TEST REPORT

Test Report Number:	N2201R-0729-01
Project Number:	A2022-01018
Applicant:	PP-Solution Inc.
Address of Applicant:	606 Seobusaet-gil #B-2311, Seoul, South Korea, 08504
Manufacturer and Country	OPHIT Co., LTD.
Address of Manufacturer/Factory:	Rm.301, 302, 501, 502, #77, Deogyeong-daero 1471beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do

Equipment Under Test (EUT)

Product Name:	RTAP2U
Model No.:	RTAP2U

■ **FCC ID** : 2A4BV-RTAP2U □ **IC**

Applicable standards:	FCC CFR Title 47 Part 15 Subpart C (15.247) ANSI C63.10-2020 KDB 558074 D01
Date of Test:	Dec. 07, 2021 to Jan. 13, 2022
Date of report issued:	Jan. 26, 2022
Test Result:	Compliance *

Prepared By: ***Date:*** Jan. 26. 2022

Project Engineer

Check By: ***Date:*** Jan. 26. 2022

Reviewer

REPORT REVISION HISTORY

Date	Revision	Page No
Jan. 24. 2022	Originally Issued	-
Jan. 26. 2022	Revise the applicant's address.	1

Contents

1. General Information

1.1 General Description of EUT

Product Name	RTAP2U
Model No.	RTAP2U
Variant Model No.	-
FCC ID	2A4BV-RTAP2U
Operation Frequency	IEEE 802.11b/g : 2412 MHz ~ 2462 MHz
Number of Channel	11
Antenna Specification	FlexPIFA Antenna
Antenna Gain	2.5 dBi
Power supply	5 V (Internal chargeable Li-ion Battery 3.7 V)

1.2 Number of Channel and Frequency

Operation Frequency each of channel	
Channel	**Frequency [MHz]**
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

Note:

The test was performed at low, middle and high channel and the selected channel as shown in the chart below:

Channel	Frequency [MHz]
Lowest channel	2422
Middle channel	2437
Highest channel	2462

1.3 Test Condition

	Normal voltage
DC Power	5.0

1.4 Test Data Rate & Target Value

Mode	Rate	Target Value		
	(Mbps)	Lowest Channel	Middle Channel	Highest Channel
802.11b	1	6000	6000	6000
802.11g	6	6000	6000	6000

* Note: This chart shows the test program setting power value

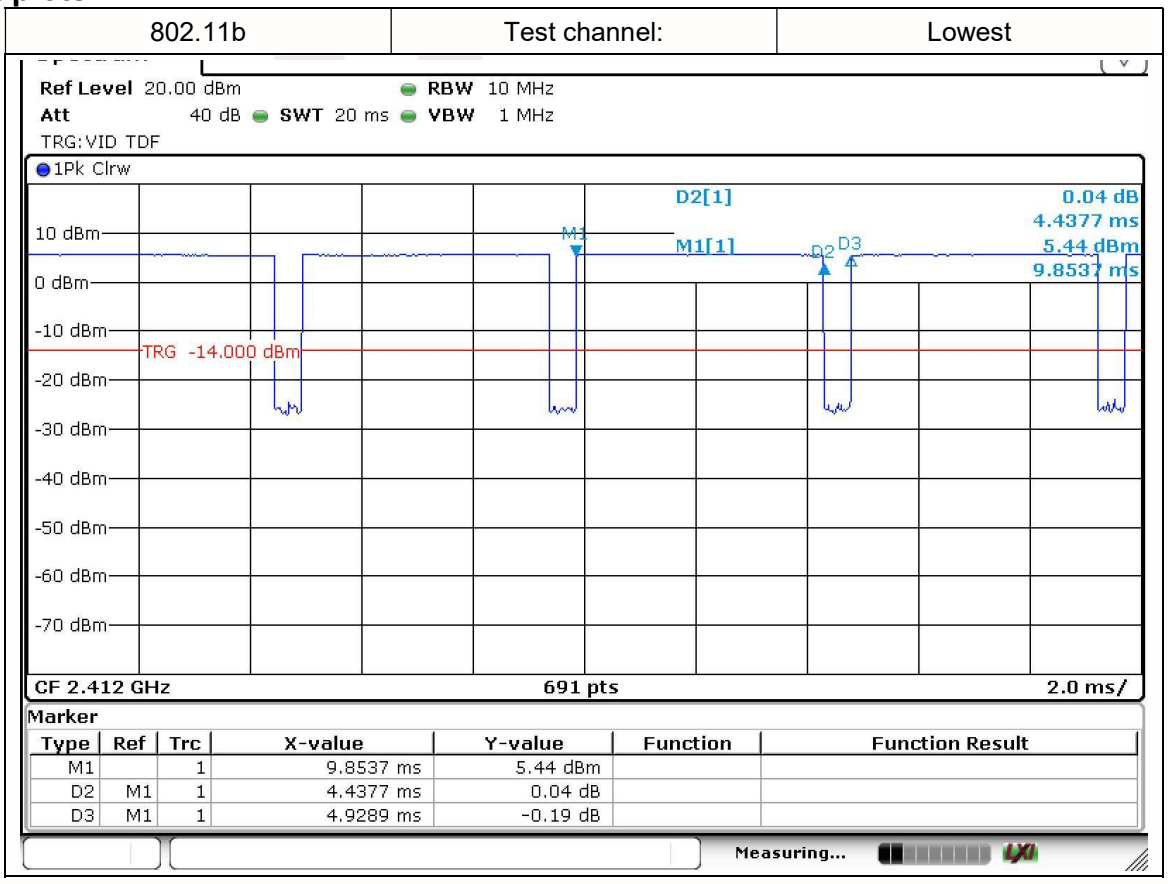
1.5 Duty Cycle

Mode	Ton (ms)	Ton+off (ms)	Duty Cycle[1)] (%)	Duty Factor[2)] (dB)
802.11b	4.438	4.929	90.04	0.46
802.11g	0.725	1.239	58.51	2.33

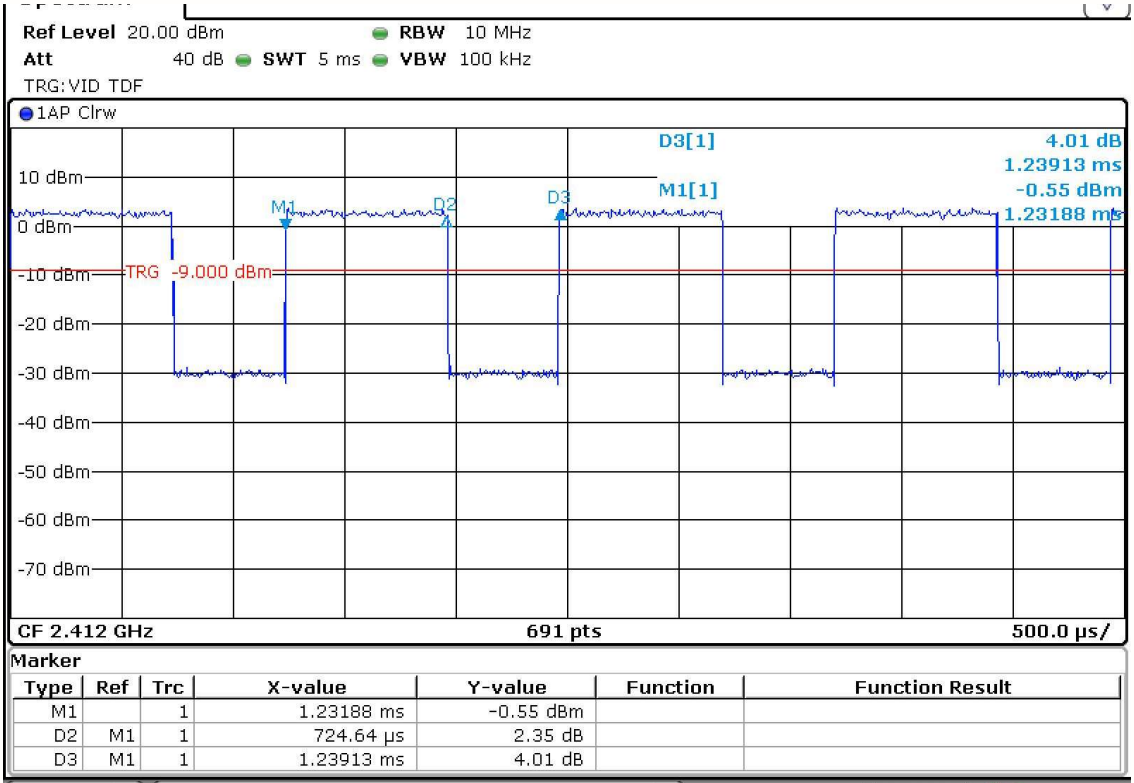
Note[1)] : Duty Cycle = (Ton/Ton+off)*100
Note[2)] : Duty Factor = 10*log(1/Duty cycle)

Test plots

802.11b	Test channel:	Lowest



802.11g	Test channel:	Lowest



1.6 Test Performed

RRA Designation No.: KR0157

KOLAS Accreditation No. : KT511

Laboratory		NTREE Co., Ltd.
1st laboratory Address	:	30, Pajangcheon-ro 44beon-gil, Jangan-gu, Suwon-si, Gyeonggi-do, 16204, KOREA
Telephone	:	+82-31-893-1000
Facsimile	:	+82-31-893-0111
2nd laboratory Address	:	228-60, Saneop-ro 155beon-gil, Gwonseon-gu, Suwon-si, Gyeionggi-do, 16648, KOREA
Telephone	:	+82-31-893-0999
Facsimile	:	+82-31-297-0444

SITE MAP

1st laboratory

2nd laboratory

* The test was performed at 2nd laboratory.

1.7 Test Instruments list

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date (mm-dd-yy)
1	Signal Analyzer	ROHDE & SCHWARZ	FSVA40	101610	05-12-22
2	DC Power Supply	AGILENT	6632B	MY43004016	06-30-22
3	DC Power Supply	TOYOTECH	DP30-05CF	17050049	07-15-22
4	Signal Generator	ROHDE & SCHWARZ	SMB100A	177568	03-11-22
5	Power Sensor	ROHDE & SCHWARZ	NRP-Z85	101554	11-02-22
6	Tri-Log Antenna	ROHDE & SCHWARZ	VULB9168	9168-721	03-24-22
7	LOOP ANTENNA	ROHDE & SCHWARZ	FMZB1519	1519-051	03-27-22
8	EMI Test Receiver	ROHDE & SCHWARZ	ESR7	101302	11-03-22
9	Attenuator	AEROFLEX	40AH2W-10	203129	03-12-22
10	Horn Antenna	Schwarzbeck	BBHA 9120D	1244	03-16-22
11	Horn Antenna	Schwarzbeck	BBHA 9170	573	03-18-22
12	Amplifier	TESTEK	TK-PA1840H	140003	03-12-22
13	Amplifier	TESTEK	TK-PA18H	160006-L	03-12-22
14	Amplifier	TESTEK	TK-PA6S	120018	11-02-22
15	Band Reject Filter	CHENGDU MICROWAVE	WT-A1205-R12	WT160105001	03-12-22
16	EMI Test Receiver	ROHDE & SCHWARZ	ESR3	102019	11-01-22
17	Two-Line V-Network(MAIN)	ROHDE & SCHWARZ	ENV216	102177	03-11-22

1.8 Summary of tests

FCC Part	Parameter	Limit	Test Result
15.247 (b)(3)	Maximum Peak Output Power	<30 dBm	Pass
15.247 (a)(2)	6 dB bandwidth	>500 kHz	Pass
2.1051, 15.247 (d)	Band Edge & Conducted Spurious Emission	-20 dBc	Pass
15.247 (e)	Power Spectral Density (PSD)	<8 dBm	Pass
15.247(d), 15.205, 15.209	Radiated Spurious Emission & Restricted Band Edge	< 54 dBuV/m(Av)	Pass
15.207(a)	AC Power Line Conducted Emission	15.207(a)	Pass
15.203	Antenna Requirement	15.203	Pass

1.9 Measurement uncertainty

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR100028-1 [2] and shall correspond to an expansion factor (coverage factor) *k*=1.96 or *k*=2 (which provide confidence levels of respectively 95% and 95.5% in the case where the distributions characterizing the actual measurement uncertainties are normal.

Parameter	Uncertainty
Transmitter output power (Conducted)	± 1.3 dB
AC Conducted emission	± 2.0 dB
Radiated spurious emission (Below 1 GHz)	± 4.8 dB
Radiated spurious emission (Above 1 GHz)	± 5.0 dB

2. Test results

2.1 Maximum Peak Output Power

2.1.1 Limit

FCC

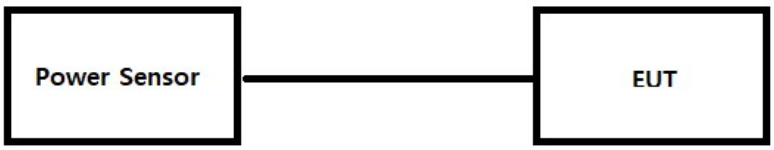
The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to ∮15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band. Employing at least 75 non-overlapping hopping channels: 1Watt.
2. According to ∮15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph(c) of this section, is transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs(b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

IC

According to RSS-247 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

2.1.2 Test configration



2.1.3 Test procedure

1. PKPM1 Peak power meter method of KDB558074 D01v05r02
   The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.
2. Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074 D01v05r02 The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Note: The measure-and-sum technique is used for test mode with multiple transmitting.

2.1.4 Test Result

Measurement Data

Test mode	Channel	Conducted output power	
		(dBm)	(W)
802.11b	Lowest	8.60	0.007
	Middle	8.55	0.007
	Highest	8.53	0.007
802.11g	Lowest	15.26	0.034
	Middle	15.08	0.032
	Highest	15.64	0.037
Limit (dBm)		30	
Limit (W)		1	
Result		Pass	

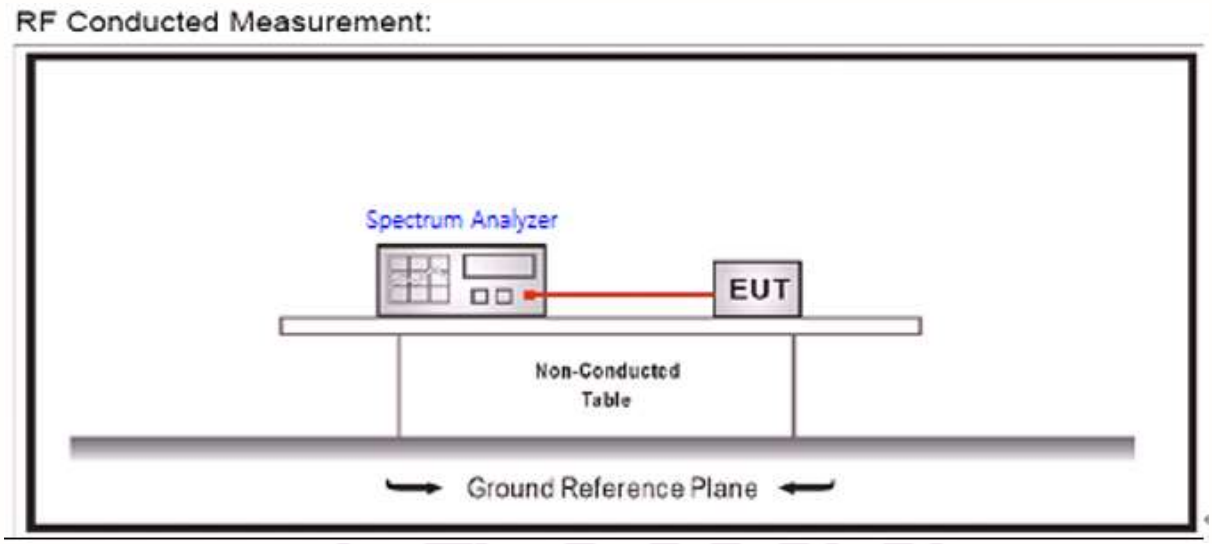
Note 1: Conducted output power (dBm) = Attenuator loss + Cable loss + Duty cycle factor

2.2 6 dB Bandwidth

2.2.1 Limit

According to 15.247(a)(2) and RSS-247 5.2(a), The minimum 6 dB bandwidth shall be 500 kHz.

2.2.2 Test Configuration



2.2.3 Test Procedure

Reference to section 11.8 in ANSI C63.10(2020): The transmitter output is connected to a spectrum analyzer with the RBW set to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

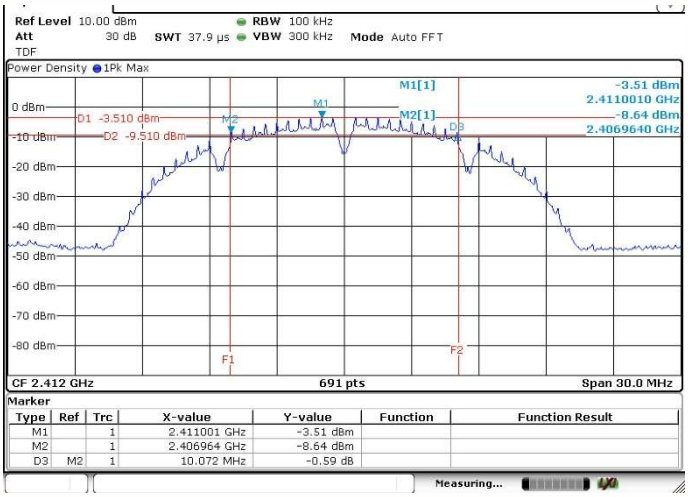
2.2.4 Test Result

Measurement Data

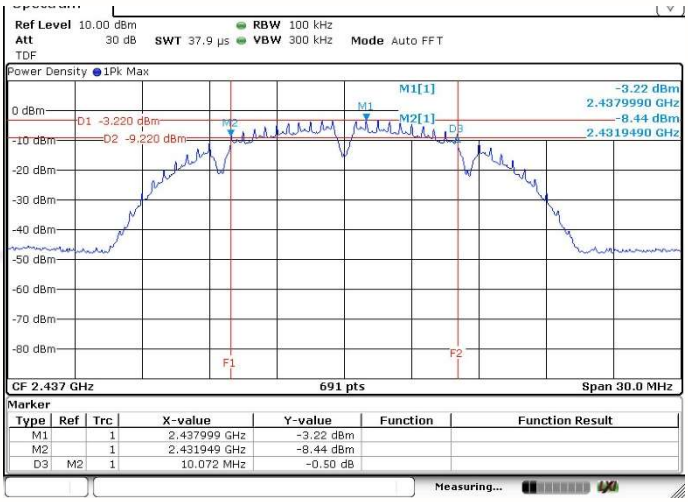
Test mode	Channel	6 dB bandwidth (MHz)	Limit (kHz)
802.11b	Lowest	10.072	≥ 500
	Middle	10.072	
	Highest	10.072	
802.11g	Lowest	15.029	
	Middle	15.224	
	Highest	15.051	
Test Result	Pass		

6 dB bandwidth test plot as follows:

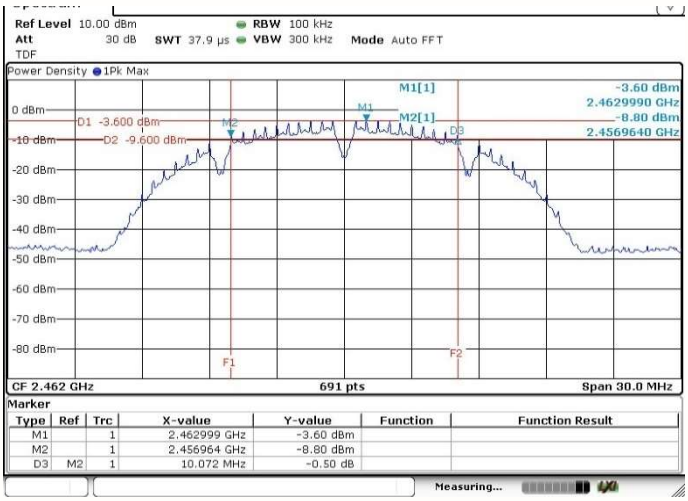
802.11b	Test channel:	Lowest



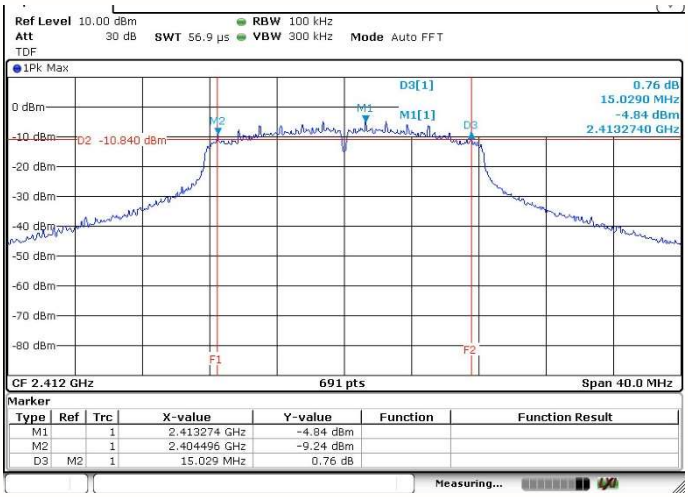
802.11b	Test channel:	Middle



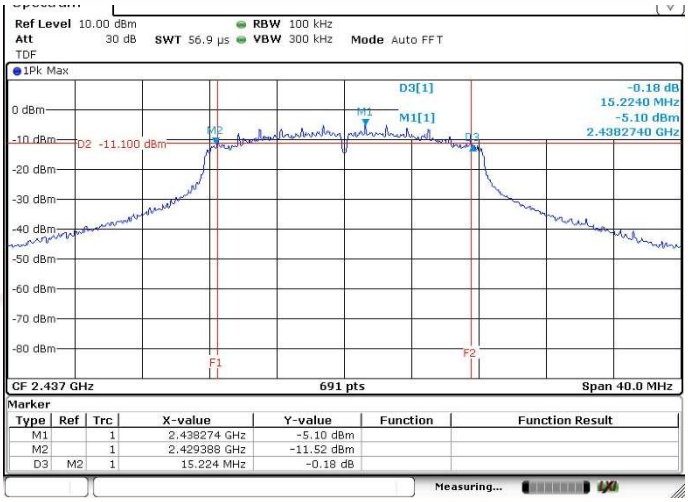
802.11b	Test channel:	Highest



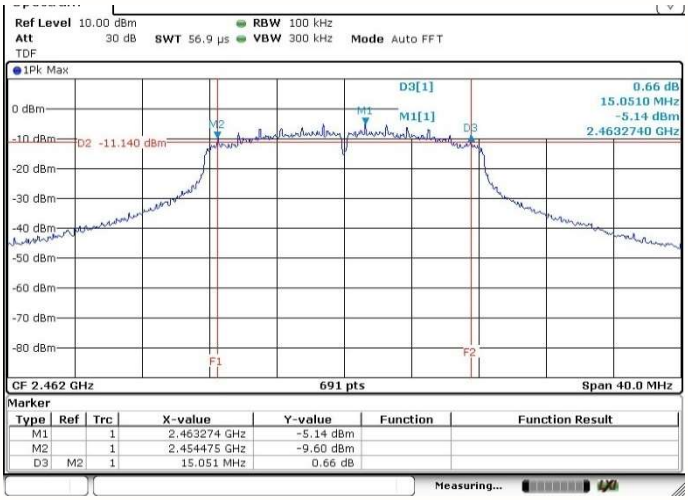
802.11g	Test channel:	Lowest



802.11g	Test channel:	Middle



802.11g	Test channel:	Highest

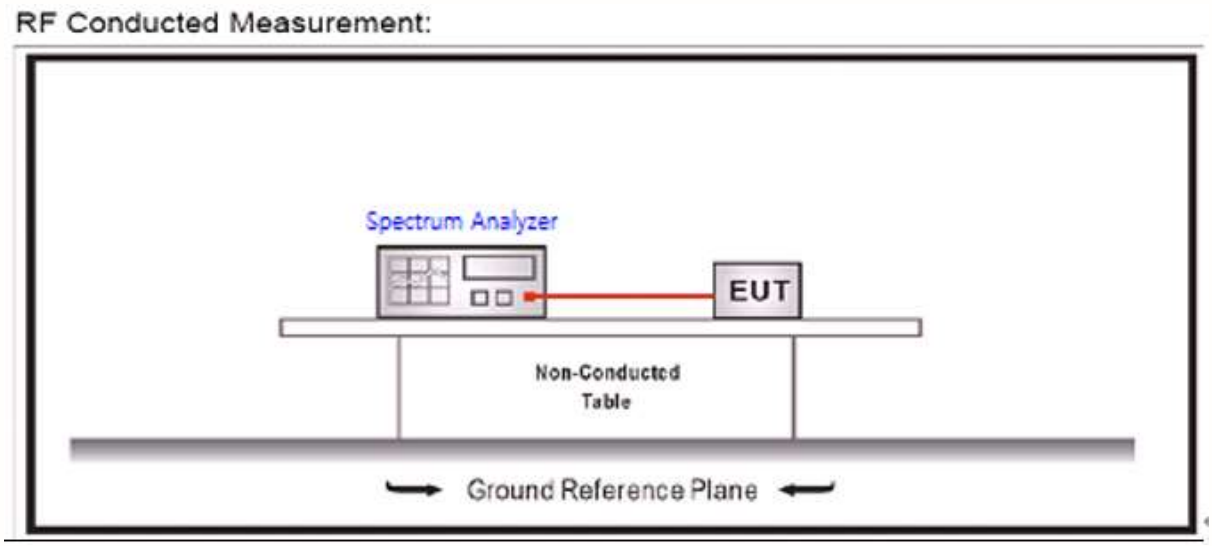


2.3 Power Spectral Density (PSD)

2.3.1 Limit

According to 15.247(e) and RSS-247 5.2(b), The transmitter 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. This power spectral density shall be determined in accordance with the provisions of section 5.4(d),(i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

2.3.2 Test Configuration



2.3.3 Test Procedure

Power Spectral Density was performed utilizing the ANSI C63.10 section 11.10.2 (Method PKPSD).

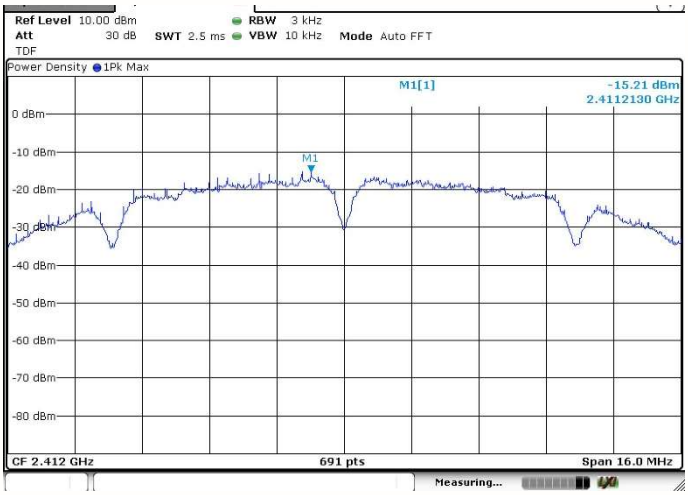
2.3.4 Test Result

Test mode	Channel	PSD (dBm)	Limit
802.11b	Lowest	-15.21	8 dBm/3 kHz
	Middle	-15.37	
	Highest	-15.38	
802.11g	Lowest	-17.93	
	Middle	-18.18	
	Highest	-18.04	
Test Result	**Pass**		

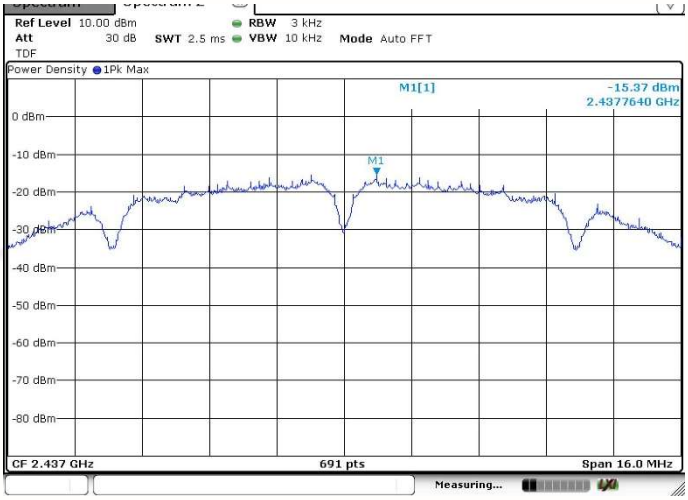
Note 1: The PSD results in plot is already included the actual values of cable loss and attenuator.

PSD test plot as follows:

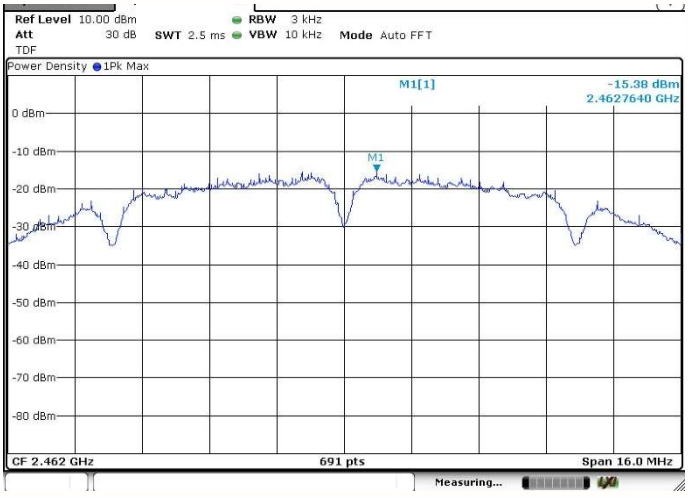
802.11b	Test Channel:	Lowest



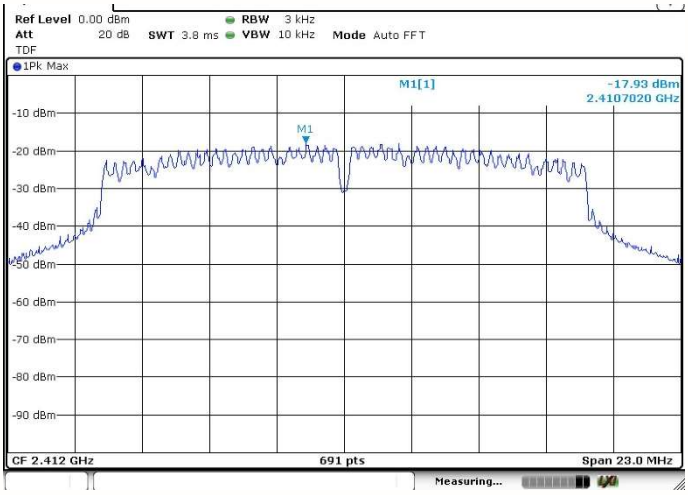
802.11b	Test Channel:	Middle



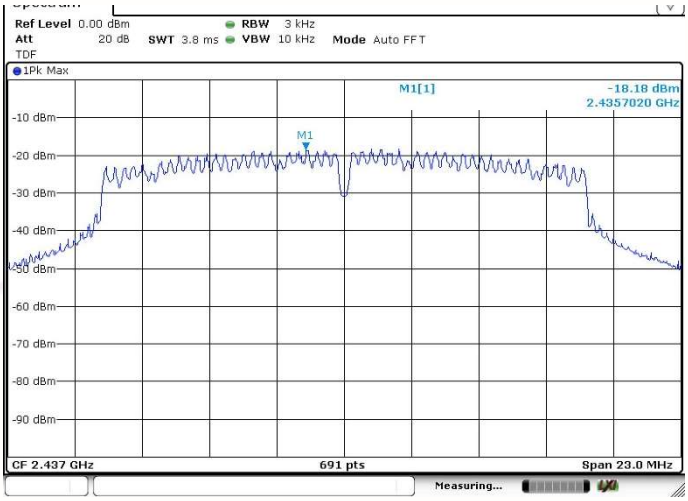
802.11b	Test Channel:	Highest



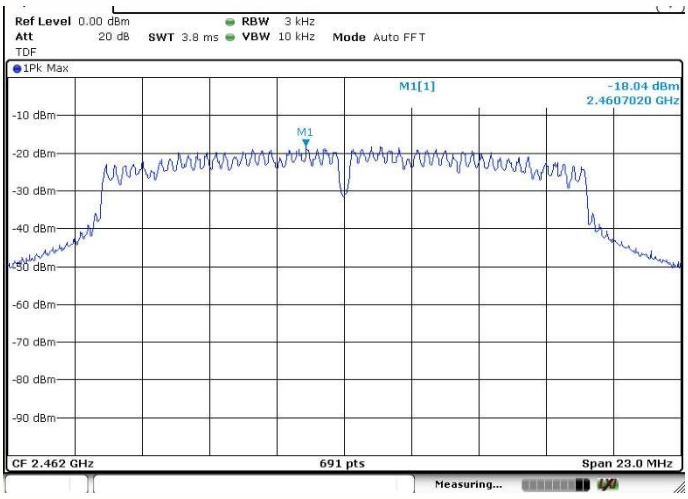
802.11g	Test Channel:	Lowest



802.11g	Test Channel:	Middle



802.11g	Test Channel:	Highest

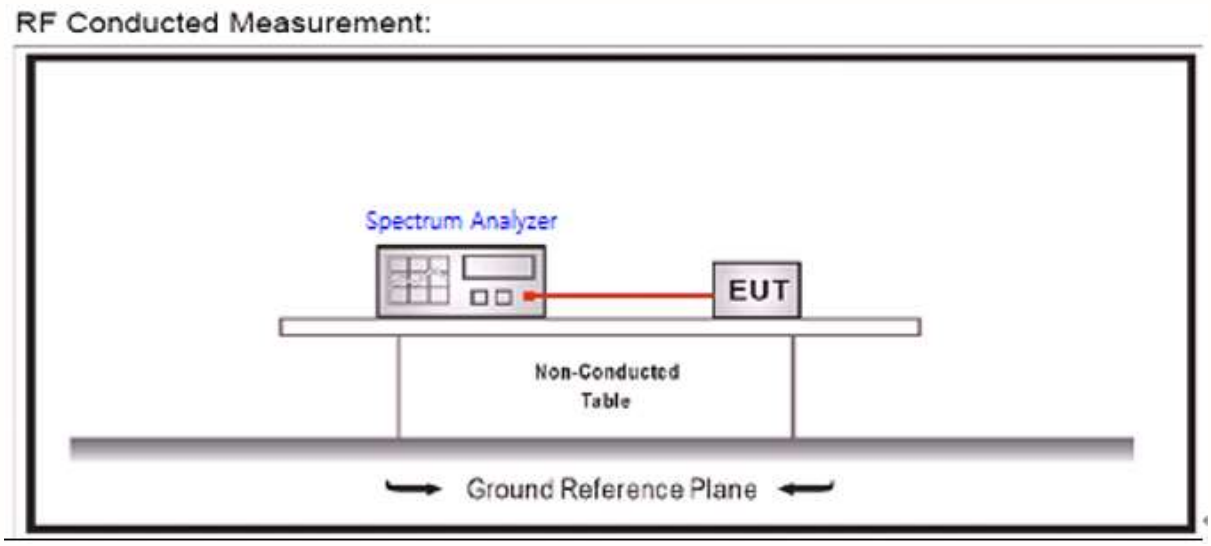


2.4 Conducted Spurious Emissions and Band Edge

2.4.1 Requirement

According to 15.247(d) and RSS-247 5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits base on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of thes section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 15.209(a) is not required.

2.4.2 Test configuration



2.4.3 Test Procedure

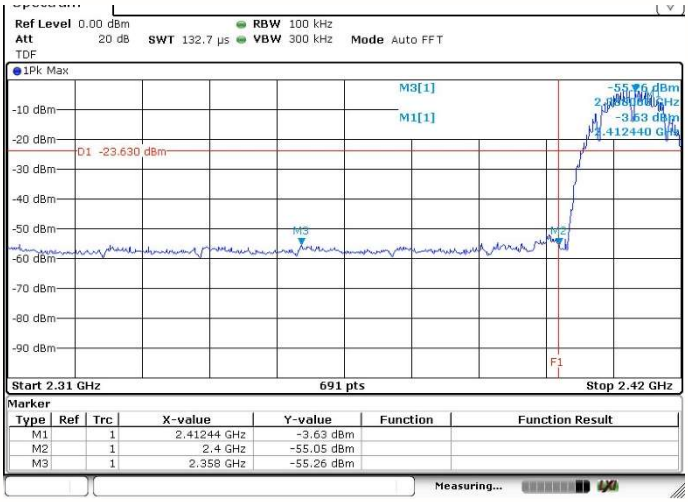
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

2.4.4 Test Result

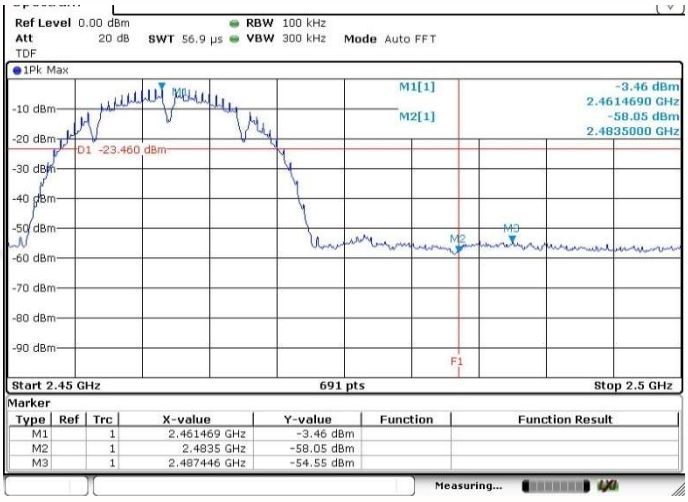
Test mode	Channel	Max. Out of band Emission (dBm)	Carrier level (dBm)	Calculated -20dBc limit (dBm)
802.11b	Lowest	-3.28	-44.84	-23.28
	Middle	-3.41	-45.25	-23.41
	Highest	-4.08	-45.42	-24.08
802.11g	Lowest	-5.03	-45.24	-25.03
	Middle	-6.38	-43.49	-26.38
	Highest	-5.80	-43.78	-25.80
Result		Pass		

Test plot as follows:

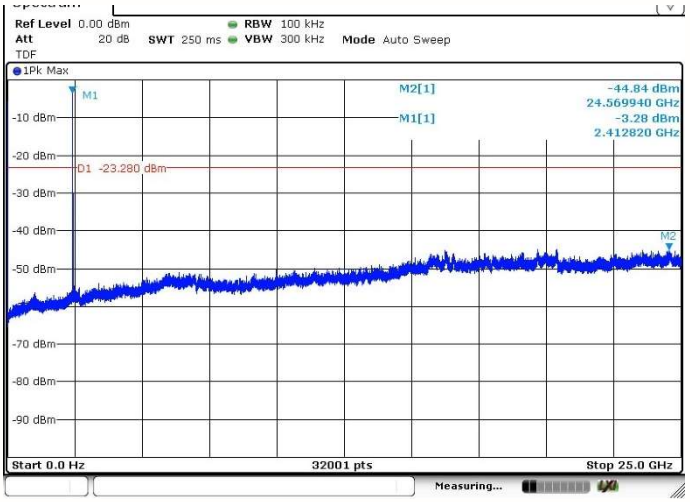
802.11b	Band Edge	Test Channel : Lowest



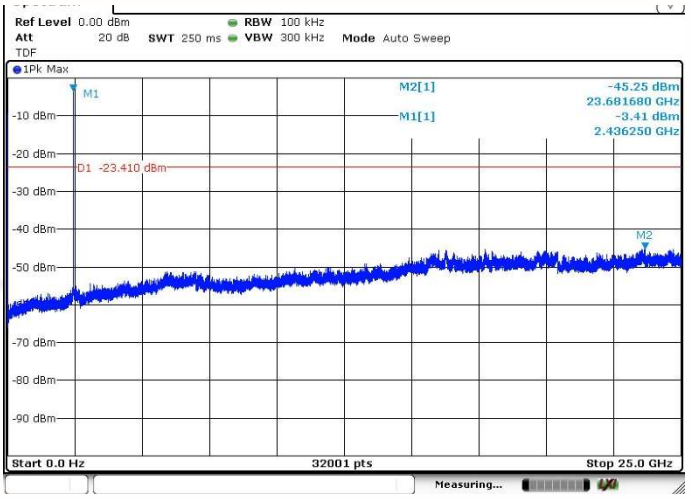
802.11b	Band Edge	Test Channel : Highest



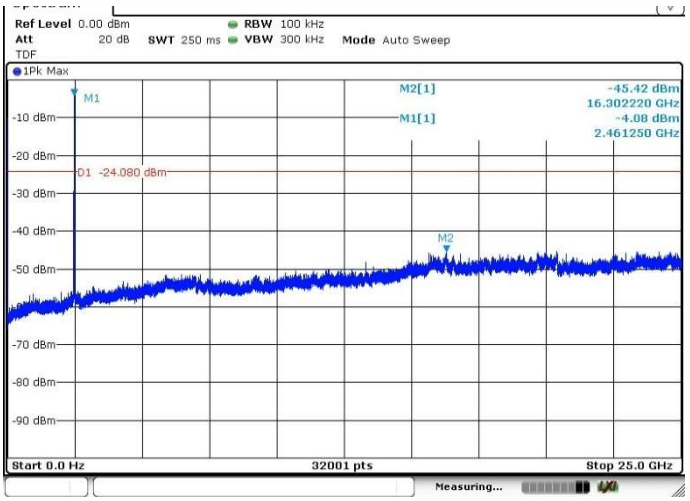
802.11b	Conducted Spurious	Test Channel : Lowest



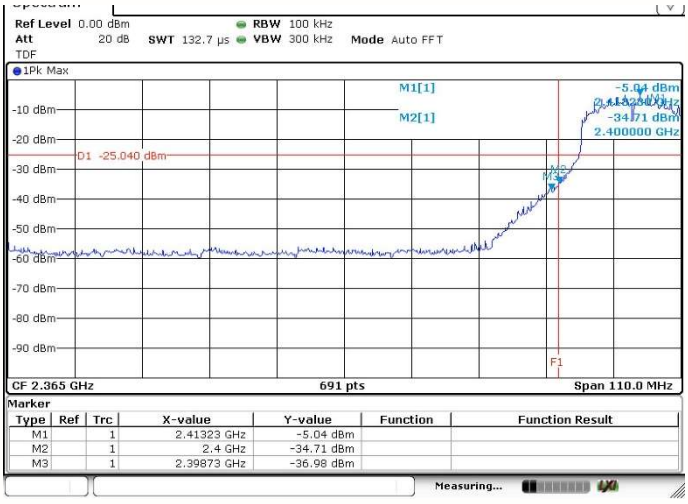
802.11b	Conducted Spurious	Test Channel : Middle



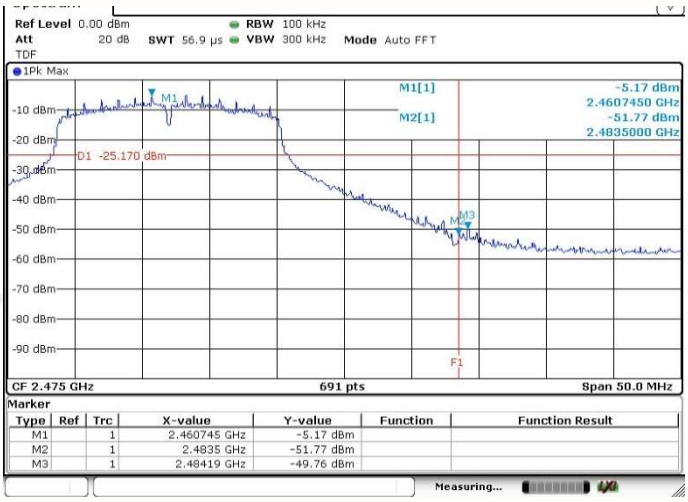
802.11b	Conducted Spurious	Test Channel : Highest



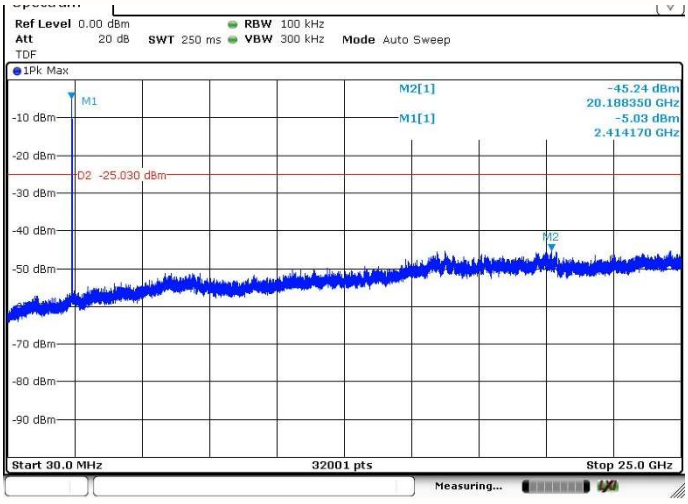
802.11g	Band Edge	Test Channel : Lowest



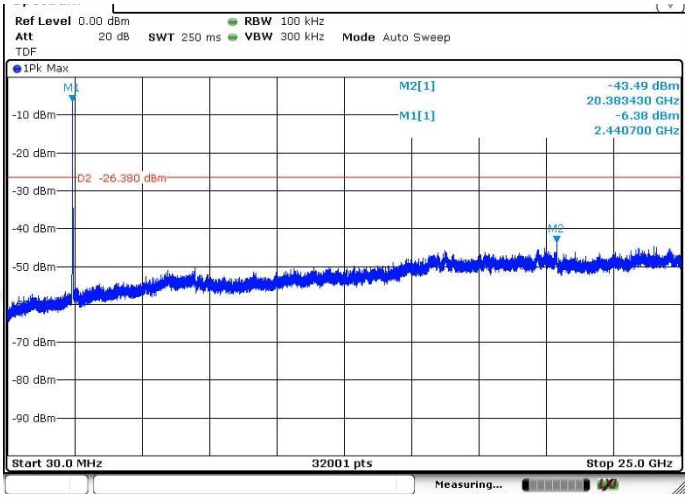
802.11g	Band Edge	Test Channel : Highest



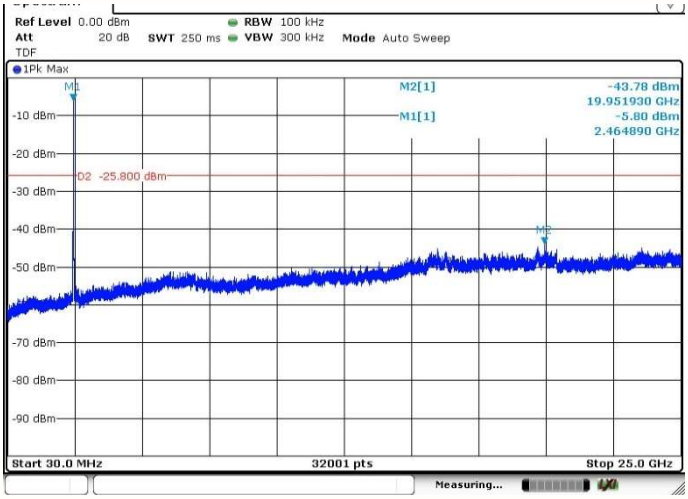
802.11g	Conducted Spurious	Test Channel : Lowest



802.11g	Conducted Spurious	Test Channel : Middle



802.11g	Conducted Spurious	Test Channel : Highest



2.5 Radiated Spurious Emission and Restricted Band Edge

The measurement was performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120 kHz.
Procedure of Test Preliminary measurements were made at 3 meter using bi-log antennas, and Spectrum Analyzer to determine the frequency producing the max. Emission in Semi-Anechoic Chamber.
Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using bi-log antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.
Final measurements were made with 3-meters test distance using bi-log antenna or horn antenna. The 3 m Full Chamber have been verified in regular for its normalized site attenuation. The test equipment was placed on a table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 m table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.
Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission. (The bandwidth below 1 GHz setting on the field strength meter is 120 kHz and above 1 GHz is 1 MHz)

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test):

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at distance of 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 m non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable.
   Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated.
   The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.

2.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (see Section 15.205(c))
All emission from a digital device, including any network of conductors and apparatus connected thereto shall not exceed the level of field strength specified below:

FCC Part 15 Subpart C paragraph 15.247(a) Limit

Fundamental Frequency (MHz)	Field Strength of Harmonics (3 m)		
	(mV/m)	(dBuV/m)	
2400 - 2483.5	500	54 (Avg.)	74 (Peak)

Note : 1. RF Field Strength (dBuV) = 20log RF Voltage(uV)
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBuV/m)
0.009-0.490	300	20log 2400/F (kHz) + 80
0.490-1.705	30	20log 24000/F (kHz) + 40
1.705-30	30	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note : 1. RF voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
4. This device used to install a within vehicular. The location of EUT measurements has the Y-plane(Stand).
5. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30 – 1000 MHz. As to 1 – 26.5 GHz, the final emission level got using PK and AV detector.
6. If measurement is made at 3m distance.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor Cable loss and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

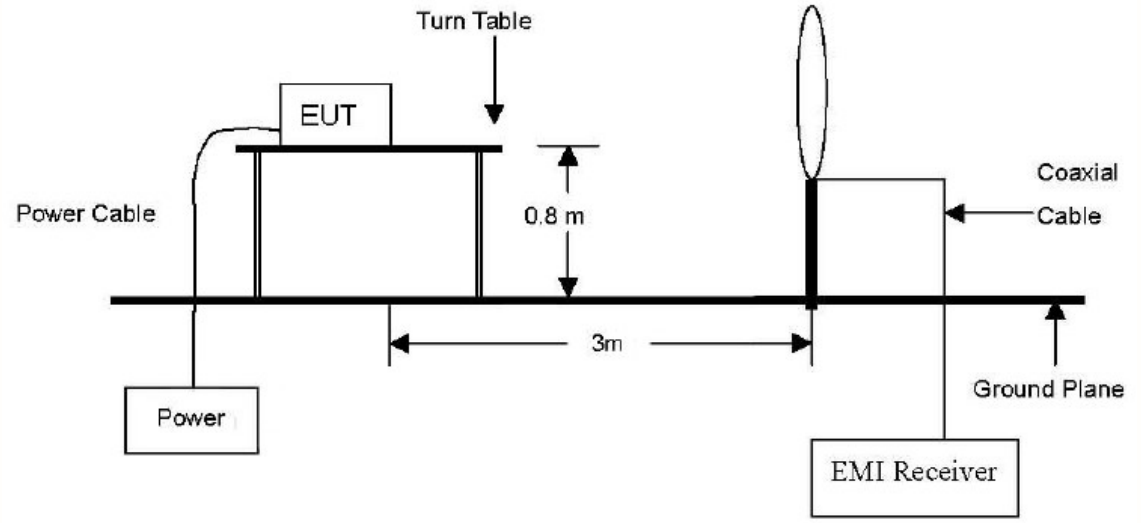
Peak = Reading + Corrected Factor

Where
Corr. Factor = Antenna Factor + Cable loss - Amplifier Gain (if any)

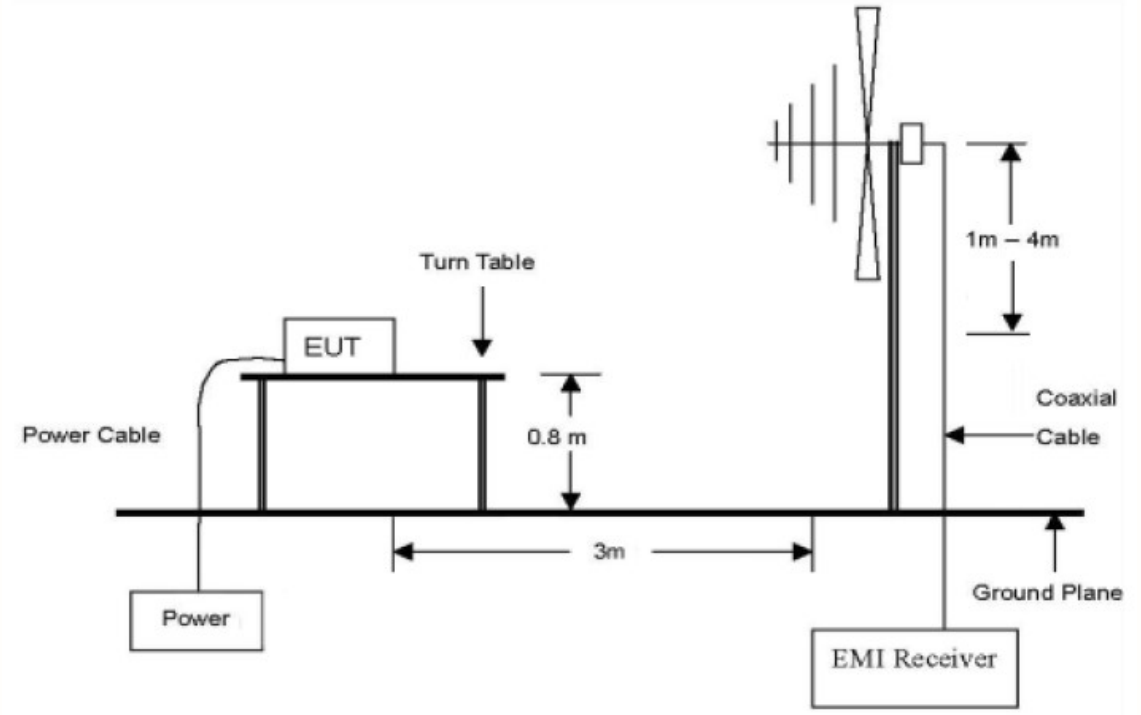
Note: Example of Field strength = 20log 2400/F + 80 = 129

2.5.2 Test Configuration

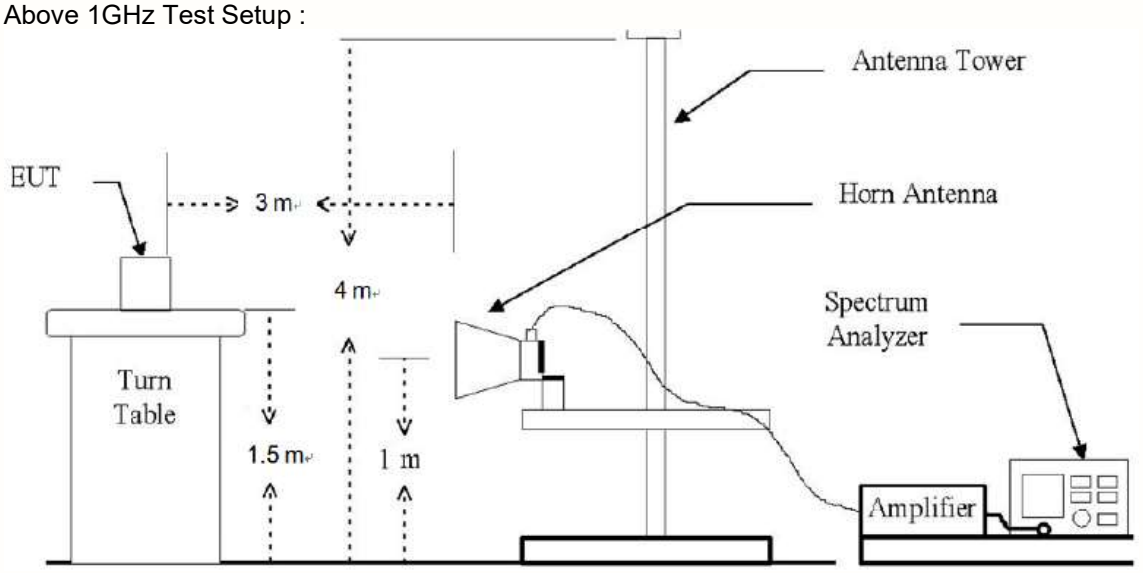
Below 30 MHz



Below 1 GHz test setup:



Above 1GHz Test Setup :



2.5.3 Test Procedure

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. (Restriced bandedge, Final detection of spurious harmonic emissions)
Duty cycle factor = 10 log (1/x). For this sample: DCF = 10log(1/0.62)=2.06 dB(Spectrum Analyzer round it up to 2.06 dB).
1/T minimum VBW = 1/Duty cycle. For this sample: minimum VBW = 1/0.38 = 0.01 kHz
Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.
The spectrum from 1 GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth.
The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission.
Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

2.5.4 Test Result (Restricted Band Edge Above 1 GHz)

The frequency spectrum above 1000 MHz was investigated. All reading values are peak and average values.

802.11b

Lowest Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
*2 310.00	29.21	P	V	27.89	3.60	-	60.70	74.00	13.30
*2 310.00	16.61	A	V	27.89	3.60	0.46	48.56	54.00	5.44
*2 399.95	30.67	P	V	28.02	3.66	-	62.35	74.00	11.65
*2 399.95	17.31	A	V	28.02	3.66	0.46	49.45	54.00	4.55
*2 400.00	28.28	P	V	27.60	3.66	-	59.54	74.00	14.46
*2 400.00	17.25	A	V	27.60	3.66	0.46	48.97	54.00	5.03

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

Middle Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

Highest Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
*2 483.50	26.16	P	V	27.70	3.74	-	57.60	74.00	16.40
*2 483.50	17.31	A	V	27.70	3.74	0.46	49.21	54.00	4.79
*2 487.04	29.64	P	V	27.72	3.75	-	61.11	74.00	12.89
*2 487.04	17.83	A	V	27.72	3.75	0.46	49.76	54.00	4.24
*2 500.00	25.89	P	V	27.60	3.76	-	57.25	74.00	16.75
*2 500.00	17.19	A	V	27.60	3.76	0.46	49.01	54.00	4.99

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

802.11g

Lowest Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
*2 310.00	25.87	P	V	27.89	3.60		57.36	74.00	16.64
*2 310.00	16.77	A	V	27.89	3.60	2.33	50.59	54.00	3.41
*2 367.67	29.42	P	V	27.88	3.64		60.94	74.00	13.06
*2 367.67	17.24	A	V	27.88	3.64	2.33	51.09	54.00	2.91
*2 400.00	29.15	P	V	27.60	3.66		60.41	74.00	13.59
*2 400.00	17.80	A	V	27.60	3.66	2.33	51.39	54.00	2.61

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

Middle Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

Highest Channel

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
*2 483.50	26.44	P	V	27.70	3.74		57.88	74.00	16.12
*2 483.50	17.68	A	V	27.70	3.74	2.33	51.45	54.00	2.55
*2 489.45	29.06	P	V	27.74	3.75		60.55	74.00	13.45
*2 489.45	17.43	A	V	27.74	3.75	2.33	51.25	54.00	2.75
*2 500.00	25.28	P	V	27.60	3.76		56.64	74.00	17.36
*2 500.00	17.77	A	V	27.60	3.76	2.33	51.46	54.00	2.54

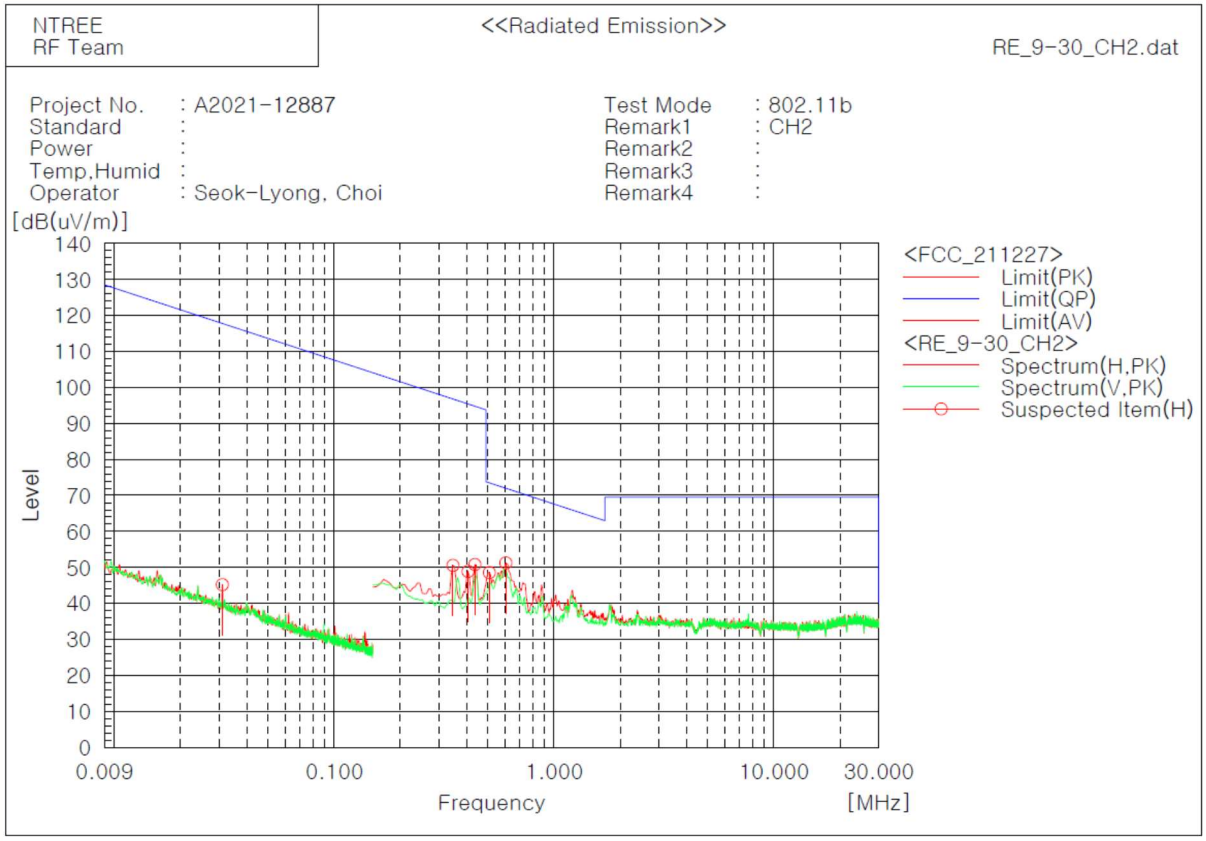
Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DCF (dB)	Actual (dBuv/m)	Limit (dBuv/m)	Margin (dB)
Above 1 000.00	Not detected								

Note)

1. P = Peak
2. A = Average
3. AF = Antenna Factor
4. CL = Cable Loss
5. DCF = Duty Cycle Factor
6. "*" means the restricted band.
7. Measuring frequencies from 1GHz to the 10th Harmonic of highest fundamental frequency.
8. According to §15.31(o), emissions level are not be reported lower than the limit by over 20dB.

2.5.5 Test Result (Spurious Emissions Above 9 kHz to Below 30 MHz)

802.11b



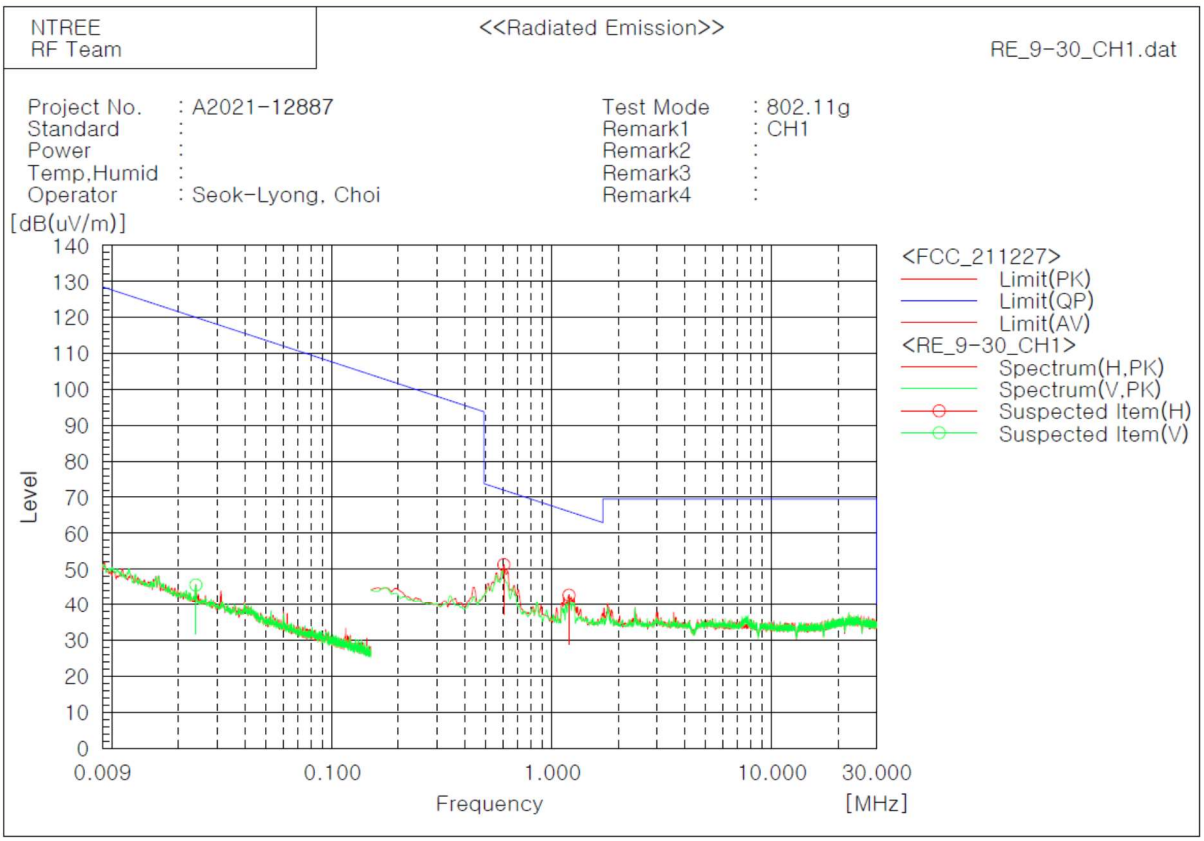
Spectrum Selection

--- Horizontal Polarization ---

No.	Frequency [MHz]	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Remark
1	0.031	26.0	19.2	45.2	117.8	72.6	
2	0.347	31.5	19.1	50.6	96.8	46.2	
3	0.407	29.7	19.2	48.9	95.4	46.5	
4	0.437	31.6	19.2	50.8	94.8	44.0	
5	0.508	29.4	19.2	48.6	73.5	24.9	
6	0.604	32.0	19.3	51.3	72.0	20.7	

Note: Worst case (Middle Channel (2 437 MHz))

802.11g



Spectrum Selection

--- Horizontal Polarization ---

No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	0.604	32.0	19.3	51.3	72.0	20.7	
2	1.195	23.3	19.5	42.8	66.1	23.3	

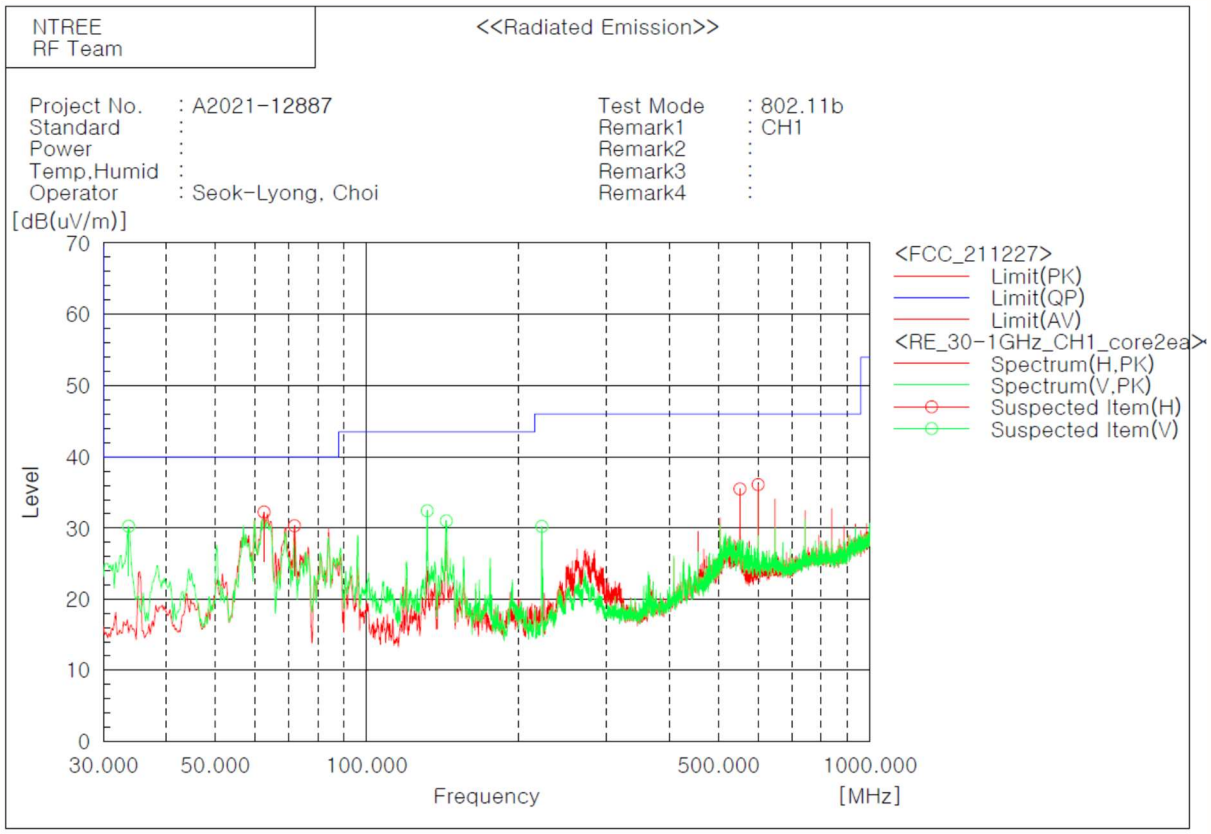
--- Vertical Polarization ---

No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	0.024	26.3	19.3	45.6	120.0	74.4	

Note: Worst case (Lowest Channel (2 412 MHz))

2.5.6 Test Result (Spurious Emissions Above 30 MHz to Below 1 GHz)

802.11b



Spectrum Selection

--- Horizontal Polarization ---

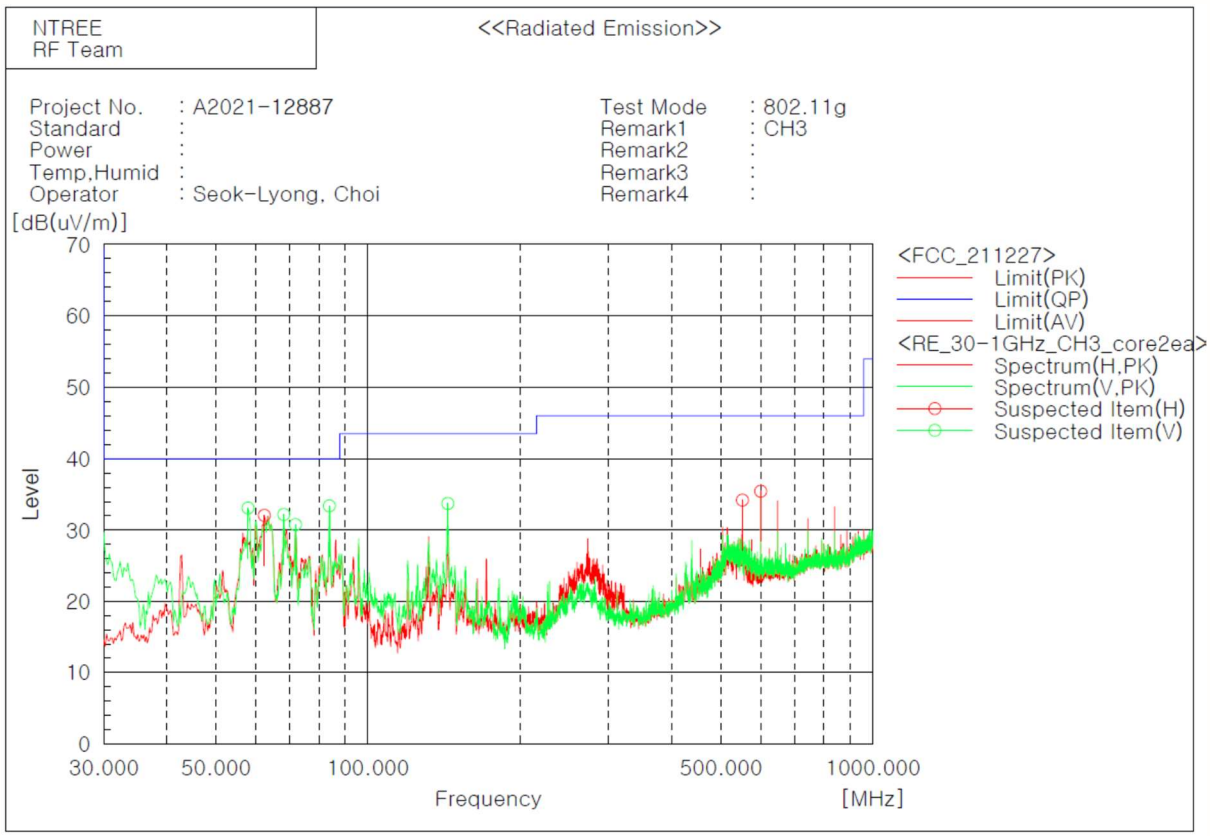
No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	62.592	62.4	-30.1	32.3	40.0	7.7	
2	71.904	61.8	-31.5	30.3	40.0	9.7	
3	552.054	56.2	-20.7	35.5	46.0	10.5	
4	599.972	55.3	-19.2	36.1	46.0	9.9	

--- Vertical Polarization ---

No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	33.686	61.8	-31.5	30.3	40.0	9.7	
2	132.044	62.0	-29.6	32.4	43.5	11.1	
3	144.072	59.5	-28.5	31.0	43.5	12.5	
4	223.030	61.4	-31.1	30.3	46.0	15.7	

Note: Worst case (Lowest Channel (2 412 MHz))

802.11g



Spectrum Selection

--- Horizontal Polarization ---

No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	62.398	62.2	-30.1	32.1	40.0	7.9	
2	552.054	54.9	-20.7	34.2	46.0	11.8	
3	599.972	54.6	-19.2	35.4	46.0	10.6	

--- Vertical Polarization ---

No.	Frequency	Reading	c.f	Result PK	Limit QP	Margin QP	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	
1	57.936	62.8	-29.7	33.1	40.0	6.9	
2	68.218	63.0	-30.8	32.2	40.0	7.8	
3	71.904	62.3	-31.5	30.8	40.0	9.2	
4	83.932	68.0	-34.6	33.4	40.0	6.6	
5	144.072	62.2	-28.5	33.7	43.5	9.8	

Note: Worst case (Highest Channel (2 462 MHz))

2.6 AC Power Line Conducted Emission

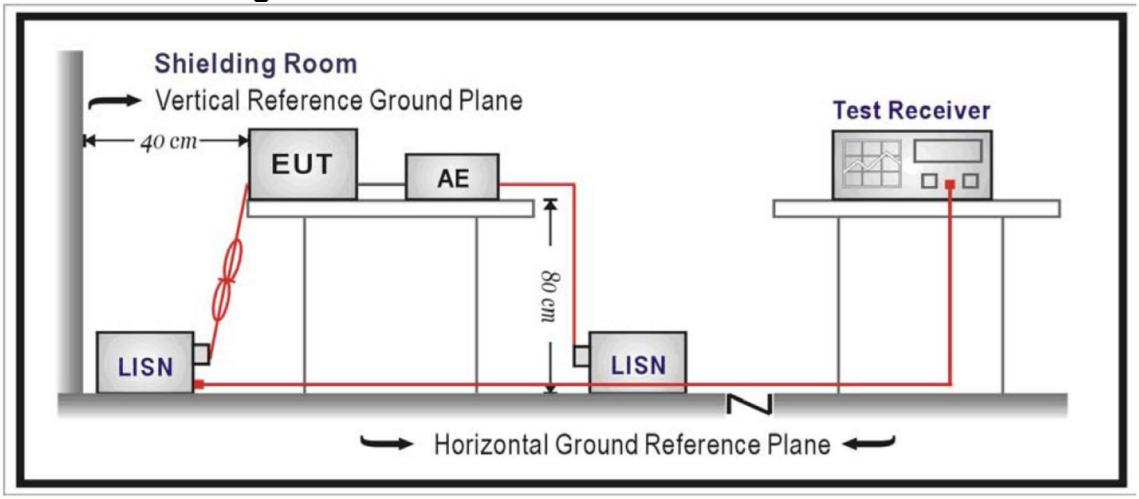
2.6.1 Limit

Test Specification: According to FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency (MHz)	Limit (dBuV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56 *	56 to 46 *
0.5 to 5	56	46
5 to 30	60	50

Note : * Decrease with the logarithm of the frequency

2.6.2 Test Configuration



2.6.3 Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50 uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)
Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed on conducted measurement.
Conducted emissions were invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9kHz.

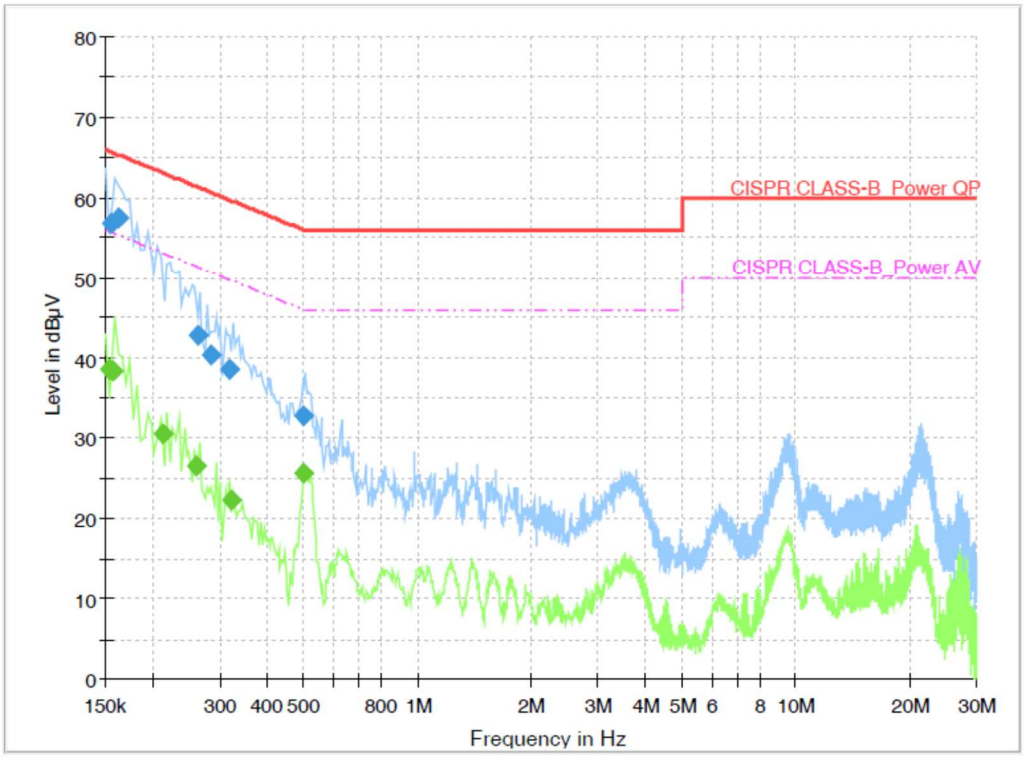
2.6.4 Test Result

Line : Hot

Test Report

Common Information

Test Description:	A2021-12887
Test Mode:	Operating Mode
Test Standard:	FCC PART 15
Environment Conditions:	AC 110 V 60 Hz, Temp. 22 / Humi. 48
Operator Name	Seok-Lyong, Choi
Comment:	-



Final_Result

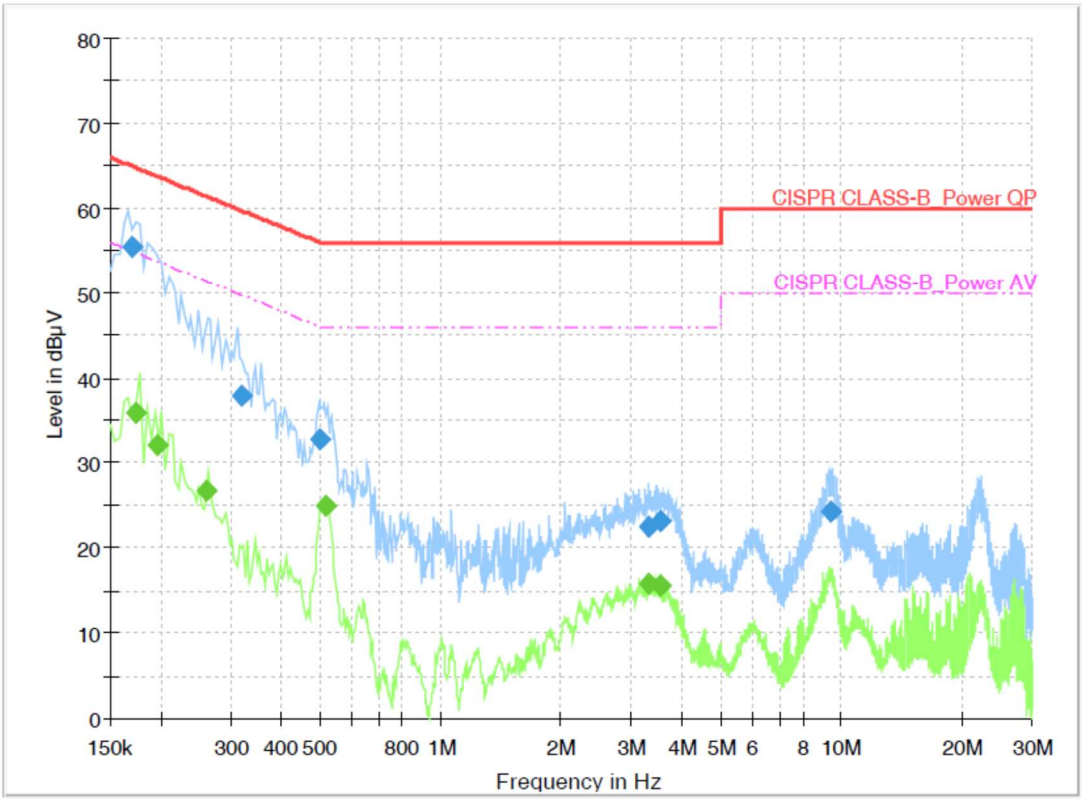
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	---	38.62	55.78	17.16	2000.0	9.000	L1	9.8
0.154500	56.83	---	65.75	8.92	2000.0	9.000	L1	9.8
0.157500	---	38.28	55.60	17.32	2000.0	9.000	L1	9.9
0.162500	57.48	---	65.34	7.86	2000.0	9.000	L1	9.9
0.212550	---	30.50	53.11	22.60	2000.0	9.000	L1	9.8
0.259350	---	26.55	51.45	24.90	2000.0	9.000	L1	9.7
0.263550	42.90	---	61.32	18.42	2000.0	9.000	L1	9.7
0.284950	40.28	---	60.67	20.39	2000.0	9.000	L1	9.7
0.317850	38.58	---	59.76	21.18	2000.0	9.000	L1	9.8
0.322050	---	22.19	49.65	27.46	2000.0	9.000	L1	9.8
0.497350	32.76	---	56.04	23.29	2000.0	9.000	L1	9.9
0.501450	---	25.63	46.00	20.37	2000.0	9.000	L1	9.9

Line : Neutral

Test Report

Common Information

Test Description:	A2021-12887
Test Mode:	Operating Mode
Test Standard:	FCC PART 15
Environment Conditions:	AC 110 V 60 Hz, Temp. 22 / Humi. 48
Operator Name	Seok-Lyong, Choi
Comment:	-



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.169500	55.48	---	64.99	9.50	2000.0	9.000	N	10.0
0.173500	---	35.79	54.79	19.00	2000.0	9.000	N	10.0
0.196950	---	32.11	53.74	21.63	2000.0	9.000	N	9.9
0.259450	---	26.67	51.45	24.78	2000.0	9.000	N	9.6
0.317750	37.91	---	59.77	21.86	2000.0	9.000	N	9.7
0.497550	32.67	---	56.04	23.37	2000.0	9.000	N	9.9
0.516950	---	25.05	46.00	20.95	2000.0	9.000	N	9.9
3.303350	---	15.76	46.00	30.24	2000.0	9.000	N	9.7
3.315550	22.49	---	56.00	33.51	2000.0	9.000	N	9.7
3.523650	---	15.69	46.00	30.31	2000.0	9.000	N	9.7
3.559050	23.25	---	56.00	32.75	2000.0	9.000	N	9.7
9.384650	24.36	---	60.00	35.64	2000.0	9.000	N	9.9

2.7 Antenna Requirement

2.7.1 Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

2.7.2 Applicable Construction

2.7.3 Test Result

Pass