edgeSync™ | OSA 5410 Series
Compact PTP grandmaster, multi-interfaces

Radio access network (RAN) technology is evolving. Reliable and highly precise delivery of phase, frequency and time-of-day synchronization across mobile backhaul networks has become critical. Real-time synchronization monitoring also plays a key role in detecting sync degradations before services are affected and assuring sync performance.

With our OSA 5410 Series, ensuring cost-effective and reliable synchronization of your base station clocks is no longer a challenge. This family of IEEE 1588v2 Precision Time Protocol (PTP) access grandmaster devices features a built-in GNSS receiver. What’s more, it also has the unique capability of monitoring synchronization quality while operating in service; powered by our Syncjack™ technology, the OSA 5410 can perform clock frequency and phase accuracy measurements of both PTP and legacy networks.
## High-level specifications

<table>
<thead>
<tr>
<th>OSA 5410</th>
<th>OSA 5411</th>
<th>Main applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- High-quality OCXO</td>
<td>- Quartz, high-quality quartz or rubidium</td>
<td>- 1588v2 PTP grandmaster, boundary and slave clock, and APTS clock</td>
</tr>
<tr>
<td>- Integrated PSU (AC/DC)</td>
<td>- Hot-swappable redundant PSU (AC/DC)</td>
<td>- GNSS receiver and PRTC</td>
</tr>
<tr>
<td>- 1RU 19” half-width chassis, ETSI compliant</td>
<td>- 1RU 19” chassis, ETSI compliant</td>
<td>- Synchronization signal conversion</td>
</tr>
<tr>
<td>- Cost-effective PTP GM, BC, slave and sync probe</td>
<td>- PTP slave capable of translating between PTP and Sync-E/BITS/CLK/PPS outputs</td>
<td>- Sync probe – Syncjack™ monitoring and assurance</td>
</tr>
</tbody>
</table>

### Built-in GNSS receiver
- Software configurable
- GPS/GLONASS/BEIDOU/GALILEO
- GPS+GLONASS
- GPS+BEIDOU
- GPS+GALILEO

### PTP operation modes
- ITU-T G.8265.1 frequency delivery profile
- ITU-T G.8275.1 (full timing support) and ITU-T G.8275.2 profiles (APTS)
- PTP enterprise profile
- Default profiles over Ethernet and IP multicast

### Syncjack™ technology
- Frequency and phase accuracy measurements
- TE, TIE and MTIE calculation
- PTP message transport analysis
- PTP network analysis

## Applications in your network

**Radio access network synchronization and in-service sync probing**
- Assured synchronization of LTE-TDD, LTE-Advanced and 5G radio base stations
- PTP slave capable of translating between PTP and Sync-E/BITS/CLK/PPS outputs
- Sync probing – In-service, network-based monitoring, testing and assurance that macro and small cell radio base station clocks are precisely tracking their master
- Time as a service into data center, financial, health and media networks

### On-site
- NTP and SDH/SONET timing delivery
- PTP time-as-a-service
- Cable network timing
- Macro cell timing
- In- and outdoor small cell timing

### Distribution network
- Timing distribution network
- Multi-technology grandmaster

### Core and cloud
- Highly scalable core grandmaster
- Enhanced primary reference time clock
- Database timing at global scale

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Product variants

<table>
<thead>
<tr>
<th></th>
<th>OSA 5410 Quartz</th>
<th>OSA 5411 Quartz</th>
<th>OSA 5411 Quartz HQ++</th>
<th>OSA 5411 Rubidium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock</td>
<td>OCXO</td>
<td>OCXO</td>
<td>High-quality DOCXO</td>
<td>Rubidium</td>
</tr>
<tr>
<td>Size</td>
<td>1RU, half-width</td>
<td>1RU 19&quot; chassis</td>
<td>1RU 19&quot; chassis</td>
<td>1RU 19&quot; chassis</td>
</tr>
<tr>
<td>PSU</td>
<td>Integrated PSU</td>
<td>Hot-swappable redundant PSU</td>
<td>Hot-swappable redundant PSU</td>
<td>Hot-swappable redundant PSU</td>
</tr>
</tbody>
</table>

Main applications
- 1588v2 PTP Grandmaster Clock (up to 64 PTP clients)
- 1588v2 PTP Boundary Clock (up to 64 PTP clients)
- 1588v2 APTS Clock (Assisted Partial Timing Support Clock)
- 1588v2 PTP Slave Clock
- GNSS Receiver and PRTC
- Synchronization signal conversion
- Sync Probe – Syncjack™ monitoring and assurance

Synchronization interfaces
- Synchronous Ethernet ITU-T G.8261/G.8262/G.8264
- 1 x BITS-in and 1 x BITS-out (2.048MHz, E1 or T1)
- 1 x 1PPS in/out and 1 x 1PPS in
- 1 x Time-of-day (ToD) +1PPS in/out
- 1 x CLK 10MHz in/out and 1 x CLK 10MHz in
- Antenna input for embedded GNSS receiver

Ethernet interfaces
- Two combo 10/100/1000BaseT or 100/1000BaseX (SFP) ports

Synchronous Ethernet (SyncE)
- Support on all Ethernet interfaces in fiber and copper modes
- Compliant to the relevant sections of ITU-T G.8261/G.8262/G.8264
- Ethernet synchronization message channel (ESMC)
- SyncE for time holdover during GNSS outage

BITS
- 1 x BITS input over shielded RJ -48
- 1 x BITS output over shielded RJ -48
- User-configurable: E1, T1, 2.048MHz
- G.823/G.824 sync interface compliant
- Synchronization status message (SSM)
- BITS input for frequency input or output (Sync-E Tx, 10M out)
- BITS input for time holdover during GNSS outage
- Output squelch option
- SSU filtering option

1PPS in/out, 1PPS In
- 1 x 1PPS input
- 1 x 1PPS input/output (user configurable)
- User configurable input and output delay compensation
- Mini SMB-M connector (50 Ohms)
- Output squelch option

Time-of-day (ToD) output
- G.8271 compliant
- ToD format – NMEA 0183 (SPZDA sentence) and CCSA
- RS422 over shielded RJ -45
- Output squelch option

CLK in/out, CLK In
- 1x CLK 10MHz input
- 1x CLK 10MHz input/output (user configurable)
- Mini SMB-M connector (50 Ohms)
- Output squelch option

GNSS receiver
- Multi-constellation GNSS (GPS, GLONASS, GALILEO and BEIDOU) L1 32 channels receiver
- User configurable antenna cable delay compensation
- Software configurable mode of operation
  - GPS (1575.42 MHz)
  - GLONASS (1601.5 MHz)
  - BEIDOU (1561MHz)
  - Combined GPS +GLONASS
  - Combined GPS +BEIDOU
- Voltage to antenna +5VDC
- Antenna connector SMA-F (50 Ohms)
Holdover performance

<table>
<thead>
<tr>
<th></th>
<th>Clock</th>
<th>Aging/Day (after 30 days)</th>
<th>Temperature stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>High-quality OCXO Stratum 3/G.812 Type III</td>
<td>±5 x 10^{-10}</td>
<td>±50 x 10^{-10}</td>
</tr>
<tr>
<td>Quartz HQ++</td>
<td>DOCXO Stratum 2/G.812 Type II</td>
<td>±5 x 10^{-12}/ ±1 x 10^{-12a}</td>
<td>±1 x 10^{-12a}</td>
</tr>
<tr>
<td>Rubidium</td>
<td>Rubidium Stratum 2/G.812 Type II</td>
<td>±5 x 10^{-12}</td>
<td>±2 x 10^{-10}</td>
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</table>

*Note: Effective daily aging for the next following three days after device has been powered for one month and locked to GPS for three days.*

<table>
<thead>
<tr>
<th></th>
<th>400nsec</th>
<th>1.1usec</th>
<th>1.5usec</th>
<th>5usec</th>
<th>10usec</th>
<th>16ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>2 hours</td>
<td>4 hours</td>
<td>5 hours</td>
<td>8 hours</td>
<td>14 hours</td>
<td>1 month</td>
</tr>
<tr>
<td>Quartz HQ++</td>
<td>15 hours</td>
<td>1.3 days</td>
<td>2 days</td>
<td>4 days</td>
<td>6 days</td>
<td>&gt;1.5 years</td>
</tr>
<tr>
<td>Rubidium</td>
<td>15 hours</td>
<td>1.3 days</td>
<td>2 days</td>
<td>4 days</td>
<td>6 days</td>
<td>&gt;5 years</td>
</tr>
</tbody>
</table>

*Note: The above are approximated values assuming constant temperature, no initial phase and frequency error, after OSA 541X has been powered for one month and locked to GPS for 72 hours.*

Sync signal conversion

<table>
<thead>
<tr>
<th></th>
<th>SyncE Tx</th>
<th>BITS OUT</th>
<th>CLK OUT (10MHz)</th>
<th>PTP</th>
<th>1PPS OUT</th>
<th>ToD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS/GNSS</td>
<td>(</td>
<td>(</td>
<td>(</td>
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<td>(</td>
</tr>
<tr>
<td>SyncE Rx</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>freq</td>
<td>n/a</td>
</tr>
<tr>
<td>BITS IN</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>freq</td>
<td>n/a</td>
</tr>
<tr>
<td>CLK IN (10MHz)</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>freq</td>
<td>n/a</td>
</tr>
<tr>
<td>PPS IN</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>PTP</td>
<td>(</td>
<td>(</td>
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</tr>
</tbody>
</table>

GM/PRTC frequency and time accuracy
y While locked to GNSS:
- Phase & time – G.8272 phase accuracy (+100nsec from UTC)
- Frequency – G.811 frequency accuracy

Syncjack™ monitoring and assurance tools
y Clock accuracy for up to two clock probes – computing TE, TIE and MTIE of physical clocks
- Calculation of maximum, constant and dynamic TE, TIE and MTIE between physical source and reference signals
- Programmable source and reference signals including SyncE, BITS, 1PPS, GNSS and 10MHz
- MTIE mask and Time Error threshold alarms based on SNMP traps
- PTP network analysis including PTP network probe
- Packet delay and packet delay variation performance statistics
- Delay asymmetry
- Network usability statistics (FPP based on G.8261.1)
- Packet loss statistics
- Programmable reference signals including SyncE, BITS, 1PPS, GNSS and 10MHz
- Enhanced sync assurance statistics, performance monitoring (15min & 24h), threshold crossing alarm (TCA) and SNMP traps

y Clock analysis for up to four PTP clock probes – packet TE, TIE and MTIE
- Calculation of packet maximum, constant and dynamic TE, TIE and MTIE between physical reference signal and timestamps within the PTP packets
- Support for active and passive probe mode
- Programmable reference signals including SyncE, BITS, 1PPS, GNSS and 10MHz
- MTIE mask and time error threshold alarms based on SNMP traps
- PTP network analysis including PTP network probe
- Packet delay and packet delay variation performance statistics
- Delay asymmetry
- Network usability statistics (FPP based on G.8261.1)
- Packet loss statistics
- Programmable reference signals including SyncE, BITS, 1PPS, GNSS and 10MHz
- Enhanced sync assurance statistics, performance monitoring (15min & 24h), threshold crossing alarm (TCA) and SNMP traps

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**PTP networking features**
- PTP profiles support:
  - ITU-T G.8265.1 frequency delivery profile (IP unicast)
  - ITU-T G.8275.1 time/phase delivery profile (Full Timing Support - Ethernet multicast)
  - ITU-T G.8275.2 time/phase delivery profile (Assisted Partial Timing Support - IP unicast)
  - PTP Enterprise profile (Mixed Multicast and Unicast over IP)
- IEEE 1588 2008 PTP default profile over IP multicast
- IEEE 1588 2008 PTP default profile over Ethernet multicast (Annex F)
- Up to 4 Master/BC IP addresses
- Up to 4 VLANs (IEEE 802.1Q customer-tagged) and stacked VLANs
- Support for multiple profiles simultaneously
- Support PTP (TAI) and arbitrary (ARB) timescales
- Support master and slave on any port simultaneously
- Up to three stacked VLANs per flow (Q-in-Q service provider tagged)
- ICMP/DSCP/TOS
- Static routes configuration of default gateways
- Enhanced PTP GM/BC/slave statistics, performance monitoring (15min & 24h), threshold crossing alarm (TCA) and SNMP traps

**Low-touch provisioning**
- Text-based configuration files
- FTP/SFTP/SCP for configuration file copy
- Remote software upgrade

**Management and security**

**Local management**
- Serial connector (RS232 over RJ 45) using CLI

**Remote management**
- Local LAN port (10/100BaseT over RJ 45) using CLI, SNMP and Web GUI interfaces
- Support for IPv4 and IPv6
- 3G/LTE USB interface
- Maintains in-band VLAN and MAC-based management tunnels
- Supported by Ensemble Suite Controller, including Ensemble Sync Director

**Management protocols**
- Telnet, SSH (v1/v2), HTTP/HTTPS, SNMP (v1/v2c/v3), ICMP

**Secure administration**
- Configuration database backup and restore
- System software download via FTP, HTTPS, SFTP or SCP (dual flash banks)
- Remote authentication via RADIUS/TACACS+
- SNMIPv3 with authentication and encryption
- Access control list (ACL)

**IP routing**
- DHCP, RIPv2 and static routes, ARP cache access control
- IPv6 NDP address resolution
- RIPvng for IPv6

**System logging**
- Syslog, alarm log, audit log and security log
- User configurable time zone & daylight saving time
- Configurable system timing source – Local/NTP/PTP/PRTC (GNSS)

**Regulatory and standards compliance**
- ITU-T G.8272, G.8273.2
- ITU-T G.8265.1, G.8275.1, G.8275.2
- IEEE 1588v2 (PTP), 802.1Q (VLAN), 802.1ad, 802.1p (Priority)
- RFC 2863 (IF-MIB), RFC 2865 (RADIUS), RFC 2819 (RMON)
- Power: ETSI 300 132-2, BTNR2511, ETS 300-019, ETS 300-019-2-[1,2,3], ANSI C84.1-1989
- Safety: EN 60950-1, 21CFR1040.10, EN 60825
- RoHS compliance

**Power supply**
- Integrated PSU: 110/240 VAC, -48 to -72VDC or +24 to +30VDC
- Hot swappable, modular AC-PSU: 110 to 240VAC (47 to 63Hz) with over-voltage and over-current protection
- Hot swappable, modular DC-PSU: -48 to -72VDC or +24 to +30VDC with over-voltage and over-current protection
- Power consumption:
  - 13W (typical), 19.5W (max)\(^1\,2\)
  - 22W (typical), 27W (max)\(^3\)
  - 25W (typical), 30W (max)\(^4\)

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Environmental

- Dimensions:
  - 1U ½ 19” compact chassis, 220mm x 44mm x 212mm / 8.7” x 1.75” x 8.4” (W x H x D), ETSI-compliant
  - 1U 19” compact chassis, 439mm x 44mm x 212mm / 17.3” x 1.75” x 8.4” (W x H x D), ETSI-compliant

- Weight: 1.834 Kg, 1.98Kg, 3.07Kg

- Operating temperature:
  - -40 to +65°C (hardened environment)
  - -40 to +45°C

- Storage temperature: -40 to +70°C (GR-63-CORE)

- Humidity: 5 to 100% (with condensation)

Optional accessories

- GNSS (GPS/GLONASS/BEIDOU/ GALILEO) antenna kits 10/20/60/120/150m (32.8ft/65.6ft/196.85ft/393.7ft/492.1ft), including indoor and outdoor cables, roof antenna, lightning protector and mounting kit

- 1:2/1:4/1:8 GNSS (GPS/GLONASS/BEIDOU/GALILEO) splitters

- GNSS window antenna

- Cables and adapters Accessory kit