COMMUNICATIONS ALLIANCE LTD

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28 GHz spectrum planning

COMMUNICATIONS ALLIANCE SATELLITE SERVICES WORKING GROUP SUBMISSION

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INTRODUCTION

The Communications Alliance Satellite Services Working Group (SSWG) welcomes the opportunity to provide this submission in response to the *28 GHz spectrum planning* Discussion Paper by the Australian Communications and Media Authority (ACMA).

The submission provides comments, with a particular focus on the 28 GHz band, in response to the Discussion Paper, but also comments on the 27.0 to 27.5 GHz band, as consideration of these bands cannot be carried out in isolation.

The SSWG has also provided a separate response to the ACMA *Wireless broadband in the 26 GHz band* Options paper.

The SSWG welcomes this Discussion Paper, which comes at a seminal time in the history of the satellite industry. Innovation, developments and investment in Ka-band are at unprecedented levels and are bringing much greater capacity, speeds, significantly lower prices, much lower latency in some cases, extended mobility capability, and of course, improvements stemming from the natural broadcasting fit of services.

At the WRC-15 Conference, these potential developments were foreshadowed in decisions not to study the identification for terrestrial IMT in the band 27.5 to 29.5 GHz, but rather to encourage satellite studies and associated regulatory frameworks in this band. That prescient confidence by the World Conference is now coming to maturity, with staggering investments in various aspects and types of satellite services and systems. Already there are well over 130 Ka-band satellites in operation, with a further order of magnitude increase in global filings (1500) for this band.

The satellite Ka-band applications and service developments have significant implications for the future of 5G (as outlined in this document), as well as a critical role to play in the burgeoning Internet of Things (IoT) - in ways which would be impossible or totally impracticable without resorting to complementary satellite solutions. Backhaul applications by satellite are very important.

The SSWG recognises that, in the ACMA's words, this 28 GHz review is a first step - a conversation starter about existing and possible future uses for the 28 GHz band. The SSWG commends the ACMA for taking an approach that offers a number of scenarios for discussion. The background leading to the SSWG's observations and proposals is outlined in the narrative of this submission, which provides compelling evidence from the satellite industry that may not have come together before in the one document.

In order to implement the SSWG model, there would also need to be subsequent changes to the ACMA's method of Class Licensing ubiquitous terminals via the current *Radiocommunications (Communication with Space Object) Class Licence* and whatever that becomes as a result of the current licensing review.

Executive Summary

The SSWG believes that no part of the 28 GHz band should be contemplated for IMT identification, because other mmWave bands offer adequate additional spectrum, if proven to be required, and the Ka band is of critical relevance to the satellite industry.

The allocation of any parts of the 28 GHz band to terrestrial IMT/5G services has no potential for global harmonisation, as it is not on the WRC-19 agenda for discussion. On the contrary, the 28 GHz band use by terrestrial IMT / 5G on a national basis will disrupt the global harmonisation for satellite use, which is of the upmost importance due to the international nature of many satellite services.

As explained in more detail below, the SSWG's preferred approach is to maintain Ka-band spectrum 27.0 to 27.5 and 27.5 to 29.5 GHz, as a satellite services band, in recognition of the substantial and sustained investments already made in the band above 27.0 GHz by the domestic and international satellite industry. There is more than enough spectrum below 27.0 GHz and in other bands to meet any realistic 5G IMT spectrum requirement.

At the centre of the ACMA's considerations is a general drive for spectrum identification for IMT in the future. The justifications of regulatory decision making will be related to the *Highest Value Use* of spectrum.

The highest value use of spectrum will arise from correct apportioning of sufficient IMT/5G spectrum, spread across the range of frequencies up to 88 GHz. Beyond that apportioning, the identification/allocation for IMT/5G would be inefficient and of little or no value, especially if other services are denied.

Communications Alliance acknowledges some of its members, including Telstra and Optus, do not agree with some aspects of this submission, and these members will be making their positions clear in separate submissions.

About Communications Alliance

Communications Alliance is the primary telecommunications industry body in Australia. Its membership is drawn from a wide cross-section of the communications industry, including carriers, carriage and internet service providers, content providers, equipment vendors, IT companies, consultants and business groups.

Its vision is to provide a unified voice for the telecommunications industry and to lead it into the next generation of converging networks, technologies and services. The prime mission of Communications Alliance is to promote the growth of the Australian communications industry and the protection of consumer interests by fostering the highest standards of business ethics and behaviour through industry self-governance.

For more details about Communications Alliance, see http://www.commsalliance.com.au.

More than enough other spectrum to meet realistic 5G/IMT 2020 mobile spectrum demand

WRC-19 Agenda Item 1.13 will consider more than 33 GHz of spectrum in aggregate as potential candidate bands for IMT-2020. It should be possible to find more than enough spectrum within this 33 GHz to meet any realistic projection of data consumption growth, without impinging upon bands already actively being used or planned to be used for current and next-generation Geostationary Earth Orbit (GEO), Medium Earth Orbit (MEO) and Low Earth Orbit (LEO) satellite systems.

Great care is needed in addressing the 28 GHz band, which is not even included among the candidate bands in the Agenda Item. WRC-15, which set the Agenda for WRC-19, excluded those frequencies from consideration for IMT-2020. In particular, WRC-15 decided overwhelmingly that, due to the existing and planned satellite use of the band, including for gateways and user terminals, it would not be appropriate to study any part of the band for designation for terrestrial IMT. This exclusion was therefore made deliberately, for the benefit of service developments other than terrestrial IMT.

In the broadband mobile world, it remains to be seen whether data consumption will grow to the extent projected under various models to support 5G mobile spectrum requests, which are extensive.

For example, a recent paper by LS Telcom illustrates that mobile data consumption growth predictions under the ITU forecast model are unrealistic. LS Telcom's approach was to consider how much data would be consumed 'in the limit, based on every mobile subscriber on the planet streaming 4K video for 16 hours per day'. It determined that under this rather implausible scenario 'the amount of global mobile data traffic would be around 3150 exabytes per month by 2035.' However, 'this is around 315 times higher than today and represents a Compound Annual Growth Rate (CAGR) of just 38% per annum, i.e. lower than the current estimates of 50% per annum.'

It is not surprising that even regulators in small, densely populated countries have come up with much lower estimates of mobile data consumption growth and, thus, much lower estimates of 5G mobile spectrum requirements. Singapore's IMDA[1], for example, recently estimated 5G mobile spectrum requirements to be closer to 2 GHz rather than the 20 GHz estimated under various models, based on (among other things) an assessment of local density of cell site deployments and expected rates of off-load on to Wi-Fi and future WiGig networks.

If the amount of spectrum required for 5G is closer to 2 GHz (or less) than to 20 GHz (or more), then the ITU under WRC-19 Agenda Item 1.13 will be able to identify more than enough globally harmonized spectrum to support 5G mobile spectrum requirements. This should be achievable without cannibalising satellite spectrum that is already in use or planned to be used for current and next-generation GEO and non-GEO High Throughput Satellite (HTS) systems that will support and augment future 5G networks.

The 26 GHz band is a likely 'pioneer' 5G band. Within this band, attention should focus first on those portions not already allocated to satellite, given the recent Broadcasting Satellite Service (BSS) feeder link allocation in the 24.65 to 25.25 GHz at WRC-12 and the recent launch of HTS satellites using the 27.0 to 27.5 GHz FSS uplink band. The 28 GHz band has a number of quite different demands specifically coming from the satellite sector.

[1] The Singapore government's *Info-communications Media Development Authority*, who develops and regulate the converging infocomm and media sectors. Website: https://www.imda.gov.sg/

A number of other mmWave opportunities in higher frequency bands will be considered for IMT-2020 terrestrial mobile services under WRC-19 Agenda Item 1.13, including the 31.8 to 33.4 GHz (32 GHz), 66 to 76 GHz (66 GHz) and the 81 to 86 GHz (81 GHz) bands. It should be possible to find adequate spectrum in these bands to meet terrestrial 5G requirements without any contention with existing and planned use of satellite spectrum that is foreseeable in the Ka, Q and V-bands. The 66 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. The 66 and 81 GHz band in the 'high' mmWave 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 high mmWave 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 Multiple-Input Multiple-Output (MIMO) antenna systems are already being manufactured.

Examples of innovation and spectrum need in the satellite industry – with emphasis on Ka-band

The need to provide and protect satellite spectrum includes the recognition that for satellites to play their role in the 5G ecosystem, they will need continued, sustainable access to appropriate spectrum. This should be taken into account in planning processes for 5G.

In this regard, it is noted that:

- many HTS satellites have already been deployed, or are being planned to be deployed, in multiple frequency bands, including in the portions of the Ka-band spectrum being considered for 5G mobile spectrum (See Table 1 on the following page).
- ITU WRC-19 Agenda Item 1.13, following WRC-15 Resolution 238, will be considering more than 33 GHz – a colossal amount of spectrum – as 5G candidate bands, including the 26 GHz band but not the 28 GHz band.
- there is more than enough spectrum under consideration by the ITU for IMT-2020 to meet realistic demand projections, and there is simply no need to re-allocate satellite spectrum already in use or planned to be used for current and next-generation GEO and non-GEO satellite systems to meet 5G mobile spectrum requirements.

Intense satellite use of the 28 GHz band and low probability of international harmonization of this band for terrestrial 5G

The 28 GHz spectrum band plays a key role in current satellite operations, in respect of which well over 130 GSO and NGSO satellite systems, including *High Throughput Satellites,* are already using the band (see Table 2). The number has been growing steadily in the past few years and will continue to grow. As the 28 GHz band is key to satellite system development and innovation on a global basis, the international satellite community has significant interests in this band. Based on latest reports available from ITU, it can furthermore be seen that 1500+ satellite network filings have been submitted which have included the said 28 GHz band. The ITU BR Space Network Systems Online currently shows that filings for over 1700 satellite systems have been submitted in the Ka-band. Internationally this band is being used heavily by companies that provide satellite broadband services to masses, including those in unserved and underserved areas.

VSATs VSAT use allows both urban and remote areas of the country to be connected. Part of the 28 GHz band is also identified, via ITU RR No. 5.516B, for use by high-density applications in the FSS, i.e. ubiquitous VSATs, in the Earth-to-space direction. In Region 3, the relevant portions of the band are 28.45 to 29.1 GHz, 29.46 to 30 GHz. Importantly access to the whole Ka band is and will increasingly be required for VSAT uplinks in the future.

ESIMs In addition to the traditional fixed satellite use, the 28 GHz band is also being considered for Earth Stations In Motion (ESIMs) under WRC-19 Agenda Item 1.5, to provide broadband connectivity to users on the move and/or in areas not reachable by terrestrial networks (e.g. aircraft/vessels), in addition to use on land.

Whilst the gateways could be few in numbers with larger antennae and known locations, the ESIMs would be ubiquitous, numerous in number and be spread across wide areas. Moreover, it is important that future earth stations and user terminals (which are of unknown location) be allowed to deploy. This would not be possible if similarly, ubiquitous IMT/5G terminals are allowed to deploy in the same band.

Gateways The 28 GHz band has a primary allocation for FSS (Fixed Satellite Service) and is used in its entirety, due to capacity requirements, for gateways of satellite systems with user payloads in Ka-band and other bands (e.g. Ku or S-band).

It is essential that FSS gateway operation in the 28 GHz band not be constrained by 5G deployment, also considering that a domestic gateway is often a regulatory requirement or benefit to the local economy.

TABLE 1
High Throughput Satellite deployment

In service	High Throughput Satellite	Orbit	Frequency bands
2005	Thaicom-4 / IPStar-1	GEO	Ku-band / **Ka-band**
2011	ViaSat-1	GEO	**Ka-band**
2013, 2014	O3b (Batch 1, 2 & 3)	MEO	**Ka-band**
2015, 2016	Sky Muster I & II (NBN-Co)	GEO	**Ka-band**
2016	Intelsat IS-33e	GEO	C-band / Ku-band / **Ka-band**
2017	Inmarsat Global Xpress (I5 F4) Chinasat-16 ViaSat-2	GEO GEO GEO	**Ka-band** **Ka-band** **Ka-band**
2018	O3b (Batch 4 & 5)	MEO	**Ka-band**
	SES-12	GEO	Ku-band / **Ka-band**
2019	Kacific-1 / JCSat-18	GEO	**Ka-band**
	OneWeb APStar-6D	LEO GEO	Ku-band / **Ka-band** **Ka-band**
2020	SpaceX	LEO	Ku-band / **Ka-band**
2021	Telesat LEO O3b mPower	LEO MEO	**Ka-band** **Ka-band**
Not Available	ViaSat-3 (APAC)	GEO	**Ka-band**

TABLE 2
Satellites operating in Ka-band

	Satellite		Satellite		Satellite		Satellite
1	SES 15	36	Amazonas 5	71	Astra 3B	106	Luch 5V
2	Galaxy 23	37	Inmarsat-5F2	72	Eutelsat 25B	107	Chinasat 2A
3	Anik F3	38	Intelsat 29E	73	Badr 5	108	Chinasat 2C
4	Spaceway 1	39	Intelsat 32e	74	Badr 7	109	Asiasat 7
5	ViaSat-1	40	Hispasat 36W-1	75	Astra 2F	110	Gaofen 4
6	Anik F2	41	Skynet 4F	76	Astra 2E	111	DFH 165
7	Wildblue 1	42	Hylas 1	77	Astra 2G	112	Chinasat 16
8	Echostar 17	43	Hylas 4	78	Hylas 2	113	Koreasat 5A
9	AMC 15	44	Hispasat 1F	79	Astra 5B	114	Koreasat 5
10	Spaceway 1	45	Hispasat 1E	80	Skynet 4C	115	Koreasat 7
11	Directv 15	46	Spainsat 1	81	Express AMU1	116	ABS-7
12	Directv 12	47	Nimiq 2	82	Athena Fidus	117	Thaicom 4
13	Directv 10	48	AlComSat 1	83	HellasSat 3	118	Asiasat 9
14	SDO	49	Al Yah 3	84	Turksat 4A	119	Cosmos 2526
15	Directv 9S	50	Intelsat 37e	85	Nigcomsat 1R	120	COMS 1
16	Directv 8	51	Telstar 12V	86	Cosmos 2520	121	Chinasat 1A
17	Directv 14	52	Cosmos 2473	87	Syracuse 3A	122	APSTAR 6C
18	Directv 11	53	Nilesat 201	88	Yahsat 1B	123	Express AM5
19	Spaceway 2	54	Syracuse 3B	89	GSAT 19	124	NBN-Co 1A
20	Echostar 19	55	Amos 3	90	Turksat 4B	125	Kizuna
21	Spaceway 3	56	Amos 7	91	Yahlive	126	NBN-Co 1B
22	Echostar G1	57	Skynet 4E	92	Express AM6	127	Mtsat 2
23	Galaxy 28	58	Thor 7	93	Intelsat 33e	128	Jcsat 16
24	Tupac Katari 1	59	Eutelsat 3B	94	Inmarsat-5F1	129	DFH 139
25	SES 12	60	Astra 4A	95	Amos 4	130	Superbird B2
26	AMC 16	61	Eutelsat 7A	96	Intelsat 20	131	Superbird B3
27	Star One D1	62	Eutelsat 7B	97	UHF 10	132	Inmarsat-5F3
28	Nimiq 4	63	Eutelsat KA-SAT 9A	98	GSAT 14	133	O3b-A (x16 +)
29	Venesat 1	64	Inmarsat 5F4	99	ABS-2	134	SES 14
30	SGDC 1	65	Sicral 1B	100	DFH 76	135	Iridium (x66 +)
31	ViaSat-2	66	Eutelsat 16A	101	Cosmos 2520		
32	Astra 1H	67	Sicral 1A	102	Chinasat 1C		
33	Eutelsat 65 West A	68	Astra 1L	103	TDRS 8		
34	Telstar 19V	69	Arabsat 5C	104	NSS 6		
35	Amazonas 3	70	SES 16	105	SES 8		

Current and future satellite deployment in the 28 GHz band make this band unsuitable for terrestrial 5G and underscores the reason why the 28 GHz band was not included in WRC-19 Agenda Item 1.13 for possible IMT identification.

Every effort should be made to avoid disrupting the major and long-term investments related to satellite network deployments, especially when there is ample other spectrum under consideration at WRC-19 that is more likely to be globally harmonized.

It is clear that the 28 GHz band will not be internationally harmonized for terrestrial 5G and is therefore a poor candidate for suitable economies of scale for 5G equipment. Further to this, use by 5G on a national basis will disrupt the global harmonisation for satellite use, which is of the upmost importance due to the international nature of satellite service.

The role of satellite in 5G communications systems

In addition to their prominent role in international broadcasting, satellite technologies are also expected to play an important role in the future 5G ecosystem, including:

- by extending terrestrial 5G connectivity from places with excellent connectivity to places that are not so well-connected or that terrestrial networks would not otherwise reach (e.g. lower population-density areas, aircraft, ships and trains).
- by efficiently supporting Machine-to-Machine (M2M) / Internet-of-Things (IoT) networks through direct connection or backhauling of aggregated M2M/IoT data from multiple locations (e.g. to support sensor networks and other Smart City applications, or to enable connected cars, planes and ships).
- to help terrestrial 5G networks meet the low latency requirements (< 1 ms) of some of the new 5G applications through efficient multicasting of commonly accessed content to storage caches at multiple 5G base stations. In this regard, while most 5G applications, e.g. the Internet of Things (IoT), will not have low latency requirements (< 1 ms), it is projected that a few, still-emerging applications might have such requirements (e.g. Virtual Reality (VR) and autonomous driving). According to the GSMA, 'any service requiring such a low latency will have to be served using content located very close to the customer, possibly at the base of every cell, including the many small cells that are predicted to be fundamental to meeting densification requirements.'
- to restore connectivity when existing terrestrial networks have been disabled, e.g. after a natural disaster.

Satellites already play essential roles providing standalone and extension services and are well placed to continue playing such roles as an integral part of 5G networks, as more High Throughput Satellites (HTS) in both geostationary (GEO) and non-geostationary (non-GEO) orbits are deployed, and as smaller, more advanced, and lower-cost ground antennas are developed.

As a result, the appropriate integration of satellites and terrestrial 5G networks should be actively encouraged and not precluded by 5G spectrum and policy decisions.

27.0 to 27.5 GHz Band and ACMA 28 GHz Options Paper

A fundamental consideration of this paper is to identify the boundaries of what is regarded as the '28 GHz band'. For purposes of this submission, the 27.0 to 27.5 GHz band should be considered part of the 28 GHz band, at least in terms of gateway operations and protection. The main issue in this band is aggregate uplink interference from 5G into satellite receivers located in space. It is not clear yet how 5G will deploy and what the constraints might be on those operations.

In the ITU however, within studies by the satellite sector, in particular by nbn Co, have provided calculations showing the oversimplicity of calculations when related to real systems in Australia and consequent dramatic reductions in the ACMA's calculated protection margins.

These issues will feed into the outcomes and should be useful. Either way, the SSWG has been supportive of the ACMA taking into account these studies and of moving to the next stage of progression toward the *refarming stage*, based on an agreed output from the Working Group. Unfortunately, it appears that the Working Group as a whole was not convinced of the assumptions and methodology proposed used and the future risks to satellite services.

28 GHz ACMA Discussion Paper

As stated above, the 28 GHz band is an essential band for satellite FSS. Growth over the last decade has been overwhelming. Innovations have allowed high throughput satellites to flourish and 100 Mbps speeds and large data plans to become the norm.

In addition, on the mobility front, a significant consideration in the 28 GHz band relates to Agenda Item 1.5. Here the satellite mobile service, under study for ESIM (Earth Stations in Motion within the 'FSS Envelope'), is 27.5 to 29.5 GHz. User terminals in maritime, aeronautical and land segments are being studied. ESIM comprise ubiquitous terminals in each of these three segments and these are not the subject of TG 5/1 (Agenda Item 1.13) studies. ITU-R WP 4A has carriage on these satellite matters.

It is highly challenging for ubiquitous IMT/5G terminals and base stations to be able to coexist with ubiquitous very small aperture terminals (VSATs), ESIMs and gateways at the same frequencies in a manner that allows both services to grow to their full potential.

The ACMA has put forward five Scenarios for consideration – with differing band usages. Given that Ka-band is critical to existing and future satellite ubiquitous service developments, the SSWG recommends that the existing class licence approach in Ka band be extended to include the ranges 18.2 to 18.8 GHz, 19.3 to 19.7 GHz, 27.5 to 28.5 GHz, and 29.1 to 29.5 GHz. As explained above, IMT/5G terminals are not compatible with ubiquitous FSS deployment in this band. In addition, it is neither necessary, nor appropriate, to consider the 28 GHz band for future 5G mobile terrestrial networks.

Preferred approach for the 27.0 to 27.5 and 28 GHz Bands

The SSWG is of the view that viable planning options can be devised to meet the needs of all prospective 27.0 to 27.5 and 28 GHz stakeholders. For example, the 27.0 to 27.5 GHz band could be included in the satellite use cases with the 28 GHz band, at least in terms of gateways for the 27.0 to 27.5 GHz band, until the end of life of the current satellites that they support.

As previously addressed in the 26 GHz SSWG submission, the preference of the SSWG is for inclusion of the 27.0 to 27.5 GHz band as part of the overall plan for satellite services going forward, at least for protection of the current coordinated earth stations in the band. The SSWG makes this request to ACMA on the basis that there are already operational gateway earth stations in the band that have been previously authorized, those coordinated earth stations are essential to bridging the digital divide in Australia, and use of this band will likely be phased out once the current generation of satellites is replaced. The 28 GHz band, however, is used extensively for uncoordinated and coordinated earth stations and the use is only getting heavier as more and more Ka band satellite networks become operational. This is because the deployment of advanced HTS has reduced the cost per bit for satellite services and significantly increased the bitrates offered to customers. This has allowed satellite operators to offer services at par for cost and quality with terrestrial service providers, which in turn has resulted in an increased number of broadband terminals deployed in urban and sub-urban locations. Likewise, there is a clear preference on the part of the mobile network operators for wide area spectrum licenses and, therefore, it is not feasible to authorize both services in the same band.

Satellite operators have invested billions of dollars in the satellites already launched and under construction, as well as the ground infrastructure to support these networks. The risk of stranding billions of dollars of satellite investments in the band can be avoided by accommodating mobile operations in a different band altogether.

The SSWG is also very concerned about any planning decisions that would deny long term security for satellite in a significant portion of the 27.0 to 27.5 and 28 GHz bands as this could jeopardise existing and ongoing investments in satellites and on network and system upgrades vital for the ongoing commercial viability of the satellite industry. This is an issue of utmost concern for the satellite community. Based on past experience, when mobile services are introduced into a band they typically become ubiquitous over time and acquire a dominant position in the band at the expense of other services and the IMT/5G proponents have not shown interest in anything other than an exclusive terrestrial use framework.

The SSWG urges the ACMA to seriously consider the proposals outlined in this submission noting, however, that any decision to segment at 27.5 GHz would have to take account of the impact on the incumbent satellite use of the 27.0 to 27.5 GHz portion.

There are a limited number of fixed point-to-point links within the band. The SSWG submits that these should be embargoed. There are existing studies supporting deployments that suggests the potential for interference to these links is low. Thus, the fixed links could be grandfathered and only cleared should a problem arise.

Practical spectrum arrangements to accommodate the full range of anticipated services and applications in the 27.0 to 27.5 GHz and 28 GHz bands Figures 1 below.

Band application	**Frequency band (GHz)**				
	27.0 to 27.5	27.5 to 28.1	28.1 to 28.5	28.5 to 29.1	29.1 to 29.5
Fixed Links RALI FX-3 apparatus licensed. See Note 1.					
Satellite low density area gateway uplink					
VSAT class licensed all area uplinks					
ESIM all area class licensed uplinks					

Note 1. Fixed Service should be embargoed and grandfathered for a limited period.

Figure 1
27.0 GHz band segmentation and allocation example

Other matters specific to 28 GHz

Prior to addressing the specific questions in the ACMA Options Paper, the SSWG offers the following comments of significance to the satellite industry in the current market place:

- around the world and in Australia, there is extensive satellite usage throughout the 27.5 to 29.5 GHz band for satellite uplinks.
- the 28.5 to 29.1 GHz band is currently available in Australia for ubiquitous Earth Stations and SSWG members would wish to retain that usage in that band segment, and seek access to additional band segments for such ubiquitous deployments, including for Earth Stations in Motion (ESIM).
- both nbn's Australian satellites and a number of global systems (e.g. O3b) have deployed apparatus-licenced earth stations in the bands between 27.5 GHz and 28.5 GHz. O3b, for example, deploys both regional gateways (in WA and NSW) and customer terminals (in Christmas Island and Norfolk Island) in this band. More earth stations can be expected to be deployed as demand grows and as more Ka-band satellite systems are launched. The SSWG believes that the existing and planned satellite investments in this band justify accommodating 5G mobile requirements in other bands rather than in the 28 GHz band.
- in ITU Regions 2 (Americas) and 3 (Asia-Pacific), the 27.0 to 27.5 GHz range is also allocated for satellite uplinks, and Australia's nbn Co is the first to make use of that band to ensure that its recently launched HTS systems have adequate gateway spectrum. The band, however, is not limited in any way to just gateway use, and the SSWG's position is that this band segment adjacent to the 27.5 to 29.5 GHz be designated for satellite use as well. But if the ACMA were to decide otherwise, then any arrangements relating to the 27.0 to 27.5 GHz range must not impact satellite usage of the adjacent 27.5 to 29.5 GHz band.

Responses to ACMA questions and recommendations

The ACMA has raised a number of questions which are specific to the scenarios developed by the ACMA for discussions purposes. These questions essentially relate to demand, geographic constraints, sharing of spectrum, technology and licensing solutions.

The SSWG proposed next step forward on these Scenarios and is more encompassing of the 27.0 to 27.5 and 28 GHz bands. Inherently, the answers to most of these questions and the foregoing text in this submission provide the background to answering the ACMA's questions without repeating those backgrounds.

The SSWG proposes that a new, more advanced and comprehensive model based on satellite broadband ubiquitous use in the 28 GHz band be adopted by the ACMA.

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