MDO LTE Air interface monitoring

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Tektronix LTE monitoring solution
Total I/F correlation

Ue & e-NodeB functions/protocols
SAE-GW Protocols

MME SAE-GW
S1-AP
GTP-U
SCTP
IP
Data Link
PHY
MAC
RRC
PDCP
RLC
MAC
S1-AP
GTP-U
SCTP
IP
Data Link
PHY
MAC
RRC
PDCP
RLC
MAC

Interface and Control Logic:
- CPRI / OBSAI interface
- Clock and Frame recovery
- Global System Control unit

Downlink Receiver:
- time- and frequency- synchronisation
- Rx OFDM processing
- Channel estimation, Channel Correction
- Common phase error correction
- Demultiplexing/demodulation/descreaming
- Rate matching and deinterleaving
- HARQ (soft combining), FEC decoder, Channel mapping
- Transport channel interface (to MAC layer)

Uplink Receiver:
- time- and frequency- synchronisation
- SC FDMA processing
- Channel estimation, Channel Correction
- Common phase error correction
- Demultiplexing, demodulation, descreaming
- Rate matching and deinterleaving
- HARQ (soft combining), FEC decoder, Channel mapping
- Transport channel interface (to MAC layer)
MAC Layer:
- Basic MAC layer functionality: mapping transport channels to MAC PDU and vice versa
- Extended MAC layer functionality: control and scheduling of up to 8 CID and up to 8 HARQ processes

Hardware Concept:
- Extendable and flexible hardware platform
- Based on programmable devices like DSP and FPGA.
- Additional DSP or FPGA can be mounted to extend the processing power of the platform for future applications.
- Integrated system controller allows on-site firmware updates via Ethernet or USB interface.
- Remote access via IP link
- Integrated CPRI/OBSAI interfaces are used for direct connection to an eNodeB or for connection of a remote radio head or specific RF.

Mechanical:
- 19” 1 HU housing
- Power supply 110/230V AC
- Power consumption max. 100W

Features:
- Monitoring of up to 300 users via Uu probe promiscuous mode in UL & DL in real time
- Real time reception of full bandwidth LTE uplink SC-FDMA signal
- 2 x 2 MIMO reception
- 4 x 4 MIMO reception (optional)
- FDD and TDD

Connectivity to NSA/Optimon
- Uu probe is fully integrated in NSA system
- Uu probe is fully configurable via NSA like all other probes
- System reliability and test & measurement quality (no frame loss, real-time processing)

Physical Layer Measurements
- RF parameter measurement (Rx power, RX bandwidth)
- Measurement of clock & timing offsets
- Frequency offset measurement
- External reference input for connection of high-accurate Rubidium-Frequency-Generator
- Time domain signal capturing and analysis
- Frequency domain signal capturing and analysis
- Constellation diagram analysis per resource block / OFDM symbol / subcarrier
- Measurement of channel transfer function
- Real time reception of all LTE compliant physical layer modes and modulation formats
- Decoding and analysis of LTE Downlink channels
- Decoding and analysis of LTE Uplink channels
- HARQ measurements
- BER measurements and CRC
- Channel quality information (CQI) Measurements

MAC Layer Measurements
- Measurement and analysis of logical channels and transport channels
- Measurement and analysis of scheduler information
- HARQ measurements
- Radio Resource Allocation Measurement
- Measurement of QoS priority handling
Tektronix Air interface monitoring
Uu Probe/ NSA System

**NSA System**
- Analysis of HARQ process performance
- MAC demultiplexing and full decoding
- Scheduling Algorithm evaluation
- Efficiency & protocol impact to higher layers & QoS/QoE
- RLC decoding, SDU reassembling, reordering, TM, UM, AM & analysis (e.g. of retransmissions with AM)
- PDCP decoding & analysis
  - Robust Header decompression
  - Deciphering
- RRC decoding and analysis
  - Analysis of RRC procedures and KPIs
- NAS decoding and analysis (KPI)
  - User Plane decoding and analysis
  - User Plane SIP, RTP, FTP, HTTP,
    - performance analysis & extraction (QoE & MOS analysis)

**Correlation of Uu performance with wireline protocol performance**
- Joint analysis of RF dependent PHY performance and performance (impact) of higher protocol layers with drill-down and drill-up functionality
- Graphical analysis of RF quality (drill down and drill up functionality to protocols on any higher layers)
- Radio Chart analysis: Cell-, User- and Call-based
- Statistical KPI analysis (numerical and graphical)
- Call based KPI analysis (numerical and graphical)
- KPI User plane analysis on Uu interface

**Multi interface analysis**
- Impact of Uu performance to fixed line interface performance and protocol behaviour
- Multi interface call trace
- KPI analysis on fixed line interfaces
- Multi interface KPI aggregation and analysis

Tektronix Air interface monitoring
Uu Probe Release 2

**Uu Probe Rel. 2**
- "LTE RX Platform"

**Interfaces:**
- 1* I&Q digital, optical and electrical
- 2 x 1GBit Ethernet Interface
- USB Interface
- External 38.4 MHz reference clock input

**Mechanical:**
- Stand alone device
- 19", 1 HU housing
- Power supply 110 / 230V AC
- Power consumption max. 100W

**General:**
- DL OFDMA, UL SC- FDMA
- Layer 1 and MAC real time processing
- Time and Frame synch

**Tektronix Air interface monitoring**
Uu Probe Release 3

**Uu Probe Rel. 3**
- "LTE RX Platform"

**Interfaces:**
- 1* I&Q digital, optical and electrical
- OBSAI RP03, CPRI
- MIMO 2x2
- Fully connected to NSA via GbE and correlation
- HARQ (soft combining),
- FEC decoder,
- Channel mapping
- Transport channel interface (to MAC layer)
- 32 Ue’s in parallel
- Channel estimation, Channel Correction

**Mechanical:**
- Stand alone device
- 19", 1 HU housing
- Power supply 110 / 230V AC
- Power consumption max. 100W

**General:**
- DL OFDMA, UL SC- FDMA
- Layer 1 and MAC real time processing
- Time and Frame synch

**Tektronix Air interface monitoring**
Uu Probe/ NSA System / General Principal

- FDD, TDD
- Up to 20MHz
- Digital I/ Q interface
- OBSAI RP03, CPRI
- MIMO 4x4
- Fully connected to NSA via GbE and correlation
- HARQ (soft combining),
- FEC decoder,
- Channel mapping
- Transport channel interface (to MAC layer)
- Up to 300 Ue’s in parallel
- Channel estimation, Channel Correction