DEKRA Testing and Certification (Suzhou) Co., Ltd.
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098

Test report No:
2290469R-RF-US-P06V02

FCC TEST REPORT

Product Name	AFC-SW01
Trademark	HISINGY 星奇世界
Model and /or type reference	md010501
FCC ID	2BAIV-MD010501
Applicant´s name / address	Cockatoo & Friends Co., Ltd. Dongxiaojing Industrial Park, No. 205 Zone B, Unit 1277, Dongba Township, Chaoyang District, Beijing, China.
Test method requested, standard	CFR 47, FCC Part 15 C § 15.249 ANSI C63.10:2013
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Jun Xu/ Project Manager
Approved by (name / position & signature)	Jack Zhang/Manager
Date of issue	2023-10-12
Report Version	V1.1
Report template No	Template_FCC 15.249-RF-V1.0

INDEX

page

General conditions 4
Environmental conditions 4
Possible test case verdicts 5
Abbreviations 5
Document History 6
Remarks and Comments 6
Used Equipment 7
Uncertainty 9
1 General Information 10
1.1 General Description of the Item(s) 10
1.2 Antenna Information 11
1.3 Channel List 12
2 Description of Test Setup 13
2.1 Operating mode(s) used for tests 13
2.2 Accessories Information 13
2.3 Test Configuration / Block diagram used for tests 14
2.4 Testing process 15
3 Verdict summary section 16
3.1 Standards 16
3.2 Deviation(s) from the Standard(s) / Test Specification(s) 16
3.3 Overview of results 17
3.4 Power setting in test 18
3.5 Test Matrix 18
3.6 Test Facility 19
4 Test Results 20
4.1 AC Power Line Conducted Emission 20
4.1.1 Limit 20
4.1.2 Test Setup 20
4.1.3 Test Procedure 20
4.2 Radiated Emission Test 21
4.2.1 Limit 21
4.2.2 Test Setup 23
4.2.3 Test Procedure 24
4.3 Band Edge 25

4.3.1 Limit 25
4.3.2 Test Setup 25
4.3.3 Test Procedure 25
4.4 20 dB Bandwidth 26
4.4.1 Limit 26
4.4.2 Test Setup 26
4.4.3 Test Procedure 26
4.5 Antenna Requirement 27
4.5.1 Limit: 27
4.5.2 Antenna Connector Construction: 27
5 Test setup photo and EUT Photo 28
Appendix A: The fundamental field strength and the harmonics 29
Appendix B: Radiated Emission 30
Appendix C: Band Edge 40
Appendix D: 20dB Bandwidth 48

COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date (receive sample)	Sept. 15, 2022
Date (start test)	Sept. 19, 2022
Date (finish test)	Feb. 15, 2023

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT : Equipment Under Test
QP : Quasi-Peak
CAV : CISPR Average
AV : Average
CDN : Coupling Decoupling Network
SAC : Semi-Anechoic Chamber
OATS : Open Area Test Site
BW : Bandwidth
AM : Amplitude Modulation
PM : Pulse Modulation
HCP : Horizontal Coupling Plane
VCP : Vertical Coupling Plane
U_N : Nominal voltage
*T*x : Transmitter
*R*x : Receiver
N/A : Not Applicable
N/M : Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
2290469R-RF-US-P06V02	V1.0	Initial issue of report.	2023-07-25
2290469R-RF-US-P06V02	V1.1	Appendix B adds test data. (The test report No.: 2290469R-RF-US-P06V02 V1.1 is to replace the test report No.: 2290469R-RF-US-P06V02 V1.0, and test report 2290469R-RF-US-P06V02 V1.0 is obsoleted.)	2023-10-12

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with CFR 47, FCC Part 15 Subpart C, ANSI C63.10:2013.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:

   - Chapter 1.1 General Description of the Item(s);
   - Chapter 1.2 Antenna Information;
   - Chapter 1.3 Channel List.

USED EQUIPMENT

Conducted Test / TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Wireless Connectivity Tester	R&S	CMW 270	102593	2022.05.21	2023.05.20
Coaxial Cable	N/A	N/A	2187	2022.06.09	2023.06.08
High and low temperature and fast temperature change test box	ASTUOD	ASTD-FBT-225K	N/A	2022.08.24	2023.08.23
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2022.07.07	2023.07.06
Test system					
4TX MIMO Power Sensor	Keysight	X8750A	MY59400102	2022.03.16	2023.03.15
MAX Signal Analyzer	Keysight	N9020B	MY59050482	2022.09.17	2023.09.16
Switch Box	Keysight	X8749A	N/A	N/A	N/A
High and low temperature and fast temperature change test box	ASTUOD	ASTD-FBT-225K	N/A	2022.08.24	2023.08.23
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY61252529	2022.07.14	2023.07.13
Frequency extender for EXG or MXG	Keysight	N5182BX07	MY59362500	2022.07.14	2023.07.13
EXG-B MW Analog Signal Generator	Keysight	N5173B	MY61252566	2022.09.28	2023.09.27
EXG-B MW Analog Signal Generator	Keysight	N5173B	MY61252566	2022.09.28	2023.09.27

Radiated Emission(30MHz-1GHz) / AC3

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100573	2022.07.10	2023.07.09
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2022.08.28	2023.08.27
Coaxial Cable	Huber+Suhner	RG 214	AC2-C	2022.03.30	2023.03.29
Loop Antenna	R&S	HFH2-Z2	833799/003	2022.04.15	2023.04.14
Temperature/Humidity Meter	RTS	RTS-8S	AC2-TH	2022.07.07	2023.07.06

Radiated Emission (1GHz-40GHz) / AC5

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
MXA Signal Analyzer	Keysight	N9020B	MY60112218	2022.12.08	2023.12.07
Preamplifier	Chengyi	EMC184045SE	980263	2022.07.19	2023.07.18
Preamplifier	Chengyi	EMC184045SE	980263	2023.07.09	2024.07.08
Preamplifier	SKET	LNPA_0118G-45	SK2021041201	2022.04.15	2023.04.14
Preamplifier	SKET	LNPA_0118G-45	SK2021041201	2023.04.14	2024.04.13
DRG Horn	ETS-Lindgren	3117	00123988	2022.08.29	2023.08.28
DRG Horn	ETS-Lindgren	3117	00123988	2023.08.27	2024.08.26
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9170	01249	2022.09.22	2023.09.21
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9170	01249	2023.09.18	2024.09.17
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.30	2023.03.29
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2023.03.26	2024.03.25
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.21	2023.03.20
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2023.03.16	2024.03.15
Notch Filter	Micro-mve	MFN-2400.2485.S1	AN0003N	2022.07.18	2023.07.17
Notch Filter	Micro-mve	MFN-2400.2485.S1	AN0003N	2023.07.12	2024.07.11
High-Pass Filter	Wainwright	WHKX7.0/18G-8SS	27	2022.06.07	2023.06.06
High-Pass Filter	Wainwright	WHKX7.0/18G-8SS	27	2023.06.05	2024.06.04

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document.The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Test item	Uncertainty
Radiated Emission(30MHz~1GHz)	Horizontal: 30MHz~200MHz: 3.50 dB 300MHz~1GHz: 3.60 dB Vertical: 30MHz~200MHz: 3.60 dB 300MHz~1GHz: 3.50 dB
Radiated Emission(1GHz~26.5GHz)	Horizontal: 1GHz~18GHz: 5.00 dB Vertical: 1GHz~18GHz: 4.80 Db Horizontal: 18GHz~26.5GHz: 5.20 dB Vertical: 18GHz~26.5GHz: 4.90 dB
The fundamental field strength and the harmonics	± 1.27dB
Radiated Emission Band Edge	± 3.9 dB
Occupied Bandwidth	±1kHz

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name ..... :	AFC-SW01
Model No. ..... :	md010501
Trademark ..... :	HISINGY 星奇世界
FCC ID ..... :	2BAIV-MD010501
Hardware Version ..... :	5.0
Software Version ..... :	1.59
Manufacturer ..... :	Goertek Robotics Co,Ltd
Manufacturer address ..... :	A218, Building A, No. 35, Lane 799, Jiasongzhong Road, Qingpu District, Shanghai
Factory ..... :	Goertek Robotics Co,Ltd
address..... :	A218, Building A, No. 35, Lane 799, Jiasongzhong Road, Qingpu District, Shanghai

Wireless specification..... :	SRD
Operating frequency range(s) ..... :	2402~2480MHz
Type of Modulation..... :	GFSK
Number of channel..... :	79

Rated power supply ..... :	Voltage and Frequency	
	☐	AC: 220 – 240 V, 50/60 Hz
	☐	AC: 110 – 130 Vac, 50/60 Hz
	☒	DC:3.7V
	☐	Adapter: Input: …… Output:……
Mounting position ..... :	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☐	Hand-held equipment/ Protable equipment
	☒	Other: RF Module

1.2 Antenna Information

Antenna model / type number ..... :	N/A			
Antenna serial number ..... :	N/A			
Antenna Delivery ..... :	☒	1TX + 1RX		
	☐	2TX + 2RX		
	☐	Others:……		
Antenna technology ..... :	☒	SISO		
	☐	MIMO	☐	CDD
			☐	Beam-forming
Antenna Type ..... :	☐	External	☐	Dipole
			☐	Sectorized
	☒	Internal	☐	PIFA
			☒	linear antenna
			☐	Dipole
			☐	Others……..
Antenna Gain ..... :	2.18 dBi			

1.3 Channel List

SRD Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2403 MHz	02	2404 MHz	03	2405 MHz
04	2406 MHz	05	2407 MHz	06	2408 MHz	07	2409 MHz
08	2410 MHz	09	2411 MHz	10	2412 MHz	11	2413 MHz
12	2414 MHz	13	2415 MHz	14	2416 MHz	15	2417 MHz
16	2418 MHz	17	2419 MHz	18	2420 MHz	19	2421 MHz
20	2422 MHz	21	2423 MHz	22	2424 MHz	23	2425 MHz
24	2426 MHz	25	2427 MHz	26	2428 MHz	27	2429 MHz
28	2430 MHz	29	2431 MHz	30	2432 MHz	31	2433 MHz
32	2434 MHz	33	2435 MHz	34	2436 MHz	35	2437 MHz
36	2438 MHz	37	2439 MHz	38	2440 MHz	39	2441 MHz
40	2442 MHz	41	2443 MHz	42	2444 MHz	43	2445 MHz
44	2446 MHz	45	2447 MHz	46	2448 MHz	47	2449 MHz
48	2450 MHz	49	2451 MHz	50	2452 MHz	51	2453 MHz
52	2454 MHz	53	2455 MHz	54	2456 MHz	55	2457 MHz
56	2458 MHz	57	2459 MHz	58	2460 MHz	59	2461 MHz
60	2462 MHz	61	2463 MHz	62	2464 MHz	63	2465 MHz
64	2466 MHz	65	2467 MHz	66	2468 MHz	67	2469 MHz
68	2470 MHz	69	2471 MHz	70	2472 MHz	71	2473 MHz
72	2474 MHz	73	2475 MHz	74	2476 MHz	75	2477 MHz
76	2478 MHz	77	2479 MHz	78	2480 MHz	N/A	N/A

Note: The general description of the Item(s), antenna information and channel list in clause 1 are provided and confirmed by the client.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Test Mode For SRD	Mode1: Transmit by SRD

Note 1: Regards to the frequency band operation: the lowest, middle and highest frequency channel were selected to perform the test, then shown on this report.

Note 2: For portable device, radiated tests was verified over X, Y, Z axis, and shown the worst case on this report.

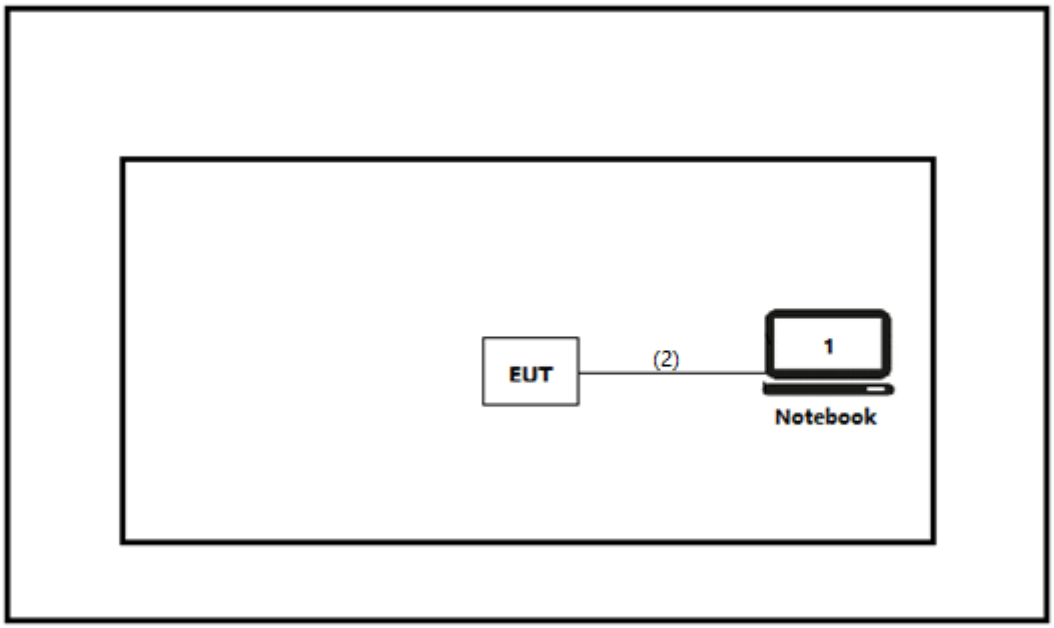
2.2 Accessories Information

Auxiliary equipment	Type / Version	Manufacturer	Supplied by
(1) Notebook	Think pad x220	Lenovo	Adapter
(2) USB Control Cable	N/A	N/A	N/A
(3) USB Control Cable	N/A	N/A	N/
software	Type / Version	Manufacturer	Supplied by
CH343SER	N/A	N/A	N/A

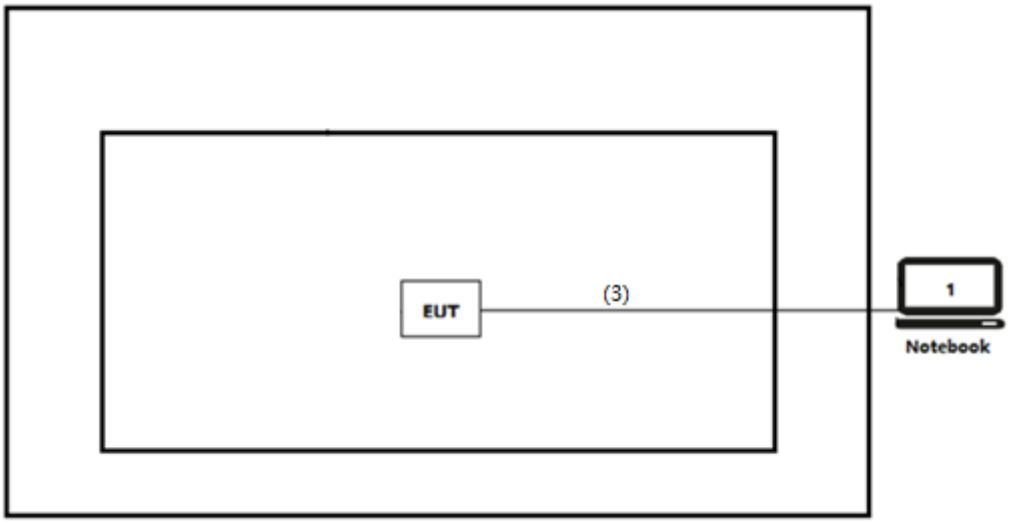
Accessories Information	Cable		
	Length used during test [m]	Attached during test	Shielded
(2)USB Control Cable	1	☒	☒
(3)USB Control Cable	8	☒	☒

2.3 Test Configuration / Block diagram used for tests

Test setup Diagram- Conducted test



Test setup Diagram- Radiated Emission



2.4 Testing process

1	Setup the EUT as shown in Section 2.4.
2	Run the software “CH343SER” on the notebook computer.
3	Open the serial port and enter the corresponding commands to configure the test mode, test channel, test power and data rate.
4	Verify that the EUT works properly.

3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

3.1 Standards

Standard	Year	Description
FCC CFR Title 47 Part 15 Subpart C Section 15.249	2023	Operation within the bands902–928 MHz, 2400–2483.5 MHz, and5725–5850 MHz.
ANSI C63.10	2013	American National Standard ofProcedures for Compliance Testing ofUnlicensed Wireless Devices

3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

(Please define the deviations from the standard(s) if applicable)

3.3 Overview of results

Requirement – Test case	Basic standard(s)	Verdict	Remark
AC Power Line Conducted Emission	FCC 15.207	N/A	The equipment is powered by DC
The fundamental field strength and the harmonics	FCC 15.249(a)	PASS	Please refer to **Appendix A**
Radiated Emission	FCC 15.249(d), FCC 15.209,15.205	PASS	Please refer to **Appendix B**
Band Edge	FCC 15.249(d), FCC 15.209,15.205	PASS	Please refer to **Appendix C**
20dB Bandwidth	FCC 15.215(c)	PASS	Please refer to **Appendix D**
Antenna Requirement	FCC 15.203	PASS	---

3.4 Power setting in test

Mode	Channel	Frequency (MHz)	Power setting
SRD	00	2402	3
	38	2440	3
	78	2480	3

3.5 Test Matrix

Test item	md010501	
	1(#1)	2(#2)
The fundamental field strength and the harmonics	☐	☒
Radiated Emission Test	☐	☒
Band Edge	☐	☒
20 dB Bandwidth	☒	☐
Antenna Requirement	☐	☒

3.6 Test Facility

USA	**:**	**FCC Designation Number: CN1199**

4 TEST RESULTS

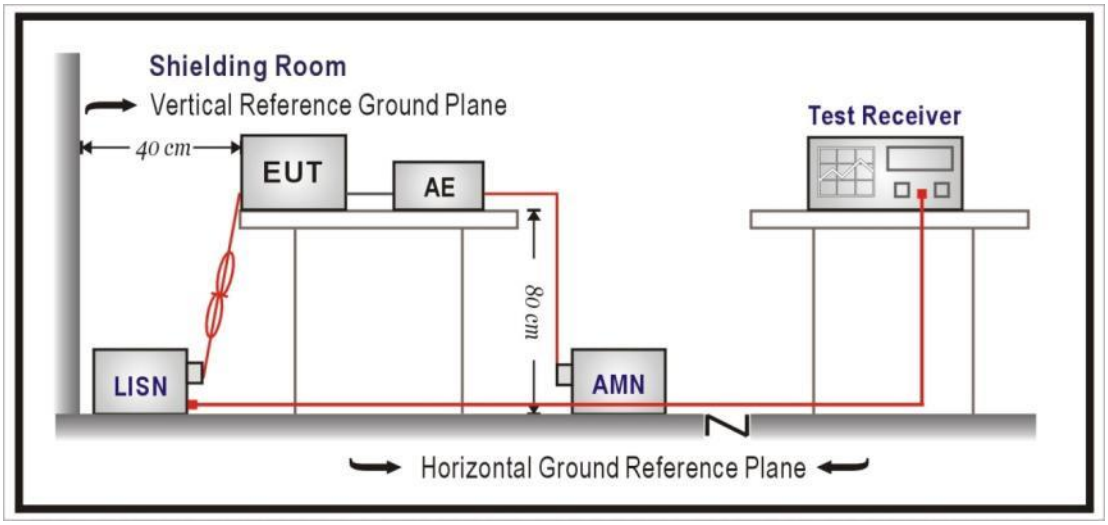
4.1 AC Power Line Conducted Emission	VERDICT: N/A

4.1.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.207	
Frequency range [MHz]	Limit: QP [dB(μV)[1)]]	Limit: AV [dB(μV) [1)]]
0,15 - 0,50	66 – 56 [2)]	56 - 46 [2)]
0,50 - 5,0	56	46
5,0 - 30	60	50

[1)] At the transition frequency, the lower limit applies.
[2)] The limit decreases linearly with the logarithm of the frequency.
NOTE 1: The exclusion band for transmitters shall be considered for transmitters operating at frequencies below 30 MHz.
NOTE 2: Where the AC output port is directly connected (or via a circuit breaker) to the AC power input port of the EUT the AC power output port need not to be tested.

4.1.2 Test Setup



4.1.3 Test Procedure

	References Rule	Chapter	Item
☒	ANSI C63.10-2013	6.2	Standard test method for ac power-line conducted emissions from unlicensedwireless devices

4.2 Radiated Emission Test — VERDICT: PASS

4.2.1 Limit

Fundamental and Harmonics Radiated Emissions 15.249(a) Limit

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902 – 928 MHz	50	500
2400 -2483.5 MHz	50	500
5725 -5875 MHz	50	500
24.0 – 24.25 GHz	250	2500

Note: 1. RF Voltage (dBuV)=20 log Voltage(uV)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3. The emission limit in this paragraph os based on measurement instrumentation employing an average detector.Measurement using instrumentation with a peak detector function,corresponding to 20dB above the maximum permitted average limit.

Spurous Radiated Emissions 15.249(d) Limit

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

Restricted Bands of operationfor FCC			
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
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
8.81425 – 8.81475	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	
13.36 – 13.41			

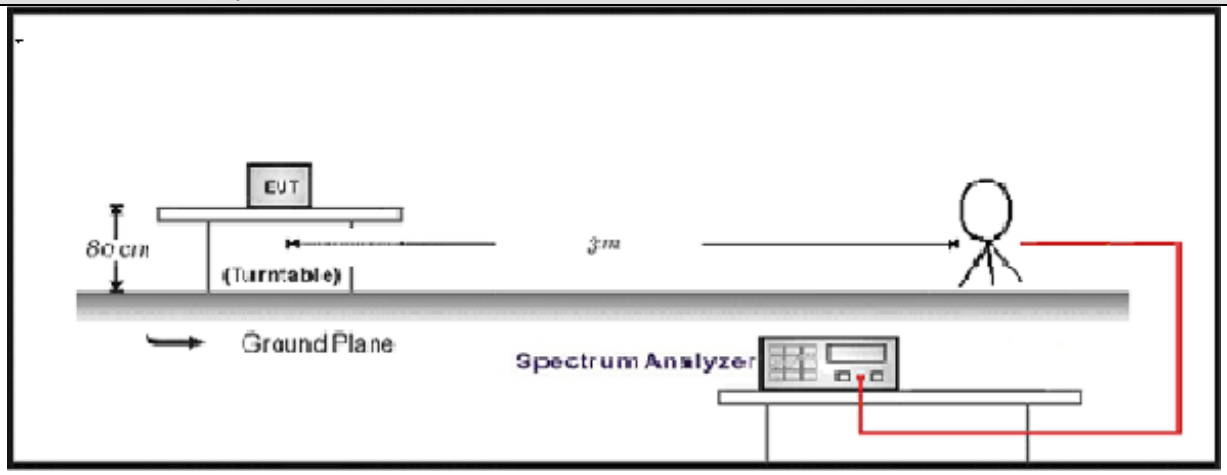
Restricted Band Emissions Limit			
Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30(Note 1)
1.705 - 30	30	29.5	30(Note 1)
30 -88	100	40	3(Note 2)
88-216	150	43.5	3(Note 2)
216 - 960	200	46	3(Note 2)
Above 960	500	54	3(Note 2)

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

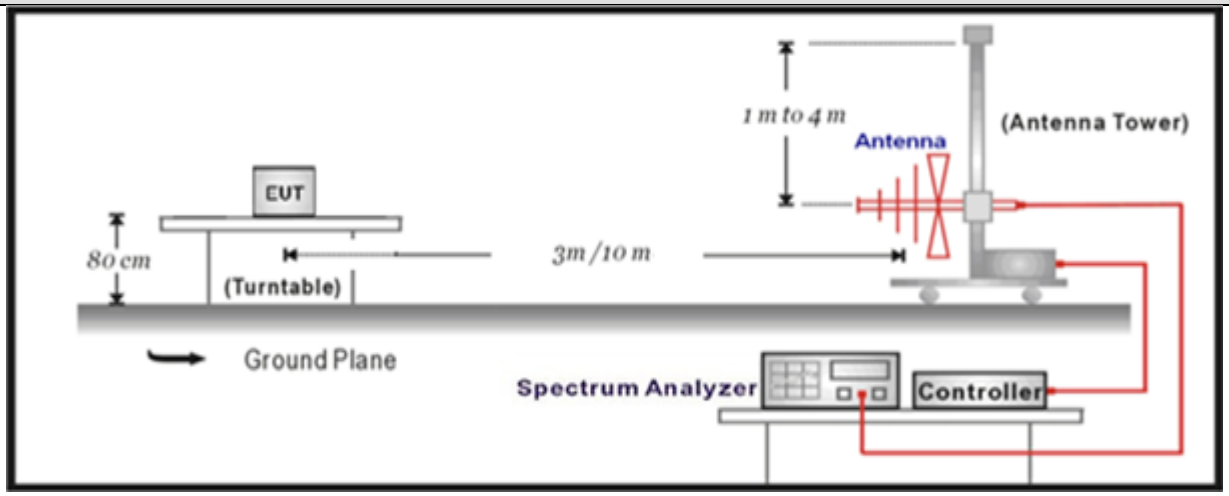
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

4.2.2 Test Setup

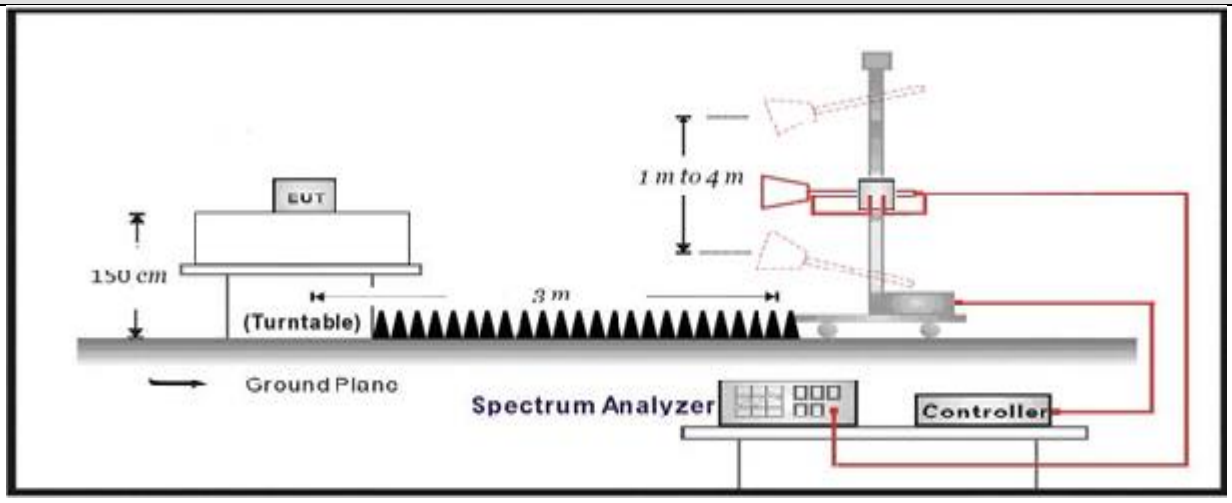
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



Above 1GHz Test Setup:



4.2.3 Test Procedure

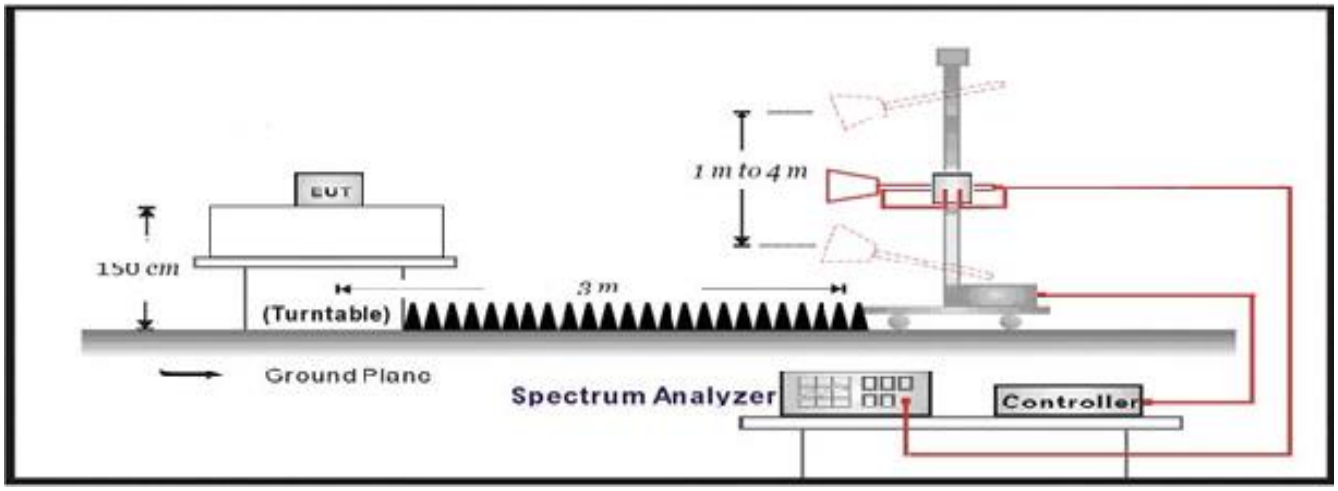
	References Rule			Chapter	Description
☒	ANSI C63.10			11.12	Emissions in restricted frequency bands
	☒	ANSI C63.10		11.12.1	Radiated emission measurements
	☒	ANSI C63.10		11.12.2.7	Radiated spurious emission test
		☒	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
		☒	ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
		☒	ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz

4.3 Band Edge — VERDICT: PASS

4.3.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.209,15.205			
Frequency bands (MHz)	Detector	Limit (dB μ V/m)	RBW (MHz)	Distance (m)
2310-2390 2483.5-2500	PK	74	1	3
	AV	54	1	3
Standard	FCC Part 15 Subpart C Paragraph 15.249(d)			
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.				

4.3.2 Test Setup



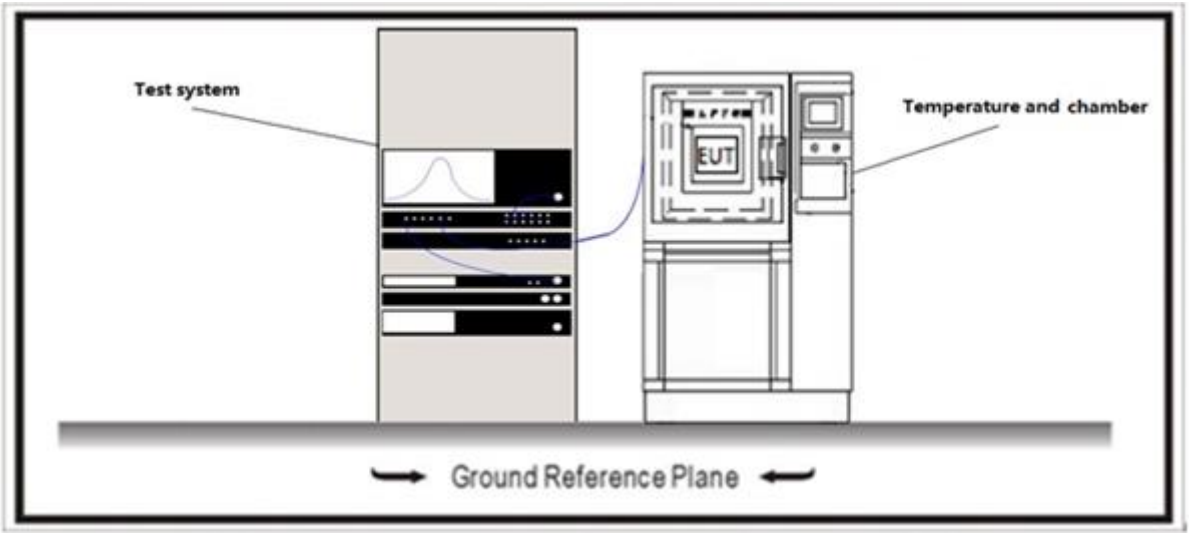
4.3.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	6.10	Band-edge testing
	☒ ANSI C63.10	6.10.5	Restricted-band band-edge measurements
	☐ ANSI C63.10	6.10.6	Marker-delta method
☒	ANSI C63.10	11.12	Emissions in restricted frequency bands
	☒ ANSI C63.10	11.12.2	Antenna-port conducted measurements
	☐ ANSI C63.10	11.12.2.3	Quasi-peak measurement procedure
	☒ ANSI C63.10	11.12.2.4	Peak power measurement procedure
	☒ ANSI C63.10	11.12.2.5	Average power measurement procedures

4.4 20 dB Bandwidth	VERDICT: PASS

4.4.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.215
Contained within the frequency band designated in the rule section under which the equipment is operated.	

4.4.2 Test Setup



4.4.3 Test Procedure

	Reference Rule		Chapter	Description
☒	ANSI C63.10		6.9	Occupied bandwidth tests
	☒	ANSI C63.10	6.9.2	Option 1
	☐	ANSI C63.10	6.9.3	Option 2

4.5 Antenna Requirement	VERDICT: PASS

4.5.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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, or §15.221. 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.

4.5.2 Antenna Connector Construction:	
☒	The use of a permanently attached antenna
☐	The antenna use of a unique coupling to the intentional radiator
☐	The use of a nonstandard antenna jack or electrical connector

Please refer to the attached document “Internal Photograph” to show the antenna connector.

5 TEST SETUP PHOTO AND EUT PHOTO

Remark: The test setup photo and EUT Photo please see appendix.

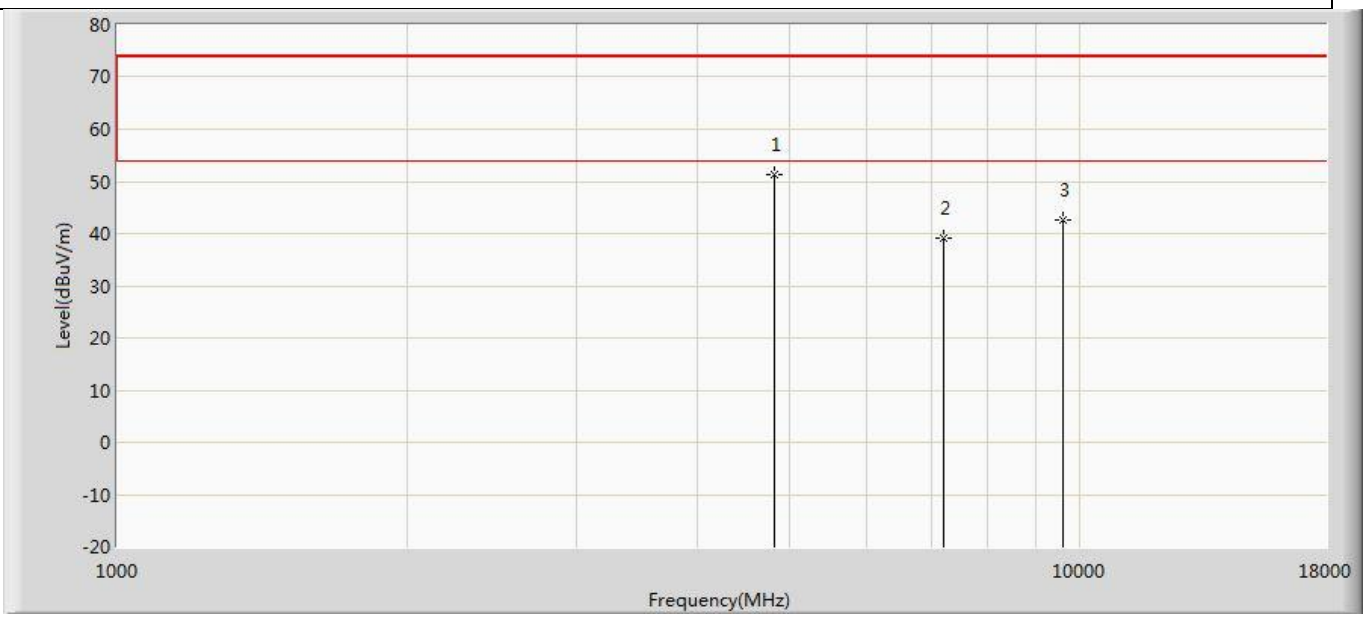
Appendix A: The fundamental field strength and the harmonics

Freq. (MHz)	Read Level (dBuV) AV/PK	Reading Level (dBuV/m)	Factor (dB)	Radiated Emissions (dB)	HORIZ/ VERT	Limits (dBuV/m) AV/PK	Margin (dB)
2402	PK	46.001	34.137	80.138	H	114	33.862
2402	AV	25.458	34.138	59.596	H	94	34.404
2402	PK	49.409	34.138	83.548	V	114	30.452
2402	AV	27.134	34.137	61.271	V	94	32.729
2440	PK	46.787	34.294	81.081	H	114	32.919
2440	AV	25.390	34.292	59.682	H	94	34.318
2440	PK	49.611	34.291	83.902	V	114	30.098
2440	AV	27.507	34.292	61.799	V	94	32.201
2480	PK	49.992	34.474	84.466	H	114	29.534
2480	AV	27.373	34.474	61.847	H	94	32.153
2480	PK	56.241	34.474	90.716	V	114	23.284
2480	AV	30.278	34.474	64.753	V	94	29.247

Note: 1. Radiated Emissions = Factor+ Reading Level
2. Margin = Limits - Radiated Emissions
3. AV Limit (dBuV/m)=20 log Voltage(uV)=20 log (50000)=94 dBuV /m
4. PK Limit (dBuV/m)= AV Limit +20dB=114 dBuV /m

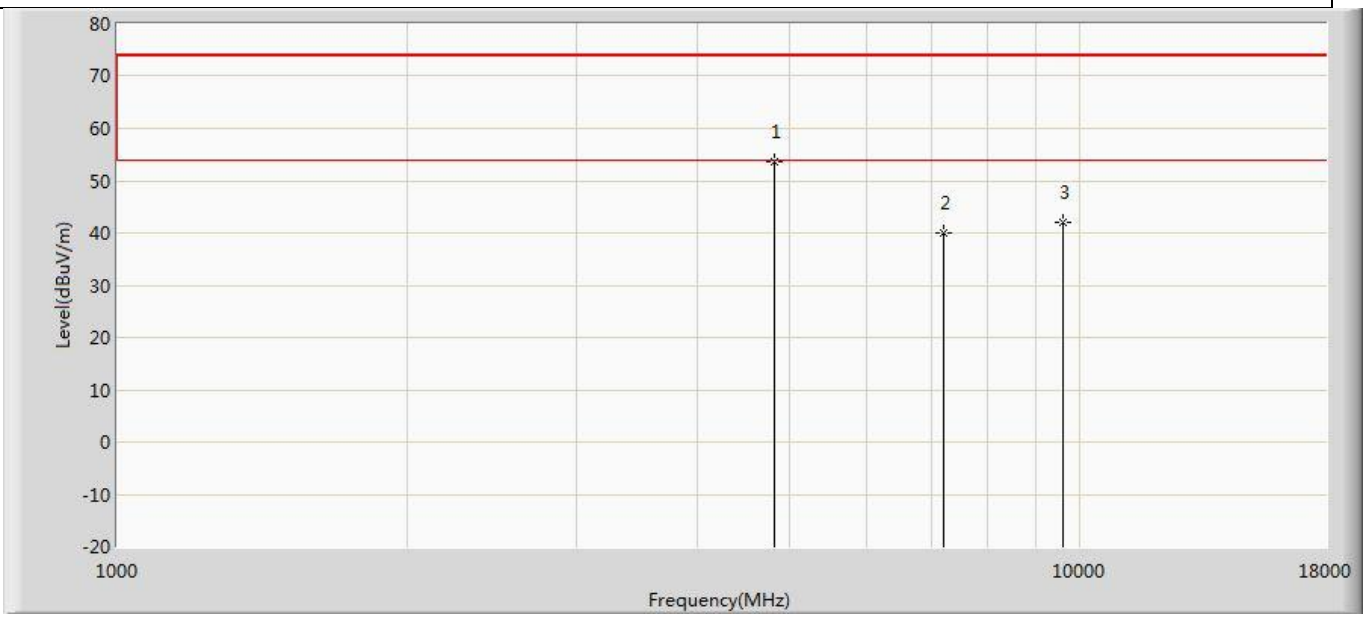
Appendix B: Radiated Emission

Profile: 2290469R	Page No.: 19
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



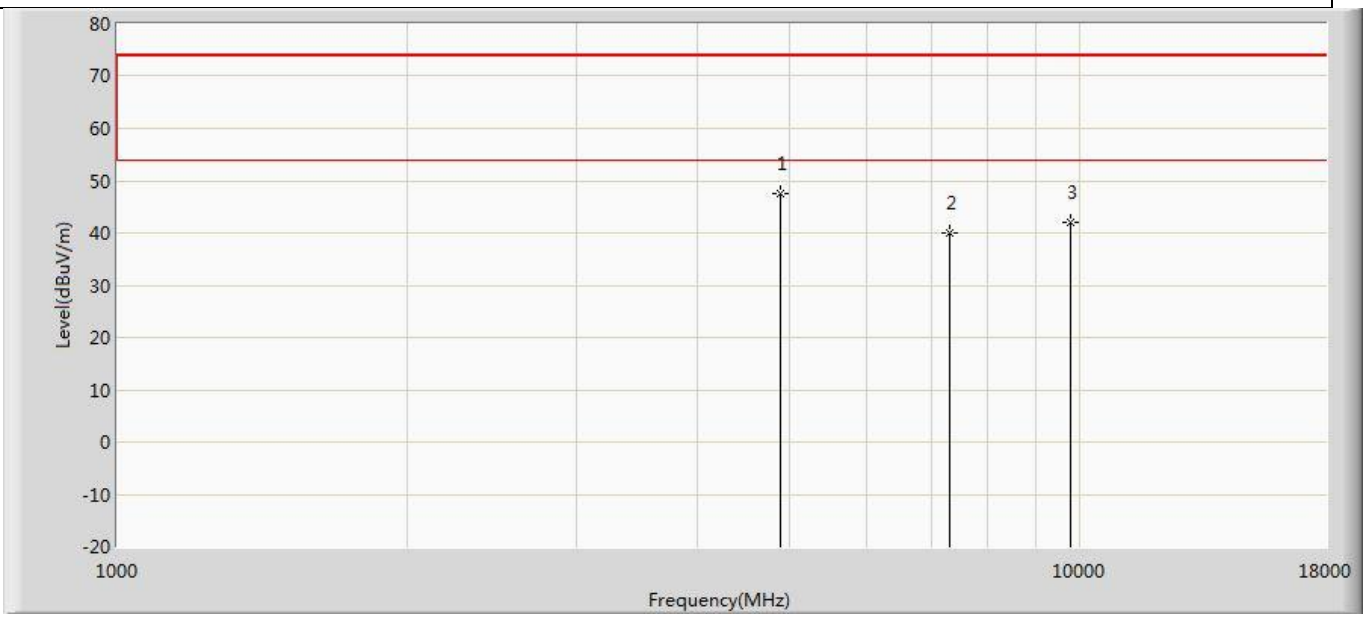
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	4808.000	51.218	68.871	-22.782	74.000	-17.652	PK
2		7206.000	39.125	54.237	-34.875	74.000	-15.112	PK
3		9608.000	42.718	55.362	-31.282	74.000	-12.644	PK

Profile: 2290469R	Page No.: 20
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



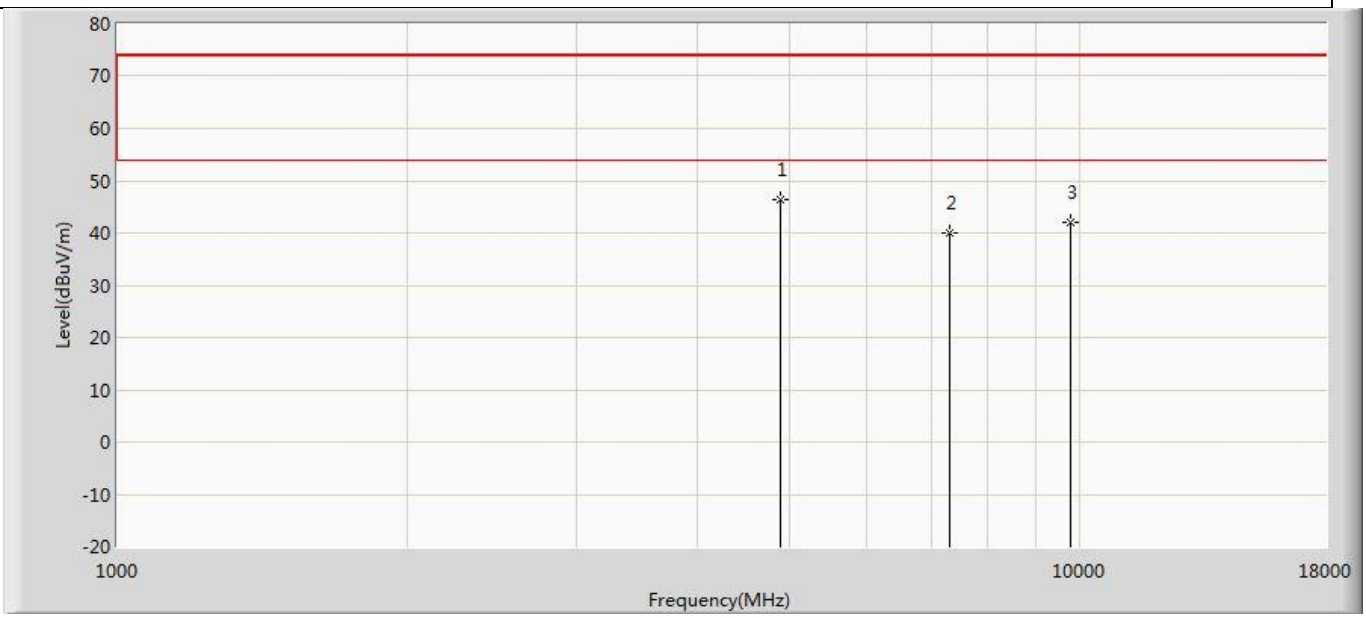
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	4808.000	53.663	71.316	-20.337	74.000	-17.652	PK
2		7206.000	39.943	55.055	-34.057	74.000	-15.112	PK
3		9608.000	42.081	54.725	-31.919	74.000	-12.644	PK

Profile: 2290469R	Page No.: 21
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2440MHz by SDR	



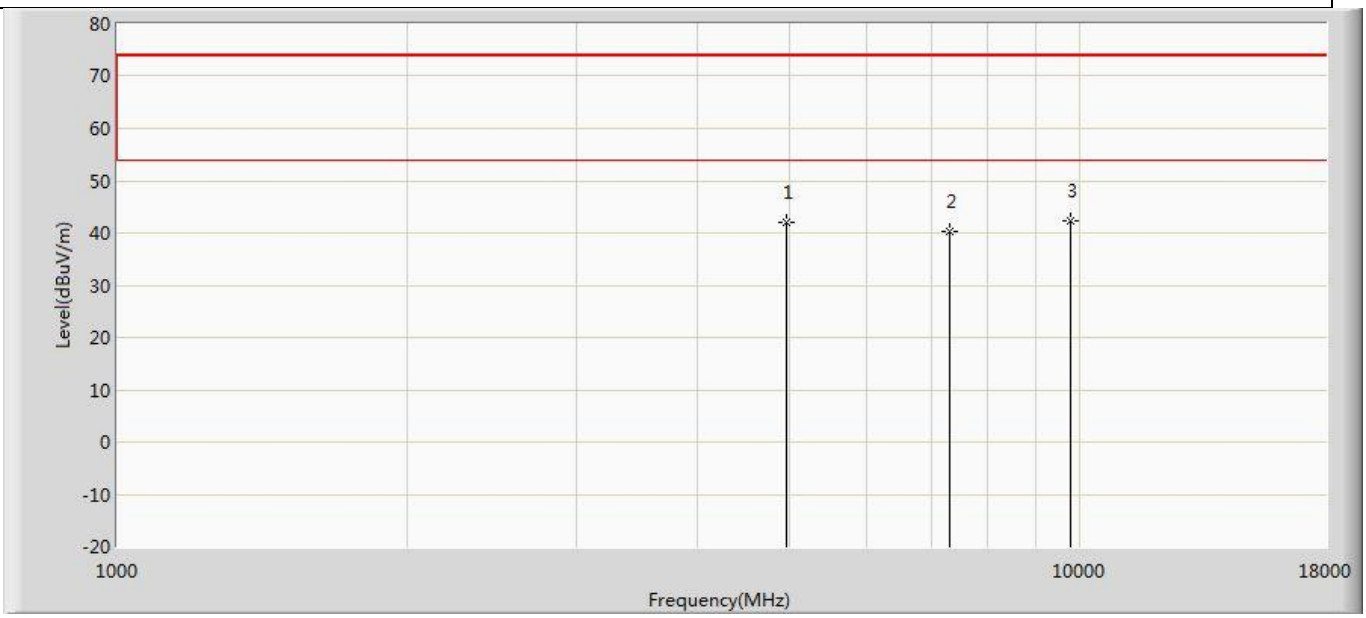
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	4876.000	47.518	65.202	-26.482	74.000	-17.684	PK
2		7320.000	40.063	54.811	-33.937	74.000	-14.747	PK
3		9760.000	41.952	54.419	-32.048	74.000	-12.466	PK

Profile: 2290469R	Page No.: 22
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2440MHz by SDR	



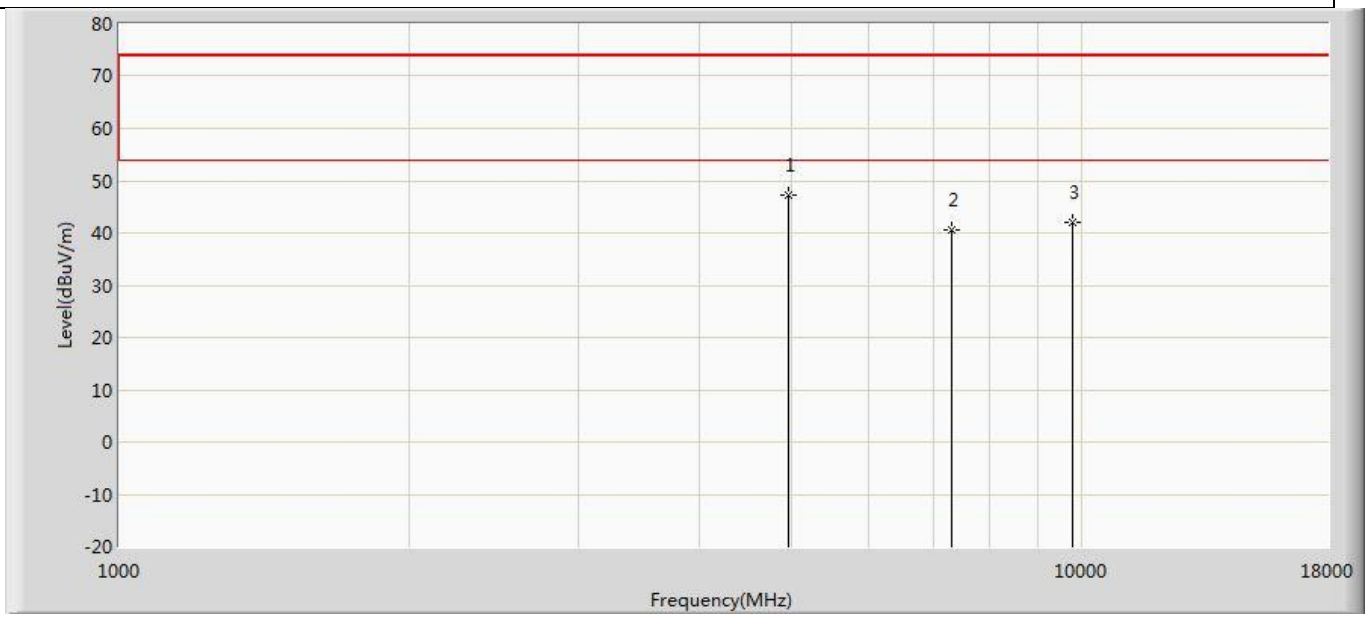
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	4876.000	46.351	64.035	-27.649	74.000	-17.684	PK
2		7320.000	39.949	54.697	-34.051	74.000	-14.747	PK
3		9760.000	41.963	54.430	-32.037	74.000	-12.466	PK

Profile: 2290469R	Page No.: 23
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		4961.000	42.141	59.539	-31.859	74.000	-17.399	PK
2		7320.000	40.278	55.026	-33.722	74.000	-14.747	PK
3	*	9760.000	42.406	54.873	-31.594	74.000	-12.466	PK

Profile: 2290469R	Page No.: 24
Engineer: YuLiu	
Site: AC5	Time: 2022/11/16 - 00:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	



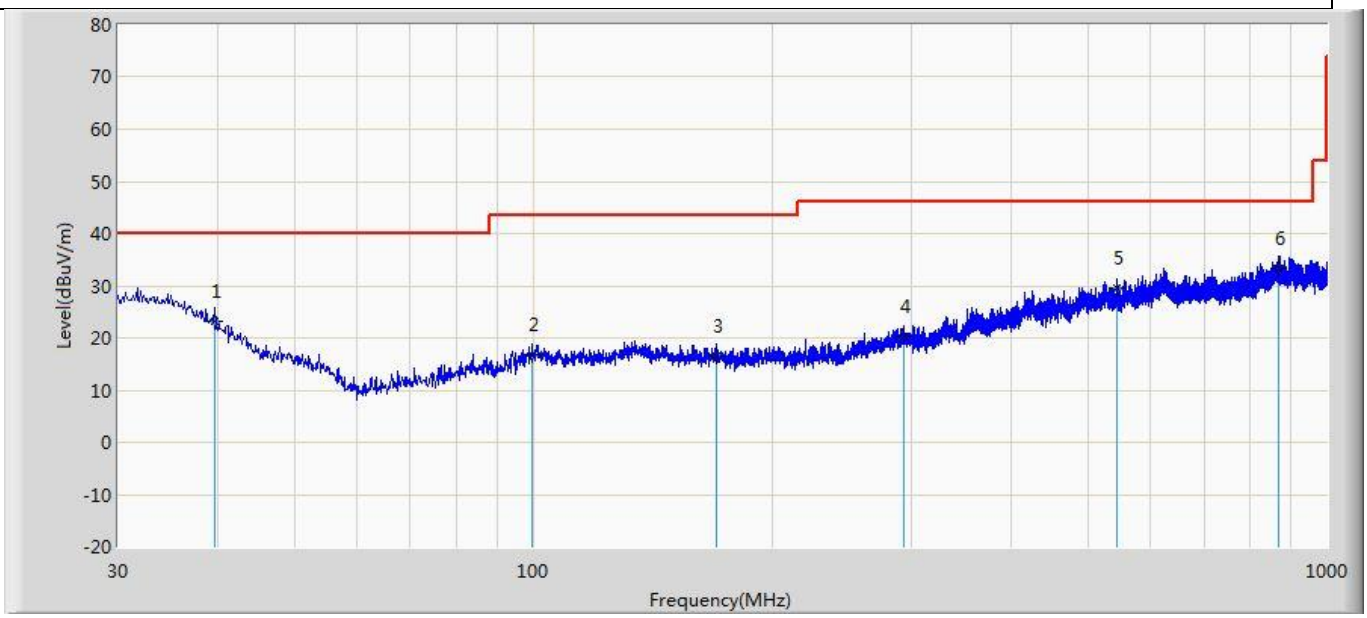
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	4961.000	47.203	64.601	-26.797	74.000	-17.399	PK
2		7320.000	40.559	55.307	-33.441	74.000	-14.747	PK
3		9760.000	42.092	54.559	-31.908	74.000	-12.466	PK

Note:
1. Measured Level = Reading Level + Factor.
2. The test frequency range 9kHz~30MHz and above 18GHz, worst case are at least 20dB below the limits, therefore no data appear in the report.
3. This limit applies for both peak and average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.
4.The points in graph are the highest data in test frequency range.

5. The above is the level of harmonics, The data other than harmonics is the noise base, so the test results comply with 15.249(d)

The worst case of Radiated Emission below 1GHz:

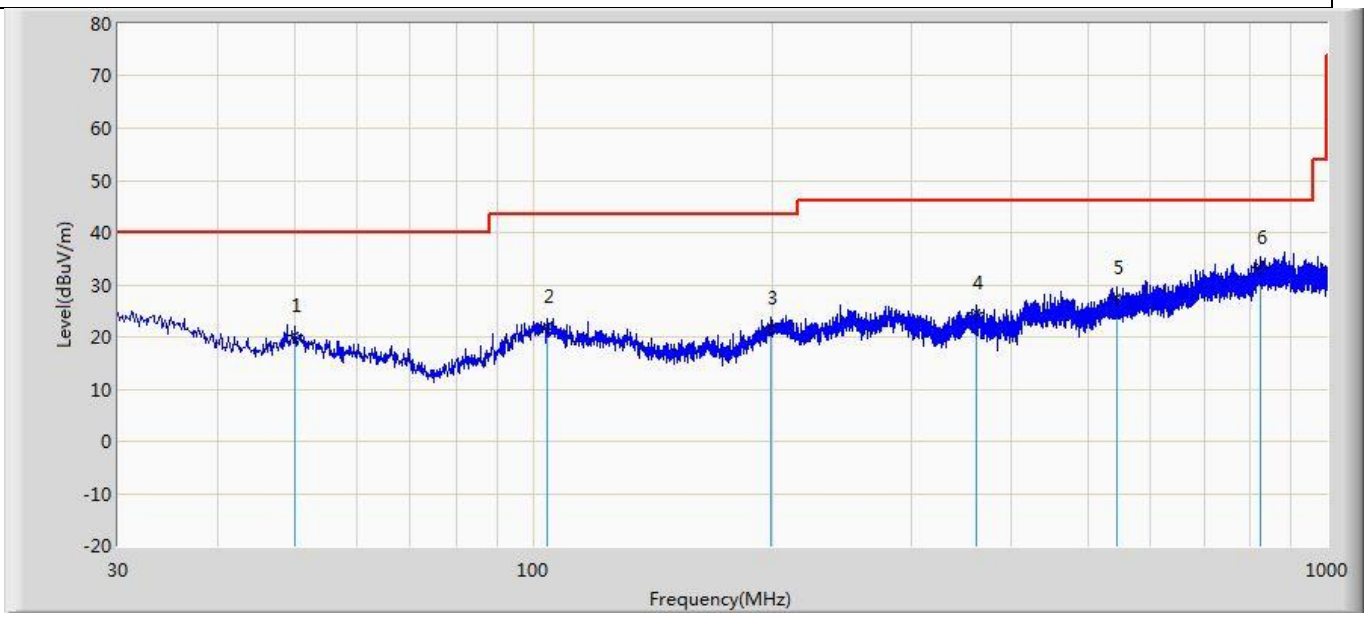
Profile: 2290469R	Page No.: 28
Engineer: Yu Liu	
Site: AC3	Time: 2022/11/16 - 22:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC3_3M(30-1000M)	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode 1: Transmit at 2440MHz by SRD	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		39.700	23.136	0.626	-16.864	40.000	22.510	QP
2		99.719	16.759	-0.313	-26.741	43.500	17.072	QP
3		170.044	16.638	-0.578	-26.862	43.500	17.216	QP
4		292.870	20.261	-0.304	-25.739	46.000	20.565	QP
5		544.100	29.515	1.640	-16.485	46.000	27.875	QP
6	*	870.505	33.468	0.547	-12.532	46.000	32.921	QP

1. " * ", means this data is the worst emission level.
2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp)

Profile: 2290469R	Page No.: 29
Engineer: Yu Liu	
Site: AC3	Time: 2022/11/16 - 23:01
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC3_3M(30-1000M)	Polarity: Horizontal
EUT: AFC-SW01	Power: DC3.7V
Note: Mode 1: Transmit at 2440MHz by SRD	

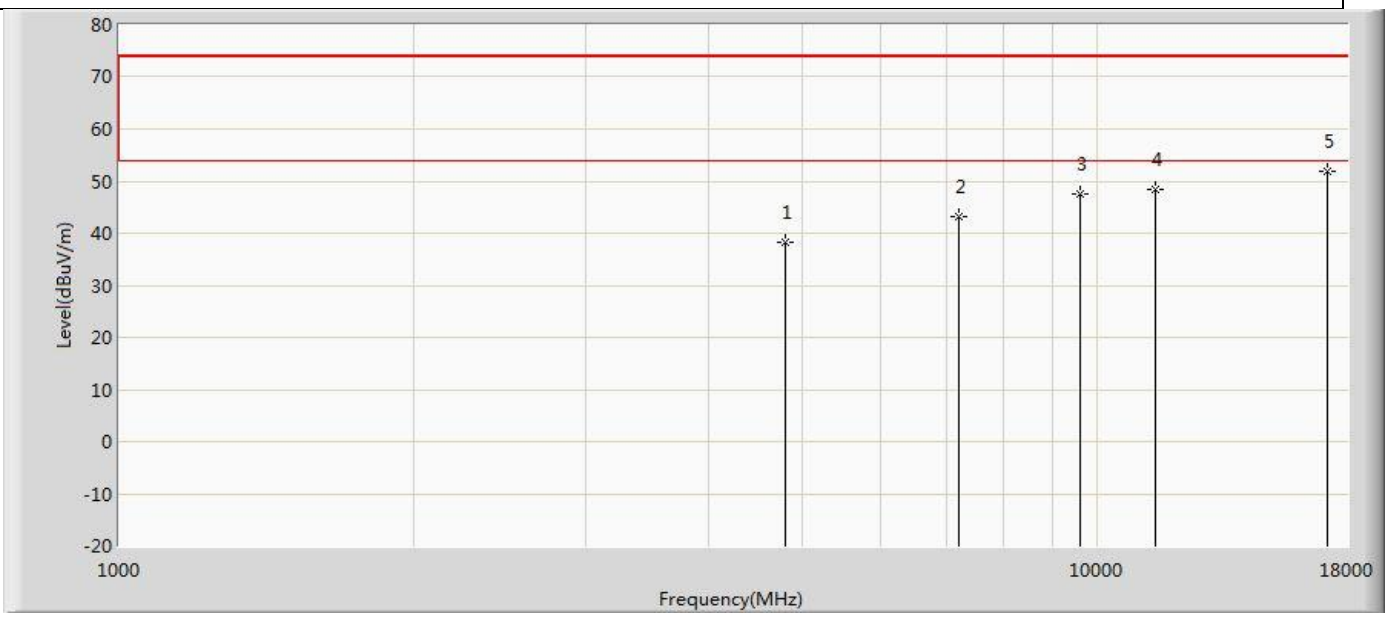


No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		50.127	20.167	0.719	-19.833	40.000	19.448	QP
2		104.205	21.900	-0.361	-21.600	43.500	22.262	QP
3		199.265	21.609	-1.690	-21.891	43.500	23.299	QP
4		361.013	24.527	0.018	-21.473	46.000	24.508	QP
5		544.100	27.484	0.580	-18.516	46.000	26.904	QP
6	*	825.643	33.359	0.792	-12.641	46.000	32.567	QP

1. " * ", means this data is the worst emission level.
2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp)

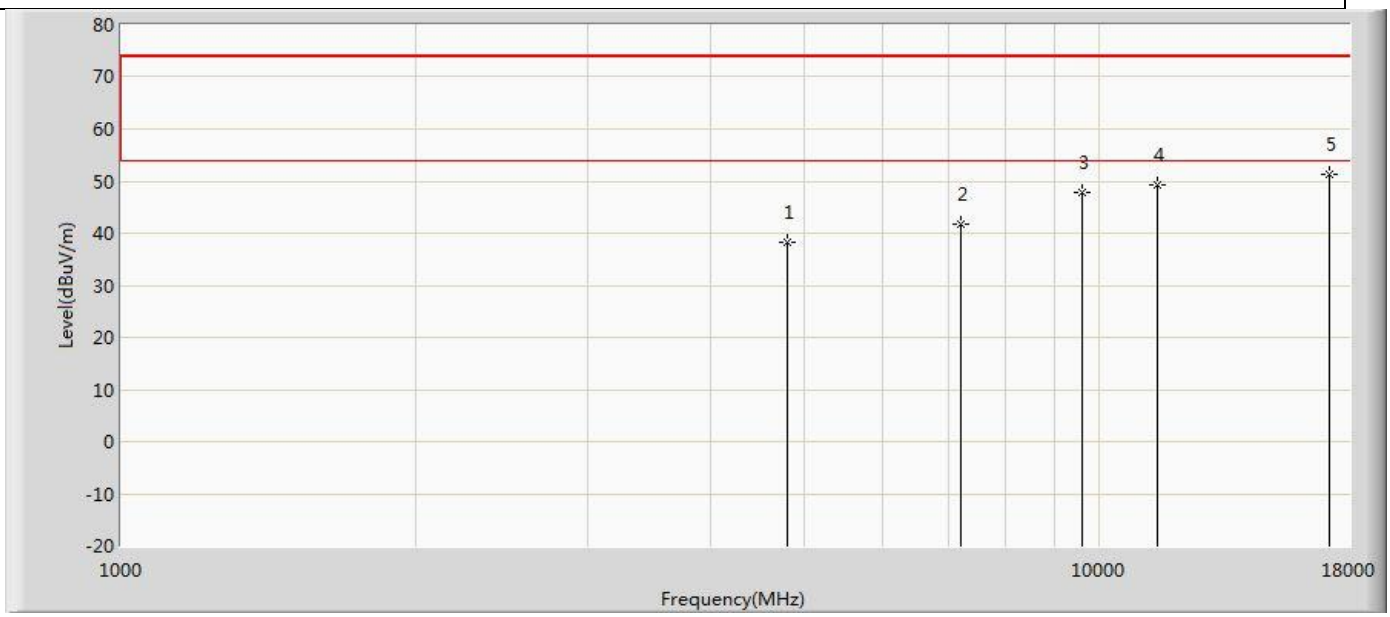
The worst case of Simultaneous Radiated Emission:

Profile: 2290469R	Page No.: 17
Engineer: Pengchengyang	
Site: AC5	Time: 2023/10/10 - 16:58
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode 1：Transmit at 2402MHz by LE_1Mbps & 5732MHz by SRD & 2402MHz by SRD	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		4804.000	38.141	52.233	-35.859	74.000	-14.092	PK
2		7206.000	43.277	51.546	-30.723	74.000	-8.269	PK
3		9608.000	47.471	50.952	-26.529	74.000	-3.481	PK
4		11464.000	48.395	49.443	-25.605	74.000	-1.049	PK
5	*	17196.000	51.789	49.003	-22.211	74.000	2.786	PK

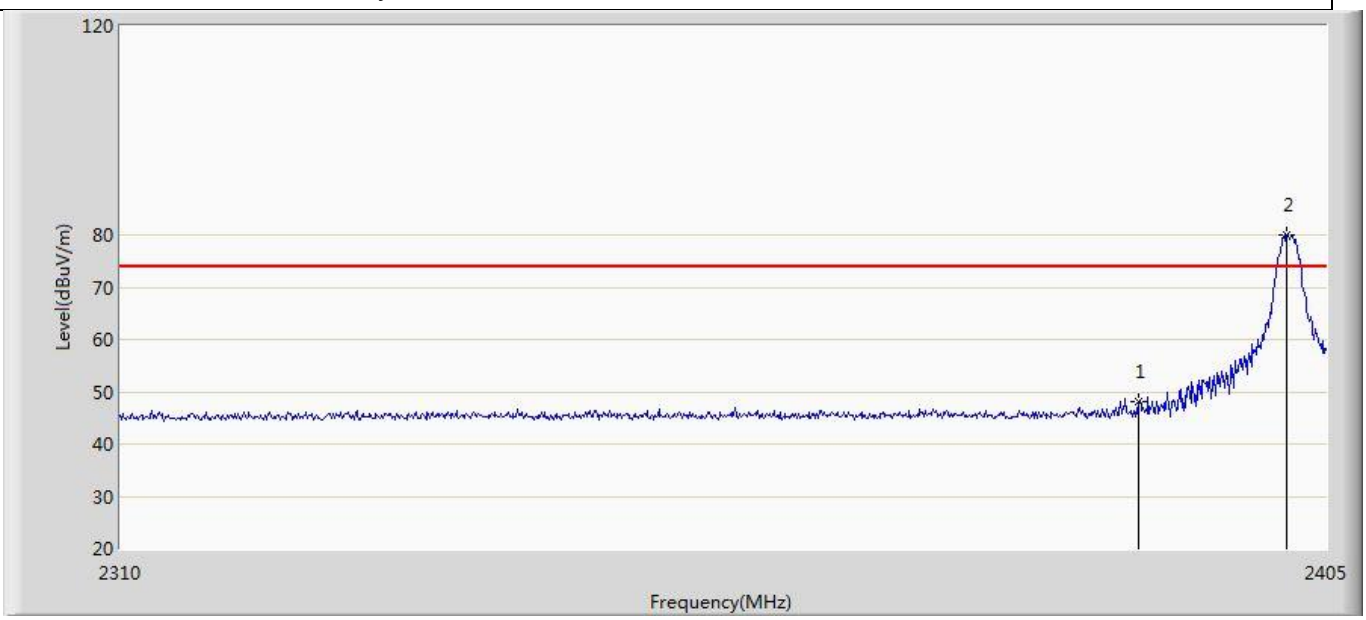
Profile: 2290469R	Page No.: 18
Engineer: Pengchengyang	
Site: AC5	Time: 2023/10/10 - 16:58
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode 1：Transmit at 2402MHz by LE_1Mbps & 5732MHz by SRD & 2402MHz by SRD	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		4804.000	38.298	52.390	-35.702	74.000	-14.092	PK
2		7206.000	41.859	50.128	-32.141	74.000	-8.269	PK
3		9608.000	47.723	51.204	-26.277	74.000	-3.481	PK
4		11464.000	49.328	50.376	-24.672	74.000	-1.049	PK
5	*	17196.000	51.206	48.420	-22.794	74.000	2.786	PK

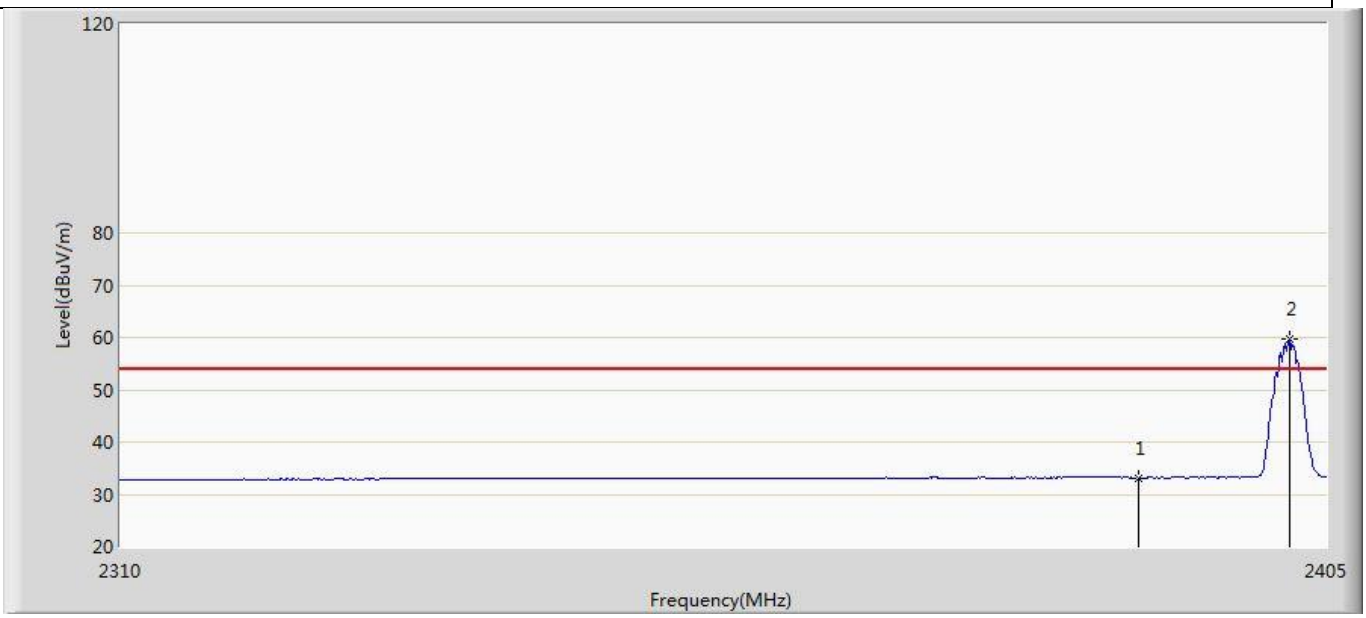
Appendix C: Band Edge

Profile: 2290469R	Page No.: 1
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:33
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



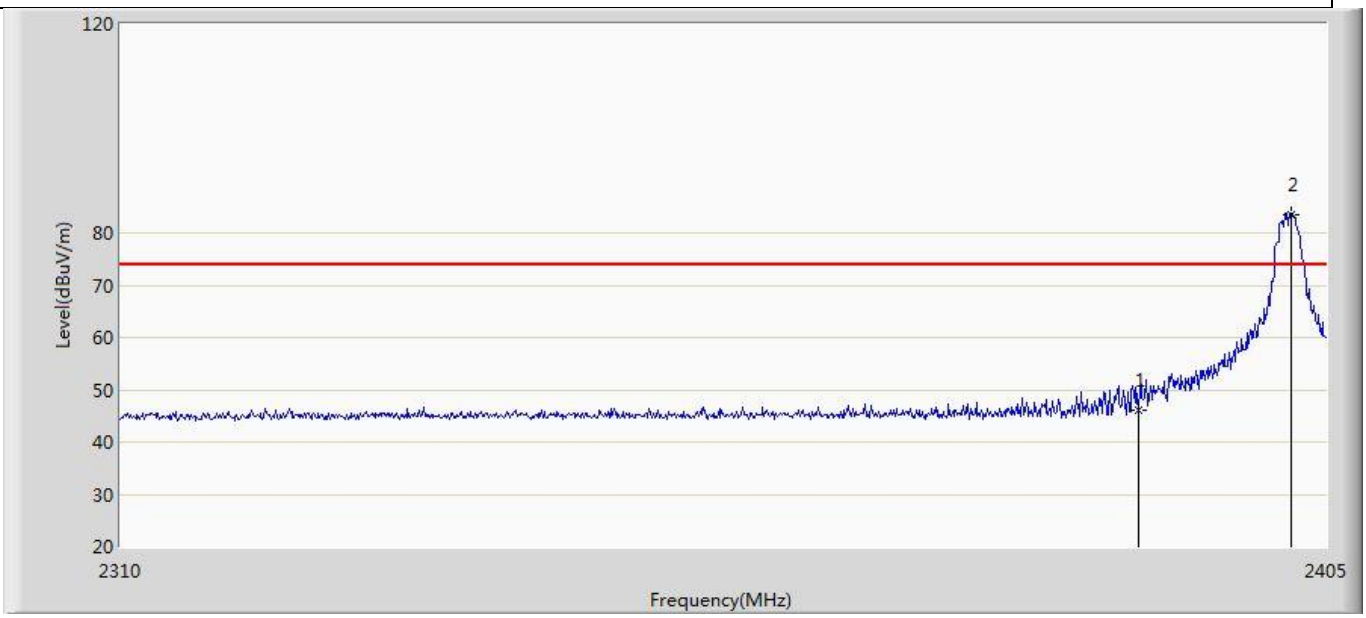
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	48.106	14.022	-25.894	74.000	34.084	PK
2	*	2401.865	80.138	46.001	N/A	N/A	34.137	PK

Profile: 2290469R	Page No.: 2
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:38
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



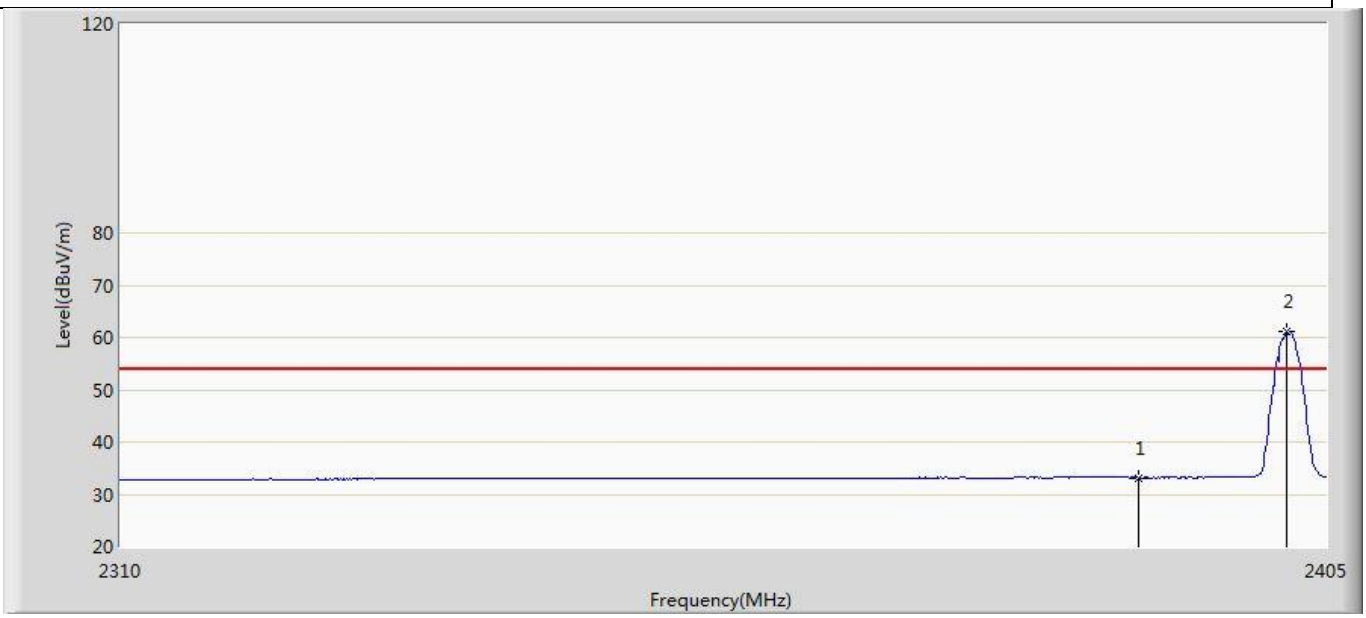
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	33.178	-0.906	-20.822	54.000	34.084	AV
2	*	2402.055	59.596	25.458	N/A	N/A	34.138	AV

Profile: 2290469R	Page No.: 3
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:39
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



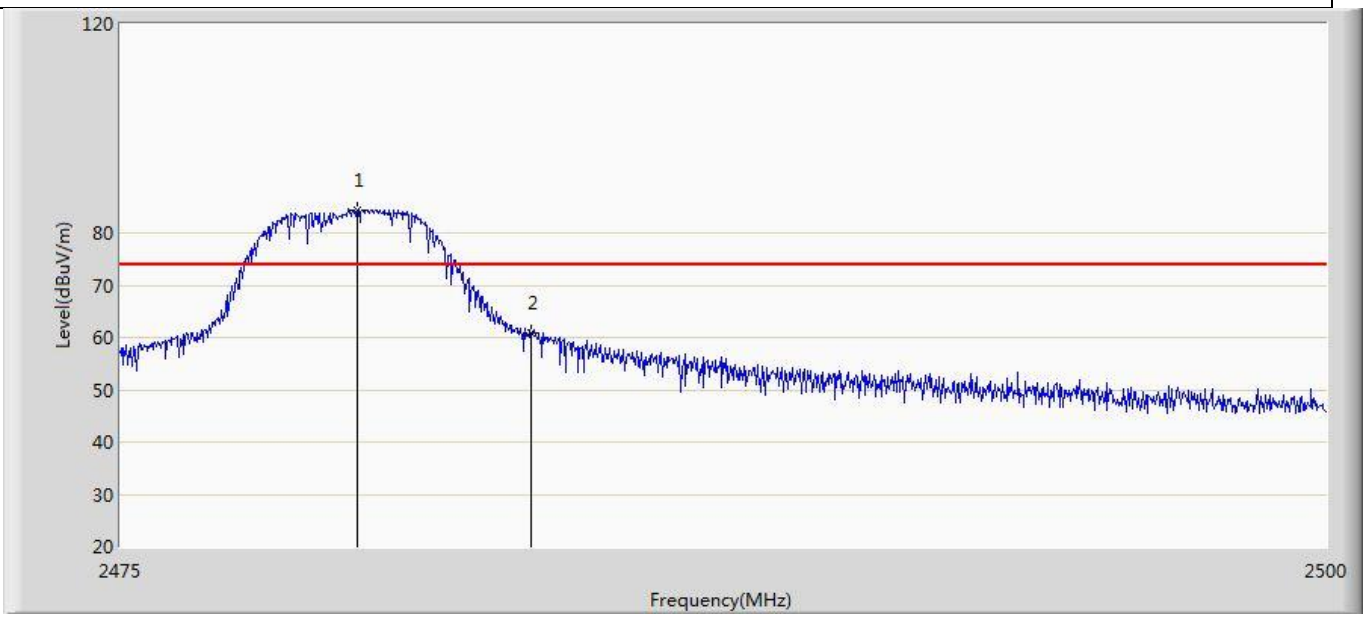
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	46.223	12.139	-27.777	74.000	34.084	PK
2	*	2402.245	83.548	49.409	N/A	N/A	34.138	PK

Profile: 2290469R	Page No.: 4
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:40
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2402MHz by SDR	



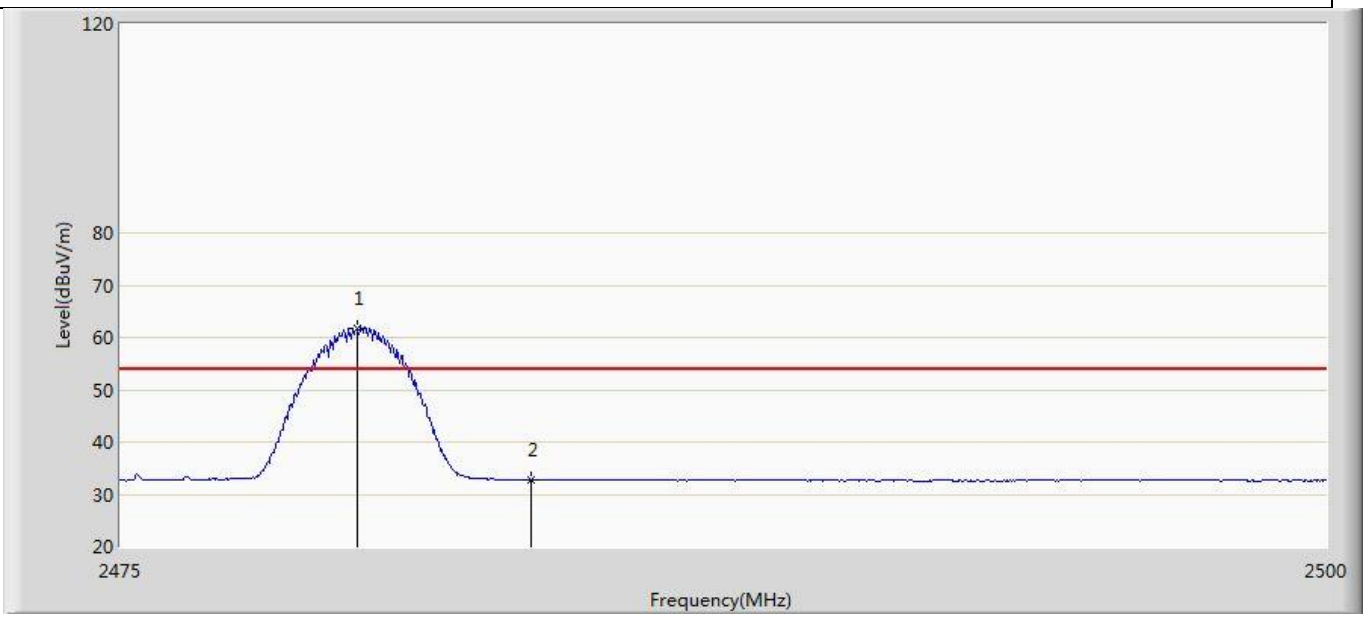
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	33.162	-0.922	-20.838	54.000	34.084	AV
2	*	2401.865	61.271	27.134	N/A	N/A	34.137	AV

Profile: 2290469R	Page No.: 9
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:49
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	



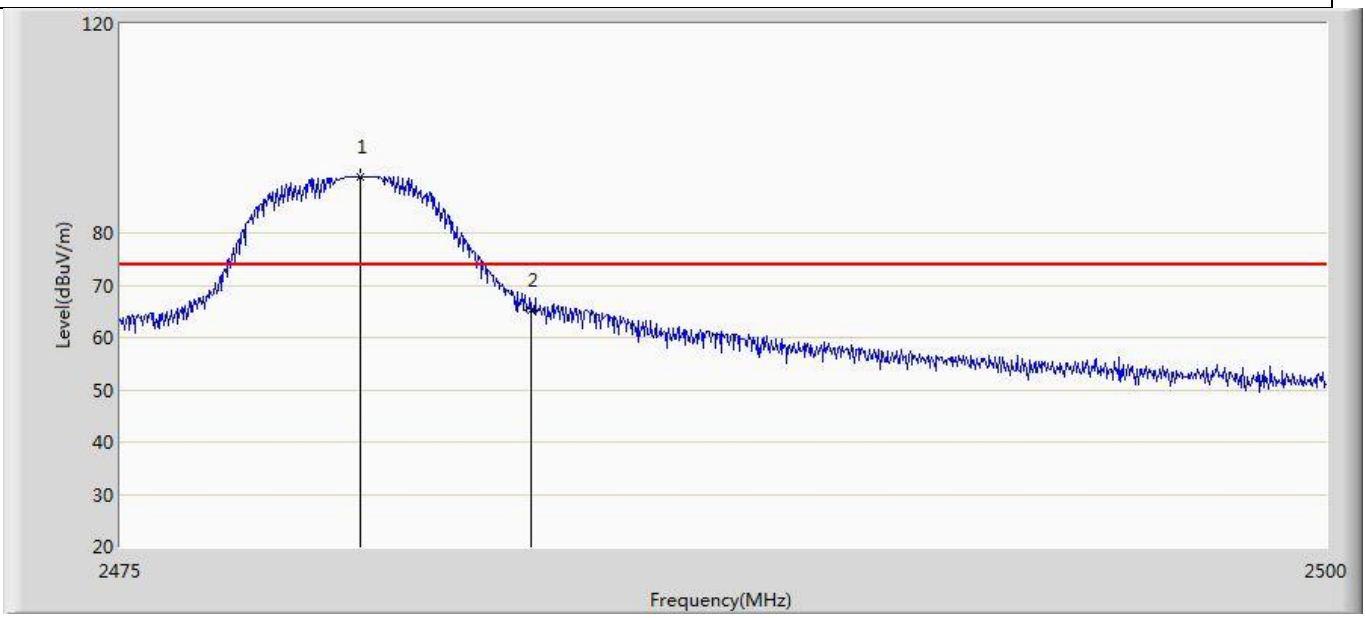
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.900	84.466	49.992	N/A	N/A	34.474	PK
2		2483.500	60.916	26.425	-13.084	74.000	34.491	PK

Profile: 2290469R	Page No.: 10
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:51
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	



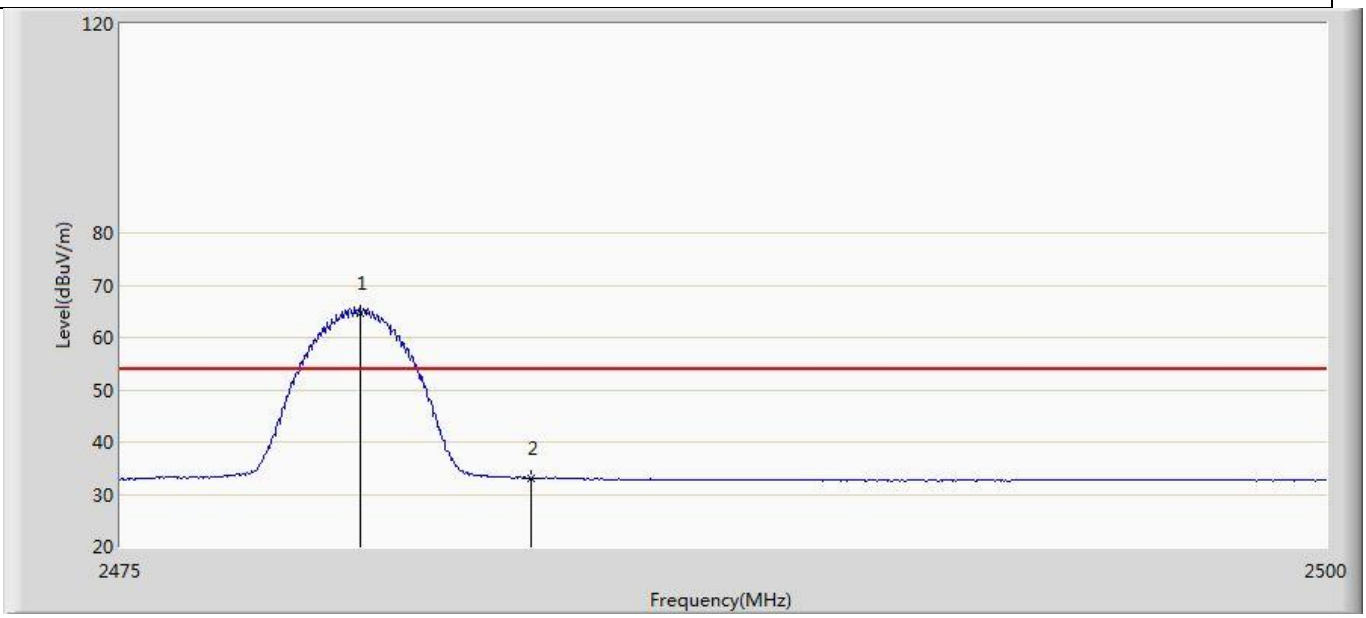
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.900	61.847	27.373	N/A	N/A	34.474	AV
2		2483.500	32.755	-1.736	-21.245	54.000	34.491	AV

Profile: 2290469R	Page No.: 11
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:53
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.975	90.716	56.241	N/A	N/A	34.474	PK
2		2483.500	65.208	30.717	-8.792	74.000	34.491	PK

Profile: 2290469R	Page No.: 12
Engineer: YuLiu	
Site: AC5	Time: 2022/11/15 - 23:54
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: AFC-SW01	Power: DC 3.7V
Note: Mode1:Transmit at 2480MHz by SDR	

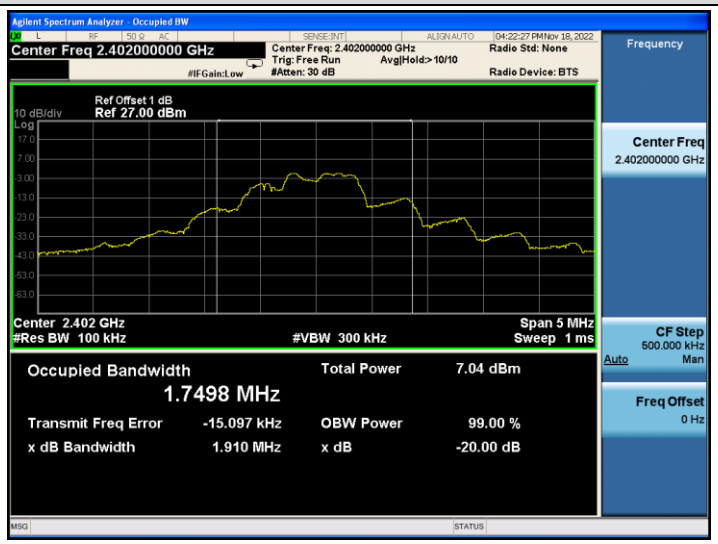


No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.975	64.753	30.278	N/A	N/A	34.474	AV
2		2483.500	33.130	-1.361	-20.870	54.000	34.491	AV

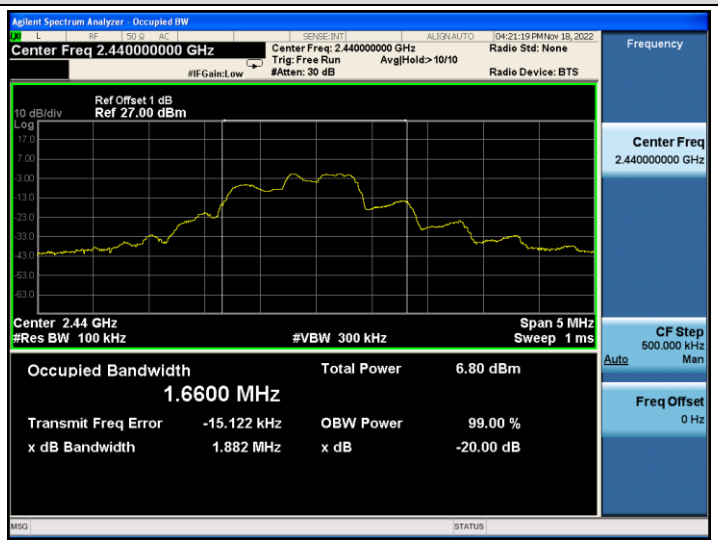
Appendix D: 20dB Bandwidth

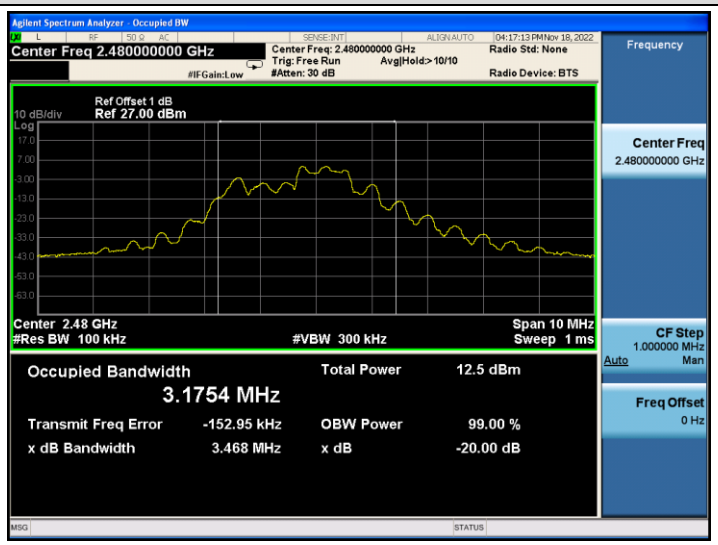
Mode	CH.	Test Freq. (MHz)	20dB Occupied Bandwidth (kHz)	Limit (kHz)	Result
1	00	2402	1.910	Within operation in frequency band	Pass
	38	2440	1.882	Within operation in frequency band	Pass
	78	2480	3.468	Within operation in frequency band	Pass

Mode 1 CH00 2402MHz



Mode 1 CH38 2440MHz



Mode 1 CH78 2480MHz


The End