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| **Radiocommunication Study Groups** |  |
| **INTERNATIONAL TELECOMMUNICATION UNION** |  |
|  |  |
| Source: Document 5A/TEMP/318(Rev.1) | **Annex 6 to Document 5A/736-E** |
| **17 July 2015** |
| **English only** |
| Annex 6 to Working Party 5A Chairman’s Report | |
| 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, Annex 7)

Attachment 1

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

(2012)

**Scope**

This Recommendation provides guidance on frequency arrangements for public protection and disaster relief (PPDR) radiocommunications in certain regions. The Recommendation addresses arrangements related to regional harmonization measures and other national information on the use of PPDR in accordance with Resolutions ITU-R 53, ITU‑R 55 and WRC Resolutions **646 (Rev.WRC-15)**, and   
**647[or 644][[1]](#footnote-1) Rev.WRC-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*

*ca)* that a continuing requirement is envisaged for narrow-band applications (supporting voice and low data-rate applications), along with wideband and broadband applications in the future;

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

*c)* 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 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 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)***;

*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-15)** encourages administrations to consider certain frequency tuning ranges[[2]](#footnote-2) or parts thereof when undertaking their national planning for the purposes of achieving global and/or regionally harmonized solutions for the provision of PPDR services and applications as shown in *recommends 1* *and 2* of this Recommendation;

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 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;

*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;

*e)* that there may be a need for suitable upgrading of such commercial systems to meet the specific needs of PPDR agencies,

*recommends*

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

3 that administrations take note of the frequency arrangements in Annex B which show other non- harmonised solutions 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[[3]](#footnote-7),[[4]](#footnote-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.

**1.3 Centre frequencies:**

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

*FCH* = band edge – (channel bandwidth/2) + *n* \* channel bandwidth

where:

*FCH* = 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[[5]](#footnote-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”[[6]](#footnote-10)

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

## 1.2 Example frequency arrangement “B”[[7]](#footnote-11)

|  |  |  |
| --- | --- | --- |
| **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. 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 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[[8]](#footnote-13)   
in accordance 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.

Annex B

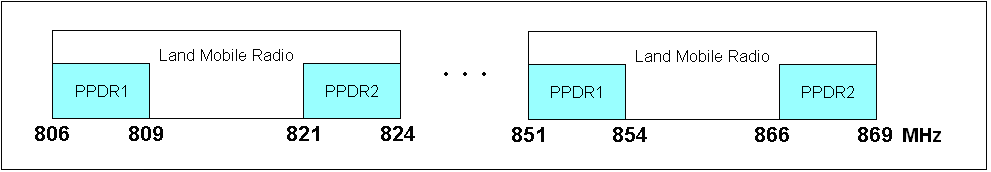
Frequency arrangements and related information to reflect national use

Annex Appendix 1

Examples of frequency arrangements for the band 806 to 869 MHz[[9]](#footnote-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[[10]](#footnote-15) |
| 821-824 | 866-869 | PPDR2[[11]](#footnote-16) |

### 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 | *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 |

Annex Appendix 2

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):

*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 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):

*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) |

Annex Appendix 3

Examples of frequency arrangements for the bands 806 to 824 MHz[[12]](#footnote-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).

806

824

Land Mobile Radio

811

813.5

816

851

869

Land Mobile Radio

856

858.5

861

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:

5 MHz

5 MHz

5 MHz

5 MHz

5 MHz

5 MHz

869

854

824

809

***Plan ‘A’****:*

*Downlink*

*Legacy narrowband systems*

851 MHz

806 MHz

*Uplink*

*Legacy narrowband systems*

852 MHz

867

5 MHz

5 MHz

5 MHz

822

5 MHz

5 MHz

5 MHz

***Plan ‘B’****:*

869 MHz

824 MHz

807 MHz

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.

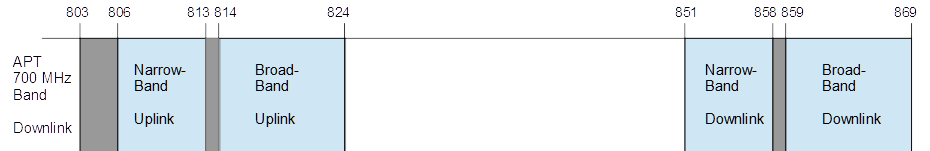
**1.3 Example narrowband and broadband in 806-824/851-869 MHz**

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 (*fN*) of the Nth channel is given by:

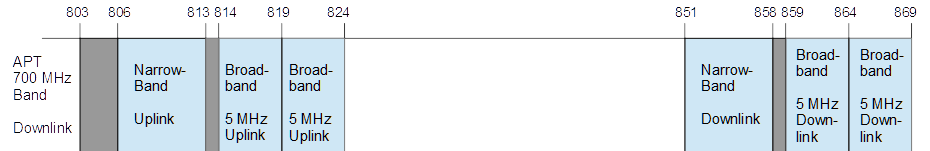
|  |  |  |  |
| --- | --- | --- | --- |
| **Channel number** | **Mobile station transmit Channel centre frequency (MHz)** | **Base station transmit Channel centre frequency (MHz)** | **Channel bandwidth (kHz)** |
| *N* = 1 to 280 | *fN* = 806.0125 + (0.025) × (*N* − 1) | *fN* = 851.0125 + (0.025) × (*N-1*)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

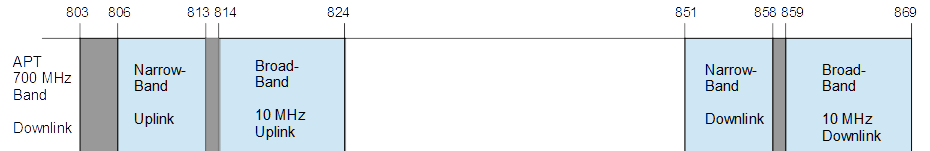
The centre frequency (*fN*) of the *N*-th channel for two 5 MHz channels is given by:

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | *f1* = 819 | *f1* = 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 and 851 to 869 MHz for narrowband and broadband public protection and disaster relief operations in 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.

## 1.2 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).

806

824

Land Mobile Radio

811

813.5

816

851

869

Land Mobile Radio

856

858.5

861

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.

## 1.3 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:

5 MHz

5 MHz

5 MHz

5 MHz

5 MHz

5 MHz

869

854

824

809

***Plan ‘A’****:*

*Downlink*

*Legacy narrowband systems*

851 MHz

806 MHz

*Uplink*

*Legacy narrowband systems*

852 MHz

867

5 MHz

5 MHz

5 MHz

822

5 MHz

5 MHz

5 MHz

***Plan ‘B’****:*

869 MHz

824 MHz

807 MHz

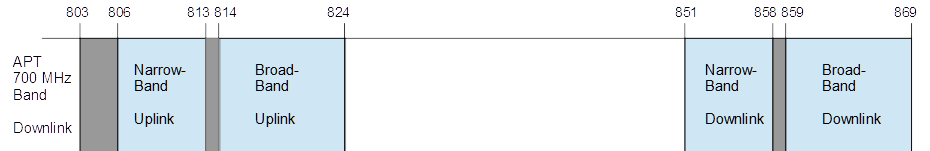
The raster for the wideband channels is 100 kHz, which means that the channel centre frequencies are an integer multiple of 100 kHz. The broadband channel bandwidth is an integer multiple of 5 MHz. This provides flexibility for administrations to implement appropriate channel arrangements in accordance 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.

## 1.4 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.

**1.4.1 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 |

**1.4.2 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 (*fN*) of the Nth channel is given by:

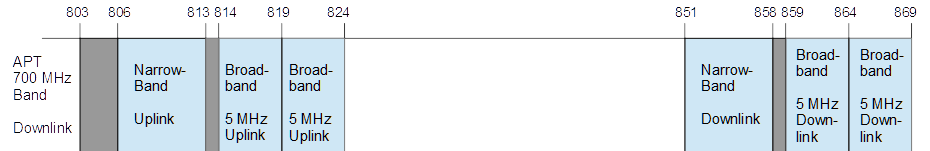
|  |  |  |  |
| --- | --- | --- | --- |
| **Channel number** | **Mobile station transmit Channel centre frequency (MHz)** | **Base station transmit Channel centre frequency (MHz)** | **Channel bandwidth (kHz)** |
| *N* = 1 to 280 | *fN* = 806.0125 + (0.025) × (*N* − 1) | *fN* = 851.0125 + (0.025) × (*N-1*)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

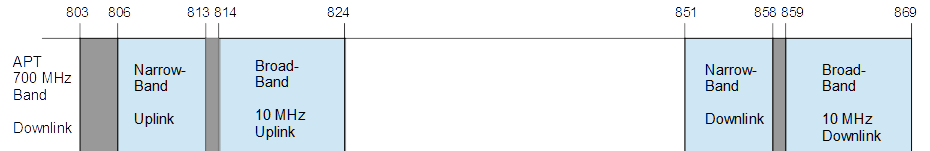
The centre frequency (*fN*) of the *N*-th channel for two 5 MHz channels is given by:

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | *f1* = 819 | *f1* = 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 700 MHz band of 2x40MHz**



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



**Figure 3. Scenario for PPDR in 700 MHz based on arrangements that are partially harmonized with APT arrangement with additional 2x5 MHz for PPDR expansion during disasters or for other government users like Military using LTE**



1. Depending on the WRC-15 decision on agenda item 9.1 issue 9.1.7 [↑](#footnote-ref-1)
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 [↑](#footnote-ref-2)
3. Venezuela has identified the band 380-400 MHz for public protection and disaster relief applications. [↑](#footnote-ref-7)
4. Some countries in Region 3 have also identified the bands 380-400 MHz for public protection and disaster relief applications. [↑](#footnote-ref-8)
5. Some countries in Region 3 have also identified the band 746-806 MHz for public protection and disaster relief applications. [↑](#footnote-ref-9)
6. 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-10)
7. 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-11)
8. These additional frequency bands are considered for use by the administration of United Arab Emirates and Jordan for PPDR: 703-713/758-768 MHz. [↑](#footnote-ref-13)
9. These additional frequency bands are used by some administrations for PPDR: 791‑801/832-842 MHz (Qatar) and 806-824/851-869 MHz (Israel). [↑](#footnote-ref-14)
10. 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-15)
11. 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-16)
12. These additional frequency bands are used by some administrations for PPDR:  
    791‑801/832-842 MHz (Qatar) and 806-824/851-869 MHz (Israel). [↑](#footnote-ref-17)