

Lucid-X Series Analog RF Signal Generator Portable Model User Manual

Revision 1.1

Warranty Statement

Products sold by Tabor Electronics Ltd. are warranted to be free from defects in workmanship or materials. Tabor Electronics Ltd. will, at its option, either repair or replace any hardware products which prove to be defective during the warranty period. You are a valued customer. Our mission is to make any necessary repairs in a reliable and timely manner.

Duration of Warranty

The warranty period for this Tabor Electronics Ltd. hardware is three years, except software and firmware products designed for use with Tabor Electronics Ltd. Hardware is warranted not to fail to execute its programming instructions due to defects in materials or workmanship for a period of ninety (90) days from the date of delivery to the initial end user.

Return of Product

Authorization is required from Tabor Electronics before you send us your product for service or calibration. Call your nearest Tabor Electronics support facility. A list is located on the last page of this manual. If you are unsure where to call, contact Tabor Electronics Ltd. Tel Hanan, Israel at 972-4-821-3393 or via fax at 972-4-821-3388. We can be reached at: support@tabor.co.il

Limitation of Warranty

Tabor Electronics Ltd. shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than authorized Tabor Electronics service personnel or without the written consent of Tabor Electronics.

Tabor Electronics Ltd. expressly disclaims any liability to its customers, dealers and representatives and to users of its product, and to any other person or persons, for special or consequential damages of any kind and from any cause whatsoever arising out of or in any way connected with the manufacture, sale, handling, repair, maintenance, replacement or use of said products. Representations and warranties made by any person including dealers and representatives of Tabor Electronics Ltd., which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitations of the liability of Tabor Electronics Ltd. as set forth above), shall not be binding upon Tabor Electronics Ltd. unless reduced to writing and approved by an officer of Tabor Electronics Ltd. This document may contain flaws, omissions, or typesetting errors. No warranty is granted nor liability assumed in relation thereto. The information contained herein is periodically updated and changes will be incorporated into subsequent editions. If you have encountered an error, please notify us at support@taborelec.com. All specifications are subject to change without prior notice. Except as stated above, Tabor Electronics Ltd. makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and except to the extent stated above, Tabor Electronics Ltd. shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise.

Proprietary Notice

This document and the technical data herein disclosed are proprietary to Tabor Electronics, and shall not, without express written permission of Tabor Electronics, be used, in whole or in part to solicit quotations from a competitive source or used for manufacture by anyone other than Tabor Electronics. The information herein has been developed at private expense and may only be used for operation and maintenance reference purposes or for purposes of engineering evaluation and incorporation into technical specifications and other documents, which specify procurement of products from Tabor Electronics.

Document Revision History

Table Document Revision History

Revision	Date	Description	Author
1.1	13-Oct-26	• Release supporting Lucid Control Panel Ver. 1.3.590 and TE Update Tool Ver. 1.1.291, Lucid-X SCPI 1.031, LSX Specs 1.10 and Lucid-X FW/FPGA version 1.19.142/003.001.24 or higher and HW version D. • 3 Portable GUI – Updated with a new GUI. • 4 Lucid-X Portable Specifications –Added LSX8081P, LSX1491P, aligned with LSX Specs 1.10. • Table 4.3 Amplitude Specifications – LP option changed from -70 to -90 dBm	Jakob Apelblat
1.0	26-Jan-25	• Original release. • Release supporting Lucid Control Panel Ver. 1.3.500 and TE Update Tool Ver. 1.1.212, Lucid-X SCPI 1.011, and Lucid-X FPGA version 1.14 or higher.	Jakob Apelblat

Acronyms & Abbreviations

Table Acronyms & Abbreviations

Acronym	Description
μs or us	Microseconds
ADC	Analog to Digital Converter
AM	Amplitude Modulation
ASIC	Application-Specific Integrated Circuit
ATE	Automatic Test Equipment
AWG	Arbitrary Waveform Generators
AWT	Arbitrary Waveform Transceiver
BNC	Bayonet Neill–Concelm (coax connector)
BW	Bandwidth
CW	Carrier Wave
DAC	Digital to Analog Converter
dBc	dB/carrier. The power ratio of a signal to a carrier signal, expressed in decibels
dBm	Decibel-Milliwatts. E.g., 0 dBm equals 1.0 mW.
DDC	Digital Down-Converter
DHCP	Dynamic Host Configuration Protocol
DSO	Digital Storage Oscilloscope
DUC	Digital Up-Converter
ENoB	Effective Number of Bits
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
FPGA	Field-Programmable Gate Arrays
GHz	Gigahertz
GPIO	General Purpose Interface Bus
GS/s	Giga Samples per Second
GUI	Graphical User Interface
HP	Horizontal Pitch (PXle module horizontal width, 1 HP = 5.08mm)
Hz	Hertz
IF	Intermediate Frequency

Acronym	Description
I/O	Input / Output
IP	Internet Protocol
IQ	In-phase Quadrature
IVI	Interchangeable Virtual Instrument
JSON	JavaScript Object Notation
kHz	Kilohertz
LCD	Liquid Crystal Display
LO	Local Oscillator
MAC	Media Access Control (address)
MDR	Mini D Ribbon (connector)
MHz	Megahertz
ms	Milliseconds
NCO	Numerically Controlled Oscillator
ns	Nanoseconds
PC	Personal Computer
PCAP	Projected Capacitive Touch Panel
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PXI	PCI eXtension for Instrumentation
PXIe	PCI Express eXtension for Instrumentation
QC	Quantum Computing
Qubits	Quantum bits
R&D	Research & Development
RF	Radio Frequency
RT-DSO	Real-Time Digital Oscilloscope
s	Seconds
SA	Spectrum Analyzer
SCPI	Standard Commands for Programmable Instruments
SFDR	Spurious Free Dynamic Range
SFP	Software Front Panel
SMA	Subminiature version A connector

Acronym	Description
SMP	Subminiature Push-on connector
SPI	Serial Peripheral Interface
SRAM	Static Random-Access Memory
TFT	Thin Film Transistor
T&M	Test and Measurement
TPS	Test Program Sets
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
VCP	Virtual COM Port
Vdc	Volts, Direct Current
V p-p	Volts, Peak-to-Peak
VSA	Vector Signal Analyzer
VSG	Vector Signal Generator
WDS	Wave Design Studio

Contents

Document Revision History.....	3
Acronyms & Abbreviations	4
Contents	7
Figures	9
Tables	10
1 General	11
1.1 Scope	11
1.2 Related Documentation	11
1.3 Software Support	11
1.4 Document Conventions	12
1.5 Safety	12
1.6 Maintenance	13
1.6.1 Preventive Maintenance	13
1.6.2 Long Term Storage or Repackaging For Shipment	13
2 Introduction	15
2.1 Unpacking	15
2.2 Front Panel	15
2.3 Right Side Panel	16
2.4 Left Side Panel	16
3 Portable GUI.....	18
3.1 CW & Modulation Tab	18
3.1.1 AM – Amplitude Modulation	21
3.1.2 FM – Frequency Modulation	22
3.1.3 PM – Phase Modulation	23
3.1.4 Pulse Definition	23
3.1.5 Pattern Sequence	24
3.2 Sweep Tab	26
3.2.1 Frequency Sweep	26
3.2.2 Power Sweep	27
3.3 List Tab	29
3.4 Run Mode Tab	30
3.5 System Tab	32
3.5.1 Store	33
3.5.2 Recall	33
3.5.3 Preset	34
3.5.4 Erase	34
3.5.5 LAN Settings	35
3.5.6 Update SW	36
3.6 About	38
4 Lucid-X Portable Specifications	39
4.1 Frequency	39
4.2 Frequency Reference	39
4.3 Amplitude	39

4.4	Phase Noise and Harmonics	40
4.5	Modulation	40
4.6	Inputs/Outputs	41
4.7	General	42
4.8	General Portable.....	43
4.9	Ordering Information & Options	43

Figures

Figure 1.1 LSX2091P – 20 GHz One Channel Analog RF Signal Generator.....	11
Figure 2.1 LSX2091P Front Panel	15
Figure 2.2 Right Side Panel.....	16
Figure 2.3 Left Side Panel.....	16
Figure 3.1 CW & Modulation Tab	18
Figure 3.2 CW Frequency Numeric Pad	19
Figure 3.3 CW Power Numeric Pad.....	19
Figure 3.4 AM – Amplitude Modulation	21
Figure 3.5 AM Depth Numeric Pad	22
Figure 3.6 FM – Frequency Modulation.....	22
Figure 3.7 PM – Phase Modulation.....	23
Figure 3.8 Pulse Definition.....	24
Figure 3.9 Pattern Sequence.....	25
Figure 3.10 Frequency Sweep.....	26
Figure 3.11 Power Sweep	27
Figure 3.12 List.....	29
Figure 3.13 Run Mode.....	30
Figure 3.14 System Tab.....	32
Figure 3.15 Store Settings	33
Figure 3.16 Recall	34
Figure 3.17 Preset Confirmation Pop-up	34
Figure 3.18 Erase.....	35
Figure 3.19 System Tab LAN settings	36
Figure 3.20 System Update	37
Figure 3.21 About.....	38

Tables

Table 4.1 Frequency Specifications.....	39
Table 4.2 Frequency Reference Specifications	39
Table 4.3 Amplitude Specifications.....	39
Table 4.4 Phase Noise and Harmonics Specifications.....	40
Table 4.5 Modulation Specifications.....	40
Table 4.6 Inputs/Outputs Specifications.....	41
Table 4.7 General Specifications.....	42
Table 4.8 General Portable Specifications	43
Table 4.9 Ordering Information & Options.....	43

1 General

1.1 Scope

The scope of this manual is to describe the setup and operating procedures of Lucid-X portable. The manual covers the following models listed in [Table 4.9 Ordering Information & Options](#).



Figure 1.1 LSX2091P – 20 GHz One Channel Analog RF Signal Generator

1.2 Related Documentation

- Lucid Control Panel User Manual
- Update Tool User Manual
- Lucid-X Programming Manual
- Tabor Lucid Multi-Channel RF Signal Generators White Paper

1.3 Software Support

The **Lucid Control Panel** is a software package that enables full control and programming of your Tabor Electronics Lucid series RF analog signal generators via a user-friendly graphical user interface. The **Update Tool** is a utility for updating the Lucid device FPGA. The **Lucid-X Programming Manual** lists and describes the set of SCPI-compatible (Standard Commands for Programmable Instruments) remote commands used to operate the Lucid devices.

The programs and the user manuals can be downloaded from the Tabor Electronics website at <http://www.taborelec.com/downloads>.

1.4 Document Conventions

Convention	Description	Example
Bold Writing	Indicates an item/message in the User Interface.	Click the On button.
<Angled and Bolded Brackets>	Indicates a physical key on the keyboard.	Press <Ctrl>+.
Caution! A Caution indicates instructions, which, if not followed, may result in damage to the equipment or to the loss of data.		
Note A Note provides additional information to help obtain optimal equipment performance.		
Idea An Idea provides an alternate procedure to obtain the same results.		

1.5 Safety

To avoid Electrical Shock, fire or personal injury:

- Use only the proper power cord and certified for the country of use.
- Do not operate this product with removed covers or panels.
- Observe all the ratings and markings on the product. Search this manual for further rating information, before connecting to it. Do not apply potential that is higher than the maximum rating.
- Do not operate in dark or wet conditions.
- Do not operate in an explosive environment. Keep product clean and dry.

1.6 Maintenance

1.6.1 Preventive Maintenance

There are no hardware adjustments within Lucid Generators. Tabor Electronics Ltd. recommends that the Lucid Generator is calibrated every two years or whenever a problem is suspected. The specific calibration interval depends upon the accuracy required. No periodic preventive maintenance is required.

1.6.2 Long Term Storage or Repackaging For Shipment

If the instrument is to be stored for a long period of time or shipped immediately, proceed as directed below. If you have any questions, contact your local Tabor Electronics representative or the Tabor Electronics Customer Service Department.

1. Repack the instrument using the wrappings, packing material and accessories originally shipped with the unit. If the original container is not available, purchase replacement materials.
2. Be sure the carton is well sealed with strong tape or metal straps.
3. Mark the carton with the model and serial number. If it is to be shipped, show the sending and return address on two sides of the box.
4. If the instrument is to be shipped for service or repair, the following information must be included with the shipment:
 - Name and address of the owner.
 - Record the model and serial number of the instrument, options, and firmware version.
 - Note the problem and symptoms – detailed information will help in verifying the problem
 - What was the instrument setup?
 - Did the unit work; then fail?
 - What other equipment was connected to the generator when the problem occurred?
 - The name and telephone number of someone familiar with the problem who can be contacted by Tabor Electronics if any further information is required.
 - Show the returned authorization order number (RMA) as well as the date and method of shipment.

Note

Always obtain a return authorization number from the factory before shipping the instrument to Tabor Electronics.

1.6.2.1 Battery Storage Guidelines

- Before storing, charge or discharge the battery to about 50% of its capacity.
- Recharge the battery to approximately 50% of its capacity at least once every six months.
- Remove the battery from the product and store it separately.

- Keep the battery in a temperature range of 5 °C to 20 °C (41 °F to 68 °F).

Note

Batteries naturally self-discharge during storage. Storing at higher temperatures (above 20 °C or 68 °F) can significantly reduce their lifespan.

2 Introduction

The Lucid-X Series portable platform offers a modern design capable of operating either as a benchtop or a portable signal generator. The series features 8, 14, 20 and 40 GHz single channel versions, all sharing the very same industry leading highlighted features. It provides extremely fast switching speed, superior signal integrity and purity, all the necessary modulated signals for analog communication systems, with built in USB interface and removable micro-SD card. The Lucid-X Series is designed to meet today's most demanding applications, whether in the lab or out in the field.

2.1 Unpacking

Check that the packaging is undamaged. If packaging is damaged, notify the carrier immediately. The Lucid-X Portable model instrument is supplied with:

- Power supply. Input 100 – 240 V AC, 1.5 A, 47-63 Hz. Output 12.0 V DC, 8.34 A, 100.0 W,
Outside  Inside
- USB cable for connecting a control PC to the instrument.
- Lucid-X software, user manual and instrument drivers can be downloaded from <https://www.taborelec.com/Downloads>.

Caution!

The Lucid-X Series RF Signal Generator ships in an antistatic package to prevent damage from electrostatic discharge (ESD). When storing the unit, use the antistatic case.

2.2 Front Panel



Figure 2.1 LSX2091P Front Panel

- **10.1" Touch LCD Display** – 1280x800 TFT display PCAP(Projected Capacitive Touch Panel) touch screen for controlling the device.

2.3 Right Side Panel

Remove the right-side cover of the ruggedized case to replace the battery.



Figure 2.2 Right Side Panel

- **Battery** – Rechargeable battery 14.4 V, Lithium Ion, 3.35 Ah, 48 Wh.

2.4 Left Side Panel

Remove the left-side cover of the ruggedized case to access the connectors.



Figure 2.3 Left Side Panel

- **Ref Out** – SMA type connector for a 10/100 MHz signal output.
- **Ref In** – SMA type connector for a 10/100 MHz signal input. This input is normally used for synchronizing system components to a single clock reference.

- **Status** –
 - **Green** – Operational.
 - **Black** – Not operational. E.g. the battery is low.
- **FM IN** – A SMP type connector for an input from an external frequency modulation source.
- **AM IN** – A SMP type connector for an input from an external amplitude modulation source.
- **Pulse/Trig In** – A SMP type connector, for an input from an external trigger source.
- **RF Out** – RF signal output, 2.92 mm connector.
- **Power** – Power button to turn on or off the device.
- **Micro SD CARD** – Removable SD card for instrument security. It is used for storing all data about used frequencies for PATTERN in the Modulation, the List, and System tabs.
 - Speed grade 10.
- **Power In** – 12V DC power supply connector. Plug type $V_+ \text{ --- } \bullet \text{ --- } V_-$
- **LAN** – A micro-USB 2 for a USB to RJ45 LAN adapter.
-  – One USB 2 Type B connector for connecting a control PC.
- **USB HOST** – Two USB 2 Type A interfaces for connecting a USB device such as a memory device for storing and recalling instrument setups, keyboard or mouse.

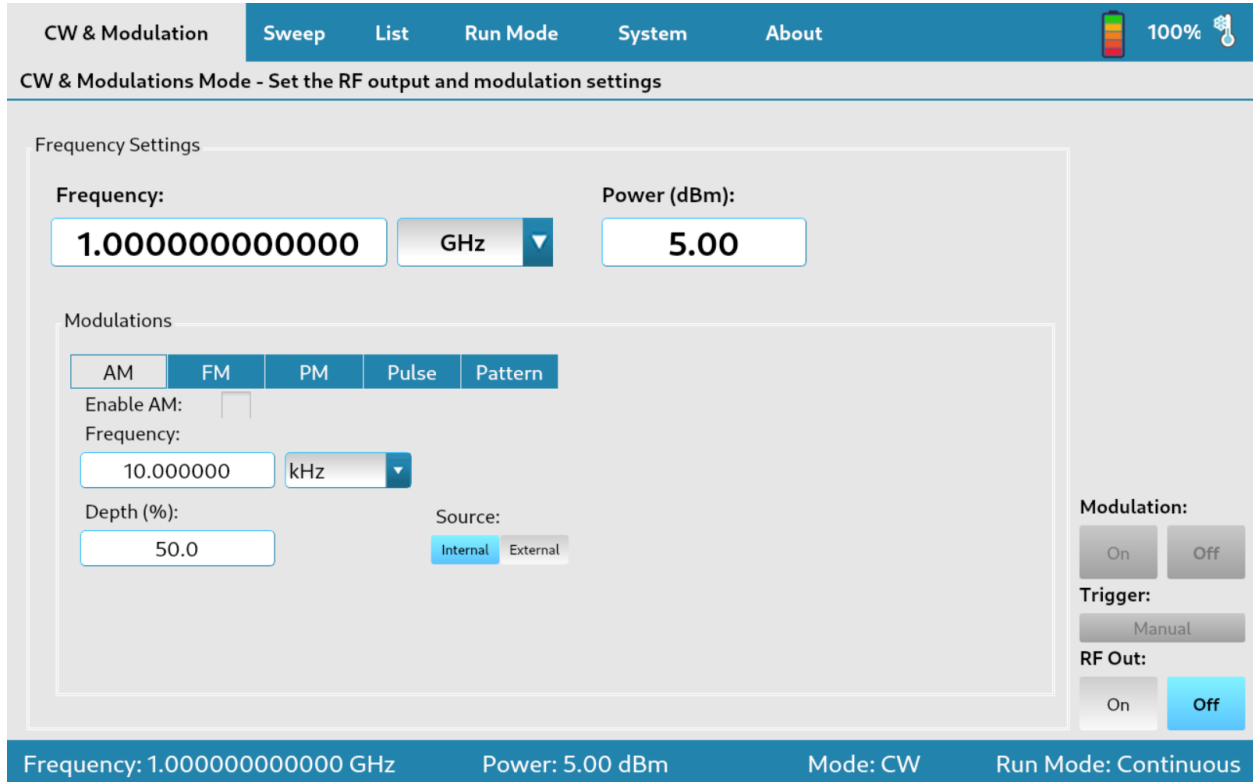
Note

The Lucid-X generator will automatically revert to external reference when a signal is detected at its input.

3 Portable GUI

3.1 CW & Modulation Tab

The CW & Modulation (Carrier Wave) tab becomes available on the front panel display after power-up of the generator. From here the user can set the output parameters of the generator.



The screenshot displays the 'CW & Modulation' tab interface. At the top, there are navigation tabs: 'CW & Modulation', 'Sweep', 'List', 'Run Mode', 'System', and 'About'. A battery status indicator shows '100%'. Below the tabs, the title 'CW & Modulations Mode - Set the RF output and modulation settings' is displayed. The main area is divided into 'Frequency Settings' and 'Modulations' sections. In 'Frequency Settings', the 'Frequency' is set to '1.000000000000' with a unit dropdown set to 'GHz', and the 'Power (dBm)' is set to '5.00'. The 'Modulations' section has buttons for 'AM', 'FM', 'PM', 'Pulse', and 'Pattern'. The 'FM' button is selected. Below these buttons, there are settings for 'Enable AM' (unchecked), 'Frequency' (10.000000 kHz), 'Depth (%)' (50.0), and 'Source' (Internal/External). On the right side, there are controls for 'Modulation' (On/Off), 'Trigger' (Manual), and 'RF Out' (On/Off). The bottom status bar displays: 'Frequency: 1.000000000000 GHz', 'Power: 5.00 dBm', 'Mode: CW', and 'Run Mode: Continuous'.

Figure 3.1 CW & Modulation Tab

Status Bar

The bar at the bottom of the screen displays a summary of the system status and is shown in all tabs:

- **Frequency** – The CW frequency.
- You can enter the value on the numeric pad pop-up and then selecting the frequency unit. Click ESC to cancel the pop-up.

CW frequency			
1.000000000000			
1	2	3	GHz
4	5	6	MHz
7	8	9	kHz
.	0		Hz
Back	Esc	Clear	
<<		>>	

Figure 3.2 CW Frequency Numeric Pad

- **Power** – The power (amplitude) of the output signal in dBm.
- You can enter the value on the numeric pad pop-up and then selecting the power unit. Cancel the pop-up by clicking Esc.

CW Power			
5.00			
1	2	3	dBμV
4	5	6	μV
7	8	9	mV
.	0	+/-	dBm
Back	Esc	Clear	
<<		>>	

Figure 3.3 CW Power Numeric Pad

- **Mode** – Shows which modulation is on (press Mode ON/Off in the respective modulation window).
- **CW** – Carrier wave (default)
- **E.g., AM,ON** – Amplitude modulation
- **Run Mode:**
 - **Continuous** – The device will generate a signal when the user clicks the RF OUT On button.
 - **Trigger** – The device waits for a trigger event.

Right Side Bar

The right-side bar displays operational commands for the instrument.

- **Modulation**
 - **ON** – Enable modulation. This button requires that at least one modulation is enabled.
 - **Off** – Disable modulation.

Note

The **RF Out On** button in the right side bar must be on.

- **Trigger**
 - **Manual** – Click the button to issue a trigger signal. The trigger button is disabled by default.

Note

To enable the button go to the Run Mode tab and select Trigger.

- **RF Out**
 - **On** – Output the signal.
 - **Off** – Stop the output of the signal.

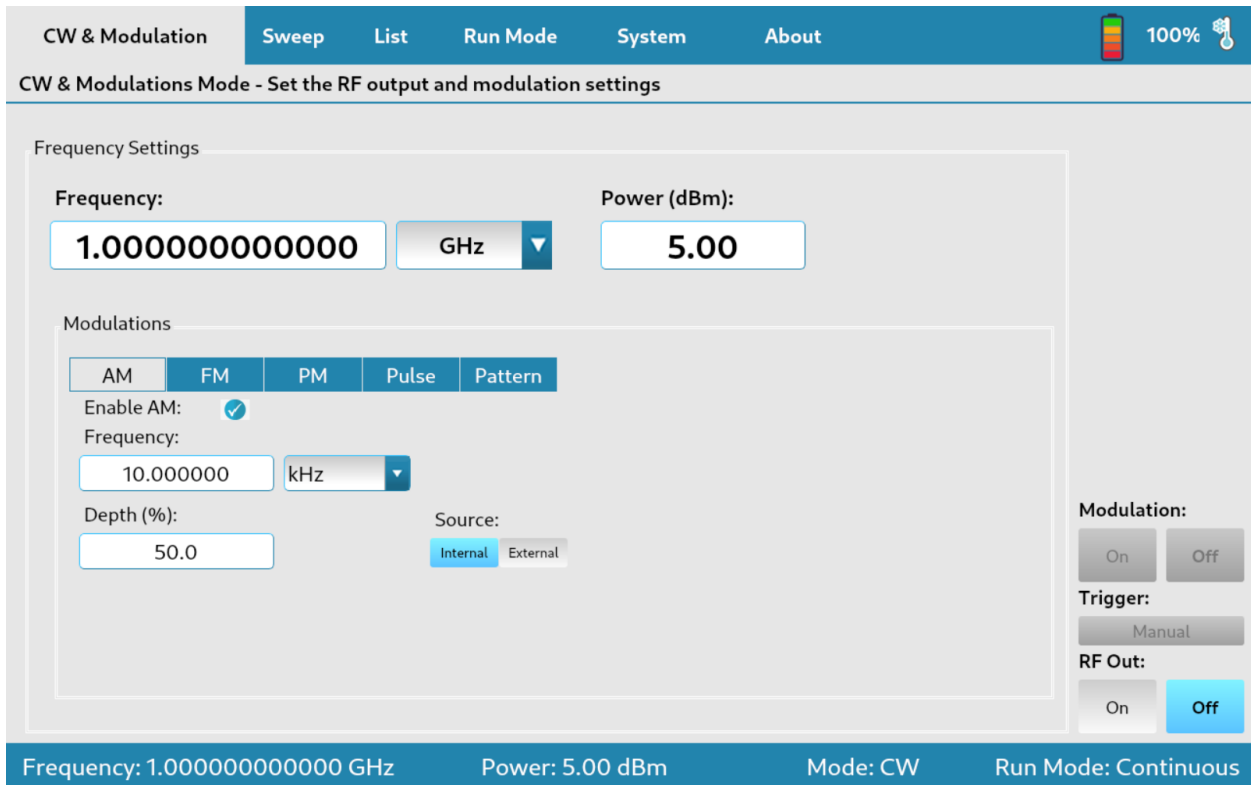
Top Bar Icons

- **Battery**  – The battery charge status. When the battery is down to 0% the instrument is powered off. After approximately 20 to 30 minutes of charging, once the battery reaches 5% capacity, the instrument will power on again.
- **Temperature**  – The instruments internal temperature. If the instrument temperature exceeds safe temperature the Lucid-X module operation will be limited.
 - **Blue** – Normal temperature.
 - **Red** – High temperature above 65°C. Limited operation (low power -20 dBm) of the instrument.

Dialog Box Fields

- **Frequency** – Sets the generator's basic frequency in Hz. You cannot enter a frequency smaller than the minimum frequency. Refer to [Table 4.1 Frequency Specifications](#) for valid frequency range.
- **Power** – Sets the power (amplitude) of the generator's output signal in dBm. The default value is 5.00 dBm.
- **Modulations** – You can press one of the modulation buttons to define the modulation. The modulation types that are available depend on the installed options.

3.1.1 AM – Amplitude Modulation



The screenshot shows the 'CW & Modulation' settings screen. The top navigation bar includes 'Sweep', 'List', 'Run Mode', 'System', and 'About'. A battery status indicator shows 100% charge. The main title is 'CW & Modulations Mode - Set the RF output and modulation settings'.

Frequency Settings:

- Frequency:** 1.000000000000
- Unit:** GHz
- Power (dBm):** 5.00

Modulations:

- Modulation Type:** AM (selected), FM, PM, Pulse, Pattern
- Enable AM:** ☒
- Frequency:** 10.000000 kHz
- Depth (%):** 50.0
- Source:** Internal (selected), External

Modulation: On (selected), Off

Trigger: Manual

RF Out: On, Off (selected)

Status Bar: Frequency: 1.000000000000 GHz | Power: 5.00 dBm | Mode: CW | Run Mode: Continuous

Figure 3.4 AM – Amplitude Modulation

- **Enable AM** – Check box to enable the AM modulation.
- **Frequency** – Set the modulation frequency (Hz/kHz).
- **Depth** – Set the AM modulation in percent of the carrier wave amplitude.
- You can enter the value on the numeric pad pop-up and then click Enter. Click Esc to cancel the pop-up.

Figure 3.5 AM Depth Numeric Pad

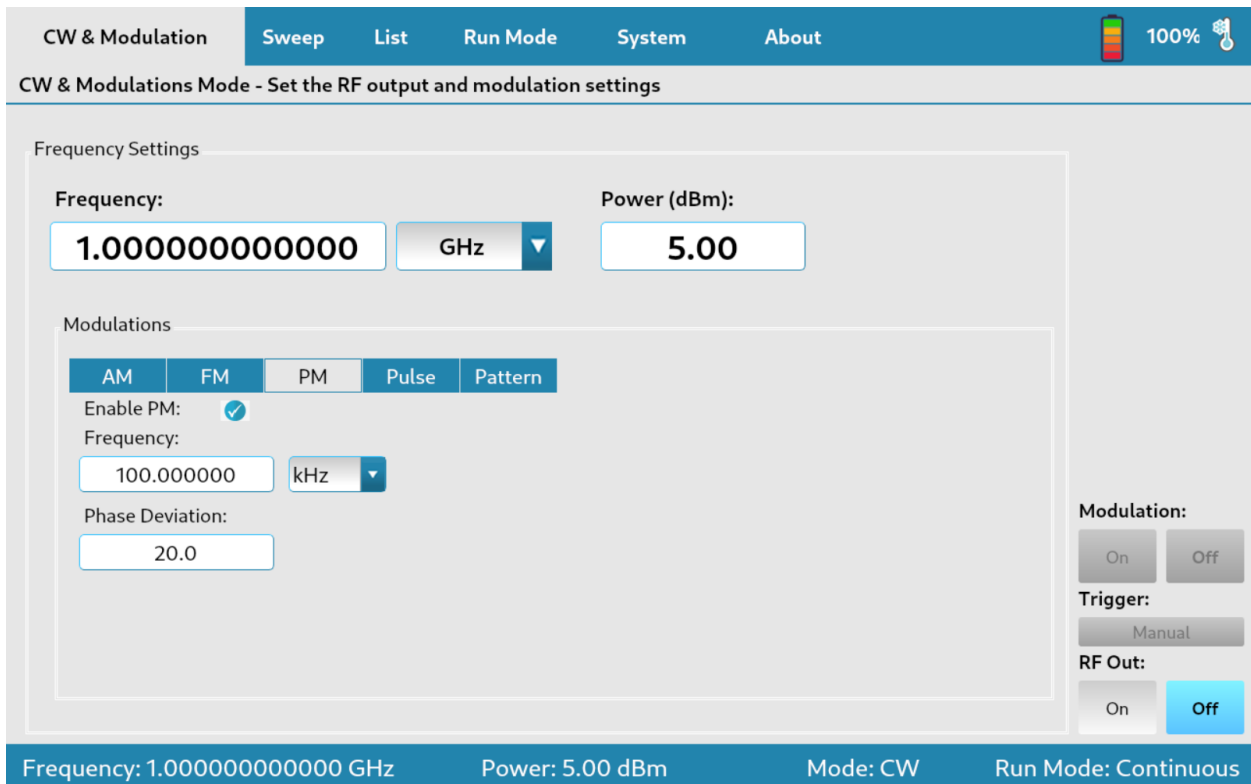
- **Source –**
 - **Internal** – Use the screen modulation parameters.
 - **External** – Use an AM source connected to the generator’s AM IN connector located on the left side panel. The instrument will accept modulating signals between DC and 100 kHz within ± 1 V (2 V p-p) amplitude.

3.1.2 FM – Frequency Modulation

Figure 3.6 FM – Frequency Modulation

- **Enable FM** – Check box to enable the FM modulation.
- **Frequency** – Set the modulation frequency (Hz).
- **Frequency Deviation** – Set the frequency deviation of the carrier wave in (Hz).
- **Source:**
 - **Internal** – Use the screen modulation parameters.
 - **External** – Use an FM source connected to the generator's FM IN connector located on the left side panel. The Generator will accept modulating signals between ± 1 V (2 V p-p) amplitude.

3.1.3 PM – Phase Modulation



CW & Modulation | Sweep | List | Run Mode | System | About | 100%

CW & Modulations Mode - Set the RF output and modulation settings

Frequency Settings

Frequency: 1.000000000000 GHz Power (dBm): 5.00

Modulations

AM | FM | PM | Pulse | Pattern

Enable PM: ☒

Frequency: 100.000000 kHz

Phase Deviation: 20.0

Modulation: On Off

Trigger: Manual

RF Out: On Off

Frequency: 1.000000000000 GHz Power: 5.00 dBm Mode: CW Run Mode: Continuous

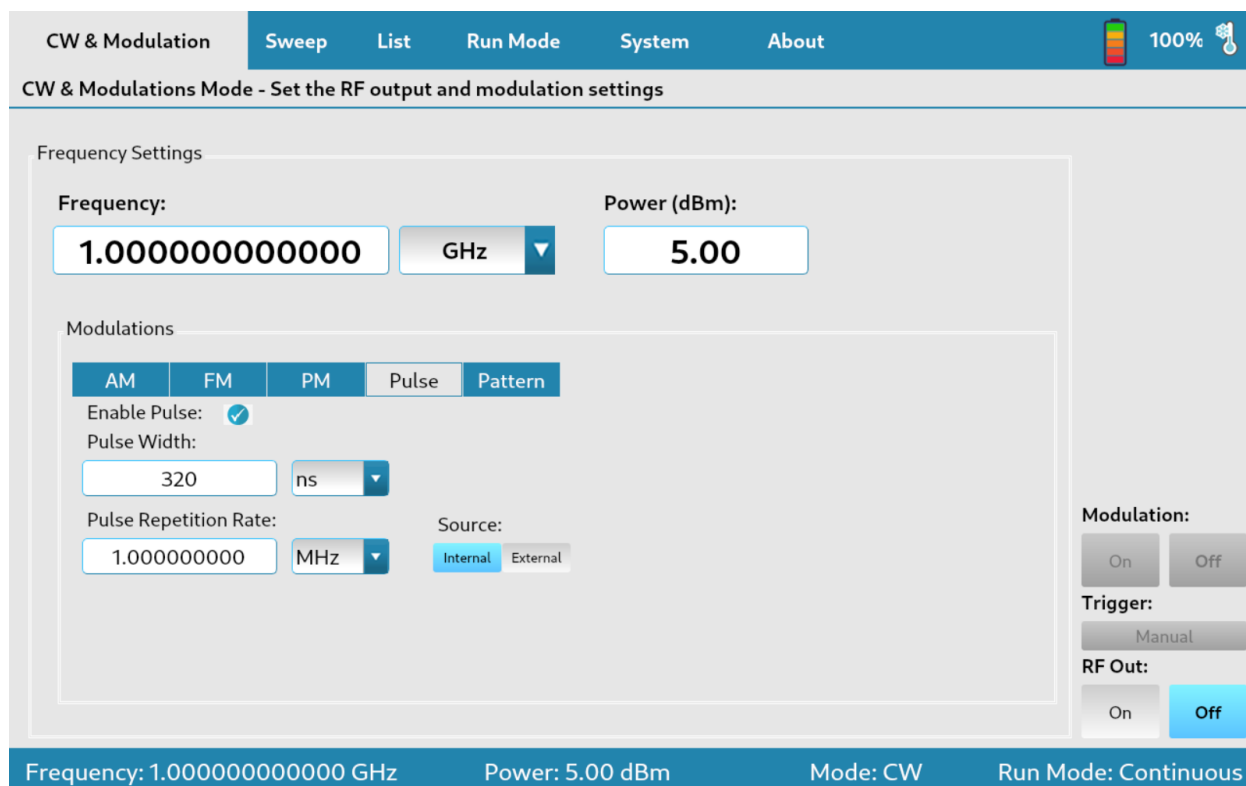
Figure 3.7 PM – Phase Modulation

- **Enable PM** – Check box to enable the PM modulation.
- **Frequency** – Set the modulation Frequency (Hz).
- **Phase Deviation** – Set the phase deviation degree of the modulation frequency.

3.1.4 Pulse Definition

Note

The **Pulse** button is only available if the device has the PLS option installed.



CW & Modulation Sweep List Run Mode System About

CW & Modulations Mode - Set the RF output and modulation settings

Frequency Settings

Frequency: 1.000000000000 GHz Power (dBm): 5.00

Modulations

AM FM PM Pulse Pattern

Enable Pulse: ☒

Pulse Width: 320 ns

Pulse Repetition Rate: 1.000000000 MHz

Source: Internal External

Modulation: On Off

Trigger: Manual

RF Out: On Off

Frequency: 1.000000000000 GHz Power: 5.00 dBm Mode: CW Run Mode: Continuous

Figure 3.8 Pulse Definition

- **Enable Pulse** – Check box to enable the pulse modulation.
- **Pulse Width** – Set the pulse modulation width.
- **Pulse Repetition Rate** – Set the pulse repetition rate in MHz, kHz or Hz.
- **Source:**
 - **Internal** – Use the screen modulation parameters.
 - **External** – Use a pulse source connected to the generator's AM/FM IN connector located on the left side panel. The Generator will accept modulating signals between ± 1 V (2 V p-p) amplitude.

3.1.5 Pattern Sequence

You can set a sequence of pulses according to the list of pulses where each step in the list defines a pulse Time On and Time Off time and the number of Loops.

Note

The **Pattern** button is only available if the device has the PAT option installed.

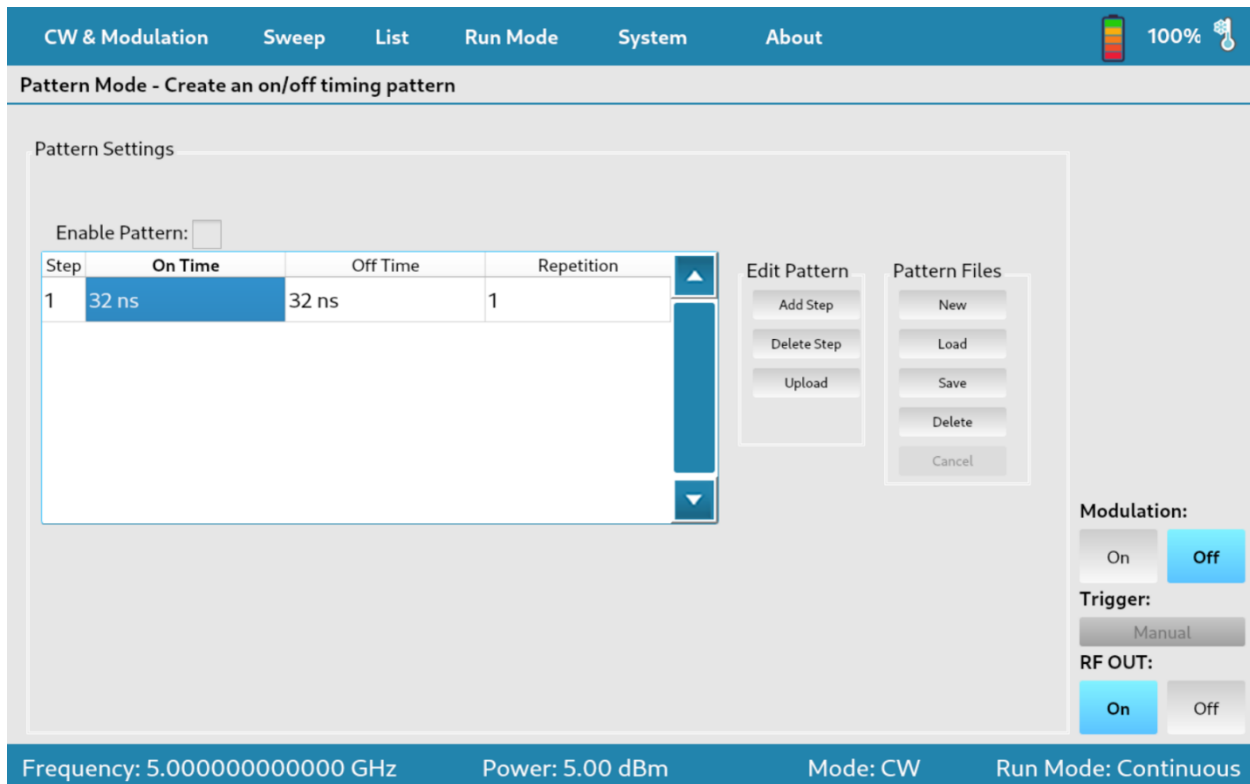


Figure 3.9 Pattern Sequence

- **Enable Pattern** – Check box to enable the pulse modulation.

Define a pattern according to the steps below.

1. **NEW** – Click the button to create a new Pattern.
2. **LOAD** – Click the button to select a file to load.
3. **SAVE** – Click the button to save the Pattern in a JSON (JavaScript Object Notation) format. You can save to a new name (valid name is only numbers) or overwrite an old file. You can select to store the data on the SD card.
4. **DEL** – Click the button to select a file to delete.
5. **Add STEP** – Click the button to add a new step.
6. Enter the duration of the pulse (On Time), the delay for next pulse (Off Time), and the number of repetitions (Repetition) of this step.
7. **Delete STEP** – Click the button to delete the last step.
8. **Upload** – Click the button to upload the Pattern to the instrument.

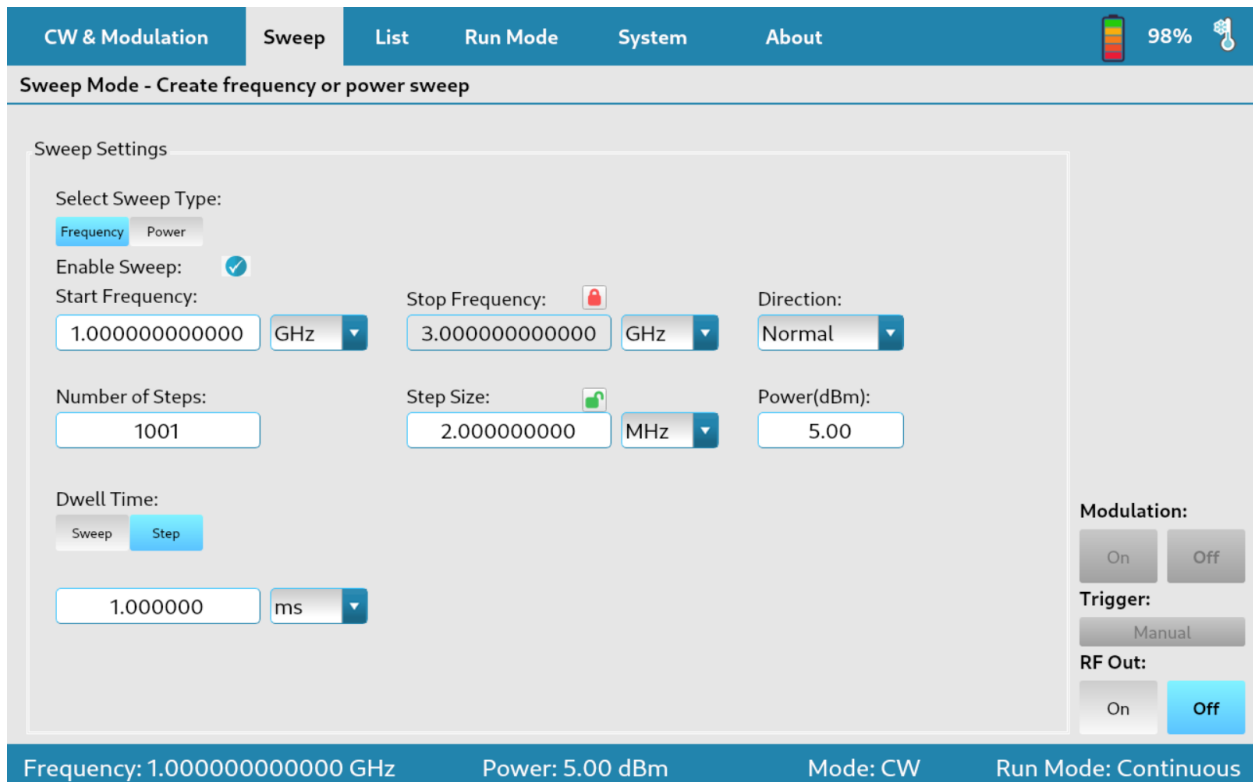
3.2 Sweep Tab

The Sweep tab menu allows you to define a signal that sweeps over a frequency or power range.

- **Select Sweep Type:**
 - **Frequency** – Frequency based, where the signal sweeps from one frequency to the next, maintaining the same amplitude.
 - **Power** – Power based, where the signal sweeps from one amplitude to the next, maintaining the same frequency.

3.2.1 Frequency Sweep

Select the Sweep tab, and then touch the Frequency button. You can now define a signal that sweeps from one frequency to the next, maintaining the same amplitude.



Sweep Mode - Create frequency or power sweep

Sweep Settings

Select Sweep Type:
☒ Frequency ☐ Power

Enable Sweep: ☒

Start Frequency: GHz

Stop Frequency: GHz

Direction:

Number of Steps:

Step Size: MHz

Power(dBm):

Dwell Time:

ms

Modulation:

Trigger:

RF Out:

Frequency: 1.000000000000 GHz Power: 5.00 dBm Mode: CW Run Mode: Continuous

Figure 3.10 Frequency Sweep

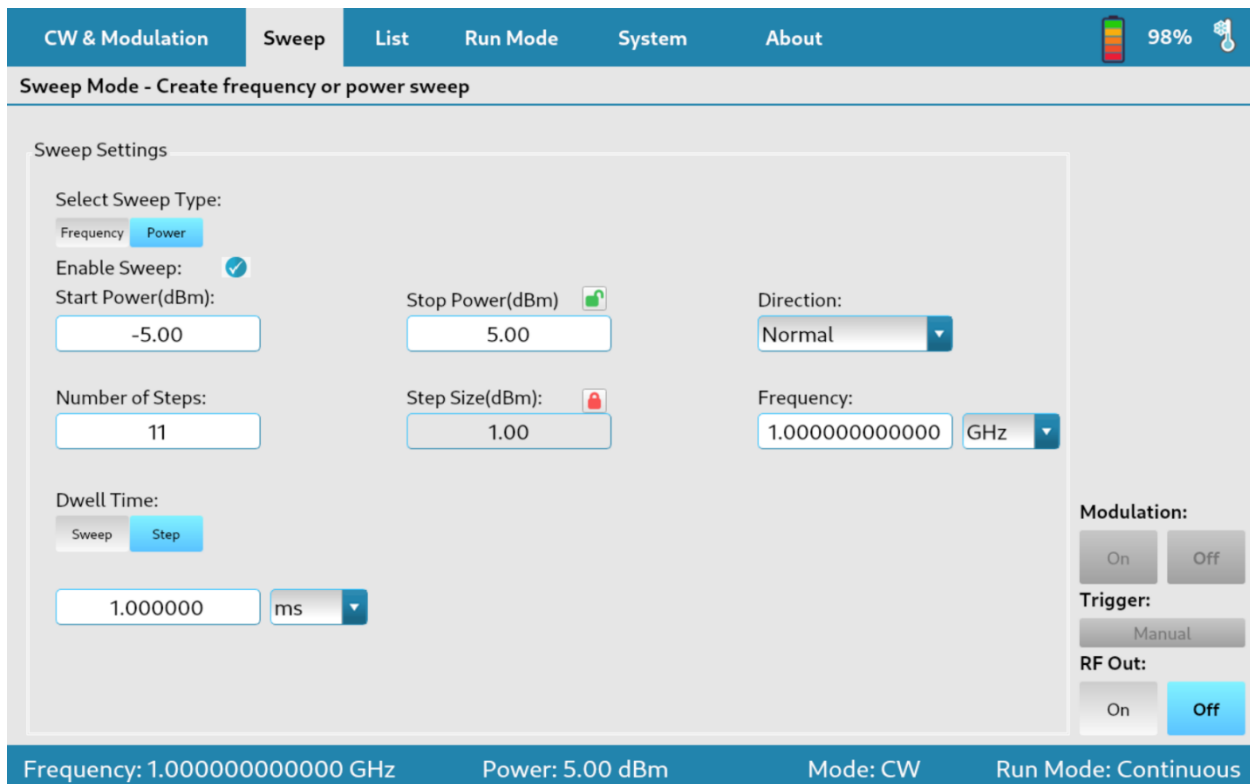
Following are the details of the frequency-based Sweep menu:

- **Enable Frequency Sweep** – Check box to enable the Frequency Sweep.
- **Lock Icon** – Click the lock icon to indicate that this field will be used for the sweep calculation.
- **Green**  – This field will be used for the sweep calculations.
- **Red**  – This field will not be used for the sweep calculations.
- **Start Frequency** – sets the sweep start frequency (in Hz).

- **Stop Frequency** – sets the sweep stop frequency (in Hz).
- **Direction** – sets the sweeping direction:
 - **UpDown** – to sweep from start frequency to stop frequency; then, from stop frequency to start frequency .
 - **Normal** – to sweep from start frequency to stop frequency.
- **Number of Steps** – sets the number of steps in one sweep (including Start and Stop). The value displayed in **Step Size** changes accordingly.
- **Step Size** – sets the size of each step (in Hz) in the sweep. The value displayed in **Number of Steps** changes accordingly.
- **Power(dBm)** – sets the signal amplitude.
- **Dwell Time** – sets the sweep dwell time that is the duration of the entire sweep.
 - **Sweep** – sets to sweep mode.
 - **Step** – sets to step mode.

3.2.2 Power Sweep

Select the Sweep tab, and then touch the PWR button. You can now define a signal that sweeps from one amplitude to the next, maintaining the same frequency.



The screenshot shows the 'Sweep Mode - Create frequency or power sweep' screen. The 'Sweep Settings' section includes:

- Select Sweep Type:** 'Frequency' and 'Power' tabs. 'Power' is selected.
- Enable Sweep:** A checked checkbox.
- Start Power(dBm):** Input field with value '-5.00'.
- Stop Power(dBm):** Input field with value '5.00'.
- Direction:** Dropdown menu set to 'Normal'.
- Number of Steps:** Input field with value '11'.
- Step Size(dBm):** Input field with value '1.00'.
- Frequency:** Input field with value '1.000000000000' and a unit dropdown set to 'GHz'.
- Dwell Time:** Input field with value '1.000000' and a unit dropdown set to 'ms'.
- Modulation:** 'On' and 'Off' buttons. 'Off' is selected.
- Trigger:** 'Manual' button.
- RF Out:** 'On' and 'Off' buttons. 'Off' is selected.

The bottom status bar displays: Frequency: 1.000000000000 GHz, Power: 5.00 dBm, Mode: CW, Run Mode: Continuous.

Figure 3.11 Power Sweep

- **Enable Power Sweep** – Check box to enable the power sweep.
- **Start Power(dBm)** – start power sets the start sweep amplitude (in dBm).
- **Stop Power(dBm)** – stop power sets the stop sweep amplitude (in dBm).
- **Direction** – sets the sweeping direction:
 - **UPDOWN** – to sweep from start power to stop power; then, from stop frequency to start frequency.
 - **NORMAL** – to sweep from start frequency to stop frequency.
- **Number of Steps** – sets the number of steps in one sweep (including **Start** and **Stop**). The value displayed in **Step Size** changes accordingly.
- **Step Size(dBm)** – sets the size of each step (in dBm) in the sweep. The value displayed in **Number of Steps** changes accordingly.
- **Frequency** – sets the power sweep frequency.
- **Dwell Time** – sets the sweep dwell time that is the duration of the entire sweep.
 - **Sweep** – sets the sweep dwell time.
 - **Step** – sets the step dwell time.

3.3 List Tab

The List tab enables you to create and generate a sequence of signals that can vary in frequency, power and dwell time.

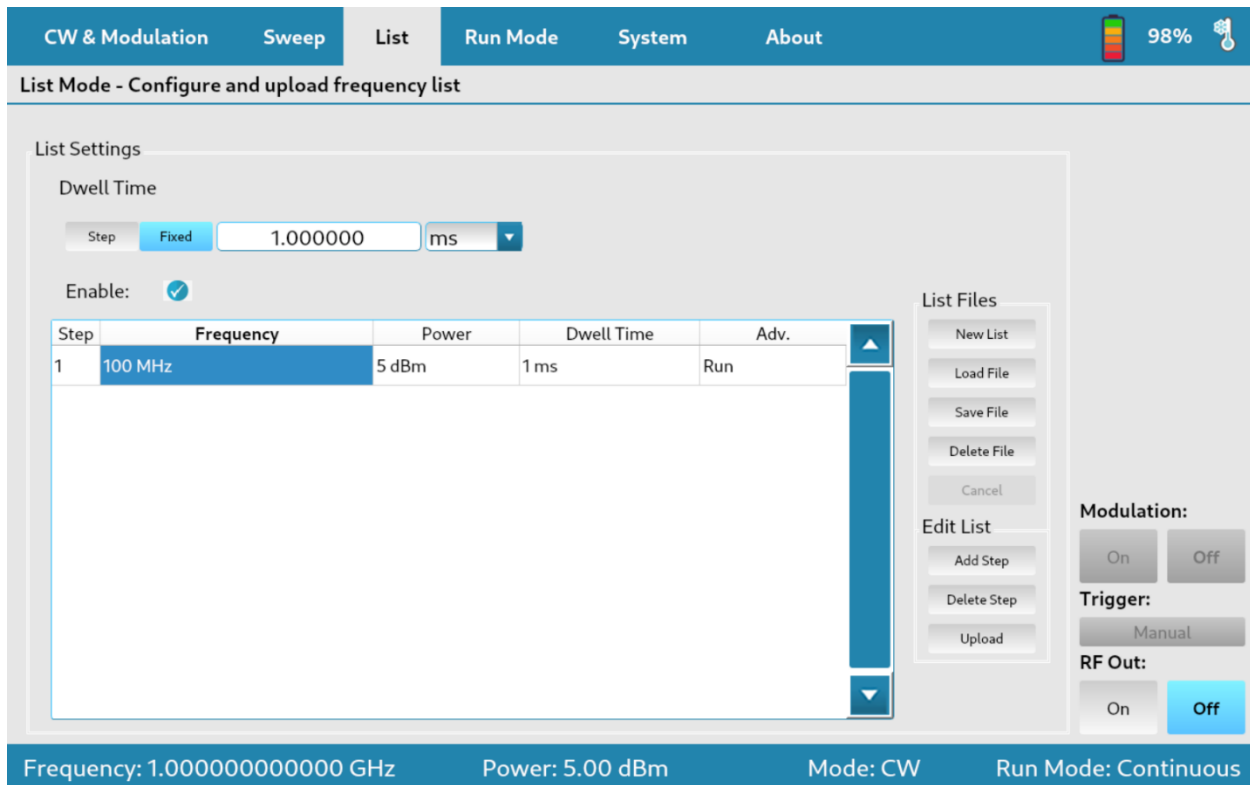


Figure 3.12 List

- **Dwell Time**
 - **Step** – the dwell time can be defined for each step.
 - **Fixed** – the dwell time is fixed for each step.

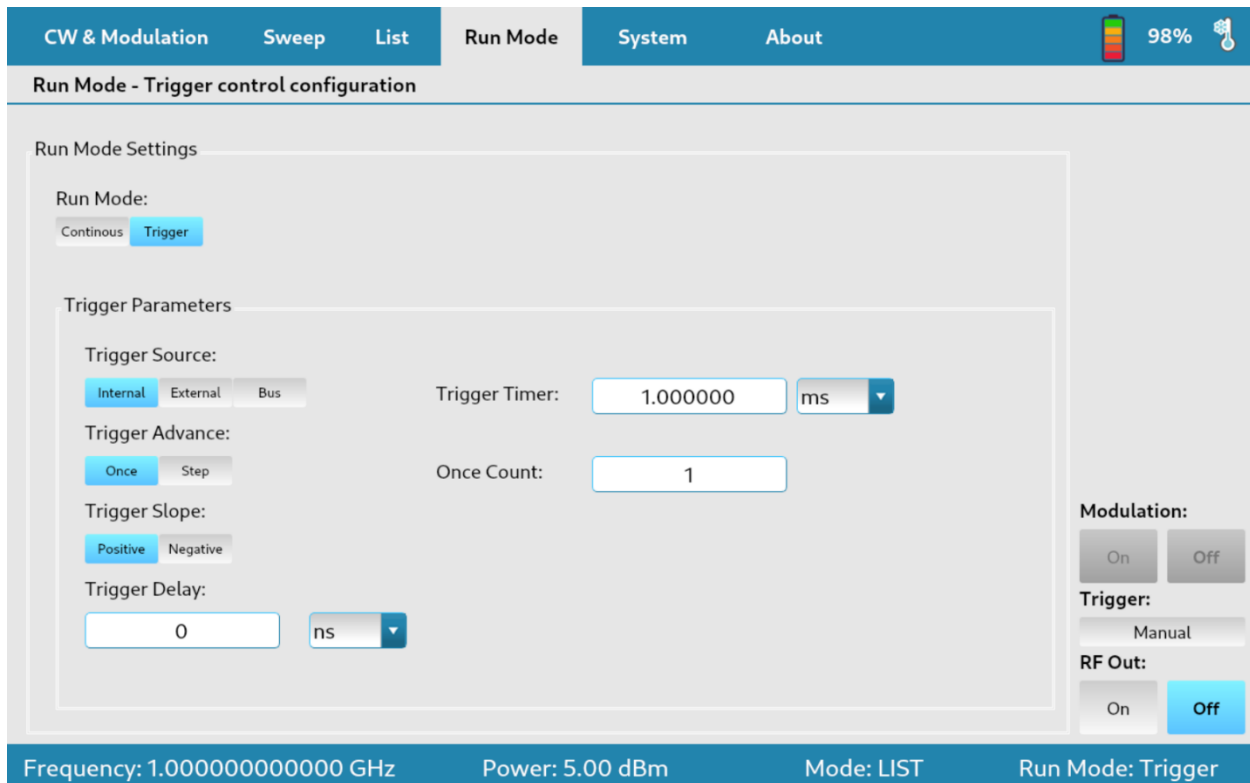
Define a pattern according to the steps below.

1. **NEW List** – Click the button to create a new list.
2. **LOAD File** – Click the button to load a previously saved list.
3. **SAVE File** – Click the button to save the list in a JSON (JavaScript Object Notation) format. You can select to store the data on the SD card or on the internal memory.
4. **DELETE File** – Click the button to delete selected step.
5. **Add STEP** – Click the button to add a new step. Enter the following parameters:
 - a. Frequency (in Hz, kHz, MHz, or GHz) - sets the step frequency.
 - b. Power (in dBm) – sets the step power.
 - c. Dwell Time– sets the duration of the step (in μ s, ms, or s).
 - d. Adv. – Advance, toggle the values by pushing the Enter button:
 - i. Run – the Dwell Time is followed by a Run to the next step
 - ii. Wait – the Dwell Time is followed by a Wait for a Trigger that advances it to the next step.

6. **Delete STEP** – Click the button to delete selected line.
7. **Upload** – Click the button to upload the list to the instrument.

3.4 Run Mode Tab

The Run Mode Tab sets the mode by which the unit will run. E.g., either continuously or by a trigger.



The screenshot displays the 'Run Mode' configuration window. At the top, there are tabs for 'CW & Modulation', 'Sweep', 'List', 'Run Mode' (selected), 'System', and 'About'. A battery status indicator shows 98% charge. The main area is titled 'Run Mode - Trigger control configuration'. It contains 'Run Mode Settings' with 'Run Mode' set to 'Trigger' (over 'Continuous'). Below is 'Trigger Parameters' with 'Trigger Source' set to 'Internal' (over 'External' and 'Bus'), 'Trigger Timer' set to '1.000000' ms, 'Trigger Advance' set to 'Once' (over 'Step'), 'Trigger Slope' set to 'Positive' (over 'Negative'), and 'Trigger Delay' set to '0' ns. On the right, 'Modulation' is set to 'Off' (over 'On'), 'Trigger' is set to 'Manual', and 'RF Out' is set to 'Off' (over 'On'). The bottom status bar shows 'Frequency: 1.000000000000 GHz', 'Power: 5.00 dBm', 'Mode: LIST', and 'Run Mode: Trigger'.

Figure 3.13 Run Mode

- **Run Mode** – sets the way in which the signals are generated.
 - **Continuous** – enables running the signal continuously, as defined in the other tabs, and regardless of the trigger events. All Trigger oriented parameters are hidden.
 - **Trigger** – enables running the signal, when a trigger event is detected.
- **Trigger Source** – sets the source of the trigger.
 - **Internal** – sets a trigger based on the internal HW clock.
 - **Trigger Timer** – sets the trigger repetition time.
 - **External** – an external source connected to the TRIG IN port issues the triggers.
 - **Bus** – a trigger is issued when the user clicks the Man Trigger button.
- **Trigger Advance:** Applicable only for a list.

- **Once** – each trigger runs the whole list. Any incoming trigger is ignored until the list is completed.
- **Once Count:** – the number of times each trigger will run the list.
- **Step** – for every trigger that is accepted the list is advanced by 1 step. While the step is being generated, any incoming trigger is ignored until the step is completed.
- **Trigger Slope:**
 - **Positive** – trig on the trigger positive rising edge.
 - **Negative** – trig on the trigger negative (falling) edge.
- **Trigger Delay:** – sets the delay of the execution after a trigger is received.

3.5 System Tab

The System Tab manages the setup parameters of the entire system. You can load a system file to use a previously used system configuration.

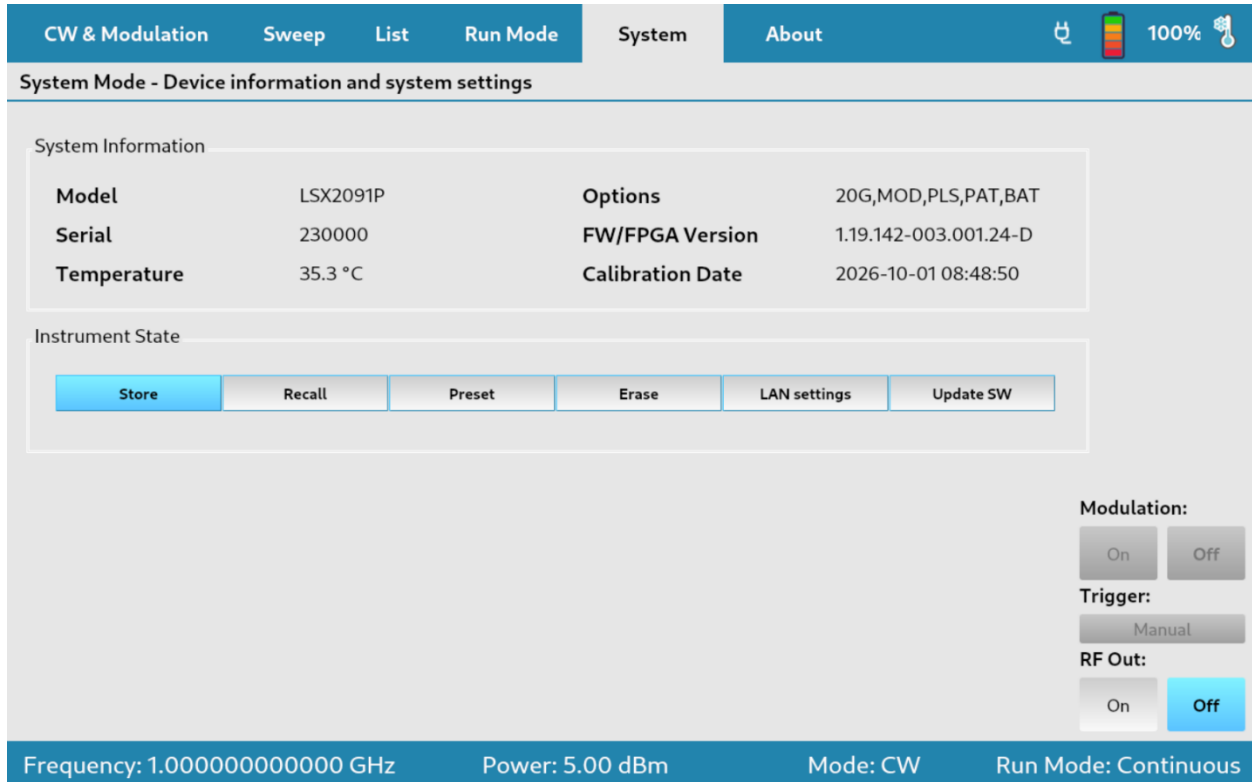


Figure 3.14 System Tab

Following are the details of the System menu:

- **Model** – the ordering model name.
- **Serial** – the serial number of the generator.
- **Temperature** – the temperature of the generator (°C).
- **Options** – the options available in this generator.
 - **xxG** – Maximum frequency of the generator.
 - **MOD** – Modulation package (AM, FM, PM).
 - **LP** – Low power option -90 dBm.
 - **PLS** – Pulse modulation.
 - **PAT** – Pattern generator.
 - **FS** – Fast switching 100 µs.
 - **UFS** – Ultra-fast switching 10 µs.

- **BAT** – 4-cell replaceable extra battery 48 Wh.
- **BAT2** – 4-cell replaceable extra battery 98 Wh.
- **FW/FPGA Version** – the firmware and FPGA version.
- **Calibration Date** – the time stamp of the last calibration.

3.5.1 Store

Select on the device display the System tab and then touch the Store button to save the current settings of the entire system in a JSON (JavaScript Object Notation) format.

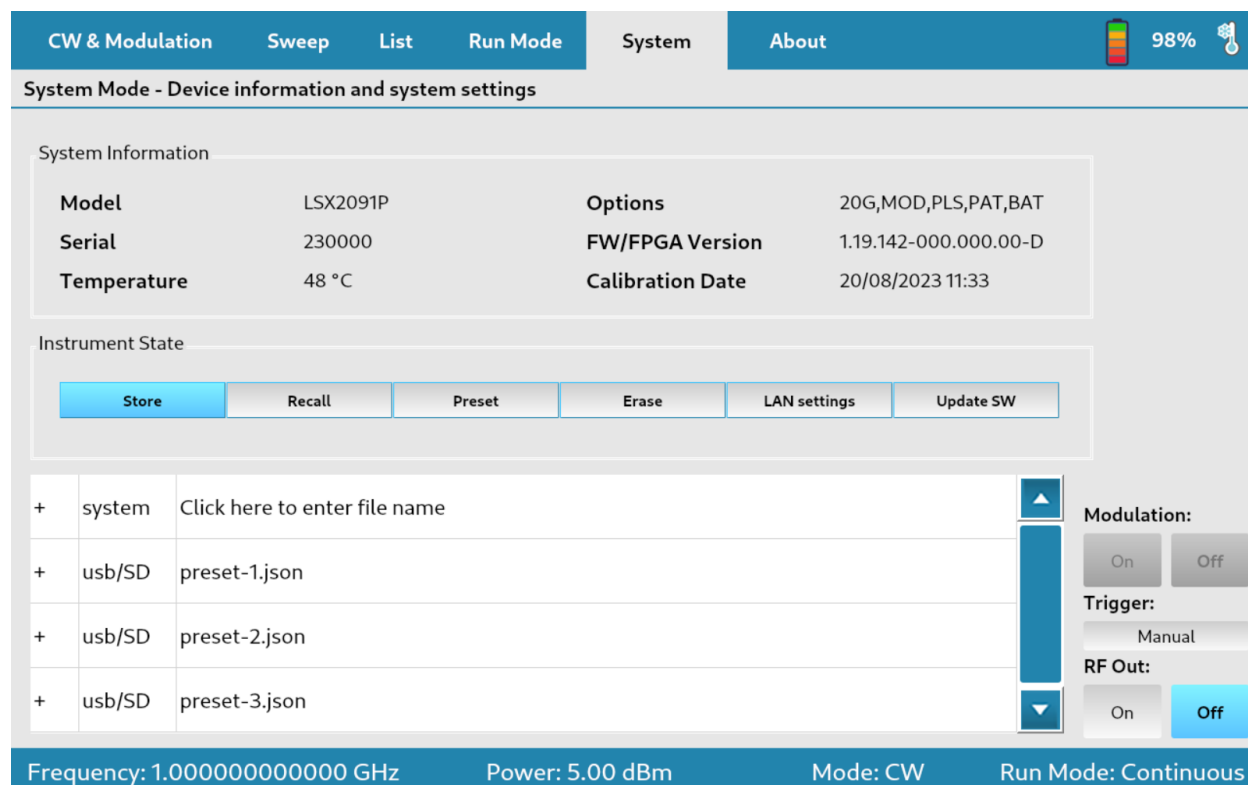


Figure 3.15 Store Settings

3.5.2 Recall

Select on the device display the System tab, and then click the **Recall** button to restore the stored settings of the entire system in a JSON (JavaScript Object Notation) format.

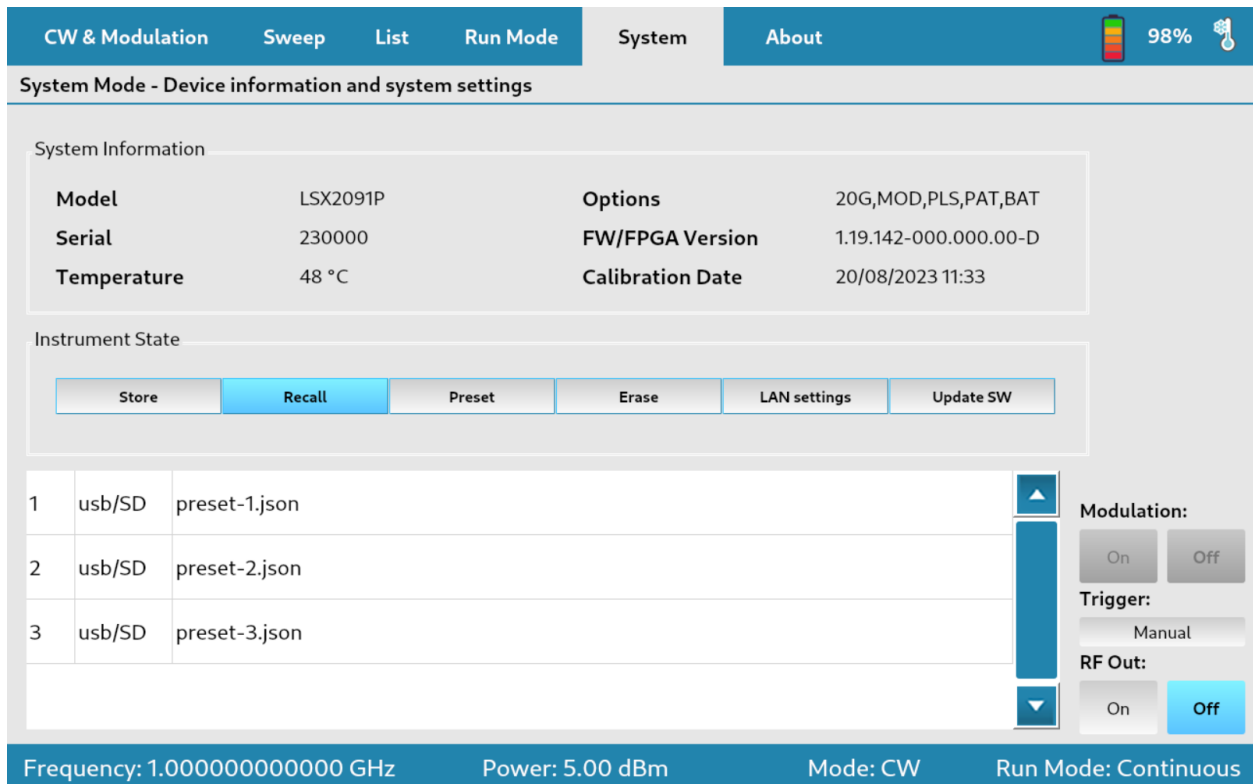


Figure 3.16 Recall

3.5.3 Preset

Select on the device display the System tab and then touch the **Preset** button to set the system settings to factory defaults. A confirmation pop-up message is displayed.

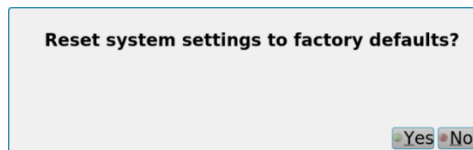


Figure 3.17 Preset Confirmation Pop-up

3.5.4 Erase

Select on the device display the System tab and then touch the **Erase** button to delete the selected system configuration.

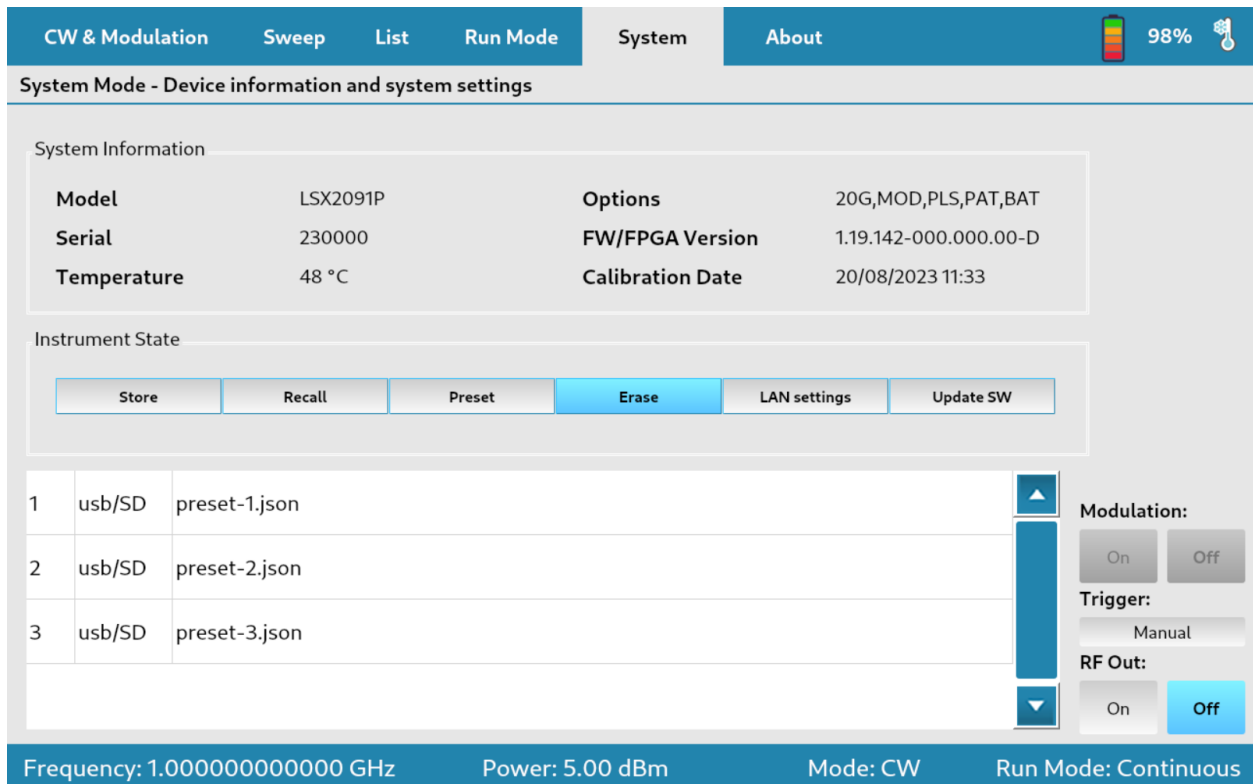
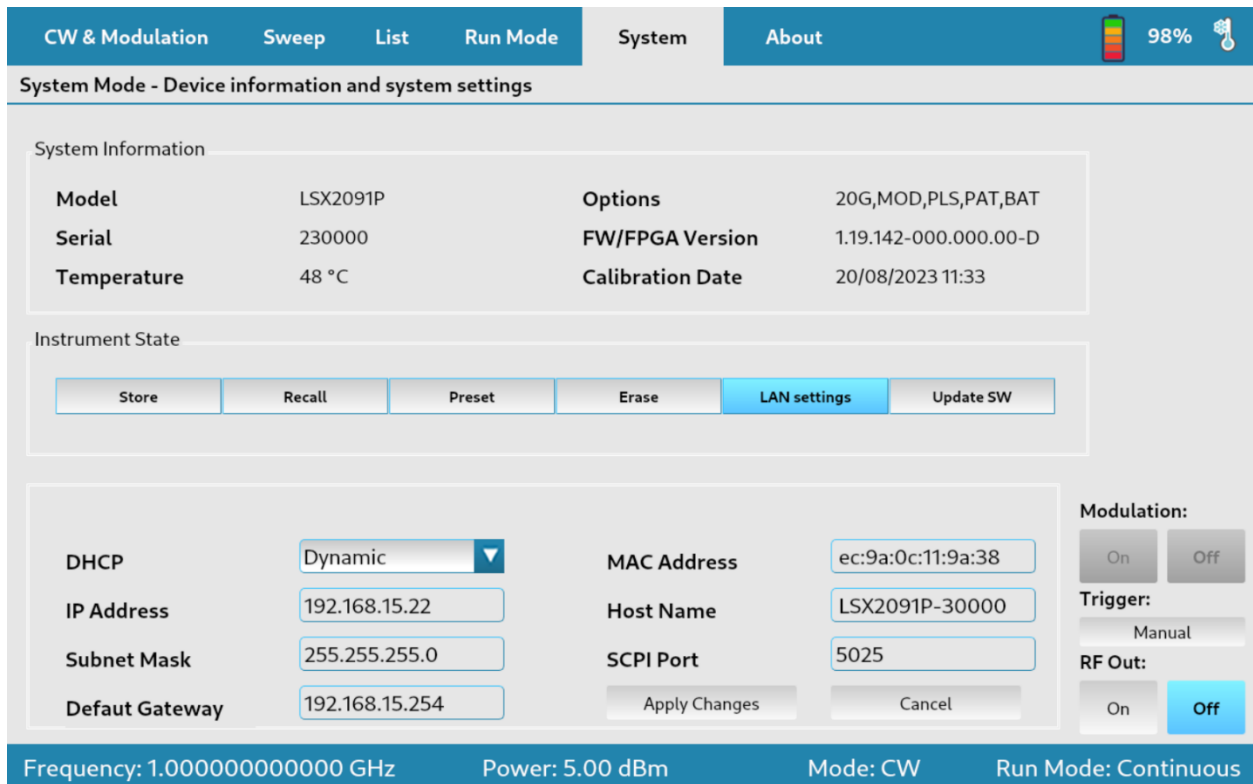


Figure 3.18 Erase

3.5.5 LAN Settings

Select on the device display the System tab and then touch the **LAN Settings** button to show or modify the IP parameters.



CW & Modulation Sweep List Run Mode **System** About 98%

System Mode - Device information and system settings

System Information

Model	LSX2091P	Options	20G,MOD,PLS,PAT,BAT
Serial	230000	FW/FPGA Version	1.19.142-000.000.00-D
Temperature	48 °C	Calibration Date	20/08/2023 11:33

Instrument State

Store Recall Preset Erase **LAN settings** Update SW

DHCP: Dynamic (dropdown)

IP Address: 192.168.15.22

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.15.254

MAC Address: ec:9a:0c:11:9a:38

Host Name: LSX2091P-30000

SCPI Port: 5025

Apply Changes Cancel

Modulation: On Off

Trigger: Manual

RF Out: On **Off**

Frequency: 1.000000000000 GHz Power: 5.00 dBm Mode: CW Run Mode: Continuous

Figure 3.19 System Tab LAN settings

- **DHCP** – Dynamic Host Configuration Protocol.
- **Fixed** – Define a static IP Address. Verify that the PC running Lucid software is on the same network.
- **Dynamic** – Get an IP address from the DHCP server. The IP Address, Port and Subnet Mask fields are not accessible (default).
- **IP Address** – Define a static IP address.
- **Subnet Mask** – Verify that the PC running Lucid software is on the same network.
- **Default Gateway** – Define the default gateway.
- **MAC Address** – The device MAC address.
- **Host Name** – The device computer name.
- **SCPI Port** – Define the SCPI port for communication. User should use a free port in the range 1 to 65535. The default SCPI port is 5025.

3.5.6 Update SW

Select on the device display the System tab and then touch the **Update SW** button to update the portable FW, Lucid-X FW and FPGA. However, you are recommended to use the Tabor Update Tool.

Device FW Update Sequence

1. Prepare on a PC a USB flash memory with a folder containing the package. You can download the files from the Tabor Electronics website at <http://www.taborelec.com/downloads>.
 - a. portable_fw.tar.gz
 - b. Manifest
2. Insert the flash memory in a free USB connector on the device.
3. Select on the device display the System tab, and then click the Update SW button to select the firmware for updating the device.

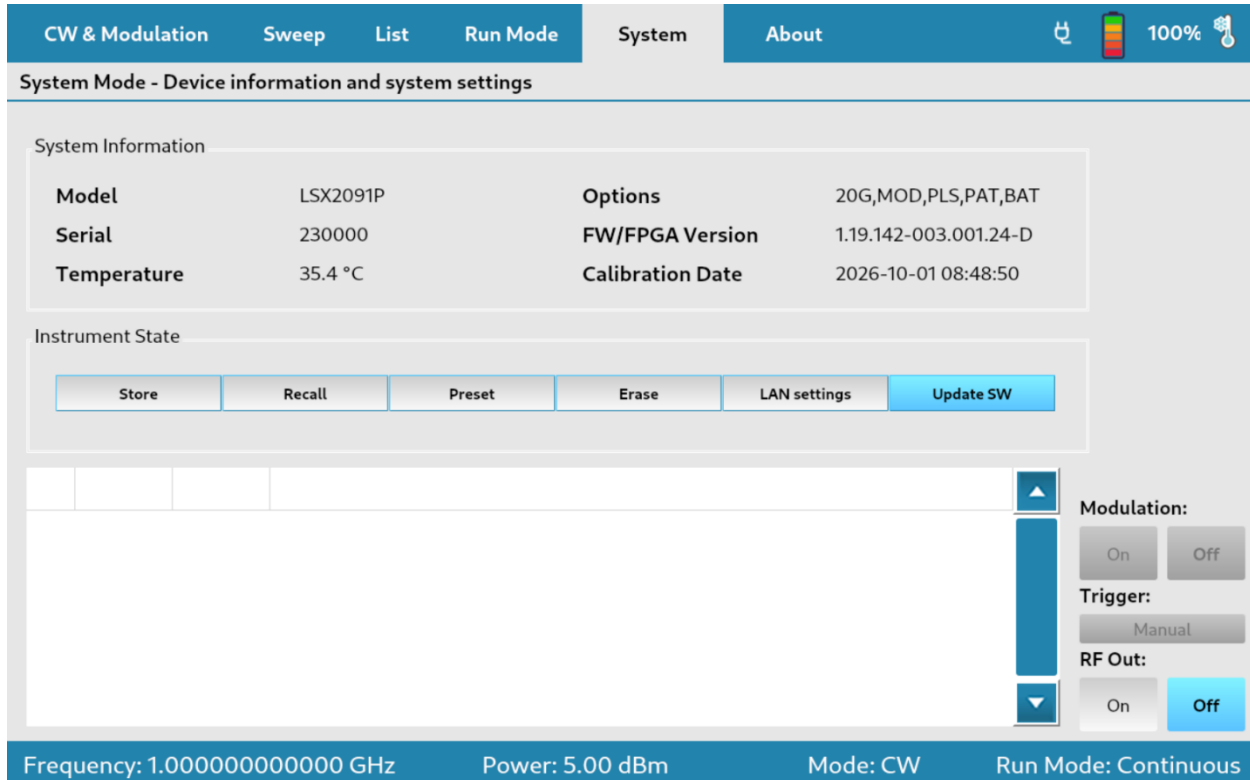


Figure 3.20 System Update

4. Wait for the operation to complete.
5. Reboot the device manually by power-down/up.

3.6 About

Select the **About** tab to show the software version of the instrument.

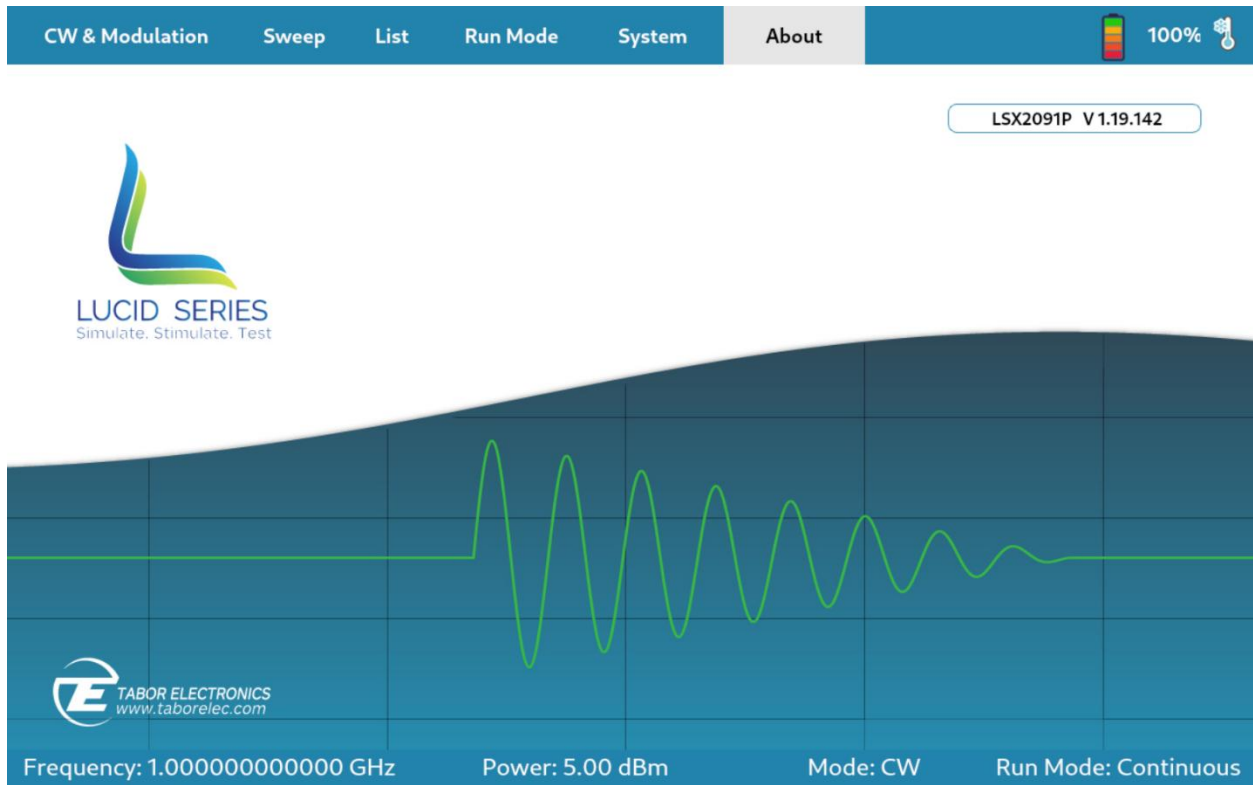


Figure 3.21 About

- **Model** – E.g., LSX2091P.
- **Software Version** – E.g., V1.19.142

4 Lucid-X Portable Specifications

4.1 Frequency

Table 4.1 Frequency Specifications

Frequency	
Range	
LSX8081P	50 kHz to 8 GHz
LSX1491P	50 kHz to 14 GHz
LSX2091P	50 kHz to 20 GHz
LSX4091P	50 kHz to 40 GHz
Resolution	0.001 Hz
Phase offset	Min 0 deg, Max 360 deg
Switching speed	
Standard	500 μ s
FS Option	100 μ s
UFS Option	10 μ s

4.2 Frequency Reference

Table 4.2 Frequency Reference Specifications

Frequency Reference	
Temperature Stability	± 10 ppb max
Aging	± 0.3 ppm 1st year
Warm up Time	30 min
Frequency Accuracy	± 0.5 ppm

4.3 Amplitude

Table 4.3 Amplitude Specifications

Amplitude		
Max Output Power	Base	LP Opt.
Settable	+20 dBm	+20 dBm
Calibrated	+15 dBm	+15 dBm
Min Output Power	Base	LP Opt.
Settable	-30 dBm	-100 dBm
Calibrated	-20 dBm	-90 dBm
Resolution	0.01 dB	
Power Mute	Min -100 dB, Max -70 dB	
Output Return Loss	-10 dBm	
Accuracy (dB)	-70 dBm to +10 dBm	
Up to 100 MHz	± 0.3 (typ.) dBm	
100 MHz to 3 GHz	± 0.4 (typ.) dBm	

Amplitude	
3 GHz to 9 GHz	±0.7 (typ.) dBm
Above 9 GHz	±1 (typ.) dBm

4.4 Phase Noise and Harmonics

Table 4.4 Phase Noise and Harmonics Specifications

Phase Noise (dBc/Hz)		
Carrier Frequency	Typical Phase Noise Measured @ 10 kHz Offset	
100 MHz	-148	
1 GHz	-133	
4 GHz	-121	
8 GHz	-115	
10 GHz	-114	
20 GHz	-108	
40 GHz	-102	
Harmonics (typ.)		
Range	0 dBm	+10 dBm
<1.5 GHz	<-50 dBc	<-40 dBc
1.5 GHz to 8 GHz	<-50 dBc	<-35 dBc
8 GHz to 12 GHz	<-40 dBc	<-32 dBc
12 GHz to 17 GHz	<-43 dBc	<-35 dBc
17 GHz to 20 GHz	<-55 dBc	<-50 dBc
20 GHz to 40 GHz	<-45 dBc	<-35 dBc
Sub-Harmonics (typ.)		
Up to 20 GHz	-75 dBc	
>20 GHz	-75 dBc	
Non-harmonics (typ.)		
Up to 20 GHz	-75 dBc	
>20 GHz	-75 dBc	

4.5 Modulation

Table 4.5 Modulation Specifications

Modulation	
Frequency Modulation	
Deviation Min/Max	1 Hz/10 MHz
Resolution	0.1% or 1 Hz (the greater)
Modulation Rate Min/Max	1 Hz/1 MHz
Resolution	1 Hz
Amplitude Modulation	
Type	Linear
AM Depth	
Maximum Settable	0 to 100%

Modulation	
Resolution	0.1% of depth
Modulation Rate	DC to 100 kHz
Phase Modulation	
Peak Deviation	0 to 360 deg
Modulation Rate	1 Hz to 10 MHz
Sweep	
Range	Same as frequency range
Modes	Frequency step, Amplitude step, List
Dwell Time	10 μ s to 562,499 s
Resolution	1 μ s
Number of Points	2 to 4,096
Step Change	Linear
Trigger	Free run, External, Bus, Timer
Pattern Modulation (PAT Option)	
Number of Steps	1 to 2048
Step Repetition	1 to 65535
On/Off Time	32 ns to 20 days
Pulse Modulation (PLS Option)	
On/Off Ratio	70 dB
Rise/Fall Time	15 ns, 10%-90% (typ.)
Resolution	10 ns
Width Min/Max	32 ns/100 ms
Repetition Frequency	1 Hz to 10 MHz

4.6 Inputs/Outputs

Table 4.6 Inputs/Outputs Specifications

Inputs / Outputs	
RF Out	
Impedance	50 Ω
Connector Type	2.92 mm
VSWR	1:2.1
Reverse Power	0.5 W, 16 VDC
Modulation Input	
Connector Type	SMP
Input Impedance	50 Ω
Max. Input Voltage	± 1 V
Input Damage Level	± 3.5 V
Pulse / Trigger Input	
Connector Type	SMP
Input Impedance	50 Ω
Input Voltage	TTL, CMOS compatible
Threshold	1.5 V

Inputs / Outputs	
Damage Level	-0.42 V or 5.42 V
Reference Input	
Connector Type	SMA
Input Impedance	50 Ω
Waveform	Sine or Square
Frequency	10/100 MHz
Power	-3 dBm to +10 dBm
Absolute Max. Level	+15 dBm

4.7 General

Table 4.7 General Specifications

General	
Temperature	
Operating	0°C to +40°C
Storage	-40°C to +70°C
Warm up Time	30 minutes
Humidity	85% RH, non-condensing
Safety	CE Marked, IEC61010-1:2010
EMC	IEC 61326-1:2013
Calibration	2 years
Warranty	3 years

4.8 General Portable

Table 4.8 General Portable Specifications

General	
Power Supply	Input 100 – 240 V AC, 1.5 A, 47-63 Hz Output 12.0 V DC, 8.34 A, 100.0 W Outside  Inside
Power Consumption	
LSX8081P	25 W typ., 35 W max.
LSX1491P	30 W typ., 45 W max.
LSX2091P	30 W typ., 45 W max.
LSX4091P	TBD
Display Type	10.1", 1280x800 TFT capacitive touch screen
Battery	
Type	4-cell, replaceable (LSX4091P 8-cell non-replaceable)
Standby	Up to 2 hours
Maximum Load LSX8081P	60 min
Maximum Load LSX1491P	40 min
Maximum Load LSX2091P	40 min
Maximum Load LSX4091P	60 min
Interface	
Host	2 x USB type A
Device	1 x USB type B 1 x micro-USB for LAN adapter
Storage	Removable SD card
Dimensions (WxHxD)	280 x 225 x 65 mm
Weight	
Without Package	3 kg
Shipping Weight	4.5 kg

4.9 Ordering Information & Options

Table 4.9 Ordering Information & Options

General	
LSX8081P	8 GHz, 1 channel, portable analog RF signal generator
LSX1491P	14 GHz, 1 channel, portable analog RF signal generator
LSX2091P	20 GHz, 1 channel, portable analog RF signal generator
LSX4091P	40 GHz, 1 channel, portable analog RF signal generator
MOD	Modulation package (AM, FM, PM)
LP	Low power option -90 dBm
PLS	Pulse modulation
PAT	Pattern modulation

FS	Fast switching 100 μ s
UFS	Ultra-fast switching 10 μ s
BAT	4-cell, replaceable extra battery 48 Wh
BAT2	8-cell, non-replaceable battery, 98 Wh default for LSX4091P
CHA	External charger
LAN	USB Ethernet adapter
WE	1 year warranty extension (standard warranty 3 years)