



FCC Test Report

Report No: FCS202211099W01

Issued for

Applicant:	Wavetec FZCO
Address:	Light Industrial Unit # 9, Dubai Silicon Oasis P.O. Box 341133, Dubai, United Arab Emirates
Product Name:	UnoQ Counter - Handset
Brand Name:	N/A
Model Name:	WH-Z4B
Series Model:	WH-Z4B-BL, WH-Z2B, WH-Z2B-BL, WT-HZ4B, WT-HZ2B, WT-HZ4B-BL, WT-HZ2B-BL, Button Handset, RSH-ZigBee-SC04, RSH-ZigBee-SC13, RSH-ZigBee-SC12, RSH-ZigBee-SC11, RSH-Zigbee, RSH-Zigbee-SC10, SR-ZS1, ESW-0ZAA-eu, UnoQ Counter - Button Handset
FCC ID:	2AGQF-WT-UNOQ-HS
Issued By: Flux Compliance Service Laboratory Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan Tel: 769-27280901 Fax:769-27280901 http://www.fcs-lab.com	

TEST RESULT CERTIFICATION

Applicant's Name.....: Wavetec FZCO
Address.....: Light Industrial Unit # 9, Dubai Silicon Oasis P.O. Box 341133, Dubai,
United Arab Emirates
Manufacture's Name.....: Wavetec FZCO
Address.....: Light Industrial Unit # 9, Dubai Silicon Oasis P.O. Box 341133, Dubai,
United Arab Emirates

Product Description

Product Name.....: UnoQ Counter - Handset
Brand Name: N/A
Model Name.....: WH-Z4B
Series Model.....: WH-Z4B-BL, WH-Z2B, WH-Z2B-BL, WT-HZ4B, WT-HZ2B,
WT-HZ4B-BL, WT-HZ2B-BL, Button Handset, RSH-ZigBee-SC04,
RSH-ZigBee-SC13, RSH-ZigBee-SC12, RSH-ZigBee-SC11,
RSH-Zigbee, RSH-Zigbee-SC10, SR-ZS1, ESW-0ZAA-eu,
UnoQ Counter - Button Handset
Test Standards.....: FCC Rules and Regulations Part 15 Subpart C, Section 249
Test Procedure.....: ANSI C63.10:2013

This device described above has been tested FCS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test.....:

Date (s) of performance of tests.: Nov 26, 2022~Dec 08, 2022

Date of Issue.....: Dec 08, 2022

Test Result.....: Pass

Tested by

:

Scott Shen

(Scott Shen)

Reviewed by

:

Duke Qian

(Duke Qian)

Approved by

:

Jack Wang

(Jack Wang)

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Revision History

Rev.	Issue Date	Effect Page	Contents
00	Dec 08, 2022	All	Initial Issue

1. SUMMARY OF TEST RESULTS

FCC Part 15.249,Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.205(a), 15.209(a), 15.249(a), 15.249(c)	Radiated Spurious Emission	PASS	--
15.209	Field strength of fundamental	PASS	
15.249(d)	Band Edge Emission	PASS	--
15.215(c)	20dB Bandwidth	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

- (1) "N/A" denotes test is not applicable in this Test Report
- (2) All tests are according to ANSI C63.10-2013

1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number: 5545.01	

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF output power, conducted	± 0.71 dB
2	Unwanted Emissions, conducted	± 2.98 dB
3	Conducted Emission (9KHz-150KHz)	± 4.13 dB
4	Conducted Emission (150KHz-30MHz)	± 4.74 dB
5	All emissions,radiated(<1G) 9KHz-30MHz	± 3.1 dB
6	All emissions,radiated(<1G) 30MHz-1000MHz	± 3.2 dB
7	All emissions,radiated (1GHz -18GHz)	± 3.66 dB
8	All emissions,radiated (18GHz -40GHz)	± 4.31 dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	UnoQ Counter - Handset
Trade Name	N/A
Model Name	WH-Z4B
Series Model	WH-Z4B-BL, WH-Z2B, WH-Z2B-BL, WT-HZ4B, WT-HZ2B, WT-HZ4B-BL, WT-HZ2B-BL, Button Handset, RSH-ZigBee-SC04, RSH-ZigBee-SC13, RSH-ZigBee-SC12, RSH-ZigBee-SC11, RSH-Zigbee, RSH-Zigbee-SC10, SR-ZS1, ESW-0ZAA-eu, UnoQ Counter - Button Handset
Model Difference	The above product with same circuit, PCB layout, electrical parts, materials and wiring structures, Appearance shape, the materials of decorative accessories is same, only different color.
Channel List	Please refer to the Note 2.
2.4G	Frequency:2410-2475MHz Modulation: GFSK Data rate: 1Mbps Channel number: 66CH
Power Supply	12VDC supply and 3VDC battery
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2410MHz	18	2427MHz	35	2444MHz	52	2461MHz
2	2411MHz	19	2428MHz	36	2445MHz	53	2462MHz
3	2412MHz	20	2429MHz	37	2446MHz	54	2463MHz
4	2413MHz	21	2430MHz	38	2447MHz	55	2464MHz
5	2414MHz	22	2431MHz	39	2448MHz	56	2465MHz
6	2415MHz	23	2432MHz	40	2449MHz	57	2466MHz
7	2416MHz	24	2433MHz	41	2450MHz	58	2467MHz
8	2417MHz	25	2434MHz	42	2451MHz	59	2468MHz
9	2418MHz	26	2435MHz	43	2452MHz	60	2469MHz
10	2419MHz	27	2436MHz	44	2453MHz	61	2470MHz
11	2420MHz	28	2437MHz	45	2454MHz	62	2471MHz
12	2421MHz	29	2438MHz	46	2455MHz	63	2472MHz
13	2422MHz	30	2439MHz	47	2456MHz	64	2473MHz
14	2423MHz	31	2440MHz	48	2457MHz	65	2474MHz
15	2424MHz	32	2441MHz	49	2458MHz	66	2475MHz
16	2425MHz	33	2442MHz	50	2459MHz		
17	2426MHz	34	2443MHz	51	2460MHz		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	NA	N/A	PCB Antenna	N/A	1.96	Antenna

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test software: FCC tool

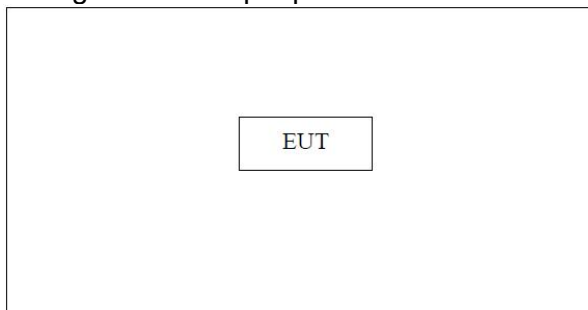
The test software was used to control EUT work in continuous TX mode, and select test channel, Wireless mode as below table

No.	Test model description
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK

Note:

1. All the test modes can be supply by battery, only the result of the worst case recorded in the report. GFSK mode is worst mode.
2. For radiated emission, 3 axis were chosen for testing for each applicable mode.
3. The EUT used fully charge battery when tested.
4. During the test, the dutycycle>98%, the test voltage was tuned from 85% to 115% of the Nominal rate supply votage, and found that the worst case was the nominal rated supply condition, So the report just shows that condition's data

Configuration and peripherals



2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.4 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2022.01.28	2023.01.27
Signal Analyzer	R&S	FSV40-N	FCS-E012	2022.01.28	2023.01.27
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2022.01.28	2023.01.27
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2022.01.28	2023.01.27
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2022.03.17	2023.03.16
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2022.01.28	2023.01.27
Pre-Amplifier(0.1M-3G Hz)	EMCI	EM330N	FCS-E004	2022.01.28	2023.01.27
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2022.01.28	2023.01.27
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2022.01.28	2023.01.27
Temperature & Humidity	HTC-1	victor	FCS-E005	2022.01.28	2023.01.27

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2022.01.28	2023.01.27
LISN	R&S	ENV216	FCS-E007	2022.01.28	2023.01.27
LISN	ETS	3810/2NM	FCS-E009	2022.01.28	2023.01.27
Temperature & Humidity	HTC-1	victor	FCS-E008	2022.01.28	2023.01.27

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
Spectrum Analyzer	Keysight	N9020A	FCS-E015	2022.01.28	2023.01.27
Spectrum Analyzer	Agilent	E4447A	MY50180039	2022.01.28	2023.01.27
Spectrum Analyzer	R&S	FSV-40	101499	2022.01.28	2023.01.27

3. RADIATED EMISSION MEASUREMENT

3.1 LIMIT

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009mhz - 1000mhz)

Frequencies (MHz)	Field Strength (micovolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

LIMITS OF FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
2400-2483.5	114	94

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

3.2 TEST PROCEDURE

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz /10 Hz (Peak detector is for Both)

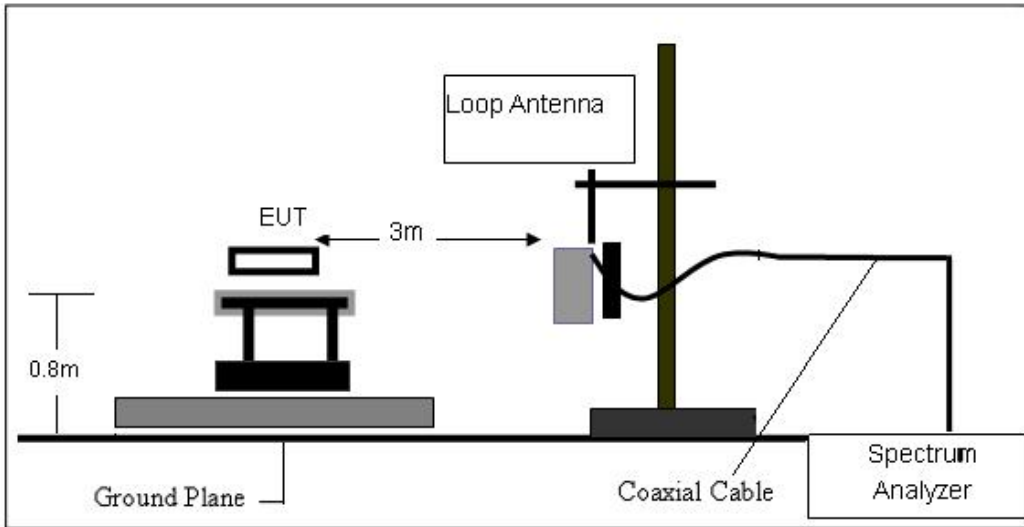
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

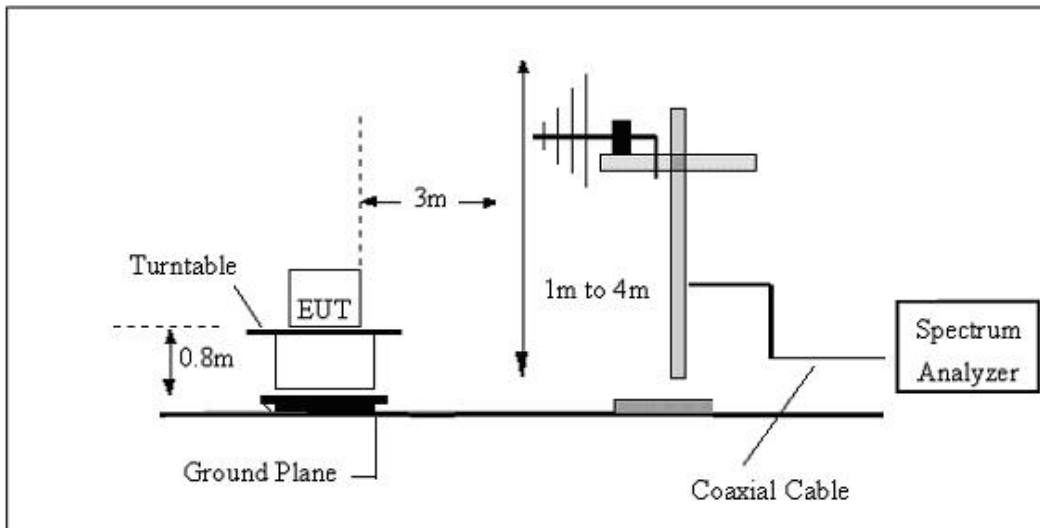
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported
 For fundamental frequency ,RBW>20dB BW ,VBW>RBW,PK detector for PK value, RMS detector for AV value.

3.3 TEST SETUP

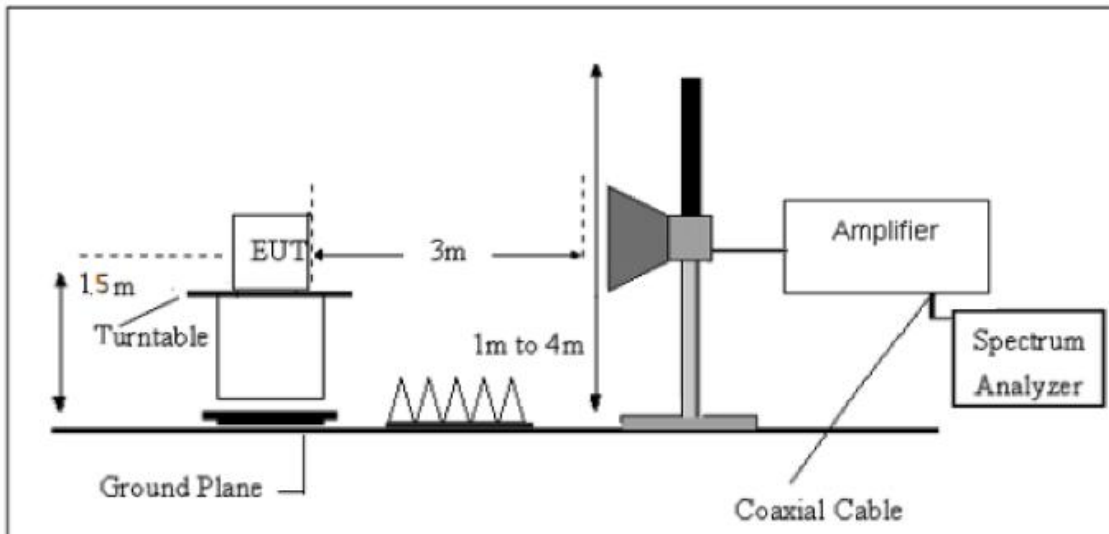
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	GFSK Mode		

For field strength of the fundamental signal

Peak

No.	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2410.0	91.04	27.58	5.39	30.18	93.83	114.00	-20.17	Horizontal
2	2410.0	88.63	27.58	5.39	30.18	91.42	114.00	-22.58	Vertical
3	2443.0	89.44	27.55	5.43	30.06	92.36	114.00	-21.64	Horizontal
4	2443.0	87.65	27.55	5.43	30.06	90.57	114.00	-23.43	Vertical
5	2475.0	92.11	27.52	5.47	29.93	95.17	114.00	-18.83	Horizontal
6	2475.0	89.08	27.52	5.47	29.93	92.14	114.00	-21.86	Vertical

Avg

No.	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2410.0	75.95	27.58	5.39	30.18	78.74	94.00	-15.26	Horizontal
2	2410.0	74.29	27.58	5.39	30.18	77.08	94.00	-16.92	Vertical
3	2443.0	74.56	27.55	5.43	30.06	77.48	94.00	-16.52	Horizontal
4	2443.0	71.91	27.55	5.43	30.06	74.83	94.00	-19.17	Vertical
5	2475.0	76.54	27.52	5.47	29.93	79.60	94.00	-14.40	Horizontal
6	2475.0	74.30	27.52	5.47	29.93	77.36	94.00	-16.64	Vertical

For spurious emission

(9KHz-30MHz)

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

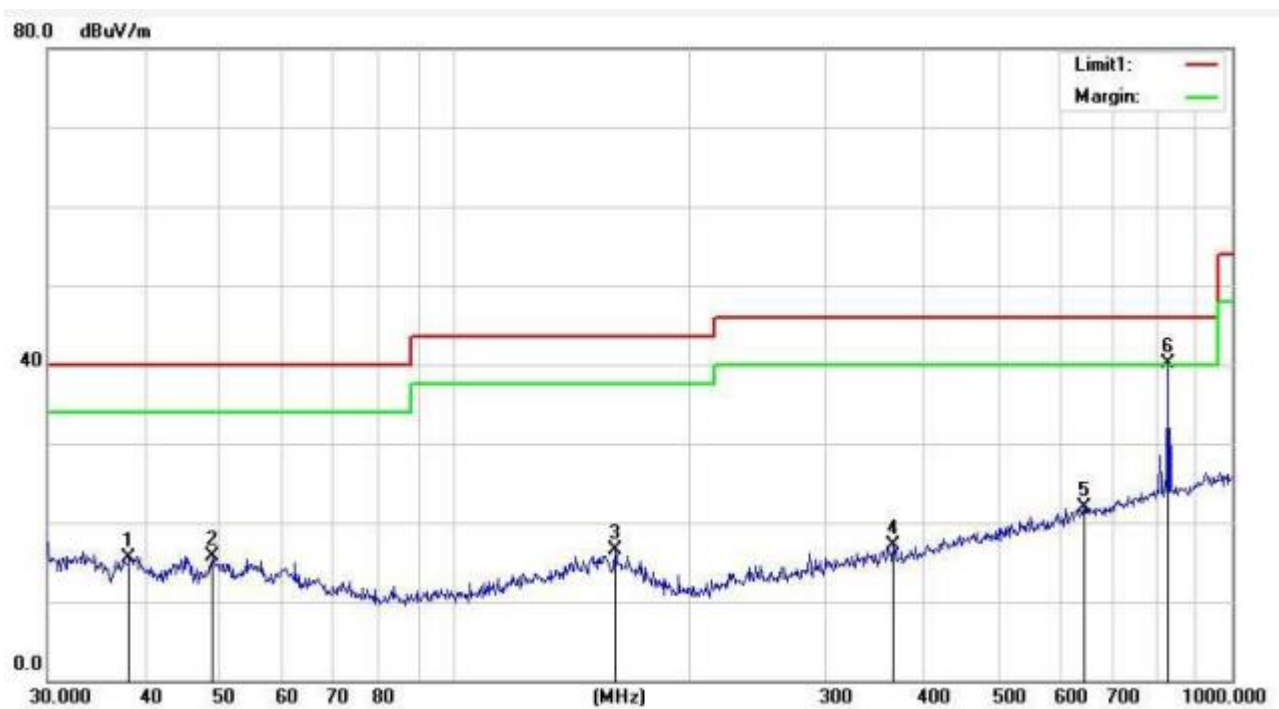
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance/test distance)(dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

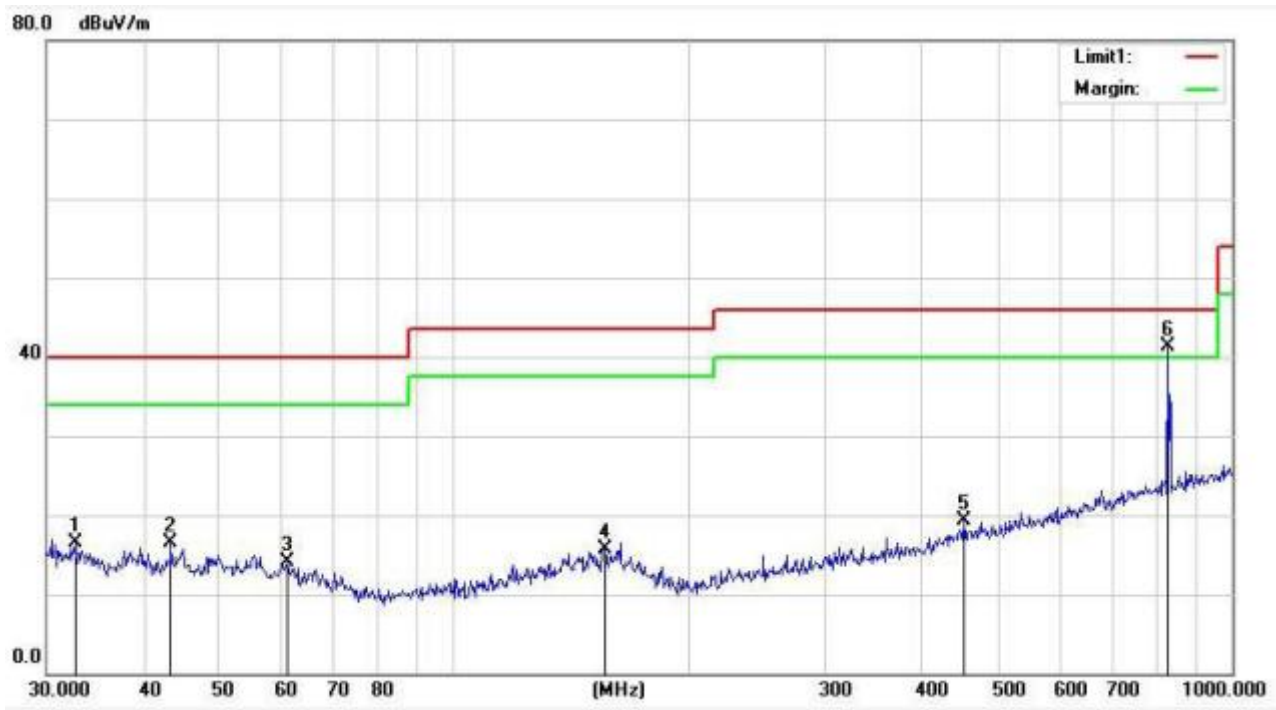
(30MHZ-1000MHZ)

Temperature:	23.7°C	Relative Humidity:	61%
Test Mode:	GFSK	Phase:	Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	38.2120	30.98	-15.45	15.53	40.00	-24.47	QP
2	48.8430	31.61	-15.91	15.70	40.00	-24.30	QP
3	160.9090	31.55	-14.99	16.56	43.50	-26.94	QP
4	366.8231	31.61	-14.58	17.03	46.00	-28.97	QP
5	645.1195	30.87	-8.97	21.90	46.00	-24.10	QP
6	827.4934	46.39	-6.38	40.01	46.00	-5.99	QP

Temperature:	22.7°C	Relative Humidity:	61%
Test Mode:	GFSK	Phase:	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	32.6340	10.85	5.72	16.57	40.00	-23.43	QP
2	43.3534	12.19	4.31	16.50	40.00	-23.50	QP
3	61.1316	10.91	3.18	14.09	40.00	-25.91	QP
4	156.4578	10.58	5.20	15.78	43.50	-27.72	QP
5	452.7197	11.33	7.90	19.23	46.00	-26.77	QP
6	827.4934	27.60	13.74	41.34	46.00	-4.66	QP

Remarks:

1. Margin = Result (Result =Reading + Factor) - Limit

(1GHZ~25GHZ)

LOW CH(GFSK)

PEAK

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4820.00	35.94	31.78	8.60	32.09	44.23	74.00	-29.77	Vertical
7230.50	30.93	36.15	11.65	32.00	46.73	74.00	-27.27	Vertical
9640.00	30.66	37.95	14.14	31.62	51.13	74.00	-22.87	Vertical
12050.50	*					74.00		Vertical
14460.00	*					74.00		Vertical
4820.00	39.95	31.78	8.60	32.09	48.24	74.00	-25.76	Horizontal
7230.50	32.56	36.15	11.65	32.00	48.36	74.00	-25.64	Horizontal
9640.00	29.96	37.95	14.14	31.62	50.43	74.00	-23.57	Horizontal
12050.50	*					74.00		Horizontal
14460.00	*					74.00		Horizontal

AVG

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4820.00	25.01	31.78	8.60	32.09	33.30	54.00	-20.70	Vertical
7230.50	19.77	36.15	11.65	32.00	35.57	54.00	-18.43	Vertical
9640.00	18.93	37.95	14.14	31.62	39.40	54.00	-14.60	Vertical
12050.50	*					54.00		Vertical
14460.00	*					54.00		Vertical
4820.00	29.09	31.78	8.60	32.09	37.38	54.00	-16.62	Horizontal
7230.50	21.85	36.15	11.65	32.00	37.65	54.00	-16.35	Horizontal
9640.00	18.55	37.95	14.14	31.62	39.02	54.00	-14.98	Horizontal
12050.50	*					54.00		Horizontal
14460.00	*					54.00		Horizontal

MIDDLE CH(GFSK)

PEAK

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4886.00	36.04	31.85	8.67	32.12	44.44	74.00	-29.56	Vertical
7329.00	30.99	36.37	11.72	31.89	47.19	74.00	-26.81	Vertical
9772.00	30.72	38.35	14.25	31.62	51.70	74.00	-22.30	Vertical
12215.00	*					74.00		Vertical
14658.00	*					74.00		Vertical
4886.00	40.07	31.85	8.67	32.12	48.47	74.00	-25.53	Horizontal
7329.00	32.63	36.37	11.72	31.89	48.83	74.00	-25.17	Horizontal
9772.00	30.02	38.35	14.25	31.62	51.00	74.00	-23.00	Horizontal
12215.00	*					74.00		Horizontal
14658.00	*					74.00		Horizontal

AVG

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4886.00	25.10	31.85	8.67	32.12	33.50	54.00	-20.50	Vertical
7329.00	19.82	36.37	11.72	31.89	36.02	54.00	-17.98	Vertical
9772.00	18.98	38.35	14.25	31.62	39.96	54.00	-14.04	Vertical
12215.00	*					54.00		Vertical
14658.00	*					54.00		Vertical
4886.00	29.19	31.85	8.67	32.12	37.59	54.00	-16.41	Horizontal
7329.00	21.91	36.37	11.72	31.89	38.11	54.00	-15.89	Horizontal
9772.00	18.61	38.35	14.25	31.62	39.59	54.00	-14.41	Horizontal
12215.00	*					54.00		Horizontal
14658.00	*					54.00		Horizontal

HIGH CH(GFSK)

PEAK

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4950.00	35.89	31.93	8.73	32.16	44.39	74.00	-29.61	Vertical
7425.00	30.89	36.59	11.79	31.78	47.49	74.00	-26.51	Vertical
9900.00	30.64	38.81	14.38	31.88	51.95	74.00	-22.05	Vertical
12375.00	*					74.00		Vertical
14850.00	*					74.00		Vertical
4950.00	39.89	31.93	8.73	32.16	48.39	74.00	-25.61	Horizontal
7425.00	32.53	36.59	11.79	31.78	49.13	74.00	-24.87	Horizontal
9900.00	29.92	38.81	14.38	31.88	51.23	74.00	-22.77	Horizontal
12375.00	*					74.00		Horizontal
14850.00	*					74.00		Horizontal

AVG

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4950.00	25.02	31.93	8.73	32.16	33.52	54.00	-20.48	Vertical
7425.00	19.77	36.59	11.79	31.78	36.37	54.00	-17.63	Vertical
9900.00	18.93	38.81	14.38	31.88	40.24	54.00	-13.76	Vertical
12375.00	*					54.00		Vertical
14850.00	*					54.00		Vertical
4950.00	29.10	31.93	8.73	32.16	37.60	54.00	-16.40	Horizontal
7425.00	21.85	36.59	11.79	31.78	38.45	54.00	-15.55	Horizontal
9900.00	18.55	38.81	14.38	31.88	39.86	54.00	-14.14	Horizontal
12375.00	*					54.00		Horizontal
14850.00	*					54.00		Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. “*”, means this data is the too weak instrument of signal is unable to test.

4. BAND EDGE TEST

4.1 LIMIT

According to §15.249(d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

4.2 TEST PROCEDURE

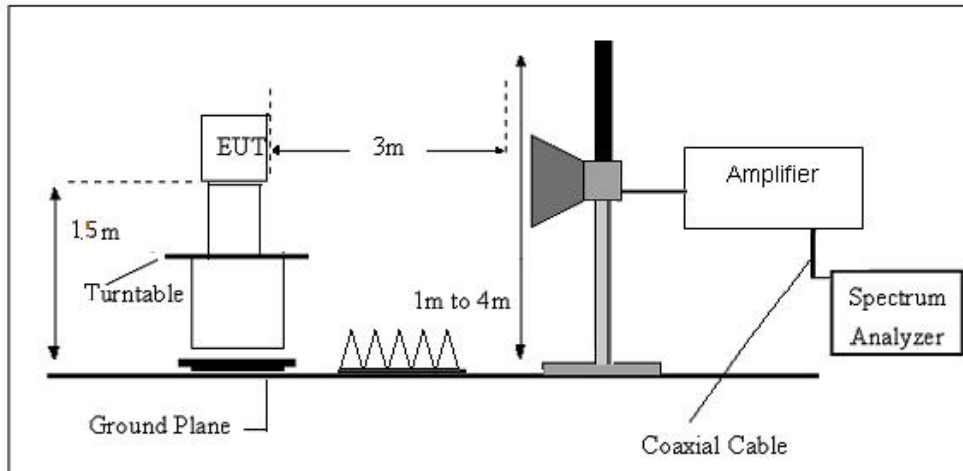
- a. The EUT is placed on a turntable, which is 1.5m above ground plane.
- b. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
Use the following spectrum analyzer settings:
- c. Span = wide enough to fully capture the emission being measured, RBW = 1 MHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
Follow the guidelines in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
- d. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with
- e. the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{duty cycle}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Note:

For fundamental frequency ,RBW>20dB BW ,VBW>RBW,PK detector for PK value, RMS detector for AV value.

4.3 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



4.4 TEST RESULTS

Low CH (GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	37.16	27.61	5.36	30.18	39.95	74.00	-34.05	Horizontal
2390.00	37.32	27.59	5.38	30.18	40.11	74.00	-33.89	Horizontal
2400.00	53.32	27.58	5.39	30.18	56.11	74.00	-17.89	Horizontal
2310.00	37.65	27.61	5.36	30.18	40.44	74.00	-33.56	Vertical
2390.00	37.34	27.59	5.38	30.18	40.13	74.00	-33.87	Vertical
2400.00	54.76	27.58	5.39	30.18	57.55	74.00	-16.45	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	29.65	27.61	5.36	30.18	32.44	54.00	-21.56	Horizontal
2390.00	29.13	27.59	5.38	30.18	31.92	54.00	-22.08	Horizontal
2400.00	40.03	27.58	5.39	30.18	42.82	54.00	-11.18	Horizontal
2310.00	28.34	27.61	5.36	30.18	31.13	54.00	-22.87	Vertical
2390.00	28.68	27.59	5.38	30.18	31.47	54.00	-22.53	Vertical
2400.00	41.15	27.58	5.39	30.18	43.94	54.00	-10.06	Vertical

High CH(GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	38.76	27.53	5.47	29.93	41.83	74.00	-32.17	Horizontal
2500.00	38.99	27.55	5.49	29.93	42.10	74.00	-31.90	Horizontal
2483.50	38.68	27.53	5.47	29.93	41.75	74.00	-32.25	Vertical
2500.00	39.46	27.55	5.49	29.93	42.57	74.00	-31.43	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	31.89	27.53	5.47	29.93	34.96	54.00	-19.04	Horizontal
2500.00	30.68	27.55	5.49	29.93	33.79	54.00	-20.21	Horizontal
2483.50	32.64	27.53	5.47	29.93	35.71	54.00	-18.29	Vertical
2500.00	30.14	27.55	5.49	29.93	33.25	54.00	-20.75	Vertical

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

5. 20 DB BANDWIDTH TEST

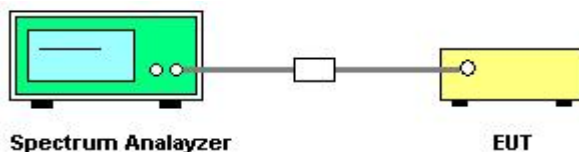
5.1 LIMIT

According to 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation

5.2 TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a
- a. known signal from an external generator
 - b. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
 - c. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

5.3 TEST SETUP

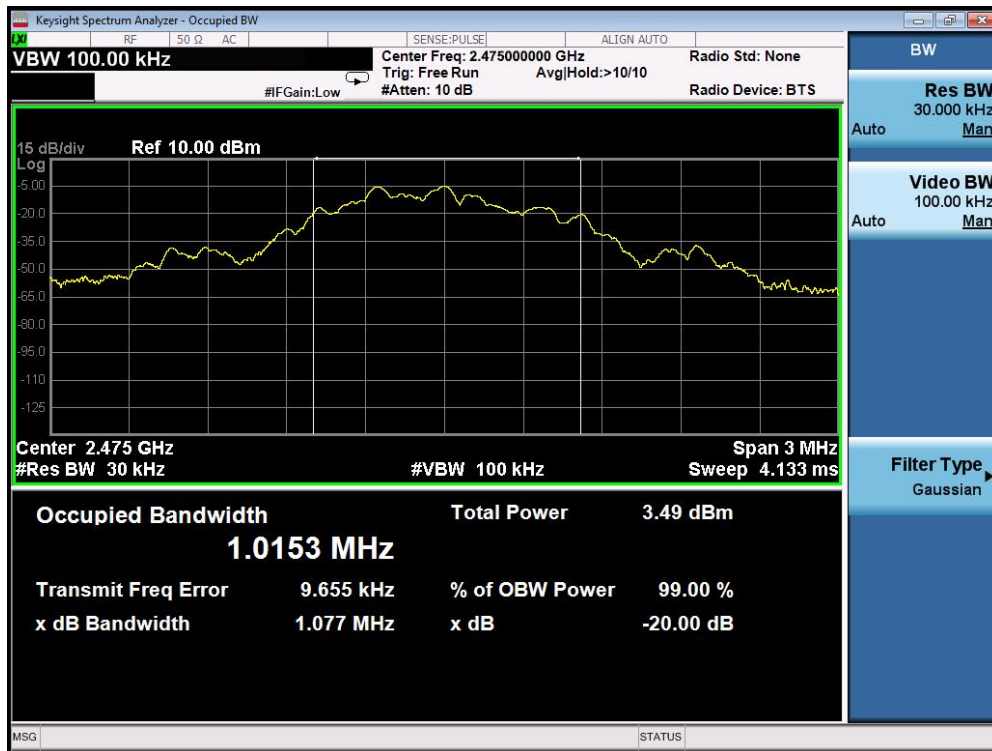


5.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	GFSK		

Frequency	20dB Bandwidth (MHz)	Result
2410 MHz	1.075	PASS
2443 MHz	1.075	PASS
2475 MHz	1.077	PASS





6. ANTENNA REQUIREMENT

6.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

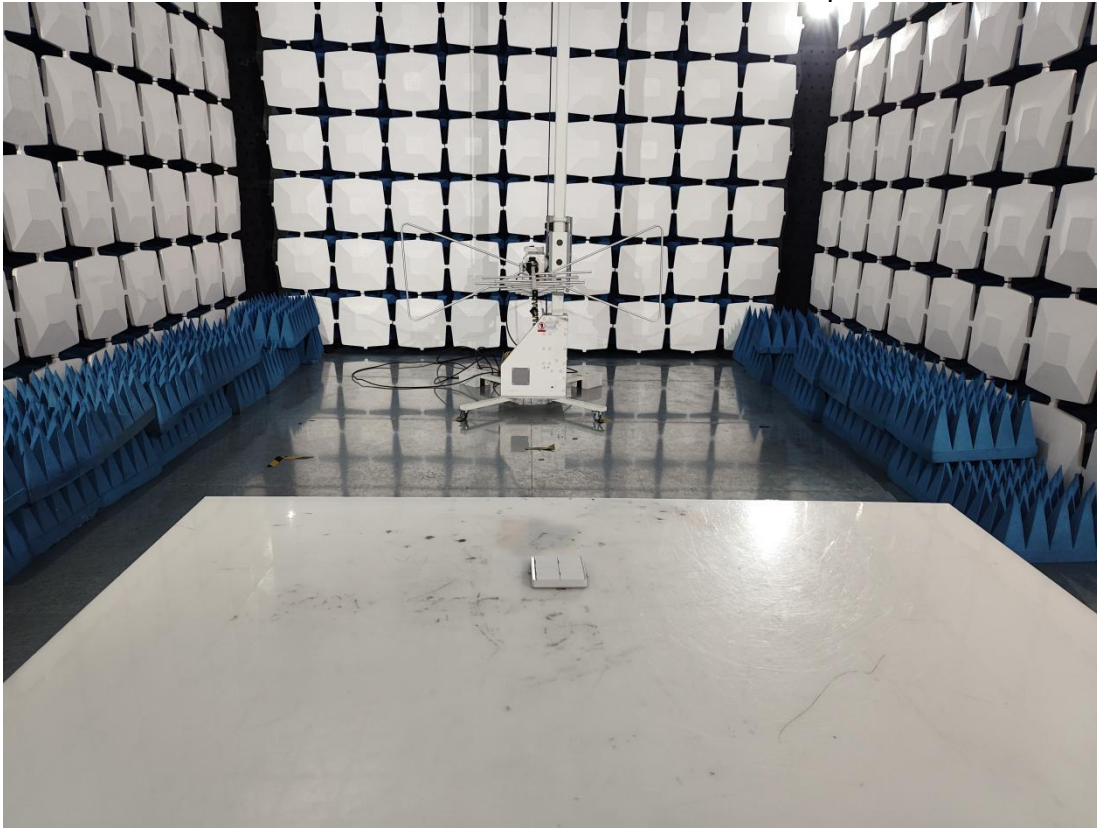
6.2 EUT ANTENNA

The antennas used for this product are internal antenna and other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 1.96dBi.

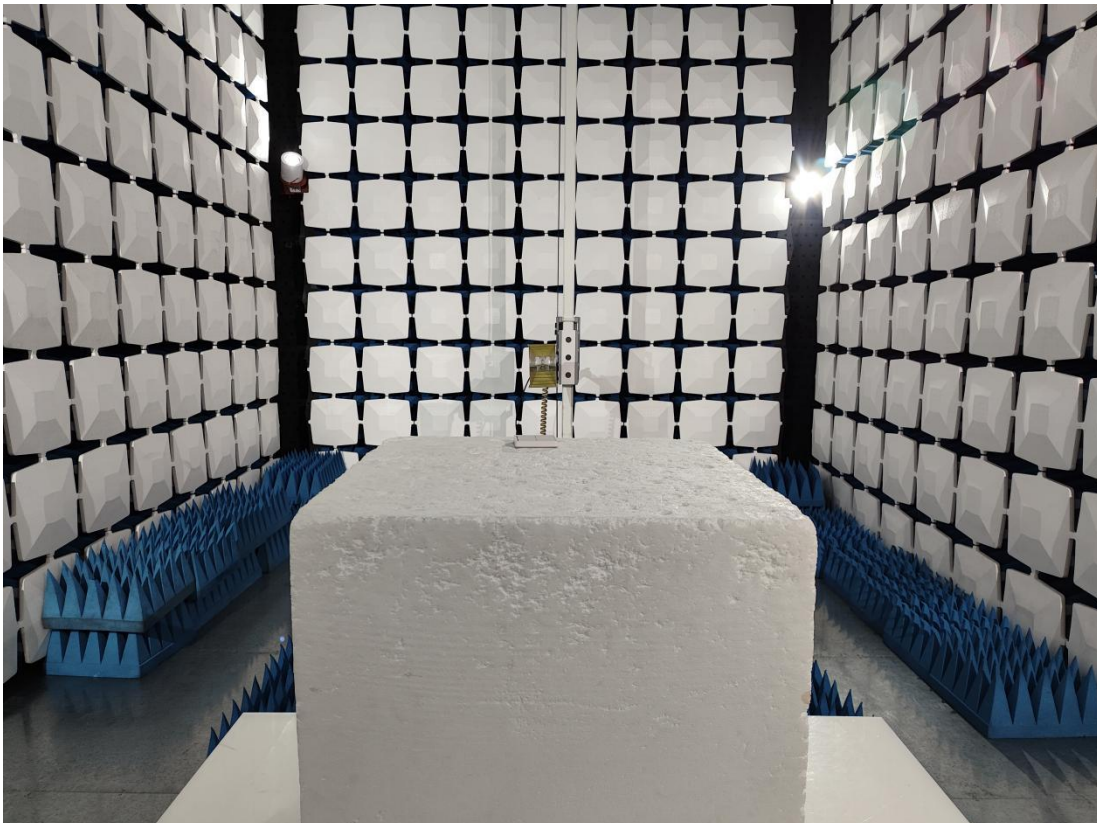
Appendix

Test setup photos

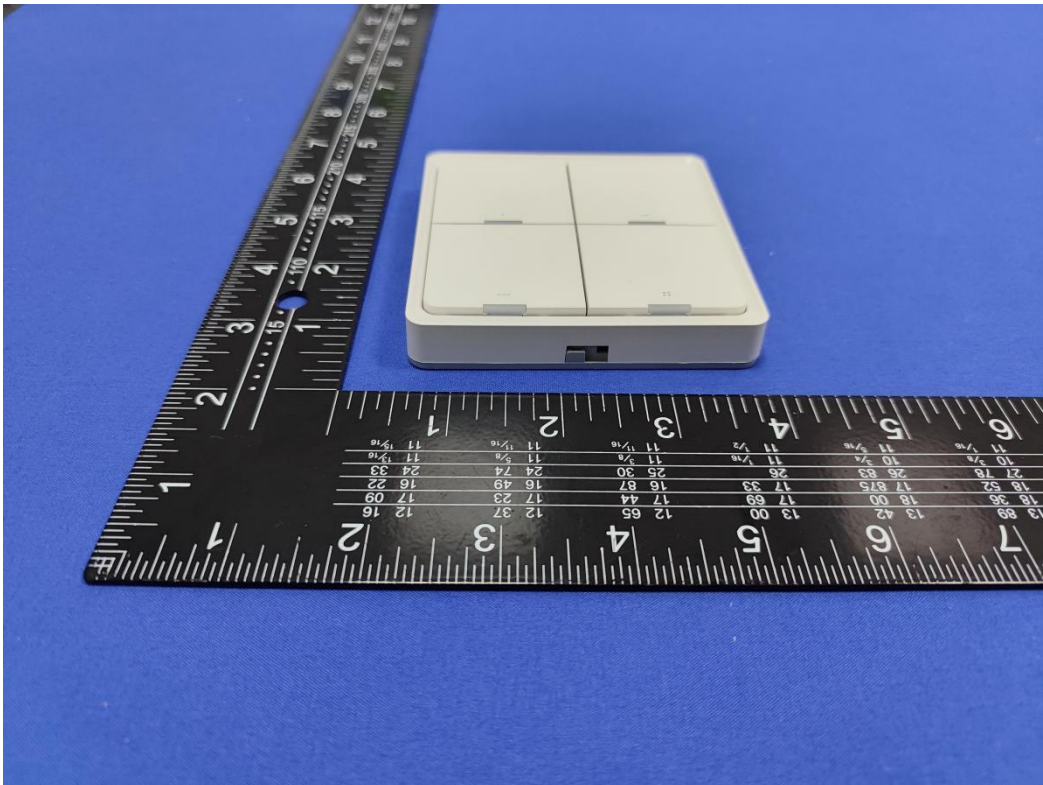
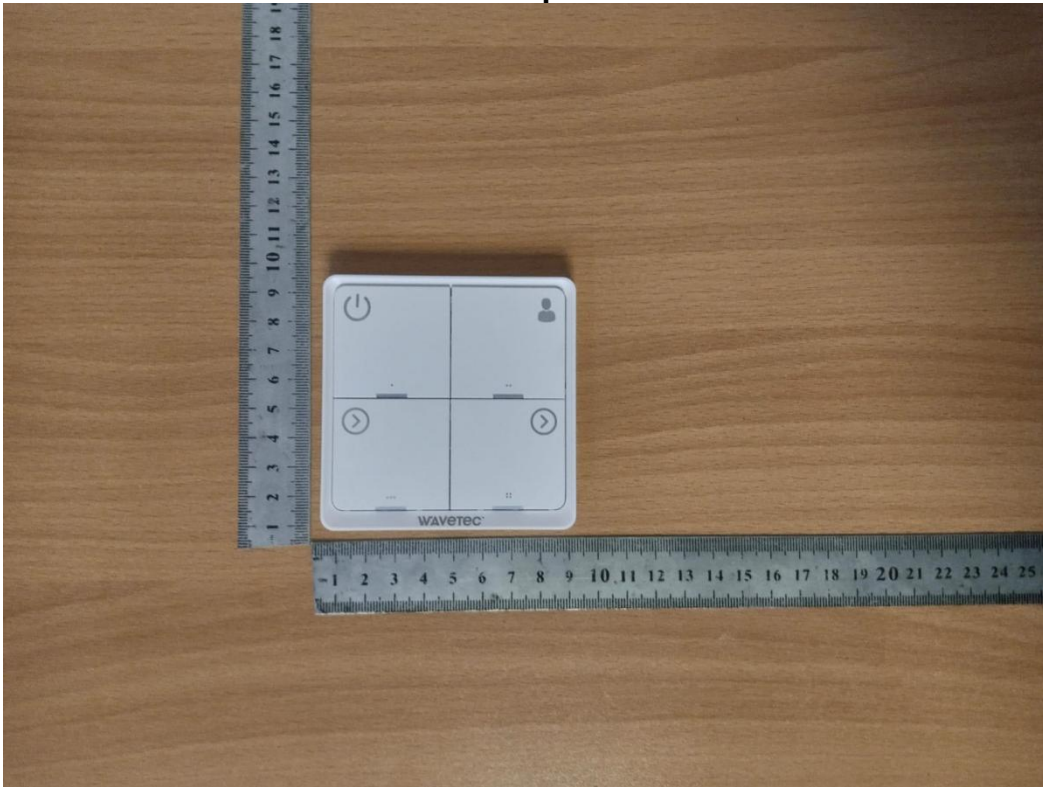
Below 1GHz for radiated emission test setup

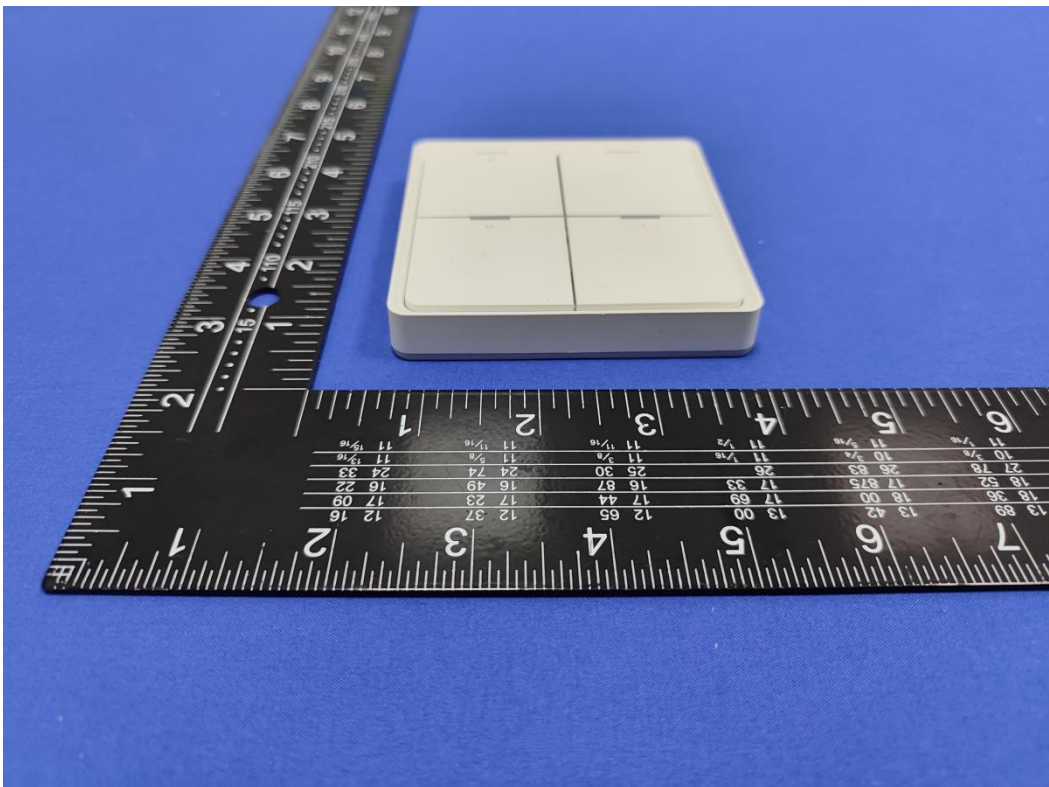
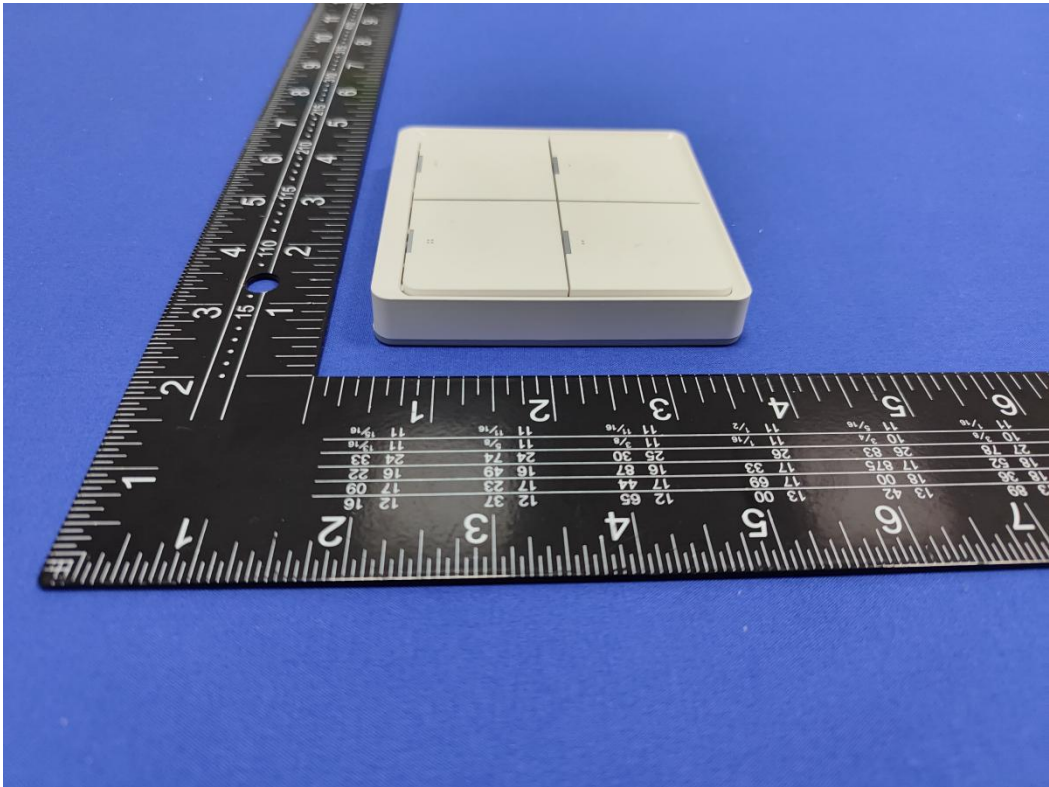


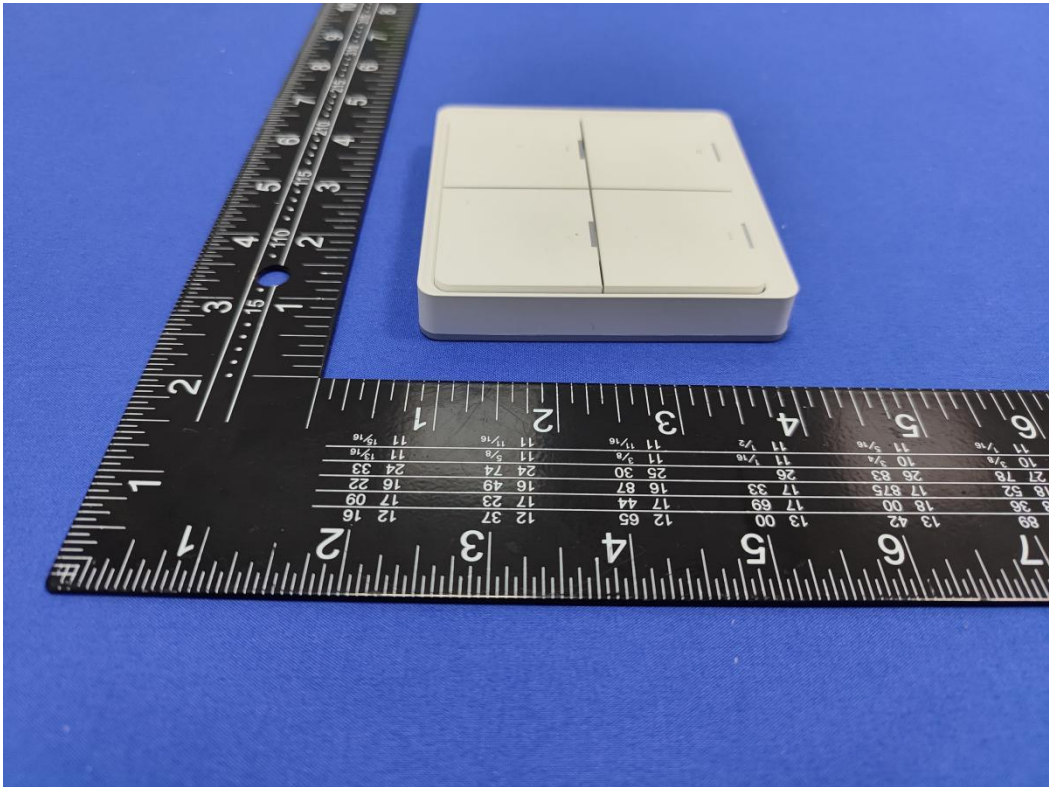
Above 1GHz for radiated emission test setup



External photos







Internal photos

