Communication Lab Report
Experiment One
Spectral Analysis

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3.1 Introducing the spectrum Analyzer.

1. Answer the following short questions:

- The frequency range that this spectrum analyzer will measure is: (150KHz-1000MHz).
- The maximum DC level that can be applied to the RF input is: (±25 V)
- The value of the RF input impedance: (50 Ω)
- The maximum signal power, in dBm and in Watts, that can be applied to the RF input: (+30 dBm, 1 Watt)

2. Calculate the following.

- The maximum amplitude sine wave (with zero DC offset) that can be applied to the RF input.

$$PdBm = 20\log\left(\frac{Vrms}{0.224}\right)$$

$$Vrms = 10^{\frac{Pmax(dBm)}{20}} * 0.224$$
$$Vrms = 7.083$$
$$Vp = Vrms * \sqrt{2} = 10.0175$$

- The maximum amplitude square wave (with zero DC offset) having 50 % duty cycle that can be applied to the RF input.

$$Vrms = 10^{\frac{Pmax(dBm)}{20}} * 0.224$$
$$Vrms = Vp = 7.083$$

3.2 Spectrum of a simple sinusoid.

1. Record the spectrum of the (200mVp-p, 1MHz sine wave signal) on the display; use the marker to identify the different frequencies and amplitudes. Compare your result with theoretical calculations.

Harmonic Number fN	Frequency (MHz)	Power Spectral Density (dBm) Mesured
1	1	-17.8
2	2	-64.0
3	3	-59.0
4	4	-80.0

2. Explain the presence of harmonics.

it refers to noise since the signal is a sine wave, it should be a single tone and that should be for a pure sine wave, but we are in the laboratory, we can't have pure function wave and there must be noise effect to signal and it causes some small harmonic and it has very small power, so when moving up or down reference level, it appears or disappear from the screen.

3.3 Spectrum of a square wave.

1. Record the spectrum of (40mVp-p, 2MHz square wave signal) on the display; use the marker to identify the different frequencies and amplitudes. Compare your result with theoretical calculations.

Harmonic Number fN	Frequency (MHz)	Power Spectral Density (dBm) Mesured
1	2	-29.6
3	6	-39.0
5	10	-44.0
7	14	-48.0
9	18	-51.0

4. conclusions.

1) **Spectrum analysis is very important for communication engineer; because it makes the signal easy to deal with when it is hard to do it in the time domain.**
2) **We can find the spectrum domain for function by using Fourier series expansion.**
3) **Spectrum analyzer graphically displays power or voltage as a function of frequency on a CRT.**
4) **Voltage in communication science have very low value so that we rather to read it in dB and dBm.**