Items to Cover……

1. General LTE UE availability, IOT and certification
2. Band 14 support – chipsets, filters
3. Multi-band support – 700 MHz band classes, other bands
4. Multi-mode support for roaming – W-CDMA / EVDO
5. Power class
6. Volumes and pricing
7. Devices for PSCR
3GPP Timeframe for a New Standard
- With Reference to LTE

Release 8 Estimated Dates

- 2009
- 2010
- 2011
- 2012

Requirements
Evaluation & Study Item / Stage 1
High Level Design / Stage 2
Detailed Specification / Stage 3
Performance Requirements
Test Specification
Core Specifications Completed
Test Validation
Conformance Testing
Interoperability Testing
Field Trials
Type Approvals
Commercial Deployment
First Commercial Launch

3-4 years to complete standard & specification
3-4 years to fully commercialise
2-3 years for large scale mass market adoption

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IOT testing / UE certification

• **Process**
  – 3GPP prepares test suites *(end 2010)*
  – Implemented by test system manufacturers *(end 2011 +)*
  – Testing of UEs *(2011 – 2012)*
  – Certification by GCF *(international)* and PTCRB *(US)* - mid 2011 +
  – Commercial operators often do own IOT in addition

• **Prior to certification**
  – “Private” IOT between UE and Infrastructure vendors
    • Logistical limit to how many combinations can be tested

• **Any new features for public safety will require additional tests**
Releases 9 and 10

• Release 9
  – Includes features such as:
    • MIMO enhancements, Femtocells, Self Organizing Network, Public Warning System, IMS features, MBMS, End User Identity (EUI), Personal Area Networks, security enhancements
  – Specs frozen. Timing of upgrade very dependent on IOT
  – SDR eNodeB and UE supports software upgrade

• Release 10
  – Includes features such as:
    • Relay Nodes, UE Dual TX options, Local area optimization, Flexible Spectrum Usage, Cognitive radio, Automatic Network Configuration, Enhanced Coding and FEC, Enhanced Interference Management, Asymmetric FDD, Hybrid OFDMA and SC-FDMA in uplink, inter eNB coordinated MIMO
  – Some features require hardware changes, others supported in SDR
700 MHz Band Class Support

• There are >24 3GPP band classes for LTE, plus 3G bands to support. 4 band classes in 700 MHz alone

• Chipsets
  – **Baseband chips:** frequency independent
  – **RF chipsets:** Some cover multiple bands (IPW), some are band-specific, some 700 MHz chips not spec’d / tested for band 14
  – **Filters / Front End Modules:**
    • Front End Module (multiple filter) manufacturers only addressing major commercial bands -e.g. band 17 / 13 in 700, in combination with other bands.
    • Band 14 filters are available (smaller volumes)
    • Multiple filters for UE covering all 700 MHz band classes- Size / cost issue rather than technical
Multi-Band and Multi-Mode

• Multi-band support
  – Volume commercial UE’s likely to address major commercial LTE bands
  – Multi-band UEs including Band 14 will be available from specialist suppliers such as IPW.

• Multi-Mode support
  – Single chip LTE / W-CDMA and LTE / EVDO solutions are 1-2 years out
  – Dual chip solutions becoming available from IPW and others
Coexistence Issues

• Narrow duplex gap between band 13 and band 14
  – Duplexor achievable with current technology

• D-Block / Public safety (if different operators)
  – Small probability of receiver blocking / adjacent channel interference of PS UE very close to D Block cell site
  – No different to situation in commercial FDD bands – operators deal with by handoff to other (higher) bands
  – Small guard band proposed by some would not achieve much
  – Co-siting of PS and D Block would avoid problems

• Commercial Band 12 Interference Issues:
  – TV channel 51 interference is not a UE interference issue
  – UE blocking / coexistence issue from D & E (MediaFlo, Echostar)
UE Power Class

- Frequent questions on increasing UE power to extend coverage
  - Standard 3GPP LTE power class is 23 dBm (1/4 watt)

- Increase to 27 – 30 dBm, or even higher?
  - Would require new 3GPP power class
  - Battery issues less in larger PS devices that commercial UE
  - Potential issue with inbound roamers with standard UE’s into a network designed for higher power
    - Translates to reduced coverage probability
    - May be acceptable in some cases
      - Analogous to hand-portable vs. mobile in PS voice networks
      - Requires analysis / testing of any increases interference
**Volumes and Pricing**

- High volume Commercial UE manufacturers typically look to 1 million + quantities
  - These volumes needed to get to prices in the ~$100 range

- Specialist UE suppliers such as IPW are able to supply PS-specific product in smaller volumes
  - Some price premium, but still relatively low in PS industry terms
User Equipment

- Band 14 USB stick available now in trial quantities
- To complete IOT with selected Band 14 infrastructure vendors
- Expect to supply to NIST this month

- Infrastructure (eNodeB and EPC)
  - Provide to NIST in 2011