This application note discusses the Power Detector's applications/uses and calculation of power in dBm and dBuV.

RFME Power Detector can detect signals from 1MHz to 10 GHz with an impressive 55 dB dynamic range with less than ± 1 dB error and is capable of accurately converting RF input signals to a corresponding decibel-scaled output. The Maximum RF input that can be given is +7dBm. It has been observed that test engineers generally do not have access to various expensive Radio frequency (RF) test equipment. This leads to a lack of verification. As a result, the manufactured device exhibits poor range of features that could not be avoided because the design itself has various problems.

RFME power detector can be used in various communication test setups for either measurement or controller modes. They are portable, cost effective and comply with the necessary quality standards. The devices display their measured results in dBm and dBuV (can be selected from front panel).

These small devices are used for monitoring emissions, detecting interference or locating miniature transmitters. The power detector can be used in combination with other antennas. It is an essential instrument for all radio monitoring tasks along with its favorable price/performance ratio. The RFME power detector is ideal for use in places that cannot be accessed with a vehicle. On a single battery charge it can operate for up to 8 to 10 hours.

dB/ dBm/ dBuV:

dB is denoted for decibel. dB is the ratio of input signal to the output signal level. It is used for various RF devices like splitters, combiners, amplifiers, directional couplers, etc.

dBm gives the signal in miliwatt. dBuV gives the signal in microvolt. These units are used for RF devices which are having resistance of 50 Ohms.

Sample calculations to convert from dBm to dBuV in a 50 Ohms system:

Value in dBm + 107dB = Value in dBuV

Power conversion formulae:

Power in dBm (P_{dBm}) to Power in miliwatt (P_{mW}):

- P_{dBm} = 10 ^ (PmW / 10)
- e.g. P_{dBm} = -20dBm, then P_{mW} = 10 ^ (-20/10) = 0.01mW

Power in milliwatts (P_{mW}) to Power in watts (PW):

- PW = P_{mW} / 1000
- e.g. P_{mW} = 0.01mW, then PW = 0.01/1000 = 0.00001

Power in watts to voltage RMS (V_{Rms}):

- V_{Rms} = Square Root (Power Watts * System Zo) where System Zo = 50 Ohms
- e.g. PW = 0.00001W, then V_{Rms} = Square Root (0.00001 * 50) = 0.02236

V_{Rms} to Power in dBuV (P_{dBuV}):

- P_{dBuV} = 20 * Log (V_{Rms} / 1uV)
- e.g. V_{Rms} = 0.02236, then P_{dBuV} = 20 * Log (0.02236 / 1E-6) = 87dBuV

For, 50 Ohm System -20dBm = 87 dBuV, or equivalently P_{dBuV} = P_{dBm} + 107.

Table for dBm/dBuV/Watts:

dBm	dBuV	Watts
0	107	0.001
3	110	0.002
6	113	0.004
10	117	0.01
20	127	0.1
30	137	1
40	147	10
50	157	100

In order to shift the dynamic range of the Power Detector on either side of the signal level, what can be done?

- Have an amplifier in the design.
- Add an attenuator in the design.

In order to shift the dynamic range of the RFME Power Detector. Additional circuitry is needed. The operating range of RFME Power Detector is -50 dBm to 0 dBm which is 50 dB dynamic range. Thus if the user wants to go above 0dBm of output than an attenuator is needed to be added at the output and on the other hand if the user wants to go lower than -50dBm than an amplifier is required to be added at the output.

The RFME Power Detector can be used as power meters with some additional circuitry. They can also be used as a RF transmitter power amplifier linearization and gain/power control, power monitoring in radio link transmitters, antenna manufacturing (gain measurement), for monitoring VSWR with the use of directional couplers, RSSI measurement in base stations, WLAN, WiMAX, radar applications, testing of shielding effectiveness, RF transmitter PA set point control and level monitoring, EMC test laboratories and scientific equipment manufacturing.

RFRx Power Detector

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