

AVANTI RESPONSE
TO THE RADIO SPECTRUM POLICY GROUP'S (RSPG) PUBLIC CONSULTATION ON STRATEGIC
SPECTRUM ROADMAP TOWARDS 5G FOR EUROPE – 2nd Draft RSPG Opinion on 5G networks

Avanti notes that the RSPG Second Opinion on 5G networks is a further development of the roadmap to facilitate the launch of 5G on a large scale in Europe starting in 2020 and that the goal of the RSPG is that the benefits of 5G-based services are made available to all European citizens in a timely manner, driving industrial and societal transformation and economic growth in Europe from 2020 and beyond.

Avanti's response is hereby issued in accordance with the RSPG's call of 23rd November 2017 as published on <http://rspg-spectrum.eu/public-consultations/> and the RSPG's second Opinion on 5G networks, which recognises that 5G promises to enable the delivery of a diverse set of applications and new services in a number of different markets, going beyond the traditional mobile broadband market.

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Response Contents:

1. About Avanti
2. Executive summary
3. Avanti's Response
4. Contact Details

1. About Avanti

1.1. Avanti Communications Group plc (Avanti) is a UK headquartered company. Our satellites provide high performance, affordable connectivity to governments, businesses and citizens across Europe, the Middle East and Africa (EMEA) either directly through satellite dishes installed at the user location, or by providing backhaul connectivity to mobile networks.

1.2. Avanti is a pioneer in the application of Ka-band satellite technology to deliver broadband and other services, connecting people wherever they are – in their homes, businesses, in government and on mobiles. Through Avanti's HYLAS satellite fleet and more than 160 partners in 118 countries, the network provides ubiquitous internet service to a quarter of the world's population. Avanti delivers the level of quality and flexibility that the most demanding telecoms customers in the world seek. Spurred by our launch of new 40Mb platforms, Avanti's satellites now provide the highest speed satellite broadband to governments, businesses and citizens in the EU.

1.3. Our first satellite, HYLAS 1, was launched in November 2010 and provides two-way coverage across Europe and beyond. HYLAS 2 was launched in August 2012 and provides coverage over EMEA. HYLAS 3 went live for commercial service in 2017. The entire HYLAS 3 payload is steerable to anywhere in EMEA, so a customer may purchase the entire service and choose to move it. HYLAS 4 will launch in March 2018 to serve the EMEA region.

1.4. Avanti has a proven track record in developing projects primarily with the ESA, in particular two significant projects: HYLAS-1 a Ka-band satellite, which was successfully launched in 2010 and the HYLAS-3 Ka-band payload being hosted on the EDRS-C satellite.

1.5. Avanti's strategy includes the goal of delivering the seamless, and economically viable, integration of satellite into 5G networks to ensure ubiquitous 5G access everywhere. Avanti's Satellite and Terrestrial Network for 5G (SaT5G) project will research, develop and validate key technologies required to enable the plug-and-play integration of satellite communications into 5G networks. The project will trial and assess these through live testbed demonstrations in the UK, Germany and Finland.

2. Executive Summary

2.1. Avanti believes that it will not be possible to realise a viable 5G ecosystem and ubiquitous coverage without the interworking or integration of satellites into 5G networks. As well as extending the reach of 5G terrestrial systems, satellite communications will be essential to an invisible and resilient overlay for terrestrial networks to realise the vision for the 'Gigabit Society'; a society in which millions of connections between people, devices, and things will require inter-connectivity and stability at unprecedented levels that terrestrial networks alone cannot deliver for Europe's citizens.

2.2. Avanti acknowledges that the band 24.25 -27.5 GHz (the "26 GHz band") is the focus of 5G spectrum identifications and future authorisations. The authorisation regime for 5G should include explicit terms and conditions that enable the future viable and sustainable use of this band by FSS/EESS/SRS services and to protect from unacceptable EESS/SRS earth stations and FSS space stations.

2.3. Avanti strongly supports the RSPG's view that the 66 - 71 GHz band should be prioritised for 5G/IMT-2020, but believes that the RSPG should go further than prioritising this band for technical studies. Avanti believes that there are compelling arguments why the 66 - 71 GHz should become the primary European band for 5G services and notes that this band could provide five network operators with up to 1 GHz of exclusive spectrum to deliver 5G services each.

2.4. Avanti also recommends that the RSPG extends the 66 – 71 GHz to include also the 71 - 76 GHz band by using the existing co-primary mobile allocations would double this. Not only could this make it possible to achieve the EC Broadband 2020 goal of 100 Mbit/s connectivity, but opening 10 GHz of spectrum from 66 - 76 GHz could afford significant future-proofing for that goal and the EU's goals for enabling a Gigabit Society.

2.5. Avanti could support the inclusion of the band 40.5 – 43.5 GHz for 5G / IMT-2020 use in Europe provided an appropriate shared basis with space / satellite services is developed in that band which enables the long term sustainable and viable use by the space services. This band will remain necessary for FSS applications, in particular for coordinated earth stations.

3. Avanti's Response

Role of satellite in an integrated 5G ecosystem

3.1. The European Commission set a goal of having access to 100 Mbit/s broadband service in 100% of the EU by 2025. In addition, numerous EU member states have adopted the EC Broadband 2020 goals of 100 Mbit/s connectivity to 50% of EU citizens by the year 2020 and 30 Mbit/s connectivity to 100% of EU citizens¹. Avanti believes that these goals cannot be realised without the use of satellites, which Avanti considers are an essential part of the 5G ecosystem.

3.2. Satellite communications already delivers mobile backhaul, push data services, linear and non-linear TV, converged media, broadband services and many M2M services that will be part of the 5G ecosystem in Europe and world-wide. In the future, consumers of 5G services will also expect to be able to use their devices in aircraft, ships and vehicles and in remote areas. Continuity of 5G networks will also be critical in times of natural disasters or terrestrial network outages. Satellite communications is the only viable means to address these important aspects of 5G deployment scenario.

3.3. The 5G ecosystem is envisioned as a highly-advanced, ubiquitous eco-system of interworking or integrated networks providing a wide range of services to consumers globally. The geographic coverage, network resilience, flexibility and efficiency of 5G networks will require a wide range of networking technologies, particularly for backhaul of the large volume of traffic that they are expected to carry. The interworking or integration of satellites into 5G is, therefore, essential.

3.4. As well as extending the reach of 5G terrestrial systems, satellite communications will provide an invisible and resilient overlay for terrestrial networks to realise the vision for the Gigabit Society. This is a society in which millions of connections between people, devices, and things will require inter-connectivity and stability at unprecedented levels that terrestrial networks alone cannot deliver.

¹ UK Space Innovation and Growth Strategy 2014-2030 Space Growth Action Plan, published in November 2013 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/298362/igs-action-plan.pdf)

Avanti's views on the draft Opinions

Opinion 1. Avanti supports the RSPG's Opinion 1 - that that Member States will in general need flexibility in the way they authorise access to spectrum using both individual licencing or a general authorisation framework. Both are used by Member States to authorise earth stations and satellite terminals.

3.5. By 2020-2025 there will be over 100 High Throughput Satellite (HTS) and Very High Throughput Satellite (VHTS) systems in orbit delivering Gigabits of connectivity across the world using Ku and Ka bands and in the future in Q/V band. These satellites will also provide cyber-resilience and data connectivity backup, especially for M2M networks.

Opinion 2. Avanti supports the RSPG's Opinion 2, but is of the view that Opinion 2 should recognise that the 5G ecosystem and ubiquitous coverage cannot be realised without satellites. Avanti proposes that the text of Opinion 2 should be modified to read:

"2. The RSPG is of the opinion - that the Commission, together with Member States, should take actions to fully support 5G related policy objectives in rural areas and wide coverage, taking into account that these policy objectives for achieving ubiquitous connectivity cannot be viably realised without the use of satellites, which are an essential part of the 5G ecosystem."

3.6. Interworking of HTS/VHTS systems and terrestrial technologies is envisaged to ensure a high-speed, robust, inclusive 5G ecosystem. The ongoing Satellite and Terrestrial Network for 5G (SaT5G) project will research, develop and validate key technologies required to enable the plug-and-play integration of satellites into 5G networks.

Opinion 3. Avanti supports the RSPG's Opinion 3, but is of the view that Opinion 3 should recognise the value of interworking or integrating of satellites into 5G networks. Avanti proposes that the text of Opinion 3 should be modified to read:

"3. The RSPG recommends that the Commission, in its research work-programs, study solutions for improving 5G connectivity and wide area coverage, especially in rural areas, using the interworking of HTS/VHTS systems and terrestrial technologies to ensure a high-speed, robust, inclusive 5G ecosystem to target the fulfilment of 5G related policy objectives."

Opinions 4 and 5. Avanti supports the RSPG's Opinion 4 and 5.

Opinion 6. Avanti supports the RSPG's Opinion 6, but would like the RSPG to note that solving issues relating to facilitating the efficient deployment of ultra-dense 5G networks in dense urban areas will require inter-connectivity and stability at unprecedented levels that terrestrial networks alone cannot deliver.

Opinion 7. Avanti believes that the trading or leasing of spectrum licences highlighted in Opinion 7 has only been successfully used in the context of commercial terrestrial networks and stations and that trading and leasing of spectrum licences is not sufficient to enable a secondary

market to operate efficiently in all cases. Furthermore, European legislation already allows Member States the flexibility to implement trading or leasing should they wish to.

Avanti believes that Opinion 7 is not only un-necessary, but could encourage Member States to exclude viable business models and reduce competition. Therefore, before adopting Opinion 7, Avanti urges the RSPG to further study whether the trading and leasing of spectrum licences has been proven to enable new market opportunities for all services delivered by terrestrial and satellite networks and in all circumstances.

Specific spectrum considerations:

3.7. Long term viable and sustainable spectrum access for GEO and Non-GEO HTS / VHTS satellite systems / services is central to the success of the 5G. The European Commission has already placed the spectrum discussion centre-table and has published a strategic roadmap for 5G spectrum² and the CEPT has mirrored this with its own 5G roadmap.

3.8. Avanti agrees that a range of spectrum resources will be required to satisfy the diverse requirements anticipated for 5G / IMT-2020 networks. Of the bands identified in ITU Resolution 238 (WRC-2015) for study for potential 5G/IMT-2020 use, satellite systems will need to continue to access and use on a long term sustainable and viable basis the various existing ITU allocated satellite / space service services allocations including within 24.25 – 27.5 GHz and in relevant segments of the '40' GHz bands.

3.9. Avanti considers that the band 27.5 – 31.0 GHz should not be considered for 5G/IMT-2020 in Europe consistent with ITU Resolution 238 and CEPT's position on WRC-2019 agenda item 1.13, taking also into account the huge investments already made into Ka-band GEO and Non-GEO satellite systems and associated services being delivered and planned to be delivered. Avanti strongly urges the RSPG to ensure that the 27.5 – 30 GHz frequency range remains out of scope for terrestrial mobile services, including 5G, to ensure that FSS services can continue to operate there and so that 5G satellite communications can provide an invisible and resilient overlay for terrestrial networks to realise the EC's vision for the 'Gigabit Society'.

Opinion 8. Avanti acknowledges that Member States are considering appropriate measures to defragment the 3400 - 3800 MHz band, the primary 5G band in the EC, in time for authorising sufficiently large blocks of spectrum by 2020 as set out in Opinion 8.

3.10 Avanti recognises the interest in this band for 5G in Europe and the need to resolve the mixed frequency assignments that have been made to terrestrial broadband systems in the past. Avanti wishes to emphasise that this band will continue to be required for FSS earth stations in Europe and hence 5G deployments in this band will need be on a shared basis with currently operating earth stations. It is also important to note that this band is very heavily used for FSS earth stations in other parts of the world and that will effectively prevent internationally harmonised use of this band for 5G.

² RADIO SPECTRUM POLICY GROUP: STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE: Opinion on spectrum related aspects for next-generation wireless systems (5G) - RSPG16-032 FINAL

Opinion 9. Avanti acknowledges that the band 24.25 -27.5 GHz (the “26 GHz band”) is the focus of 5G spectrum identifications and future authorisations. The authorisation regime for 5G should include explicit terms and conditions that enable the future viable and sustainable use of this band by FSS/EESS/SRS services and to protect from unacceptable EESS/SRS earth stations and FSS space stations.

3.11 Avanti believes that the Commission should include, as part of any technical harmonisation for the 26 GHz band, the requirement to maintain the viable scope for continued development of incumbent satellite services (FSS and EESS/SRS). Future satellite earth stations should be authorised based on transparent, objective and proportionate criteria to safeguard their future operations and service capabilities. However, ensuring that they are unlikely to have a significant impact on 5G deployment and coverage will require the development and implementation of sharing criteria and mitigation methods acceptable to all users and Member States.

3.12 Avanti considers that Member States should remain fully responsible for granting or rejecting authorisation to new satellite earth station applications in the 26 GHz band.

3.13 Avanti considers that 5G deployment in this frequency range is expected to be used for local coverage.

3.14 Avanti does not agree that regulatory flexibility for the progressive release of the 26 GHz band can facilitate an efficient introduction of 5G without having an unnecessary negative impact on the current users of the band. Avanti would want to see the details of the release plans in full before it concludes on its view.

3.15 Avanti has no view on whether Member States should plan any migration of Fixed Services links necessary for ensuring the availability of the band for 5G, taking into account the geographical dimension / extent of the market demand for 5G.

3.16 The 26 GHz band has been established by the first RSPG Opinion on 5G as the pioneer mm-wave for 5G. This first RSPG opinion also identified the 32 and 42 GHz bands as priority for studies. The RSPG Opinion on 5G has emphasized the interest of investigating the 32 and 42 GHz bands as additional bands complementing the 26 GHz “pioneer band”.

3.17 Avanti does not agree that there is no urgency for potential harmonisation of the 32 and 42 GHz bands on the assumption that the 26 GHz band will provide a capacity of up to more than 3 GHz of spectrum for 5G above 24 GHz, which is likely to cover, in the next few years, any immediate 5G demand from mobile network operators, given the potential investment level required for 5G deployment above 24 GHz.

3.18 Avanti believes that given the various sharing constraints with other in-band co-primary terrestrial services and co-primary satellite services in the 24.25 – 27.5 GHz band and given the emerging challenges of sharing high 5G/IMT stations with poor unwanted emissions characteristics with sensitive passive services below 24.25 GHz, it makes sense to take action now to also prioritise the 66 – 71 GHz, 71 – 76 GHz and the ‘42 GHz’ band for 5G / IMT-2020 use in Europe.

Bands above 26 GHz: 42 GHz

3.19 Avanti could support the inclusion of the band 40.5 – 43.5 GHz for 5G / IMT-2020 use in Europe provided an appropriate shared basis with space / satellite services is developed in that band which enables the long term sustainable and viable use by the space services. The mobile industry

has indicated that the band 40.5 - 43.5 GHz is expected to be part of a tuning range for 5G / IMT-2020 equipment from 37.0 - 43.5 GHz. Avanti considers that the potential for 5G to develop in this tuning range of 37.0 – 43.5 GHz will vary in different regions of the world and an identification for 5G/IMT-2020 services in Europe via relevant EU / CEPT actions within the 40.5 – 43.5 GHz band on a shared basis with space and terrestrial services should be progressed. It should be noted that other bands in the vicinity of 40.5-43.5 GHz will be needed for FSS applications which use uncoordinated, ubiquitous terminals. The band 39.5-40.5 GHz in particular is identified by CEPT for uncoordinated FSS applications and therefore could not be available for terrestrial 5G in Europe.

Bands above 24 GHz: 66 – 71 GHz & 71 – 76 GHz:

3.20 Avanti strongly supports the RSPG's Opinion that the 66 - 71 GHz band should be prioritised for 5G/IMT-2020. However, Avanti believes that more emphasis should be placed on using 66 - 71 GHz in an early timeframe (i.e. as from 2019 or even 2018) for 5G / IMT-2020 in Europe. Avanti recommends that spectrum in the 66 - 71 GHz range should be identified in 2018 by the RSPG and by relevant EU spectrum decision to and become a primary European band for available use by 5G / IMT services as from 2019 (or earlier).

3.21 Avanti fully supports the 66 – 71 GHz being prioritised for 5G in Europe for the following reasons:

- A recent CEPT questionnaire found there was no reported use of 66 - 71 GHz in most CEPT countries.
- Its proximity to the 57 - 66 GHz band, already designated and used for WiGig, indicates that 5G equipment could potentially be available in this band relatively early by benefiting from the ecosystem being developed in the adjacent band.
- It has already a primary ITU allocation to the terrestrial mobile service.
- It can support very high data rate 5G service including in high density urban and sub-urban indoor environments and outdoor environments.
- It can support up to say 1 GHz per mobile operator planning to deliver 5 GHz / IMT-2020 service.
- It has better propagation characteristics than the adjacent 57 - 66 GHz band (as it's outside the O2 absorption peak) and therefore can be a viable alternative to lower mm-wave bands for cell radiuses ranging from 50 to 200m or higher.

3.22 Avanti also recommends that RSPG take action to prioritise studies for the future use of the 71 – 76 GHz and 81 – 86 GHz for 5G/IMT-2020, including scope for sharing with existing space and terrestrial services in these bands. The near-term identification of the 71 – 76 GHz for 5G/IMT-2020 in Europe should be beneficial as it would allow for up to 10 GHz of contiguous spectrum between 66 – 76 GHz for future 5G/IMT-2020 services.

Consistency with ITU Framework:

3.23 Avanti strongly affirms that consideration of harmonised spectrum for 5G should only be given to those bands identified by the ITU Resolution 238 (WRC-15), where its *resolve 2*) stipulates “to conduct and complete in time for WRC-19 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, for the frequency bands: 24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-

52.6 GHz, 66-76 GHz and 81-86 GHz, which have allocations to the mobile service on a primary basis; and 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, which may require additional allocations to the mobile service on a primary basis". No consideration should be given to other bands.

Opinion 10. Avanti agrees with the RSPG that general authorised frequency use can create an important breeding ground for innovation. Avanti also agrees that the application of a general authorisation regime to the 66-71 GHz band is appropriate in the context of the physical characteristics of this band and its use for very short range, very high bandwidth communications. However, Avanti believes the use of individual authorisations in this band should not be precluded in this 66 – 71 GHz or in 71 – 76 GHz band.

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