

TEST REPORT

Reference No..... : WTX21X02011251W-1
FCC ID : 2AYV2-SM-824D2
Applicant : Shenzhen Simolio Electronic Co., Ltd
Address : 7B/F, 3 Block, Qiyu Industrial Park, Gongle Tiezai Road, Xixiang, Baoan District, Shenzhen, Guangdong, China
Product Name : Wireless headphones
Test Model. : SM-824D2
Standards : FCC Part 15.247
Date of Receipt sample : Feb.03, 2021
Date of Test..... : Feb.03, 2021 to Mar.24, 2021
Date of Issue : Mar.24, 2021
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:

Waltek Testing Group (Shenzhen) Co., Ltd.

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Block 70 Bao'an District, Shenzhen, Guangdong, China

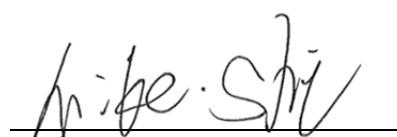
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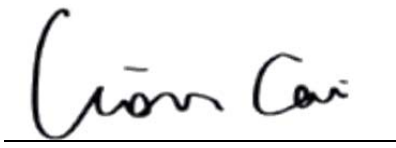
Tested by:

Reviewed By:

Approved & Authorized By:



Mike Shi / Project Engineer



Lion Cai / RF Manager



Silin Chen / Manager

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Report version

Version No.	Date of issue	Description
Rev.00	Mar.24, 2021	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Shenzhen Simolio Electronic Co., Ltd
Address of applicant: 7B/F, 3 Block, Qiyu Industrial Park, Gongle Tiezai Road,
Xixiang, Baoan District, Shenzhen, Guangdong, China

Manufacturer: Shenzhen Simolio Electronic Co., Ltd
Address of manufacturer: 7B/F, 3 Block, Qiyu Industrial Park, Gongle Tiezai Road,
Xixiang, Baoan District, Shenzhen, Guangdong, China

General Description of EUT	
Product Name:	Wireless headphones
Trade Name	SIMOLIO
Model No.:	SM-824D2
Adding Model(s):	SM-824D1, SM-824RX, SM-823 Pro, SM-823D Pro, SM-823, SM-823D, SM-827D1, SM-827D2, SM-829D1, SM-829D2, TA3, TA3D, TA41, TA42, TAR4, TA7D, TA9D
Rated Voltage:	Power in:DC5V Battery:DC3.7V
Battery Capacity:	350mAh
Power Adapter:	MODEL:PS06C050K1000UU INPUT:AC100-240V, 50/60Hz, 0.25A OUTPUT:DC5.0V,1000mA
Software Version:	BACHTX_A38B_8479
Hardware Version:	SM824T5-20180913
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model SM-824D2, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	2406-2472MHz
RF Output Power:	9.023dBm (Conducted)
Modulation:	GFSK
Quantity of Channels:	31
Channel Separation:	2MHz
Type of Antenna:	PIFA Antenna
Antenna Gain:	-2dBi

1.2 Test Standards

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.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result 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, KDB 558074 D01 15.247 Meas Guidance v05r02.

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.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

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, 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	2406MHz
TM2	Middle	2440MHz
TM3	High	2472MHz

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	50~55 %
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
DC Cable	2.0	Unshielded	Without Ferrite
Optical Fiber Cable	2.5	/	/
Audio Cable	2.0	Unshielded	Without Ferrite
RCA Audio Cable	2.0	Unshielded	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	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
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 $\pm 3.84\text{dB}$
		6-26GHz $\pm 3.92\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2020-04-28	2021-04-27
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2020-04-28	2021-04-27
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2020-04-28	2021-04-27
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2020-04-28	2021-04-27
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2020-04-28	2021-04-27
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2019-05-05	2021-05-04
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2020-04-28	2021-04-27
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2020-04-28	2021-04-27
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2020-04-28	2021-04-27
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2020-04-28	2021-04-27
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2020-04-28	2021-04-27
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2020-04-28	2021-04-27
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2020-04-28	2021-04-27
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2020-04-28	2021-04-27
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2020-04-28	2021-04-27
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	/	/	/

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; §15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.207(a)	Conducted Emission	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(a)(2)	DTS Bandwidth	Compliant
§15.247(b)(3)	RF Output Power	Compliant
§15.209(a)	Radiated Emission	Compliant
§15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: Not applicable

3. Antenna Requirement

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 Evaluation Information

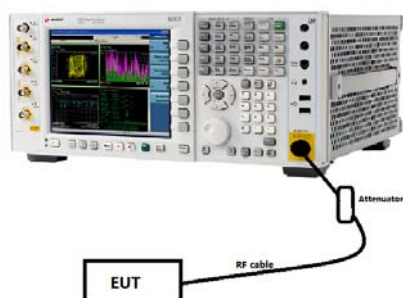
This product has a PIFA antenna, fulfill the requirement of this section.

4. Power Spectral Density

4.1 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.

4.2 Test Setup Block Diagram



4.3 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:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

4.4 Summary of Test Results/Plots

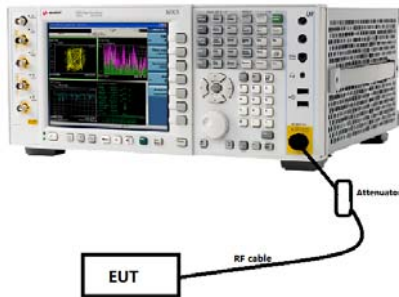
Please refer to Appendix A

5. DTS Bandwidth

5.1 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.

5.2 Test Setup Block Diagram



5.3 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:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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.

5.4 Summary of Test Results/Plots

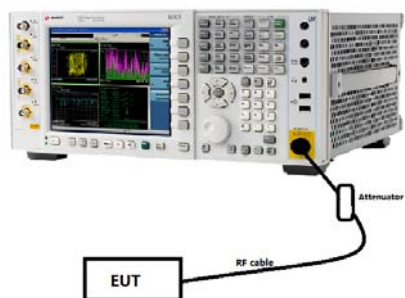
Please refer to Appendix B

6. RF Output Power

6.1 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.

6.2 Test Setup Block Diagram



6.3 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.

- Set the RBW $\geq$ DTS bandwidth.
- Set VBW $\geq 3 \times$ RBW.
- Set span $\geq 3 \times$ RBW
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

6.4 Summary of Test Results/Plots

Please refer to Appendix C

7. Field Strength of Spurious Emissions

7.1 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.

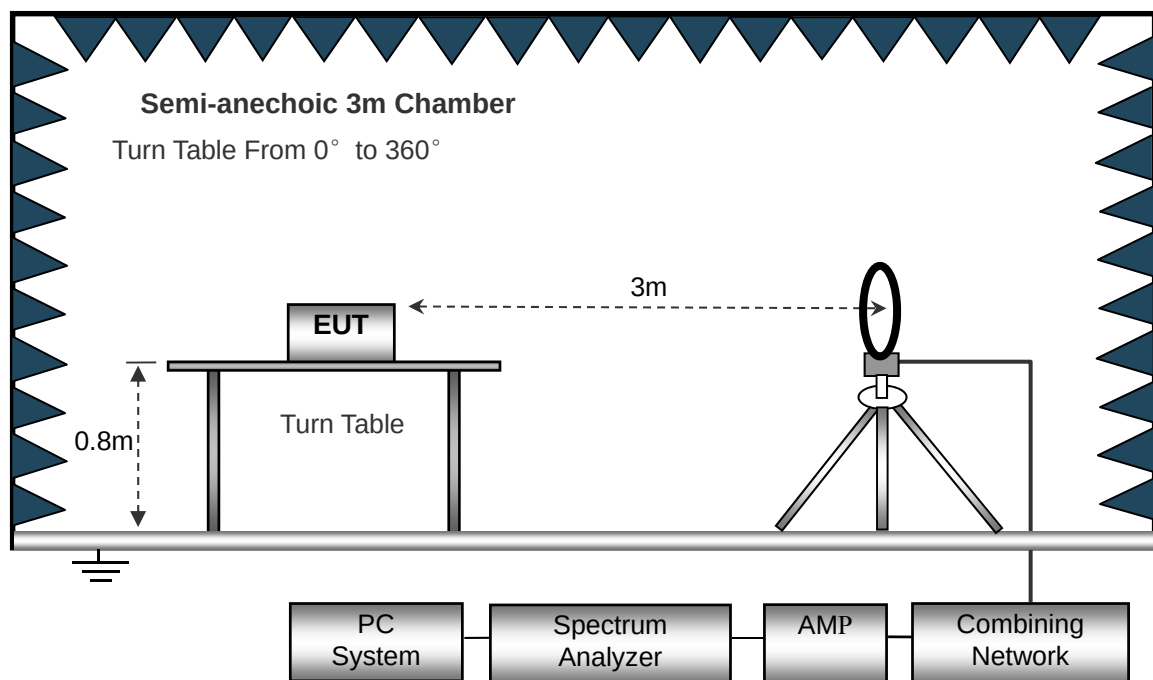
7.2 Test Procedure

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

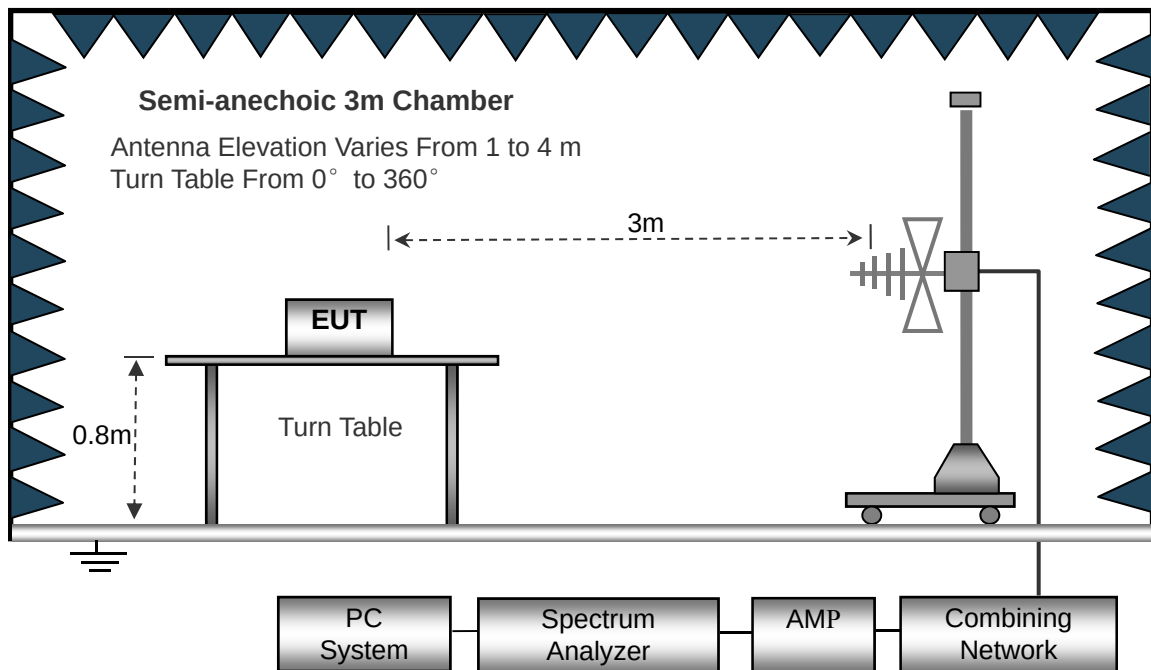
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

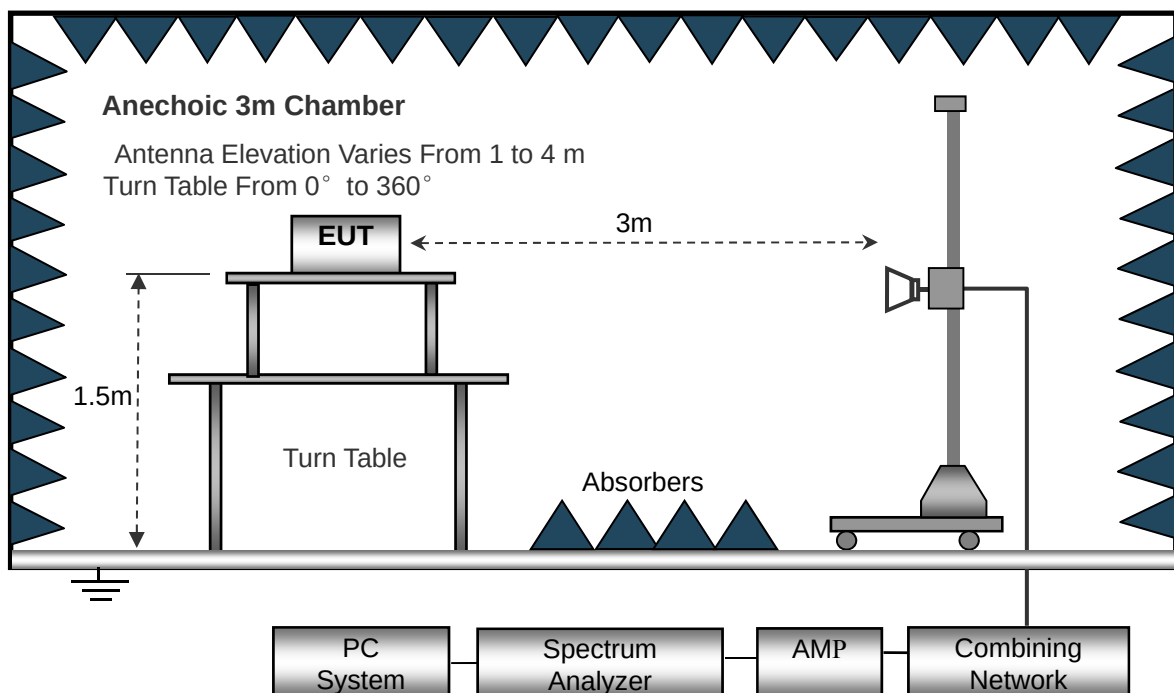
The test setup for emission measurement below 30MHz..



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



The test setup for emission measurement above 1 GHz..



Frequency :9kHz-30MHz

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

Detector function = peak, AV

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<http://www.semtest.com.cn>

7.3 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

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:

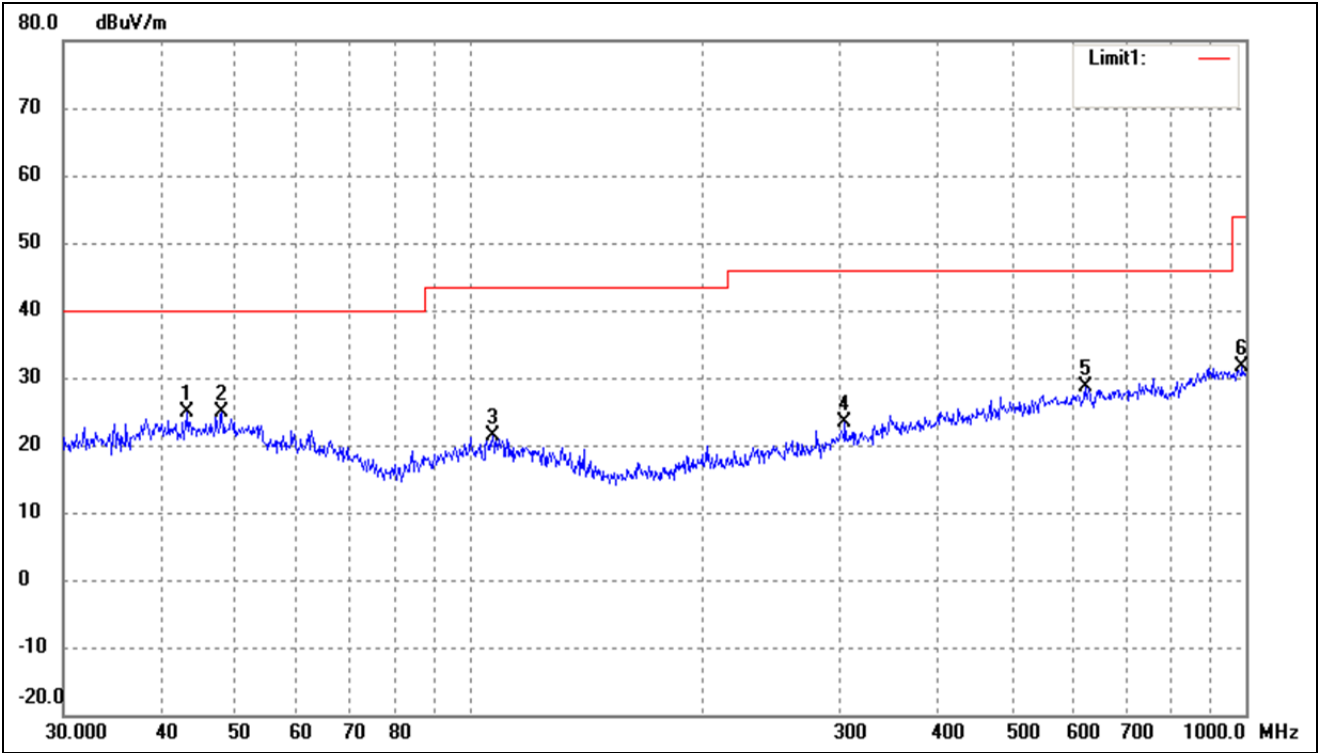
$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

7.4 Summary of Test Results/Plots

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

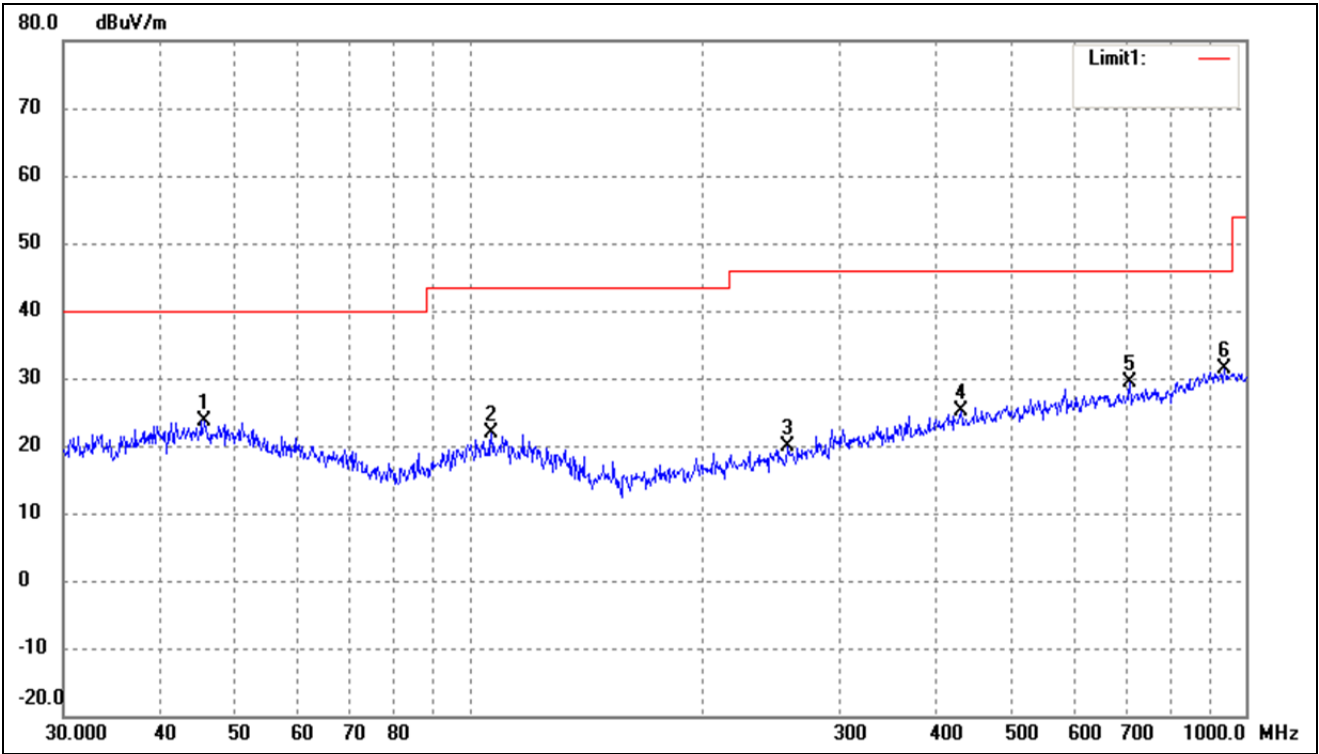
➤ Spurious Emissions Below 1GHz

Test Channel	Low	Polarity:	Horizontal
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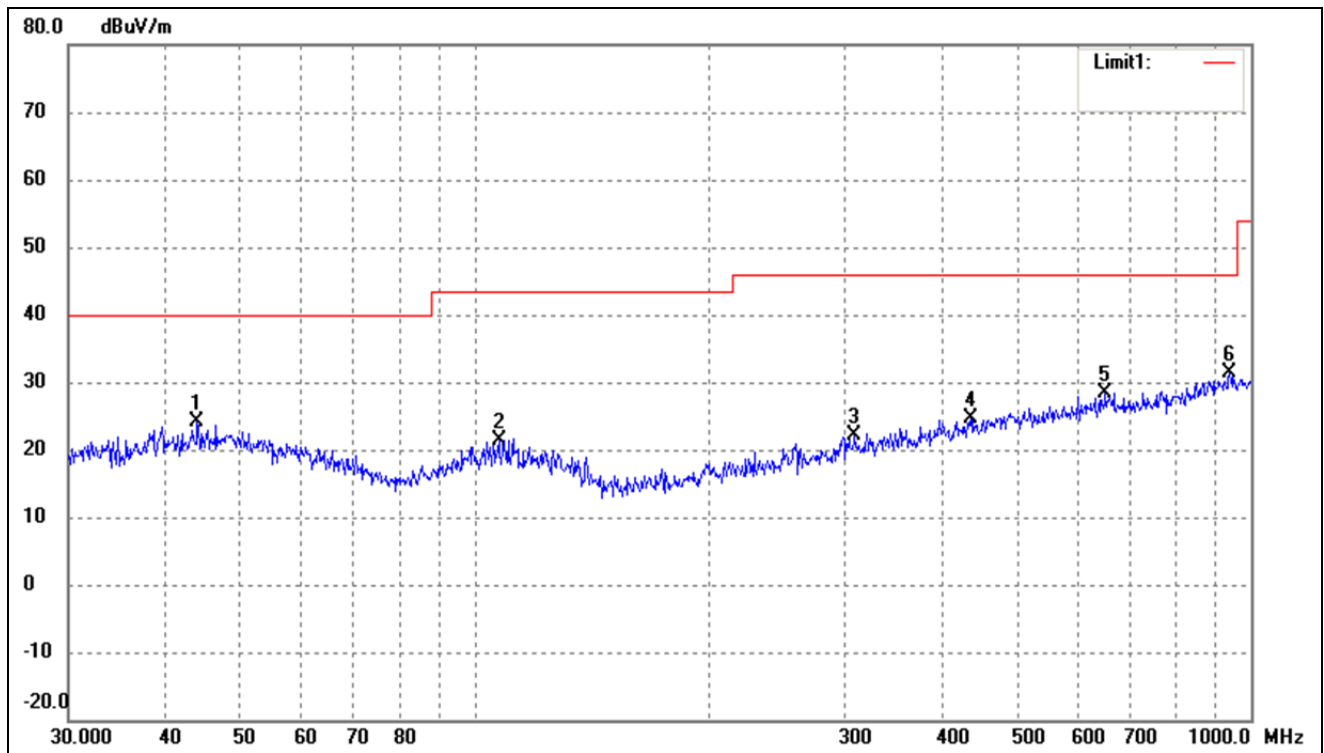
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	43.3534	36.75	-11.86	24.89	40.00	-15.11	-	-	peak
2	47.9940	36.45	-11.63	24.82	40.00	-15.18	-	-	peak
3	107.1337	34.76	-13.31	21.45	43.50	-22.05	-	-	peak
4	304.6100	32.23	-8.93	23.30	46.00	-22.70	-	-	peak
5	620.7096	30.69	-2.11	28.58	46.00	-17.42	-	-	peak
6	989.5355	29.94	1.71	31.65	54.00	-22.35	-	-	peak

Test Channel	Low	Polarity:	Vertical
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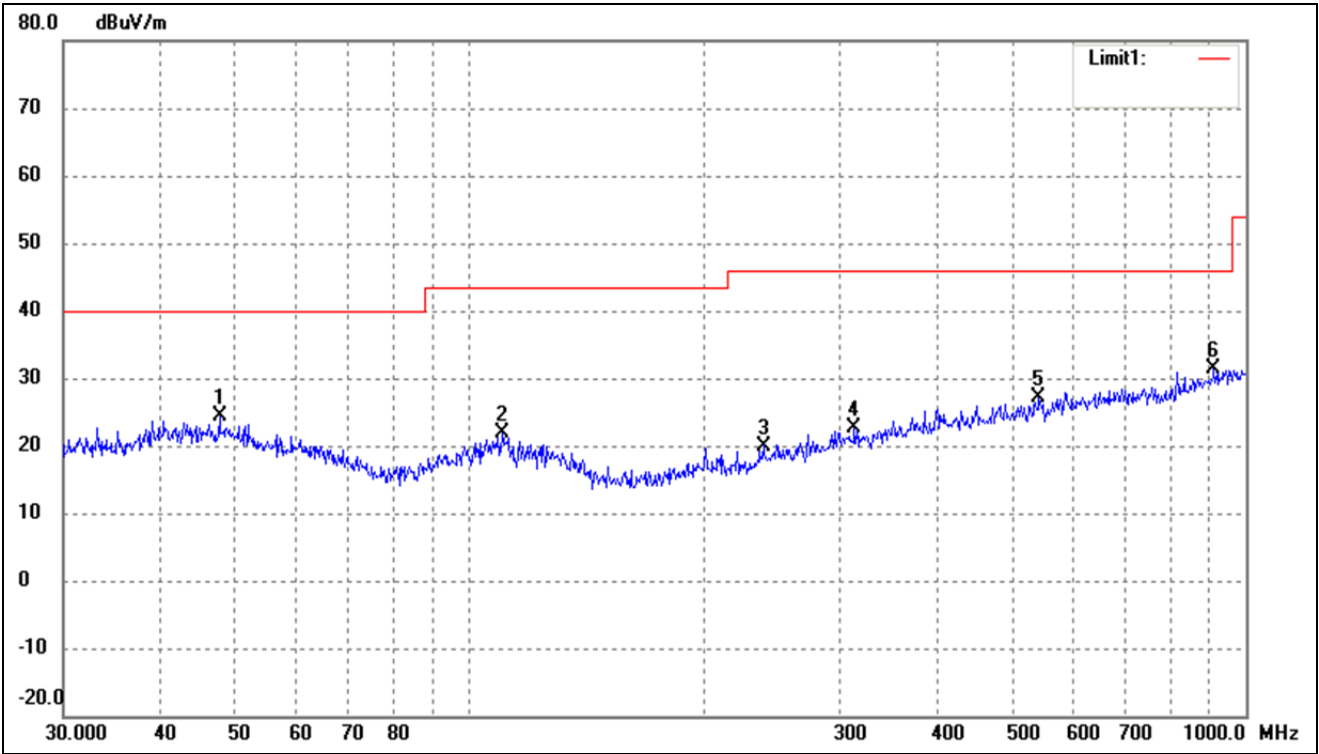
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	()	(cm)	
1	45.5348	35.38	-11.77	23.61	40.00	-16.39	-	-	peak
2	106.7587	35.09	-13.32	21.77	43.50	-21.73	-	-	peak
3	257.4222	30.72	-10.87	19.85	46.00	-26.15	-	-	peak
4	429.5228	31.01	-5.83	25.18	46.00	-20.82	-	-	peak
5	709.1823	30.97	-1.54	29.43	46.00	-16.57	-	-	peak
6	938.8326	29.72	1.59	31.31	46.00	-14.69	-	-	peak

Test Channel	Middle	Polarity:	Horizontal
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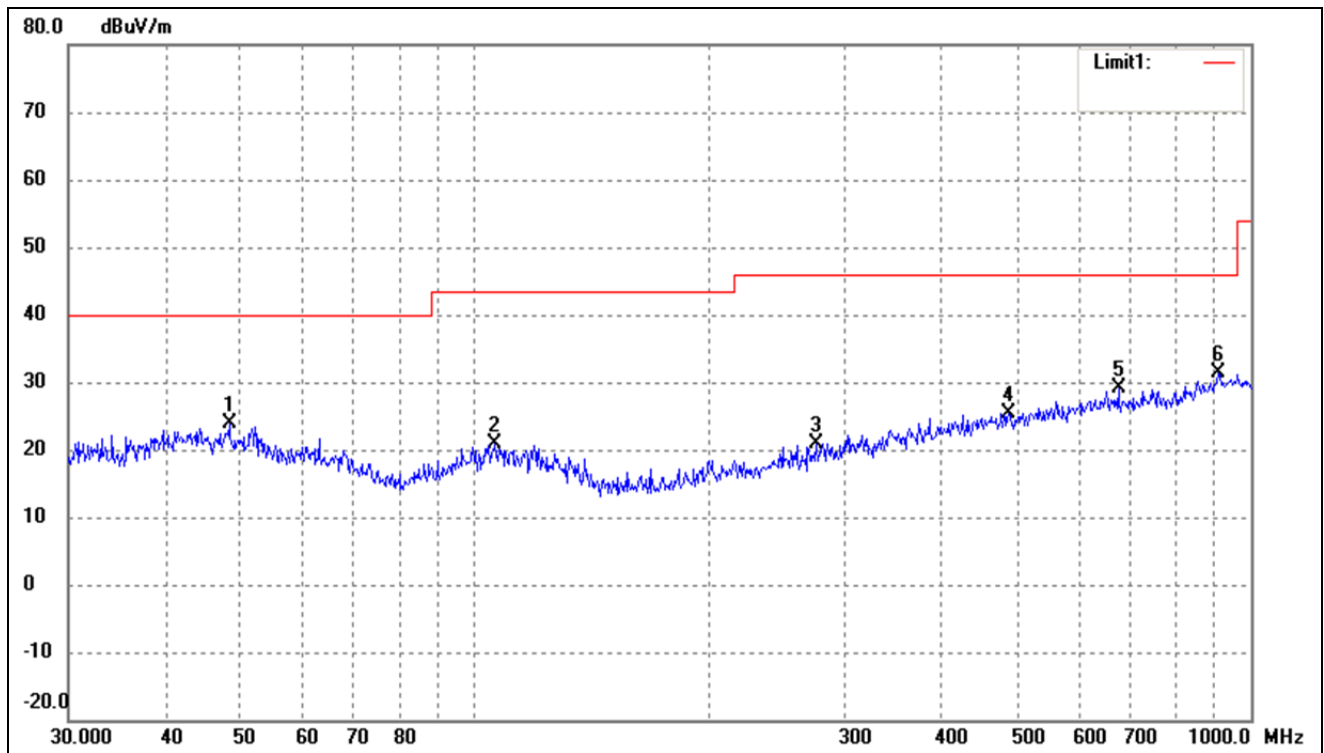
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	43.9658	35.86	-11.83	24.03	40.00	-15.97	-	-	peak
2	107.5101	34.76	-13.32	21.44	43.50	-22.06	-	-	peak
3	308.9126	31.00	-8.94	22.06	46.00	-23.94	-	-	peak
4	435.5898	30.48	-5.77	24.71	46.00	-21.29	-	-	peak
5	649.6597	30.80	-2.37	28.43	46.00	-17.57	-	-	peak
6	938.8326	29.75	1.59	31.34	46.00	-14.66	-	-	peak

Test Channel	Middle	Polarity:	Vertical
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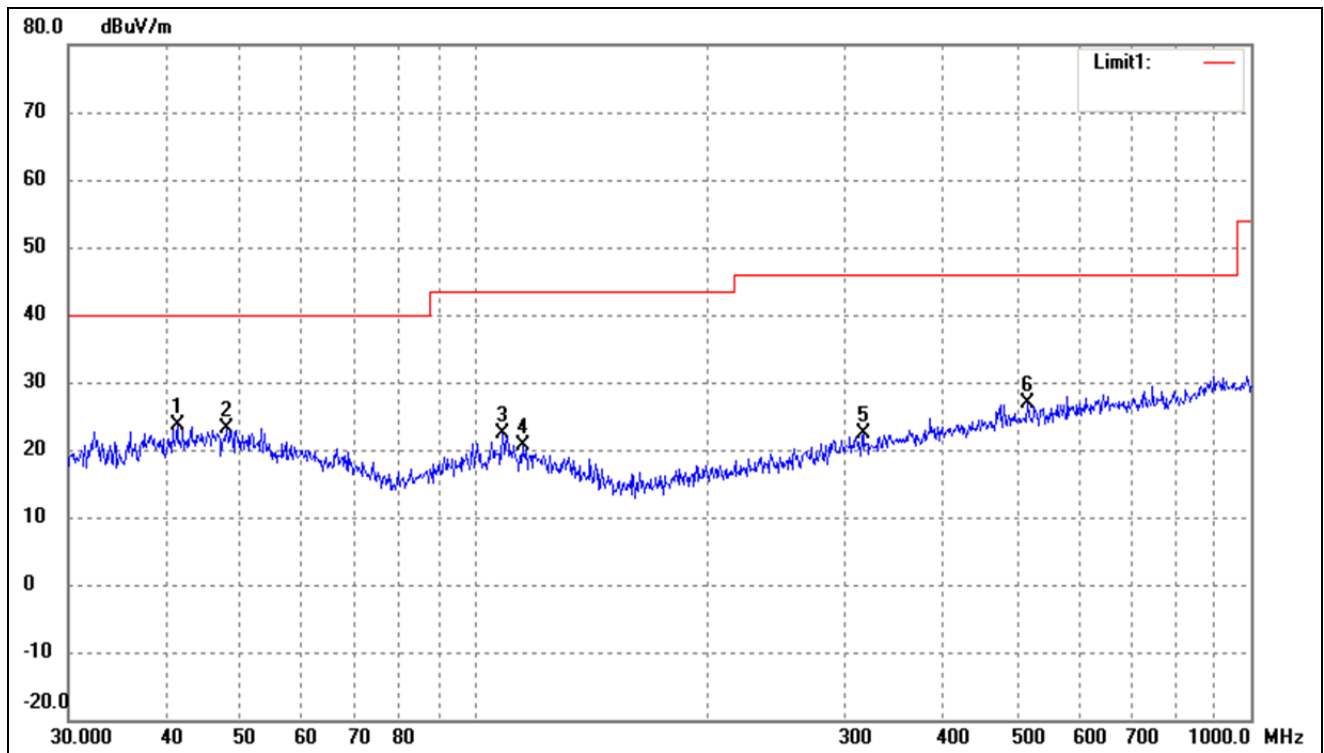
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	47.6586	36.10	-11.65	24.45	40.00	-15.55	-	-	peak
2	110.1816	35.31	-13.32	21.99	43.50	-21.51	-	-	peak
3	239.1473	31.46	-11.46	20.00	46.00	-26.00	-	-	peak
4	313.2760	31.63	-8.94	22.69	46.00	-23.31	-	-	peak
5	541.3725	31.03	-3.93	27.10	46.00	-18.90	-	-	peak
6	909.6667	29.61	1.67	31.28	46.00	-14.72	-	-	peak

Test Channel	High	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	48.3318	35.50	-11.62	23.88	40.00	-16.12	-	-	peak
2	106.3850	34.27	-13.31	20.96	43.50	-22.54	-	-	peak
3	275.1570	31.60	-10.74	20.86	46.00	-25.14	-	-	peak
4	487.3151	29.93	-4.44	25.49	46.00	-20.51	-	-	peak
5	675.2080	30.97	-1.87	29.10	46.00	-16.90	-	-	peak
6	906.4824	29.69	1.62	31.31	46.00	-14.69	-	-	peak

Test Channel	High	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	41.4215	35.57	-11.93	23.64	40.00	-16.36	-	-	peak
2	47.9940	34.84	-11.63	23.21	40.00	-16.79	-	-	peak
3	108.6470	35.66	-13.31	22.35	43.50	-21.15	-	-	peak
4	115.3205	34.45	-13.84	20.61	43.50	-22.89	-	-	peak
5	316.5890	31.38	-8.95	22.43	46.00	-23.57	-	-	peak
6	515.4374	30.97	-4.12	26.85	46.00	-19.15	-	-	peak

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	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2406MHz							
4812	56.32	-4.51	51.81	74	-22.19	H	PK
4812	53.29	-4.51	48.78	54	-5.22	H	AV
7218	52.46	-2.20	50.26	74	-23.74	H	PK
7218	49.28	-2.20	47.08	54	-6.92	H	AV
4812	54.12	-4.51	49.61	74	-24.39	V	PK
4812	50.93	-4.51	46.42	54	-7.58	V	AV
7218	49.56	-2.20	47.36	74	-26.64	V	PK
7218	47.29	-2.20	45.09	54	-8.91	V	AV
Middle Channel-2440MHz							
4880	56.18	-4.47	51.71	74	-22.29	H	PK
4880	52.71	-4.47	48.24	54	-5.76	H	AV
7320	51.84	-2.17	49.67	74	-24.33	H	PK
7320	49.43	-2.17	47.26	54	-6.74	H	AV
4880	54.08	-4.47	49.61	74	-24.39	V	PK
4880	50.51	-4.47	46.04	54	-7.96	V	AV
7320	49.81	-2.17	47.64	74	-26.36	V	PK
7320	47.07	-2.17	44.90	54	-9.10	V	AV
High Channel-2472MHz							
4944	55.65	-4.42	51.23	74	-22.77	H	PK
4944	53.12	-4.42	48.70	54	-5.30	H	AV
7416	51.72	-2.14	49.58	74	-24.42	H	PK
7416	49.22	-2.14	47.08	54	-6.92	H	AV
4944	54.18	-4.42	49.76	74	-24.24	V	PK
4944	51.48	-4.42	47.06	54	-6.94	V	AV
7416	50.21	-2.14	48.07	74	-25.93	V	PK
7416	46.79	-2.14	44.65	54	-9.35	V	AV

Note: 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.

8. Out of Band Emissions

8.1 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).

8.2 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 $\geq [3 \times \text{RBW}]$.
- 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 bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission 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 bandedge 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) $VBW \geq [3 \times RBW]$.
- 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.)

RBW as a function of frequency

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

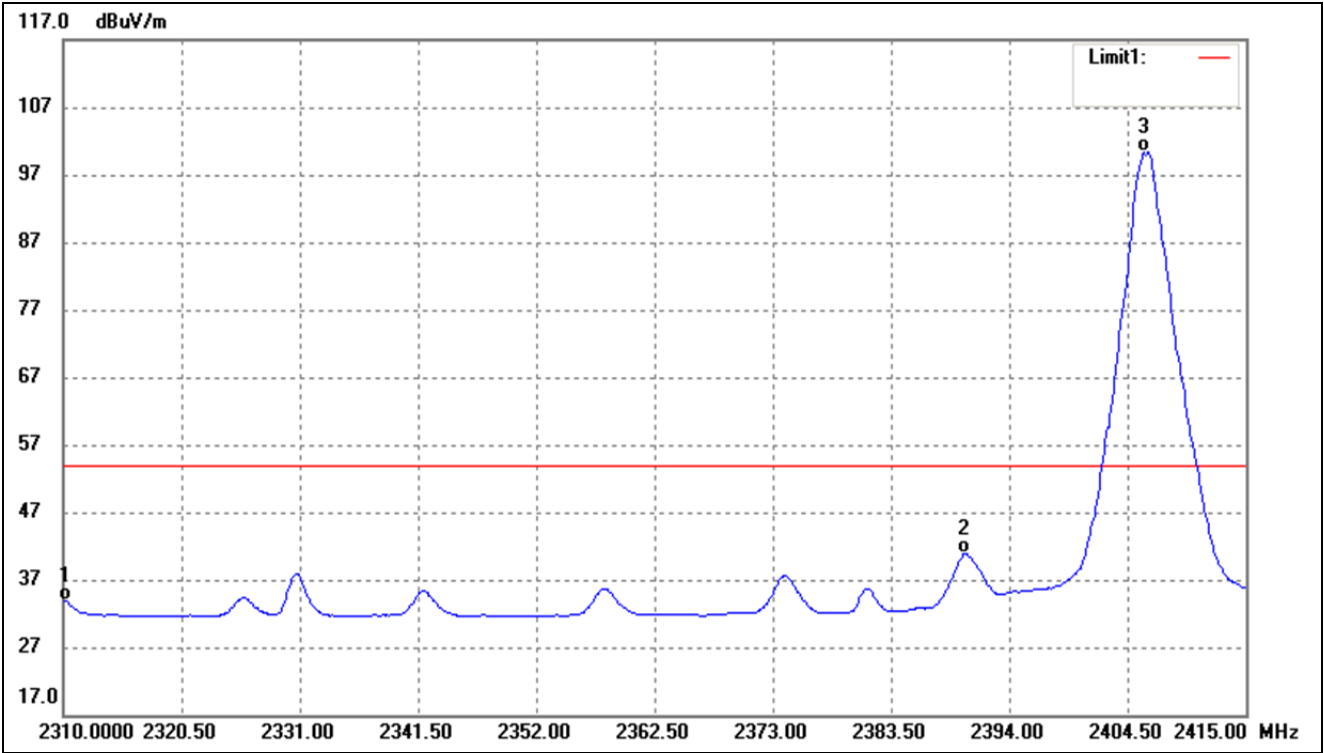
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

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. Report the three highest emissions relative to the limit.

8.3 Summary of Test Results/Plots

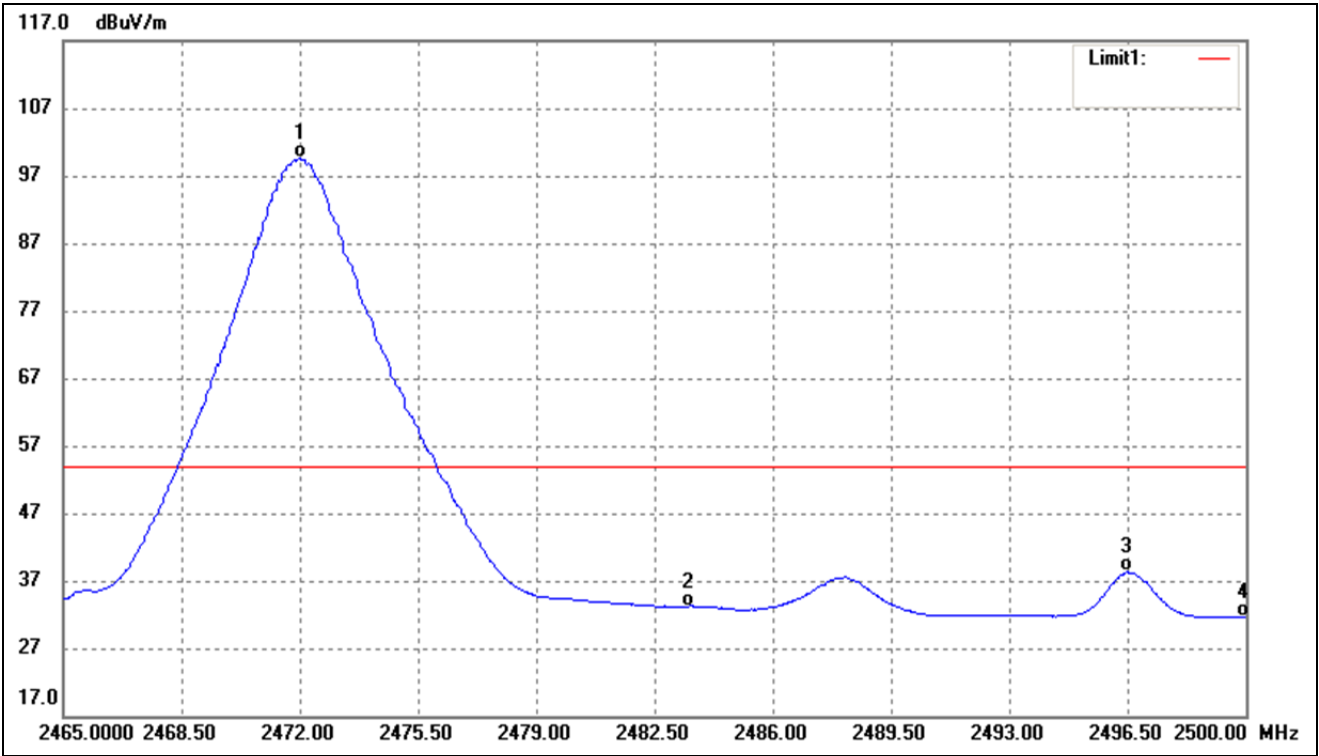
➤ Radiated test

Test Channel	Low	Polarity:	Horizontal (worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	43.65	-9.66	33.99	54.00	-20.01	Average Detector
	2310.000	64.38	-9.66	54.72	74.00	-19.28	Peak Detector
2	2390.000	50.40	-9.50	40.90	54.00	-13.10	Average Detector
	2390.000	78.16	-9.50	68.66	74.00	-5.34	Peak Detector
3	2405.970	109.96	-9.47	100.49	/	/	Average Detector
	2405.760	114.77	-9.48	105.29	/	/	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	2472.000	108.88	-9.34	99.54	/	/	Average Detector
	2472.350	111.25	-9.34	101.91	/	/	Peak Detector
2	2483.500	42.55	-9.31	33.24	54.00	-20.76	Average Detector
	2483.500	77.61	-9.31	68.30	74.00	-5.70	Peak Detector
3	2496.465	47.56	-9.29	38.27	54.00	-15.73	Average Detector
4	2500.000	40.89	-9.28	31.61	54.00	-22.39	Average Detector
	2500.000	68.21	-9.28	58.93	74.00	-15.07	Peak Detector

➤ Conducted test

Please refer to Appendix D

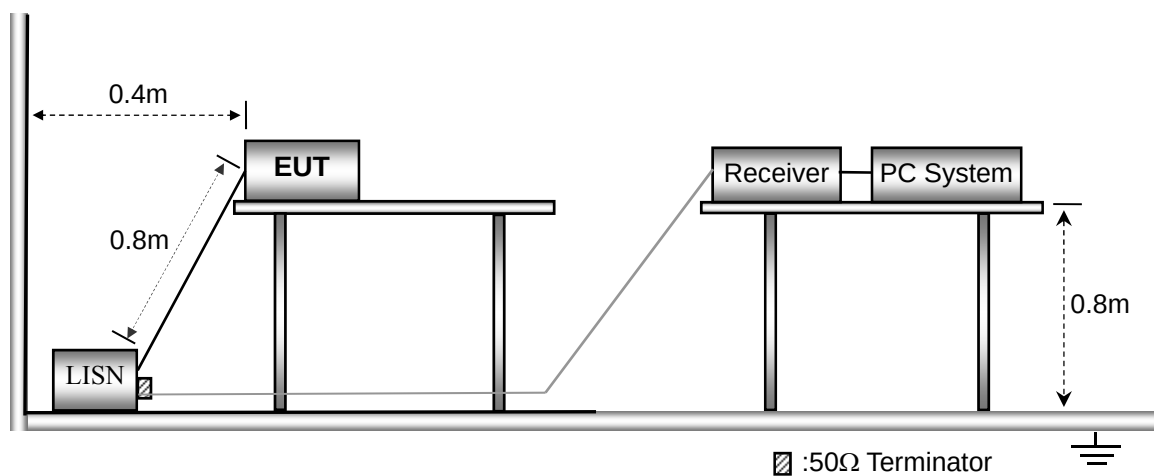
9. Conducted Emissions

9.1 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 40 cm long in the middle. The spacing between the peripherals was 10 cm.

9.2 Basic Test Setup Block Diagram



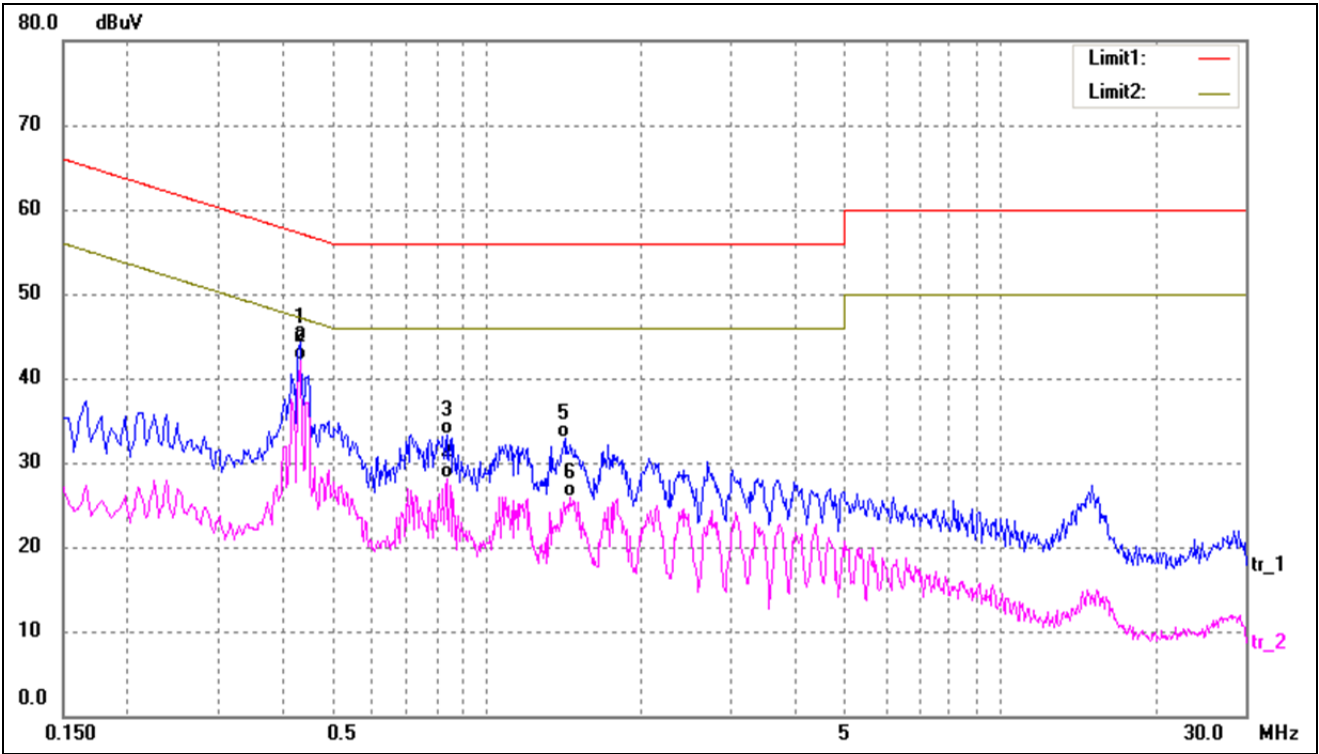
9.3 Test Receiver Setup

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

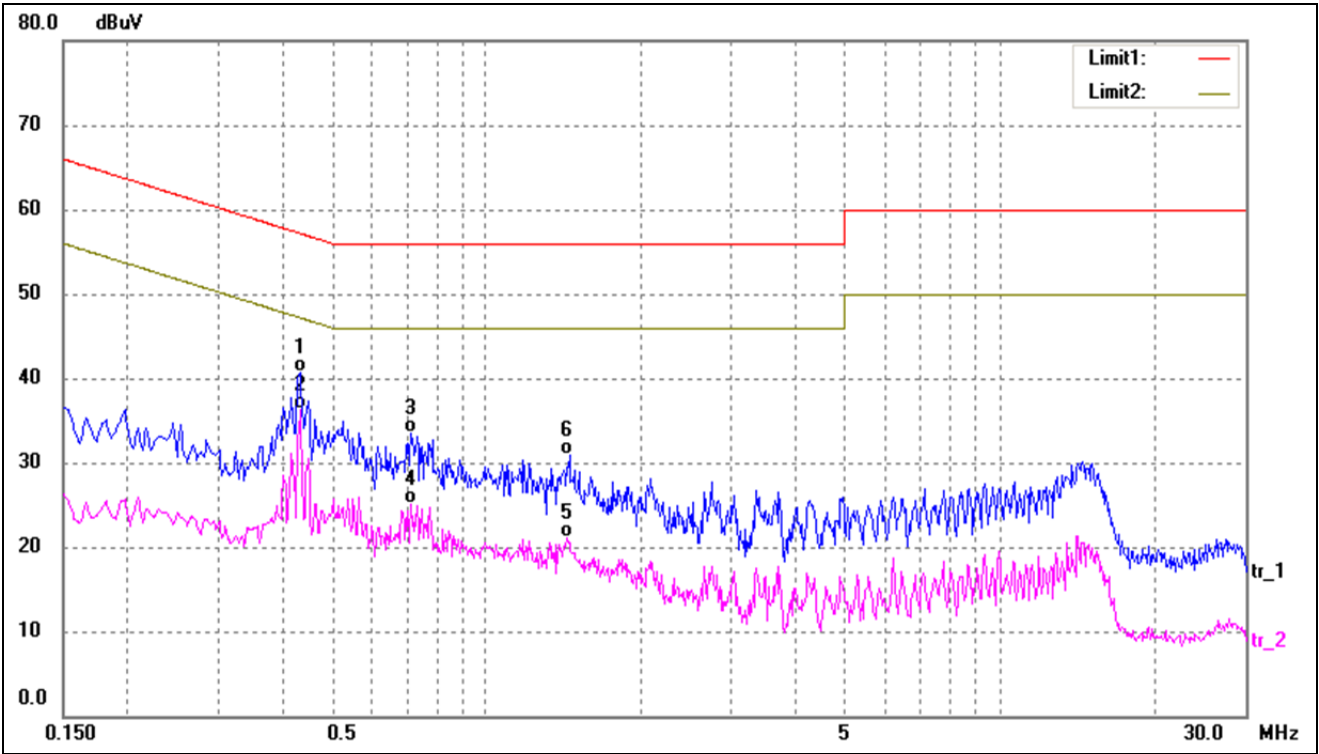
9.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.4340	34.17	10.22	44.39	57.18	-12.79	QP
2*	0.4340	31.89	10.22	42.11	47.18	-5.07	AVG
3	0.8380	23.16	10.19	33.35	56.00	-22.65	QP
4	0.8380	17.82	10.19	28.01	46.00	-17.99	AVG
5	1.4300	22.67	10.23	32.90	56.00	-23.10	QP
6	1.4500	15.65	10.23	25.88	46.00	-20.12	AVG

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.4340	30.46	10.22	40.68	57.18	-16.50	QP
2*	0.4340	26.01	10.22	36.23	47.18	-10.95	AVG
3	0.7140	23.28	10.17	33.45	56.00	-22.55	QP
4	0.7140	14.99	10.17	25.16	46.00	-20.84	AVG
5	1.4340	10.82	10.23	21.05	46.00	-24.95	AVG
6	1.4500	20.66	10.23	30.89	56.00	-25.11	QP

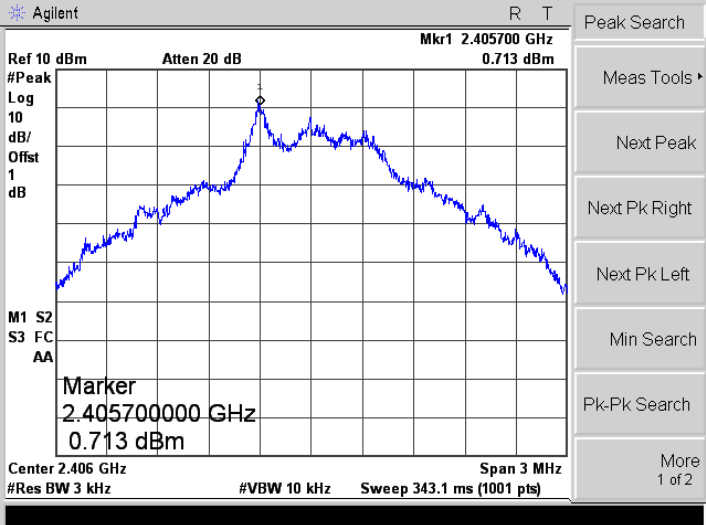
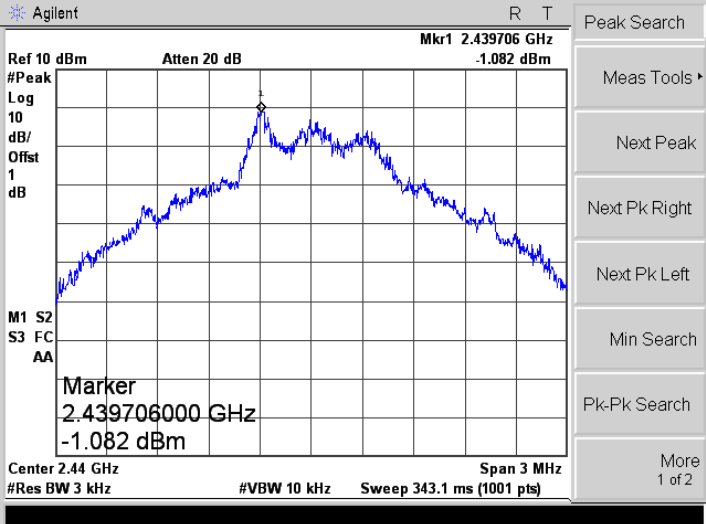
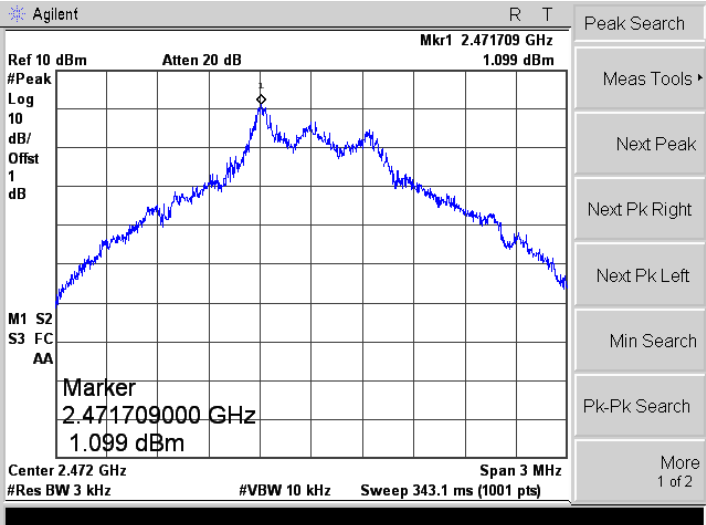
APPENDIX SUMMARY

Project No.	WTX21X02011251W	Test Engineer	Shaw
Start date	2021/3/23	Finish date	2021/3/23
Temperature	24℃	Humidity	48%
RF specifications	2.4G		

APPENDIX	Description of Test Item	Result
A	Power Spectral Density	Compliant
B	DTS Bandwidth	Compliant
C	RF Output Power	Compliant
D	Conducted Out of Band Emissions	Compliant

APPENDIX A

Power Spectral Density			
Test Mode	Test Channel	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
GFSK(2.4G)	Low	0.713	8
	Middle	-1.082	8
	High	1.099	8

Low	
Middle	
High	

APPENDIX B

Test Mode	Test Channel	6 dB Bandwidth kHz	Limit kHz
GFSK(2.4G)	Low	811.956	≥500
	Middle	825.738	≥500
	High	845.267	≥500

Low	Agilent R T Ch Freq 2.406 GHz Trig Free Occupied Bandwidth Ref Level 20.00 dBm Ref 20 dBm Atten 30 dB #Peak Log 10 dB/ Offset 1 dB Center 2.406 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts) Span 6 MHz Occupied Bandwidth 1.6856 MHz Occ BW % Pwr 99.00 % x dB -6.00 dB Transmit Freq Error 3.346 kHz x dB Bandwidth 811.956 kHz Amplitude Ref Level 20.00 dBm Attenuation 30.00 dB Auto Man Scale/Div 10.00 dB Scale Type Log Lin Presel Center Presel Adjust 0.00000000 Hz More 1 of 3
Middle	Agilent R T Ch Freq 2.44 GHz Trig Free Occupied Bandwidth Span 6.000000000 MHz Ref 20 dBm Atten 30 dB #Peak Log 10 dB/ Offset 1 dB Center 2.44 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts) Span 6 MHz Occupied Bandwidth 1.6857 MHz Occ BW % Pwr 99.00 % x dB -6.00 dB Transmit Freq Error 9.964 kHz x dB Bandwidth 825.738 kHz Span Span 6.00000000 MHz Span Zoom Full Span Zero Span Last Span Zone ▶
High	Agilent R T Ch Freq 2.472 GHz Trig Free Occupied Bandwidth Ref Level 20.00 dBm Ref 20 dBm Atten 30 dB #Peak Log 10 dB/ Offset 1 dB Center 2.472 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts) Span 6 MHz Occupied Bandwidth 1.6908 MHz Occ BW % Pwr 99.00 % x dB -6.00 dB Transmit Freq Error 16.023 kHz x dB Bandwidth 845.267 kHz Trace/View Trace 1 2 3 Clear Write Max Hold Min Hold View Blank More 1 of 2

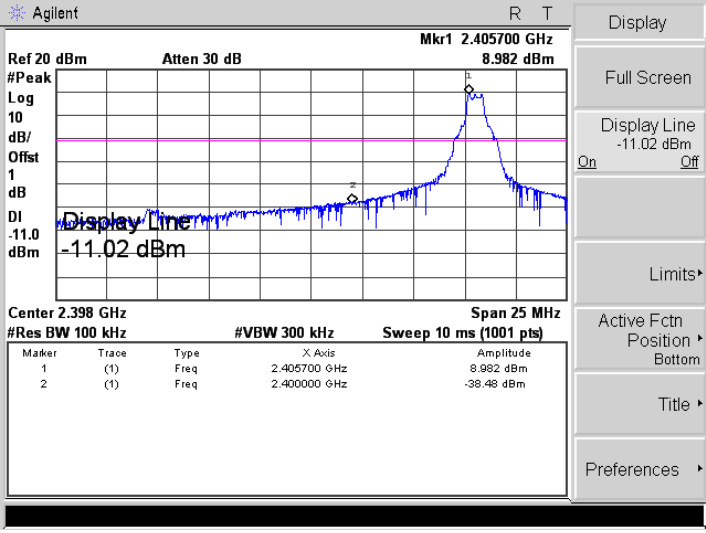
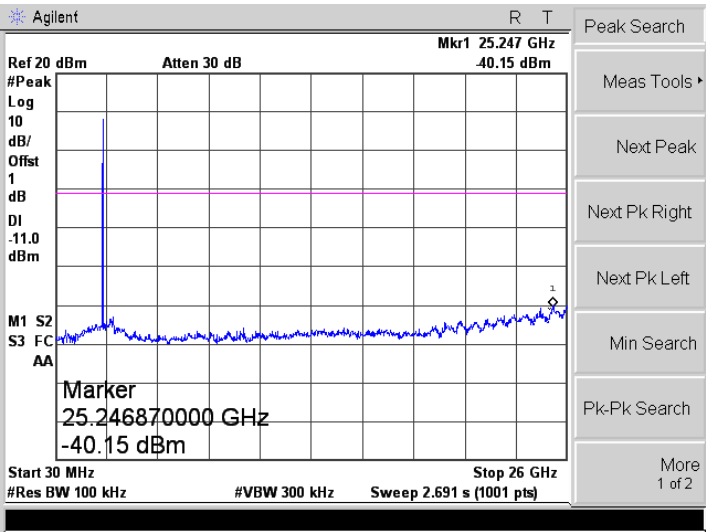
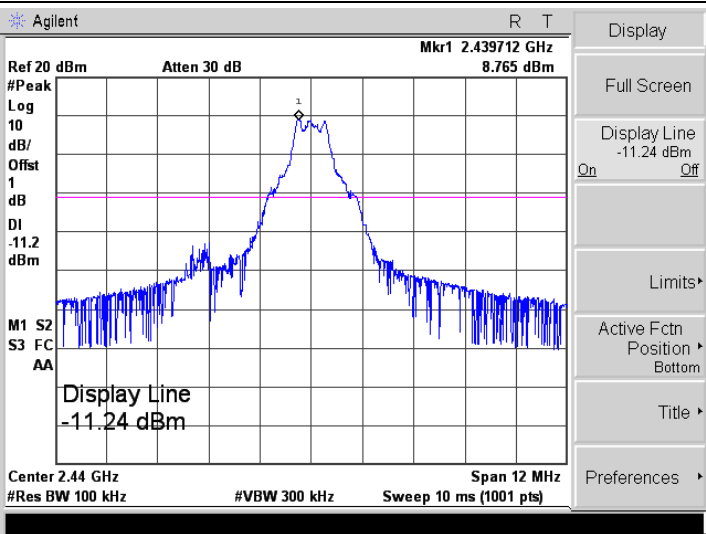
APPENDIX C

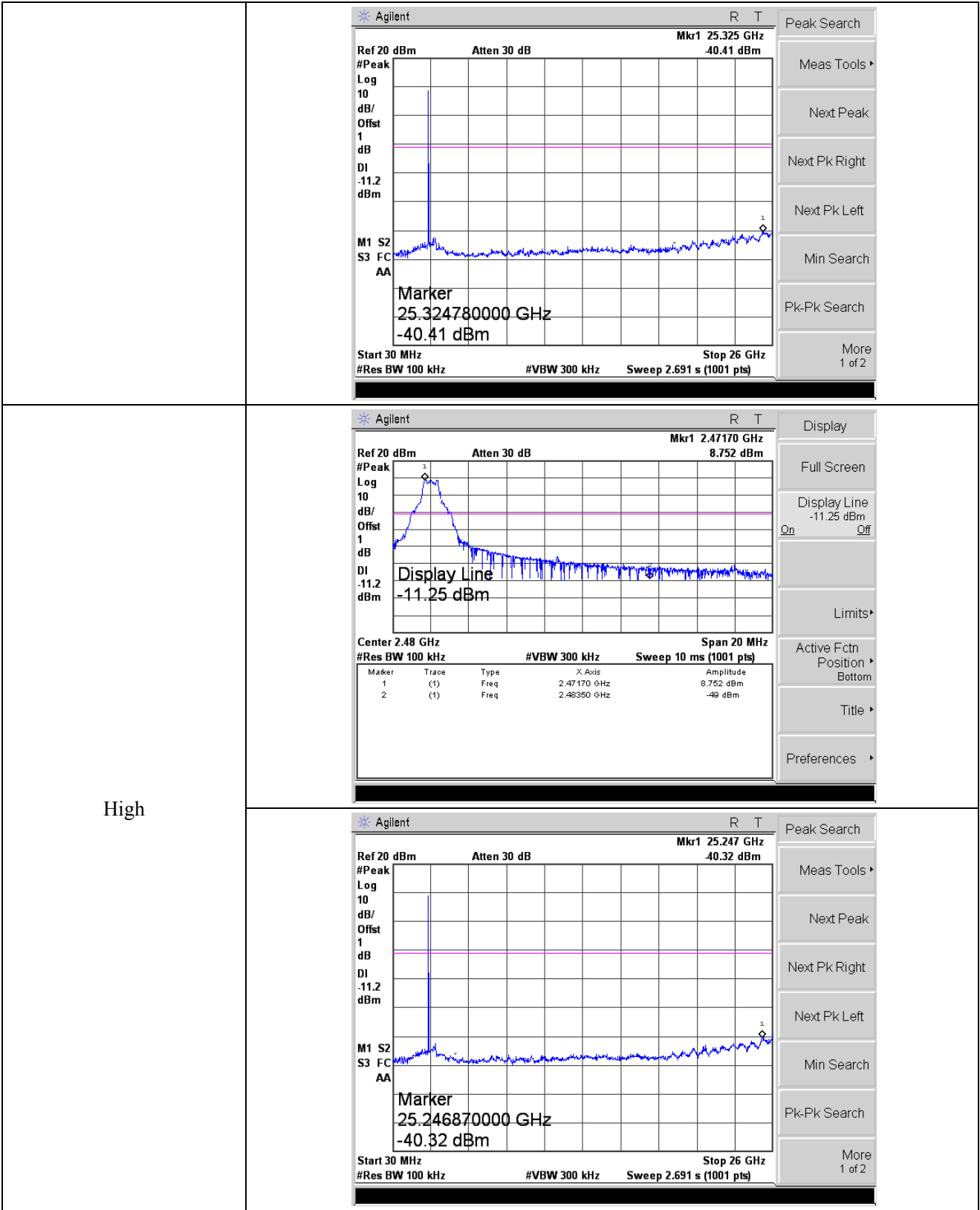
RF Output Power			
Test Mode	Test Channel	Reading dBm	Limit dBm
GFSK(2.4G)	Low	9.023	30.00
	Middle	8.738	30.00
	High	8.727	30.00

Low	Agilent Ref 20 dBm Atten 30 dB Mkr1 2.40621 GHz 9.023 dBm #Peak Log 10 dB/ Offset 1 dB M1 S2 S3 FC AA Marker 2.406210000 GHz 9.023 dBm Center 2.406 GHz #Res BW 3 MHz #VBW 3 MHz Sweep 10 ms (1001 pts) Span 10 MHz Peak Search Meas Tools ▶ Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2
Middle	Agilent Ref 20 dBm Atten 30 dB Mkr1 2.44026 GHz 8.738 dBm #Peak Log 10 dB/ Offset 1 dB M1 S2 S3 FC AA Marker 2.440260000 GHz 8.738 dBm Center 2.44 GHz #Res BW 3 MHz #VBW 3 MHz Sweep 10 ms (1001 pts) Span 10 MHz Peak Search Meas Tools ▶ Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2
High	Agilent Ref 20 dBm Atten 30 dB Mkr1 2.47231 GHz 8.727 dBm #Peak Log 10 dB/ Offset 1 dB M1 S2 S3 FC AA Marker 2.472310000 GHz 8.727 dBm Center 2.472 GHz #Res BW 3 MHz #VBW 3 MHz Sweep 10 ms (1001 pts) Span 10 MHz Peak Search Meas Tools ▶ Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2

APPENDIX D

Conducted Out of Band Emissions

Low	
	
Middle	



APPENDIX PHOTOGRAPHS

Please refer to “ANNEX”

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