

Averaging Power Readings in dBm

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When making power measurements with a spectrum analyzer it is often helpful to average several readings together to reduce the differences in readings due to their noisy nature. Often power readings are presented not in watts but dBm (decibels relative to a milliwatt). Readings in dBm should not be averaged together but should first be converted to power – averaged, and then converted back into dBm. The following example illustrates the difference in averaging methods

Method 1 – averaging in dBm

Consider 3 readings in dBm. -80, -75 and -70. If we take the average in dBm we get -75.

Method 2 - Converting first to power and taking the average and converting back into dBm we get the proper answer.

$$10^{(-80/10)} + 10^{(-75/10)} + 10^{(-70/10)} = (1\text{E-}8) + (3.2\text{E-}8) + (1\text{E-}7) = 1.42\text{E-}7$$

$$\text{And averaging} = (1.42\text{E-}7)/3 = 4.7\text{E-}8$$

$$\text{Converting back to dBm} = 10 * \text{Log} (4.7\text{E-}8) = \mathbf{-73.248 \text{ dBm}}$$