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Thales comments to the Draft RSPG Report on 6G Strategic Vision

20 December 2024

Foreword

Thales would like to thank the Radio Spectrum Policy Group for the draft Report on 6G Strategic Vision (RSPG24-030 final), and for providing the opportunity to express views on this important matter. This document contains views from Thales on selected issues addressed in the draft Report

Thales applauds the broad and encompassing scope of the Draft Report, and the consideration given to Non Terrestrial Networks as an integral part of future mobile services. Thales also supports the expressed objectives regarding environmental sustainability, resilience and sovereignty.

The Report initiates the important task of providing guidance and visibility for the stakeholders on suitable spectrum for initial and long-term phases of 6G development. Thales supports focusing terrestrial mobile roll-out on bands identified for mobile use by WRC-19 and WRC-23, as well as legacy bands to be refarmed from previous generations (2G, 3G, 4G, 5G), while ensuring the protection and continued operation of existing services.

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Spectrum for terrestrial 6G

The RSPG draft Report identifies possible spectrum bands as suitable candidates for 6G: spectrum bands already identified for ECS (700-900 MHz, 1800 to 3.8 GHz, 26 GHz, 42 GHz), bands in the 3.8-4.2 GHz range for low/medium power area networks and 6 425-7 125 MHz.

In Europe and beyond, the mmWave frequencies failed to attract interest and investment from the mobile operators for 5G implementation, despite the huge effort put by the mobile industry to make these band available to the expense of other services.

In light of this experience, Thales would urge RSPG to cautiously make its determination in respect of actual spectrum needs for 6G roll-out, noting the considerable amount already available to public mobile services below 3.8 GHz and in the 6 425 – 7 125 MHz range identified for IMT at WRC-23.

The RSPG draft Report notes that the bands being considered under WRC-27 Agenda Item 1.7 for possible IMT identification were opposed by CEPT (except 7125 - 7250 MHz) due to European strategic usages. These strategic usages are, and will remain, critical in all of the bands envisaged. Specifically:

- 4 400 – 4 800 MHz : this frequency band is used by Control, Command and Communication systems for military aircraft and UAV (*e.g*. Eurodrone, FCAS, and more generally all systems using NATO aeronautical datalink standards). The band is also adjacent to the frequencies used by radio altimeters on-board civil and military aircrafts. A large part of those radio-altimeters have just been retrofitted because of out of bands interferences induced by 5G base stations operating in the band 3400-3800 MHz. A second retrofit because of out of bands of 6G interferences will not be economically acceptable.
- 7 125 - 7 250 MHz : this frequency band is used by some space agencies for the telecommand of Earth observation and space exploration missions.
- 7 250 - 8 400 MHz (core part of so-called X-band): This frequency band is intensively used by a large number of military satellite communication systems in NATO and beyond for both down-links (7 250 – 7 750 MHz) and up-links (7 900 – 8400 MHz). The upper part of the band (8 025-8 400 MHz) is also used for the downlink of Earth observation data by a large majority European Earth Observation satellites for both military and civil purposes. Finally, the lower part of the band is also used by meteorological satellites for data transfer.
- 14.8 - 15.35 GHz : this band is used by data relay satellites for scientific missions as well as military aircraft for control command communication, datalinks and payloads purposes (NATO aeronautical standards). Different types of radar application are also operated in the adjacent band 15.4 - 15.7 GHz.

In many cases, there are currently few or no alternatives to meet the needs of the missions which could be affected, whether for lack of available frequencies in other frequency ranges, lack of diversity and/or technological maturity, or for reasons intrinsic to the physical properties of the concerned frequencies.

Thales therefore:

- Opposes strongly new identification of spectrum for IMT under WRC-27 agenda item 1.7

- Urges the RSPG to examine cautiously any expressed need for additional spectrum for terrestrial mobile in 6G

Deployment aspects of terrestrial 6G

The draft RSPG Report discusses deployment aspects of future public mobile networks, and suggests that base stations operating in new bands to be mapped on the existing grid of base stations in order to limit environmental impact. Thales fully supports the objective of environmental sustainability, but is not convinced that mapping 6G deployments at around *e.g*. 6 GHz on the grid of base stations designed for lower frequency bands would help reaching this goal. The higher propagation and build entry losses at higher frequencies would make deployment of 6 GHz base station on a grid designed for 3.5 GHz suboptimal in many instances, and will conduct to operate base stations at higher emission levels, hence increasing energy consumption. In addition, higher base stations emission levels would make more difficult the coexistence with incumbent services with which these bands are shared, potentially departing from the assumptions that have been considered in sharing studies. To support an energy-efficient 5G-6G migration, less impactful on incumbent services, the capability of new 6G base stations to support 5G should be promoted in particular in the more dense areas, rather than upgrading existing 5G sites in a suboptimal way for 6G.

Thales suggests to carefully examine the environmental cost/benefits of departing from the classical densification of base stations when using higher frequency bands, and to evaluate the impact on sharing conditions with incumbent services

Role of satellite networks in 5G and transition to 6G: D2D and broadband connectivity

The draft RSPG Report identifies the activities conducted in ITU for the definition of the satellite component of IMT-2020, and the development of radio interfaces specifications. Thales would like to bring to the attention of the RSPG that 3GPP has submitted 5G NTN and IoT NTN as candidate radio interface technologies in December 2023. ITU has examined these technologies as successfully complying with the requirements of ITU-R Report M.2514-0 in October 2024. Accordingly, the ITU-R should complete as planned the satellite IMT-2020 radio interface specification Recommendation in May 2025.

This standard-driven convergence of technologies between satellite and terrestrial mobile service enables an effective integration at network, terminal (user equipment) and service levels. This includes a safe introduction of NTN capabilities with respect to critical aspects such as adjacent channel coexistence, support of regulated services, fully defined mobility procedures between TN and NTN, etc.

The draft Report identifies D2D (Direct-to-Device) as a significant emerging trend for innovation and investment. Thales fully agrees and actively support these developments in the D2D area through its own technological developments and its actions in 3GPP (Thales is the rapporteur of NTN related work items since Rel-15) and other fora. The Report mentions a distinction between D2D in MSS bands based on 3GPP NTN standards (Release 17 and beyond) and D2D operating in MS bands based on proprietary features as network level.

Thales is of the view that implementing D2D in terrestrial mobile bands may not be an optimal solution for Europe. In effect, under this approach, a mobile network operator (MNO) under an agreement with a satellite network operator makes available a certain amount of spectrum at a sufficient geographical scale (generally nationwide) for satellite service use. Such large scale is justified because the reuse of a terrestrial frequency block by satellite implies a minimal separation distance between areas served by each component to avoid mutual interference. In Europe, where cities are not far apart, it is not possible to make a spectrum block available in rural/remote areas without depriving the partner MNO of the ability to use the same frequency block in cities nearby. In other words, the amount of spectrum made available for satellite D2D under this approach is at the expense of the spectrum available for the MNO terrestrial operations in more densely populated areas. This limits the amount of spectrum that could reasonably be devoted to D2D on a national basis. Protection distances at borders are also necessary to limit the satellite power to spill over neighbouring countries to protect mobile services, limiting the service capabilities in those border areas. The specific geography of Europe, with numerous and relatively small countries causes such effects to happen at virtually any border.

These spectrum-related complexities make the deployment of D2D in terrestrial MS bands difficult to develop to scale in Europe, and more generally in areas other than large or geographically isolated countries. The MSS spectrum in L and S bands offers by contrast a more adequate spectrum environment (harmonized with limited sharing issues) for D2D to develop under the already applicable framework, in particular when handset compatible with the 5G NTN standard are progressively being made available on the market.

Beyond D2D, Thales has identified additional critically important use cases, not mentioned in the draft RSPG Report, for broadband connectivity to address the wide-scale automotive applications, the upcoming wide scale drone applications for verticals (*e.g.* infrastructure monitoring and surveillance, public safety etc..). Such broadband applications would rely on higher frequencies, noting that the NTN standards developed in 3GPP already include Ka-band (17.3 – 20.2 GHz / 27.5 - 30 GHz, starting from Release-18) and soon the Ku-band (10.7-12.75 GHz / 14-14.5 GHz, as on-going normalisation work in Release-19) frequency bands allocated to satellite services by the ITU.

Thales therefore suggests:

- To leverage on existing MSS harmonized L and S band spectrum for D2D in priority for Europe, building on 3GPP NTN standard for performance and optimized operations: *e.g.* TN-NTN handover, support of regulated service

- To include broadband NTN in satellite service allocated bands above 10,7 GHz as a means to address automotive and certain vertical needs (*e.g.* drones)

In the 6G context, the role of NTN is expected to be expanded in terms of coverage (towards light indoor) thanks to the support of very low Signal Noise Ratio, resiliency (service and network) and sustainability aspects.

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Security and resilience of 6G

Given that telecommunication services are essential for the various activities of the population, the 6G system shall be designed to ensure high resiliency and therefore able to mitigate to the maximum extent, natural and man-made disasters leading to temporary and local failure of the system. In line with this, the 6G system shall be able:

- to operate independently of non-3GPP technology: For example, the Global Navigation Satellite System (GNSS), which is highly used in 5G system, is not exempt of vulnerabilities, such as jamming or spoofing. Hence when GNSS is degraded or unavailable, this impacts the availability of the 5G services. Therefore, the 6G system with satellite access shall be able to provide services independently of Global Navigation Satellite Systems,
- and to quickly overcome a network node failure with alternative network paths. Hence the 6G system should ensure a minimum delay in the recovery of the service in case of a temporary and local failure of the system (*e.g*. network node(s)).

Sustainability

In terms of sustainability, one can distinguish between:

- The intrinsic footprint of the NTN component of 6G. Increasingly, mega constellations are considered for the NTN component. Hence its foot print directly relates to the total mass of satellites to be launched (also related to the satellite power class), the satellite replacement rate (inversely proportional to the satellite lifetime), a set of limiting factors to the coexistence with other satellites/constellations and the need to operate terminals at high transmit power.
- The contribution of the NTN component to the footprint of the 6G system. Mechanisms of transferring traffic or User Equipment between TN and NTN or between the different orbits of the NTN component should also take into account energy consumption/saving criteria.
- The contribution of the NTN component to the hand-print of 6G system. The support of NTN component in 6G shall be ensured from day 1 since the role of NTN component is at least expected to extend the TN coverage in low populated areas especially for transport and security sectors.

About Thales

Thales is a global technology leader with more than 81,000 employees on five continents. The Group is investing in digital and “deep tech” innovations – Big Data, artificial intelligence, connectivity, cybersecurity and quantum technology – to build a future we can all trust.

In the markets of defense and security, aerospace and space, digital identity and cybersecurity, Thales provides solutions, services and products to help its customers – companies, organizations and governments – to carry out their critical missions.