



**ElectroMagnetic Compatibility (EMC)  
standard for radio equipment and services;  
Part 19: Specific conditions for Receive Only Mobile  
Earth Stations (ROMES) operating in the 1,5 GHz band  
providing data communications and GNSS receivers operating  
in the RNSS band providing positioning, navigation,  
and timing data;  
Harmonised Standard for ElectroMagnetic Compatibility**

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**Reference**REN/ERM-EMC-406

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# Foreword

This final draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.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 19 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

<b>Proposed national transposition dates</b>	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

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## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document covers the assessment of Receive Only Mobile Earth Stations (ROMES) and Global Navigation Satellite System (GNSS) receivers in respect of electromagnetic compatibility.

ROMES operate in the Land Mobile Satellite Service (LMSS) space to earth bands, 1 518 MHz to 1 559 MHz, allocated by the ITU Radio Regulations [i.3]. ROMES operate as part of a satellite system providing one way data communications.

Global Navigation Satellite System (GNSS) receivers operate in either or both of the space to earth RNSS frequency bands of 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz defined as "A radiodetermination-satellite service used for the purpose of radionavigation" (article 1.43 of ITU Radio Regulations [i.3]) with the ability to receive any GNSS (e.g. Galileo, Global Positioning System (GPS), BeiDou (BDS), GLObal NAVigation Satellite System (GLONASS), Space Based Augmentation Systems (SBAS)).

Technical specifications related to the antenna port and emissions from the enclosure port of ROMES and GNSS are not included in the present document. Such technical specifications are found in the relevant product standards for the effective use of the radio spectrum in table 1.

**Table 1: Radio Technologies in Scope of the present document**

Technology	ETSI Standard
ROMES	ETSI EN 300 487 [i.4]: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Receive-Only Mobile Earth Stations (ROMES) providing data communications operating in the 1,5 GHz frequency band; Radio Frequency (RF) specifications covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
GNSS	ETSI EN 303 413 [i.5]: "Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

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

The present document specifies the applicable test conditions, performance assessment and performance criteria for ROMES, GNSS and associated ancillary equipment.

ROMESs and GNSS can have several configurations, including:

- vehicular equipment;
- portable equipment;
- fixed equipment;
- a number of modules including a display/control interface to the user.

The performance criteria used in the present document require that the satellite communications system of which the ROMES and GNSS is a part provides reliable delivery of data or messages.

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.

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## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

- [1] ETSI EN 301 489-1 (V2.2.3) (11-2019): "ElectroMagnetic 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.

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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 (2016).
- [i.4] ETSI EN 300 487 (V2.1.2) (11-2016): "Satellite Earth Stations and Systems (SES); Harmonised Standard for Receive-Only Mobile Earth Stations (ROMES) providing data communications operating in the 1,5 GHz frequency band; Radio Frequency (RF) specifications covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.5] ETSI EN 303 413 (V1.2.1) (04-2021): "Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonised Standard for access to radio spectrum".

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

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

NOTE: It is considered as an ancillary equipment if:

- the equipment is intended for use with a receiver 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; and
- the receiver to which it is connected, is capable of providing some intended operation such as receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

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

**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.

**fixed equipment:** equipment intended for use in a fixed location and fitted with one or more antennas

**live sky signal:** signal received from actual existing satellites

**portable equipment:** radio equipment intended for portable use and powered by integral batteries or battery

NOTE: Devices will typically be handheld.

**stand-alone radio equipment:** equipment that is intended primarily as communications equipment and that is normally used on a stand-alone basis

**vehicular equipment:** radio equipment intended for installation and use in a vehicle, and powered by the main battery of the vehicle

### 3.2 Symbols

Void.

### 3.3 Abbreviations

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

AC	Alternating Current
BDS	BeiDou - Chinese satellite navigation system
dB	decibel
DC	Direct Current
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
GHz	Gigahertz
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
kHz	Kilohertz
LMSS	Land Mobile Satellite Service
MFCN	Mobile Fixed Communications Network

MHz	Megahertz
P <sub>min</sub>	Minimum power required to establish a communication link
RF	Radio Frequency
RNSS	Radio-Navigation Satellite Service
ROMES	Receive Only Mobile Earth Station
RX	Receiver
SBAS	Space Based Augmentation System
SES	Satellite Earth System

## 4 Test conditions

### 4.1 General

The manufacturer should at the time of submission of the equipment for test, supply the applicable environments, referred to in ETSI EN 301 489-1 [1], where ROMES, and or GNSS may be used.

For emission and immunity tests the test modulation, test arrangements, etc., as specified in the present document, clauses 4.1 to 4.5 shall apply.

The Equipment Under Test (EUT) is the ROMES or GNSS receiver, together with any applicable ancillary equipment.

### 4.2 Arrangements for test signals

#### 4.2.0 General

The test configuration and mode of operation shall represent the intended use and shall be recorded.

#### 4.2.1 Arrangements for test signals at the input of ROMES and GNSS receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.3 shall apply with the following modifications.

If necessary, an appropriate test fixture and/or message generator capable of generating the wanted input signal may be supplied with the ROMES or GNSS receiver to facilitate testing.

Alternatively, the wanted signal may be presented to the EUT via a live sky signal from outdoors.

For radiated immunity, the level of the wanted signal at the input of the receiver or the enclosure port of the EUT, shall be 20 dB ( $\pm 3$  dB) above the P<sub>min</sub> for the EUT. For all other tests the level of the wanted signal, required to establish a communication link, shall be representative of the EUT intended use.

**NOTE:** A simple method to establish the required communication link is establish link, reduce power to point of link failure then increase by 20 dB.

#### 4.2.2 Arrangements for test signals at the output of ROMES and GNSS receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.4 shall apply with the following modifications.

The performance of the ROMES and GNSS device shall be checked before and after the assessment using one or more of the following:

- presented messages;
- satellite information;
- call received alert signal(s).

During the immunity test with radiated RF electromagnetic fields (ETSI EN 301 489-1 [1], clause 9.2) the output of the ROMES/GNSS receiver shall be coupled to the outside of the test environment to enable the performance of the equipment to be assessed.

## 4.3 Exclusion bands

### 4.3.0 General

The provision of ETSI EN 301 489-1 [1], clause 4.3.1 shall apply with the following modifications:

- There shall be no exclusion bands for the ancillary equipment.
- The receiver exclusion bands as defined in clause 4.3.1 shall apply.

### 4.3.1 Receiver exclusion bands

#### 4.3.1.1 General

The receiver exclusion band is the band of frequencies over which no tests of radiated immunity of a receiver are made.

#### 4.3.1.2 GNSS exclusion bands

The exclusion band for immunity testing of equipment operating in the 1 559 MHz to 1 610 MHz band shall be:

- lower limit of exclusion band = 1 492 MHz (-67 MHz of the lowest band edge frequency)
- upper limit of exclusion band = 1 706 MHz (+96 MHz of the highest band edge frequency)

NOTE 1: The lower frequency is based on the presence of a MFCN below 1 492 MHz. The upper limit is based on the bandwidth of a GNSS transmission of 32 MHz and a value of  $n=3$  from ETSI EN 301 489-1 [1], clause 4.3.3. This receiver exclusion band includes the blocking test frequencies specified in the relevant product standards for the effective use of the radio spectrum.

The exclusion band for immunity testing of equipment operating in the 1 164 MHz to 1 300 MHz band shall be:

- lower limit of exclusion band = 1 100 MHz (-64 MHz of the lowest band edge frequency)
- upper limit of exclusion band = 1 364 MHz (+64 MHz of the highest band edge frequency)

NOTE 2: This is based on the bandwidth of a GNSS transmission of 32 MHz and a value of  $n=2$  from ETSI EN 301 489-1 [1], clause 4.3.3. This receiver exclusion band includes the blocking test frequencies specified in the relevant product standards for the effective use of the radio spectrum.

#### 4.3.1.3 ROMES Exclusion Bands

The receiver exclusion band is the band of frequencies over which no tests of radiated immunity are conducted.

The exclusion band for immunity testing of equipment operating in the 1 518 MHz to 1 559 MHz band shall be:

- lower limit of exclusion band = 1 492 MHz (-26 MHz of the lowest band edge frequency)
- upper limit of exclusion band = 1 627 MHz (+68 MHz of the highest band edge frequency)

NOTE: The lower frequency is based on the presence of MFCN below 1 492 MHz. The upper limit is based on the bandwidth of ROMES transmission of 34 MHz and a value of  $n=2$  from ETSI EN 301 489-1 [1], clause 4.3.3. This receiver exclusion band includes the blocking test frequencies specified in the relevant product standards for the effective use of the radio spectrum.

#### 4.3.1.4 Combined Equipment GNSS & ROMES

When equipment is designed to perform both GNSS and ROMES receive functions with shared hardware, the exclusion band shall be the union of the GNSS and the ROMES exclusion bands:

- lower limit of exclusion band = 1 492 MHz (-26 MHz of the lowest band edge frequency for the ROMES component)
- upper limit of exclusion band = 1 706 MHz (+96 MHz of the highest band edge frequency for the GNSS component)

#### 4.3.1.5 Exclusion Bands Summary

Table 2 provides a summary of exclusion bands for all GNSS and ROMES equipment.

**Table 2: Exclusion Bands Summary**

System	Frequency Band	RX Exclusion Band	
		Lower limit of exclusion band	Upper limit of exclusion band
GNSS	1 164 MHz to 1 300 MHz	1 100 MHz	1 364 MHz
GNSS	1 559 MHz to 1 610 MHz	1 492 MHz	1 706 MHz
ROMES	1 518 MHz to 1 559 MHz	1 492 MHz	1 627 MHz
Combined Equipment GNSS & ROMES (see note)	1 518 MHz to 1 610 MHz	1 492 MHz	1 706 MHz
NOTE: Combined GNSS and ROMES equipment is only used in the 1 518 MHz to 1 610 MHz band.			

## 4.4 Narrow band responses of receivers

Responses on receivers occurring during the immunity tests at discrete frequencies which are narrow band responses (spurious responses), are identified by the following method.

If during the test the immunity RF test signal causes non-compliance of the receiver with the specified performance criteria (see clause 6), it is necessary to evaluate whether this non-compliance is due to a narrow band response or a wideband phenomenon. Therefore, the frequency of the test signal is increased by an amount equal to twice the nominal 6 dB bandwidth of the IF filter immediately preceding the demodulator of the receiver, or if appropriate, the bandwidth over which the equipment is intended to operate, as declared by the manufacturer. The test is repeated with the frequency of the test signal decreased by the same amount. If the receiver is then in either or both frequency offset cases in compliance with the specified performance criteria, the response is considered as a narrow band response. If the receiver still does not comply with the specified performance criteria, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrow band response. Under these circumstances the procedure is repeated with an increase and decrease of the frequency of the test signal adjusted two and a half times the bandwidth referred to above. If the receiver still does not comply with the specified performance criteria in either or both frequency offset cases, the phenomena is considered wide band and therefore an EMC problem and the equipment fails the test.

For immunity tests, narrow band responses shall be disregarded.

## 4.5 Normal test modulation

The test modulation signal shall be a signal generated by a signal generator, so that the EUT receives a correctly representative modulated signal.

The wanted signals required to establish a communications link shall be representative of the EUT's intended use.

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## 5 Performance assessment

### 5.1 General

At the time of submission of the equipment for test, the information required in ETSI EN 301 489-1 [1], annex C and the following should be recorded in the test report:

- the operating frequency range(s) of the equipment and where applicable band(s) of operation;
- the host equipment to be combined with the radio equipment for testing;
- the normal test modulation and the format.

### 5.2 Ancillary equipment

The provision of ETSI EN 301 489-1 [1], clause 5 shall apply.

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## 6 Performance criteria

### 6.0 Introduction

Only the performance criteria specified in the present document or in ETSI EN 301 489-1 [1] where referenced shall apply.

The equipment shall meet the minimum performance criteria as specified in clauses 6.1 and 6.2 as appropriate.

For the purpose of the present document two categories of performance criteria apply:

- Performance criteria for continuous phenomena.
- Performance criteria for transient phenomena.

### 6.1 Performance criteria for Continuous phenomena

During the test, the equipment shall operate as intended, e.g. not unintentionally change its operating state and not unintentionally change critical stored data.

After the test, the equipment shall operate as intended, e.g. have no loss of function and have no loss of critical stored data.

### 6.2 Performance criteria for Transient phenomena

After the test, functions shall be self-recoverable and the equipment shall operate as intended and the equipment shall have no loss of critical stored data.

## 7 Applicability overview

### 7.1 Emission

#### 7.1.1 General

Table 3 contains the applicability of EMC emission measurements to the relevant ports of radio and/or associated ancillary equipment.

**Table 3: Emission requirements**

Phenomenon	Port	Applicability			Reference clause
		Fixed equipment	Vehicular equipment	Portable equipment	
radiated emission	enclosure of ancillary equipment	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clause 8.2
conducted emission	DC power input/output	applicable	applicable	not applicable	7.1.2
conducted emission	AC mains input/output	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.4
conducted emission	wired network	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.7

Portable equipment, or combinations of equipment, capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as vehicular equipment.

Portable or vehicular equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed equipment.

#### 7.1.2 Special conditions

The following special conditions set out in table 4, relate to the emission test methods used in ETSI EN 301 489-1 [1], clause 8.

**Table 4: Special conditions for EMC emission measurements**

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in ETSI EN 301 489-1 [1], clause 8
8.3 DC power input/output	The requirements of ETSI EN 301 489-1 [1] clause 8.3 shall be applied where the cable length exceeds 3 m or when connected to a vehicle power supply.

## 7.2 Immunity

### 7.2.1 General

Table 5 contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment.

Table 5: Immunity test requirements

Phenomenon	Port	Applicability			Reference clause	Performance Criteria clause
		Fixed Equipment	Vehicular equipment	Portable equipment		
RF electromagnetic field (80 MHz to 6 000 MHz)	enclosure	applicable	applicable	applicable	ETSI EN 301 489-1 [1], 9.2.1 and 9.2.2	6.1
electrostatic discharge	enclosure	applicable	applicable	applicable	ETSI EN 301 489-1 [1], 9.3.1 and 9.3.2	6.2
fast transients common mode	signal, wired network and control	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], 9.4.1 and 9.4.2	6.2
	DC power	applicable	not applicable	not applicable		6.2
	AC power	applicable	not applicable	not applicable		6.2
RF common mode 0,15 MHz to 80 MHz	signal, wired network and control	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], 9.5.1 and 9.5.2	6.1
	DC power	applicable	not applicable	not applicable		6.1
	AC power	applicable	not applicable	not applicable		6.1
Vehicular transients and surges	DC power input	not applicable	applicable	not applicable	ETSI EN 301 489-1 [1], 9.6.1 and 9.6.2	6.2
voltage dips and interruptions	AC mains power input	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], 9.7.1 and 9.7.2	6.2
surges, line to line and line to ground	AC mains power input	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], 9.8.1 and 9.8.2	6.2
	wired network	applicable	not applicable	not applicable		6.2

Portable equipment, or combinations of equipment, capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as vehicular equipment.

Portable or vehicular equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed equipment.

## 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 301 489-19					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Emissions: Enclosure of ancillary equipment measured on a stand-alone	3.1(b)	7.1	U	
2	Emissions: DC power input/output ports	3.1(b)	7.1	C	Only where equipment has DC power input and/or output ports with a cable length greater than 3 m or from a vehicle power supply.
3	Emissions: AC mains power input/output ports	3.1(b)	7.1	C	Only where equipment has AC mains power input and/or output ports.
4	Emissions: Wired network ports	3.1(b)	7.1	C	Only applies to fixed equipment.
5	Immunity: Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	3.1(b)	7.2	U	
6	Immunity: Electrostatic discharge	3.1(b)	7.2	U	
7	Immunity: Fast transients common mode	3.1(b)	7.2	C	Only applies to fixed equipment.
8	Immunity: Radio frequency common mode	3.1(b)	7.2	C	Only applies to fixed and/or vehicular equipment.
9	Immunity: Transients and surges in the vehicular environment	3.1(b)	7.2	C	Only applies to vehicular equipment.
10	Immunity: Voltage dips and interruptions	3.1(b)	7.2	C	Only where equipment has AC mains power input ports.
11	Immunity: Surges, line to line and line to ground	3.1(b)	7.2	C	Only applies to fixed equipment.

### 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.

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Annex B (informative):  
Void

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## Annex C (informative): Change history

<b>Version</b>	<b>Information about changes</b>
2.1.0	Addition of GNSS receivers
2.1.1	Bringing into line with latest ETSI EN 301 489-1
2.1.2	Changes and simplification following EMC#57
2.1.3	Changes following EMC#58
2.1.4	Changes following Remote Consensus

## History

<b>Document history</b>			
V1.1.1	December 2000	Publication	
V1.2.1	November 2002	Publication	
V2.1.1	April 2019	Publication	
V2.2.0	September 2020	EN Approval Procedure	AP 20201217: 2020-09-18 to 2020-12-17
V2.2.1	July 2022	Vote	V 20220830: 2022-07-01 to 2022-08-30