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Testing
NVLAP LAB CODE 600222-0

MEASUREMENT REPORT

FCC PART 15.247 / RSS-247 WLAN 802.11b/g/n

Report No.: S202005114008E02
Report Version: V02
Issue Date: 07-28-2020

Applicant: kantiantech Inc.

Address: NO.3 JinPin Street,Ya An Road,NanKai District.Tianjin China

FCC ID: 2AWHIWSPRK1
IC: 26041-WSPRK1
Application Type: Certification
Product: WYZE SPRINKLER CONTROLLER
Model No.: WSPRK1
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15 Subpart C (15.247)
IC Rule(s): RSS-247 Issue 2, RSS-GEN Issue 5
Test Procedure(s): ANSI C63.10-2013, KDB 558074 D01v05r02
Test Date: May 19 ~ July 23, 2020

Reviewed By: Line Chen
(Line Chen)
Senior Test Engineer

Approved By: Roy Cheng
(Roy Cheng)
Senior Test Engineer

FANGGUANG INSPECTION & TESTING CO.,LTD. APPROVED(02)

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 558074 D01. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of Fangguang Inspection & Testing Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date
S202005114008E02	Rev. 02	1. Added test software description, uncertainty; 2. The output power and PSD in the report are changed from AV method to PK method, the power setting value is the same as the history report.	07-28-2020

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§2.1033 General Information

Applicant:	kantiantech Inc.
Applicant Address:	NO.3 JinPin Street,Ya An Road,NanKai District.Tianjin China
Manufacturer:	kantiantech Inc.
Manufacturer Address:	NO.3 JinPin Street,Ya An Road,NanKai District.Tianjin China
Factory:	kantiantech Inc.
Factory Address:	NO.3 JinPin Street,Ya An Road,NanKai District.Tianjin China
Test Site:	Fangguang Inspection & Testing Co., Ltd.
Test Site Address:	200 Linghu Avenue, Xinwu District, Wuxi City, China
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2. Fangguang Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,LTD located at 200 Linghu Avenue, Xinwu District, Wuxi City. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	WYZE SPRINKLER CONTROLLER
Model Name:	WSPRK1
Input Voltage Range:	AC 24V~, 60Hz, 800mA
Wi-Fi Specification:	802.11b/g/n-HT20/n-HT40
Bluetooth Version:	V3.0/4.0
Adapter Information:	Model: HMQ-SM2401 Rated Input: 120V~, 60Hz , Max. Input current: 800mA, Rated Output: 24V~, 1.0A

2.2. Product Specification Subjective to this Report

Frequency Range:	802.11b/g/n-HT20: 2412 ~ 2462MHz 802.11n-HT40: 2422 ~ 2452MHz
Channel Number:	802.11b/g/n-HT20: 11 802.11n-HT40: 7
Type of Modulation:	802.11b: DSSS 802.11g/n: OFDM
Data Rate:	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: MCS0~MCS7
Antenna Type:	FPC Antenna
Antenna Gain:	2.64dBi

2.3. Operation Frequency / Channel List

802.11b/g/n-HT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz
04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz
10	2457 MHz	11	2462 MHz	--	--

802.11n-HT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz
06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	N/A	N/A	N/A	N/A

2.4. Device Capabilities

This device contains the following capabilities:

2.4GHz WLAN (DTS) & Bluetooth (v3.0/4.0)

Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are 100%.

2.5. Description of Test Software

The test utility software used during testing was “ESP_RF_test_tool”, the version was v2.3, and the emission setting value is the software default value.

2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11b Ant 1
	Mode 2: Transmit by 802.11g Ant 1
	Mode 3: Transmit by 802.11n-HT20 Ant 1
	Mode 4: Transmit by 802.11n-HT40 Ant 1

2.7. Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSP-100 Issue 11 Section 3

The manufacturer, importer or distributor shall meet the labelling requirements set out in this section for every unit:

(i) prior to marketing in Canada, for products manufactured in Canada

(ii) prior to importation into Canada, for imported products

For information regarding the e-labelling option, see Notice 2014-DRS1003. The label for the certified product represents the manufacturer's or importer's compliance with Innovation, Science and Economic Development Canada's (ISED) regulatory requirements.

Please see attachment for IC label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. The turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 shall be considered sufficient to comply with the provisions of this section."

- The antennas of the EUT are **permanently attached.**
- There are no provisions for connections to an external antenna.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2021/03/23
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2021/03/15
AMN	AFJ	LT32C/10	FWXGJC-2016-179	1 year	2021/05/29
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2021/02/28

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Loop Antenna	Schwarzbeck	FMZB 1519B	FWXGJC-2018-015	1 year	2021/08/23
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	3 year	2021/03/21
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2021/04/06
Broadband Horn Antenna	Schwarzbeck	BBHA9170	FWXGJC-2018-016	1 year	2021/08/19
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2021/03/23
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2021/03/15
Pre-Amplifier	R&S	EMC184055 SE	/	/	2020/08/09
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-386	1 year	2021/02/28
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	1 year	2021/04/10

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Keysight	N9010B	FWXGJC-2018-010	1 year	2021/05/29
RF Control Unit	Toncend	JS0806-2	FWXGJC-2018-013	1 year	2020/10/16
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2021/02/28

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	/	/	/

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.28dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.72dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 1.00 dB 1GHz-26.5GHz: 1.30 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.60dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.80dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.20MHz

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	RSS-247 [5.4]	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge	≥ 20dBc		Pass	Section 7.5
15.247(d)	RSS-247 [5.5]	Out-of-Band Emissions	≥ 20dBc		Pass	Section 7.6
15.205 15.209	RSS GEN [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS GEN [8.9])	Radiated	Pass	Section 7.7, 7.8
15.207	RSS GEN [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits (RSS GEN [8.8])	Line Conducted	Pass	Section 7.9

Notes:

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum permissible 6dB bandwidth is 500 kHz.

7.2.2. Test Procedure used

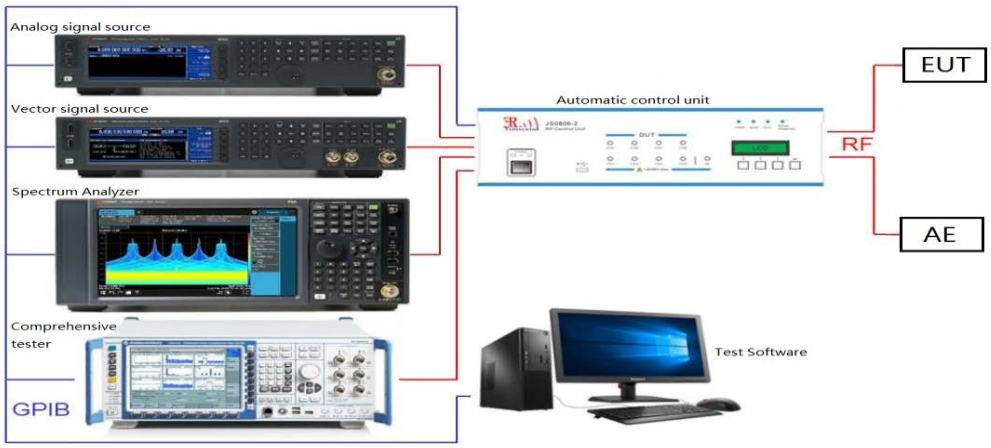
ANSI C63.10-2013 Section 11.8.2 Option 1

KDB 558074 D01 v05r02 – Section 8.2

7.2.3. Test Setting

1. Set RBW = 100 kHz
2. VBW ≥ 3 × RBW
3. Detector = peak
4. Trace mode = max hold
5. Sweep = auto couple
6. Allow the trace was allowed to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

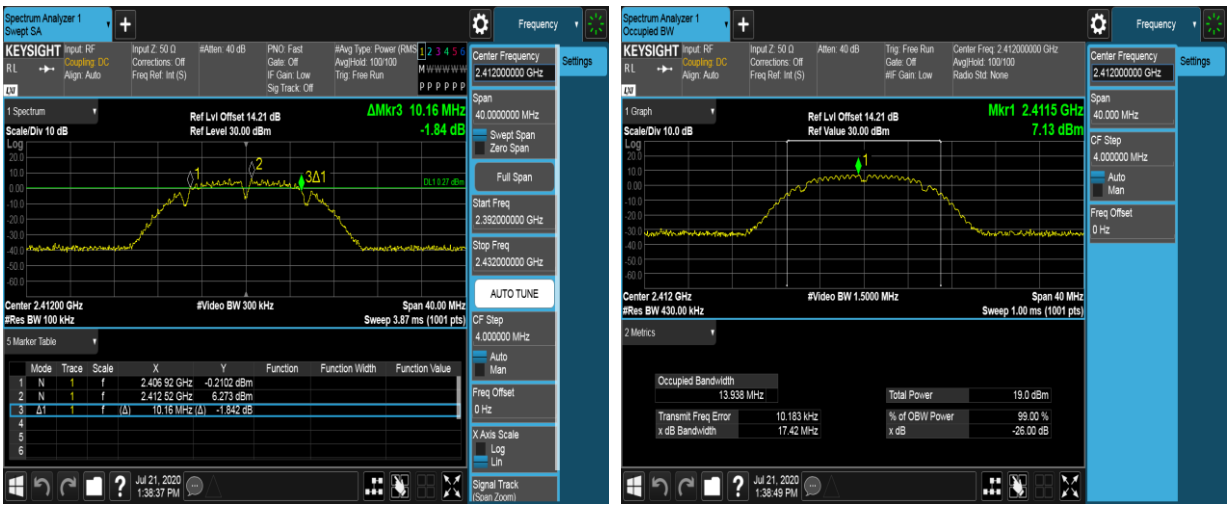
7.2.4. Test Setup



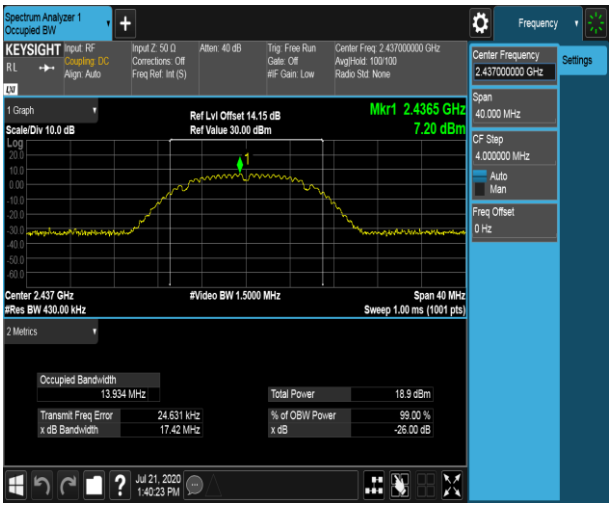
7.2.5. Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	99% BW(MHz)	Verdict
11B	Ant1	2412	10.160	2406.920	2417.080	>=0.5	13.938	PASS
		2437	10.120	2431.960	2442.080	>=0.5	13.934	PASS
		2462	10.120	2456.960	2467.080	>=0.5	13.948	PASS
11G	Ant1	2412	10.160	2406.880	2417.040	>=0.5	16.377	PASS
		2437	14.760	2429.400	2444.160	>=0.5	16.328	PASS
		2462	13.880	2455.640	2469.520	>=0.5	16.348	PASS
11N20SISO	Ant1	2412	14.240	2405.320	2419.560	>=0.5	17.449	PASS
		2437	11.400	2431.280	2442.680	>=0.5	17.398	PASS
		2462	13.920	2455.640	2469.560	>=0.5	17.442	PASS
11N40SISO	Ant1	2422	25.200	2410.640	2435.840	>=0.5	34.777	PASS
		2437	26.400	2424.440	2450.840	>=0.5	34.674	PASS
		2452	25.200	2438.160	2463.360	>=0.5	34.670	PASS

11B_Ant1_2412



11B_Ant1_2437



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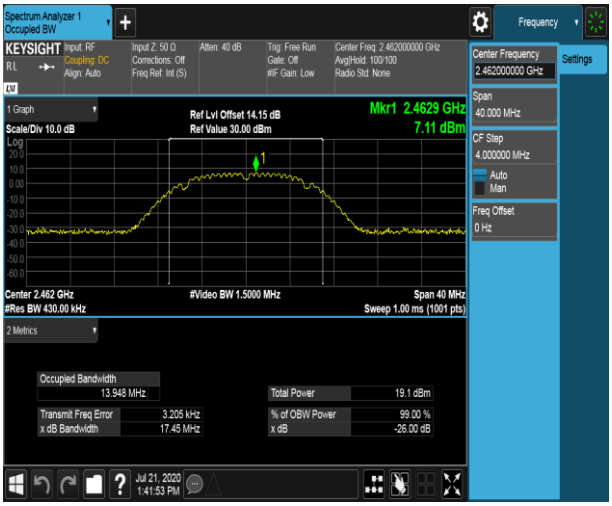

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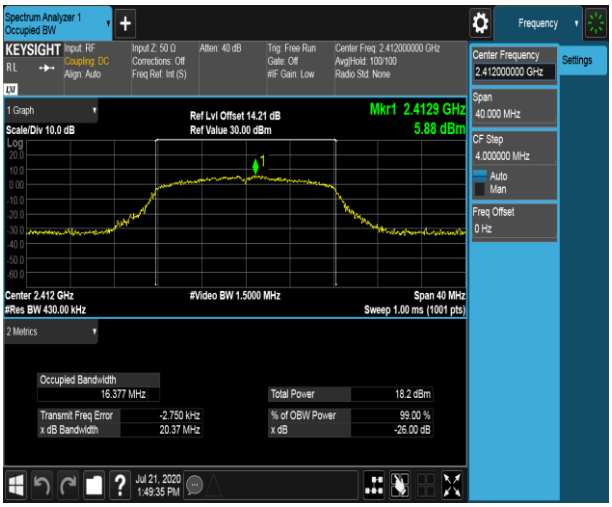

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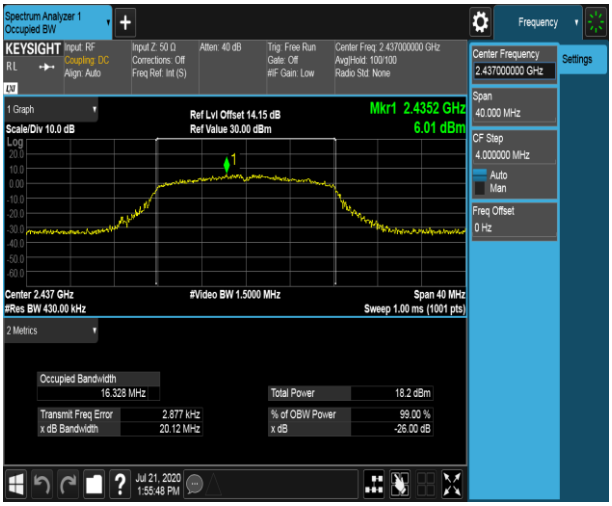

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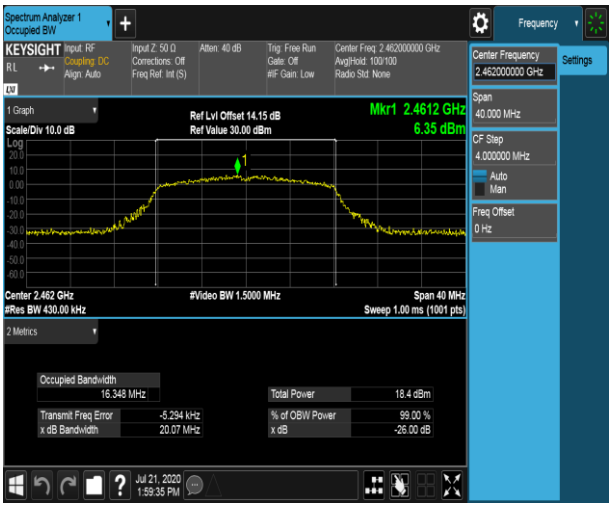

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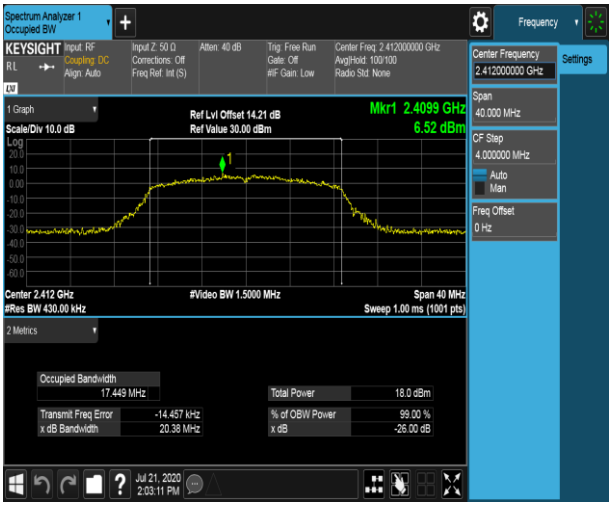

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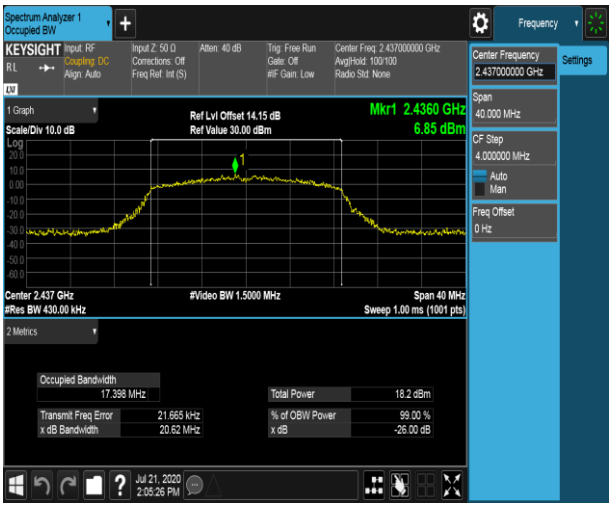

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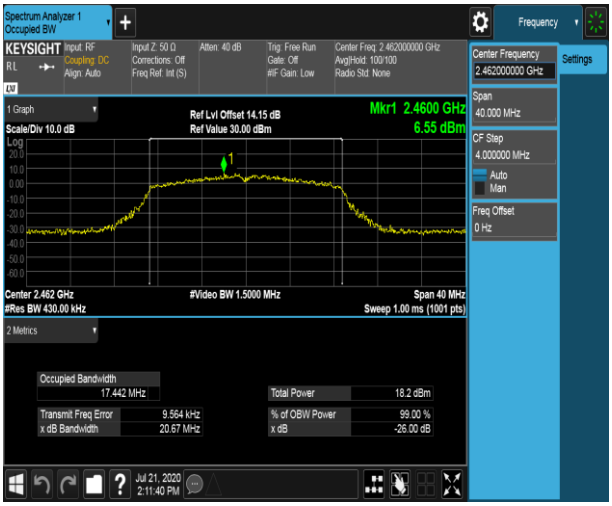

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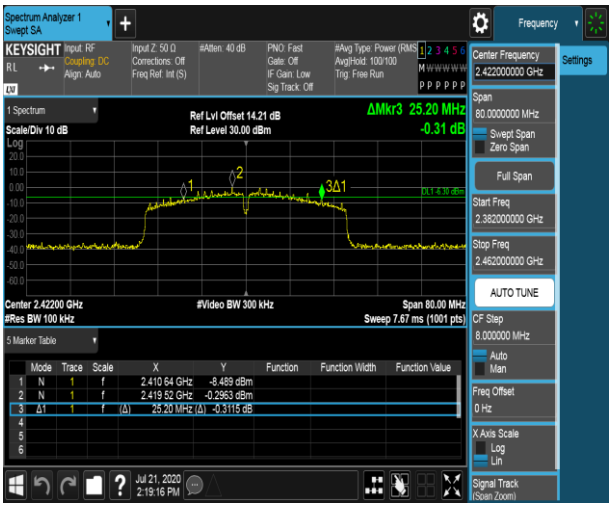
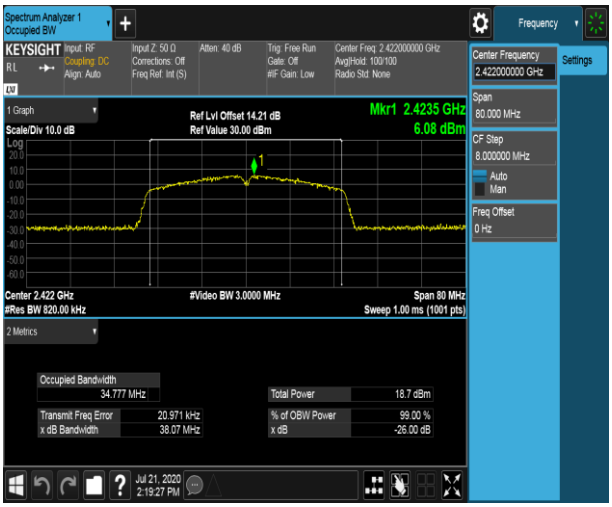
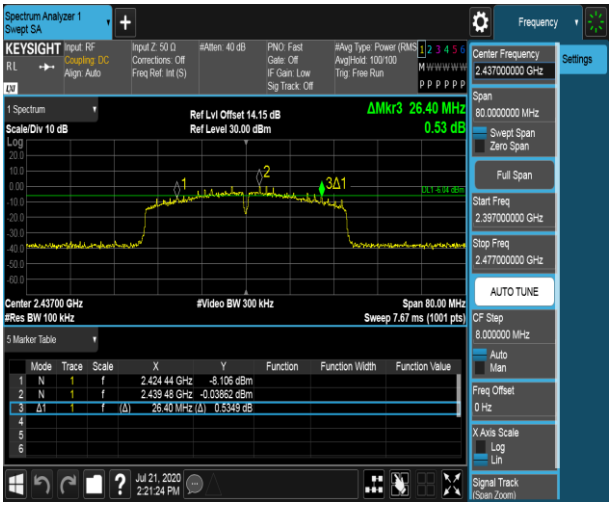
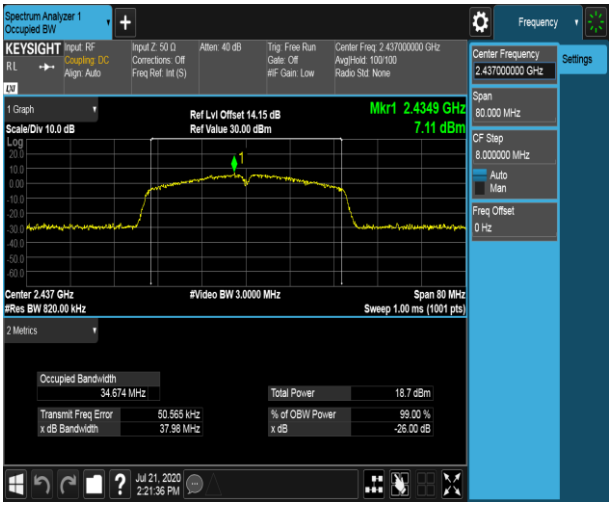
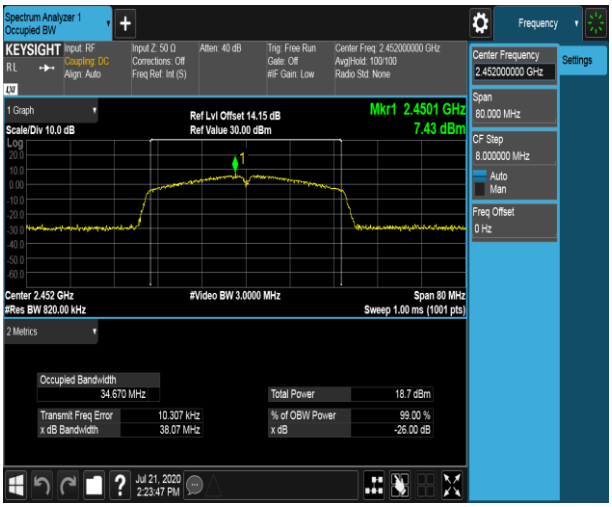




11N40SISO_Ant1_2437





11N40SISO_Ant1_2452


7.3. Output Power Measurement

7.3.1. Test Limit

The maximum permissible conducted output power is 1 Watt (30dBm).

7.3.2. Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.2

KDB 558074 D01 v05r02 – Section 8.3.1.2

7.3.3. Test Setting

1.Set the RBW = 1 MHz.

2.Set the VBW ≥ [3 × RBW].

3.Set the span ≥ [1.5 × DTS bandwidth].

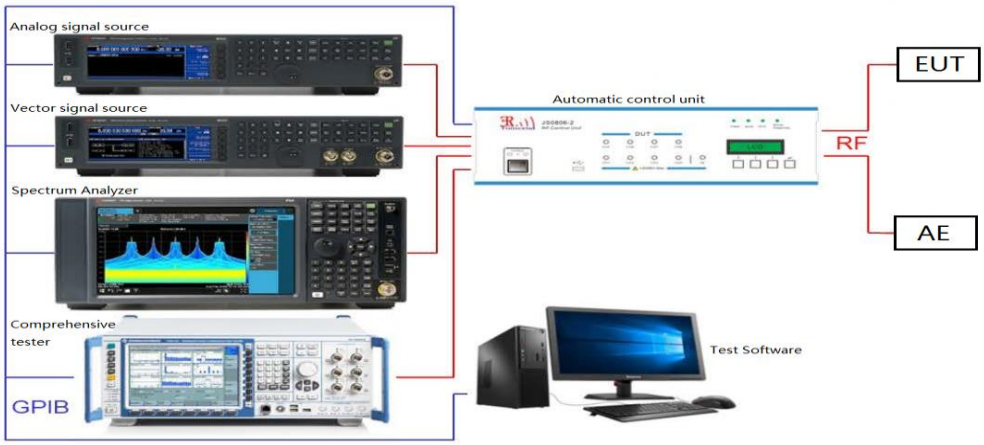
4.Detector = peak.

5.Sweep time = auto couple.

6.Trace mode = max hold.

7.Allow trace to fully stabilize.

7.3.4. Test Setup



7.3.5. Test Result of Output Power

Power output test was verified over all data rates of each mode shown as below, and then choose the maximum power output (yellow marker) for final test of each channel.

N_{TX}	Data Rate (Mbps)	
	802.11b	802.11g
1	1	6
1	2	9
1	5.5	12
1	11	18
1	--	24
1	--	36
1	--	48
1	--	54

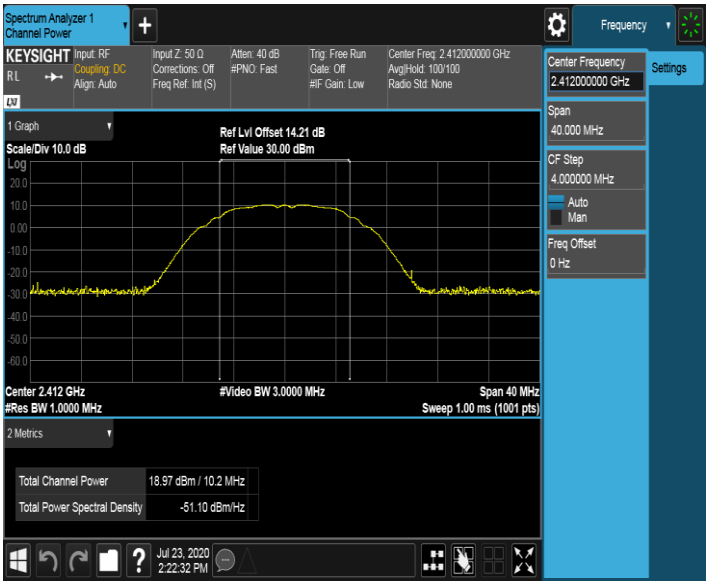
N_{Tx}	MCS Index for 802.11n	Data Rate (Mbps)			
		20MHz Bandwidth		40MHz Bandwidth	
		800ns GI	400ns GI	800ns GI	400ns GI
1	0	6.5	7.2	13.5	15.0
1	1	13.0	14.4	27.0	30.0
1	2	19.5	21.7	40.5	45.0
1	3	26.0	28.9	54.0	60.0
1	4	39.0	43.3	81.0	90.0
1	5	52.0	57.8	108.0	120.0
1	6	58.5	65.0	121.5	135.0
1	7	65.0	72.2	135.0	150.0

Note: Power output test was verified over all data rates of each mode shown as above, and then choose the maximum power output (yellow marker) for final test of each channel.

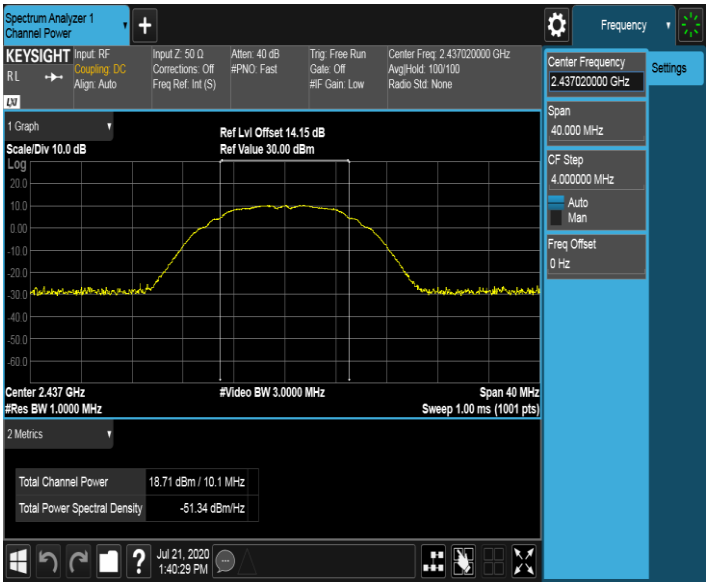
Test Result of Maximum PK conducted output power

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	18.97	<=30	PASS
		2437	18.71	<=30	PASS
		2462	18.79	<=30	PASS
11G	Ant1	2412	18.42	<=30	PASS
		2437	19.17	<=30	PASS
		2462	19.30	<=30	PASS
11N20SISO	Ant1	2412	18.73	<=30	PASS
		2437	18.19	<=30	PASS
		2462	18.88	<=30	PASS
11N40SISO	Ant1	2422	18.31	<=30	PASS
		2437	18.44	<=30	PASS
		2452	18.47	<=30	PASS

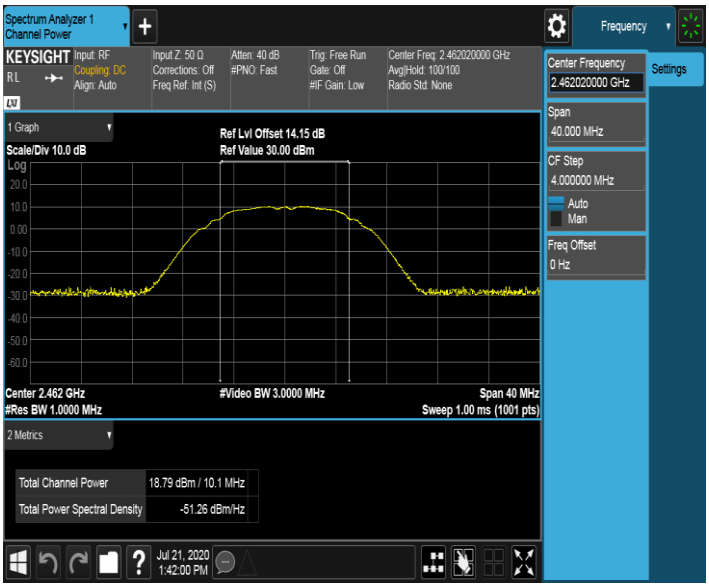
11B_Ant1_2412



11B_Ant1_2437



11B_Ant1_2462



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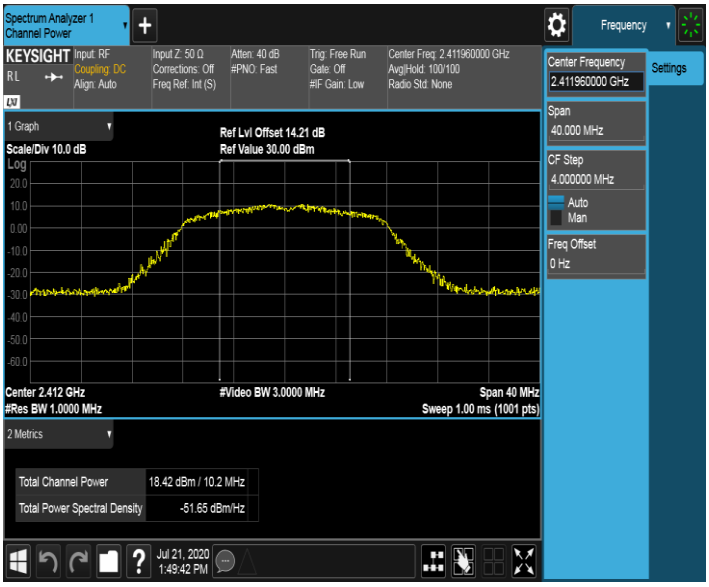

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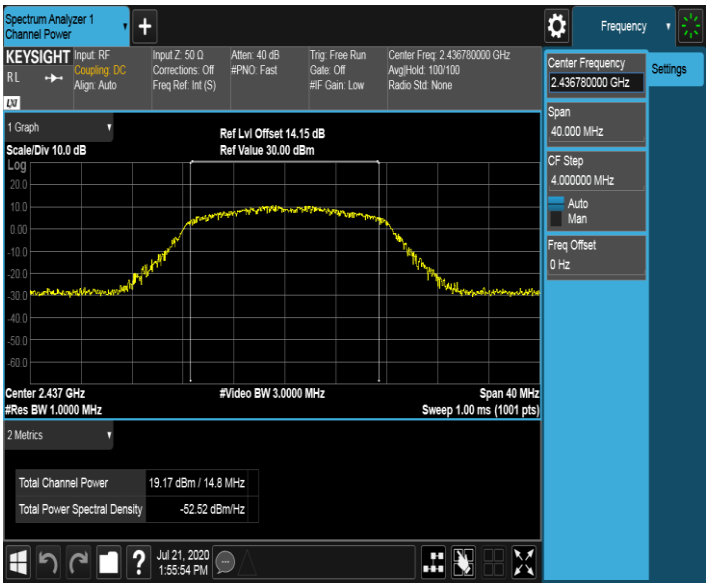

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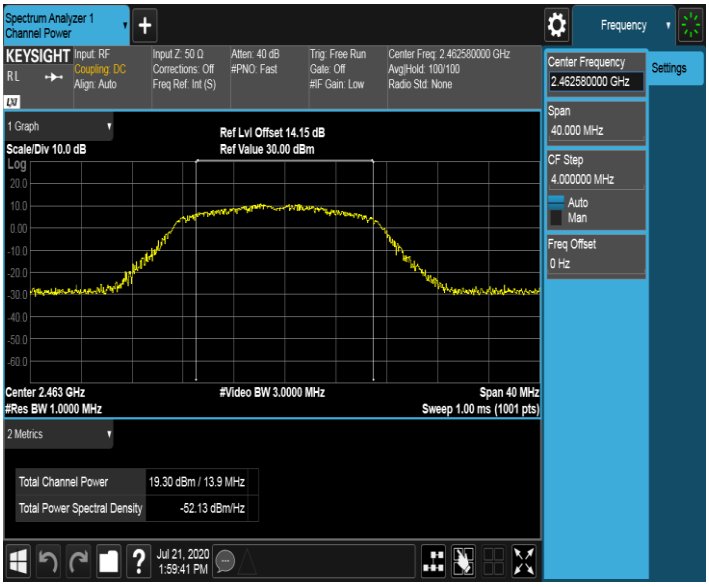

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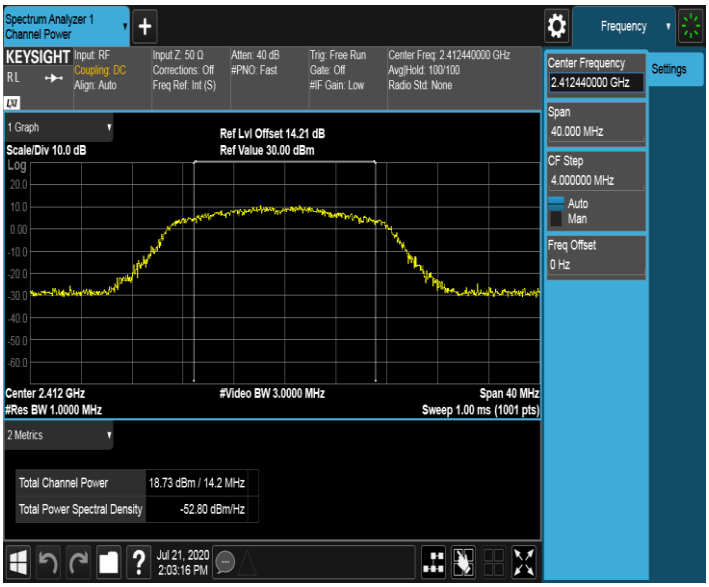

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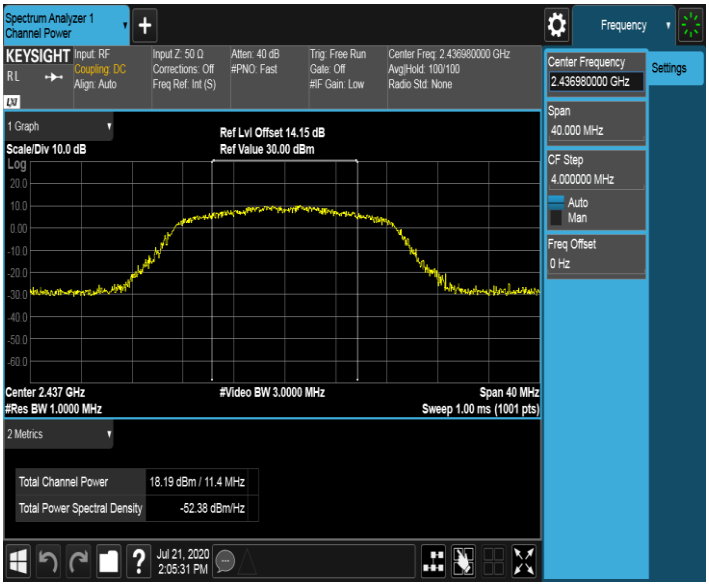

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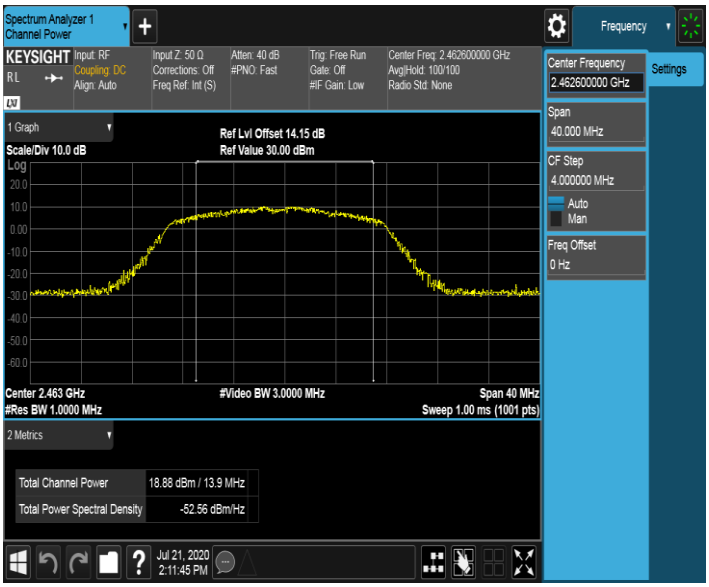
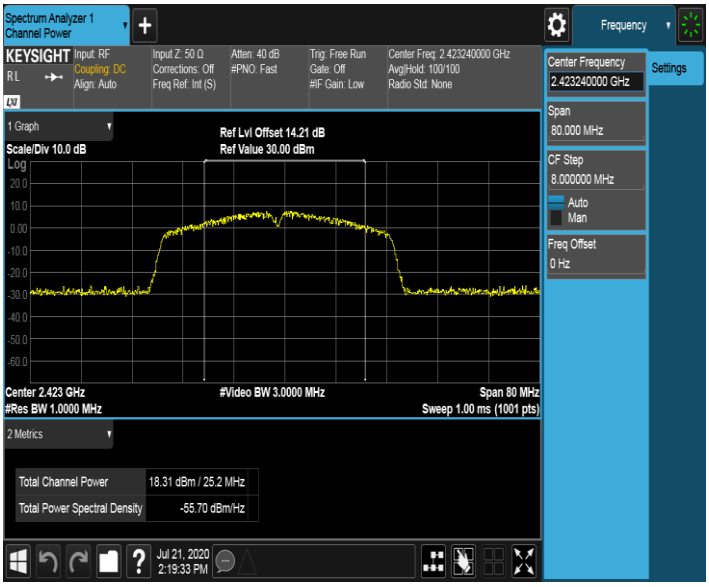


11N40SISO_Ant1_2422



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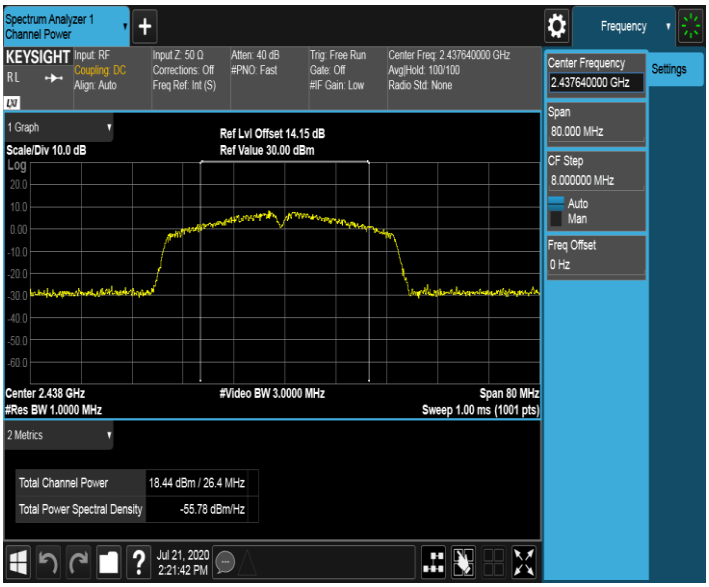

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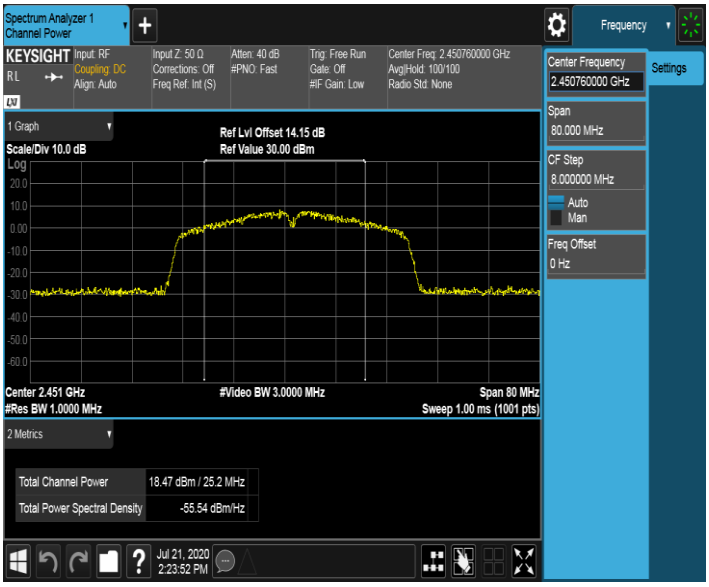


7.4. Power Spectral Density Measurement

7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

7.4.2. Test Procedure Used

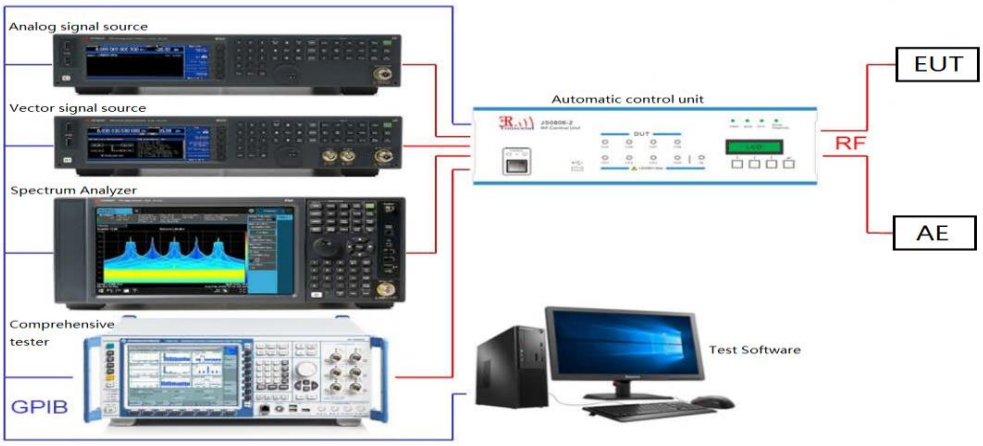
KDB 558074 D01 v05r02 - Section 8.4

ANSI C63.10 – Section 11.10.2

7.4.3. Test Setting

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ [3 × RBW].
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.

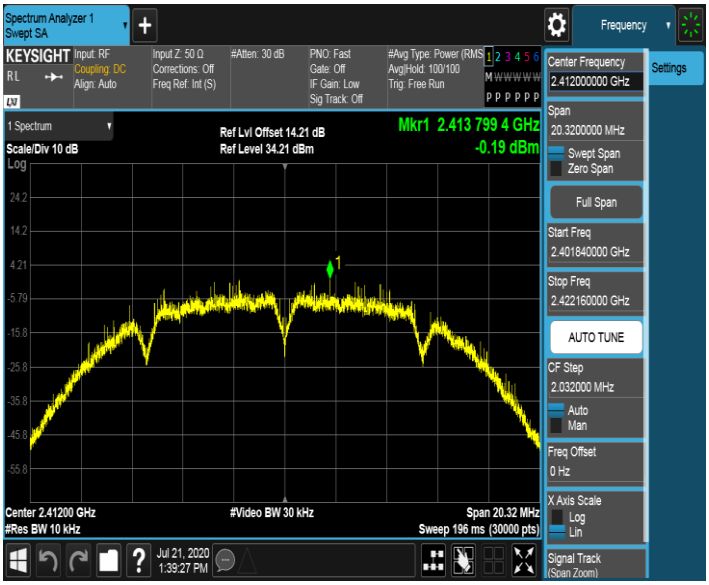
7.4.4. Test Setup



7.4.5. Test Result

Test Mode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-0.19	<=8	PASS
		2437	0.27	<=8	PASS
		2462	-0.70	<=8	PASS
11G	Ant1	2412	-7.33	<=8	PASS
		2437	-7.56	<=8	PASS
		2462	-7.23	<=8	PASS
11N20SISO	Ant1	2412	-6.64	<=8	PASS
		2437	-6.51	<=8	PASS
		2462	-6.32	<=8	PASS
11N40SISO	Ant1	2422	-8.85	<=8	PASS
		2437	-8.98	<=8	PASS
		2452	-8.88	<=8	PASS

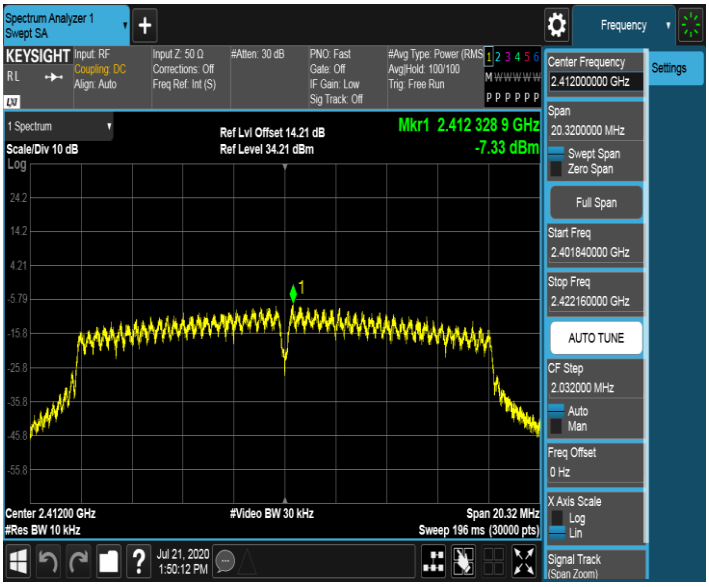
11B_Ant1_2412



11B_Ant1_2437

11B_Ant1_2462

11G_Ant1_2412



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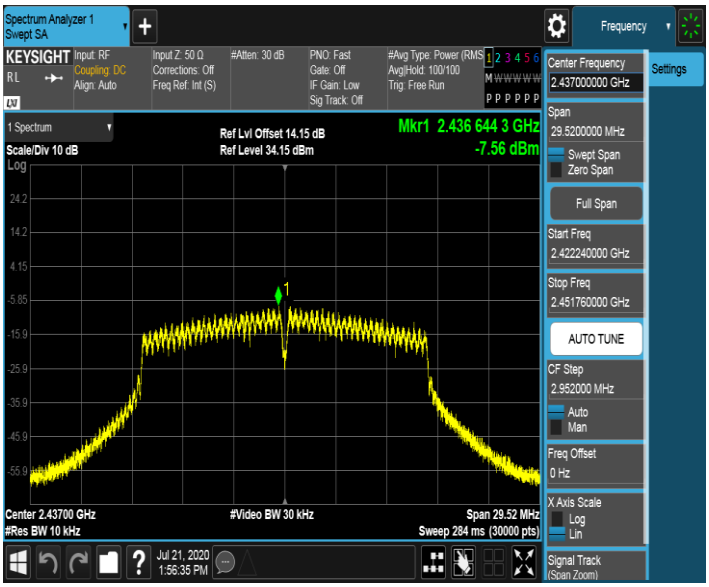

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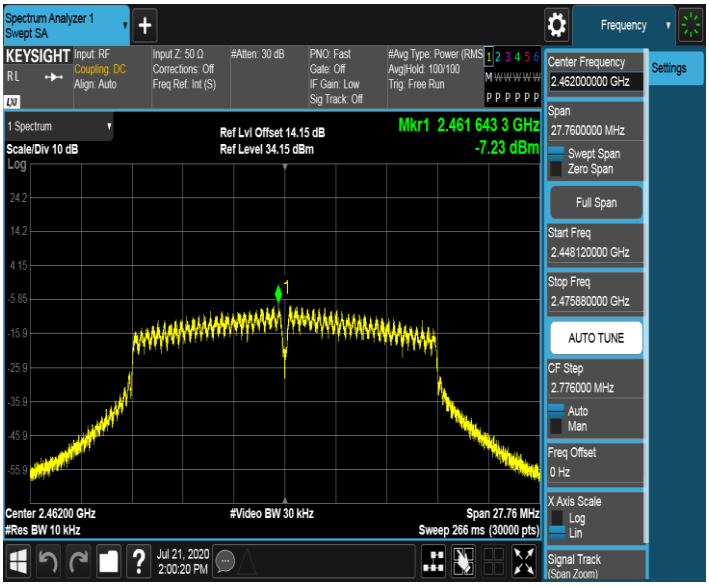

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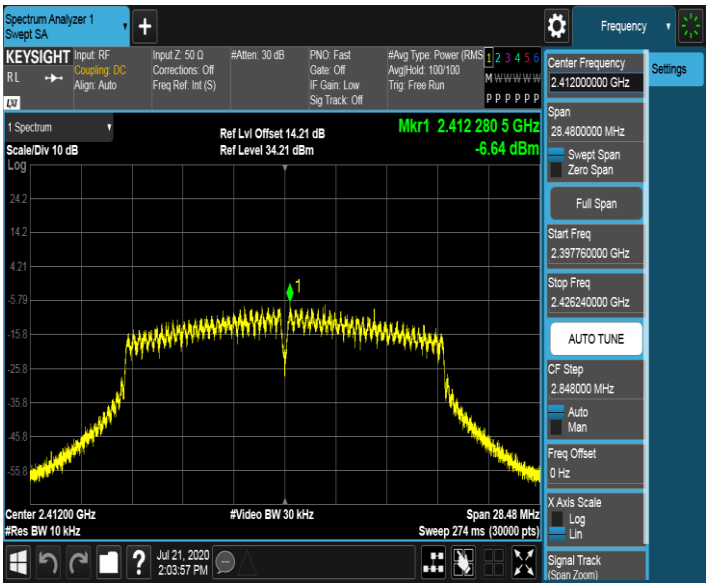

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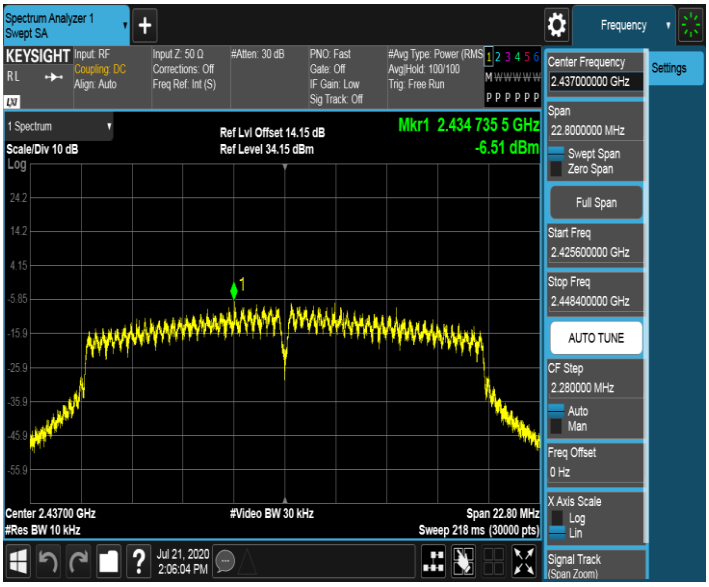

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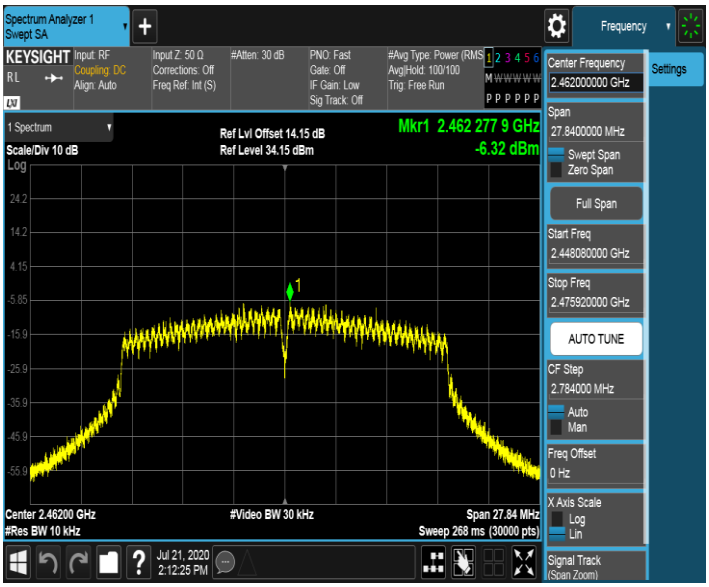

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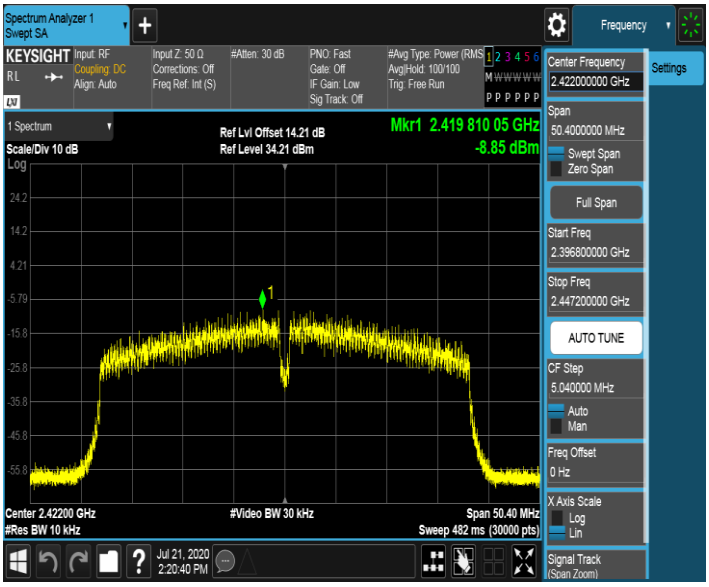

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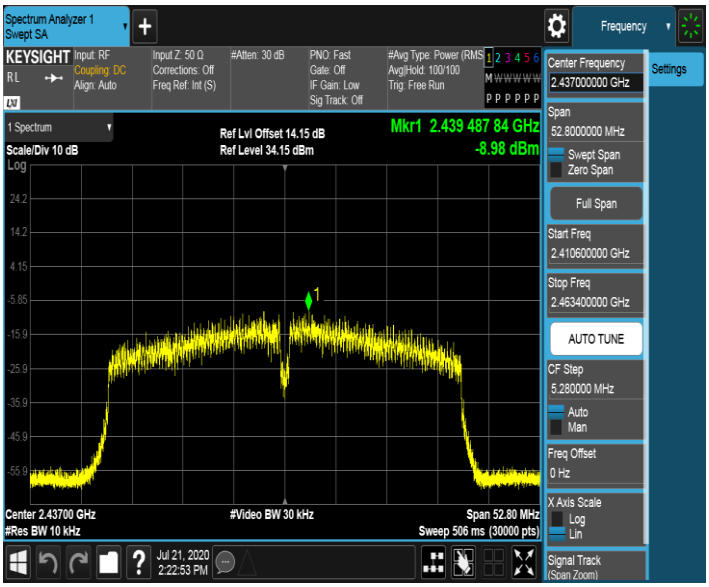
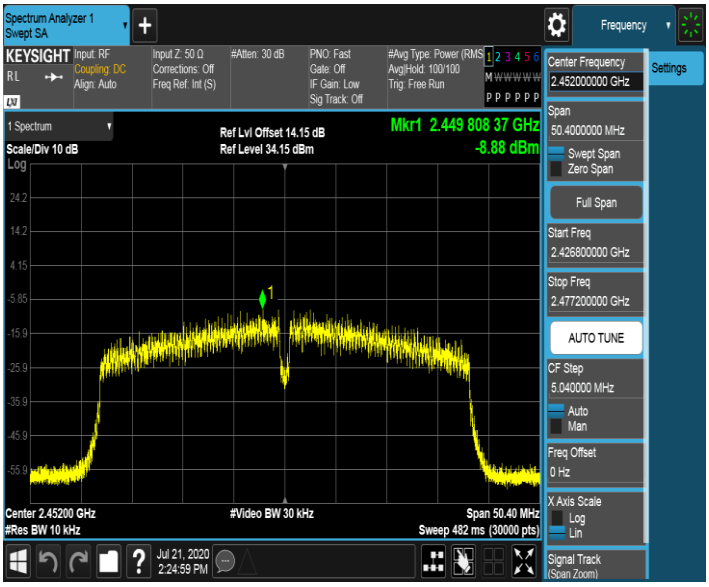
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