Formula and Reference Sheet

International System of Units (SI)

Prefix	Symbol	Value		
giga-	G	10^9	1,000,000,000	one billion
mega-	M	10^6	1,000,000	one million
kilo-	k	10^3	1,000	one thousand
(none)	(none)	10^0	1	one
centi-	c	10^{-2}	.01	one one-hundredth
milli-	m	10^{-3}	.001	one one-thousandth
micro-	µ	10^{-6}	.000001	one one-millionth
nano-	n	10^{-9}	.000000001	one one-billionth
pico-	p	10^{-12}	.000000000001	one one-trillionth

Technician Exam

Length of 1/2 wavelength antenna:

$$Length(feet) = \frac{468}{Frequency(\text{in } MHz)}$$

Length of 1/4 wavelength antenna:

$$Length(feet) = \frac{234}{Frequency(MHz)}$$

Ohm's law:

$$V = I * R, \qquad I = \frac{V}{R}, \qquad R = \frac{V}{I}$$

where:

V is the voltage in Volts (V), I is the current in Amps (A), R is the resistance in Ohms (Ω)

Power formulas:

$$P = V * I, \qquad I = \frac{P}{V}, \qquad V = \frac{P}{I}$$

where:

P is the power in Watts (W), V is the voltage in Volts (V), I is the current in Amps (A)

General Exam

Standing wave ratio:

$$SWR = \frac{highest\ impedance}{lowest\ impedance}$$

Equal-value resistors in series:

$$R_i = \frac{R_t}{n}$$

Equal-value resistors in parallel:

$$R_t = \frac{R_i}{n}$$

Resistors in parallel:

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Inductors in series:

$$L_t = L_1 + L_2$$

Equal-value inductors in parallel:

$$L_t = \frac{L_i}{n}$$

Capacitors in series:

$$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

Equal-value capacitors in series:

$$C_t = \frac{C_i}{n}$$

Capacitors in parallel:

$$C_t = C_1 + C_2 + C_3$$

Transformers:

$$E_s = E_p * \left(\frac{N_s}{N_p}\right) \qquad \frac{N_p}{N_s} = \sqrt{\frac{Z_p}{Z_s}}$$

RMS voltage:

$$V_P = \frac{V_{RMS}}{0.707}, \quad V_{RMS} = V_P * 0.707 \qquad V_{PP} = V_P * 2$$

Power:

$$P = E * I \qquad P = \frac{E^2}{R} \qquad P = I^2 * R \qquad E = \sqrt{P * R}$$

Peak envelope power:

$$PEP = \frac{V_{RMS}^2}{R}$$

Decibel math:

$$loss\ factor = 10^{\left(\frac{-loss(in\ db)}{10}\right)} \qquad percent\ loss = (1 - loss\ factor) * 100$$

Frequency modulation:

$$bandwidth = 2 * (D_{MAX} + M_{MAX})$$

Upconverter:

$$multiplier = \frac{transmitted\ frequency}{lower\ frequency}$$

$$lower\ frequency\ maximum\ deviation = \frac{transmitted\ frequency\ maximum\ deviation}{multiplier}$$

Extra Exam

Antenna gain in dBd vs dBi:

$$gain\ of\ antenna\ \text{in}\ dBd = gain\ of\ antenna\ \text{in}\ dBi - 2.15\ dB$$

Effective radiated power:

$$ERP = transmitter\ power * 10^{\left(\frac{gain\ \text{in}\ dB}{10}\right)}$$

Length of transmission line:

$$\lambda = \frac{c * velocity\ factor}{f}$$

Forward and reflected power:

$$power\ \text{to}\ load = forward\ power - reflected\ power$$

Third-order intermodulation products:

Formula	Formula Solve for f_2
$f_i = 2f_1 + f_2$	$f_2 = f_i - 2f_1$
$f_i = 2f_1 - f_2$	$f_2 = 2f_1 - f_i$
$f_i = 2f_2 + f_1$	$f_2 = \frac{f_i - f_1}{2}$
$f_i = 2f_2 - f_1$	$f_2 = \frac{f_i + f_1}{2}$

Operational amplifiers:

$$V_{OUT} = -V_{\text{IN}} * \frac{R_F}{R_1} \qquad A_V = \frac{R_F}{R_1}$$

Image response frequencies:

$$f_{img1} = f_{RF} - 2 * f_{IF} \qquad f_{img2} = f_{RF} + 2 * f_{IF}$$

Noise floor:

$$BNF = NF + 10 * \log(BW)$$

where:

BNF *is the bandwidth noise floor* (*the noise for the entire received bandwidth*) (*in dBm*)

NF *is the* 1-*Hz noise floor* (*in dBm/Hz*)

BW *is the receive filter bandwidth* (*in Hz*)

Time constant (all components in parallel):

$$Rt=\frac{R_i}{n} \qquad C_t=C_1+C_2 \qquad T=R*C$$

Parts per million:

$$maximum\ error=measurement*accuracy$$

Resonant frequency:

$$f_R=\frac{1000}{2\pi*\sqrt{LC}}$$

$where:$

$L\ in\ \mu H$

$C\ in\ pF$

$f_R\ in\ MHz$

Half-power bandwidth:

$$half-power\ bandwidth=\frac{f_R}{Q}$$

Transformer turns #1:

$$N=100\times\sqrt{\frac{L}{A_L}}$$

$where:$

$L\ in\ \mu H$

$A_L\ in\ \mu H/100\ turns$

Transformer turns #2:

$$N=1000\times\sqrt{\frac{L}{A_L}}$$

$where:$

$L\ in\ mH$

$A_L\ in\ mH/1000\ turns$

Frequency modulation:

$$deviation\ ratio=\frac{D_{MAX}}{M_{MAX}} \qquad modulation\ index=\frac{frequency\ deviation}{modulating\ frequency}$$

Inductive and capacitive reactances:

$$X_L=2\pi fL \qquad X_C=\frac{1}{2\pi fC} \qquad X=X_L-X_C$$

Phase angle:

$$\theta=\arctan\left(\frac{X}{R}\right)$$

Power factor:

$$power\ factor=\cos(\theta) \qquad apparent\ power=V_{RMS}*I$$

$$true\ power=apparent\ power*power\ factor \qquad P=I^2*R$$