

7 EMISSION LIMITATIONS MEASUREMENT

7.1 Test Equipment

The following test equipment was used during the emission limitations test:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2021.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2021.03.08	1 Year
3.	20 dB Attenuator	Mini-Circuits	VAT-20+	001	2021.08.06	1 Year

7.2 Block Diagram of Test Setup

The Same as Section. 5.2.

7.3 Specification Limits (§15.247(d))

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

In addition, radiated 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) (see §15.205(c)). (※This test result attaching to Section. 3.7)

7.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

7.5 Test Procedure

The transmitter output was connected to the spectrum analyzer.

Establish a reference level by using the following procedure:

- Set instrument center frequency to DTS channel center frequency.
 - Set the span to ≥ 1.5 times the DTS bandwidth.
 - Set the RBW = 100 kHz.
 - Set the VBW $\geq [3 \times \text{RBW}]$.
 - Detector = peak.
 - Sweep time = auto couple.
 - Trace mode = max hold.
 - Allow trace to fully stabilize.
 - Use the peak marker function to determine the maximum PSD level.
- Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Establish an emission level by using the following procedure:

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq [3 \times \text{RBW}]$.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

Scan up through 10th harmonic.

The test procedure is defined in ANSI C63.10-2013 (11.11.2 Reference level measurement and 11.11.3 Emission level measurement was used).

7.6 Test Results

PASSED.

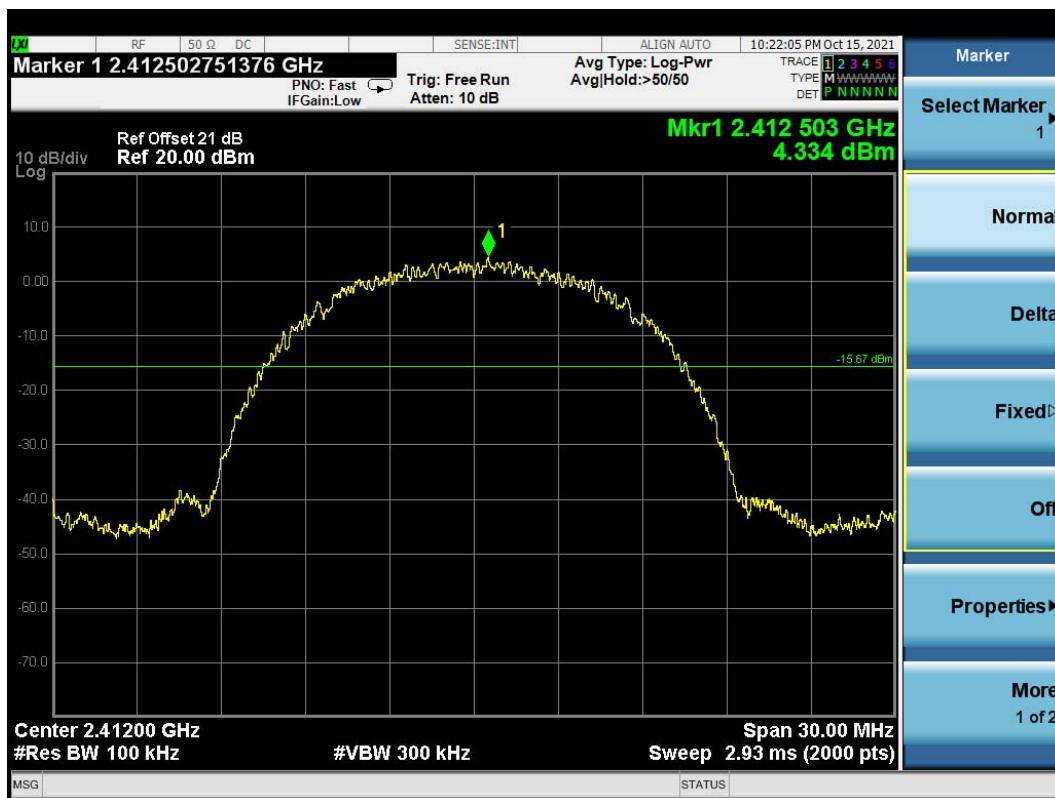
The test data was attached in the next pages.

(Test Date: 2021.10.15 Temperature: 23°C Humidity: 51 %)

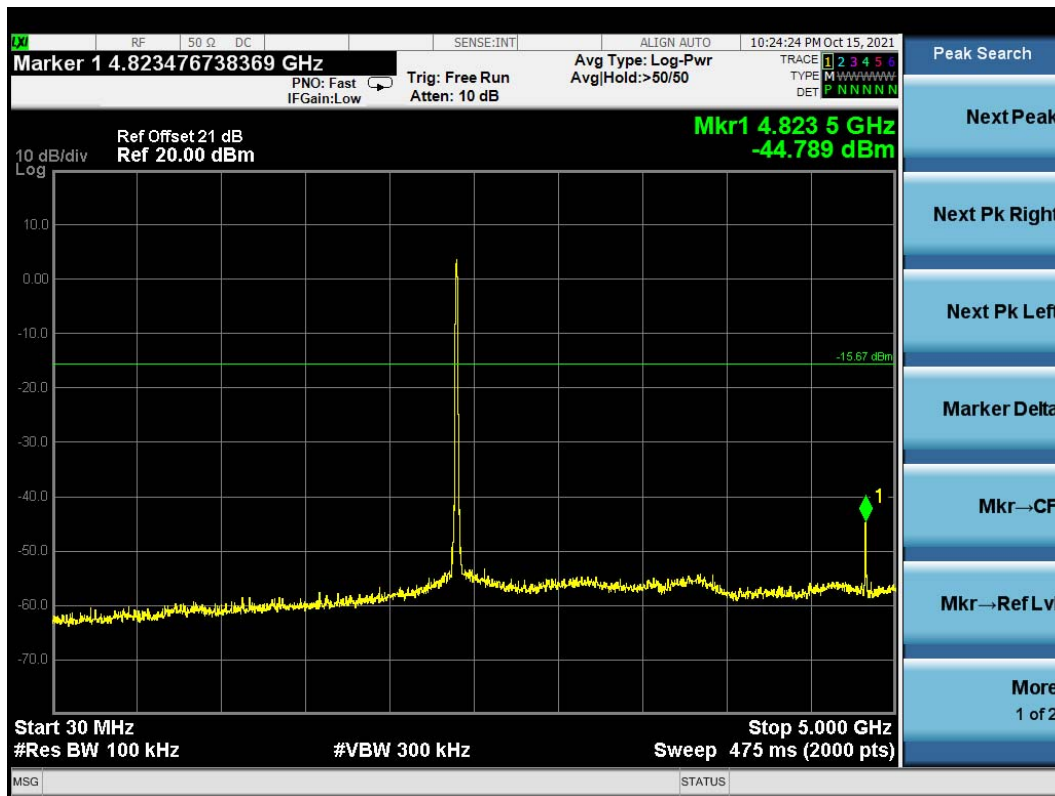
Modulation	Channel	Frequency (MHz)	Data Page
802.11b	1	2412 MHz	P48-P49
	6	2437 MHz	P50-P51
	11	2462 MHz	P52-P53
802.11g	1	2412 MHz	P54-P55
	6	2437 MHz	P56-P57
	11	2462 MHz	P58-P59
802.11n20	1	2412 MHz	P60-P61
	6	2437 MHz	P62-P63
	11	2462 MHz	P64-P65
802.11n20	3	2422 MHz	P66-P67
	6	2437 MHz	P68-P69
	9	2452 MHz	P70-P71

802.11b CH2412MHz

Reference level



Emission level



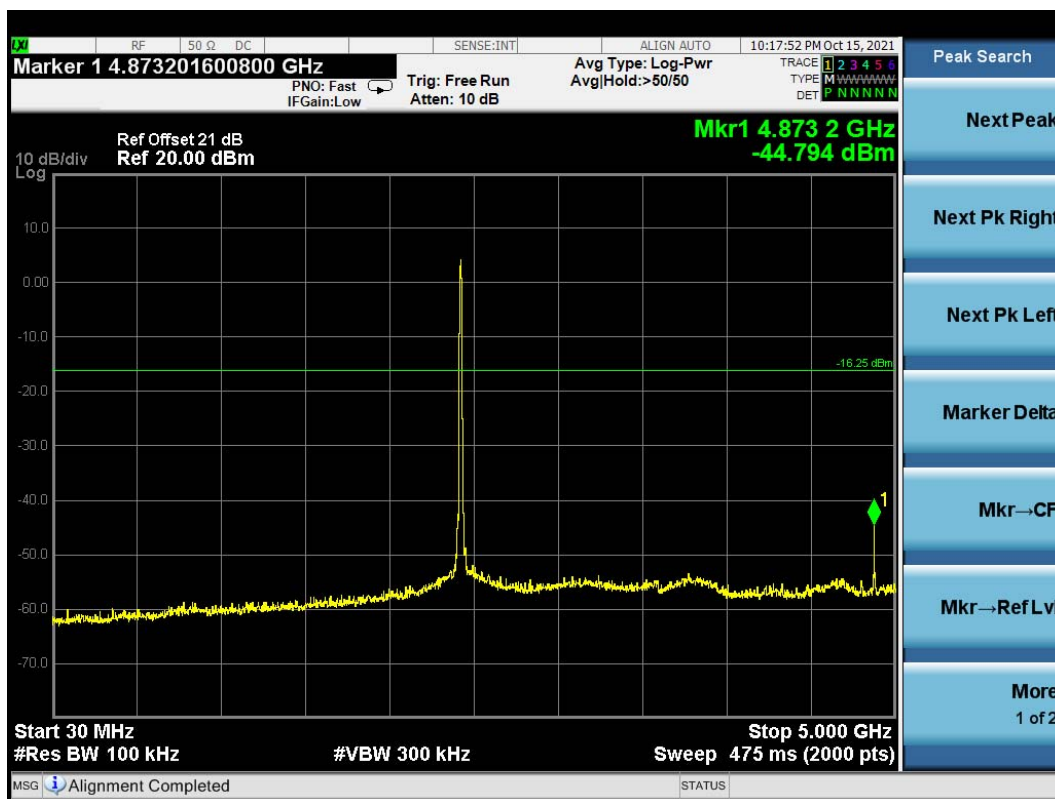


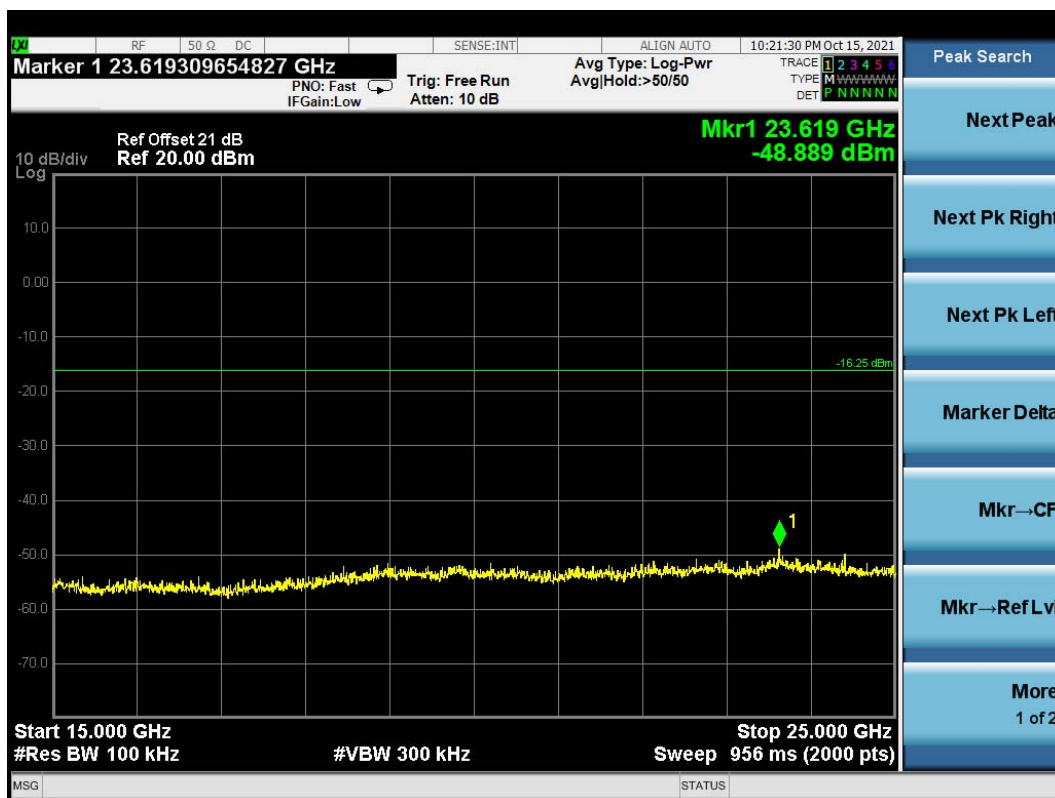
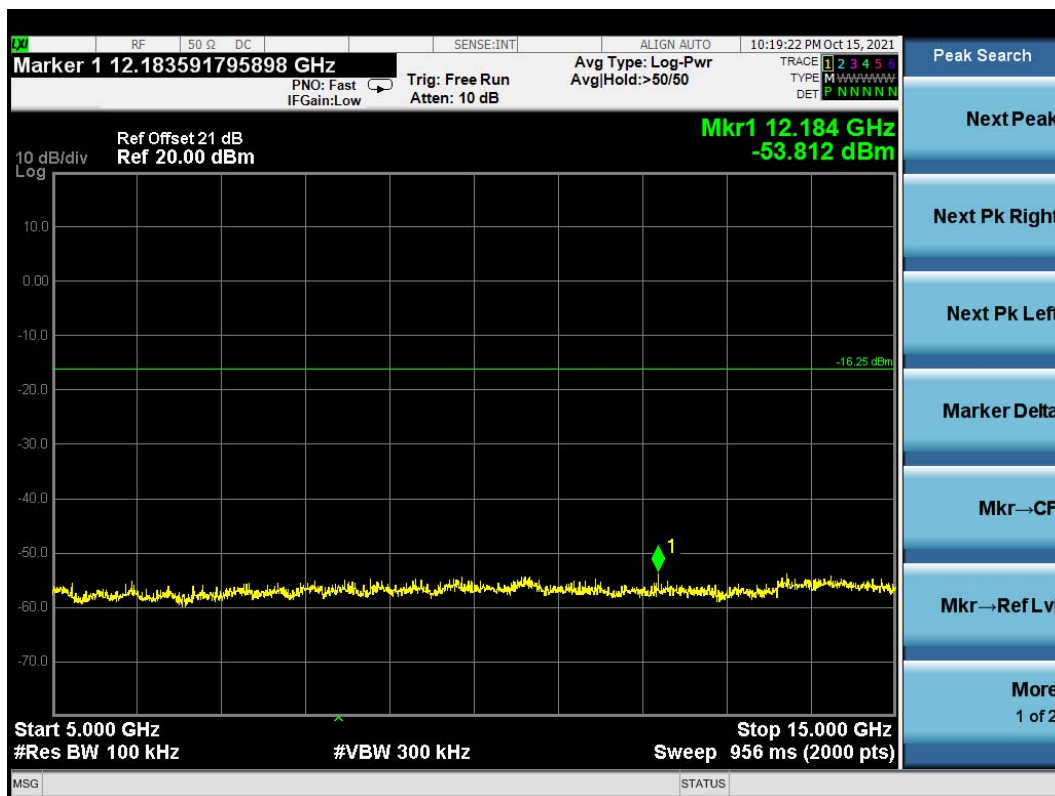
802.11b CH2437MHz

Reference level



Emission level



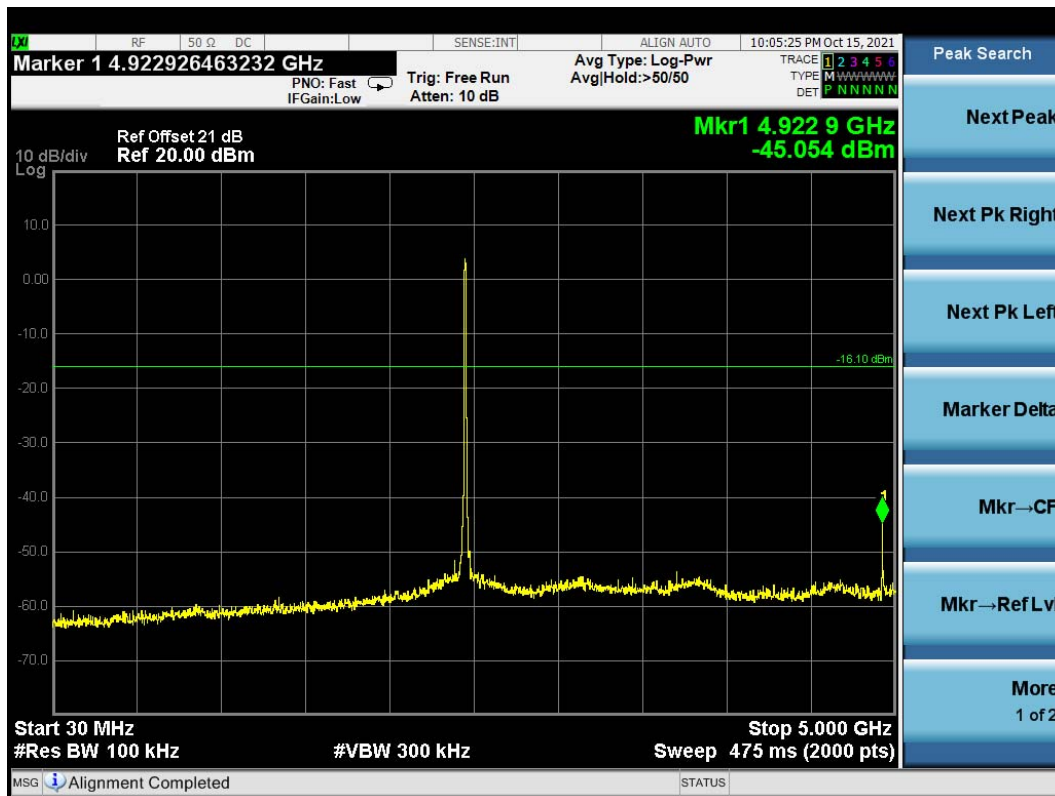


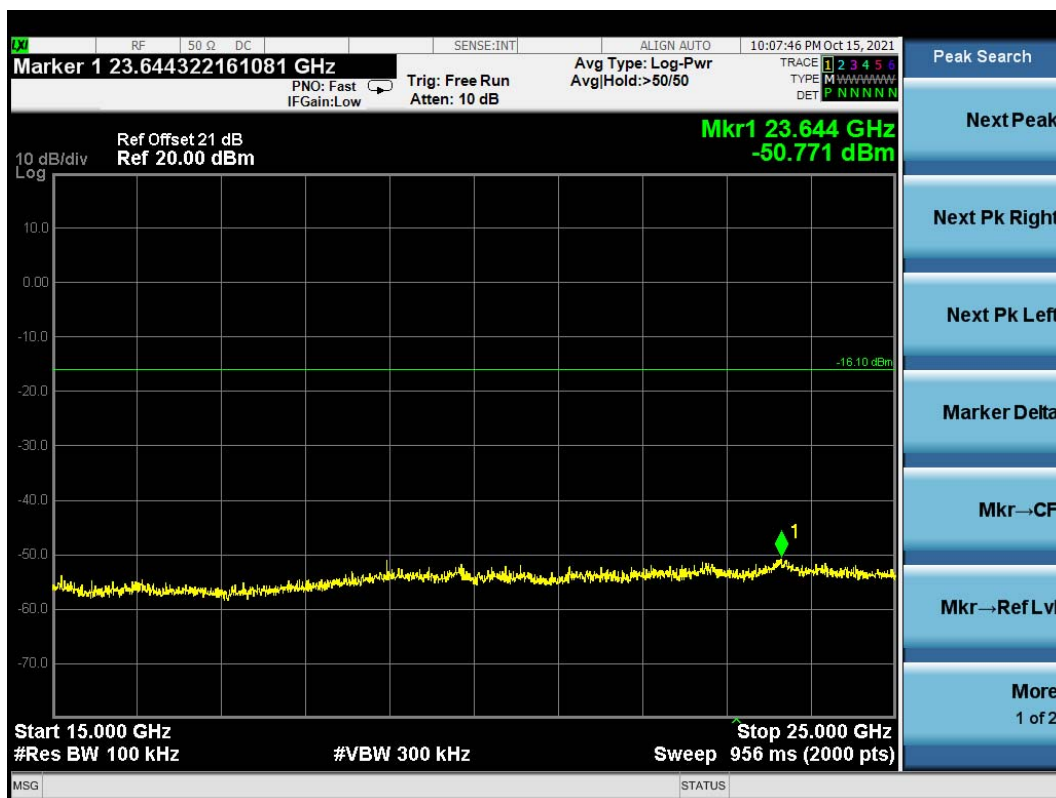
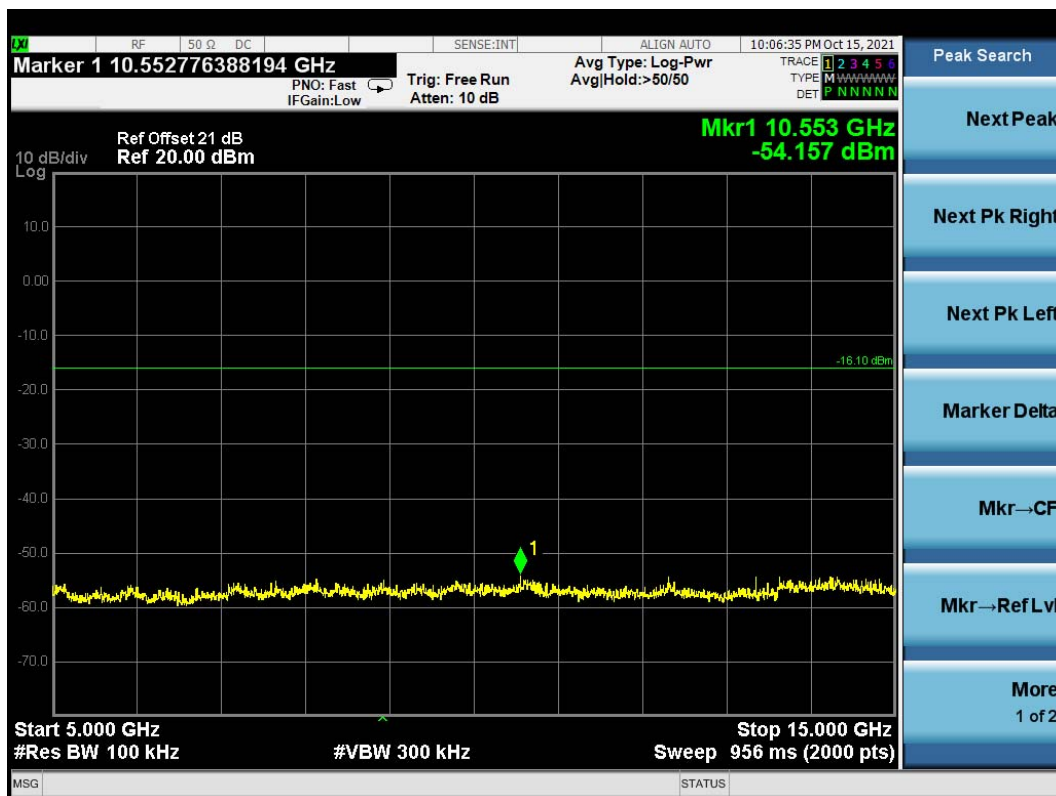
802.11b CH2462MHz

Reference level



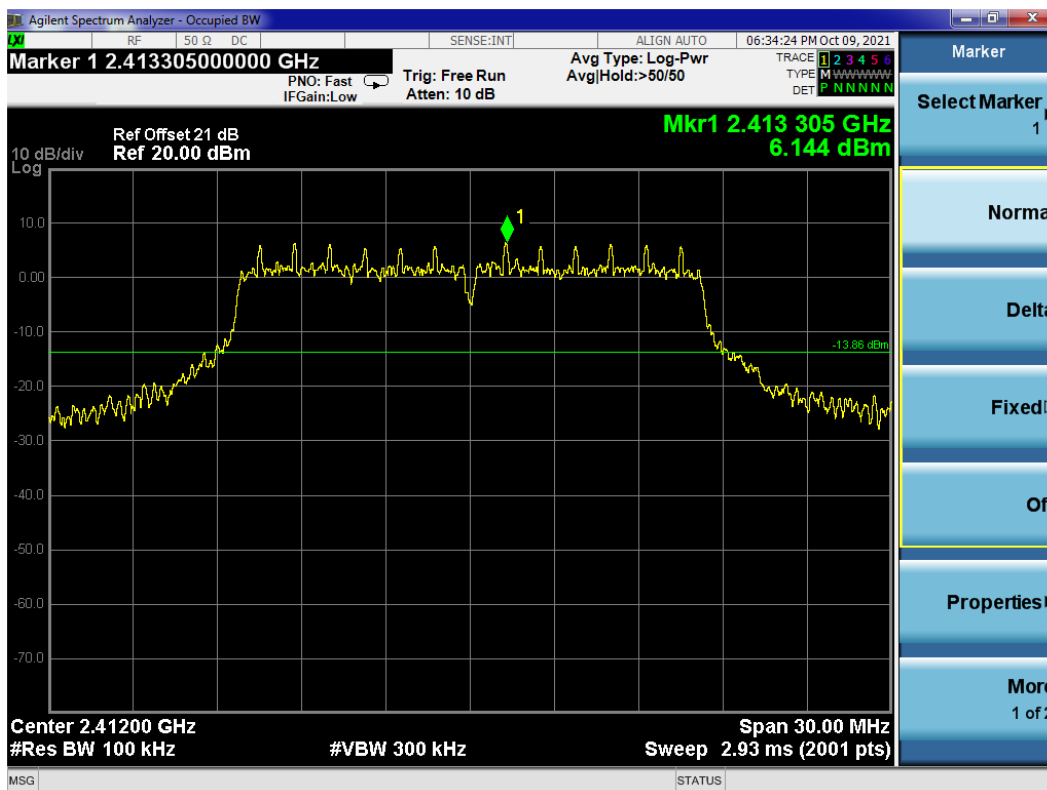
Emission level



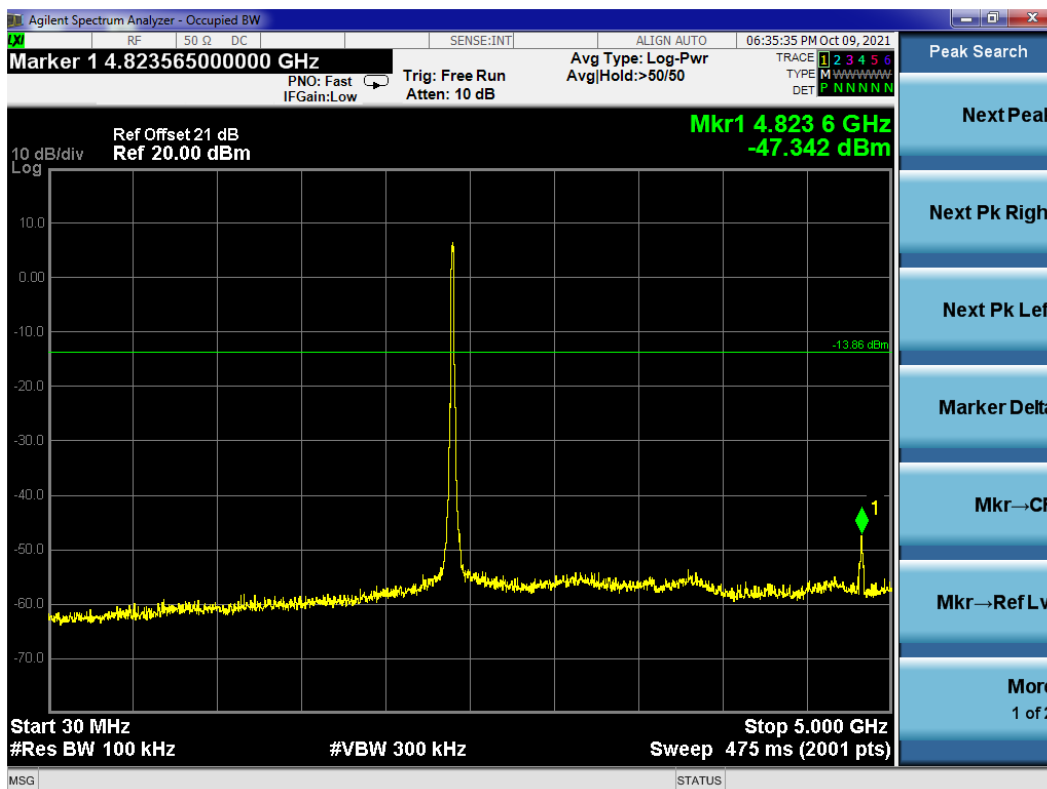


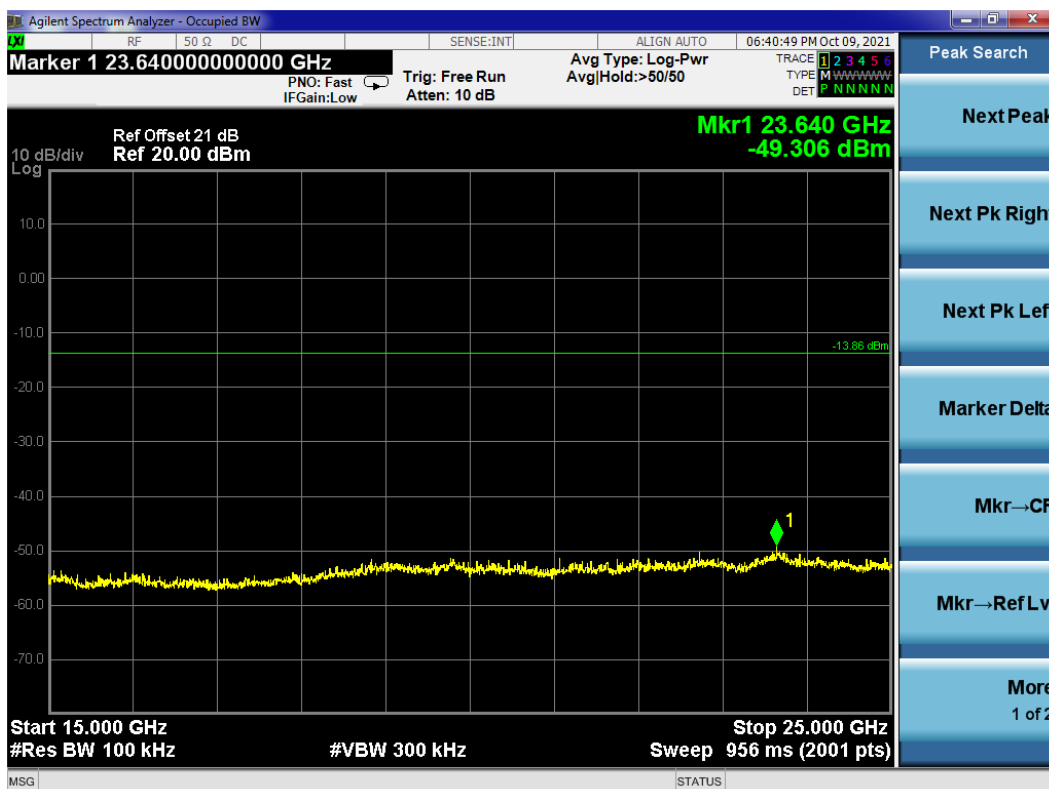
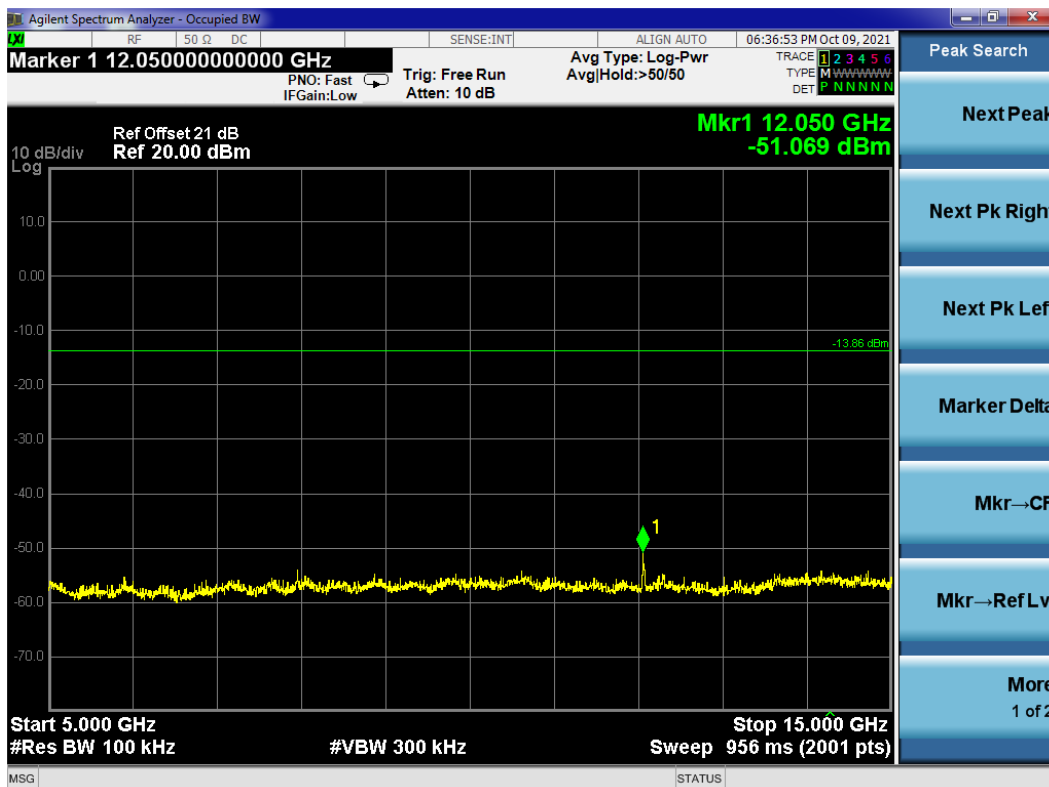
802.11g CH2412MHz

Reference level



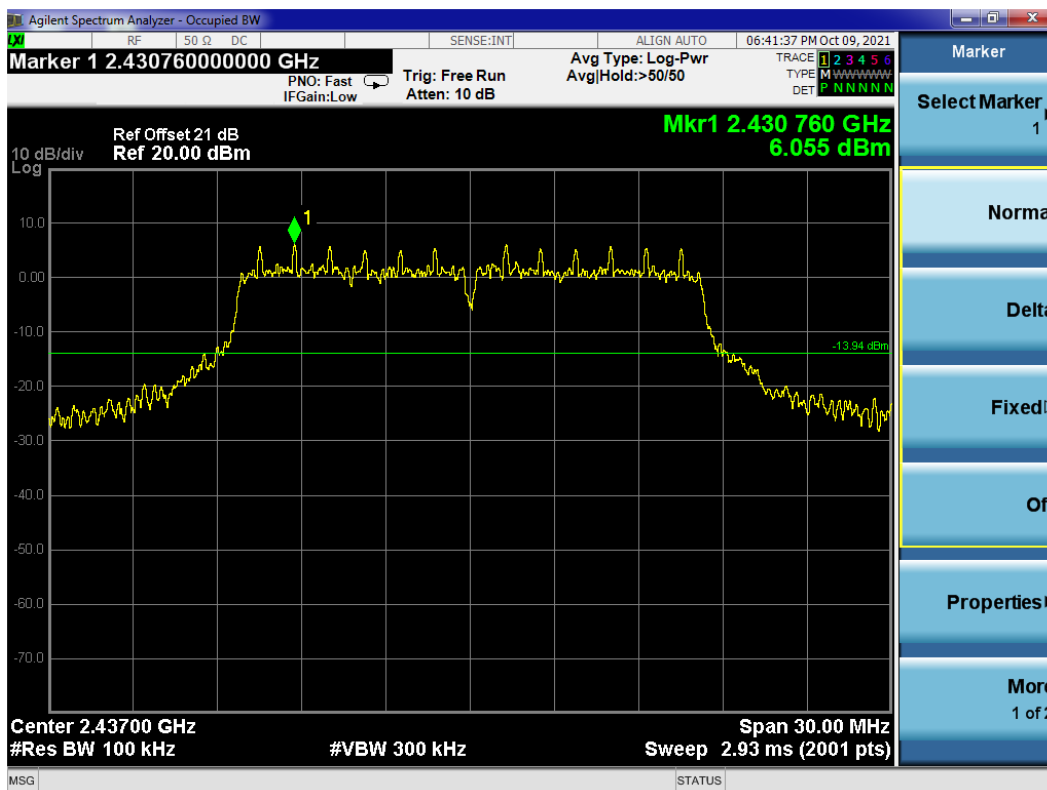
Emission level



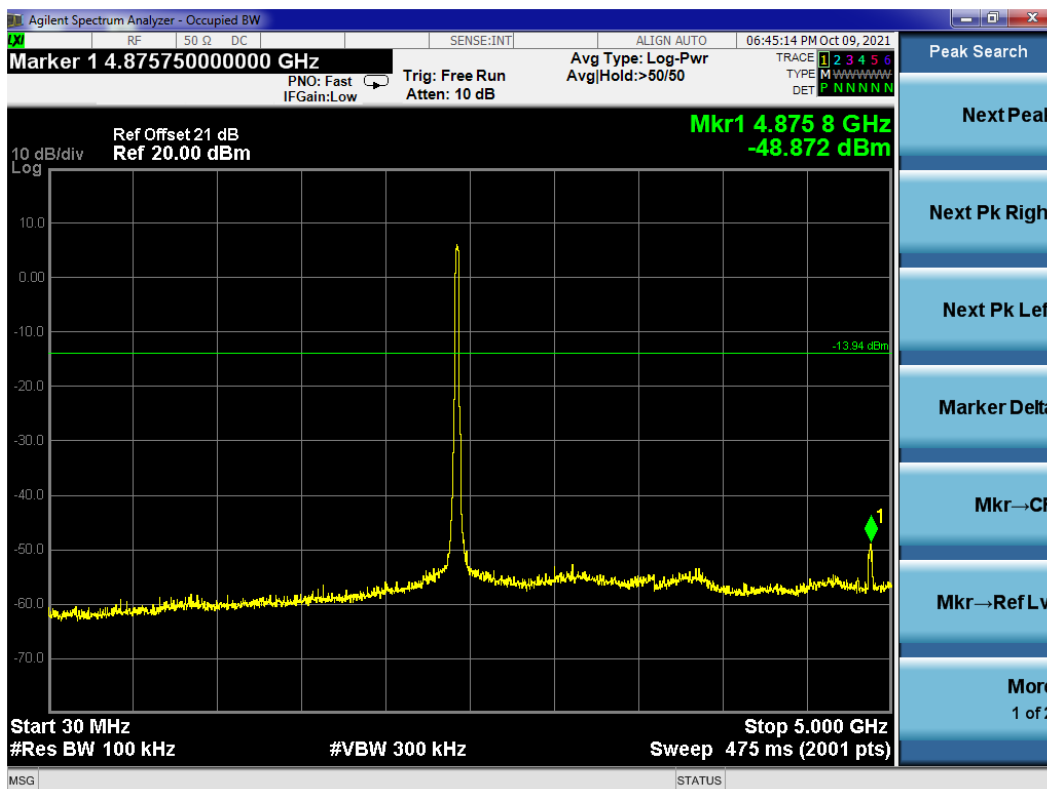


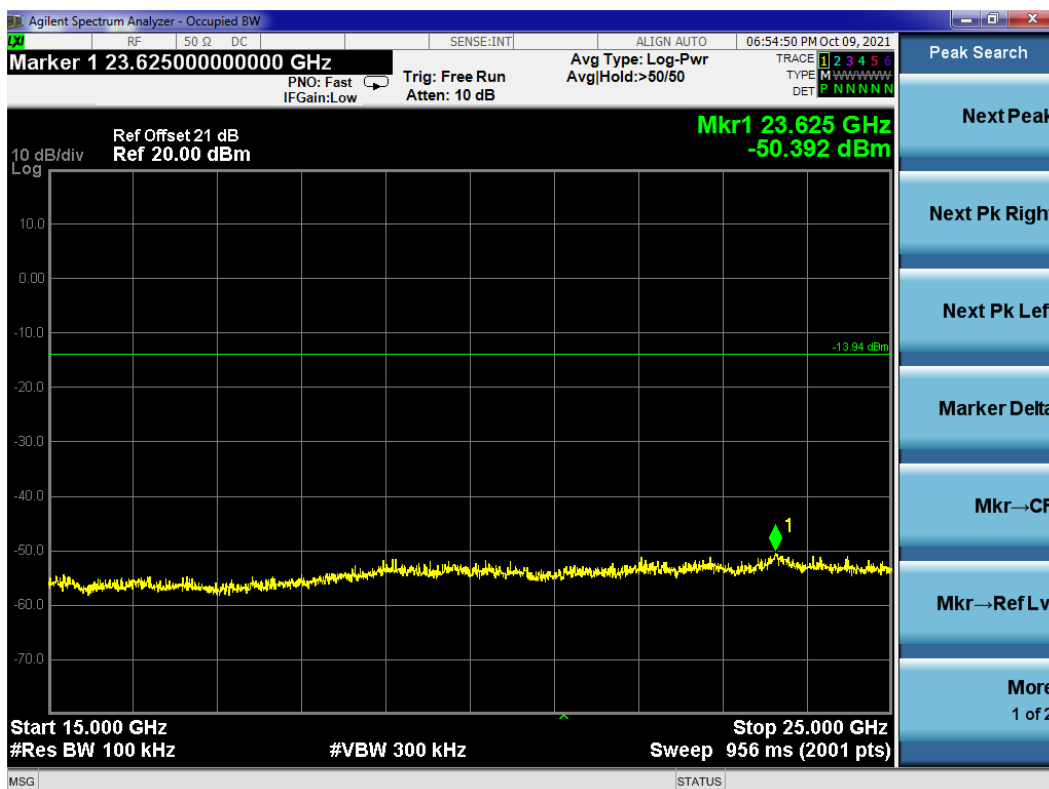
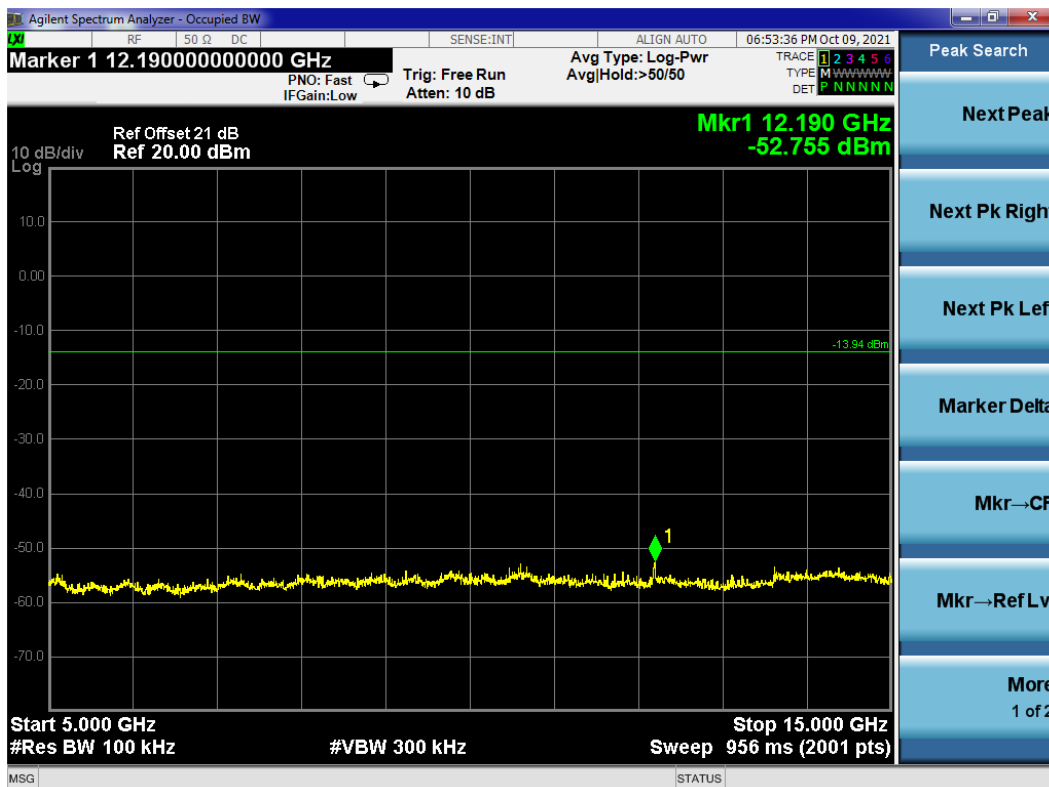
802.11g CH2437MHz

Reference level



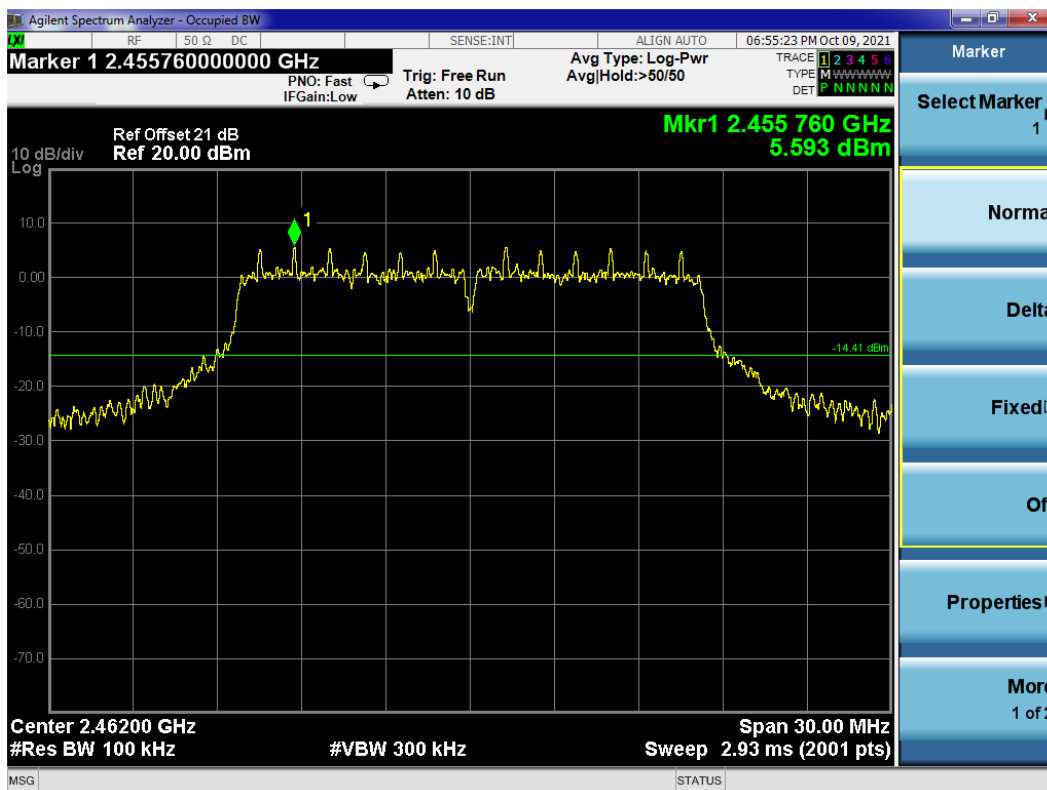
Emission level



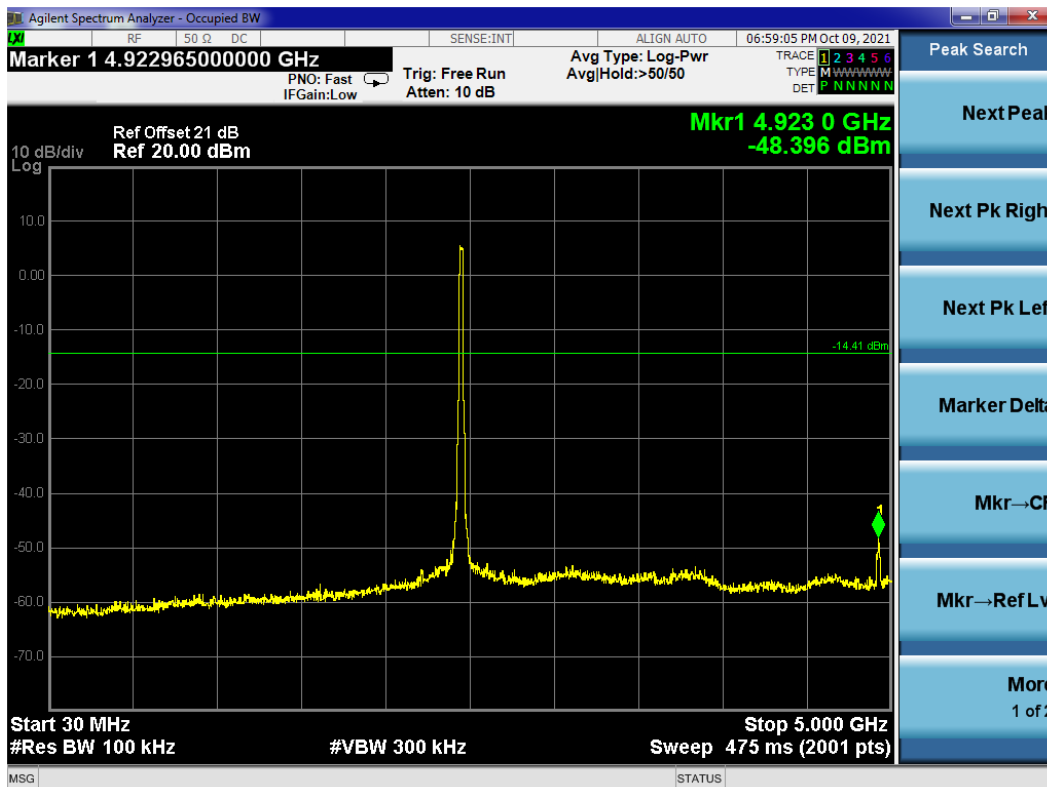


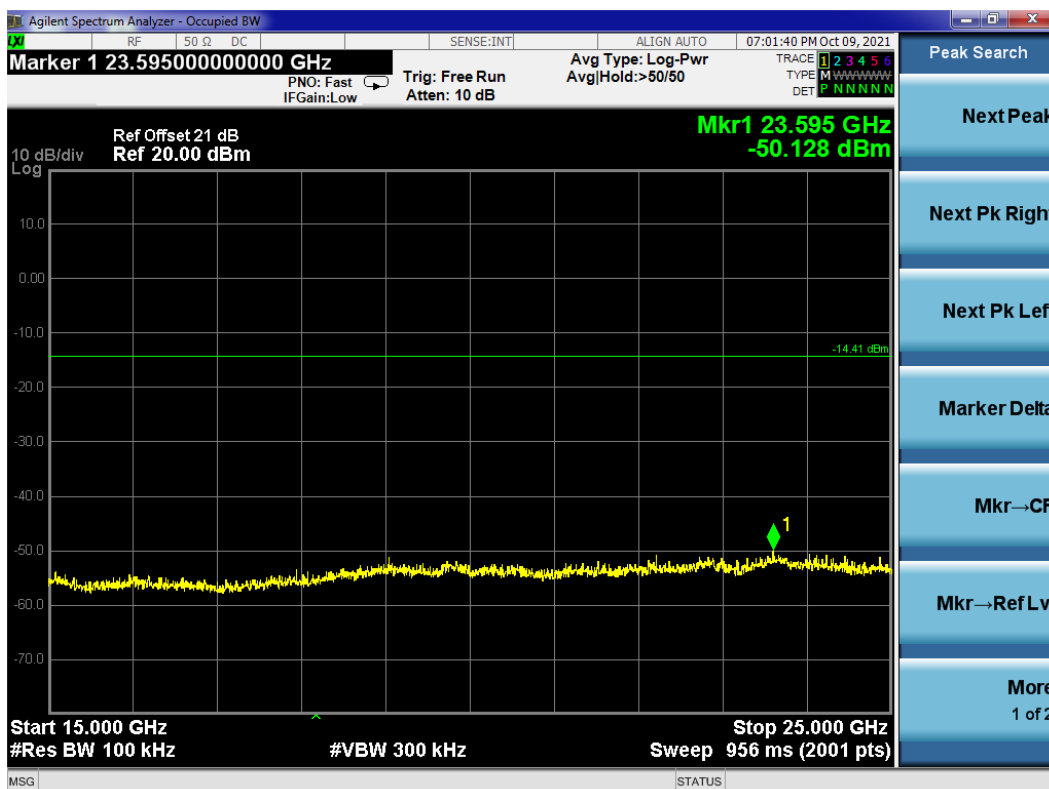
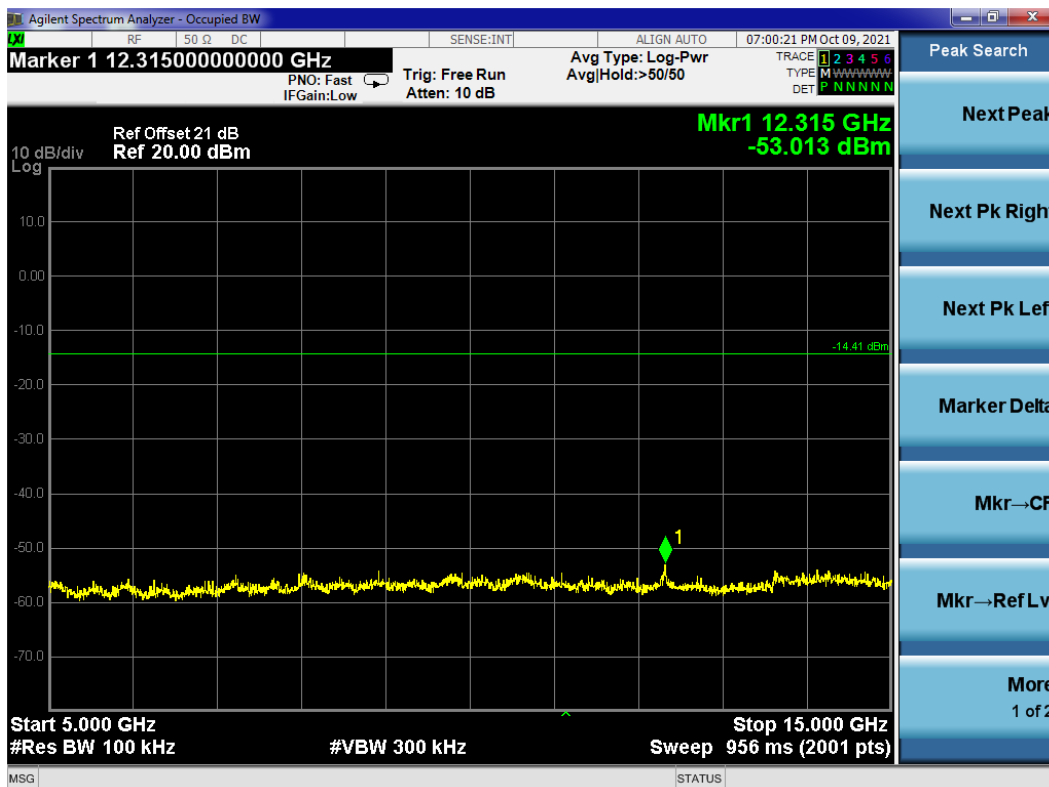
802.11g CH2462MHz

Reference level



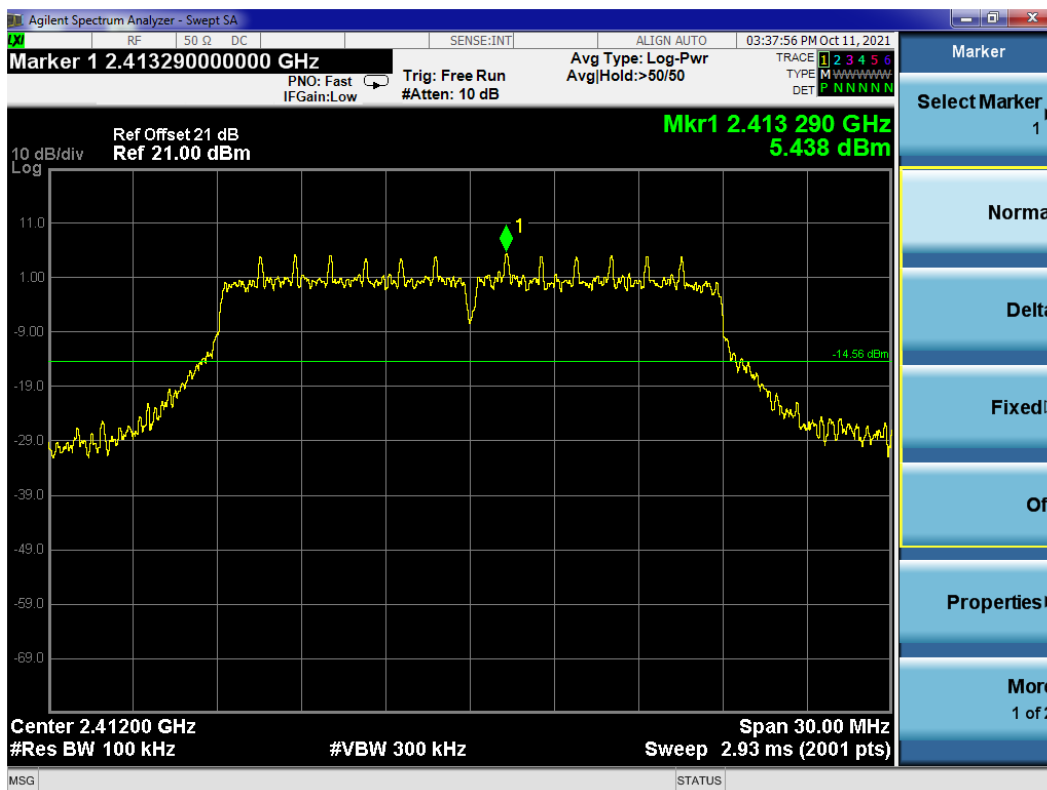
Emission level



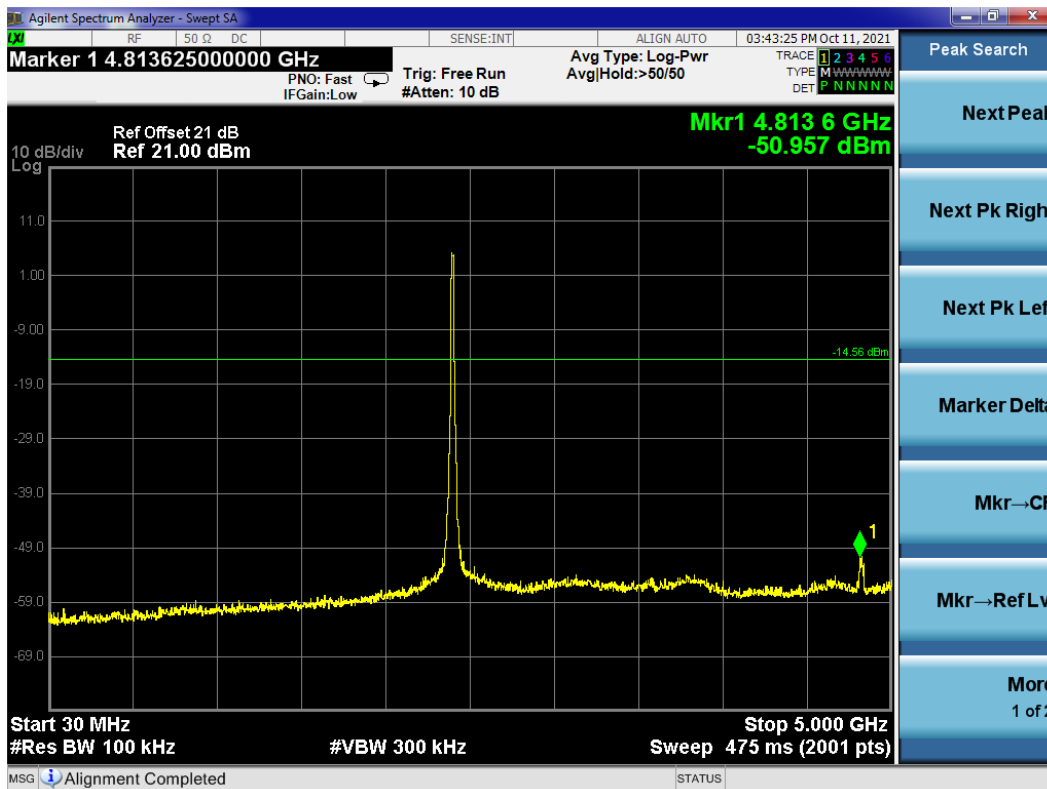


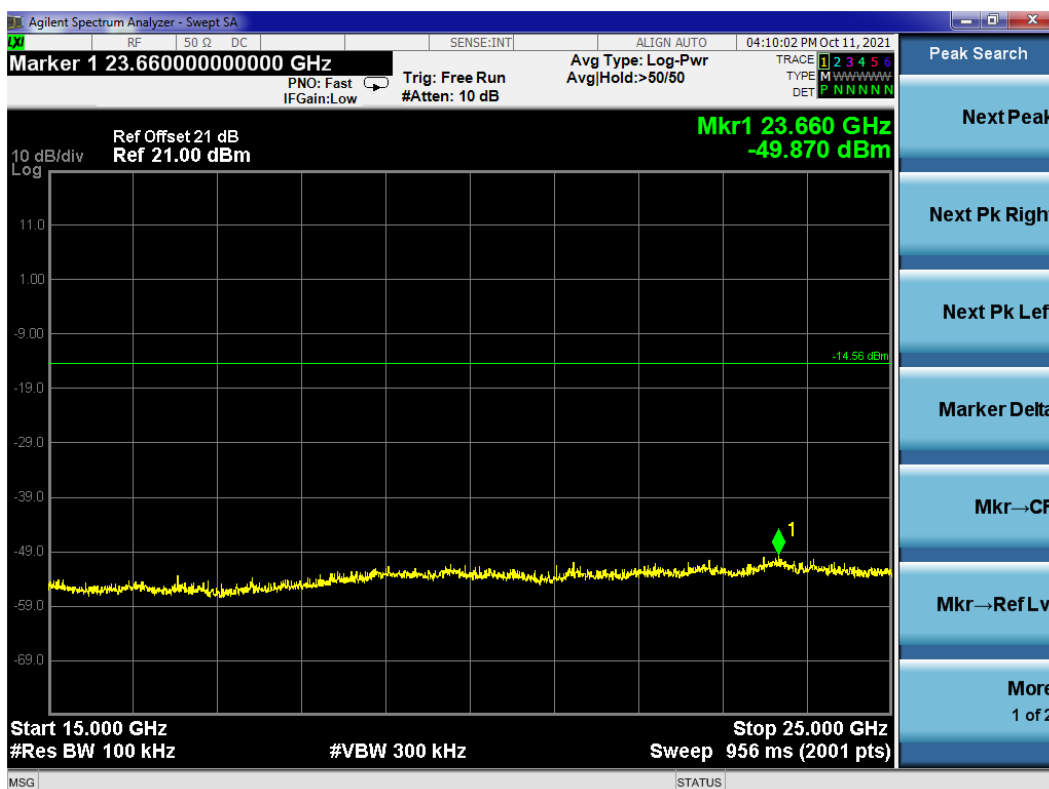
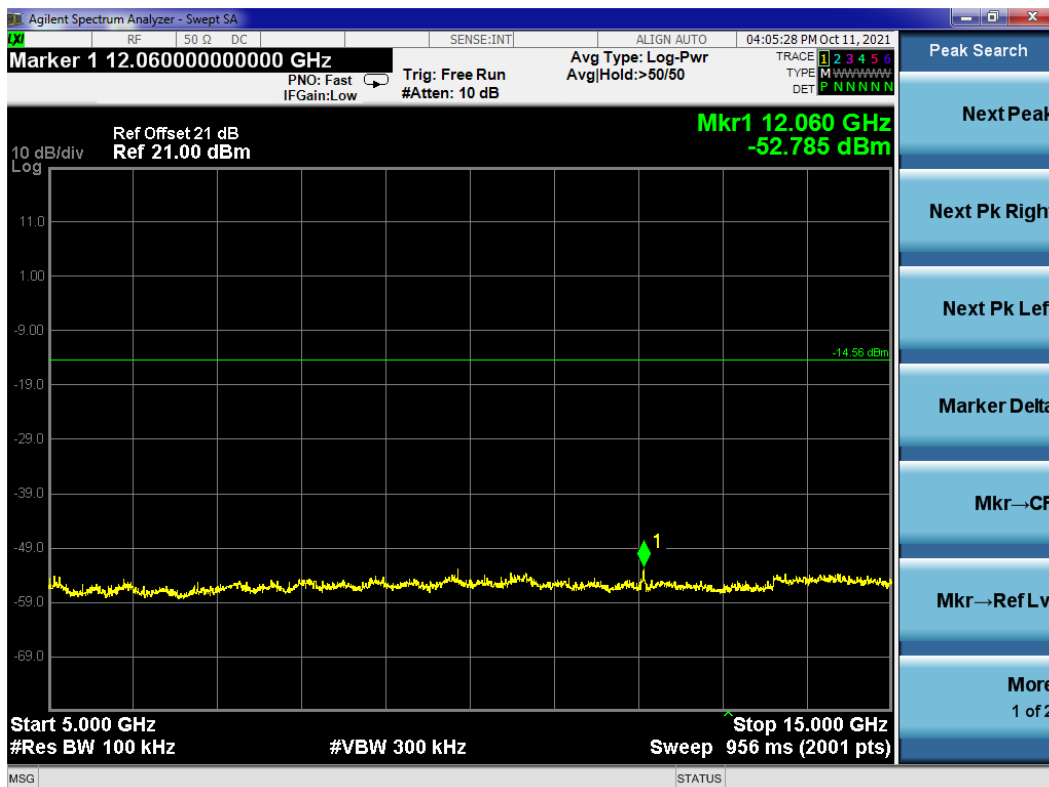
802.11n20 CH2412MHz

Reference level



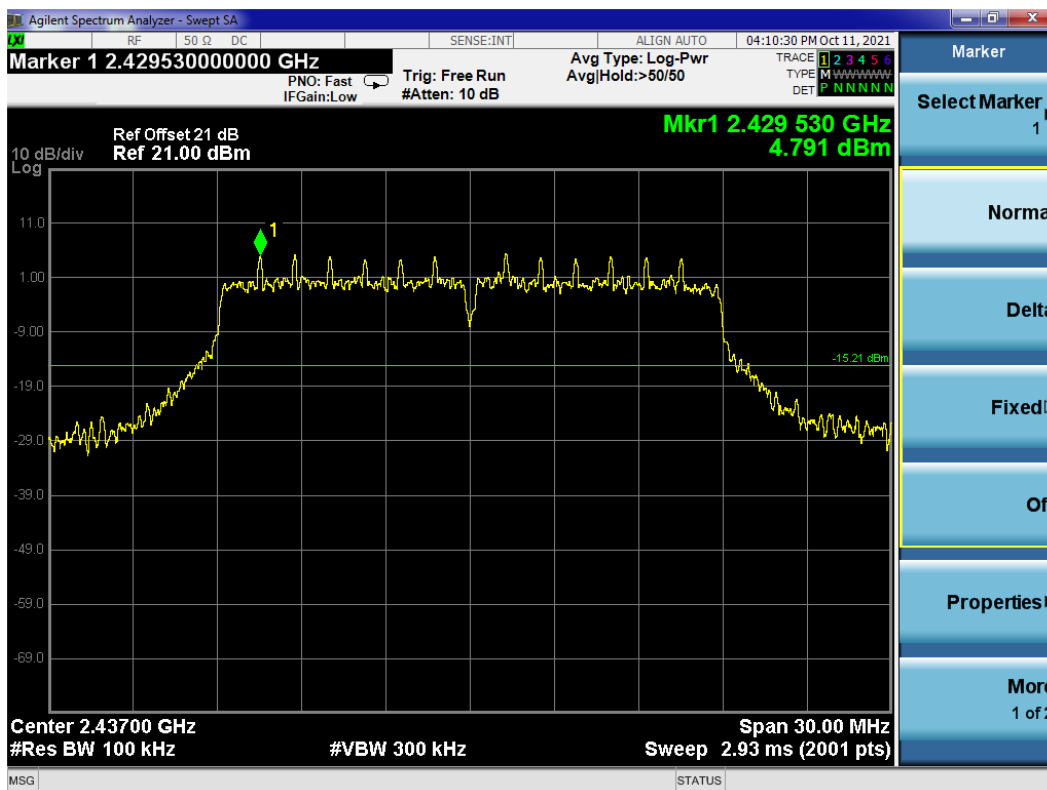
Emission level



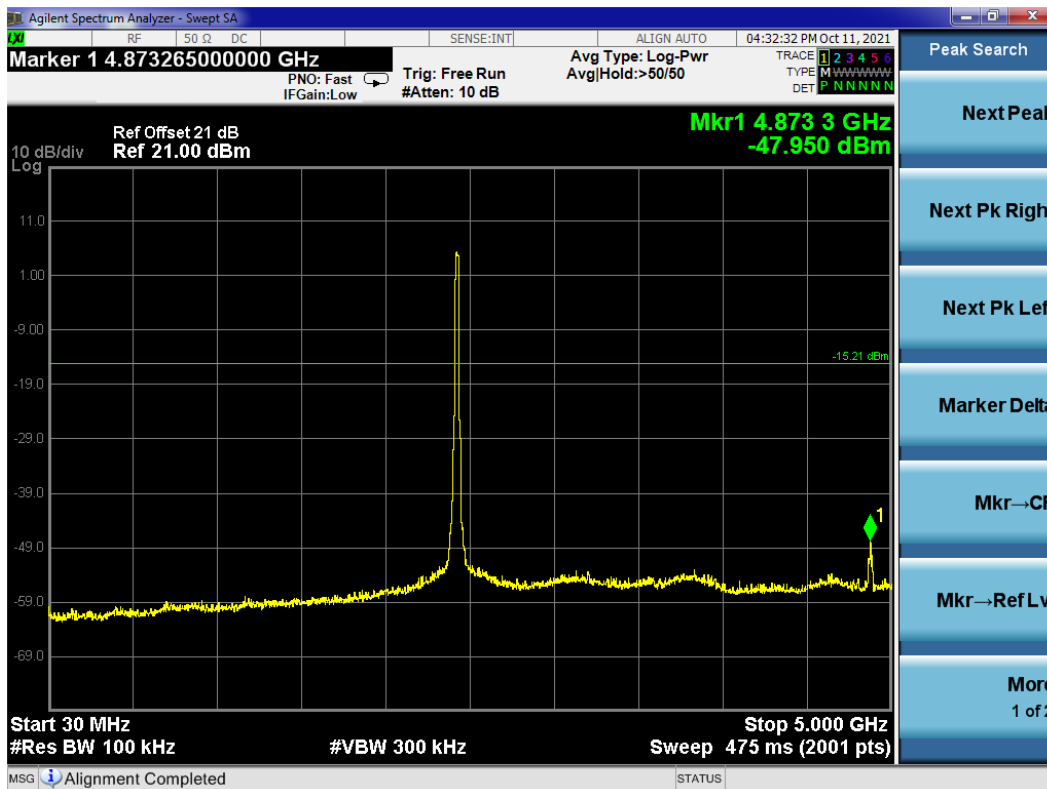


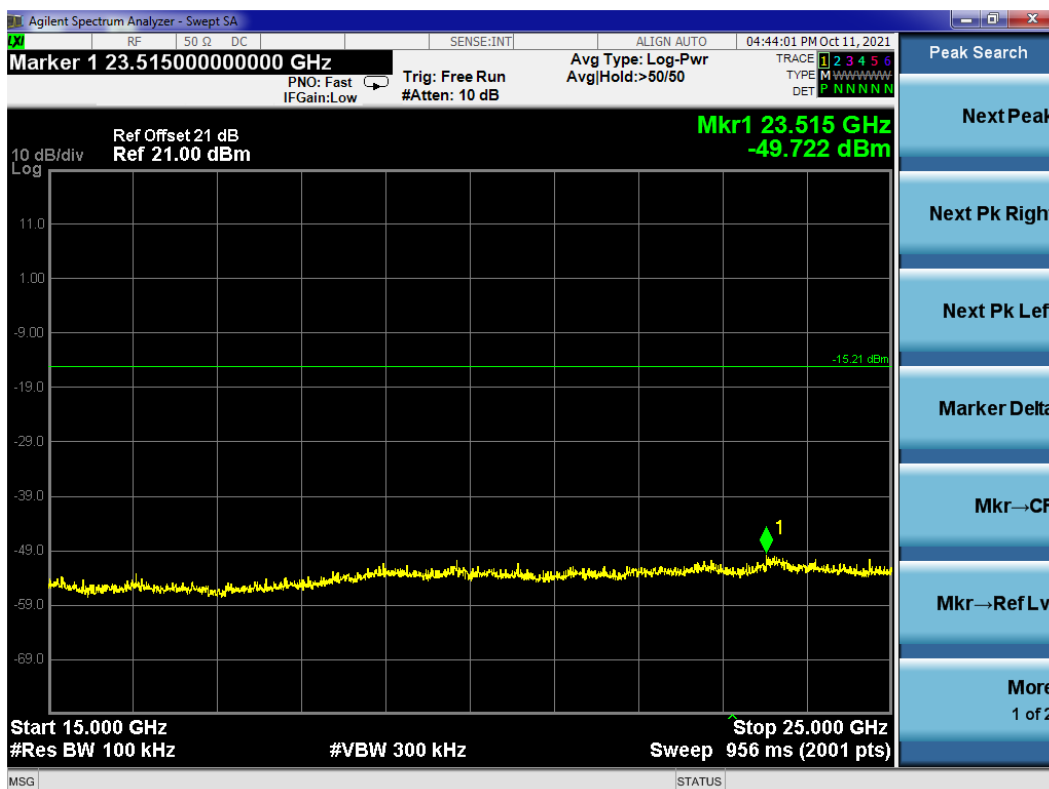
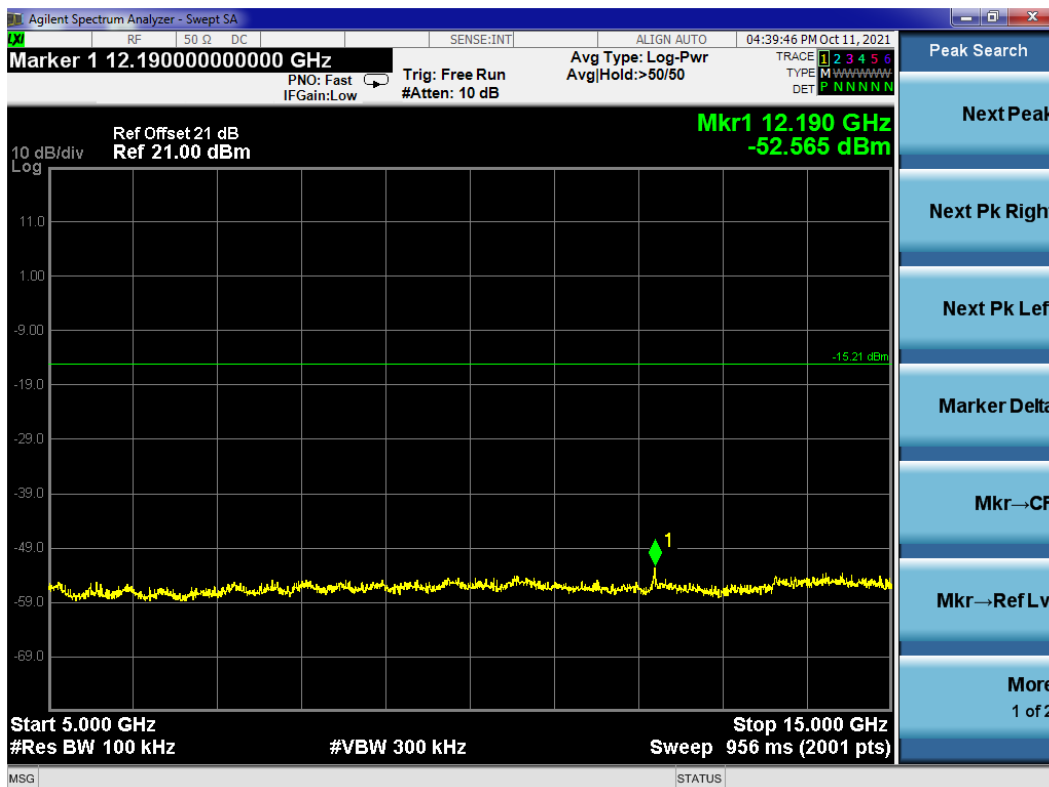
802.11n20 CH2437MHz

Reference level



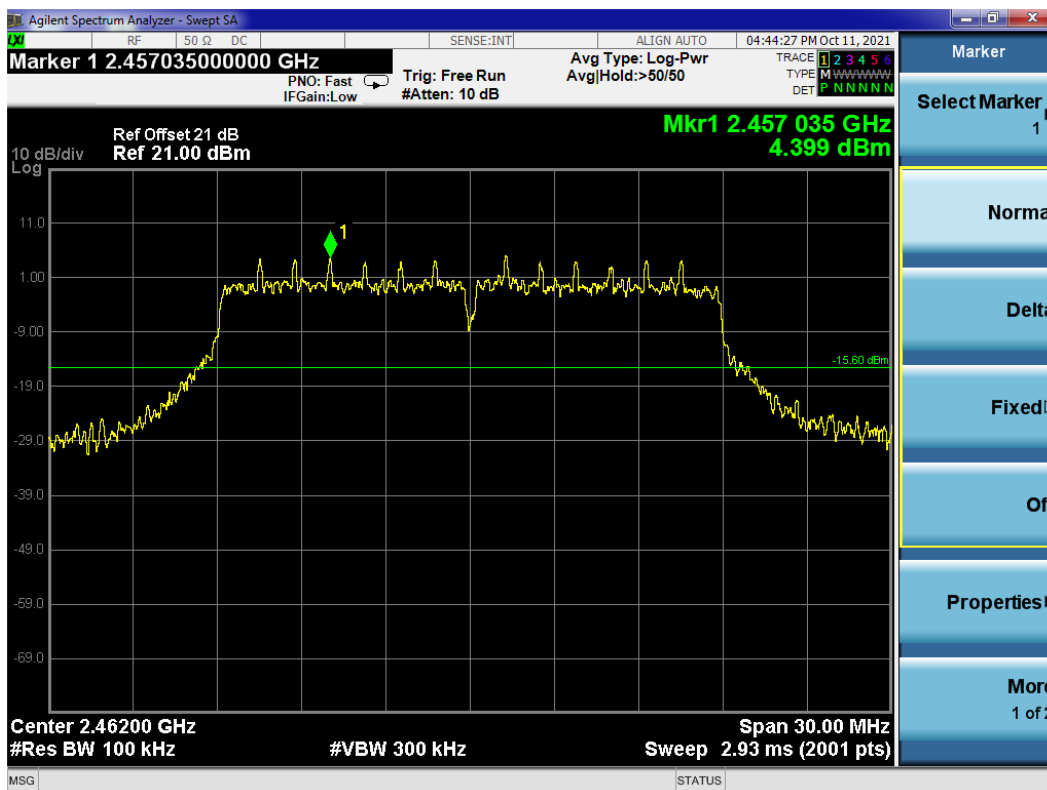
Emission level



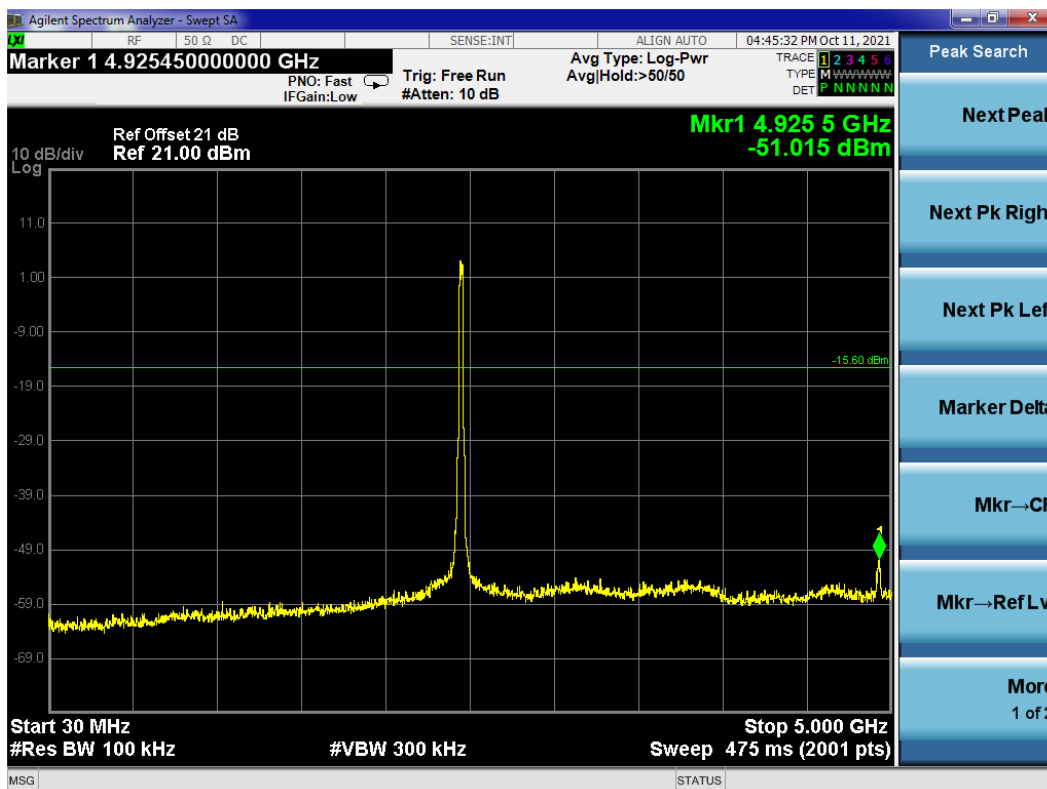


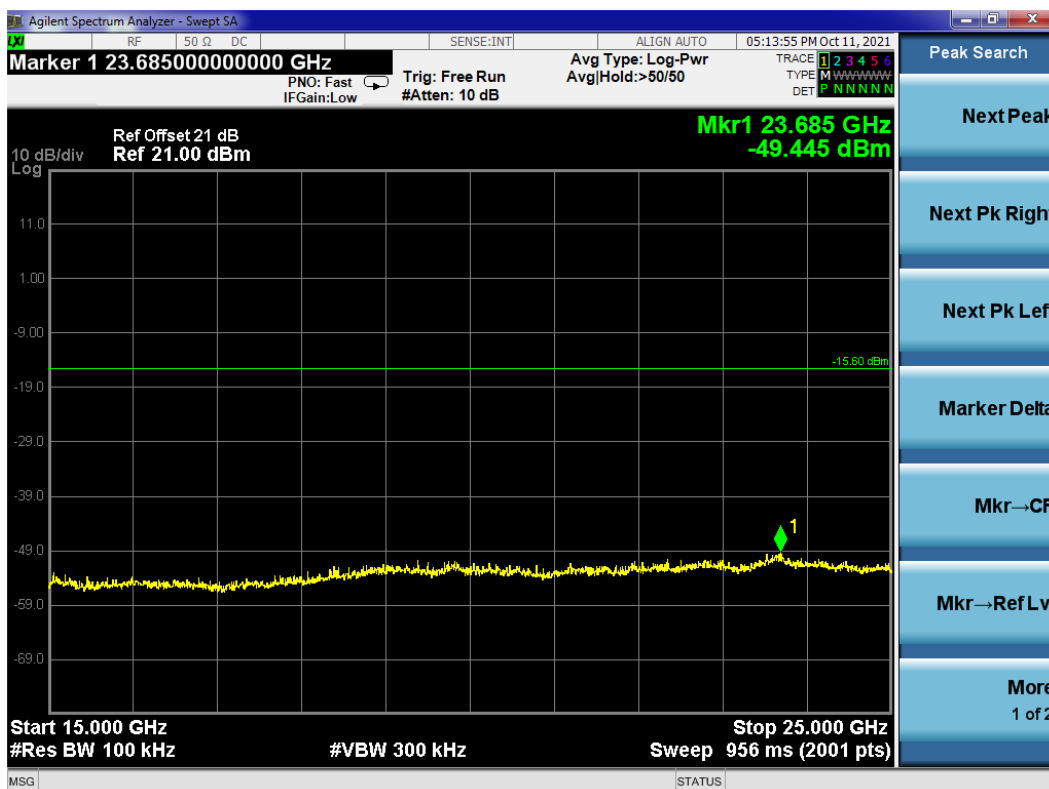
802.11n20 CH2462MHz

Reference level



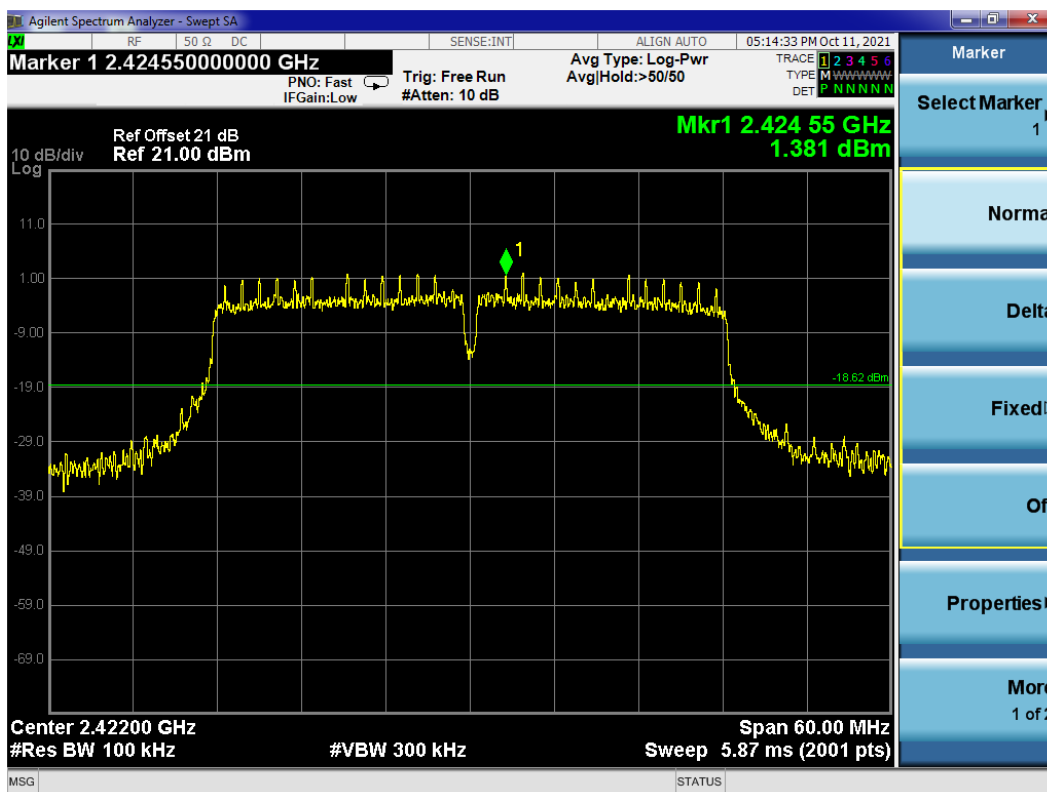
Emission level



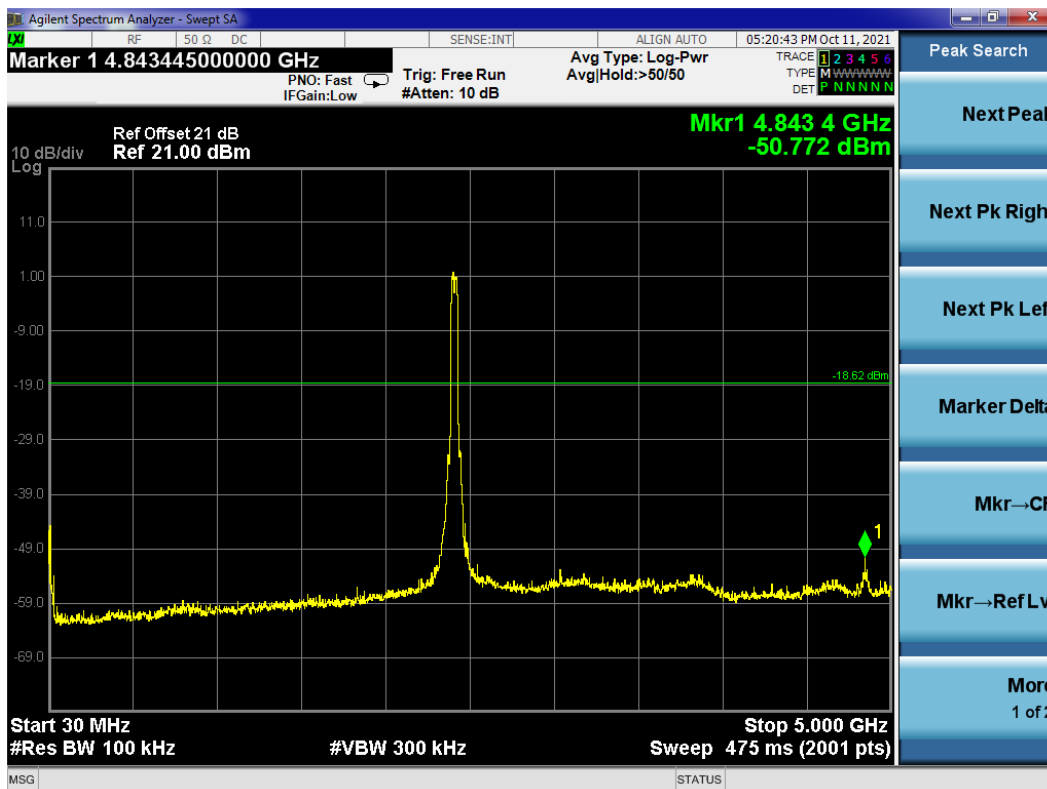


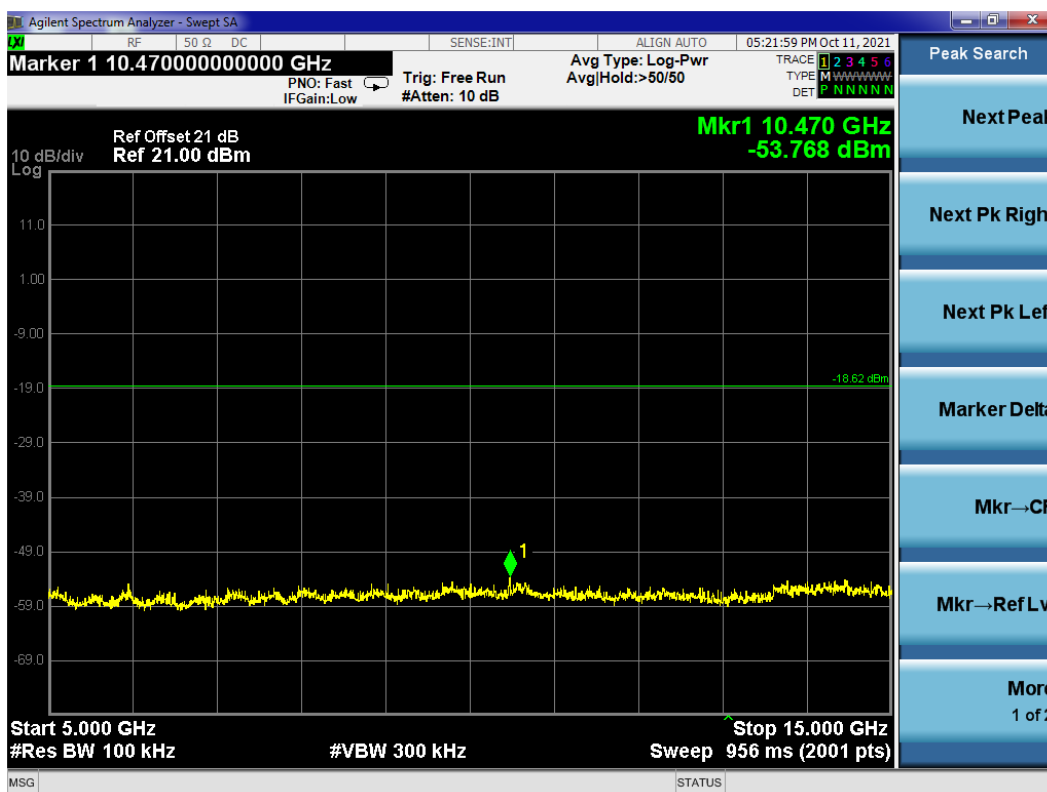
802.11n40 CH2422MHz

Reference level



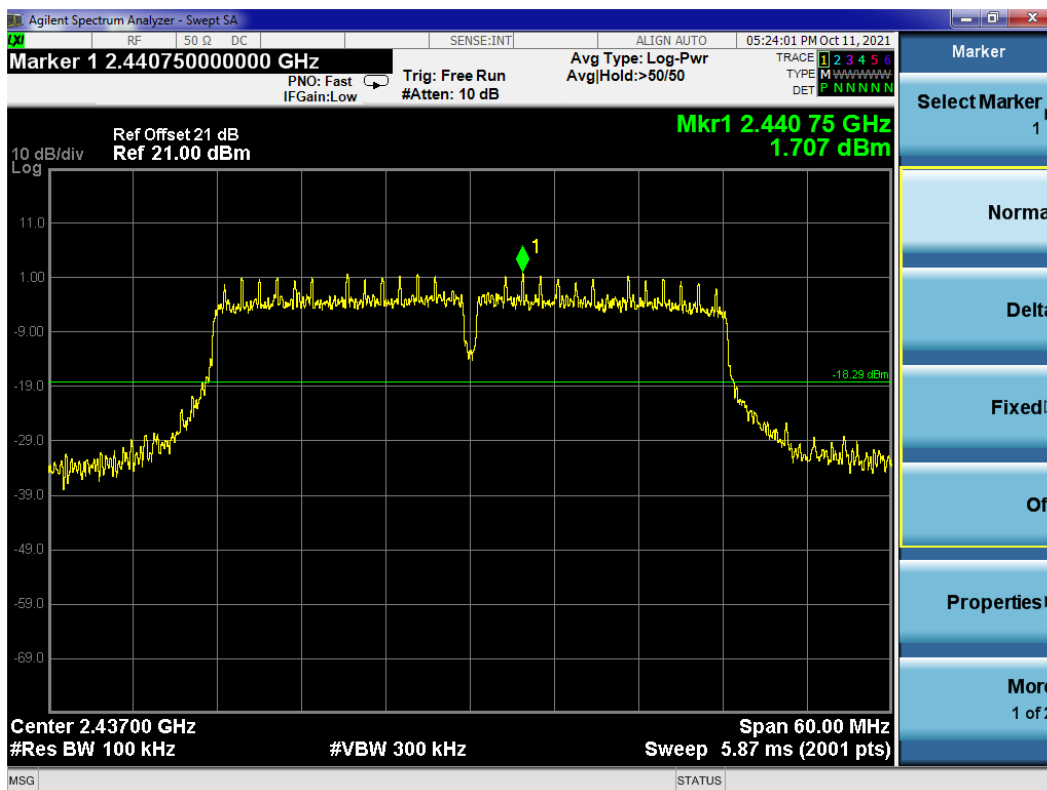
Emission level



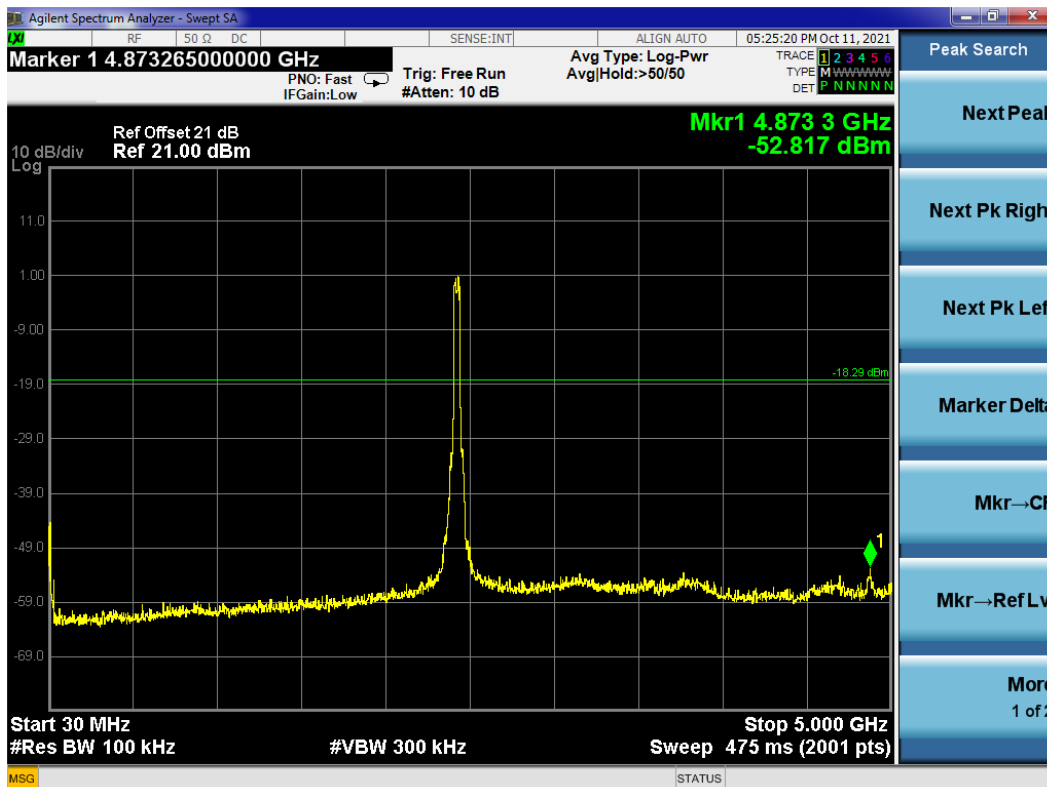


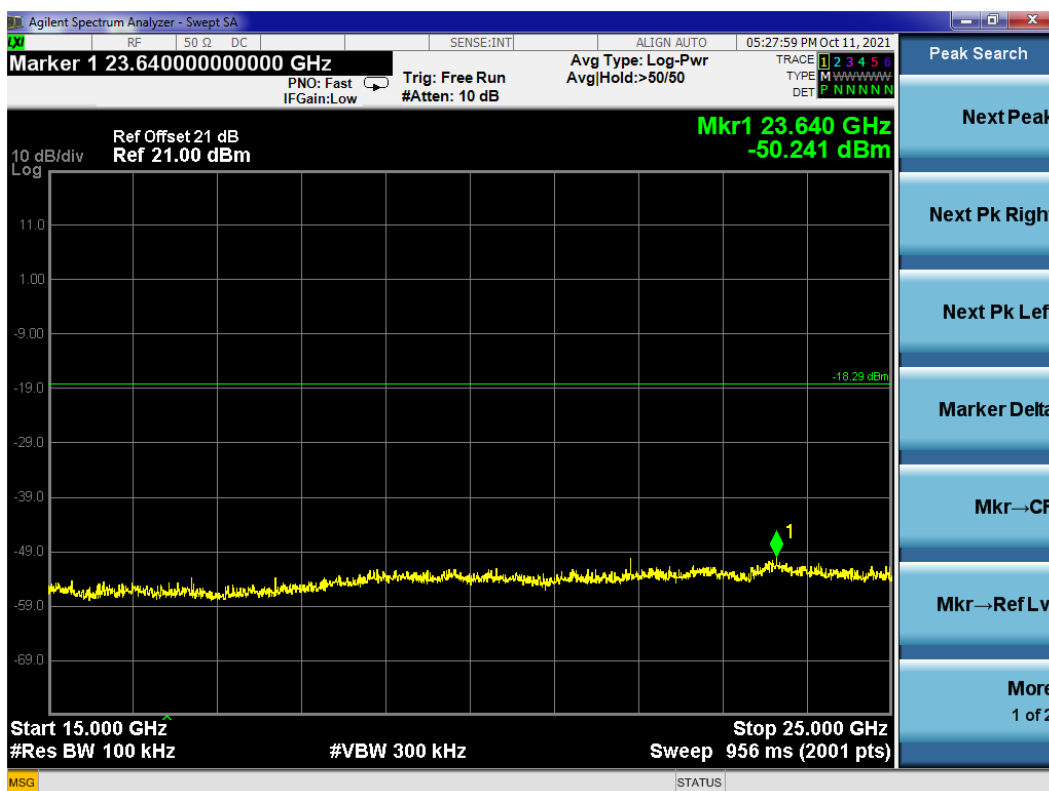
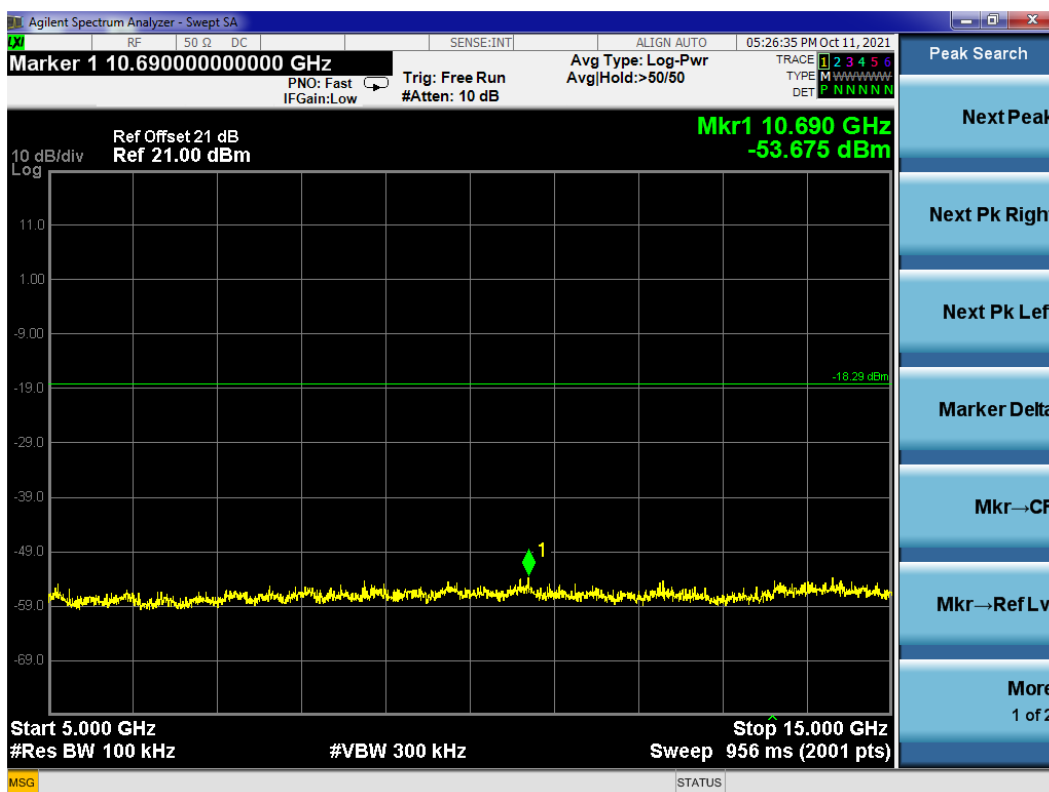
802.11n40 CH2437MHz

Reference level



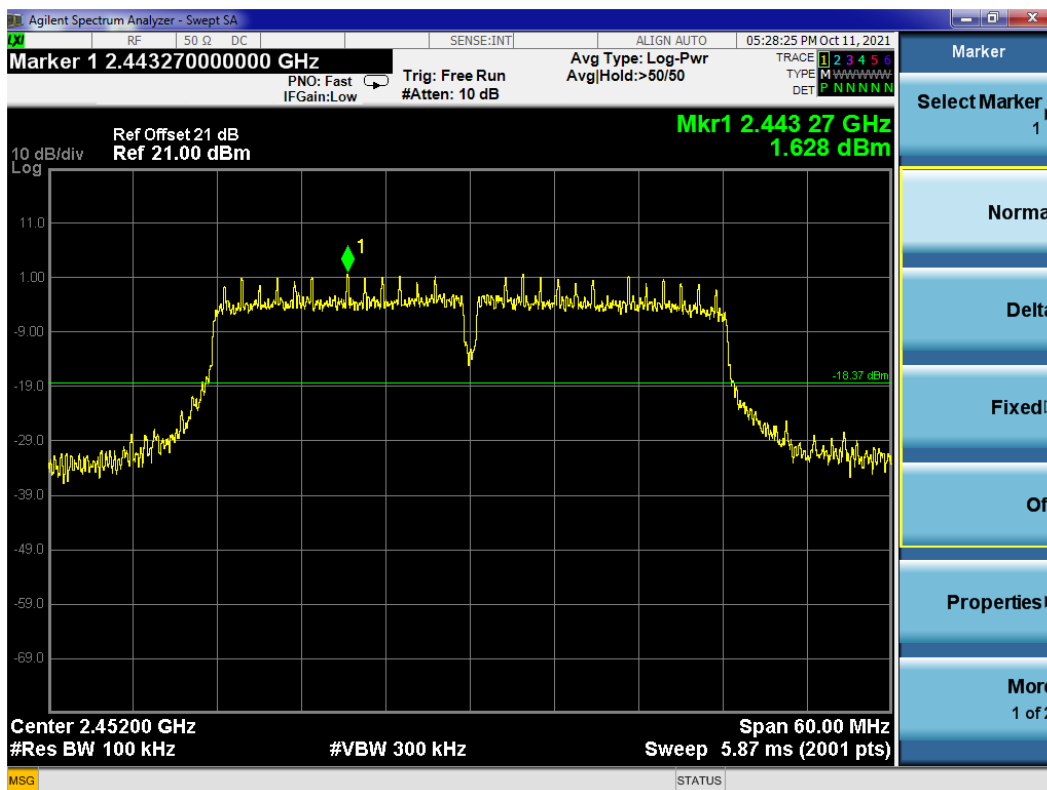
Emission level



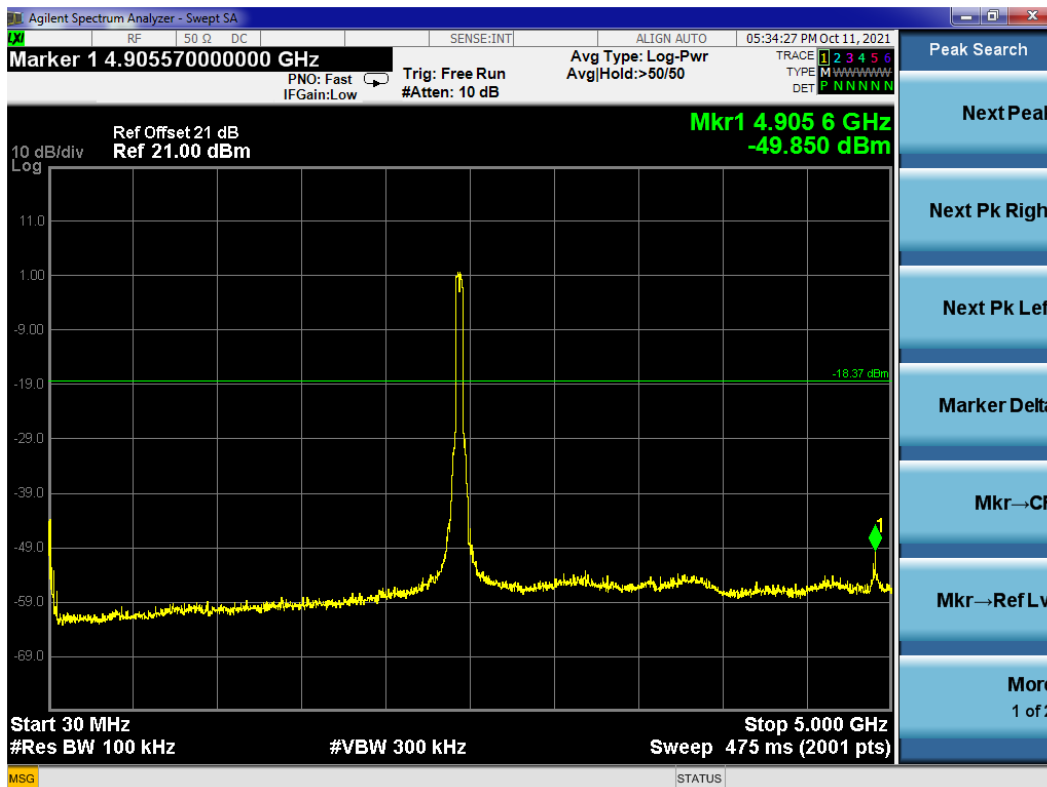


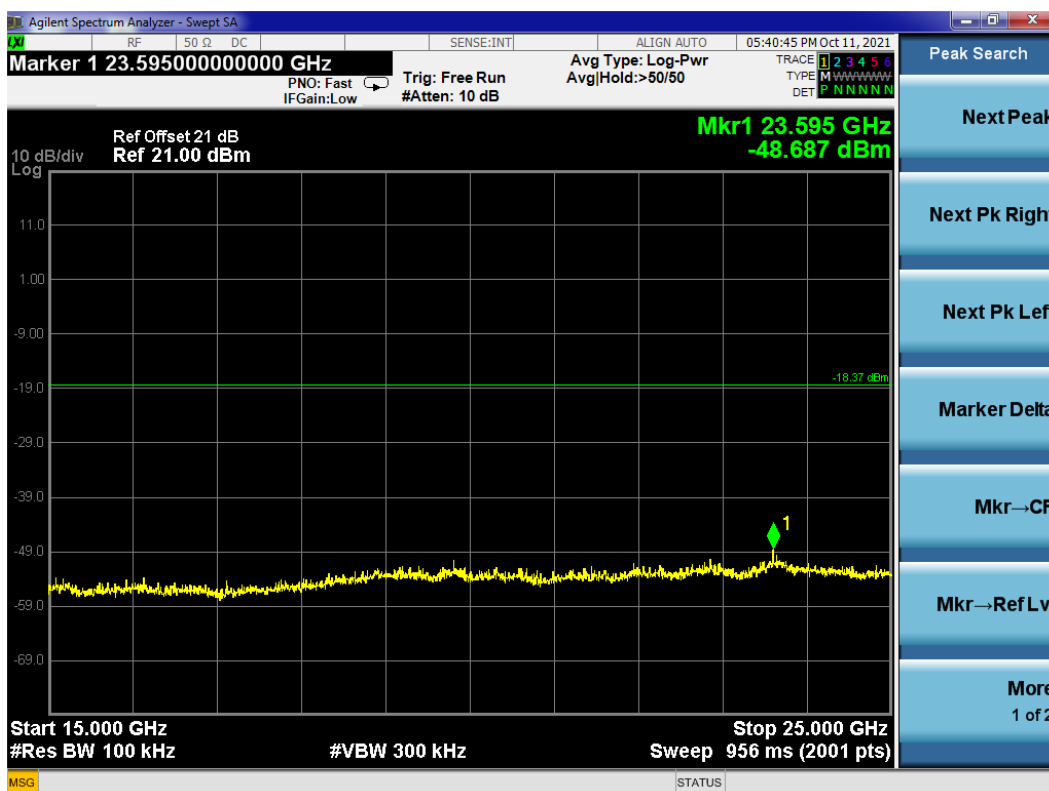
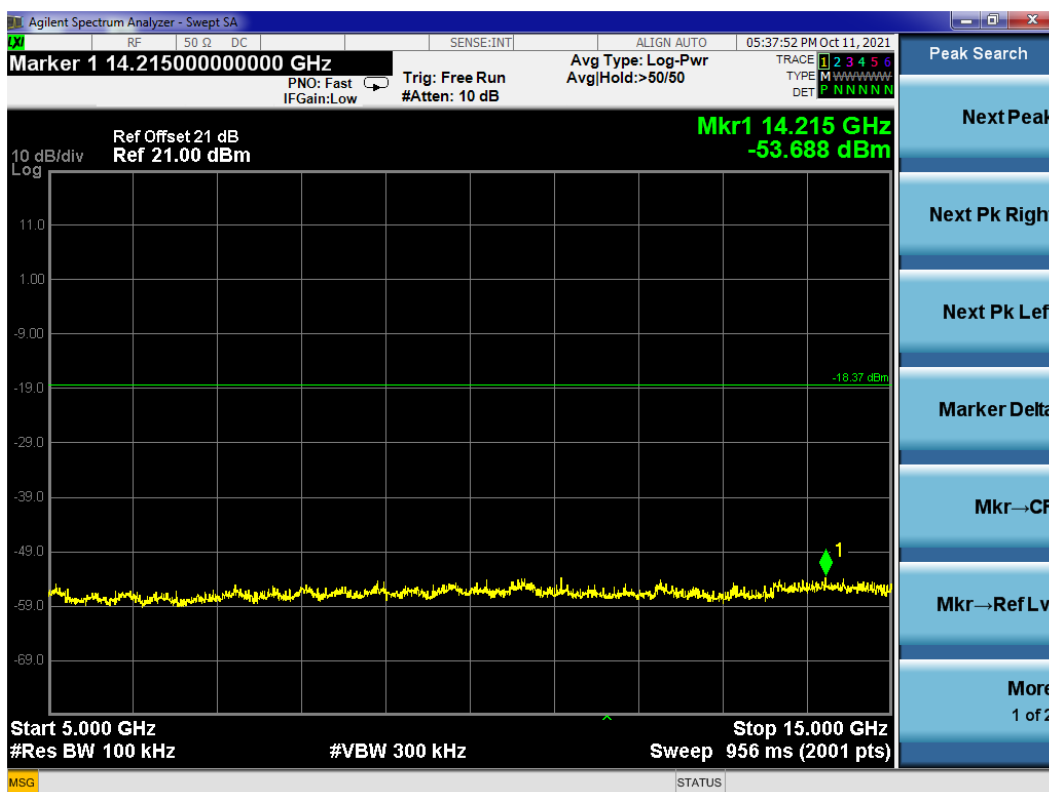
802.11n40 CH2452MHz

Reference level



Emission level





8 BAND EDGES MEASUREMENT

8.1 Test Equipment

The following test equipment was used during the band edges measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2021.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2021.03.08	1 Year
3.	20 dB Attenuator	Mini-Circuits	VAT-20+	001	2021.08.06	1 Year

8.2 Block Diagram of Test Setup

The Same as section. 5.2.

8.3 Specification Limits (§15.247(d))

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

8.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

8.5 Test Procedure

The transmitter output was connected to the spectrum analyzer. Set RBW of Test Receiver to 100kHz and VBW to 300kHz with suitable frequency span including 100kHz bandwidth from band edge.

The test procedure is defined in ANSI C63.10-2013 (11.11.3 Emission level measurement was used).

8.6 Test Results

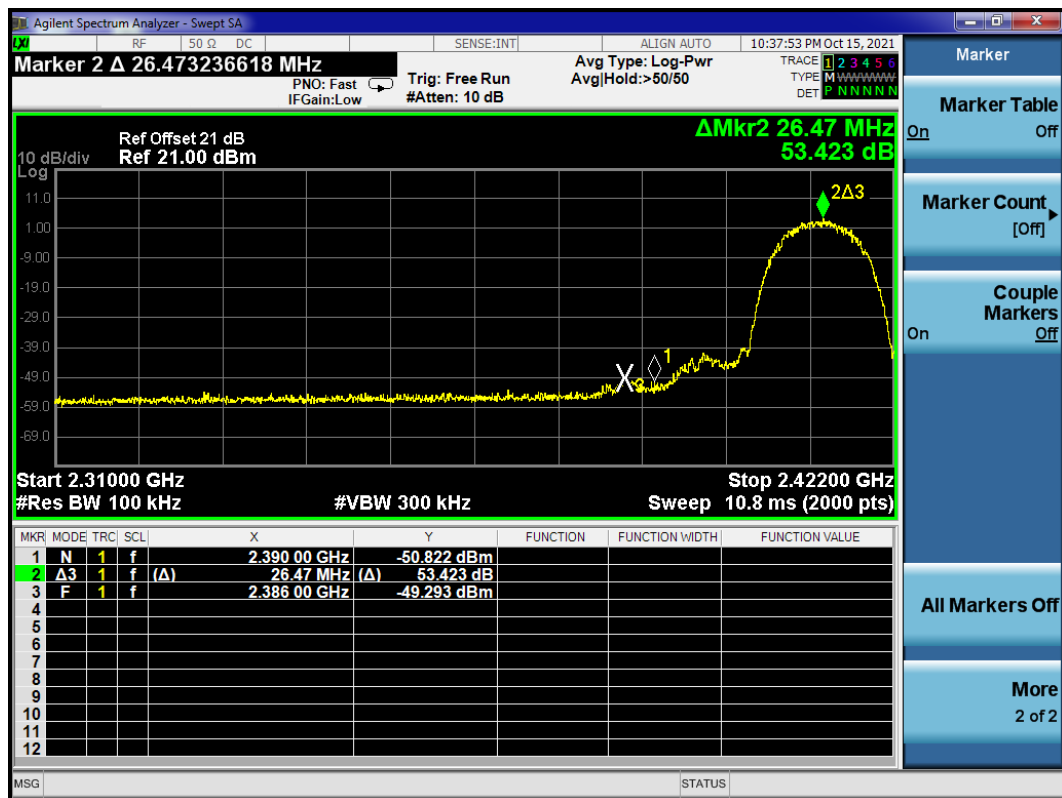
PASSED.

All the test results are attached in next pages.

(Test Date: 2021.10.15 Temperature: 23°C Humidity: 51 %)

Modulation	Location	Channel	Frequency (MHz)	Delta Marker (dB)	Result
802.11b	Below Band Edge	1	2412	53.423	More than 20 dB below the highest level of the desired power
	Upper Band Edge	11	2462	53.16	
802.11g	Below Band Edge	1	2412	43.724	More than 20 dB below the highest level of the desired power
		11	2462	38.862	
802.11n20	Below Band Edge	1	2412	39.583	More than 20 dB below the highest level of the desired power
		11	2462	37.043	
802.11n40	Below Band Edge	3	2422	32.537	More than 20 dB below the highest level of the desired power
		9	2452	30.092	

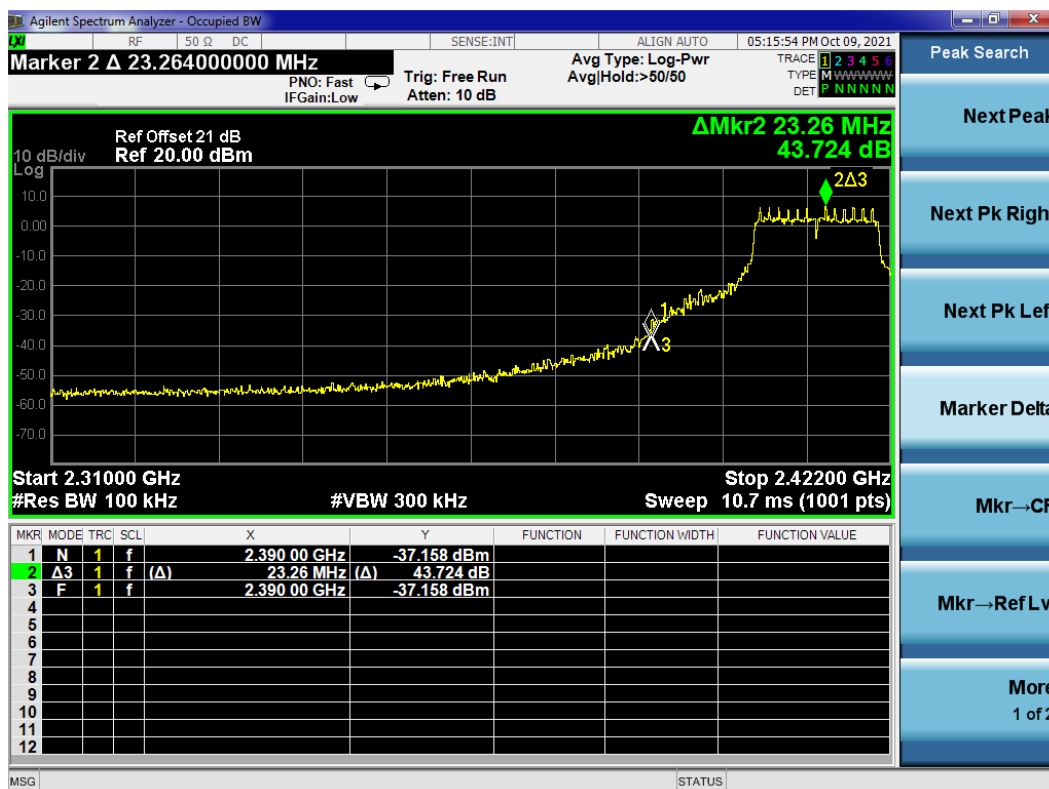
802.11b CH2412MHz (Below Edge 2390 MHz)



802.11b CH2462MHz (Upper Edge 2483.5 MHz)



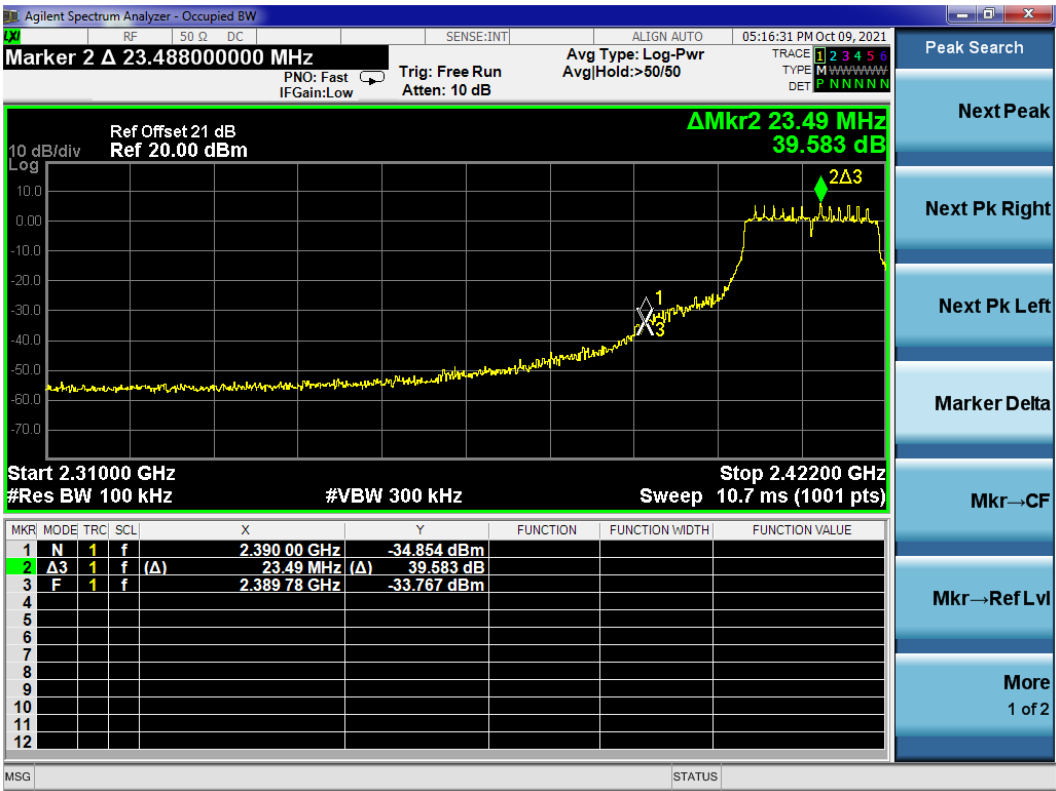
802.11g CH2412MHz (Below Edge 2390 MHz)



802.11g CH2462MHz (Upper Edge 2483.5 MHz)



802.11n20 CH2412MHz (Below Edge 2390 MHz)



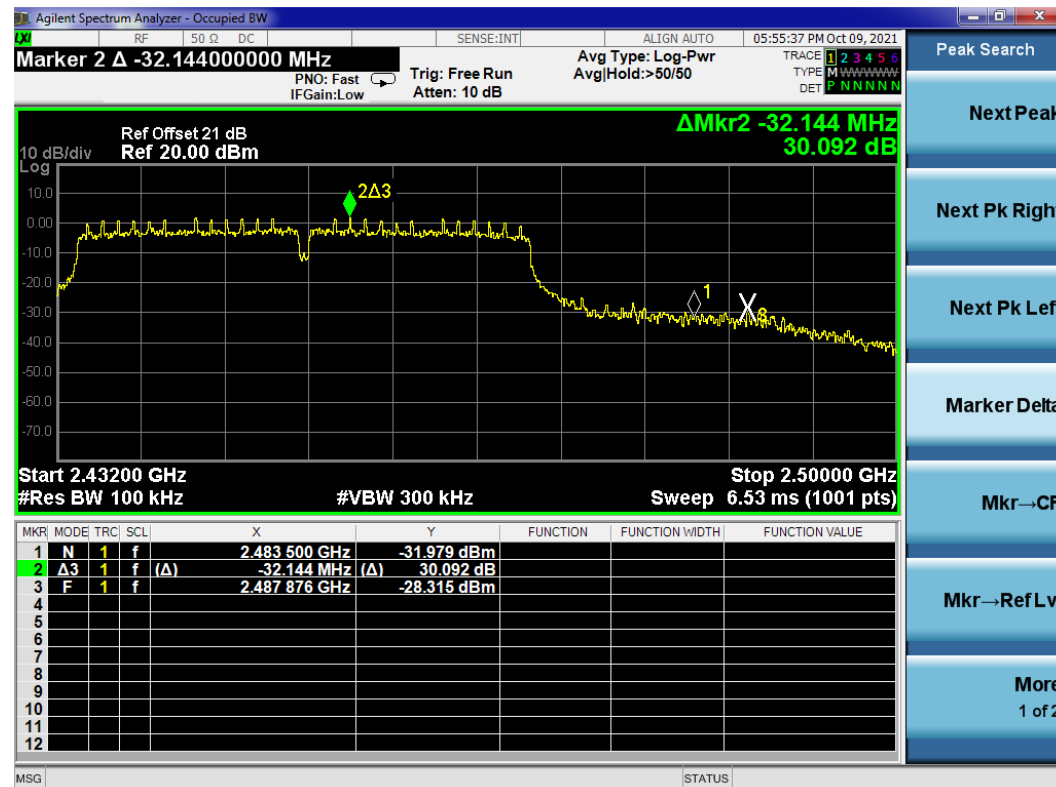
802.11n20 CH2462MHz (Upper Edge 2483.5 MHz)



802.11n40 CH2422MHz (Below Edge 2390 MHz)



802.11n40 CH2452MHz (Upper Edge 2483.5 MHz)



9 POWER SPECTRAL DENSITY MEASUREMENT

9.1 Test Equipment

The following test equipment was used during the power spectral density measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2021.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2021.03.08	1 Year
3.	20 dB Attenuator	Mini-Circuits	VAT-20+	001	2021.08.06	1 Year

9.2 Block Diagram of Test Setup

The Same as section 5.2.

9.3 Specification Limits (§15.247(e))

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band.

9.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

9.5 Test Procedure

The transmitter output was connected to the spectrum analyzer.

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq [3 \times \text{RBW}]$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

The test procedure is defined in ANSI C63.10-2013 (11.10.2 Measurement Procedure “Method PKPSD (peak PSD)” was used).

9.6 Test Results

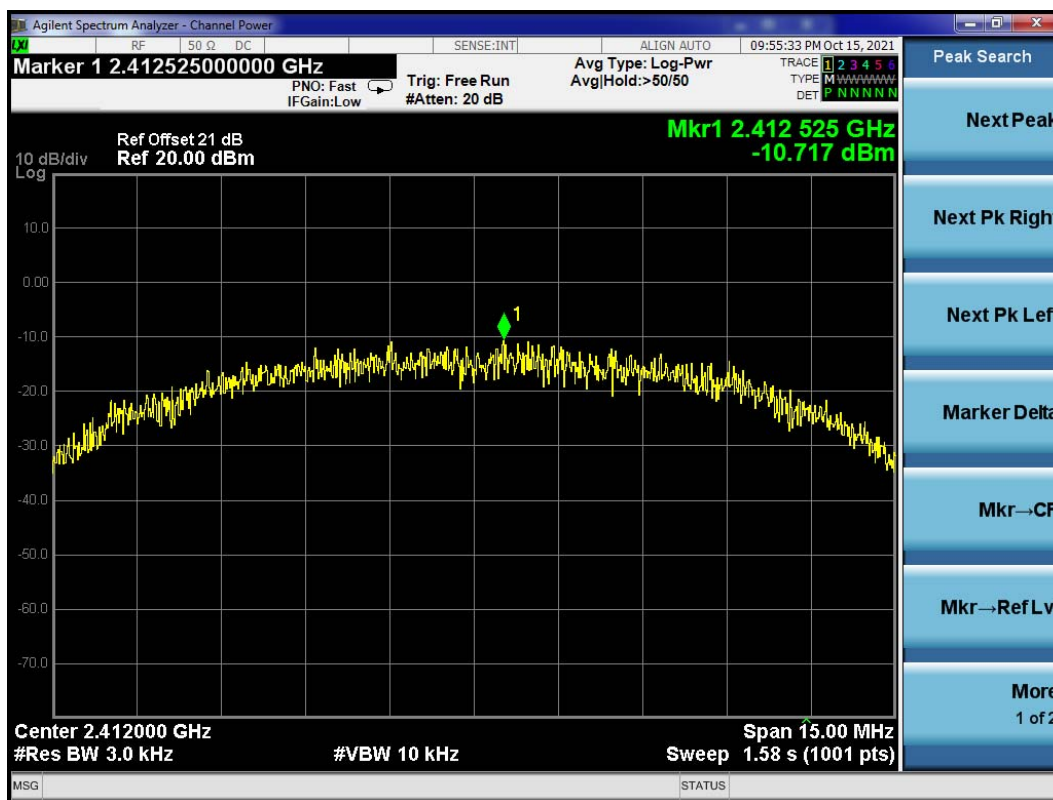
PASSED.

All the test results are attached in next pages.

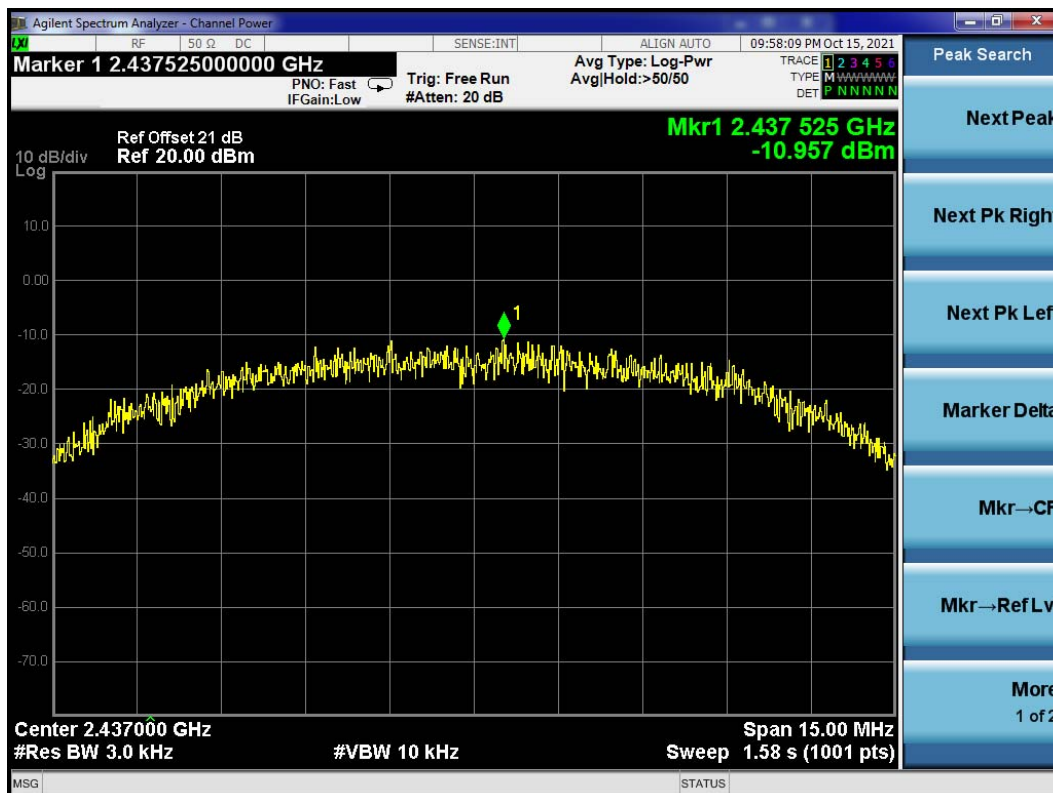
(Test Date: 2021.10.15 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit
802.11b	1	2412	-10.717	8 dBm
	6	2437	-10.957	8 dBm
	11	2462	-11.237	8 dBm
802.11g	1	2412	-8.88	8 dBm
	6	2437	-8.817	8 dBm
	11	2462	-9.311	8 dBm
802.11n20	1	2412	-9.253	8 dBm
	6	2437	-9.366	8 dBm
	11	2462	-9.918	8 dBm
802.11n40	3	2422	-11.592	8 dBm
	6	2437	-11.591	8 dBm
	9	2452	-11.847	8 dBm

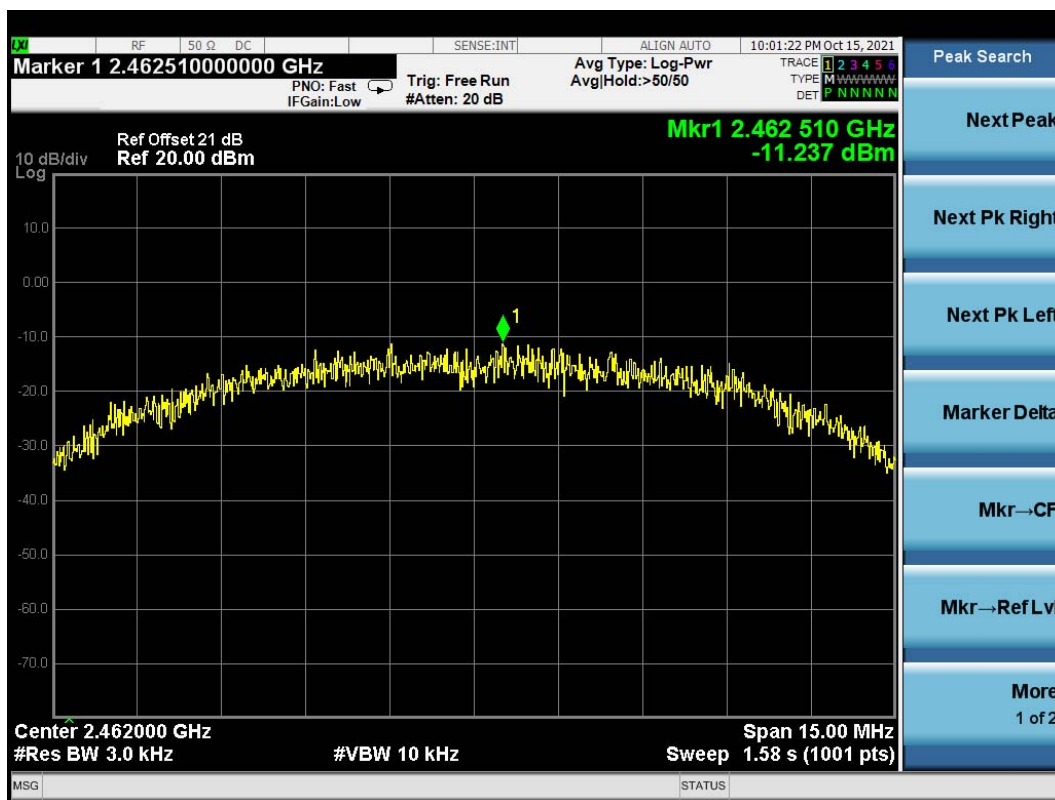
802.11b CH2412 MHz



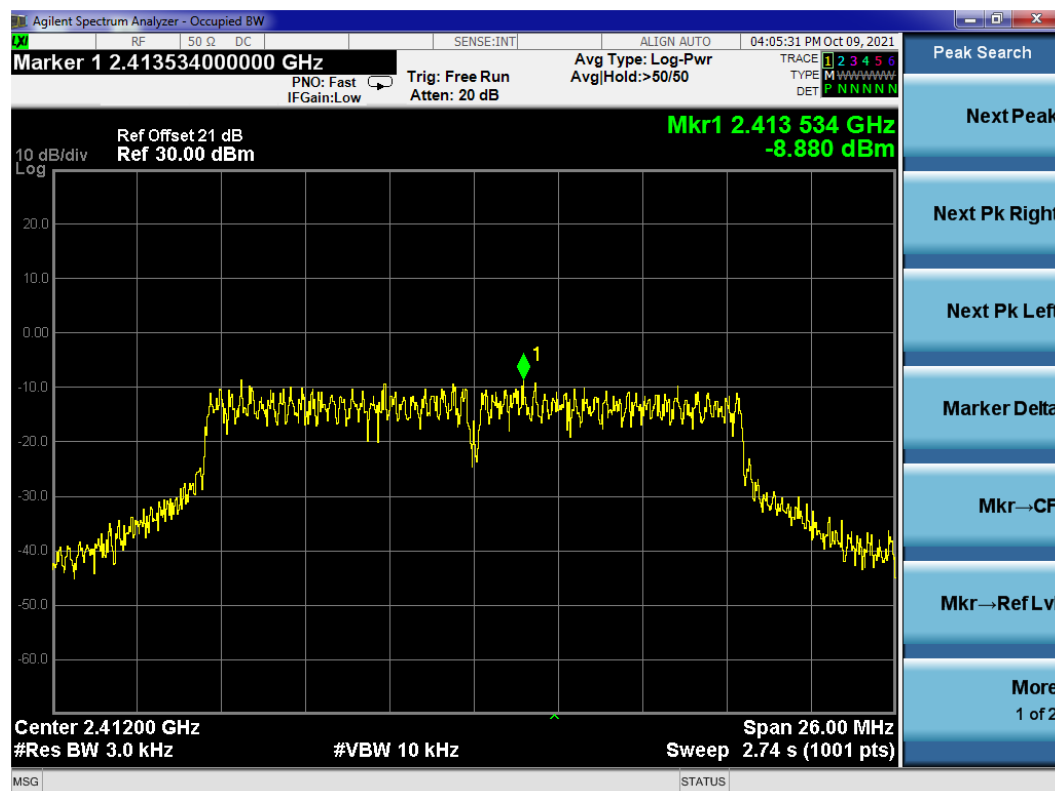
802.11b CH2437 MHz



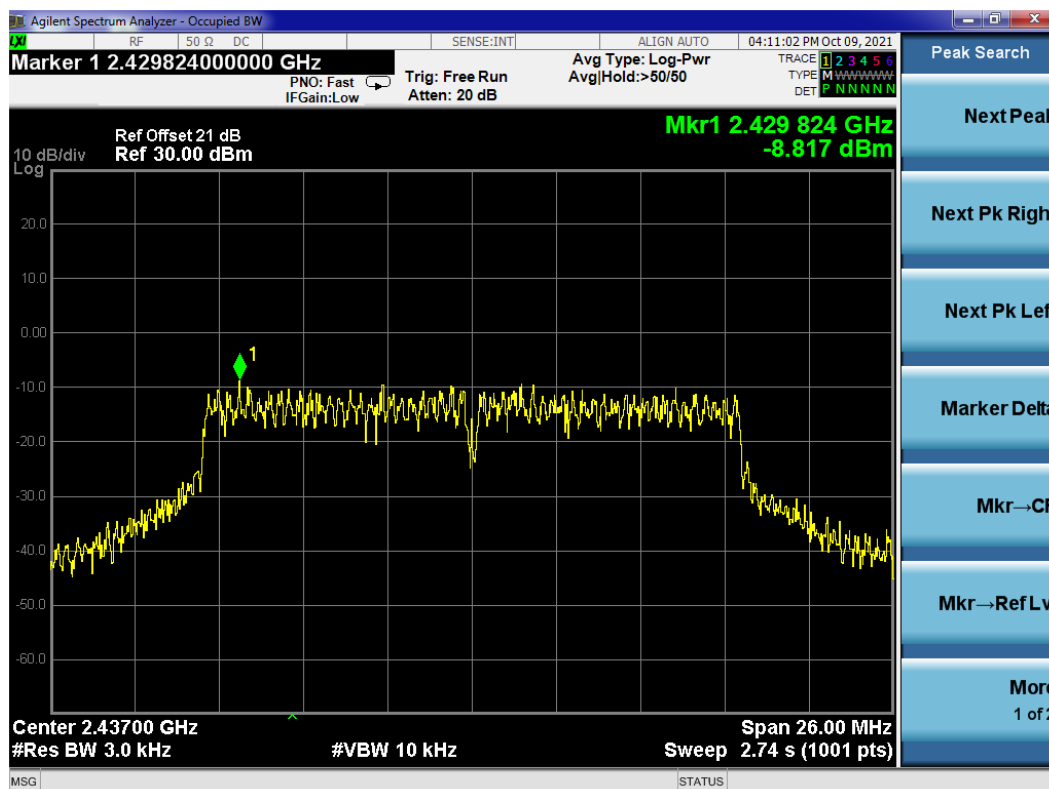
802.11b CH2462 MHz



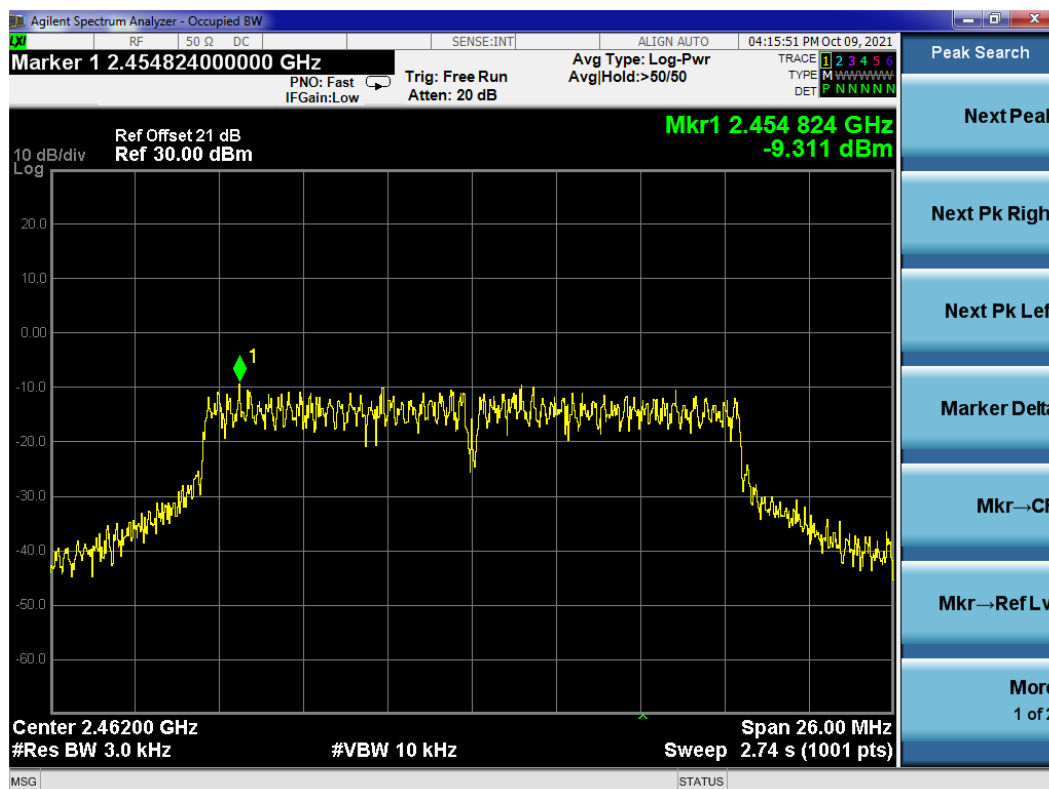
802.11g CH2412 MHz



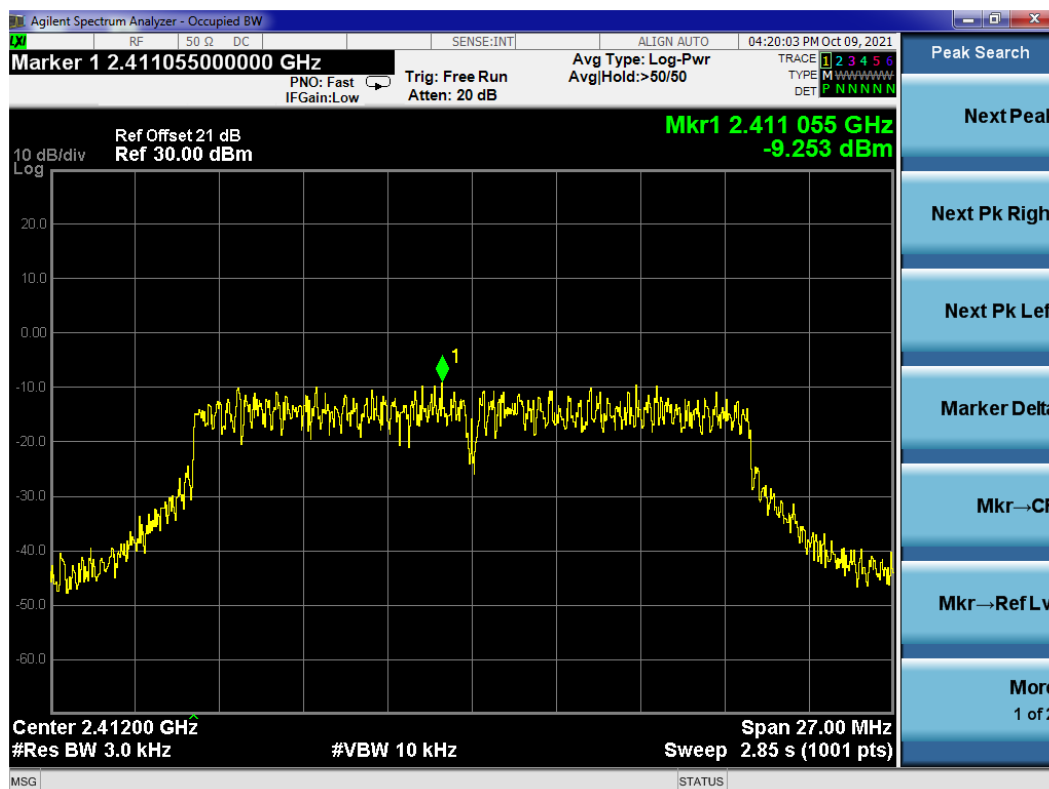
802.11g CH2437 MHz



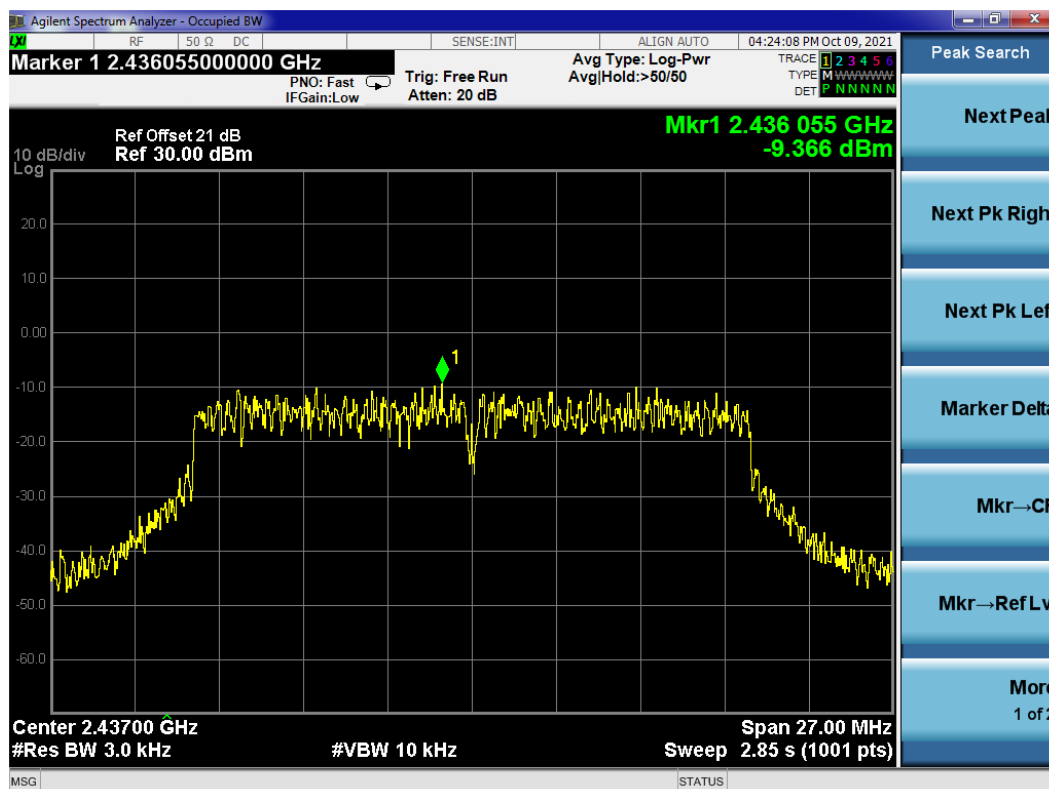
802.11g CH2462 MHz



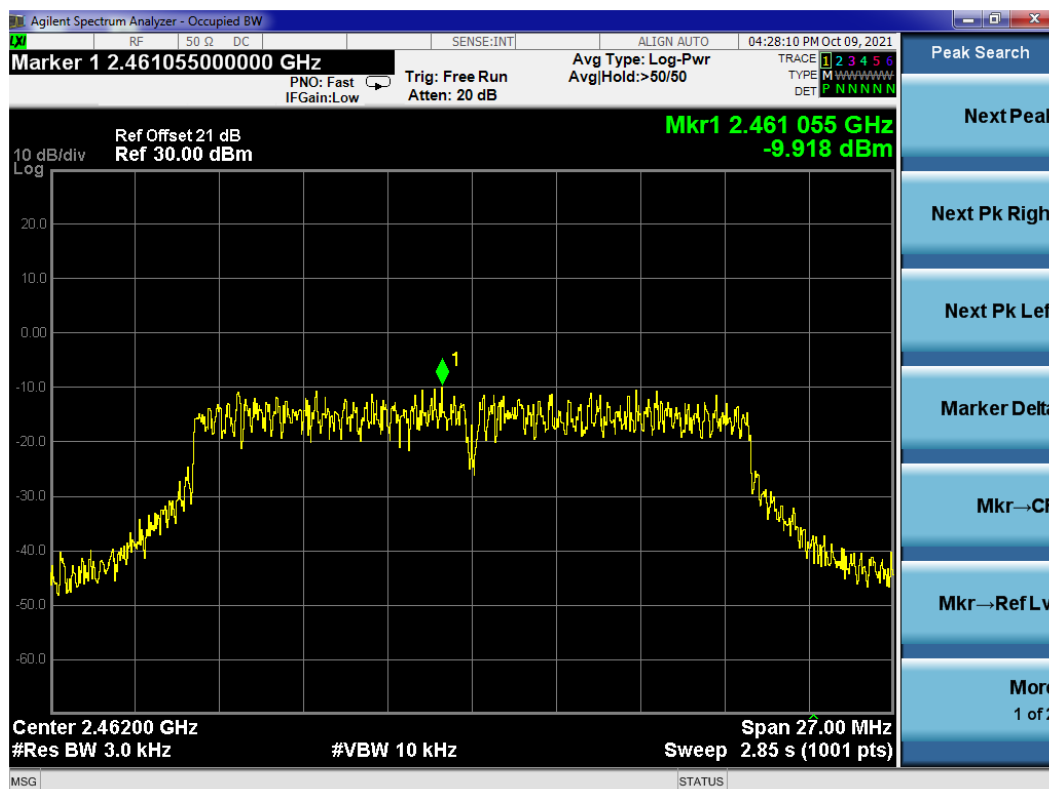
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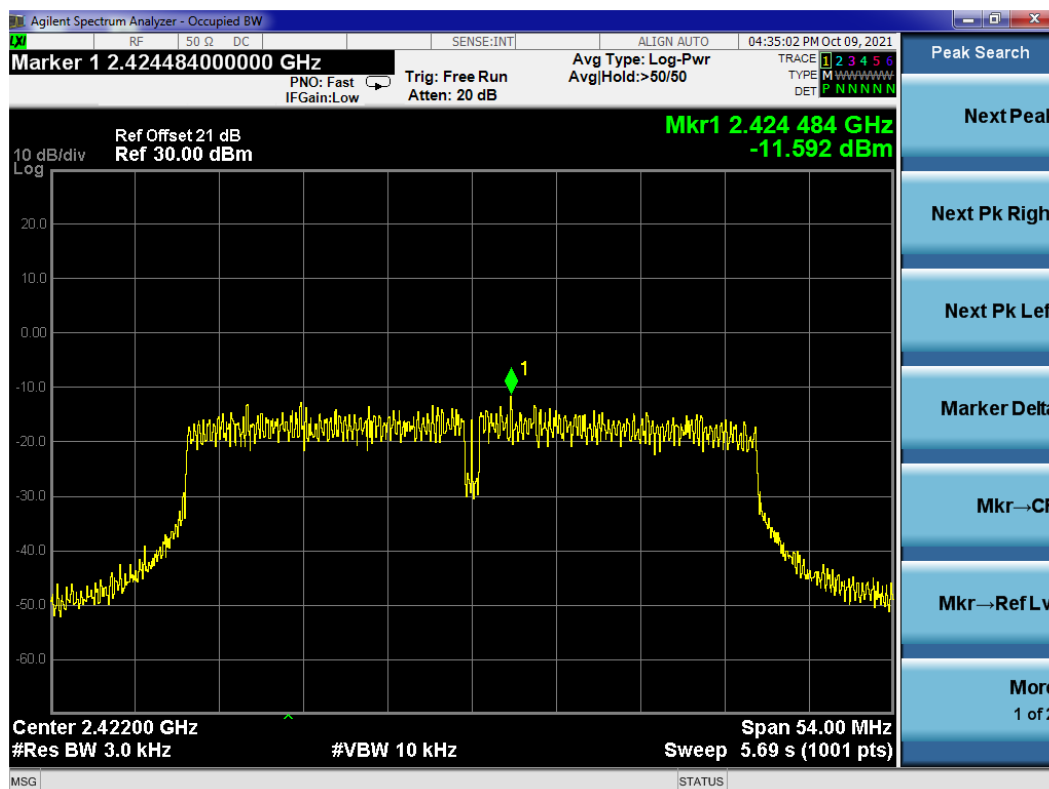
802.11n20 CH2437 MHz



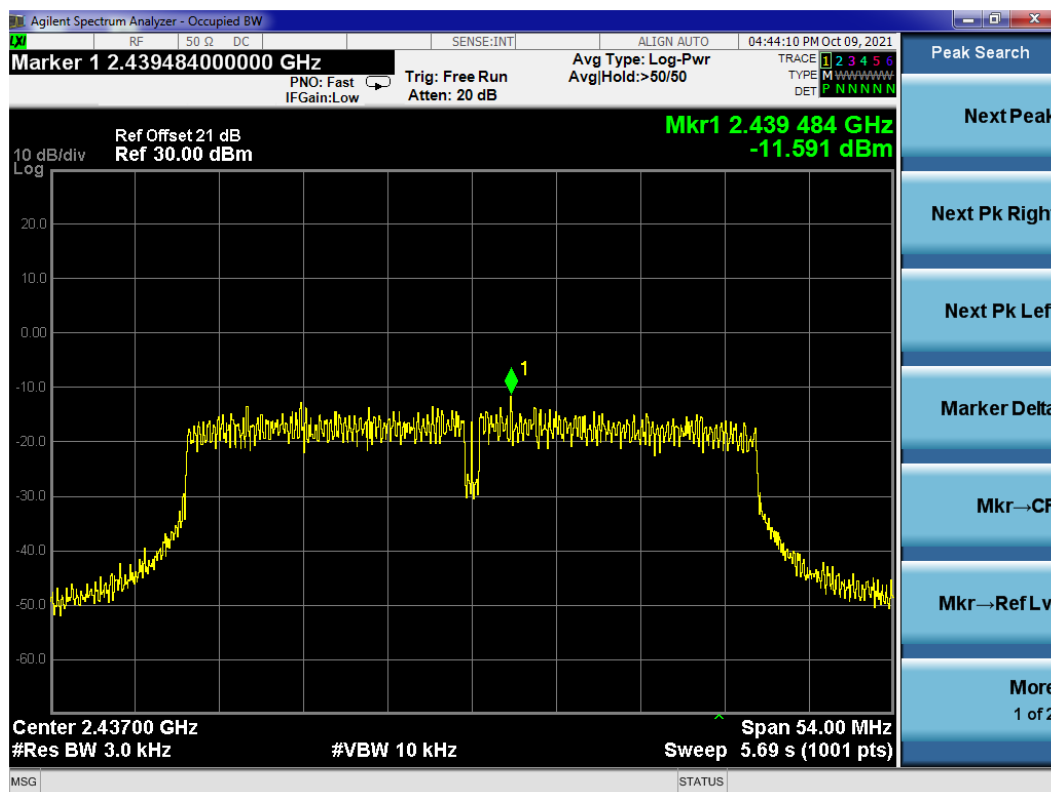
802.11n20 CH2462 MHz



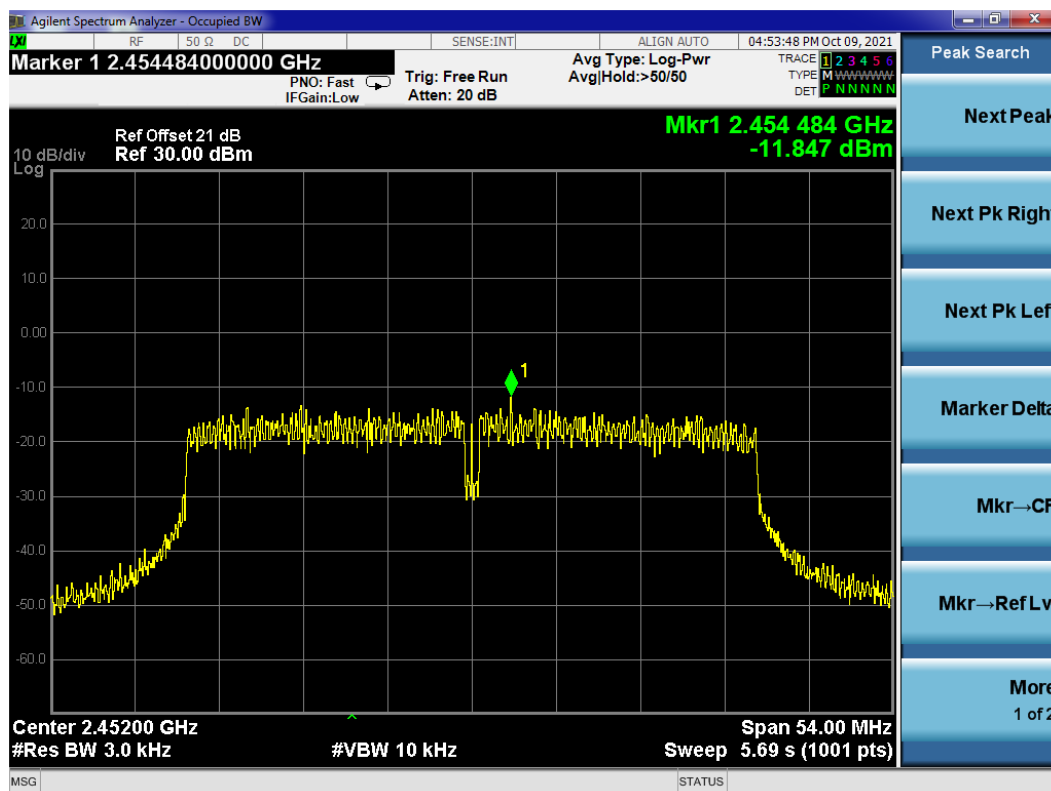
802.11n40 CH2422 MHz



802.11n40 CH2437 MHz



802.11n40 CH2452 MHz



10 DEVIATION TO TEST SPECIFICATIONS

None.

11 MEASUREMENT UNCERTAINTY LIST

The measurement uncertainty was estimated for test on the EUT according to CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage of K=2.

The uncertainties value is not used in determining the PASS/FAIL results.

Test Items/Facilities	Frequency/Equipment/Unit	Uncertainty
Conducted Emission No.1 Shielded Room	9kHz~150kHz	±3.1 dB
	150kHz~30MHz	±2.6 dB
Conducted Emission No.3 Shielded Room	9kHz~150kHz	±3.1 dB
	150kHz~30MHz	±2.6 dB
Radiated Emission	30MHz~200MHz, Horizontal	±3.8 dB
	30MHz~200MHz, Vertical	±4.1 dB
	200MHz~1000MHz, Horizontal	±3.6 dB
	200MHz~1000MHz, Vertical	±5.1 dB
	1GHz~6GHz	±5.3 dB
	6GHz~18GHz	±5.3 dB
	18GHz~40GHz	±3.5 dB
Output Power Test	50MHz~18GHz	0.77 dB
Power Density Test	9kHz~6GHz	1.08 dB
RF Frequency Test	9kHz~40GHz	6×10^{-4}
Bandwidth Test	9kHz~6GHz	1.5×10^{-3}
RF Radiated Power Test	30MHz~1000MHz	3.06 dB
Conducted Output Power Test	50MHz~18GHz	0.83 dB
AC Voltage(<10kHz) Test	120V~230V	0.04 %
DC Power Test	0V~30V	0.4 %
Temperature	-40°C~+100°C	0.52 °C
Humidity	30%~95%	2.6 %

APPENDIX I

PHOTOGRAPHS OF TEST

Test Set-Up Photos

1. Conducted Test



2. Radiated Test

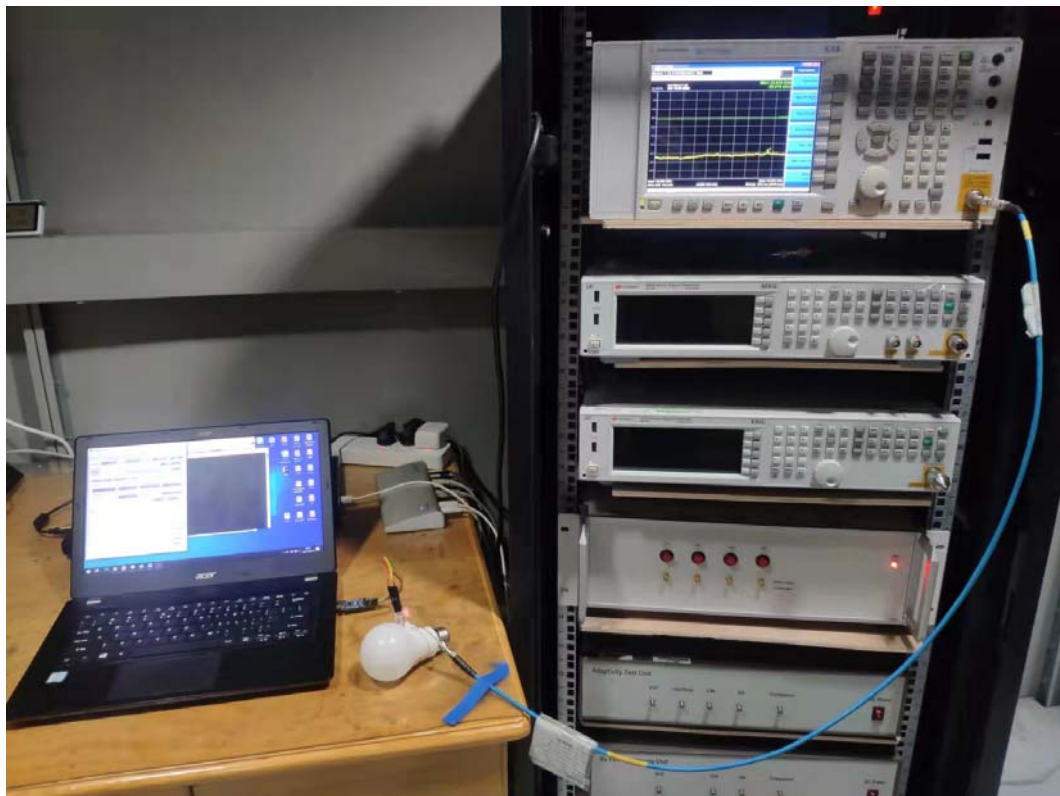


(BELOW 1GHz)



(ABOVE 1GHz)

3. Antenna-port Conducted Test



APPENDIX II

PHOTOGRAPHS OF EUT

FIGURE 1
ABODE COLOR BULB (M/N: 104062/A)
GENERAL APPEARANCE (GENERAL VIEW)



FIGURE 2
ABODE COLOR BULB (M/N: 104062/A)
GENERAL APPEARANCE (COVER REMOVED)



FIGURE 3
ABODE COLOR BULB (M/N: 104062/A)
LED (FRONT)

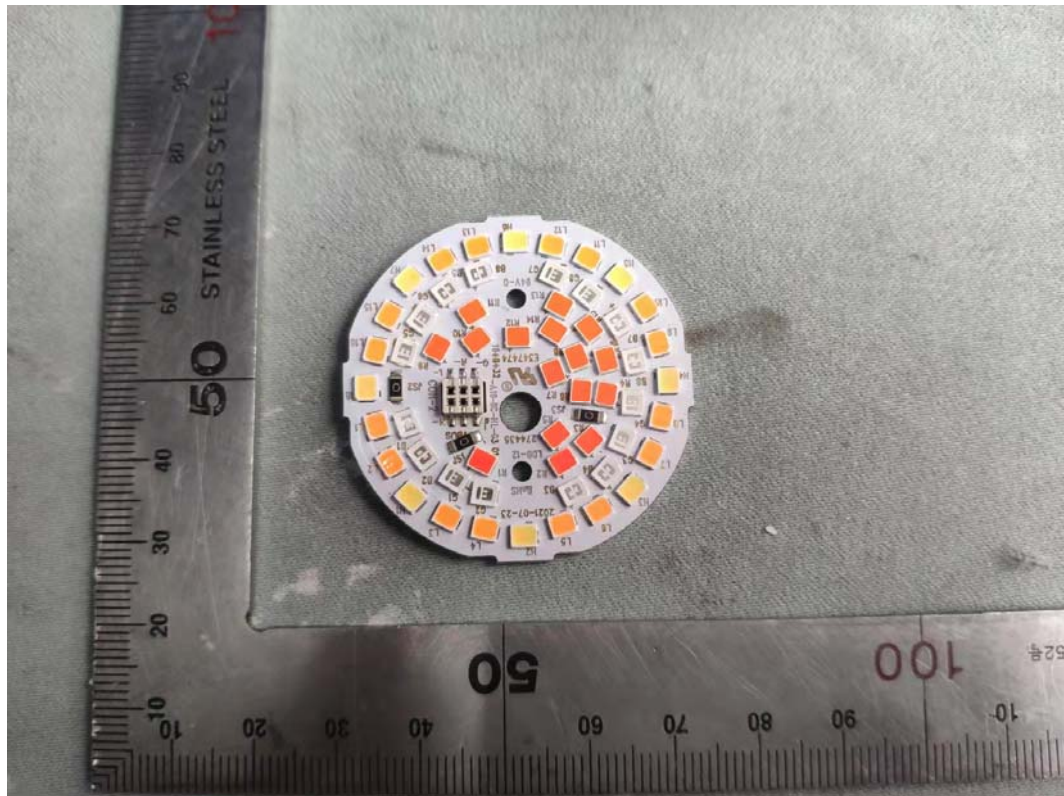


FIGURE 4
ABODE COLOR BULB (M/N: 104062/A)
LED (BACK)

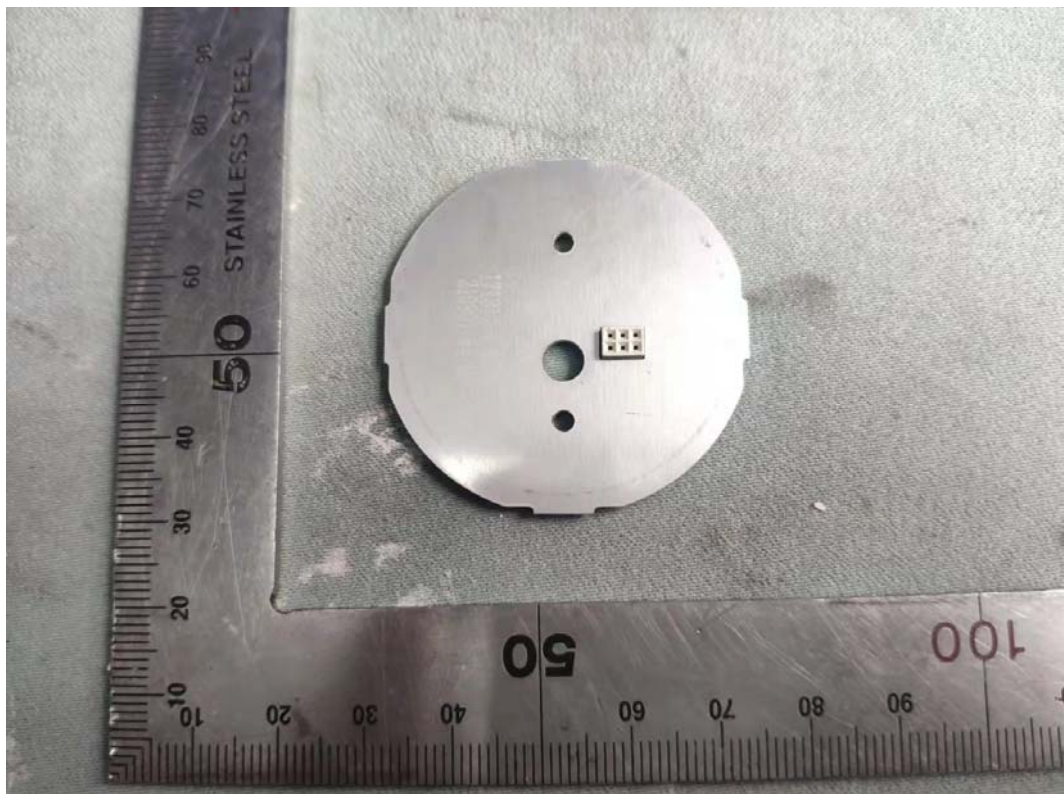


FIGURE 5
ABODE COLOR BULB (M/N: 104062/A)
MAIN BOARD (COMPONENT SIDE)

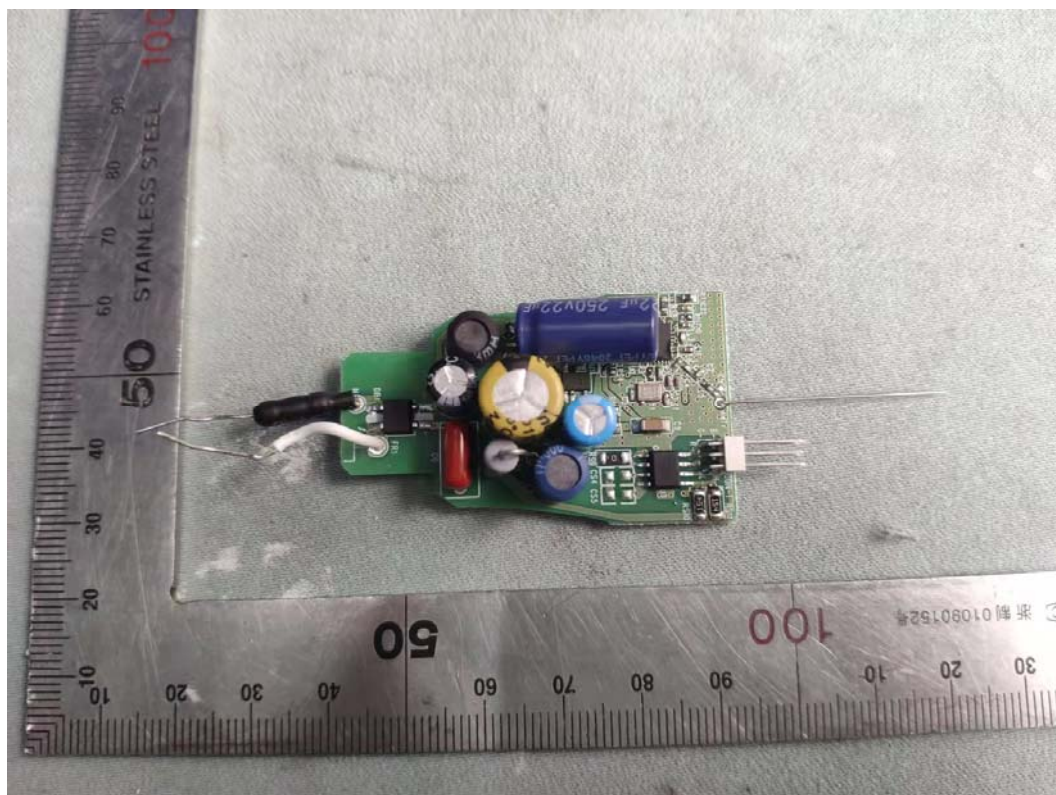


FIGURE 6
ABODE COLOR BULB (M/N: 104062/A)
MAIN BOARD (SOLDERED SIDE)

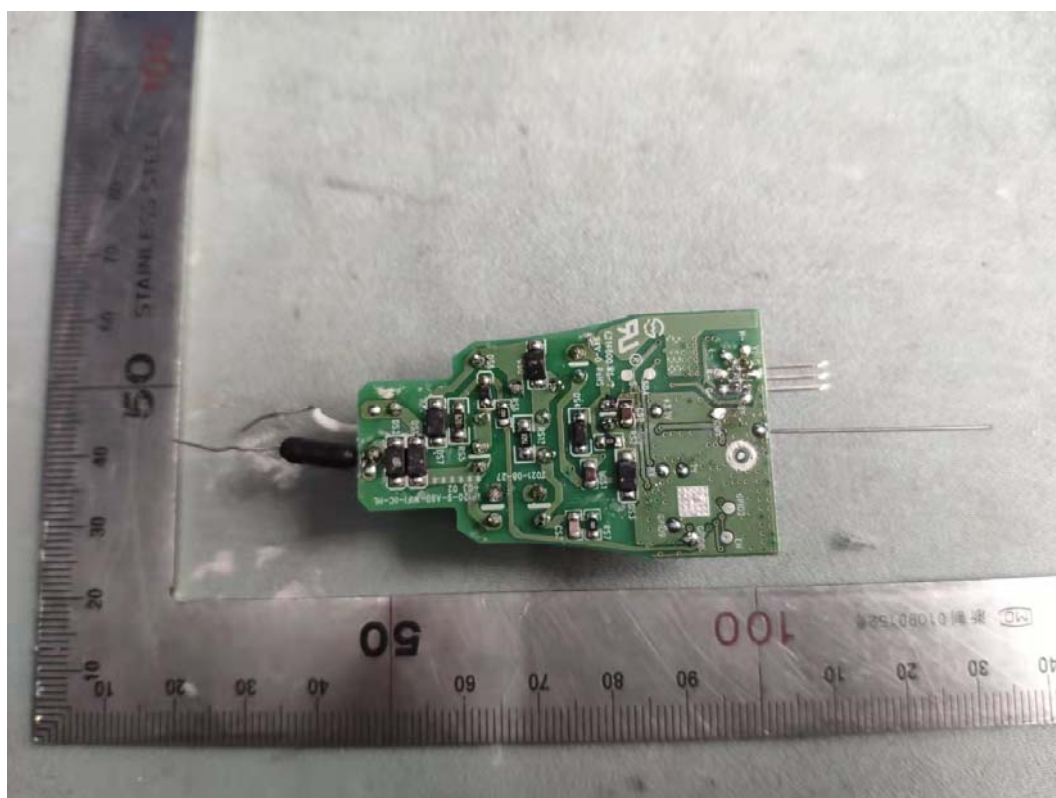


FIGURE 7
ABODE COLOR BULB (M/N: 104062/A)
CHIP AND CRYSTAL ON RF BOARD

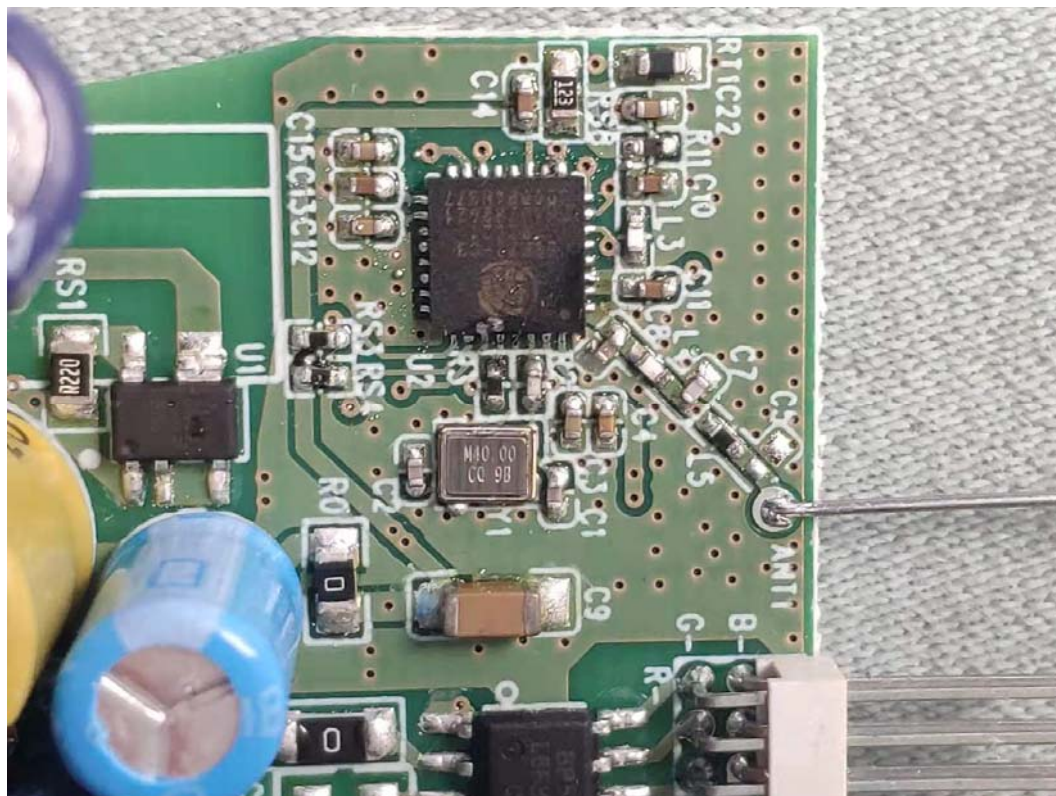


FIGURE 8
ABODE COLOR BULB (M/N: 104062/A)
ANTENNA

