COPPER MOUNTAIN
TECHNOLOGIES

COBALT SERIES
NETWORK ANALYZER

4209, 4409

4220, 4420

INSTRUCTIONS FOR CONNECTING FREQUENCY EXTENDERS TO A VNA WITH A TM0082 MODULE SET

May 2019

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Introduction

This document is a supplement to the operating manual of the Cobalt Series Vector Network Analyzers.

This instruction sheet describes the general procedure for connecting frequency extension modules of any manufacturer.

The Cobalt Series includes analyzers with loops on the configurable front panel enabling direct connection of frequency extension modules. The rear panel of the analyzers also features connectors for transmission of control signals and power supply. The frequency extenders expand the upper limit of the operating frequency range for measuring transmission and reflection coefficients up to microwave frequencies.

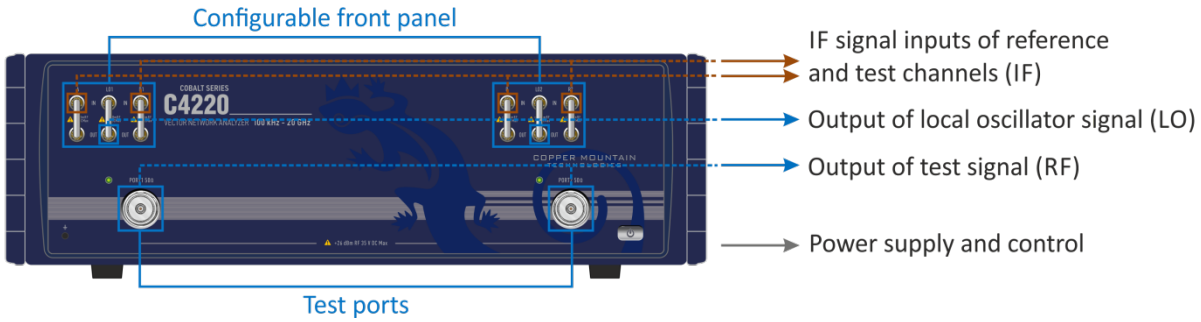


Figure 1.1 Vector network analyzer. RF measurement module.

Table 1.1 Supported analyzers

Analyzer	RF Frequency Range	RF Power Range	LO Frequency Range	LO Power Range
Two-port Analyzers				
C4209	100 kHz to 9.6 GHz	–60 to +15 dBm	20 MHz to 9 GHz	–6 to +3 dBm
C4220	100 kHz to 20 GHz	–60 to +10 dBm	3.9 GHz to 20 GHz	–6 to +6 dBm
Four-port Analyzers				
C4409	100 kHz to 9.6 GHz	–60 to +15 dBm	20 MHz to 9 GHz	–6 to +3 dBm
C4420	100 kHz to 20 GHz	–60 to +10 dBm	3.9 GHz to 20 GHz	–6 to +6 dBm

The maximum number of operating frequency extenders is determined by the number of test ports of the analyzer, i.e. two-port analyzers can simultaneously work with one or two frequency extenders, four-port analyzers can control one, two, three or four frequency extenders.

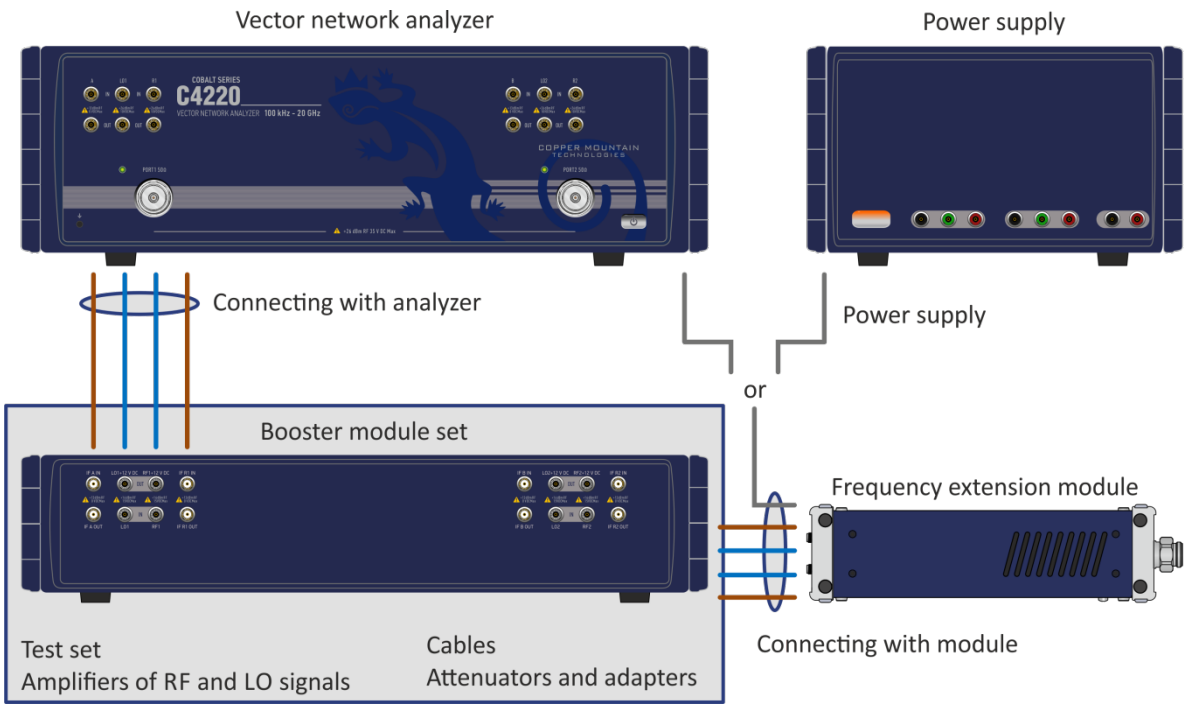


Figure 1.2 Vector Network Analyzer. Connection of the TM0082 Module.

The frequency extender modules are connected to the analyzer via a booster module set, the purpose of which is to ensure the mechanical mating of the device connectors and to set an acceptable power level of RF, LO and IF signals in the path. The booster module set includes the module itself, external RF and LO signal amplifiers, cables (optional), attenuators and coaxial adapters.

Frequency extenders can operate in either passive or active mode. Passive mode means that generation of the extender's internal signals by frequency and magnitude will have no feedback from the analyzer (there is no control from the VNA). In active mode, it is assumed that the analyzer itself will fully control the process of parameter setting of the connected extenders.

The frequency extenders, depending on their hardware design, may be powered from the analyzer, or from an external source.

COMBINATION OF ALL AFOREMENTIONED DEVICES FORMS THE MILLIMETER WAVE FREQUENCY EXTENSION SYSTEM THAT ALLOWS BUILDING A SCALABLE AND AFFORDABLE S-PARAMETER TESTING SOLUTION.

It is recommended to be familiar with the following documentation before starting:

- This instruction sheet
- The operating manual of the analyzer
- The operating manual of the frequency extension module
- The analyzer programming manual (if remote control function is desired)

Maintenance and operation of the analyzer should be performed by qualified personnel with basic experience in operating of microwave circuits.

The manufacturer is not responsible for any consequences resulting from misuse of the analyzer, including violation of safety rules or other necessary precautions.

Additional information about vector network analyzers is available on the website: https://coppermountaintech.com

1 Safety Instructions

Additional safety instructions can be found in the operating manuals of the analyzer and the frequency extenders to be used.

Devices such as analyzer, booster, power supply, and frequency extender (refer to figure **1.2**) must be grounded using their power cables. It is recommended to connect ⏚ terminal on the device with the ground bus bar. Frequency extenders, where applicable, may be grounded using the control cable directly connected to the Analyzer.

CAUTION:

DAMAGE TO THE GROUND WIRE WILL MAKE WORK DANGEROUS.

NEVER CONNECT OR DISCONNECT POWER CABLES WHEN THE EQUIPMENT IS POWERED ON.

WHEN POWERING THE MODULE FROM THE ANALYZER, NEVER CONNECT OR DISCONNECT THE CONTROL CABLE WHEN THE ANALYZER IS IN ON.

Only thoroughly trained personnel with the required skills and knowledge of safety precautions should use the devices.

Exceeding the maximum input power of the RF signal or the maximum DC peak voltage as indicated on the housing can damage the devices.

Electrostatic Discharge Protection

Make sure to protect the workplace against electrostatic discharge.

Static charge can build up on a user's body and damage sensitive internal components. To avoid damage from electric discharge, observe the following:

- *Always* discharge the static charge before touching any device.
- *Always* use a desktop grounded conductive anti-static mat on the stationary workplace.
- *Always* wear a grounding wrist strap connected to the desktop grounded conductive anti-static mat through daisy-chained 1 MΩ resistor.

2 General Overview

2.1 Description

Analyzers in combination with the devices illustrated in figure **1.2** form a unified measurement system of complex transmission and reflection coefficients (elements of the scattering matrix) of N-port networks with extending the operating frequency range upper limit. This is the millimeter wave frequency extension system.

Accessories provide proper connection of the frequency extender to the analyzer.

2.2 Standard Operating Set

Table 2.1 Two-port analyzer

Description	Quantity, pcs.
Analyzer	
C4209 or C4220	1
Power cable	1
USB cable	1
Software	1
Frequency Extension Module	
Frequency Extension Module (defined by the customer)	2
Accessories	
TM0082 Module	1
Rigid cables set	1
Locking bar	2
Amplifier (for RF and LO signals)	4
RF cable	2
LO cable	2
IF cable	4
Coaxial adapter	4
Coaxial attenuator	–

Description	Quantity, pcs.
Power supply	
Power supply	–
Power (control) cable	–
Note: Usage of a power supply, power (control) cable and coaxial attenuators depends on the module.	

Table 2.2 Four-port analyzer

Description	Quantity, pcs.
Analyzer	
C4409 or C4420	1
Power cable	1
USB cable	1
Software	1
Frequency Extension Module	
Frequency Extension Module (defined by the customer)	4
Additional Accessories	
TM0082 Module	1
Rigid cables set	1
Locking bar	2
Amplifier (for RF and LO signals)	8
RF cable	4
LO cable	4
IF cable	8
Coaxial adapter	8
Coaxial attenuator	–

Description	Quantity, pcs.
Power supply	
Power supply	–
Power (control) cable	–
Note: Usage of a Power supply, power (control) cable and coaxial attenuators depends on the module.	

Each of the previously listed analyzers has an AUX option (an additional functional capability), the presence of which is determined upon ordering. When choosing this option, the analyzer includes a two-channel DC voltmeter board, which allows measurement and display of the voltage values synchronously with the frequency tuning during the measurement of the complex transmission and reflection coefficients.

To perform reflection and transmission measurements, appropriate RF cables and adapters are required to connect Devices Under Test (DUTs) to the ports of the extenders, as well as calibration kits to reduce systematic measurement error. The description of these RF accessories should be given in the manual for the utilized frequency extender.

2.3 Specifications

Table 2.3 Analyzer specifications for operation with the frequency extender modules

Parameter	Value
«PORT» OUTPUT	
Output frequency range:	
C4209, C4409	100 kHz to 9.0 GHz
C4220, C4420	100 kHz to 20 GHz
Output power range:	
C4209, C4409	–60 to +15 dBm
C4220, C4420	–60 to +10 dBm
«LO OUT» OUTPUT	
Output frequency range:	
C4209, C4409	20 MHz to 9 GHz
C4220, C4420	3.9 GHz to 20 GHz
Output power range:	
C4209, C4409	–6 to +3 dBm
C4220, C4420	–6 to +6 dBm
«IF» INPUT	
Input frequency	15.45 MHz
Max operating input power level	0 dBm
Damage level	+13 dBm
GENERAL SPECIFICATIONS	
Full frequency accuracy	$\pm 2 \times 10^{-6}$
Power accuracy	±1.5 dB

Parameter	Value
Connection to PC:	
Connector type	USB B
Interface	USB 2.0
Warm-up time	40 minutes
Power supply	110 to 240 V, 50/60 Hz
Power consumption	
C4209	75 W
C4409	145 W
C4220	145 W
C4420	270 W
Dimensions (length, width, height):	
C4209, C4409	355 × 440 × 96 mm
C4220	430 × 440 × 140 mm
C4420	600 × 440 × 140 mm
Weight:	
C4209	7.0 kg
C4409	10.0 kg
C4220	14.0 kg
C4420	22.0 kg

Table 2.4 Technical specifications of the booster module set

Parameter	Value
TM0082. BIAS TEES	
«RF+12VDC OUT», «LO+12VDC OUT» outputs:	
DC voltage	11.5 to 12.5 V
Max DC current	0.5 A
Connector type	3.5 mm, female
«RF IN», «LO IN» inputs:	
Connector type	3.5 mm, female
TM0082. IF AMPLIFIERS	
Center frequency	15.45 MHz
Bandwidth	2 MHz
Gain	13 to 14 dB
«IF IN» inputs:	
Max operating input power level	–13 dBm
Connector type	SMA, female
«IF OUT» outputs:	
Connector type	SMA, female
TM0082 SET.AMPLIFIERS (EXTERNAL DEVICES)	
Operating frequency range	3.9 to 20 GHz
Gain	8 to 15 dB
«RF+12VDC IN» input:	
Max operating input power level	0 dBm
DC voltage	5 to 15 V
Power (current) consumption	50 mA
Connector type	3.5 mm, female

Parameter	Value
«RF OUT» output:	
Connector type	3,5 mm, female
MAX INPUT SIGNAL LEVELS	
Damage level:	
«RF+12VDC OUT», «RF IN» «LO+12VDC OUT», «LO IN»	+16 dBm
«IF IN», «IF OUT»	+13 dBm
Damage DC voltage:	
«RF+12VDC OUT», «RF IN» «LO+12VDC OUT», «LO IN»	15 V
«IF IN», «IF OUT»	0 V
GENERAL SPECIFICATIONS	
Amplifier warm-up time	30 minutes
TM0082 warm-up time	30 minutes
TM0082 power supply	110 to 240 V, 50/60 Hz
TM0082 power consumption	35 W
TM0082 dimensions (length, width, height)	355 × 440 × 96 mm
TM0082 weight	3.5 kg
Environmental specifications:	
Operating temperature	5 to 40 °C
Humidity	up to 90 % at 25 °C
Atmospheric pressure	70.0 to 106.7 kPa

Specifications of RF, LO and IF cables, adapters and attenuators will depend on the selected model and are given in the operating manuals of these devices.

2.4 Principle of Operation

This section provides a brief description of the analyzer, the frequency extender module and the booster module set needed to understand the operation of these devices.

VECTOR NETWORK ANALYZER

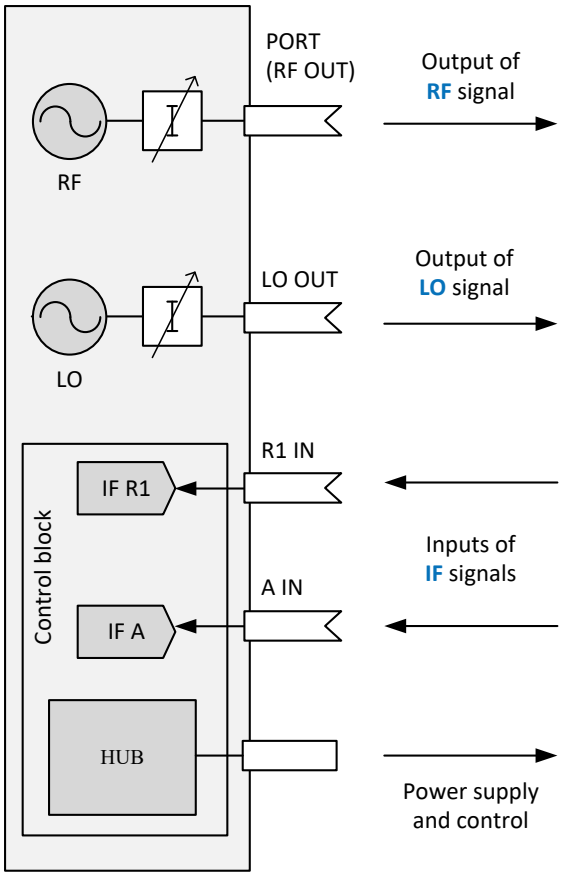


Figure 2.1 Analyzer inputs/outputs used for joint operation with the modules.

Analyzer functions:

- Generation of RF (test) and LO signals, necessary for the Module to function as intended; modules are used in a role of external frequency converters.

- Processing of the intermediate frequency signals of the reference and test channels coming from the module output.

- Electric power supply of modules (where possible).

- Control of the measurement process.

Final calculation and display of measurement results of reflection and transmission coefficients is performed by an external computer with installed software. The principle of operation is based on measuring the ratio of the magnitudes and phase differences of the source signal (incident wave) and the transmitted wave or the reflected one from the DUT.

FREQUENCY EXTENDERS

Frequency extenders are compact portable devices. In general, they consist of frequency multipliers for RF and LO signals, an output power amplifier, directional couplers, and a pair of converters with amplification and filtering of intermediate frequency signals. Additionally, for operation in active mode modules include power and control boards.

Module functions:

- Frequency multiplication of the RF signal: extending the upper limit of the Analyzer operating frequency range.

- Signal separation: incident, reflected or transmitted through the DUT.

- Conversion of the separated signals to a fixed intermediate frequency for both reference and test channels.

- Amplification of intermediate frequency signals.

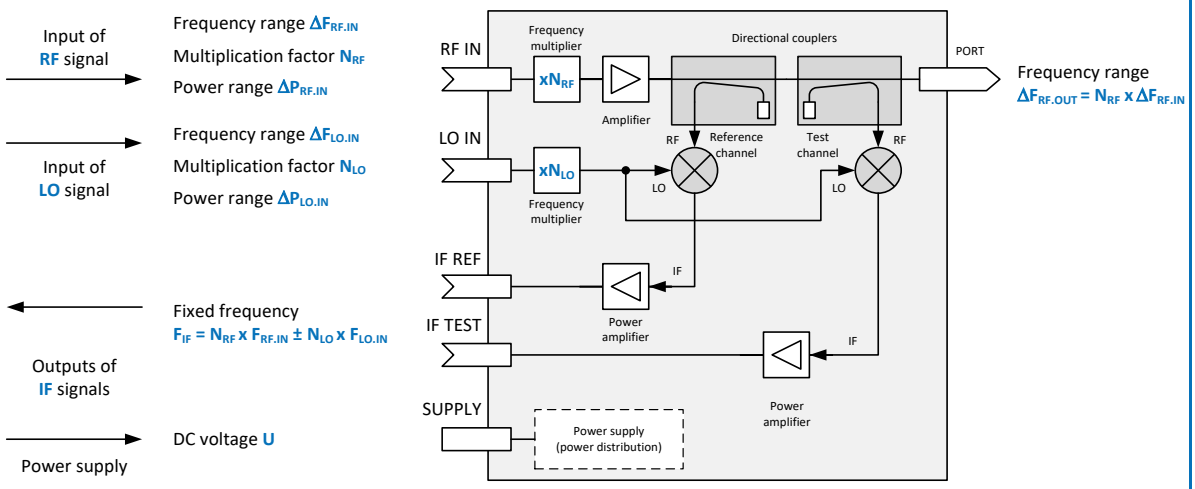


Figure 2.2 Typical module structure.

For the extender's operation, it is necessary to apply RF and LO signals with the specified frequency and power to its inputs. It is prohibited to exceed input signal levels stated in the extender's documentation or listed on its housing.

Test signal is multiplied in the extender by frequency, filtered, and scaled by level. Then the generated RF signal is transmitted to the test port through directional couplers. The directional couplers separate the incident wave, wave transmitted through the DUT, and wave reflected from its inputs. These waves are supplied to frequency converters of test and reference channels. For conversion, LO signal multiplied in the module by frequency is used. The converted IF signals are amplified and passed to the module output.

Hardware design of the module determines whether they are powered directly from the analyzer or from the external power supply.

It is recommended to be familiar with the specifications and operating manual of the extenders'. Basic specifications include: output frequency range, input frequency and power range of RF and LO signals, multiplication coefficients of input signals, frequency and power range of converted signals, power supply voltage.

Booster Module Set

Booster Module Set includes a TM0082 module, external RF and LO signal amplifiers, as well as a set of cables and adapters for connecting to the analyzer and modules ports.

TM0082 module consists of internal power supply, IF signal amplifiers and bias tees for transmitting supply voltages along the

Booster Module Set functions:

- Mechanical connection with the analyzer ports.
- Mechanical connection with the module ports.
- Insertion loss compensation of long length cables.

center conductor of cables to external RF and LO signal amplifiers.

- Increasing the upper limit of RF and LO signals output power range of the Analyzer to +13 dBm

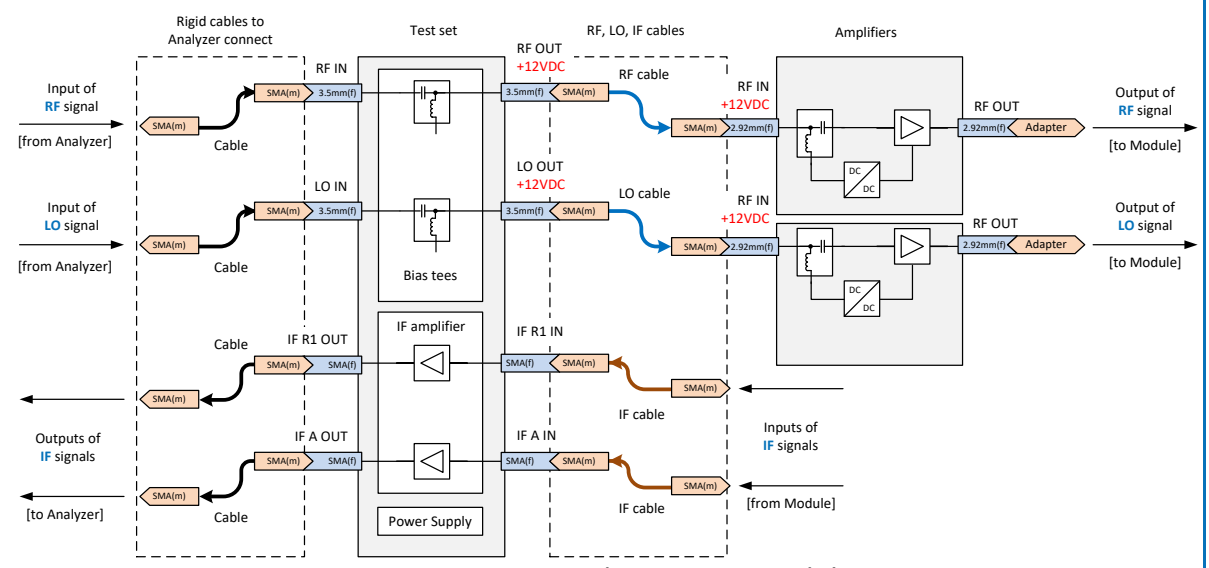


Figure 2.3. Connecting the Booster Module Set.

Connection of the analyzer, booster module set and frequency extender module is shown in figure **2.7**.

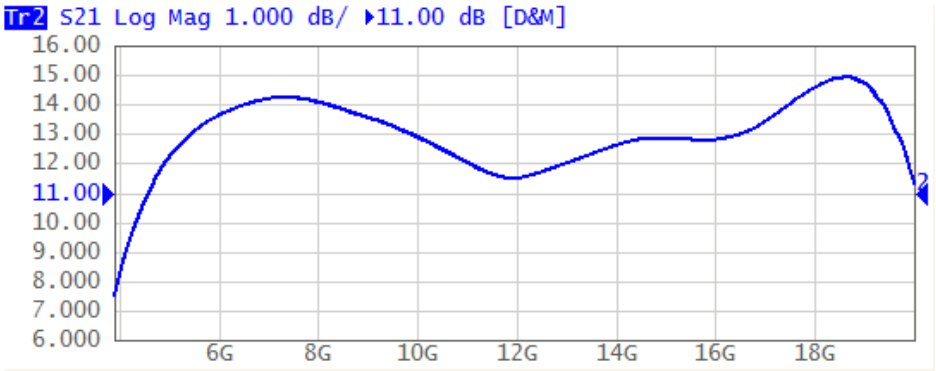


Figure 2.4 Typical gain
RF and LO signal amplifiers

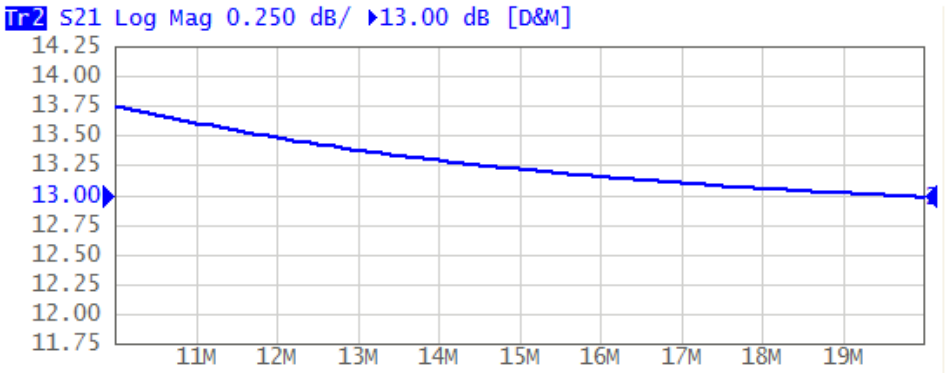


Figure2.5 Typical gain
IF signal amplifiers of test set

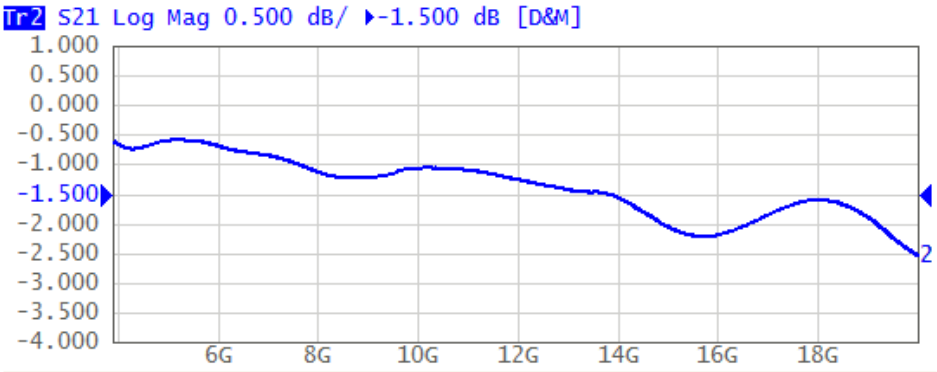


Figure 2.6 Typical transmission coefficient (insertion loss)
bias tees of test set

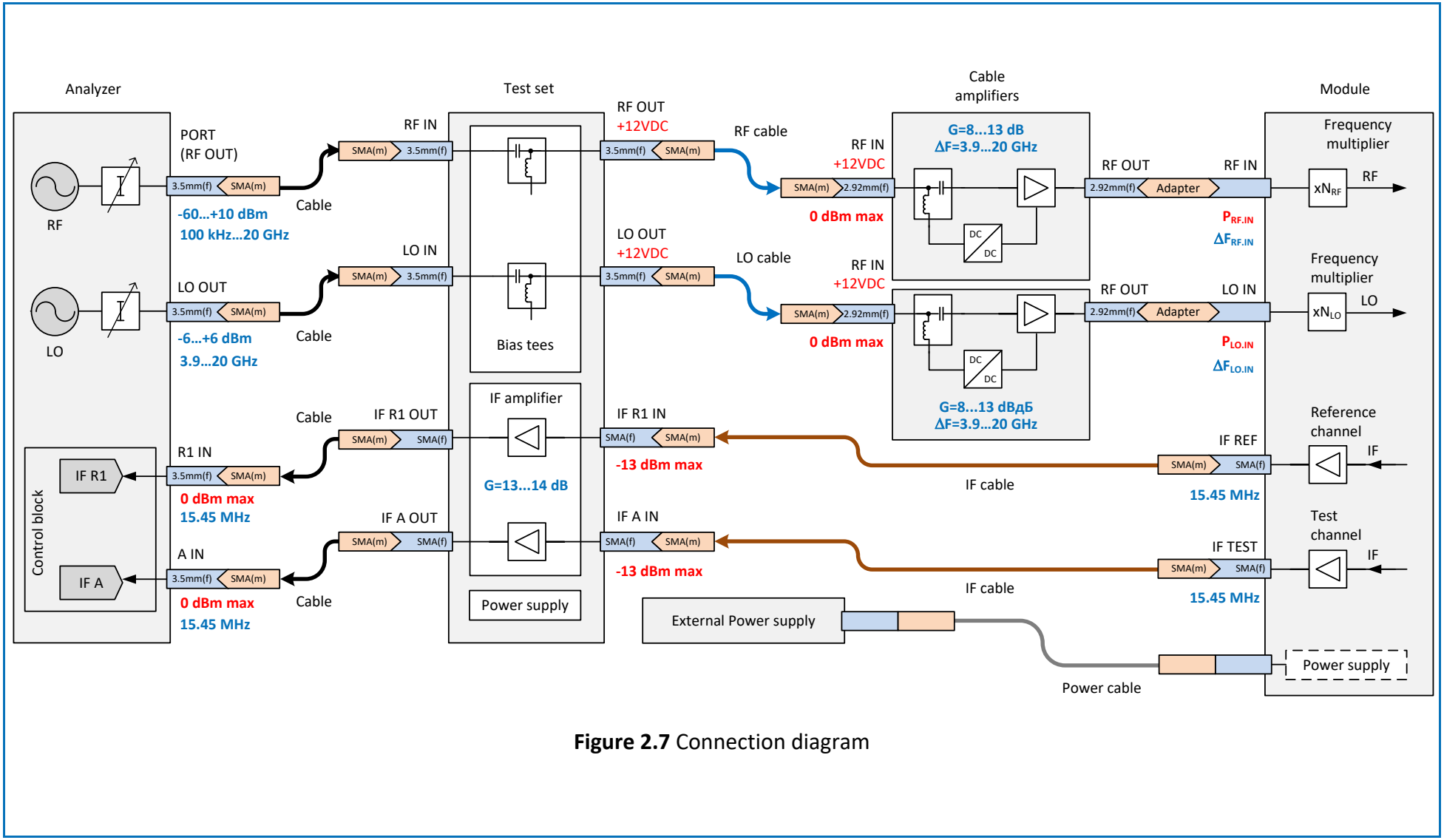


Figure 2.7 Connection diagram

3 Preparation for use

3.1 General information

The maximum distance from the modules to the analyzer will depend on length of utilized RF, LO and IF cables and ability of the booster module set to provide the required extender modules' operation mode at a distance.

ESD and safety precautions should be adhered to while operating the devices.

Vent holes of the devices' housing must not be obstructed during operation.

3.2 Visual Inspection

Visual inspection check list:

- Scratches, dents, corrosion of metal parts, and integrity of marking.
- Integrity of cables (power cable, USB cable, connecting cables) and adapters.
- Dents or irregularities on the inner and outer conductors of the coaxial connectors.

If nonconformities are found, further usage of the devices without service operations is **not** recommended.

CONNECTION:

The analyzer and the TM0082 module should both be OFF while performing any connection of cables, adapters or external amplifiers.

The maximum input power of the RF signal or the maximum DC peak voltage as indicated on the devices' housing should not be exceeded, doing so may damage them.

TM0082:

Output signal from the "RF+12V OUT" and "LO+12V OUT" ports contains the direct current voltage (DC voltage). The DC voltage between the inner and outer coaxial conductors of these ports is 12 V. If the module is ON, the electrical short of the conductors can lead to failure of the connected devices, particularly the booster module itself.

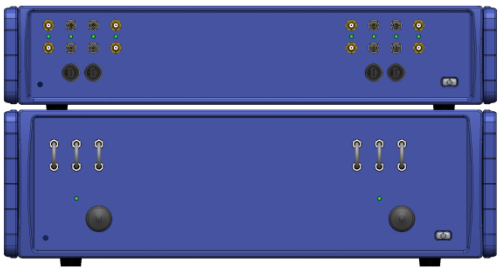
It is prohibited to connect the test set from the "RF+12V OUT" and "LO+12V OUT" ports side to the module without the external amplifiers. The module can be damaged by DC voltage.

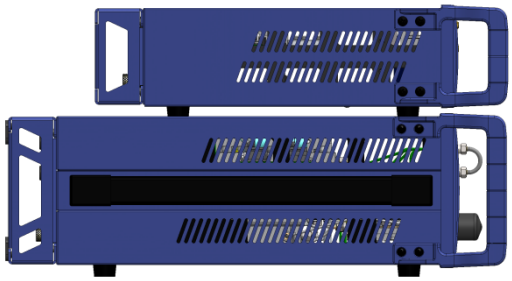
If the output RF power at the "RF +12V OUT" or "LO +12V OUT" ports of the TM0082 module needs to be measured, it is necessary to use the DC blocking capacitor connected to the input of the power meter, or the other measuring instrument that is being used.

AMPLIFIERS:

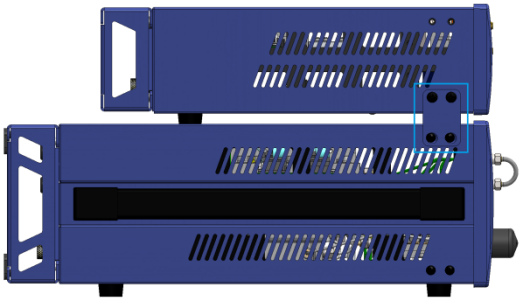
Orientation of the external amplifiers is important and should be done according to Figure 2.7.

The external amplifiers have to be connected to RF and LO cables from the "RF IN +12 VDC" port side. It is easy to damage the amplifier otherwise.

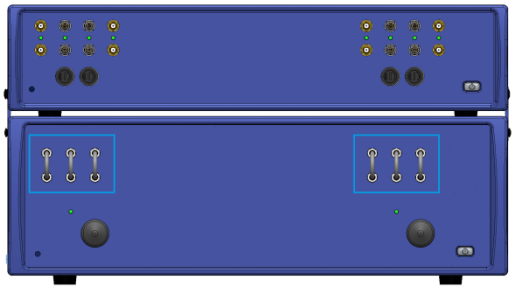




Follow ESD and safety precautions while operating the devices.



Remove the front handles of both devices. Screw the locking bars into place.



When the analyzer is powered OFF, connect the loops to the configurable front panel, if they were disconnected before.

Consistently connect the analyzer to the PC using the USB cable, and then to AC power. It is recommended to connect the analyzer housing (ground terminal) to the protective ground bus bar (when applicable).

If the extender modules operate in the active mode, they should be connected to the analyzer with the control (power) cables, any further actions should be carried out with these connected cables.

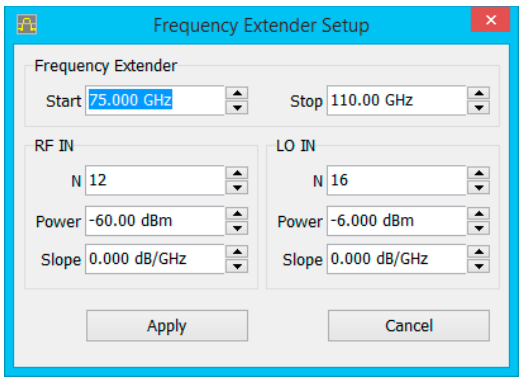
Main Menu > System > Misc Setup > Frequency Extender > None

Switch the analyzer ON, start the software.

Main menu > System > Preset > OK

Set the default settings.

Main Menu > System > Misc Setup > Frequency Extender > Custom

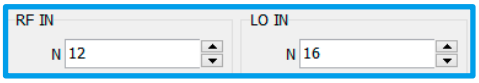


Make sure that after connecting the instrument to the software, frequency sweep is performing over operating frequency range of the analyzer, and there are no errors indicated.

Select the measurement mode with the external modules.

Enter the output frequency range of the module $\Delta F_{RF.OUT}$ in GHz according to its specification.

In the example: $\Delta F_{RF.OUT}$ from 75 GHz to 110 GHz.



Enter the N_{RF} and N_{LO} multiplication factors of the signals in the module according to its specification.

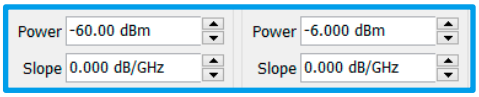
Relationship between input and output frequencies of RF and LO signals:

$$\Delta F_{RF.IN} = \Delta F_{RF.OUT} / N_{RF}$$

$$\Delta F_{LO.IN} \cong \Delta F_{RF.OUT} / N_{LO}$$

In the example: $N_{RF} = 12$, $N_{LO} = 16$, $\Delta F_{RF.IN}$ from 6.25 to 9.17 GHz, $\Delta F_{LO.IN}$ from 4.69 to 6.88 GHz.

Make sure that $\Delta F_{RF.IN}$ and $\Delta F_{LO.IN}$ frequency ranges meet specifications of the analyzer and the booster module set.



Set the minimum power level of the RF and LO signals in the analyzer (refer to table **2.3**). Apply the data entry.

Switch the analyzer OFF. Hereinafter, switching the analyzer OFF, does not require closing the software.

Figure 4.8

Remove the loops from the configurable front panel of the analyzer.

Make sure that the TM0082 module is powered OFF. Connect the Analyzer and the module by using the rigid cables.

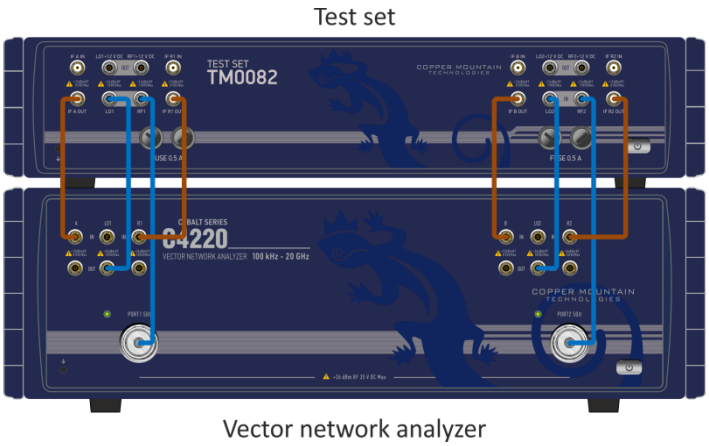


Figure 4.8 Example diagram of TM0082 connection to an analyzer

Connection	
Analyzer	TM0082
PORT 1, PORT 2, PORT 3, PORT 4	RF1 IN, RF2 IN, RF3 IN, RF4 IN
LO1 OUT, LO2 OUT, LO3 OUT, LO4 OUT	LO1 IN, LO2 IN, LO3 IN, LO4 IN
R1 IN, R2 IN, R3 IN, R4 IN	IF R1 OUT, IF R2 OUT, IF R3 OUT, IF R4 OUT
T1 (A) IN, T2 (B) IN, T3 IN, T4 IN	IF T1 (A) OUT, IF T2 (B) OUT, IF T3 OUT, IF T4 OUT

Figure 4.9

Connect all RF and LO cables to the “RF + 12VDC OUT” and “LO + 12VDC OUT” ports of TM0082. It is supposed that the specified parameters should be identical for each RF cable. Similar requirements are applied to the LO cables as well. The output power adjustment of the RF or LO signals will be simultaneously performed for all ports of the analyzer.

Connect external amplifiers to free end of the RF and LO cables. External amplifier should be connected to a cable from “RF + 12VDC IN” port side.

Connect adapter to the output port of each amplifier. The adapters should ensure the direct connection to the module ports.

Connect the amplifiers and the adapters to the “RF IN” and “LO IN” ports of the Modules from the side of all analyzer ports except the first one. The setting of the required power of RF and LO signals will be performed through the first port outputs.

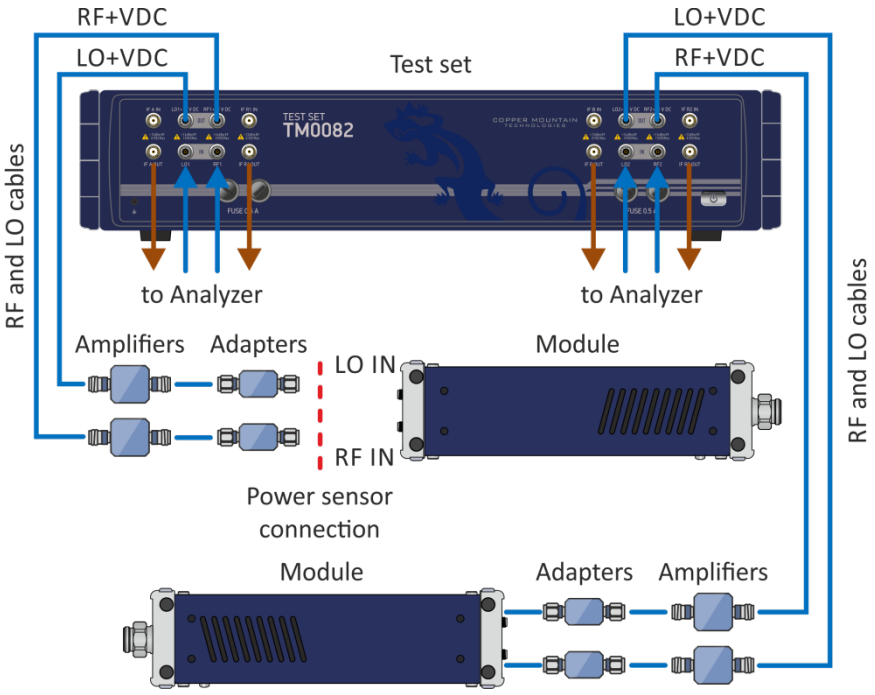


Figure 4.9 Connection of RF and LO cables, external amplifiers and adapters (do not connect IF cables; no need to connect the modules to power supply)

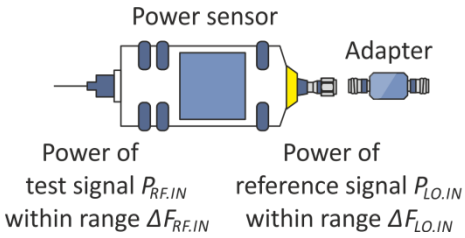


Figure **4.10**

Power level setting of $P_{RF.IN}$ and $P_{LO.IN}$ signals is performed by using the RF power meter (or power sensor) within frequency ranges $\Delta F_{RF.IN}$ and $\Delta F_{LO.IN}$ accordingly. The recommended power level of these signals is referred in the specification of the applied modules.

The start and stop frequencies of $\Delta F_{RF.IN}$ and $\Delta F_{LO.IN}$ ranges are set in the analyzer by selecting the boundary frequencies of $\Delta F_{RF.OUT}$ output range. Relationship between input and output frequencies of RF and LO signals was previously referred to in this text.

In the example: $\Delta F_{RF.IN}$ from 6.25 to 9.17 GHz, $\Delta F_{LO.IN}$ from 4.69 to 6.88 GHz. It should be remembered that power measurement will be performed exactly at the boundary frequencies of these specified ranges with RF power meter. While measuring, the frequency values will need to be entered into the power meter software to apply its frequency-dependent coefficients.

Connect RF power meter to LO signal path.

Connect TM0082 to AC mains using the power cable.

Switch the analyzer and TM0082 ON.

Main menu > Stimulus > Center > start frequency of $\Delta F_{RF.OUT}$

Main Menu > Stimulus > Span > 0 Hz

After connecting the analyzer to the software, set the start frequency of $\Delta F_{RF.OUT}$ range in CW mode of the analyzer.

In the example: start frequency is 75 GHz.

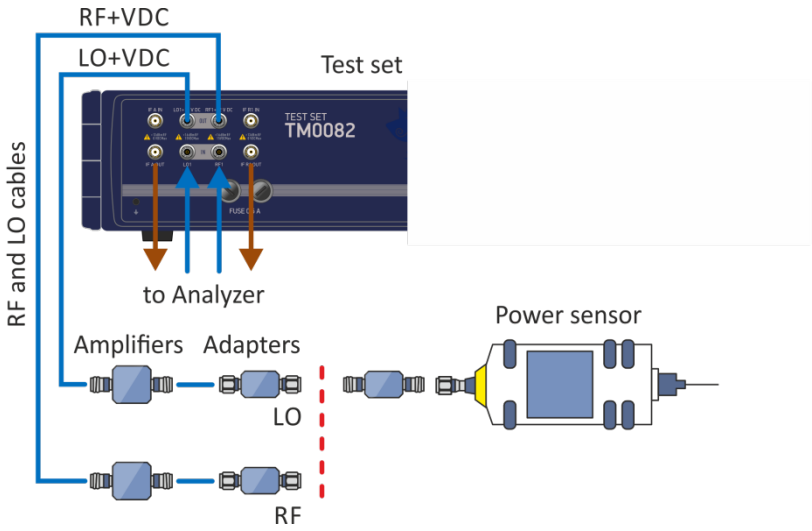
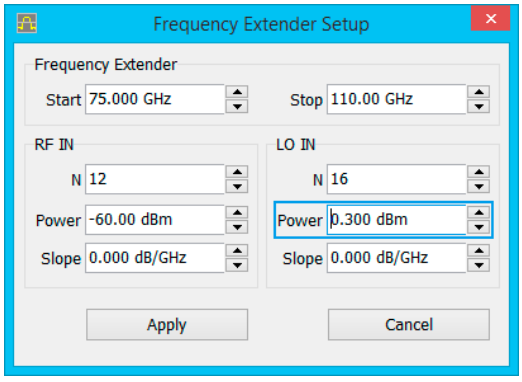


Figure 4.10 Setting of LO power level according to power meter reading (amplifier's output of RF signal is not connected)

Main menu > System > Misc Setup > Frequency Extender > Custom



Open the settings dialog window of the module.

While gradually increasing the value of LO output power, set the required level of $P_{LO.IN}$ in dBm according to the power meter reading.

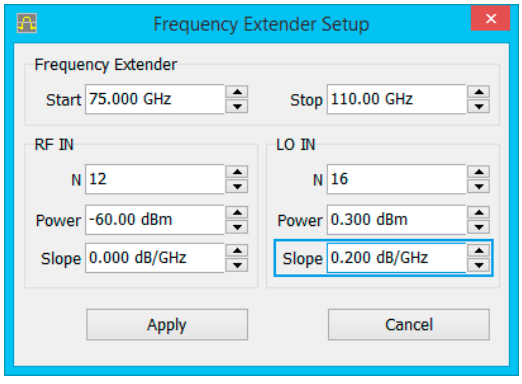
Apply data entry and close dialog window.

Main menu > Stimulus > Center > stop frequency of $\Delta F_{RF.OUT}$

Main Menu> Stimulus> Span > 0 Hz

Set the stop frequency of $\Delta F_{RF.OUT}$ range.

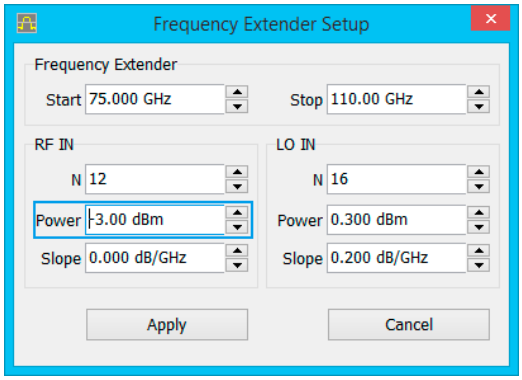
*In the example: stop **frequency** is 110 GHz.*



Open the settings dialog window of the module.

Gradually change the slope value, so that LO power level at the start and stop frequencies are approximately the same and equal to $P_{LO.IN}$. This setting is accomplished according to the power meter readings.

Apply data entry and close dialog window.

Figure 4.11	**Switch the analyzer and TM0082 module OFF.** **Disconnect the power meter.** **Connect the amplifier to "LO IN" input port of the module via the adapter.**
Figure 4.11	Connect the power meter to RF signal path. **Switch the analyzer and TM0082 ON.** Leave the module in OFF condition.
	After connecting the analyzer to the software, set the start frequency of $\Delta F_{RF.OUT}$ range in CW mode of the Analyzer. **Open the settings dialog window of the module.** Gradually increasing the value of RF output power, set the required level of $P_{RF.IN}$ in dBm according to the power meter reading. Apply data entry and close the dialog window.

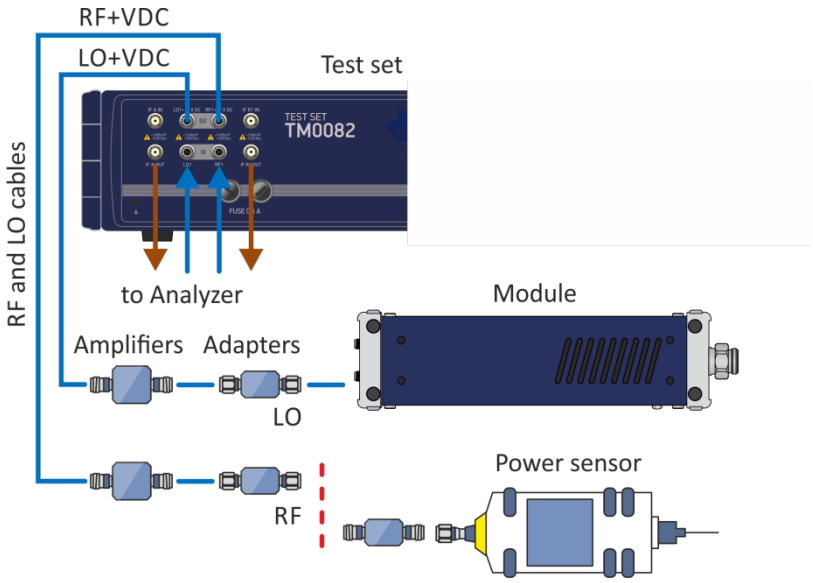


Figure 4.11 Setting of RF power level according to power meter reading
(LO signal amplifier should already be connected to the module; there is no need to connect the module to power supply)

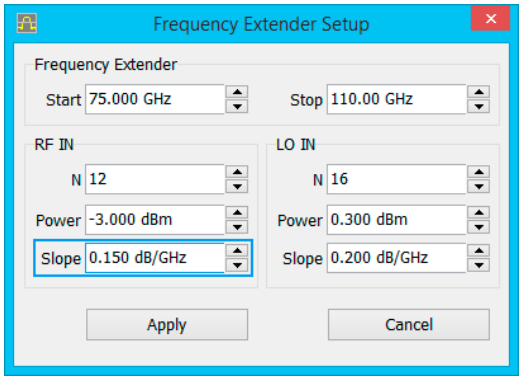


Figure **4.12**

Set the stop frequency of $\Delta F_{RF.OUT}$ range.

Open the settings dialog window of the module.

Gradually change the slope value, so that the RF power level at the start and stop frequencies are approximately the same and equal to $P_{RF.IN}$. This setting is accomplished according to the power meter readings.

Apply data entry and close dialog window.

Switch the Analyzer and TM0082 module OFF.

Disconnect the power meter.

Connect the amplifier to "RF IN" input port of the module via the adapter.

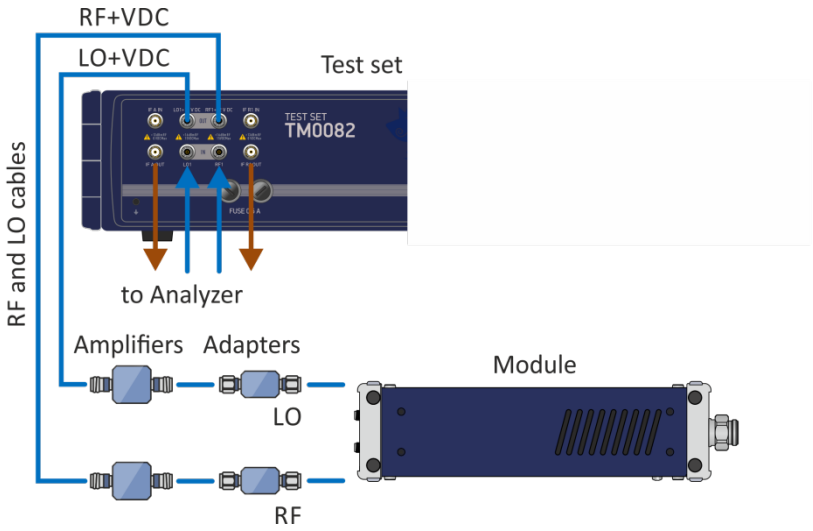


Figure 4.12 RF and LO signal amplifiers are connected to the module via adapters (module is OFF condition)

Figure **4.13**	**Connect SHORT standard to test port of the module.** **Connect IF cable to "IF TEST" output port of the module (from the first port side of the analyzer only).** **Connect power meter to the free end of the IF cable.**

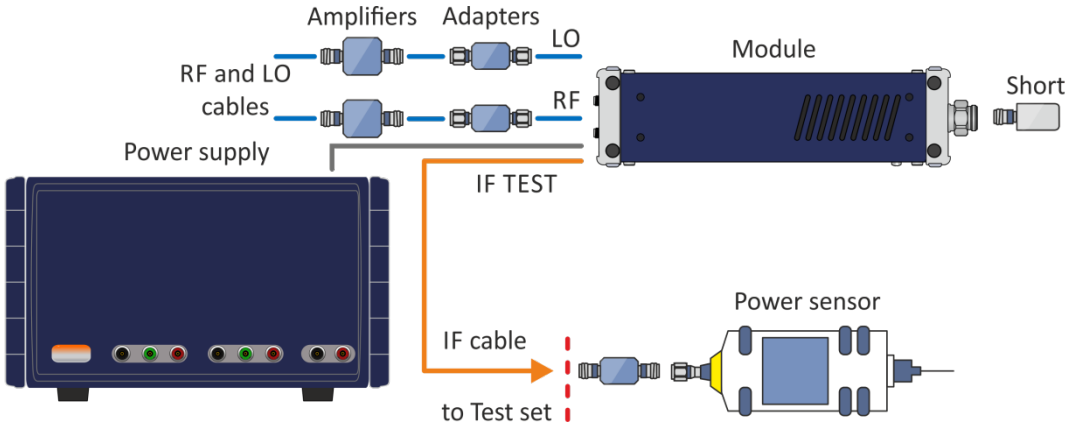


Figure 4.13 Checking the IF power level according to power meter reading

	Switch the analyzer and TM0082 module ON. After connecting the analyzer to the software, set the start frequency of $\Delta F_{RF.OUT}$ range in CW mode of the analyzer.
–	**Switch the module ON using the external power supply or the analyzer as the power source (when it is possible).** Check the power level of IF signal with the power meter. The IF signal frequency is 15.45 MHz.
–	There are several variants for connecting the IF cable depending on the measured power level at its output: - If the IF signal power level is less than minus 13 dBm, the cable should be connected to TM0082; - If the IF signal power level is within the minus 13 to 0 dBm range, the cable should be connected directly to the analyzer, bypassing TM0082; - If the IF signal power level exceeds 0 dBm, the cable should be connected to the analyzer via the attenuator. When using the attenuator, make sure that the power level does not exceed 0 dBm at its output.
Figure 4.14	**Switch the module, analyzer and TM0082 OFF.** Connect the remaining IF cables: one end to “IF TEST” and “IF REF” output ports of all applied modules, the other end to **TM0082** or analyzer, depending on the measured IF signal power level.

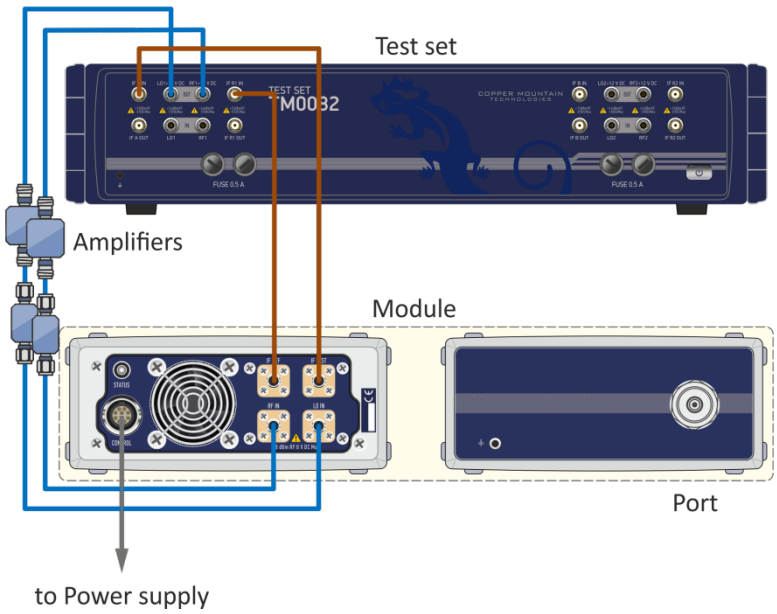


Figure 4.14 Example diagram of module connection to **test set** from the first port side of analyzer

Connection		
TM0082	Amplifier	Module
RF+12VDC OUT	RF+12VDC IN → RF OUT	RF IN
LO+12VDC OUT	RF+12VDC IN → RF OUT	LO IN
IF R1 IN	–	IF REF
IF T1 (A) IN	–	IF TEST

–	**Switch the analyzer, TM0082 and modules ON.** Set the full frequency range $\Delta F_{RF.OUT}$ of the analyzer. Assess the results of the reflection coefficient measurement of the SHORT standard without calibration of the Analyzer - there should not be any spurs over the entire frequency range, and trace noise magnitude should be less than 0.5 dB.

	–	Keep the devices in ON condition for 1 hour. Similarly repeat the power checking of the RF, LO and IF signals after warming up the devices.
	–	After checking, the modules can be connected with a device under test. Maximum module movement depends on length of the used RF, LO and IF cables, and possibility of the booster module set (TM0082 along with external amplifiers) to provide the required operation mode of the modules.