

**Introduction:**

VCL-2145-LC (VCL-GPS-2145), GPS Primary Reference Clock is a high precision frequency synchronization solution which may be used to provide ITU-T, G.811 Primary Reference Clocks which are referenced to a GPS source.

The VCL-2145-LC (VCL-GPS-2145), GPS Primary Reference (PRC) Clock is specifically designed for frequency 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 (and air-traffic control), Power generation and distribution companies and other Utility companies who require a highly precise G.811 frequency synchronization locked to a GPS Reference.



The VCL-2145-LC (VCL-GPS-2145) locks to a GPS or GLONASS reference to provide multiple G.811 / Stratum 1 quality frequency outputs. The VCL-2145-LC is also equipped highly accurate, low-noise OCXO / Rubidium oscillator which provides a high stability, ITU-T G.812 compliant holdover clock that is typical of a Network SSU in the event of unavailability of satellite signal, or antenna failure.

**Features and Highlights:**

- Reliable, Cost-Efficient Reference GPS Receiver
- 50 Channel GPS and GLONASS, L1 frequency, C/A Code Receiver
- Simultaneous tracking of up to 12 satellites
- ITU-T G.811 Primary Reference (PRC) Clock
- GPS locked G.703 compliant E1, 2.048 MBits, 1.544 Mb/s 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
- 2MHz and 2Mbps Primary Reference Clock outputs
- 1 PPS outputs
- Standard RJ45 and BNC connectors for all inputs and outputs
- ToD compliant to NMEA 0183 (DB9 Serial Port).

**Additional Features:**

- Telnet, SNMP V2 MIB, Password Protection
- Redundant AC and DC power supply options
- Power Contact and Lightning Protection as per Telcordia
- GR-1089-CORE.

**Standards & Compliance:**

- IEC - EMC – Certified to EN 55022: 2005 / CISPR 22, EN 55024:2005, IEC 61000-4-2
- CE - 2001/95/EC, 2006/95/EC, EN60950-1, EN61000-6-2, EN61000-6-4
- FCC - FCC Part 15 B Class A : Conducted Emission test on Power Line
- FCC Part 15 B Class A : Radiated Emission >1 GHz FCC, 6 GHz, on Power Line

**Available Version:**

**GPS and GLONASS Primary Reference Clock**

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

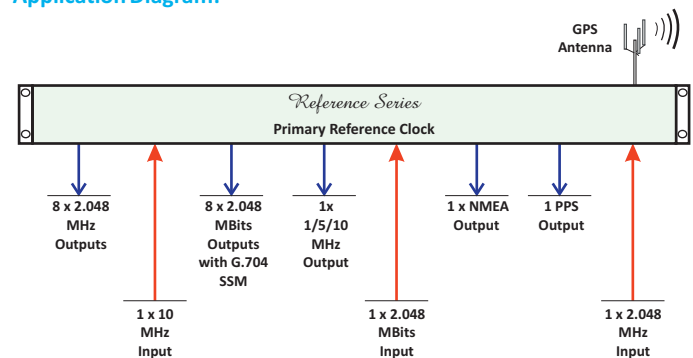
**Description:**

- (I) VCL-2145-LC, GPS Primary Reference (PRC) G.811 Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mb/s with SSM, 1.544Mb/s Frequency Outputs with High Stability OXCO (G.812) Holdover.
- (II) VCL-2145-LC, GPS Primary Reference (PRC) G.811 Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mb/s with SSM, 1.544Mb/s Frequency Outputs with Ultra-High Stability Rubidium (G.812) Holdover.

**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
- Synchronization of Defense Networks
- Synchronizing airports and aviation communications
- Synchronizing railway signaling networks and railway communications
- Broadcasting Network and Broadcast equipment
- Synchronization.

**Application Diagram:**



GPS Receiver as a Primary Reference (PRC) Clock

**MTBF:**

**MTBF for VCL-2145-LC with RbXO Option:**

- Per MIL-HDBK-217F: ≥ 17 years @ 40°C
- Per Telcordia SSR 332, Issue 1: ≥ 20 years @ 40°C

**MTBF for VCL-2145-LC with OXCO Option:**

- Per MIL-HDBK-217F: ≥ 21 years @ 40°C
- Per Telcordia SSR 332, Issue 1: ≥ 24 years @ 40°C

## Technical Specifications

### GPS and GLONASS Receiver:

- 50 Channel GPS and GLONASS Receiver
- GPS L1 frequency, C/A Code Receiver
- Tracks up to 12 satellites simultaneously
- Synchronizing Time:
  - Acquisition time - Hot Start: Less than 15 sec.
  - Acquisition time - Warm Start: Less than 45 sec.
  - Acquisition time - Cold Start: Less than 140 sec.
- 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:  $\pm 30\text{ns}$  (raw)
- Accuracy Of Time-Pulse Signal referenced to GPS:  $\pm 15\text{ns}$  (compensated)  
(Note: with all satellites in view at -130db)
- Phase Accuracy: As per ITU-T G.8272

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

- Rubidium
- OCXO (Oven-Controlled Crystal Oscillator)

### Management and Monitoring Ports:

- RS-232C, USB
- 10/100BaseT Ethernet - RJ-45
- 2 x External Alarm Relay Contacts.

### System Access, Control and Management Options:

- Telnet
- CLI Control Interface (HyperTerminal or VT100)
- SNMP V2 Traps (MIB File provided)

### Security and Protection:

- Password Protection

### Configuration and Monitoring Software:

- Telnet, CLI
- GUI (Graphical User Interface) - Runs on any PC operating on Windows XP, Windows 7, Windows 8 OS or Windows 10 OS.

### Clock performance - GPS and GLONASS:

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

### Standard Frequency and ToD\* Outputs:

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
1 PPS, phase-locked to UTC**	1	BNC
TOD (Time-Of-Day) output compliant to NMEA0183	1	DB9, RS-232C

### Part Numbers:

VCL-2145-LC-OCXO (AC or DC power 1+0 or 1+1)	VCL, 50 Channel GPS, L1 frequency, C/A Code Receiver and Primary Reference Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbps with SSM, 1.544Mbps Frequency Outputs with High Stability OCXO Holdover.
VCL-2145-LC-RbXO (AC or DC power 1+0 or 1+1)	VCL, 50 Channel GPS, L1 frequency, C/A Code Receiver and Primary Reference Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbps with SSM, 1.544Mbps Frequency Outputs with Rubidium (Atomic Clock) Holdover.

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### Frequency Accuracy:

- $< 1 \times 10^{-11}$  (24 hour average)
- G.811 quality when locked to GPS / GNSS

### Frequency holdover:

#### OCXO:

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

#### Rubidium:

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

### 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

### Power Consumption:

- Power Consumption with OCXO Oscillator:
  - < 25W during startup,
  - < 18W at steady state 23°C
- Power Consumption with Rubidium Oscillator:
  - < 40W during startup,
  - < 32W at steady state 23°C

### Environmental:

#### Environmental characteristics (Equipment):

Operational	-10°C to +60°C (Typical: +25°C)
Cold start	-0°C to +50°C
Storage	-20°C to +70°C
Humidity	95% non-condensing
Cooling	Convention Cooled. No cooling fans are required.

### External Frequency Synchronization Inputs:

Input Type	Number Of Inputs	Connector
2.048 MHz, 75 Ohms	1	BNC
10 MHz, 50 Ohms	1	BNC
2.048 Mbps	1	BNC