Radiocommunication Study Groups

INTERNATIONAL TELECOMMUNICATION UNION
Meetings of Working Parties 5A, 5B and 5C
Bucharest, Romania, 6-17 July 2015

Source: Annex 7 toDocument 5A/636, Documents 5A/679 and 5A/715

Revision 1 to Document 5A/TEMP/318-E
15 July 2015
English only

Working Party 5A
(WG 5A-3 PPDR)

ELEMENTS FOR CONSIDERATION IN FUTURE DISCUSSIONS ON RECOMMENDATION ITU-R M.2015

This document is a compendium of elements to consider for the possible future revision of Recommendation ITU-R M.2015. In addition, Documents 5A/697 and 5A/698 are carried forward.

This Annex contains three attachments:

1) A proposed example of the revision of Recommendation ITU-R M.2015 that could be implemented under either Method C or D as described in agenda item 1.3 CPM text. (Source: Document 5A/679)

2) A proposed additional example on broadband PPDR frequency arrangement 718-728/773-783 MHz. (Source: Document 5A/715)

3) A proposed example of an additional scenario based on 2 x 10 MHz for harmonized PPDR IMT starting at 698 MHz + 2 x 3 MHz for expansion or special PPDR applications.(Source Document 5A/636, Annex7)

Attention: The information contained in this document is temporary in nature and does not necessarily represent material that has been agreed by the group concerned. Since the material may be subject to revision during the meeting, caution should be exercised in using the document for the development of any further contribution on the subject.

ATTACHMENT 1

Frequency arrangements for public protection and disaster relief radiocommunication systems in ~~UHF bands in~~ accordance with Resolution 646 (Rev.WRC-~~12~~15)

(2012)

Scope

This Recommendation provides guidance on frequency arrangements for public protection and disaster relief (PPDR) radiocommunications in certain regions ~~in some of the bands below 1 GHz identified~~as listed ~~in Resolution **646 (Rev.WRC-1215)** or parts thereof~~. ~~Currently, t~~The Recommendation addresses arrangements related to regional harmonization measures and other national information on the use of PPDR ~~in the ranges 380-470 MHz in certain countries in Region 1, 746-806 MHz and 806-869 MHz in Region 2, 406.1-410 MHz, 410-430 MHz, and 806-824/851-869 MHz in some countries in Region 3~~in accordance with ~~R~~Resolutions ITU-R 53, ITU-R 55 and WRC Resolutions ~~**644 (Rev.WRC-12),**~~**646 (Rev.WRC-~~12~~15)**, and **647[or 644][1] (Rev.WRC-~~12~~15)**.

The combination of Resolution 646 and other relevant ITU-R Recommendations and Reports are to be considered as a package in relation to the provision of PPDR services and applications, therefore the considering, noting and recognising below will only mention information pertinent for this ITU-R Recommendation. All other important information is covered by related sections of Resolution **646 (Rev.WRC-15)** other relevant ITU-R Recommendations and Reports.

The ITU Radiocommunication Assembly,

considering

~~*a)* that growing telecommunication and radiocommunication needs of public protection and disaster relief (PPDR) agencies and organizationsare vital to the maintenance of law and order, protection of life and property, disaster relief and emergency response;~~

~~*b)* that many administrations wish to facilitate interoperability and interworking between systems used for PPDR radiocommunication, both nationally and for cross-border operations in emergency situations and for disaster relief;~~

*c*a)* that a continuing requirement is envisaged for narrow-band applications (supporting voice and low data-rate applications~~such as voice and various types of messaging~~), along with wideband and broadband applications in the future;

~~*d)* that continuing development of new technologies such as International Mobile Telecommunications (IMT) and Intelligent Transport Systems (ITS) may be able to serve, support or supplement advanced public protection and disaster relief applications; *e)* that, over time, traditional narrow-band public protection and disaster relief applications, such as mission critical voice and low-data-rate applications, may be provided by advanced broadband systems;~~

[1] Depending on the WRC-15 decision on agenda item 9.1 issue 9.1.7

Commented [A1]: Res 646 (Method D) considering e)

Commented [A2]: partially covered Res 646 (Method D) recognizing l)

Commented [A3]: Res 646 (Method D) considering h)

fb) that administrations may have different operational needs and spectrum requirements for their PPDR agencies and organizations depending on their ~~operational needs, spectrum requirements,~~ policy objectives and organizational structures;

~~*g)* that national spectrum planning for PPDR radiocommunication systems needs to have regard for cooperation and bilateral consultation with other concerned administrations, in order to facilitate greater levels of spectrum harmonization;~~

hc) that usage of the same frequencies of the same allocation will enable administrations to benefit from harmonization while continuing to meet national planning requirements,

noting

~~*a)* that the benefits of spectrum harmonization are:~~

~~– increased potential for interoperability~~

~~– a broader manufacturing base and increased volume of equipment resulting in economies of scale and expanded equipment availability;~~

~~– improved spectrum management and planning; and~~

~~– enhanced cross-border coordination and circulation of equipment;~~

ba) that spectrum planning for PPDR radiocommunications is performed at the national level, taking into account the need for interoperability and benefits of neighbouring administrations using harmonized or common frequency bands;

~~*c)* the benefits of cooperation between countries for the provision of effective and appropriate humanitarian assistance during disasters;~~

~~*d)* the needs of countries, particularly the developing countries, for low-cost communication equipment;~~

~~*e)* that not all frequencies within an identified common frequency range will be available within each country of the relevant ITU Region;~~

~~*f)* that flexibility must be afforded to administrations:~~

~~– to determine, at the national level, how much spectrum to make available for PPDR from the band identified in Resolution **646 (Rev.WRC-12)** in order to meet their particular national requirements;~~

~~– to have the ability for the bands identified in Resolution **646 (Rev.WRC-12)** to be used by all services having allocations according to the provisions of the Radio Regulations, taking into account the existing applications and their evolution; and~~

~~– to determine the need and timing of availability, as well as the conditions of usage of the bands identified in Resolution **646 (Rev.WRC-12)** for PPDR in order to meet specific national policy objectives, operational priorities, organizational structures and operating environments;~~

~~*g*~~*b)* that information on technologies that may be appropriate for use in these frequency arrangements is provided in 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 (Rev.WRC-12)***;

Commented [A4]: Res 646 (Method D) considering f)

Commented [A5]: Res 646 (Method D) recognizing a)

Commented [A6]: partially covered by Res 646 (Method D) recognizing d)

Commented [A7]: Res 646 (Method D) recognizing e)

Commented [A8]: Res 646 (Method D) recognizing k)

Commented [A9]: Res 646 (Method D) emphasizing c)

Commented [A10]: Res 646 (Method D) emphasizing c)

~~*h)* that Report ITU-R M.2291, *The use of International Mobile Telecommunications for broadband public protection and disaster relief applications*, describes the features and benefits that make LTE particularly suitable for PPDR applications;~~

~~i~~c) the relationship between Resolution **646 (Rev.WRC-12)** on public protection and disaster relief, which invites the development of this Recommendation, [and Resolution **647 (Rev.WRC-12)** on spectrum management guidelines for emergency and disaster relief radiocommunication and Resolution **644 (Rev.WRC-12)** on radiocommunication resources for early warning, disaster mitigation and relief operations, which also address the need to coordinate activities under these Resolutions in order to prevent any possible overlap],

recognizing

a) that Resolution **646 (Rev.WRC-~~12~~15)** encourages administrations to consider ~~the following identified~~certain frequency ~~bands/~~tuning ranges[2] or parts thereof when undertaking their national planning for the purposes of achieving global and/or regionally harmonized ~~frequency bands/ranges~~solutions for the provision of ~~advanced public protection and disaster relief~~PPDRservices and applications~~solutions~~ as shown in *recommends 1and 2* of this Recommendation;~~:~~

~~– 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 2[3]: 746-806 MHz, 806-869 MHz, 4 940-4 990 MHz;~~

~~– in Region 3[4]: 406.1-430 MHz, 440-470 MHz, 806-824/851-869 MHz, 4 940-4 990 MHz and 5 850-5 925 MHz;~~

~~bis a)~~ ~~that administrations may be using other frequency bands for the provision of~~ PPDR services and applications on a national basis as shown in *recommends 3* of this Recommendation;

b) the continuing need for development of regionally harmonized frequency arrangements for the purposes of implementing advanced PPDR solutions;

~~*c)* that, in the context of Resolution **646 (Rev.WRC-12)**, the term "frequency range" means a range of frequencies over which relevant radio equipment is envisaged to be capable of operating, but limited to specific frequency band(s) according to national conditions and requirements;~~

~~*d)* that currently some bands or parts thereof have been designated for existing public protection and disaster relief operations by some administrations, as is recognized in *recognizing g)* of Resolution **646 (Rev.WRC-12)**[5];~~

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[2] In the context of Resolution 646 (Rev.WRC-15), the term "frequency tuning range" means a range of frequencies over which radio equipment is envisaged to be capable of operating but limited to specific frequency band(s) according to national conditions and requirements

~~[3] Venezuela has identified the band 380-400 MHz for public protection and disaster relief applications.~~

~~[4] Some countries in Region 3 have also identified the bands 380-400 MHz and 746-806 MHz for public protection and disaster relief applications.~~

Commented [A11]: unnesesary commercial - all the related ITU-R deliverables ar ementioned in the 'parent' resolution

Commented [A12]: Res 646 (Method D) considering b)

Commented [A13]: to be rephrased depending on the WRC-15 decision on agenda item 9.1 issue 9.1.7

Commented [A14]: repetition of foot note 2 of Res 646, which is considered necessary here to remind on the meaning of the term 'frequency ranges' – but it should be moved to recognizing a)

Commented [A15]: superfluous after the revision on Res 646

~~*e)* that the identification of these frequency bands/ranges or parts thereof for PPDR radiocommunications does not preclude the use of, nor establish priority over, any other frequencies for PPDR[6] in accordance with the Radio Regulations including the provisions of Resolution **646 (Rev.WRC-12)**, and does not preclude the use of these bands/frequencies by any application within the services to which these bands/frequencies are allocated;~~

Commented [A16]: Res 646 (Method D) resolves 5)

~~*f)* that the frequency bands identified in Resolution **646 (Rev.WRC-12)** and covered by this Recommendation are allocated to a variety of services in accordance with the relevant provisions of the Radio Regulations;~~

Commented [A17]: Res 646 (Method D) emphasizing a)

~~*g)* that the frequency arrangements in the Annexes are provided for PPDR applications in the mobile service at the national level;~~

Commented [A18]: Res 646 (Method D) emphasizing b)

~~*h*~~*c)* that compatibility of stations using these frequency arrangements with other services operating in other countries is studied in the ITU at the service level and not at the application level;

~~*i*~~*d)* that Resolution ITU-R 53 instructs the Director of the Radiocommunication Bureau to assist Member States with their emergency radiocommunication preparedness activities, such as listing of currently available frequencies for use in emergency situations for inclusion in a database maintained by the Bureau;

Commented [A19]: to be rephrased depending on the WRC-15 decision on agenda item 9.1 issue 9.1.7

~~*j)* that World Radiocommunication Conferences have identified bands, including 450-470 MHz, and part or all of the bands 698-960 MHz in certain Regions and countries, for use by administrations wishing to implement IMT, as detailed in Nos. **5.286AA**, **5.317A**, **5.313A**, **5.316**, **5.316A** and **5.316B**, Resolution **224 (Rev.WRC-12)** and Resolution **749 (Rev.WRC-12)**;~~

Commented [A20]: reads as a possible constraint not even discussed within the considerations of the AI

~~*k)* that the Regional Radiocommunication Conference (Geneva, 2006) established Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 *situated to the west of meridian 170° E and to the north of parallel 40° S*, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz (GE-06);~~

Commented [A21]: considered unnecessary since unrelated!

~~*l*~~*e)* ~~that commercial terrestrial wireless systems may effectively complement dedicated systems in support of PPDR, particularly where advantage can be taken of the availability, high-bit rate, and reliability features of these commercial systems.~~that ~~T~~there may be a need for suitable upgrading of such commercial systems to meet the specific needs of PPDR agencies,

Commented [A22]: partially covered Res 646 (Method D) considering i)

recommends

1 that administrations implementing the regional harmonized frequency arrangements in the Annex A~~es~~ should make all necessary efforts to ensure compatibility between PPDR and stations of other services in neighbouring countries;

2 that the regional harmonized frequency arrangements in the Annex A~~es~~ should be used by administrations as guidance when making spectrum available for PPDR applications.

~~[5] 3-30, 68-88, 138-144, 148-174, 380-400 MHz (including CEPT designation of 380-385/390-395 MHz), 400-430, 440-470, 764-776, 794-806 and 806-869 MHz (including CITEL designation of 821-824/866-869 MHz).~~

~~[6] These additional frequency bands are used by some administrations for PPDR: 350-370 MHz (China), 791-801/832-842 MHz (Qatar) and 806-824/851-869 MHz (Israel). These additional frequency bands are considered for use by the administration of United Arab Emirates and Jordan for PPDR: 703-713/758-768 MHz.~~

3 that administrations take note of the frequency arrangements in Annex B ~~in order to~~ which show ~~facilitate interoperability and interworking on dependent on~~other non- harmonised solutions ~~national circumstances~~ for the provision of PPDR services and applications on a national basis.

ANNEX A

Frequency arrangements and related information in accordance with regional harmonization measures

ANNEX APPENDIX 1

Examples of frequency arrangements for the band 380-470[7,8] MHz in certain countries in Region 1 for narrow-band and wideband public protection and disaster relief operations in accordance with CEPT harmonization measure ECC/DEC/(08)05

1 Region 1

The frequency range 380-470 MHz has been identified as a tuning range for PPDR in Region 1. The frequency band 380-385 MHz (uplink)/390-395 MHz (downlink) is the harmonized core band for permanent use for PPDR. For more information relating to countries within Europe, see ECC/DEC/(08)05 and ECC Report 102.

Wideband PPDR applications use channels within available parts of the frequency range 380-470 MHz.

Additionally certain channels have been identified for DMO (Direct mode operation) and AGA (Air-ground-air operation) purposes.

1.1 DMO (Direct mode operation)

Simplex channels within the frequency bands 380-380.150 MHz and 390-390.150 MHz should be used as harmonized channels for DMO. For more information relating to countries within Europe see ERC/DEC/(01)19.

1.2 AGA (Air-ground-air operation)

Duplex channels within the frequency bands 384.800 MHz-385 MHz/394.800-395 MHz should be used as the core band for harmonized channels for AGA. Duplex channels within the frequency bands 384.750 MHz-384.800 MHz/394.750-394.800 MHz may be used as the preferred extension band for AGA when additional channels are required. For more information relating to countries within Europe, see ECC/DEC/(06)05.

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

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

1.3 Centre frequencies:

a) *For systems with a channel bandwidth of up to 150 kHz*

F_{CH} = band edge – (channel bandwidth/2) + n * channel bandwidth

where:

F_{CH} = centre frequency;

n = channel number (1, 2, 3, ...);

band edge: is lower edge of frequency band.

b) *For systems with a channel bandwidth of 200 kHz*

The centre frequencies should be selected according to the formula under *a)* with an option to offset these centre frequencies by 100 kHz.

c) *For systems with a channel bandwidth of 1.25 MHz*

The centre frequencies should be selected according to the formula under a) with an option to offset these centre frequencies by multiples of 12.5 kHz, in order to provide flexibility to locate the centre frequencies in the optimum position within the band.

ANNEX APPENDIX 2[9]

Examples of frequency arrangements within the bands 763 to 776 MHz and 793 to 806 MHz in certain countries in Region 2 for narrow-band, wideband and broadband public protection and disaster relief operations in accordance with the CITEL harmonization measure PCC.II/REC. 18 (VII-06)

1 Region 2

The frequency range 764-776 MHz and 794-806 MHz has been identified for PPDR in the CITEL PCC.II/REC. 18 (VII-06). Within this frequency range, administrations could consider a number of possible frequency arrangements examples as indicated below.

1.1 Example frequency arrangement "A"[10]

Base station transmit (MHz)	Mobile station transmit (MHz)	Frequency block
764-768	794-798	PPDR 1

1.2 Example frequency arrangement "B"[11]

Base station transmit (MHz)	Mobile station transmit (MHz)	Frequency block
758-768	788-798	PPDR 1[1]
769-775	799-805	PPDR 2[2]
768-769	798-799	PPDR internal guardband

NOTE 1 – This frequency block is used for broadband PPDR applications[12]. Broadband PPDR applications include web browsing, tactical video, surveillance video, high resolution imaging, database access, and virtual private networks.

Commented [A23]: proposal to delete outdated info from the footnote; the text is referring to M.2033 which is to be withdrawn anyhow

[9] Some countries in Region 3 have also identified the band 746-806 MHz for public protection and disaster relief applications.

[10] This frequency arrangement is from the Canadian rules. For more details, see Industry Canada's Gazette Notice No. DGTP-007-09 – Narrowband and Wideband Public Safety Radiocommunication Systems in the bands 768-776 MHz and 798-806 MHz (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09553.html).

[11] This band plan is from the United States' FCC Rules. For more details, see Part 90 of the FCC Rules at http://wireless.fcc.gov/index.htm?job=rules_and_regulations.

~~[12] The use of the term "broadband" in this Annex means indicative data rates in the order of 1-100 Mbit/s with channel bandwidths dependent on the use of spectrally efficient technologies (from Resolution 646 (Rev.WRC-12) and Report ITU-R M.2033). It is recognized 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.~~

NOTE 2 – This frequency block is used for PPDR applications that provide narrow-band voice and low-speed data services. In the context of PPDR, narrow-band is defined in Resolution **646 (Rev.WRC-12)** as "supporting voice and low data-rate applications, typically in channel bandwidths of 25 kHz or less". Narrowband channels may also be consolidated into wideband channels (50 to 150 kHz) if approval by the licensing administration is obtained through a limited waiver process.

Editor's Note: to be reviewed

APPENDIX 3

Examples of frequency arrangements within the bands 694 to 791 MHz[13] in accordance ~~to~~with the CEPT harmonization measure on broadband PPDR

Editor's Note: as announced by CEPT the information on the relevant European harmonization measure will be provided at a later stage.

[13] These additional frequency bands are considered for use by the administration of United Arab Emirates and Jordan for PPDR: 703-713/758-768 MHz.

ANNEX B

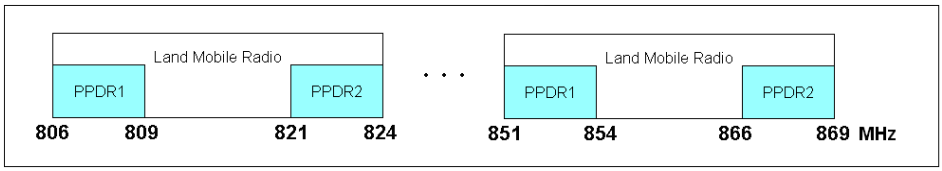
Frequency arrangements and related information to reflect national use

ANNEX APPENDIX 13

Examples of frequency arrangements for the band 806 to 869 MHz[14] in certain countries in Region 2 for narrow-band public protection and disaster relief operations

1 Region 2

In a number of countries in the Region 2, the band 806-824/851-869 MHz is allocated to the mobile service, and designated for Land Mobile Radio (LMR) applications. The duplex spacing is 45 MHz, with the base stations transmitting in the 851-869 MHz, and the mobile stations in the 806-824 MHz range. PPDR channels may be assigned throughout this band and specific blocks may be designated exclusively for PPDR applications. (See § 1.1) Radio equipment is capable of tuning to all channels in the band ensuring interoperability. To simplify cross-border coordination and to ensure that public safety agencies have access to a stable and predictable pool of radio frequency channels, neighbouring administrations could implement complementary frequency arrangements, an example being shown in the figure below.



1.1 Example frequency arrangement

1.1.1 Designation of frequency blocks

Mobile station/Control station transmit (MHz)	Base station transmit (MHz)	Frequency block
806-809	851-854	PPDR1[15]
821-824	866-869	PPDR2[16]

[14] These additional frequency bands are used by some administrations for PPDR: 791-801/832-842 MHz (Qatar) and 806-824/851-869 MHz (Israel).

[15] This frequency arrangement is from the United States' FCC Rules. For more details, see Part 90 of the FCC Rules at http://wireless.fcc.gov/index.htm?job=rules_and_regulations.

1.1.2 Channelization

The frequencies corresponding to the centre frequency of the channel number are defined by the following formulas, where *n* is the channel number:

Channel number	**Mobile station transmit Channel centre frequency (MHz)**	**Base station transmit Channel centre frequency (MHz)**	**Channel bandwidth (kHz)**
n = 1 to 600	$f_n = 806.0125 + (0.025) \times (n - 1)$	$f_n = 851.0125 + (0.025) \times (n\text{-}1)$	25
n = 602 to 790 except 639, 677, 715, 753	$f_n = 821.0375 + 0.0125 \times (n - 602) + 0.025 \times \text{floor}[(n - 601) / 38]$	$f_n = 866.0375 + 0.0125 \times (n - 602) + 0.025 \times \text{floor}[(n - 601) / 38]$	12.5
n = 601, 639, 677, 715, 753	$f_n = 821.0125 + 0.5 \times \text{floor}[(n - 601) / 38]$	$f_n = 866.0125 + 0.5 \times \text{floor}[(n - 601) / 38]$	25
n = 791 to 830	$f_n = 823.5 + (0.0125) \times (n - 791)$	$f_n = 868.5 + (0.0125) \times (n - 791)$	25

[16] This frequency arrangement is from the Canadian rules. For more details, see Standard Radio System Plan 502 at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf00050.html.

ANNEX APPENDIX 24

Examples of frequency arrangements for the range 406.1-430 MHz in certain countries in Region 3 for narrowband public protection and disaster relief operations

1 Region 3

1.1 Example frequency arrangement - 406.1-410 MHz

Parts of the band 406.1-410 MHz are used in certain Region 3 countries to accommodate trunked land mobile systems. Frequency arrangements for this spectrum are shown below.

Simplex services are accommodated within a 12.5 kHz channel raster on the following centre frequencies (MHz):

$$F_n = 406.01250 + ((N\text{-}1) * 0.0125) \quad N = 1, 2, 3,\ldots$$

1.2 Example frequency arrangement for digital PPDR within 410-430 MHz

The band 410-430 MHz is used in certain Region 3 countries to accommodate digital trunked land mobile systems.

The frequency band 410 to 430 MHz provides a total bandwidth of 20MHz for Digital Trunked Radio Systems. The 12.5/25 kHz channelling plan is the standard channelling plan for this band giving a total of 800 physical radio channels (or equivalent TRS analogue traffic channel of 1600 noting possibility of two time slots per physical channel). Although the standard channel spacing is 12.5/25 kHz, it provides flexibility to operate two or more contiguous channels (i.e. 50 kHz or 100 kHz) if needed. Administrations normally assign one or more channel based on channel spacing 12.5 kHz or 25 kHz.

The channelling plan based on a raster of 12.5 kHz and 25 kHz is shown below:

1.2.1 Frequency arrangements for 25 kHz channel spacing

Centre frequencies of the base station transmitting channel are (MHz):

$$F_n = 420.0125 + (N\text{-}1)*0.025 \quad N = 1, 2, 3,\ldots 400$$

The centre frequencies of the base station receiving channel is (MHz):

$$F_n = 410.0125 + (N\text{-}1)*0.025 \quad N = 1, 2, 3,\ldots 400$$

1.2.2 Frequency arrangements for 12.5 kHz channel spacing

Centre frequencies of the base station transmitting channel are (MHz):

$$F_n = 420.00625 + (N\text{-}1)*0.0125 \quad N = 1, 2, 3,\ldots 800$$

The centre frequencies of the base station receiving channel is (MHz):

$$F_n = 410.00625 + (N\text{-}1)*0.0125 \quad N = 1, 2, 3,\ldots 800$$

1.2.3 Channel allotment plan

The channel arrangements are divided into 4 pairs of frequency blocks (blocks A/A', blocks B/B', blocks C/C', and blocks D/D') with transmit/receive separation of 10 MHz. The channel allotment plan is designed to minimize inter-modulation and frequency interference problems by assigning

co-sited channels that are 250 kHz apart. The frequency blocks A, B, C and D, which contain 200 channels each, are divided into ten (10) channel groups (i.e. A01-A10, B01-B10, C01-C10 and D01-D10) respectively.

The numbers of channels/channel groups assigned are based on the service requirement of the user agency based among others on the area covered, grade of service (GOS), capacity and services provided.

Block	**A**	**B**	**C**	**D**
Group Nos. 01 to 10	X= 1 to 10 A= 1 to 10	X= 1 to 10 B= 1 to 10	X= 1 to 10 C= 1 to 10	X= 1 to 10 D= 1 to 10
Channel Number N=	2*A-1+20*(X-1) and 2*A+20*(X-1)	2*B+199+20*(X-1) and 2*B+200+20*(X-1)	2*C+399+20*(X-1) and 2*C+400+20*(X-1)	2*D+599+20*(X-1) and 2*D+600+20*(X-1)

ANNEX APPENDIX ~~5~~3

Examples of frequency arrangements for the bands 806 to 824 MHz[17] and 851 to 869 MHz in certain countries in Region 3 for narrowband and broadband public protection and disaster relief operations

1 Region 3

1.1 Example narrowband plan – 806-824/851-869 MHz

The entire band could be used for channel bandwidths of 25 kHz for digital trunked radio systems. However some administrations may want to use different channel bandwidths according to their policy. This sub-section provides examples of three channelling schemes. In the sub-band of 806-811/851-856 MHz the channel bandwidth is 25 kHz, in the sub-band of 811-813.5/856-858.5 MHz the channel bandwidth is 12.5 kHz and in sub-band 813.5-816/858-861 MHz the channel bandwidth is 6.25 kHz. The lower block 806-824 MHz is used for mobile station transmitters (uplink) and the upper block is used for base station transmitters (downlink).

Formulas to calculate the centre frequency of each channel are as follows:

– In sub-band of 806-811/851-856 MHz:

The band is divided into 25 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$F_N = 851.0125 + (N - 1) \times 0.025$ N = 1, 2, 3, …, 200

Centre frequency of N-th base station receiving channel (MHz):

$F_N' = 806.0125 + (N - 1) \times 0.025$ N = 1, 2, 3, …, 200

– In sub-band of 811-813.5/856-858.5 MHz:

This sub-band is divided into 12.5 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$F_N = 856.00625 + (N - 1) \times 0.0125$ N = 1, 2, 3, …, 200

Centre frequency of N-th base station receiving channel (MHz):

$FN' = 811.00625 + (N - 1) \times 0.0125$ N = 1, 2, 3, …, 200

[17] These additional frequency bands are used by some administrations for PPDR: 791-801/832-842 MHz (Qatar) and 806-824/851-869 MHz (Israel).

– In sub-band of 813.5-816/858.5-861 MHz:

This sub-band is divided into 6.25 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$$FN = 858.503125 + (N - 1) \times 0.00625 \quad N = 1, 2, 3, \ldots, 400$$

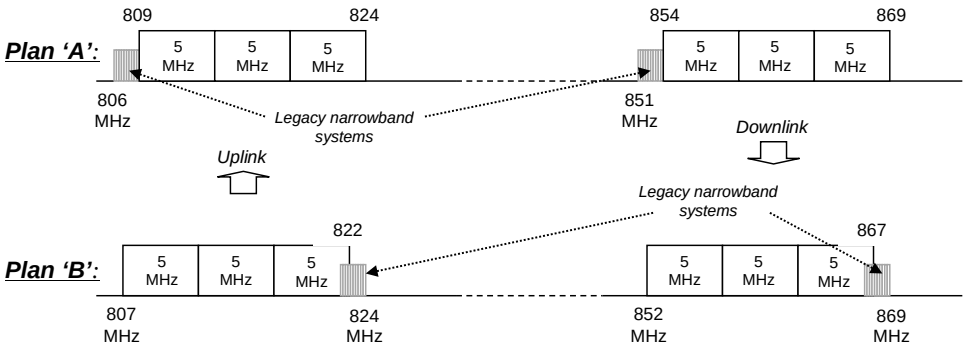
Centre frequency of N-th base station receiving channel (MHz):

$$F_N' = 813.503125 + (N - 1) \times 0.00625 \quad N = 1, 2, 3, \ldots, 400.$$

1.2 Example broadband plan – 806-824/851-869 MHz

The broadband channel plan is based on paired frequencies with mobile station transmitters used in the frequency band 806-824 MHz (uplink) and base station transmitters used in the frequency band 851-869 MHz (downlink).

To allow for possible co-existence with legacy narrowband systems and adjacent broadband channel arrangements, administrations could consider the examples below:



The raster for the wideband channels is 100 kHz, which means that the channel centre frequencies are an integer multiple of 100 kHz. The broadband channel bandwidth is an integer multiple of 5 MHz. This provides flexibility for administrations to implement appropriate channel arrangements in accordance with the above Plans 'A' or 'B', or some subset thereof, to suit specific national circumstances. Some administrations may want to use different amounts of broadband and narrowband spectrum than the examples in Plan 'A' or 'B' to allow for transition.

1.3 Example narrowband and broadband in 806-824/851-869 MHz

In Region 3 some countries, in accordance with Resolution **646 (WRC-12)**, have identified the band 806-824/ 851-869 MHz for PPDR in their national plans. With the regional adoption of the APT 700 MHz band plan, these countries wish to deploy broadband PPDR within the band 806-824/ 851-869 MHz and at same time a) provide the necessary spectrum for narrow band PPDR and b) ensure that the downlink of the APT 700 MHz band is protected from adjacent band interference from the uplink transmission of broadband systems operating in the band 806-824/851-869 MHz, particularly in cases where channel sizes of 10+10 or higher band width are use in the APT 700 MHz band.

This example shows how narrowband and broadband systems can be deployed in the band 806-824/851-869 MHz while ensuring the necessary protection of the APT 700 MHz band from adjacent band interference.

The sub-band 806-813/ 851-858 MHz is used for narrowband systems with a channel bandwidth of 25 kHz; the sub-band 814-824/ 859-869 MHz is used for broadband (LTE) systems using carrier bandwidths of 5 to 10 MHz. The sub-band 813-814/ 858-859 MHz acts as guard band between narrowband and broadband systems.

1.3.1 Example of frequency arrangement for narrowband and broadband systems

Mobile station/Control station transmit (MHz)	Base station transmit (MHz)	Frequency block
806-813	851-858	Narrowband PPDR
813-814	858-859	Guard band
814-824	859-869	Broadband PPDR

1.3.2 Example channelisation for narrowband

The channeling plan for the sub-band 806-813/ 851-858 MHz is based on the channel spacing of 25 kHz.

The centre frequency (f_N) of the Nth channel is given by:

Channel number	Mobile station transmit Channel centre frequency (MHz)	Base station transmit Channel centre frequency (MHz)	Channel bandwidth (kHz)
N = 1 to 280	$f_N = 806.0125 + (0.025) \times (N - 1)$	$f_N = 851.0125 + (0.025) \times (N-1)$	25

1.3.3 Example channelisation for broadband

The channeling plan for broadband is based on a channel bandwidth of 5 MHz or 10 MHz as shown below:

The centre frequency (f_N) of the *N*-th channel for two 5 MHz channels is given by:

Channel number	Mobile station transmit Channel centre frequency (MHz)	Base station transmit Channel centre frequency (MHz)	Channel bandwidth (MHz)
N = 1 to 2	$f_N = 816.5 + (5) \times (N - 1)$	$f_N = 861.5 + (5) \times (N-1)$	5

The centre frequency (f_N) of the *N*-th channel for one 10 MHz channels is given by:

Channel number	Mobile station transmit Channel centre frequency (MHz)	Base station transmit Channel centre frequency (MHz)	Channel bandwidth (MHz)
N = 1	f_1 = 819	f_1 = 864	10

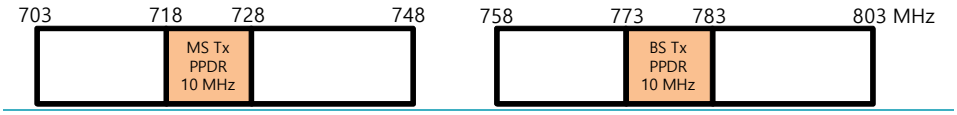
ATTACHMENT 2

Examples of frequency arrangements for the bands 718 to728 MHz and 773 to 783 MHz for broadband public protection and disaster relief operations, the bands 806 to 824 MHz and851 to 869 MHz ~~in certain countries in Region 3~~ for narrowband and broadband public protection and disaster relief operationsin certain countries in Region 3

1 Region 3

1.1 Example Broadband plan –718-728/773-783MHz

Figure below showsan example of designation of 2x10 MHz frequency block in 700 MHz band with FDD arrangement for broadband PPDR application.



The entire band could be used for channel bandwidth 10 MHz.

1.12 Example narrowband plan – 806-824/851-869 MHz

The entire band could be used for channel bandwidths of 25 kHz for digital trunked radio systems. However some administrations may want to use different channel bandwidths according to their policy. This sub-section provides examples of three channelling schemes. In the sub-band of 806-811/851-856 MHz the channel bandwidth is 25 kHz, in the sub-band of 811-813.5/856-858.5 MHz the channel bandwidth is 12.5 kHz and in sub-band 813.5-816/858-861 MHz the channel bandwidth is 6.25 kHz. The lower block 806-824 MHz is used for mobile station transmitters (uplink) and the upper block is used for base station transmitters (downlink).

Formulas to calculate the centre frequency of each channel are as follows:

– In sub-band of 806-811/851-856 MHz:

The band is divided into 25 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$F_N = 851.0125 + (N - 1) \times 0.025$ N = 1, 2, 3, …, 200

Centre frequency of N-th base station receiving channel (MHz):

$F_N' = 806.0125 + (N - 1) \times 0.025$ N = 1, 2, 3, …, 200

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– In sub-band of 811-813.5/856-858.5 MHz:

This sub-band is divided into 12.5 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$F_N = 856.00625 + (N - 1) \times 0.0125$ N = 1, 2, 3, …, 200

Centre frequency of N-th base station receiving channel (MHz):

$FN' = 811.00625 + (N - 1) \times 0.0125$ N = 1, 2, 3, …, 200

– In sub-band of 813.5-816/858.5-861 MHz:

This sub-band is divided into 6.25 kHz channels.

Centre frequency of N-th base station transmitting channel (MHz):

$FN = 858.503125 + (N - 1) \times 0.00625$ N = 1, 2, 3, …, 400

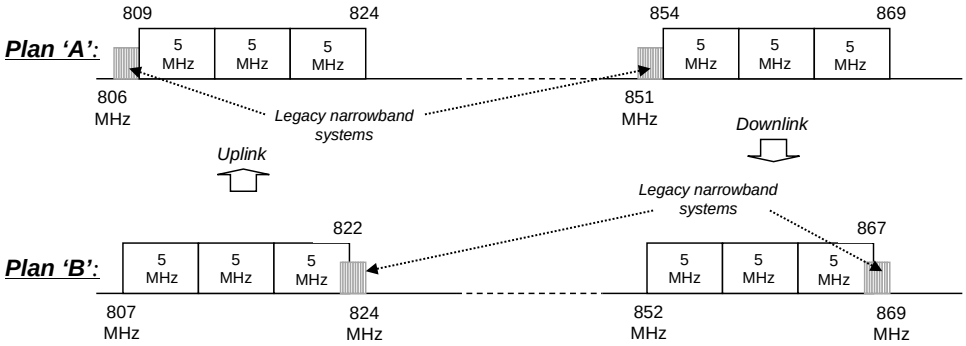
Centre frequency of N-th base station receiving channel (MHz):

$F_N' = 813.503125 + (N - 1) \times 0.00625$ N = 1, 2, 3, …, 400.

1.~~2~~3 Example broadband plan – 806-824/851-869 MHz

The broadband channel plan is based on paired frequencies with mobile station transmitters used in the frequency band 806-824 MHz (uplink) and base station transmitters used in the frequency band 851-869 MHz (downlink).

To allow for possible co-existence with legacy narrowband systems and adjacent broadband channel arrangements, administrations could consider the examples below:



The raster for the wideband channels is 100 kHz, which means that the channel centre frequencies are an integer multiple of 100 kHz. The broadband channel bandwidth is an integer multiple of 5 MHz. This provides flexibility for administrations to implement appropriate channel arrangements in accordance with the above Plans 'A' or 'B', or some subset thereof, to suit specific national circumstances. Some administrations may want to use different amounts of broadband and narrowband spectrum than the examples in Plan 'A' or 'B' to allow for transition.

1.~~3~~4 Example narrowband and broadband in 806-824/851-869 MHz

In Region 3 some countries, in accordance with Resolution **646 (WRC-12)**, have identified the band 806-824/ 851-869 MHz for PPDR in their national plans. With the regional adoption of the APT 700 MHz band plan, these countries wish to deploy broadband PPDR within the band 806-824/ 851-869 MHz and at same time a) provide the necessary spectrum for narrow band PPDR and b) ensure that the downlink of the APT 700 MHz band is protected from adjacent band interference from the uplink transmission of broadband systems operating in the band 806-824/851-869 MHz, particularly in cases where channel sizes of 10+10 or higher band width are use in the APT 700 MHz band.

This example shows how narrowband and broadband systems can be deployed in the band 806-824/851-869 MHz while ensuring the necessary protection of the APT 700 MHz band from adjacent band interference. The sub-band 806-813/ 851-858 MHz is used for narrowband systems with a channel bandwidth of 25 kHz; the sub-band 814-824/ 859-869 MHz is used for broadband (LTE) systems using carrier bandwidths of 5 to 10 MHz. The sub-band 813-814/ 858-859 MHz acts as guard band between narrowband and broadband systems.

1.~~3~~4.1 Example of frequency arrangement for narrowband and broadband systems

Mobile station/Control station transmit (MHz)	Base station transmit (MHz)	Frequency block
806-813	851-858	Narrowband PPDR
813-814	858-859	Guard band
814-824	859-869	Broadband PPDR

1.~~3~~4.2 Example channelisation for narrowband

The channeling plan for the sub-band 806-813/851-858 MHz is based on the channel spacing of 25 kHz.

The centre frequency (f_N) of the Nth channel is given by:

Channel number	Mobile station transmit Channel centre frequency (MHz)	Base station transmit Channel centre frequency (MHz)	Channel bandwidth (kHz)
N = 1 to 280	f_N = 806.0125 + (0.025) × (N − 1)	f_N = 851.0125 + (0.025) × (N-1)	25

1.3.3 Example channelisation for broadband

The channeling plan for broadband is based on a channel bandwidth of 5 MHz or 10 MHz as shown below:

The centre frequency (f_N) of the *N*-th channel for two 5 MHz channels is given by:

Channel number	**Mobile station transmit Channel centre frequency (MHz)**	**Base station transmit Channel centre frequency (MHz)**	**Channel bandwidth (MHz)**
N = 1 to 2	$f_N = 816.5 + (5) \times (N - 1)$	$f_N = 861.5 + (5) \times (N-1)$	5

The centre frequency (f_N) of the *N*-th channel for one 10 MHz channels is given by:

Channel number	**Mobile station transmit Channel centre frequency (MHz)**	**Base station transmit Channel centre frequency (MHz)**	**Channel bandwidth (MHz)**
N = 1	$f_1 = 819$	$f_1 = 864$	10

ATTACHMENT 3

Proposed PPDR within 700 MHz

FIGURE 4

Scenario based on 2 x 10 MHz for harmonized PPDR IMT starting at 698 MHz + 2 x 3 MHz for expansion or special PPDR applications

Figure 1. Scenario for PPDR in 700MHz based on UAE proposed arrangement for the 700MHz band of 2x40MHz

Figure 2. Scenario for PPDR in 700MHz if the Frequency arrangement adopted starts at 703MHz harmonized with APT lower Duplexer

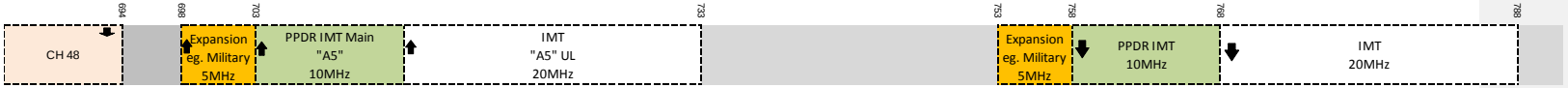


Figure 3. Scenario for PPDR in 700MHz based on arrangements that are partially harmonized with APT arrangement with additional 2x5MHz for PPDR expansion during disasters or for other government users like Military using LTE