

## **TELEMETRY SPECTRUM REALLOCATION RISK UPDATE: AN UPDATE ON THREATS TO TELEMETRY SPECTRUM**

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### **ABSTRACT**

*A review of potential spectrum reallocation risks that affect the future use of radio frequency telemetry. The International Consortium for Telemetry Spectrum (ICTS) will review the current status of agenda items that address telemetry to be considered at the 2023 World Radiocommunication Conference. Telemetry vendors and users need to be aware of, and potentially engage with, their national administrations on these agenda items.*

*The ICTS ([www.telemetryspectrum.org](http://www.telemetryspectrum.org)) was formed in 1999 and is chartered under the sponsorship of the International Foundation for Telemetry (IFT). The IFT ([www.telemetry.org](http://www.telemetry.org)) is a non-profit organization dedicated to serving the professional and technical interests of the telemetering community. This paper provides an update to potential spectrum reallocation issues per each telemetry band perceived by the ICTS as of interest to the international telemetering community.*

### **Introduction: Higher Demand**

Several factors within and outside of the telemetering community have revolutionized demand for electromagnetic spectrum, including spectrum allocated for flight test telemetry. These factors include:

- Commercial radio frequency (RF) spectrum utilization is increasing rapidly, particularly for mobile broadband, and this trend is expected to continue.
- Real-time data and video telemetry is critical to the growth of the commercial aeronautical industry.
- Frequency bands used for telemetry have been reallocated for other uses and continue to be at risk of reallocation.
- Telemetry data rates are increasing, thereby increasing the RF bandwidth needed for each mission.

Telemetry users are caught between a proverbial rock (telemetry demand is increasing) and a hard place (less spectrum is available for telemetry).

| Low-Band       |                |               |               |               |             |
|----------------|----------------|---------------|---------------|---------------|-------------|
| 406.1-608 MHz  | 960-1164 MHz   | 1300-1350 MHz | 1427-1518 MHz | 1780-1850 MHz |             |
| Mid-Band       |                |               |               |               |             |
| 3100-3550 MHz  | 4400-5000 MHz  | 5925-7125 MHz | 7125-8400 MHz | 10-10.5 GHz   |             |
| High-Band      |                |               |               |               |             |
| 25.25-27.5 GHz | 28.35-31.3 GHz | 31.8-36 GHz   | 42.5-47.2 GHz | 50.4-52.6 GHz | Over 95 GHz |

Figure 1. Desired 4G/5G Bands (CTIA)

As an example, in the United States, CTIA (the cellular industry trade association) has filed a chart with the Federal Communications Commission (FCC) presenting a list of target bands for future cellular use (4G/5G) (Figure 1). Several of these bands are currently allocated for telemetry. While carriers still prefer exclusive licenses for mobile broadband (as opposed to unlicensed spectrum as for Wi-Fi), the spectrum is congested. Clearing a band of incumbents, whether for licensed or unlicensed use, may no longer be practical. If telemetry bands become targeted for repurposing, the issue is whether mobile broadband use in either form, licensed or unlicensed, is feasible given telemetry’s need for interference-free operations.

In the United States, bands in Figure 1 – which are critical to Aeronautical Mobile Telemetry (AMT) and associated operations (telemetry command and control and time-space-position information, or TSPI) – include 1427-1518, 1780-1850, 4400-4940, and (for TSPI) 1300-1350 MHz.

These bands reside in an RF spectrum “sweet spot.” This region between 300 MHz and 3500 MHz is well-suited for mobile communications due to its RF propagation characteristics. For example, this region is ideal for AMT, where we seek to transmit data over long distances using low-power transmitters on maneuvering test articles. The cellular industry has eyed these bands for some of the same propagation characteristics.

Regardless of whether spectrum is sought for exclusive or unlicensed broadband, the interference risk for spectrum-dependent systems resulting from any reallocation (especially AMT and TSPI) is real.

### **Current Potential Spectrum Concerns:**

This section addresses U.S. domestic issues as well as those included in agenda items for World Radiocommunications Conference 2023 (WRC-23).

#### ***Lower L-Band (1350-1390 MHz)***

*Current Use:* In the United States, this band is critical for TSPI data transmission/data linkage.

*Spectrum Threat(s):*

*Cellular Interference.* While the band is currently not perceived as under scrutiny for reallocation, it is on several target lists due to its proximity to other low-band spectrum. While 1300-1350 MHz is being considered for repurposing, there is concern that this would affect all users in 1240-1390 MHz. In other words, repurposing could impact usage in the entire band, not just 1300-1350 MHz. The disposition of the band has not yet been resolved by national policymakers.

There is a concern that that TSPI data links (Advanced Range Data System (ARDS) and Common Range Integrated Instrumentation System (CRIIS), 1350-1390 MHz) may be affected by adjacent channel interference from cellular operation below 1350 Mhz. This is a watch item for test and training ranges that rely on GPS-based TSPI instrumentation as the susceptibility of the TSPI data link operations to Long Term Evolution (LTE) interference are unknown as this time. Efforts to access this susceptibility, and necessary protection criteria, are needed to analyze this threat.

#### ***Middle L-Band (1435-1525 MHz)***

*Current Use:* Allocated for manned AMT in the United States. This is the primary AMT band in the United States, and it is also used for AMT by several other administrations.

*Spectrum Threat(s):*

*International Mobile Telecommunications (IMT).* International Telecommunication Union (ITU) radio regulations give AMT priority over IMT in 1435-1535 MHz in Region 2 (North and South America). There is no pending proposal in the U.S. for reallocation of this band; however, it must remain on the list of concerns for ICTS as it resides in the low band “sweet spot” for RF propagation characteristics for international mobile communications. ITU Recommendations M. 1459 and 2116 are relevant for AMT protection criteria.

*Ligado.* The upper part of the L-band is home to several global positioning systems (GPS). Along with AMT operations below 1525 MHz, one of these signals is potentially threatened. L1 (encrypted precision code, coarse acquisition code), at 1575.42 MHz, could receive interference from a terrestrial data link proposed by Ligado Networks (Reston, VA) in the United States. Despite major pushback from the Department of Defense (DoD) and other federal agencies over GPS interference concerns, the FCC initially granted the Ligado application for a terrestrial Internet of Things (IoT) network. Several agencies and commercial interests filed Petitions for Reconsideration due to concerns about interference to GPS. If this IoT network is implemented, it could have significant impact on GPS-dependent systems (like TSPI). The U.S. Congress has enacted legislation intended to protect DoD spectrum uses against the possibility of interference.

### ***Upper L-Band (1780-1850 MHz)***

*Current Use:* Allocated for manned AMT in the United States.

*Spectrum Threat(s):*

*AWS-3 Auction.* In 2014, the FCC started the process of auctioning 65 MHz of spectrum to meet the goals of the National Broadband Plan. This was the third of three such auctions. Previous auction results had raised nearly \$1.6 billion. The AWS-3 (Advanced Wireless Services) auction generated \$44.9 billion. As a result, several government users were compensated to vacate the band. AMT operations, previously in the band 1755-1780 MHz, were compressed into the remaining spectrum between 1780 and 1850 MHz. Any further reallocation in this band would be extremely disruptive.

*HIBS.* This band is also in discussion for ITU consideration at the next WRC. WRC-23 Agenda Item 1.4 states in part: “*to consider . . . the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level [such as 1780-1850 MHz].*” Discussions on this topic are ongoing in several ITU-R Working Parties.

### ***Lower S-Band (2200-2290 MHz)***

*Current Use:* Allocated for unmanned AMT in the United States.

*Spectrum Threats(s):*

*Commercial Space Launch.* As of July 31, 2023, an FCC notice of proposed rulemaking was adopted for a new allocation in the 2025-2110 MHz band for space operations on a secondary basis. The item would also expand the spectrum available for commercial space operations on a secondary basis in 2200-2290 MHz from four channels to the entire band and adopt licensing and technical rules for space launch operations. It is understood that the new rules would provide for site-specific pre-license and pre-launch coordination, and that the FCC Office of Engineering and Technology would be directed to issue a public notice opening a new docket for comments on the expanded federal use of the non-federal satellite bands. The FCC has addressed DoD concerns raised during the proceeding (see <https://www.fcc.gov/document/fcc-ensures-commercial-space-launches-have-reliable-spectrum-resources-0>). The Aerospace and Flight Test Radio Coordinating Council, Inc. (AFTRCC) has proposed to coordinate non-Federal space launch requests with the DoD area frequency coordinators.

### ***Upper S-Band (2360-2390 MHz)***

*Current Use:* Allocated for manned AMT in the United States.

*Spectrum Threat(s):*

*Commercial Space Launch.* In the United States, the FCC is considering potential allocation of several additional bands for commercial space launch – including 2360-2395 MHz. See above. The FCC has addressed DoD concerns raised during the proceeding (see <https://www.fcc.gov/document/fcc-ensures-commercial-space-launches-have-reliable-spectrum-resources-0>).

### ***Lower C-Band (4400-4940 MHz)***

*Current Use:* In certain ITU Region 2 (North and South America) administrations, and in Australia, there are allocations for AMT. U.S. Major Range and Test Facility Base (MRTFB) installations have several AMT frequency assignments in this band.

*Spectrum Threat(s):*

*Non-Federal Use.* In the United States, AFTRCC has submitted a proposal to the FCC for a non-federal AMT allocation in this band with DoD support. AFTRCC would coordinate use of any such allocation, if approved, with DoD area frequency coordinators. [Note: This is not considered a “threat” inasmuch as AFTRCC member companies work hand-in-glove with DoD personnel in the development of new and modified aircraft and missiles for the Department.]

*R-Alt Interference.* In the band below 4400-4940 MHz, there has been major controversy regarding 5G compatibility in the 3700-3980 MHz band, with radar altimeters (R-Alt) operating in the 4200-4400 MHz band. A Federal Aviation Administration (FAA) Special Airworthiness Information Bulletin calls on R-Alt vendors and others to provide data on specific R-Alts, and to assess the need for further mitigation. Among other things, AT&T and Verizon agreed to delay deployment of certain 5G operations in 3700-3980 MHz.

*Spectrum Auction Reauthorization Act of 2023 (H.R. 3565).* This bill, currently being considered by Congress, would require the NTIA to study the 4400-4940 MHz band for possible future auction.

*WRC Threat.* The upper portion of the 4 GHz band, namely 4800-4990 MHz, is identified for IMT in numerous countries (including China, South Africa, Russia, Nigeria, Gambia, Uruguay, and Iran). WRC-23 Agenda Item 1.1 calls for studies to consider measures to protect stations of the aeronautical and maritime mobile services located in international airspace and waters from IMT operations in the 4800-4990 MHz band. France, the United States, Canada, and other administrations have sought to protect Aeronautical Mobile Service systems (AMS; note that AMT is included in AMS) and Maritime Mobile Service systems (MMS). Administrations such as Russia, China, South Africa, and others, have sought changes that would weaken existing protections for AMS/MMS in international airspace and waters. This is a controversial issue that will probably not be resolved until the WRC. This issue has been worked in ITU-R Working Parties 5D and 5B. On a related matter, the U.S. has determined that criteria specified in a working document toward revision of Recommendation ITU-R M. 2116 can protect AMT signals, and the United States has proposed that AMT – currently excluded from the scope of the Recommendation – be included.

### ***Middle C-Band (5091-5150 MHz)***

*Current Use:* Primary AMT Band for all regions.

*Spectrum Threat(s):*

*ITU.* This band is the only globally harmonized band allocated for aeronautical telemetry. It has been adopted in Region 1 by France and in Region 2 by the United States, where use is largely limited to military installations. Global telemetry users are encouraged to make use of this AMT band. AMT use may need to co-exist with airport ground communications depending on the administration.

The European Space Agency (ESA) is proposing to the European Conference of Postal and Telecommunications Administrations (CEPT) WRC-23 Agenda Item 10, which would add a preliminary WRC-31 agenda item suggesting new primary allocations for Radionavigation Satellite Service (RNSS). Specifically, based on the results of studies, the proposal would consider a new global primary allocation for RNSS (space-to-Earth) in the 5030-5150 and 5150-5250 MHz bands, or parts thereof.

As noted, ESA has been seeking CEPT support for its proposal. To this end, the agency has developed the required elements for the update of the Draft European Common Proposal and the draft CEPT brief on WRC-23 Agenda Item 10 to support this proposal.

The proposal would affect the global harmonized AMT band (5091-5150 MHz) and ITU Region 1 AMT band (5150-5250 MHz). ICTS recommends members advise their administrations of this proposal and the potential impact to telemetry in the 5 GHz bands.

### ***Upper C-Band (5925-6700 MHz)***

***Current Use:*** The ITU has identified this band for AMT in portions of Region 2. Thus far, the U.S. FCC has declined to take any action on AMT allocations for this band.

### ***Spectrum Threat(s):***

***Unlicensed Wi-Fi:*** The FCC concluded 5925-7125 MHz could be utilized for unlicensed Wi-Fi and very low-power devices for high data rate applications, such as wearables, augmented-reality, and virtual-reality. The band is also used for point-to-point microwave links; terrestrial microwave operators (mainly public safety and utilities) have unsuccessfully opposed the FCC's Wi-Fi plans. While the FCC has tabled any AMT assignments/allocations in the band, DoD has studied spectrum aggregation technologies that could enhance AMT compatibility with incumbent systems.

### **Conclusions:**

Concerns about the possible reallocation of telemetry spectrum exist both domestically (in the United States) and internationally (ITU/WRC). The encroachment of incompatible services in-band, and adjacent to, the bands used for AMT, can degrade telemetry data and result in test failure, loss of test articles, and even pose hazards to life. ICTS members are urged, in consultation with their administrations, to monitor spectrum developments affecting their bands closely. The information in this paper is presented so that telemetry practitioners are aware of developments that could affect the business of telemetry.

The International Consortium for Telemetry Spectrum is dedicated to serving the professional and technical interests of those in the telemetering community.

### **References:**

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