

FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

Sony Corporation

System Name: Home Theatre System

Model No.: HT-S40R

Active Subwoofer: SA-WS40R

Wireless Amplifier: TA-S40RWR

Speaker System: SS-S40R; SS-SS40R

EUT Name	EUT Model No.
Active Subwoofer	SA-WS40R

FCC ID: AK8SAWS40R

Prepared for : Sony Corporation
1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan

Prepared By : Audix Technology (Shenzhen) Co., Ltd.
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Report Number : ACS-F20249
Date of Test : Dec.01~05,2020
Date of Report : Dec.17,2020

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TEST REPORT CERTIFICATION

Applicant : Sony Corporation
Manufacturer : Sony Corporation
System Name : Home Theatre System
Model No. : HT-S40R
Active Subwoofer : SA-WS40R
Wireless Amplifier : TA-S40RWR
Speaker System : SS-S40R; SS-SS40R
FCC ID : AK8SAWS40R
(A) EUT Name : Active Subwoofer
(B) EUT Model No. : SA-WS40R
(C) Test Voltage : AC 120V/60Hz

Tested for comply with:
FCC CFR 47 Part 15 Subpart C

Test procedure used:
ANSI C63.10: 2013
KDB 558074 D01v05r02

The device described above is tested by AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC and IC requirements. This report contains data that are not covered by the NVLAP accreditation.

This Report is made under FCC Part 2.1074. No modifications were required during testing to bring this product into compliance.

This report applies to single evaluation of one sample of above mentioned product. This report shall not be reproduced in part without written approval of AUDIX TECHNOLOGY (SHENZHEN) CO., LTD.

The 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.

Date of Test : Dec.01~05,2020 Report of date: Dec.17,2020

Prepared by : Brave Zhang Reviewed by : Sunny Lu
Brave Zhang / Assistant Sunny Lu / Deputy Manager



信華科技(深圳)有限公司
Audix Technology (Shenzhen) Co., Ltd.
EMC 部門報告專用章

Stamp only for EMC Dept. Report

Approved & Authorized Signer :

Signature: David Jin
David Jin / Deputy General Manager

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT has been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	Standard	Results
Power Line Conducted Emission	FCC Part 15: 15.207	PASS
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.205	PASS
Band Edge Compliance	FCC Part 15: 15.247(d)	PASS
Conducted spurious emissions	FCC Part 15: 15.247(d)	PASS
6dB Bandwidth Test	FCC Part 15: 15.247(a)(2)	PASS
Peak Output Power	FCC Part 15: 15.247(b)(3)	PASS
Power Spectral Density	FCC Part 15: 15.247(e)	PASS
Antenna requirement	FCC Part 15: 15.203	PASS

2. GENERAL INFORMATION

2.1. Description of Equipment Under Test

Applicant	Sony Corporation
Applicant Address	1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan
Manufacturer	Sony Corporation
Manufacturer Address	1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan
System Name	Home Theatre System
Model No.	HT-S40R
Active Subwoofer	SA-WS40R
Wireless Amplifier	TA-S40RWR
Speaker System	SS-S40R; SS-SS40R
EUT Name	Active Subwoofer
EUT Model No.	SA-WS40R
FCC ID	AK8SAWS40R
Radio	General 2.4GHz wireless
Frequency Range	2404-2476MHz
Type of Modulation	GFSK
Channel Separation	2MHz
Remote Control	Manufacturer: Sony; Model: RMT-AH412U
Power Cable	Unshielded, Detachable, 1.5m
Optical Cable	Unshielded, Detachable, 1.5m
HDMI Cable	Shielded, Detachable, 2.0m
Sample Type	Prototype production
Date of Receipt	Nov.24,2020
Date of Test	Dec.01~05,2020
Remark	This report only for General 2.4GHz wireless.
The Product covered in this report is Home Theatre System; This product consists of Active Subwoofer (SA-WS40R) and Wireless Amplifier (TA-S40RWR)(Speaker System: SS-S40R; SS-SS40R).	

Antenna System

Type of Antenna	PCB Antenna
Antenna Peak Gain	2.5dBi

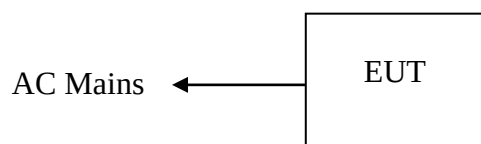
2.2.Channel list of EUT

Channel list	Frequency	Channel list	Frequency
1	2404MHz	20	2442MHz
2	2406MHz	21	2444MHz
3	2408MHz	22	2446MHz
4	2410MHz	23	2448MHz
5	2412MHz	24	2450MHz
6	2414MHz	25	2452MHz
7	2416MHz	26	2454MHz
8	2418MHz	27	2456MHz
9	2420MHz	28	2458MHz
10	2422MHz	29	2460MHz
11	2424MHz	30	2462MHz
12	2426MHz	31	2464MHz
13	2428MHz	32	2466MHz
14	2430MHz	33	2468MHz
15	2432MHz	34	2470MHz
16	2434MHz	35	2472MHz
17	2436MHz	36	2474MHz
18	2438MHz	37	2476MHz
19	2440MHz	--	--

2.3.Tested Supporting System Details

None

2.4.Block diagram of connection between the EUT and simulators



(EUT: Active Subwoofer)

2.5. Test Facility

Site Description

Name of Firm : Audix Technology (Shenzhen) Co., Ltd.
No. 6, Kefeng Road, Science & Technology Park,
Nanshan District , Shenzhen, Guangdong, China

EMC Lab. : Accredited by Industry Canada
Registration Number: IC 5183A-1
Valid Date: Mar.31, 2021

Accredited by DAkkS, Germany
: Registration No: D-PL-12151-01-00
Valid Date: Dec.07, 2021

Accredited by NVLAP, USA
: NVLAP Code: 200372-0
Valid Date: Mar.31, 2021

Certificated by FCC USA.
: Designation No.: CN5022
Valid Date: Mar.31, 2021

2.6.Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test in No. 1 Conduction	2.6dB(150KHz to 30MHz)
Uncertainty for Radiation Emission test in 3m chamber	3.6dB(30~200MHz, Polarization: H)
	4.0dB(30~200MHz, Polarization: V)
	3.6dB(200M~1GHz, Polarization: H)
	3.8dB(200M~1GHz, Polarization: V)
Uncertainty for Radiation Emission test in 3m chamber(1GHz-25GHz)	4.6dB(1~6GHz, Distance: 3m)
	4.6dB(6~25GHz, Distance: 3m)
Uncertainty for Radiated Spurious Emission test	3.7dB(30MHz~1000MHz)
	3.3dB(1~26.5GHz)
Uncertainty for Conduction Spurious emission test	2.0dB
Uncertainty for Output power test	0.8dB
Uncertainty for Bandwidth test	83kHz
Uncertainty for DC power test	1.9%
Uncertainty for test site temperature and humidity	0.6℃
	3%

Note: EMI uncertainty is evaluated by CISPR16-4-2.

The value of measurement uncertainty of EMI is less than U_{CISPR} .

The value is not calculated in the test results.

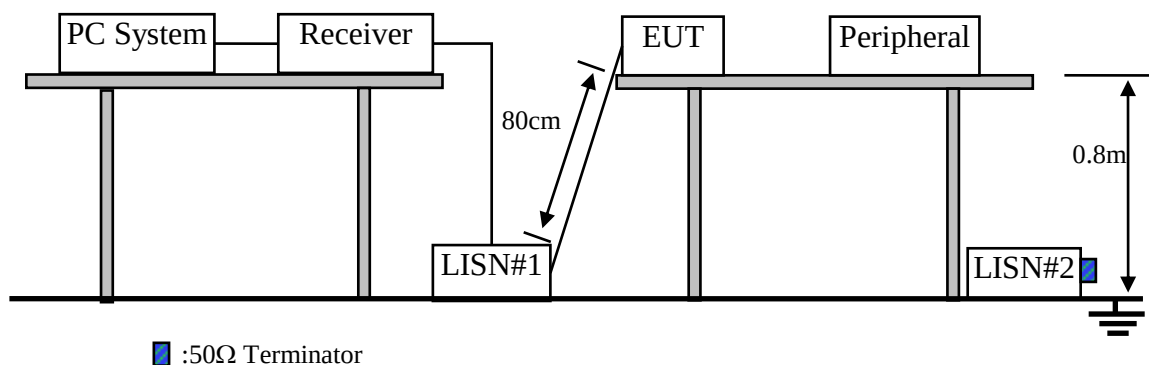
3. POWER LINE CONDUCTED EMISSION TEST

3.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	1# Shielding Room	AUDIX	N/A	N/A	May.17,18	3 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100842	Apr.12,20	1 Year
3.	L.I.S.N.#1	Rohde & Schwarz	ENV216	102160	Oct.11,20	1 Year
4.	L.I.S.N.#2	Kyoritsu	KNW-407	8-1636-1	Apr.12,20	1 Year
5.	Terminator	Hubersuhner	50Ω	No.1	Apr.12,20	1 Year
6.	Terminator	Hubersuhner	50Ω	No.2	Apr.12,20	1 Year
7.	RF Cable	EMCI	EMCCFD300-BM -NM-2000	190422	Apr.12,20	1 Year
8.	Test Software	AUDIX	e3	6.100913a	N/A	N/A

Note: N/A means Not applicable.

3.2. Block Diagram of Test Setup



3.3. Power Line Conducted Emission Test Limits

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

3.4. Configuration of EUT on Test

The following equipment are installed on Power Line Conducted Emission Test to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4.1. Active Subwoofer (EUT)

Model No. : SA-WS40R

Serial No. : N/A

3.4.2. Support Equipment: As Tested Supporting System Details, in Section 2.2.

3.5.Operating Condition of EUT

3.5.1. Setup the EUT and simulator as shown as Section 3.2.

3.5.2. Turn on the power of all equipments.

3.5.3. PC run test software to control EUT work in Tx mode.

3.6.Test Procedure

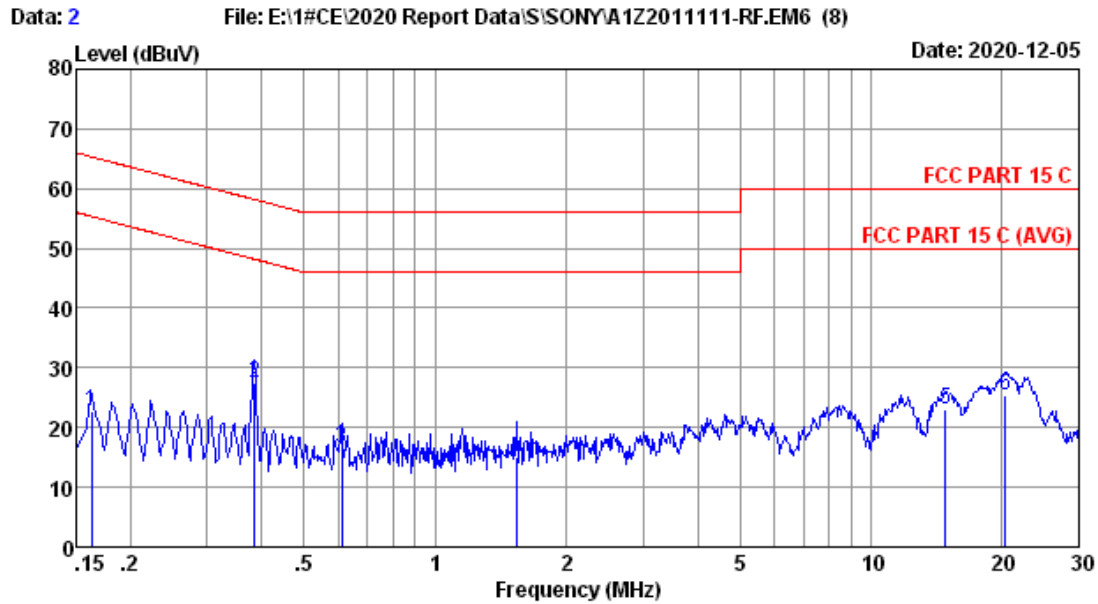
The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power Via AC unit connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.

The bandwidth of test receiver (R & S ESCI) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.7.Power Line Conducted Emission Test Results

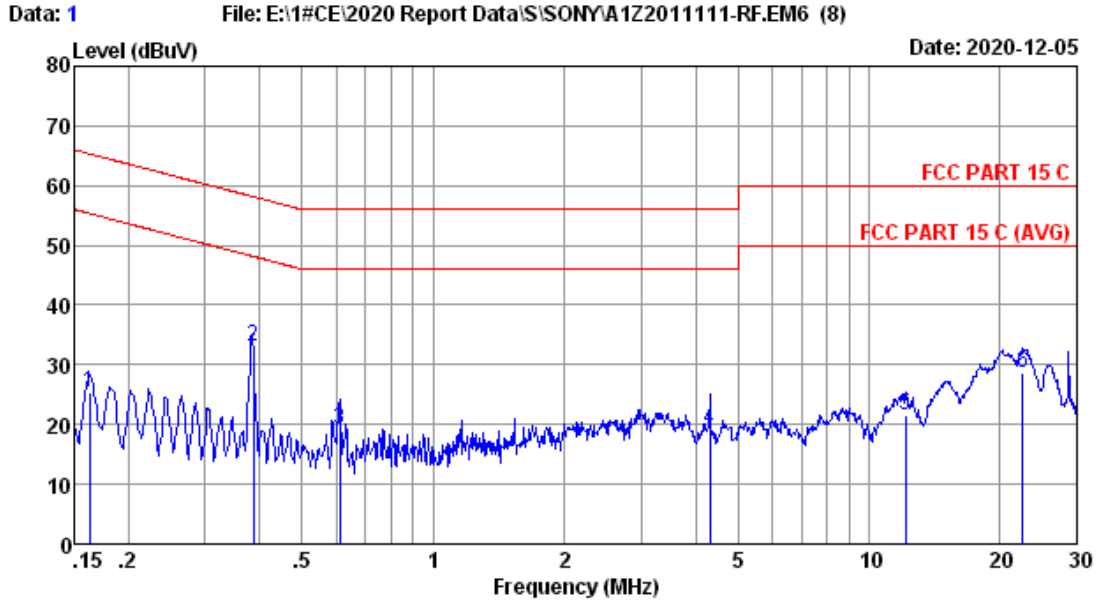
PASS. (All emissions not reported below are too low against the prescribed limits.)



Site no :1# Conduction Data No :2
 Dis./Lisn :2020 ENV216-L LISN phase:
 Limit :FCC PART 15 C
 Env./Ins. :24.0°C/42% Engineer :Evan
 Power Rating :AC 120V/60Hz
 Test Mode :Wireless 2.4G Tx Mode

No	Freq (MHz)	LISN Factor (dB)	Cable loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.162	9.70	0.01	12.96	22.67	65.34	42.67	QP
2	0.385	9.70	0.01	17.61	27.32	58.17	30.85	QP
3	0.611	9.70	0.01	6.85	16.56	56.00	39.44	QP
4	1.535	9.70	0.03	5.36	15.09	56.00	40.91	QP
5	14.828	9.80	0.08	13.03	22.91	60.00	37.09	QP
6	20.377	9.90	0.10	15.32	25.32	60.00	34.68	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
 2.If the average limit is met when using a quasi-peak detector.
 the EUT shall be deemed to meet both limits and measurement
 with average detector is unnecessary.



Site no :1# Conduction Data No :1
 Dis./Lisn :2020 ENV216-N LISN phase:
 Limit :FCC PART 15 C
 Env./Ins. :24.0°C/42% Engineer :Evan
 Power Rating :AC 120V/60Hz
 Test Mode :Wireless 2.4G Tx Mode

No	Freq (MHz)	LISN Factor (dB)	Cable loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.162	9.70	0.01	15.65	25.36	65.34	39.98	QP
2	0.386	9.70	0.01	23.40	33.11	58.15	25.04	QP
3	0.611	9.70	0.01	9.57	19.28	56.00	36.72	QP
4	4.315	9.70	0.04	9.48	19.22	56.00	36.78	QP
5	12.124	9.80	0.07	11.61	21.48	60.00	38.52	QP
6	22.535	9.90	0.11	18.67	28.68	60.00	31.32	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
 2.If the average limit is met when using a quasi-peak detector.
 the EUT shall be deemed to meet both limits and measurement
 with average detector is unnecessary.

4. RADIATED EMISSION TEST

4.1. Test Equipment

4.1.1. For frequency range 30MHz~1000MHz (In 3m Anechoic Chamber)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber(NSA)	AUDIX	N/A	N/A	May.03,20	1 Year
2.	3#Chamber(SE)	AUDIX	N/A	N/A	May.17,18	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.11,20	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR7	101547	Apr.12,20	1 Year
5.	Amplifier	HP	8447D	2648A04738	Apr.11,20	1 Year
6.	Tri-log-Broadband Antenna	SCHWARZBECK	VULB 9168	710	Oct.19,20	1 Year
7.	NSA Cable	HUBER+SUHNER	CFD400NL-LW	No.3	Oct.11,20	1 Year
8.	Coaxial Switch	Anritsu	MP59B	6201397222	Apr.11,20	1 Year
9.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A

Note: N/A means Not applicable.

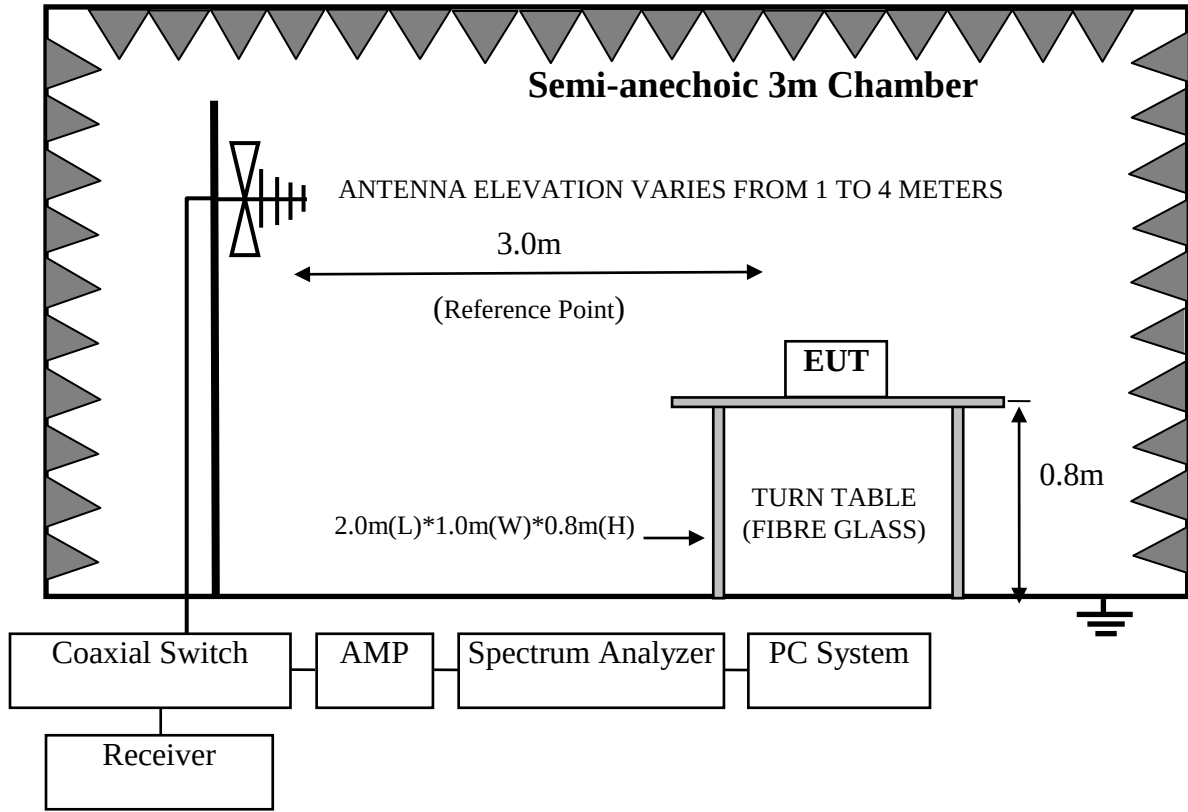
4.1.2. For frequency range 1GHz~25GHz (In 3m Anechoic Chamber)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber(Svswr)	AUDIX	N/A	N/A	Apr.15,20	1 Year
2.	3#Chamber(SE)	AUDIX	N/A	N/A	May.17,18	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.11,20	1 Year
4.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Jul.30,20	1 Year
5.	Amplifier	Agilent	83017A	MY53270084	Oct.11,20	1 Year
6.	RF Cable	Hubersuhner	SUCOFLEX-106	505238/6	Apr.11,20	1 Year
7.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A

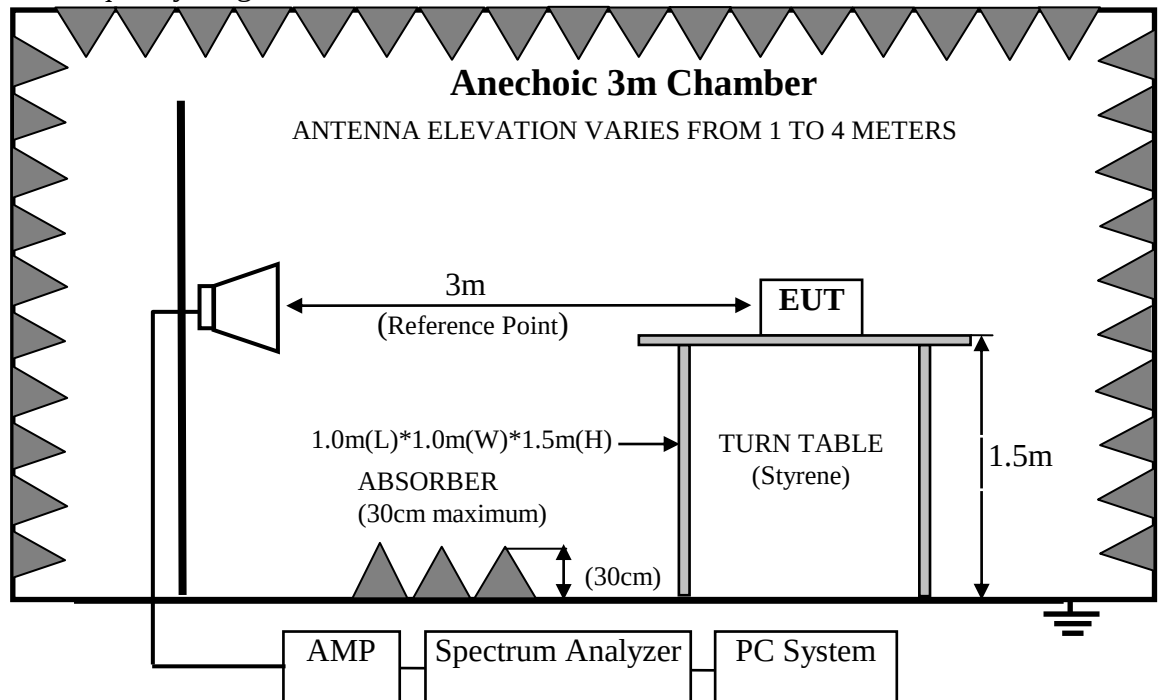
Note: N/A means Not applicable.

4.2. Block Diagram of Test Setup

For frequency range 30MHz-1000MHz



For frequency range 1GHz-25GHz



4.3. Radiated Emission Limit

4.3.1. 15.247&209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V/m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

Remark : (1) Emission level $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V/m}$

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

4.3.2. 15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.4. EUT Configuration on Test

The configurations of EUT are listed in Section 3.4.

4.5. Operating Condition of EUT

Same as Conducted Emission test that is listed in Section 3.5.

4.6. Test Procedure

Frequency below 30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)*2.4m(W)*0.3m(H) on the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horn antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10-2013 on radiated emission Test.

This test was performed with EUT in X, Y, Z position, and the worse case was found when EUT in X position as test photo indicated.

The bandwidth of the EMI test receiver (R&S ESR7) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz.

This device is pulse modulated, a duty cycle factor was used to calculate average level based measured peak level.

The frequency range from 30MHz to 10th harmonic (25GHz) is checked. And no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

4.7. Radiated Emission Test Results

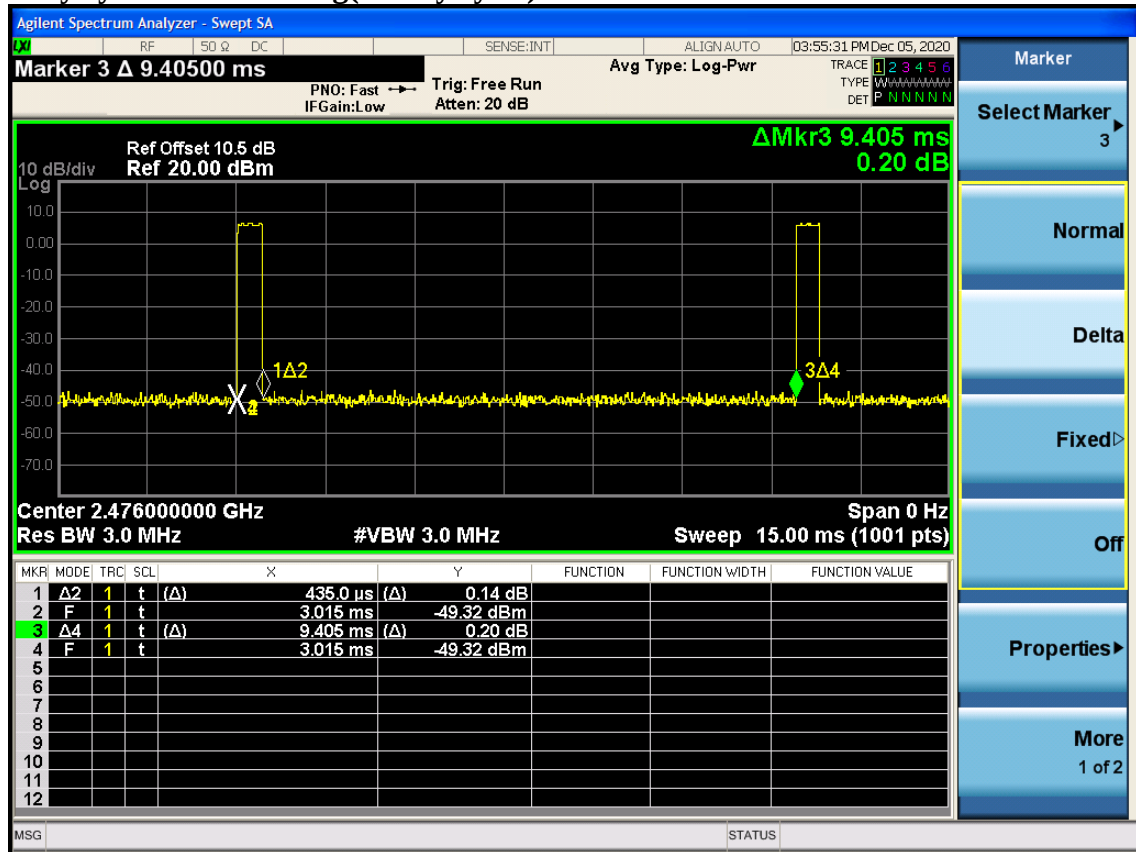
PASS.

All the emissions from 30MHz to 25 GHz were comply with 15.209 limits.

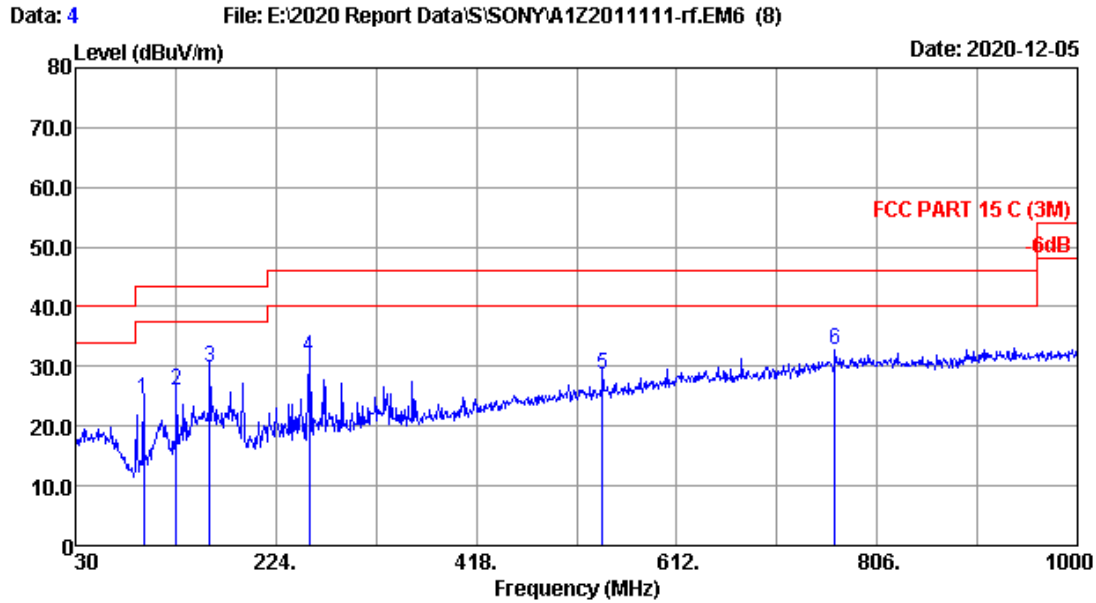
Note 1: For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

Note 2: The emissions (9kHz~30MHz) not reported for there is no emission be found.

Duty cycle Factor= $20\log(1/\text{Duty cycle}) = -26.697\text{dB}$



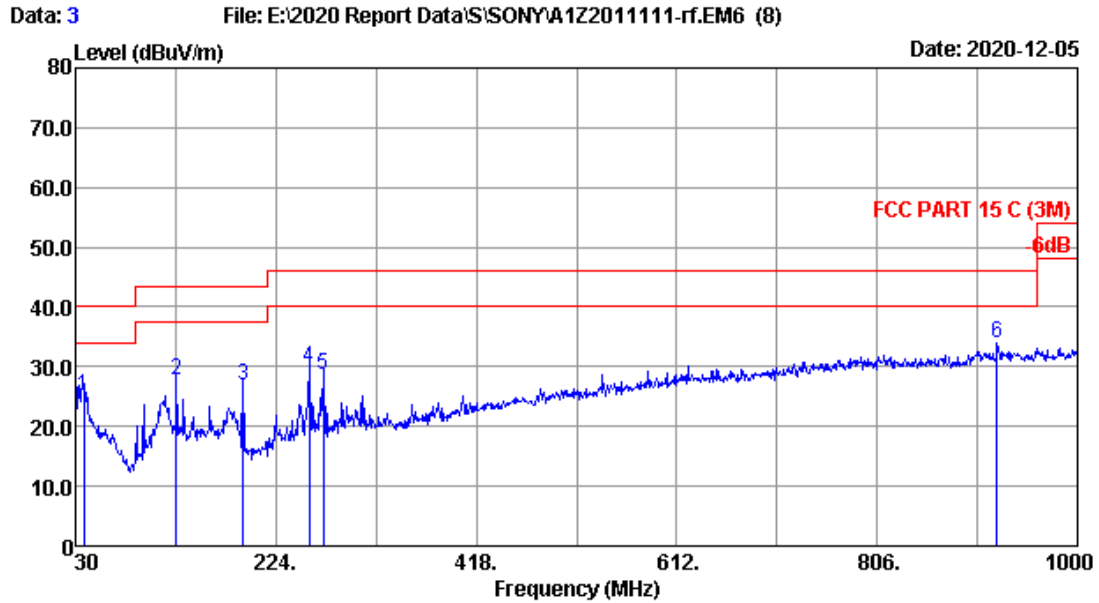
Frequency: 30MHz~1GHz



Site no. : 3m Chamber Data no. : 4
 Dis. / Ant. : 3m 2020 VULB9168-710 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15 C (3M)
 Env. / Ins. : 24.0°C/55% Engineer : Hogen
 Power rating : AC120V/60Hz
 Test Mode : Wireless 2.4G Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	95.960	14.20	0.98	9.30	24.48	43.50	19.02	QP
2	127.970	17.40	1.14	7.49	26.03	43.50	17.47	QP
3	159.980	19.20	1.28	9.35	29.83	43.50	13.67	QP
4	256.010	17.60	1.60	12.50	31.70	46.00	14.30	QP
5	540.220	23.80	2.43	2.45	28.68	46.00	17.32	QP
6	765.260	27.70	3.02	1.93	32.65	46.00	13.35	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 3
 Dis. / Ant. : 3m 2020 VULB9168-710 Ant. pol. : VERTICAL
 Limit : FCC PART 15 C (3M)
 Env. / Ins. : 24.0°C/55% Engineer : Hogen
 Power rating : AC120V/60Hz
 Test Mode : Wireless 2.4G Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	37.760	18.80	0.68	5.67	25.15	40.00	14.85	QP
2	127.970	17.40	1.14	9.29	27.83	43.50	15.67	QP
3	191.990	16.20	1.45	9.25	26.90	43.50	16.60	QP
4	256.010	17.60	1.60	10.56	29.76	46.00	16.24	QP
5	269.590	18.10	1.64	8.84	28.58	46.00	17.42	QP
6	922.400	29.14	3.38	1.31	33.83	46.00	12.17	QP

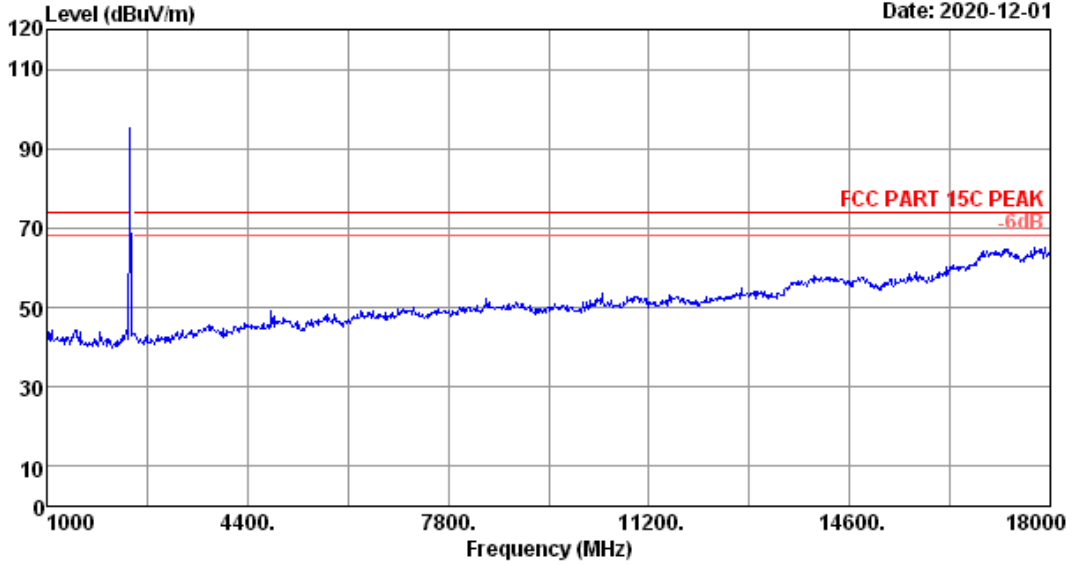
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Frequency: 1GHz~18GHz

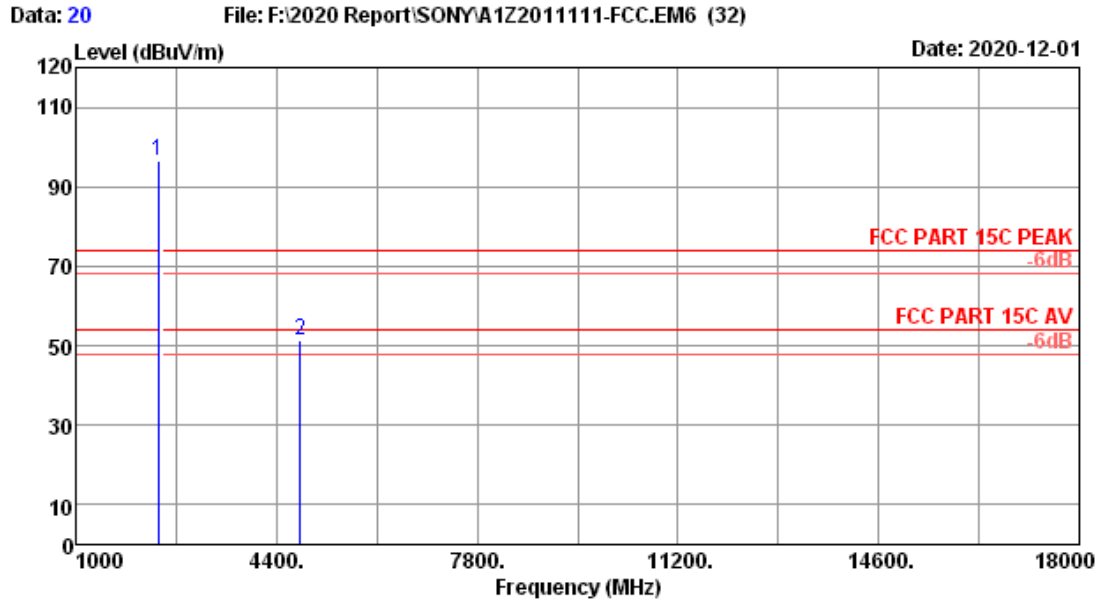
Data: 19

File: F:\2020 Report\SONYA1Z2011111-FCC.EM6 (32)

Date: 2020-12-01



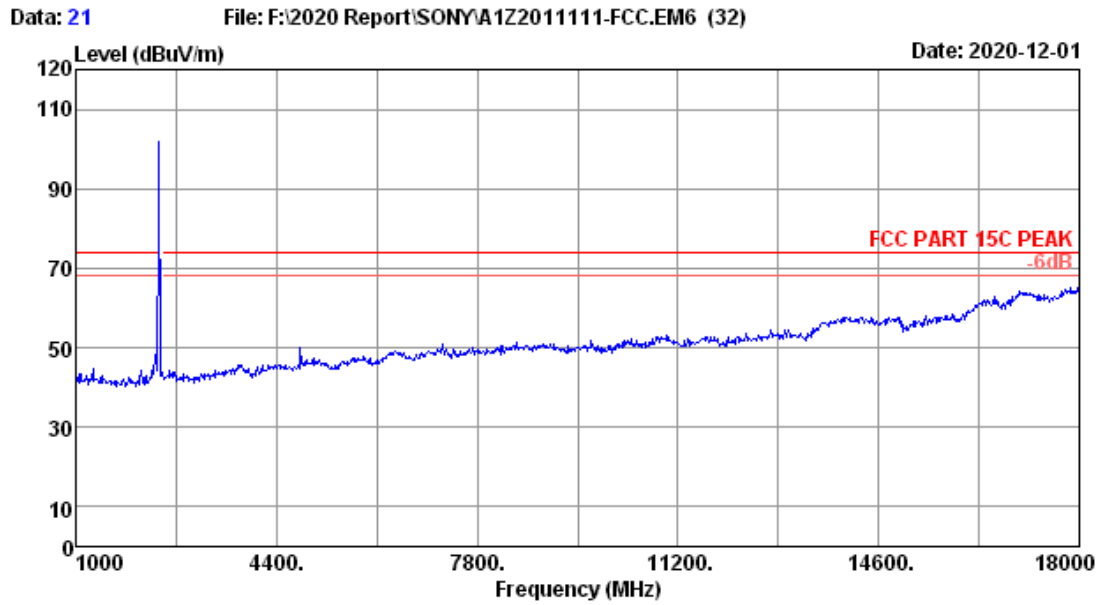
Site no.	: 3m Chamber	Data no.	: 19
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2404MHz Tx Mode		



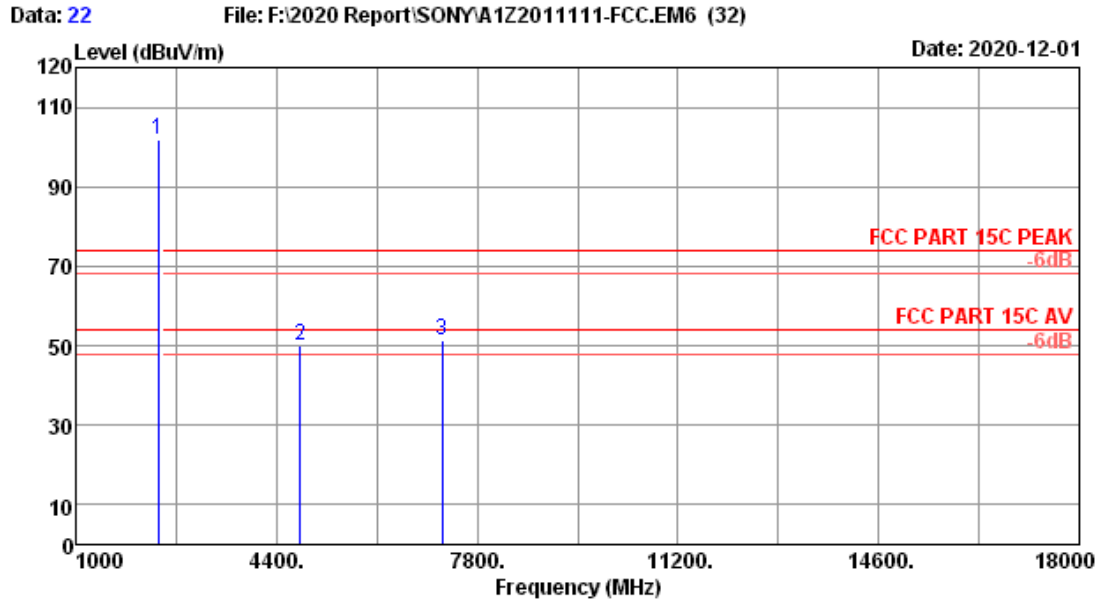
Site no. : 3m Chamber Data no. : 20
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2404MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2404.00	28.04	0.92	99.60	32.14	96.42	-----	-----	Peak
2	4808.00	32.61	1.38	48.41	31.01	51.39	74.00	22.61	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



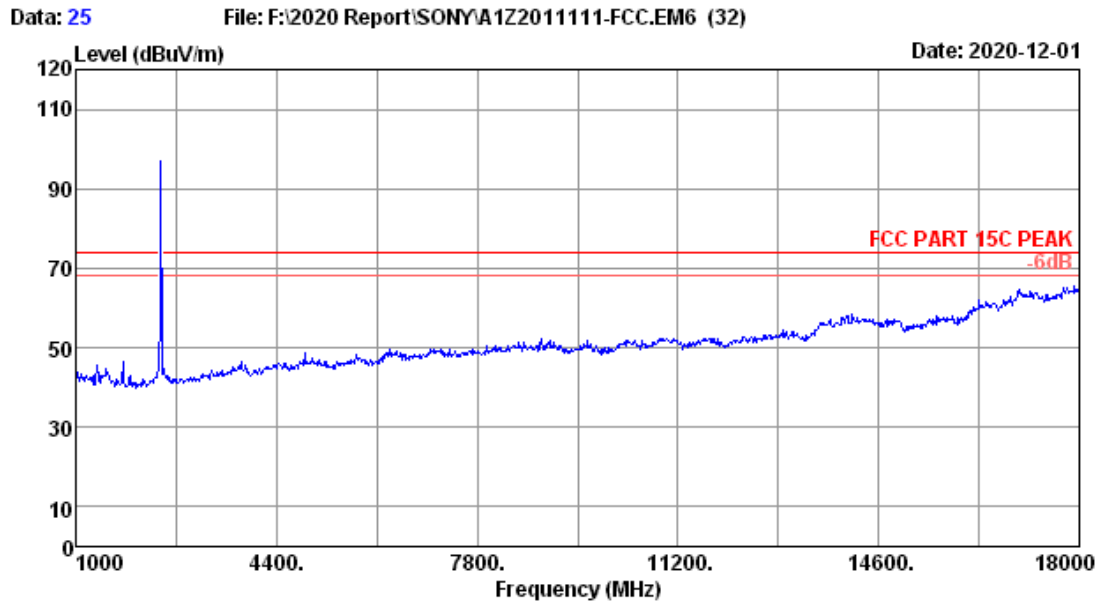
Site no.	: 3m Chamber	Data no.	: 21
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2404MHz Tx Mode		



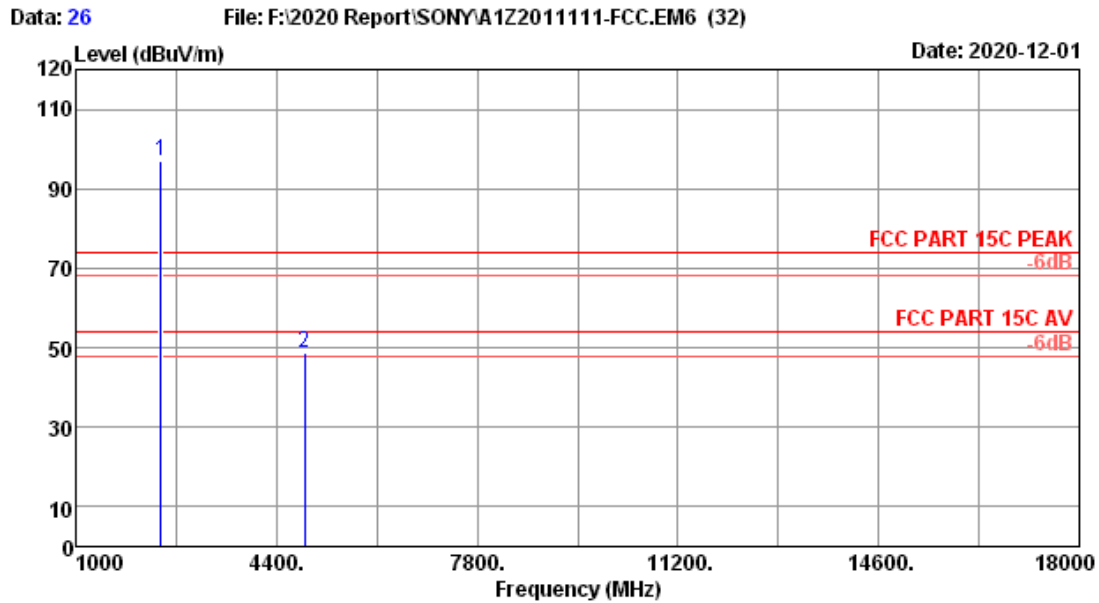
Site no. : 3m Chamber Data no. : 22
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2404MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2404.00	28.04	0.92	106.22	33.48	101.70	74.00	27.70	Peak
2	4808.00	32.61	1.38	49.31	33.18	50.12	74.00	23.88	Peak
3	7212.00	36.50	1.92	45.80	33.02	51.20	74.00	22.80	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



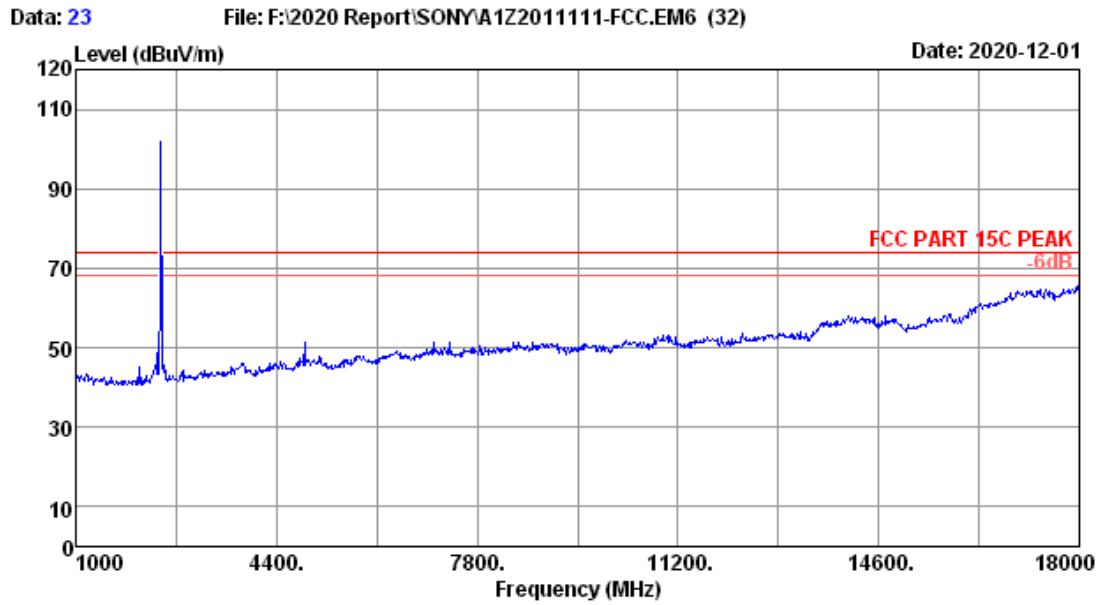
Site no.	: 3m Chamber	Data no.	: 25
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2440MHz Tx Mode		



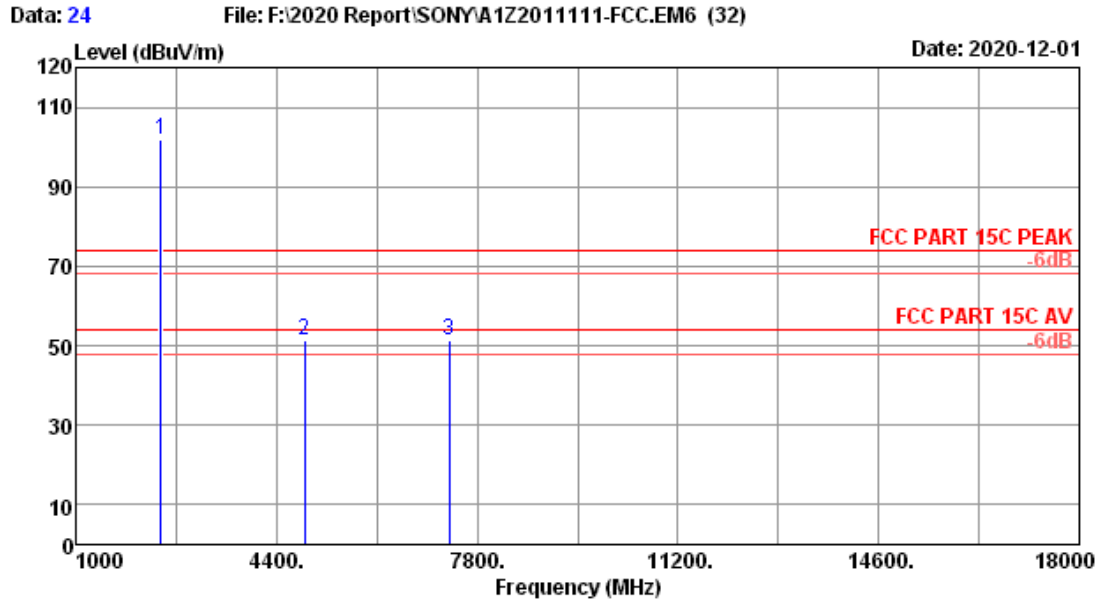
Site no. : 3m Chamber Data no. : 26
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2440MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.11	0.93	101.20	33.47	96.77	-----	-----	Peak
2	4880.00	32.68	1.39	47.95	33.19	48.83	74.00	25.17	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



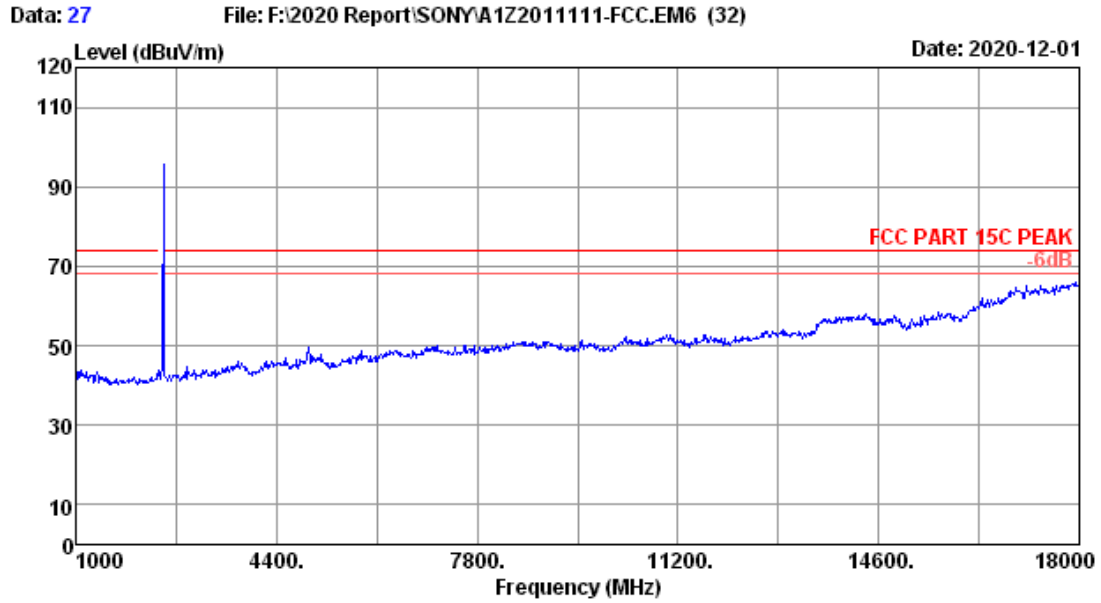
Site no.	: 3m Chamber	Data no.	: 23
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2440MHz Tx Mode		



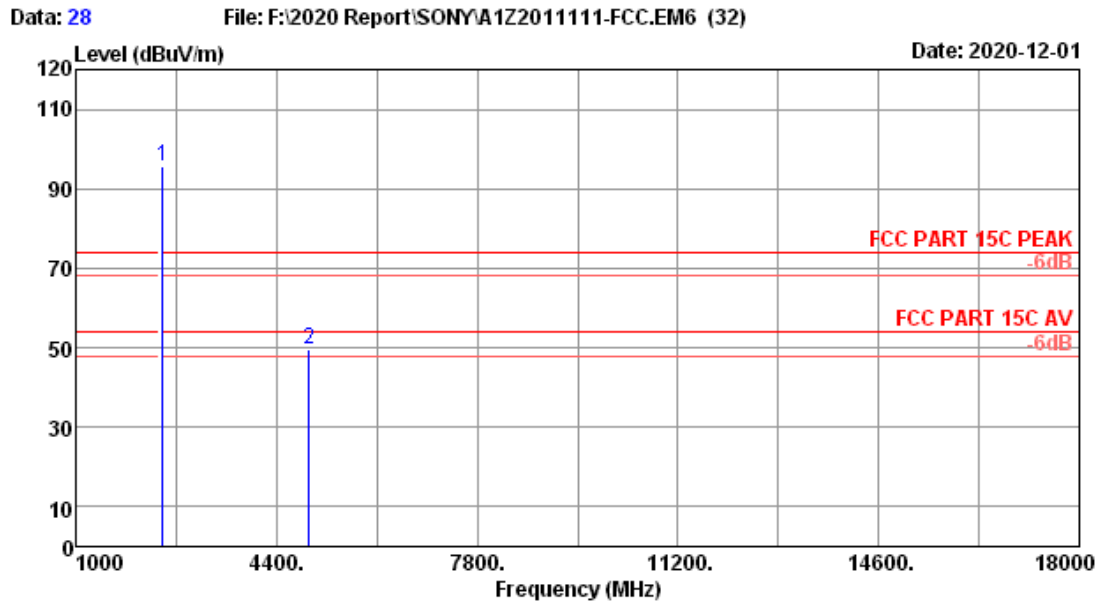
Site no. : 3m Chamber Data no. : 24
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2440MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.11	0.93	106.06	33.47	101.63	74.00	27.63	Peak
2	4880.00	32.68	1.39	50.67	33.19	51.55	74.00	22.45	Peak
3	7320.00	36.50	1.93	45.95	33.03	51.35	74.00	22.65	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



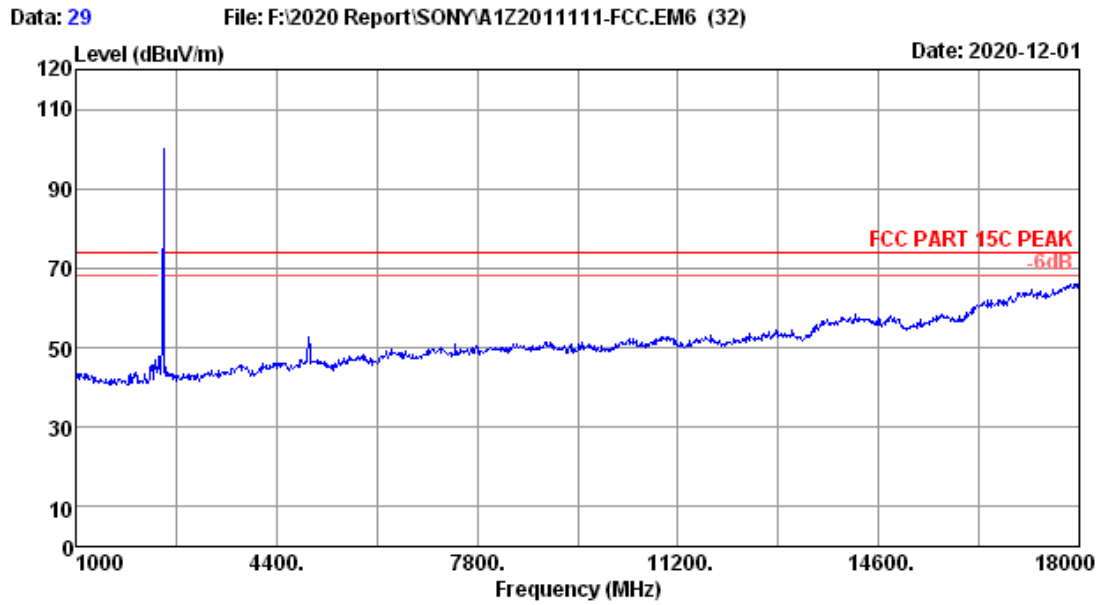
Site no.	: 3m Chamber	Data no.	: 27
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2476MHz Tx Mode		



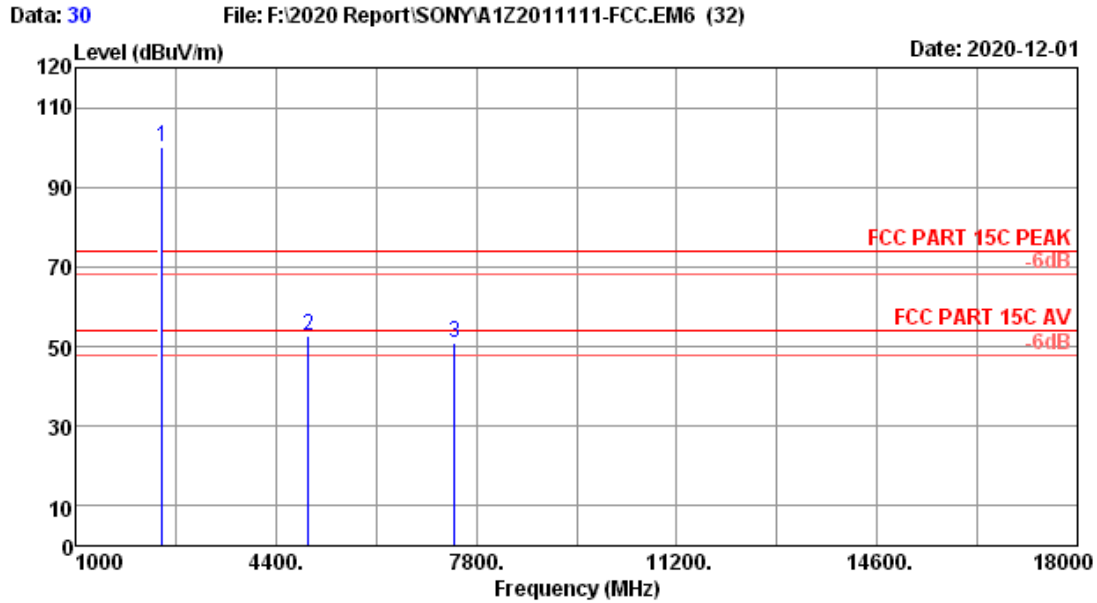
Site no. : 3m Chamber Data no. : 28
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2476MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2476.00	28.17	0.94	100.10	33.46	95.75	-----	-----	Peak
2	4952.00	32.75	1.39	48.58	33.19	49.53	74.00	24.47	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



Site no.	: 3m Chamber	Data no.	: 29
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.4°C/52.9%	Engineer	: Lynn
Test Mode	: Wireless 2.4G 2476MHz Tx Mode		



Site no. : 3m Chamber Data no. : 30
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2476MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2476.00	28.17	0.94	104.31	33.46	99.96	-----	-----	Peak
2	4952.00	32.75	1.39	51.67	33.19	52.62	74.00	21.38	Peak
3	7428.00	36.50	1.94	45.48	33.04	50.88	74.00	23.12	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.

5. CONDUCTED SPURIOUS EMISSIONS

5.1.Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Attenuator	Agilent	8491B	MY39269201	Oct.12,20	1 Year
3.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	Apr.12,20	1 Year

5.2.Block Diagram of Test Setup



5.3.Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

5.4.Test Procedure

Use the test method described in ANSI C63.10:

The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions with peak detector.

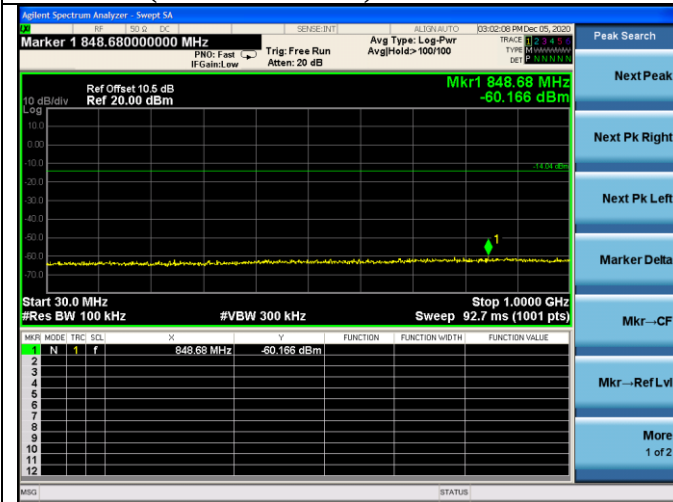
Note: The cable loss and attenuator loss were offset into spectrum analyzer as an amplitude offset.

5.5.Test result

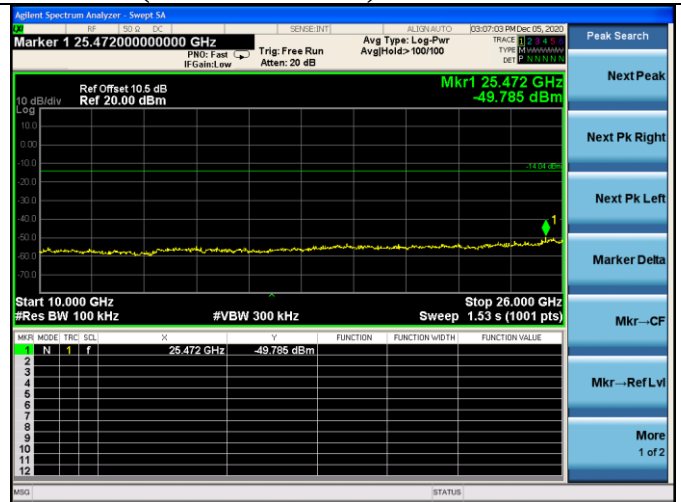
PASS (The testing data was attached in the next pages.)

EUT: Active Subwoofer		
M/N: SA-WS40R		
Test date: 2020-12-05	Pressure: 102.1 ±1.0 kpa	Humidity: 51.1 ±3.0%
Tested by: Lynn	Test site: RF site	Temperature:22.8±0.6 °C

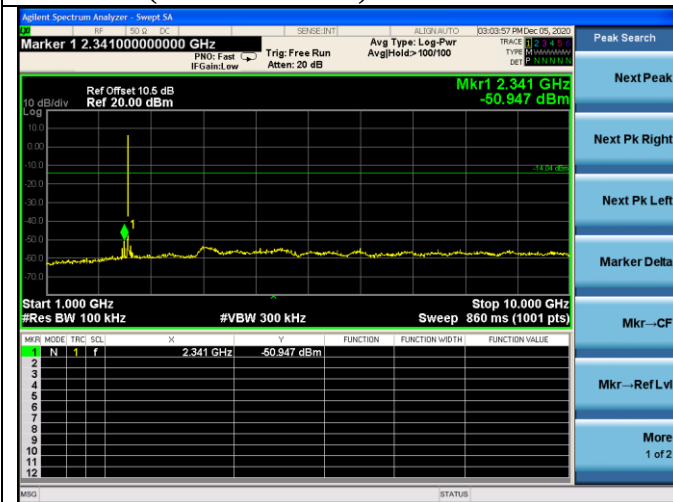
2404MHz(30MHz – 1GHz)



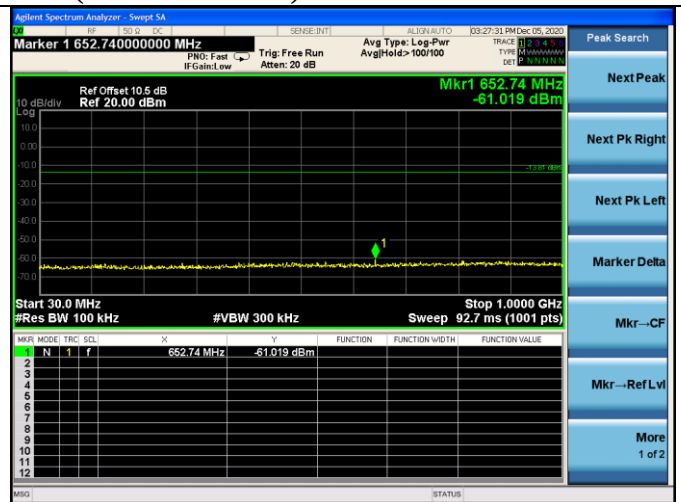
2404MHz(10GHz – 26GHz)



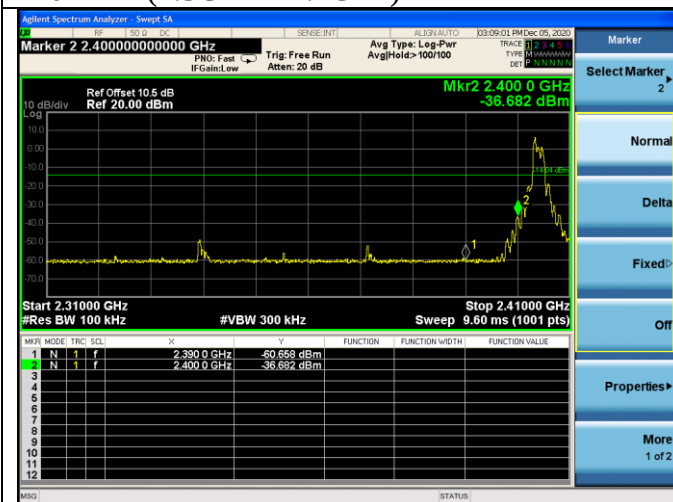
2404MHz(1GHz – 10GHz)



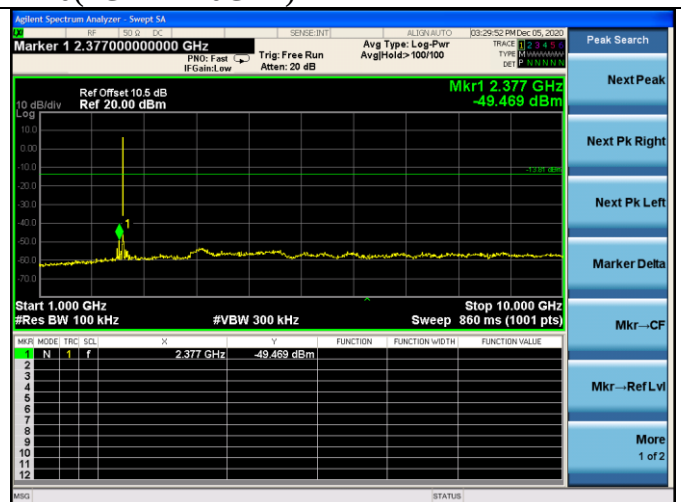
2440(30MHz – 1GHz)



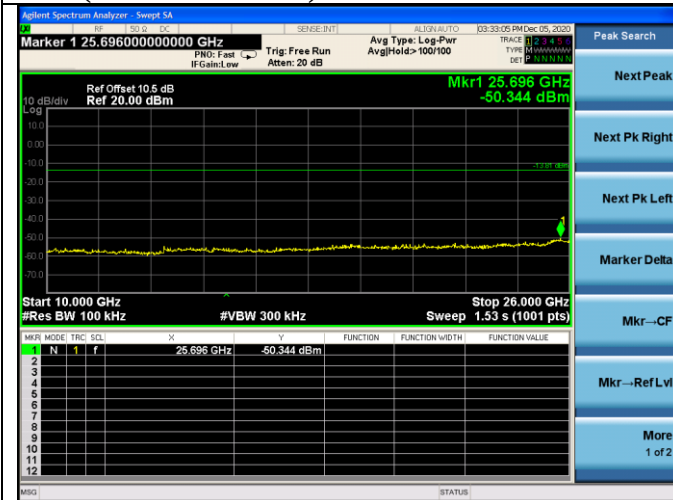
2404MHz(2.3GHz – 2.4GHz)



2440(1GHz – 10GHz)



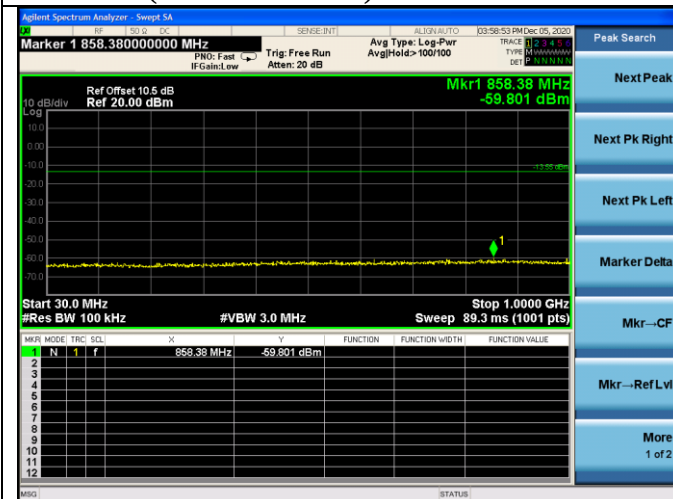
2440(10GHz – 26GHz)



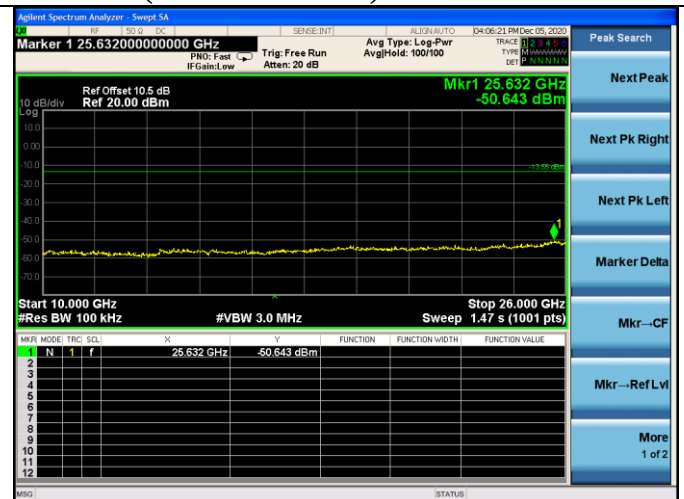
2476MHz(2.4GHz – 2.5GHz)



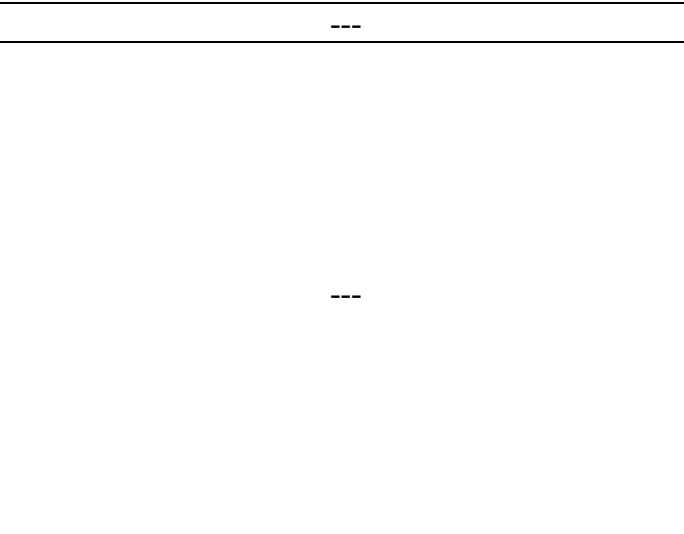
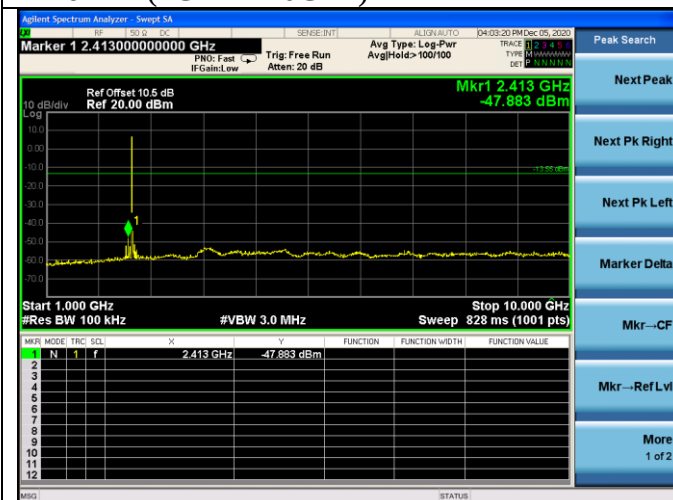
2476MHz(30MHz – 1GHz)



2476MHz(10GHz – 26GHz)



2476MHz(1GHz – 10GHz)



6. BAND EDGE COMPLIANCE TEST

6.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Amplifier	Agilent	8449B	3008A02495	Apr.11,20	1 Year
3.	Horn Antenna	ETC	MCTD 1209	DRH15F0300 6	Jul.30,20	1 Year
4.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	Apr.12,20	1 Year

6.2. Limit

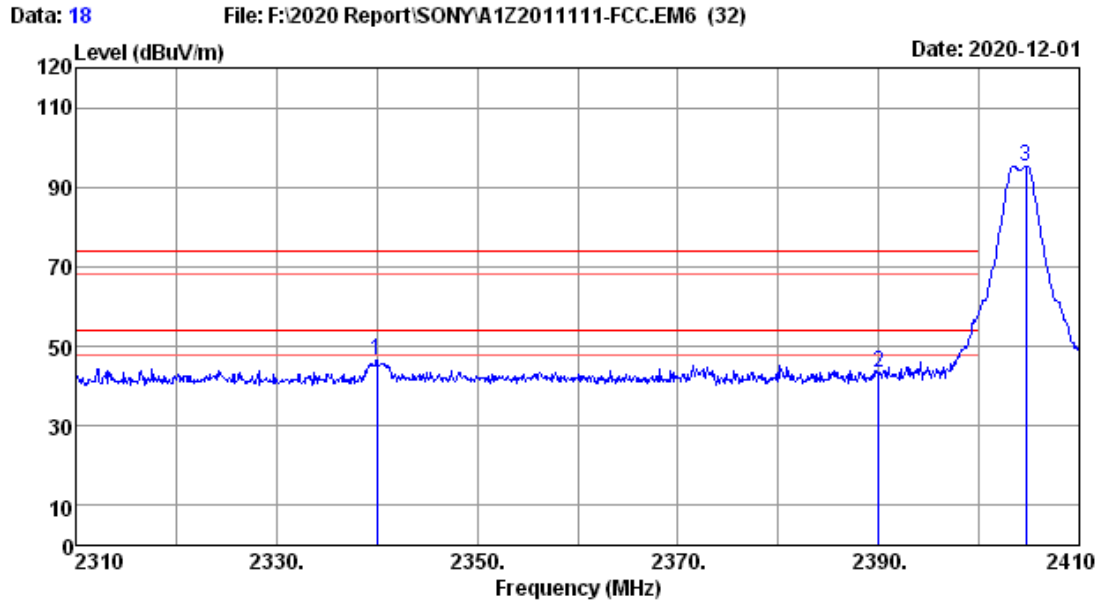
All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

6.3. Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above the ground plane and worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz ; VBW=3MHz, PK detector, Sweep=AUTO
 - (b) This device is pulse modulated, a duty cycle factor was used to calculate average level based measured peak level

6.4. Test Results

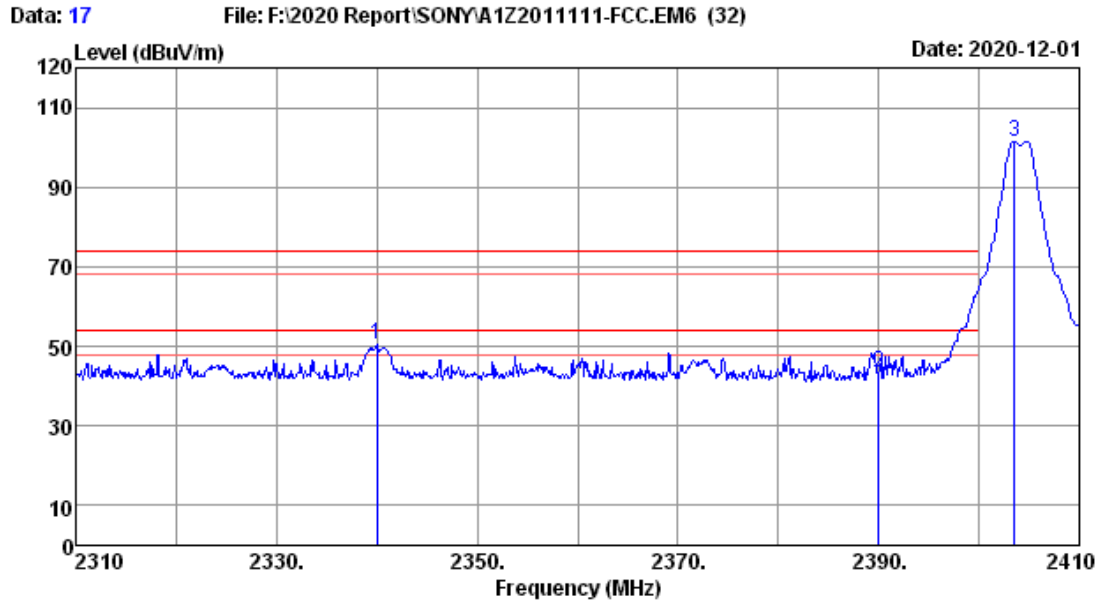
Pass (The testing data was attached in the next pages.)



Site no. : 3m Chamber Data no. : 18
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2404MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2340.00	27.92	0.90	51.32	33.50	46.64	74.00	27.36	Peak
2	2390.00	28.01	0.92	48.07	33.48	43.52	74.00	30.48	Peak
3	2404.70	28.04	0.92	99.82	33.48	95.30	-----	-----	Peak

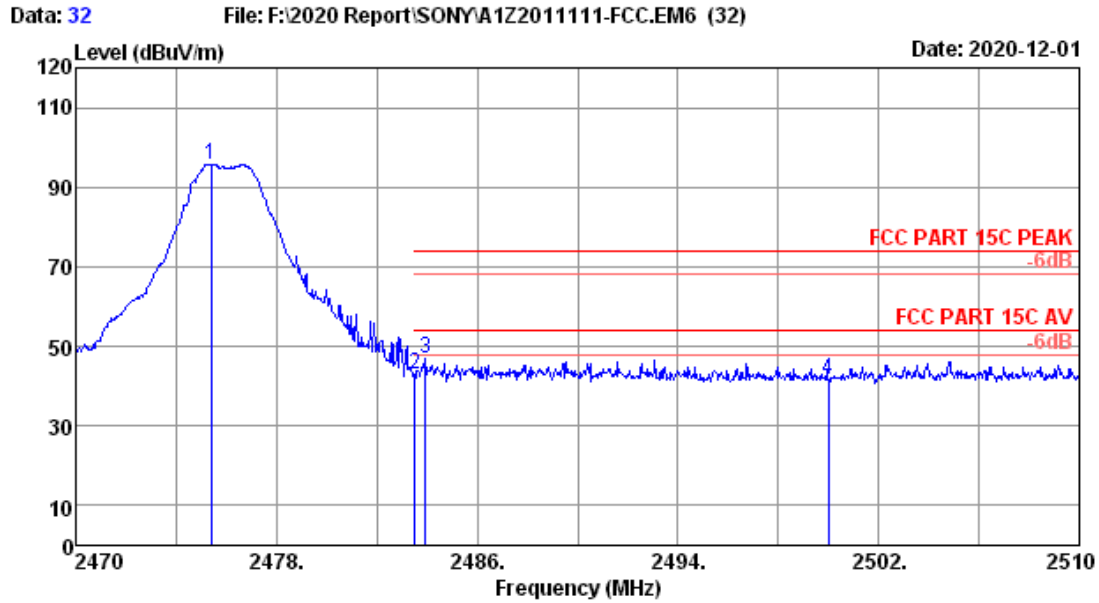
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



Site no. : 3m Chamber Data no. : 17
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2404MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2340.00	27.92	0.90	55.11	33.50	50.43	74.00	23.57	Peak
2	2390.00	28.01	0.92	47.82	33.48	43.27	74.00	30.73	Peak
3	2403.50	28.04	0.92	106.13	33.48	101.61	-----	-----	Peak

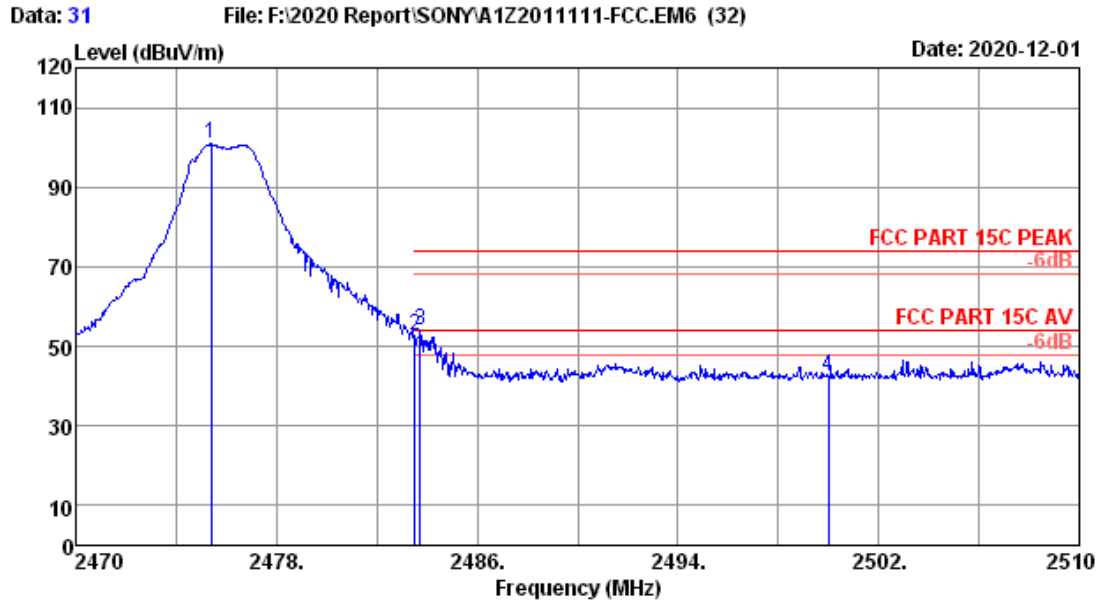
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



Site no. : 3m Chamber Data no. : 32
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2476MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2475.40	28.17	0.94	100.20	33.46	95.85	-----	-----	Peak
2	2483.50	28.17	0.94	47.48	33.46	43.13	74.00	30.87	Peak
3	2483.92	28.17	0.94	51.22	33.46	46.87	74.00	27.13	Peak
4	2500.00	28.20	0.95	45.97	33.45	41.67	74.00	32.33	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.



Site no. : 3m Chamber Data no. : 31
 Dis. / Ant. : 3m 2020 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4°C/52.9% Engineer : Lynn
 Test Mode : Wireless 2.4G 2476MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2475.40	28.17	0.94	105.12	33.46	100.77	-----	-----	Peak
2	2483.50	28.17	0.94	56.98	33.46	52.63	74.00	21.37	Peak
3	2483.72	28.17	0.94	58.33	33.46	53.98	74.00	20.02	Peak
4	2500.00	28.20	0.95	46.84	33.45	42.54	74.00	31.46	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
 -Amp factor.
 2. The emission levels that are 20dB below the official
 limit are not reported.

7. 6dB & 99% Bandwidth Test

7.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Attenuator	Agilent	8491B	MY39269201	Oct.12,20	1 Year
3.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	Apr.12,20	1 Year

7.2. Block Diagram of Test Setup



7.3. Limit

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

7.4. Test Procedure

Use the test method described in ANSI C63.10 Section 11.8:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

Use the test method described in ANSI C63.10 Section 6.9.2:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (\text{OBW}/\text{RBW})]$ below the reference level. Specific guidance is given in 4.1.5.2.
- Step a) through step c) might require iteration to adjust within the specified range.
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

7.5.Test Results

EUT: Active Subwoofer		
M/N: SA-WS40R		
Test date:2020-12-05	Pressure: 102.1 ±1.0 kpa	Humidity: 51.1 ±3.0%
Tested by: Lynn	Test site: RF site	Temperature:22.8±0.6 °C

Test Mode	Frequency (MHz)	-6dB bandwidth (MHz)	Limit (KHz)
GFSK	2404	1.561	≥ 500
	2440	1.013	
	2476	1.564	

Conclusion : PASS

Test Mode	Frequency (MHz)	99% bandwidth (MHz)	Limit (KHz)
GFSK	2404	2.2767	N/A
	2440	2.2852	
	2476	2.2797	

Conclusion : PASS

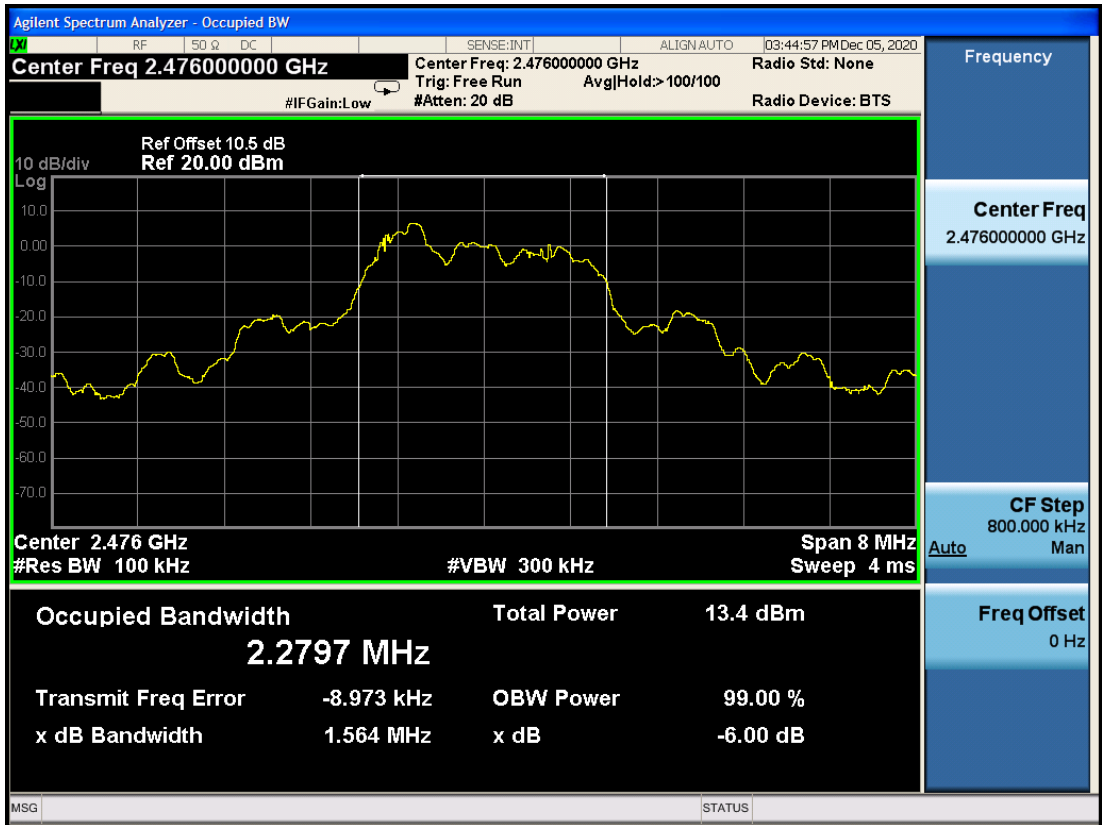
2404MHz:



2440MHz:



2476MHz:



8. OUTPUT POWER TEST

8.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Power meter	Anritsu	ML2487A	6K00002472	Apr.11,20	1 Year
3.	Power Sensor	Anritsu	MA2491A	033005	Apr.11,20	1 Year
4.	Attenuator	Agilent	8491B	MY39269201	Oct.12,20	1 Year
5.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	Apr.12,20	1 Year

8.2. Limit (FCC Part 15C 15.247 b(3))

For systems using digital modulation in the 2400—2483.5MHz, The Peak output Power shall not exceed 1W(30dBm), As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

8.3. Test Procedure

- 1, Connected the EUT's antenna port to Spectrum Analyzer.
- 2, Use the test method descried in ANSI C63.10 clause 11.9.1.1:
 - 1) Set the RBW $\geq$ DTS bandwidth.
 - 2) Set VBW $\geq$ $[3 \times \text{RBW}]$.
 - 3) Set span $\geq$ $[3 \times \text{RBW}]$.
 - 4) Sweep time = auto couple.
 - 5) Detector = peak.
 - 6) Trace mode = max hold.
 - 7) Allow trace to fully stabilize.
 - 8) Use peak marker function to determine the peak amplitude level.

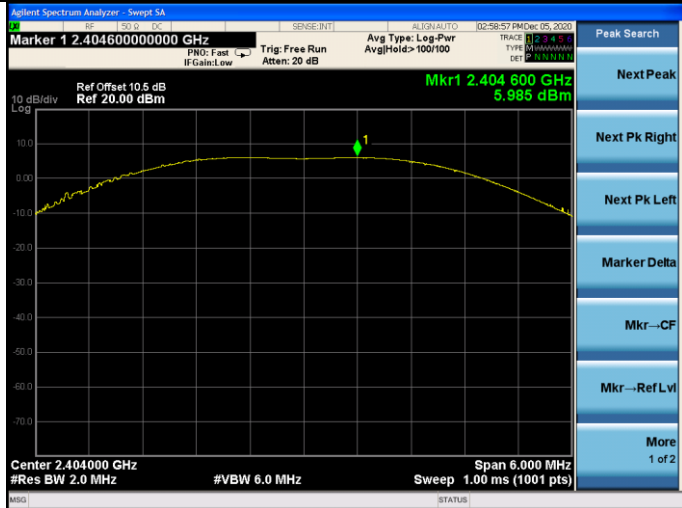
Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

8.4. Test Results

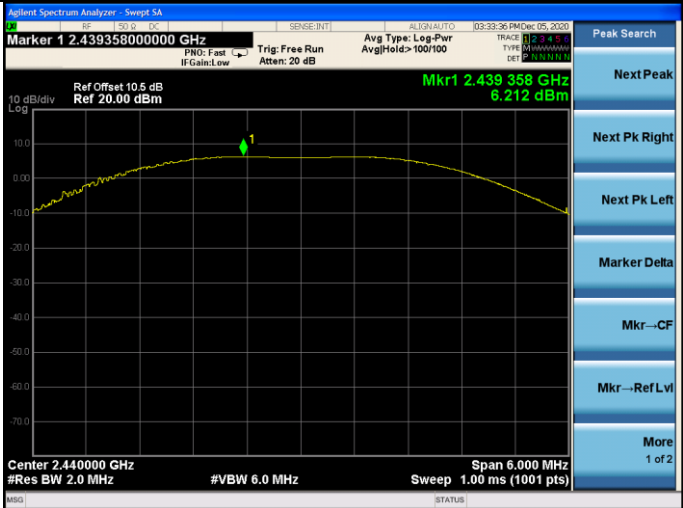
EUT: Active Subwoofer		
M/N: SA-WS40R		
Test date:2020-12-05	Pressure: 102.1 ±1.0 kpa	Humidity: 51.1 ±3.0%
Tested by: Lynn	Test site: RF site	Temperature:22.8 ±0.6 °C

Test Mode	Frequency (MHz)	Output power (dBm)	Limit (dBm)
GFSK	2404	5.985	30
	2440	6.212	
	2476	6.468	
Conclusion : PASS			

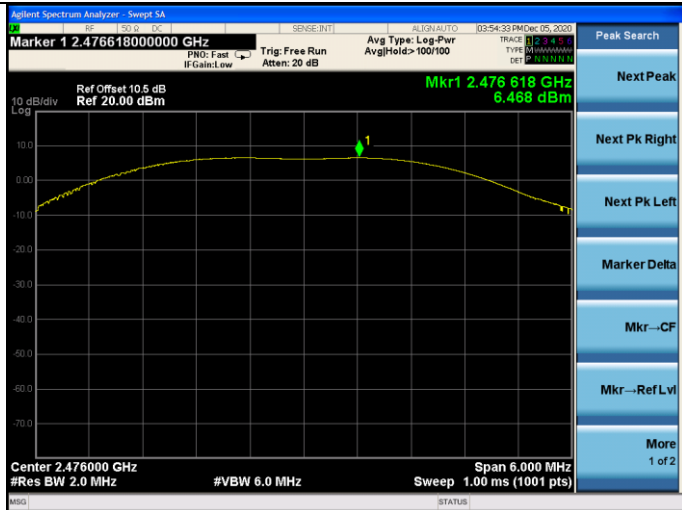
2404MHz



2440MHz



2476MHz



9. POWER SPECTRAL DENSITY TEST

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Attenuator	Agilent	8491B	MY39269201	Oct.12,20	1 Year
3.	RF Cable	EMCI	EMC102-KM-K M 3500	170702	Apr.12,20	1 Year

9.2. Limit

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

9.3. Test Procedure

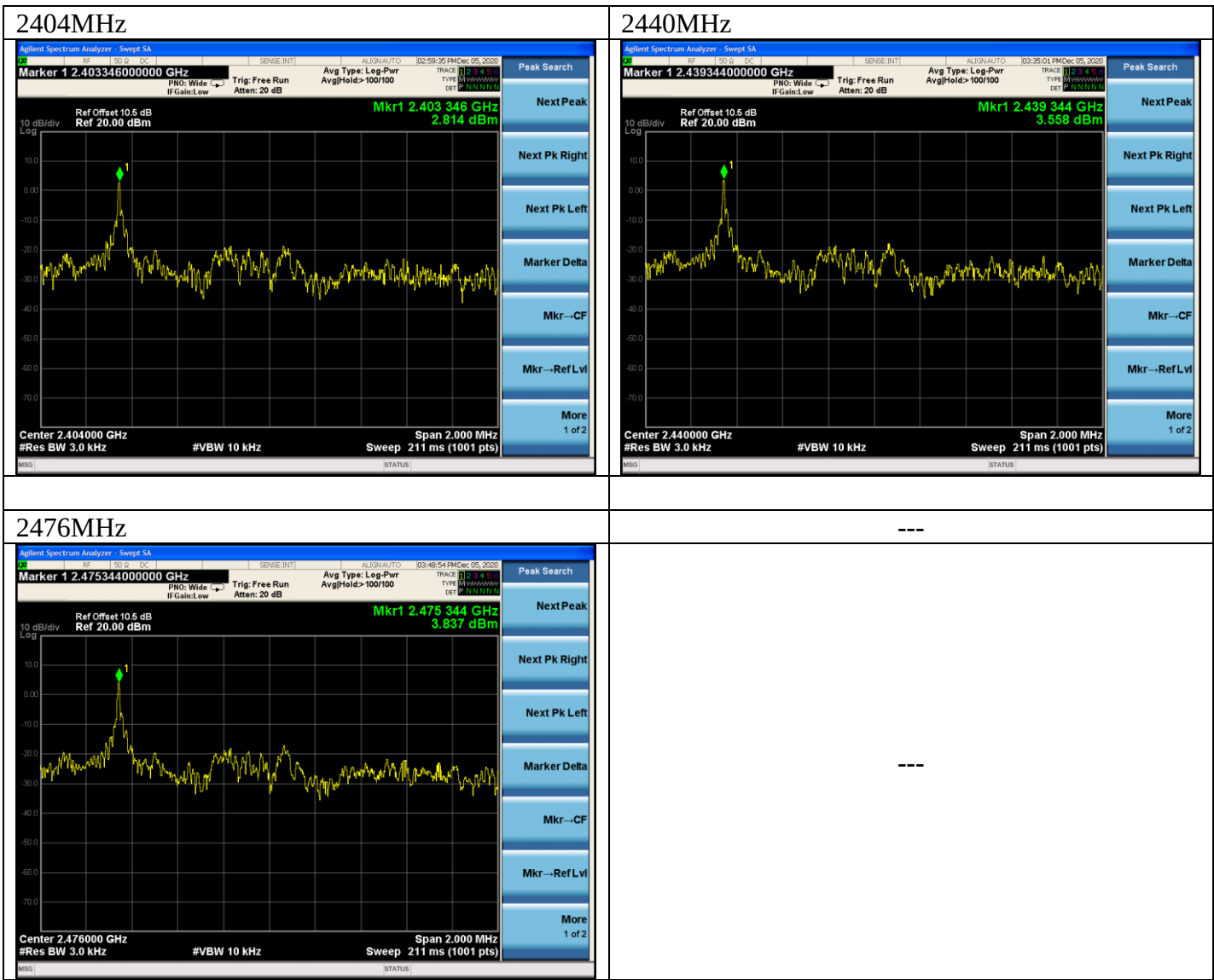
Use the test method described in ANSI C63.10 clause 11.10.2:

- 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 requirement, then reduce RBW (but no less than 3 kHz) and repeat.

9.4. Test Results

EUT: Active Subwoofer		
M/N: SA-WS40R		
Test date:2020-12-05	Pressure: 102.3±1.0 kpa	Humidity: 53.6±3.0%
Tested by: Lynn	Test site: RF site	Temperature: 25.5±0.6 °C

Test Mode	Frequency (MHz)	Power density (dBm/3KHz)	Limit (dBm/3KHz)
GFSK	2404	2.814	≤8
	2440	3.558	
	2476	3.837	
Conclusion : PASS			



10. ANTENNA REQUIREMENT

10.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

10.2. Antenna Connected Construction

The antennas used for this product are PCB antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.5dBi.

11.DEVIATION TO TEST SPECIFICATIONS

[NONE]

..... THE END