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Globalstar, Inc. (GSAT)

The Obfuscation Continues

On Friday, October 17, Kerrisdale released a report highlighting the many shortcomings of the materials that Globalstar has so far released about its proposed Terrestrial Low Power Service (TLPS). On Monday, October 20, we conducted a public conference call briefly summarizing that report and addressing inbound questions. Shortly thereafter, Globalstar responded, but once again skirted the key issues. Like Globalstar, we too would like to reiterate the value of the spectrum assets in the hands of its equity holders: zero. TLPS is a non-solution to a non-problem, and Globalstar is a highly indebted and insolvent firm shored up by hype.

Below we address Globalstar's substantive points directly. Quotations from Globalstar's press release are italicized.

> *"Globalstar has completed real-world testing designed to measure the relative speed and distance from an access point through TLPS. This testing was completed utilizing more than 3,000 discrete data points to show the relative difference in coverage from a TLPS access point versus an access point utilizing conventional Wi-Fi channels."*

This is a maddeningly vague response to a very narrow, specific argument. In our discussion of testing, we have always focused on the materials Globalstar and Jarvinian released in June 2013. As we outline in our *ex parte* letter to the FCC (p. 4-7), these materials strongly suggest that testing carried out in Cambridge, Mass., employed the Ruckus ZoneFlex 7372, a specific model of access point. However, the experimental license apparently invoked to do this testing does not contemplate the use of this device. Furthermore, many other aspects of the "test results" are suspicious, like their failure to state the user device or devices employed (a failure that continues, since the company chose to gesture in the direction of "real-world testing" rather than engage on the specific issue of its June 2013 documents). But Globalstar appears to be saying that it really did use the ZoneFlex 7372, in violation of the terms of the relevant license. If that is what Globalstar is saying, we would all appreciate a clearer admission, preferably CC'ing the FCC's Enforcement Bureau.

We have to scratch our heads over the reference to "3,000 discrete data points." Why in the world would so many data points be necessary? The "results" we have been discussing involve a ~40,000-square-foot office space with the capacity to house 221 people (see p. 5-6). Did Globalstar/Jarvinian really need to take ~14 readings *per person?* What were they measuring – throughput at shoulder height vs. throughput at ankle height?

Regardless, Globalstar sees fit to disclose how many "discrete data points" it has collected but not to disclose basic facts like what user device and throughput-measurement tool it used or even whether the "real-world testing" refers to the June 2013 results or something else entirely. But perhaps it doesn't matter, since Globalstar effectively concedes the irrelevance of these "results," albeit in less forthright

terms.

> *"Kerrisdale continues to mislead by…*[*m*]*ischaracterizing or failing to technically understand that the single access point in Globalstar's tests was used to demonstrate the field test environment and not an intended deployment scheme."*

This is a remarkable piece of revisionist history. Let's return to June 2013. Globalstar issued a joint press release with Ruckus touting the benefits of TLPS. It told the FCC that "initial test results confirm[ed the] superiority of TLPS." (Of course, it didn't bother to compare TLPS to the 5GHz band.) It claimed "no impact on public Wi-Fi operations in adjacent channels." Now Globalstar is characterizing these same "test results" as merely "demonstrat[ing] the field test environment" and not reflecting "an intended deployment scheme." (What does the phrase "demonstrate the field test environment" even mean?) In other words, Globalstar itself is insisting that its own results have no real-world importance because they do not actually resemble their vision for TLPS. So what *is* the vision for TLPS? Why did Globalstar not bother to conduct testing that actually provided a realistic view of TLPS's purported benefits? In particular, how could TLPS possibly outperform, for instance, the realistic Wi-Fi design we commissioned for the same office space? And how can Globalstar know that TLPS has "no impact on public Wi-Fi operations in adjacent channels" if the tests it purportedly drew on to make that claim don't represent "an intended deployment scheme"?

We have been quite transparent with our analysis, offering detailed images (single-AP "design", 2.4GHz and 5GHz coverage in a realistic high-capacity design), a detailed report, and even the underlying data file used to generate these summaries. Globalstar, by contrast, has only made public one set of "test results," which it now argues don't even illustrate "an intended deployment scheme" for TLPS.

> *"Kerrisdale continues to mislead by…*[*r*]*elying on faulty and contrived simulations, in contrast to the real-world tests conducted by Globalstar."*

Globalstar appears to be criticizing the Wi-Fi design that we commissioned, but, tuning out the rhetoric, we're not hearing any actual criticism. What exactly was "faulty"? What exactly was "contrived"? We offered up a realistic network layout driven with clearly stated assumptions about user requirements, crafted by an experienced professional, and thoroughly documented via commonly used specialist software (in this case, Ekahau Site Survey). Globalstar has offered strange low-resolution images and bluster about "thousands of discrete data points."

> *"Kerrisdale continues to mislead by…*[*s*]*etting its devices to antiquated modes, highlighting its unfamiliarity with Wi-Fi. Industry professionals agree that the performance of Wi-Fi devices using 802.11n is severely degraded by nearby devices using 802.11b, a mode which is meant to support legacy devices using a much older standard. Yet in its tests, Kerrisdale chose to set channel 14 devices to operate in 802.11b mode while setting channel 11 devices in 802.11n mode."*

It's hard to know whether this response is disingenuous, confused, or both. We did not "choose"

802.11b; 802.11b is the best that existing Channel 14-capable devices can do under the Wi-Fi specification. Furthermore, Globalstar is mixing up the co-channel contention impact of 802.11b, which is indeed quite negative (as we in fact mentioned in our original presentation, p. 49), with the adjacent-channel interference impact of 802.11b, which is actually what our tests measured. Since 802.11b, for all its shortcomings, uses a stricter spectral mask than 802.11n, our tests likely *understate* the true interference impact of a hypothetical 802.11n-based TLPS, as Allion itself warned us.

First, Globalstar suggests that we nefariously "**chose** to set channel 14 devices to operate in 802.11b mode while setting channel 11 devices in 802.11n mode" (emphasis added). In reality, we had no choice. Even in Japan, where Channel 14 operations are technically legal, *they are restricted to 802.11b only.* This is crystal-clear from the Wi-Fi specification (802.11-2012 §19.4.2, p. 1645):

> OFDM operation in channel 14 may not be allowed in Japan.

(OFDM, orthogonal frequency-division multiplexing, refers to the modulation used by Wi-Fi from 802.11g on; 802.11b used DSSS, direct-sequence spread spectrum.) Further verification can be found in many places, including Wikipedia and Google, as well as a Ruckus support document (p. 15, discussing changes from a prior software version: "Channel selection list no longer includes channel 14 for Japan country code due to Japan's restriction of channel 14 for use with 802.11b only") and our original Globalstar report (p. 31, "Wi-Fi's Channel 14 is today only legally permitted in Japan (and even then only using the 15-year-old 802.11b protocol)"). There is no off-the-shelf Channel 14-capable equipment using 802.11n today; the "choice" to set Channel 14 devices to use 802.11b was made by the IEEE and the Japanese government, not Kerrisdale. We thought everyone understood this point.

In fact, we would have loved to use 802.11n and urged Allion on multiple occasions to come up with a way to accomplish this, perhaps via customized firmware. After all, Globalstar has insisted that such a feat is "dead easy." Yet Allion could not find a way, lacking access to the underlying source code for, say, the MacBook Pro's Wi-Fi chipset drivers and firmware.

If anything, though, the use of 802.11b in our test setup understated the effects of adjacent-channel interference. Wi-Fi network architects detest 802.11b client devices because they can only operate at slow data rates, occupying too much airtime and thereby hurting the throughput of other devices sharing the same channel. But in our tests, the 802.11b Channel 14 devices were not sharing a channel with the 802.11n Channel 11 devices. They were, obviously, on separate channels. From the perspective of a Channel 11 device, Channel 14 network activity is just noise. Thus the low peak data rate of 802.11b has no direct effect on adjacent-channel interference. In its bid for a "gotcha" victory over Kerrisdale, Globalstar has conflated two distinct concepts.

But it's worse: 802.11b actually restricts out-of-channel emissions more tightly than 802.11n, suggesting that an 802.11b "neighbor" would be *less* harmful than an 802.11n "neighbor." Anatolij Zubow and Robert Sombrutzki, researchers from Humboldt University Berlin, explained this dynamic in their paper "Adjacent Channel Interference in IEEE 802.11n" (p. 1175, emphasis added):

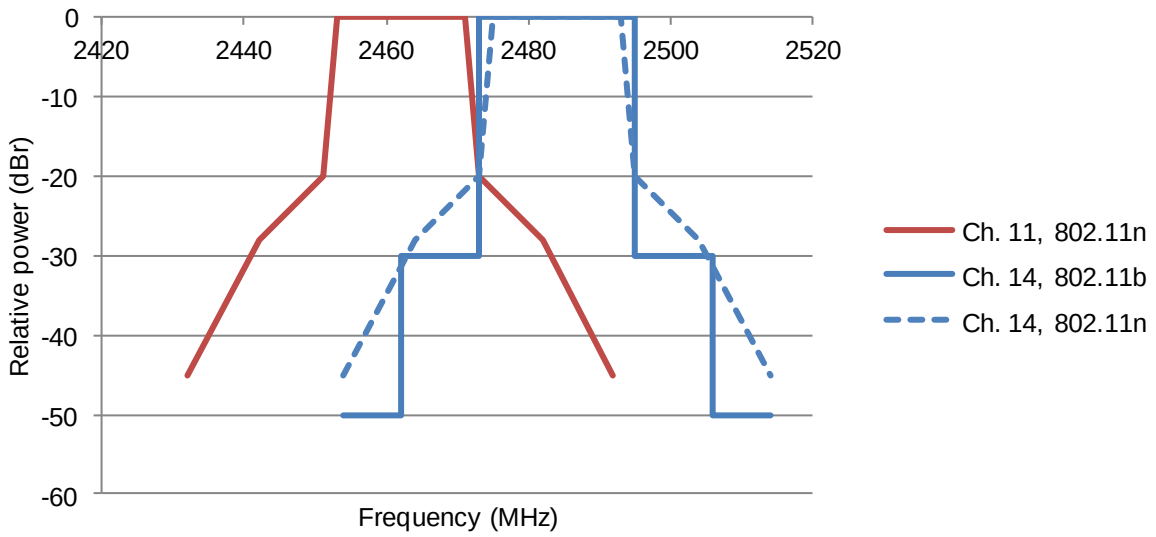
> By comparing the transmission spectrum masks of the different 802.11 PHY modes with each

> other we observe the following. The signal in 802.11b is best filtered. Starting at a frequency offset of 22 MHz, the signal is already attenuated by 50 dB. **Thus the ACI [adjacent-channel interference] impact should be the lowest.**

A recent overview of relevant research makes the same point (p. 149-150, emphasis added):

> From plotting the signals and their transmission masks of the three above standards in Fig. 2 it is seen that the 802.11g and 802.11n signals have more restrictive transmit masks in the channel **but the 802.11b signal has a more restrictive mask out-of-band.**

We present this concept graphically below. Globalstar is essentially arguing that because our tests involved the solid and not the dotted blue lines, they are biased. But if anything, they are biased in Globalstar's favor: what affects Channel 11 throughput is the spillover from Channel 14 into Channel 11, and this spillover is likely higher for 802.11n than for 802.11b, since the dotted blue line lies beyond the solid blue line.*



Source: Kerrisdale analysis based on Peter Miklavcic, "On the number of non-overlapping channels in the IEEE 802.11 WLANs operating in the 2.4 GHz band"

Sure enough, when we received our initial results from Allion, showing reductions in Channel 11 throughput after the introduction of only a handful of nearby 802.11b Channel 14 devices, the firm

* Globalstar may attempt to hide behind the fact that device performance is not exactly congruent with and is often superior to what the spectral masks dictate. But we see no reason to believe that 802.11b devices are much worse relative to their masks than 802.11n devices are. In one study we have located that compares experimentally the magnitude of adjacent-channel interference from 802.11b and 802.11n sources, Andrzej Zankiewicz's "Susceptibility of IEEE 802.11n networks to adjacent-channel interference in the 2.4GHz ISM band," the b impact is generally less severe than the n impact. See Fig. 4 and note how the b data points almost always sit above the n data points, indicating higher throughput and thus less harmful interference.

warned us that the results likely understated the impact that 802.11*n* would have.

In short, Globalstar's attempt to discredit the interference testing that we commissioned from Allion Engineering Services is a failure on every score. We made no sinister decision to use 802.11b; this "decision" was forced upon us by the realities of existing Wi-Fi equipment. While 802.11b devices can wreak havoc on the throughput of other devices with which they *share* a given channel, they have no uniquely destructive *adjacent-channel* impact, and there is reason to believe they have *less* adjacent-channel impact than equivalent 802.11n devices. As much as Globalstar would like to sweep it under the rug – along with other unpleasant topics, like the existence and popularity of 5GHz Wi-Fi – our interference testing is in fact credible.

Globalstar has still not been transparent about its "test results," choosing instead to dodge all of our specific and clearly articulated concerns. More important, it has effectively admitted that the one concrete example it has ever provided to show how TLPS would be deployed actually shows no such thing, though it never bothered to say so until now. It has still not explained the mechanism by which TLPS could possibly offer a valuable user experience, especially when compared to existing professionally designed, multi-channel, high-capacity Wi-Fi networks relying on free, unlicensed spectrum; instead, it resorts to magical terms like "carrier-grade," "differentiated," and "premium" that are devoid of technical meaning. Far from silencing its critics, it has yet again demonstrated that its grasp of Wi-Fi practicalities is superficial. This is not the behavior of a company with a logical, compelling value proposition. It is spin.

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