Ether10.Genius world smallest 10G

1. General

1.1 Operation Modes

Table 1. Operation Modes and connection modes

<table>
<thead>
<tr>
<th>10G/1P</th>
<th>Eth L1</th>
<th>E1/T1</th>
<th>Analog</th>
<th>Data</th>
<th>Clock</th>
<th>Cable</th>
<th>C37.94</th>
</tr>
</thead>
<tbody>
<tr>
<td>End-point</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Monitor</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Pass</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Loop</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>MuxDemux</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

1.2 Ports
- Port A - B: 2 x SFP, 2 x RJ45 connectors
- Port C: balanced RJ45 120Ω, unbalanced BNC 75Ω
- Port D: balanced RJ45 120Ω (through special adapter)
- Datacom Port: DTE / DCE
- VF Port: analogue voice frequency

1.3 Interfaces, test signals and timing Ports

Table 2. Time Reference Input vs. Test Signal

<table>
<thead>
<tr>
<th>Operation modes</th>
<th>10G/1P</th>
<th>E1/T1</th>
<th>Analog</th>
<th>Data</th>
<th>Clock</th>
<th>Cable</th>
<th>C37.94</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNC-1</td>
<td>10 MHz</td>
<td>2 MHz</td>
<td>1.5 MHz</td>
<td>E1/T1</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>R45S-C</td>
<td>E1/T1</td>
<td>E1/T1</td>
<td>10 MHz</td>
<td>2 MHz</td>
<td>1.5 MHz</td>
<td>E1/T1</td>
<td>YES</td>
</tr>
<tr>
<td>BNC-2</td>
<td>E1</td>
<td>E1</td>
<td>E1</td>
<td>E1</td>
<td>E1</td>
<td>E1</td>
<td>E1</td>
</tr>
</tbody>
</table>

Test signal, Clock reference signal
1.4 **Internal Clock**
- Internal time reference 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
  - Aging (1 day, 24 hours warm up): ±5.0e-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-off
  - Output freq. accuracy (after 24 h. locked): 1.5e-11 / 24 h
- Output time accuracy (after 24 h. locked): ±100 ns / 2/2h, ±1.0μs / 24 h

1.6 **Built-in GNSS**
- GPS/Glonass support
- Omnidirectional magnetic antenna
- SMA connector
- 4V to 5V DC output

1.7 **Input Clock References**
- 1544 kbs, 2048 kbs, 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 / SFP+ ports: 10GBASE-SR, 10GBASE-LR, 10GBASE-ER, 10GBASE-SW, 10GBASE-LW, 10GBASE-EW, 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 1000BASE-TX, RJ-45 ports: 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-SR, 10GBASE-LR, 10GBASE-ER, 10GBASE-SW, 10GBASE-LW, 10GBASE-EW, 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 1000BASE-TX, RJ-45 ports: 10BASE-T, 100BASE-T, 1000BASE-TX
- 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 **10G WAN Interfaces Sublayer (WIS)**
- According to IEEE 802.3-2012
- Path / Line / Section Overhead, STS Path / Section Trace
- Presentation of received pointer value

2.3 **Synchronous Ethernet**
- Interfaces
  - SFP / SFP+ ports: 10GBASE-SR, 10GBASE-LR, 10GBASE-ER, 10GBASE-SW, 10GBASE-LW, 10GBASE-EW, 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 1000BASE-TX, RJ-45 ports: 10BASE-TX, 1000BASE-T
- Timing
  - Internal, external or recovered clock in Ethernet interfaces
  - Freq offset generation up to ±125 ppm (res. 0.001 ppm)
  - Line freq (MHz), offset (ppm), drift (ppm/s)
- Synchronization
  - Sinusoidal wander generation
  - ESMC, SSN, QI: generation, decoding, forwarding

3. **Ethernet MAC**
- Formats: DIX, IEEE 802.3, IEEE 802.1Q, IEEE 802.1ad
- Jumbo frames up to 10 kB
- Sour / Dest 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 errors insertion

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

- **Protocols**
  - ARP
  - DHCP
  - DNS
  - Ping
  - Traceroute

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

5. **Traffic Generator**
- Generation over 8 independent streams

6. **Filters**
- Up to 8 simultaneous filters to be applied to the traffic
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
- IEEE 1588-2008 packets

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 (FDI): current, min, max, mean
- Delay variation (DOD or jitter): current, min, max, mean
- Reordering: Out-of-order, Duplicated count and ratio
- Loss (PLR): count, ratio
- Availability: SES count, PEU, PEA

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

8.7 Network Exploration
- Top talkers: 16 most popular MAC / IPv4 / IPv6 addresses
- Top C-VID and S-VID: 16+16 most popular tags
- Automatic 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
- Compatible with ITU-T G.8265.1 and G.8275.1 Telecom profiles

9.2 Protocol state
- Port state, 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

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, Signalling, 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
- All results include latency compensation based on PTP correction fields
- PDV metrics (Sync / Delay Request latency statistics) are captured with a resolution of one second

10. Automatic Tests
- Automatic RFC 2544 / Y.1564 tests in one/two ways mode
Datasheet - Ether10.Genius world smallest 10G

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 eSAM (ITU-T Y.1564)
- Ethernet service activation
- Four / eight services (color/not color) defined by CIR, EIR
- 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 pp
- TIE, MTIE and TDEV: for all inputs
- TE and max [TE]: for 1 pp
- 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 Ω)
- Cable delay equalization up to a 6 dB attenuation.
- Configurable output freq. offset ±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

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 for each voice channel
- Pattern: TSE, Slip, LSS, All 0, All 1
- Insertion modes: Single (anomalies), rate (anomalies), continuous (defects), burst of M (defects), M out of N (defects).

12.2 Event Insertion
- Physical: AIS, LOS
- Frame: FAS error, CRC error, REBE, MFAS error, LOF, MAIS, CRC-LOM
- 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 ±25,000 ppm
- Line codes: HD8J3, AMI
- Input Level: From 0 dB to -45 dB
- Pulse mask compliance: ITU-T G.703
- Jitter compliance: ITU-T G.823

Frame
- Generation of MFAS 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)

13.2 Event Insertion
- Physical: AIS, LOS
- Frame: FAS error, CRC error, MFAS error, REBE, LOF, MAIS, CAS-LOM, RAI, MAI, 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/FOX, 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: level, freq
- Data occupation and analysis: Current bit code in each time slot in hexa-decimal format
- CAS A, B, C, D bit analysis
- Drop to external output: Analogue, 64 kb/s coder, 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, MAI5, MAI, 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.823: 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
- Closed loop phase measurement method. Reference freq. not required
- Modulation range: -1 to 100 kHz (locking time ≥ 1 s), 1 to 100 kHz (locking time ≤ 1 s), 10 to 100 kHz (locking time < 1 s)
- Amplitude: 0 to 1000 UIpp (max. depends on modulation freq.)
- Resolution: 1 µUIpp or 1/10e4
- Accuracy: better than ITU-T O.172
- Jitter Results
- Peak to peak, RMS, jitter (resetable), 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
- Open loop method
- Range: 1 µHz to 10 Hz
- Sampling: 50 Hz
- Amplitude: 0 to ±2 (single range)
- Accuracy: 2 ns
- Layer 1-4 loopback with filtering conditions
- MPLS loop control
- Loop controls for broadcast and ICMP

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**14.5 Jitter / Wander Generation**
- Waveform: sinusoidal
- Range: 1 μHz to 100 kHz
- Resolution: 0.1 Hz (jitter), 1 μHz (wander)
- Amplitude: 0–1000 Upp. Max depends on modulation freq
- Resolution: 1 mUpp or 1/10^9 configured value
- Accuracy: better than 0.172
- Intrinsic jitter < 10 nUpp

**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**
- Bit Rate generation in steps of N x 64 kbit/s up to 768 kbit/s
- BER, ITU-T G.821 performance test
- Event detection, insertion
- Defects: LOS, AIS, LOF, RDI, LSS, All 0, All 1
- Anomalies: FAS, LSE, 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, MMF, 2048 kbit/s, 1500 meters
- SFP 1310 nm, SMF, 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 analyser 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
- Web based report and configuration file management
- Local management with CLI
- Full remote control: SNMP or 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
- Up to 6.5 hours of operation in 10GbE

**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%