to common-mode failure (i.e. one channel transmits in the event of failure in the other channel);</li> <li>d) Comprehensive BITE facilities to enable fault diagnosis to module level;</li> <li>e) Modular construction with plug/socket connections on all modules;</li> <li>f) Fully solid state;</li> <li>g) BITE status and configuration status is reported to CMS;</li> <li>h) Configuration is controlled by CMS or a dedicated terminal;</li> <li>i) User definable data to configure the replies;</li> <li>j) Compliance with all the requirements of [RD 1].</li> </ul>
<b>EMS-C03-TEN-SHA-03530</b>	The Tenderer <b>shall</b> advise what additional features could enhance the capability of the FFM (e.g. external frequency selection, battery back-up, power attenuation adjustment).
<b>EMS-C03-TEN-SHA-03540</b>	The Tenderer <b>shall</b> include in their proposal details of the Mode S site monitor configuration and how the changeover action is reported to the CMS.

<b>EMS-C03-SYS-SHA-03550</b>	<p>The user definable data to configure the replies <b>shall</b> include:</p> <ul style="list-style-type: none"> <li>a) The Mode S address for each channel is selectable as a 6-character Hexadecimal address;</li> <li>b) Separate pressure-altitude and identity information for each channel is selectable (in terms of octal Mode A code and FL respectively);</li> <li>c) Each code remains configured during periods of power interruption;</li> <li>d) Separate Aircraft Identification (call-sign) information for each channel is selectable. During switchover (due to equipment failure) the change of Aircraft Identification is announced by the use of the standard Mode S broadcast protocol. Such a facility will provide the System with an indication of site monitor failure;</li> <li>e) Separate range offset parameters for each channel is selectable;</li> <li>f) SI capability is selectable;</li> <li>g) It is anticipated that the data defined in (a), (b), (c) and (d) are all configurable via dedicated terminal in a portable test equipment (e.g. laptop computer);</li> <li>h) The portable test equipment is provided with each site monitor equipment.</li> </ul>
<b>EMS-C03-SYS-SHA-03560</b>	<p>In addition, the FFM <b>shall</b> provide the following test functions:</p> <ul style="list-style-type: none"> <li>a) Delivery of "active" II/SI code;</li> <li>b) Remote failure simulation by remote triggering of: <ul style="list-style-type: none"> <li>a. The Alert bit;</li> <li>b. The Downlink Capability Report announcement;</li> <li>c. Change of Flight Identity;</li> <li>d. Test RA broadcast</li> </ul> </li> </ul>
<b>EMS-C03-SYS-MAY-03570</b>	The System <b>may</b> provide operational parameters to configure the FFM test functions.
<b>EMS-C03-TEN-SHA-03580</b>	The Tenderer <b>shall</b> provide in their proposal implementation details on how the test functions will be implemented.
<b>EMS-C03-TEN-SHA-03590</b>	The Tenderer <b>shall</b> provide power budget calculations to support a FFM installation at different distance ranges, e.g. 3 NM, 5 NM, 10 NM, 15 NM, 25 NM, 50 NM, 80 NM, 120 NM and 160 NM.
<b>EMS-C03-SYS-SHA-03600</b>	The target reports for all FFMs <b>shall</b> be flagged in the Surveillance Data output as described in [RD 26] (field RAB = 1, item I048/020, ASTERIX Cat. 048).

<b>EMS-C03-SYS-MAY-03610</b>	The FFM <b>may</b> be able to reply only to one or a set of specific II/SI codes defined through a site-dependant parameter.
<b>EMS-C03-SYS-MAY-03620</b>	The FFM <b>may</b> be able to log the II/SI code of the received interrogations.
<b>EMS-C03-SYS-MAY-03630</b>	The FFM <b>may</b> be able to log statistical information with the type and number of interrogations that is receiving per second per II/SI code.

### 3.9 Cone of Silence

<b>EMS-C03-SYS-SHA-03640</b>	The System <b>shall</b> be able to maintain the tracks of up to 12 targets simultaneously through the CoS using historical data, so as to facilitate target to track correlation following the targets exit from the Cone of Silence.
<b>EMS-C03-SYS-SHA-03650</b>	The System <b>shall</b> respect the interrogations limits defined in 3.2, i.e. transmitted interrogations per second and replies triggered for a target that is not locked out, for any target within the CoS.
<b>EMS-C03-TEN-SHA-03660</b>	The Tenderer <b>shall</b> provide information about how the System processes the targets entering, inside or exiting the CoS. This information details all the System parameters involved in the CoS processing.
<b>EMS-C03-TEN-SHA-03670</b>	The Tenderer <b>shall</b> provide details on how the System manage the interrogations and lockout process to minimise the triggering of Mode S all-call replies from targets inside the CoS.
<b>EMS-C03-TEN-SHA-03680</b>	The Tenderer <b>shall</b> provide information about the maximum number of tracks maintained inside the CoS and the conditions (e.g. time, number of scans, etc.) to discard them.
<b>EMS-C03-SYS-SHO-03690</b>	The System <b>should</b> provide an operational parameter to define a CoS filtering angle where the targets, i.e. inside the CoS filtering angle, are not transmitted to the Surveillance Data output.

### 3.10 Ground, Pressure-altitude and Speed Suppression

<b>EMS-C03-SYS-SHO-03700</b>	The System <b>should</b> provide operational parameters to enable the suppression in configurable areas (range and azimuth) of the Surveillance Data outputs of targets reported to be on ground.
<b>EMS-C03-TEN-SHO-03710</b>	The Tender <b>should</b> provide information on how the ground suppression will be implemented and which operational parameters will be used.

<b>EMS-C03-SYS-SHO-03720</b>	The System <b>should</b> provide operational parameters to enable the suppression in the Surveillance Data outputs of targets within a defined pressure-altitude and/or speed interval.
<b>EMS-C03-SYS-SHO-03730</b>	The operational parameters for the suppression of targets within a defined pressure-altitude and/or speed interval <b>should</b> allow configuration by ranges and azimuths.
<b>EMS-C03-TEN-SHO-03740</b>	The Tender <b>should</b> provide information on how the pressure-altitude and speed suppression will be implemented and which operational parameters will be used.

### 3.11 Radio Protection

#### 3.11.1 Jamming

<b>EMS-C03-TEN-MAY-03750</b>	The Tenderer <b>may</b> offer in their response a jamming detection function to protect the Mode S processing system and announce the jamming in the Surveillance Data output.
<b>EMS-C03-SYS-SHA-03760</b>	When the Jamming detection function is included, the System <b>shall</b> announce in the Surveillance Data output, through Jamming Strobe Messages in ASTERIX Cat. 034 ([RD 25]), when a jamming strobe is detected.
<b>EMS-C03-SYS-SHA-03770</b>	When the Jamming detection function is included, the System <b>shall</b> be able to identify azimuth intervals where signals, CW or pulsed CW, can saturate or overload the receiver and video signal processing of the System.
<b>EMS-C03-SYS-SHA-03780</b>	When the Jamming detection function is included, the System <b>shall</b> suppress temporarily (e.g. until the interference disappear), if enabled by an operational parameter, the Surveillance Data output for the Jamming Strobe sectors.
<b>EMS-C03-TEN-SHA-03790</b>	When the Jamming detection function is included, the Tenderer <b>shall</b> describe which indicators will use to detect a possible Jammer and how the System will suppress the affected sector in the Surveillance Data output, e.g. azimuth size and time of the suppression.

#### 3.11.2 Solar Storms

<b>EMS-C03-TEN-MAY-03800</b>	The Tenderer <b>may</b> offer in their response a solar storm detection function to protect the Mode S processing system and announce the solar storm in the Surveillance Data output.
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<b>EMS-C03-SYS-SHA-03810</b>	When the solar storm detection function is included, the System <b>shall</b> announce in the Surveillance Data output, through Solar Storm Messages in ASTERIX Cat. 034 ([RD 25]), when a Solar Storm is detected.
<b>EMS-C03-SYS-SHA-03820</b>	When the solar storm detection function is included, the System <b>shall</b> be able to use its location (latitude, longitude and altitude) and the current date and time to calculate the Sun position.
<b>EMS-C03-SYS-SHO-03830</b>	When the solar storm detection function is included, the System <b>should</b> detect a possible Solar storm when: <ul style="list-style-type: none"> <li>a) The number of replies non-correlated to targets is increased in the azimuth of the Sun position;</li> <li>b) The number of initializations of new targets that disappear after 1 or 2 scans raise up very quickly in the azimuth of the Sun position;</li> <li>c) The Sun holds an elevation below 20 degrees.</li> </ul>
<b>EMS-C03-SYS-MAY-03840</b>	When the solar storm detection function is included, the System <b>may</b> suppress temporarily (e.g. until the interference disappear), if enabled by an operational parameter, the Surveillance Data output for the Solar Storm sectors.
<b>EMS-C03-TEN-SHA-03850</b>	When the solar storm detection function is included, the Tenderer <b>shall</b> describe which indicators will use to detect a possible Solar Storm and how the System will suppress the affected sector in the Surveillance Data output, e.g. azimuth size and time of the suppression.

### 3.12 ETSI EN 303 363-1

<b>ETSI EN 303 363-1</b>	Mode S <b>shall</b> comply with ETSI EN 303 363-1 (V1.1.1) (2022-02) Air Traffic Control Surveillance Radar Sensors; Secondary Surveillance Radar (SSR); Harmonised Standard for access to radio spectrum; Part 1: SSR Interrogator.
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..... end of Mode-S Specification (Part A) .....

#### 4 Subchapter B – Mode-S Specification (Part B)

The Compliance Matrix for Mode S Specification (Part B) is based on Eurocontrol EMS 4.0 and is an integral part of the tender and is located in Annex no.1, **Compliance Matrix tab B – Mode S (Part B)**.

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted the in color.

##### 4.1 System Interfaces

EMS-C04-CON-SHA-03860	The Contractor <b>shall</b> be wholly responsible for the consistency and correct working of all interfaces between equipment and subsystems within the complete Mode S ground station as specified in this document.
EMS-C04-SYS-SHA-03870	The System <b>shall</b> provide interfaces at least for: <ul style="list-style-type: none"><li>a) Surveillance users;</li><li>b) Passive Acquisition cooperation;</li><li>c) DAP Extraction cooperation;</li><li>d) Time Synchronization;</li><li>e) Coverage Maps;</li><li>f) The Control and Monitoring System;</li><li>g) The Local Display;</li><li>h) The Data Recorder and Playback;</li><li>i) Performance Analysis Tools.</li></ul>

##### 4.2 Network

###### 4.2.1 LAN and WAN

EMS-C04-SYS-SHO-03880	The System <b>should</b> have at least 2 internal LAN interfaces to provide redundant communication to all its systems/subsystems.
EMS-C04-SYS-SHA-03890	The System <b>shall</b> have at least 2 external WAN interfaces to exchange data with remote locations.



<b>EMS-C04-SYS-SHA-03900</b>	The LAN communication <b>shall</b> be based on Ethernet at least 100BASE-T (IEEE 802.3-2008) with support to IPv4 as Network layer and UDP (unicast and/or multicast) and TCP as Transport layer.
<b>EMS-C04-SYS-SHA-03910</b>	The WAN communication <b>shall</b> be based on Ethernet at least 100BASE-T (IEEE 802.3-2008) with support to IPv4 as Network layer and UDP (unicast and/or multicast) and TCP as Transport layer.
<b>EMS-C04-SYS-SHO-03920</b>	The WAN communication <b>should</b> support, in addition to IPv4, IPv6 as Network layer protocol.
<b>EMS-C04-SYS-MAY-03930</b>	In addition to the Ethernet interfaces, the WAN communication <b>may</b> include at least 2 serial interfaces based on RS-232/V.24 and/or RS-422/V.11 as physical layer and with X.25 or HDLC Lap-B as communication protocols with a configurable data rate.
<b>EMS-C04-TEN-SHA-03940</b>	When WAN serial interfaces are offered, the Tenderer <b>shall</b> state in their proposal the number and type of interfaces and the minimum data rates for each data stream type, considering the prevision of increase in the traffic load and the protocol headers, to avoid queuing delays.
<b>EMS-C04-SYS-SHA-03950</b>	Protocols employed within the System <b>shall</b> comply with their respectively standards, e.g. IPv4 ([RD 38]), IPv6 ([RD 39]), TCP ([RD 40]), UDP ([RD 41]), V.24 ([RD 36]), V.11 ([RD 37]), X.25 ([RD 34]), HDLC Lap-B ([RD 35]), etc.
<b>EMS-C04-TEN-SHA-03960</b>	The Tenderer <b>shall</b> detail which type of messages (protocol and format) will use the different systems/subsystem to communicate between them within the 2 internal LAN networks.

#### 4.2.2 External data Streams

<b>EMS-C04-SYS-SHA-03970</b>	<p>The System <b>shall</b> be able to configure different types of data streams for the data crossing the external WAN interfaces, including at least:</p> <ul style="list-style-type: none"> <li>a) Surveillance data (output);</li> <li>b) Surveillance cooperation data (input and output);</li> <li>c) Remote NTP messages (input);</li> <li>d) CMS messages (input and output);</li> <li>e) System status messages (output).</li> </ul>
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<b>EMS-C04-SYS-SHO-03980</b>	<p>The System <b>should</b> provide site-dependent parameters to configure data streams for the data crossing the external interfaces, including at least:</p> <ul style="list-style-type: none"> <li>a) Data stream name;</li> <li>b) External interface identifier;</li> <li>c) Data stream type (e.g. Surveillance data, remote NTP messages);</li> <li>d) Data stream format (e.g. ASTERIX Cat. 034/48, Cat. 017, NTP messages);</li> <li>e) Type of Target Report (e.g. plot or track), if applicable;</li> <li>f) Transport protocol (e.g. TCP, UDP unicast/multicast);</li> <li>g) Source IP address and Port;</li> <li>h) Destination IP address and Port;</li> <li>i) Netmask and Gateway.</li> </ul>
<b>EMS-C04-SYS-SHA-03990</b>	<p>The type of target report <b>shall</b> be selectable for each Surveillance data stream between:</p> <ul style="list-style-type: none"> <li>a) Plots;</li> <li>b) Tracks;</li> <li>c) Tracks with extrapolated misses (5.4.1.1).</li> </ul>
<b>EMS-C04-TEN-SHA-04000</b>	The Tenderer <b>shall</b> provide details on how the data streams will be configured and which parameters will be available.
<b>EMS-C04-SYS-SHA-04010</b>	The System <b>shall</b> support the creation of at least 6 independent data streams for the Surveillance Data output streams.
<b>EMS-C04-SYS-SHA-04020</b>	Each surveillance data stream <b>shall</b> be able to output Mode S target reports and service messages in ASTERIX Cat. 034/048 ([RD 25] / [RD 26]) and/or ADS-B target reports in ASTERIX Cat. 021 ([RD 23])
<b>EMS-C04-SYS-SHA-04030</b>	<p>Each surveillance data stream with ADS-B target reports in ASTERIX Cat. 021 ([RD 23]) <b>shall</b> be selectable between:</p> <ul style="list-style-type: none"> <li>a) Event driven output;</li> <li>b) Periodic output, with update interval (<math>\leq 5</math> s) and data age selectable.</li> </ul>
<b>EMS-C04-TEN-SHA-04040</b>	The Tenderer <b>shall</b> provide details of the update interval and data age configurations of the periodic output for surveillance data stream with ADS-B target reports.

EMS-C04-SYS-SHA-04050	The System <b>shall</b> support the creation of at least 6 independent data streams for the surveillance cooperation data streams.
EMS-C04-SYS-SHA-04060	Each surveillance cooperation data stream <b>shall</b> be able to input track data messages in ASTERIX Cat. 017 format ([RD 21]).
EMS-C04-SYS-SHA-04070	Each surveillance cooperation data stream <b>shall</b> be able to output track data messages in ASTERIX Cat. 017 format ([RD 21]).
EMS-C04-SYS-SHA-04080	When an independent implementation of the on-site ADS-B is performed, each surveillance cooperation data stream <b>shall</b> be able to input target report messages in ASTERIX Cat. 021 format ([RD 23]).
EMS-C04-SYS-MAY-04090	Each surveillance cooperation data stream <b>may</b> be able to input target report messages in ASTERIX Cat. 021 format ([RD 23]).
EMS-C04-SYS-SHA-04100	Each surveillance cooperation data stream <b>shall</b> be able to input and output GICB service messages and Link Management messages in ASTERIX Cat. 018 format ([RD 22]).
EMS-C04-SYS-SHA-04110	The System <b>shall</b> support the creation of at least 2 data streams for the remote NTP messages.
EMS-C04-TEN-SHA-04120	The Tenderer <b>shall</b> explain how many data streams will be dedicated for CMS messages and which will be the messages format(s).
EMS-C04-SYS-SHA-04130	Each data stream of the System transmitting surveillance data or receiving surveillance cooperation data <b>shall</b> support an average rate of at least 300 messages/second.
EMS-C04-TEN-SHA-04140	The Tender <b>shall</b> indicate the limitations in the messages/second per each type of data stream (e.g. surveillance data, remote NTP messages, etc.).
EMS-C04-SYS-SHO-04150	The System <b>should</b> support the creation of at least 2 data streams for System status messages.
EMS-C04-SYS-SHO-04160	Each System Status data stream <b>should</b> be able to output Ground System Status Reports in ASTERIX Cat. 025 format ([RD 24]).

<b>EMS-C04-TEN-SHA-04170</b>	When the System is able to output Ground System Status Reports ([RD 24]), the Tenderer <b>shall</b> indicate with subsystems, components, services, error types and statistics will be monitored.
<b>EMS-C04-SYS-SHA-04180</b>	Each System Status data stream <b>shall</b> be able to output Version Number Exchange messages in ASTERIX Cat. 247 ([RD 27]).

#### 4.2.3 ASTERIX Protocol

<b>EMS-C04-SYS-SHA-04190</b>	<p>The System <b>shall</b> conform to the requirements of the following ASTERIX ([RD 20]) messages types:</p> <ul style="list-style-type: none"> <li>a) Cat. 017, Mode S Surveillance Coordination Function Messages ([RD 21]);</li> <li>b) Cat. 018, Mode S Datalink Function Messages ([RD 22]);</li> <li>c) Cat. 021, ADS-B Target Reports ([RD 23]);</li> <li>d) Cat. 034, Transmission of Monoradar Service Messages ([RD 25]);</li> <li>e) Cat. 048, Transmission of Monoradar Target Reports ([RD 26]).</li> <li>f) Cat. 247, Version Number Exchange ([RD 27]).</li> </ul>
<b>EMS-C04-SYS-SHO-04200</b>	<p>The System <b>should</b> conform to the requirements of the following ASTERIX ([RD 20]) messages types:</p> <ul style="list-style-type: none"> <li>a) Cat. 025, CNS/ATM Ground System Status ([RD 24]);</li> </ul> <p><i>RATIONALE: The System is expected to conform to the latest edition available of the ASTERIX specifications as presented in the EUROCONTROL ASTERIX library (<a href="http://www.eurocontrol.int/asterix">www.eurocontrol.int/asterix</a>)</i></p>
<b>EMS-C04-SYS-SHA-04210</b>	Design precautions <b>shall</b> be taken to minimise the impact and the necessary effort to accommodate the introduction of ASTERIX format modifications; in particular to avoid any recompilation when upgrading these formats.
<b>EMS-C04-CON-SHA-04220</b>	The Contractor <b>shall</b> supply the Interface Control Documents (ICD) for the ASTERIX message types included in the System.

#### 4.3 Time Synchronization

Requirements on Time Synchronization are in Subchapter E– System (Part A).

#### 4.4 Coverage Maps

EMS-C04-SYS-SHA-04420	The System <b>shall</b> be able to store and load coverage maps with an ICD as described in [RD 31].
EMS-C04-SYS-SHA-04430	The System <b>shall</b> be able to select the applicable coverage maps: <ul style="list-style-type: none"><li>a) Manually, by an operator through the local or remote CMS;</li><li>b) Automatically, by a programmable time.</li></ul>
EMS-C04-SYS-SHA-04440	The applicable coverage maps <b>shall</b> be the same in both redundant channels of the Processing System.
EMS-C04-SYS-SHA-04450	The System <b>shall</b> be able to store and load the following coverage maps: <ul style="list-style-type: none"><li>a) Surveillance map;</li><li>b) Lockout map;</li><li>c) Datalink map.</li></ul>
EMS-C04-SYS-SHA-04460	If a failure in the application of the lockout map is detected, the System <b>shall</b> stop immediately Mode S operation.
EMS-C04-CON-SHA-04470	The Contractor <b>shall</b> agree with the Contracting Authority on the SSR-only MIP that will be used in case of failure in the application of the lockout map.
EMS-C04-TEN-SHA-04480	The Tenderer <b>shall</b> provide details of when a failure in the use of the coverage maps can occur.

#### 4.5 System Parameters

Requirements on System Parameters are in Subchapter E– System (Part A).

#### 4.6 Control and Monitoring System

Requirements on Control and Monitoring System are in Subchapter E– System (Part A).

#### 4.7 Real Time Monitoring

EMS-C04-SYS-SHA-04970	The monitoring function <b>shall</b> be accessible through the CMS.
EMS-C04-SYS-SHA-04980	<p>The System <b>shall</b> monitor the number of reports per scan sent through each Surveillance Data output stream, including at least:</p> <ul style="list-style-type: none"> <li>a) Number of solo Mode S reports;</li> <li>b) Number of solo SSR reports;</li> <li>c) Number of combined SSR/ Mode S reports;</li> <li>d) Number of service messages;</li> <li>e) Number of ADS-B reports;</li> <li>f) Number of Splits plots;</li> <li>g) Number of code swaps;</li> <li>h) Number of reports with duplicated Mode S address;</li> <li>i) Number of test transponders;</li> <li>j) Number of test targets.</li> </ul>
EMS-C04-SYS-SHA-04990	The System <b>shall</b> monitor the data rate in each configured surveillance data streams.
EMS-C04-SYS-SHA-05000	The System <b>shall</b> monitor the CPU load on the different processing boards.
EMS-C04-SYS-SHA-05010	The System <b>shall</b> monitor the number of FRUIT received per sector.
EMS-C04-SYS-SHA-05020	The System <b>shall</b> raise a warning in the CMS if the FRUIT rate is greater than a configurable operational parameter.
EMS-C04-SYS-SHA-05030	The System <b>shall</b> be able to report Mode A/C FRUIT rates per sector, when a warning is raised, in item I034/070 of the ASTERIX Cat. 034 Service Messages ([RD 25]).
EMS-C04-SYS-SHA-05040	The System <b>shall</b> be able to report Mode S FRUIT rates per sector, when a warning is raised, in item I034/070 of the ASTERIX Cat. 034 Service Messages ([RD 25]).
EMS-C04-SYS-SHA-05050	The System <b>shall</b> monitor the re-interrogations per sector.
EMS-C04-SYS-SHA-05060	The System <b>shall</b> raise a warning in the CMS if the re-interrogation rate is greater than a configurable operational parameter.

<b>EMS-C04-SYS-SHA-05070</b>	The System <b>shall</b> be able to report re-interrogation rates per sector, when a warning is raised, in item I034/070 of the ASTERIX Cat. 034 Service Messages ([RD 25]).
<b>EMS-C04-SYS-SHA-05080</b>	The System <b>shall</b> monitor BDS swaps and mismatched DF replies and report these situations in item I048/030 of the ASTERIX Cat. 048 target reports ([RD 24]).
<b>EMS-C04-SYS-SHA-05090</b>	The System <b>shall</b> raise a warning in the CMS if the BDS swap and mismatching DF reply rate per sector is greater than a configurable operational parameter.
<b>EMS-C04-SYS-SHA-05100</b>	The System <b>shall</b> be able to report BDS swap and mismatched DF reply rates per sector, when a warning is raised, in item I034/070 of the ASTERIX Cat. 034 Service Messages ([RD 25]).
<b>EMS-C04-SYS-SHA-05110</b>	The System <b>shall</b> monitor the OBA look up table with the opportunity traffic.
<b>EMS-C04-SYS-SHA-05120</b>	The System <b>shall</b> raise a warning, based on a configurable threshold, in the CMS if the OBA look up table is detected to be invalid.
<b>EMS-C04-SYS-SHA-05130</b>	The System <b>shall</b> be able to report amplitude, run length and number of received replies in item I048/130 of the ASTERIX Cat. 048 ([RD 25]) for each target report sent to the Surveillance Data output.
<b>EMS-C04-SYS-SHA-05140</b>	The System <b>shall</b> be able to identify Mode S transponders replying to Mode A/C only all-call interrogations with SSR Replies in item I048/030 of the ASTERIX Cat. 048 target reports ([RD 26]).
<b>EMS-C04-SYS-MAY-05150</b>	The System <b>may</b> monitor the Targets Interrogation/Reply rate per sector based on target IRM messages, i.e. based on ADS-B Extended Squitters with IRM messages (type 24, subtype 2 and 3, or phase overlay types 3 and 9).

#### 4.8 Built In Test Equipment (BITE)

Requirements on Built In Test Equipment are in Subchapter E– System (Part A).

#### 4.9 LOG

Requirements on LOG are in Subchapter E– System (Part A).

#### 4.10 Local Display

Requirements on Local Display are in Subchapter E– System (Part A).

#### 4.11 Data Recorder and Playback

<b>EMS-C04-TEN-SHA-05540</b>	<p>The Tenderer <b>shall</b> provide in their proposal details of the record/replay facilities (i.e. Data Recorder and Playback) which is used to evaluate surveillance data and details on how these facilities are connected with the System.</p> <p><i>Please see Figure 4-B: Data Recorder and Playback access points in EUROCONTROL EMS ver 4.0 document.</i></p>
<b>EMS-C04-SYS-SHA-05550</b>	<p>The Data Recorder and Playback <b>shall</b> be capable of recording and replaying of the following timestamped data:</p> <ul style="list-style-type: none"><li>a) Surveillance Data output:<ul style="list-style-type: none"><li>a. Monoradar target reports (ASTERIX Cat. 048, [RD 26]) and service messages (ASTERIX Cat. 034, [RD 25]);</li><li>b. ADS-B target reports (ASTERIX Cat. 021, [RD 23]).</li></ul></li><li>b) Status information (time, date, scan number, etc.);</li><li>c) Data flagged as Anomalies and false in the PAF and NOT sent to the Surveillance Data output;</li><li>d) Interrogation instructions;</li><li>e) Mode A/C and Mode S reply report data (from RTCC function);</li><li>f) Passive Acquisition data:<ul style="list-style-type: none"><li>a. Incoming ADS-B target reports (ASTERIX Cat. 021, [RD 23]);</li><li>b. Incoming/Outgoing Track data messages (ASTERIX Cat. 017, [RD 21]).</li></ul></li><li>g) The EHS GICB requests received from the DAP Extraction Interface (ASTERIX Cat. 018, [RD 22]).</li></ul> <p><i>RATIONALE: Monoradar target reports include Mode S, SSR, PSR and combined reports.</i></p>
<b>EMS-C04-SYS-SHA-05560</b>	<p>The Data Recorder and Playback <b>shall</b> record the same Surveillance Data as available in the external WAN interface.</p>
<b>EMS-C04-SYS-SHA-05570</b>	<p>The Data Recorder and Playback <b>shall</b> be capable of recording up to four subsets of data simultaneously.</p>
<b>EMS-C04-TEN-SHA-05580</b>	<p>The Tenderer <b>shall</b> provide details in their proposal of the method used to store the recordings.</p>



<b>EMS-C04-SYS-SHA-05590</b>	The Data Recorder and Playback <b>shall</b> be capable to perform ad-hoc and periodic recordings for up to 24 hours without interrogation instructions and reply report data (2 hours with interrogation instructions or reply report data) with the System operating at full capacity.
<b>EMS-C04-TEN-SHA-05600</b>	The Tenderer <b>shall</b> provide details on how the periodic recordings will be configured.
<b>EMS-C04-SYS-SHA-05610</b>	The Data Recorder and Playback <b>shall</b> be able to replay only a subset of the recorded data.
<b>EMS-C04-TEN-SHA-05620</b>	The Tenderer <b>shall</b> provide in the response the proposed method for data recording and playback, stating the expected maximum duration for different subsets of data.
<b>EMS-C04-SYS-MAY-05630</b>	The Data Recorder and Playback <b>may</b> be capable of recording and replaying the following time-stamped data together with azimuth information: <ul style="list-style-type: none"> <li>a) SSR quantised processed SUM video signals;</li> <li>b) Mode S quantised processed SUM video signals;</li> <li>c) ADS-B quantised processed video signals (if integrated on-site ADS-B).</li> </ul>
<b>EMS-C04-TEN-SHA-05640</b>	When offered, the Tenderer <b>shall</b> provide information in their response of the preferred approach to record and replay the quantized processed video signals.
<b>EMS-C04-SYS-SHA-05650</b>	Control of data recording <b>shall</b> be via the operator interface.
<b>EMS-C04-SYS-SHA-05660</b>	The medium to be used for digital recording <b>shall</b> allow recordings to be replayed for analysis on another computer.
<b>EMS-C04-SYS-SHA-05670</b>	The Data Recorder and Playback <b>shall</b> be able to record, store, replay and export ASTERIX files at least in raw ([RD 20]) and/or final format ([RD 28]).
<b>EMS-C04-SYS-MAY-05680</b>	The Data Recorder and Playback <b>may</b> include a lossless compression algorithm to store and export the ASTERIX recordings.
<b>EMS-C04-SYS-SHO-05690</b>	It <b>should</b> be possible filter the record or replay by any logical and/or combination of the following criteria: <ul style="list-style-type: none"> <li>a) All targets within a static volume bounded by any azimuth, range and pressure-altitude interval;</li> <li>b) Targets with selected Mode A codes (from a definable list of up to 20 Mode A codes);</li> <li>c) All targets Mode S addresses selected (from a definable list of up to 20 Mode S addresses);</li> <li>d) All plot data which falls within a dynamic box (size defined by the user). The centre of the box to be given by a target defined as in (b) or (c) above;</li> <li>e) All data described as 'anomaly' or 'false'.</li> </ul>

#### 4.12 Cyber Security

Requirements on Cyber Security are in Subchapter E– System (Part A).

#### 4.13 Test Interfaces

EMS-C04-SYS-SHA-05910	The System <b>shall</b> provide interfaces to allow analysis, maintenance and troubleshooting activities.
EMS-C04-SYS-SHA-05920	The System <b>shall</b> provide an interface to monitor the transmitted modulated signals from the Sum and Control channels.
EMS-C04-SYS-MAY-05930	The interface to monitor the transmitted modulated signals <b>may</b> include means to provide a monitoring signal with a maximum power of 15 dBm (i.e. 0.32 kW) without the need of additional external passive elements.
EMS-C04-SYS-MAY-05940	The System <b>may</b> provide an interface to monitor the transmitter base band signal before modulation.
EMS-C04-SYS-MAY-05950	The System <b>may</b> provide an interface to record the transmitter interrogations in a computer file format.
EMS-C04-SYS-SHA-05960	When an interface to record the transmitter interrogations is included, each recorded interrogation <b>shall</b> include at least a UTC time stamp, the power level and all the data contained.
EMS-C04-TEN-SHA-05970	The Tenderer <b>shall</b> indicate which interfaces will be available to monitor the Transmitter and which physical interfaces or digital formats will be used.
EMS-C04-CON-SHA-05980	The Contractor <b>shall</b> provide the ICD of any digital format used in the test interfaces to monitor the Transmitter.
EMS-C04-SYS-SHA-05990	The System <b>shall</b> provide an interface to monitor the received signals.
EMS-C04-SYS-MAY-06000	The System <b>may</b> provide an interface to record the received signals in IQ digital format.
EMS-C04-SYS-MAY-06010	The System <b>may</b> provide an interface to record the received replies in a computer file format.
EMS-C04-SYS-SHA-06020	When an interface to record the transmitter interrogations is included, each received reply to be recorded in a file format <b>shall</b> include at least a UTC time stamp, the received power and OBI levels, and all the decoded data contained.

<b>EMS-C04-TEN-SHA-06030</b>	The Tenderer <b>shall</b> indicate which interfaces will be available to monitor the Receiver and which physical interfaces or digital formats will be used.
<b>EMS-C04-CON-SHA-06040</b>	The Contractor <b>shall</b> provide the ICD of any digital format used in the test interfaces to monitor the Receiver.
<b>EMS-C04-SYS-SHA-06050</b>	The System <b>shall</b> provide an interface to monitor the azimuth data signals, e.g. in TTL video format.
<b>EMS-C04-TEN-SHA-06060</b>	The Tenderer <b>shall</b> indicate which interfaces will be available to monitor the data azimuth signals and which physical interfaces will be used.
<b>EMS-C04-SYS-SHA-06070</b>	The System <b>shall</b> provide an interface to record the Surveillance Data output.
<b>EMS-C04-TEN-SHA-06080</b>	The Tenderer <b>shall</b> provide details, including which items are available at no cost, and those requiring development, of all equipment considered necessary to provide analysis of the Mode S ground station functionality and interfaces that cannot be achieved using standard performance tools.

#### 4.14 System Interconnections

<b>EMS-C04-TEN-SHA-06090</b>	The Tenderer <b>shall</b> provide in their proposal system diagrams for the Mode S ground station showing the proposed system configurations, equipment types and interconnections.
<b>EMS-C04-TEN-SHA-06100</b>	Where appropriate, specific details <b>shall</b> be given for signals, data formats, etc., particularly where an interface is required between the Mode S ground station being provided against this specification, and another system outside the scope of this specification.
<b>EMS-C04-TEN-SHA-06110</b>	In other areas, where interface details have yet to be decided, general information <b>shall</b> be given by the Tenderer. The specific details of these interfaces will be defined and agreed with the Contracting Authority after contract award.
<b>EMS-C04-TEN-SHA-06120</b>	For the rotating antenna the Tenderer <b>shall</b> provide, in their proposal, detailed specifications of the rotating joints, with drawings, to meet the Mode S performance and interface requirements.
<b>EMS-C04-TEN-SHA-06130</b>	The System <b>shall</b> allow connection to a power distribution network supplying a nominal line voltage of 3 phase 400 V [-6%, +10%] of frequency 50 Hz [±2%]

## 5 Processing System

### 5.1 Logical Blocks

EMS-C05-TEN-SHA-06140	The Tenderer <b>shall</b> include in their proposal a Processing block diagram showing the functionalities and the differences with the logic blocks indicated in this Specification.
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### 5.2 System Management Function (SMF)

EMS-C05-SYS-SHA-06150	<p>The System <b>shall</b> include a System Management Function (SMF) which contains the following subfunctions:</p> <ul style="list-style-type: none"> <li>a) Real Time Channel Controller function (RTCC) containing: <ul style="list-style-type: none"> <li>a. A Mode A/C reply processor;</li> <li>b. A Mode S reply processor;</li> <li>c. An interrogation scheduler.</li> </ul> </li> <li>b) Link Controller function (LC) containing: <ul style="list-style-type: none"> <li>a. Plot Assignor Function (PAF);</li> <li>b. Station Selective Roll-Call lists;</li> <li>c. Communications Management Processor (CMP);</li> <li>d. Mode S Link Management Processor (LMP).</li> </ul> </li> </ul> <p><i>Please see Figure 5-A: System Management Function (SMF) overview in EUROCONTROL EMS ver. 4.0 document</i></p>
EMS-C05-TEN-SHA-06160	The Tenderer <b>shall</b> include in their proposal a block diagram showing the functionalities and input/output ports of the SMF, and detail any differences and the reason for the different approach.
EMS-C05-SYS-SHA-06170	The SMF <b>shall</b> be able to receive and process reply data from the Interrogator when it the replies are consistent with the requirements of 2.6.8.
EMS-C05-SYS-SHA-06180	The SMF <b>shall</b> be able to form plots for all targets and output them to the Surveillance Data output.
EMS-C05-SYS-SHA-06190	The SMF <b>shall</b> be able to take in uplink transactions from the DLF and the surveillance updates, to combine them and to output them to the Interrogator at a rate which meet the maximum interrogation rates specified in 3.1, 3.3.3 and [RD 1].
EMS-C05-SYS-SHA-06200	The surveillance update interrogations <b>shall</b> have priority over the DLF interrogations when the interrogation rates exceed the defined limits.

<b>EMS-C05-SYS-SHA-06210</b>	The SMF <b>shall</b> be able to process downlink transactions generated both by requests from the ground system and by transactions initiated by the airborne system (i.e. GICB and Comm-B broadcast).
<b>EMS-C05-TEN-SHA-06220</b>	The Tenderer <b>shall</b> include in their proposal details of the SMF functionalities.
<b>EMS-C05-SYS-SHA-06230</b>	<p>The SMF <b>shall</b> have interfaces to:</p> <ul style="list-style-type: none"> <li>a) The data azimuth signals of the antenna system, to receive information on the azimuth of the boresight of the beam when replies are received;</li> <li>b) The Interrogator: <ul style="list-style-type: none"> <li>a. To send interrogation modulation commands (including power level, probability of reply and Lockout flags) and data content;</li> <li>b. To obtain processed video and Off Boresight Information (OBI) for all reply pulses.</li> </ul> </li> <li>c) The Surveillance Data output, to provide ASTERIX target report data;</li> <li>d) The DLF, to obtain uplink transactions for sending to the targets and to send back received downlink transactions;</li> <li>e) Control and Monitoring System (CMS), to enable the control and monitoring functions to be performed;</li> <li>f) NTP time servers, to serve as a time reference and permit time stamping of plots, etc.</li> </ul>
<b>EMS-C05-TEN-SHA-06240</b>	The Tenderer <b>shall</b> include in their proposal's details of any changes, additions, deletions, etc. to the SMF interfaces described, stating the reasons for the different approach.

### 5.3 Real Time Channel Controller Function (RTCC)

<b>EMS-C05-SYS-SHA-06250</b>	The Real Time Channel Controller function (RTCC), by using interrogation algorithms, employing interlacing and azimuth offset techniques (where message delivery azimuth is optimised with respect to interrogation type and priority) combined with Mode S specific services interrogation requests from the LC function, <b>shall</b> schedule the interrogations to be sent to the transmitter.
<b>EMS-C05-SYS-SHA-06260</b>	The System <b>shall</b> be designed to optimise the number of transactions (i.e. minimising the number of interrogations/replies required whilst also making most efficient use of the available channel time).
<b>EMS-C05-SYS-SHA-06270</b>	The resulting replies received from the video processor function are processed by the Mode A/C reply processor, the Mode S reply processor and the ADS-B reply processor (if integrated implementation) to create a report for each reply before it is sent to the LC function.

<b>EMS-C05-TEN-SHA-06280</b>	The tenderer <b>shall</b> provide information on how the System will proceed if a valid Mode 'S' reply is not decoded in the expected listening period.
<b>EMS-C05-SYS-SHA-06290</b>	As a minimum, the Mode S Reply Processing <b>shall</b> perform preamble detection and error detection and correction.
<b>EMS-C05-TEN-SHA-06300</b>	The Tenderer <b>shall</b> include in their proposal details of the operation of the RTCC function, including details of the Mode A/C Reply Process, Mode S reply process, ADS-B reply process (if integrated implementation), scheduler and performance monitoring indicator.
<b>EMS-C05-SYS-SHA-06310</b>	The interrogation scheduler shall: <ul style="list-style-type: none"> <li>a) Control the rate and content of the Mode S only all-call interrogations;</li> <li>b) Control variable all-call interrogation scheduling (which allows for the concatenation of Selective periods);</li> <li>c) Control the rate of intermode mode A/C only all-call interrogations;</li> <li>d) Control the rate of Modes A and C interrogations;</li> <li>e) Control the timing of the Mode S selective interrogations.</li> </ul>
<b>EMS-C05-SYS-SHA-06320</b>	The RTCC function <b>shall</b> be monitored via the Control and Monitoring System (CMS)
<b>EMS-C05-TEN-SHA-06330</b>	The Tenderer <b>shall</b> provide in their proposal details of how the RTCC function will be monitored in the CMS.

#### 5.4 Link Controller Function (LC)

<b>EMS-C05-SYS-SHA-06340</b>	The Link Controller function (LC) <b>shall</b> pass Mode S specific services requested interrogations to the RTCC function for action.
<b>EMS-C05-SYS-SHA-06350</b>	The Mode A/C, the Mode S and the ADS-B (if integrated implementation) replies received from the RTCC function <b>shall</b> be sent to the Plot Assignor Function (PAF) in order to track targets.
<b>EMS-C05-SYS-SHA-06360</b>	GICB replies <b>shall</b> be sent to plot formatting for delivery as Enhanced Surveillance data in the Surveillance Data output.
<b>EMS-C05-SYSTEM-SHA-06370</b>	The Tenderer <b>shall</b> provide information on how he will achieve the enhancement of plot data with the GICB replies in the ASTERIX format.

<b>EMS-C05-SYS-SHA-06380</b>	The LC function <b>shall</b> be monitored via the Control and Monitoring System (CMS).
<b>EMS-C05-TEN-SHA-06390</b>	The Tenderer <b>shall</b> provide in their proposal details of how the LC function will be monitored in the CMS.

#### 5.4.1 Plot Assignor Function (PAF)

<b>EMS-C05-SYS-SHA-06400</b>	<p>The Plot Assignor Function (PAF) <b>shall</b> include at least the following sub-functions:</p> <ul style="list-style-type: none"> <li>a) Track initialisation, maintenance and prediction;</li> <li>b) False target processing that can discriminate against reflected replies, FRUIT replies, split targets, ring around targets and distinguish between multiple occurrences of targets in the same beam dwell, with the same non-unique address;</li> <li>c) ASTERIX plot formatting which delivers Cat. 048 ([RD 26]), Cat. 034. ([RD 25]) and, if integrated implementation, Cat. 021 ([RD 23]) data to the Surveillance Data Output;</li> <li>d) Reply merge function, to combine Mode A/C and Mode S reports from the same target</li> </ul>
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##### 5.4.1.1 Track Management

<b>EMS-C05-SYS-SHA-06410</b>	A track <b>shall</b> be initialised and maintained, both upon detection (SSR and Mode S targets) and upon receiving supplementary data (Mode S targets only).
<b>EMS-C05-SYS-SHA-06420</b>	The PAF <b>shall</b> track all the targets, including targets with duplicated addresses, and maintain the Selective Roll-Call list.
<b>EMS-C05-SYS-SHA-06430</b>	Information from a track initiated for a Mode A/C target that has been confirmed to be in the Surveillance Volume <b>shall</b> be sent to the Surveillance Data output.
<b>EMS-C05-SYS-SHA-06440</b>	<p>Information from a track initiated for a Mode S target that has been confirmed to be in the Surveillance Volume <b>shall</b> be sent to the Surveillance Data output if:</p> <ul style="list-style-type: none"> <li>a) At least one All-Call reply has been detected and confirmed by a Selective reply; or</li> <li>b) A Selective reply has been received from a Selective interrogation which was initiated by supplementary data (i.e. ADS-B passive acquisition).</li> </ul>
<b>EMS-C05-TEN-SHA-06450</b>	The Tenderer <b>shall</b> describe how a report is localized in the coverage maps when the report lacks credible pressure-altitude information (i.e. Mode S/SSR targets without credible pressure-altitude code).

<b>EMS-C05-SYS-SHA-06460</b>	The Mode C <b>shall</b> be updated on the tracks for each antenna revolution.
<b>EMS-C05-SYS-SHA-06470</b>	Aircraft surveillance data and measured position information <b>shall</b> be sent for every antenna revolution until the track is cancelled.
<b>EMS-C05-SYS-SHA-06480</b>	The position information <b>shall</b> be originated, by decreasing priority, from a detection (All-Call or Selective reply), or from an extrapolation (miss).
<b>EMS-C05-SYS-SHA-06490</b>	An operational parameter, when enabled, <b>shall</b> force the output of extrapolated target reports to the Surveillance Data output in case of miss.
<b>EMS-C05-SYS-SHA-06500</b>	Position information originating from extrapolation, if sent, <b>shall</b> be flagged accordingly.
<b>EMS-C05-SYS-SHA-06510</b>	The System <b>shall</b> provide operational parameters to define specific geographical areas where quick track initialization can be performed.
<b>EMS-C05-SYS-SHA-06520</b>	An operational parameter, when enabled, <b>shall</b> activate the delivery of early target reports to the Surveillance Data output, containing at least 3D-position (range, azimuth and pressure-altitude) and identification (Mode A and, if applicable, Aircraft Identification), after a user selectable number of scans following first detection (minimum 1, i.e. on the second scan).
<b>EMS-C05-SYS-SHA-06530</b>	An operational parameter, when enabled, <b>shall</b> activate the delivery of early target reports to the Surveillance Data output (irrespective of the detection type, e.g. Mode A, Mode C, Mode S Selective or All-Call), after a user selectable number of scans following first detection (minimum 0, i.e. on the first scan).
<b>EMS-C05-SYS-SHA-06540</b>	The System <b>shall</b> provide operational parameters to define the Surveillance Data output streams in which the early target reports will be included.
<b>EMS-C05-TEN-SHA-06550</b>	The Tenderer <b>shall</b> provide detailed information (in particular, algorithms used in the form of pseudo-code, impact on the ASTERIX data items, etc.) on the processing required to initiate a track and deliver an SSR report to the Surveillance Data output.
<b>EMS-C05-TEN-SHO-06560</b>	The Tenderer <b>should</b> provide information on the processing required to initiate a track and deliver an SSR report, supported by field data analysis results, in the form of a probability of initializing and delivering a SSR report to the Surveillance Data output in function of time.



<b>EMS-C05-TEN-SHA-06570</b>	The Tenderer <b>shall</b> provide detailed information (in particular, algorithms used in the form of pseudo-code, impact on the ASTERIX data items, etc.) on the processing required to initiate a track and deliver a Mode S report to the Surveillance Data output.
<b>EMS-C05-TEN-SHO-06580</b>	The Tenderer <b>should</b> provide information on the processing required to initiate a track and deliver a Mode S report, supported by field data analysis results, in the form of a probability of initializing and delivering a Mode S report to the Surveillance Data output in function of time.
<b>EMS-C05-TEN-SHA-06590</b>	The Tenderer <b>shall</b> provide detailed information (in particular algorithms used in form of pseudo-code, impact on the ASTERIX data items, etc.) on the track processing in particular concerning the following points: <ul style="list-style-type: none"> <li>a) Type of filter, e.g. Alpha/Beta filter, Kalman Filter, etc.;</li> <li>b) Algorithms used;</li> <li>c) Slant range correction;</li> <li>d) Tracking reference system (e.g. Rho/Theta, X/Y, etc.);</li> <li>e) Method of projection used.</li> </ul>
<b>EMS-C05-TEN-SHA-06600</b>	The Tenderer <b>shall</b> provide detailed information (in particular algorithms used in form of pseudo-code, impact on the ASTERIX data items, etc.) on the following points related to the delivery of a SSR report to the Surveillance Data output: <ul style="list-style-type: none"> <li>a) Resolution of multiple assignment;</li> <li>b) Combining of Split Plots;</li> <li>c) Code Swapping; (d) Code Validation;</li> <li>d) Code Change;</li> <li>e) Mode C Credibility Checking.</li> </ul>
<b>EMS-C05-TEN-SHA-06610</b>	The Tenderer <b>shall</b> provide detailed information (in particular algorithms used in form of pseudo-code, impact on the ASTERIX data items, etc.) on the Mode C Code Validation and Credibility Checking for the Mode S target reports to be delivered to the Surveillance Data output.
<b>EMS-C05-SYS-SHA-06620</b>	A track <b>shall</b> be cancelled when: <ul style="list-style-type: none"> <li>a) A target moves from a cell within the Surveillance Volume to one outside (there is no need to coast); or</li> <li>b) The track is not in the Cone of Silence and has not been updated within three antenna revolutions and no additional information has been received during that time period from the cooperation interface (e.g. ADS-B passive acquisition).</li> </ul>

#### 5.4.1.2 False Target Processing

EMS-C05-SYS-SHA-06630	All tracks including false targets <b>shall</b> be initiated and maintained, but not sent to the Surveillance data output as genuine targets when the target report is identified as reflection.
EMS-C05-SYS-SHA-06640	False targets due to any of the causes listed below <b>shall</b> be identified (marked) as false in the category indicated and rejected (i.e. not output as genuine targets): <ul style="list-style-type: none"> <li>a) False targets at similar range to, but at different azimuths from, an originating genuine target shall be identified as 'ring-around';</li> <li>b) False targets at similar azimuths to, but at increasingly longer ranges from, an originating genuine target shall be identified as 'multipath';</li> <li>c) False targets split from an originating genuine target due to antenna beam distortion or splitting as a result of multipath or local obstruction diffraction shall be identified as 'splits';</li> <li>d) False targets with angular separations from an originating target due to reflection of the interrogations and/or transponder responses by reflecting surfaces in the signal paths <b>shall</b> be identified as 'reflections'.</li> </ul>

#### 5.4.1.2.1 Reflections

EMS-C05-SYS-SHA-06650	The Reflection Processing <b>shall</b> continuously and automatically locate and identify the orientation and position of the reflecting objects within range of the System by analysis of the geometry of reflection data from targets with discrete codes.
EMS-C05-SYS-SHA-06660	The reflectors <b>shall</b> be used to maintain dynamic reflector surface data.
EMS-C05-SYS-SHA-06670	It <b>shall</b> be possible to program into the PAF reflector surface position and orientation data for permanent reflectors, such as hangars.
EMS-C05-SYS-SHA-06680	The processing <b>shall</b> employ the reflector data stored in the dynamic and permanent reflector surfaces to identify reflections by analyzing the geometry of the real target, the reflections and the stored reflector data.
EMS-C05-TEN-SHA-06690	The Tenderer <b>shall</b> provide detailed information on the methods proposed to eliminate both permanent and dynamic reflection surfaces.
EMS-C05-TEN-SHA-06700	The Tenderer <b>shall</b> state in their proposal the reflector storage capacities and the method of handling both the permanent and dynamic reflecting surfaces.
EMS-C05-TEN-SHA-06710	The Tenderer <b>shall</b> include in their proposal details of the SSR and Mode S reflection processing.

#### 5.4.2 Station Selective Roll-Call List

EMS-C05-SYS-SHA-06720	The Station Selective Roll-Call List <b>shall</b> contain at least identification and positional information on targets that the station is tracking.
EMS-C05-SYS-SHA-06730	The PAF <b>shall</b> maintain the station Selective Roll-Call list.
EMS-C05-SYS-SHA-06740	The PAI <b>shall</b> be able to update the station Selective Roll-Call list by including new targets information obtained from the Passive Acquisition Interface (e.g. on-site ADS-B) after the Volumetric Filtering.

#### 5.4.3 Communication Management Processor (CMP)

EMS-C05-SYS-SHA-06750	The Communication Management Processor (CMP) <b>shall</b> process all requests for transactions which are coming from the DLF.
EMS-C05-SYS-SHA-06760	The GICB request from the DLF <b>shall</b> be passed to the scheduler for transmission.
EMS-C05-SYS-SHA-06770	The Mode S downlink information related to GICB requests <b>shall</b> be received from the PAF and sent to plot formatting for delivery as Enhanced Surveillance data in the Surveillance Data output.
EMS-C05-SYS-SHA-06780	The System <b>shall</b> be able to report to the DLF when a target is leaving the coverage of the Datalink map or if no reply to a selective interrogation has been received.

#### 5.4.4 Mode-S Link Management Process (LMP)

EMS-C05-SYS-SHA-06790	The Mode S Link Management Process (LMP) <b>shall</b> control all the Mode S link activities except Mode S all-call interrogations which are controlled directly by the RTCC function.
EMS-C05-SYS-SHA-06800	The LMP <b>shall</b> schedule the interrogations which result in the acquisition of Mode S targets from the replies being formed into plots and tracked in the PAF, which in turn ensures that they are presented to the Selective Roll-Call List.
EMS-C05-SYS-SHA-06810	When a Mode S target is detected within the lockout map, the station <b>shall</b> apply immediately the all-call lockout protocol defined in that map.

<b>EMS-C05-SYS-SHA-06820</b>	For each target on the Station Selective Roll-Call List that the ground station is responsible for, and for new targets input from the Passive Acquisition Interface (e.g. on-site ADSB), the LMP <b>shall</b> assemble and send interrogation instructions to the RTCC function.
<b>EMS-C05-SYS-SHA-06830</b>	The LMP <b>shall</b> take the Mode S interrogation requests from the queues in the CMP, highest priority queue first, and form them into interrogation instructions to send to the RTCC function.
<b>EMS-C05-TEN-SHA-06840</b>	The Tenderer <b>shall</b> describe on their proposal how and in which order the interrogation instructions will be delivered to the RTCC function to ensure that a sequence of interrogations to a particular target can be maintained.
<b>EMS-C05-SYS-SHA-06850</b>	The LMP <b>shall</b> take Mode S reply status information (e.g. successful or failed delivery) to enable it to perform frame repair by making new attempts at succeeding polling intervals and report the final result to the CMP.
<b>EMS-C05-TEN-SHA-06860</b>	The Tenderer <b>shall</b> include details in their proposal of the functions of the LMP.

## 5.5 Datalink Function (DLF)

<b>EMS-C05-SYS-SHA-06870</b>	<p>The Datalink Function (DLF) <b>shall</b> contain:</p> <ul style="list-style-type: none"> <li>a) The Internal Application, that shall allow pre-configured GICB extractions. The BDS registers can be configured locally/remotely via the CMS;</li> <li>b) A DAP Extraction Interface, that shall receive and replies GICB requests from the external WAN network (3.7.2);</li> <li>c) The Broadcast Manager, that shall send all downlink broadcasts to the Internal Application;</li> <li>d) The GICB Manager, that shall combine duplicated GICB requests onto a single data flow. The GICB Manager shall send the responses to the requesting applications.</li> </ul>
<b>EMS-C05-SYS-SHA-06880</b>	The DLF <b>shall</b> have a DAP Extraction Interface to receive/send data in ASTERIX Cat. 018 format ([RD22]).
<b>EMS-C05-TEN-SHA-06890</b>	The Tenderer <b>shall</b> provide details in their proposal of the DLF functionalities and details of how they will be implemented.

<b>EMS-C05-SYS-SHA-06900</b>	The DLF <b>shall</b> be monitored via the Control and Monitoring System (CMS).
<b>EMS-C05-TEN-SHA-06910</b>	The Tenderer <b>shall</b> provide in their proposal details of how the DLF will be monitored in the CMS.

#### 5.5.1 Internal GICB Application

<b>EMS-C05-SYS-SHA-06920</b>	The System <b>shall</b> have a GICB Internal Application to perform BDS registers extraction requests.
<b>EMS-C05-SYS-SHA-06930</b>	The System <b>shall</b> allow the programmed extraction of any of the 256 BDS registers through the GICB Internal Application.
<b>EMS-C05-SYS-SHA-06940</b>	A priority <b>shall</b> be assigned to each GICB requests for the GICB Internal Application.
<b>EMS-C05-SYS-SHA-06950</b>	The BDS registers to be extracted, the periodicity of extraction and their priority <b>shall</b> be operational parameters programmed in the CMS.
<b>EMS-C05-SYS-SHA-06960</b>	All BDS registers extracted by the GICB Internal Application, from GICB and Comm-B broadcast, <b>shall</b> be delivered to the Surveillance Data output using the MB data item of ASTERIX Cat. 048 ([RD 26]), except where a dedicated data item exists (e.g. items 048/240 and 048/260).

#### 5.6 Passive Acquisition Interface (PAI)

<b>EMS-C05-SYS-SHA-06970</b>	The System <b>shall</b> include a Passive Acquisition Interface as defined in 3.7.1
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### 6 Interrogator

#### 6.1 The Interrogator

<b>EMS-C06-SYS-SHA-06980</b>	<p>The Interrogator system <b>shall</b> consist of:</p> <ul style="list-style-type: none"> <li>a) A transmitter, providing Sum and Control channel output;</li> <li>b) A monopulse receiver, accepting Sum, Difference and Control channel input;</li> <li>c) A video signal process that provides processed Sum, RSLs and OBI signals;</li> <li>d) An RF changeover unit to allow the standby channel to become the active channel.</li> </ul> <p><i>Note: Please see Figure6-A: Interrogator system overview in EUROCONTROL EMS ver 4.0 document.</i></p>
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EMS-C06-SYS-SHA-06990	<p>The Interrogator system <b>shall</b> have the following capabilities:</p> <ul style="list-style-type: none"> <li>a) Interrogation and reception on Mode S, Modes A/C and Modes A/C only all-call. Reception of ADS-B when integrated implementation;</li> <li>b) Mode S only all-call preceding either a Mode A, or a Mode C, or a Mode A only all-call, or a Mode C only all-call interrogation by between 45 microseconds and 128 microseconds timed from the sync phase reversal to the leading edge of the P3 (Modes A/C, Modes A/C only all-call);</li> <li>c) Operation on 3 interlace programmes (i.e. single, dual, triple), including stochastic All-Call and lockout override options;</li> <li>d) Operation in azimuth selectable Improved Interrogator Sidelobe Suppression (IISLS) for Modes A/C and Modes A/C only all-call (intermode P4 short);</li> <li>e) Operation of Receiver Sidelobe Suppression (RSLs);</li> <li>f) Output of data suitable for plot processing;</li> <li>g) Control of all main functions of the Interrogator locally and remotely via the CMS interface;</li> <li>h) Reception of interrogation modulation commands from the RTCC function.</li> </ul>
EMS-C06-SYS-MAY-07000	The Interrogator system <b>may</b> have the capability for interrogation and reception on Mode 1 and Mode 2.

## 6.2 Transmitter

### 6.2.1 Pulse Transmissions

EMS-C06-SYS-SHA-07010	<p>The Transmitter <b>shall</b> provide:</p> <ul style="list-style-type: none"> <li>a) One Sum channel, including transmissions of pulses P1, P2, P3, P4 and P6 (with DPSK modulation);</li> <li>b) One Control channel, including transmissions of pulses P2 and P5.</li> </ul>
EMS-C06-SYS-SHA-07020	The pulse P5 <b>shall</b> be transmitted on the Control channel for Mode S all-call and selective interrogations.
EMS-C06-TEN-SHA-07030	A detailed description of the Interrogator transmitter with block diagram and specification <b>shall</b> be provided in the proposal.
EMS-C06-SYS-SHA-07040	The Transmitter <b>shall</b> not require any adjustment or setting up following replacement of any unit.

<b>EMS-C06-SYS-SHA-07050</b>	The Transmitter <b>shall</b> not require any regular or preventative maintenance of any unit.
<b>EMS-C06-SYS-SHA-07060</b>	The Transmitter <b>shall</b> be capable of operating with a duty cycle supporting all the interrogation modes (3.1) for the defined targets load (2.6.8) and system expansion (2.6.10) requirements.
<b>EMS-C06-TEN-SHA-07070</b>	The Tenderer <b>shall</b> include in their proposal information on the Mode S duty cycle capability, including Mode S modes of operation, intermode interlace, power and range performance and transmitter modularity.
<b>EMS-C06-SYS-SHA-07080</b>	A mechanism limiting the number of interrogations <b>shall</b> protect the Transmitter against overloads and guarantee that the requirements of maximum interrogation rates specified in 3.1, 3.3.3 and [RD 1] are not exceeded.
<b>EMS-C06-SYS-SHA-07090</b>	If the limits are exceeded then the surveillance interrogations <b>shall</b> have priority.
<b>EMS-C06-TEN-SHA-07100</b>	The Tenderer <b>shall</b> provide in their proposal details of the protection of the Transmitter.
<b>EMS-C06-SYS-SHA-07110</b>	IISLS <b>shall</b> be available for interrogations by transmitting both pulses P1 and P2 on the Control channel.
<b>EMS-C06-SYS-SHA-07120</b>	When IISLS is enabled, it <b>shall</b> be possible to manually adjust the power of pulse P1 on the Control channel in steps of 1.4° for the azimuth and in steps of 2 dB for the power, till the decrease does not exceed the level of 6 dB below the power of pulse P2.
<b>EMS-C06-TEN-SHA-07130</b>	The Tenderer <b>shall</b> provide in their proposal information on IISLS to clearly show its method of implementation and performance, including the radar range over which it is available, effects on transmitted powers, detection and false targets, particularly in a congested Mode S/SSR environment.

#### 6.2.2 Power Levels

<b>EMS-C06-SYS-SHA-07140</b>	The Sum and Control channels <b>shall</b> allow an independent output power variation below the peak power through steps no greater than 2.0 dB, with a step accuracy better or equal to $\pm 1.0$ dB and reaching a minimum output power of 12 dB below peak power.
<b>EMS-C06-TEN-SHA-07150</b>	The Tenderer <b>shall</b> state in their proposal the minimum independent power variation between the Sum and the Control pulses, the incremental steps and the accuracy of the incremental steps.

### 6.2.2.1 Range Control

EMS-C06-SYS-SHA-07160	It <b>shall</b> be possible to vary the Sum and Control output power, on each selective interrogation, according to the range of the target.
EMS-C06-SYS-SHA-07170	The System <b>shall</b> have site-dependant parameters to define range intervals and the power output level applied for the selective interrogations when a target is within the intervals.
EMS-C06-TEN-SHA-07180	The Tenderer <b>shall</b> submit uplink power budget calculations to support the determination of the power level assigned per range interval for the selective interrogations.
EMS-C06-TEN-SHA-07190	The Tenderer <b>shall</b> describe the method of achieving power variation with range.
EMS-C06-SYS-MAY-07200	The System <b>may</b> be able to increase automatically the output power level for selective interrogations, up to the limit of the transmitter peak power, when the elevation of the targets is different than the elevation that provides the maximum antenna gain.
EMS-C06-SYS-SHA-07210	When the power level variation by elevation is included, the System <b>shall</b> provide site-dependent parameters to define the antenna gain depending on the elevation.
EMS-C06-TEN-SHA-07220	When the power level variation by elevation is proposed, the Tenderer <b>shall</b> describe how the vertical antenna gain will be characterize in the site-dependent parameters.
EMS-C06-SYS-SHA-07230	When the power level variation by elevation is included, the System <b>shall</b> provide a site-dependant parameter to define tilt of the antenna.
EMS-C06-TEN-SHA-07240	When the power level variation by elevation is offered, the Tenderer <b>shall</b> describe the method of achieving power variation with range and elevation.

### 6.2.2.2 Azimuth Control

EMS-C06-SYS-SHA-07250	The System <b>shall</b> provide site-dependent parameters to configure independently, as a function of azimuth, the output power level for the Sum and Control channels when transmitting Mode S all-call, Mode A/C and Mode A/C only all-call interrogations.
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<b>EMS-C06-SYS-SHA-07260</b>	The configurable output power level for the Sum and Control channels <b>shall</b> allow to configure at least 32 azimuth intervals, with steps no larger than 1°, over 360°.
<b>EMS-C06-SYS-SHA-07270</b>	The System <b>shall</b> provide site-dependent parameters to configure, as a function of azimuth, blanking sectors where there will not be output power level, i.e. RF radiation is disabled.
<b>EMS-C06-SYS-SHA-07280</b>	The configurable blanking sectors <b>shall</b> allow to configure at least 32 azimuth intervals, with steps no larger than 1°, over 360°.
<b>EMS-C06-TEN-SHA-07290</b>	The Tenderer <b>shall</b> describe the resolution (steps) of the azimuth sectors to configure the output power levels and the blanking sectors.
<b>EMS-C06-TEN-SHA-07300</b>	The Tenderer <b>shall</b> describe the method of achieving power variation with azimuth.

### 6.3 Receiver

<b>EMS-C06-SYS-SHA-07310</b>	<p>The Receiver <b>shall</b> provide:</p> <ul style="list-style-type: none"> <li>a) Sum, Difference and Control channels;</li> <li>b) Outputs to the receiver video process utilizing data from the Sum, Difference and Control channels.</li> </ul>
<b>EMS-C06-TEN-SHA-07320</b>	The Tenderer <b>shall</b> provide a detailed description of the Receivers with block diagrams and specification in their proposal.
<b>EMS-C06-SYS-SHA-07330</b>	<p>The Receiver <b>shall</b> perform the following functions:</p> <ul style="list-style-type: none"> <li>a) RF filtering;</li> <li>b) RF amplification, if necessary;</li> <li>c) IF conversion, IF filtering and logarithmic IF amplification, if necessary.</li> </ul>

#### 6.3.1 Interference

<b>EMS-C06-SYS-SHA-07340</b>	The Receiver and the System Management Function <b>shall</b> both withstand and recover, with minimum delay, from the effects of CW interference.
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<b>EMS-C06-SYS-SHA-07350</b>	The receiver <b>shall</b> be capable of operating, without saturation or overload any part of the System, in the presence of CW interference over the range 1 080 MHz to 1 100 MHz with a power from -95 dBm to -20 dBm.
<b>EMS-C06-SYS-SHA-07360</b>	The receiver <b>shall</b> be capable of operating in the presence of pulsed CW interference, over the range 1 080 MHz to 1 100 MHz, formed by two overlapping pulse trains.
<b>EMS-C06-SYS-SHA-07370</b>	Following the removal of a CW interference, replies <b>shall</b> be detected, decoded and processed, 2 ms after the end of the interference.
<b>EMS-C06-SYS-SHA-07380</b>	The System <b>shall</b> be able to decode a reply with a baseline CW transmitted 50 dB below the reply pulse peak power (i.e. between the pulses) and starting up to 10 $\mu$ s before the first pulse and finishing up to 10 $\mu$ s after the last pulse.
<b>EMS-C06-TEN-SHA-07390</b>	The Tenderer <b>shall</b> provide information on the level and effects of interference that the System can tolerate.
<b>EMS-C06-TEN-SHA-07400</b>	The Tenderer <b>shall</b> state the reaction and recovery times of the interference protection.
<b>EMS-C06-SYSTEM-SHA-07410</b>	The Tenderer <b>shall</b> state the protection modes accommodated and specify the level of protection from both ground and airborne IFF/SSR frequency systems that will be achieved.

### 6.3.2 Phase Overlay Capability

<b>EMS-C06-SYS-SHA-07420</b>	The Interrogator <b>shall</b> have a receiver with the capability to extract 8PSK phase modulation data (phase overlay, 3.6) from Mode S replies and, when the on-site ADS-B follows an integrated implementation, also from ADS-B Extended Squitters.
<b>EMS-C06-SYS-SHA-07430</b>	The receiver <b>shall</b> be able to decode 8PSK phase modulated data from signals transmitted at 1 090 MHz $\pm$ 25 KHz.
<b>EMS-C06-SYS-SHA-07440</b>	The receiver <b>shall</b> determine the zero degree phase reference using the preamble pulses as well as the first 4 bits of the reply.
<b>EMS-C06-SYS-SHA-07450</b>	The receiver <b>shall</b> be able to decode 8PSK phase modulated data from signals transmitted with a maximum of $\pm$ 43° phase drift during a message.

<b>EMS-C06-SYS-SHA-07460</b>	The receiver <b>shall</b> be able to decode 8PSK phase modulated data from signals transmitted with a phase error that is not more than 3.0° RMS and 12.2° peak for the duration of any 0.5 µs PPM reply pulse, excluding the leading and trailing edges of the pulse.
<b>EMS-C06-SYS-SHA-07470</b>	The receiver <b>shall</b> be able to decode 8PSK phase modulated data from signals with a phase transition interval, for a 1.0 µs pulse which is formed by a PPM ZERO data bit followed by a PPM ONE data bit, in which the phase is allowed to change between states less than the 400 ns interval commencing 200 ns prior to the PPM bit interval transition at the centre of the 1.0 µs pulse.

#### 6.4 Video Signal Processing

<b>EMS-C06-SYS-SHA-07480</b>	The azimuth data, received from the azimuth data generator, <b>shall</b> be decoded and used to determine boresight.
<b>EMS-C06-SYS-SHA-07490</b>	Processed Sum Video, RSLs and Off Boresight Indication (OBI) signals <b>shall</b> be provided to the RTCC function.
<b>EMS-C06-SYS-SHA-07500</b>	SSR and Mode S all-call Processed Sum video, together with OBI, <b>shall</b> be provided for monitoring in the Local Display and the Data Recorder.
<b>EMS-C06-SYS-SHA-07510</b>	The detected pulse output, following pulse detection and quantisation, <b>shall</b> accurately reflect the received pulse.
<b>EMS-C06-SYS-SHA-07520</b>	Sensitivity Time Control (STC), or an equivalent threshold method, <b>shall</b> be provided and selectable between pre-programmed logarithmic options or programmable thresholds.
<b>EMS-C06-SYS-SHA-07530</b>	The System <b>shall</b> provide several STC thresholds pre-programmed.
<b>EMS-C06-SYS-SHA-07540</b>	The System <b>shall</b> provide independent STC thresholds for Mode A/C and Mode S replies.
<b>EMS-C06-SYS-SHA-07550</b>	The programmable STC thresholds <b>shall</b> allow configuration through the CMS.
<b>EMS-C06-SYS-SHA-07560</b>	The STC thresholds configuration <b>shall</b> allow to start from a pre-programmed STC threshold and apply a constant offset and/or a change for specific range intervals.
<b>EMS-C06-SYS-SHA-07570</b>	The STC thresholds <b>shall</b> be stored with an exportable readable format.
<b>EMS-C06-SYS-SHA-07580</b>	The System <b>shall</b> be able to create azimuth intervals, with steps no larger than 1°, where to apply different STC thresholds.

<b>EMS-C06-TEN-SHA-07590</b>	The Tenderer <b>shall</b> detail how the STC thresholds will be configured and which resolution will be applied for the azimuth intervals.
<b>EMS-C06-TEN-SHA-07600</b>	The Tenderer <b>shall</b> clearly explain the technique used and the effects on the performance of Sensitivity Time Control (STC) and any other threshold in the System (e.g. short pulse elimination and received signal strength), specifically stating the STC levels assumed.
<b>EMS-C06-SYS-SHA-07610</b>	The Off-Boresight Angle (OBA) look up table <b>shall</b> be site-dependent.
<b>EMS-C06-SYS-SHA-07620</b>	The System <b>shall</b> provide a function to recalibrate the OBA look up table with opportunity traffic.
<b>EMS-C06-TEN-SHA-07630</b>	The Tenderer <b>shall</b> provide detailed information about how and when the OBA look up table is recalibrated.
<b>EMS-C06-SYS-SHA-07640</b>	The Off-Boresight Angle (OBA) precision <b>shall</b> be within 1 AU (i.e. 0.022°).
<b>EMS-C06-SYS-SHA-07650</b>	The OBA look up table <b>shall</b> be displayed numerically and graphically in the CMS.
<b>EMS-C06-SYS-SHA-07660</b>	Monopulse data from received pulses <b>shall</b> be accumulated and checked for long term consistency against the conversion facility, so as to detect any change or drift in the system monopulse azimuth accuracy.
<b>EMS-C06-TEN-SHA-07670</b>	The Tenderers proposal <b>shall</b> include details of any on-line monitoring of monopulse accuracy.
<b>EMS-C06-TEN-SHA-07680</b>	The Tenderer <b>shall</b> provide in their proposals details of the receiver channel amplitude and phase response matching requirements of the system offered stating the required tolerances to be maintained in the matching of the channels.

## 6.5 RF Changeover Unit

<b>EMS-C06-SYS-SHA-07690</b>	The RF Changeover Unit <b>shall</b> enable the Interrogator channel in operation to be connected to the antenna and the Interrogator channel in Standby to be connected to a dummy load.
<b>EMS-C06-SYS-SHA-07700</b>	During changeover, the System <b>shall</b> provide uninterrupted operation without any corruption to the Surveillance Data output.
<b>EMS-C06-SYS-SHA-07710</b>	The RF Changeover Unit <b>shall</b> only be powered by low voltage DC supplies, derived from both channels of the System.

EMS-C06-SYS-SHA-07720	The interruption of transmissions to the antenna when changing over interrogation channels <b>shall</b> meet the requirements of 8.2.1.
EMS-C06-SYS-SHA-07730	The RF Changeover Unit <b>shall</b> retain its selected state in the absence of control signals and power supplies.
EMS-C06-SYS-SHA-07740	An indication, to determine which is the active channel, <b>shall</b> be provided locally.
EMS-C06-SYS-SHA-07750	A monitoring of the RF Changeover selection <b>shall</b> be available in the local and remote CMS.
EMS-C06-SYS-SHA-07760	The equipment <b>shall</b> be of passive design and require no routine maintenance.
EMS-C06-SYS-SHA-07770	The design <b>shall</b> include a bi-directional high power precision coupler in each of the Sum, Difference and Control channels to facilitate RF injection and measurement of downlink polar diagrams.
EMS-C06-TEN-SHA-07780	The Tenderer <b>shall</b> state the Insertion Loss of the bi-directional coupler for Transmit and Receive frequencies.
EMS-C06-TEN-SHA-07790	The Tenderer <b>shall</b> state the VSWR and Phase shift between Sum and Difference channels.
EMS-C06-SYS-SHA-07800	<p>The isolation between ports and channels <b>shall</b> be:</p> <ul style="list-style-type: none"> <li>a) &gt; 40 dB between channel 1 and channel 2 ports;</li> <li>b) &gt; 70 dB between ports of the same channel (i.e. with the receiver disconnected).</li> </ul>

## 6.6 Access to Radio Spectrum

EMS-C06-SYS-SHA-07810	<p>The Transmitter of the System <b>shall</b> comply, on both the Sum and Control channels, with the ETSI harmonised standard for Secondary Surveillance Radar (SSR) Part 1, as described in [RD 17], concerning:</p> <ul style="list-style-type: none"> <li>a) Frequency tolerance;</li> <li>b) Transmitter power;</li> <li>c) Spectrum mask;</li> <li>d) Emissions in idle mode;</li> <li>e) Transmitted waveforms.</li> </ul> <p><i>Note: Please see Table 6-1, Table 6-2, Table 6-3 and Table 6-4 in EUROCONTROL EMS ver 4.0 document.</i></p>
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<b>EMS-C06-SYS-SHO-07820</b>	<p>The Receiver and Video Processing of the System <b>should</b> comply, on both the Sum and Control channels, with the ETSI harmonised standard for Secondary Surveillance Radar (SSR) Part 1, as described in [RD 17], concerning:</p> <ul style="list-style-type: none"> <li>a) Sensitivity and flatness;</li> <li>b) Saturation level and flatness;</li> <li>c) Dynamic range; (d) Signal blocking;</li> <li>d) Selectivity; (<i>Note: Please see Table 6-5 in EUROCONTROL EMS ver 4.0 document</i>)</li> <li>e) Inter-modulation response rejection;</li> <li>f) Co-channel rejection;</li> <li>g) Noise Figure.</li> </ul> <p><i>Note: Please see Table 6-5 and Table 6-6 in EUROCONTROL EMS ver 4.0 document</i></p>
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## 7 Mode S Ground Station Elements

### 7.1 The Mode-S Ground Station

<b>EMS-C07-SYS-SHA-07830</b>	<p>The following items <b>shall</b> be supplied with the Mode S ground station:</p> <ul style="list-style-type: none"> <li>a) Interrogator;</li> <li>b) Processing (SMF, DLF and PAI);</li> <li>c) On-site ADS-B;</li> <li>d) Local display;</li> <li>e) Data Recorder and Playback;</li> <li>f) Control and Monitoring Systems (CMS);</li> <li>g) Far Field Monitor;</li> <li>h) NTP Time Server.</li> </ul> <p>Items (a), (b), (c) and (g) shall be provided with dual channel functionality.</p>
<b>EMS-C07-TEN-SHO-07840</b>	<p>The Tenderer <b>should</b> advise where an alternative approach to dual functionality can be more appropriate.</p>

<b>EMS-C07-SYS-SHA-07850</b>	<p>The following items <b>may</b> be supplied with the Mode S ground station:</p> <ul style="list-style-type: none"> <li>a) LVA antenna;</li> <li>b) Antenna turning gear system with azimuth signals;</li> <li>c) ADS-B additional antenna(s);</li> <li>d) Tower with appropriated height (30 m);</li> <li>e) Radome;</li> <li>f) Obstruction lights;</li> <li>g) Lightning protection;</li> </ul>
<b>EMS-C07-SYS-SHA-07860</b>	The System <b>shall</b> provide the necessary interface functionality to support the Mode S ground station to be collocated with a primary surveillance radar.
<b>EMS-C07-TEN-SHA-07870</b>	The Tenderer <b>shall</b> provide in their response power consumption figures for the complete Mode S ground station.

## 7.2 Antenna

<b>EMS-C07-TEN-SHA-07880</b>	<p>The Tenderer <b>shall</b> propose a Large Vertical Aperture (LVA) antenna, suitable for SSR and Mode S and providing monopulse sum and difference channels with an additional omnidirectional control channel, which enables the requirements of this specification to be met in all respects.</p> <p>Adopted from <b>EMS-C07-TEN-MAY-07880</b></p>
<b>EMS-C07-TEN-SHA-07890</b>	<p>The Tenderer <b>shall</b> propose one or more additional ADS-B antennas which enable the requirements of this specification to be met in all respects.</p> <p>Adopted from <b>EMS-C07-TEN-MAY-07890</b></p>

<b>EMS-C07-TEN-SHA-07900</b>	<p>When proposed as part of the System, the Tenderer <b>shall</b> provide details in their response of the antenna(s) characteristics, with guaranteed parameter limits, and supported with measured antenna vertical and polar diagrams. As a minimum the following information is supplied by the Tenderer in their response:</p> <ul style="list-style-type: none"> <li>a) Sum vertical radiation pattern (field strengths, -3 dB beamwidth, sidelobes, underside roll off rate, etc.);</li> <li>b) Sum horizontal radiation pattern (peak forward gain, beamwidth at -3 dB, -10 dB and -20 dB, symmetry/alignment of sum peak and beamwidth over elevation, sidelobes, etc.);</li> <li>c) Control radiation pattern (coverage of sum sidelobes and sum cone of silence, crossover points, notch/minimum, symmetry/alignment over elevation, etc.);</li> <li>d) Difference radiation pattern (crossover points, peak gain, difference null, symmetry/alignment over elevation, etc.);</li> <li>e) Fully dimensioned drawings;</li> <li>f) Earthing connection;</li> <li>g) Safety (maintenance personnel, lightning strike protection);</li> <li>h) Mechanical requirements (dismantling/reassembly of columns, transportation, lifting);</li> <li>i) Environmental protection;</li> <li>j) Maximum operational wind speeds and ice depth such that the antenna can function within the performance described in chapter 2;</li> <li>k) Maintenance requirements and lifetime of the array.</li> </ul>
<b>EMS-C07-TEN-SHA-07910</b>	<p>When proposed as part of the System, the Tenderer <b>shall</b> detail where the proposed antenna will not capacitate the System to meet the requirements of this specification in all respects.</p>
<b>EMS-C07-CON-SHA-07920</b>	<p>When included as a part of the System, the Contractor <b>shall</b> deliver, as a part of the Maintenance documentation, the technical characteristics and commercial references for the products needed for each antenna maintenance (e.g. paint work material, columns radome reparation, etc.).</p>
<b>EMS-C07-CON-SHA-07930</b>	<p>When included as a part of the System, the specialized tools and material necessary for each antenna maintenance and tilt adjustment <b>shall</b> be provided.</p>
<b>EMS-C07-SYS-SHA-07940</b>	<p>When included as a part of the System, the LVA antenna <b>shall</b> guarantee a correct transmitted power relation between the omnidirectional (control) and the sum patterns above an elevation of 45° (Cone of Silence) to apply correctly the Side Lobe Suppression functionality.</p>



<b>EMS-C07-CON-SHA-07950</b>	When included as a part of the System and prior to acceptance and delivery of each antenna, the Contractor <b>shall</b> provide measured vertical and horizontal radiation patterns for the antenna(s) supplied, according to an agreed test procedure.
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### **7.3 Turning gear and azimuth data generator**

Requirements on Turning gear and azimuth data generator are in Subchapter E– System (Part A).

### **7.4 Tower**

Requirements on Tower are in Subchapter D – System Elements

### **7.5 Radome**

Requirements on Radome are in Subchapter D – System Elements

### **7.6 Obstruction lights**

Requirements on Obstruction lights are in Subchapter D – System Elements

### **7.7 Lightning protection**

Requirements on Lightning protection are in Subchapter D – System Elements

### **7.8 Earthing**

Requirements on Earthing are in Subchapter D – System Elements

### **7.9 Equipment Cabinets**

Requirements on Equipment Cabinets are in Subchapter D – System Elements

### **7.10 Peripheral Devices**

Requirements on Peripheral Devices are in Subchapter D – System Elements

### 7.11 Air Conditioning Unit

N/A Radar Electronic components are indoor installation in building

### 7.12 Shelter

N/A Radar Electronic components are indoor installation in building

### 7.13 Colocation with Primary Radar

Requirements on Colocation with Primary Radar are in Subchapter E – System (Part A)

### 7.14 Far Field Monitor

EMS-C07-TEN-SHA-09150	The Tenderer <b>shall</b> provide information on the interconnection of the FFM to the power distribution network.
EMS-C07-SYS-SHA-09160	The FFM supplied <b>shall</b> include all necessary ancillary equipment, including antenna, cabling power supplies and any needed mounting hardware.
EMS-C07-TEN-MAY-09170	The Tenderer <b>may</b> provide a detailed proposal for the following FFM items:  a) Power Attenuator; b) UPS system; ( <i>Note: Not Required by Authority</i> ) c) Outdoor packaging.
EMS-C07-TEN-SHA-09180	The FFM <b>shall</b> comply with the ETSI harmonised standard for Secondary Surveillance Radar (SSR) Part 2 (JRD 18).

## 8 General Equipment Requirements

### 8.1 Equipment Qualification

EMS-C08-SYS-SHA-09190	The Mode S Interrogator, Processing System (SMF, DLF and PAI), Cooperation Functions (Passive Acquisition and DAP Extraction Interface), on-site ADS-B (either integrated or independent), Control and Monitoring System (CMS), Local Display and Data Recorder and Playback <b>shall</b> be supplied as a fully integrated system.
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<b>EMS-C08-TEN-SHA-09200</b>	Information <b>shall</b> be included in the proposal on current operational identical equipment and/or field trials previously carried out on the same type and functionally identical equipment to those offered.
<b>EMS-C08-TEN-SHA-09210</b>	The statement of compliance and the proposal <b>shall</b> indicate the development stage of the relevant item against the corresponding paragraph identification.
<b>EMS-C08-TEN-SHA-09220</b>	The Tender Response <b>shall</b> include a complete description of the equipment design, and if any is not readily available, a development plan for completion of the equipment design.
<b>EMS-C08-TEN-SHA-09230</b>	The subsystems and equipment which are to be developed <b>shall</b> be identified in the Tender Response.  Adopted from <b>EMS-C08-TEN-SHA-09230</b>
<b>EMS-C08-TEN-SHA-09240</b>	The subsystems and equipment which are to be developed <b>shall</b> be indicated with the proportion of development and timescales in the development plan.
<b>EMS-C08-CON-SHA-09250</b>	The appointed Contractor <b>shall</b> be required to prove the equipment by Factory and Site Acceptance Testing (times and frequency to be agreed with the Contracting Authority).
<b>EMS-C08-TEN-SHA-09260</b>	The Tenderer <b>shall</b> provide full information on:  a) The stability of the proposed system, particularly with regard to amplitude and phase variations in the Interrogator transmitter output; b) The maintenance requirements of the proposed system.
<b>EMS-C08-SYSTEN-SHA-09270</b>	The Tenderer <b>shall</b> describe in their proposal the setting up and calibration procedures to obtain range and azimuth registration (i.e. north alignment and range zero relative to replies pulses P3 or P6 synch phase reversal) and quote the accuracy obtainable.

## 9 Annex D Cluster

### D.2 General

EMS-ANNEXD-SYS-SHA-13230	The Mode S ground station <b>shall</b> be capable of operating as part of a Cluster of ground stations, whereby each station will share the same Interrogator Code.
EMS-CLU-SYS-SHA-13240	<p>The System <b>shall</b> provide a Surveillance Coordination Function (SCF), as described in ANNEX D.5, to provide the Cluster functionalities and to interface with the Surveillance Coordination Network (SCN).</p> <p>The Surveillance Coordination Function (SCF) will provide:</p> <ul style="list-style-type: none"> <li>a) Network control and management including failure detection and resolution;</li> <li>b) Coordination procedures, as defined in [RD 1], between coverage areas of networked ground stations to allow targets to be acquired without need for All-Call;</li> <li>c) Track data to adjacent stations upon request.</li> </ul>
EMS-CLU-SYS-SHA-13250	When operating as part of a Cluster, each station <b>shall</b> advise other neighbor ground stations within the Cluster (nodes) of the arrival of target in their respective coverage as defined in the ICD for Intersite Coordination [RD 30].
EMS-CLU-SYS-SHA-13260	The System <b>shall</b> be able to perform Mode S selective interrogations to new targets advised from neighbour ground stations in the Cluster (i.e. the targets are already locked out on the same II/SI code, therefore they do not respond to Mode S All-Call interrogations).
EMS-CLU-SYS-SHA-13270	New targets advised from neighbor ground stations through the Cluster <b>shall not</b> trigger Mode S selective interrogations when the position of the target is outside of the volume defined in the surveillance map (i.e. surveillance responsibility).
EMS-CLU-SYS-SHA-13280	The data format to be used over the Surveillance Coordination Network shall be as described in [RD 21].
EMS-CLU-SYS-SHA-13290	The System shall provide an operational parameter to enable or disable the connection to the SCN when Maintenance Mode is selected.
EMS-CLU-SYS-SHA-13300	The Cluster related functions shall be controlled and monitored from the CMS.

<b>EMS-CLU-SYS-SHA-13310</b>	<p>The CMS shall monitor the Cluster status, including at least:</p> <ul style="list-style-type: none"> <li>a) Interrogator Code in use;</li> <li>b) SCF Mode (Standalone / Network Aided);</li> <li>c) Applied State;</li> <li>d) SCN Stability;</li> <li>e) Coverage map applied;</li> <li>f) Date/time for next coverage map change (if programmed).</li> </ul>
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### D.3 Operation Modes

<b>EMS-CLU-SYS-SHA-13320</b>	<p>The System shall support the following modes of Cluster operation:</p> <ul style="list-style-type: none"> <li>a) Central mode, where the coverage map and II/SI code are determined by a Cluster Controller (CC) as described in Appendix A of [RD 30];</li> <li>b) Distributed Mode, where the Mode S ground station Surveillance Coordination Function (SCF) perform coordination activities to ensure correct operation with other ground stations, as defined in [RD 30].</li> </ul>
<b>EMS-CLU-SYS-SHA-13330</b>	In central mode, the station shall operate with the coverage map and II/SI code determined by the Cluster Controller (CC).
<b>EMS-CLU-SYS-SHA-13340</b>	In distributed mode, the coverage map and II/SI code shall be selected by the algorithm as defined in [RD 30] operating at the Mode S ground station node.
<b>EMS-CLU-SYS-SHA-13350</b>	The Mode S ground station shall be capable of forming a Cluster with any Mode S ground station whose network interface comply with [RD 30].

### D.4 Mode Transitions and Errors

<b>EMS-CLU-SYS-SHA-13360</b>	In addition to both operation modes (distributed and centralized), the SCF shall also support 'standalone' operation where each station operates independently from the central or distributed Cluster.
<b>EMS-CLU-SYS-SHA-13370</b>	When performed manually by an operator, the connection or disconnection of the Mode S ground station to the SCN shall be possible through the CMS.

<b>EMS-CLU-SYS-SHA-13380</b>	Transitions shall proceed according to the rules detailed in [RD 30].
<b>EMS-CLU-SYS-SHA-13390</b>	The addition of a Mode S ground station to a Cluster shall be achieved without disruption to the operational service.
<b>EMS-CLU-TEN-SHA-13400</b>	The Tenderer shall describe, in their Tender Response, a method to achieve the addition of a Mode S ground station to a Cluster without disruption to the operational service.
<b>EMS-CLU-SYS-SHA-13410</b>	It shall be possible to load another solution list for the Mode S ground station without affecting its current operation.
<b>EMS-CLU-SYS-SHA-13420</b>	It shall be possible to set the date and time at which the update of a solution list becomes effective. When the new solution list becomes effective, the radar first operates standalone.
<b>EMS-CLU-SYS-SHA-13430</b>	The handling and recovery of failures shall proceed according to the rules detailed in [RD 30].
<b>EMS-CLU-SYS-SHA-13440</b>	If the Mode S ground station (node) holds a NOGO status, then it shall not be part of a Cluster
<b>EMS-CLU-SYS-SHA-13450</b>	A Mode S ground station (node) shall be removed from the Cluster by disabling the SCN connection.
<b>EMS-CLU-SYS-SHA-13460</b>	When a Mode S ground station's (node) NOGO bit is subsequently cleared, its SCN connection shall be re-enabled.
<b>EMS-CLU-SYS-SHA-13470</b>	All network and nodal failures shall be reported to the CMS.

## D.5 Surveillance Coordination Function

<b>EMS-CLU-SYS-SHA-13480</b>	<p>The SCF shall include the following:</p> <ul style="list-style-type: none"> <li>a) Capability to add and select coverage maps (Surveillance, Lockout and Datalink, as described in [RD 31]), overwriting the default selection by the LC function during Cluster operation;</li> <li>b) Capability to add or delete targets to the station Selective Roll-Call list in accordance with the SCF state;</li> <li>c) A network system status list containing information on the latest SCF state;</li> <li>d) A network control and failure control process which contains the processing and protocols required to maintain the station within the cluster;</li> <li>e) A communication interface to the SCN. The interface supports the exchange of ASTERIX messages for surveillance coordination as defined in [RD 21];</li> <li>f) A track acquisition and support protocol to ensure that any interrogator is aware of any new track entering its coverage, and used by a radar to request track information from a neighbouring node when a track miss has occurred, as detailed in [RD 30].</li> </ul>
<b>EMS-CLU-TEN-SHA-13490</b>	<p>The Tenderer shall provide details in the response of how the following processes operate:</p> <ul style="list-style-type: none"> <li>a) Station Selective Roll-Call list;</li> <li>b) Periodic Monitoring Process;</li> <li>c) Network and Failure Management Process;</li> <li>d) Network System Status List;</li> <li>e) Network Link.</li> </ul>
<b>EMS-CLU-SYS-SHA-13500</b>	The SCF shall provide track data to adjacent stations within a Cluster upon request.
<b>EMS-CLU-SYS-SHA-13510</b>	The SCF shall be designed to minimise the amount or extent of II/SI code reconfiguration.
<b>EMS-CLU-SYS-SHA-13520</b>	The SCF shall be designed to interface at least 5 other Mode S stations, as well as a Cluster Controller, if present, via the Surveillance Coordination Network (SCN).
<b>EMS-CLU-SYS-SHA-13530</b>	The SCF shall provide a Coordinate Transformation, as defined in [RD 21], to the local coordinate set for the track data received from the connected stations.
<b>EMS-CLU-SYS-SHA-13540</b>	The SCF shall provide a Coordinate Transformation as defined in [RD 21], from the local coordinate set for track data sent to connected stations.

<b>EMS-CLU-SYS-SHA-13550</b>	A switchover between the redundant channels of the Processing System and/or in the communication channel of the SCN shall not change the SCF state.
<b>EMS-CLU-SYS-SHA-13560</b>	The SCF maximum processing capacity shall be at least 500 track supports per scan while also receiving any other Cluster protocol messages, e.g. Network Information Messages (NIM), 'Move Node to New Cluster State' messages (MNNCS), etc.

#### D.6 Performance

<b>EMS-CLU-TEN-SHA-13570</b>	The Tenderer shall explain how, during handover, the probability of detection will be maintained in a Cluster whereby each station will share the same II/SI code
<b>EMS-CLU-TEN-SHA-13580</b>	The Tenderer shall detail in the proposal how the probability of detection, during handover, will be tested in the case of operation as part of a Cluster whereby each station will share the same II/SI code.

#### D.7 Real Time Monitoring

<b>EMS-CLU-TEN-SHA-13590</b>	The monitoring function of the Cluster shall be accessible through the CMS.
<b>EMS-CLU-TEN-SHA-13600</b>	<p>The Cluster monitoring function <b>shall</b> include at least:</p> <ul style="list-style-type: none"> <li>a) Number of incoming connect requests;</li> <li>b) Number of outgoing connect requests;</li> <li>c) Active nodes on the SCN (including a cluster controller if present);</li> <li>d) Passive nodes on the SCN (including a cluster controller if present);</li> <li>e) Number of sent track supports per scan;</li> <li>f) Number of received track supports per scan;</li> <li>g) Number of sent Network Information Messages (NIM);</li> <li>h) Number of received Network Information Messages (NIM);</li> <li>i) Number of received 'Move Node to New Cluster State' messages (MNNCS).</li> </ul>



## D.8 Cluster Controller

<b>EMS-CLU-SYS-SHA-13610</b>	The Cluster Controller (CC) is an external element to the Mode S ground station and, as such, it shall not require any modification in the Mode S ground station for its operation.
<b>EMS-CLU-SYS-SHA-13620</b>	The Cluster Controller shall include a CC Surveillance Coordination Function designed to operate through the Surveillance Coordination Network.
<b>EMS-CLU-SYS-SHA-13630</b>	The Cluster Controller shall be able to handle at least 4 000 targets.
<b>EMS-CLU-TEN-SHA-13640</b>	The Tenderer shall provide information on the upgradeability of the classic CC functionality to support a larger number of targets or Mode S ground station nodes.
<b>EMS-CLU-SYS-SHA-13650</b>	The Cluster Controller shall provide control and monitoring through the local and remote CMS.
<b>EMS-CLU-SYSTEM-SHA-13660</b>	The Tenderer shall provide details of the CMS capabilities provided with the classic CC.

### D.8.1.1 CC Surveillance Cooperation Function

<b>EMS-CLU-SYS-SHA-13670</b>	<p>The classic CC SCF shall maintain a Global Selective Roll-call List by using knowledge of all the solution lists for each connected ground station. Three types of target lists exist:</p> <ul style="list-style-type: none"> <li>a) The Global Tracked Target list, which contains information on every target currently tracked by the connected ground stations;</li> <li>b) For each connected station, a Station Tracked Target List containing only those targets that are fully tracked (i.e. successfully added to the selective roll-call list) by the station;</li> <li>c) For each connected station, a Station Potential Track List containing targets that the station is capable of tracking.</li> </ul>
<b>EMS-CLU-SYS-SHA-13680</b>	<p>Track information to maintain the Global Selective Roll-Call lists can be received from:</p> <ul style="list-style-type: none"> <li>a) The SCF via the SCN;</li> <li>b) The Radar Data Processing System (RDPS).</li> </ul>

<b>EMS-CLU-SYS-SHA-13690</b>	<p>The classic CC SCF shall contain the following functions:</p> <ul style="list-style-type: none"> <li>a) A pre-defined Cluster coverage map indicating all Mode S ground station responsibilities for providing lockout and handover on targets located in different regions of the cluster. The map structure is defined as in [RD 30] and is at least capable of mapping a cluster covering an area of 600 NM by 600 NM;</li> <li>b) A network system status list containing the Cluster topology determined by the Network Monitoring Protocol (NMP) running in the Network Failure and Control function of the CC. It consists of a table containing the status of all connections between the network nodes;</li> <li>c) A periodic monitoring process is responsible for the routine monitoring of the global selective roll-call list, the coverage map and the network system status list. The process ensures that status changes result in the appropriate cluster handover activity;</li> <li>d) A network and failure control process which runs the protocols required to maintain the central mode of operation within the cluster. The acquisition and lockout responsibilities is also noted in the Station Potential Track list for subsequent processing and monitoring of cluster, station and target status.</li> </ul>
<b>EMS-CLU-SYS-SHA-13700</b>	<p>The Periodic Monitoring Process (PMP) shall:</p> <ul style="list-style-type: none"> <li>a) Monitor the network system status list;</li> <li>b) Monitor the CC global selective roll-call;</li> <li>c) Based on the Cluster topology, select the coverage map and maintain the global selective roll-call list based on that map.</li> </ul>
<b>EMS-CLU-SYS-SHA-13710</b>	<p>When the PMP detects a change of target status in global selective roll-call, or of Cluster topology in the network system status list, it shall update the global selective roll-call list and ensure that the Network and Failure control process is made aware of the targets to which this change applies.</p>
<b>EMS-CLU-SYS-SHA-13720</b>	<p>The PMP shall check the consistency between the Station Potential and Station Tracked target lists and ensure that inconsistencies which could indicate a Cluster fault (e.g. targets which are being tracked but which are not and which are not subject to a lost track request) are resolved consistent with the Cluster system configuration.</p>
<b>EMS-CLU-TEN-SHA-13730</b>	<p>The Tenderer shall provide information in their Tender Response on the inconsistencies that are checked between the Station Potential and Station Tracked target lists.</p>

<b>EMS-CLU-SYS-SHA-13740</b>	<p>The PMP shall handle at least the following changes of status:</p> <ul style="list-style-type: none"> <li>a) Newly acquired targets: those targets which have flown into the cover of the classic CC coverage area;</li> <li>b) Targets flying into the surveillance coverage of clustered nodes;</li> <li>c) The network system status list indicates a change of Cluster topology. In this case the PMP selects the appropriate coverage map and amend target details of the global selective roll call to reflect the new target status.</li> </ul>
<b>EMS-CLU-TEN-SHA-13750</b>	The Tenderer shall propose in their Tender Response a method used to select the appropriate coverage map.
<b>EMS-CLU-CON-SHA-13760</b>	The final method to be used to select the appropriate coverage map shall be agreed between the Contractor and the Contracting Authority.
<b>EMS-CLU-SYS-SHA-13770</b>	<p>The Network and Failure Controller shall perform:</p> <ul style="list-style-type: none"> <li>a) Handover management, which includes running the following protocols defined in [RD 30]: <ul style="list-style-type: none"> <li>a. Track acquisition protocol, to ensure that any interrogator is aware of any new track entering its coverage;</li> <li>b. Track support protocol, used when a radar requests track information from the classic CC on targets where a track miss has occurred.</li> </ul> </li> <li>b) Cluster topology and state determination: <ul style="list-style-type: none"> <li>a. This is achieved using the Network Monitoring Protocol (NMP);</li> <li>b. The Network Monitoring Protocol (NMP) derived cluster topology is then communicated to the cluster stations as defined in [RD 30].</li> </ul> </li> <li>c) Failure management, where: <ul style="list-style-type: none"> <li>a. The SCF is able to safely reconfigure the Cluster in the event of failures;</li> <li>b. The reconfiguration ensures the fault is isolated and that the remaining Cluster can continue to provide for correct Mode S operation;</li> <li>c. The SCF reconfigures the Cluster in the case of CC failure and network failures as described in [RD 30].</li> </ul> </li> </ul>
<b>EMS-CLU-SYS-SHA-13780</b>	The Network and Failure Control process shall determine the Cluster response to the changes in target status.
<b>EMS-CLU-TEN-SHA-13790</b>	<p>The Tenderer shall provide in their proposal details of all the functions defined below:</p> <ul style="list-style-type: none"> <li>a) The coverage map and adaptations of it;</li> <li>b) The network system status list;</li> <li>c) The periodic monitoring process;</li> <li>d) The network and failure controller.</li> </ul>

<b>EMS-CLU-SYS-SHA-13800</b>	While operating in central mode, reoccurring 'Move Node to New Cluster State' messages (MNNCS) from a cluster controller with the same content shall not lead to a reloading of the coverage maps in the System.
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#### **D.8.1.2 CC Surveillance Processing Function**

<b>EMS-CLU-SYS-SHA-13810</b>	The Surveillance Processing Function maintains the Global Tracked Target List. Track data received from connected stations shall also be inserted into the respective Station Tracked List to which they are associated.
<b>EMS-CLU-SYS-SHA-13820</b>	The Surveillance Processing Function shall be responsible for the deletion of Selective Roll call entries when no further track data is received.
<b>EMS-CLU-SYS-SHA-13830</b>	The Surveillance Processing Function shall provide a Coordinate Transformation to the local coordinate set for the track data received from the connected stations.

#### **D.8.1.3 CC Network Link**

<b>EMS-CLU-SYS-SHA-13840</b>	The classic CC Network Link shall be able to provide a communication interface with the SCN, the CMS and, optionally, a RDPS.
<b>EMS-CLU-SYS-SHA-13850</b>	The SCN interface shall support TCP/IP connections (client and server over IPv4 or IPv6).
<b>EMS-CLU-SYS-MAY-13860</b>	The SCN interface may support X.25 and/or HDLC Lap-B for outgoing and incoming data.
<b>EMS-CLU-SYS-SHA-13870</b>	The interface shall support the ASTERIX format for surveillance coordination data defined in 4.2.3.
<b>EMS-CLU-TEN-SHA-13880</b>	The Tenderer shall propose information on the data bandwidth to be used for the classic CC Network Link, and how it has been calculated.

..... *end of Mode-S Specification (Part B)* .....

## 10 Subchapter C – PSR Specification

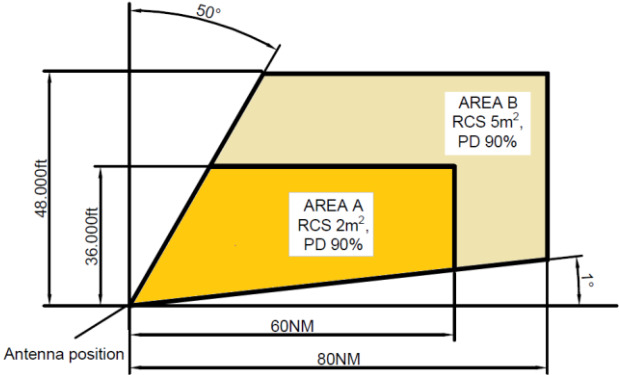
The Compliance Matrix for PSR Specification is an integral part of the tender and is located in Annex no.1, **Compliance Matrix tab C – PSR.**

### 10.1 General Requirements

<b>ANSP-SYS-SHA-00010</b>	The basic configuration of System delivery <b>shall</b> be PSR collocated with SSR Mode-S and antennas mounted on Tower and covered by Radome.
<b>ANSP-SYS-SHA-00020</b>	The radars <b>shall</b> be in continuous operation. Limited operational shutdowns are allowed only for necessary preventive maintenance
<b>ANSP-SYS-SHA-00030</b>	PSR <b>shall</b> be capable of operating asynchronously with a collocated Mode-S radar.  Adopted from <b>EMS-C07-SYS-MAY-09020</b> .  The Tenderer is expected to describe how the SSR works without PSR and vice versa.
<b>ANSP-SYS-SHA-00040</b>	The PSR, SSR Mode-S, Control and Monitoring System (CMS), Local Display <b>shall</b> be supplied as a fully integrated system.  Adopted from <b>EMS-C08-SYS-SHA-09190</b>
<b>ANSP-TEN-SHA-00050</b>	The Tenderer <b>shall</b> provide in the result of SASS-C tool-based performance measurements (PSR and SSR) done on some previously installed radars of an identical or similar configuration. The measurement results <b>shall</b> come with the following information:  a) The location, date and time of measurement; b) Recording time span and the number of samples; c) Configuration and parameters of the measured radar; d) SASS-C software version; e) Graphical presentation of all trajectories. f) Measurement results: a. probability of detection of PSR b. accuracy in range and azimuth c. false target rate

<b>ANSP-TEN-MAY-00060</b>	<p>The Tenderer <b>may</b> provide recording of raw output radar data in ASTERIX format Cat.34/48 from some previously installed radars of an identical or similar configuration. If provided, the time span of the recording <b>shall</b> be at least 3 hours from an ATS busy time period (during the day) from both PSR and SSR collocated radars.</p> <p>Possible data formats are: final format or raw ASTERIX</p>
<b>ANSP-CON-SHA-00070</b>	<p>During the commissioning phase, the Contractor <b>shall</b> analyse the radar performance with Opportunity traffic and/or Flight trials.</p>
<b>ANSP-TEN-SHA-00080</b>	<p>Information <b>shall</b> be included in the proposal on current operational identical equipment and/or field trials previously carried out on the same type and functionally identical equipment to those offered.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09200</b></p>

## 10.2 Detection Requirements

ANSP-PSR-SHA-0010	The PSR <b>shall</b> be capable of providing continuous, gap-free cover through 360° of azimuth and over a range of 0.5 NM to at least 80 NM and cone of silence not extending an elevation angle of 50° above the horizontal.
ANSP-PSR-SHA-0020	 <p>The diagram illustrates the coverage area definition. It shows an antenna position at the origin. Two areas are defined: Area A (yellow) and Area B (light yellow). Area A is bounded by a 50° elevation angle, a height of 36,000 ft, a distance of 60 NM, and a 1° elevation angle. Area B is bounded by a 50° elevation angle, a height of 48,000 ft, a distance of 80 NM, and a 1° elevation angle. The diagram also shows the ground curvature and the relationship between the two areas.</p> <p>The coverage area definition. The heights are related to ground (the curvature of the earth <b>shall</b> be respected).</p> <p>Area A:</p> <ul style="list-style-type: none"> <li>• From antenna position under angle of 50° (measured to connecting line from antenna to zenith) up to at least 36000ft above antenna level</li> <li>• in the height at least 36000ft up to distance 60 NM from antenna</li> <li>• in distance 60 NM down to 1° of elevation</li> <li>• back to antenna position</li> </ul> <p>Area B:</p> <ul style="list-style-type: none"> <li>• From antenna position under angle of 50° (measured to connecting line from antenna to zenith) up to the height of 46000ft</li> <li>• in height of 46000ft to the distance 80 NM from the antenna</li> <li>• in the distance of 80NM down to at least 1° of elevation</li> <li>• back to the antenna position</li> </ul>

<b>ANSP-PSR-SHA-0030</b>	The probability of detection (Pd) of targets in area A <b>shall</b> be 90% for targets with RSC 2m <sup>2</sup> .
<b>ANSP-PSR-SHA-0040</b>	The probability of detection (Pd) of targets in area B <b>shall</b> be at least 90% for targets with RSC 5m <sup>2</sup> .
<b>ANSP-PSR-SHA-0050</b>	The time of target position update on PSR <b>shall</b> be at maximum 4 sec, it means at minimum 15 RPM while meeting requirements: a) ANSP-PSR-SHA-0010, b) ANSP-PSR-SHA-0020, c) ANSP-PSR-SHA-0030, d) ANSP-PSR-SHA-0040
<b>ANSP-PSR-SHA-0060</b>	The Tenderer <b>shall</b> provide the actual worst probability of detection in area A for 15 RPM, in percent.
<b>ANSP-PSR-SHA-0070</b>	The Tenderer <b>shall</b> state any non-compliance with the performance requirements due radiation nulls above the horizontal.
<b>ANSP-PSR-SHA-0080</b>	The Tenderer shall state Cone of Silence of PSR beam in vertical plane above horizontal.
<b>ANSP-PSR-SHA-0090</b>	The Tenderer <b>shall</b> provide the actual worst probability of detection in area B, for 15 RPM
<b>ANSP-PSR-SHA-0100</b>	The Tenderer <b>shall</b> provide the best Pd in Area B for RCS 2m <sup>2</sup> , 15 RPM.
<b>ANSP-PSR-SHA-0110</b>	The Tenderer <b>shall</b> describe, in a graphic form, the shape of the primary antenna vertical and horizontal radiation diagrams for all beams available (e.g. in case of two feeds: lower and upper beams).
<b>ANSP-PSR-SHA-0120</b>	The Tenderer <b>shall</b> provide the actual coverage diagrams for: a) Target's RCS of 2m <sup>2</sup> , Pd=90%, RPM=15 b) Target's RCS of 5m <sup>2</sup> , Pd=90%, RPM=15 Altitude in feet and range in NM are preferred units. The coverage diagram figures <b>shall</b> contain information of the RCS, Pd and RPM. The diagrams <b>shall</b> reveal the actual coverage of Area A and Area B. Due to sitting limitations (obstructions etc.), coverage may not be available all the way to ground level. <i>Note: Range-height-elevation diagram, also known as Blake diagrams are required.</i>



<b>ANSP-PSR-SHA-0130</b>	<p>The Contractor <b>shall</b> describe in a graphic form the radar coverage (Blake diagrams) for possible high-power amplifier (HPA) degradations for still-operational radar.</p> <p>Required figures for the following combinations:</p> <p>Pd=90 %, RCS 2m<sup>2</sup>, RPM=15 Pd=90 %, RCS 5m<sup>2</sup>, RPM=15</p> <p>For all degradations N-1 to N-x, while the x is the highest number of possible degraded HPA with radar operational (despite the reduced range).</p>
<b>ANSP-PSR-SHO-0140</b>	<p>The PSR <b>should</b> have possibility that in some selected sectors coverage is more than 80 NM.</p> <p>If this possibility exist, Tenderer <b>shall</b> describe in which way this is achieved.</p>
<b>ANSP-PSR-SHO-0150</b>	<p>Radar <b>shall</b> detect moving targets at least from the velocity of 40 knots. However, it is highly desirable, to detect even slower targets.</p> <p>The Tenderer <b>shall</b> specify the actual values of minimum target's speed in knots.</p>
<b>ANSP-PSR-SHO-0160</b>	<p>Radar <b>shall</b> detect moving targets at least to the velocity of 800 knots. However, it is highly desirable, to detect even faster targets.</p> <p>The Tenderer <b>shall</b> specify the actual values of maximum target's speed in knots.</p>
<b>ANSP-PSR-SHA-0170</b>	<p>The Pd will be tested with Flight Check during SAT.</p>
<b>ANSP-PSR-SHA-0180</b>	<p>It <b>shall</b> be possible to reconfigure the PSR (and Mode-S) radar to 5 s update rate (12 RPM) if required in the future.</p>
<b>ANSP-PSR-SHA-0190</b>	<p>The Contractor <b>shall</b> provide list of operational parameters supposed to be changed when reconfiguring radar from 15 RPM to 12 RPM</p> <p><i>Note: SAT parameter values and values proposed to achieve the change are required.</i></p>

### 10.3 False Target Report

<b>ANSP-PSR-SHA-0200</b>	Average number of false target reports per antenna scan <b>shall</b> be less than 5 false targets.
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### 10.4 Systematic Errors

<b>ANSP-PSR-SHA-0210</b>	Systematic Errors <b>shall</b> be better or equal:  a) Slant range bias < 100m b) Azimuth bias < 0,1° c) Slant range gain error < 1m/NM d) Time stamp error < 100ms
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### 10.5 Random Errors

<b>ANSP-PSR-SHA-0220</b>	Random Errors (standard deviation values) <b>shall</b> be better or equal for:  a) Slant range (m) < 120m b) Azimuth (degree) < 0,15°
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### 10.6 Resolution

<b>ANSP-PSR-SHA-0230</b>	The Tenderer <b>shall</b> include in their proposal a detailed analysis of the resolution performance of the PSR.
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### 10.7 Redundancy

<b>ANSP-PSR-SHA-0240</b>	The PSR to be supplied <b>shall</b> be dual channel, complete with changeover capability, controlled both locally and remotely by the CMS.  Adopted from <b>EMS-C08-SYS-SHA-09280</b>
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<b>ANSP-PSR-SHA-0250</b>	<p>The radar <b>shall</b> support automatic cross redundancy of the main blocks (at least receiver, exciter, processor and pre-amplifier) in the PSR radar channels.</p> <p><i>Note: Cross-channel redundancy means cross-connection of redundant modules in radar channels.</i></p>
<b>ANSP-PSR-SHA-0260</b>	<p>The Tenderer <b>shall</b> provide the times of automatic switching between the duplicated sets of the radar, where are in function Operational/Stand-by.</p> <p><i>Note: Duration of the switchover in milliseconds is expected.</i></p>
<b>ANSP-PSR-SHA-0270</b>	<p>The Tenderer <b>shall</b> provide a list of automatically switched circuits (main/back-up) with no outages.</p>
<b>ANSP-PSR-SHA-0280</b>	<p>The Tenderer <b>shall</b> describe available redundancy of radar components, including degradation states. Degradation states and their impact on the radar operations of at least following components <b>shall</b> be described:</p> <ul style="list-style-type: none"> <li>a) Channel switches, beam switches</li> <li>b) One, two and more power amplifiers</li> <li>c) Preamplifier(s)</li> <li>d) Receiver; if the receiver is modular, then also any module that can be replaced during corrective maintenance.</li> <li>e) Processing block, if the processing block is modular, then also any module that can be replaced during corrective maintenance</li> <li>f) Servers or computers with high level of processing</li> <li>g) Any other block (especially blocks replaceable during corrective maintenance)</li> </ul> <p><i>Example for preamplifier:</i>  <i>Two preamplifiers operate in redundancy mode, one is active, the other is in hot-stand-by, amplifying and connected to a matched dummy load. If the currently active preamplifier fails, the whole radar channel is switched over, including generator, receiver, processing etc.</i></p> <p><b>OR</b></p> <p><i>Two preamplifiers operate in redundancy mode, one is active, the other is in hot-stand-by, amplifying and connected to a matched dummy load. If the currently active preamplifier switches over, only the preamplifier is switched over, not the whole channel, generator, receiver and processing remains of the current channel due to available cross-redundancy for that block.</i></p>

ANSP-PSR-SHA-0290	<p>Degradation states and their impact on the radar operations of the following components <b>shall</b> be described:</p> <ul style="list-style-type: none"> <li>a) One motor</li> <li>b) One of the azimuth encoders</li> <li>c) Channel switches, beam switches</li> <li>d) One, two or more power amplifiers</li> <li>e) Preamplifier(s)</li> <li>f) Receiver; if the receiver is modular, then also any module that can be replaced during corrective maintenance.</li> <li>g) Processing block, if the processing block is modular, then also any module that can be replaced during corrective maintenance</li> <li>h) Servers or computers with high level of processing</li> <li>i) Any other block (especially blocks replaceable during corrective maintenance)</li> </ul> <p><i>Example for encoders: Each encoder is fixed to only one channel. In the event of an encoder failure on the active radar channel, the radar will automatically switch to the other channel not affected by the failure. The radar channel is switched as a whole.</i></p> <p>OR</p> <p><i>Both encoders are redundantly connected to both channels. Failure of one encoder will only switch the encoder input, radar channel remains unswitched.</i></p>
ANSP-PSR-SHA-0300	<p>The Tenderer <b>shall</b> specify which blocks of the radar are exchangeable within a channel and between channels. The part exchange may require simple adjustments of jumpers, parameters or analog parts settings (attenuators, potentiometers) but the adjustment <b>shall</b> not require any instruments or tools not supplied with the radar.</p> <p>Purpose of this requirement is to explore system possibilities in case of missing spare part or partial failure or partial degradations. In some cases, it may be useful to gracefully degrade e.g. weather channel to maintain aircraft channel operational.</p> <p><i>Example of answers:</i></p> <p><i>STALO (STable Local Oscillator) can be exchanged between channels without adjustment, there is one STALO module in each radar channel.</i></p> <p><i>Receiver – There are four receivers in each channel, high beam/ low beam and aircraft/weather channel. In case of failure of two aircraft receivers the weather channel receivers can be used for aircraft channel if two jumpers are set according to corrective maintenance manual.</i></p> <p><i>LNA – There is 8 LNAs in the whole radar (high/low beam, aircraft/weather, radar channel A/B). LNAs are freely exchangeable between channels, high/low beam paths and aircraft/weather signal paths without any adjustments</i></p>

## 10.8 Target Suppression

<b>ANSP-PSR-SHA-0310</b>	The PSR <b>shall</b> be fitted with circuits or software for complete suppression of undesired targets (cars, trains).
<b>ANSP-PSR-SHA-0320</b>	<p>The Tenderer <b>shall</b> describe:</p> <ul style="list-style-type: none"> <li>the applied method of blocking or suppressing such undesired targets</li> <li>blocking zones settings – units, min-max range and azimuth, smallest step of range and azimuth settings, number of zones.</li> </ul> <p><i>Example of the answer:</i>  <i>Applied method:</i>  <i>It is possible to set local thresholds, detection margins, CFAR parameters (param1...) to suppress undesired targets in specified zones, etc.</i>  <i>Blocking zone settings:</i></p> <ol style="list-style-type: none"> <li>range in nautical miles, azimuth in degrees,</li> <li>zone min. size 1/16NM in range, 0.2° in azimuth,</li> <li>zone max. size 100 NM in range and 359° in azimuth</li> <li>smallest step of zone settings 1/16NM, 0.2°</li> <li>maximum number of zones: 128</li> </ol>
<b>ANSP-PSR-SHA-0330</b>	The PSR <b>shall not</b> suffer any degradation of performance due to interference created by the rotation of the wind turbine blades. The radar <b>shall</b> be fitted with circuits or software for complete suppression of undesired targets – wind turbine.
<b>ANSP-PSR-SHA-0340</b>	The Tenderer <b>shall</b> describe the applied method of blocking Wind Farm Doppler Effect.
<b>ANSP-PSR-SHA-0350</b>	<p>The Tenderer <b>shall</b> provide a measurement/analysis report of real test flight above wind farms to prove the actual performance of the mitigation technique.</p> <ol style="list-style-type: none"> <li>Test flight should be dedicated for the wind farm mitigation technique, opportunity traffic is not allowed as a proof of the technique</li> <li>Flight trajectory, indicated detections and wind farms positions should be indicated</li> <li>Aircraft type used during the test flight should be specified, RCS of the aircraft is welcome</li> <li>Minimum flight duration: 20 minutes</li> <li>Achieved sub clutter visibility and probability of detection should be presented in the report as a result.</li> </ol>

<b>ANSP-PSR-SHA-0360</b>	PSR <b>shall</b> make at least three permanent echoes available for display purposes. The permanent echoes used for permanent check of azimuth and distance correctness are buildings, water towers, hills etc. near the radar site. Automatic warning of incorrect azimuth and/or range measurement is preferred.
<b>ANSP-PSR-SHA-0370</b>	The Tenderer <b>shall</b> describe the applied method of non-suppression of selected fix targets.
<b>ANSP-PSR-SHA-0380</b>	The Tenderer <b>shall</b> provide a list of all operational parameters adjustable by user for primary radar. In the list of parameters shall be provided the scale of adjustment and the purpose of parameter and effect of parameter.

#### 10.9 Weather Channel

<b>ANSP-PSR-SHA-0390</b>	The PSR <b>shall</b> be equipped with Weather Channel
<b>ANSP-PSR-SHA-0400</b>	On weather channel the efficient technique for suppression ground clutter and moving targets (planes) <b>shall</b> be employed. The percentage of residual clutter or targets <b>shall</b> be less than 5% of whole area of radar coverage
<b>ANSP-PSR-SHA-0410</b>	The characteristics of radar (transmitter power, receiver sensitivity, antenna gain etc.) <b>shall</b> ensure minimum detectable reflectivity of weather echo: 20dBZ or less
<b>ANSP-PSR-SHA-0420</b>	Dynamic range of receiver <b>shall</b> enable observation of weather targets with reflectivity in range at least 18 to 57 dBZ.
<b>ANSP-PSR-SHA-0430</b>	The Tenderer <b>shall</b> provide the real value of the dynamic range for Weather Channel.
<b>ANSP-PSR-SHA-0440</b>	Weather radar echo <b>shall</b> be available in at least 6 intensity levels on equal steps covering at least reflectivity interval 20 to 60 dBZ.
<b>ANSP-PSR-SHA-0450</b>	The Tenderer <b>shall</b> provide the real value of number available intensity levels for Weather Channel.
<b>ANSP-PSR-SHA-0460</b>	Spatial resolution of output weather data <b>shall</b> be: a) in case of polar coordinates: 1.5o x 1NM or better b) in case of Cartesian coordinates: 1 NM x 1 NM or better

<b>ANSP-PSR-SHA-0470</b>	The Tenderer <b>shall</b> provide the real value of sizes of Weather Channel output cells.
<b>ANSP-PSR-SHA-0480</b>	Weather echo <b>shall</b> be integrated during several radar sweeps. The optimum is 30 sec.
<b>ANSP-PSR-SHA-0490</b>	The Tenderer <b>shall</b> provide the real value of integration during several radar sweeps.
<b>ANSP-PSR-SHA-0500</b>	Weather Channel Data <b>shall</b> be outputted in one of the following Data Formats (alternatively): a) In standard EUROCONTROL ASTERIX Cat.009, transmitted by UDP datagrams from a separate output channel. b) In standard EUROCONTROL ASTERIX Cat.008, transmitted by UDP datagrams from a separate output channel.
<b>ANSP-PSR-SHA-0510</b>	In case of alternative ASTRIX Cat.009 or/and ASTERIX Cat.008: Definition of ASTERIX Cat.008/009 User Profile <b>shall</b> be given.
<b>ANSP-PSR-SHA-0520</b>	The Tenderer <b>shall</b> provide a detailed technical description of Weather Channel output data format.

#### 10.10 Transmitter

<b>ANSP-PSR-SHA-0530</b>	The transmitter <b>shall</b> be a solid-state system in L or S radar dedicated band.
<b>ANSP-PSR-SHA-0540</b>	The transmitter <b>shall</b> be air-cooled.
<b>ANSP-PSR-SHA-0550</b>	The transmitter <b>shall</b> operate in a diverse mode with at least two frequencies.
<b>ANSP-PSR-SHA-0560</b>	The Tenderer <b>shall</b> specify number of frequencies that can be used in operational mode (in frequency diverse mode).  Note: Not the number of frequencies available in the L or S band for selection. The actual number of frequencies that will be set in the radar is requested, typically 2, 4, 8 or 16 frequencies.
<b>ANSP-PSR-MAY-0570</b>	Frequency agility mode may be available.
<b>ANSP-PSR-MAY-0580</b>	Tenderer <b>shall</b> state number of frequencies used in the agility mode.

<b>ANSP-PSR-SHA-0590</b>	The step in frequency selection <b>shall</b> be fine enough to precisely fit in current spectrum background noise. Maximum frequency step <b>shall</b> be 5 MHz.
<b>ANSP-PSR-SHA-0600</b>	The Tenderer <b>shall</b> state the actual frequency step in MHz. <i>Note: The smaller the step the better, down to 1 MHz, smaller step than 1 MHz is not necessary.</i>
<b>ANSP-PSR-SHA-0610</b>	The Tenderer <b>shall</b> select frequencies for the radar that do not conflict with the operation of other systems in the surroundings of the installation site (see the description in Annex 1)
<b>ANSP-PSR-SHA-0620</b>	Tenderer <b>shall</b> specify proposed frequency.
<b>ANSP-PSR-SHA-0630</b>	The Tenderer <b>shall</b> specify the shape and width of pulses used in operational mode.
<b>ANSP-PSR-SHA-0640</b>	The Tenderer <b>shall</b> specify the iterative frequency and the transmission sequences (timing of long/short impulse, stagger).
<b>ANSP-PSR-SHA-0650</b>	The Tenderer <b>shall</b> ensure the staggering pattern of PSR is random to avoid false detections in case of random radars antennas synchronization.
<b>ANSP-PSR-SHA-0660</b>	<p>The Tenderer <b>shall</b> describe the modulation of the transmitted pulse, including specification of intrapulse modulation (in case of frequency modulation also the frequency deviation).</p> <p>The Tenderer <b>shall</b> describe the signal frequency characteristics at the transmitter output. The frequency characteristics <b>shall</b> be documented by means of a spectrum chart and values achieved by performing relevant field measuring. The transmitter to be used for such measuring <b>shall</b> be completely identical (type, configuration, load) with the transmitter offered as part of this Bid.</p> <p>The Bid <b>shall</b> specify the following:</p> <ul style="list-style-type: none"> <li>a) Configuration;</li> <li>b) Measurement location and time;</li> <li>c) Device applied</li> </ul>
<b>ANSP-PSR-SHA-0670</b>	The Tenderer <b>shall</b> provide the number of pulses in the beam for 15 RPM and 12 RPM.



<b>ANSP-PSR-SHA-0680</b>	<p>The radar <b>shall</b> stay operational (even though the performance is degraded) with degraded output power amplifiers. The minimum percentage of power from non-degraded nominal power to keep the radar operational <b>shall</b> be specified by the Tenderer.</p> <p>Example: <i>The radar has 10 power amplifiers (10 physical modules), each provides 1 kW of peak power. The radar is still operational with two amplifiers degraded (8 kW of power remains: 2 kW of power is lost). The radar is not operational with 3 amplifiers degraded and the transmission is not possible. The minimum percentage of nominal power to use radar as operational is therefore 80 %.</i></p> <p><i>Note: This requirement explores possibilities of graceful degradations</i></p>
<b>ANSP-PSR-SHA-0690</b>	<p>The Tenderer <b>shall</b> describe what is the impact of transmitter power amplifiers degradations on radar performance.</p> <p>The description or figures <b>shall</b> indicate following:</p> <ul style="list-style-type: none"> <li>• Transmitter power in non-degraded state</li> <li>• Transmitter power in degraded states for each degraded mode (1 power amplifier is off, 2 power amplifiers are off, ... to the lowest operational degradation level)</li> <li>• Maximum radar range for RCS of 2m<sup>2</sup> and 90% Pd for each degradation level</li> <li>• Maximum radar range for RCS of 5m<sup>2</sup> and 90% Pd for each degradation level</li> </ul> <p>Preferred variant of answer as example:</p>

	<table><tr><th colspan="3">PSR RCS 2m<sup>2</sup>, PD 90%</th></tr><tr><th>Power (kW)</th><th>Range NM</th><th>Status</th></tr><tr><td>10 kW</td><td>100 NM</td><td>Fully operational</td></tr><tr><td>9 kW</td><td>80 NM</td><td>degraded operational</td></tr><tr><td>8 kW</td><td>60 NM</td><td>degraded operational</td></tr><tr><td>7 kW</td><td>40 NM</td><td>degraded operational</td></tr><tr><td>6 kW</td><td>0</td><td>non - operational</td></tr><tr><td>5 kW</td><td>0</td><td>non - operational</td></tr><tr><td>4 kW</td><td>0</td><td>non - operational</td></tr><tr><td>3 kW</td><td>0</td><td>non - operational</td></tr><tr><td>2 kW</td><td>0</td><td>non - operational</td></tr><tr><td>1 kW</td><td>0</td><td>non - operational</td></tr></table> <div><p>PSR RCS 2M<sup>2</sup> PD 90%</p><table><caption>Graph Data: PSR RCS 2M<sup>2</sup> PD 90%</caption><tr><th>Power (kW)</th><th>Range (NM)</th></tr><tr><td>10</td><td>100</td></tr><tr><td>9</td><td>80</td></tr><tr><td>8</td><td>60</td></tr><tr><td>7</td><td>40</td></tr><tr><td>6</td><td>0</td></tr></table></div>	PSR RCS 2m <sup>2</sup> , PD 90%			Power (kW)	Range NM	Status	10 kW	100 NM	Fully operational	9 kW	80 NM	degraded operational	8 kW	60 NM	degraded operational	7 kW	40 NM	degraded operational	6 kW	0	non - operational	5 kW	0	non - operational	4 kW	0	non - operational	3 kW	0	non - operational	2 kW	0	non - operational	1 kW	0	non - operational	Power (kW)	Range (NM)	10	100	9	80	8	60	7	40	6	0
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ANSP-PSR-SHA-0700	<p>The radar <b>shall</b> be provided with a measuring point to allow measurement of the total radar output power without affecting radar operation (<b>shall</b> be isolated enough). Connection of a power probe <b>shall</b> not affect radar operation.</p> <p>The measuring point <b>shall</b> be easily accessible to maintenance personnel.</p> <p>The preferred option is an SMA or N connector of a coupler at the transmitter output (or a waveguide coupler or similar point at the radar output).</p>																																																
ANSP-PSR-SHA-0710	<p>The Tenderer <b>shall</b> describe the power probe connection details:</p> <ul style="list-style-type: none"><li>• connector type</li><li>• placement</li><li>• coupling</li><li>• losses from the main output line to measuring point</li></ul>																																																
ANSP-PSR-SHA-0720	<p>The Tenderer <b>shall</b> specify the type and manufacturer of the solid-state power components of the transmitter.</p>																																																
ANSP-PSR-SHA-0730	<p>The System <b>shall</b> provide site-dependant parameters to configure, as a function of azimuth, blanking sectors where there will not be output power level, i.e. RF radiation is disabled.</p>																																																

<b>ANSP-PSR-SHA-0740</b>	The configurable blanking sectors <b>shall</b> allow to configure at least 32 azimuth intervals, with steps no larger than 1°, over 360°.
<b>ANSP-PSR-SHA-0750</b>	The PSR <b>shall</b> be capable of rejecting Multiple Time Around Targets (MTAT) under all operational conditions
<b>ANSP-PSR-SHA-0760</b>	The Tenderer <b>shall</b> provide details of the method used for rejecting MTAT
<b>ANSP-PSR-SHA-0770</b>	The PSR <b>shall</b> be capable of rejecting Multiple Time Around Clutter (MTAC) under all operational conditions.
<b>ANSP-PSR-SHA-0780</b>	The Tenderer <b>shall</b> provide details of the method used for rejecting MTAC.

#### 10.11 Receiver

<b>ANSP-PSR-SHA-0790</b>	<p>The Tenderer <b>shall</b> provide a list of radar receiver parameters:</p> <ul style="list-style-type: none"> <li>a) Preamplifier type;</li> <li>b) Receiver type;</li> <li>c) Gain</li> <li>d) Noise factor;</li> <li>e) Sensitivity in long range (dBm)</li> <li>f) Sensitivity in other ranges</li> <li>g) Dynamic range (dB)</li> <li>h) Linearity</li> </ul>
<b>ANSP-PSR-SHA-0800</b>	<p>The Tenderer <b>shall</b> provide following details for Receiver:</p> <ul style="list-style-type: none"> <li>a) Receiver operating philosophy and (functional diagram);</li> <li>b) Receiver(s) pass-band characteristics and out of band suppression;</li> <li>c) Pulse decompression techniques with special attention being given to the time-side lobe levels and their influence on target resolution, especially in the upper/lower beam switching regions.</li> </ul>

<b>ANSP-PSR-SHA-0810</b>	The receiver <b>shall</b> be enough selective for total suppress of the mobile service on L or S radar frequency band. Generally, the radar <b>shall</b> be immune to LTE/4G/5G mobile service signals.
<b>ANSP-PSR-SHA-0820</b>	Sensitivity Time Control (STC), or an equivalent threshold method, <b>shall</b> be provided and selectable between pre-programmed logarithmic options or programmable thresholds.
<b>ANSP-PSR-SHA-0830</b>	The STC <b>shall</b> be programmable in range and azimuth based on a high-resolution map.
<b>ANSP-PSR-SHA-0840</b>	The Tenderer <b>shall</b> provide details of the STC techniques applied.
<b>ANSP-PSR-SHA-0850</b>	The System <b>shall</b> provide several STC thresholds pre-programmed.
<b>ANSP-PSR-SHA-0860</b>	The programmable STC thresholds <b>shall</b> allow configuration through the CMS.
<b>ANSP-PSR-SHA-0870</b>	The STC thresholds configuration <b>shall</b> allow to start from a pre-programmed STC threshold and apply a constant offset and/or a change for specific range intervals.
<b>ANSP-PSR-SHA-0880</b>	The STC thresholds <b>shall</b> be stored with an exportable readable format.
<b>ANSP-PSR-SHA-0890</b>	The System <b>shall</b> be able to create azimuth intervals, with steps no larger than 1°, where to apply different STC thresholds.
<b>ANSP-PSR-SHA-0900</b>	The Tenderer <b>shall</b> detail how the STC thresholds will be configured and which resolution will be applied for the azimuth and range intervals.
<b>ANSP-PSR-MAY-0910</b>	Since anomalous propagation is generally seasonal in nature, the rejection mechanism <b>may</b> be auto-adaptive in order to obviate the requirement for regular intervention by maintenance personnel. “Seasonal” maps <b>may</b> be used.
<b>ANSP-PSR-SHA-0920</b>	If any auto-adaptive or seasonal rejection mechanism is used, the Tenderer <b>shall</b> provide details of the method used.

## 10.12 Processor

<b>ANSP-PSR-SHA-0930</b>	An all-digital Signal Processor of advanced design <b>shall</b> be provided for each Radar Channel and <b>shall</b> operate to the end of range.
<b>ANSP-PSR-SHA-0940</b>	Signal Processor <b>shall</b> perform the analogue-to-digital encoding of the I and Q videos if not already done at "Receiver" level.
<b>ANSP-PSR-SHA-0950</b>	Signal Processor <b>shall</b> perform MTD type digital filtering in order to eliminate ground and rain clutter.
<b>ANSP-PSR-SHA-0960</b>	The Tenderer <b>shall</b> describe in detail the principles of his MTD processing, number of Doppler filters, staggering losses (=dip between Doppler frequency filter peaks)
<b>ANSP-PSR-SHA-0970</b>	Signal Processor <b>shall</b> use high-resolution Range-Azimuth mapping/processing techniques to ensure the required Pd and Pfa limits.
<b>ANSP-PSR-SHA-0980</b>	The Tenderer <b>shall</b> provide in its Bid describe in detail principles of processing to ensure Pd and Pfa limits.
<b>ANSP-PSR-SHA-0990</b>	<p>The Tenderer <b>shall describe</b> in detail the principles of signal processing. Signal Processor <b>shall</b> perform:</p> <ul style="list-style-type: none"> <li>a) CFAR (Constant False Alarm Rate);</li> <li>b) magnitude computation;</li> <li>c) timing and generation of the RAG (Range-Azimuth Gate) Maps used;</li> <li>d) Plot extraction method</li> <li>e) the generation of primitive target reports (if applicable);</li> <li>f) positional integration and plot formatting (if applicable);</li> <li>g) zero velocity thresholding and filtering, in particular for the detection of tangentially flying targets SCV (sub-clutter visibility);</li> </ul>
<b>ANSP-PSR-SHA-1000</b>	<p>The Tenderer <b>shall</b> provide in its Bid a list of radar signal processing parameters:</p> <ul style="list-style-type: none"> <li>a) MTD – number of filters;</li> <li>b) Sub clutter Visibility;</li> <li>c) Value of the first blind velocity;</li> <li>d) Minimum radial target velocity;</li> </ul>

	<ul style="list-style-type: none"> <li>e) Maximum radial target velocity;</li> <li>f) Map of clutter and false targets;</li> <li>g) STC map (minimum azimuth and range cell size);</li> <li>h) FAR (cell size);</li> <li>i) Map of unwanted targets (azimuth and range step); =equivalent of NAI zone (non-automatic track initiation)</li> <li>j) Minimum Detectable Signal;</li> </ul>
<b>ANSP-PSR-SHA-1010</b>	<p>The Tenderer <b>shall</b> provide a list of operational performance parameters of PSR:</p> <ul style="list-style-type: none"> <li>a) Range accuracy (in meters);</li> <li>b) Slant range errors (in meters);</li> <li>c) Azimuth accuracy (in degrees);</li> <li>d) Range resolution in short range at Pd=90%, = target discrimination in no-pulse-compression zone (in meters);</li> <li>e) Range resolution in long range at Pd=90%, = target discrimination in pulse-compression zone (in meters);</li> <li>f) Azimuth resolution, = target discrimination (in degrees);</li> <li>g) Minimum residual systematic positional error after compensation (meters);</li> <li>h) Processible target characteristic (Swerling Type);</li> <li>i) Total number of targets processible on radial line (unitless);</li> <li>j) Total number of target processible in one revolution (unitless);</li> <li>k) Processing delay (seconds);</li> <li>l) Processing delay (seconds);</li> <li>m) Maximum number of false targets per revolution (unitless);</li> </ul>
<b>ANSP-PSR-MAY-1020</b>	<p>The radar <b>may</b> be equipped with a dedicated jamming detection functionality. The radar <b>may</b> continuously check selected frequencies and provide information of direction of jamming. If the function is implemented, the jamming source <b>shall</b> be indicated in a dedicated figure. The Tenderer should describe technique used as well as the form of the indication.</p>
<b>ANSP-PSR-SHA-1030</b>	<p>When the jamming detection function is implemented, it <b>shall</b> be able to process at least 25 frequencies and display result on the Local Display Screen</p>
<b>ANSP-PSR-SHA-1040</b>	<p>When the jamming detection function is implemented the azimuth resolution of the jamming <b>shall</b> be at least 3 degrees.</p>

<b>ANSP-PSR-SHA-1050</b>	The radar <b>shall</b> have a hardware or software component to suppress false targets appearing in specific weather conditions (“angels”).
<b>ANSP-PSR-SHA-1060</b>	The Tenderer <b>shall</b> describe how such targets are suppressed (“angel processing”) and what parameters are available for tuning.
<b>ANSP-PSR-SHA-1070</b>	<p>The Tenderer <b>shall</b> provide full information on:</p> <ul style="list-style-type: none"> <li>c) The stability of the proposed system, particularly with regard to amplitude and phase variations in the transmitter output;</li> <li>d) The maintenance requirements of the proposed system.</li> </ul> <p>Adopted from <b>EMS-C08-TEN-SHA-09260</b></p>
<b>ANSP-PSR-SHA-1080</b>	<p>The PSR and SSR systems <b>shall</b> be able to exchange data within the internal LAN network.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-09050</b>.</p>
<b>ANSP-PSR-SHA-1090</b>	The Tenderer <b>shall</b> specify in its Bid the peak power consumption when the radar is being switched on and the antenna starts rotating. The power consumption levels <b>shall</b> be documented by relevant measurement records.
<b>ANSP-PSR-SHA-1100</b>	<p>The Tenderer <b>shall</b> provide in its Bid a list of electrical parameters of the PSR and SSR system and highlight those parameters that are to be tested during FAT and SAT. The list <b>shall</b> include the items given in following subsection:</p> <ul style="list-style-type: none"> <li>a) Voltage and frequency tolerance;</li> <li>b) Operational electric input;</li> <li>c) Power factor;</li> <li>d) Starting current peak and its time course;</li> <li>e) Value of main circuit breaker;</li> <li>f) Grounding method and protection against dangerous touch voltage</li> </ul>
<b>ANSP-PSR-SHA-1110</b>	<p>Comprehensive BITE <b>shall</b> be provided for both on-line and off-line testing of the System to detect any fault affecting the performance of the System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05160</b></p>

### 10.13 Primary Antenna and Mechanical Components

<b>ANSP-PSR-SHA-1110</b>	Antenna polarization <b>shall</b> be switchable between linear and circular polarization. Switching of the antenna polarization <b>shall</b> be available locally on radar site and remotely. Remote polarization switch <b>shall</b> be remotely reversible action.
<b>ANSP-PSR-SHA-1120</b>	The antenna drive mechanism <b>shall</b> include two motors and two transmissions for revolutions reduction. The basic operation <b>shall</b> involve the use of both motors.
<b>ANSP-PSR-SHA-1130</b>	The radar <b>shall</b> be able to operate with just one motor.
<b>ANSP-PSR-SHA-1140</b>	If the antenna rotation is switched off for any reason, the radar <b>shall</b> automatically stop transmitting.
<b>ANSP-PSR-SHA-1150</b>	The System <b>shall not</b> enable transmission based on random antenna movement. <i>Note: Random antenna movements due to the wind or mechanical antenna inspection <b>shall</b> not enable the transmission.</i>

### 10.14 Maintenance

<b>ANSP-PSR-SHA-1160</b>	<p>The Tenderer shall provide sample of documentation of corrective maintenance description of a blocks that are replaceable by the Contractor's personnel in case of a failure. At least documentation of the following blocks shall be provided:</p> <p>Documents with description of corrective maintenance:</p> <ul style="list-style-type: none"> <li>a) In case of power amplifier failure.</li> <li>b) In case of the main combiner failure (the last part of microwave path before waveguide – where outputs from each power amplifier are combined to a single waveguide.)</li> </ul> <p>Step by step manual including pictures is expected.</p>
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#### 10.15 FAT, SAT

<b>ANSP-PSR-SHA-1170</b>	<p>The Tenderer shall provide a list of operational performance parameters that are to be tested during FAT and SAT. The list shall include at least the items given in following subsection Items:</p> <ul style="list-style-type: none"><li>a) Range accuracy;</li><li>b) Slant range errors;</li><li>c) Azimuth accuracy;</li><li>d) Range resolution;</li><li>e) Azimuth resolution;</li><li>f) Minimum residual systematic positional error after compensation;</li><li>g) Processible target characteristic (Swerling Type);</li><li>h) Total targets number processible on radial line;</li><li>i) Total target number processible in one revolution;</li><li>j) Processing delay;</li><li>k) Time stamping error;</li><li>l) Maximum number of false targets per revolution;</li></ul>
<b>ANSP-PSR-SHA-1180</b>	<p>The Tenderer <b>shall</b> provide in a list of radar transmitter parameters that are to be tested during FAT and SAT. The list shall include the items given in following subsection Items:</p> <ul style="list-style-type: none"><li>a) Operational frequency for radar</li><li>b) Transmitting sequence, diversity (timing);</li><li>c) Pulse width(s);</li><li>d) Shape of transmitted pulse(s);</li><li>e) Frequency spectrum;</li><li>f) Repetitive frequency;</li><li>g) Pulse power;</li><li>h) Average power;</li><li>i) Compression rate;</li><li>j) Type and number of power components;</li><li>k) Number of transmitter modules;</li><li>l) Transmitter cooling system;</li><li>m) Attenuation of antenna lines from transmitter to antenna connector</li></ul>

<b>ANSP-PSR-SHA-1190</b>	<p>The Tenderer <b>shall</b> provide in a list of radar receiver parameters and highlight those parameters that are to be tested during FAT and SAT.</p> <p>The list <b>shall</b> include the items given in following subsection Items</p> <ul style="list-style-type: none"> <li>a) Preamplifier type;</li> <li>b) Receiver type;</li> <li>c) Gain</li> <li>d) Noise factor;</li> <li>e) Sensitivity</li> <li>f) The Tenderer shall specify the sensitivity in the long range in dBm.</li> <li>g) Dynamic range</li> <li>h) Linearity</li> </ul>
<b>ANSP-PSR-SHA-1200</b>	<p>The Tenderer <b>shall</b> provide in its Bid a list of radar signal processing parameters and highlight those parameters that are to be tested during FAT and SAT.</p> <p>The list <b>shall</b> include the items given in following subsection Items:</p> <ul style="list-style-type: none"> <li>a) MTD – number of filters;</li> <li>b) Subclutter Visibility;</li> <li>c) Value of the first blind velocity;</li> <li>d) Minimum radial target velocity;</li> <li>e) Maximum radial target velocity;</li> <li>f) Map of clutter and false targets;</li> <li>g) STC map (minimum azimuth and range cell size, step in dB);</li> <li>h) FAR;</li> <li>i) Map of unwanted targets (azimuth and range discretion); equivalent of NAI zone (non-automatic track initiation)</li> <li>j) Minimum Detectable Signal</li> </ul> <p>FAT, SAT, Technical description</p>

..... *end of PSR Specification* .....

## 11 Subchapter D – System Elements Specification

Some requirements originate in EMS v.4 specification, but for the purpose of this tender, they are modified or extended or valid for PSR and Mode-S. In this case, the ref. number is changed to ANS pattern, ANSP-xxx-xxx-xxxxx. In the Compliance Matrix, column F indicates from which EMS requirement the ANSP requirement is adopted.

The Compliance Matrix for System Elements is based on Eurocontrol EMS 4.0 and is an integral part of the tender and is located in Annex no. 1, **Compliance Matrix tab D – System Elements**.

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted the in color.

### 11.1 Environmental Conditions

#### 11.1.1 Internal Conditions

<b>ANSP-SYS-SHA-00090</b>	<p>Any equipment housed within the ground station equipment room(s) or remote equipment shelter <b>shall</b> operate and maintain its full operational performance under the following conditions:</p> <ul style="list-style-type: none"><li>a) Temperature: 0 °C to +40 °C;</li><li>b) Relative Humidity: 90% (non-condensing at +25 °C).</li></ul> <p>Adopted from <b>EMS-C09-SYS-SHA-10310</b>.</p>
<b>ANSP-SYS-SHA-00100</b>	<p>Where it is agreed that COTS equipment can be employed in the ground station equipment room, the following condition <b>shall</b> be considered acceptable for that equipment:</p> <ul style="list-style-type: none"><li>a) Temperature: +10 °C to +40 °C;</li><li>b) Humidity: 80% (non-condensing at +25 °C).</li></ul> <p>Adopted from <b>EMS-C09-SYS-SHA-10320</b>.</p>

### 11.1.2 External Conditions

<b>ANSP-SYS-SHA-00110</b>	<p>Any equipment not housed within the ground station equipment room(s) or remote equipment shelter, including Far Field Monitor outdoor elements, LVA antenna, turning gear together with any pedestal mounted electronics, <b>shall</b> operate and maintain its full operational performance under the following conditions:</p> <ul style="list-style-type: none"> <li>a) Ambient Air Temperature: -40 °C to +50 °C;</li> <li>b) Relative Humidity: Up to 100% (Lower than 90% at 40 °C);</li> <li>c) Driving Rain: Up to 60 mm/h;</li> <li>d) Snow load: Up to 200 kg/m<sup>2</sup> (in or out of operations and in transport);</li> <li>e) Solar radiation: 1135 W/m<sup>2</sup>h during 4 hours;</li> <li>f) Hail: Up to 10 mm at 18 m/s;</li> <li>g) Wind resistance: <ul style="list-style-type: none"> <li>a. In operation, bursts up to 160 km/h without frost or ice, up to 130 km/h with 12 mm frost or ice;</li> <li>b. In survival, bursts up to 220km/h, without frost or ice, up to 180 km/h with 12 mm frost or ice.</li> </ul> </li> </ul> <p>Adopted from <b>EMS-C09-SYS-SHA-10330</b>.</p>
<b>ANSP-SYS-SHA-00120</b>	<p>All external equipment antennas and turning gear <b>shall</b> be resilient to salt atmospheres.</p> <p>RATIONALE: DEF-STAN 07-55 Test C6 ([RD 84]) provides guidance to the salt resilience to be attained.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10340</b>.</p>
<b>ANSP-TEN-SHA-00130</b>	<p>The Tenderer <b>shall</b> provide in their proposal information on the effects on the detection and accuracy performance of 2.6.1, 2.6.5 and 2.7.1 for a Mode S ground station subject to severe fresh and salt water rime ice formation on the antenna(s).</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10350</b></p>
<b>ANSP-TEN-SHA-00140</b>	<p>The Tenderer <b>shall</b> provide in their proposal information on the external effects listed on the antenna gain and beam patterns.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10360</b></p>

<b>ANSP-TEN-SHA-00150</b>	<p>The Tenderer <b>shall</b> provide in their proposal information on prevention of rime ice formation and/or recommendations to reduce the effects of these climatic conditions.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10370</b></p>
<b>ANSP-TEN-SHA-00160</b>	<p>Full, individual environmental specifications for all external equipment <b>shall</b> be provided in the proposal.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10380</b></p>

### 11.1.3 Storage Conditions

<b>ANSP-SYS-SHA-00170</b>	<p>All types of equipment, including spares, <b>shall</b> be capable of being stored under cover for a period of up to 2 years at varying temperatures from -40 °C to +60 °C with an ambient relative humidity ranging from 40% to 90%, damp heat lower than 93% at 40 °C without affecting either their operation and performance to specification, or their normal expected operational life.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10390</b></p>
<b>ANSP-SYS-SHA-00180</b>	<p>Where it is agreed that COTS equipment can be employed, the following condition <b>shall</b> be considered acceptable for that equipment when stored:</p> <ul style="list-style-type: none"> <li>a) Temperature: -10 °C to +60 °C;</li> <li>b) Humidity: 80% (non-condensing at +25 °C).</li> </ul> <p>Adopted from <b>EMS-C09-SYS-SHA-10400</b></p>
<b>ANSP-TEN-SHA-00190</b>	<p>Any equipment with components whose operational life could include time in storage, for example memory devices dependent upon batteries, <b>shall</b> be identified and described in the proposal, including the appropriate precautions to be taken and the maximum storage life.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10410</b></p>
<b>ANSP-SYS-SHA-00200</b>	<p>The equipment items <b>shall</b> be capable of undergoing, in their package, the constraints related to the transport by air, sea or land.</p> <p>Adopted from <b>MS-C09-SYS-SHA-10420</b></p>

## 11.2 Radome

<b>ANSP-TEN-SHA-00210</b>	<p>The Tenderer <b>shall</b> propose a Radome to cover and protect the PSR antenna and Mode S antenna, the turning gear unit and the azimuth data generator.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08310</b></p>
<b>ANSP-SYS-SHO-00220</b>	<p>When included as a part of the System, the Radome <b>should</b> consist in a set of panel sections joined together to form a self-sustained truncated sphere.</p> <p>Adopted from <b>EMS-C07-SYS-SHO-08320</b></p>
<b>ANSP-SYS-SHA-00230</b>	<p>When included as a part of the System, the presence of a Radome <b>shall not</b> prevent the System to comply with the performance requirements described in Chapter 2.1, Chapter 2.2 – Mode S Specification and Chapter 2.3 - PSR Specification.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08330</b></p>
<b>ANSP-TEN-SHA-00240</b>	<p>When included as a part of the System, The Tenderer <b>shall</b> provide details in their response of the Radome characteristics, with guaranteed parameter limits, and supported with measured evidences. As a minimum the following information is supplied by the Tenderer in their response:</p> <ul style="list-style-type: none"> <li>a) RF transmission loss and VSWR at the operating frequencies;</li> <li>b) Impact of Radome in Sum, Difference and Control radiation patterns (widening, narrowing, new sidelobes, new nulls, effects in cone of silence, etc.);</li> <li>c) Fully dimensioned drawings;</li> <li>d) Characteristics, Weight, Mechanical Construction and Support Construction of the Radome;</li> <li>e) Lightning strike and earthing connection;</li> <li>f) Obstruction lights connection;</li> <li>g) Safety (maintenance personnel, lightning protection);</li> <li>h) Mechanical requirements (dismantling/reassembly of panels, transportation, lifting, full installation);</li> <li>i) Environmental protection;</li> <li>j) Maintenance requirements and lifetime of the panels.</li> </ul> <p>Adopted from <b>EMS-C07-TEN-SHA-08340</b></p>

<b>ANSP-SYS-SHA-00250</b>	<p>When included as a part of the System, the Radome <b>shall</b> be able to operate under all the range of conditions detailed in 9.2.2 and to be resilient to salt atmospheres.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08350</b></p>
<b>ANSP-SYS-SHA-00260</b>	<p>When included as a part of the System, the Radome <b>shall</b> have a design life of 15 years with a minimum maintenance for operation.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08360</b></p>
<b>ANSP-SYS-SHA-00270</b>	<p>When included as a part of the System, the Radome <b>shall</b> be supplied with enough spare panels to achieve its design life.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08370</b></p>
<b>ANSP-SYS-SHA-00280</b>	<p>When included as a part of the System, the Radome <b>shall</b> be constructed to prevent fungus and algae growth.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08380</b></p>
<b>ANSP-SYS-SHA-00290</b>	<p>When included as a part of the System, the Radome <b>shall</b> be supplied with obstruction lights (7.6) and lightning rod(s) (7.7) to be mounted preferably on its upper part.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08390</b></p>
<b>ANSP-SYS-SHA-00300</b>	<p>When included as a part of the System, the Radome <b>shall</b> be supplied with internal lights to facilitate maintenance activities in low light conditions.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08400</b></p>
<b>ANSP-SYS-SHA-00310</b>	<p>When included as a part of the System, the external colour of the Radome <b>shall</b> be agreed between the Contracting Authority and the Contractor.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08410</b></p> <p><i>Note: Radome <b>shall</b> be White. (RAL 9003, RAL 9010 or RAL 9016)</i></p>

<b>ANSP-CON-SHA-00320</b>	<p>When included as a part of the System, the specialized tools and material necessary for the Radome maintenance <b>shall</b> be provided.</p> <p>Adopted from <b>EMS-C07-CON-SHA-08420</b></p>
<b>ANSP-CON-SHA-00330</b>	<p>When included as a part of the System, The Contractor <b>shall</b> deliver, as a part of the Maintenance documentation, the technical characteristics and commercial references for the products needed for the Radome maintenance (e.g. cleaning products, paintwork material, radome reparation, etc.).</p> <p>Adopted from <b>EMS-C07-CON-SHA-08430</b></p>
<b>ANSP-TEN-SHA-00340</b>	<p>The Tenderer <b>shall</b> provide details in their response of the RADOME characteristics, with guaranteed PSR and SSR parameter limits, and supported with measured evidences.</p> <p>As a minimum the following information <b>shall</b> be supplied by the Tenderer in their response:</p> <ul style="list-style-type: none"> <li>a) RF transmission loss and VSWR at the operating frequencies;</li> <li>b) Impact of RADOME in Sum, Difference and Control radiation patterns (widening, narrowing, new side-lobes, new nulls, effects in cone of silence, etc.);</li> <li>c) Fully dimensioned drawings;</li> <li>d) Characteristics, Weight, Mechanical Construction and Support Construction of the RADOME;</li> <li>e) Lightning strike and earthing connection;</li> <li>f) Obstruction lights connection;</li> <li>g) Safety (maintenance personnel, lightning protection);</li> <li>h) Mechanical requirements (dismantling/reassembly of panels, transportation, lifting, full installation);</li> <li>i) Environmental protection;</li> <li>j) Maintenance requirements and lifetime of the panels.</li> </ul>
<b>ANSP-CON-SHA-00350</b>	<p>Supplied accessories package <b>shall</b> include at least:</p> <ul style="list-style-type: none"> <li>a) Electric top flaps or other means of ventilation</li> <li>b) Interior ascend Assembly (e.g. rope ladder)</li> <li>c) Lightning Protection Kit</li> <li>d) Spare Panel Kit (manufactured with Radome)</li> </ul>



<b>ANSP-SYS-SHA-00360</b>	The pressurization for Radome <b>shall not</b> be a required.
<b>ANSP-CON-SHA-00370</b>	After the assembly, the Radome <b>shall</b> be suitably sealed against water ingress. The sealing material shall be an elastic compound.
<b>ANSP-CON-SHA-00380</b>	Contractor <b>shall</b> provide construction for attachment of the Radome to the building construction.
<b>ANSP-CON-SHA-00390</b>	The Contractor <b>shall</b> supply all screws/washers/nuts for the anchoring of the Radome onto the steel base-frame, as well as all material necessary for the connection of the lightning-rod earthing wires to the building's grounding network.
<b>ANSP-TEN-SHA-00400</b>	<p>The Tenderer <b>shall</b> prove environmental compliance of materials used for the production and maintenance of the Radome, including in case of burning.</p> <p>The proof of ecological compliance shall be reference to the corresponding EU standard. The tenderer shall indicate such EU standard or norm in the answer.</p>
<b>ANSP-SYS-SHO-00410</b>	The panel sections, including - where applicable - the panel frames, <b>should</b> be of reinforced plastic, polyester or glass-fibre laminate (sandwich), or monolithic-type, self-extinguishing, protected against erosion and rejecting solar radiation.
<b>ANSP-CON-SHA-00420</b>	The Contractor <b>shall</b> present guideline for preventive maintenance and panel repair procedure.
<b>ANSP-CON-SHA-00430</b>	<p>All special tools and material necessary for the Radome maintenance <b>shall</b> be provided. It shall include all equipment necessary to ensure easy access to all Radome parts.</p> <p>The Tenderer <b>shall</b> present actual list of material.</p>
<b>ANSP-CON-SHA-00440</b>	The Contractor <b>shall</b> deliver, as a part of the Maintenance documentation, the technical characteristics and commercial references for the products needed for the Radome maintenance (e.g. cleaning products, paintwork material, Radome repair, etc.).
<b>ANSP-SYS-SHA-00450</b>	The routine Radome maintenance procedure (sealing, repair of damaged panels) <b>shall</b> be designed to ensure that maintenance personnel without particular specialization can carry out the maintenance work.

<b>ANSP-SYS-SHA-00460</b>	The Radome <b>shall</b> be supplied with necessary aids to make the access to the Radome surface for general maintenance of the radar exterior and to eliminate excessive snow accumulations.
<b>ANSP-SYS-SHA-00470</b>	The Radome <b>shall</b> be provided with designated (certified) anchor points for personnel working on the outside of the Radome.
<b>ANSP-SYS-SHA-00480</b>	Radome <b>shall</b> be equipped with an independent anchor point (independent from the ladder) for a life line, when using a means of ascent to the top of the Radome from the inside.
<b>ANSP-SYS-SHA-00490</b>	There <b>shall</b> be independent anchor points for work lines and independent anchor points for life lines.  The Tenderer <b>shall</b> specify the number of anchor points, position, the maximum load allowed.
<b>ANSP-SYS-SHA-00500</b>	Lifetime of all anchor points <b>shall</b> be equal to the Radome service time. Tenderer shall specify procedures to check and maintain anchor points to ensure safety of potential workers using them.
<b>ANSP-SYS-SHA-00510</b>	All means which provide access to the top of the Radome from the inside <b>shall</b> be deployable by max. two maintenance workers within a reasonable time.
<b>ANSP-SYS-SHA-00520</b>	Ladders or other ascend means <b>shall</b> have a certificate or instructions for use, which will define its lifetime and the conditions set by the manufacturer for installation, use, maintenance and possible revisions.
<b>ANSP-TEN-SHA-00530</b>	The Radome structure <b>shall</b> be provided with suitable attachment points for lifting equipment of at least 600kg. The lifting equipment shall be part of the supplied equipment, it shall be capable of carrying loads such as the Antenna.  Tenderer <b>shall</b> provide actual value of the maximum load of lifting equipment.
<b>ANSP-CON-SHA-00540</b>	For the case of Radome damage, ANSP needs to be capable of removal and installation of Radome. The Contractor <b>shall</b> provide as a part of its delivery, all means for the RADOME disassembly and assembly
<b>ANSP-SYS-SHA-00550</b>	The Radome assembly and dismantling <b>shall</b> be possible using ordinary tooling.
<b>ANSP-SYS-SHA-00560</b>	In the event of replacing the Radome panels, sections, etc., these operations <b>shall</b> be carried out with a minimum number of specialists (i.e. crane driver, steeple-jacks)

<b>ANSP-TEN-SHA-00570</b>	<p>The Tenderer <b>shall</b> provide in their proposal information on prevention of rime ice formation and/or recommendations to reduce the effects of these climatic conditions.</p> <p>The prevention of rime ice and snow accumulation on the Radome is ensured by maintaining controlled internal environmental conditions during winter operation.</p> <p>The Radome <b>should</b> equipped with an internal electric heating system combined with forced air ventilation. The system maintains the internal temperature above the freezing point, typically not lower than +5 °C, to prevent ice or snow formation on the Radome surface caused by external climatic conditions.</p> <p>The heating and ventilation system operates automatically based on internal and/or external temperature sensors and dynamically adjusts heating power and air circulation as required to ensure stable thermal conditions.</p> <p>The system is designed for continuous operation during winter conditions and does not degrade or influence the RF performance of the Radome.</p> <p>Remote monitoring and remote adjustment of temperature set-points <b>may</b> be provided via the system control interface, allowing operational control without the need for on-site intervention.</p>
<b>ANSP-TEN-SHA-00580</b>	<p>The Tenderer <b>may</b> describe what failures may occur during RADOME operation and what the corrective maintenance would be. It is expected that the tenderer is aware of typical failures from his experience. (e.g. blisters on Radome segments, scratches, cracks, seal cracks).</p>
<b>ANSP-SYS-SHA-00590</b>	<p>The Radome <b>shall</b> have a design life of 20 years with a minimum maintenance for operation.</p>
<b>ANSP-SYS-SHA-00600</b>	<p>The MTBF (Mean Time Between Failure) of the Radome structure (i.e. failure of a Radome panel) <b>shall</b> be at least 50,000 hours.</p> <p>Tenderer shall state MTBF in the proposal.</p>
<b>ANSP-SYS-SHA-00610</b>	<p>The MTTR (Mean Time To Repair) (i.e. time required to replace a failed panel) <b>shall</b> not exceed 24 hours (including re-sealing).</p>

### 11.3 Obstruction Lights

<b>ANSP-TEN-SHA-00620</b>	<p>The Tenderer <b>shall</b> propose in their response obstruction lights, of 2 000 candela (steady red light) in such a way that they are visible for 360° of the azimuths, to be fitted in the Radar System ground station installation.</p> <p>Adopted from <b>EMS-C07-SYSTEM-MAY-08440</b></p>
<b>ANSP-SYS-SHA-00630</b>	<p>When included as a part of the System, the obstruction lights <b>shall</b> be designed to provide redundancy for safety reasons.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08450</b></p>
<b>ANSP-SYS-SHA-00640</b>	<p>When included as a part of the System, the obstruction lights <b>shall</b> be able to operate under all the range of conditions detailed in 9.2.2 and to be resilient to salt atmospheres.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08460</b></p>
<b>ANSP-SYS-SHA-00650</b>	<p>When the obstruction lights are included as a part of the System and located on top of the LVA antenna or on top of the Radome, the additional wind load <b>shall</b> be considered.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08470</b></p>
<b>ANSP-SYS-SHA-00660</b>	<p>When included as a part of the System, the Tender <b>shall</b> provide technical details of the offered obstruction lights, including at least details on how many units will be used, their position, and their electrical and mechanical characteristics.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08480</b></p>
<b>ANSP-SYS-SHA-00670</b>	<p>When included as a part of the System, the Tender <b>shall</b> detail how the earthing connection of the obstruction lights will be performed.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08490</b></p>
<b>ANSP-CON-SHA-00680</b>	<p>When included as a part of the System, any specialized tools and material necessary for the obstruction lights maintenance <b>shall</b> be provided.</p> <p>Adopted from <b>EMS-C07-CON-SHA-08500</b></p>
<b>ANSP-SYS-SHA-00690</b>	<p>Obstruction Light <b>shall</b> be LED design.</p> <p>Tenderer shall <b>state</b> MTBF and MTTR for proposed Obstruction Lights</p>

#### 11.4 Lightning Protection

<b>ANSP-TEN-SHA-00700</b>	<p>The Tenderer <b>shall</b> propose in their response a lightning protection, based on rods, arrestors and other suitable protection, to protect the System against induced transients from lightning surges.</p> <p>Adopted from <b>EMS-C07-TEN-MAY-08510</b></p>
<b>ANSP-SYS-SHA-00710</b>	<p>When included as a part of the System, the lightning protection <b>shall</b> include all elements in the external environment (e.g. LVA antenna, tower, Radome, shelter, cables, etc.).</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08520</b></p>
<b>ANSP-SYS-SHA-00720</b>	<p>When included as a part of the System, the lightning protection <b>shall</b> include one or more lightning rods to protect the highest elements of the installation, i.e. Antenna or Radome.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08530</b></p>
<b>ANSP-SYS-SHA-00730</b>	<p>When included as a part of the System, the cable connecting the lightning rod(s) to the earthing point <b>shall</b> be thermally insulated, so the thermal energy dissipated while discharging current is going through cable and is not destroying the panel structure because of heat.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08540</b></p>
<b>ANSP-SYS-SHO-00740</b>	<p>When included as a part of the System, the lightning protection <b>should</b> include lightning arrestors in the highest part of the installation, i.e. top of the tower, to protect the azimuth data generator units from lightning induced transients.</p> <p>Adopted from <b>EMS-C07-SYS-SHO-08550</b></p>
<b>ANSP-SYS-SHA-00750</b>	<p>When included as a part of the System, the lightning protection <b>shall</b> include lightning arrestors in the entrance of the equipment room (i.e. shelter or indoor installation) to protect the equipment from lightning induced transients.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08560</b></p>

<b>ANSP-SYS-SHO-00760</b>	When included as a part of the System, the lightning protection <b>should</b> be connected to the Mode S ground station earthing system.  Adopted from <b>EMS-C07-SYS-SHO-08570</b>
<b>ANSP-TEN-SHA-00770</b>	When included as a part of the System, the Tender <b>shall</b> provide information on how the lightning protection will be implemented.  Adopted from <b>EMS-C07-TEN-SHA-08580</b>
<b>ANSP-CON-SHA-00780</b>	When included as a part of the System, the Contractor <b>shall</b> design, supply and install a lightning protection system in accordance with BS EN/IEC 62305 (or equivalent) [RD 82].  Adopted from <b>EMS-C07-CON-SHA-08590</b>

#### 11.5 Earthing

<b>ANSP-TEN-SHA-00790</b>	The Tender <b>shall</b> provide information on how the earthing system will be implemented, including details on how earthing loops will be avoided.  Adopted from <b>EMS-C07-TEN-SHA-08600</b>
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#### 11.6 Equipment Cabinets

<b>ANSP-TEN-SHA-00800</b>	The Tenderer <b>shall</b> describe in their proposal the means of maintenance and cable access for the equipment cabinets.  Adopted from <b>EMS-C07-TEN-SHA-08610</b> .
<b>ANSP-SYS-SHO-00810</b>	Installed cabinets <b>should</b> generally be grouped on a channel basis.  Adopted from <b>EMS-C07-SYS-SHO-08620</b> .

<b>ANSP-TEN-SHA-00820</b>	The Tenderer <b>shall</b> state in their proposal for both, primary and secondary radar the height, width, depth and weight of all the major equipment units, including equipment cabinets, identifying their location with respect to each other.  Adopted from <b>EMS-C07-TEN-SHA-08630</b>
<b>ANSP-TEN-SHA-00830</b>	The Tenderer <b>shall</b> state in their proposal the height, width, depth and weight of all additional peripheral devices required to support the System.  Adopted from <b>EMS-C07-TEN-SHA-08640</b>
<b>ANSP-TEN-SHA-00840</b>	The Tenderer <b>shall</b> give power consumption and heat dissipation figures for all the equipment units, including equipment cabinets.  Adopted from <b>EMS-C07-TEN-SHA-08650</b>
<b>ANSP-SYS-SHA-00850</b>	The equipment installation <b>shall</b> be such that access to any equipment cabinet, the removal of any sub-unit or LRU, and the use where required of extender cards, external test equipment, etc. is not impeded by any adjacent cabinets, units, etc.  Adopted from <b>EMS-C07-SYS-SHA-08660</b> .
<b>ANSP-TEN-SHA-00860</b>	The Tenderer <b>shall</b> state in their proposal where forced air cooling is employed.  Adopted from <b>EMS-C07-TEN-SHA-08670</b> .

#### 11.7 Peripheral Devices

<b>ANSP-SYS-SHA-00870</b>	The number of peripheral equipment required to support the System <b>shall</b> be minimal.  Adopted from <b>EMS-C07-SYS-SHA-08680</b> .
<b>ANSP-TEN-SHA-00880</b>	The Tenderer <b>shall</b> provide in their proposal a list of the peripheral equipment required to support the System.  Adopted from <b>EMS-C07-TEN-SHA-08690</b> .

<b>ANSP-SYS-SHA-00890</b>	All peripheral equipment required to support the operation of the System <b>shall</b> be included in the delivered equipment. Adopted from <b>EMS-C07-SYS-SHA-08700</b> .
<b>ANSP-TEN-SHA-00900</b>	The Tenderer <b>shall</b> provide in their proposal details of all peripheral equipment, including any required for commissioning of the System such as special tools to program, calibrate and measure different sub-units and LRUs, data recording devices, adjustment tools, etc. Adopted from <b>EMS-C07-TEN-SHA-08710</b> .
<b>ANSP-SYS-SHA-00910</b>	The Specification for any peripheral equipment requirements (e.g. HMI, printer, etc.) <b>shall</b> be agreed with the Contracting Authority. Adopted from <b>EMS-C07-SYS-SHA-08720</b>
<b>ANSP-SYS-SHA-00920</b>	Common and internationally recognised interface standards <b>shall</b> be employed for all peripheral devices. Adopted from <b>EMS-C07-SYS-SHA-08730</b> .

..... *end of System Elements Specification* .....



## 12 Subchapter E - System Specification (Part A)

Some requirements originate in EMS v.4 specification, but for the purpose of this tender, they are modified or extended or valid for PSR and Mode-S. In this case, the ref. number is changed to ANS pattern, ANSP-xxx-xxx-xxxxx. In the Compliance Matrix, column F indicates from which EMS requirement the ANSP requirement is adopted.

The Compliance Matrix for System Specification (Part A) is based on Eurocontrol EMS 4.0 and is an integral part of the tender and is located in Annex no.1, **Compliance Matrix tab E - System (Part A)**

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted the in color.

### 12.1 Collocation with Primary Radar

<b>ANSP-SYS-SHA-00930</b>	The basic configuration of each radar system delivery <b>shall</b> be PSR collocated with SSR Mode-S and antennas mounted on Tower and covered by Radome.
<b>ANSP-SYS-SHA-00940</b>	The radars shall be in continuous operation. Limited operational shutdowns are allowed only for necessary preventive maintenance.
<b>ANSP-SYS-SHA-00950</b>	SSR <b>shall</b> be capable of operating asynchronously with a collocated PSR. Adopted from <b>EMS-C07-SYS-MAY-09020</b> . The Tenderer is expected to describe how the SSR works without PSR and vice versa.
<b>ANSP-SYS-SHA-00960</b>	The PSR and SSR systems <b>shall</b> be able to exchange data within the internal LAN network. Adopted from <b>EMS-C07-SYS-SHA-09050</b> .
<b>ANSP-TEN-SHA-00970</b>	Tenderer <b>shall</b> provide details in the proposed interfaces between the PSR and SSR. Adopted from <b>EMS-C07-TEN-SHA-09060</b> .
<b>ANSP-TEN-SHA-00980</b>	The Tenderer <b>shall</b> provide all necessary information of how it is intended to solve the problem of mutual interference. Adopted from <b>EMS-C07-TEN-SHA-09070</b> .

<b>ANSP-SYS-SHA-00990</b>	<p>The System <b>shall</b> have a Data Merger Unit to perform plot combination with the PSR data that is found to be associated with an SSR/Mode S target.</p> <p>Adopted from <b>EMS-C07-SYS-MAY-09080</b>.</p>
<b>ANSP-SYS-SHA-01000</b>	<p>The combined target reports to be sent to the Surveillance Data output <b>shall</b> be labelled accordingly in bit "TYP" of field I048/020 (Target Report Descriptor) of the ASTERIX Cat. 048 messages ([RD 26]).</p> <p>Adopted from <b>EMS-C07-SYS-SHA-09090</b>.</p>
<b>ANSP-TEN-SHA-01010</b>	<p>The Tenderer <b>shall</b> provide all necessary information about the combination processing:</p> <ul style="list-style-type: none"> <li>a) Criteria used (proximity, quality, weighting, etc.);</li> <li>b) Correlation window (size, timing, etc.);</li> <li>c) Measured position definition for combined plots (weighting, etc.);</li> <li>d) Processing time.</li> </ul> <p>Adopted from <b>EMS-C07-TEN-SHA-09100</b>.</p>
<b>ANSP-TEN-SHA-01020</b>	<p>The Tenderer <b>shall</b> state how many SSR/Mode S targets and PSR targets can be combined per second.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-09110</b>.</p>
<b>ANSP-TEN-SHA-01030</b>	<p>The Tenderer <b>shall</b> state how the following cases are processed;</p> <ul style="list-style-type: none"> <li>a) Multiple PSR targets candidates for combination with one SSR/Mode S target;</li> <li>b) Only one PSR target candidate for combination with several SSR/Mode S targets;</li> <li>c) One SSR target report candidate for combination with one Mode S target.</li> </ul> <p>Adopted from <b>EMS-C07-TEN-SHA-09120</b>.</p>
<b>ANSP-SYS-SHA-01040</b>	<p>The total system delay for a collocated system (i.e. from illumination of the target by the antennas boresight to transmission of the target report in the Surveillance Data output, including the combination process in the Data Merger Unit), <b>shall</b> not exceed the processing delays indicated in section 2.6.9.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-09130</b>.</p>

<b>ANSP-TEN-SHA-01050</b>	<p>The Tenderer <b>shall</b> state in their proposal the maximum target and system delays accounting for plot processing delays and full loads.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-09140</b>.</p>
<b>ANSP-TEN-SHA-01060</b>	The Tenderer <b>shall</b> include a detailed block diagram of the collocated radar system, including the names and functions of the respective elements.
<b>ANSP-SYS-SHA-01070</b>	The master power distributor <b>shall</b> be prepared to connect 3x400V/50Hz network cables from the Contracting Authority's main grid via UPS+DA backup network. The max. UPS capacity is 30 minutes.
<b>ANSP-SYS-SHA-01080</b>	The master power distributor in the shelter <b>shall</b> be prepared for connection to the grid by means of five-wire cables, using the TN-S system (L1, L2, L3, N and PE).
<b>ANSP-SYS-SHA-01090</b>	<p>The master power distributor in the shelter <b>shall</b> supply power to all parts of the radar, including the antenna tower equipment, all ancillary equipment and the lighting.</p> <p>The Tenderer <b>shall</b> provide in its Bid a basic scheme of the power supply network.</p>
<b>ANSP-TEN-SHA-01100</b>	The Tenderer <b>shall</b> specify in its Bid the peak power consumption when the radar is being switched on and the antenna starts rotating. The power consumption levels shall be documented by relevant measurement records
<b>ANSP-TEN-SHA-01110</b>	<p>The Tenderer <b>shall</b> provide in its Bid a list of electrical parameters of the PSR and SSR system and highlight those parameters that are to be tested during FAT and SAT. The list shall include the items given in following subsection:</p> <ul style="list-style-type: none"> <li>g) Voltage and frequency tolerance;</li> <li>h) Operational electric input;</li> <li>i) Power factor;</li> <li>j) Starting current peak and its time course;</li> <li>k) Value of main circuit breaker;</li> <li>l) Grounding method and protection against dangerous touch voltage</li> </ul>

## 12.2 Redundancy

<b>ANSP-SYS-SHA-01120</b>	<p>The System (PSR and Mode S) to be supplied <b>shall</b> be dual channel, complete with changeover capability, controlled both locally and remotely by the CMS.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09280</b></p>
<b>ANSP-TEN-SHA-01130</b>	<p>The Tenderer <b>shall</b> describe available redundancy of radar components of in its Bid, including degradation states. Degradation states and their impact on the radar operations of at least following components shall be described:</p> <ul style="list-style-type: none"> <li>a) Channel switches, beam switches</li> <li>b) One, two and more power amplifiers</li> <li>c) Preamplifier(s)</li> <li>d) Receiver; if the receiver is modular, then also any module that can be replaced during corrective maintenance.</li> <li>e) Processing block, if the processing block is modular, then also any module that can be replaced during corrective maintenance</li> <li>f) Servers or computers with high level of processing</li> <li>g) Any other block (especially blocks replaceable during corrective maintenance)</li> </ul> <p>Example for preamplifier:</p> <p>Two preamplifiers operate in redundancy mode, one is active, the other is in hot-stand-by, amplifying and connected to a matched dummy load. If the currently active preamplifier fails, the whole radar channel is switched over, including generator, receiver, processing etc.</p> <p>OR</p> <p>Two preamplifiers operate in redundancy mode, one is active, the other is in hot-stand-by, amplifying and connected to a matched dummy load. If the currently active preamplifier switches over, only the preamplifier is switched over, not the whole channel, generator, receiver and processing remains of the current channel due to available cross-redundancy for that block.</p>
<b>ANSP-TEN-SHA-01140</b>	<p>The Tenderer <b>shall</b> describe the times of automatic switching between the duplicated sets of the radar, where are in function Main/Backup.</p> <p><i>Note: Duration of the switchover in milliseconds is expected for PSR and SSR.</i></p>

ANSP-TEN-SHA-01150	<p>At least degradation states and their impact on the radar operations of the following components <b>shall</b> be described:</p> <ul style="list-style-type: none"> <li>a) One motor</li> <li>b) One of the azimuth encoders</li> <li>c) Channel switches, beam switches</li> <li>d) One, two or more power amplifiers</li> <li>e) Preamplifier(s)</li> <li>f) Receiver; if the receiver is modular, then also any module that can be replaced during corrective maintenance.</li> <li>g) Processing block, if the processing block is modular, then also any module that can be replaced during corrective maintenance</li> <li>h) Servers or computers with high level of processing</li> <li>i) Any other block (especially blocks replaceable during corrective maintenance)</li> </ul> <p>Example for encoders: Each encoder is fixed to only one channel. In the event of an encoder failure on the active radar channel, the radar will automatically switch to the other channel not affected by the failure. The radar channel is switched as a whole.</p> <p>OR</p> <p>Both encoders are redundantly connected to both channels. Failure of one encoder will only switch the encoder input, radar channel remains unswitched.</p>
ANSP-SYS-SHA-01160	The Tenderer <b>shall</b> include a list of automatically switched circuits (main/back-up) with no outages

#### 12.2.1 Operation modes

ANSP-SYS-SHA-01170	<p>Each channel of the dual channel radar system <b>shall</b> operate in any of the three operating modes as follows:</p> <ul style="list-style-type: none"> <li>a) Active: the equipment is used for the operation of the station;</li> <li>b) Stand-by: the equipment is switched on and normally available for operation, i.e. a reconfiguration, automatic or controlled, can take place. Only the redundant equipment can be in the stand-by mode;</li> <li>c) Maintenance: the equipment is under maintenance and is not available for operation.</li> </ul> <p>Adopted from <b>EMS-C08-SYS-SHA-09290</b></p>
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<b>ANSP-SYS-SHA-01180</b>	Any fault state <b>shall</b> be reported to CMS, including redundant elements in dual channel configurations.  Adopted from <b>EMS-C08-SYS-SHA-09300</b>
<b>ANSP-SYS-SHA-01190</b>	In a dual channel system, there <b>shall</b> be only one channel in Active mode.  Adopted from <b>EMS-C08-SYS-SHA-09310</b> .  <i>Note: In case of cross-redundant system the channel is considered as units creating a compact signal path. Two redundant units shall not interfere with each other.</i>
<b>ANSP-SYS-SHA-01200</b>	Switching from a Stand-by mode to an Active mode <b>shall</b> be performed according to a 'cold switchover' (8.2.3) procedure by an operator command or by a 'hot switchover' (8.2.2) when the Active channel fails.  Adopted from <b>EMS-C08-SYS-SHA-09320</b> .
<b>ANSP-SYS-SHA-01210</b>	Switching from Active to Stand-by mode <b>shall</b> be performed by a 'cold switchover' procedure, by an operator command.  Adopted from <b>EMS-C08-SYS-SHA-09330</b> .
<b>ANSP-SYS-SHA-01220</b>	The normal procedure for switching to Maintenance mode shall be performed from the Stand-by mode, by an operator command. Adopted from <b>EMS-C08-SYS-SHA-09340</b>
<b>ANSP-SYS-SHA-01230</b>	When exiting the Maintenance mode, switching <b>shall</b> be always performed to Stand-by mode  Adopted from <b>EMS-C08-SYS-SHA-09350</b>
<b>ANSP-SYS-SHA-01240</b>	Exit from the Maintenance mode <b>shall</b> be possible local or remotely through the CMS.  Adopted from <b>EMS-C08-SYS-SHA-09360</b>
<b>ANSP-SYS-SHA-01250</b>	When one channel of the System is in Maintenance or under failure, the Active channel <b>shall</b> be able to operate inside the performance specifications.  Adopted from <b>EMS-C08-SYS-SHA-09370</b> .

<b>ANSP-SYS-SHA-01260</b>	<p>The design approach <b>shall</b> be capable of ensuring that the system parameters will not change in the event of a 'switchover' of the Active channel.</p> <p>The 'hot switchover' procedure <b>shall</b> correspond to a failure of an Active equipment, where an automatic reconfiguration of the processing occurs through switching.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09380</b></p>
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### 12.2.2 Hot Switchover

<b>ANSP-SYS-SHA-01270</b>	<p>The 'hot switchover' procedure <b>shall</b> correspond to a failure of an Active equipment, where an automatic reconfiguration of the processing occurs through switching.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09390</b></p>
<b>ANSP-SYS-SHO-01280</b>	<p>In case of 'hot switch-over', the failing channel <b>should</b> be automatically switched to Maintenance mode.</p> <p>Adopted from <b>EMS-C08-SYS-SHO-09400</b></p>
<b>ANSP-SYS-SHO-01290</b>	<p>In the case than the non-Active equipment is in a failure condition (i.e. switched to Maintenance mode), a 'hot switchover' <b>should</b> be inhibited in case of additional failure in the Active equipment.</p> <p>Adopted from <b>EMS-C08-SYS-SHO-09410</b></p>
<b>ANSP-TEN-SHA-01300</b>	<p>The Tenderer <b>shall</b> include in their proposal details of how the automatic configuration occurs and the effect on the overall system performance.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09420</b></p>
<b>ANSP-SYS-SHA-01310</b>	<p>The switching <b>shall</b> be effective within one antenna revolution after the fault has been detected and comply with the requirements of 6.5.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09430</b></p>

<b>ANSP-TEN-SHA-01320</b>	<p>The Tenderer <b>shall</b> describe how the failures from the different LRUs and/or functions (Surveillance, Cooperation, Integrated ADS-B, etc.) are managed by the BITE and taken into account for switching decision.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09440</b></p>
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### 12.2.3 Cold Switchover

<b>ANSP-SYS-SHA-01330</b>	<p>The 'cold switchover' procedure corresponds to the controlled switching of all the Active chains (Interrogator, SMF, etc.) and it <b>shall</b> guarantee that no data, essential for surveillance, is lost during the switching.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09450</b></p>
<b>ANSP-SYS-SHA-01340</b>	<p>The 'cold switchover' <b>shall</b> be effective within one antenna revolution to perform from operator input.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09460</b></p>
<b>ANSP-TEN-SHA-01350</b>	<p>The Tenderer <b>shall</b> provide details in their proposal how the 'cold switchover' is performed and how it affects the operation of the System.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09470</b></p>

### 12.3 Turning Gear and Azimuth data generator

<b>ANSP-SYS-SHA-01360</b>	<p>The antenna drive mechanism <b>shall</b> include two motors and two transmissions for revolutions reduction. The basic operation shall involve the use of both motors.</p>
<b>ANSP-SYS-SHA-01370</b>	<p>The radar <b>shall</b> be able to operate with just one motor.</p>
<b>ANSP-TEN-SHA-01380</b>	<p>The Tenderer <b>shall</b> propose in their response a turning gear and azimuth data generator equipment for the Radar ground station that enables the requirements of this specification to be met in all respects.</p> <p>Adopted from <b>EMS-C07-TEN-MAY-07960</b></p>



<p><b>ANSP-TEN-SHA-01390</b></p>	<p>The following minimum information for the turning gear and the azimuth data generator equipment <b>shall</b> be supplied by the Tenderer in their response:</p> <ul style="list-style-type: none"> <li>a) PSR antenna maximum weight and details of the on mounting interfaces</li> <li>b) LVA antenna maximum weight and details of the on mounting interfaces;</li> <li>c) Details of the tilt and horizontal mechanisms;</li> <li>d) Rotation speeds and speed variations under the worst conditions of 9.2 Environmental conditions (including effects on system performance, tracking, etc.);</li> <li>e) Details of braking and locking of the antenna;</li> <li>f) Details of safety interlocks to immobilise the antenna during maintenance;</li> <li>g) Horizontal stability of the antenna/tower interface and the main antenna drive Dearing over the full turning rate and tilt range of the antenna;</li> <li>h) Details of the azimuth data generator systems;</li> <li>i) Details of alignment and maintenance of the azimuth data and north alignment;</li> <li>j) Details of how the turning information is to be validated;</li> <li>k) Details of the rotating joint including power handling capabilities;</li> <li>l) Details of the drive assembly and couplings;</li> <li>m) Details of the lifting points for each major component;</li> <li>n) Details of the turning gear lubricating system;</li> <li>o) Details of the maintenance of the turning gear system;</li> <li>p) Detailed list of the tools being delivered in order to perform the preventive and corrective maintenance operations for the LVA and the turning gear (including lifting devices).</li> </ul> <p>Adopted from <b>EMS-C07-TEN-SHA-07970</b>.</p>
<p><b>ANSP-TEN-SHA-01400</b></p>	<p>The Tenderer <b>shall</b> detail in their response where their proposed turning gear and azimuth data generator will not capacitate the System to meet the requirements of this specification in all respects.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-07980</b>.</p>
<p><b>ANSP-CON-SHA-01410</b></p>	<p>The Contractor <b>shall</b> deliver, as a part of the Maintenance documentation, the technical characteristics and commercial references for the products needed for the maintenance of the turning gear and the azimuth data generator (e.g. greasing, paintwork, etc.).</p> <p>Adopted from <b>EMS-C07-CON-SHA-07990</b></p>

<b>ANSP-CON-SHA-01420</b>	<p>The specialized tools and material necessary for the turning gear and the azimuth data generator maintenance <b>shall</b> be provided.</p> <p>Adopted from <b>EMS-C07-CON-SHA-08000</b>.</p>
<b>ANSP-SYS-SHA-01430</b>	<p>The turning gear and associated components, i.e. rotating joint, slip ring assemblies, etc. <b>shall</b> be based on proven equipment of established mechanical accuracy and reliability.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08010</b>.</p>
<b>ANSP-TEN-SHA-01440</b>	<p>Tenderer <b>shall</b> provide detailed information on the turning gear and the associated electronics for any possibility of motors configuration (e.g. 1 motor drive, 2 motor drives, etc.).</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08020</b>.</p>
<b>ANSP-SYS-SHO-01450</b>	<p>It is preferred that duplicated items in the turning gear <b>should</b> be replaced without the need to stop the antenna rotating.</p> <p>Adopted from <b>EMS-C07-SYS-SHO-08030</b>.</p>
<b>ANSP-TEN-SHA-01460</b>	<p>The Tenderer <b>shall</b> state in their response the turning gear items that require the antenna rotation to be stopped when replaced.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08040</b>.</p>
<b>ANSP-TEN-SHA-01470</b>	<p>The Tenderer <b>shall</b> describe in detail the behaviour of the System when the turning gear speed fluctuates too much due to excessive loading (e.g. due wind conditions). In particular the Tenderer indicates the consequences of such conditions on the Surveillance Data output.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08050</b>.</p>
<b>ANSP-SYS-SHA-01480</b>	<p>The turning gear <b>shall</b> incorporate a rotation preannouncement system, including visual and acoustic signals, to alert at least 30 seconds in advance that the antenna rotation will start.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08060</b>.</p>

<b>ANSP-TEN-SHA-01490</b>	<p>The Tenderer <b>shall</b> provide technical details of the visual and acoustic signals that will be used in the rotation preannouncement system of the turning gear.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08070</b>.</p>
<b>ANSP-SYS-SHA-01500</b>	<p>The turning gear <b>shall</b> incorporate safety interlocks and safety switches to stop the antenna rotation while they are activated.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08080</b></p>
<b>ANSP-SYS-SHA-01510</b>	<p>After the deactivation of a safety interlock or a safety switch, the System <b>shall not</b> start automatically the antenna rotation.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08090</b>.</p>
<b>ANSP-TEN-SHA-01520</b>	<p>The Tenderer <b>shall</b> provide technical details of the safety interlocks and safety switches that will be used to interrupt the operation of the turning gear.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08100</b>.</p>
<b>ANSP-SYS-SHA-01530</b>	<p>The azimuth data generator <b>shall</b> have a minimum resolution of 14 bits, i.e. 0.022° (360°/214).</p> <p>The Tenderer <b>shall</b> specify resolution in its Bid.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08110</b>.</p>
<b>ANSP-TEN-SHA-01540</b>	<p>The Tenderer <b>shall</b> provide in their Tender response information on the format (e.g. electrical signals) of the azimuth data.</p> <p>Adopted from <b>EMS-C07-TEN-SHA-08120</b>.</p>
<b>ANSP-SYS-SHA-01550</b>	<p>The System <b>shall not</b> enable transmissions to the air from PSR or MSSR when the antenna is not rotating and the azimuth data is not received.</p> <p>Adopted from <b>EMS-C07-SYS-SHA-08130</b></p>

<b>ANSP-SYS-SHA-01560</b>	<p>The System <b>shall not</b> enable transmission based on random antenna movement.</p> <p><i>Note: Random antenna movements due to the wind or mechanical antenna inspection shall not enable the transmission.</i></p>
<b>ANSP-SYS-SHA-01570</b>	<p>The drive mechanism <b>shall</b> be equipped with the emergency stop button to stop the antenna rotation. The button shall be easily accessible and shall be part of the interlock system.</p> <p><i>Note: This will be used in case of emergency or maintenance of the drive mechanism or the antenna.</i></p>
<b>ANSP-TEN-SHA-01580</b>	<p>The Tenderer <b>shall</b> describe the position of the emergency stop button to stop antenna turning.</p> <p><i>Note: A place close to the antenna next to the entrance to the RADOME is expected.</i></p>
<b>ANSP-SYS-SHA-01590</b>	<p>The antenna, drive mechanism and all other attached parts <b>shall</b> withstand operation with at least 15 revolutions per minute.</p>
<b>ANSP-SYS-SHA-01600</b>	<p>The antenna rotation speed <b>shall</b> be adjustable by variable frequency driver from at least 10 to 15 rpm.</p>
<b>ANSP-SYS-SHA-01610</b>	<p>The parameters of the antenna drive mechanism <b>shall</b> be monitored and the operating status presented via CMS. The Tenderer shall specify in its Bid what parameters are monitored, how and where.</p>
<b>ANSP-TEN-SHA-01620</b>	<p>The Tenderer <b>shall</b> specify what parameters and upon what changes will activate the alert system and what parameters and upon what changes will automatically switch off the antenna rotation.</p>
<b>ANSP-SYS-SHA-01630</b>	<p>The PSR/SSR <b>shall</b> be fitted with two independent azimuth encoders.</p> <p><i>Note: One unit with two internal encoders is not accepted.</i></p>
<b>ANSP-SYS-SHA-01640</b>	<p>Azimuth encoders <b>should</b> be attached directly to the main rotating shaft.</p> <p><i>Note: Auxiliary gear introduces additional random azimuth error.</i></p>
<b>ANSP-TEN-SHA-01650</b>	<p>Tenderer <b>shall</b> provide description how the azimuth encoders are mounted to the turning gear.</p> <p>The Tenderer <b>shall</b> specify the type of azimuth encoder.</p>

<b>ANSP-SYS-SHA-01660</b>	<p>The azimuth data signals <b>shall not</b> be modified for the PSR system before arriving to the Mode S system (e.g. north alignment offset).</p> <p>Adopted from <b>EMS-C07-SYS-SHA-09030</b>.</p>
<b>ANSP-SYS-SHA-01670</b>	<p>The azimuth data signals <b>shall not</b> be interrupted by any action performed in the primary radar system (e.g. system shutdown, channel switchover, etc.).</p> <p>Adopted from <b>EMS-C07-SYS-SHA-09040</b></p>
<b>ANSP-TEN-SHA-01680</b>	The Tenderer <b>shall</b> describe the stability of the output signal from the azimuth encoder (jitter value).
<b>ANSP-SYS-SHA-01690</b>	The ARP setting against ACP <b>shall</b> be based on one ACP step.
<b>ANSP-TEN-SHA-01700</b>	<p>The Tenderer <b>shall</b> specify in its Bid the type, manufacturer and life cycle of the rotary joint.</p> <p>The life cycle in years shall be specified.</p>
<b>ANSP-TEN-SHA-01710</b>	<p>The Tenderer <b>shall</b> provide a list of mechanical parameters of the PSR and SSR and highlight those parameters that are to be tested during FAT and SAT. The list shall include at least given the items following subsection:</p> <ul style="list-style-type: none"> <li>a) Antenna;</li> <li>b) Drive mechanism;</li> <li>c) Rotary joint;</li> </ul>
<b>ANSP-SYS-SHA-01720</b>	<p>Failure of either subsystem - PSR or SSR - <b>shall not</b> cause the antenna to stop rotation and cause complete radar station to fail mode.</p> <p><i>Note: If a PSR subsystem fails but the SSR is operational, the antenna shall not stop and the system shall provide at least SSR data at the output. Similarly, if the SSR subsystem fails but the PSR subsystem is operational, the antenna shall not stop and the system shall provide PSR data at the output.</i></p> <p><i>Only failures of common subsystems without redundancy (gearboxes, etc.) may lead to complete degradation.</i></p>
<b>ANSP-SYS-SHA-01730</b>	The antenna drive mechanism <b>shall</b> have independent circuit breaker from PSR and SSR channels operation.

#### 12.4 Time Synchronization

<b>ANSP-SYS-SHA-01740</b>	The System <b>shall</b> include a Time Function to provide time for the purpose of synchronisation and time-stamping. Adopted from <b>EMS-C04-SYS-SHA-04230</b> .
<b>ANSP-SYS-SHA-01750</b>	The Time Function <b>shall</b> obtain the time info information from on site and remote NTP sources or, if they are not available, by an internal clock. Adopted from <b>EMS-C04-SYS-SHA-04240</b>
<b>ANSP-SYS-SHA-01760</b>	The maximum drift of the internal clock <b>shall</b> be less than 20 milliseconds per month. Adopted from <b>EMS-C04-SYS-SHA-04250</b> .
<b>ANSP-SYS-SHA-01770</b>	The System <b>shall</b> be capable to receive and process NTP messages ([RD 33]) containing time information. Adopted from <b>EMS-C04-SYS-SHA-04260</b>
<b>ANSP-SYS-SHA-01780</b>	The System <b>shall</b> be capable to be interfaced with at least one NTP server located on site. Adopted from <b>EMS-C04-SYS-SHA-04270</b>
<b>ANSP-SYS-SHA-01790</b>	The System <b>shall</b> be capable to receive and process NTP messages coming from at least one remote location. Adopted from <b>EMS-C04-SYS-SHA-04280</b>
<b>ANSP-SYS-SHA-01800</b>	The NTP messages <b>shall</b> be available to any systems/subsystems in the network of the System for the purposes of time synchronisation. Adopted from <b>EMS-C04-SYS-SHA-04290</b>

<b>ANSP-SYS-SHA-01810</b>	<p>The System <b>shall</b> provide an operational parameter to define the default and the fallback time source for the time-stamping.</p> <p>RATIONALE: E.g., local NTP server as a default source and remote NTP server as a fall-back.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04300</b>.</p>
<b>ANSP-SYS-SHA-01820</b>	<p>In the event that the default time source fails to deliver a correct time reference, the Time Function <b>shall</b> revert its source from the default to the fallback time source.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04310</b>.</p>
<b>ANSP-SYS-SHA-01830</b>	<p>In the event that default and fallback time sources are both not available, the Time Function <b>shall</b> revert its source to the internal clock and reflect this situation in the Time Source Status as part of the Station Configuration Status item of the ASTERIX Cat. 034 messages ([RD 25]).</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04320</b>.</p>
<b>ANSP-SYS-SHA-01840</b>	<p>The System <b>shall</b> provide operational parameters to define a time difference threshold and a time difference persistence threshold between the times reported by local and remote NTP messages.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04330</b>.</p>
<b>ANSP-SYS-SHA-01850</b>	<p>If the time difference between the local and remote NTP messages is greater than the time difference threshold for longer than the time difference persistence threshold, the System <b>shall</b> indicate it in the BITE and create a message in the System log.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04340</b></p>
<b>ANSP-SYS-SHA-01860</b>	<p>The time-stamping process accuracy <b>shall</b> be such that measured position accuracy requirements defined in 2.6.5 are met for all targets speeds specified in 2.6.7 (i.e. position errors include those due to time-stamping inaccuracies).</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04350</b>.</p>

<b>ANSP-SYS-SHA-01870</b>	<p>The Coordinated Universal Time (UTC) standard <b>shall</b> be used in the time-stamping process.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04360</b>.</p>
<b>ANSP-TEN-SHA-01880</b>	<p>The Tenderer <b>shall</b> state in their proposal the accuracy, resolution and drift of the internal and external (NTP) time sources which are used for time-stamping.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04370</b>.</p>
<b>ANSP-TEN-SHA-01890</b>	<p>The Tenderer <b>shall</b> state in their proposal at which level and how the time stamping information is effectively derived and output in PSR, SSR, Mode S and ADS-B target reports.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04380</b>.</p>
<b>ANSP-TEN-SHA-01900</b>	<p>The Tenderer <b>shall</b> explain clearly in their proposal how the TSV bit of the data item I034/050 of the ASTERIX Cat. 034 messages ([RD 25]) will be set, in particular for the following cases:</p> <ul style="list-style-type: none"> <li>a) At start-up;</li> <li>b) When the RF time signal fails (e.g. GPS satellite signal lost);</li> <li>c) When the default NTP server fail;</li> <li>d) When the fallback NTP servers fail (i.e. independently and simultaneously to the default NTP server);</li> <li>e) When the internal clock fails or drifts out of specification.</li> </ul> <p>Adopted from <b>EMS-C04-TEN-SHA-04390</b>.</p>
<b>ANSP-TEN-SHA-01910</b>	<p>The Tenderer <b>shall</b> state the consequences on the System behaviour (switchover, data output, etc.) of changes in the TSV bit of the data item I034/050 of the ASTERIX Cat. 034 messages ([RD 25]).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04400</b>.</p>
<b>ANSP-TEN-SHA-01920</b>	<p>The Tenderer <b>shall</b> detail in their proposal how the System will detect and handle any kind of GPS disturbances and which actions will be taken by the System to maintain a correct time-stamping.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04410</b>.</p>



<b>ANSP-TEN-SHA-01930</b>	<p>The Tenderer <b>shall</b> describe which system units are synchronized directly to local NTP servers.</p> <p>At least the information about main PSR servers, SSR servers, processing servers, extraction servers, LCMS, RCMS and Local Display is expected.</p>
<b>ANSP-TEN-SHA-01940</b>	The Tenderer <b>should</b> present in its Bid the readiness for the time synchronisation using GALILEO system.
<b>ANSP-SYS-SHA-01950</b>	The Contracting Authority 's network gateway <b>shall not</b> be used as source for the external NTP signal.
<b>ANSP-SYS-SHA-01960</b>	For time synchronization to the Contracting Authority 's Time reference system, the System <b>shall</b> use the Network Time Protocol version 4 in accordance with RFC 5905.

## 12.5 System Parameters

<b>ANSP-SYS-SHA-01970</b>	<p>The System <b>shall</b> employ at least two types of parameters:</p> <ul style="list-style-type: none"> <li>a) Site-dependant parameters: To store data specifically configured for the System site and typically not subject to frequent changes, e.g. coverage maps, interrogator code or network data streams;</li> <li>b) Operational parameters: To store data related with the System operation and subject to possible changes due performance issues or operational constrains, e.g. MIP or Power sectors.</li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-04490</b></p>
<b>ANSP-SYS-SHA-01980</b>	<p>The System <b>shall</b> store its parameters in a suitable non-volatile medium.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04500</b></p>
<b>ANSP-SYS-SHA-01990</b>	<p>All parameters within the System <b>shall</b> be stored in a manner that allows for any parameter to be easily changed without any impact on the operational software/firmware and system safety.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04510</b></p>

<b>ANSP-SYS-SHA-02000</b>	<p>The site-dependant and operational parameter <b>shall not</b> be hard-coded within any software/firmware of the System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04520</b></p>
<b>ANSP-SYS-SHA-02010</b>	<p>The adjustment of any site-dependant or operational parameter <b>shall not</b> require any alteration or recompilation of the software/firmware.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04530</b></p>
<b>ANSP-SYS-SHA-02020</b>	<p>The Site-dependant and Operational <b>shall</b> be classified depending on their visibility in the CMS at least as:</p> <ul style="list-style-type: none"> <li>a) Standard visualization parameters: Visible in the CMS at any time (without any login);</li> <li>b) Basic operator parameters: Visible and programmable from the CMS only after Basic or Advanced operator login;</li> <li>c) Advanced operator parameters: Visible and programmable in the CMS only after Advanced operator login.</li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-04540</b></p>
<b>ANSP-SYS-SHA-02030</b>	<p>The site-dependant and operational parameters <b>shall</b> be defined in a logical manner in a human readable form with units which are related to the parameter concerned (e.g. range in NM; azimuth in degrees, etc.).</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04550</b></p>
<b>ANSP-TEN-SHA-02040</b>	<p>The Tenderer <b>shall</b> provide a list with all the site-dependant and operational parameters, including a basic description and their level of access through the CMS.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04560</b></p>
<b>ANSP-CON-SHA-02050</b>	<p>The Contractor <b>shall</b> detail all the site-dependant and operational parameters, including parameters range, format, units, storage place and format message to modify them.</p> <p>Adopted from <b>EMS-C04-CON-SHA-04570</b></p>

<b>ANSP-CON-SHA-02060</b>	<p>The Contractor <b>shall</b> deliver a special document:</p> <ul style="list-style-type: none"> <li>a) Listing all the site-dependant and operational parameters that could be accessed and/or modified via the CMS;</li> <li>b) Indicating for each parameter the default value, increment, minimum &amp; maximum values, units, etc.;</li> <li>c) Listing all the hardware components (switches, jumpers, DIP, etc.) that are accessible and/or configurable;</li> <li>d) Indicating for each hardware components the default configuration, the possible ones and the physical location on concerned PCB by means of a lay-out diagram;</li> <li>e) Describing for each parameter and configurable hardware components the impact of a change at the component, LRU, subsystem and system levels, especially from the point of view of the functionality being modified, and the effects on the output and input data.</li> </ul> <p>Adopted from <b>EMS-C04-CON-SHA-04580</b></p>
<b>ANSP-SYS-SHA-02070</b>	<p>A method <b>shall</b> be provided for changing the content of the site-dependant and operational parameters.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04590</b></p>
<b>ANSP-SYS-SHA-02080</b>	<p>The method to change the content of the site-dependant and operational parameters <b>shall</b> be capable of range checking the variables to be changed and of providing a plain language description of each parameter that can be changed.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04600</b></p>
<b>ANSP-SYS-SHA-02090</b>	<p>The method to change the content of the site-dependant and operational parameters <b>shall</b> be separated from any commands used to change the values of these parameters while the System is running.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04610</b></p>
<b>ANSP-SYS-SHA-02100</b>	<p>The programming of the parameters <b>shall</b> be possible either at the CMS locally or remotely.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04620</b></p>
<b>ANSP-TEN-SHA-02110</b>	<p>The Tenderer <b>shall</b> detail how the consistency of the parameters will be achieve when they are stored in more than one subsystem for redundancy reasons.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04630</b></p>

<b>ANSP-SYS-SHA-02120</b>	<p>The System <b>shall</b> provide the selection of diverse parameter sets.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04640</b></p>
<b>ANSP-SYS-SHA-02130</b>	<p>The System <b>shall</b> be able to establish a set of validated parameters (e.g. during SAT) as default parameters of the System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04650</b></p>
<b>ANSP-SYS-SHA-02140</b>	<p>During the life time of the System, it <b>shall</b> be possible to update the default parameters (e.g. due changes in the environment, the air traffic situation or the performance).</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04660</b></p>
<b>ANSP-SYS-SHA-02150</b>	<p>The System <b>shall</b> clearly indicate with a warning in the CMS when it's operating with a parameter set different than the default.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04670</b></p>
<b>ANSP-SYS-SHA-02160</b>	<p>The System <b>shall</b> guarantee that the site-dependant parameter containing the Interrogator Code is the same in both redundant channels of the System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04680</b></p>
<b>ANSP-SYS-SHA-02170</b>	<p>The System <b>shall</b> guarantee that site-dependant parameter selecting the applied coverage maps (i.e. Surveillance, Lockout and Datalink) are the same in both redundant channels of the System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04690</b></p>

## 12.6 Control and Monitoring System

<b>ANSP-SYS-SHA-02180</b>	<p>The System <b>shall</b> provide a Control and Monitoring System (CMS) to manage the site-dependant and operational parameters, to supervise the System Monitoring and BITE, to produce the System Log, and to control the ground station systems/subsystems.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04700</b>.</p>
<b>ANSP-SYS-SHA-02190</b>	<p>The presentation of the operating status <b>shall</b> be simultaneously indicated on the LCMS (Local Control and Monitoring System), located directly at the radar site, and on the RCMS (Remote Control and Monitoring System), located in the remote technical room.</p>
<b>ANSP-TEN-SHA-02200</b>	<p>The Tenderer <b>shall</b> state in their proposal how the control and monitoring of the following is performed:</p> <ul style="list-style-type: none"> <li>a) Antenna, turning gear and azimuth data;</li> <li>b) MSSR Interrogator system (i.e. transmitter, receiver, video processing and RF changeover unit);</li> <li>c) PSR system (i.e. transmitter, receiver, video processing, RF changeover unit, Data streams);</li> <li>d) Processing system (SMF, DLF and PAI);</li> <li>e) On-site ADS-B;</li> <li>f) Passive Acquisition Function;</li> <li>g) DAP Extraction Function;</li> <li>h) Data streams;</li> <li>i) RTQC;</li> <li>j) Far Field site monitor;</li> <li>k) General site utilities (fire and intruder alarm, air conditioning equipment, etc.).</li> </ul> <p>Adopted from <b>EMS-C04-TEN-SHA-04710</b>.</p>
<b>ANSP-SYS-SHA-02210</b>	<p>The graphical presentation of the operating status of subsystems <b>shall</b> be indicated at least with five different colours for:</p> <ul style="list-style-type: none"> <li>a) Operational,</li> <li>b) Maintenance</li> <li>c) Warning,</li> <li>d) Alarm,</li> <li>e) Not reachable</li> </ul>

<b>ANSP-TEN-SHA-02220</b>	<p>The Tender <b>shall</b> detail which systems/subsystems within the ground station will be controlled and monitored from the CMS and how this control will be performed.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04720</b>.</p>
<b>ANSP-TEN-SHA-02230</b>	<p>The Tender <b>shall</b> detail which systems/subsystems of the System will not be monitored from the CMS.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04730</b>.</p>
<b>ANSP-TEN-SHA-02240</b>	<p>The Tenderer <b>shall</b> explain how the programming of site-dependant and operational parameter will be done through the CMS and any other possibility available, as a dedicated terminal.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-04740</b>.</p>
<b>ANSP-SYS-SHA-02250</b>	<p>The System <b>shall</b> include a local CMS connected to the internal LAN interfaces.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04750</b></p>
<b>ANSP-SYS-MAY-02260</b>	<p>The System <b>may</b> include a second local CMS connected to the internal LAN interfaces to provide redundancy.</p> <p>Adopted from <b>EMS-C04-SYS-MAY-04760</b>.</p> <p>The Tenderer is expected to indicate whether second local CMS will be provided and in which form (redundant COTS server, redundant KVM and others).</p>
<b>ANSP-SYS-SHA-02270</b>	<p>The System <b>shall</b> include a remote CMS with the capability to connect to the System through the external WAN interfaces.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-04770</b>.</p>
<b>ANSP-SYS-MAY-02280</b>	<p>The System <b>may</b> include a second remote CMS, with the capability to connect the System through the external WAN interfaces, to provide redundancy.</p> <p>Adopted from <b>EMS-C04-SYS-MAY-04780</b>.</p> <p>Explanation is expected:</p> <ul style="list-style-type: none"> <li>a) Description of how the second remote CMS is connected to the system</li> <li>b) Token system management to prevent control from two CMS's at the same time</li> </ul>

<b>ANSP-TEN-SHA-02290</b>	The Tenderer <b>shall</b> provide information about how many CMS will be used and where they will be located. Adopted from <b>EMS-C04-TEN-SHA-04790</b>
<b>ANSP-SYS-SHA-02300</b>	The remote CMS <b>shall</b> use the CMS data streams to communicate with other systems/subsystems. (4.2.2) Adopted from <b>EMS-C04-SYS-SHA-04800</b> .
<b>ANSP-SYS-SHA-02310</b>	A disconnection of the CMS <b>shall not</b> create an interruption in the operation of the System. Adopted from <b>EMS-C04-SYS-SHA-04810</b> .
<b>ANSP-SYS-SHA-02320</b>	The CMS <b>shall</b> require the operator identification through user name and password (login) to allow any modification of site-dependant or operational parameters, and to send any control order to any system/subsystem. Adopted from <b>EMS-C04-SYS-SHA-04820</b>
<b>ANSP-SYS-SHA-02330</b>	The CMS <b>shall</b> allow the creation of several operator identities with different user name, password and access rights. Adopted from <b>EMS-C04-SYS-SHA-04830</b> .
<b>ANSP-SYS-SHA-02340</b>	It <b>shall</b> be possible to create at least 2 levels of access rights for the operator identities: Basic and Advanced operator. Adopted from <b>EMS-C04-SYS-SHA-04840</b> .
<b>ANSP-SYS-SHA-02350</b>	The CMS <b>shall</b> require the operator identification (basic or advance) through user name and password (login) to read the System Log. Adopted from <b>EMS-C04-SYS-SHA-04850</b> .
<b>ANSP-SYS-SHA-02360</b>	The CMS <b>shall</b> allow to observe the Monitoring stats and the BITE status without any kind of operator identification. Adopted from <b>EMS-C04-SYS-SHA-04860</b> .

<b>ANSP-SYS-SHA-02370</b>	The CMS <b>shall</b> allow to logout an operator at any moment. Adopted from <b>EMS-C04-SYS-SHA-04870</b> .
<b>ANSP-SYS-SHA-02380</b>	The CMS <b>shall</b> automatically logout any operator after a configurable time (site-dependent parameter) without activity Adopted from <b>EMS-C04-SYS-SHA-04880</b> .
<b>ANSP-SYS-SHA-02390</b>	The CMS <b>shall</b> have a Token system to avoid that more than one CMS is modifying any site-dependant or operational parameters at the same time. Adopted from <b>EMS-C04-SYS-SHA-04890</b> .
<b>ANSP-SYS-SHA-02400</b>	The CMS <b>shall</b> allow an operator to release the CMS token at any moment. Adopted from <b>EMS-C04-SYS-SHA-04900</b> .
<b>ANSP-SYS-SHA-02410</b>	The CMS <b>shall</b> release the CMS Token after a configurable time (site-dependent parameter) without activity. Adopted from <b>EMS-C04-SYS-SHA-04910</b>
<b>ANSP-TEN-SHA-02420</b>	The Tenderer <b>shall</b> provide details of the HMI, including screen layout, used in the local and remote CMS. Adopted from <b>EMS-C04-TEN-SHA-04920</b> .
<b>ANSP-TEN-SHA-02430</b>	The Tenderer <b>shall</b> provide details of the OS Platform used in the CMS and how its life cycle will be handle, e.g. installation of updates regarding future vulnerabilities. Adopted from <b>EMS-C04-TEN-SHA-04930</b>
<b>ANSP-TEN-SHA-02440</b>	The Tenderer <b>shall</b> provide details how the Monitoring and BITE will be represented on the CMS. Adopted from <b>EMS-C04-TEN-SHA-04940</b> .



<b>ANSP-CON-SHA-02450</b>	<p>The Contractor <b>shall</b> supply the Interface Control Documents (ICD) defining the interfaces, protocols and message formats used for the CMS.</p> <p>Adopted from <b>EMS-C04-CON-SHA-04960</b></p>
<b>ANSP-TEN-SHA-02460</b>	The Tenderer <b>shall</b> indicate number of access levels available for operators.
<b>ANSP-TEN-SHA-02470</b>	<p>The Tenderer <b>shall</b> provide details how both, the PSR and SSR-Mode-S radar subsystems are presented in local and remote CMS.</p> <p>Note: CMS operation handbook with required explanation is accepted.</p>
<b>ANSP-SYS-SHA-02480</b>	<p>CMS <b>shall</b> input/output “additional” information that is not related to the radar operation but monitor the environment and indicates incidents on the radar site, at least:</p> <ul style="list-style-type: none"> <li>a) Fire</li> <li>b) Unauthorised entry to the antenna system</li> <li>c) Temperature inside the instrument room</li> <li>d) Temperature inside the antenna drive mechanism area</li> <li>e) Wind speed data</li> <li>f) and other.</li> </ul>
<b>ANSP-TEN-SHA-02490</b>	The Tenderer <b>shall</b> specify an interface for additional information of CMS.
<b>ANSP-SYS-MAY-02500</b>	<p>If a defect is indicated on one of the radar blocks, the system <b>may</b>, in both LCMS and RCMS, offer a reference to relevant documents for a description of the repair procedure. The offered part of the documentation containing such description of the repair procedure shall be displayable directly in LCMS or RCMS.</p> <p>The Tenderer shall specify in its Bid the form and the scale of presented documentation.</p>
<b>ANSP-SYS-MAY-02510</b>	<p>In particular, the description of the repair procedure <b>may</b> highlight measures regarding the safety of work on the electrical equipment and the antenna.</p> <p>The Tenderer <b>shall</b> include in its Bid an example of documentation.</p>

<b>ANSP-SYS-SHA-02520</b>	RCMS and LCMS <b>shall</b> enable remote radar switching off and on the level of main radar contactor (or equivalent). The action shall be remotely reversible.
<b>ANSP-SYS-SHA-02530</b>	RCMS and LCMS <b>shall</b> enable to control antenna turning remotely in terms of switching rotation off and on. The action shall be remotely reversible.
<b>ANSP-SYS-SHA-02540</b>	RCMS and LCMS <b>shall</b> enable to switch between radar channels remotely. The action shall be remotely reversible.
<b>ANSP-SYS-SHA-02550</b>	RCMS and LCMS <b>shall</b> enable to switch transmission on/off remotely. The action shall be remotely reversible.
<b>ANSP-SYS-SHA-02560</b>	RCMS and LCMS <b>should</b> provide an automatic mechanism to check if the radar IC code is set correctly.
<b>ANSP-SYS-SHA-02570</b>	The RCMS and LCMS <b>shall</b> indicate azimuth encoder in use and azimuth encoder failure if it occurs.
<b>ANSP-SYS-SHA-02580</b>	The RCMS and LCMS <b>shall</b> indicate which data output channels are active.

## 12.7 Build in Test Equipment (BITE)

<b>ANSP-SYS-SHA-02590</b>	Comprehensive BITE <b>shall</b> be provided for both on-line and off-line testing of the System to detect any fault affecting the performance of the System.  Adopted from <b>EMS-C04-SYS-SHA-05160</b> .
<b>ANSP-SYS-SHA-02600</b>	The on-line and off-line BITE <b>shall</b> register the faulty equipment (e.g. sub-unit or LRU) and report the information to the CMS.  Adopted from <b>EMS-C04-SYS-SHA-05170</b> .
<b>ANSP-SYS-SHA-02610</b>	Off-line BITE <b>shall</b> be capable of being initiated locally and remotely.  Adopted from <b>EMS-C04-SYS-SHA-05180</b> .

<b>ANSP-SYS-SHA-02620</b>	<p>The BITE coverage rate (part of the System monitored by BITE) <b>shall</b> be at least 90%.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05190</b></p>
<b>ANSP-TEN-SHA-02630</b>	<p>The Tenderer <b>shall</b> provide details of the parts of the System that are not covered, totally or partially, by the BITE (e.g., rotary joint, antenna, etc.).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05200</b></p>
<b>ANSP-SYS-SHA-02640</b>	<p>The BITE fault finding rate, i.e., the detection and isolation within a three LRU group of all failures, <b>shall</b> be at least 95%.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05210</b>.</p> <p>Note: The Tenderer is expected to provide the actual finding rate</p>
<b>ANSP-TEN-SHA-02650</b>	<p>The Tenderer <b>shall</b> state in the response the on-line and off-line fault-finding rate that will be achieved and state under what conditions.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05220</b></p>
<b>ANSP-SYS-SHA-02660</b>	<p>The on-line and off-line testing of the System <b>shall</b> work without the need for any additional external test equipment.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05230</b></p>
<b>ANSP-SYS-SHA-02670</b>	<p>The on-line fault reporting time <b>shall</b> be less than 2 seconds after detecting the fault.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05240</b>.</p>
<b>ANSP-TEN-SHA-02680</b>	<p>The Tenderer <b>shall</b> provide details in their proposal of the BITE facilities available and what on-line tests the System will be able to perform.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05250</b></p>

<b>ANSP-SYS-SHA-02690</b>	<p>On-line testing <b>shall</b> provide performance data through the CMS, in particular performance degradation providing advance warning of a developing fault condition or the need for maintenance.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05260</b></p>
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## 12.8 Log

<b>ANSP-SYS-SHA-02700</b>	<p>The System <b>shall</b> log all user actions and system status messages, including at least:</p> <ul style="list-style-type: none"> <li>a) CMS user actions (e.g. user login, token actions, parameters modification);</li> <li>b) Systems/subsystems status (e.g. started, rebooted or powered off, operative or maintenance, master or slave);</li> <li>c) Monitoring status and warnings (e.g. CPU loading, FRUIT rate greater than parameter);</li> <li>d) BITE status of LRU: <ul style="list-style-type: none"> <li>a. Warning status;</li> <li>b. End of warning status;</li> <li>c. Failure status;</li> <li>d. End of Failure status.</li> </ul> </li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-05270</b></p>
<b>ANSP-SYS-SHO-02710</b>	<p>The log <b>should</b> include at least:</p> <ul style="list-style-type: none"> <li>a) UTC time of occurrence of the event;</li> <li>b) Event designation code;</li> <li>c) System/subsystem affected;</li> <li>d) System/subsystem status (e.g. operative or maintenance);</li> <li>e) Short description of the event.</li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHO-05280</b></p>
<b>ANSP-CON-SHA-02720</b>	<p>The Contractor <b>shall</b> provide the Log ICD.</p> <p>Adopted from <b>EMS-C04-CON-SHA-05290</b>.</p>

<b>ANSP-SYS-SHA-02730</b>	The System <b>shall</b> be able to export the log in a readable format for external analysis (e.g. in CSV format). Adopted from <b>EMS-C04-SYS-SHA-05300</b> .
<b>ANSP-SYS-SHO-02740</b>	The System <b>should</b> store the log for at least the last 30 days. Adopted from <b>EMS-C04-SYS-SHO-05310</b> The Tenderer is expected to indicate maximum and typical log capacity in days
<b>ANSP-TEN-SHA-02750</b>	The Tenderer <b>shall</b> provide a document with complete description of all RCMS and LCMS log records that can appear in log. This can be part of the RCMS Operation Handbook.

## 12.9 Local Display

<b>ANSP-SYS-SHA-02760</b>	A Local Display <b>shall</b> be provided with interfaces for video signals and target reports and service messages as described in Figure 4-A. Adopted from <b>EMS-C04-SYS-SHA-05320</b> <i>Note: Please see Figure 4-A. Local Display access points in EUROCONTROL EMS Ver 4.0 Document.</i>
<b>ANSP-SYS-SHA-02770</b>	By using the Local Display, maintenance and commissioning engineers <b>shall</b> be able to fully assess the operational performance and serviceability of the Mode S ground station. Adopted from <b>EMS-C04-SYS-SHA-05330</b>
<b>ANSP-SYS-SHA-02780</b>	The Local Display <b>shall</b> be capable of handling the target loads as specified in 2.6.8. Adopted from <b>EMS-C04-SYS-SHA-05340</b>

<p><b>ANSP-SYS-SHA-02790</b></p>	<p>The Local Display <b>shall</b> accept and display signals and data from the System on real time or from the Data Recording and Playback system, consisting of at least:</p> <ul style="list-style-type: none"> <li>a) Scanning signals: <ul style="list-style-type: none"> <li>a. Turning and trigger information (for SSR Mode A/C and Mode S all-call);</li> </ul> </li> <li>b) Video signals: <ul style="list-style-type: none"> <li>a. SSR/Mode S video signals after Receiver;</li> <li>b. Quantised Processed Sum Video for SSR and Mode S all-call, consisting in analogue video converted to digital signals synchronised to the monopulse plot extractor master clock timing.</li> </ul> </li> <li>c) Surveillance Data output: <ul style="list-style-type: none"> <li>a. Monoradar target reports (ASTERIX Cat. 048, [RD 26]) and service messages (ASTERIX Cat. 034, [RD 25]);</li> <li>b. ADS-B target reports (ASTERIX Cat. 021, [RD 23]).</li> </ul> </li> <li>d) Passive Acquisition data: <ul style="list-style-type: none"> <li>a. Incoming ADS-B target reports (ASTERIX Cat. 021, [RD 23]);</li> <li>b. Incoming/Outgoing Track data messages (ASTERIX Cat. 017, [RD 21]).</li> </ul> </li> <li>e) Current operational local Coverage maps, for a user-defined altitude: <ul style="list-style-type: none"> <li>a. Surveillance map;</li> <li>b. Lockout map;</li> <li>c. Datalink map.</li> </ul> </li> <li>f) Special plots representation: <ul style="list-style-type: none"> <li>a. The Broadcast Comm-B received;</li> <li>b. ACAS resolution advisories.</li> </ul> </li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-05350</b></p> <p><i>RATIONALE: Monoradar target reports include Mode S, SSR, PSR and combined reports.</i></p>
<p><b>ANSP-SYS-SHA-02800</b></p>	<p>The Local Display <b>shall</b> accept and show data from the System on real time or from the Data Recording and Playback system, consisting of at least:</p> <ul style="list-style-type: none"> <li>a) Reply Report Data (messages output from the Mode A/C and Mode S reply processor in the RTCC function);</li> <li>b) Data flagged as Anomalies and false plots in the PAF and NOT sent to the Surveillance Data outputs;</li> <li>c) All monoradar targets under surveillance (3-D position and identity);</li> </ul>

	<ul style="list-style-type: none"> <li>d) The Data link capability of each target (BDS register 1016);</li> <li>e) The last received message decoded per target;</li> <li>f) The GICB received;</li> <li>g) The EHS GICB requests received from the DAP Extraction Interface (ASTERIX Cat. 018, [RD 22]);</li> <li>h) The Broadcast Comm-B received;</li> <li>i) ACAS resolution advisories.</li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-05360</b></p> <p><i>RATIONALE: Monoradar target reports include Mode S, SSR, PSR and combined reports.</i></p>
<b>ANSP-TEN-SHA-02810</b>	<p>The Tenderer <b>shall</b> provide information on the subset of data and signals that can be displayed simultaneously.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05370</b></p>
<b>ANSP-SYS-SHA-02820</b>	<p>The Local Display <b>shall</b> be displayed in a geographical representation with a background map facility for up to 300 NM radius of the origin.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05380</b></p>
<b>ANSP-SYS-SHA-02830</b>	<p>The Local Display <b>shall</b> provide parameters to configure the centre of coordinates for the data representation in the geographical map.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05390</b></p>
<b>ANSP-TEN-SHA-02840</b>	<p>The Tenderer <b>shall</b> provide detailed information about the editing and display of border and coastline maps, and which maps will be delivered as standard representation.</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05400</b></p>
<b>ANSP-TEN-SHA-02850</b>	<p>The Tenderer <b>shall</b> provide detailed information about the editing and display of other geographical maps (other sensor positions, screening coverage maps, airways, runways, etc.).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05410</b></p>

<b>ANSP-TEN-SHA-02860</b>	<p>The Tenderer <b>shall</b> provide detailed information about the display of the coverage maps (Surveillance, Lockout and Datalink).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05420</b></p>
<b>ANSP-TEN-SHA-02870</b>	<p>The Tenderer <b>shall</b> provide detailed information about the display of Passive Acquisition data in ASTERIX Cat. 017 ([RD 21]) and Cat. 021 ([RD 23]).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05430</b></p>
<b>ANSP-SYS-SHA-02880</b>	<p>The System <b>shall</b> provide the operator with the ability to select any combination of data to be displayed in the Local Display.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05440</b></p>
<b>ANSP-SYS-SHA-02890</b>	<p>The symbols and colours in the Local Display <b>shall</b> be such as to distinguish between different plot types.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05450</b></p>
<b>ANSP-TEN-SHA-02900</b>	<p>The Tenderer <b>shall</b> provide detailed information on how the Local Display data is selected and retrieved from the station (e.g., software or hardware selection).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05460</b></p>
<b>ANSP-SYS-SHA-02910</b>	<p>The Local Display <b>shall</b> use the same Surveillance Data as that available in the external WAN interface.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05470</b></p>
<b>ANSP-SYS-SHA-02920</b>	<p>The Local Display <b>shall</b> recognise, process, interpret and display all the following ASTERIX messages types:</p> <ul style="list-style-type: none"> <li>a) Cat. 017 ([RD 21]);</li> <li>b) Cat. 018 ([RD 22]);</li> <li>c) Cat. 021 ([RD 23]);</li> <li>d) Cat. 034 ([RD 25]);</li> <li>e) Cat. 048 ([RD 26]).</li> </ul> <p>Adopted from <b>EMS-C04-SYS-SHA-05480</b></p>



<b>ANSP-CON-SHA-02930</b>	<p>The Contractor <b>shall</b> supply any peripherals and/or ancillary equipment that are necessary for the operation of the Local Display.</p> <p>Adopted from <b>EMS-C04-CON-SHA-05490</b></p>
<b>ANSP-TEN-SHA-02940</b>	<p>The Tenderer <b>shall</b> include in the response details of how all the information for selected plots could be displayed (e.g., including GICB reply data, status information, etc.).</p> <p>Adopted from <b>EMS-C04-TEN-SHA-05500</b></p>
<b>ANSP-SYS-SHA-02950</b>	<p>The Local Display hardware <b>shall</b> make use of an industry standard graphics work station with an industry standard Operating System.</p> <p>Adopted from <b>EMS-C04-SYS-SHA-05510</b></p>
<b>ANSP-SYS-SHA-02960</b>	<p>Where specialised external processing hardware is proposed, it <b>shall</b> be interfaced to the same Operating System as the Local Display.</p> <p>Adopted <b>EMS-C04-SYS-SHA-05520</b></p>
<b>ANSP-TEN-SHA-02970</b>	<p>The Tenderer <b>shall</b> provide details of the hardware which will be supplied for the Local Display.</p> <p>Adopted <b>EMS-C04-TEN-SHA-05530</b></p>
<b>ANSP-SYS-SHA-02980</b>	<p>The radar delivery <b>shall</b> include two technical displays, one located in the local technical room and the second one in the Technical Room at the ATC Centre.</p> <p>Technical displays <b>shall</b> be common for PSR and the SSR.</p>
<b>ANSP-SYS-SHA-02990</b>	<p>The visual presentation formats of the technical display in the local technical room and that in the ATC Centre Technical room <b>shall</b> have identical properties and HMIs.</p>
<b>ANSP-SYS-SHA-03000</b>	<p>The technical display at the radar site <b>shall</b> display raw videos of primary radar targets to full extent.</p>

<b>ANSP-SYS-MAY-03010</b>	The technical display at the radar site <b>may</b> display raw video of the meteo channel to full extent.
<b>ANSP-SYS-MAY-03020</b>	<p>The technical display <b>may</b> show signals from different steps of the radar processing.</p> <p>The tenderer may specify the signal processing steps at which the data for the visual display are available.</p> <p>Note: Example of processing steps: After I/Q demodulation, Before CFAR, After CFAR, etc.</p> <p>If other than the processed raw video is available for presentation on the local display, the tenderer may provide information on what type of video can be displayed.</p>
<b>ANSP-SYS-SHO-03030</b>	The technical display <b>should</b> visually present target and meteo channel data from belonging primary, secondary radar and ADS-B data.
<b>ANSP-SYS-SHO-03040</b>	The Tenderer <b>should</b> specify the number of external data inputs to local display.
<b>ANSP-SYS-SHA-03050</b>	<p>Technical display <b>shall</b> visually present targets from other radars (other PSR and SSR).</p> <p>Source of radar tracks/plots is UDP multicast in ASTERIX Cat 34/48.</p> <p>The Tenderer <b>shall</b> specify the interface and UAP.</p>
<b>ANSP-SYS-MAY-03060</b>	<p>Technical display <b>may</b> visually present targets from external ADS-B data source.</p> <p>The ADS-B data source is UDP multicast in ASTERIX Cat021.</p> <p>If provided, the Tenderer <b>shall</b> specify the interface and UAP.</p>
<b>ANSP-SYS-MAY-03070</b>	<p>Technical display <b>may</b> visually present targets from WAM system.</p> <p>The source of WAM data is a UDP multicast in ASTERIX Cat. 20.</p> <p>If provided, the Tenderer <b>shall</b> specify the interface and UAP</p>
<b>ANSP-SYS-MAY-03080</b>	<p>Technical display <b>may</b> visually present targets from ARTAS tracker.</p> <p>The source of ARTAS tracks is UDP multicast in ASTERIX Cat 062/065.</p> <p>If provided, the Tenderer <b>shall</b> specify the interface and UAP.</p>

<b>ANSP-SYS-SHA-03090</b>	The technical display <b>shall</b> present all plots, tracks and video signal in a single window in common projection. (external and internal data)
<b>ANSP-SYS-SHO-03100</b>	<p>The display <b>should</b> support the depiction of different track/plot symbols for different sensor types:</p> <ul style="list-style-type: none"> <li>• PSR</li> <li>• SSR</li> <li>• ADS-B</li> <li>• System Track (Cat062)</li> </ul>
<b>ANSP-SYS-SHO-03110</b>	The local display <b>should</b> allow the placement of labels in at least eight different directions.
<b>ANSP-SYS-SHO-03120</b>	The local display <b>should</b> enable the customization of labels to show selected ASTERIX item data. The label content should support a minimum of three lines of information.
<b>ANSP-SYS-SHA-03130</b>	<p>Information available for presentation in the target label <b>shall</b> be at least:</p> <p>SAC, SIC, ICAO Address, ACID, Flight status, Mode A/1/2 codes, Flight level from Mode C, time, range, azimuth, elevation, X/Y position, Lat/Lon position.</p> <p>The Tenderer <b>shall</b> provide list of information that is available for presentation in the target label.</p>
<b>ANSP-SYS-SHA-03140</b>	Technical display <b>shall</b> allow at plots and tracks basic filtration, based on Mode A, ICAO Address, ACID.
<b>ANSP-SYS-SHA-03150</b>	Technical display <b>shall</b> show BDS registers and their content extracted from a target.
<b>ANSP-SYS-MAY-03160</b>	<p>Technical display <b>may</b> allow advanced filtration based on ASTERIX items in target reports (e.g. flight level, BDS registers, etc.)</p> <p>If provided, the Tenderer <b>shall</b> describe possibilities of advanced filtering</p>
<b>ANSP-SYS-MAY-03170</b>	Technical display <b>may</b> display OBA curve of a single target under inspection in a graphical representation.
<b>ANSP-SYS-MAY-03180</b>	Technical display <b>may</b> show basic kinematic data of a selected target (at least heading, height, speed, range, azimuth).

<b>ANSP-SYS-SHO-03190</b>	Technical display <b>should</b> allow inspection of number of SSR, Mode-S All-call, Mode-S Roll-call replies for selected target.
<b>ANSP-SYS-SHA-03200</b>	<p>As a minimum, the technical display <b>shall</b> enable the following functions:</p> <ul style="list-style-type: none"> <li>a) Selecting the range;</li> <li>b) Selecting off-centring;</li> <li>c) Zoom function;</li> <li>d) At least one measuring vector for the following combinations: <ul style="list-style-type: none"> <li>- Between two points;</li> <li>- Between a point and a target;</li> <li>- Between two targets.</li> </ul> </li> <li>e) At least 6 previous positions of each target in digital format;</li> <li>f) At least 15 previous positions for at least 4 simultaneously selected targets;</li> <li>g) At least 6 previous positions of each primary target in analogue format with afterglow imitation;</li> <li>h) Display range marks in NM, with range spacing selection;</li> <li>i) Display azimuth marks with azimuth spacing selection, minimum 10° step and highlighted north;</li> <li>j) Displaying a vector map</li> </ul>
<b>ANSP-SYS-SHA-03210</b>	<p>Technical display <b>shall</b> allow to select units for range, height, angles, coordinates.</p> <p>The Tenderer shall describe in its Bid all of the available units of each measure.</p>
<b>ANSP-SYS-SHO-03220</b>	<p>The local technical display <b>should</b> present:</p> <ul style="list-style-type: none"> <li>– beam switching control map for aircraft and weather</li> <li>– STC map for aircraft and weather</li> <li>– AD/MTD map</li> <li>– clear day map</li> <li>– weather map</li> <li>– geographic filter map</li> <li>– etc.</li> </ul> <p>The Tenderer shall detail how signals are displayed.</p>

<b>ANSP-SYS-SHA-03230</b>	Technical display <b>shall</b> allow to display surveillance map and lock-out map of the radar.
<b>ANSP-SYS-SHA-03240</b>	The technical display <b>shall</b> enable the user to generate or import a new map. The Tenderer <b>shall</b> describe the map preparation and definition method in its Bid
<b>ANSP-CON-SHA-03250</b>	Supplied documentation of the local display <b>shall</b> describe data that can be modified by the user. (maps, areas, settings, parameters, recording). Description shall include data format. <i>Note: Open format is preferred.</i>
<b>ANSP-SYS-SHA-03260</b>	Technical display <b>shall</b> be time synchronized to the same time source as the radar. The actual time shall be presented in the HMI.
<b>ANSP-SYS-MAY-03270</b>	Technical display <b>may</b> provide recording and replay function. The Tenderer <b>shall</b> describe in its Bid the technical solution and recording performances.
<b>ANSP-SYS-SHA-03280</b>	Contractor <b>shall</b> provide ICD of the Local Display recordings.
<b>ANSP-SYS-MAY-03290</b>	The local display <b>may</b> record of raw data transmitted and received (uplink and downlink, UF/DF formats). This recording should be exportable to a machine-readable format. The output format should be fully specified and documented. Purpose of the recording is ex-post analysis of dubious aircraft detections, over-interrogations etc. The Tenderer <b>should</b> describe in its Bid what data are recorded and possibly exported.
<b>ANSP-SYS-SHA-03300</b>	Technical display <b>shall</b> be equipped with USB port to allow data transfer to and from flash drives (data examples: settings, parameters, recordings...)

## 12.10 Cyber Security

### 12.10.1 Non-essential elements

<b>ANSP-SYS-SHA-03310</b>	Software services of Operative Systems and applications not required for the normal operation of the Systems <b>shall</b> be disabled.  Adopted from <b>EMS-C04-SYS-SHA-05700</b> .
<b>ANSP-SYS-SHA-03320</b>	COTS applications (e.g. browsers, demo apps, developments tools, libraries) not required for the normal operation of the Systems <b>shall</b> be disabled.  Adopted from <b>EMS-C04-SYS-SHA-05710</b> .
<b>ANSP-SYS-SHA-03330</b>	Firewalls <b>shall</b> be configured to only allow essential communications (i.e., IP addresses and ports) for the normal operation of the Systems.  Adopted from <b>EMS-C04-SYS-SHA-05720</b> .
<b>ANSP-SYS-SHA-03340</b>	All hardware ports unused by the System (e.g. USB, Ethernet ports, SD cards, etc.) <b>shall</b> be disabled during normal operation by default.  Adopted from <b>EMS-C04-SYS-SHA-05730</b> .
<b>ANSP-SYS-SHA-03350</b>	The System <b>shall</b> allow to enable an unused (disabled) hardware port for a limited period of time.  Adopted from <b>EMS-C04-SYS-SHA-05740</b> .
<b>ANSP-TEN-SHA-03360</b>	The Tenderer <b>shall</b> describe how the System will allow a hardware port to be temporarily enabled and how the port will be set back to its default disabled status.  Adopted from <b>EMS-C04-TEN-SHA-05750</b> .

<b>ANSP-SYS-SHA-03370</b>	The system <b>shall</b> ensure that ports used for remote diagnostics and configuration (e.g., iLO, iDRAC, etc.) are protected against unauthorized access using the same level of security measures as the system itself, or they must be disabled.
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#### 12.10.2 Operator Credentials

<b>ANSP-SYS-SHA-03380</b>	The System <b>shall</b> require the operator identification (login), i.e. through user name and password, to allow any modification or control action in any system/subsystem.  Adopted from <b>EMS-C04-SYS-SHA-05760</b> .
<b>ANSP-SYS-MAY-03390</b>	The System <b>may</b> include an Identity Server subsystem to be located in a remote central location and to be able to provide the same Operator credentials to several Mode S ground stations.  Adopted from <b>EMS-C04-SYS-MAY-05770</b> .
<b>ANSP-TEN-SHA-03400</b>	When included as a part of the System, the Tenderer <b>shall</b> describe how the Identity Server will be integrated in the System to provide a centralized user credentials repository in a secure way.  Adopted from <b>EMS-C04-TEN-SHA-05780</b> .
<b>ANSP-SYS-SHO-03410</b>	The System <b>should</b> accept only the creation of passwords with the minimum following complexity:  a) Length: minimum 10 characters; b) Complexity: At least one lower case character, one upper case character, one number and one special character.  Adopted from <b>EMS-C04-SYS-SHO-05790</b> .
<b>ANSP-SYS-MAY-03420</b>	The System <b>may</b> request to an Operator to change the password every 90 days.  Adopted from <b>EMS-C04-SYS-MAY-05800</b> .

<b>ANSP-SYS-MAY-03430</b>	The System <b>may</b> have a password history per user to avoid password reuse. Adopted from <b>EMS-C04-SYS-MAY-05810</b> .
<b>ANSP-SYS-SHA-03440</b>	Passwords storage <b>shall</b> be encrypted. Adopted from <b>EMS-C04-SYS-SHA-05820</b> .
<b>ANSP-SYS-SHO-03450</b>	Any operator account <b>should</b> be blocked after 5 wrong attempts to login. Adopted from <b>EMS-C04-SYS-SHO-05830</b> .
<b>ANSP-SYS-SHO-03460</b>	Any system/subsystem <b>should</b> automatically logout any Operator after a configurable time (parameter) without activity. Adopted from <b>EMS-C04-SYS-SHO-05840</b>

### 12.10.3 Network

<b>ANSP-SYS-SHA-03470</b>	Access to remote services (e.g. RDP or SSH) <b>shall</b> only be granted to known network hosts. Adopted from <b>EMS-C04-SYS-SHA-05850</b> .
<b>ANSP-SYS-SHO-03480</b>	The System <b>should not</b> grant unsecure wireless access to its LAN and WAN network interfaces which differ from dedicated point-to-point radio communications, e.g. microwave links. Adopted from <b>EMS-C04-SYS-SHO-05860</b> .
<b>ANSP-SYS-SHO-03490</b>	The System <b>should</b> provide a function to secure the Surveillance Data output in the outer link of the external interfaces. <i>Note: Contracting Authority responsibility to arrange segmentation and FW rule level.</i> Adopted from <b>EMS-C04-SYS-SHO-05870</b> .



<b>ANSP-SYS-SHO-03500</b>	<p>The security function <b>should</b> use an encryption protocol to secure the link between the external interfaces and the remote locations where the data will be received.</p> <p><i>Note: Contracting Authority responsibility to arrange MAC SEC protocol on switches</i></p> <p>Adopted from <b>EMS-C04-SYS-SHO-05880</b>.</p>
<b>ANSP-TEN-SHO-03510</b>	<p>The Tenderer <b>should</b> detail which encryption protocol the System will use and which additional requirements will be needed in the other side of the link where the data will be sent.</p> <p><i>Note: Contracting Authority responsibility to arrange MAC SEC protocol on switches</i></p> <p>Adopted from <b>EMS-C04-TEN-SHO-05890</b>.</p>
<b>ANSP-SYS-MAY-03520</b>	<p>The System <b>may</b> have the capability to include a function to secure the content of the surveillance data by encapsulating the ASTERIX messages.</p> <p><i>Note: Contracting Authority responsibility to arrange MAC SEC protocol on switches</i></p> <p>Adopted from <b>EMS-C04-SYS-MAY-05900</b></p>
<b>ANSP-SYS-MAY-03530</b>	The System <b>may</b> have Certificate of conformity – Industrial Cyber Security Capability in accordance with IEC 62443-4-1.
<b>ANSP-SYS-SHO-03540</b>	Highly sensitive application systems <b>should</b> be operated on a dedicated computer / computer system.
<b>ANSP-SYS-SHA-03550</b>	The dedicated computer system <b>shall not</b> share any resources with any other information system.
<b>ANSP-SYS-SHO-03560</b>	The system <b>should</b> have software installed for the detection of malicious programs (malware).
<b>ANSP-SYS-SHA-03570</b>	The software for the detection of malicious programs (malware) <b>shall</b> be capable of being updated.
<b>ANSP-SYS-SHA-03580</b>	The system <b>shall</b> incorporate the ability to change factory default passwords, ensuring enhanced security and mitigating the risk associated with the use of default credentials.

## 12.11 System Initialization

<b>ANSP-SYS-SHA-03590</b>	<p>For an off-mounted configuration, the maximum time between the start-up command of a ground station and the sending of a report on the Surveillance Data output, regardless of the ON/OFF power states of the turning gear and the rest of the ground station, <b>shall not</b> exceed 5 minutes + rotation announcement time + two scans.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09480</b>.</p> <p><i>Note: Due to the possible PSR initialization procedures the time in this requirement was extended to 5 minutes. The Tenderer is expected to state the actual time.</i></p>
<b>ANSP-TEN-SHA-03600</b>	<p>The Tenderer <b>shall</b> provide in their proposal the maximum response time of their System for a complete and a partial start-up.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09490</b>.</p>
<b>ANSP-SYS-SHA-03610</b>	<p>The System <b>shall</b> confirm the serviceability of all hardware elements on power-up.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09500</b></p>
<b>ANSP-SYS-SHA-03620</b>	<p>Each subsystem <b>shall</b> verify that the software/firmware integrity of each sub-unit and LRU, after power up or reset, is correct.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09510</b>.</p>
<b>ANSP-TEN-SHA-03630</b>	<p>The Tenderer <b>shall</b> advise how each subsystem can verify that the hardware issue of each board on power up or reset is correct.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09520</b>.</p>
<b>ANSP-TEN-SHA-03640</b>	<p>The Tenderer <b>shall</b> advise how each subsystem can verify that the default parameters set on power up or reset is correct.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09530</b></p>

<b>ANSP-SYS-SHA-03650</b>	<p>In each of the hardware and software/firmware verifications, an error message <b>shall</b> be produced if the test fails, but not in the case of an intended reset or shutdown.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-09540</b></p>
<b>ANSP-TEN-SHA-03660</b>	<p>The Tenderer <b>shall</b> include in their proposal details of the power up and reset checks.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09550</b>.</p>
<b>ANSP-SYS-SHA-03670</b>	<p>Upon the restoration of any of the inputs listed below, following a failure of that input, and irrespective of the duration of the failure, the ground station <b>shall</b> be fully restored to the operating conditions that applied before the failure occurred, without the need for any manual intervention:</p> <ul style="list-style-type: none"> <li>a) Azimuth data;</li> <li>b) NTP time signals;</li> <li>c) Mains power supply;</li> <li>d) RF interfaces in Interrogator.</li> </ul> <p>Adopted from <b>EMS-C08-SYS-SHA-09560</b>.</p>
<b>ANSP-TEN-SHA-03680</b>	<p>The Tenderer <b>shall</b> state in their proposal the maximum duration of any interruption of the above external inputs that can occur without affecting or impairing the operational status of the System.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09570</b>.</p>
<b>ANSP-TEN-SHA-03690</b>	<p>The Tenderer <b>shall</b> state in their proposal for every external input, the effect on the Plot Assignor Function (PAF) of a failure of that input, and the recovery state and recovery time following restoration.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09580</b>.</p>

### 12.12 ANSP Central Monitoring and Control System (CMOS)

<b>ANSP-SYS-SHA-03700</b>	For the integration to CMOS, the System <b>shall</b> be equipped with possibility to monitoring the System Servers infrastructure; hardware, Operating system, OS resources (CPU, MEM, Disc usage, System process...)
<b>ANSP-SYS-SHA-03710</b>	System <b>shall</b> be equipped with possibility to monitoring the System Servers Services (applications, databases...)
<b>ANSP-SYS-SHA-03720</b>	The solution <b>shall</b> provide the following methods/protocols: <ul style="list-style-type: none"> <li>a) SNMP v1, v2 and v3 on standard (UDP 161, 162) ports</li> <li>b) ICMP</li> <li>c) TCP ports (80, 443, ...)</li> </ul>
<b>ANSP-SYS-SHA-03730</b>	The solution <b>shall</b> provide real-time reporting of non-standard events (alarms, outages, ...) of all system components via SNMP protocols (traps) and log files (syslog)
<b>ANSP-SYS-SHA-03740</b>	The solution <b>shall</b> provide a detailed description of all monitored elements (mibs, trap definitions)
<b>ANSP-SYS-SHA-03750</b>	The solution <b>shall</b> provide categorization of the criticality of all individual events (alarm severity)
<b>ANSP-SYS-SHA-03760</b>	The solution <b>shall</b> provide the possibility of setting the sending of alarms depending on the criticality of the events.
<b>ANSP-SYS-SHO-03770</b>	The solution <b>should</b> provide the possibility of monitoring security events (incorrect login, ...)

### 12.13 Hardware Requirements

<b>ANSP-SYS-SHA-03780</b>	The construction of the System and all its components <b>shall</b> be in accordance with the best current practices and standards in force at the International and European levels.  Adopted from <b>EMS-C08-SYS-SHA-09590</b>
<b>ANSP-SYS-SHA-03790</b>	The System <b>shall</b> comply with the Directive 2011/65/EU ([RD 63]) of restrictions in the use of certain hazardous substances in electronic equipment.  Adopted from <b>EMS-C08-SYS-SHA-09600</b>

<b>ANSP-SYS-SHA-03800</b>	The System <b>shall</b> comply with the Directive 2014/53/EU ([RD 62]) with regulatory framework for radio equipment Adopted from <b>EMS-C08-SYS-SHA-09610</b>
<b>ANSP-SYS-SHA-03810</b>	Compliance with the EMC standards, contained within Directive 2014/30/EU ([RD 56]), and Low Voltage standards, contained within Directive 2014/35/EU ([RD 57]), <b>shall</b> be required. Adopted from <b>EMS-C08-SYS-SHA-09620</b>
<b>ANSP-CON-SHA-03820</b>	The Contractor will be required to demonstrate that the delivered system conforms to the EMC recommendations. The cost of this demonstration <b>shall</b> be borne by the Contractor. Adopted from <b>EMS-C08-CON-SHA-09630</b>
<b>ANSP-SYS-SHA-03830</b>	The System <b>shall</b> be CE marked to demonstrate compliance with EU Directives. Adopted from <b>EMS-C08-SYS-SHA-09640</b>
<b>ANSP-TEN-SHA-03840</b>	The Tenderer <b>shall</b> provide a list with information on compliance of the System with any other relevant EU regulatory standards. Adopted from <b>EMS-C08-TEN-SHA-09650</b>
<b>ANSP-CON-SHA-03850</b>	The Contractor <b>shall</b> agree with the Contracting Authority all the EU regulatory standards that the System complies and how the compliance will be shown. Adopted from <b>EMS-C08-CON-SHA-09660</b>
<b>ANSP-TEN-SHA-03860</b>	The Tenderer <b>shall</b> state in their Tender Response the Hardware Standards and Codes of Practice which will be applied to the System. Adopted from <b>EMS-C08-TEN-SHA-09670</b>

<b>ANSP-TEN-SHA-03870</b>	<p>Copies of these standards and codes of practice <b>shall</b> be made available on request.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-09680</b></p>
<b>ANSP-TEN-SHA-03880</b>	<p>The Tenderer <b>shall</b> identify where each of the following hardware aspects are defined in the standards quoted:</p> <ul style="list-style-type: none"> <li>a) Component Selection, including, but not limited to, semiconductor devices, fuses, fans, etc.;</li> <li>b) Circuit Design;</li> <li>c) Electrical Wiring;</li> <li>d) Connections;</li> <li>e) Printed Circuits and Wiring;</li> <li>f) Circuit and Equipment Layout;</li> <li>g) Circuit and Equipment Assembly;</li> <li>h) Protective Devices;</li> <li>i) Interchangeability of equipment, sub-assemblies and components;</li> <li>j) Full accessibility of components for maintenance, with easily accessible connection, testing and fixing points;</li> <li>k) Replaceable parts located and secured so as to permit inspection, servicing and replacement without damage to, or interference with adjacent part of wiring;</li> <li>l) Fail safe characteristics for each component, circuit and equipment;</li> <li>m) Use of auto test and automatic detection and indication of failed components;</li> <li>n) Protection of cables, wiring, and board against damage from liquids, heat, shock and vibration;</li> <li>o) Marking and labelling of the various components, boards, equipment, cables and wiring;</li> <li>p) Use of warning and instruction labels for any risk of danger.</li> </ul> <p>Adopted from <b>EMS-C08-TEN-SHA-09690</b></p>
<b>ANSP-CON-SHA-03890</b>	<p>Modification to the type of equipment supplied under the Contract made by the Contractor subsequent to delivery <b>shall</b> be notified to the Contracting Authority in order that consideration can be given to the embodiment of such modifications in ancillary equipment.</p> <p>Adopted from <b>EMS-C08-CON-SHA-09700</b></p>

### 12.13.1 Maintenance

<b>ANSP-SYS-SHA-03900</b>	It is required that related equipment maintenance actions <b>shall</b> be carried out from the same side of the equipment. Adopted from <b>EMS-C08-SYS-SHA-09710</b>
<b>ANSP-SYS-SHA-03910</b>	Panels, units and chassis which require removal for maintenance <b>shall not</b> normally exceed 10 kg in weight (including the weight of the transit case). Adopted from <b>EMS-C08-SYS-SHA-09720</b>
<b>ANSP-SYS-SHA-03920</b>	Units exceeding 10 kg in weight <b>shall</b> be provided with suitable lifting facilities. Adopted from <b>EMS-C08-SYS-SHA-09730</b>
<b>ANSP-SYS-SHA-03930</b>	Units exceeding 10 kg <b>shall</b> be clearly labelled as being heavy with a warning label. Adopted from <b>EMS-C08-SYS-SHA-09740</b>
<b>ANSP-TEN-SHA-03940</b>	The Tenderer <b>shall</b> identify in their proposal any special handling requirements. Adopted from <b>EMS-C08-TEN-SHA-09750</b>
<b>ANSP-SYS-SHA-03950</b>	The design of panels, units, chassis, etc. <b>shall</b> be such that they can be safely set down without damage. Adopted from <b>EMS-C08-SYS-SHA-09760</b>
<b>ANSP-SYS-SHA-03960</b>	Fragile components <b>shall not</b> be positioned in exposed places, but protected in the best way possible (e.g. guard rails). Adopted from <b>EMS-C08-SYS-SHA-09770</b>
<b>ANSP-CON-SHA-03970</b>	The Contractor <b>shall</b> bring to the Contracting Authority's notice components or devices supplied under the Contract that could be in any way affected by electrostatic discharge and which might as a consequence be damaged by incorrect handling or storage. Adopted from <b>EMS-C08-CON-SHA-09780</b>

### 12.13.2 Labeling

<b>ANSP-SYS-SHA-03980</b>	Each hardware element of the System <b>shall</b> have attached its part and serial number in a fix form.  Adopted from <b>EMS-C08-SYS-SHA-09790</b>
<b>ANSP-SYS-SHA-03990</b>	The system <b>shall</b> employ the Latin alphabet character set (A-Z and a-z) for textual, visual, and hardware elements. Non-Latin characters or symbols from other scripts are acceptable in legitimate cases (Greek letters, math symbols, etc.).  This requirement covers all labels, printed circuit designators, documents, hardware labels etc.
<b>ANSP-SYS-SHA-04000</b>	The system <b>shall</b> primarily use Arabic numerals (0-9) for numerical representation in most contexts. Alternatively, in suitable cases, roman numerals are allowed.

..... end of System Specification (Part A) .....



### 13 Subchapter F - System Specification (Part B)

Some requirements originate in EMS v.4 specification, but for the purpose of this tender, they are modified or extended or valid for PSR and Mode-S. In this case, the ref. number is changed to ANS pattern, ANSP-xxx-xxx-xxxxx. In the Compliance Matrix, column F indicates from which EMS requirement the ANSP requirement is adopted.

The Compliance Matrix for System Specification (Part B) is based on Eurocontrol EMS 4.0 and is an integral part of the tender and is located in Annex no.1, **Compliance Matrix** tab 2.6 - System (Part B)

In Tender and Compliance Matrix requirements from EASA DS-GE.CER/DEC for Mode S compliance are specifically highlighted the in color.

#### 13.1 Software and Firmware Requirements

<b>ANSP-SYS-SHA-04010</b>	The software and firmware <b>shall</b> be designed to preclude abnormal behaviour and to limit the consequences of system failure conditions through appropriate fault avoidance techniques, fault tolerant design architecture, verification and validation methodologies.  Adopted from <b>EMS-C08-SYS-SHA-09800</b>
<b>ANSP-SYS-SHA-04020</b>	Software and firmware design, development, verification, validation and maintenance <b>shall</b> be carried out according to methodical and rigorous procedures to ensure that the System fully complies with the specification, and to ensure that performance, safety and quality objectives are met.  Adopted from <b>EMS-C08-SYS-SHA-09810</b>
<b>ANSP-TEN-SHA-04030</b>	The Tenderer <b>shall</b> list the software and firmware deliverables in a preliminary Configuration Management Plan, to be provided as part of their Tender Response.  Adopted from <b>EMS-C08-TEN-SHA-09820</b>
<b>ANSP-SYS-SHA-04040</b>	The software and firmware deliverables <b>shall</b> be produced in accordance with the best current practices and standards in force at the International and European levels.  Adopted from <b>EMS-C08-SYS-SHA-09830</b>

<b>ANSP-SYS-SHA-04050</b>	High order languages conforming to a recognised ISO or ANSI standard <b>shall</b> be used. Adopted from <b>EMS-C08-SYS-SHA-09840</b>
<b>ANSP-TEN-SHA-04060</b>	The Tenderer <b>shall</b> state in their response the software and firmware languages to be used. Adopted from <b>EMS-C08-TEN-SHA-09850</b>
<b>ANSP-TEN-SHA-04070</b>	The Tenderer <b>shall</b> identify in their Tender Response the Software and Firmware Standards and Codes of Practice which will be applied to the Project. Adopted from <b>EMS-C08-TEN-SHA-09860</b>
<b>ANSP-CON-SHA-04080</b>	The Contractor shall review with the Contracting Authority the appropriate software and firmware standards for this Project. Adopted from <b>EMS-C08-CON-SHA-09870</b>

#### 13.1.1 Design Methods

<b>ANSP-SYS-SHA-04090</b>	An industry standard method of software and firmware design <b>shall</b> be employed. Adopted from <b>EMS-C08-SYS-SHA-09880</b>
<b>ANSP-SYSTEM-SHA-04100</b>	If new software and firmware developments are needed, the Tenderer <b>shall</b> state in a preliminary Software and Firmware Development Plan the development environment in terms of hardware and software/firmware including as a minimum: <ul style="list-style-type: none"> <li>a) Software and Firmware development objectives (criticalities of functions, quality, safety, etc.);</li> <li>b) Team organisation;</li> <li>c) Interfaces;</li> <li>d) Design methodology and all tools which will be employed;</li> <li>e) Standards and activities with regards the life cycle;</li> <li>f) Technical milestones;</li> <li>g) Support environment to be used or implemented (tools, simulator, etc.);</li> <li>h) Hardware platform(s) for the tools to be used.</li> </ul> Adopted from <b>EMS-C08-SYSTEM-SHA-09890</b>

<b>ANSP-SYS-SHO-04110</b>	The standard for Software Integrity Assurance for CNS/ATM Systems ED-109A ([RD 52]) <b>should</b> be used as guidelines for the software and firmware requirements and tailoring the effort of development, verification and validation versus the criticality of the functions. Adopted from <b>EMS-C08-SYS-SHO-09900</b>
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### 13.1.2 Software and Firmware Safety

<b>ANSP-SYS-SHA-04120</b>	In order to meet the Safety Requirements defined in 9.4.2, it is essential that the software and firmware processes <b>shall</b> be examined as part of the FMECA (Failure Modes Effect and Criticality Analysis). Adopted from <b>EMS-C08-SYS-SHA-09910</b>
<b>ANSP-SYS-SHA-04130</b>	The criticality considered in the FMECA of each module/process <b>shall</b> be identified according to the role carried out by the process within the System. Adopted from <b>EMS-C08-SYS-SHA-09920</b>
<b>ANSP-TEN-SHA-04140</b>	The Tenderer <b>shall</b> identify in the Software and Firmware Development Plan the various criticalities of the tasks carried out by the software/firmware functions and the measures (in terms of developments, verification, validation and assurance activities and techniques) to ensure that the characteristics of the software/firmware, in particular its failure modes, do not impact on the overall system safety level as defined in 9.4.2. Adopted from <b>EMS-C08-TEN-SHA-09930</b>
<b>ANSP-SYS-SHO-04150</b>	Software and Firmware design <b>should</b> follow the guidelines for assurance of software level AL4 contained in ED-109A ([RD 52]). Adopted from <b>EMS-C08-SYS-SHO-09940</b>
<b>ANSP-TEN-SHA-04160</b>	The Tenderer <b>shall</b> state the levels according to which they have developed, or intend to develop the software and firmware components in terms of the Mode S and PSR ground station. Adopted from <b>EMS-C08-TEN-SHA-09950</b>

### 13.1.3 Operating System

<b>ANSP-TEN-SHA-04170</b>	The Tenderer <b>shall</b> provide in their Tender response details of the Operating System to be used.  Adopted from <b>EMS-C08-TEN-SHA-09960</b>
<b>ANSP-CON-SHA-04180</b>	The Contractor <b>shall</b> ensure that the Operating System design allows future hardware, software, firmware and communication enhancements.  Adopted from <b>EMS-C08-CON-SHA-09970</b>
<b>ANSP-TEN-SHA-04190</b>	The Tenderer <b>shall</b> state the level to which the Operating System can analyse the type and cause of detected system errors, including the level of ability to record data concerning the error and its cause for error notification and subsequent investigation from a maintenance position.  Adopted from <b>EMS-C08-TEN-SHA-09980</b>
<b>ANSP-CON-SHA-04200</b>	Where an Operating System has been written by, or is owned by the Tenderer, the source code for the Operating System <b>shall</b> be defined as a deliverable item in the Contract.  Adopted from <b>EMS-C08-CON-SHA-09990</b>
<b>ANSP-TEN-SHA-04210</b>	The Tenderer <b>shall</b> state the software and firmware booting time.  Adopted from <b>EMS-C08-TEN-SHA-10000</b>

### 13.1.4 Processing load

<b>ANSP-SYS-SHA-04220</b>	<p>For the maximum targets load conditions and for the mean FRUIT and reflection rates specified in 2.6.8, 2.6.10 and ANNEX A, and 2.7.4, 2.7.6 and ANNEX B:</p> <ul style="list-style-type: none"> <li>a) Each single processor shall not be utilised for more than 50% of the time when this time stands for a complete antenna revolution;</li> <li>b) Each single processor shall not be utilised for more than 80% of the time when this time stands for a small sector peak of 3.5°.</li> </ul> <p>Note: Utilisation of processor shall be stated for MSSR and PSR targets.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-10010</b></p>
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<b>ANSP-TEN-SHA-04230</b>	<p>The Tenderer <b>shall</b> describe the maximum utilisation of each single processor for a scanning time corresponding to a large sector peak of 45°.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-10020</b></p>
<b>ANSP-TEN-SHA-04240</b>	<p>The Tenderer <b>shall</b> state in their proposal the processor utilisation contingencies over and above the maximum capacities defined in 2.6.8</p> <p>Adopted from <b>EMS-C08-TEN-SHA-10030</b></p>
<b>ANSP-TEN-SHA-04250</b>	<p>The Tenderer <b>shall</b> state in their proposal the available storage capacity for the software and firmware of each part of the Processing System.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-10040</b></p>
<b>ANSP-SYS-SHA-04260</b>	<p>For the maximum targets load conditions defined in 2.6.8 and 2.7.4, the Processing System software within the proposed System shall not take up more than 50% of the available Random Access Memory (RAM) in each individual processors and 70% of the storage</p> <p>Adopted from <b>EMS-C08-SYS-SHA-10050</b></p>
<b>ANSP-SYS-SHA-04270</b>	<p>The contingencies about processors load, RAM and storage capacities <b>shall</b> be demonstrated and proved to be met during Factory Acceptance Testing (FAT) of the System, under maximum load conditions.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-10060</b></p>
<b>ANSP-TEN-SHA-04280</b>	<p>The Tenderer <b>shall</b> provide in their proposal an outline of how the achievement of the contingencies about processors load, RAM and storage capacities will be demonstrated.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-10070</b></p>
<b>ANSP-CON-SHA-04290</b>	<p>Where any form of distributed processing architecture is used, the Contractor <b>shall</b> provide details of procedures and specific techniques to ensure that the software/firmware that runs in each processor is compatible with the software/firmware running in all the other processors that make up one channel of the overall system.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10080</b></p>

<b>ANSP-SYS-SHA-04300</b>	<p>Suitable recovery mechanisms <b>shall</b> be coded for the case where incompatible software/firmware versions are found to be running in different processors.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-10090</b></p>
<b>ANSP-SYS-SHA-04310</b>	<p>Unless a version of software/firmware for a processor is to be kept on removable media, where changing the version of software/firmware that is running is performed by changing the media and reloading the System, the storage medium built into the System <b>shall</b> be capable of holding two versions of the Processing System software/firmware.</p> <p>Adopted from <b>EMS-C08-SYS-SHA-10100</b></p>
<b>ANSP-TEN-SHA-04320</b>	<p>The Tenderer <b>shall</b> indicate the time to switch between the two available software/firmware versions in the Processing System.</p> <p>Adopted from <b>EMS-C08-TEN-SHA-10110</b></p>

#### 13.1.5 Verification and Validation

<b>ANSP-CON-SHA-04330</b>	<p>The Contractor <b>shall</b> define in a Verification and Validation Plan the verification process being used to ensure that the results of a particular phase/activity in the software and firmware development has met the requirements of the previous phase.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10120</b>.</p>
<b>ANSP-CON-SHA-04340</b>	<p>Verification <b>shall</b> be carried out according to methodical and rigorous procedures to ensure that performance, safety and quality objectives allocated to the software and firmware are met.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10130</b>.</p>
<b>ANSP-CON-SHA-04350</b>	<p>The Contractor <b>shall</b> define in the Verification and Validation Plan the validation process being used to ensure that the results of the software and firmware development has met the requirements of the project.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10140</b>.</p>

<b>ANSP-CON-SHA-04360</b>	<p>Validation <b>shall</b> be carried out according to methodical and rigorous procedures to ensure that performance, safety and quality requirements are met.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10150</b>.</p>
<b>ANSP-CON-SHA-04370</b>	<p>When the Contractor identifies the use of simulation as appropriate to the validation process, the level of simulation <b>shall</b> be identified.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10160</b>.</p>
<b>ANSP-CON-SHA-04380</b>	<p>Any test bench used for module/subsystem testing <b>shall</b> be retained under configuration control for the duration of the Contract (including warranty period).</p> <p>Adopted from <b>EMS-C08-CON-SHA-10170</b>.</p>
<b>ANSP-CON-SHA-04390</b>	<p>All test bench software and associated test specifications <b>shall</b> be maintained so that any test performed at any time during system development can be re-performed on the versions of software modules that form the final delivery of software and firmware.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10180</b>.</p>
<b>ANSP-CON-SHA-04400</b>	<p>The Contractor <b>shall</b> state what special arrangements will be undertaken to test and validate critical software and firmware.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10190</b>.</p>
<b>ANSP-CON-SHA-04410</b>	<p>The Test Specification <b>shall</b> detail and identify the test harnesses used</p> <p>Adopted from <b>EMS-C08-CON-SHA-10200</b>.</p>
<b>ANSP-CON-SHA-04420</b>	<p>The Contractor <b>shall</b> identify in the Software and Firmware Development Plan the verification and validation processes used to integrate the Operating System and software/firmware with the hardware.</p> <p>Adopted from <b>EMS-C08-CON-SHA-10210</b>.</p>

<b>ANSP-CON-SHA-04430</b>	Results of all tests <b>shall</b> be recorded for subsequent audit.  Adopted from <b>EMS-C08-CON-SHA-10220</b> .
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### 13.1.6 Software and Firmware Development Environment

<b>ANSP-CON-SHA-04440</b>	Qualified or intensively validated tools <b>shall</b> be used to achieve the necessary level of confidence for minimising potential environment related errors.  Adopted from <b>EMS-C08-CON-SHA-10230</b>
<b>ANSP-CON-SHA-04450</b>	The Development and Verification Environment shall be subject to Configuration Management.  Adopted from <b>EMS-C08-CON-SHA-10240</b>
<b>ANSP-CON-SHA-04460</b>	If the Software and Firmware Development and Verification Environment is changed during the software/firmware life cycle, the validity of previous tests and coverage analyses shall be reconsidered by the Contracting Authority.  Adopted from <b>EMS-C08-CON-SHA-10250</b> .
<b>ANSP-CON-SHA-04470</b>	The Contracting Authority shall keep the right to request the re-verification of modules in the event of changes to the Software and Firmware Development and Verification Environment.  Adopted from <b>EMS-C08-CON-SHA-10260</b>

### 13.2 Standards

<b>ANSP-TEN-SHA-04480</b>	The Contracting Authority <b>shall</b> have the right to carry out a Pre-Contract Audit to confirm that the standards detailed by the Tenderer fully meet the Contracting Authority's requirements.  Adopted from <b>EMS-C09-TEN-SHA-10270</b>
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<b>ANSP-TEN-SHA-04490</b>	The Tenderer <b>shall</b> include the issue number and amended state of each standard to be applied. Adopted from <b>EMS-C09-TEN-SHA-10280</b>
<b>ANSP-TEN-SHA-04500</b>	The Tenderer <b>shall</b> advise in the Tender Proposal on suitable related or alternative standards. Adopted from <b>EMS-C09-TEN-SHA-10290</b>
<b>ANSP-CON-SHA-04510</b>	Contracting Authority personnel <b>shall</b> approve the agreed standards to be applied. Adopted from <b>EMS-C09-CON-SHA-10300</b>

### 13.3 Design Considerations

<b>ANSP-SYS-SHA-04520</b>	Fault tolerant design <b>shall</b> be applied wherever the potential for critical consequences results from the design or operation of System (PSR+SSR) and associated equipment. Adopted from <b>EMS-C09-SYS-SHA-10430</b> .
<b>ANSP-SYS-SHA-04530</b>	The following deterministic safety design principles <b>shall</b> be implemented as a minimum: <ul style="list-style-type: none"> <li>a) No single failure condition has a critical consequence for ATC services;</li> <li>b) No single operator error has a critical consequence for ATC services and the operator;</li> <li>c) Hardware or software/firmware failures do not cause additional failures with hazardous effects;</li> <li>d) Safety-critical functional paths (both hardware and software/firmware) are isolated or partitioned from non-safety critical functions, in order to prevent propagation of errors and failures;</li> <li>e) Alternate or redundant safety-critical functional paths are separated or protected in such a way that any event that causes the loss of one functional path will not result in the loss of alternate back-up, or redundant paths;</li> <li>f) Parametric operating ranges and performance limits for safe operation are established for the design and is specified by the Contractor;</li> <li>g) The design provides protection to avoid the erroneous acceptance of commands that can affect personnel safety or cause hardware or software damage.</li> </ul> Adopted from <b>EMS-C09-SYS-SHA-10440</b> .

<b>ANSP-SYS-SHA-04540</b>	<p>Multiple failures that result from common cause or common mode failure mechanisms <b>shall</b> be considered as single failures for the purpose of determining and designing the fault tolerant system.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10450</b>.</p>
<b>ANSP-SYS-SHA-04550</b>	<p>Failures modes <b>shall</b> be considered to originate from:</p> <ul style="list-style-type: none"> <li>a) Hardware;</li> <li>b) Software;</li> <li>c) Firmware;</li> <li>d) Procedures as the result of design error;</li> <li>e) Random failure due to environmental effects.</li> </ul> <p>Adopted from <b>EMS-C09-SYS-SHA-10460</b>.</p>
<b>ANSP-SYS-SHA-04560</b>	<p>The station <b>shall</b> be functionally modular and include facilities to evaluate the performance of individual processes for the specified operating conditions of chapter 2, ANNEX A and ANNEX B.</p> <p><i>Note: In this case chapter 2, ANNEX A and ANNEX B refer to the original EMS document.</i></p> <p>Adopted from <b>EMS-C09-SYS-SHA-10470</b>.</p>
<b>ANSP-TEN-SHA-04570</b>	<p>The Tenderer <b>shall</b> provide in their proposal details of the System and associated equipment modularity, including the design philosophy regarding technological updates and functional upgrade of the hardware and software/firmware.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10480</b></p>
<b>ANSP-SYS-SHA-04580</b>	<p>The Design <b>shall</b> allow expansion to accommodate future growth through scalable, modular design, built on structured techniques that ensure traceability and consistency between the functional requirements and the ultimate design specifications.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10490</b>.</p>

<b>ANSP-TEN-SHA-04590</b>	The Tenderer <b>shall</b> define the methodology, techniques and tools employed to achieve the system design objectives. Adopted from <b>EMS-C09-TEN-SHA-10500</b> .
<b>ANSP-TEN-SHA-04600</b>	The Tenderer <b>shall</b> demonstrate that they are compliant with the requirements in chapters 9.7.2, 9.7.3 and 9.4 of this specification, by delivery of sample design specification documentation described in MIL STD 1521 ([RD 78]). Adopted from <b>EMS-C09-TEN-SHA-10510</b>
<b>ANSP-SYS-SHA-04610</b>	Traceability, consistency and completeness <b>shall</b> be ensured between design specification and the system requirements. Adopted from <b>EMS-C09-SYS-SHA-10520</b> .
<b>ANSP-SYS-SHA-04620</b>	The System design <b>shall</b> take into account the necessary features for verification and validation testing, and for maintenance. Adopted from <b>EMS-C09-SYS-SHA-10530</b>
<b>ANSP-TEN-SHA-04630</b>	The Tenderer <b>shall</b> state how such relationships will be fostered. Adopted from <b>EMS-C09-TEN-SHA-10540</b> .
<b>ANSP-CON-SHA-04640</b>	If necessary, the Contracting Authority <b>shall</b> convene additional meetings at short notice to discuss specific problems or technical issues. <i>Note: The Contracting Authority can organize meetings to discuss specific problems or technical issues.</i> Adopted from <b>EMS-C09-CON-SHA-10550</b>

#### 13.4 Security

<b>ANSP-TEN-SHA-04650</b>	The Contracting Authority <b>shall</b> have the right to carry out a Pre-Contract Audit to confirm that the Safety standards and the management system detailed by the Tenderer fully meet the Contracting Authority's requirements. Adopted from <b>EMS-C09-TEN-SHA-10560</b>
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#### 13.4.1 Health of Personnel

<b>ANSP-CON-SHA-04660</b>	<p>The Contractor <b>shall</b> meet all International, European and National Health and Safety standards, rules and practices and the legislation that has relevance to the equipment being supplied.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10570</b>.</p>
<b>ANSP-TEN-SHA-04670</b>	<p>The Tenderer <b>shall</b> state the National Health and Safety at Work requirements which will be adhered to.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10580</b>.</p>
<b>ANSP-TEN-SHA-04680</b>	<p>The Tenderer <b>shall</b> state the Health and Safety standards relevant to the equipment being supplied.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10590</b>.</p>
<b>ANSP-CON-SHA-04690</b>	<p>The Contractor <b>shall</b>, at all times, follow the local rules regarding health and safety at work that are affecting to the personnel in their service. The expenses which arise from this obligation (including any necessary translation of documentation) are borne by the Contractor.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10600</b>.</p>
<b>ANSP-TEN-SHA-04700</b>	<p>The Tenderer <b>shall</b> show their understanding of the rules in force for the sites selected for the implementation of the System.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10610</b>.</p>
<b>ANSP-TEN-SHA-04710</b>	<p>The Tenderer <b>shall</b> provide in Tender response details of their management system for Health and Safety and demonstrate the processes used to ensure compliance.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10620</b>.</p>
<b>ANSP-SYS-SHA-04720</b>	<p>The System installation <b>shall</b> comply with the health and safety signs and markings standards described within Directives 92/58/ECC ([RD 58]) and 2014/27/EU ([RD 59]).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10630</b></p>

#### 13.4.1.1 Noise Exposure

<b>ANSP-SYS-SHA-04730</b>	<p>The noise exposure inside the shelter <b>shall</b> remain below <math>L_{EX, 8h} = 80</math> dB(A) at any space where the staff will carry their work, as requested by Directive 2003/10/EC ([RD 60]).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10640</b></p>
<b>ANSP-CON-SHA-04740</b>	<p>If the noise level is higher than <math>L_{EX, 8h} = 80</math> dB(A), the Contractor <b>shall</b> provide the proper personal noise protection elements for any personnel working inside the shelter.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10650</b></p>
<b>ANSP-SYS-SHA-04750</b>	<p>The maximum noise exposure accepted for the staff <b>shall</b> be <math>L_{EX, 8h} = 87</math> dB(A).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10660</b></p>
<b>ANSP-TEN-SHA-04760</b>	<p>The Tenderer <b>shall</b> provide in Tender response details of the acoustic noise level of the proposed equipment.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10670</b>.</p>
<b>ANSP-TEN-SHA-04770</b>	<p>The Tenderer <b>shall</b> provide information about the noise exposure levels during operation and maintenance activities.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10680</b>.</p>
<b>ANSP-CON-SHA-04780</b>	<p>The Contractor shall provide information about noise level generated by the PSR and SSR.</p>

#### 13.4.1.2 Electromagnetic Field Exposure

<b>ANSP-SYS-SHA-04790</b>	<p>The exposure of personnel to electromagnetic field risks inside the shelter <b>shall</b> remain below the limits described in Directive 2013/35/EU ([RD 61]).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10690</b></p>
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<b>ANSP-TEN-SHA-04800</b>	<p>The Tenderer <b>shall</b> provide information about the exposure of personnel to electromagnetic fields during operation and maintenance activities.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10700</b></p>
<b>ANSP-CON-SHA-04810</b>	<p>The Contractor <b>shall</b> define the safe areas for personnel, in terms of exposure to electromagnetic field risks, according to Directive 2013/35/EU ([RD 61]) and considering the System transmitting at its maximum power.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10710</b></p>

#### 13.4.1.3 Climbing Devices

<b>ANSP-SYS-SHA-04820</b>	<p>All ladders that can be required to gain access to areas that are out of reach from ground level in areas where particular hazard can exist <b>shall</b> be fitted with climbing rail-rigid lifelines to prevent personnel falling.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10720</b></p>
<b>ANSP-SYS-SHA-04830</b>	<p>All installations <b>shall</b> require the approval of the Contracting Authority's delegated Safety Officer.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10730</b></p>

## 13.5 Safety

### 13.5.1 Air Traffic Service

<b>ANSP-CON-SHA-04840</b>	<p>The Contractor <b>shall</b> demonstrate, through analysis of the design, components and maintenance procedures, their understanding of the safety requirements and that their design and implementation plans will meet all of the safety criteria.</p> <p>The Contracting Authority's safety policy is to secure high standards of safety within the air traffic services and systems. It plans, provides and operates by minimizing those risks which contribute to aircraft accidents as far as reasonably practicable. Safety is afforded the highest priority and it is an integral part of the Management function.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10740</b>.</p>
<b>ANSP-CON-SHO-04850</b>	<p>The safety activities and analysis <b>should</b> present the evidence, arguments and assumptions, at significant points in the system life cycle, to provide assurance that:</p> <ul style="list-style-type: none"><li>a) The Safety Requirements of the System are either met or that any shortcomings, limitations or unresolved hazards are understood and accepted;</li><li>b) When introduced into operational service the new system does not, on itself, exhibit any hazards due to installation, commissioning and integration activities;</li><li>c) The introduction of the new system does not adversely affect the safety of the existing Air Traffic Service (ATS).</li></ul> <p>Adopted from <b>EMS-C09-CON-SHO-10750</b></p>
<b>ANSP-CON-SHO-04860</b>	<p>The safety assurance activities <b>should</b> provide the necessary confidence that the following objectives have been met:</p> <ul style="list-style-type: none"><li>a) The Safety Requirements of the System have been correctly identified;</li><li>b) The procedures and standards used to design, develop and analyse the System are adequate and have been implemented correctly;</li><li>c) There is sufficient evidence available to show compliance with the Safety Requirements, and to allow the System to proceed to the next life cycle phase or continue in operation, as appropriate.</li></ul> <p>Adopted from <b>EMS-C09-CON-SHO-10760</b>.</p>

### 13.5.1.1 Safety Plan

<b>ANSP-CON-SHA-04870</b>	<p>The Safety Plan <b>shall</b> define the safety management, safety analysis and assurance activities to be performed by the Contractor.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10770</b>.</p>
<b>ANSP-TEN-SHA-04880</b>	<p>The Tenderer <b>shall</b> provide a preliminary Safety Plan.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10780</b></p>
<b>ANSP-TEN-SHA-04890</b>	<p>The Tenderer's Safety Plan <b>shall</b>, as a minimum, address the items detailed at ANNEX H and shall confirm that they are commensurate with ensuring the Safety Plan deliverables are met.</p> <p>Note: ANNEX H in this requirement refers to the original EMS document.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10790</b>.</p>
<b>ANSP-CON-SHA-04900</b>	<p>The Contractor <b>shall</b> provide a Safety Plan.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10800</b>.</p>
<b>ANSP-CON-SHA-04910</b>	<p>The Contractor <b>shall</b> provide the following documented deliverables resulting from the activities defined in their Safety Plan:</p> <ul style="list-style-type: none"> <li>a) Design Process and Assurance Deliverable;</li> <li>b) Installation, Commissioning, Integration and Test and Evaluation Deliverable.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10810</b>.</p>



<p><b>ANSP-CON-SHA-04920</b></p>	<p>The Design Process and Assurance deliverable <b>shall</b>:</p> <ul style="list-style-type: none"> <li>a) Provide a summary description of the Mode S functions, supported with diagrams, showing their physical location(s) and role. The boundaries of the Mode S ground station and its interface with other systems or facilities is clearly identified;</li> <li>b) Identify or reference the Safety Requirements of the Mode S ground station;</li> <li>c) Describe the physical configuration of Mode S, including permitted variations of the configuration during operation;</li> <li>d) Identify the documentation and its status, which records the system build state for Mode S;</li> <li>e) Provide a description of the design process used for the development of the hardware and software/firmware aspects of Mode S: <ul style="list-style-type: none"> <li>a. Showing the design, coding, verification and validation methods to be employed that will allow the software/firmware to meet the Safety Requirements;</li> <li>b. Providing evidence, arguments and assumptions for claiming that the hardware design has been implemented to a level consistent with the Safety Requirements.</li> </ul> </li> <li>f) Identify any dependencies on other systems or facilities that affect the ability of Mode S to meet its Safety Requirements;</li> <li>g) Address each Safety Requirement: a. <ul style="list-style-type: none"> <li>a. Providing arguments to support the claim that the Mode S design will meet the Safety Requirement;</li> </ul> </li> <li>h) Safety Requirements <ul style="list-style-type: none"> <li>a. Summarizing, and referencing, any evidence available that supports the arguments that the design will meet the Safety Requirement;</li> <li>b. Identifying the current compliant status of the Safety Requirement (met, not met, not proven);</li> <li>c. Identifying any further verification and subsequent validation that is to be performed during the Installation, Commissioning and Integration activities;</li> <li>d. Identifying any features in the design that specifically address the Safety Requirement.</li> </ul> </li> <li>i) State any limitations on the use, or maintenance, of the Mode S ground station or other shortcomings identified in the design;</li> <li>j) Specify any aspects of the Mode S and ADS-B performance that is monitored in service to provide assurance that the Safety Requirements continue to be met in operation;</li> <li>k) Detail the confidence that has been gained that the Installation, Commissioning and Integration activities will not have an adverse effect on the safety of the existing ATS.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10820</b></p>
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<p><b>ANSP-CON-SHA-04930</b></p>	<p>The Installation, Commissioning, Integration and Test and Evaluation Deliverable <b>shall</b>:</p> <ul style="list-style-type: none"> <li>a) Describe the installation, commissioning, integration and test and evaluation process and provide evidence, arguments and assumptions for claiming that this process was effective in maintaining the safety of the Mode S ground station and the existing ATS;</li> <li>b) Identify any dependencies on other systems or facilities that affect the ability of the Mode S ground station to meet the Safety Requirements;</li> <li>c) State any limitations on the use, or maintenance, of the Mode S ground station or other shortcomings identified in the design;</li> <li>d) Address each Safety Requirement: <ul style="list-style-type: none"> <li>a. Identifying the compliant status of the Safety Requirement;</li> <li>b. Identifying and reference the results of any other evidence that confirms or otherwise that the Safety Requirement will be met, and revise the status of the Safety Requirement accordingly;</li> <li>c. Where it has not been concluded that a Safety Requirement will be met provide information about the possible impact to ATS.</li> </ul> </li> <li>e) Declare and identify any other deficiencies in the Mode S ground station that can affect the safety of the ATS;</li> <li>f) Identify any aspects of the Mode S and ADS-B performance that is monitored in service to provide assurance that the Safety Requirement continue to be met in operation;</li> <li>g) Identify any Mode S ground station operation and maintenance requirements necessary to preserve the safety, including the identification and provision of relevant training;</li> <li>h) Detail the confidence that has been gained that the transition to operational use will not have an adverse effect on the safety of the existing ATS;</li> <li>i) Identify the documentation and its status, which records the Mode S ground station build state;</li> <li>j) Identify or reference the process and responsibilities for initiating, performing and approving changes to the Mode S ground station.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10830</b></p>
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### 13.5.1.2 Mode S Safety Requirements

<b>ANSP-CON-SHA-04940</b>	<p>The list of failure modes for the System <b>shall</b> be developed and refined by the Contractor, in consultation with the Contracting Authority.</p> <p>A provisional analysis has been undertaken for the Mode S Safety Requirements and was derived by consideration of the failure modes on Air Traffic Operations. ANNEX G provides the target figures for the Mode S system in the operational phase, for a limited list of failure modes. The contribution of Radar Data Processing Systems, communication links and ATC workstations to the Mode S system are not included in ANNEX G.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10840</b>.</p> <p><i>Note: ANNEX G refers to the original EMS document</i></p>
<b>ANSP-CON-SHA-04950</b>	<p>The Contractor shall demonstrate that the Mode S ground station based on their design can meet the refined Mode S System Safety Requirements.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10850</b>.</p>

### 13.5.1.3 Mode S Safety Analysis

<b>ANSP-CON-SHA-04960</b>	<p>In support of the Safety Plan deliverables the following specific safety activities <b>shall</b> be conducted by the Contractor. The product of these analyses, where appropriate, are deliverables to the Contracting Authority:</p> <ul style="list-style-type: none"> <li>a) Hazard log;</li> <li>b) Hazard Identification and Analyses;</li> <li>c) Independent Safety Assessment.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10860</b>.</p>
<b>ANSP-TEN-SHA-04970</b>	<p>The Tenderer <b>shall</b> state in their response the standards they will be using for each safety activity.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10870</b></p>

<b>ANSP-CON-SHA-04980</b>	<p>The Contractor shall:</p> <ul style="list-style-type: none"> <li>a) Produce and maintain a Hazard Log;</li> <li>b) Ensure that all changes initiate a review of existing and new hazards that can arise as a result of such changes;</li> <li>c) Use common open-source tools (word processor, spreadsheet, etc.) to maintain the Hazard Log.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10880</b></p>
<b>ANSP-CON-SHA-04990</b>	<p>The Contractor's Hazard Log shall be provided as soon as it is updated throughout the life cycle of the product, including updates resulting from third contracts.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10890</b></p>
<b>ANSP-CON-SHA-05000</b>	<p>The Contractor <b>shall</b> conduct a programme of Hazard Identification and Analyses, building on that of ANNEX G, and stating any assumptions about other systems; to ensure that the identification of hazards within Mode S ground station are both refined and extended.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10900</b></p>
<b>ANSP-CON-SHA-05010</b>	<p>The Contractor shall use the Mode S ground station Safety Requirements as the initial assessment of the safety criticality of Mode S for the subsequent hazard analysis as the design progresses.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10910</b></p>
<b>ANSP-CON-SHA-05020</b>	<p>The Contractor <b>shall</b> incorporate the results of the Hazard Identification and Analyses into the Hazard Log.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10920</b></p>

<b>ANSP-CON-SHA-05030</b>	<p>The Hazard Identification and Analyses <b>shall</b> include, but not be limited to:</p> <ul style="list-style-type: none"> <li>a) A system FMECA (Failure Modes Effect and Criticality Analysis) for Mode S hardware and software/firmware, updating it regularly during system development. In the case of hardware, the FMECA decomposes Mode S ground station elements to Line Replacement Unit (LRU) level. Where the FMECA has identified a safety significant failure, the Contractor takes steps to eliminate, mitigate, circumvent, or otherwise reduce the safety significance of the failure;</li> <li>b) A Fault Tree Analysis (FTA) to complement the FMECA, to derive quantitative probabilities of occurrences of all hazards and to demonstrate that the Safety Requirements have been met. The FTA explicitly states the source and justification of all failure probabilities used in the derivation of quantitative probabilities for each hazard.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-10930</b></p>
<b>ANSP-TEN-SHA-05040</b>	<p>The Tenderer <b>shall</b> provide in their Tender Response their approach to the Hazard Identification and Analyses with respect to software/firmware.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-10940</b></p>
<b>ANSP-CON-SHA-05050</b>	<p>The Contractor <b>shall</b> carry out an independent Verification and Validation of the implementation of the Contractor Safety Plan and its products through suitably qualified personnel independent of the development team.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10950</b></p>
<b>ANSP-CON-SHA-05060</b>	<p>The Contractor <b>shall</b> document, implement and maintain traceability procedures to allow for full forward and backward traceability of all documents, components, materials, designs, reviews, records pertaining to the safety assurance activities.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10960</b></p>

### 13.5.1.4 Safety Quality Assurance

<p><b>ANSP-CON-SHA-05070</b></p>	<p>When creating the safety documentation, including a safety plan and safety reports, the Contractor <b>shall</b> take into account these ATM and programme related applicable standards/regulations/directives (and any amendments of documents released before the establishment of the contractual relationship in which this document is referenced):</p> <ul style="list-style-type: none"> <li>a) Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Contracting Authority, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91;</li> <li>b) Commission Delegated Regulation (EU) 2023/1768 of 14 July 2023 laying down detailed rules for the certification and declaration of air traffic management/air navigation services systems and air traffic management/air navigation services constituents, including applicable AMCs;</li> <li>c) Commission Implementing Regulation (EU) 2023/1769 of 12 September 2023 laying down technical requirements and administrative procedures for the approval of organisations involved in the design or production of air traffic management/air navigation services systems and constituents and amending Implementing Regulation (EU) 2023/203, including applicable AMCs;</li> <li>d) All Directives, Community Specifications and Implementing Rules related to 3. and 4.;</li> <li>e) EUROCONTROL Guidelines on conformity assessment for the Interoperability Regulation of the Single European Sky (IOP, EUROCONTROL-GUID-137), 2012-02-20, Edition 3.0; additionally, the Contractor shall provide the verification specifications and the verification records upon request;</li> <li>f) IEC 61078 (RMA) Analysis techniques for dependability - Reliability block diagram and Boolean methods;</li> <li>g) AIR NAVIGATION SYSTEM SAFETY ASSESSMENT METHODOLOGY (SAM) of EUROCONTROL, 2.2</li> <li>h) Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation, amending Regulation (EU) No 996/2010 of the European Parliament and of the Council and repealing Directive 2003/42/EC of the European Parliament and of the Council and Commission Regulations (EC) No 1321/2007 and (EC) No 1330/2007;</li> <li>i) COMMISSION IMPLEMENTING REGULATION (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011, including applicable AMCs.</li> </ul> <p><b>SARQ0010</b></p>
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<b>ANSP-CON-SHA-05080</b>	Safety reports <b>shall</b> include the safety recommendations to Contracting Authority, as a possible means for risk mitigation. This shall include procedural and human mitigations, e.g. training, shift management, maintenance procedures, operational procedures etc.  <b>SARQ0020</b>
<b>ANSP-CON-SHA-05090</b>	The safety documentation <b>shall</b> be provided to the Contracting authority for review and approval in accordance with the milestones specified in the Documentation Plan.  <b>SARQ0030</b>

#### 13.5.1.5 Safety Audit

<b>ANSP-CON-SHA-05100</b>	The safety audit <b>shall</b> be conducted by the Contracting authority in duration of approximately one working day according to the Contracting authority's safety audit plan previously delivered, subject to mutual agreement  <b>SASA0010</b>
<b>ANSP-CON-SHA-05110</b>	The safety assurance process <b>shall</b> be audited and the Contractor shall provide full support to the Contracting authority's safety audit team including access to evidence and arguments  <b>SASA0020</b>

#### 13.5.1.6 Safety Plan

<b>ANSP-CON-SHA-05120</b>	The Contractor shall provide a Safety Plan which <b>shall</b> include all activities to be performed by the Contractor to meet the requirements related to safety, in such a way that the delivered technical system is safe for operation and minimises the risks which may contribute to aircraft accidents as far as reasonably practicable.  <b>SASP0010</b>
<b>ANSP-CON-SHA-05130</b>	A preliminary version of the Safety Plan <b>shall</b> be delivered at the latest 30 days after contract signature, and shall be reviewed and approved by the Contracting authority.  <b>SASP0020</b>

<b>ANSP-CON-SHA-05140</b>	<p>Safety activities to be specified in the Safety Plan <b>shall</b> be carried out to cover:</p> <ul style="list-style-type: none"> <li>a) All hardware and software to be delivered (components to be developed, procured, modified, or re-used), up to external interfaces of the system,</li> <li>b) Safety related procedures and training of the Slovenia Control's staff,</li> <li>c) The whole-time span of the Project and all activities with safety significance, i.e. the system specification, design, development, integration, installation, acceptance, commissioning, transition to operation and maintenance of the system.</li> </ul> <p><b>SASP0030</b></p>
<b>ANSP-CON-SHA-05150</b>	<p>The Contractor <b>shall</b> produce updates of the Safety Plan, if necessary.</p> <p><b>SASP0040</b></p>

#### 13.5.1.7 Safety Reports

<b>ANSP-CON-SHA-05160</b>	<p>Safety reports <b>shall</b> cover the Safety Assessment process, containing as a minimum, the following:</p> <ul style="list-style-type: none"> <li>a) Hazards identification and analysis for each system function, including the determination of hazard likelihood and severity, and possible effect on operation,</li> <li>b) Identification of possible effect on operation for each hazard,</li> <li>c) Identification of risk mitigation measures for each hazard.</li> </ul> <p><b>SASR0010</b></p>
<b>ANSP-CON-SHA-05170</b>	<p>Safety Reports <b>shall</b> be produced in accordance with the Safety Plan.</p> <p><b>SASR0020</b></p>
<b>ANSP-CON-SHA-05180</b>	<p>Safety Reports <b>shall</b> include, as a minimum, the following set of documents and due dates:</p> <ul style="list-style-type: none"> <li>a) Functional Hazard Assessment Report (FHAR), due date: 30 days after contract signature;</li> <li>b) Preliminary System Safety Assessment Report (PSSAR), due date: 2 calendar weeks before the FAT starting date;</li> <li>c) System Safety Assessment Report (SSAR), due date: 1 calendar week before installation of the target system;</li> <li>d) Safety Issue Log (SIL). The document shall contain all safety critical issues which shall be mitigated in a procedural or human related matter. Due date: Start of the equipment installation;</li> <li>e) Software Safety Folder.</li> </ul> <p><b>SASR0030</b></p>



### 13.5.1.8 Software Safety Requirements

<p><b>ANSP-CON-SHA-05190</b></p>	<p>These ATM and programme related applicable standards/regulations/directives (and any amendments of documents released before the establishment of the contractual relationship in which this document is referenced) are applicable for software safety assurance:</p> <ul style="list-style-type: none"> <li>• Annex IV to ED Decision 201/022/R of 30 Oct 2019 establishing a software safety assurance system to be implemented by air navigation service providers;</li> </ul> <p>The Contractor <b>shall</b> produce evidence and arguments demonstrating that:</p> <ol style="list-style-type: none"> <li>a) the software safety requirements correctly state what is required by the software, in order to meet safety objectives and requirements, as identified by the risk assessment and mitigation process;</li> <li>b) traceability is addressed in respect of all software safety requirements;</li> <li>c) the software implementation contains no functions which adversely affect safety, particularly there must not be the CSCI whose single failure would induce the effect with severity class 1 as per ESARR 4;</li> <li>d) the software satisfies its requirements with a level of confidence which is consistent with the software criticality;</li> <li>e) assurances are provided confirming that the general safety requirements set out in the previous points are satisfied, and the arguments that demonstrate the required assurances are at all times derived from: <ol style="list-style-type: none"> <li>(i) a known executable version of the software;</li> <li>(ii) a known range of configuration data;</li> <li>(iii) a known set of software products and descriptions, including specifications that have been used in the production of that version.</li> </ol> </li> </ol> <p><b>SASS0010</b></p>
<p><b>ANSP-CON-SHA-05200</b></p>	<p>The Contractor <b>shall</b> allocate software assurance levels (SWAL) to all operational software, in compliance with the following:</p> <ol style="list-style-type: none"> <li>a) The software assurance level shall relate the rigour of the software assurances to the software criticality by using the severity classification scheme of Contracting authority combined with the likelihood of occurrence of a certain adverse effect. A minimum of four software assurance levels shall be identified, with software assurance level 1 indicating the most critical level (if such software exists);</li> <li>b) An allocated software assurance level shall be commensurate with the most severe effect that software malfunctions or failures may cause. This shall, in particular, take into account the risks associated with software malfunctions or failures and the architectural and/or procedural defences identified.</li> <li>c) Software components that cannot be shown to be independent of one another shall be allocated the software assurance level of the most critical of the dependent components.</li> </ol> <p><b>SASS0020</b></p>

<b>ANSP-CON-SHA-05210</b>	<p>To assure software safety requirements validity, the Contractor <b>shall</b> describe the functional behaviour of software in nominal and downgraded modes, timing performances, capacity, accuracy, software resource usage on the target hardware, robustness to abnormal operating conditions and overload tolerance, as appropriate. Software safety requirements shall be complete and correct, and compliant with the system safety requirements.</p> <p><b>SASS0030</b></p>
<b>ANSP-CON-SHA-05220</b>	<p>To assure the software safety requirements verification, the Contractor <b>shall</b> ensure that:</p> <ul style="list-style-type: none"> <li>a) The software functional behaviour, timing performances, capacity, accuracy, software resource usage on the target hardware, robustness to abnormal operating conditions and overload tolerance, shall comply with the software requirements.</li> <li>b) The software shall be adequately verified by analysis and/or testing and/or equivalent means.</li> <li>c) The software verification shall be correct, complete and documented.</li> </ul> <p><b>SASS0040</b></p>
<b>ANSP-CON-SHA-05230</b>	<p>To assure the software configuration management, the Contractor <b>shall</b> ensure that:</p> <ul style="list-style-type: none"> <li>a) Configuration identification, traceability and status accounting facilitate that the software life cycle data is shown to be under configuration control throughout the software life cycle.</li> <li>b) Problem reporting, tracking and corrective actions facilitate that safety related problems associated with the software are shown to have been mitigated.</li> <li>c) Retrieval and release procedures facilitate that the software life cycle data is regenerated and delivered throughout the software life cycle.</li> </ul> <p><b>SASS0050</b></p>
<b>ANSP-CON-SHA-05240</b>	<p>To assure the software safety requirements traceability, the Contractor <b>shall</b> ensure that:</p> <ul style="list-style-type: none"> <li>a) Each software safety requirement is traced to the same level of design at which its satisfaction is demonstrated.</li> <li>b) Each software safety requirement, at each level in the design at which its satisfaction is demonstrated, is traced to a system safety requirement.</li> </ul> <p><b>SASS0060</b></p>
<b>ANSP-CON-SHA-05250</b>	<p>The assurances from <b>ANSP-CON-SHA-05190</b> to <b>ANSP-CON-SHA-05240</b> <b>shall</b> include the rigour for each software assurance level which shall increase as the software increases in criticality. For that purpose:</p> <ul style="list-style-type: none"> <li>a) the variation in rigour of the assurances per software assurance level must include the following criteria: <ul style="list-style-type: none"> <li>a. required to be achieved with independence;</li> <li>b. required to be achieved;</li> <li>c. not required;</li> </ul> </li> <li>b) the assurances corresponding to each software assurance level must give sufficient confidence that the software can be operated tolerably safely.</li> </ul> <p><b>SASS0070</b></p>

<b>ANSP-CON-SHA-05260</b>	<p>For any software (such as COTS, non-developmental software or previously used software, etc.), for which some of the requirements cannot be applied, the Contractor <b>shall</b> provide, through other means, the same level of confidence as the relevant software assurance level whenever defined. Those means must give sufficient confidence that the software meets the safety objectives and requirements, as identified by the safety risk assessment and mitigation process.</p> <p><b>SASS0080</b></p>
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### 13.6 Quality Assurance

<b>ANSP-SYS-SHA-05270</b>	<p>Quality Assurance (QA) <b>shall</b> be applied to all activities necessary for the achievement of the Mode S ground station project.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10970</b></p>
<b>ANSP-SYS-SHA-05280</b>	<p>Quality Assurance <b>shall</b> ensure the quality targets, requirements and specifications are correctly and completely fulfilled and ensure traceability and visibility throughout the project.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-10980</b></p>
<b>ANSP-CON-SHA-05290</b>	<p>The Contracting Authority <b>will</b> nominate one of their representatives as the Quality Assurance Authority for the purpose of the contract. The Contracting Authority Quality Assurance Authority <b>shall</b> have access granted during normal working hours (with minimal advance notice) to verify at source that the activities, processes and techniques employed in the design and manufacture of the hardware, software, firmware and associated documentation conforms to the requirements of the contract, Quality Plan and associated documents.</p> <p>Adopted from <b>EMS-C09-CON-SHA-10990</b></p>

#### 13.6.1 Quality Standards

<b>ANSP-TEN-SHA-05300</b>	<p>The Tenderer <b>shall</b> be approved to ISO 9001/9002 ([RD 44]/[RD 45]), latest version, or to an equivalent standard.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11000</b></p>
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<b>ANSP-CON-SHA-05310</b>	The approved Quality procedures <b>shall</b> apply to both hardware and software/firmware aspects of the Contract. Adopted from <b>EMS-C09-CON-SHA-11010</b>
<b>ANSP-CON-SHA-05320</b>	The terms of the applicable standard <b>shall</b> apply throughout the period of the Contract. Adopted from <b>EMS-C09-CON-SHA-11020</b>
<b>ANSP-CON-SHA-05330</b>	The scope of registration <b>shall</b> also cover the scope of the activities relating to the Contract. Adopted from <b>EMS-C09-CON-SHA-11030</b>
<b>ANSP-TEN-SHA-05340</b>	If the Tenderer is not certified to these standards, it <b>shall</b> demonstrate that they are working towards such a standard and can be audited against it. Adopted from <b>EMS-C09-TEN-SHA-11040</b>

### 13.6.2 Quality Plan

<b>ANSP-TEN-SHA-05350</b>	The Tenderer and their proposed major Subcontractors <b>shall</b> submit, as part of their technical proposal, a preliminary Quality Plan (QP) based on the requirements of this specification and which details the QA programme which would be implemented in the event of a Contract being awarded. Adopted from <b>EMS-C09-TEN-SHA-11050</b>
<b>ANSP-TEN-SHA-05360</b>	The preliminary QP <b>shall</b> list all QA related and supporting documents Adopted from <b>EMS-C09-TEN-SHA-11060</b>
<b>ANSP-CON-SHA-05370</b>	A copy of QA manuals and other related documents <b>shall</b> be supplied to the Quality Assurance Authority upon request. Adopted from <b>EMS-C09-CON-SHA-11070</b>

<b>ANSP-CON-SHA-05380</b>	<p>A Quality Plan, in accordance with BS EN ISO 9001/9002 ([RD 44]/[RD 45]), latest version, <b>shall</b> be submitted by the successful Tenderer and their major Subcontractors, detailing how QA will be applied to the Contract.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11080</b></p>
<b>ANSP-CON-SHA-05390</b>	<p>The Quality Plan <b>shall</b> be submitted for approval by the Contracting Authority and implemented immediately.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11090</b></p>
<b>ANSP-CON-SHA-05400</b>	<p>All defining documents in the Quality Plan <b>shall</b> be subject to document control procedures.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11100</b></p>
<b>ANSP-CON-SHA-05410</b>	<p>The Quality Plan <b>shall</b> require Contracting Authority approval at all issues.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11110</b></p>
<b>ANSP-CON-SHA-05420</b>	<p>The Contractor <b>shall</b> remain totally responsible for their Subcontractors.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11120</b></p>

### 13.6.3 Software and Firmware Quality Plan

<b>ANSP-CON-SHA-05430</b>	<p>A Software and Firmware Quality Plan (SFQP), in accordance with ISO 9000 3 ([RD 46]), latest version, <b>shall</b> be submitted by the Tenderer and their major Subcontractors detailing how QA will be applied to the Contract.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11130</b></p>
<b>ANSP-CON-SHA-05440</b>	<p>The SFQP <b>shall</b> describe the quality objectives, the methodologies, the quality verification and assurance activities to be implemented and the software/firmware and associated documentation to be supplied under the contract.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11140</b></p>

<b>ANSP-CON-SHA-05450</b>	<p>The SFQP <b>shall</b> state the general procedures of the Contractor's Quality Manual that apply to the Contract.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11150</b></p>
<b>ANSP-CON-SHA-05460</b>	<p>The SFQP <b>shall</b> identify additional procedures and amplification to existing procedures that are required to meet the Contract conditions.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11160</b></p>
<b>ANSP-CON-SHA-05470</b>	<p>The SFQP <b>shall</b> include, but not be limited to, the following:</p> <ul style="list-style-type: none"> <li>a) Description of software/firmware quality objectives;</li> <li>b) Definition of software/firmware life cycle model to be used;</li> <li>c) Staff and SQA organization and their relationship to the project team;</li> <li>d) Definition of deliverable items and deliverable media;</li> <li>e) Verification and Quality Assurance activities throughout the life cycle;</li> <li>f) What techniques, notations, languages, methods, standards (internal and national), conventions and tools are to be used during the project and to which activity and deliverable each applies;</li> <li>g) How the quality of deliverables is assessed;</li> <li>h) Configuration Management and Change Control procedures;</li> <li>i) Documentation to be provided and to what standards;</li> <li>j) Procedures for subcontracting of software/firmware;</li> <li>k) Defect and Non-Compliance reporting.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-11170</b></p>

#### 13.6.4 Quality Records

<b>ANSP-TEN-SHA-05480</b>	<p>The Tenderer <b>shall</b> state what information is to be recorded to monitor the control of the manufacture and test process.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11180</b></p>
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<b>ANSP-TEN-SHA-05490</b>	The Tenderer <b>shall</b> state how the information is to be recorded and how it will be shared with the Contracting Authority. Adopted from <b>EMS-C09-TEN-SHA-11190</b>
<b>ANSP-TEN-SHA-05500</b>	The Tenderer <b>shall</b> state how problems are escalated internally and how these are to be discussed with the Contracting Authority, where required, to ensure an agreed solution is reached. Adopted from <b>EMS-C09-TEN-SHA-11200</b>
<b>ANSP-TEN-SHA-05510</b>	The Tenderer <b>shall</b> state what quality initiatives are in place to ensure that all staff are involved in the quality process. Adopted from <b>EMS-C09-TEN-SHA-11210</b>
<b>ANSP-TEN-SHA-05520</b>	The Tenderer <b>shall</b> state what Quality Training their staff receive. Adopted from <b>EMS-C09-TEN-SHA-11220</b>

#### 13.6.4.1 Audit

<b>ANSP-SYS-SHA-05530</b>	Reasonable access and accommodation at the Contractor's premises <b>shall</b> be provided to the Quality Assurance Authority, or their representative, in order to perform assessment activity including: <ul style="list-style-type: none"> <li>a) A Quality assessment of the Contractor's Quality Management System to the relevant standard and to the Quality Plans prior to the start of the Contract work;</li> <li>b) Selective Quality surveillance audits against the relevant standard and Quality Plans during the term of the Contract;</li> <li>c) Similar access as described above to the premises of the major Subcontractors;</li> <li>d) Quality Progress statements, required monthly, to be provided as part of the regular project reporting procedures.</li> </ul> Adopted from <b>EMS-C09-SYS-SHA-11230</b>
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### 13.7 Configuration Management

<b>ANSP-TEN-SHA-05540</b>	<p>The Tenderer as part of their Tender Response <b>shall</b> provide details of the hardware and software/firmware Configuration Management (CM) plans they would implement following contract award.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11240</b>.</p>
<b>ANSP-TEN-SHA-05550</b>	<p>The Preliminary CM Plan <b>shall</b> include as a minimum:</p> <ul style="list-style-type: none"> <li>a) List of internal and external items of the project established as Configuration Items;</li> <li>b) Responsibilities and relevant procedures to be used;</li> <li>c) Configuration Management tools and techniques;</li> <li>d) Configuration Identification and modification policy;</li> <li>e) Configuration Status Accounting;</li> <li>f) Configuration Auditing;</li> <li>g) Software/Firmware/Hardware Interface Management;</li> <li>h) Configuration Control for spares ranging and maintenance;</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-11250</b></p>
<b>ANSP-TEN-SHA-05560</b>	<p>Change procedures <b>shall</b> be consistent with the configuration approach.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11260</b></p>
<b>ANSP-CON-SHA-05570</b>	<p>The CM Plan <b>shall</b> state the Configuration Management procedures to be used on the project.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11270</b>.</p>
<b>ANSP-CON-SHA-05580</b>	<p>A system for identifying the configuration <b>shall</b> be defined and documented, including how the identification is allocated.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11280</b>.</p>



<b>ANSP-CON-SHA-05590</b>	The Contractor <b>shall</b> maintain the system to identify the configuration. Adopted from <b>EMS-C09-CON-SHA-11290</b> .
<b>ANSP-CON-SHA-05600</b>	Configuration control <b>shall</b> also be applied to spares in maintenance process. Adopted from <b>EMS-C09-CON-SHA-11300</b> .
<b>ANSP-TEN-SHA-05610</b>	The Tenderer <b>shall</b> document their controls over software/firmware/hardware interfaces Adopted from <b>EMS-C09-TEN-SHA-11310</b> .

#### 13.7.1 Configuration Items

<b>ANSP-TEN-SHA-05620</b>	For each Configuration Item, the Tenderer <b>shall</b> state whether it classifies as COTS, OTS or needs to be developed. Adopted from <b>EMS-C09-TEN-SHA-11320</b> .
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#### 13.7.2 Hardware and Software/Firmware CM Plan

<b>ANSP-CON-SHA-05630</b>	The Contractor <b>shall</b> provide a detailed hardware CM Plan for Contracting Authority approval. Adopted from <b>EMS-C09-CON-SHA-11330</b> .
<b>ANSP-CON-SHA-05640</b>	The CM Plan <b>shall</b> include details of how the configuration of subcontracted hardware is dealt with. Adopted from <b>EMS-C09-CON-SHA-11340</b> .
<b>ANSP-CON-SHA-05650</b>	The plan <b>shall</b> describe the Contractor's CM programme that will be used to ensure adequate control of the status of all Configured Items, documentation and spares. Adopted from <b>EMS-C09-CON-SHA-11350</b> .

<b>ANSP-CON-SHA-05660</b>	The hardware CM plan <b>shall</b> also identify proposals for the Contracting Authority to assume the CM responsibility post technical completion from the Contractor.  Adopted from <b>EMS-C09-CON-SHA-11360</b>
<b>ANSP-CON-SHA-05670</b>	The Contractor <b>shall</b> provide a detailed software and firmware CM plan for Contracting Authority approval.  Adopted from <b>EMS-C09-CON-SHA-11370</b> .
<b>ANSP-CON-SHA-05680</b>	The CM plan <b>shall</b> describe the Contractor's software and firmware CM programme that will be used to ensure adequate control of the System software/firmware including documentation and deliverable software and firmware.  Adopted from <b>EMS-C09-CON-SHA-11380</b> .
<b>ANSP-CON-SHA-05690</b>	The software and firmware CM plan <b>shall</b> identify the participation of the Contractor SQA department in software/firmware CM activities. Adopted from <b>EMS-C09-CON-SHA-11390</b> .
<b>ANSP-CON-SHA-05700</b>	Key personnel for the CM plan <b>shall</b> be identified using organization charts.  Adopted from <b>EMS-C09-CON-SHA-11400</b>
<b>ANSP-CON-SHA-05710</b>	The software and firmware CM plan <b>shall</b> also identify proposals for the Contracting Authority to assume software/firmware CM authority post technical completion from the Contractor.  Adopted from <b>EMS-C09-CON-SHA-11410</b> .

### 13.7.3 Configuration Control

<b>ANSP-CON-SHA-05720</b>	The Contractor <b>shall</b> use Configuration Management software to ensure that only authorised changes are made to source code modules.  Adopted from <b>EMS-C09-CON-SHA-11420</b> .
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<b>ANSP-CON-SHA-05730</b>	<p>All Modules/files that make up the System and/or the development environment (compilers, linkers, etc.) <b>shall</b> be under the control of the CM software at all times. This includes the output files from the compile/link process in addition to the input source files.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11430</b>.</p>
<b>ANSP-CON-SHA-05740</b>	<p>Compatibility between various versions of hardware and software/firmware of the Radar System <b>shall</b> be permanently addressed in the CM Plan.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11440</b></p>
<b>ANSP-CON-SHA-05750</b>	<p>Where a third-party Operating System is used, changes to the code <b>shall</b> only be allowed through formal Configuration Control procedures.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11450</b>.</p>
<b>ANSP-CON-SHA-05760</b>	<p>Third party Operating System <b>shall</b> allow future upgrades to be provided by the original vendor.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11460</b>.</p>
<b>ANSP-CON-SHA-05770</b>	<p>All configuration details for the Operating System employed <b>shall</b> be supplied to the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11470</b>.</p>
<b>ANSP-CON-SHA-05780</b>	<p>For an in-house Operating System, formal Configuration Control procedures <b>shall</b> be fully applied.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11480</b>.</p>

#### 13.7.4 Change Control

<b>ANSP-CON-SHA-05790</b>	<p>Design records <b>shall</b> be maintained by the Contractor as part of their CM programme.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11490</b>.</p>
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<b>ANSP-CON-SHA-05800</b>	Any changes, which can alter the agreed Contract production baseline <b>shall</b> be referred to the Contracting Authority for their approval.  Adopted from <b>EMS-C09-CON-SHA-11500</b> .
<b>ANSP-TEN-SHA-05810</b>	The Tenderer <b>shall</b> propose specific procedures to monitor the project and control change.  Adopted from <b>EMS-C09-TEN-SHA-11510</b> .
<b>ANSP-CON-SHA-05820</b>	Shortcomings and subsequent corrective actions and/or proposed evolutions <b>shall</b> be described in a "Technical Issue Form" and submitted to the Contracting Authority.  Adopted from <b>EMS-C09-CON-SHA-11520</b> .
<b>ANSP-CON-SHA-05830</b>	If the proposed amendment is accepted, a "Change Request" <b>shall</b> be raised using an appropriate agreed procedure. Adopted from <b>EMS-C09-CON-SHA-11530</b> .
<b>ANSP-CON-SHA-05840</b>	Before a change is made official, its validity <b>shall</b> be confirmed and the effects on other items identified and thoroughly examined.  Adopted from <b>EMS-C09-CON-SHA-11540</b> .
<b>ANSP-CON-SHA-05850</b>	Methods to show the traceability and compatibility between changes and modified parts of system software/firmware <b>shall</b> be provided.  Adopted from <b>EMS-C09-CON-SHA-11550</b> .
<b>ANSP-CON-SHA-05860</b>	Any change having a contractual impact <b>shall</b> be the subject of a formal Contract amendment.  Adopted from <b>EMS-C09-CON-SHA-11560</b> .

#### 13.7.4.1 Audit

<b>ANSP-CON-SHA-05870</b>	The Configuration Management system <b>shall</b> be subject to audits by the Contractor to demonstrate that it is suitable and effective.  Adopted from <b>EMS-C09-CON-SHA-11570</b> .
<b>ANSP-CON-SHA-05880</b>	The Configuration Management audits <b>shall</b> verify the accuracy of the configuration information.  Adopted from <b>EMS-C09-CON-SHA-11580</b> .
<b>ANSP-CON-SHA-05890</b>	The results of these audits <b>shall</b> be made available to the Contracting Authority on request.  Adopted from <b>EMS-C09-CON-SHA-11590</b> .
<b>ANSP-CON-SHA-05900</b>	The Contractor <b>shall</b> allow access to all the necessary information to perform a specific Configuration audit by the Contracting Authority, in conformity with the agreed audit objectives and process.  Adopted from <b>EMS-C09-CON-SHA-11600</b> .

### 13.8 Integrated Logistic Support (ILS)

#### 13.8.1 Logistic

<b>ANSP-SYS-SHA-05910</b>	All parts of the ground station to be provided under this contract <b>shall</b> be designed and constructed in order to withstand possible operations of 24 hours per day, 7 days per week, and 52 weeks per year for a minimum 15-year life cycle.  Adopted from <b>EMS-C09-SYS-SHA-11610</b> .
<b>ANSP-SYS-SHA-05920</b>	The ground station equipment <b>shall</b> in such a manner that it can be progressively upgraded in functionality and performance.  Adopted from <b>EMS-C09-SYS-SHA-11620</b> .

<b>ANSP-SYS-SHA-05930</b>	<p>A modular approach <b>shall</b> be employed to allow an easy access to each LRU and test point, and to facilitate rapid replacement of faulty units, in order to satisfy the availability and maintainability requirements, whilst minimising impact on personnel and equipment safety.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11630</b>.</p>
<b>ANSP-TEN-SHA-05940</b>	<p>Logistic Support Plan for the entire planned life cycle of the System <b>shall</b> be provided by the Tenderer with their Proposal regarding cost efficient approaches to Engineering, Logistic Support and Maintenance of the system/subsystem(s), equipment and software/firmware.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11640</b>.</p>
<b>ANSP-TEN-SHA-05950</b>	<p>The Logistic Support Plan <b>shall</b> detail the methods and standards to be employed to achieve the Availability, Reliability and Maintainability objectives (including safety aspects) contained in this Specification.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11650</b></p>
<b>ANSP-TEN-SHA-05960</b>	<p>The Logistic Support Plan <b>shall</b> also provide outline details of types of personnel, training, Support and Test Equipment requirements, Spares availability, and Corrective and Preventative maintenance tasks (particularly those expected to exceed 30 minutes in length).</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11660</b></p>
<b>ANSP-TEN-SHA-05970</b>	<p>The Tenderer <b>shall</b> indicate in their Tender response the level of support available from their own resources to provide backing for the Contracting Authority or the National organisation's support facilities.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11670</b></p>
<b>ANSP-TEN-SHA-05980</b>	<p>The Tenderer <b>shall</b> indicate in their Tender Response their ability to comply with the objectives of the MIL-STD-1388-1A standard ([RD 69]) or equivalent, by citing previous examples of deliveries using Logistic Support Analysis.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11680</b></p>

#### 13.8.1.1 Delivery

<b>ANSP-CON-SHA-05990</b>	<p>The Contractor <b>shall</b> deliver the items as described in the 'List of Deliverables' at the dates agreed and to the locations specified by the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11690</b></p>
<b>ANSP-CON-SHA-06000</b>	<p>The Contractor <b>shall</b> deliver the Radar System to site for Site Acceptance Testing (SAT) as specified in this document, following successful completion of all Factory Acceptance Tests (FAT) on their factory test bench, and in addition to any internal verification and validation testing normally described in the project quality assurance and development plans.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11700</b>.</p>
<b>ANSP-CON-SHA-06010</b>	<p>For software and firmware, the Contractor <b>shall</b> provide the description and the identification of each delivered version, the associated source and executable code, the identification of the development and testing tools, the updated corresponding documentation (specifications, design, test plan, test results, listing) and the compatibility with the various hardware versions.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11710</b>.</p>

#### 13.8.1.2 Maintenance

<b>ANSP-SYS-SHO-06020</b>	<p>Maintenance philosophy for the ground station <b>should</b> be consistent with unattended operation, including at least:</p> <ul style="list-style-type: none"><li>a) Restoration of service by Line Replaceable Unit (LRU) exchange at Organisational level. This is carried out by appropriately trained Contractor, Contracting Authority or National personnel;</li><li>b) Further diagnosis and exchange of Field Replaceable Units (FRU) to be carried out by engineering staff, either contractor, Contracting Authority or National, utilising Intermediate or Depot level facilities;</li><li>c) Defective LRU/FRU are returned for appropriate action (e.g. repair, recalibration, replacement) to the Contractor or a designated National Repair Centre.</li></ul> <p>Adopted from <b>EMS-C09-SYS-SHO-11720</b>.</p>
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<b>ANSP-SYS-SHA-06030</b>	<p>The System maintenance <b>shall not</b> require any adjustment or setting up following the replacement of a LRU.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11730</b>.</p>
<b>ANSP-TEN-SHA-06040</b>	<p>The Commercial Response <b>shall</b> include appropriate cost scales for:</p> <ul style="list-style-type: none"> <li>a) Maintenance Support Contract set-up and renewal;</li> <li>b) Manufacturer's repair of LRUs and FRUs;</li> <li>c) Post Design Services contract to provide technical information and assistance to component level and to allow any changes or improvements resulting from the test and validation period to be accommodated.</li> </ul> <p>Adopted from <b>EMS-C09- TEN-SHA-11740</b>.</p>
<b>ANSP-TEN-SHA-06050</b>	<p>Examples for the maintenance cost scales detailed above, where available, <b>shall</b> be included in the Commercial Response.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11750</b>.</p>
<b>ANSP-SYSTEM-SHA-06060</b>	<p>The Tenderer <b>shall</b> guarantee the availability of all items required to support the System supplied for at least 10 years after final acceptance of the last station to be installed.</p> <p>Adopted from <b>EMS-C09-SYSTEM-SHA-11760</b></p>
<b>ANSP-SYS-SHA-06070</b>	<p>Advance warning of at least 12 months <b>shall</b> be required for inability to meet this commitment to allow the Contracting Authority the option of a Lifetime spares procurement.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11770</b></p>
<b>ANSP-SYS-SHA-06080</b>	<p>All components used in the PSR and Mode S ground station <b>shall</b> be available from more than one source, except with the prior written agreement of the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11780</b></p>



<b>ANSP-TEN-SHA-06090</b>	<p>The Tenderer <b>shall</b> include details of their intended software/firmware Maintenance Policy, including life cycles and reprogramming, in their Tender Response.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11790</b>.</p>
<b>ANSP-SYS-SHA-06100</b>	<p>Software and Firmware maintenance, including reprogramming, <b>shall</b> be addressed specifically by the Tenderer who will include details of the intended software/firmware Maintenance Policy in their Tender Response.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11800</b>.</p>
<b>ANSP-CON-SHA-06110</b>	<p>Post Contract Support shall be available for a minimum of five years after acceptance of the equipment.</p> <p>Adopted from <b>EMS-C09-CON-SHA-11810</b>.</p>
<b>ANSP-TEN-SHA-06120</b>	<p>The Tenderer <b>shall</b> describe required preventive maintenance of the System. The following shall be described at least:</p> <ul style="list-style-type: none"> <li>a) Scope of the preventive maintenance</li> <li>b) Periods of preventive maintenance (daily, weekly, monthly, yearly, etc., event triggered – e.g. once the air dryer indicates to replace a liner). In case of event-based preventive maintenance also the expected/average occurrence rate.</li> <li>c) Duration of preventive maintenance</li> <li>d) Number of personnel required for the maintenance.</li> <li>e) Required consumables</li> </ul>
<b>ANSP-TEN-SHA-06130</b>	<p>Tenderer <b>shall</b> provide number of man-days required for preventive maintenance during 1 average year.</p> <p><i>Note: Average year includes maintenance required in longer than 1 year interval (oil change, batteries replacement etc.).</i></p>
<b>ANSP-TEN-SHA-06140</b>	<p>Tenderer <b>shall</b> provide list of all consumables for preventive maintenance, their amount for average year, industry label, name or identification.</p> <p><i>Note: This includes oil, lubricants, air filters, air dryer consumables etc.</i></p>

<b>ANSP-TEN-SHA-06150</b>	The Tenderer <b>shall</b> specify the type and quantity of the applied oil and the required oil replacement frequency.
<b>ANSP-TEN-SHA-06160</b>	Tenderer <b>shall</b> include a tool list in his Tender. Whenever special tools and measurement equipment (hardware and/or software) are necessary to perform required maintenance actions (including testing, preventive and corrective maintenance) on the delivered radar system, the Contractor shall deliver all these tools in the frame of delivery.

### 13.8.1.3 Repairable Items

<b>ANSP-TEN-SHA-06170</b>	<p>To enable the Contracting Authority to fully calculate Life Cycle Cost implications, the Tenderer <b>shall</b> include as part of their proposal a provisional Build List of all repairable items.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11820</b></p>
<b>ANSP-TEN-SHA-06180</b>	<p>The following information <b>shall</b> be provided in the Tender Response for each item listed in the Build List of all repairable items:</p> <ul style="list-style-type: none"> <li>a) Mean Time Between Failures (MTBF);</li> <li>b) Mean Time To Repair (MTTR);</li> <li>c) Original Manufacturer (Name, Address, Email and Telephone Number), including Alternative Manufacturer if available;</li> <li>d) Manufacturer's Part Number and Designation</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-11830</b></p>
<b>ANSP-TEN-SHA-06190</b>	<p>The following information <b>shall</b> be provided in the Commercial Response for each item listed in the Build List of all repairable items:</p> <ul style="list-style-type: none"> <li>a) Original Manufacturer;</li> <li>b) Manufacturer's Part Number and Designation;</li> <li>c) Supply Price (including volume discount if any) and initial escalation rate.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-11840</b></p>

<b>ANSP-TEN-SHA-06200</b>	The sources for all data in the Build List <b>shall</b> be indicated.  Adopted from <b>EMS-C09-TEN-SHA-11850</b>
<b>ANSP-TEN-SHA-06210</b>	Where any item of data in the Build List is not supplied, the reason for non-inclusion <b>shall</b> be stated.  Adopted from <b>EMS-C09-TEN-SHA-11860</b>
<b>ANSP-CON-SHA-06220</b>	All data for the Build List <b>shall</b> be supplied by the Contractor within 12 months of Contract Let.  Adopted from <b>EMS-C09-CON-SHA-11870</b>
<b>ANSP-TEN-SHA-06230</b>	The Tenderer <b>shall</b> provide as part of the Commercial Response a Life Cycle Cost analysis.  Adopted from <b>EMS-C09-TEN-SHA-11880</b>

### 13.8.2 Reliability, Availability and Maintainability

<b>ANSP-SYS-SHA-06240</b>	Reliability, Availability and Maintainability are characteristics of the overall system which <b>shall</b> be specified, designed, implemented, tested, validated and documented.  Adopted from <b>EMS-C09-SYS-SHA-11890</b>
<b>ANSP-TEN-SHA-06250</b>	The methodology, techniques, processes and tools that the Tenderer intend to use to achieve the specified Reliability, Availability and Maintainability objectives <b>shall</b> be described or referenced in specific plans addressing architecture, hardware, software and firmware aspects.  Adopted from <b>EMS-C09-TEN-SHA-11900</b>
<b>ANSP-TEN-SHA-06260</b>	The Tenderer <b>shall</b> substantiate their ability to meet the specified Reliability, Availability and Maintainability by providing in their response a reliability model consisting of block diagrams covering all functions of the System.  Adopted from <b>EMS-C09-TEN-SHA-11910</b>

<b>ANSP-TEN-SHA-06270</b>	<p>The MTBF (Mean Time Between Failures), MTTR (Mean Time To Repair) and the Availability <b>shall</b> be clearly shown in either the block diagram or in a list showing the equipment breakdown to functional unit level, with identification of specific common failure mode (e.g. switch over equipment).</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11920</b></p>
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#### 13.8.2.1 Reliability

<b>ANSP-SYS-SHA-06280</b>	<p>The System reliability requirement for each Mode S ground station and PSR <b>shall</b> be greater than 20 000 hours MTBF (interruption of correct and coherent surveillance data from the Mode S ground station).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11930</b></p>
<b>ANSP-SYS-SHA-06290</b>	<p>Where appropriate, hardware and software/firmware <b>shall</b> be separately identified and included in the Reliability predictions.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-11940</b></p>
<b>ANSP-TEN-SHA-06300</b>	<p>The Tenderer <b>shall</b> state the individual MTBFs of the equipment listed below and identify which items are duplicated to achieve the required availabilities of 9.7.2.2:</p> <ul style="list-style-type: none"> <li>a) Mode S Antenna and cabling;</li> <li>b) Main bearing and drive ring;</li> <li>c) Rotary Joint and slip rings;</li> <li>d) Drive Motors and clutch;</li> <li>e) Antenna controllers;</li> <li>f) Azimuth Data Generators;</li> <li>g) NTP servers;</li> <li>h) Control and Monitoring System (Single Channel);</li> <li>i) Mode S Interrogator (Single Channel);</li> <li>j) Mode S System Management Function (Single Channel);</li> <li>k) ADS-B Antenna and cabling;</li> <li>l) Integrated ADS-B (if applicable);</li> <li>m) Independent ADS-B (if applicable);</li> <li>n) Local Display;</li> </ul>

	<ul style="list-style-type: none"> <li>o) Data Recorder and Playback;</li> <li>p) Far Field Monitor.</li> <li>q) LRU's of PSR (Single Channel)</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-11950</b></p>
<b>ANSP-SYSTEM-SHA-06310</b>	<p>The Tenderer <b>shall</b> ensure that the design minimises System outage due to preventative maintenance.</p> <p>Adopted from <b>EMS-C09-SYSTEM-SHA-11960</b></p>
<b>ANSP-TEN-SHA-06320</b>	<p>The Tenderer <b>shall</b> state in their Tender Response all expected System outages.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11970</b></p>
<b>ANSP-TEN-SHA-06330</b>	<p>The Tenderer <b>shall</b> provide in their Response reliability predictions and analysis for each site as per MIL HDBK 217 ([RD 73]) using exclusively a generic parts count method.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11980</b></p>
<b>ANSP-TEN-SHA-06340</b>	<p>A Ground Fixed environment <b>shall</b> be used for all reliability prediction calculations.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-11990</b></p>
<b>ANSP-TEN-SHA-06350</b>	<p>Reliability predictions for single channel MTBF and System MTBF <b>shall</b> be provided for the following:</p> <ul style="list-style-type: none"> <li>a) LRUs;</li> <li>b) Each major equipment group;</li> <li>c) Each single channel of the System.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12000</b></p>
<b>ANSP-TEN-SHA-06360</b>	<p>Where existing equipment is being offered to fulfil the contractual requirements, then field failure rates and MTBF data <b>shall</b> be provided to substantiate the predicted data.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12010</b></p>

<b>ANSP-TEN-SHA-06370</b>	<p>The Tenderer <b>shall</b> indicate the condemnation rate for the following:</p> <ul style="list-style-type: none"> <li>a) LRUs;</li> <li>b) Each major equipment group;</li> <li>c) Each single channel of the System.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12020</b></p>
<b>ANSP-CON-SHA-06380</b>	<p>Reliability Predictions <b>shall</b> be provided within 90 days of contract award and at agreed intervals thereafter for approval by the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12030</b></p>
<b>ANSP-CON-SHA-06390</b>	<p>The Contractor <b>shall</b> conduct a Reliability Demonstration.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12040</b></p>
<b>ANSP-TEN-MAY-06400</b>	<p>The Tenderer <b>may</b> propose an alternative Reliability Demonstration methodology, to be described in the SAT Strategy, subject to Contracting Authority approval.</p> <p>Adopted from <b>EMS-C09-TEN-MAY-12050</b></p>

### 13.8.2.2 Availability

ANSP-SYS-SHA-06410	<p>The figures for Availability quoted in this Specification are for Operational Availability (Ao) and <b>shall</b> be calculated using the following equation:</p> $A(o) = \frac{MTBF}{MTBF + MTTR + MRT}$ <p>with:</p> <ul style="list-style-type: none"> <li>• MTBF = Mean Time Between Failures, in hours;</li> <li>• MTTR = Mean Time To Repair, in hours;</li> <li>• MRT = Mean Response Time, in hours (i.e. the average time from notification of failure for a technician to be ready to commence repair action).</li> </ul> <p>Adopted from <b>EMS-C09-SYS-SHA-12060</b></p>
ANSP-SYS-SHA-06420	<p>The operational availability of correct and coherent surveillance data from the Mode S ground station site <b>shall</b> be greater than 99.98%.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-12070</b></p>
ANSP-SYSTEM-SHA-06430	<p>The Tenderer <b>shall</b> use availability figures for the customer-supplied components in order to predict the overall system availability.</p> <p>Adopted from <b>EMS-C09-SYSTEM-SHA-12080</b></p>
ANSP-SYS-SHA-06440	<p>The MTTR at Organisational Level <b>shall</b> be 30 minutes</p> <p>Adopted from <b>EMS-C09-SYS-SHA-12090</b></p>
ANSP-TEN-SHO-06450	<p>The following availability figures <b>should</b> be considered:</p> <ul style="list-style-type: none"> <li>a) The MRT is 3.5 hours;</li> <li>b) The maximum time to repair do not exceed 8 hours for 95% of all repairs;</li> <li>c) The maximum response time do not exceed 8 hours.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHO-12100</b></p>

<b>ANSP-SYS-SHA-06460</b>	<p>The operational availability of the Far Filed Monitor <b>shall</b> be greater than 99.995%, based on the same MTTR and MRT figures considered for the Mode S Ground Station.</p> <p>Adopted from <b>EMS-C09-SYS-SHA-12110</b></p>
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### 13.8.2.3 Maintainability

<b>ANSP-CON-SHA-06470</b>	<p>The Contractor <b>shall</b> meet or improve on the MTTR targets for the following functional areas:</p> <ul style="list-style-type: none"> <li>a) PSR or Mode S Antenna: 4 hours;</li> <li>b) ADS-B Antenna: 2 hours;</li> <li>c) Main Bearing: 8 hours;</li> <li>d) Motors &amp; Azimuth Data Generators: 4 hours;</li> <li>e) NTP servers: 0.5 hours;</li> <li>f) Interrogator and SMF electronics: 0.5 hours;</li> <li>g) Integrated ADS-B (if applicable): 0.5 hours;</li> <li>h) Independent ADS-B (if applicable): 0.5 hours;</li> <li>i) PSR LRU's: 0,5 hours</li> <li>j) Control and Monitoring System: 0.5 hours;</li> <li>k) Local Display and Data Recorder and Playback: 1 hours;</li> <li>l) Far Field Monitor: 0.5 hours.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-12120</b></p>
<b>ANSP-TEN-SHA-06480</b>	<p>The Tenderer <b>shall</b> provide in Tender response the MTTR estimates for each of the following:</p> <ul style="list-style-type: none"> <li>a) LRUs;</li> <li>b) Each major equipment group;</li> <li>c) Each single channel of the System.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12130</b></p>



<b>ANSP-TEN-SHA-06490</b>	<p>The Tenderer <b>shall</b> provide in their Tender Response Maintainability Predictions for the following equipment:</p> <ul style="list-style-type: none"> <li>a) LRUs;</li> <li>b) Each major equipment group;</li> <li>c) Each single channel of the System.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12140</b></p>
<b>ANSP-TEN-SHA-06500</b>	<p>MTTR predictions <b>shall</b> be in accordance with MIL-HDBK-472 ([RD 75]).</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12150</b></p>
<b>ANSP-TEN-SHA-06510</b>	<p>The Tenderer <b>shall</b> conduct a Maintenance Task Analysis in accordance with MIL STD 470 ([RD 65]).</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12160</b></p>
<b>ANSP-CON-SHA-06520</b>	<p>Maintainability Predictions <b>shall</b> be provided within 90 days of contract award and at agreed intervals hereafter for approval by the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12170</b></p>
<b>ANSP-TEN-SHA-06530</b>	<p>Tenderer <b>shall</b> provide in the Commercial Response the average material cost of repair, the average cost per repair and the depot response time for the following:</p> <ul style="list-style-type: none"> <li>a) LRUs;</li> <li>b) Each major equipment group;</li> <li>c) Each single channel.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12180</b></p>
<b>ANSP-CON-SHA-06540</b>	<p>The Contractor <b>shall</b> conduct a Maintainability demonstration in accordance with MIL-STD-471A ([RD 66]).</p> <p>Adopted from <b>EMS-C09-CON-SHA-12190</b></p>

<b>ANSP-TEN-SHA-06550</b>	<p>The Tenderer <b>shall</b> provide in a list of PSR and SSR availability parameters. The list shall include the items given in following subsection:</p> <ul style="list-style-type: none"> <li>a) MTBF - Mean time between failures;</li> <li>b) MTTR - Mean time to recovery;</li> <li>c) MTBFC - Mean Time Between Critical Failures;</li> <li>d) Maximum outage time;</li> <li>e) Life time of whole radar system;</li> <li>f) Warm up time after initial powering up;</li> <li>g) Maximum time without corrective maintenance;</li> <li>h) Others;</li> </ul>
<b>ANSP-TEN-SHA-06560</b>	<p>The radar <b>shall</b> be designed for non-stop operation. The Tenderer shall provide a calculation of MTTR. The calculations shall come with comments and a description of the calculation method.</p>
<b>ANSP-TEN-SHA-06570</b>	<p>The radar <b>shall</b> be designed for non-stop operation.</p> <p>The Tenderer <b>shall</b> provide in a calculation of MTBF. The calculations shall come with comments and a description of the calculation method.</p>
<b>ANSP-TEN-SHA-06580</b>	<p>The radar <b>shall</b> be designed for non-stop operation. The Tenderer shall provide a calculation of MTBCF.</p> <p>The calculations <b>shall</b> come with comments and a description of the calculation method.</p>
<b>ANSP-TEN-SHA-06590</b>	<p>The Tenderer <b>shall</b> describe all the preventive maintenance required for achieving the calculated MTBF, MTBCF and MTTR values.</p>

### 13.8.3 Knowledge transfer

#### 13.8.3.1 Documentation

<b>ANSP-TEN-SHA-06600</b>	<p>The Tenderer <b>shall</b> provide a detailed list of technical documents to be delivered, which include, but is not limited to, the following documents:</p> <p>System Overview;</p> <ul style="list-style-type: none"><li>a) List of Deliverable Items;</li><li>b) Statement of Compliance;</li><li>c) Project Management Documentation:<ul style="list-style-type: none"><li>a. Project Management Plan (PMP);</li><li>b. Configuration Management Plan (CFGMP);</li><li>c. Quality Plan (QP);</li><li>d. Software and Firmware Development Plan (SFDP);</li><li>e. Verification and Validation Plan (VVP);</li><li>f. Installation and Commissioning Plan (ICP).</li></ul></li><li>d) Reliability, Maintainability and Availability Predictions (RMA);</li><li>e) Lifecycle Documentation:<ul style="list-style-type: none"><li>a. Requirement Specification (SRS or DOD-2167 SSS);</li><li>b. System Architecture Design Document (SAD or DOD-2167 SSDD);</li><li>c. Software Requirement Documents (SRD or DOD-2167 SRS), for each CSCI;</li><li>d. Software Architectural Design Documents (ADD or DOD-2167 SDD), for each CSCI;</li><li>e. Interface Control Documents (ICD) for internal and external interfaces;</li><li>f. Hardware Development Specifications, for each HWCI;</li><li>g. Hardware Architectural Design Documents, for each HWCI;</li><li>h. COTS customization documents;</li><li>i. Operator Handbooks;</li><li>j. Verification and Validation Documents (for the System, the hardware and software/firmware components).</li></ul></li><li>g) COTS standard documentation;</li><li>h) Training for all three phases – theoretical, practical and on-the job and Maintenance documentation;</li><li>i) System Documentation.</li></ul>
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	<p>In the event that deficiencies are identified in the documentation or if corrections or amendments are required as part of approval process by the competent authority, the contractor shall, without undue delay and at no additional cost, carry out all necessary corrections, amendments, or provide supplementary documentation.</p> <p>The same obligation applies in the case of a subsequent compliance review by the competent authority, should it determine that additional documentation, corrections, or amendments are necessary. The contractor undertakes to promptly implement the required adjustments or additions without any extra charge in such a case.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12200</b></p>
<b>ANSP-CON-SHA-06610</b>	<p><i>Technical documents listed in <b>ANSP-TEN-SHA-06600</b> requirement <b>shall</b> be provided by Contractor and <b>shall</b> describe at least following topics:</i></p> <p><i>System:</i></p> <ul style="list-style-type: none"> <li><i>a) System manual - general description of the system</i></li> <li><i>b) Technical manual - for each LRU/item:</i> <ul style="list-style-type: none"> <li><i>a. General description</i> <ul style="list-style-type: none"> <li><i>- Detailed description</i></li> <li><i>- Physical characteristics</i></li> <li><i>- Electrical characteristics</i></li> <li><i>- Environmental characteristics</i></li> <li><i>- Operating characteristics</i></li> <li><i>- Parts list</i></li> </ul> </li> <li><i>b. Functional description</i></li> <li><i>c. Setting up and operation</i></li> <li><i>d. Preventive Maintenance</i></li> <li><i>e. Corrective Maintenance</i></li> <li><i>f. Input, output signals</i></li> <li><i>g. Indication and control interface</i></li> </ul> </li> <li><i>a) Cabling, position, labels, connection points</i></li> <li><i>b) Technical drawings and diagrams</i></li> </ul>

	<p><i>Interface Control Documents:</i></p> <ul style="list-style-type: none"> <li>a) <i>ASTERIX, UAP, Cats, editions including RE fields</i></li> <li>b) <i>Recordings, format, description, complete items</i></li> <li>c) <i>Logs ICD for</i> <ul style="list-style-type: none"> <li>a. <i>CMS application</i></li> <li>b. <i>system logs</i></li> <li>c. <i>application logs</i></li> <li>d. <i>application logging to system logs</i></li> </ul> </li> <li>d) <i>Internal LAN connections</i></li> <li>e) <i>CMS</i></li> <li>f) <i>CMOS + SNMP agent</i></li> <li>g) <i>Protocols, formats, APIs, integration guidelines</i></li> </ul> <p><i>Software:</i></p> <ul style="list-style-type: none"> <li>a) <i>Installation manual</i></li> <li>b) <i>Customization manual</i></li> <li>c) <i>Software, versions, backups</i></li> <li>d) <i>Licences, certificates, keys</i></li> <li>e) <i>Backup procedures</i></li> <li>f) <i>Restoration procedures</i></li> </ul> <p><i>Handbooks:</i></p> <ul style="list-style-type: none"> <li>a) <i>CMS, RCMS, LCMS, Local display, Servers</i> <ul style="list-style-type: none"> <li>a. <i>Installation procedures</i></li> <li>b. <i>Operation</i></li> <li>c. <i>Preventive Maintenance</i></li> <li>d. <i>Corrective Maintenance</i></li> </ul> </li> <li>b) <i>HMI description of all available controls, indications and settings</i></li> </ul> <p><i>Cybersecurity measures:</i></p> <ul style="list-style-type: none"> <li>a) <i>Recovery procedures from zero to fully operational system</i></li> <li>b) <i>Software integrity check procedure</i></li> </ul>
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	<p>Parameters:</p> <ul style="list-style-type: none"> <li>a) List of operational parameters, default values for operational parameters</li> <li>b) Procedure for backup of parameters, restoration of parameters</li> </ul> <p>Auxiliaries:</p> <ul style="list-style-type: none"> <li>a) Danger warning</li> <li>b) First aid warning/manual</li> </ul> <p>Safety and Compliance Documentation:</p> <ul style="list-style-type: none"> <li>a) Complete SAT documentation</li> <li>b) Complete FAT documentation</li> <li>c) Test report</li> <li>d) Safety guidelines</li> <li>e) Compliance documentation to industry standards</li> <li>f) Legal obligations</li> </ul> <p>Training materials for all three phases of training – theoretical, practical and on-the job:</p> <ul style="list-style-type: none"> <li>a) Presentations,</li> <li>b) Manual,</li> <li>c) Operation procedures,</li> <li>d) Troubleshooting procedures</li> </ul>
<b>ANSP-SYSTEM-SHA-06620</b>	<p>The Tenderer <b>shall</b> deliver preliminary versions of the technical documents listed in points (a), (b), (c), (d) and (e) of the <b>ANSP-TEN-SHA-06600</b> requirement.</p> <p>Adopted from <b>EMS-C09-SYSTEM-SHA-12210</b></p>
<b>ANSP-TEN-SHA-06630</b>	<p>The Tenderer <b>shall</b> state when the full set of documents will be delivered.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12220</b></p>
<b>ANSP-CON-SHA-06640</b>	<p>The exact documents delivery schedule <b>shall</b> be subject to agreement with the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12230</b></p>

<b>ANSP-CON-SHA-06650</b>	The Contractor <b>shall</b> deliver the documents identified in the Tenderer's list. Adopted from <b>EMS-C09-CON-SHA-12240</b>
<b>ANSP-SYS-SHA-06660</b>	All deliverable documentation <b>shall</b> be written in English, using standardised presentation and notation. Adopted from <b>EMS-C09-SYS-SHA-12250</b>
<b>ANSP-SYS-SHA-06670</b>	All deliverable documentation <b>shall</b> be provided as paper and computer readable in a format to be agreed with the Contracting Authority prior to contract let. Adopted from <b>EMS-C09-SYS-SHA-12260</b> <i>Note: The final versions of the system documentation shall consist of 1 hard copy per site and 1 copy on CD or USB stick.</i>
<b>ANSP-CON-SHA-06680</b>	The Contractor <b>shall</b> ensure that the Contracting Authority has the right to a free licence to copy the deliverable documentation called for under the contract, and to circulate or use the copies within the establishments of the Contracting Authority. Adopted from <b>EMS-C09-CON-SHA-12270</b>
<b>ANSP-CON-SHA-06690</b>	The Contracting Authority will not disclose the deliverable documentation called for under the contract outside their establishments without the prior written consent of the Contractor, which <b>shall not</b> be unreasonably withheld. Adopted from <b>EMS-C09-CON-SHA-12280</b>
<b>ANSP-TEN-SHA-06700</b>	The Tenderer <b>shall</b> identify in their Tender Response any deliverable documentation which will not be subject to free license. Adopted from <b>EMS-C09-TEN-SHA-12290</b>
<b>ANSP-SYS-SHA-06710</b>	Delivered documentation <b>shall</b> always be identified on the cover page with the assigned code referred to in the List of Deliverables. Adopted from <b>EMS-C09-SYS-SHA-12300</b>

<b>ANSP-SYS-SHA-06720</b>	Flow charts, block diagrams and preventative/ corrective procedures (including diagnostics) <b>shall</b> be included in the technical documentation to be delivered.  Adopted from <b>EMS-C09-SYS-SHA-12310</b>
<b>ANSP-SYS-SHA-06730</b>	Traceability through cross references of the functional requirements <b>shall</b> exist throughout all levels of the documentation produced, including maintenance phases documentation.  Adopted from <b>EMS-C09-SYS-SHA-12320</b>
<b>ANSP-CON-SHA-06740</b>	The Contractor <b>shall</b> deliver Operator Handbooks and Maintenance Documents to enable operation, maintenance, fault diagnosis and repair of the equipment by trained personnel in the Contracting Authority.  Adopted from <b>EMS-C09-CON-SHA-12330</b>
<b>ANSP-SYS-SHA-06750</b>	The System Cabling Schedule <b>shall</b> form part of the System Documentation.  Adopted from <b>EMS-C09-SYS-SHA-12340</b>
<b>ANSP-CON-SHA-06760</b>	The COTS standard documentation (User Manual, Reference Manual, etc.) <b>shall</b> be provided, together with documents describing how they were customized to fit in the procured system.  Adopted from <b>EMS-C09-CON-SHA-12350</b>
<b>ANSP-CON-SHA-06770</b>	The existing lifecycle documents belonging to the OTS products <b>shall</b> be provided, updated if they were modified to fit in the procured system.  Adopted from <b>EMS-C09-CON-SHA-12360</b>
<b>ANSP-CON-SHA-06780</b>	Full lifecycle documentation <b>shall</b> be produced and delivered for newly developed components.  Adopted from <b>EMS-C09-CON-SHA-12370</b>



<b>ANSP-CON-SHA-06790</b>	<p>All source code listings of new and OTS reused software/firmware modules <b>shall</b> be provided in in hardcopy and an appropriate computer readable format, including the full definition and identification of the software and firmware development environment used (compilers, testing tools, simulator, etc.).</p> <p>Adopted from <b>EMS-C09-CON-SHA-12380</b></p>
<b>ANSP-TEN-SHA-06800</b>	<p>The Tenderer <b>shall</b> advise the Contracting Authority in their Tender Response on the exact procedures that will be employed to amend the documentation to include subsequent updates.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12390</b></p>
<b>ANSP-CON-SHA-06810</b>	<p>Specific Procedures <b>shall</b> be defined to control the various status of documentation, its approval and to ensure that the pertinent issues of appropriate documents are available at the appropriate locations, particularly when computerized documentation is used distributed and archived.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12400</b></p>

#### 13.8.3.2 Training

<b>ANSP-CON-SHA-06820</b>	System and equipment rating training <b>shall</b> be organized for six (6) ATSEPs in duration of at least 20 working days for whole Radar system.
<b>ANSP-CON-SHA-06830</b>	The training language <b>shall</b> be English. The Contractor shall provide necessary training on all products delivered within the project.
<b>ANSP-CON-SHA-06840</b>	The Tenderer <b>shall</b> submit in its offer an initial version of the Training Plan for each phase (theoretical, practical and on-the job training). The Training Plan shall be discussed in detail with the Contractor and approved by the Contracting authority in accordance with the agreed schedule.
<b>ANSP-CON-SHA-06850</b>	The Training <b>shall</b> address all of the hardware and software delivered in the scope of the Contract, which means that the training for installation, maintenance and operation of COTS products shall be included in the Tender Documentation and in the Training Plan, as well.

<b>ANSP-CON-SHA-06860</b>	Contractor <b>shall</b> ensure that personnel engaged in the theoretical, practical and on-the-job training of Contracting authority ATSEP shall be fluent in English, and are suitably qualified to perform task of training instructor as well as competence assessor and experienced in the system domains, additionally, personnel engaged in the practical course shall have multicomplex-filter systems competences as well. Contractor shall submit documents proving that course staff is/are competent (like CV and/or number of trainings performed or any other proof, ex. statement of the contractor) of competency for each instructor.
<b>ANSP-CON-SHA-06870</b>	A detailed ATSEP training schedule for the training elements <b>shall</b> be defined after contract signature and approved by the Contracting authority.
<b>ANSP-CON-SHA-06880</b>	<p>The training documentation <b>shall</b> include the following (for the all three phases of training – theoretical, practical and on-the job training:</p> <ul style="list-style-type: none"> <li>a) Training programme/syllabus (defining the subjects and topics), including the programme for all 3 phases (could be in one document for all 3 phases);</li> <li>b) Training agenda (defining timings) for each training (theoretical, practical and on-the job);</li> <li>c) Training log book for all elements of training (for each phase), signed by the contractor’s training manager and all competent trainer/trainers (including the signed list of participants (attendance list) from the contractor authority);</li> <li>d) Name of the course manager and course trainers/instructors (can be included in the training log book)</li> <li>e) A short report about course progress for each of ATSEPs regarding achieving goals of the course - each student’s performance during each training element of this training;</li> <li>f) A summary report for practical assessment of each student;</li> <li>g) A copy of theoretical examination for each student;</li> <li>h) A certificate of competence for each person, for each training <ul style="list-style-type: none"> <li>a. A certificate shall be issued by Contractor. The certificate shall include the name and surname of participant, dates, when the training took place, date of the successfully competed course and the information, that the candidate passed the associated examination (if there will be an examination). For ATSEP personnel, the certificate shall include the statement, that the certificate is issued in compliance with the ATSEP.OR.215 System and equipment rating training requirement of Commission implementing regulation (EU) 2017/373. Each certificate should be signed either physically or digitally (only official digital signature is accepted), certificate of the contractor should be issued on the Contractor’s letterhead).</li> </ul> </li> </ul>

<p><b>ANSP-CON-SHA-06890</b></p>	<p>The training <b>shall</b> include all needed to meet following requirements:</p> <ul style="list-style-type: none"> <li>a) The system and equipment rating training of ATSEPs shall be applicable to the duties to be performed and include the following: <ul style="list-style-type: none"> <li>a. theoretical courses;</li> <li>b. practical courses;</li> <li>c. on-the-job training during system installation.</li> </ul> </li> <li>b) The system and equipment rating training shall ensure that candidate ATSEP acquire knowledge and skills pertaining to: <ul style="list-style-type: none"> <li>a. the functionality of the system and equipment;</li> <li>b. the actual and potential impact of ATSEP actions on the system and equipment;</li> <li>c. the impact of the system and equipment on the operational environment.</li> <li>d. performing repairs of the radar system</li> </ul> </li> </ul>
<p><b>ANSP-CON-SHA-06900</b></p>	<p>In compliance to the ATSEP.OR.215, the technical <b>staff</b> shall be trained by theoretical, practical and on-the-job training as well as to:</p> <ul style="list-style-type: none"> <li>a) Understand equipment architecture and configuration,</li> <li>b) Understand operational functions and features of all equipment units,</li> <li>c) Understand and use system software application(s) which are part of delivered equipment,</li> <li>d) Perform preventive maintenance of the equipment,</li> <li>e) Perform corrective maintenance, i.e. troubleshoot the system down to the LRU and SRU or component (where applicable) levels,</li> <li>f) Perform system test and alignment procedures for LRU,</li> <li>g) Perform required measurements and adjustments and to be able to use all necessary tools and instruments,</li> <li>h) Understand the diagnostic and test utilities and procedures.</li> </ul>

<b>ANSP-CON-SHA-06910</b>	<p>If requested by Contracting Authority, the Contractor <b>shall</b> present all documentation related to setting processes and proving facts that the personnel engaged in the theoretical, practical and on-the-job training are competent to perform training as per ATSEP.OR.215 is required. Contracting Authority have right to audit if and how these processes are in place and followed.</p> <p>Contractor shall agree to the following:</p> <ul style="list-style-type: none"> <li>a) Contractor gives consensus that any training related documents required by Slovenian CAA will be provided and will grant an access for CAA if necessary;</li> <li>b) Contractor gives consensus that Contracting Authority staff responsible for compliance management have access to the course and relevant documentation during or after the course, if required.</li> </ul>
<b>ANSP-CON-SHA-06920</b>	The content of the theoretical (theoretical training syllabus and theoretical training objectives) and practical (practical training syllabus, including practical exercises and the tools and instruments used for the practical hands-on training and practical training objectives) training courses, and practical on-the-job training during installation (on-the-job training objectives), <b>shall</b> be included in the Training Plan and shall be approved by the Contracting authority.
<b>ANSP-CON-SHA-06930</b>	The training material in electronic form (USB stick or sent via e-mail to the contracting authority) <b>shall</b> be made available for the trainees at least 1 week before the course begins. Paper copies of the training material <b>shall</b> be available for the trainees at the time the course begins.
<b>ANSP-CON-SHA-06940</b>	The Contractor <b>shall</b> define the course manager and compliance monitoring manager for the training and their competencies after contract signature.
<b>ANSP-CON-SHA-06950</b>	The Contractor <b>shall</b> conduct a final written examination and practical assessment for each trainee (student) at the end of the training. A Trainee shall be considered as competent ("A trainee successfully completed the course.") for system maintenance and operation if he passes a practical assessment with a score of at least 75% and a theoretical (written) examination of at least 75%. The test shall cover all topics of theoretical, and practical training.
<b>ANSP-CON-SHA-06960</b>	Contractor <b>shall</b> define the procedure in the event that an individual candidate fails to achieve the training objectives or fails to complete the training within the stipulated time of the training.
<b>ANSP-CON-SHA-06970</b>	Contractor shall define and inform all candidates about the appeal procedure if an individual candidate wishes to appeal.

<b>ANSP-CON-SHA-06980</b>	The Contractor <b>shall</b> issue Certificates of competence for the ATSEP personnel who successfully completed the System and Equipment Rating Training in accordance with the ATSEP.OR.215.
<b>ANSP-CON-SHA-06990</b>	The Contractor <b>shall</b> grant the Contracting authority access to the premises and applicable documentation for the purposes of Training requirements compliance monitoring by the Contracting authority, including access to the documentation of compliance monitoring conducted by the Contractor itself.
<b>ANSP-CON-SHA-07000</b>	After the completion of each course, the following reports <b>shall</b> be provided to the Contracting authority in accordance with <b>ANSP-CON-SHA-06880</b> .
<b>ANSP-CON-SHA-07010</b>	The Contracting Authority <b>shall</b> have the right to Training material provided from Contractor for further courses within its own organization.
<b>ANSP-CON-SHA-07020</b>	Contracting Authority covers travel and accommodation costs, incurred with attendance of Contracting authority's technical staff to training. All other costs, related to training, are included in contractual price. Contracting Authority unilaterally designates trainees.

### 13.9 Project Management

<b>ANSP-TEN-SHA-07030</b>	The Tenderer <b>shall</b> provide in their Tender Response a PMP that clearly describes all stages of the project including training, FAT, installation, commissioning, SAT, flight trial, etc.  Adopted from <b>EMS-C09-TEN-SHA-12470</b> .
<b>ANSP-TEN-SHA-07040</b>	The Tenderer <b>shall</b> state in their Tender Response the requirements in terms of resources required from the Contracting Authority at all phases of the Project.  Adopted from <b>EMS-C09-REQ-TEN-SHA-12480</b> .
<b>ANSP-TEN-SHA-07050</b>	If different development sites are planned, coordination links and procedures <b>shall</b> be provided.  Adopted from <b>EMS-C09-REQ-TEN-SHA-12490</b>

<b>ANSP-TEN-SHA-07060</b>	<p>The Tenderer <b>shall</b> provide in their Tender Response a Risk Management Plan (RMP) detailing how they will manage risks associated with this project.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12500</b>.</p>
<b>ANSP-TEN-SHA-07070</b>	<p>The areas to be covered in the RMP <b>shall</b> be, as a minimum, financial, technical (hardware and software/firmware), quality and programme.</p> <p>Adopted from <b>EMS-C09-REQ-TEN-SHA-12510</b>.</p>

### 13.10 Testing and Acceptance

<b>ANSP-CON-SHA-07080</b>	<p>It is particularly important that all Test Specifications used for proving that the System fulfils the requirement <b>shall</b> be generated directly from the overall system requirement specification, including cross references to trace back to the pertinent requirement area.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12520</b>.</p>
<b>ANSP-CON-SHA-07090</b>	<p>In addition, module and subsystem Test Specifications <b>shall</b> be generated directly from the relevant design document, including cross references to trace back to the pertinent design area.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12530</b>.</p>
<b>ANSP-CON-SHA-07100</b>	<p>A Verification Cross Reference Index (VCRI) <b>shall</b> be produced to trace continuity from the Specification through the Design Document to the FAT and SAT Acceptance Test Specifications.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12540</b>.</p>
<b>ANSP-CON-SHA-07110</b>	<p>The Cross-Reference document <b>shall</b> be updated and re-issued whenever any other document changes, including first draft issues of any other document.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12550</b>.</p>

<b>ANSP-CON-SHA-07120</b>	<p>If a deliverable is non-conformant, the Contractor <b>shall</b> correct it at their own expense and, after rectification, resubmit it for acceptance within a time schedule agreed by the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12560</b>.</p>
<b>ANSP-CON-SHA-07130</b>	<p>The Contractor <b>shall</b> formulate, arrange and conduct tests to satisfactorily demonstrate, to the Contracting Authority, compliance of the deliverable equipment with all the performance requirements of this specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12570</b>.</p>
<b>ANSP-TEN-SHA-07140</b>	<p>The Tenderer <b>shall</b> include in their proposal a preliminary Verification and Validation Plan, as detailed in section 13.10.2 (ANSP-TEN-SHA- 07250), which outlines their test program.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12580</b>.</p>
<b>ANSP-CON-SHA-07150</b>	<p>The Contractor <b>shall</b> develop an overall Verification and Validation Plan, as detailed in section 13.10.2 (ANSP-CON-SHA-07270), which will detail how the performance requirements of this specification will be verified, recorded and accepted.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12590</b>.</p>
<b>ANSP-CON-SHA-07160</b>	<p>It <b>shall</b> be the responsibility of the Contractor to arrange and perform the acceptance testing.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12600</b>.</p>
<b>ANSP-CON-SHA-07170</b>	<p>The acceptance tests <b>shall</b> be witnessed by Contracting Authority personnel in accordance with an agreed plan.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12610</b>.</p>

#### 13.10.1 Test Resources

<b>ANSP-CON-SHA-07180</b>	<p>The Contractor <b>shall</b> bear the cost of all resources required for testing (including personnel, equipment and premises) to complete FAT and SAT testing as defined in 13.10.4.1 (FAT) and 13.10.4.2. (SAT)</p> <p>Adopted from <b>EMS-C09-CON-SHA-12620</b></p>
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<b>ANSP-CON-SHA-07190</b>	<p>The Contractor <b>shall</b> provide details in the Verification and Validation Plan to show that all resources (test equipment, procedures, personnel and premises, etc.) are adequate and available to perform the testing.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12630</b>.</p>
<b>ANSP-CON-MAY-07200</b>	<p>If live data is not available at the Contractor's premises, the Contractor <b>may</b> use recorded or simulated traffic data.</p> <p>Adopted from <b>EMS-C09-CON-MAY-12640</b>.</p>
<b>ANSP-TEN-SHA-07210</b>	<p>The Tenderer <b>shall</b> state the methods they intend to use to verify the targets load models described in 2.6.8 and 2.7.4.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12650</b>.</p>
<b>ANSP-CON-SHA-07220</b>	<p>The Contractor <b>shall</b> provide details in the Verification and Validation Plan of all tests that cannot be performed at the Contractors or Subcontractors premises, including the reasons.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12660</b>.</p>
<b>ANSP-CON-SHA-07230</b>	<p>Agreement <b>shall</b> be required with the Contracting Authority of any tests that are to be deferred.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12670</b>.</p>
<b>ANSP-CON-SHA-07240</b>	<p>The Contractor <b>shall</b> submit, within the proposed Verification and Validation Plan, adequate evidences to the Contracting Authority that the methods of testing provide confirmation that the equipment actually meets the performance requirements of this specification, and that the test procedures provide the required precision and accuracy.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12680</b>.</p>

#### 13.10.2 Verification and Validation Plan

<b>ANSP-TEN-SHA-07250</b>	<p>The Tenderer <b>shall</b> include in their Tender Response a preliminary Verification and Validation Plan for the project.</p> <p>Adopted from <b>EMS-C09-TEN-SHA-12690</b>.</p>
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ANSP-TEN-SHA-07260	<p>The Verification and Validation Plan <b>shall</b> include at least the following:</p> <ul style="list-style-type: none"> <li>a) A list of the systems and subsystems to be tested;</li> <li>b) A list of the types of tests to be employed (e.g. QT, FAT, SAT, System) and the tools required at each stage;</li> <li>c) A verification matrix that will show for each paragraph of this specification which of the types of tests in (b) applies;</li> <li>d) The names, positions, authority, role and interrelationships of the personnel to be involved in the tests stated in (b).</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-12700</b>.</p>
ANSP-CON-SHA-07270	<p>The Contractor <b>shall</b> develop and supply a comprehensive Verification and Validation Plan, including at least all the following:</p> <ul style="list-style-type: none"> <li>a) List of the systems and subsystems to be tested with identification of the hardware and software/firmware versions for the equipment under test, and for the development and testing support tools;</li> <li>b) Identification of all the parameters which will be tested;</li> <li>c) A Test Specification for FAT and SAT detailing the methods and procedures that will show compliance with the performance requirements of this specification;</li> <li>d) A verification matrix that relates each and every performance requirement of this specification to the specific test(s) that will be performed to demonstrate compliance with that requirement;</li> <li>e) A verification matrix that relates each and every requirement of this specification to the specific test(s) that will be performed to demonstrate compliance with that requirement;</li> <li>f) The names, positions, authority, role and interrelationships of the personnel to be involved in the tests stated in (c).</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-12710</b>.</p>
ANSP-CON-SHA-07280	<p>The agreed procedures and test data sheets <b>shall</b> form the basis for the testing of the deliverable items.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12720</b>.</p>
ANSP-CON-SHA-07290	<p>The agreed procedures and test data sheets <b>shall</b> form the basis for the testing of the deliverable items.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12730</b></p>

<b>ANSP-CON-SHA-07300</b>	Testing, as identified in 13.10. <b>shall not</b> begin until the test specifications have been agreed between the Contracting Authority and the Contractor.  Adopted from <b>EMS-C09-CON-SHA-12740</b> .
<b>ANSP-CON-SHA-07310</b>	After agreement has been reached the Contractor <b>shall</b> provide 30 working days' notice of the commencement of scheduled testing.  Adopted from <b>EMS-C09-CON-SHA-12750</b> .
<b>ANSP-CON-SHA-07320</b>	Test notification <b>shall not</b> be given until the Contractor has carried out preliminary tests to ensure the equipment is fully compliant with the test procedures.  Adopted from <b>EMS-C09-CON-SHA-12760</b> .
<b>ANSP-CON-SHA-07330</b>	A QA certified copy of the preliminary test results <b>shall</b> be provided 10 working days prior to the commencement of official testing.  Adopted from <b>EMS-C09-CON-SHA-12770</b> .

#### 13.10.3 Test Results

<b>ANSP-CON-SHA-07340</b>	Two copies of all test results, certified by an authorized representative of the Contractor's QA organization, <b>shall</b> be provided to the Contracting Authority.  Adopted from <b>EMS-C09-CON-SHA-12780</b> .
<b>ANSP-CON-SHA-07350</b>	One copy <b>shall</b> be sent to site with the tested equipment and another, i.e. a second copy, to the Contracting Authority's designated Project Manager.  Adopted from <b>EMS-C09-CON-SHA-12790</b> .

<b>ANSP-CON-SHA-07360</b>	<p>The test result sheets <b>shall</b> clearly identify the equipment name, type, serial number, test specification number and the test date.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12800</b></p>
<b>ANSP-CON-SHA-07370</b>	<p>Each individual test result <b>shall</b> be clearly identified and signed, in the test result sheet, by the Contractor's QA representative and countersigned by the Contracting Authority witness.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12810</b>.</p>
<b>ANSP-CON-SHA-07380</b>	<p>Any failed unit during testing <b>shall</b> be repaired.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12820</b>.</p>
<b>ANSP-CON-SHA-07390</b>	<p>The cause of failure of any unit during testing <b>shall</b> be determined and if necessary, processes and/or materials or components changed so that all requirements of the specification are met.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12830</b>.</p>
<b>ANSP-CON-SHA-07400</b>	<p>Repaired units, and all other units that can have been affected by the failed unit, <b>shall</b> be re-tested to demonstrate final compliance with the test specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12840</b>.</p>
<b>ANSP-CON-SHA-07410</b>	<p>All software and firmware failures <b>shall</b> be rectified and the cause of the error determined.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12850</b>.</p>
<b>ANSP-CON-SHA-07420</b>	<p>All software and firmware modules that can have been affected by a failed module <b>shall</b> be re-tested.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12860</b>.</p>

<b>ANSP-CON-SHA-07430</b>	All test failures <b>shall</b> be logged, as Problem Reports by the Contractor's QA Representative, and subject to closure, following explanation to be agreed by the Contracting Authority, or the raising of an approved engineering change order.  Adopted from <b>EMS-C09-CON-SHA-12870</b> .
<b>ANSP-CON-SHA-07440</b>	All test failures <b>shall</b> be categorised and agreed with the Contracting Authority.  Adopted from <b>EMS-C09-CON-SHA-12880</b> .
<b>ANSP-CON-SHA-07450</b>	Any equipment damage caused as a result of any testing <b>shall</b> be corrected and the equipment refurbished at the Contractor's expense prior to Contracting Authority acceptance.  Adopted from <b>EMS-C09-CON-SHA-12890</b> .

#### 13.10.4 Testing

##### 13.10.4.1 Factory Acceptance Tests (FAT)

<b>ANSP-CON-SHA-07460</b>	Complete and thorough testing <b>shall</b> be conducted in factory to demonstrate compliance with the equipment design criteria.  Adopted from <b>EMS-C09-CON-SHA-12900</b> .
<b>ANSP-CON-SHA-07470</b>	Unless otherwise agreed by the Contracting Authority, all factory testing (FAT) <b>shall</b> occur at the Contractor's or main Subcontractor's premises.  Adopted from <b>EMS-C09-CON-SHA-12910</b> .
<b>ANSP-CON-SHA-07480</b>	FAT testing <b>shall</b> be carried out using the deliverable hardware, software and firmware.  Adopted from <b>EMS-C09-CON-SHA-12920</b>

<b>ANSP-CON-SHA-07490</b>	<p>The FAT <b>shall</b> prove conclusively that the equipment meets all applicable specifications and will meet the operational and performance requirements of this specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12930</b>.</p>
<b>ANSP-CON-SHA-07500</b>	<p>The Factory Acceptance Test <b>shall</b> include the following software/operating system aspects:</p> <ul style="list-style-type: none"> <li>a) Configuration Identification of every file/module under test. No file or module used in this process is in a development state as reported by the CM software. All files are registered/authenticated before the process starts.</li> <li>b) Recompilation of every source file to be built into the system software followed by rebuilding the executable software loads. If a Software Development Facility is one of the deliverables, every file used, at the version used in this process, is delivered to the Contracting Authority under the control of CM software.</li> <li>c) Recreation of the operating system from either: <ul style="list-style-type: none"> <li>a. The delivery kit and configuration details if a third-party operating system is used.</li> <li>b. The source code and configuration details if an in-house operating system is used.</li> </ul> </li> <li>d) Validation of operating system performance.</li> <li>e) Confirmation that each adaptation parameter can be changed, and that the changes have the required impact on the operation of the overall system.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-12940</b>.</p>
<b>ANSP-CON-SHA-07510</b>	<p>To confirm the performance parameters not tested during FAT at the factory, the Contractor <b>shall</b> make provision for demonstrations of the systems functionality, prior to delivering the equipment for SAT, in a test site nominated by the Contractor.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12950</b>.</p>

#### 13.10.4.2 Site Acceptance Tests (SAT)

<b>ANSP-CON-SHA-07520</b>	<p>The following <b>shall</b> be provided to the Contracting Authority 10 working days prior to the commencement of SAT testing:</p> <ul style="list-style-type: none"> <li>a) Evidence of closure of all previously raised observations, or agreement of action with respect to outstanding observations;</li> <li>b) Records of changes made since the FAT;</li> <li>c) The hardware, software and firmware build states;</li> <li>d) All test documentation to be available and agreed;</li> <li>e) Justification and explanation in writing of the choice of site parameters.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-12960</b>.</p>
<b>ANSP-CON-SHA-07530</b>	<p>The SAT testing <b>shall</b> demonstrate the accuracy, stability, electromagnetic compatibility, availability, reliability and maintainability of the deliverable hardware and software/firmware over all parameters to meet all the operational and performance requirements of this specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12970</b></p>
<b>ANSP-CON-SHA-07540</b>	<p>The SAT testing <b>shall</b> utilise all the deliverable hardware and software/firmware of all subsystems, both individually and as a complete system, and will be performed using test equipment and live target data as appropriate.</p> <p>Adopted from <b>EMS-C09-CON-SHA-12980</b>.</p>
<b>ANSP-CON-SHA-07550</b>	<p>The SAT testing <b>shall</b> comprise the following discrete elements:</p> <ul style="list-style-type: none"> <li>a) Deferred FAT Tests;</li> <li>b) System;</li> <li>c) Reliability Demonstration;</li> <li>d) Maintainability Demonstration;</li> <li>e) Environmental Tests.</li> <li>f) Cyber security Penetration Test</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-12990</b>.</p> <p><b>Note:</b> <i>Cyber Security Penetration Test will be organized by Contracting Authority.</i></p>

	<p>The Contractor shall support the Cyber Security Penetration Tests by:</p> <ul style="list-style-type: none"> <li>– Using operational software in the IT/ICS environment, including remote monitoring equipment, without additional security measures.</li> <li>– Providing system access with a non-privileged user account for grey box testing for all relevant equipment.</li> <li>– Supplying network schemes, IP ranges, and access rights for all roles.</li> <li>– Ensuring no additional firewalls beyond operational use are installed.</li> <li>– Actively supporting the tests, including network access and user account creation.</li> <li>– Participating in the debriefing and addressing identified vulnerabilities and risks.</li> </ul>
<b>ANSP-CON-SHA-07560</b>	<p>The Contractor <b>shall</b> conclude the Factory Acceptance Testing by performing all tests deferred to site due to lack of live data or associated facilities.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13000</b></p>
<b>ANSP-CON-SHA-07570</b>	<p>The Contractor <b>shall</b> perform complete and thorough testing of all units, modules and subsystems interconnected to form the whole deliverable System to demonstrate the System's compliance with all the operational and performance requirements of this specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13010</b>.</p>
<b>ANSP-CON-SHA-07580</b>	<p>The System tests <b>shall</b> include network or site to site interfaces and functional tests as necessary to prove compliance with the requirements of this specification.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13020</b>.</p>
<b>ANSP-CON-SHA-07590</b>	<p>The Reliability demonstration <b>shall</b> be performed in accordance with EMS 9.7.2.1.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13030</b>.</p>
<b>ANSP-CON-SHA-07600</b>	<p>The Maintainability demonstration <b>shall</b> be performed in accordance with EMS 9.7.2.3.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13040</b>.</p>

<b>ANSP-CON-SHA-07610</b>	<p>The Contractor <b>shall</b> provide a QA-approved report which ensures that the System continues to operate and meet all the operational and performance requirements of this specification whilst operating in the internal and external conditions described in 9.2.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13050</b></p>
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#### 13.10.4.3 Acceptance

<b>ANSP-CON-SHA-07620</b>	<p>Following satisfactory completion of all Site Acceptance Tests the Contractor <b>shall</b> offer the System for formal acceptance by the Contracting Authority.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13060</b>.</p>
<b>ANSP-CON-SHA-07630</b>	<p>A formal Technical Completion (TC) meeting <b>shall</b> be held to consider the Provisional Acceptance of the System.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13070</b></p>
<b>ANSP-CON-SHA-07640</b>	<p>The Technical Completion (TC) meeting <b>shall</b> examine the following areas to establish their completion or identify outstanding observations that have to be cleared within prescribed timescales:</p> <ul style="list-style-type: none"> <li>a) System: The complete Configuration Control (build state) will be provided for all deliverable hardware, software and firmware. Special to type test equipment and support/test software is included as part of the build state. A complete list of all major concessions and production permits is provided with their relevant build states;</li> <li>b) Training: All training is complete (all 3 phases) to ensure that adequately trained engineers are available to undertake equipment maintenance;</li> <li>c) Spares: The Configuration Control (build state) of all deliverable spares is provided. All spares has been tested and delivered prior to TC. The build state of spares is identical to that of the main equipment;</li> <li>d) Documentation: All deliverable documentation has been provided;</li> <li>e) Test Equipment: All deliverable test equipment including software and hardware support facilities (if applicable) has been provided.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-13080</b>.</p>



<b>ANSP-CON-SHA-07650</b>	<p>All Problem Reports and observations <b>shall</b> be closed or action assigned and agreed.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13090</b></p>
<b>ANSP-CON-SHA-07660</b>	<p>Completion of the SAT <b>shall</b> be recorded on the SAT Completion Certificate.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13100</b>.</p>
<b>ANSP-CON-SHA-07670</b>	<p>Certificate of Conformance documentation <b>shall</b> be provided for all deliverable items (including software and firmware)</p> <p>Adopted from <b>EMS-C09-CON-SHA-13110</b></p>
<b>ANSP-CON-SHA-07680</b>	<p>Technical Completion can occur on a subsystem basis, if this option is chosen then a System Technical Completion meeting <b>shall</b> be held to ensure all System aspects have been completed.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13120</b>.</p>
<b>ANSP-CON-SAC-07690</b>	<p>Upon successful completion of the SAT, calibration and commissioning of the Radar into test operation, training of Contracting Authority, and fulfillment of other contractor's obligations as specified in the technical specifications, the Contracting Authority shall issue the »Site Acceptance Certificate« (SAC).</p> <p>Note: Contracting Authority Responsibility</p>

### 13.11 Installation and Commissioning

<b>ANSP-SYS-SHA-07700</b>	<p>The System <b>shall</b> be designed to be located in a site which has been prepared for the purpose of containing the ground station (SSR+PSR).</p> <p>Adopted from <b>EMS-C09-SYS-SHA-13130</b>.</p>
<b>ANSP-CON-SHA-07710</b>	<p>The Contractor shall prepare, deliver and apply an Installation and Commissioning Plan, describing the objectives, the strategy, the milestones, the installation and site testing procedures, acceptance criteria and the respective responsibilities between the Contracting Authority and the Contractor.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13140</b></p>
<b>ANSP-CON-SHA-07720</b>	<p>The Installation and Commissioning Plan <b>shall</b> be subject to a specific planned review, not later than 120 working days before delivery of the radar system.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13150</b>.</p>
<b>ANSP-CON-SHA-07730</b>	<p>The Contractor <b>shall</b> provide all necessary studies and equipment to complete installation at the chosen installation site, and all welfare and temporary services in support of their installation team.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13160</b>.</p>
<b>ANSP-CON-SHA-07740</b>	<p>The Installation and Commissioning Plan <b>shall</b> be approved by the Contracting Authority.</p> <p>RATIONALE: In order to provide a consistent response for the cost of Installation, the following site facilities will be provided by the Contracting Authority:</p> <ul style="list-style-type: none"> <li>a) Tower foundation (Contractor states size and bearing load);</li> <li>b) Electricity supply (Contractor states requirements);</li> <li>c) Data lines and telephone lines (Contractor states requirements);</li> <li>d) Access to site;</li> <li>e) Hard standing for personal vehicles.</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-13170</b></p>

<b>ANSP-CON-SHA-07750</b>	<p>The Installation and Commissioning Plan <b>shall</b> include, but not be limited to, the following aspects:</p> <ul style="list-style-type: none"> <li>a) Physical dimensions and weight of all equipment;</li> <li>b) Power consumption of all equipment;</li> <li>c) Heat dissipation of all equipment;</li> <li>d) Full wiring schedules, interconnection diagram and routing for power, signal, earthing cables;</li> <li>e) Full details of waveguide and RF coax connections and fixing including full dimensions and routing;</li> <li>f) All details for lifting, assembling and fixing the Antennas;</li> <li>g) Procedures for levelling of antenna platform and alignment of the antenna(s);</li> <li>h) Details of site accommodation requirements;</li> <li>i) Details of site plant requirements</li> </ul> <p>Adopted from <b>EMS-C09-CON-SHA-13180</b>.</p>
<b>ANSP-CON-SHA-07760</b>	<p>The documentation <b>shall</b> be updated periodically in order to reflect accurately the complete installation.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13190</b>.</p>
<b>ANSP-TEN-SHA-07770</b>	<p>The Tenderer <b>shall</b> state in their proposal the aspects of the installation to be included in the documentation concerning:</p> <ul style="list-style-type: none"> <li>a) Cabling Arrangements, routing and identification;</li> <li>b) Interference and susceptibility to radio frequency;</li> <li>c) Earthing arrangements;</li> <li>d) Equipment mounting and cooling.</li> </ul> <p>Adopted from <b>EMS-C09-TEN-SHA-13200</b>.</p>
<b>ANSP-CON-SHA-07780</b>	<p>The Contractor <b>shall</b> be responsible for all transportation and delivery of equipment to the sites where installation takes place.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13210</b>.</p>
<b>ANSP-CON-SHA-07790</b>	<p>Commissioning will be granted after successful on-site testing with a specified operational environment and acceptance of the associated deliverables specified in the plans.</p> <p>Adopted from <b>EMS-C09-CON-SHA-13220</b>.</p>

### 13.12 Professional References

ANSP-TEN-SHA-07800	<p>The Tenderer <b>shall</b> submit Professional References (<b>Form D/3 and D/3a – Professional Reference</b>) where <b>shall</b> be specified supplies within last 6 years, including the location of the operator's or owner's installation and the period of performance.</p> <p>The reference radar <b>shall not</b> be a prototype; <b>shall not</b> be at the end of the production program and is still repeatedly in production.</p> <p>Within the listed supplies <b>shall</b> be at least:</p> <ol style="list-style-type: none"> <li>1. 4 x reference Mode-S/PSR of the same or similar performance as in the offer for Contracting Authority and of which: <ol style="list-style-type: none"> <li>a) 2 x stand-alone Mode-S of the same or similar performance including instrument range as stated in the offer operated or used by Civilian ATS in the European environment (in EUROCONTROL member states)</li> <li>b) 2 x Mode-S collocated with PSR of the same or similar performance including instrument range as stated in the offer operated or used by Civilian ATS in the European environment (in EUROCONTROL member states)</li> </ol> </li> <li>2. 1 x reference Radome of the same type and similar size for PSR/Mode-S as in the offer for Contracting Authority.</li> <li>3. 1 x reference Tower of the same type and similar size for PSR/Mode-S System as in the offer for Contracting Authority.</li> </ol>
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### 13.13 Warranty Period

ANSP-CON-SHA-07810	The warranty period for all HW and SW mentioned above <b>shall</b> be at least 60 months from the date the Site Acceptance is approved - signing the Site Acceptance Certificate by Contracting Authority.
ANSP-CON-SHA-07820	The Contractor's obligation to correct defects and deficiencies <b>shall</b> apply until all the reported and pending defects and deficiencies from the Site Acceptance, as well as from the warranty reporting period, have been corrected in a satisfactory way.

13.14 Compliance with Regulation (EU) 2017/373

<b>ANSP-CON-SHA-07830</b>	In accordance with Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulations (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377, and amending Regulation (EU) No 677/2011 (OJ L 62, 8.3.2017, p. 1–126), the Contractor <b>shall</b> ensure to the Contracting Authority that, throughout the duration of the contract, it will comply with the safety requirements arising from the aforementioned Regulation in relation to the Contracting Authority’s outsourced services, and shall allow the competent oversight authority in the field of civil aviation safety and security — the Slovenian Civil Aviation y — to carry out a possible safety audit.
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..... *end of System Specification (Part B)* .....

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