4600E

IIIII NETWORK TESTING

PORTABLE ATS-QSIG TEST SET IIII

Puma 4600E

The Portable Solution for ATS-QSIG Testing and Qualification

Consultronics Products Group

EXFO

EXPERTISE REACHING OUT

The Puma 4600E Test Set

The Puma 4600E Test Set was developed in conjunction with EUROCONTROL, the European Organisation for the Safety of Air Navigation, specifically for ATS-QSIG applications. The instrument is to be used by Air Navigation Service Providers for commissioning, routine maintenance and fault diagnosis in the field. The instrument includes interfaces to ATS-QSIG (ECMA 312) channels on Co-directional (64kbit/sec) circuits. Facilities to test E1 (2048 kbit/sec) PCM circuits are also incorporated. Fully compliant G.728 Voice Path Encoding is featured. The test set is a robust hand-held package, powered by a rechargeable internal battery. A clear colour graphical display giving a simple and comprehensive user interface to the various tests.

Applications
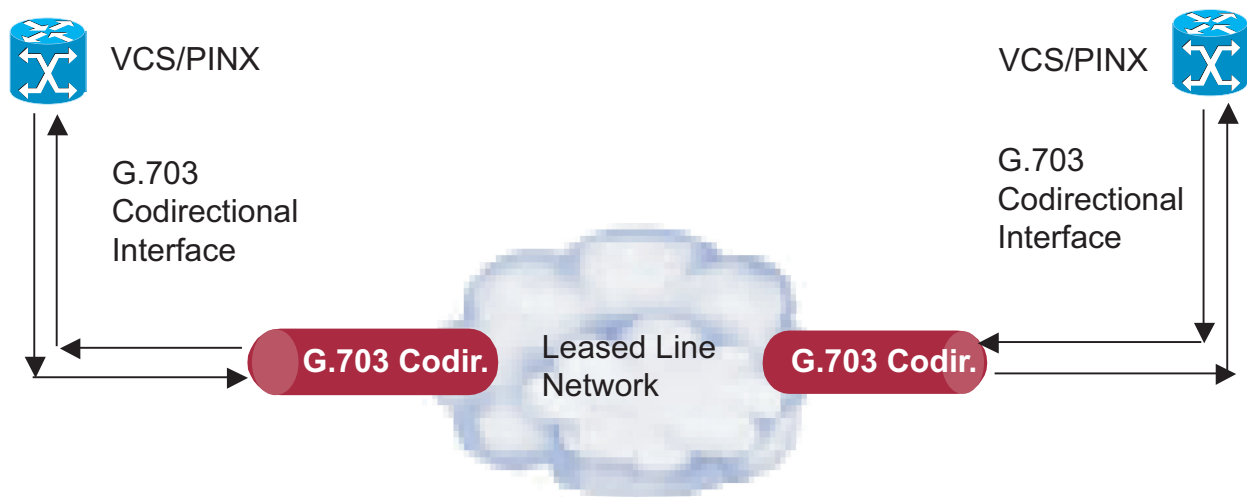
Typical ATS-QSIG NetworkConfiguration

A typical ATS-QSIG network configuration consists of two VCSs (Voice Communications Systems) connecting over G.703 Codirectional channels to a Leased Line Network. The VCS/PINXs (Private Interconnect network eXchanges) provide Voice and data communications at each Air Navigation Centre, which link to the Leased Line Network allowing inter-centre communications via voice and one data channel per Leased Line connection.

The Puma 4600E Test set can monitor Inter-PINX communications at the G.703 Codirectional or E1 link points or may substitute for a VCS/PINX and facilitates the making and receiving of calls using the ETS-QSIG (ECMA 312) protocol.

Typical applications of the test set include:

- **Commissioning of new links following Installation** – The Puma 4600E incorporates a simple User Interface suitable for use by technicians to conduct initial Go/No-Go testing following installation. The Puma 4600E can establish the link condition, LEDs and front-panel display indicating quickly whether the link is operating correctly and suitable for connection to the VCS/PINX equipment. On obtaining indication of a healthy link it is usually a straight-forward process afterwards to connect the VCS/PINX and verify full link functionality

- **Diagnosis of a Faulty Link** – If at the commissioning stage or later the link is found to be malfunctioning the Puma 4600E can provide more advanced tests to fully diagnose the fault and allow corrective action to be taken. The Puma 4600E may fully Emulate a VCS/PINX and conduct line testing. Alternatively the 4600E can be connected in Monitor configuration (high-impedance mode) and monitor activity between two ATS-QSIG PINXs, using ECMA 312 protocol whilst the circuit is in-service.

- **Laboratory Testing and Equipment Qualification** – The Puma 4600E is a reliable qualification tool that can be used during equipment development or at the manufacturing test phase. Inter-PINX communications may be qualified using either emulation of a PINX using ECMA 312 protocol as a terminal exchange or in Monitor configuration between two VCS/PINXs. The PUMA 4600E Test Set incorporates fully compliant G.728 Voice Path Encoding enabling test calls to be made via the in-built Microphone and speaker or via a headset connection. Protocol Messages may be interpreted down to bit level.

In addition to these specific ATS-QSIG applications the PUMA 4600E Test Set has additional capabilities geared to E1 (2048 kbit/sec) 75 ohm balanced and 120 ohm unbalanced circuits:

- **Monitor Mode** – Monitor both directions of a E1 PCM 2048 kbit/sec 120 Ohm balanced or 75 Ohm unbalanced circuit (high-impedance termination).

- **BER Test** – Stress test a channel with and End-to-End or Looped-Back Bit Error Rate Test using a wide range of pseudo-random or regular data patterns.

- **VF Test[1]** – Generate a defined Tone into a defined time-slot or time-slot group and monitor the quality and level of the received or reflected signal.

- **Mux/Demux Test** – Transmit through Mux/Demux equipment and check the true transfer of data between E1 and Co-directional interfaces.

- **ISDN Monitor[1]** – Monitor an ISDN primary-rate link in both directions and capture/display the protocol messages

- **ISDN/DTMF Call Set-up[1]** – Originate calls on ISDN Primary-rate or DTMF circuits.

- **Jitter Measurement and Generation[1]** – Measure and Generate Jitter on an E1 circuit.

- **Propagation Delay Measurement** – Measure the Propagation Delay through an E1 circuit.

Note

1- That some E1 testing functions are not installed as standard and are available as chargeable options.

ATS-QSIG In-Service Testing (Monitor-Mode)
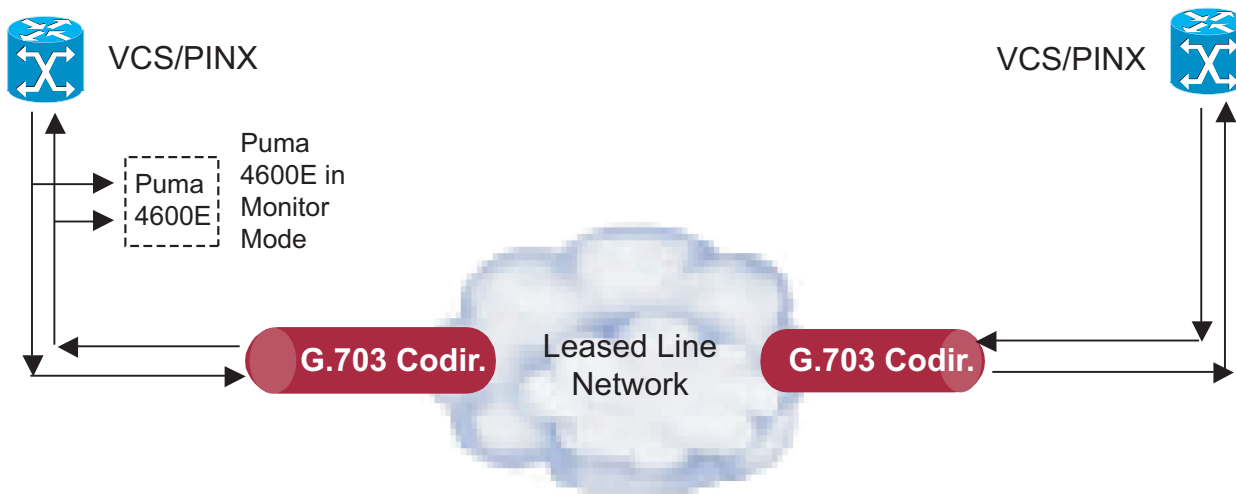
The Puma 4600E Test Set can be connected directly to an inter-PINX link via its twin high-impedance G.703 Co-directional input channels to monitor both directions of the link.

The circuit may be monitored at protocol layers 1, 2 and 3.

Layer 1

Port Compliance – ITU-T G.703 Co-directional Interfaces

64 kbit/sec Circuit – High Impedance connection to a 64 kbit/sec digital unrestricted leased line with 8kHz octet timing integrity (D64U) per ETS 300 290 ad ETS 300 290 A1.

120 Ohm Twisted Pair – Connection to 120 Ohm twisted pair via RJ45 connection ports

ECMA 235 Compliance – Mapping function of 64kbit/sec Circuit Mode of 16 kbit/sec sub-multiplexing compliant with ECMA 253

Sync Indication – LED indicates Layer 1 Synchronisation.

Layer 2

Decoding – Compliant with ETS 300 402 (ISDN; Digital Subscriber Signalling Systems No. One (DSS1) protocol: Data Link layer; Part 2; General Protocol Specification Q.921 (1993), modified (1995) and Part 4; Protocol Implementation Conformance Statement (PICS) proforma specification for the general protocol (1999).

Frame Display – Decodes Layer 2 frames in real-time.

Layer 3

Basic Call Standard – Compliant with ECMA 143 (ISO/IEC 11572) for all Layer 3 Basic Call messages and their associated information elements.

Generic Functional Protocol Standard – Compliant with ECMA 165 (ISO/IEC 11582) for all Layer 3 Generic Functional Protocol messages and their associated information elements.

Transit Counter – Compliant with ECMA 225 for the Transit Counter Information Element; part of Codeset 4 (ISO).
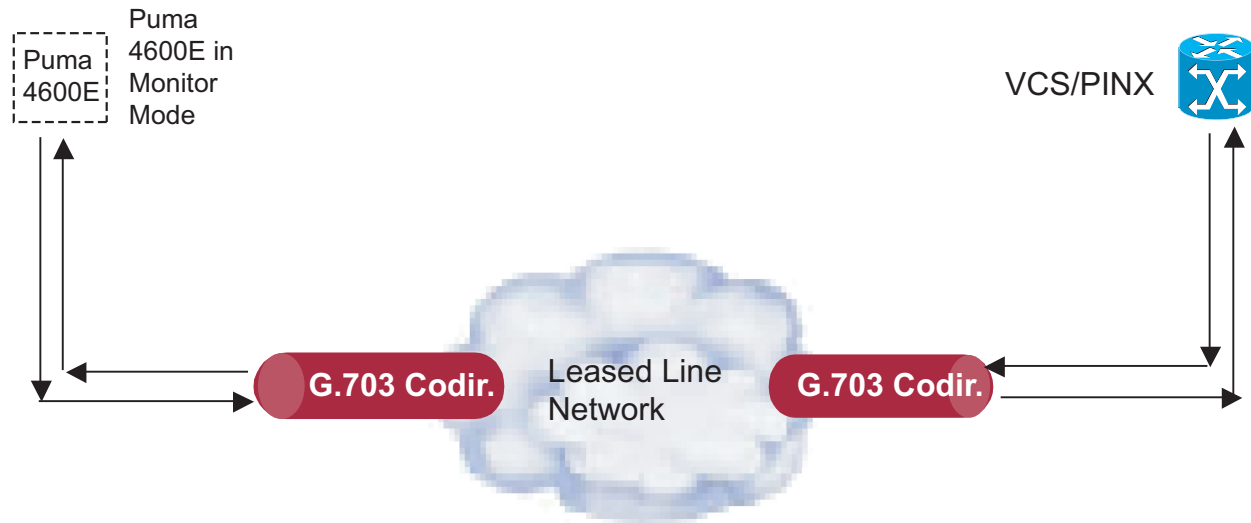
Bearer Capability – Compliant with ECMA 312.

Calling and Called Party Numbers – Both calling and called information element compliant with ECMA 312.

Call Intrusion Supplementary Service – Compliant with ECMA 203 (ISO/IEC 14846).

Call Priority Interrupt Supplementary Service – Compliant with ECMA 264 (ISO/IEC 15992).

ATS-QSIG Out-of-Service Testing (PINX Emulation)

The Puma 4600E Test Set can be connected to terminate a link to a PINX via its 120 Ohm G.703 Co-directional Tx/Rx ports. The instrument is then capable of emulation of a PINX at protocol layers 1, 2 and 3.

Layer 1

Port Compliance – ITU-T G.703 Co-directional Interfaces

64 kbit/sec Circuit – High Impedance connection to a 64 kbit/sec digital unrestricted leased line with 8kHz octet timing integrity (D64U) per ETS 300 290 ad ETS 300 290 A1.

120 Ohm Twisted Pair – Connection to twisted pair via RJ45 connection ports for both Tx and Rx paths and terminating both with 120 Ohms.

ITU-T G.728 Voice Coding – Compression and decompression of voice signals on each of the three 16 kbit/sec channels according to G.728 LD-CELP voice coding.

ECMA 235 Compliance – Mapping function of 64kbit/sec Circuit Mode of 16 kbit/sec sub-multiplexing compliant with ECMA 253

Sync Indication – LED indicates Layer 1 Synchronisation.

Audible Tones – Locally generates audible tones (dial tone, ringing, etc.).

BER Testing – Bit error Rate tests can be conducted on the link utilising a wide range of standard pseudo-random patterns or user defined patterns. Locally generates audible tones (dial tone, ringing, etc.). A BER test may be used to stress the link to ensure that the network is not introducing an unacceptable error rate.

Layer 2

Decoding – Compliant with ETS 300 402 (ISDN; Digital Subscriber Signalling Systems No. One (DSS1) protocol: Data Link layer; Part 2; General Protocol Specification Q.921 (1993), modified (1995) and Part 4; Protocol Implementation Conformance Statement (PICS) proforma specification for the general protocol (1999).

Network/User Side – Can be configured to emulate eith Network of User side.

Link Established Indication – LED indicates Layer Link Established.

Link Established (SABME) – Requests Layer 2 data link establishment with a PINX and enters Multiframe Established state by sending an unnumbered SABME frame and accepting the UA frame as acknowledgement.

Data Link Disconnection (DISC) – Requests link disconnection with a PINX and enters the TEI assigned state, by sending and unnumbered DISC frame and accepting UA frame as acknowledgement.

RR Supervisory Frames – Ensures that the data link remains established with the PINX at Layer 2 through exchange of RR Supervisory frames.

Layer 3

Basic Call Standard – Compliant with ECMA 143 (ISO/IEC 11572) for all Layer 3 Basic Call messages and their associated information elements

Generic Functional Protocol Standard – Compliant with ECMA 165 (ISO/IEC 11582) for all Layer 3 Generic Functional Protocol messages and their associated information elements.

Transit Counter – Compliant with ECMA 225 for the Transit Counter Information Element; part of Codeset 4 (ISO)

Bearer Capability – Compliant with ECMA 312

Calling and Called Party Numbers – Both calling and called information element compliant with ECMA 312

Call Intrusion Supplementary Service – Compliant with ECMA 203 (ISO/IEC 14846)

Call Priority Interrupt Supplementary Service – Compliant with ECMA 264 (ISO/IEC 15992)

A/B Position Configuration – Both "A" and "B" positions in the network can be configured.

Emulation Functions

Outgoing Routine and Priority Calls – Emulates a PINX to make outgoing ATS-QSIG calls to another PINX, requesting channel 1, 2 or 3 for the communication, incorporating a keypad for dialled numbers. When the call is answered a speech path is established with speech encoding compliant with ITU-T G.728 (LD-CELP), via hands-free speaker/microphone or headset.

Incoming Routine and Priority Calls – Emulates a PINX to receive incoming ATS-QSIG calls from another PINX, indicating the channel 1,2 or 3 to be used for the communication. An audible ringing tone is generated on receipt of the incoming ATS-QSIG call. The call may be answered by depressing the "Enter" button and the speech path is established with speech encoding compliant with ITU-T G.728 (LD-CELP), via hands-free speaker/microphone or headset.

General Capabilities

The Puma 4600E Test Set includes twin E1 (2048 kbit/sec) channels allowing both line monitoring and emulation of E1 circuits. Both channels have 120 Ohm balanced and 75 ohm unbalanced connections (adapter cables are not required). The instrument enables a wide range of testing of E1 links for commissioning, routine maintenance and fault diagnosis of general and ATS QSIG services

In-Service Performance Analysis (Monitor Mode)

Isolating E1 Errors and Alarms In-service – The Puma 4600E Test Set monitor FAS Errors, AIS and FAS Distant Alarms allows the technician to sectionalise E1 circuits and therefore identify the source of errors. For example the presence of a FAS distant Alarm indicates there is a problem downstream of the current location whereas the Presence of an AIS Alarm indicates that a problem lies upstream.

Monitoring ATS QSIG links using E1 (2048 kbit/sec) Circuits – The Puma 4600E Test Set can directly monitor E1 links non-intrusively connecting in high impedance mode or via monitor points. In this mode the E1 Channel usage is displayed graphically and individual 64 kbit/sec timeslots may be selected, ATS QSIG protocols decoded or sub-channelised 16 kbit/sec voice channels monitored.

Monitoring ISDN PRI – The Puma 4600E Test Set can verify primary rate ISDN services using its ISDN monitoring options. Full decodes are given in Plain English and Hex.

VF (Voice frequency) testing (64 kbit/sec) – Voice channels can be monitored in-service as a first level check of analogue level and quality. This is achieved through the built-in speaker. For more detailed audio channel analysis, fixed frequency tones from 1Hz to 4kHz at levels from −55 to +5dBmO are inserted and measured. The Level, Received Frequency, Max (+) and (-) Peak code (A-law/G.711), Coder offset, Peak Coder offsets; positive and negative may be determined.

Drop and Insert BER Tests In-Service – The Puma 4600E Test Set supports full Drop and Insert testing. This allows m & n x 64kbps services to be tested in contiguous and non-contiguous time slot assignments. This type of testing ensures that all DACS and MUX equipment is correctly configured for the planned sequence of timeslots and that the integrity of these sequences is maintained across a network. The Puma 4000 series has two E1 transmit ports and two E1 receive ports for fully Bi-directional Drop and Insert Test modes that allow m & n x 64kbps circuits to be simultaneously tested in both directions with a single unit.

E1 (2048 Kbit/sec) PCM Functions

Out-of-service Testing

Verification of E1 transmission – The Puma 4600E Test Set can check the integrity of the E1 faults and perform acceptance tests. Using two units, one at each end of the circuit, allows verification of performance in both directions. BER Tests may be performed over the entire 2048 kbit/sec link using either a G.703 unframed or G.704 framed HDB3/AMI signal. The ability to inject errors in the pattern, framing and alarm bits enables the user to verify tests and examine error response. The instrument has one of the most extensive ranges of patterns available including; user defined (up to 32 bits), fixed 4 and 8 bits, QRSS, PRBS patterns from 23-1 to 232-1. The instrument has conformity to ITU-T O.151, O.152, O.153, thus allowing the network to be stressed intensively.

G.821, G.826, M.2100 Results – The Puma 4600E Test Set allows all relevant BERT results including G.821, G.826, M.2100 and other measurements to be easily evaluated. Results can be stored, recalled and printed.

Slips Analysis – The Puma 4600E Test Set allows both Pattern Slips and Clock Slips to be detected and counted.

Frequency Offset – Marginal network components can be isolated with the frequency offset feature. The instrument may transmit using a fixed frequency offset thus simulating the stress placed on network equipment when timing problems exist.

Propagation Delay – The Puma 4600E Test Set can measure propagation delay across a network with a resolution of 1μS.
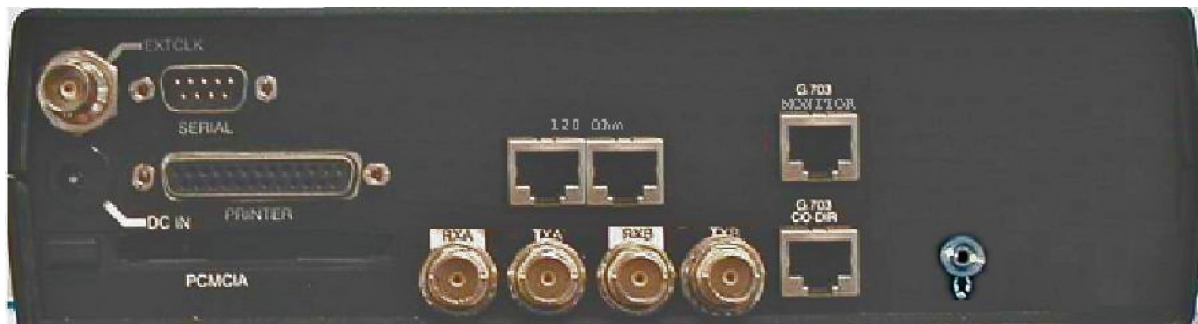
The 4600E has the following test connections:

ATS-QSIG G.703 Co-dir. (64kbit/sec) Channels – RJ45 Tx plus Dual Rx (120 Ohm balanced)

E1 (2048 bit/sec) PCM (120 Ohm balanced) – Dual RJ45 connectors for 2 full Tx/Rx channels

E1 (2048 bit/sec) PCM (75 Ohm unbalanced) – Dual BNC connectors for 2 full Tx/Rx channels

G.703 Co-dir. (64kbit/sec) Channel – RJ45 single Tx/Rx (for Mux/Demux tests)

Serial Control/Printer Port – 9-way D-type connector

Parallel Printer Port – 25-way D-type connector

External Clock Input – BNC (TTL Level)

Headset Socket – 2.5mm Jack

GENERAL SPECIFICATION

Display	Full Resolution VGA – 640 x 480 pixels 125 x 95 mm with back-light, Monochrome
Status LEDs	16 Quad-state LEDs, assigned according to test mode, user selectable small and large legends
Hot Keys	8 soft function keys, assigned according to test mode
Other Keys	Screen cursor control, Run/Stop, screen contrast control, speaker On/Off and volume control, Power On/Off
Battery Operation	Rechargeable Nickel Metal Hydride, up to 8 hours operation (mono display), graphic display of charge remaining with hours and minutes indication. LED indicating battery state.
Keyboard lock	Prevents keyboard operation – key sequence to activate and de-activate
Printer Features	Serial or parallel port connection, BERT result printing on demand or routine including G.821, G826*, M.2100*, event log printing, M.2100* report printing from E1 line monitor mode. Serial: 9 pin D-type, 300 to 115200 baud, fully configurable Parallel: Standard 25 way 'D'
Serial Port loading	RS232 - 9 pin D-type, 300 to 115200 baud, fully configurable – for serial printers, uploading results, Remote Control, software
Remote Control	Uses Remote Control command language to set up tests, retrieve results. Operates via RS232 port.
Self-test	The unit self tests on power up, the pass/fail result of each test is shown on the self test result screen
Result and Configuration Storage	500 Kbytes of non-volatile internal memory storage (NVRAM) for result sets, test configurations and event logs. Also, PCMCIA storage cards (4/8 Mbytes) can be used for additional storage.
Software and Option Upgradeable in the Field	The operating software can be upgraded in the unit in the field via the RS232 port or via PCMCIA card. Also software options can be enabled in the unit in the field via the RS232 port or via the front panel keypad.
VT100 Terminal Emulator	All units have a VT100 style Terminal Emulator which operates through the RS232 serial port. User data entry is via the front panel keypad or a screen based virtual keyboard.
Factory Reset Option	At any time the Factory Reset Option can be activated to set the unit back to default factory conditions.
Protective Rubber Boot	The unit is supplied with a protective rubber boot
Dimensions/Weight	Approx. 235 x 175 x 65 mm, Approx. 2 kg including all Interfaces

Find out more about EXFO's extensive line of high-performance portable instruments by visiting our website at **www.EXFO.com.**

Rugged Handheld Solutions

OPTICAL	DSL/COPPER
- OLTSs	- ADSL/ADSL2+, SHDSL, VDSL test sets
- Power meters	- VoIP and IPTV test sets
- Light sources	- Ethernet test sets
- Talk sets	- POTS Test sets

Platform-Based Solutions

OPTICAL FIBER	DWDM Test Systems	Transport/Datacom
- OTDRs	- OSAs	- SONET/DSn (DS0 to OC-192) testers
- OLTSs	- PMS analyzers	- SDH/PDH (64 kb/s to STM-64c) testers
- ORL meters	- Chromatic dispersion analyser	- T1/T3 testers
- Variable Attenuators		- E1 testers
		- 10/100 and Gigabit Ethernet testers
		- Fibre Channel testers
		- 10 Gigabit Ethernet testers

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