SLOVENSKI STANDARD
SIST EN 303 364-2 V1.1.1:2021

01-april-2021

Primarni nadzorni radar (PSR) - Harmonizirani standard za dostop do radijskega spektra - 2. del: Senzorji PSR za nadzor zračnega prometa (ATC), ki delujejo v frekvenčnem pasu od 2700 MHz do 3100 MHz (pas S)

Primary Surveillance Radar (PSR) - Harmonised Standard for access to radio spectrum - Part 2: Air Traffic Control (ATC) PSR sensors operating in the frequency band 2 700 MHz to 3 100 MHz (S band)

Ta slovenski standard je istoveten z: **ETSI EN 303 364-2 V1.1.1 (2021-02)**

ICS:

03.220.50	Zračni transport	Air transport
33.060.99	Druga oprema za radijske komunikacije	Other equipment for radiocommunications

SIST EN 303 364-2 V1.1.1:2021 **en**

ETSI EN 303 364-2 V1.1.1 (2021-02)

Primary Surveillance Radar (PSR); Harmonised Standard for access to radio spectrum; Part 2: Air Traffic Control (ATC) PSR sensors operating in the frequency band 2 700 MHz to 3 100 MHz (S band)

Reference
DEN/ERM-TGAERO-31-2

Keywords
aeronautical, harmonised standard, radar, radio

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
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

Copyright Notification

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

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.2] 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 2 of a multi-part deliverable covering ground based ATC Primary Surveillance Radar (PSR), as identified below:

Part 1: "Air Traffic Control (ATC) PSR sensors operating in the frequency band 1 215 MHz to 1 400 MHz (L band)";

Part 2: "Air Traffic Control (ATC) PSR sensors operating in the frequency band 2 700 MHz to 3 100 MHz (S band)";

Part 3: "Air Traffic Control (ATC) PSR sensors operating in the frequency band 8 500 MHz to 10 000 MHz (X band)".

National transposition dates	
Date of adoption of this EN:	18 February 2021
Date of latest announcement of this EN (doa):	31 May 2021
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2021
Date of withdrawal of any conflicting National Standard (dow):	30 November 2022

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.

1 Scope

The present document specifies technical characteristics and methods of measurements for ground based monostatic ATC primary surveillance radars with the following characteristics:

- operating in the 2 700 MHz to 3 100 MHz frequency range;
- transmitter output peak power up to 100 kW;
- the transceiver-antenna connection uses a hollow metallic rectangular waveguide of type WR284/WG10/R32 according to IEC 60153-2 [i.6] with a minimum length between the output of the power amplifier and the input to the antenna of 2,886 m (20 times the wavelength of the waveguide cut-off frequency);
- the antenna rotates, is waveguide-based and passive;
- the transceiver output uses a RF circulator.

NOTE 1: Phased array ATC primary surveillance radars are not covered by the present document.

NOTE 2: 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] ECC/Recommendation (02)05 (2012): "Unwanted emissions".

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

[3] Recommendation ITU-R M.1177-4 (04/2011): "Techniques for measurement of unwanted emissions of radar systems".

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] 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.3] ITU Radio Regulations (2020).

[i.4] Recommendation ITU-R SM.1541-6 (08/2015): "Unwanted emissions in the out-of-band domain".

[i.5] ETSI EG 203 336 (V1.2.1) (2020): "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] IEC 60153-2 (2016): "Hollow metallic waveguides - Part 2: Relevant specifications for ordinary rectangular waveguides".

[i.7] Recommendation ITU-R SM.331-4 (07/1978): "Noise and sensitivity of receivers".

[i.8] Recommendation ITU-R SM.332-4 (07/1978): "Selectivity of receivers".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

active state: state which produces the authorized emission

auxiliary receiver: radar receiver not included in the transceiver

NOTE: For example an auxiliary receiver could be used for high beam antenna pattern.

dummy load: device connected to a waveguide or coaxial cable and matched to their impedance (typically 50 Ohms) to absorb the RF energy propagating inside

equipment under test: device that is the subject of the specific test investigation being described

matched filter: receiver filter that matches the transmitted radar waveform, i.e. this is the filter that maximizes the signal-to-noise ratio of the received pulse

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 1: This definition is taken from ITU Radio Regulation [i.3].

NOTE 2: For Primary radars the necessary bandwidth B_N is considered to be B_{-20} (20 dB bandwidth) as defined in Recommendation ITU-R SM.1541-6 [i.4].

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 β/2 of the total mean power of a given emission

NOTE 1: This definition is taken from ITU Radio Regulation [i.3].

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

operating frequencies: frequencies on which the radar is tuned to operate

operating mode: predefined configuration for a given service accessible to the operator of the radar system

NOTE 1: Several operating modes may be available.

NOTE 2: Changing operating mode might affect the radio characteristics of the radar system.

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 Regulation [i.3].

product configuration: hardware variant of the same typology of system under test (e.g. different power outputs, magnetrons)

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

pulse fall time: time taken for the trailing edge of the pulse to decrease from 90 % to 10 % of the maximum amplitude (voltage)

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

receiver output: output of the digital matched filter function

system coupler: directional waveguide coupler with forward and reverse port or only a forward port

NOTE: The system coupler is inserted in the waveguide run between the circulator and the antenna but not directly located behind the antenna. Usually it is located very close behind the circulator.

unwanted emissions: spurious emissions and out-of-band emissions

NOTE: This definition is taken from ITU Radio Regulation [i.3].

3.2 Symbols

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

B_{-20}	-20 dB bandwidth below PEP of the spectrum of the transmitted waveform
B_{-40}	-40 dB bandwidth below PEP of the spectrum of the transmitted waveform
B_C	Chirp bandwidth
B_N	Necessary bandwidth
B_{res}	3 dB resolution bandwidth of transceiver
dB/dec	dB per decade
dBpp	dB with respect to peak power
$D_{no\ spur}$	Detectability Factor
f_o	Operating Frequency
f_{IF}	Intermediate Frequency
f_{RF}	Receiver operating Frequency
f_{image}	Image Frequency
k	Boltzmann's constant
f_{LO}	Local Oscillator Frequency
Pt	Pulse power of transmission
RF	Radio Frequency
S/N	Signal-to-Noise ratio
t	Time
T_C	Pulse length (of individual chirp waveforms) in seconds
tp	Pulse duration
tr	Pulse rise time
tf	Pulse fall time
T_0	Temperature in Kelvin
λ	Wavelength

3.3 Abbreviations

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

AC	Alternating Current
ATC	Air Traffic Control

CW	Continuous Wave
EIA	Electronic Industries Alliance
IEC	International Electrotechnical Commission
IF	Intermediate Frequency
ITU	International Telecommunication Union
na	not available
NF	Noise Factor
OoB	Out-of-Band
PEP	Peak Envelope Power
ppm	parts per million
PSR	Primary Surveillance Radar
RCSC	Radio Components Standardization Committee
RF	Radio Frequency
WG	Waveguide

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 Transmitter requirements

4.2.1.1 Maximum frequency deviation

4.2.1.1.1 Definition

The maximum frequency deviation is the maximum allowed departure from the operating frequency.

4.2.1.1.2 Limits

The maximum frequency deviation of ATC radar systems at the defined operating frequency shall not exceed 1 250 ppm.

NOTE: This value is specified in Appendix 2 of the ITU Radio Regulations [i.3].

4.2.1.1.3 Conformance

The conformance tests are specified in clause 5.3.1.1.

The results obtained shall not exceed the limits specified in clause 4.2.1.1.2.

4.2.1.2 Transmitter power

4.2.1.2.1 Definition

The transmitter power is the peak value of the transmitter pulse power during the transmission pulse (PEP).

NOTE: The transmitter power is measured at the output port of the transceiver.

4.2.1.2.2 Limits

The transmitter power shall not exceed 100 kW (i.e. 80 dBm).

4.2.1.2.3 Conformance

The conformance tests are specified in clause 5.3.1.2.

The results obtained shall not exceed the limit specified in clause 4.2.1.2.2.

4.2.1.3 Measured B_{-40} bandwidth

4.2.1.3.1 Definition

The measured -40 dB bandwidth (B_{-40}) is the measured bandwidth of the emissions 40 dB below the measured PEP.

4.2.1.3.2 Limits

The measured B_{-40} bandwidth shall always be contained within the 2 700 to 3 100 MHz frequency band.

4.2.1.3.3 Conformance

The conformance tests are specified in clause 5.3.1.3.

The results obtained shall not exceed the limit specified in clause 4.2.1.3.2.

4.2.1.4 Unwanted emissions

4.2.1.4.1 General requirements

The Out-of-Band emission limits and the spurious emission limits shall be based on the calculated B_{-40} bandwidth as defined in annex B. The OoB and spurious domain boundaries are defined in clause 5.3.1.5.

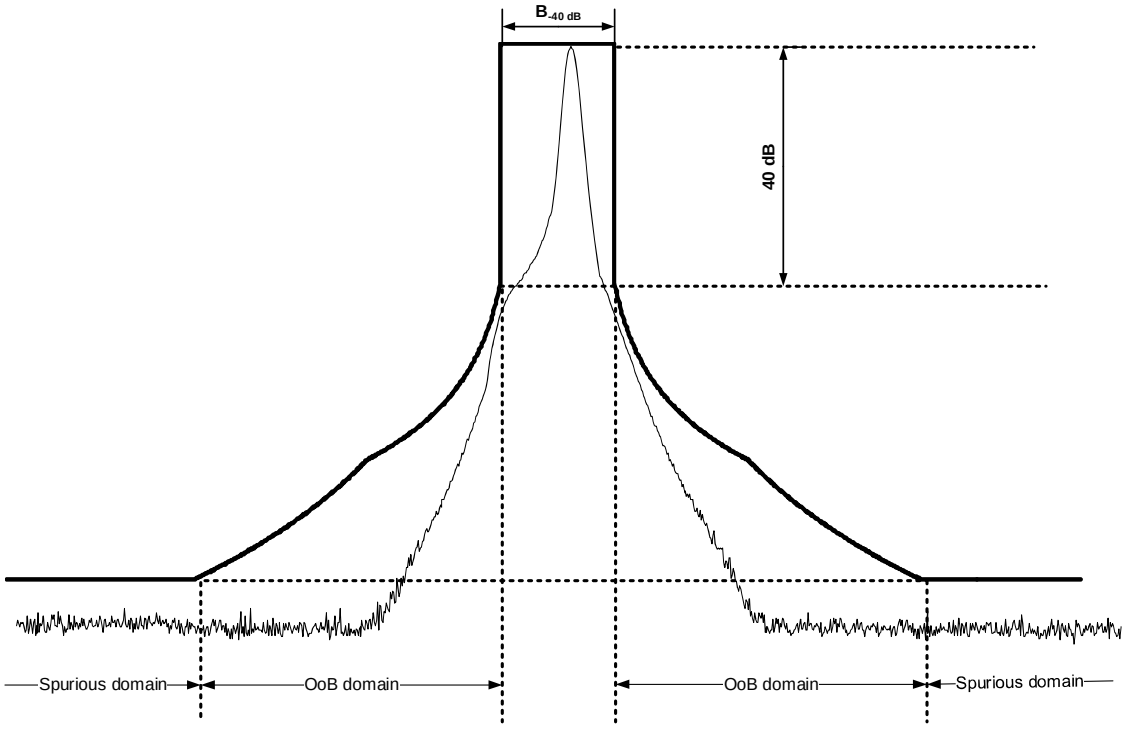

Figure 1: Definition of OoB and spurious emission domains (case of a single operating frequency) (Not to scale)