

November 10, 2014

**Via Electronic Filing**

Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street SW  
Washington, DC 20554

**Re: Written Ex Parte Communication**  
***Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks;***  
***Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service***  
***Systems, IB Docket No. 13-213, RM-11685***

Dear Ms. Dortch:

On October 30, 2014, Globalstar, Inc. (Globalstar) filed an *ex parte* letter<sup>1</sup> responding to two letters submitted by Kerrisdale Capital Management, LLC (Kerrisdale) that questioned the value of Globalstar's Terrestrial Low Power Service (TLPS) concept, criticized materials that the company and its partner, Jarvinian Wireless Innovation Fund (Jarvinian), submitted to the Commission in 2013, and offered new evidence to show that easing out-of-band emission (OOBE) restrictions at the upper end of the 2.4 GHz band would not harm Globalstar's satellite business and would promote the global harmonization of unlicensed spectrum.<sup>2</sup> Globalstar's response is obfuscatory, self-contradictory, and factually wrong on many points. The company ignored a host of pointed questions and instead made a series of conclusory assertions. At the same time, it tacitly admitted the inadequacy of its prior "testing" and laid bare the baselessness of its claim that TLPS "had no impact on public Wi-Fi operations in adjacent channels" during its "initial tests."<sup>3</sup> Kerrisdale maintains that Globalstar's TLPS will not result in any effective increase in the spectrum available for mobile broadband. Rather than let a single

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<sup>1</sup> See Letter from L. Barbee Ponder IV, General Counsel and Vice President Regulatory Affairs, Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213, RM-11685 (dated Oct. 30, 2014) ("Globalstar Response"), available at <http://apps.fcc.gov/ecfs/document/view?id=60000977216>.

<sup>2</sup> See Letter from Sahm Adrangi, Kerrisdale Capital Management, LLC, to Marlene H. Dortch, Secretary, FCC, IB 13-213, RM-11685 (dated Oct. 10, 2014) (Kerrisdale October 10 Letter), available at <http://apps.fcc.gov/ecfs/document/view?id=60000972585>; Letter from Sahm Adrangi, Kerrisdale Capital Management, LLC, to Marlene H. Dortch, Secretary, FCC, IB 13-213, RM-11685 (dated Oct. 22, 2014) (Kerrisdale October 22 Letter), available at <http://apps.fcc.gov/ecfs/document/view?id=60000975262>.

<sup>3</sup> See Letter from L. Barbee Ponder IV, General Counsel and Vice President Regulatory Affairs, Globalstar, Inc., to Mignon Clyburn, Chairwoman, FCC, RM-11685, at 1 (dated June 10, 2013 Letter), available at <http://apps.fcc.gov/ecfs/document/view?id=7022424140>.

company's poorly justified business plan prevent a move toward the harmonization of global unlicensed spectrum that would benefit everyone, the Commission should work toward the alternative of expanding the usable supply of unlicensed spectrum by relaxing OOB limits to permit Wi-Fi on Channels 12 and 13.

## Tacit Admissions

### *There Were No Real Tests of TLPS.*

Kerrisdale previously argued that Globalstar's purported TLPS "test results" lacked any useful detail – in particular about the user devices involved – and appeared to be based on simulations rather than genuine tests in which users connected to access points (APs) and assessed the quality of service. Globalstar has effectively conceded that its results did not involve user devices (*e.g.*, phones, laptops, or tablets – often referred to in Wi-Fi parlance as "stations"), but instead merely "access point transmissions" – *not* two-way connections between APs and stations. Indeed, neither it nor Jarvinian has ever sought experimental licenses for TLPS user devices at all, so there is no way it could legally have tested such connections outside of an anechoic chamber.

The lack of real testing renders Globalstar's purported results worthless. Based on the testing submitted into the record, Globalstar has yet to connect a single TLPS client to a single TLPS AP. The absence of real client testing calls into question the purported "public-interest benefits" of TLPS and the claims about its "capacity," and it lends itself directly to a gross overstatement of TLPS's effective range. For instance, while Globalstar's purported test AP transmitted at a power level of 23 dBm, the recently released iPhone 6, for example, only transmits in the 2.4 GHz band at an average power of ~15 dBm,<sup>4</sup> a difference of 8 dB. Focusing solely on the "coverage" of the AP neglects the problem that even if the AP can reach the user, the user may not be able to reach the AP – something that would have become readily apparent had Globalstar employed actual user devices in its "tests." This reinforces our previous contention that Globalstar overstated the usable range of TLPS.

Furthermore, Globalstar has never presented actual signal-strength readings, just signal-to-noise ratios (SNRs). It has never explained how it measured noise or what noise level it assumed. Consider, for example, a noise floor of -100 dBm and a signal at -97 dBm. This scenario could *theoretically* translate to a signal-to-noise ratio of 3 dB, seemingly providing a just barely usable Wi-Fi connection. But most real-world devices can't "hear" a signal as "quiet" as -97 dBm, so the SNR is irrelevant and the device won't connect. Globalstar insists that TLPS will boast little noise, but without testing real user devices it has no way of knowing to what degree lower noise alone will actually translate to better performance. Calculating SNRs is no substitute for actually measuring throughput.

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<sup>4</sup> SAR Evaluation Report for Cellular Phone with Bluetooth and WLAN Radio, Model: A1524, A1522; FCC ID: BCG-E2817A, 14U17676-S1C (BCG-E2817A) FCC SAR Report, at 79, <https://apps.fcc.gov/eas/GetApplicationAttachment.html?id=2360755> (last visited Nov. 7, 2014).

Since Globalstar did not conduct real tests with user devices, its claim that TLPS “had no impact on public Wi-Fi operations in adjacent channels” lacked any basis in fact. As our own lab testing has shown, TLPS would, in fact, harm public Wi-Fi operations in adjacent channels – a fact Globalstar once denied on the basis of its “tests” but now wishes to dismiss as irrelevant.

### *To Date, TLPS Has Used a Technology Globalstar Describes as “Virtually Obsolete.”*

Globalstar attempts to discredit the lab tests introduced into the record by Kerrisdale, which were conducted by Allion Engineering Services (Allion), arguing that they are invalid because “the Channel 14 access points and client devices . . . were set to operate in the now fifteen-year old and virtually obsolete 802.11b mode, a mode that would never be deployed in TLPS.”<sup>5</sup> As Globalstar should well know, under the IEEE 802.11 protocol, and even in Japan, Channel 14 can *only* be used in 802.11b (DSSS) mode. This is not Kerrisdale’s testing “choice”; it is built into the 802.11 specification. In its letter, Globalstar says, “*In the future*, TLPS operations on Channel 14 will be in the more interference compatible 802.11n mode.”<sup>6</sup> Nowhere does it say that it has ever used existing Wi-Fi devices in that mode; it merely hopes to do so “in the future” but is itself currently falling back on 802.11b. Globalstar thus insists that Kerrisdale achieve today something that Globalstar only hopes to accomplish “in the future.”

Given that Globalstar has not conducted tests with user devices and has apparently not yet operated its intended technology (802.11n) on Channel 14, its assertions about TLPS’s benefits are speculative at best. As others in the record have asserted, the Commission should require thorough, well defined, and transparent testing rather than let an unproven concept threaten the health of ubiquitous wireless networks.

## **Dodged Questions**

Globalstar failed to acknowledge or respond to the factual inconsistencies in its filings, which Kerrisdale pointed out in its letters. First, Globalstar argues for making Wi-Fi Channel 14 the quasi-exclusive property of Globalstar rather than sharing it on an unlicensed basis because it says Globalstar’s mobile satellite services (MSS) operations would suffer harmful interference. Indeed, Globalstar argues that even Wi-Fi activity on Channels 12 and 13 would threaten MSS. Yet, as we pointed out in our October 10 letter, Globalstar has begun to sell products that combine MSS functionality with Wi-Fi transmitters using the 2.4 GHz band.<sup>7</sup> Globalstar makes no attempt to encourage the use of lower-frequency channels within that band even though doing so would reduce any potential interference. It

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<sup>5</sup> Globalstar Response at 4.

<sup>6</sup> *Id.* at 4-5 (emphasis added).

<sup>7</sup> Kerrisdale October 10 Letter at 10-11.

is senseless to argue that Channel 12 Wi-Fi transmissions would threaten MSS connectivity while simultaneously promoting MSS products with built-in Channel 11 transmitters, operating just 5 megahertz away and within the same physical unit – yet this is precisely what Globalstar is doing. Again, Globalstar simply ignores this argument. Its interference worries instead appear to be designed solely to support its case for keeping Channel 14 all to itself and to prevent the opening up of Channels 12 and 13.

Second, in our October 10 letter, we pointed out that Globalstar’s partner, Jarvinian, purported to conduct a test in Cambridge, Mass., using a Ruckus ZoneFlex 7372 access point on Channel 14, but had no experimental license to use that device in that location.<sup>8</sup> Globalstar never acknowledges this fact but asserts that “Jarvinian’s conclusions . . . were based on real-world measurements of access point transmissions on Channel 14 (TLPS) and Channel 6 (public Wi-Fi). Jarvinian collected more than 3,000 such data points.”<sup>9</sup> Either Jarvinian transmitted on Channel 14 using a Ruckus ZoneFlex 7372 without the proper legal authority, or it incorrectly alleged to have done so in its prior submissions in this proceeding. Globalstar and Jarvinian ought to address this inconsistency.

## Factual Errors

### *Globalstar’s Claims About the Range and Popularity of 5 GHz Wi-Fi Are Wrong.*

Globalstar’s letter makes a host of incorrect and misleading claims about 5 GHz Wi-Fi, falsely minimizing the importance of the Commission’s farsighted and ongoing efforts to allocate more spectrum to this technology. Apparently drawing on a recent CableLabs study, Globalstar says that “5 GHz transmissions decay at roughly 4.5 times the rate of 2.4 GHz signals in free space.”<sup>10</sup> But this figure refers only to the incremental loss of *signal strength* as measured in, *e.g.*, milliwatts; it does not directly translate into *distance* as measured in, *e.g.*, meters. For example, assuming a transmitter with 20 dBm of EIRP and a target received signal strength of -70 dBm, a 2.4 GHz Wi-Fi signal on Channel 1 (center frequency 2412 MHz) has a range in free space of 310 meters. Using the same assumptions, a 5 GHz band Wi-Fi signal on Channel 36 (center frequency 5180 MHz) has a range of 145 meters. The ratio of the 2.4 GHz range to the 5 GHz range is 2.1x, far lower than the “roughly 4.5 times” that Globalstar cites. Moreover, using free-space path loss exaggerates this disparity because empirical studies in real-world environments typically find higher path-loss exponents that depress the effective range of all transmissions. One simple yet more realistic path-loss model, the IEEE 802.11 TGn channel model, includes six different stylized environments; in all cases, the path-loss exponent is 2 up to some “breakpoint” distance, after which it increases to 3.5. In TGn’s Model B, corresponding to a small space like a residence, the effective range of Channel 1 in the 2.4 GHz band under the same aforementioned

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<sup>8</sup> *Id.* at 5-6.

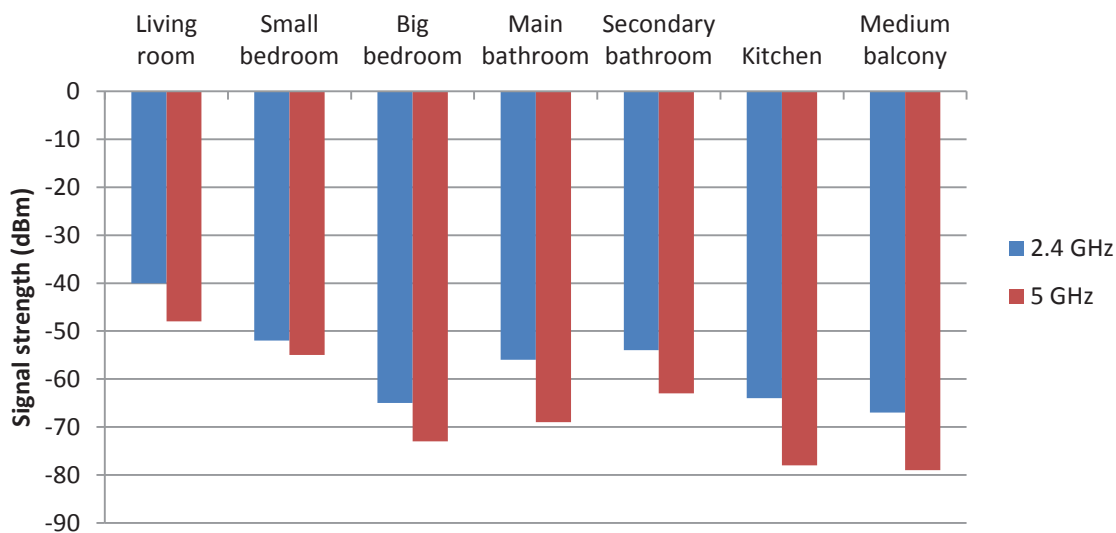
<sup>9</sup> Globalstar Response at 2.

<sup>10</sup> *Id.* at 3.

assumptions is a much more realistic 53 meters, while the effective range of Channel 36 in the 5 GHz band is 34 meters. With this less idealized, more empirically grounded model, the ratio of the ranges falls to just 1.5x. Globalstar’s attempt to write off the 5 GHz band as too short-range to be effective is baseless.

Further, Globalstar neglects the fact that several features of 5 GHz band Wi-Fi – including its ability to support wider channels, its lower noise levels, and, with 802.11ac, its superior peak data rates – can deliver better throughput relative to the 2.4 GHz band at a given distance *even though its signal strength declines more rapidly*. In many real-world environments, these advantages clearly outweigh the disadvantage of lower signal strength. For example, in a recent detailed review<sup>11</sup> of a consumer-grade 802.11ac access point (the ASUS RT-AC56U) conducted in a two-bedroom/two-bathroom apartment, 5 GHz band signal strength was clearly worse than 2.4 GHz band signal strength in every room:

### ASUS RT-AC56U: Signal Strength by Location, 2.4 GHz Band vs. 5 GHz Band



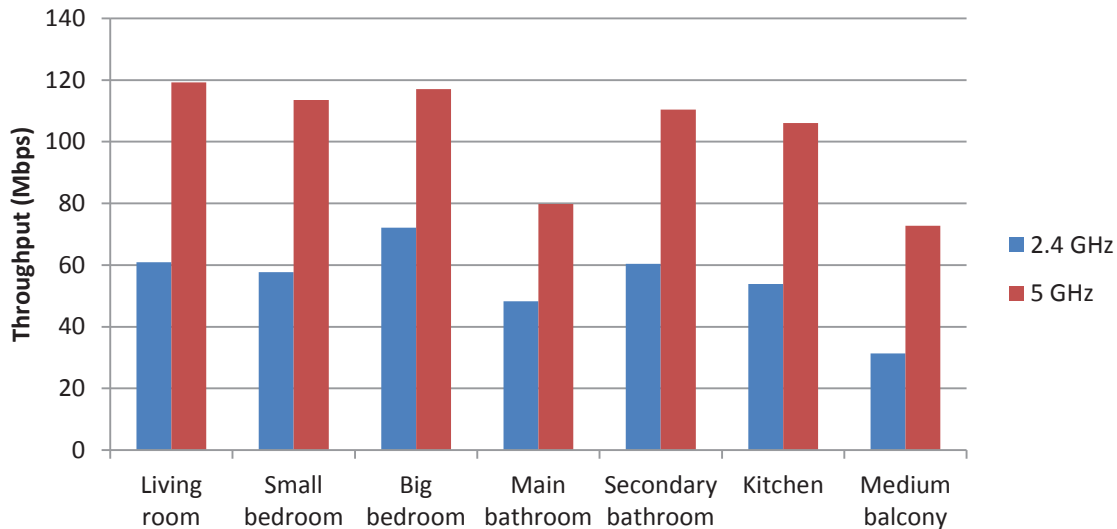
Source: Kerrisdale analysis, adapted from Ciprian Adrian Rusen, *Reviewing the ASUS RT-AC56U – A Reasonably Priced AC Router*, 7Tutorials (July 14, 2014), <http://www.7tutorials.com/reviewing-asus-rt-ac56u-wireless-ac1200-affordable-ac-router>.

However, we believe that users don’t care about signal strength; they care about throughput. With respect to throughput, as shown in the chart below, 5 GHz *beat* 2.4 GHz in every room, even those, like the kitchen, farthest away from the test AP. It’s pointless and academic to discuss the “superior” propagation of 2.4 GHz band signals without recognizing that, from a user perspective, the 5 GHz band

<sup>11</sup> Ciprian Adrian Rusen, “Reviewing the ASUS RT-AC56U - A Reasonably Priced AC Router,” 7Tutorials (July 14, 2014), <http://www.7tutorials.com/reviewing-asus-rt-ac56u-wireless-ac1200-affordable-ac-router>.

Wi-Fi experience is often better than the 2.4 GHz band experience at the same distance from the AP, in large part because the abundance of available spectrum permits wider channels.

### ASUS RT-AC56U: Throughput by Location, 2.4 GHz Band vs. 5 GHz Band



Source: Kerrisdale analysis, adapted from Ciprian Adrian Rusen, “Reviewing the ASUS RT-AC56U – A Reasonably Priced AC Router,” 7Tutorials (July 14, 2014), <http://www.7tutorials.com/reviewing-asus-rt-ac56u-wireless-ac1200-affordable-ac-router>.

Focusing on range alone, however, misses the point. As any wireless local area network (WLAN) professional will attest, achieving mere *coverage* – a strong enough signal in a wide area – is rarely the goal in today’s world, especially in high-density environments. As the WLAN educator and consultant Keith Parsons recently explained:

“There are many more facets to WLAN design than merely thinking about coverage. I’ve been teaching advanced wireless design classes for well over a decade and use the following term repeatedly until it sinks in the students’ heads . . . ‘Coverage is Easy’ – repeat three times to yourself. ‘Coverage is Easy, Coverage is Easy, Coverage is Easy’. . . Perhaps 10-15 years ago the idea was to design for coverage. But we have been far past that for the last 10 years. We now know we need to design for more than mere coverage.”<sup>12</sup>

<sup>12</sup> Keith R. Parsons, “Value of a Post-Installation Wi-Fi Validation Survey,” Ekahau (Sept. 3, 2014), <http://www.ekahau.com/wifidesign/blog/2014/09/03/value-of-a-post-installation-wi-fi-validation-survey-2/>.

While longer-range signals may better achieve *coverage*, the challenge for WLAN professionals is to deliver *capacity*, *i.e.*, high throughput in a given area or for a given set of users. Higher capacity comes from creating small cells that interfere with each other as little as possible and serve as few users as is cost-effective. In these capacity-oriented, high-density areas – the very areas that Globalstar claims are the justification for TLPS – the wider propagation of 2.4 GHz band signals is in fact a *problem*, not a benefit, because it leads to larger than desired cell sizes. By contrast, the shorter range of 5 GHz band signals – as well as the availability of many free channels – better ensures that cells stay small.

Globalstar seems unaware of these WLAN-design basics, insisting that the great capacity benefits of the 5 GHz band are somehow evidence of its flaws. In reality, not only is the 5 GHz band “a direct alternative to 2.4 GHz,” it often yields superior throughput at a given distance even in low-density environment like homes, and it is the band of choice in all enterprise deployments. The notion that “the 5 GHz band because of its limited propagation will never achieve the same functionality as the 2.4 GHz band” is wrong.<sup>13</sup> In reality, users pay real money to buy APs that attempt to shove users by any means available onto the 5 GHz band. This feature, typically known as “band steering,” is rare in consumer-oriented APs but very common in enterprise-grade APs produced by the likes of Cisco, Aruba, and Ruckus. A world in which savvy enterprise users *go out of their way to acquire* APs with band steering – implying a strong preference for the 5 GHz band over the 2.4 GHz band – is not a world in which the 5 GHz band is hobbled and barely usable, as Globalstar depicts it.

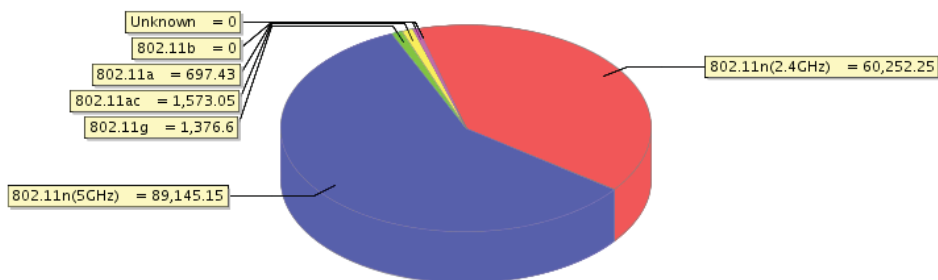
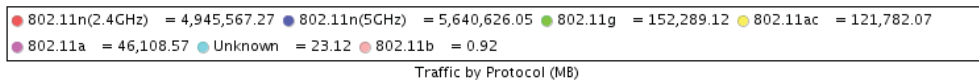
Thanks to advances like band steering, as well as rapidly increasing user-device support over the past several years, the 5 GHz band is now primary in many environments. For example, below is a screenshot from the network-management program Cisco Prime Infrastructure showing recent Wi-Fi traffic trends at a large American university. Over the past few months, 60% of total traffic (measured in gigabytes) used the 5 GHz band (58% via 802.11n, 1% via 802.11ac, and 0.5% via 802.11a), while a minority – 40% – used the 2.4 GHz band. This real-world data refutes Globalstar’s baseless assertion that the 5 GHz band cannot be viewed as “a direct alternative to 2.4 GHz.”<sup>14</sup>

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<sup>13</sup> Globalstar Response at 3.

<sup>14</sup> *Id.*





Client Summary by Protocol

Protocol	Average Number of Sessions	Maximum Number of Clients	Average Number of Clients	Total Session Time (Hours)	Total Traffic (GB)	% of Sessions	% of Clients	% of Session Time	% of Traffic
802.11n(2.4GHz)	242832	31065	23199	4945567.27	60252.25	55.38	49.91	45.35	39.37
802.11n(5GHz)	183958	27110	18963	5640626.05	89145.15	41.96	40.8	51.72	58.25
802.11g	6682	5957	2629	152289.12	1376.6	1.52	5.66	1.4	0.9
802.11ac	3368	2123	941	121782.07	1573.05	0.77	2.02	1.12	1.03
802.11a	1607	2081	749	46108.57	697.43	0.37	1.61	0.42	0.46
Unknown	2	1	1	23.12	0.0	0.0	0.0	0.0	0.0
802.11b	1	1	1	0.92	0.0	0.0	0.0	0.0	0.0

Clients by Protocol

Source: Screenshot from the network-management program Cisco Prime Infrastructure showing recent Wi-Fi traffic trends at a large American university.

One good way to anecdotally observe the massive trend toward increased 5 GHz band utilization is to look at social media sites where a vibrant community of Wi-Fi experts exchange views and experiences. For instance, in June, Glenn Cate, an experienced WLAN engineer with numerous professional certifications, wrote a humorous post titled “2.4 GHz, R.I.P.” At the “funeral,” “Uncle 5 GHz” boasts of his capabilities:

“There were great things I learned from ol’ 2.4 Ghz that he could never do! He couldn’t handle his legacy very well, but when I did the OFDM, I could sure cut some mean subcarriers! He wasn’t that good at channel bonding or even beamforming, but I could do them both really well! His channel restriction kept him from doing what he really wanted to do. But I have so many channels, I still *dream* about all the things I can do.”<sup>15</sup>

Though informal in tone, this piece gives a good indication of the expert consensus on the bright future of the 5 GHz band. Another WLAN professional, Devin Akin, wrote on Twitter in October, “2.4GHz is

<sup>15</sup> Glenn Cate, “2.4 GHz, R.I.P.,” gcatwifi (June 11, 2014), <http://gcatwifi.wordpress.com/2014/06/11/2-4-ghz-rip/>.



dead. Put a fork in it. Leave it for those who like to troubleshoot lost causes. #JustSayin”<sup>16</sup> and later added, “My very first observation in WLAN optimization is ‘can I remove 2.4G altogether?’”<sup>17</sup> Also in October, another engineer, Eddie Forero, tweeted a screenshot showing a large number of clients using the 5 GHz band and happily wrote, “That’s what I’m talking about! Get on that 5Ghz!”<sup>18</sup> In September, Will Jones, who describes himself as a “WiFi specialist focusing on high-density & large public venue networks,” posted the screenshot below showing a high number of client devices using the 5 GHz band (629 out of 725, or 87%) and wrote exultantly, “Death to the legacy clients!” – eliciting jealousy from another professional.<sup>19</sup> He added, “Pretty typical though for me these days to see 85% 5GHz.”

Protocol	
Client Protocol	Count
802.11n(2.4GHz)	94
802.11n(5GHz)	609
802.11g	2
802.11ac	20

Source: @wjcomms (Will Jones), September 1, 2014.

Even more recently, Lee Badman, a network engineer and technology writer, asked his followers, “What % of your clients are on 5 GHz NOW? What about 2 years ago? What do you predict 2 years from now?” His own response was “55% or better now, was 35% 2 years ago, I expect 65-70% 2 years from now.” One respondent said, “I see the same in schools, but lower percentage in hotels.”<sup>20</sup> Another linked to materials from the international Web Summit, a high-tech conference held in Dublin. The summit organizers said the following:

“We’ll provide free wifi to all delegates at the Web Summit on the 5Ghz frequency band throughout the venue. We will have a limited number of hotspots throughout the venue where we’ll also be providing wifi on the 2.4Ghz frequency band. This means that older devices may not see the wifi in the larger spaces at the event.”<sup>21</sup>

<sup>16</sup> Devin Akin, @DevinAkin, Twitter (Oct. 16, 2014), <https://twitter.com/DevinAkin/status/522984354885435392>.

<sup>17</sup> Devin Akin, @DevinAkin, Twitter (Oct. 17, 2014), <https://twitter.com/DevinAkin/status/523213162989232129>.

<sup>18</sup> Eddie Forero, @HeyEddie, Twitter (Oct. 10, 2014), <https://twitter.com/HeyEddie/status/520597750509871105>.

<sup>19</sup> Will Jones, @wjcomms, Twitter (Sept. 1, 2014), <https://twitter.com/wjcomms/status/506472876791590913>.

<sup>20</sup> Lee Badman, @wirednot, Twitter (Oct. 31, 2014), <https://twitter.com/wirednot/status/528237125477875712>.

<sup>21</sup> Paddy Cosgrave, Free Wifi for Everybody, Web Summit (Oct. 23, 2014), <http://blog.websummit.net/wifi14/>.

Again and again, we see very clearly that Wi-Fi experts already view 5 GHz as the primary Wi-Fi band, especially in high-density areas with many users per unit area – precisely the places that Globalstar falsely claims will benefit from TLPS.

Globalstar is wrong about the effective range of the 5 GHz band and even more wrong about its current and future popularity. Using unlicensed spectrum in the 5 GHz band is the only way Wi-Fi engineers have been able to achieve feats like serving 20,638 unique users at AT&T Park during Game 5 of the World Series while moving 1.6 terabytes of data.<sup>22</sup> In these environments, the greater reach of the 2.4 GHz band is a disadvantage.

To be sure, outside of high-density and enterprise settings, the 2.4 GHz band is still very commonly used, and even in instances where it handles only a minority of traffic and primarily supports legacy devices, it is still an important part of the Wi-Fi ecosystem. In particular, based on our research and discussions with Wi-Fi professionals, older healthcare-oriented devices like Wi-Fi-enabled IV pumps at hospitals still rely heavily on the 2.4 GHz band.<sup>23</sup> In the future, less bandwidth-hungry applications like machine-to-machine communications and “Internet of Things” devices may also operate in the unlicensed 2.4 GHz band. Though the 5 GHz band is already highly effective at handling dense environments, opening up Channels 12 and 13 will help support ongoing and future productive and innovative uses of the 2.4 GHz band.

In casting aspersions on the effectiveness of 5 GHz band Wi-Fi and engaging in fear-mongering about spectrum scarcity, Globalstar’s motives are clear. It hopes to foster a false sense of urgency and thereby rush this rulemaking to the finish line in order to prop up its stock price. But the spectrum crisis it portrays is a fiction belied by the ongoing success of large-scale and high-density Wi-Fi networks – success that the Commission is already working to “future-proof” by freeing up additional unlicensed spectrum. In reality, there is absolutely no pressing “need” for TLPS. The Commission should take its time to consider the information now on the record and assess alternative policies rather than accept Globalstar’s rhetoric.

### *Globalstar Mischaracterizes the Problems Caused by 802.11b.*

In its letter, Globalstar seeks to discredit our interference testing by claiming that, because the Channel 14 APs used 802.11b (as discussed above, the only protocol that Channel 14 operations can use under the Wi-Fi specification), the results were rigged to show maximal interference.<sup>24</sup> This is incorrect.

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<sup>22</sup> Paul Kapustka, “Half a Stadium Using Wi-Fi? 2014 World Series Games Set Wi-Fi Records at AT&T Park,” Mobile Sports Report (Oct. 28, 2014), <http://www.mobilesportsreport.com/2014/10/half-a-stadium-using-wi-fi-2014-world-series-games-set-wi-fi-records-at-att-park/>.

<sup>23</sup> See, e.g., David Hoglund and Vince Varga, “Building a Reliable Wireless Medical Device Network,” Draeger Medical Systems (2014), <http://www.draeger.com/sites/assets/PublishingImages/Segments/Hospital-US/Wireless%20Patient%20Monitoring/WiFi-Monitoring-wp-9068680-en.pdf>.

<sup>24</sup> Globalstar Response at 4.

It confuses co-channel contention – *e.g.*, an 802.11b client sharing a channel with 802.11n clients and hogging the airtime – with adjacent-channel interference – *e.g.*, an 802.11b network operating physically nearby but several channels removed from an 802.11n network. The destructive impact of 802.11b clients that Wi-Fi experts warn about in the materials that Globalstar cites pertains to co-channel contention, not adjacent-channel interference. But our tests measured the latter, not the former, so Globalstar’s complaints are irrelevant.

In fact, because the 802.11b protocol requires a stricter spectral mask than 802.11n, our tests likely *understate* TLPS’s true potential to interfere with neighboring Wi-Fi networks using unlicensed spectrum. Anatolij Zubow and Robert Sombrutzki, researchers from Humboldt University Berlin, explained this dynamic in their paper, “Adjacent Channel Interference in IEEE 802.11n”:

“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.**”<sup>25</sup>

A recent overview of relevant research makes the same point:

“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.**”<sup>26</sup>

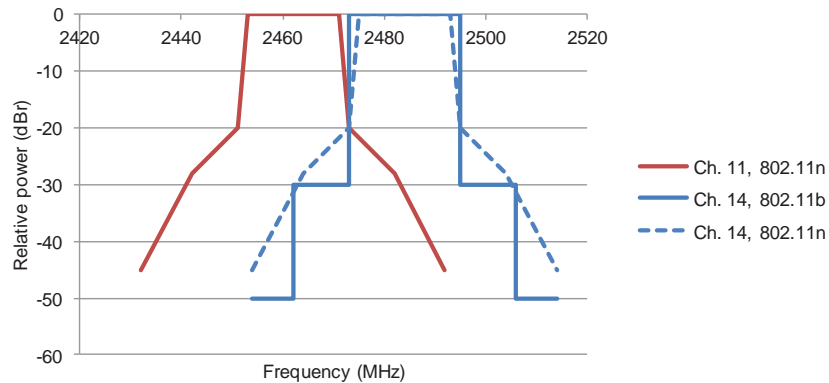
We present this concept graphically below. Globalstar is essentially arguing that because our tests involved the solid and not the dotted blue lines, they are biased. But if anything, they are biased in Globalstar’s favor: what affects Channel 11 throughput is the spillover from Channel 14 into Channel 11, and this spillover is likely higher for 802.11n than for 802.11b, since the dotted blue line lies above the solid blue line.<sup>27</sup>

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<sup>25</sup> Anatolij Zubow and Robert Sombrutzki, *Adjacent Channel Interference in IEEE 802.11n*, 2012 IEEE Wireless Communications and Networking Conference, at 1175 (2012), available at <http://lens1.csie.ncku.edu.tw/Library/Paper/IEEE%20WCNC%202012/papers/p1173-zubow.pdf> (emphasis added).

<sup>26</sup> Peter Miklavcic, *On the number of non-overlapping channels in the IEEE 802.11 WLANs operating in the 2.4 GHz band*, at 149-150 (2014), available at <http://ev.fe.uni-lj.si/3-2014/Miklavcic.pdf> (emphasis added).

<sup>27</sup> 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, the b impact is generally less severe than the n impact. See Andrzej Zankiewicz, *Susceptibility of IEEE 802.11n networks to adjacent-channel interference in the 2.4 GHz ISM band*, *Przegląd Elektrotechniczny* (Electrical Review), at 288



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 (2014)*, available at <http://ev.fe.uni-lj.si/3-2014/Miklavcic.pdf>.

Sure enough, when we received our initial results from Allion, showing dramatic reductions in Channel 11 throughput after the introduction of only a handful of nearby 802.11b Channel 14 devices, Allion warned us that the results likely understated the impact that 802.11n – which Globalstar says that TLPS will use “in the future” – would have.

### *Globalstar’s Dismissal of the 1/5/9/13 Channel Plan is Baseless.*

Globalstar asserts without evidence or citation that “the Channel 1/5/9/13 alignment is almost never used,” even internationally where restrictive OOB limits at the upper end of the ISM band do not apply.<sup>28</sup> By contrast, our October 10 letter offered a range of evidence that it is used: among other things, it’s a default option in the planning program Ekahau Site Survey; it’s mentioned directly in a popular industry reference book; it was specifically recommended for 2.4 GHz band Wi-Fi deployments by the South Korean government; and it was effectively replicated as the optimal setup by a sophisticated, automated channel-planning algorithm in a published study conducted at a European university.<sup>29</sup> Very recently, the WLAN professional Arsen Bandurian wrote a three-part series of blog posts discussing the same European study we referenced. In the first post, he noted that “even between channels 1-5 (2-6, etc) there’s sometimes enough attenuation to prevent decoding. This instantly allows squeezing in another channel in the 13-channel EU/ETSI frequency space and explains how (and when) **the popular 1-5-9-13 scheme works.**”<sup>30</sup> In the second part, he notes that the 2.4 GHz channel distribution arrived at by the aforementioned algorithm “seems familiar to **the good old 1-5-9-**

(2012), available at <http://pe.org.pl/articles/2012/9b/73.pdf> (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).

<sup>28</sup> Globalstar Response at 5.

<sup>29</sup> Kerrisdale October 10 Letter at 9.

<sup>30</sup> *WLAN Channel Management F1 Style: Part 1 of 3*, Arsen Bandurian: Technical Blog (Oct. 20, 2014), <http://arsenb.wordpress.com/2014/10/20/wlan-channel-management-f1-style-part-1-of-3-2/> (emphasis added).

13.”<sup>31</sup> Meanwhile, in the comments section of a blog post on Wi-Fi design in schools, “James” wrote in May (emphasis added):

“I am guilty of deploying a 1 AP per classroom network. . . . I do have the luxury of being in Australia meaning I can go with a 1,5,9,13 channel plan, and iPads prefer 5GHz even without band steering. So I’m quite happy with the result, but if I did it again today with 2x2:2 iPad Airs the result may have been different. Really, for density you want 5GHz only APs, or APs with two 5GHz radios and no 2.4GHz.”<sup>32</sup>

The evidence we have marshaled belies Globalstar’s conclusory assertion that such an “alignment” is “almost never used.” By discussing the lower adjacent-channel-interference risk of a 1/6/11/14 channel plan relative to a 1/5/9/13 plan, Globalstar again misses the point. If *all unlicensed spectrum users* in the 2.4 GHz band had access to Channel 14, then a 1/6/11/14 structure would indeed perform better. But that is not Globalstar’s business plan for TLPS. Instead, it seeks to have Channel 14 all to itself. Thus, there is no reason whatsoever to expect that the existing traffic on the 2.4 GHz band would ever be spread evenly across four channels. By contrast, easing OBE limits and promoting global harmonization in the 2.4 GHz band would give all Wi-Fi network designers the option of deploying four non-overlapping 2.4 GHz band channels where this configuration made sense, thereby further easing whatever congestion might exist in that band. Globalstar speaks about the “benefits” of TLPS as if they would be shared evenly by all Wi-Fi users, yet its entire business case rests on the opposite scenario.

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<sup>31</sup> *WLAN Channel Management F1 Style: Part 2 of 3*, Arsen Bandurian: Technical Blog (Oct. 25, 2014), <http://arsenb.wordpress.com/2014/10/25/wlan-channel-management-f1-style-part-2-of-3>.

<sup>32</sup> Comment on Keith R. Parsons, “Why One Access Point Per Classroom Approach Is Wrong,” WLAN Professionals (May 3, 2014), <http://www.wlanpros.com/one-ap-per-classroom-approach-wrong/#comment-2042>.

## Kerrisdale's Credibility

Globalstar spent part of its letter attacking Kerrisdale's credibility and accusing us of engaging in "pseudoscience" and seeking short-term gain. It is audacious for a company 70% owned<sup>33</sup> by a single billionaire whose personal wealth skyrocketed over a period of months as a result of hype over TLPS<sup>34</sup> to accuse another party of having only financial self-interest at heart. Globalstar, like Kerrisdale, is obligated to serve the interests of its investors. We are no more financially motivated or short-term-oriented than Globalstar is.

Moreover, while Kerrisdale is certainly not a telecommunications firm or technology vendor, it is a highly credible participant in the capital markets, with a strong reputation built on a history of exposing fraudulent and overhyped firms. In November 2010, we published research on China Education Alliance, alleging that the company was "mostly a hoax."<sup>35</sup> Subsequently, in 2013, the Securities and Exchange Commission filed an enforcement action against the company's auditor for failing to properly audit China Education Alliance, including with respect to verifying bank balances and revenue, in response to our report.<sup>36</sup> In November 2011, we published research on ChinaCast Education Corporation revealing how the company was committing fraud against U.S. investors.<sup>37</sup> Two years later, the Securities and Exchange Commission sued ChinaCast's former executives for fraud.<sup>38</sup> Throughout our history, we have uncovered numerous companies that have committed fraud, made highly misleading technological claims, or used other devices to artificially inflate their stock prices for the benefit of company insiders. We take great pride in the accuracy of our work.

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<sup>33</sup> Globalstar Value Proposition, Globalstar, at 6 (Oct. 9, 2014), <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MjU0MzI3fENoaWxkSUQ9LTF8VHlwZT0z&t=1>.

<sup>34</sup> See, e.g., Brendan Coffey, "Billionaire Spurned by Buffett Pursues Global Wi-Fi Network," Bloomberg News (Oct. 28, 2014), <http://www.bloomberg.com/news/2014-10-28/billionaire-spurned-by-buffett-seeks-global-wi-fi-network.html>.

<sup>35</sup> Kerrisdale Capital, *China Education Alliance (CEU)*, at 1 (Nov. 2010), <http://kerrisdalecap.com/wp-content/uploads/2010/11/CEU-Report-November-2010.pdf>.

<sup>36</sup> *Sherb & Co., LLP, et al.*, Order Instituting Public Administrative and Cease-and-Desist Proceedings Pursuant to Sections 4C and 21C of the Securities Exchange Act of 1934 and Rule 102(e) of the Commission's Rules of Practice, Making Findings, and Imposing Remedial Sanctions and Cease-and-Desist Order, Exchange Act Release No. 70823 (Nov. 6, 2013), available at <http://www.sec.gov/litigation/admin/2013/34-70823.pdf>.

<sup>37</sup> See Kerrisdale Capital, *ChinaCast Education Corporation* (Nov. 2011), <http://kerrisdalecap.com/2011/11/29/chinacast-education-corporation>.

<sup>38</sup> *SEC v. Chan Tze Ngon & Jiang Xiangyuan*, Complaint, No. 13 Civ. 6828 (S.D.N.Y. Sept. 26, 2013), available at <https://www.sec.gov/litigation/complaints/2013/comp-pr2013-200.pdf>.

## Conclusion

Time and again, Globalstar has extolled the purported “public interest benefits” of its TLPS proposal without sufficient evidence to back up its claims. It has done the same thing in response to Kerrisdale’s letters by attacking Kerrisdale’s credibility and tests rather than provide additional support for its own assertions. If Kerrisdale’s arguments had no credibility, Globalstar would not be bothering to respond to them, as it has done at great, albeit unconvincing and ineffective, length in several different fora over the past month. Instead of focusing on pedigrees and purported motives, the Commission should hone in on the quality of the evidence presented. Globalstar has not offered any compelling proof of TLPS’s “public-interest benefits,” just a barrage of incorrect and misleading claims. The Commission should therefore consider alternative, more effective ways of expanding the supply of spectrum available for wireless broadband services, especially easing the OOB limits at the upper edge of the 2.4 GHz band in line with international practice.

Pursuant to Section 1.1206(b)(2) of the Commission’s rules, an electronic copy of this letter is being filed for inclusion in the above-referenced dockets. Please direct any questions regarding this filing to the undersigned.

Respectfully submitted,

/s/ Sahm Adrangi

KERRISDALE CAPITAL MANAGEMENT, LLC

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