FCC RF Test Report

For

SHANGHAI SUPERSUN TECHNOLOGY LIGHTING CO.,LTD

Test Standards:	Part 15C Subpart C §15.247
Product Description:	LED bulb
Tested Model:	SPSWS5A60G**XXZ
Brand Name	SUPERSUN
FCC ID:	2ATSUS5A60
Classification	(DTS) Digital Transmission System
Report No.:	EC1905023RF01
Tested Date:	2019-10-08 to 2019-10-16
Issued Date:	2019-10-16
Prepared By:	Tiny Yang/ Engineer
Approved By:	Bacon Wu / RF Manager

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Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2019.10.16	Valid	Original Report

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Summary Of Test Result

FCC Rule	IC Rule	Description	Limit	Result	Remark
15.247(a)(2)	RSS-247 5.2(1)	6dB Bandwidth	≥ 0.5MHz	Pass	-
-	RSS-Gen 6.6	99% Bandwidth	-	Pass	-
15.247(b)(3)	RSS-247 A5.4(4)	Peak Output Power	≤ 30dBm	Pass	-
15.247(e)	RSS-247 5.2(2)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
15.247(d)	RSS-247 5.5	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
15.247(d)	RSS-247 5.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.78 dB at 4824 MHz
15.207	RSS-GEN 8.8	AC Conducted Emission	15.207(a)	Pass	Under limit 32.35 dB at 0.406 MHz
15.203 & 15.247(b)	N/A	Antenna Requirement	N/A	Pass	-

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number: L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1244 , Test Firm Registration Number: 793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Code : 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

2 General Description

2.1 Applicant

SHANGHAI SUPERSUN TECHNOLOGY LIGHTING CO.,LTD
Room.1038 ,First build ,Shangfeng Road NO.633 ,Pudong,Pudong New District,Shanghai,China

2.2 Manufacturer

JIANGXI SUPERSUN TECHNOLOGY LIGHTING CO.,LTD
SUPERSUN Park, Fengshou Industrial zone ,Wannian Town,Shangrao City, JiangXi Province ,China

2.3 General Description Of EUT

Product	LED bulb
Model No.	SPSWS5A60G**XXZ
Additional No.	SPSWS2A60G**XXZ, SPSWS4A60G**XXZ, SPSWS2P38G**XXZ, SPSWS4P38G**XXZ, SPSWS5P38G**XXZ,SPSWS5R30G**XXZ, SPSWS2R30G**XXZ, SPSWS4R30G**XXZ, SPSWS5GU10G**XXZ, SPSWS2GU10G**XXZ, SPSWS4GU10G**XXZ,
Difference Description	The working principle and IC module design are same, just different from model name and shape structure.
FCC ID	2ATSUS5A60
Power Supply	120Vac 3.3Vdc (test fixture)
Modulation Technology	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Type	802.11b : DSSS 802.11g/n : OFDM
Operating Frequency	2412-2462MHz
Number Of Channel	11
Max. Output Power	802.11b : 12.87 dBm (0.019 W) 802.11g : 11.75 dBm (0.015 W) 802.11n HT20 : 11.64 dBm (0.015 W)
Antenna Type	PCB Antenna type with 2.5dBi gain
I/O Ports	Refer to user's manual
Cable Supplied	USB cable: Unshielded, detachable, 1.0m

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013
- KDB 558074 D01 15.247 Meas Guidance v05r02

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

11 channels are provided for 802.11b, 802.11g and 802.11n(HT20):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

The transmitter has a maximum average conducted output power as follows:

Frequency Range(MHz)	Mode	Rate	Output Power(dBm)
2412~2462	802.11b	1Mbps	12.87
2412~2462	802.11g	6Mbps	11.75
2412~2462	802.11n HT20	MCS0	11.64

a. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

3.2 Test Mode

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases			
Test Item	Modulation		
	802.11 b	802.11 g	802.11n HT20
Conducted Test Cases	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	Modulation
	802.11b CH01(2412MHz)

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna

diversity architecture) and packet type. Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.3 Radiated Emission Test (Above 1GHz)

Test Item	Modulation		
	802.11 b	802.11 g	802.11n HT20
Radiated Test Cases	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011	Mode 1: CH01 Mode 2: CH06 Mode 3: CH011

Note : 1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

3.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : WLAN Link

3.3 Support Equipment

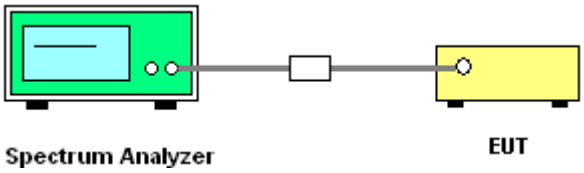
Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
2.	Notebook	Lenovo	E540	FCC DoC	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m

3.4 Test Setup

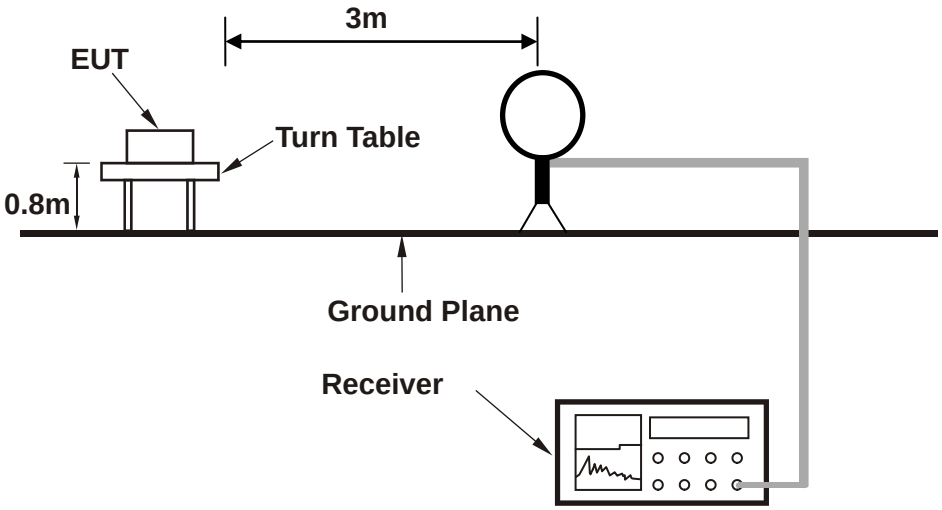
The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

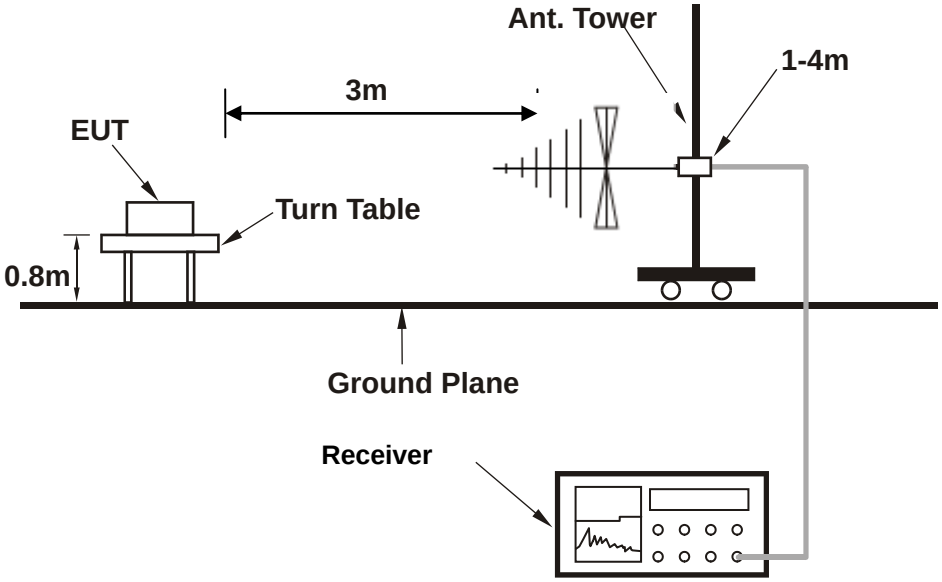
Setup diagram for Conducted Test



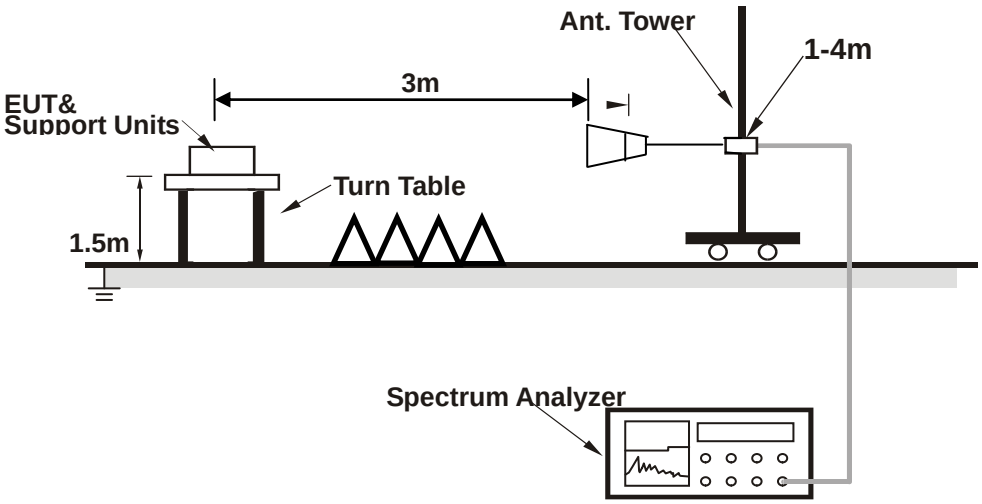
Setup diagram for Radiation(9KHz~30MHz) Test



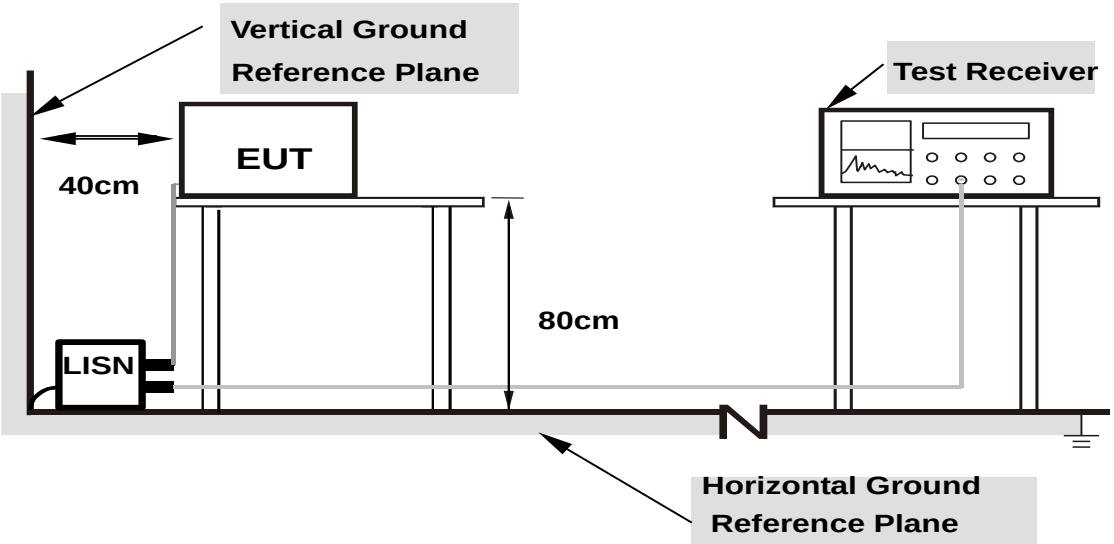
Setup diagram for Radiation(Below 1G) Test



Setup diagram for Radiation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 5 + 10 = 15 (dB)

4 Test Result

4.1 6dB and 99% Bandwidth Measurement

4.1.1 Limit of 6dB and 99% Bandwidth

FCC §15.247 (a) (2)

IC RSS-247 5.2(1)

The minimum 6 dB bandwidth shall be at least 500 kHz.

4.1.2 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05r02.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Turn on the EUT and connect it to measurement instrument.
4. Set to the maximum power setting and enable Transmitting the EUT transmit continuously
5. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
6. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 100KHz and set the Video bandwidth (VBW) = 300KHz.

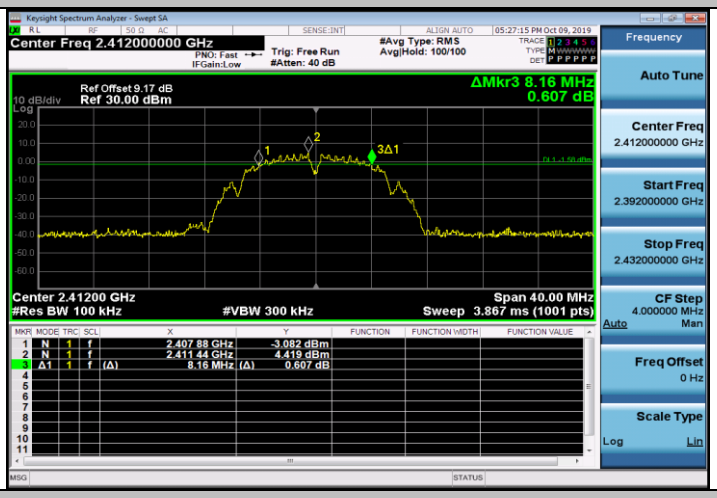
4.1.3 Test Result of 6dB Bandwidth

Test Mode :	TX Mode	**Temperature :**	24~26℃
Test Engineer :	Victorique Gao	**Relative Humidity :**	50~53%

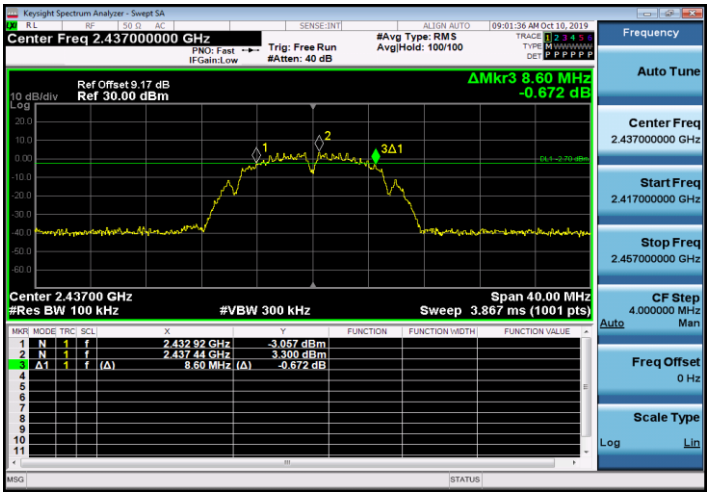
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.160	2407.880	2416.040	>=0.5	PASS
		2437	8.600	2432.920	2441.520	>=0.5	PASS
		2462	8.120	2457.880	2466.000	>=0.5	PASS
11G	Ant1	2412	15.760	2404.000	2419.760	>=0.5	PASS
		2437	15.760	2429.000	2444.760	>=0.5	PASS
		2462	15.880	2454.000	2469.880	>=0.5	PASS
11N20SISO	Ant1	2412	15.320	2404.160	2419.480	>=0.5	PASS
		2437	15.200	2429.320	2444.520	>=0.5	PASS
		2462	15.800	2454.080	2469.880	>=0.5	PASS

6dB Bandwidth Plot

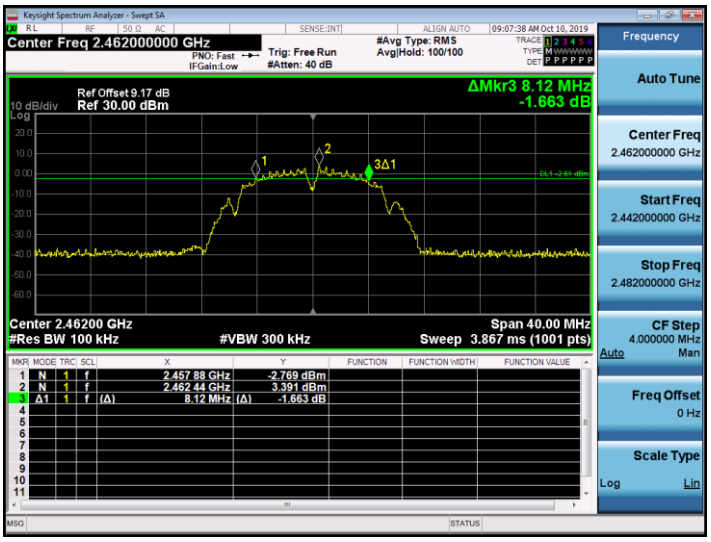
11B_Ant1_2412



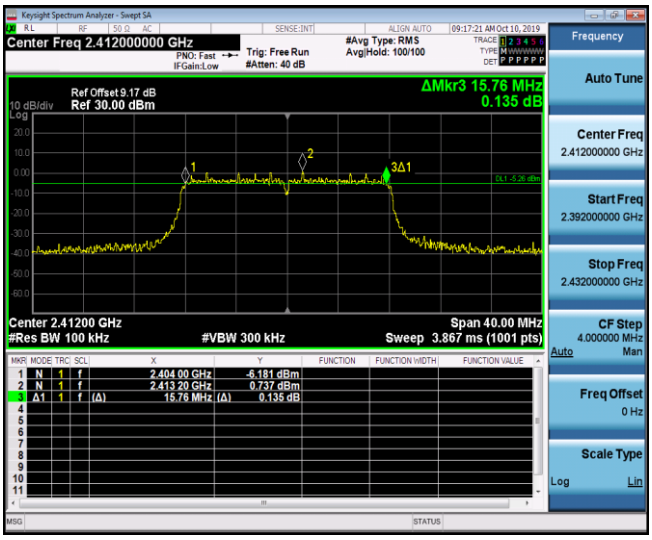
11B_Ant1_2437



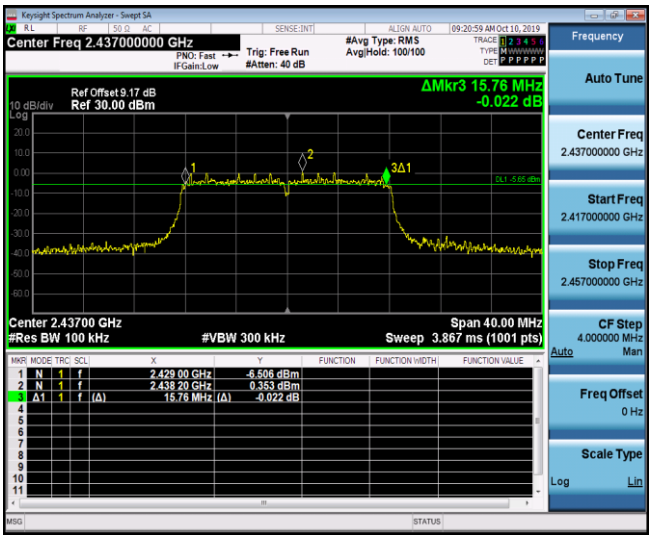
11B_Ant1_2462



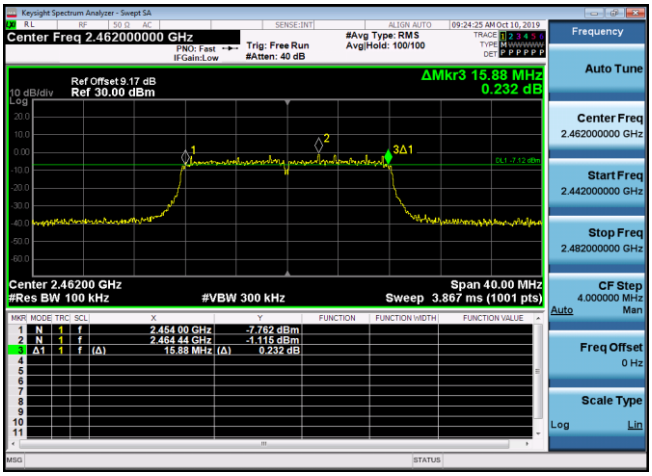
11G_Ant1_2412



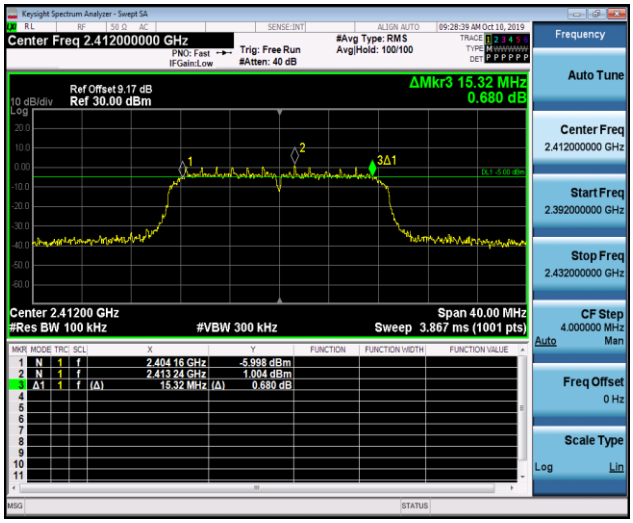
11G_Ant1_2437



11G_Ant1_2462



11N20SISO_Ant1_2412



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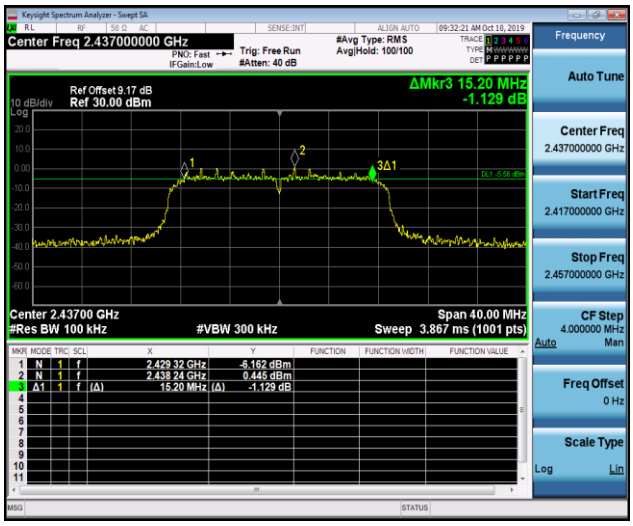

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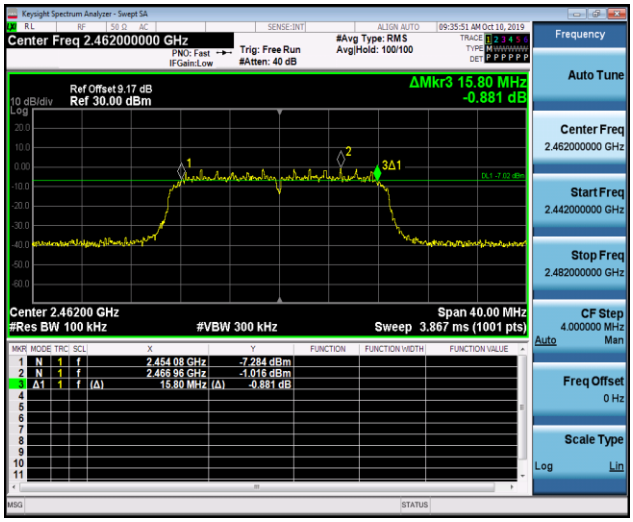


4.1.4 Test Result of 99% Bandwidth

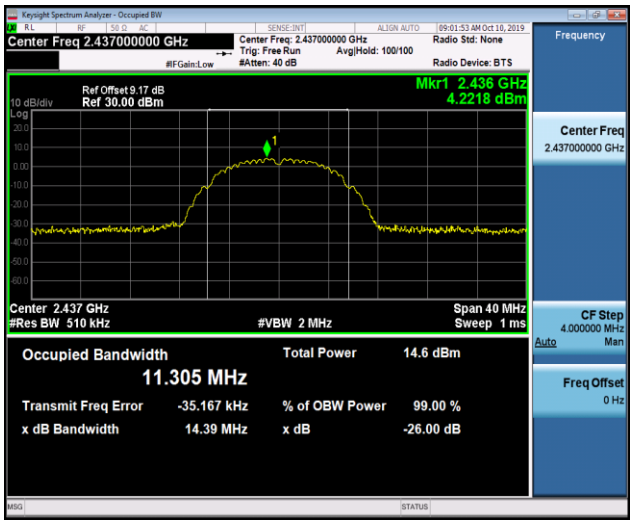
Test Mode :	TX Mode	**Temperature :**	24~26℃
Test Engineer :	Victorique Gao	**Relative Humidity :**	50~53%

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	11.255	2406.303	2417.558	---	PASS
		2437	11.305	2431.312	2442.617	---	PASS
		2462	11.270	2456.338	2467.608	---	PASS
11G	Ant1	2412	16.471	2403.695	2420.166	---	PASS
		2437	16.493	2428.711	2445.204	---	PASS
		2462	16.481	2453.706	2470.187	---	PASS
11N20SISO	Ant1	2412	17.334	2403.274	2420.608	---	PASS
		2437	17.332	2428.303	2445.635	---	PASS
		2462	17.340	2453.289	2470.629	---	PASS

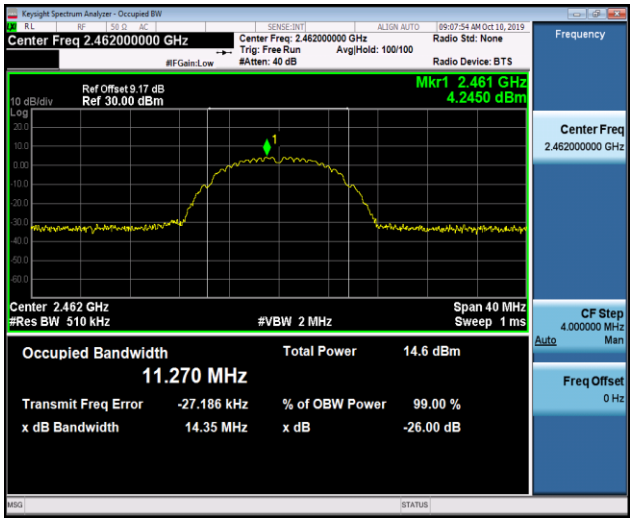
99% Bandwidth Plot

11B_Ant1_2412

11B_Ant1_2437



11B_Ant1_2462



11G_Ant1_2412

11G_Ant1_2437

11G_Ant1_2462

11N20SISO_Ant1_2412

11N20SISO_Ant1_2437

11N20SISO_Ant1_2462

4.2 Output Power Measurement

4.2.1 Limit of Output Power

FCC §15.247 (b)(3)

IC RSS-247 A5.4(4)

For systems using digital modulation in the 2400-2483.5 MHz bands: 30dBm.

4.2.2 Test Procedures

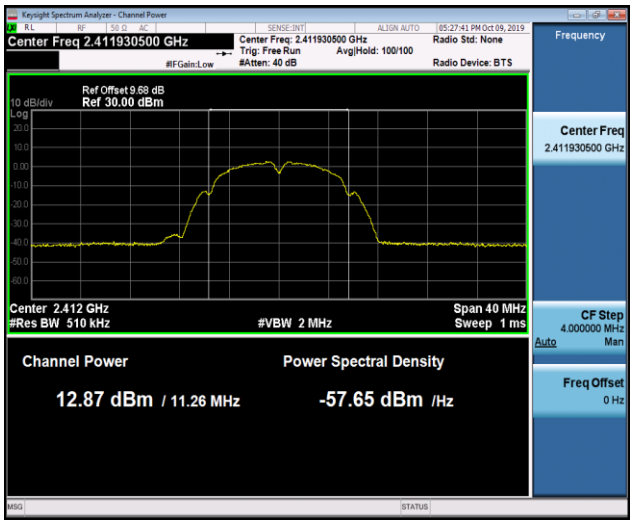
1. The testing follows the Measurement Procedure of ANSI C63.10-2013 section 11.9.2.2.4 Measurement using a spectrum analyzer.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Turn on the EUT and connect it to spectrum analyzer.
4. Set to the maximum power setting and enaBle Transmitting the EUT transmit continuously
5. Measure the duty cycle, x, of the transmitter output signal as described in below:
   a. Set the center frequency of the instrument to the center frequency of the transmission.
   b. Set RBW to the largest availaBle Transmitting value.
   c. Set detector = peak
6. Set span to at least 1.5*OBW.Set RBW=510KHz,VBW=2MHz, Number of points in sweep ≥ 2/3* span, Sweep time = auto. Detector = RMS
7. Allow the sweep to “free run”. Trace average 100 traces in RMS mode
8. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s Channel power measurement function with band limits set equal to the OBW band edges.
9. Add 10 log (1/x), where x is the duty cycle.

4.2.3 Test Result of Output Power

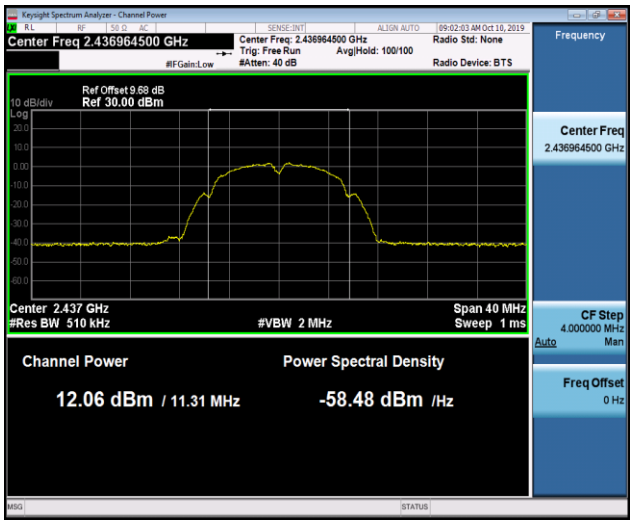
Test Mode :	**TX Mode**		**Temperature :**	24~26℃	
Test Engineer :	Victorique Gao		**Relative Humidity :**	50~53%	
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	12.87	<=30	PASS
		2437	12.06	<=30	PASS
		2462	11.81	<=30	PASS
11G	Ant1	2412	11.75	<=30	PASS
		2437	11.35	<=30	PASS
		2462	10.18	<=30	PASS
11N20SISO	Ant1	2412	11.64	<=30	PASS
		2437	11.13	<=30	PASS
		2462	10.08	<=30	PASS

Meas.Level Plot

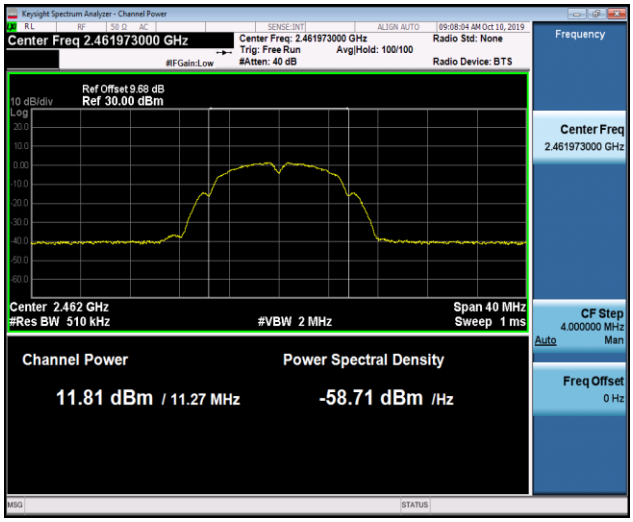
11B_Ant1_2412



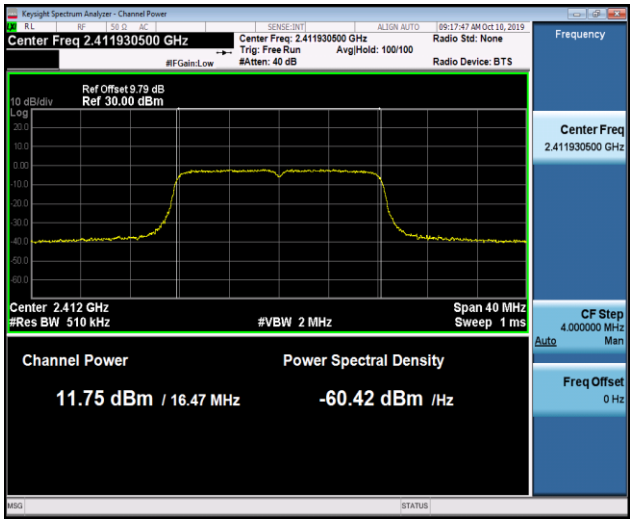
11B_Ant1_2437



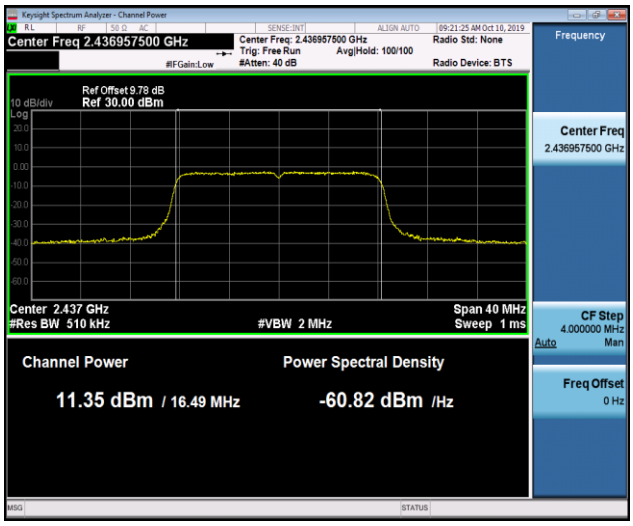
11B_Ant1_2462



11G_Ant1_2412

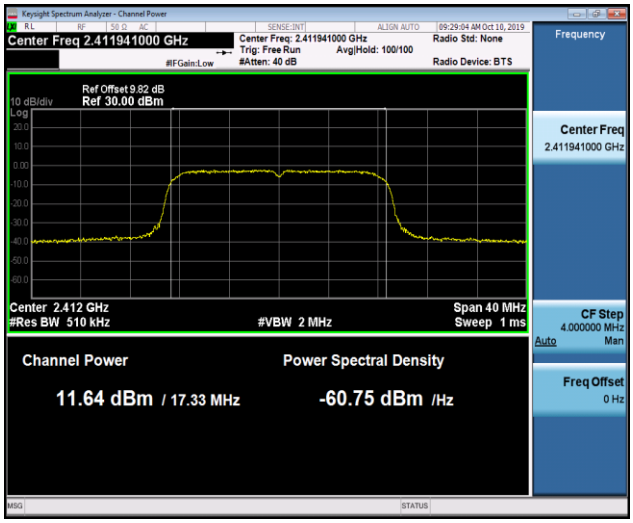


11G_Ant1_2437



11G_Ant1_2462

11N20SISO_Ant1_2412



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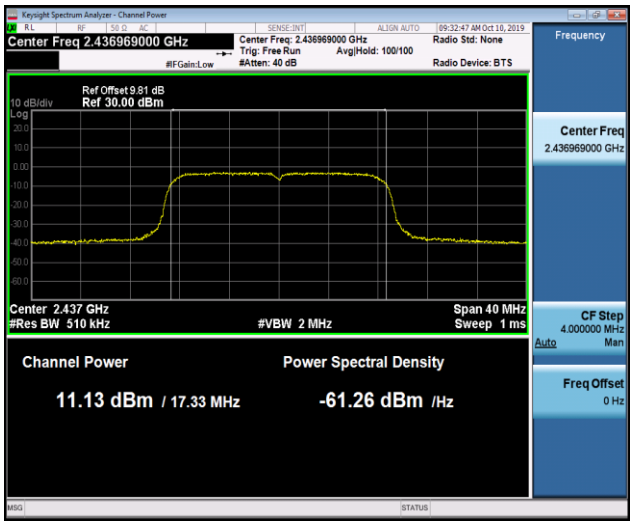
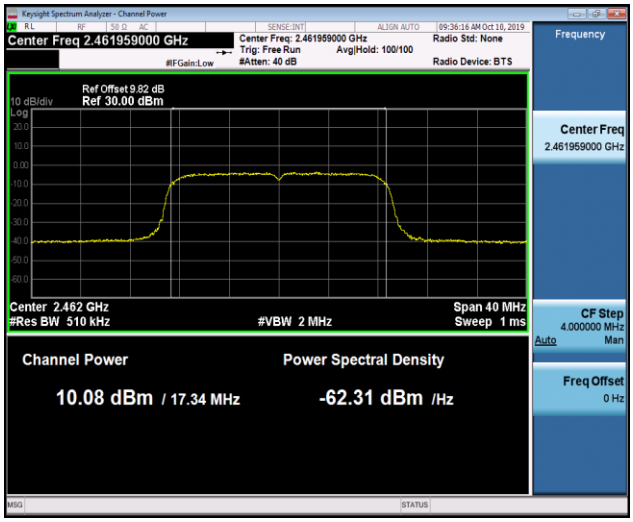


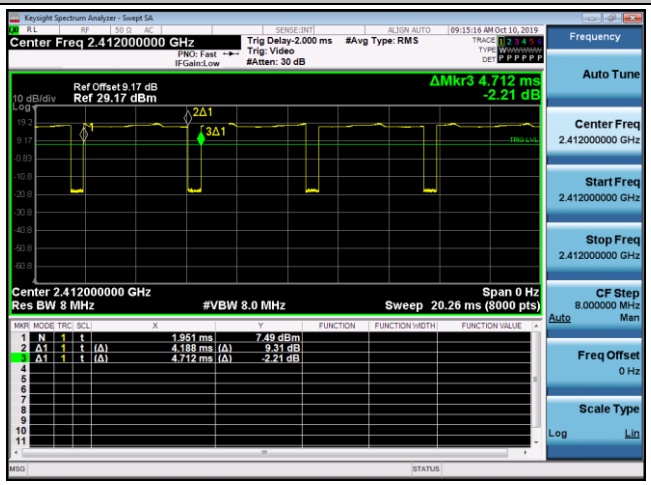
11N20SISO_Ant1_2462



Duty cycle Plot

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2412	4.19	4.71	88.87
		2437	4.19	4.71	88.87
		2462	4.19	4.71	88.87
11G	Ant1	2412	0.69	0.79	86.76
		2437	0.69	0.79	86.92
		2462	0.69	0.79	86.92
11N20SISO	Ant1	2412	0.65	0.76	86.14
		2437	0.65	0.76	86.29
		2462	0.65	0.76	86.14

11B_Ant1_2412



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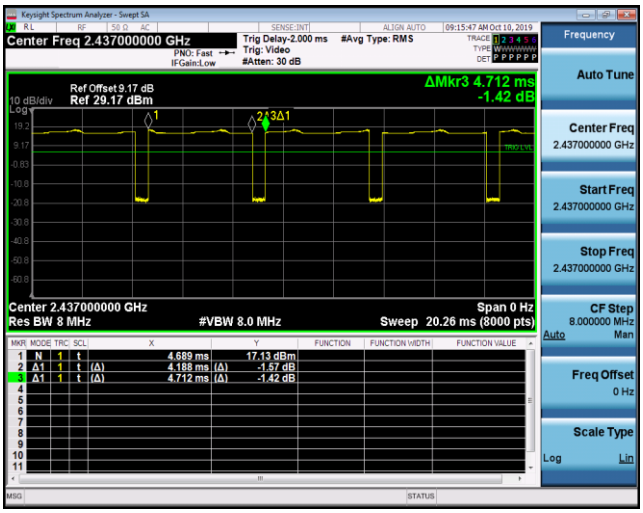

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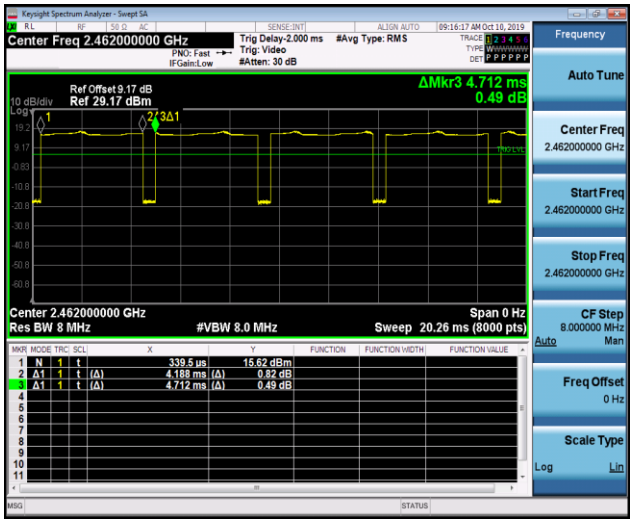

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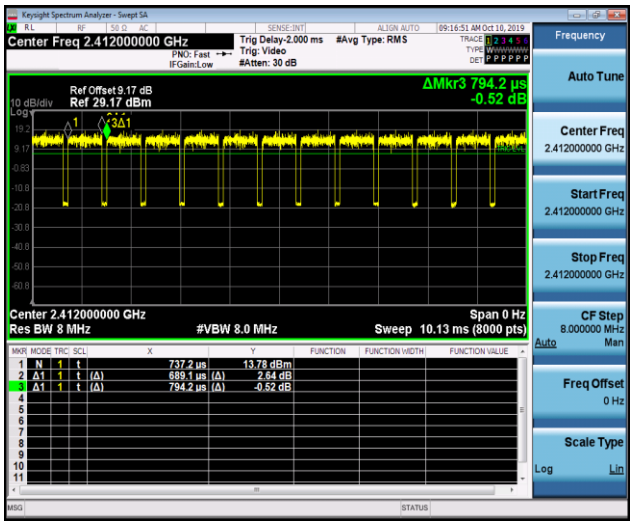

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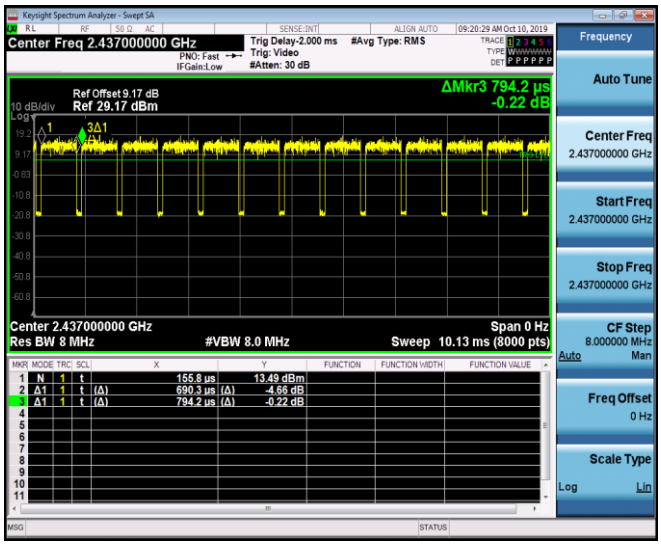

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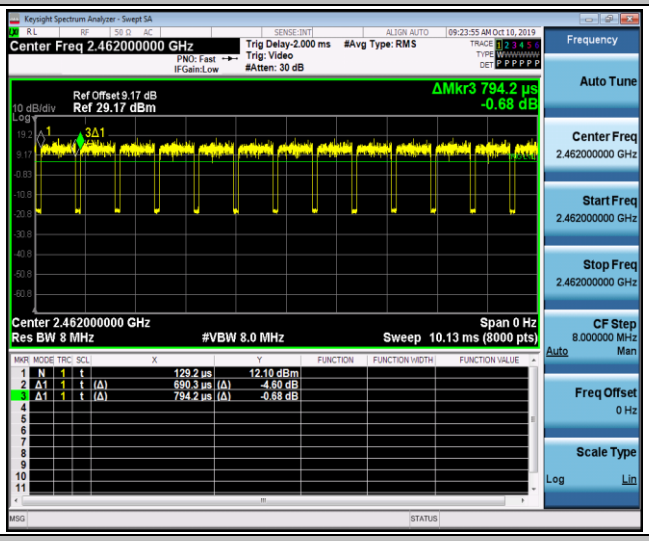

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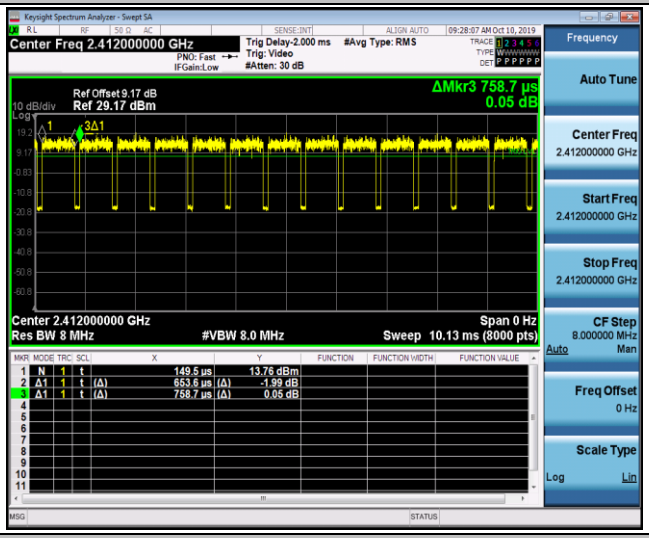

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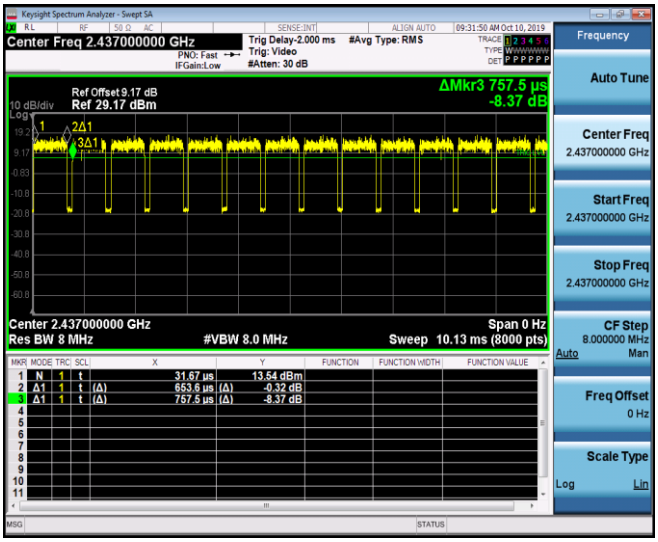

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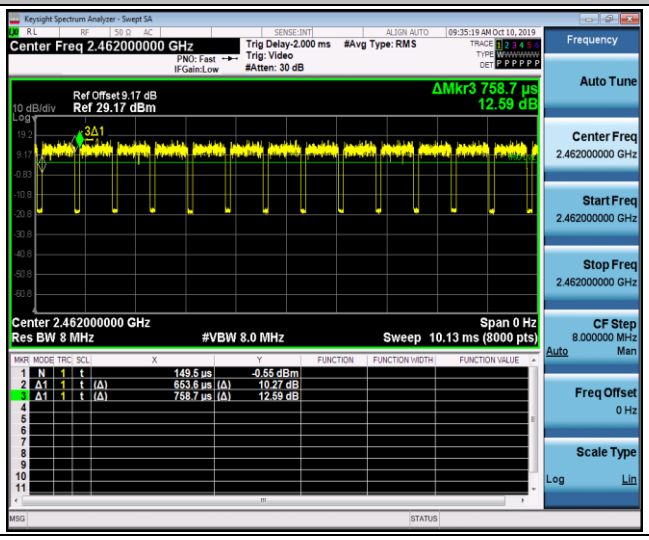


4.3 Power Spectral Density Measurement

4.3.1 Limits of Power Spectral Density

FCC§15.247(e)

IC RSS-247 5.2(2)

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

4.3.2 Test Procedure

1. The testing follows Measurement Procedure 8.4 DTS maximum power spectral density level in the fundamental emission of ANSI C63.10-2013 section 11.9.2.2.4
2. Turn on the EUT and connect it to measurement instrument.
3. Measure the duty cycle, x, of the transmitter output signal as described in below:
   a. Set the center frequency of the instrument to the center frequency of the transmission.
   b. Set RBW to the largest availaBle Transmitting value.
   c. Set detector = peak
4. Set span to at least 1.5*OBW.Set RBW= 10 KHz,VBW=30 KHz, Number of points in sweep ≥ 2/3* span, Sweep time = auto.
5. Detector = power averaging (rms), Sweep time = auto couple, Trace mode = averaging (rms) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.
6. Add 10 log (1/x), where x is the duty cycle.
7. Measure and record the results in the test report.
8. The Measured power density (dBm)/ 100kHz is a reference level and used as 30dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

4.3.3 Test Result of Power Spectral Density

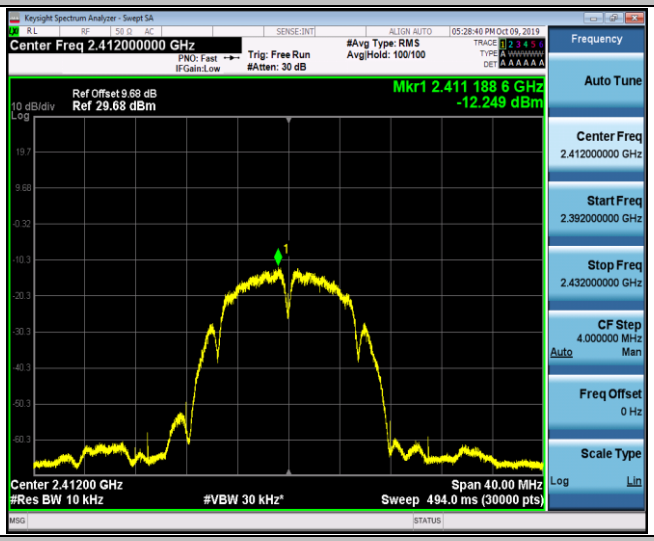
Test Mode :	TX Mode	**Temperature :**	24~26℃
Test Engineer :	Victorique Gao	**Relative Humidity :**	50~53%

TestMode	Antenna	Channel	Result[dBm/10kHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-12.25	-17.48	<=8	PASS
		2437	-13.82	-19.05	<=8	PASS
		2462	-13.35	-18.58	<=8	PASS
11G	Ant1	2412	-15.11	-20.34	<=8	PASS
		2437	-8.57	-13.80	<=8	PASS
		2462	-16.07	-21.30	<=8	PASS
11N20SISO	Ant1	2412	-15.17	-20.40	<=8	PASS
		2437	-15.21	-20.44	<=8	PASS
		2462	-16.62	-21.85	<=8	PASS

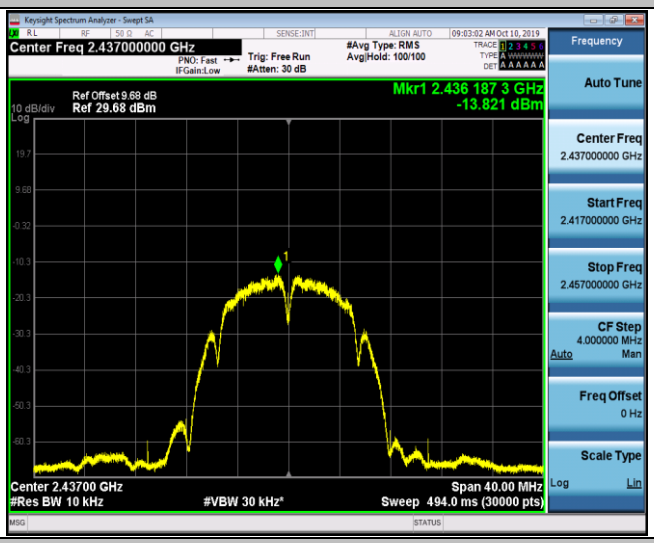
Note: Result[dBm/3kHz]= Result[dBm/10kHz]+10*LOG(3/10)

Power Spectral Density Plot

11B_Ant1_2412



11B_Ant1_2437



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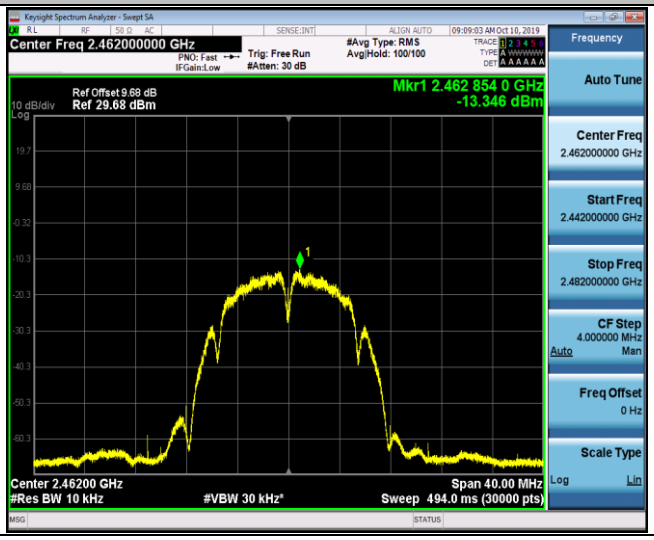
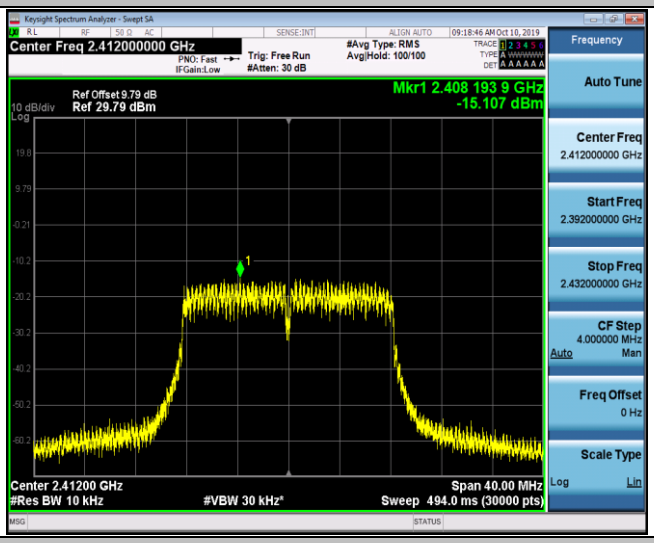


11G_Ant1_2412



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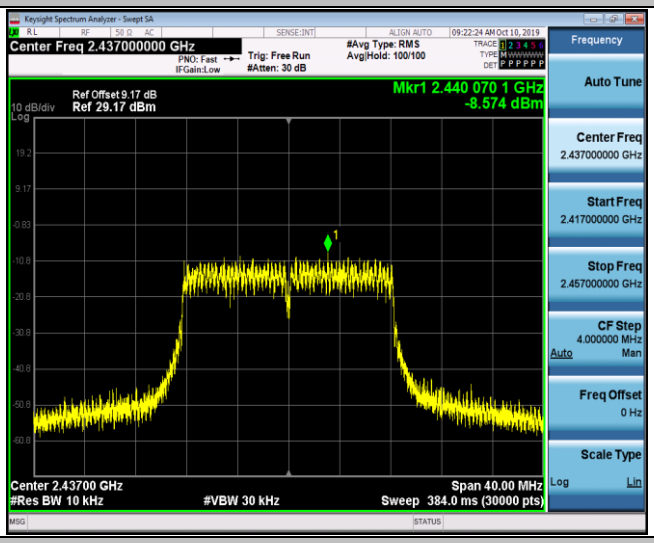

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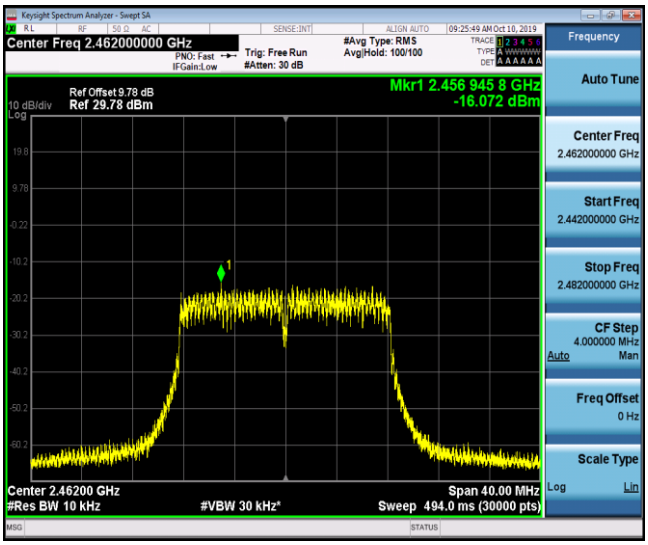
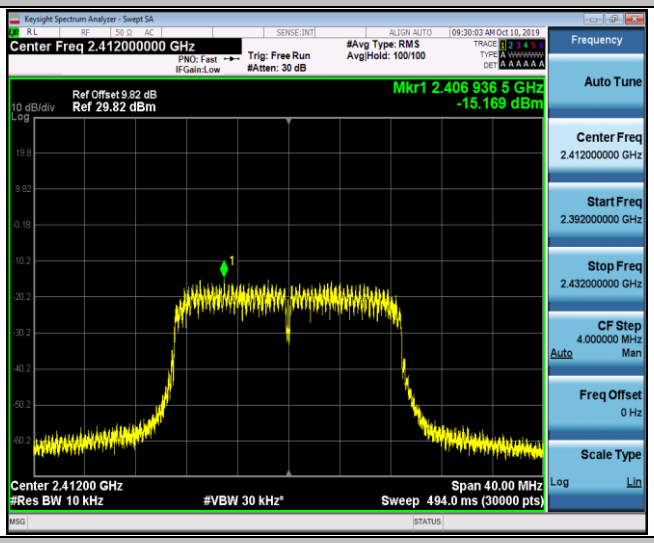


11N20SISO_Ant1_2412



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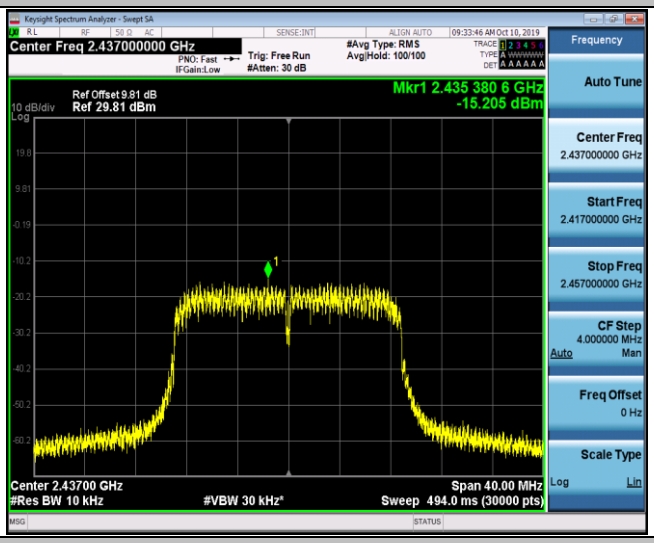

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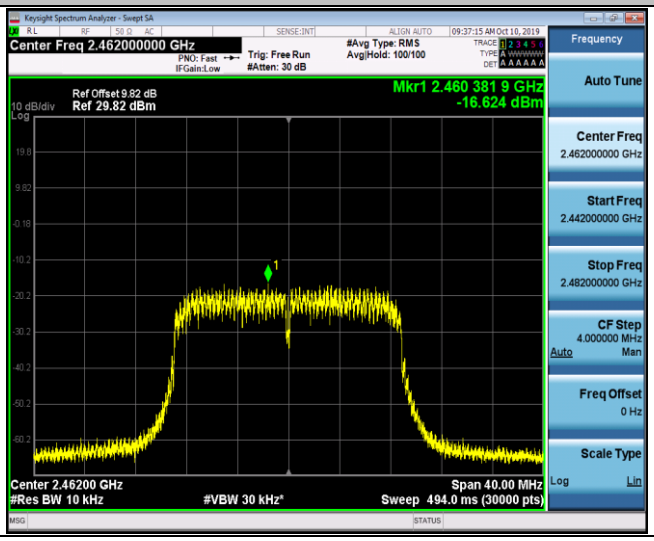


4.4 Conducted Band Edges and Spurious Emission Measurement

4.4.1 Limit of Conducted Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

Maximum conducted (average) output power was used to determine compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

4.4.2 Test Procedures

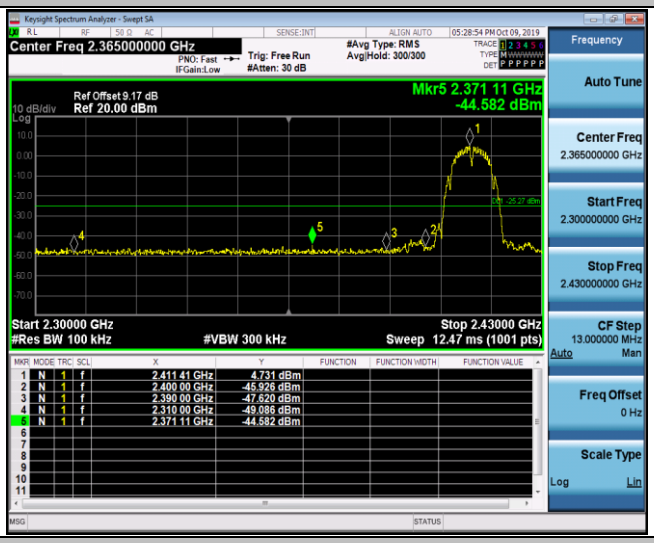
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.4.3 Test Result of Conducted Band Edges

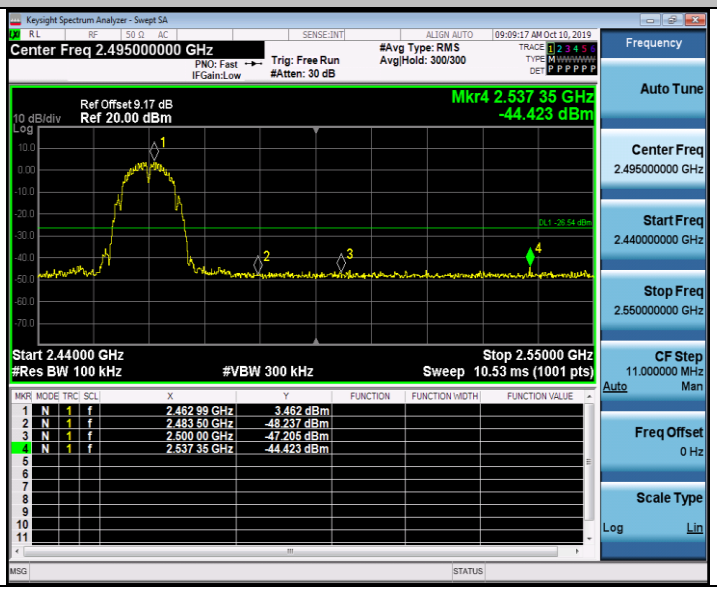
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	4.73	-44.58	<=-25.27	PASS
		High	2462	3.46	-44.42	<=-26.54	PASS
11G	Ant1	Low	2412	0.79	-42.94	<=-29.21	PASS
		High	2462	-0.62	-45.79	<=-30.62	PASS
11N20SISO	Ant1	Low	2412	0.90	-42.69	<=-29.11	PASS
		High	2462	-0.72	-45.83	<=-30.72	PASS

Conducted Band Edges Plot

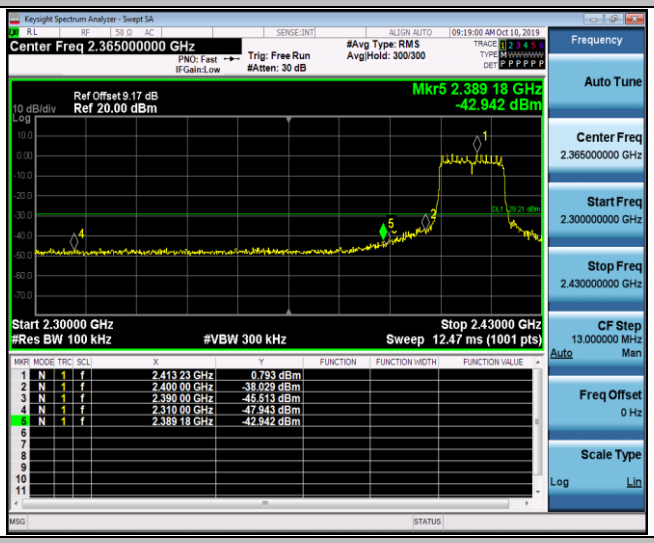
11B_Ant1_Low_2412



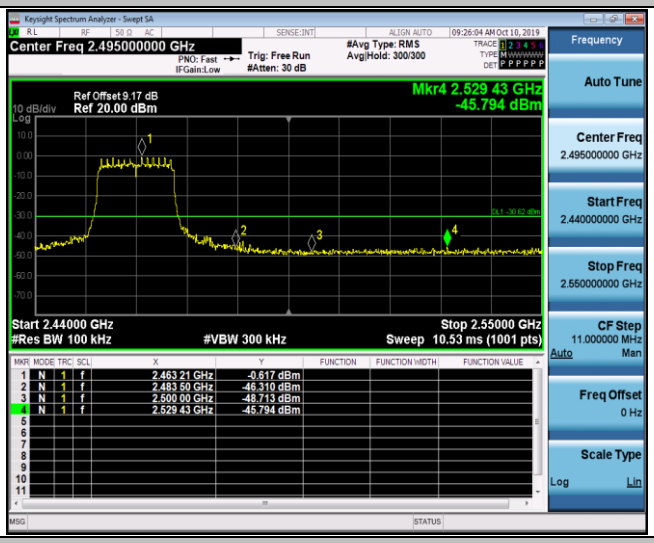
11B_Ant1_High_2462



11G_Ant1_Low_2412



11G_Ant1_High_2462



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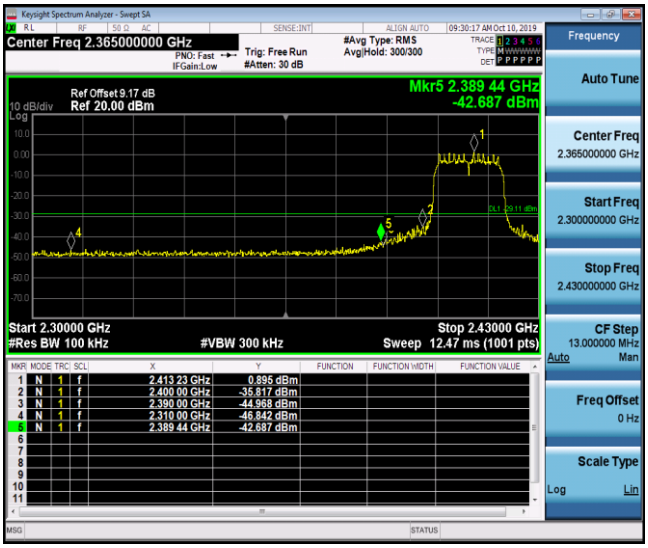
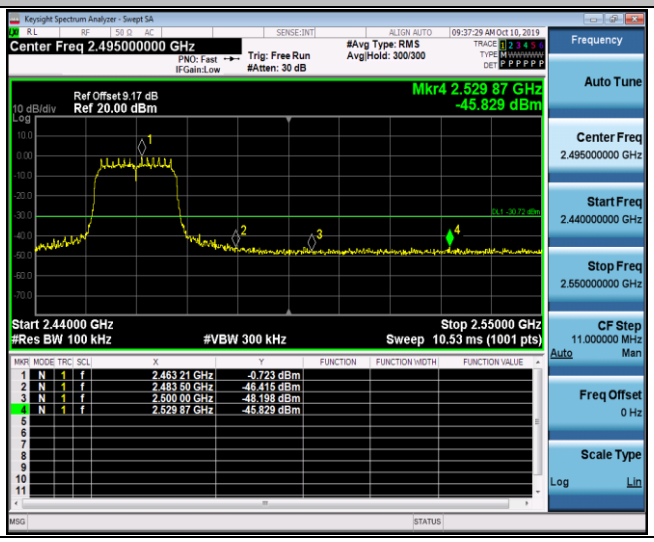
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