

Test No.13

Name of Test:	Radio Frequency Exposure	Test Standard:	FCC OET Bulletin 65 & RSS-GEN& RSS-102
Tested By:	WEI LI	Test Date:	03/16/2020-03/26/2020

Minimum Standard: For FCC, per Public Exposure to Radio Frequency Energy Levels (1.1307 (b)(1)) Limits:

From §1.1310 Table 1 (B), for Public $S = 1.0 \text{ mW/cm}^2$;
 for Professional, $S = 5.0 \text{ mW/cm}^2$.

For IC: per RSS-102, Sec. 2.5.2, Exemption Limits for Routine Evaluation, with formula of $1.31 \times 10^{-2} f^{0.6834} \text{ W}$, more restricted EIRP limit value are 1.37W at 902MHz, 2.67W at 2400MHz, 4.52W at 5180MHz.

Method of Measurement:

$$d = 0.282 * 10^{\frac{(P + G)}{20}} / \sqrt{S}$$

$$S = 0.0795 * 10^{\frac{(P + G)}{10}} / d^2$$

Equation (1)
 Equation (2)

where

d = MPE distance in cm
 P = Power in dBm
 G = Antenna Gain in dBi
 S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.
 Equation (2) and the measured peak power is used to calculate the Power density.

Test Result:

Complied with MPE limit

Test Data:

NA

Calculation:

A. For FCC MPE compliance:

1) For GPR alone , max emission level is under the limit set in Section 15.209. No RF hazard need to be concerned.

2) With co-location of GPR and pre-certified RF module, the following calculation shows total RF exposure is still under the MPE limit:

For GPR Tx, max. level measured at 3m distance: 56.8 dBμV/m, i.e. P+G= -38.4dBm

Plug all three items into equation (2), yielding,

Power Density Limit (mW/cm ²)	Output Power (dBm)	Antenna Gain (dBi)	Power Density at 20cm (mW/ cm ²)	Max. EIRP (W)
1.0			2.8E-8	1.5E-7

For RF module, made by Texas Instruments Inc., WiFi and BT Module, Model # WL18MODGI. (FCC ID: Z64-WL18DBMOD, IC: 451I-WL18DBMOD). Worst case MPE per report #FA4O0971:

Power Density Limit (mW/cm ²)	Output Power (dBm)	Antenna Gain (dBi)	Power Density at 20cm (mW/ cm ²)	Max. EIRP (W)
1.0	19.5	4.5	0.050	0.251

Thus, co-location calculations:

$$\Sigma MPE = 2.8E-8 \text{ mW/cm}^2 + 0.251 \text{ mW/cm}^2 = 0.251 \text{ mW/cm}^2 \text{ which is less than the limit } 1.0 \text{ mW/cm}^2$$

Additionally,

$$\Sigma SeqnSlimn = Seq1Slim1 + Seq2Slim2 \leq 1$$

$$\text{Herein } \Sigma SeqnSlimn = 2.8E-8/1.0 + 0.251/1.0 = 0.251 \leq 1$$

B. For IC ISSED MPE compliance:

GPR max. EIRP = 1.5E-7W and RF module EIRP = 0.251W. Thus co-location max. EIRP = 0.251W < limit 1.37W / 2.67W / 4.52W.

NOTE: For mobile or fixed location transmitters, the minimum separation distance between the antenna & radiating structures of the device and nearby persons is 20 cm, even if calculations indicate that the MPE distance would be less.