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| **The 4th Meeting of the APT Conference Preparatory Group for WRC-19 (APG19-4)** | **APG19-4/INP-89** |
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Papua New Guinea

**preliminary views on WRC-19 AGENDA ITEM 1.13**

**Agenda Item 1.13:**

*to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution* ***238*** *(****WRC-15****)*

1. **Background**

Agenda item 1.13 is studying a total of 33 GHz in frequency bands between 24.25 GHz and 86 GHz, many of which are allocated to satellite services on a co-primary basis. Some of these frequency bands already contain thriving satellite operations or are planned for future satellite systems. Therefore, careful consideration should be given to the bands considered for IMT identification under agenda item 1.13 in order to provide IMT 5G services with the spectrum resources that they realistically require without jeopardizing existing satellite operations and investments in these frequency ranges.

1. **Satellites Facilitate Universal Connectivity, 5G Deployment, and Innovation**

For decades, satellites have provided essential connectivity to the Pacific Islands and other parts of the Asia-Pacific region. Even with the expansion of submarine cables in the Pacific, for example, many countries in the region remain underserved or unserved by fiber optics. Satellites thus play an important role in enhancing the lives of Pacific Islanders and the broader Asia-Pacific region. Satellites, for example, enable mobile network operators throughout the Asia-Pacific region to cost-effectively extend their 3G and 4G networks into unserved and underserved areas, including in Indonesia, Myanmar, Pakistan, Papua New Guinea and other Pacific Islands. Satellites also contribute to the economic well-being of the region by enabling communications networks for the: (i) tourism, resources and oil & gas sectors; (ii) banking services (iii) disaster relief operations (iv) resource surveillance and monitoring (v) governmental communications and programmes such as e-health and e-learning.

Satellite is expected to continue playing these important roles in the IMT-2020/5G ecosystem, by, for example:

a. Providing connectivity to the terrestrially unconnected by directly connecting or cost-effectively extending IMT-2020/5G networks into remote, unserved and underserved areas;

b. Providing broadband connectivity to aircraft, ships, and trains (ESIMs);

c. Directly connecting or backhauling aggregated Machine-to-Machine (M2M) / Internet-of-Things (IoT) data from multiple locations to support sensor networks, Smart City applications, and to enable connected cars, planes and ships;

d. Multicasting of commonly accessed content to storage caches at multiple IMT-2020/5G base stations, to enable terrestrial 5G networks to meet the low latency requirements of certain 5G applications;

e. Restoring connectivity when existing terrestrial networks have been disabled (e.g. after a natural disaster).

In addition, the satellite industry has been continuously upgrading its space and ground segments to massively increase spectrum efficiency and enable orders of magnitude more data rates, to be provided at much lower costs.

1. **Assured Access to Satellite Spectrum is Essential for the Asia-Pacific Region and Beyond**

High throughput satellites (HTS)– use multiple concentrated spot beams, with coverage areas of the order of 100 times smaller than regional beams, a high degree of frequency re-use, and in some cases ultra-wideband transponders. HTSs can achieve 20 times greater throughput (e.g. 30 – 100 Gbit/s) and lower cost per bit than other satellites, enabling cost effective, high capacity data communications in underserved areas, to air, land and maritime mobility applications, 4/5G mobile backhaul services, as well as international telecommunications and video distribution.

A number of HTSs are serving the wider region today, operating in C-, Ku- and Ka- bands. Those providing Ka-band capacity in the 26 or 28 GHz bands include: IPStar, O3b (MEO constellation), Sky Muster I & II (NBN-Co), Inmarsat Global Xpress (I5 F1, I5 F3 and I5 F4), Intelsat IS-33e, Chinasat-16, SES-12 and Intelsat IS-Horizons 3e. In the next two years Kacific-1 / JCSAT-18, OneWeb (LEO constellation), APStar 6D, Chinasat-18, SpaceX (LEO constellation) and Inmarsat-6 will also be launched to serve the region, all providing Ka-band capacity in the 26 or 28 GHz bands. In 2021-2022, these will be joined by Telesat LEO constellation, O3b mPower (MEO constellation), Viasat-3, MEASAT-3R and MEASAT-2a, all providing Ka-band capacity in the 26 or 28 GHz bands. The collective investment in all these satellites, along with associated ground infrastructure, amounts to many billions of USD.[[1]](#footnote-1)

 A number of satellite operators have or are about to deploy latest and next-generation HTS covering the Pacific Islands in multiple frequency bands and in both geostationary and non-geostationary orbits. For instance:

* Eutelsat has launched Eutelsat-172B which provides expanded C-band and Ku-band HTS coverage of the Pacific;
* Inmarsat has launched a fourth GX satellite to provide additional Ka-band HTS capacity to the APAC region;
* O3b has added four more Ka-band Medium Earth Orbit (MEO) satellites to its constellation this year, with another four already under construction;
* Intelsat and SKY Perfect JSAT have launched Horizons 3e, a satellite based on the Intelsat EpicNG high throughput design with optimized C-band and high throughput Ku-band capacity to address the growing mobility and broadband connectivity demands in the Asia-Pacific region;
* Kacific has just ordered and will be launching a Ka-band HTS payload on Kacific-1 in 2019 with dedicated Pacific coverage;
* OneWeb will be launching a global constellation of 800+ non-geostationary satellites in Low-Earth Orbit (LEO) operating in Ku-band FSS frequencies starting from 2020, which will provide ubiquitous low latency and high throughput solutions for broadband applications and backhaul to mobile network (e.g., for 3G/LTE/5G/WiFi applications at homes, schools and hospitals, emergency and government), as well as mobility solutions on ships and aircraft.
1. **Identification of Additional Spectrum for IMT-2020 Should Not Encroach on Satellite Spectrum Outside the Scope of Agenda Item 1.13 (Resolution 238 (WRC-15))**

In recognition of the important roles that satellites play, and will continue to play, in communications infrastructure of the Asia-Pacific Region, the Asia-Pacific Telecommunity resolves that the identification of additional spectrum for IMT-2020 should be limited to the bands mentioned in Resolution 238 (WRC-15).

Resolution 238 mentions more than 33 GHz worth of millimetre wave spectrum for possible IMT-2020/5G identification. From this vast quantity of spectrum, all foreseeable IMT-2020 requirements can be met (with appropriate protections for other primary services) without encroaching on satellite spectrum bands that are outside the scope of the Resolution, especially as such spectrum (e.g. the 27.5-29.5 GHz (or “28 GHz”) band) is already in use throughout the world for the provision of important satellite services. Equally important, adherence to the scope of WRC-19 Agenda Item 1.13 and Resolution 238 remains the best path to globally harmonised spectrum for new IMT-2020/5G services.

1. **Identification for IMT must include feasible/practical measures to protect FSS in shared bands**

The 24.25-27.0 GHz band, which includes the 24.65-25.25 GHz FSS uplink allocation to support BSS downlink in 21.4-22 GHz, could be identified for IMT provided there are appropriate regulatory measures for the protection of other primary services and to enable continuing and viable access for FSS and other space service operations. Since 27.0-27.5 GHz is used for ubiquitous deployment of FSS earth stations, this band should not be identified for IMT. There is little to no scope for frequency sharing between ubiquitous 5G mobile broadband systems and ubiquitous satellite services.

It should be possible to find adequate spectrum in portions of the bands 37-52 GHz (Q/V band), 66-71 GHz (66 GHz), 71-76 GHz (70 GHz) and the 81-86 GHz (80 GHz) bands in order to meet all plausible terrestrial 5G requirements without the contention with existing and planned use of satellite spectrum that is foreseeable in the Ka-band.

Portions of the Q/V-bands (37-52 GHz) may be available to meet 5G mobile requirements. However, portions of these bands are likely to be contended, since they are already being incorporated into next-generation Very High Throughput Satellite systems (including 6 global non-GEO systems proposed by Boeing, SpaceX, Telesat, O3b, OneWeb, and Theia).   Allocation of Q-/V-band spectrum for High Altitude Platforms is separately under consideration (AI 1.14), as also additional V-band spectrum for VHTS systems (AI 9.1.9).  Although there is a significant amount of Q/V-band spectrum under study, a careful evaluation of the various spectrum requirements will need to be undertaken to establish bands for 5G and sharing arrangements that also meet the spectrum requirements of other services.

The 66 GHz, 70 GHz and 80 GHz band, in particular, are considered very good prospects for international harmonization given their limited existing and planned use by other radio services. These bands should yield about 15 GHz of spectrum in contiguous blocks that can be used in conjunction with 56-61 GHz which is also available for terrestrial broadband, and could support very wide-band 5G/IMT-2020 carriers. These bands should therefore be able to support the development of 5G mobile networks in high-density indoor and outdoor scenarios, such as stadiums, campuses or shopping malls located in urban and suburban areas. The use of these bands would also benefit from synergies with WiGig, currently being deployed at 56-61 GHz, for which chipsets and MIMO antenna systems are already being manufactured.

1. **Papua New Guinea’s Proposals for each band**

Having regard to the above considerations, Papua New Guinea would propose the following in respect of each of the candidate bands for IMT-2020/5G under consideration in WRC-19 Agenda Item 1.13.

**Band 24.25-27.5 GHz**

An identification for IMT in the sub-band 24.25-27 GHz is possible with appropriate regulatory measures to protect and enable sustainable, viable access for FSS and other space service operations. Specifically, Papua New Guinea would support the draft CPM text, Method A2 (either Alternative 1 or 2) for IMT identification with the following conditions (and draft ITU-R Resolution [A113-IMT 26 GHZ] (WRC-19)):

Protection Measures for FSS earth stations at known locations

The 24.65-25.25 GHz band is to be used for large FSS Earth stations at known locations (i.e. gateways), therefore appropriate zones around FSS Earth stations where IMT base stations could potentially receive interference can be determined, and co-existence be ensured. Need to adopt provisions to enable deployment of future FSS earth stations.

CPM text: Condition A2d Option 1.

Protection Measures for FSS and ISS space stations in the band 24.25-27.5 GHz

To limit the aggregate IMT interference into FSS space receivers through the introduction in the RR of a limit on the Total Radiated Power (TRP) for IMT base station of 37 dBm/200 MHz. Furthermore, the main beam of IMT base stations should not point above the horizon. Such limit on IMT base stations would not put any undue constraints on IMT deployment. The level of 37 dBm/200MHz is based on the baseline level as provided by WP5D, which was 25 dBm/200 MHz, and to which was added the 12 dB of margin derived from TG 5/1 studies. These levels provide maximum flexibility for IMT operations.

CPM text: Condition A2e Option 2 (with 37 dBm/200 MHz).

Protection Measures for multiple services

Condition A2g Option 3 (Monitoring of IMT characteristics including deployment) is supported.

In the 27-27.5 GHz sub-band, in which there is an FSS allocation that would allow the deployment of small FSS earth stations at unspecified locations, sharing between IMT and FSS is not feasible as the minimum separation distance cannot be guaranteed. Consequently, IMT-2020 will need to be identified in a different band.

**Band 37-43.5 GHz**

Papua New Guinea is of the view that:

* The band 40.5-43.5 GHz can be shared between IMT and coordinated gateway earth stations in Region 3, while spectrum below 40.5 GHz is required for uncoordinated FSS terminals that cannot share with IMT (see figure 2);
* It is necessary to preserve FS and FSS in Region 3 in the band 37-40.5 GHz;
* There is no need to identify IMT globally in the range 37-43.5 GHz in the Radio Regulations to support a tuning range for IMT equipment. If anything, the wide tuning range of such equipment would enable the said equipment to adapt to the IMT band in each country without losing any economies of scale;
* Bands identified for IMT should be feasible for use in many countries and conversely bands that are not suitable in the majority of countries should not be identified for IMT to ensure a harmonised and efficient use of spectrum. It is not appropriate for any country to propose identification in a band it does not intend to use.

Global economies of scale for IMT equipment, as well as preservation of FS and FSS in 37-40.5 GHz in Region 3, can be achieved through identification of 3 GHz of spectrum for IMT in each ITU Region (see figure 3), provided the RF equipment can tune across the whole 37-43.5 GHz range.

*Figure 2: Current HDFSS (s-E) identifications within 37-43.5 GHz*

*Figure 3: Papua New Guinea’s proposal for IMT in the range 37-43.5 GHz*



It is therefore proposed that:

* Region 3: IMT identification in the band 40.5-43.5 GHz, that preserves current HDFSS identifications in 40-40.5 GHz, as well as an additional portion of downlink spectrum at 40 GHz for uncoordinated FSS Earth stations, possibly to harmonise with Region 1. It should be noted that ASMG and CEPT have indicated they have no intention of using the band below 40.5 GHz for IMT.

This would provide 3 GHz of spectrum for IMT in all ITU-R Regions and would allow common IMT equipment to be used, provided the RF equipment can tune across the whole 37-43.5 GHz range. To facilitate co-existence between IMT and the FSS, a limit on the Total Radiated Power (TRP) of IMT base stations of 44 dBm/200MHz should be introduced into the Radio Regulations. Noting this level is based on the baseline values provided by WP5D, added to the margin that was derived from the studies in TG 5/1.

Regarding the draft CPM text and its Methods, we support:

In the band 37-40.5 GHz:

* In Region 3: Method C1 (NOC) for the band 37-40.5 GHz

In the band 40.5-42.5 GHz:

* In Region 3: Method D2, Conditions D2a Option 3

In the band 42.5-43.5 GHz:

* In Region 3: Method E2, Condition E2a Option 1 or 6, Condition E2c Option 3, and Condition E2d Option 1 (though currently omitted in draft CPM text, and expected to be added at CPM) similar to Condition A2d Option 1 (i.e., FSS earth stations at known locations) is needed.

Methods are to be considered in conjunction with the draft WRC-19 Resolution [B113-IMT 40/50 GHZ] of the draft CPM text.

**Bands 47.2-50.2 GHz and 50.4-51.4 GHz**

Since large amounts of spectrum are supported for possible IMT identification in other bands, no change to the RR in the bands 47.2 –50.2 GHz and 50.4-52.6 GHz is recommended.

Regarding the draft CPM text and its Methods, we support:

Method H1 and I1 (NOC) for the bands 47.2-50.2 GHz and 50.4-52.6 GHz respectively**.**

**Band 66-71 GHz**

IMT identification through Method J2 (either alternative 1 or 2) with the conditions of ITU-R Resolution [C113-IMT 66/71GHZ] (WRC-19).

**Bands 71-76 GHz, 81-86 GHz**

IMT identification in these bands would be acceptable, through Method K2 (either alternative 1 or 2) in 70 GHz band and Method L2 (either alternative 1 or 2) in 80 GHz with the conditions of draft ITU-R Resolution [E113-IMT 70/80GHZ]..

**Other Bands**

Frequency bands outside of **Resolution 238** (**WRC-15**) shall not be considered for Agenda Item 1.13. In particular, as noted above, satellite spectrum bands that are currently in use throughout the world and which are outside the scope of the Resolution and Agenda Item should not be considered for IMT-2020/5G.

1. **Proposal**

The APG is invited to consider developing an APT preliminary view or preliminary common proposal, whichever relevant, for WRC-19 agenda item 1.13 based on the proposals outlined above, and as summarised below.

**Summary of Papua New Guinea Proposals for Agenda Item 1.13**

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| **Band** | **IMT-2020** | **Draft CPM Text** |
| 24.25-27.00 GHz | Yes | Method A2 (Alternative 1 or 2), subject to:* Condition A2d Option1
* Condition A2e Option 2 (with 37 dBm/200 MHz)
* Condition A2g Option 3

Draft ITU-R Resolution [A113-IMT 26 GHZ] (WRC-19) |
| 27.0-27.5 GHz | No | Method A1 in 27-27.5 GHz  |
| 37.0-40.5 GHz | No | Region 3: Method C1 (No Change)Draft ITU-R Resolution **[**B113-IMT 40/50GHZ**]** |
| 40.5-42.5 GHz | Yes | Region 3: Method D2, subject to:* Condition D2a, Option 3

Draft ITU-R Resolution [B113-IMT 40/50GHZ**]** |
| 42.5-43.5 GHz | Yes | Region 3: Method E2, subject to:* Condition E2a Option 1 or 6
* Condition E2c Option 3
* Condition E2d Option 1 (text currently missing from draft CPM report; text similar to Condition A2d Option 1 (protection of FSS earth stations at known locations) for the 24.65-25.25 GHz band is expected to be included at CPM)

Draft ITU-R Resolution [B113-IMT 40/50GHZ**]**  |
| 47.2-50.2 GHz | No | Method H1 (No Change) |
| 50.4-52.6 GHz | No | Method I1 (No Change) |
| 66-71 GHz | Yes | Method J2 (either alternative 1 or 2) with the conditions of draft ITU-R Resolution [C113-IMT 66/71GHZ-J2] (WRC-19) |
| 71-76 GHz | Yes | Method K2 (either alternative 1 or 2) with the conditions of draft ITU-R Resolution [E113-IMT 70/80GHZ] (WRC-19) |
| 81-86 GHz | Yes | Method L2 (either alternative 1 or 2) with the conditions of draft ITU-R Resolution [E113-IMT 70/80GHZ] (WRC-19) |

1. See, e.g., Peter B. de Selding, *ViaSat details $1.4-billion global Ka-band satellite broadband strategy to oust incumbent players*, <http://spacenews.com/viasat-details-1-4-billion-global-ka-band-satellite-broadband-strategy-to-oust-incumbent-players/> (10 Feb. 2016); Peter B. de Selding, *SES bets more than $1 billion that Boeing satellites can lure Amazon Web Services et al*, <https://www.spaceintelreport.com/ses-bets-1-billion-boeing-satellites-can-lure-amazon-web-services-et-al/> (19 Sep. 2017). [↑](#footnote-ref-1)