ROHDE&SCHWARZ

Test and Measurement Division

Software Manual

Measurements with Power Sensors

Application Firmware R&S FS-K9

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This software manual provides information on how to operate Application Firmware R&S FS-K9. It describes the menus and remote control commands for measurements with a power sensor.
All other details about operation can be found in the relevant operating manual.

This software manual consists of the following chapters:

Chapter 1　　　Describes the installation of the application firmware and the power sensor and how to enable the application firmware.

Chapter 2　　　Describes the first operating steps for measurements with a power sensor.

Chapter 3　　　Describes the test setup for measurements with a power sensor.

Chapter 4　　　Contains a detailed description of all functions as a reference for manual operation. The chapter also lists the corresponding IEC/IEEE bus command for each function.

Chapter 5　　　Describes all remote control commands defined for the application firmware. An alphabetic list of all remote control commands and a table containing the IEC/IEEE bus commands assigned to the softkeys are included at the end of the chapter.

Chapter 6　　　Contains the index for this software manual.

1 Installation and Enabling

Installation

Application Firmware R&S FS-K9 is part of the basic firmware of the base unit. The application is available starting with basic firmware version 3.2x.

If the basic firmware has to be updated, start the update with the floppy disks containing the basic firmware by *SETUP → NEXT → FIRMWARE UPDATE*.

Caution:

- *The instrument must be switched off before connecting the power sensor.*
- *The drivers required for controlling the power sensor are installed along with the basic firmware for the analyzer, i.e. the software supplied with the power meter does not have to be installed.*

The R&S NRP-Zx power sensor is connected to the instrument using the R&S NRP USB adapter. For details, refer the operating manual for the R&S NRP-Zx power sensor.

Enabling

Application Firmware R&S FS-K9 is enabled in the *SETUP → GENERAL SETUP* menu by entering a keyword. The keyword is supplied together with the application firmware. If the application firmware is installed at the factory, it will already be enabled.

GENERAL SETUP menu:
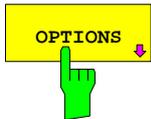
OPTIONS

The OPTIONS softkey opens a submenu in which you can enter the keywords for the application firmware. The existing applications are displayed in a table that opens when you enter the submenu.

INSTALL
OPTION

The *INSTALL OPTION* softkey enables entry of the keyword for application firmware.

If the keyword is valid, the message *OPTION KEY OK* is displayed and the application firmware is entered in the *FIRMWARE OPTIONS* table.

If an invalid keyword is entered, *OPTION KEY INVALID* is displayed.

2 Getting Started

Before you can start measurements, you must adjust the instrument settings to the properties of the device under test. The following procedure is recommended:

1. **Set the spectrum analyzer to its default state.**

   ➢ Press the *PRESET* button.
   The device is now in its default state.

2. **Activate measurements with the power sensor.**

   ➢ Press the *PWR METER* hotkey.
   Measurements with the power sensor will be activated and the menu with the settings for the power sensor will be opened.

3. **Set the frequency**

   ➢ In the default setting, the frequency of the power sensor is coupled with the center frequency of the analyzer, i.e. when the center frequency of the analyzer is set (*FREQ* button), the power sensor is automatically set to the frequency to be measured.

4. **Set the measurement time.**

   ➢ Press the *MEAS TIME* softkey.
   The list of available measurement times is opened.

   ➢ Using the *cursor keys*, select the desired measurement time and confirm with *ENTER*.

5. **Set the unit**

   ➢ Press the *UNIT / SCALE* softkey.
   The list of available units will be opened.

   ➢ Using the *cursor keys*, select the desired unit and confirm with *ENTER*.

Additional setting options are described in the following reference section of the manual.

3 Test Setup for Measurements with Power Sensors

> ***Caution:***
>
> *Before the instrument is put into operation, make sure the following are done:*
>
> - *The instrument cover is on and screwed into place.*
> - *The ventilation openings are unobstructed.*
> - *No signal voltage levels exceed permitted limits.*
> - *The instrument outputs are not overloaded or improperly connected.*
>
> ***Not complying with these precautions may cause damage to the instrument.***

This chapter describes the basic settings for the analyzer for measurements with a power sensor. Before measurements can be started, the analyzer must be correctly configured and powered as described in Chapter 1 of the operating manual for the base unit. Furthermore, Application Firmware R&S FS-K9 must be enabled. Chapter 1 of this manual describes how to install and enable the application firmware.

Standard Test Setup
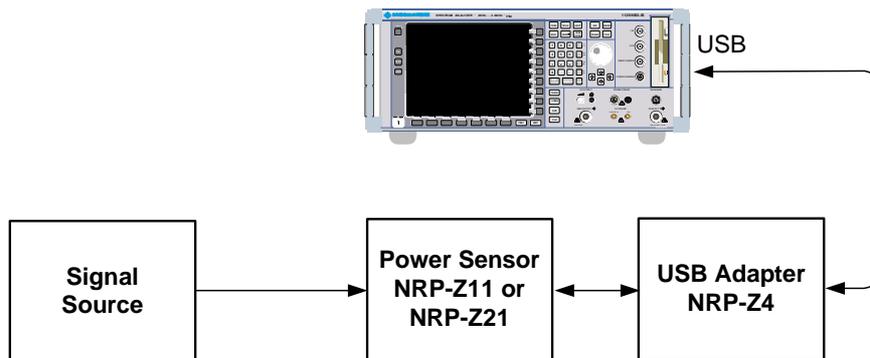
Fig. 3-1   Test setup

4 Configuration of Power Measurement

Application Firmware R&S FS-K9 (measurements with power sensor) is activated with the **PWR METER** hotkey.
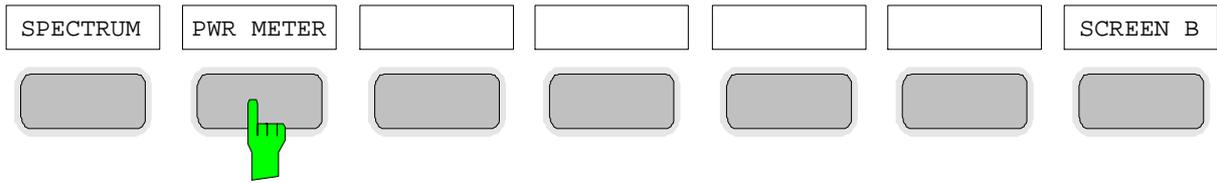
Fig. 4-1 Hotkey bar with Application Firmware R&S FS-K9 enabled
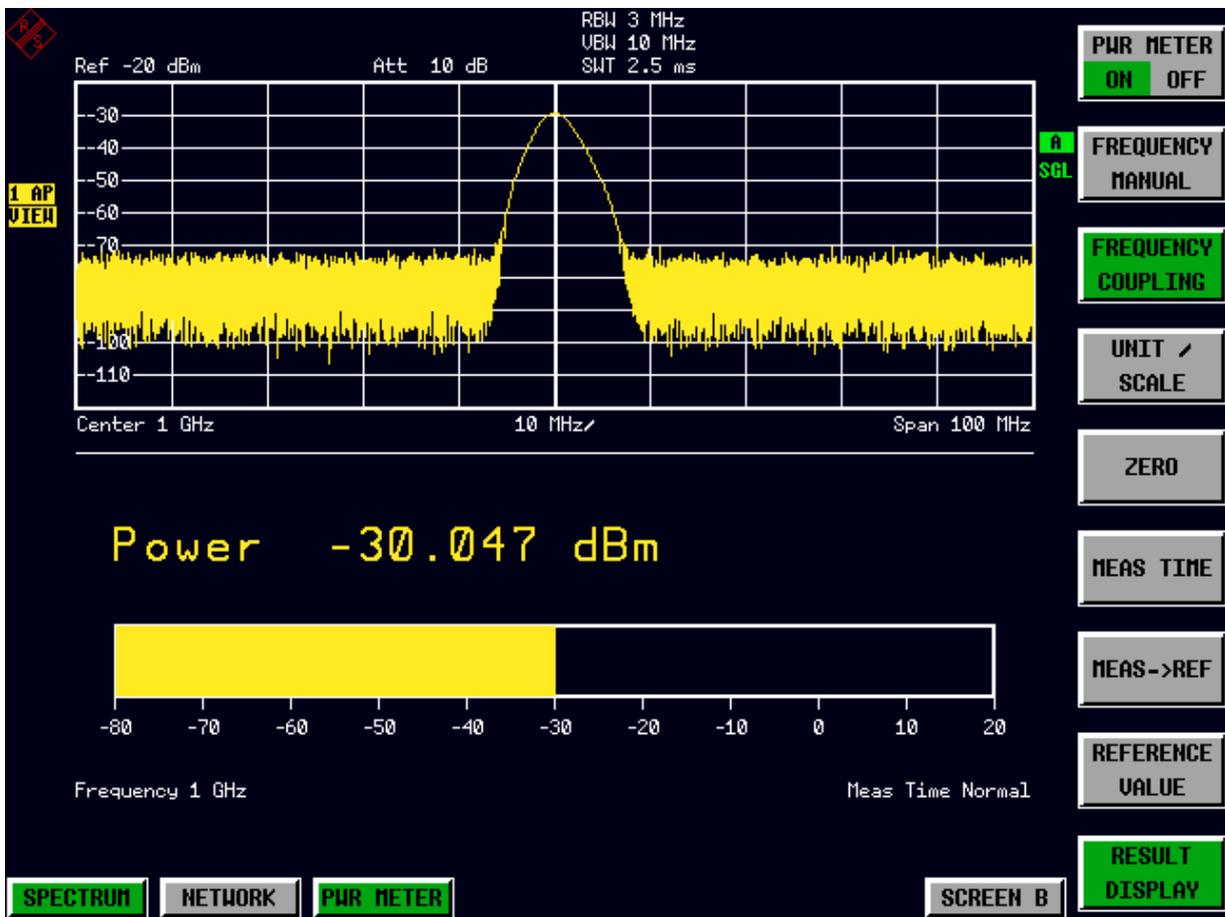
Fig. 4-2   Result display of Application Firmware R&S FS-K9

If the hotkey bar is being used by an application, Application Firmware R&S FS-K9 can also be activated by pressing *SETUP → NEXT → PWR METER*.

The **PWR METER** hotkey opens the menu for configuring the power measurement.

```
PWR METER    →    PWR METER
                  ON    OFF
                  ──────────
                  FREQUENCY
                  MANUAL
                  ──────────
                  FREQUENCY
                  COUPLING
                  ──────────
                  UNIT /
                  SCALE
                  ──────────
                  ZERO
                  ──────────
                  MEAS TIME
                  ──────────
                  MEAS->REF
                  ──────────
                  REFERENCE
                  VALUE
                  ──────────
                  RESULT
                  DISPLAY
```
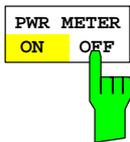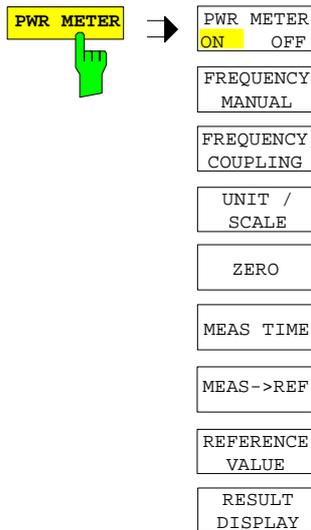
The *PWR METER ON / OFF* softkey switches the power measurement on or off.

IEC/IEEE bus command: [SENS:]PMET[:STAT] ON

The *FREQUENCY MANUAL* softkey opens the data entry field for the frequency of the signal to be measured.

The power sensor has a memory with frequency-dependent correction factors. This allows extreme accuracy for signals of a known frequency.

IEC/IEEE bus command: [SENSe:]PMET:FREQ 1GHZ
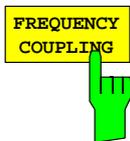
The *FREQUENCY COUPLING* softkey activates automatic coupling of the frequency to the center frequency of the instrument or to marker 1.
A list is used to make a selection. It is opened by pressing the softkey.

```
FREQUENCY COUPLING
√ CENTER
  MARKER 1
```

IEC/IEEE bus command: [SENS:]PMET:FREQ:LINK CENT
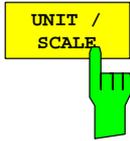
UNIT / SCALE

The *UNIT / SCALE* softkey opens a list for selecting the unit with which the measured power is to be displayed.

```
UNIT / SCALE
√ dBm
  dB
  Watt
  %
```
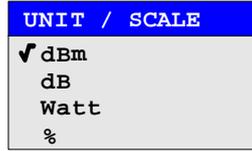
If dB or % is selected, the display is relative to a reference value that is defined with either the *MEAS→REF* softkey or the *REFERENCE VALUE* softkey.

IEC/IEEE bus command: UNIT:PMET:POW DBM
                             UNIT:PMET:POW:RAT DB
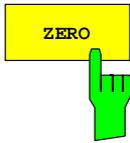
ZERO

The *ZERO* softkey starts zeroing of the power sensor.

Before zeroing starts, the user is prompted to disconnect all signals from the input of the power sensor.

```
ZEROING POWER SENSOR
Before zeroing the power
sensor, please remove all
signals from the sensor input.
CONTINUE        CANCEL
```
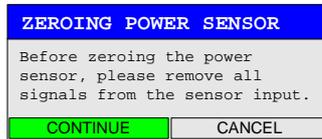
During zeroing, the following message appears:

```
ZEROING POWER SENSOR
Zeroing power sensor, please
wait...
           CANCEL
```

When zeroing is complete, the following message appears:

```
ZEROING POWER SENSOR
Power Sensor Zero OK.

             OK
```
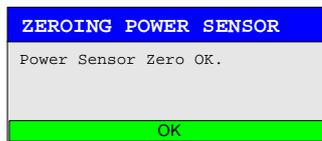
It disappears after approx. 3 seconds.

IEC/IEEE bus command: CAL:PMET:ZERO:AUTO ONCE;*WAI

MEAS TIME

The *MEAS TIME* softkey opens a list in which the measurement can be set. Results are more stable with longer measurement times, particularly if signals with lower power are measured.

```
MEAS TIME
√ SHORT
  NORMAL
  LONG
```
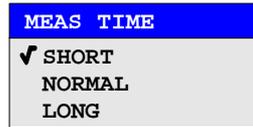
Stationary signals with high power (>-40dBm) require only a short measurement time to yield stable and exact results. In this case, the *SHORT* setting is recommended because it provides the highest repetition rates.

The *NORMAL* setting increases the stability of the displayed results for the measurement of signals with lower power or of modulated signals.

The *LONG* setting is recommended for signals at the lower end of the measurement range (<-50 dBm). This setting can be used to minimize the influence of noise.

IEC/IEEE bus command: `[SENS:]PMET:MTIM LONG`
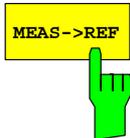
MEAS->REF

The *MEAS→REF* softkey is used to obtain the currently measured power as a reference value for the relative display.

The reference value can also be set manually via the *REFERENCE VALUE* softkey.

IEC/IEEE bus command: `CALC:PMET:REL[:MAGN]:AUTO ONCE`
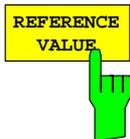
REFERENCE VALUE

The *REFERENCE VALUE* softkey activates manual entry of a reference value for relative measurements in the unit dBm.

IEC/IEEE bus command: `CALC:PMET:REL[:MAGN] –30DBM`

RESULT
DISPLAY

The *RESULT DISPLAY* softkey switches the result display of the power measurement on or off. If the display is switched off, the measured power appears in the Marker Info field.

Note: *The softkey is available only in the spectrum analysis mode as long as the lower half of the screen is not already being used for another result display (e.g. ACP measurement).*
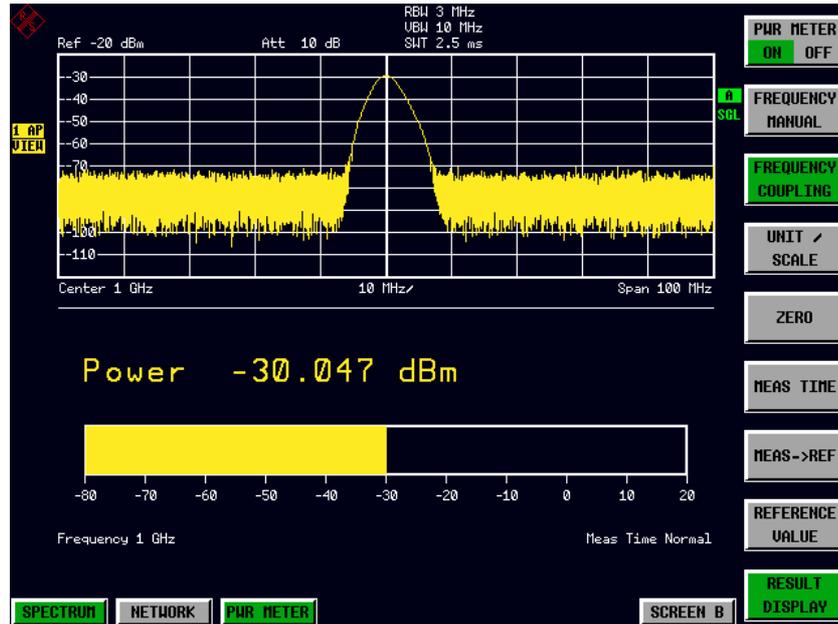
Fig. 4-3   Result display with *RESULT DISPLAY ON*
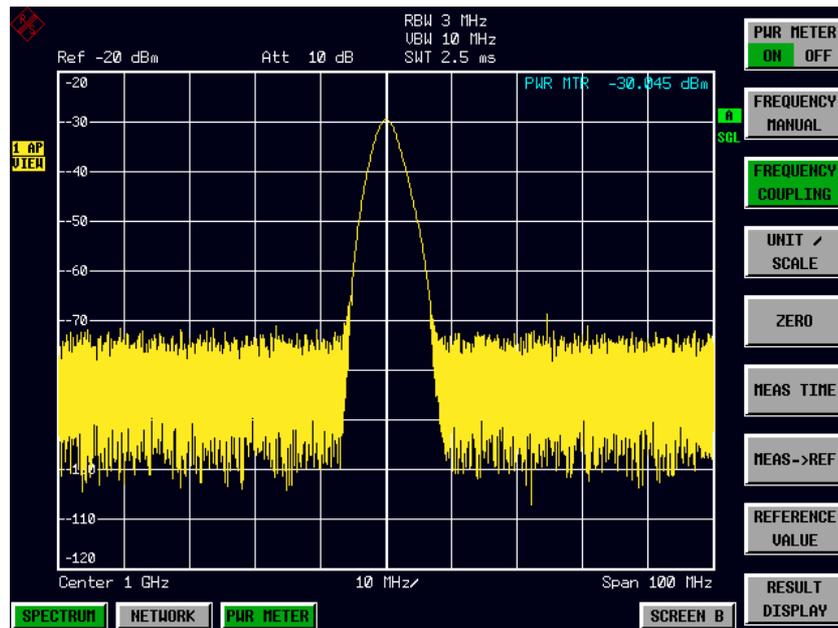
Fig. 4-4   Result display with *RESULT DISPLAY OFF*

IEC/IEEE bus command: DISP[:WIND]:PMET:STAT OFF

5 Remote Control Commands

This chapter describes the remote control commands for the application firmware. An alphabetic list following the text of the manual provides a quick overview of the commands.

The commands that also apply to the base unit in the *SPECTRUM* mode and the system settings are described in the operating manual for the analyzer.

Common Commands

Command	Parameters	Comment
*OPT?		Option Identification Query; query only

*OPT?

  OPTION IDENTIFICATION QUERY polls the options contained in the device and returns a list of installed options. The options are separated by commas. The identifier for option R&S FS-K9 is contained in the response string at position 34:

Example:
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,K9,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

CALCulate:PMETer Subsystem

This subsystem controls the settings of the instrument for measurements with a power sensor. The measurement window is selected via CALCulate1 (SCREEN A) and CALCulate2 (SCREEN B).

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
:PMETer			Option K9
:RELative			
[:MAGNitude]	<numeric_value>	dBm	
:AUTO	ONCE		
:STATe	<Boolean>		

CALCulate<1|2>:PMETer:RELative[:MAGNitude] -200 to 200

This command sets the reference value for relative measurements.

Example:	`":CALC:PMET:REL –30"`	' sets the reference value for relative measurements to –30 dBm
Properties:	*RST value: 0 SCPI: device-specific	
Mode:	PSM	

CALCulate<1|2>:PMETer:RELative[:MAGNitude]:AUTO ONCE

This command accepts the current result as a reference value for relative measurements.

Example:	`":CALC:PMET:REL:AUTO ONCE"`	'accepts the current result as a reference value for relative measurements
Properties:	*RST value: - SCPI: device-specific	
Mode:	PSM	

CALCulate<1|2>:PMETer:RELative:STATe ON | OFF

This command switches between relative and absolute display of the result.

Example:	`":CALC:PMET:REL:STAT ON"`	' activates relative display of the result
Properties:	*RST value: OFF SCPI: device-specific	
Mode:	PSM	

CALibration Subsystem

The commands of the CALibration subsystem determine the data for system error correction in the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
CALibration			
:PMETer			Option K9
:ZERO			
:AUTO	ONCE	--	no query

CALibration:PMETer:ZERO:AUTO ONCE

This command zeroes the power sensor.

Example: `":CAL:PMET:ZERO:AUTO ONCE;*WAI"`   ' zeroes the power sensor and waits until zeroing is completed before executing additional commands

Properties: *RST value: -
SCPI: device-specific

Mode: PSM

DISPlay Subsystem

The DISPlay subsystem controls the selection and presentation of text and graphics information as well as measurement data on the screen.
The measurement window is selected via WINDow1 (SCREEN A) or WINDow2 (SCREEN B).

COMMAND	PARAMETERS	UNIT	COMMENT
DISPlay			
[:WINDow<1|2>]			
:TRACe<1...3>			
:Y			
[:SCALe]			
:RLEVel		DB	
:OFFSet	<numeric_value>		Option K9
:PMETer		--	
:STATe	<Boolean>		

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel:OFFSet −200 dB to 200 dB
    This command defines the reference level offset in the selected measurement window. Depending on the coupling of the measurement windows, this command is valid for both screens (`INSTrument:COUPle ALL`) or only for the selected measurement window (`INSTrument:COUPle NONE`).
    The numeric suffix under TRACe <1...3> is irrelevant.
    Example: `"DISP:WIND1:TRAC:Y:RLEV:OFFS -10dB"`
    Properties: *RST value: 0dB
                           SCPI: compliant
    Mode: A, GSM/EDGE, PSM

:DISPlay[:WINDow<1|2>]:PMETer:STATe ON | OFF

    This command switches bargraph display on or off for measurements with a power sensor. If bargraph display is switched off, the measurement value appears in the Marker Info field.

    Example: `"DISP:PMET:STAT OFF"`   ' switches bargraph display off

    Properties: *RST value: ON
                        SCPI: device-specific

    Mode: PSM

FETCh:PMETer Subsystem

This subsystem contains the commands for outputting the results of the measurements with a power sensor without starting the measurement itself.

COMMAND	PARAMETERS	UNIT	COMMENT
FETCh<1|2>			Option FS-K9
:PMETer?	--	--	query only

FETCh<1|2>:PMETer?

This command outputs the result of the power sensor.

Example: `"FETC:PMET? "`   'outputs the result of the power sensor

Properties: *RST value: -
            SCPI: device-specific

Mode: PSM

If no measurement has been carried out yet, a query error is triggered. This command is strictly a query and thus does not have a *RST value.

INITiate Subsystem

The INITiate subsystem is used to control the measurement sequence in the selected measurement window. The measurement window is selected using INITiate1 (SCREEN A) and INITiate2 (SCREEN B) .

COMMAND	PARAMETERS	UNIT	COMMENT
INITiate<1|2>			
:CONTinuous	<Boolean>	--	
[:IMMediate]	--	--	no query

INITiate<1|2>:CONTinuous   ON | OFF

This command determines whether the device performs measurements continuously ("Continuous") or only individual measurements ("Single").

In the spectrum analysis mode, this setting refers to the sweep operation (switchover between Continuous and Single Sweep).

Example:	`"INIT2:CONT OFF"`	'switches operation in screen B to Single Sweep
	`"INIT2:CONT ON"`	'switches operation to Continuous Sweep

Properties:	*RST value:	ON
	SCPI:	compliant
Mode:	all	

INITiate<1|2>[:IMMediate]

This command starts a new measurement sequence in the specified measurement window.

This command starts a new measurement sequence (sweep) in the specified measurement window. A sweep count > 0 or average count > 0 means the number of specified measurements will be restarted. In the case of the trace functions MAXHold, MINHold and AVERage, the previous results are reset when the measurement is restarted.
In the Single Sweep mode, the commands *OPC, *OPC? or *WAI can be used to perform synchronization with the end of the specified number of measurements. In the Continuous Sweep mode, synchronization with the end of the sweep is not possible because the entire measurement "never" actually ends.

Example:	`"INIT:CONT OFF"`	'switches to Single Sweep mode
	`"DISP:WIND:TRAC:MODE AVER`	'activates Trace Averaging
	`"SWE:COUN 20"`	'sets the sweep counter to 20 sweeps
	`"INIT;*WAI"`	'starts the measurement by waiting for the end of 20 measurements

Properties:	*RST value:	-
	SCPI:	compliant
Mode:	all	

This command is an "event" and thus has neither a *RST value nor a query.

READ:PMETer Subsystem

This subsystem contains the commands for starting measurements with a power sensor and outputting the results.

COMMAND	PARAMETERS	UNIT	COMMENT
READ<1|2>			Option FS-K9
:PMETer?	--	--	query only

READ<1|2>:PMETer?

This command triggers a measurement with the power sensor and then outputs the result.

Example: `"READ:PMET? "`   ' starts a measurement and output the result

Properties: *RST value: -
                 SCPI: device-specific

Mode: PSM

 This command is strictly a query and thus does not have a *RST value.

SENSe:PMETer Subsystem

This subsystem controls the settings of the instrument for measurements with a power sensor. The measurement window is selected via SENSe1 (SCREEN A) and SENSe2 (SCREEN B).

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:PMETer			Option FS-K9
[:STATe]	<Boolean>		
:FREQuency	<numeric_value>	Hz	
:LINK	CENTer	MARKer1	OFF		
:MTIMe	SHORT	NORMAL	LONG		

[SENSe<1|2>:]PMETer[:STATe] ON | OFF

This command switches measurements with a power sensor on or off.

Example: `"PMET ON"`   ' switches measurements with a power sensor on

Properties: *RST value: OFF
                     SCPI: device-specific

Mode: PSM

[SENSe<1|2>:]PMETer:FREQuency f_{min} to f_{max}

This command sets the frequency of the power sensor.
The limit values f_{min} and f_{max} are set by the power sensor that is connected.

Example: `"PMET:FREQ 1GHZ"`   ' sets the frequency of the power sensor to 1 GHz

Properties: *RST value: 50 MHz
                     SCPI: device-specific

Mode: PSM

[SENSe<1|2>:]PMETer:FREQuency:LINK CENTer | MARKer1 | OFF

This command sets the coupling for the frequency of the power sensor.

Parameter: CENTer   couples the frequency to the center frequency of the analyzer
                     MARKer1   couples the frequency to the position of marker 1
                     OFF   deactivates the coupling of the frequency

Example: `"PMET:FREQ:LINK CENT"`   ' couples the frequency to the center
                                                 frequency of the analyzer

Properties: *RST value: CENT
                     SCPI: device-specific

Mode: PSM

[SENSe<1|2>:]PMETer:MTIMe SHORt | NORMal | LONG

This command determines the measurement time of the power sensor.

Example: `"PMET:MTIM SHOR"`   ' selects the short time for the measurement of
                                                     stationary signals with high power

Properties: *RST value: NORM
                     SCPI: device-specific

Mode: PSM

UNIT Subsystem

The Unit subsystem is used to switch the basic measurement unit of setting parameters. In split-screen display, a distinction is made between UNIT1 (SCREEN A) and UNIT2 (SCREEN B).

COMMAND	PARAMETERS	UNIT	COMMENT
UNIT<1|2>			
:PMETer:			Option FS-K9
:POWer	DBM | WATT | W		
:RATio	DB | PCT		

UNIT<1|2>:PMETer:POWer   DBM | WATT | W

This command selects the unit for absolute measurements with a power sensor.

Example: `"UNIT:PMET:POW DBM"`

Properties: *RST value: DBM
SCPI: compliant

Mode: PSM

UNIT<1|2>:PMETer:POWer:RATio   DB | PCT

This command selects the unit for relative measurements with a power sensor.

Example: `"UNIT:PMET:POW DB"`

Properties: *RST value: DB
SCPI: compliant

Mode: PSM

Table of Softkeys with Assignment of IEC/IEEE Bus Commands

PWR METER Hotkey

PWR METER ON OFF	`[SENSe<1	2>:]PMETer[:STATe] ON	OFF`
FREQUENCY MANUAL	`[SENSe<1|2>:]PMETer:FREQuency:LINK OFF` `[SENSe<1|2>:]PMETer:FREQuency` f_{min} `..` f_{max}
FREQUENCY COUPLING	`[SENSe<1	2>:]PMETer:FREQuency:LINK CENTer	MARKer1`
UNIT / SCALE	`CALCulate<1|2>:PMETer:RELative:STATe ON	OFF` `UNIT<1|2>:PMETer:POWer DBM	WATT	W` `UNIT<1|2>:PMETer:POWer:RATio DB	PCT`
ZERO	`CALibration:PMETer:ZERO:AUTO ONCE`
MEAS TIME	`[SENSe<1	2>:]PMETer:MTIMe SHORt	NORMal	LONG`
MEAS→REF	`CALCulate<1|2>:PMETer:RELative[:MAGNitude]:AUTO ONCE`
REFERENCE VALUE	`CALCulate<1|2>:PMETer:RELative[:MAGNitude] -200 to 200`
RESULT DISPLAY	`DISPlay[:WINDow<1	2>]:PMETer:STATe ON	OFF`

AMPL Key

REF LEVEL OFFSET	`DISPlay[:WINDow<1|2>]:TRACe:Y[:SCALe]:RLEVel:OFFSet  -200dB to 200dB`

SWEEP Key

CONTINUOUS SWEEP	`INITiate<1|2>:CONTinuous ON`
SINGLE SWEEP	`INITiate<1|2>:CONTinuous OFF` `INITiate<1|2>[:IMMediate]`

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