



Recommendation ITU-R M.2009
(03/2012)

Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance with Resolution 646 (WRC-03)

M Series
Mobile, radiodetermination, amateur and related satellite services

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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

Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance with Resolution 646 (WRC-03)

(2012)

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 M.2015 – Frequency arrangements for public protection and disaster relief radiocommunication systems in UHF bands in accordance with Resolution 646 (WRC-03).
- Report ITU-R M.2033 – Radiocommunication objectives and requirements for public protection and disaster relief.
- Report ITU-R M.2014 – Digital land mobile systems for dispatch traffic.

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 Annex 3;

6 Recognizing

- a) that Resolution 646 (WRC-03) encourages administrations to consider the following identified frequency bands/ranges or parts thereof when undertaking their national planning for the purposes of achieving regionally harmonized frequency bands/ranges for advanced public protection and disaster relief solutions:
- in Region 1: 380-470 MHz as the frequency range within which the band 380-385/390-395 MHz is a preferred core harmonized band for permanent public protection activities within certain countries of Region 1 which have given their agreement;
 - in Region 2¹: 746-806 MHz, 806-869 MHz, 4 940-4 990 MHz;
 - in Region 3²: 406.1-430 MHz, 440-470 MHz, 806-824/851-869 MHz, 4 940-4 990 MHz and 5 850-5 925 MHz;
- 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 (WRC-03) 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 (WRC-03)

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 Annex 3, 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 Venezuela has identified the band 380-400 MHz for public protection and disaster relief applications.

² Some countries in Region 3 have also identified the bands 380-400 MHz and 746-806 MHz for public protection and disaster relief applications.

1 Technology “A”

Technology “A” corresponding to the IMT-2000 CDMA-MC technology is 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 Technology “B”

Technology “B” corresponding to IMT-2000 CDMA-DS, specifically UTRA FDD, is developed within 3GPP (3rd Generation Partnership Project). 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 Technology “C”

Technology “C” corresponding to OFDMA TDD WMAN is developed within the 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 Technology “D”

Technology “D” corresponding to TDMA-SC is developed within 3GPP (3rd Generation Partnership Project). 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 Technology “E”

Technology “E” corresponding to IMT-2000 CDMA TDD, specifically UTRA TDD, technology is developed within 3GPP (3rd Generation Partnership Project). This radio interface is called the Universal Terrestrial Radio Access (UTRA) time division duplex (TDD), where three options, called 1.28 Mchip/s TDD, 3.84 Mchip/s TDD and 7.68 Mchip/s can be distinguished. 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 Technology “F”

Technology “F” corresponding to E-UTRA (LTE) technology is developed within 3GPP (3rd Generation Partnership Project). This radio interface is called the Evolved Universal Terrestrial Radio Access (E-UTRA) also referred to as the Long-Term Evolution (LTE). LTE supports scalable carrier bandwidths, from 20 MHz down to 1.4 MHz, and supports both frequency division duplexing (FDD) and time division duplexing (TDD). For additional information, see §§ 5.1 and 5.3 of [Recommendation ITU-R M.1457](#).

Annex 2

Narrow-band radio interface standards for use by PPDR operations in accordance with Resolution 646 (WRC-03)

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 Annex 3, 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 Technology “A”

Technology “A” corresponding to Project 25 is developed by TIA TR-8 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 Technology “B”

Technology “B” corresponding to 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 Technology “C”

Technology “C” corresponding to 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

PPDR user requirements

PPDR is defined in Resolution 646 (WRC-03) through a combination of the terms “public protection radiocommunication” and “disaster relief radiocommunication”. The first term refers to radiocommunications used by responsible agencies and organizations dealing with maintenance of law and order, protection of life and property and emergency situations, and the second term refers to radiocommunications used by agencies and organizations dealing with a serious disruption of the functioning of society, posing a significant widespread threat to human life, health, property or the environment, whether caused by accident, natural phenomena or human activity, and whether developing suddenly or as a result of complex, long-term processes.

In addition, Resolution 646 and Report ITU-R M.2033 describe a range of requirements for PPDR. It is recognized that there is a need for narrow-band, wideband and broadband applications, and Resolution 646 and Report ITU-R M.2033 provide general definitions of these terms applicable for PPDR. It is recognized, however, that other definitions of these terms exist in other ITU texts (such as Recommendation ITU-R F.1399) or in the rules of various individual administrations. As a result, the terms are defined in the Annexes to this Recommendation in a manner appropriate for how they are used within this Recommendation.

PPDR requirements from a user perspective are described in detail in Report ITU-R M.2033, specifically in § 3.2 of Annex 1. These user requirements include priority access, grade of service/quality of service, coverage, a variety of capabilities (including push-to-talk, fast call set-up, hardened equipment that is capable of operating in harsh environments, interconnection to the PSTN, one touch broadcasting/group call capabilities), secure communications, interoperability and regulatory compliance. It is noted that individual administrations or PPDR organizations may have their own requirements for PPDR that go beyond those described herein, and that each standard would need to be evaluated on a case-by-case basis against those requirements.

A Key capabilities of broadband systems relevant to PPDR organizations

- Advanced broadband data capabilities. Broadband data capability enables a broad range of applications. These basic capabilities allow end-users to retrieve information from databases, send information to central locations, such as control centres, and exchange information with other users in their own group or in other user groups. In addition, messaging services offered by SMS, EMS and MMS range from simple text messages to multimedia including transmission of pictures and photos, which is very effective in property protection and recovery operations. With MMS, real-time video transmission also is possible. Real-time video can be an efficient way for public safety users to communicate between the scene of an accident and central locations such as control centres and hospitals.

- Interoperability. Open standards-based technology allows any manufacturer to provide equipment interoperable with equipment from any other manufacturer.
- Economies of scale. As standard-based technologies designed for carrier-class commercial deployment are also used, economies of scale can be achieved. In addition to commercial off-the-shelf equipment, specialized PPDR devices or features required by some PPDR entities can be accommodated with modifications to commercial products and designs.
- IP-based services. Fully compatible with IP-based services.
- Push-to-talk. This function allows predefined groups of users to communicate over a packet channel by pressing a special key.
- Location-based services. Advanced technology solutions built into handsets and networks, and often utilizing satellite signals such as GPS, can enable public safety officials to accurately locate an emergency situation or track a secure shipment. Advanced methods of location measurements from both satellite constellations and the terrestrial infrastructure are capable of sending information that can compute a device's position and relay it back to a requesting entity.
- Encryption. Encryption of voice and data can be provided in several ways, such as over the radio interface, which is standard in different network technologies, or between network equipment. End-to-end encryption of voice can be supported by special terminals or by carrying voice over an encrypted data channel.
- Prioritization (in protocol level) of public safety services over commercial services in case of emergency.

B Key capabilities of narrow-band systems relevant to PPDR organizations

- Effective, efficient, and reliable intra-agency and inter-agency communications so organizations can easily implement interoperable and seamless joint communication in both routine and emergency circumstances.
- User-friendly equipment so users can take full advantage of their radios' lifesaving capabilities on the job – even under adverse conditions – with minimal training.
- Radio spectrum efficiency so networks will have enough capacity to handle calls and allow room for growth, even in areas where the spectrum is crowded and it is difficult for agencies to obtain licenses for additional radio frequencies.
- System designs that provide effective and efficient one-to-many half-duplex communications throughout a PPDR organization's coverage area, reconfiguration of dispatch talk groups, as well as specialized communications configurations at an incident scene when required.

Annex 4

Acronyms and abbreviations

3GPP – 3rd Generation Partnership Project

3GPP2 – 3rd Generation Partnership Project 2

APCO – Association of Public Safety Communications Officials International

CDMA TDD – Code division multiple access time division duplex
CDMA-DS – Code division multiple access – Direct spread
CDMA-MC – Code division multiple access – Multi-carrier
DMR – Digital mobile radio
EMS – Enhanced messaging service
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
MMS – Multimedia messaging service
NASTD – National Association of State Technology Directors
NCS – National Communications System
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
SDO – Standards Developing Organization
SMS – Short message service
TDMA – SC – Time division multiple access – Single carrier
TETRA – Terrestrial trunked radio
TIA – Telecommunications Industry Association
TR – Technical report
UHF – Ultra high frequency
UTRA – Universal terrestrial radio access
