

Power Level Calculations

Change Log 11/23/2015 HM: digitize calculations

	Roof to Re-Radiator in Engineering Bay	Name	Comment/Equation	Signal Level	Units	Refs
GIVEN	GPS Roof Antenna Avg Rec Power L1/L2	PRX		-130	dBm	
	GPS L1 Signal Frequency	L1	signal bandwidth: 24 MHz	1575.42	MHz	
	GPS L2 Signal Frequency	L2	signal bandwidth: 24 MHz	1227.6	MHz	
PARAMETERS						
	Outdoor Active Antenna Gain	GRX	sum of LNA gain and isotropic antenna gain	39	dB	A
	Cable and connector loss	LC	125 feet of LMR400 cable	7.5	dB	B
	Amplifier Gain	GAMP	fixed gain unit	15	dB	C
	Indoor re-radiating GPS passive antenna gain	GTX	isotropic gain	4.1	dBi	D
CALCULATED	Indoor antenna distance to nearest exterior wall	DI		8.6	m	
	Output Power from Amplifier	PAMP	$PAMP = PRX + GRX - LC + GAMP$	-83.5	dBm	
				4.47	pW	
	Radiated Power at indoor antenna, ERP	PTX	$PTX = PAMP + GTX - 2.15 \text{ dB}$	-81.55	dBm	
				7.0	pW	
	Total System Gain	GSYS	$GSYS = GRX - LC + GAMP + GTX$	50.6	dB	
	Indoor antenna distance to 30 m from building	D	$D = DI + 30$	38.6	m	
	Freespace propagation loss, worst case (i.e. L2 has least loss)	LP	$LP = 20 \text{ Log}_{10} L2HZ + 20 \text{ Log}_{10} Dm - 27.5$	66.0	dB	E, eqn 9
	Equivalent Isotropically Radiated Power @ 30 m from building	ERIP @ RANGE	$ERIP @ \text{Range} = PRX + GSYS - LP$	-145.4	dBm/24 MHz	
	Effective Radiated Power @ 30 m from building	ERP @ RANGE	$ERP = ERIP - 2.15 \text{ dB}$	-147.6	dBm/24 MHz	E, eqn 5

Hence meeting the -140 dBm/24 MHz NTIA regulations for power received at 30 m from building