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HARMONISED EUROPEAN STANDARD

**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

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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.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 Radars (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)".

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.

# 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 $\beta/2$ 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 ($\beta/2$) 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.
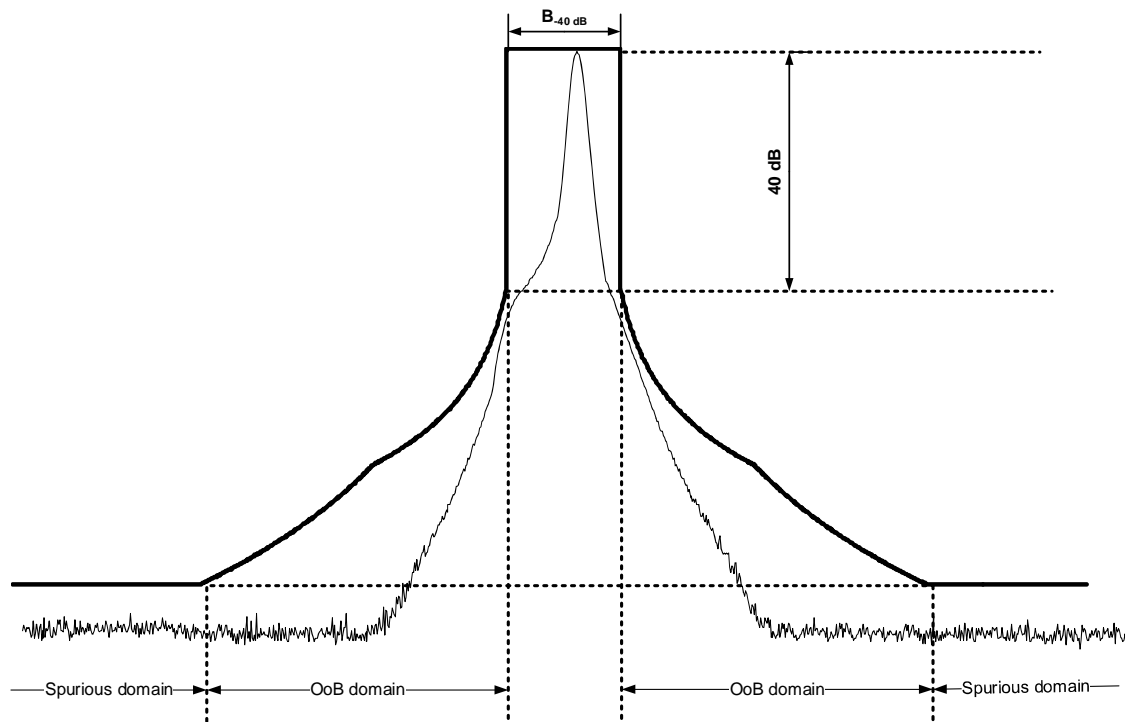
**Figure 1: Definition of OoB and spurious emission domains
(case of a single operating frequency) (Not to scale)**

4.2.1.4.2   Emissions in the Out-of-Band domain

4.2.1.4.2.1   Definition

Out-of-Band emissions refer to emissions in the region between the calculated B_{-40} and the spurious Domain.

4.2.1.4.2.2   Limits

The limits of emissions in the OoB domain shall be as specified in annex 2 of ECC/Recommendation (02)05 [1] and also shown in table 1 (for single frequency radars) and table 2 (for multiple frequency radars).

Table 1: Limits for emissions in the OoB domain for single frequency radars

Frequency offset relative to B_{-40}	Limit dBpp	Slope dB/decade
0,5 to 5	-40 to -70	-30
5 to 15,8	-70 to -100 / -30 dBm (see note 1)	-60
NOTE 1: From -70 to -100 or -30 dBm whichever is less stringent.		
NOTE 2: Frequency offset is a multiplicative factor of B_{-40} value.		

Table 2: Limits for emissions in the OoB domain for multiple frequency radars

Frequency offset relative to B_{-40}	Limit dBpp	Slope dB/decade
0,5 to 2,3	-40 to -43 - 10 × log(PEP) / -60 (see note 1)	-30
NOTE 1: From -40 to -43 - 10 × log(PEP) or -60 dBpp whichever is less stringent.		
NOTE 2: Frequency offset is a multiplicative factor of B_{-40} value.		
NOTE 3: PEP unit is Watt.		

For radars using multiple pulse waveforms, the emission mask shall be calculated for each individual pulse and the widest mask shall be considered.

4.2.1.4.2.3   Conformance

The conformance tests are specified in clause 5.3.1.5.1.

The results obtained shall not exceed the limits specified in clause 4.2.1.4.2.2.

4.2.1.4.3   Emissions in the spurious domain

4.2.1.4.3.1   Definition

Spurious emissions are unwanted emissions in the spurious domain. They include:

- harmonic emissions (i.e. whole multiples of the operating frequency);

- parasitic emissions;

- emissions from intermodulation products (e.g. between oscillator and operating frequency, or between oscillator and harmonics);

- emissions from frequency conversion products.

For transmitters in active state, the spurious domain is all frequencies outside the OoB domain.

4.2.1.4.3.2   Limits

The spurious emissions limits are related to the PEP and shall be as specified in ERC/Recommendation 74-01 [2] annex 5 and also shown in table 3.

Table 3: Limits for emissions in the spurious domain

Radar type	Limits (see note)
Single frequency	100 dB or -30 dBm
Multi-frequency	43 + 10 × log(PEP) or 60 dB whichever is less stringent
NOTE: Absolute levels (dBm in PEP in the reference bandwidth) or attenuation (dB) below the power (PEP) supplied to the antenna port.	

4.2.1.4.3.3 Conformance

The conformance tests are specified in clause 5.3.1.5.2.

The results obtained shall not exceed the limits specified in clause 4.2.1.4.3.2.

4.2.1.4.4 Stand-by mode emissions

4.2.1.4.4.1 Definition

Stand-by mode emissions are residual emissions at the transceiver output when the transmitter is in stand-by mode. In this mode, the transmitter is available for operation, but is not in the active state.

4.2.1.4.4.2 Limits

The stand-by mode emissions shall not exceed -47 dBm as specified in table 15 of ERC/Recommendation 74-01 [2] in the frequency range from 2 077 MHz (the cut-off frequency of the waveguide) up to the 5th harmonic of the operating frequency, apart from ±250 % of the measured necessary bandwidth B_N where no limits are specified.

> NOTE: The radars covered by the present document use WR284/WG10/R32 waveguides to transfer power between the transmitter and the antenna and the waveguide cut-off frequency is 2 077 MHz. Therefore, measurements below this frequency are not required since the waveguide is unable to support power transfer along its length below the cut-off frequency and the limits below this frequency are met.

4.2.1.4.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1.5.3.

The results obtained shall not exceed the limit in clause 4.2.1.4.4.2.

4.2.2 Receiver requirements

4.2.2.1 General requirement

The S-band ATC radars use an RF receiver inside the transceiver function and may use additional RF receivers connected to the radar antenna receiving beams patterns. The receiver requirements shall be tested for all the receivers of the radar.

4.2.2.2 Noise Figure

4.2.2.2.1 Definition

The noise figure is the noise factor as defined below expressed in dB.

The noise factor is the ratio of noise power measured at the output of the receiver to the noise power which would be present at the output if the thermal noise due to the resistive component of the source impedance were the only source of noise in the system; both noise powers are determined at an absolute temperature of the source equal to $T = 293$ K.

> NOTE: The definition of noise factor is taken from ITU-R Recommendation SM.331-4 (§ Recommend 2) [i.7].

4.2.2.2.2   Limits

The Noise Figure shall not exceed 6 dB.

4.2.2.2.3   Conformance

The conformance tests are specified in clause 5.3.2.1.

The result obtained shall not exceed the limits specified in clause 4.2.2.2.2.

4.2.2.3   Receiver Compression Level

4.2.2.3.1   Definition

The compression level is defined as the level of the input signal at which one of the receiver stages becomes non-linear thereby causing distortion and other non-linear effects that prevent proper operation of the receiver itself.

The receiver compression level is defined as the input power when the receiver gain is reduced by 1 dB (i.e. when the receiver output is 1 dB into compression) as shown in figure 2.

Figure 2: Illustration of finding the receiver 1 dB compression point

4.2.2.3.2   Limits

The receiver input compression level of the radar shall be at least -40 dBm.

4.2.2.3.3   Conformance

The conformance tests are specified in clause 5.3.2.2.

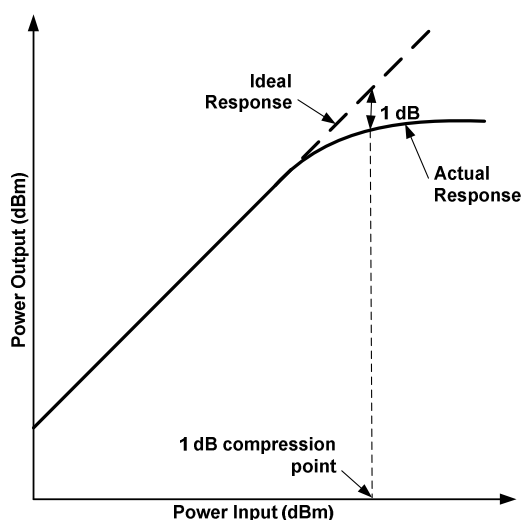The result obtained shall not exceed the limits specified in clause 4.2.2.3.2.

4.2.2.4   Receiver selectivity

4.2.2.4.1   Definition

The radar receiver selectivity is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals.

    NOTE 1: The definition of selectivity is taken from Recommendation ITU-R SM.332-4 [i.8].

NOTE 2: Radar receiver selectivity refers to effects measured within the linear range of the receiver to transpose at its output the radar desired signal and to reject unwanted perturbing signals located outside the B_{-40} bandwidth.

NOTE 3: Unwanted signals inside the B_{-40} bandwidth are not considered for the receiver selectivity since they fall into the desired frequency range for the reception of wanted signals.

NOTE 4: The selectivity curve is the rejection of an unwanted CW signal for a range of frequencies.

4.2.2.4.2 Limit

The required input selectivity characteristic of the radar receiver is based on the calculated B_{-40} bandwidth (see annex B).

The selectivity of a receiver tuned at an operating frequency fo shall be verified in the following frequency ranges:

$$fo - B_{-40}/2 - 500\ \text{MHz} \leq f \leq fo - B_{-40}/2$$

$$fo + B_{-40}/2 \leq f \leq fo + B_{-40}/2 + 500\ \text{MHz}$$

If the image frequencies, as calculated in formula (1) below, are not covered by the frequency ranges defined above, the selectivity measurement shall be done also on the following frequency range:

$$f_{image} - B_{-40}/2 \leq f \leq f_{image} + B_{-40}/2$$

to cover the image frequencies susceptibility.

$$f_{Image} = \begin{cases} f_o + 2 \times f_{IF}, & if\ f_{LO} > f_o \\ f_o - 2 \times f_{IF}, & if\ f_{LO} < f_o \end{cases} \tag{1}$$

The receiver selectivity mask shall be as defined in table 4. An example is shown in figure 3.

Table 4: Receiver selectivity mask

Frequency offset relative to *fo* by multiple of the B_{-40} bandwidth	Relative output level in dB referenced to in-band level	Slope dB/decade
0 to 0,5	0	
0,5	-40	-∞
0,5 to 2,3	-40 to -60	-30
2,3 to ∞	-60 dB	0
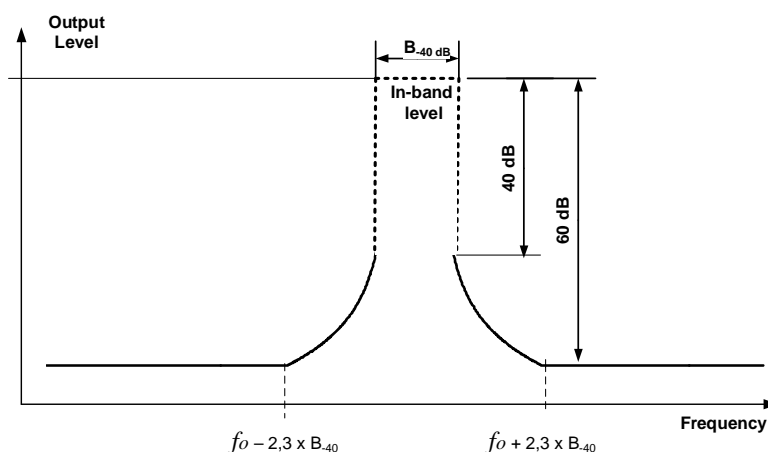
Figure 3: Example of receiver selectivity mask (not to scale)

4.2.2.4.3 Conformance

The conformance tests are specified in clause 5.3.2.3.

The results obtained shall not exceed the limits of the selectivity mask specified in clause 4.2.2.4.2.

5   Testing for compliance with technical requirements

5.1   General requirements

The manufacturer shall ensure that all operating modes and product configurations are in compliance with the technical requirements in the present document.

5.2   Environmental conditions for testing

5.2.1   Test conditions

Unless otherwise stated, all tests shall take place under the following normal test conditions. The standard operating parameters depend very much on the type of the radar. If a particular operating mode is used for measurement this shall be noted by the manufacturer.

5.2.2   Normal temperature and humidity

The temperature and humidity conditions for tests shall be within the following ranges:

   a)   temperature   +15 ºC to +35 ºC

   b)   relative humidity   not exceeding 75 %

5.2.3   Normal test power supply

The test voltage for equipment to be connected to an AC supply shall be the nominal mains voltage declared by the manufacturer -10 % to +10 %. The frequency of the test voltage shall be 50 Hz ± 1 Hz.

5.3   Radio test suites

5.3.1   Transmitter test specification

5.3.1.1   Maximum frequency deviation

The measurement set-up shall be as described in annex C.

To measure the frequency deviation a spectrum analyser shall be used.

The frequency measurements shall be performed with combinations of pulse lengths and PRFs that provide minimum and maximum duty cycles.

The spectrum analyser shall be used to display the frequency spectrum so that the central frequency is determined from the 20 dB below PEP frequencies of the spectrum as measured when determining the B_{-20} bandwidth.

The frequency deviation of the central frequency shall be measured at least at the lowest and highest operating frequency.

The value of the measured operating frequencies shall be noted in the test report.

5.3.1.2   Transmitter power

The measurement set-up shall be as described in annex C.

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

The PEP shall be measured at least at the lowest and highest operating frequency.

If the transmitter power is varied over the azimuth coverage, the highest PEP value set shall be considered. The value of the measured PEP shall be noted in the test report.

### 5.3.1.3	Measured B_{-40} bandwidth

The measurement setup shall be as described in annex C.

The bandwidth of the emissions 40 dB below PEP shall be measured for the lowest and the highest selectable operating frequencies.

The values of the measured lower and upper frequencies of the B_{-40} bandwidth shall be noted in the test report.

### 5.3.1.4	Measured B_{-20} bandwidth

The measurement setup shall be as described in annex C.

The bandwidth of the emissions 20 dB below PEP shall be measured for the lowest and the highest selectable operating frequencies.

The value(s) of the measured B_{-20} bandwidth shall be noted in the test report.

NOTE:	These measurement values are used to define the frequency boundaries for the test of conformance of standby mode emissions.

### 5.3.1.5	Unwanted emissions

### 5.3.1.5.1	Emissions in the Out-of-Band domain

The measurement set-up shall be as described in annex C.

The Out-of-Band power emissions of the transmitter shall be measured at the output port of the transceiver tuned at the operating frequency of the radar.

For multi frequency radar, the test shall be executed for the lowest and highest selectable operating frequencies.

For single operating frequency radars, the Out-of-Band power emissions shall be measured in the frequency range given in table 5.

For multi operating frequencies radars, the Out-of-Band power emissions shall be measured in the frequency range given in table 6.

Table 5: Out-of-Band emissions boundaries for single operating frequency

Lower OoB measurement limit	Upper OoB measurement limit
Maximum value between (Operating frequency - 15,8 x B_{-40}) and 2 077 MHz	Operating frequency + 15,8 x B_{-40}
NOTE 1: 2 077 MHz corresponds to the cut-off frequency of the output waveguide. NOTE 2: B_{-40} is calculated using the formulae in annex B.	

Table 6: Out-of-Band emissions boundaries for multiple operating frequencies

Lower OoB measurement limit	Upper OoB measurement limit
Maximum value between (Operating frequency - 2,3 x B_{-40}) and 2 077 MHz	Operating frequency + 2,3 x B_{-40}
NOTE 1: 2 077 MHz corresponds to the cut-off frequency of the output waveguide. NOTE 2: B_{-40} is calculated from the formulae in annex B.	

Out-of-band boundaries are taken from ECC Recommendation (02)05 [1].

The radars covered by the present document use WR284/WG10/R32 waveguides to transfer power between the transmitter and the antenna and the waveguide cut-off frequency is 2 077 MHz. Therefore, measurements below this frequency do not provide valid results since the waveguide is unable to support power transfer along its length below the cut-off frequency.

All measurements of Out-of-Band emissions shall be made with a reference bandwidth of 1 MHz.

> NOTE: The reference bandwidth is defined in annex 1 of Recommendation ITU-R M.1177-4 [3].

The resolution bandwidth of the measurement equipment shall be in accordance with annex 1 of Recommendation ITU-R M.1177-4 [3].

> EXAMPLE: For a radar with a single operating frequency at 2,8 GHz, a pulse duration of $t = 100$ µs and a rise time of $t_r = 200$ ns, the 40 dB bandwidth calculated applying the equation given at annex B is of the order of 10 MHz depending on the modulation bandwidth. This leads to OoB boundaries at 100 dB below peak power of the operating frequency which are $15,8 \times 10$ MHz = 158 MHz away from the operating frequency. For this example, the absolute boundaries between out-of-band emissions and spurious emissions are: 2,8 GHz - 0,158 GHz = 2,642 GHz and 2,8 GHz + 0,158 GHz = 2,958 GHz.

The measurements of Out-of-band emissions shall be noted in the test report.

5.3.1.5.2   Emissions in the spurious domain

The measurement set-up shall be as described in annex D.

The spurious emissions of the transmitter shall be measured at the output port of the transceiver tuned at the operating frequency of the radar.

For multi frequency radar the test shall be executed for the lowest and highest selectable operating frequency.

The spurious emissions shall be measured in frequency ranges outside the Out-of-Band emissions boundaries as defined in table 7.

All measurements of spurious emissions shall be made with a reference bandwidth of 1 MHz according to ERC/Recommendation 74-01 [2].

Table 7: Spurious emissions measurement bands

Lower band measurement limits	Upper band measurement limits
From 2 077 MHz to the lower OoB boundary	From the upper OoB boundary to 5th harmonic of the operating frequency
NOTE 1: The lower frequency corresponds to the cut-off frequency for ATC radars output waveguide WR-284/R32/WG10 waveguide as defined in IEC 60153-2 [i.6].	
NOTE 2: For fo = 3 100 MHz, this 5th harmonic is equal to 15,5 GHz.	

The radars covered by the present document use WR284/WG10/R32 waveguides to transfer power between the transmitter and the antenna and the waveguide cut-off frequency is 2 077 MHz. Therefore, measurements below this frequency do not provide valid results since the waveguide is unable to support power transfer along its length below the cut-off frequency.

The measurements of the spurious emissions shall be noted in the test report.

5.3.1.5.3   Stand-by mode emissions

The measurement set-up shall be as described in annex D.

The radar system shall be placed in stand-by mode.

The standby mode emissions shall be measured in the frequency ranges outside ± 2,5 times the measured necessary bandwidth aside the operating frequency.

The standby mode emissions shall be measured at the output port of the transceiver tuned at the operating frequency of the radar.

For multi frequency radar the test shall be executed for the lowest and highest selectable operating frequency.

The radars covered by the present document use WR284/WG10/R32 waveguides to transfer power between the transmitter and the antenna and the waveguide cut-off frequency is 2 077 MHz. Therefore, measurements below this frequency do not provide valid results since the waveguide is unable to support power transfer along its length below the cut-off frequency.

All measurements of stand-by mode emissions shall be made as indicated in table 8 where:

- f is the measurement frequency;

- f_{m1} = fo - 2,5 x B_N where B_N is the measured Necessary Bandwidth, i.e. the B_{-20} bandwidth measured in clause 5.4.1.4

- f_{m2} = fo + 2,5 x B_N.

Table 8: Frequency range for measurement and Reference Bandwidths

Frequency Range	Reference Bandwidth
2 077 MHz ≤ f < f_{m1}	1 MHz
f_{m2} ≤ f ≤ 5th harmonic of the operating frequency fo	1 MHz
NOTE 1: The Out-of-Band Domain is defined in clause 4.2.1.4.2.	
NOTE 2: 2 077 MHz correspond to the cut-off frequency of the WR-284/R32/WG10 waveguide as defined in IEC 60153-2 [i.6].	
NOTE 3: The upper band measurement limit corresponds to the 5th harmonic of the upper limit of the operating frequency band as defined in ERC Recommendation 74-01 [2], table 1. For fo = 3 100 MHz, the 5th harmonic is equal to 15,5 GHz.	

The measurements of stand-by mode emissions shall be noted in the test report.

5.3.2   Receiver test specification

5.3.2.1   Noise Figure

The measurement set-up shall be as described in annex E.

The noise figure shall be measured at the input port of the receiver tuned at the operating frequency of the radar.

For multi frequency radar the measurement shall be executed for the lowest and highest selectable operating frequency.

The Y-factor method for the measurement of the receiver noise figure shall be used. A noise source is connected to the radar receiver input port. The receiver noise figure is then determined from the ratio between the noise power values at the output of the intermediate frequency stage with noise source on and noise source off.

The Noise Figure (NF) measurement of the radar receiver shall include the complete receiving signal chain. It shall be measured using a calibrated noise source connected to a noise figure meter.

The receiver frequency shall be documented in the test report.

The noise figure value(s) shall be noted in the test report.

5.3.2.2   Receiver Compression Level

The measurement set-up shall be as described in annex F.

The receiver compression level power shall be measured at the input port of the receiver when the input signal is tuned at the operating frequency of the radar.

For multi frequency radar the measurement shall be executed for the lowest and highest selectable operating frequency.

The receiver frequency shall be documented in the test report.

The method to measure the receiver compression level is to increase the power of a RF sine wave signal injected into the receiver and check linearity at the output of the receiver.

A CW test signal tuned at the operating frequency shall be injected into the radar receiver input port.

The gain response curve of the complete receiver shall be measured and the 1 dB compression point shall be noted.

5.3.2.3   Receiver selectivity

5.3.2.3.1   General setup

The measurement setup shall be as described in annex F.

In order to determine if the receiver selectivity follows the required mask, a disturbing test signal level is applied at the radar receiver input port and the residual level of test signal is measured at the output of the matched filter of the radar receiver.

5.3.2.3.2   Disturbing Test Signals

The disturbing signal shall be a CW signal. The input level of the disturbing signal shall be 4 dB below the receiver compression level measured in clause 5.3.2.2 such that the receiver will not be saturated. The value of this level shall be noted (Ref_In).

A selectivity curve shall be built up incrementally using a disturbing signal which steps through the entire frequency ranges described in clause 4.2.2.4.2.

For the measurement of the receiver(s) of the radar transceiver which is fed through a WG10 waveguide, the selectivity shall be tested only for frequency ranges above the cut-off frequency of 2 077 MHz.

The discrete frequency steps of the disturbing signal shall not exceed half of the bandwidth of the matched filter, or 1 MHz, whichever is smaller.

5.3.2.3.3   Measurement Procedure

Selectivity curves shall be built for the receiver tuned at the minimum and the maximum selectable operating frequencies.

The receiver operating frequency and measurement parameters shall be documented in the test report for each measured selectivity curves.

The measurement steps shall be as follow:

a)   Inject at the receiver's input the disturbing CW signal with a Ref_In level and tuned at the operating frequency of the receiver. Then measure the level of the CW signal at the receiver's output, which shall be noted as the output reference level (Ref_Out).

b)   For each frequency steps over the frequency range, inject the disturbing CW signal and then measure the remaining level of the CW signal at the receiver's output. This shall be noted as the frequency dependent rejected levels P_Out(f).

c)   The difference (in dB) of P_Out(f) to the output reference level Ref_Out shall be recorded as the measured selectivity curve over the frequency range, and shall be compared to the selectivity mask calculated according to the limits described in clause 4.2.2.4.2. The relevant diagram shall be reported in the test report.

If spurious signals from the signal generator are present, this shall be documented in the test report.

Annex A (informative):
Relationship between the present document and the essential requirements of Directive 2014/53/EU

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.

**Table A.1: Relationship between the present document and
the essential requirements of Directive 2014/53/EU**

Harmonised Standard ETSI EN 303 364-2					
Requirement				**Requirement Conditionality**	
No	**Description**	**Essential requirements of Directive**	**Clause(s) of the present document**	**U/C**	**Condition**
1	Maximum frequency deviation	3.2	4.2.1.1	U	
2	Transmitter power	3.2	4.2.1.2	U	
3	Measured B_{-40} Bandwidth	3.2	4.2.1.3	U	
4	Emissions in the Out-of-Band domain	3.2	4.2.1.4.2	U	
5	Emissions in the spurious domain	3.2	4.2.1.4.3	U	
6	Stand-by mode Emissions	3.2	4.2.1.4.4	U	
7	Noise Figure	3.2	4.2.2.2	U	
8	Receiver Compression Level	3.2	4.2.2.3	U	
9	Receiver selectivity	3.2	4.2.2.4	U	

Key to columns:

Requirement:

No   A unique identifier for one row of the table which may be used to identify a requirement.

Description   A textual reference to the requirement.

Essential requirements of Directive

   Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

   Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C   Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition   Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (normative):
Calculation of the B$_{-40}$ bandwidth

Annex 8 of Recommendation ITU-R SM.1541-6 [i.4] defines B$_{-40}$ for various types of waveforms (e.g. pulsed radar signals) assuming that:

- the radar is operating in the band 2 700 MHz to 3 100 MHz;

- the pulse rise time t_r is greater than $0,0094 \cdot t$, where t is the pulse duration.

For primary non-FM pulse radars B$_{-40}$ is determined as follows:

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

(B.1)

Where:

t is the pulse duration.

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

   NOTE 1: For non-FM pulse PSR radars, typical values of a pulse duration of $t = 1\mu s$ and a rise time of $t_r = 200$ ns the formula above yields a -40 dB bandwidth value of 17 MHz.

For pulse FM radars, two formulas are specified in Recommendation ITU-R SM.1541-6 [i.4] for B$_{-40}$:

$$B_{-40} = 1,5\left\{B_C + \sqrt{\pi} \cdot [\ln(B_C \cdot \tau)]^{0,53} \cdot \left[Min\left(B_{rise}, B_{fall}, B_{rise\&fall}\right) + Max\left(B_{rise}, B_{fall}, B_{rise\&fall}\right)\right]\right\} \text{ (B.2)}$$

Where:

- B$_{-40}$ is the -40 dB bandwidth in Hz;

- B$_c$ is the bandwidth of the frequency deviation (total frequency shift during the pulse generation);

- τ is the pulse length including rise & fall times;

$B_{rise} = \frac{1}{\sqrt{\tau \cdot t_r}}$ to account for the rise time;   (B.3)

$B_{fall} = \frac{1}{\sqrt{\tau \cdot t_f}}$ to account for the fall time;   (B.4)

$B_{rise\&fall} = \frac{1}{\sqrt[3]{\tau \cdot t_r \cdot t_f}}$ to account for both the rise and fall times combination;   (B.5)

- t_r is the rise time in seconds;

- t_f is the fall time in seconds:

$$B_{-40} = \frac{K}{\sqrt{t \cdot t_r}} + 2\left(B_C + \frac{A}{t_r}\right)$$

(B.6)

Where:

- K = 7.6 and A = 0,065

   NOTE 2: The term A/t_r adjusts the value of B$_{-40}$ to account for the influence of the rise time, which is substantial when the time-bandwidth product B$_c \cdot t$, is small or moderate and the rise time is short.

   NOTE 3: For FM pulse PSR radars, typical values for a pulse duration of $t = 100 \mu s$ and a rise time of $t_r = 200$ ns the formulas above yield a -40 dB bandwidth value of ≈10 MHz depending on the modulation bandwidth.

Equation (B.2) is only valid when the following conditions are both met:

   1)   the product B_C Minimum (t_r, t_f) is greater than or equal to 0,10; and

   2)   the product of B_C τ or compression ratio is greater than 10.

In all other cases, equation (B.6) is used.

For radars with an asymmetrical spectrum (e.g. magnetron based radars), the B_{-40} bandwidth can be offset from the frequency of maximum emission level.

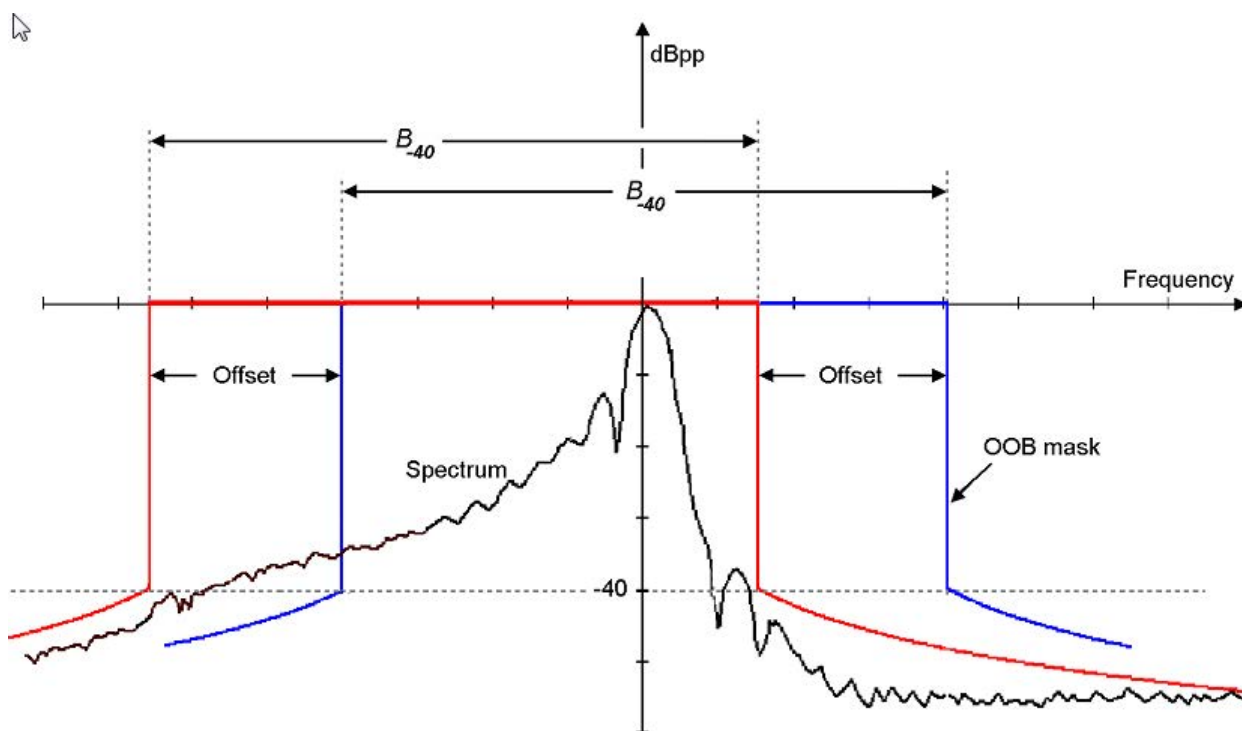The application of this rule is illustrated in figure B.1.

Figure B.1: Application of the offset-rule for the Out-of-Band emission limit mask

Annex C (normative):
Frequency deviation, transmitter power, B_{-40}, B_{-20} and Out-of-band emissions measurement set-up

The radio frequency measurements are performed at the waveguide output of the transceiver with dismounted connection toward the antenna system. The antenna shall be replaced by a dummy load.

A WR-284/WG10/R32 waveguide shall be used to connect the transceiver output.

The test set-up for measurement of the operation frequency, transmit power, B_{-40}, B_{-20} and out-of-band emissions shown in figure C.1 shall be applied.
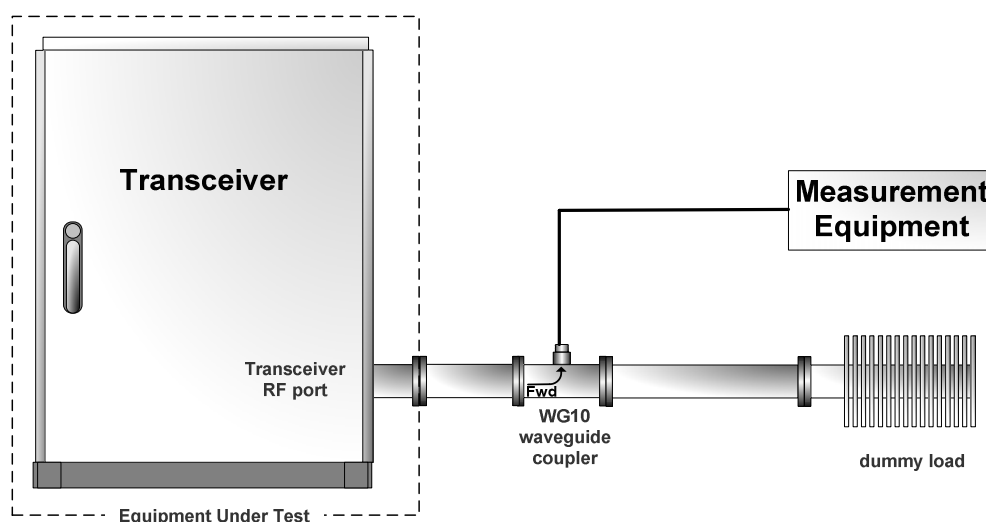
Figure C.1: Test set-up for Operating frequency, transmitter power, B_{-40}, B_{-20} and unwanted Out-of-band emissions measurements

The length of the WG10 waveguide between the output of the transceiver and the directional coupler shall be at least of 20 cm, to avoid measurement of potential evanescent waves. On that flange a directional coupler will be mounted with its main port terminated by the dummy load.

The coupling ratio of the waveguide directional coupler shall be added to the measurement.

To determine the Peak Envelope Power of the pulse, a measurement equipment (spectrum analyser) with direct reading of the transmitter peak power shall be used.

Annex D (normative):
Spurious and stand-by emissions measurement set-up

The radio frequency measurements are performed at the waveguide output of the transceiver with dismounted connection toward the antenna system which is replaced by a dummy load.

The test set-up for measurement of the spurious emissions shown in figure D.1 shall be applied.
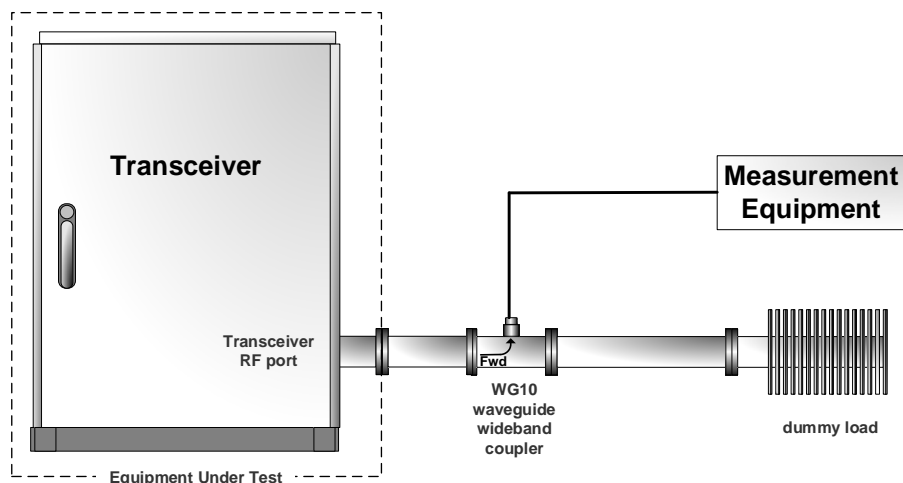
Figure D.1: Test set-up for the spurious emissions measurements

A WR-284/WG10/R32 waveguide shall be used to connect the transceiver output.

A wideband RF coupler inserted between the transceiver output and a dummy load shall applied.

The frequency range of directivity port of the coupler shall be from 2 077 GHz to 15,5 GHz.

The length of the WG10 waveguide between the output of the transceiver and the coupler shall be at least of 20 cm, to avoid measurement of potential evanescent waves.

The coupling ratio from the WG10 waveguide coupler shall be added to the measurement. To obtain a sufficient dynamic range, the radar signal may need to be suppressed by adding a notch filter in front the measurement equipment.

The test set-up for measurement of the stand-by emissions shown in figure D.2 shall be applied.
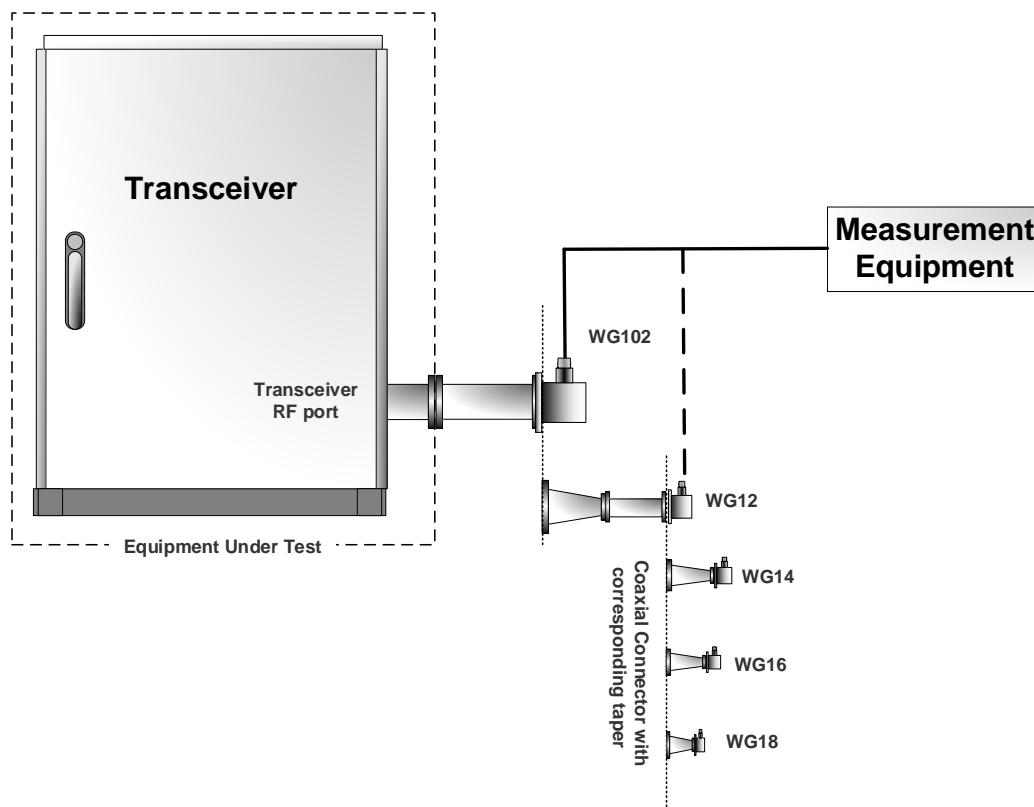
Figure D.2: Test-set-up for the stand-by emissions measurements

The length of the WG10 waveguide between the output of the transceiver and the WG10 coupler shall be at least of 20 cm.

The length of the WG12 waveguide, used as high pass filter, shall be at least of 15 cm.

The frequency ranges of the used waveguides to coaxial transition can be seen in table D.1.

Due to the ambiguous propagation modes of the used S-Band waveguide for higher frequencies, smaller waveguides with linear tapers shall be used for the measurement of higher frequencies. These frequency ranges are also referred to as waveguide bands as described in table D.1.

Each waveguide band shall be measured with its corresponding waveguide resulting in unambiguously measurements for the spurious measurements.

EXAMPLE: For the measurement of the frequency range 5,85 GHz to 8,2 GHz the following setup is used: a taper from WG10 to WG12 followed by a second taper from WG12 to WG14, followed by at least 15 cm of WG14 waveguide terminated with a WG14 to coax transition.

Table D.1: Waveguide bands and associated waveguides

Waveguide band	Frequency range	Cut-off frequency	Waveguide designation		
			EIA	RCSC	IEC
S	2 077 MHz to 3 950 MHz	2 077 MHz	WR284	WG10	R32
C under	3 950 MHz to 5 850 MHz	3 152 MHz	WR187	WG12	R48
C above	5 850 MHz to 8 200 MHz	4 300 MHz	WR137	WG14	R70
X	8 200 MHz to 12 400 MHz	6 556 MHz	WR90	WG16	R100
Ku	12 400 MHz to 18 000 MHz	9 486 MHz	WR62	WG18	R140

Annex E (normative):
Noise Figure measurement set-up

The test set-up for the measurement of the noise figure measurement of the transceiver shown in figure E.1 shall be applied.

For the measurement of the noise figure, the noise level shall be applied using a calibrated noise source connected to the waveguide input of the transceiver through a Coaxial/WG10 transition and measurements shall be performed at the IF output of the receiver.
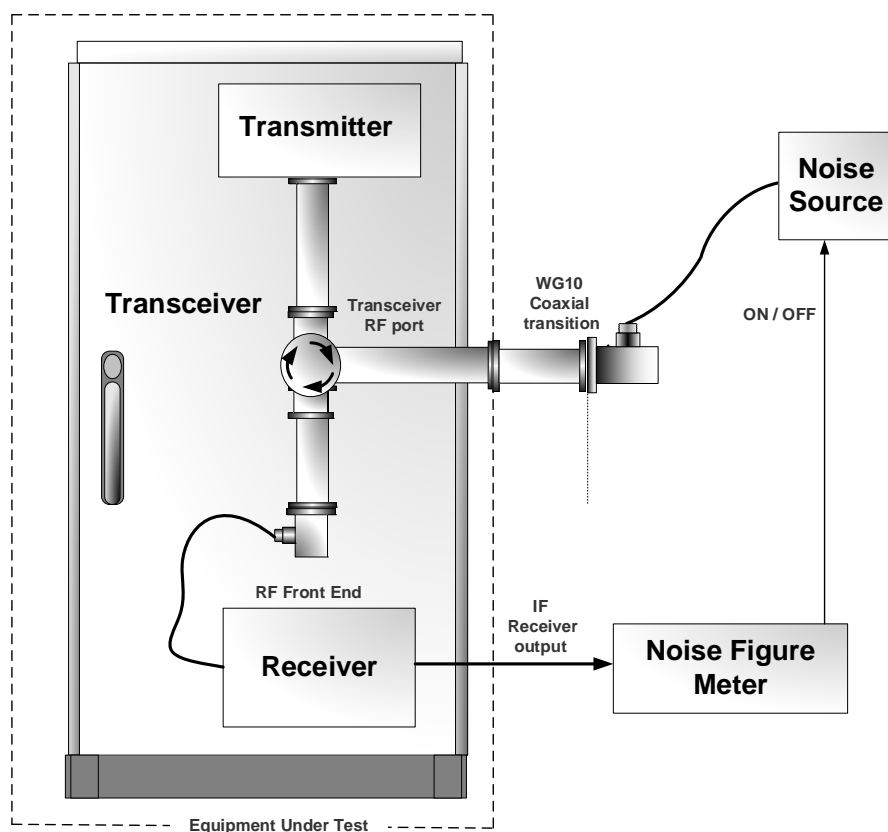
Figure E.1: Test set-up for Noise Figure measurement of the transceiver

In case the auxiliary receiver is with coaxial input, the test setup shown in figure E.2 shall be applied.

For the measurement of the noise figure, the noise level shall be applied using a calibrated noise source connected to the coaxial input of the auxiliary receiver and measurements shall be performed at the IF output of the receiver.
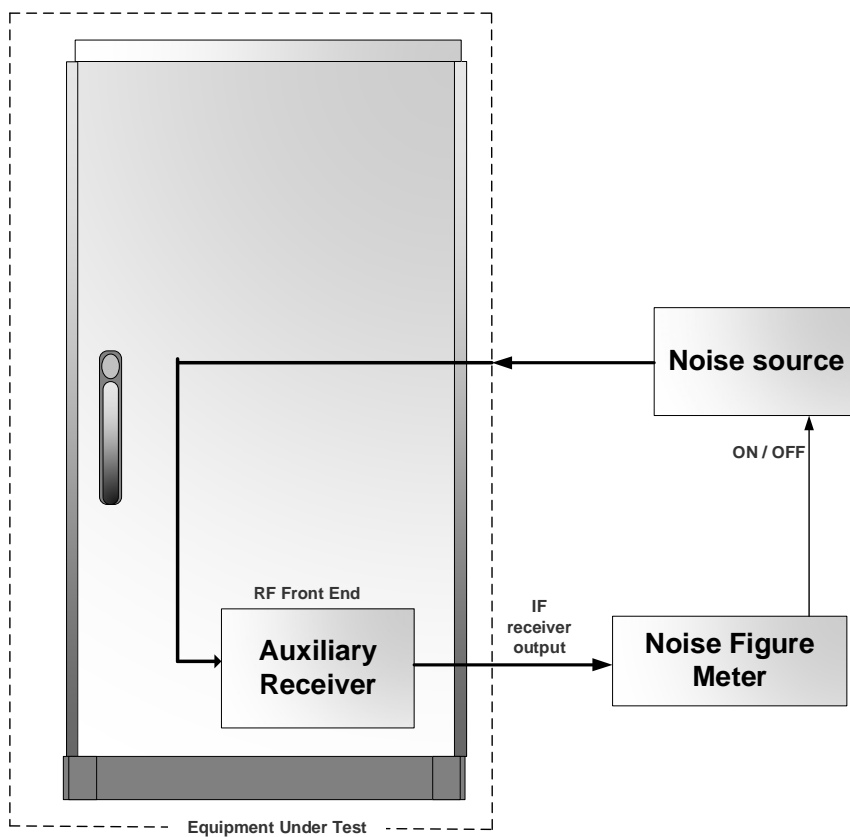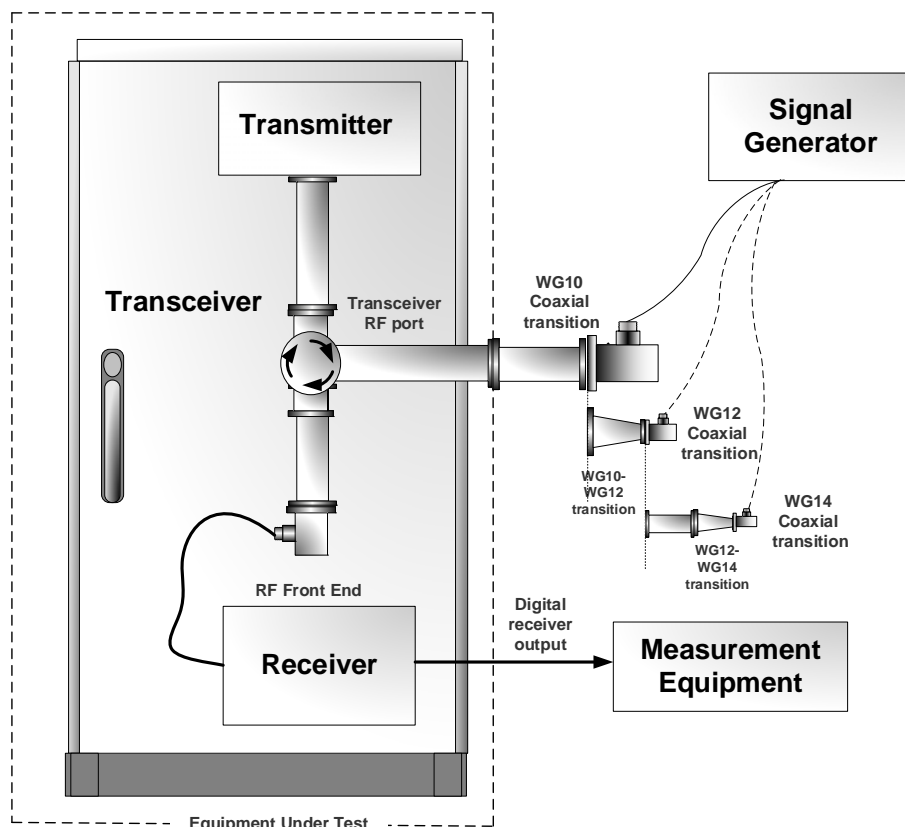
Figure E.2: Test setup for Noise Figure measurement of an auxiliary receiver with coaxial input

Annex F (normative):
Compression level and selectivity measurement set-up

The test set-up for the measurements of the compression level and the receiver selectivity of the transceiver shown in figure F.1 shall be applied.

Figure F.1: Test setup for compression level and selectivity measurements of the transceiver

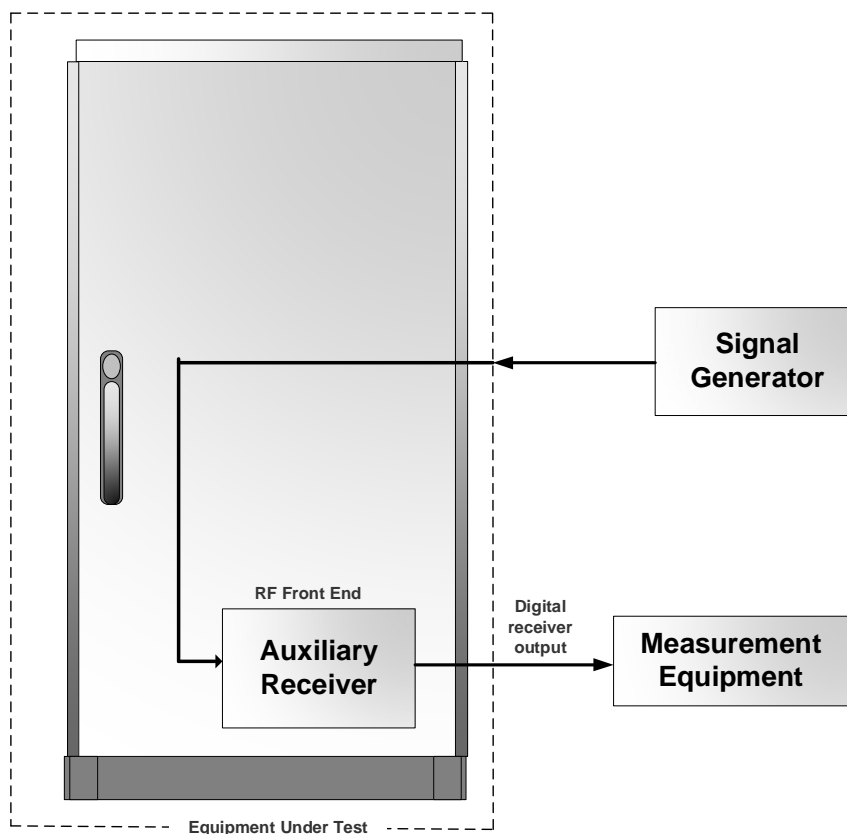The radar transmitter shall be placed in stand-by mode.

For the measurement of the compression level, using a RF signal generator, the test signal shall be applied to the waveguide input of the transceiver through a Coaxial/W10 transition.

For the measurement of the selectivity, using a RF signal generator, the disturbing signal shall be applied to the waveguide input of the transceiver with alternatively the appropriate waveguides and transitions as defined below:

- WG10 for disturbing signal with a frequency between 2 200 MHz and 3 600 MHz

- WG10 if the image frequency is between 2 077 MHz and 2 200 MHz, or between 3 600 MHz and 3 950 MHz

- WG10 and WG12 combination if the image frequency is between 3 950 MHz and 5 850 MHz. The WG12 is connected to the WG10 as shown in figure F.1 (dotted line)

- WG10, WG12, and WG14 combination if the image frequency is between 5 850 MHz and 8 200 MHz. The WG14 is connected to the WG12 as shown in figure F.1 (dotted line)

The measurement equipment shall be connected at the output the digital receiver. This output shall copy the signal received after the radar matched filter function.

In case the auxiliary receiver is with coaxial input, the test setup shown in figure F.2 shall be applied.

**Figure F.2: Test setup for compression level and selectivity measurements
of an auxiliary receiver with coaxial input**

The radar transmitter shall be placed in stand-by mode.

The test signal using a RF signal generator shall be applied to the coaxial input port of the auxiliary receiver.

The measurement equipment shall be connected at the output the digital receiver. This output shall copy the signal received after the radar matched filter function.

Annex G (informative):
Maximum Measurement Uncertainty

The measurements described in the present document are based on the following assumptions:

- the measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the present document;

- the value of the measurement uncertainty for the measurement of each parameter is included in the test report.

Table G.1 shows the recommended values for the maximum measurement uncertainty figures.

Table G.1: Maximum measurement uncertainty

Parameter	Uncertainty
Environment measurements	
Temperature	1 °C
Relative humidity	5 %
Mains Supply Voltage	±2 %
Transmitter measurements	
Frequency	±1 ppm
Transmitter power	±1,5 dB
Out-of-Band emissions	±4 dB
Spurious emissions	±4 dB
Receiver measurements	
Noise Figure	±1 dB
Receiver Selectivity	±4 dB
Receiver Compression Level	±1 dB

Annex H (informative):
WR284/WG10 waveguide characteristics

The cut-off frequency (TE$_{10}$) of a WR284/WG10 waveguide is 2 077 MHz. EM Fields below this frequency will not propagate through the waveguide, corresponding to a fast exponential decrease of the fields. The theoretical waveguide loss inside a waveguide will behave asymptotical at the cut off frequency as shown in figure H.1 below.
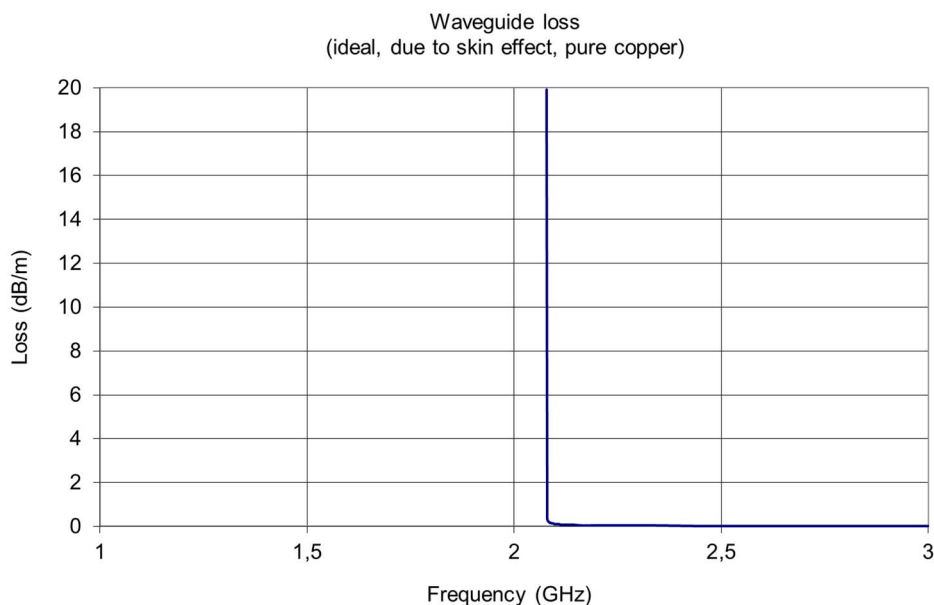
Figure H.1: Attenuation for an ideal waveguide

This is also confirmed by a practical measurement. As shown in figure H.2 below, the measurement of a 210 cm long WR284/WG10 waveguide (with flanges) has produced an attenuation of at least 110 dB below the cut-off frequency. Since what is shown on the left side of figure H.2 represents noise (thermal noise and the noise floor of the measurement instrument) the real attenuation below the cut-off frequency is greater than 110 dB. The following has to be pointed out:

1) An attenuation of 110 dB below PEP is already sufficient to fulfil the unwanted emission requirement specified in table 15 of ERC/Recommendation 74-01 [2].

2) A radar system can have several meters of waveguide between the transmitter and the antenna resulting in a still higher attenuation of the emissions below the cut-off frequency.
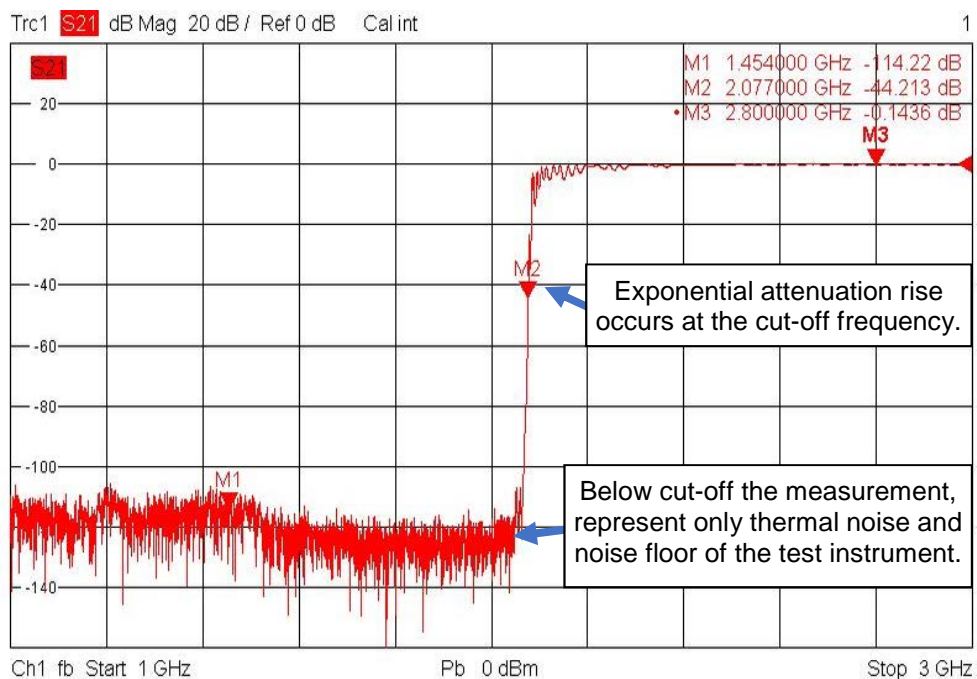
Figure H.2: Measured waveguide attenuation for a length of 210 cm

It can therefore be inferred that:

- A PSR radar using waveguide transmission lines to the antenna is not able to transmit any disturbances below the cut-off frequency and so cause harmful interference. The emissions below cut-off will be immeasurably low due to the strong attenuation of EM fields below the cut-off frequency.

- Any emissions below the cut-off frequency produced by the transmitter cannot be conducted to the test equipment, and so cannot even be measured.

All things considered and following a conservative approach it can be concluded that measurements below the cut-off frequency of the waveguide are not necessary when the undisturbed length of the waveguide is at least 20 wavelengths of the cut-off frequency (2,886 m for a WR284/WG10/R32 waveguide).

Annex I (informative): Checklist

This annex provides in table I.1 a traceability of the technical parameters for article 3.2 of Directive 2014/53/EU [i.1] defined in ETSI EG 203 336 [i.5] with the technical requirements for conformance defined in clause 4 of the present document. If a technical parameter for article 3.2 of Directive 2014/53/EU [i.1] defined in ETSI EG 203 336 [i.5] has not been included in the present document, an explanation is provided. An explanation is also provided whenever a technical parameter defined in ETSI EG 203 336 [i.5] is covered by an alternative technical requirement.

Some technical parameters defined in ETSI EG 203 336 [i.5] are applicable only to communication systems and not to non-cooperative radar systems such as ATC radar systems. Non-cooperative radar systems are different from radiocommunication systems since they do not communicate with a known target with known properties. They continually scan for unknown targets of any nature and do not adjust receiver or transmitter parameters according to what they detect.

Table I.1: Checklist

Technical Parameters defined in EG 203 336 [i.5]	Clauses of the present document	Comments
Transmitter Parameters		
Transmit power limits and accuracy	4.2.1.2	
Transmitter Spectrum mask	4.2.1.4	
Transmitter frequency stability	4.2.1.1	
Transmitter Intermodulation attenuation	na	At the transceiver output an RF circulator is used as indicated in the Scope. This prevents an interfering signal entering from the antenna into the transmitter.
Transmitter unwanted emissions (OoB and spurious domains)	4.2.1.4.1 4.2.1.4.2 4.2.1.4.3 4.2.1.4.4	
Transmitter Time domain characteristics (e.g. e.g. the duty cycle, turn-on and turn-off, frequency hopping cycle, dynamic changes of modulation scheme and others)	na	ATC radar systems are not able to share the occupied frequency band as commonly used with communication systems. Otherwise the reception of the echoes would not be possible if another system transmitted during its reception.
Transmitter Transients	4.2.1.4.2 4.2.1.4.3	The presence of transients in time domain has its equivalent in the frequency domain which is covered by the unwanted emissions parameter in active mode.

Receiver Parameters		
Receiver sensitivity	4.2.2.2	The radar output power is not varied as a result of the received signal strength of a single target, which means that it does not affect the efficient use of the radio spectrum. Nevertheless an integral part of the receiver sensitivity is the noise figure.
Receiver co-channel rejection	na	ATC radar systems in the same location cannot operate on the same operating frequency, as it would not be possible to meet radar operational performance with respect to stringent safety requirements on low rate of false alarms.
Adjacent band/channel selectivity	4.2.2.4	ATC radar systems are not operating in a channelized frequency arrangement, but in accordance with national frequency plan taking into account geographical distances between all radars.Therefore, the requirements for selectivity differ from scenarios with channelization. Adjacent band/channel selectivity for multiple signals is addressed by requiring a high compression level in the receiver selectivity for single signals.
Receiver blocking	4.2.2.3	Receiver Blocking is addressed by requiring a high compression level in the receiver.
Receiver spurious response rejection	4.2.2.4	This is covered by the selectivity test.
Receiver radio-frequency intermodulation	na	The intermodulation requirement is not meant for radars sharing the same band. This is due to their specific characteristics: rotating high directivity antennas, pulsed transmission schemes, gating of receiver, multi-frequency usage, digital processing, coding of signal emissions, not co-siting, etc. then this is not considered to be an actual issues in modern radar receivers.
Receiver unwanted emissions in the spurious domain	4.2.1.4.3 4.2.1.4.4	
Receiver dynamic range	4.2.2.2 4.2.2.3	The lower end of the receiver dynamic range is addressed by the noise figure. The upper end is addressed by the receiver compression level.
Reciprocal mixing	4.2.2.3 4.2.2.4	Interference characteristics are specified in terms of selectivity and/or blocking requirements, thus removing the need for this parameter to be explicitly included, as the effects of receiver selectivity and reciprocal mixing cannot be separated.

Annex J (informative):
Bibliography

- Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".

- Recommendation ITU-R SM.1539: "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329".

History

Document history			
V1.0.1	November 2020	EN Approval Procedure	AP 20210218: 2020-11-20 to 2021-02-18