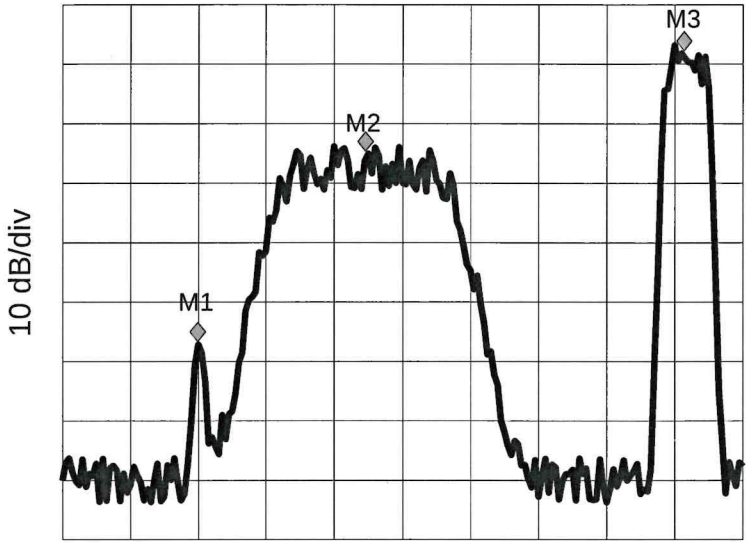
Exercise n. 3

Consider a swept-frequency spectrum analyser having the following specifications:

a) frequency range: from 10 kHz to 6 GHz;
b) input impedance: 50 Ω;
c) *resolution bandwidth* ($B_R = 2B_{-3dB}$): variable from 100 Hz to 10 MHz in steps, according to the sequence 1-3-10 (that is, 100 Hz, 300 Hz, 1kHz, … etc.);
d) selectivity (B_{-60dB}/B_{-3dB}) = 15;
e) $ENBW/B_R$ = 1.4.



Measurement set-up is:

- centre frequency: 780 MHz;
- frequency span: 200 MHz;
- resolution bandwidth B_R = 1 MHz.

The trace reported in the figure refers to the analysis of three signals, indicated by the three cursor positions M1, M2, M3:

- **position M1**: **sinusoidal** component, indicated value -76 dBm;
- **position M2**: **continuous spectrum** component, indicated value -45.3 dBm;
- **position M3**: **continuous spectrum** component, indicated value -28.6 dBm.

a) determine the value of RMS voltage for the sinusoidal component;
b) determine the power spectral density, in dBm/Hz, of each continuous spectrum component;
c) calculate total signal power and indicate the value in a suitable sub-multiple of W.

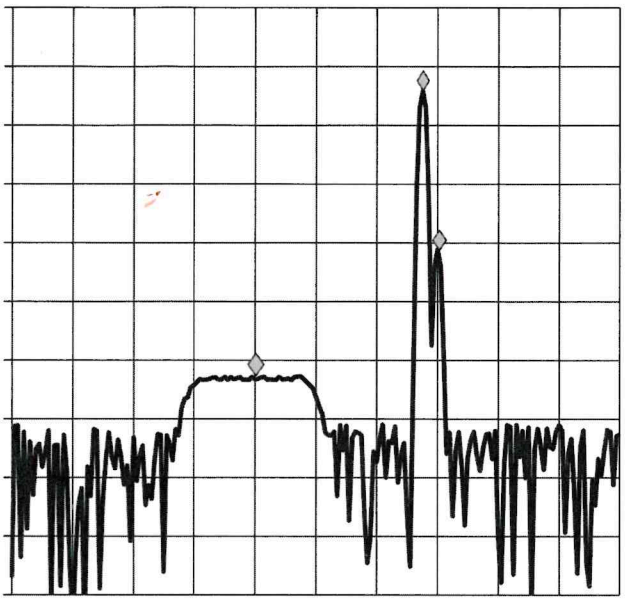
TIME TO COMPLETE: 90 minutes

Exercise n. 3

Consider a swept-frequency spectrum analyser having the following specifications:

a) frequency range: from 10 kHz to 6 Ghz;
b) input impedance: 50 Ω;
c) *resolution bandwidth* ($B_R = 2B_{-3dB}$): variable from 100 Hz to 10 MHz in steps, according to the sequence 1-3-10;
d) selectivity (B_{-60dB}/B_{-3dB}) = 15;
e) $ENBW/B_R = 1.4$.

The trace reported in the figure below refers to the analysis of a signal composed by two sinusoidal components and a continuous spectrum component.



Scale references on the display are:

- start frequency: 210 MHz; stop frequency: 310 MHz;
- reference level: 0 dBm;
- vertical scale factor: 10 dB/div.

Resolution bandwidth is B_R = 1 MHz. The continuous spectrum component extends between 240 MHz and 255 MHz with an approximately constant value. Within this interval, the marker indication is M_1 = -63.5 dBm. The two sinusoidal components have frequencies f_2 = 277 MHz and f_3 = 280 MHz; the corresponding markers provide the following readings: M_2 = -13.8 dBm and M_3 = -41 dBm

(***Note***: marker approximate positions are represented by grey diamonds on the trace).

Using these information:

a) determine the **power spectral density** of the continuous-spectrum component in [dBm/Hz];
b) determine the **rms value** of each sinusoidal component;
c) calculate the **total power** of the signal, reporting its value by a suitable sub-multiple of [W];
d) calculate the minimum sweep time value required for correct measurement;
e) discuss whether spectral interference may affect measurement accuracy for the two sinusoidal components. If so, propose a new setting that allows more correct measurement.

TIME TO COMPLETE: 90 minutes