**VALIANT COMMUNICATIONS**

## Introduction:

**VCL-2145 (VCL-GPS-2145), GPS Primary Reference Clock with IEEE-1588v2 Grandmaster and NTP Server** is a high precision**,** multi-service, time and frequency synchronization solution which can be used to provide ITU-T, G.811 Primary Reference Clocks which are referenced to a GPS source, as well as to synchronize the time-of-day and frequency across multiple nodes of the network. The VCL-2145 (VCL-GPS-2145) Receiver also has an integrated, high bandwidth NTP Server engine that is capable of handling up to 7200 NTP requests per second. Multiple IRIG-B Outputs are also provided to synchronize local clock (time-of-day) display units as well as RTUs to a central timing source with nanosecond accuracy.

The **VCL-2145 (VCL-GPS-2145)**, GPS Primary Reference (PRC) Clock is specifically designed for the synchronization of 2G, 3G, HetNet and LTE mobile telecommunications networks as well as backhaul wire-line SDH / SONET and Synchronous Ethernet networks. It may be also used by Railways, Airports (including air-traffic control), Power generation and distribution companies and other Utility companies who not only require a highly precise time-of-day and G.811 frequency synchronization locked to a GPS Reference but who also need to distribute highly precise time-of-day and frequency synchronization across all nodes of their networks.



The VCL-2145 / VCL-GPS-2145 is always locked to a GPS reference to provide multiple G.811 / Stratum 1 quality frequency and time-of-day (IRIG-B and NTP) outputs. The VCL-2145 is also equipped highly accurate, low-noise OCXO / Rubidium oscillator which provides a high stability holdover clock that is typical of a Network SSU in the event of the GPS signal or its antenna failure.

## Features and Highlights:

- Reliable, Cost-Efficient Reference GPS Receiver
- 50 Channel GPS, L1 frequency, C/A Code Receiver
- Simultaneous tracking of up to 12 GPS satellites
- ITU-T G.811 Primary Reference (PRC) Clock
- GPS locked G.703 compliant E1, 2.048MBits, 1.544Mbits and 2.048 MHz outputs
- Primary reference and holdover functionality:
  - ITU-T G.811 / Stratum 1 compliant (PR) Primary Reference when locked to GPS
  - ITU-T G.812 compliant holdover
- SSM Message format  Compliant with ITU-T G.704. Optional GR-378-CORE for SONET Networks
- 1/5/10 MHz output
- 1 PPS outputs
- IEEE-1588v2 Precision Time Protocol Grandmaster
- PTP Grandmaster support for up to 150 PTP Clients
- Supports Multicast and Unicast PTP packets
- Nanosecond accuracy
- IRIG-B outputs
- Standard RJ45 and BNC connectors for all inputs and outputs
- ToD compliant to NMEA 0183 (DB9 Serial Port).

## Additional Features:

- High bandwidth NTP Server capable of supporting up to 7200 NTP requests per second
- Separate, independent, IEEE-1588 and NTP Server engines
- IPv4 and IPv6 compatible NTP Server
- SSH, Telnet, Radius, SNMP V2 MIB, Password Protection
- Redundant AC and DC power supply options
- 4, 10/100/1000BaseT Network Interface Ethernet Ports
- VLAN and Packet priority feature - allows the user to assign priorities to different types of clients
- Supports QoS, 802.1p based packet priority
- Supports 802.1Q based VLANs.
- Power Contact and Lightening Protection as per Telcordia GR-1089-CORE.

## Available in two Version:

**1. GPS, PTP IEEE-1588v2 Grandmaster and Primary Reference Clock**

**Product:** VCL-2145 (VCL-GPS-2145), GPS Primary Reference (PRC) Clock

**Description:** (i) VCL-2145, GPS Primary Reference (PRC) G.811 Clock.  Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbits with SSM, 1.544Mbits Frequency Outputs with High Stability OCXO and Rubidium (G.812) Holdover Clock options.

(ii) VCL-2145, GPS Primary Reference (PRC) G.811 Clock and PTP Grandmaster (IEEE-1588v2) with NTP Server. May be used in multi-service applications as a G.811, Primary Reference (PRC) Clock as well as a IEEE-1588v2 Grandmaster and NTP Server (IPv4 and IPv6). Provides IRIG-B, 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbits with SSM, 1.544Mbits GPS referenced outputs. OCXO and Rubidium (G.812) Holdover Clock options available.

**2. PTP (IEEE-1588v2) Slaves**

**Product:** VCL-2145, (IEEE-1588v2) PTP Slave for ToD (Time of Day) and Frequency Synchronization

**Description:** (i) PTP (IEEE-1588v2) Slave - synchronizes to PTP Grandmaster to provide IRIG-B, 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbits outputs. OCXO and Rubidium Holdover Clock options available.

(ii) PTP (IEEE-1588v2 Slave) for ToD (Time of Day) Synchronization. PTP (IEEE-1588v2) Slave - synchronizes to PTP Grandmaster to provide IRIG-B, 1PPS, NMEA, 2.048MHz, 2.048Mbits outputs.

## Application Diagram:
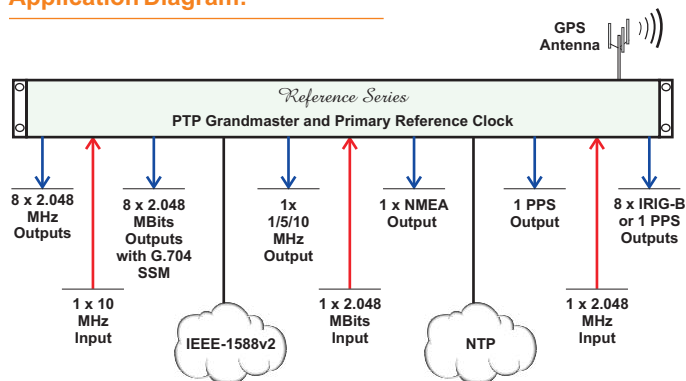


GPS Receiver as a Primary Reference (PRC) Clock with IEEE-1588v2 Grandmaster and NTP Server

## Typical Synchronization Applications:

- Synchronizing Cellular networks like UMTS, GPRS, 3G and LTE
- Power generation and distribution companies and other utility companies
- Wireless and Wireline Telecom synchronization
- Distributing Time (ToD) and Frequency reference for power utilities across all nodes of the network
- Synchronization of Defense Networks
- Synchronizing airports and aviation communications
- Synchronizing railway signaling networks and railway communications
- Synchronizing traffic management
- Broadcasting Network and Broadcast equipment synchronization.

## Technical Specifications

### GPS Receiver:

- 50 Channel GPS Receiver
- GPS L1 frequency, C/A Code Receiver
- Tracks up to 12 satellites simultaneously
- Synchronizing Time:
  - Acquisition time - Hot Start: Less than 15 sec. (90%)
  - Acquisition time - Warm Start: Less than 45 sec. (90%)
  - Acquisition time - Cold Start: Less than 140 sec. (90%)
- GPS Signal
  - Tracking and Navigation: -162 dBm
  - Reacquisition -160 dBm
  - Cold Start -148 dBm
- Antenna Connector: TNC
- Accuracy Of Time-Pulse Signal referenced to GPS: +/-30ns (raw)
- Accuracy Of Time-Pulse Signal referenced to GPS: +/-15ns (compensated)
  *(Note: with all satellites in view at -130db)*

### Clock performance - GPS:

- Performance when locked to GPS / GNSS Timing accuracy: < 60ns (at constant temperature) < 90ns (at variable temperature, -5°C to +55°C)

### Internal (G.812) Synchronization Options:

- Rubidium,    • OCXO (Oven-Controlled Crystal Oscillator)

### Frequency holdover:

**OCXO:**
- Long-term stability: $1 \times 10^{-10}$/day, $2 \times 10^{-8}$/year
- Frequency stability: $6 \times 10^{-10}$($-5^0$C to $+55^0$C)

**Rubidium:**
- Long term stability: $\pm 5 \times 10^{-11}$ / month
- Frequency stability: $< 1 \times 10^{-10}$ (-5°C to +55°C)

### Standard Frequency and ToD* Outputs:

### NTP Server:

- NTP Protocols: NTP v2 (RFC 1119), NTP v3 (RFC 1305), NTP v4
- IP Protocols: IPV4, IPV6
- Time Protocol: (RFC 868)
- Daytime Protocol: (RFC 867)
- Synchronization of IEC 61850 compliant devices using NTP/SNTP protocol
- Capable of processing up to 7200 requests per second.

### IEEE-1588v2 PTP Grandmaster:

- Compliant with IEEE-1588 v2 (2008) specifications
- Maximum number of addressable PTP Clients - 128
- Power and Telecom Profiles

### Management and Monitoring Ports:

- RS-232C Connector
- USB Connector
- 10/100BaseT Ethernet
- 1 x External Alarm Relay Contact.

### System Access, Control and Management Options:

- Telnet, SSH, RADIUS
- CLI Control Interface (HyperTerminal or Vt100)
- SNMP V2 Traps (MIB File provided)

### Security and Protection:

- Password Protection
- Secured Access via SSH V2
- Separate VLAN on monitoring and access

### Power Supply Options:

- Dual Redundant
- 1+1 AC power (100 to 240V AC, 50/60 Hz)
- 1+1 DC 24V power
- 1+1 DC -48V power
- 1+1 DC 110/125V DC power
- AC or DC

### MTBF:

**MTBF for VCL-2145 with RbXO Option:**
- Per MIL-HDBK-217F: $\geq$ 17 years @ $40^0$C
- Per Telcordia SSR 332, Issue 1: $\geq$ 20 years @ $40^0$C

**MTBF for VCL-2145 with OCXO Option:**
- Per MIL-HDBK-217F: $\geq$ 21 years @ $40^0$C
- Per Telcordia SSR 332, Issue 1: $\geq$ 24 years @ $40^0$C

### External Frequency Synchronization Inputs:

| Intput Type | Number Of Inputs | Connector |
|---|---|---|
| 2.048 MHz, 75 Ohms | 1 | BNC |
| 10 MHz, 50 Ohms | 1 | BNC |
| 2048 Mbps | 1 | BNC |

| Output Type | Number Of Outputs | Connector |
|---|---|---|
| 2.048 Mbit/s (E1) / 1.544 Mbit/s (T1) compliant with ITU-T G.703 | 8 (8E1 or 8T1) | RJ45 |
| 2.048 MHz, 75 Ohms, phase-locked to GPS | 8 | BNC |
| 1/5/10 MHz, 50 Ohms, phase-locked to GPS | 1 | BNC |
| IRIG-B, synchronized to GPS** | 8 | BNC |
| 1 PPS, phase-locked to UTC** | 8 | BNC |
| TOD (Time-Of-Day) output compliant to NMEA0183 | 1 | DB9, RS-232C |
| NTP / PTP (10/100/1000) Network Interface | 4 | RJ45 |

**Note: User selectable between IRIG-B and 1PPS Outputs*

Revision 2.2 – May 02, 2016