Radio access network technology is evolving. Reliable and assured delivery of precise phase, frequency and time-of-day synchronization across mobile backhaul networks has become critical to support data rates up to 1Gbit/s while making more efficient use of the available spectrum.

Do you find it difficult to achieve the accurate frequency and phase synchronization needed by modern LTE-TDD and LTE-Advanced technology? Are you struggling to understand how accurately your base station clocks are tracking your master? We hear it a lot and can help. With our OSA 5410 Series, a family of IEEE 1588v2 Precision Time Protocol (PTP) access grandmaster devices optimized for synchronization distribution, testing and assurance, cost-effective and reliable synchronization of your base station clocks is no longer a challenge.

Your Benefits

◆ Compact and Cost-Effective
Small form factor design optimized for access network deployment

◆ Built-In GNSS Receiver
PRTC/PRC and Grandmaster clock functionality for accurate frequency, phase and time-of-day delivery

◆ High-Availability Design
Automatic clock selection, self-calibrating delay asymmetry compensation and power supply redundancy

◆ Unique Flexibility
Configurable to operate in Grandmaster clock, Assisted Partial Timing Support (APTS), boundary clock and slave clock mode

◆ Syncjack™ Technology
Built-in synchronization accuracy monitoring, testing and assurance functionality

◆ Operational Simplicity
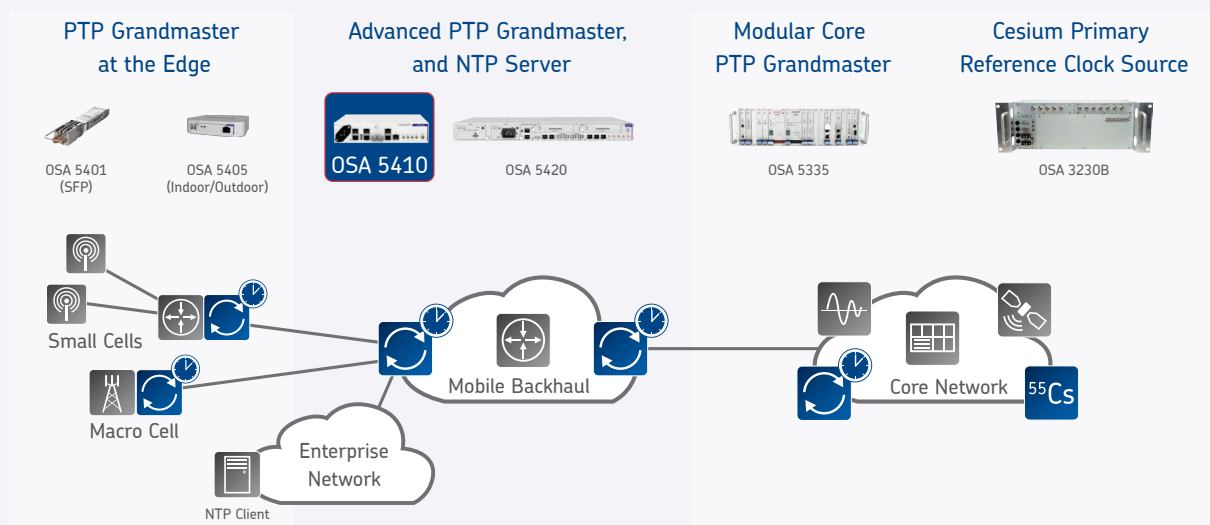FSP Sync Manager platform for superior management and monitoring capabilities

High-Level Specifications

OSA 5410

- High-quality OCXO
- Integrated PSU (AC/DC)
- 1HU 19" half-width chassis, ETSI compliant
- Cost-effective PTP GM ,BC, slave and sync probe

OSA 5411

- Quartz, high-quality quartz or rubidium
- Hot-swappable redundant PSU (AC/DC)
- 1HU 19" chassis, ETSI compliant

Main Applications

- 1588v2 PTP grandmaster, boundary and slave clock, and APTS clock
- GNSS Receiver and PRTC
- Synchronization signal conversion
- Sync probe – Syncjack™ monitoring and assurance

Built-in GNSS Receiver

- Software configurable
- GPS/GLONASS/BEIDOU
- GPS+GLONASS
- GPS+BEIDOU
- GALILEO (hardware ready)

Management

- 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

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

- Timing distribution and assurance at the edge of mobile backhaul networks for assured delivery of frequency and phase synchronization to LTE-TDD and LTE-Advanced 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

PTP Grandmaster at the Edge	Advanced PTP Grandmaster, and NTP Server	Modular Core PTP Grandmaster	Cesium Primary Reference Clock Source
OSA 5401 (SFP)	OSA 5410	OSA 5335	OSA 3230B
OSA 5405 (Indoor/Outdoor)	OSA 5420		

Small Cells

Macro Cell

NTP Client

Enterprise Network

Mobile Backhaul

Core Network

^{55}Cs

Product specifications are subject to change without notice or obligation.

Product Variants

	OSA 5410 Quartz HQ [1]	OSA 5411 Quartz [2]	OSA 5411 Quartz HQ++ [3]	OSA 5411 Rubidium [4]
Clock	High-quality OCXO	DOCXO	DOCXO	Rubidium
Size	1HU, half-width	1HU 19" chassis	1HU 19" chassis	1HU 19" chassis
PSU	Integrated PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)

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

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

PTP Modes of Operation

- Fully compatible with ITU-T G.8265.1 frequency delivery profile
- Fully compatible with ITU-T G.8275.1 time/phase delivery profile (full timing support)
- Designed to support ITU-T G.8275.2 time/phase delivery profile (Assisted Partial Timing Support)
- Enterprise profile – IP hybrid multicast/unicast
- Default profile IEEE 1588 2008 – Ethernet and IP multicast

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
- 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 and in congruent with PTP

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 and in congruent with PTP
- Output squelch 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 ($GPZDA sentence) and CCSA
- RS422 over shielded RJ-45
- Output squelch option

CLK In/Out, CLK In

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

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GNSS Receiver

- Multi-constellation GNSS (GPS and GLONASS) L1 32 channels receiver
- Hardware-ready for Galileo
- 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

	Aging/Day (after 30 days)	Temperature stability
Quartz	± 5e-10	± 50e-10
Quartz HQ++	± 5e-11	± 1e-11
Rubidium	± 5e-12	± 2e-10

	400nsec	1.1usec	1.5usec	5usec	10usec	16ppb
Quartz	2 hours	4 hours	5 hours	8 hours	14 hours	1 month
Quartz HQ++	15 hours	1.3 days	2 days	4 days	6 days	>1 year
Rubidium	15 hours	1.3 days	2 days	4 days	6 days	>1 year

Note: The above are approximated values assuming constant temperature, no initial phase and frequency error, after OSA 541X was powered for one month and locked to GPS for 24 hours

GM/PRTC Frequency and Time Accuracy

- While locked to GNSS:
  - Phase & time – G.8272 phase accuracy (±100nsec from UTC)
  - Frequency – G.811 frequency accuracy

Sync Signal Conversion

	SyncE Tx	BITS OUT	CLK OUT (10MHz)	PTP	1PPS OUT	ToD
GPS/GNSS	✔	✔	✔	✔	✔	✔
SyncE Rx	✔	✔	✔	✔	freq	n/a
BITS IN	✔	✔	✔	✔	freq	n/a
CLK IN (10MHz)	✔	✔	✔	✔	freq	n/a
PTP	✔	✔	✔	✔	✔	✔

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Syncjack™ Monitoring and Assurance Tools

- 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
- 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
  - PTP Networking Features
- PTP over IPv4 (G.8265.1) and over Ethernet (G.8275.1), hybrid mode (enterprise profile)
- One/Two Way, One/Two Step
- Up to four master/BC IP addresses
- Up to four VLANs (IEEE 802.1Q customer-tagged) and stacked VLANs
- Up to three stacked VLANs per flow (Q-in-Q service provider tagged)
- ICMP/DSCP/TOS
- Static routes configuration of default getaways
- Enhanced PTP GM/BC/slave statistics, performance monitoring (15min & 24h), threshold crossing alarm (TCA) and SNMP traps

Low-Touch Provisioning

- Text-based configuration files
- TFTP for configuration file copy
- Remote software upgrade

Management and Security

Local management

- Serial connector (RS232 over RJ45) using CLI
- Remote management

- Local LAN port (10/100BaseT over RJ45) using CLI, SNMP and Web GUI interfaces
- 3G/LTE USB interface
- Maintains in-band VLAN and MAC-based management tunnels
- Supported by FSP Sync Network Manager

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
- SNMPv3 with authentication and encryption
- Access control list (ACL)

IP routing

- DHCP, RIPv2 and static routes, ARP cache access control

System logging

- Syslog, alarm log, audit log and security log
- Configurable system timing source – Local/NTP/PTP/PRTC (GNSS)

Regulatory and Standards Compliance

- ITU-T G.8261, G.8262, G.8264, G.703, G.781
- ITU-T G.8272
- ITU-T G.8265.1, G.8275.1
- 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
- EMI: EN 55022 2010 Class A, EN 61000-3-2-2006, EN 61000-3-3 2008, EN 300 386 v1.6.1 2012, FCC 47FR Part 15 2014 Class A, ICES-002 2012 Class A
- ROHS 6 compliance

Power Supply

- Integrated PSU1: 110/240 VAC, -48 to -72VDC or +24 to +30VDC
- Hot swappable, modular AC-PSU[2]: 110 to 240VAC (47 to 63Hz) with over-voltage and over-current protection
- Hot swappable, modular DC-PSU[2]: -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[1]
  - 1U 19" compact chassis, 439mm x 44mm x 212mm / 17.3" x 1.75" x 8.4" (W x H x D), ETSI-compliant[2,3,4]
- Weight: 1.834 Kg[1], 2.98Kg[2], 3.07Kg[3,4]
- Operating temperature:
  - -40 to +65°C (hardened environment)[1,2,3]
  - -40 to +45°C[4]
- Storage temperature: -40 to +70°C (GR-63-CORE)
- Humidity: 5 to 95% (non-condensing)

Product Legend

[1] OSA 5410

[2] OSA 5411 Quartz

[3] OSA 5411 Quartz HQ++

[4] OSA 5411 Rubidium

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