COMMUNICATIONS
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Satellite Industry Spectrum Strategy 2022

A Communications Alliance Satellite Services Working Group Paper

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Purpose of this paper

This paper is to brief Australia's radiocommunications regulatory decision makers (Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) and the ACMA) and other stakeholders on the Australian satellite industry's strategy for spectrum use in Australia. The paper highlights the need for consistent, long-term planning to foster the industry and the benefits that accrue to Australian satellite services consumers, industry and the national economy from that approach.

The document looks at spectrum on a band-by-band system approach and does take a retrospective look at some bands, such as 28 GHz, where SSWG believes some adjustments are warranted.

About Communications Alliance

Communications Alliance is the primary communications 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, platform providers, equipment vendors, IT companies, consultants and business groups.

Its vision is to be the most influential association in Australian communications, co-operatively initiating programs that promote sustainable industry development, innovation and growth, while generating positive outcomes for customers and society.

The prime mission of Communications Alliance is to create a co-operative stakeholder environment that allows the industry to take the lead on initiatives which grow the Australian communications industry, enhance the connectivity of all Australians and foster the highest standards of business behaviour.

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

General comment on international activities

Many SSWG members are closely involved with ITU and APT activities because what happens internationally affects the satellite industry globally. Indeed, while domestic planning such as for the 28 GHz is important, so is steering the ITU and APT in the direction that benefits the satellite industry globally.

Large areas of Australia, airlines, shipping services, mines, farms, remote and indigenous communities and other users are dependent on satellite for access to broadband. Emerging high-throughput services such as ViaSat's 'ViaSat-3' network and low latency systems such as Amazon Kuiper combined with 'anywhere anytime' MSS services promise to significantly bridge the digital divide. But this can only happen if spectrum allocations are protected and are, as far as is possible, global allocations.

The SSWG is therefore occasionally somewhat disappointed when our members are told certain issues being addressed by the ITU are considered 'domestic matters' from an Australian perspective and that our local regulatory stakeholders do not wish to engage in a global coordination process. Very few, if any issues in the ITU are domestic matters, in our view, and the outcome of deliberations on all of them affect the industry. The SSWG will highlight current issues in our discussions below, but the comment is a general one. The SSWG encourages the ACMA to be more involved in relevant ITU and APT discussions and to empower industry representatives to make their needs and perspectives heard in the forums.

1500 MHz MSS

The frequency bands 1525 – 1559 MHz and 1626.5 – 1660.5 MHz continue to be used to support a variety of MSS systems, providing a wide range of MSS services to users. This includes safety services to support the maritime community (GMDSS) and the aviation community (AMS(R)S). Other critical services are provided to land, maritime and aviation users, including satellite IoT, voice communications to handheld terminals, high data rate communications (up to around 1 MBit/s) to laptop sized terminals, and communications to drones. These services are widely utilised throughout Australia, by commercial and government users, and by ships and aircraft anywhere in the world.

Satellite operators continue to invest in new services and new capabilities. Inmarsat is continuing to develop and launch new satellites and to develop new terminals and services for users, using the 1500 MHz MSS bands.

WRC-03 allocated globally additional spectrum for MSS, in the bands 1518 – 1525 MHz and 1668 – 1675 MHz, known as 'extended L-band'. The SSWG supports that these bands be also made available for MSS operations in Australia as soon as possible. It is recognised that the band 1518 – 1525 MHz may have other incumbent users in Australia and hence some compatibility issues will need to be addressed. The extended L-band frequencies were allocated almost 20 years ago, and satellite capacity to enable the use of these frequencies in Australia will soon be available[1]. The SSWG is pleased to note that the ACMA issued a discussion paper on 5 May 2022 to review the use of these bands. To allow MSS L-band users in Australia to fully utilise their current and future terminals, the SSWG would encourage the ACMA to expedite the allocation of this band for MSS in Australia.

[1] Inmarsat 6F1 launched in December 2021 will provide extended L-band coverage to the Asia Pacific Region, including Australia.

2 GHz MSS and Space Operations

The SSWG welcomes the ACMA's decision to allocate 2 x 12.5 MHz (paired) of 2 GHz spectrum for licensed MSS use but has concerns about the proposal for a 2 x 5 MHz 'narrowband' MSS (N-MSS) allocation.

The SSWG welcomes the decision to allocate the 2 GHz bands to MSS. However, for several important reasons, the proposal for a 2 x 5 MHz allocation for a 'narrowband' MSS would result in the inefficient use of spectrum. First, limiting spectrum to a specific proprietary application will likely result in valuable spectrum being underused. Second, since there is no harmonised global or regional band plan for the 2 GHz band that includes a 'narrowband' use of this spectrum, it is likely that few countries will authorise similar use. This calls into question whether such an application will achieve the required economies of scale to be commercially successful and benefit Australia. This issue is demonstrated at ITU-R WP4C on WRC Agenda Item 1.18, where there are difficulties making progress on studies related to narrowband MSS.

The SSWG therefore calls on the ACMA to pause its consideration of plans for a bespoke 2 x 5 MHz allocation to narrowband MSS, and to release 2 x 15 MHz to industry for generic MSS use and to look at harmonising future MSS allocations.

3600 – 4200 MHz: C-Band Earth Receive (space to Earth)

The 3400 – 4200 MHz (space-to-Earth) band paired with the 5925 – 6725 MHz (Earth-to-space) band has historically been used for satellite operations for the past 40 years or so.

C-band spectrum is unmatched for comprehensive, wide area satellite coverage with the implementation of hemispherical and global coverage beams which are implementable thanks to the specific favourable propagation characteristics of the band. The wide area coverage simplifies the ground infrastructure required to provide connectivity between remote points and contributes to lowering the total cost of ownership of a telecommunications solution, compared to an equal-reach terrestrial microwave network.

Australian remote areas, oceanic and Pacific Islands are a natural beneficiary of wide coverage beams, with the hemispherical and global beams able to connect maritime, oil and gas, mining, government and customers over extensive areas. The unparalleled capabilities offered by this frequency range, in terms of resilience to service disruptions due to intense rain, makes it fundamental for high-reliability services with constant throughput requirements.

Several SSWG members operate C-band gateway Earth Stations in metropolitan and other areas of Australia to support the maritime, mining, energy, defence, telecommunications and government sectors. These gateways have been providing vital communication links for decades to remote and regional areas in Australia and the Asia Pacific, especially in tropical and oceanic areas, often where no other telecommunications options are available.

In Australia, the Fixed Satellite Service (FSS) has a secondary allocation in the 3400 – 3600 MHz band[2] and a primary allocation in the 3600 – 4200 MHz band.

In recent years ACMA has allocated significant parts of the 3400 – 3700 MHz band to mobile services (5G) via spectrum licences. This has resulted in FSS being pushed out of the 3400 – 3700 MHz band (on a regional basis). In addition, FSS access and operations in the

[2]Unlike Australia, in all ITU regions, FSS has a primary allocation in 3400-3600 MHz

adjacent 3700 – 4200 MHz band has been negatively impacted by high power 5G services in close proximity to FSS Earth stations. This historical context explains why the FSS earth station receivers are equipped with LNB (Low Noise Block downconverters) capable of receiving in the entire 3.4 – 4.2 GHz band.

Within the Metropolitan areas, the 3700 – 4000 MHz band is in the process of being allocated to 5G and Wireless Broadband (WBB) in addition to the previous C-band spectrum that have been made available for 5G deployment (i.e. 3400 – 3700 MHz). The ACMA is planning to allocate 3700-3800 MHz to 5G (WA WBB) in metro and regional areas via spectrum licences on an exclusive basis, which will result in FSS being no longer able to access the 3700 – 3800 MHz band in metropolitan and regional areas. The ACMA is planning to allocate the 3800 – 4000 MHz band to LA-WBB (Local Area Wireless Broadband) in metro and regional areas on a shared basis with FSS. The whole of the 3400 – 4000 MHz is being allocated to LA-WBB in remote areas on a shared basis with FSS. Only the 4000 – 4200 MHz band will be protected for FSS Earth receive across metro, regional and remote areas, which will not be shared with 5G or WBB services. This matter is of continued concern to FSS operators, who request access to adequate and economically viable C-band spectrum to support Australian customer requirements, as well as technical and regulatory measures that will adequately protect the continuation of the current and future FSS receiver operations.

Co-frequency sharing in the same geographical area between FSS and IMT systems is neither feasible nor practical. Numerous ITU-R studies have shown this fact, and both satellite and terrestrial mobile industry agree that this is true. Even when 5G and FSS operate in adjacent bands, interference to FSS receivers will occur unless mitigation techniques are implemented.

For the WBB services operating in remote areas in the 3400 – 4000 MHz band, the ACMA's proposed filtering assumptions of FSS Rxs are not practical and implementable. The passband of the receive earth station's filter needs to be assumed as 3400 – 4200 MHz and WBB Txs operating in the 3400 – 4000 MHz band would be considered as in-band in relation to FSS Rxs and large separation distances would be required to operate both the WBB and FSS services in the same band.

The ACMA is proposing that Area Wide Licences (AWLs) will be used for LA-WBB licensing and FSS in metropolitan and regional areas in the 3800 – 4000 MHz band. The ACMA's proposal on AWL for FSS receivers is that 'the intention would be, for FSS receivers operating under any AWL framework in these areas, would have sufficient spectrum and geographic areas such that the potential interference from neighbouring (in location and in frequency) LA-WBB AWLs is acceptable to the FSS licensee, by accepting the appropriate device boundary criteria and unwanted emissions limits for the spectrum space'.[3] The SSWG believes that not only is the area needed disproportionately larger once interference management is considered, but it is also totally unnecessary for FSS given the nature of the service. By enforcing AWLs onto FSS, satellite service providers would effectively be made to take up a coverage far larger than their intended needs leading to unreasonable costs linked to this AWL scheme.

The SSWG urges the ACMA to seriously reconsider the potential unintended consequences of imposing a license type that is unsuitable for a particular technology type (in this case, FSS). It is envisaged that imposing AWLs scheme in the 3800 – 4000 MHz band would invariably and systematically disadvantage FSS for the benefit of LA WBB, which we do not believe the ACMA intends to do. The result of implementing the AWL scheme for FSS Receive Earth station would be that FSS is driven entirely out of that area and band.

[3] From ACMA's 3400-4000 MHz – Technical Liaison Group paper v3 (pg. 40).

We acknowledged that AWL licensing was partially adopted for FSS Earth-to-space in the 28 GHz band. However, we would note that there is a big difference when assessing licensing schemes for FSS ES in the Earth-to-space direction (transmitting ES) and in the space-to-Earth direction (receiving ES).

The SSWG presented a technical paper indicating that the size of an AWL for Receive Earth Station needs to be significantly large to protect the Receive Earth Station from WBB emissions in its submission to the ACMA public consultation on proposed spectrum re-allocation declaration for the 3.4 GHz and 3.7 GHz bands (IFC# 10/2022).

The study proposed that it is more spectrum efficient for Receive Earth Stations to continue to be licensed through site-specific ALs (Apparatus Licenses) with a coordination procedure. As the ACMA has identified that spectrum licence arrangements are not suited for a multi-operator restricted cell LA WBB use-case (i.e. multiple scattered small cells), likewise AWLs are not suitable for FSS where they are often single sites and no wide area terrestrial coverage is required.

The SSWG believes that the implementation of the ACMA's proposals to allocate 5G and WBB particularly in the 3700 – 4000 MHz band are likely to result in costly earth station relocation and/or re-tuning costs by the FSS incumbents and significant negative financial impact due to revenue loss. The SSWG urges the ACMA to seriously consider compensating incumbents for at least the associated costs and losses due to the replanning of the 3700 – 4200 MHz band. Similar compensation has occurred in the United States in relation to the clearance of satellite services from the C-band. Australian free-to-air broadcasters were also compensated when required to vacate frequencies to create the so-called 'Digital Dividend'.

Communications Alliance will raise this issue with Government and would welcome supportive interaction from the ACMA

In addition, as a result of the ACMA's proposal to re-allocate the band 3700 – 3800 MHz for 5G, and pushing FSS out of this band, the SSWG is of the view that FSS will eventually be a secondary allocation in Australia for the band 3400 – 3800 MHz in the near future.

4500 – 4800 MHz: C-Band Earth Receive

This band is allocated in the RRs world-wide on a co-primary basis to FSS, FS and MS. In Australia, the band is designated to be used principally for the purposes of defence and national security as described in footnote AUS101 of the ARSP. The possible requirement for Defence to coordinate with FSS is noted in AUS67.

The use of this 4 500 – 4 800 MHz band (space-to-Earth) and corresponding 6 725 – 7 025 MHz (Earth-to-space) band for FSS is regulated by the ITU-R's provisions of Appendix 30B.

In Australia, this band is used by FS P2P links in a limited way. Defence operates wide bandwidth Australia-wide land mobile services across the whole band. There are no FSS licences issued in this band.

Internationally, Japan has made the 4500 – 4600 MHz band available for 5G and is considering options for the 4600 – 4900 MHz band. China is also considering use of the band for 5G.

The ACMA reports[4] that there is some interest from domestic fixed and mobile wireless broadband users in pursuing this band for mobile broadband in Australia.

5091 – 5250 MHz: C-Band Earth to Space

The 5091 – 5150 MHz band is allocated in the RRs world-wide on a co-primary basis to FSS, AMS, AMS(R)S and ARNS. The band 5150 – 5250 MHz is allocated in the RRs world-wide on a co-primary basis to FSS, ARNS and MS.

In Australia, through footnote AUS25 the aeronautical radionavigation service in the 5000 – 5250 MHz band is subject to the provisions of Annex 10 to the *Convention on International Civil Aviation* and the *Standards and Recommended Practices* of the International Civil Aviation Organisation (ICAO). Footnote 444 has a similar requirement for the 5030 – 5150 MHz band.

Footnote 444A and 447A indicate that the use of the allocation to the FSS (Earth-to-space) in the 5091 – 5250 MHz band is limited to feeder links of NGSO systems in the MSS.

Footnote 447B indicates that the 5150 – 5216 MHz band is also allocated to the FSS (space-to-Earth) on a primary basis. This allocation is limited to feeder links of non-geostationary-satellite systems in the mobile–satellite service.

In Australia, this band is used by FSS (Earth-space) gateways by a number of satellite operators including Omnispace, Pivotel and Globalstar.

5850 – 7075 MHz: C-Band Earth to Space (and s–E in 6700 – 7075 MHz)

The frequency range 5850 – 7075 MHz is globally allocated to the Fixed Satellite Service (FSS) on a primary basis, however there are certain frequency bands which are of the upmost importance for the operation of existing, planned, and future networks of the fixed-satellite service. For example, the 6725 – 7025 MHz band in which the use of the FSS is in accordance with the provisions of Appendix 30B, this appendix is essential for some developing countries because it helps to guarantee equitable access to the geostationary satellite orbit.

Another band that is crucial for the FSS is 6700 – 7075 MHz, which is widely used to enable the global operation of feeder links for non-geostationary satellite systems of the mobile-satellite service in accordance with No. 5.458B of the Radio Regulations.

Moreover, the 5925 – 7125 MHz band has been object of discussions around the world to allow the operation of unlicensed devices such as RLAN for the development of Wi-Fi 6 technology. Some countries such as United States have made available the whole 1200 MHz, while some other countries/regions such as CEPT are taking a more cautious approach by adopting initially 500 MHz for RLAN in the 5925 – 6425 MHz band. The SSWG encourages the ACMA to take the approach of enabling the 5925 – 7125 MHz frequency band for RLAN, because the use of RLAN could coexist with the operation of incumbent services such as the FSS with certain conditions.

If class licensing arrangements are to be made in the 5925 – 6425 MHz band for RLANs, the SSWG would support only low power indoor (LPI) and very low power (VLP) outdoor deployments of RLANs based on the parameters expressed in the ACMA's preliminary views[5].

[4] ACMA's Five-year spectrum outlook 2021–26 work program (Sept 2021)
[5] The ACMA's consultation paper Exploring RLAN use in the 5 GHz and 6 GHz bands – maximum 24 dBm EIRP, 11 dBm/MHz EIRP density for LPI, and 14 dBm EIRP, 1 dBm/MHz EIRP

In addition, if RLANs are allowed in 6425 – 7075 MHz, in addition to the LPI and VLP power requirements, appropriate measures may also be required to protect non-GSO MSS feeder downlinks in a portion of this band, as several ground stations for the Globalstar and Omnispace NGSO MSS systems are situated in Australia. The SSWG would not oppose an ACMA consultation to consider such issues in greater detail.

We do not support any consideration of the use of the 6 GHz band for IMT, as it implies exclusive, primary use of the band for mobile services. Compatibility between high-powered outdoor IMT deployments and both FSS uplinks and downlinks in the same band will be difficult to achieve and impractical - refer to ITU-R Report S.2367 and ITU-R Report S.2368.

10.7 – 11.7 GHz, 11.7 – 12.2 GHz, 12.2 – 12.75 GHz: Ku-band space-to-Earth

The use of the 10.7 – 10.95 GHz and 11.2 – 11.45 GHz frequency bands by geostationary-satellite systems in the FSS shall be in accordance with the provisions of Appendix 30B of the ITU RR. Meanwhile, the 11.7 – 12.2 GHz frequency band, allocated to the BSS on a primary basis in Regions 1 and 3, is governed by Appendix 30 of the ITU RR. The BSS Plan and the FSS Plan provide each ITU Member State equitable access to spectrum and orbit resources. Late comers, usually developing countries, may no longer have access to unplan bands as early users have consumed those available and thus, in the spirit of ITU cooperation, the FSS Plan and BSS Plan must be protected.

Satellite operators have been utilising the unplan FSS allocated on a primary basis in the Ku-bands of 10.95 – 11.2 GHz and 11.45 – 11.7 GHz globally, 12.2 – 12.5 GHz in Region 3 and 12.5 – 12.75 GHz in Regions 1 and 3. Furthermore, there are operations as well concerning additional use/system in the FSS Plan and BSS Plan bands for wider coverage and more emission characteristics. The said bands, together with the related uplink, have been used by satellites for a long time and extensively for a myriad of applications including very small aperture terminal (VSAT) services, internet services, satellite news gathering, direct-to-home (DTH), tracking, telemetry and command (TT&C) purpose for satellites, aeronautical and maritime services.

WRC-23 agenda item 1.8 seeks to consider, on the basis of ITU R studies in accordance with Resolution 171 (WRC–19), appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution 155 (Rev.WRC–19) and RR No. 5.484B to accommodate the use of FSS networks by control and non-payload communications (CNPC) of unmanned aircraft systems (UAS). To ensure continuity of service provided by Ku-band satellites, UAS CNPC links in the frequency bands considered under WRC-23 agenda item 1.8 shall operate under FSS networks without safety status, together with other non-safety FSS networks under conditions laid out by their respective ITU submissions and associated coordination agreements. Safety of life or other special requirements for UAS CNPC operation shall not be used as an argument to request more protection than what is normally considered during the regular bilateral coordination process between FSS networks.

12.75 – 13.25 GHz: Ku-band Earth-to-space

Today, Earth Stations In Motion (ESIM) are being used around the world by airlines on thousands of planes, by the maritime sector on cargo, tanker, ferry and passenger vessels, and for public and private transportation on trains, buses, emergency response vehicles and other motor vehicles. The increasing demand from airline and cruise passengers, government

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density for VLP – is generally consistent with those studied and adopted in the UK, Europe and South Korea.

and enterprise sectors are resulting in a rapid growth in the demand for flight and cruise ship broadband internet.

The use of the frequency band 12.75 – 13.25 GHz by geostationary-satellite systems in the FSS shall be in accordance with the provisions of Appendix 30B of the ITU RR.

WRC-23 agenda item 1.15 calls for ITU-R studies on the possible operation of earth stations on aircraft and vessels communicating with geostationary space stations in the FSS in the 12.75 – 13.25 GHz frequency band (Earth-to-space), in accordance with Resolution 172 (WRC-19) and work has been progressing within ITU-R WP 4A. The agenda item intends to address the increasing demand for internet-based applications for the aviation and maritime industry and their passengers. The availability of the band for the use by aeronautical and maritime earth stations would allow satellite network operators to provide additional capacity for the growing needs in these sectors.

The SSWG recently released a paper[6] to brief DITRDC, the ACMA and other stakeholders on the progress of ITU-R technical studies on Ku-band GSO Earth Stations In Motion (ESIM) and the benefits for Australia in supporting the ITU-R studies and their consequent regulatory introduction into Australia.

The SSWG encourages the ACMA to support the development of ITU-R studies on Ku Band GSO ESIM in WP 4A, APG23, CPM23, and WRC-23, noting that Australia was one of the proponents for Ka Band GSO ESIM studies from the previous ITU-R study cycle (i.e. WRC-19). The SSWG also encourages the ACMA to incorporate measures within the domestic regulatory framework to promote the deployment of ESIM in the 13 GHz band for aeronautical and maritime broadband services.

13.75 – 14.5 GHz: Ku-band Earth-to-space

The frequency band 13.75 – 14.5 GHz is globally allocated to FSS on a primary basis. In the band 13.75-14 GHz, certain limitations, as provided in RR Nos. 5.502 and 5.503, are imposed on earth stations for the protection of other services in Australia also allocated in the band. In the band 14 – 14.5 GHz, earth stations located on board vessels (ESV) may communicate with space stations of the fixed-satellite service, in accordance with Resolution 902 (WRC-03).

As stated above (see '10.7 – 11.7 GHz, 11.7 – 12.2 GHz, 12.2 – 12.75 GHz: Ku-Band band space-to-Earth'), to ensure continuity of service provided by Ku-band satellites, UAS CNPC links in the frequency bands considered under WRC-23 agenda item 1.8 shall operate under FSS networks without safety status, together with other non-safety FSS networks under conditions laid out by their respective ITU submissions and associated coordination agreements. Safety of life or other special requirements for UAS CNPC operation shall not be used as an argument to request more protection than what is normally considered during the regular bilateral coordination process between FSS networks.

14 – 14.5 GHz: Ku-band Earth-to-space

For the frequency range 14.0 – 14.5 GHz, non-GSO ESIM are already authorised to operate in Europe via a CEPT/ECC decision for CEPT countries and it is expected that this band will provide additional opportunities for deployment of ESIM in other areas as well. A proposal for studies has been accepted in the APT Wireless Group (AWG) and this is anticipated to lay the groundwork for harmonised regulation for the operation of non-GSO maritime and aeronautical ESIM in our Region in due course. It is anticipated that work will commence in

[6] https://commsalliance.com.au/__data/assets/pdf_file/0020/84071/CA-SSWG-Ku-Band-GSO-ESIM-Future-of-Australian-Satellite-Services.pdf

the ITU-R to develop international regulations for their use in due course. Initial studies indicate that Ku non-GSO ESIM can be deployed in a manner that does not lead to unacceptable interference to other services, but further technical studies are required to support regulations for the authorisation of non-GSO ESIM in the 14.0 – 14.5 GHz portion of the Ku band.

Moreover, some Asia Pacific countries such as New Zealand and China have allowed the operations of Ku band GSO land-based ESIM also known as VMES (Vehicle Mounted Earth Stations) in their territory as indicated in APT Report# 110 in the band 14.0 – 14.5 GHz. In addition to APT Report# 110, the below table shows the developments of VMES in other regional organisations.

	Ku Band			
Terminal Type	**USA (FCC)**	**CEPT (ECC)**	**Europe (ETSI)**	**International (ITU)**
VMES	CFR 47 §25.226	ECC/DEC 18(04) published in 2019	EN 302 977	Recommendation ITU-R S.1857

Land-based ESIM considered in the ECC Decision 18(04) are to be deployed with GSO satellite networks already in operation or that may be deployed in the future. The ECC Decision 18(04) addresses the harmonised use, exemption from individual licensing, and free circulation and use of land based ESIM operating to Ku-band GSO satellite networks. This ECC Decision provides a regulatory framework for authorising land-based ESIM, on the condition that such deployment will not cause harmful interference to other authorised services. The regulatory framework specifies that land-based ESIM should be exempt from individual licensing and offered free circulation and use. The other authorised services within the CEPT are limited to the fixed service (FS) in the band 14.25 – 14.5 GHz, deployed in limited number of administrations, and radio astronomy service (RAS) in the 14.47 – 14.5 GHz, where astronomy observations are carried out at a limited number of observatories within the CEPT. The technical conditions established for land based ESIM to maintain compatibility with FS and RAS are also described in this ECC Decision.

Technical studies carried out by the CEPT have identified the technical solutions to protect the FS in the 14.25 – 14.5 GHz band and RAS in the 14.47 – 14.5 GHz band. Such protection is achieved by ceasing transmissions from land based ESIM in the frequency bands that overlap the frequency assignments of FS and/or RAS stations when the land based ESIM enter or located within the zones identified for the protection of FS and/or RAS stations ('protection zones').

14.5 – 14.8 GHz, 17.3 – 18.1 GHz: Ku-band Earth-to-space

The frequency bands 14.5 – 14.8 GHz, 17.3 – 18.1 GHz for the feeder links for the BSS in Regions 1 and 3, excluding Europe for the 14.5 – 14.8 GHz, are governed by Appendix 30A of the ITU RR.

The BSS Plan and the FSS Plan afford each ITU Member State equitable access to spectrum and orbit resources. Late comers, usually developing countries, may no longer have access to unplan bands as early users have consumed those available and thus, in the spirit of ITU cooperation, the FSS Plan and BSS Plan must be protected.

As stated above, both the BSS Plan and unplan Ku-bands have been extensively used by satellites for a wide range of applications. Stable regulatory environment is essential for the continuity of satellite services in Ku-band.

17.7 – 20.2 GHz: Ka-band space-to-Earth

The 17.7 – 20.2 GHz band is a FSS downlink band. In Australia and many other Administrations this band or portion thereof is shared with the Fixed Service (FS). In Australia, the fixed service in 17.7 – 19.7 GHz is defined in RALI FX-3 (18 GHz band).

Both the ACMA and NBN conducted studies in 2011 which showed that interference from FS into ubiquitous FSS terminals was unlikely due to the very narrow beams of FS antennas and the usual high placement of the antenna systems. Since then NBN FSS deployments have supported these findings.

This band is vital to the ongoing viability of FSS and, while sharing with FS is possible, sharing with FWA or mobile systems is not as the antenna systems are very different.

Recent comments by the US in WP-5A and WP-5C suggest they may be considering this band for some form of mobile service. The SSWG encourages the ACMA and the Department to oppose this move should it arise and to empower industry delegates to speak against any such comments when made.

20.2 – 21.2 GHz: Ka-band space-to-Earth

This band is the lower of the paired 'Defence 20/30 GHz' bands which have been held tightly by Defence for over two decades. These are FSS bands and at this frequency, coordination between satellite networks having orbital separations of 2° or more is possible. This means up to 60 GSO FSS systems could utilise this band along with a number of NGSO systems using ITU coordination procedures. These same ITU procedures combined with any genuinely necessary domestic requirements would also protect legitimate Australian Defence operations in the bands.

The SSWG calls on the ACMA to investigate actual Australian Defence use of the band and with that knowledge open these bands to civil systems as far as possible.

24.65 – 25.25 GHz: Ka-band Earth-to-space (feeders)

While the ACMA has allocated this band for 5G services, it has taken the necessary steps to protect NBN feeders. However the presence of 5G services may limit future systems and the SSWG calls on the ACMA to monitor FSS requirements and possibly make it simpler for new feeder links to be established.

27.5 – 29.5 GHz: Ka-band Earth-to-space

Australia is moving towards the final stages of releasing this band, on a shared basis in some parts and some areas with FWA. Given Ku-band has become congested and IMT has been encroaching into the C-band, so called '5G mid-band spectrum', this band is vital for the delivery of high throughput satellite services globally.

The SSWG is generally very supportive and grateful for the ACMA's work on this band, particularly the work done to enable Aeronautical ESIM (A- ESIM), however the SSWG remains concerned that the burden of coordination between other FSS applications and FWA in 28 GHz and 5G services in 26 GHz falls disproportionally on the FSS.

One of the ACMA's 'Principles of Spectrum Management' is a balance between certainty and flexibility. The ACMA also strives to look for the most economically effective use of the

band, however the SSWG believes these two worthy goals fail when looking at sharing between services in a band.

The SSWG encourages the ACMA to take a fresh look at the following issues in the 28 GHz band.

Sharing with Maritime ESIM (M-ESIM)

M-ESIMs are a high value service. They enable end to end transport logistics control, monitoring of ship systems and deliver modern broadband communication systems for both work and entertainment when on board. Having to turn these off and resort to narrow-band communications when in port is simply impractical.

For the sharing with FWA in 27.5 – 28.1 GHz, FSS gateways need to meet a PFD limit at the edge of the Area Wide Licence (AWL) in which FWA operates. For AWL-to-AWL coordination (which includes both FWA and FSS) this has been set by the ACMA at –91 dBW/m²/MHz measured at a height of five metres above the ground. A 6 dB increase in this power is available if the FWA system uses an adaptive antenna but is not available for a NGSO-FSS system using an adaptive antenna.

For M-ESIM the protection requirements are set at –112.2 dBW/m²/MHz measured at a height of 30 metres above the ground. This represents a 21.2 dB impost on M-ESIM. A more equitable balance would be to adopt –91 dBW/m²/MHz measured at a height of 5 metres above the ground for all services at an AWL edge and, in the case of M-ESIM recognise that port-side operations are a very high value use of the spectrum compared with a small incremental loss of service area to FWA at that port.

Aeronautical ESIM

The SSWG calls on the ACMA to adopt the same pfd limit and time percentages applied to AWL-to-AWL coordination for A-ESIM.

30 – 31 GHz: Ka-band Earth-to-space

See the discussion on 20.2 – 21.2 GHz.

37.5 – 42.5 GHz: Q-band space-to-Earth / 42.5 – 43.5 GHz, 43.5 – 47 GHz, 47.2 – 50.2 GHz, 50.4 – 52.4 GHz: V-band Earth-to-space

With the aim of providing high-capacity means of communication even to the most isolated regions, these bands are vital for the future development of satellite services. A large numbers of satellite network filings have been submitted to the ITU containing the said bands. At present, tens of Q/V-band satellites have been manufactured and plans are underway for future satellites intending to use these bands for gateway links and for user terminals as well.

As has become a habit, the IMT community is attempting to have the portions of the bands identified for IMT application. The satellite industry has seen many examples in the past that, despite sharing studies saying sharing is possible, 5G services simply displace any other service in the same band and geographic area.
With respect to sharing with the FS, the high gain, narrow beamwidth directional nature of Q/V-band antenna beams, together with high elevation angles for transmitting to satellites, result in small coordination zones that facilitate sharing.

The SSWG calls upon the ACMA to resist the push by IMT proponents for these bands given the vast amounts of spectrum they have already and to preserve these for satellite services and other services that successfully share these bands.

71-76 GHz : E-band space-to-Earth / 81-86 GHz : E-band Earth-to-space

This is an internationally allocated co-primary band for FSS and other services including FS. Footnote 561 of the Australian table includes specific protections for the FSS downlink in 74 – 76 GHz from FS services.

The E-band's large available bandwidth will support high throughput satcom services. The ACMA has already licenced many short P-P FS in this band, using a self-coordinated approach described in RALI FX20.

The high gain, narrow beamwidth directional nature of E-band antenna beams, together with high elevation angles for transmitting to satellites, results in small coordination zones that facilitate sharing with FS.

There is a large number of ITU-R FSS satellite network filings that include the use of E-band, which indicates the satellite operator intention to use this band.

Considering the satellite operator interest in using the E-band to provide high throughput services, the SSWG recommends that ACMA urgently undertakes planning for the introduction of a self-coordinated light-licencing framework for E-band to facilitate the early introduction of satcom services in this band in Australia.

Acronyms

ACMA	Australian Communications and Media Authority
APT	Asia-Pacific Telecommunity
AWL	Area Wide Licence
BSS	Broadcast Satellite Service
CEPT	European Conference of Postal and Telecommunications Administrations
CNPC	Control and Non-Payload Communications
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DTH	Direct-to-Home
ECC	CEPT Electronic Communications Committee
ESIM	Earth Stations In Motion
ESV	Earth Stations located on board Vessels (also called M-ESIM)
FS	Fixed Service
FSS	Fixed Satellite Service
FWA	Fixed Wireless Access
GSO	Geostationary Orbit
IMT	International Mobile Telecommunications
ITU	International Telecommunication Union
LA-WBB	Local Area Wireless Broadband
M-ESIM	Maritime ESIM
MSS	Mobile Satellite Service
NGSO	Non-Geostationary Orbit
N-MSS	Narrowband' MSS
P-P	Point to Point
RALI	ACMA Radiocommunications Assignment and Licensing Instruction
RLAN	Radio Local Area Network
RR	ITU Radio Regulations
SSWG	Communications Alliance Satellite Services Working Group
TT&C	Tracking, Telemetry and Command
UAS	Unmanned Aircraft Systems
VMES	Vehicle Mounted Earth Stations
WBB	Wireless Broadband
WRC	World Radiocommunication Conference

Communications Alliance Satellite Services Working Group membership

Amazon Web Services
EchoStar Global Australia
Foxtel
FreeTV
GVF
Inmarsat
Intelsat
Ipstar
Lockheed Martin
nbn
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