Test No.13

Name of Test:	***Radio Frequency Exposure***	**Test Standard:**	***FCC OET Bulletin 65***
Tested By:	WEI LI	**Test Date:**	08/21/2023-09/07/2023

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

From §1.1310 Table 1 (B),
for Public S = 1.0 mW/cm^2
for Professional, S = 5.0 mW/cm^2

Method of Measurement:

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

$$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2$$ 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:	
Test Data:	**NA**

Calculation

For GPR UWB Transmitter:

For FCC Approval:
1-mW Test Exemption:
Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions.

For this EUT, max emission level is under the 0dBm limit set in Part 15F. No RF hazard need to be concerned.

The max. power density can be obtain by using the max. P+G=0dBm and d=20cm, and plug all three items into equation (2), yielding,

Power Density Limit (mW/cm^2)	**Max. Output Power+ Antenna] Gain (dBm)**	**Calculated Power Density (mW/cm^2)**
1.0/5.0	0	0.0002

For UWB and WiFi Transmitters transmitting simultaneously:

For FCC Application, the following evaluation is for combined MPE compliance: While d=20cm, if

$[Pd(1) / LPd(1)] + [Pd(2) / LPd(2)] + \ldots + [Pd(n) / LPd(n)] < 1$

then, the device complies with FCC's RF radiation exposure limit for general population as a mobile device. Where;
Pd(n) = Power density of n^{th} transmitter at 20cm.
LPd(n) = Power density limit for the n^{th} transmitter

From WiFi module's MPE report (FCC ID: 2AKKWWIZFI630S): Worse case is 802.11b mode.

Calculated Result and Limit

Mode	Frequency (MHz)	output power (dBm)	output power (mW)	Target power（dBm）	Antenna gain		Power Density (S) (mW /cm2)	Limited of Power Density (S) (mW /cm2)	Test Result
					(dBi)	(Linear)			
IEEE 802.11b	2412	16.01	39.90	16±1	3.2	2.10	0.02088	1	Compiles
	2437	16.05	40.27	16±1	3.2	2.10	0.02088	1	Compiles
	2462	15.41	34.75	15±1	3.2	2.10	0.01663	1	Compiles

We can use reported 0.02088mW/ cm^2 as the max. power density for WiFi transmission.
Therefore

[Pd(1) / LPd(1)] + [Pd(2) / LPd(2)]=0.0002/1+0.02088/1=0.02108 <1

The EUT meets RF radiation exposure limit for general population as a mobile device.