Measuring signals using the Spectrum Analyzer: Calculating input voltage

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- The spectrum analyzer has an input impedance of 50 Ω
- Given a power measurement in dBm we can determine the corresponding input voltage
- Example:

A radio receives a sinusoidal signal of average power -70 dBm and its input port has impedance equal to 50 Ω. What is the peak-to-peak voltage A_{pp} across the input port?

The received power is $10\log_{10}(P_R) = -70$ dBm. Therefore:

$$P_R = 10^{-70/10}\ \mathrm{mW} = 10^{-7}\ \mathrm{mW}.$$

The rms voltage across the input port is obtained as follows:

$$P_R = \frac{A_{\mathrm{rms}}^2}{50} = 10^{-10}\ \mathrm{W} \longrightarrow A_{\mathrm{rms}} = \sqrt{50 \times 10^{-10}} = 70.71\ \mu\mathrm{V}.$$

It follows that the peak-to-peak voltage is

$$A_{pp} = 2\,A = 2\left(\sqrt{2}A_{\mathrm{rms}}\right) = 200\ \mu\mathrm{V},$$

where A is the amplitude of the received sinusoidal signal.

- In some experiments, you are required to change the circuit input voltage so that the measured power changes by certain amount Δ dB.
- You will need to use $10^{\Delta/20}$ as a factor
- Example: If the current input voltage is $V_c = 5$ V and a change in power by -1 dB is required, the new input voltage V_n is computed as follows: $\Delta = -1$ dB and

$$V_n = V_c \times 10^{\Delta/20} = 5 \times 10^{-1/20} = 4.456 \text{ V}$$