

EMF TEST REPORT

Test Report No. : OT-25N-RWD-049
Reception No. : 2510003461
Applicant : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
Manufacturer : Samsung Electronics Co Ltd
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea
Type of Equipment : Wi-Fi/BT Transceiver
FCC ID. : A3LWCH731R
Model Name : WCH731R
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 19 pages (including this page)
Date of Incoming : October 15, 2025
Date of issue : November 27, 2025

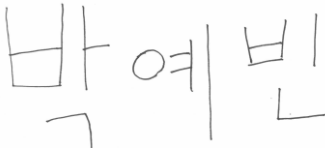
SUMMARY

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 test report is not associated with the accreditation granted by the Korean Laboratory Accreditation Scheme (KOLAS).





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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-25N-RWD-049	November 27, 2025	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd

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Telephone No. : +82-10-8798-3916

FCC ID : A3LWCH731R

Model Name : WCH731R

Brand Name : 

Serial Number : N/A

Date : November 27, 2025

E.U.T. DESCRIPTION	Modular Transmitter, Wi-Fi/BT Transceiver
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 Samsung Electronics Co Ltd, Model WCH731R (referred to as the EUT in this report) is a Wi-Fi/BT Transceiver. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Wi-Fi/BT Transceiver		
Temperature Range	-10 °C ~ 50 °C		
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
	Bluetooth	2 402 MHz ~ 2 480 MHz	
	WLAN 2.4 GHz	2 412 MHz ~ 2 472 MHz (802.11b/g/n(HT20))	
	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))	
	WLAN 5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20))	
		5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))	
		5 775 MHz (802.11ac(VHT80))	
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps / 2 Mbps	
	Bluetooth	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): 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	1 Mbps	12.05 dBm
		2 Mbps	12.15 dBm
	Bluetooth	1 Mbps	12.31 dBm
		2 Mbps	11.41 dBm
		3 Mbps	11.91 dBm

RF OUTPUT POWER	WLAN 2.4 GHz	SISO Antenna 0	17.53 dBm(802.11b) 16.59 dBm(802.11g) 16.46 dBm(802.11n_HT20)
		SISO Antenna 1	17.42 dBm(802.11b) 16.11 dBm(802.11g) 16.72 dBm(802.11n_HT20)
		MIMO Antenna 0	16.04 dBm(802.11n_HT20)
		MIMO Antenna 1	16.38 dBm(802.11n_HT20)
		MIMO Multiple Antenna	19.22 dBm(802.11n_HT20)
	WLAN 5 150 MHz ~ 5 250 MHz Band	SISO Antenna 0	16.88 dBm(802.11a) 13.51 dBm(802.11n_HT20) 13.11 dBm(802.11n_HT40) 13.06 dBm(802.11ac_VHT80)
		SISO Antenna 1	16.94 dBm(802.11a) 13.65 dBm(802.11n_HT20) 13.61 dBm(802.11n_HT40) 13.17 dBm(802.11ac_VHT80)
		MIMO Antenna 0	13.26 dBm(802.11n_HT20) 13.09 dBm(802.11n_HT40) 13.14 dBm(802.11ac_VHT80)
		MIMO Antenna 1	13.77 dBm(802.11n_HT20) 15.60 dBm(802.11n_HT40) 13.04 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna	16.53 dBm(802.11n_HT20) 16.37 dBm(802.11n_HT40) 16.10 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 250 MHz ~ 5 350 MHz Band	SISO Antenna 0	16.90 dBm(802.11a) 15.44 dBm(802.11n_HT20) 15.53 dBm(802.11n_HT40) 14.74 dBm(802.11ac_VHT80)
		SISO Antenna 1	16.76 dBm(802.11a) 15.70 dBm(802.11n_HT20) 15.74 dBm(802.11n_HT40) 14.51 dBm(802.11ac_VHT80)
		MIMO Antenna 0	15.50 dBm(802.11n_HT20) 15.25 dBm(802.11n_HT40) 14.57 dBm(802.11ac_VHT80)
		MIMO Antenna 1	15.68 dBm(802.11n_HT20) 15.60 dBm(802.11n_HT40) 14.43 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna	18.60 dBm(802.11n_HT20) 18.44 dBm(802.11n_HT40) 17.51 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 470 MHz ~ 5 725 MHz Band	SISO Antenna 0	16.67 dBm(802.11a) 15.69 dBm(802.11n_HT20) 15.33 dBm(802.11n_HT40) 14.48 dBm(802.11ac_VHT80)
		SISO Antenna 0 Straddle	13.14 dBm(802.11a) 12.06 dBm(802.11n_HT20) 12.73 dBm(802.11n_HT40) 12.43 dBm(802.11ac_VHT80)
		SISO Antenna 1	16.89 dBm(802.11a) 15.88 dBm(802.11n_HT20) 15.77 dBm(802.11n_HT40) 14.27 dBm(802.11ac_VHT80)
		SISO Antenna 1_Straddle	14.55 dBm(802.11a) 13.52 dBm(802.11n_HT20) 14.28 dBm(802.11n_HT40) 12.40 dBm(802.11ac_VHT80)
		MIMO Antenna 0	15.63 dBm(802.11n_HT20) 15.28 dBm(802.11n_HT40) 13.80 dBm(802.11ac_VHT80)
		MIMO Antenna 0 Straddle	10.35 dBm(802.11n_HT20) 11.16 dBm(802.11n_HT40) 11.04 dBm(802.11ac_VHT80)
		MIMO Antenna 1	14.61 dBm(802.11n_HT20) 15.67 dBm(802.11n_HT40) 14.24 dBm(802.11ac_VHT80)
		MIMO Antenna 1 Straddle	11.66 dBm(802.11n_HT20) 12.76 dBm(802.11n_HT40) 10.91 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna	18.16 dBm(802.11n_HT20) 18.49 dBm(802.11n_HT40) 18.44 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna _Straddle	14.06 dBm(802.11n_HT20) 15.04 dBm(802.11n_HT40) 13.99 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 725 MHz ~ 5 850 MHz Band	SISO Antenna 0	16.65 dBm(802.11a) 14.91 dBm(802.11n_HT20) 15.13 dBm(802.11n_HT40) 13.55 dBm(802.11ac_VHT80)
		SISO Antenna 0 Straddle	5.84 dBm(802.11a) 5.29 dBm(802.11n_HT20) 0.64 dBm(802.11n_HT40) -3.79 dBm(802.11ac_VHT80)
		SISO Antenna 1	16.84 dBm(802.11a) 15.77 dBm(802.11n_HT20) 15.41 dBm(802.11n_HT40) 14.33 dBm(802.11ac_VHT80)
		SISO Antenna 1_Straddle	7.34 dBm(802.11a) 6.83 dBm(802.11n_HT20) 2.20 dBm(802.11n_HT40) -4.63 dBm(802.11ac_VHT80)
		MIMO Antenna 0	15.21 dBm(802.11n_HT20) 15.58 dBm(802.11n_HT40) 13.77 dBm(802.11ac_VHT80)
		MIMO Antenna 0 Straddle	3.60 dBm(802.11n_HT20) -0.87 dBm(802.11n_HT40) -5.25 dBm(802.11ac_VHT80)
		MIMO Antenna 1	15.58 dBm(802.11n_HT20) 15.36 dBm(802.11n_HT40) 14.34 dBm(802.11ac_VHT80)
		MIMO Antenna 1 Straddle	4.95 dBm(802.11n_HT20) 0.67 dBm(802.11n_HT40) -5.67 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna	18.41 dBm(802.11n_HT20) 18.48 dBm(802.11n_HT40) 17.07 dBm(802.11ac_VHT80)
		MIMO Multiple Antenna _Straddle	7.34 dBm(802.11n_HT20) 2.98 dBm(802.11n_HT40) -2.44 dBm(802.11ac_VHT80)

ANTENNA TYPE	PCB Antenna		
ANTENNA TRANSMIT TYPE	WLAN 5 GHz: 2T2R WLAN 2.4 GHz: 2T2R Bluetooth / Bluetooth LE: 1T1R		
ANTENNA GAIN	Bluetooth LE	0.70 dBi	
	Bluetooth	0.70 dBi	
	WLAN 2.4 GHz	Antenna 0	1.20 dBi
		Antenna 1	1.70 dBi
		Multiple Antenna	4.47 dBi
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	1.90 dBi
		Antenna 1	1.10 dBi
		Multiple Antenna	4.53 dBi
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	1.60 dBi
		Antenna 1	0.30 dBi
		Multiple Antenna	4.01 dBi
	5 470 MHz ~ 5 725 MHz Band	Antenna 0	0.40 dBi
		Antenna 1	-0.40 dBi
		Multiple Antenna	3.03 dBi
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	-0.40 dBi
		Antenna 1	-0.10 dBi
		Multiple Antenna	2.76 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.

-. None

3. EUT MODIFICATIONS

-. None

4. SYSTEM TEST CONFIGURATION

4.1 Antenna Configurations

Band	SISO		MIMO
	ANT 0	ANT 1	ANT 0 + ANT 1
802.11 b	O	O	X
802.11 g	O	O	X
802.11 a	O	O	X
802.11 n(HT20/40)	O	O	O
802.11 ac(VHT20/40/80)	O	O	O

Note

- 1) O : Support, X : Not Support
- 2) SISO : Single Input Single Output
- 3) MIMO : Multiple Input Multiple Output

Directional Gain Calculation

According to KDB 662911 D01 Multiple Transmitter Output v02r01 F,2),f), ii)

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

Technology	ANT 0	ANT 1	Directional Gain
	Peak Gain (dBi)	Peak Gain (dBi)	Peak Gain (dBi)
WLAN 2.4G	1.20	1.70	4.47
WLAN 5G UNII1	1.90	1.10	4.53
WLAN 5G UNII2A	1.60	0.30	4.01
WLAN 5G UNII2C	0.40	-0.40	3.03
WLAN 5G UNII3	-0.40	-0.10	2.76

Note

According to Ansi C63.10-2020 Section 14.6.3, the directional gain is calculated using the formula, where N_{ANT} is the total number of antennas used.

$$Directional\ Gain = 10 \cdot \log(((10^{(ANT1\ Gain/20)} + 10^{(ANT2/20)})^2)/N_{ANT}))\ dBi$$

Sample Calculation :

ANT 1 Gain : 1.90 dBi, ANT 2 Gain : 1.10 dBi

$$10 \cdot \log(((10^{(1.90/20)} + 10^{(1.10/20)})^2)/2)) = 4.53\ dBi$$

5. MAXIMUM PERMISSIBLE EXPOSURE

5.1 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

5.2 EUT Description

Kind of EUT	Wi-Fi/BT Transceiver
Device Category	☐ Portable (< 20 cm separation) ☐ Mobile (> 20 cm separation) ☒ Others
Exposure Evaluation Applied	☒ MPE ☐ SAR ☐ N/A

5.3 Calculated MPE Safe Distance for WLAN (SISO)

5.3.1 DATA for Antenna 0

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			
2 400 ~ 2 483.5	802.11b	17.53 ± 2.0	19.53	89.74	1.20	1.32	3.07	0.023 5	1
	802.11g	16.59 ± 2.0	18.59	72.28			2.75	0.019 0	1
	802.11n20	16.46 ± 2.0	18.46	70.15			2.71	0.018 4	1
5 150 ~ 5 250	802.11a	16.88 ± 2.0	18.88	77.27	1.90	1.55	3.08	0.023 8	1
	802.11n20	13.51 ± 2.0	15.51	35.56			2.09	0.011 0	1
	802.11n40	13.11 ± 2.0	15.11	32.43			2.00	0.010 0	1
	802.11ac80	13.06 ± 2.0	15.06	32.06			1.99	0.009 9	1
5 250 ~ 5 350	802.11a	16.90 ± 2.0	18.90	77.62	1.60	1.45	2.99	0.022 3	1
	802.11n20	15.44 ± 2.0	17.44	55.46			2.52	0.015 9	1
	802.11n40	15.53 ± 2.0	17.53	56.62			2.55	0.016 3	1
	802.11ac80	14.74 ± 2.0	16.74	47.21			2.33	0.013 6	1
5 470 ~ 5 725	802.11a	16.67 ± 2.0	18.67	73.62	0.45	1.10	2.53	0.016 1	1
	802.11n20	15.69 ± 2.0	17.69	58.75			2.26	0.012 8	1
	802.11n40	15.33 ± 2.0	17.33	54.08			2.17	0.011 8	1
	802.11ac80	14.48 ± 2.0	16.48	44.46			1.97	0.009 7	1
5 725 ~ 5 850	802.11a	16.65 ± 2.0	18.65	73.28	-0.40	0.91	2.31	0.013 3	1
	802.11n20	14.91 ± 2.0	16.91	49.09			1.89	0.008 9	1
	802.11n40	15.13 ± 2.0	17.13	51.64			1.94	0.009 4	1
	802.11ac80	13.55 ± 2.0	15.55	35.89			1.61	0.006 5	1

According to above table, for 5 150 ~ 5 250 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(77.27 * 1.55)/1.00} = 3.08 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 77.27 * 1.55 / (4 * \pi * 20^2) = 0.023 8$$

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

5.3.2 DATA for Antenna 1

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			
2 400 ~ 2 483.5	802.11b	17.42 ± 2.0	19.42	87.50	1.70	1.48	3.21	0.025 7	1
	802.11g	16.11 ± 2.0	18.11	64.71			2.76	0.019 0	1
	802.11n20	16.72 ± 2.0	18.72	74.47			2.96	0.021 9	1
5 150 ~ 5 250	802.11a	16.94 ± 2.0	18.94	78.34	1.10	1.29	2.83	0.020 1	1
	802.11n20	13.65 ± 2.0	15.65	36.73			1.94	0.009 4	1
	802.11n40	13.61 ± 2.0	15.61	36.39			1.93	0.009 3	1
	802.11ac80	13.17 ± 2.0	15.17	32.89			1.84	0.008 4	1
5 250 ~ 5 350	802.11a	16.76 ± 2.0	18.76	75.16	0.30	1.07	2.53	0.016 0	1
	802.11n20	15.70 ± 2.0	17.70	58.88			2.24	0.012 6	1
	802.11n40	15.74 ± 2.0	17.74	59.43			2.25	0.012 7	1
	802.11ac80	14.51 ± 2.0	16.51	44.77			1.95	0.009 5	1
5 470 ~ 5 725	802.11a	16.89 ± 2.0	18.89	77.45	-0.40	0.91	2.37	0.014 1	1
	802.11n20	15.88 ± 2.0	17.88	61.38			2.11	0.011 1	1
	802.11n40	15.77 ± 2.0	17.77	59.84			2.08	0.010 9	1
	802.11ac80	14.27 ± 2.0	16.27	42.36			1.75	0.007 7	1
5 725 ~ 5 850	802.11a	16.84 ± 2.0	18.84	76.56	-0.10	0.98	2.44	0.014 9	1
	802.11n20	15.77 ± 2.0	17.77	59.84			2.16	0.011 6	1
	802.11n40	15.41 ± 2.0	17.41	55.08			2.07	0.010 7	1
	802.11ac80	14.33 ± 2.0	16.33	42.95			1.83	0.008 4	1

According to above table, for 2 400 ~ 2 483.5 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(87.50 * 1.48)/1.00} = 3.21 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 87.50 * 1.48 / (4 * \pi * 20^2) = 0.025 7$$

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

5.4 Calculated MPE Safe Distance for WLAN (MIMO)

5.4.1 DATA for Antenna 0

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			
2 400 ~ 2 483.5	802.11n20	16.04 ± 2.0	18.04	63.68	1.20	1.32	2.58	0.016 7	1
5 150 ~ 5 250	802.11n20	13.26 ± 2.0	15.26	33.57	1.90	1.55	2.03	0.010 3	1
	802.11n40	13.09 ± 2.0	15.09	32.28			1.99	0.009 9	1
	802.11ac80	13.14 ± 2.0	15.14	32.66			2.01	0.010 1	1
5 250 ~ 5 350	802.11n20	15.50 ± 2.0	17.50	56.23	1.60	1.45	2.54	0.016 2	1
	802.11n40	15.25 ± 2.0	17.25	53.09			2.47	0.015 3	1
	802.11ac80	14.57 ± 2.0	16.57	45.39			2.28	0.013 1	1
5 470 ~ 5 725	802.11n20	15.63 ± 2.0	17.63	57.94	0.45	1.10	2.25	0.012 6	1
	802.11n40	15.28 ± 2.0	17.28	53.46			2.16	0.011 7	1
	802.11ac80	13.80 ± 2.0	15.80	38.02			1.82	0.008 3	1
5 725 ~ 5 850	802.11n20	15.21 ± 2.0	17.21	52.60	-0.40	0.91	1.95	0.009 5	1
	802.11n40	15.58 ± 2.0	17.58	57.28			2.04	0.010 4	1
	802.11ac80	13.77 ± 2.0	15.77	37.76			1.65	0.006 9	1

According to above table, for 5 250 ~ 5 350 MHz Band(802.11 n20), safe distance,

$$D = 0.282 * \sqrt{(56.23 * 1.45)/1.00} = 2.54 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 56.23 * 1.45 / (4 * \pi * 20^2) = 0.016 2$$

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

5.4.2 DATA for Antenna 1

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			
2 400 ~ 2 483.5	802.11n20	16.38 ± 2.0	18.38	68.87	1.70	1.48	2.85	0.020 3	1
5 150 ~ 5 250	802.11n20	13.77 ± 2.0	15.77	37.76	1.10	1.29	1.97	0.009 7	1
	802.11n40	15.60 ± 2.0	17.60	57.54			2.43	0.014 7	1
	802.11ac80	13.04 ± 2.0	15.04	31.92			1.81	0.008 2	1
5 250 ~ 5 350	802.11n20	15.68 ± 2.0	17.68	58.61	0.30	1.07	2.23	0.012 5	1
	802.11n40	15.60 ± 2.0	17.60	57.54			2.21	0.012 3	1
	802.11ac80	14.43 ± 2.0	16.43	43.95			1.94	0.009 4	1
5 470 ~ 5 725	802.11n20	14.61 ± 2.0	16.61	45.81	-0.40	0.91	1.82	0.008 3	1
	802.11n40	15.67 ± 2.0	17.67	58.48			2.06	0.010 6	1
	802.11ac80	14.24 ± 2.0	16.24	42.07			1.75	0.007 6	1
5 725 ~ 5 850	802.11n20	15.58 ± 2.0	17.58	57.28	-0.10	0.98	2.11	0.011 1	1
	802.11n40	15.36 ± 2.0	17.36	54.45			2.06	0.010 6	1
	802.11ac80	14.34 ± 2.0	16.34	43.05			1.83	0.008 4	1

According to above table, for 2 400 ~ 2 483.5 MHz Band(802.11 n20), safe distance,

$$D = 0.282 * \sqrt{(68.87 * 1.48)/1.00} = 2.855 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 68.87 * 1.48 / (4 * \pi * 20^2) = 0.020 3$$

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

5.4.3 DATA for Multiple Transmit

According to above equation, the following result was obtained.

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			
2 400 ~ 2 483.5	802.11n_n20	19.22 ± 2.0	21.22	132.54	4.47	2.80	5.43	0.073 8	1
5 150 ~ 5 250	802.11n20	16.53 ± 2.0	18.53	71.33	4.53	2.84	4.01	0.040 3	1
	802.11n40	17.53 ± 2.0	19.53	89.83			4.50	0.050 7	1
	802.11ac80	16.10 ± 2.0	18.10	64.57			3.82	0.036 5	1
5 250 ~ 5 350	802.11n20	18.60 ± 2.0	20.60	114.85	4.01	2.52	4.80	0.057 5	1
	802.11n40	18.44 ± 2.0	20.44	110.63			4.71	0.055 4	1
	802.11ac80	17.51 ± 2.0	19.51	89.35			4.23	0.044 8	1
5 470 ~ 5 725	802.11n20	18.16 ± 2.0	20.16	103.76	3.03	2.01	4.07	0.041 5	1
	802.11n40	18.49 ± 2.0	20.49	111.94			4.23	0.044 7	1
	802.11ac80	17.04 ± 2.0	19.04	80.09			3.58	0.032 0	1
5 725 ~ 5 850	802.11n20	18.41 ± 2.0	20.41	109.88	2.76	1.89	4.06	0.041 3	1
	802.11n40	18.48 ± 2.0	20.48	111.73			4.10	0.042 0	1
	802.11ac80	17.07 ± 2.0	19.07	80.81			3.48	0.030 4	1

According to above table, for 2 400 ~ 2 483.5 MHz Band(802.11 n20), safe distance,

$$D = 0.282 * \sqrt{(132.54 * 2.80)/1.00} = 5.43 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 132.54 * 2.80 / (4 * \pi * 20^2) = 0.073 8$$

According to above table, for 5 250 ~ 5 350 MHz Band(802.11 n20), safe distance,

$$D = 0.282 * \sqrt{(114.85 * 2.52)/1.00} = 4.80 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 114.85 * 2.55 / (4 * \pi * 20^2) = 0.057 5$$

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

5.5 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	1 Mbps	12.05 ± 2.0	14.05	25.41	0.70	1.17	1.54	0.005 9	1
	2 Mbps	12.15 ± 2.0	14.15	26.00			1.56	0.006 1	1

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

$$D = 0.282 * \sqrt{(26.00 * 1.17)/1.00} = 1.56 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 26.00 * 1.17 / (4 * \pi * 20^2) = 0.006 1$$

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

5.6 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	12.31 ± 2.0	14.31	26.98	0.70	1.17	1.59	0.006 3	1
	2 Mbps	11.41 ± 2.0	13.41	21.93			1.43	0.005 1	1
	3 Mbps	11.91 ± 2.0	13.91	24.60			1.52	0.005 8	1

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

$$D = 0.282 * \sqrt{(26.98 * 1.17)/1.00} = 1.59 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 26.98 * 1.17 / (4 * \pi * 20^2) = 0.006 3$$

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

5.7 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 2.4 G	Bluetooth (1 Mbps)	12.31 ± 2.0	14.31	26.98	0.006 3	0.080 1	1.00
	WLAN 2 G (802.11 n20)	19.22 ± 2.0	21.22	132.43	0.073 8		
Bluetooth + WLAN 5 G	Bluetooth LE (1 Mbps)	12.31 ± 2.0	14.31	26.98	0.006 3	0.063 8	1.00
	WLAN 5 G (UNII2A_802.11 a)	18.60 ± 2.0	20.60	114.82	0.057 5		