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|  | **Radiocommunication Study Groups** | |  |
| **INTERNATIONAL TELECOMMUNICATION UNION** | |  | |
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| Source: Document 5A/TEMP/74(Rev.1) | | **Annex 21 to Document 5A/298-E** | |
| **21 November 2016** | |
| **English only** | |
| Annex 21 to Working Party 5A Chairman’s Report | | | |
| Working document toward a preliminary draft revision of RECOMMENDATION ITU-R M.2015-1 | | | |
| Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance  with Resolution 646 (Rev.WRC-15) | | | |

(2012-2014)

Summary of the revision

[TBD]

Scope

This Recommendation is intended to promote global and regional harmonization of frequency bands for public protection and disaster relief. It 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 the Resolution **646 (Rev.WRC-15)**, as well as countries’ frequency arrangements.

[The combination of Resolution **646** **(Rev.WRC-15)** 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 recognizing 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**.]**

Keywords

PPDR, frequency arrangements[TBD]

The ITU Radiocommunication Assembly,

considering

*a)* that Resolution **646 (Rev.WRC-15)** encourages administrations to use harmonized frequency ranges for PPDR to the maximum extent possible when undertaking their national planning for their PPDR applications;

*b)* that Resolution **646 (Rev.WRC-15)** resolved to include harmonized PPDR frequency arrangements within the frequency ranges specified in *resolves* 2 and 3 of that Resolution*,* as well as countries’ frequency arrangements for PPDR, in this Recommendation;

*c)*that addressing the growing telecommunication and radiocommunication needs of PPDR agencies and organizations is vital to the maintenance of law and order, protection of life and property, disaster relief and emergency response;

*d)* 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;

*e)* that, although narrowband and wideband systems will continue to be used to meet PPDR requirements, there is a growing need for broadband applications to support improved data and multimedia capabilities, which require higher data rates and higher capacity;

*f)* that, over time, narrowband public protection and disaster relief (PPDR) applications, for example mission critical voice and low-data rate applications, may be provided by broadband systems;

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

*h)* that usage of the same frequency bands will enable administrations to achieve the benefits of harmonization, such as:

– increased potential for interoperability;

– clear guidance for standardization;

– increased volume of equipment resulting in economies of scale, more cost-efficient and affordable equipment and expanded equipment availability, which is of particular benefit to developing countries;

– improved spectrum management and planning;

– more effective international aid during disasters and major events; and

– enhanced cross-border coordination and circulation of equipment;

*i)* that some commercial terrestrial and satellite systems are complementing the dedicated systems in support of PPDR, and that the use of commercial solutions will be in response to technology development and market demands,

noting

*a)* 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;

*b)* that flexibility must be afforded to administrations:

– to determine, at the national level, how much spectrum to make available for PPDR from the ranges in the resolves part of Resolution **646 (Rev.WRC-15)** taking into account the existing applications and their evolution, in order to meet their particular national requirements;

– to determine the need and timing of availability, as well as the conditions of usage, of the bands for PPDR in order to meet specific regional or national situations,

[Moved to *recognizings* and revised there] [Moved to *recognizings* and revised there][moved to recognizing and revised there]

recognizing

*a)* that Resolution **646 (Rev.WRC-15)** encourages administrations to consider the identified frequency bands/ranges or parts thereof in *resolves* *2 & 3* when undertaking their national planning for the purposes of achieving harmonized frequency bands/ranges for advanced PPDR systems and applications;

*b)* that administrations may be using other frequency arrangements for the provision of PPDR, as listed in Annex 2 and there is a need for administrations using these frequency arrangements to ensure compatibility between PPDR applications and stations of other services in neighbouring countries operating in accordance with the Radio Regulations;*c)* the continuing need for development of regionally harmonized frequency arrangements for the purposes of implementing advanced PPDR solutions;

*d)* that the frequency arrangements in the Annexes are provided for PPDR applications in the mobile service;

*e)* 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;

*f)* the relationship between Resolution **646 (Rev.WRC-15)** on public protection and disaster relief, which invites to review and revise of this Recommendation, and Resolution **647 (Rev.WRC-15)** on radiocommunication aspects, including spectrum management guidelines, for early warning, disaster prediction, detection, mitigation and relief operations relating to emergencies and disasters, which also addresses the need to coordinate activities under these Resolutions in order to minimize any possible overlap[moved from *noting i)* and revised]

*g)* that Recommendation ITU‑R M.2009 provides information on technologies that may be appropriate for use in these frequency arrangements; [moved from noting g and revised]

*h)* that Report ITU-R M.2291 addresses the current and possible future use of international mobile telecommunications (IMT), including the use of long term evolution (LTE), in support of broadband PPDR communications; [moved from *noting h)* and revised]

*i)* that Report ITU-R M.2377 contains the radiocommunication objectives and requirements for PPDR;

*j)* that some of the bands addressed in this Recommendation have been identified by World Radiocommunication Conferences for use by administrations wishing to implement IMT,

recommends

1 that the harmonized frequency arrangements in Annex 1 should be used by administrations as guidance when making spectrum available for PPDR applications;[moved from *recommends* 2 and revised]

2 that administrations implementing the harmonized frequency arrangements in the Annex 1 should make all necessary efforts to ensure compatibility between PPDR applications and stations of other services in neighbouring countries operating in accordance with the Radio Regulations. [moved from *recommends* 1 and revised]

*[Editor’s note: Recommends may need to be revised based on restructured annexes.]*

Annex 1

*[Editor’s note: Page numbers to be inserted at a later stage.]*

|  |  |  |
| --- | --- | --- |
| Annex 1  Harmonized Frequency Arrangements | | |
| Section 1: Arrangements in parts of the frequency range 694-894 MHz  (as per *resolves* 2 of Resolution **646 (Rev.WRC-15)**) | | |
| Region / Sub Section | Example Frequency Arrangement(s) | Page |
| 1 | Examples of frequency arrangements within the bands 698 to 791 MHz in accordance with the CEPT harmonization measure on public protection and disaster relief operations |  |
| 1 | Examples of frequency arrangements within the bands 694 to 791 MHz in Arab States for public protection and disaster relief operations |  |
| 1 | Examples of frequency arrangements within the bands 791 to 862 MHz in some countries in Region 1 for broadband public protection and disaster relief operations |  |
| 2 | Examples of frequency arrangements within the 694-894 MHz band in certain countries in Region 2 for narrowband, wideband and broadband public protection and disaster relief operations in accordance with the CITEL harmonization measures PCC.II/REC. 18 (VII-06) and PCC.II/REC.49 (XXVII-16) |  |
| 3 | Examples of frequency arrangements within the bands 694 to 894 MHz in accordance with the APT harmonization measure on broadband public protection and disaster relief operations in accordance with APT-AWG Report 08 |  |
| 3 | Examples of frequency arrangements for the bands 806 to 824 MHz and 851 to 869 MHz in Region 3 for narrowband and broadband public protection and disaster relief operations in accordance with the APT harmonization measure APT-AWG Report 08 |  |
| 3 | Examples of frequency arrangements for the band 694-894 MHz in certain countries in Region 3 for broadband public protection and disaster relief operations |  |

|  |  |  |
| --- | --- | --- |
| Annex 1  Harmonized Frequency Arrangements | | |
| Section 2: Frequency Arrangements in parts of the frequency range 380-470 MHz (as per *resolves* 3 of Resolution **646 (Rev.WRC-15)**) | | |
| Region / Sub Section | Example Frequency Arrangement(s) | Page |
| 1 | Examples of frequency arrangements for the band 380-470 MHz in certain countries in Region 1 for narrowband and wideband public protection and disaster relief operations in accordance with CEPT harmonization measure ECC/DEC/(08)05 |  |
| 1 | Examples of frequency arrangements for the band 450-470 MHz in Region 1 (CEPT) for broadband public protection and disaster relief operations |  |
| 1 | Examples of frequency arrangements for the band 380-399.3 MHz in some countries in Region 1 for narrowband PPDR |  |
| 2 | There are no bands listed for Region 2 in *resolves* 3 of Resolution **646 (Rev.WRC-15)** |  |
| 3 | Examples of frequency arrangements for the band 406.1-430 MHz in Region 3 for narrowband public protection and disaster relief operations in accordance with APT harmonization measures APT-AWG Report 08 |  |
| Section 3: Frequency Arrangements in parts of the frequency range 4 940-4 990 MHz  (as per *resolves* 3 of Resolution **646 (Rev.WRC-15)**) | | |
| Region | Example Frequency Arrangement(s) | Page |
| 3 | Examples of frequency arrangements for the band 4 940‑4 990 MHz in Region 3 for broadband public protection and disaster relief operations in accordance with APT harmonization measure APT-AWG Recommendation 01 |  |

*[Editor’s note: The consistency of language (e.g., 700 MHz band) needs to be reviewed at a later stage.]*

Recommended arrangements for public protection and disaster relief operations in the bands listed in *resolves* 2 and 3 of Resolution 646 (Rev.WRC-15)

Section 1 – 694-894 MHz

Sub Section 1: Region 1

Examples of frequency arrangements within the bands 698 to 791 MHz   
in accordance with the CEPT harmonization measure   
on public protection and disaster relief operations

CEPT countries wishing to introduce BB-PPDR in parts of the 700 MHz range shall apply the least restrictive technical conditions (LRTC) to ensure coexistence with other services. The paired frequency arrangements according to ECC/DEC/(16)02 are:

a) 698-703 MHz (uplink) / 753-758 MHz (downlink) with LRTC specified in Annex 1 of ECC/DEC/(16)02

b) 703-733 MHz (uplink) / 758-788 MHz (downlink) with LRTC specified in ECC/DEC/(15)01

c) 733-736 MHz (uplink) / 788-791 MHz (downlink) with LRTC specified in Annex 1 of ECC/DEC/(16)02

Figure x

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 698-703 | 703-708 | 708-713 | 713-718 | 718-723 | 723-728 | 728-733 | 733-736 | 736-752 | 753-758 | 758-763 | 763-768 | 768-773 | 773-778 | 778-783 | 783-788 | 788-791 |
| PPDR  a)  up-link | PPDR  b)  uplink  (MFCN) | | | | | | PPDR  c)  up-link | … | PPDR  a)  down-link | PPDR  b)  downlink  (MFCN) | | | | | | PPDR  c)  down-link |
| 5 MHz | 30 MHz (6 blocks of 5 MHz) | | | | | | 3 MHz |  | 5 MHz | 30 MHz (6 blocks of 5 MHz) | | | | | | 3 MHz |

Administrations requiring 2x10 MHz for BB-PPDR, as calculated in Report ITU-R M.2377-0 and ECC Report 199, and authorizing the full 2x30 MHz in option b) for commercial MFCN can no longer identify 2x10 MHz for dedicated BB-PPDR networks within the 700 MHz band. These administrations may therefore need to use the remaining part as shown in option a) and c) and additionally use the 400 MHz range (see frequency arrangement R1-1-2).

For further information on BB-PPDR in CEPT please see ECC/DEC/(16)02 and the relevant reports mentioned therein.

Examples of frequency arrangements within the bands 694 to 791 MHz   
in Arab States for public protection and disaster relief operations

The following frequency arrangement is harmonized for implementation of Broadband PPDR based on IMT technology in Arab States with bandwidth of 2x5 MHz (UL: 698-703 MHz, DL: 753-758 MHz), which has the potential to be harmonized in Region 1.

This arrangement is in line with 3GPP Band 68 with OOBE of -25 dBm/8 MHz

3GPP **Band 28** LD Mobile TX

**New** 3GPP **Band 68** Mobile TX

New 3GPP **Band 68** Base TX

3GPP **Band 28 LD** Base TX

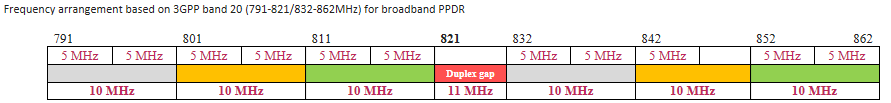
694. 698 703 728-733-736 753 758-------------------783-788 791

Harmonized arrangements for 700MHz Broadband PPDR in Arab states

Administrations wishing to implement wider channel bandwidth up to 2x20 MHz can combine multiple blocks of 5 MHz based on 3GPP Band 68 and/or Band 28 to meet their national Broadband PPDR requirements ( e.g. UL: 698–718, DL: 753–773 MHz).

Examples of frequency arrangements within the bands 791 to 862 MHz   
in some countries in Region 1 for broadband public protection and disaster relief operations

Some countries in Region 1 implemented Broadband PPDR based on the frequency arrangement (791-821 MHz UL and 832-862 MHz DL) (3GPP Band 20).



Sub Section 2: Region 2

Examples of frequency arrangements within the 694-894 MHz band in certain countries in Region 2 for narrowband, wideband and broadband public  
protection and disaster relief operations in accordance with the CITEL harmonization measures PCC.II/REC. 18 (VII-06) and   
PCC.II/REC.49 (XXVII-16)

# 1 703-748/758-803 MHz broadband PPDR

The frequency range 703-748/758-803 MHz is included in CITEL PCC.II/REC. 49 (XXVII-16) for broadband PPDR. According to the Recommendation, this aligns with the following frequency arrangement (A5 scheme of Recommendation ITU-R M.1036):

|  |  |  |  |
| --- | --- | --- | --- |
| Mobile station transmitter (MHz) | Centre gap (MHz) | Base station transmitter (MHz) | Duplex separation(MHz) |
| 703-748 | 10 | 758-803 | 55 |



*[Editor’s note: Remove column with “A5”]*

PCC.II/REC.49 (XXVII-16) recommends that administrations that wish to define a particular frequency range for PPDR within this frequency range preferably use the lower portion of this band.

# 2 758-768/788-798 MHz broadband PPDR

The frequency range 758-768/788-798 MHz is included in CITEL PCC.II/REC. 49 (XXVII-16) for broadband PPDR.

# 3 807-869 MHz broadband PPDR

The frequency range 807-824/852-869 MHz is included in CITEL PCC.II/REC. 49 (XXVII-16) for broadband PPDR. According to the Recommendation, this aligns with the following frequency arrangement

*[Placeholder for figure to come from CITEL PCC.II]*

# 4 764-776 and 794-806 MHz Broadband/Wideband/Narrowband PPDR

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.

## 14.1 Example frequency arrangement “A”[[1]](#footnote-5)

|  |  |  |
| --- | --- | --- |
| Base station transmit (MHz) | Mobile station transmit (MHz) | Frequency block |
| 764-768 | 794-798 | PPDR 1 |
| 768-776 | 798-806 | PPDR 2 |



## 14.2 Example frequency arrangement “B”[[2]](#footnote-6)

|  |  |  |
| --- | --- | --- |
| **Base station transmit (MHz)** | **Mobile station transmit (MHz)** | **Frequency block** |
| 758-768 | 788-798 | PPDR 11 |
| 769-775 | 799-805 | PPDR 22 |
| 768-769 | 798-799 | PPDR internal guardband |
| NOTE 1 – This frequency block is used for broadband PPDR applications[[3]](#footnote-7). Broadband PPDR applications include web browsing, tactical video, surveillance video, high resolution imaging, database access, and virtual private networks.  NOTE 2 – This frequency block is used for PPDR applications that provide narrowband voice and low-speed data services. In the context of PPDR, narrowband was 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. | | |



# 5 806-824/851-869 MHz narrowband PPDR

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. 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.



## 5.1 Designation of frequency blocks

|  |  |  |
| --- | --- | --- |
| Mobile station/ Control station transmit (MHz) | Base station transmit  (MHz) | Frequency block |
| 806-809 | 851-854 | PPDR1[[4]](#footnote-8) |
| 821-824 | 866-869 | PPDR2[[5]](#footnote-9) |

## 15.2 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 | *fn* = 806.0125 + (0.025) × (*n* − 1) | *fn* = 851.0125 + (0.025) × (*n* − 1) | 25 |
| *n* = 602 to 790 except 639, 677, 715, 753 | *fn* = 821.0375 + 0.0125 × (*n* − 602) + 0.025 × floor[(*n* − 601) / 38] | *fn* = 866.0375 + 0.0125 × (*n* − 602) + 0.025 × floor[(*n* − 601) / 38] | 12.5 |
| *n* = 601, 639, 677, 715, 753 | *fn* = 821.0125 + 0.5 × floor[(*n* − 601) / 38] | *fn* = 866.0125 + 0.5 × floor[(*n* − 601) / 38] | 25 |
| *n* = 791 to 830 | *fn* = 823.5 + (0.0125) × (*n* − 791) | *fn* = 868.5 + (0.0125) × (*n* − 791) | 25 |

Sub Section 3: Region 3

Examples of frequency arrangements within the bands 694 to 894 MHz in accordance with the APT harmonization measure on broadband public protection and disaster relief operations in accordance with APT-AWG Report 08[[6]](#footnote-10)

APT has selected the following frequency arrangements within the band 694‑894 MHz to be considered by administrations in Region 3 as harmonized frequency bands for broadband PPDR:

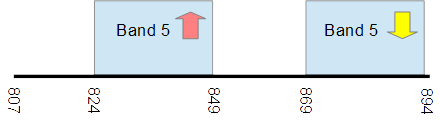
1 3GPP Band 5 (824-849/869-894 MHz),

2 3GPP Band 26 (814-849/859-894 MHz),

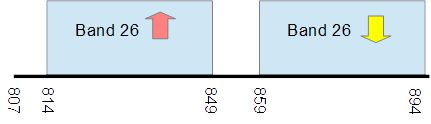
3 3GPP Band 27 (807‑824/852-869 MHz), and

4 3GPP Band 28 (703-748/758-803 MHz).

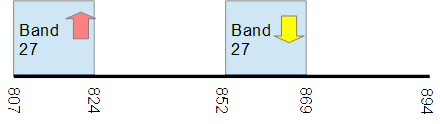
# 1 3GPP Band 5: 824-849/869-894 MHz



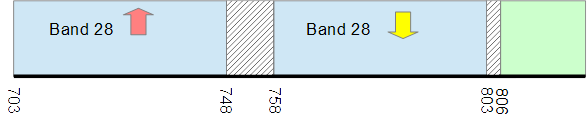
# 2 3GPP Band 26: 814-849/859-894 MHz



# 3 3GPP Band 27: 807-824/852-869 MHz



# 4 3GPP Band 28: 703-748/758-803 MHz



Examples of frequency arrangements for the bands 806 to 824 MHz and 851 to 869 MHz in Region 3 for narrowband and broadband public protection and disaster relief operations in accordance with the APT harmonization measure APT-AWG Report 08

## 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):

*FN* = 851.0125 + (*N* − 1) × 0.025 *N* = 1, 2, 3, …, 200

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

*FN*′ = 806.0125 + (*N* − 1) × 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):

*FN* = 856.00625 + (*N* − 1) × 0.0125 *N* = 1, 2, 3, …, 200

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

*FN*′ = 811.00625 + (*N* − 1) × 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) × 0.00625 *N* = 1, 2, 3, …, 400

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

*FN*′ = 813.503125 + (*N* − 1) × 0.00625 *N* = 1, 2, 3, …, 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 center 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 bandwidth are used 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 channelization for narrowband

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

The centre frequency (*fN*) of the *N*th 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 | *fN* = 806.0125 + (0.025) × (*N* − 1) | *fN* = 851.0125 + (0.025) × (*N –* 1) | 25 |

### 1.3.3 Example channelization for broadband

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

The centre frequency (*fN*) 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 | *fN* = 816.5 + (5) × (*N* − 1) | *fN* = 861.5 + (5) × (*N −* 1) | 5 |



The centre frequency (*fN*) 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 |



Examples of frequency arrangements for the band 694-894 MHz in certain countries in Region 3 for broadband public protection and disaster relief operations

Figure below shows an 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.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Section 2 – 380-470 MHz

Sub Section 1: Region 1 380-470 MHz

**in accordance with CEPT harmonization measure ECC/DEC(08)05**

Examples of frequency arrangements for the band 380-470 MHz in certain countries in Region 1 for narrowband and wideband public protection and disaster relief operations.

Examples of frequency arrangements for the band 450-470 MHz in Region 1 (CEPT) for broadband public protection and disaster relief operations

Administrations in certain countries in Region 1 wishing to introduce additional spectrum for BB-PPDR in parts of the 400 MHz range shall apply least restrictive technical conditions (LRTC) to ensure coexistence with other services. The channelling arrangements 1.4 MHz, 3 MHz or 5 MHz within the following paired frequency ranges according to ECC/DEC/(16)02 are:

a) 450.5-456.0 MHz (uplink) / 460.5-466.0 MHz (downlink) with LRTC specified in Annex 2 of ECC/DEC/(16)02

b) 452.0-457.5 MHz (uplink) / 462.0-467.5 MHz (downlink) with LRTC specified in Annex 2 of ECC/DEC/(16)02

Figure

450-470 MHz range examples



The centre frequencies of the above may be shifted within the band based on national circumstances. BB-PPDR within the 452.5-457.5/462.5-467.5 MHz can be used to benefit from existing conditions of 3GPP band 31 however it should be noted that this has not been studied and may cause interference for countries where channel 21 is used for DTT. For further information see ECC Report 218.

This 400 MHz range does not provide enough available spectrum to provide a stand-alone solution in certain countries in Region 1 requiring 2x10 MHz for BB-PPDR as calculated in ECC Report 199, however this 400 MHz range can offer national flexibility, e.g. in the context of additional spectrum beside the 700 MHz range.

Examples of frequency arrangements for the band 380-399.3 MHz   
in some countries in Region 1 for narrowband public protection   
and disaster relief operations



Sub Section 2: Region 2

There are no bands listed for Region 2 in *resolves* 3 of Resolution **646 (Rev.WRC-15)**.

**Sub Section 3: Region 3 – 406.1-430 MHz and 440-470 MHz**

**Examples of frequency arrangements for the range 406.1-430 MHz  
in Region 3 for narrowband public protection   
and disaster relief operations in accordance with APT harmonization measures[[7]](#footnote-11) APT-AWG Report 08**

## 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):

*Fn* = 406.01250 + ((*N* – 1) \* 0.0125) *N* = 1, 2, 3,…

## 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 20 MHz 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 trucked radio system analogue traffic channel of 1 600 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):

*Fn* = 420.0125 + (*N* – 1)\*0.025 *N* = 1, 2, 3,… 400

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

*Fn* = 410.0125 + (*N* – 1)\*0.025 *N* = 1, 2, 3,… 400

### 1.2.2 Frequency arrangements for 12.5 kHz channel spacing

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

*Fn* = 420.00625 + (*N* – 1)\*0.0125 *N* = 1, 2, 3,… 800

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

*Fn* = 410.00625 + (*N* – 1)\*0.0125 *N* = 1, 2, 3,… 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) |

\*\*\*\*\*\*\*\*\*\*\*\*\*

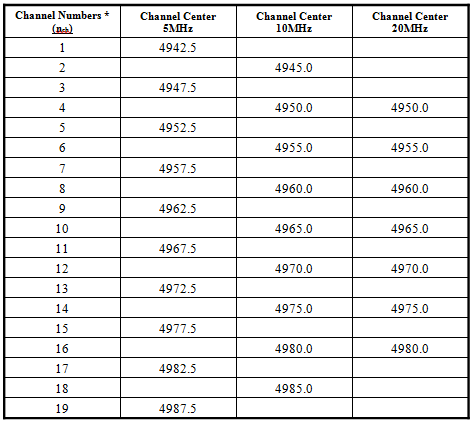
Section 3 – Region 3 4940-4990 MHz

Examples of frequency arrangements for the band 4940-4990 MHz in Region 3 for broadband public protection and disaster relief operations in accordance with APT harmonization measure[[8]](#footnote-12)

**Channel Plan:** The following channeling plan (see Table 1), which supports channel widths from 5 MHz to 20 MHz, to provide the flexibility needed for Administrations to support a variety of PPDR operational requirements. Because these channels overlap one another, Administrations may take precautions in their assignment procedures to ensure that overlapping channels do not occur in close enough proximity to cause conflicts between multiple PPDR users. Note that not all of the channels are available in some countries.

Table 1

Example channeling plan for 4 940-4 990 MHz



Annex 2

*[Editor’s note: Page numbers to be inserted at a later stage.]*

|  |  |  |
| --- | --- | --- |
| Annex 2  Country-Specific Frequency Arrangements (as per *resolves* 4 of Resolution 646 (Rev.WRC-15)) | | |
| Region of country(ies) / Section | Example Frequency Arrangement(s) | Page |
| 1 | There are no frequency arrangements provided by Region 1 administrations for inclusion here as per *resolves* 4 of Resolution **646 (Rev.WRC-15)** |  |
| 2 | Examples of frequency arrangements for the band 380-399.99 MHz in certain countries in Region 2 for narrowband public protection and disaster relief operations |  |
| 2 | Examples of frequency arrangements for the band 4 940–4 990 MHz in certain countries in Region 2 for public protection and disaster relief operations in accordance with CITEL harmonization measures |  |
| 3 | Examples of frequency arrangements for the band 138-144 MHz in certain countries in Region 3 for narrowband public protection and disaster relief operations |  |
| 3 | Examples of frequency arrangements for the band 170-205 MHz in certain countries in Region 3 for broadband public protection and disaster relief operations |  |
| 3 | Examples of frequency arrangements for the bands 1 447 to 1 467 MHz in certain countries in Region 3 for broadband public protection and disaster relief operations |  |

Country frequency arrangements for public protection and disaster relief   
as per *resolves* 4 of Resolution 646 (Rev.WRC-15)

Section 1 – Region 1 country-specific frequency arrangements

There are no frequency arrangements provided by Region 1 administrations for inclusion here as per *resolves* 4 of Resolution **646 (Rev.WRC-15)**.

\*\*\*\*\*\*\*\*\*\*\*\*

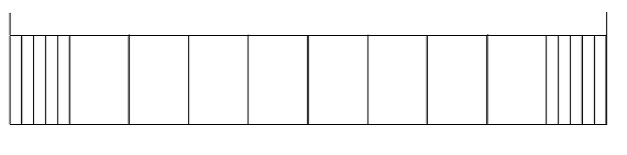
Section 2 – Region 2 country-specific frequency arrangements

Examples of frequency arrangements for the band 380-399.99 MHz in certain countries in Region 2 for narrowband public protection and disaster relief operations

*[Editor’s note: Mexico to provide frequency arrangement for next meeting]*

Examples of frequency arrangements for the band 4 940–4 990 MHz in certain countries in Region 2 for public protection and disaster relief operations   
in accordance with CITEL harmonization measures[[9]](#footnote-13)

The CITEL PCC.II recommended frequency channeling plan for the 4 940-4 990 MHz band for public protection and disaster relief consists of ten 1 MHz channels and eight 5 MHz channels as per Figure 1 and Table 1. Channels may be aggregated for higher capacity or higher bandwidth applications to allow maximum flexibility and implementation of future broadband technologies. Some countries may also choose to partition the 5 MHz channels.



4940

MHz

4990

MHz

5

x 1 MHz wide channels

8

x 5 MHz wide channels

5

x 1 MHz wide channels

Figure 1

Table 1: CITEL PCC.II channeling plan for the band 4 940-4 990 MHz for public safety

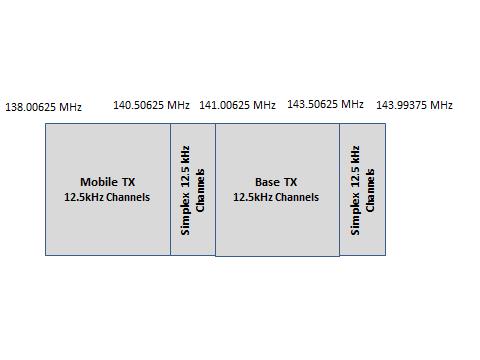
|  |  |  |
| --- | --- | --- |
| Channel | Lower frequency (MHz) | Upper frequency (MHz) |
| 1 | 4 940 | 4 941 |
| 2 | 4 941 | 4 942 |
| 3 | 4 942 | 4 943 |
| 4 | 4 943 | 4 944 |
| 5 | 4 944 | 4 945 |
| 6 | 4 945 | 4 950 |
| 7 | 4 950 | 4 955 |
| 8 | 4 955 | 4 960 |
| 9 | 4 960 | 4 965 |
| 10 | 4 965 | 4 970 |
| 11 | 4 970 | 4 975 |
| 12 | 4 975 | 4 980 |
| 13 | 4 980 | 4 985 |
| 14 | 4 985 | 4 986 |
| 15 | 4 986 | 4 987 |
| 16 | 4 987 | 4 988 |
| 17 | 4 988 | 4 989 |
| 18 | 4 989 | 4 990 |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Section 3 – Region 3 country-specific frequency arrangements

Examples of frequency arrangements for the band 138-144 MHz in certain countries in Region 3 for narrowband public protection and disaster relief operations

The 138-144 MHz band supports both duplex and simplex channels with the simplex channels accommodated within the duplex centre band gap and immediately above the duplex Base TX spectrum as depicted below:



The entire band uses a 12.5 kHz channel bandwidth.

Example channelization of duplex arrangement

For the duplex channels, the centre frequency (*fN*) of the *N*th 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 200 | *FN* = 138.0125 + (0.0125) × (*N* − 1) | *FN* = 141.0125 + (0.0125) ×  (*N –* 1) | 12.5 |

Example channelization of simplex arrangement

For simplex channels 1-40 the centre frequency (*fN*) of the *N*th channel is given by:

|  |  |  |
| --- | --- | --- |
| Channel number | Channel centre frequency (MHz) | Channel bandwidth  (kHz) |
| *N* = 1 to 40 | *fN* = 140.51250 + (0.0125) × (*N* − 1) | 12.5 |

For simplex channels N41-N79, the centre frequency (*fN*) of the *N*th channel is given by:

|  |  |  |
| --- | --- | --- |
| Channel number | Channel centre frequency (MHz) | Channel bandwidth  (kHz) |
| *N* = 41 to 79 | *fN* = 143.51250 + (0.0125) × (*N* − 41) | 12.5 |

Examples of frequency arrangements for the band 170-205 MHz in certain countries in Region 3 for broadband public protection and disaster relief operations

*[Editor’s note: Japan to provide frequency arrangement for next meeting]*

Examples of frequency arrangements for the bands 1 447 to 1 467 MHz   
in certain countries in Region 3 for broadband public protection   
and disaster relief operations

The frequency range 1 447-1 467 MHz has been identified by the Ministry of Industry and Information Technology of the People’s Republic of China for PPDR.It is noticed that a number of broadband trunking system trial networks have been deployed on the 1 447~1 467 MHz band, for example in Beijing, Nanjing, and Tianjin.

Channel bandwidth may be assigned throughout this band and specific blocks may be designated exclusively for government applications, as illustrated in the chart below:

Bandwidth = 5 MHz

TDD 5MHz TDD 5 MHz TDD 5 MHz TDD 5MHz

1447 1452 1457 1462 1467

Bandwidth = 10 MHz

TDD 10MHz TDD 10MHz

1447 1457 1467

Bandwidth = 20 MHz

TDD 20MHz

1447 1467

1. 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>). [↑](#footnote-ref-5)
2. 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>. [↑](#footnote-ref-6)
3. The use of the term “broadband” in this Annex means indicative data rates in the order of 25 Mbit/s. 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. [↑](#footnote-ref-7)
4. 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>. [↑](#footnote-ref-8)
5. 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>. [↑](#footnote-ref-9)
6. PT AWG Report-08 is presently being updated and updated report is expected to be approved before next WP 5A meeting. [↑](#footnote-ref-10)
7. [APT/AWF/REP-08](http://www.aptsec.org/sites/default/files/APT-AWF-REP-08APT_Report_on_PPDR.doc) APT Report on "Possible Harmonized Use of Bands 406.1-430 MHz, 806‑824/851-869 MHz, 4940-4990 MHz, 5850-5925 MHz for PPDR Application in some APT Countries" [↑](#footnote-ref-11)
8. APT-AWG Recommendation 01. [↑](#footnote-ref-12)
9. PCC.II/REC. 16 (VII-06): Use of the 4940-4990 MHz band in the Americas for Public Protection and Disaster Relief. [↑](#footnote-ref-13)