Configuration, WLAN Module with WWAN Module	WWAN MODULE		WLAN MODULE	
Radio Module Part Number	Warbler		Barolo	
FFC ID	N7N-MC5725-H		BCM94312MCG	
Conducted Power Levels From FCC Grant	Watts	mW	Watts	mW
Conducted power, 1851.25 - 1908.75 MHz, Part 24E	0.3048	304.8		
Conducted power, 824.7 - 848.31 MHz, Part 22H	0.3258	325.8		
Conducted power, 2412.0 - 2462.0 MHz, Part 15C			0.1790	179
Conducted power, 5745.0 - 5825.0 MHz, Part 15C				0
Conducted power, 5180.0 - 5240.0 MHz, Part 15E				0
Conducted power, 5260.0 - 5320.0 MHz, Part 15E				0

	dBi	Dimensionless
Maximum Antenna Gain for, 1851.25 - 1908.75 MHz, from WWAN Grant, 4.0 dBi	4.15	2.60
Maximum Antenna Gain for, 824.7 - 848.31 MHz, from WWAN Grant, 8.0 dBi	5.10	3.24
Maximum Antenna Gain for, 2412.0 - 2462.0 MHz	3.00	2.00
Maximum Antenna Gain for 5180.0 to 5850.0 MHz	5.00	3.16

MPE Power Density Limit above 300 to 1500 MHz, General Population Exposure, f/1500 mW/sqcm (f= frequency in MHz). In 824.7-848.31 MHz range, worse case f=824.7	0.55
MPE Power Density Limit above 1.5GHz, General Population Exposure, mW/sqcm	1.00

Worse Case Duty Cycle for WWAN (fraction less than or equal to 1, dimensionless)	1.00
Worse Case Duty Cycle for WLAN (fraction less than or equal to 1, dimensionless)	1.00

Co-located Power Density at 20 **cm**

Power Densities or Combined Percentages Limits of Both Radios Based on Data From Sheet 'Power Levels & Gains'

Active Transmiter Bands	**2412.0 - 2462.0 MHz**	**5180 - 5850.0 MHz**	**Units**	**Limit**
824.7 - 848.31 MHz	**45.22%**	**38.12%**	%	100%
1851.25 - 1908.75 MHz	**0.23**	**0.16**	mW/sqcm	1.0mW/sqcm

Power Densities or Percentage of Limits for Each Individual Radio

Band	**2412.0 - 2462.0 MHz**	**5180 - 5850.0 MHz**	**824.7 - 848.31 MHz**	**1851.25 - 1908.75 MHz**
Percentage of Limit	7.10%	0.00%	38.12%	
Power Density, mW/cm^2	0.07	0.00	0.21	0.16

Cross Check

Combined Limt %			
2400/800	**5000/824**	**Combined limit Power Density**	
45.22%	38.12%	**2400/1900**	**5000/1900**
		0.23	0.16

Notes:
1) Where frequencies are in same range of power density limits then the power and gain products are combined linearly.
2) Where frequencies are in different ranges then the ratio of the power density with the limit is taken and the fractional parts summed.
3) For the 824.7 - 848.31 MHz band the worse case power density limit for f=824.7 MHz is used for the whole band
4) For the 5180 - 5850 MHz band the worse case conducted transmit power level of 0.209 Watts

S = (EIRP*Duty Cycle) / 4(pi)R^2
S=(0.079524*P*G*DC)/(d^2)

CALCULATIONS

Given
E = √ (30 * P * G) / d
and
S = E ^ 2 / 3770

So
S=(30*P*G)/(3770*d^2)

where,
E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:
d = √ ((30 * P * G) / (3770 * S))

Changing to units of Power to mW and Distance to cm, using:
P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)
yields
d = 100 * √ ((30 * (P / 1000) * G) / (3770 * S))
d = 0.282 * √ (P * G / S)
S=(0.079524*P*G)/(d^2)

where
d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power * Gain product of each transmitter.

yields
d = 0.282*SQRT((P1 * G1) + (P2 * G2) + ... + (Pn * Pn)) / S) Equation (1)
where
d = distance in cm
Px = Power of transmitter x in mW
Gx = Numeric gain of antenna x
S = Power Density in mW/cm^2

The summation is made in linear terms, and this yields a single distance for the colocated configuration.

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100% in terms of percentage.