



**Advanced Surface Movement Guidance and
Control System (A-SMGCS);
Part 5: Harmonised Standard for access to
radio spectrum for Multilateration (MLAT) equipment;
Sub-part 1: Receivers and Interrogators**

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.3] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is part 5, sub-part 1, of a multi-part deliverable covering Advanced Surface Movement Guidance and Control System (A-SMGCS), as identified below.

- Part 1: "Community Specification for A-SMGCS surveillance service including external interfaces";
- Part 2: "Community Specification for A-SMGCS airport safety support service";
- Part 3: "Community Specification for a deployed cooperative sensor including its interfaces";
- Part 4: "Community Specification for a deployed non-cooperative sensor including its interfaces";
- Part 5: "Harmonised Standard for access to radio spectrum for Multilateration (MLAT) equipment":**
 - Sub-part 1: "Receivers and Interrogators";**
 - Sub-part 2: "Reference and vehicle transmitters";
- Part 6: "Harmonised Standard for access to radio spectrum for deployed surface movement radar sensors";

Part 7: "Community Specification for A-SMGCS routing service";

Part 8: "Community Specification for A-SMGCS guidance service".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

A-SMGCS are systems providing routing, guidance, surveillance and control to aircraft and affected vehicles in order to maintain movement rate under all local weather conditions within the Aerodrome Visibility Operational Level (AVOL) whilst maintaining the required level of safety.

[ETSI EN 303 213-5-1 V2.0.0 \(2023-07\)](#)

<https://standards.iteh.ai/catalog/standards/sist/3f9506e8-5db5-4aab-824f-61090443c784/etsi-en-303-213-5-1-v2-0-0-2023-07>

1 Scope

The present document specifies technical characteristics and methods of measurements for the following equipment:

- 1) Interrogators transmitting in the 1 030 MHz band, used in Mode S multilateration equipment in an Advanced Surface Movement Guidance and Control System (A-SMGCS).
- 2) Receivers, receiving in the 1 090 MHz band, used in Mode S multilateration equipment in an Advanced Surface Movement Guidance and Control System (A-SMGCS).

Antennas for this equipment are passive without an additional amplifier.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in Annex A.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] <http://www.icao.int/DocLibrary/3880/3880.pdf> **ICAO Annex 10, Volume IV**: "Surveillance Radar and Collision Avoidance Systems", 5th edition, July 2014, including amendments up to amendment 91 dated 18-07-2022.
- [2] Void.
- [3] [ETSI EN 300 019-1-3 \(V2.4.1\) \(2014-04\)](#): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".
- [4] [ETSI EN 300 019-1-4 \(V2.2.1\) \(2014-04\)](#): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

2.2 Informative references

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] [Directive 2014/53/EU](#) of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

- [i.2] ITU Radio Regulations (2020).
- [i.3] [Commission Implementing Decision C\(2015\) 5376 final of 4.8.2015](#) on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.4] [ECC/Recommendation \(02\)05 \(2012\)](#): "Unwanted emissions".
- [i.5] ETSI EG 203 336 (V1.2.1): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.6] [ERC/Recommendation 74-01 \(2019\)](#): "Unwanted emissions in the spurious domain".
- [i.7] EUROCAE ED-117A (September 2016): "MOPS for Mode S Multilateration Systems for Use in Advanced Surface Movement Guidance and Control Systems (A-SMGCS)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

conducted measurements: measurements which are made using a wired connection to the EUT

duty cycle: ratio expressed as a percentage, of the cumulative duration of transmissions within an observation interval and the interval itself, as measured in an observation bandwidth

equipment under test: system of constituents provided by the manufacturer for qualification under the present document

ground based multilateration equipment or ground station: aeronautical station equipment intended for use in an A-SMGCS multilateration component

interrogator: aeronautical station equipment including at least one transmitter designed to produce aeronautical mobile service signals at 1 030 MHz

Mode S: particular type of uplink or downlink message defined in ICAO Annex 10, Volume IV [1]

multilateration: surveillance technique which provides position derived from the Secondary Surveillance Radar (SSR) transponder signals (replies or squitters) primarily using Time Difference Of Arrival (TDOA) techniques

NOTE: Additional information, including identification, can be extracted from the received signals.

Operating Channel (OC): frequency range in which the transmission from the EUT occurs, or in which the EUT is intended to receive transmissions

operating frequency: centre of the OC

out of band emissions: power transmitted at frequencies outside the OC but within the specified spectral mask

probability of detection: rate of correctly received and decoded squitter messages

receiver: EUT which includes the capability to convert RF signals into binary content

resolution bandwidth: bandwidth that is used for spectral measurements

transmission: radio emission consisting of one uplink or downlink Mode S message

transmitter: EUT which includes the capability to convert binary content into RF signals

transponder: aeronautical station equipment including at least one transmitter designed to produce aeronautical mobile radionavigation service signals at 1 090 MHz and zero or more receivers designed to receive aeronautical mobile radionavigation service signals at 1 030 MHz

unwanted signal: any signal other than the wanted signal or as described in a specific test case

wanted signal: in-band signal modulated according to the Mode specification

NOTE: Some manufacturers may also accept Mode 3A/C and other modulations which is beyond the scope of the present document.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dB	decibel
dBc	dB relative to carrier
dBm	power in dB relative to 1 milliwatt
dBpp	dB below PEP
f	measurement frequency
μs	Microsecond
Ω	Ohm

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
ADS-B	Automatic Dependant Surveillance Broadcast
A-SMGCS	Advanced Surface Movement Guidance and Control System
AVOL	Aerodrome Visibility Operational Level
CRC	Cyclic Redundancy Check
CW	Continuous Wave
DC	Direct Current
DF	Downlink Format
DME	Distance Measuring Equipment
EUT	Equipment Under Test
ICAO	International Civil Aviation Organization
MOPS	Minimum Operational Performance Specification
NA	Not Applicable
NA	Not Applicable
OC	Operating Channel
OOB	Out Of Band
PD	Probability of Detection
PEP	Peak Envelope Power
RBW	Reference BandWidth
RF	Radio Frequency
RMS	Root Mean Square
RX	Receive
SSR	Secondary Surveillance Radar
TX	Transmit
VBW	Video BandWidth

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use but, as a minimum, shall be that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 Conformance Requirements

4.2.1 Applicability

4.2.1.1 Equipment with and without integral antenna

For the purposes of conducted measurements on an EUT, a 50 Ω connection point shall be provided for test purposes.

For EUT with integral antenna, the connection point shall correspond to the input of the integral antenna.

4.2.1.2 Equipment with multiple functions

Any ground station which includes the interrogator function shall comply with the requirements in clause 4.2.2.

Any ground station which includes the receiver function shall comply with the requirements in clause 4.2.3.

4.2.2 Transmitter requirements

4.2.2.1 Operating frequency and frequency error

4.2.2.1.1 Definition

The operating frequency is the nominal value of the carrier frequency.

The frequency error is the difference between the actual carrier frequency and its nominal value of 1 030 MHz.

4.2.2.1.2 Limits

The nominal value of carrier frequency of the interrogation and control transmissions shall be 1 030 MHz.

The absolute value of the frequency error shall not exceed 0,01 MHz.

NOTE: This limit is specified in ICAO Annex 10, Volume IV [1], clause 3.1.2.1.1 and is stricter than the requirement defined in the ITU Radio Regulations [i.2], Appendix 2.

4.2.2.1.3 Conformance

The conformance tests for this requirement are defined in clause 5.3.1.

4.2.2.2 Spectrum mask

4.2.2.2.1 Definition

A spectrum mask is a set of limit lines applied to a plot of a transmitter spectrum.

The Out of Band domain extends to ± 125 MHz from the actual carrier frequency of 1 030 MHz. The frequencies outside the Out of Band domain are defined as the spurious domain.

4.2.2.2.2 Limits

The measured spectrum shall be below the limit lines shown in Figure 1.

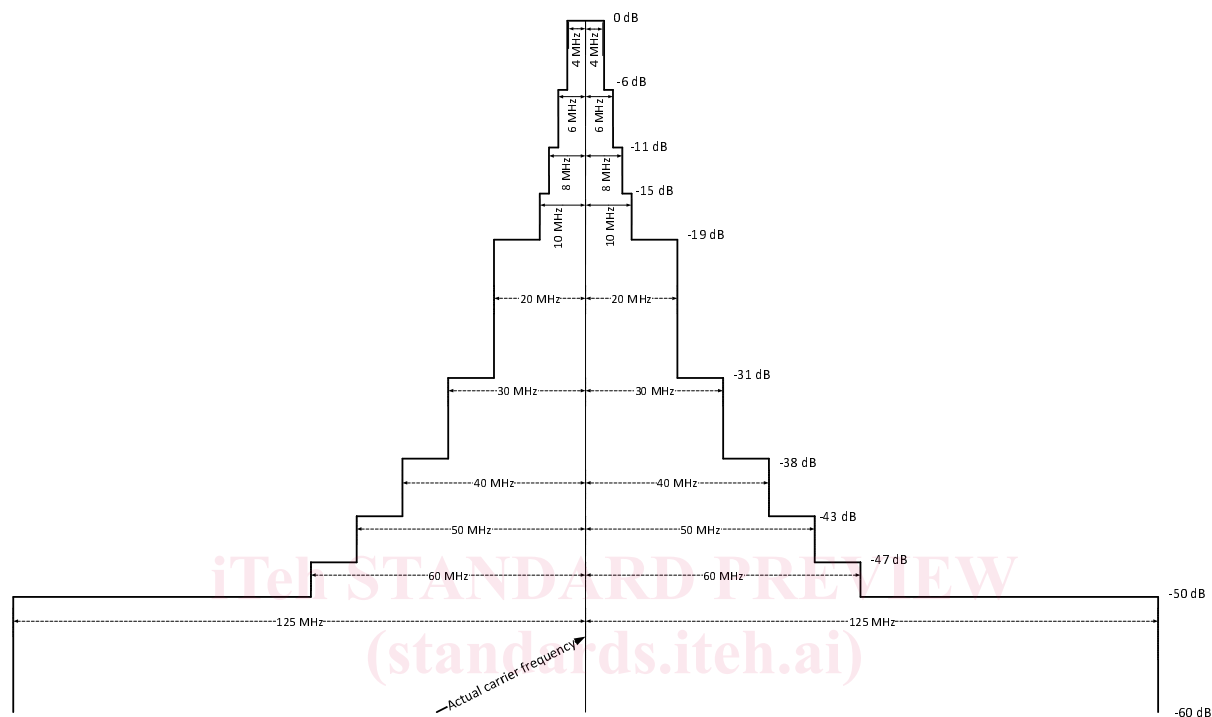


Figure 1: Spectrum mask for an interrogator transmitter

NOTE: The spectrum mask specified in ICAO Annex 10, Volume 4 [1], Figure 3-2 has been modified in order to be consistent with the ITU Radio Regulations [i.2], Appendix 3. The ICAO mask was extrapolated from the last three steps to determine when the mask would intercept the -60 dB point. A value of approximately 125 MHz was reached. 125 MHz is also the point reached when extrapolating the mask from the -40 dB (i.e. 40 MHz) by -40 dB per decade, which is the design objective for the 60 dBpp systems reflected in ECC/Recommendation (02)05 [i.4], Table 3 until the spurious limit is reached. This is also reflected in ECC/Recommendation (02)05 [i.4], Figure A2.1, item a), the Emission Mask for radars.

4.2.2.2.3 Conformance

The conformance tests for this requirement are defined in clause 5.3.2.

4.2.2.3 Residual Power Output

4.2.2.3.1 Definition

The residual power output is the power output when not in the active state.

4.2.2.3.2 Limits

The residual power output shall not exceed the limits specified in Table 1.

Table 1: Limits and measurement bands for the residual power output

Frequency Range	Limits
9 kHz \leq f \leq 1 000 MHz	-57 dBm
1 000 MHz < f \leq 6 000 MHz (see note 1)	-47 dBm
NOTE 1: The upper band measurement limit corresponds to the 5 th harmonic (5 150 MHz) as defined in ERC/Recommendation 74-01 [i.6], Table 1 plus a margin.	
NOTE 2: These limits are specified in ERC/Recommendation 74-01 [i.6], Table 2.	

4.2.2.3.3 Conformance

The conformance tests for this requirement are defined in clause 5.3.3.

4.2.2.4 Spurious emissions of transmitter in active mode

4.2.2.4.1 Definition

Spurious emissions are unwanted emissions in the spurious domain. For active transmitters, the spurious domain is all frequencies apart from the operating channel and the Out-of-Band domain.

4.2.2.4.2 Limits

The power of any unwanted emission in the spurious domain shall not exceed 43 + 10·log (PEP) or 60 dB below PEP (whichever is less stringent) in the frequency range defined in Table 2.

NOTE 1: For PEP \leq 50 W, the limit is equal to -13 dBm.

Table 2: Measurement bands for the emissions in the spurious domain

Lower band	Upper band
9 kHz \leq f < 905 MHz (see note 1, note 3)	1 155 MHz < f \leq 6 000 MHz (see note 2, note 4)
NOTE 1: The lower band measurement limits are defined in ERC/Recommendation 74-01 [i.6].	
NOTE 2: The upper band measurement limit corresponds to the 5 th harmonic (5 150 MHz) as defined in ERC/Recommendation 74-01 [i.6], Table 1 plus a margin.	
NOTE 3: The lower edge of the Out-of-Band Domain equals $f_c - 125$ MHz = 905 MHz.	
NOTE 4: The upper edge of the Out-of-Band Domain equals $f_c + 125$ MHz = 1 155 MHz.	

NOTE 2: These limits are specified in the ITU Radio Regulations [i.2], Appendix 3.

4.2.2.4.3 Conformance

The conformance tests for this requirement are defined in clause 5.3.4.

4.2.2.5 Transmitter Intermodulation attenuation

4.2.2.5.1 Definition

The transmitter intermodulation attenuation is a measure of the capability of a transmitter to inhibit the generation of signals in its non-linear elements caused by the presence of the transmitter power and an interfering signal entering the transmitter via its antenna. It is expressed by the intermodulation attenuation ratio specified as the ratio, in dB, of the PEP level to the power level of the third order intermodulation product.

4.2.2.5.2 Limits

The intermodulation attenuation ratio shall be at least 50 dB in the presence of an external unmodulated CW signal at a power level of +20 dBm or PEP -30 dB (whichever is lower) within a frequency range from 960 MHz to 1 215 MHz.