



European Standard

**Fixed Radio Systems;
Point-to-point and Multipoint Systems;
Unwanted emissions in the spurious domain and receiver
immunity limits at
equipment/antenna port of Digital Fixed Radio Systems**

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

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

Major changes with respect to previous version

This revision is consequent to recent revision of CEPT/ERC Recommendation 74-01 [4] and inclusion in other ETSI point-to-point standards of systems with bandwidth wider than 500 MHz, which have some different regulation in ECC/REC(02)05 [5] and Recommendation ITU-R SM.1539 [2].

Therefore alignment is needed on the following arguments:

- Spurious emission domain limits for BWA systems in bands between 1 GHz and 6 GHz
- Boundary between out of band and spurious domains for systems with bandwidths > 500 MHz
- Updated of examples in clause B.2

1 Scope

The term Spurious emissions is used for simplicity elsewhere in the present document but with the more broader meaning of "*unwanted emissions in the spurious domain*" introduced by Recommendation ITU-R SM.329 [1] for clarifying the Radio Regulation definitions and the application of recommended limits for all unwanted emissions; it also recommends that spurious emissions limits apply to all unwanted emissions falling in the spurious domain.

Therefore the present document deals with limits for unwanted emissions in the spurious domain at antenna port of Digital Fixed Radio Systems (DFRS) as defined by Recommendation ITU-R SM.329 [1] and CEPT/ERC Recommendation 74-01 [4] and ECC Recommendation (02)05 [5].

Moreover it covers immunity characteristics at receiver's antenna port.

Scope of the present document is to define specific limits at antenna port for spurious emissions domain and receiver immunity for suitable inter-working of Digital Fixed Radio Systems (i.e. Point-to-point and Multipoint systems) in the same or in different frequency band whenever allocated to Fixed Service in the range 9 kHz to 300 GHz.

However systems with fundamental emission below 30 MHz are not considered relevant for Digital Fixed Radio Systems and are outside the scope of the present document.

Spurious emissions domain levels and immunity performance at antenna port are also relevant to essential requirements under article 3.2 of Directive 1999/5/EC [i.12] on Radio equipment and Telecommunication Terminals equipment (R&TTE).

The present document complements CEPT/ERC Recommendation 74-01 [4] which gives limits for Unwanted emissions in the Spurious domain with particular regards to "inter Services" operations, while WG TM4 assumed that in some case more protection is required for compatibility among fixed radio systems deployed in the same geographical area.

Additional considerations and background for producing the present document are:

- Recommendation ITU-R SM.329 [1] considers emissions from any system, including digital modulation and allows options for the definition of the frequency boundary between out-of-band domain and spurious emissions domain. It recommends different category of level limits applicable to the Fixed Service;
- Recommendation ITU-R SM.1539 [2] describes the application of the boundary concept between out-of-band and spurious emission domains;
- Recommendation ITU-R F.1191 [3] define the application of Radio Regulations [i.13] and SM set of Recommendation ITU-Rs concepts of out-of-band, unwanted and spurious emissions to DFRS, clarify the applicability for the boundary between out-of-band and Spurious emissions domains but maintain the same possible limit options provided by ITU-R Recommendation SM.329-10 [1];
- CEPT/ERC Recommendation 74-01 [4], endorses only the more stringent Category B limits of Recommendation ITU-R SM.329-10 [1];
- after the coming into force of RTTE Directive [i.12] the emissions and immunity at antenna port fall under its article 3.2 requirements for "*effective use of spectrum*" and "*avoidance of harmful interference*" and they are no longer an EMC requirement;
- it is convenient to maintain a single EN covering these parameters instead of replicating them on each single product standard, avoiding possible deviation from what required by other CEPT and ITU-R normative;
- limits for unwanted emissions in the spurious domain are supposed to be fixed in view of inter-working compatibility among various Fixed Radio Systems in same or different band exploited in the same area;
- the measurement of the required limits should also be feasible in a suitable and cost effective conformance test (annex B gives also information in this field);
- it is necessary that DFRS receivers provide a minimum level of immunity at antenna port towards possible interference at any frequency band of practical interest;

- a suitable and easy to perform criterion for DFRS receivers' immunity at antenna port may be considered the application of a CW interference.

Some ETSI deliverables for DFRS, sometimes, provide limits for both "external" and "internal" spurious domain emissions and the latter are outside the scope of the present document. Moreover the limits for emissions given in the present document do not prevent more stringent requirement given in those deliverables for intra-system purpose (i.e. local Transmitter to Receiver interference usually referred as "internal").

In order to fix the suitable limits, in annex B, spurious domain emissions are analysed from the point of view of a suitable test method for conformance testing.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For a specific reference, only the cited version applies. For a non-specific reference, 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 <http://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.

2.1 Normative references

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

- [1] Recommendation ITU-R SM.329-12: "Unwanted emissions in the spurious domain".
- [2] Recommendation ITU-R SM.1539-1: "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".
- [3] Recommendation ITU-R F.1191-3: "Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems".
- [4] CEPT/ERC Recommendation 74-01 (2011): "Unwanted emissions in the spurious domain".
- [5] ECC Recommendation (02)05 (2012): "Unwanted emissions".

2.2 Informative references

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] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment - Definitions, general requirements and test procedures".
- [i.2] ETSI EN 301 126-2-1: "Fixed Radio Systems; Conformance testing; Part 2-1: Point-to-Multipoint equipment; Definitions and general requirements".
- [i.3] ETSI EN 301 126-2-2: "Fixed Radio Systems; Conformance testing; Part 2-2: Point-to-Multipoint equipment; Test procedures for FDMA systems".
- [i.4] ETSI EN 301 126-2-3: "Fixed Radio Systems; Conformance testing; Part 2-3: Point-to-Multipoint equipment; Test procedures for TDMA systems".
- [i.5] ETSI EN 301 126-2-4: "Fixed Radio Systems; Conformance testing; Part 2-4: Point-to-Multipoint equipment; Test procedures for FH-CDMA systems".

- [i.6] ETSI EN 301 126-2-5: "Fixed Radio Systems; Conformance testing; Part 2-5: Point-to-Multipoint equipment; Test procedures for DS-CDMA systems".
- [i.7] ETSI EN 301 126-2-6: "Fixed Radio Systems; Conformance testing; Part 2-6: Point-to-Multipoint equipment; Test procedures for Multi Carrier Time Division Multiple Access (MC-TDMA) systems".
- [i.8] ETSI EN 302 217-2-2: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonized EN covering the essential requirements of Article 3.2 of the R&TTE Directive".
- [i.9] ETSI EN 302 217-2-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied".
- [i.10] ETSI TR 101 036-1: "Fixed Radio Systems; Generic wordings for standards on DFRS (Digital Fixed Radio Systems) characteristics; Part 1: General aspects and point-to-point equipment parameters".
- [i.11] Recommendation ITU-R F.746-10: "Radio-frequency arrangements for fixed service systems".
- [i.12] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.13] ITU-R Radio Regulations (2008) Article 1.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

boundary between out-of-band and spurious domains: frequency limit that subdivides the two domains and the applicability

NOTE: Recommendation ITU-Rs SM.329 [1] and SM.1539 [2] describe the possible application to all radio emissions. Recommendation ITU-R F.1191 [3] details it for Fixed Service systems.

EN: European Standard (Telecommunications series)

evaluation bandwidth: bandwidth where the spurious domain emission limits are measured (e.g. the spectrum analyser resolution bandwidth) for further normalization/integration to the reference bandwidth

Broadband wireless access (BWA) system: access system used for the deployment of radio access networks in both the fixed service and the mobile service

Channel Separation(CS): distance between adjacent channels in a radio frequency channels arrangement (defined in ECC or ITU-R or national recommendations)

NOTE 1: it represents one of the major parameters for the identification of the radio equipment use and relevant requirements.

NOTE 2: Some channel arrangements give only a continuous raster of elementary frequency slots for composing multiple ($N \times$ elementary slot) aggregated channels of various size. In this case the actual CS would be equal to the $N \times$ elementary slot used by the radio system. When no channel arrangement or elementary slot raster is defined in the band of operation of the radio system, the occupied bandwidth should be considered in substitution of the CS.

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 (Radio Regulations [i.13])

NOTE: For the purpose of the present document, $\beta/2$ is assumed to be equal to 0,5 % (Recommendation ITU-R F.1191 [3]).

out-of-band domain (of an emission): frequency range, immediately outside the necessary bandwidth but excluding the *spurious domain*, in which *out-of-band emissions* generally predominate

NOTE: Out-of-band emissions, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. Spurious emissions likewise may occur in the out-of-band domain as well as in the spurious domain. However, the limit in the out-of-band-domain applies to any unwanted emissions independently from their formal identification as out-of-band or spurious emissions.

out-of-band emissions: any unwanted emission, outside the channel bandwidth, which falls at frequencies separated from the centre frequency of the emission by less than 250 % of the relevant channel separation, where the system is intended to be used.

NOTE: See Recommendation ITU-R F.1191 [3].

receiver spurious emissions: spurious sent backwards to the antenna port by a receiver

NOTE: Sometimes they are also referenced as "spurious radiations"

reference bandwidth: bandwidth where the spurious emission limits are defined

NOTE: See also Recommendation ITU-R SM.329-10 [1].

spurious domain (of an emission): frequency range beyond the *out-of-band domain* in which *spurious emissions* generally predominate

NOTE: Spurious emissions may occur in the out-of-band domain as well as in the spurious domain. Likewise out-of-band emissions, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. However, the limit in the spurious-domain applies to any unwanted emissions independently from their formal identification as out-of-band or spurious emissions.

spurious emissions: any unwanted emission which falls at frequencies separated from the centre frequency of the emission by 250 % or more of the relevant channel separation, where the system is intended to be used

NOTE: See Recommendation ITU-R F.1191 [3].

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

3.2 Symbols

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

dBc	decibels relative to carrier mean power
dB _i	decibel relative to an isotropic radiator
dB _m	decibels relative to milliwatt
GHz	GigaHertz
kHz	kiloHertz
MHz	MegaHertz

3.3 Abbreviations

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

ATe	external ATtenuator
ATI	internal spectrum analyser input ATtenuator
ATPC	Automatic Transmission Power Control
BER	Bit Error Rate

BWA Broadband Wireless Access
 BWe evaluation BandWidth for spectral measurement

NOTE: i.e. spectrum analyser resolution bandwidth.

BW_r reference BandWidth
 CEPT Conférence Européenne des administrations des Postes et des Télécommunications
 (European Conference of Postal and Telecommunications administrations)
 CS Channel Separation
 CW Continuous Wave
 DFRS Digital Fixed Radio Systems
 DUT Device Under Test
 ECC Electronic Communication Committee of the CEPT
 EMC ElectroMagnetic Compatibility
 ERC European Radiocommunications Committee of the CEPT, presently become ECC
 F_c cut-off Frequency
 HDFFS High Density Fixed Service, according Resolution 75 (WRC 2000)
 IM InterModulation
 i.m.p. intermodulation products
 ITU-R International Telecommunication Union - Radiocommunications standardization sector
 MP MultiPoint

NOTE: Generic term including both P-MP and MP to MP mesh architectures.

MS Master Station of a P-MP system

NOTE: Also known as Base Station in mobile terminology.

P-MP Point-to-MultiPoint system
 P-P Point-to-Point system
 QAM Quadrature Amplitude Modulation
 RF Radio Frequency
 RR Radio Regulations
 RS Repeater Station (of a P-MP system)
 RSL Receiver Signal Level
 R&TTE Radio and Telecommunication Terminals Equipment
 Rx Receiver
 STM-1 Synchronous Transport Module Level 1
 Sub-STM-1 old terminology for STM-0

NOTE: Synchronous Transport Module Level 0.

TS Terminal Station

NOTE: Remote out-station with subscriber interface of a P-MP system.

Tx Transmitter
 VSWR Voltage Standing Wave Ratio
 WRC World Radio Conference

4 Transmitter spurious domain emissions at antenna port

According to Recommendation ITU-R SM.329 [1] and the application to fixed service provided by Recommendation ITU-R F.1191 [3], the spurious domain emissions limits are applied to unwanted emissions at frequencies which are, for channel separations ≤ 500 MHz, ± 250 % of the relevant channel separation outside the nominal carrier frequency (spurious emission domain).

For channel separation > 500 MHz, according Recommendation ITU-R SM.1539 [2] and CEPT/ERC Recommendation 74-01 [4], the spurious domain emissions limits are applied to unwanted emissions at frequencies which are outside the nominal carrier frequency by more than $\pm (500 \text{ MHz} + 150 \%$ of the relevant channel separation expressed in MHz) of the relevant channel separation (spurious emission domain).

According Recommendation ITU-R F.1191 [3], the Channel Separation (CS) is taken as $XS/2$ for alternated frequency channel arrangements and XS for co-channel and interleaved frequency channel arrangements as defined by Recommendation ITU-R F.746 [i.11].

The emission within $\pm 250 \%$, or in case $\pm (500 \text{ MHz} + 150 \%)$, of the relevant channel separation (out-of-band domain) includes only fundamental and unwanted emissions in the out-of-band domain which are outside the scope of the present document.

4.1 Limits

Unless more severe requirement were reported into a specific product ETSI deliverable, the unwanted emissions in the spurious domain delivered at antenna port, of both transmitter and receiver, of Fixed Radio Systems shall be limited within the average power limits reported below.

For "noise-like" emissions, the limits are intended not to be exceeded in any elementary measuring bandwidth.

The limit values are defined at reference point C' shown in the general RF block diagram of figure 1.

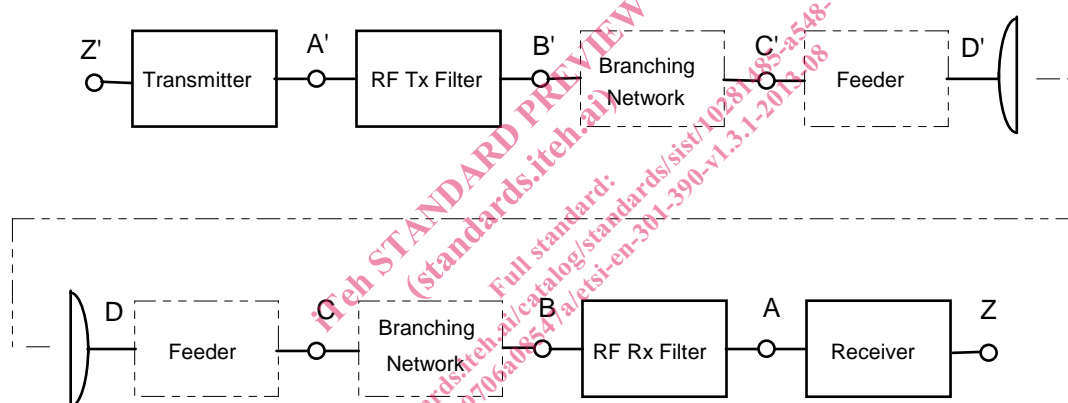


Figure 1: RF block diagram

4.1.1 Point-to-point equipment

The CEPT/ERC Recommendation 74-01 [4] shall apply.

For reader convenience, annex A gives the details for its application to practical systems.

4.1.2 Multipoint equipment with fundamental emission below 21,2 GHz

The CEPT/ERC Recommendation 74-01 [4] shall apply.

For reader convenience, annex A gives the details for its application to practical systems.

4.1.3 Multipoint equipment with fundamental emission above 21,2 GHz

The CEPT/ERC Recommendation 74-01 [4] shall apply as spurious domain emissions limit in the frequency range 9 kHz to 21,2 GHz and above 43,5 GHz.

For spurious domain emissions, falling in the range 21,2 GHz to 43,5 GHz, the tighter limits shown in figures 2 and 3 shall apply to both Central and Terminal Stations.