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PIA Gen3 Remote Interface
Passive Intermodulation Analyzer
*IM-A-xxxx, IM-B-xxxx, IM-R-xxxx Series*

1 Connection Setup

Communication is done via a **Telnet** connection over TCP/IP **Port 5025**. The IP Address of PIM Analyzer is shown in the bottom right corner on the desktop background, if the application is minimized.

There are various simple Telnet programs available, e.g. PuTTY, TeraTerm etc., or open a Socket in your own program:
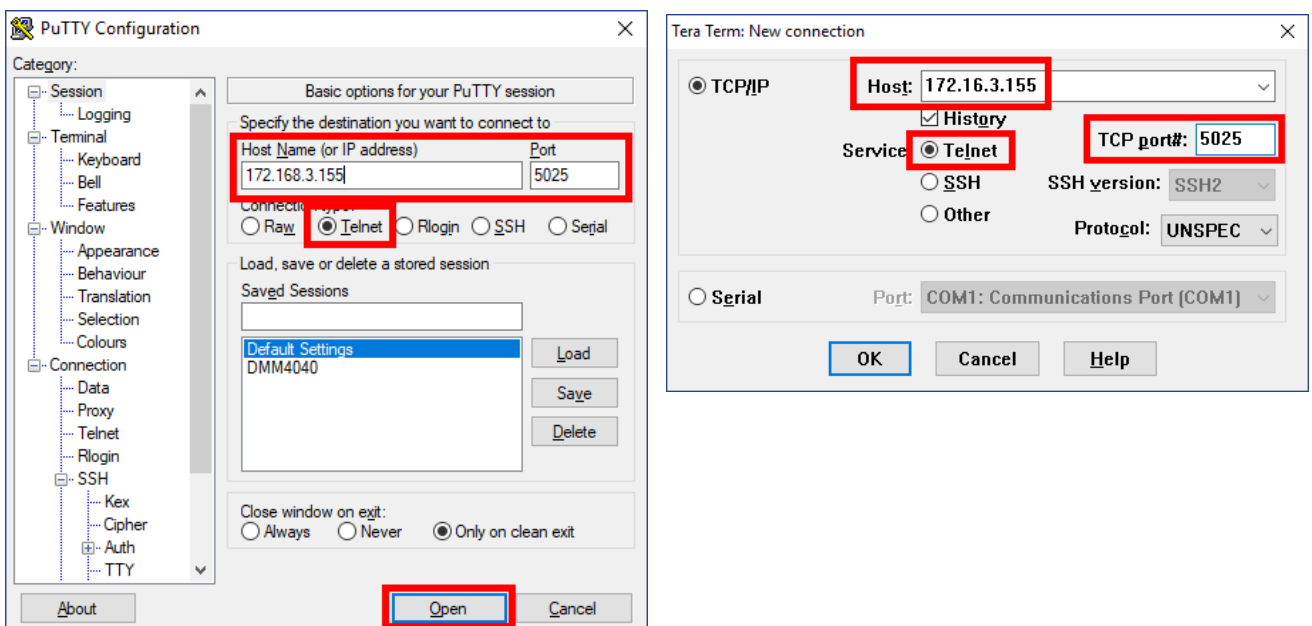
Once a connection is established, you could test the availability using ***IDN?**:
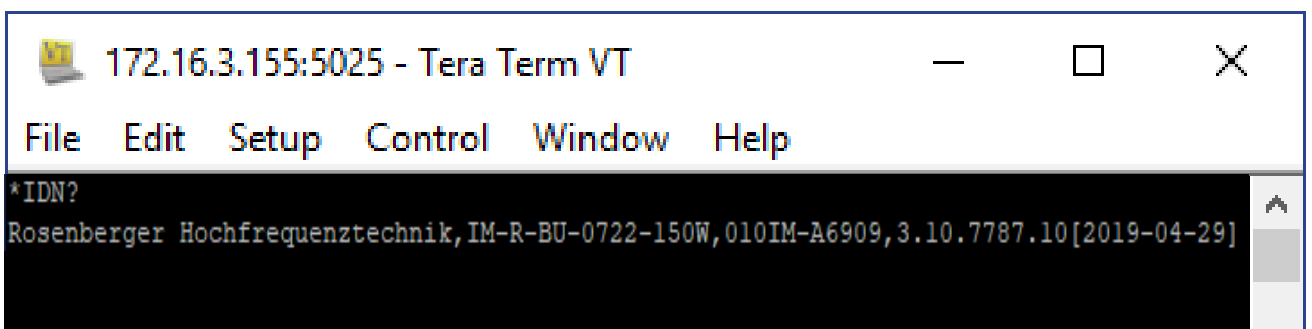
Congratulations, you are now ready to use the SCPI commands described in Chapter 2!

Please consider: We preserve the right to add and modify SCPI commands with future development! The dll will check for compatibility during connection setup and throw an error.

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2 Table of Commands

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	Command	Parameter	Unit	Page
Manual Mode	OUTPut<1|2>[:STATe][?]	0 | 1 | OFF | ON	bool	14
	SOURce<1|2>:FREQuency[?]	Limits from <FILT:FREQ?>	float	14
	SOURce<1|2>:POWer[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	14
	INPut<1|2>[:STATe][?]	0 | 1 | OFF | ON	bool	14
	INPut<1|2>:FREQuency[?]	Limits from <FILT:FREQ?>	float	14
	INPut1:PATH[?]	PIM | FWD	enum	14
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2-Tone	MEAS:TWOTone:CONFigure?	<Parameter Name> <Value>	string	16
	:F1[?]	Limits from <FILT:FREQ?>	float	16
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	:P1[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	16
	:P2[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	16
	:PSENabled	0 | 1 | OFF | ON	bool	
	:PSONtime	1 … 10000	uint [ms]	
	:PSOFftime	10 … 10000	uint [ms]	
	:IMORder[?]	3 | 5 | 7 … 19	uint	16
	:DFIMorder	3 | 5 | 7 … 19	uint	17
	:DURation[?]	0 … 2 147 483 648	int [s]	17
	:REFCheck[?]	0 | 1 | OFF | ON	bool	17
	:DETector[?]	AVG | PEAK	mnemonic	17
	MEAS:TWOTone:STARt	„<Time1>;<Value1>", „<Time2>;<Value2>", …	String [ms];[dBm]	17
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	Command	Parameter	Unit	Page
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	:F1Low[?]	Limits from <FILT:FREQ?>	float	18
	:F1High[?]	Limits from <FILT:FREQ?>	float	18
	:F1Fix[?]	Limits from <FILT:FREQ?>	float	18
	:F1STep[?]	1 …	float	18
	:F2Low[?]	Limits from <FILT:FREQ?>	float	18
	:F2High[?]	Limits from <FILT:FREQ?>	float	18
	:F2Fix[?]	Limits from <FILT:FREQ?>	float	19
	:F2STep[?]	1 …	float	19
	:P1[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	19
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	:IMORder[?]	3 | 5 | 7 … 19	uint	19
	:DFIMorder	3 | 5 | 7 … 19	uint	19
	:REFCheck[?]	0 | 1 | OFF | ON	bool	19
	:DETector[?]	AVG | PEAK	mnemonic	19
	MEAS:FSWeep:STARt	„<Freq1Up>;<Value1>", „<Freq2Up>;<Value2>", … CRLF „<Freq1Down>;<Value1>", „<Freq2Down>;<Value2>", …	String [Hz];[dBm]	20
	MEAS:FSWeep:STOP			20

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	Command	Parameter	Unit	Page
Power Sweep	MEAS:PSWeep:CONFigure?	<Parameter Name> <Value>	string	21
	:F1[?]	Limits from <FILT:FREQ?>	float	21
	:F2[?]	Limits from <FILT:FREQ?>	float	21
	:STARt[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	21
	:STOP[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	21
	:STEP[?]	0.1 …	float [dBm]	21
	:IMORder[?]	3 | 5 | 7 … 19	uint	21
	:DFIMorder	3 | 5 | 7 … 19	uint	21
	:REFCheck[?]	0 | 1 | OFF | ON	bool	22
	:DETector[?]	AVG | PEAK	mnemonic	22
	MEAS:PSWeep:STARt	„<TXPower1>;<Value1>", „<TXPower2>;<Value2>", …	String [dBm];[dBm]	22
	MEAS:PSWeep:STOP			22
Isolation Sweep	MEAS:ISOLation:CONFigure?	<Parameter Name> <Value>	string	23
	:STARt[?]	Limits from <FILT:FREQ?>	float	23
	:STOP[?]	Limits from <FILT:FREQ?>	float	23
	:STEP[?]	1 …	float	23
	:POWer[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	23
	:REFCheck[?]	0 | 1 | OFF | ON	bool	23
	MEAS:ISOLation:STARt	„<Freq1>;<Value1>", „<Freq2>;<Value2>", …	String [Hz];[dBm]	23
	MEAS:ISOLation:STOP			23
ReturnLoss Frequency Sweep	MEAS:RLFRequency:CONFigure?	<Parameter Name> <Value>	string	25
	:STARt[?]	Limits from <FILT:FREQ?>	float	25
	:STOP[?]	Limits from <FILT:FREQ?>	float	25
	:STEP[?]	1 …	float	25
	:POWer[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	25
	:FWDCheck[?]	0 | 1 | OFF | ON	bool	25
	:SWRPort[?]	0 | 1 | OFF | ON	bool	25
	MEAS:RLFRequency:STARt	„<Freq1>;<Value1>", „<Freq2>;<Value2>", …	String [Hz];[dBm]	25
	MEAS:RLFRequency:STOP			26

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	Command	Parameter	Unit	Page
Spectrum Sweep	MEAS:SPECtrum:CONFigure?	<Parameter Name> <Value>	string	27
	:STARt[?]	Limits from <FILT:FREQ?>	float	27
	:STOP[?]	Limits from <FILT:FREQ?>	float	27
	:RBW[?]	1E3 | 2E3 | 5E3 | 1E4 | 2E4 | 5E4 | 1E5 | 2E5 | 5E5 | 1E6	float	27
	:VBW[?]	1E3 | 2E3 | 5E3 … <RBW>	float	27
	MEAS:SPECtrum:STARt	„<Freq1>;<Value1>“, „<Freq2>;<Value2>“, …	String [kHz];[dBm]	27
	MEAS:SPECtrum:STOP			27
PIM Location	MEAS:PIMLocation:CONFigure?	<Parameter Name> <Value>	string	28
	:P1[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	28
	:P2[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	28
	:VELocity[?]	<Section1:Factor1>, <Section2:Factor2>, …	float [m]:[%*100]	28
	:IMORder[?]	3 | 5 | 7 … 19	uint	28
	:REFCheck[?]	0 | 1 | OFF | ON	bool	28
	MEAS:PIMLocation:STARt	„<Count>;<Freq1>;<Freq2>; <Freq3>“ CRLF „<Dist1>;<Value1>“, „<Dist2>;<Value2>“, … CRLF „<Uncertainty1Neg>; <Uncertainty1Pos>; <ExactValue1>“, …	String [kHz];[dBm]	28
	MEAS:PIMLocation:STOP			29
ReturnLoss Location	MEAS:RLLocation:CONFigure?	<Parameter Name> <Value>	string	30
	:P1[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	30
	:P2[?]	Limits from <FILT:MINP?; MAXP?>	float [dBm]	30
	:VELocity[?]	<Section1:Factor1>, <Section2:Factor2>, …	float [m]:[%*100]	30
	:OUTPut[?]	1 | 2 | 3	uint	30
	:FWDCheck[?]	0 | 1 | OFF | ON	bool	30
	MEAS:RLLocation:STARt	„<Count>;<Freq1>;<Freq2>; <Freq3>“ CRLF „<Dist1>;<Value1>“, „<Dist2>;<Value2>“, … CRLF „<Uncertainty1Neg>; <Uncertainty1Pos>; <ExactValue1>“, …	String [kHz];[dBm]	30
	MEAS:RLLocation:STOP			31

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3   SCPI Commands

3.1   Common Interface Notations

- Commands:
    - SCPI is not case sensitive
    - It is enough to write the (capital) abbreviation of commands, e.g.:
      `syst:cald?` instead of `system:caldate?`
    - Commands within the same node can be nested with a semicolon e.g.:
      `meas:twot:conf:f1 1.805E9;f2 1.880E9;p1 43.3;p2 43.5;dur 20`
      is a single line short form of:
      `meas:twot:conf:f1 1.805E9`
      `meas:twot:conf:f2 1.880E9`
      `meas:twot:conf:p1 43.3`
      `meas:twot:conf:p2 43.5`
      `meas:twot:conf:dur 20`
- Variables: Variables to be replaced by an actual value are written in parenthesis as <Variable>
- Strings: Text inputs are written in quotation marks "`<This is a text variable>`"
    They do not contain a new line, unless otherwise noted (`CRLF`)
- Bool: Bool parameters can be sent as:
    `0` or `OFF`
    `1` or `ON`
    Results are always sent as a number: `0` or `1`
- Mnemonic: Some commands are using a mnemonic or enum as setting. It is written as a string but without quotation marks. E.g. `AVG, PEAK, PIM, FWD, ISO, REF` …
- Power: Unit of power is dBm and related to the corresponding input/output interface.
    Corrections to compensate test fixture/cable has to be done by user application!
- Frequencies: Frequencies can be written in following notations (e.g. 1805 MHz):
    `1805000000 | 1805000KHZ | 1805MHZ | 1.805GHZ | 1805E6 | 1.805E9`
    Results are always in Hz and in exponential notation (e.g. 1805 MHz): `1.805E9`
- Lists: Some Queries/Functions are delivering a bunch of grouped results, these are comma separated strings which may contain a semicolon as separator within
    "`<x1>;<y1>`","`<x2>;<y2>`","`<x3>;<y3>`","`<x4>;<y4>`"
- Macro Functions: Each measurement type has a MEAS:<MeasurementType>:STARt function which provides the easiest way to perform a measurement. This macro delivers a stream of measurement results with the highest possible speed.
    The settings of each measurement are predefined with useful defaults and can be modified with the corresponding MEAS:<MeasurementType>:CONF:<Parameter> <Value> commands.
    It is possible to perform user defined measurements using the manual functions of chapter 3.3.15.

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3.2 General

3.2.1 *IDN?

The identification query contains information about manufacturer, model, serial number and version of test equipment.

Result:　　　　"Rosenberger Hochfrequenztechnik,<Model>,<Serial>,<Version>"
Example:　　　`"Rosenberger Hochfrequenztechnik,IM-R-BU-0722-150W,010IM-A1234,`
`3.10.7781.10[2019-04-29]"`

3.2.2 *RST

The reset command resets the test equipment to its default settings and input/outputs to their default state.

3.2.3 *OPC?

The operation complete flag can be polled to check if an asynchronous command has been processed. Configurations (and SYSTem:INIT) are synchronous commands, thus holding back response and delivering a `1` when finished. Measurements are asynchronous and polling results in `0` until measurement is finished.
It does not necessarily mean the command was successful – use SYSTem:ERRor:COUnt? query to check!

Result:　　　　<OperationCompleteFlag>　　　[bool]
Example:　　　`1`

3.2.4 SYSTem:ERRor[:NEXT]?

System error query delivers the last of an error queue with ID and description string. It is recommended to check for error after each command.

Result:　　　　<Error ID>,"<Error Description>"　[uint],[string]
Example:　　　`4711,"Cannot set default values for IM9, frequencies out of range!"`

3.2.5 SYSTem:ERRor:COUnt?

System error count delivers the number of errors in queue.

Result:　　　　<ErrorCount>　　　　　　　[uint]
Example:　　　`1`

3.2.6 SYSTem:SERRor[:NEXT]?

System Static Error delivers the last of a system error queue with ID and description string. It is only deleted when problem cause is removed!
Note: A local disconnect at the GUI (see SYSTem:DEINit) causes a static error seen by remote operator also.

Result:　　　　<Error ID>,"<Error Description>"　[uint],[string]
Example:　　　`4,"SBC disconnect"`

3.2.7 SYSTem:SERRor:COUnt?

System error count delivers the number of system errors in queue.

Result:　　　　<ErrorCount>　　　　　　　[uint]
Example:　　　`0`

3.2.8 SYSTem:SHUTdown

Shutdown closes application and shuts down the device.

Result:　　　　1　　　　　　　　　　　[uint]

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3.2.9   SYSTem:AVER?

ActualVersion returns the current SCPI Version of the device.
Note: **ActualVersion is incremented if commands are added or changed.** This Command Reference is based on the latest SCPI Version (see footer).

Result: <ActualSCPIVersion>   [uint]
Example: 11

3.2.10   SYSTem:CVER?

CompatibleVersion returns the last backward compatible SCPI Version of the device.
Note: **It is recommended to check if application written based on older Command-Reference (see footer) is still compatible.**

Result: <CompatibleSCPIVersion>   [uint]
Example: 10
                        In this example, a user application based on command reference v9 will not work properly!

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3.3 Setup

3.3.1 SYSTem:INIT

Without initialization, commands are limited to *IDN?, SYSTem:ERROr? and *OPC?
Proper initialization is mandatory to control all measurement functions and to prevent unintended RF power at the output. Init is used to establish a connection to the device. Use a meaningful ID to login into the unit (e.g. UserName or Workstation ID), which can be added to the trusted list and shown at the device screen. First login always needs a local authentication, later logins are authenticated through the trusted list.

Remote control is limited to one IP address, thus one user at a time! But initialization survives a socket disconnect.

Local control is blocked while a remote control is established, but remote user can be disconnected manually or through timeout.

Define a proper timeout [s] which ensures that a stopped user application unblocks the device. Timeout is optional, if left blank session expires after 30s. Use timeout 0 for infinite sessions.

Parameter: "<User Name>"[, <Timeout>]   [string],[uint]
Example: "Worker: John Deere",60

3.3.2 SYSTem:DEINit

Closes the connection and unblocks the device.

3.3.3 SYSTem:CALDate?

Used to query the last calibration date of base unit in format YYYY-MM-DD (see 0 for filter calibration date).

Result: "<Date>"   [string]
Example: "2019-02-04"

3.3.4 BATTery:INFos?

Used to get information about inserted battery packs in portable units IM-A-BU-xxxx and IM-B-BU-xxxx.

Result: "<Status>","<SystemBattery>","<PA1Battery>","<PA2Battery>"

- <Status>   "0;1;1;1;0;0":
  - Field1: System battery connected   [bool]
  - Field2: PA1 battery connected   [bool]
  - Field3: PA2 battery connected   [bool]
  - Field4: Supply connected   [bool]
  - Field5: LowPowerCharger connected   [bool]
  - Field6: System battery supported   [bool]
           (IM-A-BU-xxxx has system battery, IM-B-BU-xxxx has not!)
- <Battery>   "88;98;26;02F9;2019-04-08":
  - Field1: State of charge   [%]
  - Field2: Health   [%]
  - Field3: Temperature   [°C]
  - Field4: Serial number   [hex]
  - Field5: Production date of battery   [YYYY-MM-DD]

3.3.5 REFerence:CONNected?

Used to check if external 10 MHz reference source is locked.

Result: <RefConnected>   [bool]
Example: 1

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3.3.6 FILTer[:NAMe]:LIST?

This command lists all available filter units which are initialized by the base unit during application boot. Most filters have only one band (which equal to the filter name), some have two bands (e.g. LTE 700L + LTE 700U, PCS + AWS).

Result: "<Filter1>","<Filter2>","<Filter3>",…[string]

- <Filter1>   "<Filter1Name>;<Filter1Band1>;<Filter1Band2>"
  - Field1:   Filter name   [string]
  - Field2:   Name of main filter band 1   [string]
  - [Field3:]   Name of filter band 2 [optional]   [string]
- <Filter2>   "<Filter2Name>;<Filter2Band1>;<Filter2Band2>"
  - Field1:   Filter name   [string]
  - Field2:   Name of main filter band 1   [string]
  - [Field3:]   Name of filter band 2 [optional]   [string]
- <Filter3>   "<Filter3Name>;<Filter3Band1>;<Filter3Band2>"
  - Field1:   Filter name   [string]
  - Field2:   Name of main filter band 1   [string]
  - [Field3:]   Name of filter band 2 [optional]   [string]

Example: `"LTE 700LU;LTE 700L;LTE 700U","EGSM 900;EGSM 900","PCS/AWS 1900;PCS;PCS/AWS"`

3.3.7 FILTer[:NAMe][?]

This command selects an available filter unit (one of FILTer[:NAMe]:LIST?) and sets switch matrix accordingly.

Parameter: "<FilterName>"   [string]
Example: "DIGDIV 800"

3.3.8 FILTer:BAND:LIST?

This command lists the available frequency bands covered by the current selected filter. Most filters have only one band (which equal to the filter name), some have two bands (e.g. LTE 700L + LTE 700U, PCS + AWS).

Result: "<Band1>","<Band2>",…   [string]
Example: `"LTE 700L","LTE 700U"`

3.3.9 FILTer:BAND[?]

This command selects an available filter frequency band of the current selected filter unit.

Parameter: "<BandName>"   [string]
Result: `"LTE 700L"`

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3.3.10   FILTer:FREQuencies?

This command lists the available frequency ranges of all bands of current selected filter unit.

Result: "<FilterName>;<NumberOfSupportedBands>;
                   <Band1>;<B1F1Min>;<B1F1Max>;<B1F2Min>;<B1F2Max>;<B1RXMin>;<B1RXMax>;
                   <Band2>;<B2F1Min>;<B2F1Max>;<B2F2Min>;<B2F2Max>;<B2RXMin>;<B2RXMax>,…"

- Field1:   Filter Name <FILTer[:NAMe]?>   [string]
- Field2:   Number of supported Bands   [uint]
- Field3:   Band Name <FILTer:BAND?>   [string]
- Field4:   Carrier1 minimum frequency   [float]
- Field5:   Carrier1 maximum frequency   [float]
- Field6:   Carrier2 minimum frequency   [float]
- Field7:   Carrier2 maximum frequency   [float]
- Field8:   Receive minimum frequency   [float]
- Field9:   Receive maximum frequency   [float]
- Field10:   Band Name 2…

Example: "LTE 700LU;2;LTE 700L;7.28E8;7.4E8;7.5E8;7.64E8;6.98E8;7.16E8;LTE
                700U;7.28E8;7.4E8;7.5E8;7.64E8;7.76E8;7.98E8"

3.3.11   FILTer:MINPower?

This command derives the minimum configurable output power within this filter band.

Result: <minPower>   [float]
Example: 23

3.3.12   FILTer:MAXPower?

This command derives the maximum achievable output power within this filter band. It is internally calculated based on maximum amplifier output minus filter and cable losses.

Result: <minPower>   [float]
Example: 45.8

3.3.13   FILTer:MODel?

This query delivers our manufacturer part number of the selected filter unit. It contains a rough frequency notation, the E-UTRA Band number which is compatible to and hardware option description.

Result: "<ModelName>"   [string]
Example: "IM-R-FI-26/B7-R"

3.3.14   FILTer:SERial?

This query delivers the serial number of the selected filter unit.

Result: <FilterSerial>   [string]
Example: "010IM-A0815"

3.3.15   FILTer:CALDate?

Used to query the last calibration date of filter unit in format YYYY-MM-DD (see 3.3.30 for base unit calibration date).

Result: "<Date>"
Example: "2019-04-08"

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3.3.16 CONNections:OUTCable[?]

Used to set up a cable offset between the Test Port of the Analyzer and the DUT. With type 0 a predefined cable is used with offsets from a look up table and type 1 defines a numerical offset in dB (at all frequencies).

Parameter: `<Enabled>,<Type>,"<Value>"`   [bool],[enum],[string]
- Field1:   Offset Enabled   [bool]
- Field2:   Predefined Cable or Loss   [enum]
- Field3:   Cable Name or Value   [string]

Example: `1,0,"IM-Cable-4310-4310-300"`
Example: `1,1,"0.24"`

3.3.17 SWRModule:CONFigure?

Used to query the configuration of built in VNA Module (Hardware Option). As reconfiguration always requires recalibration which must be done manually at the unit, this command is read only.
If the VNA Module is not installed the command only returns `"CONNECTED 0"`

Result: `"<ConnectedState>;<CalibrationState>;<StartFrequency>;`
                    `<StopFrequency>;<MaxDistance>;<IFBandwidth>"`

- Field1:   Is HW Option available   [bool]
- Field2:   Calibration Status   [bool]
- Field3:   Start Frequency   [float]
- Field4:   Stop Frequency   [float]
- Field5:   Maximum Distance   [float]
- Field6:   IF Bandwidth   [float]

Example: `"CONNECTED 1;CALIBRATED 1;STARTFREQ 5.0E8;STOPFREQ 2.7E9;`
                    `MAXDIST 100;IFBW 1000"`

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3.4   Manual Measurement

Manual measurements are mainly used to do some quick tests, experiments or define own measurement sequences. It is possible to switch on and off carriers individually, change the frequency, power and read receiver values at configurable frequencies while carrier is on.

3.4.1   OUTPut<1|2>[:STATe][?]

This command is used to activate the power amplifier 1 or 2.

Parameter: 0 | 1 | OFF | ON   [bool]
Default: OFF

3.4.2   SOURce<1|2>:FREQuency[?]

This command is used to set the transmitter frequencies. Settings are limited to current <FILTer:FREQuencies?>.

Parameter: <Frequency>   [float]

3.4.3   SOURce<1|2>:POWer[?]

This command is used to set the transmitter output powers. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Result: <Output#Power>   [float]

3.4.4   INPut<1|2>[:STATe][?]

This command activates or disables the input.

Parameter: 0 | 1 | OFF | ON   [bool]

3.4.5   INPut<1|2>:FREQuency[?]

This command is used to set the frequency of corresponding input. Settings are limited to current <FILTer:FREQuencies?>.

Parameter: <Frequency>   [float]

3.4.6   INPut1:PATH[?]

This command is used to select the input path of receiver 1 which can be either PIM or FWD.

Parameter: <Input1Path>   [mnemonic]

3.4.7   INPut2:PATH[?]

This command is used to select the input path of receiver 2 which can be either ISO or REF.

Parameter: <Input2Path>   [mnemonic]

3.4.8   INPut<1|2>:POWer?

This query is used to read the receiver input value in dBm

Result: <RFPower>   [float]
Example: −128.7

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3.4.9   INPut:DFIMorder

This command calculates and sets the TX & RX frequencies depending on the defined order and filter frequency limits.

Parameter: \<IM-Order\>   [uint]
Example: 5

3.4.10   INPut:DETector

This command is used to select either AVG or PEAK detector for both receivers.
AVG Detector: Bandwidth 1kHz, average of 20 samples per result (available each 20ms)
Peak Detector: Bandwidth 10kHz, maximum of 200 samples per result (available each 20ms)

Parameter: \<DetectorType\>   [mnemonic]
Example: AVG

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3.5 PIM 2-Tone Measurement

A 2-Tone or Timesweep PIM Measurement measures PIM over time with two static TX carriers. It is used for dynamic PIM testing to measure PIM during mechanical stress.

3.5.1 MEAS:TWOTone:CONFigure?

This query lists the configured settings for 2-Tone measurement. All queries of MEAS:TWOT:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "F1 <FrequencyTX1>;F2 <FrequencyTX2>;P1 <PowerTX1>;P2 <PowerTX2>;IMORDER <IM Order>;DURATION <Duration>;REFCHECK <Refcheck>;DETECTOR <Detector>"

Example: "F1 9.25E8;F2 9.60E8;P1 43.7;P2 43.8;IMORDER 3;DURATION 12;REFCHECK 1;DETECTOR PEAK"

3.5.2 MEAS:TWOTone:CONFigure:F1[?]

This command is used to set the frequency of carrier 1 (TX1). Settings are limited to current <FILTer:FREQuencies?>.

Parameter: <Frequency>   [float]

3.5.3 MEAS:TWOTone:CONFigure:F2[?]

This command is used to set the frequency of carrier 2 (TX2). Settings are limited to current <FILTer:FREQuencies?>.

Parameter: <Frequency>   [float]

3.5.4 MEAS:TWOTone:CONFigure:P1[?]

This command is used to set the power of carrier 1 (TX1). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.5.5 MEAS:TWOTone:CONFigure:P2[?]

This command is used to set the power of carrier 2 (TX2). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.5.6 MEAS:TWOTone:CONFigure:PSENabled[?]

This command is used to activate or deactivate the Power Saving mode.
Note: Set MEAS:TWOTone:CONFigure:DETector to PEAK to capture the maximum PIM value during pulses. Not recommended for qualification measurements. Recommended to reduce heating and increase battery lifetime for PIM hunting durations >60s.

Parameter: 0 | 1 | OFF | ON   [bool]

3.5.7 MEAS:TWOTone:CONFigure:PSONtime[?]

This command is used to set the power-on time in Power Save mode.

Parameter: <On-Time>   [uint, ms]
Example: 20

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3.5.8 MEAS:TWOTone:CONFigure:PSOFftime[?]

This command is used to set the power-off time in Power Save mode.

Parameter: <Off-Time>   [uint, ms]
Example: 180

3.5.9 MEAS:TWOTone:CONFigure:IMORder[?]

This command sets the IM order for PIM measurement and is used for calculation of corresponding RX frequency. It is recommended to use MEAS:TWOT:CONF:DFIMorder to avoid frequency-out-of-range errors and need for your own calculation.

Parameter: <IM-Order>   [uint]

3.5.10 MEAS:TWOTone:CONFigure:DFIMorder

This command calculates and sets the TX & RX frequencies depending on the defined order and filter frequency limits.

Parameter: <IM-Order>   [uint]

3.5.11 MEAS:TWOTone:CONFigure:DURation[?]

This command sets the duration of 2-Tone measurement in seconds.

Parameter: <Duration>   [uint, s]
Example: 10

3.5.12 MEAS:TWOTone:CONFigure:REFCheck[?]

This command activates or deactivates a return loss check prior measurement. Amplifier turn on time is faster without check, but measuring with very bad VSWR is not recommended because it stresses components.

Parameter: 0 | 1 | OFF | ON   [bool]

3.5.13 MEAS:TWOTone:CONFigure:DETector[?]

This command is used to select either AVG or PEAK detector.
AVG Detector: Bandwidth 1kHz, average of 20 samples per result (available each 20ms)
Peak Detector: Bandwidth 10kHz, maximum of 200 samples per result (available each 20ms)

Parameter: <DetectorType>   [mnemonic]
Example: PEAK

3.5.14 MEAS:TWOTone:STARt

This command initiates a 2-Tone measurement macro. The amplifiers will ramp up to the configured power and receiver read out continuously every 20ms. The result is a stream of "<Time>;<Value>" pairs and ends with CRLF. Unit of time is milli-seconds [ms].

Result: "<Time1>;<Result1>","<Time2>;<Result2>",…CRLF
Example: "0;-62.1","20;-62.1","40;-60.8",...CRLF

3.5.15 MEAS:TWOTone:STOP

This command interrupts the 2-Tone measurement macro before the configured <MEAS:TWOT:CONF:DURation>. The amplifiers will ramp down and stream is stopped.

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3.6 PIM Frequency Sweep Measurement

A (Frequency-) Sweep PIM Measurement measures PIM sweeping one TX carrier while the second is kept static. It is the recommended additional test method because a ripple in resulting graph indicates two or more PIM sources.

3.6.1 MEAS:FSWeep:CONFigure?

This query lists the configured settings for PIM sweep measurement. All queries of MEAS:FSW:CONF:xx are grouped in one big string, sorted by upsweep and downsweep parameters. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "F1LOW <StartFreqTX1>;F1HIGH <StopFreqTX1>;F1STEP <StepsizeTX1>;
              F2FIX <FixFreqTX2>;F2HIGH <StartFreqTX2>;F2LOW <StopFreqTX2>;
              F2STEP <StepsizeTX2>;F1FIX <FixFreqTX1>;P1 <PowerTX1>;P2 <PowerTX2>;
              IMORDER <IM Order>;REFCHECK <Refcheck>;DETECTOR <Detector>"

Example: "F1LOW 9.25E8;F1HIGH 9.35E8;F1STEP 1E6;F2FIX 9.6E8;F2HIGH 9.6E8;F2LOW
              9.4E8;F2STEP 1E6;F1FIX 9.25E8;P1 43.7;P2 43.8;IMORDER 3;REFCHECK
              1;DETECTOR AVG"

3.6.2 MEAS:FSWeep:CONFigure:F1Low[?]

This command is used to set the start frequency for upsweep of carrier 1 (F1Low). Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

3.6.3 MEAS:FSWeep:CONFigure:F1High[?]

This command is used to set the stop frequency for upsweep of carrier 1 (F1High). Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

3.6.4 MEAS:FSWeep:CONFigure:F1Fix[?]

This command is used to set the fixed frequency (F1Fix) for downsweep of carrier 2. Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

3.6.5 MEAS:FSWeep:CONFigure:F1STep[?]

This command is used to set the frequency step size for upsweep of carrier 1 (F1STep).

Parameter: <Frequency>   [float]

3.6.6 MEAS:FSWeep:CONFigure:F2Low[?]

This command is used to set the stop frequency for downsweep of carrier 2 (F2Low). Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

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3.6.7   MEAS:FSWeep:CONFigure:F2High[?]

This command is used to set the start frequency for downsweep of carrier 2 (F2High). Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

3.6.8   MEAS:FSWeep:CONFigure:F2Fix[?]

This command is used to set the fixed frequency (F2Fix) for downsweep of carrier 1. Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder) to achieve widest possible sweep range.

Parameter: <Frequency>   [float]

3.6.9   MEAS:FSWeep:CONFigure:F2STep[?]

This command is used to set the frequency step size for downsweep of carrier 2 (F2STep).

Parameter: <Frequency>   [float]

3.6.10   MEAS:FSWeep:CONFigure:P1[?]

This command is used to set the power of carrier 1 (TX1). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.6.11   MEAS:FSWeep:CONFigure:P2[?]

This command is used to set the power of carrier 2 (TX2). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.6.12   MEAS:FSWeep:CONFigure:IMORder[?]

This command sets the IM order for PIM measurement and is used for calculation of corresponding RX frequency. It is recommended to use MEAS:FSW:CONF:DFIMorder to avoid frequency-out-of-range errors and need for your own calculation of proper sweep range.

Parameter: <IM-Order>   [uint]

3.6.13   MEAS:FSWeep:CONFigure:DFIMorder

This command calculates and sets the optimum sweep frequencies depending on the defined order and filter frequency limits.

Parameter: <IM-Order>   [uint]

3.6.14   MEAS:FSWeep:CONFigure:REFCheck[?]

This command activates or deactivates a return loss check prior measurement. Amplifier turn on time is faster without check, but measuring with very bad VSWR is not recommended because it stresses components.

Parameter: 0 | 1 | OFF | ON   [bool]

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3.6.15 MEAS:FSWeep:CONFigure:DETector[?]

This command is used to select either AVG or PEAK detector.
AVG Detector: Bandwidth 1kHz, average of 20 samples per result (available each 20ms)
Peak Detector: Bandwidth 10kHz, maximum of 200 samples per result (available each 20ms)

Parameter: <DetectorType>   [mnemonic]
Example: PEAK

3.6.16 MEAS:FSWeep:STARt

This command initiates a sweep measurement macro. The amplifiers will ramp up to the configured power and receiver read out. Carrier1 will be increased by F1Step and receiver read again, …. until upsweep is completed. Then carrier2 will be decreased by F2Step until downsweep is finished. The result is a stream of "<Frequency>;<Value>" pairs with CRLF between up- and downsweep and ends with CRLF.

Result: "<Frequency1Up>;<Result1Up>","<Frequency2Up>;<Result2Up>",…CRLF
               "<Frequency1Down>;<Result1Down>","<Frequency2Down>;<Result2Down>",…CRLF
Example: "8.9E8;-62.1","8.92E8;-62.5","8.94E8;-63.8",...CRLF
               "8.9E8;-62.2","8.91E8;-62.3","8.92E8;-62.5",...CRLF

3.6.17 MEAS:FSWeep:STOP

This command interrupts the sweep measurement macro before the configured upsweep and downsweep are finished. The amplifiers will ramp down and stream is stopped.

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3.7 Power Sweep Measurement

With a Power Sweep Measurement the frequency of both carriers is fixed, but the power is increased linearly. It is used to characterize the behavior of a DUT or to define the maximum power to achieve a given PIM limit.

3.7.1 MEAS:PSWeep:CONFigure?

This query lists the configured settings for power sweep measurement. All queries of MEAS:PSW:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "F1 <FreqTX1>;F2 <FreqTX2>;START <StartPower>;STOP <StopPower>;
STEP <Stepsize>;IMORDER <IM Order>;REFCHECK <Refcheck>;DETECTOR <Detector>"

Example: `"F1 730000;F2 762000;START 23;STOP 46;STEP 1;IMORDER 3;REFCHECK ON;DETECTOR AVG"`

3.7.2 MEAS:PSWeep:CONFigure:F1[?]

This command is used to set the fixed frequency (F1) of carrier 1. Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder).

Parameter: <Frequency>   [float]

3.7.3 MEAS:PSWeep:CONFigure:F2[?]

This command is used to set the fixed frequency (F2) of carrier 2. Settings are limited to current <FILTer:FREQuencies?>.
Default is derived from IM Order (MEAS:FWS:CONF:DFIMorder).

Parameter: <Frequency>   [float]

3.7.4 MEAS:PSWeep:CONFigure:STARt[?]

This command is used to set the start power of both carriers. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.7.5 MEAS:PSWeep:CONFigure:STOP[?]

This command is used to set the stop power of both carriers. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.7.6 MEAS:PSWeep:CONFigure:STEP[?]

This command is used to set the power step size of both carriers. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.7.7 MEAS:PSWeep:CONFigure:IMORder[?]

This command sets the IM order for PIM measurement and is used for calculation of corresponding RX frequency. It is recommended to use MEAS:PSW:CONF:DFIMorder to avoid frequency-out-of-range errors and need for your own calculation of proper sweep range.

Parameter: <IM-Order>   [uint]

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3.7.8 MEAS:PSWeep:CONFigure:DFIMorder

This command calculates and sets the optimum sweep frequencies depending on the defined order and filter frequency limits.

Parameter: <IM-Order>   [uint]

3.7.9 MEAS:PSWeep:CONFigure:REFCheck[?]

This command activates or deactivates a return loss check prior measurement. Amplifier turn on time is faster without check, but measuring with very bad VSWR is not recommended because it stresses components.

Parameter: 0 | 1 | OFF | ON   [bool]

3.7.10 MEAS:PSWeep:CONFigure:DETector[?]

This command is used to select either AVG or PEAK detector.
AVG Detector: Bandwidth 1kHz, average of 20 samples per result (available each 20ms)
Peak Detector: Bandwidth 10kHz, maximum of 200 samples per result (available each 20ms)

Parameter: <DetectorType>   [mnemonic]
Example: PEAK

3.7.11 MEAS:PSWeep:STARt

This command initiates a power sweep measurement macro. The amplifiers will ramp up to the configured power and receiver read out. Power of both carriers will be increased by <Stepsize> and receiver read again, …. until sweep is completed. The result is a stream of "<Power>;<Value>" pairs and ends with CRLF.

Result: "<Power1>;<Result1>","<Power2>;<Result2>","<Power3>;<Result3>",…CRLF
Example: "23;-132.1","24;-133.5","25;-132.8",...,"45;-85.7","46;-83.9"CRLF

3.7.12 MEAS:PSWeep:STOP

This command interrupts the sweep measurement macro before the configured range is completed. The amplifiers will ramp down and stream is stopped.

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3.8 Isolation Measurement

An Isolation (-Sweep) Measurement measures the isolation (loss) in dB between the Antenna port and the Isolation input port over frequency. It is used to measure the crosstalk between +45° and -45° port of an antenna, for instance.

3.8.1 MEAS:ISOLation:CONFigure?

This query lists the configured settings for isolation measurement. All queries of MEAS:ISOL:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "START <StartFreq>;STOP <StopFreq>;STEP <Stepsize>;POWER <PowerTX>; REFCHECK <Refcheck>

Example: "START 9.25E8;STOP 9.6E8;STEP 1E6;POWER 43.7;REFCHECK 1"

3.8.2 MEAS:ISOLation:CONFigure:STARt[?]

This command is used to set the start frequency for frequency sweep of carrier. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency> [float]

3.8.3 MEAS:ISOLation:CONFigure:STOP[?]

This command is used to set the stop frequency for frequency sweep of carrier. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency> [float]

3.8.4 MEAS:ISOLation:CONFigure:STEP[?]

This command is used to set the frequency step size for carrier.

Parameter: <Frequency> [float]

3.8.5 MEAS:ISOLation:CONFigure:POWer[?]

This command is used to set the power of carrier. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.
Caution: Please ensure that the power received at isolation input does never exceed +27dBm!
Increase the output power only above +27dBm if it is necessary for high dynamic range reasons, if DUT has sufficient losses and is stable. The received power is checked prior measurement to protect the instrument.

Parameter: <Power> [float]

3.8.6 MEAS:ISOLation:CONFigure:REFCheck[?]

This command activates or deactivates a return loss check prior measurement. Amplifier turn on time is faster without check, but measuring with very bad VSWR is not recommended because it stresses components.

Parameter: 0 | 1 | OFF | ON [bool]

3.8.7 MEAS:ISOLation:STARt

This command initiates an isolation sweep measurement macro. The amplifier will ramp up to the configured power and receiver read out. The frequency will be increased by Stepsize and receiver read again, …. until the sweep is completed. If the filter unit is built with a combiner filter, the gap is blank and the unit switches to second amplifier in the upper downlink band. The result is a stream of "<Frequency>;<Value>" pairs and ends with CRLF.

Result: "<Frequency1>;<Result1>","<Frequency2>;<Result2>","<Frequency3>;<Result3>",…CRLF
Example: "9.25E8;-48.3","9.26E8;-48.5","9.27E8;-48.8",...CRLF

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3.8.8 MEAS:ISOLation:STOP

This command interrupts the isolation measurement macro before the configured range is completed. The amplifiers will ramp down and stream is stopped.

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3.9   Return Loss / VSWR Measurement

A Return Loss (VSWR) Measurement measures the Return Loss (or Voltage Standing Wave Ratio) at the Antenna port over frequency. Result is measured as Return Loss in dB (See 3.9.6 for conversion).

3.9.1   MEAS:RLFRequency:CONFigure?

This query lists the configured settings for return loss measurement. All queries of MEAS:RLFR:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "START <StartFreq>;STOP <StopFreq>;STEP <Stepsize>;POWER <PowerTX>;
                REFCHECK <Refcheck>
Example: "START 9.25E8;STOP 9.6E8;STEP 1E6;POWER 43.7;REFCHECK 1"

3.9.2   MEAS:RLFRequency:CONFigure:STARt[?]

This command is used to set the start frequency for frequency sweep of carrier. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency>   [float]

3.9.3   MEAS:RLFRequency:CONFigure:STOP[?]

This command is used to set the stop frequency for frequency sweep of carrier. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency>   [float]

3.9.4   MEAS:RLFRequency:CONFigure:STEP[?]

This command is used to set the frequency step size for carrier.
Parameter: <Frequency>   [float]

3.9.5   MEAS:RLFRequency:CONFigure:POWer[?]

This command is used to set the power of carrier. Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.
Warning: RL measurements normally are done using a low power level. Here the power can be increased up to +46dBm – carefully check the power handling capability of DUT before measurement!

3.9.6   MEAS:RLFRequency:CONFigure:FWDCheck[?]

This command activates or deactivates the forward power check prior measurement. It is recommended to perform this check at least one time after hardware wiring at the switch matrix was done to detect critical misconnections.

Parameter: 0 | 1 | OFF | ON   [bool]

3.9.7   MEAS:RLFRequency:CONFigure:SWRPort[?]

This command selects between the main test port at the filter unit (used for PIM measurements) and the test port of the VNA Module (Hardware option).

Parameter: 0 | 1 | OFF | ON   [bool]

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3.9.8   MEAS:RLFRequency:STARt

This command initiates a return loss sweep measurement macro. The amplifier will ramp up to the configured power and receiver read out. The frequency will be increased by Stepsize and receiver read again, …. until the sweep is completed. If the filter unit is built with a combiner filter, the gap is blank and the unit switches to second amplifier in the upper downlink band. The result is a stream of "<Frequency>;<Value>" pairs and ends with CRLF.

Result: "<Frequency1>;<Result1>","<Frequency2>;<Result2>","<Frequency3>;<Result3>",…CRLF
Example: "9.25E8;-15.7","9.26E8;-16.2","9.27E8;-15.9",...CRLF

Note: Conversion of RL$_{[dB]}$ to VSWR: $VSWR = \dfrac{1+10^{-\frac{RL}{20}}}{1-10^{-\frac{RL}{20}}}$

3.9.9   MEAS:RLFRequency:STOP

This command interrupts the return loss measurement macro before the configured range is completed. The amplifiers will ramp down and stream is stopped.

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3.10 Spectrum Measurement

A Spectrum Measurement measures the power density at the antenna port within the uplink frequency band. It is used to test if the uplink band is free of external interferers which would lead to false error assumptions in PIM measurements.

3.10.1 MEAS:SPECtrum:CONFigure?

This query lists the configured settings for return loss measurement. All queries of MEAS:SPEC:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "START <StartFreq>;STOP <StopFreq>;RBW <ResolutionBW>;VBW <VideoBW>
Example: "START 9.25E8;STOP 9.6E8;RBW 1E3;VBW 1E3;ENDLESS ON"

3.10.2 MEAS:SPECtrum:CONFigure:STARt[?]

This command is used to set the start frequency for spectrum measurement. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency>   [float]

3.10.3 MEAS:SPECtrum:CONFigure:STOP[?]

This command is used to set the stop frequency for spectrum measurement. Settings are limited to current <FILTer:FREQuencies?>.
Parameter: <Frequency>   [float]

3.10.4 MEAS:SPECtrum:CONFigure:RBW[?]

This command is used to set the resolution bandwidth of spectrum measurement. The lower the resolution bandwidth setting, the lower the noise floor. Settings are limited to 1E3 | 2E3 | 5E3 | 1E4 | 2E4 | 5E4 | 1E5 | 2E5 | 5E5 | 1E6.
Parameter: <Frequency>   [float]

3.10.5 MEAS:SPECtrum:CONFigure:VBW[?]

This command is used to set the video bandwidth of spectrum measurement. Settings are limited to 1E3 | 2E3 | 5E3 | 1E4 … <RBW>.
Parameter: <Frequency>   [float]

3.10.6 MEAS:SPECtrum:STARt

This command initiates a spectrum measurement within the uplink band at the antenna port. The result is a stream of "<Frequency>;<Value>" pairs and ends with CRLF.

Result: "<Frequency1>;<Result1>","<Frequency2>;<Result2>","<Frequency3>;<Result3>",…CRLF
Example: "9.25E8;-103.5","9.26E8;-102.9","9.27E8;-104.7",...CRLF

3.10.7 MEAS:SPECtrum:STOP

This command aborts the current FFT measurement and stops the output stream.

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3.11 PIM Location Measurement

A PIM Location Measurement measures the distance between the reference plane and the PIM source. The measurement starts with coarse pre-measurement and proceeds with a final measurement per found PIM source. The test frequencies are automatically set.

3.11.1 MEAS:PIMLocation:CONFigure?

This query lists the configured settings for return loss measurement. All queries of MEAS:PIML:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "P1 <PowerTX1>;P2 <PowerTX2>;IMORDER <IM Order>;
                REFCHECK <Refcheck>;VELOCITY <Section1:Factor1,Section2:Factor2,…>"
Example: "P1 43.0;P2 43.0;IMORDER 3;REFCHECK 1;VELOCITY 0:1,3:0.81,150:1"

3.11.2 MEAS:PIMLocation:CONFigure:P1[?]

This command is used to set the power of carrier 1 (TX1). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.11.3 MEAS:PIMLocation:CONFigure:P2[?]

This command is used to set the power of carrier 2 (TX2). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.11.4 MEAS:PIMLocation:CONFigure:VELocity[?]

This command sets the velocity (shortening factor) of the used cable sections and is used for calculation of mechanical length to the measured PIM source. Assuming a cable starts at 0m, the first section ends with the cable length and its velocity factor (between 0.01 and 1.0), the following cable ends at length2 with factor2. To prevent the results to be misleading, define the velocity up to the maximum (150m) to be 1 (speed of light) with 150:1 as last pair.

Parameter: <0:1,Length1:Factor1,Length2:Fact2,…,150:1> [float]:[float]
Example: "3:0.81,33:0.88,150:1"
                Defines a 3m jumper cable with 81% at the beginning, connected to a 30m feeder with 88%.

3.11.5 MEAS:PIMLocation:CONFigure:IMORder[?]

This command sets the IM order for PIM location measurement.

Parameter: <IM-Order>   [uint]

3.11.6 MEAS:PIMLocation:CONFigure:REFCheck[?]

This command activates or deactivates a return loss check prior measurement. Amplifier turn on time is faster without check, but measuring with very bad VSWR is not recommended because it stresses components.

Parameter: 0 | 1 | OFF | ON   [bool]

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3.11.7 MEAS:PIMLocation:STARt

This command initiates a PIM location measurement. The result is streamed as soon it is available in three lines, each ending with CRLF.
The first line of the result contains the used bandwidth and frequencies.
The second line is a stream of "<Distance>;<PIMValue>" pairs for the graph (also in the negative direction!).
The third line contains the precise results as "<Distance>;<Uncertainty>;<Value>".

Result: "<Bandwidth>;<Carrier1 Frequency>;<Carrier2 Frequency>;<Receiver Frequency>"CRLF
           "<GraphX1>;<GraphY1>","<GraphX2>;<GraphY2>","<GraphX2>;<GraphY3>",…CRLF
           "<Distance1>;<Uncertainty1>;<Value1>","<Distance2>;<Uncertainty2>;<Value2>",…CRLF

Example: "10.00E+06;7.3076E+08;7.589E+08;7.0262E+08"CRLF
               "-2.0;-100.7","5.3;-84.9","12.8;-90.5",...CRLF
               "5.9;0.08;-83.2","42.1;0.12;-92.7"CRLF

3.11.8 MEAS:PIMLocation:STOP

This command interrupts the location measurement before it is completed. The amplifiers will ramp down and measurement is stopped.

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3.12 RL Location Measurement

3.12.1 MEAS:RLLocation:CONFigure?

This query lists the configured settings for return loss measurement. All queries of MEAS:RLL:CONF:xx are grouped in one big string. See command definitions below.

It can also be used as a nested command to set all parameters at once.

Result: "OUTPUT <OutputPort>;P1 <PowerTX1>;P2 <PowerTX2>;
         FWDCHECK <Fwdcheck>;VELOCITY <Section1:Factor1,Section2:Factor2,…>"
Example: "1;P1 43.0;P2 43.0;FWDCHECK 1;VELOCITY 0:1,3:0.81,150:1"

3.12.2 MEAS:RLLocation:CONFigure:P1[?]

This command is used to set the power of carrier 1 (TX1). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.12.3 MEAS:RLLocation:CONFigure:P2[?]

This command is used to set the power of carrier 2 (TX2). Settings are limited to current <FILTer:MINPower?> and <FILTer:MAXPower?>.

Parameter: <Power>   [float]

3.12.4 MEAS:RLLocation:CONFigure:VELocity[?]

This command sets the velocity (shortening factor) of the used cable sections and is used for calculation of mechanical length to the measured PIM source. Assuming a cable starts at 0m, the first section ends with the cable length and its velocity factor (between 0.01 and 1.0), the following cable ends at length2 with factor2. To prevent the results to be misleading, define the velocity up to the maximum (150m) to be 1 (speed of light) with 150:1 as last pair.

Parameter: <0:1,Length1:Factor1,Length2:Fact2,…,150:1> [float]:[float]
Example: "3:0.81,33:0.88,150:1"
          Defines a 3m jumper cable with 81% at the beginning, connected to a 30m feeder with 88%.

3.12.5 MEAS:RLLocation:CONFigure:OUTPut[?]

This command selects between the main test port at the filter unit (Value 1 | 2) and the test port of the VNA Module (Value 3) if the hardware option is installed.
At units with combiner-filters (Site Analyzer Alpha) it is used to define which amplifier (i.e. combiner passband) is used as stimulus.
If output 3 is used, settings of SWRModule:CONFigure? will apply.

Parameter: 0 | 1 |3   [uint]

3.12.6 MEAS:RLLocation:CONFigure:FWDCheck[?]

This command activates or deactivates the forward power check prior measurement. It is recommended to perform this check at least one time after hardware wiring at the switch matrix was done to detect critical misconnections.

Parameter: 0 | 1 | OFF | ON   [bool]

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3.12.7 MEAS:RLLocation:STARt

This command initiates a missmatch location measurement. The result is streamed as soon it is available in three lines, each ending with CRLF.
The first line of the result contains the used bandwidth and frequency.
The second line is a stream of "<Distance>;<RLValue>" pairs for the graph (also in the negative direction!).
The third line contains the precise results as "<Distance>;<Uncertainty>;<Value>".

Result: "<Bandwidth>;<Carrier Frequency>;<Receiver Frequency>"CRLF
            "<GraphX1>;<GraphY1>","<GraphX2>;<GraphY2>","<GraphX2>;<GraphY3>",…CRLF
            "<Distance1>;<Uncertainty1>;<Value1>","<Distance2>;<Uncertainty2>;<Value2>",…CRLF
Example: "10.00E+06;7.34E+08;7.34E+08"CRLF
            "-2.0;-25.9","4.8;-6.9","18.5;-17.2",...CRLF
            "5.1;0.11;-6.7","47.1;0.08;-10.3"CRLF

3.12.8 MEAS:RLLocation:STOP

This command interrupts the location measurement before it is completed. The amplifiers will ramp down and measurement is stopped.

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4   Programming Examples using SCPI

The following examples describe how to perform a simple PIM test using a Terminal program.
;Comments are just for clarification – they are not transferred!

4.1   Derive Model, Serial and Calibration Date

Input	Response
`*IDN?` ;Query Instrument ID & Serial	`Rosenberger Hochfrequenztechnik,IM-B-BU-0727,010IM-A4711,3.11.7791.10[2019-04-30]`
`SYSTEM:SERROR?` ;Test for static Errors	`0,"No error"`
`SYSTEM:INIT "Hans",0` ;Init instrument with User Name "Hans" and infinite timeout	
`SYSTEM:ERROR:COUNT?` ;Test for Errors	`0`
`SYSTEM:CALDATE?` ;Query Caldate of Base Unit	`"2017-01-16"`
`FILTER:MODEL?` ;Query Model of Filter Unit	`"IM-B-FI-700/B13+14"`
`FILTER:SERIAL?` ;Query Serial of Filter Unit	`"010IM-A7518"`
`FILTER:CALDATE?` ;Query Caldate of Filter Unit	`"2017-09-14"`
`SYSTEM:ERROR:COUNT?` ;Test for Errors – just to be sure	`0`

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4.2 2-Tone Measurement

Input	Response
MEAS:TWOTONE:CONF:F1 730 MHZ;F2 762 MHZ;P1 43;P2 43;IMORDER 3;DURATION 2;REFCHECK ON;DETECTOR AVG ;**Optional reconfiguration** to ;customize a 2-Tone measurement ;Omit if defaults are acceptable	
SYSTEM:ERROR:COUNT? ;Test for errors	0
MEAS:TWOTONE:START ;Start a Measurement and get results immediately	"0;-134.9","20;-137.1","40;-134.9", "60;-134.9","80;-134.9","100;-137.1", "120;-134.9","140;-134.9","160;-134.9", "180;-137.1","200;-134.9","220;-134.9", "240;-134.9","260;-137.1","280;-134.9", "300;-134.9","320;-134.9","340;-137.1", "360;-134.9","380;-134.9","400;-134.9", . . . "1760;-134.9","1780;-137.1","1800;-134.9", "1820;-134.9","1840;-134.9","1860;-137.1", "1880;-134.9","1900;-134.9","1920;-134.9", "1940;-137.1","1960;-134.9","1980;-134.9", "2000;-134.9"CRLF ;Newline (CRLF) when finished
MEAS:TWOTONE:STOP ;Optional to abort measurement	
*OPC? ;Poll until measurement is complete (1)	1
SYSTEM:ERROR:COUNT? ;Finally test if an error occurred	0

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4.3   Sweep Measurement

Input	Response
MEAS:FSWEEP:CONF:F1LOW 728.6 MHZ;F1HIGH 740 MHZ;F2FIX 763.3 MHZ;F2HIGH 763.3 MHZ;F2LOW 752.3 MHZ;F1FIX 728.6 MHZ;F1STEP 1 MHZ;F2STEP 1 MHZ;P1 43;P2 43;IMORDER 3;REFCHECK ON;DETECTOR AVG ;**Optional reconfiguration** to ;customize a sweep measurement ;Omit if defaults are acceptable	
SYSTEM:ERROR:COUNT? ;Test for errors	0
MEAS:FSWEEP:START ;Start a Measurement and get results immediately	;Upsweep "7.98e+8;-130.0","7.97e+8;-129.5", "7.96e+8;-127.7","7.95e+8;-127.2", "7.94e+8;-127.5","7.93e+8;-128.2", "7.92e+8;-128.9","7.91e+8;-129.2", "7.9e+8;-128.6","7.89e+8;-127.8", "7.88e+8;-128.3","7.87e+8;-128.5"CRLF ;Newline (CRLF) after upsweep ;Downsweep "7.98e+8;-128.6","7.96e+8;-129.6", "7.94e+8;-127.2","7.92e+8;-129.4", "7.9e+8;-127.9","7.88e+8;-127.9", "7.86e+8;-128.5","7.84e+8;-128.4", "7.82e+8;-128.7","7.8e+8;-129.4", "7.78e+8;-129.9","7.76e+8;-127.6"CRLF ;Newline (CRLF) when finished
MEAS:FSWEEP:STOP ;Optional to abort measurement	
*OPC? ;Poll until measurement is complete (1)	1
SYSTEM:ERROR:COUNT? ;Finally test if an error occurred	0