National Information and Communications Technology Authority

DRAFT BAND PLAN
3 500 MHz

Papua New Guinea

Document Ref. XXX.2023

DOCUMENT REVISION DETAILS

Revision	Date	Who	Details
1	09/02/2023	Visia J	First Draft
2			
3			
4			
5			
6			
7			
8			
9			
10			

Table of Contents

DISCLAIMER

Due to the continuous developments in Radiocommunication technologies and enhancement in related applications, the PNG spectrum plan covering Service Allocations and their applications may change with the outcome of each World Radio Conference (WRC).

This document is based on the ITU Radio Regulations of WRC-15, WRC-19 and provisions for ITU Region 3, as well as relevant APT recommendations. This document must be read with all relevant references quoted to understand various sub-band plans and channeling 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 & GLOSSARY

3GPP	3rd Generation Partnership Project is the international body responsible for the standardisation of (cellular) mobile (including broadband) telecommunications.
3500 MHz band	The frequencies covered by the 3500 MHz band plan, being 3 400–3 600MHz.
APT	Asia Pacific Telecommunity
Band plan	Either an administrative or legislative instrument that sets out the allocations of frequencies to services within a specific radiofrequency band.
Apparatus licence	An apparatus licence authorises, under the *NICTA 2010 Licensing & Spectrum Regulations*, the use of a particular service type, in a particular frequency range and at a particular geographic location for a period of 5 years.
BS	Base Station
Guard Band	A frequency band that is either deliberately vacant or has specific operating conditions to minimise intra-band interference between the two bands on either side (analogous to a 'buffer').
IMT	International Mobile Telecommunications: International Mobile Telecommunications (IMT) encompasses IMT-2000, IMT-Advanced, IMT-2020 and defines the requirements of 3rd generation (3G), 4th generation (4G), and fifth generation (5G) technologies.
ITU	International Telecommunications Union
LTE	Long Term Evolution—a 3GPP technology standard for wireless communications including high-speed data for mobile devices
MS	Mobile Station
NICTA	National Information and Communications Technology Authority
RX	Receive
TDD	Time Division Duplex
TX	Transmit
UE	User Equipment
WRC - 15	World Radio Conference 2015
WRC - 19	World Radio Conference 2019
WRC - 23	World Radio Conference 2023

1. INTRODUCTION

1.1 Demand for Mobile Broadband Access continues to increase thus creating the need for more radio frequency spectrum. The 3 500 MHz Band is well recognised as essential spectrum resource with perfect radio transmission characteristics. This band offers a good balance between coverage and capacity.

1.2 This 3 500 MHz Band plan relates to spectrum between 3 400 and 3 600 MHz.

1.3 Other services within the band are also mentioned briefly for sharing and compatibility reasons.

1.4 This document provides information on technical characteristics of radio systems, frequency channeling and coordination initiatives in order to maximize the band utilization and minimize interference by applications in operation within this band.

1.5 This band plan intends to guide assignments and regulate usage of this spectrum in Papua New Guinea.

1.6 The 3 500 MHz Band Plan is based on Article 5 of the ITU Radio Regulations, provisions for Region 3 and consequent PNG Allocations as per updates from WRC-15 and WRC-19.

2. RADIO SPECTRUM PLAN

2.1 In accordance with the ITU Radio Regulations and provisions for Region 3, the Papua New Guinea Table of Frequency Allocations (see Annex A) provides for the following Primary Service in this 3.5 GHz Band;

- FIXED
- MOBILE (in part of the band from 3500 – 3600 MHz)

2.2 The 3.5 GHz band accommodates the following Service Applications;

- High Density Fixed and Mobile

2.3 Other applications permitted in this band are secondary application and includes;

- Professional Amateur Radio Service

2.4 Globally, the 3 500 MHz band has been identified for IMT 2020 (5G) deployment. This core spectrum band is ideal for 5G deployment as it is able to provide both capacity and coverage.

2.5 For the benefit of consumers and citizens in PNG, NICTA determines that the highest value use of the 3.5 GHz (3 400 -3 600 MHz) band is IMT 2020 (5G).

2.6 Following outcome of WRC-23, the 3.5GHz band may be extended to included portions of the band which are not currently harmonised globally.

3. CHANNELLING PLAN

3.1 The channel arrangement for the 3 500 MHz Band will be as per 3GPP band specification. Refer to Table1 and Figure 1 below:

Frequency Band	3GPP Band Number	Frequency Range	Duplex Mode
FR 1 (sub-6 GHz)	n78	3.4-3.6 GHz	TDD

Table 1: 3GPP Band Specification for 3 500 MHz Band

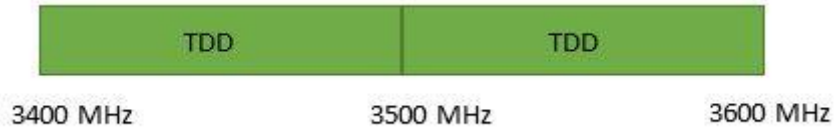

Figure 2: TDD Frequency Arrangement for 3 500 MHz Band

3.2 Channelling arrangement is by 10 MHz block for deployment of IMT 2020 (5G). Multiples of 10 MHz contiguous spectrum can also be used depending on spectrum availability and specific requirements.

3.3 Synchronisation of the Networks deployed in this band will be as per NICTA Network Synchronisation Guideline (reference to doc). Appropriate frame structure selection for local, national and international is required to avoid potential harmful interference between adjacent networks operating in this band.

1. PRINCIPLES OF ASSIGNMENT

1.1 Authorisation to use the frequency band;

- Any license assignment for parts or portion of 3500 MHz is subject to conditions in the Operator Licensing Regulation, 2010 and Radio Spectrum Regulation, 2010.

1.2 Required types of Radiocommunications Licences are;

i. **Spectrum Licence** is needed for the operation of a device or devices within a defined spectrum space (geographic area and frequency band) on the condition that the device(s) operate with accordance to their licence conditions and terms that were set by NICTA for that specific spectrum. This licence is issued for a period of five (5) to fifteen (15) years and fees paid annually.

ii. **Apparatus Licence** is needed for the operation of a device or type of devices at specific locations with specific operating conditions set by NICTA in order to provide an approved service. Apparatus Licences are intended to be directed at certain categories of 'Transmitting' and 'Receiving' apparatus. This licence is issued for a period of five (5) years.

2. REFERENCES

1 ITU Radio Regulations Articles Edition of 2020
2 ITU NRFAT-2016-Rev 2
3 ITU-R Recommendation M.1036-5 (10/2015)
4 Papua New Guinea Table of Frequency Allocations 2017
5 Papuan New Guinea Radiofrequency Spectrum Allocation Chart May 2017
6 3GPP TS 38.104 V17.0.0 (2020-12)

Annex A: Extract of Article 5 - ITU Radio Regulation 2020 and Papua New Guinea Spectrum Plan

Allocation to services				
Region 1	**Region 2**	**Region 3**	**Papua New Guinea**	**Usage**
2 700-2 900 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation 5.423 5.424			**2 700-2 900** AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation 5.423	Ground-based 10 cm (S-band) long-range surveillance primary radar and associated airborne transponders in accordance to ICAO Annex 10, Vol.1, chapter 3.
2 900-3 100 RADIOLOCATION 5.424A RADIONAVIGATION 5.426 5.425 5.427			**2 900-3 100** RADIOLOCATION 5.424A RADIONAVIGATION 5.426 5.425 5.427	Ground-based 10 cm (S-band) long-range surveillance primary radar and associated airborne transponders in accordance to ICAO Annex 10, Vol.1, chapter 3. Maritime SIT and RACON S-band radars.
3 100-3 300 RADIOLOCATION Earth exploration-satellite (active) Space research (active) 5.149 5.428			**3 100-3 300** RADIOLOCATION Earth exploration-satellite (active) Space research (active) 5.149	Ground-based 10 cm (S-band) long-range surveillance primary radar and associated airborne transponders in accordance to ICAO Annex 10, Vol.1, chapter 3. High power shipboard and airborne radars for searching, tracking and surveillance in the band 3100 – 3600 MHz.
3 300-3 400 RADIOLOCATION 5.149 5.429 5.429A 5.429B 5.430	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F	**3 300-3 400** RADIOLOCATION Amateur 5.149	High power shipboard and airborne radars for searching, tracking and surveillance in the band 3100 – 3600 MHz. Amateur service is restricted to professional amateurs only.
3 400-3 600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.430A Radiolocation 5.431	**3 400-3 500** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.431A 5.431B Amateur Radiolocation 5.433 5.282	**3 400-3 500** FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.432 5.432B Radiolocation 5.433 5.282 5.432A	**3 400-3 500** FIXED Amateur Mobile 5.282 5.433	The band 3400-3600 MHz designated for high-density fixed and mobile systems. Amateur service is restricted to professional amateurs only.
	3 500-3 600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.431B Radiolocation 5.433	**3 500-3 600** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.433A Radiolocation 5.433	**3 500-3 600** FIXED MOBILE except aeronautical mobile	The band 3400-3600 MHz designated for high-density fixed and mobile systems".
3 600-4 200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	**3 600 – 3 700** **FIXED** **FIXED-SATELLITE (space-to-Earth)** **MOBILE except aeronautical mobile 5.434** **Radiolocation 5.433**	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation	Microwave links in the 4 GHz band in accordance with ITU-R Rec. F.635 and F.382. Point-to-multipoint access network (MDS) (Annex 4 in ITU-R Rec. F.755). Frequency block arrangement in accordance with ITU-R Rec. F.1488.
	3 700-4 200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		**3 700-4 200** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	Microwave links in the 4 GHz band in accordance with ITU-R Rec. F.635 and F.382. point-to-multipoint access network (MDS) (Annex 4 in ITU-R Rec. F.755). Frequency block arrangement in accordance with ITU-R Rec. F.1488.

4 200-4 400	AERONAUTICAL MOBILE (R) 5.436 **AERONAUTICAL RADIONAVIGATION 5.438** 5.437 5.439 5.440	**4 200-4 400** AERONAUTICAL RADIONAVIGATION 5.438 5.440 AERONAUTICAL MOBILE (R) 5.436	Reserved for radio altimeters installed on board aircraft and for the associated transponders on the ground (5.438). This band is also allocated for exclusive use by wireless avionics-intracommunication (5.436)

Annex B: 3GPP Operating Bands and Channel Arrangements

Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	410 MHz – 7125 MHz
FR2	24250 MHz – 52600 MHz

NR *operating bands* in FR1

NR *operating band*	Uplink (UL) *operating band* BS receive / UE transmit $F_{UL,low}$ – $F_{UL,high}$	Downlink (DL) *operating band* BS transmit / UE receive $F_{DL,low}$ – $F_{DL,high}$	Duplex mode
n1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD
n2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD
n3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	FDD
n5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD
n7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	FDD
n8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
n12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
n13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
n14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
n18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD
n20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD
n25	1850 MHz – 1915 MHz	1930 MHz – 1995 MHz	FDD
n26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
n28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
n29	N/A	717 MHz – 728 MHz	SDL
n30	2305 MHz – 2315 MHz	2350 MHz – 2360 MHz	FDD
n34	2010 MHz – 2025 MHz	2010 MHz – 2025 MHz	TDD
n38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	TDD
n39	1880 MHz – 1920 MHz	1880 MHz – 1920 MHz	TDD
n40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	TDD
n41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
n46	5150 MHz – 5925 MHz	5150 MHz – 5925 MHz	TDD[3]
n48	3550 MHz – 3700 MHz	3550 MHz – 3700 MHz	TDD
n50	1432 MHz – 1517 MHz	1432 MHz – 1517 MHz	TDD
n51	1427 MHz – 1432 MHz	1427 MHz – 1432 MHz	TDD
n53	2483.5 MHz – 2495 MHz	2483.5 MHz – 2495 MHz	TDD
n65	1920 MHz – 2010 MHz	2110 MHz – 2200 MHz	FDD
n66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	FDD
n70	1695 MHz – 1710 MHz	1995 MHz – 2020 MHz	FDD
n71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD
n74	1427 MHz – 1470 MHz	1475 MHz – 1518 MHz	FDD
n75	N/A	1432 MHz – 1517 MHz	SDL
n76	N/A	1427 MHz – 1432 MHz	SDL
n77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD
n78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD
n79	4400 MHz – 5000 MHz	4400 MHz – 5000 MHz	TDD
n80	1710 MHz – 1785 MHz	N/A	SUL
n81	880 MHz – 915 MHz	N/A	SUL
n82	832 MHz – 862 MHz	N/A	SUL
n83	703 MHz – 748 MHz	N/A	SUL
n84	1920 MHz – 1980 MHz	N/A	SUL
n86	1710 MHz – 1780 MHz	N/A	SUL
n89	824 MHz – 849 MHz	N/A	SUL
n90	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
n91	832 MHz – 862 MHz	1427 MHz – 1432 MHz	FDD[2]
n92	832 MHz – 862 MHz	1432 MHz – 1517 MHz	FDD[2]
n93	880 MHz – 915 MHz	1427 MHz – 1432 MHz	FDD[2]
n94	880 MHz – 915 MHz	1432 MHz – 1517 MHz	FDD[2]
n95[1]	2010 MHz – 2025 MHz	N/A	SUL
n96[4]	5925 MHz – 7125 MHz	5925 MHz – 7125 MHz	TDD[3]
n97[5]	2300 MHz – 2400 MHz	N/A	SUL
n98[5]	1880 MHz – 1920 MHz	N/A	SUL
NOTE 1: This band is applicable in China only.			

NOTE 2:	Variable duplex operation does not enable dynamic variable duplex configuration by the network, and is used such that DL and UL frequency ranges are supported independently in any valid frequency range for the band.
NOTE 3:	This band is restricted to operation with shared spectrum channel access as defined in [20].
NOTE 4:	This band is applicable in the USA only subject to FCC Report and Order [FCC 20-51].
NOTE 5:	The requirements for this band are applicable only where no other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area. For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NR *operating bands* in FR2

NR *operating band*	**Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive $F_{UL,low}$ – $F_{UL,high}$ $F_{DL,low}$ – $F_{DL,high}$**	**Duplex mode**
n257	26500 MHz – 29500 MHz	TDD
n258	24250 MHz – 27500 MHz	TDD
n259	39500 MHz – 43500 MHz	TDD
n260	37000 MHz – 40000 MHz	TDD
n261	27500 MHz – 28350 MHz	TDD