



ALBEDO Ether10.Genius is a multitechnology Ethernet tester that includes a Rubidium clock. It is ideal to install and measure advanced services based on GbE, SyncE, PTP, T1/E1, 1 pps, ToD, C37.94, Datacom, OWD

Datasheet

Updated on 30/9/16

Ether.Genius all-in-on tester

1. General

1.1 Interfaces, test signals and timing

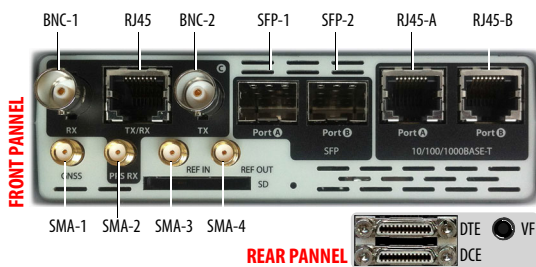


Table 1. Time Reference Input vs. Test Signal

	Test Signal								
	GbE/IP	E1/T1	Analog	Data	Clock	Cable	L1	C37.94	
Internal Clock	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm	TCXO OCXO Rubidm
BNC-1	10 MHz 2.0 MHz 1.5 MHz E1/T1	T&M			T&M ⁱ	10 MHz 2.0 MHz 1.5 MHz E1/T1	10 MHz 2.0 MHz 1.5 MHz E1/T1		
RJ45-C	E1/T1	T&M				E1/T1	E1/T1		
BNC-2		T&M							
RJ45-A	T&M SyncE					T&M	T&M		
RJ45-B	T&M SyncE					T&M	T&M		
SFP-1	T&M SyncE					T&M	T&M	T&M	
SFP-2	T&M SyncE					T&M	T&M	T&M	
SMA-1	GPS	GPS	GPS	GPS	GPS	GPS	GPS	GPS	
SMA-2					T&M				
SMA-3	PPS	PPS	PPS	PPS	PPS	PPS	PPS		
DTE	PPS-ToD	10 MHz 2.0 MHz 1.5 MHz E1/T1 PPS-ToD	10 MHz 2.0 MHz 1.5 MHz E1/T1 PPS-ToD	T&M		PPS-ToD	PPS-ToD	10 MHz 2.0 MHz 1.5 MHz E1/T1 PPS-ToD	
DCE				T&M					
VF			T&M						

i. 10, 2.0, 1.5 MHz

Table 2. Time Reference Output

Output Interface	Test Signal							
	GbE/IP	E1/T1	Analog	Data	Clock	Cable	L1	C37.94
BNC-2	10 MHz 2.0 MHz					10 MHz 2.0 MHz	10 MHz 2.0 MHz	
SMA-4	PPS	PPS	PPS	PPS	PPS	PPS	PPS	
DTE	PPS-ToD	PPS-ToD	PPS-ToD		PPS-ToD	PPS-ToD	PPS-ToD	
VF			Tone					

1.2 Ports

- Port A - B: 2 x SFP, 2 x RJ45 connectors
- Port C - D: balanced RJ45 120 Ω, unbalanced BNC 75 Ω
- Datacom Port: DTE / DCE
- VF Port: analogue voice frequency

1.3 Operation Modes

Table 3. Operation Modes and connection modes

	GbE/IP	E1/T1	Analog	Data	Clock	Cable	L1	C37.94
End-point	YES	YES	YES	YES		YES	YES	YES
Monitor	YES	YES		YES	YES			YES
Pass	YES	YES						
Loop	YES	YES						
MuxDemux		YES						

1.4 Internal Clock

- TCXO better than ±2.0 ppm
- OCXO better than ±0.1 ppm
- Rubidium better than ±5.0e-11

1.5 Internal Rubidium Clock

Freerun (No GPS)

- Output freq. accuracy (7.5 minutes warm up): ±1e-9
- Output freq. accuracy on shipment (24 h. warm up): ±5e-11
- Aging (1 day, 24 hours warm up): ±.5e-11
- Aging (1 year): ±1e-9

GPS Locked

- Time/Phase Accuracy to UTC: ±20 ns at 1σ after 24 hours lock
- Frequency Accuracy: ±1e-11 (averaged over one week)

Hold-over

- Output freq. accuracy (after 24 h. locked): ±1.5e-11 / 24h
- Output time accuracy (after 24 h. locked): ±100 ns / 2h, ±1.0μs / 24 h

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1.6 **Built-in GNSS**

- GPS/Glonass support
- Omnidirectional magnetic antenna
- SMA connector
- 4V to 5V DC output

1.7 **Input Clock References**

- 1544 Mb/s, 2048 Mb/s
- 1544 MHz, 2048 MHz, 10 MHz
- 1 pps over SMA

1.8 **Output Clock**

- 2048 MHz, 10 MHz
- 1 pps over SMA

2. **Ethernet Phy**

2.1 **Interfaces**

- SFP ports: 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 100BASE-FX, 100BASE-TX, 10BASE-T
- RJ-45 ports: 10BASE-T, 100BASE-TX, 1000BASE-T
- On / Off laser control
- Insertion of code errors

Auto-Negotiation

- Bit rate: 10 Mbit/s, 100 Mbit/s, 1 Gbit/s
- Master and Slave roles in the 1000BASE-T
- Disable auto-negotiation, force line settings

Power over Ethernet (PoE)

- Interfaces: 10BASE-T, 100BASE-T, 1000BASE-TX
- PoE pass-through in transparent mode

2.2 **Synchronous Ethernet**

Interfaces

- SFP ports: 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 100BASE-TX
- RJ-45 ports: 100BASE-TX, 1000BASE-T

Timing

- Internal, external or recovered clock in Ethernet interfaces
- Freq offset generation up to ± 125 ppm (res. 0.001 ppm)

Synchronization

- Sinusoidal wander generation
- ESMC, SSM, QL: generation, decoding, forwarding

3. **Ethernet MAC**

- Formats: DIX, IEEE 802.3, IEEE 802.1Q, IEEE 802.1ad
- Jumbo frames up to 10 kB
- Source / Destination MAC address setting
- Type / Length Setting
- Enable / Disable VLAN and Q-in-Q modes
- VLAN VID / User Priority setting
- S-VLAN VID, DEI, PCP, C-VLAN VID, User Priority
- FCS error insertion

4. **IP**

4.1 **IPv4**

- Source / Destination IPv4 address setting
- Dest. MAC address by hand or ARP
- DSCP CoS labels, TTL and transport protocol
- IP checksum errors insertion

4.2 **Protocols**

- ARP
- DHCP
- DNS
- Ping
- Traceroute

4.3 **MPLS**

- MPLS generation / analysis
- Double label stack support
- TTL exp, label fields

5. **Traffic Generator**

- Generation over 8 independent streams

5.1 **Bandwidth Profile**

Operation Modes

- Continuous
- Periodic
- Ramp
- Random

5.2 **Test Patterns and Payloads**

- Layer 1 BER: HF, LF, MF, Long/Short continuous random, PRBS $2^{31}-1$, A-seed, B-seed, mixed-frequency
- Layer 2-4: PRBS $2^{11}-1$, PRBS $2^{15}-1$, PRBS $2^{20}-1$, PRBS $2^{23}-1$, PRBS $2^{31}-1$ along with their inverted versions, user (32 bits). These patterns apply to stream 1 only
- SLA payload
- All zeros
- Insertion of TSE: single, rate, random

6. **Filters**

- Up to 8 simultaneous filters to be applied to the traffic
- Selection by Ethernet, IP, TCP/UDP fields
- Generic filter by using 16 bit mask and arbitrary offset

6.1 **Ethernet Selection**

- MAC Addr: Source and Destination
- Type / Length value with selection mask
- C-VID and S-VID with selection mask
- Service and Customer priority codepoint

6.2 **MPLS Selection**

- Top and Bottom MPLS headers
- Label value
- Exp field

6.3 **IPv4 Selection**

- IPv4 Source and Destination address
- IPv4 Protocol
- DSCP fields

6.4 **IPv6 Selection**

- IPv6 Source and Destination address
- IPv6 flow label
- DSCP
- Next Header

6.5 **UDP Selection**

- Port: single value or ranges of values

7. **PHY Results**

7.1 **Cable Tests**

- Optical power (over compatible SFP)
- Inactive links: Open/short, distance to fault
- 10/100 Mbit/s links: current local port MDI/MDI-X status
- 1000 Mbit/s links: current, polarities, skew

7.2 **Auto-Negotiation**

- Bit rate and duplex mode
- Master / Slave role indication (1000BASE-T)

7.3 **Synchronous Ethernet**

- Frequency (MHz), offset (ppm), drift (ppm/s)
- Decoding of the QL transported in SSM
- TIE / MTIE / TDEV verification based on the following masks: EEC ITU-T G.8261 (option 1), EEC ITU-T G.8261 (option 2), EEC ITU-T G.8262 Wander generation, const. temp. (option 1), EEC ITU-T G.8262 Wander generation, temp. effects (option 1), EEC ITU-T G.8262 Wander generation (option 2), EEC ITU-T G.8262 Wander tolerance (option 1), EEC ITU-T G.8262 Wander tolerance (option 2), EEC ITU-T G.8262 Noise transfer (option 2), EEC ITU-T G.8262 Phase discontinuity (option 2)

8. **Frame Analysis**

- Modes: One-way (port A - A), two-way (port A - B)
- Separate statistics for Port A / B, Tx / Rx, Filter

8.1 **Ethernet Statistics**

- Counts: Ethernet, VLAN, IEEE 802.1ad frames, Q-in-Q, Control, Pause

- Frames: unicast, multicast, broadcast
- FCS errors, Undersized, Oversized, Fragments, Jabbers
- Size: < 64, 65-127, 128-255, 256-511, 512-1023, 1024-1518, 1519-1522, 1523-1526 and 1527-MTU bytes

8.2 **MPLS Statistics**

- MPLS stack size: max, min

8.3 **IP Statistics**

- Packet counts: IPv4 packets, IPv6 packets
- Packet counts: unicast, multicast and broadcast
- UDP packets, ICMP packets
- IPv4 checksum errors, IPv6 checksum errors

8.4 **Bandwidth Statistics**

- Current, max, min, avg (Tx / Rx, Port A / B)
- Unicast, multicast and broadcast counts
- IP and UDP statistics

8.5 **SLA Statistics**

- Delay (FTD): current, min, max, mean
- Delay variation (FDV or jitter): current, min, max, mean
- Reordering: Out-of-order, Duplicated packets
- Loss (FLR): count, ratio
- Availability: SES count, PEU

8.6 **BER**

- Count, seconds, ratio and pattern loss secs at layer 1-4

8.7 **Network Exploration**

- Top talkers: 25 most popular MAC / IPv4 / IPv6 addr
- Top C-VID and S-VID: 25+25 most popular tags
- Atomic setup of 8 filtering blocks

9. **PTP (IEEE 1588)**

9.1 **Operation**

- Generation / Decoding of PTP - IEEE 1588-2008
- Master / Slave operations, ability to force master or slave roles
- Generation / Analysis of 128 PTP packet/sec
- 1-step and 2-step mechanism synchronization
- PTP pass-through monitoring
- Encapsulations: PTP over UDP / IPv4, PTP over Ethernet
- Unicast / Multicast profiles

9.2 **Protocol state**

- Port state, best master clock, master identity, grandmaster: identity, BMC priorities, clock class, accuracy, clock variance, time source

9.3 **Time Error tests**

- TE and max |TE| measurement on PTP
- Constant TE (cTE) and dynamic TE (dTE) components

9.4 **PTP Wander test**

- Measurements: TIE, MTIE, TDEV
- Masks: PEC-S-F ITU-T G.8261.1 (case 3), PEC-S-F ITU-T G.8263 Constant temperature, PEC-S-F ITU-T G.8263 Variable temperature, PRTC ITU-T G.8271 Time error in locked mode, ITU-T G.8271.1 PTP limits at reference point C, PRTC ITU-T G.8272 Locked mode, BC G.8273.2 dTE Constant temperature.

9.5 **PDV metrics**

- Floor delay packet population, ratio/percentage/count
- Count (FPC), Rate (FPR), Percent (FPP).
- Configurable Pass / Fail threshold

9.6 **Path Delay Asymmetry**

- Between PTP master clock and client clocks

9.7 **Counts & statistics**

- PTP message counts: Sync, Delay request, Delay response Peer delay request, Peer delay response, Follow up, Peer delay response follow up, Announce, Signaling, Management
- Sync delay: current, max, min, avg, standard deviation, range
- Sync delay variation: current, max, avg
- Sync inter arrival time: min, max, avg, current
- Delay request: current, max, min, avg, standard deviation, range

- Round trip delay: current, mean
- Correction field: current, max, avg

10. **Automatic Tests**

- Automatic RFC 2544 / Y.1564 tests in one / two ways mode

10.1 **Port Loopback**

- Layer 1-4 loopback with Filtering conditions
- MPLS loop control
- Loop controls for broadcast and ICMP

10.2 **RFC 2544**

- Throughput, Frame-loss, Latency, Back-to-back, Recovery
- Symmetric and Asymmetric test modes

10.3 **Y.1564**

- Ethernet service activation
- Eight / four services (color/not color) CIR, EIR, max, Throughput
- FTD, FDV, FLR, availability objectives
- Symmetric and Asymmetric test modes

Test Phases

- Phase 1: steps, step duration
- Phase 2: duration, bandwidth profile (deterministic, random)

11. **Clock Monitor Mode**

- Frequency inputs: 2048, 1544 and 10 kHz
- Time inputs: 1 pps
- TIE, MTIE and TDEV: for all inputs
- TE and max |TE|: for 1 pps
- TE dynamic and constant components
- Jitter and wander generation in 1544 and 2048 kHz interfaces

12. **ANSI T1.102 / T1 interface**

12.1 **Line**

- Configurable impedance: nominal, PMP 20, 25, 30 dB, high > 1000 W
- Cable delay equalization up to a 6 dB attenuation.
- Configurable output freq. offset $\pm 25,000$ ppm
- Line codes: B8ZS, AMI
- Input Level: From 0 dB to -45 dB
- Pulse mask compliance: ANSI T1.102-1999, ITU G.703
- Jitter compliance: ANSI T1.102-1999, ITU-T G.824

Frame

- 1544 kb/s unframed, SF (D4) and ESF in accordance with ANSI T1.403-1999 and ITU-T G.704.
- CAS A, B, C, D bit generation

12.2 **Event Insertion**

- Physical: AIS, LOS
- Frame: FAS error, CRC error, LOF, RAI
- Pattern: TSE, Slip, LSS, All 0, All 1

Modes

- Anomalies: single, rate
- Defects: continuous, burst of M, M out of N

13. **ITU-T G.703 / E1 Interface**

13.1 **Line**

- Configurable impedance: nominal, PMP 20 / 25 / 30dB, high (> 1000 Ω)
- Configurable output freq. offset $\pm 25,000$ ppm
- Line codes: HDB3, AMI
- Input Level: From 0 dB to -45 dB
- Pulse mask compliance: ITU-T G.703
- Jitter compliance: ITU-T G.823

13.2 **Frame**

- 2048 kb/s unframed, ITU-T G.704, ITU-T G.704 CRC, ITU-T G.704 CAS, ITU-T G.704 CRC + CAS
- Generation of NFAS spare bits (ITU-T G.704 with CRC-4 multiframe)
- CAS A, B, C, D bit generation for each voice channel.
- Generation of CAS spare bits (ITU-T G.704 with CAS multiframe)

13.3 **Event Insertion**

- Physical: AIS, LOS
- Frame: FAS error, CRC error, MFAS error, REBE, LOF, MAIS, CAS-LOM, RAI, MRAI, CRC-LOM

- Pattern: TSE, Slip, LSS, All 0, All 1

Modes

- Anomalies: single, rate
- Defects: continuous, burst of M, M out of N

14. T1 / E1 analysis

14.1 Test Patterns and Signals

- PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 6 inv, PRBS 7 inv PRBS 9 inv., PRBS 11 inv., PRBS 15 inv., PRBS 20 inv., PRBS 23 inv, QRSS, QRSS inv, QBF, all 0, all 1
- User configurable 32 bit word
- Tone (from 10 Hz to 4 kHz, from +6 dBm to -60 dBm)
- External signal insertion: analogue and datacom interfaces

14.2 Events Detection and Performance testing

- G.711 occupation and analysis: max/min/avg code, level, freq.
- CAS A, B, C, D bit analysis
- Drop to external output: Analogue, 64 kb/s codirectional, datacom

Analogue

- Line attenuation (dB), freq. (Hz), freq. dev. (ppm)

Latency

- Round Trip Delay test (RTD)
- One-Way Delay (OWD) test assisted with GPS / GLONASS

Defects

- E1: LOS, LOF, AIS, RAI, CRC-LOM, CAS-LOM, MAIS, MRAI, LSS, All 0, All 1
- T1: LOS, LOF, AIS, RAI, LSS, All 0, All 1

Anomalies

- E1: Code, FAS error, CRC error, REBE, MFAS error, TSE, Slip
- T1: Code, FAS error, CRC error, TSE, Slip

Performance

- G.821: ES, SES, UAS, DM with pass / fail indications
- G.826: ES, SES, UAS, BBE (near & far-end) with pass / fail
- M.2100: ES, SES, UAS, BBE (near & far-end) with pass / fail

14.3 Jitter Analysis

- Modulation range: 1 to 100 kHz (locking time 10 s), 1 to 100 kHz (locking time 1 s), 10 to 100 kHz (locking time < 1 s)
- Amplitude: 0 to 1000 U_{Ipp} (max. depends on modulation freq.)
- Resolution: 1 mU_{Ipp} or 1/10e4
- Accuracy: better than ITU-T 0.172

Jitter Results

- Peak to peak, RMS, jitter, hits, and count
- Observation time: 1, 10, 60 secs.

Filters E1

- LP (f < 100 kHz)
- LP+HP1 (20 Hz < f < 100 kHz)
- LP+HP2 (18 kHz < f < 100 kHz)
- LP+RMS (12 kHz < f < 100 kHz)

Filters T1

- LP (f < 40 kHz)
- LP+HP1 (10 Hz < f < 40 kHz)
- LP+HP2 (8 kHz < f < 100 kHz)

14.4 Wander Analysis

- Range: 1 μHz to 10 Hz
- Sampling: 50 Hz
- Amplitude: 0 to ±2 s (single range)
- Accuracy: 2 ns
- Wander masks: E1 ITU-T G.823, PDH ITU-T G.823 / ETSI EN 300 462-3-1, PDH ITU-T G.8261 CES, PDH ITU-T G.8261 CES (option 2A), PDH ITU-T G.8261 CES, PRC ITU-T G.811, PRC ETSI EN 300 462-3-1, PRC ITU-T G.823, SSU ITU-T G.823 / ETSI EN 300 462-3-1, SSU ITU-T G.812 Noise generation, constant temperature, SSU ITU-T G.812 Noise tolerance, SSU ITU-T G.812 Noise generation, variable temperature, SSU ITU-T G.812 Noise transfer, SEC ITU-T G.823 / ETSI EN 300 462-3-1, SEC ITU-T G.813 Constant temperature (option 1), SEC ITU-T G.813 Constant temperature (option 2), SEC ITU-T G.813 Holdover (option 2), SEC ITU-T G.813 Noise tolerance (option 1), SEC ITU-T G.813 Noise tolerance (option 2), SEC ITU-T G.813 Noise transfer (option 2), SEC ITU-T G.813 Reference switching (option 2), SEC ITU-T G.813 Variable temperature (option 1).

Results

- Built-in and real time

- Instantaneous: TIE, freq. offset, freq. drift
- Statistics results: TIE, MTIE, TDEV
- Statistics range: 10⁻², 10⁻³, 10⁻⁴, 10⁻⁵, 10⁻⁶ s
- Tables and Graphs

14.5 Jitter / Wander Generation

- Waveform: sinusoidal
- Range: 1 μHz to 100 kHz
- Resolution: 0.1 Hz (jitter), 1 μHz (wander)
- Amplitude: 0–1000 U_{Ipp}. max depends on modulation freq
- Resolution: 1 mU_{Ipp} or 1/10⁴ configured value
- Accuracy: better than 0.172
- Intrinsic jitter < 10m U_{Ipp}

14.6 Pulse Mask Analysis

- Operation modes: Eye diagram or continuous run
- Width, rise / fall time, level, overshoot / undershoot (± pulses)

Pass / Fail

- Compliance with ITU-T G.703 E1 mask
- Compliance with ANSI T1.101-1999 T1 mask

15. IEEE C37.94

15.1 Operation Modes

- Unframed or framed operation
- Clock: Recovered or Internal
- End point or terminal mode
- Results with pass / fail indications

15.2 C37.94 Testing

- Follows specifications of IEEE C.37.94 section 7
- Bit Rate generation in steps of nx64 kb/s up to 768 kb/s
- BER, ITU-T G.821 performance test
- Event detection, insertion
- Defects: LOS, AIS, LOF, RDI, LSS, All 0, All 1
- Anomalies: FAS, TSE, Slip
- Round Trip Delay (ms)
- One-way Delay synchronized with GPS
- Frequency (Hz), deviation (ppm), max deviation
- Optical power meter

15.3 SFP

- SFP 850 nm, Multi-mode, 2048 kbit/s, 1500 meters
- SFP 1310 nm, Single-mode, 2048 kbit/s, 10 km

16. ITU-T G.703 / E0 (Co-Directional)

16.1 Connector

- Balanced (RJ-45) 120 Ω

16.2 Features

- Bit rate N x 64 kbit/s (N from 1 to 4)
- Test pattern generation, analysis over co-directional
- Defect insertion, analysis: LOS, AIS, LSS, All 0, All 1
- Anomaly insertion, analysis: TSE, Slip

17. Analogue Test

- Tone Generation (from 10 to 4000 Hz, from 0 to -60 dBm)
- Level, frequency
- ITU-T G.711 analysis: max code, min code, avg code

18. Data Communications

18.1 Connectors

- Smart Serial Universal datacom connector for DTE / DCE

18.2 Interfaces

- V.24/V.28 asynchronous (RS-232) from 50 bit/s to 128 kbit/s
- V.24/V.28 synchronous (RS-232) from 50 bit/s to 128 kbit/s
- X.21/V.11 from 50 bit/s to 2048 kbit/s
- V.35 from 50 bit/s to 2048 kbit/s
- V.36 (RS-449) from 50 bit/s to 2048 kbit/s
- EIA-530 from 50 bit/s to 2048 kbit/s

18.3 Tests

- Operation: DTE / DCE emulation, FDX monitor
- Test pattern generation, analysis over a datacom

- Logic analyzer capability
- Defects: LOC, AIS, LSS, All 0, All 1
- Anomalies: TSE, Slip
- Analogue: Line attenuation (dB), freq (Hz), deviation (ppm)
- One-way Delay synchronized with GPS

19. Platform

19.1 Ergonomics

- Size: 223 x 144 x 65 mm
- Weight: 1.2 kg (with rubber boot, one battery pack)
- Screen: 4.3 inch, TFT color (480 x 272 pixels)

19.2 Graphical User Interface

- GUI controlled by Touch-screen, Keyboard or Mouse
- Direct configuration and management in graphical mode
- User interface by touch-screen, keyboard and mouse
- Configuration up/down through Internet, USB and SNMP
- Local management with CLI
- Full remote control: SNMP, SSH, VNC

19.3 Results

- Local storage in txt and pdf files
- File transfer to SD card and USB port
- File management through web interface and SNMP

19.4 Board

- 2 x USB ports
- 1 x RJ45 port
- 2 x LEDs
- Software upgrade through USB port

19.5 Batteries

- Li Ion Polymer
- Up to 24 hours of operation in T1/E1
- Up to 11 hours of operation in GbE

19.6 Operational Ranges

- IP rating: 54
- Operational range: -10°C to +50°C
- Storage range: -20°C to +70°C
- Operation humidity: 5% - 95%

