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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

Reference

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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 application under the Single European Sky Interoperability Regulation EC 552/2004 for A-SMGCS surveillance service including external interfaces";

Part 2: "Community Specification for application under the Single European Sky Interoperability Regulation EC 552/2004 for A-SMGCS airport safety support service";

Part 3: "Community Specification for application under the Single European Sky Interoperability Regulation EC 552/2004 for a deployed cooperative sensor including its interfaces";

Part 4: "Community Specification for application under the Single European Sky Interoperability Regulation EC 552/2004 for a deployed non-cooperative sensor including its interfaces";

Part 5: "Harmonised Standard for access to radio spectrum for multilateration 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 application under the Single European Sky Interoperability Regulation EC 552/2004 for A-SMGCS routing service";

Part 8: "Community Specification for application under the Single European Sky Interoperability Regulation EC 552/2004 for A-SMGCS guidance service".

National transposition dates	
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Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2020
Date of withdrawal of any conflicting National Standard (dow):	31 December 2021

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.

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 external and passive without an additional amplifier.

The present document does not apply to equipment which includes a transponder function, to ground vehicle locators and to reference transmitters which do not contain receivers for the purpose of replying to interrogation.

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 specific, identified by date of publication and/or edition number or version number. Only the cited version 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] ICAO Annex 10, Volume IV: "Surveillance and Collision Avoidance Systems", 5th edition, July 2014, including amendments up to amendment 89.

[2] EUROCAE ED-117A (September 2016): "MOPS for Mode S Multilateration Systems for Use in Advanced Surface Movement Guidance and Control Systems (A-SMGCS)".

[3] ERC/Recommendation 74-01 (2019): "Unwanted emissions in the spurious domain".

2.1 Informative 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.

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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 (2016).

[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".

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

environmental profile: range of environmental conditions under which the EUT is declared by the manufacturer to comply with the provisions of the present document

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

NOTE: A ground station can include sensor, interrogator and/or transponder components. A ground station can be fixed or mobile.

inactive state: entire period between transmissions, less 100 µs transition periods preceding and following the transmission

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 transponder 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 measurements used for spectral measurements

sensor: aeronautical station equipment including at least one receiver designed to receive aeronautical mobile service signals at 1 030 MHz and/or 1 090 MHz

spurious emissions: power transmitted at frequencies below or above the Out-of-Band domain

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude Out of Band emissions.

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
PD	Probability of Detection

3.3 Abbreviations

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

ADS-B	Automatic Dependant Surveillance Broadcast
A-SMGCS	Advanced Surface Movement Guidance and Control System
AVOL	Aerodrome Visibility Operational Level
CRC	Cyclic Redundancy Check
DME	Distance Measuring Equipment
EUT	Equipment Under Test
ICAO	International Civil Aviation Organization
MOPS	Minimum Operational Performance Specification
OC	Operating Channel
PEP	Peak Envelope Power
RBW	Reference BandWidth
RF	Radio Frequency
RMS	Root Mean Square
SSR	Secondary Surveillance Radar

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 declared by the manufacturer in accordance to the environmental requirements stated in EUROCAE ED-117A [2], Chapter 4 (Requirements [REQ 73.] to [REQ 78.]). The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared environmental profile.

4.2 Conformance Requirements

4.2.1 Applicability

4.2.1.1 Equipment with multiple functions

Any ground station which includes the interrogator function shall comply with the requirements in clause 4.2.2 to clause 4.2.5.

Any ground station which includes the receiver function shall comply with the requirements in clause 4.2.6 to clause 4.2.12.

4.2.2 Transmitter operating frequency and frequency error

4.2.2.1 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.

4.2.2.2 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 as specified in ICAO Annex 10, Volume IV [1], clause 3.1.2.1.1.

NOTE: This limit is stricter than the requirement defined in the ITU Radio Regulations [i.2], Appendix 2.

4.2.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.4.1.

4.2.3 Spectrum mask

4.2.3.1 Definition

A spectrum mask is a set of limit lines applied to a plot of a transmitter spectrum. The purpose is to constrain emissions at frequencies in the Out of Band domain which lies immediately outside the intended Operating Channel.

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

The definition of the spectrum mask is chosen as an alternative method to the specification of Out of Band domain emissions.

4.2.3.2 Limits

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