



Features:

- * 4G LTE eNodeB + EPC + UE replication in Lab
- * LTE Advanced Release 10 as per 3Gpp.org.
- * Throughput of upto 150Mbit/second
- * Multiple UE simultaneous connections
- * Basic Video Streaming and Voice support
- * Fully functional FDD LTE Band 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
- * Programmable Bandwidth of 1.4, 3, 5, 10, 15 & 20MHz
- * ASIC Architecture: combines LNA, PA driver, RX/TX Mixers, RX/TX Filters, Synthesizers, RX Gain control, TX power control
- * 0dBm Transmit power & -120dBm Sensitivity Receiver
- * SISO & 2X2 MIMO built in
- * Low power FCC compliant license free operation to 10m range
- * No recurring cost of software or licences
- * Orthogonal frequency domain multiple access (OFDMA) DL
- * Single-carrier frequency domain multiple access (SC-FDMA) UL
- * Timing Measurement though PRACH coordinated multipoint transmission and reception
- * NAT based IP routing all IP core network, the System Architecture Evolution (SAE)
- * S1 and X2 using Stream Control Transmission Protocol
- * Implements MAC, RLC, PDCP and RRC layers
- * X2AP interface between eNodeBs
- * Calibrated +0.1ppm TCXO frequency reference
- * USB 3.0 Super speed Interface to EPC
- * Wireshark MAC LTE capture
- * IPV6 supported
- * Handling of UE procedures attach, authentication, security configuration, detach, tracking area update, service access, radio bearer establishment, paging
- * Configurable user data base

Description:

The Amitec 4G LTE NIB Network in a box, Advanced Mobile communication Lab, MCL04 is intended for lab use and ideal for universities and testing labs. It allows to replicate small 4G LTE Advanced (Voice + Data) cellular network. Amitec makes it easy for you setup a LTE Advanced network release 10 as per 3Gpp.org. The release 10 is a recent version of LTE with advanced technologies like MIMO. The lab is complete with reconfigurable EnB's, multiband LTE cellular phones and EPC pre-configured. The lab is future ready to handle 1Gbps future data rate with software provided for exceptional value and performance.

The system is based on a reconfigurable RF/FPGA/ARM hardware platform and an LTE ENb software. This approach allows for tremendous flexibility at a reduced cost.

The USB 3.0 super speed interface serves as the connection between the ENB and Radio head. This enables the user to realize upto 150 Mb/s of peak data rates in downlink and 75Mbps in uplink modes.

The Radio is configurable as SISO or MIMO 2X2 and compatible to commercial LTE phones and dongles. The system emulates commercial base stations deployed by large network operators costing millions and makes available to student the best practices of telecommunication industry at an affordable price. A real system is a boon to researchers to test their new algorithms and study mobile phone and base station in class room.

All the parameters of physical layer are accessible to the user to create infinite test scenarios in lab environment.

Complete turnkey solution with Hardware (EnodeB Radio + LTE Antennas + LTE Smartphone + LTE Test SIM) + Software (eNobeB + EPC + IMS Server server) + Service (1 year warranty + Upgrade + Tech support + Training) in a package for peace of mind.

Features	
ASIC Architecture	Combines LNA, PA driver, RX/TX Mixers, RX/TX Filters, Synthesizers, RX Gain and TX Power Control
Frequency Band	400MHz-4000MHz
Compliance to 3Gpp.org	Upto release 10 LTE Advanced for all layers
Bandwidth	Programmable to 1.4, 3, 5, 10, 15 & 20MHz
Multiplexing	FDD supported,
Transmission Mode	SISO & 2X2 MIMO
Physical Layer Features	Intraband or interband configurations; Wideband CQI/PMI report, HARQ support; Timing measurement thru the PRACH; Closed-loop UE power control; Frequency based MMSE equalizer; Highly optimized software turbo decoder; PAPR reduction support; Positioning Reference Signals (PRS) support; CSI-RS support; Multi-cluster PUSCH allocation; PUCCH 3 and PUCCH channel selection support;
Protocol Layer Features	Implements the MAC, RLC, PDCP and RRC layers; Round-robin MAC scheduler with dynamic MCS selection; Support of full and half duplex UEs; Number of active users only limited by the available bandwidth; Fully configurable System Information Blocks; Integrity check and encryption using the AES and Snow3G algorithms; Support of RRC measurement with measurement gap; Supports intra eNodeB, S1 or X2 handovers; QoS support with user selectable DRB configuration for each QCI; ROHC support (RTP, UDP and IP v1 profiles)
Network Interface	Standard S1AP and GTP-U interfaces to the Core Network; Several PLMNs and S1 interfaces can be used simultaneously; X2AP interface between eNodeBs
Core Network EPC Features	Implements one MME with built-in SGW, PGW and HSS; - Supports several eNodeBs with standard S1 interface (S1AP and GTP-U protocols); NAS integrity check and encryption using the AES and Snow3G algorithms; Support of USIM cards using the XOR or Milenage authentication algorithm; Handling of UE procedures: attach, authentication, security configuration, detach, tracking area update, service access, radio bearer establishment, paging; Multi-PDN support; Transparent access to the IP network (no external Serving Gateway nor PDN Gateway are necessary); Configurable access point name, IP range, DNS and ERAB QoS; Configurable user database. No external HSS is needed; IPv6 support; Configurable logging system for all channels with built-in text decoders; Command line monitor

Real-time Interface

- **Setup a real-time 4G LTE Mobile Communication Network emulating a practical network**
- **Emulate a working LTE network in any band on FDD**
- **Start from the basics of modern mobile communication to advanced components with in-depth control over all interfaces**
- **Comprehensive understanding of User Equipment, enodeB, EPC, MME, SGW, PGW, IMS and various interfaces**
- **Even emulate the User Equipment (Phone) based on software defined radio**
- **Connect 4G LTE capable handset for call and data connectivity**
- **Complete end-to-end user connectivity with voice and video calls**
- **Understand all procedures involved in a network including Attach, Authentication, Security, Paging, Detach and others**

Area and Scope of Learning

- Setting up multiple eNodeBs with multi-cell configuration and multi-UEs
- Understanding different interfaces such as X1 and S1 for eNodeB-to-eNodeB connectivity and eNodeB-to-EPC connectivity. Monitoring real-time traffic using Wireshark and decoding packets.
- Fully functional FDD LTE Band 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
- Programmable Bandwidth of 1.4, 3, 5, 10, 15 & 20MHz
- All the parameters of physical layer are accessible to the user to create infinite test scenarios in lab environment.
- Role of NAS integrity check and encryption using the AES and Snow3G algorithms
- Support of USIM cards using the XOR or Milenage authentication algorithm
- Understanding different channels such as PDSCH (physical downlink shared data channel), PDCCH (physical downlink control channel), PCFICH (physical control format indicator channel), PHICH (physical HARQ indicator channel), PBCH (physical broadcast channel), Synchronization Channels PSS and SSS along with PUSCH (physical uplink shared data channel), PUCCH (physical uplink control channel), PRACH (physical random access channel), DRS (demodulation reference signals), SRS (sounding reference signal)
- Understanding complete Mobile Communication Network including different subsystems. Functioning and role of different components.
- Integrating separate components to form a scalable network
- Measure and observe the spectral distribution of LTE frequencies at a given location, decode the channels and geo-locate all the functioning LTE eNodeB towers
- Practically understanding the concept of traffic and control channels
- Understanding the role of different procedures involved in a network including Attach, Authentication, Security, Paging, Detach and others
- Configuring the eNodeB to set Mobile country code, Network operator code, LTE band and EARFCN channel. Understanding the concept of frequency reuse and calculating channel number
- Call logging and CDR analysis and importance of Operation and Maintenance Centre
- Understanding the practical concept of SIM card, IMSI, TMSI, Ki/Kc keys and encryption
- Configure the communication server for IP PBX and VOIP gateway. Understanding the role of various protocols such as SIP and RTP
- Registration of phones to the LTE network and practical working of HSS and other components
- Understanding the complete flow of registration with each and every associated channel
- Transmission and Reception of Voice and Video calls using mobile network and SMS server
- List the TMSI of the phones registered on network and its importance in security of network
- To establish a voice phone call on mobile phone using mobile network, decoding physical and network layer parameters to understand the complete flow control
- Forming mobile sectors with frequency reuse
- Capture LTE packets using Wireshark and analyse the vulnerability of wireless network
- SIM programming and use of encryption keys along with different encryption methods available
- Data communication link and understanding the IP data flow via various interfaces and role of SGW and PGW
- Role of backhaul network in designing and planning the network architecture

Technical Specifications

Frequency Bands		LTE Physical Layer	
FDD LTE Band 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31		Modulation	64 QAM in Downlink 16 QAM in Uplink
RF		DL Channels	PBCH, PDCCH, PDSCH, PCFICH, PHICH, PMCH, PSS, SSS
Maximum Output Power	0 dBm ***	UL Channels	PRACH, PUSCH, PUCCH, SRS, DRS
Output Level Setting	1 dB	HARQ Support	Yes, both UL and DL
Sensitivity	-100 dBm	Duplex	FDD and TDD
Clock Accuracy	< 50 ppb Factory Calibrated	CQI/PMI reporting	Yes
LTE Protocol Layer		Evolved Packet Core	
Layers	MAC, RLC, PDCP and RRC layers	Implementations	MME, SGW, PGW and HSS
Interfaces	S1AP and GTP-U interfaces to the Core Network	NAS	Integrity and encryption using the AES algorithm
IP connectivity	IPv4 and IPv6 support	UE procedures	attach, authentication, service access, radio bearer establishment
Embms(optional)	MCH, MCCH, MTCH	IP connectivity	IPv4 and IPv6 support
Encryption	AES algorithm		
Physical Interface		Antenna Specification	
Rx Antenna	N-type	Operating Frequency	700 MHz - 2700 MHz
Tx Antenna	N-type	Type of Antenna	Omni
Network Interface	Ethernet/IP RJ45	VSWR	< 1.5
Power Input	19V/ 6A	Nominal Impedance	50 Ohm