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 32 satellites
- ITU-T G.811 Primary Reference (PRC) Clock
- GPS locked G.703 compliant E1, 2.048 MBits, 1.544 Mbits 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 NMEA0183 (DB9 Serial Port).

Standards & Compliance:

- 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

Additional Features:

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

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, 2.048Mbits with SSM, 1.544Mbits Frequency Outputs with High Stability OCXO (G.812) Holdover.

(II) VCL-2145-LC, GPS Primary Reference (PRC) G.811 Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbits with SSM, 1.544Mbits 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
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: +/-30ns (raw)
- Accuracy Of Time-Pulse Signal referenced to GPS: +/-15ns (compensated)
  *(Note: with all satellites in view at -130db)*

**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.

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

**Standard Frequency and ToD* Outputs:**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Number Of Outputs</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.048 Mbit/s (E1) / 1.544 Mbit/s (T1) compliant with ITU-T G.703</td>
<td>8 (8E1 or 8T1)</td>
<td>RJ45</td>
</tr>
<tr>
<td>2.048 MHz, 75 Ohms, phase-locked to GPS</td>
<td>8</td>
<td>BNC</td>
</tr>
<tr>
<td>1/5/10 MHz, 50 Ohms, phase-locked to GPS</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>1 PPS, phase-locked to UTC**</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>TOD (Time-Of-Day) output compliant to NMEA0183</td>
<td>1</td>
<td>DB9, RS-232C</td>
</tr>
</tbody>
</table>

**Part Numbers:**
- VCL-2145-LC-OCXO (AC or DC power 1+0 or 1+1)
- VCL-2145-LC-RbXO (AC or DC power 1+0 or 1+1)

**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

**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)

**Frequency Accuracy:**
- <1x10^-9 (24 hour average)
- G.811 quality when locked to GPS / GNSS

**Frequency holdover:**
- OCXO:
  - Long-term stability: 1x10^-1/day, 2x10^-1/year
  - Frequency stability: 6x10^-12 (-5°C to +55°C)
- Rubidium:
  - Long term stability: ± 5x10^-11 / month
  - Frequency stability: < 1x10^-11 (-5°C to +55°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.

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

**External Frequency Synchronization Inputs:**

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Number Of Inputs</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.048 MHz, 75 Ohms</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>10 MHz, 50 Ohms</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>2.048 Mbps</td>
<td>1</td>
<td>BNC</td>
</tr>
</tbody>
</table>

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