



10 June 2022

Australian Communications and Media Authority (ACMA)

Submitted electronically

RE: Comments of Inmarsat to the *Review of the 1.5 GHz band Discussion Paper*

Dear Sir/Madam:

Inmarsat welcomes the opportunity to provide comments on the Australian Communications and Media Authority's ("ACMA's") *Review of the 1.5 GHz band Discussion paper* published May 2022 ("Discussion Paper").

We note that this review addresses only the early first stage of possible future re-planning of the 1.5 GHz frequency band in Australia and so look forward to further engagement with the ACMA if a decision is ultimately made to proceed to the *preliminary replanning stage* for this important band.

1. Introduction and General Comments

Inmarsat is a leader in global mobile satellite communications, operating a system of 14 satellites that provide communications solutions to customers on land, in the air, and at sea. The company has a long track record of operating reliable global mobile satellite communications networks, sustaining business applications and mission-critical safety and operational applications globally, including in Australia. Inmarsat recently announced the rollout of Orchestra—a unique, global, multi-dimensional, dynamic mesh network that will support the growing demand for mobility worldwide with high average speeds and low average latency. In the largest-ever transformation of Inmarsat's market-leading services, Orchestra will provide a seamless integration of Inmarsat's ELERA (L-band) and Global Xpress (GX, Ka-band) networks with terrestrial 5G, targeted low earth orbit ("LEO") capacity, and dynamic mesh technologies, to create a single advanced solution for global mobility.

Our L-band services are extensively used across Australia from manufacturing and mining to farming and logistics. Our services are used to run, protect and enhance critical infrastructure systems and government services including the Australian defence forces, the electrical grid, first responders and railways.

2. Inmarsat Plans

As noted in our submission to the *Five-year spectrum outlook 2021-2026* ("FYSO"), Inmarsat launched in 2021 the first of two new "Inmarsat-6" satellites that will enable use of the extended L-band frequencies in Australia and other countries in the Asia Pacific region. The satellite is planned to be brought into operational use later this year. As noted in the 1.5 GHz Review, the

new satellite system will include the extended L-band frequencies of 1 518 to 1 525 MHz (space-to-Earth) and 1 668 to 1 675 MHz (Earth-to-space).

Since 2013, Inmarsat has introduced a general requirement for new mobile satellite service (“MSS”) terminals to be able to tune over standard L-band and extended L-band. This enables the same terminals to operate using the extended L-band frequencies when used in Europe, the Middle East and Africa, where extended L-band is already available, through the Inmarsat “Alphasat” satellite. This means that many terminals currently operating in Australia will be able to access the extended L-band frequencies with no equipment change, as soon as the ACMA authorises the use of those additional frequencies for MSS services.

3. Policy Initiatives

Inmarsat notes that several communications policy initiatives have been identified as relevant to replanning in the band.

In its “*Communications Technologies and Services Roadmap 2021-2030*”, December 2021, the Australian Space Agency (“ASA”) envisages using “space communications capability to drive economic growth and industry transformation”.

In addition, the ASA acknowledges that a “Collaboration across industry, government, the research sector and with our international space agency counterparts is vital to achieving a globally responsible and respected space sector that lifts the broader economy and inspires and improves the lives of Australians.”¹

As noted above, Inmarsat has an ongoing investment in the space industry in Australia and we are looking to continue and expand our presence. We see that this will continue to contribute to the Space Strategy and will assist in driving the Australian economy forward.

The 1.5 GHz Review notes the Digital Economy Strategy sets out how Australia will secure its future as a modern and leading digital economy and society by 2030. While largely focused on modern mobile systems, as well as digital infrastructure supported by NBN, companies such as Inmarsat are also playing their part to ensure that by 2030, the strategy’s goal are met, with:

- all Australians having access to high-speed internet services and the ability to use it effectively; and
- integrated data and technologies are making life easier.

Inmarsat has a long history of providing high-speed, reliable, broadband services as well as specialist services for the maritime and aeronautical industries.

4. Specific Comments

The Discussion Paper asks a series of questions designed to solicit “views on existing and emerging uses” in the 1 427–1 518 MHz, 1 518–1 525 MHz and 1 668–1 675 MHz bands (collectively, the “1.5 GHz band”). Below, Inmarsat responds to each.

¹ Communications Technologies and Services Roadmap 2021-2030, December 2021, page 3.

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| Q1. Are there any international arrangements or technology trends that the ACMA should be aware of? |
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In the 1.5 GHz Review, discussion of Recommendation ITU-R M.1036², a reference is made to the ongoing studies being undertaken in accordance with Resolution 223 (Rev WRC-19) and the possibility of technical measures to facilitate adjacent band compatibility between international mobile telecommunications (“IMT”) operating below 1 518 MHz and MSS operating above 1 518 MHz.

As noted in the review document, this work has been ongoing as a joint effort between Working Party 4C and Working Party 5D.

The 1.5 GHz Review notes that the outcome of this work may lead to a possible revision to the frequency arrangements contained in Recommendation ITU-R M.1036. More likely, and perhaps more importantly, will be the completion of a new Recommendation that provides advice to national administrations such as the ACMA on optimum sharing arrangements between IMT services below 1 518 MHz and MSS above 1 518 MHz. This new Recommendation will include suitable limits and requirements to enable sharing, including measures for use in areas where there is a greater likelihood of interference between IMT and MSS systems, such as in maritime ports, waterways and airports.

Existing MSS receivers operating in the bands above 1 525 MHz were not designed with the expectation of IMT/ wireless broadband (“WBB”) operating in the adjacent frequency band and may suffer from blocking interference from IMT base stations transmitting on the nearby frequencies. Also, IMT base station unwanted emissions will fall into the MSS band, above 1518 MHz or 1525 MHz, potentially causing interference that could prevent the reception of the satellite signal. Accordingly, IMT/WBB operation in the bands below 1 518 MHz creates interference to the MSS receivers. This has been recognised in the development of the ITU-R Recommendation on sharing between IMT and MSS systems.

The 1.5 GHz Review document notes that most IMT, or WBB, use around the world is in the frequency ranges below 1 492 MHz. This understanding is also shared by Inmarsat and is backed up by the information shown in Table 5 of the Discussion Paper, which shows the availability of 4G devices following the frequency division duplex (“FDD”) arrangements adopted in Japan and the supplemental downlink (“SDL”) arrangement for the band 1 452-1 496 MHz, which has been adopted in some countries. There are apparently only eight 5G devices that follow the n75 band (SDL in 1 432-1 517 MHz). Hence, despite the fact that the 1 500 MHz band was identified for IMT in 2015, the availability of 5G equipment is extremely limited and apparently no time division duplex (“TDD”) or FDD 5G equipment is available. It is also clear that mobile operators are focussed on the 3.6 GHz band, for which 5G equipment is more readily available and globally harmonized. The 1 500 MHz band has seen relatively small demand to date and we understand that Slovakia and Norway have postponed authorisation of the 1 500 MHz band due to lack of demand, and outside of Europe and Japan we are not aware of any country that uses the 1 500 MHz band for WBB. In particular, the USA will not allow use of this band for long term evolution (“LTE”) due to the critical government users in the band.

² Page 15.

Where demand for WBB exists in the 1.5 GHz band it appears to be narrow and focused on the 1 452-1 492 MHz portion of the band. However, the 1.5 GHz Review references information from the GSA regarding plans for use of the 1.5 GHz band by a number of countries. We feel that the list of countries is rather misleading as it includes countries that have allocated only a small portion of the band for generic mobile services which could even be decades old allocations with no plans for LTE 5G licensing. For example, our understanding is that Italy, Netherlands and Romania have current mobile operations, or planned operations, only in the 1 452-1 492 MHz portion of the band, leaving the remainder of the band (*i.e* 1 492-1 518 MHz) for other services. Countries like the USA and Germany have no plans to license LTE 5G in the band

Q2. What is the demand for access to the 1.5 GHz band for WBB, MSS and broadcasting services? Are there any other new services that should be considered?

Inmarsat's L-band system is used in large numbers for critical industrial, government and military applications across Australia and its territories. This heavy use and growing demand for MSS in Australia is currently in the "standard L-band" 1 525-1 559 MHz and 1 626.5-1 660.5 MHz segments and needed in the 1 518-1 525 MHz and 1 668-1 675 MHz band segments (the "Extended L-band") as is other countries.

With high reliability and small terminal size, L-band MSS will continue to drive industrial IoT in sectors such as energy, mining and transportation. Furthermore, L-band MSS will continue to support connectivity solutions essential to public safety, disaster response, telemedicine, remote education, and various other applications.

To support the growing demand for L-band MSS, Inmarsat launched its Inmarsat-6 ("I-6") F1 satellite in December 2021. I-6 is the first hybrid MSS satellite operating in the L-band (1 525-1 559 MHz and 1 626.5-1 660.5 MHz), Extended L-band (1 518-1 525 MHz and 1 668-1 675 MHz), and Ka-band (GX).

The L-band MSS network also provides unmanned aircraft systems ("UAS") operators with the ability to send and receive data beyond visual line of sight, which is important for safe and efficient air traffic management.

Given the demand for, and innovation in, the 1.5 GHz band, Inmarsat urges the ACMA to address the use of MSS in the Extended L-band as soon as possible.

Q3. What are the ongoing requirements for incumbent services in the 1.5 GHz band? Are there any viable alternative options?

As indicated in our response to Q2, Inmarsat has a need to use the entire 1 518 to 1 559 MHz MSS downlink band for an expanding range of MSS applications. And we need to be able to continue operating our MSS services without receiving harmful interference from future 1.5 GHz terrestrial IMT/WBB services.

We see no viable alternative options to our ongoing MSS operations in the 1.5 GHz band.

Q4. What planning scenarios should be considered in the 1.5 GHz band?

As the ACMA notes in the Discussion Paper, the 1 427-1 518 MHz band was harmonised for IMT (for example, 4G and 5G) within International Telecommunication Union (“ITU”) Regions 2 and 3 and most of Region 1 at WRC-15. However, use of the 1 427-1 518 MHz band for terrestrial IMT poses a significant risk of harmful interference to legacy and future MSS operations from out-of-band emissions and receiver overload in the MSS terminals.

In fact, over the last 7 years, ITU-R Working Parties 4C and 5D have been jointly developing a Recommendation to assist administrations such as Australia to undertake their domestic L-band re-planning work. However, the sharing and compatibility studies have been technically complex and it is currently unlikely that this Recommendation (together with a consequentially updated ITU-R M.1036 Recommendation for this band) will be available for some time yet.

If the ACMA decided to proceed prior to the publication of the above ITU-R Recommendations, the simplest way to avoid compatibility issues would be to limit terrestrial IMT deployments to the 1 452-1 492 MHz band. There is extensive use of land MSS services in Australia, which are used in rural and urban areas. Land MSS terminals include small, low power IoT terminals which have limited capability to implement improved receiver filtering. To provide compatibility with those services the most practical solution is to limit WBB use to the band 1 452-1 492 MHz, leaving use of the band 1 492-1 518 MHz for other applications which are more compatible with MSS use. Several European Conference of Postal and Telecommunications Administrations (“CEPT”) administrations have already taken this approach, including the Netherlands, Romania and Malta.

If the ACMA did decide to authorise such WBB deployments in all or part of the 1 427-1 517 MHz band (scenario 1 and 2) or 1427 – 1518 MHz band (scenario 3), especially the 1 492 – 1518 MHz band before the ITU-R Recommendations were available, it would need to establish mandatory (and enforceable) technical rules to ensure operational compatibility between the terrestrial and satellite services. In particular, appropriate power flux density limits would be needed to protect MSS operations at ports/waterways and airports where MSS terminals are in regular use. Additional protections could include frequency separation below 1 518 MHz, i.e. enforcement of a formal frequency guard band together with 5G base station deployment restrictions in critical areas like airports and harbours. Without such protections, the introduction of WBB into the 1 492-1 518 MHz band could disrupt critical maritime and aeronautical safety operations. Even with these measures, land MSS operations would remain at significant risk of harmful interference.

WBB Planning Scenarios

In relation to the WBB planning scenarios, the potential for interference from the WBB systems to the MSS systems is substantially increased if the mobile, or user equipment (“UE”), devices occupy spectrum near the top of the band. Accordingly, Inmarsat prefers Scenario 1: SDL WBB or Scenario 3: FDD WBB, but with adequate guard band to ensure compatibility with MSS services in extended L-band and standard L-band. These scenarios provide base station (“BS”) transmitters in the upper portion of the band.

Inmarsat notes that a specific guard band has not been proposed but that the ACMA is seeking comments. For the reasons described above, Inmarsat recommends a guard band (i.e. no WBB deployment) between 1 492 MHz and 1 518 MHz. This will reduce the likelihood of interference to MSS systems and is in line with the spectrum usage in other parts of the world. This “guard band” could be used for other services which are more compatible with MSS operations.

MSS Planning Scenarios

Inmarsat considers that a mixture of scenarios 4 and 5 is most appropriate. The likelihood of interference to or from most of the existing incumbent services in the bands above 1 518 MHz is low. On the other hand, fixed services can employ substantial radiated power to the extent that land-based MSS receivers will receive interference over most, if not all, of the operating band. On this basis, Inmarsat considers that the fixed service should not share with the MSS systems. In line with our suggestions above, it may be possible to accommodate the fixed service in parts of the bands 1 427-1 452 MHz and 1 492-1 518 MHz in a manner compatible with MSS operations.

Regarding radio astronomy use of the band 1 660-1 670 MHz, such use is likely to require some constraints on MSS operations in the ARQZWA, but such constraints may be limited to the 2 MHz band which overlaps with the MSS: the band 1 668-1 670 MHz. Since MetSat and Meteorological Aids use is in the band 1 675-1 710 MHz, which does not overlap with MSS, there should be no compatibility issues.

We also note that Defence is licensed in the bands but it is not clear whether there is currently actual overlap with the MSS band 1 518-1 525 MHz. We note that Defence has requested that the entire band 1 435-1 535 MHz be retained for aeronautical mobile telemetry (“AMT”) operation at select Defence ranges and bases (page 12). AMT ground stations could receive interference from MSS downlinks, in particular if AMT antennas are pointed towards the GSO MSS satellites. We suggest therefore that any ongoing use of the band 1 518-1 535 MHz for AMT systems should be on the basis of not seeking protection from MSS downlinks.

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| <p>Q5. Comment is sought on the coexistence scenarios identified, including the ACMA’s preliminary thinking on these scenarios. Are there any other coexistence scenarios the ACMA should consider?</p> |
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Inmarsat fully agrees with the ACMA’s statement in the Discussion Paper that “There are currently arrangements in place for MSS to operate in the 1 525–1 559 MHz frequency range. The possible extension of these arrangements to cover the 1 518–1 525 MHz frequency range is also under consideration. Since this spectrum is used for MSS space-to-Earth transmissions, coexistence between WBB transmitters and MSS receivers needs to be considered.” MSS services in the 1 518-1 559 MHz band fulfill crucial public safety functions, including by providing communication services for the delivery of humanitarian aid and during disaster relief operations. MSS services also support key, growing sectors of the economy, including the maritime and aeronautical industries; Inmarsat MSS services in the 1 518-1 559 MHz band include use for the global maritime distress and safety system (“GMDSS”) to support maritime safety operations and aeronautical mobile-satellite (R) service (“AMS(R)S”) to support air traffic management.

WBB services - Coexistence with services above 1 518 MHz

The Discussion Paper notes the likelihood of interference from WBB systems below 1 518 MHz into MSS systems above 1 518 MHz. It also notes the ongoing work in the ITU-R Working Parties and the possibility of implementing measures to enable coexistence.

As noted above, Inmarsat recommends that WBB is limited to the band below 1 492 MHz, which would avoid the need for any particular mitigation measures with respect to MSS operations. This applies to potential new MSS operations in the band 1 518-1 525 MHz and existing MSS operations in the band 1 525-1 559 MHz. If, however, the ACMA does consider WBB in the band 1 492-1 518 MHz, it will be necessary to include suitable limits to enable sharing in areas where there is a greater likelihood of interference between IMT and MSS systems, in particular in maritime ports, waterways and airports. Inmarsat would recommend the use of protections as set out in the evolving ITU-R Recommendation. These measures would constrain the use of WBB in the vicinity of ports/waterways and airports to provide compatibility with MSS operations at those locations.

Regarding minimum MSS receiver blocking requirements, these requirements have already been adopted in applicable equipment standards and there will be a gradual roll-out of new equipment in Australia which meets this requirement.

MSS – Coexistence with radio astronomy services

Inmarsat agrees with the ACMA's comments with respect to extending the CSO class licences to cover the frequency range 1 668 to 1 670 MHz. This would be a significant constraint on MSS operations but would be an acceptable constraint if limited to this 2 MHz band. Regarding the possible extension of subsection 8(2) to cover 1 670-1 675 MHz, this restriction seems to be unnecessary given that MSS has operated in the band 1 626.5-1 660 MHz, adjacent to the radioastronomy band, for many years, apparently without concern.

MSS – Coexistence with other services

Regarding coexistence with fixed services, stratospheric balloon communications and aeronautical mobile services in the band 1 427-1 518 MHz, Inmarsat does not foresee the need to clear those services from that band.

Comments in relation to sharing with incumbent services and with WBB have been outlined in the sections above.

Regarding coexistence with fixed services, stratospheric balloon communications and aeronautical mobile services in the band 1 518-1 525 MHz, such operations could cause interference to MESs if authorised in the same band. Inmarsat does not have the information on the extent of use of these services to judge the likely impact but given that the use of the 1 500 MHz band by the fixed service is reducing, it seems possible that any ongoing fixed service use could be concentrated in the band below 1 518 MHz. In any case, it is important that MSS downlinks can be provided in this band to a power flux density level necessary for service to users in Australia.

Regarding coexistence with fixed services, stratospheric balloon communications and aeronautical mobile services above 1 525 MHz, since the band above 1 525 MHz is already used for MSS downlinks in Australia, there should be no new issues.

Regarding coexistence with Metsat services in the band 1 668-1 675 MHz, we note there would be partial overlap with the apparatus licence in the band 1 673.38-1 678.62 MHz at Yarragadee. It is Inmarsat's experience that Metsat use of the band 1 670-1 675 MHz has largely transitioned to the adjacent band 1 675-1 710 MHz. It would therefore be worthwhile to check that Metsat use of the band 1 673.38-1 675 MHz at this station is still required. Regarding coexistence with Met Aids and Metsat services operated by the Bureau of Meteorology in the bands 1 679.85–1 680.15 MHz and 1 683–1 710 MHz, we agree that there should be no issue with respect to MSS operations in the band 1 668-1 675 MHz since there is no frequency overlap.

Respectfully submitted,

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