



Features:

- * 4G LTE eNodeB + EPC + UE replication in Lab
- * LTE Advanced Release 12 as per 3Gpp.org.
- * Throughput of upto 150Mbit/second over 20MHz bandwidth
- * Unlimited UE simultaneous connections
- * Video Streaming, Voice over LTE 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
- * Fully functional TDD LTE Band 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
- * Programmable Bandwidth of 1.4, 3, 5, 10, 15 & 20MHz
- * Carrier Aggregation support with scheduling
- * ASIC Architecture: combines LNA, PA driver, RX/TX Mixers, RX/TX Filters, Synthesizers, RX Gain control, TX power control
- * +5dBm Transmit power & -120dBm Sensitivity Receiver
- * SISO & 2X2 MIMO built in and expandable to 8X8 in future
- * Low power FCC compliant licence 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 through PRACH
- * Self organising network (SON) features, such as optimization
- * location services (LCS) to pinpoint the location of a UE
- * relay nodes to support Heterogeneous Networks
- * coordinated multipoint transmission and reception
- * enhanced inter-cell interference coordination (eICIC)
- * 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
- * Evolved multimedia broadcast and multicast service (eMBMS)
- * 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 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 12 as per 3Gpp.org. The release 12 is a recent version of LTE with advanced technologies like MIMO, carrier aggregation etc. The lab is complete with reconfigurable EnB's, multiband LTE cellular phones & EPC pre configured & future ready to handle 1Gbps future data rate with software provided for exceptional value & 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 EPC. This enables the user to realize 150 Mb/s of peak data rates in downlink and 75Mbps in uplink modes.

The Radio is configurable as SISO or MIMO 2X2 and ungradable to 8X8 and compatible to all 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 X1 (Mobile Work Station EPC + EnodeB Radio + LTE Antennas + LTE Smartphone + LTE Test SIM) + Software (eNobeB + EPC + IMS Server + eMBMS server) + Service (3 years warranty + Upgrade + Tech support + Training) in a package for peace of mind.

Technical Specifications	
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 12 LTE Advanced for all layers
Bandwidth	Programmable to 1.4, 3, 5, 10, 15 & 20MHz
Multiplexing	TDD & FDD supported,
Transmission Mode	SISO & 2X2 MIMO
Physical Layer Features	Intraband or interband configurations; Handle several cells in intra-band or inter-band 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; Support of other radio heads can be added with an external shared library; Positioning Reference Signals (PRS) support; CSI-RS support; Multi-cluster PUSCH allocation; PUCCH 3 and PUCCH channel selection support; Carrier Aggregation support with cross carrier scheduling; CoMP testing features (DMRS scrambling identity and QCL parameters can be selected); 256QAM DL support for PDSCH and MBMS; Support of release 11 TDD special subframe configurations 7 and 9.
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); Public Warning System (CMAS/ETWS) support; MBMS support; Category 0 UE support.
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; M1 interface for MBMS; IPv6 support,
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 and built-in dynamic ERAB setup for easy VoLTE/IMS testing; 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; Support sending of Public Warning System messages (ETWS/CMAS); IPv6 support; Configurable logging system for all channels with built-in text decoders; Command line monitor

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Feature	(a) Downlink	(b) Uplink
Frequency Band Capability and Configurability	LTE Bands as per 3GPP LTE Specification	LTE Bands as per 3GPP LTE Specification
RF Cabling	RF ports can be connected via SMA cables	RF ports can be connected via SMA cables
RF antennas over the air transmission	RF antennas can receive wireless	RF antennas can transmit wireless
LTE Channel bandwidths (MHz)	1.4, 3, 5, 10, 15, 20 MHz	1.4, 3, 5, 10, 15, 20 MHz
Time division and frequency division duplexing	FDD & TDD supported Fully	FDD & TDD Supported Fully
Waveforms	OFDMA in downlink	SC-FDMA in uplink
Peak Data Rate	Maximum: 150 Mbps @ 20MHz	Maximum 75 Mbps @ 20MHz
Antenna	2x2 MIMO ready	Multi User Collaborative MIMO
Modulations supported	QPSK, 16QAM, 64 QAM	QPSK, 16QAM, (64QAM handset)
Channels	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	PUSCH (physical uplink shared data channel) PUCCH (physical uplink control channel) PRACH (physical random access channel) DRS (demodulation reference signals) SRS (sounding reference signal)
OFDM Size	FFT128, FFT 256, FFT512, FFT 1024 FFT 1536, FFT 2048	FFT128, FFT 256, FFT512, FFT 1024 FFT 1536, FFT 2048
OFDM Cyclic Prefix type	Normal, Extended	Normal, Extended
Wireless Channel Models	AWGN: Additive White Gaussian Noise EPA: Extended Pedestrian A Model EVA Extended Vehicular A Model ETU Extended Typical Urban Model Rician Channel Models Rayleigh Fading Channel	
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ADC & DAC Word length	12 bit ADC & DAC	
ADC Dynamic Range	85dB	
Antenna Configuration	SISO Diversity, 2X2 MIMO	
Diversity Support a) SFBC (space frequency block coding) (b)STBC (space time block coding) (c)Receiver Diversity (d)Transmitter Diversity		
Number of OFDM data subcarrier (a) 1200 subcarriers (b) 900 subcarriers (c) 600 subcarriers (d) 300 subcarriers (e) 128 subcarriers (f) 72 subcarriers		
Carrier/Phase recovery tolerance range in KHz and ppm	Frequency Correction Range 75KHz-90KHz	
ADC/DAC/Frequency Clock Stability	Less than ± 0.1 PPM	
Equalization	LS: Least Squares MMSE: Minimum mean square Equalizer DFT-MMSE: DFT based MMSE	
Mobility/Doppler Support	Doppler shift upto 300Kmph	
Error Correction Coding and Decoding	a. Convolution Encoder and Tail biting Viterbi Decoder. Constraint Length 7 Compliant with LTE. b. Turbo encoder and decoder. Compliant with LTE. Coding rate 1/3. Parallel Concatenated Convolution Code with two 8 state constituent encoders and one turbo code internal inter leaver	
Measurement Support (a) SNR versus BER (b) EVM measuring instruments (c) Spectrum Plots (d) Time-domain plots		
RF Accessories (a) Front Panel Ports and Antenna Connectors (b) Power Supply Adapters (c) RF Attenuators (variable and fixed) (d) SMA Cables (e) SMA SMA adapters (f) LTE Antennas Omni Directional		

Disclaimer: Images shown are Indicative only. Color or Model may differ from the picture shown (Features will remain same or More). Specifications are subject to change without notice.

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User Interface:

- (a) Configurable logging system for all channels with inbuilt text decoders.
- (b) Wireshark MAC-LTE Capture
- (c) Command line monitor
- (d) Test commands to initiate handover
- (e) Change power level of each cell dynamically

Hardware & Software Deliverables

- (a) (EPC+ ENodeB) X1 + LTE UE X1 pc + Test SIM X1pc + SIM Programmer X1pc
- (b) LTE Antennas X 4pcs
- (c) Operating System: Linux
- (d) Programming Language: ANSI C ++
- (e) LTE e Node B Software, + EPC + IMS server +eMBMS server + Wireshark

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