Estimating Minimum Power for a Power Meter and Detector System

One of the most common questions received regarding power meters and low power detectors is "What is the lowest power reading resolvable by my power meter?" In most cases, the information that is actually being sought is the lowest resolvable power of a power meter and detector system.

In Tech Note #4 the question of the lowest reading obtainable by a power meter and how to calculate it is discussed. In most cases the power meter is capable of displaying or resolving a much lower measurement than can be obtained with the detector head being used. Now we will consider the combined system of detector and power meter.

In order to perform the calculation you must first determine the NEP (Noise Equivalent Power) of the detector head. This value is usually given in $W/\sqrt{Hz}$, and has been specified for you. You can find the NEP on the specification page of the manual supplied with your detector, in the Newport on-line or paper catalog, or in the table provided at the end of this note.

You will also need to determine the bandwidth of the power meter in its lowest range setting. Again, this information can be found in the specifications section of the manual for the power meter and is often given in terms of the type of measurement to be made, eg. DC Continuous, Peak to Peak, or Pulsed. Power meter manuals are available on-line or by request from an Applications Engineer.

Plugging these values into the following formula will give you a minimum value that will be within the noise floor of the system.

Minimum Power $_{\text{noise floor}}$ = (NEP) $\sqrt{(B)}$

where,

NEP =detector noise equivalent power in $W/\sqrt{Hz}$
B = bandwidth of lowest range setting on power meter in Hz

In order to approximate a more realistic value that can be seen above the noise floor of the system, multiply the result by 10. This will give a minimum power value that has a good margin of signal to noise ratio. Then compare this value with that of the actual resolution capability of the power meter.

Use whichever value is higher.

Below is a table listing the DC continuous bandwidth for the lowest range setting for many of Newport Corporations current and legacy power meters, as well as minimum power resolution capability of the power meters. A table of NEP values for the 818-, 918- and 918D-series low power detectors is also shown.

Power Meter	Bandwidth (Hz)	Minimum Power Resolution
1815-C	10	20 nW
1825-C	150	50 pW
1830-C	45	100 fW
1835-C / 2835-C	80	100 fW
2832-C	80	100 fW
1930-C	1.2	1 pW
1931-C / 2931-C	1.2	11 fW
1935-C /2935-C	480	1 pW
1936-C / 2936-C	1.2	11 fW
1916-C	16	5.3 pW
1918-C	480	11 pW
840-C	--	100 pW*
841-P-USB	2.6	1 nW
841-PE	16	5.3 pW
842-PE	16	5.3 pW

* lowest possible power obtainable for all Newport low power detectors used with this meter

NEP values for 818-, 918-, and 918D-series Low Power Detectors

	NEP by Material Suffix (pW/$\sqrt{Hz}$)			
	UV	SL	IR	IG
Detector Series				
818	0.89	0.55	0.7	0.03
918	20 fW/√Hz	20 fW/√Hz	9	20 fW/√Hz
918D	0.89	0.55	0.7	0.03

NEP values for wand detectors

Detector	NEP (pW/$\sqrt{Hz}$)
818-ST	0.015
818-ST-UV	0.018

NEP values for universal fiber detectors

Detector	**NEP** (pW/$\sqrt{Hz}$)
818-IS-1	3
918D-IS-1	3
918D-IS-SL	3
918D-IS-IG	3