


# RF MEASUREMENT REPORT

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**FCC ID:** 2AAJGR1510  
**Applicant:** Guangzhou Robustel Co., Ltd.  
**Product:** Industrial Cellular VPN Router  
**Model No.:** R1510-4L  
**Trade Mark:**   
**FCC Classification:** Digital Transmission System (DTS)  
**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)  
**Result:** Complies  
**Received Date:** 2023-07-25  
**Test Date:** 2023-08-02 ~ 2023-08-18

**Reviewed By:**

\_\_\_\_\_  
Vincent Yu

**Approved By:**

\_\_\_\_\_  
Robin Wu



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 ANSI C63.10-2013. 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 MRT Technology (Suzhou) Co., Ltd.

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### Revision History

Report No.	Version	Description	Issue Date	Note
2307RSU053-U2	V01	Initial Report	2023-08-28	Valid

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## CONTENTS

Description	Page
<b>1. General Information .....</b>	<b>5</b>
1.1. Applicant .....	5
1.2. Manufacturer .....	5
1.3. Testing Facility .....	5
1.4. Product Information.....	6
1.5. Radio Specification under Test .....	6
1.6. Working Frequencies .....	7
1.7. Antenna Details.....	7
<b>2. Test Configuration .....</b>	<b>8</b>
2.1. Test Mode.....	8
2.2. Test System Connection Diagram.....	8
2.3. Test Software .....	9
2.4. Applied Standards.....	9
2.5. Test Environment Condition .....	9
<b>3. Antenna Requirements .....</b>	<b>10</b>
<b>4. Measuring Instrument .....</b>	<b>11</b>
<b>5. Decision Rules and Measurement Uncertainty .....</b>	<b>12</b>
5.1. Decision Rules .....	12
5.2. Measurement Uncertainty .....	12
<b>6. Test Result.....</b>	<b>13</b>
6.1. Summary.....	13
6.2. 6dB Bandwidth Measurement.....	14
6.2.1. Test Limit .....	14
6.2.2. Test Procedure .....	14
6.2.3. Test Setting .....	14
6.2.4. Test Setup .....	14
6.2.5. Test Result .....	14
6.3. Output Power Measurement .....	15
6.3.1. Test Limit .....	15
6.3.2. Test Procedure .....	15
6.3.3. Test Setting .....	15
6.3.4. Test Setup .....	15
6.3.5. Test Result .....	15
6.4. Power Spectral Density Measurement .....	16
6.4.1. Test Limit .....	16

6.4.2.	Test Procedure .....	16
6.4.3.	Test Setting .....	16
6.4.4.	Test Setup .....	16
6.4.5.	Test Result .....	16
6.5.	Conducted Band Edge and Out-of-Band Emissions Measurement .....	17
6.5.1.	Test Limit .....	17
6.5.2.	Test Procedure .....	17
6.5.3.	Test Setting .....	17
6.5.4.	Test Setup .....	17
6.5.5.	Test Result .....	18
6.6.	Radiated Spurious Emission Measurement.....	19
6.6.1.	Test Limit .....	19
6.6.2.	Test Procedure .....	19
6.6.3.	Test Setting .....	19
6.6.4.	Test Setup .....	21
6.6.5.	Test Result .....	22
6.7.	Radiated Restricted Band Edge Measurement .....	23
6.7.1.	Test Limit .....	23
6.7.2.	Test Procedure .....	24
6.7.3.	Test Setting .....	24
6.7.4.	Test Setup .....	25
6.7.5.	Test Result .....	25
6.8.	AC Conducted Emissions Measurement .....	26
6.8.1.	Test Limit .....	26
6.8.2.	Test Setup .....	26
6.8.3.	Test Result .....	26
<b>Appendix A – Test Result .....</b>		<b>27</b>
A.1	Duty Cycle Test Result .....	27
A.2	6dB Bandwidth Test Result .....	28
A.3	Output Power Test Result .....	35
A.4	Power Spectral Density Test Result.....	37
A.5	Conducted Band Edge and Out-of-Band Emissions Test Result.....	46
A.6	Radiated Spurious Emission Test Result.....	63
A.7	Radiated Restricted Band Edge Test Result.....	71
A.8	AC Conducted Emissions Test Result .....	119
<b>Appendix B – Test Setup Photograph .....</b>		<b>121</b>
<b>Appendix C – EUT Photograph .....</b>		<b>122</b>



#### 1.4. Product Information

Product Name	Industrial Cellular VPN Router
Model No.	R1510-4L
Sample No.	20230725Sample#02 (Conducted Testing) 20230725Sample#03 (Radiated & Line Conducted Testing)
Wi-Fi Specification	802.11b/g/n
GSM Operating Band(s)	GSM 850/900/1800/1900
WCDMA Operating Band(s)	WCDMA Band I / II / V / VIII
LTE Operating Band(s)	FDD Band 1/2/3/4/5/7/8/28 TDD Band 40
Antenna Information	Refer to Section 1.7
Power Type	AC/DC Adapter
Accessories	
AC/DC Adapter	Model: GQ24-120150-AX Input: 100-240V ~ 50/60Hz 1.0A Max Output: 12.0V = 1.5A 18.0W
Antennas	Wi-Fi Antenna Used: #1: Wi-Fi Rubber Antenna #2: Wi-Fi PCB Antenna WWAN Optional Antenna: #1: LTE Rubber Antenna #2: LTE Magnetic Antenna
<p>Note 1: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.</p> <p>Note 2: This device contains a certified WWAN module (FCC ID: XMR201805EC25AU), and only GSM 850/1900, WCDMA Band II/V and LTE Band 2/4/5/7 are used for US.</p>	

#### 1.5. Radio Specification under Test

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: up to 300Mbps

### 1.6. Working Frequencies

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	--	--	--	--

### 1.7. Antenna Details

Antenna Type	Frequency Band (MHz)	Tx Paths	Antenna Gain (dBi)	Directional Gain (dBi)	
				For Power	For PSD
Wi-Fi Antennas					
Antenna 0: Rubber Antenna Antenna 1: PCB Antenna	2400 ~ 2483.5	2	Antenna 0: 5.00 Antenna 1: 0.00	5.00	8.01

Note 1: The antenna gain is from antenna data sheet provided by the manufacturer.

Note 2: The EUT supports SISO mode for 802.11b/g and CDD mode for 802.11n.

Note 3: For CDD transmissions, Directional Gain is calculated as follows.

Directional Gain =  $G_{ANT\ Max}$  + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,  
Array Gain =  $10 \log (N_{ANT} / N_{SS})$  dB;
- For power measurements on IEEE 802.11 devices,  
Array Gain = 0 dB for  $N_{ANT} \leq 4$

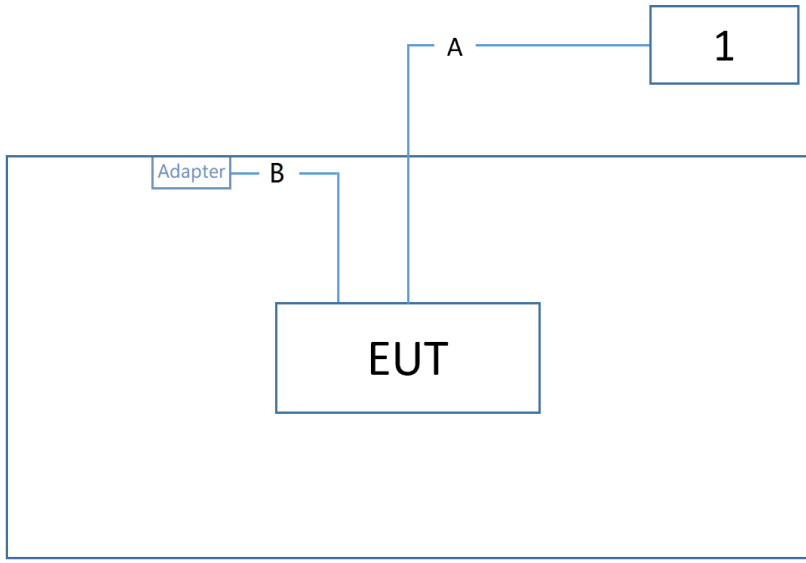
## 2. Test Configuration

### 2.1. Test Mode

Mode 1: Transmit by 802.11b (1Mbps) - SISO Mode
Mode 2: Transmit by 802.11g (6Mbps) - SISO Mode
Mode 3: Transmit by 802.11n-HT20 (MCS0) - MIMO Mode
Mode 4: Transmit by 802.11n-HT40 (MCS0) - MIMO Mode
Note 1: All modes of operation and data rates were investigated, so all RF test requirements shall be executed at the worse data rate which power is the greatest.
Note 2: This device can operate with one spatial stream (NSS = 1) or two spatial streams (NSS = 2) for CDD mode. The worst case directional gain will occur when NSS = 1; Therefore, the power settings for this device is obtained from the testing for the case of NSS = 1.

### 2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.

Connection Diagram – Radiated Emission testing & AC Conducted Emissions			
 <pre>                     graph TD                         EUT[EUT] --- Adapter[Adapter B]                         EUT --- LAN[LAN Cable A]                         LAN --- Device1[1]                     </pre>			
Cable Type		Cable Description	
A	LAN Cable	Non shielded, > 10m	
B	Power Cable	Non shielded, 1.2m	
Product		Manufacturer	Model No.
1	Notebook	Lenovo	E495



### 2.3. Test Software

The test utility software used during testing was “ART2-GUI”, and the version was 4.9.815.

### 2.4. Applied Standards

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

- FCC Part 15.247
- KDB 558074 D01v05r02
- KDB 662911 D01v02r01
- ANSI C63.10-2013

### 2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~ 75%RH

### 3. 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 PCB antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The unit complies with the requirement of §15.203.

#### 4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2023-12-28	SIP-AC1
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2023-11-07	SIP-AC1
Loop Antenna	Schwarzbeck	FMZB 1519 B	MRTSUE06937	1 year	2024-02-26	SIP-AC1
TRILOG Antenna	Schwarzbeck	VULB9168	MRTSUE06645	1 year	2024-07-13	SIP-AC1
Horn Antenna	Schwarzbeck	HF907	MRTSUE06610	1 year	2024-06-17	SIP-AC1
Preamplifier	EMCI	EMC051845SE	MRTSUE06600	1 year	2023-11-07	SIP-AC1
Thermal Hygrometer	testo	608-H1	MRTSUE06620	1 year	2023-11-27	SIP-AC1
Thermal Hygrometer	testo	608-H1	MRTSUE06616	1 year	2023-11-01	SIP-AC1
Anechoic Chamber	RIKEN	SIP-AC1	MRTSUE06554	1 year	2023-12-22	SIP-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE06613	1 year	2024-05-23	SIP-AC2
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2023-10-25	SIP-AC2
TRILOG Antenna	Schwarzbeck	VULB9168	MRTSUE06647	1 year	2024-06-17	SIP-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06648	1 year	2023-10-22	SIP-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06598	1 year	2023-11-05	SIP-AC2
Preamplifier	EMCI	EMC051845SE	MRTSUE06601	1 year	2023-11-22	SIP-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2023-10-10	SIP-AC2
Thermal Hygrometer	testo	608-H1	MRTSUE06623	1 year	2023-11-27	SIP-AC2
Thermal Hygrometer	testo	608-H1	MRTSUE06624	1 year	2023-11-27	SIP-AC2
Anechoic Chamber	RIKEN	SIP-AC2	MRTSUE06781	1 year	2023-12-22	SIP-AC2
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2024-07-31	SIP-TR1
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2024-05-23	SIP-TR1
Attenuator	MVE	MVE2213	MRTSUE11101	1 year	2024-06-08	SIP-TR1
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2023-11-01	SIP-TR1
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2024-05-23	SIP-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06612	1 year	2024-05-23	SIP-SR2
Thermohygrometer	testo	608-H1	MRTSUE06621	1 year	2023-11-27	SIP-SR2
Shielding Room	MIX-BEP	SIP-SR2	MRTSUE06949	5 years	2024-10-23	SIP-SR2

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable
BenchVue Power Meter	2021	Power

## 5. Decision Rules and Measurement Uncertainty

### 5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.2. 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  $k = 2$ .

<b>AC Conducted Emission Measurement</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
<b>Radiated Disturbance</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): Coaxial: 9kHz~30MHz: 2.59dB Coplanar: 9kHz~30MHz: 2.60dB Horizontal: 30MHz~200MHz: 3.85dB 200MHz~1GHz: 4.36dB 1GHz~40GHz: 4.98dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.91dB
<b>Spurious Emissions, Conducted</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
<b>Output Power</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.5dB
<b>Power Spectrum Density</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
<b>Occupied Bandwidth</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 3.2%

## 6. Test Result

### 6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.247(a)(2)	6dB Bandwidth	Conducted	Pass
15.247(b)(3)	Output Power		Pass
15.247(e)	Power Spectral Density		Pass
15.247(d)	Band Edge / Out-of-Band Emissions		Pass
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

#### Notes:

- 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.
- For radiated emission tests, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.

## 6.2. 6dB Bandwidth Measurement

### 6.2.1. Test Limit

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

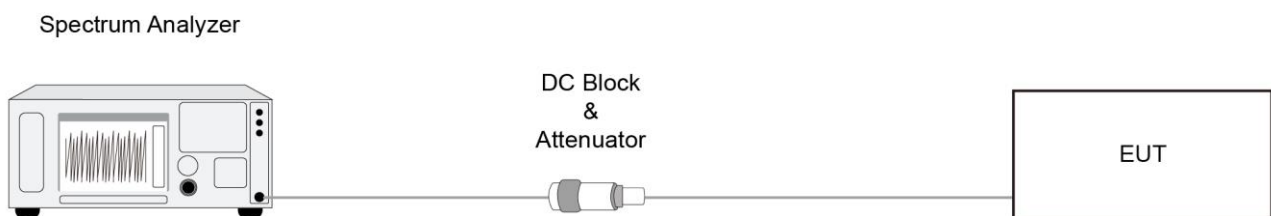
### 6.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

### 6.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to  $X = 6$ . The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3.  $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

### 6.2.4. Test Setup



### 6.2.5. Test Result

Refer to Appendix A.2.

### 6.3. Output Power Measurement

#### 6.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 6.3.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.1.3

ANSI C63.10 - 2013 - Section 11.9.2.3.2

#### 6.3.3. Test Setting

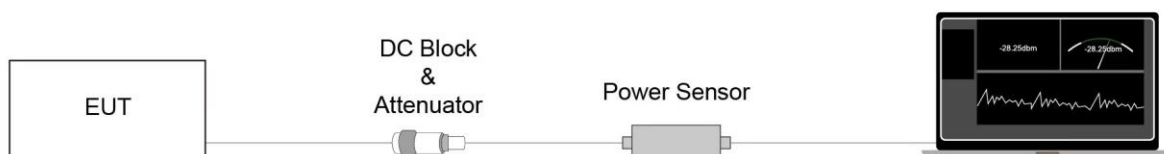
##### **Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)**

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

##### **Average Power Measurement**

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

#### 6.3.4. Test Setup



#### 6.3.5. Test Result

Refer to Appendix A.3.

## 6.4. Power Spectral Density Measurement

### 6.4.1. Test Limit

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

The same method of determining the conducted output power shall be used to determine the power spectral density.

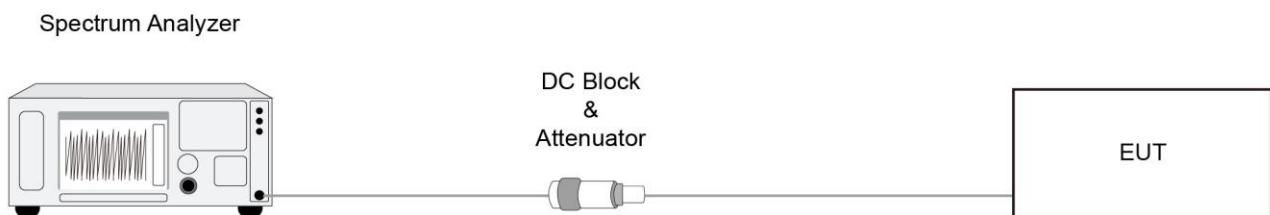
### 6.4.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.10.2

### 6.4.3. Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

### 6.4.4. Test Setup



### 6.4.5. Test Result

Refer to Appendix A.4.



## 6.5. Conducted Band Edge and Out-of-Band Emissions Measurement

### 6.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

### 6.5.2. Test Procedure

ANSI C63.10-2013 - Section 11.11

### 6.5.3. Test Setting

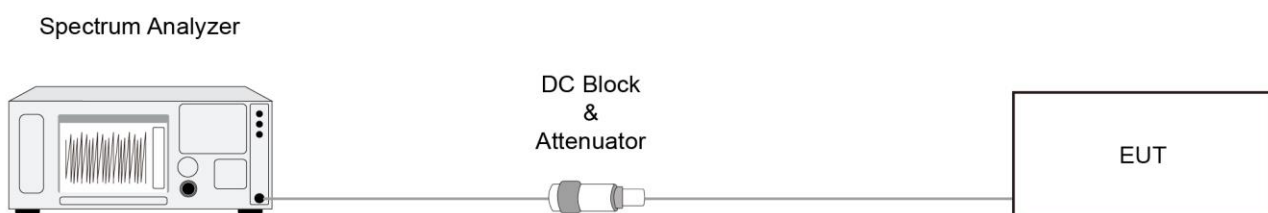
#### Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to  $\geq 1.5$  times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW  $\geq 3 \times$  RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

#### Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. Trace was allowed to stabilize

### 6.5.4. Test Setup



### **6.5.5. Test Result**

Refer to Appendix A.5.

## 6.6. Radiated Spurious Emission Measurement

### 6.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [ $\mu\text{V/m}$ ]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 6.6.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.11 & 11.12

ANSI C63.10 - 2013 - Section 6.3 (General Requirements)

ANSI C63.10 - 2013 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - 2013 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - 2013 - Section 6.6 (Standard test method above 1GHz)

### 6.6.3. Test Setting

**Table 1 - RBW as a function of frequency**

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000MHz	1MHz

**Quasi-Peak Measurements below 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

**Peak Measurements above 1GHz**

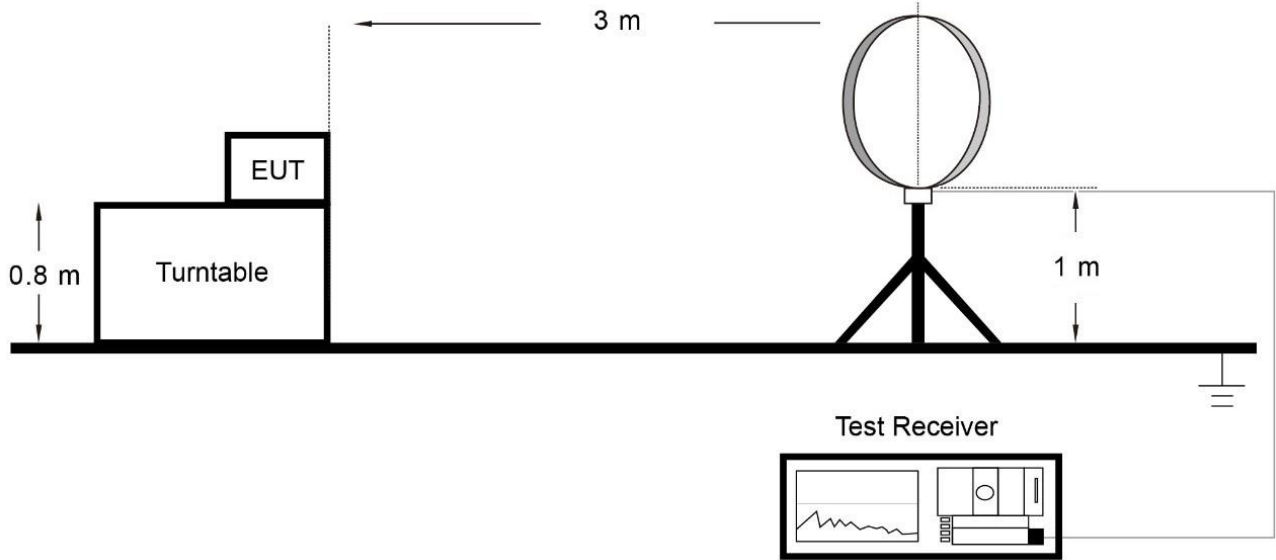
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**Average Measurements above 1GHz (Method VB)**

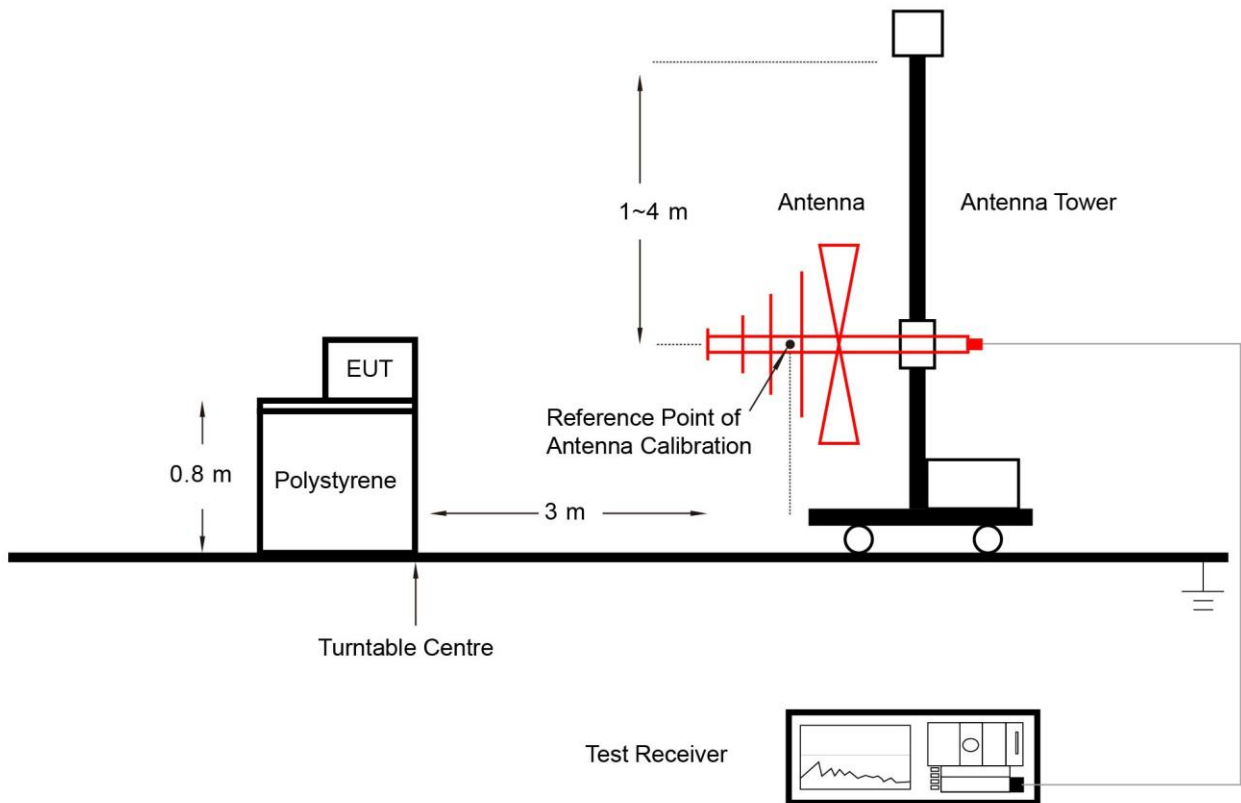
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.  
If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

### 6.6.4. Test Setup

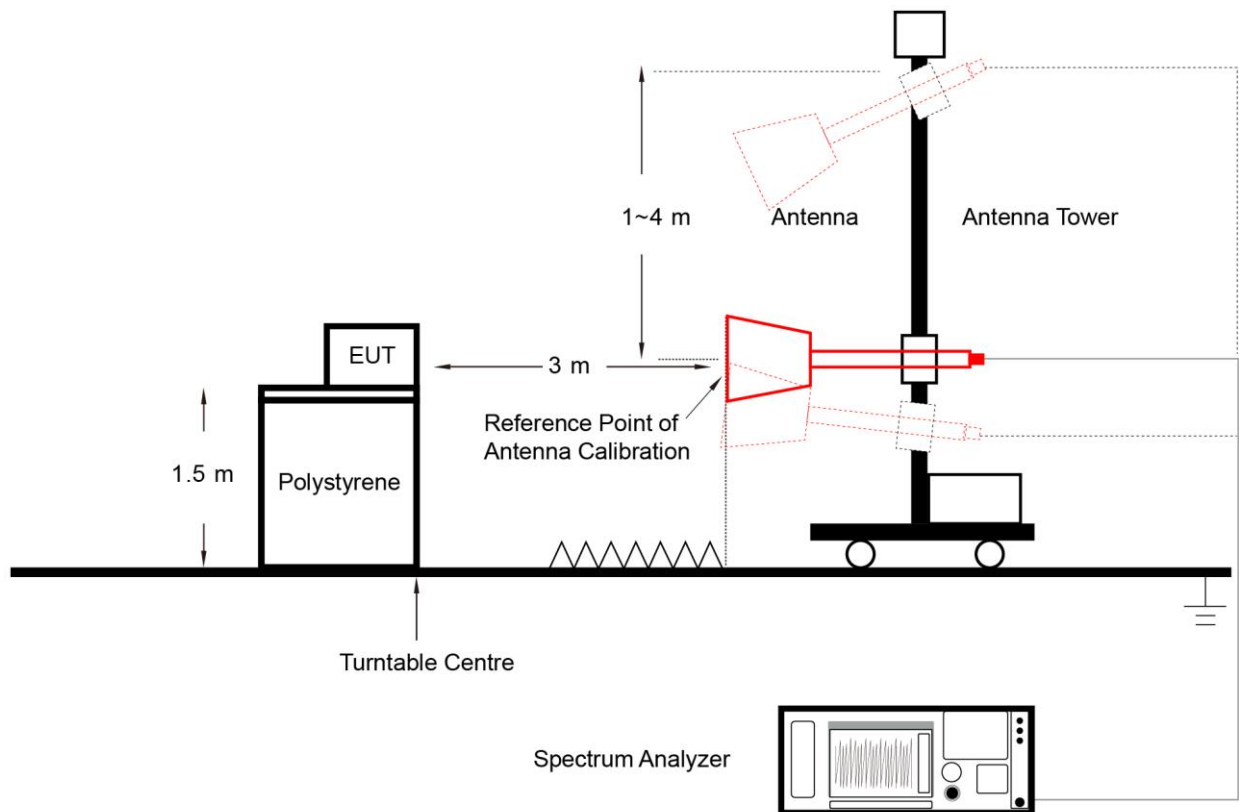
Below 30MHz Test Setup:



Below 1GHz Test Setup:



### Above 1GHz Test Setup:



### 6.6.5. Test Result

Refer to Appendix A.6.

## 6.7. Radiated Restricted Band Edge Measurement

### 6.7.1. Test Limit

#### For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [ $\mu\text{V/m}$ ]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 6.7.2. Test Procedure

ANSI C63.10-2013 Section 6.3 & 6.6 & 11.13

### 6.7.3. Test Setting

#### Peak Field Strength Measurements

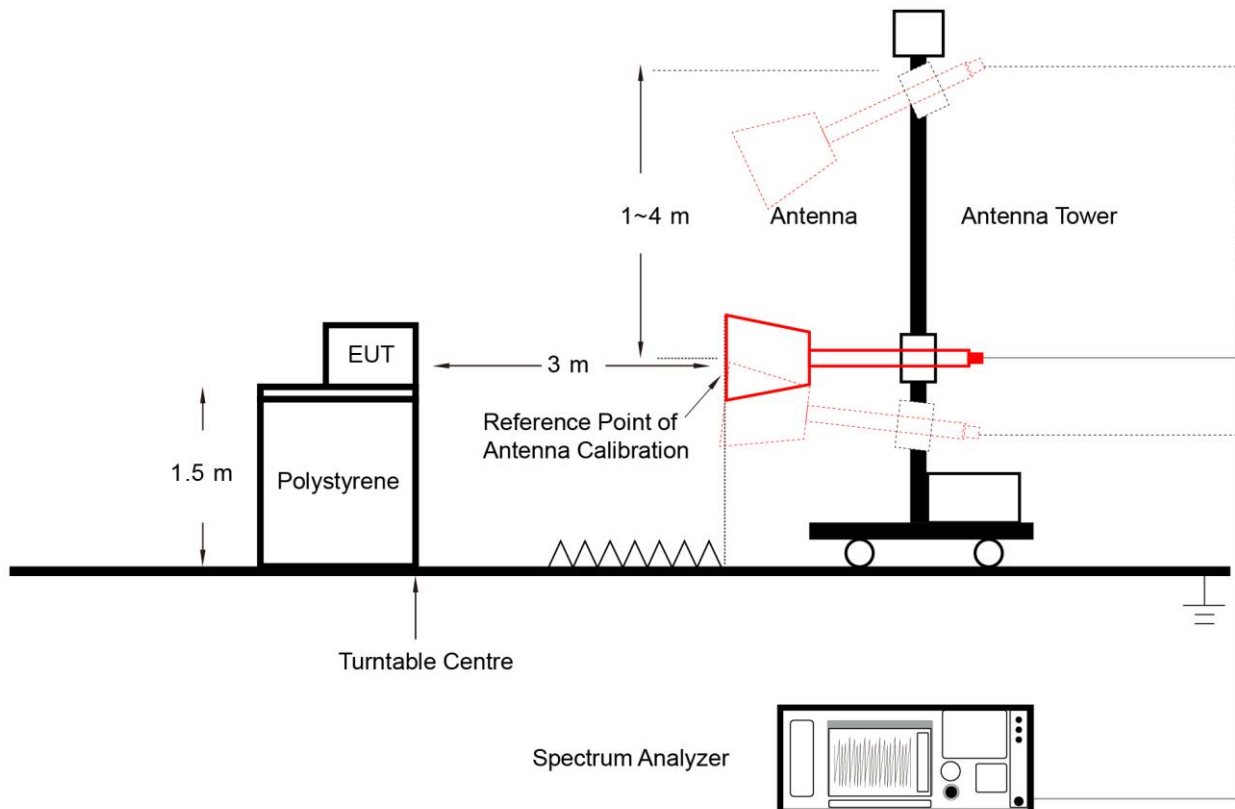
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize



### Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW  $\geq 1/T$
4. Average Type = Voltage
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

#### 6.7.4. Test Setup



#### 6.7.5. Test Result

Refer to Appendix A.7.

## 6.8. AC Conducted Emissions Measurement

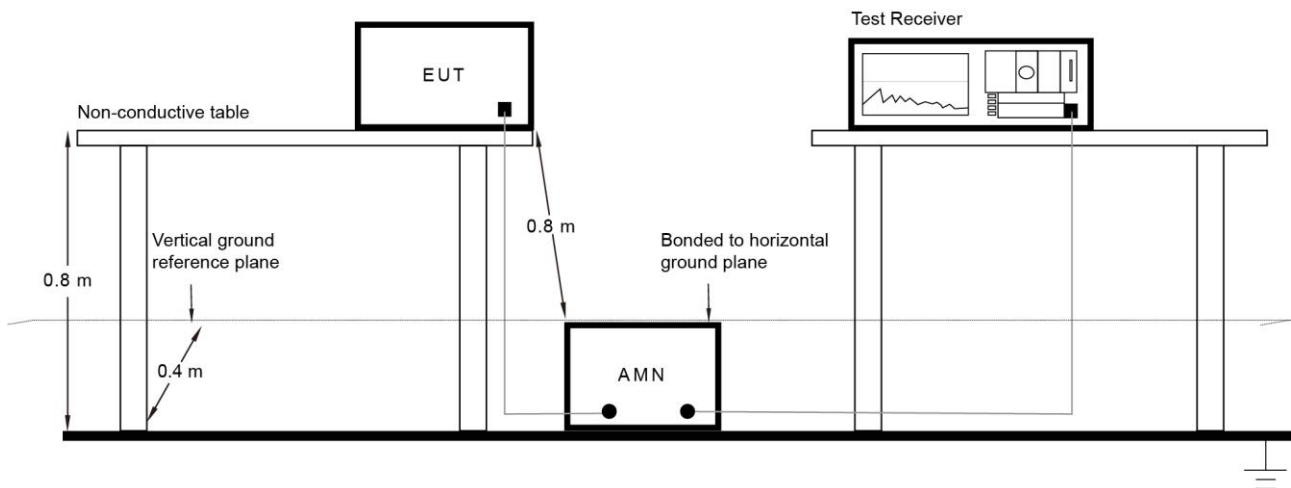
### 6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dB $\mu$ V)	AV (dB $\mu$ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 6.8.2. Test Setup



### 6.8.3. Test Result

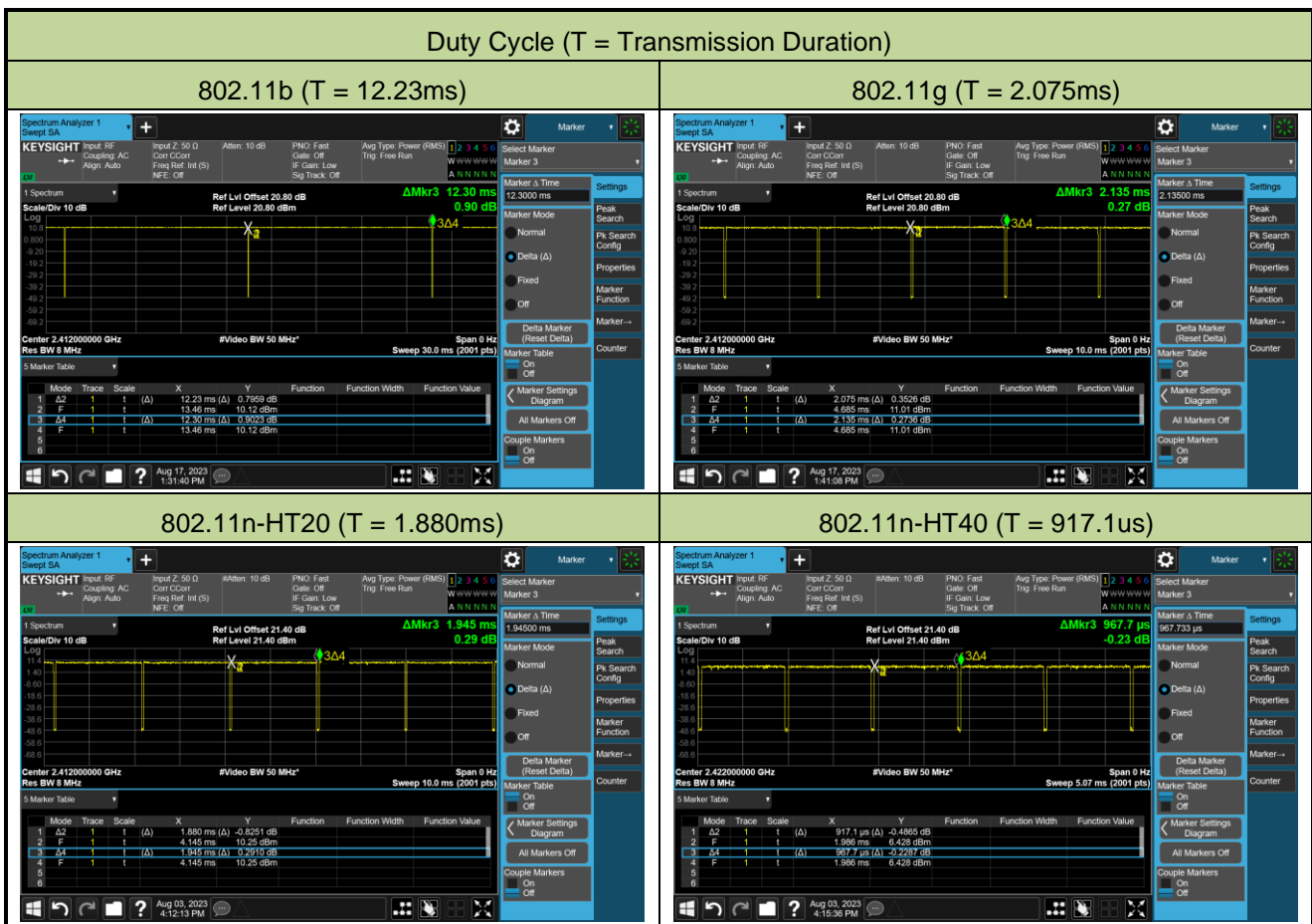
Refer to Appendix A.8.

## Appendix A – Test Result

### A.1 Duty Cycle Test Result

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-03 ~ 2023-08-17		

Test Mode	Duty Cycle
802.11b	99.43%
802.11g	97.19%
802.11n-HT20	96.66%
802.11n-HT40	94.77%



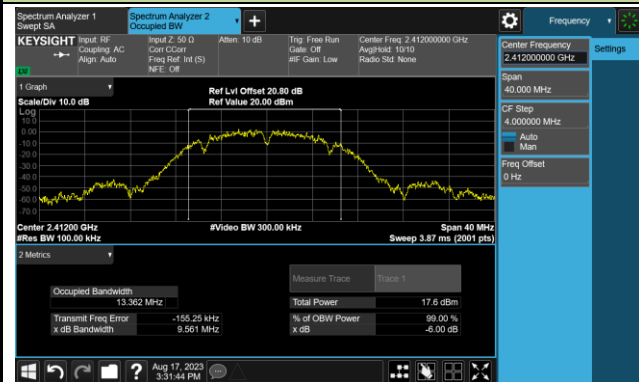
**A.2 6dB Bandwidth Test Result**

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-17		

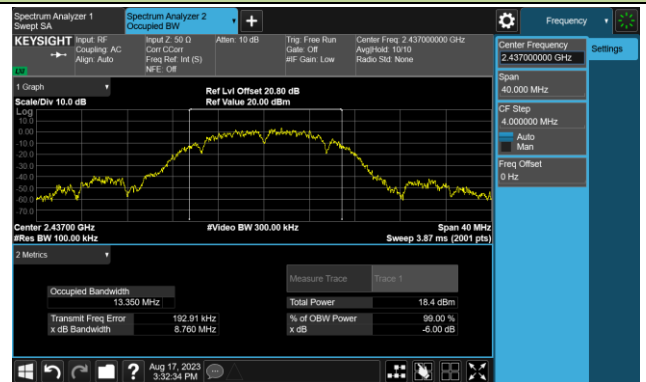
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
<b>SISO Mode Ant 0</b>					
11b	1Mbps	01	2412	9.561	≥ 0.5
11b	1Mbps	06	2437	8.760	≥ 0.5
11b	1Mbps	11	2462	9.966	≥ 0.5
11g	6Mbps	01	2412	14.44	≥ 0.5
11g	6Mbps	06	2437	13.85	≥ 0.5
11g	6Mbps	11	2462	12.90	≥ 0.5
<b>SISO Mode Ant 1</b>					
11b	1Mbps	01	2412	9.568	≥ 0.5
11b	1Mbps	06	2437	9.085	≥ 0.5
11b	1Mbps	11	2462	9.093	≥ 0.5
11g	6Mbps	01	2412	15.93	≥ 0.5
11g	6Mbps	06	2437	15.56	≥ 0.5
11g	6Mbps	11	2462	15.49	≥ 0.5
<b>MIMO Mode Ant 0</b>					
11n-HT20	MCS0	01	2412	11.94	≥ 0.5
11n-HT20	MCS0	06	2437	14.67	≥ 0.5
11n-HT20	MCS0	11	2462	15.89	≥ 0.5
11n-HT40	MCS0	03	2422	36.30	≥ 0.5
11n-HT40	MCS0	06	2437	30.04	≥ 0.5
11n-HT40	MCS0	09	2452	32.83	≥ 0.5

802.11b 6dB Bandwidth - SISO Mode Ant 0

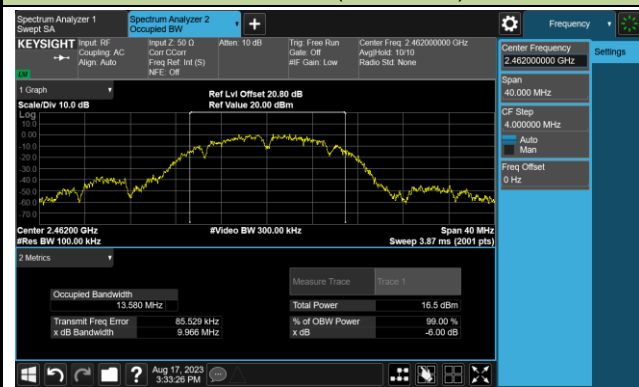
Channel 01 (2412MHz)



Channel 06 (2437MHz)

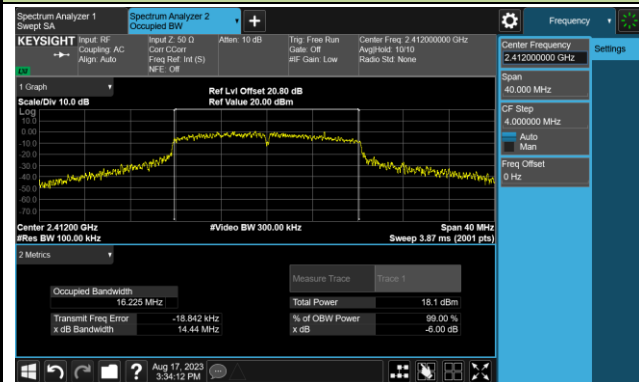


Channel 11 (2462MHz)

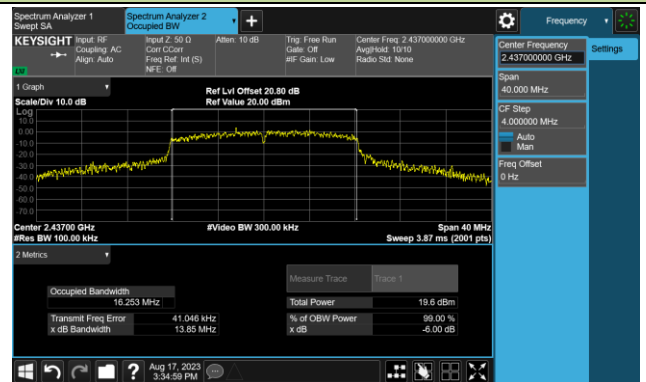


802.11g 6dB Bandwidth - SISO Mode Ant 0

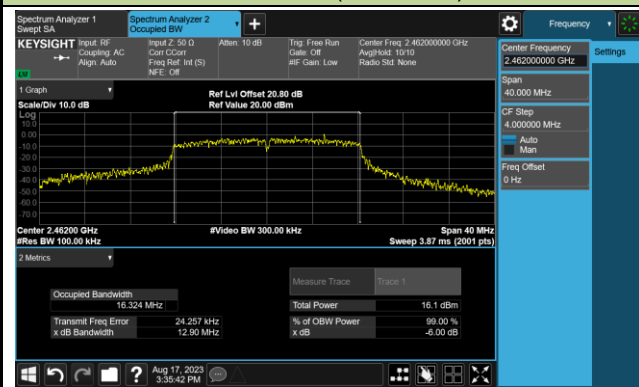
Channel 01 (2412MHz)



Channel 06 (2437MHz)

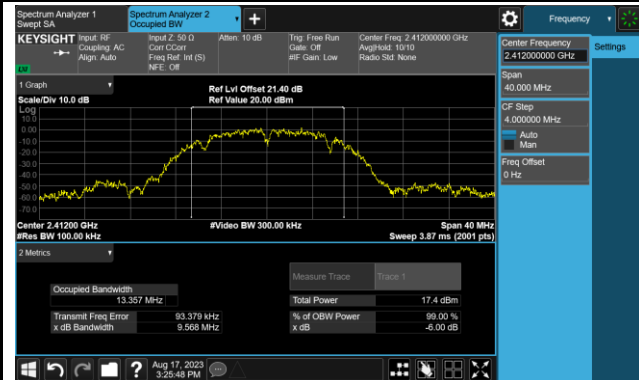


Channel 11 (2462MHz)

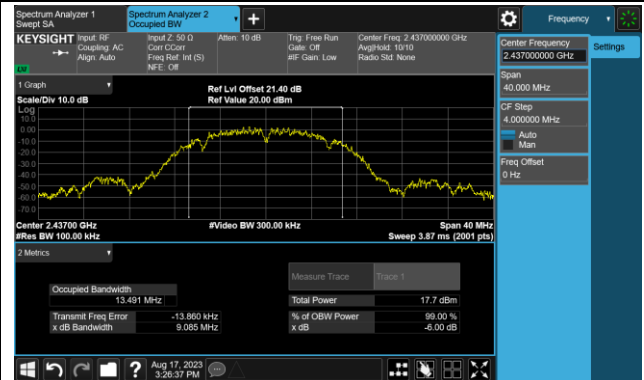


802.11b 6dB Bandwidth - SISO Mode Ant 1

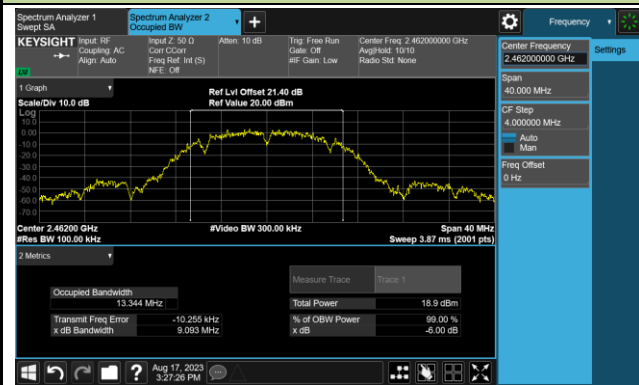
Channel 01 (2412MHz)



Channel 06 (2437MHz)

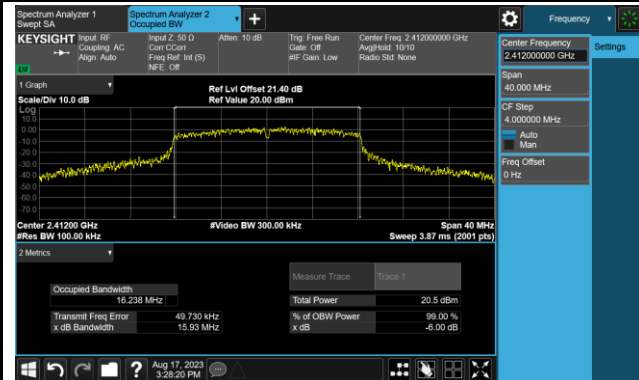


Channel 11 (2462MHz)

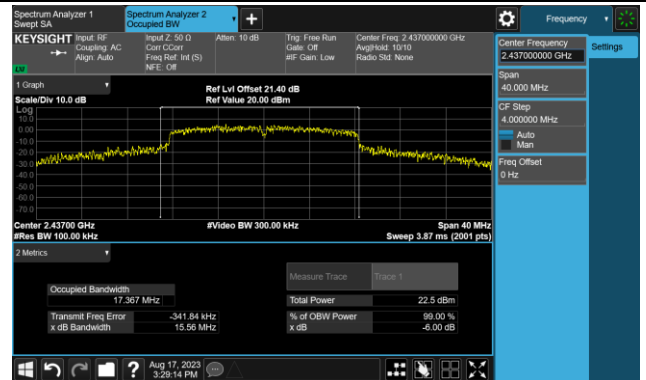


802.11g 6dB Bandwidth - SISO Mode Ant 1

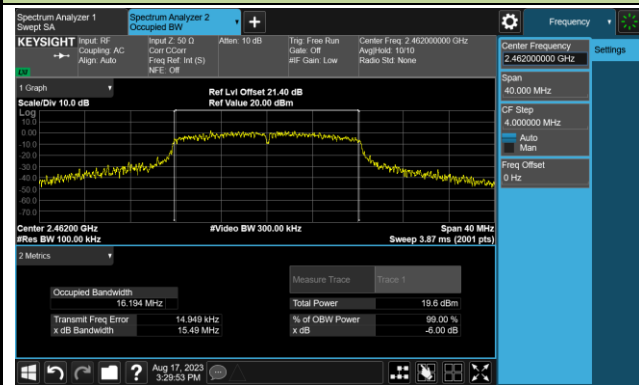
Channel 01 (2412MHz)



Channel 06 (2437MHz)



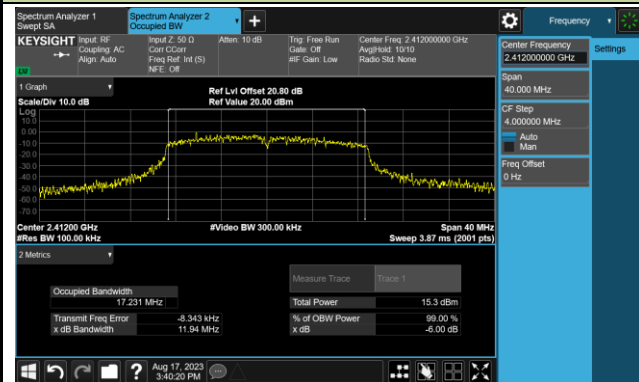
Channel 11 (2462MHz)



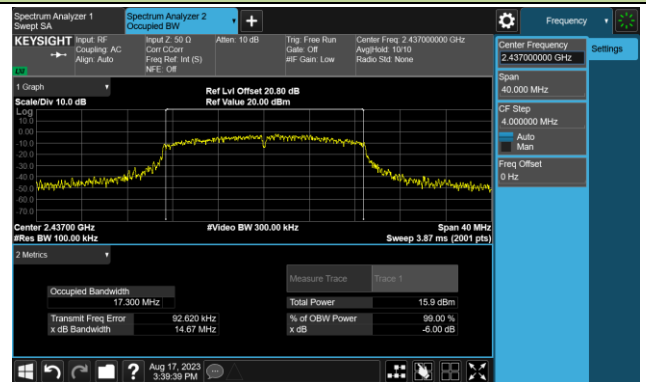


802.11n-HT20 6dB Bandwidth - MIMO Mode Ant 0

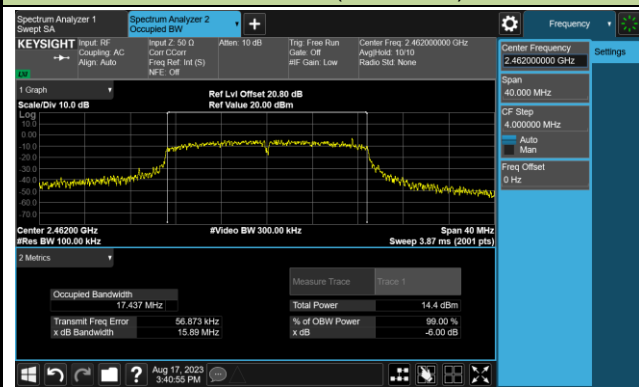
Channel 01 (2412MHz)



Channel 06 (2437MHz)

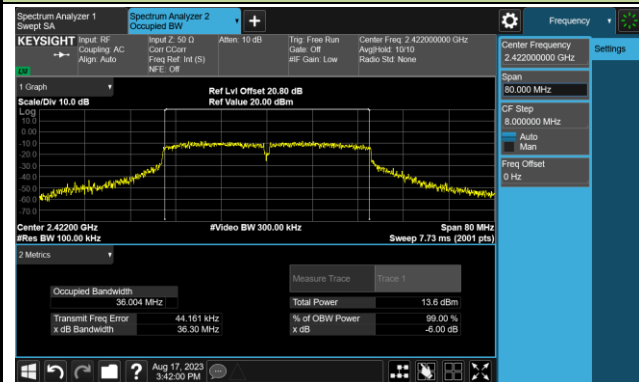


Channel 11 (2462MHz)

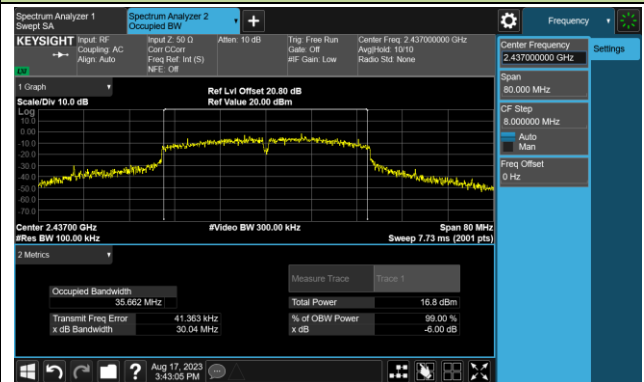


802.11n-HT40 6dB Bandwidth - MIMO Mode Ant 0

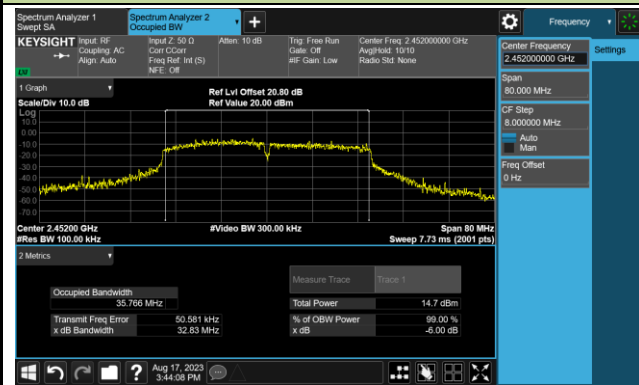
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



**A.3 Output Power Test Result**

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-02 ~ 2023-08-16	Test Mode	SISO Mode

**Test Result of Peak Output Power**

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Peak Power (dBm)		Limit (dBm)
				Ant 0	Ant 1	
11b	1Mbps	01	2412	14.25	14.92	≤ 30.00
11b	1Mbps	06	2437	15.98	14.76	≤ 30.00
11b	1Mbps	11	2462	13.55	16.01	≤ 30.00
11g	6Mbps	01	2412	18.46	21.11	≤ 30.00
11g	6Mbps	06	2437	20.17	20.89	≤ 30.00
11g	6Mbps	11	2462	17.26	20.61	≤ 30.00

**Test Result of Average Output Power (Reporting Only)**

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Limit (dBm)
				Ant 0	Ant 1	
11b	1Mbps	01	2412	11.96	12.39	≤ 30.00
11b	1Mbps	06	2437	13.53	12.47	≤ 30.00
11b	1Mbps	11	2462	11.17	13.63	≤ 30.00
11g	6Mbps	01	2412	13.38	15.89	≤ 30.00
11g	6Mbps	06	2437	14.57	17.68	≤ 30.00
11g	6Mbps	11	2462	11.66	14.95	≤ 30.00

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-02 ~ 2023-08-16	Test Mode	MIMO Mode

**Test Result of Peak Output Power**

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Peak Power (dBm)		Total Peak Power (dBm)	Limit (dBm)
				Ant 0	Ant 1		
11n-HT20	MCS0	01	2412	16.61	18.27	20.53	≤ 30.00
11n-HT20	MCS0	06	2437	17.91	16.97	20.48	≤ 30.00
11n-HT20	MCS0	11	2462	16.79	18.24	20.59	≤ 30.00
11n-HT40	MCS0	03	2422	14.98	15.19	18.10	≤ 30.00
11n-HT40	MCS0	06	2437	16.94	17.02	19.99	≤ 30.00
11n-HT40	MCS0	09	2452	14.46	14.85	17.67	≤ 30.00

Note: Total Peak Power(dBm) =  $10 \cdot \log(10^{\text{Ant 0 Peak Power}/10} + 10^{\text{Ant 1 Peak Power}/10})$ .

**Test Result of Average Output Power (Reporting Only)**

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Average Power (dBm)	Limit (dBm)
				Ant 0	Ant 1		
11n-HT20	MCS0	01	2412	11.11	11.83	14.50	≤ 30.00
11n-HT20	MCS0	06	2437	11.67	10.65	14.20	≤ 30.00
11n-HT20	MCS0	11	2462	10.08	11.74	14.00	≤ 30.00
11n-HT40	MCS0	03	2422	9.45	10.02	12.75	≤ 30.00
11n-HT40	MCS0	06	2437	11.48	11.37	14.44	≤ 30.00
11n-HT40	MCS0	09	2452	9.33	9.36	12.36	≤ 30.00

Note: Total Average Power(dBm) =  $10 \cdot \log(10^{\text{Ant 0 Average Power}/10} + 10^{\text{Ant 1 Average Power}/10})$ .

**A.4 Power Spectral Density Test Result**

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-16	Test Mode	SISO Mode

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Peak PSD (dBm/3kHz)		Limit (dBm/3kHz)	Result
				Ant 0	Ant 1		
11b	1Mbps	01	2412	-10.39	-10.23	≤ 8.00	Pass
11b	1Mbps	06	2437	-8.95	-10.08	≤ 8.00	Pass
11b	1Mbps	11	2462	-10.54	-8.85	≤ 8.00	Pass
11g	6Mbps	01	2412	-9.91	-7.46	≤ 8.00	Pass
11g	6Mbps	06	2437	-8.91	-6.42	≤ 8.00	Pass
11g	6Mbps	11	2462	-12.23	-7.18	≤ 8.00	Pass

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-16	Test Mode	MIMO Mode

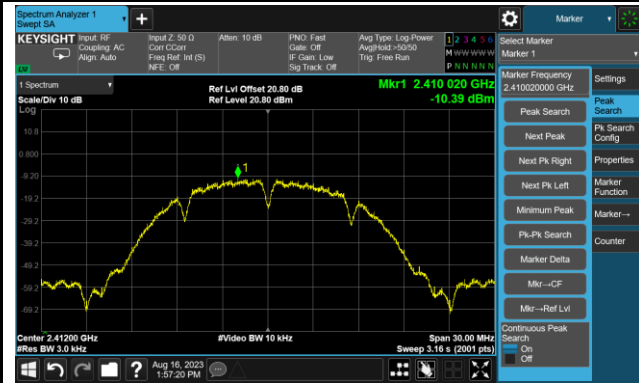
Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Peak PSD (dBm/3kHz)		Total Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
				Ant 0	Ant 1			
11n-HT20	MCS0	01	2412	-12.58	-11.67	-9.09	≤ 5.99	Pass
11n-HT20	MCS0	06	2437	-11.53	-13.13	-9.25	≤ 5.99	Pass
11n-HT20	MCS0	11	2462	-13.36	-11.25	-9.17	≤ 5.99	Pass
11n-HT40	MCS0	03	2422	-16.79	-14.63	-12.57	≤ 5.99	Pass
11n-HT40	MCS0	06	2437	-14.22	-14.75	-11.47	≤ 5.99	Pass
11n-HT40	MCS0	09	2452	-15.93	-15.93	-12.92	≤ 5.99	Pass

Note 1: Total Peak PSD (dBm/3kHz) =  $10 \cdot \log(10^{\text{Ant 0 Peak PSD}/10} + 10^{\text{Ant 1 Peak PSD}/10})$ .

Note 2: Limit (dBm/3kHz) = 8 (dBm/3kHz) - (Directional Gain For PSD (dBi) - 6 (dBi))

802.11b - Peak PSD - SISO Mode Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)

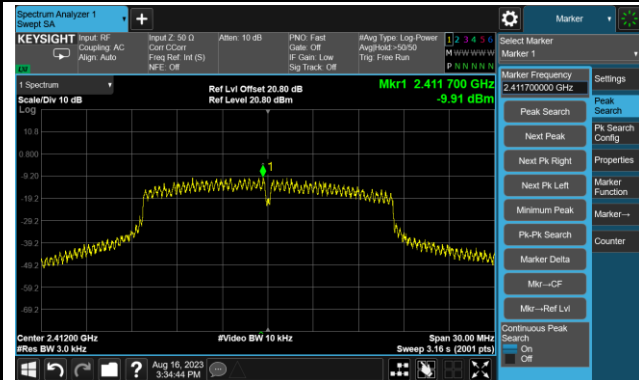


Channel 11 (2462MHz)

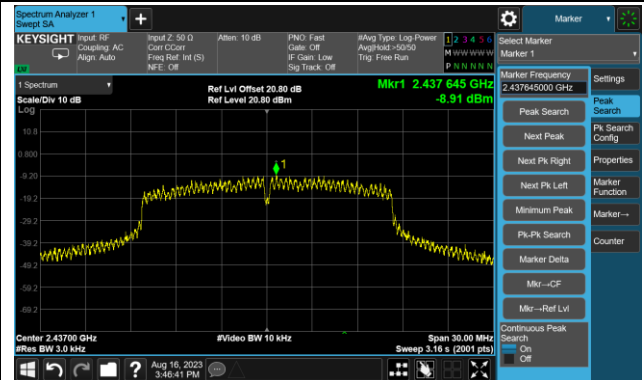


802.11g - Peak PSD - SISO Mode Ant 0

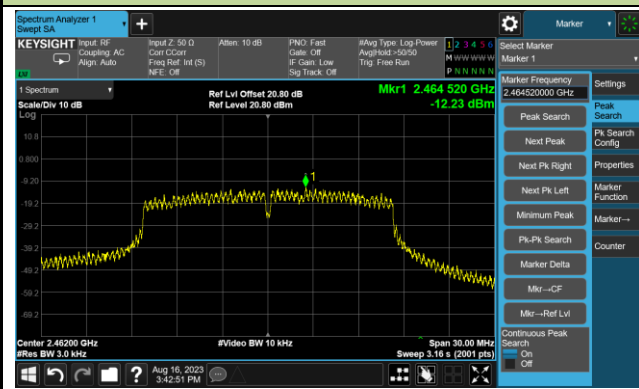
Channel 01 (2412MHz)



Channel 06 (2437MHz)

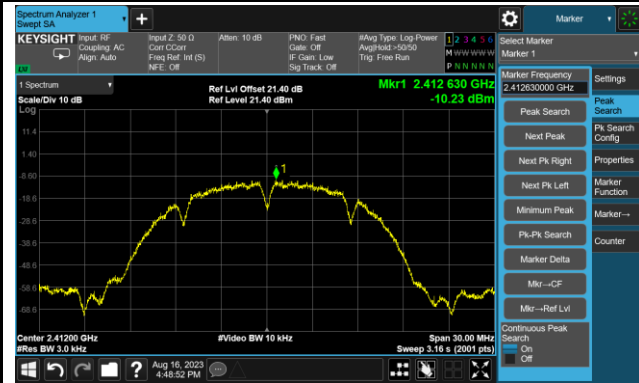


Channel 11 (2462MHz)



802.11b - Peak PSD - SISO Mode Ant 1

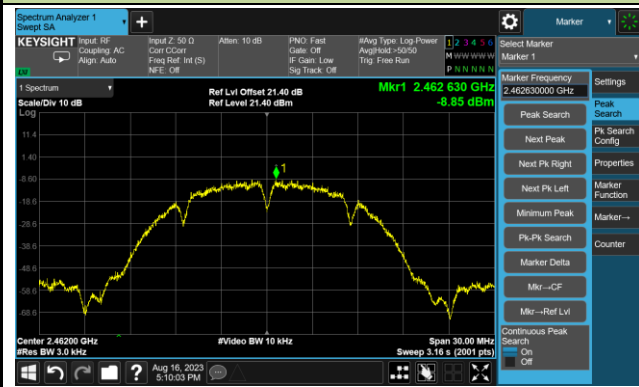
Channel 01 (2412MHz)



Channel 06 (2437MHz)



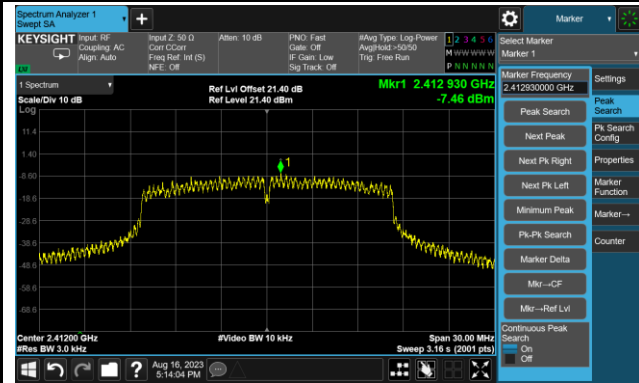
Channel 11 (2462MHz)



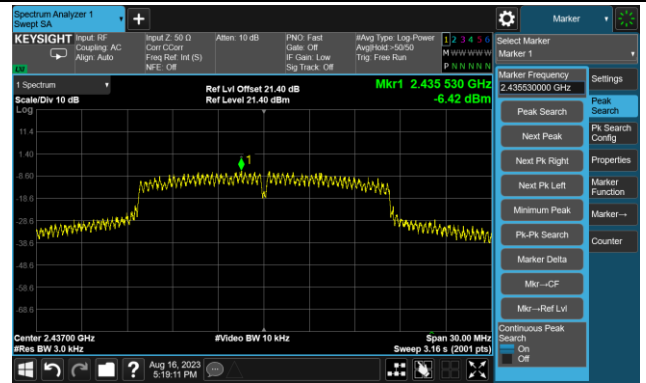


802.11g - Peak PSD - SISO Mode Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)

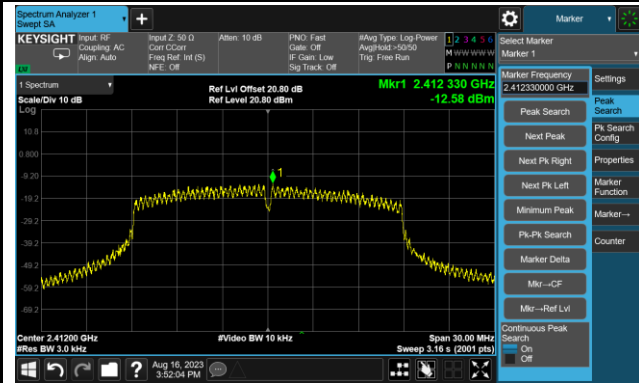


Channel 11 (2462MHz)

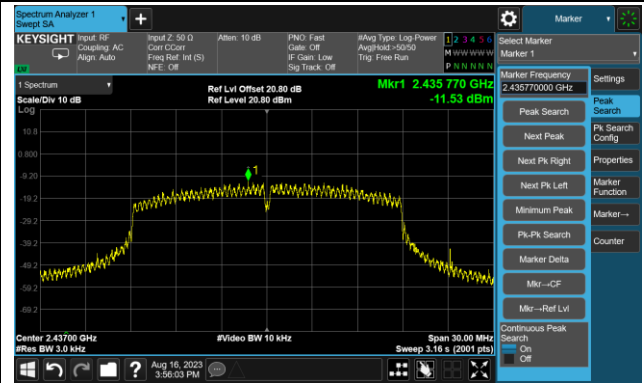


802.11n-HT20 - Peak PSD - MIMO Mode Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)

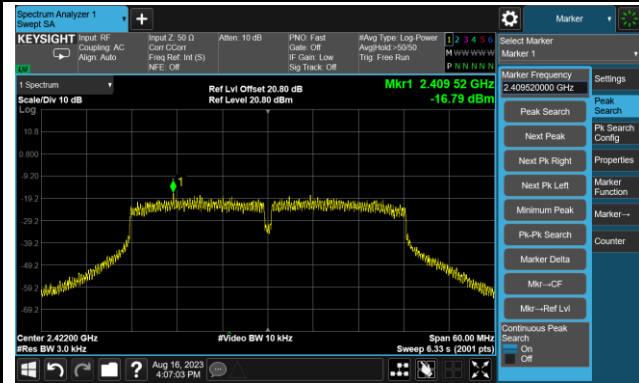


Channel 11 (2462MHz)

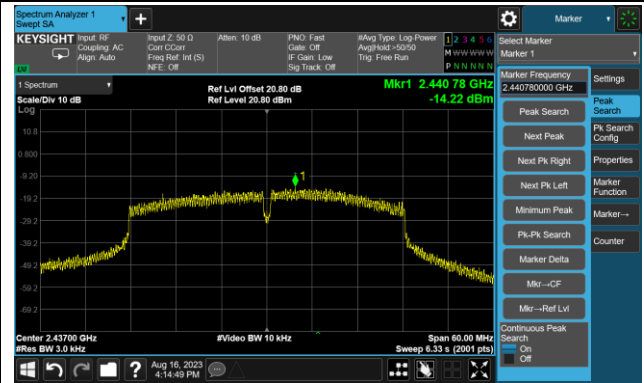


802.11n-HT40 - Peak PSD - MIMO Mode Ant 0

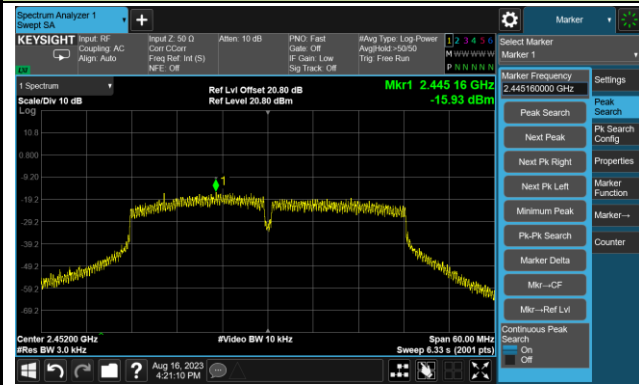
Channel 03 (2422MHz)



Channel 06 (2437MHz)

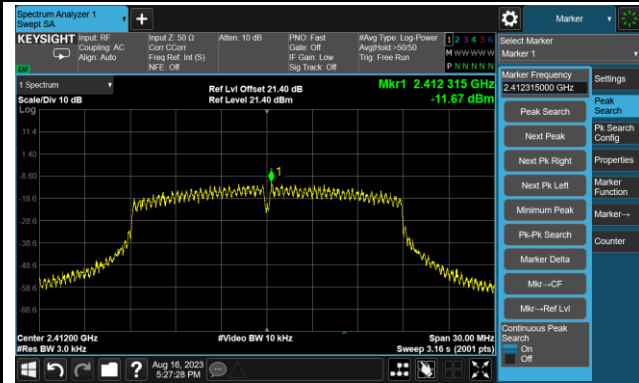


Channel 09 (2452MHz)

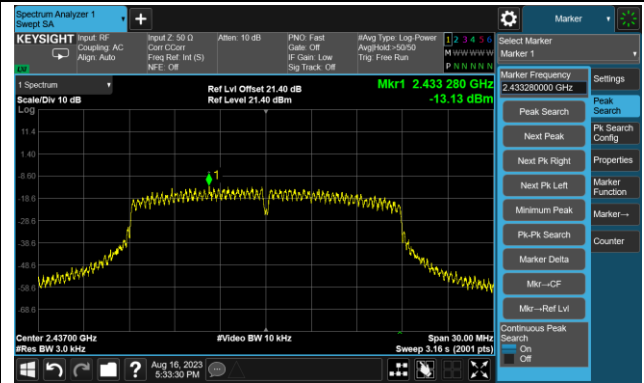


802.11n-HT20 - Peak PSD - MIMO Mode Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)

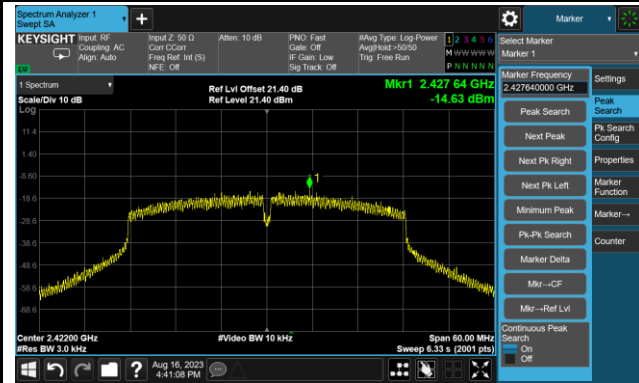


Channel 11 (2462MHz)

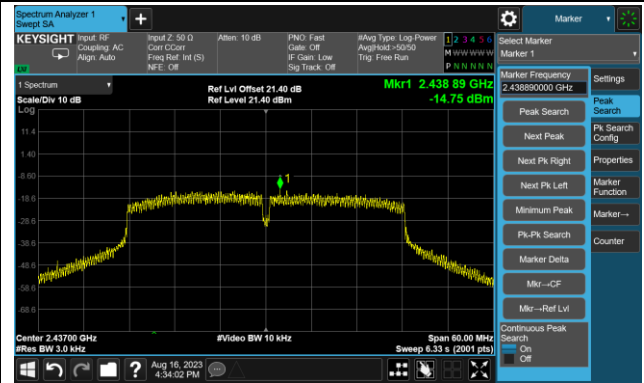


802.11n-HT40 - Peak PSD - MIMO Mode Ant 1

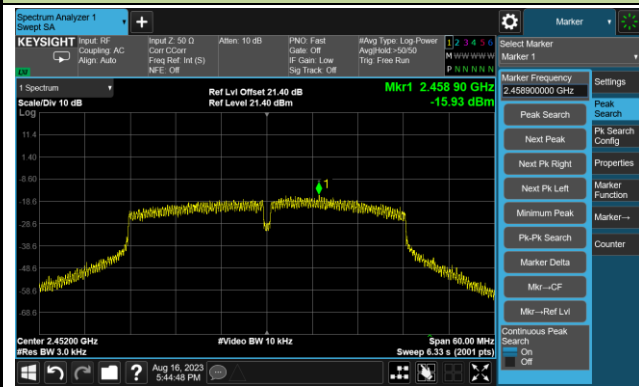
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



**A.5 Conducted Band Edge and Out-of-Band Emissions Test Result**

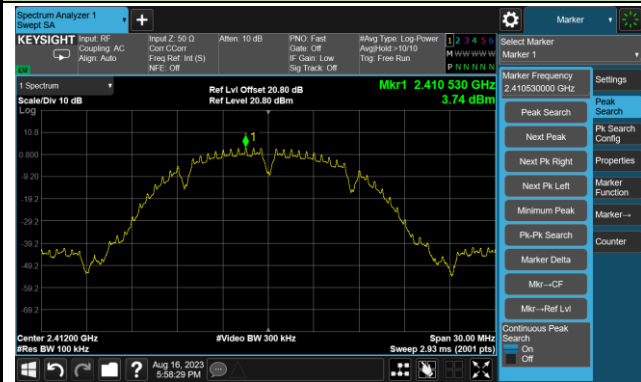
Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2023-08-16~2023-08-17		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit
<b>SISO Mode</b>				
11b	1Mbps	01	2412	20dBc
11b	1Mbps	06	2437	20dBc
11b	1Mbps	11	2462	20dBc
11g	6Mbps	01	2412	20dBc
11g	6Mbps	06	2437	20dBc
11g	6Mbps	11	2462	20dBc
<b>MIMO Mode</b>				
11n-HT20	MCS0	01	2412	20dBc
11n-HT20	MCS0	06	2437	20dBc
11n-HT20	MCS0	11	2462	20dBc
11n-HT40	MCS0	03	2422	20dBc
11n-HT40	MCS0	06	2437	20dBc
11n-HT40	MCS0	09	2452	20dBc

### 802.11b Out-of-Band Emissions - SISO Mode Ant 0

#### Channel 01 (2412MHz)

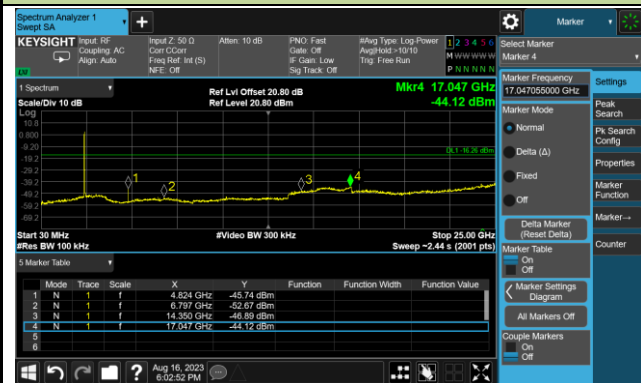
##### 100kHz PSD Reference Level



##### Low Band Edge



##### Spurious Emission

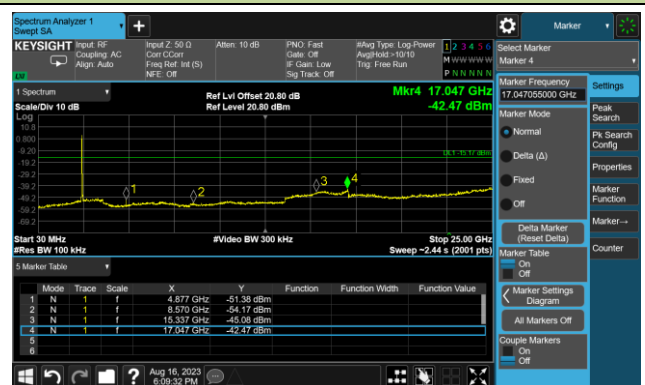


#### Channel 06 (2437MHz)

##### 100kHz PSD Reference Level



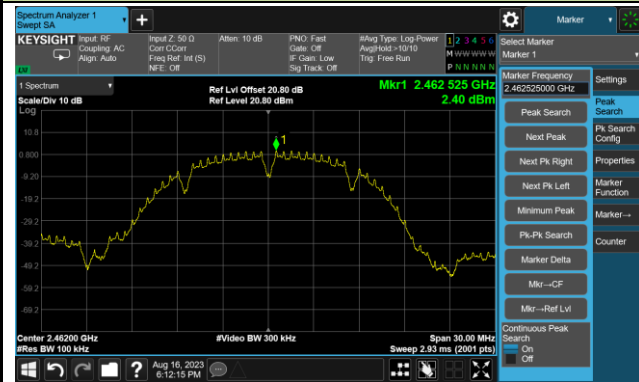
##### Spurious Emission



802.11b Out-of-Band Emissions - SISO Mode Ant 0

Channel 11 (2462MHz)

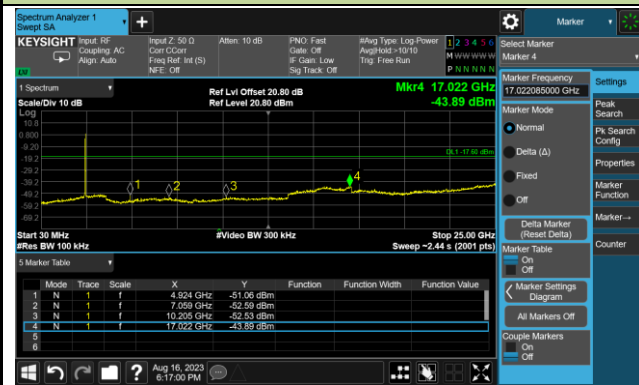
100kHz PSD Reference Level



High Band Edge



Spurious Emission

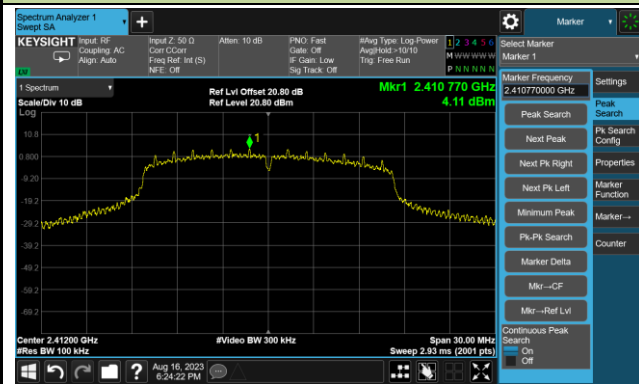




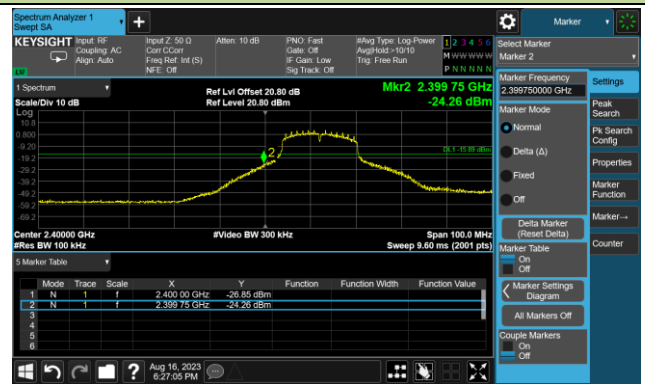
### 802.11g Out-of-Band Emissions - SISO Mode Ant 0

#### Channel 01 (2412MHz)

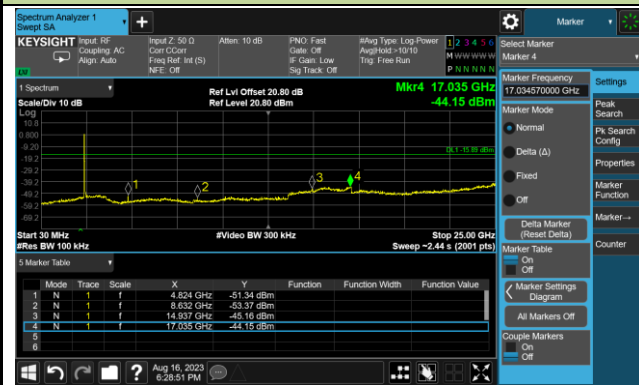
##### 100kHz PSD Reference Level



##### Low Band Edge

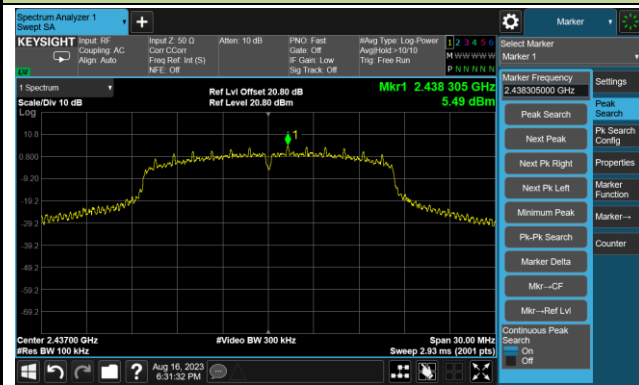


##### Spurious Emission



#### Channel 06 (2437MHz)

##### 100kHz PSD Reference Level



##### Spurious Emission

