Keysight Technologies U5532C Sensor Module

N5531X Measuring Receiver System

KEYSIGHT

USER'S AND SERVICE 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

A **WARNING** 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 personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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.

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

https://www.keysight.com/find/u5532c

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

https://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:

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

Table of Contents

Keysight Technologies
U5532C Sensor Module

User's and Service 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

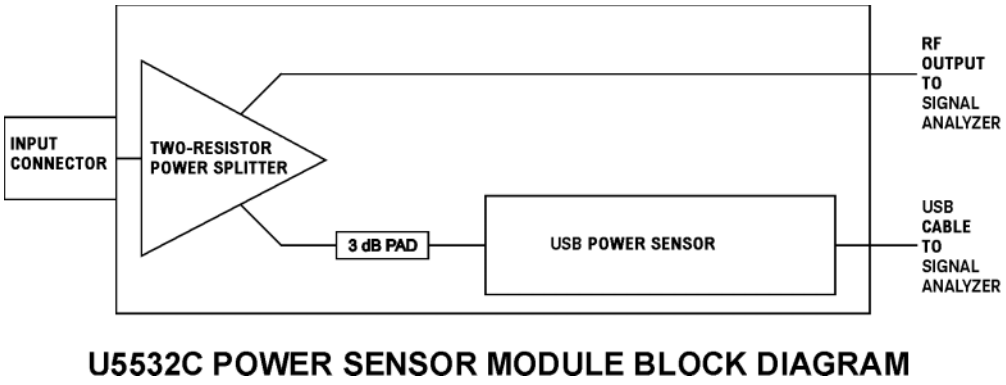
An optional CD ROM drive (p/n: 1DVR001A) can be ordered with the N5531X Measuring Receiver System to load cal factor data from CD ROM disc.

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

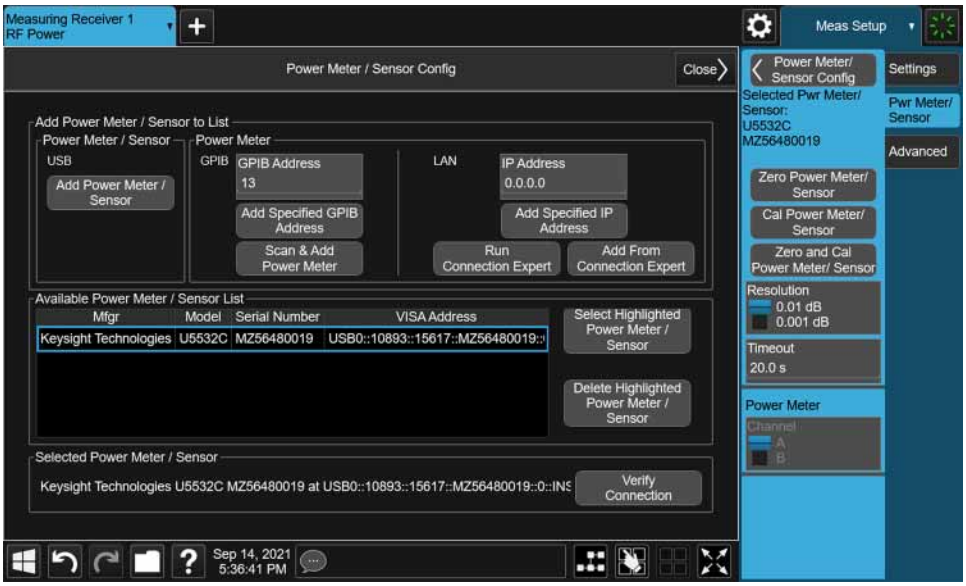
BEFORE CONNECTING THE SENSOR MODULE TO OTHER INSTRUMENTS, ensure that all instruments are connected to the protective (earth) ground. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury and cause damage to the sensor module.

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.

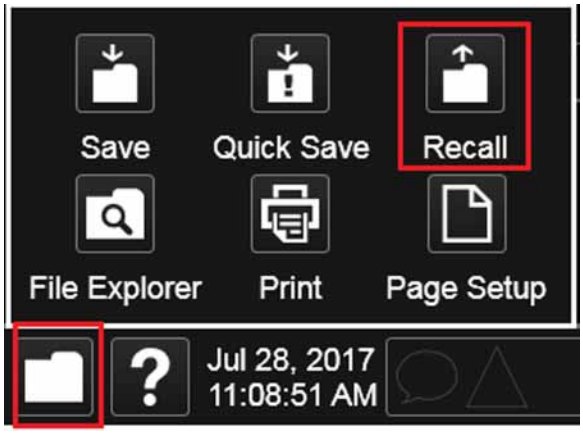
Installing the Cal Factors in the N5531X (N9091EM0E) Via a File

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.**

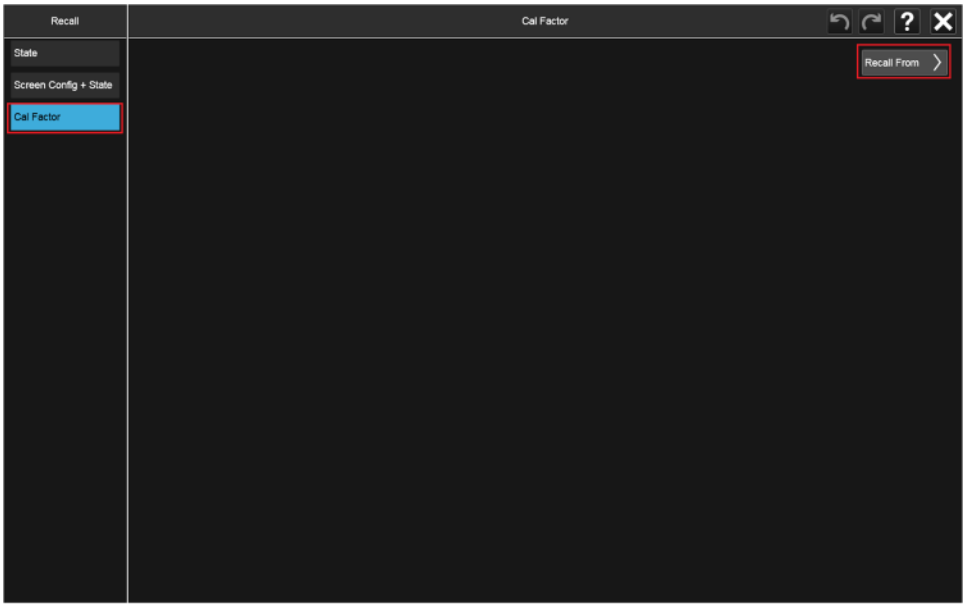
NOTE

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:
Information to the user:
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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Cet appareil ISM est conforme a la norme NMB-001 du Canada.

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This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/ 96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

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.

4 Maintenance and Repair

Maintenance

Cleaning Solutions

A solution of pure isopropyl or ethyl alcohol can be used to clean the connector (keeping in mind its flammable nature).

Connector Cleaning

Clean the connector face using a cotton swab dipped in isopropyl alcohol. If the swab is too big, use a round wooden toothpick wrapped in a lint free cotton cloth dipped in isopropyl alcohol.

Repair

Tools required:

- 8 mm open-end wrench (550)
- 5/16-inch open-end wrench
- 7 mm open-end wrench
- 1/4-inch open-end wrench (504, 518, 526)
- 3/16-inch open-end wrench
- 2.5 mm hex driver
- 2 mm hex driver
- 1.5 mm hex driver
- 30 inch-lbs torque wrench with 9/16-in head
- 12 inch-lbs torque wrench with 3/4-in head (504, 518, 526)
- 10 inch-lbs torque wrench with 5/16-in head
- 8 inch-lbs torque driver with 2.5 mm hex head
- 7 inch-lbs torque driver with Pozidriv head
- 5 inch-lbs torque driver with T8 head
- 3 inch-lbs torque driver with T8 and 2 mm hex heads
- 1.5 inch-lbs torque driver with 1.5 mm hex head
- Diagonal Cutter (550)
- Threadlocker (p/n 0470-0231)

Assembly Replacement Procedures

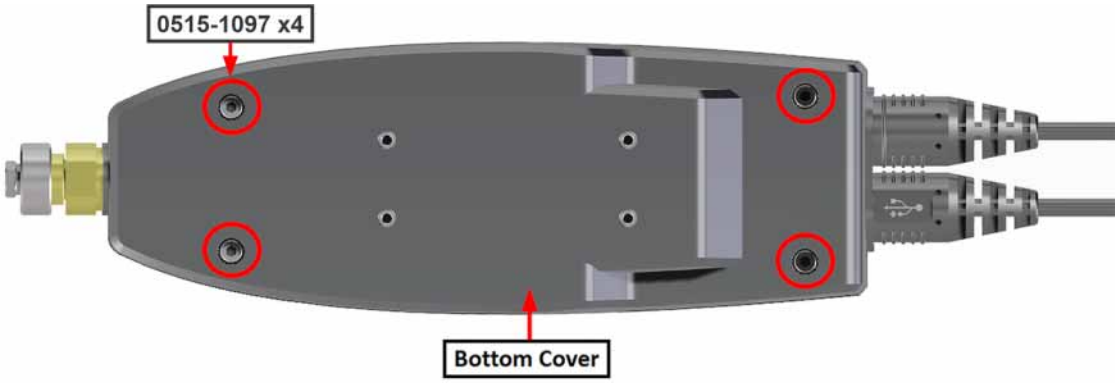
Sensor Module Covers and Cable Bracket

Use this procedure to remove and replace the instrument covers and cable bracket for all sensor module frequency range models (Option 504, 518, 526, 550).

To remove the sensor module covers:

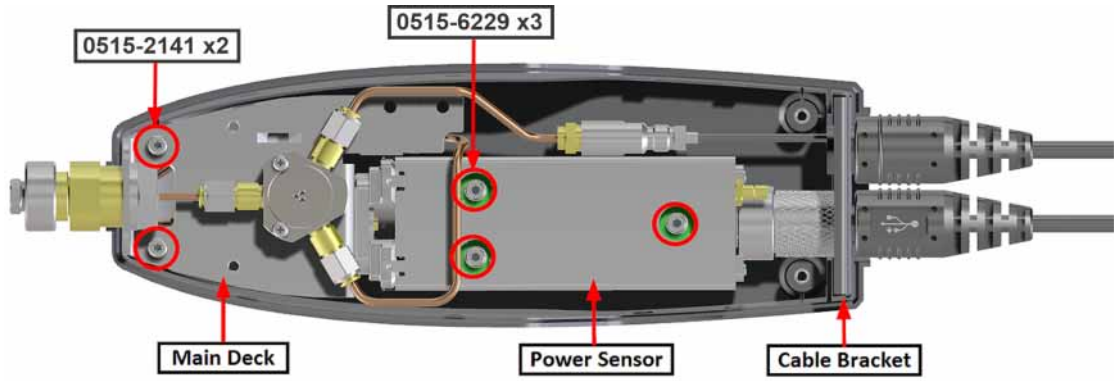
1. Lay the instrument with top facing down and remove the four 2.5 mm hex screws (0515-1097) from the module assembly, then remove the bottom cover (see Figure 4-1).

Figure 4-1 Removal of screws and bottom cover



2. Remove the three T8 screws (0515-6229) holding the power sensor to the top cover and the two T8 screws (0515-2141) holding the main deck to the top cover (see Figure 4-2).

Figure 4-2 Removal of screws holding top cover (typical)



3. Remove the internal assembly. The cable bracket comes out of the covers with the assembly.

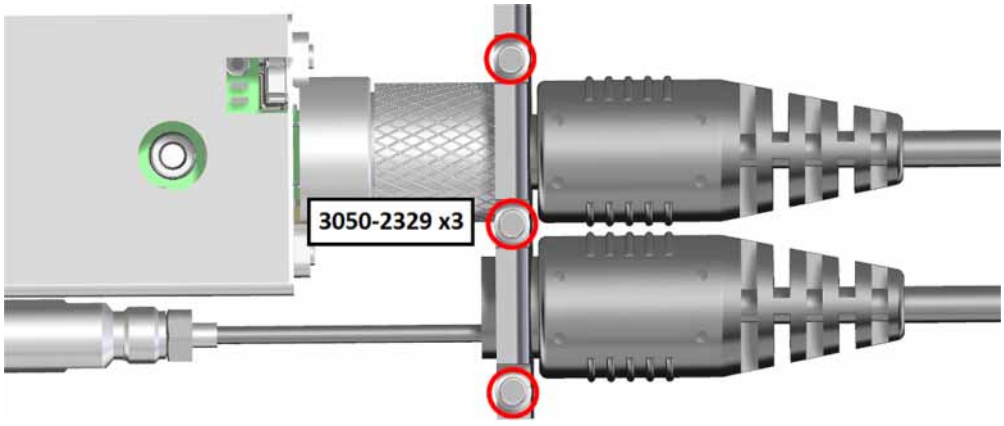
To replace the sensor module covers:

1. Place the assembly into the top housing.
2. Place the two screws (0515-2141) in the main deck thru-holes and the three screws (0515-6229) in the power sensor thru-holes to attach the assembly to the top cover (see Figure 4-2). Put threadlocker on three full threads on the end of the screws prior to inserting.
3. Torque the main deck screws with 5 in-lbs and power sensor screws to 3 in-lbs.
4. Place the bottom cover in position and secure with the four screws (0515-1097) (see Figure 4-1). Put threadlocker on three full threads on the end of the screws and torque to 8 in-lbs.

To remove and replace the cable bracket:

1. Remove the three 2 mm hex screws (3050-2329) on the top side (see Figure 4-3).
2. After parts replacement, install the cable bracket (see Figure 4-3). Put threadlocker (0470-0231) on three full threads on the end of the screws and torque with 3 in-lbs.

Figure 4-3 Cable Bracket Top View



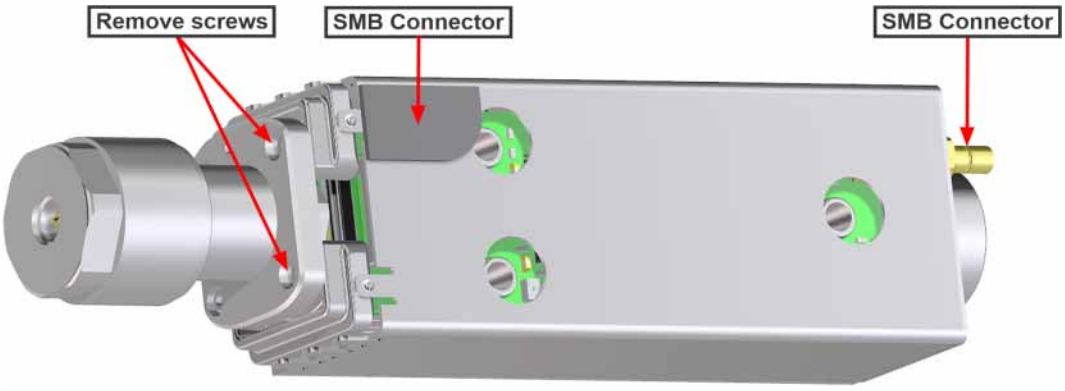
Replacement Sensor Preparation

Use this preliminary procedure if the power sensor requires replacement for all sensor module frequency range models (Option 504, 518, 526, 550). Two hex screws must be removed from the RF input connector flange of the new replacement assembly, as they will be replaced by the longer screws that fasten it to the main deck.

To prepare the replacement power sensor:

1. Remove the two screws using a 1.5-mm hex driver (see Figure 4-4). Note that the screws you need to remove are on the opposite end, and same side of the SMB connector, in the power sensor cable connector.
2. Options 504, 518, 526 only: Place vibration pad U5532-40005 on the sensor as shown in Figure 4-4.

Figure 4-4 Replacement Power Sensor Preparation

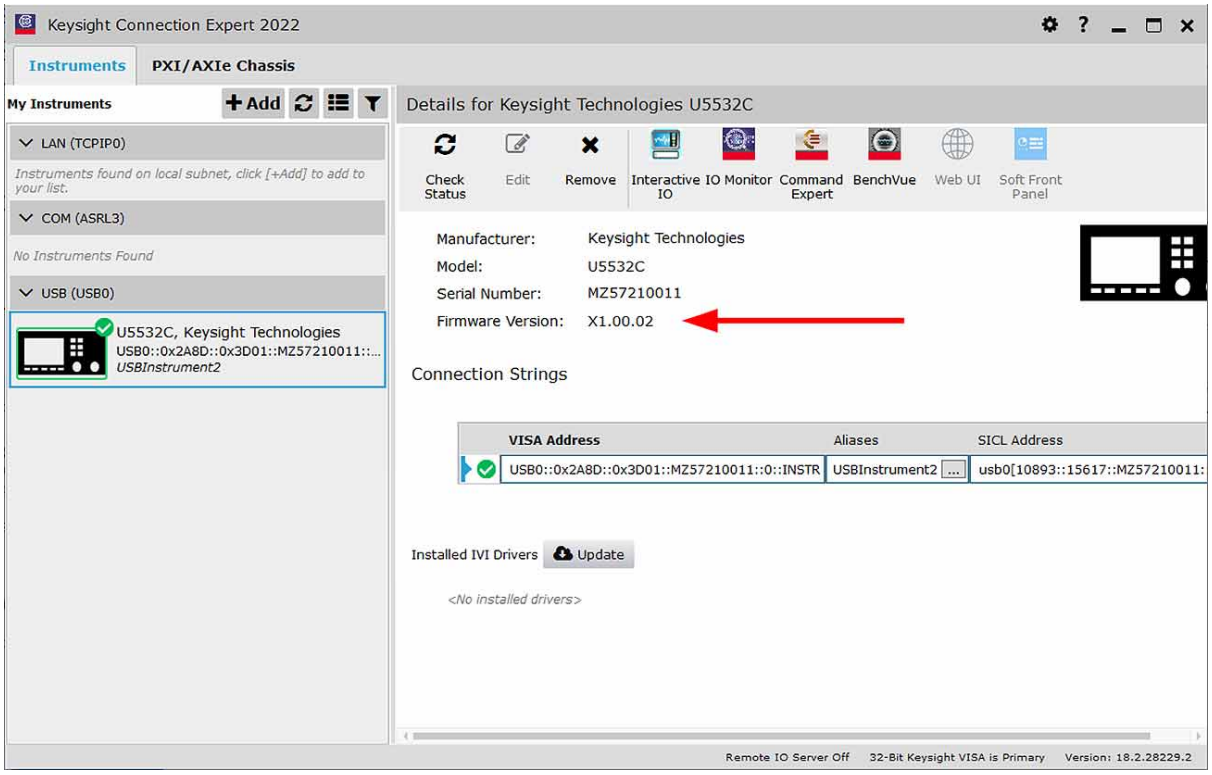


Firmware Upgrade

Instruments shipped with the serial prefix SG/MY6013 and later have firmware version ≥A1.00.01, which enables the storing of standard correction data within the sensor module. Instruments with serial prefix SG/MY5831 were originally shipped with firmware version X1.00.01 that does not support the storing of correction data inside the sensor module. The standard process for sensor modules with older firmware that are sent in for calibration or service to a Keysight service center is for the service center to upgrade the firmware prior to servicing or calibration. There is not a firmware upgrade tool that is available to users.

The firmware version can be determined from the instrument details in Keysight Connection Expert (see Figure 4-5).

Figure 4-5 Instrument Details



Hardware Configuration for 4.2 GHz and 18 GHz (Options 504 and 518)

Use the following procedures to remove and replace the parts for sensor modules with Option 504 or 518. Refer to Figure 4-6 and Figure 4-7 for part locations.

Figure 4-6 Options 504 and 518 Top View

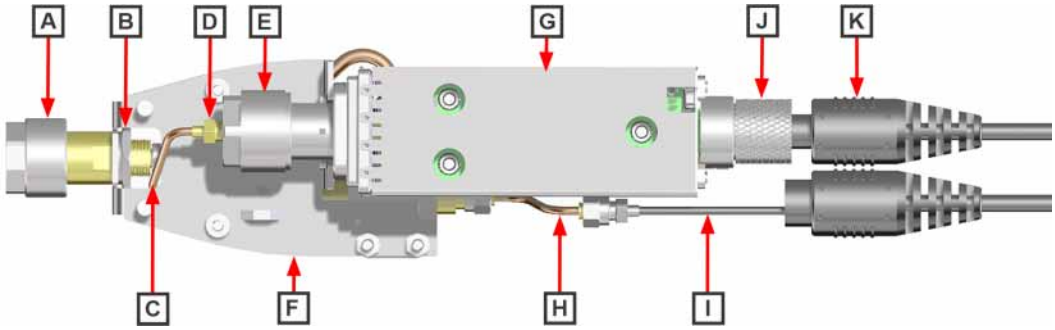
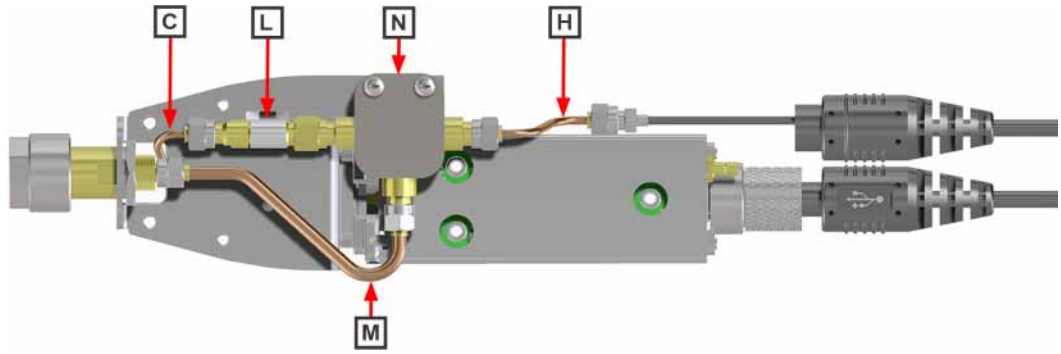


Figure 4-7 Options 504 and 518 Bottom View



A	Input Connector, Type-N
B	Hex Nut and Lock Washer
C	Cable, Attenuator to Sensor
D	Connector (Semi-Rigid Cable)
E	Connector (Power Sensor)
F	Deck, Main
G	Power Sensor

H	Cable, Splitter to Output
I	Cable, RF Output
J	Connector (Mini USB Cable)
K	Cable, Mini USB
L	3 dB Attenuator
M	Cable, Input to Splitter
N	Power Splitter

Type-N Input Connector (A)

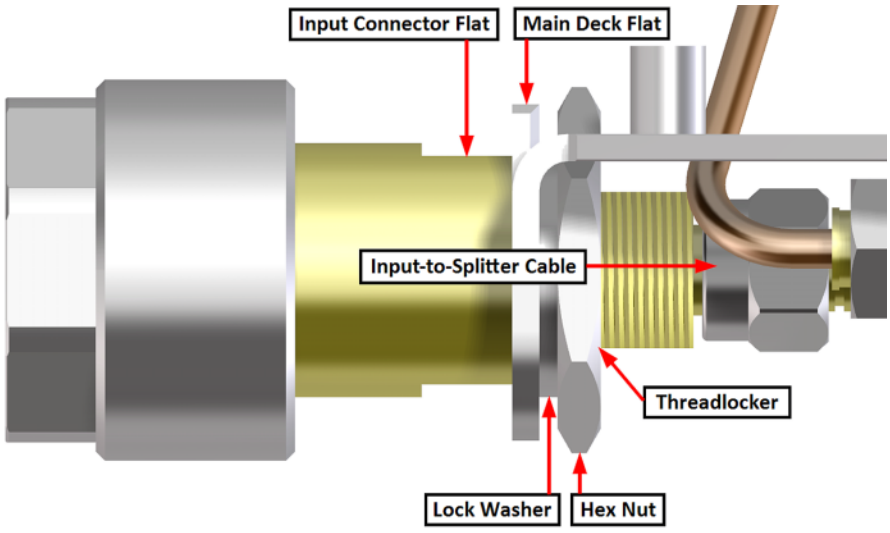
To remove the input connector, Type-N:

1. Using a 5/16-inch wrench, loosen the input-to-splitter cable (M) at the input connector until the nut is disengaged from the input connector.
2. Using a 9/16-inch wrench, remove the hex nut (B) holding the input connector on the main deck (F). Allow it, and the lock washer, to slide onto the cable.
3. Remove the input connector.

To replace the input connector, Type-N:

1. Line up the flat on the input connector with the flat on the main deck (see Figure 4-8) and slide the input connector into the main deck. Loosely attach the input-to-splitter cable (M) as it slides in.
2. Place the lock washer onto the connector. Put threadlocker on the next two exposed threads, and loosely screw on the hex nut (see Figure 4-8).
3. Torque the hex nut (B) to 30 in-lbs.
4. Torque the cable to 10 in-lbs.
5. Verify that the other end of the cable, connected to the power splitter (N), is torqued to 10 in-lbs.

Figure 4-8 Option 508 and 514 Input Connector Replacement



Power Splitter (N)

To remove the power splitter:

1. Disconnect the attenuator-to-sensor cable (C) and 3 dB attenuator (L) from the sensor module without separating them, holding the cable connector (D) with a ¼-inch open-end wrench. Let them hang free in the main deck (F).
2. Remove the cable bracket (see "To remove and replace the cable bracket:"), then remove the splitter-to-output cable (H) from the power splitter without separating it from the RF output cable (I).
3. Remove the mounting screws attaching the power splitter to the main deck (F).
4. Disconnect the power splitter from the input-to-splitter cable (M).

To replace the power splitter:

1. Loosely connect the power splitter to the input-to-splitter cable (M).
2. Install the mounting screws.
    a. Put the two screws through the power splitter and deck (F).
    b. Holding the screws in place, turn the entire assembly upside down, then place the lock washers and hex nuts on the screws.
    c. Hold the hex nut with the 3/16-inch open-end wrench and torque the screw to 7 in-lbs.
3. Loosely connect the attached attenuator-to-sensor cable (C) and 3 dB attenuator (L), and then the splitter-to-output cable (H), to their positions on the sensor module.
4. Torque all cable connections to 10 in-lbs, except for the cable connector (D) at the power sensor connector (E). Torque this connection to 12 in-lbs, holding the cable connector with a ¼-inch open-end wrench.

Power Sensor (G)

To remove the power sensor:

1. Remove the attenuator-to-sensor cable (C).
    a. Loosen the cable from the 3 dB attenuator (L) with a 5/16-inch wrench, until the nut is disengaged.
    b. Loosen the sensor connection (E) to the cable with a ¾-inch wrench, holding the cable connector at (D) with a ¼-inch open-end wrench.
    c. Let the cable hang free in the main deck (F).
2. Remove the cable bracket (see "To remove and replace the cable bracket:"), then disconnect the splitter-to-output cable (H) at the RF output cable (I).
3. Remove the two screws attaching the sensor to the main deck with a 1.5 mm hex wrench.
4. Remove the sensor from the mini USB cable (K), unscrewing the connector (J).

To replace the power sensor:

1. Prepare the replacement power sensor, as described in "Replacement Sensor Preparation".
2. Fasten the power sensor to the main deck (F) with the two screws (0515-1185) and lock washers, with three full threads of threadlocker. Torque the screws to 1.5 in-lbs with a 1.5 mm hex wrench.
3. Loosely connect the attenuator-to-sensor cable (C) to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (L).
4. On the sensor end, hold the connector (D) with 1/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 12 in-lbs.
5. On the attenuator end, hold the 3 dB attenuator with 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.
6. Connect the mini USB cable (K).
7. Connect the RF output cable (I) to the splitter-to-output cable (H), torque to
10 in-lbs, and then attach the cable bracket.

3 dB Attenuator (L)

To remove the 3 dB attenuator:

1. Loosen the connection between the 3 dB attenuator and the attenuator-to- sensor cable (C) with a 5/16-inch wrench, holding the attenuator with a ¼-inch open-end wrench, until the nut is disengaged.
2. Disconnect the other end of the cable from the power sensor (G), holding the cable connector at (D) with a ¼-inch open-end and loosening the sensor connection (E) with a ¾-inch wrench.
3. Let the attenuator-to-sensor cable hang free in the main deck (F).
4. Remove the 3 dB attenuator from the power splitter (N).

To replace the 3 dB attenuator:

1. Attach the 3 dB attenuator to the power splitter (N) and torque to 10 in-lbs.
2. Loosely connect the attenuator-to-sensor cable (C) to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator.
3. On the sensor end, hold the connector (D) with 1/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 12 in-lbs.
4. On the attenuator end, hold the 3 dB attenuator with 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.

Cables (M, C, H)

To remove the input-to-splitter cable (M):

1. Loosen the cable connectors using a 5/16-inch wrench.
2. Remove the input connector (A), as described in "To remove the input connector, Type-N:".
3. Disconnect the cable from the power splitter (N).

To replace the input-to-splitter cable (M):

1. Loosely connect the cables to the power splitter (N), as shown in Figure 4-7.
2. Install the input connector (A), as described in "To replace the input connector, Type-N:".
3. Torque both ends of the cable to 10 in-lbs.

To remove the attenuator-to-sensor cable (C):

1. Remove the input connector (A), as described in "To remove the input connector, Type-N:".
2. Loosen the cable from the 3 dB attenuator (L) with a 5/16 wrench.
3. Hold connector (D) with a 1/4-inch open-end wrench while loosening the power sensor connector (E) with ¾-inch wrench.
4. Remove the cable from both connections.

To replace the attenuator-to-sensor cable (C):

1. Place the cable through the rectangular hole in the main deck (F) with the female connector (D) on the side of the power sensor (G).
2. Install the input connector (A), as described in "To replace the input connector, Type-N:".
3. Loosely connect the female connector to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (L).
4. On the sensor end, hold the cable connector with a 1/4-inch open-end wrench while tightening the power sensor connector. Torque to 12 in-lbs.
5. On the attenuator end, hold the 3 dB attenuator with a 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.

To remove the splitter-to-output cable (H):

1. Remove the cable bracket, as described in "To remove and replace the cable bracket:".
2. Remove the cable from the assembly, using a 5/16-inch wrench on both ends.

To replace the splitter to output cable (H):

1. Loosely connect one end of the cable to the power splitter (N) and the other end to the RF output cable (I).
2. Torque both connections to 10 in-lbs.

Hardware Configuration for 26.5 GHz (Option 526)

Use the following procedures to remove and replace the parts for sensor modules with Option 526. Refer to Figure 4-9 and Figure 4-10 for part locations.

Figure 4-9 Option 526 Top View

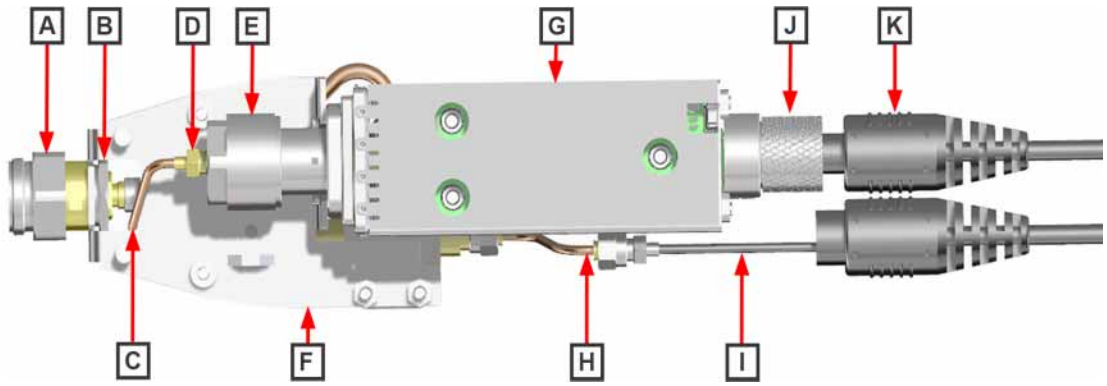
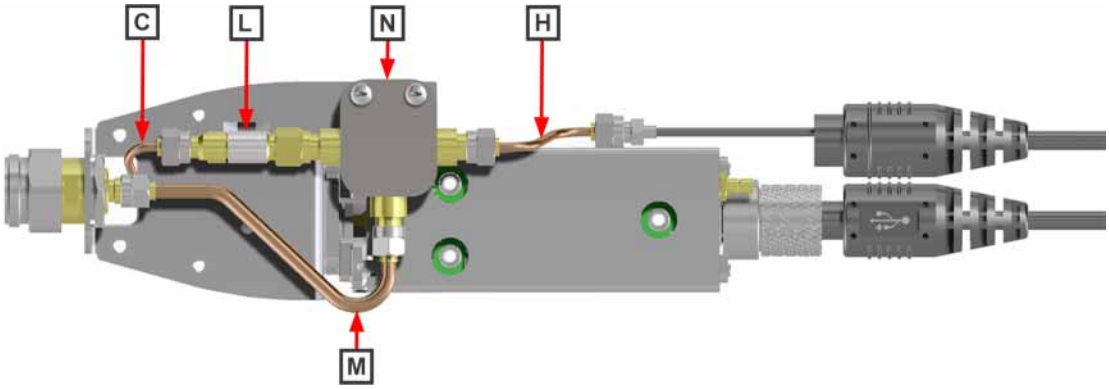


Figure 4-10 Option 526 Bottom View



A	Input Connector, 3.5 mm
B	Hex Nut and Lock Washer
C	Cable, Attenuator to Sensor
D	Connector (Semi-Rigid Cable)
E	Connector (Power Sensor)
F	Deck, Main
G	Power Sensor

H	Cable, Splitter to Output
I	Cable, RF Output
J	Connector (Mini USB Cable)
K	Cable, Mini USB
L	3 dB Attenuator
M	Cable, Input to Splitter
N	Power Splitter

3.5 mm Input Connector (A)

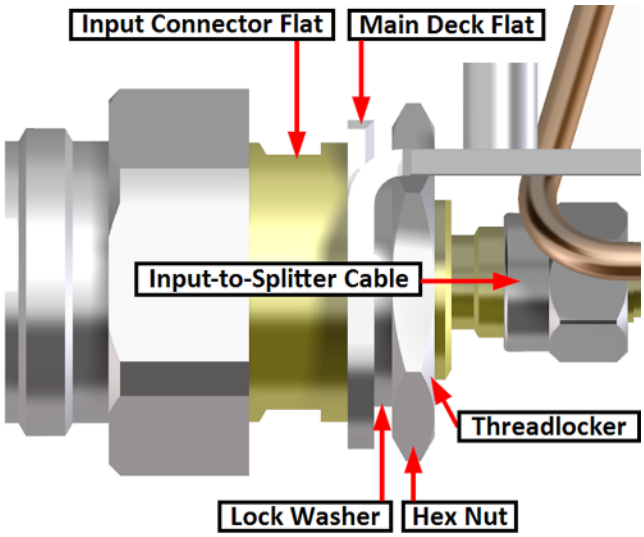
To remove the input connector, 3.5 mm:

1. Using a 5/16-inch wrench, loosen the input-to-splitter cable (M) at the input connector until the nut is disengaged from the input connector.
2. Using a 9/16-inch open-end wrench, remove the hex nut (B) holding the input connector on the main deck (F). Allow it and the lock washer to slide onto the cable.
3. Remove the input connector.

To replace the input connector, 3.5 mm:

1. Line up the flat on the input connector with the flat on the main deck (see Figure 4-11) and slide the input connector into the main deck. Loosely attach the input-to-splitter cable (M) as it slides in.
2. Place the lock washer onto the connector, put threadlocker on the next two exposed threads, and loosely screw on the hex nut (see Figure 4-11).
3. Torque the hex nut (B) to 30 in-lbs.
4. Torque the cable to 10 in-lbs.
5. Verify that the other end of the cable, connected to the power splitter (N), is torqued to 10 in-lbs.

Figure 4-11 Option 526 Input Connector Replacement



Power Splitter (N)

To remove the power splitter:

1. Disconnect the attenuator-to-sensor cable (C) and 3dB attenuator (L) from the sensor module without separating them, holding the cable connector at (D) with a ¼-inch open-end wrench. Let them hang free in the main deck (F).
2. Remove the cable bracket (see "To remove and replace the cable bracket:"), then remove the splitter-to-output cable (H) from the power splitter without separating it from the RF output cable (I).
3. Remove the mounting screws attaching the power splitter to the main deck (F).
4. Disconnect the power splitter from the input-to-splitter cable (M).

To replace the power splitter:

1. Loosely connect the power splitter to the input-to-splitter cable (M).
2. Install the mounting screws.
    a. Put the two screws through the power splitter and deck (F).
    b. Holding the screws in place, turn the entire assembly upside down, then place the lock washers and hex nuts on the screws.
    c. Hold the hex nut with the 3/16-inch wrench and torque the screw to 7 in-lbs.
3. Loosely connect the attached attenuator-to-power sensor cable (C) and 3 dB attenuator (L), and then the splitter-to-output cable (H), to their positions on the sensor module.
4. Torque all cable connections to 10 in-lbs, except for the cable connector (D) at the power sensor connector (E). Torque this connection to 12 in-lbs, holding the cable connector with a ¼-inch open-end wrench.

Power Sensor (G)

To remove the power sensor:

1. Remove the attenuator-to-sensor cable (C).
    a. Loosen the cable from the 3 dB attenuator (L) with a 5/16-inch wrench, until the nut is disengaged.
    b. Loosen the sensor connection (E) to the cable with a ¾-inch wrench, holding the cable connector at (D) with a ¼-inch open-end wrench.
    c. Let the cable hang free in the main deck (F).
2. Remove the cable bracket (see "To remove and replace the cable bracket:"), then disconnect the splitter-to-output cable (H) at the RF output cable (I).
3. Remove the two 1.5 mm hex screws attaching the sensor to the main deck.
4. Remove the sensor from the mini USB cable (K), unscrewing the connector (J).

To replace the power sensor:

1. Prepare the replacement power sensor, as described in "Replacement Sensor Preparation".
2. Fasten the power sensor to the main deck (F) with the two screws (0515-1185) and lock washers, with three full threads of threadlocker. Torque the screws to 1.5 in-lbs with a 1.5 mm hex wrench.
3. Loosely connect the attenuator-to-sensor cable (C) to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (L).
4. On the sensor end, hold the connector (D) with 1/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 12 in-lbs.
5. On the attenuator end, hold the 3 dB attenuator with 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.
6. Connect the mini USB cable (K).
7. Connect the RF output cable (I) to the splitter-to-output cable (H), torque to 10 in-lbs, and then attach the cable bracket.

3 dB Attenuator (L)

To remove the attenuator:

1. Loosen the connection between it and the attenuator-to-sensor cable (C) with a 5/16-inch wrench, holding the 3 dB attenuator with a ¼-inch open-end wrench, until the nut is disengaged.
2. Disconnect the other end of the cable from the power sensor (G), holding the cable connector at (D) with a ¼-inch open-end and loosening the sensor connection (E) with a ¾-inch wrench.
3. Let the attenuator-to-sensor cable hang free in the main deck (F).
4. Remove the 3 dB attenuator from the power splitter (N).

To replace the attenuator:

1. Attach the 3 dB attenuator to the power splitter (N) and torque to 10 in-lbs.
2. Loosely connect the attenuator-to-sensor cable (C) to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator.
3. On the sensor end, hold the connector (D) with 1/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 12 in-lbs.
4. On the attenuator end, hold the 3 dB attenuator with 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.

Cables (M, C, H)

To remove the input-to-splitter cable (M):

1. Loosen the cable connectors using a 5/16-inch open-end wrench.
2. Remove the input connector (A), as described in "To remove the input connector, 3.5 mm:".
3. Disconnect the cable from the power splitter (N).

To replace the input-to-splitter cable (M):

1. Loosely connect the cable to the power splitter (N), as shown in Figure 4-7.
2. Install the input connector (A), as described in "To replace the input connector, 3.5 mm:".
3. Torque both ends of the cable to 10 in-lbs.

To remove the attenuator-to-sensor cable (C):

1. Remove the input connector (A), as described in "To remove the input connector, 3.5 mm:".
2. Loosen the cable from the 3 dB attenuator (L) with a 5/16 open-end wrench.
3. Hold the connector (D) with a 1/4-inch open-end wrench while loosening the power sensor connector (E) with a 5/16 open-end wrench.
4. Remove the cable from both connections.

To replace the attenuator-to-sensor cable (C):

1. Place the cable through the rectangular hole in the main deck (F) with the female connector (D) on the side of the power sensor (G).
2. Install the input connector (A), as described in "To replace the input connector, 3.5 mm:".
3. Loosely connect the female connector to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (L).
4. On the sensor end, hold the connector with 1/4-inch open-end wrench while tightening the power sensor connector. Torque to 12 in-lbs.
5. On the 3 dB attenuator end, hold the 3 dB attenuator with a 1/4-inch open-end wrench while tightening the hex nut. Torque to 10 in-lbs.

To remove the splitter-to-output cable (H):

1. Remove the cable bracket, as described in "To remove and replace the cable bracket:".

2. Remove the cable from assembly, using a 5/16-inch open-end wrench on both ends.

To replace the splitter to output cable (H):

1. Loosely connect one end of the cable to the power splitter (N) and the other to the RF output cable (I).
2. Torque both connections to 10 in-lbs.

Hardware Configuration for 50 GHz (Option 550)

Use the following procedures to remove and replace the parts for sensor modules with Option 550. Refer to Figure 4-12, and either Figure 4-13 or Figure 4-14, for part locations.

Figure 4-12 Option 550 Top View

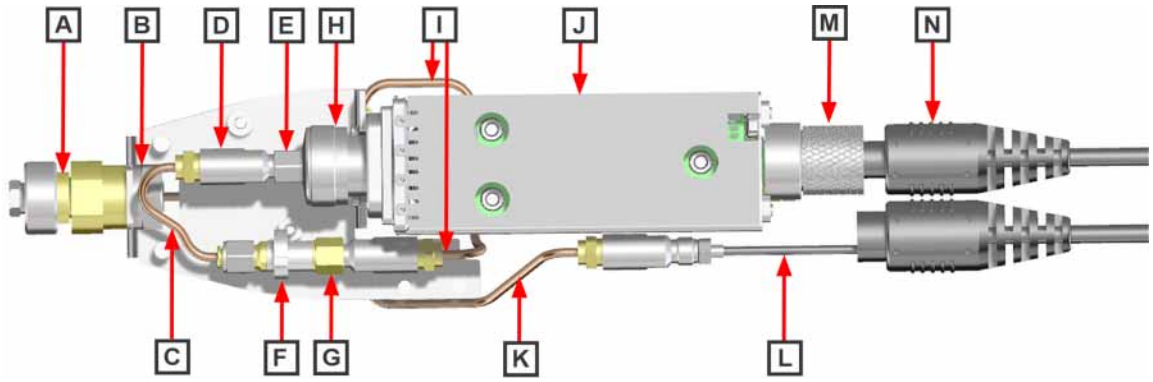


Figure 4-13 Option 550 Bottom View, Old

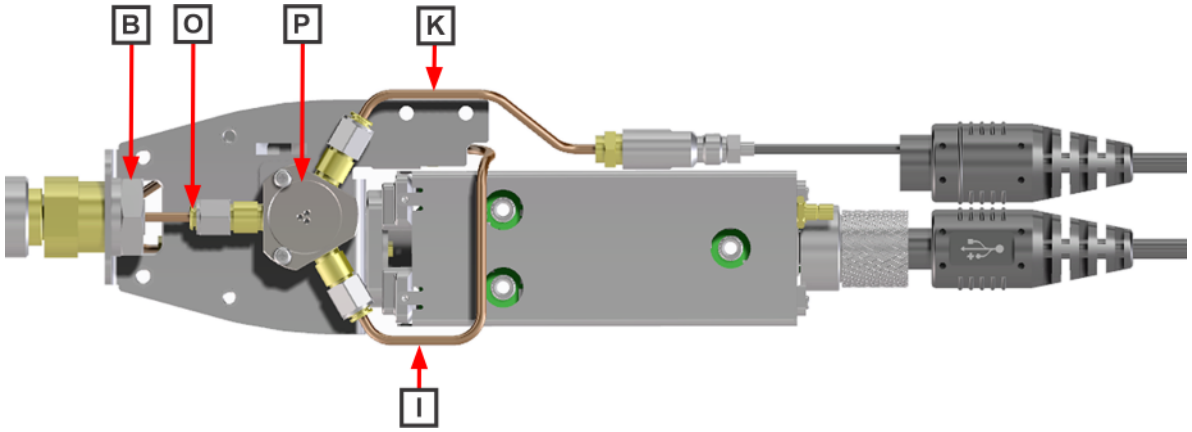
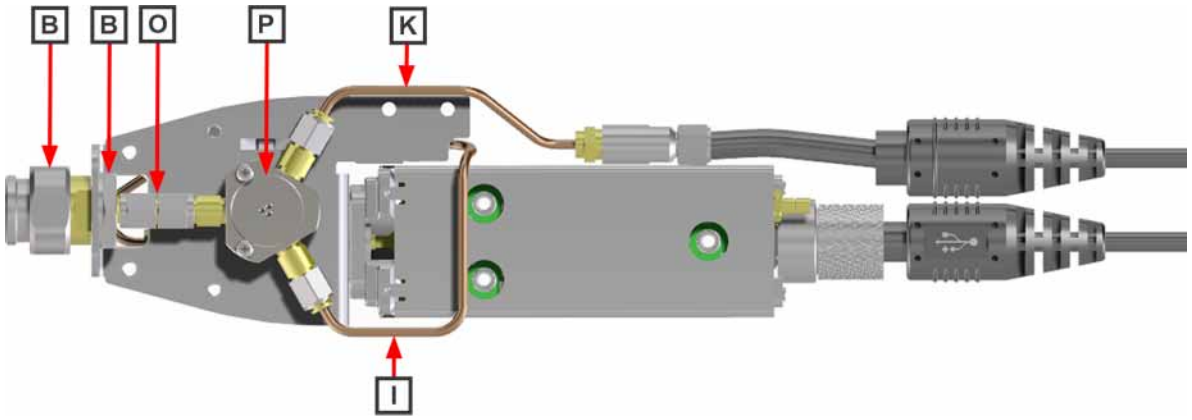


Figure 4-14 Option 550 Bottom View, New



A	Input Connector, 2.4 mm
B	Hex Nut and Lock Washer
C	Cable, Attenuator to Sensor
D	Connector (Semi-Rigid Cable)
E	Connector (Power Sensor)
F	Cable Tie
G	3 dB Attenuator
H	Deck, Main

I	Cable, Splitter to Attenuator
J	Power Sensor
K	Cable, Splitter to Output
L	Cable, RF Output
M	Connector (Mini USB Cable)
N	Cable, Mini USB
O	Cable or Adapter, Input-to-Splitter
P	Power Splitter

Upgrade Kit

50 GHz U5532C sensor modules with serial numbers ≥ MY61370156 have been manufactured with several part changes. Modules with older prefixes must be upgraded with all of the new parts using the upgrade kit U5532-60005 if:

A. Any of these individual parts need to be replaced during repair.

- Input connector (A) (See "2.4 mm Input Connector (A)")
- Cable, Input to Splitter (O) (See "Cables (O, C, I, K)")
- Cable, Splitter to Attenuator (I) (See "Cables (O, C, I, K)")
- Cable, Splitter to Output (K) (See "Cables (O, C, I, K)")

B. The sensor module is failing Input SWR/VSWR specification testing.

A sensor module with a serial number < MY61370156 that already has been upgraded can be identified by the input connector, prior to opening the module cover (see Figure 4-15).

Figure 4-15 Option 550 Input Connector, Old (left) vs New (right)

NOTE

There are additional parts that must be replaced other than the four above, all included with the upgrade kit. See Table 4-2 for full list of parts in the upgrade kit.

2.4 mm Input Connector (A)

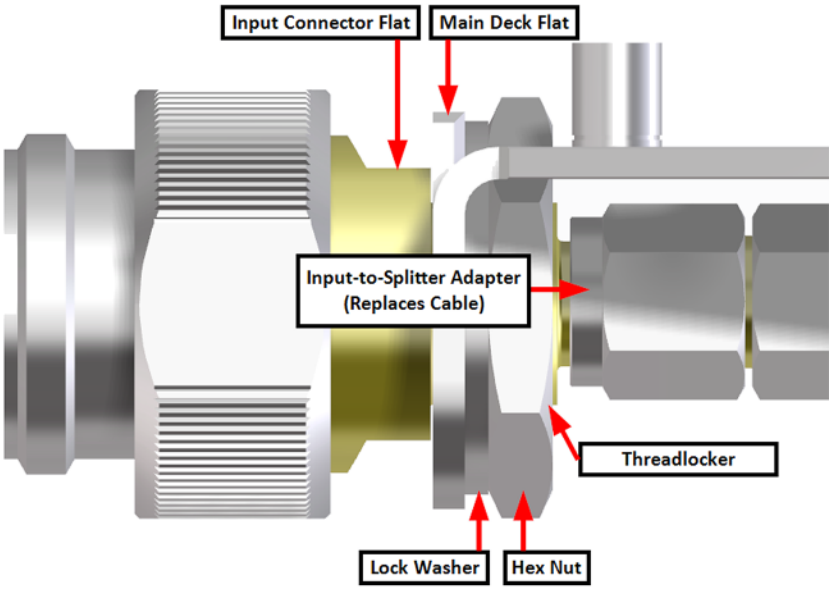
To remove the input connector, 2.4 mm:

1. Loosen the input-to splitter cable or adapter (O) at both ends, using a 5/16-inch wrench.
2. Using a 17 mm wrench, remove the hex nut (B) holding the input connector on the main deck (F). Allow it and the lock washer to slide onto the cable or adapter.
3. Remove the input connector.

To replace the input connector, 2.4 mm:

1. If the sensor module is of the old Option 550 configuration (see Figure 4-13), ensure the parts are replaced as described in "Upgrade Kit", including the hex nut and lock washer (B) and main deck (H).
2. Hang the hex nut and lock washer from the input-to-splitter adapter (O) so they can go on the input connector, with hex nut towards power splitter (P).
3. Line up the flat on the input connector with the flat on the main deck (see Figure 4-16) and slide the input connector into the main deck. Loosely attach the adapter as it slides in.
4. Slide the lock washer onto the connector, put threadlocker on the next two exposed threads, and screw on the hex nut (see Figure 4-16).
5. Torque the hex nut (B) to 30 in-lbs.
6. Torque the adapter to 10 in-lbs on both ends, input connector end first.

Figure 4-16 Option 550 Input Connector Replacement, New



Power Splitter (P)

To remove the power splitter:

1. Remove the cable bracket (see "To remove and replace the cable bracket:", then remove the splitter-to-output cable (K) from the power splitter using a 5/16-inch wrench.
2. Remove the splitter-to-attenuator cable (I) from both ends, using a second 5/16-inch wrench to hold the flat of the female end.
3. Remove the power splitter mounting hardware (screws, lock washers, hex nuts, and spacer).
4. Disconnect the power splitter from the input-to-splitter cable or adapter (O).

To replace the power splitter:

1. Cut the cable tie (F) from the main deck (H) and remove the power sensor, with cable (C) and 3 dB attenuator (G) attached, using a 1.5 mm hex driver to remove the screws. This will expose the splitter mounting screw holes for ease of access.
2. Loosely connect the power splitter to the input-to-splitter cable or adapter (O).
3. Install the power splitter mounting hardware.
    a. Insert the spacer in between the power splitter and main deck, and align the thru-holes of all three.
    b. Put the two screws through the power splitter, spacer, and deck.
    c. Holding the screws in place, turn the entire assembly upside down, then place the lock washers and hex nuts on the screws.
    d. Hold the hex nut with a 3/16-inch wrench and torque the screw to 7 in-lbs.
4. Install the power sensor onto the main deck (with cable and 3 dB attenuator attached). Torque the screws to 1.5 in-lbs with a 1.5 mm hex wrench.
5. Replace the cable tie so that it goes through the main deck slot and around the 3 dB attenuator. Snip the excess cable tie.
6. Connect the splitter-to-attenuator cable (I), using a 5/16 open-end wrench to hold the flat of the female cable connector.
7. Connect the splitter-to-output cable (K) to the power splitter.
8. Torque all cable or adapter connections to 10 in-lbs, holding the flats of the female cable connectors with a 5/16 open-end wrench and the 3 dB attenuator with a 1/4-inch open-end wrench.

Power Sensor (J)

To remove the power sensor:

1. Remove the attenuator-to-sensor cable (C).
    a. Loosen the cable from the 3 dB attenuator (G) using a 5/16 wrench, holding the flat of the attenuator with a 1/4-inch open-end wrench, until the nut is disengaged.
    b. Disconnect the cable from the sensor connection (E), holding the flat of the cable connector (D) with another 5/16 open-end wrench.
2. Remove the two screws attaching the sensor to the main deck with a 1.5 mm hex wrench.
3. Remove the sensor from the mini USB cable (N), unscrewing the connector (M).

To replace the power sensor:

1. Prepare the replacement power sensor, as described in “Replacement Sensor Preparation”.
2. Fasten the power sensor to the main deck (F) with the two screws (0515-1185) and lock washers, with three full threads of threadlocker. Torque the screws to 1.5 in-lbs with a 1.5 mm hex wrench.
3. Connect the attenuator-to-sensor cable (C) to the sensor module.
    a. Loosely connect the cable to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (G). Then, loosely connect the nut on the male end to the 3 dB attenuator.
    b. Torque both connections to 10 in-lbs, using a ¼-inch open-end wrench to hold the flat of the 3 dB attenuator and a second 5/16-in open-end wrench to hold the flat of the cable connector (D).
4. Connect the mini USB cable (N).

3 dB Attenuator (G)

To remove the 3 dB attenuator:

1. Remove the attenuator-to-sensor cable (C).
    a. Loosen the cable from the 3 dB attenuator using a 5/16 wrench, holding the flat of the attenuator with a 1/4-inch open-end wrench, until the nut is disengaged.
    b. Disconnect the cable from the sensor connection (E), holding the flat of the female cable connector (D) with another 5/16 open-end wrench.
2. Cut the cable tie (F).
3. Disconnect the 3 dB attenuator from the splitter-to-attenuator cable (I), holding the cable connector with a 5/16-inch open-end wrench.

To replace the 3 dB attenuator:

1. Loosely connect the 3 dB attenuator to the attenuator-to-splitter cable (I).
2. Loosely connect the attenuator-to-sensor cable (C) to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator. Then, loosely connect the nut on the male end to the attenuator.
3. Replace the cable tie so that it goes through the main deck slot and around the 3 dB attenuator. Snip the excess cable tie.
4. Torque all connections to 10 in-lbs, using a ¼-inch open-end wrench to hold the flat of the 3 dB attenuator and a 5/16-in open-end wrench to hold the flats of the female cable connectors.

Cables (O, C, I, K)

To remove the input-to-splitter cable (O, serial < MY61370156):

1. Remove the input connector (A), as described in "To remove the input connector, 2.4 mm:".
2. Disconnect the cable from the power splitter (P).
3. This cable must be replaced by the adapter in the upgrade kit.

To remove the input-to-splitter adapter (O, serial number ≥ MY61370156"):

1. Remove the input connector (A), as described in "To remove the input connector, 2.4 mm:".
2. Disconnect the adapter from the power splitter (P) using a 5/16-inch wrench.

To replace the input-to-splitter adapter (O):

1. Loosely connect the adapter to the power splitter (P) with the input connector's hex nut and lock washer (B) around the adapter, hex nut towards the power splitter.
2. Install the input connector (A), as described in "To replace the input connector, 2.4 mm:".
3. Torque both ends of the adapter to 10 in-lbs.

To remove the attenuator-to-sensor cable (C):

1. Loosen the cable from the 3 dB attenuator (G) using a 5/16-inch wrench, holding the attenuator with a ¼-inch open-end wrench, until the nut is disengaged.
2. Disconnect the sensor connection (E) to the cable using a 5/16-inch wrench, holding the flat of the female cable connector (D) with a second 5/16-inch open-end wrench.

To replace the attenuator-to-sensor cable (C):

1. Loosely connect the cable to the power sensor connector (E), while mating the other end of the cable to the 3 dB attenuator (G). Then, loosely connect the nut on the male end to the 3 dB attenuator.
2. Torque both connections to 10 in-lbs, using a ¼-inch open-end wrench to hold the flat of the 3 dB attenuator and a second 5/16-in open-end wrench to hold the flat of the cable connector (D).

To remove the splitter-to-attenuator cable (I):

1. Loosen the cable on both ends using a 5/16-inch wrench, with a second 5/16-inch open-end wrench to hold the flat of the female end mated to the 3 dB attenuator (G).

2. Disconnect the male end from the power splitter (P), then the other end from the 3 dB attenuator.

To replace the splitter-to-attenuator cable (I):

1. If the sensor module is of the old Option 550 configuration (see Figure 4-13), ensure the parts are replaced as described in "Upgrade Kit".
2. Loosely connect the cable to the power splitter (P), then the other end to the 3 dB attenuator (G).
3. Torque all connections to 10 in-lbs, using a 5/16-inch open-end wrench to hold the flat of the female cable connector.

To remove the splitter-to-output cable (K):

1. Remove the cable bracket, as described in "To remove and replace the cable bracket:".
2. Loosen the cable connections with a 5/16-inch open-end wrench, using a second 5/16-inch open-end wrench to hold the flat of the female end mated to the RF output cable (L).
3. First remove the cable from the power splitter (P), then from the RF output cable.

To replace the splitter-to-output cable (K):

1. If the sensor module is of the old Option 550 configuration (see Figure 4-13), ensure the parts are replaced as described in "Upgrade Kit".
2. Loosely connect the cable to the RF output cable (L) first, then to the power splitter (P).
3. Install the cable bracket (see "To remove and replace the cable bracket:") over the RF output and mini USB cables (L and N).
4. Torque both connections to 10 in-lbs, using a second 5/16-inch open-end wrench to hold the flat of the female end mated to the RF output cable.

Replaceable Parts

Table 4-1 U5532C Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4.2 GHz)	Opt 518 (18 GHz)	Opt 526 (26.5 GHz)	Opt 550 (50 GHz)
Sensor Module Cover and Main Deck					
Label, UKCA	5183-1665	X	X	X	X
Label - Rear, Regulatory 20mm x 40 mm	U5532-80002	X	X	X	X
Overlay - Front	U5532-80003	X			
Overlay - Front	U5532-80004		X		
Overlay - Front	U5532-80005			X	
Overlay - Front	U5532-80006				X
Cover, plastic (top)	U5532-40001	X	X	X	X
Cover, plastic (bottom)	U5532-40002	X	X	X	X
Screw, hex, socket head, M3X0.5 14mm For attaching bottom cover to sensor module	0515-1097	X	X	X	X
Cable Bracket U5532C (Top)	U5532-00003	X	X	X	X
Cable Bracket U5532C(Bottom)	U5532-00004	X	X	X	X
Screw, hex, socket head, 2-56 .625 inch long For attaching top and bottom cable brackets together	3050-2329	X	X	X	X
Washer, lock, helical #2, 0.088-in-ID For attaching top and bottom cable brackets together	2190-0112	X	X	X	X
Deck, Main	U5532-00007[a]	X	X	X	X
Screw, w/ washer, Torx-T8, pan head, M2.5X0.45 14mm For attaching main deck to top cover	0515-2141	X	X	X	X
Screw, w/ washer, Torx-T8, pan head, M2.5X0.45 24mm For attaching sensor module to top cover	0515-6229	X	X	X	X
Power Sensor					
Power Sensor, 4.2 GHz, 18 GHz, 26.5 GHz	U8485-66004	X	X	X	
Power Sensor, 50 GHz	U8487-66004				X

Table 4-1 U5532C Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4.2 GHz)	Opt 518 (18 GHz)	Opt 526 (26.5 GHz)	Opt 550 (50 GHz)
Screw, hex, socket head, M1.6X0.35 10mm For mounting sensor to main deck	0515-1185	X	X	X	X
Washer, lock, helical, #0, 0.062-in-ID, 0.1-in-OD For mounting sensor to main deck	2190-0572	X	X	X	X
Vibration pad for power splitter	U5532-40005	X	X	X	
Input Connector					
Input connector, Type-N	N5532-60015	X	X		
Input connector, 3.5 mm	U5532-60002			X	
Input connector, 2.4 mm	U5532-20020[a]				X
Nut, hex, UNEF-2B-THD, 0.094-in-thick, 0.563-in A/F For mounting input connector to main deck.	2950-0132[a]	X	X	X	X
Washer, lock, 7/16 inch, 0.439-in-ID For mounting input connector to main deck.	2190-0104[a]	X	X	X	X
Power Splitter					
Power Splitter, 26.5 GHz	5067-4086	X	X	X	
Power Splitter, 50 GHz	11667-60021				X
Screw, pozidriv, pan head, 4-40 .625 inch For mounting power splitter to deck	2200-0149	X	X	X	
Nut, hex, 4-40, 0.063-in-thick For mounting power splitter to deck	2260-0002	X	X	X	
Washer, lock, 0.115-in-ID, 0.253-in-OD For mounting power splitter to deck	2190-0003	X	X	X	
Screw, pozidriv, pan head, 2-56, 0.75 inch long For mounting power splitter to deck	0520-0137				X
Nut, hex, 2-56, 0.062-in-thick For mounting power splitter to deck	0610-0002				X
Washer, lock, helical #2, 0.088-in-ID For mounting power splitter to deck	2190-0112				X
Spacer for power splitter	U5532-00002				X

Table 4-1 U5532C Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4.2 GHz)	Opt 518 (18 GHz)	Opt 526 (26.5 GHz)	Opt 550 (50 GHz)
3 dB Attenuator					
3 dB Attenuator, 26.5 GHz	08493-60013	X	X	X	
3 dB Attenuator, 50 GHz	08490-60010				X
Cable tie, 91-mil-wide nylon gray For securing 3 dB attenuator (50 GHz) to main deck	1400-0249				X
Cables					
Cable, Input to Splitter, 3.5 mm male to 3.5 mm male	U5532-20006	X	X		
Cable, Input to Splitter, 3.5 mm male to 3.5 mm male	U5532-20005			X	
Adapter, Input to Splitter, 2.4mm male to 2.4 mm male	85056-60005[a]				X
Cable, Attenuator to Sensor, 3.5 mm male to 3.5 mm female	U5532-20008	X	X	X	
Cable, Attenuator to Sensor, 2.4 mm male to 2.4mm female	U5532-20004				X
Cable, Splitter to Output, 3.5 mm male to 3.5 mm male	U5532-20007	X	X	X	
Cable, Splitter to Output, 2.4 mm male to 2.4 mm female	U5532-20017[a]				X
Cable, Splitter to Attenuator, 2.4mm male to 2.4 mm female	U5532-20018[a]				X
Cable, RF Output, 3.5 mm female to 3.5 mm male, 1.75 meters long	U5532-20011	X	X	X	
Cable, RF Output, 2.4 mm male to 2.4 mm male, 1.77 meters long	U5532-20010				X
Cable, USB Sensor Output 1.7 meters	U5532-20012	X	X	X	X
Cable Clip For USB sensor and RF output cables	U5532-40006	X	X	X	X

a. If the sensor module has a serial number < MY61370156, and has not been previously upgraded already (see Figure 4-14), order the upgrade kit U5532-60005 instead of the listed part number to upgrade it to the latest hardware.

Table 4-2 U5532-60005, U5532C-550 Upgrade Kit

Part Description	**Part Numbers**
Cable tie, 91-mil-wide nylon gray	1400-0249
Adapter, input to Splitter, 2.4mm male to 2.4 mm male	85056-60005
Deck, main	U5532-00007
Cable, splitter to output, 2.4 mm male to 2.4 mm female	U5532-20017
Cable,splitter to attenuator, 2.4mm male to 2.4 mm female	U5532-20018
Input connector, 2.4 mm	U5532-20020

Calibration

Keysight Technologies recommends that repair and calibration of the U5532C Sensor modules be performed at an Keysight Technologies service center. The service center has the required calibration standards and the ability to produce a calibration data disk in the format that the N5531X Measuring Receiver System requires.

However, if your cal lab currently calibrates Keysight thermocouple power sensors such as the U8480 Series and the calibration standards and test metrology used meet the U5532C specifications listed in Table 3-1 on page 20, you may wish to develop your own calibration process. Refer to Keysight Technologies Application Notes 1449-1 through 1449-4 for information regarding the fundamentals of RF and microwave power measurements. Application Note 1449-1 includes an overview of the theory and practice of sensor calibration.

Figure 1-1 on page 9 shows that the U5532C Sensor Modules consist basically of a power splitter and an Keysight U8480 Series Power Sensor with a padded input. Therefore, the match of the U5532C Sensor Module is different than the match of a standard U8480 Series Power Sensor. The module is calibrated with the RF output cable terminated with a matched 50 Ω load.

The calibration power at the input should be 0 dBm ±2 dB. This is to ensure enough power is provided so the sensing element in the U5532C Sensor Module stays above its noise floor. The maximum calibration must not exceed +10 dBm to avoid non-linearities in the calibration standards (reference sensor or standard sensor).

The presence of the splitter and cable create a ripple in the sensor's input efficiency, so many frequency calibration points are required to accurately characterize the sensor module.

Figure 4-17 Cal Factor (Ripple Due to Power Splitter and PSA Line Loading)

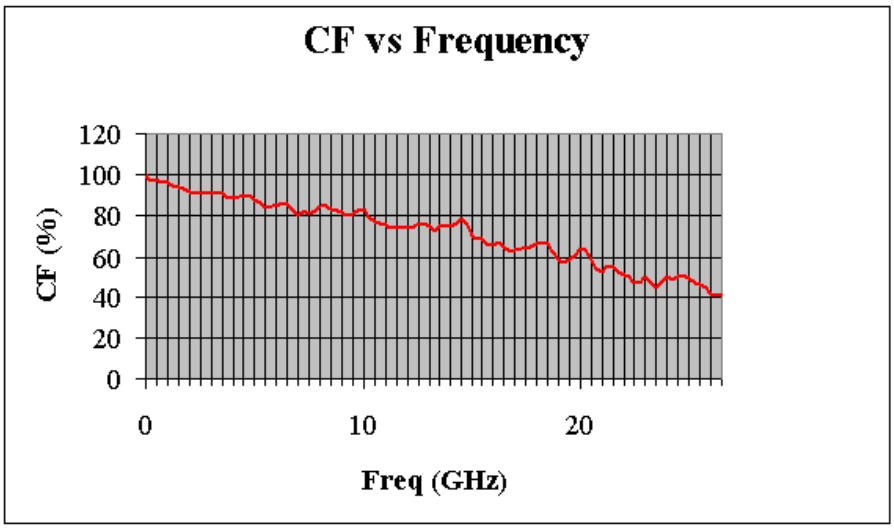


Table 4-3 Recommended Calibration Points

U5532C Power Sensor	Frequency Points
Option 504	100 kHz
	300 kHz
	1 MHz
	3 MHz
	5 MHz
	10 MHz
	30 MHz
	50 MHz
	100 MHz to 4.2 GHz in 100 MHz steps (50 steps)
Option 518	10 MHz
	30 MHz
	50 MHz
	100 MHz to 18 GHz in 100 MHz steps (183 steps)
Option 526	10 MHz
	30 MHz
	50 MHz
	100 MHz to 26.5 GHz in 100 MHz steps (267 steps)
Option 550	30 MHz
	50 MHz
	100 MHz to 50 GHz in 100 MHz steps (501 steps)

Typical Cal Factor ranges for the Power Sensors are between 90% and 100%, depending on the efficiency of the sensor's thermocouple over the specified frequency range. With the added loss from the other passive components in front of the power sensor, there is approximately another 9 to 11 dB loss (or another 25% loss) from 50 MHz to 26.5 GHz. This, coupled with the fact that typical power sensor Cal Factor is defined with a constant power level at the input, and this application has a sloped power input, an additional 25% efficiency component is added. As a result, the U5532C Sensor Module will have about a 40% Cal Factor at 26.5 GHz and about a 30% Cal Factor at 50 GHz. This is acceptable because the sensor is characterized with this behavior and thus will be corrected in the N5531X Measuring Receiver System.

Upon calibrating the sensor module, the cal factor data is stored on a CD ROM. This disk allows you to transfer the cal data to the N5531X Measuring Receiver System. Since there are hundreds of data points, manual entry is highly impractical.

Cal Factor Data File Format

The U5532C data, "CFData.xml", is stored in an xml format. On each CD-ROM, the data file is accompanied with an xsl file, "CalTable.xsl". This file contains the xml formatting instructions which are used by an xml viewer, such as Microsoft Edge. However, the xml file may be viewed by any text editor and will appear as shown below.

The system software does not need the xsl file because it's not trying to display the data. The system, however, does look for the specific "bookmarks" or "tags" used by the xml format. So, for the system to properly read the data from the file, the calibration data needs to be stored as shown in the following sample file.

Figure 4-18 File Format for the U5532C Sensor Module CD-ROM (Two Data Points Shown)

```
<?xml version="1.0" encoding="utf-8"?>
<!--This file is used with the Agilent N5532A power sensor module.-->
<?xml-stylesheet type="text/xsl" href="CalTable.xsl"?>
<Calibration>
        <Version>1.0</Version>
        <ModelNumber>N5532A</ModelNumber>
        <Options>526</Options>
        <SerialNumber>US00010004</SerialNumber>
        <DateCalibrated>7/22/2004</DateCalibrated>
        <ReferenceCF>99</ReferenceCF>
        <CalFactor>
                <Frequency Unit= "Mhz">30</Frequency>
                <CalFactor Unit= "Percent">99.5127892581548</CalFactor>
                <CalFactorUnc Unit= "Percent">1.73435915811032</CalFactorUnc>
                <ReflectionMag Unit= "Linear">6.23774528503418E-03</ReflectionMag>
                <ReflectionPhase Unit= "Degrees">-82.1718749999999</ReflectionPhase>
                <ReflectionMagUnc Unit= "Linear">1.10418066980155E-03</ReflectionMagUnc>
        </CalFactor>
        <CalFactor>
                <Frequency Unit= "Mhz">50</Frequency>
                <CalFactor Unit= "Percent">99</CalFactor>
                <CalFactorUnc Unit= "Percent">1.24220367426375</CalFactorUnc>
                <ReflectionMag Unit= "Linear">8.19176435470581E-04</ReflectionMag>
                <ReflectionPhase Unit= "Degrees">65.3320312499999</ReflectionPhase>
                <ReflectionMagUnc Unit= "Linear">2.91455027642453E-03</ReflectionMagUnc>
        </CalFactor>
</Calibration>
```

The structure of the file is as follows:

- The first 3 lines are for the xml format.
- The fourth line marks the start of the calibration data, while the last line marks the end of the calibration data.
- The next 5 lines contain sensor-specific information: data format version, model number, option, serial number, and date calibrated.
- The next line is the reference calibration factor.
- The rest of the data file is filled with frequency-dependent data. There are 6 lines for every data point and each data point is marked by the beginning <CalFactor> and the ending </CalFactor>. The data set includes frequency, cal factor, cal factor uncertainty, reflection magnitude, reflection phase, and reflection magnitude uncertainty.

Contacting Keysight Technologies

Keysight Technologies has offices around the world to provide you with complete support for your accessories. To obtain servicing information or to order replacements, contact the nearest Keysight Technologies office listed in Table 4-4. In any correspondence or telephone conversations, refer to your accessory by its product number and full serial number.

Table 4-4

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

Americas

Canada 1 877 894 4414	Latin America (305) 269 7500	United States 1 800 829 4444

Asia Pacific

Australia 1 800 629 485	China 800 810 0189	Hong Kong 800 938 693
India 1 800 112 929	Japan 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		

Europe & Middle East

Austria 43 (0) 1 360 277 1571	Belgium 32 (0) 2 404 93 40	Denmark 45 70 13 15 15
Finland 358 (0) 10 855 2100	France 0825 010 700* *0.125 Euros/minute	Germany 49 (0) 7031 464 6333
Ireland 1890 924 204	Israel 972-3-9288-504/544	Italy 39 02 92 60 8484
Netherlands 31 (0) 20 547 2111	Spain 34 (91) 631 3300	Sweden 0200-88 22 55
Switzerland 0800 80 53 53	United Kingdom 44 (0) 118 9276201	

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

Sales and Technical Support

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

- https://www.keysight.com/find/n5531x
  (product-specific information and support, software and documentation updates)
- https://www.keysight.com/find/u5532c
  (product-specific information and support, software and documentation updates)
- https://www.keysight.com/find/assist
  (worldwide contact information for repair and service)

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