International Telecommunication Union

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Recommendation ITU-R M.2009-2
(01/2019)

Radio interface standards for use by public protection and disaster relief operations in accordance with Resolution 646 (Rev.WRC-15)

M Series

Mobile, radiodetermination, amateur and related satellite services

International Telecommunication Union

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Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R M.2009-2

Radio interface standards for use by public protection and disaster relief operations in accordance with Resolution 646 (Rev.WRC-15)

(2012-2015-2019)

Scope

This Recommendation identifies radio interface standards applicable for public protection and disaster relief (PPDR) operations in accordance with Resolution **646 (Rev.WRC-15)**. The broadband standards included in this Recommendation are capable of supporting users at broadband data rates, taking into account the ITU-R definitions of "wireless access" and "broadband wireless access" found in Recommendation ITU-R F.1399.

This Recommendation addresses the standards themselves and does not deal with the frequency arrangements for PPDR systems, for which a separate Recommendation exists: Recommendation ITU-R M.2015.

This Recommendation also addresses radio interface standards for use for public protection and disaster relief operations. These standards are based on common specifications developed by standards development organizations (SDOs). Using this Recommendation, regulators, manufacturers and PPDR operators should be able to determine the most suitable standards for their needs.

Keywords

PPDR, IMT, radio interface standards

Related ITU-R Recommendations, Reports

Recommendation ITU-R F.1399 – Vocabulary of terms for wireless access

Recommendation ITU-R M.1457 – Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)

Recommendation ITU-R M.1801 – Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz

Recommendation ITU-R M.2012 – Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)

Recommendation ITU-R M.2015 – Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance with Resolution **646 (Rev.WRC-15)**

Report ITU-R M.2014 – Digital land mobile systems for dispatch traffic

Report ITU-R M.2291 – The use of International Mobile Telecommunications (IMT) for broadband Public Protection and Disaster Relief (PPDR) applications

Report ITU-R M.2377 – Radiocommunication objectives and requirements for public protection and disaster relief

Report ITU-R M.2415 – Spectrum needs for public protection and disaster relief (PPDR).

The ITU Radiocommunication Assembly,

considering

a) that administrations can determine which technologies to deploy for PPDR operations;

b) that inclusion of standards in this Recommendation does not preclude the use of other standards for PPDR operations,

noting

the acronyms and abbreviations listed in Annex 3,

recognizing

a)   that Resolution **646 (Rev.WRC-15)** encourages administrations to consider the frequency bands/ranges or parts thereof as specified in that Resolution when undertaking their national planning in order to achieve harmonization for advanced public protection and disaster relief solutions;

b)   that Resolution **646 (Rev.WRC-15)** encourages administrations to use harmonized frequency ranges for PPDR to the maximum extent possible, taking into account the national and regional requirements and also having regard to any needed consultation and cooperation with other concerned countries;

c)   that Recommendation ITU-R M.2015 – Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance with Resolution **646 (Rev.WRC-15)** provides guidance on frequency arrangements for public protection and disaster relief radiocommunications, in particular within the frequency ranges specified in *resolves* 2 and 3 of Resolution **646 (Rev.WRC-15)**, as well as countries' frequency arrangements;

d)   that Report ITU-R M.2291 addresses the capabilities of IMT, including the use of Long Term Evolution (LTE) and LTE-Advanced, in support of broadband PPDR communications;

e)   that Report ITU-R M.2377 addresses PPDR objectives and requirements,

recommends

that for PPDR operations the radio interface standards as contained in Annexes 1 and 2 should be used.

Annex 1

Broadband radio interface standards for use by PPDR operations in accordance with Resolution 646 (Rev.WRC-15)

This Annex provides information on broadband standards for use by PPDR operations. References are provided to ITU texts which contain more detailed descriptions of these standards and their capabilities. It is recognized that these standards may not fulfil all the user requirements described in Report ITU-R M.2377, and that each administration and its PPDR organizations will have to analyse the information and determine which standard is most appropriate for their purposes.

1   IMT-2000 Code division multiple access Multi-Carrier

The specifications for the radio interface standard IMT-2000 Code division multiple access (CDMA) Multi-Carrier (IMT-2000 CDMA-MC) are developed within 3GPP2 (3rd Generation Partnership Project 2). A full description is available in Annex 2 of Recommendation ITU-R M.1801. For additional information, see also § 5.2 of Recommendation ITU-R M.1457.

2 IMT-2000 CDMA Direct Spread

The specifications for the radio interface standard IMT-2000 CDMA Direct Spread (IMT-2000 CDMA-DS), specifically UTRA FDD, are developed within 3GPP (3rd Generation Partnership Project). This radio interface standard also includes the FDD elements of the Evolved Universal Terrestrial Radio Access (E-UTRA) referred to as Long-Term Evolution (LTE). A full description is available in Annex 2 of Recommendation ITU-R M.1801. For additional information, see also § 5.1 of Recommendation ITU-R M.1457.

3 IMT-2000 orthogonal frequency-division multiple access time-division duplex wireless metropolitan area network

The radio interface standard IMT-2000 orthogonal frequency-division multiple access (OFDMA) time-division duplex (TDD) wireless metropolitan area network (WMAN) (IMT-2000 OFDMA TDD WMAN) is developed within the Institute of Electrical and Electronics Engineers (IEEE). A full description is available in Annex 2 of Recommendation ITU-R M.1801. For additional information, see also § 5.6 of Recommendation ITU-R M.1457.

4 IMT-2000 time-division multiple access single-carrier

The radio interface standard IMT-2000 time division multiple access (TDMA) single-carrier (TDMA-SC) (IMT-2000 TDMA-SC) is developed by the Alliance of Telecommunications Industry Solutions (ATIS) utilizing 3GPP specifications. A full description is available in Annex 2 of Recommendation ITU-R M.1801. For additional information, see also § 5.4 of Recommendation ITU-R M.1457.

5 IMT-2000 CDMA time-division duplex

The specifications for the radio interface standard IMT-2000 CDMA time-division duplex (TDD), specifically UTRA TDD, are developed within 3GPP. This radio interface is called the Universal Terrestrial Radio Access (UTRA) TDD, where three options, called 1.28 Mchip/s TDD, 3.84 Mchip/s TDD and 7.68 Mchip/s can be distinguished. This radio interface standard also includes the TDD elements of the Evolved Universal Terrestrial Radio Access (E-UTRA) referred to as Long-Term Evolution (LTE). A full description is available in Annex 2 of Recommendation ITU-R M.1801. For additional information, see also § 5.3 of Recommendation ITU-R M.1457.

6 LTE-Advanced

"The IMT-Advanced terrestrial radio interface specifications known as LTE-Advanced and based on LTE Release 10 and beyond are developed by 3GPP. In 3GPP terminology, the term E-UTRA (Evolved-UTRA) is also used to indicate the LTE radio interface.

LTE-Advanced is a set of Radio Interface Technologies (RITs) consisting of one FDD RIT and one TDD RIT designed for operation in paired and unpaired spectrum, respectively. The TDD RIT is also known as TD-LTE Release 10 and Beyond or TD-LTE-Advanced. The two RITs have been jointly developed, providing a high degree of commonality while, at the same time, allowing for optimization of each RIT with respect to its specific spectrum/duplex arrangement."[1]

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[1] See § 1.1.1 of Recommendation ITU-R M.2012-1 – Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced).

A full description is available in Annex 3 of Recommendation ITU-R M.1801.

For additional information, see Annex 1 of Recommendation ITU-R M.2012.

7   Synchronous Code Division Multiple Access

The radio interface standard Synchronous Code Division Multiple Access (SCDMA) is developed within the China Communications Standards Association (CCSA). The radio interface supports a channel bandwidth of a multiple of 1 MHz up to 5 MHz. Sub-channelization and code spread, specially defined inside each 1 MHz bandwidth, provides frequency diversity and interference observation capability for radio resource assignment with bandwidth granularity of 8 kbit/s. The channelization also allows coordinated dynamic channel allocations among cells to efficiently avoid mutual interference.

The system employs TDD to separate uplink and downlink transmission. For additional information, see Annex 7 of Recommendation ITU-R M.1801.

8   B-TrunC

The radio interface standard B-TrunC is developed by the CCSA and published by the Ministry of Industry and Information Technology of the People's Republic of China. B-TrunC supports scalable carrier bandwidths, from 20 MHz down to 1.4 MHz. Moreover, B-TrunC can support one-to-many voice call, one-to-many video call, and other PPDR applications by introducing new one-to-many transmission mechanism in radio interface. For additional information, see also YD/T 2741-2014.

Annex 2

Narrow-band radio interface standards for use by PPDR operations in accordance with Resolution 646 (Rev.WRC-15)

This Annex provides information on narrow-band standards for use by PPDR operations. References are provided to ITU texts which contain more detailed descriptions of these standards and their capabilities. It is recognized that these standards may not fulfil all the user requirements described in Report ITU-R M.2377, and that each administration and its PPDR organizations will have to analyse the information and determine which standard is most appropriate for their purposes.

1   Project 25

Project 25 is developed by the Telecommunications Industry Association (TIA) with input from the Project 25 steering committee made up of representatives from the Association of Public Safety Communications Officials International (APCO), the National Association of State Technology Directors (NASTD), selected federal agencies and the National Communications System (NCS). Project 25 operates in 12.5 kHz or 25 kHz channels.

For additional information on the technical and operational characteristics of Project 25, see Report ITU-R M.2014 and Volume 3 of the Land Mobile Handbook.

2 Terrestrial Trunked Radio (TETRA)

The Terrestrial Trunked Radio (TETRA) system was developed in the European Telecommunications Standards Institute (ETSI) as ETSI Project TETRA (now known as ETSI Technical Committee (TC) TETRA) to deliver a digital trunked mobile radio set of standards, under a mandate from the European Commission, for a PMR communications system that could be deployed in Western Europe.

Besides meeting the needs of traditional PMR user organizations, the TETRA standard has also been developed to meet the needs of Public Access Mobile Radio (PAMR) operators.

For additional information on the technical and operational characteristics of TETRA, see Report ITU-R M.2014.

3 Digital Mobile Radio (DMR)

The Digital Mobile Radio (DMR) system was developed by ETSI as a direct digital replacement for analogue PMR while imposing no fundamental changes in the architecture of either conventional or trunked systems.

DMR is a scalable system that can be used in unlicensed mode, and in licensed mode, subject to national frequency planning. It is developed in three "tiers":

– Tier 1 is the low-cost, licence-exempt "digital PMR446".
– Tier 2 is for the professional market offering peer-to-peer mode and repeater mode (licensed).
– Tier 3 is for trunked operation (licensed).

DMR is a two slot Time-Division Multiple Access (TDMA) system offering digital voice and data solutions, and uses a 4FSK modulation scheme utilizing 6.25 kHz per channel. The standard is designed to operate within the existing 12.5 kHz channel spacing.

For additional information on the technical and operational characteristics of DMR, see ETSI Technical Report TR 102 398 that provides a useful introduction to DMR. Technical Specification TS 102 362 parts 1 to 3 covers DMR protocol conformance testing and test suites, and Technical Specification TS 102 490 defines the narrow-band or "digital PMR" protocol.

The System Reference Documents are ETSI Technical Report TR 102 335-1 (Tier 1 DMR) and TR 102 335-2 (licensed).

Annex 3

Acronyms and abbreviations

3GPP	3rd Generation Partnership Project
B-TrunC	Broadband Trunking Communication
CDMA TDD	Code division multiple access time division duplex
DMR	Digital mobile radio
ETSI	European Telecommunications Standards Institute

E-UTRA	Evolved universal terrestrial radio access
FDD	Frequency division duplex
FDMA	Frequency division multiple access
IEEE	Institute of Electrical and Electronics Engineers
LTE	Long-term evolution
OFDMA TDD WMAN	Orthogonal Frequency Division Multiple Access Time Division Duplex Wireless Metropolitan Area Network
PAMR	Public access mobile radio
PMR	Private mobile radio
PPDR	Public protection and disaster relief
SCDMA	Synchronous Code Division Multiple Access
TETRA	Terrestrial trunked radio
TR	Technical report
UHF	Ultra high frequency
UTRA	Universal terrestrial radio access.