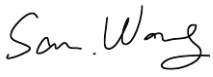
Shenzhen GUOREN Certification Technology Service Co., Ltd.

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No..... :	**GRCTR250202011-02**	
FCC ID..... :	**2ATI2-RIGEL2**	
Compiled by (position+printed name+signature).. :	Testing Engineer Jimmy Wang	
Supervised by (position+printed name+signature).. :	Project Engineer Kelley Zhang	
Approved by (position+printed name+signature).. :	Manager Sam Wang	
Date of issue..... :	Feb. 25, 2025	
Testing Laboratory Name..... :	**Shenzhen GUOREN Certification Technology Service Co., Ltd.**	
Address..... :	101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China	
Applicant's name..... :	**SHENZHEN GREENJOY TECHNOLOGY CO.,LTD**	
Address..... :	2606,UnitA,Building11,Shenzhen Bay Technology and Science Eco-Park,Nanshan,Shenzhen	
Test specification..... **:**		
Standard..... :	**FCC Part 15.247**	

Test item description.....:	**Overhead golf launch monitor**
Trade Mark..... :	GolfJoy
Manufacturer..... :	SHENZHEN GREENJOY TECHNOLOGY CO.,LTD
Model/Type reference..... :	Rigel 2
Listed Models ..... :	Rigel 2 MAX,Rigel 2 Lite
Firmware Version..... :	V1.0
Hardware Version..... :	V1.0
Modulation Type..... :	DSSS/ OFDM
Operation Frequency..... :	From 2412 - 2462MHz
Rating..... :	DC 24V From External Circuit
Result..... :	**PASS**

T E S T R E P O R T

Equipment under Test	:	Overhead golf launch monitor
Model /Type	:	Rigel 2
Listed Models	:	Rigel 2 MAX,Rigel 2 Lite
Applicant	:	**SHENZHEN GREENJOY TECHNOLOGY CO.,LTD**
Address	:	2606,UnitA,Building11,Shenzhen Bay Technology and Science Eco-Park,Nanshan,Shenzhen
Manufacturer	:	**SHENZHEN GREENJOY TECHNOLOGY CO.,LTD**
Address	:	2606,UnitA,Building11,Shenzhen Bay Technology and Science Eco-Park,Nanshan,Shenzhen

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2020: American National Standard for Testing Unlicensed Wireless Devices
KDB558074 D01 v05r02: Guidance for Compliance Measurements on Digital Transmission Systems (DTS) ,Frequency Hopping Spread Spectrum System(HFSS), and Hybrid System Devices Operating Under §15.247 of The FCC rules.

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Feb. 11, 2025
Testing commenced on	:	Feb. 11, 2025
Testing concluded on	:	Feb. 25, 2025

2.2 Product Description

Product Name:	Overhead golf launch monitor
Model/Type reference:	Rigel 2
Listed Models:	Rigel 2 MAX,Rigel 2 Lite(The products are identical in interior structure, electrical circuits and components, just model names, color and installation methods are different.)
Power supply:	DC 24V From External Circuit
Adapter Information:	Model:GM95-240375-F Input:100-240V~ 50/60Hz, 2.5A Output:24.0V⎓3.75A;90.0W
testing sample ID：	GRCTR250202011-1# (Engineer sample), GRCTR250202011-2# (Normal sample)
WIFI:	
Supported type:	802.11b/802.11g/802.11n(H20) /802.11n(H40)
Modulation:	802.11b: DSSS 802.11g/802.11n(H20) /802.11n(H40): OFDM
Operation frequency:	802.11b/802.11g/802.11n(H20): 2412MHz~2462MHz 802.11n(H40): 2422MHz~2452MHz
Channel number:	802.11b/802.11g/802.11n(H20): 11 802.11n(H40): 7
Channel separation:	5MHz
Antenna type:	PCB antenna
Antenna gain*(Supplied by the customer):	3.76 dBi
Remark:*When the information provided by the customer was used to calculate test results, if the information provided by the customer is not accurate, shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.	

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 24V From External Circuit

2.4 Short description of the Equipment under Test (EUT)

This is a Overhead golf launch monitor.
For more details, refer to the user's manual of the EUT.

2.5 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	Notebook	M/N:	Air 14
		Manufacturer:	Xiaomi

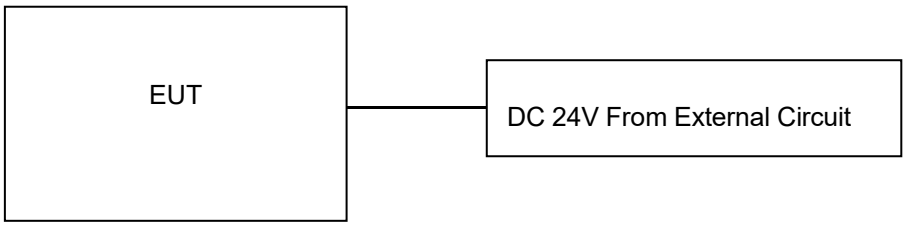
2.6 EUT operation mode

The Applicant provides communication tools software(SecureCRT) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) for testing meet KDB558074 test requirement.

IEEE 802.11b/g/n H20/n H40: Thirteen channels are provided to the EUT.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432		
6	2437		
7	2442		

2.7 Block Diagram of Test Setup



2.8 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.9 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen GUOREN Certification Technology Service Co., Ltd.
101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 920798 Designation Number: CN1304

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6202.01

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27264 CAB identifier: CN0115
Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

CNAS-Lab Code: L15631
Shenzhen GUOREN Certification Technology Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories for the Competence of Testing and Calibration Laboratories.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	15-35 ℃
Relative Humidity	30-60 %
Air Pressure	950-1050mbar

3.4 Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(2)	6dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Conducted Output Power	PASS
FCC Part 15.247(e)	Power Spectral Density	PASS
FCC Part 15.109/ 15.205/ 15.209	Radiated Emissions	PASS

FCC Part 15.247(d)	Band Edge	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

Data Rate Used:
Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel
Maximum Peak Conducted Output Power Power Spectral Density 6dB Bandwidth Spurious RF conducted emission Radiated Emission 9KHz~1GHz& Radiated Emission 1GHz~10th Harmonic	11b/DSSS	1 Mbps	1/6/11
	11g/OFDM	6 Mbps	1/6/11
	11n(20MHz)/OFDM	6.5Mbps	1/6/11
	11n(40MHz)/OFDM	13.5Mbps	3/6/9
Band Edge	11b/DSSS	1 Mbps	1/11
	11g/OFDM	6 Mbps	1/11
	11n(20MHz)/OFDM	6.5Mbps	1/11
	11n(40MHz)/OFDM	13.5Mbps	3/6/9

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen GUOREN Certification Technology Service Co., Ltd.quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GUOREN Certification Technology Service Co., Ltd.:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Max output power	30MHz~18GHz	0.54 dB	(1)
Power spectral density	/	0.56 dB	(1)
Spectrum bandwidth	/	1.2%	(1)

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

3.6 Equipments Used during the Test

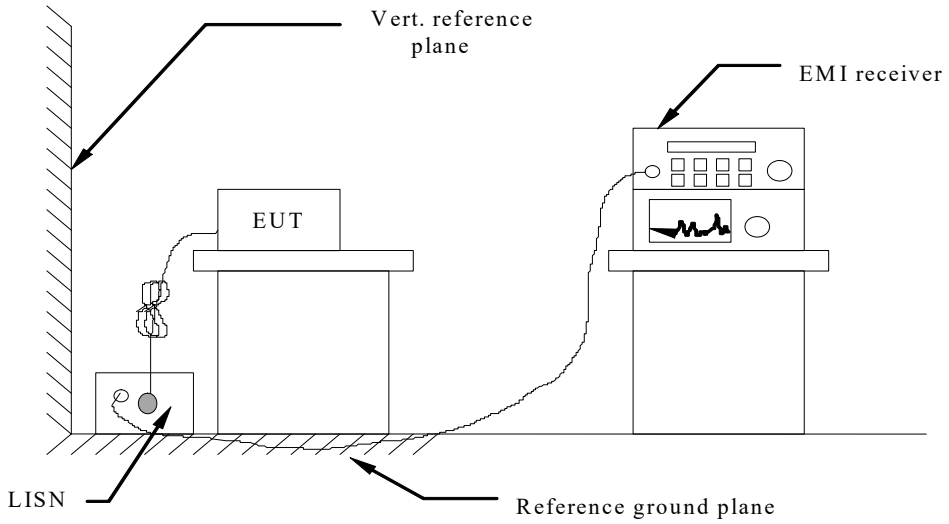
Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	GRCTEE009	2024/09/19	2025/09/18
LISN	R&S	ENV216	GRCTEE010	2024/09/19	2025/09/18
EMI Test Receiver	R&S	ESPI	GRCTEE017	2024/09/19	2025/09/18

EMI Test Receiver	R&S	ESCI	GRCTEE008	2024/09/19	2025/09/18
Spectrum Analyzer	Agilent	N9020A	GRCTEE002	2024/09/19	2025/09/18
Spectrum Analyzer	R&S	FSP	GRCTEE003	2024/09/20	2025/09/19
Vector Signal generator	Agilent	N5181A	GRCTEE007	2024/09/19	2025/09/18
Analog Signal Generator	R&S	SML03	GRCTEE006	2024/09/19	2025/09/18
Climate Chamber	QIYA	LCD-9530	GRCTES016	2024/09/19	2025/09/18
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	GRCTEE018	2023/09/28	2026/09/27
Horn Antenna	Schwarzbeck	BBHA 9120D	GRCTEE019	2023/09/28	2026/09/27
Loop Antenna	Zhinan	ZN30900C	GRCTEE020	2023/10/15	2026/10/14
Horn Antenna	Beijing Hangwei Dayang	OBH100400	GRCTEE049	2023/09/28	2026/09/27
Amplifier	Schwarzbeck	BBV 9745	GRCTEE021	2024/09/19	2025/09/18
Amplifier	Taiwan chengyi	EMC051845B	GRCTEE022	2024/09/19	2025/09/18
Temperature/Humidity Meter	Huaguan	HG-308	GRCTES037	2024/09/19	2025/09/18
Directional coupler	NARDA	4226-10	GRCTEE004	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA18	GRCTEE053	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA27	GRCTEE054	2024/09/19	2025/09/18
Automated filter bank	Tonscend	JS0806-F	GRCTEE055	2024/09/19	2025/09/18
Power Sensor	Agilent	U2021XA	GRCTEE070	2024/09/19	2025/09/18
Cable	Times	Cable-CE	GRCTEE086	2024/09/19	2025/09/18
Cable	Times	Cable-RE-1	GRCTEE087	2024/09/19	2025/09/18
Cable	Times	Cable-RE-2	GRCTEE088	2024/09/19	2025/09/18
EMI Test Software	ROHDE & SCHWARZ	ESK1-V1.71	GRCTEE060	N/A	N/A
EMI Test Software	Fera	EZ-EMC	GRCTEE061	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2020.
2 Support equipment, if needed, was placed as per ANSI C63.10-2020
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2020
4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) and RSS-Gen Issue 5 AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

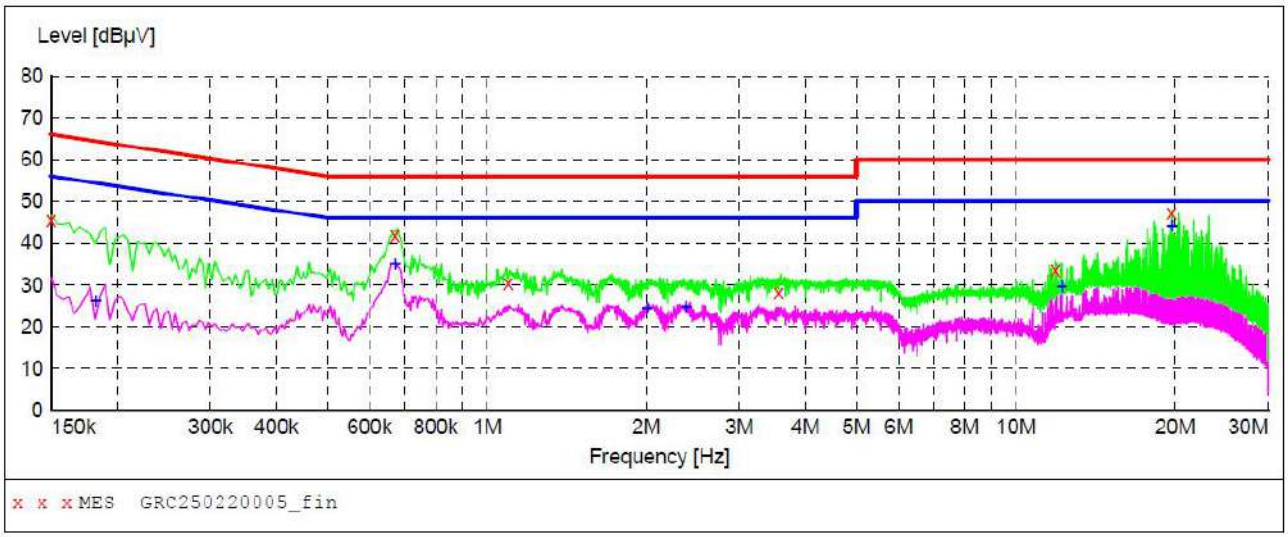
TEST RESULTS

Remark:

1. All three channels (lowest/middle/highest) of each mode were measured and recorded worst case at 802.11b low channel.

2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

Power supply:	DC 24V from Adapter AC 120V/60Hz	Polarization	L



MEASUREMENT RESULT: "GRC250220005_fin"

2/20/2025 9:21AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	45.40	9.6	66	20.6	QP	L1	GND
0.670000	41.80	9.6	56	14.2	QP	L1	GND
1.098000	30.40	10.0	56	25.6	QP	L1	GND
3.554000	28.10	9.9	56	27.9	QP	L1	GND
11.894000	33.60	10.0	60	26.4	QP	L1	GND
19.710000	47.30	10.2	60	12.7	QP	L1	GND

MEASUREMENT RESULT: "GRC250220005_fin2"

2/20/2025 9:21AM

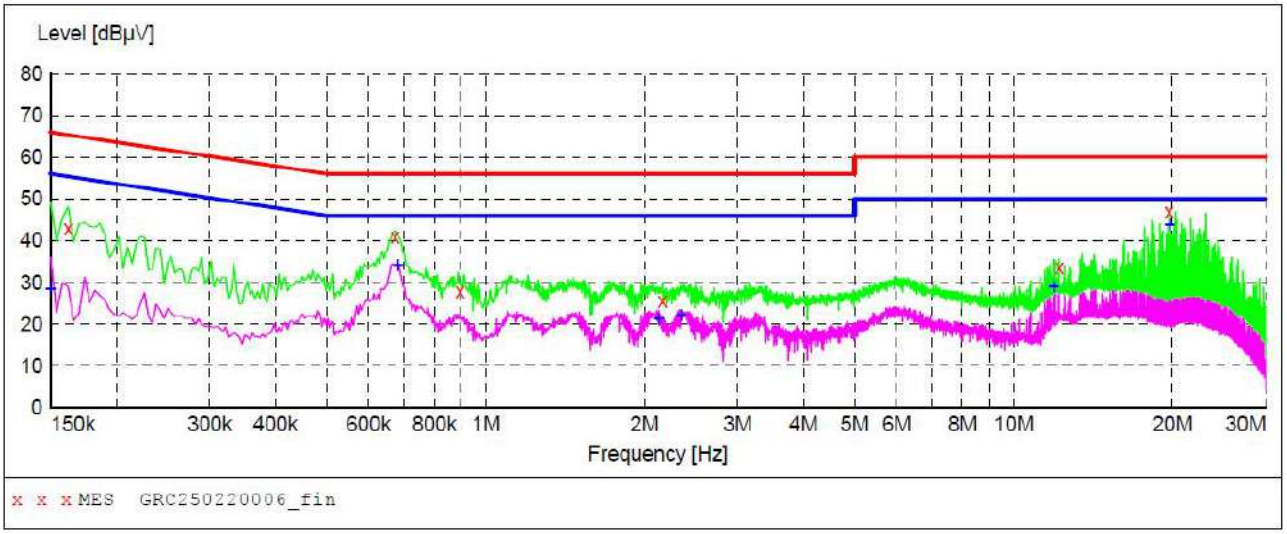
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.182000	26.20	9.5	54	28.2	AV	L1	GND
0.670000	35.10	9.6	46	10.9	AV	L1	GND
2.006000	24.40	10.0	46	21.6	AV	L1	GND
2.378000	24.60	10.0	46	21.4	AV	L1	GND
12.198000	29.50	10.0	50	20.5	AV	L1	GND
19.710000	44.20	10.2	50	5.8	AV	L1	GND

Note:1).Level (dBµV)= Reading (dBµV)+ Transducer (dB)

2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

Power supply:	DC 24V from Adapter AC 120V/60Hz	Polarization	N



MEASUREMENT RESULT: "GRC250220006_fin"

2/20/2025 9:25AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.162000	42.80	9.5	65	22.6	QP	N	GND
0.674000	41.00	9.6	56	15.0	QP	N	GND
0.894000	27.80	9.7	56	28.2	QP	N	GND
2.162000	25.60	10.0	56	30.4	QP	N	GND
12.198000	33.50	10.0	60	26.5	QP	N	GND
19.710000	47.00	10.2	60	13.0	QP	N	GND

MEASUREMENT RESULT: "GRC250220006_fin2"

2/20/2025 9:25AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	28.40	9.6	56	27.6	AV	N	GND
0.682000	34.20	9.6	46	11.8	AV	N	GND
2.126000	21.30	10.0	46	24.7	AV	N	GND
2.342000	22.10	10.0	46	23.9	AV	N	GND
11.894000	29.10	10.0	50	20.9	AV	N	GND
19.710000	43.90	10.2	50	6.1	AV	N	GND

Note:1).Level (dBµV)= Reading (dBµV)+ Transducer (dB)

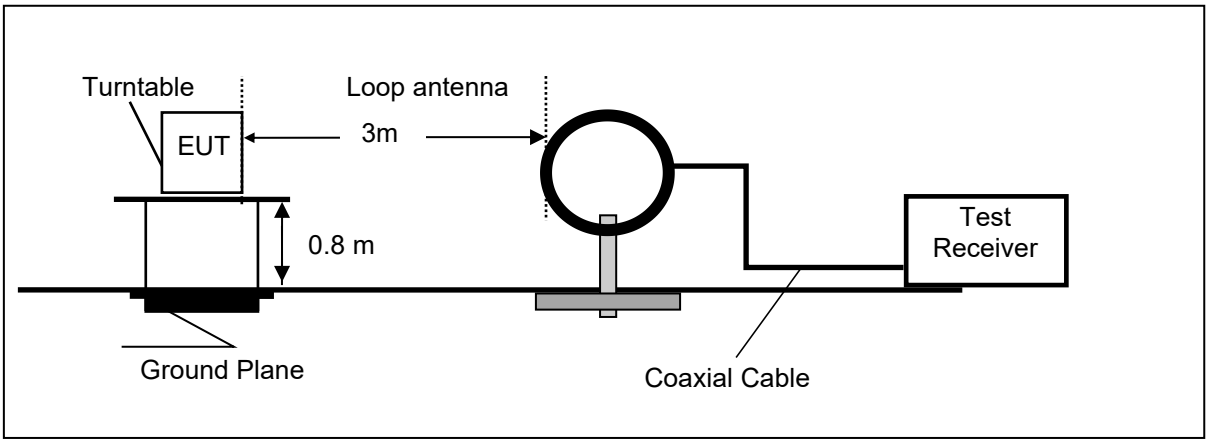
2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

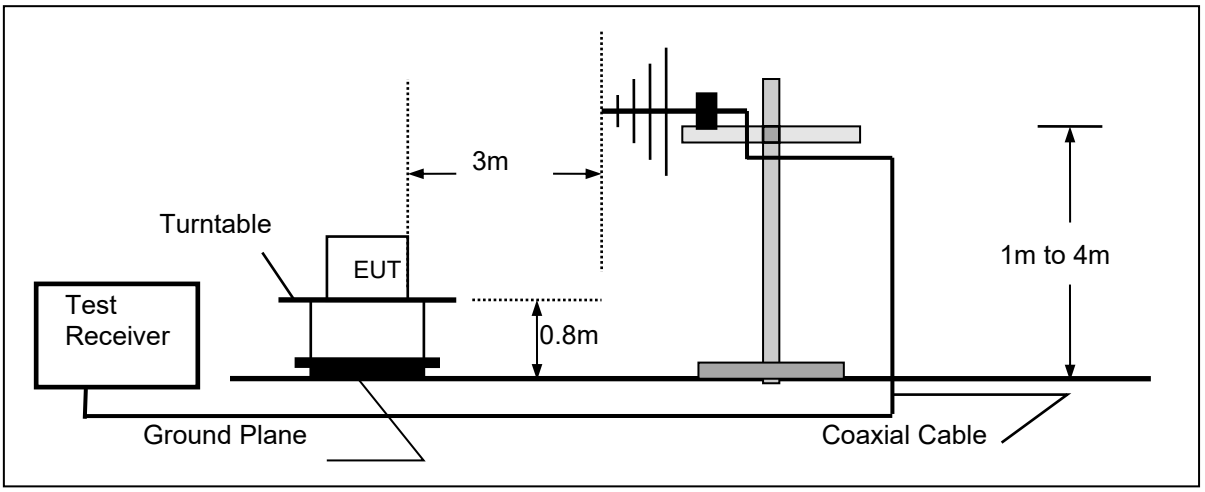
4.2 Radiated Emission

TEST CONFIGURATION

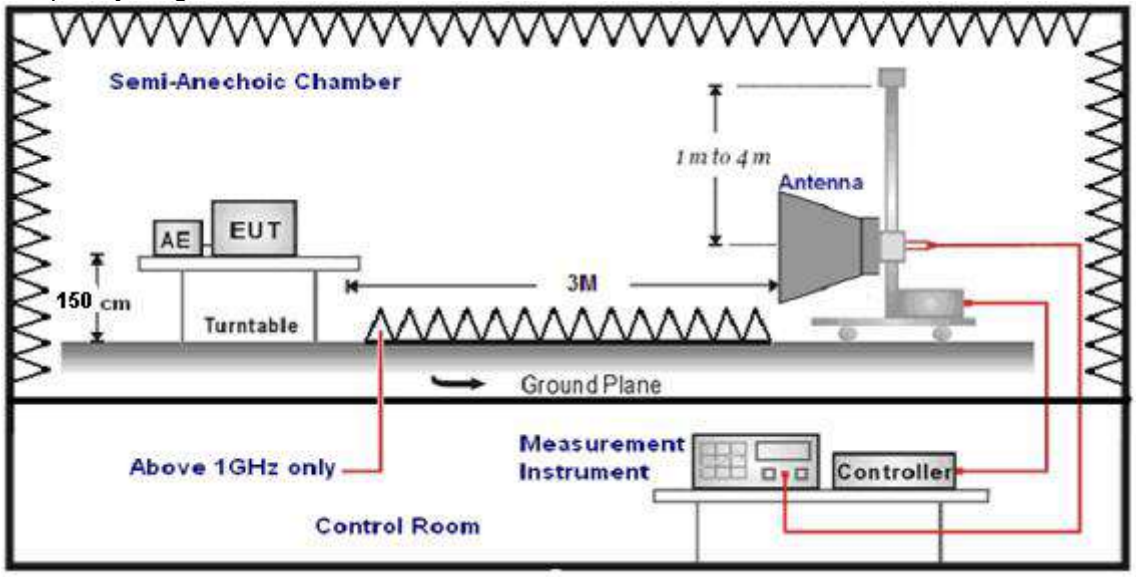
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz, the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-40GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

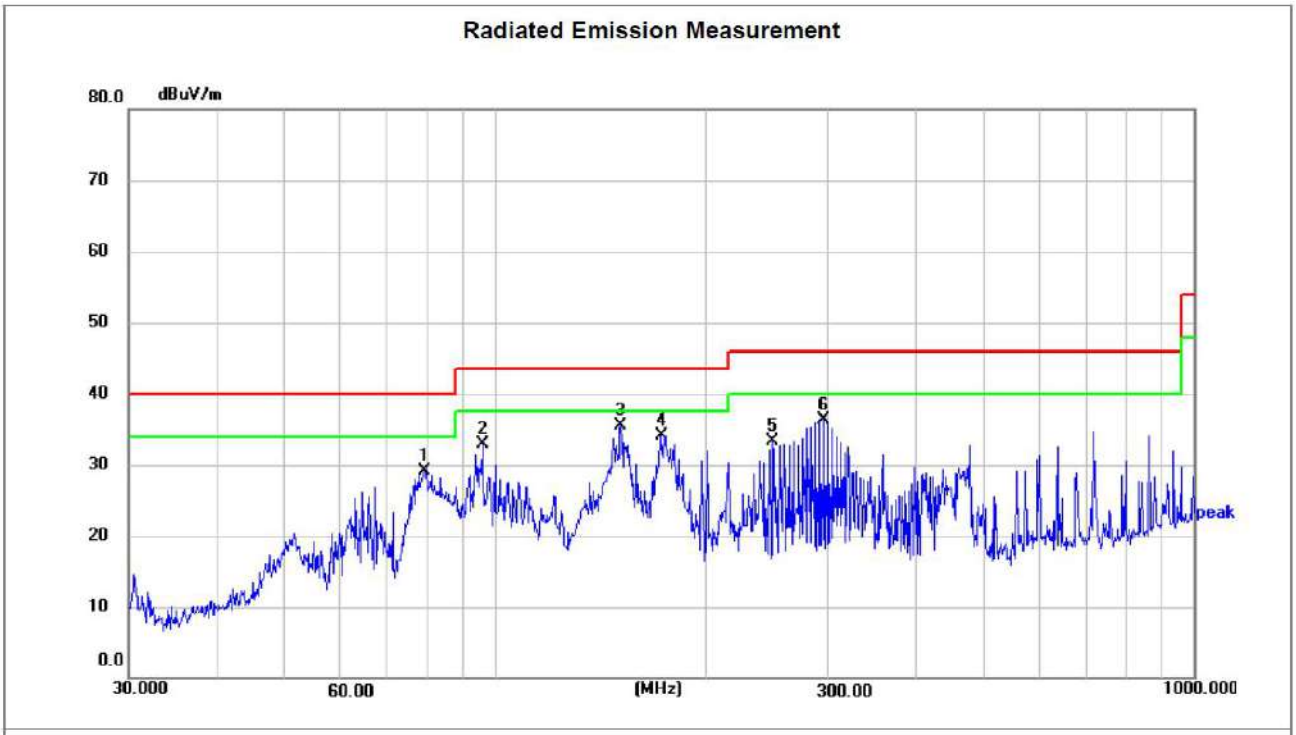
TEST RESULTS

Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. All three channels (lowest/middle/highest) of each mode were measured below 1GHz and recorded worst case at 802.11b low channel.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT: Overhead golf launch monitor
M/N: Rigel 2
Mode: 802.11b CH 01
Note: N/A

Polarization: *Horizontal*
Power: AC120V/60Hz
Distance: 3m

Temperature: 18(C)
Humidity: 52 %

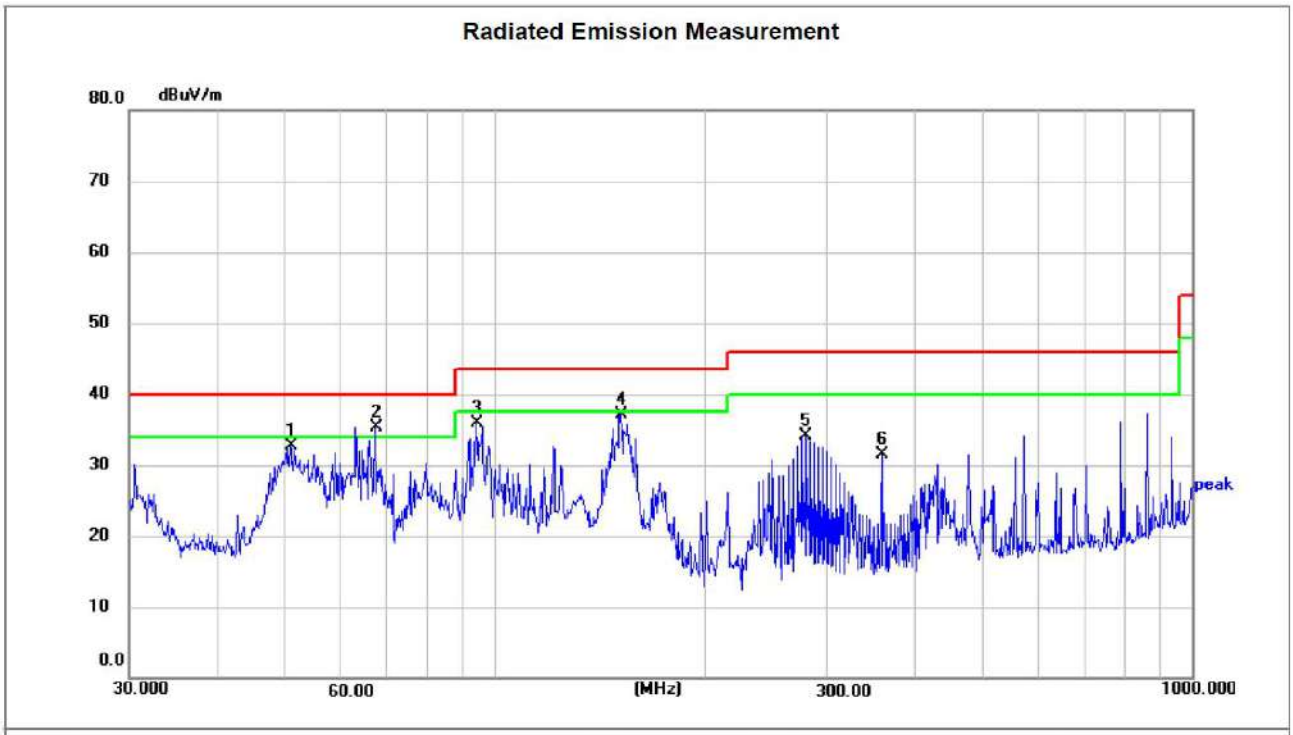
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	79.5209	51.62	-22.57	29.05	40.00	-10.95	peak	200	1	P	
2	96.0986	52.64	-19.73	32.91	43.50	-10.59	peak	200	208	P	
3 *	151.5972	57.30	-21.73	35.57	43.50	-7.93	peak	200	67	P	
4	172.5988	55.32	-21.13	34.19	43.50	-9.31	peak	200	199	P	
5	249.4250	51.54	-18.31	33.23	46.00	-12.77	peak	100	80	P	
6	296.1836	53.45	-17.08	36.37	46.00	-9.63	peak	100	71	P	

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Level (dBμV/m) - Limit (dBμV/m)

Vertical



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT: Overhead golf launch monitor
M/N: Rigel 2
Mode: 802.11b CH 01
Note: N/A

Polarization: *Vertical*
Power: AC120V/60Hz
Distance: 3m

Temperature: 18(C)
Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	50.9420	50.14	-17.52	32.62	40.00	-7.38	peak	100	358	P	
2 *	67.4382	55.48	-20.20	35.28	40.00	-4.72	peak	100	59	P	
3	94.0979	56.02	-20.05	35.97	43.50	-7.53	peak	100	36	P	
4	151.5972	58.89	-21.73	37.16	43.50	-6.34	peak	100	9	P	
5	280.0237	51.67	-17.51	34.16	46.00	-11.84	peak	100	27	P	
6	359.1860	47.80	-16.39	31.41	46.00	-14.59	peak	100	339	P	

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)
2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)
3). Margin(dB) = Level (dBμV/m) - Limit (dBμV/m)

For 1GHz to 25GHz

Note: 802.11b/802.11g/802.11n (H20)/802.11n (H40) Mode all have been tested, only worse case 802.11b mode is reported.

(above 1GHz)

Frequency(MHz):			2412		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4824.00	54.05	PK	74	19.95	75.28	28.37	5.10	54.70	-21.23
4824.00	42.36	AV	54	11.64	63.59	28.37	5.10	54.70	-21.23
7236.00	51.22	PK	74	22.78	65.71	34.10	6.42	55.01	-14.49
7236.00	39.44	AV	54	14.56	53.93	34.10	6.42	55.01	-14.49

Frequency(MHz):			2412		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4824.00	55.20	PK	74	18.80	76.43	28.37	5.10	54.70	-21.23
4824.00	42.80	AV	54	11.20	64.03	28.37	5.10	54.70	-21.23
7236.00	51.81	PK	74	22.19	66.30	34.10	6.42	55.01	-14.49
7236.00	38.94	AV	54	15.06	53.43	34.10	6.42	55.01	-14.49

Frequency(MHz):			2437		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4874.00	54.62	PK	74	19.38	74.89	28.76	5.35	54.38	-20.27
4874.00	42.18	AV	54	11.82	62.45	28.76	5.35	54.38	-20.27
7311.00	52.66	PK	74	21.34	66.29	34.40	6.83	54.86	-13.63
7311.00	40.54	AV	54	13.46	54.17	34.40	6.83	54.86	-13.63

Frequency(MHz):			2437		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4874.00	55.86	PK	74	18.14	76.13	28.76	5.35	54.38	-20.27
4874.00	42.20	AV	54	11.80	62.47	28.76	5.35	54.38	-20.27
7311.00	53.55	PK	74	20.45	67.18	34.40	6.83	54.86	-13.63
7311.00	41.64	AV	54	12.36	55.27	34.40	6.83	54.86	-13.63

Frequency(MHz):			2462		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4924.00	54.98	PK	74	19.02	74.43	29.54	5.66	54.65	-19.45
4924.00	42.32	AV	54	11.68	61.77	29.54	5.66	54.65	-19.45
7386.00	54.26	PK	74	19.74	67.40	34.51	7.25	54.9	-13.14
7386.00	40.98	AV	54	13.02	54.12	34.51	7.25	54.9	-13.14

Frequency(MHz):			2462		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4924.00	56.09	PK	74	17.91	75.54	29.54	5.66	54.65	-19.45
4924.00	43.28	AV	54	10.72	62.73	29.54	5.66	54.65	-19.45
7386.00	51.85	PK	74	22.15	64.99	34.51	7.25	54.9	-13.14
7386.00	42.91	AV	54	11.09	56.05	34.51	7.25	54.9	-13.14

1) Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor.
2) Margin value = Limits-Emission level.
3) -- Mean the PK detector measured value is below average limit.
4) The other emission levels were very low against the limit.
5) RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

Results of Band Edges Test (Radiated)

Note: 802.11b/802.11g/802.11n (H20)/802.11n (H40) Mode all have been tested, only worse case 802.11b mode is reported.

Frequency(MHz):			**2412**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	54.16	PK	74	19.84	78.88	25.72	4.32	54.76	-24.72
2390.00	39.33	AV	54	14.67	64.05	25.72	4.32	54.76	-24.72
2400.00	56.72	PK	74	17.28	81.15	25.73	4.33	54.75	-24.26
2400.00	41.49	AV	54	12.51	65.92	25.73	4.33	54.75	-24.26
Frequency(MHz):			**2412**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	54.96	PK	74	19.04	79.68	25.72	4.32	54.76	-24.72
2390.00	37.95	AV	54	16.05	62.67	25.72	4.32	54.76	-24.72
2400.00	56.31	PK	74	17.69	80.74	25.73	4.33	54.75	-24.26
2400.00	41.15	AV	54	12.85	65.58	25.73	4.33	54.75	-24.26
Frequency(MHz):			**2462**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	54.92	PK	74	19.08	79.49	25.78	4.48	54.83	-24.57
2483.50	39.31	AV	54	14.69	63.88	25.78	4.48	54.83	-24.57
Frequency(MHz):			**2462**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	55.34	PK	74	18.66	79.91	25.78	4.48	54.83	-24.57
2483.50	38.96	AV	54	15.04	63.53	25.78	4.48	54.83	-24.57

Note：

1) Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor.
2) Margin value = Limits-Emission level.
3) -- Mean the PK detector measured value is below average limit.
4) The other emission levels were very low against the limit.
5) RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

4.3 Maximum Conducted Output Power

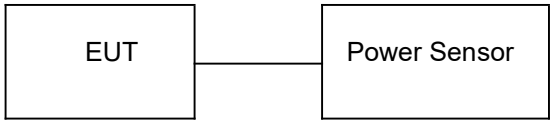
Limit

The Maximum Peak Output Power Measurement is 30dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

Type	Channel	Output power PK (dBm)	Limit (dBm)	Result
802.11b	01	10.22	30.00	Pass
	06	10.45		
	11	10.95		
802.11g	01	10.20	30.00	Pass
	06	10.28		
	11	10.88		
802.11n(HT20)	01	10.26	30.00	Pass
	06	10.21		
	11	10.94		
802.11n(HT40)	03	10.71	30.00	Pass
	06	10.68		
	09	10.02		

Note:
1) Measured output power at difference data rate for each mode and recorded worst case for each mode.
2) Test results including cable loss.
3) Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40.

4.4 Power Spectral Density

Limit

The resulting peak PSD level shall not be greater than 8 dBm/3KHz.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level shall not be greater than 8 dBm/3KHz.

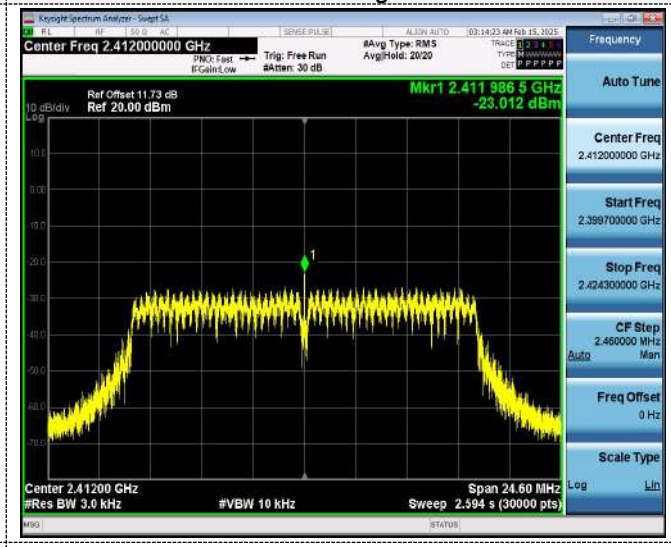
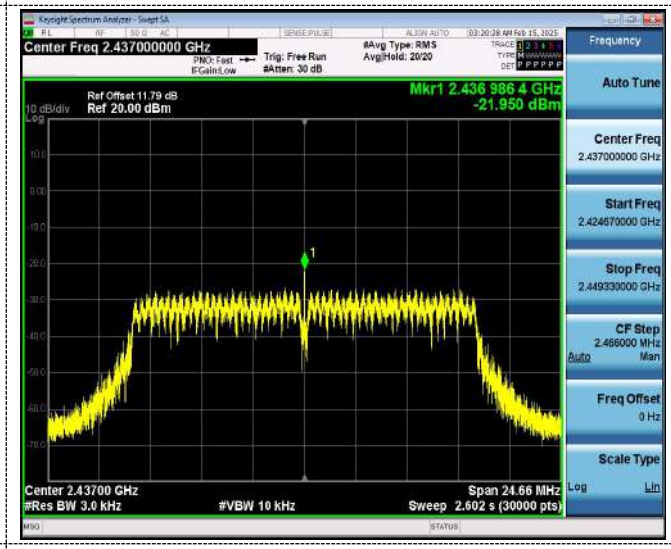
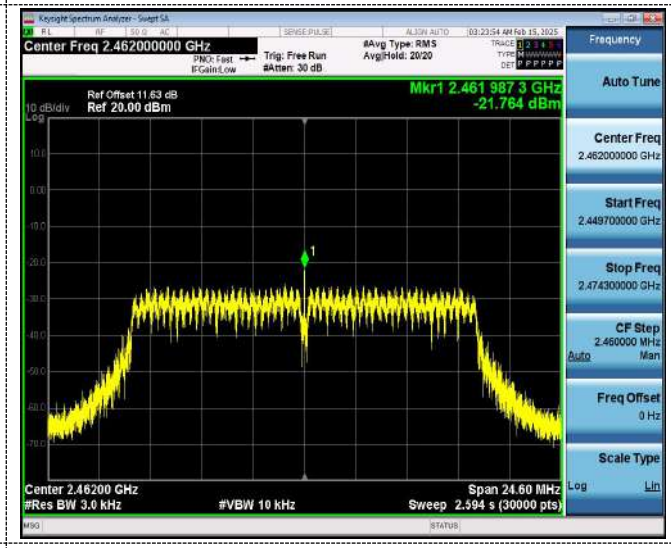
Test Configuration

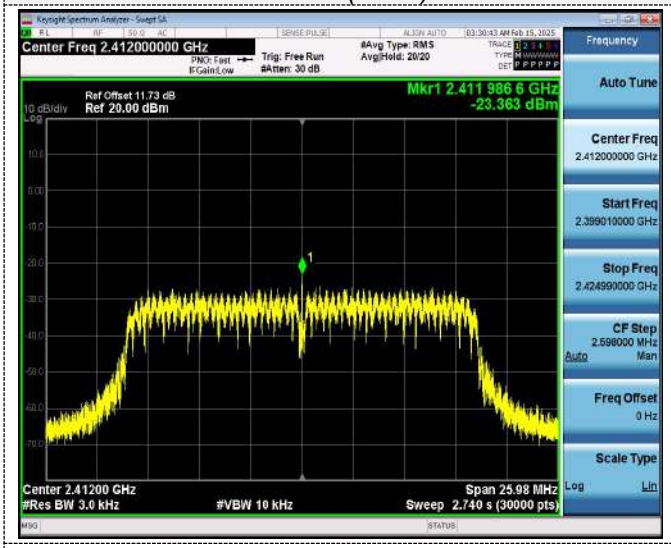
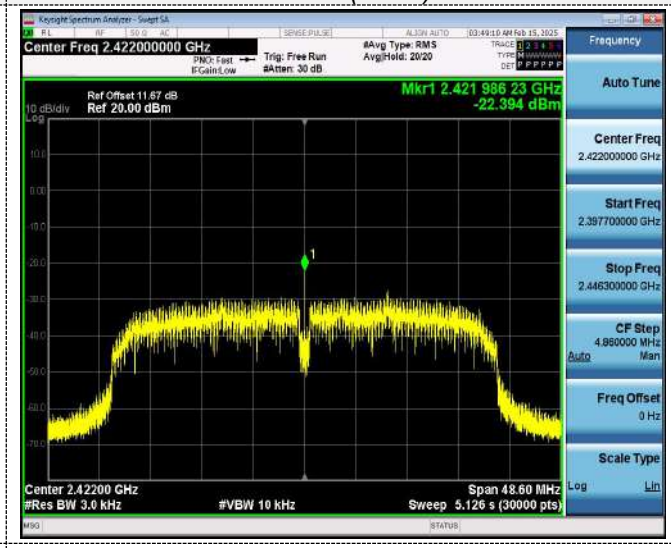
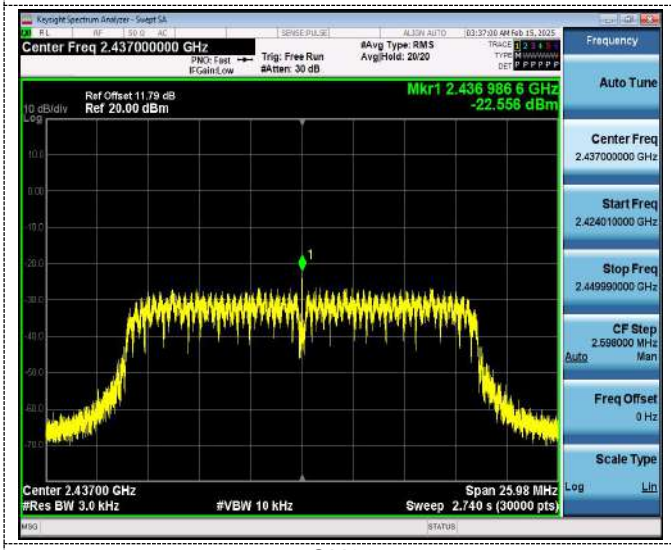
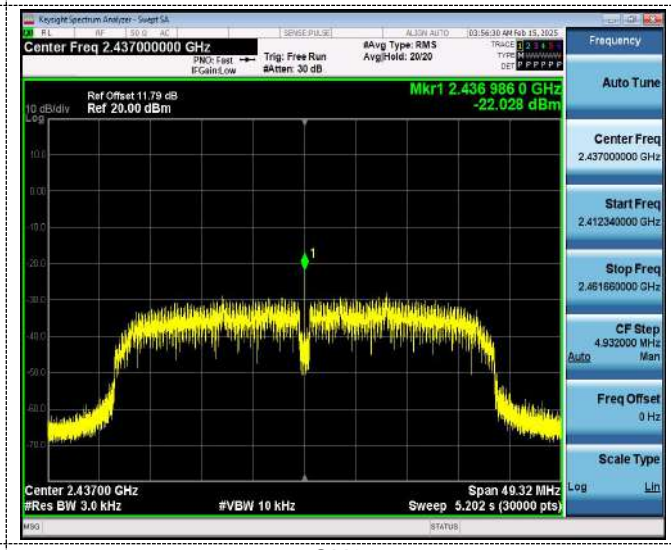
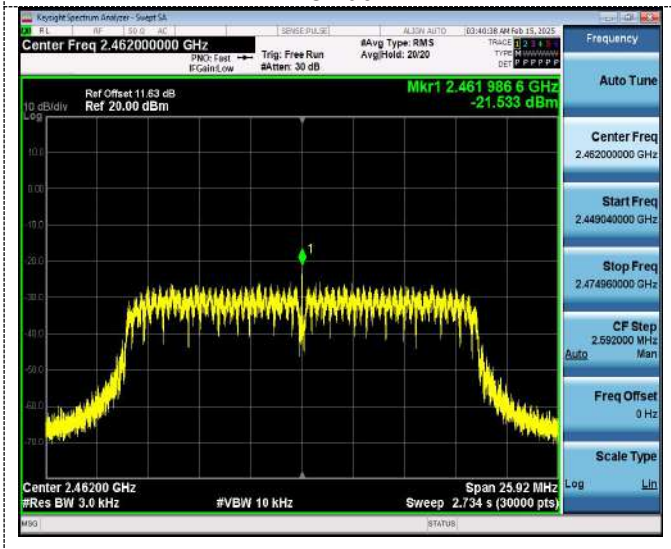
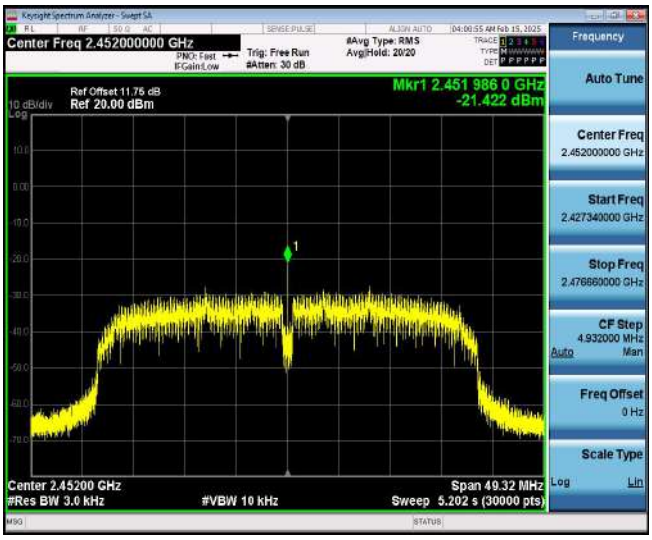
Test Results

Type	Channel	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
802.11b	01	-21.75	8.00	Pass
	06	-22.69		
	11	-21.74		
802.11g	01	-23.01	8.00	Pass
	06	-21.95		
	11	-21.76		
802.11n(HT20)	01	-23.36	8.00	Pass
	06	-22.56		
	11	-21.53		
802.11n(HT40)	03	-22.39	8.00	Pass
	06	-22.03		
	09	-21.42		

Note:
1) Measured peak power spectrum density at difference data rate for each mode and recorded worst case for each mode.
2) Test results including cable loss;
3) Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40.

Please refer to following plots;

802.11b	802.11g
	
CH01	CH01
	
CH06	CH06
	
CH11	CH11

802.11n(HT20)	802.11n(HT40)
	
CH01	CH03
	
CH06	CH06
	
CH11	CH09

4.5 6dB Bandwidth

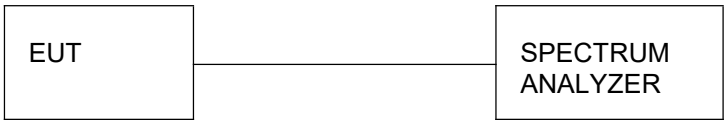
Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

Test Configuration

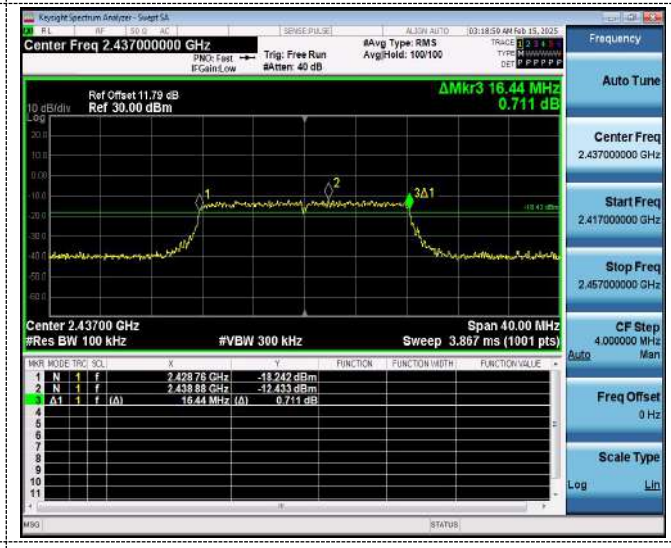
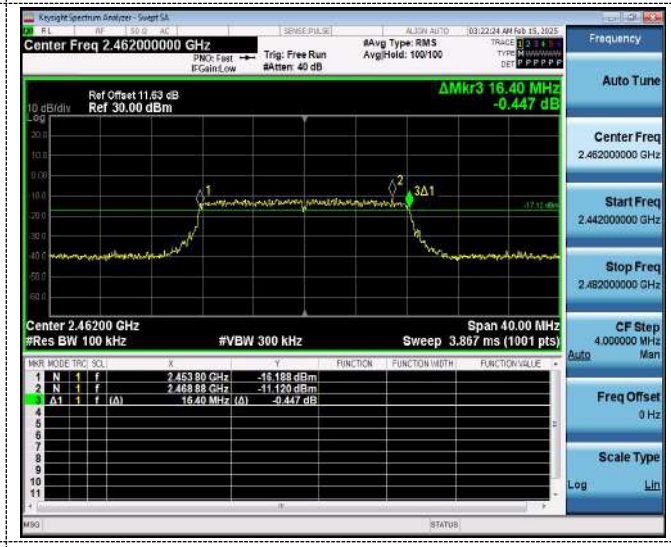


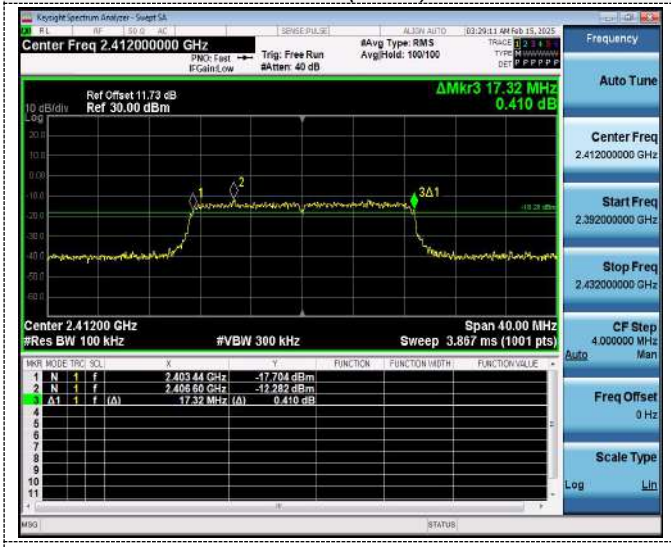
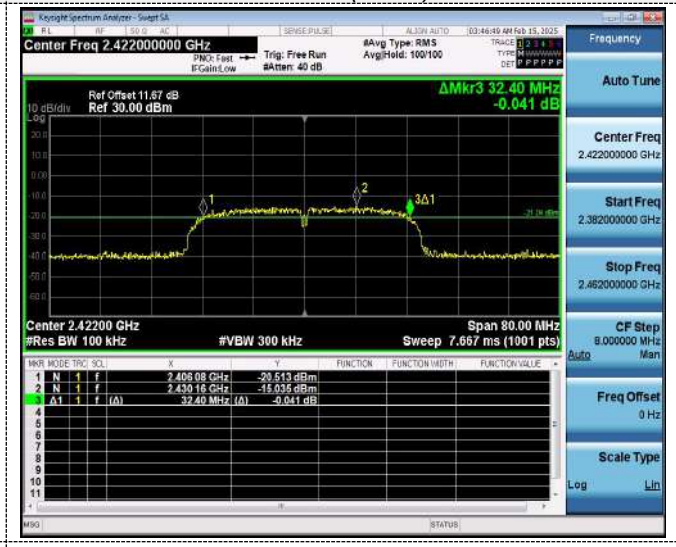
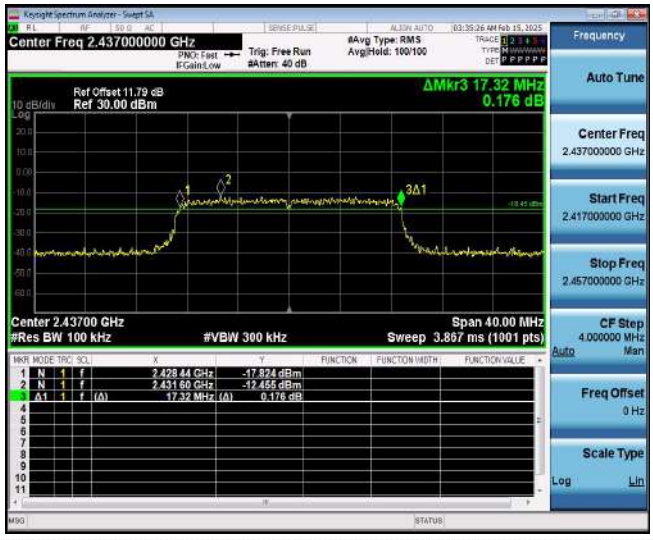
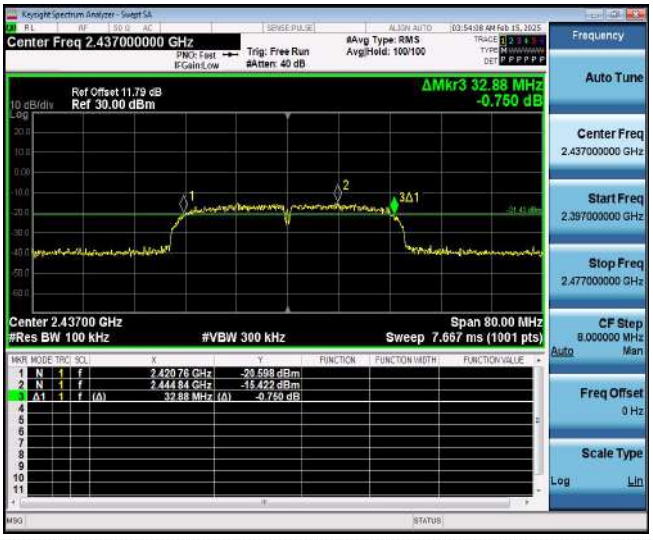
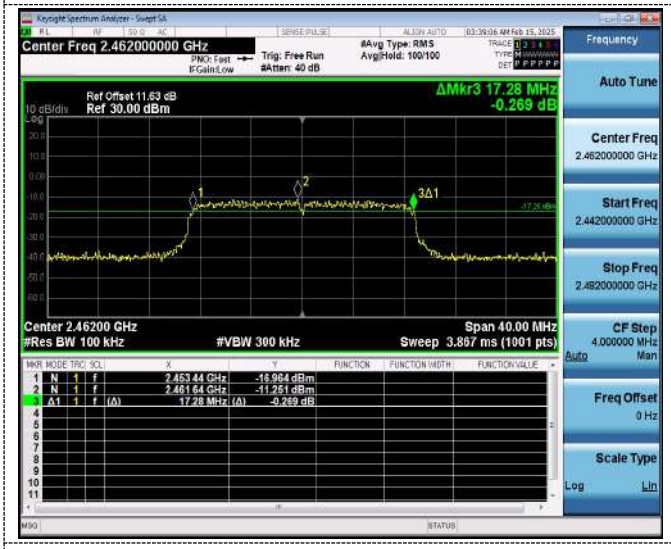
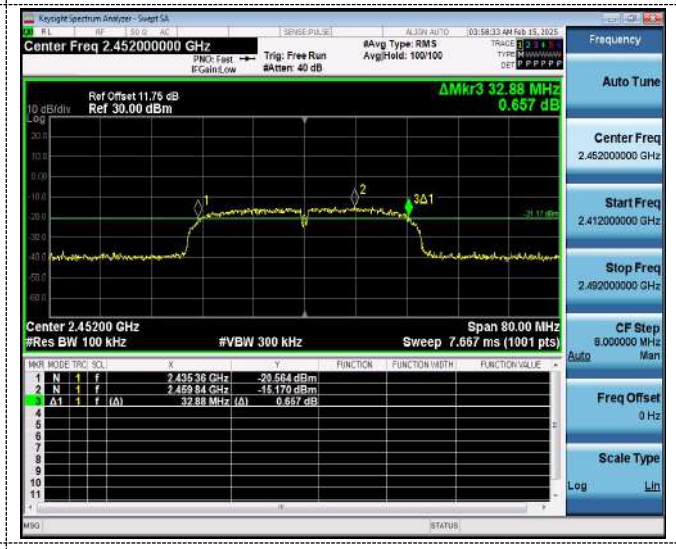
Test Results

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11b	01	10.000	≥500	Pass
	06	8.760		
	11	9.360		
802.11g	01	16.400	≥500	Pass
	06	16.440		
	11	16.400		
802.11n(HT20)	01	17.320	≥500	Pass
	06	17.320		
	11	17.280		
802.11n(HT40)	03	32.400	≥500	Pass
	06	32.880		
	09	32.880		

Note:
1) Measured peak power spectrum density at difference data rate for each mode and recorded worst case for each mode.
2) Test results including cable loss;
3) Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40;

Please refer to following plots;

802.11b	802.11g
	
CH01	CH01
	
CH06	CH06
	
CH11	CH11

802.11n(HT20)	802.11n(HT40)
	
CH01	CH03
	
CH06	CH06
	
CH11	CH09

4.6 Out-of-band Emissions

Limit

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 con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this 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.

Test Procedure

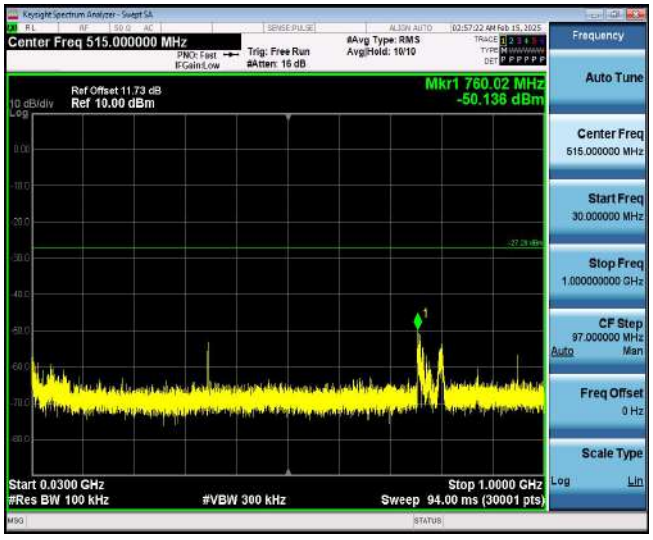
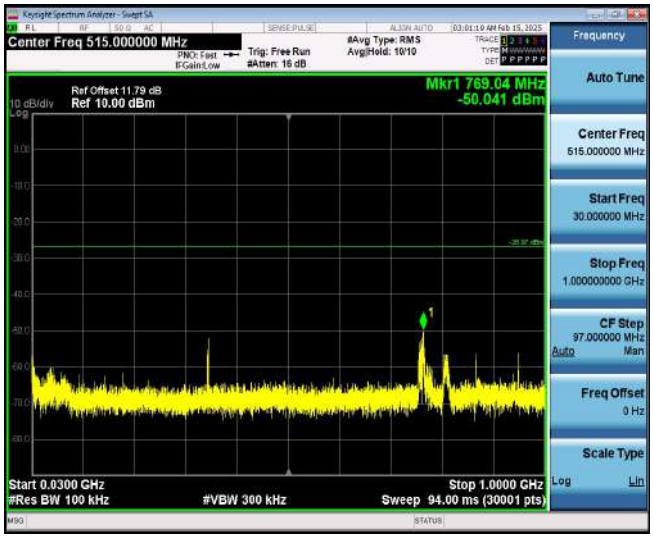
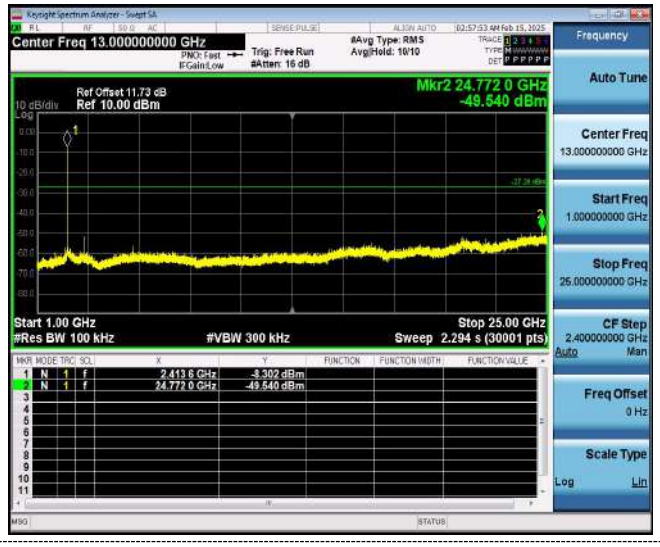
Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

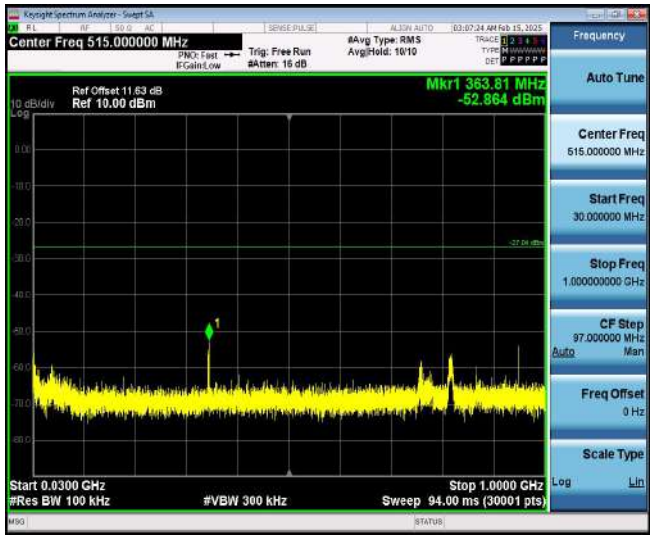
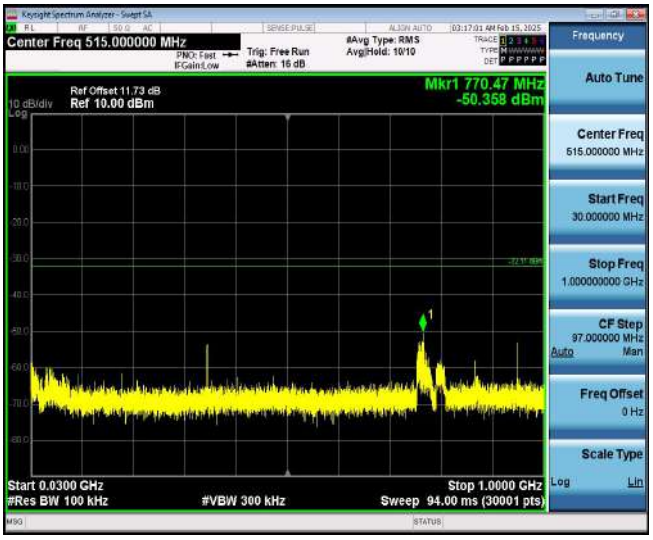
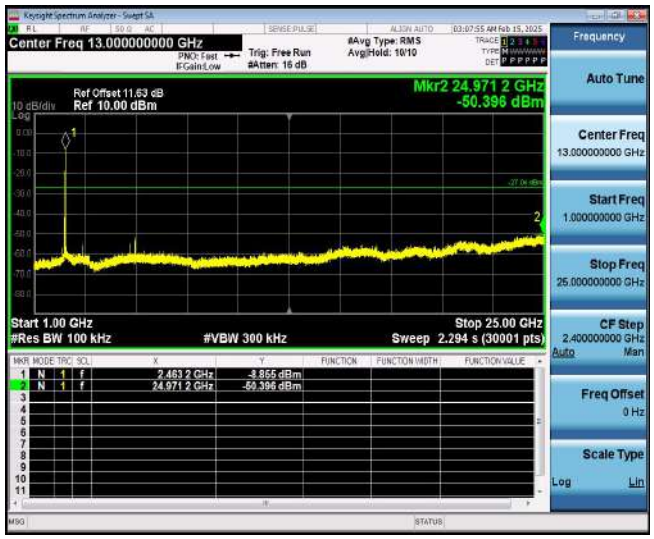
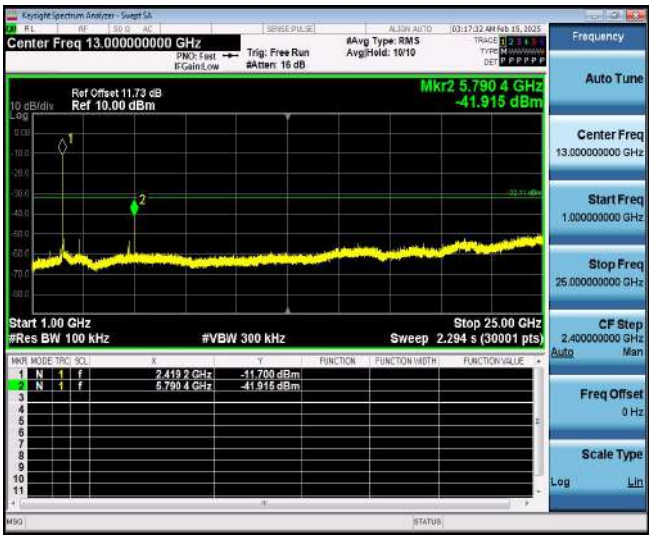
Test Configuration

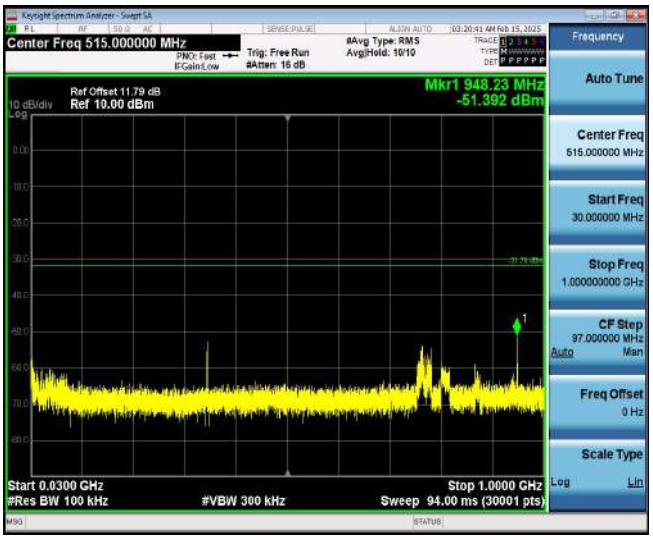
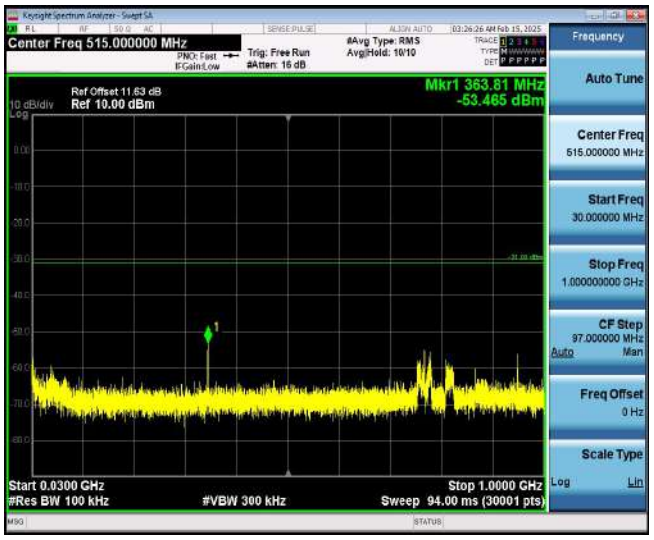
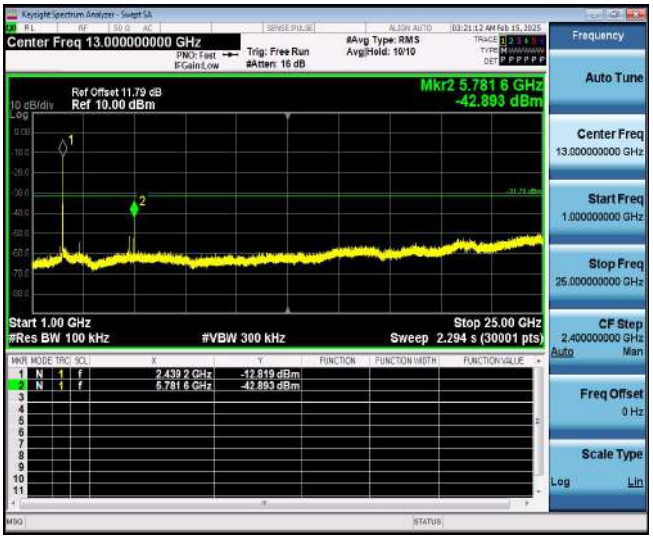
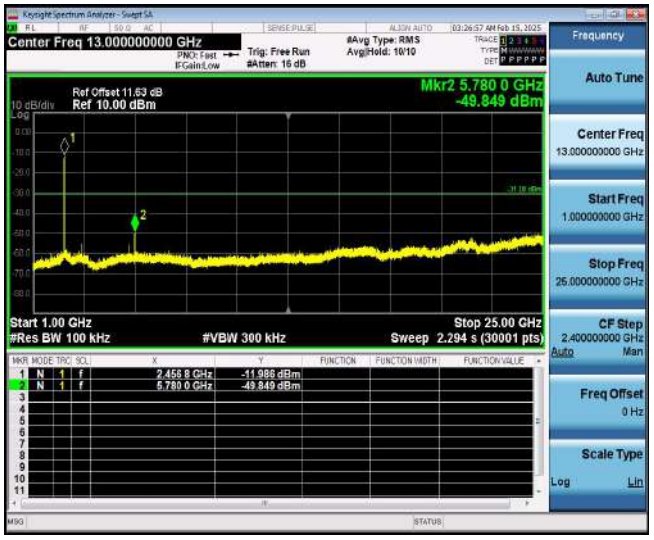
Test Results

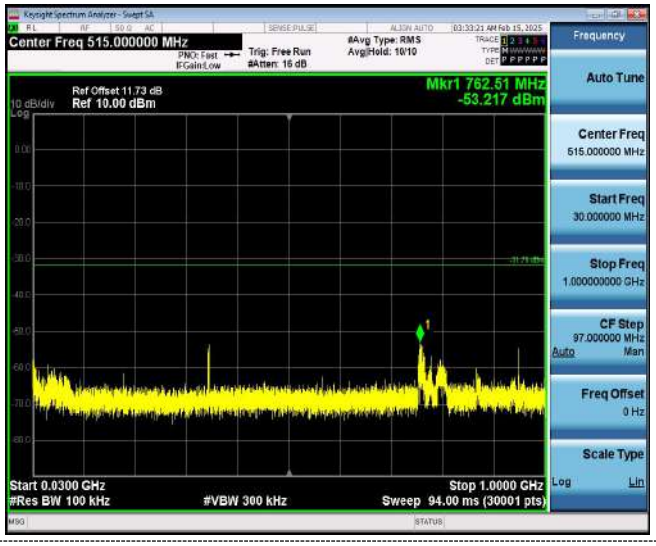
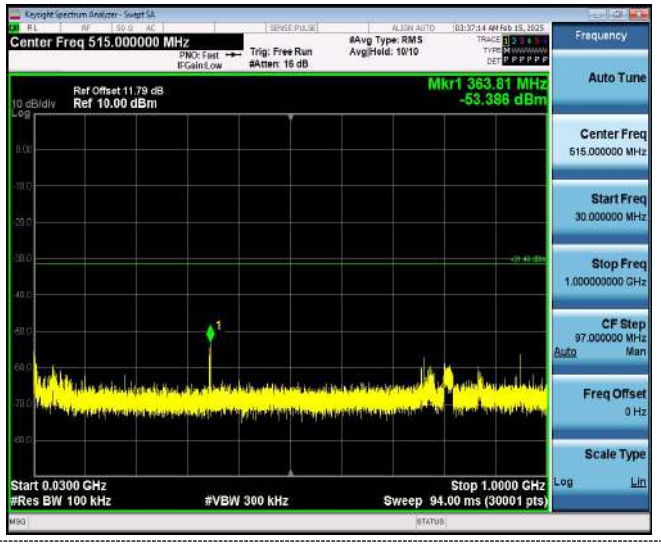
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data. And record the worst data in the report.

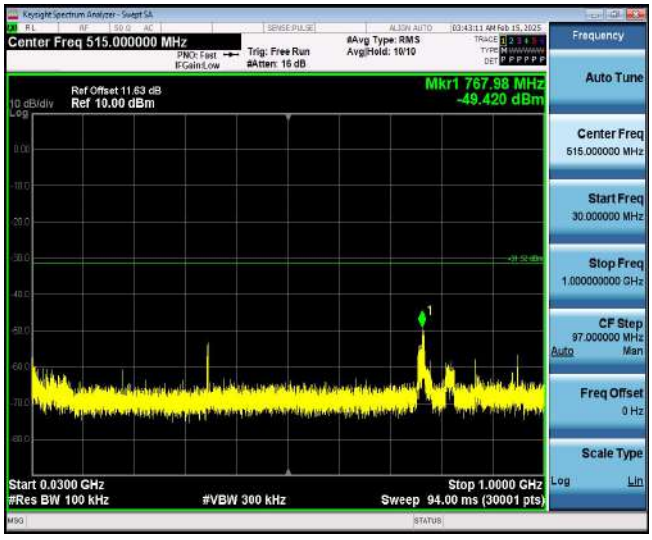
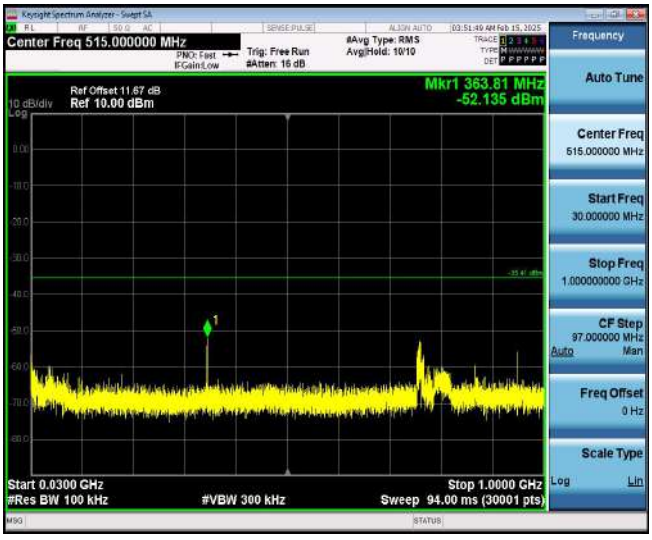
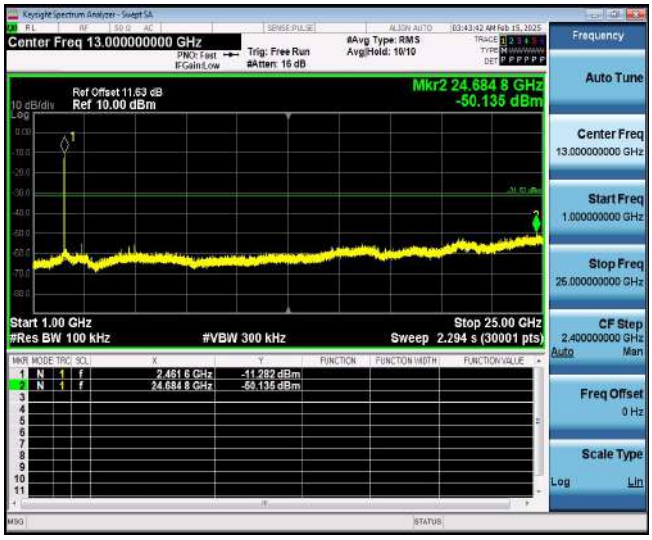
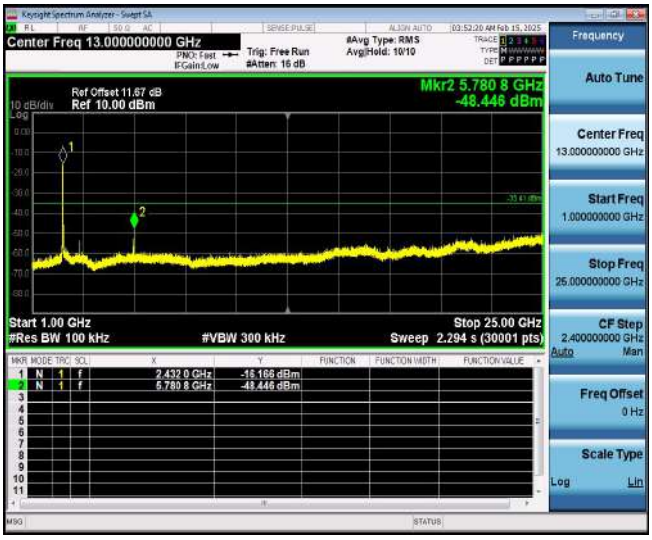
Test plot as follows:

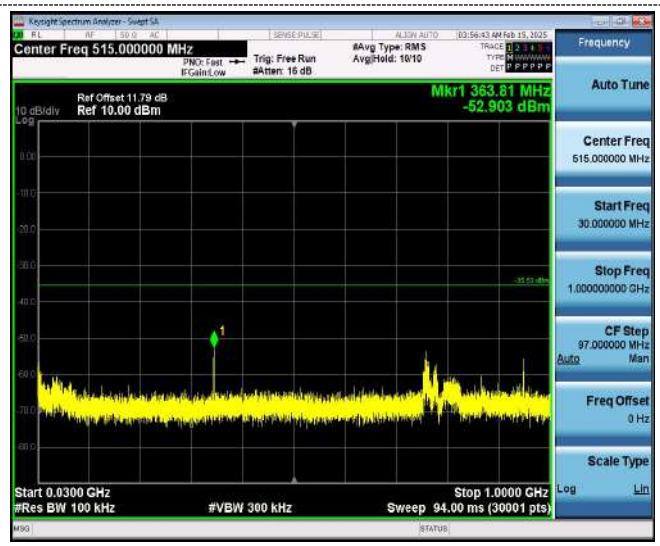
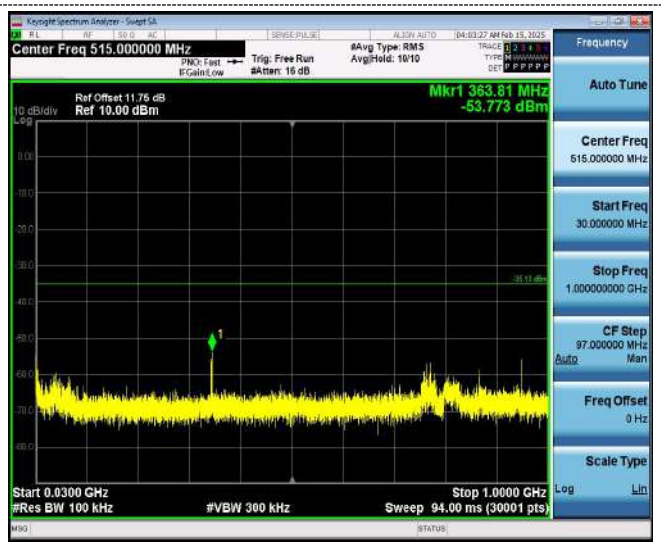
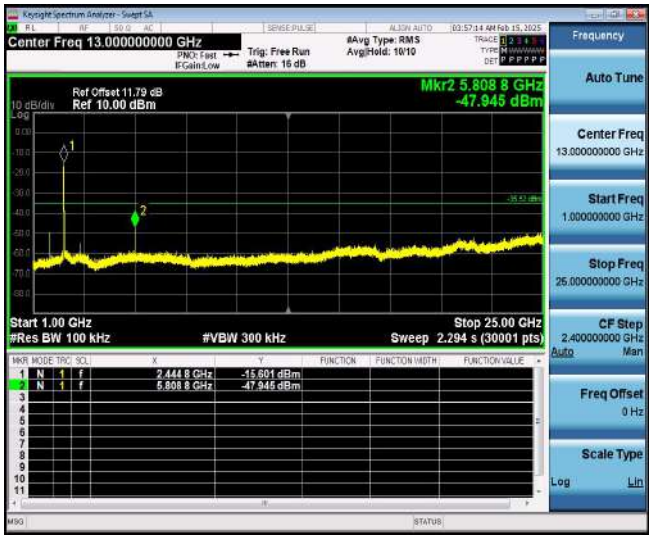
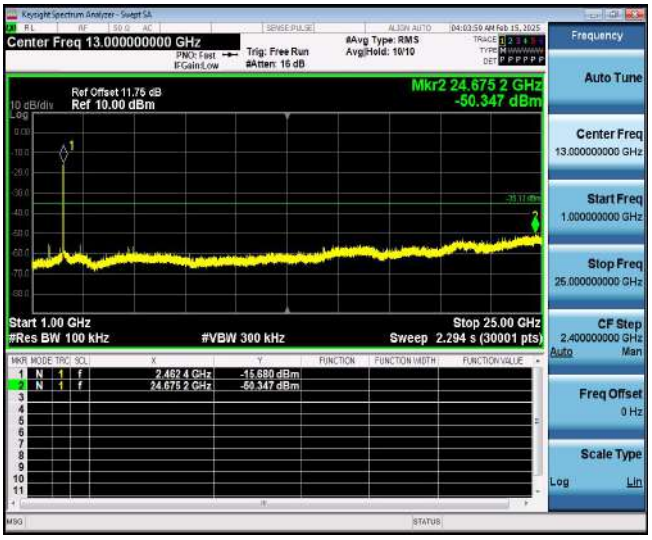
802.11b	
	
CH01	***CH06***
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

802.11b	802.11g
	
CH11	***CH01***
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

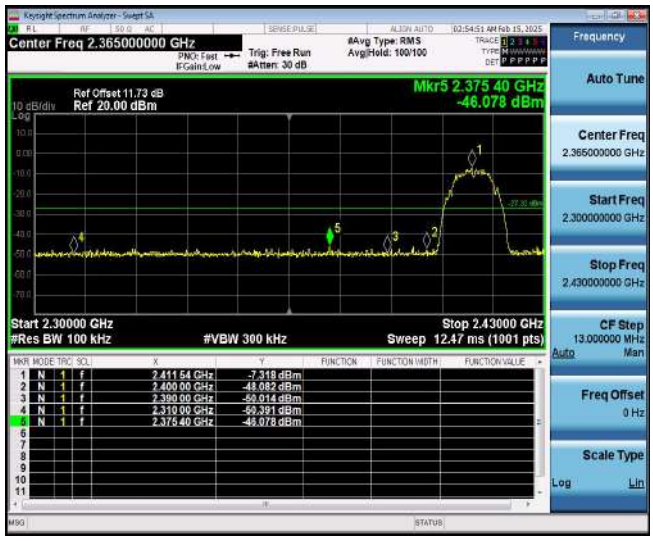
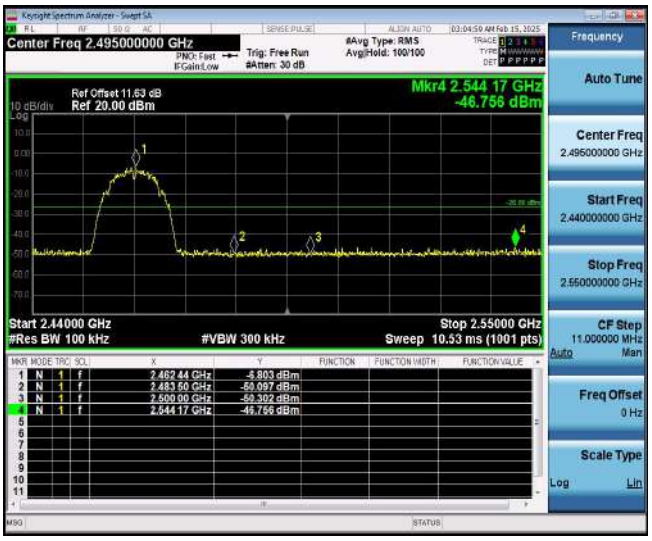
802.11g	
	
CH06	***CH11***
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

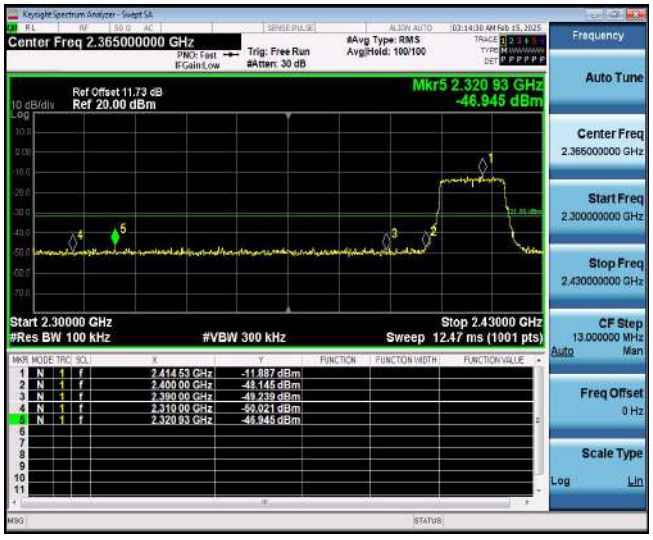
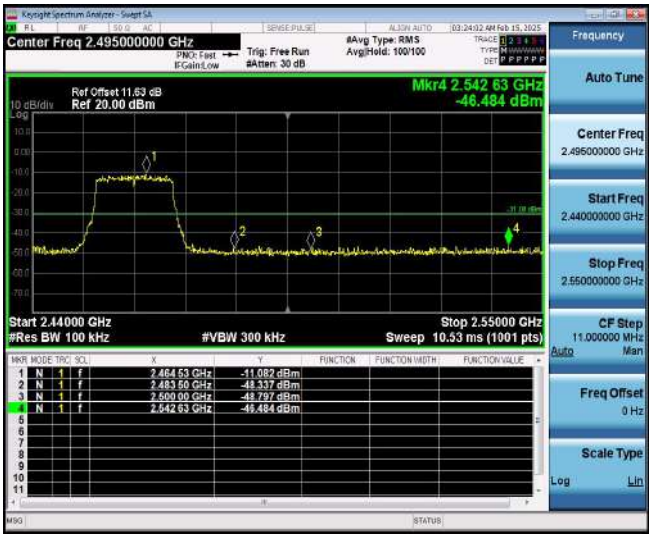
802.11n(HT20)	
	
CH01	CH06
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

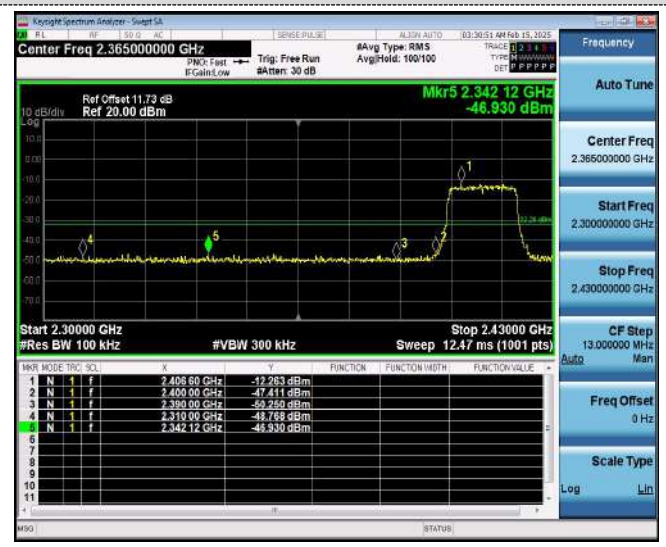
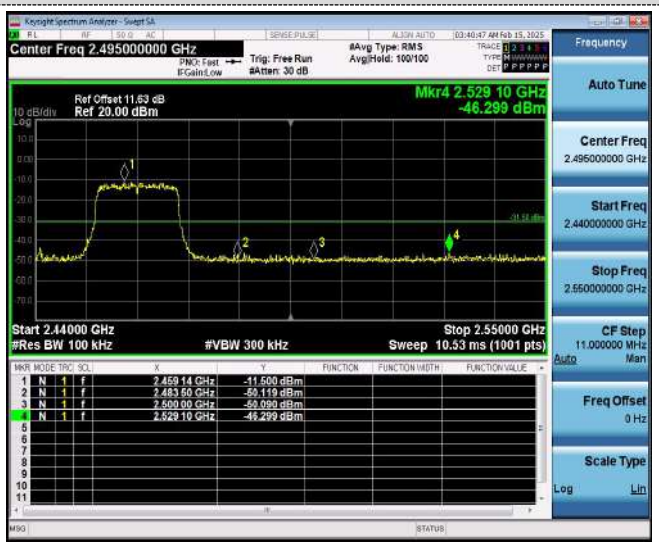
802.11n(HT20)	802.11n(HT40)
	
CH11	CH03
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

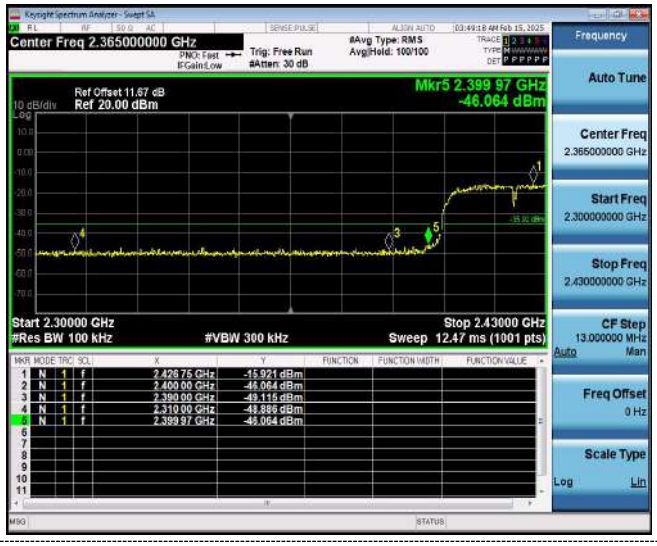
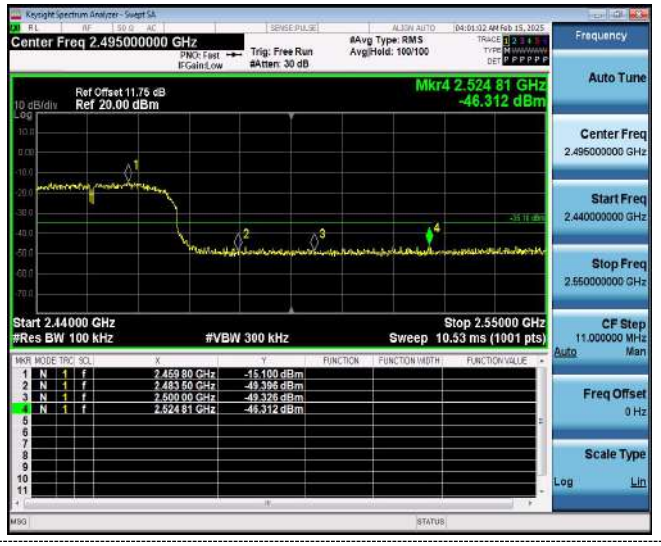
802.11n(HT40)	
	
CH06	***CH09***
	
30MHz-1GHz	30MHz-1GHz
	
1GHz -25GHz	1GHz -25GHz

Band-edge Measurements for RF Conducted Emissions:

802.11b	
	
Left bandedge	Right bandedge

802.11g	
	
Left bandedge	Right bandedge

802.11n(HT20)	
	
Left bandedge	Right bandedge

802.11n(HT40)	
	
Left bandedge	Right bandedge

4.7 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

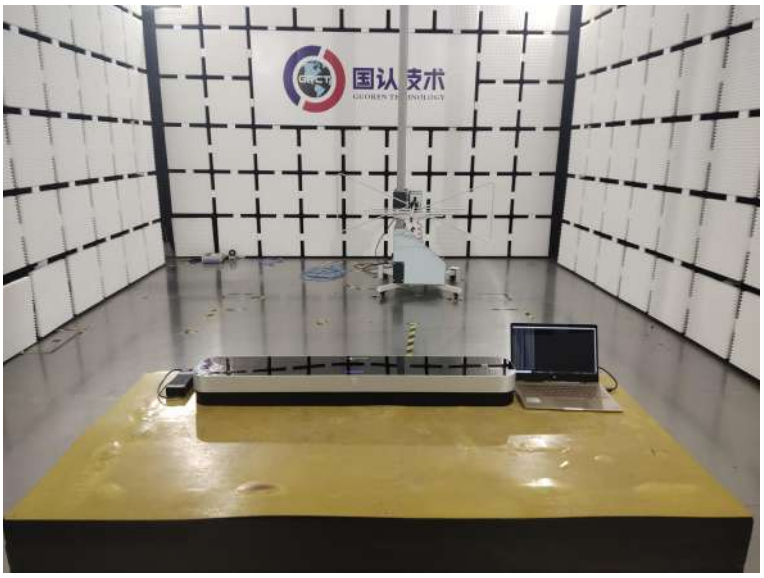
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional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

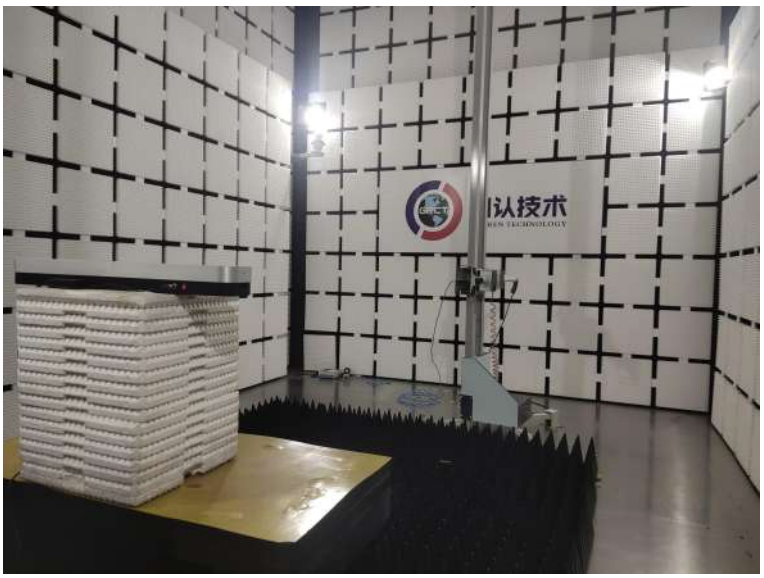
Test Result:

The maximum gain of antenna was 3.76 dBi.

Remark:The antenna gain is provided by the customer, if the data provided by the customer is not accurate, Shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.

5 Test Setup Photos of the EUT





6 Photos of the EUT

Reference to the test report No. **GRCTR250202011-01.**

********** End of Report **********