



FCC/ISED - TEST REPORT

Report Number

:

709502403822-00A Rev1

Date of Issue:

November 4, 2024

Model

:

Lime-CCU23

Product Type

:

CCU

FCC ID

:

2APB2-LIME-CCU23

IC

:

32977-LIMECCU23

Applicant

:

Neutron Holdings, Inc.

Address

:

85 2nd St, San Francisco, CA 94105 USA

Manufacturer

:

Neutron Holdings, Inc.

Address

:

85 2nd St, San Francisco, CA 94105 USA

Test Result

:

☒ Positive

☐ Negative

Total pages including Appendices

:

55



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This revised report replaced all the version issued before.



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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
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FCC Registration No.:	820234
FCC Designation Number:	CN1183
ISED CAB identifier	CN0101
IC Registration No.:	31668



3 Description of the Equipment under Test

Product:	CCU
Model no.:	Lime-CCU23
Hardware Version Identification No. (HVIN)	Lime-CCU23
Product Marketing Name (PMN)	Lime-CCU23
FCC ID:	2APB2-LIME-CCU23
IC:	32977-LIMECCU23
Options and accessories:	NA
Rating:	DC 42V/54V
RF Transmission Frequency:	For 2.4G Wi-Fi: For 802.11b/g/n-HT20: 2412~2462 MHz For 5G Wi-Fi: 5180~5240 MHz (U-NII-1) 5260~5320 MHz (U-NII-2A) 5500~5720 MHz (U-NII-2C) 5745~5825 MHz (U-NII-3) The device shall not be capable of transmitting in the 5600-5650 MHz band. For BLE (Module1): 2402~2480 MHz For EDR (Module1): 2402~2480 MHz For BLE (Module2): 2402~2480 MHz For EDR (Module2): 2402~2480 MHz
No. of Operated Channel:	For 2.4G Wi-Fi: 11 for 802.11b/802.11g/802.11n(H20) For 5G Wi-Fi: 5180~5240 MHz (U-NII-1)



5260~5320 MHz (U-NII-2A)
5500~5590, 5660~5720 MHz (U-NII-2C)
5745~5825 MHz (U-NII-3)

For BLE (Module1): 40

For EDR (Module1): 79

For BLE (Module2): 40

For EDR (Module2): 79

Modulation:

For 2.4G Wi-Fi:
Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n

For 5G Wi-Fi:
Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a/n/ac

For BLE (Module1): GFSK

For EDR (Module1): GFSK, $\pi/4$ DQPSK, 8DPSK

For BLE (Module2): GFSK

For EDR (Module2): GFSK, $\pi/4$ DQPSK, 8DPSK

Hardware Version: EG21GGFR07A01M4G_OCPU_NCFG_QDM549_01.200.01.002

Software Version: V1.2

Data speed:

For 2.4G Wi-Fi:
11b 1-11Mbps
11g 6-54Mbps
11n(H20) 6.5-72.2Mbps

For 5G Wi-Fi:
11a 6 ~ 54Mbps,
11n HT20 6.5 ~ 72.2Mbps,
11ac VHT20 6.5 ~ 86.7Mbps, 11ac VHT40 13.5 ~ 200Mbps,
11ac VHT80 29.3 ~ 433.3Mbps

For BLE (Module1): 1Mbps

For EDR (Module1): 1Mbps, 2Mbps, 3Mbps

For BLE (Module2): 1Mbps, 2Mbps

For EDR (Module2): 1Mbps, 2Mbps, 3Mbps

Channel list:

For 2.4G Wi-Fi:

802.11b/g/n(HT20)			
Ch	Fre(MHz)	Ch	Fre(MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

For 5G Wi-Fi:

Band (GHz)	Operating Channel Number	Channel center frequencies for 20MHz bandwidth (MHz)
5.15GHz~5.25GHz	36	5180
	40	5200
	44	5220
	48	5240
5.25GHz~5.35GHz	52	5260
	56	5280
	60	5300
	64	5320
5.5GHz~5.7GHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	132	5660
	136	5680
	140	5700
5.725GHz~5.825GHz	144	5720
	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

Band (GHz)	Operating	Channel center
------------	-----------	----------------

	Channel Number	frequencies for 40MHz bandwidth (MHz)
5.15GHz~5.25GHz	38	5190
	46	5230
5.25GHz~5.35GHz	54	5270
	62	5310
5.5GHz~5.7GHz	102	5510
	110	5550
	134	5670
	142	5710
5.725GHz~5.825GHz	151	5755
	159	5795

Band (GHz)	Operating Channel Number	Channel center frequencies for 80MHz bandwidth (MHz)
5.15GHz~5.25GHz	42	5210
5.25GHz~5.35GHz	58	5290
5.5GHz~5.7GHz	106	5530
	138	5690
5.725GHz~5.825GHz	155	5775

For BLE

Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

For EDR

Ch	Fre (MH)	Ch	Fre (MH)	Ch	Fre (MH)	Ch	Fre (MH)	Ch	Fre (MHz)
1	2402	17	2418	33	2434	49	2450	65	2466
2	2403	18	2419	34	2435	50	2451	66	2467
3	2404	19	2420	35	2436	51	2452	67	2468
4	2405	20	2421	36	2437	52	2453	68	2469
5	2406	21	2422	37	2438	53	2454	69	2470
6	2407	22	2423	38	2439	54	2455	70	2471
7	2408	23	2424	39	2440	55	2456	71	2472



8	2409	24	2425	40	2441	56	2457	72	2473
9	2410	25	2426	41	2442	57	2458	73	2474
10	2411	26	2427	42	2443	58	2459	74	2475
11	2412	27	2428	43	2444	59	2460	75	2476
12	2413	28	2429	44	2445	60	2461	76	2477
13	2414	29	2430	45	2446	61	2462	77	2478
14	2415	30	2431	46	2447	62	2463	78	2479
15	2416	31	2432	47	2448	63	2464	79	2480
16	2417	32	2433	48	2449	64	2465		

Antenna Type: For 2.4G Wi-Fi: FPC

For 5G Wi-Fi: FPC

For BLE (Module1): FPC

For EDR (Module1): FPC

For BLE (Module2): FPC

For EDR (Module2): FPC

Antenna Gain: For 2.4G Wi-Fi: 1.96 dBi

For 5G Wi-Fi: 3.52 dBi

For BLE (Module1): 1.96 dBi

For EDR (Module1): 1.96 dBi

For BLE (Module2): 3.16 dBi

For EDR (Module2): 3.16 dBi

Description of the EUT: The Equipment Under Test (EUT) is a CCU with Wi-Fi Module, BLE/EDR Module and LTE Module. The EUT support Wi-Fi operated at 2.4GHz and 5GHz.

Test sample no.: SHA-843416-2 (Radiated sample)
SHA-843416-3 (Conducted sample)

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart E, 2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart E - Unlicensed National Information Infrastructure Devices
RSS-Gen Issue 5 Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

Test Method:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

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



5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart E & RSS-247 Issue 3/RSS-Gen Issue 5						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	--	Site 1	☒	☐	☐
§15.407(a)(2), (e) & RSS-247 6.2.1.2, RSS-247 6.2.2.1, RSS-247 6.2.3.1, RSS-247 6.2.4.2, RSS-Gen 6.7	Emission bandwidth	16-17	Site 1	☒	☐	☐
15.407(a)(1)(2)(3) & RSS-247 6.2	Maximum Conducted Output Power and EIRP	18-19	Site 1	☒	☐	☐
15.407(a)(1)(2)(3) & RSS-247 6.2	Maximum Power Spectral Density	20-21	Site 1	☒	☐	☐
§15.407(g) & RSS-GEN 6.11	Frequencies Stability	22	Site 1	☒	☐	☐
§15.407(b)(1), 15.407(b)(2), 15.407(b)(3), 15.407(b)(4), 15.407(b)(8), 15.407(b)(9), 15.209 & RSS-247 6.2 RSS-GEN 8.9	Unwanted Emissions	23-51	Site 1	☒	☐	☐
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.

Remark 2: The EUT only operation at 2.4G Wi-Fi and 5G Wi-Fi UNII Band (5180MHz-5240MHz, 5260~5320 MHz, 5500~5720 MHz, 5745MHz-5825MHz).

Note 1: The EUT uses a FPC antenna, which gain is 1.96 dBi for 2.4G Wi-Fi, 3.52 dBi for 5G Wi-Fi. In accordance to §15.203 and RSS-Gen 6.8, It is considered sufficiently to comply with the provisions of this section.

15.203 requirement: 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, 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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2APB2-LIME-CCU23, IC: 32977-LIMECCU23 complies with Section 15.207, 15.209, 15.407 of the FCC Part 15, Subpart E Rules and RSS-247, RSS-GEN.

This report is only for 5GHz Wi-Fi test report, for the 2.4GHz Wi-Fi test report please refer to 709502403822-00C, for the BLE (Module1) test report please refer to 709502403822-00D, for the EDR (Module1) test report please refer to 709502403822-00E, for the BLE (Module2) test report please refer to 709502403822-00F, for the EDR (Module2) test report please refer to 709502403822-00G.

We tested it and listed the worst data in this report.

SUMMARY:

All tests according to the regulations cited on page 9 were

■ - Performed

□ - Not Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: June 19, 2024

Testing Start Date: July 31, 2024

Testing End Date: August 26, 2024

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



Hui TONG
Review Engineer

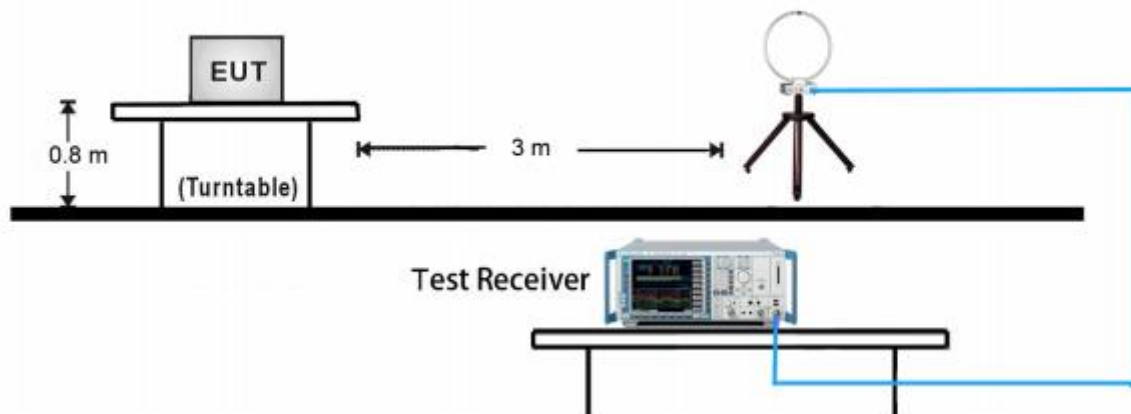
Wenqiang LU
Project Engineer

Chengjie GUO
Test Engineer

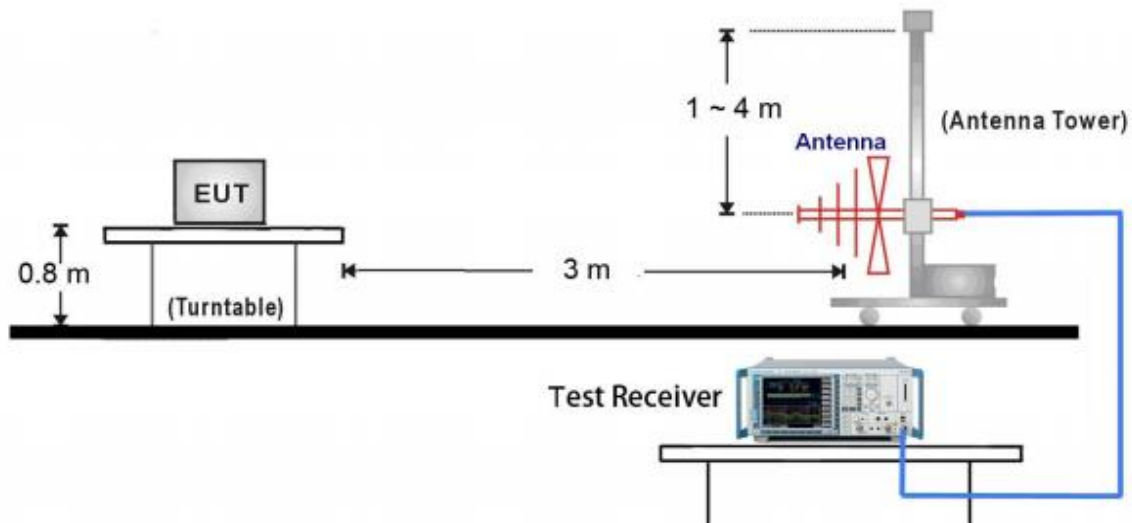
7 Test Setups

7.1 Radiated test setups

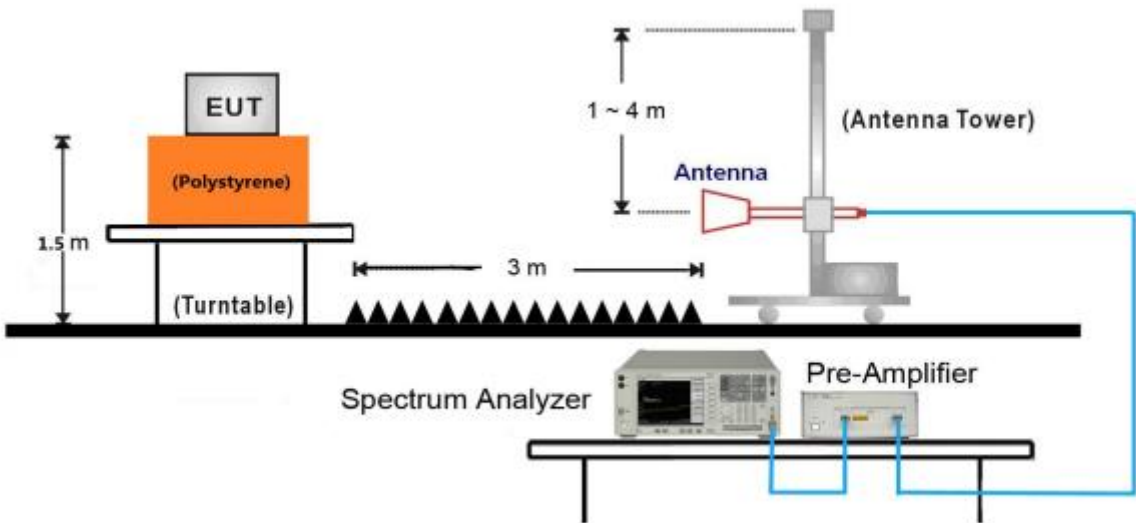
9kHz ~ 30MHz Test Setup:



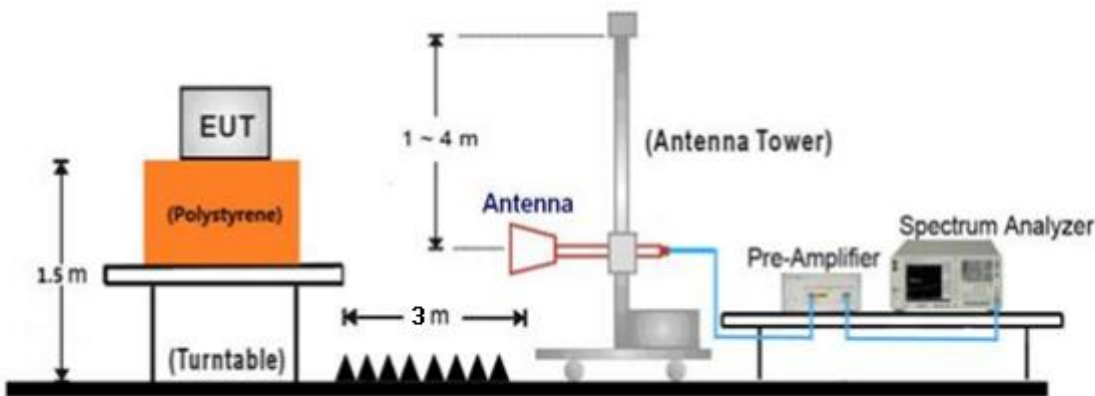
30MHz ~ 1GHz Test Setup:



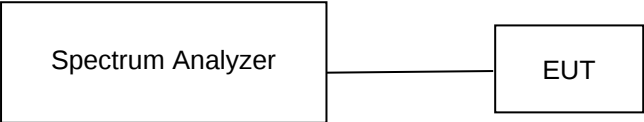
1GHz ~ 18GHz Test Setup:



18GHz ~ 40GHz Test Setup:



7.2 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	E470	PF-OU5TS7 17/09

Test software: adb.exe, which used to control the EUT in continues transmitting mode.
The system was configured to channel:

Test Mode	Channel (MHz)		
802.11a, 802.11n HT20 802.11ac VHT20	5G WIFI-Band 1		
	CH36 (5180MHz)	CH40 (5200MHz)	CH48 (5240MHz)
	5G WIFI-Band 2A		
	CH52 (5260MHz)	CH56 (5280MHz)	CH64 (5320MHz)
	5G WIFI-Band 2C		
	CH100 (5500MHz)	CH108 (5540MHz)	CH116 (5580MHz)
	CH132 (5660MHz)	CH136 (5680MHz)	CH140 (5700MHz)
	CH144 (5720MHz)		
	5G WIFI-Band 3		
	CH149 (5745MHz),	CH157 (5785MHz)	CH165 (5825MHz)

Test Mode	Channel (MHz)		
802.11ac VHT40	5G WIFI-Band 1		
	CH38 (5190MHz)	CH46 (5230MHz)	
	5G WIFI-Band 2A		
	CH54 (5270MHz)	CH62 (5310MHz)	
	5G WIFI-Band 2C		
	CH102 (5510MHz)	CH110 (5550MHz)	CH118 (5590MHz)
	CH134 (5670MHz)	CH142 (5710MHz)	
	5G WIFI-Band 3		
	CH151 (5755MHz)	CH159 (5795MHz)	

Test Mode	Channel (MHz)	
802.11ac VHT80	5G WIFI-Band 1	
	CH42 (5210MHz)	
	5G WIFI-Band 2A	
	CH58 (5290MHz)	
	5G WIFI-Band 2C	
	CH106 (5530MHz)	CH138 (5690MHz)
	5G WIFI-Band 3	
	CH155 (5775MHz)	



The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

	Modulation Type	Data Rate	Index Value (Power level setting)
SISO	802.11a OFDM	6Mbps	17
	802.11n (HT20): OFDM	MCS0 (6.5Mbps)	16
	802.11ac (VHT20): OFDM	11ac 6.5Mbps	16
	802.11ac (VHT40): OFDM	11ac 13.5Mbps	14.5
	802.11ac (VHT80): OFDM	11ac 29.3Mbps	14

9 Technical Requirement

9.1 Emission bandwidth

1、Test Method of 26dB Bandwidth

According to KDB789033 D02

- a) Set RBW = approximately 1% of the emission bandwidth.
- b) Set the VBW > RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Limit: No limit

2、Test Method of 6dB Bandwidth

According to KDB789033 D02

- a) Set RBW = 100KHz
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit: $\geq 500\text{KHz}$

3、Test Method of 99% Bandwidth

According to KDB789033 D02

- a) Set center frequency to the nominal EUT channel center frequency
- b) Set span = 1.5 times to 5.0 times the OBW.
- c) Set RBW = 1 % to 5 % of the OBW
- d) Set VBW $\geq 3 \cdot$ RBW
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f) Use the 99 % power bandwidth function of the instrument (if available).
- g) If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total



is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Limit: No limit

26dB Bandwidth Test Result:

Test data should be referred to Appendix A for 709502403822-00A.

6dB Bandwidth Test Result:

Test data should be referred to Appendix A for 709502403822-00A.

99% Bandwidth Test Result

Test data should be referred to Appendix A for 709502403822-00A.

9.2 Maximum conducted output power and EIRP

Test Method

According to C63.10, the EUT was placed on 0.8m height table, the RF output of EUT was connected to the Spectrum Analyzer by RF cable. The path loss was compensated to the results for each measurement.

1. Measure the duty cycle
2. Use the following spectrum analyzer settings:
RBW=1MHz, VBW≥3MHz, Span≥ the 99% Bandwidth of the emission being measured
Sweep = auto, Detector function = power averaging.
3. Trace average at least 100 traces in power averaging (rms) mode
4. Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times

15.407 Limits:

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26dB emission bandwidth in megahertz.

For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

RSS 247 Limits:

For client devices in the 5.15-5.25 GHz band, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.

For the 5.25-5.35 GHz bands, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

For the 5.47-5.6 and 5.65-5.725 GHz bands, The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.



For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

Maximum conducted output power Test Result:

Test data should be referred to Appendix A for 709502403822-00A.

9.3 Maximum power spectral density

Test Method

According to C63.10, the EUT was placed on 0.8m height table, the RF output of EUT was connected to the test power meter by RF cable. The path loss was compensated to the results for each measurement.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
 2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
 3. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log (1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
 4. The result is the Maximum PSD over 1 MHz reference bandwidth.
 5. For devices operating in the bands 5.15–5.25 GHz, 5.25–5.35 GHz, and 5.47–5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5) & RSS-247 6.2. For devices operating in the band 5.725–5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set $RBW \geq 1/T$, where T is defined in II.B.I.a).
 - b) Set $VBW \geq 3$ RBW.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz}/RBW)$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log (1\text{MHz}/RBW)$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
- Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.



Limit: The maximum power spectral density shall not exceed 11dBm for the 5.15-5.25GHz, 5.25-5.35GHz, 5.47-5.725 GHz Band in any 1 megahertz band.
For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30dBm in any 1 500kHz band.

Test Result:

Test data should be referred to Appendix A for 709502403822-00A.



9.4 Frequencies Stability

Test Method

1. Connect the UUT to the spectrum analyzer
2. Set Centre Frequency of the channel under test.
3. Set Detector PEAK
4. Set RBW: 10KHz, VBW: 3RBW
5. Set Span: Encompass the entire emissions bandwidth (EBW) of the signal.
6. Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

User manual temperature is -20 to 60 °C.

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Limit: 20ppm

Test Results (All conditions and all modes were performed, only list Worst-Case in the report)

Remark: NV is normal Voltage: DC 54V, HV is High Voltage: DC 75V, LV is Low Voltage: DC 28V, NT is normal Temperature: +20 °C.

Test Result:

Test data should be referred to Appendix A for 709502403822-00A.

9.5 Unwanted emissions

Transmitting spurious emission test result as below:

Test Method

Radiated Mode:

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
5. Use the following spectrum analyzer settings According to C63.10:
For Above 1GHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW $\geq$ RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
For Below 1GHz
Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz, VBW $\geq$ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.



(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

According to part 15.407(b) & RSS-247 6.2, the radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205 and RSS-GEN 8.10, must comply with the radiated emission limits specified in section 15.209 & RSS-GEN 8.9.

Frequency MHz	Field Strength uV/m	Field Strength dBμV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case listed in the report.

Transmitting spurious emission worse case test result:

Transmitting spurious emission test result as below:

Band1

Test mode:5G_U-NII-1_802.11a_5180MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1996.10	38.94	74.00	35.06	PK	Hor
2133.16	45.00	74.00	29.00	PK	Ver
5150.02	44.06	74.00	29.94	PK	Hor
5150.10	49.86	74.00	24.14	PK	Ver
10359.03	47.24	74.00	26.76	PK	Ver
10367.53	47.86	74.00	26.14	PK	Hor

Test mode:5G_U-NII-1_802.11a_5200MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1957.31	48.23	74.00	25.77	PK	Ver
2127.84	38.67	74.00	35.33	PK	Hor
4247.53	46.50	74.00	27.50	PK	Ver
10401.00	48.24	74.00	25.76	PK	Ver
10402.06	46.65	74.00	27.35	PK	Hor

Test mode:5G_U-NII-1_802.11a_5240MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2125.19	43.40	74.00	30.60	PK	Hor
2129.97	44.16	74.00	29.84	PK	Ver
10480.16	48.22	74.00	25.78	PK	Hor
10481.22	46.65	74.00	27.35	PK	Ver

Test mode:5G_U-NII-1_802.11ac20_5180MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2132.10	43.31	74.00	30.69	PK	Ver
2133.16	45.27	74.00	28.73	PK	Hor
5150.10	45.28	74.00	28.72	PK	Hor
5150.10	47.47	74.00	26.53	PK	Ver
10363.28	46.23	74.00	27.77	PK	Hor
10363.81	47.93	74.00	26.07	PK	Ver



Test mode:5G_U-NII-1_802.11ac20_5200MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2123.06	45.45	74.00	28.55	PK	Ver
2127.31	44.60	74.00	29.40	PK	Hor
10398.88	47.40	74.00	26.60	PK	Ver
10409.50	48.58	74.00	25.42	PK	Hor

Test mode:5G_U-NII-1_802.11ac20_5240MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1957.84	42.87	74.00	31.13	PK	Ver
2132.63	46.64	74.00	27.36	PK	Hor
10481.75	46.55	74.00	27.45	PK	Ver
10486.00	49.32	74.00	24.68	PK	Hor

Test mode:5G_U-NII-1_802.11ac40_5190MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2126.25	43.76	74.00	30.24	PK	Hor
2132.10	44.35	74.00	29.65	PK	Ver
5143.58	57.52	74.00	16.48	PK	Ver
5149.04	54.51	74.00	19.49	PK	Hor
5149.90	43.10	54.00	10.90	AV	Hor
5150.20	46.60	54.00	7.40	AV	Ver
10380.81	48.42	74.00	25.58	PK	Hor
10380.81	46.81	74.00	27.19	PK	Ver

Test mode:5G_U-NII-1_802.11ac40_5230MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2123.06	47.38	74.00	26.62	PK	Ver
2128.38	44.25	74.00	29.75	PK	Hor
10461.03	46.82	74.00	27.18	PK	Hor
10461.56	48.06	74.00	25.94	PK	Ver



Test mode:5G_U-NII-1_802.11ac80_5210MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2128.90	40.31	74.00	33.69	PK	Hor
5141.76	57.74	74.00	16.26	PK	Ver
5145.61	53.05	74.00	20.95	PK	Hor
5149.90	42.60	54.00	11.40	AV	Hor
5149.90	45.50	54.00	8.50	AV	Ver
10420.66	46.47	74.00	27.53	PK	Ver

Test mode:5G_U-NII-1_802.11n_5180MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2124.66	46.57	74.00	27.43	PK	Hor
2129.44	44.36	74.00	29.64	PK	Ver
5150.02	48.84	74.00	25.16	PK	Ver
5150.16	45.48	74.00	28.52	PK	Hor
10359.56	47.82	74.00	26.18	PK	Ver
10365.41	48.46	74.00	25.54	PK	Hor

Test mode:5G_U-NII-1_802.11n_5200MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2127.84	38.70	74.00	35.30	PK	Hor
2129.97	49.23	74.00	24.77	PK	Ver
2401.97	50.90	74.00	23.10	PK	Ver
10405.25	47.55	74.00	26.45	PK	Hor
10407.91	49.21	74.00	24.79	PK	Ver

Test mode:5G_U-NII-1_802.11n_5240MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2126.25	43.97	74.00	30.03	PK	Hor
2127.84	45.29	74.00	28.71	PK	Ver
2401.97	47.10	74.00	26.90	PK	Hor
3197.25	44.97	74.00	29.03	PK	Ver
10480.69	47.51	74.00	26.49	PK	Hor
10483.88	48.76	74.00	25.24	PK	Ver

Band2A

Test mode:5G_U-NII-2A_802.11a_5260MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1990.78	45.14	74.00	28.86	PK	Hor
2124.13	46.92	74.00	27.08	PK	Ver
2127.84	45.49	74.00	28.51	PK	Hor
4252.31	47.34	74.00	26.66	PK	Ver
5979.41	51.74	74.00	22.26	PK	Ver
10520.53	47.31	74.00	26.69	PK	Hor
10521.06	47.49	74.00	26.51	PK	Ver

Test mode:5G_U-NII-2A_802.11a_5280MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2126.78	46.61	74.00	27.39	PK	Ver
2133.16	47.12	74.00	26.88	PK	Hor
4254.97	46.85	74.00	27.15	PK	Ver
10559.31	47.45	74.00	26.55	PK	Ver
10561.44	47.40	74.00	26.60	PK	Hor

Test mode:5G_U-NII-2A_802.11a_5320MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1996.63	45.81	74.00	28.19	PK	Hor
2130.50	44.36	74.00	29.64	PK	Ver
5350.10	45.71	74.00	28.29	PK	Hor
5350.34	45.17	74.00	28.83	PK	Ver
5993.75	50.43	74.00	23.57	PK	Ver
10639.00	48.42	74.00	25.58	PK	Hor
10641.13	48.26	74.00	25.74	PK	Ver

Test mode:5G_U-NII-2A_802.11ac20_5260MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2124.13	43.27	74.00	30.73	PK	Hor
2128.38	45.87	74.00	28.13	PK	Ver
3193.00	45.24	74.00	28.76	PK	Ver
10519.47	47.05	74.00	26.95	PK	Ver
10520.53	48.15	74.00	25.85	PK	Hor



Test mode:5G_U-NII-2A_802.11ac20_5280MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2128.38	46.94	74.00	27.06	PK	Ver
2128.91	46.37	74.00	27.63	PK	Hor
10559.84	47.35	74.00	26.65	PK	Ver
10560.38	48.17	74.00	25.83	PK	Hor

Test mode:5G_U-NII-1_802.11ac20_5320MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2125.72	40.10	74.00	33.90	PK	Hor
2128.91	44.07	74.00	29.93	PK	Ver
3185.03	43.73	74.00	30.27	PK	Ver
5350.38	46.86	74.00	27.14	PK	Hor
5350.85	46.77	74.00	27.23	PK	Ver
10640.06	47.84	74.00	26.16	PK	Ver
10642.19	47.35	74.00	26.65	PK	Hor

Test mode:5G_U-NII-2A_802.11ac40_5270MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2125.19	46.59	74.00	27.41	PK	Hor
2127.31	47.82	74.00	26.18	PK	Ver
10541.25	47.77	74.00	26.23	PK	Ver
10541.78	47.28	74.00	26.72	PK	Hor

Test mode:5G_U-NII-2A_802.11ac40_5310MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2126.78	46.43	74.00	27.57	PK	Ver
2131.56	44.77	74.00	29.23	PK	Hor
5350.49	56.88	74.00	17.12	PK	Hor
5350.49	59.28	74.00	14.72	PK	Ver
5350.60	42.80	54.00	11.20	AV	Hor
5350.60	44.70	54.00	9.30	AV	Ver
10619.88	47.05	74.00	26.95	PK	Hor
10624.66	48.05	74.00	25.95	PK	Ver

Test mode:5G_U-NII-2A_802.11ac80_5290MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2129.44	46.03	74.00	27.97	PK	Hor
2129.97	48.54	74.00	25.46	PK	Ver
5350.00	41.60	54.00	12.40	AV	Ver
5350.49	49.97	74.00	24.03	PK	Hor
5351.25	51.80	74.00	22.20	PK	Ver
10580.31	47.89	74.00	26.11	PK	Ver
10587.47	57.74	74.00	16.26	PK	Hor

Test mode:5G_U-NII-2A_802.11n_5260MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
1997.69	40.96	74.00	33.04	PK	Hor
2125.72	49.19	74.00	24.81	PK	Ver
5997.47	51.96	74.00	22.04	PK	Ver
10522.66	48.00	74.00	26.00	PK	Hor
11521.94	48.84	74.00	25.16	PK	Ver

Test mode:5G_U-NII-2A_802.11n_5280MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2126.78	44.55	74.00	29.45	PK	Hor
2128.91	48.08	74.00	25.92	PK	Ver
10560.91	47.58	74.00	26.42	PK	Hor
10563.56	48.41	74.00	25.59	PK	Ver

Test mode:5G_U-NII-2A_802.11n_5320MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2127.31	44.51	74.00	29.49	PK	Ver
2128.38	40.00	74.00	34.00	PK	Hor
5350.08	51.02	74.00	22.98	PK	Ver
5350.89	48.00	74.00	26.00	PK	Hor
10641.13	46.44	74.00	27.56	PK	Ver
10650.16	47.87	74.00	26.13	PK	Hor

Bnad2C

Test mode:5G_U-NII-2C_802.11a_5500MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2132.63	42.45	74.00	31.55	PK	Hor
3194.06	43.56	74.00	30.44	PK	Ver
5350.08	40.16	74.00	33.84	PK	Hor
5470.31	48.82	74.00	25.18	PK	Hor
5470.64	48.58	74.00	25.42	PK	Ver
5976.75	50.70	74.00	23.30	PK	Ver
11001.84	48.62	74.00	25.38	PK	Hor

Test mode:5G_U-NII-2C_802.11a_5600MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1990.25	45.81	74.00	28.19	PK	Ver
2126.78	45.76	74.00	28.24	PK	Hor
3188.75	44.43	74.00	29.57	PK	Ver
11202.13	49.40	74.00	24.60	PK	Hor
11204.25	48.10	74.00	25.90	PK	Ver

Test mode:5G_U-NII-2C_802.11a_5700MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2125.19	44.13	74.00	29.87	PK	Ver
2127.84	46.03	74.00	27.97	PK	Hor
5725.01	52.84	74.00	21.16	PK	Ver
5725.73	51.62	74.00	22.38	PK	Hor
11399.22	50.21	74.00	23.79	PK	Ver
11405.06	49.10	74.00	24.90	PK	Hor

Test mode:5G_U-NII-2C_802.11a_5720MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2125.72	49.04	74.00	24.96	PK	Ver
2127.84	44.59	74.00	29.41	PK	Hor
5460.06	42.26	74.00	31.74	PK	Ver
5460.66	41.81	74.00	32.19	PK	Hor
5850.56	41.90	74.00	32.10	PK	Ver
5850.67	41.44	74.00	32.56	PK	Hor
11439.59	48.59	74.00	25.41	PK	Hor
11442.25	48.46	74.00	25.54	PK	Ver



Test mode:5G_U-NII-2C_802.11ac20_5500MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2123.06	48.92	74.00	25.08	PK	Ver
2131.56	40.80	74.00	33.20	PK	Hor
5470.20	47.20	74.00	26.80	PK	Ver
5470.31	46.36	74.00	27.64	PK	Hor
11007.16	48.46	74.00	25.54	PK	Hor
11009.81	47.55	74.00	26.45	PK	Ver

Test mode:5G_U-NII-2C_802.11ac20_5600MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1961.03	48.19	74.00	25.81	PK	Ver
2127.31	42.90	74.00	31.10	PK	Hor
11196.28	48.85	74.00	25.15	PK	Hor
11197.88	47.32	74.00	26.68	PK	Ver

Test mode:5G_U-NII-2C_802.11ac20_5700MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2124.13	41.72	74.00	32.28	PK	Hor
2129.44	41.17	74.00	32.83	PK	Ver
5724.95	49.17	74.00	24.83	PK	Ver
5725.10	47.89	74.00	26.11	PK	Hor
11401.80	49.11	74.00	24.89	PK	Ver
11401.88	49.34	74.00	24.66	PK	Hor

Test mode:5G_U-NII-2C_802.11ac20_5720MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2127.31	47.89	74.00	26.11	PK	Hor
2132.63	44.96	74.00	29.04	PK	Ver
5460.00	42.71	74.00	31.29	PK	Hor
5460.94	41.93	74.00	32.07	PK	Ver
5850.72	41.44	74.00	32.56	PK	Ver
5850.78	42.85	74.00	31.15	PK	Hor
11442.78	48.82	74.00	25.18	PK	Hor
114406.56	46.94	74.00	27.06	PK	Ver



Test mode:5G_U-NII-2C_802.11ac40_5510MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2129.44	42.93	74.00	31.07	PK	Ver
2132.09	40.22	74.00	33.78	PK	Hor
5452.49	51.96	74.00	22.04	PK	Hor
5452.82	52.21	74.00	21.79	PK	Ver
5470.00	40.70	54.00	13.30	AV	Hor
5470.00	42.90	54.00	11.10	AV	Ver
11019.91	46.06	74.00	27.94	PK	Hor
11020.44	46.47	74.00	27.53	PK	Ver

Test mode:5G_U-NII-2C_802.11ac40_5590MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2128.38	42.53	74.00	31.47	PK	Ver
2132.63	39.10	74.00	34.90	PK	Hor
11180.88	48.56	74.00	25.44	PK	Ver
11181.94	47.88	74.00	26.12	PK	Hor

Test mode:5G_U-NII-2C_802.11ac40_5670MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2128.38	45.13	74.00	28.87	PK	Hor
2131.56	43.87	74.00	30.13	PK	Ver
5725.00	37.20	54.00	16.80	AV	Ver
5725.01	54.78	74.00	19.22	PK	Ver
5725.24	45.02	74.00	28.98	PK	Hor
5728.35	52.11	74.00	21.89	PK	Hor
5743.79	53.64	74.00	20.36	PK	Ver
11349.28	48.57	74.00	25.43	PK	Ver
11349.81	48.87	74.00	25.13	PK	Hor



Test mode:5G_U-NII-2C_802.11ac40_5710MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2129.97	45.08	74.00	28.92	PK	Hor
2130.50	43.81	74.00	30.19	PK	Ver
5460.00	41.55	74.00	32.45	PK	Ver
5460.17	41.98	74.00	32.02	PK	Hor
5849.68	43.14	74.00	30.86	PK	Ver
5850.83	43.58	74.00	30.42	PK	Hor
11420.47	48.58	74.00	25.42	PK	Hor
11420.47	48.19	74.00	25.81	PK	Ver

Test mode:5G_U-NII-2C_802.11ac80_5530MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2124.66	40.84	74.00	33.16	PK	Hor
2125.19	44.63	74.00	29.37	PK	Ver
3191.94	44.42	74.00	29.58	PK	Ver
5470.75	50.30	74.00	23.70	PK	Hor
5475.04	51.29	74.00	22.71	PK	Ver
11059.75	48.08	74.00	25.92	PK	Hor
11061.34	47.42	74.00	26.58	PK	Ver

Test mode:5G_U-NII-2C_802.11ac80_5610MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
2124.13	43.92	74.00	30.08	PK	Ver
2131.03	44.75	74.00	29.25	PK	Hor
5725.10	47.48	74.00	26.52	PK	Hor
5725.26	48.04	74.00	25.96	PK	Ver
11220.19	46.95	74.00	27.05	PK	Ver
11220.72	47.95	74.00	26.05	PK	Hor

Test mode:5G_U-NII-2C_802.11ac80_5690MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2127.84	46.19	74.00	27.81	PK	Hor
2130.50	42.95	74.00	31.05	PK	Ver
5460.83	41.96	74.00	32.04	PK	Ver
5460.93	41.91	74.00	32.09	PK	Hor
5850.23	43.03	74.00	30.97	PK	Hor
5850.40	43.18	74.00	30.82	PK	Ver
11380.63	48.03	74.00	25.97	PK	Ver
11384.88	48.86	74.00	25.14	PK	Hor

Test mode:5G_U-NII-2C_802.11n_5500MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2127.31	40.16	74.00	33.84	PK	Hor
2128.38	45.88	74.00	28.12	PK	Ver
5350.08	41.03	74.00	32.97	PK	Hor
5350.60	40.50	74.00	33.50	PK	Ver
5470.64	47.21	74.00	26.79	PK	Hor
5470.75	48.47	74.00	25.53	PK	Ver
10990.69	49.16	74.00	24.84	PK	Hor
11001.31	49.41	74.00	24.59	PK	Ver

Test mode:5G_U-NII-2C_802.11n_5600MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2127.31	50.50	74.00	23.50	PK	Ver
2129.44	41.08	74.00	32.92	PK	Hor
4265.06	46.05	74.00	27.95	PK	Ver
5999.59	49.14	74.00	24.86	PK	Ver
11199.47	48.95	74.00	25.05	PK	Hor
11210.63	48.10	74.00	25.90	PK	Ver

Test mode:5G_U-NII-2C_802.11n_5700MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2124.66	45.40	74.00	28.60	PK	Ver
2129.97	43.41	74.00	30.59	PK	Hor
5724.95	48.15	74.00	25.85	PK	Hor
5725.03	48.72	74.00	25.28	PK	Ver
11400.81	48.32	74.00	25.68	PK	Hor
11401.88	50.29	74.00	23.71	PK	Ver



Test mode:5G_U-NII-2C_802.11n_5720MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M	Margin (dB)	Detector	Polarization
1998.22	42.41	74.00	31.59	PK	Ver
2125.72	42.93	74.00	31.07	PK	Hor
5460.06	41.21	74.00	32.79	PK	Hor
5460.67	42.20	74.00	31.80	PK	Ver
5850.12	43.20	74.00	30.80	PK	Ver
5850.83	43.35	74.00	30.65	PK	Hor
11440.13	48.44	74.00	25.56	PK	Hor
11440.13	48.83	74.00	25.17	PK	Ver

Bnad3

Test mode:5G_U-NII-3_802.11a_5745MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1993.44	46.64	74.00	27.36	PK	Ver
2128.38	45.60	74.00	28.40	PK	Hor
4257.09	46.52	74.00	27.48	PK	Ver
5725.08	56.85	74.00	17.15	PK	Ver
5725.56	60.37	74.00	13.63	PK	Hor
11490.59	47.39	74.00	26.61	PK	Hor
11492.72	48.25	74.00	25.75	PK	Ver

Test mode:5G_U-NII-3_802.11a_5785MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1401.63	38.77	74.00	35.23	PK	Hor
1788.91	42.57	74.00	31.43	PK	Ver
3194.59	43.55	74.00	30.45	PK	Ver
11571.34	48.58	74.00	25.42	PK	Ver
11571.88	46.74	74.00	27.26	PK	Hor

Test mode:5G_U-NII-3_802.11a_5825MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1992.38	45.75	74.00	28.25	PK	Ver
2125.72	43.15	74.00	30.85	PK	Hor
5850.01	47.38	74.00	26.62	PK	Hor
5850.34	48.06	74.00	25.94	PK	Ver
5984.82	49.37	74.00	24.63	PK	Ver
11649.97	48.80	74.00	25.20	PK	Hor
11657.94	49.39	74.00	24.61	PK	Ver

Test mode:5G_U-NII-3_802.11ac20_5745MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1994.50	49.55	74.00	24.45	PK	Ver
2124.13	39.99	74.00	34.01	PK	Hor
5725.23	52.14	74.00	21.86	PK	Ver
5725.28	55.63	74.00	18.37	PK	Hor
11490.59	47.22	74.00	26.78	PK	Hor
11491.66	48.81	74.00	25.19	PK	Ver

Test mode:5G_U-NII-3_802.11ac20_5785MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1993.44	48.02	74.00	25.98	PK	Ver
2131.03	40.89	74.00	33.11	PK	Hor
11569.75	47.73	74.00	26.27	PK	Hor
11572.41	48.71	74.00	25.29	PK	Ver

Test mode:5G_U-NII-3_802.11ac20_5825MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1998.75	40.61	74.00	33.39	PK	Hor
2126.25	48.42	74.00	25.58	PK	Ver
5850.44	45.90	74.00	28.10	PK	Hor
5850.72	45.56	74.00	28.44	PK	Ver
5995.98	49.45	74.00	24.55	PK	Ver
11651.03	48.54	74.00	25.46	PK	Ver
11653.16	48.85	74.00	25.15	PK	Hor

Test mode:5G_U-NII-3_802.11ac40_5755MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1992.91	44.06	74.00	29.94	PK	Hor
2123.59	45.05	74.00	28.95	PK	Ver
5725.42	59.43	74.00	14.57	PK	Hor
5725.70	57.85	74.00	16.15	PK	Ver
11515.03	48.47	74.00	25.53	PK	Ver
11518.22	49.66	74.00	24.34	PK	Hor

Test mode:5G_U-NII-3_802.11ac40_5795MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1198.69	44.86	74.00	29.14	PK	Ver
2126.78	44.44	74.00	29.56	PK	Hor
2128.38	48.89	74.00	25.11	PK	Ver
5850.39	50.07	74.00	23.93	PK	Ver
5850.58	48.86	74.00	25.14	PK	Hor
5992.80	48.76	74.00	25.24	PK	Ver
11591.00	49.24	74.00	24.76	PK	Ver
11591.53	47.22	74.00	26.78	PK	Hor

Test mode:5G_U-NII-3_802.11ac80_5775MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1403.22	43.39	74.00	30.61	PK	Hor
1995.56	47.97	74.00	26.03	PK	Ver
2129.97	46.25	74.00	27.75	PK	Hor
5725.28	56.48	74.00	17.52	PK	Hor
5725.28	55.60	74.00	18.40	PK	Ver
5850.63	46.49	74.00	27.51	PK	Hor
5851.67	45.69	74.00	28.31	PK	Ver
11550.09	47.62	74.00	26.38	PK	Hor
11550.09	48.01	74.00	25.99	PK	Ver

Test mode:5G_U-NII-3_802.11n_5745MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1990.78	46.32	74.00	27.68	PK	Ver
2128.91	41.83	74.00	32.17	PK	Hor
5725.04	53.84	74.00	20.16	PK	Hor
5725.47	52.53	74.00	21.47	PK	Ver
11490.59	48.20	74.00	25.80	PK	Ver
11492.72	48.02	74.00	25.98	PK	Hor

Test mode:5G_U-NII-3_802.11n_5785MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1962.63	44.92	74.00	29.08	PK	Ver
2130.50	40.62	74.00	33.38	PK	Hor
11571.34	48.14	74.00	25.86	PK	Hor
11571.34	46.88	74.00	27.12	PK	Ver

Test mode:5G_U-NII-3_802.11n_5825MHz					
Frequency MHz	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
1196.56	48.28	74.00	25.72	PK	Hor
2129.97	47.64	74.00	26.36	PK	Ver
2131.56	37.74	74.00	36.26	PK	Hor
5850.68	44.80	74.00	29.20	PK	Hor
5850.72	46.25	74.00	27.75	PK	Ver
5927.77	50.95	74.00	23.05	PK	Hor
5982.58	48.45	74.00	25.55	PK	Ver
11649.44	48.19	74.00	25.81	PK	Hor
11651.03	47.37	74.00	26.63	PK	Ver



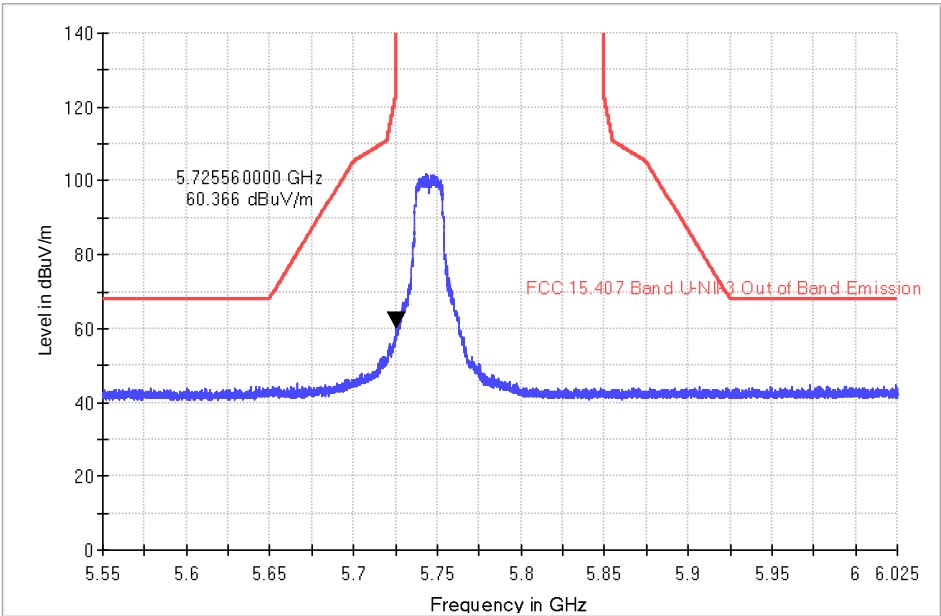
Remark:

- (1) Above 1GHz Corrector factor= Antenna Factor +Cable Loss - Amp. Factor.
- (2) Below 1GHz Corrector factor= Antenna Factor +Cable Loss.
- (3) “*” is not in restricted band, its limit is -27dBm/MHz. At a distance of 3 meters, the field strength limit in dB μ V/m can be determined by adding a “conversion” factor of 95.2dB to the EIRP limit of -27dBm/MHz to obtain the limit for out of band spurious emissions.
- (4) “#” is band edge band
- (5) Testing is carried out with frequency rang 30MHz to 40GHz, which data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (6) The Low frequency, which start from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



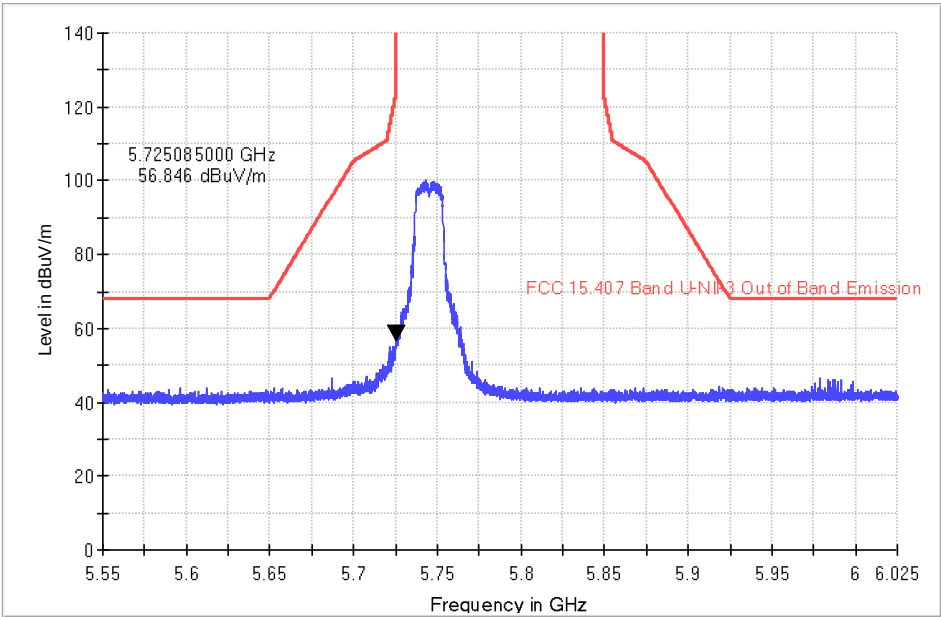
Out of Band Emission
802.11a: CH 5745MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

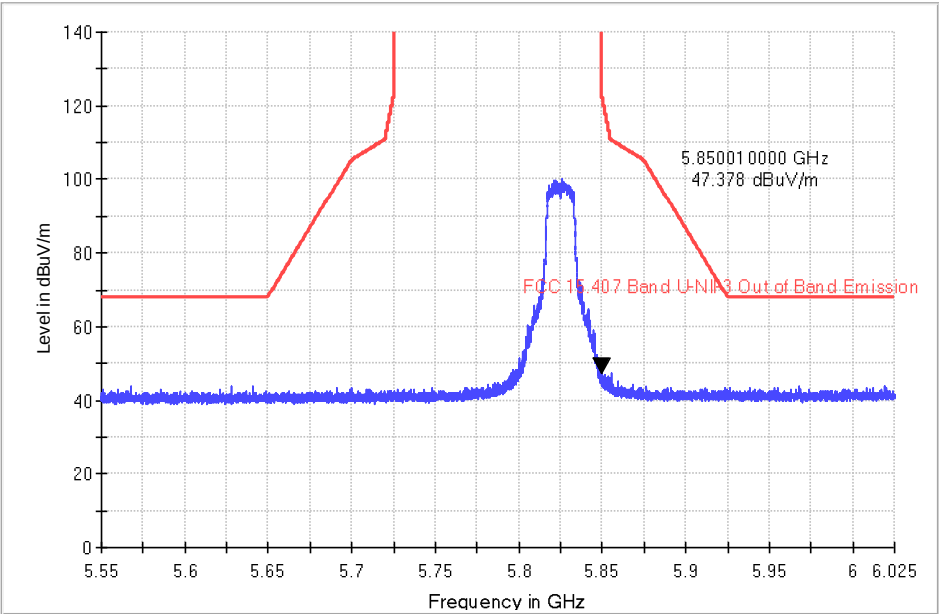
FCC 15.407 U-NII Out of Band Emission





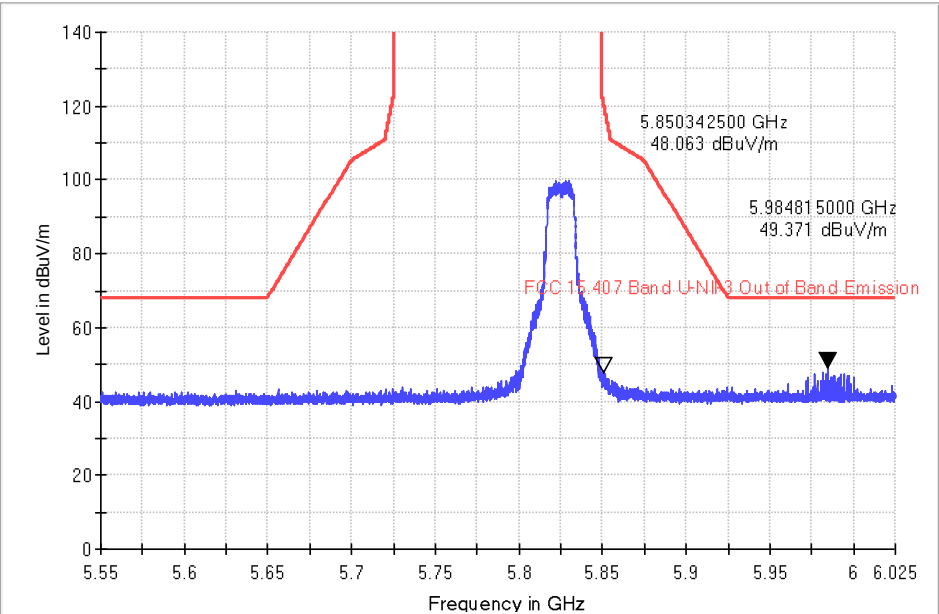
802.11a: CH 5825MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

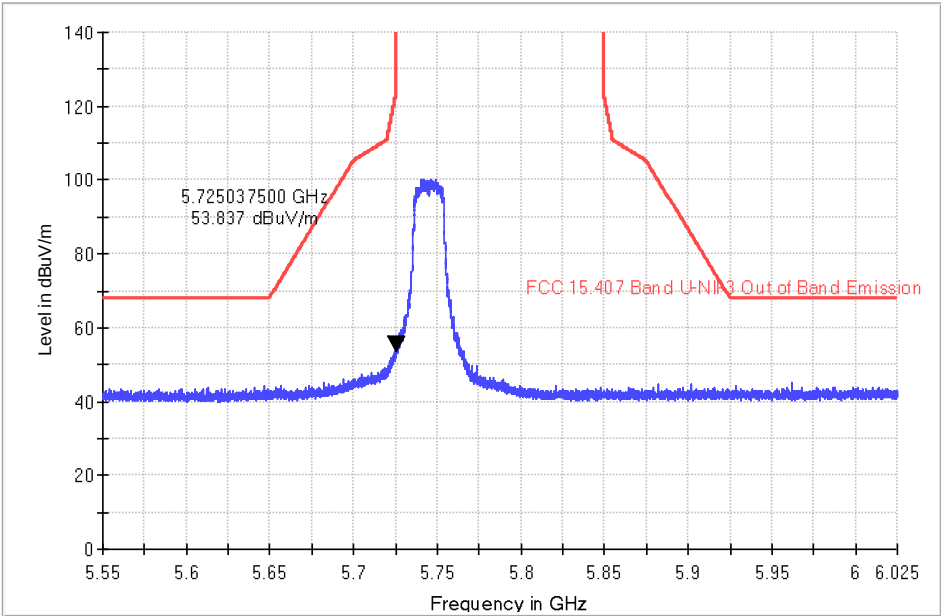
FCC 15.407 U-NII Out of Band Emission





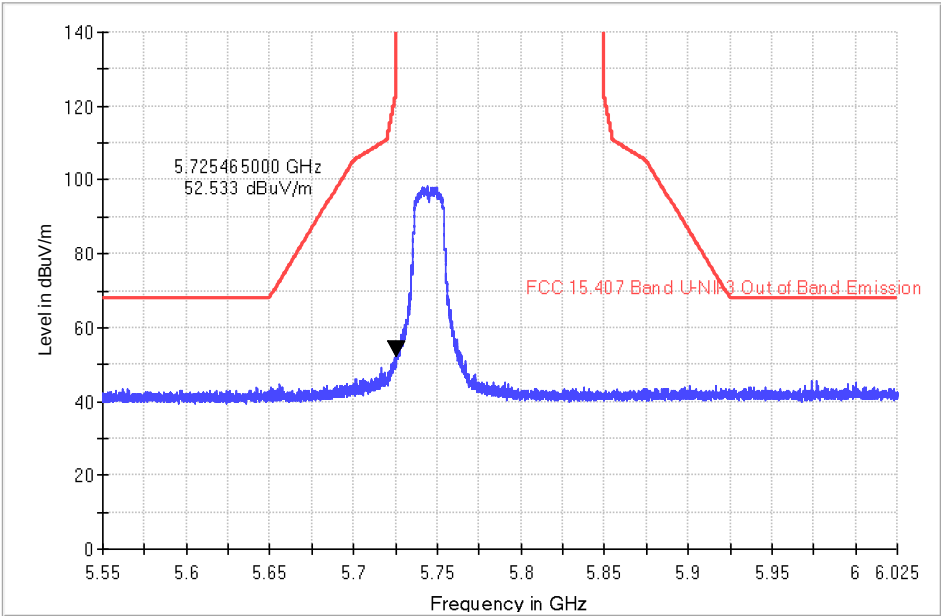
802.11n20: CH 5745MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

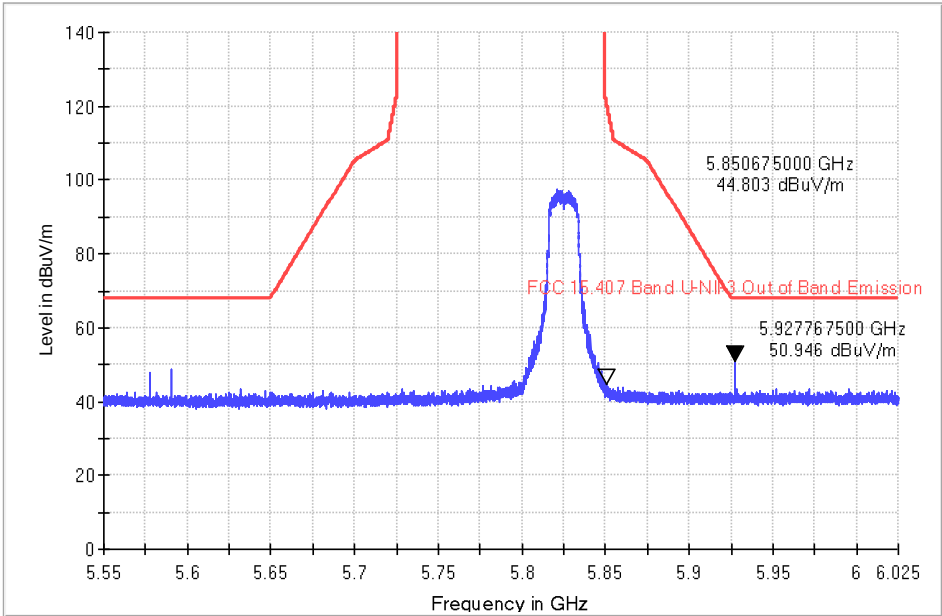
FCC 15.407 U-NII Out of Band Emission





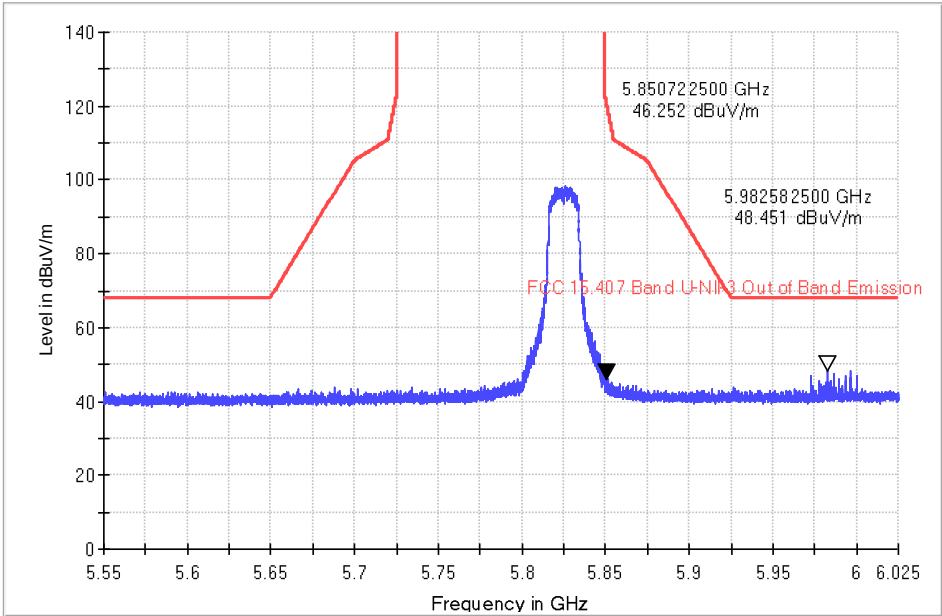
802.11n20: CH 5825MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

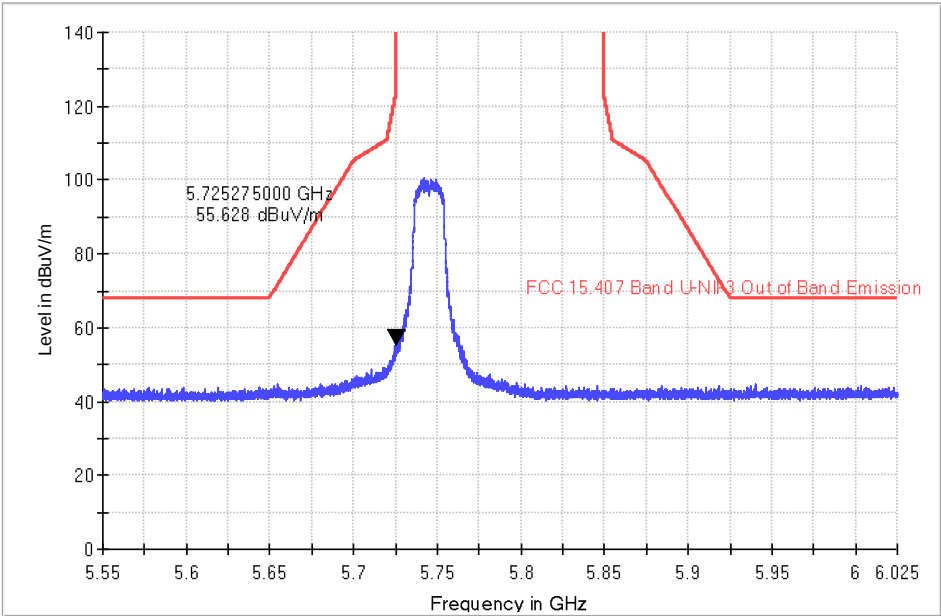
FCC 15.407 U-NII Out of Band Emission





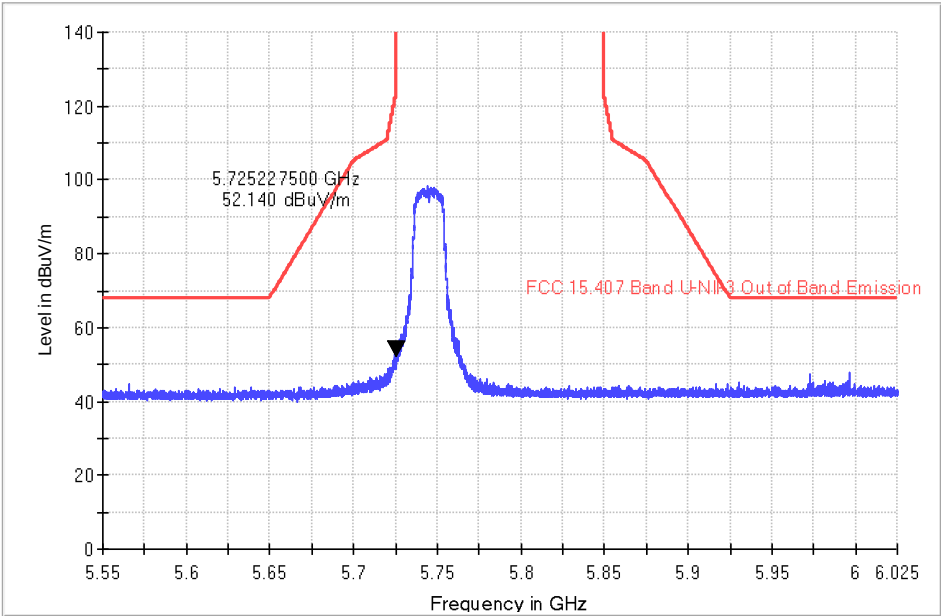
802.11ac20: CH 5745MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

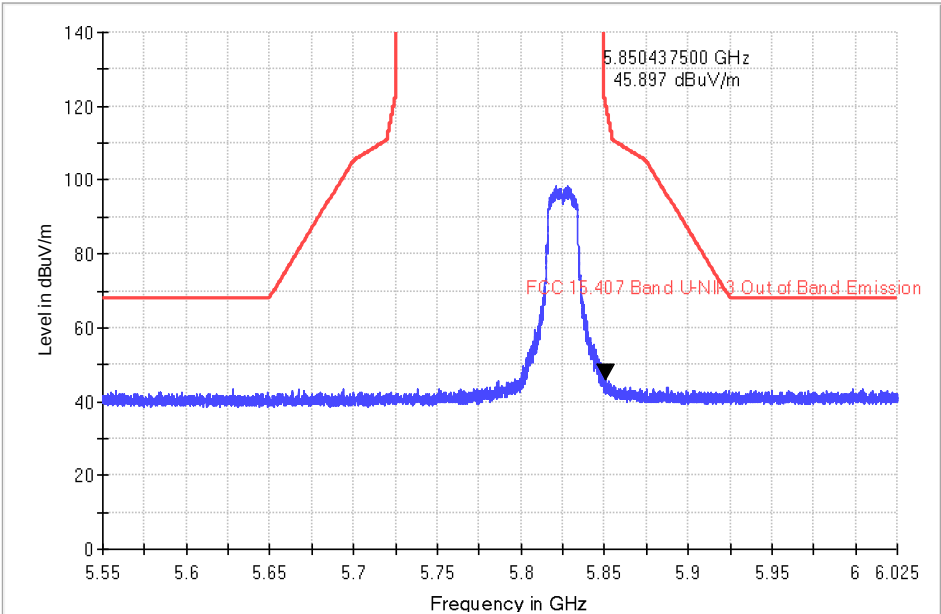
FCC 15.407 U-NII Out of Band Emission





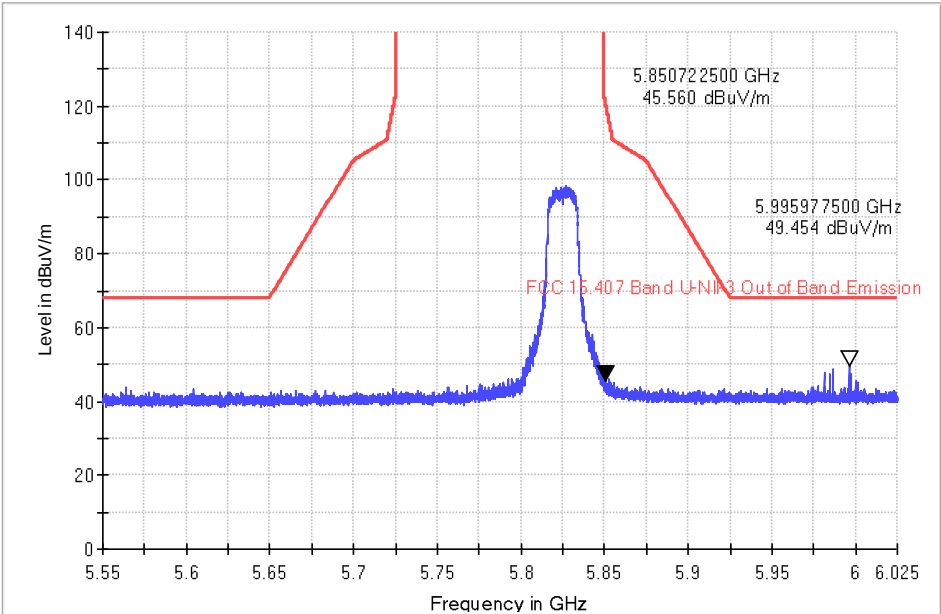
802.11ac20: CH 5825MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

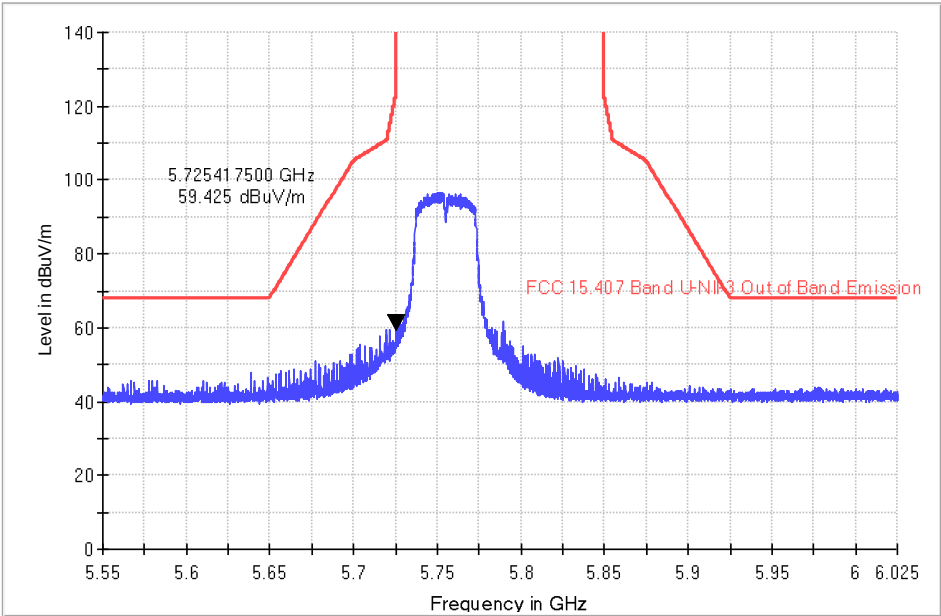
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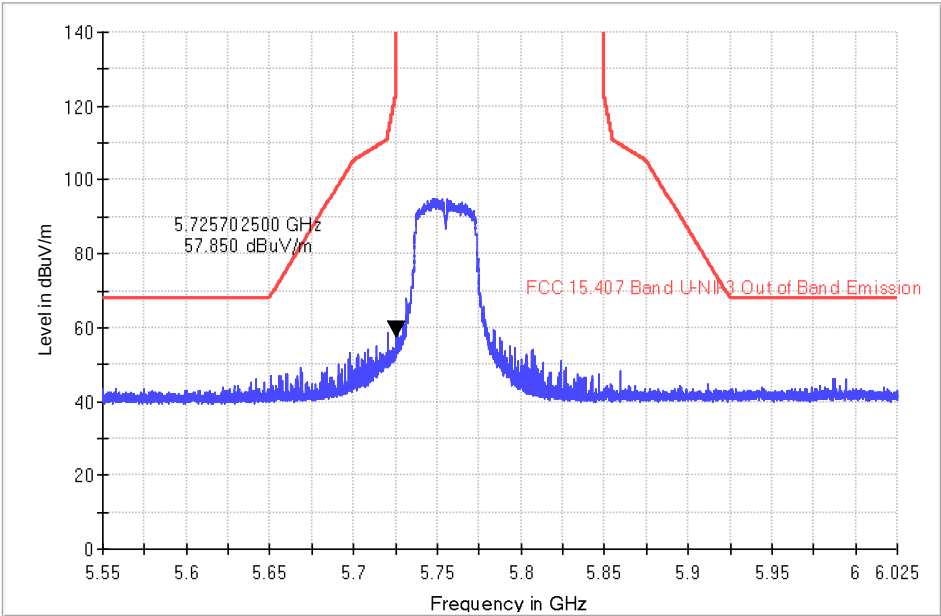
802.11ac40: CH 5755MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

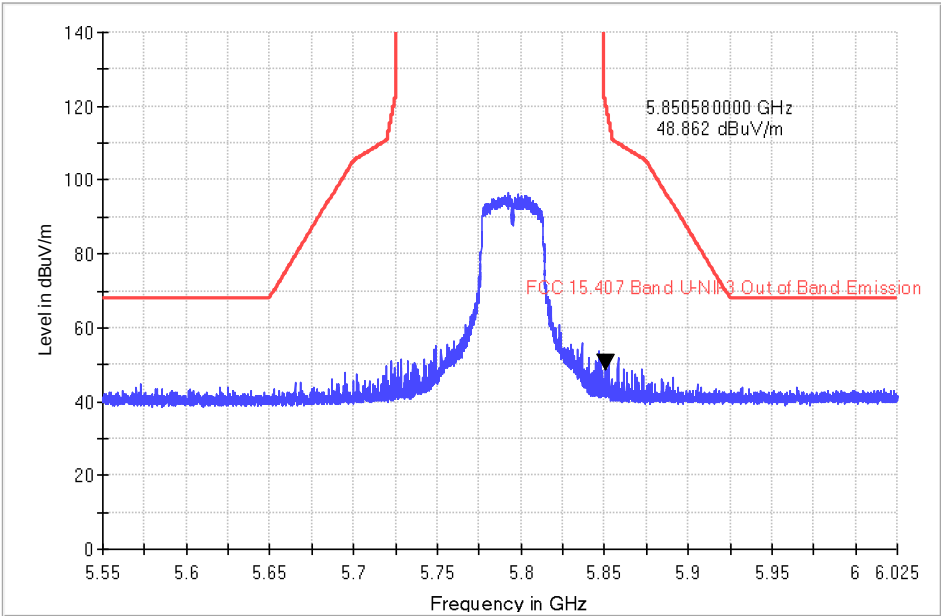
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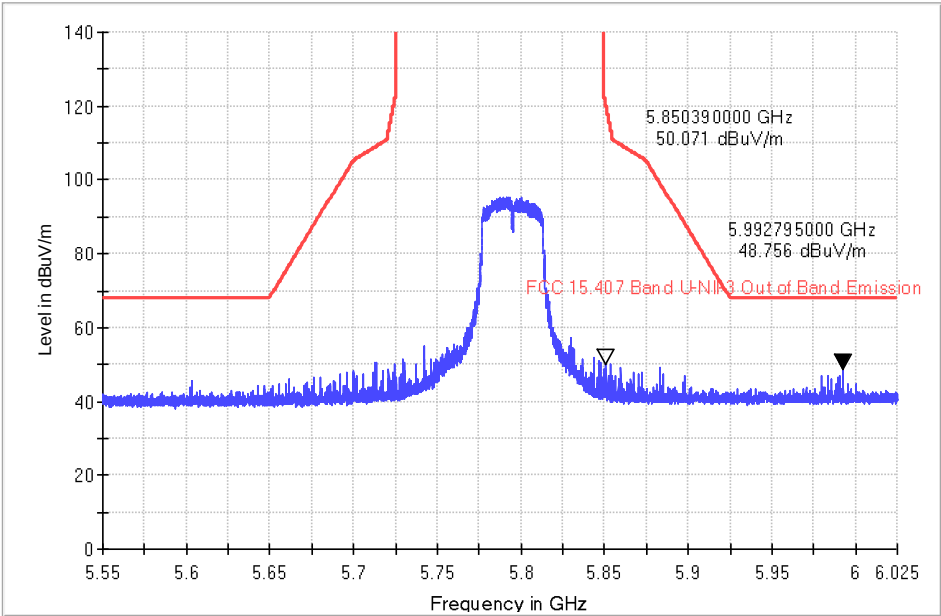
802.11ac40: CH 5795MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

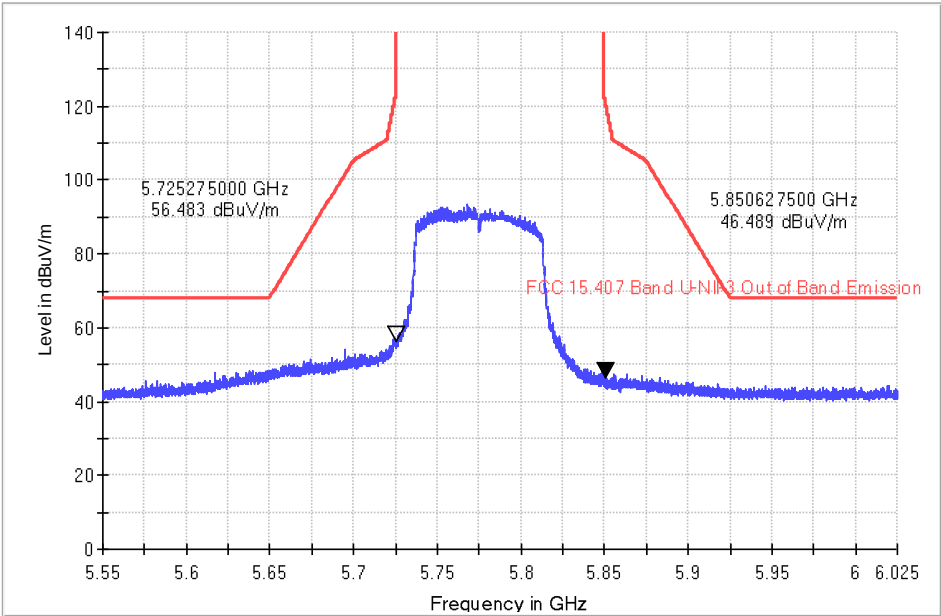
FCC 15.407 U-NII Out of Band Emission





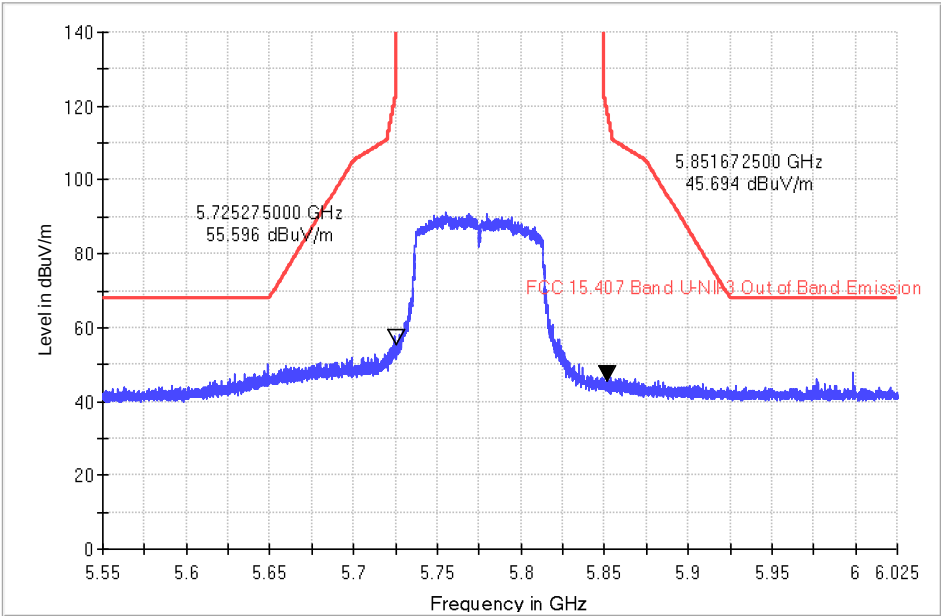
802.11ac80: CH 5775MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



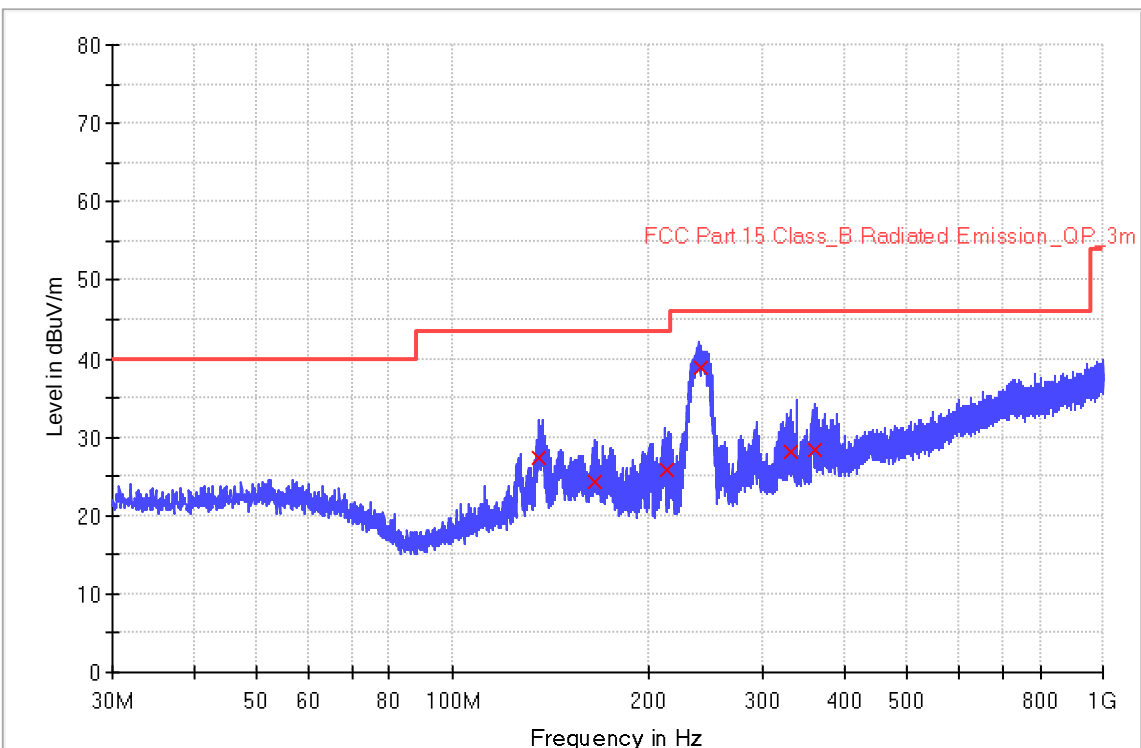


Transmitting spurious emission test result as below:

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2024/08/02 – 8:49
Limit: FCC Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: CCU, Model no: Lime-CCU23	Power: DC 42V
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
135.960000	27.3	1000.0	120.000	123.0	H	142.0	19.9	16.2	43.5
165.720000	24.2	1000.0	120.000	187.0	H	186.0	20.6	19.3	43.5
212.760000	25.9	1000.0	120.000	132.0	H	132.0	17.6	17.6	43.5
240.360000	38.7	1000.0	120.000	126.0	H	164.0	19.6	7.3	46.0
330.640000	28.2	1000.0	120.000	132.0	H	112.0	22.6	17.8	46.0
361.160000	28.3	1000.0	120.000	164.0	H	122.0	23.0	17.7	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

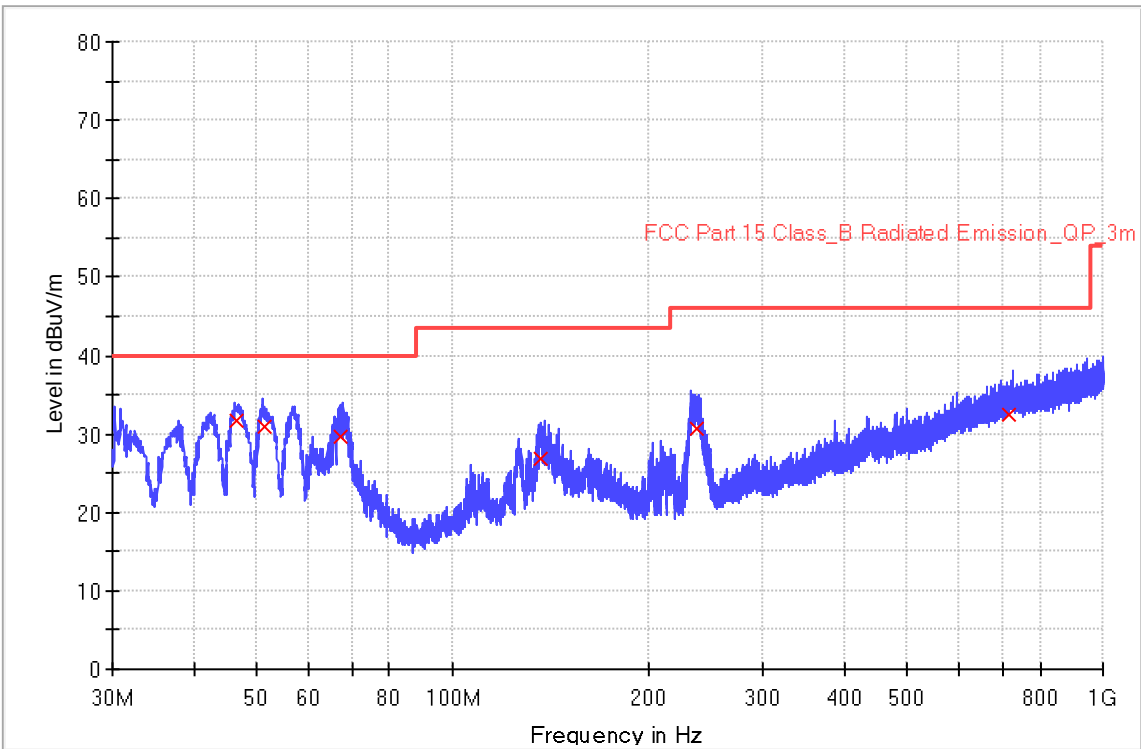
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.



The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2024/08/02 - 09:01
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: CCU, Model no: Lime-CCU23	Power: DC 42V
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
46.520000	31.8	1000.0	120.000	1164.0	V	153.0	20.5	8.2	40.0
51.480000	31.0	1000.0	120.000	133.0	V	112.0	20.6	9.0	40.0
67.440000	29.8	1000.0	120.000	122.0	V	175.0	19.1	10.2	40.0
136.200000	26.8	1000.0	120.000	118.0	V	215.0	19.9	16.7	43.5
236.560000	30.7	1000.0	120.000	186.0	V	186.0	19.1	15.3	46.0
716.600000	32.6	1000.0	120.000	192.0	V	212.0	30.9	13.4	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.



10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal spectrum analyzer	Agilent	N9020B	MY59050168	2024-2-19	2025-2-18
	Wideband power sensor	Rohde & Schwarz	NRP-Z81	105903	2024-2-19	2025-2-18
	10dB Attenuator	Aeroflex Weinschel	CG-4689	93459	2024-2-19	2025-2-18
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2023-8-1	2024-7-31
	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2024-8-1	2025-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2023-8-1	2024-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2024-8-1	2025-7-31
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2021-9-23	2024-9-22
	Double-ridged waveguide horn antenna	Rohde & Schwarz	HF907	102393	2024-4-14	2025-4-13
	Pre-amplifier	Shenzhen HzEMC	HPA-081843	HYP A23026	2024-4-16	2025-4-15
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2024-6-26	2025-6-25
	Double Ridged Horn Antenna	ETS-Lindgren	3116C	00246076	2023-7-7	2026-7-6
	3m Semi-anechoic chamber	TDK	9X6X6	----	2024-5-8	2027-5-7

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	MTS 8310	MWRFtest	3.0.0.0
RE	EMC 32	Rohde & Schwarz	V10.50.40

C - Conducted RF tests

- Conducted peak output power
- 6dB Occupied Bandwidth
- Power spectral density*



11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Radiated Disturbance	9kHz to 30MHz, 3.52dB 30MHz to 1GHz, 5.03dB (Horizontal) 5.12dB (Vertical) 1GHz to 18GHz, 5.49dB 18GHz to 40GHz, 5.63dB
RF Conducted Measurement	Power related: 1.16dB Frequency related: 6.00×10 ⁻⁸

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3.



12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END