TEST REPORT

Reference No.	:	WTF25F02028883W002
FCC ID	:	2BN7S-BN-XXL-MC
Applicant	:	Guangdong Ice energy Technology Co., Ltd
Address	:	Cunwei Industrial Development Zone, Nanzhuang Town, Chancheng District, Foshan, Guangdong, P.R. China
Manufacturer	:	The same as above
Address	:	The same as above
Product Name	:	Portable Cooler Speaker
Model No.	:	BN-8L-MC, BN-13L-MC, BN-15L-MC, BN-16L-MC, BN-18L-MC, BN-20L-MC, BN-21L-MC, BN-24L-MC, BN-28L-MC, BN-30L-MC, BN-38L-MC, BN-52L-MC, BN-12QT-MC, BN-20QT-MC, BN-35L-MC, BN-45L-MC, BN-70L-MC, BN-50L-MC
Test specification	:	FCC CFR47 Part 15 Subpart C (Section 15.247)
Date of Receipt sample	:	2025-02-19
Date of Test	:	2025-02-20 to 2025-03-09
Date of Issue	:	2025-03-24
Test Report Form No.	:	WEW-15247A-01B
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.

Prepared By:
Waltek Testing Group (Foshan) Co., Ltd.
Address: 1/F., Building 19, Sunlink Machinery City, Xingye 4 Road,
Guanglong Industrial Park, Chihua Neighborhood Committee, Chencun Town,
Shunde District, Foshan, Guangdong, China
Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

Tested by: Approved by:

Kyrie Yun Danny Zhou

1 Revision History

Test Report No.	Date of Issue	Description	Status
WTF25F02028883W002	2025-03-24	Original	Valid

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3 General Information

3.1 General Description of E.U.T

Product Name ..... : Portable Cooler Speaker

Model No. ..... : BN-8L-MC, BN-13L-MC, BN-15L-MC, BN-16L-MC, BN-18L-MC, BN-20L-MC, BN-21L-MC, BN-24L-MC, BN-28L-MC, BN-30L-MC, BN-38L-MC, BN-52L-MC, BN-12QT-MC, BN-20QT-MC, BN-35L-MC, BN-45L-MC, BN-70L-MC, BN-50L-MC

Model Description ..... : All models are identical except for the outlook color. Therefore the full tests were performed on model BN-13L-MC.

Rating ..... : USB Input: DC 5V, 2A

Battery Capacity ..... : 3.7V, 1500mAh

Power Adapter ..... : ---

3.2 Technical Characteristics of EUT

Bluetooth Version ..... : Bluetooth LE

Frequency Range ..... : 2402-2480MHz

RF Output Power ..... : -5.19dBm (Conducted)

Modulation ..... : GFSK

Data Rate ..... : 1Mbps

Quantity of Channels ..... : 40

Channel Separation..... : 2MHz

Type of Antenna ..... : PCB Antenna

Antenna Gain ..... : 0dBi

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

FCC Rules Part 15.247	Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science an Economic Development Canada(ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number:21895, March 12, 2019

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. 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 820106, August 16, 2018

- **FCC – Designation No.: CN5034**

Waltek Testing Group (Foshan) Co., Ltd. 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. Designation No. CN5034.

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.6 Abnormalities from Standard Conditions

None.

3.7 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.

4 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List

Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2440MHz
TM3	High Channel	2480MHz

Test Conditions

Temperature:	22~25℃
Relative Humidity:	50~55%
Atmospheric pressure:	101.9kPa

5 Equipment Used during Test

5.1 Equipment List

☐**Conducted Emissions 1#**

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal Due Date
1.	EMI Test Receiver	R&S	ESR3	102423	2025-01-06	2026-01-05
2.	LISN	R&S	ENV216	101343	2025-01-06	2026-01-05
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	223NN624	2025-01-06	2026-01-05
4.	Switch	CD	RSU-A4	RSUA4008	2025-01-06	2026-01-05

☒**Conducted Emissions 2#**

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	2025-01-06	2026-01-05
2.	LISN	R&S	ENV216	101215	2025-01-07	2026-01-06
3.	Cable	LMR195UF-BMNM-5.00M	Times Micorwave Systems	---	2025-01-08	2026-01-07
4.	Switch	ESE	RSU/M2	---	2025-01-06	2026-01-05

☐**Conducted Emissions 3#**

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal Due Date
1.	EMI Test Receiver	R&S	ESR3	102842	2025-01-06	2026-01-05
2.	LISN	R&S	ENV216	101542	2025-01-06	2026-01-05
3.	Cable	YIHENG	LMR195UF-NMNM-2.5	---	2025-01-06	2026-01-05
4.	Manual RF Switch	YIHENG	SW-2	RSU0402	2025-01-06	2026-01-05

☒**Radiation Emissions**

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	2024-01-05	2027-01-04
2.	EMI Test Receiver	R&S	ESR7	102454	2025-01-06	2026-01-05
3.	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
4.	Active Loop Antenna	SCHWARZBECK	FMZB1519B	00004	2025-01-06	2026-01-05
5.	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2025-01-12	2026-01-11
6.	Coaxial Cable (below 1GHz)	Times Micorwave Systems	RG223-NMNM-10M	-	2025-01-07	2026-01-06
7.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2025-01-13	2026-01-12
9.	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2025-01-06	2026-01-05
10.	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2025-01-06	2026-01-05

☒RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
2.	EXG Analog Signal Generator	Agilent	N5181A	MY48180720	2025-01-06	2026-01-05
3.	RF Control Unit	CHANGCHUANG	JS0806-2	-	2025-01-08	2026-01-07

☐: ***Not Used***

☒: ***Used***

5.2 Test Software

Description	Manufacturer	Model	Version
EMI Test Software (Conducted Emission 1#)	FARATRONIC	EZ-EMC	EMEC-3A1
EMI Test Software (Conducted Emission 2#)	FARATRONIC	EZ-CON	FARAD-3A1.1+
EMI Test Software (Conducted Emission 3#)	FARATRONIC	EZ-EMC	EMC-CON 3A1.1+
EMI Test Software (Radiated Emission)	FARATRONIC	EZ-EMC	RA-03A1-2
RF Conducted Test Software	TONSCEND	JS1120-2	V2.6

5.3 Special Accessories and Auxiliary Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.
1.	/	/	/	/

5.4 Measurement Uncertainty

Parameter	Uncertainty
RF Output Power	±2.2dB
Occupied Bandwidth	±1.5%
Conducted Emission	±2.6dB
Transmitter Spurious Emission	±3.8dB (for 25MHz-1GHz)
	±5.0dB (for 1GHz-18GHz)

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

6 Summary of Test Result

Test Items	FCC Rules	Result
Antenna Requirement	§15.203; §15.247(b)(4)(i)	Compliant
Restricted Band of Operation	§15.205	Compliant
Conducted Emissions	§15.207(a)	Compliant
Radiated Spurious Emissions	§15.209(a)	Compliant
Power Spectral Density	§15.247(e)	Compliant
DTS Bandwidth	§15.247(a)(2)	Compliant
RF Output Power	§15.247(b)(1)	Compliant
Band edge (Out of Band Emissions)	§15.247(d)	Compliant

Remark:

Pass Test item meets the requirement

Fail Test item does not meet the requirement

N/A Test case does not apply to the test object

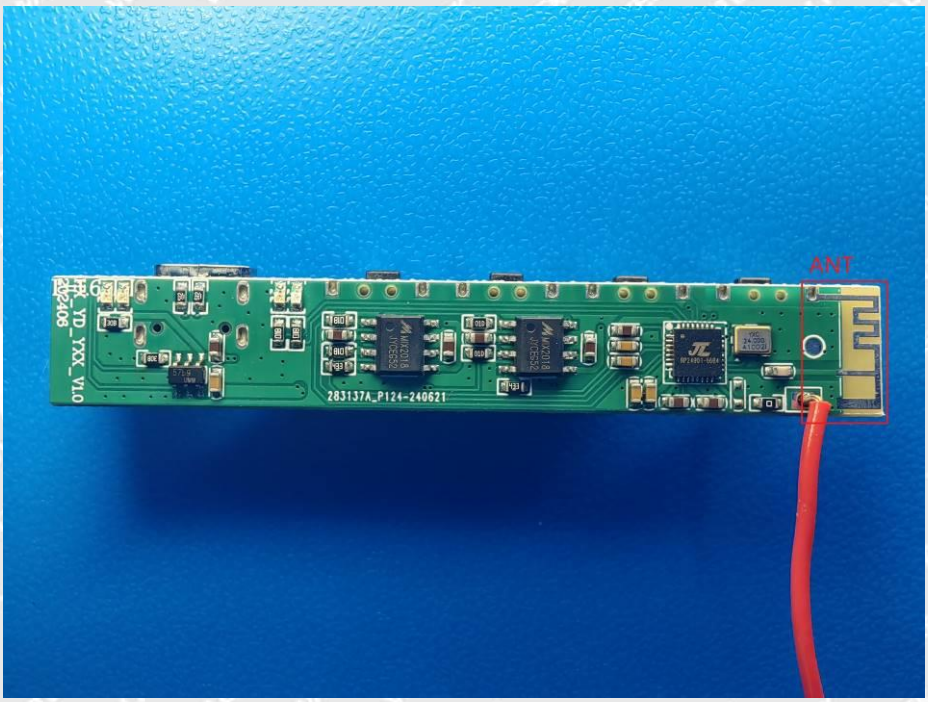
6.1 Antenna Requirement

6.1.1 Standard Applicable

According to FCC Part 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 an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

6.1.2 Evaluation Information

The EUT has a PCB Antenna, the gain is 0 dBi, fulfil the requirement of this section.



6.2 Radiated Spurious Emissions

6.2.1 Standard Applicable

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

6.2.2 Test Procedure

1) The EUT is placed on a turntable, which is 0.8m(Below 1G) 1.5m(above 1G)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 moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

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.

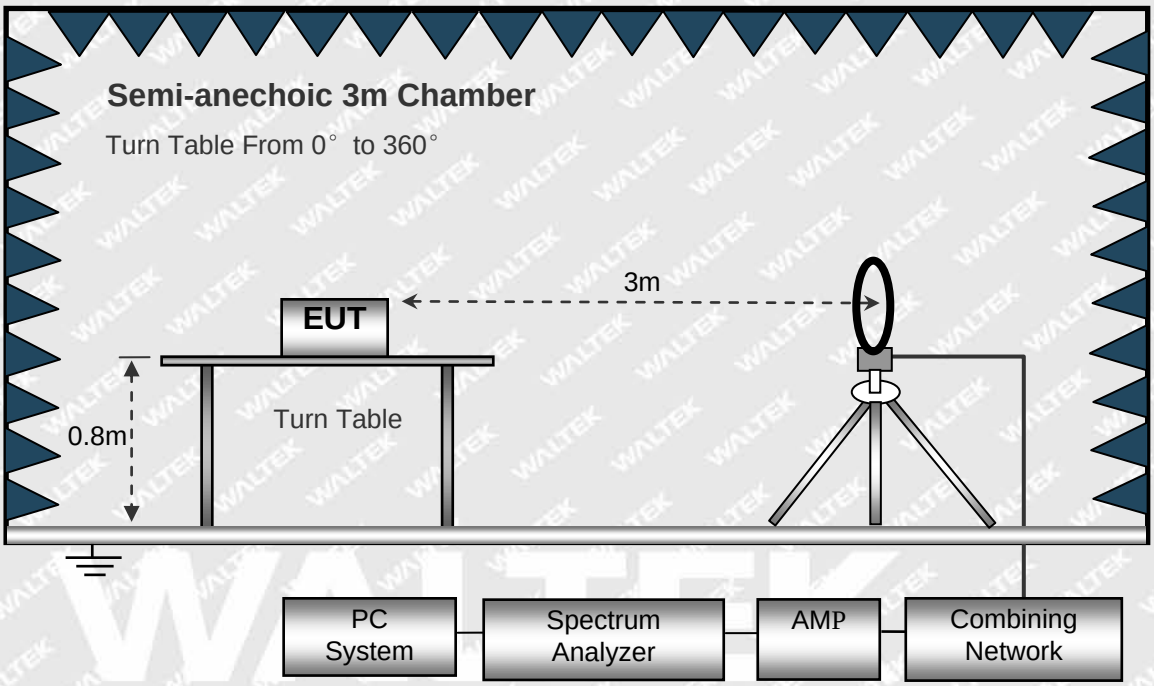
7) The radiation measurements are tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

6.2.3 Test Setup

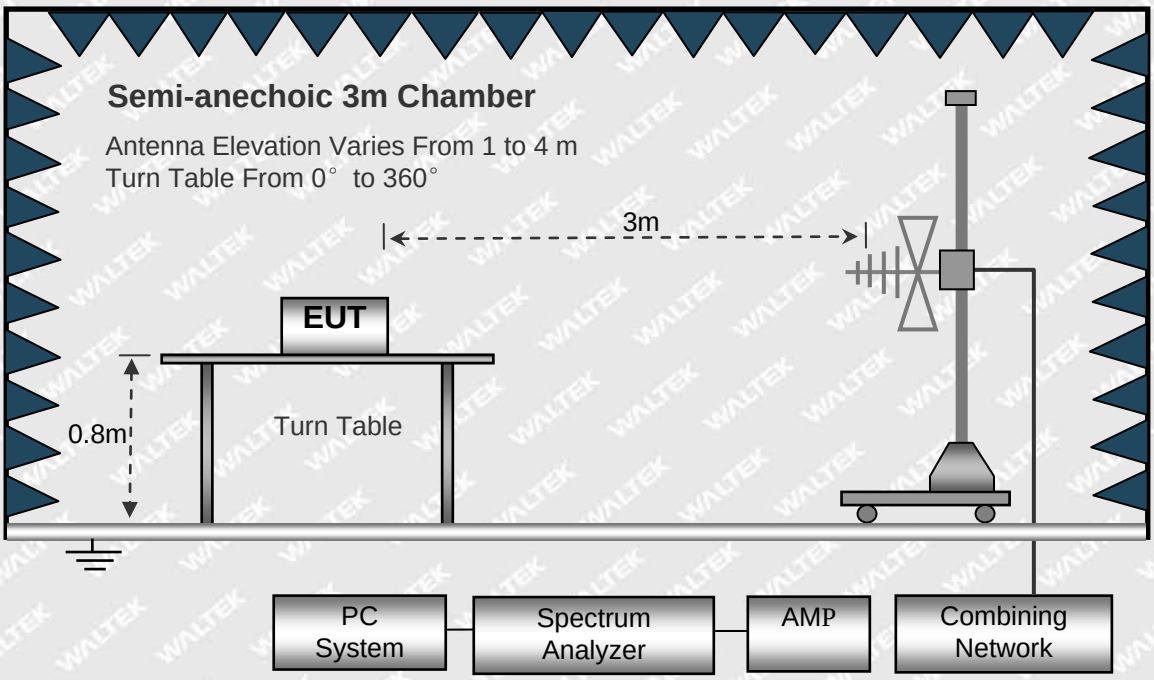
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

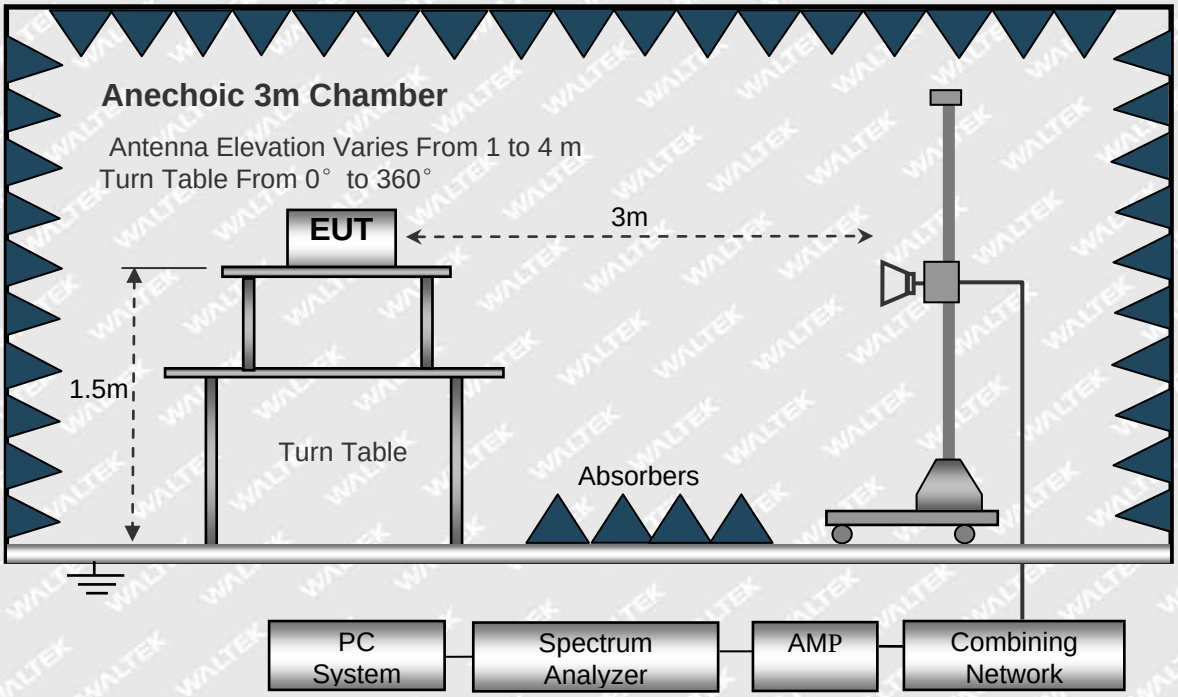
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



6.2.4 Spectrum Analyzer Setup

9KHz-30MHz	30MHz-1GHz	Above 1GHz
RBW=10kHz	RBW=120kHz	RBW=1MHz
VBW=30kHz	VBW=300kHz	VBW=3MHz(Peak), 10MHz(AV)
Sweep time=Auto	Sweep time=Auto	Sweep time=Auto
Trace=Max hold	Trace=Max hold	Trace=Max hold
Detector function=peak	Detector function=peak, QP	Detector function=peak, AV

6.2.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Corr. Factor

Corr.Factor=Antenna Factor + Cable Factor - Amplifier Gain

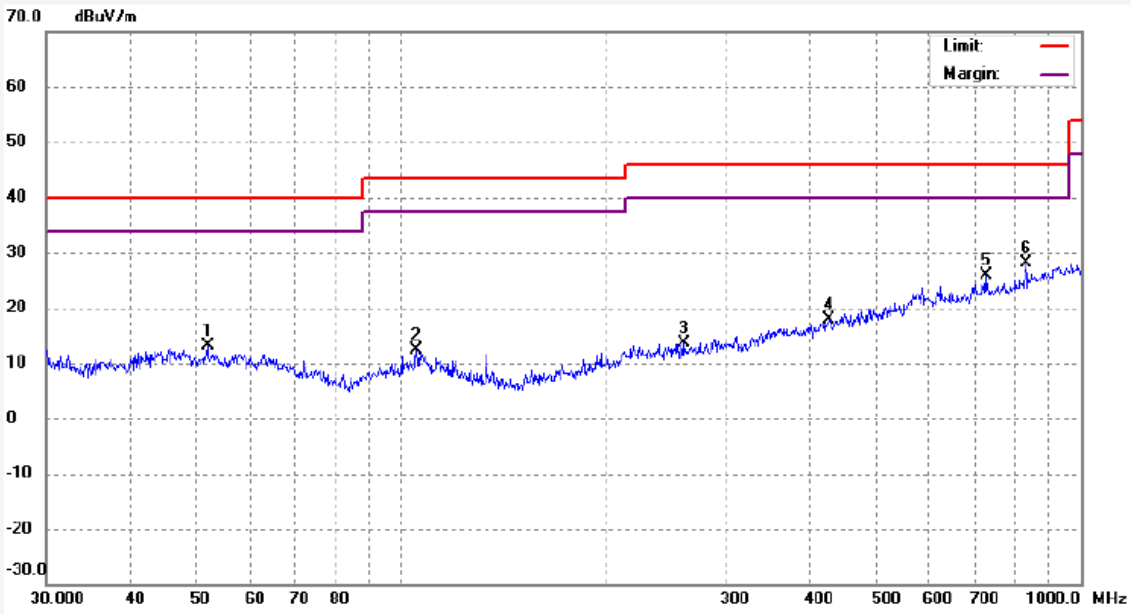
The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

6.2.6 Test Results

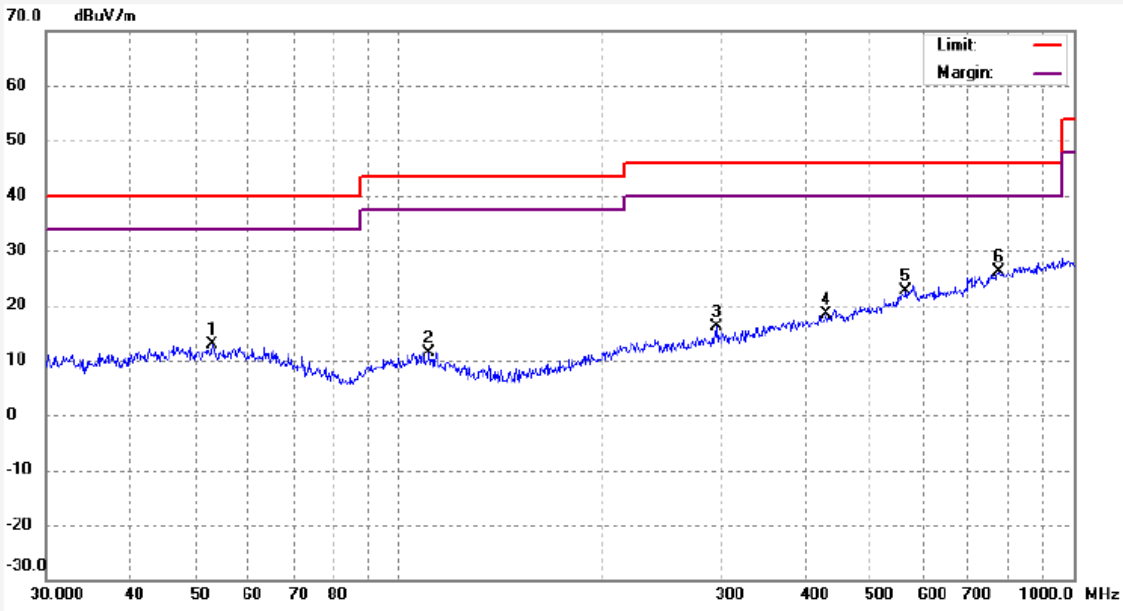
Test Frequency: Below 1GHz

Test Channel Low **Polarization** Vertical



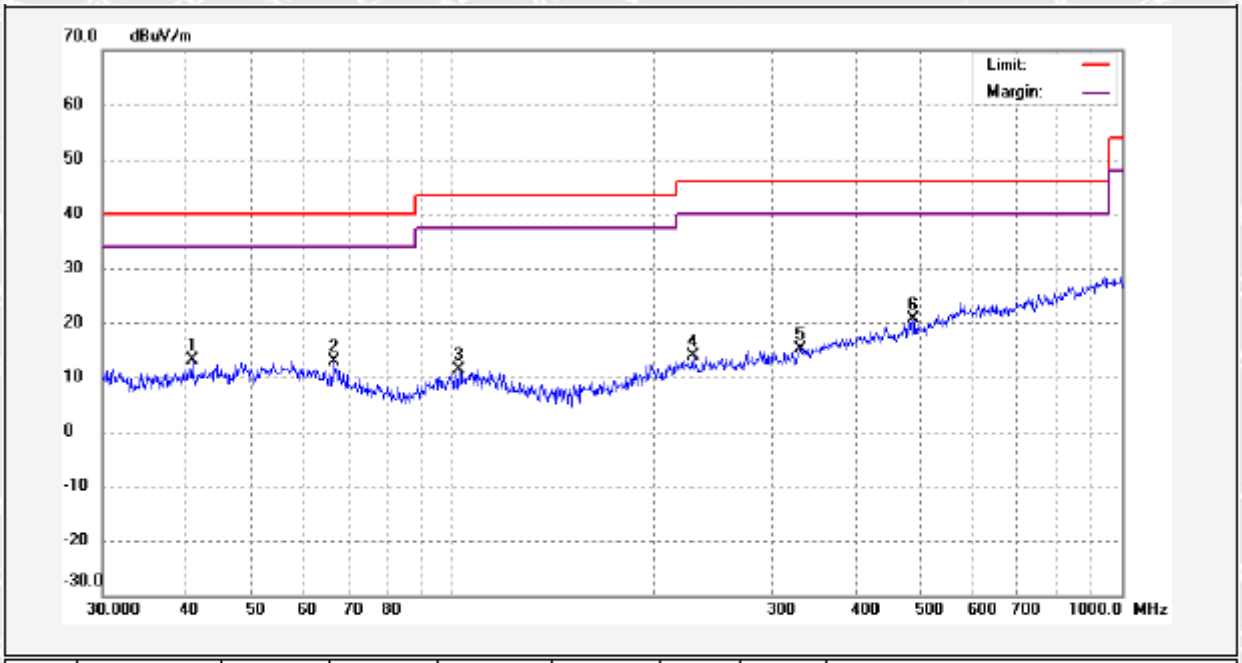
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	51.9704	-1.28	14.37	13.09	40.00	-26.91	peak	
2	105.3826	-0.67	13.07	12.40	43.50	-31.10	peak	
3	260.7838	-1.07	14.64	13.57	46.00	-32.43	peak	
4	425.3262	-0.70	18.70	18.00	46.00	-28.00	peak	
5	726.8052	1.52	24.29	25.81	46.00	-20.19	peak	
6	830.4002	1.76	26.33	28.09	46.00	-17.91	peak	

Test Channel Low **Polarization** Horizontal



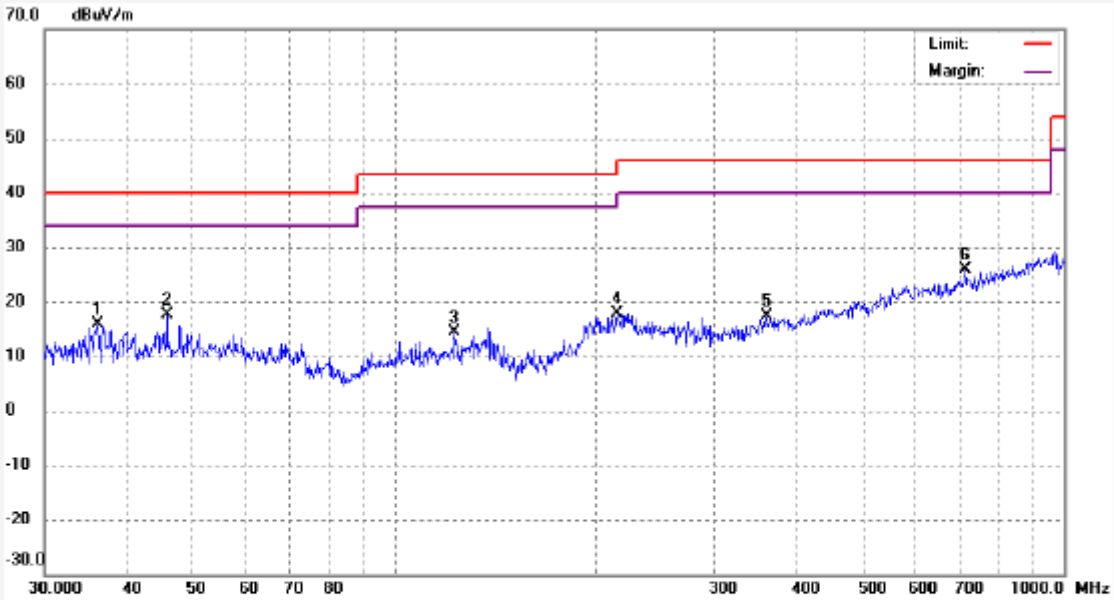
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	53.0568	-1.48	14.32	12.84	40.00	-27.16	peak	
2	111.2687	-1.06	12.55	11.49	43.50	-32.01	peak	
3	297.1198	0.48	15.72	16.20	46.00	-29.80	peak	
4	429.8241	-0.54	18.83	18.29	46.00	-27.71	peak	
5	564.8368	-0.05	22.57	22.52	46.00	-23.48	peak	
6	776.3331	0.77	25.26	26.03	46.00	-19.97	peak	

Test Channel Middle Channel **Polarization** Vertical



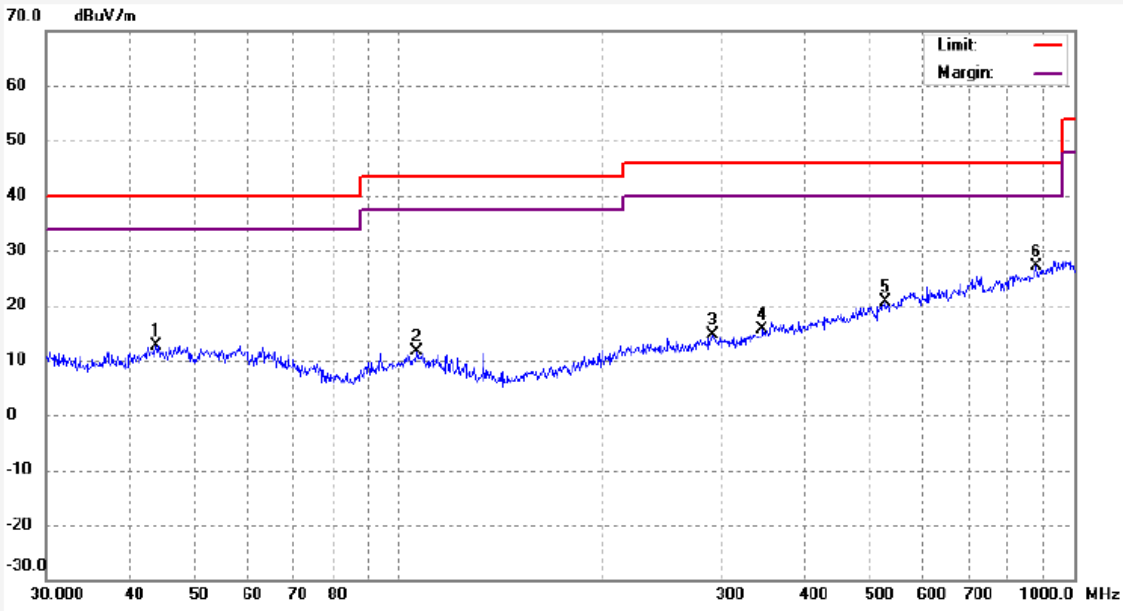
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	40.9019	-0.37	13.47	13.10	40.00	-26.90	peak	
2	66.7091	0.16	12.72	12.88	40.00	-27.12	peak	
3	102.4673	-1.17	12.67	11.50	43.50	-32.00	peak	
4	229.2930	-0.26	14.24	13.98	46.00	-32.02	peak	
5	331.7034	-1.04	16.29	15.25	46.00	-30.75	peak	
6	487.8279	0.15	20.36	20.51	46.00	-25.49	peak	

Test Channel Middle Channel **Polarization** Horizontal



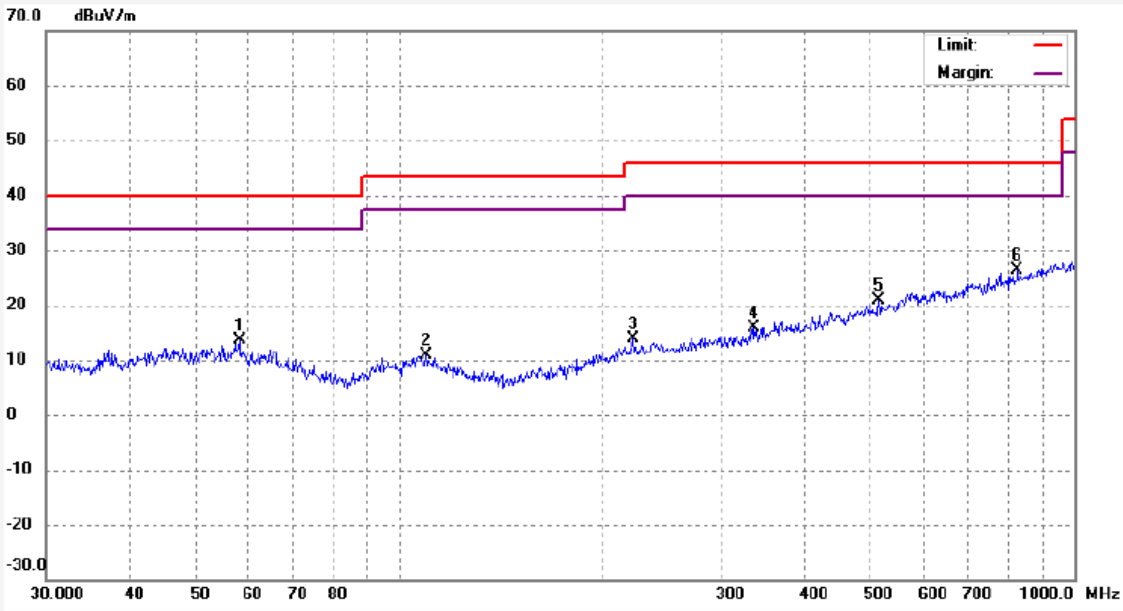
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	36.0386	3.54	12.38	15.92	40.00	-24.08	peak	
2	45.7589	3.50	14.04	17.54	40.00	-22.46	peak	
3	123.2222	3.46	10.90	14.36	43.50	-29.14	peak	
4	215.2678	3.68	14.17	17.85	43.50	-25.65	peak	
5	360.3214	-0.34	17.81	17.47	46.00	-28.53	peak	
6	712.6724	1.91	24.03	25.94	46.00	-20.06	peak	

Test Channel High Channel **Polarization** Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	43.6738	-1.55	14.13	12.58	40.00	-27.42	peak	
2	106.4969	-1.48	12.99	11.51	43.50	-31.99	peak	
3	291.7512	-1.06	15.59	14.53	46.00	-31.47	peak	
4	346.5660	-1.32	17.02	15.70	46.00	-30.30	peak	
5	526.7660	-0.50	21.20	20.70	46.00	-25.30	peak	
6	880.1713	0.96	26.17	27.13	46.00	-18.87	peak	

Test Channel High Channel **Polarization** Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	58.1418	-0.61	14.29	13.68	40.00	-26.32	peak	
2	109.8729	-1.83	12.74	10.91	43.50	-32.59	peak	
3	222.1697	-0.40	14.32	13.92	46.00	-32.08	peak	
4	336.1530	-0.55	16.53	15.98	46.00	-30.02	peak	
5	514.1737	0.41	20.41	20.82	46.00	-25.18	peak	
6	826.9132	0.06	26.27	26.33	46.00	-19.67	peak	

Test Frequency: Above 1GHz

Frequency (MHz)	Reading (dBμV/m)	Detector	Polar (H/V)	Corrected Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low Channel							
4804	52.07	PK	H	-6.71	45.36	74	-28.64
4804	43.23	AV	H	-6.71	36.52	54	-17.48
7206	54.07	PK	H	-1.46	52.61	74	-21.39
7206	44.85	AV	H	-1.46	43.39	54	-10.61
4804	46.13	PK	V	-6.71	39.42	74	-34.58
4804	36.81	AV	V	-6.71	30.10	54	-23.90
7206	53.23	PK	V	-1.46	51.77	74	-22.23
7206	44.01	AV	V	-1.46	42.55	54	-11.45
Middle Channel							
4882	36.23	PK	H	-6.50	29.73	74	-44.27
4882	27.05	AV	H	-6.50	20.55	54	-33.45
7323	46.38	PK	H	-1.12	45.26	74	-28.74
7323	36.86	AV	H	-1.12	35.74	54	-18.26
4882	38.17	PK	V	-6.50	31.67	74	-42.33
4882	29.62	AV	V	-6.50	23.12	54	-30.88
7323	48.63	PK	V	-1.12	47.51	74	-26.49
7323	38.47	AV	V	-1.12	37.35	54	-16.65
High Channel							
4960	35.7	PK	H	-6.29	29.41	74	-44.59
4960	25.82	AV	H	-6.29	19.53	54	-34.47
7440	49.09	PK	H	-0.80	48.29	74	-25.71
7440	39.17	AV	H	-0.80	38.37	54	-15.63
4960	36.73	PK	V	-6.29	30.44	74	-43.56
4960	27.25	AV	V	-6.29	20.96	54	-33.04
7440	48.71	PK	V	-0.80	47.91	74	-26.09
7440	38.39	AV	V	-0.80	37.59	54	-16.41

Note:

1.Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

2. Average measurement was not performed if peak level is lower than average limit 54 dBuV/m) for above 1GHz.

6.3 Power Spectral Density

6.3.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.3.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.10.2, the test method of power spectral density as below:

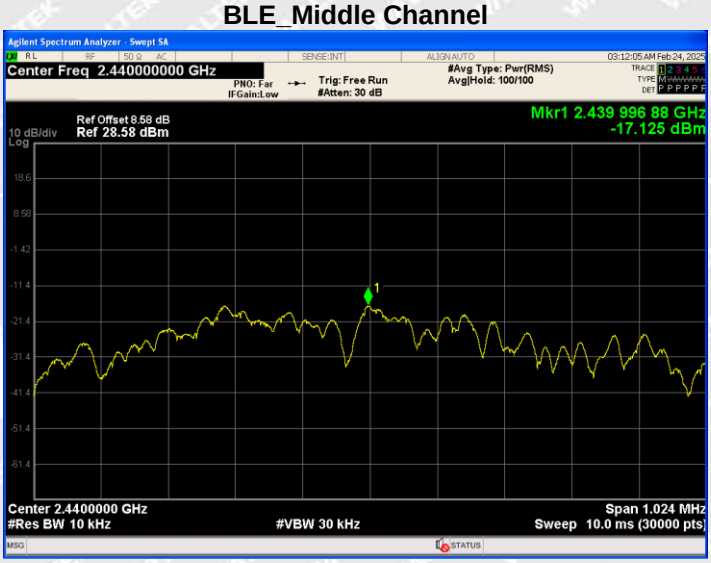
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3.3 Test Result

Test Mode	Test Channel	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
BLE	Low	-17.86	8
	Middle	-17.13	8
	High	-16.54	8

BLE_Low Channel

BLE_Middle Channel



BLE_High Channel

6.4 DTS Bandwidth

6.4.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.4.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.2 and ANSI C63.10-2013 Subclause 11.8.1, the test method of DTS Bandwidth as below:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

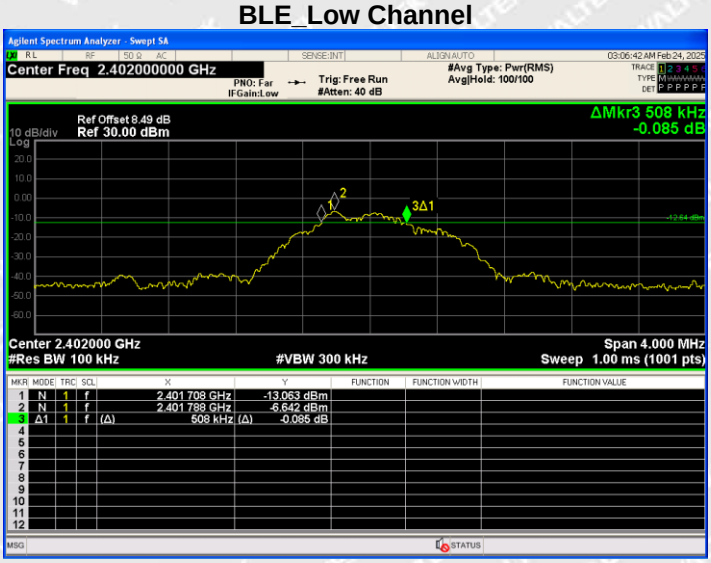
f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

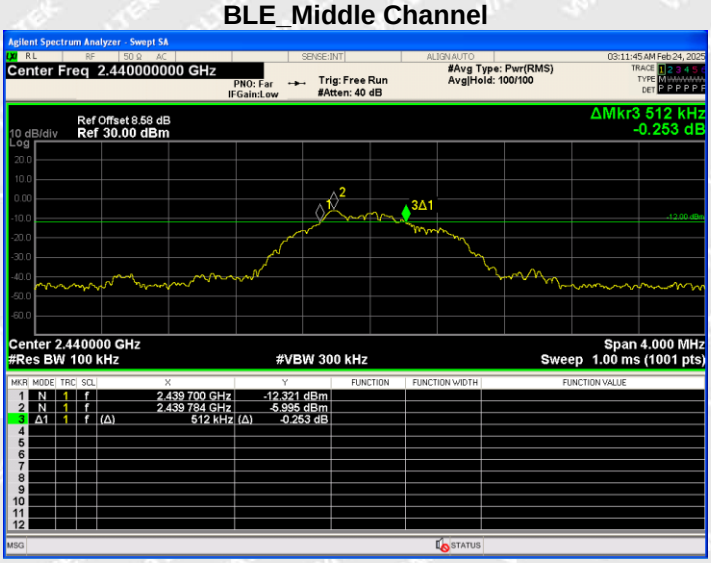
6.4.3 Test Result

Test Mode	Test Channel	6dB Bandwidth kHz	Limit kHz
BLE	Low	508	≥500
	Middle	512	≥500
	High	504	≥500

BLE_Low Channel



BLE_Middle Channel



BLE_High Channel

6.5 RF Output Power

6.5.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

6.5.2 Test Procedure

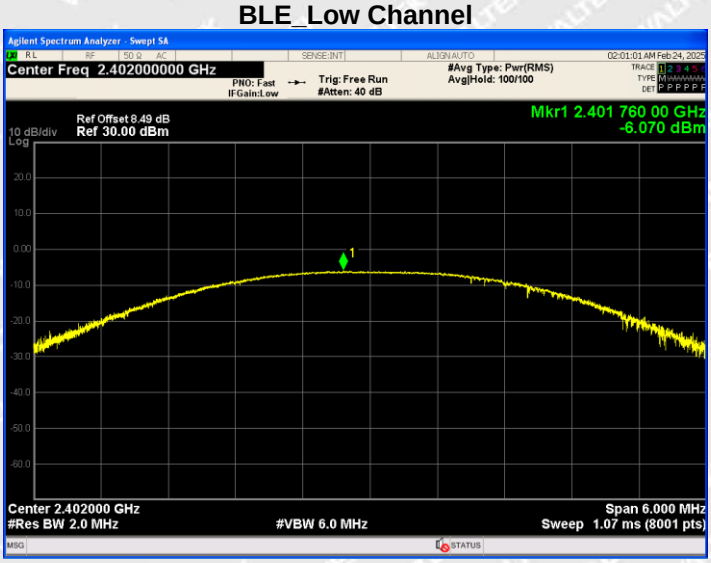
According to the KDB-558074 D01 v05r02 Subclause 8.3.1.1 and ANSI C63.10-2013 Subclause 11.9.1.1, this procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

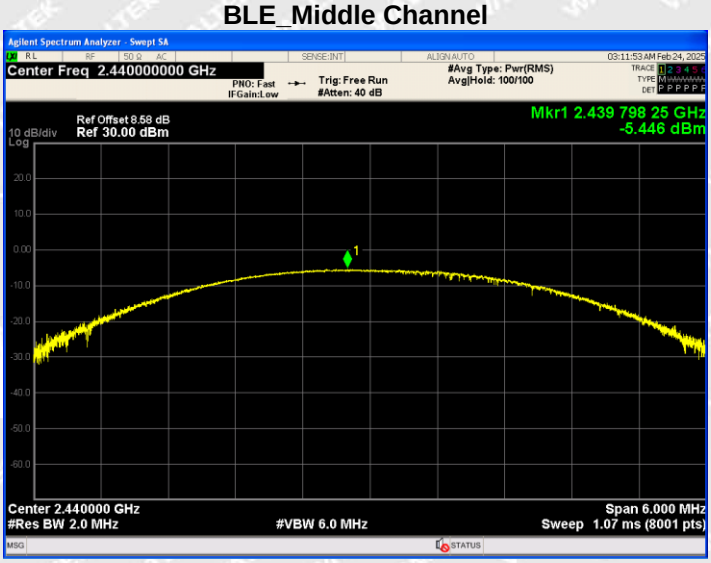
6.5.3 Test Result

Modulation	Test Channel	Reading (dBm)	Output Power (mW)	Limit (mW)
BLE	Low	-6.07	0.247	1000
	Middle	-5.45	0.285	1000
	High	-5.19	0.303	1000

BLE_Low Channel



BLE_Middle Channel



BLE_High Channel

6.6 Out of Band Emissions

6.6.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

6.6.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.11, the Emissions in nonrestricted frequency bands test method as follows:

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

According to the KDB 558074 D01 v05r02 Subclause 8.5 and ANSI C63.10-2013 Subclause 11.12, the Emissions in restricted frequency bands test method as follows:

A. Radiated emission measurements:
Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge,
as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz
for low bandedge, 2460MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak/average; Trace = max hold
All the trace to stabilize, set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emissions must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205.

Note that the method of measurement KDB publication number: 913591 may be used for the radiated band edge measurements.

B. Antenna-port conducted measurements

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 9/

b) VBW ≥ [3 × RBW].

c) Detector = peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

Table 9—RBW as a function of frequency

Frequency	RBW
9 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1000 MHz	100 kHz to 120 kHz
>1000 MHz	1 MHz

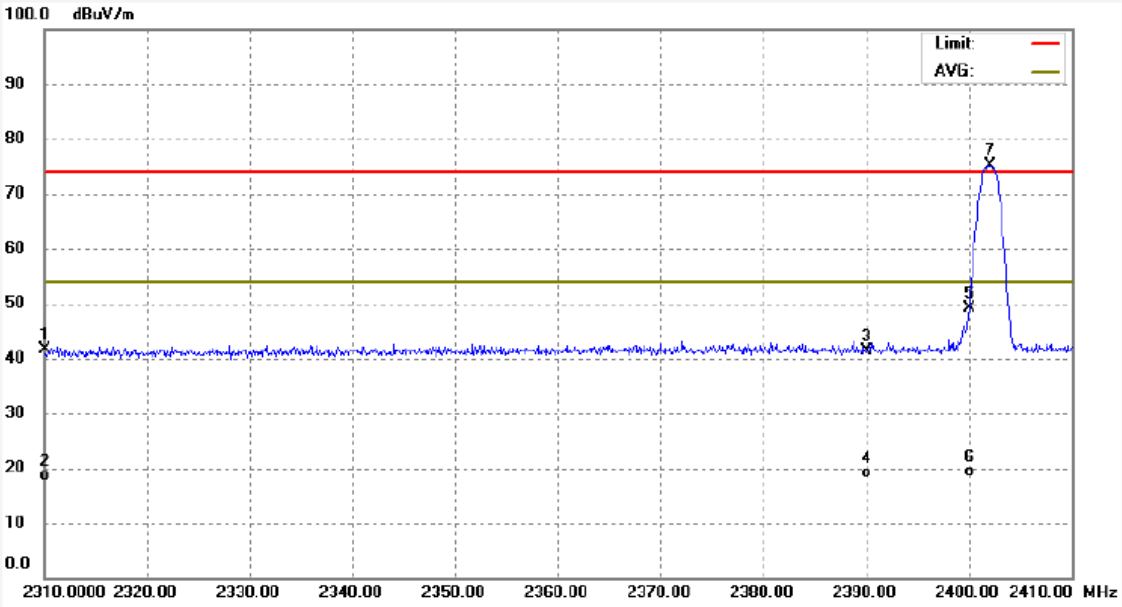
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1.

6.6.3 Test Result

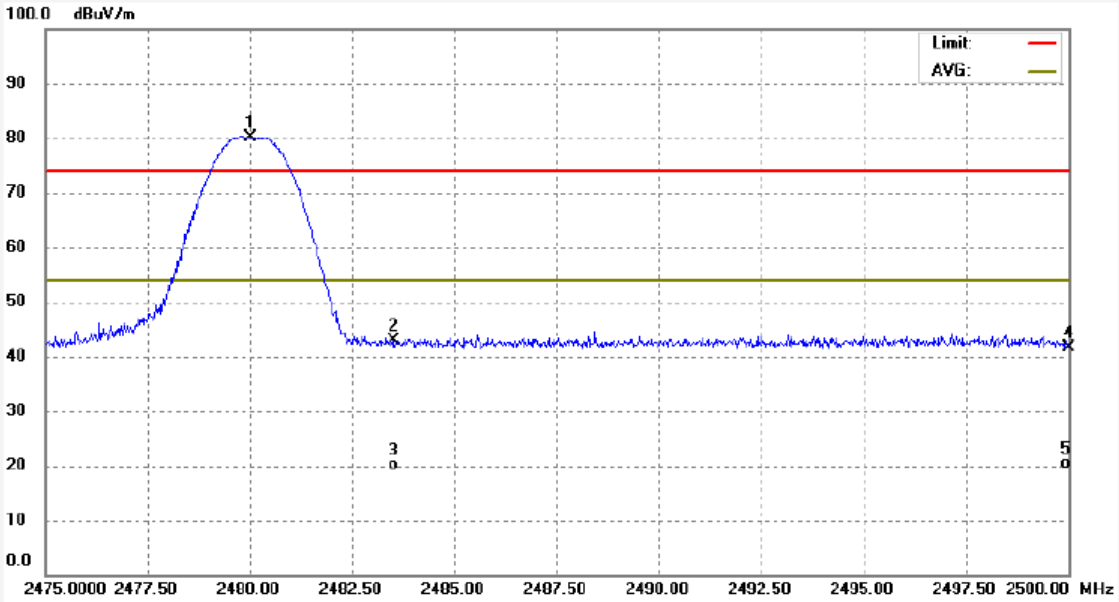
Radiated Test

Test Channel Low Channel **Polarization** Horizontal (worst case)



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2310.000	9.45	32.17	41.62	74.00	-32.38	peak	
2	2310.000	-13.57	32.17	18.60	54.00	-35.40	AVG	
3	2390.000	8.84	32.50	41.34	74.00	-32.66	peak	
4	2390.000	-13.25	32.50	19.25	54.00	-34.75	AVG	
5	2400.000	16.54	32.54	49.08	74.00	-24.92	peak	
6	2400.000	-13.10	32.54	19.44	54.00	-34.56	AVG	
7	2402.000	42.53	32.55	75.08	74.00	1.08	peak	

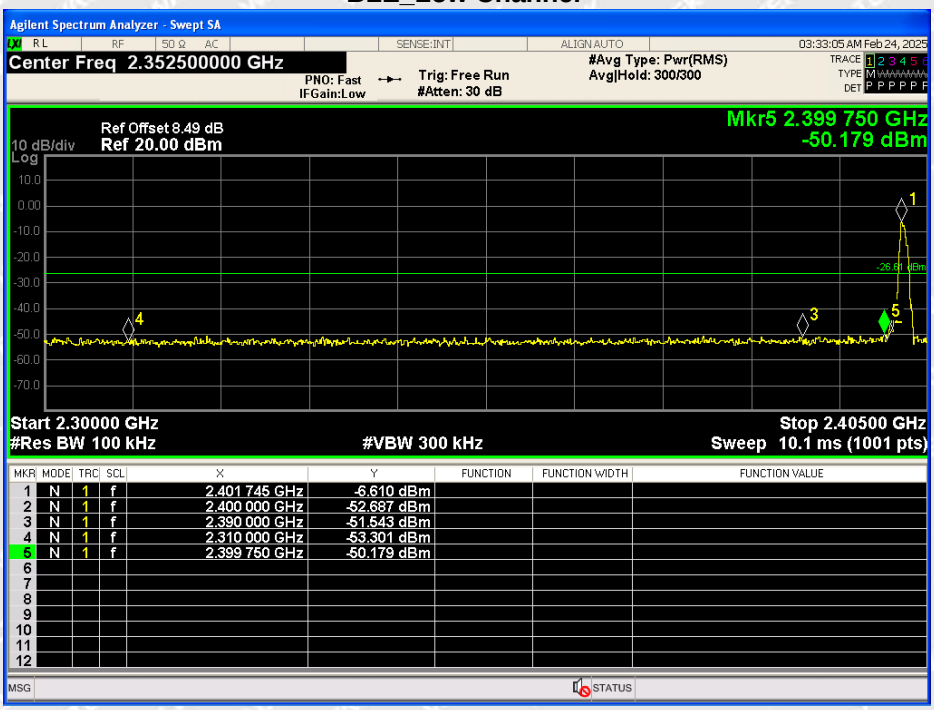
Test Channel High Channel **Polarization** Horizontal (worst case)



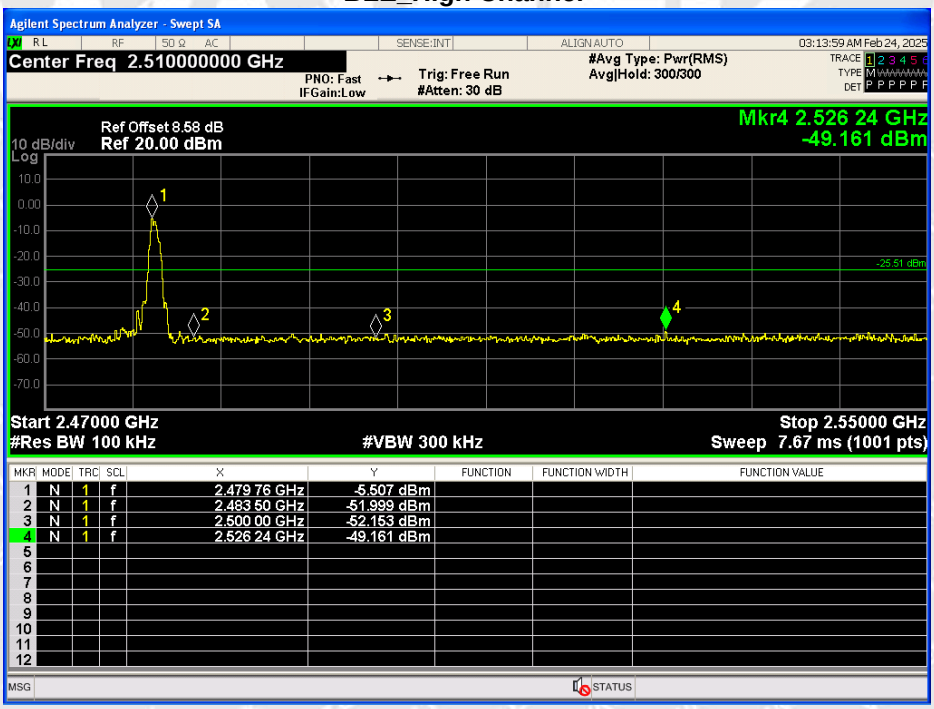
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	47.27	32.88	80.15	74.00	6.15	peak	
2	2483.500	9.87	32.89	42.76	74.00	-31.24	peak	
3	2483.500	-12.76	32.89	20.13	54.00	-33.87	AVG	
4	2500.000	8.78	32.96	41.74	74.00	-32.26	peak	
5	2500.000	-12.52	32.96	20.44	54.00	-33.56	AVG	

Conducted Test

BLE_Low Channel



BLE_High Channel



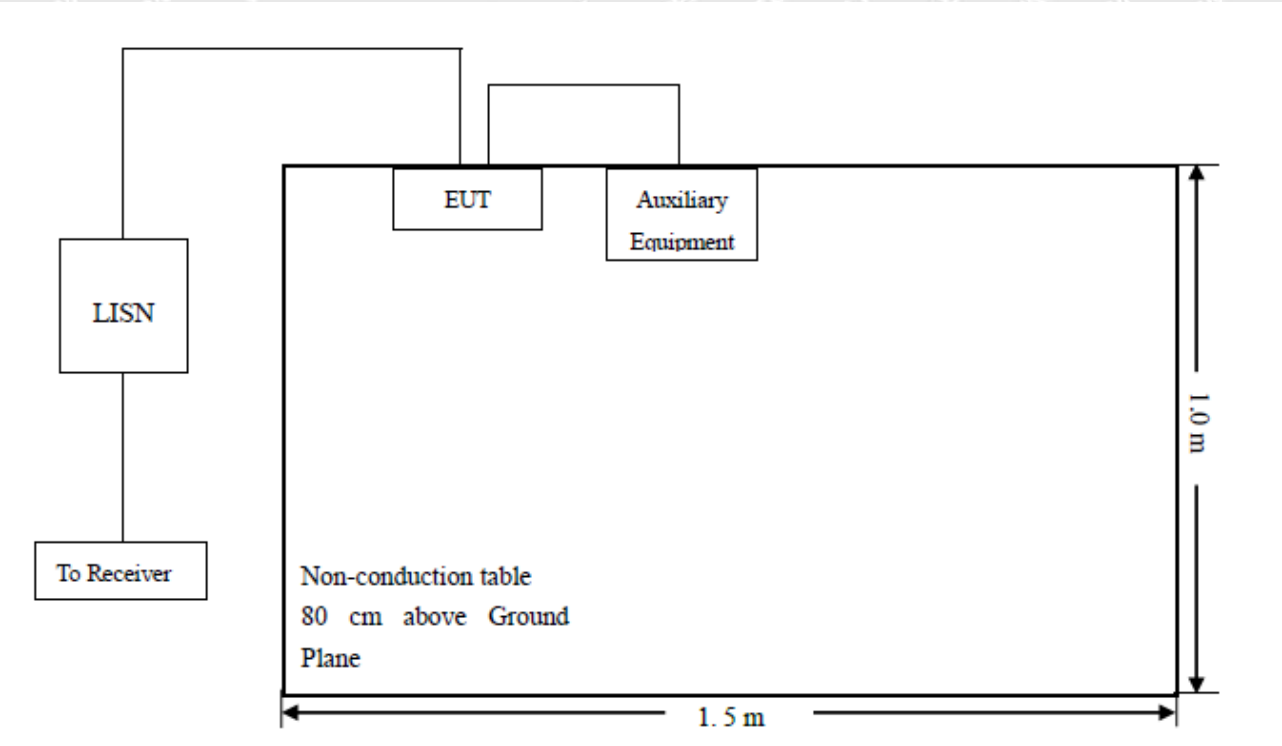
6.7 Conducted Emissions

6.7.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013measurement procedure. The specification used was with the FCC Part 15.207Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in themiddle. The spacing between the peripherals was 10 cm.

6.7.2 Basic Test Setup Block Diagram



6.7.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency.....150 kHz

Stop Frequency.....30 MHz

Sweep Speed.....Auto

IF Bandwidth.....10 kHz

Quasi-Peak Adapter Bandwidth.....9 kHz

Quasi-Peak Adapter Mode.....Normal

6.7.4 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7.5 Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF(Voltage Division Facotr), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Measurement=Reading Level+Correct Factor

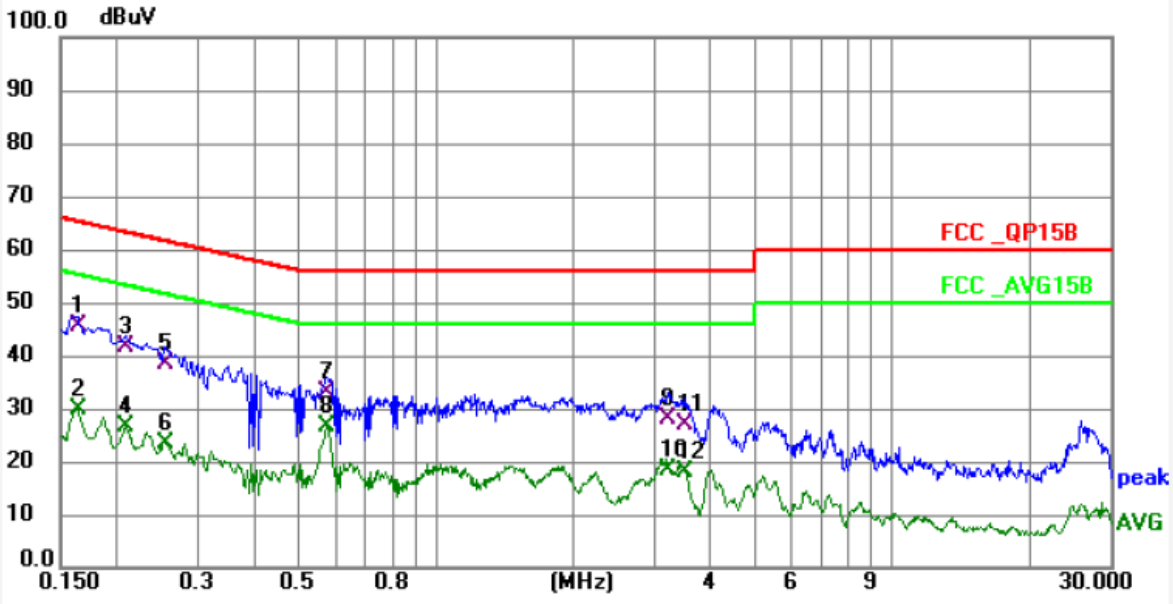
Correct Facotor=LISN VDF+Cable Loss

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin= Measurement-Limit

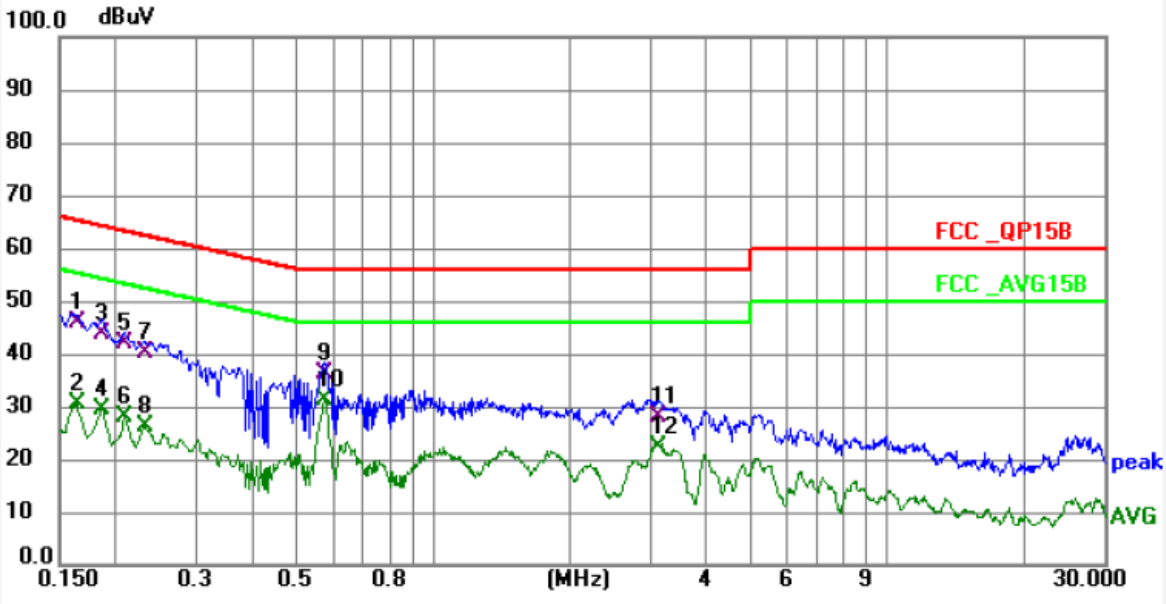
6.7.6 Test Result

Test Mode Communication mode (AC 120V/60Hz) **Polarity** Line



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.164	35.84	9.61	45.45	65.26	-19.81	QP	
2	0.164	20.04	9.61	29.65	55.26	-25.61	AVG	
3	0.208	31.95	9.61	41.56	63.28	-21.72	QP	
4	0.208	16.96	9.61	26.57	53.28	-26.71	AVG	
5	0.254	28.89	9.61	38.50	61.63	-23.13	QP	
6	0.254	13.77	9.61	23.38	51.63	-28.25	AVG	
7	0.573	23.35	9.65	33.00	56.00	-23.00	QP	
8	0.573	16.93	9.65	26.58	46.00	-19.42	AVG	
9	3.232	18.26	9.80	28.06	56.00	-27.94	QP	
10	3.232	8.49	9.80	18.29	46.00	-27.71	AVG	
11	3.494	17.27	9.81	27.08	56.00	-28.92	QP	
12	3.494	8.31	9.81	18.12	46.00	-27.88	AVG	

Test Mode Communication mode (AC 120V/60Hz) **Polarity** Neutral



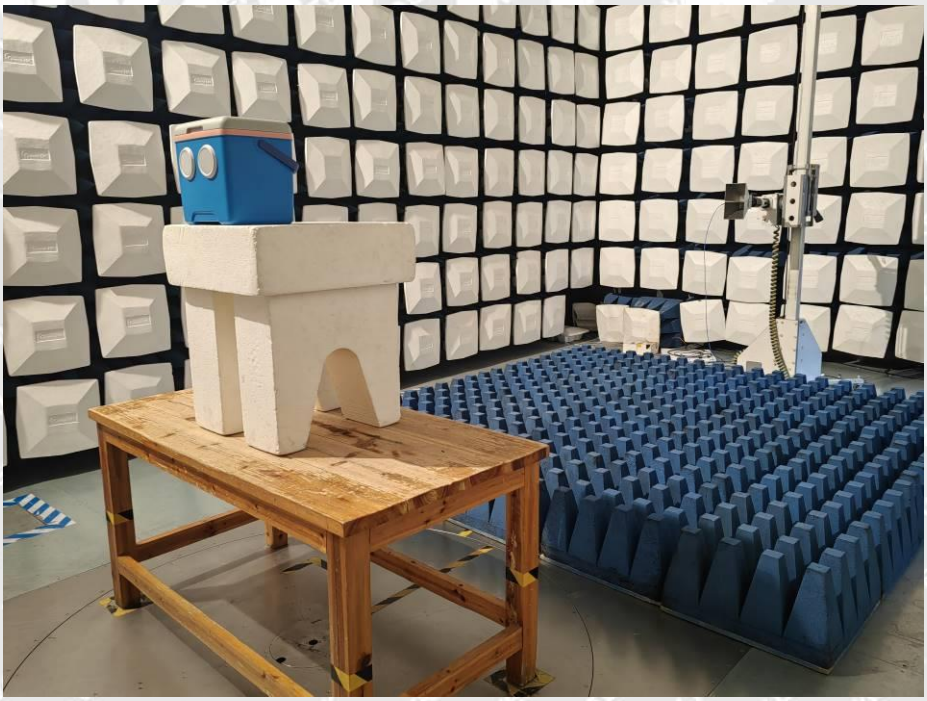
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.164	36.31	9.53	45.84	65.26	-19.42	QP	
2	0.164	20.89	9.53	30.42	55.26	-24.84	AVG	
3	0.186	34.39	9.53	43.92	64.21	-20.29	QP	
4	0.186	19.78	9.53	29.31	54.21	-24.90	AVG	
5	0.208	32.50	9.53	42.03	63.28	-21.25	QP	
6	0.208	18.45	9.53	27.98	53.28	-25.30	AVG	
7	0.231	30.80	9.54	40.34	62.41	-22.07	QP	
8	0.231	16.69	9.54	26.23	52.41	-26.18	AVG	
9	0.578	26.51	9.58	36.09	56.00	-19.91	QP	
10	0.578	21.73	9.58	31.31	46.00	-14.69	AVG	
11	3.151	18.22	9.71	27.93	56.00	-28.07	QP	
12	3.151	12.66	9.71	22.37	46.00	-23.63	AVG	

7 Photographs Test Setup

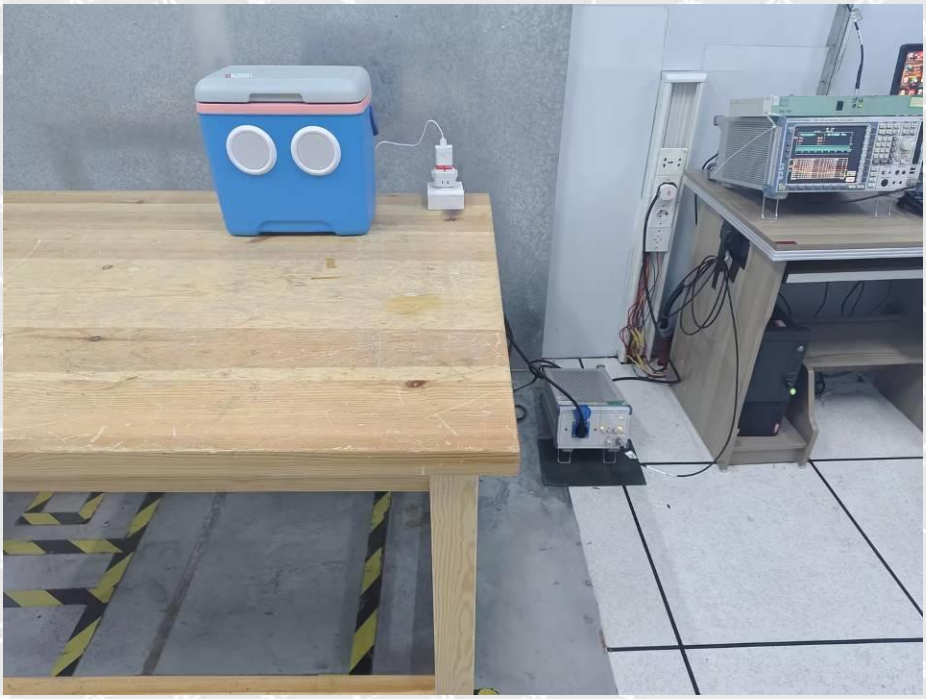
7.1 Photographs - Radiated Emission Test Setup

30MHz-1GHz

Above 1GHz



7.2 Photographs – Conducted Emission Test Setup



8 Photographs – EUT Constructional Details

Please refer to “ANNEX”.

======End of Report======