

Test No.13

<b>Name of Test:</b>	<i>Radio Frequency Exposure</i>	<b>Test Standard:</b>	<i>FCC OET Bulletin 65 &amp; RSS-GEN &amp; RSS-102</i>
<b>Tested By:</b>	WEI LI	<b>Test Date:</b>	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:**

$$d = 0.282 * 10^{((P + G) / 20) / \sqrt{S}} \quad \text{Equation (1)}$$

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

where

- d = MPE distance in cm
- P = Power in dBm
- G = Antenna Gain in dBi
- S = Power Density Limit in  $\text{mW/cm}^2$

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

Thus, co-location calculations:

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

Additionally,

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

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

B. For IC ISED 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.*