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Keysight Technologies U5532C Sensor Module

N5531X Measuring Receiver System

KEYSIGHT TECHNOLOGIES

User's Guide

Notices

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CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

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Where to Find the Latest Information

Documentation is updated periodically. For the latest information about this instrument, including firmware upgrades, application information, and product information, click the website link below.

http://www.keysight.com/find/n5531x

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

Table of Contents

Keysight Technologies
U5532C Sensor Module

User's Guide

1 General Information

This user's guide contains information about installation, operation, and product specifications for the U5532C sensor module.

Description

The U5532C is intended to be used with the N5531X Measuring Receiver. The N5531X system contains an N9030B PXA Signal Analyzer with the N9091EM0E Measuring Receiver application. The U5532C is essentially a USB power sensor with a power splitter at the input. See Figure 1-1 on page 9. In use, the sensor's output RF cable and USB cable are connected to the PXA signal analyzer. The sensor module is calibrated such that the power meter indicates the power supplied by the source under test.

The U5532C Sensor Module is offered in four frequency configurations:

- Option 504 covers 100 kHz to 4.2 GHz
- Option 518 covers 10 MHz to 18 GHz
- Option 526 covers 10 MHz to 26.5 GHz
- Option 550 covers 30 MHz to 50 GHz

The sensor module accurately measures power levels from –20 dBm to +30 dBm (10 µW to 1 W). Calibration Factor (Cal Factor) information is unique to each sensor module and is stored internally and supplied on a CD Rom disc included with each U5532C. Calibration Factors are automatically loaded into the instrument when a connection is established to the sensor module. Additionally, the user can provide custom calibration data such as calibration data for additional points and can load that data from a file. Please refer to "Installing the Calibration Factors from a File" on page 16 for more information on using the Cal Factor Data.

NOTE

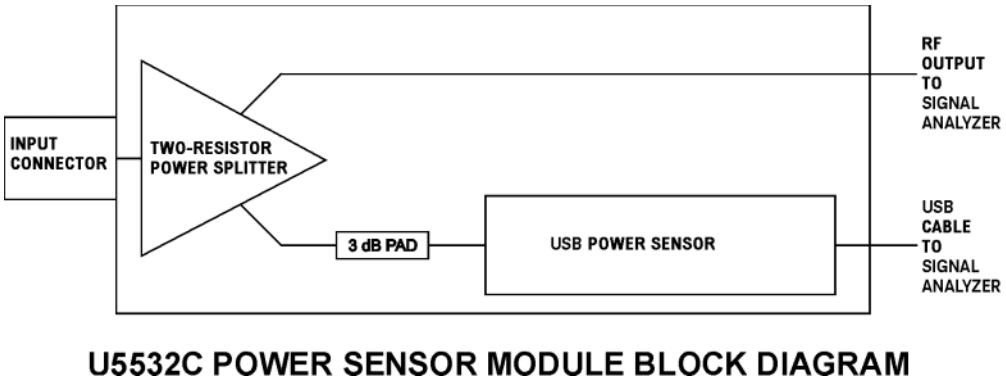
An optional CD ROM drive (p/n: 1DVR001A) can be ordered with the N5531X Measuring Receiver System to load cal factor data from CD ROM disc.

Minimum PXA (N9030B) Firmware Version Required
A.27.02 (July 2020) – Automatic loading of embedded calibration data from U5532C.
A.21.06 (August 2018) – Manual loading of calibration data via a calibration file.

Included Adapters		
Option	**Description**	**Part Number**
504, 518, or, 526	3.5 mm female to female	85027-60005
550	2.4 mm female to female	85056-60006

U5532C Block Diagram

Figure 1-1 U5532C Sensor Module



Instruments Covered by Manual

These instruments have a two-part serial number: the prefix (two letters and the first four numbers), and the suffix (the last four numbers). The two letters identify the country in which the unit was manufactured. The four numbers of the prefix are a code identifying the date of the last major design change incorporated in your Keysight Technologies product. The four-digit suffix is a sequential number and coupled with the prefix, provides a unique identification for each unit produced. The contents of this manual apply directly to all serial numbers unless otherwise indicated.

Serial Prefix	Support for Embedded Calibration Data
MY/SG5831	Did not originally support. Upon recalibration after July 2020 will support embedded cal data.
≥MY/SG6013	Includes embedded calibration data stored in sensor module.

2 Installation

Initial Inspection

Inspect the shipping container for damage. If the shipping container or packaging material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is mechanical damage notify the nearest Keysight Technologies office as shown in below. Keep the damaged shipping materials (if any) for inspection by the carrier and an Keysight Technologies representative.

Contacting Keysight Technologies

To obtain servicing information or to order replacements, contact the nearest Keysight Technologies office listed in Table 2-1. In any correspondence or telephone conversations, refer to your accessory by its product number and full serial number.

Table 2-1

Online assistance: http://www.keysight.com/find/assist

Americas

Canada 1 877 894 4414	Brazil 55 11 3351 7010	United States 1 800 829 4444
Mexico 001 800 254 2440		

Asia Pacific

Australia 1 800 629 485	China 800 810 0189	Hong Kong 800 938 693
India 1 800 112 929	Japan 0 120 (421) 345	Korea 080 769 0800
Malaysia 1 800 888 848	Singapore 1 800 375 8100	Taiwan 0800 047 866
Thailand 1 800226 008	Other AP Countries (65) 6375 8100	

Europe & Middle East

Austria 0800 001122	Belgium 0800 58580	Denmark 45 70 13 15 15
Finland 0800 523252	France 0805 980333	Germany 0800 6270999
Ireland 1800 832700	Israel 1 809 343051	Italy 800 599100
Netherlands 0800 0233200	Spain 0800 000154	Sweden 0200-88 22 55
Switzerland 0800 80 53 53	United Kingdom 0800 0260637	Luxembourg +32 800 58580

Table 2-1

Other European Countries: http://www.keysight.com/find/contactus

Operating Precautions

NOTE

For optimal results, the sensor module must be placed on a supportive surface with the serial number label facing up. This orientation provides repeatable measurements by eliminating strain on the input connector.

The input connector should be torqued to 12 in-lb (135 Ncm) for the type-N connector, 8 in-lb (90 Ncm) for the APC 3.5 mm connector, or 8 in-lb (90 Ncm) for the 2.4 mm connector to ensure a repeatable connection in order to meet the published specifications. Exceeding these torque settings may damage the connector.

Connect the sensor module by turning only the hex nut portion of the connector. Damage can occur if torque is applied to the sensor module body.

The connector plastic insulator bead deteriorates when contacted by acetone, trichloroethylene, carbon tetrachloride, benzene, etc.

WARNING

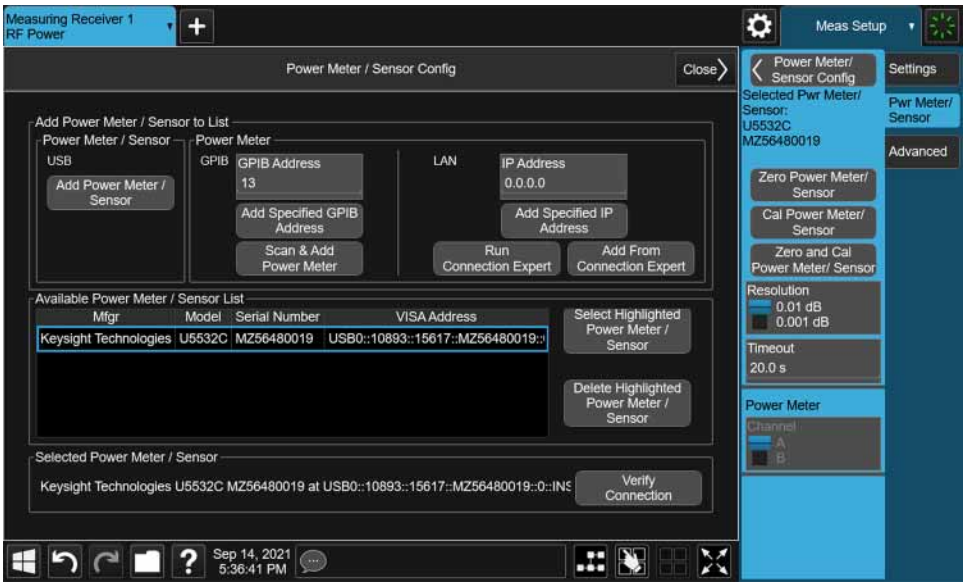
BEFORE CONNECTING THE SENSOR MODULE TO OTHER INSTRUMENTS, ensure that all instruments are connected to the protective (earth) ground. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury and cause damage to the sensor module.

CAUTION

1. Do not permit the interconnect cables of the sensor module to extend out where anyone passing by could accidentally push and exert leverage on the cables. This consideration is especially important when the DUT is a light-weight instrument that sits freely on a table.
2. When possible, lay the sensor module on a supportive surface with the model ID label facing up (see picture below). This consideration is especially important when rigid RF adapters are used to directly interconnect the sensor module to the DUT. RF adapters lengthen the leverage arm of the sensor module and are often fragile. When level-accuracy requirements permit, use flexible cables to interconnect the sensor module to the DUT.
3. Do not bend or coil the interconnect cables (more than necessary) to a diameter circumscribing less than 150 mm (6 in.). This precaution often applies when the instruments are rack-mounted and interconnected to rear-panel connectors. Repeated flexing of coiled, interconnect cables can degrade SWR and increase RFI of the RF output cable.
4. Do not attempt to tighten the sensor module input connector by twisting the body of the sensor module.

Selecting Power Sensor and Loading Calibration Factors

1. Choose the Measuring Receiver RF Power measurement under the **Mode/Measurement/View Selector** screen of the instrument. This can be accessed by pressing the **Mode/Meas** key.
2. Press **Meas Setup** and then **Pwr Meter/Sensor**.
3. As shown in the screen image below, press **Add Power Meter/Sensor** under the USB column of “Add Power Meter/Sensor to List”.
4. Press **Select Highlight Power Meter/Sensor**.
5. For sensor modules with embedded calibration data, the message “Cal Factor loaded from USB Sensor” will appear momentarily.



Installing the Calibration Factors from a File

Cal factors can be loaded from a file instead of using the embedded calibration data. This allows for users to calibrate and provide their own calibration data. User calibration data can have additional calibration points that are not otherwise provided with factory calibration data embedded in the sensor module. The calibration data is automatically accessed during RF power measurements (after the measuring receiver has tuned to the frequency) to correct for the non-linear response of the power sensor. If no entry in the table directly corresponds to the frequency being measured, the measuring receiver derives a cal factor through linear interpolation using the nearest calibration points in the table.

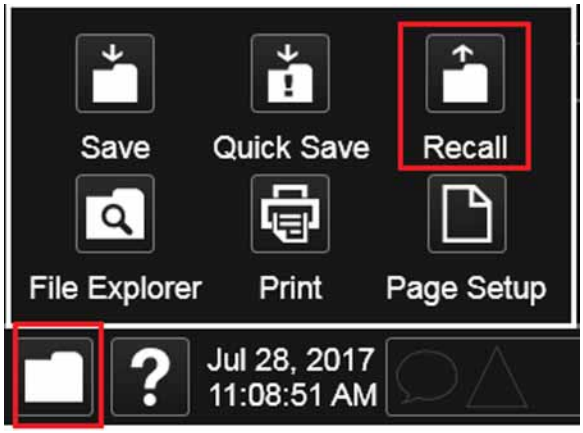
Installing the Cal Factors in the N5531X (N9091EM0E) Via a File

1. **Connect the external storage device via USB that contains the U5532C calibration files to the PXA. The U5532C calibration files come on a CD-ROM allowing you to use an external USB CD-ROM drive to load the files onto the instrument.**

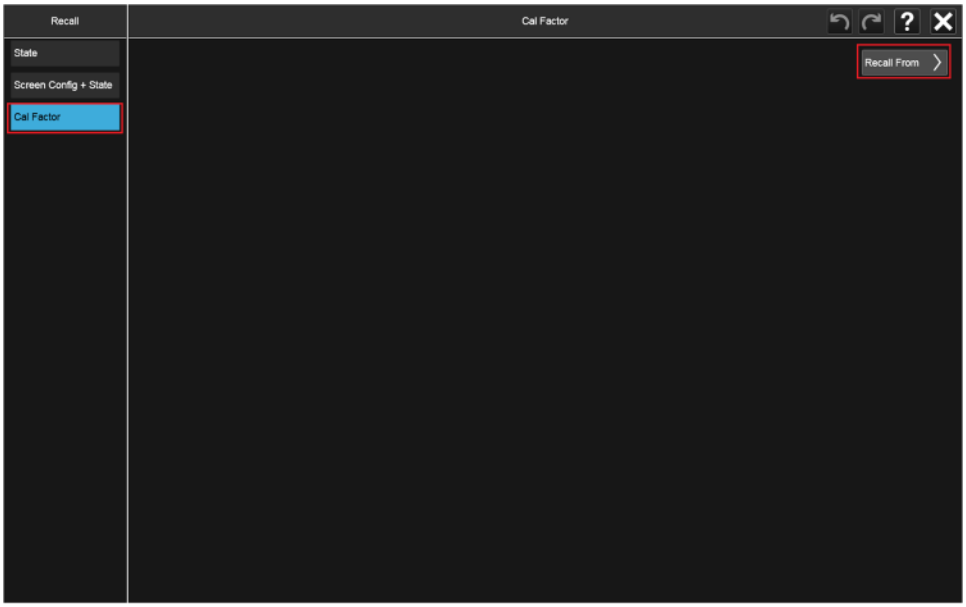
NOTE

You can copy calibration files for sensor modules onto the PXA's SSD to provide for easy access of files. You can give each file a unique name based on the serial number of the sensor module. For example: U5532C_MY12345678.xml.

2. On the application, click **Recall**.



3. Select **Cal Factor** > **Recall From**. Use the Browser to navigate to the file and select **Recall**.



3 Specifications

The specifications listed in Table 3-1, "Specifications," are the performance standards or limits against which the sensor module may be tested. These specifications are valid ONLY after proper calibration of the power meter.

U5532C Sensor Module Specifications

Table 3-1 Specifications

Description	Specification	Comments
Frequency Range Option 504 Option 518 Option 526 Option 550	 100 kHz to 4.2 GHz 10 MHz to 18 GHz 10 MHz to 26.5 GHz 30 MHz to 50 GHz	
Power Range	+30 dBm (1 watt) to –20 dBm (10 μW)	
Maximum Safe Power	+30 dBm	Average Total Power
Sensor Module Linearity *Opt. 504* +30 to +20 dBm +20 to -5 dBm < -5 dBm	 ±3% < 0.6%	 < 0.6% nominal
Sensor Module Linearity *Opt. 518* +30 to +20 dBm +20 to -5 dBm < -5 dBm	 ±3% < 0 .6%	 < 0.6% nominal
Sensor Module Linearity *Opt. 526* +30 to +20 dBm +20 to -5 dBm < -5 dBm	 ±3% < 0.6%	 < 0.6% nominal
Sensor Module Linearity *Opt. 550* +30 to +20 dBm +20 to -5 dBm < -5 dBm	 ±3% < 0.6%	 < 0.6% nominal
Input SWR[a] *Opt. 504* 100 kHz to 2 GHz > 2 GHz to 4.2 GHz	 < 1.10:1 < 1.28:1	

Table 3-1 Specifications

Description	Specification	Comments
Input SWR[a] *Opt. 518* 10 MHz to 2 GHz > 2 GHz to 18 GHz	 < 1.10:1 < 1.28:1	
Input SWR[a] *Opt. 526* 10 MHz to 2 GHz > 2 GHz to 18 GHz > 18 GHz to 26.5 GHz	 < 1.10:1 < 1.28:1 < 1.40:1	
Input SWR[a] *Opt. 550* 30 MHz to 2 GHz > 2 GHz to 18 GHz > 18 GHz to 26.5 GHz > 26.5 GHz to 33 GHz > 33 GHz to 40 GHz > 40 GHz to 50 GHz	 < 1.10:1 < 1.28:1 < 1.40:1 < 1.55:1 < 1.70:1 < 1.75:1	
Zero Set	±500 nW	
Measurement Noise	< 1.1 µW	
Zero Drift	< 70 nW	
Relative Cal Factor Uncertainty[b] *Opt. 504* 100kHz to 30MHz > 30 MHz to 2 GHz > 2 GHz to 4.2 GHz	 ±2% ±2% ±2%	
Relative Cal Factor Uncertainty[b] *Opt. 518* 10 MHz to 2 GHz > 2 GHz to 4.2 GHz > 4.2 GHz to 10 GHz > 10 GHz to 18 GHz	 ±2% ±2.13% ±2.77% ±3.01%	
Relative Cal Factor Uncertainty[b] *Opt. 526* 30 MHz to 2 GHz > 2 GHz to 4.2 GHz > 4.2 GHz to 10 GHz > 10 GHz to 18 GHz > 18 GHz to 26.5 GHz	 ±2% ±2.13% ±2.93% ±3.24% ±3.75%	

Table 3-1 Specifications

Description	Specification	Comments
Relative Cal Factor Uncertainty[b] *Opt. 550*		
30 MHz to 2 GHz	±2%	
> 2 GHz to 4.2 GHz	±2.47%	
> 4.2 GHz to 10 GHz	±2.59%	
> 10 GHz to 18 GHz	±2.88%	
> 18 GHz to 26.5 GHz	±3.78%	
> 26.5 GHz to 50 GHz	±7.49%	

a. When connected to PXA with at least 30 dB attenuation
b. The characterized calibration factor should not deviate between periodic calibrations by more than the specified maximum relative uncertainty. Compliance is confirmed by the relative deviation $(\frac{|CF_1 - CF_2|}{CF_1} * 100)$ being less than or equal to √2 times the specified maximum uncertainty. √2 * U_{max} with a reference calibration factor of 100%.

U5532C Sensor Module Supplemental Information

Table 3-2 Supplemental Information

Description	Supplemental Information	Comments
Input Impedance	50 ohms	
Input Connector		Recommended Torque
Option 504 Option 518 Option 526 Option 550	Type-N (male) Type-N (male) APC 3.5 mm (male) 2.4 mm (male)	12 in-lbs (135 Ncm) 12 in-lbs (135 Ncm) 8 in-lbs (90 Ncm) 8 in-lbs (90 Ncm)
RF Output Connector		
Option 504 Option 518 Option 526 Option 550	APC 3.5 mm (male) APC 3.5 mm (male) APC 3.5 mm (male) 2.4 mm (male)	
RF Output Insertion Loss *Opt. 504*	 7 dB @ 3 Hz to 8 dB @ 4.2 GHz	 Nominal
RF Output Insertion Loss *Opt. 518*	 7 dB @ 3 Hz to 11 dB @ 18 GHz	 Nominal
RF Output Insertion Loss *Opt. 526*	 7 dB @ 3 Hz to 13 dB @ 26.5 GHz	 Nominal
RF Output Insertion Loss *Opt. 550*	 7 dB @ 3 Hz to 16 dB @ 50 GHz	 Nominal
ICA (25 ± 10°C)	± 1.27% (0.055 dB)	
Altitude Operating Storage	 < 4600 meters (15,000 feet) <7620 meters (25,000 feet)	
Temp. Range Operating Storage	 0 to +55 °C – 40 to 70 °C	
Calibration Cycle	1 year	

Table 3-3 Product Dimensions and Weight

Dimensions and Weight	Opt 504	Opt 518	Opt 526	Opt 550
Product Weight	0.68 kg	0.68 kg	0.70 kg	0.68 kg
Shipping Weight	1.67 kg	1.67 kg	1.69 kg	1.67 kg
Height	52 mm	52 mm	52 mm	52 mm
Width	60 mm	60 mm	60 mm	60 mm
Length Without Cable	215 mm	215 mm	206 mm	215 mm
Length With Cable	1885 mm	1885 mm	1876 mm	1885 mm

Regulatory Information

The U5532C complies with the following Electromagnetic Compatibility (EMC) compliances:

- IEC 61326-1 / EN 61326-1
- Canada: ICES/NMB-001
- Australia/New Zealand: AS/NZS CISPR11

Regulatory Markings

The RCM mark is a registered trademark of the Australian Communications and Media Authority.

This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

R-R-Kst-WN18515

This symbol is a South Korean Class A EMC Declaration, with the product identification code "R-R-Kst-WN18515"
R - Identification of broadcasting and communications equipment.
R - Identification of basic certification information.
Kst - Identification of applicant's information.
WN18515 - Product identification.
This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.

South Korean Class A EMC declaration:
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This equipment has been conformity assessed for use in business environments.
In a residential environment this equipment may cause radio interference.

*This EMC statement applies to the equipment only for use in business environment.

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Product category

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The affixed product label is as shown below.

Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit http://about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/u5532c
  (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
  (worldwide contact information for repair and service)

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