FCC TEST REPORT

Test report
On Behalf of
IDEA ELECTRONICS INC
For
Pico Projector
Model No.: P100B, P100C, P100D, P100E, P100F

FCC ID: 2AIZY19MP-01

Prepared for :	**IDEA ELECTRONICS INC** **13620 Benson Ave. Suite B, Chino, California, 91710 United States**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Jun. 27, 2019 ~ Jul. 04, 2019**
Date of Report:	**Jul. 04, 2019**
Report Number:	**HK1907041549-2E**

TEST RESULT CERTIFICATION

Applicant's name ..... : IDEA ELECTRONICS INC

Address ..... : 13620 Benson Ave. Suite B, Chino, California, 91710 United States

Manufacture's Name ..... : Shenzhen Wanchuangbo Industry Development Co., Ltd.

Address ..... : 2407,24th floor, building A, xinghe yabao phase 1, meiban avenue, bantian street, longgang district, shenzhen city.

Product description

Trade Mark: IDeaPLAY, Atomicx

Product name..... : Pico Projector

Model and/or type reference : P100B, P100C, P100D, P100E, P100F

Standards ..... : FCC Rules and Regulations Part 15 Subpart C Section 15.249
ANSI C63.10: 2013

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Date of Test ..... :

Date (s) of performance of tests..... : Jun. 27, 2019 ~ Jul. 04, 2019

Date of Issue..... : Jul. 04, 2019

Test Result..... : **Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

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1. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

FCC PART15.249		
CONDUCTED EMISSIONS TEST	§ 15.207	PASS
RADIATED EMISSION TEST	§ 15.249 (a) (d)/ §15.209	PASS
Out of Band Emissions	§ 15.249 (d)/ §15.205	PASS
OCCUPIED BANDWIDTH MEASUREMENT	§ 15.215 (c)	PASS
ANTENNA REQUIREMENT	§ 15.203	PASS

1.2 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

Designation Number : CN1229

1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Pico Projector
Model Name	P100B
Serial Model	P100C, P100D, P100E, P100F
Trade Mark	IDeaPLAY, Atomicx
Model Difference	All model's the function, software and electric circuit are the same, only with color, model named and trade mark different. So test sample model: P100B.
FCC ID	**2AIZY19MP-01**
Operation Frequency:	2402-2480MHz
Number of Channels	LE: 40CH BDR+EDR: 79CH
Modulation Type	LE: GFSK BDR+EDR: GFSK, Pi/4DQPSK, 8DPSK
Antenna Type	Internal Antenna
Antenna Gain	Antenna 1:1dBi
Power Supply:	DC 5A from micro USB or DC 3.7V From Battery
Note: 15B SDoC has been separately tested in another report and shown compliance with the 15B rule.	

2.1.1 Carrier Frequency of Channels

LE Channel List							
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
01	2402	11	2422	21	2442	31	2462
02	2404	12	2424	22	2444	32	2464
03	2406	13	2426	23	2446	33	2466
04	2408	14	2428	24	2448	34	2468
05	2410	15	2430	25	2450	35	2470
06	2412	16	2432	26	2452	36	2472
07	2414	17	2434	27	2454	37	2474
08	2416	18	2436	28	2456	38	2476
09	2418	19	2438	29	2458	39	2478
10	2420	20	2440	30	2460	40	2480

BDR+EDR Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

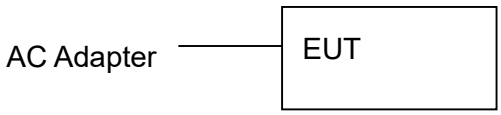
2.2 Operation of EUT during testing

LE Operating Mode
The mode is used: **Transmitting mode**
Low Channel: 2402MHz
Middle Channel: 2440MHz
High Channel: 2480MHz

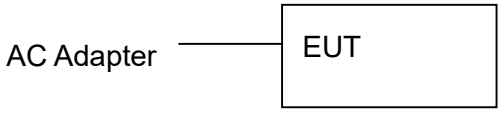
BDR+EDR Operating Mode
The mode is used: **Transmitting mode**
Low Channel: 2402MHz
Middle Channel: 2441MHz
High Channel: 2480MHz

2.3 DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing and Radiation testing:



Operation of EUT during Above1GHz Radiation testing:



- Adapter information
  Model: JHD-AP013U-050240BB-A
  Input: AC10-240V, 50-60Hz, 0.35A
  Output: 5VDC, 2.4A

The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is X&Z position

2.4 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 27, 2018	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 27, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 27, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year

3. CONDUCTED EMISSIONS TEST

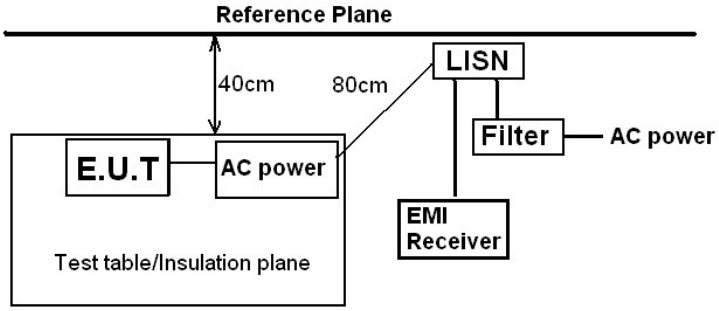
3.1 Conducted Power Line Emission Limit

For intentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

3.2 Test Setup



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

3.3 Test Procedure

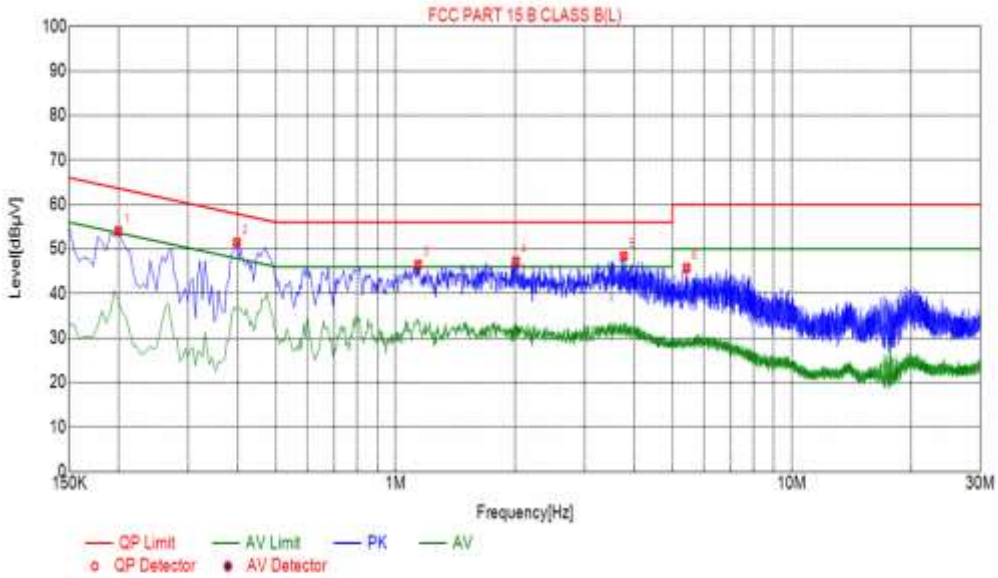
1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5, All support equipments received AC power from a second LISN, if any.
6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

3.4 Test Result

PASS

All the test modes completed for test. only the worst result of AC 120V/60Hz(GFSK Low Channel) was reported as below:

Test Specification: Line



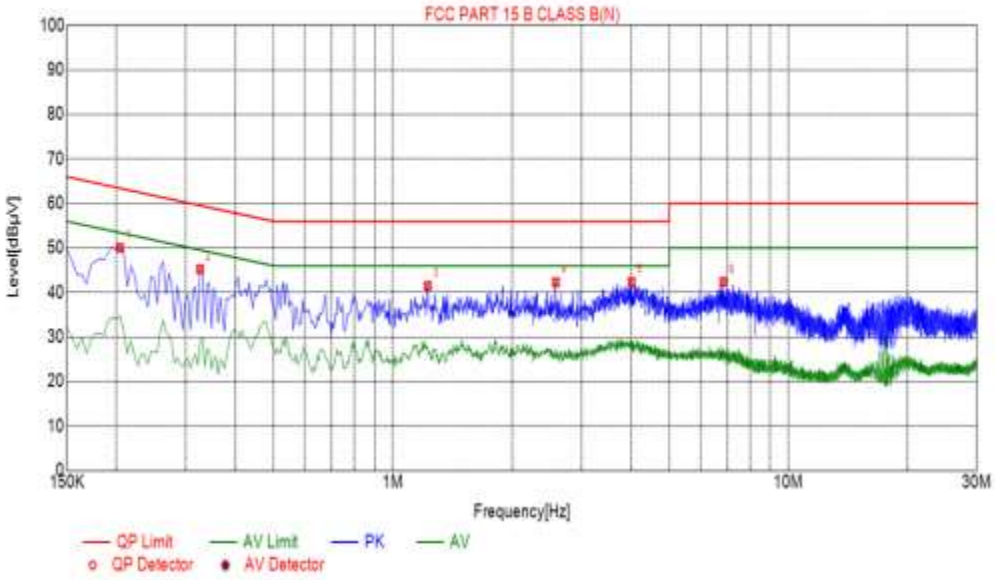
Suspected List						
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Detector
1	0.1995	54.01	10.03	63.63	9.62	PK
2	0.3975	51.43	10.04	57.91	6.48	PK
3	1.1400	46.50	10.09	56.00	9.50	PK
4	2.0130	47.21	10.15	56.00	8.79	PK
5	3.7680	48.37	10.25	56.00	7.63	PK
6	5.4285	45.74	10.26	60.00	14.26	PK

Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor

Test Specification: Neutral



Suspected List						
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Detector
1	0.2040	50.06	10.04	63.45	13.39	PK
2	0.3255	45.25	10.05	59.57	14.32	PK
3	1.2255	41.51	10.09	56.00	14.49	PK
4	2.5845	42.32	10.20	56.00	13.68	PK
5	4.0155	42.36	10.25	56.00	13.64	PK
6	6.8505	42.40	10.20	60.00	17.60	PK

Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor

4 RADIATED EMISSION TEST

4.1 Radiation Limit

For intentional device, according to § 15.209(a), the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

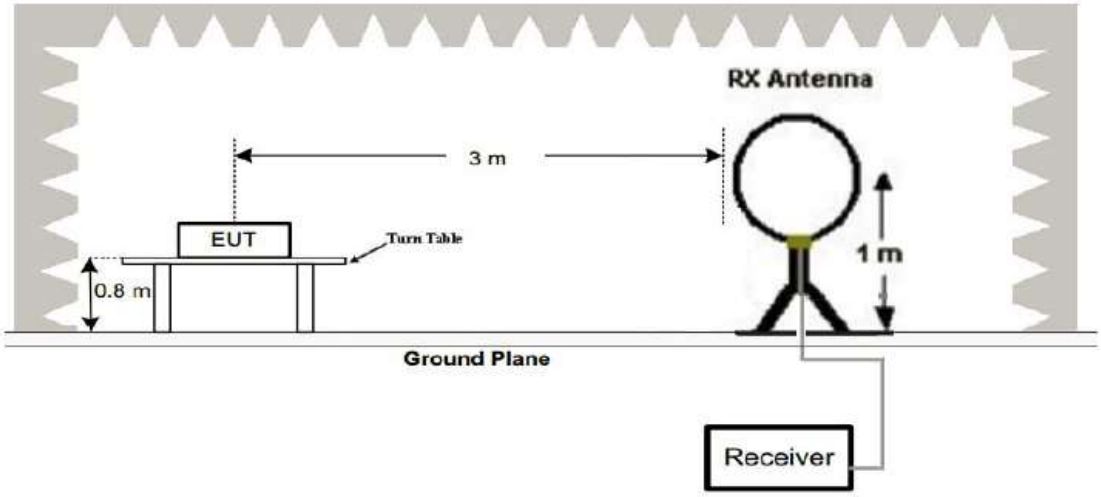
§15.249(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
2400-2483.5 MHz	50	500

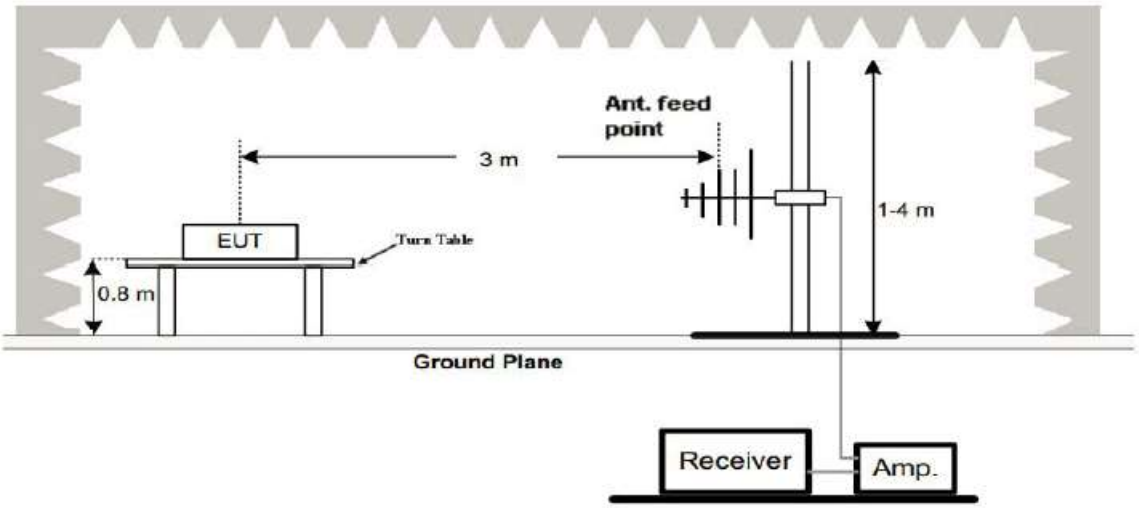
§15.249(e) – As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

4.2 Test Setup

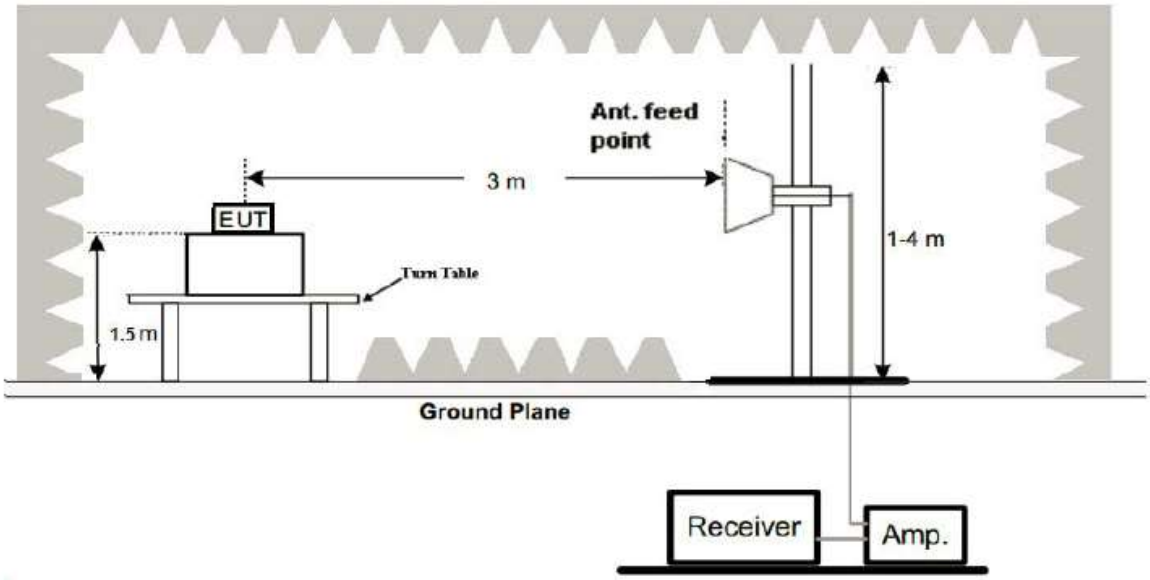
（1）Radiated Emission Test-Up Frequency Below 30MHz



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



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



4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).

Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

4.4 Test Result

PASS
All the test modes completed for test. only the worst result of GFSK Low Channel was reported as below:

Harmonics and Spurious Emissions

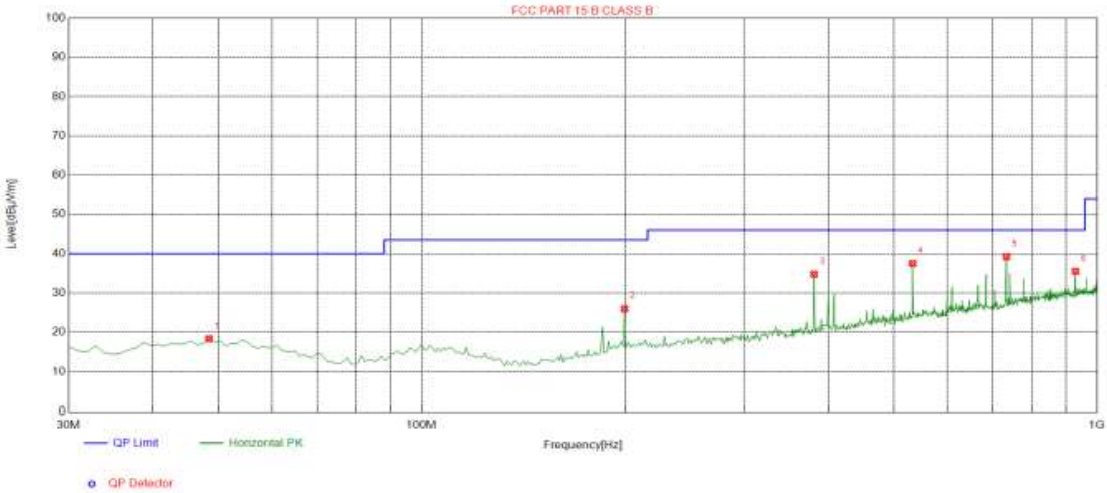
Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note:*1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor*

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

BDR+EDR:
Below 1GHz Test Results:
Antenna polarity: H

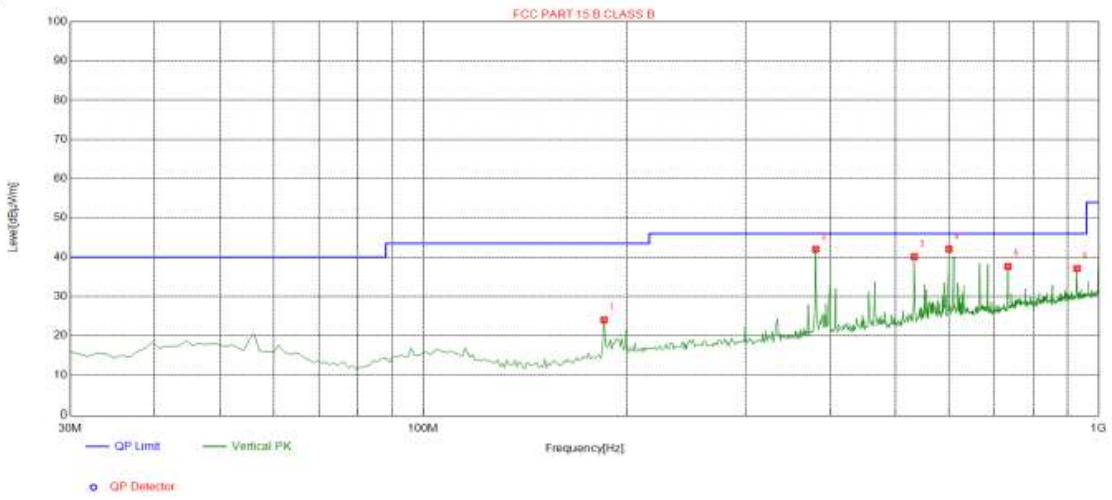


Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	18.39	-13.65	40.00	21.61	100	176	Horizontal
2	199.750	26.00	-15.08	43.50	17.50	100	40	Horizontal
3	381.140	34.80	-10.81	46.00	11.20	100	292	Horizontal
4	533.430	37.52	-7.37	46.00	8.48	100	170	Horizontal
5	734.220	39.21	-4.37	46.00	6.79	100	351	Horizontal
6	929.190	35.53	-1.84	46.00	10.47	100	133	Horizontal

Remark:
Margin = Limit – Level
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Antenna polarity: V



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	185.200	24.02	-16.42	43.50	19.48	100	185	Vertical
2	381.140	42.03	-10.81	46.00	3.97	100	175	Vertical
3	533.430	40.16	-7.37	46.00	5.84	100	63	Vertical
4	600.360	42.06	-6.09	46.00	3.94	100	229	Vertical
5	734.220	37.65	-4.37	46.00	8.35	100	231	Vertical
6	929.190	37.12	-1.84	46.00	8.88	100	282	Vertical

Remark:
Margin = Limit – Level
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

BDR+EDR:

Above 1 GHz Test Results:

CH Low (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	114.08	-5.81	108.27	114.00	-5.73	peak
2402	85.24	-5.81	79.43	94.00	-14.57	AVG
4804	55.90	-3.65	52.25	74.00	-21.75	peak
4804	45.84	-3.65	42.19	54.00	-11.81	AVG
7206	52.59	-0.95	51.64	74.00	-22.36	peak
7206	40.34	-0.95	39.39	54.00	-14.61	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	111.97	-5.81	106.16	114.00	-7.84	peak
2402	83.30	-5.81	77.49	94.00	-16.51	AVG
4804	52.03	-3.65	48.38	74.00	-25.62	peak
4804	42.06	-3.65	38.41	54.00	-15.59	AVG
7206	56.60	-0.95	55.65	74.00	-18.35	peak
7206	40.58	-0.95	39.63	54.00	-14.37	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH Middle (2441MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441.00	107.37	-5.73	101.64	114.00	-12.36	peak
2441.00	84.97	-5.73	79.24	94.00	-14.76	AVG
4882.00	58.62	-3.54	55.08	74.00	-18.92	peak
4882.00	41.16	-3.54	37.62	54.00	-16.38	AVG
7323.00	53.32	-0.81	52.51	74.00	-21.49	peak
7323.00	35.20	-0.81	34.39	54.00	-19.61	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441.00	106.27	-5.73	100.54	114.00	-13.46	peak
2441.00	86.89	-5.73	81.16	94.00	-12.84	AVG
4882.00	55.16	-3.54	51.62	74.00	-22.38	peak
4882.00	43.86	-3.54	40.32	54.00	-13.68	AVG
7323.00	54.32	-0.81	53.51	74.00	-20.49	peak
7323.00	38.60	-0.81	37.79	54.00	-16.21	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH High (2480MHz)

Horizontal:

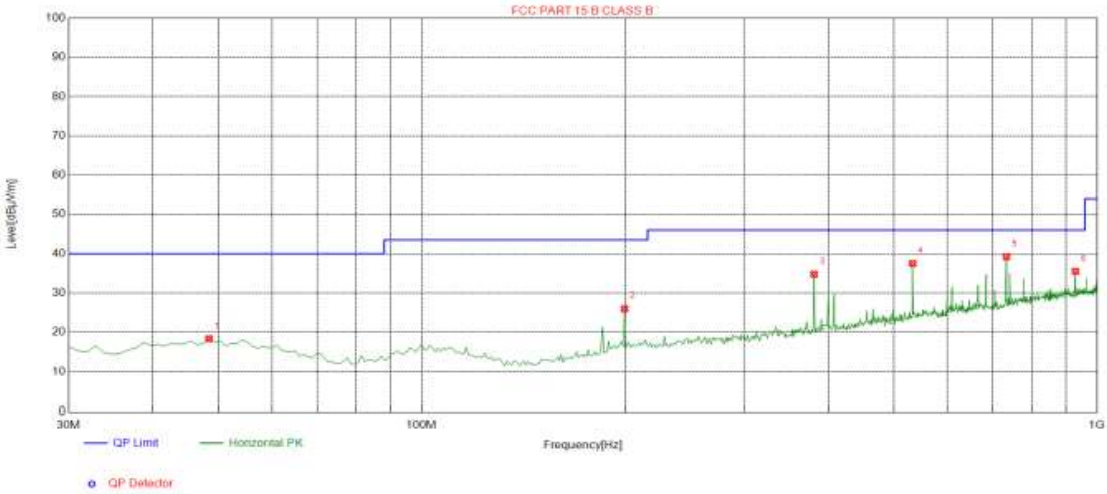
Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	102.09	-5.63	96.46	114.00	-17.54	peak
2480	81.61	-5.63	75.98	94.00	-18.02	AVG
4960	53.48	-3.43	50.05	74.00	-23.95	peak
4960	45.74	-3.44	42.30	54.00	-11.70	AVG
7440	51.42	-0.77	50.65	74.00	-23.35	peak
7440	37.59	-0.77	36.82	54.00	-17.18	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	101.87	-5.63	96.24	114.00	-17.76	peak
2480	81.30	-5.63	75.67	94.00	-18.33	AVG
4960	52.76	-3.43	49.33	74.00	-24.67	peak
4960	41.30	-3.44	37.86	54.00	-16.14	AVG
7440	52.79	-0.77	52.02	74.00	-21.98	peak
7440	37.70	-0.77	36.93	54.00	-17.07	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 9KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak
detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions are reported.

LE:
Below 1GHz Test Results
Antenna polarity: H

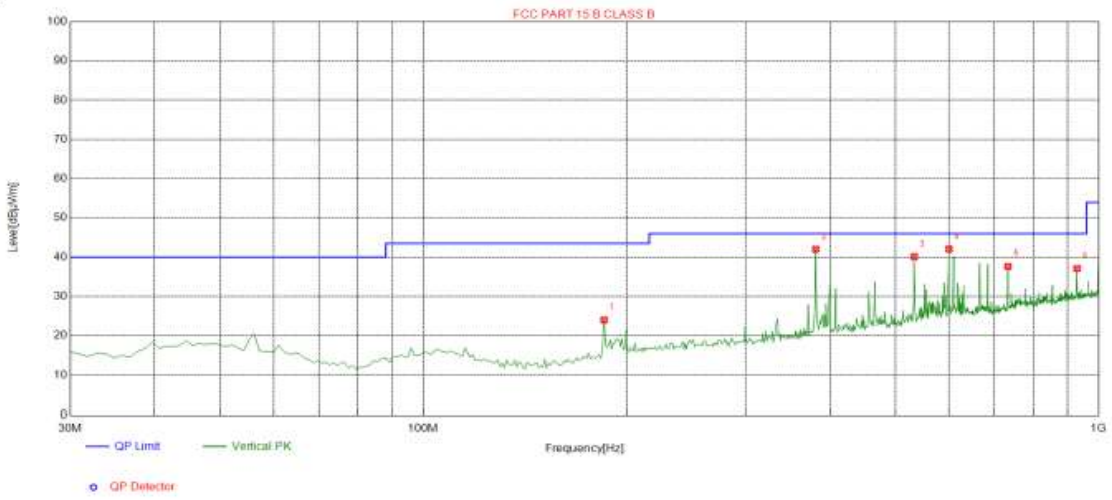


Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	18.39	-13.65	40.00	21.61	100	176	Horizontal
2	199.750	26.00	-15.08	43.50	17.50	100	40	Horizontal
3	381.140	34.80	-10.81	46.00	11.20	100	292	Horizontal
4	533.430	37.52	-7.37	46.00	8.48	100	170	Horizontal
5	734.220	39.21	-4.37	46.00	6.79	100	351	Horizontal
6	929.190	35.53	-1.84	46.00	10.47	100	133	Horizontal

Remark:
Margin = Limit – Level
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Antenna polarity: V



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	185.200	24.02	-16.42	43.50	19.48	100	185	Vertical
2	381.140	42.03	-10.81	46.00	3.97	100	175	Vertical
3	533.430	40.16	-7.37	46.00	5.84	100	63	Vertical
4	600.360	42.06	-6.09	46.00	3.94	100	229	Vertical
5	734.220	37.65	-4.37	46.00	8.35	100	231	Vertical
6	929.190	37.12	-1.84	46.00	8.88	100	282	Vertical

Remark:
Margin = Limit – Level
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

LE: Above 1 GHz Test Results:

CH Low (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	114.25	-5.81	108.44	114.00	-5.56	peak
2402	85.14	-5.81	79.33	94.00	-14.67	AVG
4804	56.23	-3.65	52.58	74.00	-21.42	peak
4804	46.35	-3.65	42.70	54.00	-11.30	AVG
7206	53.24	-0.95	52.29	74.00	-21.71	peak
7206	42.11	-0.95	41.16	54.00	-12.84	AVG

Remark:
Margin = Level- Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	112.16	-5.81	106.35	114.00	-7.65	peak
2402	83.42	-5.81	77.61	94.00	-16.39	AVG
4804	53.16	-3.65	49.51	74.00	-24.49	peak
4804	42.97	-3.65	39.32	54.00	-14.68	AVG
7206	56.75	-0.95	55.80	74.00	-18.20	peak
7206	40.26	-0.95	39.31	54.00	-14.69	AVG

Remark:
Margin = Level-Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

CH Middle (2440MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440.00	107.23	-5.73	101.50	114.00	-12.50	peak
2440.00	84.24	-5.73	78.51	94.00	-15.49	AVG
4880.00	57.29	-3.54	53.75	74.00	-20.25	peak
4880.00	40.28	-3.54	36.74	54.00	-17.26	AVG
7320.00	52.07	-0.81	51.26	74.00	-22.74	peak
7320.00	34.18	-0.81	33.37	54.00	-20.63	AVG

Remark:
Margin = Level-Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440.00	105.07	-5.73	99.34	114.00	-14.66	peak
2440.00	85.18	-5.73	79.45	94.00	-14.55	AVG
4880.00	54.36	-3.54	50.82	74.00	-23.18	peak
4880.00	42.64	-3.54	39.10	54.00	-14.90	AVG
7320.00	54.64	-0.81	53.83	74.00	-20.17	peak
7320.00	36.11	-0.81	35.30	54.00	-18.70	AVG

Remark:
Margin = Level-Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

CH High (2480MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	103.28	-5.63	97.65	114.00	-16.35	peak
2480	82.97	-5.63	77.34	94.00	-16.66	AVG
4960	54.25	-3.43	50.82	74.00	-23.18	peak
4960	46.14	-3.44	42.70	54.00	-11.30	AVG
7440	51.26	-0.77	50.49	74.00	-23.51	peak
7440	38.29	-0.77	37.52	54.00	-16.48	AVG

Remark:
Margin = Level-Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	101.23	-5.63	95.60	114.00	-18.40	peak
2480	81.32	-5.63	75.69	94.00	-18.31	AVG
4960	53.56	-3.43	50.13	74.00	-23.87	peak
4960	42.06	-3.44	38.62	54.00	-15.38	AVG
7440	53.17	-0.77	52.40	74.00	-21.60	peak
7440	36.78	-0.77	36.01	54.00	-17.99	AVG

Remark:
Margin = Level-Limit
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 9KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions are reported.

5 Out of Band Emissions

5.1 Limits

FCC PART 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.

5.2 Test Procedure

The out of band emission should be measured by following guidance in ANSI C63.10:2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization ect.

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz.

5.3 Test Result

PASS

Radiated Band Edge Test:

LE Mode:

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case):

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	56.29	-5.81	50.48	74	-23.52	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	57.22	-5.84	51.38	74	-22.62	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	53.18	-5.84	47.34	74	-26.66	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	56.07	-5.81	50.26	74	-23.74	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	54.08	-5.84	48.24	74	-25.76	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	54.29	-5.84	48.45	74	-25.55	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2480MHz)

Horizontal (Worst case)

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.78	-5.81	50.97	74	-23.03	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	54.28	-6.06	48.22	74	-25.78	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	55.29	-5.81	49.48	74	-24.52	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	52.17	-6.06	46.11	74	-27.89	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

BDR+EDR mode:

Radiated Band Edge Test:

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case)

Horizontal (Worst case):

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	55.65	-5.81	49.84	74	-24.16	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	55.52	-5.84	49.68	74	-24.32	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	51.83	-5.84	45.99	74	-28.01	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	57.64	-5.81	51.83	74	-22.17	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	53.56	-5.84	47.72	74	-26.28	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	51.42	-5.84	45.58	74	-28.42	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2480MHz)

Horizontal (Worst case)

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	55.6	-5.81	49.79	74	-24.21	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	53.16	-6.06	47.1	74	-26.9	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.21	-5.81	50.4	74	-23.6	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	53.13	-6.06	47.07	74	-26.93	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

6 OCCUPIED BANDWIDTH MEASUREMENT

6.1 Test Setup

Same as Radiated Emission Measurement

6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW= 30KHz. VBW= 100 KHz, Span=2MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

6.3 Measurement Equipment Used

Same as Radiated Emission Measurement

6.4 Test Result

PASS

LE mode:

Test Mode	Frequency	20dB Bandwidth (MHz)	Result
GFSK	2402 MHz	1.205	**PASS**
	2440 MHz	1.200	**PASS**
	2480 MHz	1.197	**PASS**

Test Mode: GFSK

CH: 2402MHz

CH: 2440MHz

CH: 2480MHz

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 4 MHz
Sweep 4.267 ms
CF Step
400.000 kHz
Auto
Man
Occupied Bandwidth
1.0656 MHz
Total Power 9.55 dBm
Transmit Freq Error 1.500 kHz
OBW Power 99.00 %
x dB Bandwidth 1.197 MHz
x dB -20.00 dB
Freq Offset
0 Hz
MSG
STATUS

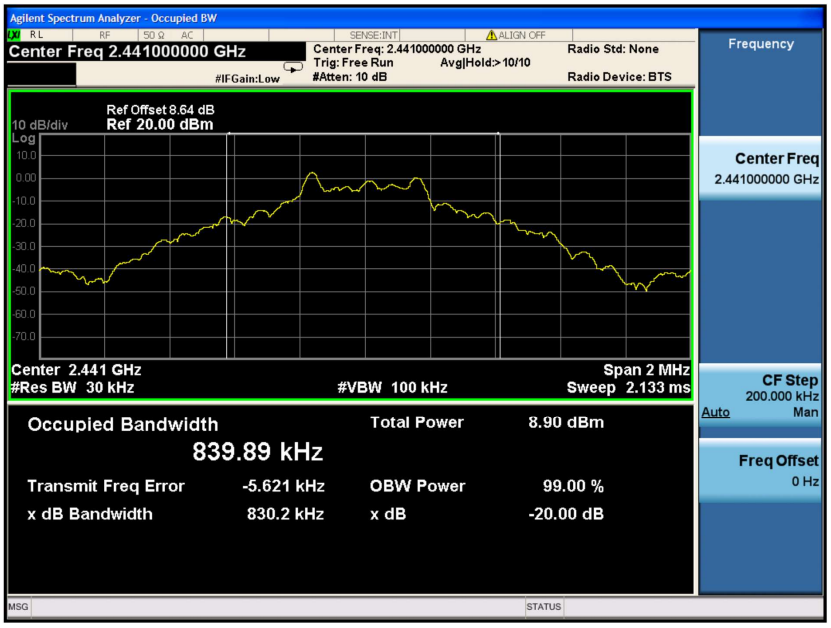
BDR+EDR

Test Mode	Frequency	20dB Bandwidth (MHz)	Result
GFSK	2402 MHz	0.8331	**PASS**
	2441 MHz	0.8302	**PASS**
	2480 MHz	0.8280	**PASS**
π/4DQPSK	2402 MHz	1.115	**PASS**
	2441 MHz	1.115	**PASS**
	2480 MHz	1.118	**PASS**
8DPSK	2402 MHz	1.145	**PASS**
	2441 MHz	1.147	**PASS**
	2480 MHz	1.122	**PASS**

Test Mode: GFSK

CH: 2402MHz

CH: 2441MHz

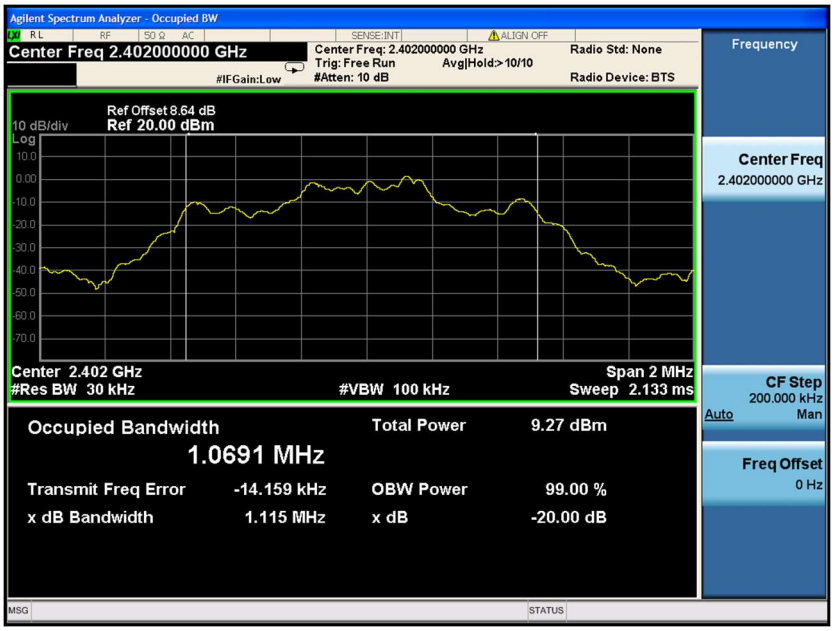

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.441000000 GHz
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2 MHz
Sweep 2.133 ms
CF Step
200.000 kHz
Auto
Man
Occupied Bandwidth
839.89 kHz
Total Power
8.90 dBm
Transmit Freq Error
-5.621 kHz
OBW Power
99.00 %
x dB Bandwidth
830.2 kHz
x dB
-20.00 dB
Freq Offset
0 Hz
MSG
STATUS

H: 2480MHz

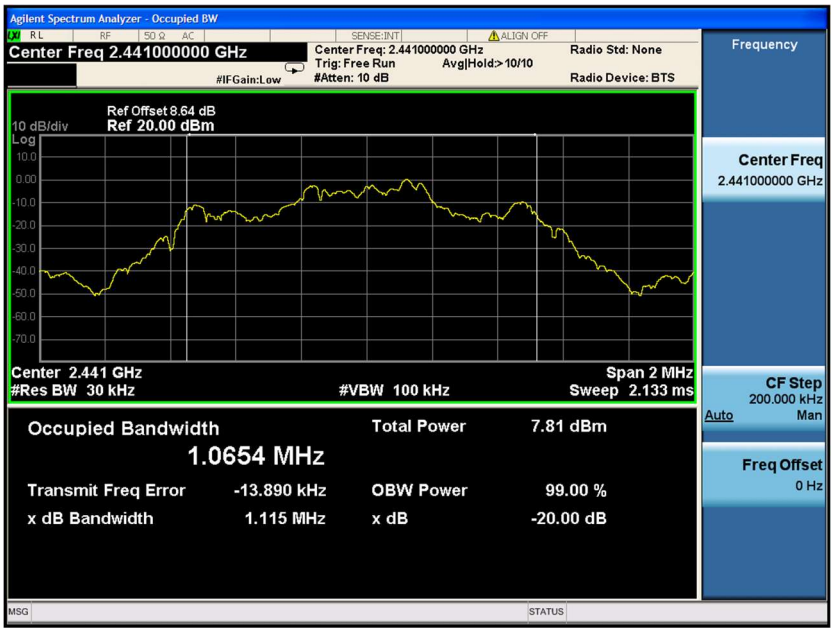
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2 MHz
Sweep 2.133 ms
CF Step
200.000 kHz
Auto
Man
Occupied Bandwidth
840.96 kHz
Total Power
9.14 dBm
Transmit Freq Error
-5.591 kHz
OBW Power
99.00 %
x dB Bandwidth
828.0 kHz
x dB
-20.00 dB
Freq Offset
0 Hz
MSG
STATUS

Test Mode: π/4DQPSK

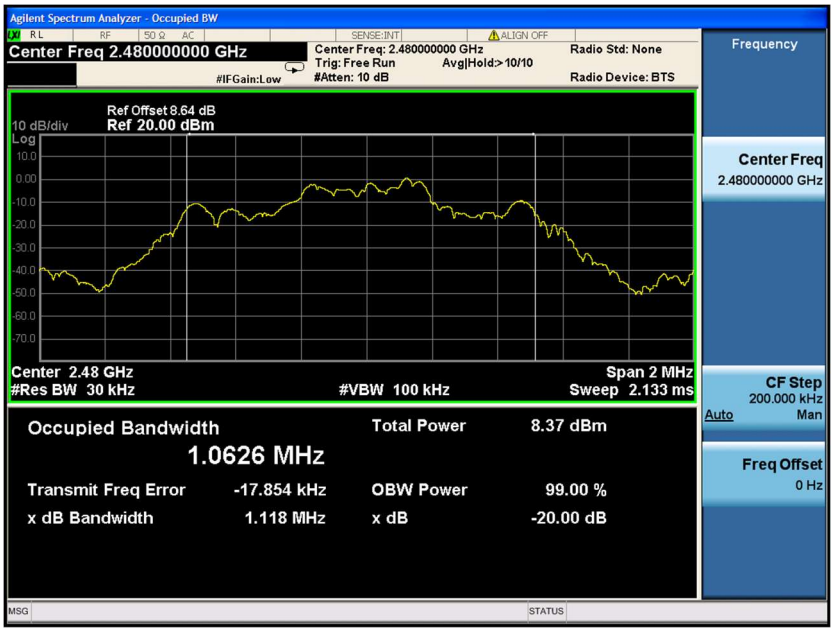
CH: 2402MHz



CH: 2441MHz

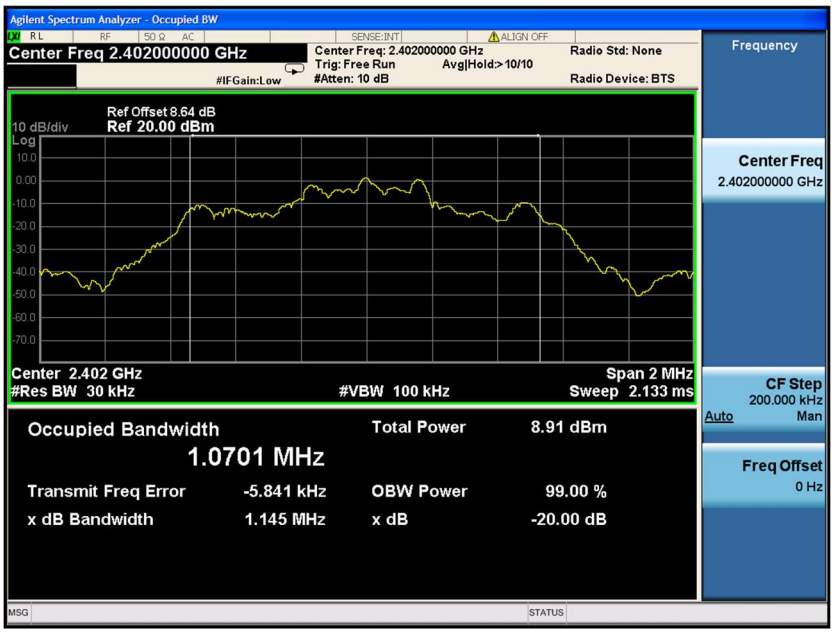


CH: 2480MHz

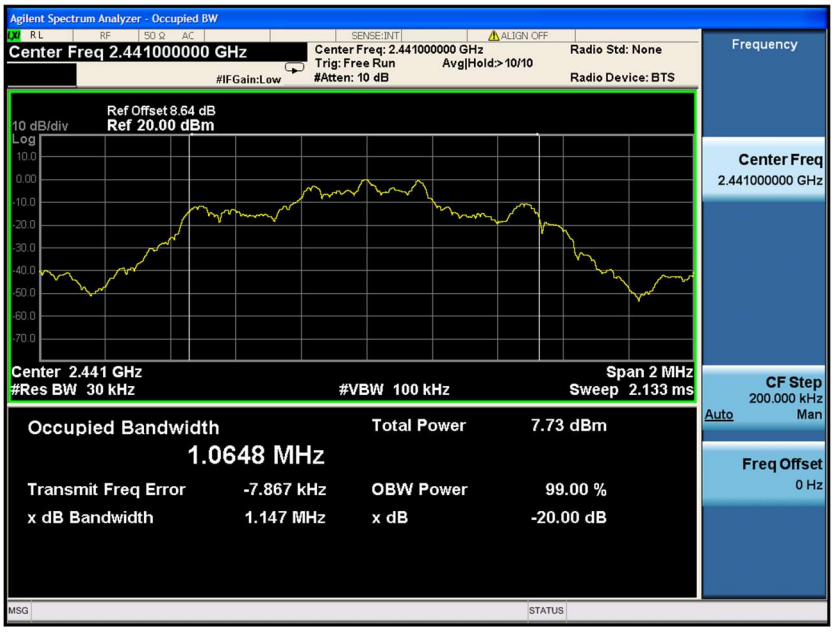

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2 MHz
Sweep 2.133 ms
CF Step
200.000 kHz
Auto
Man
Occupied Bandwidth
1.0626 MHz
Total Power 8.37 dBm
Transmit Freq Error -17.854 kHz
OBW Power 99.00 %
x dB Bandwidth 1.118 MHz
x dB -20.00 dB
Freq Offset
0 Hz
MSG
STATUS

Test Mode: 8DPSK

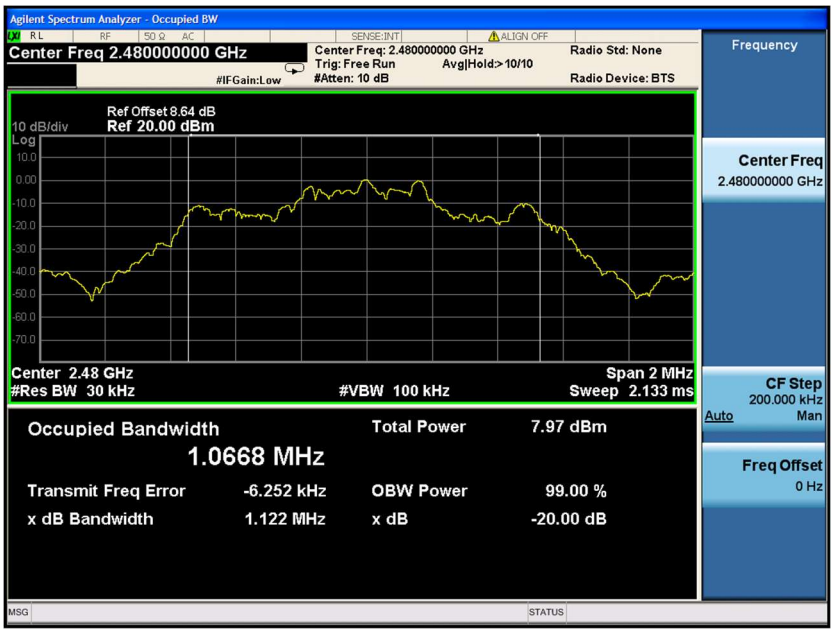
CH: 2402MHz



CH: 2441MHz



CH: 2480MHz

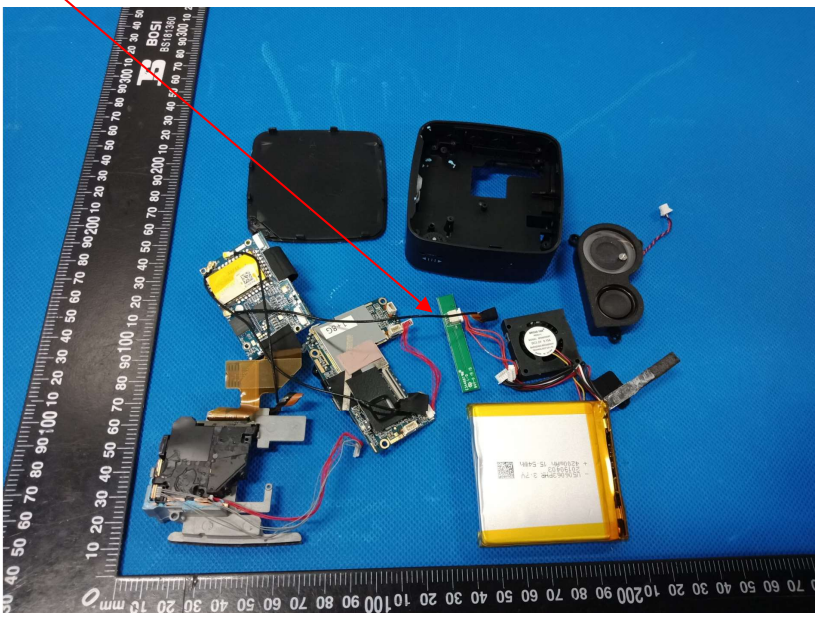

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2 MHz
Sweep 2.133 ms
CF Step
200.000 kHz
Auto
Man
Occupied Bandwidth
1.0668 MHz
Total Power 7.97 dBm
Transmit Freq Error -6.252 kHz
OBW Power 99.00 %
x dB Bandwidth 1.122 MHz
x dB -20.00 dB
Freq Offset
0 Hz
MSG
STATUS

7 ANTENNA REQUIREMENT

Standard Applicable
For intentional device, according to FCC 47 CFR Section 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.

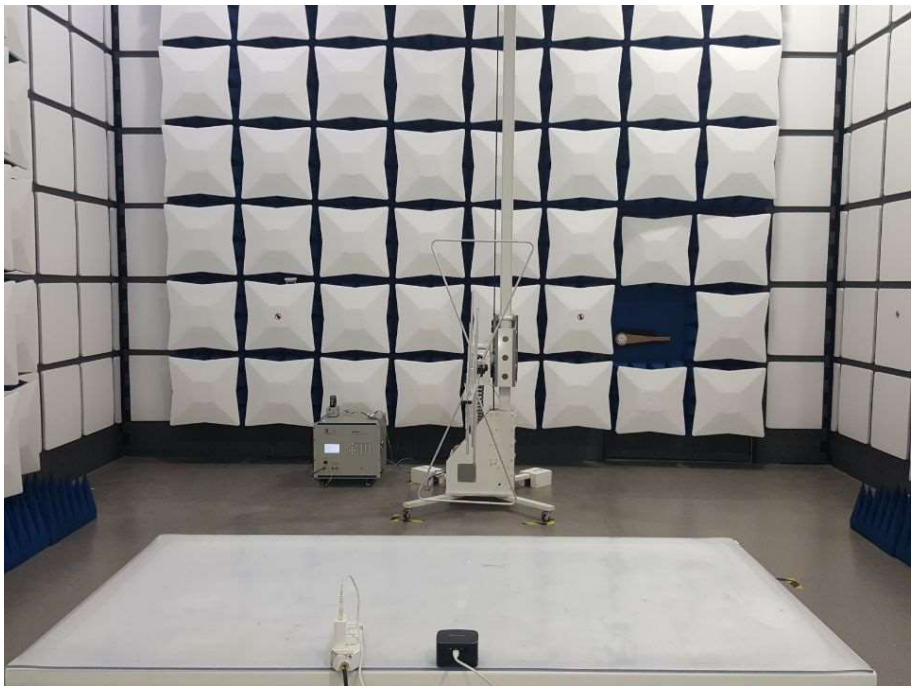
Antenna Connected Construction
The antenna used in this product is an internal Antenna, the directional gains of antenna used for transmitting is 1dBi.

ANTENNA



8 PHOTOGRAPH OF TEST

8.1 Radiated Emission



8.2 Conducted Emission

9 PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos

---------End of test report---------