Hogan Lovells US LLP
Columbia Square
555 Thirteenth Street, NW
Washington, DC 20004
T +1 202 637 5600
F +1 202 637 5910
www.hoganlovells.com

November 30, 2011

VIA ELECTRONIC DELIVERY

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Room TWA325
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation
WT Docket No. 11-18; RM-11592

Dear Ms. Dortch:

On November 28, 2011, Vulcan Wireless LLC ("Vulcan") representatives Scott Wills, Paul Nagle, Paul Kolodzy, and Michele Farquhar, along with C Spire Wireless ("C Spire") representatives Ben Moncrief and Doug Hyslop, met with Julius Knapp, Bruce Romano, Geraldine Matise, and Walter Johnston of the Office of Engineering and Technology; and Tom Peters, Peter Trachtenberg, and Chris Helzer from the Wireless Telecommunications Bureau to discuss a new 700 MHz interference study that supports the critical need for a condition on the AT&T-Qualcomm acquisition that would help restore the original Lower 700 MHz band plan, which would consolidate and unify the fragmented Lower 700 MHz band classes (Band Classes 12 and 17).

The group discussed the results of a "real world" study, funded by a consortium of several Lower 700 MHz A Block licensees,[1] to test the underlying assumptions originally put forth regarding the need for a separate Band Class 17 in the Lower 700 MHz band. The study also set out to test a series of unsubstantiated claims put forth by AT&T and Qualcomm regarding the technical feasibility and cost impact of possible conditions on the pending AT&T-Qualcomm acquisition. The study included a combination of in-market field environmental measurements in Atlanta along with lab bench testing of AT&T 4G LTE devices.

The study found that the anticipated interference circumstances were unfounded and the underlying assumptions put forth for a separate Lower 700 MHz Band Class 17 were overstated. The real world data confirms that the use of Band Class 12 would not lead to degraded service for Lower 700 MHz B & C Block users. The data demonstrates that different operators' systems in the

[1] The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS.

Lower B and C Blocks actually pose a threat of interference to each other that is greater than any threat that would be introduced from a unified Lower 700 MHz band class that includes the A Block. Moreover, the AT&T devices tested proved that the device designs successfully handled these differences in signal levels. Thus, neither high power E Block transmissions nor Channel 51 transmissions present an interference threat. Specifically, AT&T LTE devices currently receive and successfully manage greater disparities in signal levels from within their B and C Blocks than need to be accounted for by incorporating the A Block. In addition, concerns and claims made about reverse intermodulation distortion interference were shown to be unfounded, as the commercially deployed AT&T devices did not experience such interference. Finally, vague, alarmist, and unsubstantiated concerns and claims about the potential increase in cost and/or size of devices are inaccurate and misstated, as the current bill of materials costs will remain virtually unchanged. Therefore, the parties urged the Commission to impose a condition on the AT&T-Qualcomm acquisition that would help restore the original, unified Lower 700 MHz band plan, which would reconsolidate the fragmented Lower 700 MHz A, B, and C Blocks.

The attached materials were provided by Vulcan to Bureau staff during the discussion. Pursuant to Section 1.1206(b) of the Commission's rules, I am filing this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

Michele C. Farquhar
Counsel to Vulcan Wireless LLC

Partner
michele.farquhar@hoganlovells.com
D 1+ 202 637 5663

cc: Julius Knapp
Bruce Romano
Geraldine Matise
Walter Johnston
Tom Peters
Peter Trachtenberg
Chris Helzer

Study to Review Interference Claims that have Thwarted Interoperability in the Lower 700 MHz Band

November 28, 2011

Testing Commissioned

- A consortium of several 700 MHz A Block license holders funded a “real world” study by conducting a variety of tests and collaborative engineering analyses/evaluations regarding the underlying assumptions originally put forth regarding the need for a separate Band Class 17 in the Lower 700 MHz band that has precluded interoperability
- The study also set out to quantify results that would either prove or disprove several of the recent claims put forth by AT&T, QUALCOMM and RIM regarding the technical feasibility of possible interoperability conditions on the pending QUALCOMM spectrum sale to AT&T
- The study included a combination of in-market field environmental measurements along with device lab bench testing of several 4G devices
- The study included field measurements in Atlanta, a market with a high power E Block system (50 kW), AT&T Lower B and C Block LTE system, Verizon Upper C Block LTE system, a high power Channel 51 broadcaster and an LPTV broadcaster. Also included in the test were AT&T LTE 4G devices.

Study Objectives

- Provide “Real World” hard engineering data that specifically addresses and quantifies previously submitted general claims that has led to confusion regarding the impact of interference in the lower 700 MHz band
- Quantify answers to questions: If AT&T were to use Band Class 12 versus Band Class 17, would AT&T experience any increased levels of interference, degraded service or increases in handset costs?
  - Are the fundamental assumptions used to support AT&T’s adoption/creation of a separate Band Class 17 technically necessary or marketplace motivated?
- How does the AT&T acquisition of D and E Block licenses affect the need for Band Class 17 ?
  - Has the main rationale originally used to rationalize the creation of Band Class 17 been technically eliminated with this acquisition
  - Could the acquisition of these licenses impact interoperability among other license holders in the lower 700 MHz band

Lab Measurements and Field tests in Atlanta Demonstrated that Anticipated Interference Circumstances were Unfounded and the Underlying Assumptions put forth for a separate Lower 700 MHz Band Class 17 were Overstated. "Real World" data confirms that the use of Band Class 12 would Not Lead to Degraded Service for B & C Block users.

- Channel 51 DTV and LPTV signals were very weak (generally less than -40 dBm) and would not create "reverse intermodulation distortion interference"
- Currently, Band Class 17 already has greater levels of internal interference than levels of interference experienced in Band Class 12 from high power E Block transmissions.
- Therefore there are no technical reasons for Band Class 17
  - Devices deployed by AT&T (and Verizon) operate beyond minimum 3GPP specifications yet previous assumptions put forth did not reveal this performance; and
  - Measurements indicate RF environment is much more benign than stated by the rationale to create a separate Band Class 17
- Therefore, these analyses and measurements confirm the lack of interference issues with regard to interoperability and thus the cost, size, and power impact to devices would be either zero (in volume) or near zero (as shown later in the study).

Summary of Findings

- Band Class 17 B and C Blocks already suffer greater interference threats from each other than what would be introduced from a unified Lower 700 MHz Band Class that includes the Lower A Block. Neither high power E Block transmissions nor Channel 51 transmissions create an increased interference threat; in fact, the interference threat is lower.
  - AT&T LTE devices currently receive and successfully manage levels of interference from within the B and C Blocks than need to be accounted for by unifying the Lower 700 MHz paired bands
  - Concerns and claims made about reverse intermodulation distortion interference are unfounded

- Concerns and claims about increase in cost and/or size of devices are greatly exaggerated as current BOM costs will remain virtually unchanged.

Environmental Measurements and Device Testing

- Drive tests were performed in Atlanta to characterize real world environmental conditions that may cause interference from high power E Block or Channel 51 transmitters
  - Atlanta selected since it has multiple E Block transmission facilities at 50 kW, a deployed VZW LTE system in the Upper 700 MHz C Block, and a deployed AT&T LTE system in the Lower 700 MHz B & C Blocks and a high power Channel 51 broadcaster (1 MW)
- Device tests were performed in the laboratory to characterize the capabilities of the devices and the conditions necessary to create interference
  - Selected AT&T LTE 700 MHz devices

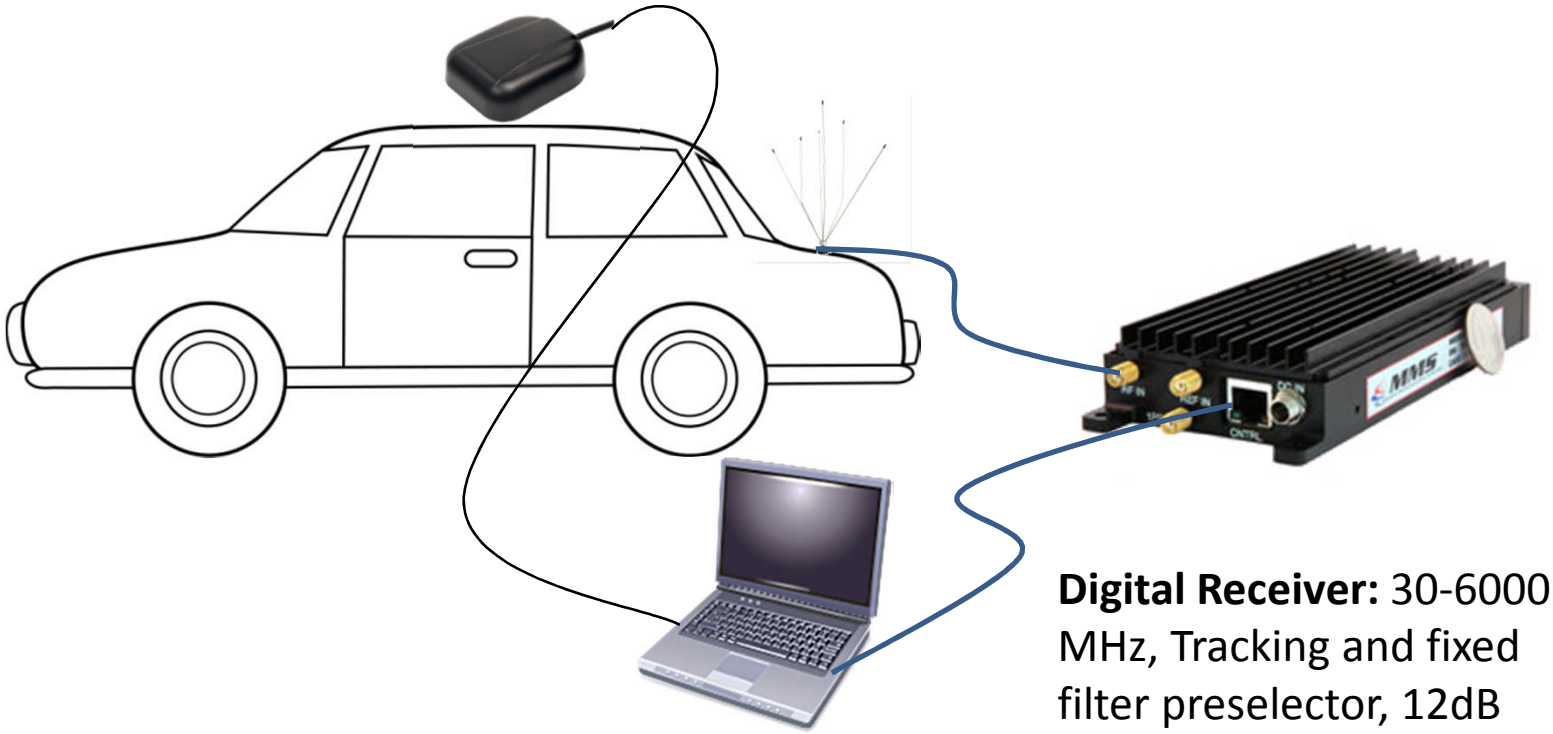
AT&T 700 MHz LTE Devices were tested in the Laboratory

AT&T Elevate 4G LTE

AT&T Momentum 4G LTE

Devices for Laboratory Testing

Location, Signal Strength, and Time were recorded across the entire 700 MHz and upper 600 MHz bands

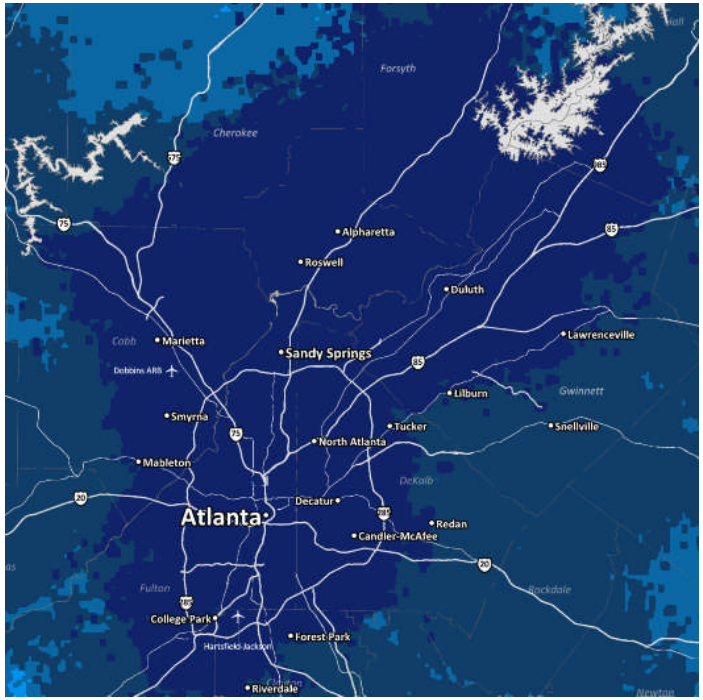


Digital Receiver: 30-6000 MHz, Tracking and fixed filter preselector, 12dB NF, +5dBm IP3, 14bit ADC, 80dB typical Image/IF rejection

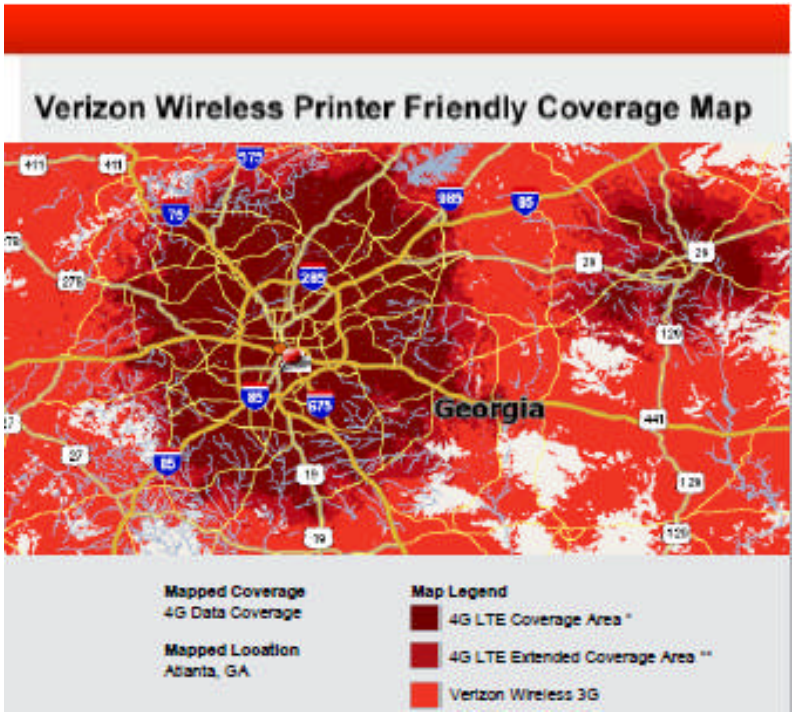
Field Measurement Configuration

Both AT&T and Verizon have significant footprints in Atlanta and thus provided typical signal strengths.

AT&T 4G LTE Coverage



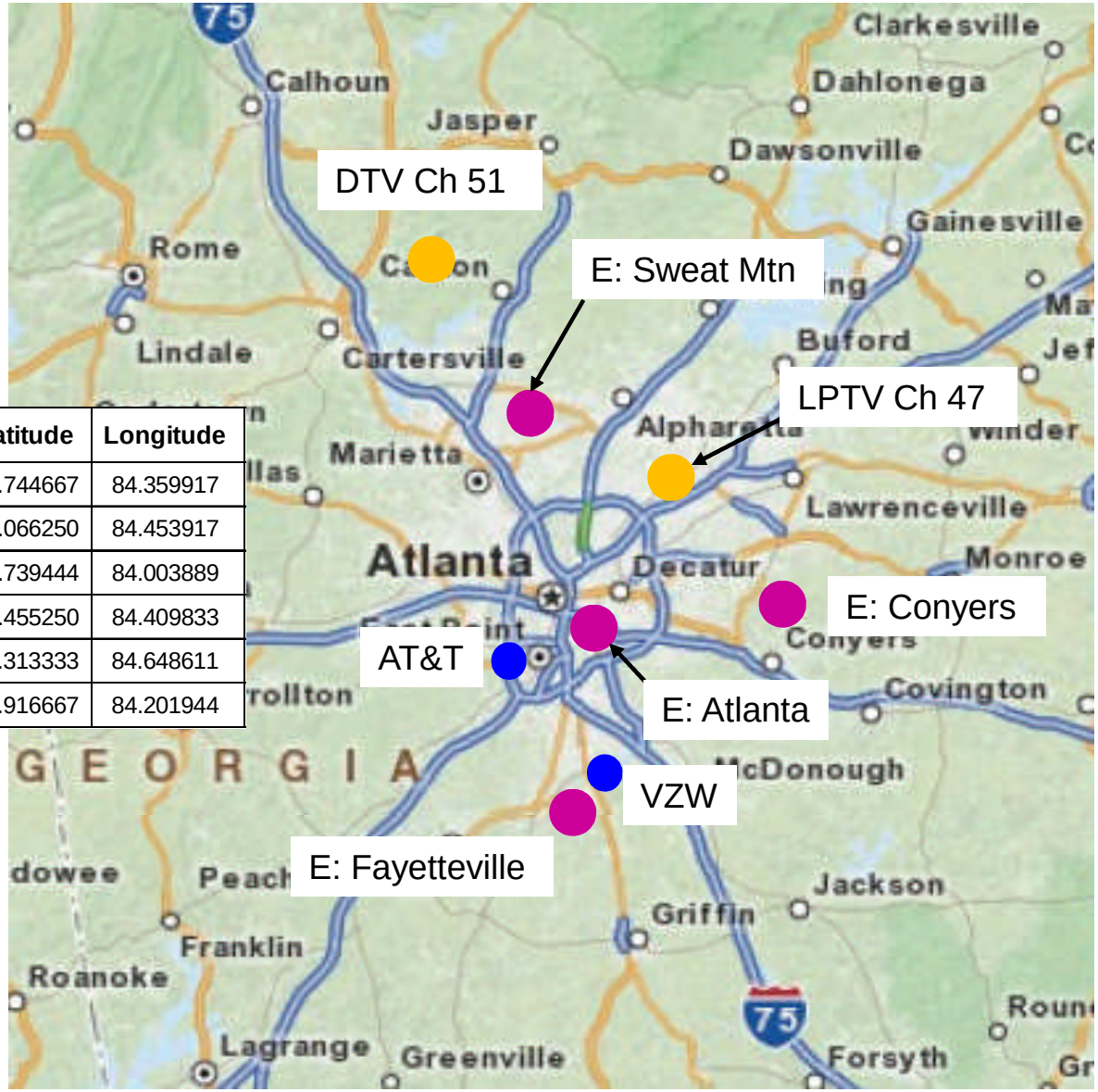
Verizon Wireless 4G LTE Coverage



Commercial LTE Systems in Atlanta

Atlanta E Block, TV Broadcaster and LTE Test Sites

Band	City	State	AGL (m)	ERP (kW)	Latitude	Longitude
E	Atlanta	GA	329	50	33.744667	84.359917
E	Sweat Mountain	GA	Mtn	20	34.066250	84.453917
E	Conyers	GA	350	50	33.739444	84.003889
E	Fayetteville	GA	151	50	33.455250	84.409833
DTV 51	Rome	GA	246	1000	34.313333	84.648611
LPTV 47	Norcross	GA	138	10	38.916667	84.201944



Evaluation Results Regarding:

REVERSE INTERMODULATION PERFORMANCE ANALYSES AND MEASUREMENTS

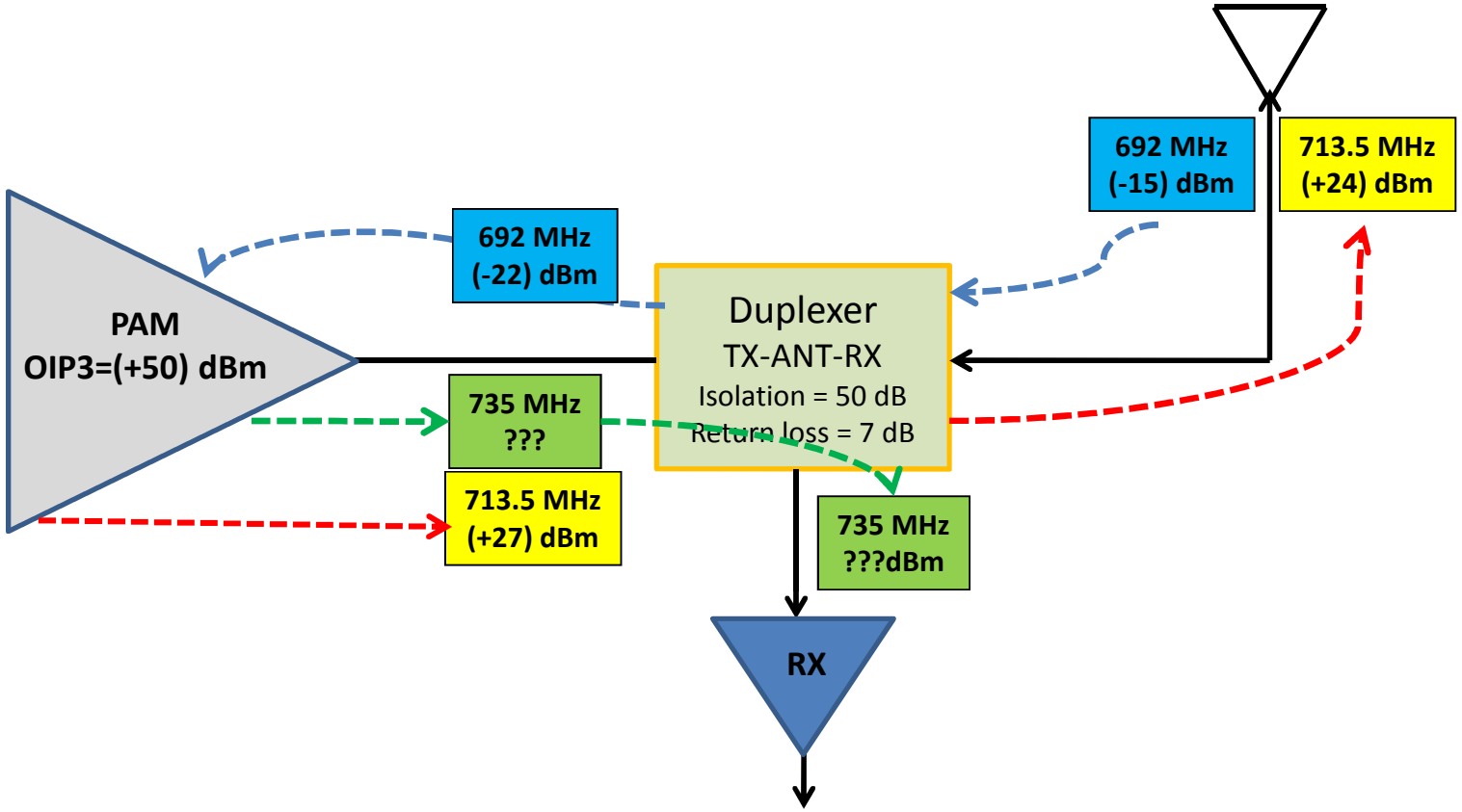
Reverse Intermodulation Distortion Analysis

- One assertion made regarding the need for a separate Band Class 17 was that reverse intermodulation distortion caused by Channel 51 using a Band Class 12 device would create an interfering signal in the B Block receiver;
- Analysis shows that a 0 dBm signal (or stronger) is necessary to create an interference signal at the noise floor of the B Block receiver;
- Measurements in Atlanta on Channel 51 and LPTV transmitters shows signal levels lower than -21 dBm

Conclusion:

- Reverse Intermodulation Distortion cannot credibly be claimed as a source of interference for Band Class 12 devices.

For the LTE 10 MHz mode, the device receiver sensitivity is -94 dBm. The worst case scenario includes a very strong DTV Channel 51 signal (-15 dBm), the strongest mobile transmit signal, and the weakest possible LTE downlink coverage.

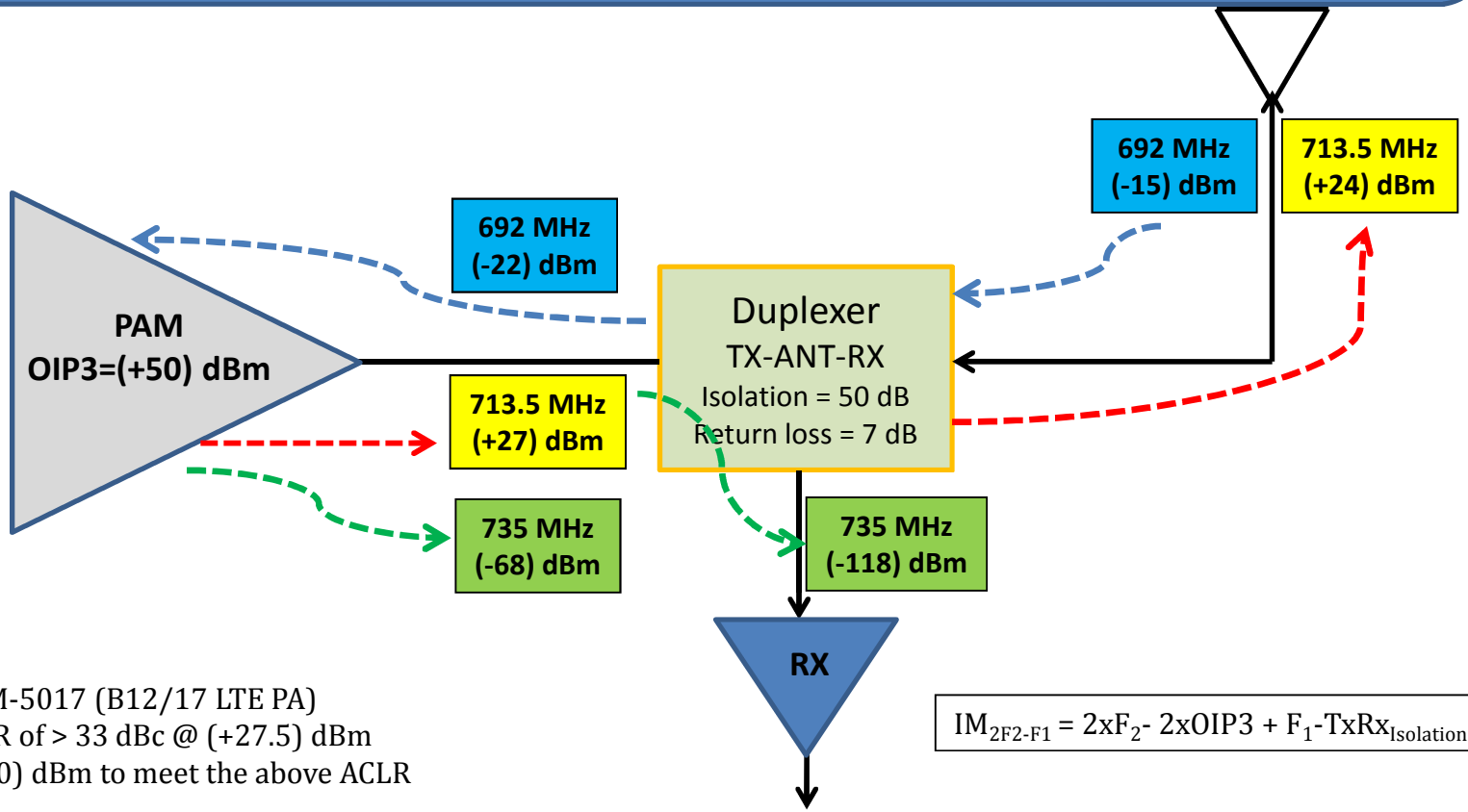


Reverse Intermodulation Performance

(Analysis)

For the worst case, the reverse IM strength would be 24 dB below the noise floor (-118 dBm signal versus -94 dBm sensitivity) – therefore, too weak to cause any possible degradation to the device performance.

→ Channel 51 Signals need to be >0 dBm for Reverse IM to Occur



Example:
Avago ACPM-5017 (B12/17 LTE PA)
-Meets ACLR of > 33 dBc @ (+27.5) dBm
-OIP3 = (+50) dBm to meet the above ACLR

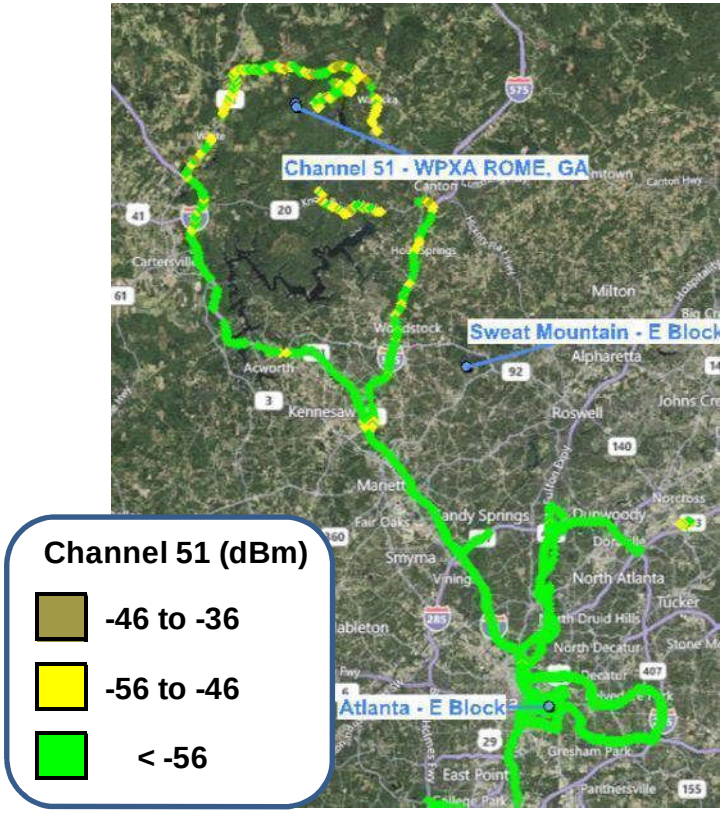
$$IM_{2F2-F1} = 2xF_2 - 2xOIP3 + F_1 - TxRx_{Isolation}$$

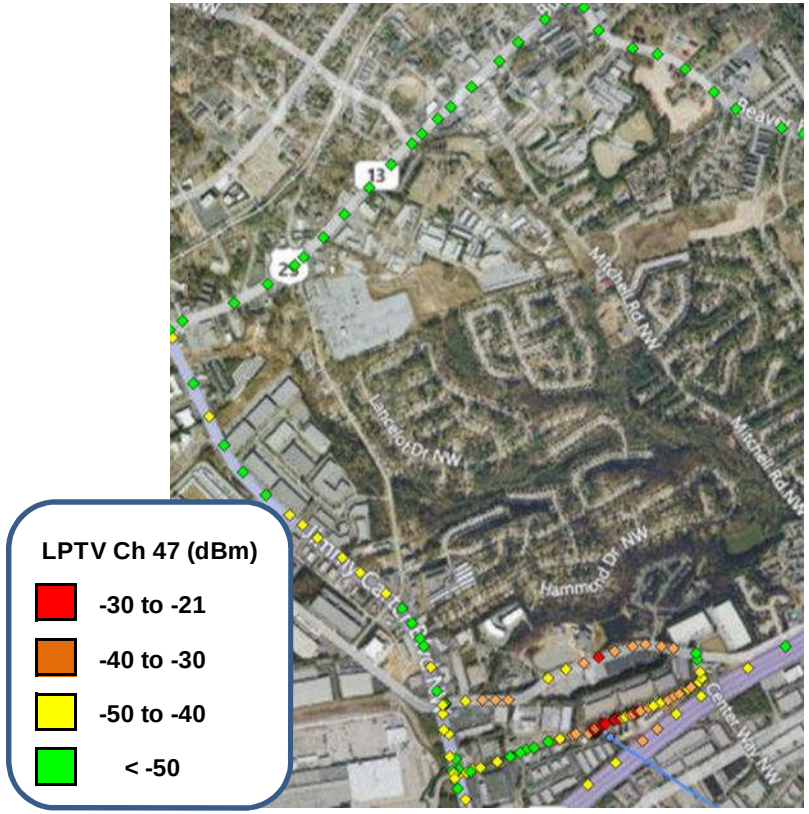
Reverse Intermodulation Performance

(Analysis)

Signal Levels for Channel 51 DTV or LPTV Stations were below anticipated levels and not strong enough to trigger “Reverse Intermodulation”

- The strongest signal level on DTV 51 was -36 dBm, within 2 km of the mountaintop tower
- LPTV signal levels greater than -40 dBm are only found within 0.25 miles of the tower
- Strongest signal was -21 dBm, measured with a +3 dBi antenna gain

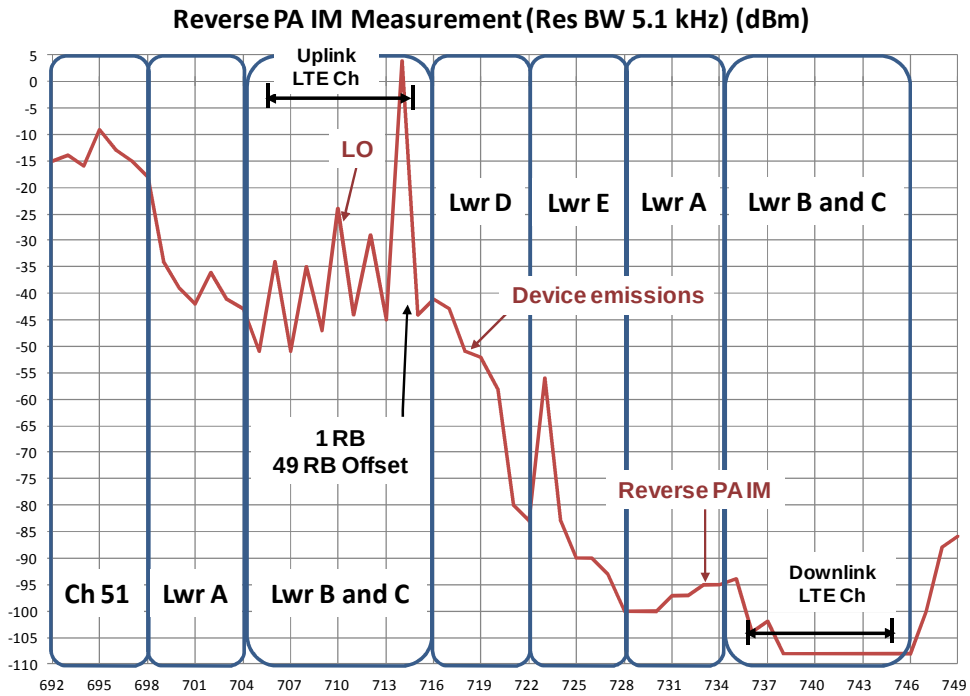




Reverse Intermodulation Performance

(Atlanta Environment Measurements)

Testing showed device performance handles the worst case power ratios measured in Atlanta – Therefore, reverse intermodulation worries are not valid rationale for needing a separate Band 17



- Channel 51 Signal at PAM = 12.7 dBm
- C Block Transmitter = 29 dBm
- IM Signal = -64 dBm
- $IM_{2F2-F1} = 2xF_2 - 2xOIP3 + F_1$
- Computed OIP3 = 42.5 dBm

- Computed OIP3 is 7.5 dB lower than available components

Conclusion:

- Noise floor for 10 MHz Band 12 (or Band 17) is -111 dBm/RB (resource block)
- Signal level of -11.5 dBm at the duplexer from Channel 51 is needed to create an IM that is equal to noise floor
- 700 MHz device antenna gain is -5 dBi*, strongest DTV51 signal at the device antenna can be -6.5 dBm (Not seen in Atlanta)
- If Avago PA was used, additional 7.5 dB OIP3 which translates into 15 dB of additional protection → +8.5 dBm signal required to interfere

Reverse Intermodulation Performance

(Device Measurements)

*Atlanta measurements used +3 dBi antenna

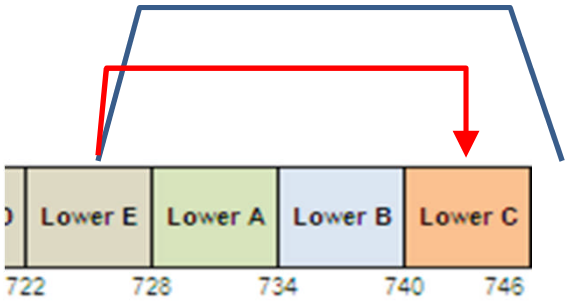
Evaluation Results Regarding:

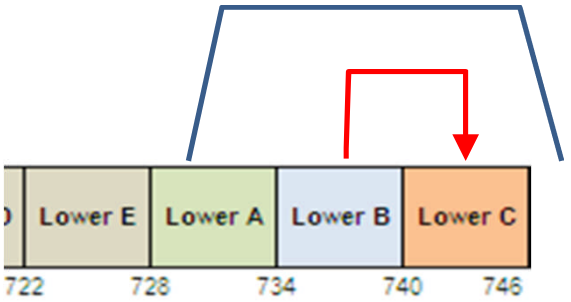
BLOCK INTERFERENCE FROM E BLOCK TRANSMISSION TESTING

Block Interference from E Block Transmission Testing

- Another assertion regarding the need for a separate Band Class 17 was that E Block transmissions at 50 kW were sufficient to cause blocking interference to Band Class 12 devices;
- Device testing showed that a 75 dB power ratio between E Block and the B Block signal is necessary to produce blocking;
- Device testing also showed that a 60 dB power ratio between B Block and C Block is necessary to produce blocking;
- Measurements in Atlanta on the E Block and B Block produced power ratios of less than 45 dB and up to 60 dB within a few blocks of an E Block transmitter. Therefore, not significant enough to cause interference.
- Measurements in Atlanta on the Upper 700 C Block (as a surrogate for a separate, not co-located provider on the Lower 700 C Block) and B Block produced power ratios of less than 45 dB and up to 60 dB within a few blocks of an Upper 700 C Block transmitter. Therefore, it's possible to create interference between the B and C Blocks, with which AT&T devices already cope. The B and C Blocks already suffer greater interference threats from each other than what would be introduced from a common band class that includes the Lower A Block.
- Interference from E Block to B Block using Band 12 is not credible
- Interference from C Block to B Block using Band 17 is credible, but not specific to Band Class 12

Testing Configuration for B Block Interference from E Block





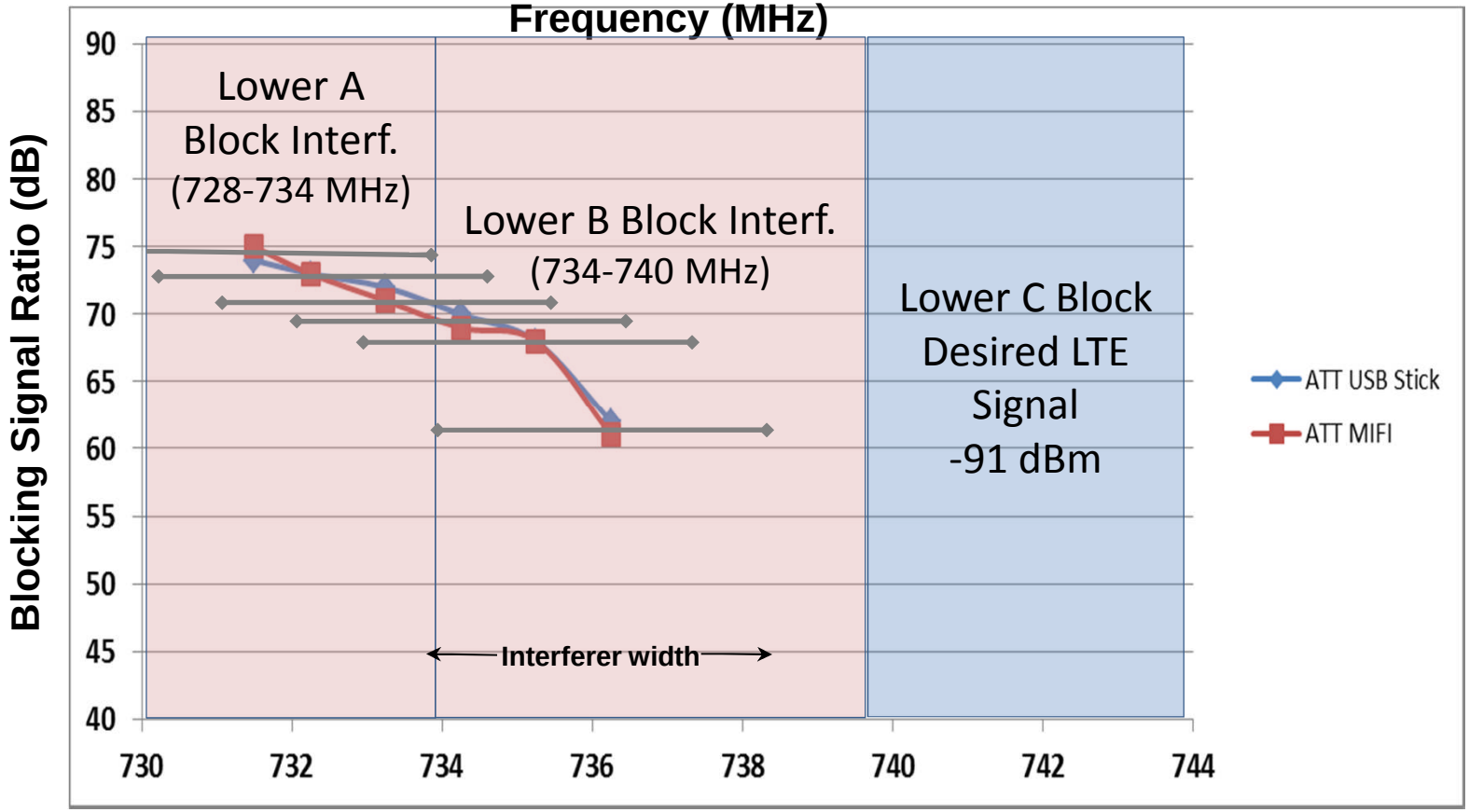
- Band Class 17 advocates claim that E Block base station transmissions will have sufficient signal strength to cause blocking interference to Band Class 12 devices due to lack of sufficient filter roll-off
- Testing will use Band Class 17 devices to emulate the same 1st and 2nd adjacent channel configurations as would be present in the Band Class 12 device

Only Band Class 17 Devices were available.

Used Lower A Block on the Band Class 17 devices to emulate the conditions of E Block on a Band Class 12 device.

With a weak LTE signal level of -91 dBm, the AT&T devices withstood an adjacent interfering signal 60 dB stronger, with <5% error rate.

The device rejection of the 2nd adjacent channel is 73 dB; this is analogous to a -17 dBm signal in the E Block for a Band Class 12 device receiving in Lower B.

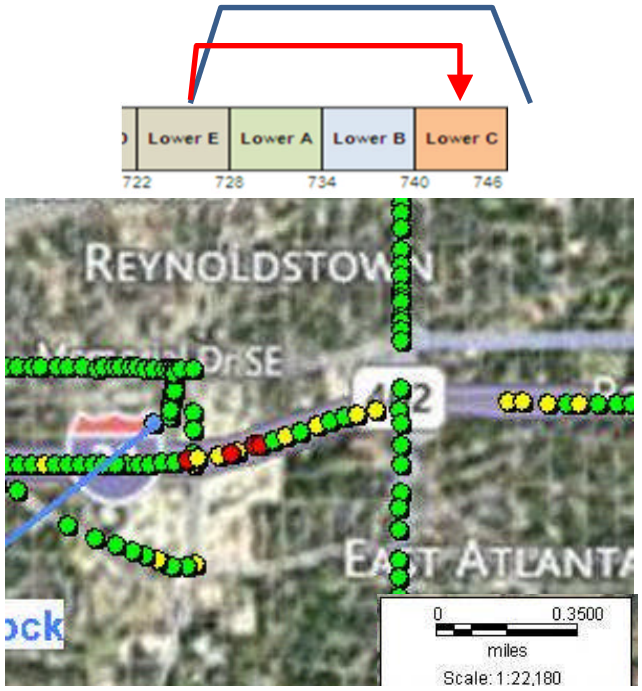


Blocking Performance

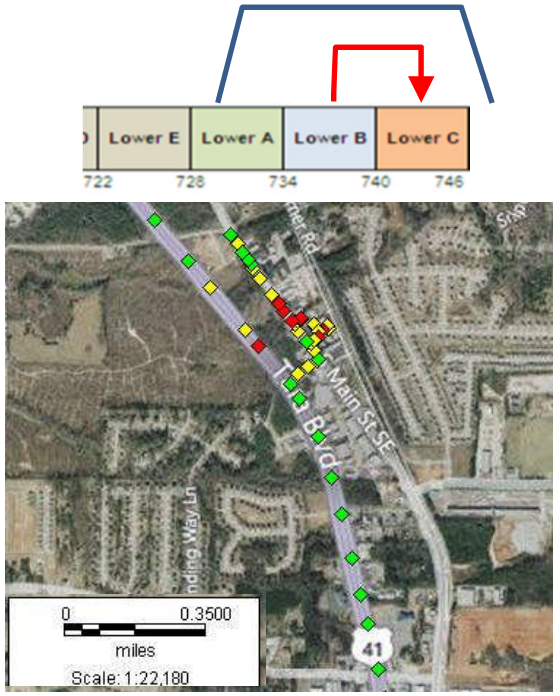
(Commercial Device Lab Measurements)

Measurements in Atlanta showed power ratios are below 45 dB everywhere but locally around the interfering transmitter (which was as high as 60 dB). This was true for Lower E to Lower B AND Upper C to Lower B.

Interference ratios between two wireless providers are equivalent to those between high power E Block and AT&T B/C Block



E Block → B or C Block



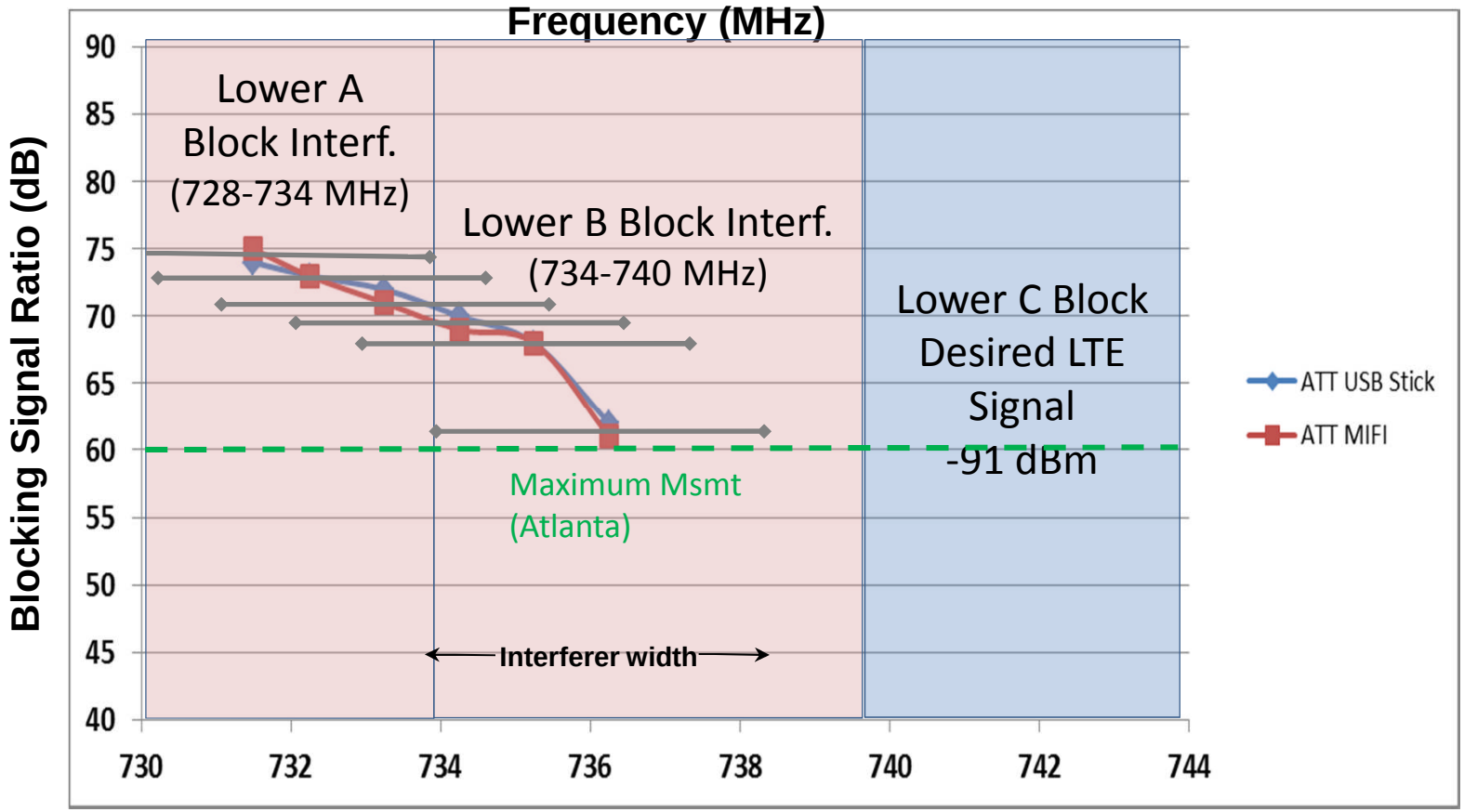
B Block → C Block

Power Ratio

- 45 to 60 dB
- 35 to 45 dB
- < 35 dB

RF Environment and Blocking Interference

Testing showed device performance handles the worst case power ratios measured in Atlanta – Therefore, Band Class 12 provides sufficient protection for Lower A, B and C Block operations.



Blocking Performance

(Commercial Device Lab Measurements)

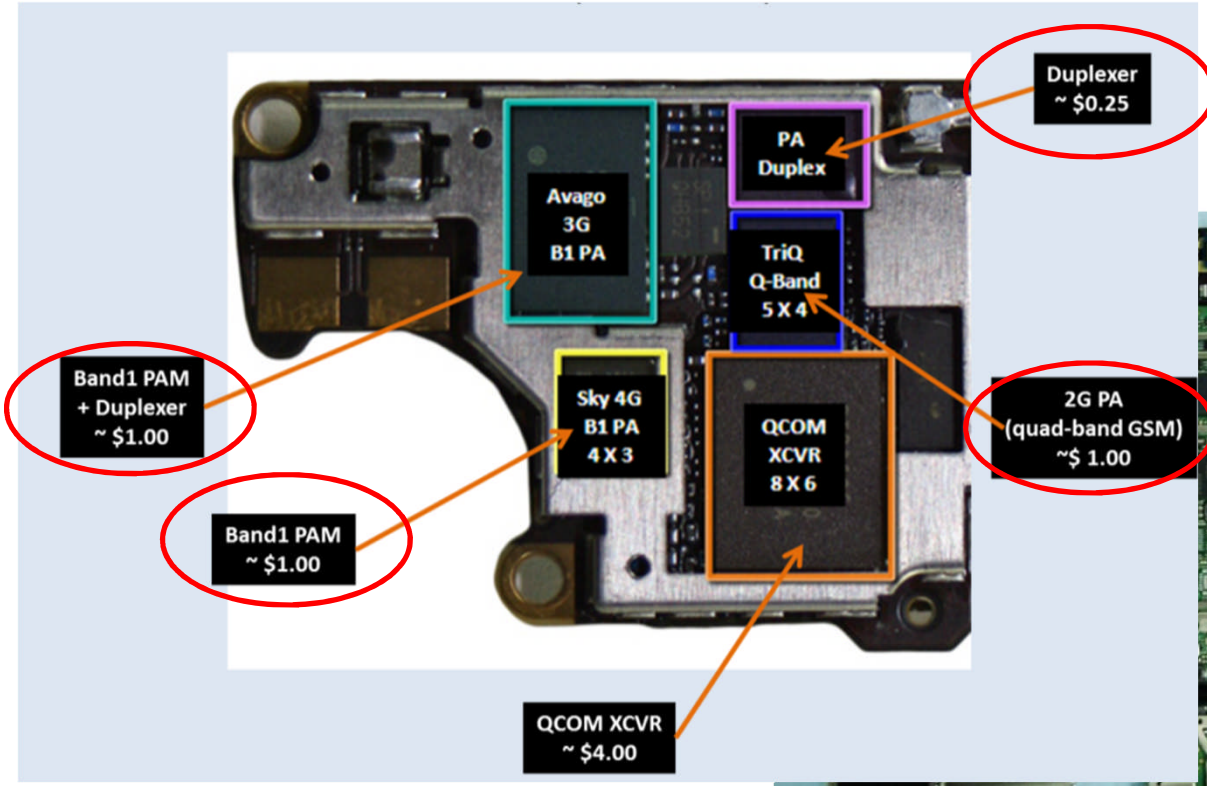
Evaluation Results Regarding:

COST IMPACT OF INTEROPERABILITY REGARDING DEVICES

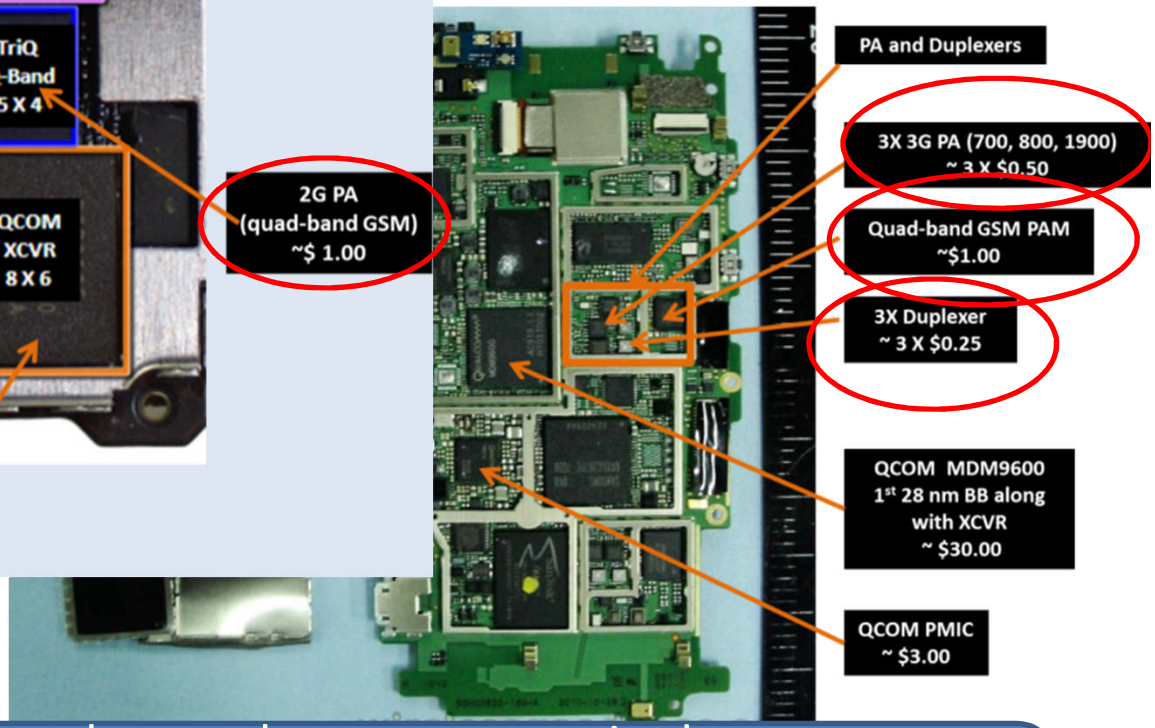
No Cost Increases Anticipated in Either Apple or Android Bill of Materials

(Impact of Band Class 12)

iPhone 4S



HTC Thunderbolt



Device Performance indicates that no changes are required except to simply broaden the duplexer to cover Lower A, B and C Blocks. However, if new filter (and potentially new Power Amplifier Module) components are required, similar BOMs component prices are all < $1 and, in quantity, have no cost impact.

Summary of Findings

- Band Class 17 B and C Blocks already suffer greater interference threats from each other than what would be introduced from a unified Lower 700 MHz Band Class that includes the Lower A Block. Neither high power E Block transmissions nor Channel 51 transmissions create an increased interference threat; in fact, the interference threat is lower than the in-band LTE deployments.
  - AT&T LTE devices currently receive and successfully manage levels of interference from within the B and C Blocks than need to be accounted for by unifying the Lower 700 MHz paired bands
  - Concerns and claims made about reverse intermodulation distortion interference are unfounded

- Concerns and claims about increase in cost and/or size of devices are greatly exaggerated as current BOM costs will remain virtually unchanged.

Conclusion:

NEED FOR INTEROPERABILITY

The AT&T-Qualcomm License Transfer Would Exacerbate the Interoperability Problems in the Lower 700 MHz Band

- The AT&T-Qualcomm acquisition, if approved, would magnify AT&T's market power in the Lower 700 MHz band and increase its ability to exert undue influence within the 3GPP process to the detriment of other Lower 700 MHz band licensees.
- The acquisition would specifically threaten interoperability by increasing the potential for significant interference across the Lower 700 MHz band.
  - For example, AT&T has argued that adjacent and other transmissions in or around 700 MHz caused interference concerns and required the creation of Band Class 17. But these concerns apparently do not apply to AT&T itself, which is now suggesting that it does not and will not cause interference to others, including by using the adjacent D & E Blocks.
  - **Nonetheless, there has already been a request at 3GPP to reduce the usable bandwidth for Band Class 12 licensees. This AT&T influenced request comes even before their acquisition is completed**
  - **AT&T's public submissions to the FCC never revealed that its use of the D Block spectrum would require other licensees to reduce their use of spectrum to create guard band for AT&T's purposes**
- Moreover, if the acquisition is approved, AT&T will have no incentive to cooperate with Lower Band licensees on *any* issues that may arise in the Lower 700 MHz Band, as it will function as a separate ecosystem. This will further threaten interoperability.
- Without interoperability, there will be no roaming across the Lower 700 MHz band and there will be a greater risk of exclusive handset arrangements, both of which will hinder competition and create islands of incompatibility – especially in the Lower 700 MHz A Block.
- The FCC should not approve the proposed license transfer without transaction-specific conditions to remedy these related interoperability concerns.