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USER MANUAL: USB Power Sensor PS310

Introduction

Power sensor PS310 is a thermally stabilized radio frequency CW power detector with USB connectivity, 3-GHz bandwidth and 50-dB dynamic range. The power is detected with internal logarithmic power detector. Measured data is displayed via USB and virtual COM port. Power sensor PS310 is USB powered device and does not require any external power supply.

The accuracy of the power probe PS310 is ± 0.1 dB and uncertainty better than 0.3 dB. This is valid for the frequency range from 10 MHz to 3 GHz and input power from -40 dBm to +10 dBm. Temperature coefficient is 0.008 dB/K. To achieve this very low temperature coefficient, environmental temperature has to be between 10°C and 40°C.

PS310 is enclosed in a high quality aluminium enclosure (sized 100 x 44 x 20 mm). RF input connector is of type SMA female with included high grade SMA male-to-male adapter. PS310 is calibrated with SMA male-to-male adapter.

Different acquisition types, averaging and running averaging are implemented and are user-definable via a command-line interface (CLI). Command line interface enables compatibility with instrument control software. PS310 sampling rate is 800 Sa/s.

Virtual COM port

To use and control power sensor PS310, a personal computer, mobile device or similar with USB port (2.0 or higher) is required. Drivers for serial-to-USB converter are available here:

<http://www.ftdichip.com/Drivers/VCP.htm>

PS310 can be controlled via any serial terminal, such as RealTerm, PuTTY, CuteCom and Serial USB Terminal for example.

Due to the power sensor PS310's feature of using a virtual COM port and simple command line interface, the integration with an instrument control software is easy. No additional libraries are needed.

Serial port on power sensor PS310 uses the following settings:

Baudrate: 115200
Data bits: 8
Stop bit: 1
Parity: None
HW flow control: None

Detailed information regarding the command line interface may be found in the next chapter.

Command line interface

PS310 Command list:

PWR (PoWeR)

Prints out last valid power acquisition in [dBm]. Turns off logging. Sets RAVG to 1.

ACQ (ACQuisite)

Starts acquisition and prints out the power when valid in [dBm]. Turns off logging. Sets RAVG to 1.

LOG (LOGging)

Toggles logging. Logging periodically prints out power in [dBm]. Time interval is set by acquisition averaging. See the AVerAGe command.

LON (LoggingON)

Turns on logging. Logging periodically prints out power in [dBm]. Time interval is set by acquisition averaging. See the AVerAGe command.

LOFF (LoggingOFF)

Turns off logging. Power is acquired silently, but not printed out. Use PWR to print out the last valid power.

AVG (AVerAGe) <no_of_samples>

Set the number of samples to be averaged in one acquisition. Data is sampled with 800 samples per second. Minimum AVG value is 1, maximum is 8000. If no parameter is entered, the command prints out the current value of AVG.

RAVG (RunningAVerAGe) <no_of_acquisition_samples>

Set the number of acquisition samples to be used by an overlay running average. This does not change the AVG in anyway as RAVG is calculated from the data provided by averaging samples (AVG). Minimum RAVG value is 1 (default), maximum is 200. If number of valid samples is lower than the RAVG value, only valid samples are averaged (only true when time since sensor powered up is less than complete RAVG cycle - $RAVG \times AVG / 800$ [s]). If no parameter is entered the command prints out the current value of RAVG.

FREQ (FREQuency) <frequency_in_MHz>

Set the frequency in [MHz] of the measured signal. Valid inputs are from 10 MHz to 3000 MHz rounded to 1 MHz. If no parameter is entered, the command prints out the current value of FREQ.

H (HeLp)

Prints out help (this output)

SN (SerialNumber)

Prints out serial number.

Note: Carriage return <CR> or line feed <LF> must be used after command input.

Data acquisition and sampling rate

In general there are two modes of measuring RF power with the PS310 Power Sensor:

1. Power on request mode
2. Continuous acquisition mode

Power on request mode

In this mode user can select between two acquisition commands; PWR (PoWeR) or ACQ (ACQuisite), and sets the number of samples to be averaged with the AVG (AVerage) command.

PWR command returns last power acquisition where ACQ command returns the next valid acquisition. A running average option is disabled in this mode (RAVG is set to 1).

Sampling rate of the digital acquisition system is fixed to 800 samples per second (Sa/s). When averaging is applied (AVG command), the time until data becomes valid is increased accordingly. See figure 1 for more information.

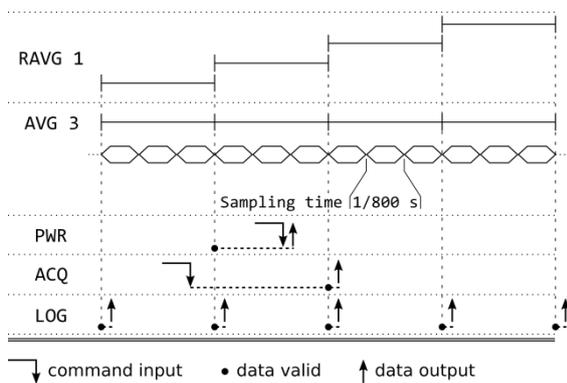


Figure 1: Acquisition options when running average is disabled; RAVG is 1, AVG is 3. User can select between PWR and ACQ commands in the power on request mode or LOG command in the continuous acquisition mode. An output data interval is ready every $3/800$ s.

Continuous acquisition mode

In this mode user can operate with LOG (LOGging) command, which periodically prints out power. Sampling rate of the digital acquisition system is also fixed to 800 samples per second (Sa/s) and the output data rate is defined by acquisition averaging (AVG command). A running average option (RAVG) can be used in this acquisition mode. See figure 2 for more information.

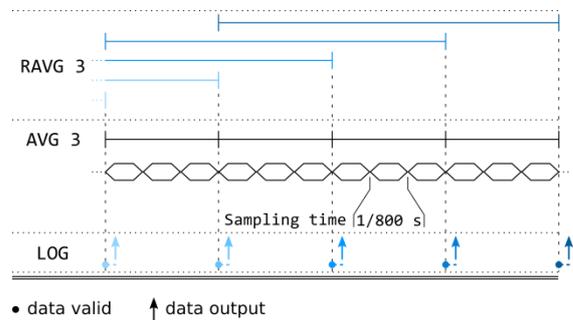


Figure 2: Acquisition option when running average is enabled; RAVG is 3, AVG is 3. User can use LOG command in continuous acquisition mode. Data output interval is still ready every $3/800$ s but each measurement result is averaged over 3 previous intervals (RAVG is 3).

Examples

When USB power sensor PS310 is connected to a computer via USB port and drivers for FTDI USB-to-serial converter are installed, user may control PS310 with a serial terminal (e.g. PuTTY).

Firstly, user has to set the frequency. If the frequency of measured signal is 1530 MHz, user writes the following command:

FREQ 1530

Command has to be sent with a carriage return <CR> or a line feed <LF> character. To read the power of the applied signal, the **Power** command is used:

PWR

After the command is sent, PS310 returns the last valid measurement immediately. User can choose an averaging value with the **AVerage** command. For example:

AVG 400

In this case, 400 measurement values will be averaged. Because the sampling rate is 800 Sa/s, the measurement itself lasts 0.5 s. If the **Power** command is used more often than the duration of a measurement time, the PS310 will return the same result. Furthermore, to read power the **ACQuisite** command is available:

ACQ

When power sensor PS310 receives this command, it starts the acquisition process. The time duration depends on the averaging time.

User can also set the power sensor to return the measurement values periodically:

LON

When the command **LoggingON** is sent, power sensor returns the measured value each cycle (the length of the cycle depends on averaging factor). If averaging is set to 400, PS310 will print the power value every 0.5 s. If a different interval is needed, the averaging factor must be changed. When the averaging factor is set to e.g. 800, measurements will be printed each second.

When logging is used, user can also set the running average. For example, 10:

RAVG 10

The **RunningAVerage** command works only with logging turned on. For more commands, please see chapter *Command line interface*.

Example 1: Power logging with instrument control software

If PS310 is connected to a signal source with known frequency and its power must be measured periodically, the command sequence can be as follows:

FREQ 2951 (*set the frequency*)

AVG 800 (*set averaging*)

Loop [every 2 seconds]:

PWR (*measure power*)

End Loop

The upper example gets power information from the PS310 every 2 s. Averaging is set to 800 and one power measurement takes 1 s.

Example 2: Using PS310 in a control loop

Should the frequency and power change continuously, the necessary command sequence is as follows:

AVG 100 (*set averaging*)

Loop

```
F_data=signal_frequency  
(read frequency with frequency counter)  
FREQ F_data (set PS310 frequency)  
ACQ (measure power starting now)
```

End Loop

In this example, averaging is set to 100. This means that when ACQ command is sent, power sensor PS310 will start the acquisition process. Due to averaging factor setting of 100, the acquisition process takes between 125 ms and 250 ms.

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