N5532B Sensor Module
User's and Service Guide

for the Agilent N5531S Measuring Receiver Systems

Agilent Technologies

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WARNING

***Warning* denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION

Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

NOTE

Note calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

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Contents

1 General Information

This user guide contains information about installation, operation, product specifications, calibration data, maintenance and repair, and storage conditions of the N5532B Sensor Module.

Description

The N5532B is intended to be used with the N5531S. It is essentially a power sensor with a power splitter at the input. See Figure 1-1 on page 7. In use, the sensor module's two output cables are connected to a power meter (E4418/19, E4416/17, or N1911/12 Series) and the Performance Spectrum Analyzer (PSA) RF Input. When using an N1911 or N1912 Series power meter, it is necessary to use an adapter (N5532B Option 019) to connect the output cable of the sensor module to the power meter. The sensor module is calibrated such that the power meter indicates the power supplied by the source under test.

The N5532B 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 30 MHz to 26.5 GHz
- Option 550 covers 30 MHz to 50 GHz
  (with adaptor 11903D 2.4mm (f) to Type N (m))

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 supplied on a floppy disc included with each N5532B. Please refer to "Installing the Calibration Factors" on page 2-12 for more information on using the Cal Factor Data.

Minimum Power Meter Firmware Version Required for N5532B	
N1911A/12A P Series	A.05.02
EPM-P Series E4416A	A1.05.01
EPM-P Series E4417A	A2.05.01
EPM Series E4418B	A1.09.01
EPM Series E4419B	A2.09.01

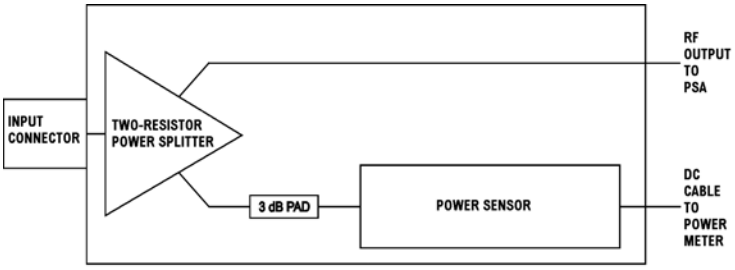
Minimum PSA Firmware Version Required
A.11.11

Included Adapters	
Description	**Part Number**
3.5 mm female to female	85027-60005
Male N type to female 3.5 mm	1250-1744

NOTE The N5532B Sensor Module is compatible ONLY with the newer E4418/19, E4416/17, or N1911/12 Series power meters. They are NOT compatible with the earlier 430 Series or 70100 power meters. If used with an N1911/12 Series power meter, an adapter (N5532B Option 019) is required to connect the dc cable to the power meter.

N5532B Block Diagram

Figure 1-1 **N5532B 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 Agilent 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.

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 Agilent Technologies office as shown in Table on page 44. Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

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 To prevent physical damage to the sensor module or device-under-test (DUT), pay careful attention to the mechanical setup. The mechanical design of the sensor module minimizes SWR. However, the weight and length of the module, combined with the stiffness of the interconnect cables, enables the exertion of considerable leverage at the module's input connector. To prevent physical damage to the sensor module, the DUT, and the mating connectors, and to assure best electrical performance, observe the following precautions:

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 serial number label facing up. 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.

Installing the Calibration Factors

Cal factors can be entered and stored in an internal table (Automatic Cal Factors) in the PSA's non-volatile memory. The table 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 N5531S

1. Insert the floppy disk in to PSA floppy disk drive. Make sure the disk is for the sensor module you are using.
2. Press **MODE, Measuring Receiver, File**, **Load**, **Type**, and select **Calibration Factor** as the file type. Press **Dir Up, Up Arrow**, **Dir Select** to ensure the "A" drive is selected. Then press **Load Now** to load the cal factor file (`CFDATA.XML`) to the PSA spectrum analyzer.

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.

N5532B 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 30 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 dBm	 ±3% negligible	
Sensor Module Linearity *Opt. 518* +30 to +20 dBm < +20 dBm	 ±3% negligible	
Sensor Module Linearity *Opt. 526* +30 to +20 dBm < +20 dBm	 ±3% negligible	
Sensor Module Linearity *Opt. 550* +30 to +20 dBm < +20 dBm	 ±3% negligible	
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* 30 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	

a. When connected to PSA with at least 30 dB attenuation

N5532B Sensor Module Supplemental Information

Table 3-2 **Supplemental Information**

Description	Supplemental Information	Comments
Input Impedance	50 ohms	
Input Connector Option 504 Option 518 Option 526 Option 550	 Type-N (male) Type-N (male) APC 3.5 mm (male) 2.4 mm (male)	**Recommended Torque** 12 in-lbs (135 Ncm) 12 in-lbs (135 Ncm) 8 in-lbs (90 Ncm) 8 in-lbs (90 Ncm)
RF Output Insertion Loss *Opt. 504*	7 dB @ 3 Hz to 8 dB @ 4.2 GHz	Typical
RF Output Insertion Loss *Opt. 518*	7 dB @ 3 Hz to 11 dB @ 18 GHz	Typical
RF Output Insertion Loss *Opt. 526*	7 dB @ 3 Hz to 13 dB @ 26.5 GHz	Typical
RF Output Insertion Loss *Opt. 550*	7 dB @ 3 Hz to 16 dB @ 50 GHz	Typical
Military Specification	Type tested to an equivalent of MIL-PRF-28800F class 3 environmental specifications	
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	
Weight	0.72 kgm (1.5 lb)	
Shipping Weight	1.28 kgm (2.8 lb)	
Dimensions Height	 51.2 mm (2 in)	

Table 3-2 **Supplemental Information**

Description	Supplemental Information	Comments
Width	62.4 mm (2.5 in)	
Length[a]	210 mm (8.3 in)	
Length[b]	1905 mm (75 in)	

a. From input connector to end of plastic casing.
b. From input connector to end of cable.

Table 3-3 **Typical Cal Factor Uncertainty**

	Typical Cal Factor Uncertainty			
Frequency Range	**Opt 504**	**Opt 518**	**Opt 526**	**Opt 550**
100 kHz to ≤ 30 MHz	± 2.0%			
30 MHz to ≤ 2 GHz	± 2.0%	± 2.0%	± 2.0%	± 2.0%
2 GHz to ≤ 4.2 GHz	± 2.0%	± 2.0%	± 2.0%	± 2.5%
2 GHz to ≤ 10 GHz		± 2.0%	± 2.0%	± 2.5%
10 GHz to ≤ 18 GHz		± 2.5%	± 2.3%	± 2.5%
18 GHz to ≤ 26.5 GHz			± 2.5%	± 2.8%
26.5 GHz to ≤ 50 GHz				± 4.5%

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:

3/4-inch open end wrench

5/16-inch or 8 mm open end wrench (torque wrench preferred)

1/4-inch open end wrench

3/16-inch open end wrench

17 mm open end wrench

7 mm open end wrench

1.5 mm hex wrench

1/16-inch hex wrench

5/64-inch or 2 mm hex wrench

Torx - 10 driver

Needle-nose pliers

Diagonal cutters

Assembly Replacement Procedures

Remove and Replace the Instrument Covers

Use this procedure to remove and replace the instrument covers for all sensor models.

1. Remove 4 screws and the bottom cover from the module assembly.
2. Locate the two aluminum deck blocks near the input connector. Notice that there is a left and right side block, and how they fit. Remove the deck blocks and separate the sensor module assembly from the plastic housing.

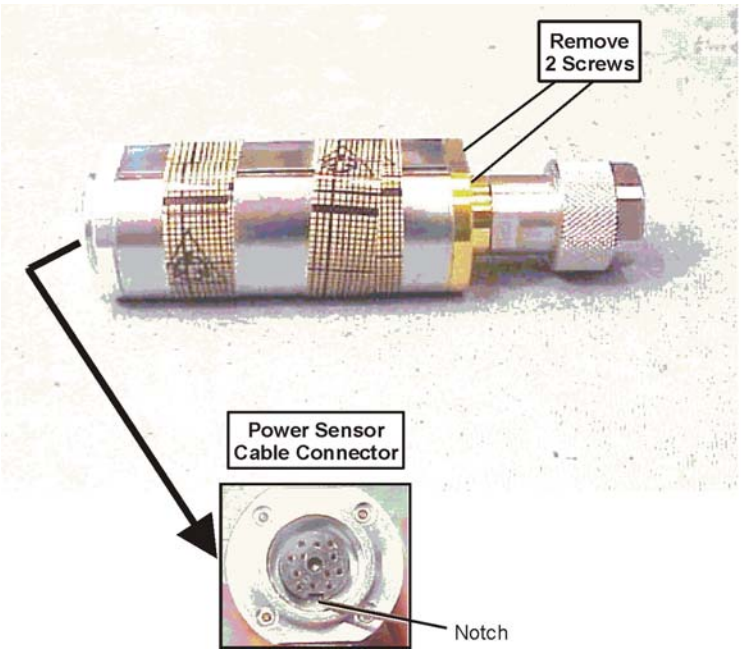
Figure 4-1 Deck Blocks

3. After parts replacement, place the assembly into the top housing. Place the right and left aluminum deck blocks into their correct positions and hand tighten. The deck blocks may need to be adjusted slightly if the plastic cover is difficult to install.
4. Place the bottom housing in position and secure with the four screws. The machine screws go in the two holes near the input connector. Hand tighten.

Power Sensor Replacement

If the power sensor requires replacement, 2 screws must be removed from the RF input connector flange of the replacement assembly. Prepare the replacement power sensor by removing the 2 screws using a 1.5-mm hex driver. Refer to Figure 4-2 for location of screws. Note that the screws you need to remove are on the opposite end and opposite side of the notch in the power sensor cable connector.

Figure 4-2 Location of Screws to be Removed



Options 504 and 518

Refer to Figure 4-3 and Figure 4-4 for part locations for Options 504 and 518. For earlier model sensors, refer to Figure 4-5 and Figure 4-6.

Figure 4-3 Options 504 and 518 Top View

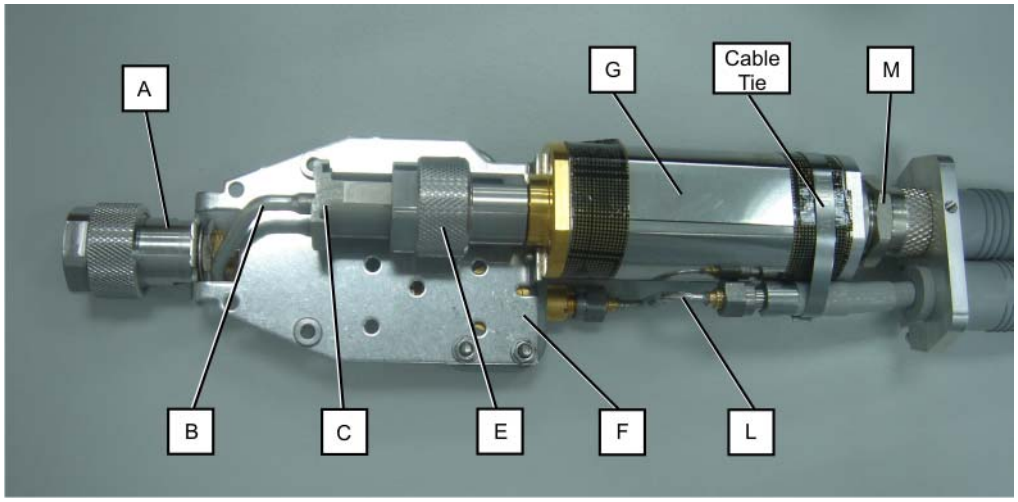
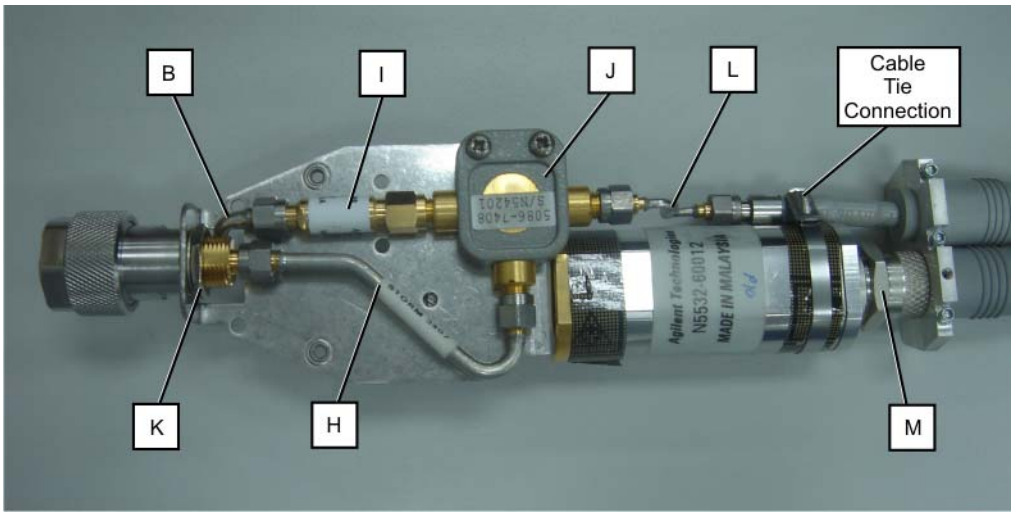


Figure 4-4 Options 504 and 518 Bottom View



A	Input connector, Type-N		H	Cable, input connector to splitter
B	Cable, attenuator to sensor		I	3 dB attenuator
C	Connector (part of cable)		J	Power splitter
E	Power Sensor connector		K	Hex Nut
F	Deck, main		L	Cable, splitter to output
G	Power sensor, 4.2 GHz or Power sensor, 18 GHz		M	Power Sensor Nut

Figure 4-5 **Options 504 and 518 Top View (Early Models)**

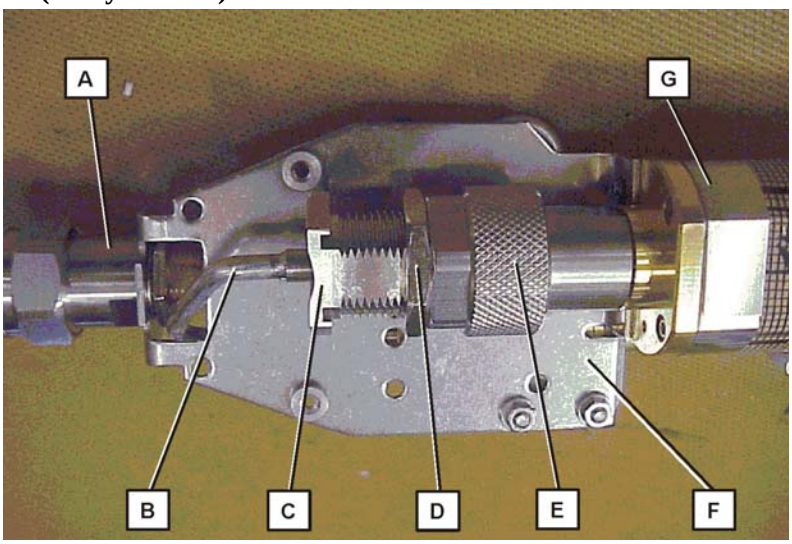
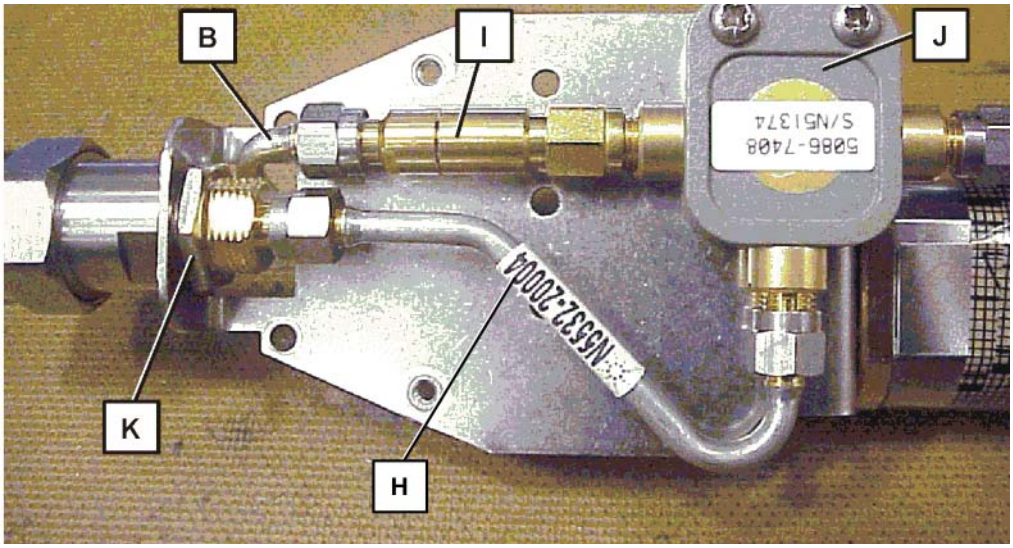


Figure 4-6 **Options 504 and 518 Bottom View (Early Models)**



A	Input connector, Type-N		G	Power sensor, 4.2 GHz or Power sensor, 18 GHz
B	Cable, attenuator to sensor		H	Cable, input connector to splitter
C	Connector (part of cable)		I	3 dB attenuator
D	Nut		J	Power splitter
E	Power Sensor connector		K	Hex Nut
F	Deck, main			

Input Connector

1. To remove the input connector (A), first remove the input connector to splitter cable, (H), using a 5/16 inch wrench until the nut is disengaged from the input connector.
2. Using a large wrench, remove the hex nut (K) holding the input connector on the deck. Remove the input connector and washer.
3. To replace the input connector, line up the flat on the input connector with the flat on the main deck and slide the input connector into the main deck. Replace the lock washer and hex nut. Loosely attach the input connector to splitter cable, (H) to the input connector. Torque the hex nut (K) to 25 inch-lbs.
4. Torque the cable to 8 inch-lbs.

Power Splitter

1. To remove power splitter (J), loosen the cable connectors but do not remove the 2 cables or the 3 dB attenuator until the power splitter mounting screws are removed. Removing the mounting screws will allow the splitter to move around and reduce damage to the center conductors.
2. Cut the metal tie wrap. Remove the splitter to output cable (L) using a 7 mm wrench to hold the output connector while using a 5/16-inch wrench to remove the cable connector.
3. Remove the input to splitter cable (H).
4. Disconnect the splitter from the attenuator.
5. When installing the power splitter, connect to the 3 dB attenuator first. Then reinstall the input to splitter cable (H) and the splitter to output cable (L). Leave all connections loose at this time.
6. Put the 2 screws through the power splitter and deck. Holding the screws in place, turn the entire assembly upside down. Place the lock washers and hex nuts on the screws. Hold the hex nut with the 3/16-inch open end wrench and torque the screw to 3 inch-lbs. Then secure the screw with a manual driver and torque the nut to 3 inch-lbs.
7. Torque all cable connections to 8 inch-lbs.
8. Install a new metal cable tie.

Cable Tie Installation

The replacement cable tie secures the RF output cable to the power sensor. Use the stainless steel cable tie called out in the parts list. Do not use a plastic cable tie since it is too thick and will case the instrument cover to crack.

NOTE When installing the cable tie, care must be taken to avoid cutting your fingers. The cable tie can be installed using pliers and side cutters. See Figure 4-4 for a typical installation of the cable tie. It is important to position the cable tie so that the flat part of the cable tie touches the top and bottom of the power sensor, and the cable tie connection is off to the side as shown. The actual position of the cable tie relative to the cable connection may vary between sensor module options.

Power Sensor

1. To remove the power sensor (G), first loosen the sensor connection to the attenuator to sensor cable, (B), holding the cable connector at (C) and loosening the sensor connection (E).
2. For earlier model sensors, refer to Figure 4-4 and Figure 4-5. To remove the attenuator to sensor cable, (B), hold connector (C) with 3/4-inch open-end wrench while loosening nut (D) and power sensor connector (E).
3. Disconnect the splitter to output cable, (L) at either end.
4. Remove the two screws attaching the sensor to the main deck.
5. Cut the metal tie wrap.
6. Loosen the nut (M) to remove the sensor from the cable.
7. Prepare the replacement power sensor as described on page 22.
8. When fastening the power sensor (G) to the main deck (F), torque the 2 screws holding it to 3 inch-pounds.
9. Connect the power sensor connector (E) to the cable (B) and torque to 8 inch-pounds while holding connector (C) with a 3/4-inch open-end wrench. For earlier model sensors, it will be necessary to now tighten the locknut (D) against the sensor connector (E).
10. Install a new metal cable tie.

Attenuator

1. To remove the attenuator (I), loosen the connection between the attenuator and the attenuator to sensor cable, (B).
2. Remove the power splitter (J). After the power splitter is removed, the attenuator can be removed from the attenuator to sensor cable, (B).
3. To replace the attenuator, attach it to the power splitter but do not tighten.
4. Replace the power splitter into position, attaching the other 2 cables. Leave all connections loose at this time.
5. Put the 2 screws through the power splitter and deck. Holding the screws in place, turn the entire assembly upside down. Place the lock washers and hex nuts on the screws. Hold the hex nut with the 3/16-inch open end wrench and torque the screw to 3 inch-lbs. Then secure the screw with a manual driver and torque the nut to 3 inch-lbs.
6. Torque all cable connections to 8 inch-lbs.

Cables

1. The input connector (A) must be removed before the attenuator to sensor cable, (B) can be removed.
2. To remove the attenuator to sensor cable, (B), hold connector (C) with 3/4-inch open-end wrench while loosening the power sensor connector (E).
3. For earlier model sensors, refer to Figure 4-4 and Figure 4-5. To remove the attenuator to sensor cable, (B), hold connector (C) with 3/4-inch open-end wrench while loosening nut (D) and power sensor connector (E).
4. To replace the attenuator to sensor cable, (B), place it through the rectangular hole in the main deck (F) before installing the bulkhead connector (A). Place lock washer and nut (K) on bulkhead connector and torque to 25 inch-lbs.
5. Connect the cable to the attenuator and the other end to the sensor. Torque the attenuator end to 8 inch-lbs.
6. On the sensor end, hold connector (C) with 3/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 8 inch-lbs.
7. For earlier model sensors, it will be necessary to now tighten the locknut (D) against the sensor connector (E).
8. To replace either of the other 2 cables, simply disconnect them at both ends. When replacing, torque all cable connections to 8 inch-lbs.

Option 526

Refer to Figure 4-7 and Figure 4-8 for part locations for Option 526.

Figure 4-7 Option 526 Top View

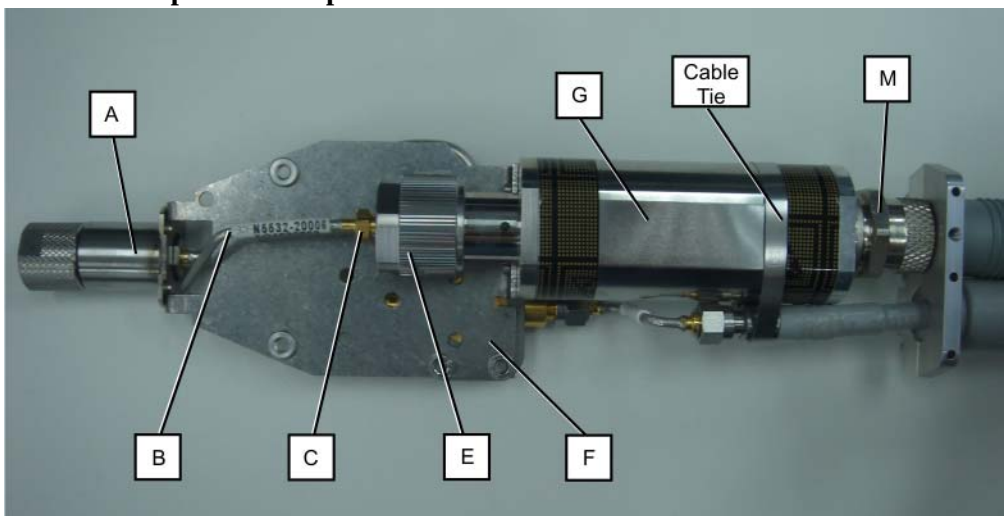
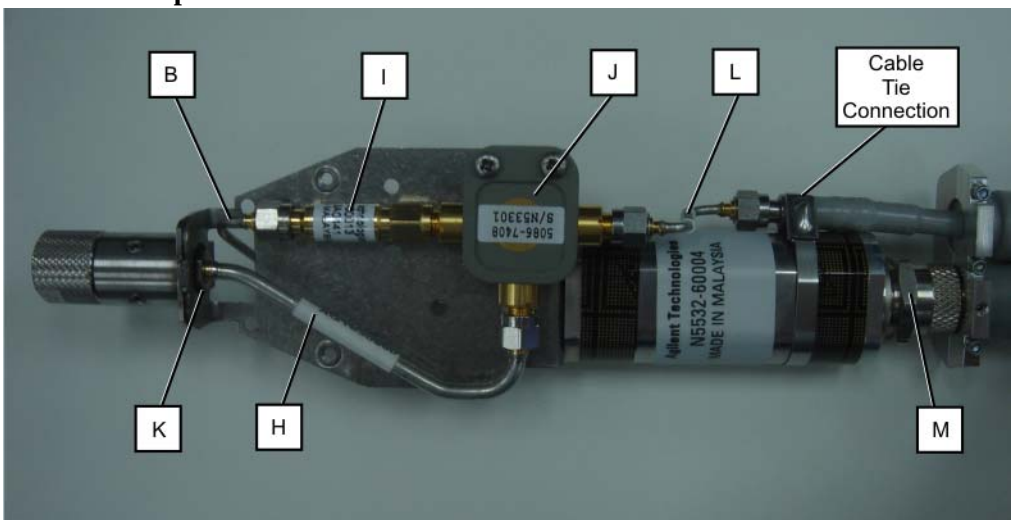


Figure 4-8 Option 526 Bottom View



A	Input connector, 3.5 mm		H	Cable, input connector to splitter
B	Cable, attenuator to sensor		I	3 dB attenuator, 26 GHz
C	Connector (part of cable)		J	Power splitter, 26.5 GHz
E	Power Sensor connector		K	Hex Nut
F	Deck, main		L	Cable, splitter to output
G	Power sensor, 26.5 GHz		M	Power Sensor Nut

Input Connector

1. Loosen but do not remove the two set screws in the input connector body (A), using a 1/16-inch hex wrench.
2. Locate the input connector to splitter cable, (H), and using a 5/16-inch wrench loosen the input connector nut about one turn. Avoid damaging the nut since it is difficult to get the wrench on fully.
3. Remove the nut on the splitter end of the input cable and disconnect the cable from the splitter.
4. Slide the input connector and cable out of the main deck, and replace the input connector. Assure the connections are clean. Attach the input cable loosely.
5. To replace the input connector, line up the flat on the input connector with the flat on the main deck and slide the input connector into the main deck.
6. Attach the input cable to the splitter.
7. Torque both ends of the cable to 8 inch-lbs.
8. Tighten the two set screws to secure the input connector to the main deck. Torque to 10 inch-lbs.

Power Splitter

1. To remove power splitter (J), loosen the cable connectors but do not remove the 2 cables or the 3 dB attenuator until the power splitter mounting screws are removed. Removing the mounting screws will allow the splitter to move around and reduce damage to the center conductors.
2. Cut the metal tie wrap. Remove the splitter to output cable (L) using a 7 mm wrench to hold the output connector while using a 5/16-inch wrench to remove the cable connector.
3. Remove the input to splitter cable (H).
4. Disconnect the splitter from the attenuator.
5. When installing the power splitter, connect to the 3 dB attenuator first. Then reinstall the input to splitter cable (H) and the splitter to output cable (L). Leave all connections loose at this time.
6. Put the 2 screws through the power splitter and deck. Holding the screws in place, turn the entire assembly upside down. Place the lock washers and hex nuts on the screws. Hold the hex nut with the 3/16-inch open end wrench and torque the screw to 3 inch-lbs. Then secure the screw with a manual driver and torque the nut to 3 inch-lbs.
7. Torque all cable connections to 8 inch-lbs.
8. Install a new metal cable tie.

Cable Tie Installation

The replacement cable tie secures the RF output cable to the power sensor. Use the stainless steel cable tie called out in the parts list. Do not use a plastic cable tie since it is too thick and will case the instrument cover to crack.

NOTE When installing the cable tie, care must be taken to avoid cutting your fingers. The cable tie can be installed using pliers and side cutters. See Figure 4-8 for a typical installation of the cable tie. It is important to position the cable tie so that the flat part of the cable tie touches the top and bottom of the power sensor, and the cable tie connection is off to the side as shown. The actual position of the cable tie relative to the cable connection may vary between sensor module options.

Power Sensor

1. To remove the power sensor (G), first loosen the sensor connection to the attenuator to sensor cable, (B), holding the cable connector at (C) and loosening the sensor connection (E).
2. Disconnect the splitter to output cable, (L) at either end.
3. Remove the two screws attaching the sensor to the main deck.
4. Cut the metal tie wrap.
5. Loosen the nut (M) to remove the sensor from the cable.
6. Prepare the replacement power sensor as described on page 22.
7. When fastening the power sensor (G) to the main deck (F), torque the 2 screws holding it to 3 inch-pounds.
8. Connect the power sensor connector (E) to the cable (B) and torque to 8 inch-pounds while holding connector (C) with a 3/4-inch open-end wrench.
9. Install a new metal cable tie.

Attenuator

1. To remove the attenuator (I), loosen the connection between the attenuator and the attenuator to sensor cable, (B).
2. Remove the power splitter (J). After the power splitter is removed, the attenuator can be removed from the cable, attenuator to sensor (B).
3. To replace the attenuator, attach it to the power splitter but do not tighten.
4. Replace the power splitter into position, attaching the other 2 cables. Leave all connections loose at this time.
5. Put the 2 screws through the power splitter and deck. Holding the screws in place, turn the entire assembly upside down. Place the lock washers and hex nuts on the screws. Hold the hex nut with the 3/16-inch open end wrench and torque the screw to 3 inch-lbs. Then secure the screw with a manual driver and torque the nut to 3 inch-lbs.
6. Torque all cable connections to 8 inch-lbs.

Cables

1. To remove the attenuator to sensor cable, (B), hold connector (C) with 1/4-inch open-end wrench while loosening the power sensor connector (E).
2. To replace the attenuator to sensor cable, (B), place it through the rectangular hole in the main deck (F).
3. Connect the cable to the attenuator and the other end to the sensor. Torque the attenuator end to 8 inch-lbs.
4. On the sensor end, hold connector (C) with 1/4-inch open-end wrench while tightening the power sensor connector (E). Torque to 8 inch-lbs.
5. To replace either of the other 2 cables, simply disconnect them at both ends. When replacing, torque all cable connections to 8 inch-lbs.

Option 550

Refer to Figure 4-9 and Figure 4-10 for part locations for Option 550.

Figure 4-9 Option 550 Top View

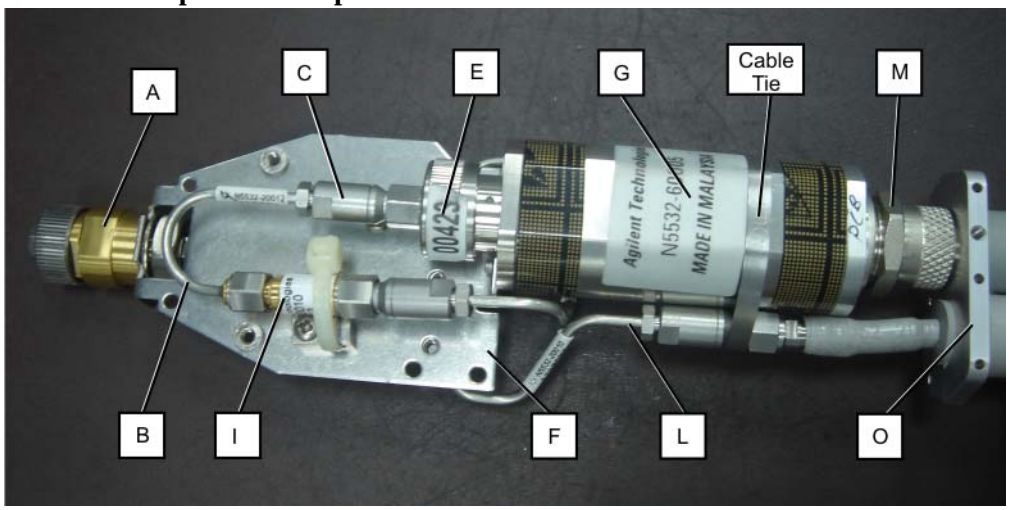
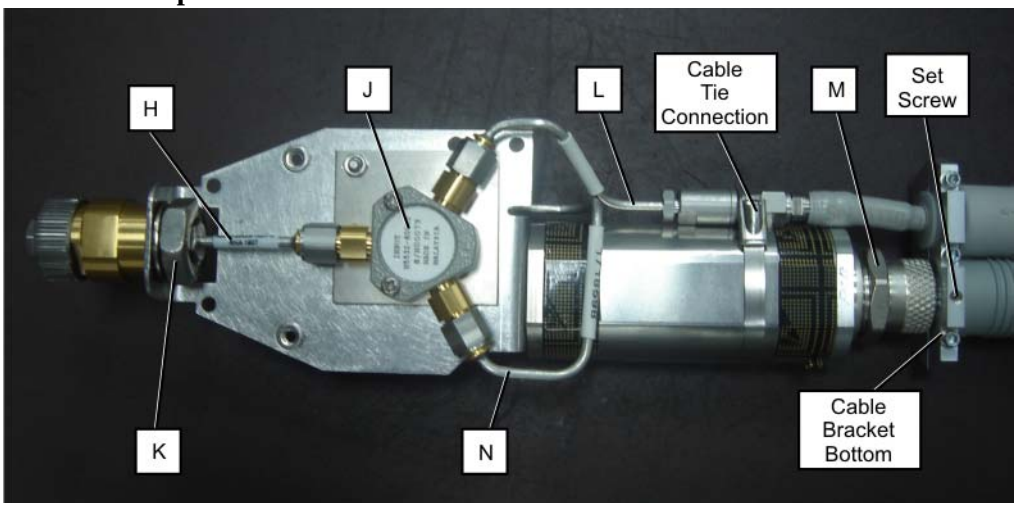


Figure 4-10 Option 550 Bottom View



A	Input connector, 2.4 mm		I	3 dB attenuator, 50 GHz
B	Cable, attenuator to sensor		J	Power splitter, 50 GHz
C	Connector (part of cable)		K	Hex Nut
E	Power Sensor connector		L	Cable, splitter to output
F	Deck, main		M	Power Sensor Nut
G	Power sensor, 50 GHz		N	Cable, splitter to attenuator
H	Cable, RF input, 2.4 mm		O	Bracket, cable (top)

Input Connector

1. To remove the input connector (A), first loosen the input connector to splitter cable, (H) on both ends using a 5/16-inch wrench.
2. Using a 17 mm wrench, remove the hex nut (K) holding the input connector on the deck.
3. Using a 5/16-inch wrench, remove the cable from the splitter.
4. Remove the input connector, washer, and cable.
5. To replace the input connector, line up the flat on the input connector with the flat on the main deck and slide the input connector into the main deck. Replace the lock washer and hex nut. Loosely attach the input connector to splitter cable, (H) to the input connector. Torque the hex nut to 25 inch-lbs.
6. Torque the input connector to splitter cable, (H) to 8 inch-lbs at both ends.

Power Splitter

1. To remove power splitter (J), loosen the cable connectors but do not remove the 3 cables until the power splitter mounting screws are removed. Removing the mounting screws will allow the splitter to move around and reduce damage to the center conductors.
2. Cut the metal tie wrap. Remove the splitter to output cable (L) using a 7 mm wrench to hold the output connector while using a 5/16-inch wrench to remove the cable connector.
3. Remove the input to splitter cable (H).
4. Disconnect the splitter from the splitter to attenuator cable (N).
5. When installing the power splitter, connect to the splitter to attenuator cable (N) first. Then reinstall the input to splitter cable (H) and the splitter to output cable (L). Leave all connections loose at this time.
6. Put the 2 screws through the power splitter and deck. Holding the screws in place, turn the entire assembly upside down. Place the lock washers and hex nuts on the screws. Hold the hex nut with the 3/16-inch open end wrench and torque the screw to 3 inch-lbs. Then secure the screw with a manual driver and torque the nut to 3 inch-lbs.
7. Torque all cable connections to 8 inch-lbs.
8. Install a new metal cable tie.

Cable Tie Installation

The replacement cable tie secures the RF output cable to the power sensor. Use the stainless steel cable tie called out in the parts list. Do not use a plastic cable tie since it is too thick and will case the instrument cover to crack.

NOTE When installing the cable tie, care must be taken to avoid cutting your fingers. The cable tie can be installed using pliers and side cutters. See Figure 4-10 for a typical installation of the cable tie. It is important to position the cable tie so that the flat part of the cable tie touches the top and bottom of the power sensor, and the cable tie connection is off to the side as shown. The actual position of the cable tie relative to the cable connection may vary between sensor module options.

Power Sensor

1. To remove the power sensor (G), first loosen the sensor connection to the attenuator to sensor cable, (B), holding the cable connector at (C) with a 1/4-inch wrench and loosening the sensor connection (E) with a 5/16-inch wrench.
2. Disconnect the splitter to output cable, (L) at either end.
3. Remove the two screws attaching the sensor to the main deck.
4. Cut the metal tie wrap.
5. Loosen the nut (M) to remove the sensor from the cable.
6. Prepare the replacement power sensor as described on page 22.
7. When fastening the power sensor (G) to the main deck (F), torque the 2 screws holding it to 3 inch-pounds.
8. Connect the power sensor connector (E) to the cable (B) and torque to 8 inch-pounds while holding connector (C) with a 1/4-inch open-end wrench.
9. Install a new metal cable tie.

Attenuator

1. To remove the attenuator (I), remove the attenuator to sensor cable, (B). Hold the cable connector at (C) with a 1/4-inch wrench and loosen the sensor connection (E) with a 5/16-inch wrench. On the attenuator end of the cable, hold the attenuator with a 5/16-inch wrench and loosen the cable with another 5/16-inch wrench.
2. Using a 1/4-inch wrench to hold the attenuator, loosen the splitter to attenuator cable (N) and remove the attenuator.
3. To replace the attenuator, attach it to the splitter to attenuator cable (N) but do not tighten.
4. Replace the attenuator to sensor cable, (B).
5. Torque all cable connections to 8 inch-lbs. Hold the cable connector at (C) with a 1/4-inch wrench and tighten the sensor connection (E) with a 5/16-inch wrench. On the attenuator end of the cable, hold the attenuator with a 5/16-inch wrench and tighten the cable with another 5/16-inch wrench.

Cables

1. To remove the input to splitter cable (H) it is necessary to remove the input connector. Refer to the input connector removal procedure.
2. To remove the attenuator to sensor cable, (B), hold connector (C) with 1/4-inch open-end wrench while loosening the power sensor connector (D) using a 5/16-inch open-end wrench. On the attenuator end of the cable, hold the attenuator with a 5/16-inch wrench and loosen the cable with another 5/16-inch wrench.
3. To remove the splitter to attenuator cable (N), hold the attenuator with a 5/16-inch wrench and use a 1/4-inch wrench to loosen the cable.
4. To remove the splitter to output cable (L), use a 5/16-inch wrench to disconnect it at both ends.
5. When replacing the cables, torque all cable connections to 8 inch-lbs.

Replaceable Parts

Table 4-1 N5532B Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4 GHz)	Opt 518 (18 GHz)	Opt 526 (26 GHz)	Opt 550 (50 GHz)
Power sensor adapter (same as N5532B Opt 019)	N5532-60013	X	X	X	X
Screw, metric, 3.0 x 0.50 Front screws for cover attachment	0515-0667	X	X	X	X
Screw, socket head cap, metric 1.6 x 0.35, 10 mm long For sensor mounting	0515-1185	X	X	X	X
Washer, lock, helical, #0, 0.062-in-ID, 0.1-in-OD For sensor mounting	2190-0572	X	X	X	X
Screw, tapping, 4-20, 0.835 inch long, pan head, TORX For support block mounting and rear screws for cover attachment	0624-0824	X	X	X	X
Screw, 4-40, 0.562 inch long, pan head, Pozidrive For power splitter mounting	2200-0091	X	X	X	
Washer, lock, #4, helical, 0.115-in-ID For power splitter mounting	2190-0003	X	X	X	
Screw, 2-56, 0.75 inch long, pan head, Pozidrive For power splitter mounting	0520-0137				X
Washer, lock, 3/8 inch, 0.384-in-ID For mounting 2.4 mm input connector	2190-0022				X
Hex nut, dbl chamfer, M10 x 1.0, 6 mm thick For mounting 2.4 mm input connector	0535-0992				X
Nut, 4-40, 0.063-in-thick For power splitter mounting	2260-0002	X	X	X	
Washer, lock, 7/16 inch, 0.439-in-ID For Type-N connector	2190-0104	X	X		

Table 4-1 N5532B Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4 GHz)	Opt 518 (18 GHz)	Opt 526 (26 GHz)	Opt 550 (50 GHz)
Hex nut, UNEF-2B-THD, 0.094-in-thick For Type N connector	2950-0132	X	X		
Washer, lock, helical, #2, 0.088-in-ID For cable bracket	2190-0112	X	X	X	X
Screw, socket head cap, 2-56, 0.25-in-long For cable bracket	3030-0053	X	X	X	X
Setscrew, 4-40, 0.25-in-long For sensor cable bracket (see Figure 4-10)	3030-0824	X	X	X	X
Setscrew, 6-32, 0.125-in-long For input connector	3030-0022			X	
Hex nut, 2-56, 0.062-in-thick For power splitter mounting	0610-0002				X
Deck, main	N5532-00001	X	X		X
Deck, main (526)	N5532-20001			X	
Cable tie 0.18 Strp WD stainless steel	1400-3340	X	X	X	X
Deck support block (right)	N5532-20021	X	X	X	X
Deck support block (left)	N5532-20022	X	X	X	X
Spacer, for splitter	N5532-20003				X
Bracket, cable (top) (see Figure 4-9)	11722-20006	X	X	X	X
Bracket, cable (bottom) (see Figure 4-10)	11722-20007	X	X	X	X
Cover, plastic (top)	11722-40001	X	X	X	X
Cover, plastic (bottom)	11722-40002	X	X	X	X
Cable clip For sensor and RF output cables	11722-40003	X	X	X	X
Label, option ID	5185-1867	X	X	X	X
Label, product ID	N5532-80009	X	X	X	X
3 dB attenuator, 26 GHz	08493-60013	X	X	X	

Table 4-1 N5532B Series Sensor Module Replaceable Parts

Description	Part Number	Opt 504 (4 GHz)	Opt 518 (18 GHz)	Opt 526 (26 GHz)	Opt 550 (50 GHz)
3 dB attenuator, 50 GHz	08490-60010				X
Input connector, Type-N	N5532-60015	X	X		
Input connector, 3.5 mm	08673-60402			X	
Input connector, 2.4 mm	N5532-20015				X
Power splitter, 26.5 GHz	5086-7408	X	X	X	
Power splitter, 50 GHz	N5532-60002				X
Power sensor, 4.2 GHz	N5532-60021	X			
Power sensor, 18 GHz	N5532-60020		X		
Power sensor, 26.5 GHz	N5532-60022			X	
Power sensor, 50 GHz	N5532-60023				X
Cable, input connector to splitter	N5532-20004	X	X		
Cable, input connector to splitter	N5532-20007			X	
Cable, RF input, 2.4 mm	N5532-20009				X
Cable, splitter to output	N5532-20018	X	X	X	
Cable, splitter to output	N5532-20010				X
Cable, splitter to attenuator	N5532-20011				X
Cable, attenuator to sensor	N5532-20012				X
Cable, attenuator to sensor	N5532-20006			X	
Cable, attenuator to sensor	N5532-20019	X	X		
Cable, sensor output, shielded	N5532-60010	X	X	X	X
Cable, RF output, 3.5 mm, 66 inches long	N5532-20013	X	X	X	
Cable, RF output, 2.4 mm, 66 inches long	N5532-20017				X

Calibration

Agilent Technologies recommends that repair and calibration of the N5532B Sensor modules be performed at an Agilent 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 N5531S Measuring Receiver System requires.

However, if your cal lab currently calibrates Agilent thermocouple power sensors such as the N8480 Series Option CFT (N848x-CFT) and the calibration standards and test metrology used meet the N5532B specifications listed in Table 3-1 on page 14, you may wish to develop your own calibration process. Refer to Agilent 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 7 shows that the N5532B Sensor Modules consist basically of a power splitter and an Agilent N8480 Series Option CFT Power Sensor with a padded input. Therefore, the match of the N5532B Sensor Module is different than the match of a standard N848x-CFT 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 N5532B 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 4-11 **Cal Factor (Ripple Due to Splitter and PSA Line Loading)**

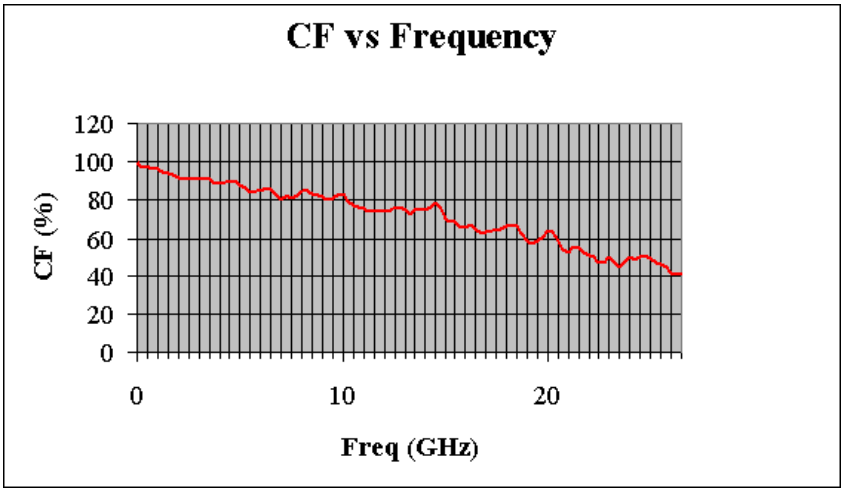


Table 4-2 Recommended Calibration Points

N5532B 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	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 N5532B 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 N5531S/30S Measuring Receiver System.

Upon calibrating the sensor module, the cal factor data is stored on a floppy disk. This disk allows you to transfer the cal data to the N5531S Measuring Receiver System. Since there are hundreds of data points, manual entry is highly impractical.

Cal Factor Data File Format

The N5532B data, "CFData.xml", is stored in an xml format. On each data disk, 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 Internet Explorer. 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 4-12 File Format for the N5532B Sensor Module Data Disk (Two Data Points Shown)


```xml
<?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 Agilent Technologies

Agilent 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 Agilent Technologies office listed in Table 4-3 on page 44. In any correspondence or telephone conversations, refer to your accessory by its product number and full serial number.

Table 4-3 **Locations for Agilent Technologies**

Online assistance: http://www.agilent.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: http://www.agilent.com/find/contactus