



**ElectroMagnetic Compatibility (EMC)
standard for radio equipment and services;
Part 54: Specific conditions for fixed ground based
aeronautical and meteorological radars;
Harmonised Standard for electromagnetic compatibility**

<https://standards.iteh.ai/catalog/standards/sist/4ee22adf-2796-4450-8dce-ed629ab283c5/etsi-en-301-489-54-v1-0-1-2022-07>

ReferenceDEN/ERM-EMC-401

Keywordsaeronautical, EMC, harmonised standard,
measurement, radar

ETSI650 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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://standards.etsi.org/People/CommitteeSupportStaff.aspx> 4450-8dec-

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022.

All rights reserved.

Contents

Intellectual Property Rights	4
Foreword.....	4
Modal verbs terminology.....	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	7
3 Definition of terms, symbols and abbreviations.....	7
3.1 Terms.....	7
3.2 Symbols.....	8
3.3 Abbreviations	9
4 Test conditions	9
4.1 General requirements	9
4.2 Arrangements for test signals.....	9
4.2.1 Arrangements for test signals at the input of transmitters.....	9
4.2.2 Arrangements for test signals at the output of transmitters.....	9
4.2.3 Arrangements for test signals at the input of receivers	10
4.2.4 Arrangements for test signals at the output of receivers	10
4.3 RF exclusion band for radio equipment	10
4.3.1 General requirements.....	10
4.3.2 Exclusion band for transmitters or the transmitter part of transceivers.....	10
4.3.3 Exclusion band for receivers or the receiver part of the transceivers	10
4.4 Normal test modulation.....	11
5 Performance Assessment.....	11
5.1 General requirements	11
6 Performance criteria	11
6.1 General requirements	11
7 Applicability tables.....	12
7.1 EMC Emission	12
7.1.1 General requirements.....	12
7.1.2 Special Conditions	12
7.2 Immunity	13
7.2.1 General requirements.....	13
7.2.2 Special Conditions	13
Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU	15
Annex B (normative): Acceptable Degraded Performance corresponding to Performance Criteria B	17
History	18

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are 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 Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, 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.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

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 54 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ETSI EN 301 489-54 V1.0.1 \(2022-07\)](#)

<https://standards.iteh.ai/catalog/standards/sist/4ee22adf-2796-4450-8dcc-ed629ab283c5/etsi-en-301-489-54-v1-0-1-2022-07>

1 Scope

The present document specifies technical characteristics and methods of measurement in respect of ElectroMagnetic Compatibility (EMC) for the following radar systems:

- Fixed and ground based monostatic aeronautical Primary Surveillance Radar (PSR) and Surface Movement Radar (SMR)
- Fixed and ground based monostatic meteorological radar system, for example weather radar systems or wind profiler

with the following characteristics:

- operating in at least one of the frequency ranges as shown in table 1;
- operated only by AC power.

The above mentioned radio equipment is intended to be used at a fixed location (permanent or temporarily) and is equipped with rotating passive antennas.

A radar system consists of one or more enclosures that contain at least the following radar functionalities: transmitter, receiver, signal processing. Other parts which are not part of the radar functionality e.g. local UPS, air conditioning equipment, dehumidifying equipment, communication network equipment, etc., are not in the scope of the present document, unless these parts are implemented inside the radar system enclosure(s).

Table 1: Frequency range of fixed ground based aeronautical and meteorological radar systems

Operating frequency ranges
1 215 MHz to 1 400 MHz
2 700 MHz to 3 100 MHz
5 250 MHz to 5 850 MHz
8 500 MHz to 10 500 MHz

<https://standards.iteh.ai/catalog/standards/sist/4ee22adf-2796-4450-8dcc->

Technical specifications related to the antenna port of the radio equipment are not included in the present document. Such technical specifications are found in the relevant product standards under article 3.2 of Directive 2014/53/EU [i.1].

Emission requirements in the present document are specified for frequencies above 9 kHz.

The environmental classification and the emission and immunity requirements used in the present document are as stated in ETSI EN 301 489-1 [1], except for any special conditions included in the present document.

NOTE: The relationship between the present document and essential requirements of article 3.1(b) 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] ETSI EN 301 489-1 (V2.2.3) (11-2019): "Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility".

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] EN 55032:2015: "Electromagnetic compatibility of multimedia equipment - Emission Requirements", (produced by CENELEC).
- [i.5] Recommendation ITU-R SM.1541-6 (08/2015): "Unwanted emissions in the out-of-band domain".

<https://standards.iteh.ai/catalog/standards/sist/4ee22adf-2796-4450-8dcc-1624b3e55811/en-301-489-54-v1.0.1-2022-07>

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

ancillary equipment: electrical or electronic equipment, that is intended to be used with a receiver or transmitter

NOTE 1: It is considered as an ancillary equipment if:

- the equipment is intended for use with a receiver or transmitter to provide additional operational and/or control features to the radio equipment (e.g. to extend control to another position or location);
- the ancillary equipment cannot be used without being connected to radio equipment to provide user functions independently of a receiver or transmitter; and
- the receiver or transmitter, to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

NOTE 2: An example of ancillary equipment would be a docking station for radio equipment whose interface is dedicated to a particular product or range of products.

antenna port: port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy

centre frequency (f_c): centre of the transmitter necessary bandwidth

critical stored data: data that is essential for an EUT to perform a primary function in accordance with that EUT's specification

NOTE: This may include data previously stored by the user.

enclosure port: physical boundary of the equipment through which electromagnetic fields may radiate or impinge

NOTE: Also known as cabinet radiation.

Equipment Under Test (EUT): equipment subject to the performance requirements of the present document

mode of operation: operational status of the radar system, for example but not limited to standby or operating mode

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; unless otherwise specified in a Recommendation ITU-R for the appropriate class of emission, the value of $\beta/2$ should be taken as 0,5 %

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

operating mode: mode of operation which produces the authorized emission

port: interfaces of the equipment with the external environment and other equipment

NOTE: An example of the ports is shown in figure 1.

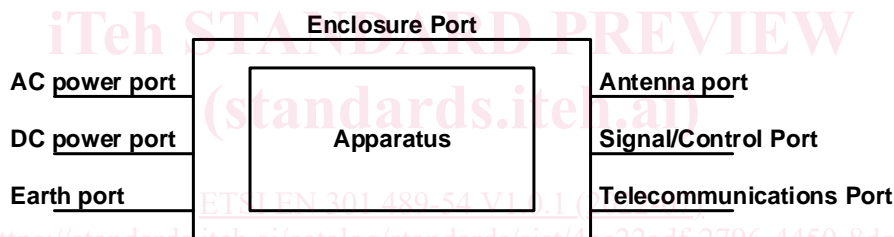


Figure 1: Example of ports

standby mode: mode of operation where the transmitter is available for operation but is not in the operating mode

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 301 489-1 [1] and the following apply:

$\text{Band}_{\text{RX}}(\text{lower})$	Lower edge, in terms of frequency, of the tuning range or allocated band of the receiver under assessment
$\text{Band}_{\text{RX}}(\text{upper})$	Upper edge, in terms of frequency, of the tuning range or allocated band of the receiver under assessment
B_{-40}	-40 dB bandwidth
B_C	Chirp bandwidth
$\text{EXband}(\text{lower})$	Exclusion band lower frequency edge
$\text{EXband}(\text{upper})$	Exclusion band upper frequency edge
k	Boltzmann's constant
t	Pulse duration
t_r	Pulse rise time

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 301 489-1 [1] and the following apply:

AC	Alternating Current
BITE	Built In Test Equipment
dB	decibel
DC	Direct Current
EM	ElectroMagnetic
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
f_c	centre frequency
PPI	Plan Position Indicator
PSR	Primary Surveillance Radar
RF	Radio Frequency
SMR	Surface Movement Radar

4 Test conditions

4.1 General requirements

For the purpose of the present document, the provisions of ETSI EN 301 489-1 [1], clause 4 shall apply with the following additions from clauses 4.2.1 to 4.2.4 of the present document.

The EUT shall be tested in the operating mode and standby mode to confirm there are no unintentional responses.

If the equipment has a number of ports with identical design, then at least one of these ports shall be activated and shall be monitored during the tests. The decision and justification not to perform tests on all available ports shall be recorded in the test report.

Conducted immunity test shall not be applied to the signal ports that, according to the product documentation, are not permanently connected but just used to setup or perform a maintenance activity of the equipment; these maintenance activities are not intended as operating conditions.

The test configuration and modes of operation shall represent the intended use and shall be recorded in the test report.

4.2 Arrangements for test signals

4.2.1 Arrangements for test signals at the input of transmitters

The provisions of ETSI EN 301 489-1 [1], clause 4.2.1 apply with the following additions:

- The transmitter shall be modulated with normal test modulation by an internal or external signal source capable of producing the appropriate drive signal (see clause 4.4).

4.2.2 Arrangements for test signals at the output of transmitters

The provisions of ETSI EN 301 489-1 [1], clause 4.2.2 apply with the following additions:

- The transmitter shall be operated at its maximum rated RF peak output power and maximum possible duty cycle.
- The RF output power of the transmitter shall be directed to a dummy load.

4.2.3 Arrangements for test signals at the input of receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.3 apply with the following additions:

- The radar shall be kept in an operating mode which represents the intended use and all necessary signal processing shall be enabled in the same manner. All external inputs and outputs necessary for the intended use shall be connected.
- As ground based aeronautical and meteorological radars do not establish a communication link, a test signal shall be connected to the antenna input port of the receiver. The applied test signal shall generate data at the outputs of the radar system, which are similar to the data generated during the intended operation mode of the radar system. If an internal test signal is available this shall be used otherwise an external test signal shall be applied.

NOTE: Aeronautical and meteorological radar systems usually have an internal test signal generator.

4.2.4 Arrangements for test signals at the output of receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.4 apply.

4.3 RF exclusion band for radio equipment

4.3.1 General requirements

The exclusion band for transmitters and transmitter sections of transceivers is the band of frequencies over which no immunity tests with radiated RF are made.

The transmitter and receiver exclusion bands as defined in clauses 4.3.2 and 4.3.3 shall apply. For equipment operating at frequencies above 6 000 MHz the transmitter and receiver exclusion bands are not applicable as test ranges stop at 6 000 MHz.

NOTE: ETSI EN 301 489-1 [1] requires emission and immunity tests of frequencies up to 6 000 MHz.

Whenever an exclusion band is applied, the specific frequency range(s) excluded from assessment shall be detailed in the technical documentation.

4.3.2 Exclusion band for transmitters or the transmitter part of transceivers

Exclusion bands shall not be applied when measuring transmitters in standby mode. When the transmitter is in operating mode the exclusion band extends 250 % of the occupied bandwidth either side of the centre frequency.

NOTE: Exclusion band of 250 % is based on the definition from ITU Radio Regulations [i.3], 1.146, 1.146A and 1.146B and is specified in the Recommendation ITU-R SM.1541-6 [i.5].

For radar systems capable of multi-frequency operation, the total transmitter exclusion band shall be the combination of the exclusion bands for each operating frequency supported by the radar system.

4.3.3 Exclusion band for receivers or the receiver part of the transceivers

The exclusion band shall be calculated by using the following formula:

$$EXband(lower) = 0,95 \times Band_{Rx}(lower)$$

and for the upper edge of the exclusion band:

$$EXband(upper) = 1,05 \times Band_{Rx}(upper)$$

Exclusion bands are not applied when testing emissions of receivers or receiver part of transceivers.

For radar systems capable of multi-frequency operation, the total transmitter exclusion band shall be the combination of the exclusion bands for each operating frequency supported by the radar system.