Public Safety Communications Research (PSCR)

Demo and Evaluation Tests

Department of Commerce – Boulder Labs

Test Plan Overview (1)

- The overall purpose of the PSCR test plan is to have a common framework for Public Safety testing of LTE networks.
  - This test plan provides a commonality in discussion between the vendors and the Public Safety user community with respect to LTE testing.
  - Allows for repeatability and reliability of common test cases amongst multiple vendors, software releases and configurations.
  - Open test plan to all participants

Test Plan Overview (2)

- The purpose of the test plan is not for comparison of different vendor's systems.
  - Vendor specific test results will not be publicly released, although the results maybe shared with the manufacturers whose devices are being tested.
  - Not a marketing trial or test bed

- Reports and test results that get published by PSCR will be generic in nature regarding the vendor but may be specific regarding the test case.

- The plan helps to determine the tests that are relevant to public safety.

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Test Plan Overview (3)

- The test plan has been segmented into two parts: **Demonstration and Evaluation.**

- The end user's perspective of the LTE network differs from the engineer.

- Demonstration
  - Demonstration tests are tests that illustrate the end user experience. These tests will include application level tests as well as some functional, operational, and interoperability tests.
  - Primarily qualitative tests

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Test Plan Overview (4)

- Evaluation
  - Evaluation tests examine the systems ability to meet particular engineering criteria.
  - These tests may involve specialized software or instrumentation and are typically quantitative rather than qualitative in nature.

- Demo Days
  - Series of days when specific demo or evaluation tests can be shown to public safety

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LTE Test Plan
Track 2: Demonstration Tests

Demonstration Test Plan

- The demonstration tests are primarily application level tests that are designed to display the capability of the end user experience.

- These tests are designed specifically to emulate public safety (PS) tasks and typify the end user experience.

- These test are primarily derived from the 700MHz Broadband (BB) Statement of Requirements (SoR) v0.6 and the 700MHz Broadband Task Force (BBTF) Final v1.1 Report.

- PSCR attempted to harmonize the application category within these documents.

- PSCR is seeking public safety's and the vendor community's inputs to these test categorizations and the demonstration tests.

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Demonstration Test Plan
Current Application Categories

Application Category	Description
File Transfer	700MHz BB SoR v0.6
Functional	PSCR Category Typically these tests exhibit a functionality of a system or device.
Generic Traffic	BBTF Category
Internet Access	BBTF Category
Interoperability	PSCR Category
Location Services	BBTF Category
Messaging	BBTF Category
Network O&M data	BBTF Category
Secure data	PSCR Category
Strategic data	PSCR Category Typically this data is non-real time used for planning and positioning resources.
System information	BBTF Category
Tactical data	PSCR Category Typically this is real time incident data
Video	PSCR Category & 700MHz BB SoR v0.6 Category
Voice	BBTF Category & 700MHz BB SoR v0.6 Category

Demonstration Test Plan
Desired Outcomes

- Obtain input from Public Safety and vendor community to help further develop and define LTE demonstration tests.

- Find agreement from the Public Safety community for the test categorizations.

- Eliminate test case redundancy in the demonstration test plan.

  – As an example, consolidate all of the video tests into four tests.

  – Note that qualitative tests are inherently subjective. The subjective experience may differ even though the underlying mechanism may be the same. Therefore, there maybe some overlap in the final set of demonstration test.

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Public Safety Perspective

- General Comments?

- Concerns?

- What isn't included in the list of categories that needs to be?

Industry Perspective

- General Impressions?

- Concerns?

- Anything that needs to be added? Taken out?

- Feasibility of performing these tests?

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Demo Days

- What do you want these to look like?
- Concerns?

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Working Groups

- How often should we meet?

- When should we meet?

- Who should be involved?

- We will pass around a sign-up sheet.

- Note: There may be one Testing working group to cover both Demonstration and Evaluation Tests

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LTE Test Plan
Track 2: Evaluation Tests

Evaluation Tests - Descriptions

- # Evaluation

  – Evaluation tests examine the system's ability to meet particular engineering criteria. These tests may involve specialized software or instrumentation and are typically quantitative rather than qualitative in nature.

Evaluation Test Plan

- PSCR has developed an *Evaluation Test Pool (ETP)* which contains all tests from the sources listed above.
  - From this list, PSCR selected those tests that appear to have the greatest importance to PS, noted them in the list by red font, and gave a brief summary of the selection motivation.
- Primary Sources:
  - Release 8 3GPP Documents
    - TS 36.141 - BS Conformance Tests
    - TS 36.143 - FDD Repeater Performance
    - TS 36.521-X - Ue Rx & Tx Conformance
    - TS 36.523-X - Ue Protocol Conformance
    - TS 36.903 – Radio Resource Management (RRM) Conformance; Doesn't exist for R8
  - Publicly Available Verizon Test Plan
    - Compliance test document published in February 2010
  - Public Safety Communications Research (PSCR)
    - Tests that are unique to PS
  - DC Office of Chief Technology Officer (OCTO)
    - Tests that are unique to PS
- Phase One
  - Leverage existing tests when possible
  - Limit scope of testing to the LTE air interface

Evaluation Test Plan

- Present Categories
  - Ue
    - Channel State Information, Environmental Tests, EPS Mobility Management, eUTRA Radio Bearer Tests, General Test – SMS, Idle Mode Operations, Latency Test, Layer 2, Measurement Performance Requirements, Measurement Procedures, Multilayer Procedures, Mobility Management – IPv6, Over-the-Air Device Management, Performance Requirements, Radio Resource Control, RRC Connection Mobility, RRC eUTRAN Connected State Mobility, RRC Idle State Mobility, Rx Characteristics, Signaling Tests, Throughput Tests, Timing and Signaling Characteristics, TX Characteristics
  - eNodeB
    - Performance, Performance Requirements, Rx Characteristics, Tx Characteristics
  - System
    - Capacity, Capacity & Throughput Test, Configuration, Functional, QoS, Throughput Tests
  - Repeater
    - Adjacent Channel Rejection Ratio, Error Vector Magnitude, Frequency Stability, Input Intermodulation, Out of Band Gain, Output Intermodulation, Output Power, Unwanted Emissions

Over 650 potential Phase One tests!

- ## Phase 2 and Beyond
  - ### Evolved Packet Core Tests (Conformance, Interoperability, etc.)
    - EPC S10 (MME to MME)
    - EPC S11 (MME to S-GW)
    - EPC S12 (RNC to MME)
    - EPC S1-MME (MME to eNB)
    - EPC S1-U (eNB to S-GW)
    - EPC S4 (SGSN to S-GW)
    - EPC S5/S8 (S-GW to P-GW)
    - EPC S6a (HSS to MME)
    - EPC S6b (3GPP AAA to P-GW)
    - EPC SGi (P-GW to Interne and P-GW to IMS)
    - EPC SWn (ePDG to Untrusted Access) (IPSec)
    - EPC X2 (eNB to eNB)

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Evaluation Test Selection Criterion (ETSC)

1. ## Subsystem Performance Tests.

   - Answers the question "How good/high/low is the device ..?"

2. ## Operational Tests

   - Answers the question "Can the network do ...?"

3. ## End-to-End Performance Tests

   - Answers the question "How well can the network....?

4. ## Message Level Tests

   - Answers the question "How is the network doing....?

- PSCR has identified ~150 Phase One Tests from the ETP that appear to be important to Public Safety
  - Does this subset reasonably represent the most important technical issues facing the development of LTE infrastructure and handsets that contain features desired by PS?
  - In addition, does this subset reasonably represent the most important technical issues PS may face after deployment of LTE infrastructure and handsets in the field?
  - Which of these test results may be available from vendors?
  - Which of these tests must be modified to address PS concerns?
  - Are there resources available to conduct these tests?
  - Are there other important sources of tests that are publicly available?
- Additional ideas and inputs are welcomed

Working Groups

- How often should we meet?

- When should we meet?

- Who should be involved?

- We will pass around a sign-up sheet.

- Note: There may be one Testing working group to cover both Demonstration and Evaluation Tests

Backup (if time)

Test Equipment Questions

- **Efficiency of PSCR Testing Resources**
  - Limited time, $ and labor
  - Looking for test equipment that is flexible, low cost and comprehensive

- **700 MHz Ue and eNB Availability to PS**
  - When?

- **700 MHz Radiated Testing Equipment**
  - Still searching

- **Drive Tests versus Bench Tests**
  - Is there a single solution?
  - Test tool cross compatibility

Even more Test Equipment Questions

- **End-to-End Testing**
  - Call flow message tracing
  - Timing Correlation between EPC and RAN measurements
- **Equipment for Radiated MIMO Testing**
  - Does it exist?
- **System Loading**
  - Loading of the RF side.
    - How many "UEs"?
  - Core interface loading
    - X2, S1-U, S1-MME ….