CTC Laboratories, Inc.

TEST REPORT

Report No. .....:	**CTC2024234906**
FCC ID.....:	**2AASG-CS2290**
Applicant .....:	**Shenzhen MinDe Electronics Technology Ltd.**
Address.....:	5th Floor, Section 1, 25th Block, No.5, Kezhi Xi Road, Keji Yuan, Nanshan District, Shenzhen, P.R. China
Manufacturer.....:	Shenzhen MinDe Electronics Technology Ltd.
Address.....:	5th Floor, Section 1, 25th Block, No.5, Kezhi Xi Road, Keji Yuan, Nanshan District, Shenzhen, P.R. China
Product Name .....:	**Cordless Image Scanner**
Trade Mark .....:	MINDEO
Model/Type reference.....:	CS2290-HD(BT)
Listed Model(s) .....:	CS2XXX-XX, CS2XXX-XX(BT), CS2XXXS-XX, CS2XXXS-XX(BT) (X Stand for 0-9, A-Z)
Standard .....:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Test Report Form No .....:	CTC-TR-058_A1
Master TRF.....:	Dated 2024-09-20
Date of receipt of test sample.....:	Aug. 26, 2024
Date of testing.....:	Aug. 26, 2024 to Oct. 30, 2024
Date of issue.....:	Dec. 25, 2024
Result.....:	**PASS**

Compiled by: (Printed name+signature)	Jim Jiang	Jim Jiang
Supervised by: (Printed name+signature)	Eric Zhang	Eric Zhang
Approved by: (Printed name+signature)	Totti Zhao	Totti Zhao

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz.
RSS-247 Issue 3: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus.
ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.2. Report Version

Revised No.	Report No.	Date of issue	Description
01	CTC2024234906	Dec. 25, 2024	Original

1.3. Test Description

FCC Part 15 Subpart C (15.247) / RSS-247 Issue 3				
Test Item	**Standard Section**		**Result**	**Test Engineer**
	FCC	**ISED**		
Antenna Requirement	15.203	RSS-Gen 6.8	Pass	Jim Jiang
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Jim Jiang
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS-247 5.5	Pass	Jim Jiang
Radiated Band Edge and Spurious Emissions	15.205&15.209& 15.247(d)	RSS-247 5.5	Pass	Jim Jiang
6dB Bandwidth	15.247(a)(2)	RSS-247 5.2 (a)	Pass	Jim Jiang
Occupied Bandwidth	/	RSS-GEN 6.7	Pass	Jim Jiang
Conducted Max Output Power	15.247(b)(3)	RSS-247 5.4 (d)	Pass	Jim Jiang
Power Spectral Density	15.247(e)	RSS-247 5.2 (b)	Pass	Jim Jiang
Transmitter Radiated Spurious	15.209&15.247(d)	RSS-247 5.5& RSS-Gen 8.9	Pass	Jim Jiang

Note:
1. The measurement uncertainty is not included in the test result.
2. N/A: means this test item is not applicable for this device according to the technology characteristic of device.

1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: Room 101 of Building B, Room 107, 108, 207, 208 of Building A, No. 7, Lanqing 1st Road, Luhu Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 951311, Aug 26, 2017.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.

Test Items	Measurement Uncertainty	Notes
DTS Bandwidth	±0.0196%	(1)
Maximum Conducted Output Power	±0.686 dB	(1)
Maximum Power Spectral Density Level	±0.743 dB	(1)
Band-edge Compliance	±1.328 dB	(1)
Unwanted Emissions In Non-restricted Freq Bands	9kHz-1GHz: ±0.746dB 1GHz-26GHz: ±1.328dB	(1)
Conducted Emissions 9kHz~30MHz	±3.08 dB	(1)
Radiated Emissions 9kHz~30MHz	±4.26 dB	(1)
Radiated Emissions 30~1000MHz	±4.51 dB	(1)
Radiated Emissions 1~18GHz	±5.84 dB	(1)
Radiated Emissions 18~40GHz	±6.12 dB	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.6. Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15 °C to 35 °C
Relative Humidity:	20 % to 75 %
Air Pressure:	101 kPa

2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Shenzhen MinDe Electronics Technology Ltd.
Address:	5th Floor, Section 1, 25th Block, No.5, Kezhi Xi Road, Keji Yuan, Nanshan District, Shenzhen, P.R. China
Manufacturer:	Shenzhen MinDe Electronics Technology Ltd.
Address:	5th Floor, Section 1, 25th Block, No.5, Kezhi Xi Road, Keji Yuan, Nanshan District, Shenzhen, P.R. China

2.2. General Description of EUT

Product Name:	Cordless Image Scanner
Trade Mark:	MINDEO
Model/Type reference:	CS2290-HD(BT)
Listed Model(s):	CS2XXX-XX, CS2XXX-XX(BT), CS2XXXS-XX, CS2XXXS-XX(BT) (X Stand for 0-9, A-Z)
Model Difference:	All these models are identical in the same PCB, layout, electrical circuit and enclosure. The difference is the model name.
Sample ID:	CTC240926-006-S002, CTC240926-006-S003
Power Supply:	5V ⎓ 0.5A from Cradle 3.7V 2600mAh from lithium battery
Hardware Version:	/
Software Version:	/
Bluetooth 4.2 / BLE	
Modulation:	GFSK
Operation Frequency:	2402MHz~2480MHz
Channel Number:	40
Channel Separation:	2MHz
Data Rate:	1Mbps
Antenna Type:	Multilayer Ceramic Antenna
Antenna Gain:	2.66dBi

2.3. Accessory Equipment Information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkBook 14 G3 ACL	MP246QDR	Lenovo
Notebook	X220	4291GM8	Lenovo
Cradle	CS2X19-BT	/	MINDEO
Cable Information			
Name	Shielded Type	Ferrite Core	Length
USB Cable	Unshielded	NO	100cm
USB Cable	Unshielded	NO	200cm
Test Software Information			
Name	Version	/	/
RTLBTAPP	5.2.3.54	/	/

2.4. Operation State

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT BLE, 40 channels are provided to the EUT. Channels 00/19/39 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
00	**2402**
01	2404
⋮	⋮
18	2438
19	**2440**
20	2442
⋮	⋮
38	2478
39	**2480**

Note: The display in grey were the channel selected for testing.

Test Mode:

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT charges through the Cradle.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

2.5. Measurement Instruments List

RF Test System - SRD					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	MXA Signal Analyzer	Keysight	N9020A	MY52091402	Aug. 21, 2025
2	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 12, 2024
3	PSG Analog Signal Generator	Agilent	E8257D	MY46521908	Dec. 12, 2024
4	USB Wideband Power Sensor	Keysight	U2021XA	MY55130004	Mar. 21, 2025
5	USB Wideband Power Sensor	Keysight	U2021XA	MY55130006	Mar. 21, 2025
6	Wideband Radio Communication Tester	R&S	CMW500	102414	Dec. 12, 2024
7	RF Control Unit	Tonscend	JS0806-2	/	Aug. 21, 2025
8	Test Software	Tonscend	JS1120-3	V3.3.38	/
9	High and low temperature test chamber	ESPEC	MT3035	/	Mar. 21, 2025

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9163	01026	Dec. 18, 2024
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Sep. 25, 2025
3	Test Receiver	Keysight	N9038A	MY56400071	Dec. 12, 2024
4	Broadband Amplifier	SCHWARZBECK	BBV9743B	259	Dec. 12, 2024
5	Mirowave Broadband Amplifier	SCHWARZBECK	BBV9718C	111	Dec. 12, 2024
6	3m chamber 3	YIHENG	EE106	/	Aug. 28, 2026
7	Test Software	FARA	EZ-EMC	FA-03A2	/

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	LISN	R&S	ENV216	101112	Dec. 12, 2024
2	LISN	R&S	ENV216	101113	Dec. 12, 2024
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 12, 2024
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 12, 2024
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 12, 2024
6	Test Software	R&S	EMC32	6.10.10	/

Note: 1. The Cal. Interval was one year.

2. The Cal. Interval was three years of the antenna.

3. The cable loss has been calculated in test result which connection between each test instruments.

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

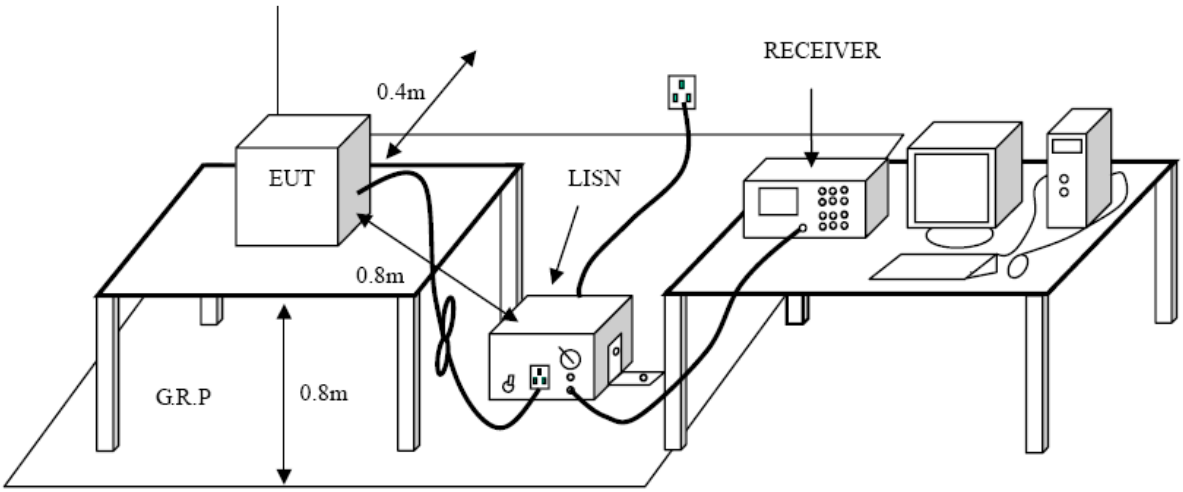
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207 / RSS-Gen 8.8

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46 *
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration



Test Procedure

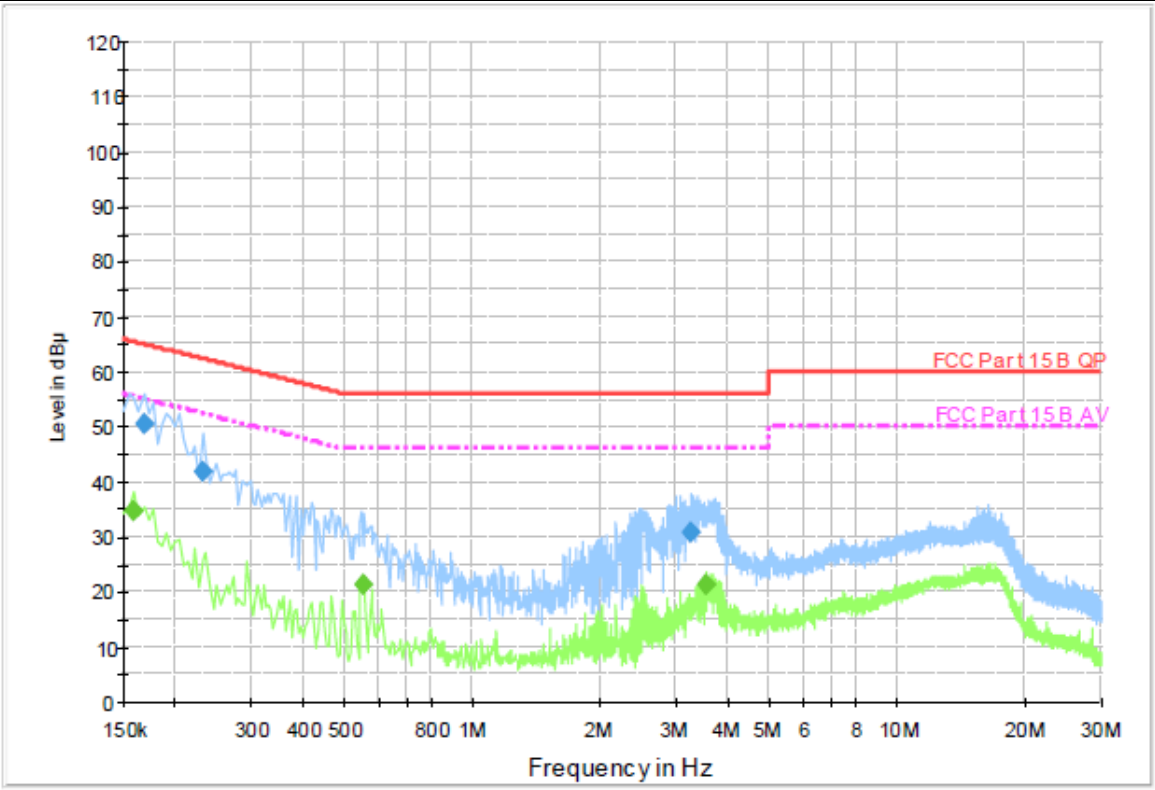
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm / 50 μH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

Test Mode

Please refer to the clause 2.4.

Test Result

Test Voltage:	AC 120V/60Hz
Terminal:	Line
Remark:	Only worse case is reported.



Final Measurement Detector 1

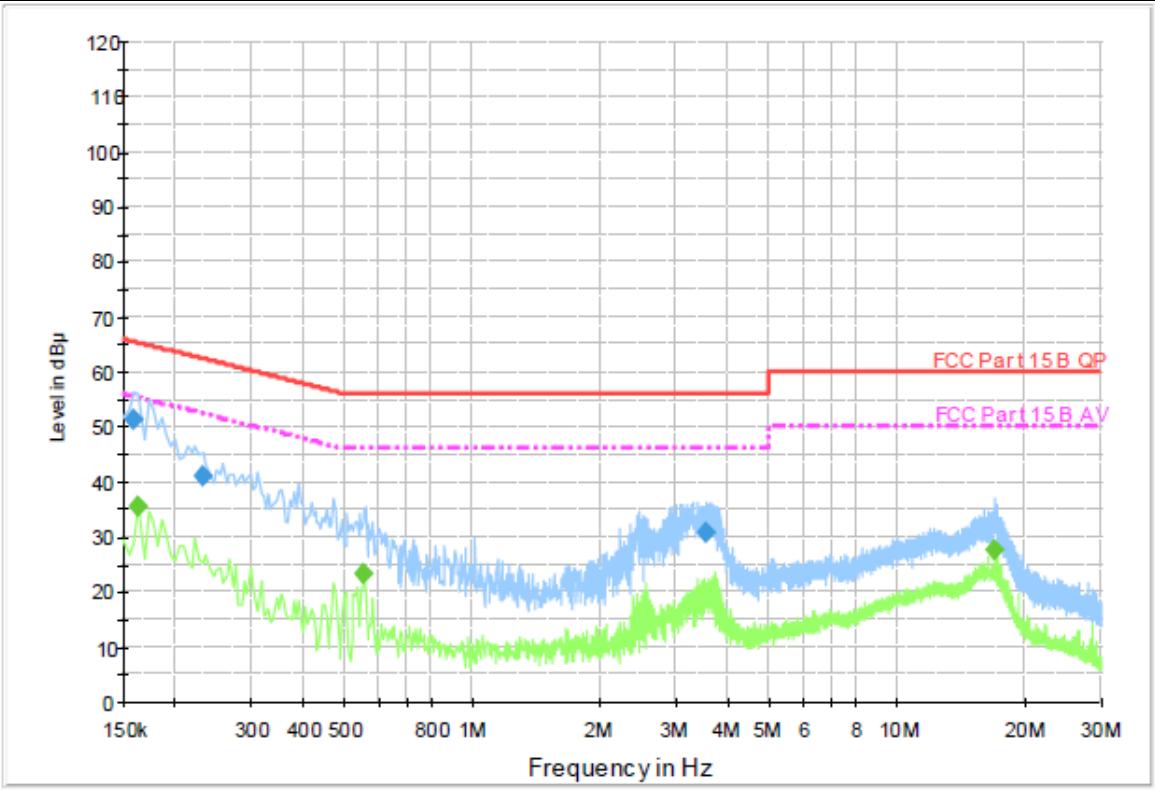
Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.168000	50.4	1000.00	9.000	On	L1	9.5	14.7	65.1	
0.231000	42.0	1000.00	9.000	On	L1	9.5	20.4	62.4	
3.250500	30.9	1000.00	9.000	On	L1	9.5	25.1	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.159000	34.8	1000.00	9.000	On	L1	9.5	20.7	55.5	
0.555000	21.3	1000.00	9.000	On	L1	9.5	24.7	46.0	
3.529500	21.4	1000.00	9.000	On	L1	9.5	24.6	46.0	

Emission Level = Read Level + Correct Factor

Test Voltage:	AC 120V/60Hz
Terminal:	Neutral
Remark:	Only worse case is reported.



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.159000	51.3	1000.00	9.000	On	N	9.5	14.2	65.5	
0.231000	40.9	1000.00	9.000	On	N	9.4	21.5	62.4	
3.543000	30.8	1000.00	9.000	On	N	9.4	25.2	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.163500	35.7	1000.00	9.000	On	N	9.5	19.6	55.3	
0.555000	23.4	1000.00	9.000	On	N	9.4	22.6	46.0	
16.858500	27.8	1000.00	9.000	On	N	9.6	22.2	50.0	

Emission Level = Read Level + Correct Factor

3.2. Radiated Emission

Limit

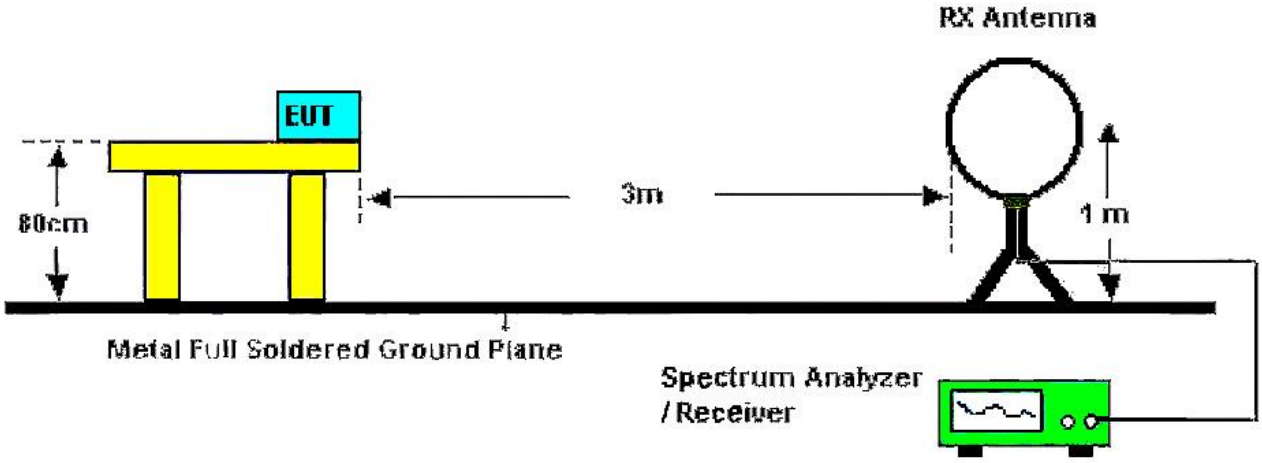
FCC CFR Title 47 Part 15 Subpart C Section 15.209 / RSS-Gen 8.9

Frequency (MHz)	Field Strength (microvolts/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
960~1000	500	3

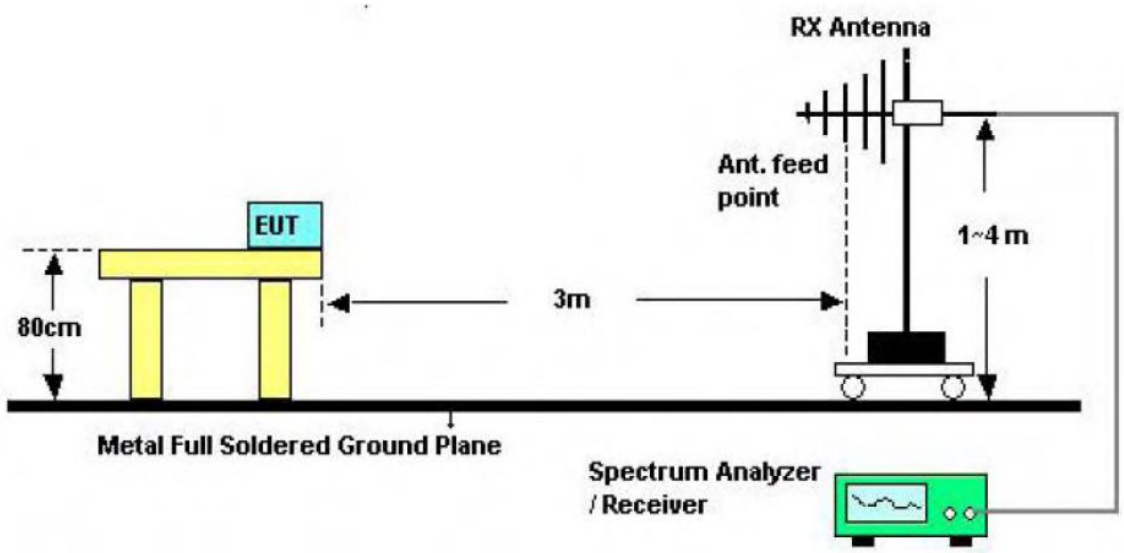
Frequency Range (MHz)	dBμV/m (at 3 meters)	
	Peak	Average
Above 1000	74	54

Note:
(1) The tighter limit applies at the band edges.
(2) Emission Level (dBμV/m)=20log Emission Level (μV/m).

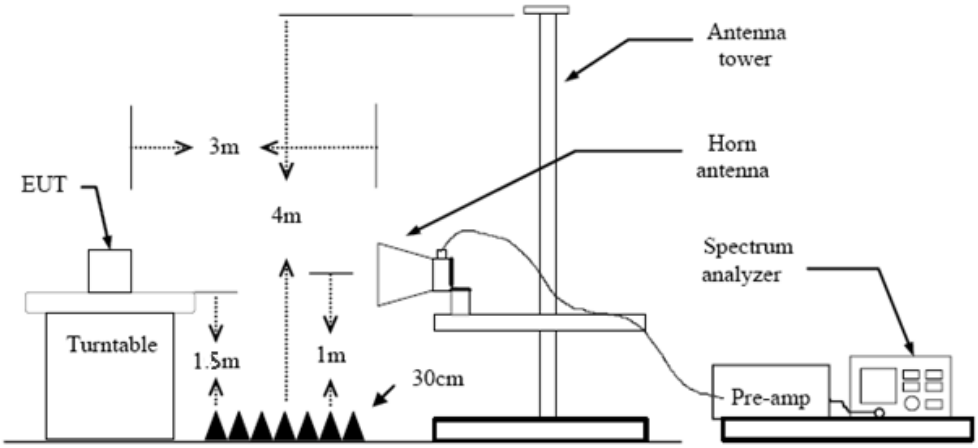
Test Configuration



Below 30MHz Test Setup



30-1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings

(1) Span shall wide enough to fully capture the emission being measured;

(2) 9k – 150kHz:
RBW=300 Hz, VBW=1 kHz, Sweep=auto, Detector function=peak, Trace=max hold
(3) 0.15M – 30MHz:
RBW=10 kHz, VBW=30 kHz, Sweep=auto, Detector function=peak, Trace=max hold
(4) 30M - 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
(5) From 1 GHz to 10^{th} harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.8 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

Test Result

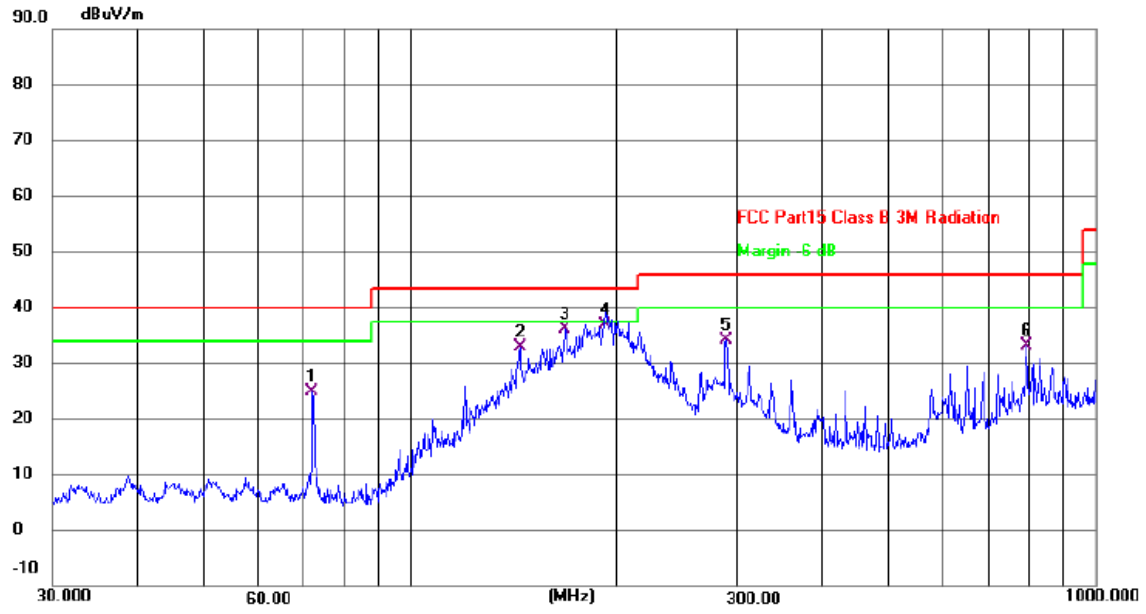
9 kHz~30 MHz

From 9 kHz to 30 MHz: The conclusion is PASS.

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

30MHz-1GHz

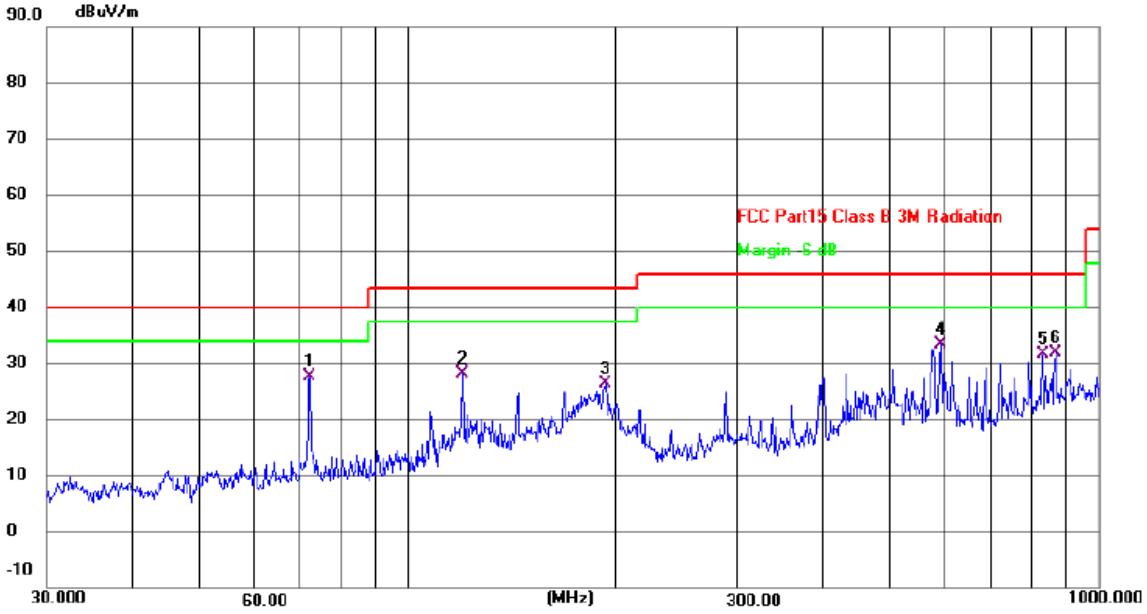
Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2402MHz
Remark:	Only worse case is reported.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	71.8320	45.63	-20.73	24.90	40.00	-15.10	QP
2	144.3348	51.43	-18.60	32.83	43.50	-10.67	QP
3	167.8243	55.25	-19.14	36.11	43.50	-7.39	QP
4 *	192.4186	57.73	-20.73	37.00	43.50	-6.50	QP
5	289.0021	52.07	-17.90	34.17	46.00	-11.83	QP
6	793.3960	39.30	-6.06	33.24	46.00	-12.76	QP

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2402MHz
Remark:	Only worse case is reported.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	72.0843	48.45	-20.77	27.68	40.00	-12.32	QP
2	119.8556	48.83	-20.63	28.20	43.50	-15.30	QP
3	193.0945	47.20	-20.77	26.43	43.50	-17.07	QP
4	590.9737	43.00	-9.69	33.31	46.00	-12.69	QP
5	830.4000	37.35	-5.60	31.75	46.00	-14.25	QP
6	866.0879	37.06	-5.27	31.79	46.00	-14.21	QP

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Above 1GHz

Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4732.583	40.79	1.93	42.72	74.00	-31.28	peak
2	7231.417	37.01	10.19	47.20	74.00	-26.80	peak
3	8688.417	39.18	11.13	50.31	74.00	-23.69	peak
4	9949.583	39.17	13.20	52.37	74.00	-21.63	peak
5	11285.167	37.80	14.93	52.73	74.00	-21.27	peak
6 *	12362.250	37.30	15.66	52.96	74.00	-21.04	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4807.000	40.43	2.08	42.51	74.00	-31.49	peak
2	6491.167	38.53	7.30	45.83	74.00	-28.17	peak
3	7967.750	38.22	10.80	49.02	74.00	-24.98	peak
4	9620.583	38.27	12.65	50.92	74.00	-23.08	peak
5 *	10717.250	38.37	14.39	52.76	74.00	-21.24	peak
6	12327.000	37.03	15.71	52.74	74.00	-21.26	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2440MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4807.000	40.44	2.08	42.52	74.00	-31.48	peak
2	6436.333	38.46	7.13	45.59	74.00	-28.41	peak
3	7862.000	38.08	10.59	48.67	74.00	-25.33	peak
4	9644.083	37.91	12.70	50.61	74.00	-23.39	peak
5	10803.417	38.54	14.56	53.10	74.00	-20.90	peak
6 *	12667.750	37.05	16.31	53.36	74.00	-20.64	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2440MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1199.750	47.34	-7.59	39.75	74.00	-34.25	peak
2	5151.667	40.14	2.78	42.92	74.00	-31.08	peak
3	7920.750	38.96	10.70	49.66	74.00	-24.34	peak
4	9730.250	37.93	12.87	50.80	74.00	-23.20	peak
5	10889.583	38.01	14.65	52.66	74.00	-21.34	peak
6 *	12017.583	37.42	15.67	53.09	74.00	-20.91	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2480MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1438.667	46.20	-6.85	39.35	74.00	-34.65	peak
2	5183.000	40.39	2.87	43.26	74.00	-30.74	peak
3	8026.500	39.40	10.79	50.19	74.00	-23.81	peak
4	9507.000	37.72	12.58	50.30	74.00	-23.70	peak
5	10838.667	38.03	14.60	52.63	74.00	-21.37	peak
6 *	12456.250	36.92	15.76	52.68	74.00	-21.32	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2480MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1199.750	48.94	-7.59	41.35	74.00	-32.65	peak
2	4360.500	40.45	1.08	41.53	74.00	-32.47	peak
3	6385.417	39.04	6.96	46.00	74.00	-28.00	peak
4	8324.167	38.99	10.43	49.42	74.00	-24.58	peak
5	10349.083	38.07	13.91	51.98	74.00	-22.02	peak
6 *	12436.667	37.26	15.71	52.97	74.00	-21.03	peak

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

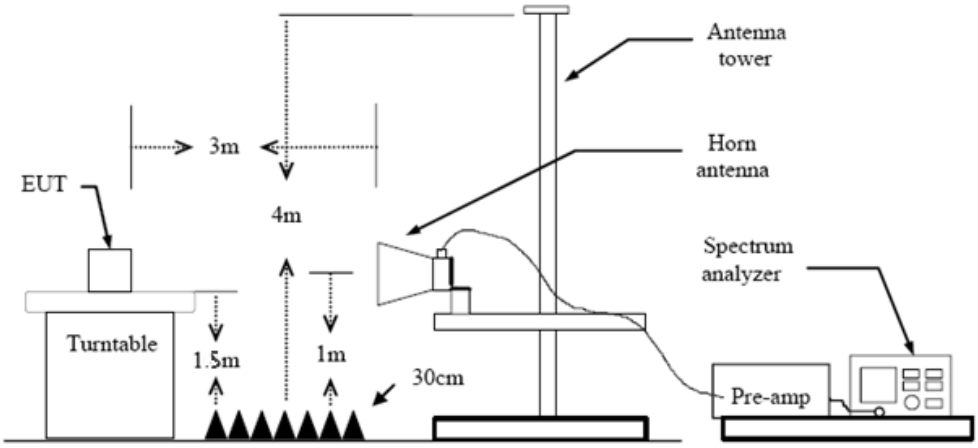
3.3. Band Edge Emissions (Radiated)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d) / RSS-247 5.5

Restricted Frequency Band (MHz)	(dBμV/m) (at 3m)	
	Peak	Average
2310 ~ 2390	74	54
2483.5 ~ 2500	74	54

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:

RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

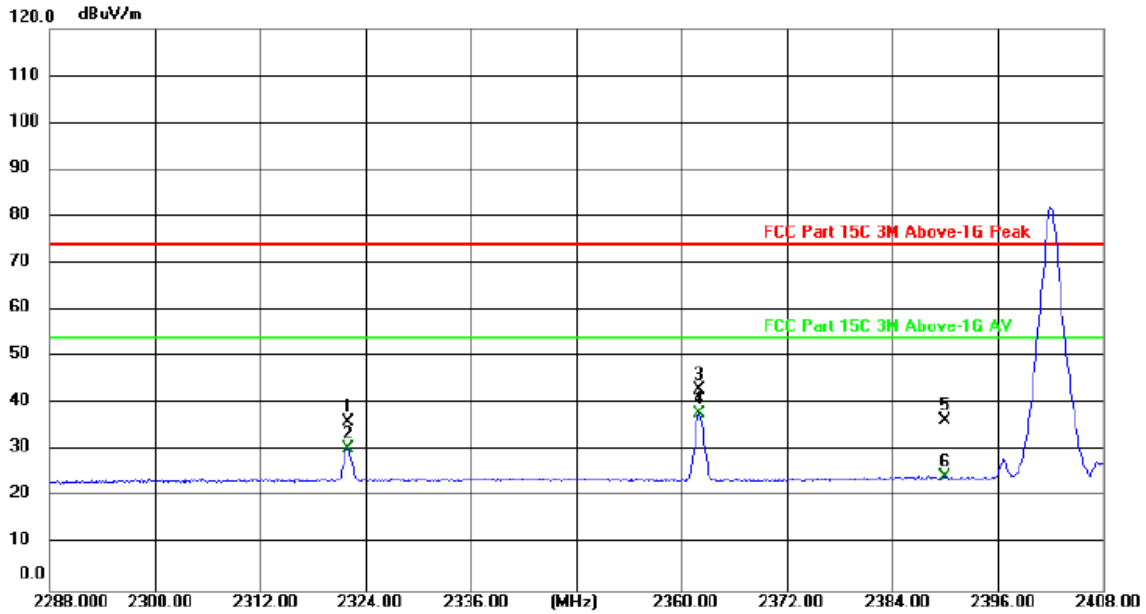
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.8 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

Test Result

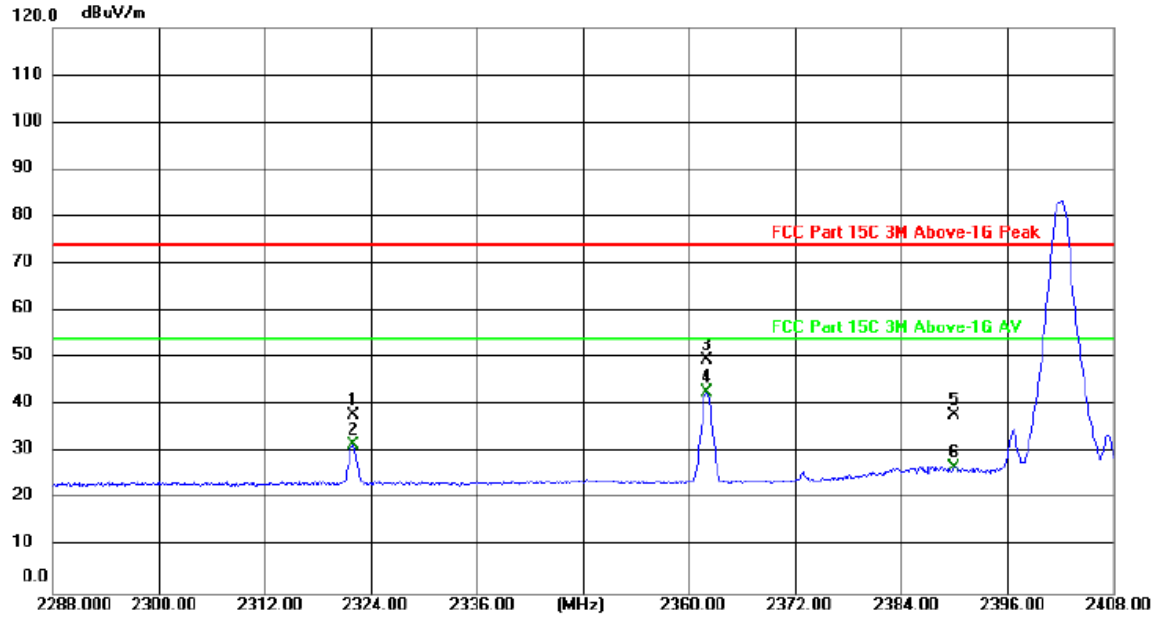
Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2321.960	45.52	-9.32	36.20	74.00	-37.80	peak
2	2321.960	39.79	-9.32	30.47	54.00	-23.53	AVG
3	2361.920	52.31	-9.17	43.14	74.00	-30.86	peak
4 *	2361.920	47.00	-9.17	37.83	54.00	-16.17	AVG
5	2390.000	45.40	-9.08	36.32	74.00	-37.68	peak
6	2390.000	33.43	-9.08	24.35	54.00	-29.65	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

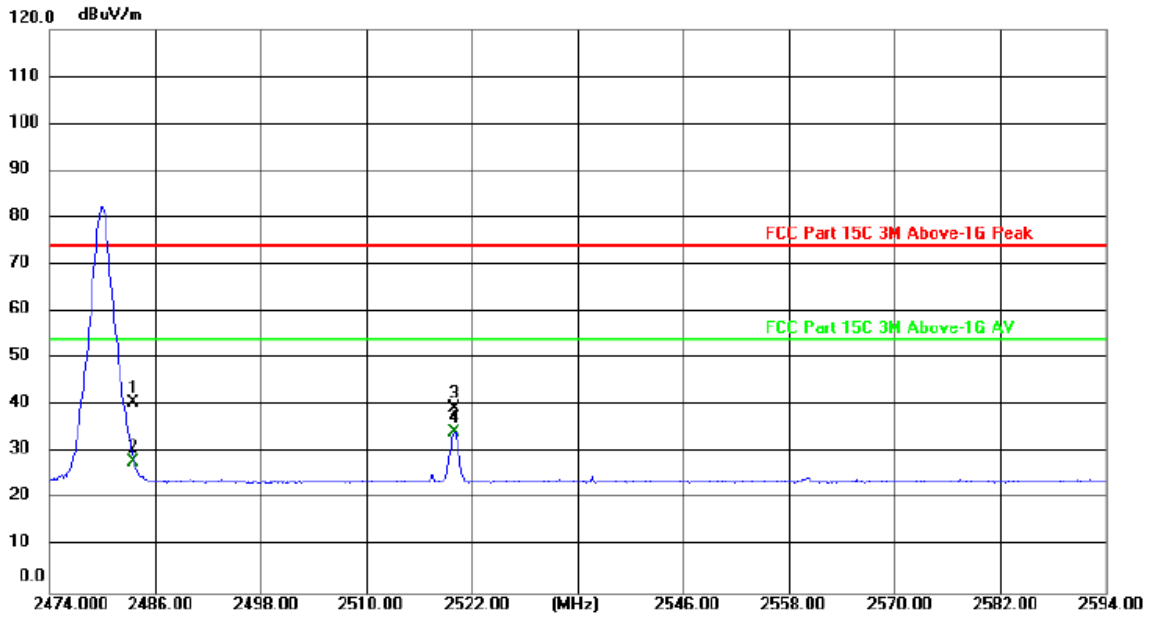
Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2321.960	47.26	-9.32	37.94	74.00	-36.06	peak
2	2321.960	40.89	-9.32	31.57	54.00	-22.43	AVG
3	2362.040	58.77	-9.17	49.60	74.00	-24.40	peak
4 *	2362.040	52.05	-9.17	42.88	54.00	-11.12	AVG
5	2390.000	47.16	-9.08	38.08	74.00	-35.92	peak
6	2390.000	35.87	-9.08	26.79	54.00	-27.21	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

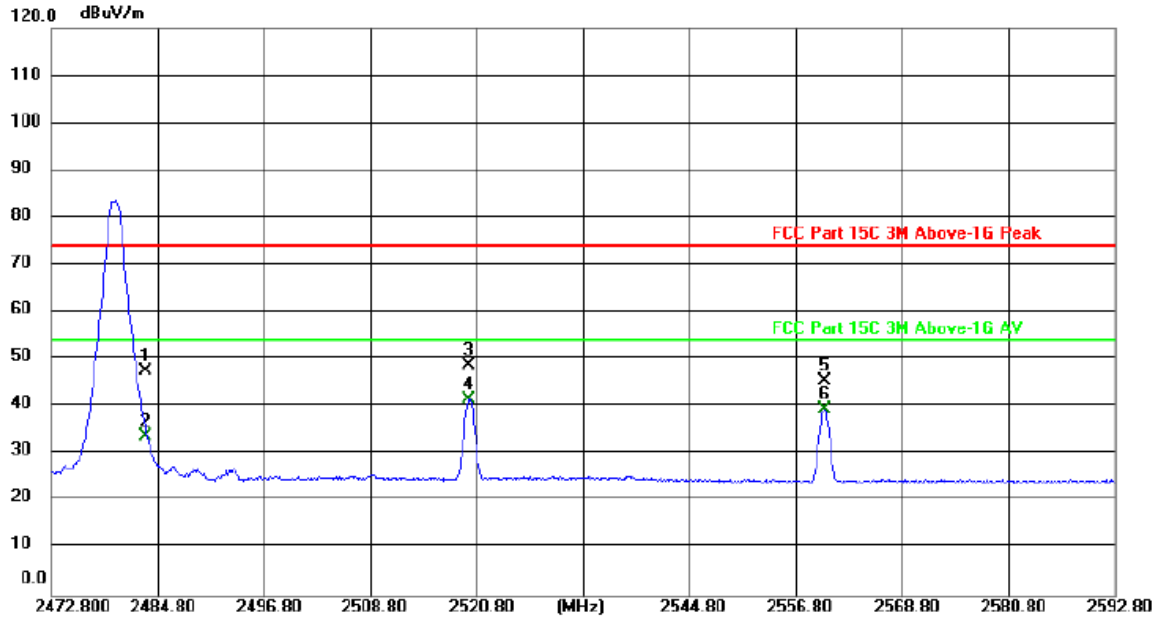
Ant. Pol.	Horizontal
Test Mode:	TX BLE 1M Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	49.46	-8.76	40.70	74.00	-33.30	peak
2	2483.500	36.76	-8.76	28.00	54.00	-26.00	AVG
3	2519.960	48.02	-8.64	39.38	74.00	-34.62	peak
4 *	2519.960	43.04	-8.64	34.40	54.00	-19.60	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX BLE 1M Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	56.37	-8.76	47.61	74.00	-26.39	peak
2	2483.500	42.62	-8.76	33.86	54.00	-20.14	AVG
3	2519.960	57.35	-8.64	48.71	74.00	-25.29	peak
4 *	2519.960	50.20	-8.64	41.56	54.00	-12.44	AVG
5	2560.040	53.90	-8.50	45.40	74.00	-28.60	peak
6	2560.040	47.88	-8.50	39.38	54.00	-14.62	AVG

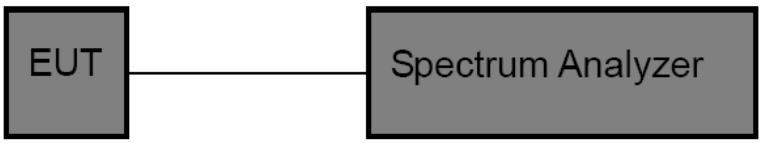
Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

3.4. Band Edge and Spurious Emissions (Conducted)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d) / RSS-247 5.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Configuration



Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW, scan up through 10th harmonic.
   Sweep = auto, Detector function = peak, Trace = max hold.
4. Measure and record the results in the test report.

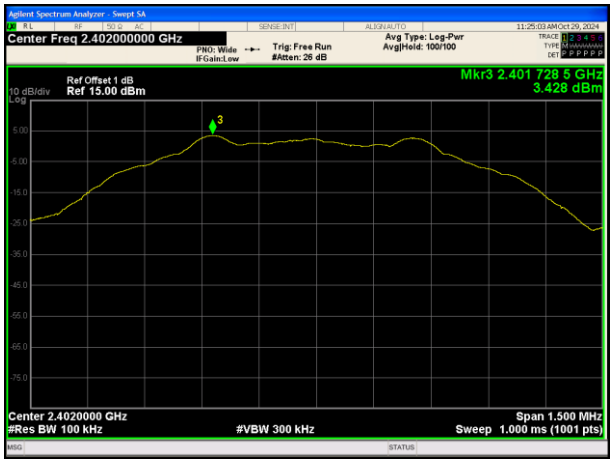
Test Mode

Please refer to the clause 2.4.

Test Result

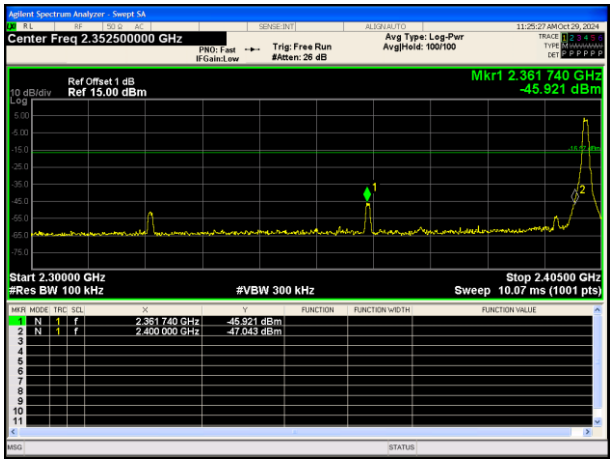
Mode	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
BLE 1M	0	2361.74	-45.921	-16.57	-29.351	PASS
		2400.00	-47.043	-16.57	-30.473	PASS
		4803.80	-46.504	-16.57	-29.934	PASS
	19	4879.30	-47.090	-17.45	-29.640	PASS
	39	2483.50	-59.822	-18.36	-41.462	PASS
		4960.45	-48.227	-18.36	-29.867	PASS

Test Graphs:



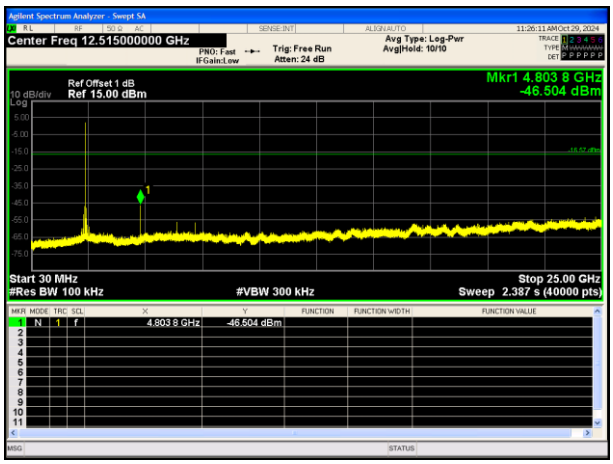
In-Band Reference Level

BLE 1M_Channel 0



Out Of Band Emission

BLE 1M_Channel 0

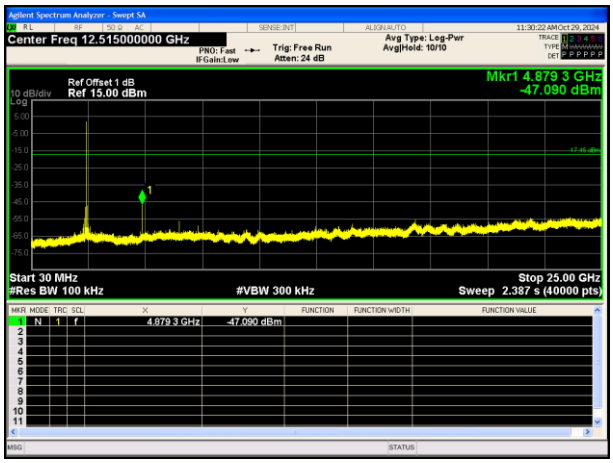


30.0 MHz - 25000.0 MHz

BLE 1M_Channel 0

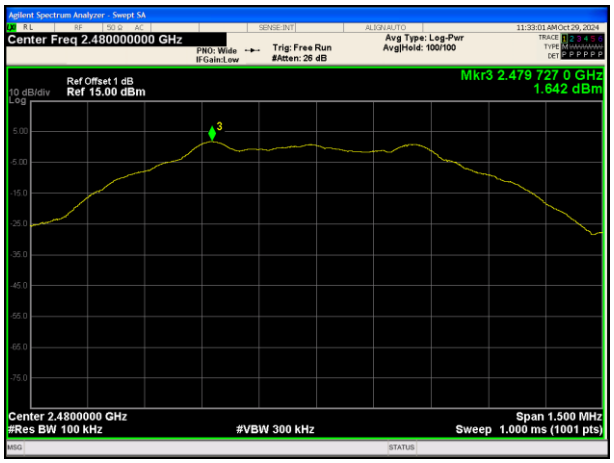
In-Band Reference Level

BLE 1M_Channel 19



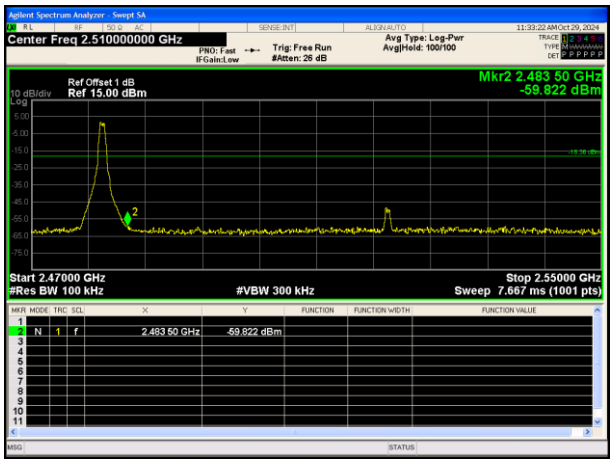
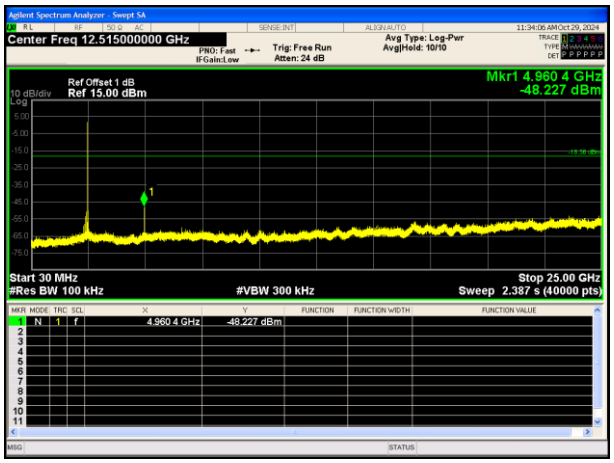
30.0 MHz - 25000.0 MHz

BLE 1M_Channel 19



In-Band Reference Level

BLE 1M_Channel 39

	
Out Of Band Emission **BLE 1M_Channel 39**	**30.0 MHz - 25000.0 MHz** **BLE 1M_Channel 39**

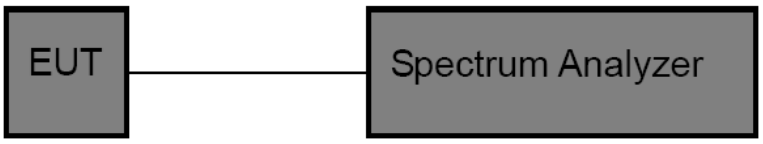
3.5. DTS Bandwidth

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2) / RSS-247 5.2 a

Test Item	Limit	Frequency Range (MHz)
DTS Bandwidth	⩾500 kHz (6dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. DTS Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.
   OCB Spectrum Setting:
   (1) Set RBW = 1% ~ 5% occupied bandwidth.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

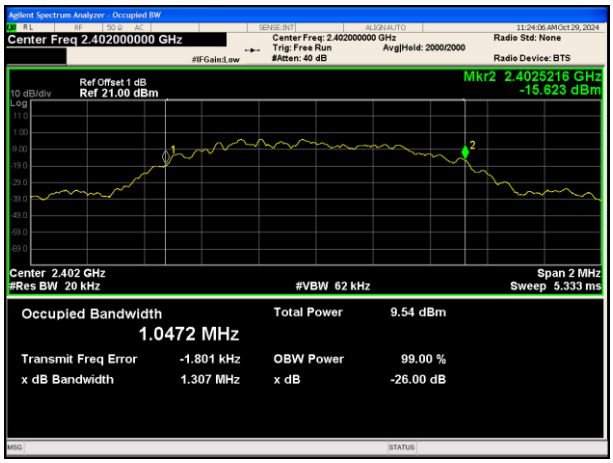
Test Mode

Please refer to the clause 2.4.

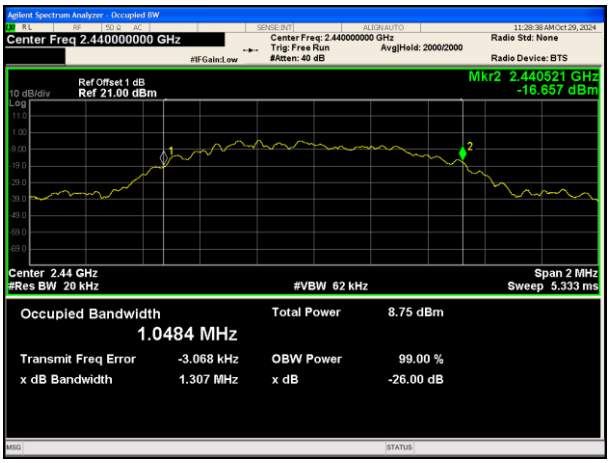
Test Result

Test Mode	Frequency (MHz)	99% Bandwidth (MHz)	DTS Bandwidth (MHz)	Limit (MHz)	Verdict
BLE_1M	2402	1.0472	0.7000	≥0.5	Pass
	2440	1.0484	0.7081	≥0.5	Pass
	2480	1.0470	0.7117	≥0.5	Pass

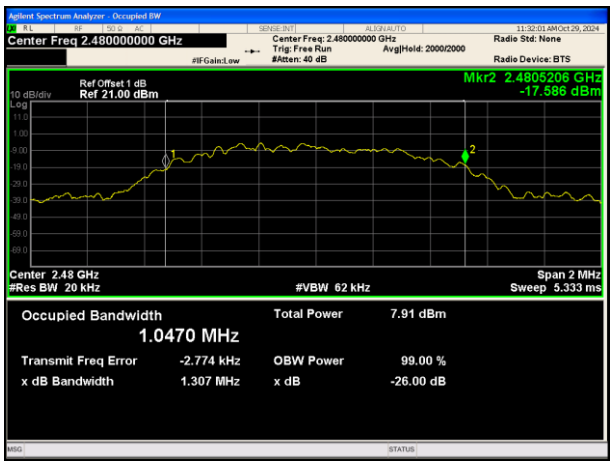
99% Bandwidth:



BLE 1M_Channel 0

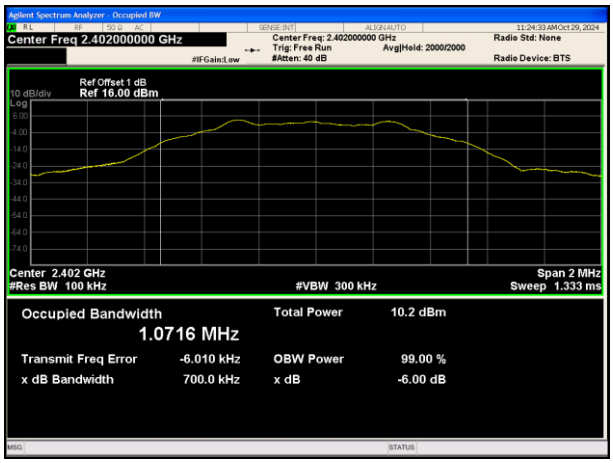


BLE 1M_Channel 19

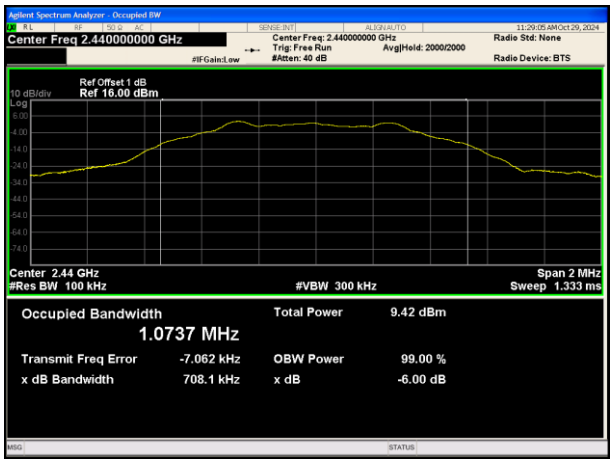


BLE 1M_Channel 39

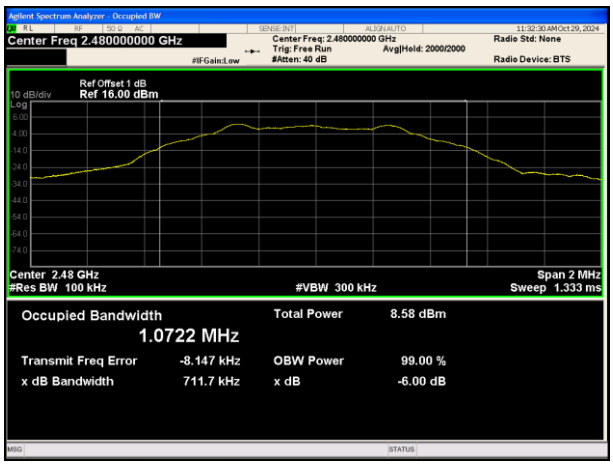
DTS Bandwidth:



BLE 1M_Channel 0



BLE 1M_Channel 19



BLE 1M_Channel 39

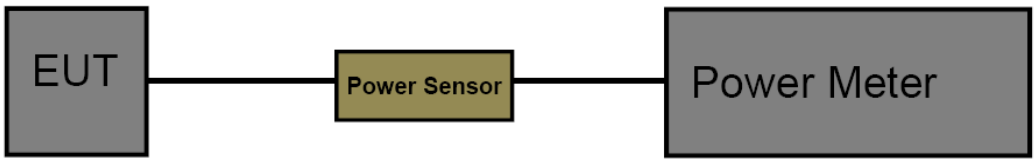
3.6. Peak Output Power

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3) / RSS-247 5.4 d

Section	Test Item	Limit	Frequency Range (MHz)
FCC CFR 47 Part15.247 (b)(3)	Maximum Conducted Output Power	1 Watt or 30dBm	2400~2483.5
ISED RSS-247 5.4 d	Maximum Conducted Output Power	1 Watt or 30dBm	2400~2483.5
	EIRP	4 Watt or 36dBm	2400~2483.5

Test Configuration



Test Procedure

1. The maximum conducted output power may be measured using a broadband Peak RF power meter.
2. Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor.
3. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
   Record the measurement data.

Test Mode

Please refer to the clause 2.4.

Test Result

Test Mode	Antenna	Channel	Peak Output Power[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	3.712	≤30	PASS
		2440	3.113	≤30	PASS
		2480	2.174	≤30	PASS

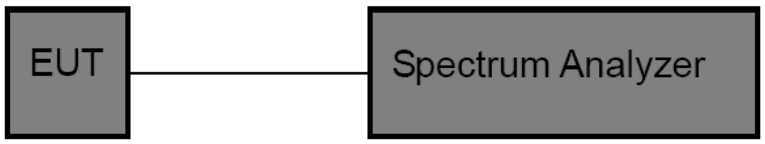
3.7. Power Spectral Density

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e) / RSS-247 5.2 b

Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	8 dBm (in any 3 kHz)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 3 kHz.
Set the VBW to: 10 kHz.
Detector: peak.
Sweep time: auto.
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

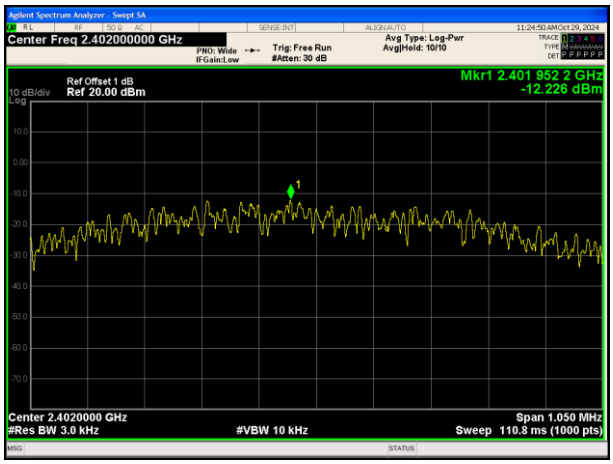
Test Mode

Please refer to the clause 2.4.

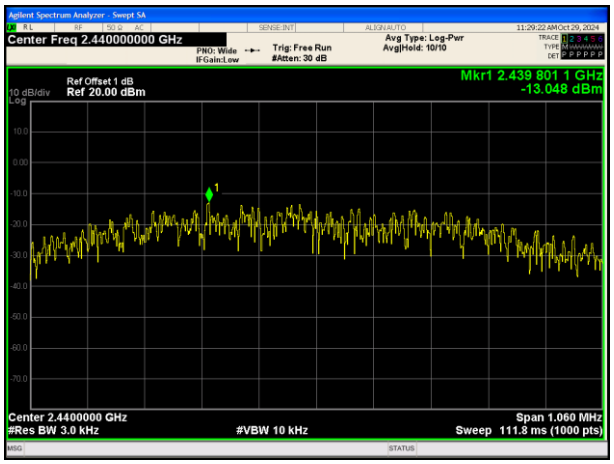
Test Result

Test Mode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-12.226	≤8	PASS
		2440	-13.048	≤8	PASS
		2480	-13.661	≤8	PASS

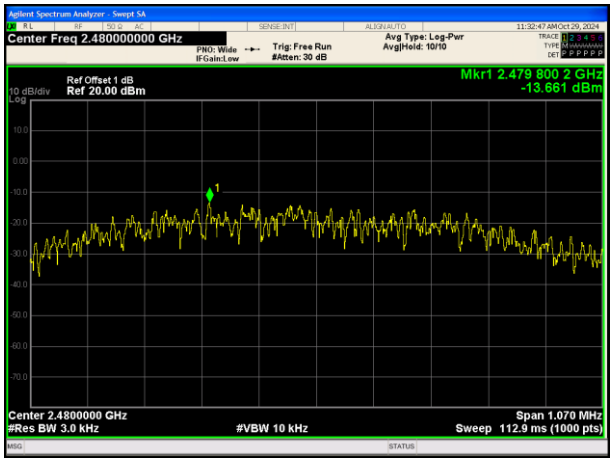
Test Graphs:



BLE 1M_Channel 0



BLE 1M_Channel 19



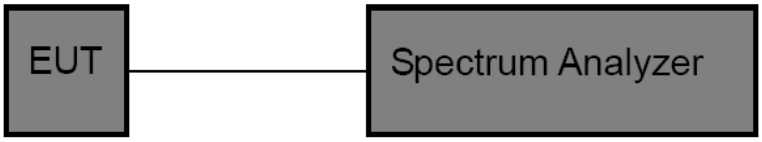
BLE 1M_Channel 39

3.8. Duty Cycle

Limit

None, for report purposes only.

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to test channel center frequency.
Set the span to 0Hz.
Set the RBW to 10MHz.
Set the VBW to 10MHz.
Detector: Peak.
Sweep time: Auto.
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

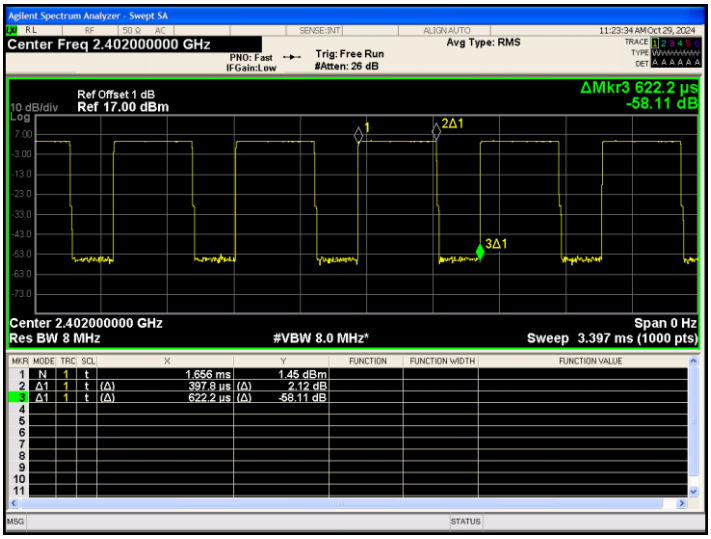
Test Mode

Please refer to the clause 2.4.

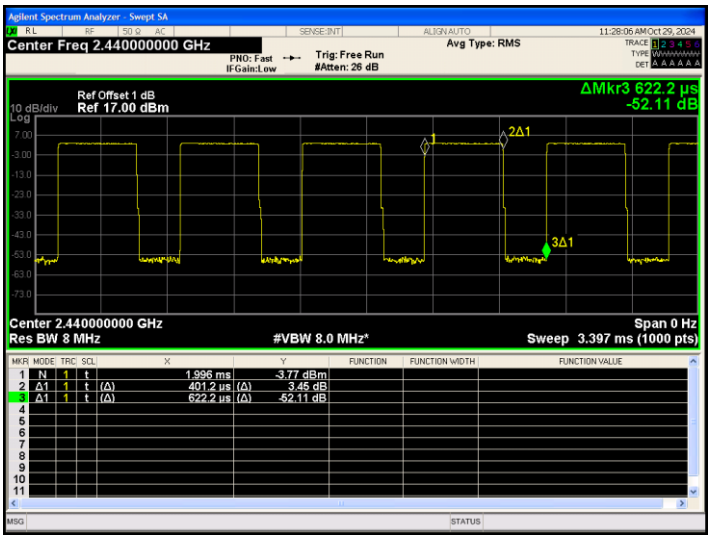
Test Result

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW (kHz)	Final Setting for VBW (kHz)
BLE_1M	2402	0.398	0.622	63.93	2.51	3
	2440	0.401	0.622	64.48	2.49	3
	2480	0.398	0.622	63.93	2.51	3

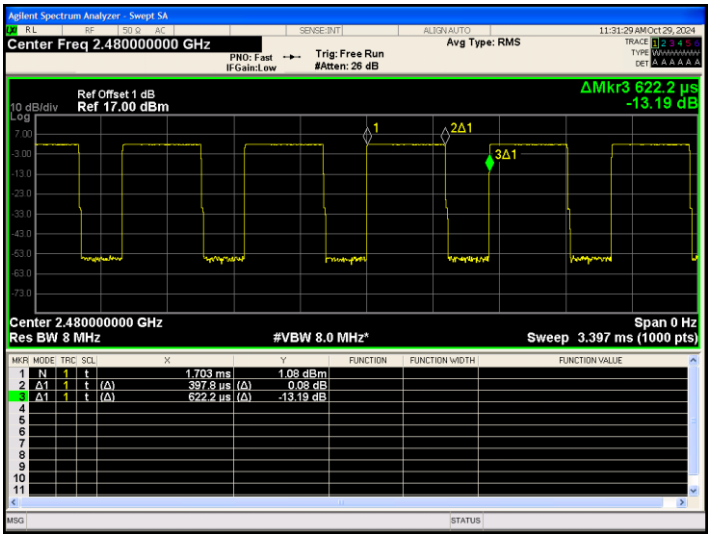
Test Graphs:



BLE 1M_Channel 0



BLE 1M_Channel 19



BLE 1M_Channel 39

3.9. Antenna Requirement

FCC CFR Title 47 Part 15 Subpart C 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. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i)

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Result

The directional gain of the antenna is less than 6dBi, please refer to the EUT internal photographs antenna photo.

RSS-Gen Issue 5 Section 6.8

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power(e.i.r.p.) limits specified in the applicable standard (RSS) for licence-exempt apparatus.

Result

PASS.

The EUT has 1 antenna: a Multilayer Ceramic Antenna for BT.

Note: ☒Antenna use a permanently attached antenna which is not replaceable.
☐Not using a standard antenna jack or electrical connector for antenna replacement.
☐The antenna has to be professionally installed (please provide method of installation).
Which in accordance to RSS-Gen 6.8, please refer to the internal photos.

**************************THE END**************************