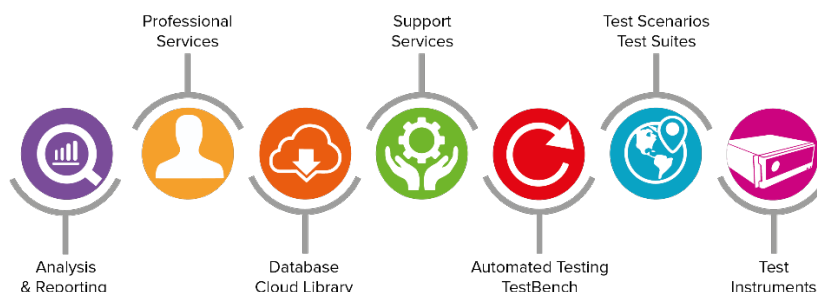


Spirent **GSS6450** Multi-frequency Record & Playback system



Spirent **GSS6450 Multi-frequency Record & Playback System**

Purpose of this document

This datasheet describes the operation and performance of Spirent's GSS6450 GNSS Record\Playback & Playback only systems and is intended to assist potential users in making a purchase decision. This document forms part of the contract of sale, but is subject to change.

A detailed user manual is supplied with the unit to guide the user in its operation.

NOTE: The GSS6450 is a modular platform and can be purchased with various options. Unless otherwise indicated this document refers to all options. Where information is included which refers to only one option this will be clearly indicated in the text or in the paragraph heading. For further information about options please refer to the performance specification tables provided.

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Table of Contents

Purpose of this document	2
Table of Contents	3
List of Tables	4
List of Figures	4
Key Features	5
About the GSS6450 Record & Playback System	6
Product Variants	11
Operation Overview	16
Performance Specifications	22
Physical and Environmental	27
Safety and EMC Conformity	27
System Variants and Options	29
Deliverables	31
Glossary of Terms	33
Referenced Documents	34
For more information	35

List of Tables

Table 1 GSS6450 Hardware & Software Options 11

Table 2 GNSS Frequencies and Constellations Supported 13

Table 3 Estimated Recording Times PER Terabyte 19

Table 4 Data Recording File Formats Supported by the GSS6450 21

Table 5 Throughput Limitations 22

Table 6 General Specifications 22

Table 7 Connectivity 24

Table 8 Control Interfaces 26

Table 9 Physical and Environmental 27

Table 10 Deliverable Items 31

Table 11 Accessories 32

List of Figures

Figure 1 Supported GNSS Bands 7

Figure 2 GSS6450 RPS Rear Panel 10

Figure 3 GSS6450 RPS Main Screen 16

Figure 4 Built-in Web-Server Main Menu Page 17

Figure 5 Built-in Play Menu Page 18

Key Features

The GSS6450 GNSS Multiple Constellation Record Playback System (RPS) from Spirent is a simple and efficient way to capture real world GNSS and augmentation signals and replay them in the laboratory. The GSS6450 takes RF recording and playback systems to a whole new level of performance and flexibility, while being housed in a small, battery powered, portable case. The GSS6450 can record any GNSS signals currently available with bit depths up to 16 bits 'I' & 16 bits 'Q' and bandwidths of up to 50 MHz. The flexible product structure allows the system capability to grow with your testing needs.

❖ Key Features

- Multiple Constellations and Frequencies*
 - GPS, GLONASS, Galileo, BeiDou, QZSS
 - L1, L2, L5, B3
- Bit depth (I&Q – 4 or 8 or 16 bits) *
- Disk space * – 1 TB internal and 1 TB removable. (2 TB internal and removable drives available as options)
- Bandwidth (10, 30 or 50 MHz, depending on configuration)
- Control from front panel Touch Screen, over WiFi, webserver or scripts
- Highly Portable, complete with shoulder strap
- Fully integrated, no PC or external drives required
- OCXO used on record and playback for high frequency stability
- Record & playback of up to 4 video streams using webcams
- USB 3.0 supported. Allows data transfer to or from an external hard drive
- In-built GNSS receiver (L1-GPS, GLONASS, Galileo, BeiDou), can record NMEA data

❖ Recorder

- Record any 4 (depending on configuration) signals simultaneously
Record 2 bit signals for playback on a GSS6425
- Internal battery (record time up to 1.5 hours) and vehicle DC power adapter
- Single touch record
- Synchronous and asynchronous storage of external data
- Event markers

❖ Playback Functionality

- Attenuation across all channels or control per channel
- Browser control over network
- Batch file playback
- Configure files to play
- File start and stop times
- Start at any point in a file, to a resolution of 1ms
- Scripts allow inclusion in automatic test routines
- GSS6425 Compatibility mode to play back 2 bit files recorded on a GSS6425

Spirent GSS6450 Multi-frequency Record & Playback System

About the GSS6450 Record & Playback System

What the GSS6450 does

With the Spirent GSS6450 RPS, it's simple and quick to capture GNSS signals as they are received for subsequent use in a laboratory test environment.

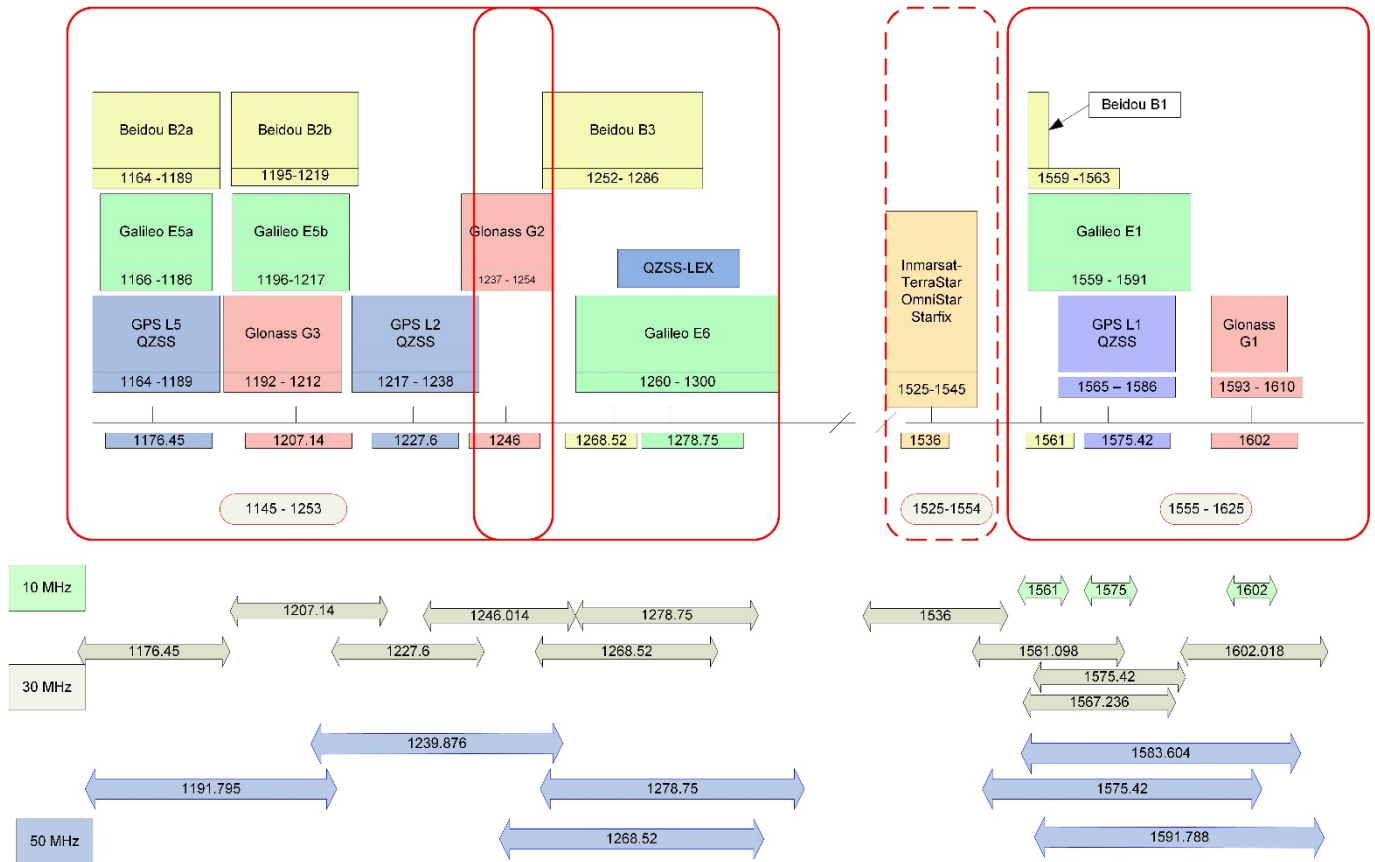
The GSS6450 RPS digitises and stores the RF signals from real GNSS satellites along with any interference observed in the GNSS bands. These recordings are then made available for subsequent playback, faithfully reproducing propagation effects such as multipath, fading, obscuration and interference to allow testing of GNSS chipsets, receivers and systems under realistic conditions. You save project, travel and engineering costs while improving product performance, quality and time to market.

The flexibility of the GSS6450 to record multiple frequency bands concurrently means the RPS can be used to test multi-GNSS chipsets and devices in automotive, navigation, aerospace, and defence and survey applications. The user can select different bit depths depending on their application and storage requirements.

What signals are supported?

The GSS6450 Multi Constellation RPS can record and play back up to four GNSS frequency bands as described in Table 2 and within the throughput capacity limits in Table 5. Throughput capacity is a function of the bandwidth selected and the bit depth. Each band may contain several GNSS signals. For example, if the frequency you select is 1176.45 MHz the RPS will automatically record both the GPS L5 and Galileo E5a GNSS signals. You can select particular frequencies using the front panel Touch Screen or Web Server. Figure 1 shows the frequencies and constellations the RPS supports, with the red boxes representing the GSS6450 internal filters. You can record and playback any frequency and signal shown within the red boxes.

- GPS\SBAS, GLONASS, Galileo, BeiDou and regional signals
 - GPS L1 (C/A, L1c, P(Y) and M)
 - GPS L2c, P(Y) and M,
 - GPS L5 signals
 - GLONASS L1 (C/A, P), L2 C/A,P, L3
 - Galileo E1(B and C), E5a, E5b E5ab, E6 (authorised users only)
 - BeiDou B1, B2, B3
 - QZSS L1 (C/A, SAIF, L1c), L2c, L5, L6
 - SBAS L1, L5 (WAAS, EGNOS, MSAS, GAGAN)
 - IRNSS L5
- Nominal Bandwidths
 - 50 MHz (Wide)
 - 30 MHz (Medium)
 - 10 MHz (Narrow) for L1/E1/B1 civil signals
- Bit Depth (I and Q)
 - 4 bits
 - 8 bits
 - 16 bits



Note: Actual bandwidths are 10.23 MHz, 30.69MHz and 51.15 MHz.

Figure 1 Supported GNSS Bands

If you use satellite based corrections distributed using Inmarsat around the 1542 MHz frequency band, your GSS6450 can also record these corrections (this is available upon request).

GSS6425 Compatibility Mode

The GSS6450 can play back any GSS6425 recordings, once they are uploaded to the GSS6450; or you can record data for playing back on a GSS6425 on a GSS6450. This is provided that the same signals are enabled on both units. Note that the format of the video files on the GSS6450 and GSS6425 are different and so video files are not transferrable.

What's in the box?

- GSS6450 Record and Playback System
- Appropriate antenna¹ with 3 metre cable
- External Power supply with mains cable
- 12 Volt vehicle power adapter

¹ For most users, Spirent recommends using the supplied antenna. For other applications, Spirent advises using active antennas compatible with 3.3 V or 5 V input voltage, with a maximum 100 mA current.

Spirent **GSS6450** Multi-frequency Record & Playback System

- CD with operating manual loaded
- Ethernet cable
- 1 or 2 TB removable SSD
- DC block
- Shoulder strap
- Lens cloth
- Quick Start Guide
- Carry case
- USB 3.0 cable for connection of removable drive to PC
- An optional USB Wi-Fi dongle is available to control the GSS6450

Why you might need the GSS6450?

The GSS6450 Record and Playback System reduces your field-trial and travel costs substantially by allowing you to record real-life GNSS signals (including real world fades, multipath and in-band interference) onto the internal SSD of the RPS.

Once you have recorded this data you can repeatedly play it back into your system under test in the comfort of your own lab, without the need to return to the field, saving you time and money.

Typical Applications include:

- Software and Hardware Testing
 - Repeatability tests
 - Manufacturing test
 - Performance analysis
 - System trials
- Algorithm studies
 - Position
 - Multipath
 - Sensitivity
- Interference Monitoring and jamming
- Application Sectors:
 - GNSS chip and board design
 - Aerospace and Defence
 - Survey
 - Research
 - GNSS Product Manufacturers

How it works

The GSS6450 RPS employs a low noise amplifier for optimum overall system noise performance prior to down-converting to IF for digitising. An AGC circuit caters for a wide range of active or passive antenna gains. Standard antennas with gains of up to 27 dB and 3.3 or 5 Volt nominal DC power can be used directly.

The digitised IF is stored on an internal 1 TB SSD giving up to 25 hours² of record time. Along with the data file containing the digitised signals, an accompanying information file is automatically generated containing details such as record time and date. You can add further data to this file for record keeping purposes. The internal hard disk contains the Linux file system together with the applications and all user data. You have more than 900 GB available to store signal data. You can plug a second removable SATA drive into the front panel SATA port. This second drive is a bare drive without a housing, plugging directly into the SATA port.

The GSS6450 incorporates a 1.5 GHz quad core AMD-G Series processor with 8 GB RAM, which runs the Linux Mint operating system. You can add your own applications and scripts to this PC; simply add a display and keyboard (not supplied) to see the Linux Desktop. The Webserver is also available from the Desktop.

Several sampling options are available. 2 or 4 bit sampling is suitable for commercial applications testing while keeping data storage levels down; the full 16 bit sampling provides a much larger dynamic range for interference and jamming testing scenarios.

You can record serial data streams (such as 1PPS timing signals and dead-reckoning sensor data) synchronously with the raw GNSS signal. The data is stored in the SAME file as the raw GNSS signal, so playing back the GNSS signal file synchronously plays back the data. You cannot separately download the stored data. You can record two Synchronous Inputs per frequency recorded, up to a maximum of eight synchronous inputs.

During any recording session you can log data on the Serial COM 1 port to a file. The RPS stores these files separately from the GNSS signal data, and you can separately view, download or edit them. You can add a timestamp to the serial data. NMEA data from the internal GNSS receiver can also be stored to a file.

You can record or playback Video files through the attachment of a Webcam to any of the four USB ports. Therefore up to four video streams can be stored at any time. Video files, although stored separately from the main GNSS data file, will play back within 0.5 seconds of the GNSS data, with a potential drift rate of 0.25 seconds per hour.

On playback the IF signal is recreated and then up-converted to RF at the relevant GNSS frequency using the same built-in oven stabilised local oscillator (OCXO) as used to record the data for minimum phase noise. A stepped attenuator provides attenuation across all channels in 1 dB steps up to a maximum of 31 dB. You can add an additional 31 dB attenuation, in 1.0 dB steps on a per channel basis, allowing you to vary the replayed signal levels with respect to each other, or balance the C/No values as reported on an attached GNSS receiver. You can turn on, or off, individual signal channels using the webserver.

You can also configure the RF output standard, or high-level, using a switchable 30 dB attenuator. The high-level setting (attenuator disabled) is nominally 30 dB higher than when set as normal output (attenuator enabled).

Typically, the GSS6450 RPS plays back recorded signals within 1 to 2 dB of the original signal levels as seen on an attached GNSS receiver.

The GSS6450 includes an internal, L1 only, GNSS receiver that allows you to view the satellites tracked during recording or playback. The internal receiver shows GPS and Galileo signals with either GLONASS or BeiDou. The front panel display and Webserver let you view C/No levels and position of the GSS6450.

You can synchronously start recording or playback of the GSS6450 on receipt of a pulse at the AUX port. This is useful for synchronising record/playback with other systems.

The GSS6450 is available in a Replay only configuration; for which the performance is identical to the GSS6450 RPS, except the record functionality is absent.

² Refer to Table 3 Estimated Recording Times PER Terabyte for more details

Spirent **GSS6450** Multi-frequency Record & Playback System

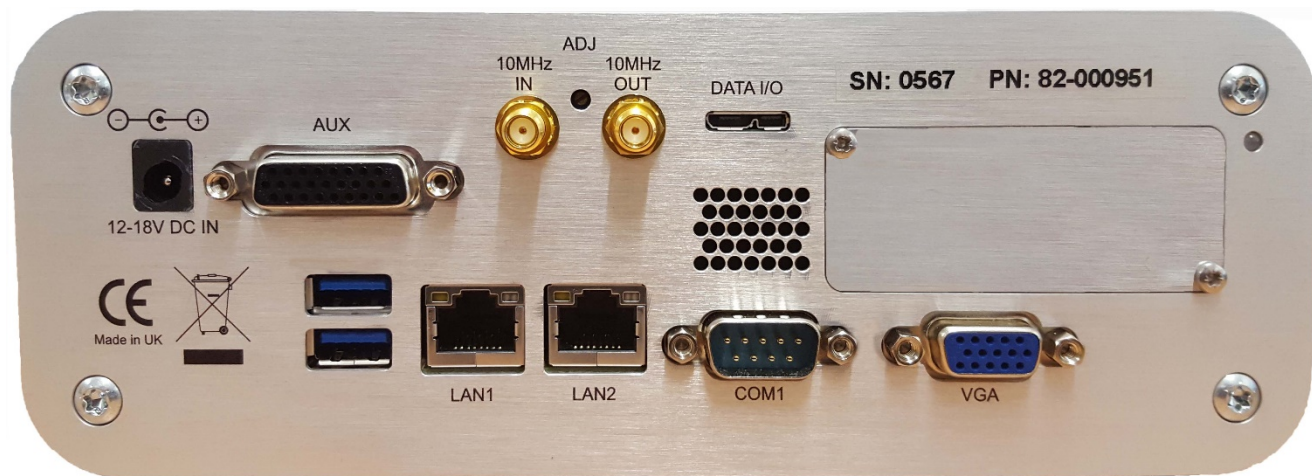


Figure 2 GSS6450 RPS Rear Panel

Product Variants

GSS6450 is a flexible test platform, comprising of hardware and software components. You can add capabilities to the system by adding various options, see Table 1.

For any standard system, it is **mandatory** to have a hardware chassis (A, B, C or D) with a GNSS Constellation Band option (E to J). The Base system is pre-configured with 10 MHz bandwidth; two, 1 TB SSDs (1 x 1TB internal, 1 x 1TB removable) and 4 bits quantization. For bit depths of 8 or 16 bits choose the appropriate Bit Depth Option (N, or O). For Constellation Bands requiring 30 MHz bandwidth (H, I, J, L and M) you must purchase the 30 MHz option (P) or the 30/50 MHz option (Q).

Table 1 GSS6450 Hardware & Software Options

Product Elements	Options	With 10 MHz Bandwidth	With 30 MHz Bandwidth option	With 30 /50 MHz Bandwidth option
Hardware Chassis \ Type (Base system)	A. Record & playback (std) B. Replay ONLY (std) C. Record & playback (Inmarsat) D. Replay ONLY (Inmarsat)			
	Constellations	10 MHz	30 MHz	30/50 MHz
GNSS Constellation Band (centre frequency MHz) <i>(option)</i> <i>Table 2 shows a complete list of constellations that can be recorded at selected centre frequency and bandwidth</i>	E. GPS, GAL, BEI L1	1561.098 1575.42	NA	NA
	F. GPS, GAL, GLO L1	1575.42 1602.018	NA	NA
	G. GPS, GAL, GLO, BEI L1	1561.098 1575.42 1602.018	1567.236 1561.098 1575.42 1602.018	NA
	H. GPS L1, L2	1575.42	1575.42 1227.6	NA
	I. GPS L1, L5	1575.42	1575.42, 1176.45	N/A

Spirent GSS6450 Multi-frequency Record & Playback System

Product Elements	Options	With 10 MHz Bandwidth	With 30 MHz Bandwidth option	With 30 /50 MHz Bandwidth option
	J. GNSS L1, L2, L5, B3	1561.098 1575.42 1602.018	1176.45 1207.14 1227.6 1246.014 1268.52 1561.098 1567.236 1575.42 1602.018	1191.795 1239.876 1268.52 1575.42 1583.604 1591.788
	K. GNSS L1, L2,L5, B3, E6	Please contact Spirent for more information.		
	L. Inmarsat based augmentations		As J plus 1536 MHz, but minus B3 (1268 MHz)	
	M. QZSS L6		1278.75	
Bit Depth (I/Q Quantization) (option)	N. 8 bits O. 8 and 16 bits			
Bandwidth (option)	P. 30 MHz Q. 30 and 50 MHz			

Notes

1. Constellation band options E and F can record at 10 MHz only
2. With constellation band options E, F, H and I, you can simultaneously record and playback up to two RF centre frequencies. With options G, J, K and L you can record and playback up to four RF centre frequencies
3. You need 30 MHz (or 30 and 50 MHz) bandwidth options for constellation band options H, I, J, L and M, although you can choose 10 MHz bandwidths on the indicated signals. Please contact Spirent for any other configurations required, including recording Galileo E6
4. For complete flexibility (in most cases) you can upgrade the GSS6450 using a software key, you do not need to return your GSS6450 to Spirent for upgrades.
5. Overall product configurations and recording options are subject to the throughput constraints detailed in Table 5.

6. If you want to record Inmarsat based augmentation systems (Starfire, Terastar and so on) you need Base Chassis C or D. You must also purchase the 'Inmarsat based augmentations' Option L, and the 30 bandwidth option P, or the 30/50 MHz bandwidth option Q. You cannot use these systems to record BeiDou B3 or Galileo E6.
7. As an option both drives can be upgraded to 2TB.

Example product variant:

To order an RPS GSS6450 system that can record GPS L1, GLONASS L1 RF signals with 10 and 30 MHz bandwidth, and 4 bit quantization, you will need to order a system as follows:

- Option A: Record and playback hardware
- Option G: GPS L1 and GLONASS L1 constellation license
- Option P: 30MHz bandwidth

Table 2 GNSS Frequencies and Constellations Supported

Item	Centre Frequency, MHz	Constellations Supported	Bandwidth, MHz
1	1176.45	GPS L5 Galileo E5a QZSS L5 SBAS L5 IRNSS L5	30 or 50
2	1227.6	GPS L2 (L2c, P(Y) and M) QZSS L2c	30
3	1246.014	GLONASS L2 (C/A and P)	30
4	1583.604	GPS L1 (C/A, P(Y), L1c and M) Galileo E1 (B and C, with CBOC) QZSS L1 (C/A, SAIF, L1c with TMBOC) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN) GLONASS L1 (C/A and P) BeiDou B1 ** Note: you may notice up to 2 dB signal degradation on the upper channels of the L1 GLONASS signal	50

Spirent GSS6450 Multi-frequency Record & Playback System

Item	Centre Frequency, MHz	Constellations Supported	Bandwidth, MHz
5	1591.788	GPS L1 (C/A, P(Y), L1c and M) Galileo E1 (B and C, with CBOC)** QZSS L1 (C/A, SAIF, L1c with TMBOC) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN) GLONASS L1 (C/A and P) ** Note: you may notice up to 2 dB signal degradation on the E1 Galileo signal	50
6	1239.876	GPS L2 (L2c, P(Y) and M) QZSS L2c GLONASS L2 (C/A and P)	50
7	1561.098	BeiDou B1	10 or 30
8	1575.42	GPS L1 (C/A, L1c – BOC(1,1) only) Galileo E1 (B and C, BOC(1,1) only) QZSS L1 (C/A, SAIF, L1c – BOC(1,1) only) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN)	10
		GPS L1 (C/A, P(Y), L1c and M) Galileo E1 (B and C, with CBOC) QZSS L1 (C/A, SAIF, L1c with TMBOC) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN)	30
		GPS L1 (C/A, P(Y), L1c and M) Galileo E1 (B and C, with CBOC) QZSS L1 (C/A, SAIF, L1c with TMBOC) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN) BeiDou B1	50
9	1602.018	GLONASS L1 (C/A)	10
		GLONASS L1 (C/A and P)	30
10	1207.14	BeiDou B2b Galileo E5b GLONASS L3	30

Item	Centre Frequency, MHz	Constellations Supported	Bandwidth, MHz
11	1567.236	GPS L1 (C/A, L1c) BeiDou B1 Galileo E1 (B and C, with CBOC) QZSS L1 (C/A, SAIF, L1c – BOC(1,1) only) SBAS L1 (WAAS, EGNOS, MSAS, GAGAN)	30
12	1268.52	BeiDou B3	30 or 50
13	1191.795	BeiDou B2 Galileo E5 (E5a +E5b) GLONASS L3 GPS L5 QZSS L5 SBAS L5 IRNSS L5 ** Note: this setting is optimised for Galileo E5ab, there may be minor degradation on the other signals	50
14	1536.0	Inmarsat based SBAS (such as Omnistar, Terastar and Starfire)	30
15	1278.75	QZSS L6	30

Spirent GSS6450 Multi-frequency Record & Playback System

Operation Overview

The GSS6450 is extremely flexible in operation and can be operated:

- From the front panel Touch Screen
- Using a local monitor, keyboard and mouse
- Via the built-in web server using a suitable web browser
- Remotely using VNC
- Using shell scripts
- Wirelessly from a PC, Tablet or Smartphone

This flexibility caters for a range of situations from simple one-touch record operation for collecting field data to manufacturing operations where multiple GSS6450s can be monitored and controlled from a single PC over a standard Ethernet network.

Front Panel Operation

You can control most of the GSS6450 functions using the front panel touchscreen LCD display:

- 2.4" LCD-TFT display graphics
- 240 x 320 VGA resolution, RGB touch screen



Figure 3 GSS6450 RPS Main Screen

The following operations are available from the front panel:

- Start and stop playing and recording of files
- File management actions, such as deleting files or monitoring disk usage
- Ability to control location of recording and transfer of data
- Choose number of frequencies to record
- Use of a configuration file
- Adjusting settings, such as the attenuator
- Monitoring status, such as system status, battery level, IP address and software version

- Controlling asynchronous logging on each channel or synchronous logging
- Changing frequencies to record
- Powering and shutting down the system
- Choosing antenna voltage (3.3 Volts, 5 Volts or off)
- View the GPS/Galileo/GLONASS/BeiDou status of the internal receiver
- Single press “instant” record by holding down the “Start Record”

Front panel icons are multicolour, indicating:

- Power/ Battery status
- Record and antenna status
- Playback and attenuation status

Web Server operation

When the GSS6450 is connected to a network, you can view the dynamically assigned IP address on the front panel display by navigating to the appropriate status screen using the front panel scroll keys.

Using any suitable browser, you can navigate to the home page at the given IP address. You can then navigate the GSS6450 control menus by clicking on the appropriate “links” to adjust the GSS6450 settings.

You can also attach a display, keyboard and mouse to access the Webserver. With the optional Wi-Fi dongle you can control the GSS6450 from any Wi-Fi enabled platform, such as a PDA or tablet.

The web-server lets you perform a full range of operations, including configuring the GSS6450, managing files, transferring files between internal and external SSDs, controlling record and playback, adjusting attenuation settings, or changing the local time.

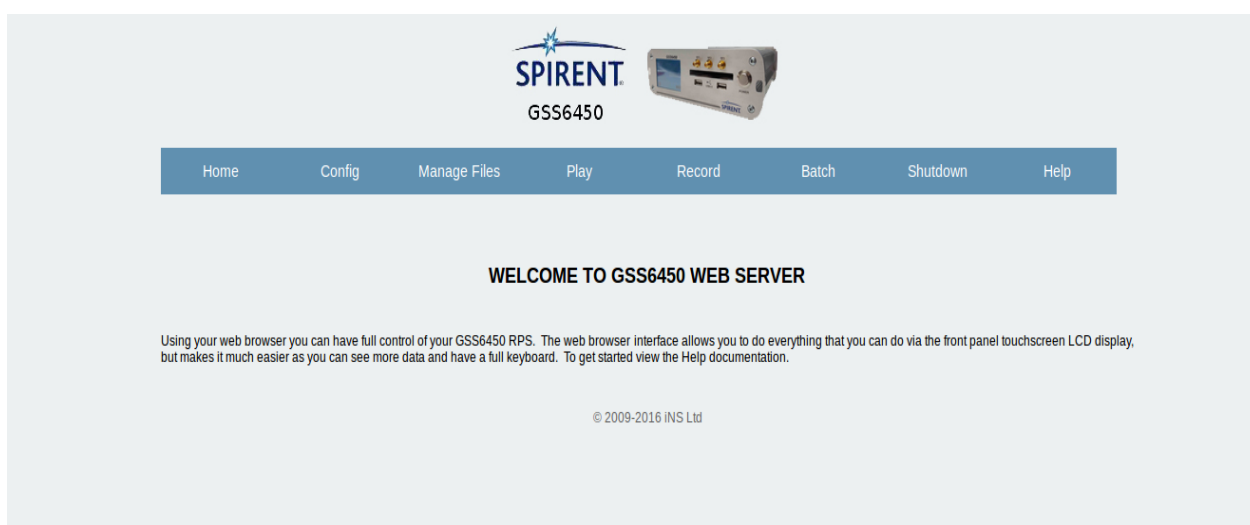


Figure 4 Built-in Web-Server Main Menu Page

Spirent GSS6450 Multi-frequency Record & Playback System

Additional features available through the Webserver include switching on or off a particular signal during playback, playing back part way into a file, or setting up a Batch replay mode. Batch replay mode allows the setting up of a number of files to playback, and for each file the user can choose the number of repetitions, alter the attenuation, or start or stop time within the file.

Remote Operation

You can manage the GSS6450 RPS over a network using its internal VNC server, rather than connecting an external monitor, keyboard and mouse. VNC is a powerful, easy to use and free software application that uses a network (or internet) connection to display the screen of one computer on a second, remote, computer.

The VNC application lets you use the mouse and keyboard of the remote computer to control the in-built Linux PC of the GSS6450, giving you the flexibility to control the GSS6450 RPS from a remote location.

To use the VNC connection you need to install a suitable VNC viewer on the remote computer. The VNC access allows you to manage your GSS6450 as local user, such as performing software updates, manage files, add users and so on.

You can also control the GSS6450 using HTTP POST and HTTP GET commands.

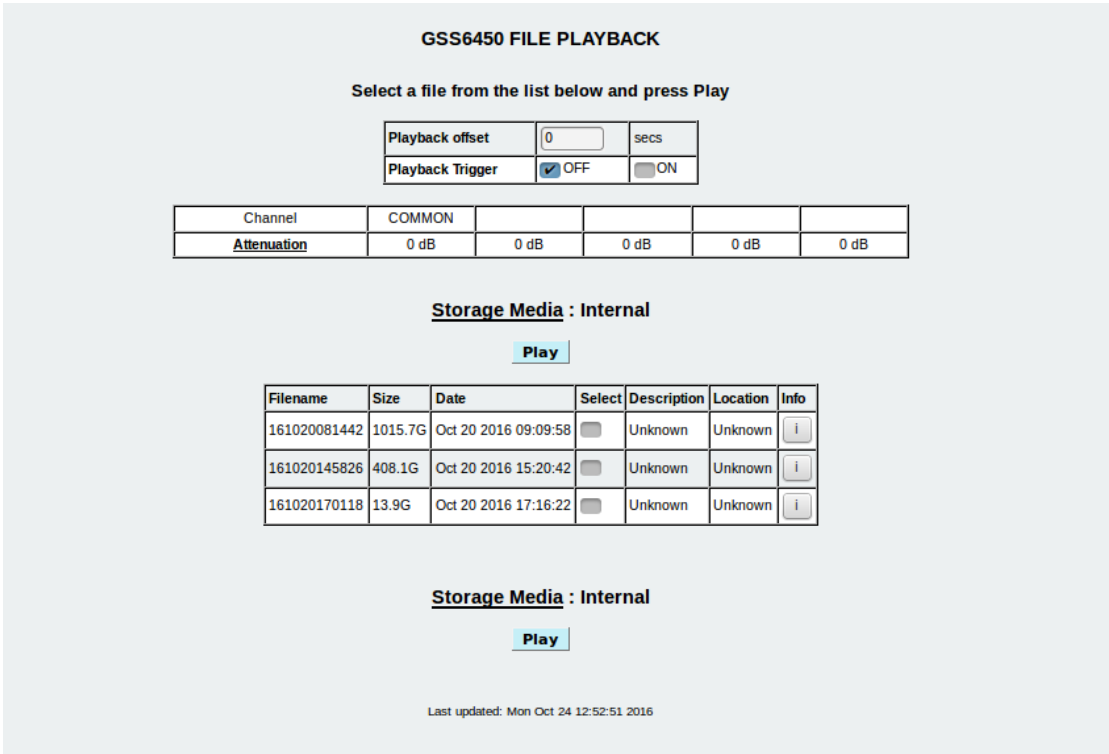


Figure 5 Built-in Play Menu Page

Data management

Table 3 shows estimated recording times.

Table 3 Estimated Recording Times PER Terabyte

Number of Frequencies recorded (4 bit)	Available Recording time* (hours)		
	Narrow Bandwidth (10 MHz)	Wide Bandwidth (30 MHz)	Ultra-Wide Bandwidth (50 MHz)
1	25	7.5	4.5
2	12.5	3.75	2.25
3	8.33	2.5	1.5
4	n/a	1.9	1.12

Number of Frequencies recorded (8 bit)	Available Recording time* (hours)		
	Narrow Bandwidth (10 MHz)	Wide Bandwidth (30 MHz)	Ultra-Wide Bandwidth (50 MHz)
1	12.5	3.75	2.25
2	6.25	1.9	1.12
3	4.17	1.25	0.75
4	n/a	0.94	0.66

Number of Frequencies recorded (16 bit)	Available Recording time* (hours)		
	Narrow Bandwidth (10 MHz)	Wide Bandwidth (30 MHz)	Ultra-Wide Bandwidth (50 MHz)
1	6.25	1.9	1.12
2	3.1	0.95	n/a
3	2.08	n/a	n/a
4	n/a	n/a	n/a

For easy storage of recorded files, you can transfer data between the Internal SSD and any Removable SSD or external drive. You can also upload data onto the Internal SSD drive. Notice you can record or playback directly from both the Internal and any Removable drive.

Spirent supplies each GSS6450 with its own FTP Server and Client. This allows fast transfer of data to a network or between units.

Spirent **GSS6450 Multi-frequency Record & Playback System**

Configuration Files allow you to change the following recording and playback options in the GSS6450.

- Attenuation Offset
- Attenuation Table (slope of the attenuation curve)
- Synchronous data recording using 0 bits (off), 1 or 2 bit stream recording
- Asynchronous Serial Port Communications Settings (baud), and assumes n,8,1
- Time stamp on/off for Asynchronous recording
- Set Antenna voltage

Batch mode allows a number of files to be played back in sequence, you can control:

- Files to play, and number of iterations
- File start/stop times
- Attenuation used in each playback
- Repeat in a continuous loop

A 'Trigger' feature lets the GSS6450 start recording or playing back based on an external pulse. You can use two GSS6450 connected in Master/Slave mode, which lets you record more signals. The synchronisation between two GSS6450 is better than 15 nanoseconds.

Data Recording File Formats

Table 4 Data Recording File Formats Supported by the GSS6450

Data Type	Description	File Extension
GNSS Signals (GSS6450)	GSS6450 stored GNSS data	.xgns
GNSS Signals (GSS6425)	Compatibility mode for playback of GSS6425 files	.gns
Serial Data	Data presented on the COM 1 port	.txt
Video Capture	Webcam video sources (0 to 3) captured in compressed MPG file format	.mpg
Scenario file	Information about the recording	.scn

Spirent will supply the format of the digitised data on request if you want to directly access the data.

Calibration Requirements

Spirent recommends you calibrate the OCXO annually by comparison to a known, accurate 10 MHz source (GPS or atomic clock derived). The calibration potentiometer is accessible on the rear panel without opening the GSS6450.

No other calibration is required

Spirent GSS6450 Multi-frequency Record & Playback System

Performance Specifications

Table 5 shows the allowed combinations of channel, bandwidth and bit depths that ensure you do not exceed data throughput requirements.

Table 5 Throughput Limitations

No of Channels	No of Bits per Sample	Bandwidth MHz		
		10	30	50
1	4	Y	Y	Y
	8	Y	Y	Y
	16	Y	Y	Y
2	4	Y	Y	Y
	8	Y	Y	Y
	16	Y	Y	N
3	4	Y	Y	Y
	8	Y	Y	Y
	16	Y	N	N
4	4	n/a	Y	Y
	8	n/a	Y	N
	16	n/a	N	N

Y: configuration allowed

N: configuration not allowed

n/a: configuration not allowed

Table 6 General Specifications

Feature		Item	Specification	Note
RF1	Frequency bands	RF in and Out	1161-1300 & 1550-1610 MHz	GNSS, up to four frequencies
	Bandwidth	Bandwidth 3 dB points	10.23, 30.69, 51.15 MHz	Same as sampling rate
	Noise Figure	System noise figure	< 3 dB	Measured at RF in
	Quantisation		2, 4, 8, 16 bits	Number of bits of both I and Q
	Sample Freq		10.23, 30.69, 51.15 MHz	
	RF output	Additive phase noise	Better than -45 dBC @ 1 kHz	
	I/F	Record/replay storage	baseband	4, 8 or 16 bit I and Q samples stored

Feature	Item	Specification	Note
Storage capacity	Internal SSD	1 TB	See Table 3
	Removable HDD	1 TB	
Attenuator	Internal stepped attenuator ³	31 dB in 1 dB steps, all channels plus 31 dB in 1 dB steps, per channel Ability to switch off a complete channel	
Asynchronous recording	External data recording on Serial Port	4800 to 115200 baud	Stored in editable log file. NMEA data from the internal GNSS receiver can be stored.
Synchronous recording	Eight channels of external data i/o on Aux port	Max suggested bit rate 300 kbps @ 10.23 MHz 900 kbps @ 30.69 MHz 1500 kbps @ 51.15 MHz	Data not editable Sampled at 1/8 th of the main sampling rate.
Built-in controller and web server	Operating System	Linux Kernel 3.2 or later	
Power	Internal Battery	90 Wh, 1.5 hr record or playback time ⁴	
	External Power	12 to 18 V DC 4.5 A	Rear panel 2.1mm socket
	PSU supplied	Input: 90 to 260 V AC	
		Output: 18 V DC	2.1mm DC jack
	Vehicle cigarette lighter adapter supplied	Cigarette lighter plug to locking 2.1 mm jack	
Warm up period	10 minutes before recording or playback		

³ You can use attenuation to recreate real-world effects, such as degradation of signals when using poorly designed antenna or obscured signals. The GSS6450 provides a simple way of attenuating signals and provides for overall or individual channel adjustment. However, the C/No ratios that an attached GNSS receiver reports may not change dB for dB with the input attenuation because of the way the GNSS receiver calculates its C/No ratio and adjusts its AGC. In wider bandwidth recordings it is possible that not all signals will decrease at exactly the same rate. For a given GNSS receiver, however, the results using the in-built attenuator will be repeatable. Spirent recommends using a simulator for high accuracy sensitivity testing.

⁴ 1.5 hours when operating at ambient temperatures in the range 0 to 30°C.

For ambient temperatures between 30 and 40°C, battery life may be reduced.

Spirent GSS6450 Multi-frequency Record & Playback System

Feature	Item	Specification	Note
OCXO	< +/- 1 x 10 ⁻¹¹ over 1 sec	Short term stability	
	< +/- 1 x 10 ⁻⁸	Temperature stability	
AGC	Min input power level -130 dBm	AGC presents optimum levels at the ADC for a Gaussian distribution over 90 dB input signal level range. Each signal has independent AGC control up to 50 dB.	
	Max input power level -40 dBm		
Dynamic Range	Based on an in-band CW jammer	Dynamic Range*	
		4 bits 21 dB	
		8 bits 45 dB	
		16 bits 80 dB	
Playback Offset		Can set the playback offset to 1ms	
Master/Slave time alignment		10MHz: Time alignment not guaranteed	
		30MHz: Typical: 7ns, max ~11ns	
		50MHz: Typical: 5s, max ~9ns	

Table 7 Connectivity

Category	Item	Specification	Note
Input	RF 1 GNSS (input/Output)	Front panel SMA	3.3 Volts nominal to power antenna 5 Volts as an option (user selectable) Limited to 100 mA by self-healing fuse
	RF 2 Wireless (input/Output)	Front panel SMA	Future option
	RF 3 Wideband (input/Output)	Front panel SMA	Future option
	Power	2.1 mm locking socket	12 to 18 Volts DC
	10 MHz reference	Rear panel SMA	-15 dBm into 50 Ohm

Category	Item	Specification	Note
	Video	Webcam	USB port Maximum four webcams (two front, two rear), depends on data storage rates
	Synchronous data	Aux Port	Two data channels, up to a maximum of eight, recorded per frequency logged
	Trigger	Aux Port	Three pins on port to synchronise two GSS6450, or with an external system
Output	RF 1-3	Front panel SMA (as above)	Use DC block supplied for any receiver supplying > 5 Volts
	10 MHz reference	Rear panel SMA	50 Ohm, -3 dB nominal Output during record or replay
	RF out High level RF 1-3	-50 dBm nominal at 50 Ohms, measured at 30 kHz bandwidth	Combined with the standard RF output, 30 dB attenuation normally applied.
	Video	15 Way D	VGA
	Time Pulse	Aux Port 3.3V Active High	Configurable to 1s, 10s and 1 minute
	Synchronous data	Aux Port	Two data channels, up to a maximum of eight, recorded per frequency logged
	Aux Port	26 Way High Density D	Includes 5 Volt, 200 mA maximum, Output to power external modules
	10/100/1000 Ethernet	2 x RJ45	
	2 x USB 2.0 2 x USB 3.0	USB 2 Type A (female) USB 3 Type A (female)	Front panel Rear panel
I/O	Serial (UART) x 1	9-way D (male)	
Interface / Control	Keyboard	USB	
	Removable SSD	SATA	
	VGA Monitor	1x 15-way D (female)	

Spirent **GSS6450** Multi-frequency Record & Playback System

Table 8 Control Interfaces

Category	Item	Specification	Note
Local - Front Panel	Display	240 x 320 pixel resolution, RGB 65K true to life colours, TFT screen with Integrated 4-Wire Resistive Touch Panel.	Graphical.
	Keypad	Touchscreen LCD	
	Power	Front panel On/Off switch	
	Status indicators	LCD icons	
	Keyboard	USB	
	Monitor	RGB	VGA 15-way D-type (female)
	Mouse	USB	
Remote	Web Server	Dynamic i/p address	Requires web-browser, or HTTP POST commands
	VNC	VNC server built-in	Requires VNC viewer
	Scripts	Linux shell scripts	

Physical and Environmental

Table 9 Physical and Environmental

Parameter	Value	Units	Notes
Size	216 x 200 x76 8.5 x 7.9 x 3.0	mm inch	Excludes feet
Weight	2.2 4.85	kg lbs	
Operating Temperature	0 to + 40 32 to 104	Degrees C Degrees F	
Operating Humidity	40 to 90	% RH	Non-condensing
Storage	-40 to +60 -40 to 140	Degrees C Degrees F	
Storage Humidity	20 to 90	% RH	Non-condensing

Safety and EMC Conformity

The GSS6450 complies with the following harmonised standards:

EN 61010-3-2:2014

EN 61326-2:2013 using the common technical requirements of EN 61326-1:2013

EN 301489-3: V1.6.1, using the common technical requirements of EN301489-1: V1.9.2

EN 61000-3-2:2014 and EN61000-3-3:2013

FCC CFR 47 Parts 15.107 and 15.109 and ICES-003 Issue 6

Spirent **GSS6450** Multi-frequency Record & Playback System

System Variants and Options

Component	Option identifier (see Table 1)	Part number	Description	What's included?
Hardware Chassis (base system)	A	6450-1000	GSS6450 Record and Playback (Standard)	Hardware chassis with ability to record & replay RF GNSS signals. SSD (1 x TB internal, 1 x TB removable drive), 10 MHz Bandwidth, 4 bits record or playback.
	B	6450-1001	GSS6450 Replay only (Standard)	Hardware chassis with ability to ONLY replay RF GNSS signals. SSD (1 x TB internal, 1 x TB removable drive), 10 MHz Bandwidth, 4 bits playback.
	C	6450-1002	GSS6450 Record and Playback (Inmarsat)	Hardware chassis with ability to record & replay RF GNSS signals. SSD (1 x TB internal, 1 x TB removable drive), 10 MHz Bandwidth, 4 bits record or playback.
	D	6450-1003	GSS6450 Replay only (Inmarsat)	Hardware chassis with ability to ONLY replay RF GNSS signals. SSD (1 x TB internal, 1 x TB removable drive), 10 MHz Bandwidth, 4 bits playback.
GNSS Constellation Band	E	6450-3000	GPS, GAL, BEI L1	Constellation license
	F	6450-3001	GPS, GAL, GLO L1	Constellation license
	G	6450-3002	GPS, GAL, GLO, BEI L1	Constellation license
	H	6450-3003	GPS L1, L2	Constellation license
	I	6450-3004	GPS L1, L5	Constellation license
	J	6450-3005	GNSS L1, L2, L5, B3	Constellation license
	K	6450-3006-R	GNSS L1, L2, L5, B3 including E6	Constellation License (restricted)
	L	6450-3007	Inmarsat based augmentations, such as Omnistar and Starfire	Constellation license (needs base chassis C or D, and bandwidth option O or P)
	M	6450-3008	QZSS L6	Constellation License

Spirent GSS6450 Multi-frequency Record & Playback System

Component	Option identifier (see Table 1)	Part number	Description	What's included?
Bit Depth (I/Q Quantization)	N	6450-3021	8 bit	Additional support for 8 bits bit depth.
	O	6450-3022	8 bits and 16 bits	Additional support for 8 and 16 bits bit depth.
Bandwidth	P	6450-3030	30 MHz	Additional support for 30 MHz bandwidth.
	Q	6450-3031	30 and 50 MHz	Additional support for 30 and 50 MHz bandwidth.

Contact Spirent for details on upgrades from one standard configuration to another standard configuration.

For non-standard configurations please contact Spirent.

Deliverables

Table 10 Deliverable Items

Item No.	Quantity	Component	Comment
1	1	GSS6450 RPS main unit	
2	1	Power Supply	PSU, Desk Top, 18 V, 6 A, 90 W
3	1	Power Supply cable	UK, USA or EU versions
4	1	Active GNSS antenna	L1 only
5	1	Cigarette lighter adaptor	With 2.1 mm jack plug
6	1	Manual	Supplied on the CD
7	1	1 TB or 2 TB removable SSD	2 TB SSD are options
8	1	DC Block	
9	1	Ethernet cable (straight)	
10	1	Carry case	
11	1	Shoulder strap	
12	1	Lens cloth & Stylus	
13	1	Quick start guide	
14	1	USB 3.0 to SATA 2.5" HDD adapter cable	

Spirent GSS6450 Multi-frequency Record & Playback System

Table 11 Accessories

Accessory Description	System order code
Accessory kit (3 cameras, IPAD, Wi-Fi adapter)	1000-8000
External 8TB RAID drive*	1000-8001
Removable external 2TB SSD drive	1000-8002
Removable external 1TB SSD drive	1000-8003
Spare battery pack	1000-8004
USB Wi-Fi / Wireless Network Micro Adapter	1000-8005
Multi-Frequency Antenna – L1, L2, L5 and B3	6450-6001
Upgrade to 2TB internal SSD & 2 TB removable drive (at time of system purchase)	6450-9001
Remove internal SSD (at time of system purchase) and supply 2 x 2 TB removable SSDs	6450-9002
Alignment Certificate and Test Report	6450-9003

* The primary function of this option is to store the data recorded from the GSS6450.

Glossary of Terms

1PPS	One Pulse-Per-Second
ADC	Analogue to Digital Converter
AGC	Automatic Gain Control
Aux	Auxiliary
BeiDou	Chinese GNSS System
C/No	Carrier to Noise Density Ratio
EMC	Electromagnetic Compatibility
FTP	File Transfer Protocol
GALILEO	EU GNSS System
GLONASS	GLObal NAVigation Satellite System (Russian Federation)
GNSS	Global Navigation Satellite System (Galileo + GPS + SBAS + GLONASS + IRNSS + BeiDou)
GPS	Global Positioning System US GNSS system
IRNSS	Indian Regional Navigation Satellite System
OCXO	Over Controlled Crystal Oscillator
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RPS	Record and Playback System
SBAS	Space-Based Augmentation System (such as WAAS, EGNOS, MSAS)
SSD	Solid State Desk
VNC	Virtual Network Computing

Spirent **GSS6450** Multi-frequency Record & Playback System

Referenced Documents

- a) DGP01444AAA GSS6450 RPS Manual [latest issue]

For more information

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