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August 8, 2013

**EX PARTE PRESENTATION**

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

Re: Ex Parte Presentation in WT Docket No. 12-69, *Promoting Interoperability in the 700 MHz Commercial Spectrum*

Dear Ms. Dortch:

Pursuant to Section 1.1206 of the Commission's rules, 47 C.F.R. § 1.1206, DISH Network Corporation ("DISH") submits this letter summarizing a meeting on Tuesday, August 6, 2013 with Tom Peters, Chief Engineer, Wireless Telecommunications Bureau; Jim Schlichting, Deputy Chief, Wireless Telecommunications Bureau; Charles Mathias, Associate Chief, Wireless Telecommunications Bureau; Nese Guendelsberger, Division Chief, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau; Paul D'Ari, Deputy Chief, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau; Thuy Tran, Engineer, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau; Stacy Jordan, Economist, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau (by telephone); Paroma Sanyal, Economist, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau; and Jennifer Salhus, Attorney, Spectrum and Competition Policy Division, Wireless Telecommunications Bureau. Present on behalf of DISH were Jeffrey Blum, Senior Vice President and Deputy General Counsel; Mariam Sorond, Vice President, Technology Development; Alison Minea, Director and Senior Counsel; Hadass Kogan, Associate Corporate Counsel; John Kim, Technology Development Principal; and Doug Hyslop, outside consultant (by telephone). During the meeting, DISH distributed to staff copies of slide numbers 1-5 in Attachment A hereto.

During the meeting, DISH reiterated that power levels for its Lower 700 MHz E Block licenses are irrelevant to the Commission's goals with respect to interoperability. As discussed below, in 2002 and 2007 the Commission found the currently authorized power level of 50 kW for the E Block to be in the public interest, and the record reflects neither technical nor policy arguments that form a basis for departing from those earlier conclusions. The only technical data submitted in the record to date actually reinforces the Commission's 2002 and 2007 public interest determinations that 50 kW power levels will not cause harmful interference to other Lower 700 MHz operators. In addition, AT&T, Inc. ("AT&T") and QUALCOMM Inc. ("QUALCOMM") have repeatedly told the Commission that they support 50 kW power levels in

the Lower 700 MHz band, and that even with only 1 MHz of separation, high power broadcast and two-way voice/data communications can co-exist without harmful interference.

## I. The Commission Adopted Technical Rules for the Lower 700 MHz E Block That It Found to be in the Public Interest, and Nothing in the Record Justifies Reversing Those Findings.

The Commission can adopt interoperability rules without addressing the issue of DISH's authorized power levels for its 700 MHz E Block licenses. The Commission does not have a sufficient basis to upset the technical rules adopted prior to the 700 MHz auction, which the Commission found to be in the public interest, and upon which DISH relied when it chose to participate in that auction.

No party has submitted actual lab or field measurement data that demonstrates that Band 12 devices will suffer harmful interference from E Block operations at the currently authorized power levels, nor are there any public policy concerns or market changes that have developed since the E Block rules were adopted that would justify changing those rules for a license after it has been auctioned.

When DISH bid on its 700 MHz E Block licenses, its business plans were based upon (among other things) the established power limits, which allow licensees to operate at power levels of up to 50 kW ERP.[1] Since initially setting service rules for the Lower 700 MHz band, the Commission has repeatedly found that those power limits serve the public interest by fostering flexible use of the spectrum, while protecting against interference. The Commission established the 50 kW ERP power limit for portions of the Lower 700 MHz band in its *2002 700 MHz Report and Order*.[2] The Commission concluded that this limit would promote efficient use and preserve technology neutrality in the band:

> A 50 kW maximum ERP limit [for Lower 700 MHz band licensees] will promote efficiency and maximize flexibility to the extent practicable by allowing the greatest number of different services to co-exist – and to serve more consumers – subject only to reasonable standards for non-interference. We believe such a power limit will produce the most efficient use of this spectrum resource.[3]

In the same order, the Commission also considered, and rejected, proposals that the 50 kW power level should be reduced to avoid harmful interference. While the Commission recognized the potential for interference to systems operating at lower power levels, it concluded

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[1] *See* 47 C.F.R. § 27.50(c)(7). *See also* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, et al., *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 06-150, 22 FCC Rcd 8064, 8097 ¶ 88 (2007) ("*2007 Report and Order*").

[2] *See* Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), *Report and Order*, GN Docket No. 01-74, 17 FCC Rcd 1022, 1064 ¶ 103 (2002) (*2002 700 MHz Report and Order*).

[3] *Id.*

that "any risk that such interference will be harmful can be mitigated so as not to outweigh the added flexibility that is afforded by the higher power limit."[4]

The Commission revisited this determination in 2007 just prior to the Lower 700 MHz auction, and maintained the 50 kW limit established in 2002.[5] In the *2007 Report and Order*, the Commission reexamined the issue of interference with respect to the 50 kW power limit and again expressly found that the designated power level provides appropriate protections. Significantly, the Commission also recognized the harm that can arise when incumbent users are subjected to changes in power limits *after* they have already acquired licenses: "it would not be appropriate to reduce the power limits of incumbent Lower 700 MHz Band licensees, who acquired their spectrum with the expectation that they would be able to employ 50 kW ERP transmissions in the band."[6]

## II. AT&T and QUALCOMM's Previous Technical Submissions Suggest That E Block 50 kW Power Levels Will Not Cause Interference to the B and C Blocks.

AT&T and QUALCOMM have called for E Block power levels to be reduced in this proceeding, but they previously told the Commission that high power broadcast operations can co-exist with lower power voice/data communications with as little as 1 MHz of guard band between them.

AT&T, which now claims E Block has the potential to with Band 12 devices,[7] previously admitted to the Commission that a 1 MHz guard band is sufficient to protect two-way voice/data communications (*e.g.*, LTE) from adjacent high power 50 kW broadcast operations. In a 2007 submission, AT&T discussed the need to have a guard band between the high power Lower 700 MHz C Block and the Upper 700 MHz C Block (which was to be used for two-way communications).[8] To prevent interference, AT&T stated that a 1 MHz guard band (created by the 1 MHz A Block guard band between the Lower C Block and the Upper C Block) would be sufficient: "Filters which meet the OOBE requirements would likely provide an additional 8 dB of attenuation within the 1 MHz A Block guard band."[9] In particular, AT&T said that "keeping the A Block guard band located at 746 MHz can help mitigate interference, thereby maintaining a reasonable and cost effective handset design for operation in the Upper 700 MHz C Block."[10] The significance of this quotation should not be lost: as recently as 7 months before the auction, AT&T definitively stated that a 1 MHz guard band from a 50 kW transmitter would be adequate

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4 *Id*. ¶ 104.

5 *2007 Report and Order* ¶ 95.

6 *Id*. ¶ 96.

7 *See* Letter from Joan Marsh, AT&T, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69, at 1 (July 12, 2013) ("High-power broadcasts from Channel 51 and the E Block create the potential for debilitating interference to Band 12 devices . . .").

8 *See* AT&T Inc. Reply Comments, WT Docket No. 06-150, at 25-26 (June 4, 2007).

9 *Id.* at 28.

10 *Id.*

for device design and coexistence. Subsequently, 3GPP implemented a 1 MHz mandatory guard band between the Lower E Block and the Lower A Block as part of the Band 12 definition, which was finalized in 2010.[11] Today, Band 12 meets all technical requirements stipulated by AT&T prior to the auction.

Similarly, QUALCOMM previously represented to the Commission that it supports 50 kW power levels in the Lower 700 MHz band: "[T]here is no evidence to support a reduction of the existing 50 kW power limit for the Lower 700 MHz spectrum licensed to QUALCOMM, and, therefore, the Commission should not reduce that power limit."[12] QUALCOMM also stated: "We see no public interest benefit to a reduction in the power limits because operation with mitigated interference is possible within the present power limits."[13] QUALCOMM noted that the Commission adopted safeguards to protect lower-power operations from neighboring 50 kW broadcast operations—the power flux density ("PFD") limit and the requirement for high power licensees to notify adjacent operators in advance so that interference concerns could be studied and, if necessary, mitigated.[14]

## III. No Technical Data Submitted to Date Would Justify Changing the Current E Block Power Levels.

If the Commission were to change the authorized power levels for the E Block, it is unclear what would be the technical justification for such a change. Test data submitted for the record in 2012 (the "Hyslop-Kolodzy Report") demonstrated that an E Block 50 kW transmission will not adversely impact device reception of nearby Band 12 devices.[15] The Hyslop-Kolodzy Report summarized the results of laboratory testing of commercial Band 17 devices using a test methodology that emulated a Band 12 scenario by placing a high power signal adjacent to the Band 17 operating channel. Tests of the two commercial LTE devices available at the time noted normal performance with an equivalent E Block signal of -16 to -17 dBm.

Based on field measurements taken at an E Block tower in Fayetteville, Georgia, the results demonstrated a 13 dB margin beyond the threshold of blocking interference – thus

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[11] *See* R4-104458, CR for Correction to Band 12 Frequency Range, 3GPP TSG-RAN WG4 Meeting #57 (November 2010), *available at* http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_57/Docs/.

[12] QUALCOMM Incorporated Reply Comments, WT Docket No. 06-150, at 3 (Oct. 20, 2006).

[13] QUALCOMM Incorporated Comments, WT Docket No. 06-150, at 23 (Sept. 29, 2006).

[14] *Id.* at 22-23.

[15] *See* Letter from R. Nash Neyland, Cavalier Wireless LLC; Eric B. Graham, C Spire Wireless; E.B. Martin, Jr., Continuum 700 LLC; Allison C. DiNardo, King Street Wireless, L.P.; Mark A. Stachiw, MetroPCS Communications, Inc.; Grant B. Spellmeyer, U.S. Cellular; and Michele C. Farquhar, Counsel to Vulcan Wireless, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69, Attachment: Lower 700 MHz Test Report: Laboratory and Field Testing of LTE Performance near Lower E Block and Channel 51 Broadcast Stations (May 29, 2012) ("Hyslop-Kolodzy Report").

concluding that there is no threat of E Block interference to Band 12 devices operating in the Lower B and C Blocks.[16]

The Hyslop-Kolodzy Report conclusions were validated in a subsequent technical submission by V-COMM, L.L.C. ("V-COMM"), which performed tests of Band 12 and Band 17 devices.[17] With a desired signal 10 dB above the device receiver sensitivity (a very weak signal level relative to typical outdoor LTE signals) the LTE device did not begin to experience blocking until the E Block signal exceeded -20 dBm, which is consistent with the Hyslop-Kolodzy Report's findings.

A subsequent DISH technical study built upon the two previous technical submissions by concluding that, as the result of the strict ground-level PFD limits applicable to the E Block, a high power Lower E Block broadcast transmission causes less ground level signal than would a lower power 1 kW/MHz base station transmission deployed in the same block.[18] This conclusion is explained by the different approach to site design of a broadcast system. With broadcast, the goal is to cover as much area as possible with each site. The operator selects the highest tower available and installs an antenna designed to focus energy toward the horizon, to increase the coverage range. The area around the broadcast tower is clear of obstructions, such as tall buildings, to ensure maximum propagation down-range. An LTE device operating in close proximity to the broadcast tower would not be in the main beam of the antenna pattern, greatly reducing the broadcast signal toward the device. Furthermore, the greater distance to the broadcast antenna, by virtue of the tall tower, increases the RF propagation path loss to the ground, reducing the ground-level signal strength.

The DISH technical study found that reducing authorized E Block power levels to 1 kW/MHz could result in higher ground level power compared to the current PFD-limited 50 kW level. If DISH were constrained to a lower ERP of 1 kW/MHz, then the PFD rule would not apply, and the resulting DISH deployment of broadcast operations in the Lower E Block would result in a stronger ground-level signal than would the currently planned 50 kW deployment. Thus, not only would DISH be forced to construct tens of thousands of additional E Block sites to make up for the reduced power, but adjacent Lower A, B and C Block operators may actually begin to experience pockets of increased interference around each 1 kW/MHz E Block site, given the stronger ground-level signals.

DISH used the 1 kW/MHz ERP transmit level in its technical study, because it is the same level that applies to the rest of the Lower 700 MHz Blocks and to the handful of E Block

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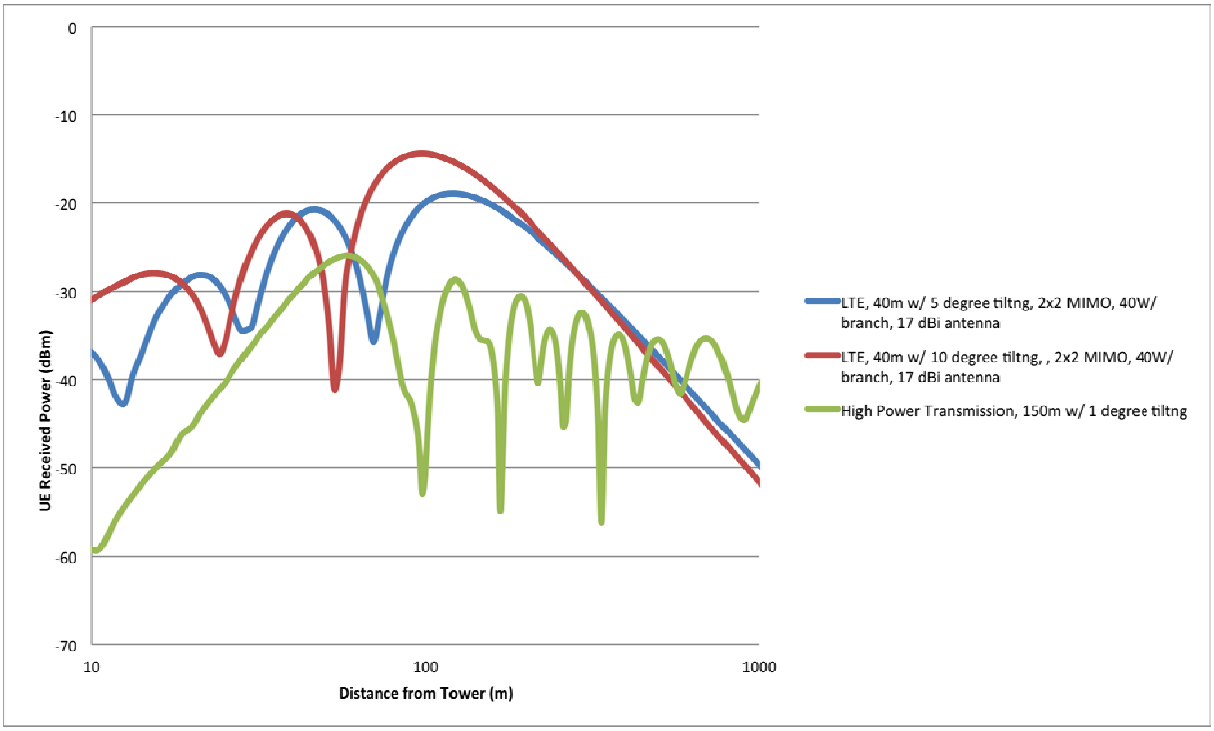
16 *Id.* at 35.

17 *See* V-COMM, L.L.C. Reply Comments, WT Docket No. 12-69 (July 13, 2012) ("V-COMM Report").

18 *See* Letter from Jeffrey H. Blum, DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69 (May 29, 2013).

licenses that DISH does not own.[19] Using the 1 kW/MHz transmit level, DISH simulated the ground signal levels resulting from a hypothetical low power E Block base station deployment. It is important to note that the DISH analysis used the current and actual maximum power level allowed by the FCC's rules and assumed the maximum signal level that would be permitted under the regulatory requirements. Although not all LTE deployments will reach the maximum permissible level of 1 kW/MHz, actual transmission levels from LTE deployments are vendor- and equipment-specific and each operator will source from the vendor/equipment that can meet its network and service objectives. At the same time, a comparison reveals that the 1 kW/MHz level is not an overestimation. Assuming each transmit branch is able to deliver 40 W output power, a 2x2 MIMO LTE base station integrated with a 17 dBi antenna would yield a total output power of 4009 W EIRP, only 3 dB less than DISH's assumed level of 8200 W EIRP (5000 W ERP) for a 5 MHz carrier. Figure 1 shows a ground signal level comparison between a high power E Block transmission and the aforementioned LTE transmission. It shows that the LTE base station generally produces a stronger ground-level signal within 1 km of the tower, consistent with DISH's earlier findings:

**Figure 1.**
**Received Signal Comparison Between 40 m LTE Transmission vs. 150 m High Power in Lower E Block**




Finally, DISH independently conducted adjacent channel selectivity ("ACS") and blocking tests with a commercially available Band 12 device at one of its lab facilities. Results

[19] *See* 47 C.F.R. § 27.50(c)(7). *See also* Application of AT&T Inc. and Qualcomm Incorporated For Consent to Assign Licenses and Authorizations, *Order*, 26 FCC Rcd 17589, 17615-17618 ¶¶ 59-68 (2011).

from the tests (included in Attachment A hereto) demonstrate that the Band 12 device exceeds the 3GPP minimum ACS and blocking specifications by more than 30 dB and can perform at 95% throughput at adjacent E block levels as high as -13 dBm. DISH's device test results are consistent with the earlier test data provided by the Hyslop-Kolodzy and V-COMM reports, re-confirming commercial LTE devices' resiliency in the presence of strong adjacent signals. DISH's recent test results thus offer the third set of test data on record refuting the argument that Band 12 devices will be adversely impacted by an E Block broadcast deployment.

Notably, neither AT&T nor QUALCOMM have submitted technical data to rebut these detailed submissions from Hyslop-Kolodzy, V-COMM, and DISH. QUALCOMM merely has offered some misleading criticisms of the technical data that others have submitted:

- **Filter Performance.**

QUALCOMM states that the Hyslop-Kolodzy Report authors "concede that they do not know which filter is used in the AT&T device being tested, what its performance characteristics are, or what level of E Block signal rejection it provides"[20] and that the "subsequent generalization and assertion that this unknown filter will be representative of all devices (existing and future) makes this test configuration, and any generalizations derived from it, unsupported and unreliable."[21]

QUALCOMM appears to have misunderstood the tests described in the Hyslop-Kolodzy Report. The Report's authors noted the lack of information regarding the Band 17 filter performance and consequently designed the test to quantify the receiver performance inside of the Band 17 RF filter passband.[22] The test results document the performance of the receiver itself, without assistance from the RF filter in the device. Importantly, the RF receiver of the commercial LTE devices performed admirably, demonstrating that Band 12 devices would experience no harmful interference in a market with Lower E Block 50 kW towers.[23]

- **Receiver Performance.**

QUALCOMM criticizes the Hyslop-Kolodzy Report for testing only two devices, arguing that "[a] more prudent approach to assessing device performance would be to use a performance level based on the 3GPP standard. Manufacturers build devices to meet the 3GPP standard, thereby enabling them and the carriers who sell the devices to be able to accurately predict performance no matter what particular device a consumer chooses."[24]

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[20] *See* QUALCOMM Incorporated Reply Comments, WT Docket No. 12-69, at 12 (July 16, 2012) ("QUALCOMM 2012 Reply").

[21] *Id.*

[22] *See* Hyslop-Kolodzy Report at 16.

[23] *Id*. at 4.

[24] QUALCOMM 2012 Reply at 14.

QUALCOMM's viewpoint is perplexing, in that the 3GPP performance levels were first defined in the late 1990s for the first version of W-CDMA, before equipment was even available to test. The levels have not been updated since, despite multiple generations of technological advances.

Moreover, it is typical and widely accepted to submit data, and make decisions based on, actual performance of commercially available devices as opposed to using 3GPP standards. For example, AT&T, T-Mobile, and Sprint all used actual device performance when offering technical studies in the H Block proceeding,[25] and QUALCOMM apparently had no concerns with that approach. Consistent with this practice, the Hyslop-Kolodzy Report tested the Lower 700 MHz devices that were commercially available at the time (October 2011), using test procedures consistent with the procedures followed by the H Block test reports recently presented to the Commission.

The Hyslop-Kolodzy Report's test results demonstrated that commercial devices exceed the 3GPP performance levels by 28 dB in adjacent channels, and 39 dB in the second adjacent channel.[26] This markedly better performance cannot be explained as a design margin necessary for manufacturers. Put in layman's terms, the 39 dB improvement means the 3GPP level was exceeded by nearly 8,000 times.

In addition, the Hyslop-Kolodzy test results concurred with the subsequent V-COMM tests of Band 12 devices. V-COMM's Band 12 tests revealed a receiver selectivity of 78 dB or more,[27] relative to the Hyslop-Kolodzy selectivity test result of 74 dB. DISH's own measurement shows Band 12 device receiver selectivity ranging between 72-73 dB. An important measure of a test's validity is repeatability. The Lower E Block test data is now validated by three independent test reports, including DISH's test data. Critically, no dissenting test data has been submitted by anyone, including AT&T and QUALCOMM.

While variations in blocking performance do exist among various devices, the three reports are consistent in reporting that all the tested commercial LTE devices exceed the minimum 3GPP requirements by large margins. These test results show that, unlike QUALCOMM's claim, device manufacturers are going beyond the minimum 3GPP requirements and building in substantial performance margins to their devices. Device manufacturers need to introduce these additional performance margins in order to ensure proper performance under hostile real-world conditions and differentiate their products in the competitive market place.

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[25] *See* Letter from Linda Vandeloop, AT&T, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-357, at Attachment: H-Block Compatibility Analysis for GSM, UMTS and LTE (May 14, 2013); Letter from Tamara Preiss, Verizon Wireless, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-357, at Attachment: H-Block Interference Test Results with Verizon CDMA Devices (April 18, 2013); Sprint Nextel Corporation Reply Comments, WT Docket No. 12-357 (March 7, 2013).

[26] *See* Hyslop-Kolodzy Report at 24.

[27] *See* V-COMM Report at pp. 8, 36.

Although it is difficult to predict the exact performance levels of future LTE devices, it is clear that the overall device performance will continue to improve as more advances in filter design and LTE chipset are introduced. A good example of natural device performance progression over time can be found again in the recent H Block proceedings. Test data supplied by PCS operators indicate newer PCS devices exhibit improved intermodulation and blocking performances against potential H Block interference compared to the ones tested in 2004.[28]

- **Difference in E Block and LTE Signal Patterns.**

QUALCOMM also criticizes the Hyslop-Kolodzy Report for reporting results that are purportedly limited to situations where an LTE user is near an E Block tower, which QUALCOMM believes would not apply when farther away from the base station:

> The HK Paper presents a "theoretical comparison of Lower E Block and LTE downlink power" in its Table 4.5. This table suggests a general finding that, throughout a geographic area, consumer devices will experience "a maximum of 8 dB stronger ground-level [E Block] signal than an LTE system." This conclusion is incorrect. While the HK Paper's reported results may be reasonable in the limited situations where a consumer is near an LTE base station, its results are unreasonable in the far more common situation where this is not the case.[29]

The analysis in the Hyslop-Kolodzy Report focused on ground-level results close to a tower because this is the location of interest where a strong E Block signal may exist. As documented in the laboratory tests, a mobile device performs normally in the presence of E Block signals up to -20 dBm or higher. The theoretical comparison of close-in signals (at 250 m from the tower) illustrated that the LTE tower signals would be within 8 dB of the E Block signal in such environments.

QUALCOMM claimed that at farther distances, the signal difference between the E Block and LTE signals will be more than 8 dB;[30] but this is irrelevant, because the E Block signals would be well below the blocking level at such distances. This is another case where QUALCOMM maintains that the 3GPP minimum blocking level, -56 dBm, would cause a blocking problem for a real, commercial LTE device – which it would not. If commercial devices truly performed as poorly as QUALCOMM claims, then every LTE base station in the market would pose a blocking hazard, and the Commission should consider severely limiting the base station transmit power in the Lower A, B or C Blocks. Fortunately, QUALCOMM is wrong.

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[28] *See* Letter from Tamara Preiss, Verizon Wireless, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-357, at Attachment: H-Block Interference Test Results with Verizon CDMA Devices (April 18, 2013). *See also* Sprint Nextel Corporation Reply Comments, WT Docket No. 12-357 (March 7, 2013).

[29] *See* QUALCOMM 2012 Reply at 16-17.

[30] *Id.* at 18.

- **Desensitization.**

QUALCOMM criticizes the Hyslop-Kolodzy Report's assumptions regarding receiver desensitization guidelines:

> Because the 3GPP testing levels already include significant levels of receiver desensitization, the HK Paper's assertion that "[i]nterfering signals stronger than that shown [in Table 4.1] may degrade the reference receiver performance, causing bit errors or interrupting communications"12 is misleading. In fact, receivers will begin experiencing interference at E Block power levels significantly lower than the levels shown in Table 4.1. In other words, contrary to the assumptions of the HK Paper, the 3GPP test levels do not constitute a threshold for interference-free operations. No wireless carrier would be able to deliver interference-free operations if its devices suffered 6 dB of desensitization.[31]

The fact that 3GPP test levels have specific receiver desensitization guidelines is not unusual. In fact, receiver blocking performance is typically tied to a specific desensitization level. There is nothing misleading about Table 4.1 in the Hyslop-Kolodzy Report, which was provided for informational purposes only, and played no role in the test results. The test results speak for themselves – not only did commercial devices experience no interference at the prescribed levels, contrary to QUALCOMM's claims, but the devices exceeded the claimed levels by nearly 8,000 times.

It is entirely inappropriate for QUALCOMM to present the minimum 3GPP requirements for "device performance" as the main criteria for testing for E Block interference in a real-world deployment. Those requirements are for benchmarking device performance in lab environments and do not constitute network design requirements. Using QUALCOMM's own logic, even an adjacent Lower A Block LTE deployment, not just the high power E Block deployment, would be detrimental to Lower B and C Block operations, because field measurements show LTE signals routinely exceeding the 3GPP minimum performance levels. For example, QUALCOMM uses the minimum in-band blocking level of -56 dBm as the baseline threshold for identifying E Block interference using its previous MediaFLO deployment data[32] without considering the impact of the desired signal level. The blocking performance is a function of both the interfering and desired signals; the stronger the desired signal, the better tolerance against higher adjacent signals. The -56 dBm level applies when the reference desired signal level (REFSENS) is set very low (-97 dBm for QPSK, 5 MHz Carrier),[33] the level rarely observed, if at all, in real LTE deployments.[34] First, identifying the interfering signal alone is not enough to determine the actual device performance impact in actual deployments. Second, even

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31 *Id.* at 6.

32 *See* QUALCOMM Incorporated Comments, WT Docket No. 12-69, at 8 (June 1, 2012).

33 *See* 3GPP TS 36.101 v12.0, User Equipment Radio Transmission and Reception, Sections 7.3.1, *available at* http://www.3gpp.org/ftp/Specs/archive/36_series/36.101/36101-c00.zip.

34 *See* Hyslop-Kolodzy Report at 38.

at such low unrealistic desired levels, actual commercial devices can tolerate much higher interference levels than -56 dBm. Using the -56 dBm threshold, the minimum performance level, produces overly pessimistic and unrealistic results.

## IV. Lower A Block Deployment Will Not Be Adversely Impacted by E Block's Current Regulatory Requirements.

Finally, DISH previously produced a study demonstrating that a PFD-limited high power broadcast transmission in the Lower E Block is no more harmful to adjacent and neighboring block operations, including the Lower A Block, than the lower power alternative.[35] Attachment A, presenting the results of DISH's recently conducted lab test, shows that a Band 12 device operating in the Lower A Block can withstand an E Block signal level up to -13 dBm, demonstrating that E Block transmissions will not have an adverse impact on Lower A Block operations. DISH is unaware of any record submission indicating potential E Block interference concerns are impacting current or future Lower A Block deployment plans. Among DISH's 13 E Block test sites, two sites are located in Lower A Block operator's markets (Raleigh, NC and Milwaukee, WI), and no interference complaints have been received by DISH.

In addition, LTE systems are designed to provide a relatively strong outdoor signal level to ensure coverage to subscribers in cars and inside buildings. For example, the Hyslop-Kolodzy Report noted that all ground-level, outdoor measurements of the Verizon Wireless LTE system within the city of Atlanta were -80 dBm or higher.[36] The laboratory tests confirmed that LTE devices – without the benefit of the attenuation that a Band 12 filter would provide – performed normally with a signal 60 dB stronger in the E Block. DISH field measurements over the past two years showed no measured signals greater than -20 dBm. Therefore, an A Block deployment with the most unfavorable possible site placement, resulting in -80 dBm near the E Block tower, would still not cause a blocking issue to A Block receivers. The Band 12 RF filter performance would add further margin over this already favorable situation.

Respectfully submitted,
*/s/ Jeffrey H. Blum*
Jeffrey H. Blum

cc: Tom Peters
Jim Schlichting
Charles Mathias
Nese Guendelsberger
Paul D'Ari

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[35] *See* Letter from Jeffrey H. Blum, DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-69, at Attachment: Lower 700 MHz E-Block Transmit Power & Ground-Level Signal Analysis (May 29, 2013).

[36] *See* Hyslop-Kolodzy Report at 38.

Thuy Tran
Stacy Jordan
Paroma Sanyal
Jennifer Salhus

Attachment

# ATTACHMENT A

# DISH Lower E Block Analysis

August 6, 2013

# Test Data Demonstrates that E Block Will Not Adversely Impact Adjacent Operations

- Test data shows that 50 kW transmission will not impact adjacent device reception. *See Lower 700 MHz Test Report: Laboratory and Field Testing of LTE Performance near Lower E Block and Channel 51 Broadcast Stations*, WT Docket No. 12-69, May 29, 2012 ("Hyslop-Kolodzy Report").
- The Hyslop-Kolodzy Report provided extensive testing, which simulated a Band 12 scenario by placing a high power signal adjacent to Band 17 devices**.**
- Tests of the two commercial LTE devices available at the time noted normal performance with a simulated E Block signal of -16 to -17 dBm (very strong).

## Hyslop-Kolodzy Report

LTE device performs normally with -16 dBm signal two channels away (p. 24)

| Interferer Location | Interferer Center Frequency (MHz) | Upper Edge of Interfering Frequency (MHz) | Frequency Separation (MHz) | Interferer Power Level/4.5 MHz (dBm) | LTE BLER % | Receiver Selectivity (dB) |
|---|---|---|---|---|---|---|
| Lower B | 736.25 | 738.5 | 1.75 | -30 | 1% | 60.3 |
| Lower B | 735.25 | 737.5 | 2.75 | -23 | 1% | 67.3 |
| Lower A/B | 734.25 | 736.5 | 3.75 | -22 | 0% | 68.3 |
| Lower A/B | 733.25 | 735.5 | 4.75 | -20 | 1% | 70.3 |
| Lower A/B | 732.25 | 734.5 | 5.75 | -18 | 1% | 72.3 |
| Lower A | 731.5 | 733.75 | 6.5 | -16 | 1% | 74.3 |

# Test Data Demonstrates that E Block Will Not Adversely Impact Adjacent Operations

- Field test data provided in the Hyslop-Kolodzy Report noted that no interference would result to Lower B and C Blocks in the operational Atlanta market.
- AT&T and Verizon commercial LTE systems and DISH E Block broadcast towers were measured.
- Results demonstrated a 13 dB margin beyond the threshold of blocking interference – revealing there is no threat of interference. *See* Hyslop-Kolodzy Report at 35.

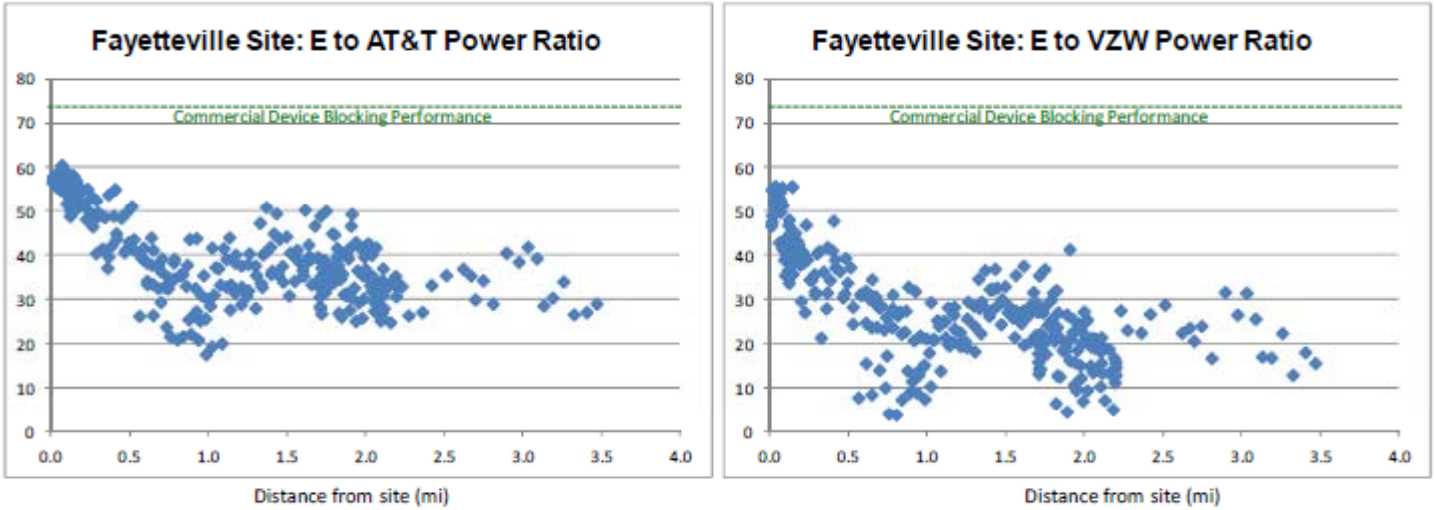


**Figure 4.13: Dish Broadcast Power Ratio Relative to AT&T and VZW LTE**

# Data Further Supports No Adverse Impact to Lower A Block

- The Hyslop-Kolodzy Report also assessed adjacent channel performance with a 1 MHz guard band, as would be seen between the Lower E Block and Lower A Block.

## Hyslop-Kolodzy Report

LTE device performs normally with -30 dBm signal in adjacent channel (p. 24)

| Interferer Location | Interferer Center Frequency (MHz) | Upper Edge of Interfering Frequency (MHz) | Frequency Separation (MHz) | Interferer Power Level/4.5 MHz (dBm) | LTE BLER % | Receiver Selectivity (dB) |
|---|---|---|---|---|---|---|
| Lower B | 736.25 | 738.5 | 1.75 | -30 | 1% | 60.3 |
| Lower B | 735.25 | 737.5 | 2.75 | -23 | 1% | 67.3 |
| Lower A/B | 734.25 | 736.5 | 3.75 | -22 | 0% | 68.3 |
| Lower A/B | 733.25 | 735.5 | 4.75 | -20 | 1% | 70.3 |
| Lower A/B | 732.25 | 734.5 | 5.75 | -18 | 1% | 72.3 |
| Lower A | 731.5 | 733.75 | 6.5 | -16 | 1% | 74.3 |

- The commercial LTE device operating in the A Block (Band 12) would perform normally with a -30 dBm signal in the E Block.
- All devices tested would comply with the 3GPP Band 17 specification for E Block rejection (-30 dBm).
- Band 12 commercial devices would thus comply with the 3GPP Band 17 specification.

# Other Test Report Validations

- V-COMM later performed tests of Band 12 and Band 17 devices. *See* V-COMM, L.L.C. Reply Comments, WT Docket No. 12-69, June 13, 2012.
- With a desired signal 10 dB above reference sensitivity, the LTE device in a worst-case reception scenario experiences blocking with an E Block signal of -20 dBm or stronger.

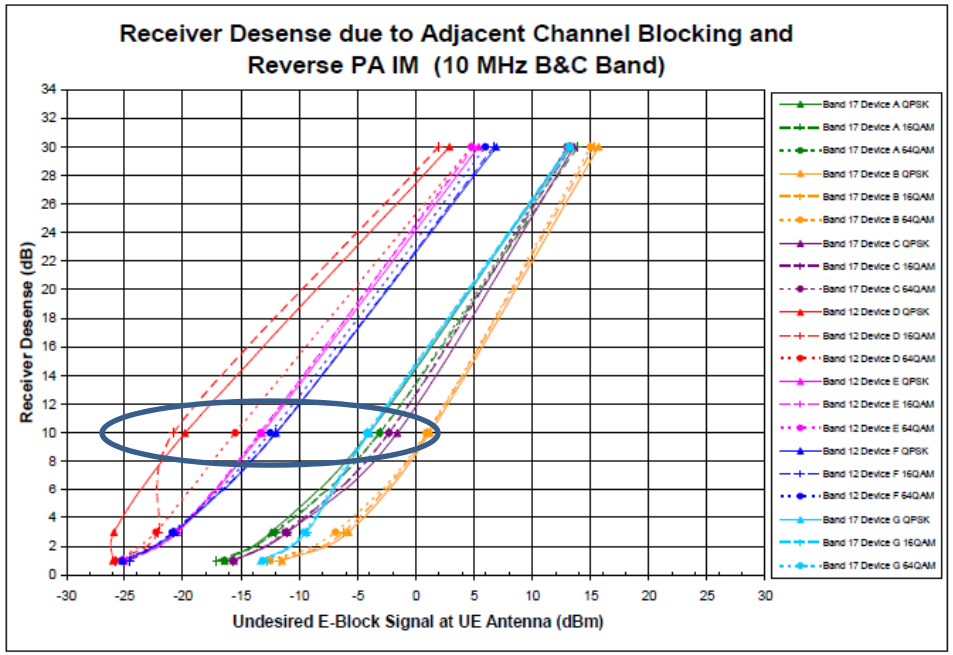


**Figure 24 –Adjacent Channel Blocking and Reverse PA IM, 10 MHz B+C Carrier**

# DISH Study Confirms FCC PFD Rule Protects Adjacent Licensees

- DISH provided analyses of ground-level signals from 50 kW transmitters at various heights, while complying with the ground-level power flux density rule. *See* DISH Network Corp. Ex Parte, WT Docket No. 12-69, May 29, 2013.
- The 50 kW transmitter, by virtue of its taller radiation center and antenna pattern, produced a **lower** (less than -20 dBm) ground-level signal than an LTE tower at a lower height.

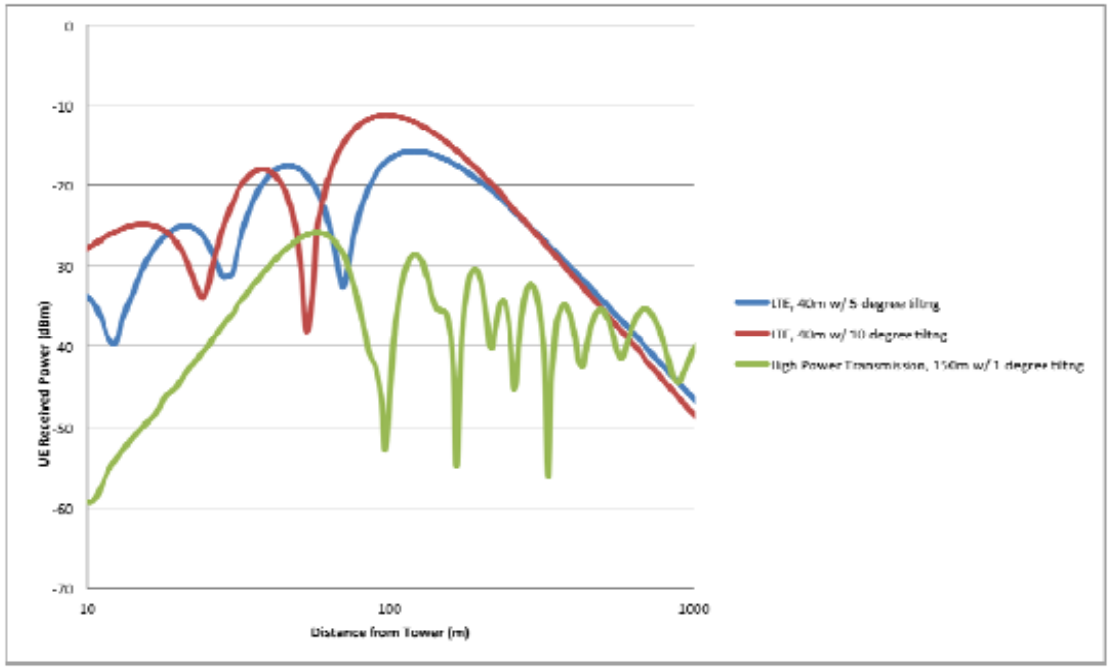


Figure 8. Received Signal Comparison Between 40 m Base Station Transmission vs. 150 m High Power in Lower E Block

# DISH Recent Lab Tests Confirm No Adverse Impact to Band 12 Devices

- DISH recently performed additional device tests and confirmed that commercially available Band 12 devices perform significantly better than minimum 3GPP specs:
  - Results shown in the following slides demonstrate that there is a 39 dB improvement with respect to 3GPP specifications. Devices can thus tolerate E-block signals up to -13 dBm tested as per 3GPP ACS guidelines.

- DISH also performed field measurements regarding E-block received power:
  - Results shown in the following slides demonstrate that the maximum power levels will not exceed -22 dBm, which is 9 dB below the lab device tolerance level for ACS. This substantial margin is more than sufficient to protect against any adverse impact for future Band 12 devices.

- The combined results from the lab tests and field measurements demonstrate that the lower A, B, and C-Block downlink band will not experience an adverse device impact from broadcast towers in E-Block.



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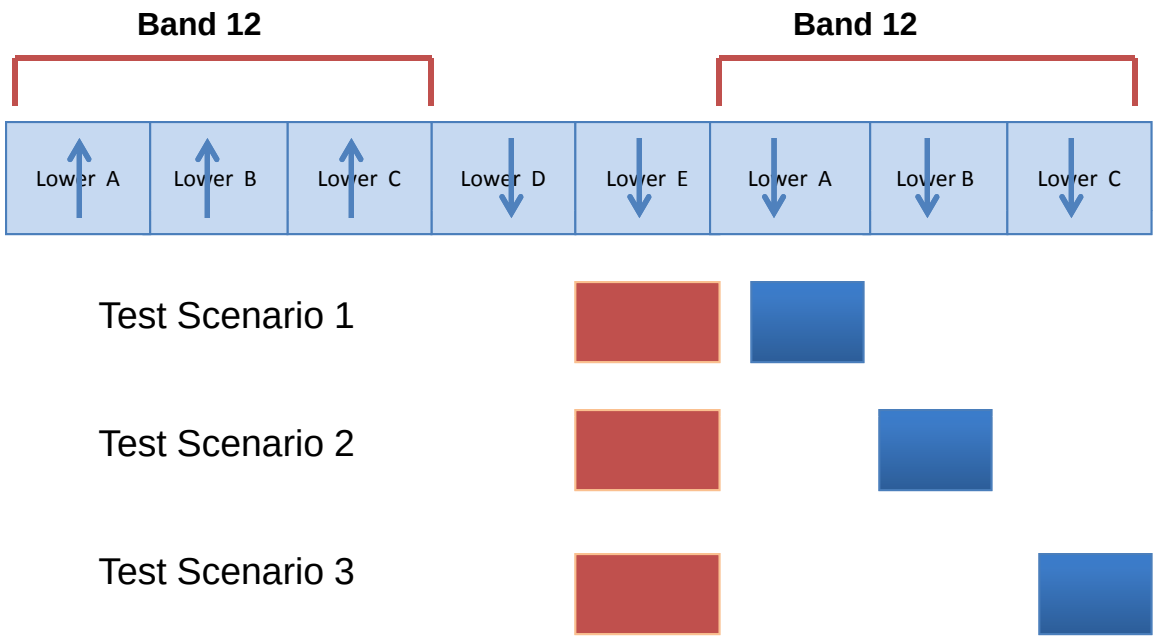
# Test Scenarios - Band 12 ACS and blocking performance

- U.S Cellular's Band 12 device (Samsung Galaxy S Aviator) was tested in the lab to measure ACS and blocking performance in the presence of E-Block transmissions.



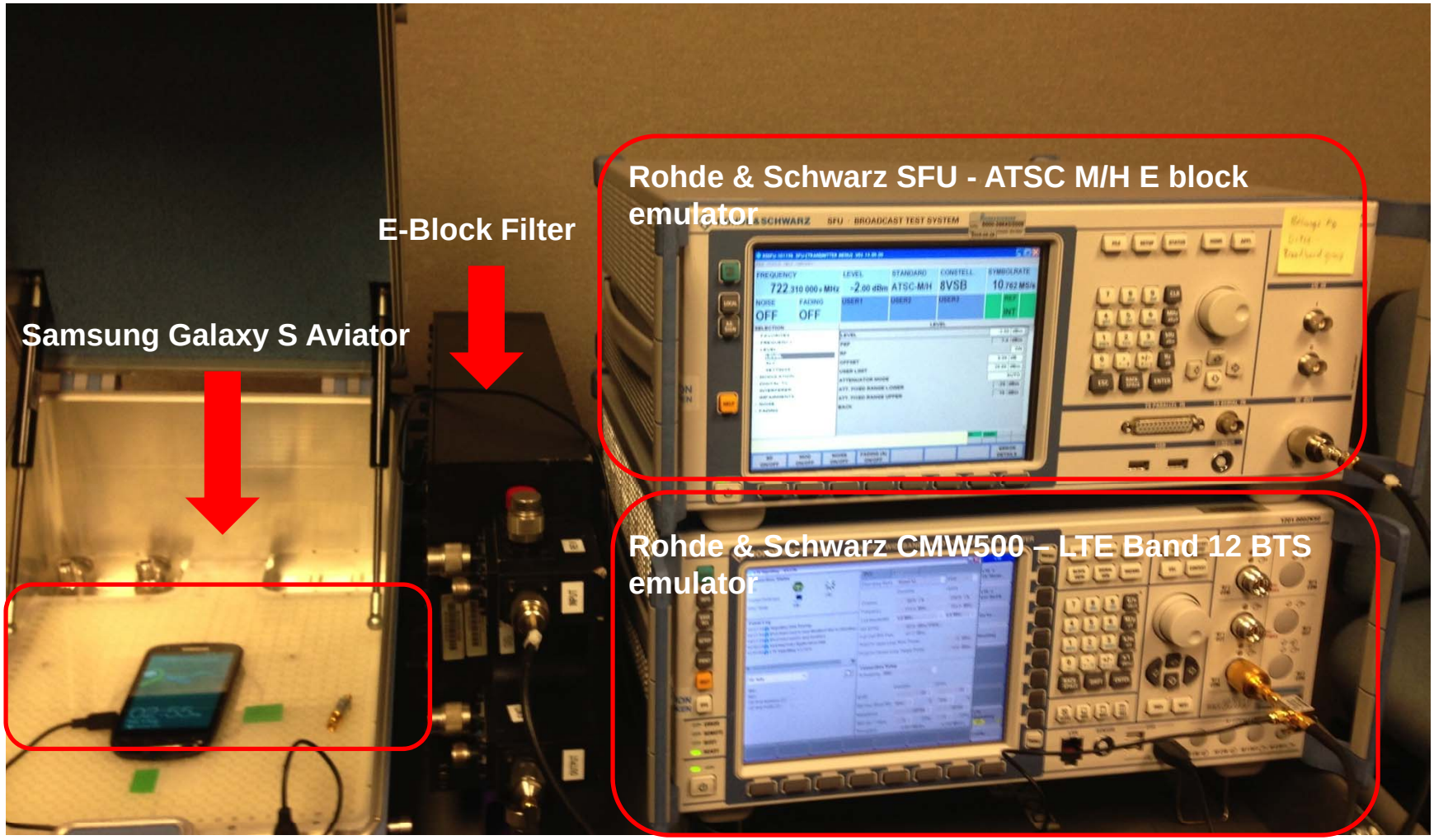

**Impact Demonstrated:**

E-Block on Band 12 Deployments in A Block (5 MHz, DL Fc= 731.5 MHz).

E-Block on Band 12 deployments in B-Block ( 5 MHz, DL Fc= 736.5 MHz)

E-Block on Band 12 deployments in C-Block ( 5 MH, DL Fc=742.5 MHz)

# Test Setup - Band 12 ACS and blocking performance



# Test Results – Band 12 devices exceed 3GPP specifications

- U.S Cellular's Samsung Galaxy S Aviator (a commercially available Band 12 device) was tested in the lab to compare performance relative to the 3GPP minimum requirements.

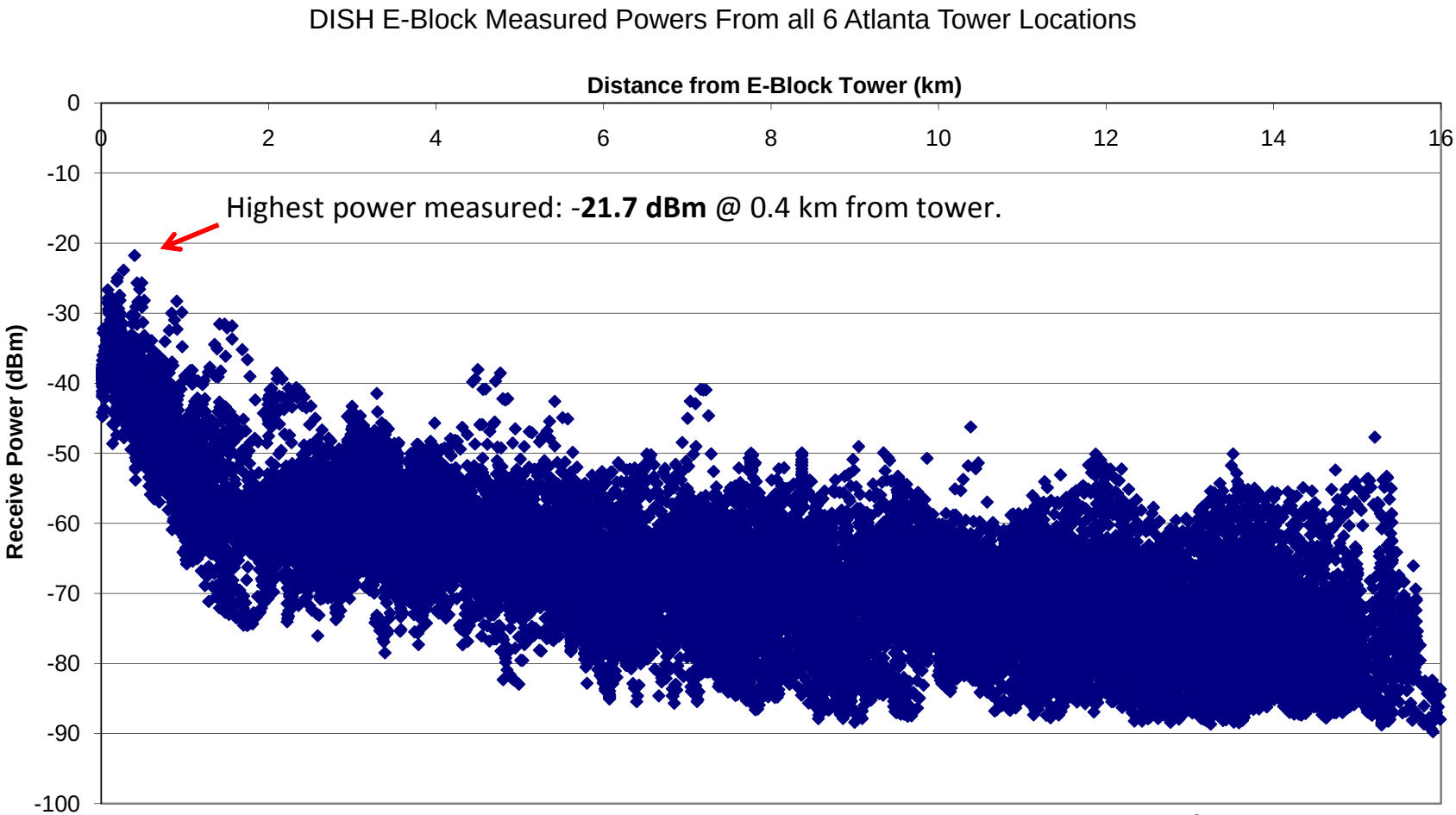
| | 3GPP Spec | | 3GPP Requirement (dB) | DISH Measured Results (dB) | Desired signal power | E-block received power | Band 12 Throughput (95% ) |
|---|---|---|---|---|---|---|---|
| **Test 1 Scenario** | TS 36.101 7.5.1 | Adjacent Channel Selectivity | 31.5 | 70 dB | -83 dBm | -13 dBm | 1.84 Mbps |
| **Test 2 Scenario** | TS 36.101 7.6.1.1 | In-Band Blocking (2nd adjacent) | 35 | 72 dB | -91 dBm | -19 dBm | 1.84 Mbps |
| **Test 3 Scenario** | TS 36.101 7.6.1.1 | In-Band Blocking (3rd adjacent) | 47 | 73 dB | -91 dBm | -18 dBm | 1.84 Mbps |
| **Maximum throughput observed was 1.95 Mbps, 5% BLER corresponded to an observed throughput of 1.84 Mbps.** | | | | | | | |

- Tests show that the U.S Cellular Band 12 device performs significantly better than minimum 3GPP ACS and blocking requirements – 39 dB better ( 70 - 31.5)

- Field measurements show E-block power levels lower than -35 dBm at distances greater than 1.7 km from the broadcast tower. Maximum power levels observed are no higher than -22 dBm within 0.4 km of the broadcast tower.

- To summarize, E-block transmissions will not have an adverse impact on Band 12 devices.

# DISH Field Testing – Measured Power From All Towers




FCC rules limit E-Block ground level power to maximum of -11.75 dBm (3 mW/m$^2$ as measured with a dipole)