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FM/AM-1600S/CSA
Cellular Protocol Analyzer

Ideal for conformance and protocol testing of UWC-136 base stations and terminals



- Industry accepted protocol analyzer for TIA/EIA-136 conformance testing
- Dual-Band, 400/800 MHz cellular
- TIA/EIA 553A protocol compliance testing
- Analog/digital authentication compliance testing option
- TIA/EIA-136 handoff test capability
- Fully automated remote testing ability with RS-232 or IEEE-488 (GPIB) interfaces
- Intuitive test set up screens for easy "Guided" user testing
- Full featured 1 GHz service monitor with a full range spectrum analyzer and tracking generator
- Easy to read color display simplifies analysis of complex protocols

Full Featured TIA/EIA-136 Test Solution

The FM/AM-1600S/CSA provides you with the industry's only fully approved test solution for TIA/EIA 553A analysis. The FM/AM-1600S/CSA is accepted for confirming the proper operation of the critical dual mode analog/digital authentication procedure. It also offers a complete suite of tools for comprehensive signaling protocol compliance testing of TIA/EIA-136 dual mode TDMA/DAMPS phones on all the world's cellular frequency assignments below 1 GHz.

The FM/AM-1600S/CSA provides both base station and mobile phone conformance test capabilities.

The AC1036 conformance test option verifies and thoroughly documents that your handset's signaling software conforms to current TIA/EIA-136 series specifications.

AMPS Solutions

Engineered to be a flexible test solution, the FM/AM-1600S/CSA also incorporates AMPS and NAMPS mobile terminal and base station signaling compliance test features as well as standard radio measurements.



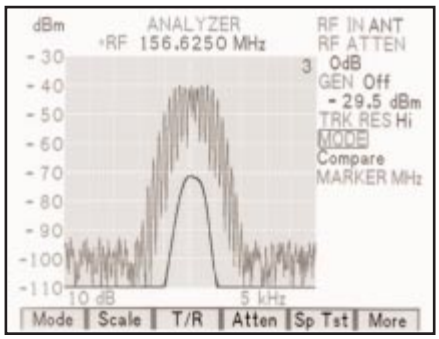
Full AMPS testing modes are available with the FM/AM-1600S/CSA

As a true dual mode solution, the FM/AM-1600S/CSA incorporates AMPS and NAMPS mobile terminal tests as a standard feature. Optional base station testing routines, unique to the type of infrastructure under test, automate cell site testing chores so that maximum network quality is easily maintained. Automatic test routines and user defined print outs enhance manual mode testing for both mobiles and base sites.

Comprehensive control channel simulations, voice channel signaling, home/roam condition, SID assignments, SAT, DSAT, DST, DCC, SINAD reference points, RF power windows, and other helpful functions and signaling manipulation tools let you test analog AMPS/NAMPS systems and radios as thoroughly as you need to.

A Full Complement of Radio Test Set Functions to 1 GHz.

The FM/AM-1600S/CSA gives you full frequency domain analysis to 1 GHz with a fully featured spectrum analyzer and tracking generator.



The FM/AM-1600S/CSA gives you full featured service monitor functions.

The FM/AM-1600S/CSA also offers a full complement of traditional service monitor features including a full scan digitized oscilloscope to 1 MHz, a DVM, SINAD meter and functions, frequency and channel tables, selectable IF filters, and a wide variety of displays.

In addition to the full coverage 1 GHz RF generator, the FM/AM-1600S/CSA also gives you full audio/data generator

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capabilities, full level control and measurement facilities of modulation, and precision power meter features for enhanced sensitivity and high accuracy testing needs.

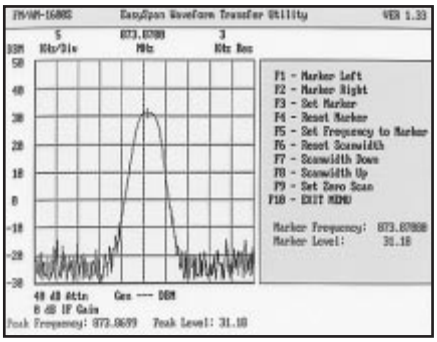
Analog paging encoding/decoding, DTMF, tone coded squelch, digital squelch, AM modulation/demodulation with two separate AF generators and a cross band duplex feature gives you added test versatility in a variety of public and private wireless systems.

Software Options Make Complex Testing Simple

As with every IFR test set, you get the advantage of IFR applications engineering support.

Our comprehensive portfolio of application software options is designed to automate and expand the functionality of your instrument.

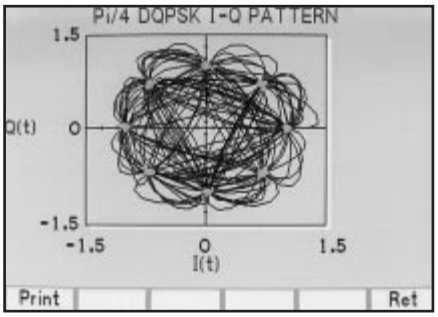
Plus, on-going software support means that you can easily upgrade your FM/AM-1600S/CSA when standards definitions or test and service requirements change.



- AC1009W - EasySpan is a Windows-based software utility which extracts spectrum analyzer and tracking generator traces from the IFR FM/AM-1600S/CSA to a PC for further off-line analysis.
- AC1011 - Simultaneously analyzes the signal strength or channel activity of up to three voice channel groups or 100 frequencies.
- AC1012 - AutoCell 882 is a comprehensive test package for Ericsson model 882 base station transceivers.
- AC1017 - AutoCell-Series II is a comprehensive program for FCC compliance testing of Lucent Series II cell sites.
- AC1018 - Provides automated testing and calibration of Motorola HD-II/LD cell sites.
- AC1019 - EasySweep is a swept measurement utility designed to test antennas and transmission lines.
- AC1020D - AutoCell NT and AutoCell NTD provides automated testing of Northern Telecom cell sites.

Dynamic IQ Constellation Display Simplifies Analysis

The FM/AM-1600S/CSA provides you with a dynamic, high speed constellation display for precise RF modulation analysis of π/4 DQPSK digitally modulated waveforms from 10 MHz to 1 GHz. This unique FM/AM-1600S/CSA feature gives a near-real time display of digital modulation characteristics that points out the cause of the trouble in digital radios.



IQ Constellation display allows for comprehensive digital modulation testing

Complex Functionality Made Easy

Even with its elaborate capabilities, the FM/AM-1600S/CSA was developed to execute complex tests simply and with minimal operator training.

Using field-proven front panel and user man-machine interfaces, the FM/AM-1600S/CSA gives you the performance and ease-of-use features that significantly reduce your testing and training time.

Its test macro command programming language (TMAC) can be easily configured to perform complex automatic tests on base stations and terminals (including single and multi-mode as well as single and multi-band radios), and baseband equipment. This powerful capability allows you to create and save simple "one button" test routines for future use. This flexibility means you can create and execute complex and repeatable routines no matter what your level of expertise.

A color display gives FM/AM-1600S/CSA users vivid screen clarity. Extensive use of softkeys reduces your complex cellular and PCS parametric and protocol tests to fast, simple and manageable routines.

Specification

RF Signal Generator

(T/R & DUPLEX CONNECTORS)

Frequency Range
400 kHz to 999.9999 MHz

Resolution
100 Hz

Accuracy
Same as Master Oscillator

Output Level Range (T/R)
-137 dBm to 0 dBm into 50 Ω
(-40 dBm maximum with reverse power present)

Duplex Level Range
-120 dBm to + 7 dBm or into 50 Ω

Duplex Resolution
0.1 dB

Level Accuracy (T/R)
±1.5 dB (level ≥-110 dBm)
±2.5 dB (levels from <-110 dBm to -127 dBm)

Duplex Level Accuracy
±1.5 dB (level ≥-100 dBm)
±2.5 dB (levels from <-100 dBm to -120 dBm)

VSWR (T/R)
<1.35:1 typical

Duplex VSWR
<1.38:1

INPUT PROTECTION

(T/R)
See RF Power Meter

(DUPLEX)
65 W (15 seconds with alarm)

SPECTRAL PURITY

Harmonics
<-26 dBc

Non-Harmonics
<-50 dBc

Residual FM
<10 Hz (RMS, 0.3 kHz to 3 kHz BW)

Residual AM
<0.05% (RMS, 0.3 kHz to 3 kHz BW)

SSB Phase Noise
<-90 dBc/Hz (25 kHz offset)
<-85 dBc/Hz (25 kHz offset, f_c ≥930 MHz)
<-80 dBc/Hz (25 kHz offset, f_c <1 MHz)

Modulation

Internal FM Range
Off, 100 Hz to 100 kHz Dev

Accuracy
±5% (1 kHz to 25 kHz Dev, 1 kHz rate)
±7% (<1 kHz Dev and >25 kHz Dev, 1 kHz rate)

Resolution
100 Hz (≤ 25 kHz Dev)
500 Hz (>25 kHz Dev)

Rate
Off, 30 Hz to 40 kHz
(≤ 20 kbs digital)

Waveforms
Sine, Square, Triangle, Ramp and Pulse

Distortion
<1 % (1 kHz rate, 0.3 kHz to 3 kHz BW, 1 kHz to 25 kHz deviation)

INTERNAL AM RF GENERATOR

Range
500 kHz to 999.9999 MHz

Internal AM Range
Off, 1% to 90%

Accuracy
±5% of setting (30% to 90% modulation, 1 kHz sinewave)
±10% of setting (30% to 90% modulation, 1 kHz sinewave f_c < 1 MHz)

Resolution
1 %

Rate
100 Hz to 10 kHz

Waveforms
Sine, Square, Triangle, Ramp and Pulse

Distortion
<1% (30% to 70% modulation, 1 kHz sinewave, f_c >1 MHz, 0.3 kHz to 3 kHz BW)

Internal Phase Modulation Range
Off, 0.1 to 10 Radians

Accuracy
±10% (at 1 kHz rate, > 0.3 Rad)

Resolution
0.1 Radians

Rate
Off, 30 Hz to 6 kHz

Waveforms
Sine, Square, Triangle, Ramp and Pulse

Distortion
<2% (1 kHz rate, 0.3 kHz to 3 kHz BW, ≥0.5 Rad)

External
External inputs with the same characteristics as the internal modulation sources are supported.
A 10 Vp-p injection level is required to obtain indicated setting ±10%.

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Synthesizer Switching Speed Settling Time
1.5 ms (within 1 kHz of desired frequency, 1 MHz ≤f_c <100 MHz, 25 kHz steps)
2.5 ms (within 1 kHz of desired frequency, 400 kHz ≤f_c ≤999.9999 MHz, 100 Hz steps)

AF Signal Generators

AF GENERATORS #1 AND #2

Frequency Range
10 Hz to 40 kHz

Frequency Resolution
0.1 Hz (≤2 kHz), 1 Hz (>2 kHz)

Frequency Accuracy
±0.1%

Level Range
0.5 mV RMS to 2.5 VRMS (into 150 Ω)
Up to 3 VRMS (into 600 Ω)

Level Resolution
0.1 mV RMS (10 mVRMS to 200 mVRMS)
0.8 mV RMS (> 200 mVRMS)

Level Accuracy
±0.1 mV or < 3% (≤10 kHz, into 150 Ω)
±5% (10 kHz to 25 kHz, into 150 Ω)

SPECTRAL PURITY

THD
<0.25% (sinewave, 10 Hz to 1.1 kHz, >100 mV RMS)
<1% (sinewave, 1.1 kHz to 35 kHz, >100 mV RMS)

Waveshape
Sinewave, Square, Triangle, Ramp and Pulse

Audio Frequency Counter

Range
10 Hz to 40 kHz (in 4 decade ranges)

Accuracy
Same as Master Oscillator

Resolution
0.1 Hz (10 Hz to ≤2 kHz)
1 Hz (>2 kHz to ≤20 kHz)
10 Hz (>20 kHz to 40 kHz)

Input Waveform
Sine or Square

External Level
0.5 VRMS to 30 VRMS (SINAD/BER input)
0.1 VRMS to 3.5 VRMS (EXT MOD input)

Impedance
1 MΩ (SINAD/BER input)
100 kΩ (EXT MOD input)

Signal Selections
Demod Audio
SINAD/BER
AF Generators
RF Power
External Audio

RF Counter

RF COUNTER

Frequency Range
250,000 Hz to 999,999,990 Hz

Accuracy
Same as Master Oscillator

Resolution
1 Hz (f_c <20 MHz)
10 Hz (f_c ≥20 MHz)

Level
-10 dBm to +50 dBm (T/R connector)
-80 dBm to +10 dBm (ANT connector)

RF Frequency Error Meter

Digital Meter Range
0 Hz to ± 150 kHz

Bar Graph Meter Range
0 to ±100 kHz (in 4 decade ranges)

Accuracy
Same as Master Oscillator

Resolution
1 Hz (±1 Hz to ≤ ±10 kHz)
10 Hz (> ±10 kHz to ±150 kHz)

Level
-10 dBm to +50 dBm (T/R connector)
-80 dBm to +10 dBm (ANT connector)

RF Power Meter

Frequency Range
1.5 MHz to 1 GHz

Input Level
0.2 mW to 200 W

Ranges
20 mW to 200 W full scale (1-2-5 sequence)

Resolution
0.1 mW

Accuracy
±10% ±2 counts

VSWR
<1.15:1 (0.25 MHz ≤ f_c ≤100 MHz)
<1.23:1 (100 MHz <f_c ≤400 MHz)
<1.38:1 (400 MHz <f_c ≤999.9999 MHz)

Receiver

Frequency Range
400 kHz to 999.9999 MHz

Sensitivity
≤2 µV for 10 dB SINAD
(1 kHz rate, 6 kHz Dev, FM 1)

	RX IF Selectivity Bandwidth	*AF Mode Bandwidth*
FM 4	300 kHz	100 kHz
FM 3	300 kHz	20 kHz
FM 2	30 kHz	10 kHz
FM 1	30 kHz	3 kHz
AM 1	2.9 kHz	3 kHz
AM 2	30 kHz	10 kHz
USB	2.9 kHz	3 kHz
LSB	2.9 kHz	3 kHz
PM	30 kHz	3 kHz

Adjacent Channel Rejection

RX IF Bandwidth	*>30 dB Down*
300 kHz	±485 kHz maximum
30 kHz	±52 kHz maximum
2.9 kHz	±2.5 kHz maximum

DEMODULATION OUTPUT

Output Level (FM)
5 Vp-p ±10% (at full scale, into 600 Ω)

(PM)
40 mV RMS ±10% (5 Rad, into 600 Ω)

(AM)
1 VRMS ±10%
(80% modulation, into 600 Ω)

(SSB)
1. 15 VRMS ±10% (Beat tone, into 600 Ω)

DISTORTION + NOISE

(FM)
<2% (1 kHz rate, >1 kHz Dev, 0.3 kHz to 3 kHz BW)

(AM)
<2% (1 kHz rate, 30% to 90% modulation, 0.3 kHz to 3 kHz BW)

Impedance
<1 Ω

ANT Input Protection
≤65 W for 15 sec with alarm

FM Deviation Meter

Range
±100 kHz (± peak in 6 ranges)

Resolution
50 Hz (≤20 kHz ranges)
1 kHz(>20 kHz ranges)

Accuracy
±4% ±2 counts + source residual (300 kHz IF, <15 kHz rate)
±7% ±2 counts + source residual (300 kHz IF, ≥15 kHz rate)
±7% ± 2 counts + source residual (30 kHz IF)

Rate
100 Hz to 40 kHz

Carrier Range
400 kHz to 999.9999 MHz

Carrier Level
-10 dBm to +50 dBm (T/R connector)
-70 dBm to +10 dBm (ANT connector)

PM Deviation Meter

Range
0 Rad to 10 Rad (Peak)

Resolution
0.01 Rad (≤5 Rad)
0.1 Rad (>5 Rad)

Accuracy
±3% full scale ±1 count + source residual

Rate
300 Hz to 4 kHz

Carrier Range
400 kHz to 999.9999 MHz

Carrier Level
-10 dBm to +50 dBm (T/R connector)
-80 dBm to +10 dBm (ANT connector)

AM Modulation Meter

Range:
1% to 100%

Resolution
1 %

Accuracy
±5% of full scale ±1 count + source residual (30% to 90%)

Rate
100 Hz to 10 kHz

Carrier Range
400 kHz to 999.9999 MHz

Carrier Level
-10 dBm to +50 dBm (T/R connector)
-80 dBm to +10 dBm (ANT connector)

Distortion Meter

Distortion Range
0.1 % to 20 %

Resolution
0.1 %

Accuracy
±0.5 % distortion ±1 count (1 % to 10 %)
±2 % distortion ±1 count (>1 % to 20 %)

SINAD Meter

Signal Frequency
600 Hz to 1.4 kHz

Range
3 dB to 30 dB

Resolution
0.1 dB

Accuracy
±1 dB ±1 count (@12 dB SINAD)

Signal Level
0.1 VRMS to 30 VRMS (SINAD/BER input)

Error Vector Magnitude (EVM) Meter

Input Range
NT 400 Channels
Cellular 800 MHz Channels

Minimum Carrier Level
-60 dBm (ANT connector)

EVM Range
0 to 100 %

EVM Resolution
0.01 %

Meter Residual EVM
<2 % indication

Accuracy
±3.0% indication, ±1 LSD + meter residual EVM

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FM/AM-1600S/CSA

Digital Multimeter

VOLTMETER (DC/AC)

Ranges
200 mV to 2000 V (full scale, decade sequence, 1 MΩ)

Maximum Input (DC)
1000 VDC
500 VAC

Resolution
3.5 digit (maximum resolution 0.1 mV on 200 mV range)

Accuracy
±5% of full scale ± 1 count (AC, where ACV/kHz <140)
±1% of full scale ± 1 count (DC)

Frequency
DC, 50 Hz to 20 kHz

Input Impedance
1 MΩ (±5%)
150 Ω (±5%)
600 Ω (±5%)

OHMMETER

Ranges

200 Ω to 20 MΩ (full scale, decade sequence)

Resolution
3.5 digit (maximum resolution 0.1 on 200 Ω range)

Accuracy
±5% or 0.1 Ω (±1 count)

Current Meter (DC/AC)

Ranges
20 mA to 2 A (full scale, decade sequence, 20 A maximum when using external shunt)

Resolution
3.5 digit (maximum resolution 0.01 mA on 20 mA range)

Accuracy
±5 % or 0.1 mA ±1 count

Oscilloscope

Vertical BW
1 MHz (-3 dB)

Input Ranges
1 mV/Div to 50 V/Div (1-2-5 sequence, 8 divisions)

Max Input
200 V Peak

Accuracy
±5% of full scale
±10% of full scale (1 mV and 2 mV ranges)

Resolution
1 % of full scale/256 datapoints, 8 divisions

Coupling
AC, DC, GND

Horizontal Sweep Rate
1 μSec /Div to 100 mSec/Div (1-2-5 sequence, 10 divisions)

Accuracy
±1 % of full scale

Resolution
1 % of full scale/400 datapoints per sweep

External Input Impedance
1 MΩ (shunted by 27 pF nominal)

Internal Signal Routing
425 kHz IF
Demod Audio
Function Generator
SINAD/BER
RF Power
EXT MOD

Spectrum Analyzer

Range
400 kHz to 999.9999 MHz

Frequency Span Range
1 kHz/Div to 100 MHz/Div plus Zero Scan
(10 divisions in a 1-2-5 sequence)

Accuracy
±5% of span width + timebase accuracy

Display
Log 10 dB/Div and 2 dB/Div

Vertical Resolution
Full scale/1 dB full scale

Displayed Range (Dynamic)
60 dB (0 dB attenuation, span <1 MHz/Div)
70 dB (0 dB attenuation, 1 kHz/Div, Ant connector)

Bandwidth Switching Error
<2 dB (5 kHz/Div thru 1 MHz/Div)
<3 dB (<5 kHz/Div or >1 MHz/Div)

Overall Accuracy
±4 dB (10 MHz to 400 MHz) (normalized)
±5 dB (>400 MHz to 2010 MHz) (normalized)
±2 dB Log Linearity

Input Attenuator
0 dB, 20 dB, 40 dB (User selectable, ANT Input Port)
40 dB, 60 dB, 80 dB, (User selectable Pwr ≤2 W, T/R Port)
60 dB, 80 dB, 100 dB, (User selectable, Pwr >2 W, T/R)

Bit Error Meter (BER)

Range
1×10^{-1} to 1×10^{-5}

Data Rates
75, 150, 300, 600, 1200, 2400, 4800 bps and 16 kbps

Data Pattern Size
100 to 100,000 bits

Data Pattern Type
Random, Fixed and User Defined

Input/Output (I/O)

IEEE 488.1-1987 Internally Assigned GPIB Addresses
System Control Processor (GPIB Address=4)
TDMA Control Processor (GPIB Address=5)

RS-232 (Asynchronous) SCSI-1 External Video Port Operation Mode
EGA Compliant

Frequency Reference Ports
BNC Input for External 10 MHz Sync
BNC Output of Internal 10 MHz Sync

IQ Output Interface
BNC Connector

TDMA Timeslot Sync
BNC Connector

Master Oscillator

Frequency Standard
10 MHz (Nominal)

Temp Stability
±0.01 ppm (0 to 50°C)

Ageing
±0.1 ppm per year

General Characteristics

Dimensions
477 mm (18.8 in) wide, 187 mm (7.4 in) high, 635 mm (25 in) deep (with bail handle and front panel cover in place, without CSA)

Weight
21.8 kg (48 lb) without CSA
(60 lb) with CSA

Operating Temperature Range
0 to 50°C

Power Requirements

Line
85 - 135 to 180 - 260 VAC
50 to 400 Hz @ 200 W Maximum
170 W Typical

Display

Type
Color, CRT 70° deflection, inline

Size
172 mm (6.8 in) diagonal, 142 mm (5.6 in) wide, 132 mm (5.2 in) high

Resolution
640 pixel x 350 pixels.

Versions and Accessories

When ordering please quote the full ordering number information

Ordering Numbers	*Versions*
1600S	FM/AM-1600S Service Monitor
1600S-C	FM/AM-1600S Service Monitor with Certificate of Calibration
CSA4	CSA4 (IS-54, GPIB, UWC-136, TDMA, 400 & 800 MHz)
CSA4-C	CSA4 (IS-54, GPIB, UWC-136, TDMA, 400 & 800 MHz) with Certificate of Calibration
1600SNAMPS	FM/AM-1600S/CSA, NAMPS
1600SCSA4	CSA4 System (includes 1600S Service Monitor CSA4 with IS-54, GPIB, UWC-136, TDMA, 400 & 800 MHz) with Certificate of Calibration
1600SCSA4-C	CSA4 Systems (includes 1600S Service Monitor and CSA4 with IS-54, GPIB, UWC-136, TDMA, 400 & 800 MHz) with Certificate of Calibration
	Accessories
AC0300	TMAC User Manual
AC510	Paging Encoder
AC1009	EasySpan for DOS (Waveform Transfer Software)
AC1009W	EasySpan for Windows (Transfer Software)
AC1010	Easy-Com-FM (Land Mobile Test Software)
AC1011	EasyScan (Spectral Usage Software)(req. AC9157)
AC1012	AutoCell-882 (Ericsson 882 Test Software)(req. AC9157)
AC1017	AutoCell Series II (Lucent Series II Test)(req. AC9157)
AC1018	AutoCell-Motorola (Motorola LD & HD Test)(req. 1600SNAMPS and AC9157)
AC1019	EasySweep (Swept Antenna Measurements)(req. AC9157)
AC1020D	AutoCell-NTD (NT/Novatel/GE/NTTRU)(req. AC9157)
AC1021	CellScan Cellular Bar Graph RF Level Meter (req. AC9157)
AC1036	UWC-136 Conformance Software (req. CSA4)
AC1048	SSD Update & Authentication Test (req. CSA4)
AC1201	Telescopic Antenna
AC4101	Return Loss Bridge (5 MHz to 1 GHz)
AC4102	Return Loss Bridge Kit (5 MHz to 1 GHz) (includes AC1019)
AC4103	Return Loss Bridge Kit (5 MHz to 2 GHz) (includes AC1019)
AC8600	Maintenance Manual
AC8645	Microphone
AC9153	Carrying Case
AC9154	NT400 System Test (req. CSA4)
AC9155	AMPS Cellular System Analyzer
AC9156	AMPS Mobile Station Test
AC9157	2.5 MB Flle System
AC9158	Rubidium Time Base

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