

TEST REPORT

Reference No...... : WTX22X02010194W-1
FCC ID..... : 2A4GPVT-FF004E
Applicant : LETUO E-COMMERCE (DONGGUAN) CO., LTD.
Address : Dahegu Cultural Industry Park, No.1,Wangao Rd., Wanjiang St., Dongguan
Product Name : Fish Finder
Test Model : VT-FF004E
Standards : FCC Part 15.249
Date of Receipt sample : February 10, 2022
Date of Test : February 10, 2022 to February 13, 2022
Date of Issue : February 14, 2022
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 compiler and approver.

Prepared By:

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Report version

Version No.	Date of issue	Description
Rev.00	February 14, 2022	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: LETUO E-COMMERCE (DONGGUAN) CO., LTD.
 Address of applicant: Dahegu Cultural Industry Park, No.1,Wangao Rd., Wanjiang St., Dongguang

Manufacturer: LETUO E-COMMERCE (DONGGUAN) CO., LTD.
 Address of manufacturer: Dahegu Cultural Industry Park, No.1,Wangao Rd., Wanjiang St., Dongguang

General Description of EUT	
Product Name:	Fish Finder
Trade Name:	Venterior
Model No.:	VT-FF004E
Adding Model:	XJ01, XJ02, VT-FF004EBK, VT-FF004ER
Rated Voltage:	DC 6V from Battery
Battery capacity:	/
Power Adaptor:	/
Serial Number:	56LE1701
<p><i>Note: The test data is gathered from a production sample provided by the manufacturer. provided by the manufacturer. The appearance of others models listed in the report is different from main-test model VT-FF004E, but the circuit and the electronic construction do not change, declared by the manufacturer.</i></p>	

Technical Characteristics of EUT	
Frequency Range:	2402MHz-2470MHz
Max. Field Strength:	95.02dBuV/m
Modulation:	GFSK
Antenna Type:	Integral
Antenna Gain:	1dBi
<p><i>Note: The Antenna Gain is provided by the customer and can affect the validity of results.</i></p>	

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

Address of the test laboratory

Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.

Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

FCC – Registration No.: 125990

Waltek Testing Group (Shenzhen) 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. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

1.5 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, and to measure its highest possible emissions level, more detailed description as follows:

Channel list as follow:

channel	Frequency (MHz)						
01	2402	08	2421	15	2440	22	2458
02	2405	09	2424	16	2443	23	2460
03	2407	10	2427	17	2445	24	2463
04	2410	11	2430	18	2448	25	2465
05	2412	12	2433	19	2450	26	2468
06	2415	13	2436	20	2453	27	2470
07	2418	14	2438	21	2455		

Test Mode List

Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2440MHz
TM3	High Channel	2470MHz

Test Conditions

Temperature:	22~25 °C
Relative Humidity:	45~55 %
ATM Pressure:	1019 mbar

EUT Cable List and Details

Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details

Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty

Parameter	Conditions	Uncertainty
RF Output Power	Conducted	± 0.42dB
Occupied Bandwidth	Conducted	± 1.5%

Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	9-150kHz $\pm 3.74\text{dB}$
		0.15-30MHz $\pm 3.34\text{dB}$
Transmitter Spurious Emissions	Radiated	30-200MHz $\pm 4.52\text{dB}$
		0.2-1GHz $\pm 5.56\text{dB}$
		1-6GHz $\pm 3.84\text{dB}$
		6-18GHz $\pm 3.92\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
SEMT-1075	Communication Tester	Rohde & Schwarz	CMW500	148650	2021-03-27	2022-03-26
SEMT-1063	GSM Tester	Rohde & Schwarz	CMU200	114403	2021-03-27	2022-03-26
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY4144040 0	2021-03-27	2022-03-26
SEMT-1079	Spectrum Analyzer	Agilent	N9020A	US47140102	2021-03-27	2022-03-26
SEMT-1080	Signal Generator	Agilent	83752A	3610A01453	2021-03-27	2022-03-26
SEMT-1081	Vector Signal Generator	Agilent	N5182A	MY4707020 2	2021-03-27	2022-03-26
SEMT-1028	Power Divider	Weinschel	1506A	PM204	2021-03-27	2022-03-26
SEMT-1082	Power Divider	RF-Lambda	RFLT4W5M18G	14110400027	2021-03-27	2022-03-26
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	/	/
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	/	/
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	/	/
SEMT-C004	Cable	Zheng DI	2M0RFC	/	/	/
SEMT-C005	Cable	Zheng DI	1M0RFC	/	/	/
SEMT-C006	Cable	Zheng DI	1M0RFC	/	/	/
<input checked="" type="checkbox"/> Chamber A: Below 1GHz						
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2021-03-27	2022-03-26
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2021-03-27	2022-03-26
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2021-04-12	2022-04-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2021-03-19	2023-03-18
SEMT-1068	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2021-03-19	2023-03-18
<input checked="" type="checkbox"/> Chamber A: Above 1GHz						
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2021-03-27	2022-03-26
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2021-03-27	2022-03-26
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2021-04-12	2022-04-11
SEMT-1042	Horn Antenna	ETS	3117	00086197	2021-03-19	2023-03-18
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA91705 82	2021-04-27	2023-04-26
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2021-04-27	2022-04-26
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2021-03-27	2022-03-26
SEMT-1166	Power Limiter	Agilent	N9356B	MY4545037 6	2021-03-27	2022-03-26
<input type="checkbox"/> Chamber B: Below 1GHz						

SEMT-1068	Trilog Broadband Antenna	Schwarz beck	VULB9163(B)	9163-635	2021-04-09	2023-04-08
SEMT-1067	Amplifier	Agilent	8447D	2944A10179	2021-04-12	2022-04-11
SEMT-1066	EMI Test Receiver	Rohde & Schwarz	ESPI	101391	2021-05-06	2022-05-05
<input type="checkbox"/> Chamber C: Below 1GHz						
SEMT-1319	EMI Test Receiver	Rohde & Schwarz	ESIB 26	100401	2021-12-03	2022-12-02
SEMT-1343	Trilog Broadband Antenna	Schwarz beck	VULB 9168	1194	2021-05-28	2023-05-27
SEMT-1333	Amplifier	HP	8447F	2944A03869	2021-04-15	2022-04-14
<input checked="" type="checkbox"/> Conducted Room 1#						
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2021-04-12	2022-04-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2021-04-15	2022-04-14
SEMT-1003	AC LISN	Schwarz beck	NSLK8126	8126-224	2021-04-12	2022-04-11

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing.

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.207(a)	Conducted Emission	N/A
§15.209(a)(f)	Radiated Spurious Emissions	Compliant
§15.249(a)	Field Strength of Emissions	Compliant
§15.249(d)	Out of Band Emission	Compliant
§15.215(c)	Emission Bandwidth	Compliant

N/A: Not applicable.

3. Antenna Requirements

3.1 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.

3.2 Test Result

This product has an integral antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §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 (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

(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.

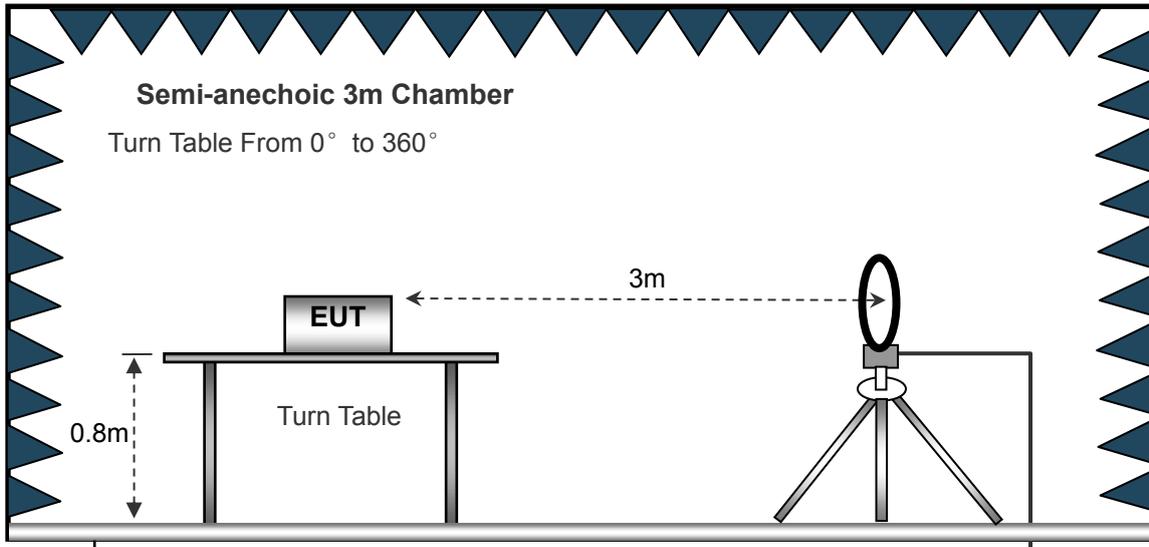
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.2 Test Procedure

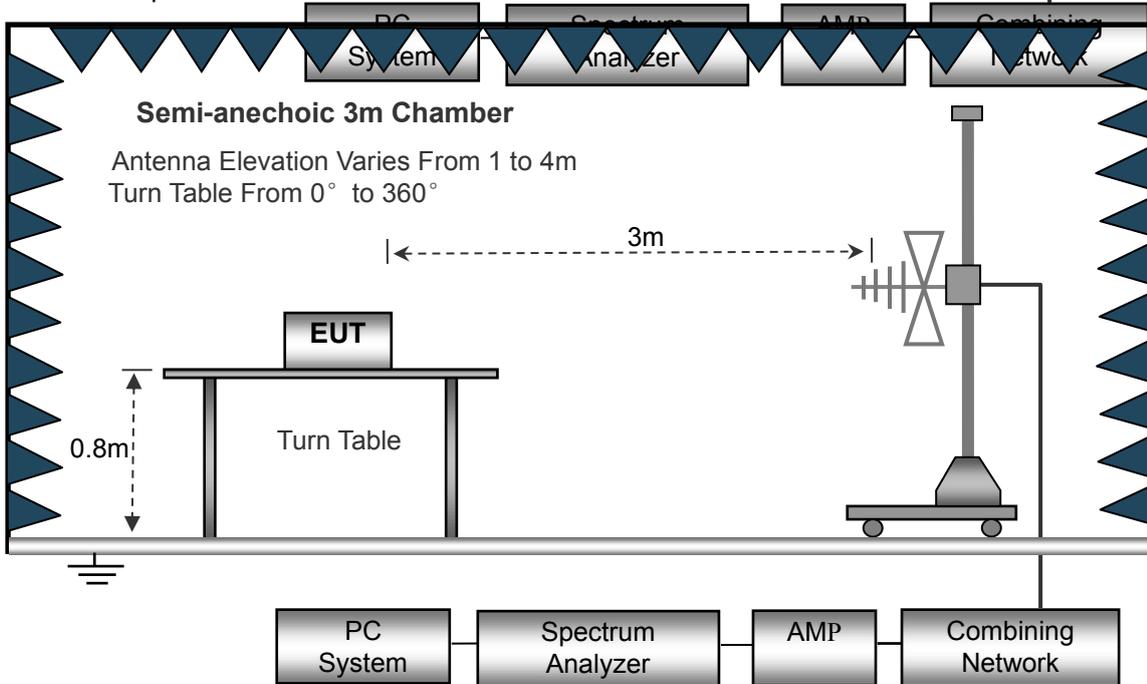
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

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

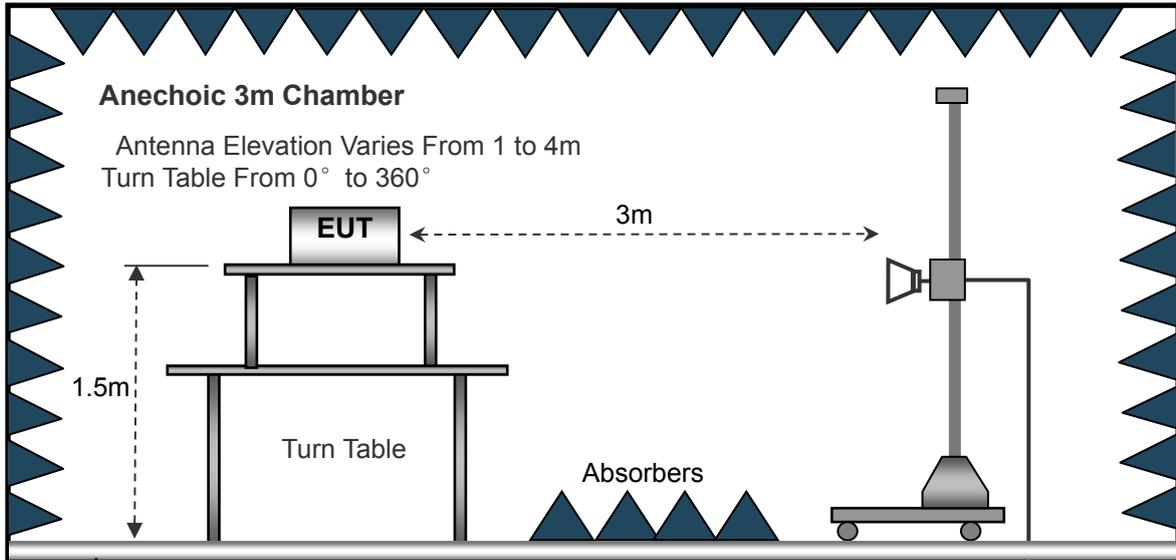
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1GHz.



Frequency : 9kHz-30MHz
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz
 PC System
 Spectrum Analyzer
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz
 AMP
 Combining Network (AV)
 Trace = max hold
 Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

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

$$\begin{aligned}\text{Result} &= \text{Indicated Reading} + \text{Correct} \\ \text{Correct} &= \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}\end{aligned}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

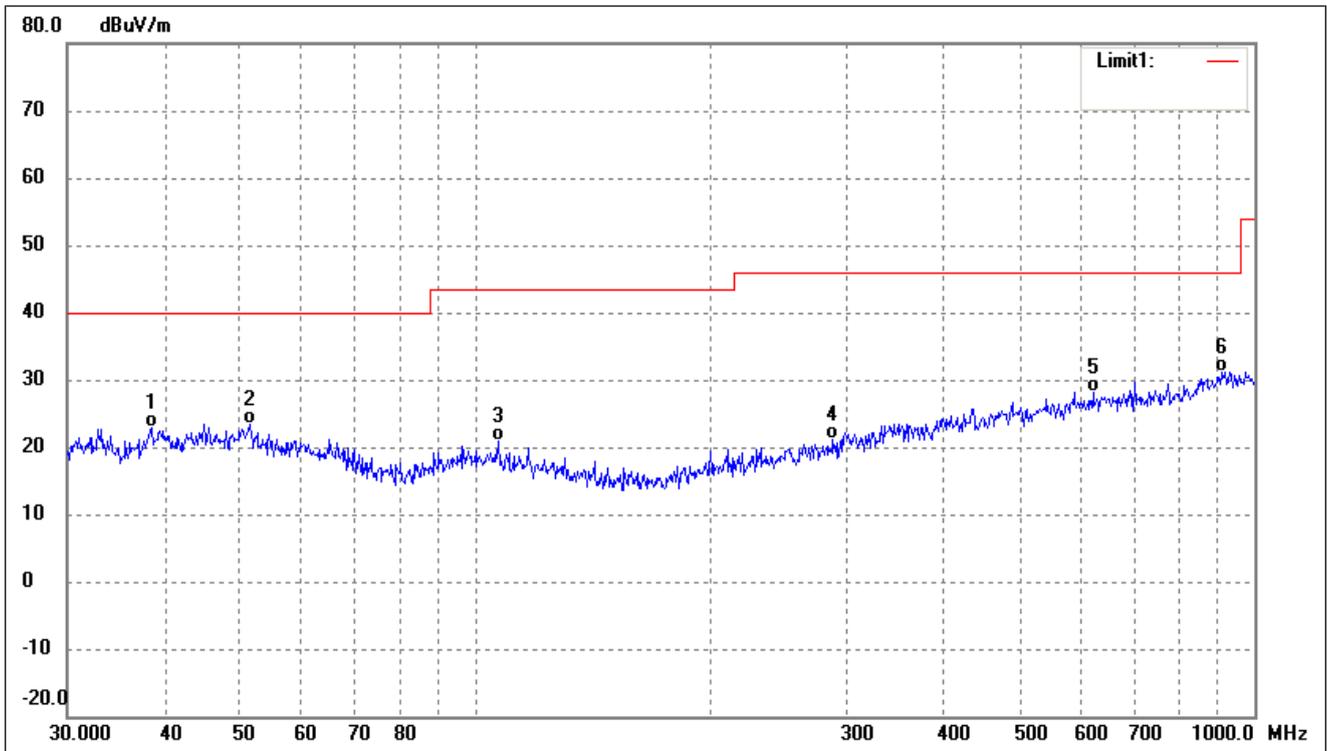
$$\text{Margin} = \text{Result} - \text{FCC Part 15C Limit}$$

4.4 Summary of Test Results/Plots

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

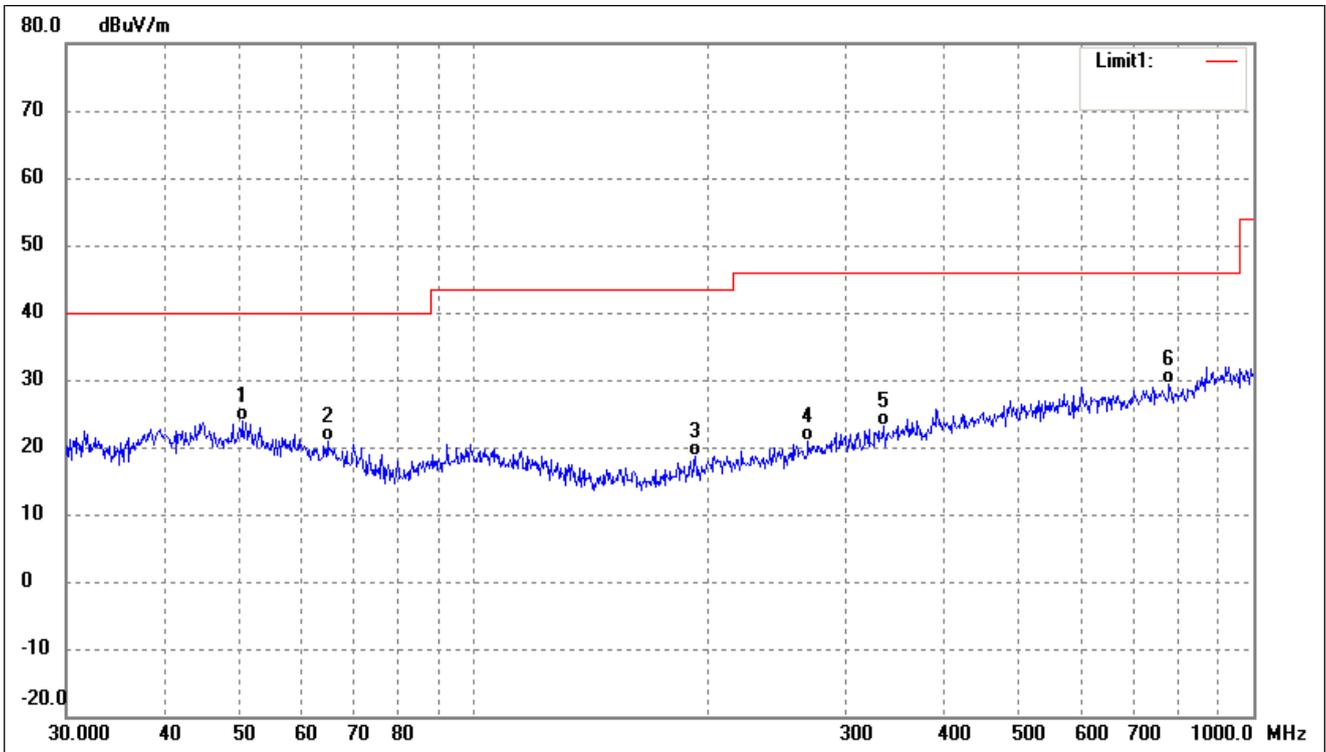
➤ Spurious Emissions Below 1GHz

Test Channel	TX-Low channel	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	38.4809	35.32	-12.56	22.76	40.00	-17.24	-	-	QP
2	51.4807	35.32	-11.96	23.36	40.00	-16.64	-	-	QP
3	107.1337	34.22	-13.31	20.91	43.50	-22.59	-	-	QP
4	287.9904	31.00	-9.81	21.19	46.00	-24.81	-	-	QP
5	620.7096	30.30	-2.11	28.19	46.00	-17.81	-	-	QP
6	906.4824	29.59	1.62	31.21	46.00	-14.79	-	-	QP

Test Channel	TX-Low channel	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	50.4089	35.41	-11.65	23.76	40.00	-16.24	-	-	QP
2	64.8865	34.72	-13.91	20.81	40.00	-19.19	-	-	QP
3	192.4186	31.68	-12.94	18.74	43.50	-24.76	-	-	QP
4	268.4853	31.60	-10.78	20.82	46.00	-25.18	-	-	QP
5	334.8589	31.56	-8.36	23.20	46.00	-22.80	-	-	QP
6	779.6068	30.39	-1.13	29.26	46.00	-16.74	-	-	QP

Remark: „-“Means“ the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

Spurious Emissions Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
2402	104.49	-9.47	95.02	114	-18.98	H	PK
2402	101.78	-9.47	92.31	94	-1.69	H	AV
4804	52.65	-4.52	48.13	74	-25.87	H	PK
4804	52.23	-4.52	47.71	54	-6.29	H	AV
7206	50.10	-2.20	47.90	74	-26.10	H	PK
7206	38.11	-2.20	35.91	54	-18.09	H	AV
2402	100.89	-9.47	91.42	114	-22.58	V	PK
2402	98.45	-9.47	88.98	94	-5.02	V	AV
4804	55.61	-4.52	51.09	74	-22.91	V	PK
4804	50.79	-4.52	46.27	54	-7.73	V	AV
7206	45.66	-2.20	43.46	74	-30.54	V	PK
7206	40.27	-2.20	38.07	54	-15.93	V	AV
Middle Channel-2440MHz							
2440	103.34	-9.41	93.93	114	-20.07	H	PK
2440	100.49	-9.41	91.08	94	-2.92	H	AV
4880	55.28	-4.47	50.81	74	-23.19	H	PK
4880	48.33	-4.47	43.86	54	-10.14	H	AV
7320	49.95	-2.17	47.78	74	-26.22	H	PK
7320	37.38	-2.17	35.21	54	-18.79	H	AV
2440	100.36	-9.41	90.95	114	-23.05	V	PK
2440	98.65	-9.41	89.24	94	-4.76	V	AV
4880	54.27	-4.47	49.80	74	-24.20	V	PK
4880	52.44	-4.47	47.97	54	-6.03	V	AV
7320	45.54	-2.17	43.37	74	-30.63	V	PK
7320	43.12	-2.17	40.95	54	-13.05	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
High Channel-2470MHz							
2470	103.46	-9.34	94.12	114	-19.88	H	PK
2470	100.81	-9.34	91.47	94	-2.53	H	AV
4940	51.01	-4.43	46.58	74	-27.42	H	PK
4940	51.31	-4.43	46.88	54	-7.12	H	AV
7410	54.07	-2.14	51.93	74	-22.07	H	PK
7410	40.90	-2.14	38.76	54	-15.24	H	AV
2470	100.36	-9.34	91.02	114	-22.98	V	PK
2470	98.65	-9.34	89.31	94	-4.69	V	AV
4940	53.75	-4.43	49.32	74	-24.68	V	PK
4940	53.48	-4.43	49.05	54	-4.95	V	AV
7410	47.05	-2.14	44.91	74	-29.09	V	PK
7410	45.16	-2.14	43.02	54	-10.98	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured. The measurements greater than 20dB below the limit from 9kHz to 30MHz..

5. Out of Band Emissions

5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB 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

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Corrected Amplitude & Margin Calculation

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

$$\begin{aligned} \text{Result} &= \text{Indicated Reading} + \text{Correct} \\ \text{Correct} &= \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain} \end{aligned}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Result} - \text{FCC Part 15C Limit}$$

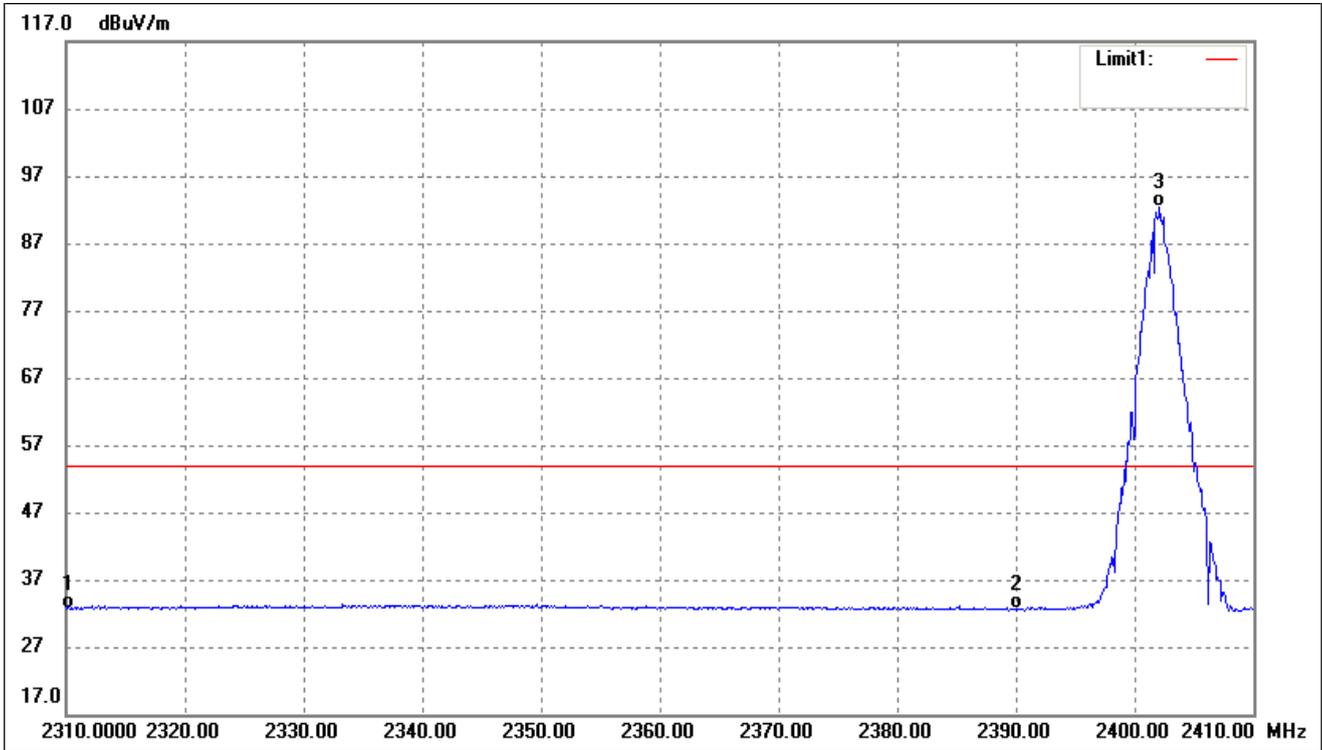
5.4 Summary of Test Results/Plots

Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	<54 dBuV	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

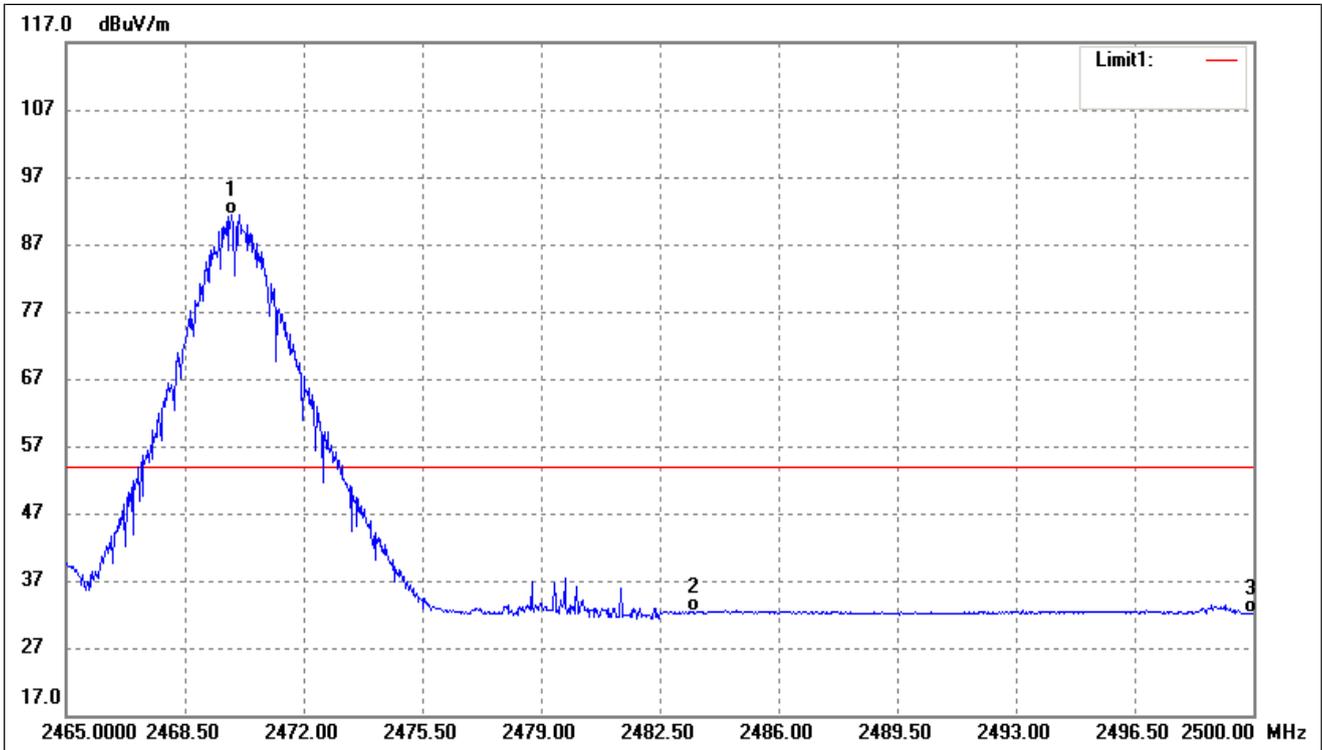
Please refer to the test plots as below.

Test Channel	Low	Polarity:	Horizontal (worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	42.40	-9.66	32.74	54.00	-21.26	Ave Detector
	2310.000	53.99	-9.66	44.33	74.00	-29.67	Peak Detector
2	2390.000	42.24	-9.50	32.74	54.00	-21.26	Ave Detector
	2390.000	53.76	-9.50	44.26	74.00	-29.74	Peak Detector
3	2402.100	101.78	-9.47	92.31	/	/	Ave Detector
	2402.000	104.49	-9.47	95.02	/	/	Peak Detector

Test Channel	High	Polarity:	Horizontal (worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2469.865	100.81	-9.34	91.47	/	/	Ave Detector
	2469.970	103.46	-9.34	94.12	/	/	Peak Detector
2	2483.500	41.71	-9.31	32.40	54.00	-21.60	Ave Detector
	2483.500	52.58	-9.31	43.27	74.00	-30.73	Peak Detector
3	2500.000	41.38	-9.28	32.10	54.00	-21.90	Ave Detector
	2500.000	53.38	-9.28	44.10	74.00	-29.90	Peak Detector

6. Emission Bandwidth

6.1 Standard Applicable

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

6.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 5MHz, centered on a transmitting channel

RBW \geq 1% 20dB Bandwidth, VBW \geq RBW

Sweep = auto

Detector function = peak

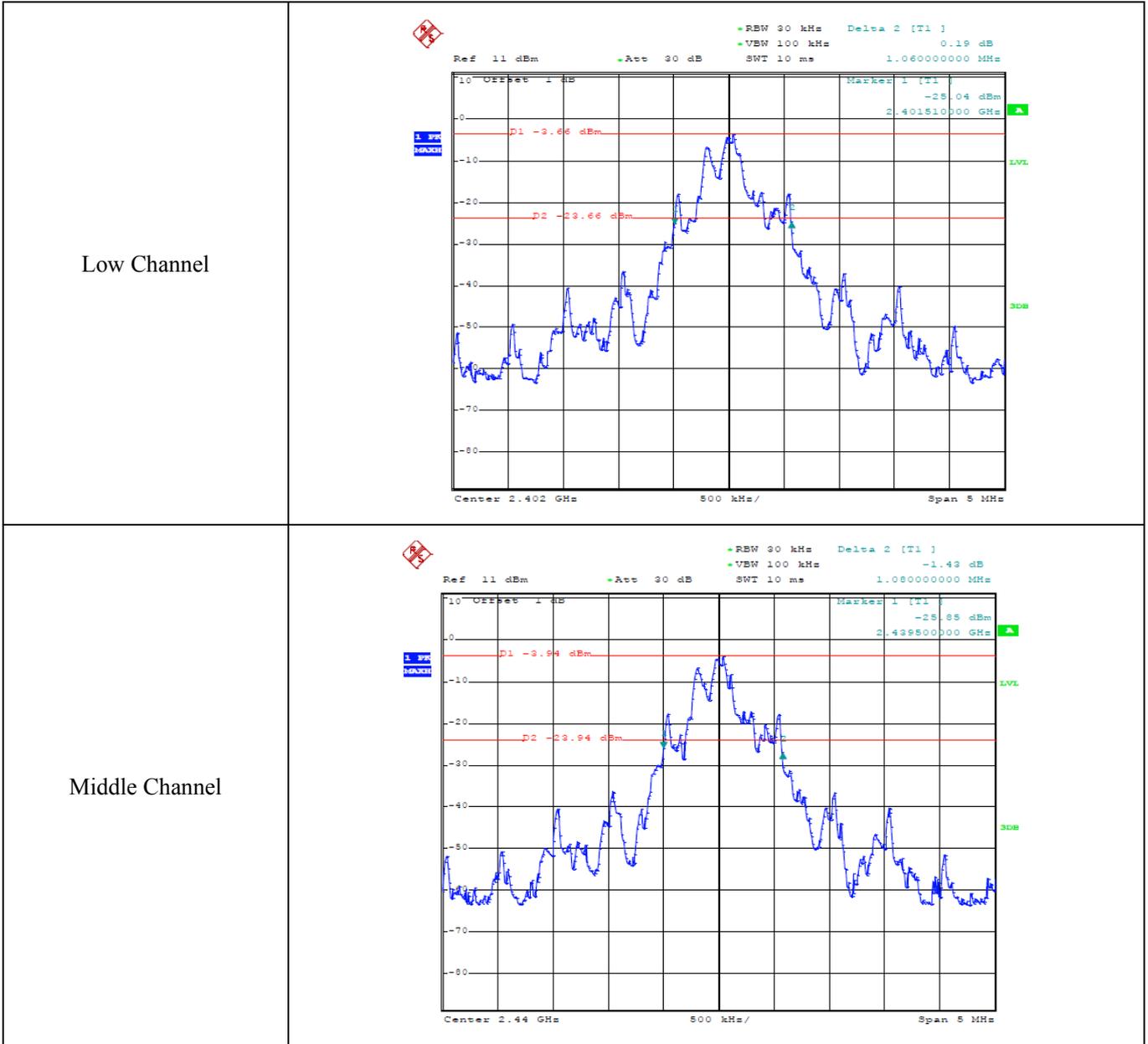
Trace = max hold

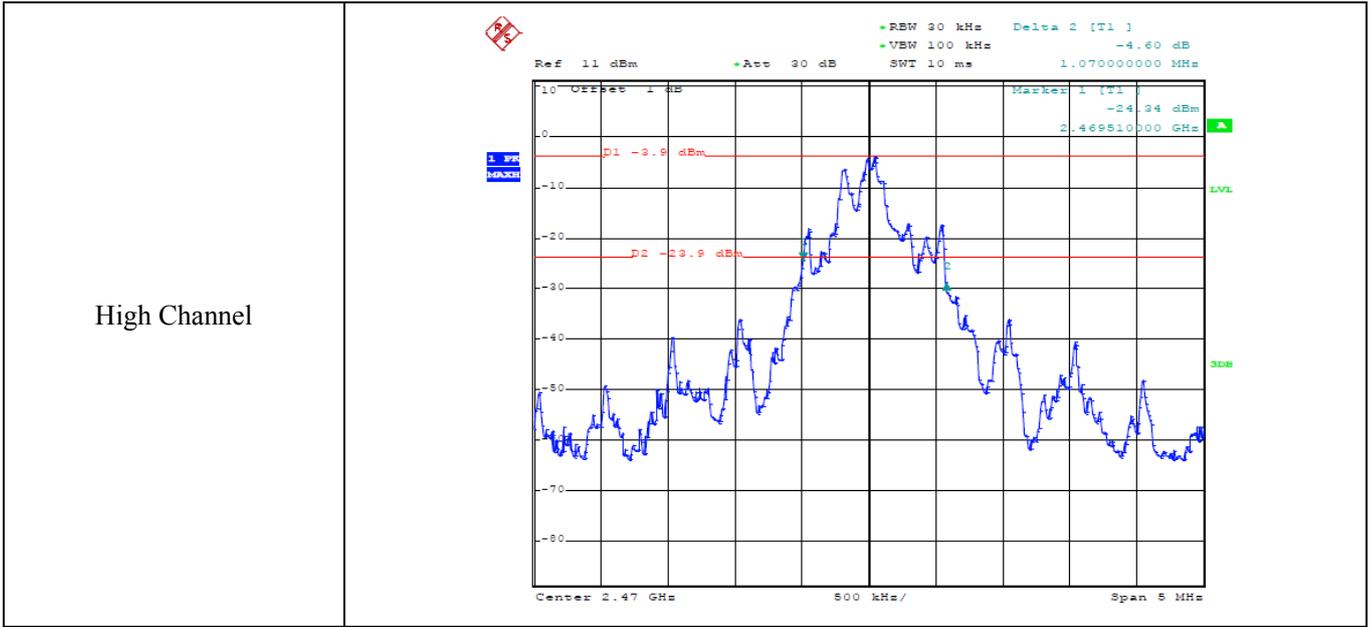
All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

6.3 Summary of Test Results/Plots

Test Channel	20dB Bandwidth(MHz)
Low Channel	1.06
Middle Channel	1.08
High Channel	1.07

Please refer to the following test plots:





7. Conducted Emissions

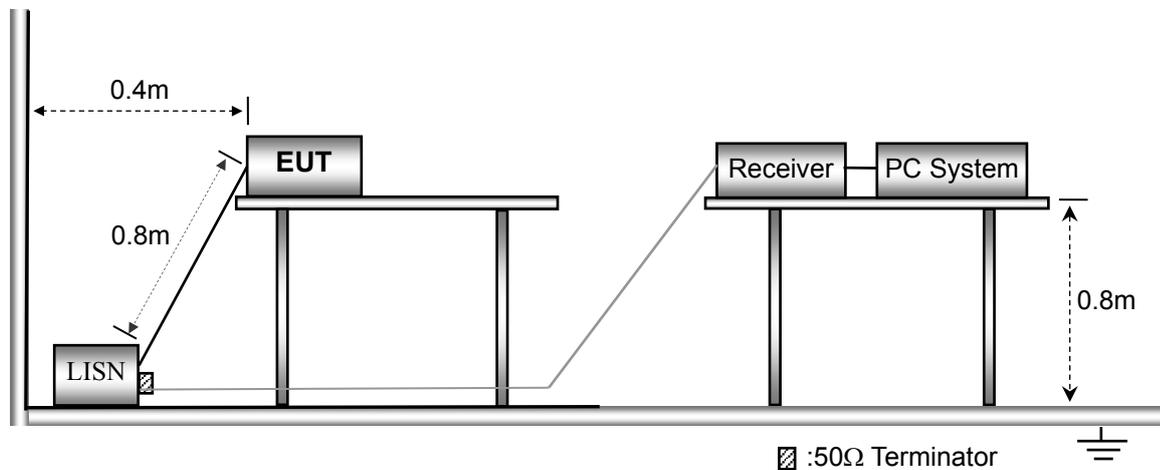
7.1 Test Procedure

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

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

The spacing between the peripherals was 10cm.

7.2 Basic Test Setup Block Diagram



7.3 Test Receiver Setup

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

Start Frequency	150kHz
Stop Frequency	30MHz
Sweep Speed	Auto
IF Bandwidth.....	10kHz
Quasi-Peak Adapter Bandwidth	9kHz
Quasi-Peak Adapter Mode	Normal

7.4 Summary of Test Results/Plots

Note: The EUT is DC supply, so this item is not applicable.

APPENDIX PHOTOGRAPHS

Please refer to “ANNEX”

******* END OF REPORT *******