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London, 4th March 2022

Re: Long-Term Spectrum Outlook for Independent Communications Authority of South Africa

Dear Dr Modimoeng,

Avanti Communication would like to thank the Independent Communications Authority of South Africa (ICASA) warmly for the opportunity to present our comments on ICASA's Long-Term Spectrum Outlook. We would like to congratulate ICASA on a comprehensive piece of work and commend the stakeholder consultation process to refine the Spectrum Outlook for it to serve the goals ICASA has formulated to achieve the economic and social benefits of spectrum use for South Africa in an ever-evolving ecosystem of technologies, applications and use cases.

Avanti Communications is a world-leading provider of agile, secure and pioneering satellite technology across Africa, the Middle East and Europe. We invested $1.2 billion in the latest Ka-band technology and shaped it to meet the communications industry, making Avanti the leading Ka-band connectivity provider in Sub-Saharan Africa. We operate a fleet of 5 satellites with 50 GHz of Ka-band capacity and we own a fully licensed, resilient and secure ground network of 7 gateway earth stations.

Across our HYLAS fleet, more than 70% of our coverage is over Africa, where we have been connecting people for more than a decade. To help power growth, we have also committed 75% of our total investment to help connect the continent. Avanti is an active stakeholder in South Africa, as you and your colleagues may remember from the visit to Avanti's gateway just before the pandemic began.

Avanti believes everyone has potential to 'Be More', and connectivity empowers people to achieve their full potential. Avanti fully supports ICASA's aim to bring the potential efficient spectrum use holds to its fullest benefit for the South African nation, particularly in a post-pandemic world, where reliance on connectivity is evolving, and the unconnected become even further removed from the digital world and its socio-economic benefits.

We respectfully submit Avanti's comments to this consultation and look forward to discussing the next stages of this Spectrum Outlook document in the near future.

With kind regards,

Bridget Sheldon-Hill
Legal Counsel
Avanti Communications Group

Please note Avanti has selected questions where our industry view would be best placed to provide an insight, we have chosen not to comment to the questions not mentioned below. Avanti has also contributed to the GSOA submission for this consultation, therefore some of the answers below also refer to the GSOA position on particular questions.

Questions:

To Section 1: Introduction

1. Please comment on whether the above captures the relevant regulatory and policy aspects of long-term spectrum planning?

This section sets out the framework in which, and the conditioning factors influencing how South Africa's spectrum policy will change in the next 30 years, and beyond. It uses predicted growth in Mobile use (see section 4.2.1) as an example that a possible increase in spectrum use may need to be catered for. However, this raises some important questions, mainly how licensing of mobile (terrestrial) services can be accommodated in coexistence with other services deployed in the same frequency band or adjacent bands. It is extremely important that regulators approach this licensing in a way that enables the continued and safe operations of existing and future services, in particular Fixed Satellite Services (FSS).

Avanti as a satellite operator needs certainty about the conditions that will guarantee a stable regulatory environment to support its considerable investment in infrastructure, for its local partners to provide broadband and other connectivity services to citizens and consumers in South Africa. It is essential that frequency bands allocated to both terrestrial and satellite services contain the necessary regulatory provisions to ensure the delivery of interference-free services.

Avanti would like to underline that technical analysis has demonstrated that co-existence between ubiquitously deployed satellite services and terrestrial mobile services (co-frequency and co-coverage) is not feasible (please refer to the relevant ITU studies of this matter). Co-frequency sharing between FSS and MS remains complex especially in the case of FSS Earth stations at known location, as large separation distances must be observed in order to avoid harmful interference into the earth station receivers. In the case of space station receivers, the aggregate interference arising from the ubiquitous deployment of mobile cellular terminals will inevitably result in harmful interference unless administrations find an effective mechanism to monitor and control this situation globally.

The licensing of mobile services for 5G also raises the question of the amount of spectrum needed for each mobile operator. Several studies and reports demonstrate that it is possible to commence deploying 5G networks with (far) less spectrum than 100 MHz per operator (please refer to the GSOA input to this consultation for details of these studies), but this view does not take into account improvements in efficiency of spectrum use.

Avanti as a company is committed to enabling people, countries, and continents to 'Be More'. By helping communities across South Africa to become better connected, we have been able to create better access to education, medicine and help provide a safer environment for them to live in.
Avanti supports ICASA's proposals to identify future technological trends, and its suggestion to keep the regulatory framework flexible and undogmatic, and under regular review. Avanti would like to urge ICASA to ensure such proposals provide a balanced approach and include an ecosystem of different technologies to provide connectivity for urban, suburban and rural areas without further creating a digital divide among communities.

To Section 3: Spectrum Management and Economic Impact – 3.1 Impact of Broadband

2. Are there services, in addition to broadband, that ought to be considered as important for economic growth? If so, please explain what these services might be and what the trade-offs are between using spectrum for broadband and alternative services. Please provide any evidence from other countries that may be relevant?

The Spectrum Outlook rightly identifies low access to broadband, particularly in rural provinces of South Africa, as an obstacle to economic growth. The matter of the connection between broadband service and economic growth has been subject of a number of international studies in the last decade. These well-known studies postulate this link as an endogenous problem and one that is subject to network effects, that is, where the benefits are appreciable after a certain threshold of connections have been put in place (e.g. World Bank, 2016: https://documents1.worldbank.org/curated/en/178701467988875888/pdf/102955-WP-Box394845B-PUBLIC-WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf). These studies also indicate that it likely flows both ways when discussing the topic of causation. Other authors have postulated that the nature of the influence of telecommunications upon economic development and growth lies in the presence of positive externalities, complementarities, and a “network effect”, which other types of infrastructure either lack or have in a lesser amount. This does not take into account In particular, the presence of positive externalities in the relationship between the telecommunications sector with other sectors of the economy is what is said to increase the efficiency of the economy as a whole. However, inter-system interference and inter-service interference is a negative externality, which requires regulatory control in order to ensure that the welfare achieved from spectrum resources can be maximised.

Sub-Saharan Africa has succeeded in the last decade in bringing voice services within reach of some three quarters of the population. Still, there remains key challenges to tackle to further develop broadband connectivity in Africa. Rural connectivity in Africa remains a challenge with many areas not having even basic connectivity. Telecommunications is an essential service, and broadband access is vital to all members of society. A significant challenge in terms of connectivity in rural Africa is low population densities coupled with the low income of the population. Rural Africa lacks much-needed supporting infrastructure such as roads and electric power. The low population density, low income, and lack of supporting infrastructure make the establishment and continued operation of conventional terrestrial ICT networks in these areas economically unsustainable. In addition to broadband services such areas could benefit from a variety of services that can also be provided through satellite telecommunications which are all important avenues to economic growth: broadcasting, connectivity for humanitarian and inter-governmental programs, emergency response, supporting healthcare services (telemedicine), connectivity for critical operations (oil and gas, mining…), government defence, maritime, air traffic management and navigation, mobile backhauling.

Satellite already provides the bandwidth needed for Internet service to end users. Satellite has and continues to provide expanded Internet bandwidth for sub-Saharan Africa and South Africa. Access to satellite broadband will only continue to increase with the construction of new High Throughput and Ultra-High Throughput GSO and NGSO satellites.

Avanti supports Mobile Network Operators (MNOs) across the continent and in South Africa with its Extend service. Designed specifically for MNOs, Avanti Extend provides high-performance and cost-effective 2G, 3G and 4G solutions to remote and hard-to-reach areas across sub-Saharan Africa. This enables customers to provide reliable cellular service to the 100 million people living in challenging locations that would otherwise be impossible to reach using traditional terrestrial infrastructure.

Satellite communication remains the most viable way of ensuring Universal Access to broadband in South Africa, and the latest generation of satellites will provide even more options for consumers in South Africa, and in so doing will help South Africa to erase the effects of the existing digital divide.

In addition, the benefits that other technologies can provide to the overall economy and society should not be disregarded, such as earth observation satellite services - which require spectrum - supporting agriculture, disaster management and other economically critical fields.

To Section 3.2 Broadband Penetration in South Africa

3. Please comment on the above assessment of the status quo on broadband penetration in South Africa, and what role spectrum may play in addressing the gaps identified?

Avanti supports Africa's target of achieving a higher broadband penetration by supporting its MNO's with our own satellite service, Avanti EXTEND. This is a new managed service for rural connectivity, which brings together terrestrial and satellite use of spectrum to support partners in their efforts to connect rural Africa. Avanti EXTEND provides high-performance and cost-effective 2G, 3G and 4G solutions to remote and hard-to-reach areas across sub-Saharan Africa, including South Africa. It enables MNOs and other partners to provide reliable cellular service to the 100 million people living in these challenging locations that would otherwise be impossible to reach using traditional terrestrial infrastructure.

The critical issue for South Africa today expanding coverage and bridging the digital divide. Avanti has demonstrated that satellites, and especially the new generation of high throughput satellites, have a vital role to play in ensuring that no one should ever be excluded from the knowledge society, and this will help South African users keep pace with market growth. However, regulatory uncertainty can seriously undermine the investment needed to ensure growth for the satellite industry.

The satellite industry is constantly evolving and is at the forefront of innovation. The recent introduction of HTS and VHT GSO and NGSO satellites aims to bring much more satellite capacity to the region. The lower unit costs will enable significantly lower retail pricing for satellite broadband services within Africa and South Africa.

Terrestrial networks are vulnerable to major man-made and natural events that can result in significant service outages. Satellite services are not vulnerable to these types of outages and can provide robust capabilities through these types of disasters.

Lastly, Avanti has, and continues to demonstrate that satellite broadband is the key to achieving rural access throughout Africa. Therefore, it is a key ingredient for equitable socio-economic development. Satellite bandwidth can be delivered to any location in South Africa. The socio-economic benefits of providing broadband through satellites in rural areas include helping to redress the urban/rural divide in broadband access, and the implications for economic growth associated with broadband.

To Section 3.3 Key Trends

4. What future changes, if any, should ICASA examine with regard to the existing licensing regime to better plan for innovative new technologies and applications and allow for benefits that new technology can offer, such as improved spectrum efficiency?

From the satellite perspective, the following principles should form the basis of any framework for satellite licensing in South Africa:

- Licensing of satellite networks or services should comply with rules that govern radio spectrum and associated orbital resources;
- An "Open Skies" policy, where landing rights are not imposed as an additional requirement in addition to a separate domestic authorization process;
- Transparent regulatory framework with clear rules to establish regulatory certainty to support a long-term investment environment;

- Domestic user terminals should be licence-exempt or licenced without the need for individual terminal-by-terminal authorisation (*e.g.*, on a blanket licensing basis);
- Free circulation of foreign visiting earth station in motion (ESIM), based on mutual recognition of authorisations issued by other countries;
- Publish timely procedures for authorising user terminals operations;
- Ensuring adequate spectrum for existing and future satellite services allowing for innovation; and
- Reasonable spectrum fees based on administrative costs.

To Section 3.3 Key Trends
5. What future emerging technologies are to be taken into consideration and which technologies will have a significant impact? When are these technologies expected to become available?

Today, satellite broadband services provide connectivity to fixed locations and mobile users wherever they may be around the globe. As detailed under question 3, Avanti's Extend product extends the reach of MNOs and brings connectivity to rural and ultra-rural communities in South Africa.

To Section 3.3 Key Trends
6. What and how will technology developments and/or usage trends aid in relieving traffic pressures? When are these technologies expected to become available?

GSOA would like to highlight the following technology developments that are geared towards ensuring that satellite broadband services are part of the overall 5G ecosystem:

- Massive Multiple-Input-Multiple-Output (MIMO) – This technology entails the use of a multiple antennas at the transmit and receive communication endpoints. MIMO technologies will improve network coverage and deliver enhanced network capacity, without imposing additional spectrum bandwidth requirements. MIMO is a key feature of the 5G NR standard (https://www.rcrwireless.com/20210921/carriers/massive-mimo-boosts-capacity-and-availability-for-5g-operators-in-speed-tests-analyst-angle).
- Spectrum Refarming – Mobile network operators (MNOs) across the globe have commenced decommissioning of legacy 2G/3G networks. Some of these network shutdowns have been initiated by regulators in consultation with the industry, but most have been operator-led. The spectrum released through these decommissioning initiatives can be refarmed for the 5G networks thus providing ample additional spectrum bandwidth to cater for the forecasted mobile data traffic growth. Based on GSOA's assessment, the decommissioning of current 2G/3G networks in South Africa has the potential to unlock a minimum of 186 MHz of spectrum bandwidth (assuming migration from the currently assigned 900 MHz and 2100 MHz spectrum bands).
- Spectrum for Wi-Fi – Using the mm-Wave spectrum made available by WRC-19 to ensure that localised traffic pressures can be offloaded from cellular networks onto HTS satellite networks.

To Section 4: Spectrum Demand Outlook - 4.2. Spectrum Outlook for Commercial Electronic Communications Network Services (Fixed, Mobile, Including IMT)
11. How should demand for commercial mobile services and IMT in the next few years be determined? What traffic model should be used in South Africa for traffic demand expectations? What are your comments on the spectrum requirements set out on Table 2 Reference source not found.? What are your views on using the Recommendation ITU-R M.1768-1 methodology to forecast IMT spectrum demand in South Africa? Please complete the input parameters in the

attached spreadsheet for the market study information needed to apply the Recommendation ITU-R M.1768-1.

GSOA recommends that ICASA conduct an audit analysis and examine what progress has been made with regards to IMT deployment, and how much spectrum has yet to be allocated and licensed or used from already existing and harmonized mobile spectrum. New spectrum identifications for IMT in South Africa should take into account all other uses of the bands of interest.

Whilst the ITU identifies particular pieces of spectrum for IMT services, not all of that spectrum may necessarily be able to be used for those services. In some cases, the spectrum needs to be divided into specific frequency bands.

The ITU has devoted several study cycles and WRCs to this topic. At WRC-19, the decisions taken opened up entirely new allocations for IMT deployment. Avanti believe that ICASA's spectrum policy should be to incentivise the IMT industry to effectively use the spectrum that they already have, rather than continually seeking more.

To Section 4.2.1. Mobile

17. Assuming that South Africa follows the ITU's recommendations to assign up to 1,940MHz of spectrum for IMT-2000 and IMT-advanced services, and that South Africa follows trends in Europe for potentially another 2,000 MHz of spectrum for IMT-2020, what bands would need to be freed up?

ITU Region 1 covers Europe (including the CIS), the Middle East and Africa. As these regions have significantly different uses of spectrum driven by different regulatory regimes (for example, the European Union which makes directives for all countries in its purview). In Africa, the amount of spectrum identified for IMT by the ITU amounts to a total of between 1272 and 1372 MHz depending on the specific country, from which 1080 MHz forms harmonised mobile bands.

To date the average amount of spectrum licensed in this region today is 477 MHz, which is well under 50% of that which is harmonised. There remains vast amounts of harmonized spectrum identified for IMT that can be allocated and licensed before additional spectrum is identified. GSOA encourages ICASA to release identified IMT spectrum before considering additional spectrum for IMT. Any future spectrum should only be identified and released once a market-based need has been identified.

To Section 4.2.1. Mobile

18. What are your views on reallocating the following bands for IMT over the next years?

Above 3600 MHz and up to 4200 MHz, satellite (FSS) services are essential for video distribution, with the result that C-band spectrum is intensely used by satellite, both on a frequency and geographic basis. This part of C-band frequencies is heavily used and is a cornerstone of satellite services, providing connectivity within and to areas where other available satellite frequency bands are inappropriate or where other technologies cannot provide reliable coverage and services. Many operators utilize C-band frequencies for critical satellite services, such as the distribution of television channels, broadcasting and the coverage of special events (such as major sports events), network connectivity and network extension services, VSAT networks, government services, disaster relief, and other applications.

In South Africa, as is the case across the Africa, C-band is the backbone of video distribution as was noted by the responded to the ICASA inquiry for the implementation of the Radio Frequency Migration Plan and IMT Roadmap (Government Gazette Number 45247 - Notice 580 of 2021). In addition, FSS serves as the backhaul for cellular networks in much of Africa including South Africa.

"There is considerable concern that the rollout of 5G could simply serve to aggravate the digital divide. For example, in sub-Saharan Africa less than half the population has access to mobile services, and the dominant technology remains 2G. Even in South Africa, around a third of subscribers do not have access to a smartphone."

According to GSMA itself, mobile penetration in Sub-Saharan Africa in 2020 was at 45%, while mobile internet user penetration was at 26%. In the foreseeable future, 4G will be the dominant technology which currently only amounts to 11% of all connections, while 2G still amounts to almost 45% of all connections. Furthermore, according to the GSMA (https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/09/GSMA_MobileEconomy2020_SSA_Eng.pdf):

"5G trials have been conducted elsewhere in Sub-Saharan Africa, including in Gabon, Kenya, Nigeria and Uganda. However, mass adoption of mobile 5G is not imminent in the region. With significant unused 4G capacity and 4G adoption still relatively low, the focus in the near term for operators and other stakeholders is to increase 4G uptake".

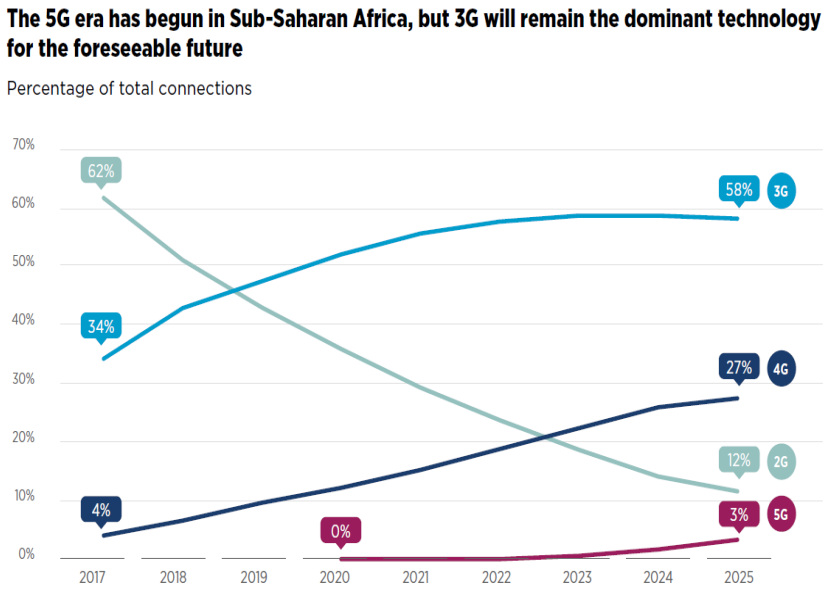

Figure 1: GSMA research does not support the need for more spectrum, since 3G/4G will be the dominate technology

As can be seen from the above figure, simply adding more mid-band spectrum is not the answer to the challenges faced by the mobile industry in South Africa and broadly speaking in Sub Sahara Africa.

Therefore, Avanti supports the notion that efficient and effective management of spectrum is key to maximise the opportunities that mobile connectivity can bring to society, by making sure the required spectrum resources are available under the right conditions and thus lowering broadband costs, increasing coverage and boosting connectivity. Hence it is most efficient to first ensure that existing spectrum in both sub 1GHz and 3.5 GHz band ranges, as well as in other IMT bands, is fully utilized before seeking additional spectrum for future 5G technology. This considering that 5G technology will only account for 2% of all connections in Africa by 2025 (according to GSMA, "The Mobile Economy 2020" Report, 2020) while migrating satellite services operating in C-band today will be welfare destruction.

• 24 250-27 500 (3250MHz)

GSOA supports the identification of the globally harmonized 24,250-27,500 GHz (26 GHz) band for IMT. Satellite operators provide broadband services in the adjacent 28 GHz frequency band. As such, GSOA is concerned about potential out-of-band emissions from the 26 GHz band by terrestrial IMT/5G systems into the 28 GHz band. Increases in power by terrestrial IMT/5G systems in the 26 GHz band could increase IMT out-of-band emissions into the 28 GHz band. Increased out-of-band emissions in the 26 GHz band could adversely affect the interference environment in the 28 GHz band by interfering with the ability of satellite receivers in space to receive signals from earth stations. Therefore, GSOA respectfully requests that ICASA limit out-of-band emissions from IMT operations into the 26 GHz band to protect satellite broadband service in the adjacent 28 GHz band. GSOA also requests that ICASA ensure that the *aggregate level* of IMT out-of-band emissions from the 26 GHz band into the adjacent 28 GHz band does not cause harmful interference to satellite receivers in the 28 GHz band.

GSOA members have supported the study and development of reasonable operating parameters for IMT in the 26 GHz band throughout the ITU WRC-19 process. To this end, GSOA urges ICASA to conform domestic implementation of terrestrial IMT/5G to the operating parameters decided in Resolution 242 (WRC-19). Among several items, GSOA emphasizes the importance of the portion of Resolution 242 (WRC-19) that requires that IMT base stations within the 26 GHz frequency band with high power operations (e.i.r.p. per beam exceeding 30 dB (W/200 MHz)) not point their antenna beams upward and maintain a minimum separation angle of ≥ 7.5 degrees from the geostationary orbit. GSOA urges ICASA to include these technical limitations on IMT base stations, as outlined in Resolution 242 (WRC-19).

These power and separation angle limitations provide specific limits on the IMT services operating in the 26 GHz band to protect existing satellite services in the adjacent 28 GHz band. Therefore, GSOA respectfully requests that ICASA adopt these IMT limitations to protect critical satellite broadband services operating above 27.5 GHz.

To Section 4.3.3 Defence Systems

32. What will impact on the demand for these services/applications in the coming 10-20 years? What is the realistic demand for these services in the next 10 to 20 years? Are there adequate spectrum allocations for Defence services in South Africa?

Avanti believes that key spectrum bands (e.g. for space operations at 2GHz, terrestrial military and aeronautical radar systems in L, S, and C-band, satellite services in X-band and vital government satellite services in the upper Ka-band) must be protected.

To Section 4.3.8 Satellite Systems

39. What will impact on the demand for these services/applications in the coming 10-20 years? What is the realistic demand for these services in the next 10 to 20 years? Are there adequate spectrum allocations for Satellite services in South Africa?

The demand for spectrum for satellite services is considered on a band-by-band basis in the answers given to question 40. below. However, Avanti firmly believes that satellite services will continue to play a vital role in telecommunications throughout Africa and the world, that satellite services will require access to spectrum to deliver this and the fundamental role satellite systems will play in the 5G ecosystems of the future and the physics of radio link budgets, particularly for mobile applications (e.g. ESIM) means that refarming to higher bands above Ka-band is not feasible as a strategy.

To Section 4.3.8 Satellite Systems
40. Which applications and allocations will require the most frequency spectrum demand in the following frequency bands?

- ***Ka-band***

Ka-band will continue to be a critical band for the delivery of Avanti's satellite services now and in the long term in South Africa. These services include, through Avanti's partners, broadband services direct to homes, businesses and government users as well as cellular backhaul services for MNOs. More generally for the satellite industry, today there are -hundreds of millions of devices across the globe providing users with broadband connectivity over Ka- band satellite networks and more are being launched and put into service. These number are projected to grow in the years ahead, including in South Africa. In addition, innovative satellite designs and smaller, more mobile user terminals are expected to increase the places and users that Ka band satellite networks are able to serve. All of these developments will require adequate spectrum resources for existing and future services in the Ka band.

To Section 4.3.8 Satellite Systems
41. What and how will technology developments and/or usage trends aid in relieving traffic pressures and addressing spectrum demand for satellite services? When are these technologies expected to become available?

Advances in satellite antenna technology, particularly the development of stabilized and flat panel array antennas, capable of maintaining a high degree of pointing accuracy even when moving rapidly, have allowed the development of mobile terminals with very stable pointing and efficient form factor characteristics. These mobile terminals are designed to operate in the same interference environment and comply with regulatory constraints for ubiquitous FSS earth stations.

To section 6.3 Alternative Spectrum Sharing Scenarios
59. Are there specific frequency bands that will be in higher demand over the next 10 to 20 years and do you expect higher demands for spectrum in these frequency bands in South Africa? Are there any other frequency bands that should be considered for release in the next 10 to 20 years for commercial mobile, fixed, satellite, or licence-exempt that are not discussed above? Provide motivations for your proposal.

Avanti supports the view expressed by GSOA that highlights the anticipated future high demand for the Q/V frequency bands. These frequency bands will play a vital role in delivering feeder links to next generation high throughput satellite systems. The Q/V bands are highly favourable due to their sizeable contiguous bandwidth and the opportunity to augment bandwidth other bands. The utilisation of Q/V bands will also be fuelled by the rapidly falling costs of Q/V band components, making satellite systems that operate in these bands more affordable.

Satellite operators such as Inmarsat are conducting trials in the Q/V band to better understand performance in real world deployment scenarios.