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Napredni sistem za vodenje in nadzor gibanja po zemlji (A-SMGCS) - 6. del: Harmonizirani EN, ki zajema bistvene zahteve člena 3.2 direktive R&TTE za aktivno zaznavalo radarja za površinsko gibanje - 1. poddel: Zaznavala z impulznimi signali in oddajno močjo do 100 kW

Advanced Surface Movement Guidance and Control System (A-SMGCS) - Part 6: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for deployed surface movement radar sensors - Sub-part 1: sensors using pulsed signals and transmitting power up to 100 kW

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Harmonized European Standard (Telecommunications series)

Advanced Surface Movement Guidance and Control System (A-SMGCS); Part 6: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for deployed surface movement radar sensors; Sub-part 1: Sensors using pulsed signals and transmitting power up to 100 kW

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document is part 6, 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 Level 1 including external interfaces";

Part 2: "Community Specification for application under the Single European Sky Interoperability Regulation EC 552/2004 for A-SMGCS Level 2 including external interfaces";

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: "Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for transmitter used in multilateration equipment";

Part 6: "Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for deployed surface movement radar sensors";

Sub-part 1: "Sensors using pulsed signals and transmitting power up to 100 kW".

NOTE: SMR systems using FM-CW signals may be covered by future sub-parts of this multi-part deliverable.

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):	6 months after doa

1 Scope

The present document applies to radar transceiver equipment intended for the surveillance of airport surface movement traffic. The present document covers the essential requirements of article 3.2 of the R&TTE Directive [i.1].

NOTE 1: An airport Surface Movement Radar (SMR) consists of radar transceiver and an antenna.

The scope of the present document is the radar transceiver without antenna. The prerequisite for this is that by using a circulator at the transceiver-output, the transceiver characteristics remain independent from the connected antenna.

It is assumed that the radar antenna is a separate element and not considered as part of the radio equipment. The antenna is considered to be passive, rotating and waveguide-based.

NOTE 2: Since only passive antennas are used for SMR, it is assumed that the antenna does not deteriorate the radio frequency characteristics of the SMR.

Since only waveguide-based SMR systems are covered, the frequency spectrum that needs to be addressed covers 6,56 GHz to 26 GHz.

NOTE 3: The lower limit of this frequency range of 6,56 GHz is obtained as cut-off frequency of the combination of WR112/R84 taper section and a WR90/R100 Waveguide IEC 60153-2 [6]. The upper limit corresponds to the upper limit stated in ERC/Recommendation 74-01 [5].

The present document covers airport surface movement radar sensors operating in the frequency range of 9 000 MHz to 9 200 MHz or 9 300 MHz to 9 500 MHz.

NOTE 4: According Article 5 of the ITU Radio Regulations [1] the band 9 000 MHz to 9 200 MHz is allocated to the Aeronautical Radionavigation Service on a primary basis and the band 9 300 MHz to 9 500 MHz is allocated to the Aeronautical Radionavigation Service on a secondary basis.

Only radars with a maximum peak power up to 100 kW are covered in the present document.

SMR systems comprising active electronically scanned antennas are not covered by the present document.

2 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 reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://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.

2.1 Normative references

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

[1] International Telecommunication Union (ITU) Geneva 2008: "Radio Regulations".

[2] ITU-R Recommendation M.1177-3 (2003): "Techniques for measurement of unwanted emissions of radar systems".

[3] ITU-R Recommendation SM.1541-2 (2006): "Unwanted emissions in the out-of-band domain".

[4] ECC/Recommendation (02)05 (2002): "Unwanted emissions".

[5] ERC/Recommendation 74-01 (2005): "Unwanted emissions in the spurious domain".

[6] IEC 60153-2 (Edition 2.0, 1974): "Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides".

NOTE: More stringent requirements envisioned for future versions of ITU-R Recommendation SM.1541-2, ECC/Recommendation (02)05 and ERC/Recommendation 74-01 (2005) may need to be considered in a future version of the present document.

2.2 Informative references

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 1999/5/EC of The European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[i.2] Merrill I. Skolnik:"Radar Handbook", 2nd Edition, McGraw Hill publications.

3 Symbols and abbreviations

3.1 Symbols

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

B_{-40}	-40 dB bandwidth
B_C	Chirp bandwidth
B_n	necessary bandwidth
B_{res}	3dB resolution bandwidth of transceiver
dBpp	dB with respect to peak power
$D_{no\ spur}$	Detectability Factor (function of PD & Pfa) = 0,1
k	Boltzmanns constant
MD	Minimum Detectable Signal
NF_{sys}	Noise Figure of the system
PD	Probability of detection = 10^{-3} (selected value)
Pfa	Probability of false detection = 10^{-3} (selected value)
P_m	Mean power of transmission
PRT	Pulse Repetition Time
P_t	Pulse power of transmission
t	Time
t_p	Pulse duration of transmission
t_r	Pulse rise time
T_0	Temperature in Kelvin
T_C	Chirp length in sec.
λ	Wavelength

3.2 Abbreviations

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

FM-CW	Frequency Modulated Continuous Wave
LNA	Low Noise Amplifier
OoB	Out-of-Band
PEP	Peak Envelope Power
PRT	Pulse Repetition Time
R&TTE	Radio and Telecommunication Terminal Equipment

SMR Surface Movement Radar

4 Technical requirements

4.1 Environmental profile

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile which, as a minimum, shall be that specified in the test conditions contained in the present document.

As technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions as specified in the present document to give confidence of compliance for the affected technical requirements (which shall also be within the boundary limits of the declared operational environmental profile).

4.2 Conformance requirements

4.2.1 Operating frequency

4.2.1.1 Definition

In the case of a single- or a dual-frequency pulse radar, the transmitter produces short microwave pulses, which causes a broad frequency spectrum, depending on the pulse duration and the pulse repetition frequency. The operating frequency is to be understood as the frequency of the microwave during the transmitting pulse and is represented by the spectral line of highest amplitude.

4.2.1.2 Limits

In all operating modes the operation frequency and the occupied bandwidth of the signal shall be contained completely within the frequency ranges 9 000 MHz to 9 200 MHz or 9 300 MHz to 9 500 MHz.

The limit for the frequency tolerance for unmodulated pulsed SMR is ±30 MHz.

4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.1 shall be carried out.

4.2.2 Transmitter power

4.2.2.1 Definition

The transmitter power shall be referenced with respect to the output port of the radar transmitter.

The transmitter power of a pulse radar is understood as the transmitter pulse power P_t which is determined as the mean value of the microwave power during the transmission pulse. For the arithmetic mean value of the transmitting power, integrated over the PRT, the abbreviation P_m will be used.

If the transmitter power varies over the azimuth, the peak power over one rotation period has to be used.

4.2.2.2 Limits

The transmitter power shall be as specified by the manufacturer with an accuracy of at least ±0,5 dB. The peak power value shall not exceed 100 kW (50 dBW).

4.2.2.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out.

4.2.3 Radiated Out-of-band emissions

4.2.3.1 Definition

An important parameter of the Out-of-Band (OoB) emissions mask of the radar is the -40 dB bandwidth. Annex 8 of ITU-R Recommendation SM.1541-2 [3] specifies the -40 dB bandwidth specified for various types of waveforms (e.g. pulsed radar signals). With the following assumptions which apply to most airport surface movement radars these specifications can be further simplified:

- the radar is operating in the bands 9 000 MHz to 9 200 MHz or 9 300 to 9 500 MHz
- the pulse power is below 100 kW
- the pulse rise time t_r is greater than 0,0094·t, where t is the pulse duration

With the aforementioned assumptions the -40 dB bandwidth (B_{-40}) for primary non-FM pulse radars can be determined as follows:

$$B_{-40} = \frac{7.6}{\sqrt{t \times t_r}}$$

Where:

t is the pulse duration

t_r is the rise time in the case of a trapezoidal pulse

NOTE: For typical values of a pulse duration of t = 50 ns and a rise time of t_r = 10 ns the formula above yields a -40 dB bandwidth value of 340 MHz.

For radars with multiple pulse waveforms, the B_{-40} bandwidth should be calculated for each individual pulse type and the maximum B_{-40} bandwidth obtained shall be used to establish the shape of the emission mask.

For radars with a highly asymmetrical spectrum, the B_{-40} dB bandwidth can be offset from the frequency of maximum emission level, but the necessary bandwidth, B_N (ITU Radio Regulation No. 1.152 [1]) and preferably, the overall occupied bandwidth (ITU Radio Regulation No. 1.153 [1]), should be contained completely within the allocated band as stipulated in section 4 of Appendix 8 of ITU-R Recommendation SM.1541-2 [3].