OSCILLOQUARTZ
An ADVA Company

OSA 5422

PTP grandmaster, NTP server, GNSS receiver

Reliable and accurate delivery of synchronization is essential to meet the stringent requirements of mission-critical applications in multiple market areas such as mobile backhaul, power utilities and broadcasting. Network operators need a robust, scalable solution to provide assured phase, frequency and time-of-day synchronization. However, achieving this in a cost-effective way is a challenge.

Our OSA 5422 is a versatile and accurate synchronization device that can meet the stringent frequency and phase synchronization demands of new applications, such as 5G, while supporting legacy networks using IRIG, BITS or NTP. With a compact and flexible design optimized for deployment at the network edge, it ensures that cost-effective and accurate synchronization is no longer a challenge. Our OSA 5422 offers unique flexibility. It can be used as an IEEE 1588v2 PTP grandmaster clock. With its NTP server and GNSS receiver capabilities including multiple synchronization fan-out options, our OSA 5422 is also ideal for deployment in legacy synchronization architectures. To meet all installation demands, two ordering options are available: one with all connectors at the front and one with connectors at the rear side and a display at the front. All these features make our OSA 5422 ideal for the delivery of accurate and reliable synchronization for new and legacy solutions at the network edge.

Your benefits

⊘ **Leading edge GNSS receiver**

Enables ePRTC/PRTC-A/-B and grandmaster clock functionality for frequency, phase and time-of-day delivery using multiple constellations and multi-band GNSS receiver options

⊘ **Unique flexibility**

Can be used as PTP grandmaster clock, APTS, boundary clock and slave clock as well as NTP server and SSU/TSG

⊘ **Extended holdover performance**

High-end quartz and rubidium oscillator options

⊘ **High-availability design**

Automatic clock selection, self-calibrating delay asymmetry compensation, power supply redundancy and DoS protection

⊘ **Syncjack™ technology**

Built-in synchronization accuracy monitoring and assurance functionality

⊘ **Operational simplicity**

Ensemble Controller, including Ensemble Sync Director, for superior management and synchronization monitoring capabilities
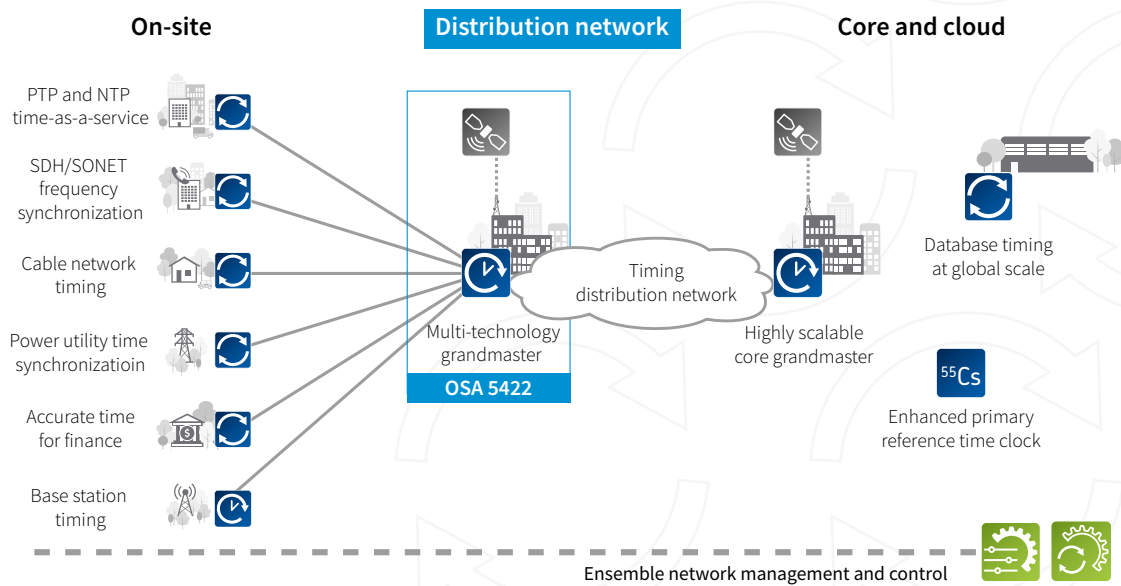
High-level specifications

OSA 5422

- OCXO, high-quality OCXO, high-quality DOCXO and rubidium
- Up to two expansion line cards
- Multiple 1G/10G ports
- Up to 1024 unicast slaves @128pps
- Hot-swappable redundant PSU

Operation modes

- ePRTC, PRTC A and PRTC B
- PTP GM, BC type D, slave, probe
- NTP server
- SSU – up to 32 x E1 / T1 outputs
- GNSS receiver fan-out – up to 32x clock / PPS / PPS+ToD

Built-in GNSS receiver

- Embedded L1 multi-constellation receiver (GPS/ GALILEO/ BEIDOU/GLONASS)
- Optional multi-band, multi-constellation receiver for enhanced accuracy
- Jamming, spoofing detection

IEEE 1588 2008 PTP profiles

- L2 (Ethernet) and L3 (IP) default profiles
- Telecom profiles
- Enterprise hybrid profile
- Power and utility profiles

NTP server

- High capacity server
- Hardware timestamping
- NTP/PTP/Sync-E/SSU supported simultaneously
- PTP to NTP conversion
- NTP authentication

Expansion cards (Up to 2)

- 16x E1/T1/ 2.048MHz outputs (120/100/ 75ohm)
- 16x PPS outputs (50ohm) 16x clock (10/5MHz 50ohm)
- 16x PPS+ToD outputs (RJ-45)
- 4x 1GbE (Fiber)
- 10x Time code IRIG

Applications in your network

Synchronization and time-as-a-service applications with the highest availability

- Timing distribution at the edge of mobile backhaul and fronthaul networks for frequency and phase synchronization
- Cable networks (DOCSIS 3.1) synchronization
- Synchronization delivery within buildings for indoor small cell radio base stations
- Synchronization of legacy network architectures based on NTP and SSU
- Time as a service into data center, financial, health and media networks
- Modernized power utility networks

On-site

PTP and NTP time-as-a-service

SDH/SONET frequency synchronization

Cable network timing

Power utility time synchronizatioin

Accurate time for finance

Base station timing

Distribution network

Multi-technology grandmaster

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Timing distribution network

Core and cloud

Highly scalable core grandmaster

Database timing at global scale

55Cs

Enhanced primary reference time clock

Ensemble network management and control

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Product variants

	OSA 5422 quartz	OSA 5422 quartz HQ+	OSA 5422 quartz HQ++	OSA 5422 rubidium
Clock	OCXO	High-quality OCXO	High-quality DOCXO	Rubidium
Expansion line cards	2	2	2	2
Multi-band GNSS	(*)	Optional	Optional	Optional
PSU	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)

Note: please, consult factory

Main applications

- ePRTC , PRTC-A and PRTC-B
- 1588v2 PTP grandmaster clock (up to 1024 PTP unicast clients at 128pps)
- 1588v2 PTP boundary clock (up to 1024 PTP unicast clients at 128pps)
- G.8273.2 boundary clock class D
- 1588v2 APTS clock
- 1588v2 PTP slave clock
- Fan-out of multiple physical synchronization output interfaces
- Synchronization supply unit (SSU)
- NTP server
- Synchronization protocol and physical signal conversion
- Sync probe – Syncjack™ monitoring and assurance

PTP features

- PTP profiles support:
  - ITU-T G.8265.1 frequency delivery profile (IP unicast over IPv4/IPv6)
  - ITU-T G.8275.1 time/phase delivery profile (Full timing support - Ethernet multicast)
  - ITU-T G.8275.2 time/phase delivery profile (APTS)
  - PTP enterprise profile (Mixed multicast and unicast over IPv4/IPv6)
  - IEEE 1588 2008 PTP default profile over IPv4/IPv6 multicast
  - IEEE 1588 2008 PTP default profile over Ethernet multicast (Annex F)
  - PTP power and utility profiles: IEC/IEEE 61850-9-3, IEEE C37.238-2011, IEEE C37.238-2017
- Up to 16 master/BC IP addresses
- Up to 16 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
- Configurable static routes and default getaways

- Enhanced PTP GM/BC/Slave statistics, performance monitoring (15min and 24h), threshold crossing alarm (TCA) and SNMP traps
- In-house best-in-class clock recovery algorithms
- DoS protection using hardware access control list (ACL) and traffic rate limiting

NTP features

- Stratum 1 NTP server when locked to GNSS
- NTP v1, v2, v3, v4 and SNTP over IPv4/IPv6
- NTP unicast/multicast/broadcast
- Symmetric key and Autokey authentication
- TIME & DAYTIME protocols
- NTP peering
- Hardware timestamping
- Accuracy within +/–100nsec from UTC
- Up to 16 NTP server IP addresses
- Support PTP and NTP on same Ethernet port
- PTP to NTP translation
- Up to three stacked VLANs per flow (Q-in-Q service provider tagged)
- Enhanced NTP statistics and client lists
- Up to 8000 transactions per second
- PTP backup in case of GNSS outage

Synchronization interfaces (onboard)

- Synchronous Ethernet (SyncE) over Ethernet interfaces
- 2x BITS-in and 2x BITS-out (2.048MHz, E1 or T1 (DS1) including SSM)
- 2x PPS in/out
- 2x time-of-day (ToD) + PPS in/out
- 2x CLK 10/2.048MHz in/out
- Antenna input for embedded GNSS receiver

Ethernet ports

- Hardware-based timestamping (PTP & NTP)
- 2x 100/1000BaseT copper ports
- One copper port is PoE driver (802.3af class 2 , 6.49W max)
- Up to 8x 1GbE (SFP) or 10GbE (SFP+), user configurable
- Additional 4x 1GbE (SFP) using expansion card
- All fiber ports support SM/MM colored/non-colored SFP and copper SFP
- Per-flow hardware-based policing and scheduling
- Configurable link asymmetry delay compensation

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Synchronous Ethernet (SyncE)
- Supported by all Ethernet interfaces in fiber and copper modes
- Compliant to ITU-T G.8261/G.8262/G.8264
- Ethernet synchronization message channel (ESMC)
- Sync-E for time holdover during GNSS outage

BITS
- 2x BITS input + output over shielded RJ-48
- User-configurable: E1, T1 (DS1), 2.048MHz
- G.823 / G.824 sync interface compliant
- Synchronization status message (SSM)
- BITS input for time holdover during GNSS outage
- Output squelch option
- EEC/SEC/SSU filtering options

PPS in/out
- 2x PPS input/output (user configurable)
- User configurable input and output delay compensation
- SMA-F connector (50ohm)
- 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

GNSS Receiver

Single-band receiver
- Multi-constellation GNSS L1 72 channels receiver
- GPS (L1C) , GLONASS (L1OF), GALILEO, BeiDou (B1l) , QZSS (L1C/A) ,SBAS (L1C/A: WAAS, EGNOS, MSAS, GAGAN)
- Three concurrent GNSS constellations

Multi-band GNSS receiver option
- Provide enhanced accuracy for ePRTC and PRTC-B
- Multi -band, Multi-constellation 184-channel GNSS receiver
- GPS (L1C/A L2C), Galileo (E1B/C E5b) ,GLONASS (L1OF, L2OF) , BeiDou (B1l, B2l) , QZSS (L1C/A L2C) ,SBAS (L1C/A: WAAS, EGNOS, MSAS, GAGAN)
- Four concurrent GNSS constellations
- Jamming and spoofing detection

Common GNSS receiver features
- Skyview and GNSS satellites status
- Configurable SNR, elevation and PDOP masks
- User-configurable antenna cable delay compensation
- Support fixed positioning – single satellite mode
- Voltage to antenna +5VDC
- Antenna connector SMA-F (50ohm)

CLK in/out
- 2 x CLK 10MHz input (10/2.048MHz) / output (10MHz) (user configurable)
- SMA-F connector (50ohm)
- Output squelch option

OLED display module
- Optional OLED display (reverse mounting)
- Press buttons
- Status LEDs
- USB type A / serial connectors

Output expansion line cards
- Up to two expansion cards
- Hot insertion/ extraction support
- Overvoltage/ current protection
- Two expansion cards share a single mountable patch panel with 16x RJ-48 / RJ-45 / 16x BNC / 10xIRIG options

IRIG card
- 1x IRIG optical output
  - ST connector – fiber 62/125um
  - Optical: wavelength 820nm multimode
  - IRIG-B006/007/004 CF per IEEE1344/IEEE C37.118
- Alarm/pulse relay
  - Connector: WR-TBL 3-pin Serie 382 - 2.50 mm
  - Electrical: Relay contact NC / NO – 50VDC @ 250mA
  - Code Format Selectable function: PPH/PPM/locked/ alarm
- RS422 output
  - RJ11 Connector
  - Electrical: RS-422
  - Code format selectable: DCLS (IRIG-B002/004/006/007) or pulse (PPS/PPM/PPH)
- 1x IRIG isolated input - HW ready
- 10x IRIG outputs
  - Fanout cable (10x BNC female 50 ohms) or patch panel options
  - CH 1-8: DCLS 5V (IRIG-B002/004/006/007/PPS/PPM/ PPH) or AM (IRIG-B122/124/126/127)
  - CH 9-10: DCLS 5V or 10V (IRIG-B002/004/006/007/PPS/ PPM/PPH)
- IRIG patch panel:
  - CH 1-2: 2xIRIG optical outputs (820nm ST connectors)
  - CH-1-8: 8x IRIG AM/DCLS 5V outputs (BNC-F connector)
  - CH-9-10: 2x IRIG DCLS 5V/10V outputs (BNC-F connector)
  - 1x Optical /electrical converter: IRIG Optical input (820nm ST connectors) to IRIG DCLS output (BNC-F)

Product specifications are subject to change without notice or obligation.

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Low phase noise (LPN) card

- Providing 4x Low phase noise outputs
- SMA-F connector (50ohm)
- Amplitude : 13dBm +/- 1
- Harmonics : ≤ -40 dBc
- Spurious : ≤ -70 dBc
- Each output enabled individually
- Squelch option per clock status (per card)

ADEV	10MHz
@1s	≤ 3 e-12
@10s	≤ 4.5e-12
@100s	≤ 7.0e-12

Phase noise	10MHz
@1 Hz	≤ -95 dBc/Hz
@10 Hz	≤ -125 dBc/Hz
@100 Hz	≤ -145 dBc/Hz
@1 kHz	≤ -150 dBc/Hz
@10 kHz	≤ -155 dBc/Hz
@100 kHz	≤ -155 dBc/Hz
@1 MHz	≤ -155 dBc/Hz

Line cards	16x BITS	16x CLK / PPS	16x PPS+ToD
Capabilities	16x BITS outputs over high density connector (VHDCI) – supporting 2.048MHz, E1 or T1 (DS1). Per output configurable signals type (E1, 2.048MHz)	16x clock 10MHz or 5MHz outputs over unbalanced 50ohm interface or 16x PPS outputs over unbalanced 50ohm interface	16x PPS+ToD outputs over balanced interface
Number of cards	2	2	2
Power consumption	5W	4W	4W

Line cards	4x 1G	IRIG	LPN
Capabilities	4x 100/1000bit/s Ethernet ports (PTP / NTP / Sync-E) Sync-E and PTP monitoring and assurance using Syncjack™	1x IRIG isolated input 1x IRIG optical output Alarm/pulse relay RS422 output 10x IRIG outputs	4x 10MHz low phase noise clock outputs unbalanced 50ohm interface
Number of cards	1	2	2
Power consumption	4W	8W	8W

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Holdover performance

	Clock	Aging / day (after 30 days)	Temperature stability
Quartz	OCXO Stratum 3 / G.812 Type III	$\pm5\times10^{-10}$	$\pm50\times10^{-10}$
Quartz HQ+	High-quality OCXO G.812 Type I	$\pm2\times10^{-10}$ / $\pm1\times10^{-10}$ **	$\pm2\times10^{-10}$
Quartz HQ++	High-quality DOCXO Stratum 2 / G.812 Type II	$\pm5\times10^{-11}$ / $\pm1\times10^{-11}$ **	$\pm1\times10^{-11}$
Rubidium	Rubidium Stratum 2 / G.812 Type II	$\pm5\times10^{-12}$	$\pm2\times10^{-10}$ / $\pm2\times10^{-11}$ ***

* Note: Effective daily aging after device has been powered for one month and locked to GPS for three days, for the following three days
***Note: effective temperature stability after compensation

	200nsec	400nsec	1.1usec	1.5usec	5usec	10usec	16ppb
Quartz	1 hours	2 hours	4 hours	5 hours	8 hours	14 hours	1 month
Quartz HQ+	4 hours	8 hours	14.5 hours	16.5 hours	1.5 days	2 days	0.5 years
Quartz HQ++	10 hours	17 hours	1.5 days	2.2 days	4.4 days	6.6 days	>1.5 years
Rubidium	1 day	1.8 days	3.5 days	4 days	8 days	12 days	>5 years

Note: The above are typical values (1 sigma confident) assuming controlled temperature environment, after the device has been powered for one month and locked to GPS for 72 hours. Due to the excellent temperature stability of the HQ++, the HQ++ holdover will outperform the Rubidium holdover when significant temperature variations are presented.

Sync signal conversion

From / To	SyncE Tx	BITS OUT	CLK OUT (10MHz)	PTP	NTP	PPS OUT	ToD
GPS/GNSS	✓	✓	✓	✓	✓	✓	✓
SyncE Rx	✓	✓	✓	✓	n/a	freq.	n/a
BITS IN	✓	✓	✓	✓	n/a	freq.	n/a
CLK IN	✓	✓	✓	✓	n/a	freq.	n/a
PPS IN	✓	✓	✓	✓	✓	✓	✓
PTP	✓	✓	✓	✓	✓	✓	✓

GM / PRTC frequency and time accuracy

- While locked to GNSS:
- Phase and time
  - Single band GNSS, PRTC-A: ±100nsec from UTC
  - Multi band GNSS, PRTC-B: ±40nsec from UTC
  - ePRTC (with ePRC input) : ±30nsec from UTC
- Frequency – exceed PRC / G.811 frequency accuracy

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, PPS, GNSS and CLK
  - MTIE mask and time error threshold alarms based on SNMP traps
  - TE/TIE raw data collection and export to server
  - Daily MTIE and TE performance monitoring reports
- 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, PPS, GNSS and CLK
  - MTIE mask and Time Error threshold alarms based on SNMP traps
  - TE/TIE raw data collection and export to server
  - Daily MTIE and TE performance monitoring reports
- 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, PPS, GNSS and CLK
- All probes include enhanced sync assurance statistics, performance monitoring (15min & 24h), including data export, threshold crossing alarm (TCA) and SNMP traps
- User-configurable MTIE masks

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

Management and security

Local management
- Serial port (RS232 over RJ45) for CLI

Remote management
- Local LAN port (100/1000BaseT over RJ45) using CLI, SNMP and Web GUI interfaces
- Support for IPv4 and IPv6
- Barrier free GUI
- Maintains in-band VLAN and MAC-based management tunnels
- Static routes & configuration of default getaways
- Fully interoperable with ADVA FSP 150 and ADVA FSP 3000 products
- Supported by Ensemble Controller, including Ensemble Sync Director and GNSS assurance

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

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)
- ICMP filtering and rate limiting

IP networking
- DHCP
- ARP cache access control
- RIPv2 and static routes
- IPv6 NDP address resolution
- RIPng for IPv6
- ICMP

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

Standards compliance
- ITU-T G.8261, G.8262, G.8264, G.703, G.781, G.812
- 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)
- RFC 1059 (NTPv1), RFC 1119 (NTPv2), RFC 1305 (NTPv3), RFC 5905 (NTPv4), RFC 4330 (SNTPv4)

Regulatory compliance
- CE compliance (directive 2011/65/EU)
- RoHS compliance (directive 2011/65/EU)
- LVD compliance (directive 2014/35/EU)
- WEEE compliance (2002/96/EC)
- EMC compliance (2014/30/EU)
- Power: ETSI 300 132-2, BTNR2511, ETS 300-019, ETS 300-
- 019-2-[1,2,3], ANSI C84.1-1989
- Safety: UL/TUV IEC 62386-1 , 21CFR1040.10, EN 60825 ,
- EMI: EN 55022 2010 Class A, EN550035,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

Environmental
- Dimensions: 443mm x 44mm x 250mm /17.44" x 1.73" x 9.84" (W x H x D), ETSI-complaint
- Weight: 4.15 - 5.2Kg
- Operating temperature (ambient):
  - Quartz, Quartz HQ+, Quartz HQ++: AC: -40 to +65°C (hardened environment)
  - Rubidium: -20 to +65°C
  - Low phase noise card: -10 to 45°C
  - Cold restart: -10°C
- Storage temperature: -40 to +70°C (GR-63-CORE)
- Humidity: 5 to 100% (with condensation)

Power supply
- Hot-swappable, modular AC-PSU: 100 to 240VAC (47 to 63Hz) with over-voltage and over-current protection
- Hot-swappable, modular DC-PSU: -48 to -60VDC (tolerate -36 to -72VDC) with over-voltage and over-current protection
- Power consumption (with OLED display, without LCs or SFPs, two PSUs and Vin=48V):
  - OSA 5422 Quartz: 36W (typical), 40W (max.)
  - OSA 5422 Quartz HQ+: 38W (typical), 44W (max.)
  - OSA 5422 Quartz HQ++: 40W (typical), 48W (max.)
  - OSA 5422 Rubidium: 42W (typical), 50W (max.)

Optional accessories
- Single and multi-band GNSS (GPS/ GLONASS/BEIDOU/ GALILEO/SBAS/QZSS) antenna kits 10/20/60/120/150m (32.8ft/65.6ft/196.85ft/393.7ft/492.1ft), including indoor and outdoor cables, roof antenna, lighting protector and mounting kit
- 1:2 / 1:4 / 1:8 GNSS (GPS/ GLONASS/BEIDOU/GALILEO) splitters
- GNSS window antenna
- Cables and adapters accessory kit
- Patch panels for BITS / CLK / PPS / PPS+ToD / IRIG

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