FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

Andover Audio LLC

2.0 Bluetooth speaker

Model Number: speakeasy 4

FCC ID: 2AQL4AAMD4SE4XX01NA

Applicant :	Andover Audio LLC
Address:	15 High St, North Andover, Massachusetts, 01845, United States
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
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Report Number:	ESTE-R2401158
Date of Test:	Nov. 08, 2023~Jan. 15, 2024
Date of Report:	Jan. 15, 2024

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Applicant: **Address:**	Andover Audio LLC 15 High St, North Andover, Massachusetts, 01845, United States
Manufacturer: **Address:**	Andover Audio LLC 15 High St, North Andover, Massachusetts, 01845, United States
Factory: **Address:**	Dongguan AS AUDIO Co., Ltd. NO.19 Yinping Road, Qingxi Town, Dongguan City, Guangdong Province, China
E.U.T:	2.0 Bluetooth speaker
Model Number:	speakeasy 4
Power Supply:	AC 100-240V, 50/60Hz
Trade Name:	Andover Audio Serial No.: ------
Date of Receipt:	Nov. 08, 2023 Date of Test: Nov. 08, 2023~Jan. 15, 2024
Test Specification:	FCC Part 15 Subpart C (15.247) ANSI C63.10:2013 FCC KDB 558074 D01 15.247 Meas Guidance v05r02
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd. **Date:** Jan. 15, 2024

Prepared by:	Reviewed by:	Approved by:
Ring Yang / Assistant	Seven Wang / Engineer	Iceman Hu / Manager

Other Aspects:
None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

1.GENERAL INFORMATION

1.1.Description of Device (EUT)

Product Name	:	2.0 Bluetooth speaker
Model Number	:	speakeasy 4
Software Version	:	N/A
Hardware Version	:	N/A
Operation frequency	:	2402MHz~2480MHz
Number of channel	:	79
Max Output Power (PEAK)	:	8.92dBm
Modulation Type	:	BT BDR(1Mbps): GFSK BT EDR(2Mbps): π/4-DQPSK BT EDR(3Mbps): 8-DPSK
Sample Type	:	Prototype production

Note:For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2.Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	Internal	-	1.03

Note:
1.The antenna gain is declared by the customer and the laboratory is not responsible for the accuracy of the antenna gain.
2.The test results of this report only apply to the sample as received.

1.3.Information of RF Cable

Cable Loss(dB)	Provided by
1.0	Andover Audio LLC

Note:
1.The customer declared the loss value of the RF Cable. and the test results of this report only apply to the sample as received.
2.The laboratory is not responsible for the accuracy of the cable loss.

2.SUMMARY OF TEST

2.1.Summary of test result

No.	Description of Test Item	FCC Standard Section	Results
1	Maximum Peak Output Power	15.247(a)(1)	PASS
2	20dB Bandwidth	15.247(a)(1)	PASS
3	Carrier Frequency Separation	15.247(a)(1)	PASS
4	Number Of Hopping Channel	15.247(a)(1)(iii)	PASS
5	Dwell Time	15.247(a)(1)(iii)	PASS
6	Conducted Band Edge	15.247(d)	PASS
7	Conducted Spurious Emissions	15.247(d)	PASS
8	Radiated Spurious Emissions and Band Edge	15.205 15.209 15.247(d)	PASS
9	AC Power Line Conducted Emissions	15.207	PASS
10	Antenna Requirement	15.203	PASS

Note:“N/A” denotes test is not applicable in this test report.

2.2.Test Facilities

EMC Lab	:	Accredited by CNAS, CHINA Registration No.: L5288 This Accreditation is valid until: November 12, 2029 Recognized by FCC, USA Designation Number: CN1215 This Recognition is valid until: January 31, 2024 Accredited by A2LA, USA Registration No.: 4366.01 This Accreditation is valid until: January 31, 2024 Recognized by Industry Canada CAB identifier No.: CN0035 This Recognition is valid until: January 31, 2024 Recognized by VCCI, Japan Registration No.:C-14103; T-20073; R-13663; R-20103; G-20097 Date of registration: Apr. 20, 2020 This Recognition is valid until: Apr. 19, 2026 Recognized by TUV Rheinland, Germany Registration No.: UA 50413872 0001 Date of registration: July 31, 2018 Recognized by Intertek Registration No.: 2011-RTL-L2-64 Date of registration: November 08, 2018
Name of Firm	:	EST Technology Co., Ltd.
Site Location	:	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

2.3.Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	±3.48dB
Uncertainty for spurious emissions test (Below 30MHz)	±1.62 dB
Uncertainty for spurious emissions test (30MHz-1GHz)	±4.60 dB(Polarize: H)
	±4.68 dB(Polarize: V)
Uncertainty for spurious emissions test (1GHz to 25GHz)	±4.96dB
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

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

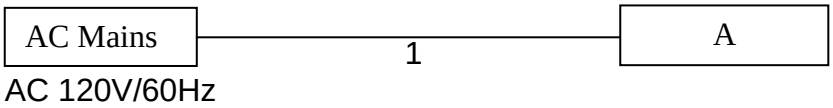
2.4.Assistant equipment used for test

Item	Equipment	Manufacturer	Model Name/Type No.	Equipment No.	Series No.
A	Laptop computer	DELL	Insprion 5493	EST-E316	5376699759

Item	Equipment	Manufacturer	Model Name/Type No.	Equipment No.	Series No.
1	cable	/	/	EST-E308	/

2.5.Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.



AC 120V/60Hz

(EUT: 2.0 Bluetooth speaker)

2.6.Test mode

Combining all the rates, modulations, and packet types, the Pre-scans had been carried out. The worst case test mode was selected for the final test as listed below.

Test Item	Modulation Type	Operating Mode	Packet Type	Test Channel
Maximum Peak Output Power	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High
20dB Bandwidth	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High
Carrier Frequency Separation	GFSK&8-DPSK &π/4-DQPSK	Hopping	DH5	Low/Middle/High
Number Of Hopping Channel	GFSK&8-DPSK &π/4-DQPSK	Hopping	DH5	All Channel Hopping
Dwell Time	GFSK&8-DPSK &π/4-DQPSK	Hopping	DH1/DH 3/DH5	Middle(All Channel Hopping)
Conducted Band Edge	GFSK&8-DPSK &π/4-DQPSK	Non Hopping&Hopping	DH5	Low/ High& All Channel Hopping
Conducted Spurious Emissions	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High
Radiated Spurious Emissions(Below 1GHz)	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High
Radiated Spurious Emissions(Above 1GHz)	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High
Radiated Band Edge	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/High
AC Power Line Conducted Emissions	GFSK&8-DPSK &π/4-DQPSK	Non Hopping	DH5	Low/Middle/High

Note: In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane.**

2.7.Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

2.8.Power Setting of Test Software

Software Name	BT FCC Tool V2.24		
Frequency(MHz)	2402	2441	2480
GFSK(1Mbps) Setting	3	3	3
π/4-DQPSK (2Mbps) Setting	3	3	3
8-DPSK(3Mbps) Setting	3	3	3

Note: This information is provided by the applicant.

2.9.Test Equipment

For conducted emission test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	EST-E001	LISAI	June 12,23	1 Year
Artificial Mains Network	Rohde & Schwarz	ENV216	EST-E002	LISAI	June 12,23	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	EST-E078	LISAI	June 12,23	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A

For radiated emission test(9 kHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 12,23	1 Year
Active Loop Antenna	SCHWAREBECK	FMZB 1519B	EST-E054	LISAI	June 12,23	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	N/A	EST-001	N/A	N/A	N/A	N/A

For radiated emissions test (30-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 12,23	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	June 12,23	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For radiated emission test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBECK	BBHA9120D	EST-E144	LISAI	June 12,23	1 Year
Horn Antenna	Com-Power	AHA-840	EST-E133	LISAI	June 12,23	1 Year
Low Noise Amplifier	RF	TRLA-010180 G45N	EST-E142	LISAI	June 12,23	1 Year
Spectrum Analyzer	Rohde &Schwarz	FSV40	EST-E069	LISAI	June 12,23	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

For connect EUT antenna terminal test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
TS 1120	Tonscend	/	/	/	/	/
Test Software	Tonscend	TS1120-3	3.3.38	/	/	/
RF Control Unit	Tonscend	JS0806-2	EST-E134	LISAI	June 12,23	1 Year
Signal and Spectrum Analyzer	Keysight	N9010B	EST-E141	LISAI	June 12,23	1 Year

3.MAXIMUM PEAK OUTPUT POWER

3.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

3.2.Test Setup

3.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	3MHz
VBW	3MHz
Span	7.5MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

3.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 3.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

3.5.Test Result

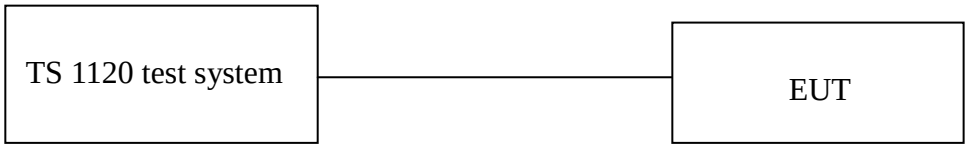
Refer to section 13: Appendix B

4.20 DB BANDWIDTH

4.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

4.2.Test Setup



4.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	30KHz
VBW	100KHz
Span	3MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

4.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 4.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the ndB down function to measure 20dB Bandwidth.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

4.5.Test Result

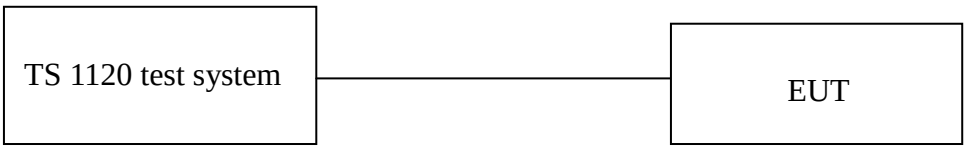
Refer to section 13: Appendix A

5.CARRIER FREQUENCY SEPARATION

5.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.2.Test Setup



5.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	30KHz
VBW	100KHz
Span	3MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

5.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 5.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-delta function to measure channel separation between two adjacent channels.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

5.5.Test Result

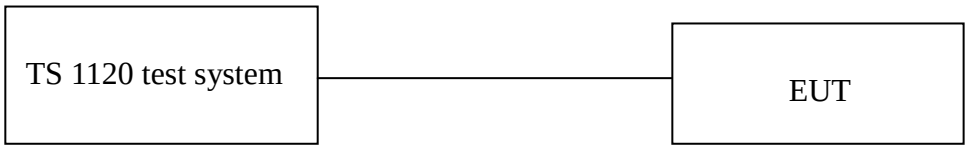
Refer to section 13: Appendix C

6.NUMBER OF HOPPING CHANNEL

6.1.Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

6.2.Test Setup



6.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	300KHz
VBW	300KHz
Start frequency	2400MHz
Stop frequency	2483.5MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

6.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 6.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-peak function to mark the first and last frequency hopping channel.
e. Repeat above procedures until all test modes were measured.
f. Record the results in the test report.

6.5.Test Result

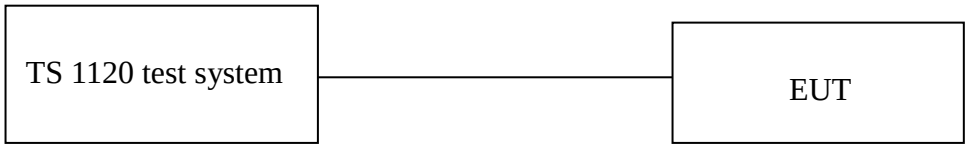
Refer to section 13: Appendix E

7.DWELL TIME

7.1.Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

7.2.Test Setup



7.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz
VBW	1MHz
Span	Zero
Detector	Peak
Sweep Time	2.5ms(DH1)/10ms(DH3)/20ms(DH5)
Sweep Mode	Single Sweep

7.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 7.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-delta function to measure single pulse duration.
e. Repeat above procedures until all test modes were measured.
f. Record the results in the test report.

7.5.Test Result

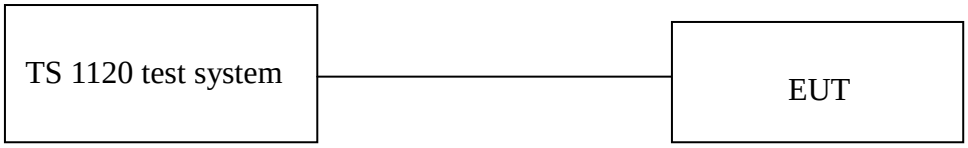
Refer to section 13: Appendix D

8.CONDUCTED BAND EDGE

8.1.Limit

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) (see §15.205(c)).

8.2.Test Setup



8.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	100MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

8.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 8.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all channels and test modes were measured(including frequency hopping off and frequency hopping on).
f. Record the results in the test report.

8.5.Test Result

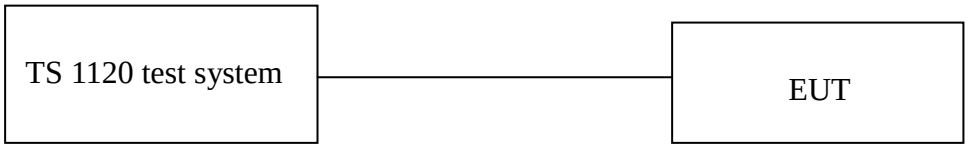
Refer to section 13: Appendix F & H

9.CONDUCTED SPURIOUS EMISSIONS

9.1.Limit

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 ntentional 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) (see §15.205(c)).

9.2.Test Setup



9.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	26.5GHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

9.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 9.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

9.5.Test Result

Refer to section 13: Appendix G & H

10. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

10.1. Limit

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.

15.205 Restricted frequency band

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])

15.209 Limit

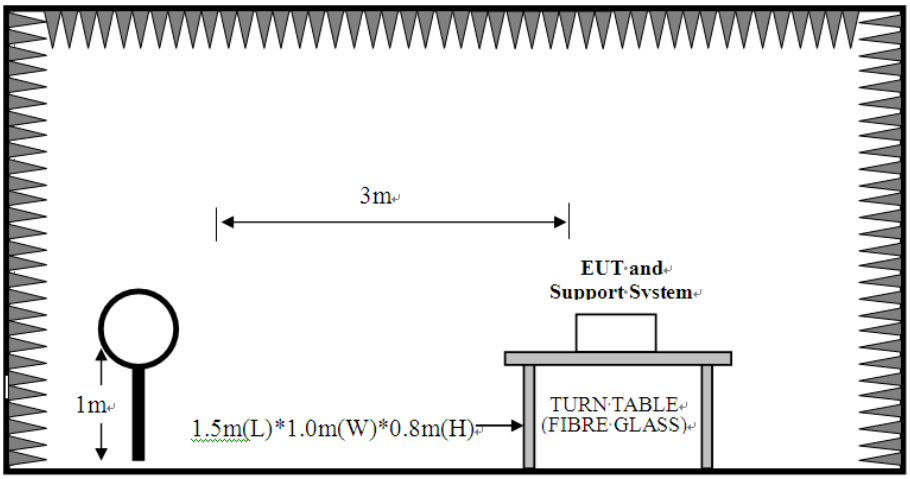
Frequency (MHz)	Field Strength(μV/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

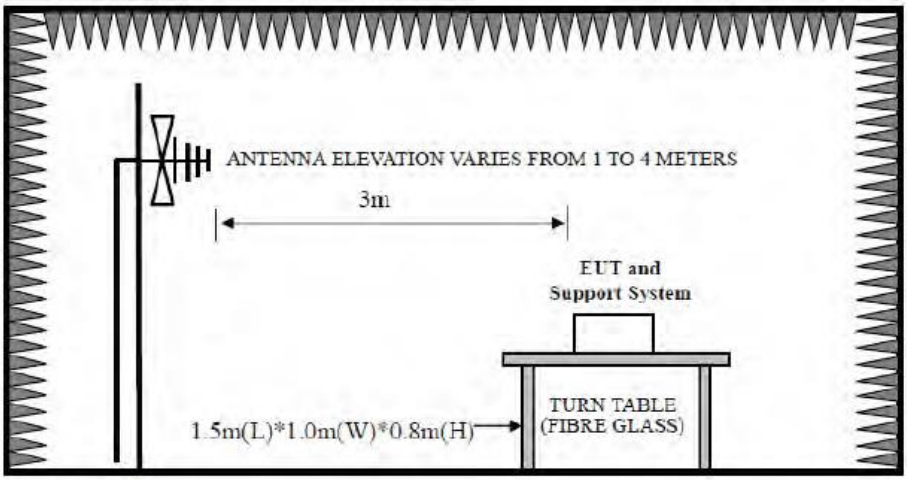
(1) Emission level dBμV = 20 log Emission level μV/m.
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument,antenna and the closest point of any part of the device or system.

10.2. Test Setup

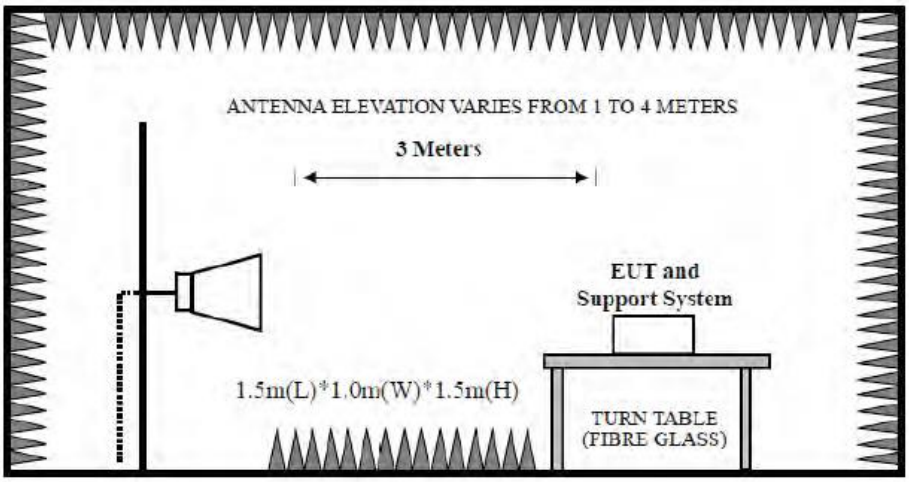
9kHz~30MHz



30~1000MHz



Above 1GHz



10.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
VBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For Above 1GHz

Spectrum Parameters	Setting	
RBW	1MHz	
VBW	PEAK Measurement	AVG Measurement
	3MHz	Duty cycle≥98%,VBW=10Hz
		Duty cycle＜98%,VBW≥1/T
Start frequency	1GHz	
Stop frequency	25GHz	
Sweep Time	Auto	
Detector	PEAK	
Trace Mode	Max Hold	

10.4. Test Procedure

a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
b. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
c. Set the EUT transmit continuously with maximum output power.
d. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
e. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
f. Spectrum analyzer setting parameters in accordance with section 10.3.
g. Repeat above procedures until all channels and test modes were measured.
h. Record the results in the test report.

Note:

1. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
2. The frequency 2402MHz ,2441MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

10.5. Test Result

Radiated Emissions Below 1GHz

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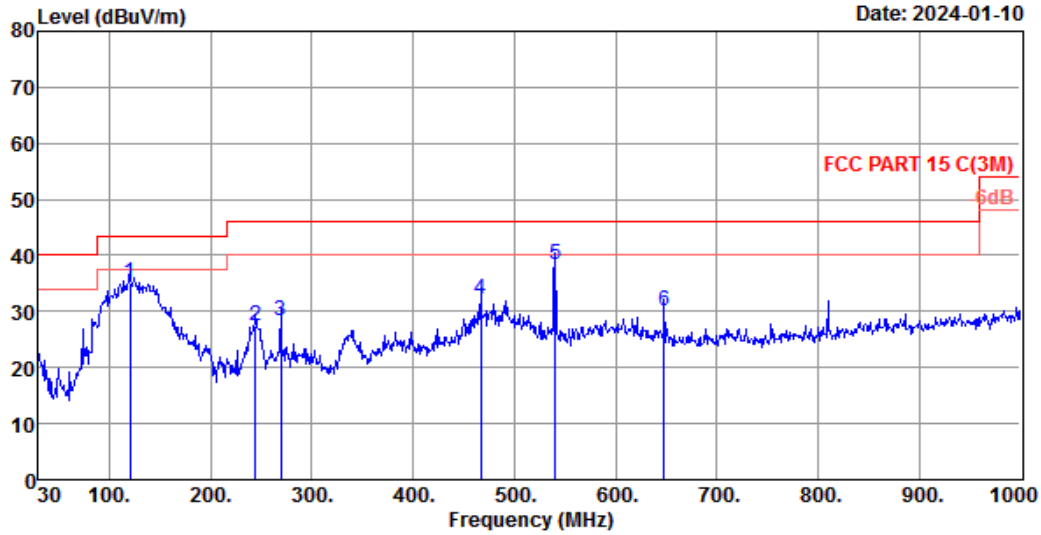
Data: 1 File: \\EMC-966-2\test data\2024\RF\A\Ai Sheng.EM6 (4)



Site no. : 2# 966 chamber Data no. : 1
Dis. / Ant. : 3m 47018 Ant. pol. : VERTICAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:26.6℃;Humi:58%;Press:101.52kPa
Engineer : GBond
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : Speakeasy 4
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	120.21	11.60	1.68	21.99	35.27	43.50	8.23	QP
2	244.37	11.95	1.92	13.72	27.59	46.00	18.41	QP
3	269.59	13.70	2.05	12.57	28.32	46.00	17.68	QP
4	466.50	17.66	2.81	11.68	32.15	46.00	13.85	QP
5	540.22	19.60	3.07	15.76	38.43	46.00	7.57	QP
6	647.89	21.42	3.45	5.29	30.16	46.00	15.84	QP

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

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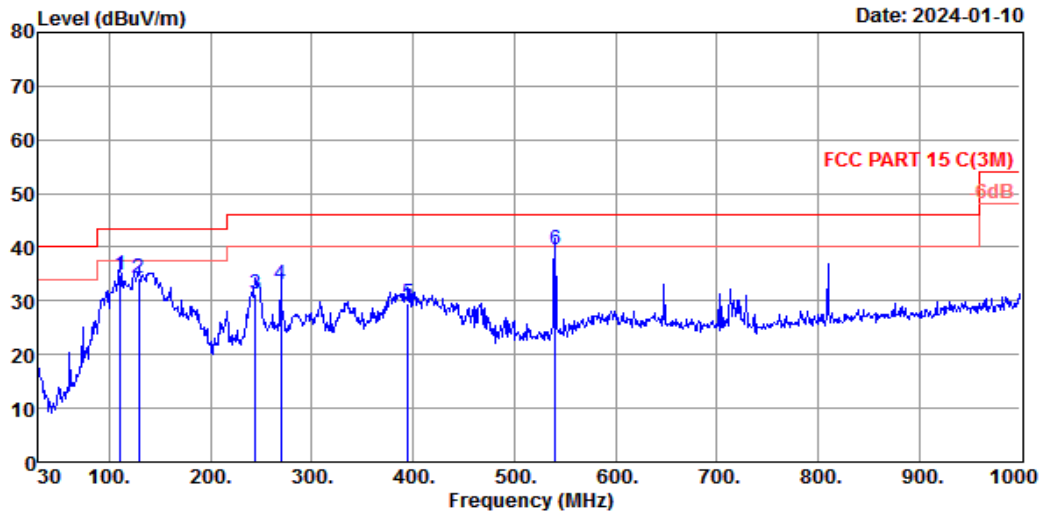
Data: 2 File: \\EMC-966-2\test data\2024\RF\A\Ai Sheng.EM6 (4)



Site no. : 2# 966 chamber Data no. : 2
Dis. / Ant. : 3m 47018 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:26.6℃;Humi:58%;Press:101.52kPa
Engineer : GBond
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : Speakeasy 4
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	110.51	10.97	1.74	22.13	34.84	43.50	8.66	QP
2	128.94	12.06	1.63	20.57	34.26	43.50	9.24	QP
3	244.37	11.95	1.92	17.50	31.37	46.00	14.63	QP
4	269.59	13.70	2.05	17.24	32.99	46.00	13.01	QP
5	394.72	16.35	2.57	10.47	29.39	46.00	16.61	QP
6	540.22	19.60	3.07	16.92	39.59	46.00	6.41	QP

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

Note:

1. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test,only the worst case was reported.

Radiated Emissions Above 1G

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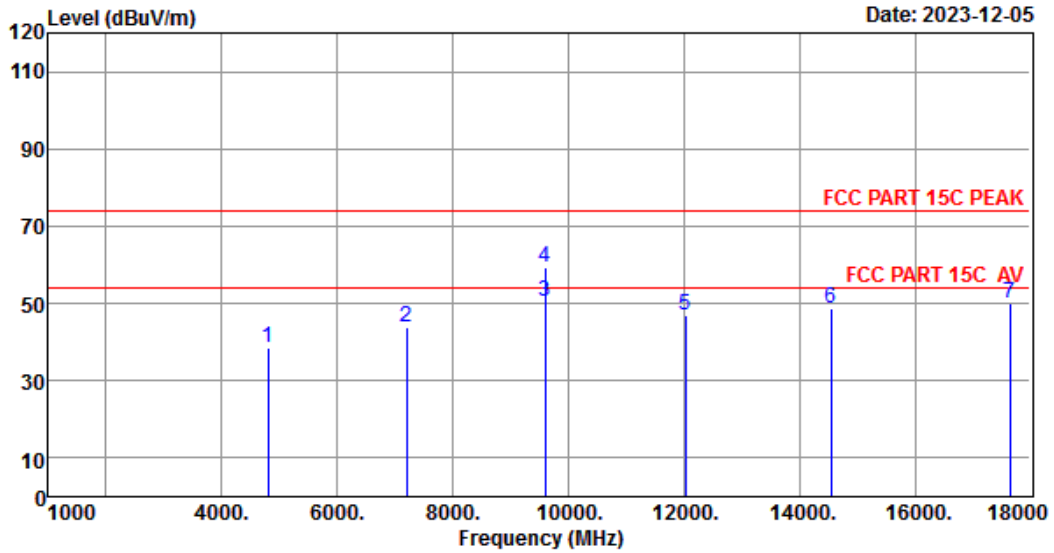
Data: 19 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 19
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4804.00	32.39	5.20	44.49	45.32	38.42	74.00	35.58	Peak
2	7206.00	36.16	6.67	44.08	45.07	43.82	74.00	30.18	Peak
3	9602.00	38.12	7.77	43.64	48.28	50.53	54.00	3.47	Average
4	9602.00	38.12	7.77	43.64	57.04	59.29	74.00	14.71	Peak
5	12033.00	38.83	8.84	42.15	41.38	46.90	74.00	27.10	Peak
6	14549.00	39.73	10.03	42.16	41.06	48.66	74.00	25.34	Peak
7	17643.00	40.42	12.14	43.23	40.71	50.04	74.00	23.96	Peak

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

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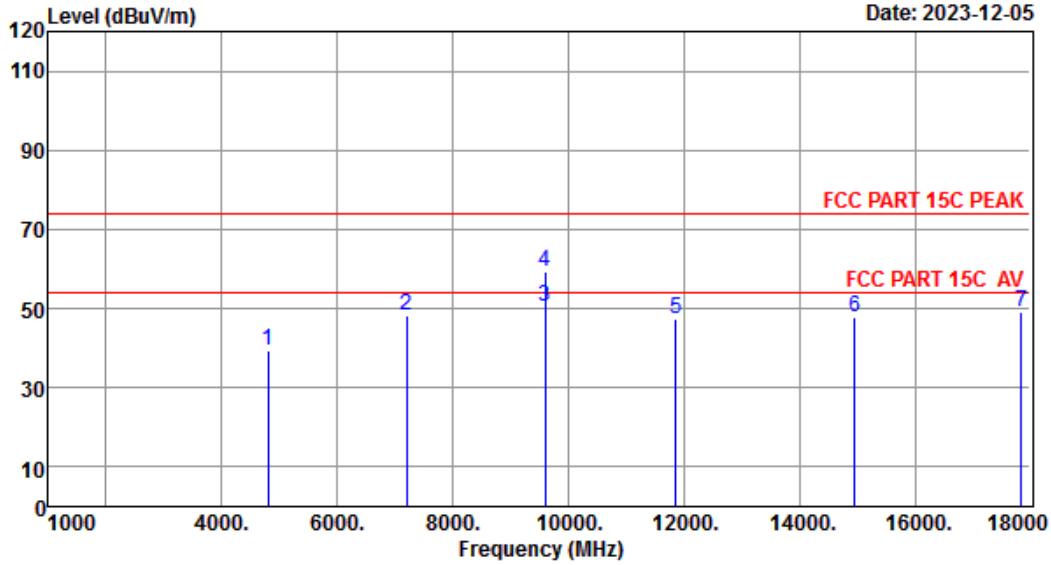
Data: 20 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 20
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4804.00	32.39	5.20	44.49	46.19	39.29	74.00	34.71	Peak
2	7206.00	36.16	6.67	44.08	49.57	48.32	74.00	25.68	Peak
3	9602.00	38.12	7.77	43.64	48.28	50.53	54.00	3.47	Average
4	9602.00	38.12	7.77	43.64	56.91	59.16	74.00	14.84	Peak
5	11863.00	38.81	8.75	42.31	42.07	47.32	74.00	26.68	Peak
6	14957.00	39.52	10.23	43.17	41.22	47.80	74.00	26.20	Peak
7	17847.00	41.10	12.32	42.93	38.76	49.25	74.00	24.75	Peak

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

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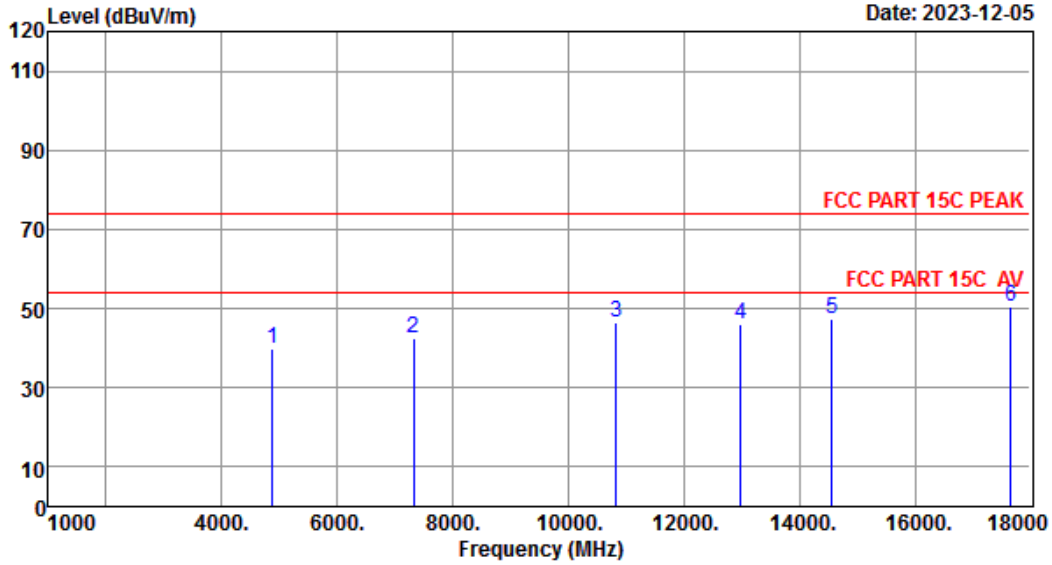
Data: 21 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 21
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4880.00	32.55	5.28	44.42	46.26	39.67	74.00	34.33	Peak
2	7320.00	36.26	6.70	44.07	43.64	42.53	74.00	31.47	Peak
3	10826.00	38.78	8.18	43.14	42.87	46.69	74.00	27.31	Peak
4	12985.00	39.69	9.25	40.82	38.13	46.25	74.00	27.75	Peak
5	14566.00	39.72	10.04	42.20	39.82	47.38	74.00	26.62	Peak
6	17660.00	40.48	12.15	43.21	40.90	50.32	74.00	23.68	Peak

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

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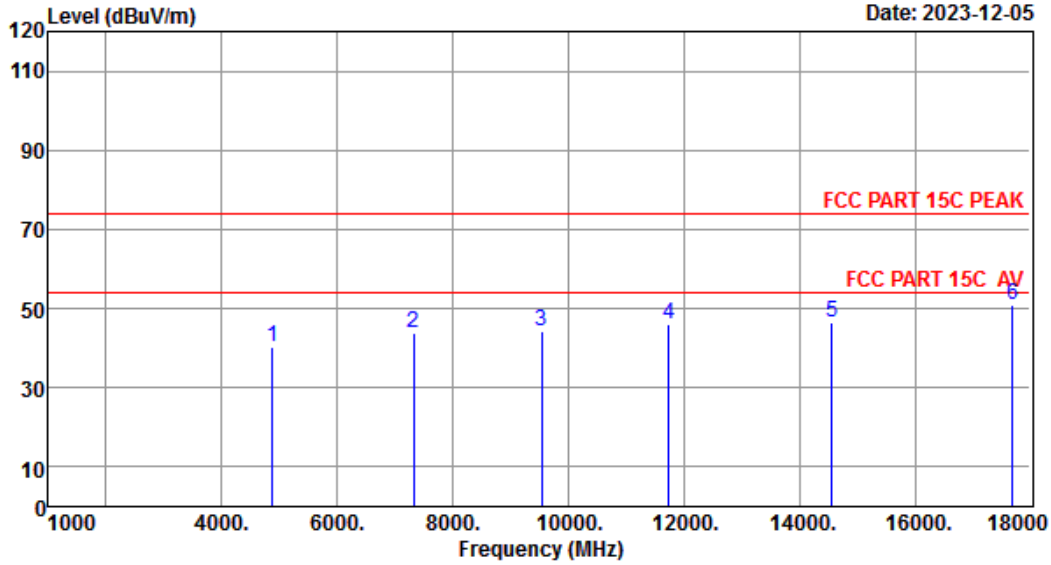
Data: 22 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 22
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4880.00	32.55	5.28	44.42	46.96	40.37	74.00	33.63	Peak
2	7320.00	36.26	6.70	44.07	44.88	43.77	74.00	30.23	Peak
3	9534.00	38.11	7.77	43.61	42.09	44.36	74.00	29.64	Peak
4	11744.00	38.83	8.69	42.40	41.03	46.15	74.00	27.85	Peak
5	14566.00	39.72	10.04	42.20	39.10	46.66	74.00	27.34	Peak
6	17694.00	40.59	12.18	43.16	41.20	50.81	74.00	23.19	Peak

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

EST Technology

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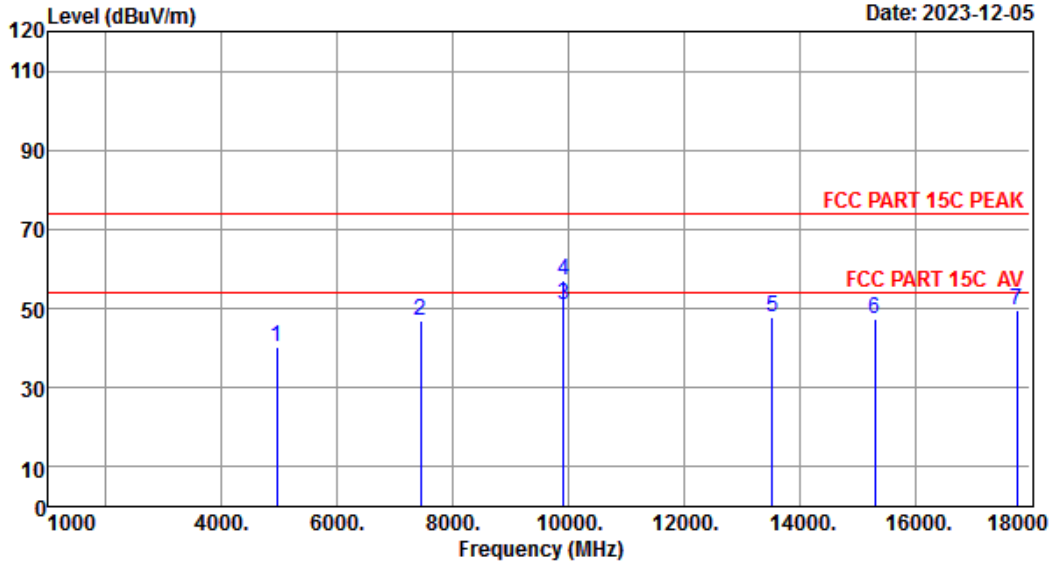
Data: 23 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 23
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4960.00	32.72	5.37	44.33	46.65	40.41	74.00	33.59	Peak
2	7440.00	36.35	6.74	44.06	47.82	46.85	74.00	27.15	Peak
3	9925.00	38.19	7.77	43.77	48.57	50.76	54.00	3.24	Average
4	9925.00	38.19	7.77	43.77	54.82	57.01	74.00	16.99	Peak
5	13529.00	39.86	9.53	40.80	39.40	47.99	74.00	26.01	Peak
6	15314.00	38.97	10.37	43.55	41.63	47.42	74.00	26.58	Peak
7	17762.00	40.81	12.24	43.06	39.54	49.53	74.00	24.47	Peak

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

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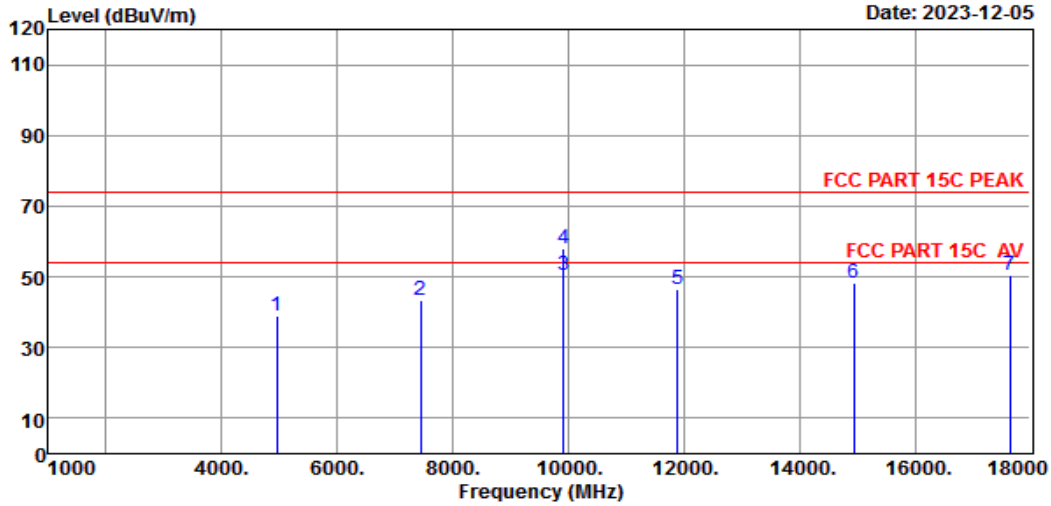
Data: 24 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 24
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4960.00	32.72	5.37	44.33	45.09	38.85	74.00	35.15	Peak
2	7440.00	36.35	6.74	44.06	44.34	43.37	74.00	30.63	Peak
3	9925.00	38.19	7.77	43.77	48.27	50.46	54.00	3.54	Average
4	9925.00	38.19	7.77	43.77	55.88	58.07	74.00	15.93	Peak
5	11897.00	38.81	8.77	42.28	41.39	46.69	74.00	27.31	Peak
6	14940.00	39.53	10.22	43.13	41.69	48.31	74.00	25.69	Peak
7	17643.00	40.42	12.14	43.23	41.04	50.37	74.00	23.63	Peak

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

Note:

1. The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test,only Low/Middle/High Channel of the worst case modulation mode was reported.

Radiated Band Edge

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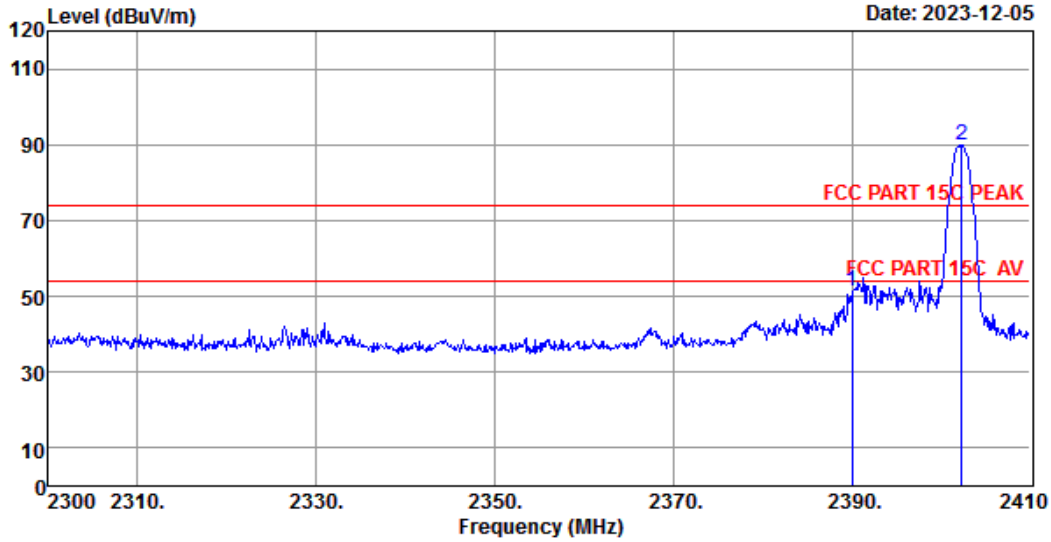
Data: 1 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 1
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	3.55	45.01	65.24	51.21	74.00	22.79	Peak
2	2402.30	27.47	3.55	45.01	103.72	89.73	74.00	-15.73	Peak

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

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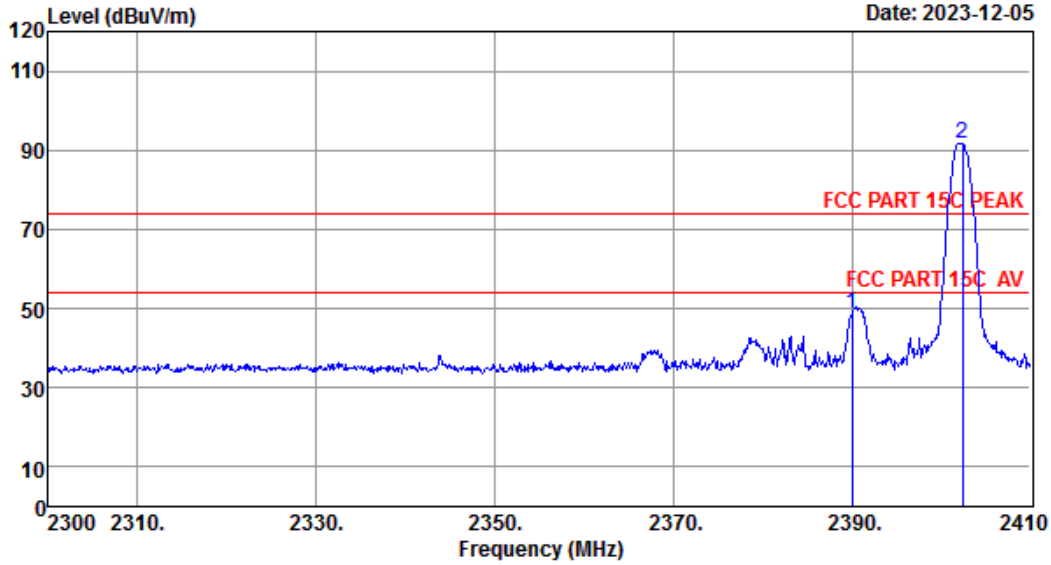
Data: 2 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 2
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	3.55	45.01	62.62	48.59	74.00	25.41	Peak
2	2402.41	27.47	3.55	45.01	105.77	91.78	74.00	-17.78	Peak

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

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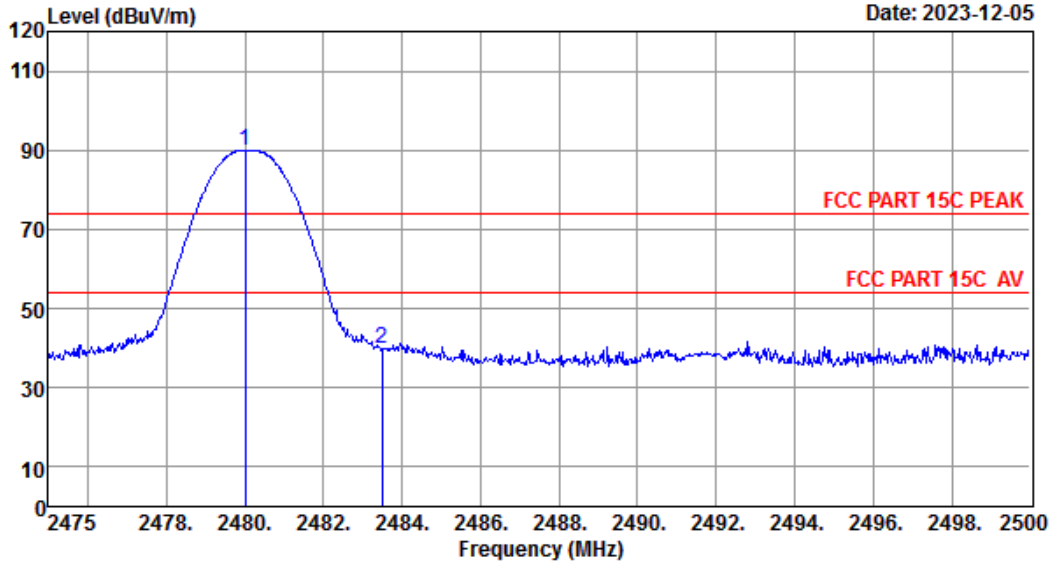
Data: 3 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 3
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.69	3.62	44.93	103.67	90.05	74.00	-16.05	Peak
2	2483.50	27.70	3.62	44.93	53.68	40.07	74.00	33.93	Peak

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

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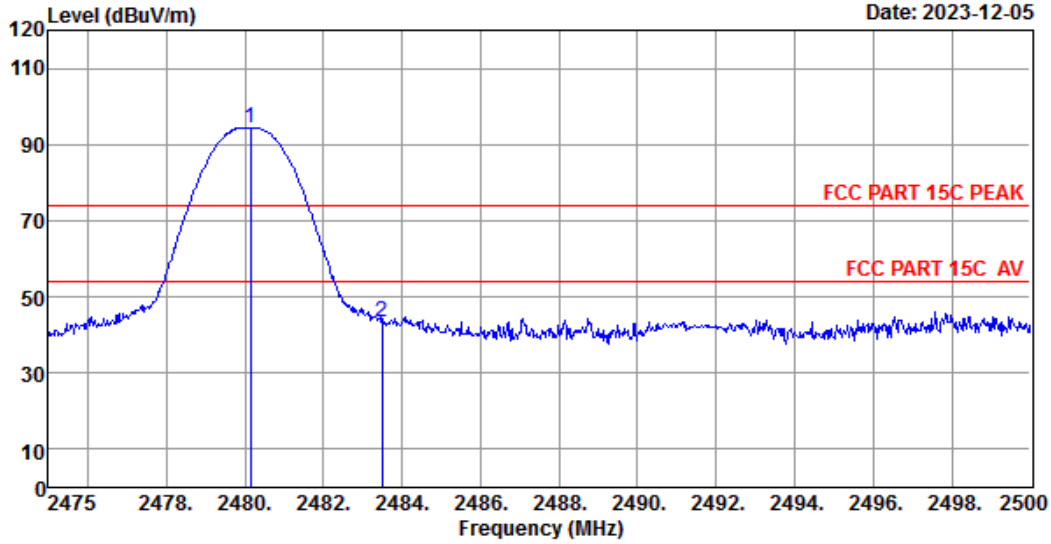
Data: 4 File: \\EMC-966-1\test data\2023\RF\A\AI SHENG\speakeasy 4.EM6 (30)



Site no. : 1# 966 Chamber Data no. : 4
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5℃;Humi:50%;Press:101.55kPa
Engineer : QQZ
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.15	27.69	3.62	44.93	108.12	94.50	74.00	-20.50	Peak
2	2483.50	27.70	3.62	44.93	57.00	43.39	74.00	30.61	Peak

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

Note: All test mode had been pre-test,only Low/High Channel of the worst case modulation mode was reported.

11. AC POWER LINE CONDUCTED EMISSIONS

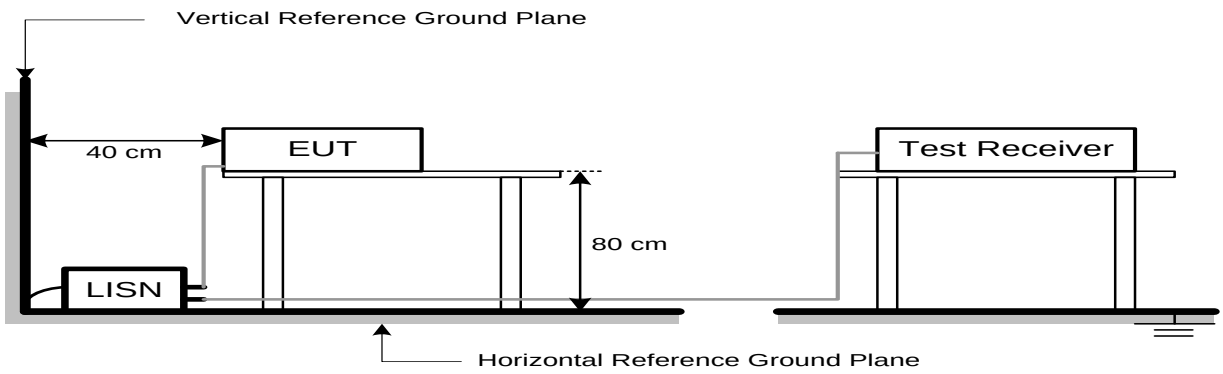
11.1. Limit

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

Note:

1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

11.2. Test Setup



11.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP/AVG
Trace Mode	Max Hold

11.4. Test Procedure

a. The EUT was placed on a non-metallic table, 80cm above the ground plane.
b. The EUT Power connected to the power mains through a line impedance stabilization network.
c. Provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs).
d. Set the EUT transmit continuously with maximum output power.
e. Spectrum analyzer setting parameters in accordance with section 11.3.
f. 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.
g. Record the results in the test report.

11.5. Test Result

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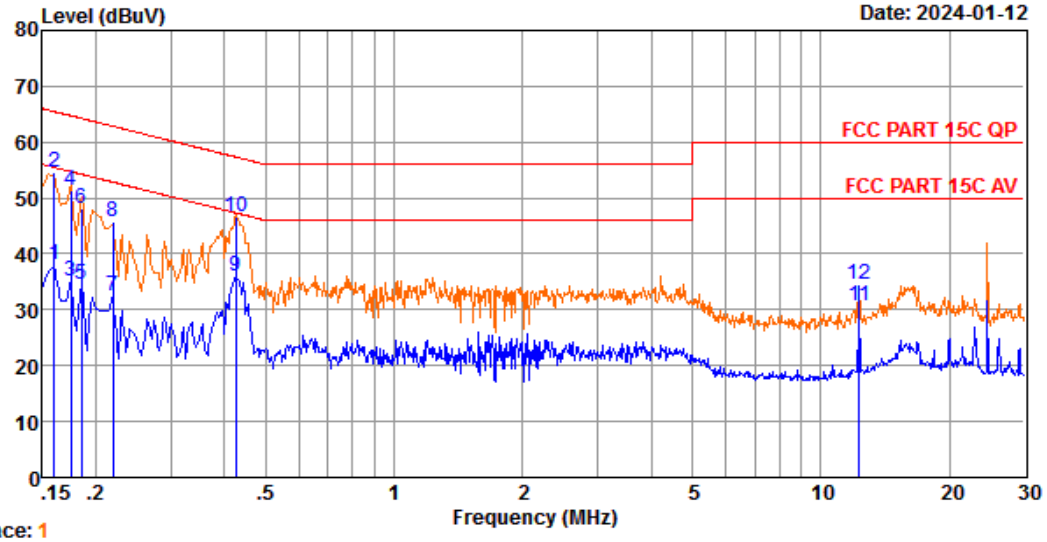
Data: 2 File: \\EMC-CE-2\Test Data\2024\RF\A\Ai Sheng.EM6 (8)



Trace: 1

Site no : 2#CE Shield Room Data no. : 2
Env. / Ins. : Temp:24.8℃ Humi:55% Press:101.50kPa LINE Phase : LINE
Limit : FCC PART 15C QP
Engineer : XJF
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (db)	Cable Loss (db)	Reading dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.16	10.12	9.89	18.06	38.07	55.47	17.40	Average
2	0.16	10.12	9.89	34.50	54.51	65.47	10.96	QP
3	0.17	10.16	9.93	15.02	35.11	54.72	19.61	Average
4	0.17	10.16	9.93	31.20	51.29	64.72	13.43	QP
5	0.19	10.16	9.93	14.44	34.53	54.24	19.71	Average
6	0.19	10.16	9.93	28.10	48.19	64.24	16.05	QP
7	0.22	10.16	9.94	12.31	32.41	52.83	20.42	Average
8	0.22	10.16	9.94	25.60	45.70	62.83	17.13	QP
9	0.43	10.09	9.92	15.89	35.90	47.33	11.43	Average
10	0.43	10.09	9.92	26.50	46.51	57.33	10.82	QP
11	12.32	10.36	10.02	10.45	30.83	50.00	19.17	Average
12	12.32	10.36	10.02	14.20	34.58	60.00	25.42	QP

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

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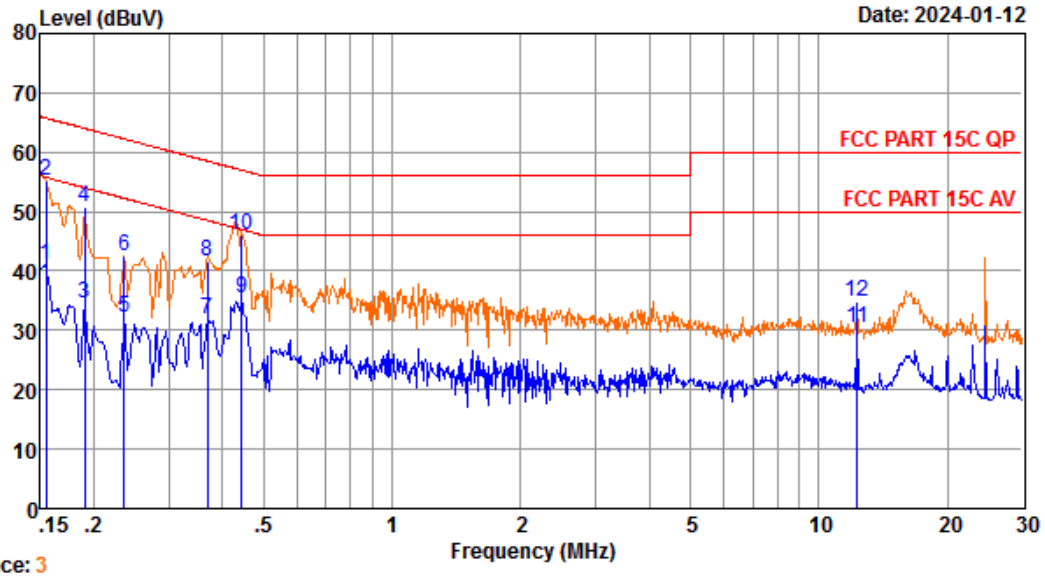
Data: 4 File: \\EMC-CE-2\Test Data\2024\RF\A\Ai Sheng.EM6 (8)



Trace: 3

Site no : 2#CE Shield Room Data no. : 4
Env. / Ins. : Temp:24.8℃ Humi:55% Press:101.50kPa LINE Phase : NEUTRAL
Limit : FCC PART 15C QP
Engineer : XJF
EUT : 2.0 Bluetooth speaker
Power : AC 120V/60Hz
M/N : speakeasy 4
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (db)	Cable Loss (db)	Reading dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.15	10.22	9.89	20.96	41.07	55.74	14.67	Average
2	0.15	10.22	9.89	35.00	55.11	65.74	10.63	QP
3	0.19	10.14	9.93	14.36	34.43	54.02	19.59	Average
4	0.19	10.14	9.93	30.60	50.67	64.02	13.35	QP
5	0.24	10.16	9.95	12.21	32.32	52.26	19.94	Average
6	0.24	10.16	9.95	22.29	42.40	62.26	19.86	QP
7	0.37	10.10	9.89	11.86	31.85	48.52	16.67	Average
8	0.37	10.10	9.89	21.50	41.49	58.52	17.03	QP
9	0.44	10.01	9.93	15.58	35.52	46.98	11.46	Average
10	0.44	10.01	9.93	26.09	46.03	56.98	10.95	QP
11	12.32	10.29	10.02	10.24	30.55	50.00	19.45	Average
12	12.32	10.29	10.02	14.50	34.81	60.00	25.19	QP

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

12. ANTENNA REQUIREMENTS

12.1. Limit

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

12.2. Test Result

The antennas used for this product is internal antenna ,so compliance with antenna requirements. (Please refer to the EUT photo for details)

13.APPENDIX

Appendix A: 20dB Emission Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.023	2401.550	2402.573	---	---
DH5	Ant1	2441	0.945	2440.616	2441.561	---	---
DH5	Ant1	2480	1.026	2479.541	2480.567	---	---
2DH5	Ant1	2402	1.269	2401.460	2402.729	---	---
2DH5	Ant1	2441	1.281	2440.445	2441.726	---	---
2DH5	Ant1	2480	1.323	2479.412	2480.735	---	---
3DH5	Ant1	2402	1.257	2401.436	2402.693	---	---
3DH5	Ant1	2441	1.320	2440.415	2441.735	---	---
3DH5	Ant1	2480	1.320	2479.415	2480.735	---	---

Test Graphs

DH5-Ant1-2402

DH5-Ant1-2441

DH5-Ant1-2480

2DH5-Ant1-2402

2DH5-Ant1-2441

2DH5-Ant1-2480

3DH5-Ant1-2402

3DH5-Ant1-2441

3DH5-Ant1-2480

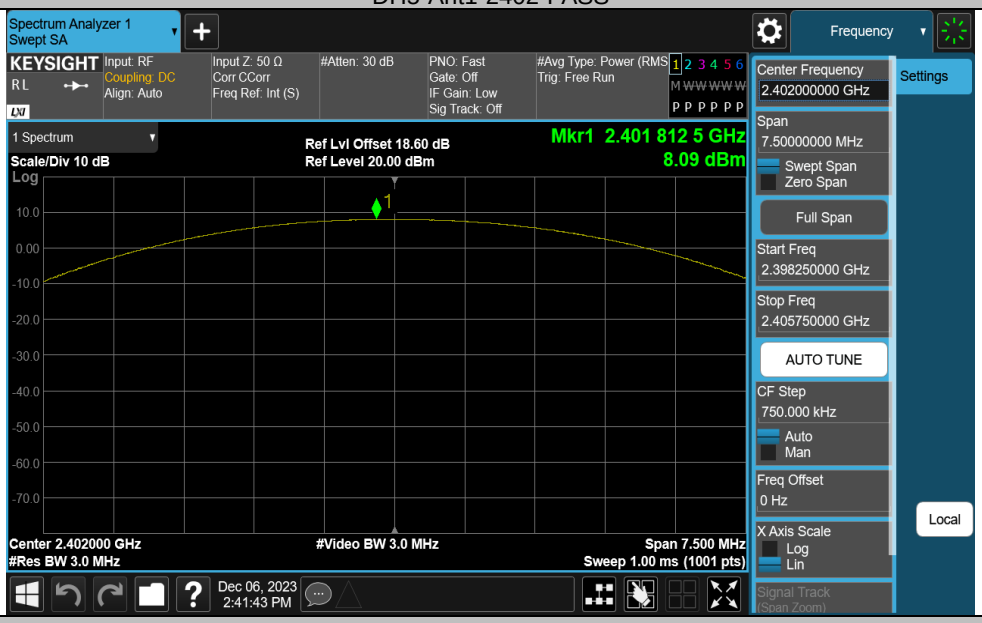
Appendix B: Maximum conducted output power

Test Result Peak

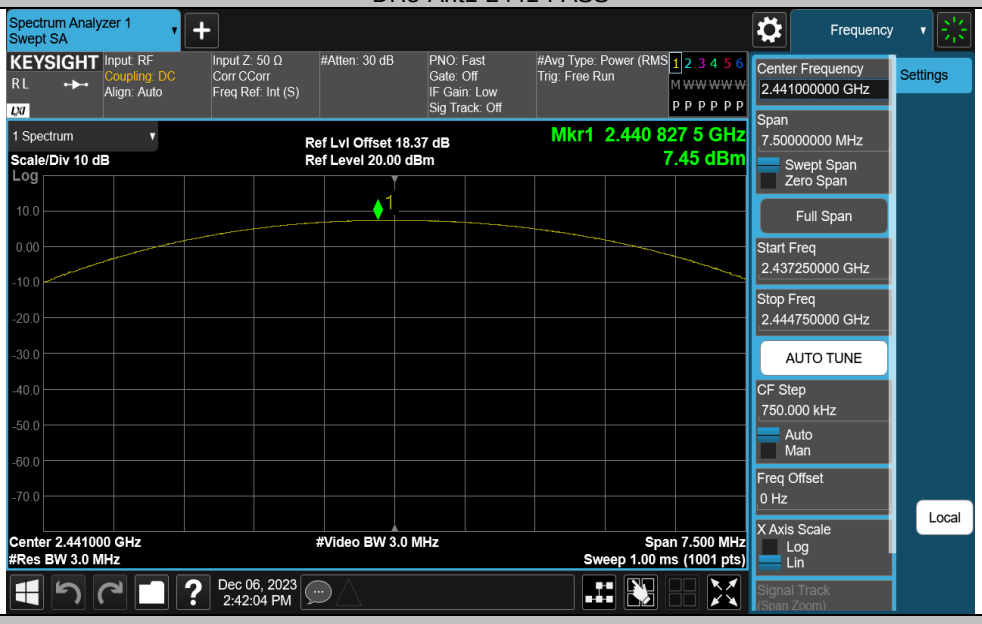
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant1	2402	8.09	≤20.97	PASS
DH5	Ant1	2441	7.45	≤20.97	PASS
DH5	Ant1	2480	6.94	≤20.97	PASS
2DH5	Ant1	2402	8.63	≤20.97	PASS
2DH5	Ant1	2441	7.91	≤20.97	PASS
2DH5	Ant1	2480	7.43	≤20.97	PASS
3DH5	Ant1	2402	8.92	≤20.97	PASS
3DH5	Ant1	2441	8.19	≤20.97	PASS
3DH5	Ant1	2480	7.72	≤20.97	PASS

Test Graphs

DH5-Ant1-2402-PASS

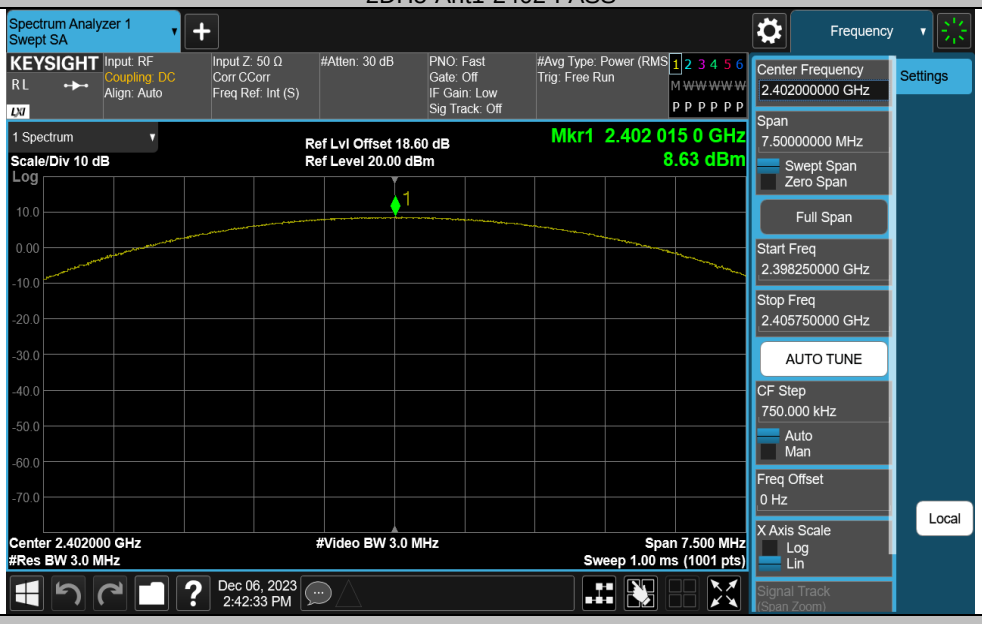


DH5-Ant1-2441-PASS

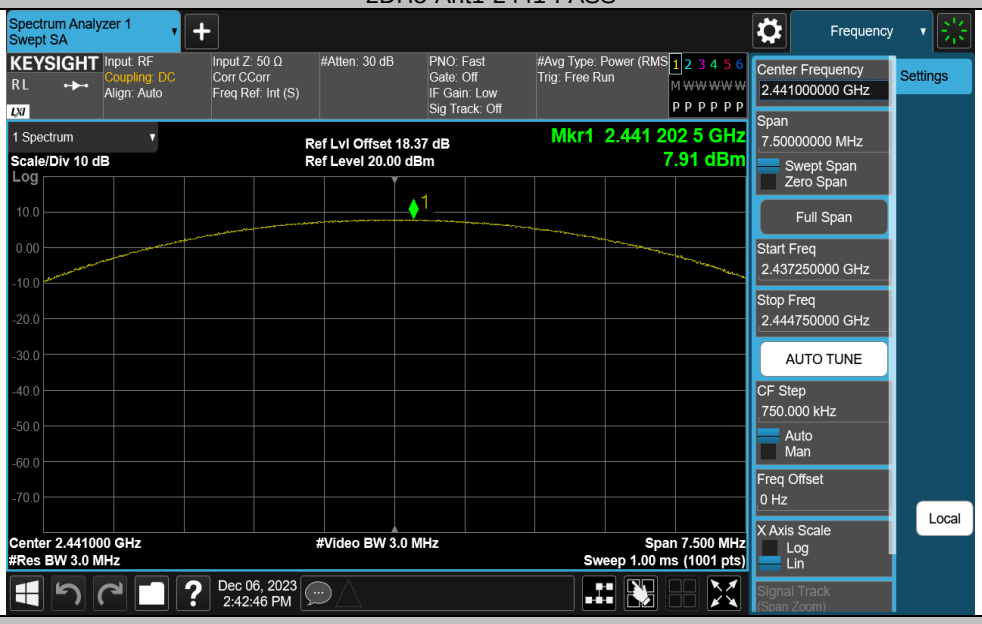


DH5-Ant1-2480-PASS

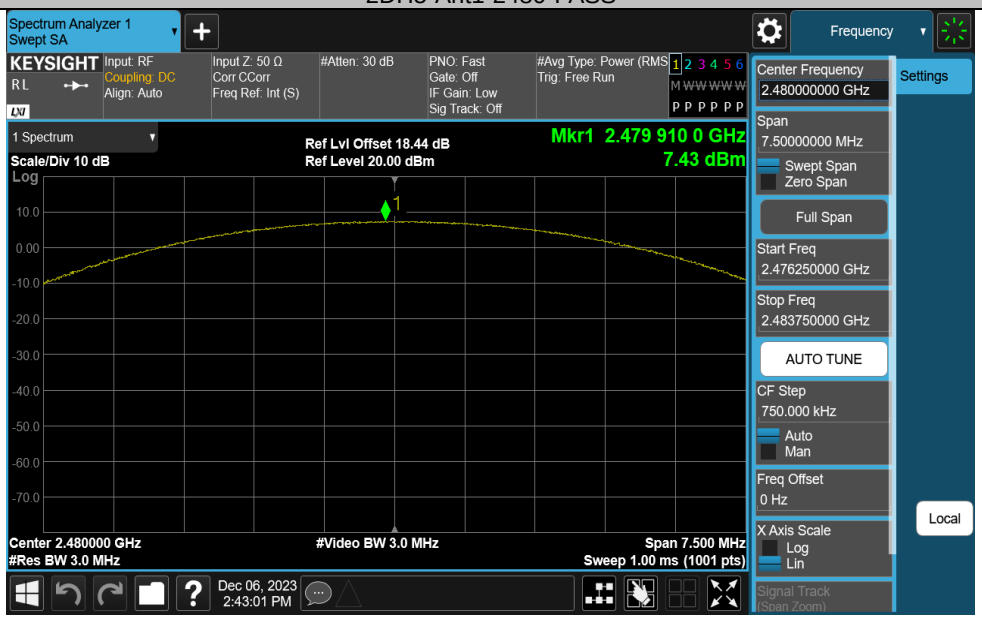
2DH5-Ant1-2402-PASS



2DH5-Ant1-2441-PASS

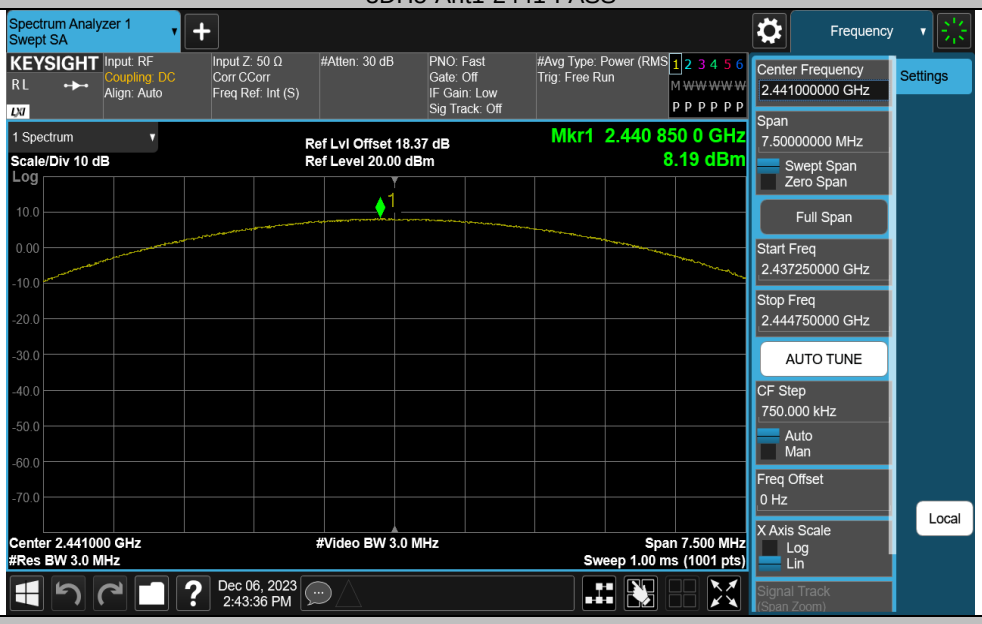


2DH5-Ant1-2480-PASS

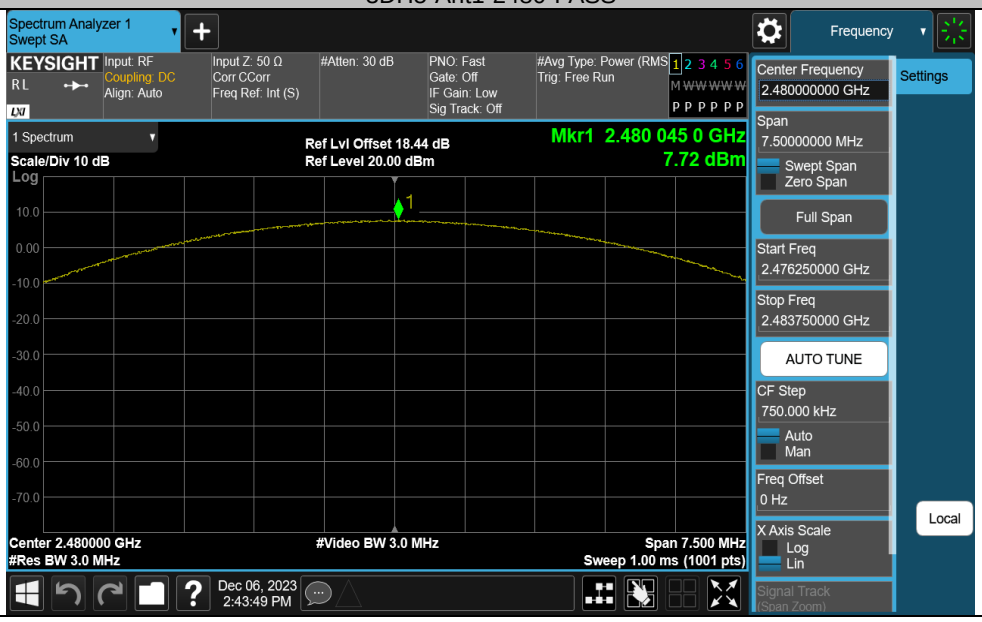


3DH5-Ant1-2402-PASS

3DH5-Ant1-2441-PASS



3DH5-Ant1-2480-PASS



Appendix C: Carrier frequency separation

Test Result

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.17	≥1.026	PASS
DH5	Ant1	2441	1.014	≥0.684	PASS
DH5	Ant1	2480	1.023	≥0.684	PASS
2DH5	Ant1	2402	1.008	≥0.882	PASS
2DH5	Ant1	2441	1.158	≥0.882	PASS
2DH5	Ant1	2480	1.02	≥0.882	PASS
3DH5	Ant1	2402	0.99	≥0.880	PASS
3DH5	Ant1	2441	1.017	≥0.880	PASS
3DH5	Ant1	2480	1.011	≥0.880	PASS

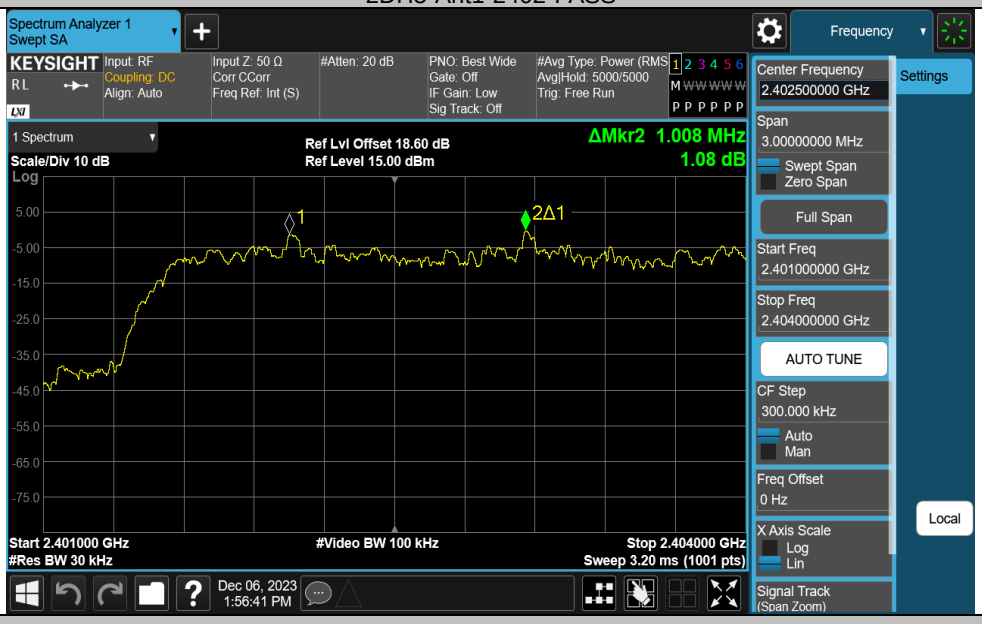
Test Graphs

DH5-Ant1-2402-PASS

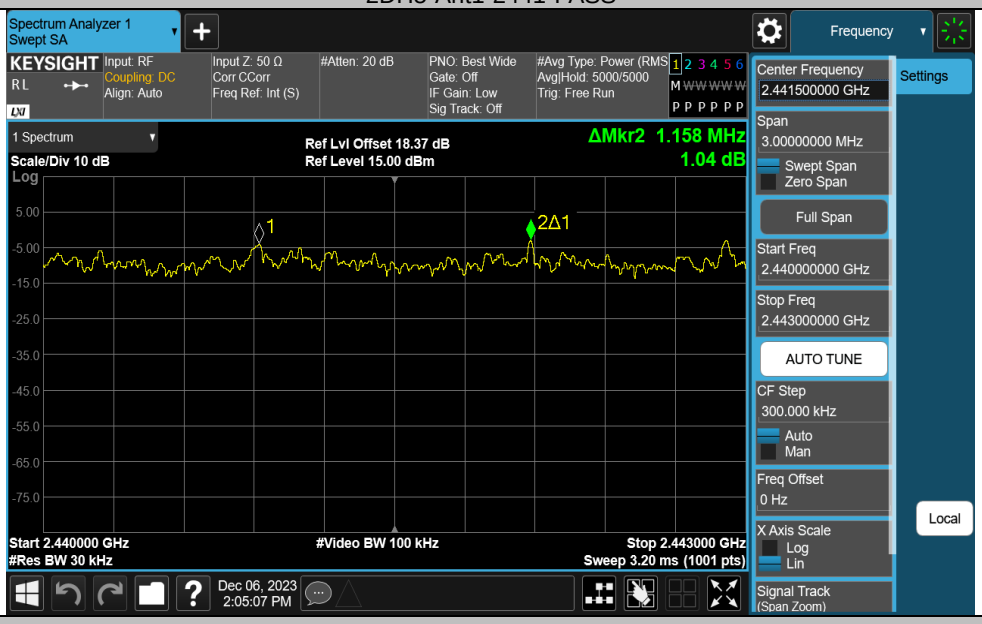
DH5-Ant1-2441-PASS

DH5-Ant1-2480-PASS

2DH5-Ant1-2402-PASS

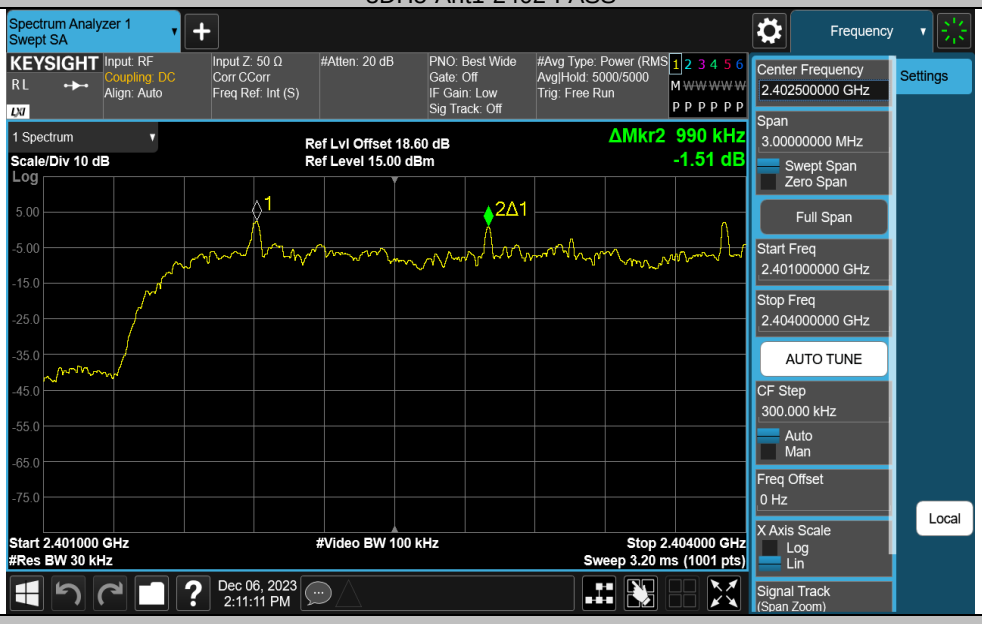


2DH5-Ant1-2441-PASS

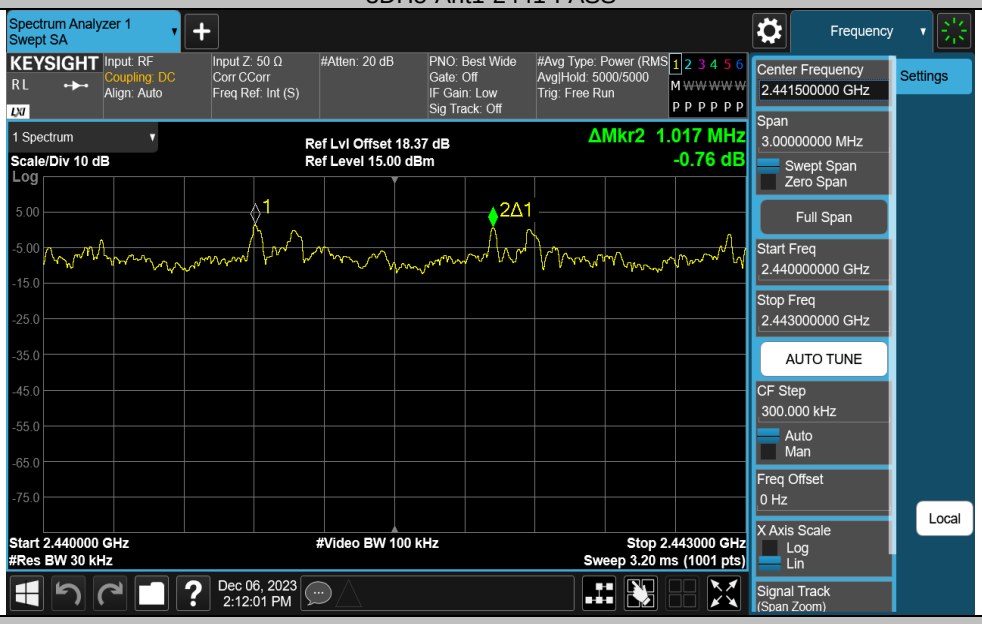


2DH5-Ant1-2480-PASS

3DH5-Ant1-2402-PASS



3DH5-Ant1-2441-PASS



3DH5-Ant1-2480-PASS

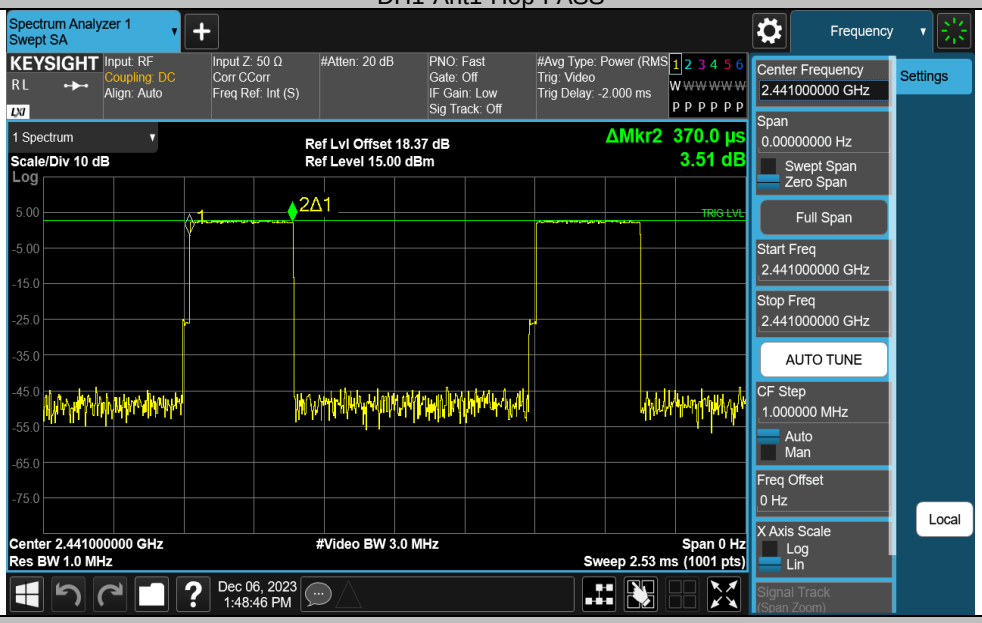
Appendix D: Time of occupancy

Test Result

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.370	320	0.118	≤0.4	PASS
DH3	Ant1	Hop	1.600	160	0.256	≤0.4	PASS
DH5	Ant1	Hop	2.850	106.67	0.304	≤0.4	PASS
2DH1	Ant1	Hop	0.377	320	0.121	≤0.4	PASS
2DH3	Ant1	Hop	1.610	160	0.258	≤0.4	PASS
2DH5	Ant1	Hop	2.870	106.67	0.306	≤0.4	PASS
3DH1	Ant1	Hop	0.377	320	0.121	≤0.4	PASS
3DH3	Ant1	Hop	1.610	160	0.258	≤0.4	PASS
3DH5	Ant1	Hop	2.850	106.67	0.304	≤0.4	PASS

Test Graphs

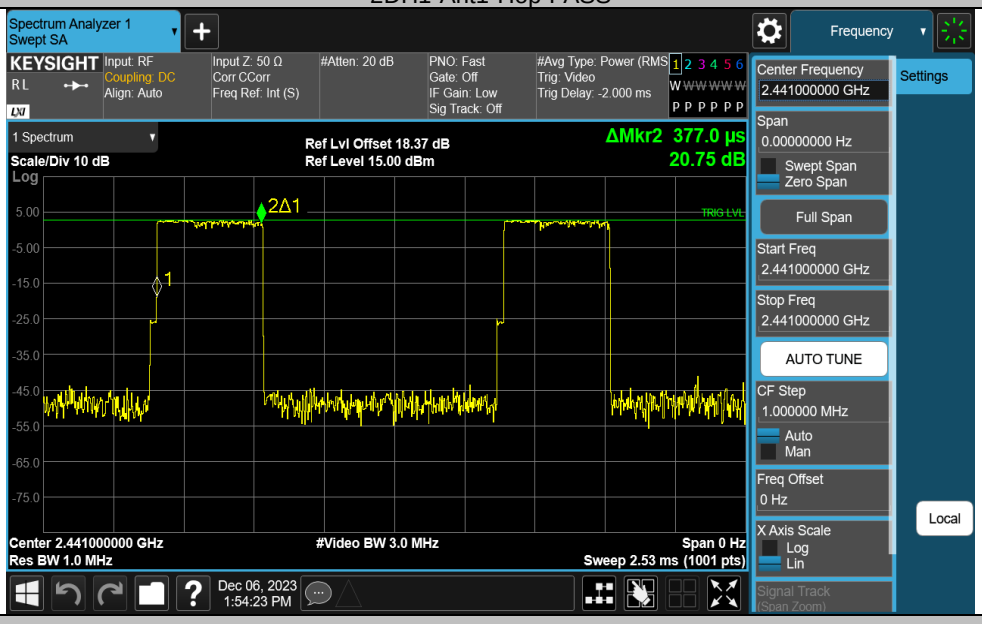
DH1-Ant1-Hop-PASS



DH3-Ant1-Hop-PASS

DH5-Ant1-Hop-PASS

2DH1-Ant1-Hop-PASS



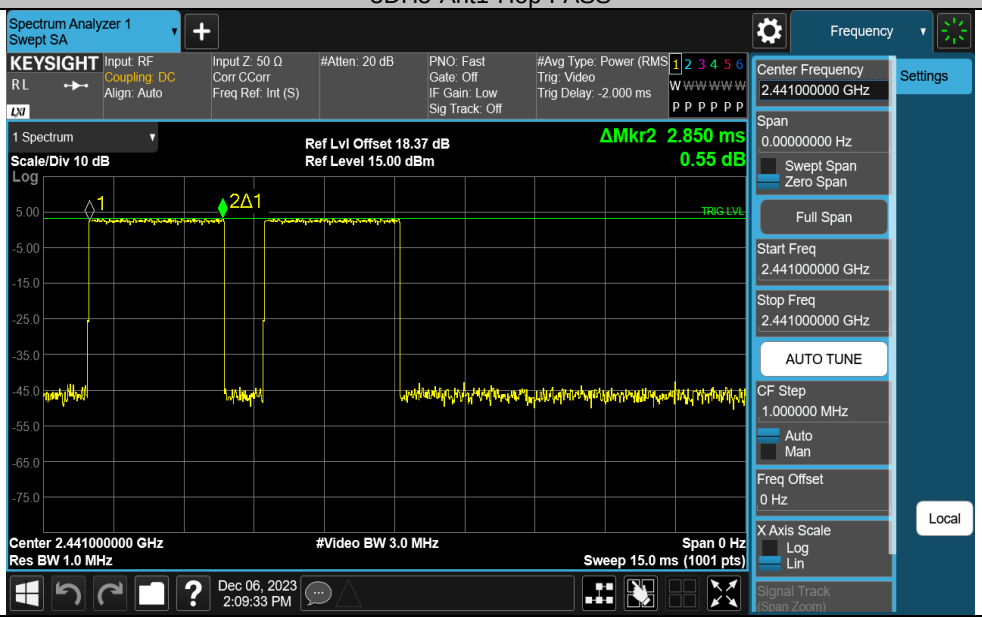
2DH3-Ant1-Hop-PASS

2DH5-Ant1-Hop-PASS

3DH1-Ant1-Hop-PASS

3DH3-Ant1-Hop-PASS

3DH5-Ant1-Hop-PASS



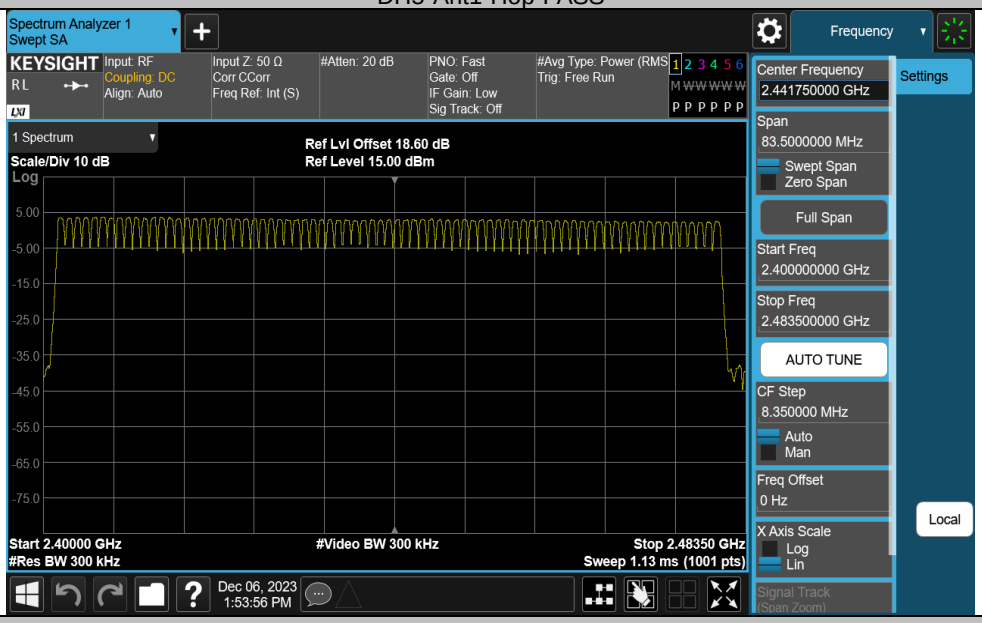
Appendix E: Number of hopping channels

Test Result

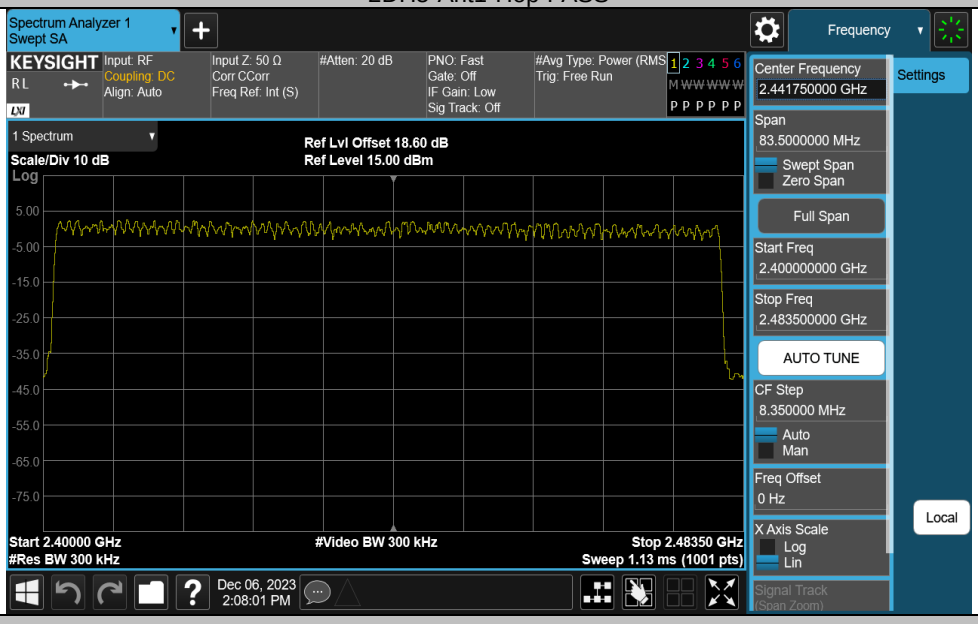
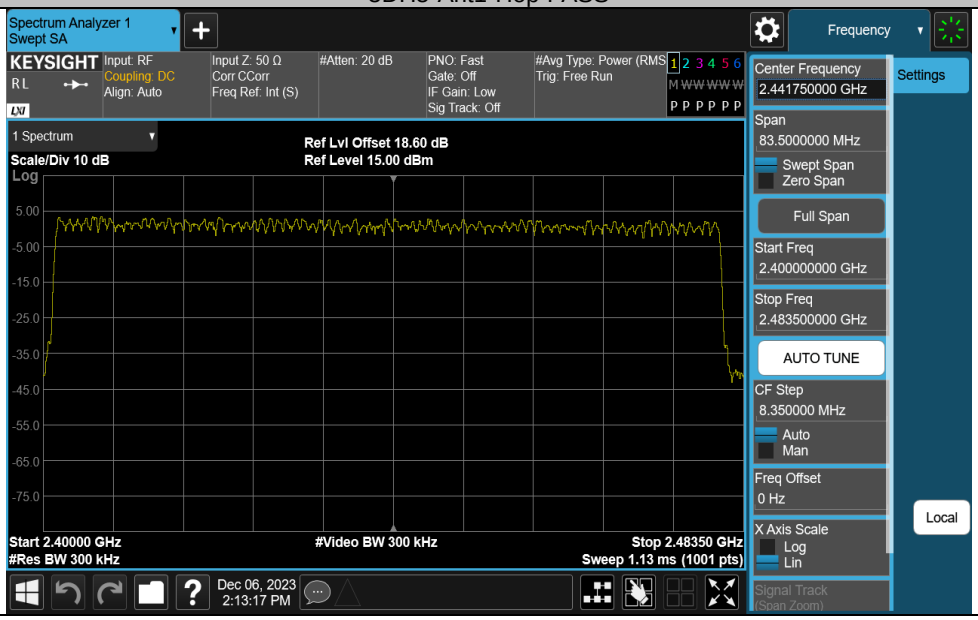
TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

Test Graphs

DH5-Ant1-Hop-PASS



2DH5-Ant1-Hop-PASS



3DH5-Ant1-Hop-PASS