



Public Safety Communications Research
(PSCR)

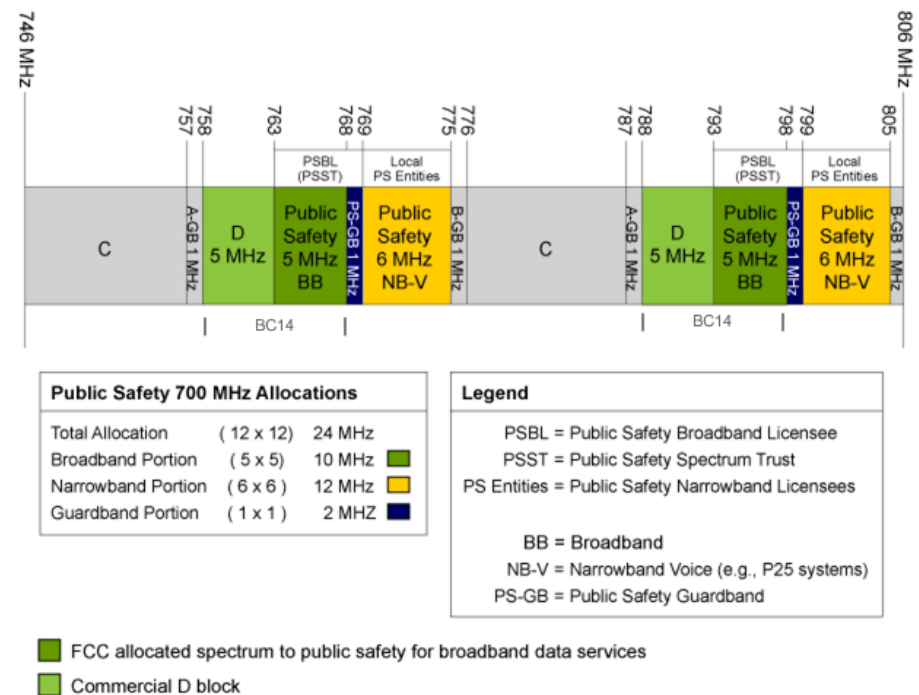
UE--BC14-Interference-MIMO

Department of Commerce – Boulder Labs

Band Class 14

- 3GPP defines BC 14 as a 10 MHz channel size (3GPP TS 36.101)
 - Allows 50 RB and 25 RB allocations
 - Public safety will use upper 25 RB allocation for 5 MHz channel
 - 763-768 MHz eNodeB TX
 - 793-798 MHz eNodeB RX

Public Safety Spectrum Allocation in the 700 MHz Band



PSCR Demo Team wants to evaluate and understand the eNodeB & UE filter requirements

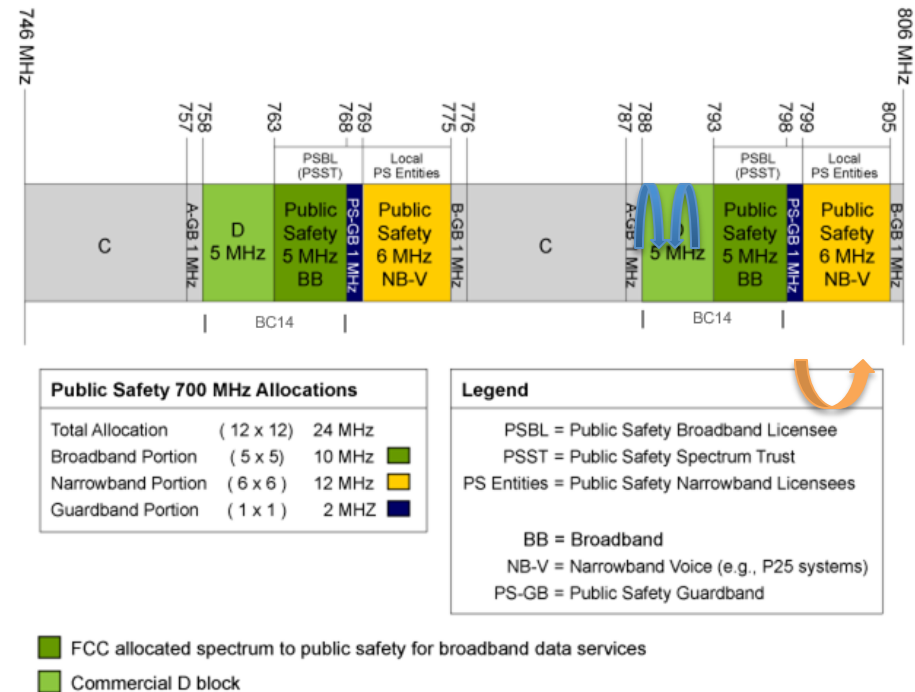
OUBE

- Currently D-Block is required to only provide enhanced OUBE to public safety narrowband spectrum
- C-Block required to provide enhanced OUBE to both public safety narrow and broadband spectrum
- Potential requirement (3rd FNPRM) for C & D blocks to provide the same OUBE to public safety spectrum
 - May reduce allowed EIRP (less coverage)
 - May require improved filtering (\$\$\$)
 - May require guard band (less spectrum)
- LTE and LMR vendors need to “understand each other”
 - LTE BW = 5 MHz & LMR BW = 6.25 khz (mostly 12.5 kHz deployed)
 - LTE & LMR use different RF specifications in Tx Pwr versus ACLR versus ACS

GPS & OOB

- C-Block & D-Block or full BC 14 LTE UE Tx (785-790 MHz) combining with GPS L1 2nd harmonic (1575 MHz/2 = 787.5 MHz)
- PSBB LTE UE Tx ACLR may leak (OOBE) into LMR channel and raise the noise floor of the LMR fixed stations

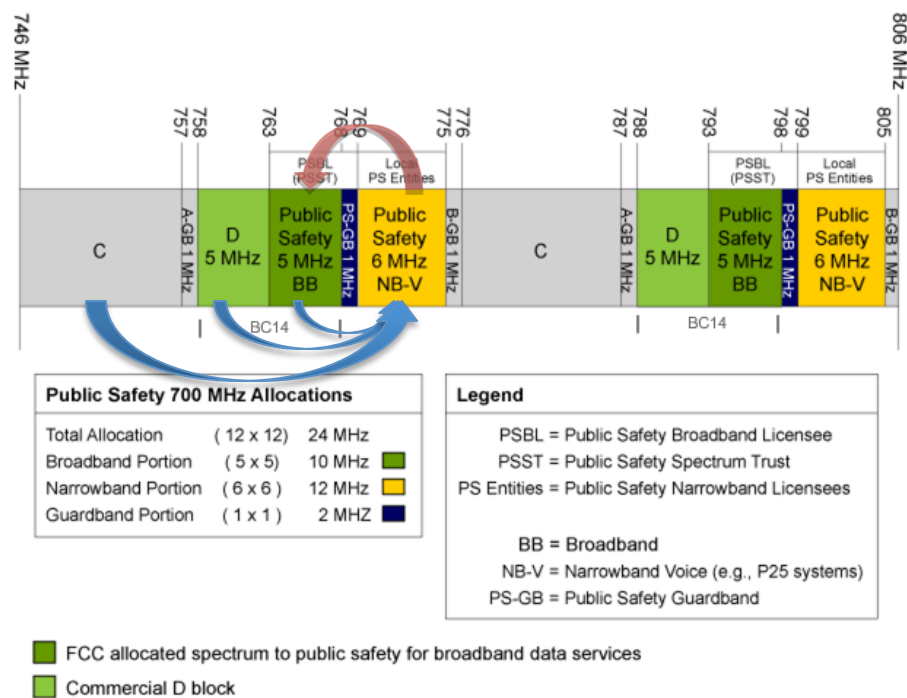
Public Safety Spectrum Allocation in the 700 MHz Band



Interference Issues

- C-Block, D-Block, PSBB LTE eNodeB Tx (746 – 768 MHz) to Portable/Mobile LMR (769-775 MHz)
 - May require additional or more stringent eNodeB filters than -46 dBm/6.25 kHz emission limit
- Petition for Rule Making Regarding the Need for 700 MHz Mobile Equipment to be Capable of Operating on All Paired Commercial 700 MHz Frequency Blocks
 - Potential filter related issues, which may lead to increased interference, cost and poorer overall performance
 - Portable/Mobile/Fixed Station LMR Tx to LTE UE PSBB Rx
 - LMR is much higher Tx power
 - LTE UE Rx may require narrow band blocker specification

Public Safety Spectrum Allocation in the 700 MHz Band



****NOTE – Colorado has one of the largest installed 700 MHz LMR networks in the nation. PSCR working with State of Colorado to ensure zero negative impact to existing system***

MIMO

- To get more throughput we essentially need to send out more data in the same channel (frequency)
 - Requires **MIMO – Multiple Input Multiple Output**
- 700 MHz wavelength is over 15 inches long. Problem in handset to get 4 inches (1/4 wave) of antenna separation for good de-correlation, which limits the effectiveness of MIMO, creates problems in handset antenna design.

•What methods can be used to test UE MIMO capability?

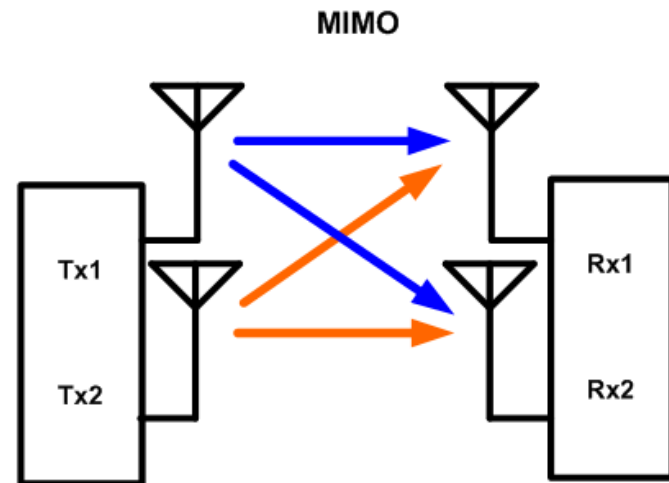
•Is MIMO behavior in the UE orientation dependant?

•What portion of the cell area can be expected to support MIMO – does this vary greatly from cell to cell and how do we determine this?

•What about in-vehicle MIMO – is it speed dependant or vehicle dependant; are external antennas necessary in some cases?

•What happens with QOS when the switch from MIMO to spatial diversity occurs – how can QOS guarantees be

maintained?



Subscriber Unit Info

- LTE UE subscriber unit market is very small currently and typically...
 - USB and PC card formats
 - LTE only – no multi-RAT
 - Single Band Class only
 - No production quality or quantity BC14
- Driven by RF and Baseband Chipset providers



Configuration

- Public Safety band support
 - Can full BC14 be supported (10MHz and both 5 MHz channels) – what are the implications
- UICC and ISIM support required for authentication and QoS support
- Initial USB/PC Card form factor OK – when will handset form factors be available?
- SNOW3G support for security
- Compliance/support of BBTF and SoR UE requirements

Questions?