

Draft **ETSI EN 302 018** V2.0.3 (2016-12)



**Transmitting equipment for the  
Frequency Modulated (FM) sound broadcasting service;  
Harmonised Standard covering the essential requirements  
of article 3.2 of Directive 2014/53/EU**

*iTeh STANDARD PREVIEW*  
(standards.it-eh.com)  
Full name: ETSI EN 302 018 - e818-  
<https://standards.iteh.ai/catalog/standards/sist/818-e818-e818-4daf-b2cc-840f7eb9fb99/etsi-en-302-018-v2-0-3-2016-12>

---

**Reference**

---

REN/ERM-TG17-013

---

**Keywords**

---

audio, broadcasting, FM, harmonised standard,  
radio, regulation, terrestrial, transmitter

---

**ETSI**

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

---

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

---

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

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 only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

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://portal.etsi.org/People/CommitteeSupportStaff.aspx>

---

**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.

© European Telecommunications Standards Institute 2016.  
All rights reserved.

DECT<sup>TM</sup>, PLUGTESTS<sup>TM</sup>, UMTS<sup>TM</sup> and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.  
3GPP<sup>TM</sup> and LTE<sup>TM</sup> are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.  
GSM<sup>®</sup> and the GSM logo are Trade Marks registered and owned by the GSM Association.

# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	6
Introduction .....	6
1 Scope.....	7
2 References .....	7
2.1 Normative references .....	7
2.2 Informative references.....	7
3 Definitions, symbols and abbreviations .....	8
3.1 Definitions.....	8
3.2 Symbols.....	9
3.3 Abbreviations .....	9
4 Technical requirements specifications .....	10
4.1 Environmental profile.....	10
4.2 Conformance requirements .....	10
4.2.1 Rated output power.....	10
4.2.1.1 Definition .....	10
4.2.1.2 Limit.....	10
4.2.1.3 Conformance.....	10
4.2.2 Frequency drift.....	10
4.2.2.1 Definition .....	10
4.2.2.2 Limit.....	10
4.2.2.3 Conformance.....	10
4.2.3 Deviation sensitivity stability .....	10
4.2.3.1 Definition .....	10
4.2.3.2 Limit.....	10
4.2.3.3 Conformance.....	11
4.2.4 Residual AM (Hum and noise) .....	11
4.2.4.1 Definition .....	11
4.2.4.2 Limits .....	11
4.2.4.3 Conformance.....	11
4.2.5 Synchronous AM (AM due to FM) .....	11
4.2.5.1 Definition .....	11
4.2.5.2 Limit.....	11
4.2.5.3 Conformance.....	11
4.2.6 Modulator performance (pulse response) .....	11
4.2.6.1 Definition .....	11
4.2.6.2 Limit.....	11
4.2.6.3 Conformance.....	12
4.2.7 MPX intermodulation .....	12
4.2.7.1 Definition .....	12
4.2.7.2 Limit.....	12
4.2.7.3 Conformance.....	12
4.2.8 Deviation limiting.....	12
4.2.8.1 Definition .....	12
4.2.8.2 Limit.....	12
4.2.8.3 Conformance.....	12
4.2.9 FM Signal to Noise Ratio (SNR) .....	12
4.2.9.1 Definition .....	12
4.2.9.2 Limit.....	13
4.2.9.3 Conformance.....	13
4.2.10 Spurious emissions .....	13
4.2.10.1 Definition .....	13
4.2.10.2 Limit.....	13

4.2.10.3	Conformance.....	14
4.2.11	Transmitter muting during frequency shift .....	14
4.2.11.1	Definition .....	14
4.2.11.2	Limit.....	14
4.2.11.3	Conformance.....	14
4.2.12	Out-of-band emissions .....	15
4.2.12.1	Definition .....	15
4.2.12.2	Limit.....	15
4.2.12.3	Conformance.....	15
5	Testing for compliance with technical requirements.....	16
5.1	Environmental conditions for testing .....	16
5.2	Interpretation of the measurement results .....	16
5.3	Methods of measurement .....	16
5.3.1	Rated output power.....	16
5.3.1.1	Initial conditions .....	16
5.3.1.2	Procedure .....	17
5.3.1.2	Test requirements.....	17
5.3.2	Frequency drift.....	17
5.3.2.1	Initial conditions .....	17
5.3.2.2	Procedure .....	17
5.3.2.3	Test requirements.....	17
5.3.3	Deviation sensitivity stability .....	18
5.3.3.1	Initial conditions .....	18
5.3.3.2	Procedure .....	18
5.3.3.3	Test requirements.....	18
5.3.4	Residual AM (Hum and noise).....	18
5.3.4.1	Initial conditions .....	18
5.3.4.2	Procedure .....	19
5.3.4.3	Test requirements.....	19
5.3.5	Synchronous AM (AM due to FM).....	19
5.3.5.1	Initial conditions .....	19
5.3.5.2	Procedure .....	19
5.3.5.3	Test requirements.....	20
5.3.6	Modulator performance (pulse response).....	20
5.3.6.1	Initial conditions .....	20
5.3.6.2	Procedure .....	20
5.3.6.3	Test requirements.....	21
5.3.7	MPX intermodulation .....	21
5.3.7.1	Initial conditions .....	21
5.3.7.2	Procedure .....	21
5.3.7.3	Test requirements.....	21
5.3.8	Deviation limiting.....	22
5.3.8.1	Initial conditions .....	22
5.3.8.2	Procedure .....	22
5.3.8.3	Test requirements.....	22
5.3.9	FM Signal to Noise Ratio (SNR).....	23
5.3.9.1	Initial conditions .....	23
5.3.9.2	Procedure .....	23
5.3.9.3	Test requirements.....	23
5.3.10	Spurious emissions .....	23
5.3.10.1	Initial conditions .....	23
5.3.10.2	Procedure .....	24
5.3.10.3	Test requirements.....	24
5.3.11	Transmitter muting during frequency shift .....	24
5.3.11.1	Initial conditions .....	24
5.3.11.2	Procedure .....	24
5.3.11.3	Test requirements.....	25
5.3.12	Out-of-band emissions.....	25
5.3.12.1	Initial conditions .....	25
5.3.12.2	Procedure .....	25
5.3.12.3	Test requirements.....	26

<b>Annex A (informative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b>	<b>27</b>
<b>Annex B (normative):</b>	<b>General measuring arrangements .....</b>	<b>28</b>
B.1	Testing arrangements for antenna port measurements .....	28
B.1.1	Testing arrangement for monophonic transmitters .....	28
B.1.2	Testing arrangement stereophonic transmitters .....	29
B.1.3	Test frequency range .....	30
B.1.4	Test modulating signal .....	30
B.2	Test load characteristics .....	32
<b>Annex C (informative):</b>	<b>Change History .....</b>	<b>33</b>
History .....		34

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

Full standard:  
<https://standards.iteh.ai/catalog/standards/sist/8f9658f8-e8f8-4daf-b2cc-840f7eb9fbd9/etsi-en-302-018-v2.1.1-2017-04>

---

## Intellectual Property Rights

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

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

---

## 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.4] 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.

<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

---

## 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.

---

## Introduction

The present document describes the requirements for the design and operation of an FM sound broadcasting service transmitter to meet the essential requirements of article 3.2 of Directive 2014/53/EU [i.1].

# 1 Scope

The present document specifies technical characteristics and methods of measurements for transmitter equipment for broadcast sound services using the frequency modulated sound broadcasting service operating in the frequency range 68 MHz to 108 MHz.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

# 2 References

## 2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version 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] Recommendation ITU-R BS.468-4 (1986): "Measurement of audio-frequency noise voltage level in sound broadcasting".
- [2] Recommendation ITU-R BS.450-3 (2001): "Transmission standards for FM sound broadcasting at VHF".

## 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] ETSI TR 100 028-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [i.3] ETSI TR 100 028-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.4] 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.5] Recommendation ITU-R BS.412 (1998): "Planning standards for terrestrial FM sound broadcasting at VHF".

- [i.6] Recommendation ITU-R BS.641 (1986): "Determination of radio-frequency protection ratios for frequency-modulated sound broadcasting".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.1] and the following apply:

**antenna port:** port of an apparatus which is designed, in normal operation, to be connected to an antenna using coaxial cable

**broadcasting service:** radio communication service in which the transmissions are intended for direct reception by the general public

NOTE: This service may include sound transmissions, television transmissions or other types of transmission.

**channel L:** left hand channel of a stereophonic signal

**channel R:** right hand channel of a stereophonic signal

**carrier power:** average power supplied to the antenna port by a transmitter during one cycle taken under the condition of no modulation

**class of emission:** set of characteristics of an emission, designated by standard symbols, e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics

**composite:** See "Multiplex (MPX) signal".

**dBc:** decibels relative to the unmodulated carrier power of the emission

NOTE: In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power P.

**difference signal:** signal (S) theoretically equal to half the difference between the left (L) and right (R) stereophonic signals.  $S = (L - R) / 2$

**exclusion band:** band of radio frequencies where no measurements are made

**frequency tolerance:** maximum permissible departure of the characteristic frequency of an emission from the assigned frequency

NOTE: The frequency tolerance is expressed in parts per  $10^6$  or in Hz.

**harmonic:** component of order greater than 1 of the Fourier series of a periodic quantity

**harmonic number:** integral number given by the ratio of the frequency of a harmonic to the fundamental frequency (second harmonic =  $2 \times$  fundamental frequency)

**mean power:** average power supplied to the antenna port by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope taken under normal operating conditions

**MultiPlex (MPX) signal:** contains all information, including the pilot tone and any supplementary signal which is used to frequency modulate the VHF FM transmitter

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

**out-of-band emissions:** emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions



**pilot tone:** 19 kHz tone used to recover the stereo subcarrier in the stereo-receiver

**reference bandwidth:** bandwidth in which the emission level is specified

**signal L:** corresponds to the information in the left channel of the stereophonic signal

**signal R:** corresponds to the information in the right channel of the stereophonic signal

**spurious emissions:** emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

**stereo subcarrier:** 38 kHz subcarrier used to carry the difference signal

**sum signal:** signal (M) theoretically equal to half of the sum of the left (L) and right (R) stereophonic signals.

$$M = (L + R) / 2$$

**unwanted emissions:** consist of spurious emissions and out of band emissions

## 3.2 Symbols

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

$\Omega$	ohms (unit of resistance)
$\mu$	micro, $10^{-6}$

## 3.3 Abbreviations

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

a.c.	alternating current
AF	Audio Frequency
AM	Amplitude Modulation
BS	Broadcast Sound
d.c.	direct current
dB	deciBel
dBm	dB relative to one milliwatt
EC	European Commission
EFTA	European Free Trade Area
EN	European Norm
ERM	Electromagnetic compatibility and Radio spectrum Matters
EUT	Equipment Under Test
FM	Frequency Modulation
Hz	Hertz (cycles per second)
MPX	MultiPleX
RF	Radio Frequency
rms	root mean square
SNR	Signal to Noise Ratio
V	Volts
VHF	Very High Frequency

## 4 Technical requirements specifications

### 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A at all times when operating within the boundary limits of the declared operational environmental profile.

### 4.2 Conformance requirements

#### 4.2.1 Rated output power

##### 4.2.1.1 Definition

The rated output power is the carrier power that the EUT shall deliver at its antenna port under manufacturers specified conditions of operation.

##### 4.2.1.2 Limit

The carrier output power shall be within  $\pm 0,5$  dB of the rated output power under normal operating conditions as defined by the manufacturer.

##### 4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.1 shall be carried out.

#### 4.2.2 Frequency drift

##### 4.2.2.1 Definition

The frequency drift of an emission is the uncontrolled continuous and irreversible variation of frequency against a predetermined timescale.

##### 4.2.2.2 Limit

For a period of not less than ninety days, the frequency tolerance of the transmitter shall stay within  $\pm 300$  Hz.

##### 4.2.2.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.

#### 4.2.3 Deviation sensitivity stability

##### 4.2.3.1 Definition

Stability of the required audio or MPX input level to the transmitter to achieve desired deviation.

##### 4.2.3.2 Limit

- a) The deviation sensitivity of the transmitters shall remain within  $\pm 3$  % of the declared value under the manufacturers declared operating conditions.

- b) For frequency-agile transmitters the deviation sensitivity shall remain within  $\pm 5$  % of the declared value under the manufacturers declared operating conditions.

#### 4.2.3.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out.

### 4.2.4 Residual AM (Hum and noise)

#### 4.2.4.1 Definition

The amplitude modulated hum and noise level is the peak voltage of the a.c. component at the output of a linear envelope detector, in the absence of any modulation signal. The result is expressed as a percentage of the d.c. component of the envelope detector output.

#### 4.2.4.2 Limits

The permitted level of residual AM in the absence of modulation shall not exceed 1 % when measured in a bandwidth of 20 Hz to 20 kHz (unweighted).

#### 4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out.

### 4.2.5 Synchronous AM (AM due to FM)

#### 4.2.5.1 Definition

Synchronous amplitude modulation is evaluated by measuring the peak voltage of the a.c. component at the output of a linear envelope detector due to presence of a specified modulating signal. The result is expressed as a percentage of the d.c. component corresponding to the unmodulated carrier.

#### 4.2.5.2 Limit

The permitted level of AM due to FM shall not exceed 2 % for a peak deviation of  $\pm 40$  kHz at a modulation frequency of 500 Hz.

#### 4.2.5.3 Conformance

Conformance tests as defined in clause 5.3.5 shall be carried out.

### 4.2.6 Modulator performance (pulse response)

#### 4.2.6.1 Definition

The amplitude and phase performance required for the transmitter to ensure compliance with the maximum frequency deviation.

NOTE: If the amplitude and phase performance of a modulator is out of tolerance the pulse response leads to the result of overdeviation respectively underdeviation. Overdeviation leads to a wider spectrum and in case of clipping etc. to intermodulation products.

#### 4.2.6.2 Limit

The frequency deviation limits in table 4.1 shall apply.