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Via Email
James Platt (james.platt@hq.dhs.gov)
Director, Position, Navigation and Timing Office
Department of Homeland Security

RE: Meeting Summary of ATIS/DHS Call on December 8, 2017

Dear Mr. Platt:

This letter is a follow-up to the call between the Alliance for Telecommunications Industry Solutions (ATIS) and DHS on December 8, 2017, and provides a summary of the main points made during the discussion. The discussion centered around two synchronization requirements –one outlining time requirements for 4G-LTE and the other outlining frequency requirements for wireless technologies:

> General timing/synchronization specifications required from a backup for maintaining network functionality are reported at:
>
> Communications (Wired & Wireless) 1.5 µs – 4G-LTE/network backbone
>
> Communications (Wired & Wireless) 50-200 ppb frequency stability

ATIS' SYNC, which develops and recommends standards and solutions related to telecommunications network synchronization, has examined these requirements and note that they represent the application requirements as defined by 3GPP and also what the timing and synchronization network must deliver. For the 1.5 µs figure, this is ±1.5 µs to UTC time. Likewise, the 50 ppb is ±50 ppb to UTC frequency. In the case of the ±1.5 µs, the 3GPP requirement is that the time reference at cells should differ by no more than 3 µs between cells. This is accomplished if all cells are kept within ±1.5 µs of UTC time.

At the ITU-T, budgeting is done in a way that the timing delivered to the application does not take the entire time or frequency budget. Thus, the corresponding frequency synchronization delivery requirement is ±16 ppb for the ±50 ppb case and the corresponding time synchronization delivery requirement is ±1.1 µs for the ±1.5 µs case. This is shown in the ITU-T G.8261.1 Clause 7.2.2 for the former and in the ITU-T G.8271.1 Clause 7.3 for the latter.

There are primary reference clocks associated with time and frequency delivery. Any system backing up GPS should consider the requirements associated with these primary references. For frequency, the primary reference source is a "primary reference clock" (PRC) and its requirement is 1 part in 10^{11} or better to UTC frequency. For time, the primary reference source is a "primary reference time clock" (PRTC) and its requirement is ±100 ns to UTC time. The ITU-T G.811 document

defines PRC performance and the ITU-T G.8272 document defines PRTC performance.

To summarize:

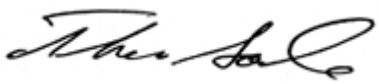
	Application Rqmt	Sync Network Rqmt	Primary Reference Rqmt
Frequency (e.g. LTE-FDD)	50 ppb (3GPP)	16 ppb (G.8261.1)	$1 \cdot 10^{-11}$ (G.811 PRC)
Time (e.g. LTE-TDD)	1.5 µs (3GPP)	1.1 µs (G.8271.1)	100 ns (G.8272 PRTC)

Notes on U.S. Wireless Carrier Technology reliance on GPS:

- LTE-FDD is the principal technology for AT&T, Verizon, and Sprint.
- LTE-TDD macrocells cannot typically operate more than 24 hours without GPS.
- Some LTE-FDD services such as OTDOA (E911 support) cannot operate without GPS, while normal voice and data services can continue to operate for weeks or months.
- As LTE-FDD is so widely deployed in the U.S., network resilience is tied to 50 ppb, which a quality oscillator typically deployed in a macrocell can maintain without GPS for a long period time (up to a year).
- An LTE-TDD small cell may not have an oscillator of the quality to maintain time for 24 hours, and nearby macrocells may be able to pick up the slack.
- CDMA technology continues to be used for voice by Verizon and Sprint. LTE is expected to eventually replace it.
- CDMA has a 10 µs requirement, which if exceeded could create an "island cell" effect.
- A CDMA "island cell" can continue to be used for calls for stationary users, and the ability to handoff to another cell is compromised. Users in motion traversing a cell boundary are impacted.
- 5G requirements are being defined; the 1.5 µs figure is currently the network-wide requirement.
- 5G local synchronization (i.e., between neighboring signal transmitters) may have different requirements than 1.5 µs.
- The timing requirements associated with 5G services have yet to be discussed.
- 5G timing requirements are evolving and should be monitored.

If you would like additional information or have any questions, please do not hesitate to contact the undersigned.

Sincerely,



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