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Inmarsat Singapore, THAICOM

**INFORMATION PAPER ON WRC-19 AGENDA ITEM 1.13**

**AVIA’S AND APSCC’S POSITION ON**

**WRC-19 AGENDA ITEM 1.13**

**This paper presents the position of the Asia Video Association (AVIA) and the Asia-Pacific Satellite Communications Council (APSCC) on agenda item 1.13[[1]](#footnote-1)\***

**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 identified for IMT under agenda item 1.13 in order to provide IMT 5G services with the spectrum resources that they realistically require without jeopardizing existing and future satellite operations and investments in these frequency ranges.

1. **Satellites facilitate 5G Deployment and Innovation**

Satellite is expected to play a significant role in the 5G service provisions including:

1. Connecting the terrestrially unconnected: remote, unserved and underserved areas; aircraft, ships, cars and trains (ESIMs)
2. 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, aircrafts and ships
3. Multicasting of commonly accessed content to storage caches at multiple 5G base stations, to enable terrestrial 5G networks to meet extremely low latency (<1ms) requirements of 5G applications, such as virtual/augmented reality and autonomous vehicles
4. By restoring connectivity when existing terrestrial networks have been disabled (e.g. after a natural disaster).

Other 5G satellite applications include: i) Backhaul for 5G terrestrial mobile networks, ii) governmental / institutional closed-user groups, iii) oil & gas services at fixed locations, iv) distance learning, telemedicine and v) Voice over IP (VoIP).

The satellite industry has been innovating and 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. **Satellite broadcast technology continues to evolve**

Wideband transponders– compared to using multiple (say) 27, 36, 54 MHz transponders, using a smaller number of (say) 500 MHz transponders reduces satellite mass and launch cost. Used with appropriate wideband modulation, wideband transponders can also make more efficient use of the spectrum as a far lower proportion of spectrum is lost to guard bands between the adjacent transponder bands. Previously, use of wideband transponders necessitated multi-carrier operation, which itself both reduced the bandwidth efficiency, due to guardbands required between carriers, and reduced the power efficiency, due to the need for transponder backoff to operate the travelling wave tube amplifiers linearly. Use of advanced modulation (such as DVB-S2X standardized in 2014) and wideband tuner / demodulators in ground based reception equipment enable very high efficient bandwidth and power utilisation to be achieved with wideband transponders, which, in turn, require large amount of spectrum.

1. **Satellite innovation in Phased Array Antenna Technology**

As satellite communication terminals continue to become cheaper, smaller and more power efficient, a wide variety of terminal technology is being made available. A new wave of flat panel antenna technology is emerging for satellite communications. These 'phased array' antennas have no mechanical components, relying on software and electronics for steering making them more suitable for mobile platforms like cars, boats, planes and more.

1. **HTS Satellites in the Asia Pacific Region require spectrum**

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, 4G/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 batches 1 to 5), Sky Muster I & II (NBN-Co), Inmarsat Global Xpress (I5 F1, I5 F3, and I5 F4), Intelsat IS-33e, Chinasat-16, SES-12, Intelsat IS-20. 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.[[2]](#footnote-2)

1. **Encroachment of IMT into Satellite Spectrum**

It is important for APT to note that the IMT industry is not only gaining access to spectrum identified by the ITU / WRC processes, but also directly with administrations, outside of the ITU / WRC processes. What is formally included in this agenda item is thus not all of the millimetre wave spectrum that IMT industry is lobbying for. The “28 GHz” band (27.5 to 29.5 GHz band), is not among the candidate bands in this Agenda Item, yet the IMT industry is still fervently lobbying for it creating unnecessary regulatory uncertainty.

In recognition of the important roles that satellites play, and will continue to play, in communications infrastructure of the Asia-Pacific Region, it is recommend the APT resolves that identification of additional spectrum for IMT 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 identification. From this vast quantity of spectrum, all foreseeable IMT 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 services.

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

The 24.25-27 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.

It should be possible to find adequate spectrum in portions of the bands 37-52 GHz (Q/V band), 66-76 GHz (66 GHz), 71-76 GHz (70 GHz) and the 81-86 GHz (81 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 81 GHz bands, 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 of at least 5 GHz, which 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 61 GHz, for which chipsets and MIMO antenna systems are already being manufactured.

1. **AVIA’S and APSCC’s Position and Proposal**

**Band 24.25-27.5 GHz**

An identification for IMT in the sub-band 24.25-27 GHz is possible with appropriate adequate and enforceable regulatory measures, such as power limits on IMT base stations above the horizon, must be adopted to ensure there is no harmful interference. Such regulatory measures will ensure to protect and enable sustainable, viable access for FSS and other space service operations. Specifically, 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)) is supported:

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 in Regions 2 and 3 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 in the APT region at least.

**Band 37-43.5 GHz**

**AVIA and APSCC** are of the view that:

* The band 40.5-43.5 GHz can be shared between IMT and coordinated gateway earth stations in Region 3 with suitable regulatory provisions, 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.
* Bands identified for IMT should be feasible for its 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: AVIA’s and APSCC’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 align with Region 1.

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.

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

In the band 37-40.5 GHz:

* In Region 3: 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 Options 1 and 6, Condition E2c Option 3 Condition E2d Option 1.

Methods are to be considered in conjunction with the draft WRC-19 Resolution 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 50.4-51.4 GHz is recommended.

If however IMT identifications are considered, appropriate protection measures similar to the ones in the band 42.5-43.5 GHz should be adopted.

**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**

Fine with IMT identification, no preference on the Method.

**Other Bands**

Frequency bands outside of **Resolution 238** (**WRC-15**) shall not be considered for Agenda item 1.13.

**Proposal**

The APG is courteously invited to consider developing a proposal for WRC-19 agenda item 1.13 based on the positions outlined above.

1. \* except SKY Perfect JSAT [↑](#footnote-ref-1)
2. 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-2)