Before the
DEPARTMENT OF TRANSPORTATION
Washington, DC 20590

In the Matter of	)
	)
Draft Test Plan To Obtain Interference	) Docket No. DOT-OST-2015-0099
Tolerance Masks for GNSS Receivers in the	)
L1 Radiofrequency Band (1559-1610 MHz)	)

COMMENTS OF THE
ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS

The Alliance for Telecommunications Industry Solutions (ATIS) submits these comments on behalf of its Copper/Optical Access, Synchronization and Transport (COAST) Committee[1], in response to the draft test plan released by the Department of Transportation (DOT) in the above-captioned proceeding. These comments provide additional information about the important role that GPS receivers play in the U.S. telecommunications industry and ATIS COAST's suggestions related to the DOT test plan.

GPS receivers are essential to the telecom industry: The telecommunications industry has deployed a large number of GPS receivers and is constantly adding new receivers each year as the network grows, especially in wireless. These GPS receivers, which have a lifetime of more than 15 years, are used for precision timing from fixed locations. Based on industry estimates, less than 5% of these units are used to support optical networks and more than 95% are used to support the fixed infrastructure for wireless (i.e. wireless base stations - CDMA, LTE and E911

[1] ATIS is a technology and solutions development organization. COAST, one of ATIS' 15 industry forums, develops standards and technical reports related to telecommunications network technology pertaining to network synchronization interfaces over copper and optical mediums, and hierarchical structures for U.S. telecommunications networks. The COAST Synchronization (COAST SYNC) Subcommittee is responsible for validating the network interface standards developed within COAST, to ensure successful synchronization between carriers. Experts on synchronization have been working together within COAST SYNC for more than 30 years through many changes in technologies with new synchronization requirements.

augmentation systems). The telecommunications industry is dependent on these receivers for precision time accuracy. The time standard, UTC, can only be widely distributed from GPS with today's technology. There is no other option. In addition, the telecom GPS timing systems are the enabling systems for others systems such as E911 triangulation and AGPS, which are used to find the location of wireless handsets.

The impact of interference to GPS receivers deployed to the telecom industry would be significant: The GPS receivers deployed by the telecommunications industry each support many customers. While the total number of receivers may be lower than in other sectors, the impact of a problem with a telecom receiver has a larger impact because the receiver supports many customers. For instance, a problem with a precision timing GPS receiver located at a wireless base station could impact all wireless handset users that use that base station to connect the handsets to the fixed part of the wireless carrier's network. Considering the requirements of the FCC related to network reliability and the provision of E911 positioning services, the correct operation of these GPS receivers is important both to the operation of carriers' networks and to users of voice, data and location services.

Telecom GPS receivers cannot be moved: GPS receivers are co-located at wireless base station sites, which have been chosen carefully. Because telecommunication GPS receivers are at fixed locations, they could be negatively impacted from interference from stronger LTE base stations (which would be fixed as well) on the adjacent spectrum and from mobile LTE handsets (which would have varying impacts depending on the numbers and density of the users).

Adjacent band signals could degrade GPS receiver performance: If strong signals are allowed in bands adjacent to GPS signals, the performance of the GPS receivers used throughout telecommunications networks could be significantly degraded. Although mitigation techniques

are being proposed to address this issue, they will not help with the specific impacts on precision timing receivers. Hence, the result could be a decline in network reliability and resiliency.

Narrow band or sharp cut-off antenna filters degrade precision timing receivers: Some receivers may have stronger filters at the antenna, but this may not be appropriate for precision timing antennas. The timing requirements for telecommunications have become more stringent over time. The current industry requirement for LTE timing accuracy between base stations is going from 1 μs (microsecond) to 500 ns (nanoseconds) and may be further reduced in the future to 100 ns (nanoseconds); equipment vendor requirements may require even greater accuracy (in the tens of nanoseconds). The RF filtering circuit used in a narrow band or sharp cut-off filtered GPS antenna will have a delay through the antenna that varies more strongly with temperature. While variations of this delay may not affect navigation and position, they would directly impact timing accuracy. The antennas for this application are mounted outside to get the best view of the sky, so these antennas will be exposed to a range of outdoor temperatures that are within the performance of the current wideband antennas, but the more stringent timing requirement may be unachievable with a filtered antenna that is overly narrow or has sharp cutoffs.

Suggestions to the DOT Adjacent Band Interference Testing: ATIS Coast has reviewed the DOT testing plan and recommends that it be revised to incorporate testing of the time produced by GPS receivers, rather than focusing solely on contrast-to-noise (CNR) measurements. The timing signal should be measured against a reference which would be a significant clear measurement of the receiver's ability to tolerate interference. A measure of the output time per satellite (if available) would further clarify the receiver’s response to interference.

Timing data could include the phase difference between the 1 pps of the simulator and the 1 pps from the timing receiver. A parallel measurement may be on frequency outputs (such as 10 MHz) between the same two pieces of equipment. Precision telecom timing requirements are 100 ns for phase and 1 part in 10^{11} for fractional frequency accuracy. The receiver log files may contain an estimate of the receiver's own performance per satellite, which can be compared to the measured timing results.

The timing data would also allow for a measurement of temperature dependence, which is an important parameter for timing receivers. ATIS COAST believes that the analysis of the timing data will likely show that there is no clear way to measure temperature dependence if only measuring CNR. This critical analysis should be the focus of future work.

Finally, ATIS recommends that DOT make the simulator test files and receiver log files available to the community for independent testing and verification.

Conclusion. ATIS appreciates the opportunity to provide its feedback on this matter and respectfully requests that the DOT consider its comments in the development of the test plan to obtain interference tolerance masks for global navigation satellite system receivers in the 1559-1610 MHz band.

Respectfully submitted,

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October 20, 2015