Keysight Technologies
N9342C/N9343C/N9344C HSA
Handheld Spectrum Analyzer

Demonstration Guide

KEYSIGHT TECHNOLOGIES

Table of Contents

Introduction

This demonstration guide shows you how to use the basic functions of the N9342C/43C/44C handheld spectrum analyzers (HSAs) and take advantage of their extensive features. The demonstrations apply to all of the HSA models, which are collectively referred to as N934xC HSAs in this document.

Demonstrated features include:

- Panel tour
- Auto-brightness and back-lit keys
- Save, recall, and the unique User key
- GPS
- Task planner
- Spectrum monitoring and interference hunting
- Remote control via LAN or USB port
- Marker, marker table, and peak table
- Advanced marker functions
- Limit lines and limit masks
- Multiple traces and simultaneous detectors
- Trace math functions
- Tracking generator
- Power meter

Demonstration Preparation

This demonstration provides the step-by step instructions for using the extensive features of N934xC HSAs.

All demonstration key strokes surrounded by [ ] indicate front panel hard keys and key strokes surrounded by { } indicate soft keys on the right edge of the display.

Instructions between E4438C and N934xC HSAs

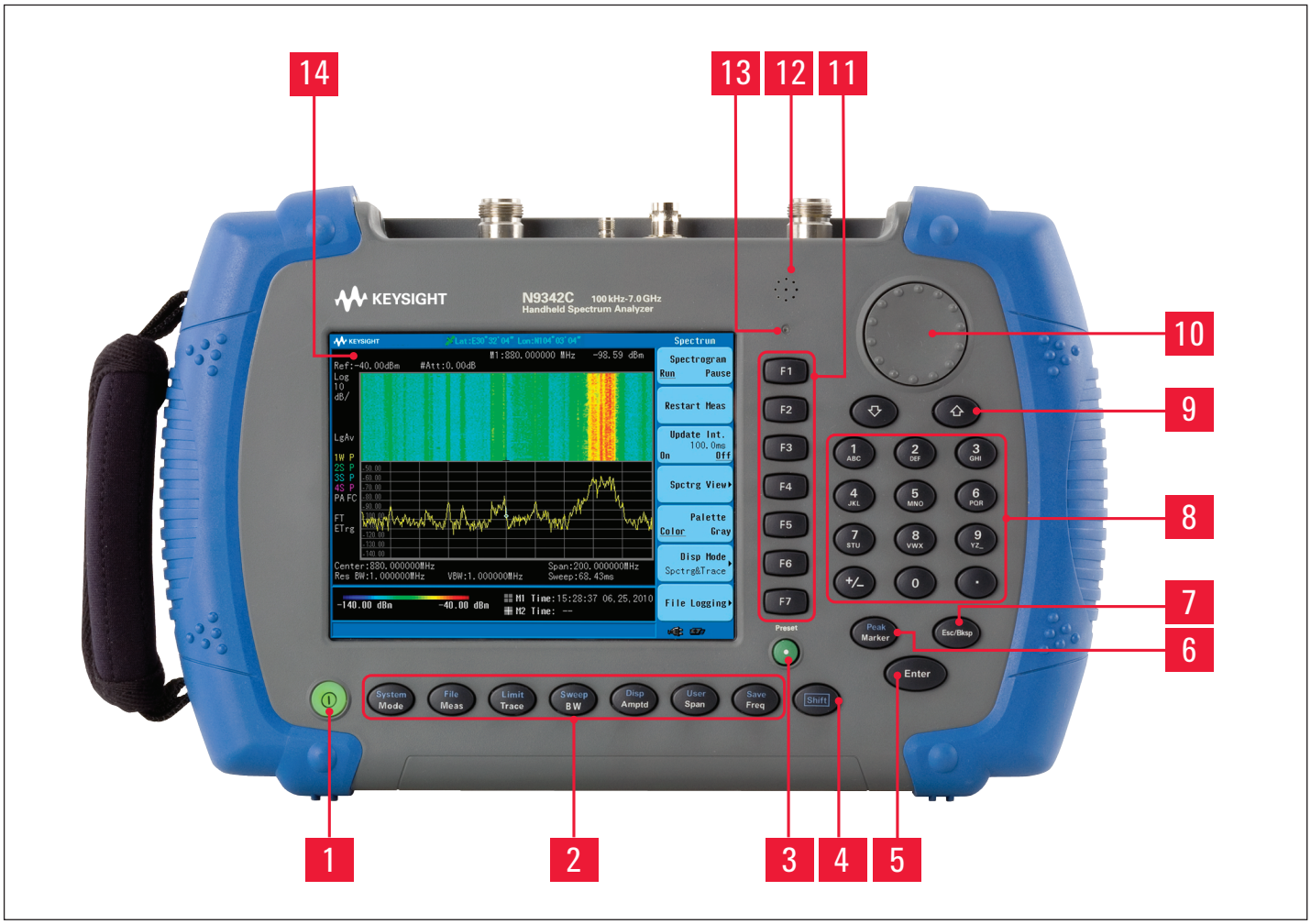
- Connect the 10 MHz out of E4438C to the Ext Trig/Ext Ref of the HSA
- Press N934xC HSA's [Shift], [System], {More 1 of 2}, {Port Setting}, {Ext Input (Ref)}
- Connect the RF out of the E4438C to RF In of the N934xC HSA
- Power on both the E4438C and HSA

Model no.	Product type	Options
E4438C-503	ESG vector signal generator	400 602
N934xC	Handheld spectrum analyzer	N9342C-PA7 N9343C-P13 N9344C-P20 N934xC-PWM N934xC-SIM N934xC-TG7 N934xC-GPS N934xC-GPA N934xC-TPN
	An AM/FM antenna	
	An Omni antenna (which is used to receive over-the-air signals)	
	A bandpass filter	

Figure 1. Instrument connection

Panel Tour

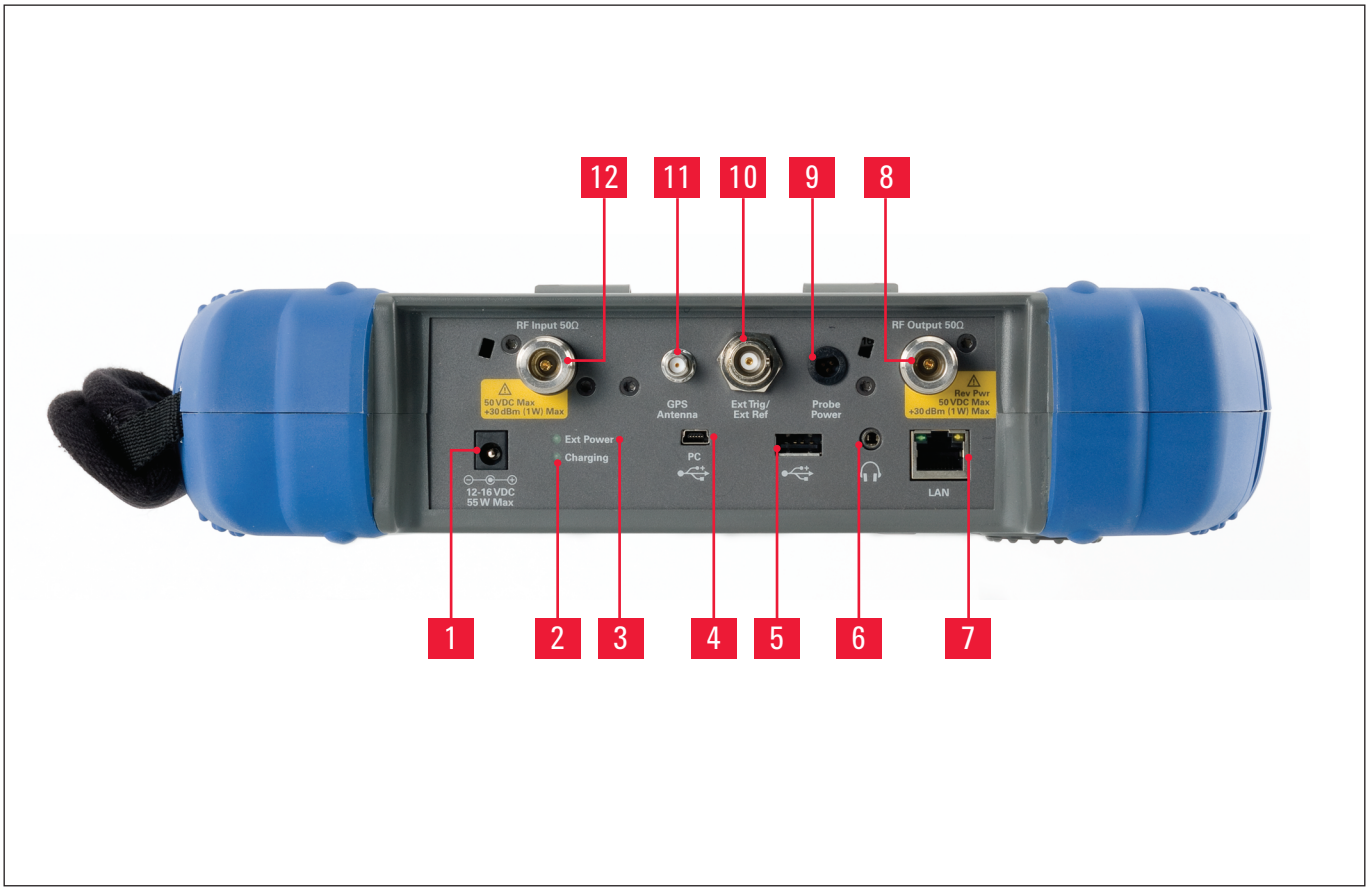
Front panel



No.	Caption	Function
1	Power switch	Toggles the analyzer between on and off
2	Function keys	Includes function hard keys for measurements
3	Preset	Returns the analyzer to a known state, also On/Off power save features (press and hold for 1 sec)
4	Shift	Switches alternate upper function of the function keys and [Peak/Marker]
5	Enter	Confirms a parameter selection or configuration
6	Peak/Marker	Activates the peak search or marker function
7	ESC/Bksp	Exits and closes the dialog box or clears the character input as a back space key
8	Alphanumeric keys	Includes a positive/negative, a decimal point, and ten alphanumeric keys
9	Arrow keys	Increases or decreases a parameter step by step
10	Knob	Selects an option item or edits a numerical parameter
11	Softkeys	Indicates current menu functions on the screen
12	Speaker	Actives in demodulation mode
13	Light sensor	Adjust the brightness automatically
14	Screen	Displays spectrum traces and status information

Panel Tour (continued)

Top panel



No.	Caption	Function
1	External DC power connector	Provides input for the DC power source via an AC-DC adapter, or automotive type DC adapter
2	LED indictor (charging)	Lights (On) when the battery is charging
3	LED indictor	Lights (On) when external DC power is connected
4	USB interface (device)	Connects to a PC
5	USB interface (host)	Connects to a USB memory stick or disk
6	Headphone	Connects to a headphone
7	LAN interface (option)	Connects to a PC for SCPI remote control
8	RF OUT connector	The output for built-in tracking generator (enabled with Option TG7)
9	Probe power	Provides power for high-impedance AC probes or other accessories (+15 V, -12 V, 150 mA maximum)
10	EXT TRIG IN/REF IN (BNC, female)	Connects to an external TTL signal or a 10-Hz reference signal. The TTL signal is used to trigger the analyzer's internal sweep
11	GPS antenna connector	Connects to an external GPS antenna for GPS application
12	RF IN connector (50 Ω)	Accepts an external input with a frequency range from 100 kHz to 7 GHz, tunable to 9 kHz

Demonstration 1

Auto-brightness and back-lit keys

Communication system maintenance and repair often require a technician to trouble-shoot in bright daylight or in the darkness of night. The light sensor on the front panel of the N934xC HSA senses the ambient light and automatically adjusts the brightness of the display and the back-lit keys.

The user can also manually set the brightness of the display, and the brightness of the back-lit keys, so they can be seen clearly even in any light. The duration of the key light is settable to provide maximum battery life.

1.1 Adjust the display brightness

Instructions for HSA	Keystrokes for HSA
Switch the screen brightness state from automatic to manual	[Shift], [System], {Screen Setting}, {Brightness (Man)}
Rotate the knob to adjust the display brightness	
Switch the screen brightness state back to automatic	{Brightness (Auto)}
Cover the light sensor with your finger and watch as the display brightness adjusts automatically	

1.2 Back-lit key demo

Instructions for HSA	Keystrokes for HSA
Turn on key backlight	[Shift], [System], {Keypad Setting}, {Backlight Brightness}, {Auto}
Adjust backlight flash time to 5, 10, 15, 30 seconds, or “always on”	{Backlight off}, {15 s}

Demonstration 2

Measurement basics: frequency, span, amplitude

The key measurement setup parameters of a spectrum analyzer are:

- Frequency
  Adjust the frequency range measured
- Span
  Adjust how closely you look at the signal
- Amplitude
  Adjust the view of the signal's level

A typical spectrum analyzer measurement procedure contains the following three steps:

1. Tune the center frequency of the analyzer to the signal of interest.
2. Adjust the span to zoom in on the signal of interest.
3. Adjust the amplitude to give the optimum view of the signal.

In this demonstration, we will set signal generator to output a signal to N934xC HSA with an RF cable and set these parameters.

Instructions for the source	**Keystrokes for the source**
Set 2 GHz center frequency, amplitude -10 dBm, CW signal	[Preset], [FREQ], [2], {GHz}, [AMPTD], [-10], {dBm}, [RF On]
Instructions for HSA	**Keystrokes for HSA**
Tune the center frequency to 2 GHz	[Freq], [2], {GHz}
Adjust span so signal fills the screen	[Span], [10], {MHz}
Set reference level to -10 dBm so that the signal peak is at the top of graticule line (Figure 2)	[Amptd], {Ref Level}, [-10], {dBm}

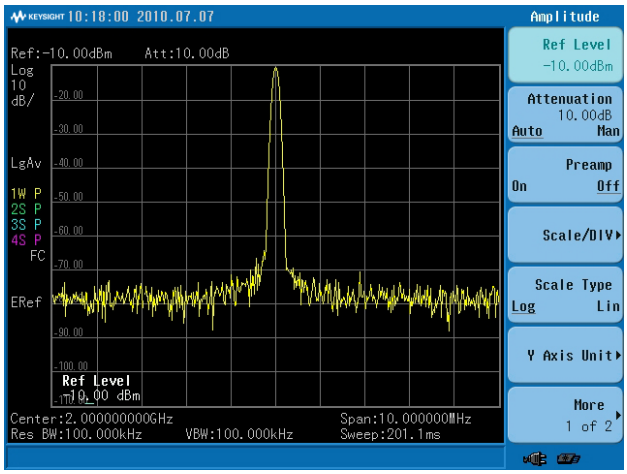


Figure 2. Adjust reference level

Demonstration 3

Save, recall, and the unique User key

The N934xC HSAs let you save the state, trace data, measurement results (peak and marker table), limit lines, and screen captures to an internal file, a USB drive, or remotely via LAN or USB.

The N934xC HSAs provide a dedicated Save button to let you save a file quickly with a single button press. When the Save button is used, you can choose to name the file by yourself, or let the HSA automatically pick a file name that consists of a prefix (N934xC is the default but can be edited) and a index.

Another unique feature on the N934xC HSAs is the User key, which provides a quick way to set up the instrument. You can select from 7 predefined instrument setups with a single button push.

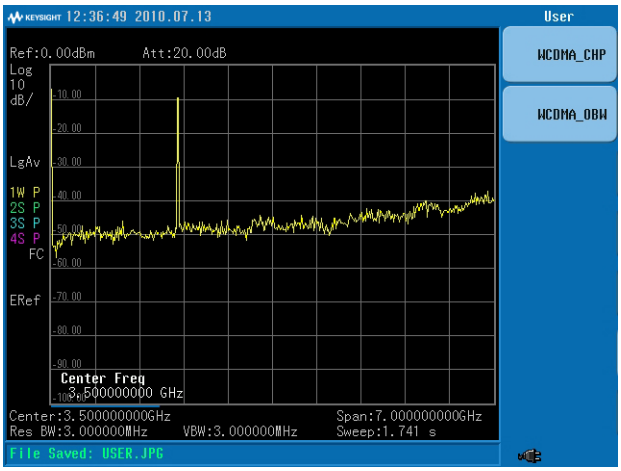


Figure 3. USER key

Instructions for the source	**Keystrokes for the source**
Set 2-GHz center frequency, amplitude -10 dBm, W-CDMA signal	[Preset], [Freq], [2], {GHz}, [Amplitude], [-10], {dBm}, [Mode], {W-CDMA}, {Arb W-CDMA (3GPP 12-2004}, {W-CDMA (On)}, [Mod On], [RF On]
Instructions for HSA	**Keystrokes for HSA**
Preset N934xC HSA	[Preset]
Select internal C:/USER/STATE folder *Note: For the user key feature, the STA file must be placed under the USER/STATE directory*	[Shift], [File], rotate the knob to select the USER folder, [Enter], rotate the knob to select the STATE folder, [Enter], {Return}
You may have to create the USER and STATE directory folders	[Shift], [File], {Directory}, {Create Folder}
Set QSave file type	[Shift], [File], {Setup}, {QSave Type}, {STA}
Turn on QSave naming	{QSave Naming (On)}, {Return}
Set center frequency and span	[Freq], {Center Freq}, [2], {GHz}, [Span], [10], {MHz}
Turn on channel power	**[Meas], {Channel Power}**
Set integrated BW	{Integrated BW}, [5], {MHz}
Save file	[Shift], [Save], input the file name [WCDMA_CHP] in the “Save As” dialog box and press [Enter]
Turn on OBW	**[Meas], [Meas], {Occupied BW}**
Save file	[Shift], [Save], input the file name [WCDMA_OBW] in the “Save As” dialog box, [Enter]
Preset N934xC HSA	[Preset]
Use the User key *(As shown in Figure 17, channel power and OBW's state file name appears on the soft key button)*	[Shift], [User]
Make measurement with User key	
Channel power	{WCDMA_CHP}
OBW	[Shift], [User], {WCDMA_OBW}

Demonstration 4

GPS

The HSA has a built-in GPS receiver and antenna (Option GPS). In addition to the internal antenna, the HSA also supports the external GPS antenna (Option GPA), providing convenience in the field. You can save measurement results with GPS location data (latitude, longitude, and altitude).

In this demonstration, we will show how to use the N934xC HSA's GPS feature.

Instructions for HSA	Keystrokes for HSA
In order to receive a GPS signal, you need to move to an open space to use the internal GPS antenna, or connect an external GPS antenna (option GPA) to the HSA and make sure the head of the external GPS antenna is in an open space.	
Turn on GPS	[Shift], [System], {More 1 of 2}, {GPS}, {GPS, (On)}
	A icon will appear at the top of the display after successful lock of GPS satellites
Turn on GPS information on the display	{GPS Info, (On)}
	Location information from GPS displays on the right of icon (Figure 3)

Note: The N934xC must have an unobstructed view of the sky in order to lock onto GPS satellites.

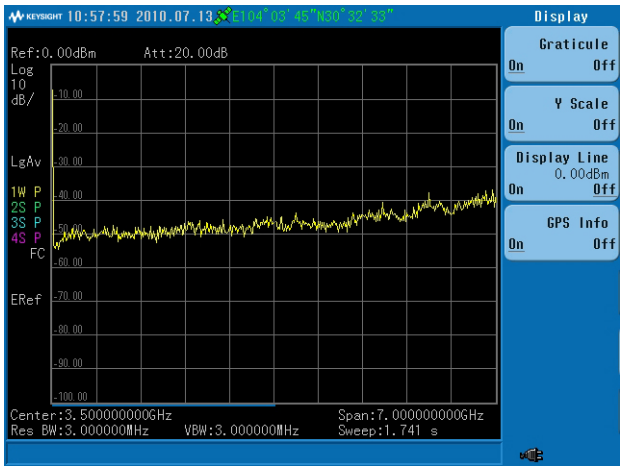


Figure 4. GPS information

Demonstration 5

Task planner

Task planner is a unique tool provided with N934xC HSA as an optional feature. It's easy to sequentially execute many pre-defined measurements, log results, and generate reports automatically.

The measurement modules which task plan supports include: SA, ACP, CHP, and OBW. One task planner file (*.tpf) can execute up to 20 test tasks.

In this demonstration, we will compile a task planner file (w_cdma.tpf) and run it. Before compiling it, you must install N934xC HSA PC software and the Keysight Technologies, Inc. I/O library on your PC (download available at www.keysight.com/find/hsapc).

Step 1: Create a task plan file (.TPF)

Action 1: Save state file

Instructions for HSA	Keystrokes for HSA
Set center frequency and span	[Freq], {Center Freq}, [2], {GHz}, [Span], [10], {MHz}
Task 1: Channel power	
Enter channel power	[Meas], {Channel Power}
Set integrated bandwidth (BW)	{Integrated BW}, [5], {MHz}
Save the state file for channel power	[Shift], {File}, {Save As}, input the file name [WCDMA_CHP], use the rotating knob to choose file type: STA, [Enter]
Task 2: Occupied bandwidth (OBW)	
Enter OBW	[Meas], [Meas], {OBW}
Save the state file for OBW	[Shift], {File}, {Save As}, input the file name [WCDMA_OBW], use the rotating knob to choose file fype: STA, [Enter]
Task 3: Adjacent channel power ratio (ACPR)	
Enter ACPR	[Meas], [Meas], {ACPR}
Set main channel BW, adjacent channel BW, and space	{Main Channel}, [3.84], {MHz}, {Adj Chn BW}, [3.84], {MHz}, {adj Chn Space}, [5], {MHz}
Save the state file for ACPR	[Shift], {File}, {Save As}, input the file name [WCDMA_ACPR], use the rotating knob to choose file fype: STA, [Enter]

Demonstration 5

Task planner (continued)

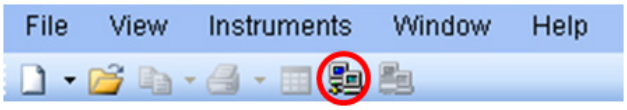


Figure 5. Connect to the N934xC HSA

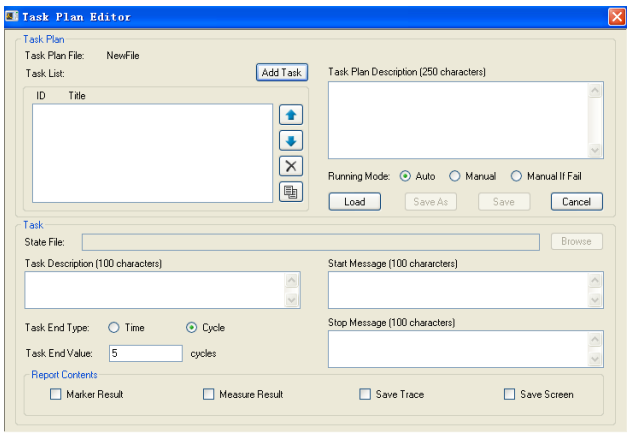


Figure 6. Task plan editor

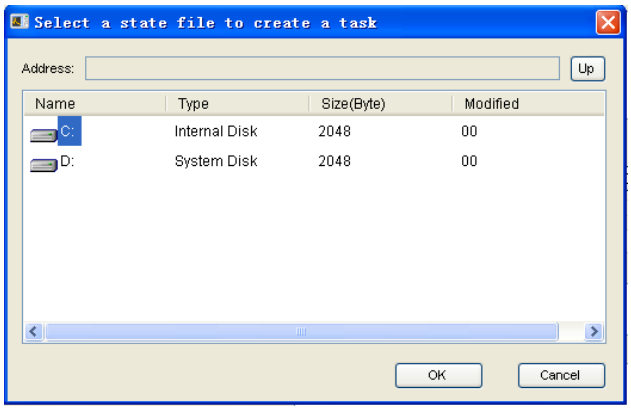


Figure 7. Add from the device

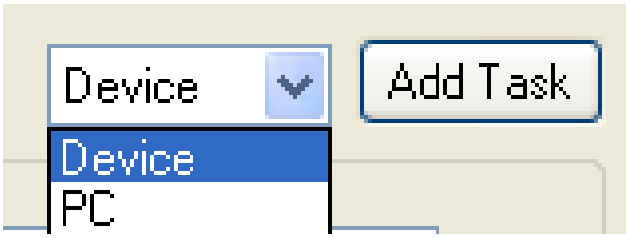


Figure 8. Select a state file

Action 2: Compile task plan file (.TPF) with the free N934xC HSA PC software

Instructions for HSA	Keystrokes for HSA
Make sure the Keysight I/O library and the N934xC HSA PC software are correctly installed. Connect the N934xC HSA and PC via a USB cable	
Run the N934xC HSA PC software *Note: In order for the Keysight I/O library to "discover" the HSA USB connection, you must connect the instrument to the PC via the USB cable and follow the "wizard" directions. Running the Keysight Connection Expert within the I/O library may be required*	Click the shortcut key of Keysight HSA PC software on the PC screen
Establish the connection between the PC and the N934xC HSA	– Click the connection shortcut in the toolbar as shown in Figure 5 – Select the N934xC HSA in the connect instrument dialog box – Click "Ok"
Add state files into the task plan file	– Click "Instruments" then "Task Plan Editor" to open the task plan editor as shown in Figure 6 – Click "Add Task" in the task plan editor dialog box as shown in Figure 7 *Note: If these state files are on the PC, you should choose media type "PC" before clicking "Add Task" button* – Double click the "Driver C" in the "Select a state file to create a task" dialog box as shown in Figure 8 – Double click file WCDMA_CHP.STA – Repeat the steps from b to d to add WCDMA_OBW.STA, and WCDMA_ACPR.STA to the task plan

Note: If these state files are on the PC, you should choose media type "PC" before clicking "Add Task" button.

Demonstration 5

Task planner (continued)

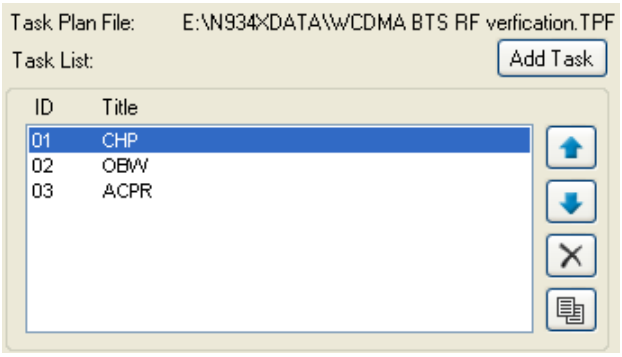


Figure 9. Task list

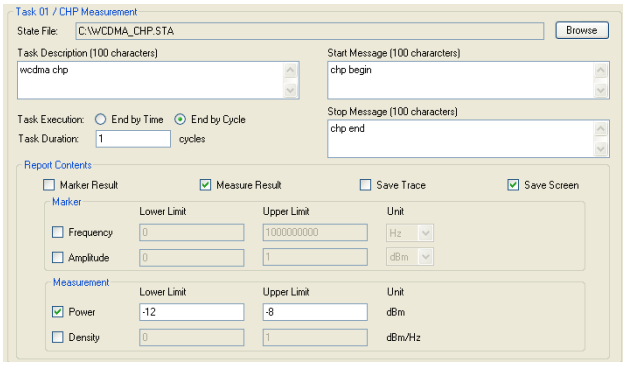


Figure 10. Edit a task

Action 2: Compile task plan file (.TPF) with the free N934xC HSA PC software

Instructions for HSA	Keystrokes for HSA
Edit the task list	As shown in Figure 9, the task list can be easily edited: – Click and to move up or down the file – Click to delete task files – Click to copy files – Double click the selected task file to rename the selected task
Edit the task description, start/stop message, report contents, and limits	The following demonstration is on Test 1: Channel power (Figure 10)
About report contents. Four types of report content are provided: 1. Marker result. If this is selected, the N934xC will log the marker readout if the marker is enabled in the state file. The upper and lower limits can be set up for marker frequency and amplitude to indicate the PASS/FAIL of the marker readout 2. Measure result. Measure result is only shown when the measurement is CHP, OBW, or ACPR. The upper and lower limits can be set up to indicate the PASS/FAIL of the measurement result 3. Save trace. If this is selected, the N934xC HSA will save the trace (.TRC) at the end of the current task 4. Save screen. If this is selected, the N934xC HSA will capture the screen (.JPG) at the end of the current task	– Task description: – Select CHP in the task list – Input “wcdma chp” in the task description box – Input “chp begin” in the start message box – Input “chp end” in the stop message box *Note: Use the task description and start/stop message to provide brief test setup instructions to field engineer/technician* – “End by Cycle“ and set task duration to 1 – Set report contents as the following: – CHP’s lower limit is -12 dBm and upper limit is -8 dBm – Select the task “OBW” – Input “wcdma obw” in the Task Description box – Input “obw begin” in the start message box – Input “obw end” in the stop message box – Set lower limit as 4 MHz and upper limit as 5 MHz – Select the task “ACPR” – Input “wcdma acpr” in the task description box – Input “acpr begin” in the start message box – Input “acpr end” in the stop message box – Set ±5 MHz ACPR’s lower limit as -60 dBc and upper limit as -44.2 dBc – Set ±10 MHz ACPR’s lower limit as -60 dBc and upper limit as -49.2 dBc

Demonstration 5

Task planner (continued)

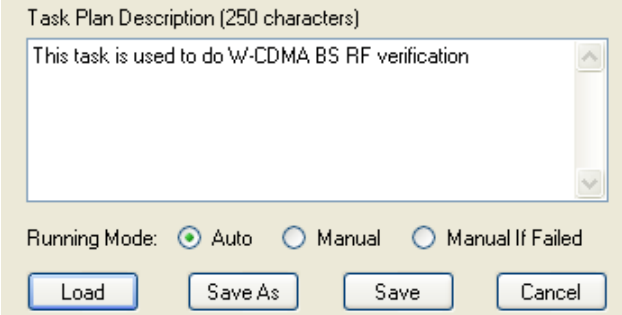


Figure 11. Task plan running mode

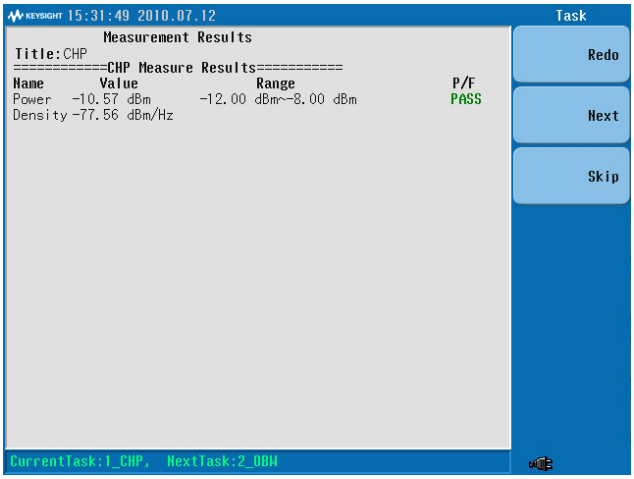


Figure 12. Test measurement result (manual mode)

Instructions for HSA	Keystrokes for HSA
Edit the task plan description, running mode, and save the task plan	– Input “This task is used to do W-CDMA BS RF verification” as the task plan description – Select “Auto” as the running mode – Click “Save as” and save this file as:“W_CDMA.tpf”. Close the “Task Plan Editor” dialog box

Running mode

There are three choices (see Figure 11):

1. Auto
   - Tasks are executed non-stop until tasks are completed
2. Manual
   - After one measurement task is finished, there is a measurement result report and you can choose to
   - {Redo}
     Redo the current task
   - {Next}
     Execute the next task
   - {Skip}
     Skip the next task
3. Manual if failed
   - The measurement tasks are executed non-stop and there is a failed result, e.g. passing the defined limit, it will enter “Manual” mode (Figure 12)

Note: A “Load” button is provided to load an existing *.TPF for future modification

Demonstration 5

Task planner (continued)

There are two ways to transfer the task plan file to the N934xC HSA: via a USB flash drive or using the N934xC HSA PC software. In this example we will use N934xC HSA PC software to transfer the task plan file to the N934xC HSA.

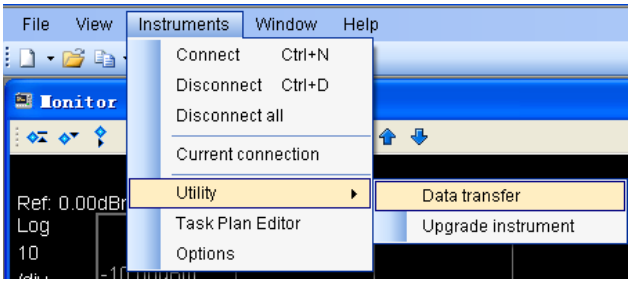


Figure 13. Data transfer

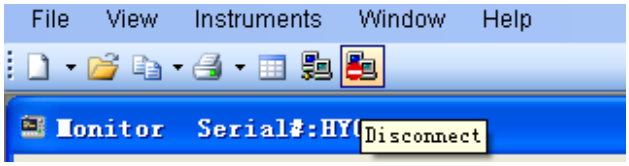


Figure 14. Disconnect

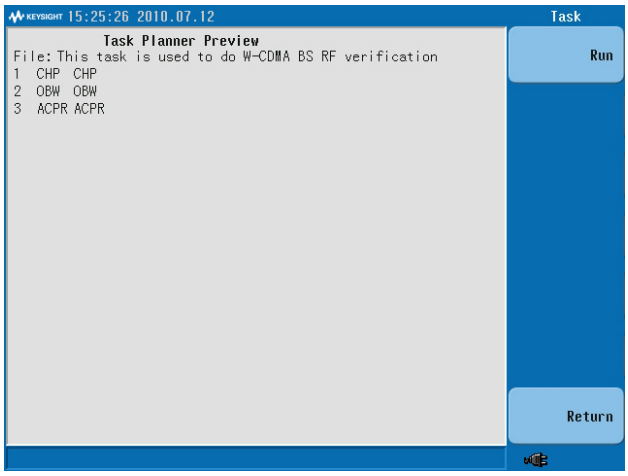


Figure 15. Task plan preview

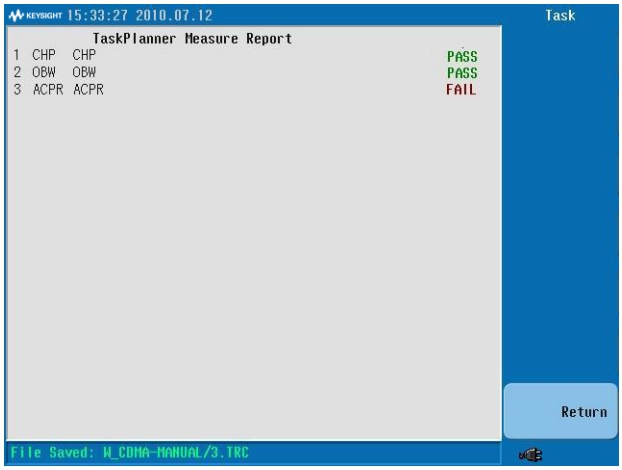


Figure 16. Task plan measurement result

Step 2: Transfer the task plan file to the HSA

Instructions for HSA	Keystrokes for HSA
Transfer the task plan file to the N934xC HSA	– As shown Figure 13, click the “Data transfer” – Just like Windows file operation, drag the W_CDMA.tpf file from the PC to N934xC HSA’s Internal disc C – Close the “Data Transfer” box
N934xC HSA back to local mode	– Click the shortcut key of disconnection as shown in Figure 14 – Press [Enter] on the N934xC HSA and return to loc

Demonstration 5

Task planner (continued)

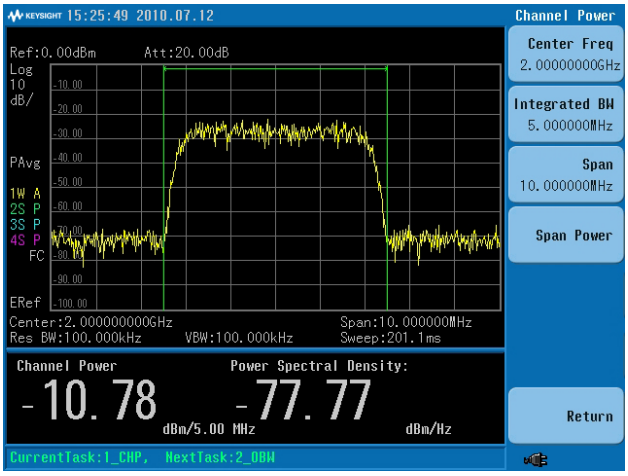


Figure 17. Channel power measurement result

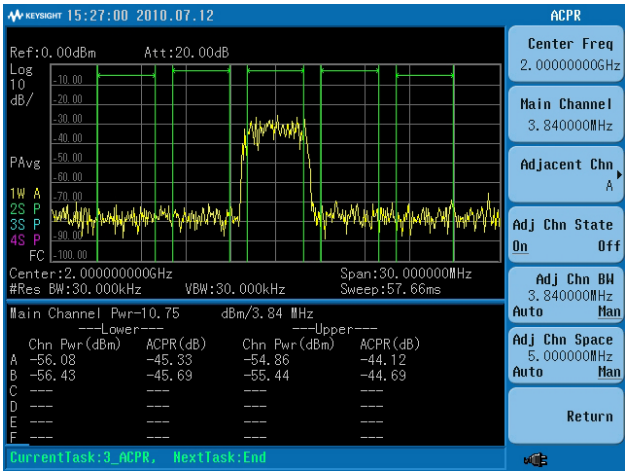


Figure 19. ACPR measurement result

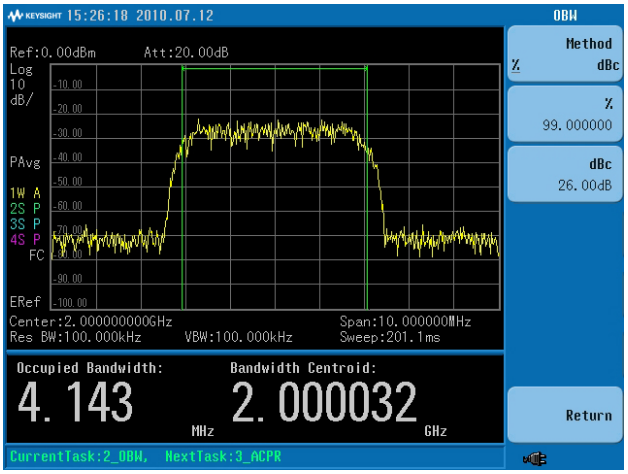


Figure 18. OBW measurement result

Step 3: Run task planner

Instructions for the source	**Keystrokes for the source**
Set 2 GHz center frequency, amplitude -10 dBm, W-CDMA signal	[Preset], [Freq], [2], {GHz}, [Amplitude], [-10], {dBm}, [Mode], {W-CDMA}, {Arb W-CDMA (3GPP 12-2004}, {W-CDMA (On)}, [Mod On], [RF On]
Instructions for HSA	**Keystrokes for HSA**
Load the task plan file	[Shift], [File], use the rotating knob to choose W-CDMA.tpf, [Enter]
Run the task plan file (Figure 15)	{Run}
Run task 1: Channel power	– Press [Enter] after the “chp begin Enter/Esc to Confirm” message appears – Press [Enter] after the “chp end Enter/Esc to Confirm” message appears
Run task 2: OBW	– Press [Enter] after the “obw begin Enter/Esc to Confirm” message appears – Press [Enter] after the “obw end Enter/Esc to Confirm” message appears
Run task 3: ACPR	– Press [Enter] after “acpr begin Enter/Esc to Confirm” message appears – Press [Enter] after “acpr end Enter/Esc to Confirm” message appears
	N934xC HSA automatically creates a folder whose name is the same as the task plan file name (for this demo, the directory is named as W_CDMA) to save all report contents, including a text report, screenshots, and trace files depending on the choices of report contents. The PASS/FAIL result is shown in the report (Figures 17 to 19)

Demonstration 6

Spectrum monitoring and interference hunting

Option SIM provides a spectrogram that provides a three-dimensional display of the spectrum with power over frequency and time. This feature helps find intermittent interference signals, as well as locate and identify unwanted signals that cause dropped calls and poor quality service in communications systems. The X-axis represents frequency as in a normal spectrum display, but amplitude is represented by color: red for a strong signal and blue for noise floor. The Y-axis represents time, with the trace from the newest sweep displayed at the bottom of the screen. Earlier traces move up towards the top of the screen with each new sweep. Two coupled markers allow you to place a marker on any trace in the spectrogram and view the normal spectrum for the time of that sweep. The time interval between sweeps can be adjusted, and up to 1,500 traces can be displayed and saved.

In this demonstration, the N9311X-500 whip antenna is used to receive over the air GSM uplink signal. For interference hunting application, a directional antenna like the N9311X-504 is recommended.

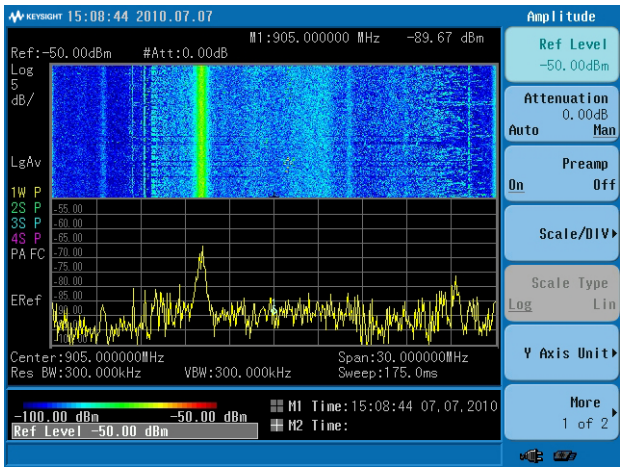


Figure 20. Spectrum

Instructions for HSA	Keystrokes for HSA
Connect the N9311X-500 whip antenna to the N934xC HSA RF input connector	
Set the center frequency and span	[FREQ], {Center Freq}, [925], {MHz}, [Span], [70], {MHz}
Set Y scale/div and On Hi- Sensitivity to On *Note: If Hi-Sensitivity is On, parameters below can be set automatically:* – *Reference level -50 dBm* – *Attenuator 0 dB* – *Preamp On*	[Amptd], {Scale/Div}, {5/DIV}, {More 1 of 2}, {Hi-Sensitive (On)}
Turn on spectrum monitor (N934xC-SIM option needed)	[Meas], {Spectrum Monitor}
Instructions for HSA	**Keystrokes for HSA**
Set the update interval time between two frames	{Update Int. (On)}, rotating knob or pressing numeric keypads to set the update interval time
Turn on Marker 1 and Marker 2 *(Note: Marker 1 is on by default)*	[MARKER], {Marker (2)}, {State (On)}
Move marker to the location by setting frequency or time	{Frequency} or {Time}, rotating knob or pressing numeric keypads to change the marker's location as desired
Turn on file logging Note: There are manual and automatic methods to save data, and the filename's format is <Prefix>_<Index>_HHMMSS – <Prefix> is N934X by default, you can edit the <Prefix> by pressing {File Path}, {Setup}, {Prefix Edit}, input the name in the "Save as" dialog box, [Enter] – <Index> is 0, 1, 2, 3.... – HHMMSS is the time to start saving	[Meas], {File Logging}
Manual save data *Note: To stop saving press {Stop Save}*	{Start Save}
Automatic save data *Note: To stop saving pressing {Return}, {Stop Save}*	{Timed Setting}, {Start Date}, date format is YYMMDD, such as: [20100712], [Enter], {Start time}, time format is HHMMSS, such as: [145945], [Enter], {Stop date}, [20100712], [Enter], {Stop time}, [133000], [Enter], {Time Save (On)}
Recall the saved spectrogram file and playback (Figure 20)	[Shift], [File], rotating knob and highlight the spectrogram file, {Recall}, {Spctrg View}, {Playback}, {Play}

Demonstration 7

Remote control via LAN or USB port

In order to keep a communication system working reliably long term, you need to monitor the spectrum routinely. Regular spectrum monitoring is usually accomplished automatically by using remote control software to drive the spectrum analyzer. You can remotely control the HSA using SCPI commands over LAN and USB, or use the HSA PC software to monitor spectral changes. There are two modes that are used to set up the HSAs' LAN IP address: static and DHCP.

In this demonstration, we will show how to set HSA's IP address.

Instructions for HSA	Keystrokes for HSA
Set HSA's IP address is in static mode	[Shift], {System}, {More 1 of 2}, {Port Setting}, {IP Config}, {IP Address (Static)}
Set IP address such as: 192.168.0. 12	[192.168.0.12], [Enter]
Set gateway such as: 192.168.0.8	[192.168.0.8], [Enter]
Set subnet mask such as: 255.255.255.0	[255.255.255.0], [Enter], {Apply}
Set HSA's IP address automatically using DHCP mode	[Shift], {System}, {More 1 of 2}, {Port Setting}, {IP Config}, {IP Address (DHCP)}, {Apply}

Demonstration 8

Marker, marker table, and peak table

The N934xC HSAs each have a total of six markers that can be used in normal or delta mode. In addition to the marker table and peak search, each N934xC HSA also has a peak table feature which automatically searches 10 max or min peak signals simultaneously and is updated after each sweep.

In this demonstration, we will use peak table to find the absolute values of FM signal sidebands.

Note: To prevent data corruption when saving the table to a USB memory device, set the file directory to USB then reset to INT before removing the device.

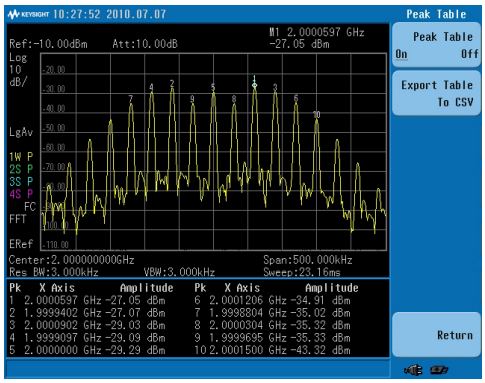


Figure 21. FM sidebands peak values in peak table

Instructions for the source	Keystrokes for the source
Set 2 GHz center frequency, amplitude -10 dBm, 100 kHz deviation, 30 kHz rate, FM signal	[Preset], [FREQ], [2], {GHz}, [AMPTD], [-10], {dBm}, [FM/ΦM], {FM On}, {FM Dev} [100], {kHz}, {FM Rate}, [30], {kHz}, [Mod On], [RF On]
Instructions for HSA	**Keystrokes for HSA**
Set center frequency to 2 GHz	[Freq], [2], {GHz}
Set span to 500 kHz	[Span], [500], {kHz}
Set reference level to -10 dBm	[Amptd], {Ref Level}, {10}, {dBm}
Peak search	[Shift], [Peak], {Peak Search}
Measure the absolute peak amplitude of FM sidebands using the peak search table. Peak search table will display up to 10 peaks (Figure 21)	{More 1 of 2}, {Peak Table}, {Peak Table On}
Change peak criterion	[Shift], [Peak], {More 1 of 2}, {Peak Criterion}, user can set the peak threshold limit, peak excursion limit and peak type
Save peak table in a .csv format	[Shift], [Peak], {More 1 of 2}, {Peak Table}, {Export Table to CSV}, input file name, [Enter]
Turn the peak table off	[Shift], [Peak], {More 1 of 2}, {Peak Table}, {Peak Table Off}

Demonstration 9

Advance marker functions

The N934xC HSAs provide powerful marker functions. In addition to normal and delta marker modes, the instrument marker system provides noise markers, frequency counter markers, AM/FM tune and listen, and band power measurement. For the AM/FM tune and listen feature, the AM/FM demodulated audio can be heard with the internal speaker or the provided headphone. Speaker volume and delay time can be adjusted to meet your specific needs.

In this demonstration, we will perform an AM/FM tune and listen measurement using an external AM/FM antenna.

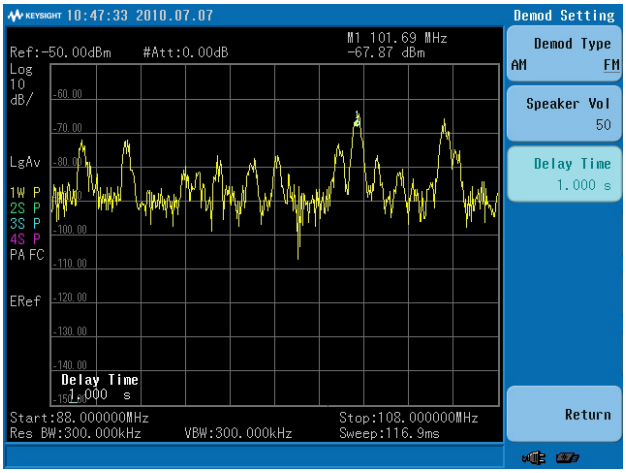


Figure 22. AM/FM-tune and listen marker

Instructions for HSA	Keystrokes for HSA
Connect an AM/FM antenna (such as 88 MHz to 108 MHz) to HSA RF input port	
Set start frequency and stop frequency	[Freq], {Start Freq}, [88], {MHz}, {Stop Freq}, [108], {MHz}
Turn on the hi sensitivity mode *Note: If Hi-Sensitive is On, parameters below can be set automatically:* – Reference level -50 dBm – Attenuator 0 dB – Preamp On	[Amptd], {More 1 of 2}, {Hi-Sensitive (On)}
Enter into FM and listen mode	[Marker], {Function}, {Demod}, {Demod Setting}, {Demod Type (FM)}, rotate the knob to move the marker to one of the displayed FM broadcast stations
In order to make sound smooth and clear	
Set speaker volume	{Speaker Vol}, [50], {Enter}
Set delay time	{Delay Time}, [1], {s}

Demonstration 10

Limit lines and limit masks

The N934xC HSA offers two different limit lines. Limit lines/limit masks and associated margins allow you to quickly and easily identify signals that do not meet specified requirements.

In this demonstration, we will create a limit line and perform a pass/fail test.

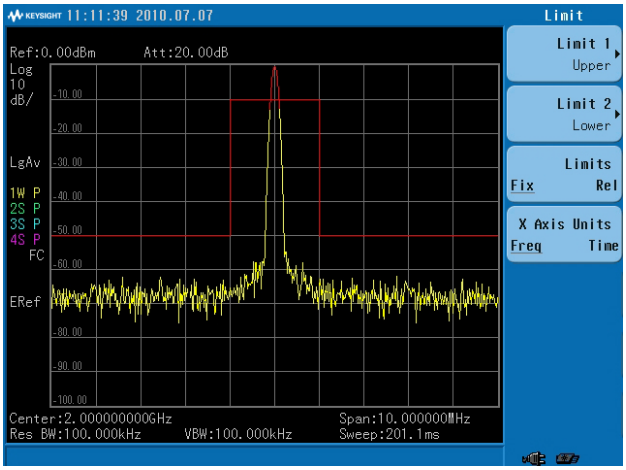


Figure 23. Limit lines

Instructions for the source	Keystrokes for the source
Connect the source output to the HSA input. Set 2 GHz center frequency, amplitude -10 dBm, CW signal	[Preset], [FREQ], [2], {GHz}, [AMPTD], [-10], {dBm}, [RF On]
Instructions for HSA	**Keystrokes for HSA**
Preset, set center frequency and span	[Preset], [Freq], [2], {GHz}, [Span], [10], {MHz}
Enter into limit menu	[Shift], [Limit]
Set the upper limit	{Limit 1}
Activate the limit	{Limit (On)}
Edit the limit mask (Figure 23)	{Limit Edit}
Edit point 0	{Frequency}, [1.995], {GHz}, {Amplitude}, [-50], {dBm}
Edit point 1	{Add}, {Frequency}, [1.999], {GHz}
Edit point 2	{Add}, {Amplitude}, [-10], {dBm}
Edit point 3	{Add}, {Frequency}, [2.001], {GHz}
Edit point 4	{Add}, {Amplitude}, [-50], {dBm}
Edit point 5	{Add}, {Frequency}, [2.005], {GHz}, {Return}
Save the limit line	{More 1 of 2}, {Save Limits}, input file name, [Enter]
Set signal level to 0 dBm, CW	[AMPTD], [0], {dBm}

Note: Portions of trace which fail the limit are displayed in red

Demonstration 11

Multiple traces and simultaneous detectors

The N934xC HSA has a total of four traces and supports simultaneous detectors including peak, average, sample, negative peak, and the normal detector. Plus the N934xC HSA supports simultaneous detectors, meaning that different detectors can be used on four different traces in a single sweep—this will greatly increase the throughput to measure crest factor of pseudo-noise signals, as well as amplifiers.

In this demonstration, we will turn on three traces with peak, RMS, and neg peak detectors.

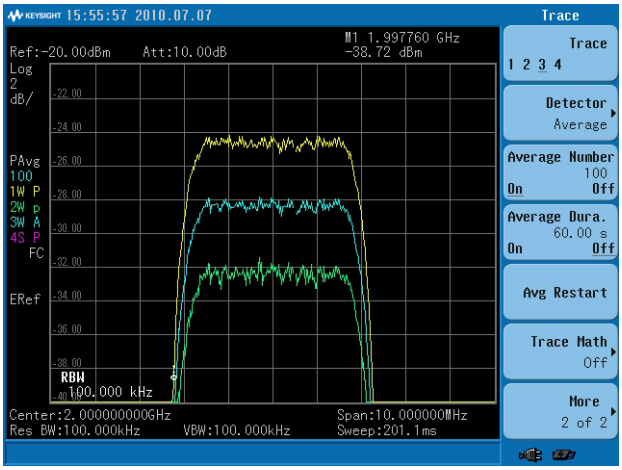


Figure 24. Multiple traces and simultaneous detectors

Instructions for the source	Keystrokes for the source
Set 2 GHz center frequency, amplitude -10 dBm, W-CDMA signal	[Preset], [Freq], [2], {GHz}, [Amplitude], [-10], {dBm}, [Mode], {W-CDMA}, {Arb W-CDMA (3GPP 12-2004}, {W-CDMA (On)}, [Mod On], [RF On]
Instructions for HSA	**Keystrokes for HSA**
Preset, set the center frequency, span, and RBW	[Preset], [Freq], {Center Freq}, [2], {GHz}, [Span], [10], {MHz}, [BW], {RBW} (Man), {10 kHz}
Set reference level	[Amptd], [-30], {dBm}
Set Y scale	[Amptd], {Scale/DIV}, {2/DIV}
Set peak detector for trace 1 and turn on average function.	[Trace], {More 1 of 2}, {Detector}, {Pos Peak}, {Return}, {Average Number (On)}, {More 2 of 2}
Set neg peak detector for trace 2 and turn on average function	{Trace (2)}, {Clear Write}, {More 1 of 2}, {Detector}, {Neg Peak}, {Average Number 100 (On)}
Set RMS detector for trace 3 and turn on average function	[BW], {Average Type}, {Power}, {Trace (3)}, {Clear Write}, {More 1 of 2}, {Detector}, {Average (RMS)}, {Average Number (On)}

Demonstration 12

Trace math functions

The math functions in the N934xC HSA are true power calculations, meaning that the measurements are converted to power, the math function is performed, and the results are displayed in dBm.

In this demonstration, we will subtract -6 dBm from 0 dBm and the result will be -1.2 dBm. In order to get the correct results, the source should be adjusted to as close to the required power as possible as shown by the analyzer marker:

- 0 dBm = 1 mw
- -6 dBm = 0.25 mw
- -1.2 dBm = 0.75 mw

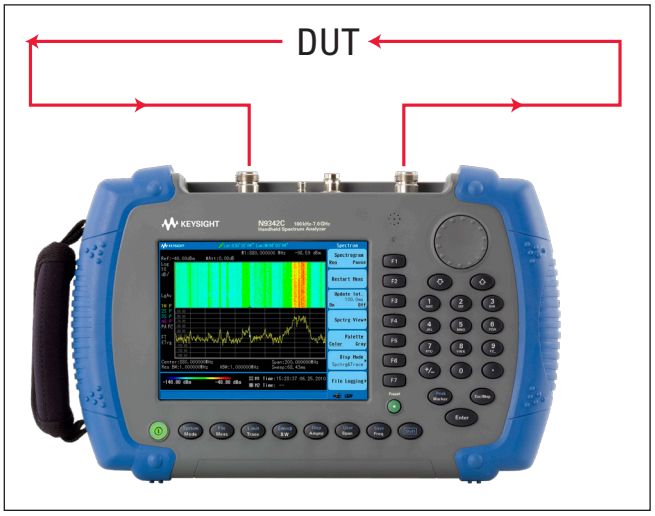
Instructions for the source	**Keystrokes for the source**
Generate a 1 GHz, 0 dBm CW signal	[Preset], [Freq], [1], {GHz}, [Amptd], [0], {dBm}, [Mod Off], [RF On]
Adjust the power of the signal to -6 dBm on the HSA	[Amptd], [-6], {dBm} Adjust the knob so that the marker on the analyzer reads -6 dBm
Instructions for HSA	**Keystrokes for HSA**
Set the center frequency	[Freq], {Center Freq}, [1], {GHz}
Set zero span	[Span], {Zero Span}
Set reference level and scale	[Amptd], [4], {dBm}, {Scale/Div}, [2], {dB}, if needed, adjust amplitude on the ESG so that the signal on the HSA reads 0 dBm
Place trace 1 in view mode and trace 2 in clear write mode	[Trace], {View}, {Trace (2)}, {Clear Write}
Place marker 1 on trace 2	[Marker], {Marker Trace}, {Trace2}
Adjust the power of the signal to -6 dBm on the HSA	[Amptd], [-6], {dBm} Adjust the knob so that the marker on the analyzer reads -6 dBm
Subtract trace 2 from trace 1 and place the result on trace 3	[Trace], {More 1 of 2}, {Trace Math}, {Math By (Pwr)}, {Math Type}, {A-B->C}
Move the marker to trace 3 and read the results	[Marker], {Marker Trace}, {Trace3} The marker will read approximately -1.2 dBm. To see the difference between rms power difference and log difference, go to [Trace], {More 1 of 2}, {Trace Math}, {Math By (Log Pwr}

Demonstration 13

Tracking generator

In many cases, stimulus response characteristic measurements are important. A spectrum analyzer equipped with a tracking generator forms a stimulus response measurement system that can easily perform scalar component test with high dynamic range (due to the spectrum analyzer's tuned receiver architecture and narrow IF bandwidths). The Keysight N924xC HSAs each have an optional high-performance, built-in tracking generator (Option TG7) (frequency range from 5 MHz to 7 GHz). With this option, the HSA performs stimulus response measurements.

In this demonstration, we'll measure the passband and rejection of a bandpass filter.



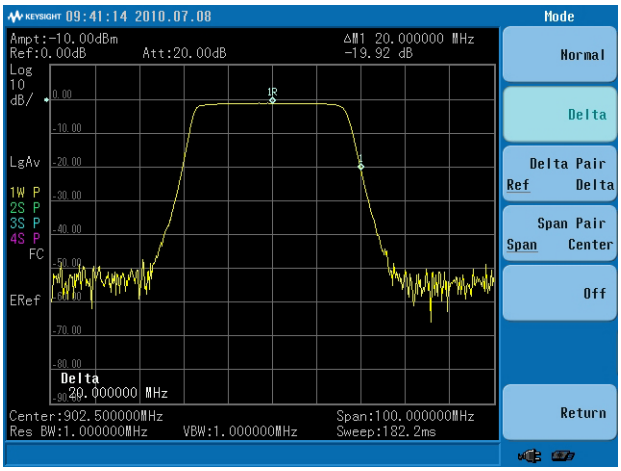


Figure 25. Stimulus response measurements

Instructions for HSA	Keystrokes for HSA
Preset the HSA	[Preset]
Turn on the tracking generator and set its output amplitude to -10 dBm	[Mode], {Track Generator}, {Amplitude, (On)}, [-10], {dBm}
Set start frequency and stop frequency *Note: Select frequencies appropriate for the device being tested*	[Freq], {Start Freq}, [852.5], {MHz}, [Stop Freq], [952.5], {MHz}
Note: Decrease the resolution bandwidths to increase dynamic range	
To measure the test system's frequency response more accuracy, directly connect the cable from the tracking generator output to the analyzer RF input	
The normalization function is used to eliminate the test system's frequency response error from the measurements. Store the frequency response of the test system in trace 4 and make the Normalize On	[Meas], {Normalize}, {Store Ref 1->4}, {Normalize (On)}
Connect the DUT to the analyzer	
Change the normalized reference position to optimize the view range (Figure 25)	{Norm Ref Posn}, [9], {Enter}
Measure the rejection of the filter 20 MHz above to the center frequency	[Marker], [902.5], {MHz}, {Mode}, {Delta}, [20], {MHz}

Demonstration 14

Power meter

The Keysight U2000 Series USB power sensor works with the N934xC HSA to provide high accuracy average power measurement. The frequency range for power measurements is from 9 kHz to 24 GHz and power levels from -60 dBm to +20 dBm at a measurement speed of up to 1,000 readings per second in buffered mode. The N934xC HSA provides power to the sensor and retrieves measurement results over USB.

The N934xC HSA displays the measurement results and provides pass/fail indication with user-settable upper and lower limits. The results are displayed in dBm and W for absolute power measurements and in dB and percentage for relative measurements. Results can be displayed on a fast updating meter display or on a chart of power versus time.

In this demonstration, we use the N934xC HSA with U2000A USB power sensor to measure the output power of an external signal generator.

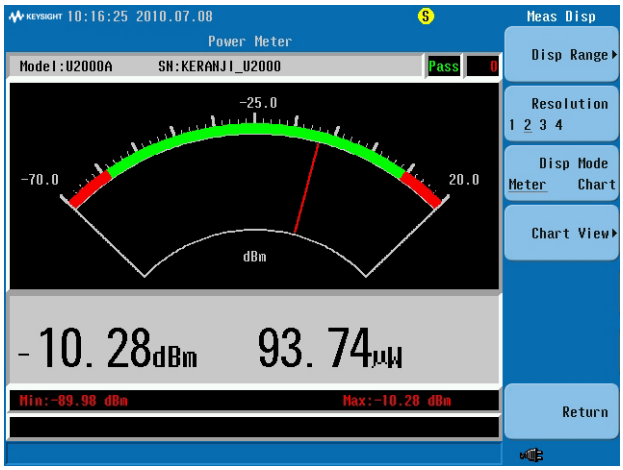


Figure 26. Power meter mode

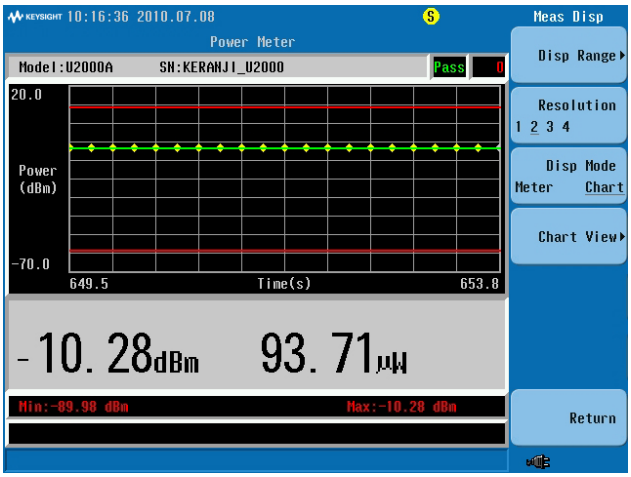


Figure 27. Chart mode

Instructions for the source	Keystrokes for the source
Set 2 GHz center frequency, amplitude -10 dBm, W-CDMA signal	[Preset], [Freq], [2], {GHz}, [Amplitude], [-10], {dBm}, [Mode], {W-CDMA}, {Arb W-CDMA (3GPP 12-2004}, {W-CDMA (On)}, [Mod On], [RF On]
Instructions for HSA	**Keystrokes for HSA**
Connect the Keysight U2000A power sensor to the N934xC HSA via USB cable	
Turn on the power meter function (N934xC-PWM option needed) (Figure 26) *Note: Please don't operate until the warning message "Connection initialization" disappears and model number "U2000A" appears on the display*	[Mode], {Power Meter}
Zero and the zero type is INT *Note: "Zero calibration, waiting..." warning message appears*	{Zero}, {Zero Type} to INT
Connect the signal generator's RF output to the USB power sensor's RF IN connector and turn on the signal generator's output	
Turn on the limit function. Sound warning when power is beyond limit value	{Return}, {Meas Setup}, {Limits}, {Limits (on)}, {Limit Beep (On)}, {Return}, {Return}
Change the display mode from meter to chart (Figure 27)	{Meas Disp}, {Disp Mode (Chart)}

myKeysight

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.lxistandard.org
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-09-23-14)

KEYSIGHT TECHNOLOGIES

Published in USA, August 1, 2014
5990-7132EN
www.keysight.com