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VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 Twelfth Street, S.W.  
Washington, D.C. 20228

Re: IB Docket No. 13-213, RM-11685

Dear Ms. Dortch,

Globalstar's Ex Parte filings posted on March 30<sup>th</sup> and 31<sup>st</sup> further illustrate the need for comprehensive testing of their TLPS proposal. Globalstar would obviously like nothing more than to rush TLPS through the approval process without further scrutiny. However, only transparent and appropriately designed system-level tests will enable the FCC and interested parties to identify and quantify risks that TLPS poses to the widely used ecosystem of Bluetooth, "Free Wi-Fi", and other existing services.

Contrary to Globalstar's claims, their demonstrations provide neither the level of technical rigor nor the level of information necessary for the FCC to make an informed decision regarding TLPS. Using information from Globalstar's most recent Ex Parte filings, the following pages explain why.

**Review of Globalstar's Ex Parte Filing Submitted on March 27, 2015, Posted on March 30, 2015 (1 of 2)**

(<http://apps.fcc.gov/ecfs/comment/view?id=60001027707>)

Globalstar's first March 30<sup>th</sup> filing notes FCC staff conducted testing on two of the four Ruckus Wireless access points used in the TLPS demonstrations at the TEC center. It is important the following information be disclosed to the public as soon as possible:

- **Details of the exact emissions tests conducted and measurement results.**

Every Wi-Fi enabled device sold in the United States undergoes emissions testing as required under Part 15.247. These tests are conducted by FCC-accredited laboratories, and the full test reports are filed to the Office of Engineering and Technology's (OET) website.

Given the technical controversy surrounding Globalstar's TLPS proposal, it is critical all interested parties have a chance to review relevant Part 15.247 emissions test results for the Ruckus access points used in the TLPS demonstrations. This is especially important in light of the fact that there has NEVER been a published set of emissions test results for any 802.11n Wi-Fi device transmitting on Channel 14/TLPS.

- **Globalstar has failed to answer a simple question critically important to any RF emissions tests: *Were any hardware modifications made to any of the Ruckus 7982 Access Points used in the TLPS demonstrations?***

Based on analysis of Ruckus 7982 Part 15.247 test reports, I believe the production models contain an RF coexistence filter that will impair an 802.11n signal being transmitted or received on Wi-Fi channel 14/TLPS. As explained in my March 25<sup>th</sup>, 2015 comment (<http://apps.fcc.gov/ecfs/comment/view?id=60001027411>), understanding whether this filter was removed for the TLPS demonstrations is critically important.

Furthermore, if the production model of the Ruckus 7982 includes an RF coexistence filter, and it was removed, this would materially impact the emissions profile. This is one more reason the emissions tests and results need to be disclosed in order to assess technical risks of TLPS.

For the sake of transparency, relevant emissions tests should include measurements on all three transmit chains of every Ruckus access point used in the TLPS demonstrations. In addition, serial numbers of all devices tested at the FCC laboratory should be cross-referenced with those used during the TLPS demonstrations. This is the only way to assure all interested parties that no single transmit chain was modified in such a way that would provide specific benefit to TLPS (for example, removing a coexistence filter from a single transmit chain of a single access point used in the demonstrations).

**Review of Globalstar's Ex Parte Filing Submitted on March 27, 2015, Posted on March 30, 2015 (2 of 2)**

<http://apps.fcc.gov/ecfs/comment/view?id=60001027710>

Globalstar's second filing on March 30<sup>th</sup> presents a response from Roberson and Associates, Globalstar's paid technical consultants, to the Bluetooth SIG report from March 20, 2015. Among other things, Roberson contends:

- **Globalstar and Bluetooth SIG “reached agreement on basic test conditions” which included the “traffic load at each access point”. Apparently, this is used both as a justification for Globalstar/Roberson/AT4 refusing the Bluetooth SIG’s request to increase user-level traffic rates during their tests, and as a defense that their demonstration set-up was somehow representative of real-world conditions.**  
<http://apps.fcc.gov/ecfs/comment/view?id=60001027184> )

The Bluetooth SIG test plan implies a user-level throughput level of ~3.75Mbps on all Wi-Fi channels. However, without an appropriate level of information provided by Globalstar beforehand, the Bluetooth SIG had no way of knowing whether the 3.75Mbps request equated to an ~8% “traffic load” or a ~75% “traffic load”.<sup>1</sup>

It is disingenuous for Roberson to claim Globalstar was justified in refusing Bluetooth SIG's request to increase the traffic load AFTER Bluetooth SIG learned of the true channel capacity.

It strains credulity to declare that tests utilizing less than 8% of the TLPS channel's “PHY layer” definitively demonstrate “that TLPS is a good neighbor to...Bluetooth device operations”.

Globalstar's refusal to allow Bluetooth to conduct tests using a more realistic traffic load, regardless of whether that was agreed upon or not, prevented the Bluetooth SIG and the FCC from understanding this issue better. It is not a stretch to imagine that Globalstar's refusal was

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<sup>1</sup> : *Like the Bluetooth SIG, I need to make certain assumptions due to the lack of information provided by Globalstar. For the TLPS demonstration setup, I assume a 1x1 (non-MIMO or single antenna) configuration for the 20MHz 802.11n channels. Furthermore, I assume the system is configured in HT (High Throughput) mode with an 800ns guard interval since the shorter 400ns guard interval (yielding even higher rates) is not allowed for non-MIMO configurations. Given these assumptions, the available Wi-Fi “PHY Layer” data rates range from 6.5Mbps to 65Mbps. Globalstar's demonstration results indicate a maximum “TCP Throughput” rate of ~50Mbps, which is ~77% (=50/65) of the maximum possible “PHY Layer” rate. Using this same ratio, the lower “PHY Layer” corresponds to a “TCP Throughput” rate of 5.0Mbps (=0.77\*6.5).*

*At the lowest “PHY Layer” data rate, a 3.75Mbps user-level rate translates to a 75% (=3.75/5) “traffic load” of the channel. However, for the highest “PHY Layer” data rate, a 3.75Mbps user-level rate translates to only a 7.5% (=3.75/50) “traffic load” of the channel.*

*The critical thing to understand when assessing TLPS/Bluetooth interference is that the “traffic load”, or the approximate percentage of time there is RF activity on the TLPS Wi-Fi channel, is the KEY determinant of the level of co-channel interference TLPS will cause to overlapping (in time and frequency) Bluetooth channels. Keep this in mind throughout the rest of the discussion.*

*For simplicity, the above analysis assumes the 3.75Mbps rate quoted in the Bluetooth demonstrations is equivalent to a “TCP Throughput” rate. In reality, since the system was using UDP to stream video, the corresponding “TCP Throughput” rate would be slightly lower. For the purposes of illustrating “traffic load” vs. “PHY Layer” rate vs. “user-level” rate, I believe the approximation of UDP/TCP equivalency is legitimate.*

due to fear that a more meaningful and realistic load would make the Bluetooth interference more apparent.

Whether or not you agree Bluetooth was impaired enough to be noticed at the “human sensory” level, the Bluetooth SIG’s Packet Error Rate statistics prove there is a material increase in Bluetooth interference with only a ~8% traffic load on TLPS. Instead of limiting tests to this unrealistic “single user” scenario, what if Bluetooth/TLPS interference tests were conducted with the traffic equivalent of two (~16% load), three (~24% load), or four users (~32% load)? Unfortunately, Globalstar’s behavior during the Bluetooth SIG tests prevented the FCC and other interested parties from understanding TLPS’s impact on Bluetooth under more realistic traffic conditions.

- **Globalstar/Roberson dispute the Bluetooth SIG’s assertion that there may have been a lower level of “traffic load” on Channel 14 vs. Channels 1, 6, and 11.**

The Bluetooth SIG’s contention there was less “traffic load” on Channel 14 vs Channels 1,6, and 11 is consistent with the analysis detailed in my March 17<sup>th</sup> filing (see page 6 of <http://apps.fcc.gov/ecfs/comment/view?id=60001026845> ) .

Roberson’s attempt to discredit the Bluetooth SIG’s analysis reminds me of a popular quote attributed to Groucho Marx:

*“Who are you going to believe, me or your lying eyes?”*

If the Bluetooth SIG is incorrect to believe there was a lower level of RF activity on Channel 14/TLPS vs. Channels 1, 6, and 11, Roberson needs to explain the following (from my March 17<sup>th</sup> filing):

- In an already lightly loaded traffic scenario, why does the following figure seem to show even less activity on Channel 14 vs. Channels 1/6/11 (snapshot taken at the 12 second mark, after Channel 14 data had started)? With the demonstration plan specifying EACH channel is streaming HD video at a nominal rate of 3.75Mbps, why does the spectrogram seem to indicate less activity on Channel 14 than the others?



**Figure 4**

Spectrogram Showing “RF activity” on Channels 1/6/11/14 during “reenactment” of Globalstar’s Bluetooth/Wi-Fi Demonstration taken on March 10,2015. Color density seems to imply less traffic on Channel 14 vs. Channels 1/6/11

In the interest of time, I am submitting this comment without analysis of Roberson’s claims in sections 4 through 8. Given time, I may do so in the future.

## **Review of Globalstar's Ex Parte Filing Submitted on March 30, 2015, Posted on March 31, 2015**

<http://apps.fcc.gov/ecfs/comment/view?id=60001027816>

In meetings with legal advisors to Commissioners Clyburn and O'Rielly, as well as the Chief of the International Bureau's Satellite Division, Globalstar "urged the Commission to adopt its proposed rules expeditiously". In other words, Globalstar wants the FCC to approve TLPS based on currently available information.

With that in mind, it is worth reviewing what we do and don't know from a technical perspective.

### **What DO we know?**

- Relative to "free Wi-Fi", TLPS will increase co-channel interference with Bluetooth.
- TLPS will add a new source of adjacent-channel interference to Wi-Fi Channel 11 that did not exist before.
- The effects of adjacent-channel interference among 20MHz 802.11n "Free Wi-Fi" channels (1 to 11) have been studied extensively, and are well understood. For instance, we know:
  - "Non-overlapping" channels spaced 25MHz apart (1, 6, and 11) allow for maximum throughput rates on each channel.
  - "Overlapping" channels spaced 20MHz or less apart cause material throughput degradation on both channels.
  - There are no published studies quantifying the effects of two channels spaced 22MHz apart, as Channel 11 and 14/TLPS are spaced.
- There are no published Part 15.247 test reports (in full or in part) for ANY device operating on Channel 14/TLPS using 20MHz 802.11n.

### **What DON'T we know?**

- Starting with a known (publicly defined, reviewable) combination of "Free Wi-Fi" and Bluetooth traffic, how does an increasing "traffic load" on Channel 14/TLPS affect Bluetooth performance?
  - In this case, "traffic load" is defined as the percent of time there is Wi-Fi RF activity on Channel 14/TLPS.
  - Furthermore, for different combinations of "Free Wi-Fi" and Bluetooth traffic, how does an increasing TLPS "traffic load" affect Bluetooth performance?
- What is the effect on Channel 11 (configured as 20MHz 802.11n) from an adjacent-channel interferer 22MHz away?
  - Like existing studies of 802.11n adjacent channel interference, characterizing the effect would require a representative set of RF scenarios.
  - Under a reasonable range of RF scenarios, will Channel 11 achieve full throughput as it does with non-overlapping channel 6? Or, will Channel 11 throughput be

impaired as it is for any channel  $\leq$  20MHz away? Or will the results be somewhere in between?

- Did Globalstar/Ruckus remove the coexistence filter from the Ruckus 7982 access point used for the TLPS demonstrations (and/or earlier field trials)?
  - If the coexistence filter was removed, why? After all, Globalstar emphatically claims “all devices” only require a “firmware modification” to support TLPS.
  - If the coexistence filter was not removed, why not say so? In addition, why not publish relevant emissions test results? (see <http://apps.fcc.gov/ecfs/comment/view?id=60001027411> )
- What was the precise Wi-Fi configuration for the TLPS demonstrations conducted at the TEC on March 6, 9, and 10, 2015?
  - Presumably, the system was configured for 802.11n’s HT (High Throughput) mode (not legacy mode). However, I am not aware of this being specified before or after the demonstrations.
  - What was the MCS Index value for each Wi-Fi channel, and was that value constant throughout all the demonstrations?
    - As detailed in footnote 1, a change in this value means a change in the Wi-Fi “PHY layer” channel capacity, which would have a material effect on the “traffic load” (as defined above) even for a constant user-level throughput.
    - In fact, the discrepancy in spectrogram “activity” between channels 1, 6, and 11 vs. Channel 14/TLPS could exist for identical user-level traffic rates if you assume the MCS Index is lower for channels 1, 6, and 11. As far as I know, this would be the only way the discrepancy can be explained away.
- How will RF coexistence filters used in almost all popular LTE-enabled devices affect the performance of Channel 14/TLPS?
  - I and others have conducted straightforward engineering analysis (based on publicly available data) to explain why commercial coexistence filters are likely to impair TLPS.
  - Neither Globalstar nor their technical consultants at Roberson or Jarvinian have presented any technical evidence supporting their claims this is a “non-issue”.
  - In fact, Globalstar could easily prove the coexistence filters are indeed a “non-issue” by publishing spectrum analyzer plots from relevant emissions tests, showing the coexistence filter WAS in all Ruckus 7982’s (on all three transmit chains) used in the TLPS demonstrations.
- What was the make/model of the Wi-Fi clients in the TLPS demonstrations? The “Globalstar TLPS Demonstration Plan” submitted on February 26, 2015 specifies “Client Devices” as “Nexus Tablets or Equivalent”.
  - The specific make/model/FCC ID number should be specified. On the surface, the Bluetooth SIG’s claim that the channel capacity was up to 200Mbps was incorrect. However, without knowing the specifics of the client devices (namely whether each had multiple transmit/receive chains) this mistake is understandable. If client devices supported three antennas each (like the iPad Air 2), then 802.11n’s 3x3

MIMO configuration would have allowed a maximum “PHY level” capacity of ~200MBps.

- What were the details of the test equipment hardware and software?
  - It is standard practice for system-level test/demonstration reports to precisely define the test equipment hardware and software used. Neither Globalstar, Roberson, nor AT4 provide the necessary level of disclosure in this area.

In closing, many important technical questions remain outstanding which should be answered prior to approving TLPS. Only through rigorous, independent testing can the FCC, interested parties, and the public understand the impact of TLPS on the broad, existing ecosystem. I encourage the FCC to require answers to legitimate technical questions before making a final decision regarding this matter.

Respectfully Submitted,

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