UK SPF Cluster 1 & 4: 6G Spectrum

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Spectrum needs for IMT mobile networks beyond 2030

- Additional ~ 500 – 750 MHz wide-area spectrum per network depending on the amount of existing mid-bands spectrum available and on the number of networks in the country[1].

- High capacity and low latency use cases such as advanced XR, holographic communications, and joint communication and sensing will drive the need for additional wide-area spectrum going forward.

1 “IMT-2030 (6G) Spectrum needs and candidate bands” Huawei Technologies Sweden AB, LM Ericsson, Nokia Corporation, Qualcomm, ZTE France SASU - PTA(23)047 input, April 2023.

Need for a European 6G spectrum roadmap

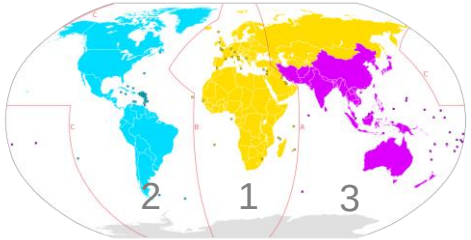
Europe needs a proactive approach towards a 6G spectrum strategy leading to a 6G “spectrum roadmap” in the next two years.

Selection of 6G primary and pioneer bands:

- ❑ Leveraging the positive experience of the European 5G spectrum strategy.
- ❑ Accounting for the coverage and capacity needs of 6G use cases and usage scenarios.
- ❑ Successful introduction of new mobile generation greatly benefits from dedicated “launch” spectrum.
- ❑ Accounting for ongoing activities in other regions[1] and the opportunity for the UK to influence global developments.
- ❑ Carefully considering the 5G licence durations aiming at consistent timelines for the introduction of 6G networks to foster the required economies of scale.

1 “Spectrum strategy implementation plan”, NTIA, March 2024. The implementation plan will consider the availability of the following bands for commercial use: 3100–3450 MHz, 5030–5091 MHz, 7125–8400 MHz, 18.1–18.6 GHz, 37.0–37.6 GHz.

WRC-27 Agenda Item 1.7



- This relates to studies towards WRC-27 on spectrum bands for 6G. WRC-23 approved the following:

WRC-27 agenda item 1.7 – "to consider studies on sharing and compatibility and develop technical conditions for the use of International Mobile Telecommunications (IMT) in the frequency bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz taking into account existing primary services operating in these, and adjacent, frequency bands, in accordance with Resolution COM6/26 (WRC-23)"

RESOLUTION COM6/26 (WRC-23)

Sharing and compatibility studies and development of technical conditions for the use of International Mobile Telecommunications (IMT) in the frequency bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz for the terrestrial component of IMT

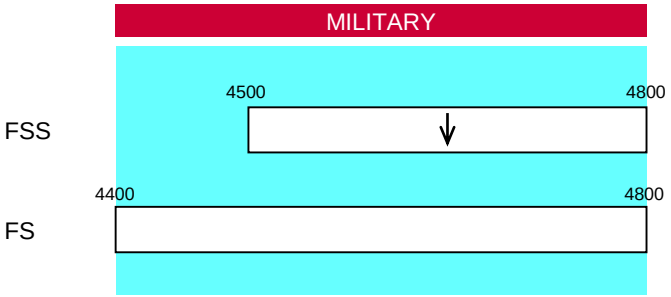
invites the 2027 world radiocommunication conference

to consider, based on results of studies, the identification of frequency band(s):

– 4 400-4 800 MHz, or parts thereof, in Region 1 and Region 3;
– 7 125-8 400 MHz, or part thereof, in Region 2 and Region 3;
– 7 125-7 250 MHz and 7 750-8 400, or part thereof, in Region 1;
– 14.8-15.35 GHz,

for the terrestrial component of IMT.

4400 – 4800 MHz



FSS: Fixed Satellite Service
FS: Fixed Service

Important NATO band used for aeronautical, land, and maritime military systems.

Other primary incumbents are:

- **FSS (downlink)** – For AP30B satellites (reserved satellite orbit slots of interest to developing nations).
- **FS** – Not heavily used in this band.

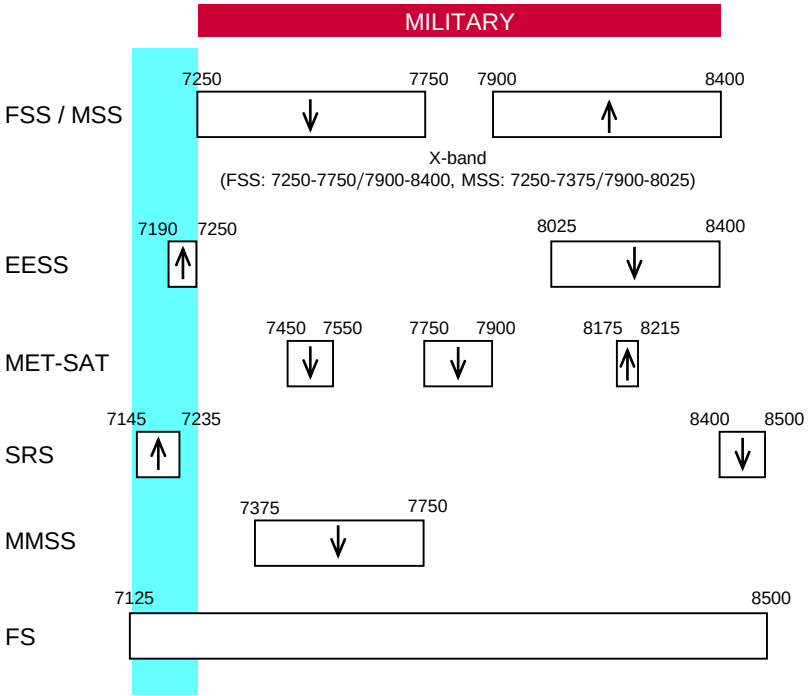
The adjacent band 4.2 – 4.4 GHz is used by radio altimeters globally.

Summary:

Challenging prospects of IMT identification in Europe due to military use. The challenge is the protection of aeronautical mobile systems which results in very stringent conditions for IMT (as seen at WRC-23 for 4.8 – 4.99 GHz), allowing only small cells. Protection of radio altimeters (and future EESS) in lower adjacent band is also likely to require a guard-band and/or reduced powers.

The suitability of the band for macro-cellular IMT is as yet uncertain.

7125 – 7250 MHz



FSS: Fixed Satellite Service, MSS: Mobile Satellite Services, EESS: Earth Exploration Satellite Service, MET-SAT: Meteorological Satellite Service, SRS: Space Research Service, MMSS: Maritime Mobile Satellite Service, FS: Fixed Service.

No military use.

Primary incumbents are:

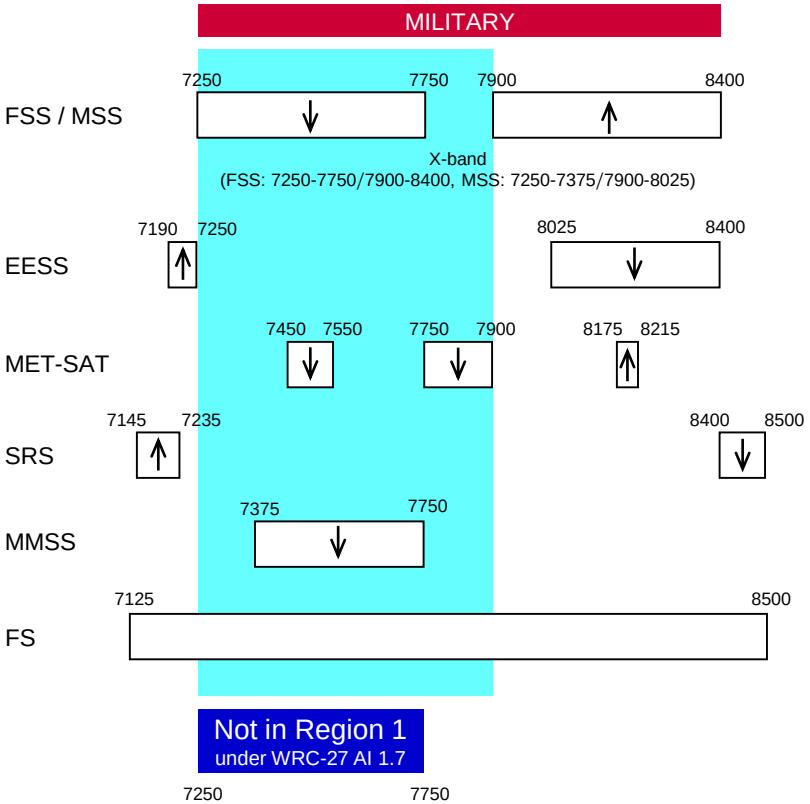
- **EESS (uplink)** – Used for tracking and telemetry of GSO and NGSO satellites, but shall not claim protection.
- **SRS (uplink)** – Used for deep space communications. GSO satellites shall not claim protection. In any case, in Europe SRS seems to be only an issue for RUS and ESP.
- **FS** – Long-haul microwave links, with deployments in APAC, Middle East, Africa, and LATAM.

The band is also used for passive microwave measurements. Similar measurements (sea surface temperature) are performed in the 6 GHz band. WRC-27 AI 1.19 is tasked with identifying 4.2 – 4.4 and 8.4 – 8.5 GHz for such measurements under EESS.

Summary:

Technical conditions for coexistence with EESS/SRS are as yet uncertain at 7125 – 7250 MHz.

7250 – 7900 MHz



Used globally for land and satellite military systems.

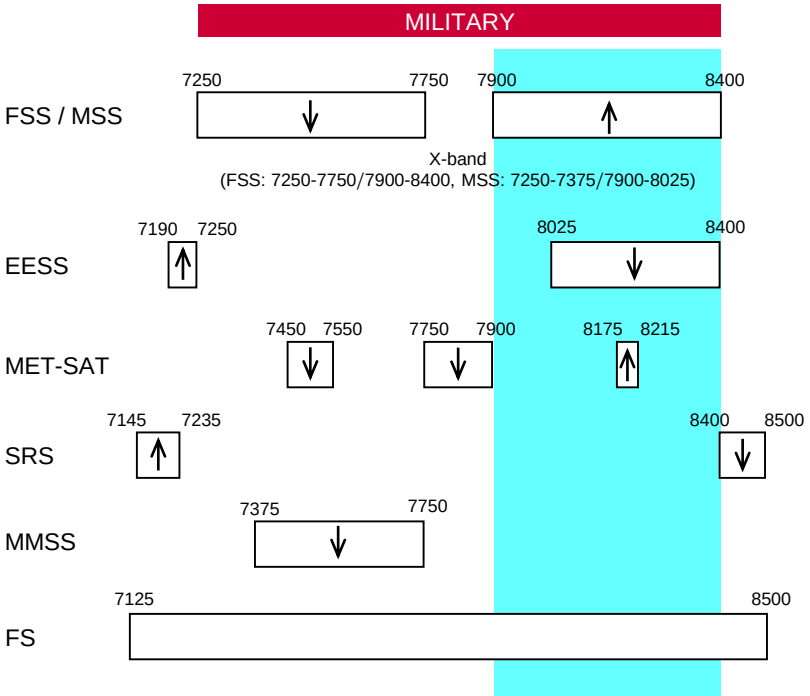
Other primary incumbents are:

- **FSS/MSS (downlink)** – Used for GSO and NGSO systems, with transportable earth stations moving across borders. Coexistence is not a purely national issue.
- **MET-SAT (downlink)** – Used for GSO (lower sub-band) and NGSO (upper sub-band) systems. Number of earth stations might be low.
- **MMSS (downlink)** – Used by GSO systems, and shall not claim protection.
- **FS** – Long-haul microwave links, with deployments in APAC, Middle East, Africa, and LATAM.

Summary:

IMT identification will need to consider military use, and international nature of FSS/MSS earth stations.

7900 – 8400 MHz



Used globally for land and satellite military systems.

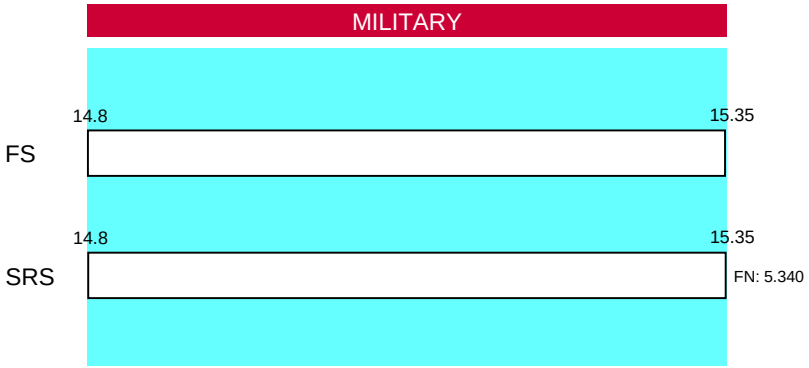
Other primary incumbents are:

- ❑ **FSS/MSS (uplink)** – Used for GSO and NGSO systems.
- ❑ **EESS (downlink)** – Used for GSO and NGSO systems. Number of earth stations might be low.
- ❑ **MET-SAT (uplink)** – Used for GSO and NGSO systems.
- ❑ **FS** – Long-haul microwave links, with deployments in APAC, Middle East, Africa, and LATAM.

Summary:

IMT identification will need to consider military use. Technical conditions for the protection of NGSO uplink will be of particular interest.

14.8 – 15.35 GHz



FS: Fixed Service
SRS: Space Research Service

Important NATO band used for aeronautical, land, and maritime military systems.

Other primary incumbents are:

- **FS** – Long-haul microwave back-haul links, widely deployed in many countries globally.
- **SRS** – Upgraded to primary at WRC-23 for s-to-s, s-to-E, E-to-s and for satellites less than 2 million km from Earth (primary for s-to-s only in 19 countries).

The band is adjacent to 15.35 – 15.4 GHz, which is subject to 5.340 (all emissions are prohibited).

Summary :

IMT identification will need to consider military use. Restrictions for protection of in-band SRS and adjacent band passive EESS/SRS are uncertain. The band is likely more similar to high-bands (mmWaves) than mid-bands. Suitability for macro-cellular deployments and market interest are uncertain.

Beyond 2030:
7-15 GHz for additional wide area capacity

For Europe to lead in the 6G technological race, new spectrum for additional wide-area capacity will be required.

WRC-27 opportunities[1] for Europe in the 7-15 GHz range.

Prioritization of 7125-8400 MHz for wide-area macro-cellular coverage:

- ❑ Leverage the primary allocations to the Mobile service.
- ❑ Study coexistence with other primary users.

1 WRC-23 Provisional Final Acts: RESOLUTION COM6/26 (WRC-23): "[…] invites the 2027 world radiocommunication conference to consider, based on results of studies, the identification of frequency band(s) for the terrestrial component of IMT:

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Thank you