



Unleash the Lower 700 MHz Spectrum

November 29, 2012

**Hello
Better.**

Summary

- Restoring Interoperability is the key to development of a robust 4G LTE ecosystem which will unleash additional Lower 700 MHz deployment and deliver consumer benefits.
- Interoperability is implemented with ease.
- There are no technical impediments to implementing Band 12 across the Lower 700 MHz band. Every real-world technical study confirms no customer impacting interference.
- The FCC must adopt a rule this year to restore Interoperability across Lower 700 MHz networks.

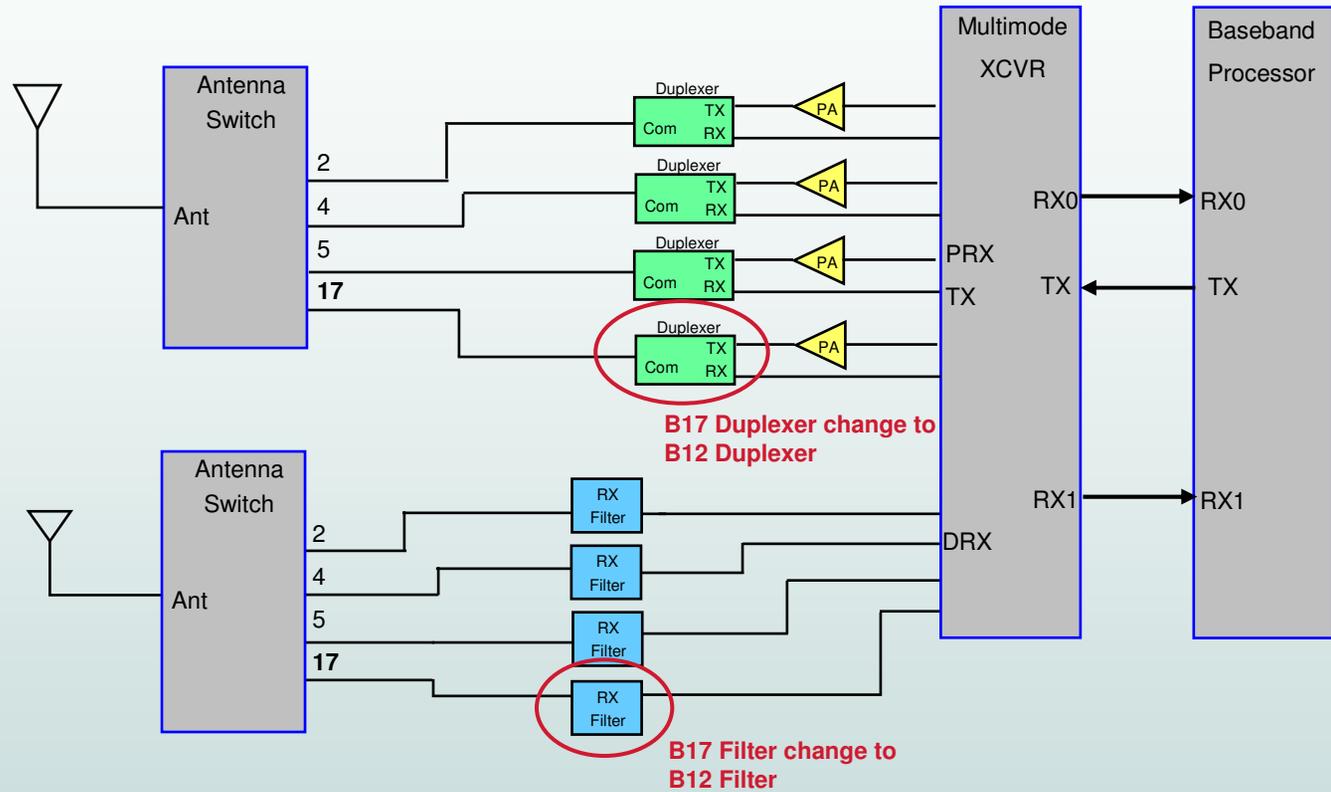
Minimal Device Change Enables Interoperability

- New devices can easily be designed to accommodate both Band 12 and Band 17.
- The only hardware design change is replacing the Band 17 Duplexer and RX Filter with Band 12 components.
- Chipset manufacturers will need to supply modem software to support Band 12 and Band 17.
- This upgraded device will be able to operate on Band 12 or Band 17 networks - No network upgrade required.
- The only incremental cost would be associated with validating the additional band support.

Device RF Diagram

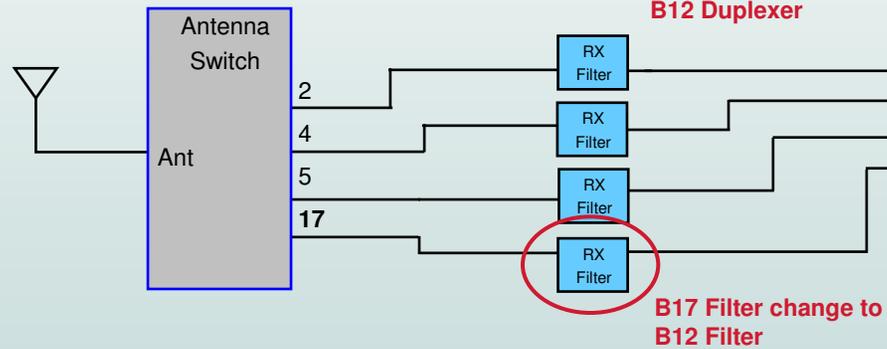
3G/LTE Antenna
Bands 2,4,5,17

Tx/Rx



Diversity/MIMO Antenna
Bands 2,4,5,17

Rx



B12 & B17 Component Details

- B12 duplexers are pin-compatible with B17 duplexers
- B12 filters are pin-compatible with B17 filters
 - no circuit board change
- Commercially available components
 - B12 duplexer: Epcos B7931, Murata SAYFH707MCA0F0A
 - B17 duplexer: Epcos B7924, Murata SAYFH710MCE0F0A
 - Similar cost
 - B12 filter: Murata SAFEA737MCL0F00
 - B17 filter: Murata SAFEA740MCL0F00
 - Similar cost
- All other device RF components support both Band 12 & 17

Device Manufacturer – Platform Reduction

- Device Manufacturers are reducing the number of platforms/SKU's to drive efficiencies in the device development and manufacturing processes
 - A **stock-keeping unit** or **SKU** is a code that identifies a unique product or item for sale
 - Motorola has publically announced plans to stop making low end devices and focus on a “few cellphones instead of dozens”... and “...plans to cut the number of devices Motorola makes from the 27 it introduced last year to just a few”
http://www.nytimes.com/2012/08/13/technology/motorola-to-cut-20-of-work-force-part-of-sweeping-change.html?_r=1&pagewanted=all
 - HTC has also publically announced a similar strategy, including plans to “...to slash the size of its smartphone portfolio this year and focus on delivering a few key ‘hero’ devices in a bid to claw back market share.”
http://www.mobiletoday.co.uk/News/13765/HTC_is_holding
 - Apple’s core go to market strategy has been well documented in that whenever it has been able, Apple produces a minimal number of versions or SKU’s for its products

World-wide support with a few SKUs

- iPhone 5 – two SKUs; three models
 - GSM model A1428*: UMTS/HSPA+/DC-HSDPA (850, 900, 1900, 2100 MHz); GSM/EDGE (850, 900, 1800, 1900 MHz); LTE (Bands 4 and 17)
 - CDMA model A1429*: CDMA EV-DO Rev. A and Rev. B (800, 1900, 2100 MHz); UMTS/HSPA+/DC-HSDPA (850, 900, 1900, 2100 MHz); GSM/EDGE (850, 900, 1800, 1900 MHz); LTE (Bands 1, 3, 5, 13, 25)
 - GSM model A1429*: UMTS/HSPA+/DC-HSDPA (850, 900, 1900, 2100 MHz); GSM/EDGE (850, 900, 1800, 1900 MHz); LTE (Bands 1, 3, 5)
<http://www.apple.com/iphone/specs.html>

MFBI is not a solution

- Multi-Band Frequency Indicator (MFBI) is not a solution to interoperability
 - MFBI allows the network to send a message to the device that it supports multiple overlapping bands
 - The device must support the MFBI message received from the network
 - Even with MFBI, Band 17 devices will not be able to operate on Lower 700 MHz A-Block networks

Interoperability Validation Testing



V- COMM and USCC Testing Overview

Comprehensive Lab Testing

- V-COMM lab testing evaluated the most commercial devices (3) B12 and (4) B17 devices
- V-COMM lab testing evaluated the most network deployment scenarios including 5 MHz B deployment, 5 MHz C deployment and 10 MHz B+C deployment
- V-COMM lab testing evaluated potential for both CH51 and E-Block interference to devices
- V-COMM lab testing evaluated device performance across (3) modulation schemes including QPSK, 16QAM and 64QAM

Comprehensive Field Testing

- V-COMM and USCC tested a commercial B12 device within a CH51 broadcaster footprint on a commercial network in Waterloo, Iowa configured as 5 MHz B deployment, 5 MHz C deployment and 10 MHz B+C deployment
- V-COMM and USCC benchmarked and compared device performance in Waterloo across a 5 MHz B Block network and a purported interference ridden 5 MHz C Block network and identified no difference in performance
- 50% of the data points collected in Waterloo occurred in areas of CH51 strength which AT&T claim as problematic however did not demonstrate performance degradation
- The Waterloo B12 network operates today in a AT&T purported interference scenario of 10 MHz B+C B12 configuration which supports approx. 6,500 subscribers in the Waterloo market
- V-COMM conducted field measurements of (3) CH51 broadcasters in Chicago, Cedar Rapids and Montclair, NJ to verify CH51 propagation results

AT&T Testing Overview

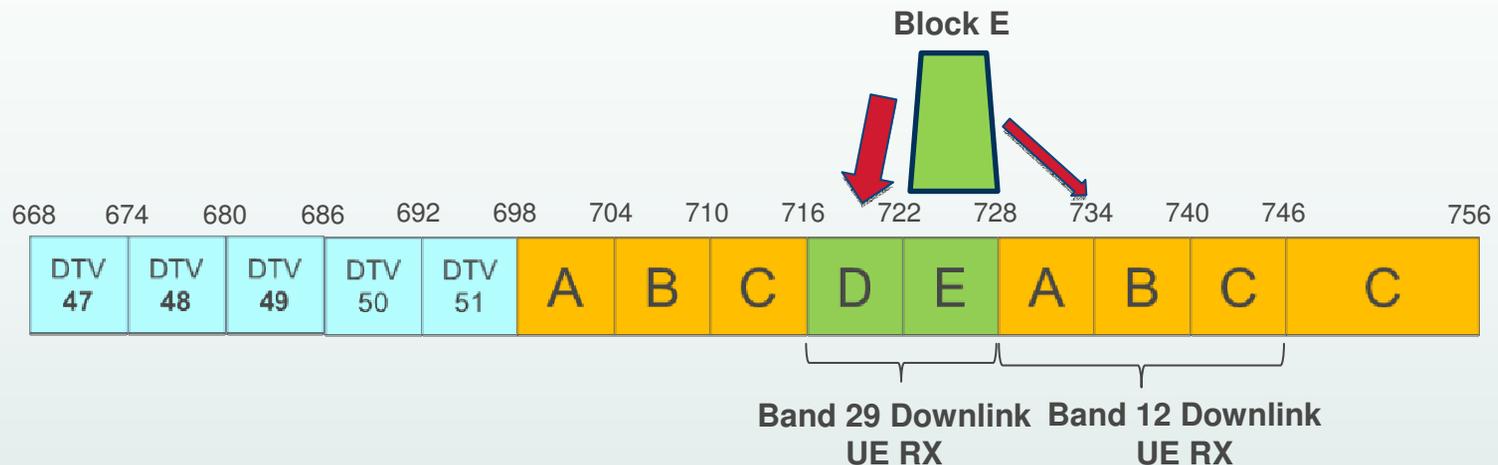
Limited Lab Testing

- AT&T tested (1) B12 device and (1) B17 device
- AT&T tested only a 10 MHz B+C deployment and did not test a 5 MHz B-Block or 5 MHz C-Block deployment
- AT&T did not conduct testing consistent with its commercial 10 MHz deployments which are centered at 709/739 MHz
- AT&T's testing did not include sufficient filtering of the test equipment noise
- AT&T did not conduct testing of E-Block interference
- Only the PCTEST data set included B17 device performance results

No Field Testing

- AT&T conducted no field testing to illustrate the potential interference caused by CH51
- AT&T conducted no field testing to illustrate the potential interference caused by E- Block

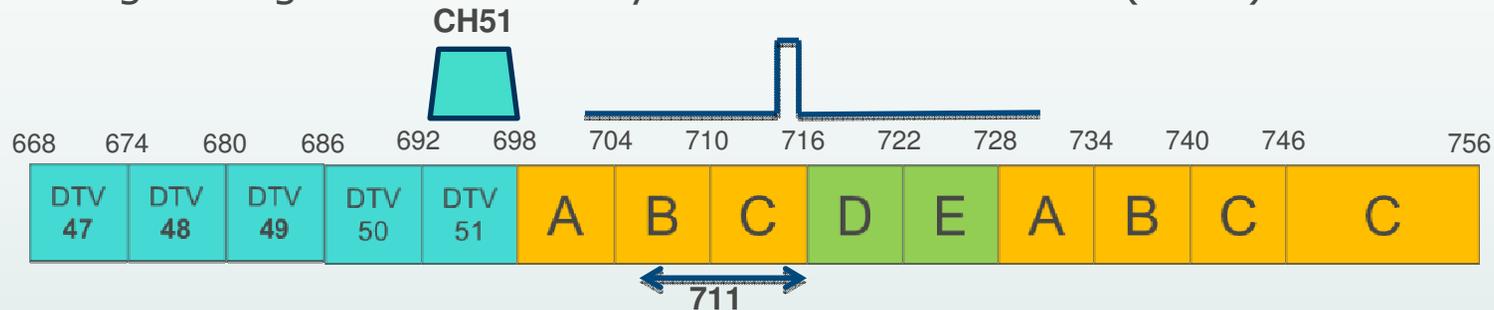
AT&T's E-Block Analysis Inconsistencies



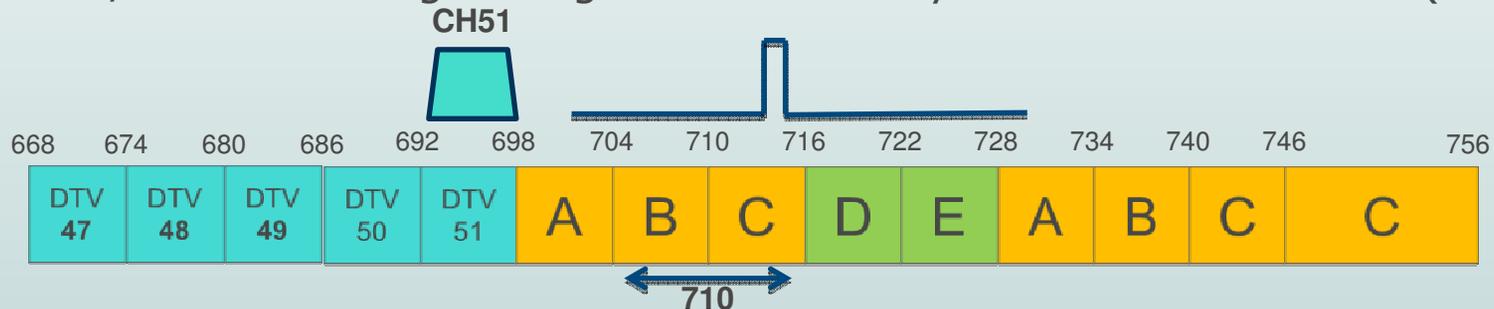
- AT&T has stated concerns with interference resulting from potential high power E-Block deployments to B12 UE RX, however AT&T fails to acknowledge that the most impactful interference from any E-Block deployment will impact B29 UE RX significantly more than B12
- The obvious E-Block to B29 UE RX interference concerns have not prevented AT&T from publically announcing detailed plans to move forward with planned use of B29 <http://apps.fcc.gov/ecfs/document/view?id=7021027712>
- While USCC disagrees with the AT&T's assessment of the interference potential of E-Block impacting B12, any mitigation technique employed by AT&T to support B29 could certainly be applied to B12

More AT&T Inconsistencies

- AT&T's initial testing centered 10 MHz LTE Channel at 711/741 MHz using the rightmost 5 UL Physical Resource Blocks (PRBs)



- AT&T's subsequent testing AT&T centered a 10 MHz LTE Channel at 710/740 MHz using the rightmost 5 UL Physical Resource Blocks (PRBs)



- Interestingly, AT&T's 10 MHz commercial LTE networks are all centered at 709/739 MHz, yet AT&T has failed to produce any test results that are consistent with its commercially deployed network that are centered at 709/739 MHz
- AT&T has failed to produce any test results that simulate a 5 MHz C-Block deployment

Proposal

- The Commission should adopt an interoperability order before the end of 2012 that within six months (“Implementation Date”) requires;
 - that carriers operating in any portion of the Lower 700 MHz band only provide devices to users from the Implementation Date forward that, (whether designed to operate alone or in combination via carrier aggregation with contiguous or non-contiguous spectrum in other bands), are capable of operating on all paired spectrum in the Lower 700 MHz band;
 - and that all mobile networks operating within the Lower 700 MHz band must permit the use of such devices.