FCC TEST REPORT

Test report

On Behalf of

SOTEN TECHNOLOGY (HONGKONG) CO., LIMITED

For

Rugged Tablet

Model No.: T101, S101, K101, S70V2, T60

FCC ID: 2AI62T101

Prepared for :	**SOTEN TECHNOLOGY (HONGKONG) CO., LIMITED** **FLAT/RM A 20/F KIU FU COMMERCIAL BLDG 300 LOCKHART ROAD WAN CHAI HK**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Nov. 13, 2018 ~ Jan. 14, 2019**
Date of Report:	**Jan. 15, 2019**
Report Number:	**HK1811161629E**

TEST RESULT CERTIFICATION

Applicant's name..... :	SOTEN TECHNOLOGY (HONGKONG) CO., LIMITED
Address ..... :	FLAT/RM A 20/F KIU FU COMMERCIAL BLDG 300 LOCKHART ROAD WAN CHAI HK
Manufacture's Name ..... :	Shenzhen SOTEN Technology Co., Ltd.
Address ..... :	10th Floor,2nd Building,BaiWang Research and development building, No. 5308 Shahe west road,Xili,Nanshan district,ShenZhen, China
Factory's Name	Shenzhen SOTEN Technology Co., Ltd.
Address..... :	10th Floor,2nd Building,BaiWang Research and development building, No. 5308 Shahe west road,Xili,Nanshan district,ShenZhen, China
Product description	Rugged Tablet
Brand name	HUGEROCK
Mode name	T101, S101, K101, S70V2, T60
Test model name	T101
Difference description	All the same except for the model name.
Standards..... :	FCC Rules and Regulations Part 15 Subpart C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05

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Date of Test..... :	
Date (s) of performance of tests ..... :	**Nov. 13, 2018 ~ Jan. 14, 2019**
Date of Issue ..... :	**Jan. 15, 2019**
Test Result ..... :	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

Revision History

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 15, 2019	Valid	Initial Release

TABLE OF CONTENTS

1. GENERAL INFORMATION 6
1.1. PRODUCT DESCRIPTION 6
1.2. TABLE OF CARRIER FREQUENCYS 6
1.3. IEEE 802.11N MODULATION SCHEME 7
1.4. RELATED SUBMITTAL(S) / GRANT (S) 7
1.5. TEST METHODOLOGY 8
1.6. SPECIAL ACCESSORIES 8
1.7. EQUIPMENT MODIFICATIONS 8
2. MEASUREMENT UNCERTAINTY 9
3. DESCRIPTION OF TEST MODES 10
4 SYSTEM TEST CONFIGURATION 11
4.1. CONFIGURATION OF EUT SYSTEM 11
4.2. EQUIPMENT USED IN EUT SYSTEM 11
4.3. SUMMARY OF TEST RESULTS 11
5. TEST FACILITY 12
6. OUTPUT POWER 13
7.1. MEASUREMENT PROCEDURE 13
6.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 13
6.3. LIMITS AND MEASUREMENT RESULT 14
7. 6DB BANDWIDTH 16
7.1. MEASUREMENT PROCEDURE 16
7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 16
8.3. LIMITS AND MEASUREMENT RESULTS 17
9. CONDUCTED SPURIOUS EMISSION 20
9.1. MEASUREMENT PROCEDURE 20
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 20
9.3. MEASUREMENT EQUIPMENT USED 20
9.4. LIMITS AND MEASUREMENT RESULT 21
10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY 28
10.1 MEASUREMENT PROCEDURE 28
10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 28
10.3 MEASUREMENT EQUIPMENT USED 28
10.4 LIMITS AND MEASUREMENT RESULT 29
11. RADIATED EMISSION 32
11.1. MEASUREMENT PROCEDURE 32

11.2. TEST SETUP 33
11.3. LIMITS AND MEASUREMENT RESULT 34
11.4. TEST RESULT 35
12. BAND EDGE EMISSION 38
12.1. MEASUREMENT PROCEDURE 38
12.2. TEST SET-UP 38
12.3. RADIATED TEST RESULT 39
12.4. CONDUCTED TEST RESULT 40
13. FCC LINE CONDUCTED EMISSION TEST 42
13.1. LIMITS OF LINE CONDUCTED EMISSION TEST 42
13.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST 42
13.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST 43
13.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST 44
13.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST 45
APPENDIX A: PHOTOGRAPHS OF TEST SETUP 47

1. GENERAL INFORMATION

1.1. PRODUCT DESCRIPTION

The EUT is designed as “Rugged Tablet”. It is designed by way of utilizing the DSSS and OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.412 GHz～2.462GHz
Output Power	IEEE 802.11b:**15.66**dBm, IEEE 802.11g:**13.49**dBm; IEEE 802.11n(20):**13.36**dBm,IEEE 802.11n(40):**13.42**dBm
Modulation	DSSS(DBPSK/DQPSK/CCK);OFDM(BPSK/QPSK/16-QAM/64-QAM)
Number of channels	11 Channels (IEEE802.11b/g/n20)& 7 Channels (IEEE802.11n40)
Hardware Version	T101-MainBoard-P3
Software Version	T101-20181026-Q
Antenna Designation	PIFA Antenna
Antenna Gain	0dBi
Power Supply	DC3.7V by Built-in Li-ion Battery

1.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11

For 802.11n 40MHZ bandwidth system use Channel 3 to Channel 9.

1.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps) 800nsGI	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

1.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AI62T101** filing to comply with the FCC Part 15 requirements.

1.5. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013).
Radiated testing was performed at an antenna to EUT distance 3 meters.
Others testing (listed at item 5.3) was performed according to the procedures in FCC Part 15.247 rules KDB 558074 D01 DTS Meas Guidance v04.

1.6. SPECIAL ACCESSORIES

Refer to section 5.2.

1.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2. MEASUREMENT UNCERTAINTY

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

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

3. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal operating

Note:
Transmit by 802.11b with Date rate (1/2/5.5/11)
Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)
Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)
Transmit by 802.11n (40MHz) with Date rate (13.5/27/40.5/54/81/108/121.5/135)

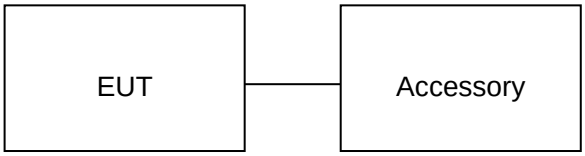
Note:

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the eut is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

4 SYSTEM TEST CONFIGURATION

4.1. CONFIGURATION OF EUT SYSTEM

Configure:



4.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Rugged Tablet	T101	FFDD	EUT
2	Adapter	8395-UW01-1070	DC 5.3V 2.0A	Accessory
3	Battery	47206128	DC3.7V/ 14600mAh	Accessory
4	USB	N/A	N/A	Accessory

Note: All the accessories have been used during the test in conduction emission test.

4.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power SPECTRAL Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant

5. TEST FACILITY

Site	Shenzhen HUAK Testing Technology Co., Ltd.
Location	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China
Designation Number	CN1229
Test Firm Registration Number : 616276	

ALL TEST EQUIPMENT LIST

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Power meter	Agilent	E4417B	HKE-107	Dec. 26, 2019
Power Sensor	Agilent	E9327A	HKE-113	Dec. 26, 2019
RF cable	Times	1-40G	HKE-034	Dec. 26, 2019
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 26, 2019
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 26, 2019
Signal generator	Agilent	N5183A	HKE-071	Dec. 26, 2019
Receiver	R&S	ESCI-7	HKE-010	Dec. 26, 2019
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
Preamplifier	EMCI	EMC051845SE	HKE-015	Dec. 26, 2019
Preamplifier	Agilent	83051A	HKE-016	Dec. 26, 2019
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 26, 2019
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Dec. 26, 2019
Horn antenna	Schwarzbeck	9120D	HKE-013	Dec. 26, 2019
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Dec. 26, 2019
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A
RF cable	Times	1-40G	HKE-034	Dec. 26, 2019

6. OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

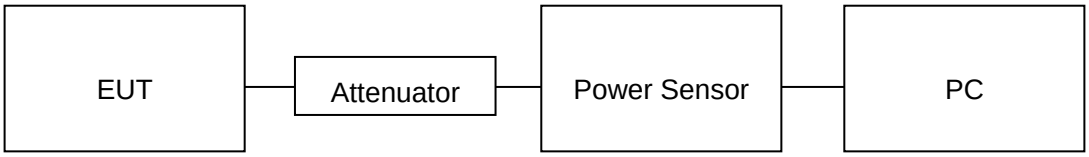
For max average conducted output power test:

1. Connect EUT RF output port to power probe through an RF attenuator.
2. Connect the power probe to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

Note：The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

6.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

AVERAGE POWER SETUP



6.3. LIMITS AND MEASUREMENT RESULT

TEST ITEM	OUTPUT POWER
TEST MODE	802.11b with data rate 1

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	14.37	30	Pass
2.437	15.66	30	Pass
2.462	15.21	30	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11g with data rate 6

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	12.20	30	Pass
2.437	13.49	30	Pass
2.462	13.08	30	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11n 20 with data rate 6.5

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	12.43	30	Pass
2.437	13.36	30	Pass
2.462	13.05	30	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11n 40 with data rate 13.5

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.422	12.34	30	Pass
2.437	13.42	30	Pass
2.452	12.28	30	Pass

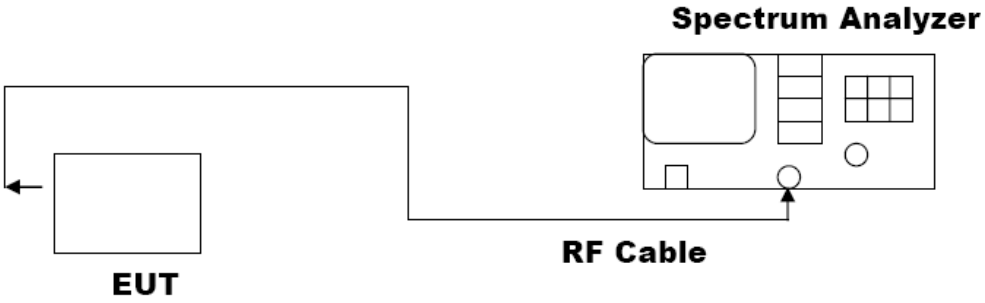
7. 6dB BANDWIDTH

7.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW⩾3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

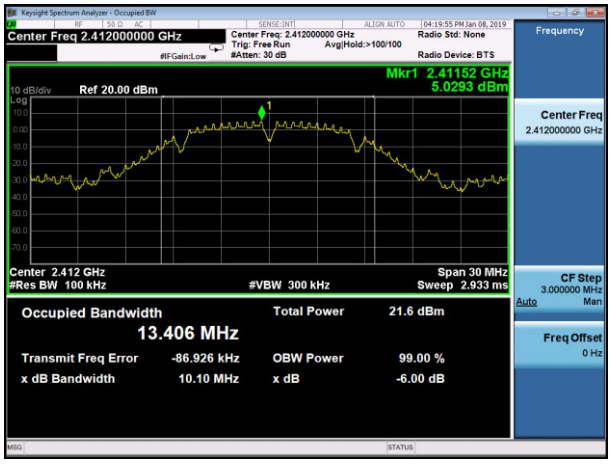


8.3. LIMITS AND MEASUREMENT RESULTS

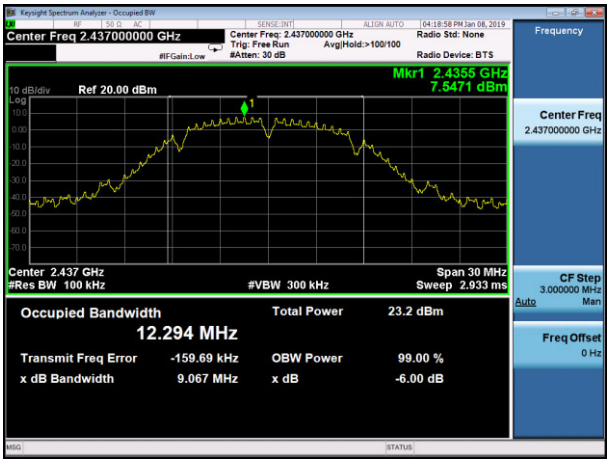
Mode	Channel	6dB Bandwidth [MHz]	Verdict
11b	LCH	10.10	PASS
	MCH	9.067	PASS
	HCH	9.625	PASS
11g	LCH	16.34	PASS
	MCH	15.08	PASS
	HCH	15.77	PASS
11nHT20	LCH	17.58	PASS
	MCH	15.08	PASS
	HCH	16.39	PASS
11nHT40	LCH	20.16	PASS
	MCH	22.61	PASS
	HCH	35.73	PASS

Test Graph

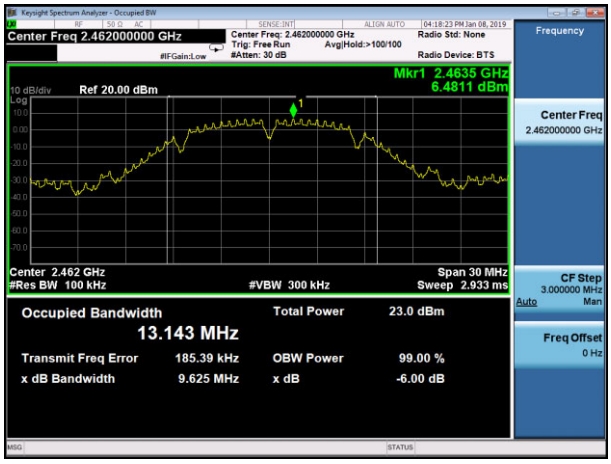
11b-LCH



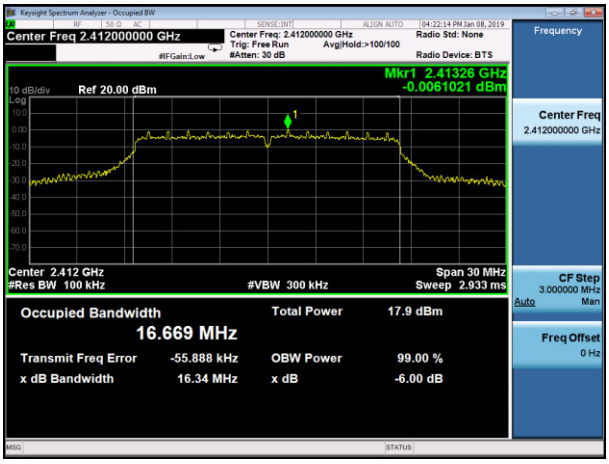
11b-MCH



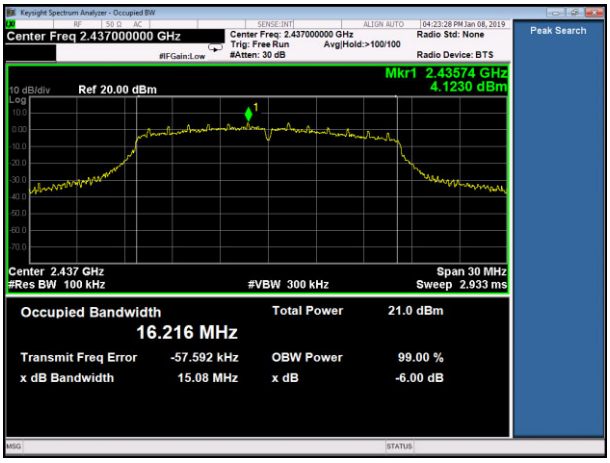
11b-HCH



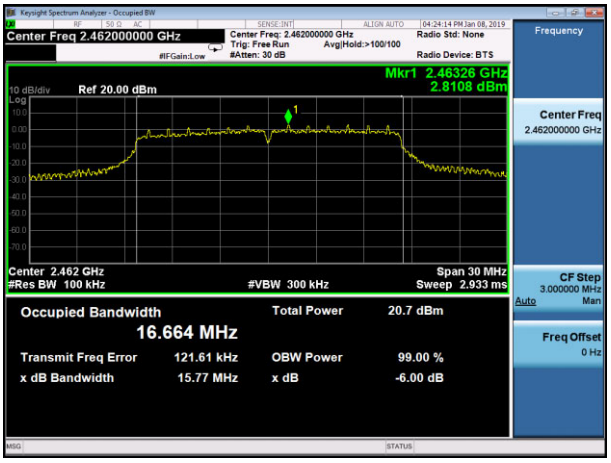
11g-LCH

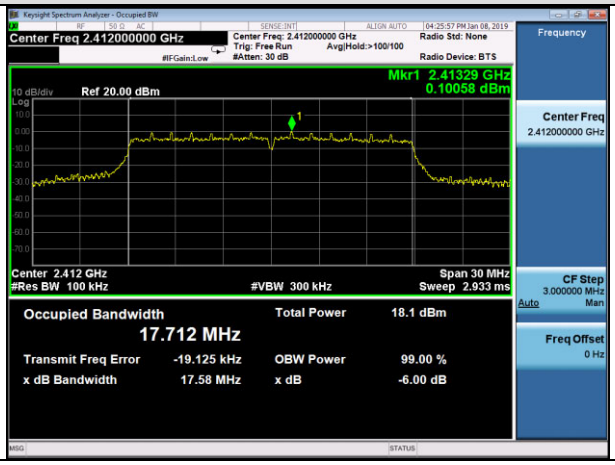
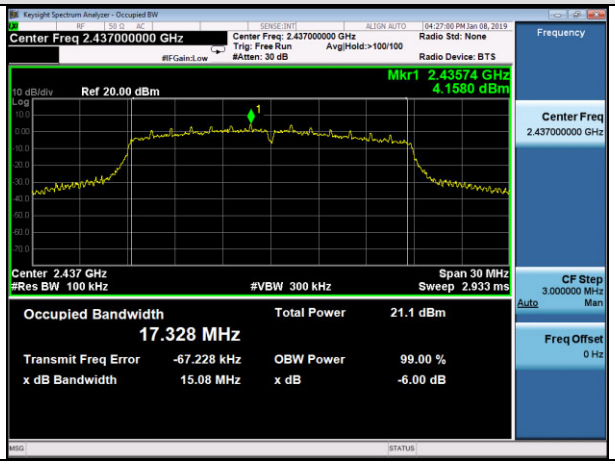


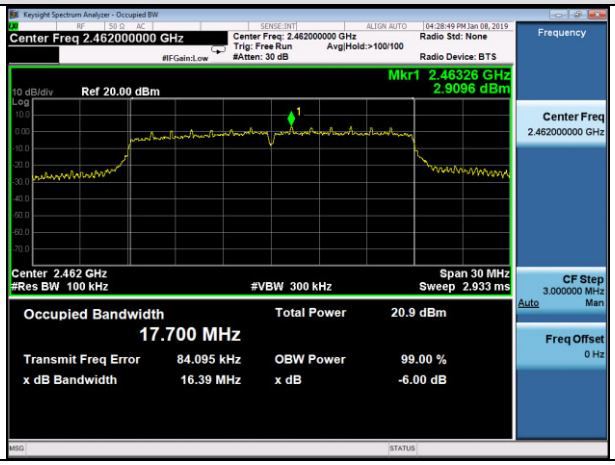
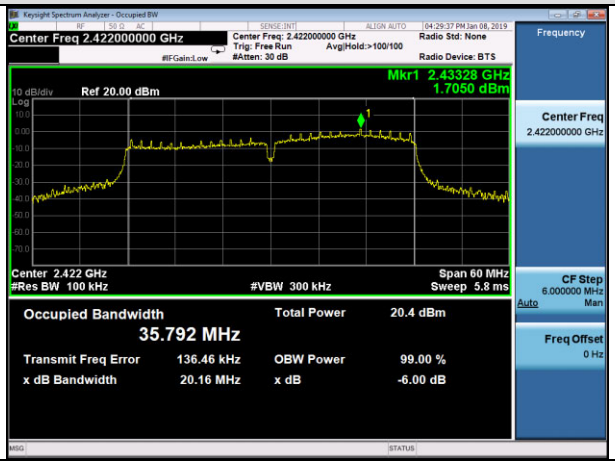
11g-MCH

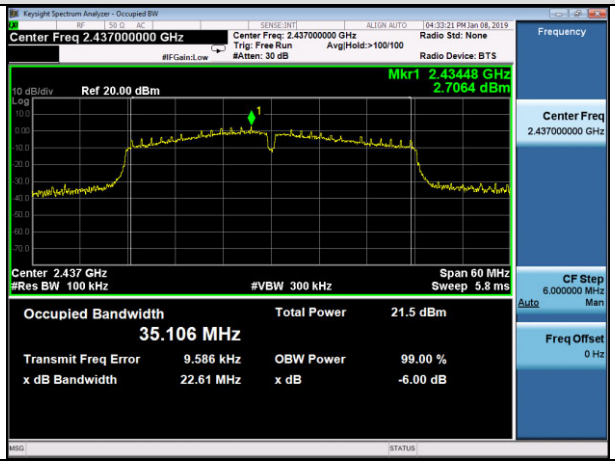
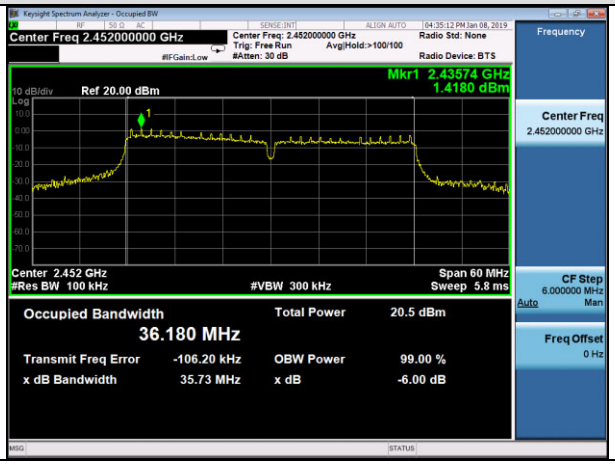


11g-HCH



11nHT20-LCH	11nHT20-MCH
	

11nHT20-HCH	11nHT40-LCH
	

11nHT40-MCH	11nHT40-HCH
	

9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW＞RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW＞RBW) are conform to the requirement.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

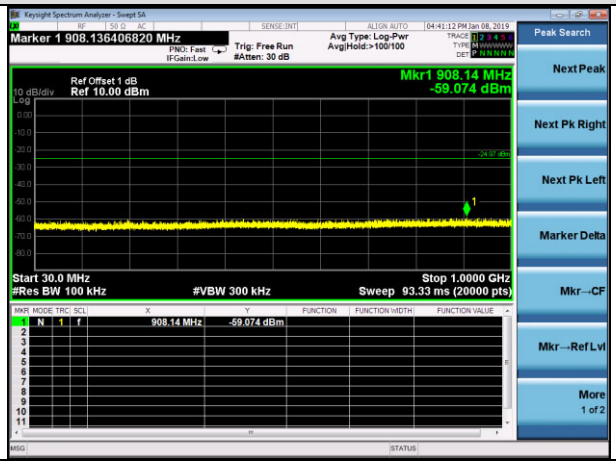
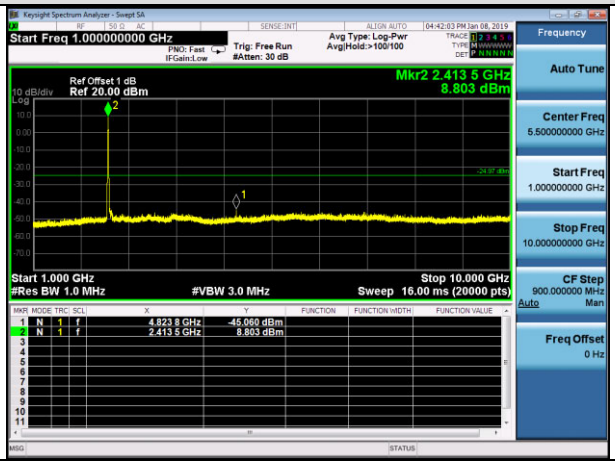
9.3. MEASUREMENT EQUIPMENT USED

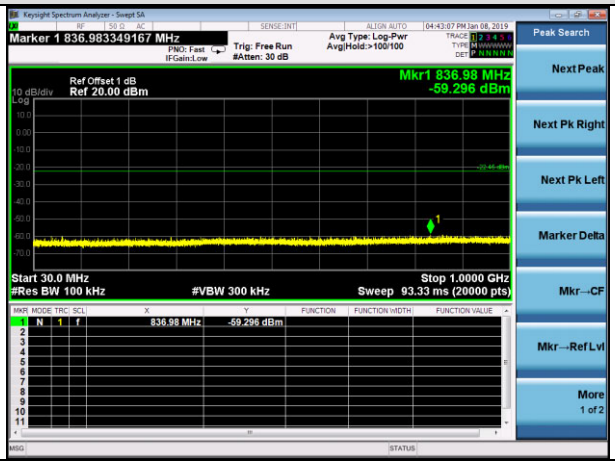
The same as described in section 6.

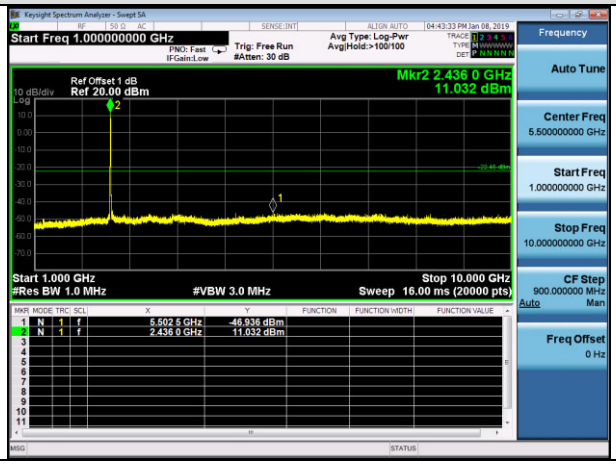
9.4. LIMITS AND MEASUREMENT RESULT

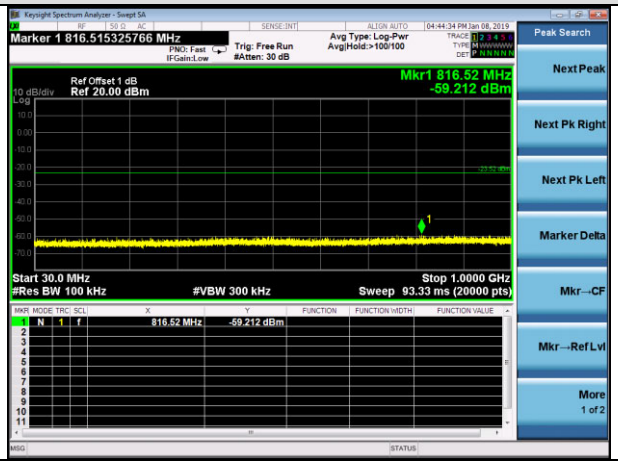
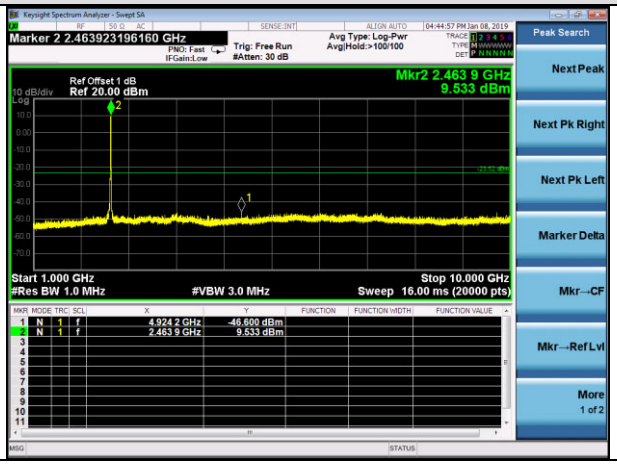
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 30 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	Refer Test Graph	PASS

Test Graph

11B-LCH	11B-LCH
	

11B-LCH	11B-MCH
	

11B-MCH	11B-MCH
	

11B-HCH	11B-HCH
	

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	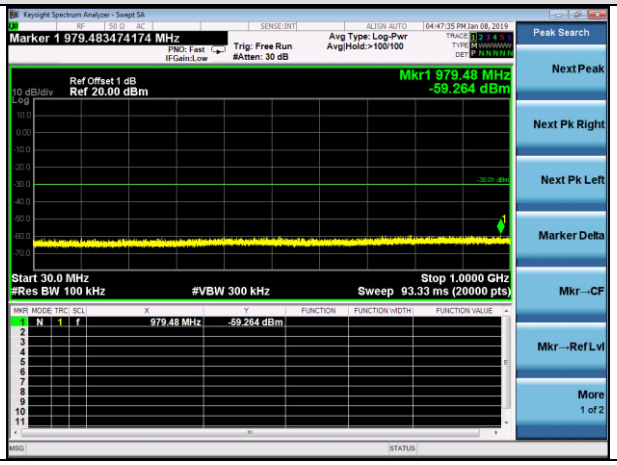

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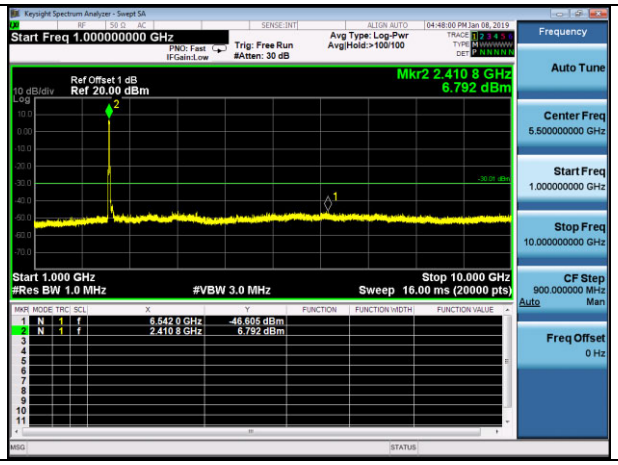
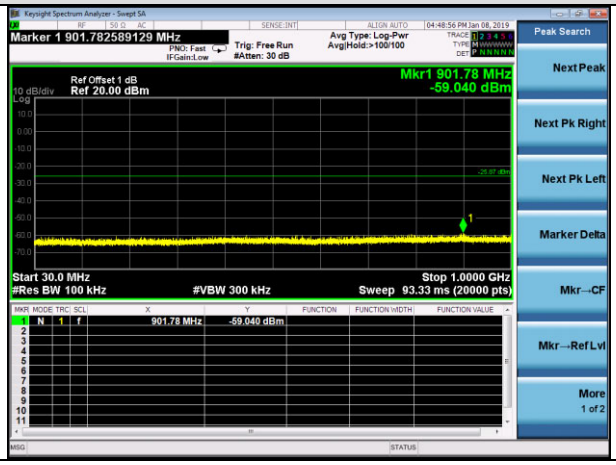
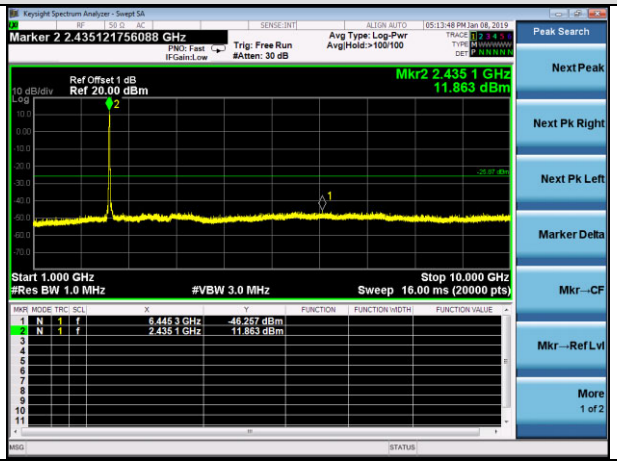
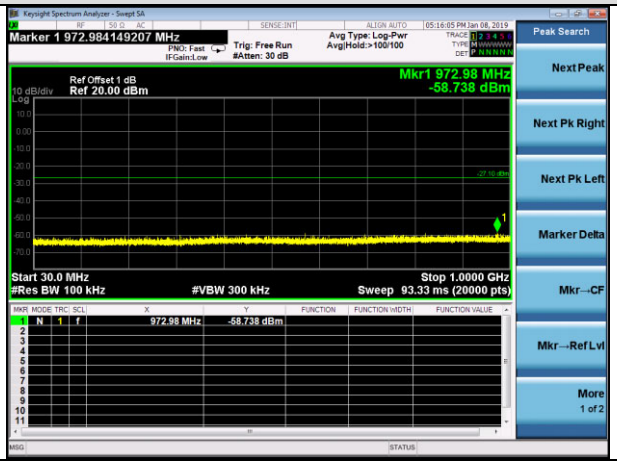
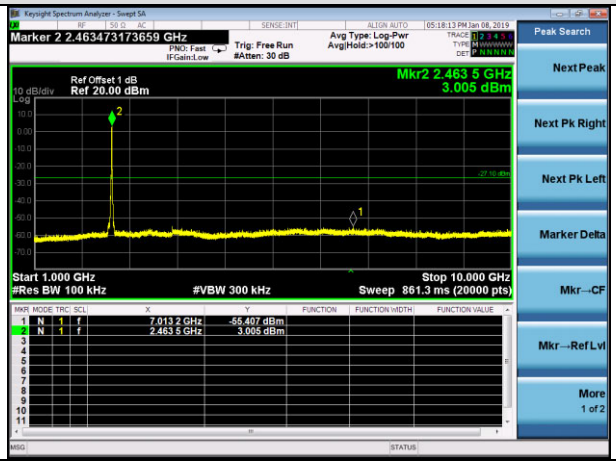
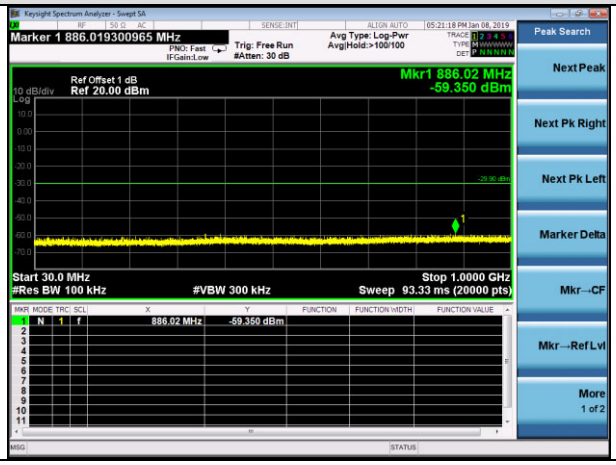
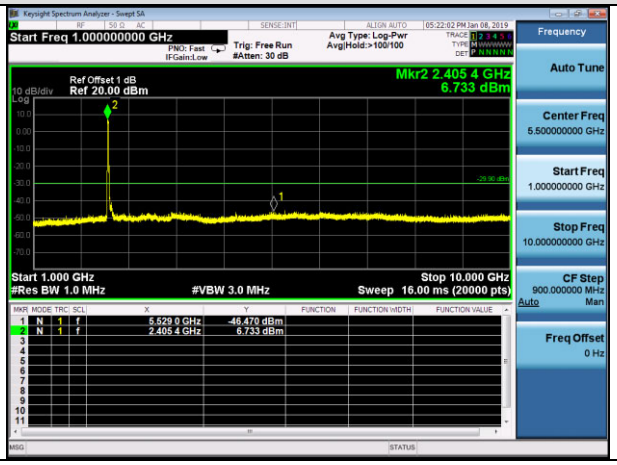
	

11G-MCH	11G-MCH
	

11G-MCH	11G-HCH
	

11G-HCH	11G-HCH
	

11nHT20-LCH	11nHT20-LCH
	

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	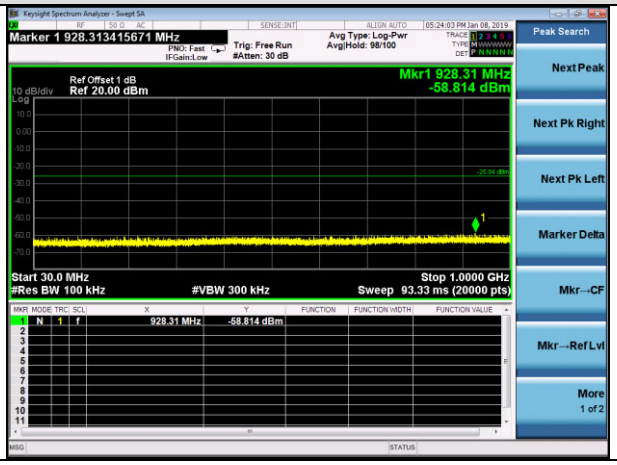

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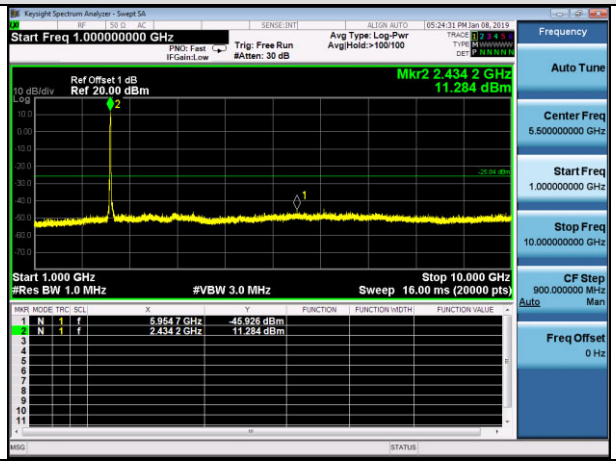
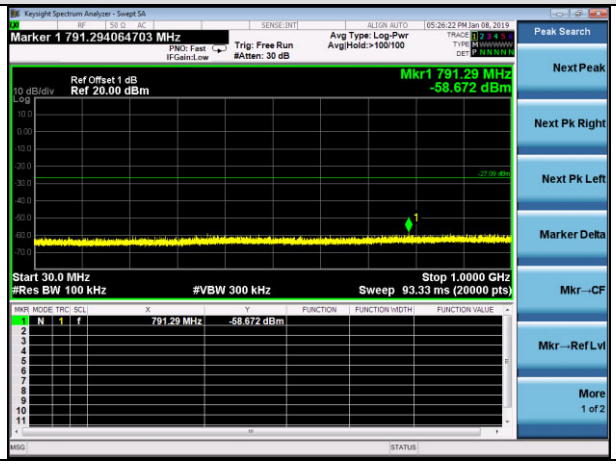
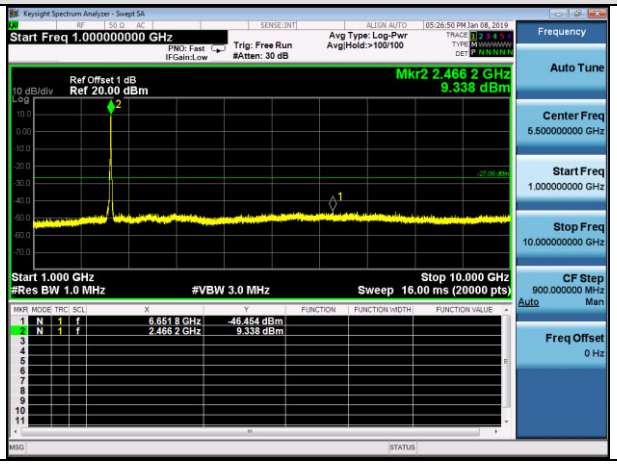
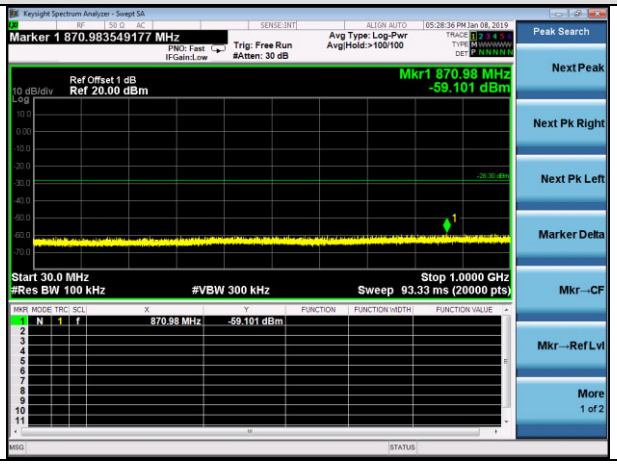
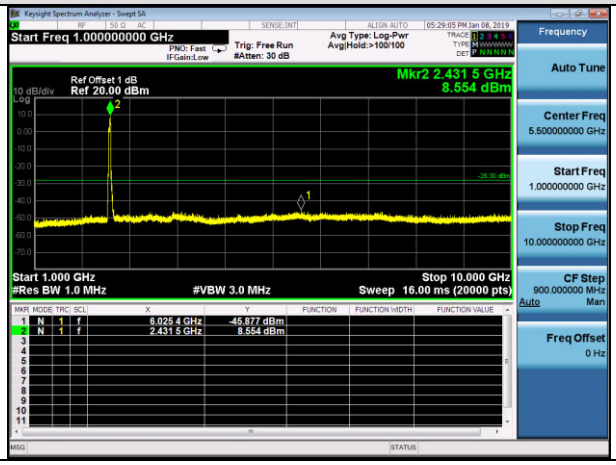
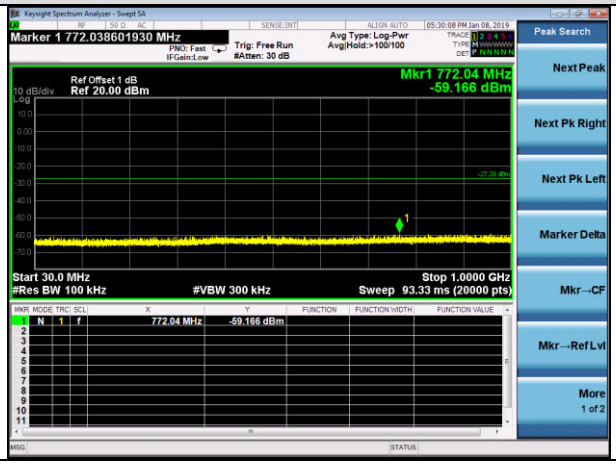
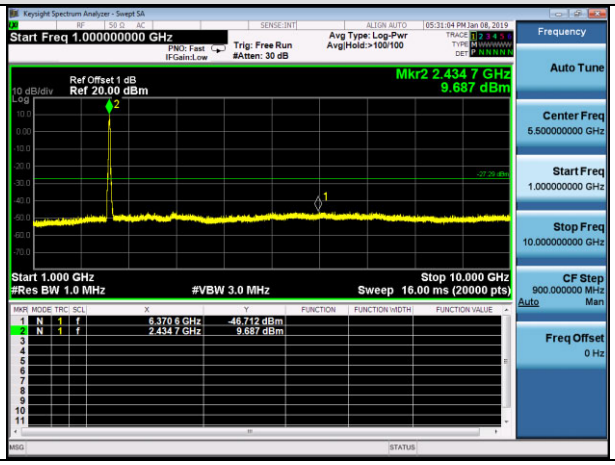
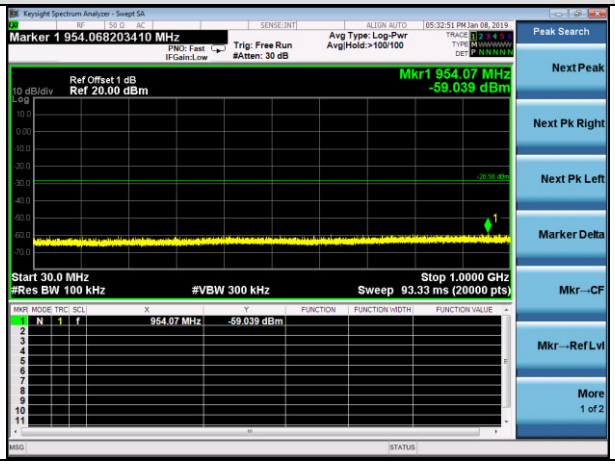
	

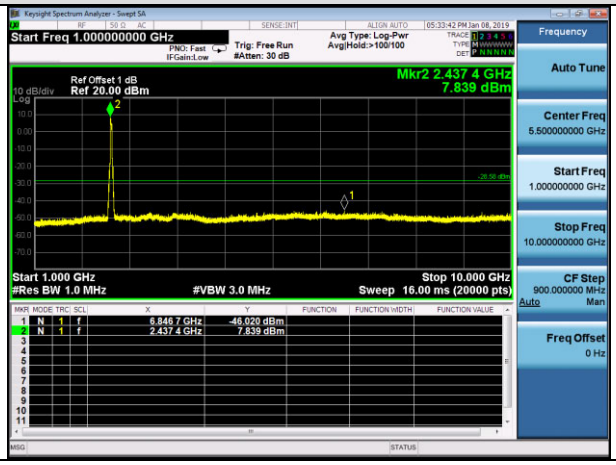
11nHT20-HCH	11nHT20-HCH
	

11nHT20-HCH	11nHT40-LCH
	

11nHT40-LCH	11nHT40-LCH
	

11nHT40-MCH	11nHT40-MCH
	

11nHT40-MCH	11nHT40-HCH
	

11nHT40-HCH	11nHT40-HCH
	

10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

10.1 MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator

(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.

(3). Set SPA Trace 1 Max hold, then View.

Note: The method of AVGPSD-1 in the ANSI C63.10 (2013) item 11.10 was used in this testing.

10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

10.3 MEASUREMENT EQUIPMENT USED

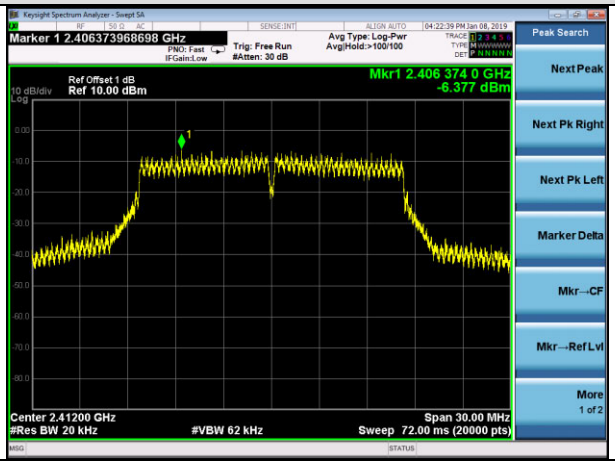
Refer To Section 6.

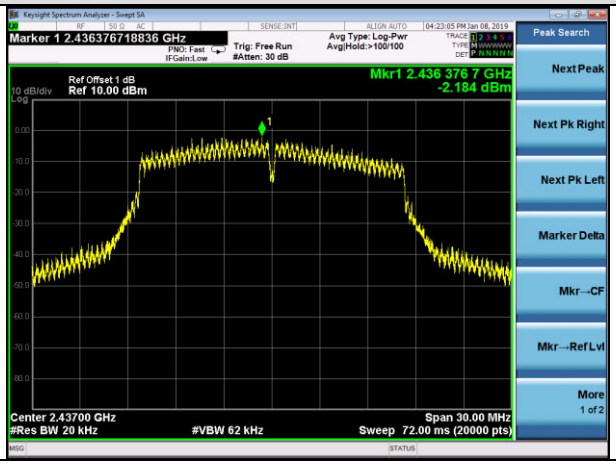
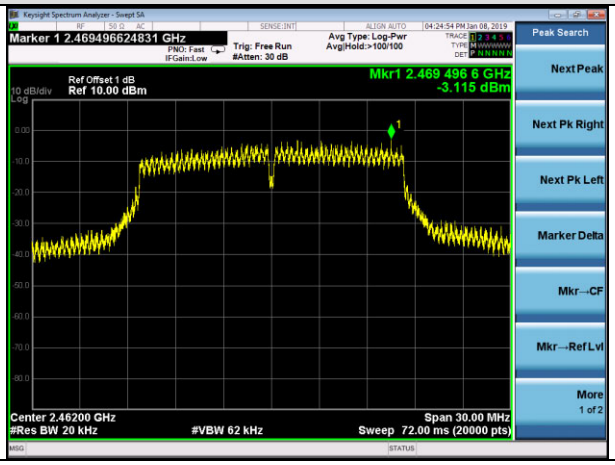
10.4 LIMITS AND MEASUREMENT RESULT

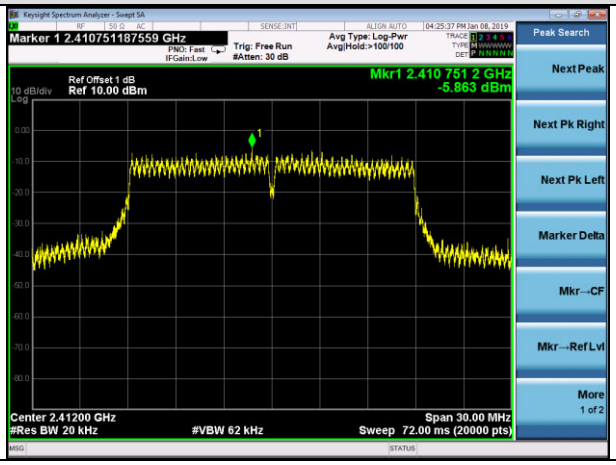
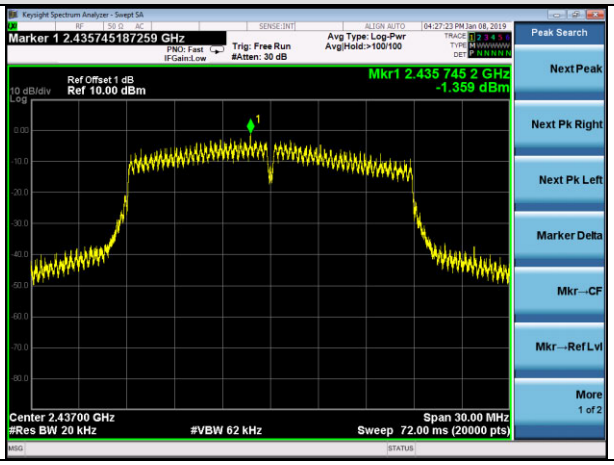
Mode	Channel	PSD [dBm/20kHz]	Limit[dBm/3kHz]	Verdict
11b	LCH	-0.630	8	PASS
	MCH	2.549	8	PASS
	HCH	0.826	8	PASS
11g	LCH	-6.377	8	PASS
	MCH	-2.184	8	PASS
	HCH	-3.115	8	PASS
11nHT20	LCH	-5.863	8	PASS
	MCH	-1.359	8	PASS
	HCH	-2.964	8	PASS
11NHT40	LCH	-4.968	8	PASS
	MCH	-3.703	8	PASS
	HCH	-5.816	8	PASS

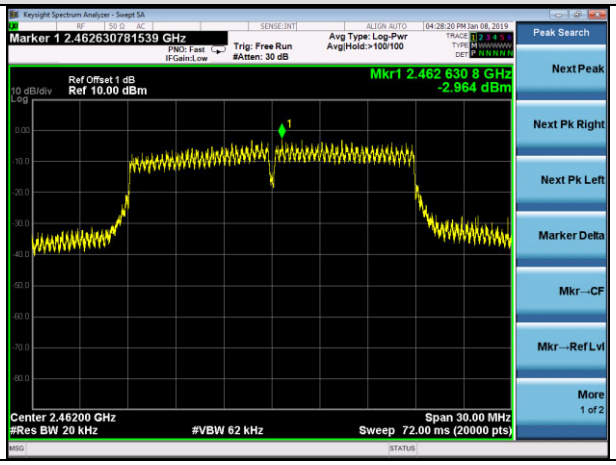
Test Graph

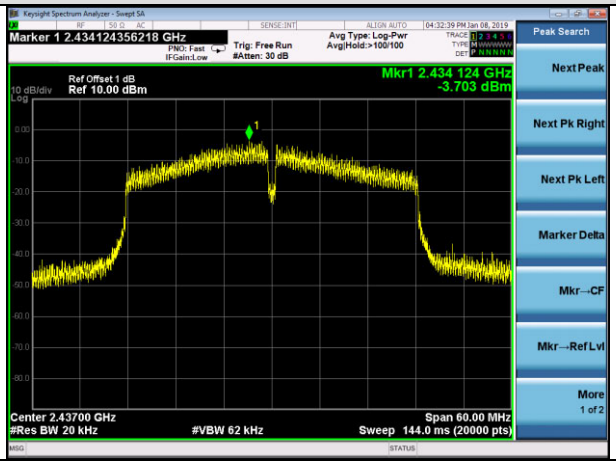
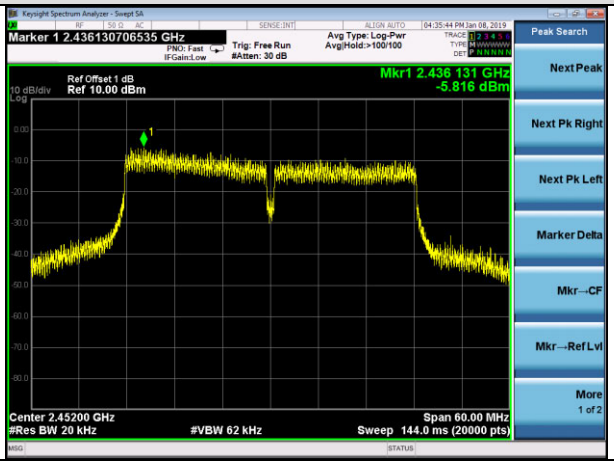
11b-LCH	11b-MCH

11b-HCH	11g-LCH
	

11g-MCH	11g-HCH
	

11nHT20-LCH	11nHT20-MCH
	

11nHT20-HCH	11nHT40-LCH
	

11nHT40-MCH	11nHT40-HCH
	

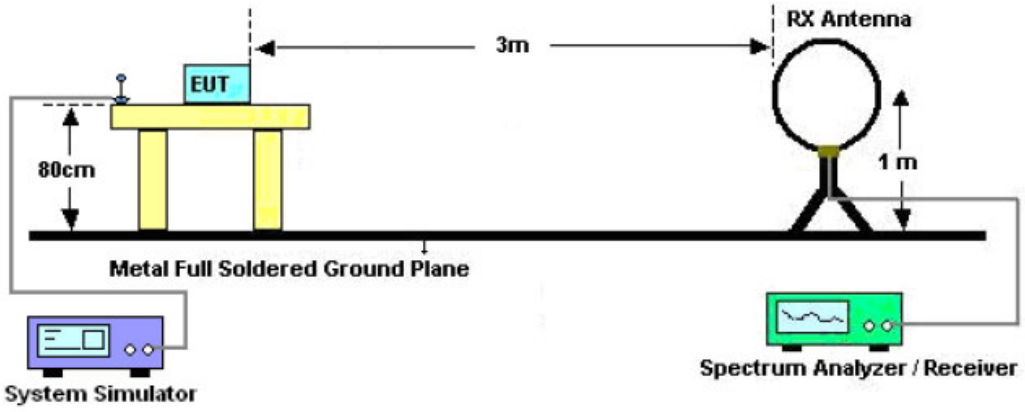
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

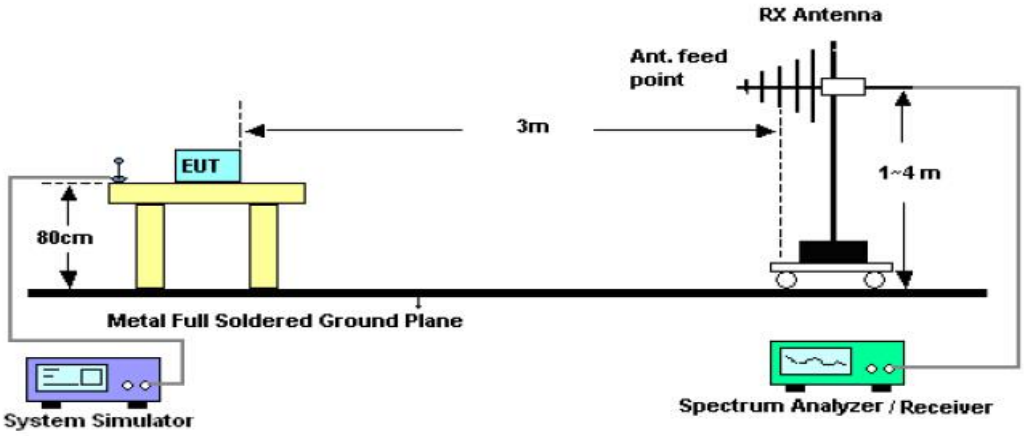
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

11.2. TEST SETUP

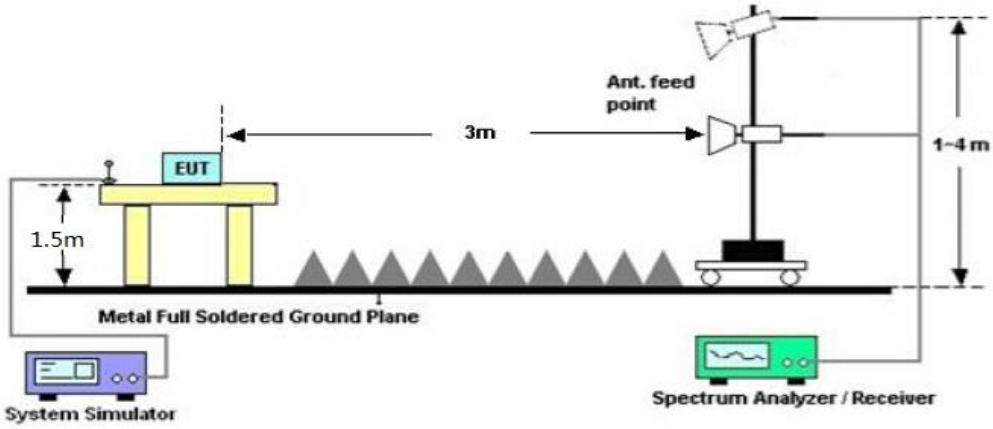
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



11.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

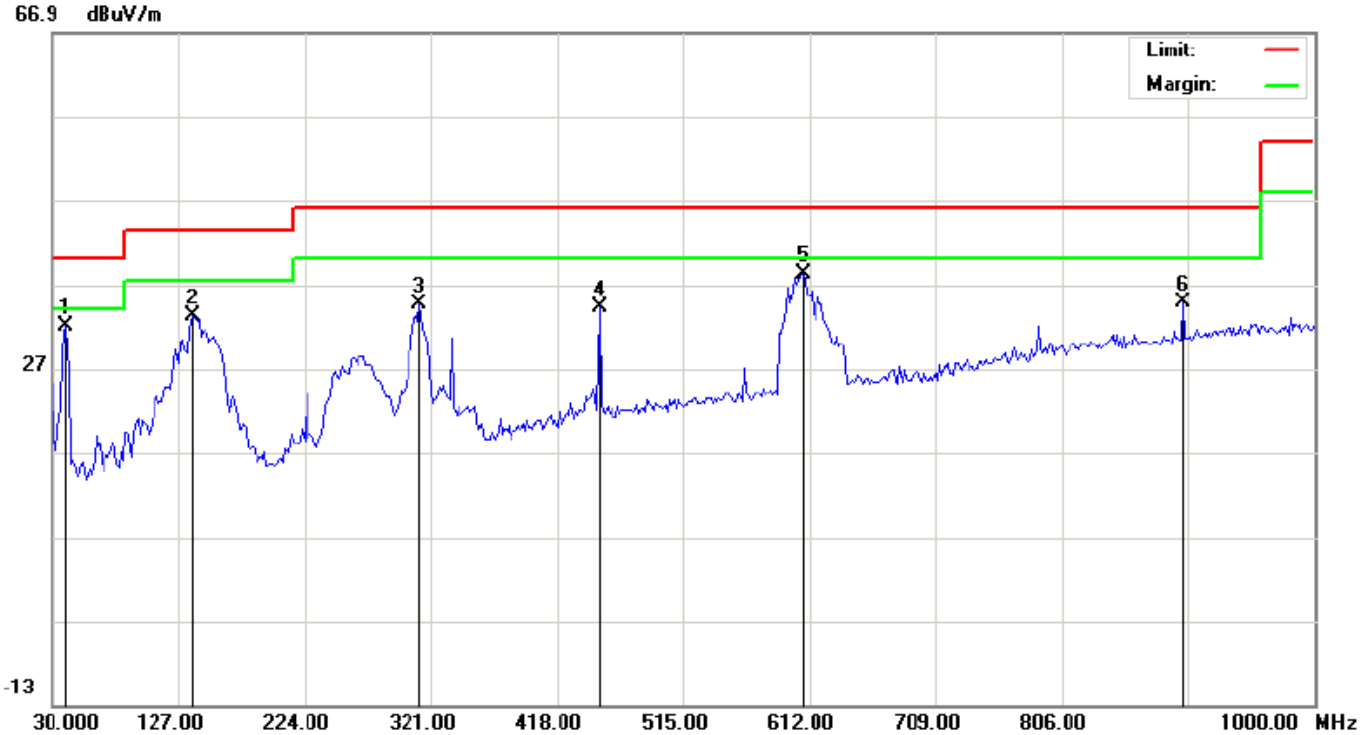
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

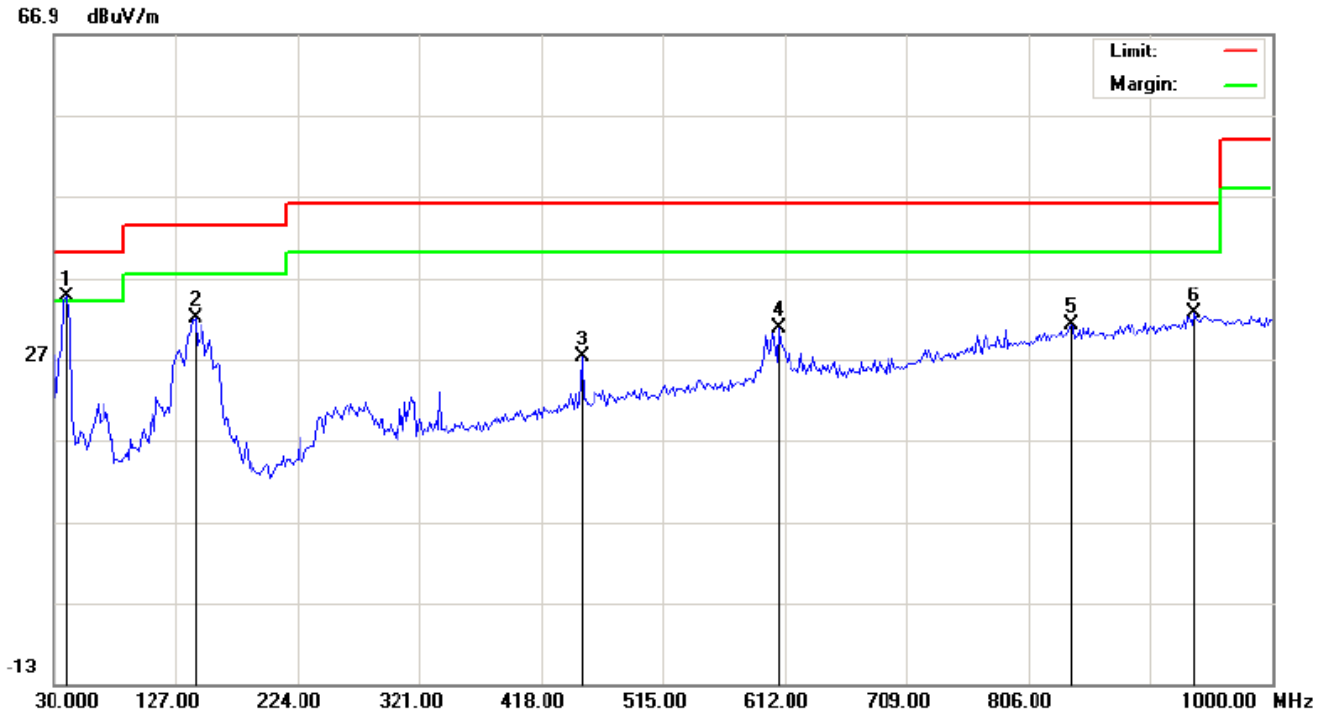
RADIATED EMISSION TEST- (30MHZ-1GHZ) -HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		41.3166	17.44	14.60	32.04	40.00	-7.96	QP			
2		138.3166	19.09	14.11	33.20	43.50	-10.30	QP			
3		312.9166	19.06	15.60	34.66	46.00	-11.34	QP			
4		450.3333	14.15	20.00	34.15	46.00	-11.85	QP			
5	*	607.1499	14.90	23.32	38.22	46.00	-7.78	QP			
6		899.7667	6.08	28.67	34.75	46.00	-11.25	QP			

RESULT: PASS

RADIATED EMISSION TEST- (30MHZ-1GHZ) -VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	41.3166	20.06	14.60	34.66	40.00	-5.34	QP			
2		143.1666	17.78	14.23	32.01	43.50	-11.49	QP			
3		450.3333	7.23	20.00	27.23	46.00	-18.77	QP			
4		607.1499	7.48	23.32	30.80	46.00	-15.20	QP			
5		839.9500	3.35	27.77	31.12	46.00	-14.88	QP			
6		938.5666	3.51	29.06	32.57	46.00	-13.43	QP			

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin= Result -Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

3. All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
TX 11b 2412MHz					
4824	48.39	74	-25.61	Pk	Horizontal
4824	42.23	54	-11.77	AV	Horizontal
7236	49.21	74	-24.79	pk	Horizontal
7236	41.13	54	-12.87	AV	Horizontal
4824	48.89	74	-25.11	Pk	Vertical
4824	40.88	54	-13.12	AV	Vertical
7236	48.09	74	-25.91	Pk	Vertical
7236	41.91	54	-12.09	AV	Vertical
TX 11b 2437MHz					
4874	48.44	74	-25.56	Pk	Horizontal
4874	42.28	54	-11.72	AV	Horizontal
7311	49.26	74	-24.74	Pk	Horizontal
7311	41.18	54	-12.82	AV	Horizontal
4874	48.94	74	-25.06	Pk	Vertical
4874	40.93	54	-13.07	AV	Vertical
7311	48.14	74	-25.86	Pk	Vertical
7311	41.96	54	-12.04	AV	Vertical
TX 11b 2462MHz					
4924	48.5	74	-25.5	Pk	Horizontal
4924	42.34	54	-11.66	AV	Horizontal
7386	49.32	74	-24.68	Pk	Horizontal
7386	41.24	54	-12.76	AV	Horizontal
4924	49	74	-25	Pk	Vertical
4924	40.99	54	-13.01	AV	Vertical
7386	48.2	74	-25.8	Pk	Vertical
7386	42.02	54	-11.98	AV	Vertical

RESULT: PASS

Note:

1. Margin = Emission Level - Limit

2.1GHz-25GHz(All test modes had been pre-tested. The 802.11b mode is the worst case and recorded in the report. No recording in the test report at least have 20dB margin).