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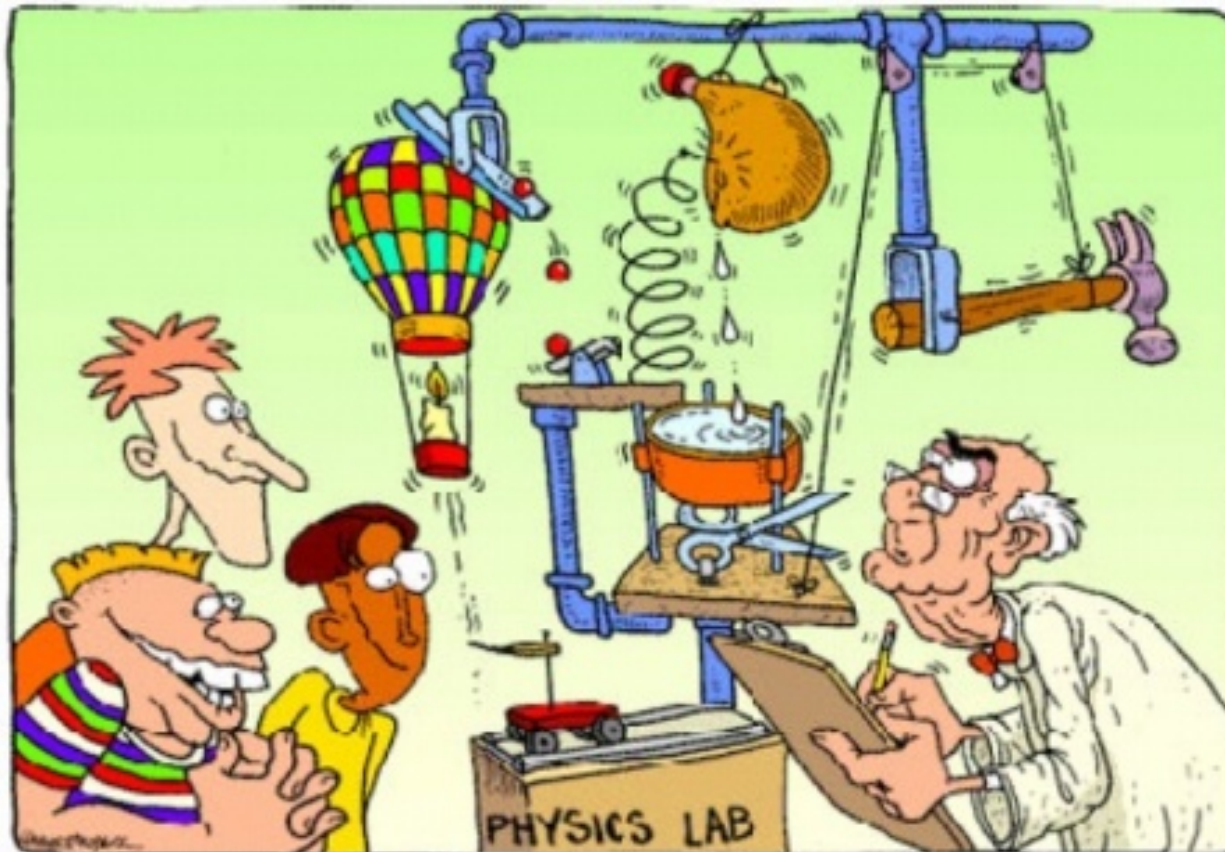# *A few Microwave/RF Basics*

Ralph J. Pasquinelli

Welcome to the Microwave Measurements Class

R. J. Pasquinelli

Course Outline

Fermilab

Microwave Measurements and Beam Instrumentation Laboratory
Instructors: Ralph Pasquinelli and Dave McGinnis

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| Lecture topic	Instructor	Lab topics
Class details. Spetrum analyzer basics	Ralph	Spectrum analyzer basics
Transmission lines part 1,2	Dave	Matching with transmission lines
Network analyzer basics	Ralph	Beam signal lab
Accelerator Beam Signals	Dave	Noise figure lab
RF cavities	Dave	TDR lab
Microwave components	Ralph	Measure cavity coupling and Q
TDR, Mixers , VSA	Ralph	Cavity bead pull measurements
Noise in electronic systems	Ralph	component measurements
RF systems for accelerators	Ralph	Mixer lab
Final Quiz		

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**MICROWAVE
THEORY
AND
APPLICATIONS**

**Stephen F. Adam
Hewlett Packard**

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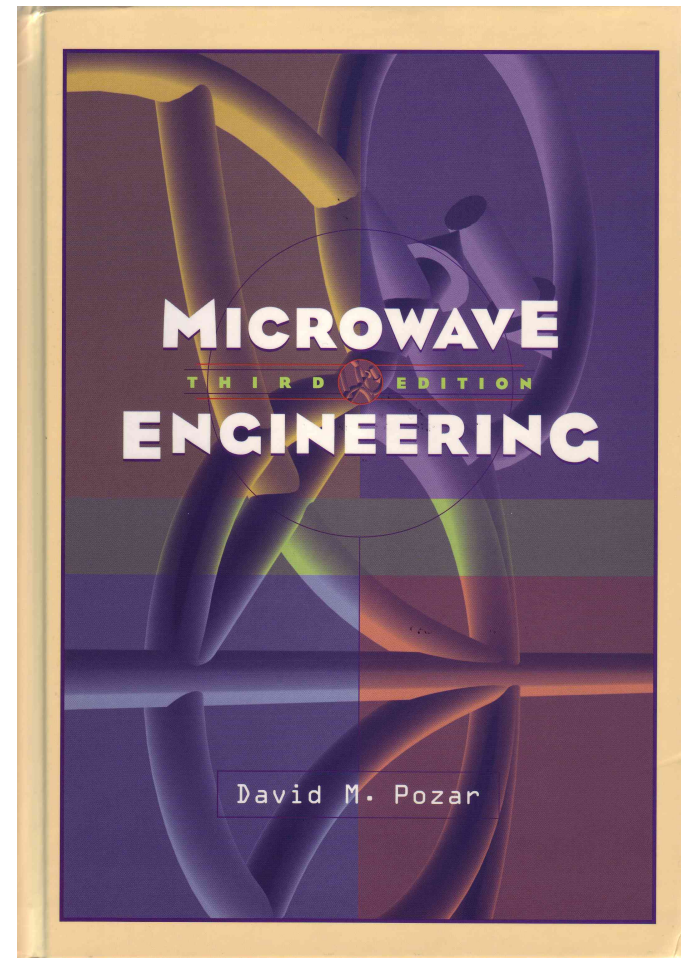
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What' a dB?

dB (decibel)

Means of expressing large ranges via a logarithmic ratio.

Can be the ratio of anything For RF it is POWER.
$10*\log(A/B) = dB$

In RF and Microwave systems, typical ratios of voltage and power are often expressed in dB

An amplifier or attenuator doesn't know or care if you are interested in volts or watts, a dB is a POWER ratio.

Watts = Volts^2/Resistance
Or
$P = V^2/R$

Ratio of watts is $10*\log (P1/P2) = dB$

Ratio of volts is
$10*\log (V1/V2)^2 = dB$
$20*\log(V1/V2) = dB$

for normalization to one volt, or one watt, or one milliwatt
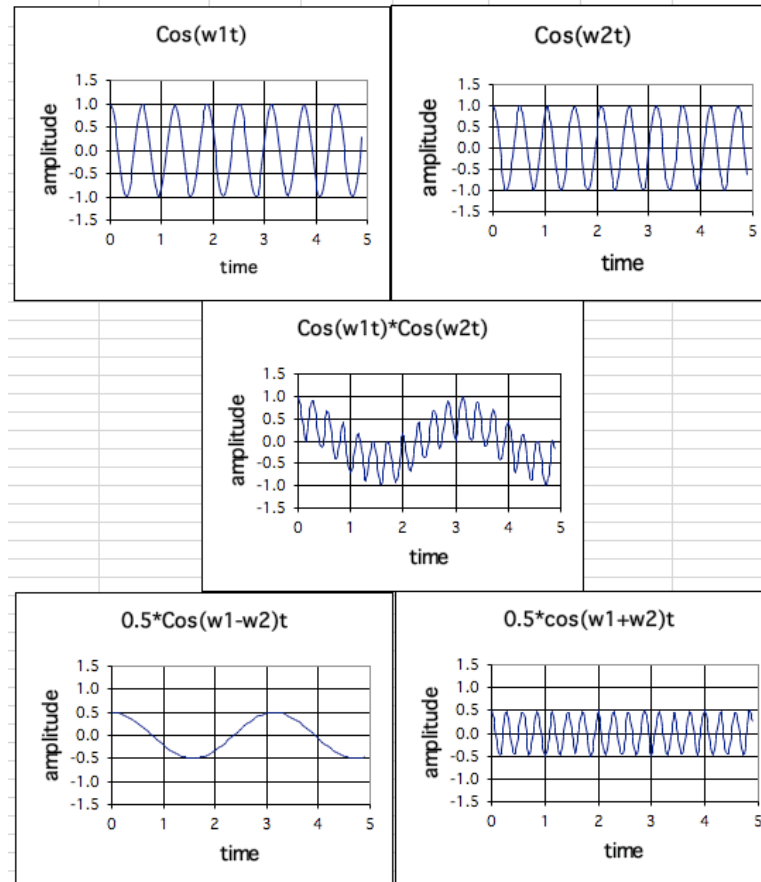set V2 or P2 to that value to get
dBV, dBW, or dBm

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Fermilab *Multiplying or Mixing*

Multiplying or "Mixing" signals

$$Cos(w1t)*Cos(w2t)=0.5*[Cos(w1-w2)t+Cos(w1+w2)t]$$

RJP 1/03/02

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Connectors

Type N

APC 7

TNC

BNC

SMA

Lemo

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TRUST NO ONE

A simple lesson on how to measure youself

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Fermilab   # *Use Caution!*

Treat this equipment as though you owned it.

Static Electricity
Will ruin the instruments!

Don't over or under
Tighten connections
ALWAYS Turn the NUT!

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Have Fun!

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