National Information and Communications Technology Authority

CALL FOR COMMENTS

SPECTRUM IDENTIFIED FOR IMT 2020 (5G) IN PAPUA NEW GUINEA

BACKGROUND:

IMT 2020 (5G) is the next step in mobile broadband wireless communications. Compared with 4G, 5G offers a new network architecture to help significantly boost overall performance. 5G will deliver over 10 Gbps data rate, millisecond-level latency, and ultra-high-dense connections. With these remarkable features, 5G is set to welcome a world filled with unlimited possibilities and an exciting new era that promises the connectivity of everything.

In accordance with the *NICT Act 2009*, it is NICTA's mandate to develop Radio spectrum plans including frequency band plans in PNG, taking into account global and regional harmonization. All band plans are developed in accordance with recommendations developed by the Radiocommunications sector of the International Telecommunications Union (ITU-R).

In the interest of PNG particularly the ICT sector, NICTA is conducting this general consultation on the 'Mid' and 'High' frequency bands that were identified in the ITU World Radiocommunication Conferences of 2015 (WRC-15) and 2019 (WRC-19) for deployment of 5G Mobile telecommunication service. NICTA will draft specific band plans taking into account feedback from the consultation.

FEEDBACK CONSIDERATIONS:

NICTA welcomes feedback from the operators, stakeholders and general public taking into account the following;

- Current and future spectrum demands to support mobile broadband applications in Papua New Guinea
- Potential frequency band arrangements (i.e. Frequency Division Duplex (FDD), Time Division Duplex (TDD) etc.)
- Sharing and Implications on incumbent services including GSO and N-GSO satellite links
- Spectrum Harmonization and Economies of scale considerations

ATTACHMENT

1. Spectrum Identified for IMT 2020 (5G) in Papua New Guinea document.

National Information and Communications Technology Authority

Spectrum Identified for IMT 2020 (5G)

in Papua New Guinea

Papua New Guinea

Document Ref. XXXX.XX

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ABBREVIATIONS

3GPP	3rd Generation Partnership Project
eMBB	Enhanced Mobile Broadband
FDD	Frequency Division Duplex
IMT	International Mobile Telecommunications
IMT 2020	International Mobile Telecommunications 2020
ITU	International Telecommunications Union
MNO	Mobile Network Operator
mMTC	Massive Machine Type Communications
NICTA	National Information and Communications Technology Authority
TDD	Time Division Duplex
uRLLC	Ultra-Reliable Low Latency Communications
WRC - 19	World Radio Conference 2019

1. INTRODUCTION

ITU-R IMT 2020 is the next step in mobile broadband wireless communications. ITU has specified key characteristics for IMT 2020 which is similar to service requirements and main system characteristics developed by various standardisation organisations for 5G. 5G is the new global wireless standard after 1G, 2G, 3G, and 4G.

5G is the fifth-generation wireless technology for digital cellular networks. Compared with 4G, 5G offers a new network architecture to help significantly boost overall performance. 5G will deliver over 10 Gbps data rate, millisecond-level latency, and ultra-high-dense connections. With these remarkable features, 5G is set to welcome a world filled with unlimited possibilities and an exciting new era that promises the connectivity of everything.

2. SCOPE

This document outlines frequency bands identified for 5G use in Papua New Guinea. It also aims to generate debate and seek ICT stakeholders especially MNOs and public views and reactions with regards to the frequency bands identified for IMT 2020 (5G) and beyond in Papua New Guinea.

3. 5G SPECTRUM REQUIREMENTS

The ITU-R IMT-2020 (5G) Vision includes three usage scenarios: eMBB, mMTC and uRLLC. It also specifies the key capabilities of IMT-2020, which represent great improvements in comparison with the previous generation of IMT systems.

- Enhanced Mobile Broadband (eMBB): Including peak download speeds of at least 20 Gbps and a reliable 100 Mbps user experience data rate in urban areas. This will better support increased consumption of video as well as emerging services like virtual and augmented reality.
- Massive Machine Type Communications (mMTC): Including 1ms latency and very high availability, reliability and security to support services such as autonomous vehicles and mobile healthcare.
- Ultra-Reliable Low Latency Communications (uRLLC): Including the ability to support at least one million IoT connections per square kilometre with very long battery life and wide coverage including inside buildings.

In order to meet the three ITU-R usage scenarios, significant amount of spectrum is required. 5G needs spectrum across low, mid and high spectrum ranges to deliver widespread coverage and support all use cases.

- Low-Bands (sub-1 GHz) support widespread coverage across urban, suburban and rural areas and help support Internet of Things (IoT) services.
- Mid-Bands typically offer a good mixture of coverage and capacity benefits. In the long term more spectrum is needed to maintain 5G quality of service and growing demand in bands between 3 and 24 GHz.
- High-Bands (mmWave) are needed to meet ultra-high broadband speeds envisioned for 5G. Currently 26 GHz, 28 GHz and 40 GHz have most international support and momentum.

At least 80-100 MHz of contiguous spectrum per MNO at mid-bands is needed for the first wave of 5G deployments.

4. 5G BAND SPECIFICATION

Spectrum harmonisation continues to be important for the mobile industry in the 5G era. Globally harmonised spectrum enables economies of scale and facilitates cross-border coordination and roaming for end users: a critical factor for initial deployment of 5G.

Hence Papua New Guinea will adopt 3GPP specifications for initial 5G bands and associated band combinations for 5G deployment. Annex A shows new 5G-NR frequency bands specified by 3GPP.

5. BANDS IDENTIFIED FOR IMT 2020 (5G) IN PNG

Consistent with ITU WRC-19 Global IMT Band identification, bands identified for IMT 2020 (5G) in Papua New Guinea are in the Mid-Band and High-Band.

Mid-Bands

- 2 600 MHz (2 500 – 2 690 MHz) *
- 3.5 GHz (3 400 – 3 600 MHz)

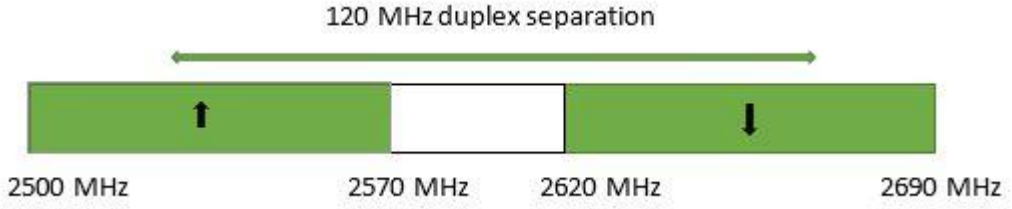
i. 2.6 GHz band (2 500 – 2 690 MHz)
- This band is identified for both 4G and 5G deployment according to ITU recommendation, ITU-R M.1036.
- The band is suitable to cater for current 4G spectrum needs in PNG.
- Draft NICTA 2.6 GHz band plan is based on this immediate need.

ii. 3.5 GHz Band (3 400 – 3 600 MHz)
- This band is currently allocated for both Fixed and Mobile Service.
- The band is critical for satellite service in the Downlink direction of extended C-Band.

Proposed Channelling arrangements

i. 2.6 GHz Band *

Organization	Frequency Arrangement Number/3GPP Band Number	Paired arrangements			Un-paired Arrangements (TDD) (MHz)	Duplex Mode
		Mobile station transmitter (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)		
ITU (M.1036)/3GPP	C1 /n7	2 500-2 570	2 620-2 690	120	2 570-2 620	FDD & TDD



**2.6 GHz draft band plan outlines detailed channel arrangement for this band.*

ii. 3.5 GHz Band

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

***Note**: Channels may be reduced to 80MHz if sharing with C-Band downlink is not possible.*

High-Bands (mmWave)

- 24.25 – 27.5 GHz
- 37 – 43.5 GHz
- 66 – 71 GHz

i. 26 GHz (24.25 – 27.5 GHz)

- This band is identified for IMT globally as per WRC-19 decision.
- PNG administration has also identified this band to be used for IMT in consistent with WRC-19 final acts. However, this band is also allocated for Fixed, Radionavigation, Fixed-Satellite, Inter-Satellite, Earth Exploration-Satellite and Space Research on a primary basis. Also portion of this band is allocated to ISM applications.
- 5G spectrum identification in this band has to take into consideration existing services operating in this band.

ii. 40 GHz (37 – 43.5 GHz)

- This band is identified for IMT globally as per WRC-19 decision.
- PNG administration has also identified this band to be used for IMT in consistent with WRC-19 final acts. However, this band is also allocated for Fixed, Fixed-Satellite, Mobile-Satellite, Space Research, Earth Exploration-Satellite, Land-Mobile, Broadcasting, Broadcasting-Satellite and Land-Mobile on a primary basis.
- 5G spectrum identification in this band has to take into consideration existing services operating in this band.
- Portions of this band may be used to address 5G capacity issues in the future.
- Studies and development are in progress on how to utilize this band as per ITU IMT 2020 framework.
- NICTA will closely follow research and development progress and identify portions of this band for IMT 2020 (5G). Identification of 5G spectrum in this band will be aligned to APT regional recommendations.

iii. 66 – 71 GHz

- This band is identified for IMT globally as per WRC-19 decision.
- No 3GPP standard has been developed at this stage for this band.
- PNG administration has also identified this band to be used for IMT in consistent with WRC-19 final acts. However, this band is also allocated for Inter-Satellite, Mobile-Satellite, Radionavigation and Radionavigation-Satellite on a primary basis.
- 5G spectrum identification in this band has to take into consideration existing services operating in this band.

- NICTA will closely follow research and development progress and identify portions of this band for IMT 2020 (5G). Identification of 5G spectrum in this band will be aligned to APT regional recommendations.

Proposed Channelling arrangements

i. 26 GHz (24.25 – 27.5 GHz)

Frequency Band	3GPP Band Number	Frequency Range	Frequency Identified for 5G in PNG	Duplex Mode
FR 2 (above-6 GHz)	n258	24.25-27.5 GHz	25.25-27.5 GHz	TDD

ii. 37 – 43.5 GHz

Frequency Band	3GPP Band Number	Frequency Range	Duplex Mode	Remarks
FR 2 (above-6 GHz)	n259/n260	37-43.5 GHz	TDD	Future 5G use

iii. 66 – 71 GHz

Frequency Band	3GPP Band Number	Frequency Range	Duplex Mode	Remarks
FR 2 (above-6 GHz)	*N/A at this stage*	66-71 GHz	TDD	3GPP standard yet to be developed

The respective tables above show frequency bands identified for 5G usage in Papua New Guinea. Initial deployment or trials can be done in the mid-bands and high-bands. Respective band plans will be developed prior to assignments to MNOs.

6. PAPUA NEW GUINEA IMPLICATIONS AND CONSIDERATIONS

- Connecting Rural communities in Papua New Guinea still remains one of the biggest challenges. Most of the rural areas in Papua New Guinea are covered by 2G or 3G mobile service with 4G in major towns. The Low-Band spectrum has been fully assigned to 2G, 3G or 4G. Hence the Mid-Band and the High-Band are the only suitable bands for 5G trials and initial deployment at this stage.

- NICTA envisage to see 5G trials and initial deployment in the Mid-Band and eventually moving into High-Bands to address capacity issues.

- NICTA understands that making spectrum available in a timely manner is key to enabling progress in technology development and enabling economy growth.

- Licensing consideration will be a factor to consider when dealing with mmWave as most of the bands may be Licence exempt. Collaboration is required to ensure a suitable Licencing Regime is agreed to by all parties to ensure growth and development of 5G.

- NICTA will also consider setting spectrum allocation limits per MNO to ensure fairness.
- NICTA will work to develop band plans for identified 5G bands and welcomes views and opinions from all interested stakeholders.

7. REFERENCES

1 3GPP TS 38.104 V17.0.0 (2020-12)
2 5G Spectrum GSMA Public Policy Position March 2020
3 5G Spectrum Huawei Public Policy Position February 2020
4 ITU-R Recommendation M.2083, "IMT Vision-Framework and overall objectives of the future development of IMT for 2020 and beyond.
5 ITU World Radiocommunication Conference (WRC-19) Final Acts
6 Papua New Guinea Table of Frequency Allocations 2017

ANNEX A: 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