

EMF TEST REPORT

Test Report No. : OT-256-RWD-038

Reception No. : 2505001660

Applicant : LG Innotek Co., Ltd.

Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, 07796, South Korea

Manufacturer : LG Innotek Co., Ltd.

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Type of Equipment : 4PPoE-BLE WLAN Bridge

FCC ID. : YZP-ETPPDRPP01

Model Name : ETPPDRPP01

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 25 pages (including this page)

Date of Incoming : May 07, 2025

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SUMMARY

The equipment complies with the regulation; **CFR §2.1093**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-256-RWD-038	June 25, 2025	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Innotek Co., Ltd.
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 FCC ID : YZP-ETPPDRPP01
 Model Name : ETPPDRPP01
 Brand Name : -
 Serial Number : N/A
 Date : June 25, 2025

E.U.T. DESCRIPTION	Modular Transmitter, 4PPoE-BLE WLAN Bridge
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	KDB 447498 D01 General RF Exposure Guidance v06
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
Modifications on the Equipment to Achieve Compliance	None

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. GENERAL INFORMATION

2.1 Product Description

The LG Innotek Co., Ltd., Model ETPPDRPP01 (referred to as the EUT in this report) is a 4PPoE-BLE WLAN Bridge.

The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	4PPoE-BLE WLAN Bridge	
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
		2 422 MHz ~ 2 452 MHz (802.11n(HT40))
	WLAN 5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))
		5 210 MHz (802.11ac(VHT80))
	WLAN 5 250 MHz ~ 5 350 MHz Band	5 260 MHz ~ 5 320 MHz (802.11a/n(HT20)/ac(VHT20))
		5 270 MHz ~ 5 310 MHz (802.11n(HT40)/ac(VHT40))
		5 290 MHz (802.11ac(VHT80))
	WLAN 5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 720 MHz (802.11a/n(HT20)/ac(VHT20))
		5 510 MHz ~ 5 710 MHz (802.11n(HT40)/ac(VHT40))
		5 530 MHz ~ 5 690 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps / 2 Mbps
		GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK)
		802.11g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
	WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)

RF OUTPUT POWER	Bluetooth LE	125 kbps	7.69 dBm
		500 kbps	7.90 dBm
		1 Mbps	7.69 dBm
		2 Mbps	7.77 dBm
	Bluetooth	1 Mbps	8.14 dBm
		2 Mbps	10.44 dBm
		3 Mbps	10.59 dBm
	WLAN 2.4 GHz	SISO_Antenna 0	20.95 dBm(802.11b) 19.16 dBm(802.11g) 19.13 dBm(802.11n_HT20) 17.11 dBm(802.11n_HT40)
		SISO_Antenna 1	20.72 dBm(802.11b) 19.20 dBm(802.11g) 19.01 dBm(802.11n_HT20) 17.13 dBm(802.11n_HT40)
		MIMO_Antenna 0	14.82 dBm(802.11n_HT20) 11.45 dBm(802.11n_HT40)
		MIMO_Antenna 1	14.83 dBm(802.11n_HT20) 11.44 dBm(802.11n_HT40)
		MIMO_Multiple Antenna	14.82 dBm(802.11n_HT20) 11.45 dBm(802.11n_HT40)

RF OUTPUT POWER	WLAN 5 150 MHz ~ 5 250 MHz Band	SISO_Antenna 0	15.81 dBm(802.11a) 15.98 dBm(802.11n_HT20) 15.32 dBm(802.11n_HT40) 15.34 dBm(802.11ac_VHT20) 15.28 dBm(802.11ac_VHT40) 11.65 dBm(802.11ac_VHT80)
		SISO_Antenna 1	15.97 dBm(802.11a) 15.54 dBm(802.11n_HT20) 15.31 dBm(802.11n_HT40) 15.26 dBm(802.11ac_VHT20) 15.73 dBm(802.11ac_VHT40) 11.66 dBm(802.11ac_VHT80)
		MIMO_Antenna 0	11.82 dBm(802.11n_HT20) 11.05 dBm(802.11n_HT40) 11.84 dBm(802.11ac_VHT20) 11.51 dBm(802.11ac_VHT40) 8.26 dBm(802.11ac_VHT80)
		MIMO_Antenna 1	11.58 dBm(802.11n_HT20) 11.02 dBm(802.11n_HT40) 11.42 dBm(802.11ac_VHT20) 11.33 dBm(802.11ac_VHT40) 8.18 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna	14.71 dBm(802.11n_HT20) 14.05 dBm(802.11n_HT40) 14.64 dBm(802.11ac_VHT20) 14.38 dBm(802.11ac_VHT40) 11.23 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 250 MHz ~ 5 350 MHz Band	SISO_Antenna 0	16.66 dBm(802.11a) 16.92 dBm(802.11n_HT20) 15.80 dBm(802.11n_HT40) 16.38 dBm(802.11ac_VHT20) 15.68 dBm(802.11ac_VHT40) 12.34 dBm(802.11ac_VHT80)
		SISO_Antenna 1	16.24 dBm(802.11a) 15.95 dBm(802.11n_HT20) 15.47 dBm(802.11n_HT40) 15.61 dBm(802.11ac_VHT20) 15.93 dBm(802.11ac_VHT40) 11.92 dBm(802.11ac_VHT80)
		MIMO_Antenna 0	12.38 dBm(802.11n_HT20) 12.08 dBm(802.11n_HT40) 12.17 dBm(802.11ac_VHT20) 12.13 dBm(802.11ac_VHT40) 8.77 dBm(802.11ac_VHT80)
		MIMO_Antenna 1	11.48 dBm(802.11n_HT20) 11.25 dBm(802.11n_HT40) 11.38 dBm(802.11ac_VHT20) 11.54 dBm(802.11ac_VHT40) 8.41 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna	14.96 dBm(802.11n_HT20) 14.70 dBm(802.11n_HT40) 14.80 dBm(802.11ac_VHT20) 14.82 dBm(802.11ac_VHT40) 11.60 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 470 MHz ~ 5 725 MHz Band	SISO_Antenna 0	18.09 dBm(802.11a) 18.14 dBm(802.11n_HT20) 18.83 dBm(802.11n_HT40) 17.64 dBm(802.11ac_VHT20) 18.66 dBm(802.11ac_VHT40) 14.32 dBm(802.11ac_VHT80)
		SISO_Antenna 0_Straddle	14.82 dBm(802.11a) 14.41 dBm(802.11n_HT20) 15.98 dBm(802.11n_HT40) 14.52 dBm(802.11ac_VHT20) 16.09 dBm(802.11ac_VHT40) 14.58 dBm(802.11ac_VHT80)
		SISO_Antenna 1	17.08 dBm(802.11a) 16.91 dBm(802.11n_HT20) 16.73 dBm(802.11n_HT40) 16.49 dBm(802.11ac_VHT20) 16.92 dBm(802.11ac_VHT40) 13.83 dBm(802.11ac_VHT80)
		SISO_Antenna 1_Straddle	13.35 dBm(802.11a) 12.91 dBm(802.11n_HT20) 14.16 dBm(802.11n_HT40) 13.08 dBm(802.11ac_VHT20) 13.99 dBm(802.11ac_VHT40) 12.46 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 470 MHz ~ 5 725 MHz Band	MIMO_Antenna 0	13.47 dBm(802.11n_HT20) 14.25 dBm(802.11n_HT40) 13.24 dBm(802.11ac_VHT20) 14.48 dBm(802.11ac_VHT40) 9.87 dBm(802.11ac_VHT80)
		MIMO_Antenna 0_Straddle	8.06 dBm(802.11n_HT20) 9.56 dBm(802.11n_HT40) 8.43 dBm(802.11ac_VHT20) 9.75 dBm(802.11ac_VHT40) 10.11 dBm(802.11ac_VHT80)
		MIMO_Antenna 1	12.51 dBm(802.11n_HT20) 12.51 dBm(802.11n_HT40) 12.48 dBm(802.11ac_VHT20) 12.57 dBm(802.11ac_VHT40) 9.33 dBm(802.11ac_VHT80)
		MIMO_Antenna 1_Straddle	7.02 dBm(802.11n_HT20) 8.14 dBm(802.11n_HT40) 6.91 dBm(802.11ac_VHT20) 8.15 dBm(802.11ac_VHT40) 7.99 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna	15.76 dBm(802.11n_HT20) 16.48 dBm(802.11n_HT40) 15.49 dBm(802.11ac_VHT20) 16.64 dBm(802.11ac_VHT40) 12.62 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna _Straddle	10.58 dBm(802.11n_HT20) 11.92 dBm(802.11n_HT40) 10.75 dBm(802.11ac_VHT20) 12.03 dBm(802.11ac_VHT40) 12.19 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 725 MHz ~ 5 850 MHz Band	SISO_Antenna 0	18.61 dBm(802.11a) 18.61 dBm(802.11n_HT20) 18.44 dBm(802.11n_HT40) 18.26 dBm(802.11ac_VHT20) 18.35 dBm(802.11ac_VHT40) 17.68 dBm(802.11ac_VHT80)
		SISO_Antenna 0_Straddle	8.54 dBm(802.11a) 8.71 dBm(802.11n_HT20) 4.90 dBm(802.11n_HT40) 8.78 dBm(802.11ac_VHT20) 4.86 dBm(802.11ac_VHT40) -0.89 dBm(802.11ac_VHT80)
		SISO_Antenna 1	18.71 dBm(802.11a) 18.48 dBm(802.11n_HT20) 18.19 dBm(802.11n_HT40) 18.14 dBm(802.11ac_VHT20) 18.42 dBm(802.11ac_VHT40) 17.41 dBm(802.11ac_VHT80)
		SISO_Antenna 1_Straddle	7.35 dBm(802.11a) 7.46 dBm(802.11n_HT20) 3.30 dBm(802.11n_HT40) 7.60 dBm(802.11ac_VHT20) 3.27 dBm(802.11ac_VHT40) -2.68 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 725 MHz ~ 5 850 MHz Band	MIMO_Antenna 0	13.98 dBm(802.11n_HT20) 13.79 dBm(802.11n_HT40) 13.91 dBm(802.11ac_VHT20) 13.87 dBm(802.11ac_VHT40) 13.33 dBm(802.11ac_VHT80)
		MIMO_Antenna 0_Straddle	2.38 dBm(802.11n_HT20) -1.57 dBm(802.11n_HT40) 2.70 dBm(802.11ac_VHT20) -1.43 dBm(802.11ac_VHT40) -5.40 dBm(802.11ac_VHT80)
		MIMO_Antenna 1	14.07 dBm(802.11n_HT20) 13.76 dBm(802.11n_HT40) 13.91 dBm(802.11ac_VHT20) 13.84 dBm(802.11ac_VHT40) 13.10 dBm(802.11ac_VHT80)
		MIMO_Antenna 1_Straddle	1.63 dBm(802.11n_HT20) -2.48 dBm(802.11n_HT40) 1.53 dBm(802.11ac_VHT20) -2.49 dBm(802.11ac_VHT40) -7.20 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna	16.90 dBm(802.11n_HT20) 16.78 dBm(802.11n_HT40) 16.83 dBm(802.11ac_VHT20) 16.86 dBm(802.11ac_VHT40) 16.23 dBm(802.11ac_VHT80)
		MIMO_Multiple Antenna _Straddle	5.03 dBm(802.11n_HT20) 1.01 dBm(802.11n_HT40) 5.16 dBm(802.11ac_VHT20) 1.08 dBm(802.11ac_VHT40) -3.20 dBm(802.11ac_VHT80)

ANTENNA TYPE	PCB Antenna, Dipole Antenna		
ANTENNA GAIN	Bluetooth LE	0.15 dBi	
	Bluetooth	0.15 dBi	
	WLAN 2.4 GHz	Antenna 1	0.87 dBi
		Antenna 2	3.12 dBi
		Multiple Antenna	5.15 dBi
	5 150 MHz ~ 5 250 MHz Band	Antenna 1	0.22 dBi
		Antenna 2	3.90 dBi
		Multiple Antenna	5.45 dBi
	5 250 MHz ~ 5 350 MHz Band	Antenna 1	-0.09 dBi
		Antenna 2	3.90 dBi
		Multiple Antenna	5.36 dBi
	5 470 MHz ~ 5 725 MHz Band	Antenna 1	1.56 dBi
		Antenna 2	3.92 dBi
		Multiple Antenna	5.91 dBi
	5 725 MHz ~ 5 850 MHz Band	Antenna 1	1.39 dBi
		Antenna 2	3.85 dBi
		Multiple Antenna	5.80 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		40 MHz	

2.2 Alternative type(s)/model(s); also covered by this test report.

-. Current Diplexer and SMPS components will be co-located with equivalent parts from other Vendors.

-. The following lists consist of the added model and their differences.

Division	DiPlexer		SMPS	
	Basic	Dualization of parts	Basic	Dualization of parts
P/N	DP1608-A2455DTA0	RFDIP1606LE1319W9K	SHP2401LE	SN00952DG
Vendor	ACX	Walsin	Sungho	Mass-Power

Model Name	Differences	Tested
ETPPDRPP01	Basic: Diplexer (Basic), SMPS (Basic)	☒
	Option 1: Diplexer (Dualization of parts), SMPS (Basic)	☒
	Option 2: Diplexer (Basic), SMPS (Dualization of parts)	☐
	Option 1: Diplexer (Dualization of parts), SMPS (Dualization of parts)	☐

Note: 1. Since the applicant has commissioned the basic model and Option1 testing, this test report only guarantees the contents for the units for which the testing has been completed.

2. The Applicant/manufacture is responsible for the compliance of all variants.

3. EUT MODIFICATIONS

-. None

4. MAXIMUM PERMISSIBLE EXPOSURE

4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are $f/1500$ mW/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric field strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using $P \text{ (mW)} = P \text{ (W)} / 1\,000$, $d \text{ (cm)} = 0.01 * d \text{ (m)}$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

4.2 EUT Description

Kind of EUT	4PPoE-BLE WLAN Bridge
Device Category	☐ Portable (< 20 cm separation) ☐ Mobile (> 20 cm separation) ☒ Others
Exposure Evaluation Applied	☒ MPE ☐ SAR ☐ N/A

4.3 Calculated MPE Safe Distance for WLAN

4.3.1 DATA for Antenna 0_SISO

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11b	20.95 ± 2.0	22.95	197.24	0.87	1.22	4.38	0.047 9	1
	802.11g	19.16 ± 2.0	21.16	130.62			3.56	0.031 7	1
	802.11n_HT20	19.13 ± 2.0	21.13	129.72			3.55	0.031 5	1
	802.11n_HT40	17.11 ± 2.0	19.11	81.47			2.81	0.019 8	1
5 150 ~ 5 250	802.11a	15.81 ± 2.0	17.81	60.39	0.22	1.05	2.25	0.012 6	1
	802.11n_HT20	15.98 ± 2.0	17.98	62.81			2.29	0.013 1	1
	802.11ac_VHT20	15.32 ± 2.0	17.32	53.95			2.12	0.011 3	1
	802.11n_HT40	15.34 ± 2.0	17.34	54.20			2.13	0.011 3	1
	802.11ac_VHT40	15.28 ± 2.0	17.28	53.46			2.11	0.011 2	1
	802.11ac80	11.65 ± 2.0	13.65	23.17			1.39	0.004 8	1
5 250 ~ 5 350	802.11a	16.66 ± 2.0	18.66	73.45	-0.09	0.98	2.39	0.014 3	1
	802.11n_HT20	16.92 ± 2.0	18.92	77.98			2.46	0.015 2	1
	802.11ac_VHT20	15.80 ± 2.0	17.80	60.26			2.17	0.011 7	1
	802.11n_HT40	16.38 ± 2.0	18.38	68.87			2.32	0.013 4	1
	802.11ac_VHT40	15.68 ± 2.0	17.68	58.61			2.14	0.011 4	1
	802.11ac80	12.34 ± 2.0	14.34	27.16			1.45	0.005 3	1
5 470 ~ 5 725	802.11a	18.09 ± 2.0	20.09	102.09	1.56	1.43	3.41	0.029 1	1
	802.11n_HT20	18.14 ± 2.0	20.14	103.28			3.43	0.029 4	1
	802.11ac_VHT20	18.83 ± 2.0	20.83	121.06			3.71	0.034 5	1
	802.11n_HT40	17.64 ± 2.0	19.64	92.04			3.24	0.026 2	1
	802.11ac_VHT40	18.66 ± 2.0	20.66	116.41			3.64	0.033 2	1
	802.11ac80	14.32 ± 2.0	16.32	42.85			2.21	0.012 2	1

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
5 725 ~ 5 850	802.11a	18.61 ± 2.0	20.61	115.08	1.39	1.38	3.55	0.031 5	1
	802.11n_HT20	18.61 ± 2.0	20.61	115.08			3.55	0.031 5	1
	802.11ac_VHT20	18.44 ± 2.0	20.44	110.66			3.48	0.030 3	1
	802.11n_HT40	18.26 ± 2.0	20.26	106.17			3.41	0.029 1	1
	802.11ac_VHT40	18.35 ± 2.0	20.35	108.39			3.45	0.029 7	1
	802.11ac80	17.68 ± 2.0	19.68	92.90			3.19	0.025 5	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(197.24 * 1.22)/1.00} = 4.38 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 197.24 * 1.22 / (4 * \pi * 20^2) = 0.047 9$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.3.2 DATA for Antenna 1_SISO

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11b	20.72 ± 2.0	22.72	187.07	3.12	2.05	5.52	0.076 3	1
	802.11g	19.20 ± 2.0	21.20	131.83			4.64	0.053 8	1
	802.11n_HT20	19.01 ± 2.0	21.01	126.18			4.54	0.051 5	1
	802.11n_HT40	17.13 ± 2.0	19.13	81.85			3.65	0.033 4	1
5 150 ~ 5 250	802.11a	15.97 ± 2.0	17.97	62.66	3.90	2.45	3.50	0.030 6	1
	802.11n_HT20	15.54 ± 2.0	17.54	56.75			3.33	0.027 7	1
	802.11ac_VHT20	15.31 ± 2.0	17.31	53.83			3.24	0.026 3	1
	802.11n_HT40	15.26 ± 2.0	17.26	53.21			3.22	0.026 0	1
	802.11ac_VHT40	15.73 ± 2.0	17.73	59.29			3.40	0.029 0	1
	802.11ac80	11.66 ± 2.0	13.66	23.23			2.13	0.011 3	1
5 250 ~ 5 350	802.11a	16.24 ± 2.0	18.24	66.68	3.90	2.45	3.61	0.032 6	1
	802.11n_HT20	15.95 ± 2.0	17.95	62.37			3.49	0.030 5	1
	802.11ac_VHT20	15.47 ± 2.0	17.47	55.85			3.30	0.027 3	1
	802.11n_HT40	15.61 ± 2.0	17.61	57.68			3.36	0.028 2	1
	802.11ac_VHT40	15.93 ± 2.0	17.93	62.09			3.48	0.030 3	1
	802.11ac80	11.92 ± 2.0	13.92	24.66			2.19	0.012 0	1
5 470 ~ 5 725	802.11a	17.08 ± 2.0	19.08	80.91	3.92	2.47	3.98	0.039 7	1
	802.11n_HT20	16.91 ± 2.0	18.91	77.80			3.91	0.038 2	1
	802.11ac_VHT20	16.73 ± 2.0	18.73	74.64			3.83	0.036 6	1
	802.11n_HT40	16.49 ± 2.0	18.49	70.63			3.72	0.034 7	1
	802.11ac_VHT40	16.92 ± 2.0	18.92	77.98			3.91	0.038 3	1
	802.11ac80	13.83 ± 2.0	15.83	38.28			2.74	0.018 8	1

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
5 725 ~ 5 850	802.11a	18.71 ± 2.0	20.71	117.76	3.85	2.43	4.77	0.056 8	1
	802.11n_ HT20	18.48 ± 2.0	20.48	111.69			4.64	0.053 9	1
	802.11ac_ VHT20	18.19 ± 2.0	20.19	104.47			4.49	0.050 4	1
	802.11n_ HT40	18.14 ± 2.0	20.14	103.28			4.46	0.049 9	1
	802.11ac_ VHT40	18.42 ± 2.0	20.42	110.15			4.61	0.053 2	1
	802.11ac80	17.41 ± 2.0	19.41	87.30			4.10	0.042 1	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(187.07 * 2.05)/1.00} = 5.52 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 187.07 * 2.05 / (4 * \pi * 20^2) = 0.076 3$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.3.3 DATA for Antenna 0_MIMO

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11n_ HT20	14.82 ± 2.0	16.82	48.08	0.87	1.22	2.16	0.011 7	1
	802.11n_ HT40	11.45 ± 2.0	13.45	22.13			1.47	0.005 4	1
5 150 ~ 5 250	802.11n_ HT20	11.82 ± 2.0	13.82	24.10	0.22	1.05	1.42	0.005 0	1
	802.11ac_ VHT20	11.05 ± 2.0	13.05	20.18			1.30	0.004 2	1
	802.11n_ HT40	11.84 ± 2.0	13.84	24.21			1.42	0.005 1	1
	802.11ac_ VHT40	11.51 ± 2.0	13.51	22.44			1.37	0.004 7	1
	802.11ac80	8.26 ± 2.0	10.26	10.62			0.94	0.002 2	1
5 250 ~ 5 350	802.11n_ HT20	12.38 ± 2.0	14.38	27.42	-0.09	0.98	1.46	0.005 3	1
	802.11ac_ VHT20	12.08 ± 2.0	14.08	25.59			1.41	0.005 0	1
	802.11n_ HT40	12.17 ± 2.0	14.17	26.12			1.43	0.005 1	1
	802.11ac_ VHT40	12.13 ± 2.0	14.13	25.88			1.42	0.005 0	1
	802.11ac80	8.77 ± 2.0	10.77	11.94			0.96	0.002 3	1
5 470 ~ 5 725	802.11n_ HT20	13.47 ± 2.0	15.47	35.24	1.56	1.43	2.00	0.010 0	1
	802.11ac_ VHT20	14.25 ± 2.0	16.25	42.17			2.19	0.012 0	1
	802.11n_ HT40	13.24 ± 2.0	15.24	33.42			1.95	0.009 5	1
	802.11ac_ VHT40	14.48 ± 2.0	16.48	44.46			2.25	0.012 7	1
	802.11ac80	9.87 ± 2.0	11.87	15.38			1.32	0.004 4	1
5 725 ~ 5 850	802.11n_ HT20	13.98 ± 2.0	15.98	39.63	1.39	1.38	2.08	0.010 9	1
	802.11ac_ VHT20	13.79 ± 2.0	15.79	37.93			2.04	0.010 4	1
	802.11n_ HT40	13.91 ± 2.0	15.91	38.99			2.07	0.010 7	1
	802.11ac_ VHT40	13.87 ± 2.0	15.87	38.64			2.06	0.010 6	1
	802.11ac80	13.33 ± 2.0	15.33	34.12			1.93	0.009 3	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 n_HT20), safe distance,

$$D = 0.282 * \sqrt{(48.08 * 1.22)/1.00} = 2.16 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 48.08 * 1.22 / (4 * \pi * 20^2) = 0.011 7$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.3.4 DATA for Antenna 1_MIMO

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11n_ HT20	14.83 ± 2.0	16.83	48.19	3.12	2.05	2.80	0.019 7	1
	802.11n_ HT40	11.44 ± 2.0	13.44	22.08			1.90	0.009 0	1
5 150 ~ 5 250	802.11n_ HT20	11.58 ± 2.0	13.58	22.80	3.90	2.45	2.11	0.011 1	1
	802.11ac_ VHT20	11.02 ± 2.0	13.02	20.04			1.98	0.009 8	1
	802.11n_ HT40	11.42 ± 2.0	13.42	21.98			2.07	0.010 7	1
	802.11ac_ VHT40	11.33 ± 2.0	13.33	21.53			2.05	0.010 5	1
	802.11ac80	8.18 ± 2.0	10.18	10.42			1.43	0.005 1	1
5 250 ~ 5 350	802.11n_ HT20	11.48 ± 2.0	13.48	22.28	3.90	2.45	2.09	0.010 9	1
	802.11ac_ VHT20	11.25 ± 2.0	13.25	21.13			2.03	0.010 3	1
	802.11n_ HT40	11.38 ± 2.0	13.38	21.78			2.06	0.010 6	1
	802.11ac_ VHT40	11.54 ± 2.0	13.54	22.59			2.10	0.011 0	1
	802.11ac80	8.41 ± 2.0	10.41	10.99			1.46	0.005 4	1
5 470 ~ 5 725	802.11n_ HT20	12.51 ± 2.0	14.51	28.25	3.92	2.47	2.35	0.013 9	1
	802.11ac_ VHT20	12.51 ± 2.0	14.51	28.25			2.35	0.013 9	1
	802.11n_ HT40	12.48 ± 2.0	14.48	28.05			2.35	0.013 8	1
	802.11ac_ VHT40	12.57 ± 2.0	14.57	28.64			2.37	0.014 1	1
	802.11ac80	9.33 ± 2.0	11.33	13.58			1.63	0.006 7	1
5 725 ~ 5 850	802.11n_ HT20	14.07 ± 2.0	16.07	40.46	3.85	2.43	2.79	0.019 5	1
	802.11ac_ VHT20	13.76 ± 2.0	15.76	37.67			2.70	0.018 2	1
	802.11n_ HT40	13.91 ± 2.0	15.91	38.99			2.74	0.018 8	1
	802.11ac_ VHT40	13.84 ± 2.0	15.84	38.37			2.72	0.018 5	1
	802.11ac80	13.10 ± 2.0	15.10	32.36			2.50	0.015 6	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 n_HT20), safe distance,

$$D = 0.282 * \sqrt{(48.19 * 2.05)/1.00} = 2.80 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 48.19 * 2.05 / (4 * \pi * 20^2) = 0.019 7$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.3.5 DATA for Multiple Transmit

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/c m ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11n_ HT20	17.84 ± 2.0	19.84	96.28	5.15	3.27	5.01	0.062 7	1
	802.11n_ HT40	14.46 ± 2.0	16.46	44.21			3.39	0.028 8	1
5 150 ~ 5 250	802.11n_ HT20	14.71 ± 2.0	16.71	46.90	5.45	3.51	3.62	0.032 7	1
	802.11ac_ VHT20	14.05 ± 2.0	16.05	40.23			3.35	0.028 1	1
	802.11n_ HT40	14.65 ± 2.0	16.65	46.19			3.59	0.032 2	1
	802.11ac_ VHT40	14.43 ± 2.0	16.43	43.97			3.50	0.030 7	1
	802.11ac80	11.23 ± 2.0	13.23	21.04			2.42	0.014 7	1
5 250 ~ 5 350	802.11n_ HT20	14.96 ± 2.0	16.96	49.70	5.36	3.44	3.68	0.034 0	1
	802.11ac_ VHT20	14.70 ± 2.0	16.70	46.72			3.57	0.031 9	1
	802.11n_ HT40	14.80 ± 2.0	16.80	47.90			3.62	0.032 7	1
	802.11ac_ VHT40	14.86 ± 2.0	16.86	48.48			3.64	0.033 1	1
	802.11ac80	11.60 ± 2.0	13.60	22.93			2.50	0.015 7	1
5 470 ~ 5 725	802.11n_ HT20	16.03 ± 2.0	18.03	63.49	5.91	3.90	4.44	0.049 3	1
	802.11ac_ VHT20	16.48 ± 2.0	18.48	70.42			4.67	0.054 6	1
	802.11n_ HT40	15.89 ± 2.0	17.89	61.47			4.37	0.047 7	1
	802.11ac_ VHT40	16.64 ± 2.0	18.64	73.10			4.76	0.056 7	1
	802.11ac80	12.62 ± 2.0	14.62	28.96			3.00	0.022 5	1
5 725 ~ 5 850	802.11n_ HT20	17.04 ± 2.0	19.04	80.09	5.80	3.80	4.92	0.060 6	1
	802.11ac_ VHT20	16.79 ± 2.0	18.79	75.60			4.78	0.057 2	1
	802.11n_ HT40	16.92 ± 2.0	18.92	77.99			4.86	0.059 0	1
	802.11ac_ VHT40	16.87 ± 2.0	18.87	77.01			4.83	0.058 2	1
	802.11ac80	16.23 ± 2.0	18.23	66.48			4.48	0.050 3	1

Remark 1: Calculated Output Power= $10 \log (10^{(\text{Antenna0 Output Power}/10)} + 10^{(\text{Antenna1 Output Power}/10)})$

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 n_HT20), safe distance,

$$D = 0.282 * \sqrt{(96.28 * 3.27)/1.00} = 5.01 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 96.28 * 3.27 / (4 * \pi * 20^2) = 0.062 7$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

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4.4 Calculated MPE Safe Distance for Bluetooth LE

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	125 kbps	7.69 ± 2.0	9.69	9.31	0.15	1.04	0.88	0.001 9	1
	500 kbps	7.90 ± 2.0	9.90	9.77			0.90	0.002 0	1
	1 Mbps	7.69 ± 2.0	9.69	9.31			0.88	0.001 9	1
	2 Mbps	7.70 ± 2.0	9.77	9.48			0.88	0.002 0	1

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(8.81 * 1.04)/1.00} = 0.85 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 8.81 * 1.04 / (4 * \pi * 20^2) = 0.001 8$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.5 Calculated MPE Safe Distance for Bluetooth

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	8.14 ± 2.0	10.14	10.33	0.15	1.04	0.92	0.002 1	1
	2 Mbps	10.44 ± 2.0	12.44	17.54			1.20	0.003 6	1
	3 Mbps	10.59 ± 2.0	12.59	18.16			1.22	0.003 7	1

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(10.33 * 1.04)/1.00} = 0.92 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 10.33 * 1.04 / (4 * \pi * 20^2) = 0.002 1$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

4.6 DATA for Intermodulation Transmit

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Power Density (mW/cm ²) @ 20 cm Separation	Sum Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)			
Bluetooth + WLAN 2 G + WLAN 5 G	Bluetooth (3 Mbps)	10.59 ± 2.0	12.97	19.82	0.003 7	0.108 5	1.00
	WLAN 2 G (802.11 b_Ant 0)	20.95 ± 2.0	22.95	197.24	0.047 9		
	WLAN 5 G (UNII 3 802.11 a Ant 1)	18.71 ± 2.0	20.71	117.76	0.056 8		
Bluetooth LE + WLAN 2 G + WLAN 5 G	Bluetooth LE (500 kbps)	7.90 ± 2.0	9.90	9.77	0.002 0	0.106 8	1.00
	WLAN 2 G (802.11 b_Ant 0)	20.95 ± 2.0	22.95	197.24	0.047 9		
	WLAN 5 G (UNII 3 802.11 a Ant 1)	18.71 ± 2.0	20.71	117.76	0.056 8		