

## THE 400 MHz BAND PLAN

## THE 400 MHz BAND

### BACKGROUND

This plan applies to the spectrum between 359 and 520 MHz which for convenience will be referred to as the 400 MHz Band. For some parts of this band frequency plans already exist while for others there are no relevant documents. There is a definite need to have formally approved frequency plans and channel arrangements in this band which will update existing frequency plans and provide for spectrum for current and future services.

### RADIOCOMMUNICATION SERVICES ACCOMMODATED IN THE 400MHz BAND

In accordance with the ITU Radio Regulations for Region 3, the Papua New Guinea Table of Frequency Allocations makes provision for a variety of services in the 400 MHz Band such as:

- |                             |  |
|-----------------------------|--|
| _ Fixed                     | _ Mobile Satellite                             |
| _ Mobile                    | _ Space Research                               |
| _ Amateur                   | _ Standard Frequency and Time Signal Satellite |
| _ Broadcasting              | _ Space Operation                              |
| _ Radionavigation Satellite | _ Earth Exploration Satellite                  |
| _ Radiolocation             | _ Radio Astronomy                              |
| _ Meteorological Aids       | _ Aeronautical Radionavigation                 |
| _ Meteorological Satellite  | _ Citizen Band Radio Service                   |

### RADIOCOMMUNICATION SYSTEMS

This document provides the necessary technical details regarding the channel arrangements for the Land Mobile and Fixed Services for various radiocommunication systems such as:

- \_ Land Mobile:
  - \* Conventional Two Frequency Systems
  - \* Miscellaneous Single Frequency Systems
- \_ Fixed:
  - \* Point to point:
    - Single Channel Links:
      - Rural Telephone Subscriber Systems (RTSS)
      - VHF Repeater Links
      - RTSS equipment Links
    - Telemetry and Telecommand Systems
    - Data Communication Systems
    - Multi-channel PSTN Links
    - Sound Broadcasting Studio to Transmitter Links (STLs)
  - \* Point to Multi-point
    - Telemetry and Telecommand Systems
    - Data Communication Systems
  - \* Miscellaneous Single Frequency Systems

### MISCELLANEOUS CATEGORY

The miscellaneous category is intended to provide for radiocommunication services and systems not explicitly provided for elsewhere in this band. This category applies to the

single frequency segments which may be used both by the fixed and mobile services. If required to accommodate a two frequency radiocommunication system, these single frequency segments may be paired as appropriate.

The proposed spectrum arrangements in this band are regarded as basic planning guidelines, however maximum flexibility will be applied whenever possible in order to satisfy user demand.

### RESERVED SPECTRUM

The proposed band plan is based on user demand and PANGTEL projections for the next 7 year period, in light of which it is deemed unnecessary to make frequency plans for the whole of the 400 MHz spectrum. Some parts of this band have conveniently been reserved until such time when they are required by user demand for existing services or for the implementation of new services. Additionally, not all the spectrum allocated for fixed links will be permitted to be used in urban areas, thus enabling future developments in various parts of the 400 MHz Band.

### BAND SUB-DIVISIONS

For convenience and according to usage the band has been subdivided into 4 sub-bands namely: 359 - 400 MHz, 400 - 450 MHz, 450 - 480 MHz and 480 - 520 MHz. See the attached "SPECTRUM ALLOCATIONS IN THE 400 MHz BAND".

### THE 359 - 400 MHz BAND

This band is exclusively used for PSTN multi-channel links. There are 8 standard channels; A1 to A8, and 8 interleaved channels; B1 to B8. The spacing between adjacent channels is 2 MHz and the separation between paired transmit and receive channels is 25 MHz.

Channels A8 and B8 will not be permitted for use in urban areas after 31.12.1997. The spectrum occupied by these channels i.e between 373 and 375 MHz and the frequency segment between 375 and 383 MHz has been reserved by PANGTEL in order to facilitate the accommodation of new services that may evolve. Ideally most of this segment should be used for fixed single channel PSTN links or other services related to Telecom. That will enable Telecom to concentrate most of their services away from land mobile segments and other services thus reducing the likelihood for interference between fixed and mobile services and alleviating the task of frequency planning and assignment.

Emission bandwidth of channel B8 should always be kept within necessary limits in order to avoid overlapping with the 399.9 - 400.05 MHz segment which is allocated to the Radio Navigation Satellite Service.

## THE 400 - 450 MHz BAND

### Mobile Satellite

WARC 92 allocated the 400.15 - 401 MHz frequency segment internationally to the mobile satellite service on a primary basis. This segment will therefore be set aside for that purpose. Detailed plans will be made when necessary in order to reflect technological developments in this service and the demand for it in PNG.

### Multi-channel PSTN Links

The 402 to 420 MHz sub-band is being used by Telecom for multi-channel PSTN links. There are 8 standard channels; C1 to C8, and 8 interleaved channels; D1 to D8. The spacing between adjacent channels is 1 MHz and the separation between paired transmit and receive channels is 9.45 MHz.

The sub-band between 420 and 438 MHz has been allocated to the fixed service to cater for Telecom's demand for additional frequencies for the multi-channel PSTN links. There are 8 standard channels; E1 to E8, and 8 interleaved channels; F1 to F8. The spacing between adjacent channels is 1 MHz and the separation between paired transmit and receive channels is 9.45 MHz.

Channels C1, C2, D1 and D2 of the existing 402 to 420 sub-band are not permitted for use in urban areas after 31.12.1997. Likewise, channels E7, E8, F7 and F8 of the proposed 420 to 438 sub-band are not permitted for use in urban areas after the approval of this band plan.

### Emergency Position Indicating Radio Beacons (EPIRBs)

The 406 - 406.1 MHz frequency segment is an international allocation for the EPIRBs. As this segment falls within the 402 - 420 MHz sub-band there is a likelihood for interference with the fixed PSTN links. According to this band plan, the EPIRB segment coincides with the centre frequency of intermediate channel D4, which therefore should not be used in any area. Additionally, the bandwidths of channels C4 and C5 should be limited so that overlapping with the EIPRB segment is avoided.

### Radio Amateur

The PNG Table of Frequency Allocations allocates the 430 to 440 MHz and 440 to 450 MHz sub-bands to the amateur service as a secondary and permitted service respectively.

## THE 450 - 480 MHz BAND

The number of assignments in the 450 - 480 MHz band is very low compared to the number of available channels. It is expected that this number will grow gradually as applicants for the more popular VHF Bands are redirected to use this band. However it is not envisaged that the demand will be greater than the availability of channels. Therefore an overall changeover to 12.5 kHz from the present 25 kHz is not necessary. According to usage, this band has been divided into two parts ie the 450 - 470 MHz and 470 - 480 MHz bands.

## THE 450 - 470 MHz BAND

### RTSS

The 450 to 470 MHz sub-band has been modified in order to accommodate the increased demand by Telecom for RTSS channels. The number of RTSS channels in segment U3 has been increased to 48 from the previous 36. These channels will be made available to Telecom on a nation wide basis. For the purpose of combining transmitters and receivers it is proposed that channels be grouped in blocks of 4 with a frequency separation of 300 kHz between adjacent channels in a block.

### Land Mobile

The channel arrangements in segments U6 and U7 are not the best option available as the frequency spacing of 325 kHz between adjacent channels in a block does not achieve two fold symmetry when the transmit receive separation is 9.45 MHz. An attempt has been made to adjust the channel spacing to 300 kHz and achieve symmetry but that would have affected most users in Port Moresby. Therefore the channel arrangements in these segments will remain unchanged.

There are 98 and 156 channels in segments U6 and U7 respectively, however, not all channels will be made available. New assignments of channels above channel 78 from segments U6 and U7 will not be made. These channels will be reserved for future planning when the upper 78 channels from segment U7 may for example be allocated to trunked systems if required. If necessary, when the new plans are made, existing assignments from the upper portions of segments U6 and U7 may be reallocated to the lower portions.

### Single Frequencies

There are 169 single frequency channels in segments U3, U4, U5, U11 and U12 available for miscellaneous use. Channels from segments U4 and U5 may be paired with channels from U11 and U12 respectively. Nominal channel spacing is 25 kHz.

## THE 470 - 480 MHz BAND

This sub-band has predominantly been allocated to fixed services. These services will usually include linking of VHF repeater links, RTSS equipment links, STL links and data communication systems. While single frequencies may be used for repeater links the two frequency mode is preferred as it permits the use of a greater number of links at a given site.

### Single Channel Links

Channels from segment U14 may be used for linking of repeaters and RTSS equipment. Nominal channel spacing is 25 kHz. Channels are grouped with 300 kHz separation between adjacent channels in a block. The transmitter receiver separation is 5.25 MHz. Strict rules regarding the relationship between transmit and receive frequencies will be observed when more than one link from the same frequency segment is used at the same site.

### Studio to Transmitter Links

Segments U15 and U21 have been allocated to STL for sound broadcasting. Two segments are required for compatibility with other fixed systems at the same site. While STLs are single frequency services for, purposes of multi-hopping two adequately separated frequencies are required. Nominal channel bandwidth is 125 kHz for mono programmes while for stereo programmes three adjacent channels may be used. For the purpose of multi-hopping any channel from U15 may be paired with any channel from U21.

### Point to Point and Point to Multi-Point Links

Segments U16 and U18 have been allocated to the point to multi-point and point to point fixed services respectively. These segments will be used primarily for data communications, telemetry and telecommand systems, however voice communication will be permitted on the same channel. Nominal channel spacing is 25 kHz. Channel bandwidths other than 25 kHz may be authorised provided that adjacent channel operation is not affected. For the purpose of combining channels are grouped with frequency separation of 300 kHz between adjacent channels in a block. The transmit receive separation is 5.25 MHz.

Transmit receive site sense must be observed when more than one channel from any segment of the fixed links segments are allocated at a site.

### Single Frequencies

The single frequency segments U13, U17 and U19 will be available for miscellaneous use. Nominal channel spacing is 25 kHz.

### Citizen Band Radio Service

Channel arrangements in segment U20 ie the CBRS will remain unchanged.

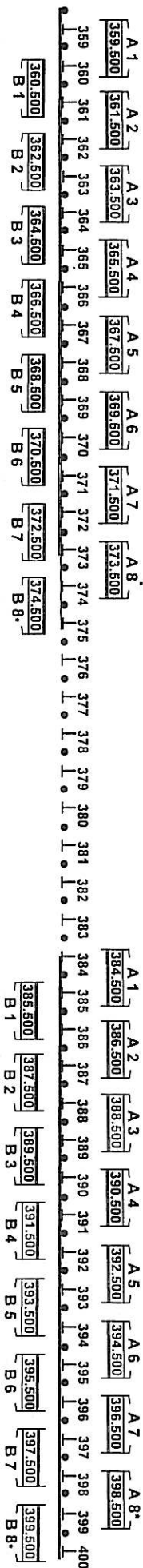
### The 480 - 520 MHz Band

It is not necessary to make plans for this band at this time. The number of available channels in other bands is sufficient to satisfy long term demand. Therefore it is proposed that this band be reserved for future planning until such a time when it is necessary to satisfy demand or accommodate a service that cannot be accommodated elsewhere.

Until proper plans are made for this band it can be used if required but on a temporary basis. Users should be made aware that they may have to be reassigned to another band if necessary when this band is allocated.

# SPECTRUM ALLOCATIONS IN THE 359 - 400 MHz BAND

A,B: PSTN LINKS.



## PSTN LINKS.

Normal Pattern	
A1	359.500 384.500
A2	361.500 386.500
A3	363.500 388.500
A4	365.500 390.500
A5	367.500 392.500
A6	369.500 394.500
A7	371.500 396.500
A8*	373.500 398.500
B1	360.500 385.500
B2	362.500 387.500
B3	364.500 389.500
B4	366.500 391.500
B5	368.500 393.500
B6	370.500 395.500
B7	372.500 397.500
B8*	374.500 399.500

UNALLOCATED SEGMENTS ARE RESERVED FOR FUTURE PLANNING AND MAY BE USED ON A TEMPORARY BASIS.

THE CHANNELING ARRANGEMENTS SHOWN ARE NOMINAL. OTHER CHANNEL SPACINGS MAY BE USED PROVIDED THAT CHANNEL BANDWIDTH DOES NOT EXCEED THE SEGMENT LIMITS.

\* THESE CHANNELS CAN NOT BE USED IN URBAN AREAS AFTER 31.12.1997



## 359 – 400 MHz

\* THESE CHANNELS CAN NOT BE USED IN URBAN AREAS AFTER 31. 12.1997

400 - 450 MHz

\* THESE CHANNELS CAN NOT BE USED IN URBAN AREAS AFTER 31. 12.1997

(399.9 – 400.05) RADIONAVIGATION SATELLITE: (400.05 – 400.15) STANDARD FREQUENCY AND TIME SIGNAL: (406 – 406.1) EBIRBS

## 450 - 480 MHz

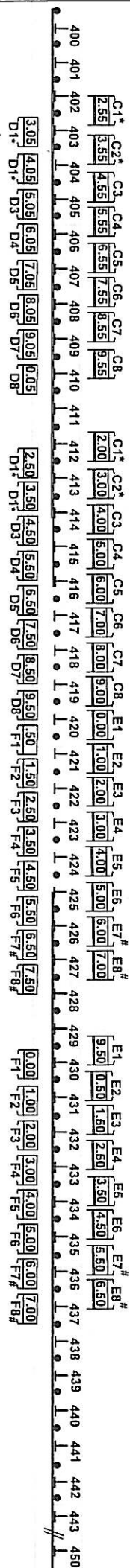
450 - 480 MHz

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# SPECTRUM ALLOCATIONS IN THE 400 - 450 MHz BAND

C,D,E,F: PSTN LINKS.



PSTN LINKS.

PSTN LINKS.

Normal Pattern	Interleaved Pattern	Normal Pattern	Interleaved Pattern
C1* 402.550	D1* 403.050	E1 420.000	F1 420.050
C2* 403.550	D2* 404.050	E2 421.000	F2 421.050
C3 404.550	D3 405.050	E3 422.000	F3 422.050
C4 405.550	D4 406.050	E4 423.000	F4 423.050
C5 406.550	D5 407.050	E5 424.000	F5 424.050
C6 407.550	D6 408.050	E6 425.000	F6 425.050
C7 408.550	D7 409.050	E7# 426.000	F7# 426.050
C8 409.550	D8 410.050	E8# 427.000	F8# 427.050

# THESE CHANNELS CANNOT BE USED IN URBAN AREAS

\* THESE CHANNELS CANNOT BE USED IN URBAN AREAS AFTER 31.12.97.  
UNALLOCATED SEGMENTS ARE RESERVED FOR FUTURE PLANNING AND MAY BE USED ON A TEMPORARY BASIS.  
THE CHANNELLING ARRANGEMENTS SHOWN ARE NOMINAL. OTHER CHANNEL SPACINGS MAY BE USED PROVIDED THAT THE CHANNEL BANDWIDTH DOES NOT EXCEED THE SEGMENT LIMITS.

