

Members of the Space Based Positioning, Navigation, and Timing Advisory Board:

The FCC’s decision to approve Ligado Networks’ use of a portion of the L-band spectrum is ill-advised, and constitutes a dereliction of duty on the FCC’s part. Frequency spectrum is a precious national asset and we are all obligated to protect it. Not only does this decision benefit just the shareholders of one company, but it is a dangerous decision that must be reversed.

This land grab of public frequency spectrum and gifting it to a private company will harm not only aviation and everyone who relies on it, but anyone who depends on ATM or other financial transactions, emergency responders, modern farming, the emerging benefits of autonomous vehicles, and even the production of precision mapping and survey products. Testing and studies performed by DOD and DOT supported by nine federal agencies concluded Ligado’s solution will cause interference both for civilian and military users. The decision impacts warfighter testing, training, exercises and homeland defense missions – putting national security at risk.

Putting the narrow commercial interests of one company ahead of our national security and the needs of our country is wrongheaded and dangerous.

Simply put, the FCC authorized Ligado terrestrial signal is much stronger than the GPS signal, and will overwhelm the ability to “hear” the GPS signal.

Existing satellite communications users will have to replace equipment to accommodate the relocation of the satellite signals and provide additional interference filtering for the new terrestrial signals. This includes The Aircraft Communications Addressing and Reporting System (ACARS) which uses INMARSAT – ACARS will need to be upgraded or replaced as a result. This is a principal concern by the aviation industry and users. Another SATCOM concern is the interference from the Ligado cell phones with the aircraft Iridium satellite communications at frequencies above GPS.

- Contrary to Ligado’s position, 1536-1559 MHz is not a “Guard Band.” Rather, it is allocated and used for satellite voice and data communication as Mobile Satellite Services (MSS). MSS data communications are used to improve the performance of some high accuracy GPS receivers. The Ligado signal resides inside the larger MSS band that used to be a quiet zone. The band where FCC has authorized Ligado to transmit at 10 watts previously was limited to extremely low power satellites signals only.
- MSS frequencies are also used for Aircraft Communications Addressing and Reporting System (ACARS), Aviation Controller Pilot Data Link Communications (CPDLC), Automatic Dependent Surveillance — Contract (ADS-C) position reporting, Pilot to Dispatch Communications and real-time engine health monitoring. Aircraft International Marine/Maritime Satellite (INMARSAT) equipment that operates in the MSS band where the Ligado terrestrial transmitters will operate will need to be upgraded or replaced at the Airlines’ expense. Iridium and their aviation user communities have identified that Ligado cell phone transmissions overload Iridium cell phones since the cell phone power is so much greater than the Iridium satellite signals that the Iridium transceivers are attempting to receive in their authorized spectrum that is separated by only 1 MHz from the Ligado cell phones. Reportedly, there is no currently identified resolution to the Ligado interference with Iridium cell phones since the frequencies are so close together.
- GPS receivers are very sensitive and require a very “quiet” neighborhood to function. Ligado’s operations will act like a loud neighbor and overload the sensitive GPS satellite signal receivers. In fact, Ligado’s proposed use will include adjacent band powers that are two Billion times

greater than the power of the GPS signals that the receivers are “listening” for. This will overwhelm the GPS receivers and make them unable to “hear” the sensitive GPS signals that they need to receive and process.

- Ligado’s claims that receivers “can easily be made to coexist” are incorrect. Coexistence would require antenna replacements and extensive redesign and replacement of the receivers. Such replacements are often larger, heavier and have reduced performance that may be inadequate for many high precision applications needs. Many GPS receivers are deeply integrated into the application systems and would require system-level hardware/software redesign and recertification at high cost. Retrofits would take systems offline with corresponding operational as well as cost impacts.
- For sound reasons, Ligado’s terrestrial operations have never been tried before in the proposed band. No Mobile Satellite Service (MSS) ancillary terrestrial components (ATC) service has ever been deployed within this MSS band despite the FCC authorization for MSS ATC services. The FCC made it clear in 2003, when it adopted the original MSS ATC rules, that a stand-alone terrestrial service was not intended for the MSS band. In that 2003 MSS ATC Order, FCC stated: “We do not intend, nor will we permit, the terrestrial component to become a stand-alone service.” The FCC’s rules (47 CFR 25) include provision 25.255 that “if harmful interference is caused to other services by ancillary MSS ATC operations, either from ATC base stations or mobile terminals, the MSS ATC operator must resolve any such interference.” The existence of 25.255 demonstrates that FCC is aware of the consequences of interference in this band.
- The contention that Ligado Networks enables 5G is misleading. None of Ligado’s bands are included in the 3GPP’s consortium’s 5G standards and the 10 MHz bandwidth is not consistent with most 5G providers and user needs for high bandwidth applications such as YouTube, FaceTime, Zoom, etc. There is currently not a deficit of frequency division duplexing (FDD) cellular handset spectrum in the L-band or below. FDD handset bands in L-band or below are currently underutilized.
- Contrary to Ligado’s assertion, the FCC Order and Authorization does not provide “total protection” to all GPS devices and users at the 1dB level. The DOT maintains that the FCC would need to reduce its authorization of Ligado operations from the currently-approved 10 watts to approximately one milliwatt (a factor of 10,000) to protect all existing GPS receivers.
- Contrary to Ligado’s assertion, the FAA did not conclude that 10 watts was sufficient to protect all aviation use of GPS. 10 watts protects only certain GPS receivers—those that are certified, Instrument Flight Rule (IFR) capable and outside a 250’ horizontal assessment zone. Ligado emissions can impact certified aviation GPS receivers when aircraft are within 250’ (e.g., aircraft at terminals and helicopter or drone/UAV operations at lower altitudes). Significantly, 10 watts does **not** protect aviation VFR rated receivers used by drones/UAVs, many VFR aircraft, GPS handheld/electronic flight bag and some helicopter safety systems (H-TAWS/EGPWS). The 10 watt Ligado emission can impact VFR (non-certified) GPS receivers at distances up to one kilometer. High precision drones/UAVs used for mapping, survey, construction, and agriculture can be impacted at distances up to 3 kilometers. In light of all of these caveats, the FAA did not conclude that the 10 watts protects all aviation use of GPS.
- Contrary to Ligado’s assertion, the DOT testing did not solely rely on the 1dB degradation level metric to make determinations about harmful GPS interference. In fact, DOT’s testing identified many receivers that completely failed at the FCC authorized 10 watt power level. During this testing, the GPS receivers lost lock on all visible satellites, rendering complete loss of GPS function, not just “harmful interference.” Thus, these receivers were rendered completely nonfunctional at the 10 watt power level approved by the FCC for Ligado operations and even lower power levels in many instances. A direct correlation was also identified between the 1dB

metric and important performance metrics such as the length of time needed for a GPS receiver to begin providing a position output. Even within Ligado Networks’ sponsored NASCTN and Roberson & Associates testing, there is evidence that harmful interference will occur if the Ligado network is deployed: their studies also demonstrate loss-of-lock by some receivers during testing.

Of special note is a possible conflict of interest – a filing by Mr. Dennis Roberson, who serves on the TAC FCC Federal Advisory Committee. His firm – Roberson & Associates, a technology and management consulting company - was hired by Ligado’s counsel – Covington and Burling LLP – to perform constrained testing of a very limited set of GPS receivers under less than representative test conditions.

Also of note is that Julius Knapp, Chief of the Federal Communications Commission’s Office of Engineering, was well aware of the GPS receiver overload by adjacent band terrestrial use in 2012. Yet, the FCC Chairman holds firm that the Ligado decision was based upon sound FCC engineering (led by Mr. Knapp). Please refer to Mr. Knapp’s statement (included) before the House Oversight and Investigations Subcommittee of the Energy and Commerce Committee from September 2012.

Wishful thinking and hoping that things will work out is not an effective strategy and cannot repeal the laws of physics. I urge you to reverse the FCC’s decision approving Ligado’s proposal.

Additional Materials:

1. Addendum1.Slides.SullenbergerStatement.1Jul2020
2. Addendum2.Knapp2012Testimony.SullenbergerStatement.1Jul2020