Product Name:	DASH CAM
Model No.:	X5002
Applicant:	MASI AUTO Co., LTD. 7F.-10, No.9, Sec. 2, Nankan Rd., Luzhu Dist., Taoyuan City 338, Taiwan
Date of Receipt:	Jul. 12, 2020
Finished date of Test:	Oct. 20, 2020
Applicable Standards:	47 CFR Part 15, Subpart C, 15.247 ANSI C63.10: 2013

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: 11/3/2020

(Richard Lin)

Approved By : , Date: 11/3/2020

(Johnson Ho, Director)

Testing Laboratory 1016

Revisions History

Report No.	Issue Date	Revisions
FCCA19071210	Nov. 03, 2020	Initial issue

Table of Contents

1. DOCUMENT POLICY AND TEST STATEMENT 5
1.1 DOCUMENT POLICY 5
1.2 TEST STATEMENT 5
1.3 EUT MODIFICATION 5
2. DESCRIPTION OF EUT AND TEST MODE 6
2.1 GENERAL DESCRIPTION OF EUT 6
2.2 DESCRIPTION OF EUT INTERNAL DEVICE 6
2.3 DESCRIPTION OF TEST MODE 7
2.4 EUT OPERATING CONDITION 7
2.5 DESCRIPTION OF SUPPORT UNIT 8
2.6 CHANNEL AND FREQUENCY TABLE 8
3. DESCRIPTION OF APPLIED STANDARDS 9
3.1 DESCRIPTION OF APPLIED KDB 9
3.2 SUMMARY OF TEST RESULTS 10
4. TECHNICAL CHARACTERISTICS TEST 11
4.1 CONDUCTED EMISSION TEST 11
4.1.1 LIMIT 11
4.1.2 TEST EQUIPMENT 11
4.1.3 TEST SETUP 12
4.1.4 TEST PROCEDURE 12
4.1.5 TEST RESULT 13
4.2 RADIATED EMISSION TEST 15
4.2.1 LIMIT 15
4.2.2 TEST EQUIPMENT 16
4.2.3 TEST SET-UP 17
4.2.4 TEST PROCEDURE 18
4.2.5 TEST RESULT 19
4.3 BANDWIDTH TEST 22
4.3.1 LIMIT 22
4.3.2 TEST EQUIPMENT 22
4.3.3 TEST SET-UP 22
4.3.4 TEST PROCEDURE 22
4.3.5 EUT OPERATING CONDITION 22
4.3.6 TEST RESULT 23
4.4 PEAK CONDUCTED OUTPUT POWER TEST 25
4.4.1 LIMIT 25
4.4.2 TEST EQUIPMENT 25
4.4.3 TEST SET-UP 25
4.4.4 TEST PROCEDURE 25
4.4.5 EUT OPERATING CONDITION 25
4.4.6 TEST RESULT 26
4.5 BAND EDGE TEST 27
4.5.1 LIMIT 27

4.5.2 TEST EQUIPMENT 28
4.5.3 TEST SETUP 29
4.5.4 TEST PROCEDURE 29
4.5.5 EUT OPERATING CONDITION 30
4.5.6 TEST RESULT 31
4.6 POWER SPECTRAL DENSITY TEST 34
4.6.1 LIMIT 34
4.6.2 TEST EQUIPMENT 34
4.6.3 TEST SET-UP 34
4.6.4 TEST PROCEDURE 34
4.6.5 EUT OPERATING CONDITION 34
4.6.6 TEST RESULT 35
5. ANTENNA APPLICATION 36
5.1 ANTENNA REQUIREMENT 36
5.2 RESULT 36
6. TERMS OF ABBREVIATION 37

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, DC 3.7V of charge battery or DC 5.0V from PC USB Port, was used during the test.

1.3 EUT MODIFICATION

- No modification in SRT Lab.

2. DESCRIPTION OF EUT AND TEST MODE

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	DASH CAM
MODEL NO.	X5002
POWER SUPPLY	DC power source, DC 3.7V of charge battery or DC 5.0V from PC USB Port
CABLE	NA
FREQUENCY BAND	2400 MHz ~ 2483.5 MHz
CARRIER FREQUENCY	2412 MHz
NUMBER OF CHANNEL	802.11g_CH01：2412 MHz
RATED RF OUTPUT POWER	11.86 dBm (15.35 mW)
MODULATION TYPE	IEEE802.11g OFDM(BPSK/16-QAM/64-QAM)
MODE OF OPERATION	Duplex
NUMBER OF CHANNELS	1
ANTENNA TYPE	Chip Antenna (Brand：RainSun Model：AN1003)
ANTENNA GAIN	1.5 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
Car Charger	MASI	SM CC-F	N/A	3.5m shielded power cable
Y-Cable	MASIGO	MCB1	N/A	6.0m shielded power cable
Lithium battery	Shenzhen BetterPower Battery Co., Ltd.	PL 482530H	N/A	3.7V 280mAh 1.03Wh

2.3 DESCRIPTION OF TEST MODE

There are test modes for each test configuration as below:

Mode		Channel	Frequency (MHz)
01	802.11g	CH01	2412

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

1. For use customer provided continuous transmission EUT.
2. Turn on the power of all equipment and EUT.
3. Open the hyperterminal and enter the continuous transmission instruction.

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	Galaxy S8	SAMSUNG	SM-G950FD	CCAK174G0090T1	64G
2	Switching AC/DC power adapter	TOPCOM	TC-92	R53590	INPUT:100~240V ~ 50/60Hz, 0.3A OUTPUT:DC 5.0V, 2.1A
3	Micro SD card	TOSHIBA	N/A	N/A	容量：8G
4	Mini HDMI to HDMI cable	C&E	CNE457494	N/A	1.0m shielded data cable

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

2.6 CHANNEL AND FREQUENCY TABLE

802.11g	
Channel	**Frequency**
CH01	2412 MHz

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

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

3.1 DESCRIPTION OF APPLIED KDB

Related KDB used in the test:

FCC publication KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement on Digital Transmission Systems (DTS) Operating under Section 15.247 Apr. 02, 2019

3.2 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	PASS
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 CONDUCTED EMISSION TEST

4.1.1 LIMIT

Frequency (MHz)	Class A (dBμV)		Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

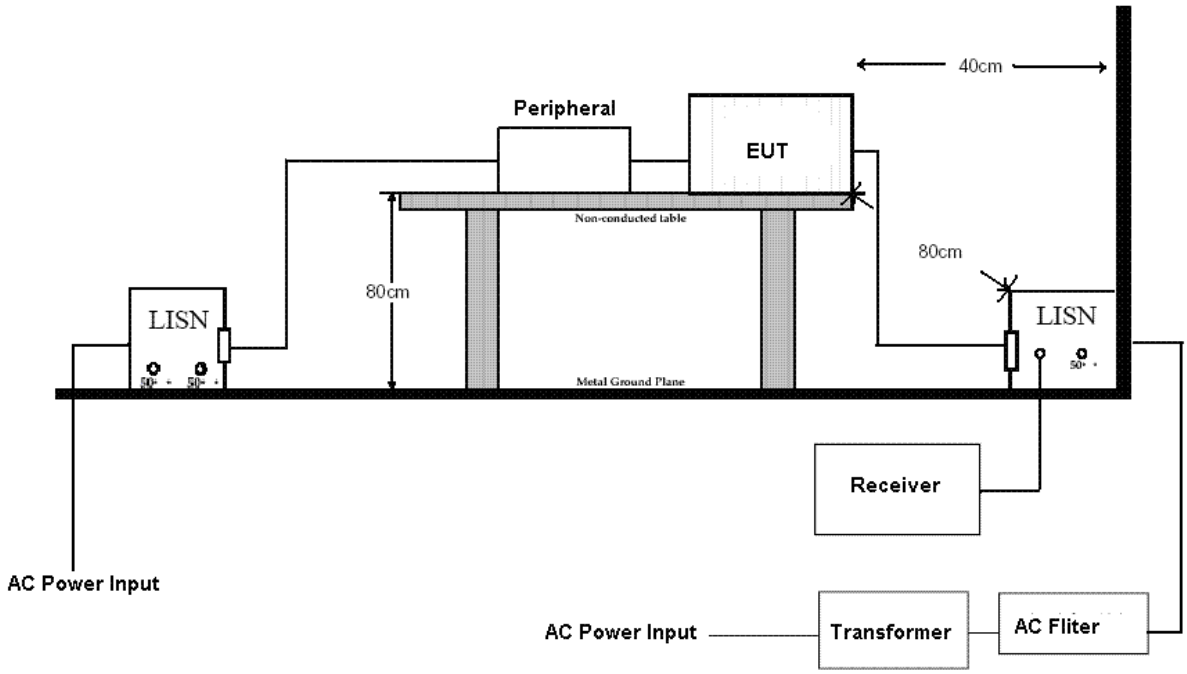
4.1.2 TEST EQUIPMENT

The following test equipment was used for the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER	FINAL TEST BE USED
EMI TEST RECEIVER	9 kHz ~ 2.75 GHz	ROHDE & SCHWARZ	ESCS30 / 100376	JAN. 06, 2021 ETC	☐
EMI TEST RECEIVER	9 kHz ~ 30 MHz	ROHDE & SCHWARZ	ESHS30 / 826003/008	JAN. 13, 2021 ETC	■
LISN	50 μH, 50 ohm	SOLAR	9252-50-R-24-BNC/951315	OCT. 20, 2021 ETC	■
LISN	50 μH, 50 ohm	SCHWARZBECK	NSLK 8127/ 8127-808	DEC. 10, 2020 ETC	■
50Ω BNC TYPE TERMINATOR	50 ohm	N/A	11593A/ L1TEQU005	NOV. 06, 2021 ETC	■
50Ω BNC TYPE TERMINATOR	50 ohm	N/A	B00-CD-357/ L1TEQU009	MAY. 25, 2021 ETC	☐
COAXIAL CABLE	5 m	HUBER+SUHNER	RG214/U / L1TCAB013(#5m)	MAY. 25, 2021 ETC	■
FILTER	2 LINE, 30 A	FIL.COIL	FC-943 / 771	NCR	■
GROUND PLANE	2 m (H) x 3 m (W)	SRT	N/A	NCR	■
GROUND PLANE	2.5 m (H) x 3 m (W)	SRT	N/A	NCR	■
PULSE LIMITER	9 kHz ~ 30 MHz Insertion Loss= 10dB±0.3dB	ROHDE & SCHWARZ	ESH3Z2/ L1TTES009	DEC. 19, 2020 ETC	■
THERMO-HYGRO	15 – 40 °C, 0- 100% RH	TES	TES-1161/ 180704762	MAR. 06, 2021 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 SETUP



NOTE :
1. The EUT was put on a wooden table with 0.8m heights above ground plane, and 0.4m away from reference ground plane (> 2mx2m).
2. For the actual test configuration, please refer to the photos of testing.

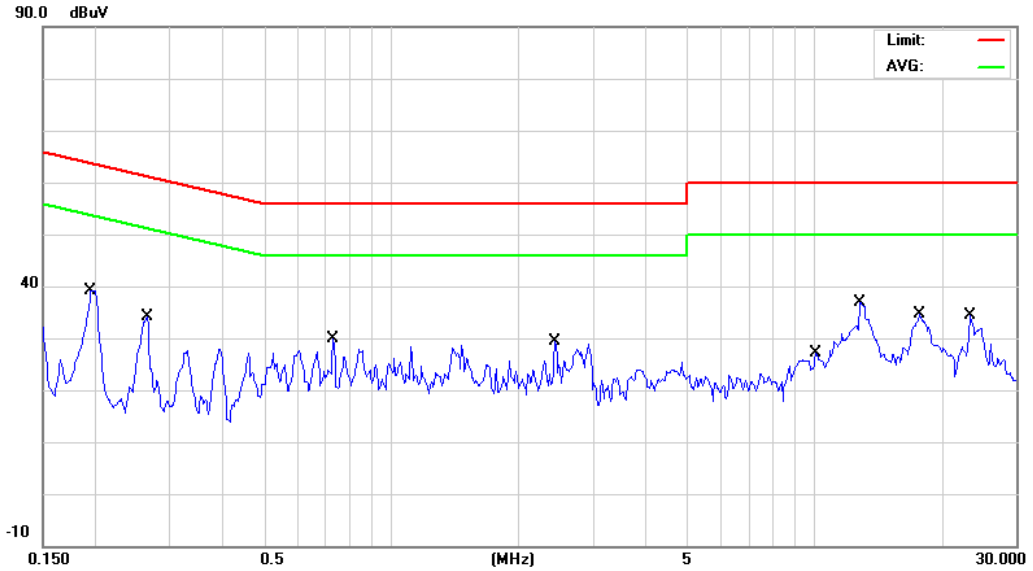
4.1.4 TEST PROCEDURE

The EUT was tested according to the requirement of ANSI C63.10:2013 and CISPR22:2003. The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm/50μH as specified. All readings were quasi-peak and average values with 10 kHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. Both lines of the power mains of EUT were measured and 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.

4.1.5 TEST RESULT

Temperature:	22 °C	Humidity:	69 %RH
Frequency Range:	0.15 – 30 MHz	Tested Mode:	802.11g_CH01
Receiver Detector:	Q.P. and AV.	Tested Date:	Sep. 16, 2020

Power Line Measured：Line

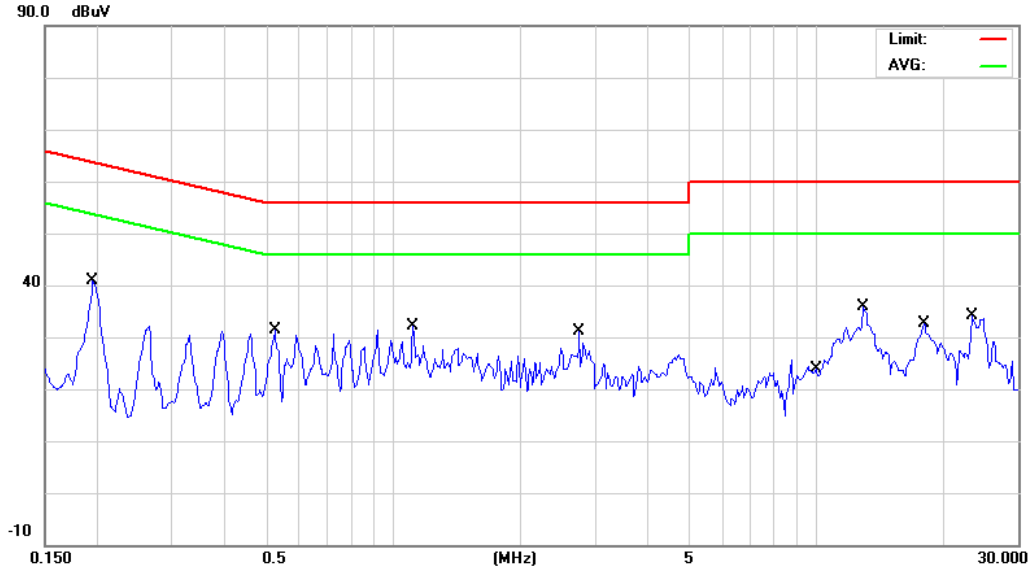


Mk.	No.	Frequency (MHz)	Reading (dBuV)	Corrected factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Comment
	1	0.1950	38.45	-0.17	38.28	63.82	-25.54	QP	
*	2	0.1950	33.38	-0.17	33.21	53.82	-20.61	AVG	
	3	0.2650	31.81	-0.17	31.64	61.27	-29.63	QP	
	4	0.2650	27.21	-0.17	27.04	51.27	-24.23	AVG	
	5	0.7300	21.71	-0.15	21.56	56.00	-34.44	QP	
	6	0.7300	12.00	-0.15	11.85	46.00	-34.15	AVG	
	7	2.4450	16.17	-0.07	16.10	56.00	-39.90	QP	
	8	2.4450	6.79	-0.07	6.72	46.00	-39.28	AVG	
	9	10.0000	17.45	0.17	17.62	60.00	-42.38	QP	
	10	10.0000	10.49	0.17	10.66	50.00	-39.34	AVG	
	11	12.8500	32.62	0.25	32.87	60.00	-27.13	QP	
	12	12.8500	26.44	0.25	26.69	50.00	-23.31	AVG	
	13	17.6650	28.40	0.36	28.76	60.00	-31.24	QP	
	14	17.6650	19.12	0.36	19.48	50.00	-30.52	AVG	
	15	23.3300	32.46	0.49	32.95	60.00	-27.05	QP	
	16	23.3300	27.49	0.49	27.98	50.00	-22.02	AVG	

NOTE :
1. Measurement uncertainty is 2.92 dB.
2. Result = Reading + Correction factor.
3. Corrected Factor = Cable loss + Insertion loss of LISN
   Difference of Pulse Limiter Factor between EMI Test Receiver corrected 10dB insertion loss.
4. Margin = Result – Limit.

Temperature:	22 °C	Humidity:	69 %RH
Frequency Range:	0.15 – 30 MHz	Tested Mode:	802.11g_CH01
Receiver Detector:	Q.P. and AV.	Tested Date:	Sep. 16, 2020

Power Line Measured：Neutral



Mk.	No.	Frequency (MHz)	Reading (dBuV)	Corrected factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Comment
	1	0.1950	37.85	-0.16	37.69	63.82	-26.13	QP	
	2	0.1950	32.41	-0.16	32.25	53.82	-21.57	AVG	
	3	0.5250	30.10	-0.14	29.96	56.00	-26.04	QP	
	4	0.5250	26.39	-0.14	26.25	46.00	-19.75	AVG	
	5	1.1150	30.80	-0.11	30.69	56.00	-25.31	QP	
*	6	1.1150	26.51	-0.11	26.40	46.00	-19.60	AVG	
	7	2.7550	20.58	-0.05	20.53	56.00	-35.47	QP	
	8	2.7550	13.86	-0.05	13.81	46.00	-32.19	AVG	
	9	10.0000	17.43	0.16	17.59	60.00	-42.41	QP	
	10	10.0000	10.54	0.16	10.70	50.00	-39.30	AVG	
	11	12.8700	32.72	0.23	32.95	60.00	-27.05	QP	
	12	12.8700	26.42	0.23	26.65	50.00	-23.35	AVG	
	13	18.0000	28.52	0.33	28.85	60.00	-31.15	QP	
	14	18.0000	18.36	0.33	18.69	50.00	-31.31	AVG	
	15	23.3300	31.90	0.44	32.34	60.00	-27.66	QP	
	16	23.3300	28.61	0.44	29.05	50.00	-20.95	AVG	

NOTE :
1. Measurement uncertainty is 2.92 dB.
2. Result = Reading + Correction factor.
3. Corrected Factor = Cable loss + Insertion loss of LISN
   Difference of Pulse Limiter Factor between EMI Test Receiver corrected 10dB insertion loss.
4. Margin = Result – Limit.

4.2 RADIATED EMISSION TEST

4.2.1 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 (dBμV/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, antemma, 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

4.2.2 TEST EQUIPMENT

Below 1 GHz The following test equipment was used during the radiated emission test:

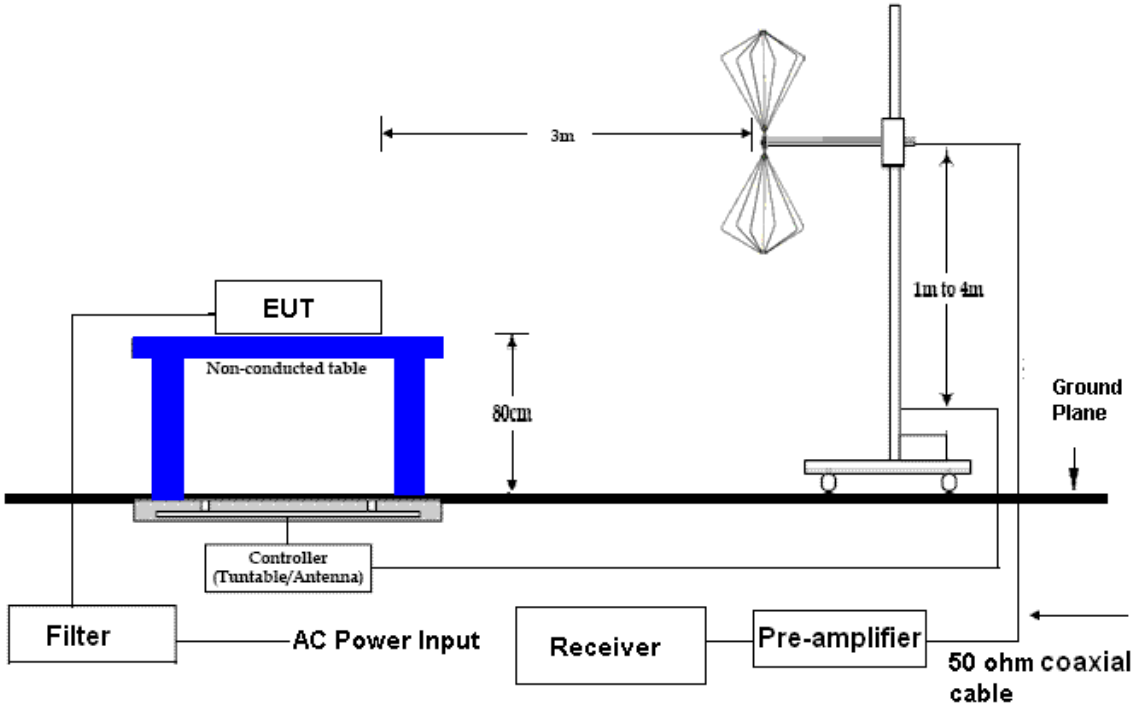
EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER	FINAL TEST BE USED
EMI TEST RECEIVER	9 kHz ~ 2.75 GHz	ROHDE & SCHWARZ	ESCS30 / 100376	JAN. 06, 2021 ETC	■
LOOP ANTENNA	9 kHz ~ 30 MHz	ROHDE & SCHWARZ	HFH2-Z2 / 860605/002	JUL. 13, 2021 ETC	□
BICONICAL ANTENNA	30 MHz ~ 200 MHz	EMCO	3110/ 11966C	JUL. 03, 2021 ETC	■
LOG PERIODIC ANTENNA	200 MHz ~ 1 GHz	EMCO	3146/ 9002-2686	MAR. 03, 2021 ETC	■
OPEN AREA TEST SITE	3 – 10 M MEASUREMENT	SRT	A02 / SRT002	MAR. 06, 2021 SRT	■
COAXIAL CABLE	30 M	TIMES	LMR-400 / #30M(L1TCAB014)	JUN. 08, 2021 ETC	■
COAXIAL CABLE	9k - 1GHz	Suncity	J400-2M-2NHP/ L1ACAB009(1.5m)	JUL. 23, 2021 ETC	■
FILTER	2 LINE, 30 A	FIL.COIL	FC-943 /869	NCR	■
PRE-AMPLIFIER	0.1 MHz ~ 1.3 GHz	HP	8447D / 2944A06746	DEC. 08, 2020 ETC	■
THERMO-HYGRO	15 – 40°C, 0- 100% RH	TOP	20-A / 6644	SEP. 07, 2021 ETC	■

Above 1 GHz The following test equipment was used during the radiated emission test:

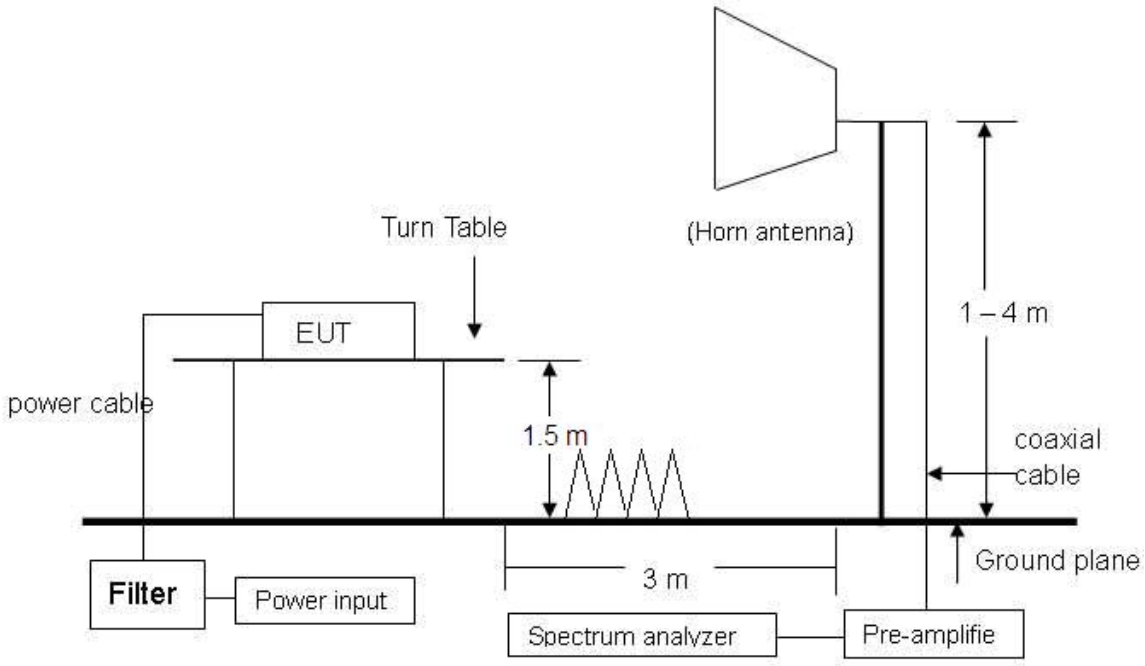
EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER	FINAL TEST BE USED
SPECTRUM ANALYZER	9 kHz ~ 40 GHz	ROHDE & SCHWARZ	FSP40 / 100093	JAN. 06, 2021 ETC	■
PRE-AMPLIFIER	1 GHz ~ 26.5 GHz	AGILENT	8449B/ 3008A01995	JAN. 05, 2021 ETC	■
HORN ANTENNA	1 GHz ~ 18 GHz	EMCO	3115/ 9602-4681	NOV. 13, 2020 ETC	■
HORN ANTENNA	18 ~ 40 GHZ	ETS-LINDGREN	3116 /00032255	JAN. 14, 2021 ETC	■
ANECHOIC CHAMBER	3 M MEASUREMENT	SRT	A01 / SRT001	DEC. 24, 2020 SRT	■
RF CABLE	UP TO 18 GHz 1.5 m	JYEBAO	A30A30-L 142 / EQF-0035(001)	NOV. 24, 2020 ETC	■
RF CABLE	UP TO 26.5 GHz 3.5 m	EMCI	EMC104-SM-SM-3500 / 150601	AUG. 18, 2021 ETC	■
K-TYPE CABLE	UP TO 40 GHz 3 m	HUBER+SUHNER	SF102-46/2*11SK252 /MY2611/2	MAR. 15, 2021 ETC	■
K-TYPE CABLE	UP TO 40 GHz, 1 m	HUBER+SUHNER	SF102/2*11SK252 /MY3331/2	SEP. 16, 2021 ETC	■
FILTER	2 LINE, 30 A	FIL.COIL	FC-943/869	NCR	■
THERMO-HYGRO	15 – 40 ℃, 0- 100% RH	TOP	20-A / 6644	SEP. 07, 2021 ETC	■

4.2.3 TEST SET-UP

30 MHz ~ 1 GHz



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.

4.2.4 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.

4.2.5 TEST RESULT

Temperature:	24 °C	Humidity:	63 %RH
Frequency Range:	30 M – 1 GHz	Tested Mode:	802.11g_CH01
Detector Type:	Quasi-peak	IF Bandwidth:	120 kHz
Tested By:	Richard	Tested Date:	Oct. 06, 2020

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)
181.48	2.96	16.30	27.68	41.40	32.99	44	-10.51	142	3.54
203.26	3.13	11.97	27.57	39.59	27.12	44	-16.38	295	3.39
514.07	5.71	18.72	28.49	43.18	39.12	46	-6.88	65	2.56
623.99	6.45	19.66	28.52	37.07	34.66	46	-11.34	100	2.17
719.51	7.07	21.29	28.36	33.37	33.37	46	-12.63	208	1.82
856.83	8.02	22.96	27.90	31.18	34.26	46	-11.74	134	1.42

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)
118.16	2.46	13.60	27.99	41.00	29.07	44	-14.43	259	1.28
514.79	5.71	18.72	28.49	39.24	35.18	46	-10.82	71	2.33
623.45	6.45	19.66	28.52	35.26	32.85	46	-13.15	196	2.75
719.38	7.07	21.29	28.36	30.20	30.20	46	-15.80	42	3.02
770.64	7.40	21.60	28.22	29.37	30.14	46	-15.86	301	3.27
856.01	8.02	22.96	27.90	29.37	32.45	46	-13.55	91	3.51

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

Temperature:	26 °C	Humidity:	65 %RH
Frequency Range:	1 GHz – 25 GHz	Tested Mode:	802.11g_CH01
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Oct. 06, 2020

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.		
1103.30	-33.86	26.11	51.63	41.13	43.88	33.38	74	54	-30.12	-20.62	140	2.49
1468.82	-32.72	26.68	51.21	40.78	45.17	34.74	74	54	-28.83	-19.26	331	2.35
2941.97	-31.13	29.85	46.89	36.35	45.60	35.06	74	54	-28.40	-18.94	87	1.96
3167.15	-30.86	30.73	44.90	34.41	44.77	34.28	74	54	-29.23	-19.72	215	1.82
4084.72	-29.87	32.13	43.57	33.02	45.83	35.28	74	54	-28.17	-18.72	93	1.55
5506.39	-28.73	34.10	42.20	31.79	47.57	37.16	74	54	-26.43	-16.84	142	1.13

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.		
1091.08	-33.90	26.05	53.19	42.66	45.34	34.81	74	54	-28.66	-19.19	55	1.04
1594.44	-32.48	25.90	55.61	45.13	49.03	38.55	74	54	-24.97	-15.45	158	1.17
2943.67	-31.13	29.86	50.26	39.75	48.99	38.48	74	54	-25.01	-15.52	72	1.56
3592.98	-30.32	31.35	44.08	33.52	45.11	34.55	74	54	-28.89	-19.45	102	1.74
3827.35	-30.11	32.25	43.10	32.68	45.24	34.82	74	54	-28.76	-19.18	305	1.86
5534.02	-28.72	34.10	42.17	31.77	47.55	37.15	74	54	-26.45	-16.85	248	2.33

NOTE:

1. Measurement uncertainty is 4.04 dB.
2. Emissiom 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 stregth of fundamental frequency.

Temperature:	26 °C	Humidity:	65 %RH
Frequency Range:	1 GHz – 25 GHz	Tested Mode:	802.11g_CH01 (Fundamental and Harmonics)
Detector:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Oct. 06, 2020

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.		
2412.00 (F)	-31.52	28.12	97.25	83.97	93.85	80.57	--	--	--	--	264	1.66
4824.00	-29.00	32.90	40.22	29.76	44.12	33.66	74	54	-29.88	-20.34	315	1.56
7236.00	-27.96	36.27	41.25	30.74	49.56	39.05	74	54	-24.44	-14.95	80	1.46
9648.00	-27.56	37.40	40.69	30.14	50.54	39.99	74	54	-23.46	-14.01	277	1.63
12060.00	-25.88	38.88	39.54	29.08	52.54	42.08	74	54	-21.46	-11.92	47	1.56
14472.00	-23.73	42.30	31.27	20.73	49.84	39.30	74	54	-24.16	-14.70	67	1.69

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.		
2412.00 (F)	-31.52	28.12	91.17	79.04	87.77	75.64	--	--	--	--	129	1.44
4824.00	-29.00	32.90	40.98	30.44	44.88	34.34	74	54	-29.12	-19.66	292	1.53
7236.00	-27.96	36.27	41.45	30.90	49.76	39.21	74	54	-24.24	-14.79	106	1.55
9648.00	-27.56	37.40	40.73	30.27	50.58	40.12	74	54	-23.42	-13.88	166	1.65
12060.00	-25.88	38.88	39.52	29.06	52.52	42.06	74	54	-21.48	-11.94	316	1.45
14472.00	-23.73	42.30	31.39	20.88	49.96	39.45	74	54	-24.04	-14.55	177	1.61

NOTE:
1. Measurement uncertainty is 4.04 dB.
2. Emissiom 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 stregth of fundamental frequency.

4.3 BANDWIDTH TEST

4.3.1 LIMIT

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

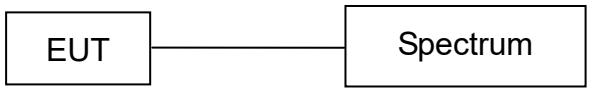
4.3.2 TEST EQUIPMENT

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	JUL. 30, 2021 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 operated in continuous transmission mode or any specific channel.

Printed out the test result from the spectrum by hard copy function.

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

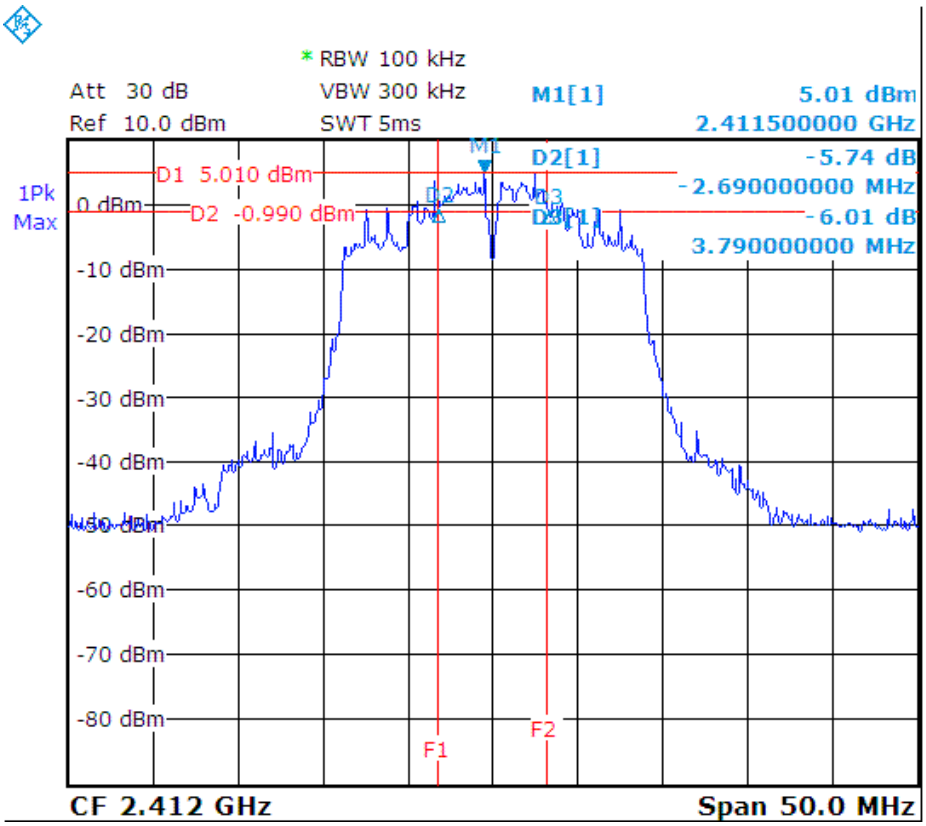
6dB Bandwidth：

Temperature:	25°C	Humidity:	67 %RH
Detector:	Peak	Test Mode:	802.11g
RBW:	100 kHz	VBW:	300 kHz
Tested By:	Richard Lin	Tested Date:	Oct. 20, 2020

Channel Number	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)
CH01	2412	6.48	0.5

2.69 MHz + 3.79 MHz = 6.48 MHz

G_CH01：

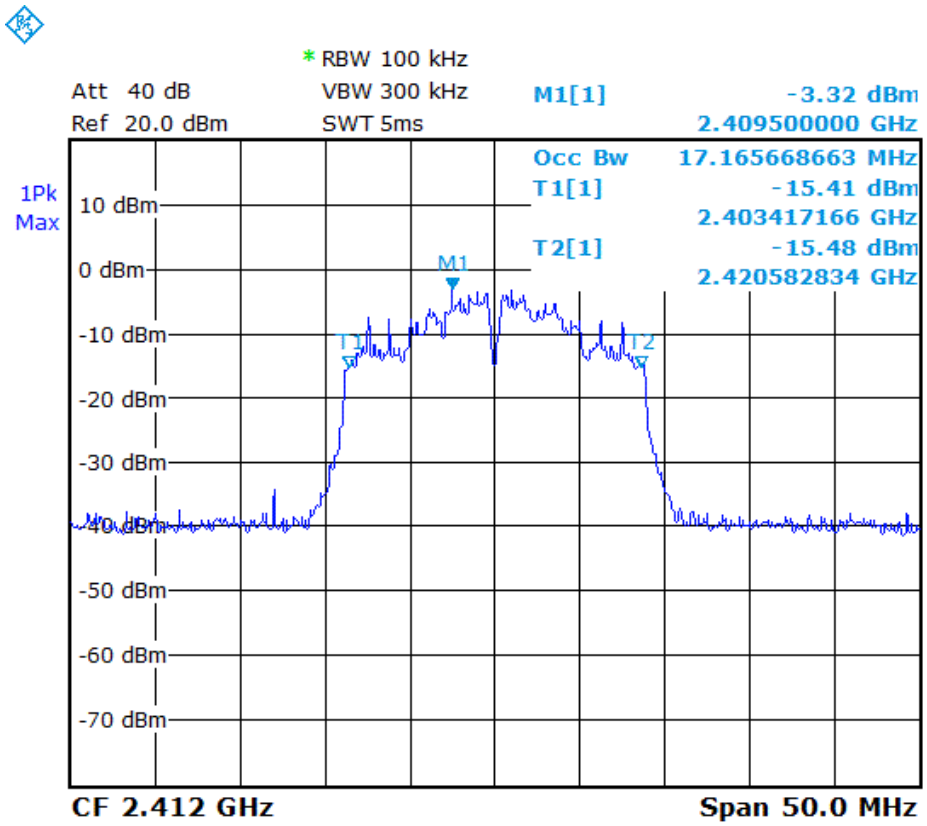


99% Bandwidth：

Temperature:	25 °C	Humidity:	67 %RH
Detector:	Peak	Test Mode:	802.11g
RBW:	100 kHz	VBW:	300 kHz
Tested By:	Richard Lin	Tested Date:	Oct. 20, 2020

Channel Number	Channel Frequency (MHz)	99% Bandwidth (MHz)
CH01	2412	17.17

G_CH01：



4.4 PEAK CONDUCTED OUTPUT POWER TEST

4.4.1 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.

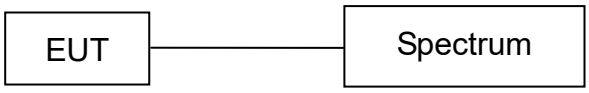
4.4.2 TEST EQUIPMENT

The following test equipment was used during the test：

Equipment/ Facilities	Specifications	Manufacturer	Model#/ Serial#	Due Date of Cal. & Cal. Center
EMI TEST RECEIVER (INCLUDE SPECTRUM ANALYZER)	9 KHz ~ 6 GHz	ROHDE & SCHWARZ	ESL /100176	JUL. 30, 2021 ETC

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

4.4.3 TEST SET-UP



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

4.4.4 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.

4.4.5 EUT OPERATING CONDITION

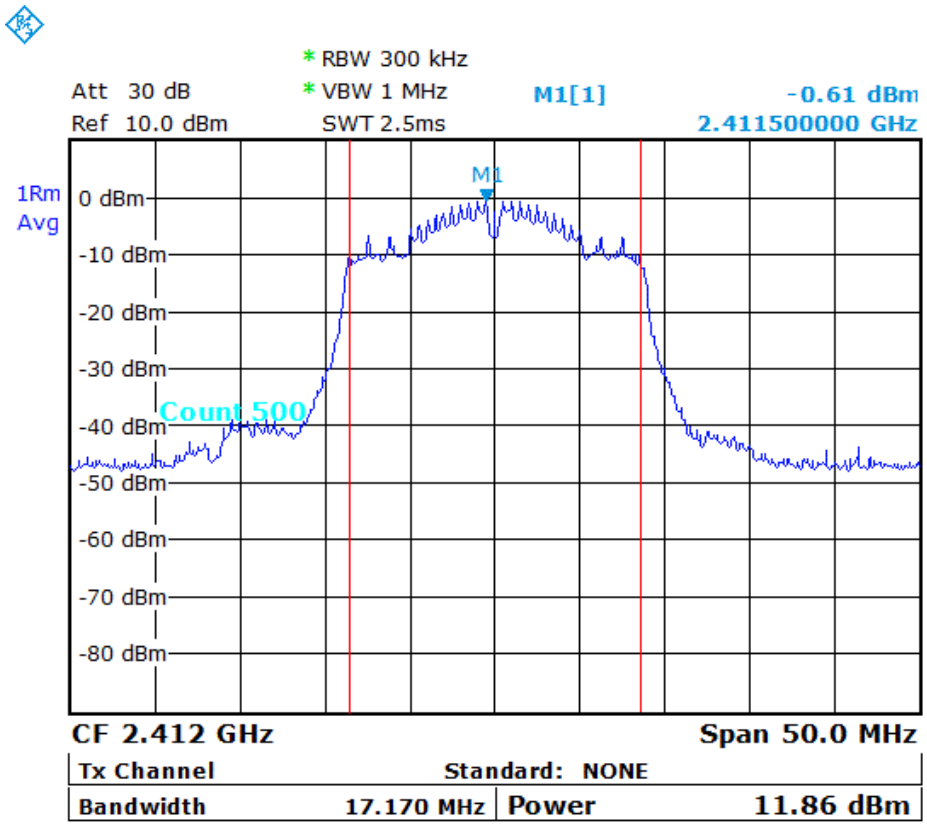
1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

4.4.6 TEST RESULT

Temperature:	25 °C	Humidity:	67 %RH
Detector:	RMS	Test Mode:	802.11g
RBW:	300 kHz	VBW:	1 MHz
Tested By:	Richard Lin	Tested Date:	Oct. 20, 2020

Channel Number	Channel Frequency (MHz)	99% Bandwidth (MHz)	Peak Conducted Output Power		Limit (dBm)
			(dBm)	(mW)	
CH01	2412	17.17	11.86	15.35	30

G_CH01：



4.5 BAND EDGE TEST

4.5.1 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:

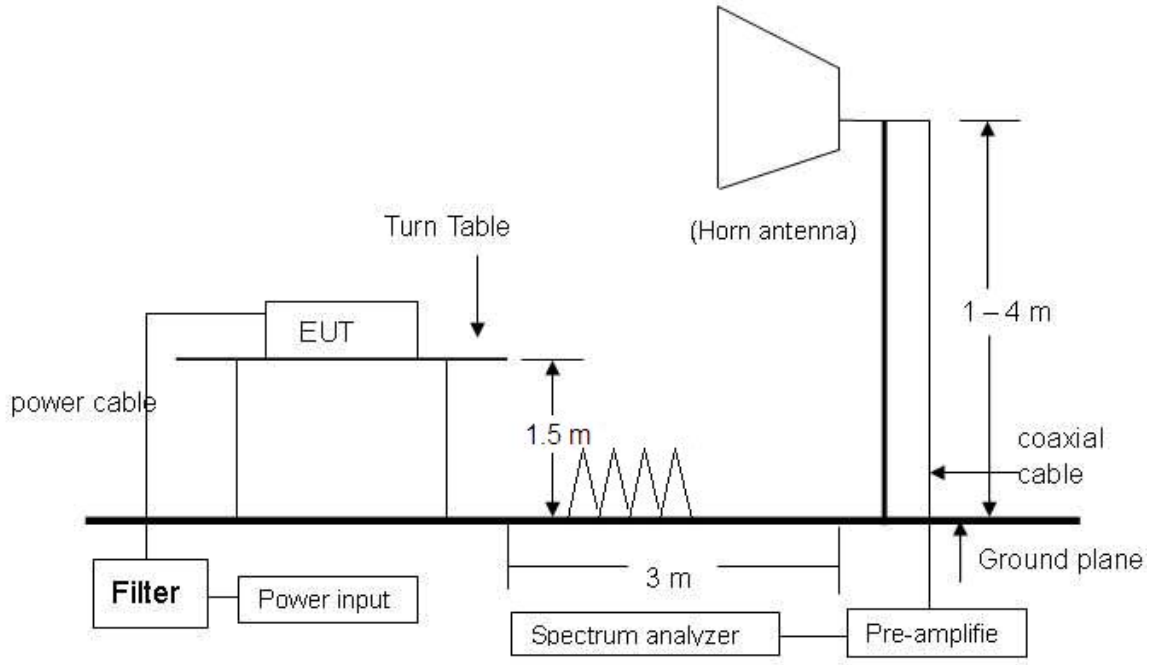
4.5.2 TEST EQUIPMENT

The following test equipment was used during the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER	FINAL TEST BE USED
SPECTRUM ANALYZER	9 kHz ~ 40 GHz	ROHDE & SCHWARZ	FSP40 / 100093	JAN. 06, 2021 ETC	■
PRE-AMPLIFIER	1 GHz ~ 26.5 GHz	AGILENT	8449B/ 3008A01995	JAN. 05, 2021 ETC	■
HORN ANTENNA	1 GHz ~ 18 GHz	EMCO	3115/ 9602-4681	NOV. 13, 2020 ETC	■
HORN ANTENNA	18 ~ 40 GHZ	ETS-LINDGREN	3116 /00032255	JAN. 14, 2021 ETC	■
ANECHOIC CHAMBER	3 M MEASUREMENT	SRT	A01 / SRT001	DEC. 24, 2020 SRT	■
RF CABLE	UP TO 18 GHz 1.5 m	JYEBAO	A30A30-L 142 / EQF-0035(001)	NOV. 24, 2020 ETC	■
RF CABLE	UP TO 26.5 GHz 3.5 m	EMCI	EMC104-SM-SM-3500 / 150601	AUG. 18, 2021 ETC	■
K-TYPE CABLE	UP TO 40 GHz 3 m	HUBER+SUHNER	SF102-46/2*11SK252 /MY2611/2	MAR. 15, 2021 ETC	■
K-TYPE CABLE	UP TO 40 GHz, 1 m	HUBER+SUHNER	SF102/2*11SK252 /MY3331/2	SEP. 16, 2021 ETC	■
FILTER	2 LINE, 30 A	FIL.COIL	FC-943/869	NCR	■
THERMO-HYGRO	15 – 40 ℃, 0- 100% RH	TOP	20-A / 6644	SEP. 07, 2021 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 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.

4.5.4 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.

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.

4.5.6 TEST RESULT

Below 2400MHz (G_CH01)

Temperature:	26 °C	Humidity:	65 %RH
Frequency Range:	2.30 GHz – 2.44 GHz	Tested Mode:	802.11g
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Oct. 06, 2020

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
2398.24	-31.53	28.10	H	56.91	46.42	53.47	42.98	74.00	54.00	-20.53	-11.02
2396.31	-31.53	28.09	V	54.40	43.96	50.96	40.52	74.00	54.00	-23.04	-13.48
2400.00	-31.53	28.10	H	54.06	43.51	50.63	40.08	74.00	54.00	-23.37	-13.92
2400.00	-31.53	28.10	V	50.74	40.29	47.31	36.86	74.00	54.00	-26.69	-17.14

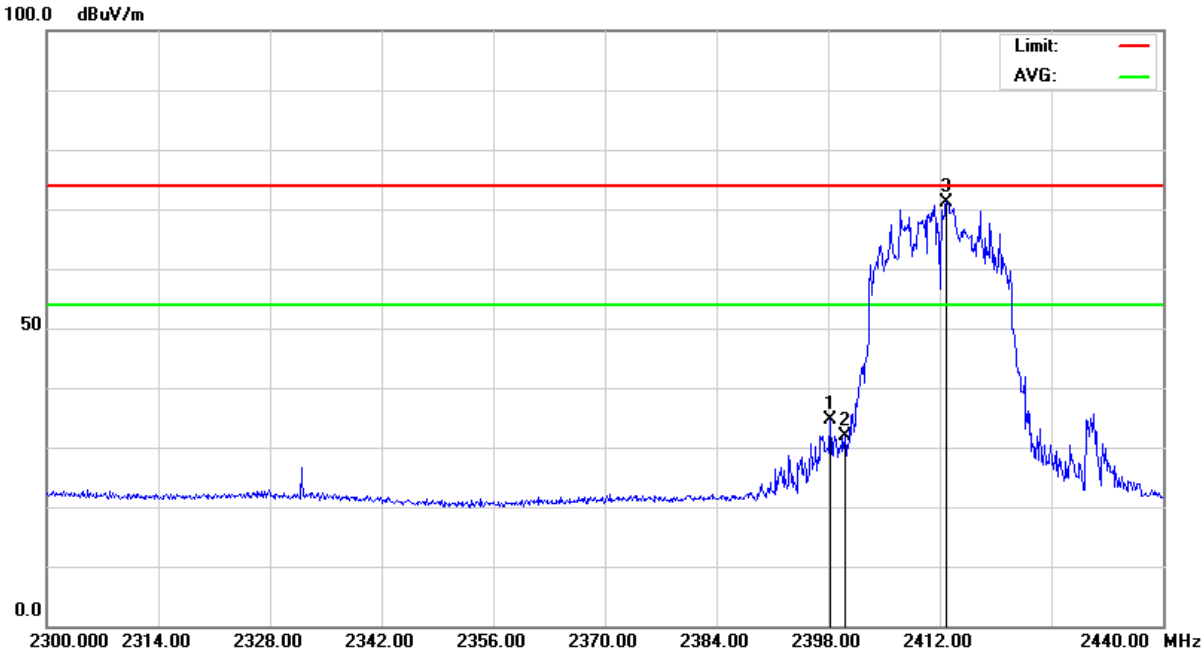
Above 2483.5MHz (G_CH01)

Temperature:	26 °C	Humidity:	65 %RH
Frequency Range:	2.4 GHz – 2.6 GHz	Tested Mode:	802.11g
Detector Type:	PK. and AV.	IF Bandwidth:	1 MHz
Tested By:	Richard Lin	Tested Date:	Oct. 06, 2020

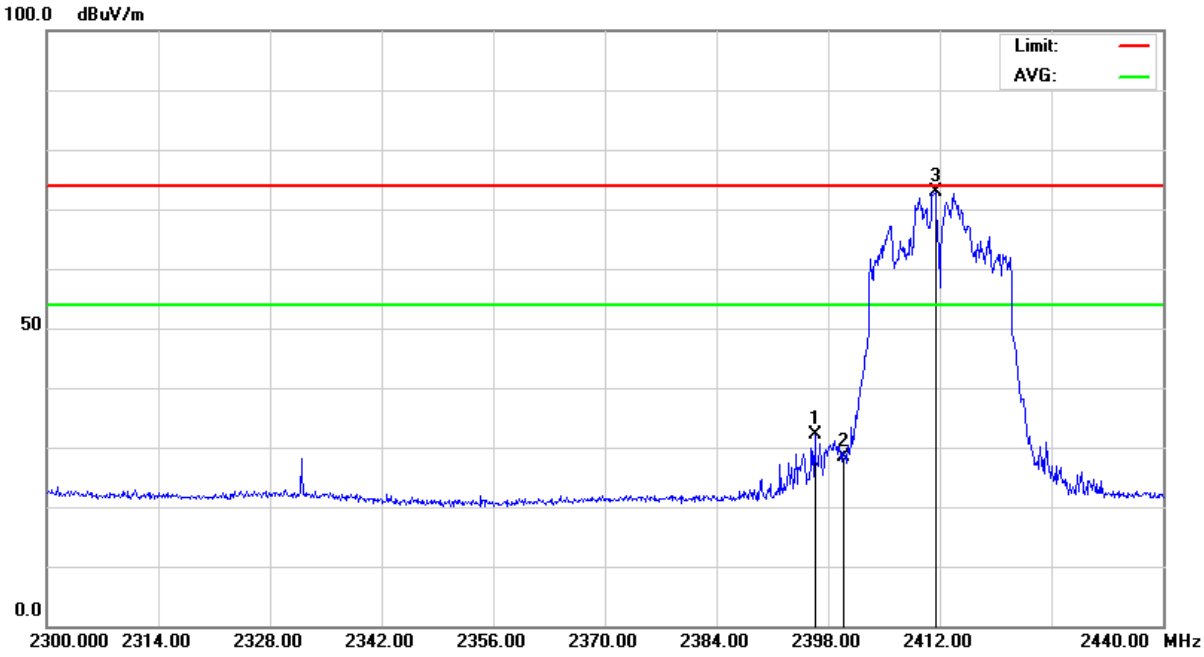
Frequency (MHz)	Correct Factor (dB)	Ant. Fac. (dB/m)	Ant. Pol. (H/V)	Reading (dBuV)		Emission (dBuV/m)		Limit Line (dBuV/m)		Over Limit (dB)	
				PK	AV	PK	AV	PK	AV	PK	AV
2483.50	-31.46	28.33	H	44.54	34.03	41.41	30.90	74.00	54.00	-32.59	-23.10
2483.50	-31.46	28.33	V	44.07	33.58	40.94	30.45	74.00	54.00	-33.06	-23.55
2525.27	-31.43	28.50	H	46.03	35.53	43.09	32.59	74.00	54.00	-30.91	-21.41
2523.45	-31.43	28.49	V	45.57	35.06	42.62	32.11	74.00	54.00	-31.38	-21.89

Below 2400MHz (G_CH01)

Antenna Polarization：Horizontal

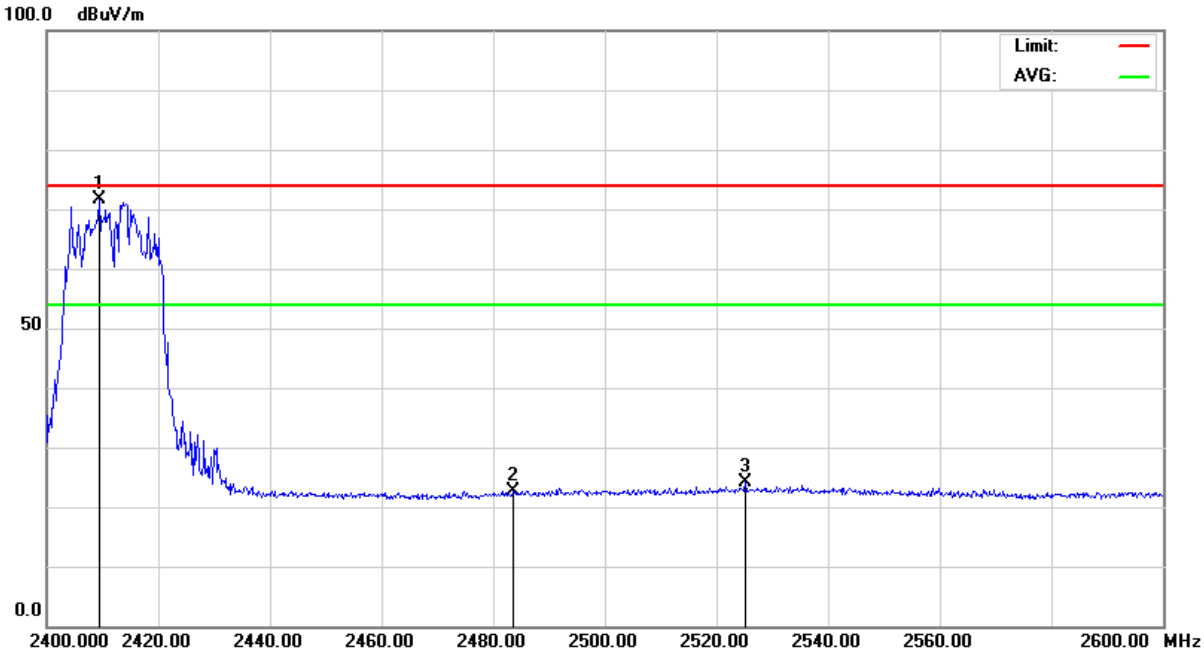


Antenna Polarization：Vertical

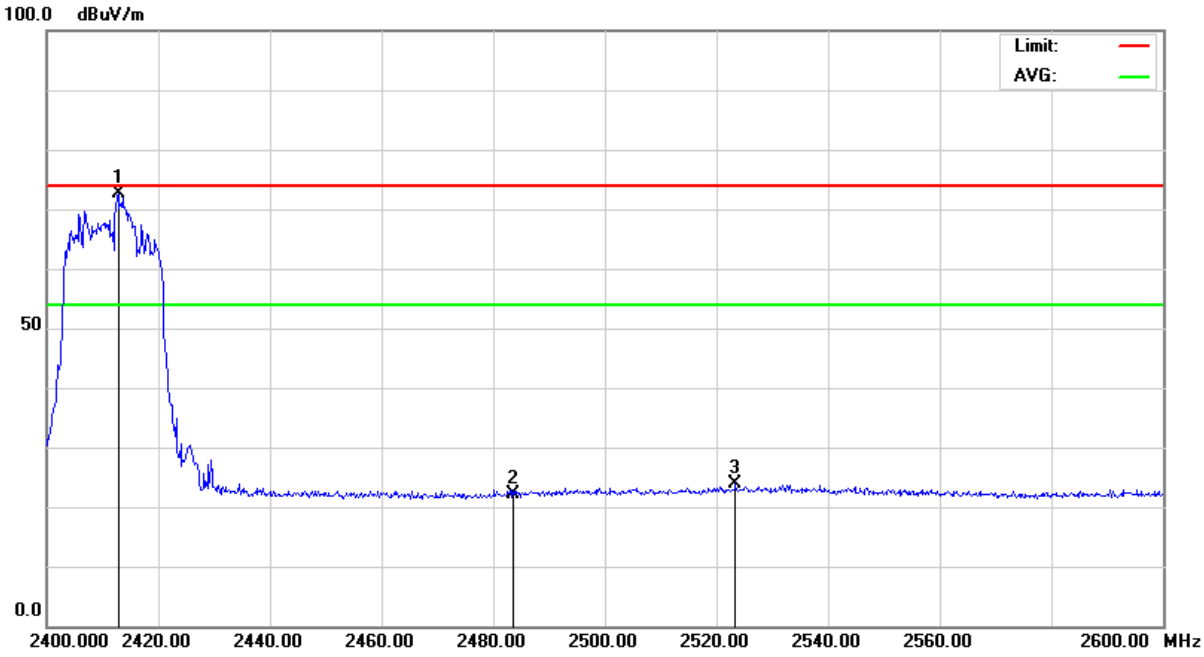


Above 2483.5MHz (G_CH01)

Antenna Polarization：Horizontal



Antenna Polarization：Vertical



4.6 POWER SPECTRAL DENSITY TEST

4.6.1 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

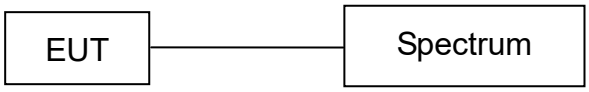
4.6.2 TEST EQUIPMENT

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	JUL. 30, 2021 ETC

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

4.6.3 TEST SET-UP



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

4.6.4 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.

4.6.5 EUT OPERATING CONDITION

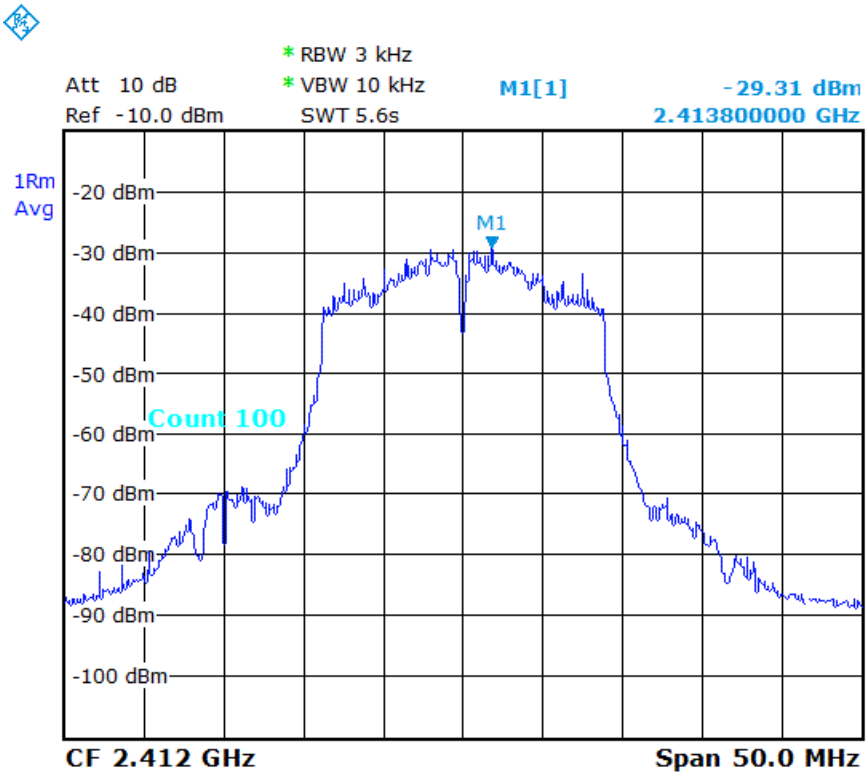
1. Set the EUT under continuous transmission condition.
2. The EUT was set to the highest available power level.

4.6.6 TEST RESULT

Temperature:	25 °C	Humidity:	67 %RH
Detector:	RMS	Test Mode:	802.11g
RBW:	3 kHz	VBW:	10 kHz
Tested By:	Richard Lin	Tested Date:	Oct. 20, 2020

Channel Number	Channel Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)
CH01	2412	-29.31	8

G_CH01：



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 Chip Antenna (Brand：RainSun Model：AN1003). Gain of 1.5 dBi that meet the requirement.

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