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| **Recommendation ITU-R M.2009-1**  **(02/2015)** |
| **Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance with Resolution 646 (Rev.WRC-12)** |
| **M Series**  **Mobile, radiodetermination, amateur**  **and related satellite services** |  |

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

# Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU‑T/ITU‑R/ISO/IEC and the ITU-R patent information database can also be found.

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| Series of ITU-R Recommendations  (Also available online at <http://www.itu.int/publ/R-REC/en>) | |
| **Series** | Title |
| **BO** | Satellite delivery |
| **BR** | Recording for production, archival and play-out; film for television |
| **BS** | Broadcasting service (sound) |
| **BT** | Broadcasting service (television) |
| **F** | Fixed service |
| M | Mobile, radiodetermination, amateur and related satellite services |
| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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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.2009-1

Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance  
with Resolution 646 (Rev.WRC-12)

(2012-2015)

**Keywords:** PPDR, IMT, radio interface standards, UHF band

# 1 Scope

This Recommendation identifies radio interface standards applicable for public protection and disaster relief (PPDR) operations in some parts of the UHF band. 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.

# 2 Introduction

This Recommendation 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.

# 3 Relevant Recommendations and Reports

The existing Recommendations and Reports that are considered to be of importance in the development of this particular Recommendation are as follows:

– 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 UHF bands in accordance with Resolution **646 (Rev.WRC-12)**.

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

– Report ITU-R M.2033 – Radiocommunication objectives and requirements for public protection and disaster relief.

# 4 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;

# 5 Noting

The PPDR user requirements outlined in Report ITU-R M.2033 and the acronyms and abbreviations listed in Annex 3;

# 6 Recognizing

a) that Resolution **646 (Rev.WRC-12)** encourages administrations to consider the frequency bands/ranges or parts thereof as identified in that Resolution when undertaking their national planning for the purposes of achieving regionally harmonized frequency bands/ranges for advanced public protection and disaster relief solutions;

b) that Recommendation ITU-R M.2015 – Frequency arrangements for public protection and disaster relief radiocommunication systems in UHF bands in accordance with Resolution **646 (Rev.WRC-12)** provides guidance on frequency arrangements for public protection and disaster relief radiocommunications in certain regions in some of the bands below 1 GHz identified in Resolution 646.

# 7 Recommendation

The ITU Radiocommunication Assembly,

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-12)

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.2033, 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](http://www.itu.int/rec/R-REC-M.1801/en). For additional information, see also § 5.2 of [Recommendation ITU-R M.1457](http://www.itu.int/rec/R-REC-M.1457/en).

# 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](http://www.itu.int/rec/R-REC-M.1801/en). For additional information, see also § 5.1 of [Recommendation ITU-R M.1457](http://www.itu.int/rec/R-REC-M.1457/en).

# 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](http://www.itu.int/rec/R-REC-M.1801/en). For additional information, see also § 5.6 of [Recommendation ITU-R M.1457](http://www.itu.int/rec/R-REC-M.1457/en).

# 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](http://www.itu.int/rec/R-REC-M.1801/en). For additional information, see also § 5.4 of [Recommendation ITU-R M.1457](http://www.itu.int/rec/R-REC-M.1457/en).

# 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](http://www.itu.int/rec/R-REC-M.1801/en). For additional information, see also § 5.3 of [Recommendation ITU-R M.1457](http://www.itu.int/rec/R-REC-M.1457/en).

# 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]](#footnote-1)

A full description is available in Annex 3 of [Recommendation ITU-R M.1801](http://www.itu.int/rec/R-REC-M.1801/en).

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](http://www.itu.int/rec/R-REC-M.1801/en).

# 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](http://www.ccsa.org.cn/english/show_article.php?categories_id=737fa209-91aa-9568-4f4a-46b7e24c3a99&article_id=cyzx_f8ee005b-8736-e347-4737-5365989a05f6).

Annex 2  
  
Narrow-band radio interface standards for use by PPDR operations  
in accordance with Resolution 646 (Rev.WRC-12)

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.2033, 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](http://www.itu.int/publ/R-REP-M.2014/en) 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](http://www.itu.int/publ/R-REP-M.2014/en).

# 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.

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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). [↑](#footnote-ref-1)