PSCR UE Testing Update

Public Safety Communications Research

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PSCR Role

- PSCR is not a PCS Type Certification Review Board certification (PTCRB) lab
  - Not seeking PTCRB certification - no devices or test equipment will be validated or certified at PSCR
- PSCR requires all devices to be PTCRB certified before they come to our network. However...
  - We are early in the evolution of devices and there are only a few Band 14 vendors/chipsets
- PSCR will be performing some lab conformance, performance and OTA tests

PSCR CRADA Partners

- Labs
  - 7Layers Lab
  - AT4 Wireless
  - Cetecom

- Test Equipment Vendors
  - Rohde & Schwarz
  - Anritsu
  - Agilent
  - Anite
  - Aeroflex

- UE Vendors
  - LGE
  - IPWireless
  - Harris
  - MSI
  - InMotion[+]
  - CalAmp[+]
  - Cassidian[+]

+Devices not delivered yet to PSCR

- **Currently 269 LTE user devices available globally by 57 manufacturers**
- **142 devices capable of operation in 700 MHz spectrum (Band 12, 13, 14, 17 as applicable)**

*Jan 2012 GSA

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Current PSCR Process

- All UE accepted (minimal entrance criteria)
- Subset of PTCRB BC 14 testing executed
  - PTCRB BC14 test regimen can be segmented into three major categories:
    - RF Conformance (3GPP TS 36.521-1)
    - Protocol Signaling Conformance (3GPP TS 36.523-1)
    - RRM Conformance (3GPP TS 36.521-3)
- Very time consuming process
  - Early devices and test equipment issues
- PSCR initiated voluntary UE sharing program to "kick-start" PTCRB Process

TX Conformance Test Results

Test Case	Band	Bandwidth	DUT 1	DUT 2	DUT 3
LTE FDD 6.2.2 Maximum Output Power	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.2.3 Maximum Power Reduction (MPR)	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.2.4 Additional Maximum Power Reduction (A-MPR)	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.2.5 Config UE trans. Output Power	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.3.2 Minimum Output Power	FDD14	5 MHz	Failed	Passed	Passed
LTE FDD 6.3.5.1 Power Control Absolute power tolerance	FDD14	5 MHz	Passed	Passed	Failed
LTE FDD 6.3.5.2 Power Control Relative power tolerance	FDD14	5 MHz	Failed	Passed	Passed
LTE FDD 6.3.5.3 Aggregate Power Control tolerance	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.5.1 Frequency Error	FDD14	5 MHz	Passed	Inconclusive	Inconclusive
LTE FDD 6.5.2.1 Error Vector Magnitude (EVM)	FDD14	5 MHz	Passed	Inconclusive	Inconclusive
LTE FDD 6.5.2.2 Carrier Leakage	FDD14	5 MHz	Passed	Inconclusive	Inconclusive
LTE FDD 6.5.2.3 In-Band Emissions For Non Allocated RB	FDD14	5 MHz	Passed	Inconclusive	Inconclusive
LTE FDD 6.5.2.4 EVM Equalizer Spectrum Flatness	FDD14	5 MHz	Passed	Inconclusive	Inconclusive
LTE FDD 6.6.1 Occupied Bandwidth	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 6.6.2.1 Spectrum Emission Mask	FDD14	5 MHz	Passed	Inconclusive	Passed
LTE FDD 6.6.2.2 Additional Spectrum Emission Mask	FDD14	5 MHz	Passed	Inconclusive	Passed
LTE FDD 6.6.2.3 Adjacent Channel Leakage Power Ratio (ACLR)	FDD14	5 MHz	Passed	Inconclusive	Passed
LTE FDD 6.7 Transmit Intermodulation	FDD14	5 MHz	Inconclusive	Inconclusive	Inconclusive
LTE 6.2.0 Power Regression Test	FDD14	5 MHz	Failed	Passed	Inconclusive

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Rx and Signaling Test Results

Rx Conformance

Test Case	Band	Bandwidth	DUT 1	DUT 2	DUT 3
LTE FDD 7.3 Reference Sensitivity Level	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 7.4 Maximum Input Level	FDD14	5 MHz	Passed	Inconclusive	Passed
LTE FDD 7.5 Adjacent Channel Selectivity (ACS)	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 7.6.1. In-band blocking	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 7.6.3. Narrow band blocking	FDD14	5 MHz	Passed	Passed	Passed
LTE FDD 7.8.1 Wide Band Intermodulation	FDD14	5 MHz	Passed	Passed	Passed

Signaling Conformance

PASS verdicts	56
FAIL verdicts	10
INCONCLUSIVE verdicts	19
Other results	15
Total number of test cases executed	**100**

Partial run of Priority 1 & 2 test cases from Chap 6-12 (GCF)
Fail & Inconclusive tests could be the result of development/prototype quality test equipment and/or user equipment

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FCC Order & Law

- Both the May and December 2010 FCC (Docket #06-229) Waiver Order state

"…At ERIC's recommendation, we require that, within six months of either (1) the Commission or Bureau's release of a public notice announcing the availability of the **PTCRB testing process for Band 14,** or (2) the Petitioner's date of service availability—whichever date is later— each Petitioner must certify to the Commission that it has completed this process in consultation with a **certified laboratory.** In this certification, each network operator must also commit to any future testing called for within the certification process. Petitioners may submit these certifications as part of their quarterly reports."

HR 3630 Title 6 states "…the development of a list of certified devices and components meeting appropriate protocols and standards for public safety entities and commercial vendors to adhere to, if such entities or vendors seek to have access to, use of, or compatibility with the nationwide public safety broadband network."

PTCRB Status

- The PCS Type Certification Review Board (PTCRB) has established Request For Test (RFT) #76 which encompasses Band 14 LTE testing.

- At the latest PVG meeting several CRs were accepted that now have Band 14 at an acceptable level to start validating devices.

  – What the carriers typically require is that at some given time (based upon critical mass of validated test cases) they require vendors to test to the latest NAPRD specification. In this case it would be NAPRD03 Version 5.10 or subsequent updates.

Specification	Band	Number of TC in RFT 76	Number of TC valid	Number of TC valid as %
3GPP TS 36.521-1	FDD 14	53	45	85%
3GPP TS 36.521-3	FDD 14	29	12	41%
3GPP TS 36.523-1	FDD 14	288	225	78%

GCF Reciprocity

- Concern by some commercial service providers that use the Global Certification Forum (GCF) for their LTE device tests and not PTCRB

- Both GCF and PTCRB generate their tests from 3GPP and their is reciprocity agreement between GCF and PTCRB for specific tests. The specific language from PTCRB NAPRD03 v5.9 (released Nov 21, 2011) states….

  - *"GCF Certification test results for GCF Bands will be recognized as a substitute for PTCRB test results in these bands, provided the GCF lab conducting the tests is at a minimum an active observing member of the PVG. Otherwise, GCF Band test cases must be performed in a PTCRB lab. The PTCRB lab will be responsible for uploading the GCF Certification test results to PTCRB's database along with their own test results."*

- What this allows - is for a GCF certified device to meet PTCRB requirements that utilize the same test without having to perform PTCRB specific validation.

- Ideal for "roaming" type inter/intra RAT tests

New PSCR Process

- PCS Type Certification Review Board (PTCRB – www.ptcrb.org) testing is required of BC14 capable UEs before they are integrated with LTE infrastructure that exists in the PSCR LTE demonstration network.
  - This helps to ensure that BC 14 UEs meet the specifications set forth by 3GPP which in turn assists UE interoperability and it also will help to reduce the amount of time PSCR spends troubleshooting UE specific issues.
- Band 14 UE, test equipment, test labs and test cases are still in early in development – prior to this week PTCRB testing was not available therefore…
- Vendors who submit a non-PTCRB certified device must present PSCR with a projected date as to when the device will be submitted to the PTCRB for testing.
- Devices must have Win 7 drivers & support PSCR selected drive test equipment

OTA Testing

- Multi-user (load testing)

- Handover (Application)

- Inter-LTE (other Bands)

- Inter-RAT

- CTIA Certification Program Working Group
  - CTIA LTE IOT Program (CPWG110615-1)
  - TS.11 (formerly DG.11) Test Cases (GSMA Testcase Section)
    - 20 Initial tests identified

Additional Requirements Testing

- PTCRB is the absolute minimum level of testing required for a device to be on the network.

- Example: VZW performs the following in addition to full lab conformance testing
  - Safe-For-Network Test Plan
  - 3GPP Device Interoperability Test Plan
  - Field Test Plan
  - SMS Test Plan
  - Lab conformance Test Plan
  - Data Retry Test Plan
  - All part of VZW Certification Process

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Questions???

Thanks