ETSI EN 302 326-2 V2.1.1 (2021-09)

Fixed Radio Systems;
Multipoint Equipment and Antennas;
Part 2: Harmonised Standard for access to radio spectrum

Reference
REN/ATTM-0436

Keywords
access, DFRS, DRRS, FWA, multipoint, radio, system

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

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.

The present document covers characteristics and requirements for fixed multipoint radio equipment using a variety of access and duplex methods and operating at a variety of bit rates in frequency bands as specified in the present document.

The present document is part 2 of a multi-part deliverable covering the Fixed Radio Systems; Multipoint Equipment and Antennas, as identified below:

Part 1: "Overview and Requirements for Digital Multipoint Radio Systems";

Part 2: "Harmonised Standard for access to radio spectrum";

Part 3: "Multipoint Antennas".

NOTE: Part 1 is no longer maintained and referenced in other parts of the series.

National transposition dates	
Date of adoption of this EN:	30 August 2021
Date of latest announcement of this EN (doa):	30 November 2021
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 May 2022
Date of withdrawal of any conflicting National Standard (dow):	31 May 2023

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 defines the essential characteristics for multipoint radio equipment and up to 43,5 GHz to comply with article 3.2 of Directive 2014/53/EU [i.1].

For the purpose of the present document, multipoint radio systems can be considered as radio systems which interconnect a number of fixed stations (usually more than two). The topology of the systems may be Point-to-MultiPoint (P-MP), or MultiPoint-to-MultiPoint (MP-MP), known as "Mesh".

Depending on the application, MultiPoint Systems can be seen either as "Fixed Wireless Access" (FWA) systems to grant multiple access to different services with a variety of bit rates, or as "infrastructure" or "backhaul" applications when different stations in a network will be connected to support, e.g. duplex mobile telephony.

Either as narrowband or wideband system MultiPoint technology facilitates access to public and private networks (PSTN, Internet, PDN, etc.) to connect residential and business subscribers in urban, suburban and rural areas.

Access and infrastructure applications can be supported simultaneously.

In order to (technically) cover different market and network requirements, with an appropriate balance of performance to cost and effective use of the radio spectrum, the present document, together with ETSI EN 302 326-3 [i.2], offers a number of radio equipment types and antennas alternatives (integral or dedicated antennas).

Those options include:

- channel separation alternatives (as provided by the relevant CEPT Recommendation);
- spectral efficiency class alternatives (different modulation formats provided in radio equipment standards).

Antenna characteristics are not relevant for access to radio spectrum of MP fixed radio systems (see technical description in ETSI TR 101 506 [i.6]). For information, the most common types of antennas are standardized in Part 3 of this multi-part deliverable [i.2].

The applicability of this whole multi-part deliverable to MP equipment is governed by the definition of a number of equipment/system profiles that define the set of consistent requirements to which equipment would comply.

For compliance purposes, a specific type of equipment needs to be identified by an Equipment Classification (EqC) coherent set, as specified in annex C.

Based on this Equipment Classification, the appropriate clauses of the present document have to be applied.

The present document introduces new technical features compared to the previous version in terms of RX intermodulation requirements and ATPC functionality, mandatory for managing the different CS/RS link lengths where the system has to operate as intended. In addition, it covers equipment operating in the band 40,5 GHz to 43,5 GHz frequency band, previously separated and handled covered by ETSI EN 301 997-2 [i.27], under the regime of Directive 1999/5/EC [i.39].

For more background information on the antenna parameters, not relevant to article 3.2 of Directive 2014/53/EU [i.1], see ETSI EN 302 326-3 [i.2].

Following annexes are embedded in the present document:

- Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU [i.1]
- Annex B (normative): Test report in relation to flexible systems applications
- Annex C (normative): Equipment classification (EqC) and system capacity
- Annex D (informative): Transmitter Radio Frequency Spectrum mask background for ATPC and/or RTPC implementation
- Annex E (informative): Overview of technology features of multipoint systems
- Annex F (informative): Frequency bands
- Annex G (informative): Summary Table of EqC subject to conformance declaration
- Annex H (informative): System architecture
- Annex I (informative): Mixed-mode operation
- Annex J (informative): Antennas
- Annex K (informative): Typical reference model for BER, MGBR and EMO
- Annex L (informative): Test interpretation and measurement uncertainty
- Annex M (informative): Bibliography
- Annex N (informative): Change History

1 Scope

The present document specifies technical characteristics and methods of measurements applicable to radio equipment used in MultiPoint (MP) Digital Fixed Radio Systems (DFRS) (see note 2) designed for use in the following sub-ranges (see note 3):

- 30 MHz to 1 GHz.
- 1 GHz to 3 GHz.
- 3 GHz to 11 GHz.
- 24,25 GHz to 29,5 GHz.
- 31,0 GHz to 33,4 GHz.
- 40,5 GHz to 43,5 GHz.

NOTE 1: 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.

The present document is applicable to multipoint radio system equipment using any arbitrary access method. It applies to all equipment composing the MP systems, i.e. to Central Station (CS), Terminal Station (TS) and Repeater Station (RS).

Time Division Duplex (TDD) or Frequency Division Duplex (FDD or H-FDD) can be used on an equivalent basis.

Systems implementing an actual FH-CDMA access method with hopping period exceeding 400 ms are not considered within the scope of the present document.

NOTE 2: Applications intended for offering in the bands 3,4 GHz to 3,8 GHz the option of Nomadic Wireless Access (NWA), according to the NWA definition in Recommendation ITU-R F.1399 [i.14], are also considered in the scope of the present document.

NOTE 3: For more information on the applicable frequency bands, refer to Annex F.

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] CEPT/ERC/REC 74-01 (2019): "Unwanted emissions in the spurious domain".

[2] ETSI EN 301 390 (V1.3.1) (08-2013): "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".

[3] ETSI EN 301 126-2-1 (V1.1.1) (12-2000): "Fixed Radio Systems; Conformance testing; Part 2-1: Point-to-Multipoint equipment; Definitions and general requirements".

[4] ETSI EN 301 126-2-2 (V1.1.1) (11-2000): "Fixed Radio Systems; Conformance testing; Part 2-2: Point-to-Multipoint equipment; Test procedures for FDMA systems".

[5] ETSI EN 301 126-2-3 (V1.2.1) (11-2004): "Fixed Radio Systems; Conformance testing; Part 2-3: Point-to-Multipoint equipment; Test procedures for TDMA systems".

[6] ETSI EN 301 126-2-4 (V1.1.1) (11-2000): "Fixed Radio Systems; Conformance testing; Part 2-4: Point-to-Multipoint equipment; Test procedures for FH-CDMA systems".

[7] ETSI EN 301 126-2-5 (V1.1.1) (11-2000): "Fixed Radio Systems; Conformance testing; Part 2-5: Point-to-Multipoint equipment; Test procedures for DS-CDMA systems".

[8] ETSI EN 301 126-2-6 (V1.1.1) (02-2002): "Fixed Radio Systems; Conformance testing; Part 2-6: Point-to-Multipoint equipment; Test procedures for Multi Carrier Time Division Multiple Access (MC-TDMA) systems".

[9] ETSI EN 300 019-1-3 (V2.4.1) (04-2014): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".

[10] ETSI EN 300 019-1-4 (V2.2.1) (04-2014): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

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 EN 302 326-3: "Fixed Radio Systems; Multipoint Equipment and Antennas; Part 3: Multipoint Antennas".

[i.3] ITU Radio Regulations (2016).

[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] ETSI EG 203 336 (V1.2.1): "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] ETSI TR 101 506 (V2.2.1): "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements covering article 3.2 of Directive 2014/53/EU to Fixed Radio Systems".

[i.7] 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".

[i.8] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.9] ETSI TR 102 215: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Recommended approach, and possible limits for measurement uncertainty for the measurement of radiated electromagnetic fields above 1 GHz".

[i.10] ETSI TR 103 103 (V1.1.1): "Fixed Radio Systems; Point-to-point systems; ATPC, RTPC, Adaptive Modulation (mixed-mode) and Bandwidth Adaptive functionalities; Technical background and impact on deployment, link design and coordination".

[i.11] ERC Report 25: "The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz".

[i.12] ETSI TR 101 274: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in the access network: Overview of different access techniques".

[i.13] Recommendation ITU-R F.746: "Radio-frequency arrangements for fixed service systems".

[i.14] Recommendation ITU-R F.1399: "Vocabulary of terms for wireless access".

[i.15] CEPT/ECC/DEC(05)01: "The use of the band 27.5-29.5 GHz by the Fixed Service and uncoordinated Earth stations of the Fixed-Satellite Service (Earth-to-space)".

[i.16] CEPT/ERC/REC(01)02: "Preferred channel arrangement for digital fixed service systems operating in the frequency band 31.8 - 33.4 GHz".

[i.17] CEPT/ECC/REC(04)05: "Guidelines for accommodation and assignment of multipoint Fixed Wireless Systems in frequency bands 3.4-3.6 GHz and 3.6-3.8 GHz".

[i.18] CEPT/ECC/REC(11)01: "Guidelines for assignment of frequency blocks for fixed wireless systems in the bands 24.5-26.5 GHz, 27.5-29.5 GHz AND 31.8-33.4 GHz".

[i.19] CEPT/ERC/REC 12-05: "Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10.0 - 10.68 GHz".

[i.20] CEPT/ERC/REC 12-08: "Harmonized radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3 600 MHz to 4 200 MHz".

[i.21] CEPT/ERC/REC T/R 13-02: "Preferred channel arrangements for the fixed services in the range 22.0 - 29.5 GHz".

[i.22] CEPT/ERC/REC 14-03: "Harmonized radio frequency channel arrangements for low and medium capacity systems in the band 3 400 MHz to 3 600 MHz".

[i.23] CEPT/ECC/REC(02)02: "Channel arrangements for digital fixed service systems (point-to-point and point-to-multipoint) operating in the frequency band 31 - 31.3 GHz".

[i.24] ETSI EG 202 306: "Transmission and Multiplexing (TM); Access networks for residential customers".

[i.25] ETSI ETS 300 019 (all parts): "Equipment engineering; Environmental conditions and environmental tests for telecommunications equipment".

[i.26] ETSI EN 300 019 (all parts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

[i.27] ETSI EN 301 997-2: "Transmission and Multiplexing (TM); Multipoint equipment; Radio equipment for use in Multimedia Wireless Systems (MWS) in the frequency band 40,5 GHz to 43,5 GHz; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

[i.28] ETSI EN 301 126-3-2 (V1.2.1) (12-2003): "Fixed Radio Systems; Conformance testing; Part 3-2: Point-to-Multipoint antennas - Definitions, general requirements and test procedures".

[i.29] Recommendation ITU-R P.525-4: "Calculation of free-space attenuation".

[i.30] CEPT/ECC/REC(01)04: "Recommended guidelines for the accommodation and assignment of multimedia wireless systems (MWS) and point-to-point (P-P) fixed wireless systems in the frequency band 40.5 - 43.5 GHz".

[i.31] Decision 2007/344/EC: "Commission Decision of 16 May 2007 on harmonised availability of information regarding spectrum use within the Community".

[i.32] Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

[i.33] Commission Implementing Decision (EU) 2019/784 of 14 May 2019 on the harmonisation of the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union.

[i.34] Decision 2008/411/EC: "Commission Decision of 21 May 2008 on the harmonisation of the 3 400 - 3 800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community".

[i.35] ECO Frequency Information System (EFIS).

NOTE: Available at ECO Frequency Information System (cept.org).

[i.36] ECO Report 04: "Fixed Service in Europe Implementation Status".

[i.37] Technical Regulation Information System (TRIS).

NOTE: Available at https://ec.europa.eu/growth/tools-databases/tris/en.

[i.38] ISO/IEC 7498-1: "Information technology -- Open Systems Interconnection -- Basic Reference Model: The Basic Model".

[i.39] 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).

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

active antenna: antenna including one or more active electronic components that interact with the Radio Frequency (RF) signal as e.g. amplifier or diode

antenna: part of the transmitting or receiving system that is designed to transmit or receive electromagnetic radiation

assigned band: frequency block or the aggregation of all RF channels assigned to a MP system

NOTE: The assigned band may consist also of several non-contiguous RF channels (see Figure 1).

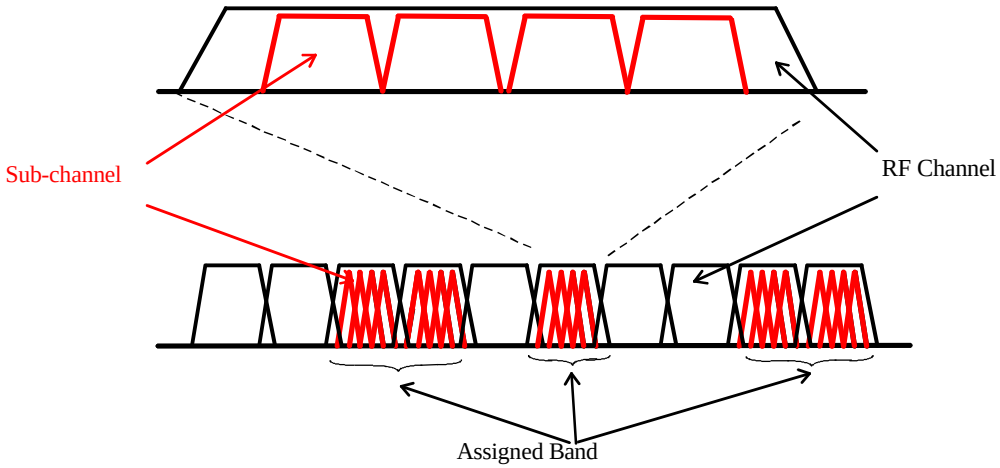

Figure 1: Relationship between "sub-channel", "RF channel" and "assigned band"

Automatic Transmit Power Control (ATPC): function implemented to offer a dynamic power control that delivers maximum power only during deep fading; in this way for most of the time the interference is reduced and the transmitter operates in a higher linearity mode

NOTE: When this function is used, the transmit power is dynamically changed with respect the propagation conditions. In principle, when ATPC is implemented, three different level of power may be identified:

- maximum available power (delivered only in conditions of deep fading);
- maximum nominal power (useable on a permanent basis when ATPC is disabled); it should be noted that this power is "nominal for the equipment" and is not to be confused with the "nominal link level" possibly set by the frequency co-ordinating body in the licensing conditions. The latter is achieved through passive RF attenuators or use of the RTPC type 1 function;
- minimum power (delivered in unfaded conditions).

Central Station (CS): base station which communicates with Terminal Stations and in some cases Repeater Stations

Channel Separation (ChS): separation between the centre frequencies of neighbouring RF channels according Recommendation ITU-R F.746 [i.13] and used for adjacent channel interference requirements

NOTE 1: In some access methodologies the whole channel given to the system is subdivided in sub-channels for use by subsets of terminal stations; however also in this case the channel separation is still intended in the same way as the above definition (minimum continuous segment of bandwidth made available to the system, generally identified by the ChS occupancy of the CS).

NOTE 2: In this whole multi-part deliverable Channel Separation (ChS) is a free variable the value(s) of which the manufacturer declares. Limiting values of some other parameters which are requirements of the present document are expressed as functions of ChS. In general, MP licenses are given within a block of frequencies exclusively assigned to an operator; within that block, the licensing conditions provided by the responsible national administration may leave free use of any ChS or may place restrictions on which ChS values are permitted.

dedicated antenna: antenna specifically designed for being attached to the radio equipment (i.e. with special mechanical fixing to the antenna port of the specific radio supplied), but can be separated from the equipment (typically for transport purpose)

downlink: direction of traffic flow from Central Station towards a Terminal Station (TS)

DS-CDMA maximum system loading: maximum number of 64 kbit/s signals or equivalent which can be transmitted and received by a single CS within a specified RF-bandwidth, fulfilling given performance and availability objectives in respect to fading conditions

Equipment Classification (EqC): multi-field classification which indicates the principal characteristics of a particular equipment within the scope of the present document and indicates which alternative consistent sets of requirements are applicable to that equipment

FDMA signal: signal comprising all permitted carriers in a channel at full system load

FH-CDMA Frequency Hopping (FH): spread spectrum technique whereby individual radio links are continually switched from one sub-channel to another

NOTE: Such links are not constrained to a single RF channel.

FH-CDMA hopping sequence: the activation sequence of sub-channels which a particular link follows

FH-CDMA slow frequency hopping: FH technique where the hopping period is larger than the symbol period

Frequency Hopping (FH): See **FH-CDMA Frequency Hopping (FH)**.

Full Load Condition (FLC): traffic conditions, as declared by manufacturer according the specific technology design (see notes 1 and 2), related to the maximum TX and RX spectrum utilization

NOTE 1: In some cases, Full Load Conditions may be different for TX and RX performances evaluation, as well as for CS, TS and RS equipment.

NOTE 2: For DS-CDMA access method see also definition of *DS-CDMA maximum system loading.*

gain (of an antenna): ratio of the radiation intensity, in a given direction, to the radiation intensity that would be obtained if the power accepted by the antenna was radiated isotropically

gross bit rate: transmission bit rate over the air. In case of a transmitter working in burst mode, the gross bit rate is the instantaneous maximum transmission bit rate during the burst

NOTE: The gross bit rate has a unique relationship to the symbol rate through the implemented modulation format. In the case of OFDMA this relationship is unique when all OFDMA sub-carriers are in use. Gross bit rate for TDMA/OFDMA systems is the aggregate bit rate of all OFDMA sub-carriers transmitting simultaneously (e.g. for a TDMA/OFDMA system, in any single TDMA burst any single OFDMA TS may be dynamically assigned a subset of the OFDMA sub-channels. Multiple TS are allowed to transmit at the same time on disjoint sets of OFDM-sub-carriers, so the MGBR is defined when all available OFDM-sub-carriers are in use at the same time).

hopping sequence: See **FH-CDMA hopping sequence**.

integral (or integrated) antenna: antenna which is declared as part of the radio equipment by the manufacturer

NOTE: Even when equipment with integral antenna is concerned, it may still be possible to separate the antenna from the equipment using a special tool. In such cases the assessment of the radio equipment against requirements of the present document and of the antenna against requirements of ETSI EN 302 326-3 [i.2] could be done separately by the actual manufacturer(s).

Maximum System Loading (MSL): (only defined for DS-CDMA systems), see **DS-CDMA maximum system loading**.

mixed-mode system: system having the capability for stations (CS or TS or RS) to operate on different modulation orders and/or switch dynamically between different modulation orders

NOTE: This capability may be used to improve deployment and capacity capabilities or to adaptively adjust for varying channel impairments, or to improve spectral efficiency by dynamically allocating transmission capacity. The switching between modulation orders may occur as frequently as appropriate to the system (e.g. on a per-burst or per-timeslot or per-carrier basis).

multi-carrier system: system where more than one modulated sub-carrier is radiated from the same transmitter

NOTE 1: A system that uses several transmitters sharing a single passive antenna is not considered as a multi-carrier system. Systems using FDM/OFDM modulation formats are also not considered multi-carrier unless more than one separate FDM/OFDM signal set is transmitted from the same transmitter.

NOTE 2: FDMA systems are intrinsically multicarrier, because any single sub-carrier may be easily discriminated at RF level (unlike OFDM modulations) and activated according to the traffic requirements. However, for the purpose of the present document, a FDMA system are also considered as a whole (fully loaded) single signal set (comprised of multiple carriers), unless more than one FDMA signal set is transmitted from the same transmitter.