VoLTE Lab

Complete test suite for Voice-over-LTE

VoLTE Lab is a complete test suite for Voice-over-LTE, that includes the Neutrino 224, the YateBTS Minicore 4G and two iPhone 12. It is fully configured and intended for use as a VoLTE test bed and learning environment.

With VoLTE Lab you can have a deep view into the internals of VoLTE technology, with Wireshark.

You can run Wireshark on the LTE Phy radio interface.

You can run Wireshark on S1-MME and S1-U interfaces and also on the S6a interface.

Components

- ✓ **iPhone 12**: UEs with a very good VoLTE implementation.
- ✓ **Yate MiniCore**: a software-defined compact core network for LTE/IMS and GSM/GPRS.
- ✓ **Baicell Neutrino 224:** an indoor 2x125 mW picocell eNodeB (eNB) that offers low-cost access for indoor Customer Premise Equipment (CPE).

Features and benefits

- ✓ Wireshark enabled
- ✓ Fully configured, fully functional VoLTE test suite
- ✓ Built on general purpose hardware
- ✓ Running Yate / YateBTS / YateENB software on Linux
- ✓ Three management interfaces (SSH, HTTP-local and remote)
- ✓ Easy to order, worldwide delivery
- ✓ Easy licensing system

YateBTS Minicore 4G

YateHSS/HLR & YateUCN in a box for testing & research

YateBTS Minicore 4G combines our YateHSS/HLR, YateUCN and YateSMSC in a small package.

Components

The YateBTS Minicore 4G is a small factor PC computer that has preinstalled the following software components:

- ✓ **YateUCN** (MSC/VLR, GMSC, gsmSCF, MME/SGW/SGSN, PGW/GGSN, IMS CSCF)
- ✓ **YateHLR/HSS** (AuC, HLR, HSS, Subscriber management)
- ✓ **YateSMSC** (SMS store-and-forward, routing, home routed SMS)
- ✓ **YateSTP** (routing of SS7 messages by Point Code or Global Title)
- ✓ **YateDRA** (routing of Diameter messages by host, realm, application)
- ✓ **YateMMI** (Web management interface)

On demand additional components can be installed on the same hardware.

Features

- ✓ Setup/edit mobile network and component preferences via **MMI management interface**
- ✓ **Minimal monitoring of each network component**, additional YateBTS monitoring possible
- ✓ **Wireshark capture** of communication between components including decrypted IMS traffic
- ✓ **JSON API integration** with any SIM management and CRM systems
- ✓ **JSON and REST API** for sending SMS
- ✓ Can use both **SIGTRAN/SS7 and Diameter** for signaling
- ✓ **Supports both IPv4 and IPv6**
- ✓ **Works both stand alone and with external components**

Communication interfaces

- ✓ **C interface** (MAP, HLR <-> GMSC)
- ✓ **D interface** (MAP, HLR <-> VLR)
- ✓ **E interface** (MAP, MSC <-> MSC)
- ✓ **F interface** (MAP, MSC <-> EIR)
- ✓ **J interface** (MAP, HSS <-> gsmSCF for USSD)
- ✓ **Gr interface** (MAP, HLR <-> GMSC)
- ✓ **Gc interface** (GTP or MAP, GGSN <-> HSS, optional)
- ✓ **S6a/S6d** (Diameter, MME/SGSN <-> HSS)
- ✓ **S13** (Diameter <-> VLR)
- ✓ **S1 interface** (S1AP & GTP-U, YateENB <-> EPC)
- ✓ **Gn/Gp interface** (GTPv1, SGSN and GGSN)
- ✓ **S5/S8 interface** (GTPv2, SGW and PGW)
- ✓ **Gi/SGi interface** (IP, connects to Public Data Network)

Communication protocols

MAP/SS7/SIGTRAN	- M2PA or M3UA-ASP over SIGTRAN, SCTP (CRC32) - ITU TCAP, ETSI MAP v3 - ITU or ANSI SCCP and SS7 MTP - E.164, E.212 (ANSI), E.214 (ITU), TT or PC SCCP addressing - Can connect to multiple STP/GW - CAMEL phase 2
Diameter	- 3GPP Applications S6a/S6d, Cx/Dx - SCTP or TCP transport - Can establish or listen for connections - Can connect to multiple Routing Agents
HTTP	- JSON API server for configuration and subscriber management - JSON API for monitoring and information retrieval - REST API client for visited network change notification - JSON and REST API for sending SMS
SNMP	- SNMP v2 or v3 for information retrieval - Traps sending for alarms
Telnet	- Management CLI for each component - Optional SSL and password protection
Voice interconnect	- SIP and RTP - G711, GSM and AMR codecs
SIP	- Supported standards (RFC3261) - Registrar function - B2BUA for calls - RTP (RFC3550) with sideband DTMF (RFC2833) - SMS and USSD over IP
SMPP	- Standard version 3.3 - Supports bidirectional communication
RADIUS	- Authorization of voice calls, data sessions and short messages - Postpaid accounting for voice, data and SMS - Prepaid support by re-authorization - Support for 3GPP, Cisco VoIP VSA and Cisco ISG VSA dictionaries
SMS	- Format: SMS PDU (MO and MT) - MAP/SS7 transport (T-PDU format) - SIP MESSAGE transport (SMS over IP, R-PDU format)
CDR	- Flexible file format (default .tsv files) with customizable table headers - Automatic file rotation - Optional file transfer: FTP, SFTP - JSON HTTP push API - RADIUS with 3GPP and Cisco dictionaries

Hardware Interfaces

- ✓ Dual Gigabyte ethernet
- ✓ DVI and HDMI video*
- ✓ USB for mouse and keyboard
- ✓ 12V Power supply, 100-240V AC, 50-60Hz (included)

Neutrino 224

Indoor Base Station

The Neutrino224 is an indoor 2x125 mW picocell eNodeB (eNB) that offers low-cost access for indoor Customer Premise Equipment (CPE).

INTRODUCTION

It provides indoor coverage for blind spots and enhances hotspot capacity. It is explicitly designed for use by families, small enterprises, and other indoor scenarios to provide reliable wireless coverage in areas where outdoor signals may not be strong enough to penetrate the building walls. In addition, the Neutrino224 supports Long-Term Evolution (LTE) technology and operates in Time Division Duplexing (TDD) mode.

With high capacity and easy deployment, the Neutrino224 TDD series eNB can help mobile operators to provide better coverage and higher capacity with lower network deployment cost and operating expense (OPEX).

This product has a standard one-year warranty.

HIGHLIGHTS

NOTE: Features can vary based on model or region.

- ✓ Standard LTE TDD Bands 38/40/42/48
- ✓ GUI-based local and remote Web management
- ✓ Compact, all-in-one design of external antenna
- ✓ Any IP-based backhaul can be used, including public transmission protected by Internet Protocol Security (IPsec)
- ✓ Peak rate: Up to DL 110 Mbps with 20 MHz bandwidth
- ✓ Peak rate: Up to UL 20 Mbps with 20 MHz bandwidth
- ✓ 32 RRC connected users
- ✓ PoE+ power supply; only one Ethernet cable is required for data transmission and power supply
- ✓ Configured out-of-the-box to work with Baicells CloudCore
- ✓ Plug-and-play with Self-Organizing Network (SON) capabilities
- ✓ Interoperable with standard LTE Evolved Packet Core (EPC)
- ✓ Lower power consumption to reduce OPEX
- ✓ Supports TR-069 network management interface

TECHNOLOGY

Standard	LTE TDD RAN (3GPP R10 compliant)
TDD UL/DL Configuration	1, 2 (with Special Subframe Configuration 7
Frequency Band	B38 (2570 MHz–2620 MHz) B40 (2300 MHz–2400 MHz) B42 (3400 MHz–3600 MHz) B48 (3550 MHz–3700 MHz
Channel Bandwidth	5/10/15/20 MHz
Multiplexing	MIMO: 2x2 (DL)
Security	Radio: SNOW 3G/AES-128/ZUC Backhaul: IPsec (X.509 AES-128, AES-256, SHA-128, SHA-256)

INTERFACE

Ethernet Interface	One RJ-45 Ethernet backhaul interface (1 GE) and one RJ-45 local management interface (1 GE)
Power Supply	12 VDC, AC adaptor (multiple standards optional), PoE+, complies with IEEE 802.3at standard
Protocols Used	IPv4/IPv6 (Dual Stack), UDP, TCP, ICMP, NTP, SSH, IPsec, TR-069, HTTP/HTTPs, 1588v2, DHCP
Network Management	IPv4/IPv6, HTTP/HTTPs, TR-069, SSH, Embedded EPC
VLAN/VxLAN	802.IQ/VxLAN
LED Indicators	1 x status LED

PERFORMANCE

Peak Data Rate	20 MHz:	SA1: DL 80 Mbps, UL 20 Mbps SA2: DL 110 Mbps, UL 10 Mbps
	10 MHz:	SA1: DL 40 Mbps, UL 7 Mbps SA2: DL 55 Mbps, UL 5 Mbps
User Capacity	32 RRC connected users	
Latency	30 milliseconds	
Receive Sensitivity	Band 40: -101 dBm Band 38/42/48: -100 dBm	
Modulation	MCS0 (QPSK) to MCS28 (64 QAM) DL: QPSK, 16 QAM, 64 QAM UL: QPSK, 16 QAM	
Transmit Power Range	0 to 21 dBm per channel (combined +24 dBm, configurable) (1 dB interval)	

Quality of Service	Nine-level priority indicated by QoS Class Identifiers (QCI)
ARQ/HARQ	Supported
Synchronization	GPS, 1588v2, network listening (NL)

FEATURES

Voice	VoLTE, Circuit Switched Fallback (CSFB) to GSM and UTRAN
Inter-RAT Mobility	To GSM, UTRAN and 5G NSA/SA
SON	Self-Organizing Network • Automatic setup • Automatic Neighbor Relation (ANR) • PCI confliction detection
EPC	HaloB (Embedded EPC)
Traffic Offload	Local breakout
UL Interference Detection	Supported
SON	• Local/Remote Web maintenance • Online status management • Performance statistics • Fault management • Local/Remote software upgrade • Logging • Connectivity diagnosis • Automatic start and configuration • Alarm reporting • User information tracing

LINK BUDGET

Antenna Type	External Omni Antenna • Horizontal Beamwidth 360° • Vertical Beamwidth 40°±5 • Polarization: Vertical
RF Antenna Gain	5 dBi
GPS Antenna	External GPS antenna, SMA connector
Maximum EIRP	29 dBm
Power Control	UL Open-loop/Closed-loop Power Control, DL Power Allocation (3GPP TS 36.213 compliant)

PHYSICAL

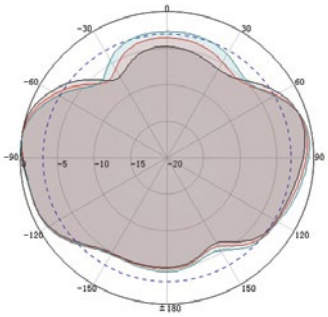
MTBF	≥ 150000 hours
MTTR	1≤ 1 hour
Operating Temperature	23°F to 113°F / -5°C to 45°C
Storage Temperature	14°F to 122°F / -10°C to 50°C
Humidity	5% to 95% RH
Power Consumption	Typical 11.25 W, maximum 15 W
Weight	1.0 lb/455 g
Dimensions (HxWxD)	Flat antenna: 11.9 x 6.9 x 1.2 inches 301.6 x 175 x 30.5 millimeters Vertical antenna: 5.8 x 6.9 x 7.1 inches 146.5 x 175 x 180.4 millimeters
Installation	Ceiling or wall mount, or desktop

MODEL NUMBERS

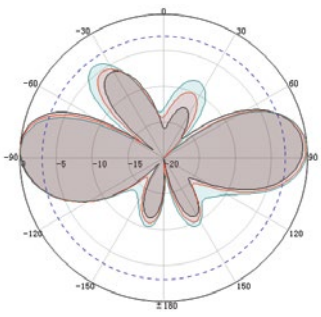
pBS4100	Neutrino224 Indoor TDD eNB – LTE Release 10, 2x125 mW (21 dBm), 2 GE, 5 dBi external antenna, 2.3 GHz, B40
pBS4110	Neutrino224 Indoor TDD eNB – LTE Release 10, 2x125 mW (21 dBm), 2 GE, 5 dBi external antenna, 3.5 GHz, B48
pBS4130	Neutrino224 Indoor TDD eNB – LTE Release 10, 2x125 mW (21 dBm), 2 GE, 5 dBi external antenna, 3.4 GHz, B42
pBS4150	Neutrino224 Indoor TDD eNB – LTE Release 10, 2x125 mW (21 dBm), 2 GE, 5 dBi external antenna, 2.5 GHz, B38

NOTE: Customized versions can be requested

ANTENNA PATTERN



H-Pattern



V-Pattern

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