

TEST REPORT OF FCC CFR 47 PART 15 SUBPART C

ON BEHALF OF

Shenzhen Raysgem Electronic Science and Technology Co., LTD
4/5F, Bldg 2, BaoNan Rd. Industrial Park, Nanyue Communities, LongGang,
Shenzhen, China

Product Name: **LOONA**
Model/Type No.: **RC133N1, RC133N1S, RC133N2, RC133N2S**
FCC ID Number: **FCC ID: 2AM99-RC133N**
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Shenzhen Raysgem Electronic Science and Technology Co., LTD
Address of Applicant:	4/5F, Bldg 2, BaoNan Rd. Industrial Park, Nanyue Communities, LongGang, Shenzhen, China
Manufacturer:	Shenzhen Raysgem Electronic Science and Technology Co., LTD
Address of Manufacturer:	4/5F, Bldg 2, BaoNan Rd. Industrial Park, Nanyue Communities, LongGang, Shenzhen, China

General Description of E.U.T

Items	Description
EUT Description:	LOONA
Model No.:	RC133N1
Brand Name:	LOONA
Supplementary Model:	RC133N1S, RC133N2, RC133N2S
Frequency Band:	IEEE 802.11b : 2412MHz~2462MHz; IEEE 802.11g : 2412MHz~2462MHz; IEEE 802.11n HT20 : 2412MHz~2462MHz;
Channel Spacing:	IEEE 802.11b : 11MHz IEEE 802.11g : 54MHz IEEE 802.11n HT20 : 65MHz
Number of Channels:	IEEE 802.11b :11 Channels; IEEE 802.11g :11 Channels; IEEE 802.11n HT20:11 Channels;
Transmit Data Rate:	maximum of 150Mbps
Type of Modulation:	IEEE 802.11b: DQPSK, DBPSK, CCK IEEE 802.11g: OFDM /64-QAM,16-QAM, QPSK, BPSK IEEE 802.11n HT20: OFDM /64-QAM,16-QAM, QPSK, BPSK
Antenna Type:	Internal Antenna
Antenna Gain:	2dBi
Power Rating:	Adapter : Input: AC 100V~240V, 50/60Hz, 1.2A Output: DC 12V, 3A

Remark:* The test data gathered are from the production sample provided by the manufacturer.

* All models are with same structure,performance and parameters. Differences are limited to appearance and color.

1.2 Test standards

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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

KDB558074 D01 V04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247.

RSS-GEN Issue 4: General Requirements for Compliance of Radio Apparatus.

RSS 247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices.

1.3 Test Facility

All measurement required was performed at laboratory of Shenzhen CTL Testing Technology Co., Ltd. Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China. There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

FCC – Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December, 2013.

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

2.3 General Test Procedures

Conducted Emissions: The EUT is placed on the table, which is 0.8 m above ground plane According to the requirements in ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions: The EUT is a placed on as turntable, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10-2013.

2.4 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Transmitter power conducted	+/- 0.57 dB
Transmitter power Radiated	+/- 2.20 dB
Conducted spurious emission 9KHz-40 GHz	+/- 2.20 dB
Occupied Bandwidth	+/- 0.01 dB
Power Line Conducted Emission	+/- 3.20 dB
Radiated Emission	+/- 4.32 dB

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

2.5 Measure Results Explanation Example

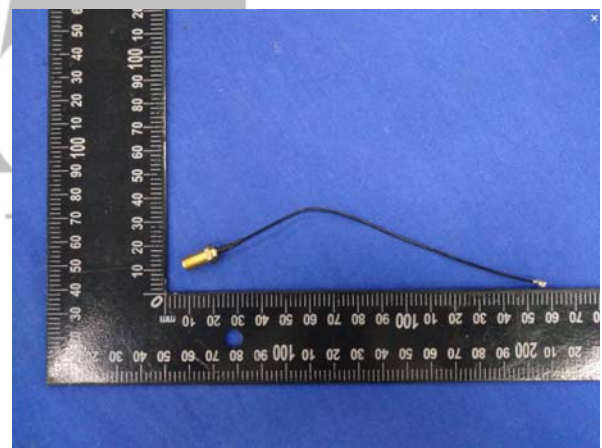
For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable less and attenuator factor.
Offset= RF cable less+ attenuator factor.

Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

Equipment	Manufacturer	Model No.	Frequency range(GHz)	Attenuation values(dBm)
Line	Zhenjiang south electronic	RG316	1-12	0.08
			<1G	0.03
			>12G	1.00
Connector	Zhenjiang south electronic	SMA-K/N-J	1-12	0.01
			<1G	0.005
			>12G	0.03



2.6. Block diagram of EUT configuration for test

The test software was used to control EUT work in Continuous TX mode, and select test channel, wireless mode as below table.

Mode	Data rate (Mbps) (see Note)	Channel	Frequency (MHz)
IEEE 802.11b	11	CH1	2412
	11	CH6	2437
	11	CH11	2462
IEEE 802.11g	54	CH1	2412
	54	CH6	2437
	54	CH11	2462
IEEE 802.11N HT20	65	CH1	2412
	65	CH6	2437
	65	CH11	2462

Note: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test.

2.7 List of Measuring Equipments Used

Test equipments list of Shenzhen CTL Testing Technology Co., Ltd.

No.	Equipment	Manufacturer	Model No.	S/N	Last Calculator	Due Calculator
1	EMI Test Receiver	R&S	ESCI	100687	2016-7-25	2017-7-24
2	EMI Test Receiver	R&S	ESPI	100097	2016-10-1	2017-10-31
3	Amplifier	HP	8447D	1937A02492	2016-7-25	2017-7-24
4	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-324	2016-7-25	2017-7-24
5	RF POWER AMPLIFIER	FRANKONIA	FLL-75	1020A1109	2016-7-25	2017-7-24
6	6DB Attenuator	FRANKONIA	N/A	1001698	2016-7-25	2017-7-24
7	10dB attenuator	ELECTRO-METRICS	EM-7600	836	2016-7-25	2017-7-24
8	Spectrum Analyzer	R&S	FSP	100397	2016-10-1	2017-10-31
9	Broadband preamplifier	SCHWARZBECK	BBV9718	9718-182	2016-7-25	2017-7-24
10	Power Sensor	Anritsu	ML2438A	1241002	2016-7-25	2017-7-24
11	Power Sensor	Anritsu	MA2411B	1207366	2016-7-25	2017-7-24
12	Horn Antenna	SCHWARZBECK	BBHA 9120D	0437	2016-7-25	2017-7-24
13	Horn Antenna	SCHWARZBECK	BBHA9170	0483	2016-7-25	2017-7-24

3. SUMMARY OF Test RESULTS

FCC/IC Rules	Description of Test	Result
FCC §15.207 IC RSS-GEN Clause 8.8	AC Power Line Conducted Emission	Pass
FCC §15.247(b) IC RSS-247 Issue2 Clause 5.4 (4)	Output Power Measurement	Pass
FCC §15.247(e) IC RSS-247 Issue2 Clause 5.2 (2)	Power Spectral Density	Pass
FCC §15.247(a) IC RSS-247 Issue2 Clause 5.2 (1) IC RSS-GEN Clause 6.6	6dB Bandwidth 99%Occupied Bandwidth	Pass
FCC §15.247 (d) IC RSS-247 Issue2 Clause 5.5	Conducted Spurious Emission	Pass
FCC §15.205 and §15.209 IC RSS-247 Issue2 Clause 5.5	Radiated Spurious Emission	Pass
FCC§15.247 (d) and §15.205 and §15.209 IC RSS-247 Issue2 Clause 5.5	Unwanted Emissions	Pass
FCC §15.203/15.247(b)/(c) IC RSS-GEN Clause 8.3	Antenna Requirement	Pass

4. Test OF AC POWER LINE CONDUCTED EMISSION

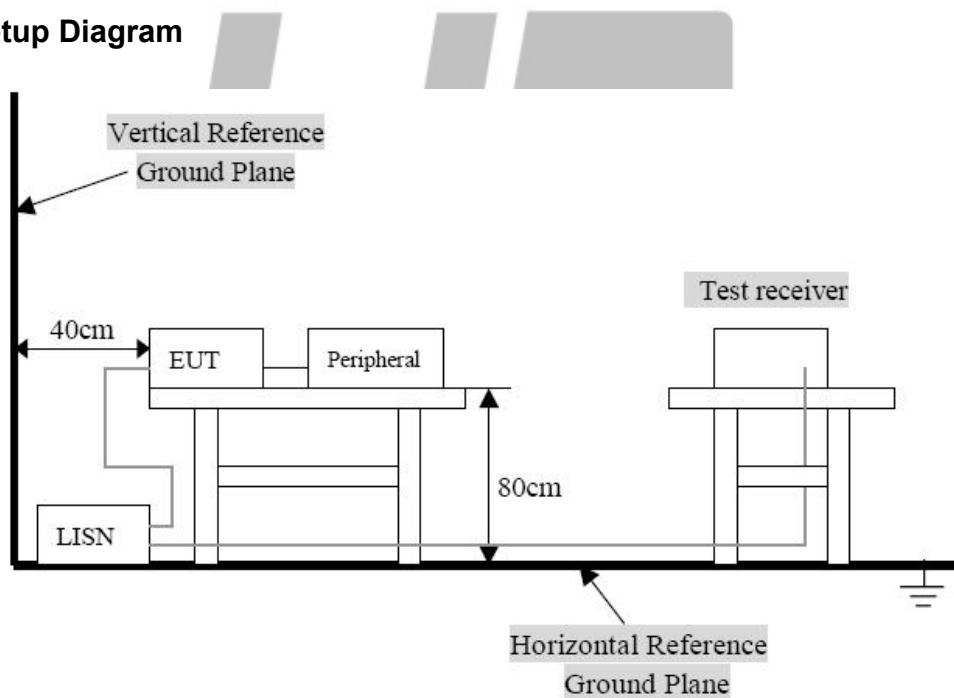
4.1 Applicable standard

Refer to FCC §15.207 and IC RSS-GEN Clause 8.8

For a Low-power Radio-frequency Device is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency Range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.150~0.500	66~56	56~46
0.500~5.000	56	46
5.000~30.00	60	50

4.2 Test Setup Diagram



Remark: The EUT was connected to a 120 VAC/ 60Hz power source.

4.3 Test Result

Temperature (°C) : 23~25	EUT: LOONA
Humidity (%RH) : 45~58	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Tx Mode

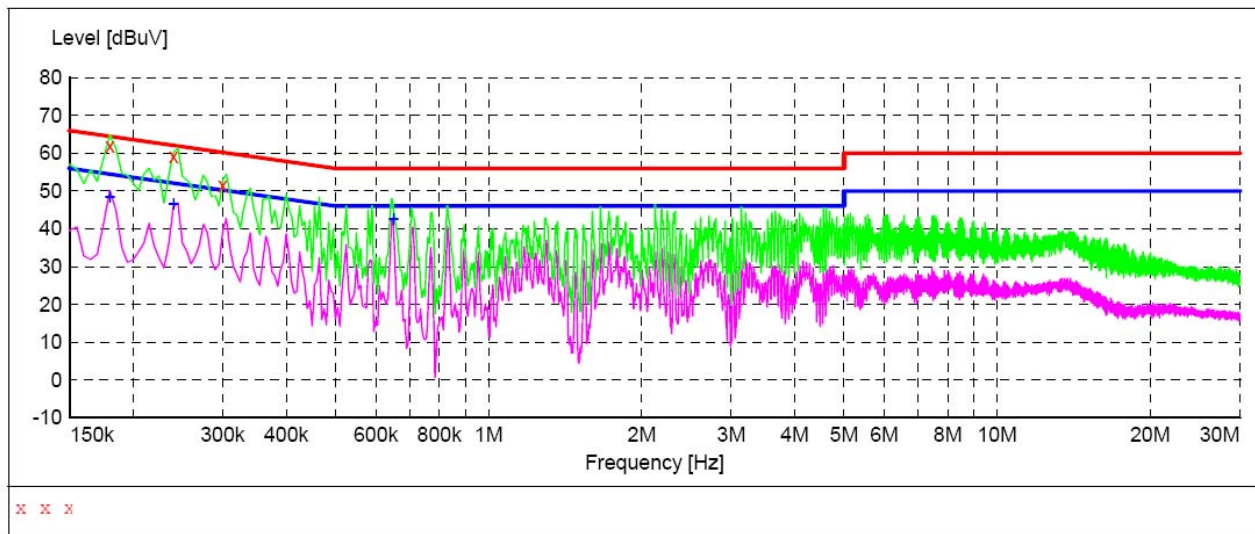
Test result: PASS

Conducted Emission Test Data

EUT: LOONA
 M/N: RC133N1
 Operating Condition: Tx Mode
 Test Site: Shielded Room
 Operator: Li
 Test Specification: AC 120V/60Hz
 Comment: Live Line
 Start of Test: Tem:25°C Hum:50%

SCAN TABLE: "Voltage (150K-30M) FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.180000	61.90	12.0	65	2.6	QP	L1	GND
0.240000	59.00	13.6	62	3.1	QP	L1	GND
0.300000	51.50	11.0	60	8.7	QP	L1	GND

MEASUREMENT RESULT:

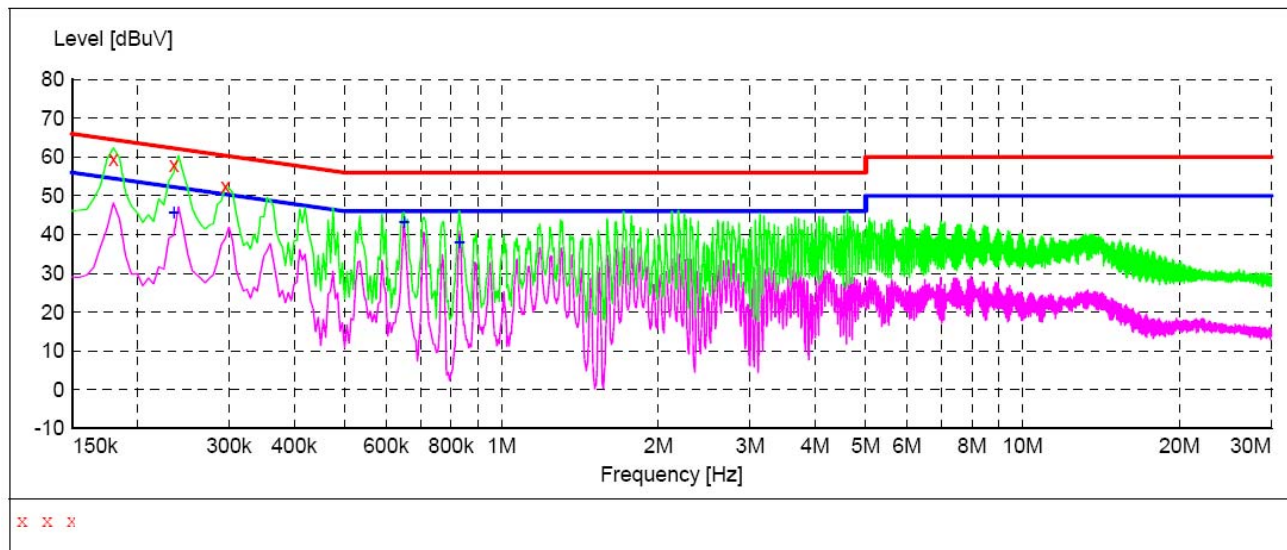
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.180000	48.30	12.0	55	6.2	AV	L1	GND
0.240000	46.60	13.6	52	5.5	AV	L1	GND
0.650000	42.70	10.4	46	3.3	AV	L1	GND

Conducted Emission Test Data

EUT: LOONA
M/N: RC133N1
Operating Condition: Tx Mode
Test Site: Shielded Room
Operator: Li
Test Specification: AC 120V/60Hz
Comment: Neutral Line

SCAN TABLE: "Voltage (150K-30M) FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.180000	59.40	12.0	65	5.1	QP	N	GND
0.235000	58.00	13.4	62	4.3	QP	N	GND
0.295000	52.40	11.2	60	8.0	QP	N	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.235000	45.80	13.4	52	6.5	AV	N	GND
0.650000	43.10	10.4	46	2.9	AV	N	GND
0.830000	38.10	10.3	46	7.9	AV	N	GND

5. Output Power Measurement

5.1 Applicable standard

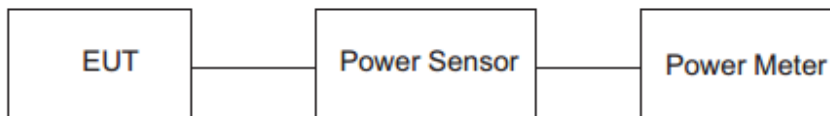
Refer to FCC §15.247 (b) and IC RSS-247 Issue2 Clause 5.4 (4).

KDB558074 D01 V04 – Section 9.1.2 PKPM1 Peak Power, Method

KDB558074 D01 V04 – Section 9.2.3.2 Method AVGPM-G

The maximum permissible conducted output power is 1Watt.

5.2 EUT Setup



5.3 Test Equipment List and Details

See section 2.5 or 2.6

5.4 Test Procedure

Method PKPM1 (Peak Power Measurement)

Peak power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was than or equal to 50MHz.

Method AVGPM-G (Average Power Measurement)

Average power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse meter implemented triggering and fating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

5.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Continuously Tx Mode

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	12.16	19.60	30	PASS
Middle	2437	13.71	17.78	30	PASS
High	2462	12.23	17.56	30	PASS

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	12.12	18.32	30	PASS
Middle	2437	13.21	18.75	30	PASS
High	2462	14.22	18.24	30	PASS

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	15.01	17.12	30	PASS
Middle	2437	16.23	18.74	30	PASS
High	2462	16.24	18.46	30	PASS

6. Test of Peak Power Spectral Density

6.1 Applicable standard

Refer to FCC §15.247 (e) and IC RSS-247 Issue2 Clause 5.2 (2).

KDB558074 D01 V04 – Section 10.2 Method PKPSD

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.2 EUT Setup



6.3 Test Equipment List and Details

See section 2.5 or 2.6

6.4 Test Procedure

The transmitter output was connected to the spectrum analyzer and the parameter was set as below:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW $\geq 3 \times$ RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Tx Mode

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Power Level in 3KHz RBW (dBm)	Maximum Limit (dBm)	Pass / Fail
Low	2412	-12.66	8	PASS
Middle	2437	-7.53	8	PASS
High	2462	-7.00	8	PASS

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Power Level in 3KHz RBW (dBm)	Maximum Limit (dBm)	Pass / Fail
Low	2412	-10.58	8	PASS
Middle	2437	-11.95	8	PASS
High	2462	-10.76	8	PASS

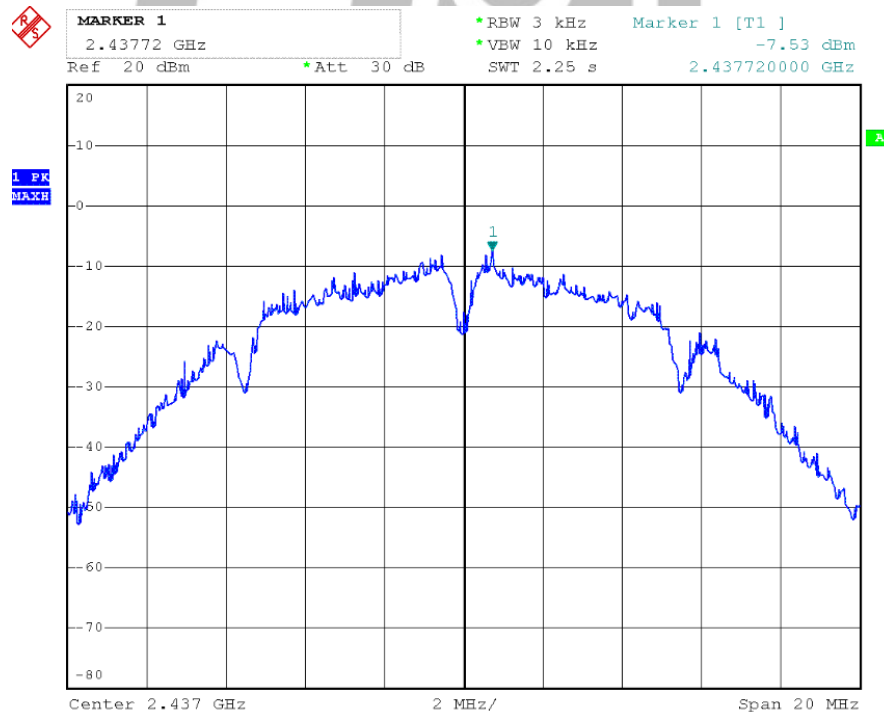
IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	Power Level in 3KHz RBW (dBm)	Maximum Limit (dBm)	Pass / Fail
Low	2412	-10.85	8	PASS
Middle	2437	-12.12	8	PASS
High	2462	-11.10	8	PASS

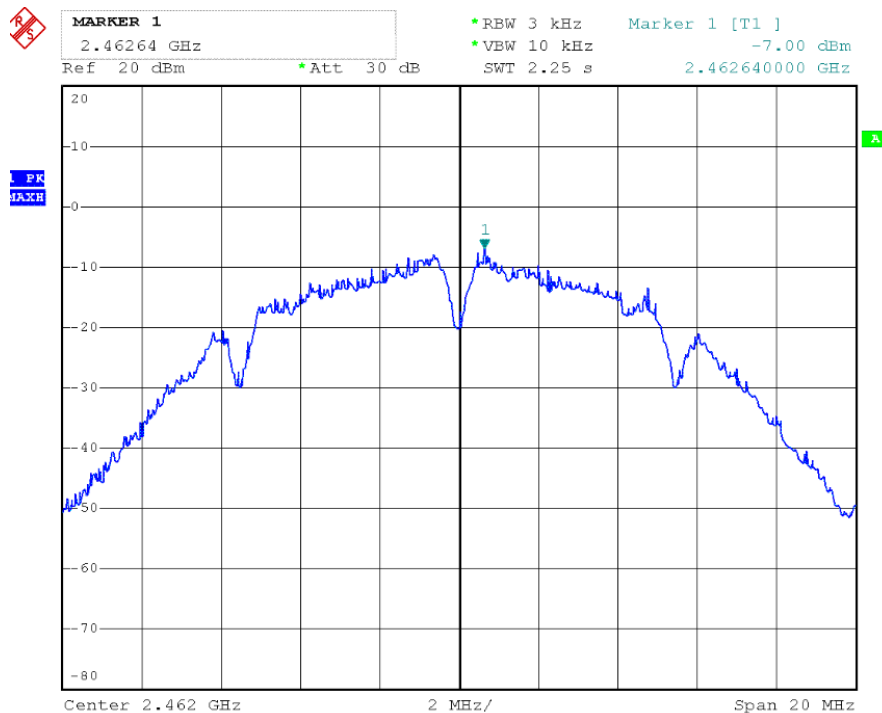
POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH Low)



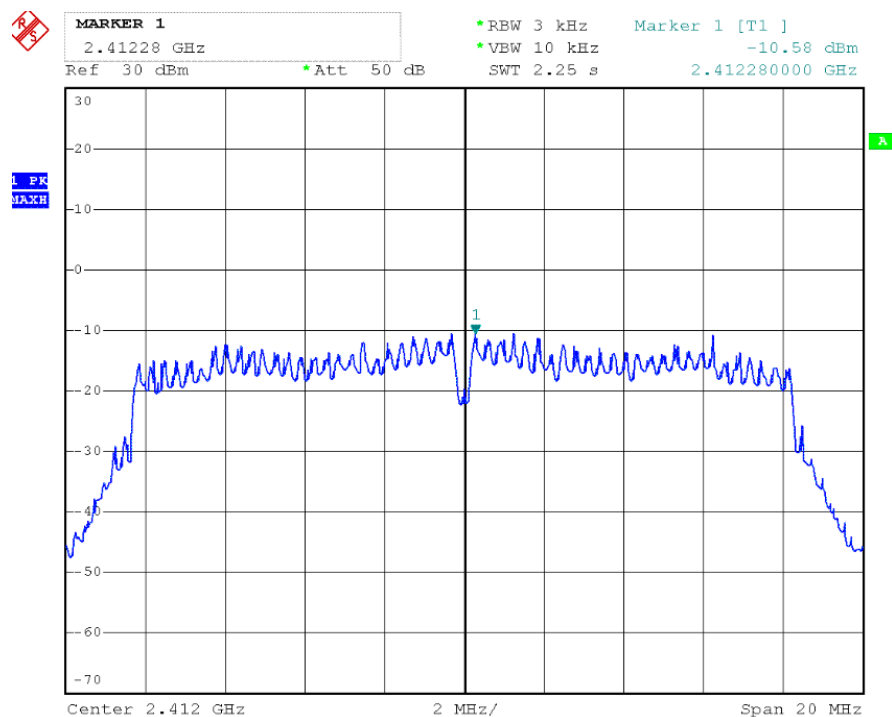
POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH Mid)



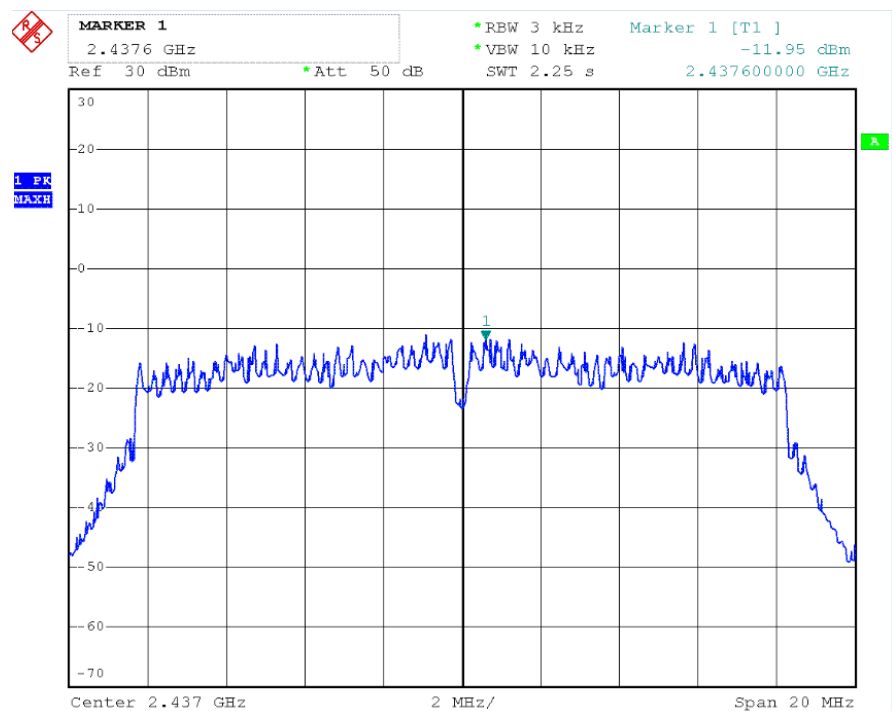
POWER SPECTRAL DENSITY (IEEE 802.11b MODE CH High)



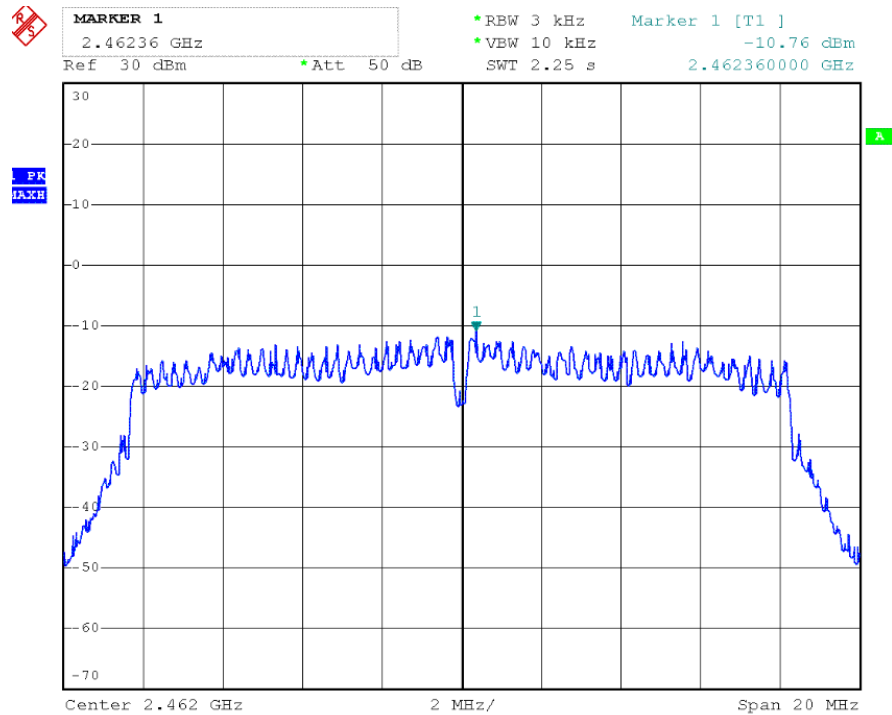
POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH Low)



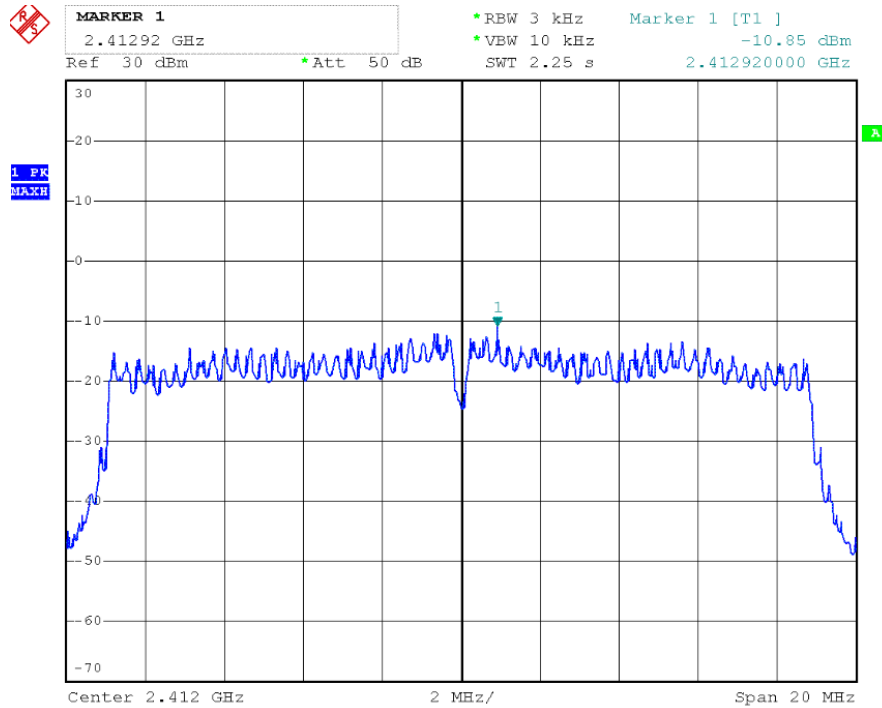
POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH Mid)



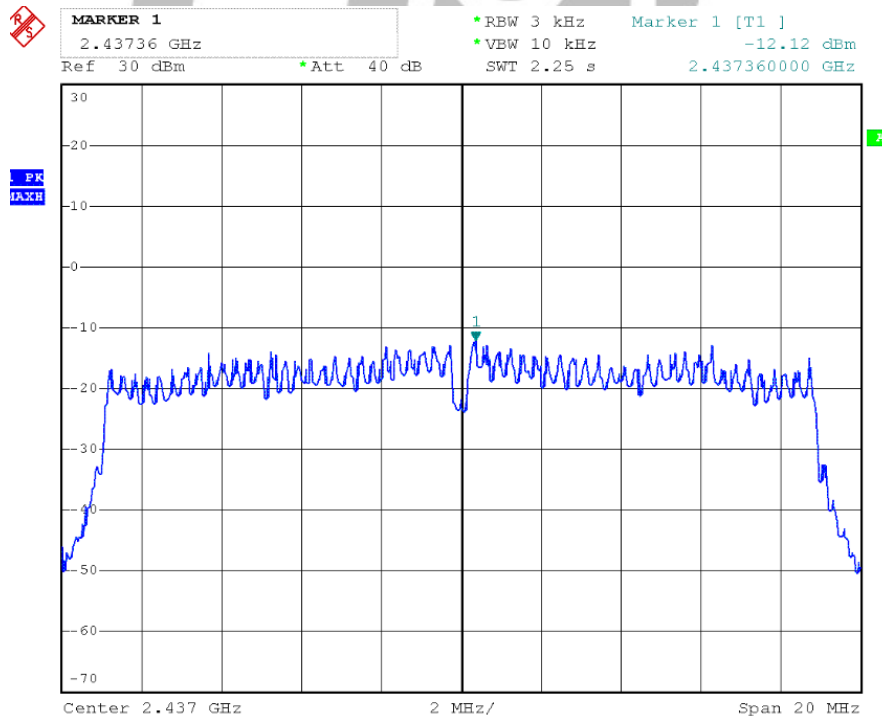
POWER SPECTRAL DENSITY (IEEE 802.11g MODE CH High)



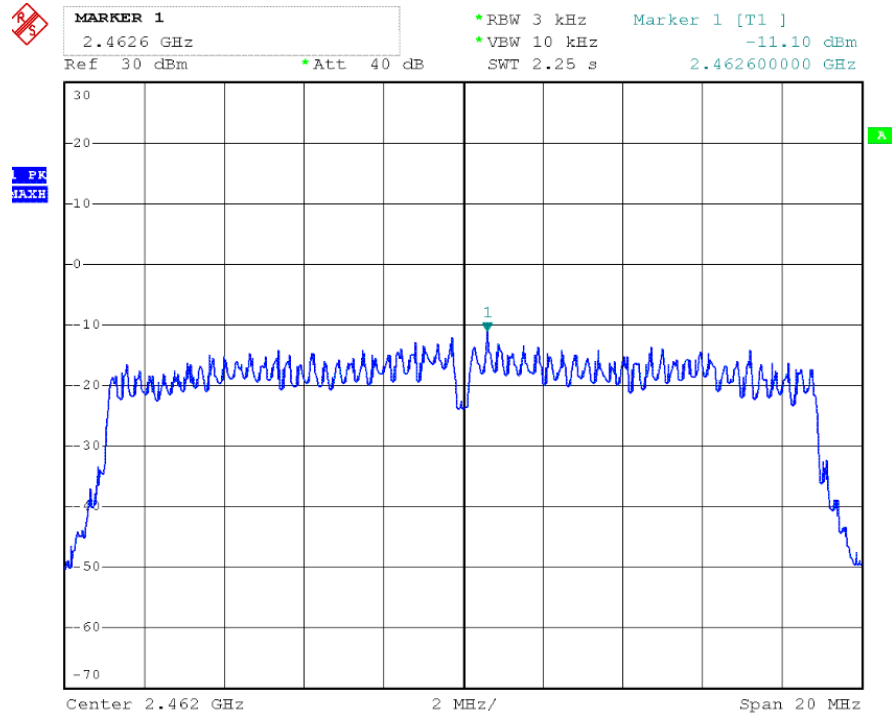
POWER SPECTRAL DENSITY (IEEE 802.11n HT20 MODE CH Low)



POWER SPECTRAL DENSITY (IEEE 802.11n HT20 MODE CH Mid)



POWER SPECTRAL DENSITY (IEEE 802.11n HT20 MODE CH High)



HCT
 HONGCAI TESTING

7. Test of 6dB Bandwidth

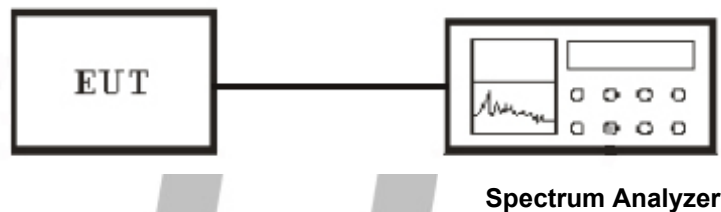
7.1 Applicable standard

Refer to FCC §15.247 (a) (2) and IC RSS-247 Issue2 Clause 5.2 (1), IC RSS-GEN Clause 6.6

KDB558074 D01 V04 – Section 8.2 Option 2

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

7.2 EUT Setup



7.3 Test Equipment List and Details

See section 2.5 or 2.6

7.4 Test Procedure

The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. The transmitter output was connected to a spectrum analyzer and the parameter was set as below:

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Continuously Tx Mode

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	7.56	500	PASS
Middle	2437	8.60	500	PASS
High	2462	9.04	500	PASS

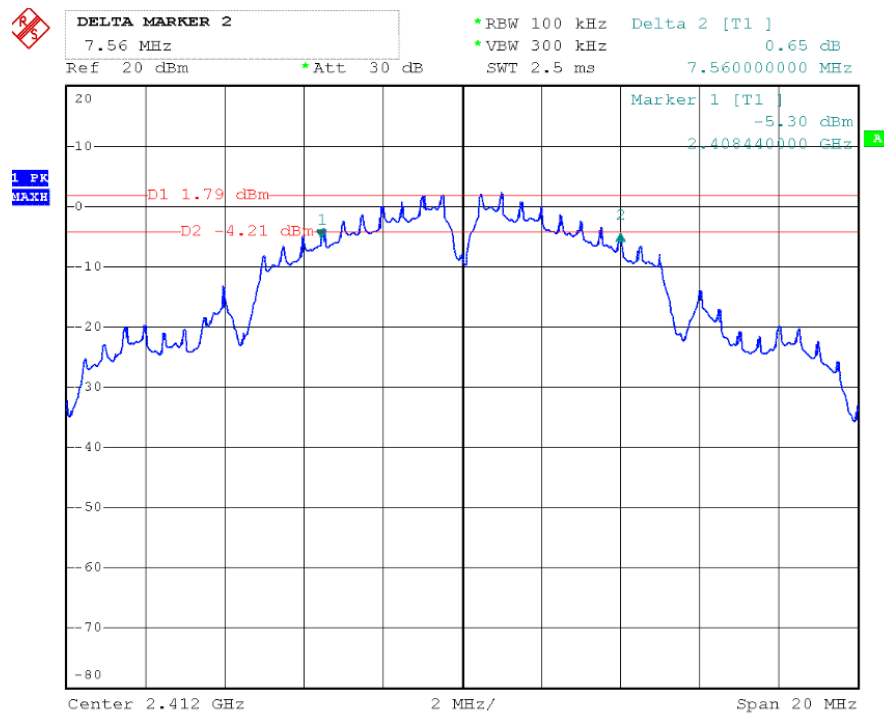
IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	15.12	500	PASS
Middle	2437	15.36	500	PASS
High	2462	15.72	500	PASS

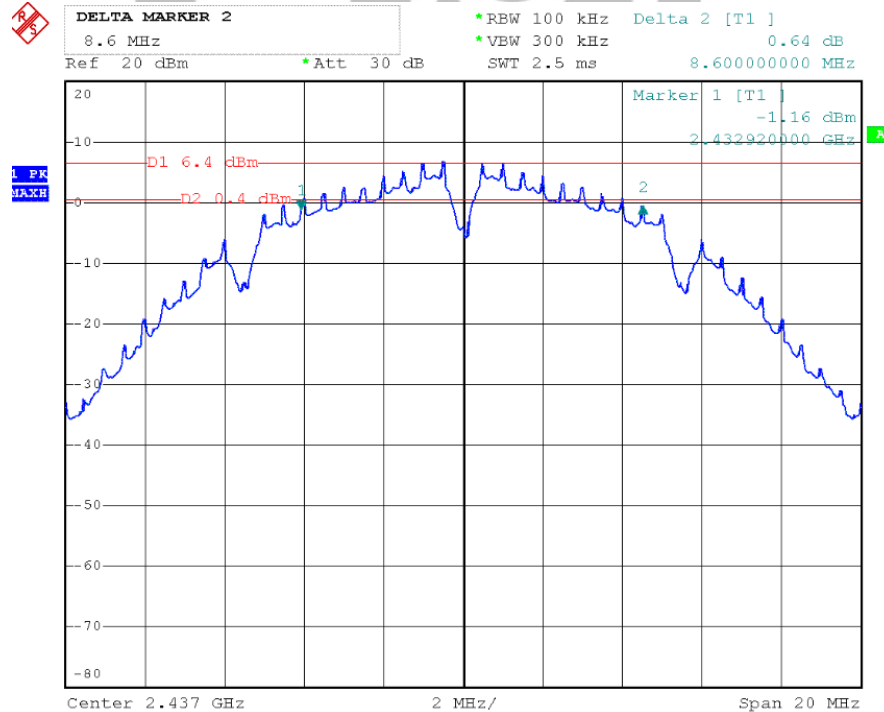
IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	17.72	500	PASS
Middle	2437	17.80	500	PASS
High	2462	17.80	500	PASS

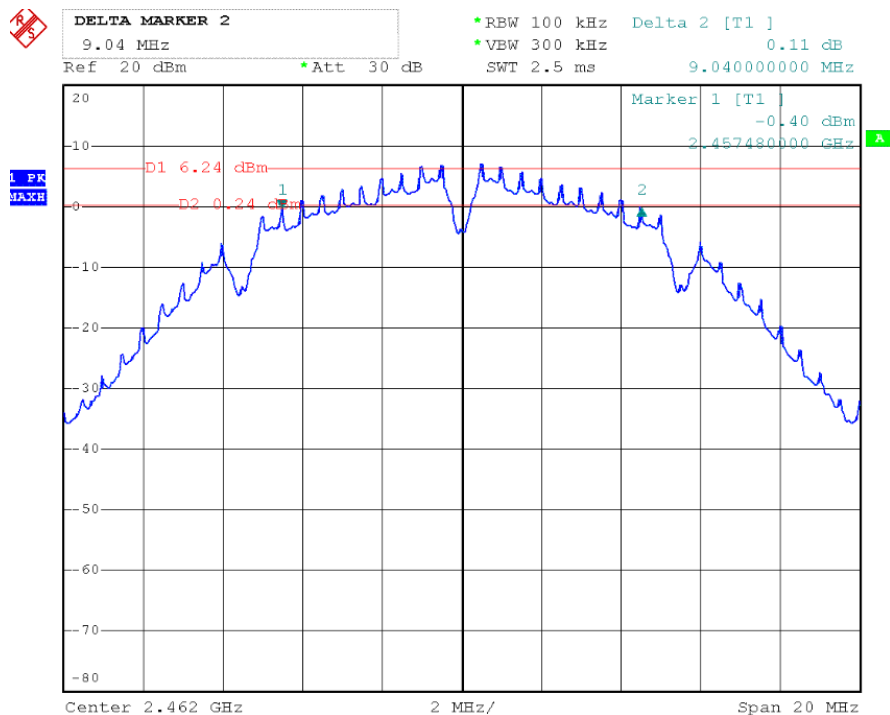
6dB BANDWIDTH (IEEE 802.11b MODE CH Low)



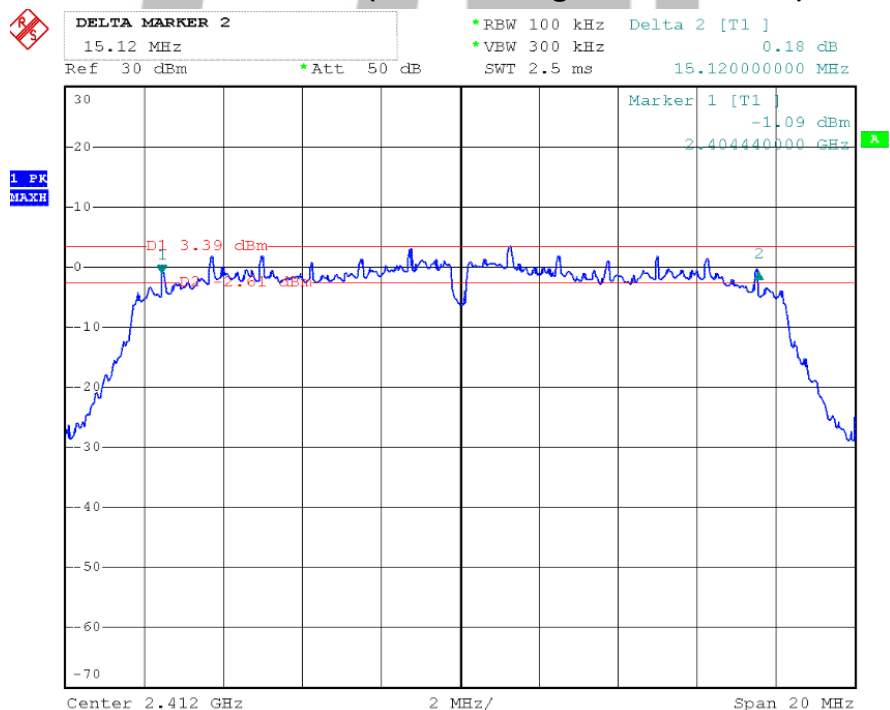
6dB BANDWIDTH (IEEE 802.11b MODE CH Mid)



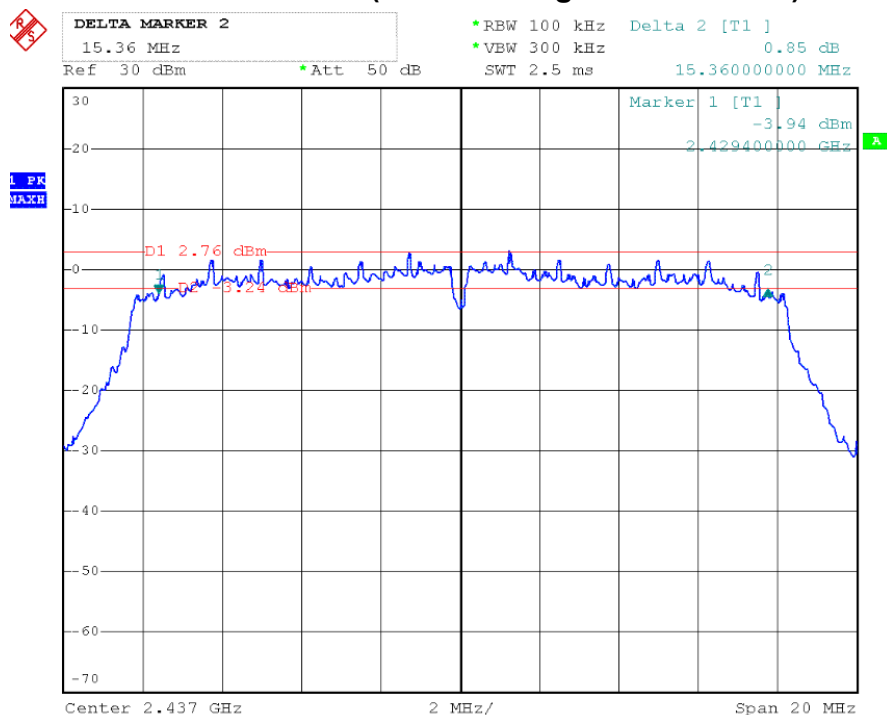
6dB BANDWIDTH (IEEE 802.11b MODE CH High)



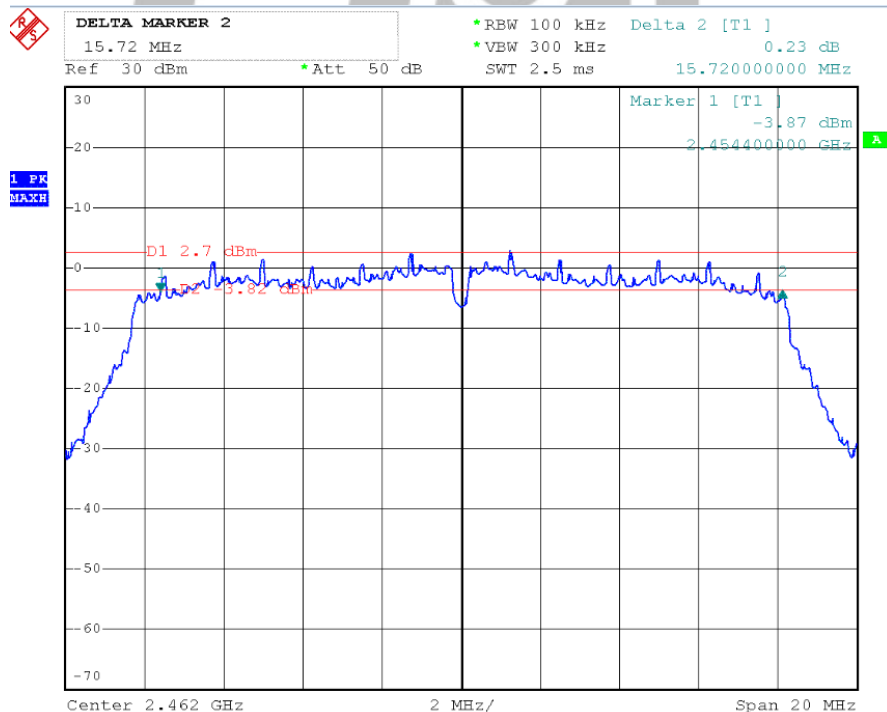
6dB BANDWIDTH (IEEE 802.11g MODE CH Low)



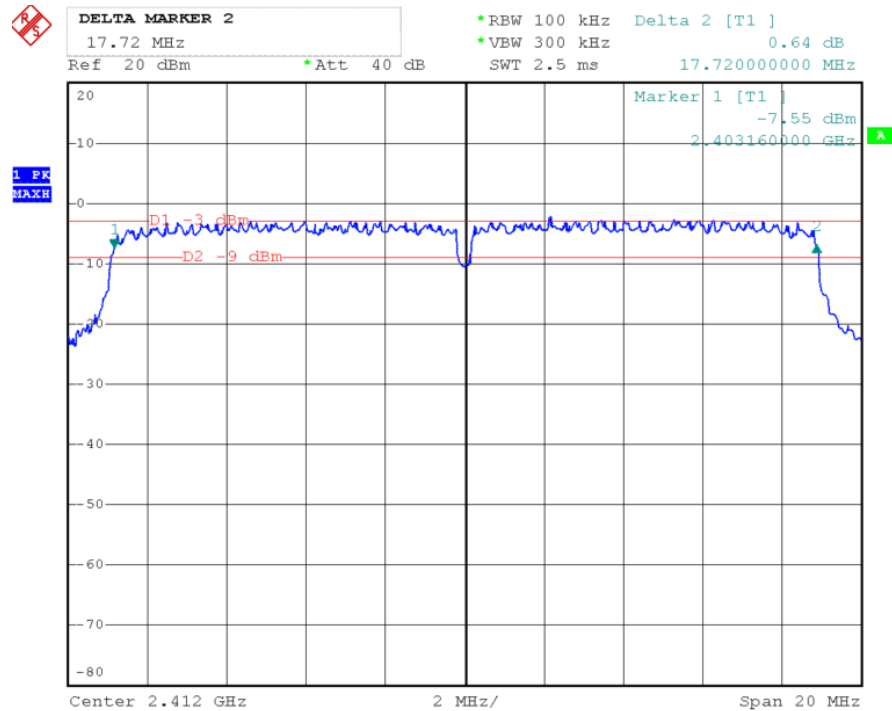
6dB BANDWIDTH (IEEE 802.11g MODE CH Mid)



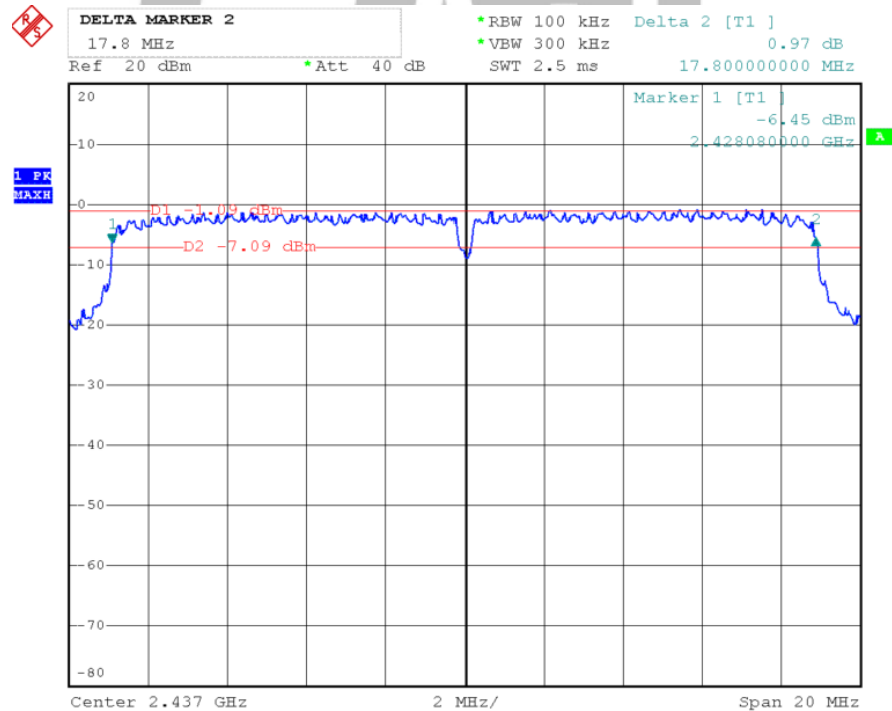
6dB BANDWIDTH (IEEE 802.11g MODE CH High)



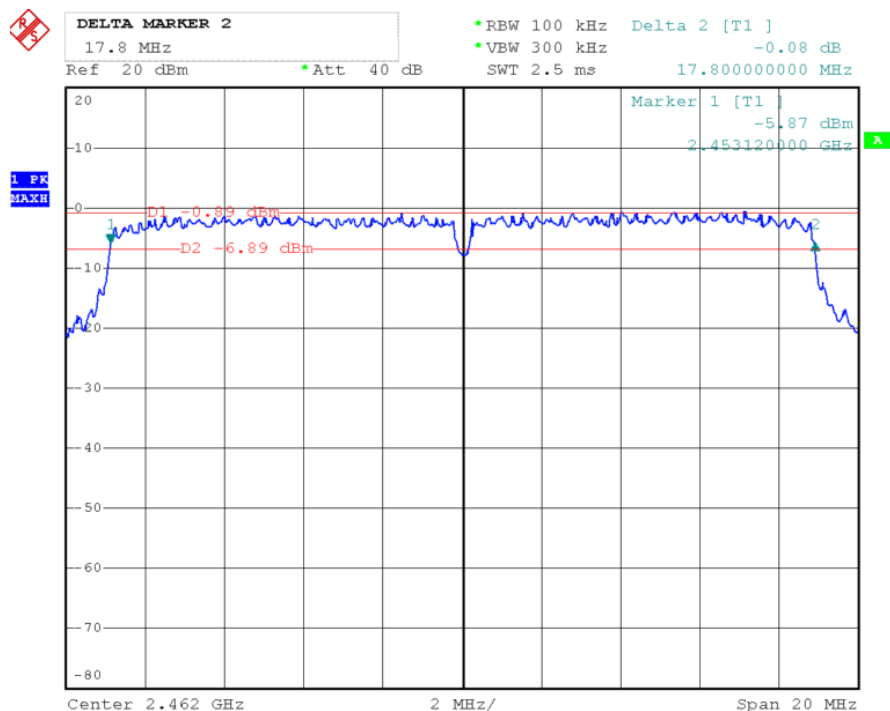
6dB BANDWIDTH (IEEE 802 11n HT20 MODE CH Low)



6dB BANDWIDTH (IEEE 802 11n HT20 MODE CH Mid)



6dB BANDWIDTH (IEEE 802.11n HT20 MODE CH High)



8. Test of Conducted Spurious Emission

8.1 Applicable standard

Refer to FCC §15.247 (d) and IC RSS-247 Issue2 Clause 5.5 and KDB558074 D01 V04 – Section 11.3

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

8.2 EUT Setup



8.3 Test Equipment List and Details

See section 2.5 or 2.6

8.4 Test Procedure

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW $\geq$ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

8.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Continuously TX Mode

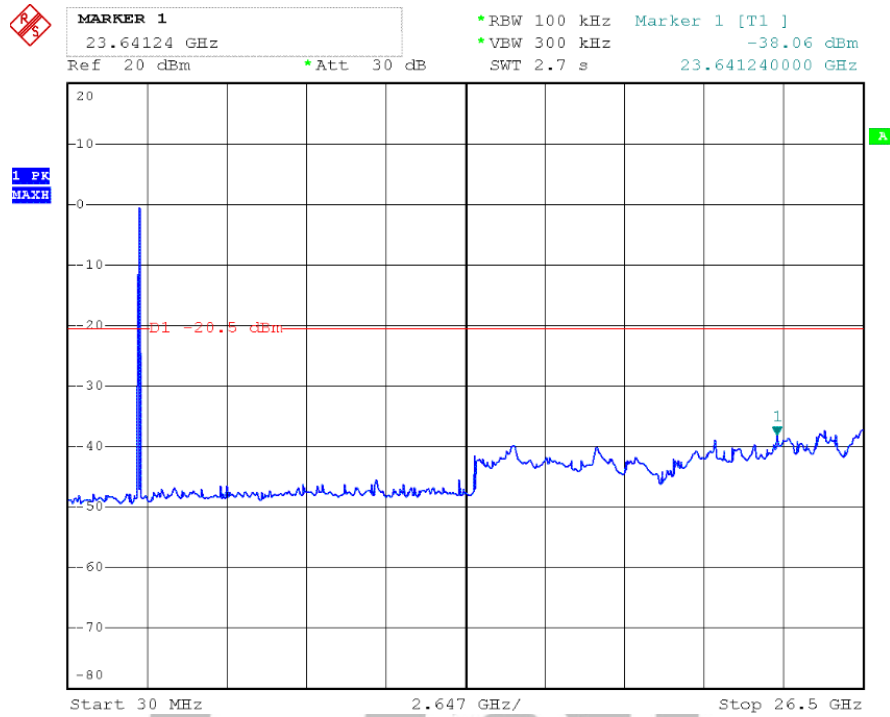
Test Result: PASS

Report No.: HCT17GR186E-2

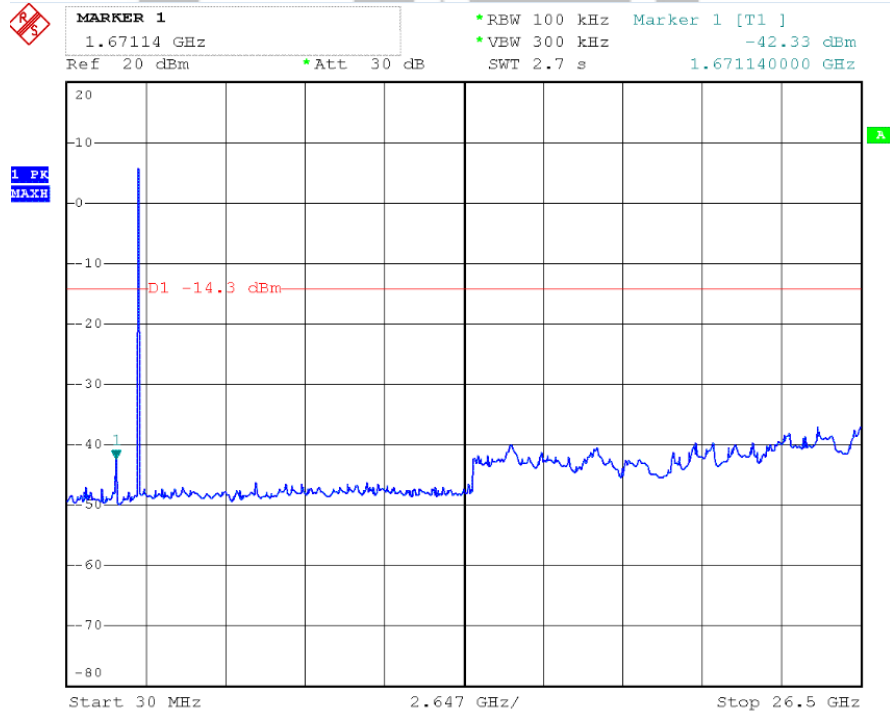
Page 30 of 58

FCC ID: 2AM99-RC133N

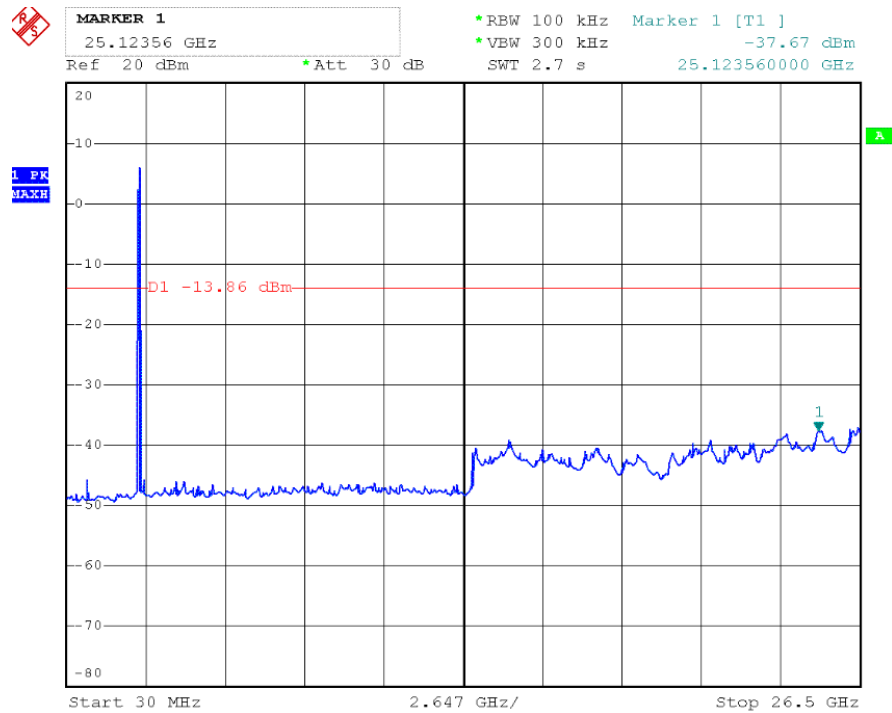
IEEE 802.11b mode CH Low



CH Mid

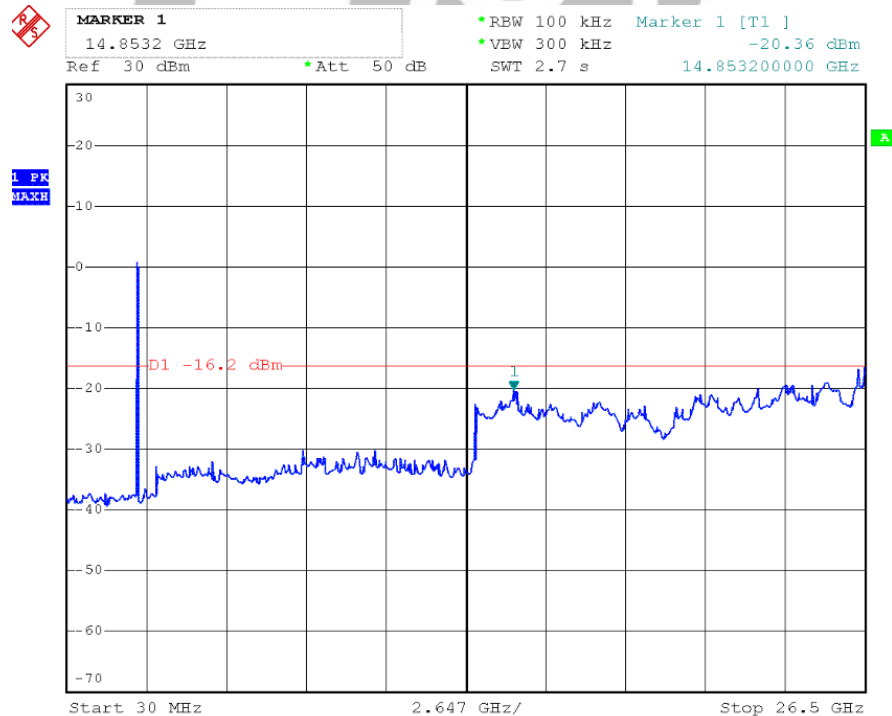


CH High

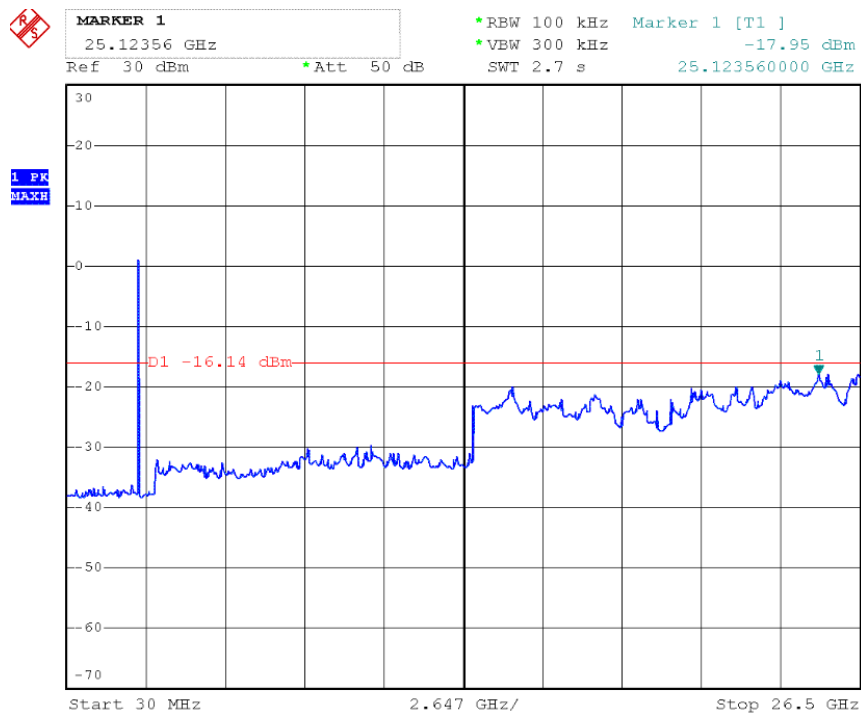


IEEE 802.11g mode

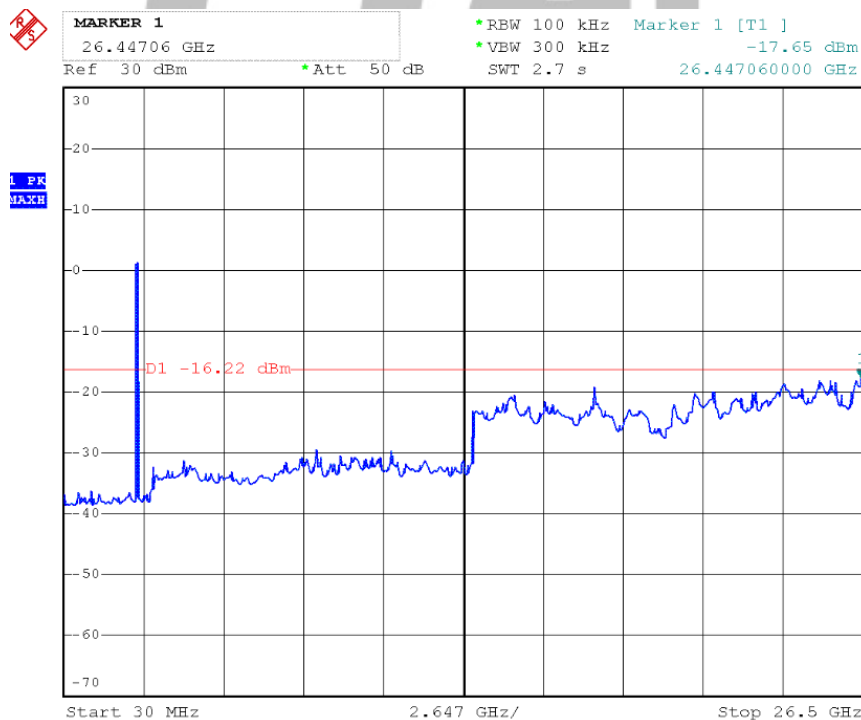
CH Low



CH Mid

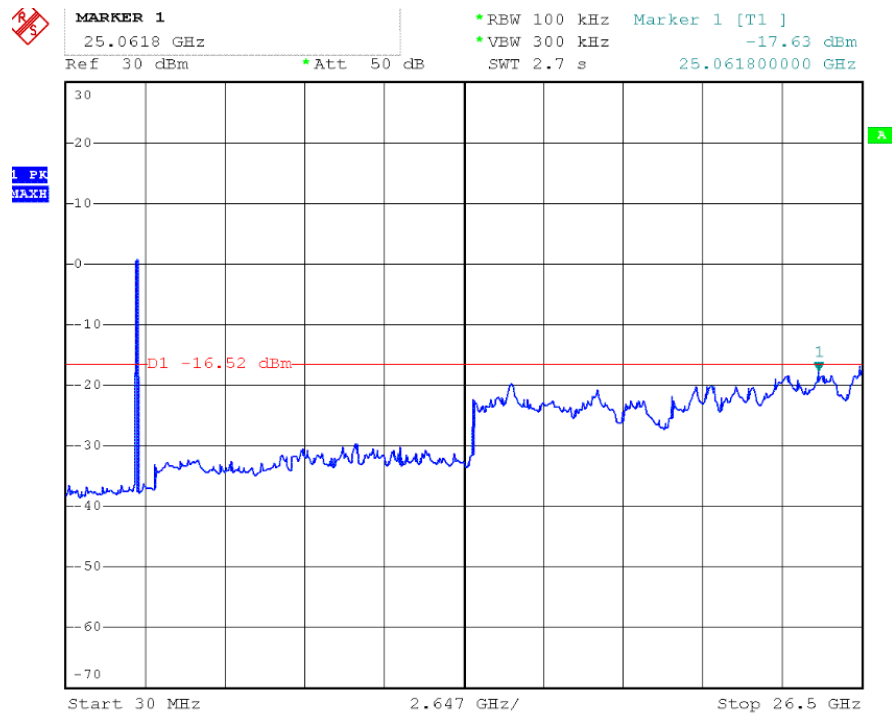


CH High

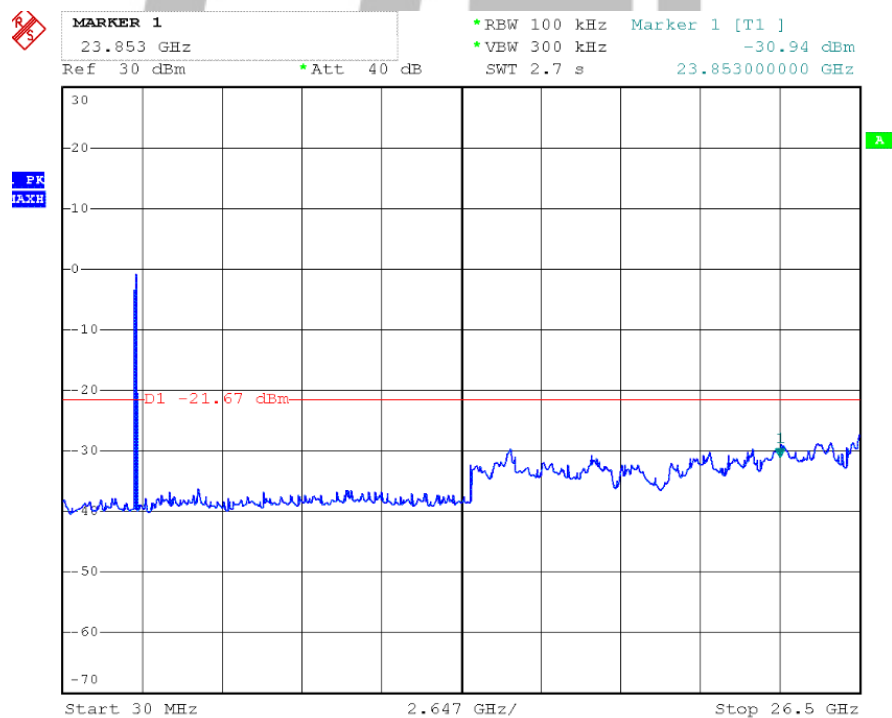


IEEE 802 11n HT20 mode

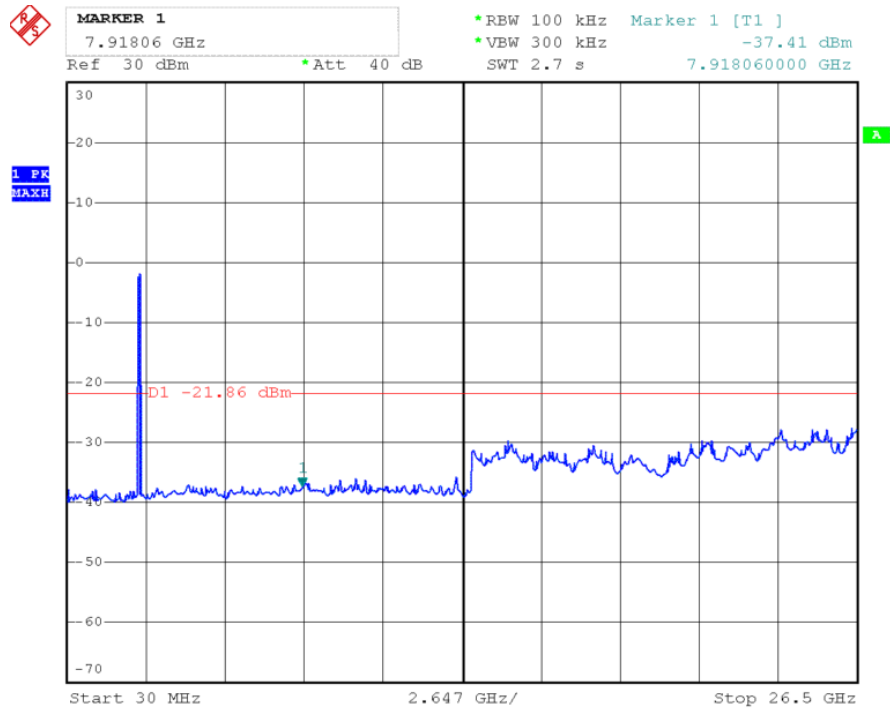
CH Low



CH Mid



CH High



9. Test of Radiated Spurious Emission

9.1 Radiated Spurious Emission

Refer to FCC §15.205 and §15.209, IC RSS-247 Clause 5.5

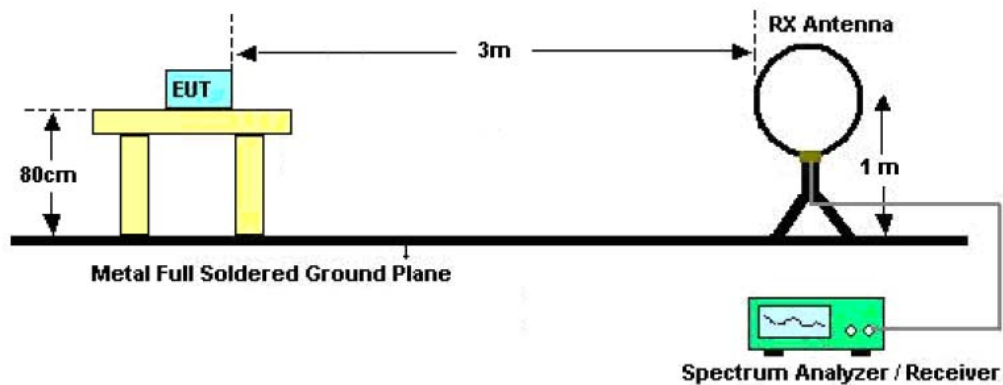
9.2 Limits

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

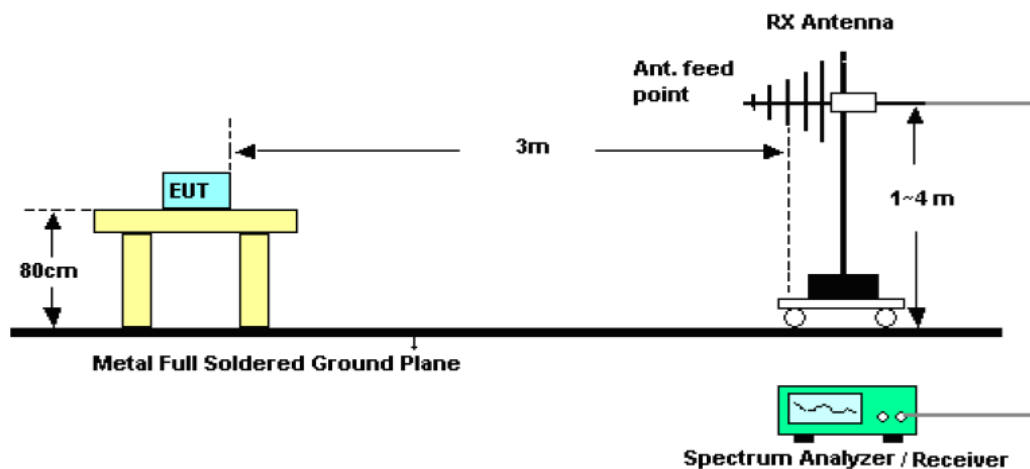
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

9.3 EUT Setup

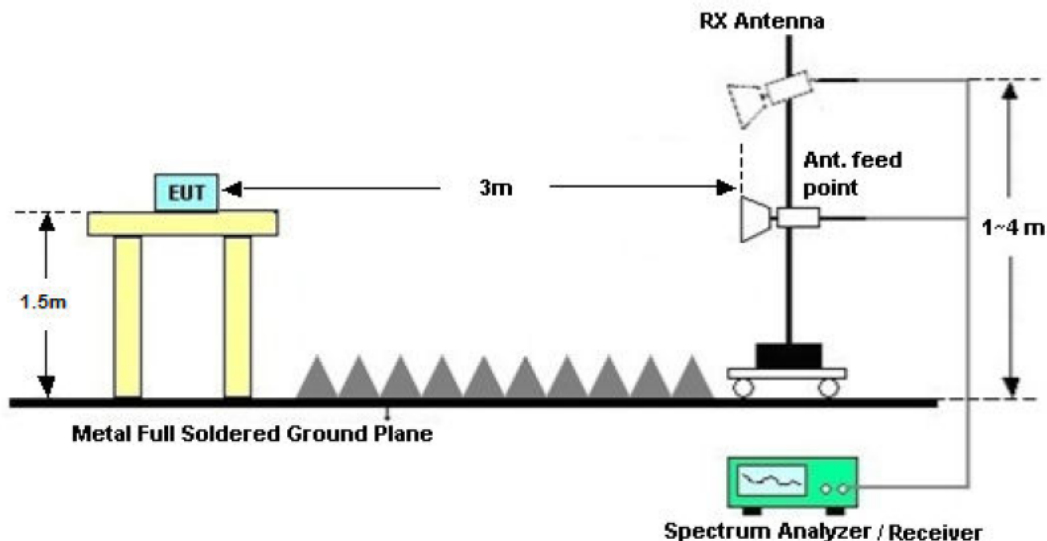
For radiated emission below 30MHz



For radiated emission from 30MHz to 1GHz



For radiated emission from above 1GHz



9.4 Test Procedure

KDB558074 D01 V04 – Section 12.1, 12.2.7

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 120kHz(for emissions from 30MHz-1GHz)
3. Detector = Quasi-Peak
4. Trace Mode = max hold.
5. Sweep = auto couple.
6. Trace was allowed to stabilize

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = Peak
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points=1001 ($\geq 2 \times \text{span/RBW}$)
6. Sweep = auto couple.
7. Trace (RMS) averaging was performed over at least 100 traces

NOTE:

1. Configure the EUT according to ANSI C63.10-2013
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

9.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: TX Mode

Note:

1. Worst-case radiated emission below 30MHz is IEEE 802.11b TX (CH Low) mode;
2. Worst-case radiated emission below 1GHz is IEEE 802.11g TX (CH Low, Middle, High) mode.
3. Worst-case radiated emission above 1GHz is IEEE 802.11n HT20 TX (CH Low, Middle, High)

RADIATED EMISSION BELOW 30 MHz

IEEE 802.11 b TX (CH Low) operating Mode:

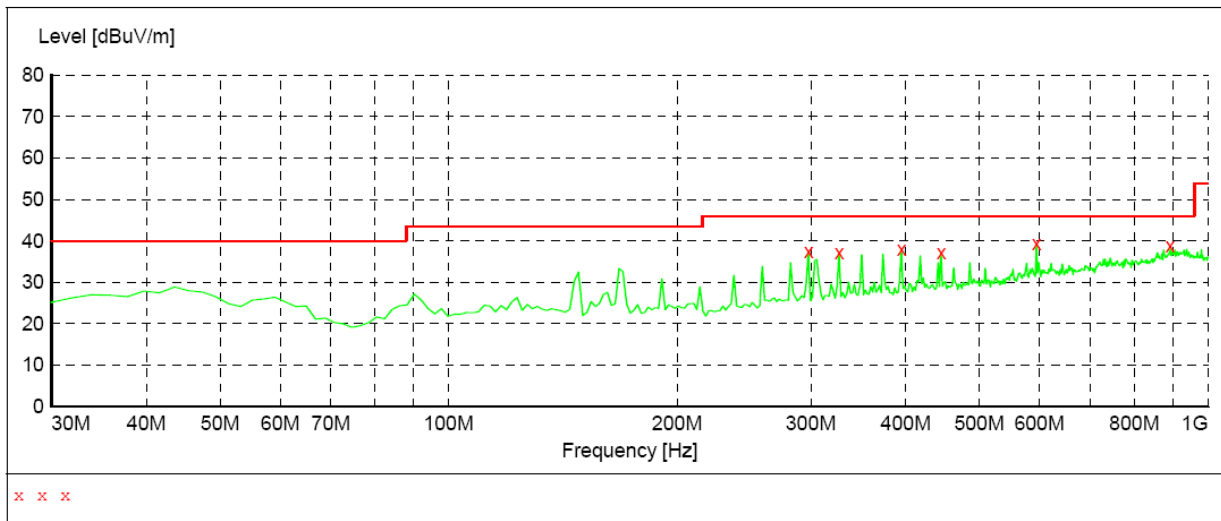
Frequency (MHz)	Meter Reading (dBμV)	Antenna Factor (dB/M)	Cable Loss (dB)	Emission Levels (dBμV/M)	Limits (dB μ V/M)	Margin (dB)	Detector Mode PK/QP
0.64	33.88	8	1.16	43.04	71.5	-28.46	QP
20.07	33.33	8.76	1.3	43.39	69.5	-26.11	QP
24.61	34.65	8.94	1.19	44.78	69.5	-24.72	QP
29.56	34.75	8.12	1.77	44.64	69.5	-24.86	QP

Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Low)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

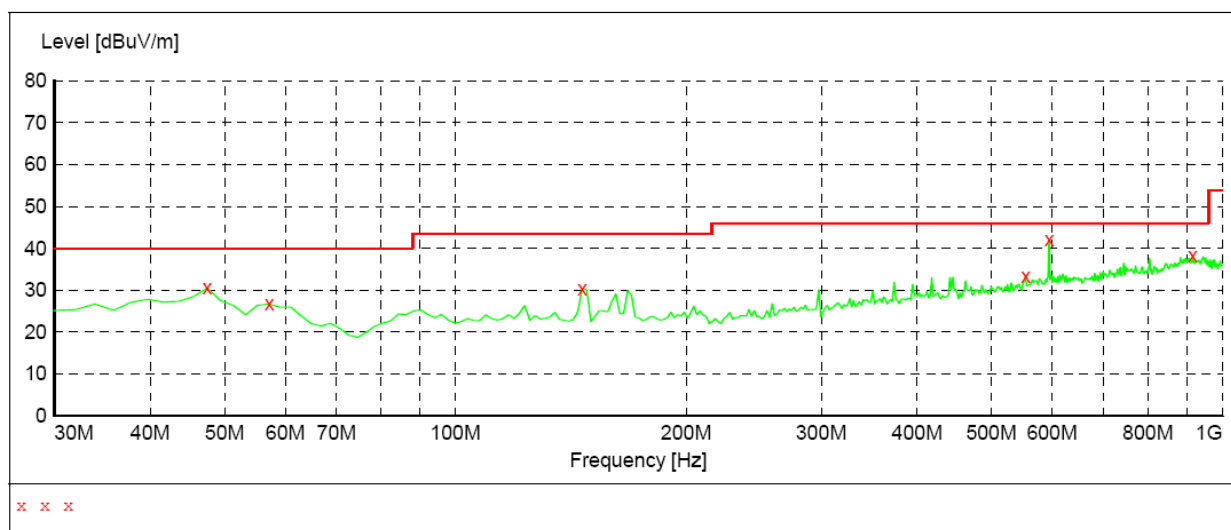
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
297.720000	37.40	14.8	46.0	8.6	QP	300.0	0.00	HORIZONTAL
326.820000	37.30	16.0	46.0	8.7	QP	100.0	0.00	HORIZONTAL
394.720000	37.90	17.5	46.0	8.1	QP	100.0	0.00	HORIZONTAL
445.160000	37.10	18.3	46.0	8.9	QP	300.0	0.00	HORIZONTAL
594.540000	39.30	21.5	46.0	6.7	QP	100.0	0.00	HORIZONTAL
891.360000	38.80	25.5	46.0	7.2	QP	300.0	0.00	HORIZONTAL

Spurious Emission Below 1GHz : IEEE 802.11g TX (CH Low)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength		Transducer	
Start	Stop	Detector	Meas. Time	IF Bandw.	
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

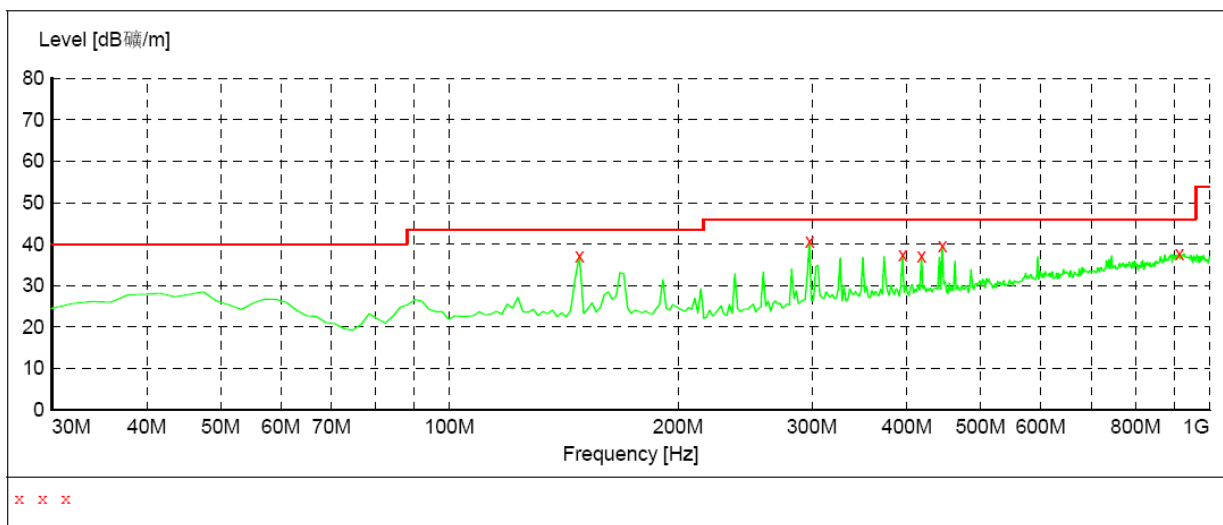
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.50	16.7	40.0	9.5	QP	100.0	0.00	VERTICAL
57.160000	26.70	15.7	40.0	13.3	QP	100.0	0.00	VERTICAL
146.400000	30.30	12.0	43.5	13.2	QP	100.0	0.00	VERTICAL
553.800000	33.40	20.4	46.0	12.6	QP	100.0	0.00	VERTICAL
594.540000	42.20	21.5	46.0	3.8	QP	100.0	0.00	VERTICAL
914.640000	38.20	25.8	46.0	7.8	QP	100.0	0.00	VERTICAL

Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Mid)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

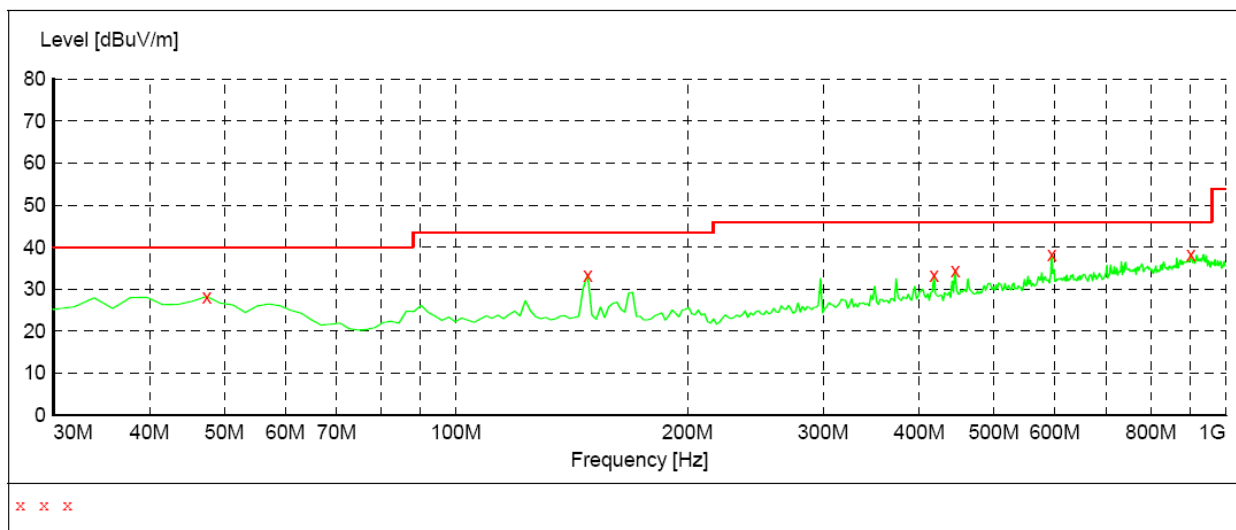
Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
148.340000	37.20	11.7	43.5	6.3	QP	300.0	0.00	HORIZONTAL
297.720000	40.70	14.8	46.0	5.3	QP	100.0	0.00	HORIZONTAL
394.720000	37.50	17.5	46.0	8.5	QP	300.0	0.00	HORIZONTAL
418.000000	37.20	18.2	46.0	8.8	QP	100.0	0.00	HORIZONTAL
445.160000	39.60	18.3	46.0	6.4	QP	100.0	0.00	HORIZONTAL
912.700000	37.70	25.8	46.0	8.3	QP	100.0	0.00	HORIZONTAL

Spurious Emission Below 1GHz: IEEE 802.11g TX (CH Mid)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

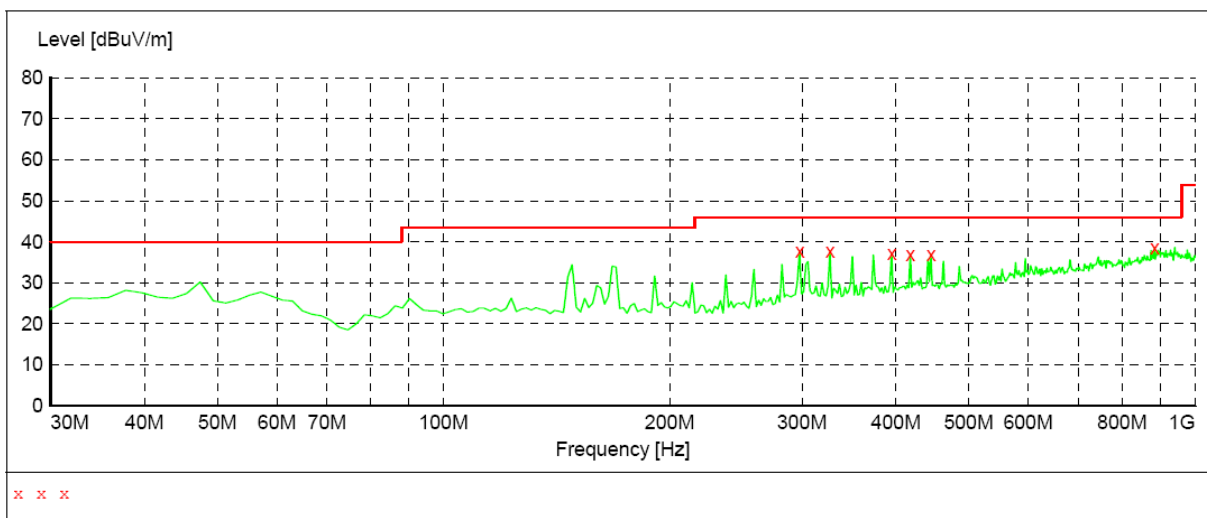
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	28.30	16.7	40.0	11.7	QP	100.0	0.00	VERTICAL
148.340000	33.40	11.7	43.5	10.1	QP	100.0	0.00	VERTICAL
418.000000	33.30	18.2	46.0	12.7	QP	100.0	0.00	VERTICAL
445.160000	34.50	18.3	46.0	11.5	QP	100.0	0.00	VERTICAL
594.540000	38.40	21.5	46.0	7.6	QP	100.0	0.00	VERTICAL
901.060000	38.30	25.8	46.0	7.7	QP	100.0	0.00	VERTICAL

Spurious Emission Below 1GHz: IEEE 802.11g TX (CH High)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency 30.0 MHz	Frequency 1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

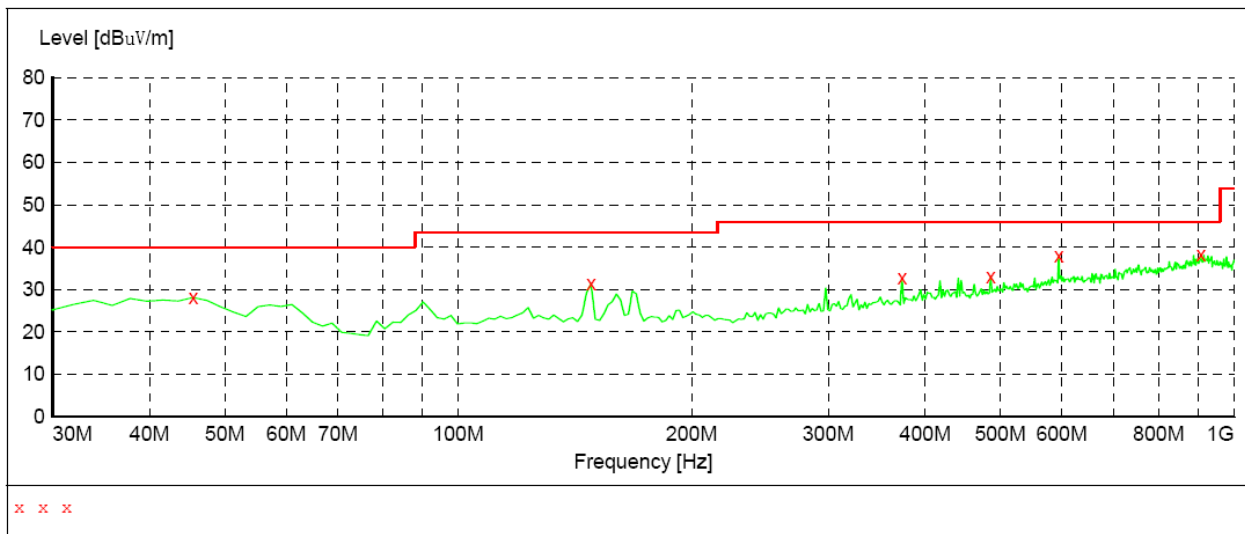
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
297.720000	37.60	14.8	46.0	8.4	QP	100.0	0.00	HORIZONTAL
326.820000	37.80	16.0	46.0	8.2	QP	300.0	0.00	HORIZONTAL
394.720000	37.10	17.5	46.0	8.9	QP	300.0	0.00	HORIZONTAL
418.000000	37.00	18.2	46.0	9.0	QP	100.0	0.00	HORIZONTAL
445.160000	37.00	18.3	46.0	9.0	QP	300.0	0.00	HORIZONTAL
883.600000	38.60	25.4	46.0	7.4	QP	100.0	0.00	HORIZONTAL

Spurious Emission Below 1GHz: IEEE 802.11g TX (CH High)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



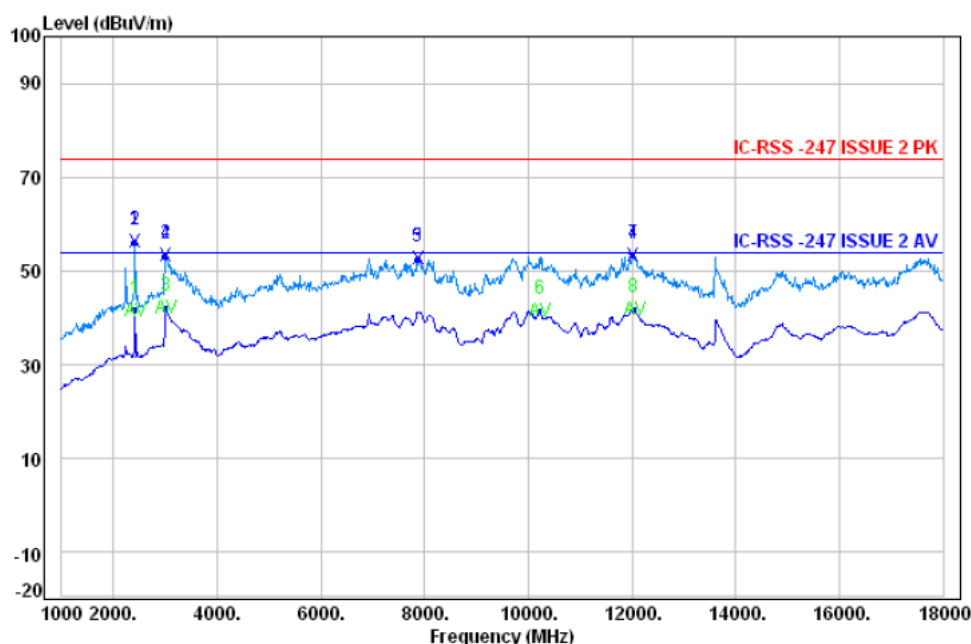
MEASUREMENT RESULT:

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
45.520000	28.10	16.8	40.0	11.9	QP	100.0	0.00	VERTICAL
148.340000	31.40	11.7	43.5	12.1	QP	100.0	0.00	VERTICAL
373.380000	32.70	17.0	46.0	13.3	QP	100.0	0.00	VERTICAL
485.900000	33.00	19.2	46.0	13.0	QP	100.0	0.00	VERTICAL
594.540000	38.00	21.5	46.0	8.0	QP	100.0	0.00	VERTICAL
906.880000	38.30	25.8	46.0	7.7	QP	100.0	0.00	VERTICAL

RADIATED EMISSION ABOVE 1 GHz

IEEE 802.11n HT20 (CH Low)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

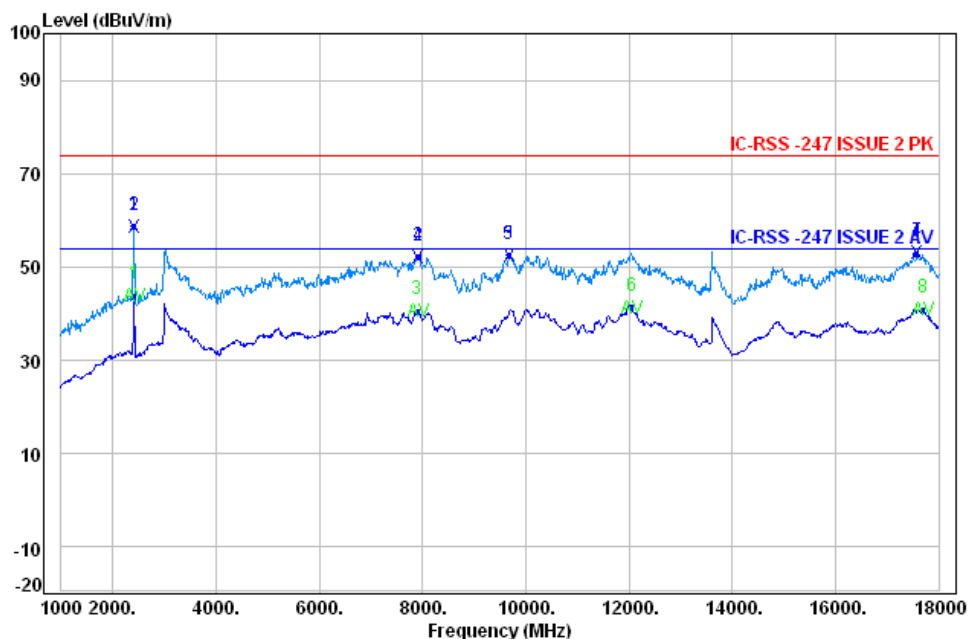


Ant	Read	Limit	Over
Freq	Factor	Level	Level

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	2411.00	30.74	52.61	41.75	74.00	-32.25 Average
2	2411.00	30.74	67.11	56.25	74.00	-17.75 Peak
3	3006.00	31.60	51.75	42.20	74.00	-31.80 Average
4	3006.00	31.60	62.83	53.28	74.00	-20.72 Peak
5	7868.00	39.47	66.08	52.65	74.00	-21.35 Peak
6	10214.00	39.49	54.81	41.58	74.00	-32.42 Average
7	12016.00	41.42	65.30	53.43	74.00	-20.57 Peak
8	12033.00	41.43	53.89	41.95	74.00	-32.05 Average

IEEE 802.11n HT20 (CH Low)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal

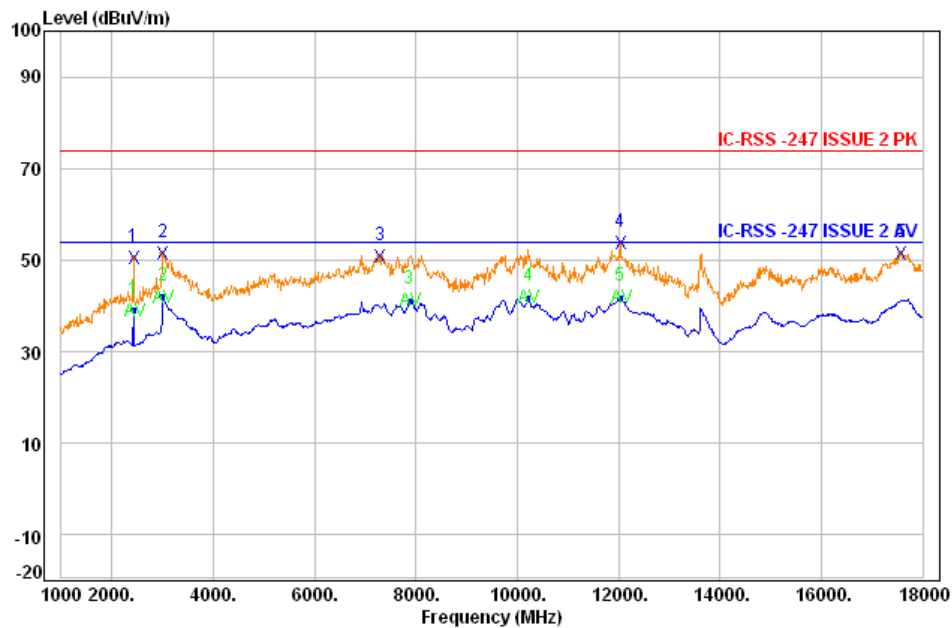


Ant Read Limit Over
Freq Factor Level Level Line Limit Remark

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2411.00	30.74	54.75	43.89	74.00	-30.11	Average
2	2411.00	30.74	69.61	58.75	74.00	-15.25	Peak
3	7902.00	39.48	54.10	40.62	74.00	-33.38	Average
4	7919.00	39.48	65.76	52.25	74.00	-21.75	Peak
5	9670.00	39.14	66.70	52.50	74.00	-21.50	Peak
6	12050.00	41.45	53.39	41.39	74.00	-32.61	Average
7	17575.00	44.17	75.61	52.95	74.00	-21.05	Peak
8	17694.00	43.17	64.12	40.87	74.00	-33.13	Average

IEEE 802.11n HT20 (CH Mid)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal

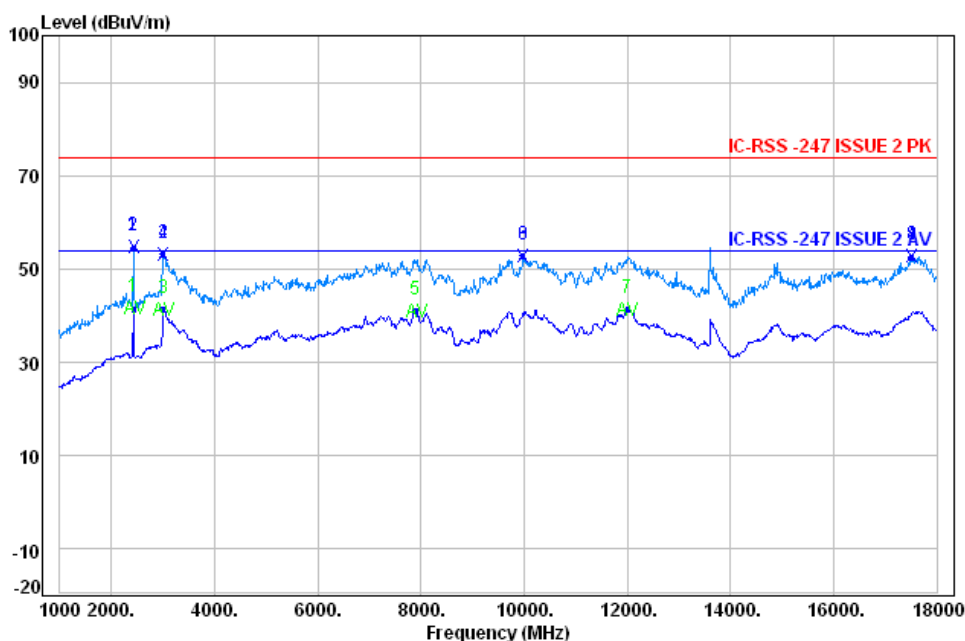


	Ant	Read	Limit	Over	
Freq	Factor	Level	Level	Line	Limit Remark

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2437.00	30.73	49.98	39.13	74.00	-34.87	Average
2	3006.00	31.60	51.67	42.12	74.00	-31.88	Average
3	7868.00	39.47	54.58	41.15	74.00	-32.85	Average
4	10214.00	39.49	55.04	41.81	74.00	-32.19	Average
5	12033.00	41.43	53.80	41.86	74.00	-32.14	Average

IEEE 802.11n HT20 (CH Mid)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

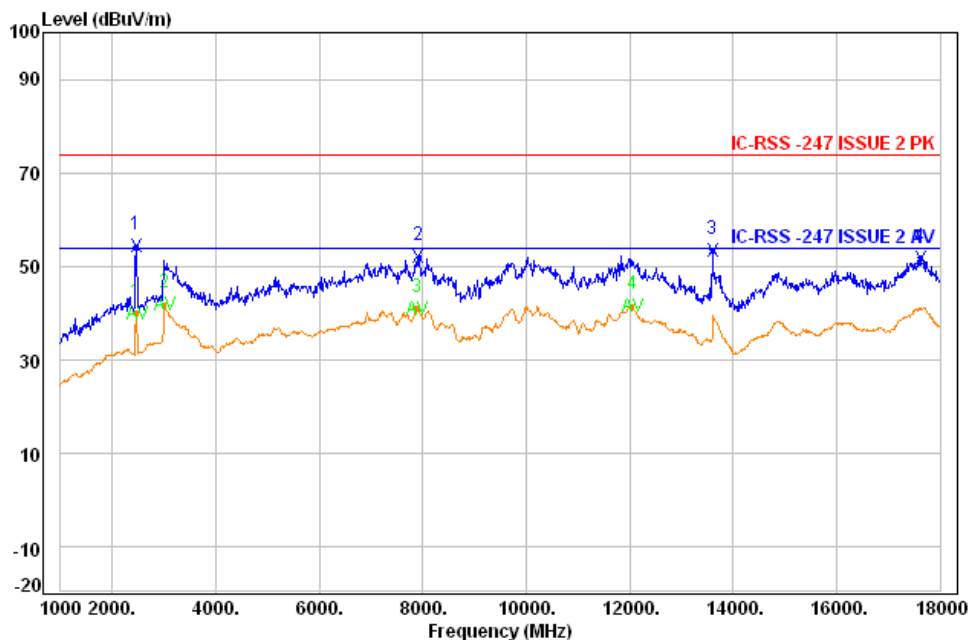


Ant	Read	Limit	Over
Freq	Factor	Level	Level
Line	Limit	Remark	

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	2437.00	30.73	52.42	41.57	74.00	-32.43 Average
2	2437.00	30.73	65.50	54.65	74.00	-19.35 Peak
3	3006.00	31.60	50.89	41.34	74.00	-32.66 Average
4	3006.00	31.60	62.70	53.15	74.00	-20.85 Peak
5	7902.00	39.48	54.59	41.11	74.00	-32.89 Average
6	9976.00	39.38	65.60	52.90	74.00	-21.10 Peak
7	11999.00	41.40	53.25	41.44	74.00	-32.56 Average
8	17524.00	44.60	75.06	52.66	74.00	-21.34 Peak

IEEE 802.11n HT20 (CH High)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Vertical

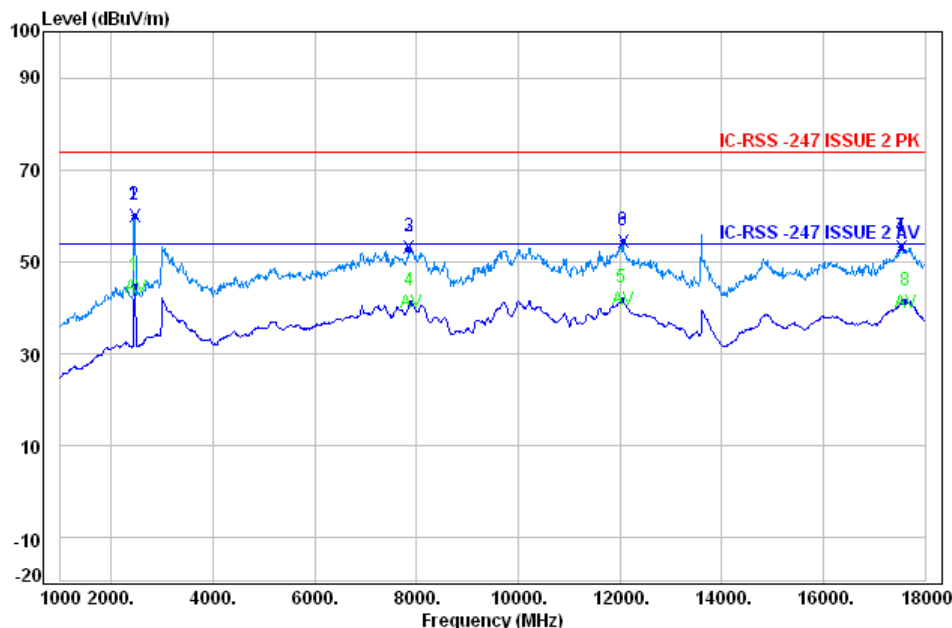


Ant	Read	Limit	Over			
Freq	Factor	Level	Level	Line	Limit	Remark

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2462.00	30.72	65.12	54.29	74.00	-19.71	Peak
2	7919.00	39.48	65.58	52.07	74.00	-21.93	Peak
3	13597.00	42.38	72.11	53.53	74.00	-20.47	Peak
4	17626.00	43.74	74.70	51.79	74.00	-22.21	Peak

IEEE 802.11n HT20 (CH High)

EUT: LOONA
M/N: RC133N1
Operating Condition: TX Mode
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: AC 120/60Hz
Comment: Polarization: Horizontal



Ant	Read	Limit	Over
Freq	Factor	Level	Level

	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	Remark
1	2462.00	30.72	55.52	44.69	74.00	-29.31	Average
2	2462.00	30.72	70.78	59.95	74.00	-14.05	Peak
3	7851.00	39.47	66.45	53.04	74.00	-20.96	Peak
4	7868.00	39.47	54.64	41.21	74.00	-32.79	Average
5	12033.00	41.43	53.82	41.88	74.00	-32.12	Average
6	12067.00	41.47	66.46	54.40	74.00	-19.60	Peak
7	17541.00	44.46	75.67	53.19	74.00	-20.81	Peak
8	17609.00	43.88	64.19	41.36	74.00	-32.64	Average

10. Test of Band Edges Emission

10.1 Applicable standard

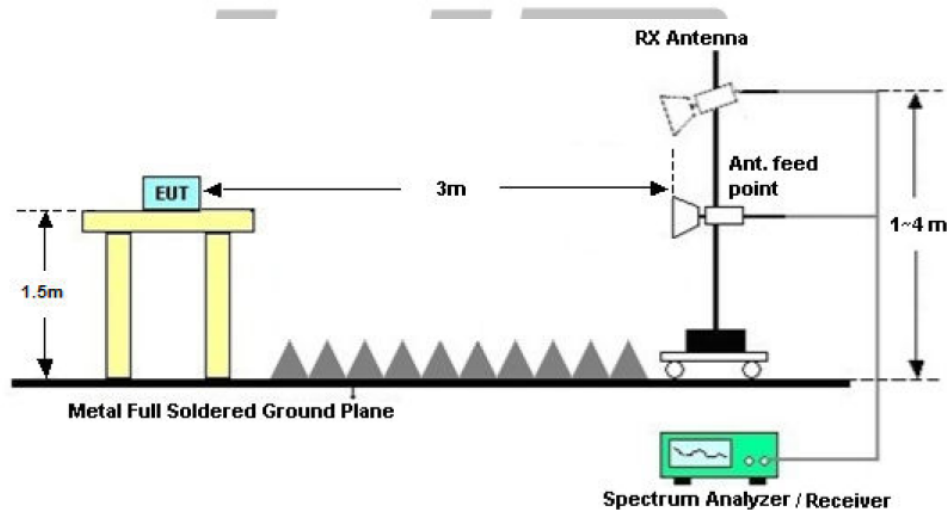
Refer to FCC §15.247 (d), IC RSS-247 Issue2 Clause 5.5

KDB558074 D01 V04 – Section 11.3

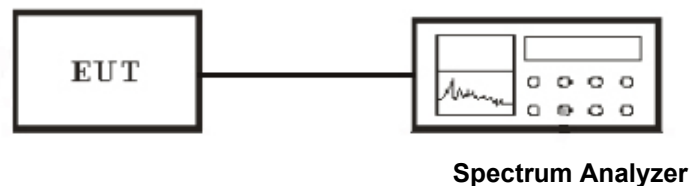
Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

10.2 EUT Setup

Radiated Measurement Setup



Conducted Measurement Setup



10.3 Test Equipment List and Details

See section 2.6 or 2.7

10.4 Test Procedure

Conducted Measurement

KDB558074 D01 V04 – Section 11.3

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

Radiated Measurement

KDB558074 D01 V04 – Section 12.1, 12.2.7

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = Peak
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = power average (RMS)
5. Sweep = auto couple.
6. Trace (RMS) averaging was performed over at least 100 traces

NOTE :

1. Configure the EUT according to ANSI C63.10-2013
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

10.5 Test Result

Temperature (°C) : 22~23	EUT: LOONA
Humidity (%RH) : 50~54	M/N: RC133N1
Barometric Pressure (mbar) : 950~1000	Operation Condition: Continuously Tx Mode

Radiated Test Result

IEEE 802.11b mode

Channel	Freq.(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dB)	Detector
	2400	49.48	74	-24.52	Peak
LOW	2400	37.29	54	-16.71	Average
	2483.5	48.52	74	-25.48	Peak
HIGH	2483.5	37.09	54	-16.91	Average

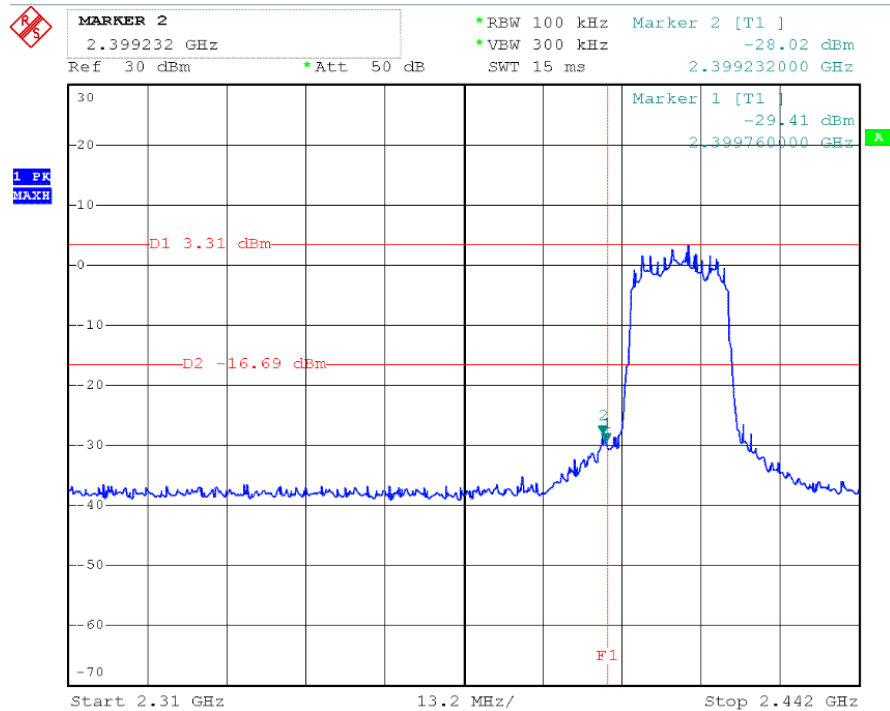
IEEE 802.11g mode

Channel	Freq.(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dB)	Detector
	2400	48.46	74	-25.54	Peak
LOW	2400	36.31	54	-17.69	Average
	2483.5	49.32	74	-24.68	Peak
HIGH	2483.5	37.1	54	-16.9	Average

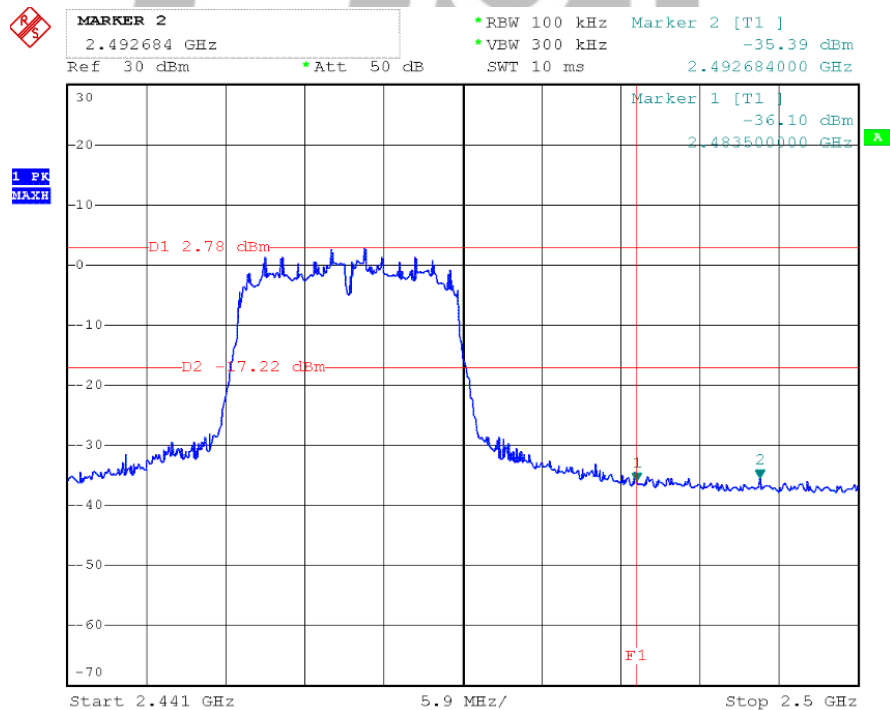
IEEE 802 11n HT20 mode

Channel	Freq.(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dB)	Detector
	2400	45.05	74	-28.95	Peak
LOW	2400	34.08	54	-19.92	Average
	2483.5	47.09	74	-26.91	Peak
HIGH	2483.5	34.87	54	-19.13	Average

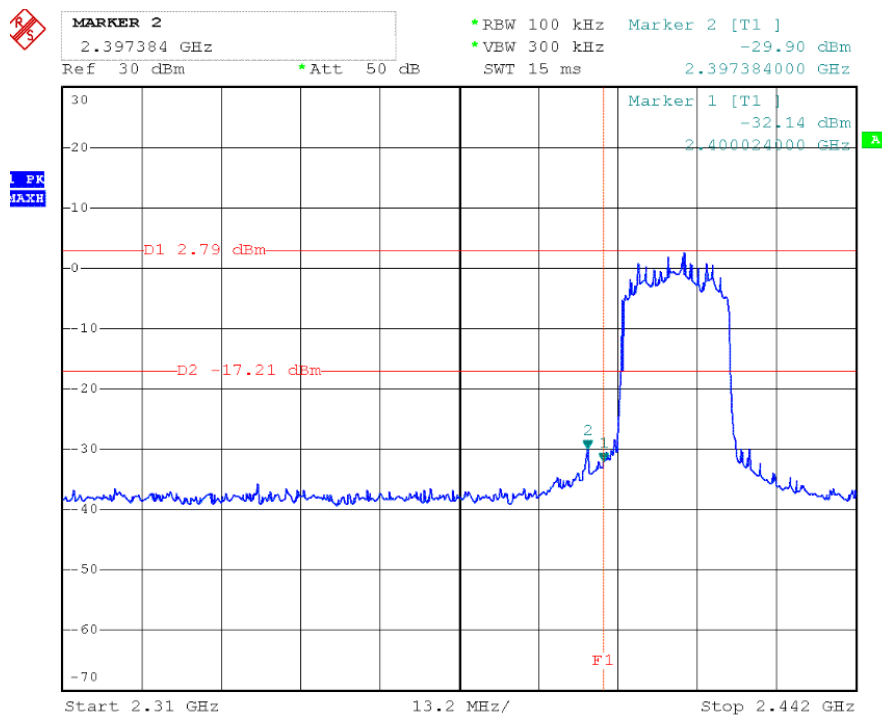
CH Low (802.11g MODE)



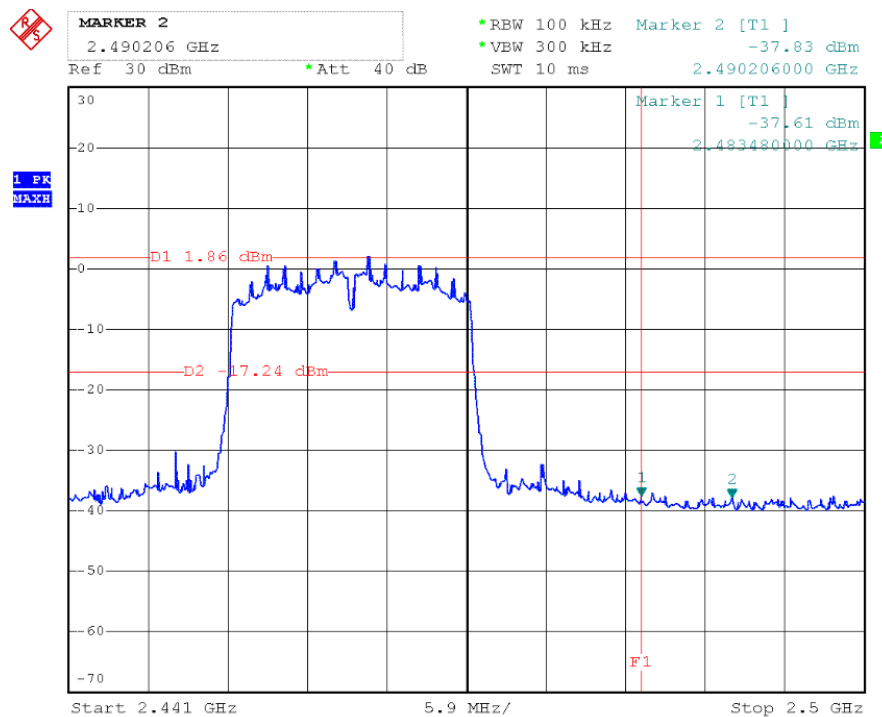
CH High (802.11g MODE)



CH Low (802.11n(HT20) MODE)



CH High (802.11n(HT20) MODE)



11. ANTENNA REQUIREMENT

11.1 standard Applicable

Section 15.203 & IC RSS-GEN Clause 8.3

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.

Section 15.247(b)/(c)

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Antenna Connected Construction

There are no provisions for connections to an external antenna.
The antenna is designed with permanent attachment and no consideration of replacement. The antenna used in this product is complied with standard. The maximum Gain of the antenna lower than 6.0dBi and have the definite antenna Specification.

...End of Report...