



**Advanced-Surface Movement Guidance  
and Control System (A-SMGCS);  
Part 6: Harmonised Standard covering the essential  
requirements of article 3.2 of the Directive 2014/53/EU for  
deployed surface movement radar sensors;  
Sub-part 1: X-band sensors using pulsed signals and  
transmitting power up to 100 kW**

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## Foreword

This final 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 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.13] 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 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: "Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU for transmitter used in multilateration equipment";
- Part 6: "Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU for deployed surface movement radar sensors";**

**Sub-part 1: "X-band 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):	18 months after doa

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## 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.

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## Executive Summary

The present document covers the essential requirements for efficient use of radio spectrum by surface movement radar sensors in the bands 9 000 MHz to 9 200 MHz and 9 300 MHz to 9 500 MHz using pulsed signals and a transmitting power up to 100 kW. The current version includes necessary changes due to adaption to the new Radio Equipment Directive 2014/53/EU [i.1].

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# 1 Scope

The present document applies to X-band radar sensors intended for the surveillance of airport surface movement traffic with the following characteristics:

- Operating in one or both of the following frequency ranges:
  - 9 000 MHz to 9 200 MHz and 9 300 MHz to 9 500 MHz utilizing modulated or unmodulated pulses.
- Transmitter Peak Envelope Power up to 100 kW.
- The transceiver-antenna connection is using a hollow metallic rectangular waveguide.
- The antenna is rotating, waveguide-based and passive.
- At the transceiver output an RF-circulator is used.

NOTE 1: Since transceiver and antenna are hollow metallic rectangular waveguide based the frequency range for measurements that needs to be addressed covers 6,56 GHz to 26 GHz. The lower limit of this frequency range is obtained as cut-off frequency of the combination of WR112/R84 taper section and a WR90/R100 Waveguide IEC 60153-2 [i.3]. The upper limit corresponds to the upper limit stated in ERC/Recommendation 74-01 [i.5].

NOTE 2: Since at the transceiver output an RF circulator is used, it is assumed that the transceiver characteristics remain independent from the antenna.

NOTE 3: Aeronautical Surface Movement Radars covered by the present document are expected to use the bands 9 000 MHz to 9 200 MHz and/or 9 300 MHz to 9 500 MHz. According Article 5 of the ITU Radio Regulations [i.6] 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 Radionavigation Service on a primary basis.

The present document contains requirements to demonstrate that "... *Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*" [i.1].

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the Radio Equipment Directive 2014/53/EU [i.1] as well as essential requirements under the SES Interoperability Regulation 552/2004 [i.9] and related implementing rules and/or essential requirements under the EASA basic regulation 216/2008 [i.12] may apply to equipment within the scope of the present document.

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## 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 <http://docbox.etsi.org/Reference>.

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

Not applicable.

## 2.2 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.

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] Merrill I. Skolnik: "Radar Handbook", 2nd Edition, McGraw Hill publications.
- [i.3] IEC 60153-2 (Edition 2.0, 1974): "Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides".
- [i.4] ECC/Recommendation (02)05 (2012): "Unwanted emissions".
- [i.5] ERC/Recommendation 74-01 (2011): "Unwanted emissions in the spurious domain".
- [i.6] ITU Radio Regulations (2012).
- [i.7] Recommendation ITU-R M.1177-4 (2011): "Techniques for measurement of unwanted emissions of radar systems".
- [i.8] Recommendation ITU-R SM.1541-5 (2013): "Unwanted emissions in the out-of-band domain".
- [i.9] EC Regulation No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (interoperability Regulation), OJ L 96, 31.03.2004, p. 26 as amended by Regulation (EC) No 1070/2009, OJ L 300, 14.11.2009, p. 34.
- [i.10] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.11] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.12] Regulation (EC) 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC.
- [i.13] 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.

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**necessary bandwidth:** width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions for a given class of emission

NOTE: This definition is taken from ITU Radio Regulations [i.6].



**occupied bandwidth:** width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage  $\beta/2$  of the total mean power of a given emission

NOTE 1: This definition is taken from ITU Radio Regulations [i.6].

NOTE 2: Unless otherwise specified in an ITU-R Recommendation for the appropriate class of emission, the value of  $\beta/2$  should be taken as 0,5 %.

**peak envelope power:** average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions

NOTE: This definition is taken from ITU Radio Regulations [i.6].

**pulse duration:** time between the 50 % amplitude (voltage) points

**pulse rise time:** time taken for the leading edge of the pulse to increase from 10 % to 90 % of the maximum amplitude (voltage)

## 3.2 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
$B_{res}$	3 dB resolution bandwidth of transceiver
dB/dec	dB per decade
$dB_{pp}$	dB with respect to peak power
$D_{no\ spur}$	Detectability Factor (function of PD & Pfa)
$k$	Boltzmann's constant
$MDS$	Minimum Detectable Signal
$NF_{sys}$	Noise Figure of the system
$PD$	Probability of detection
$Pfa$	Probability of false alarm
$P_t$	Pulse power of transmission
$t$	Time
$t_p$	Pulse duration
$t_r$	Pulse rise time
$T_0$	Temperature in Kelvin
$T_C$	Chirp length in seconds
$\lambda$	Wavelength

## 3.3 Abbreviations

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

AC	Alternating Current
A-SMGCS	Advanced-Surface Movement Guidance and Control System
EASA	European Aviation Safety Agency
FM	Frequency Modulation
FM-CW	Frequency Modulated Continuous Wave
LNA	Low Noise Amplifier
MDS	Minimum Detectable Signal
OoB	Out-of-Band
PEP	Peak Envelope Power
RF	Radio Frequency
SES	Single European Sky
SMR	Surface Movement 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 supplier, 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 declared operational environmental profile.

### 4.2 Conformance requirements

#### 4.2.1 Transmitter requirements

##### 4.2.1.1 Operating frequency

###### 4.2.1.1.1 Definition

The transmitter of a pulsed radar produces microwave pulses, which cause a broad frequency spectrum, depending on the pulse duration.

In the present document the operating frequency is considered to be the frequency of the microwave emission during the transmitting pulse and is represented by the spectral line of highest amplitude.

NOTE: It is only practicable to indicate an operating frequency for radars with unmodulated pulses. In this case a limit for the frequency tolerance is specified. For radars with modulated pulses such a limit is not applicable. In any case the occupied bandwidth is completely contained in the allocated frequency band(s).

###### 4.2.1.1.2 Limits

The frequency tolerance for SMR applying unmodulated pulses shall be  $\pm 30$  MHz.

For all radar types covered by the present documents 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 in all operating modes.

###### 4.2.1.1.3 Conformance

The conformance tests are specified in clause 5.3.1.1.

##### 4.2.1.2 Transmitter power

###### 4.2.1.2.1 Definition

In the present document the transmitter power of a pulse radar is considered to be the peak value of the transmitter pulse power during the transmission pulse (PEP).

If the transmitter power varies over the azimuth, the highest PEP over at least one rotation period has to be used.

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

###### 4.2.1.2.2 Limits

The transmitter power shall be as specified by the manufacturer with an accuracy of at least  $\pm 1$  dB. The peak power value shall not exceed 100 kW (50 dBW).

###### 4.2.1.2.3 Conformance

The conformance tests are specified in clause 5.3.1.2.