National Information and Communications Technology Authority

BAND PLAN

71 - 76 & 81 – 86 GHz

Papua New Guinea

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Disclaimer

Due to the dynamic nature of wireless and the ICT industry in general, the spectrum allocations including the primary and secondary service allocations may change with the outcome of each World Radio Conference and consequent PNG re-allocations.

This document is provided for reference purpose and is mostly based on the recommendations of WRC-15, relevant regulations and allocations for ITU Region 3 and consequent Papua New Guinea allocations. This document must be read with all relevant references quoted to understand various sub-band plans and channelling arrangements. The National Information and Communication Technology Authority (NICTA) of Papua New Guinea hereby expressly disclaims any and all liability connected with or arising from any sole use of or reliance on the contents of this document alone for any purpose whatsoever.

List of Abbreviations

ITU	International Telecommunication Union
WRC	World Radio Conference
FSS	Fixed satellite Service
MSS	Mobile Satellite Service
LMSS	Land Mobile Satellite Service
AMSS	Aeronautical Mobile Satellite Service
MMSS	Maritime Mobile Satellite Service
EIRP	Effective Isotropic Radiated Power

INTRODUCTION

This document covers the Band plan and channelling arrangement for fixed wireless systems operating in the 71-76GHz and 81-86GHz frequency range which are also commonly known as the E-band. Other services within the band are also mentioned briefly in this document for sharing and compatibility reasons. It provides information on technical characteristics of radio systems, frequency channeling, coordination initiatives to maximize the utilization, and minimizes interference by applications in the said bands. It is also intended to regulate the usage of the spectrum in PNG

The Band Plan is based on the Article 5 of ITU Radio Regulations, provisions for region 3 and consequent PNG Allocations as per updates of WRC-15.

1. RADIOCOMMUNICATION SERVICES IN THE 71-76GHz & 81-86GHz BAND

In accordance with the ITU Radio Regulations and provisions for Region 3, the Papua New
Guinea Table of Frequency Allocation makes provision for the following services in the 7176 GHz to 81-86GHz Band on both a primary and secondary basis;

- Fixed
- Fixed Satellite
- Mobile
- Mobile Satellite
- Mobile Broadcasting
- Broadcasting Satellite
- Radio Navigation
- Radionavigation Satellite
- Radio Astronomy

2.1 SPECTRUM PLAN ARRANGEMENT AND USAGE

This band plan for 71-76GHz and 81-86GHz accommodates fixed point-to-point backhaul services for small cells in high density urban environments or last mile WiFi mesh networks. Other applications permitted in the band include;

- High capacity links between main transmission nodes
- High capacity replacement to serve multimode 3G/4G macrocells
- Last mile for small cells or street level mesh networks

2.2 FIXED WIRELESS SERVICES

The broadband wireless technology known as E Band includes the bands of 71-76 GHz and 81-86 GHz. This high capacity point-to-point fixed link technology provides up to 10 GHz of bandwidth and can be utilised under various channelling plans as shown in Figures 1 to 8 in section 3 of this document. The common channel plans being 250 MHz and 500 MHz

The propagation characteristics of the 71-76 GHz and 81-86 GHz bands allow for high capacity broadband transmission and are useful for FWS up to 3 kilometres

Millimeter-wave radios have numerous indoor and outdoor applications that include such sectors as residential, business, public(libraries, etc),and commercial (hotels, cafes, etc) MMW is suitable for in-home applications like audio/video transmission, desktop connections, and portable devices. In addition, it can be used for outdoor point-to-point applications. The applications can be divided into the following categories;

Point-to-Point

- ❖ Wireless backhaul for IMT systems in high density urban areas
- ❖
- ❖ Video relay of uncompressed HDTV

Point-to-Multipoint

- ❖ High-definition video streaming
- ❖ File Transfer
- ❖ Wireless gigabit Ethernet
- ❖ Wireless docking station and desktop point-to-multipoint connections ❖ Wireless ad hoc networks

When there is need for Fixed Wireless Systems (FWS) for large data capacity transport such as

1. High Definition television signal (HDTV) transmission
2. Mobile Network applications
3. Short range high capacity microwave systems

Potential applications

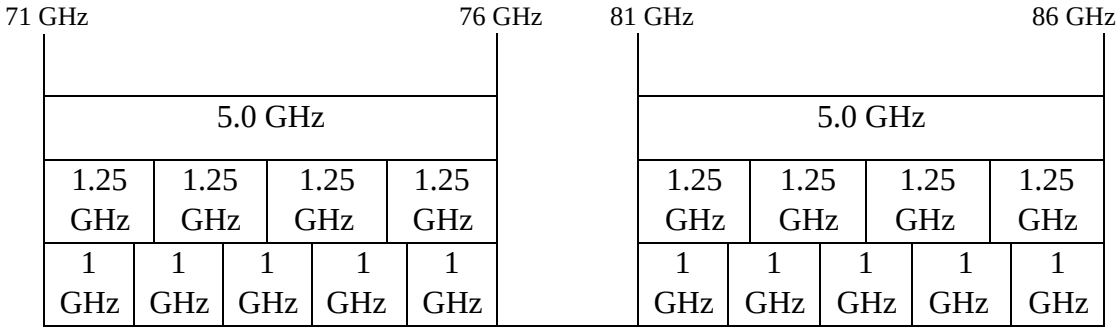
- ❖ High Definition Video Broadcast
- ❖ Fibre (Backbone) POP Access
- ❖ Local Area Network(LAN) extension ❖ Wireless Backhaul
- ❖ Line-of-sight radio relay systems

3 CHANNEL PLANNING AND GUARD BANDS FOR FIXED WIRELESS SERVICE

This arrangement is based on the use of the basic 5 GHz sub-bands, which can be subdivided to form smaller paired blocks, as shown in Fig. 1. According to the needs, other block subdivisions are possible, including blocks of different size.

FIGURE 1

Examples of frequency block arrangement for the ranges 71-76/81-86 GHz

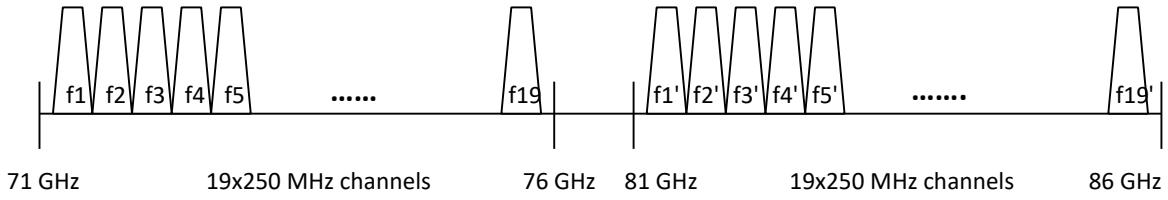


3.1 Pairing and aggregating basic channels in frequency bands 71-76 / 81-86 GHz

The principle of using the 2 □ 19 basic channels from within the bands 71-76 GHz and 81-86 GHz jointly in a single duplex FDD arrangement with 10 GHz duplex separation is described in the Fig. 2.

Figure 2

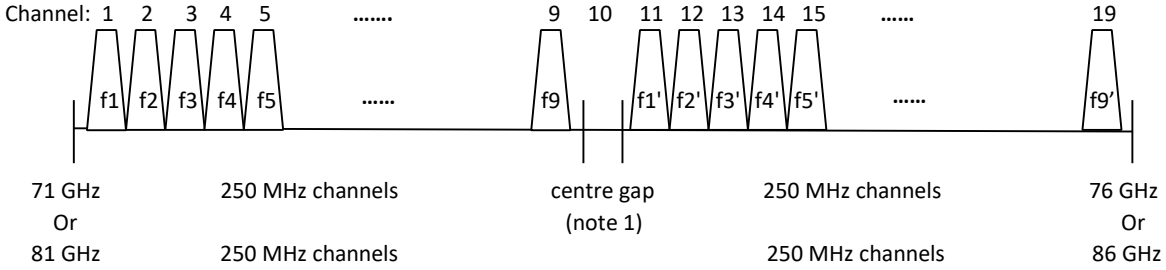
Combining the 250 MHz channels from 71-76 / 81-86 GHz bands into a single FDD arrangement
with duplex separation of 10 GHz



The principle of using the 2 □ 19 basic channels within a single band 71-76 GHz or 81-86 GHz with two separate FDD arrangement with duplex separation of 2.5 GHz (note 1) is shown in Fig.3. NOTE 1: Wider duplex separation may be possible

Figure 3

Combining the 250 MHz channels from single 71-76 GHz or 81-86 GHz band into separate
FDD arrangement with duplex separation of [less than 5 GHz] 2.5 GHz



NOTE 1: Wider centre gap may be obtained with wider duplex separation (e.g. centre gap made by basic channels 9, 10 and 11 resulting in 2.75 GHz duplex separation)

When wider channels are needed, e.g. for very high bitrate and high system gain applications (e.g. employing FSK modulation and/or gigabit/s or higher capacity), then a flexible number of consecutive 250 MHz channels may be aggregated into FDD channels, as illustrated in Fig. 4, for duplex separation equal or more than 10 GHz, or in Fig. 5, for duplex separation of 2.5 GHz. Administrations that prefer to use of multiple sizes channels in predefined positions may refer to the arrangements in section 4 of this Annex.

Figure 4

Example of aggregating multiple 250 MHz channels, possibly alongside with original 250 MHz wide channels
within the joint 71-76 GHz and 81-86 GHz FDD arrangement

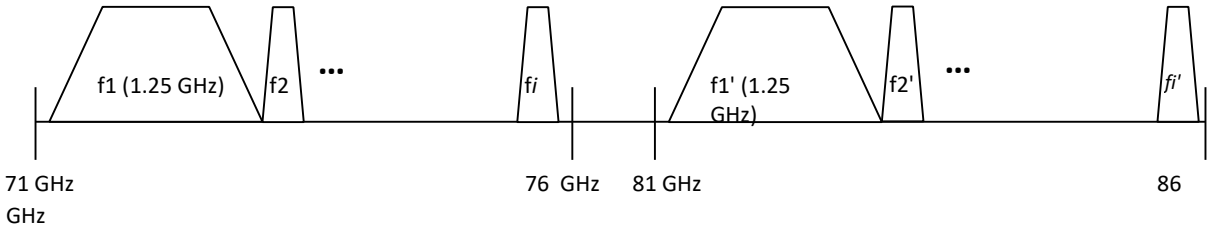
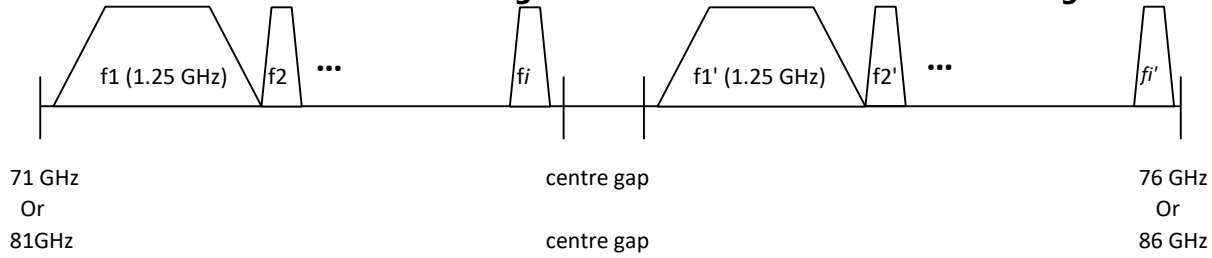


Figure 5

Example of aggregating multiple 250 MHz channels, possibly alongside with original 250 MHz wide channels within the single band 71-76 or 81-86 GHz FDD arrangements

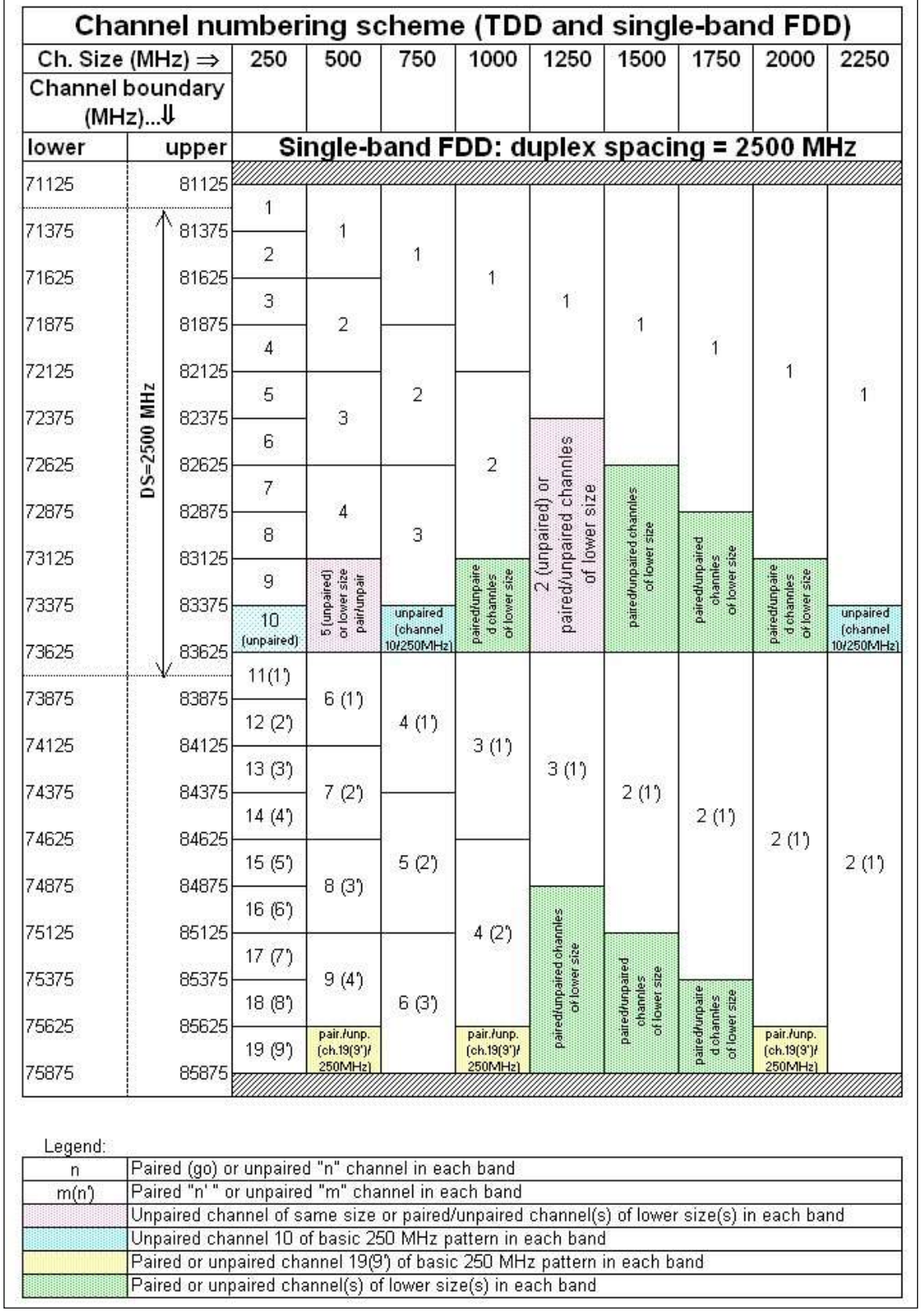


3.2 Specific channel arrangements for multiple size FDD/TDD aggregated channels in frequency bands 71-76 / 81-86 GHz

A multiple sizes channel arrangement for these bands depends on the basic assumptions that an administration makes for the deployment, e.g.:

- TDD, FDD or their mixed use of the band;
- Paired FDD assignments with fixed duplex;
- FDD channels paired either in each single band or in cross-band pairing, or both contemporarily;

For maximum flexibility all possible channel size of N □ 250 MHz are described in the arrangements.
N = 1, 2, …..9 resulting in channel size from 250 MHz to 2 250 MHz as described in Fig. 6 for the separate arrangements in 71-76 GHz and 81-86 GHz with duplex separation 2.5 GHz.
N = 1, 2, …..18 resulting in channel size from 250 MHz to 4 500 MHz as described in Fig. 7 for the joint arrangement in 71-76 GHz and 81-86 GHz with duplex separation 10 GHz. In this case channels from 250 MHz to 2 250 MHz maintain the same centre frequency of the corresponding channels in previous separate arrangements; this makes easier, when necessary, the contemporary coordination of systems with 2.5 GHz and 10 GHz duplex separation.
Figure 6
Channel positions for TDD and single-band FDD applications
(2.5 GHz Fixed duplex for all channels)

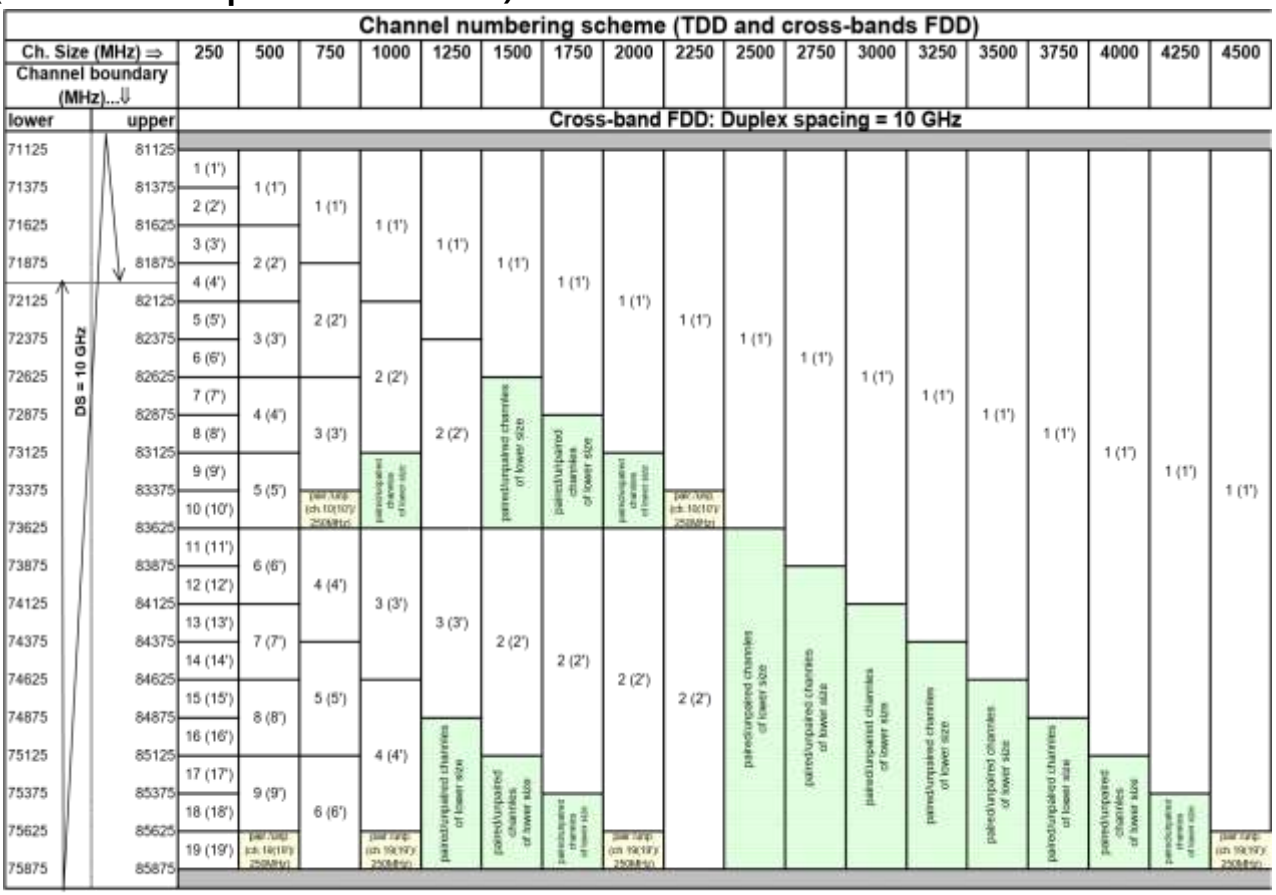


Legend:

n	Paired (go) or unpaired "n" channel in each band
m(n')	Paired "n' " or unpaired "m" channel in each band
	Unpaired channel of same size or paired/unpaired channel(s) of lower size(s) in each band
	Unpaired channel 10 of basic 250 MHz pattern in each band
	Paired or unpaired channel 19(9') of basic 250 MHz pattern in each band
	Paired or unpaired channel(s) of lower size(s) in each band

Figure 7

Channel positions for TDD and joint cross-bands FDD applications (10 GHz Fixed duplex for all channels)



Legend:

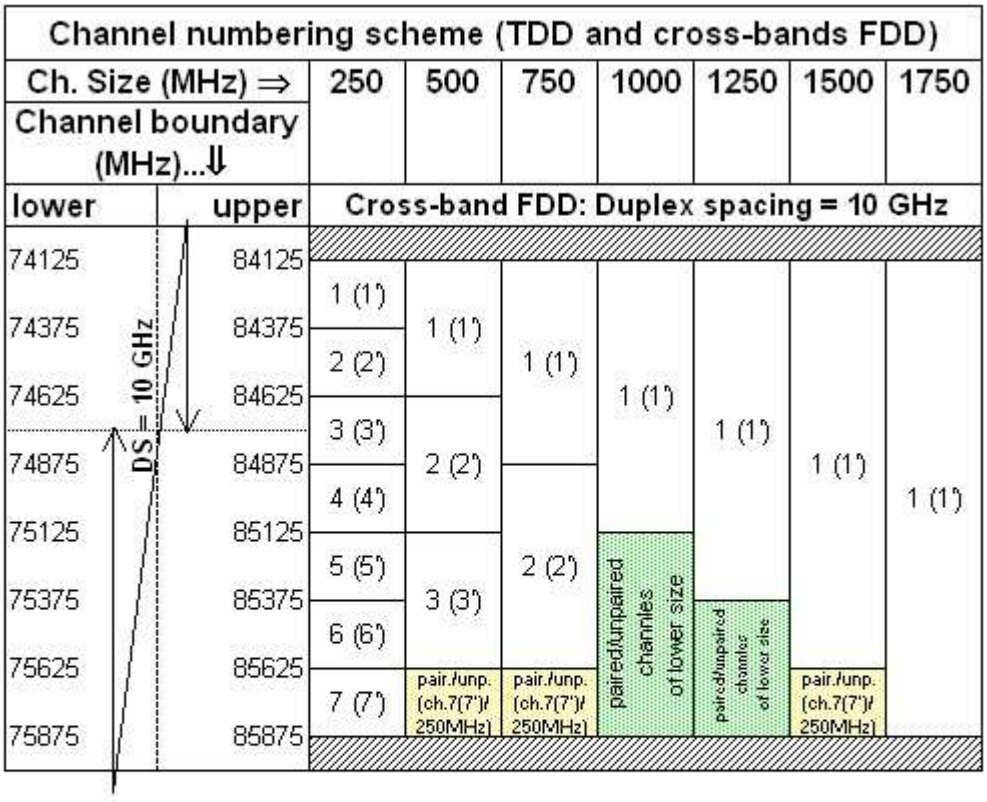
n(n')	Paired channels (i.e. "n" go/lower band and "n' " return/upper band) or unpaired channels (i.e. "n" in each band)
	Channels 10(10') and 19(19') of basic 250 MHz pattern: paired (i.e. "10" and/or "19" go/lower band, "10' " and/or "19' " return/upper band) or unpaired (i.e. "10" and/or "19" in each band)
	Lower size(s) channel(s), paired (i.e. "n" go/lower band and "n' " return/upper band) or unpaired (i.e. "n" in each band)

3.3 Specific channel arrangements for multiple sized FDD/TDD aggregated channels in the reduced frequency bands 74-76 / 84-86 GHz

In case only these reduced portions of the whole bands are available, only the joint arrangement with 10 GHz duplex separation is retained appropriate. It is shown in Fig.8.

Figure 8

Channel positions for TDD and cross-bands FDD applications (Limited to 74-76 GHz and 8486 GHz bands with 10 GHz duplex separation)



4. RADIOLOCATION SERVICE AND AUTOMOTIVE RADARS

WRC-15 agreed on Primary allocation to the radiolocation service in the 77.5 to 80.0 GHz for ground based applications including automotive radars for collision avoidance and safety. This band plan therefore recognizes the spectrum segment for these applications including relevant technical and operational requirements.

5. PROVISION FOR OTHER SERVICES

5.1 Radio Astronomy Service

According to International footnote 149, it is advised that steps be taken to protect radio astronomy observations from harmful interference when planning allocations of other services to the 81-84 GHz and 84-86 GHz bands. Emmisions from spaceborne or airborne stations can be particularly serious source of interference to the radio astronomy services.

5.2 Mobile Service

There is a limited potential for outdoor mobile applications in the 71-74 GHz and 81-84 GHz bands because of high attenuation and line-of-sight propagation in these bands. Interference from 70/80 GHz point-to-point links to mobile services is highly unlikely due to the use of narrow beamwidth antennas that are proposed for these applications.

5.3 Broadcasting and Broadcasting-Satellite Services

The 74-76 GHz band is also allocated for the broadcasting and broadcasting satellite services.

However, there are no current plans to use this band in PNG for broadcasting proposes and future proposals along those lines would seem unlikely due to the high atmospheric losses.

5.4 Space Research Service

There is no indication that the 71-76 and 81-86 GHz bands might be used for purposes of the space research in the near future in Papua New Guinea. The allocation is done on a Secondary basis

5.5 Fixed-Satellite Service

In Papua New Guinea, fixed-satellite services are primarily delivered within C-band (3.4-4.2 GHz for downlink and 5.85—6.65 GHz for uplink) and Ku-band (11.45-12.75 GHz downlink and 14-14.5 GHz for uplink), and as such their operations will not be affected by fixed point-to-point services in 70/80 GHz band.

5.6 Mobile-Satellite Service

No evidence of demand for the use of the 71-76 and 81-86 GHz bands for mobile-satellite services is known to NICTA at this stage, and it seems unlikely that these bands would be considered for mobile-satellite services due the high atmospheric losses.

In summary, except for Radioastronomy services that is proposed to be protected by the notification zone, NICTA is not aware of any other existing systems that might be affected by deployment of fixed links in these bands.

References:

1 ITU RR Document F2006
2 ITU RR Document
3 ITU –R Document ITU-R F.747-4
4 WCA-PCG-7080-1, "Path coordination guide for the 71-76 and 81-86 GHz Millimeter Wave Bands"
5 ETSI TS 102 524 v1.1.1"Fixed Radio Systems; Radio Equipment and Antennas for use in Point-to-point Milimeter wave application in the Fixed Service frequency band 71 to 76 GHz and 81 to 86 GHz", July 2006