



Spectrum Research & Testing Lab., Inc.

No.167, Ln. 780, Shan-Tong Rd., Ling 8, Shan-Tong Li, Chung-Li Dist., Taoyuan City 320, Taiwan (R.O.C.)

TEST REPORT

Reference No.: A18011901
Report No.: FCCA18011901
FCC ID : 2AO3WR-TEST
Page: 1 of 33
Date: Apr. 17, 2018

Product Name: Radius-Test
Model No.: Radius-Test
National Formosa University
Applicant: No.64, Wunhua Rd., Huwei Township, Yunlin County 632, Taiwan
Date of Receipt: Jan. 19, 2018
Finished date of Test: Apr. 16, 2018
Applicable Standards: 47 CFR Part 15, Subpart C, 15.247
ANSI C63.10: 2013
FCC publication KDB 558074 D01 DTS Meas Guidance v04
Measurement on Digital Transmission Systems (DTS)
Operating under Section 15.247 Apr 5, 2017

We, **Spectrum Research & Testing Laboratory Inc.**, hereby certify that one sample of the above was tested in our laboratory with positive results according to the above-mentioned standards. The records in the report are an accurate account of the results. Details of the results are given in the subsequent pages of this report.

Tested By : Richard Lin , Date: 4/17/2018
(Richard Lin)

Approved By : Johnson Ho , Date: 4/17/2018
(Johnson Ho, Director)



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Revisions History

Report No.	Issue Date	Revisions
FCCA18011901	Apr. 17, 2018	Initial issue



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1. DOCUMENT POLICY AND TEST STATEMENT

1.1 DOCUMENT POLICY

- The report shall not be reproduced except in full, without the written approval of SRT Lab, Inc.
- FCC Registered Test Site Number : TW1016

1.2 TEST STATEMENT

- The test results in the report apply only to the unit tested by SRT Lab.
- There was no deviation from the requirements of test standards during the test.
- DC power source from Battery DC 3.7V.

1.3 EUT MODIFICATION

- No modification in SRT Lab.



2. DESCRIPTION OF EUT AND TEST MODE

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Radius-Test
MODEL NO.	Radius-Test
POWER SUPPLY	DC power source from Battery 3.7V x 4
CABLE	NA
FREQUENCY BAND	2.4 GHz ~ 2.4835 GHz
CARRIER FREQUENCY	WLAN : 2.447 GHz
NUMBER OF CHANNEL	1 ch (CH09)
RATED RF OUTPUT POWER	802.11b : 18.40 dBm (69.18 mW)
MODULATION TYPE	IEEE802.11b DSSS(BPSK/QPSK/CCK)
MODE OF OPERATION	Duplex
ANTENNA TYPE	Dipole Antenna
ANTENNA GAIN	-3.0 dBi

NOTE:

For more detailed information, please refer to the EUT's specification or user's manual provided by manufacturer.

2.2 DESCRIPTION OF EUT INTERNAL DEVICE

DEVICE	BRAND / MAKER	MODEL #	FCC ID / DOC	REMARK
Li-ion Battery x 4	Panasonic	NCR18650B	DoC	DC 3.7V, 3350mAh

2.3 DESCRIPTION OF TEST MODE

There are test modes for each test configuration as below:

Mode	Channel	Frequency (MHz)
802.11b	CH09	2447

966 chamber Pre-test result summary:

axis	Modulation	Polarizatio	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
X	802.11b_CH09	H	798.57	31.12	46.0	-14.88
X	802.11b_CH09	V	169.52	31.24	44.0	-12.26
Y	802.11b_CH09	H	192.44	21.92	44.0	-21.58
Y	802.11b_CH09	V	208.91	25.26	44.0	-18.24
Z	802.11b_CH09	H	209.38	17.54	44.0	-25.96
Z	802.11b_CH09	V	744.31	29.64	46.0	-16.36

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NOTE:

1. Below 1 GHz were pre-tested in chamber and chosen the worst case for conducted and radiated emission test.
2. Above 1 GHz were tested individually.
3. The axis X,Y and Z we evaluate in chamber, the X axis is worst case.

2.4 EUT OPERATING CONDITION

Step1: Turn ON the Power Switch and Power ON.

Step2: There is the LED indicator light is on when the Power Switch is ON.

Step3: Open the Application Program "Laser R-test.exe" . The program must be installed first in a Personal Computer or Notebook.

Step4: The "Laser R-test.exe" will receive data from Laser Radius-Test.(Only 80.11b_CH09 frequency will continue to transmit)

2.5 DESCRIPTION OF SUPPORT UNIT

The EUT was configured by the requirement of ANSI C63.10:2013. All interface ports were connected to the appropriate support units via specific cables. The support units and cables are listed below.

NO	DEVICE	BRAND	MODEL #	FCC ID/DOC	CABLE
1	PC	ASUS	M32AA1	R31018	1.5m unshielded power cable.
2	LCD Monitor	DELL	U2412Mb	R43002	1.8m unshielded power cable. 1.5m shielded data cable.
3	Keyboard	ASUS	AW211	D41108	1.8m unshielded data cable.
4	Mouse	ASUS	MOBTUO	R41108	1.5m unshielded data cable.
5	Printer	HP	C8991A	R33001	1.5m unshielded power cable. 1.5m shielded data cable.
6	USB 2.0 HDD	TERASYS	F12-U	4912A002	1.5m unshielded power cable.
7	USB Storage	Kingston	N/A	DoC	8GB
8	USB cable	N/A	N/A	N/A	1.2m shielded data cable.

NOTE: For the actual test configuration, please refer to the photos of testing.

2.6 CHANNEL AND FREQUENCY TABLE

WLAN_802.11b	
Channel	Frequency
CH09	2447 MHz



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3. DESCRIPTION OF APPLIED STANDARDS

The EUT is a wireless product. According to the specifications provided by the applicant, it must comply with the requirements of the following standards:

47 CFR Part 15, Subpart C, 15.247

ANSI C63.10: 2013

FCC publication KDB 558074 D01 DTS Meas Guidance v04 Measurement on
Digital Transmission Systems (DTS) Operating under Section 15.247 Apr 5, 2017

All tests have been performed and recorded as the above standards.

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3.1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

STANDARD SECTION	TEST TYPE AND LIMIT RESULTS	RESULTS
15.203 15.247(c)(1)(i)	Antenna requirement	PASS
15.207	AC Power Line Conducted Emission	N/A
15.247(a)(2)	6 dB Bandwidth	PASS
15.247(b)	Maximum Peak Conducted Output Power	PASS
15.247(d)	Band Edge Measurement:	PASS
15.247(d)	Transmitter Radiated Emissions Limit: Table 15.209	PASS
15.247(e)	Power Density: Limit: 8dBm/3kHz	PASS



4. TECHNICAL CHARACTERISTICS TEST

4.1 RADIATED EMISSION TEST

4.1.1 LIMIT

FCC Part15, Subpart C Section 15.209 limit of radiated emission for frequency below1000MHz. The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

FREQUENCY (MHz)	FIELD STRENGTH (microvolts/meter)	DISTANCE (m)	FIELD STRENGTH (dB μ V/m)
0.009 - 0.490	2400/F(kHz)	300	67.6-20log(kHz)
0.490 - 1.705	24000/F(kHz)	30	87.6-20log(kHz)
1.705 - 30	30	30	30
30 - 88	100	3	40.0
88 - 216	150	3	43.5
216 - 960	200	3	46.0
Above 960	500	3	54.0

NOTE:

1. 30 dBuV (in 30m) = 70 dBuV (in 3m).
2. In the emission tables above , the tighter limit applies at the band edges.
3. Distance refers to the distance between measuring instrument, antenna, and the closest point of any part of the device or system.

FCC Part 15, Section15.35(b) limit of radiated emission for frequency above 1000 MHz

FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80.0	60.0	74.0	54.0

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4.1.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test:

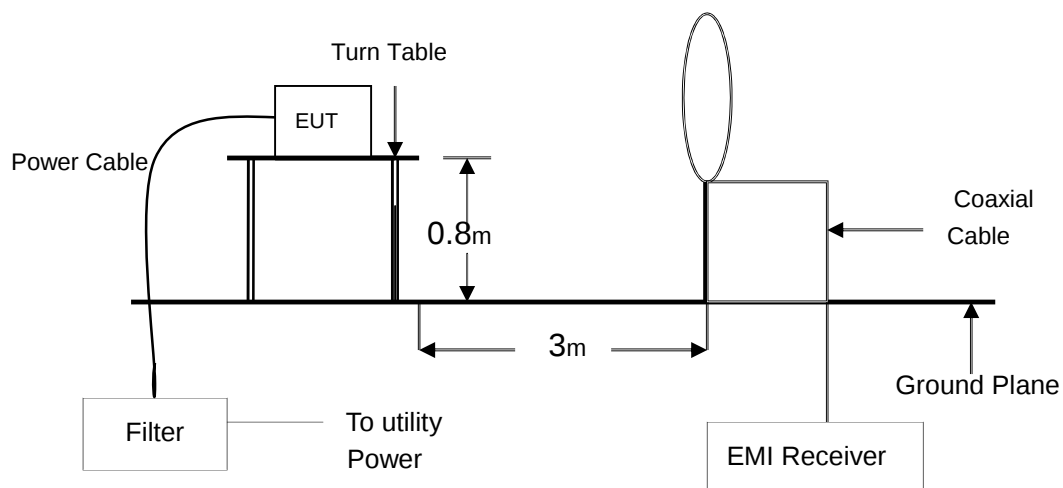
EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER	9 kHz ~ 2.75 GHz	ROHDE & SCHWARZ	ESCS30 / 100376	JAN. 01, 2019 ETC
SPECTRUM ANALYZER	9 kHz ~ 40GHz	ROHDE & SCHWARZ	FSP40 / 100093	JAN. 01, 2019 ETC
LOOP ANTENNA	9 kHz ~ 30 MHz	ROHDE & SCHWARZ	HFH2-Z2 / 860605/002	FEB. 24, 2019 ETC
BICONICAL ANTENNA	30 MHz ~ 200 MHz	EMCO	3110/ 11966C	MAY 14, 2018 ETC
LOG PERIODIC ANTENNA	200 MHz ~ 1 GHz	EMCO	3146/ 9002-2686	OCT. 27, 2018 ETC
HORN ANTENNA	1 GHz ~ 18 GHz	EMCO	3115/ 9602-4681	NOV. 24, 2018 ETC
HORN ANTENNA	18 ~ 40 GHZ	ETS-LINDGREN	3116 /00032255	DEC. 25, 2018 ETC
PRE-AMPLIFIER	0.1 MHz ~ 1.3 GHz	HP	8447D / 2944A06746	NOV. 14, 2018 ETC
PRE-AMPLIFIER	1 GHz ~ 26.5 GHz	AGILENT	8449B/ 3008A01995	DEC. 29, 2018 ETC
OPEN AREA TEST SITE	3 – 10 M MEASUREMENT	SRT	A02 / SRT002	MAR. 09, 2018 SRT
ANECHOIC CHAMBER	3 M MEASUREMENT	SRT	A01 / SRT001	SEP. 13, 2018 SRT
COAXIAL CABLE	30 M	TIMES	LMR-400 / #30M(L1TCAB014)	MAY 08, 2018 ETC
K-TYPE CABLE	UP TO 40 GHz 3 m	HUBER+SUHNE R	SF102-46/2*11SK 252 /MY2611/2	FEB. 23, 2018 ETC
K-TYPE CABLE	UP TO 40 GHz, 1 m	HUBER+SUHNE R	SF102/2*11SK252 /MY3331/2	SEP. 28, 2018 ETC
FILTER	2 LINE, 30 A	FIL.COIL	FC-943/ 869	NCR
THERMO-HYGR O	15 – 40 °C, 0- 100% RH	TOP	20-A / 7685	SEP. 17, 2018 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

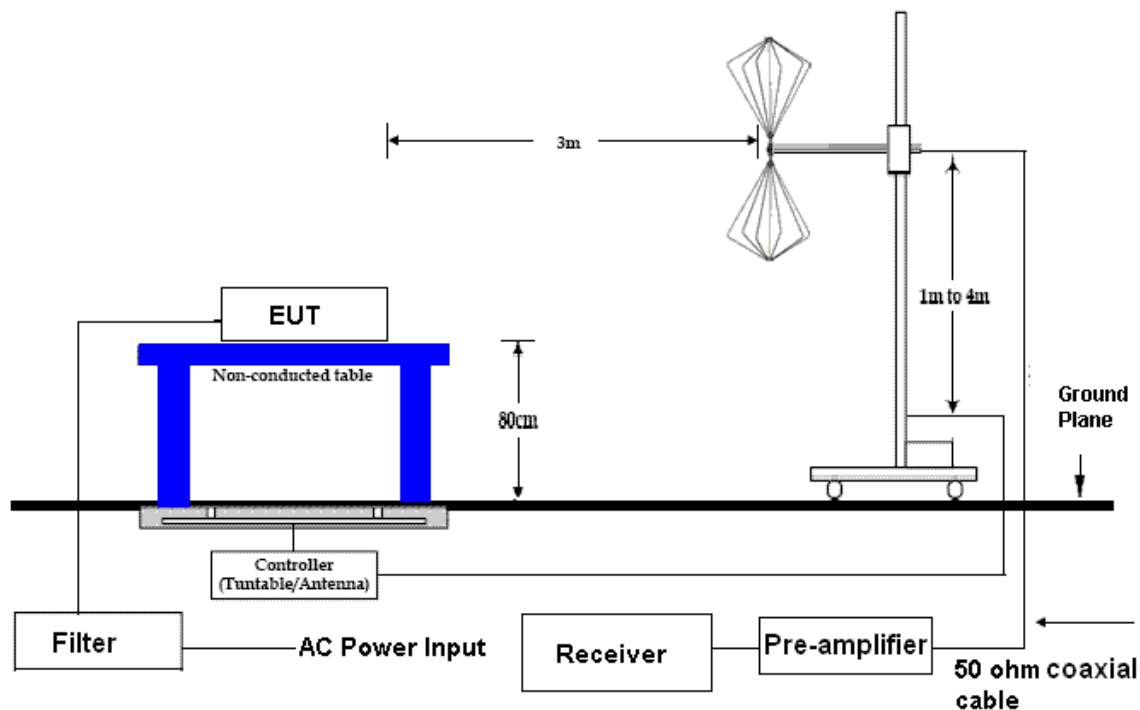


4.1.3 TEST SET-UP

9KHz ~ 30MHz



30 MHz ~ 1 GHz





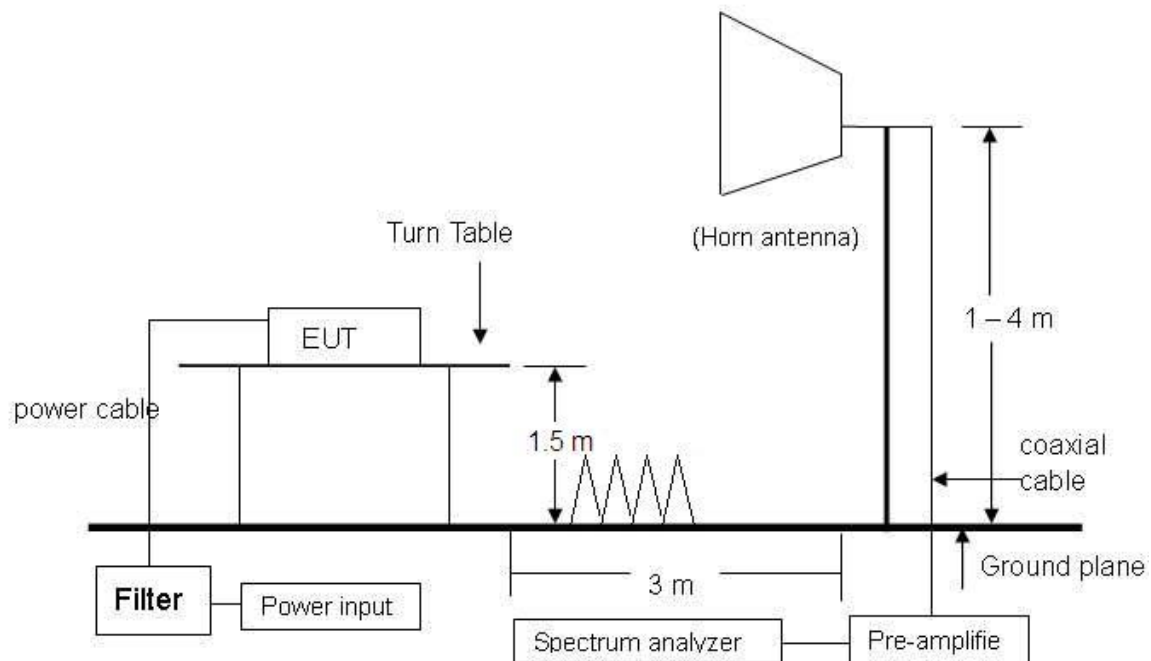
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Above 1 GHz



NOTE: The EUT system was put on a wooden table with 1.5m heights above a ground plane.
For the actual test configuration, please refer to the photos of testing.

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4.1.4 TEST PROCEDURE

The EUT was tested according to the requirement of ANSI C63.10:2013 and CISPR 22:2003. When the frequency spectrum measured started from 9 kHz to 30 MHz, then use antenna is a loop antenna. When the frequency spectrum measured started from 30 MHz to 1 GHz, then use antenna is a BICONICAL ANTENNA & LOG PERIODIC ANTENNA. The measurements were made at an open area test site with 3 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz to 1 GHz, all readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak or average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency. First, find the margin or higher points at least 6 points by software, then use manual to find the maximum data. The procedure is referred on the test procedure of SRT LAB.

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4.1.5 TEST RESULT**9KHz ~ 30MHz :**

Temperature:	20 °C	Humidity:	67 %RH
Frequency Range:	9 kHz – 30 MHz	Measured Distance:	3 m
Receiver Detector:	AV.	Tested Mode:	802.11b_CH09
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Frequency (MHz)	Cable Loss (dB)	Ant. Fac. (dB/m)	Reading (dBμV)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5.74	1.09	20.46	4.51	26.06	70.00	-43.94
8.33	1.18	20.67	4.93	26.78	70.00	-43.22
10.69	1.26	20.89	5.34	27.49	70.00	-42.51
13.61	1.36	21.27	4.82	27.44	70.00	-42.56
17.27	1.46	21.74	5.29	28.49	70.00	-41.51
23.85	1.59	22.25	5.04	28.88	70.00	-41.12

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Temperature:	20 °C	Humidity:	67 %RH
Frequency Range:	30 M – 1 GHz	Tested Mode:	802.11b_CH09
Detector Type:	Quasi-peak	IF Bandwidth:	120 kHz
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Antenna Polarization : Horizontal

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-Amp (dB)	Reading Data (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	AZ(°)	EL(m)
69.31	2.25	6.90	28.20	32.46	13.41	40	-26.59	88	3.51
192.44	3.01	15.92	27.63	33.39	24.69	44	-18.81	135	3.39
209.38	3.13	12.04	27.56	34.62	22.23	44	-21.27	302	3.30
441.69	4.67	17.58	28.16	30.35	24.44	46	-21.56	245	2.19
716.36	6.20	21.86	28.34	29.74	29.46	46	-16.54	219	1.84
798.57	6.66	22.30	28.10	30.11	30.98	46	-15.02	97	1.44

Antenna Polarization : Vertical

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-Amp (dB)	Reading Data (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	AZ(°)	EL(m)
54.62	2.21	10.44	28.25	32.68	17.09	40	-22.91	60	1.13
99.34	2.41	10.14	28.10	36.93	21.37	44	-22.13	152	1.35
169.41	2.87	15.84	27.75	40.01	30.97	44	-12.53	281	1.49
183.62	2.96	16.45	27.68	33.54	25.27	44	-18.23	213	1.66
493.91	4.95	18.58	28.43	34.69	29.79	46	-16.21	74	2.41
717.65	6.21	21.87	28.34	30.01	29.74	46	-16.26	126	3.34

NOTE :

1. Measurement uncertainty is 4.20 dB.
2. "*": Measurement does not apply for this frequency.
3. Emission Level = Reading Value + Ant. Factor + Cable Loss – Pre-Amplifier.
4. The field strength of other emission frequencies were very low against the limit.

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Temperature:	22 °C	Humidity:	65 %RH
Frequency Range:	1 GHz – 25 GHz	Tested Mode:	802.11b_CH09
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Antenna Polarization : Horizontal

Frequency (MHz)	Correct Factor (dB)	Ant. Factor (dB/m)	Reading Data (dBμV)		Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)		AZ (°)	EL (m)
			PK.	AV.	PK.	AV.	PK.	AV.	PK.	AV.		
1469.16	-32.45	26.11	47.01	35.52	40.67	29.18	74	54	-33.33	-24.82	219	2.42
2301.68	-31.36	28.26	47.59	37.01	44.49	33.91	74	54	-29.51	-20.09	52	2.15
3154.29	-30.60	30.58	45.82	35.33	45.81	35.32	74	54	-28.19	-18.68	323	1.89
3398.07	-30.23	30.88	45.66	35.19	46.31	35.84	74	54	-27.69	-18.16	257	1.74
4251.95	-29.38	32.60	45.13	34.68	48.35	37.90	74	54	-25.65	-16.10	69	1.50
5528.46	-28.41	34.30	45.97	35.44	51.86	41.33	74	54	-22.14	-12.67	128	1.26

Antenna Polarization : Vertical

Frequency (MHz)	Correct Factor (dB)	Ant. Factor (dB/m)	Reading Data (dBμV)		Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)		AZ (°)	EL (m)
			PK.	AV.	PK.	AV.	PK.	AV.	PK.	AV.		
1785.34	-31.91	27.17	46.92	36.41	42.18	31.67	74	54	-31.82	-22.33	60	1.17
2699.05	-31.06	29.26	47.13	36.67	45.32	34.86	74	54	-28.68	-19.14	110	1.59
3201.98	-30.52	30.64	45.69	35.12	45.81	35.24	74	54	-28.19	-18.76	178	1.69
3991.42	-29.65	32.57	45.48	34.97	48.40	37.89	74	54	-25.60	-16.11	302	1.80
4650.80	-28.91	32.99	45.27	34.74	49.35	38.82	74	54	-24.65	-15.18	294	2.04
5374.39	-28.41	34.20	45.01	34.55	50.79	40.33	74	54	-23.21	-13.67	57	2.39

NOTE:

1. Measurement uncertainty is 4.04 dB.
2. Emission Level = Reading Value + Ant. Factor + Correct Factor (incl.: Cable Loss and Pre-Amplifier Gain)
3. The field strength of other emission frequencies were very low against the limit.
4. (F): The field strength of fundamental frequency.



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Temperature:	22 °C	Humidity:	65 %RH
Frequency Range:	1 GHz – 25 GHz	Tested Mode:	802.11b_CH09 (Fundamental and Harmonics)
Detector:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Antenna Polarization : Horizontal

Frequency (MHz)	Correct Factor (dB)	Ant. Factor (dB/m)	Reading Data (dBμV)		Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)		AZ (°)	EL (m)
			PK.	AV.	PK.	AV.	PK.	AV.	PK.	AV.		
2447.00 (F)	-31.26	28.44	108.69	91.35	105.87	88.53	--	--	--	--	113	1.53
4894.00	-28.55	33.62	45.39	34.82	50.46	39.89	74	54	-23.54	-14.11	259	1.59
7341.00	-27.62	36.12	43.08	32.57	51.58	41.07	74	54	-22.42	-12.93	334	1.50
9788.00	-27.08	37.87	42.51	32.01	53.31	42.81	74	54	-20.69	-11.19	182	1.48
12235.00	-25.46	39.25	40.18	29.69	53.98	43.49	74	54	-20.02	-10.51	61	1.44
14682.00	-23.65	41.60	31.66	21.14	49.61	39.09	74	54	-24.39	-14.91	195	1.63

Antenna Polarization : Vertical

Frequency (MHz)	Correct Factor (dB)	Ant. Factor (dB/m)	Reading Data (dBμV)		Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)		AZ (°)	EL (m)
			PK.	AV.	PK.	AV.	PK.	AV.	PK.	AV.		
2447.00 (F)	-31.26	28.44	105.34	90.41	102.52	87.59	--	--	--	--	83	1.60
4894.00	-28.55	33.62	42.55	32.07	47.62	37.14	74	54	-26.38	-16.86	192	1.57
7341.00	-27.62	36.12	42.83	32.38	51.33	40.88	74	54	-22.67	-13.12	257	1.55
9788.00	-27.08	37.87	42.85	32.39	53.65	43.19	74	54	-20.35	-10.81	314	1.62
12235.00	-25.46	39.25	40.31	29.85	54.11	43.65	74	54	-19.89	-10.35	60	1.49
14682.00	-23.65	41.60	31.59	21.02	49.54	38.97	74	54	-24.46	-15.03	128	1.52

NOTE:

1. Measurement uncertainty is 4.04 dB.
2. Emission Level = Reading Value + Ant. Factor + Correct Factor (incl.: Cable Loss and Pre-Amplifier Gain)
3. The field strength of other emission frequencies were very low against the limit.
4. (F): The field strength of fundamental frequency.



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4.2 BANDWIDTH TEST

4.2.1 LIMIT

FCC Part15, Subpart C Section 15.247 (a)(2). The minimum 6dB bandwidth shall be at least 500 kHz.

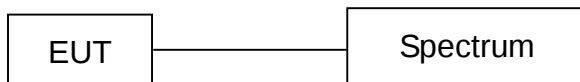
4.2.2 TEST EQUIPMENT

The following test equipment was used during the test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER (INCLUDE SPECTRUM ANALYZER)	9 KHz ~ 6 GHz	ROHDE & SCHWARZ	ESL /100176	MAY 21, 2018 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

4.2.3 TEST SET-UP



The EUT was connected to a spectrum through a 50Ω RF cable.

4.2.4 TEST PROCEDURE

The EUT was operated in continuous transmission mode or any specific channel.
Printed out the test result from the spectrum by hard copy function.

4.2.5 EUT OPERATING CONDITION

1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

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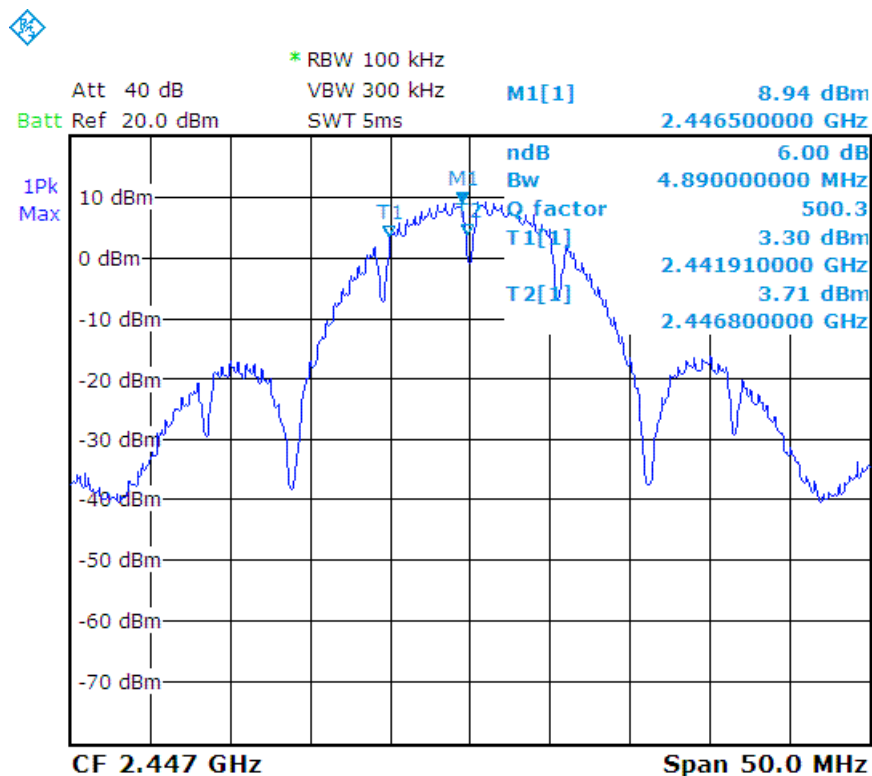
4.2.6 TEST RESULT

6dB Bandwidth :

Temperature:	24 °C	Humidity:	61 %RH
Detector:	Peak	Test Mode:	802.11b
RBW:	100 kHz	VBW:	300 kHz
Tested By:	Richard Lin	Tested Date:	Apr. 16, 2018

Channel Number	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)
CH09	2447	4.89	0.5

b_CH09 :



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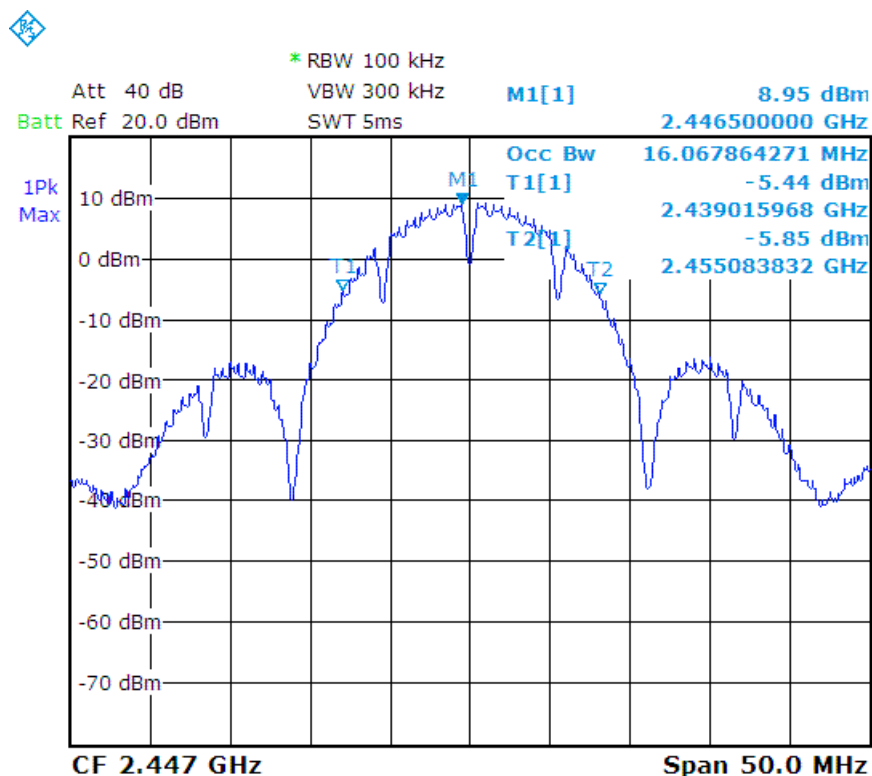
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99% Bandwidth :

Temperature:	24 °C	Humidity:	61 %RH
Detector:	Peak	Test Mode:	802.11b
RBW:	100 kHz	VBW:	300 kHz
Tested By:	Richard Lin	Tested Date:	Apr. 16, 2018

Channel Number	Channel Frequency (MHz)	99% Bandwidth (MHz)
CH09	2447	16.07

b_CH09 :



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4.3 PEAK CONDUCTED OUTPUT POWER TEST

4.3.1 LIMIT

FCC Part15, Subpart C Section 15.247(b).

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

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

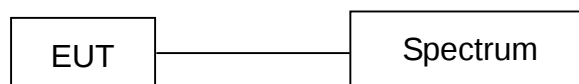
4.3.2 TEST EQUIPMENT

The following test equipment was used during the test :

Equipment/ Facilities	Specifications	Manufacturer	Model#/ Serial#	Due Date of Cal. & Cal. Center
EMI TEST RECEIVER (INCLUDE SPECTRUM ANALYZER)	9 KHz ~ 6 GHz	ROHDE & SCHWARZ	ESL /100176	MAY 21, 2018 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST SET-UP



The EUT was connected to a spectrum through a 50Ω RF cable.

4.3.4 TEST PROCEDURE

The EUT was operating in continuous transmission mode or could control its channel. Printed out the test result from the spectrum by hard copy function.

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4.3.5 EUT OPERATING CONDITION

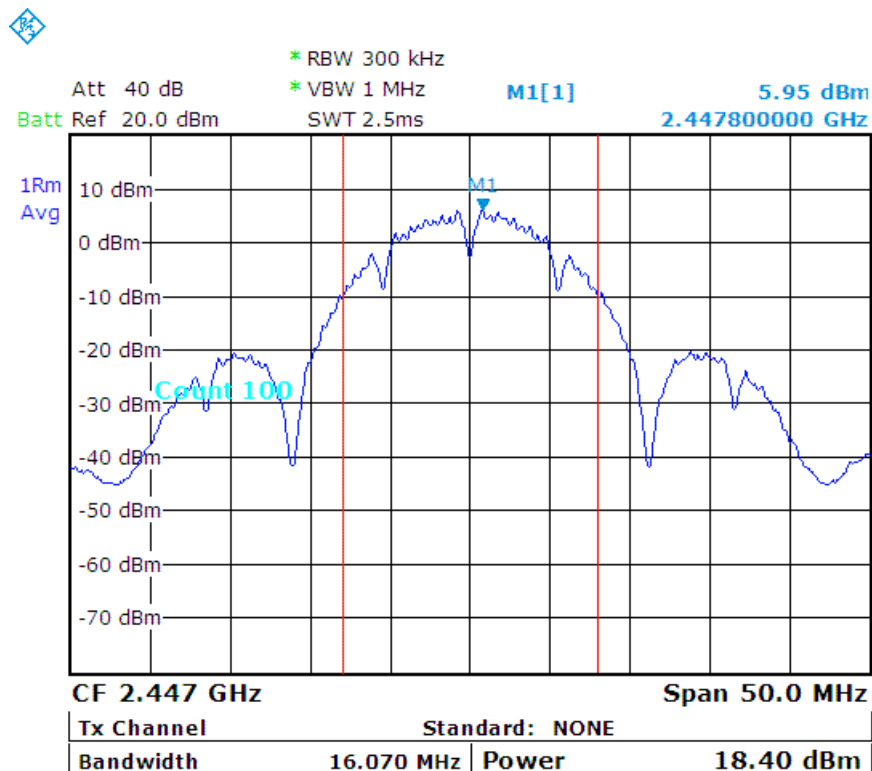
1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

4.3.6 TEST RESULT

Temperature:	24 °C	Humidity:	61 %RH
Detector:	RMS	Test Mode:	802.11b
RBW:	300 kHz	VBW:	1 MHz
Tested By:	Richard Lin	Tested Date:	Apr. 16, 2018

Channel Number	Channel Frequency (MHz)	99% Bandwidth (MHz)	Peak Conducted Output Power		Limit (dBm)
			(dBm)	(mW)	
CH09	2447	16.07	18.40	69.18	30

b_CH09 :



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4.4 BAND EDGE TEST**4.4.1 LIMIT**

FCC Part15, Subpart C Section 15.247(d).

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 emissions 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)).

OPERATING FREQUENCY RANGE (MHz)	SPURIOUS EMISSION FREQUENCY (MHz)	LIMIT	
		Peak power ration to emission(dBc)	Emission level(dBuV/m)
2400 - 2483.5	< 2400	> 20	N/A
	> 2483.5-2500	N/A	54

NOTE:

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4.4.2 TEST EQUIPMENT

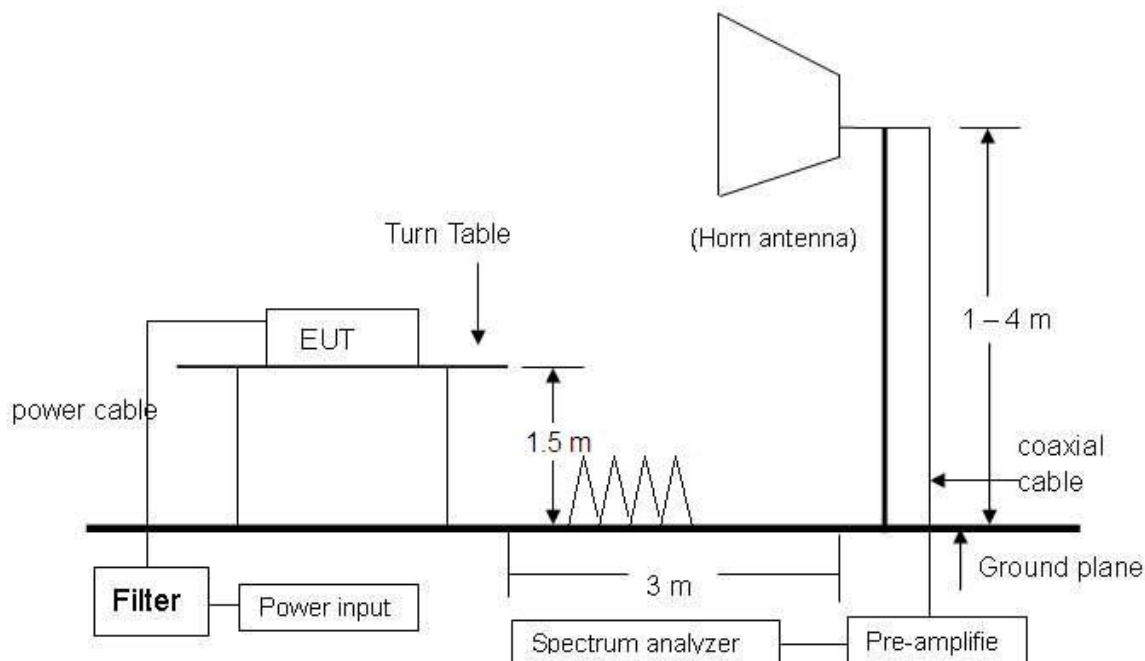
The following test equipment was used during the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM ANALYZER	9 kHz ~ 40GHz	ROHDE & SCHWARZ	FSP40 / 100093	JAN. 01, 2019 ETC
EMI TEST RECEIVER (INCLUDE SPECTRUM ANALYZER)	9 KHz ~ 6 GHz	ROHDE & SCHWARZ	ESL /100176	MAY 21, 2018 ETC
HORN ANTENNA	1 GHz ~ 18 GHz	EMCO	3115/ 9602-4681	NOV. 24, 2018 ETC
PRE-AMPLIFIER	1 GHz ~ 26.5 GHz	AGILENT	8449B/ 3008A01995	DEC. 29, 2018 ETC
OPEN AREA TEST SITE	3 – 10 M MEASUREMENT	SRT	A02 / SRT002	MAR. 09, 2018 SRT
ANECHOIC CHAMBER	3 M MEASUREMENT	SRT	A01 / SRT001	SEP. 13, 2018 SRT
K-TYPE CABLE	UP TO 40 GHz 3 m	HUBER+SUHNE R	SF102-46/2*11SK 252 /MY2611/2	FEB. 23, 2018 ETC
K-TYPE CABLE	UP TO 40 GHz, 1 m	HUBER+SUHNE R	SF102/2*11SK252 /MY3331/2	SEP. 28, 2018 ETC
FILTER	2 LINE, 30 A	FIL.COIL	FC-943/ 869	NCR

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.



4.4.3 TEST SETUP



NOTE: The EUT system was put on a wooden table with 1.5m heights above a ground plane. For the actual test configuration, please refer to the photos of testing.

4.4.4 TEST PROCEDURE

The EUT was tested according to the requirement of ANSI C63.10:2013 and CISPR 22:2003. When the frequency spectrum measured started from 30 MHz to 1 GHz, then use antenna is a BICONICAL ANTENNA & LOG PERIODIC ANTENNA. The measurements were made at an open area test site with 3 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz to 1 GHz, all readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak or average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency. First, find the margin or higher points at least 6 points by software, then use manual to find the maximum data. The procedure is referred on the test procedure of SRT LAB.



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4.4.5 EUT OPERATING CONDITION

1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

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4.4.6 TEST RESULT

Below 2400MHz

Temperature:	22 °C	Humidity:	65 %RH
Frequency Range:	2.30 GHz – 2.46 GHz	Tested Mode:	802.11b
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Frequency (MHz)	Correct Factor (dB)	Ant. Fac. (dB/m)	Ant. Pol. (H/V)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Over Limit (dB)	
				PK	AV	PK	AV	PK	AV	PK	AV
2395.02	-31.29	28.37	H	37.09	26.55	34.17	23.63	74.00	54.00	-39.83	-30.37
2382.84	-31.30	28.36	V	35.53	25.01	32.59	22.07	74.00	54.00	-41.41	-31.93
2400.00	-31.29	28.38	H	35.68	25.17	32.77	22.26	74.00	54.00	-41.23	-31.74
2400.00	-31.29	28.38	V	34.19	23.68	31.28	20.77	74.00	54.00	-42.72	-33.23

Above 2483.5MHz

Temperature:	22 °C	Humidity:	65 %RH
Frequency Range:	2.43 GHz – 2.60 GHz	Tested Mode:	802.11b
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Apr. 13, 2018

Frequency (MHz)	Correct Factor (dB)	Ant. Fac. (dB/m)	Ant. Pol. (H/V)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Over Limit (dB)	
				PK	AV	PK	AV	PK	AV	PK	AV
2483.50	-31.23	28.48	H	32.91	22.46	30.16	19.71	74.00	54.00	-43.84	-34.29
2483.50	-31.23	28.48	V	34.25	23.79	31.50	21.04	74.00	54.00	-42.50	-32.96
2489.39	-31.23	28.49	H	34.96	24.45	32.22	21.71	74.00	54.00	-41.78	-32.29
2516.66	-31.21	28.56	V	36.25	25.77	33.60	23.12	74.00	54.00	-40.40	-30.88



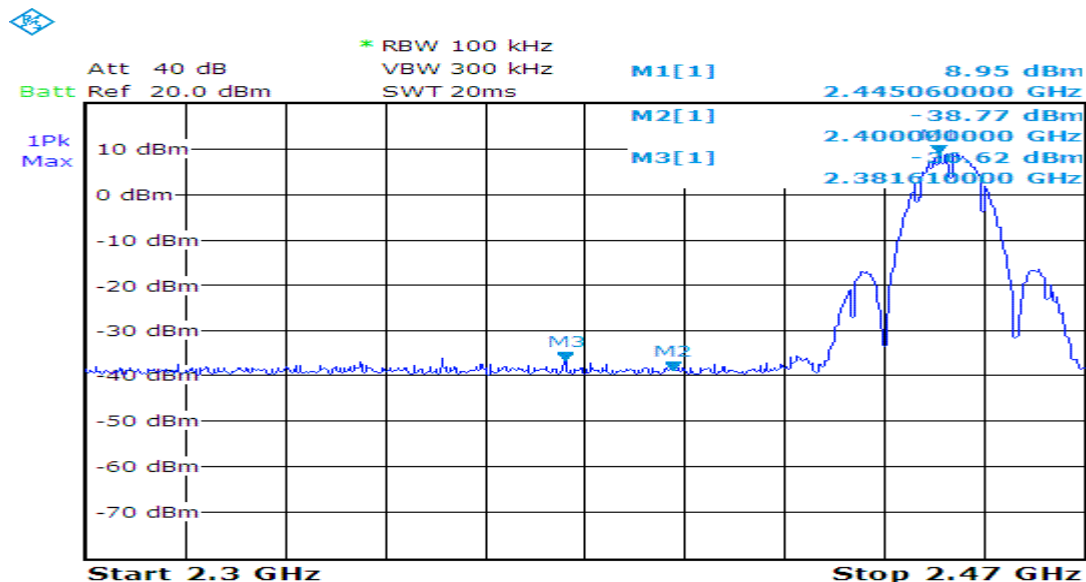
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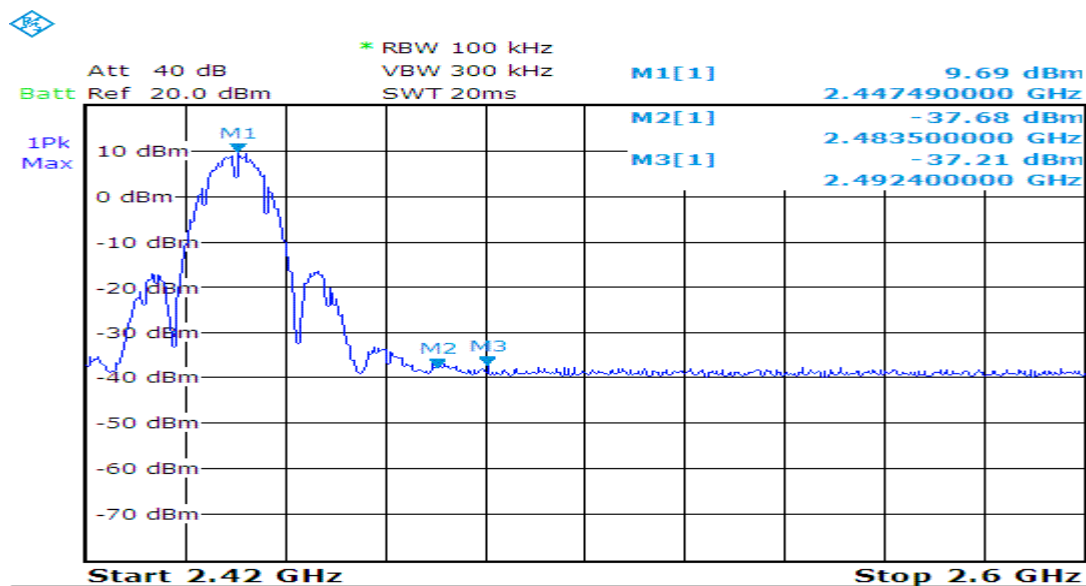
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Below 2400MHz



Above 2483.5MHz



4.5 POWER SPECTRAL DENSITY TEST

4.5.1 LIMIT

FCC Part15, Subpart C Section 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

FREQUENCY RANGE	Limit
2.40 - 2.4835 GHz	8 dBm / 3 kHz

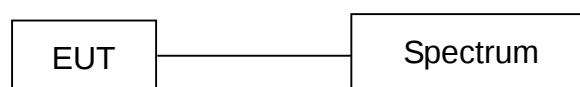
4.5.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER (INCLUDE SPECTRUM ANALYZER)	9 KHz ~ 6 GHz	ROHDE & SCHWARZ	ESL /100176	MAY 21, 2018 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

4.5.3 TEST SET-UP



The EUT was connected to a spectrum through a 50Ω RF cable.

4.5.4 TEST PROCEDURE

The EUT was operating in transmitter mode and could be controlled its channel.
 Printed out the test result from the spectrum by hard copy function.

4.5.5 EUT OPERATING CONDITION

1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

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4.5.6 TEST RESULT

Temperature: 24 °C

Humidity: 61 %RH

Detector: RMS

Test Mode: 802.11b

RBW: 3 kHz

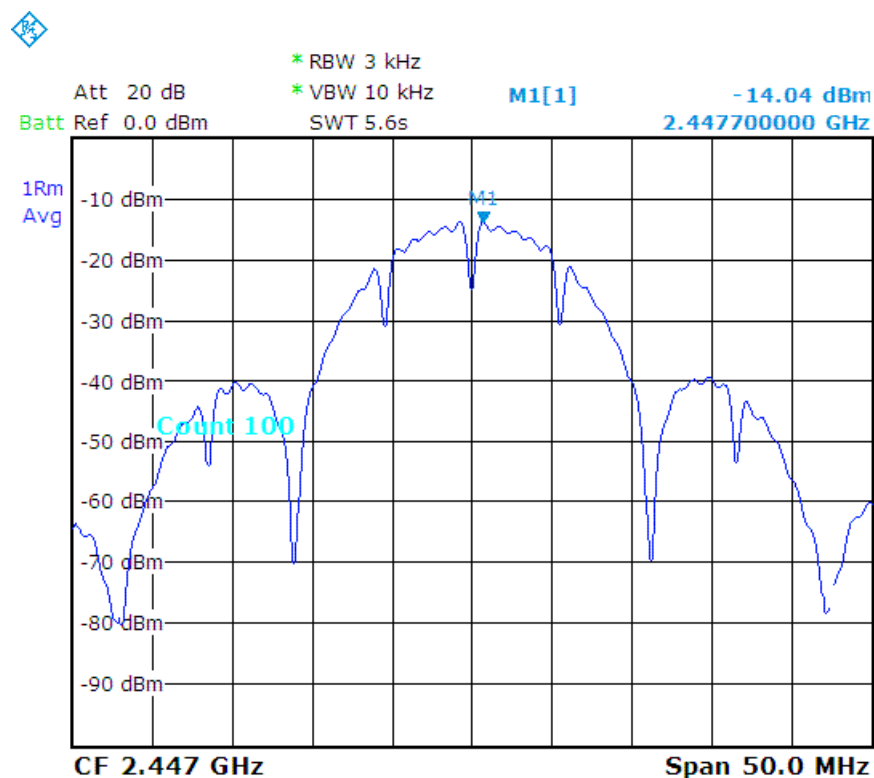
VBW: 10 kHz

Tested By: Richard Lin

Tested Date: Apr. 16, 2018

Channel Number	Channel Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)
CH09	2447	-14.04	8

b_CH09 :





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5. Antenna application

5.1 Antenna requirement

The EUT's antenna is met the requirement of FCC Part 15C section 15.203 and 15.204.

FCC Part 15C section 15.247 requirement:

Systems operating in the 2400-2483.5 MHz band that are 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.

5.2 Result

The EUT's antenna used a Dipole Antenna. Gain of -3.0 dBi, that meet the requirement.

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6. TERMS OF ABBREVIATION

AV.	Average detection
AZ(°)	Turn table azimuth
Correct.	Correction
EL(m)	Antenna height (meter)
EUT	Equipment Under Test
Horiz.	Horizontal direction
LISN	Line Impedance Stabilization Network
NSA	Normalized Site Attenuation
Q.P.	Quasi-peak detection
SRT Lab	Spectrum Research & Testing Laboratory, Inc.
Vert.	Vertical direction