

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT

OF

**Applicant:** Cal-Comp Big Data, Inc.  
No. 147, Sec. 3, Beishen Rd., Shenkeng Dist., New Taipei City 222,  
Taiwan (R.O.C.)

**Product Name:** HiMirror

**Brand Name:** HiMirror

**Model No.:** BM619, BM609

**Model Difference:** Light Bar & Cover Glass

**FCC ID:** 2AJTF-BM619

**Report Number:** E2/2017/80111

**FCC Rule Part:** §15.407, Cat: NII

**Issue Date:** Oct. 17, 2017

**Date of Test:** Aug. 21, 2017 ~ Oct. 12, 2017

**Date of EUT Received:** Aug. 21, 2017

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

**Prepared By:**                     Karen Huang                      
Karen Huang / Clerk

**Approved By:**                     Jim Chang                      
Jim Chang / Asst. Manager



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## Revision History

Report Number	Revision	Description	Issue Date
E2/2017/80111	Rev.00	Initial creation of document	Oct. 17, 2017

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## 1 GENERAL INFORMATION

### 1.1 Product Description

#### General:

Product Name:	HiMirror	
Brand Name:	HiMirror	
Model No.:	BM619, BM609	
Model Difference:	Light Bar & Cover Glass	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	12Vdc from AC/DC adapter	
	Adapter:	Model No.: WA-36A12FU, Supplier: Asian Power Devices Inc.

#### WLAN 5GHz:

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (Avg.) (dBm)	Modulation Technology
a	5150~5250	4	13.95	OFDM
n_HT 20M	5150~5250	4	HT: 12.96	OFDM
n_HT 40M	5150~5250	2	HT: 11.94	OFDM
Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only			
Transition Rate:	802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 72.2Mbps 802.11 n_40MHz: 13.5 - 150.0Mbps			

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PCB / Main	Walsin Technology Corporation	RFPCA371025IMLB901	5150~5250	4.50
PCB / Aux		RFPCA371035IMLB901	5150~5250	4.13

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## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules

FCC KDB 662911 D01 Multiple Transmitter Output

FCC KDB 644545 D03 Guidance for IEEE 802.11ac

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,  
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Number and Designation number are: 735305 / TW0002

## 1.4 Special Accessories

There are no special accessories used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

### 2.4 Measurement Results Explanation Example

#### For all conducted test items:

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

#### Note:

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

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## 2.5 Configuration of Tested System

Fig. 2-1 Conducted (Antenna Port) Emission Configuration

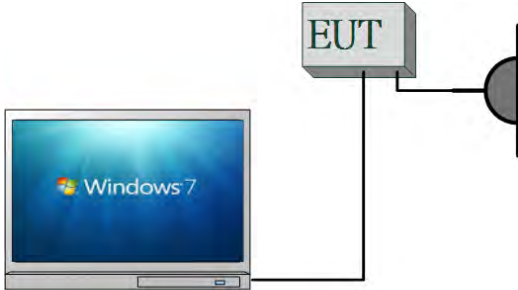


Fig 2-3 Conduction (AC Power Line) Radiated Emission

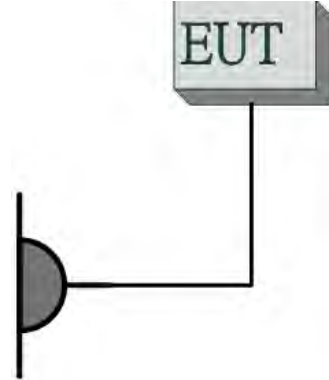


Fig 2-2 Radiated Emission

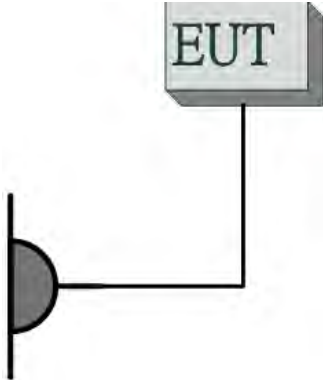


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L430	R9-YYG88	Shielded	Unshielded

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### 3 SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(b)	Undesirable Radiated Emissions	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.203 §15.407(a)	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
Channel	Frequency
36	5180
40	5200
44	5220
48	5240

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
38	5190
46	5230

### 4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

### RADIATED EMISSION TEST:

MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
<b>RADIATED EMISSION TEST (BELOW 1 GHz)</b>						
802.11a	5180~5240	36 to 48	44	OFDM	6	Main
<b>RADIATED EMISSION TEST (ABOVE 1 GHz)</b>						
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	Main
802.11n_HT20				OFDM	MCS0	SISO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	SISO

**Note:** The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11a/n WLAN Transmitter for channel Low, Mid and High, the worst case H position was reported

### ANTENNA PORT CONDUCTED MEASUREMENT:

<b>CONDUCTED TEST</b>						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	Main
802.11n_HT20				OFDM	MCS0	SISO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	SISO

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
26dB & 6dB Emission Bandwidth	+/- 123.36 Hz
The Maximum Output Power Measurement	+/- 0.96 dB
Peak Power Spectral Density Measurement	+/- 1.67 dB
Frequency Stability	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

### Radiated Spurious Emission:

Measurement uncertainty (Polarization : <b>Vertical</b> )	9kHz-30MHz: +/-2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	9kHz-30MHz: +/-2.87dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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## 6 CONDUCTED EMISSION TEST

### 6.1. Standard Applicable

Frequency range within 150 kHz to 30 MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 6.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-1 50cm	N/A	08/30/2017	08/29/2018
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2017	06/17/2018
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

### 6.3. EUT Setup

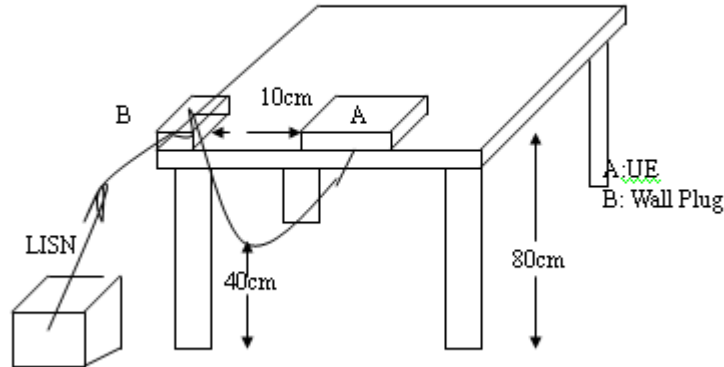
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz power source.

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## 6.4. Test SET-UP



## 6.5. Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed.

## 6.6. Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closet to the limit

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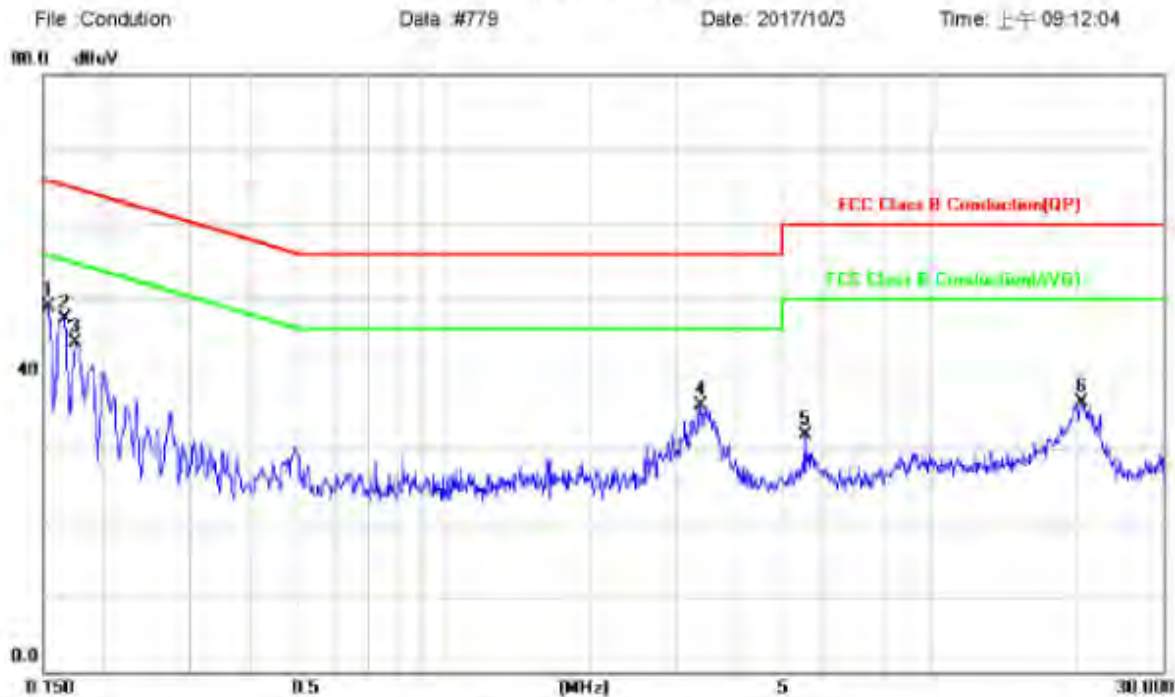
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## AC POWER LINE CONDUCTED EMISSION TEST DATA

Site : Conduction Room	Phase: <b>L1</b>	Temperature: 23 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 72 %
Mode:		
Note:		

### Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1540	29.34	19.65	48.99	65.78	-16.79	peak	
2		0.1660	27.59	19.65	47.24	65.16	-17.92	peak	
3		0.1740	24.51	19.65	44.16	64.77	-20.61	peak	
4		3.3660	15.42	20.35	35.77	56.00	-20.23	peak	
5		5.5340	11.59	20.09	31.68	60.00	-28.32	peak	
6		20.4060	15.87	20.23	36.10	60.00	-23.90	peak	

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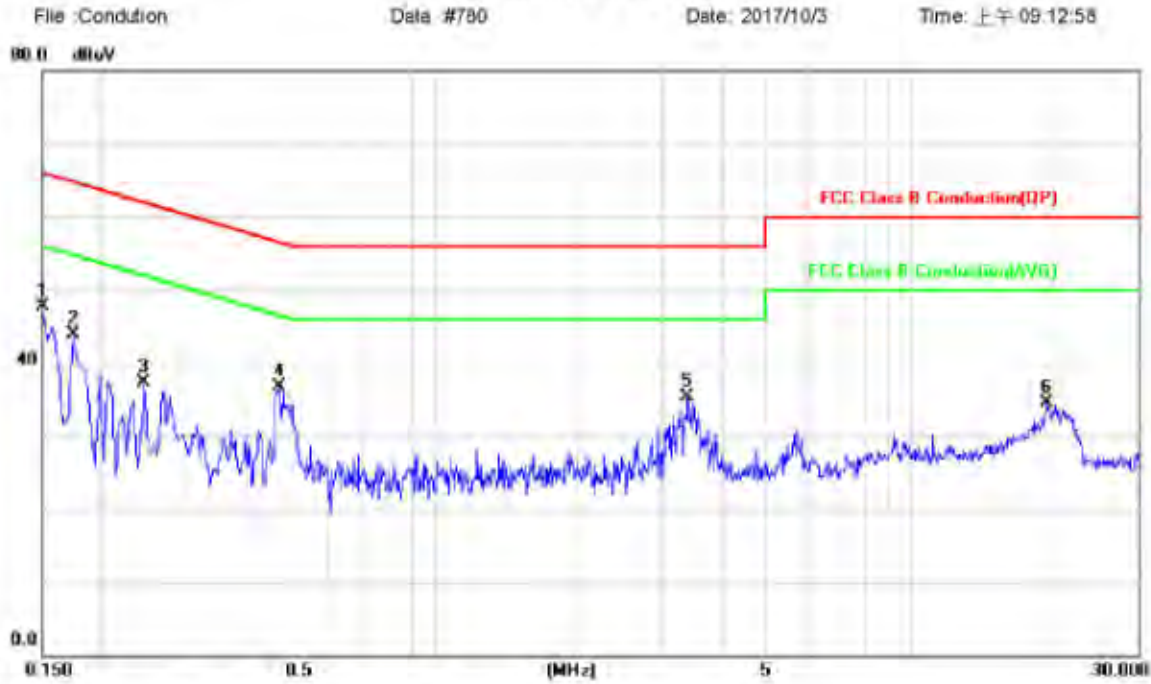
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Site : Conduction Room                      Phase: **N**                      Temperature: 23 ℃  
 Limit: FCC Class B Conduction(QP)                      Power: AC 120V/60Hz                      Humidity: 72 %  
 Mode:  
 Note:

### Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1500	28.14	19.50	47.64	66.00	-18.36	peak	
2		0.1740	24.32	19.50	43.82	64.77	-20.95	peak	
3		0.2460	17.79	19.57	37.36	61.89	-24.53	peak	
4		0.4740	16.66	19.95	36.61	56.44	-19.83	peak	
5		3.4020	15.13	20.20	35.33	56.00	-20.67	peak	
6		19.4060	14.46	20.05	34.51	60.00	-25.49	peak	

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## 7 DUTY CYCLE TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

### Formula:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

### Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

Mode	Duty Cycle (%)	Duty Factor (dB) =10*log ( 1/Duty Cycle )
802.11a	93.25	0.30
802.11n_20	92.91	0.32
802.11n_40	86.82	0.61

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9325) = 0.3$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9291) = 0.32$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.8682) = 0.61$$

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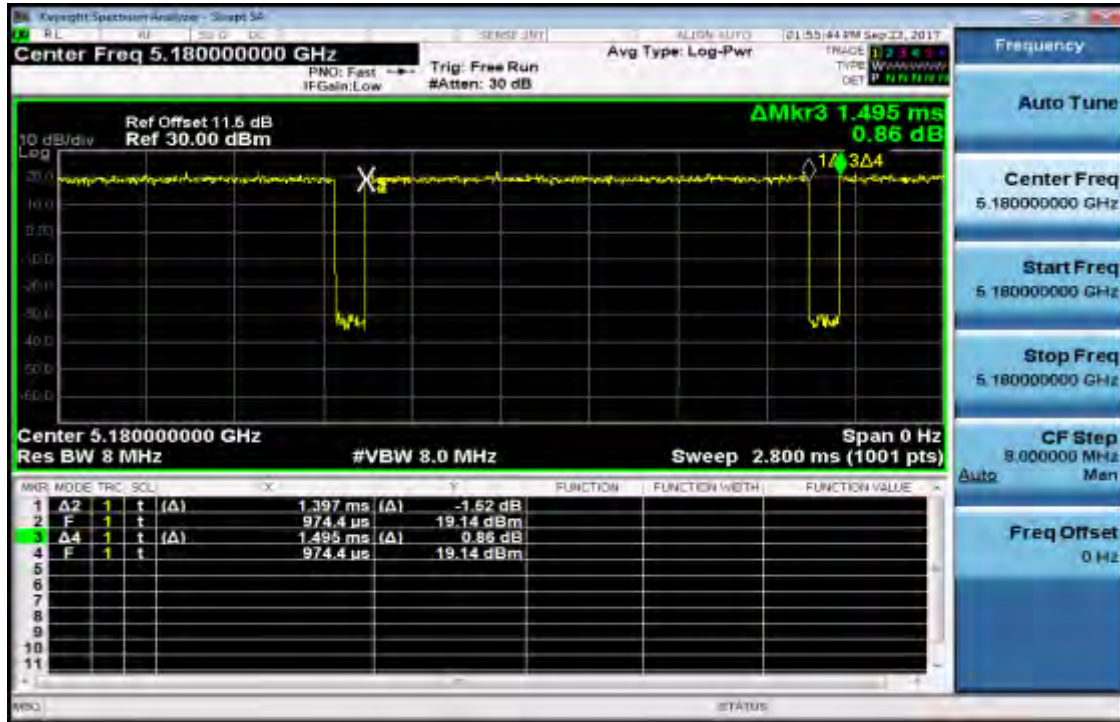
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## DUTY CYCLE TEST SIGNAL Measurement Result 802.11a



## 802.11n HT20



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## 802.11n HT 40



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## 8 26DB & 6DB EMISSION BANDWIDTH MEASUREMENT

### 8.1 Standard Applicable

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.  
The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

### 8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
  - a. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
  - b. Mark the peak frequency and -26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
5. Minimum Emission Bandwidth for the band 5.725-5.850GHz.
  - a. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detector=Peak, Sweep=auto
  - b. Mark the peak frequency and -6dB (upper and lower) frequency.
6. Repeat above procedures until all test default channel measured were complete.

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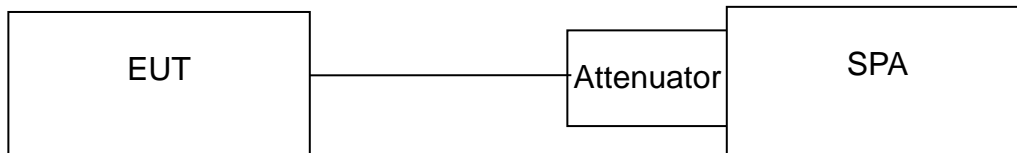
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### 8.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equip-ment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

### 8.4 Test Set-up



### 8.5 Measurement Result 26dB Bandwidth

#### 802.11a\_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.23	12.840
5220	19.28	12.851
5240	19.14	12.819

#### 802.11n\_HT20\_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.78	12.962
5220	20.15	13.042
5240	19.59	12.921

#### 802.11n\_HT40\_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	45.52	16.582
5230	45.62	16.591

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**99% BW to prove that all signals in band I is no over band I**

**802.11a\_Main**

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.28	< 5250

**802.11n\_HT20\_Main**

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.76	< 5250

**802.11n\_HT40\_Main**

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5248.15	< 5250

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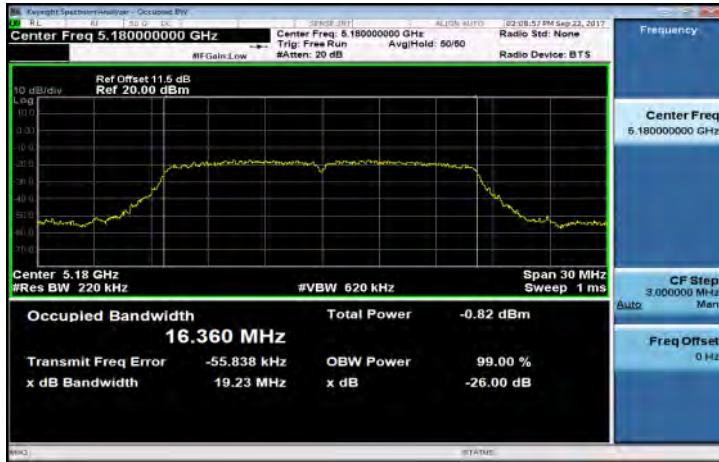
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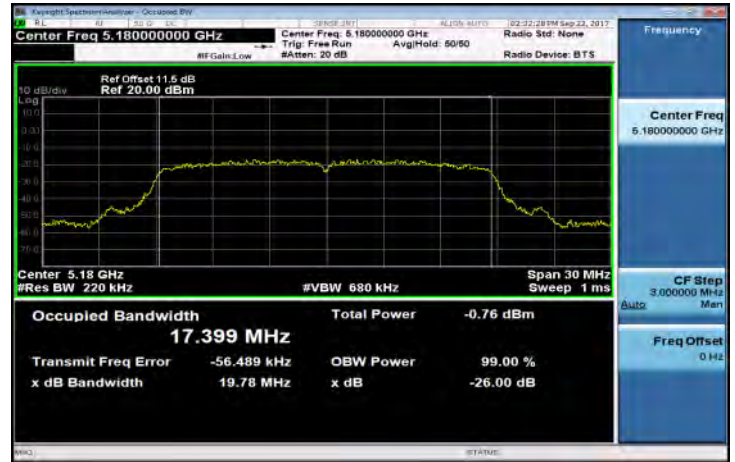
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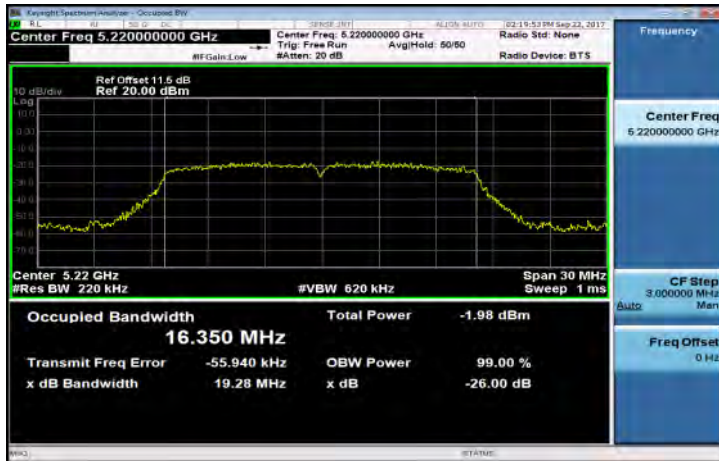
802.11a (Main) 5180MHz



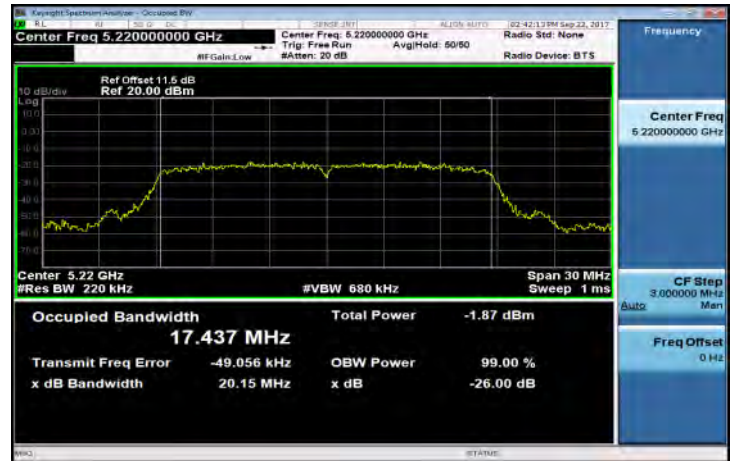
802.11n HT20 (Main) 5180 MHz



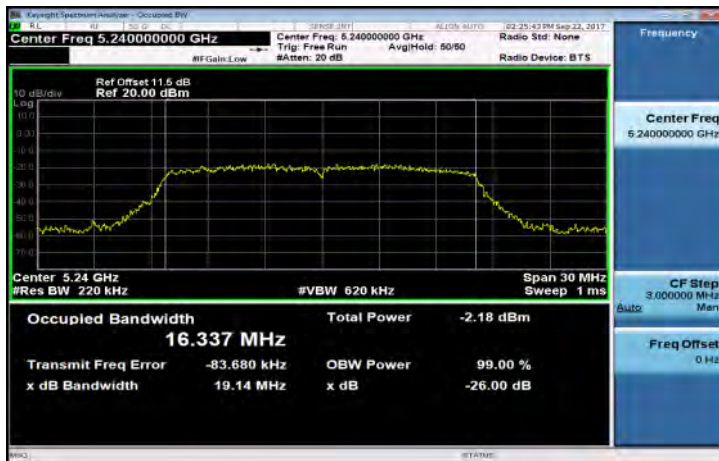
5220MHz



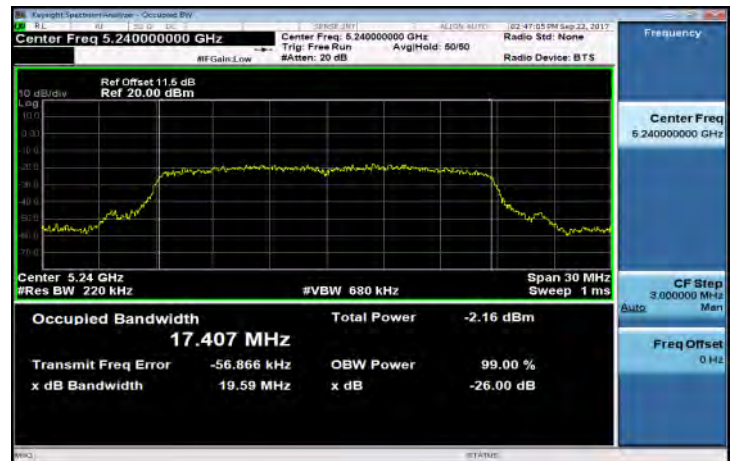
5220 MHz



5240MHz



5240 MHz

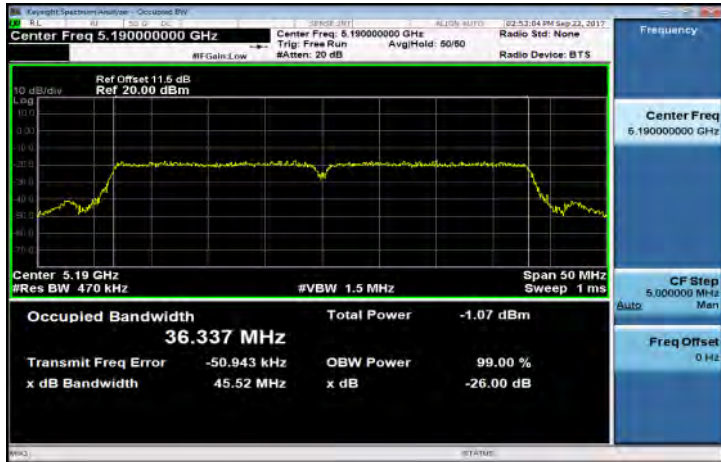


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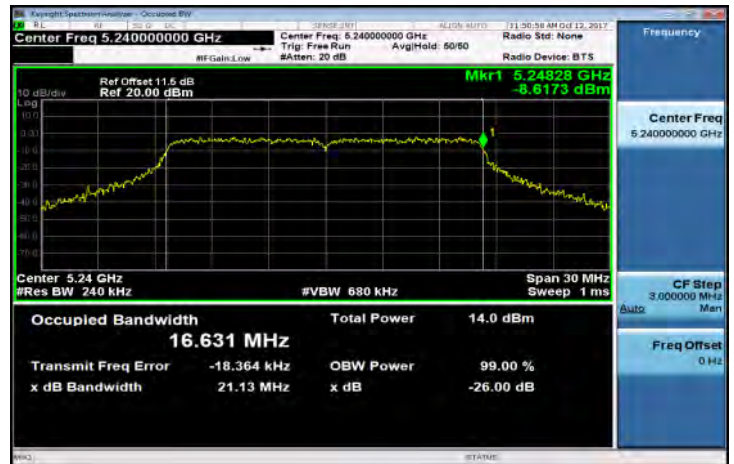
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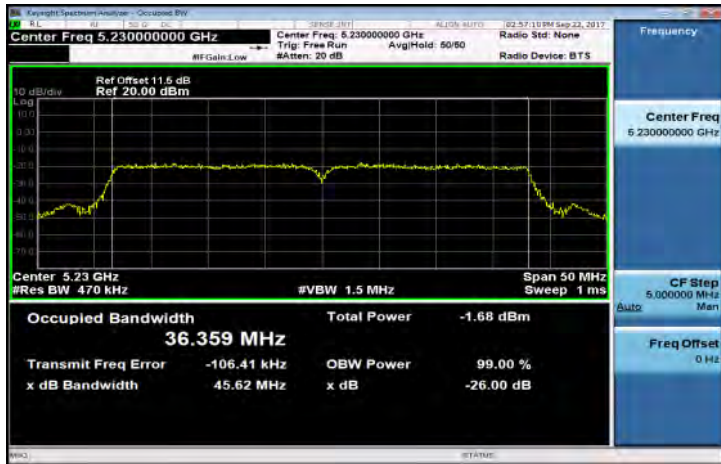
802.11n HT40 (Main) 5190 MHz



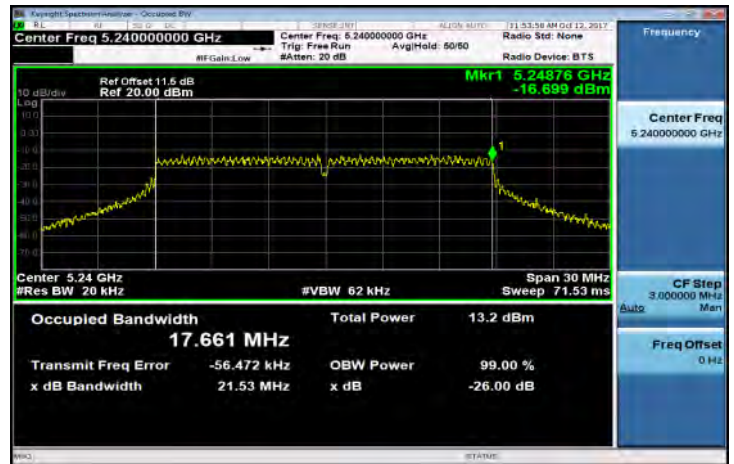
99% BW to prove that all signals in band I is no over band I  
802.11a\_5240MHz (Main)



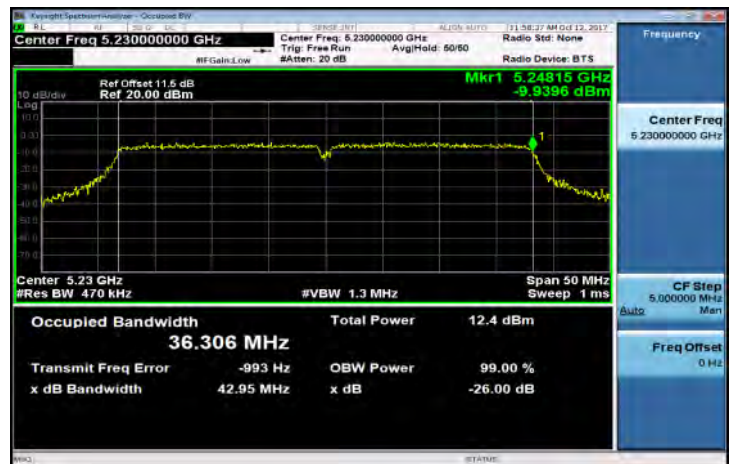
5230 MHz



802.11n\_20MHz\_5240MHz (Main)



802.11n\_40MHz\_5230MHz (Main)



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## 9 MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

### 9.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device )	1 Watt(30dBm)
		Fixed point-to-point Acess Ponit	1 Watt(30dBm)
	√	Mobile and portable clinet device	250mW(23.98dBm)
U-NII-2A			250mW(23.98dBm) or 11dBm+10 log B
U-NII-2C			250mW(23.98dBm) or 11dBm+10 log B
U-NII-3			1 Watt(30dBm)

### 9.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
4. Power Meter is used as the auxiliary test equipment to conduct the output power measurement.
5. Record the max. reading and add 10 log(1/duty cycle).
6. Repeat above procedures until all frequency (low, middle, and high channel) measured were complete.

### 9.3 Measurement Equipment Used

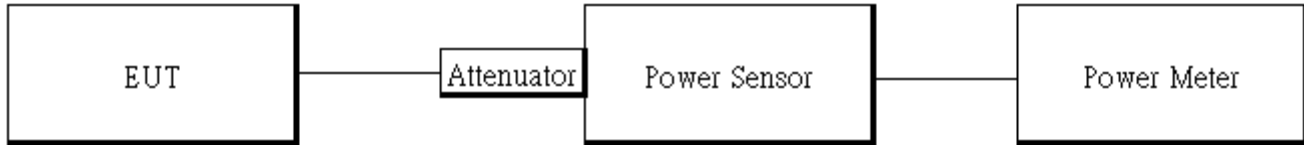
SGS Conducted Room					
Name of Equip-ment	Manufacturer	Model	Serial Num-ber	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2496A	1326001	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315048	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315049	06/23/2017	06/22/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

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## 9.4 Test Set-up



## 9.5 Measurement Result

## Conducted output power

**802.11a\_Main**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	13.86	24.342	23.98	PASS
44	5220	6	<b>13.95</b>	24.851	23.98	PASS
48	5240	6	13.81	24.063	23.98	PASS

**802.11a\_Aux1**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	13.51	22.457	23.98	PASS
44	5220	6	13.58	22.822	23.98	PASS
48	5240	6	13.47	22.251	23.98	PASS

**802.11n\_HT20\_Main**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	12.88	19.406	23.98	PASS
44	5220	MCS0	<b>12.96</b>	19.767	23.98	PASS
48	5240	MCS0	12.83	19.184	23.98	PASS

**802.11n\_HT20\_Aux1**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	12.75	18.834	23.98	PASS
44	5220	MCS0	12.83	19.184	23.98	PASS
48	5240	MCS0	12.78	18.964	23.98	PASS

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**802.11n\_HT40\_Main**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
38	5190	MCS0	11.94	15.645	23.98	PASS
46	5230	MCS0	11.90	15.502	23.98	PASS

**802.11n\_HT40\_Aux1**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
38	5190	MCS0	11.88	15.431	23.98	PASS
46	5230	MCS0	11.77	15.045	23.98	PASS

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## 10 PEAK POWER SPECTRAL DENSITY

### 10.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device )	17dBm/ MHz
		Fixed point-to-point Access Ponit	
	√	Mobile and portable clinet device	11dBm/ MHz
U-NII-2A			11dBm/ MHz
U-NII-2C			11dBm/ MHz
U-NII-3			30dBm/ 500kHz

### 10.2 Measurement Procedure

- Place the EUT on the table and set it in transmitting mode.
- The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spec-trum.
- For U-NII1, U-NII-2A, U-NII-2C Band:**  
Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)  
**For U-NII-3 Band:**  
Set RBW=500 kHz, VBW≥ 3RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
- Use the cursor on spectrum to peak search the highest level of trace
- Record the max. reading and add 10 log(1/duty cycle).
- Repeat above procedures until all default test channel (low, middle, and high) was complete.

### 10.3 Measurement Equipment Used

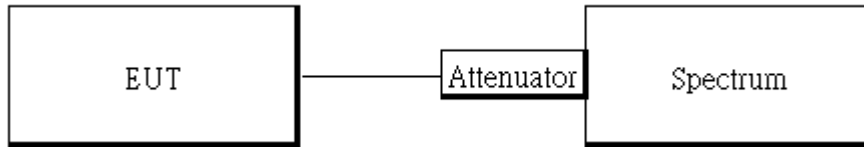
SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

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### 10.4 Test Set-up



### 10.5 Measurement Result

POWER DENSITY 802.11a MODE					
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180	-20.39	0.30	-20.09	11	-31.09
5220	-20.14	0.30	-19.84	11	-30.84
5240	-19.66	0.30	-19.36	11	-30.36
POWER DENSITY 802.11n HT20 MODE					
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180	-21.23	0.32	-20.91	11	-31.91
5220	-21.30	0.32	-20.98	11	-31.98
5240	-21.31	0.32	-20.99	11	-31.99
POWER DENSITY 802.11n HT40 MODE					
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5190	-25.96	0.61	-25.35	11	-36.35
5230	-25.96	0.61	-25.35	11	-36.35

**Note:**

SISO offset= 11.5 dB

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802.11a 5150~5250 MHz

802.11n HT20, 5150~5250 MHz

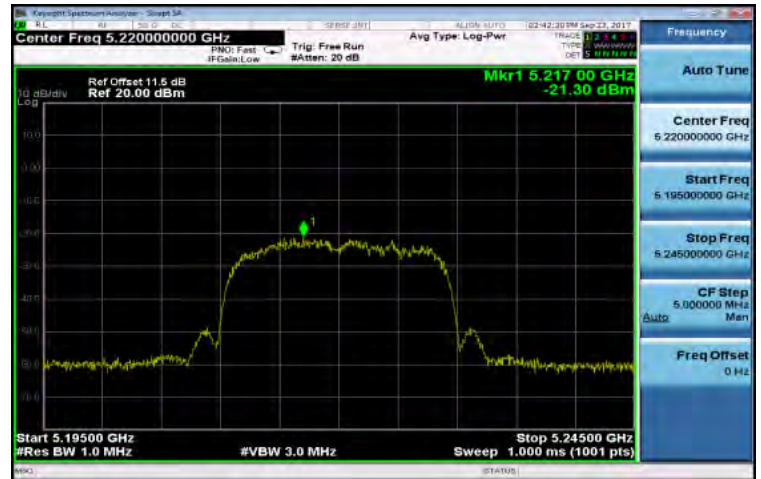
Peak Power Spectral Density Data Plot (CH Low 5180 MHz)

Peak Power Spectral Density Data Plot (CH Low 5180 MHz)



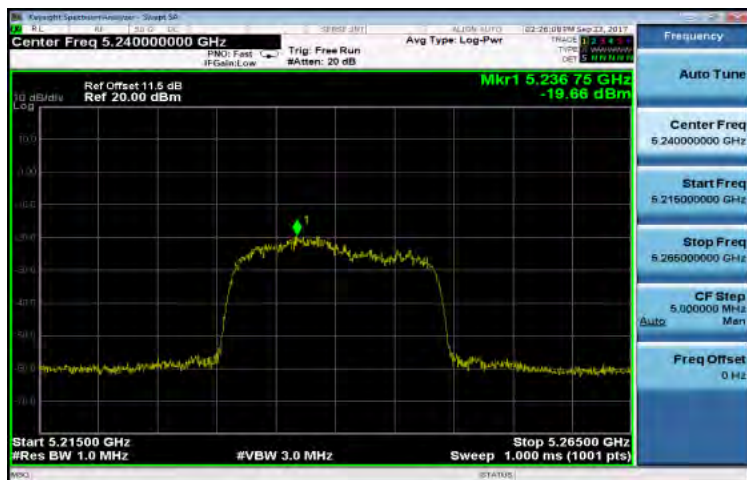
Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)

Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)



Peak Power Spectral Density Data Plot (CH High 5240 MHz)

Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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802.11n HT40, 5150~5250 MHz

Peak Power Spectral Density Data Plot (CH Low 5190 MHz)



Peak Power Spectral Density Data Plot (CH High 5230 MHz)



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## 11 UNDESIRABLE RADIATED EMISSION MEASUREMENT

### 11.1 Standard Applicable

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

1. For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
2. For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

APPLICABLE TO	LIMIT	
FCC KDB 789033 D02 General UNII Test Procedures New Rules	FIELD STRENGTH AT 3m	
	PK: 74 (dBµV/m)	AV 54 (dBµV/m)
APPLICABLE TO	EIRP LIMIT	FIELD STRENGTH AT 3m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.3 (dBµV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)(i)	PK:-27 (dBm/MHz) *1 PK:10 (dBm/MHz) *2 PK:15.6 (dBm/MHz) *3 PK:27 (dBm/MHz) *4	PK: 68.2(dBµV/m) *1 PK:105.2 (dBµV/m) *2 PK: 110.8(dBµV/m) *3 PK:122.2 (dBµV/m) *4
*1 beyond 75 MHz or more above of the bandedge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.		

$EIRP = (E \cdot d)^2 / 30$ , where E is the field in V/m, d is the measurement distance (3m), EIRP is the equivalent isotropically radiated power in Watts.

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Unwanted spurious emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

Frequency (MHz)	Field strength (microvolts/meter)	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

**Note:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBµV/m) = 20 log Emission level (dBµV/m)

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## 11.2 Measurement Equipment Used

SGS SAC-III					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/18/2017	04/17/2018
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2016	12/22/2017
Broadband Antenna	TESEQ	CBL 6112D	35240	11/03/2016	11/02/2017
Horn Antenna	ETS-Lindgren	3117	00143272	12/15/2016	12/16/2017
Horn Antenna	Schwarzbeck	BBHA9170	185	08/01/2017	07/31/2018
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC184045B	980135	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017
Site NSA	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
Site VSWR	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2017	05/03/2018
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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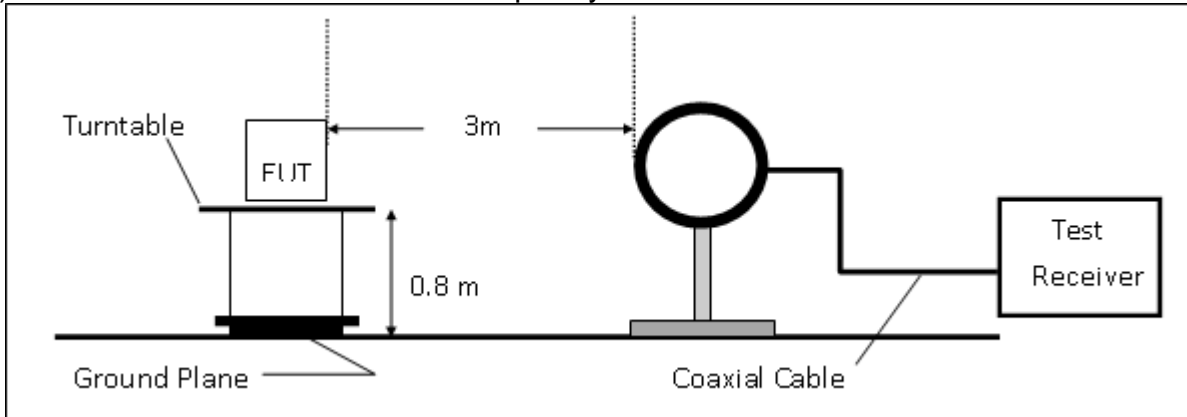
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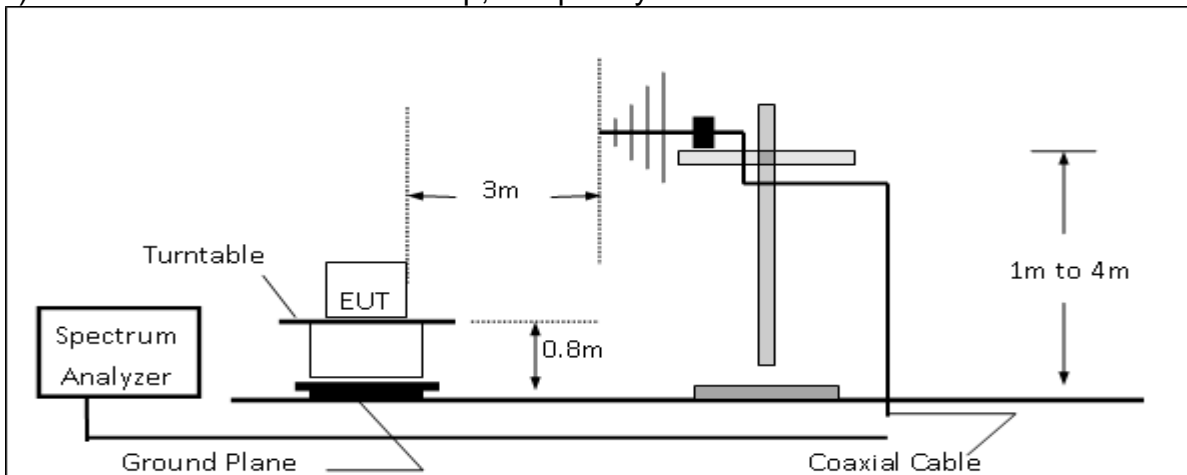


### 11.3 Test SET-UP

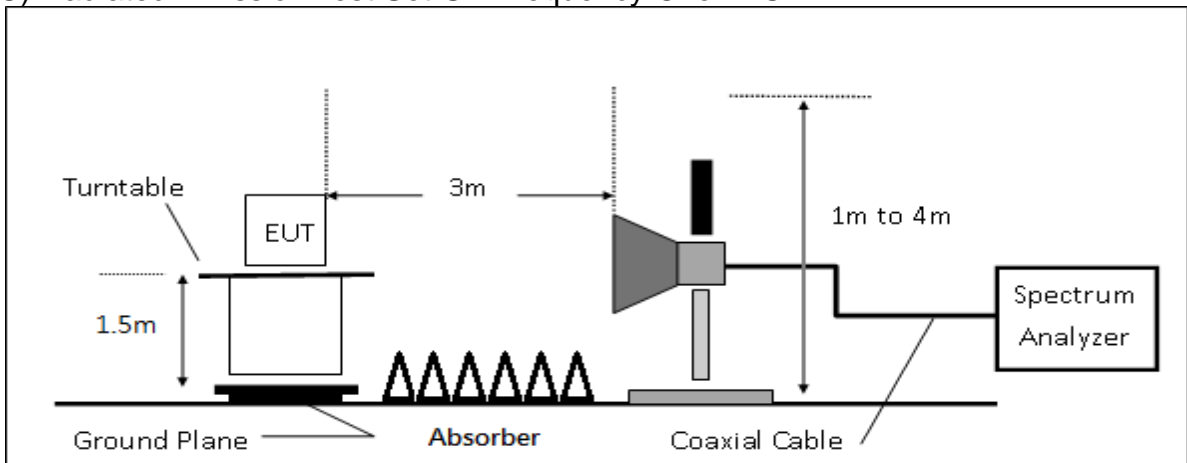
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-UP, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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### 11.4 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
4. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
5. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.

Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
802.11a	93.25	1397	0.71	1kHz
802.11n_20	92.91	1297	0.77	1kHz
802.11n_40	86.82	636.5	1.57	3kHz

9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
11. Repeat above procedures until all frequency measured were complete.

### 11.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

$$\text{Actual FS(dB}\mu\text{V/m)} = \text{SPA. Reading level(dB}\mu\text{V)} + \text{Factor(dB)}$$

$$\text{Factor(dB)} = \text{Antenna Factor(dB}\mu\text{V/m)} + \text{Cable Loss(dB)} - \text{Pre\_Amplifier Gain(dB)}$$

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**Note :**

“**F**” : denotes Fundamental Frequency. ; “**H**” : denotes Harmonic Frequency.

“**E**” : denotes Band Edge Frequency. ; “**S**” : denotes Spurious Frequency.

**11.6 Test Results of Radiated Spurious Emissions form 9 KHz to 30 MHz**

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

**11.7 Measurement Result**

Refer to next page for tabular data sheets.

Note: There is a comparison data of both open-field test site and semi-Anechoic, and test result came out very similar.

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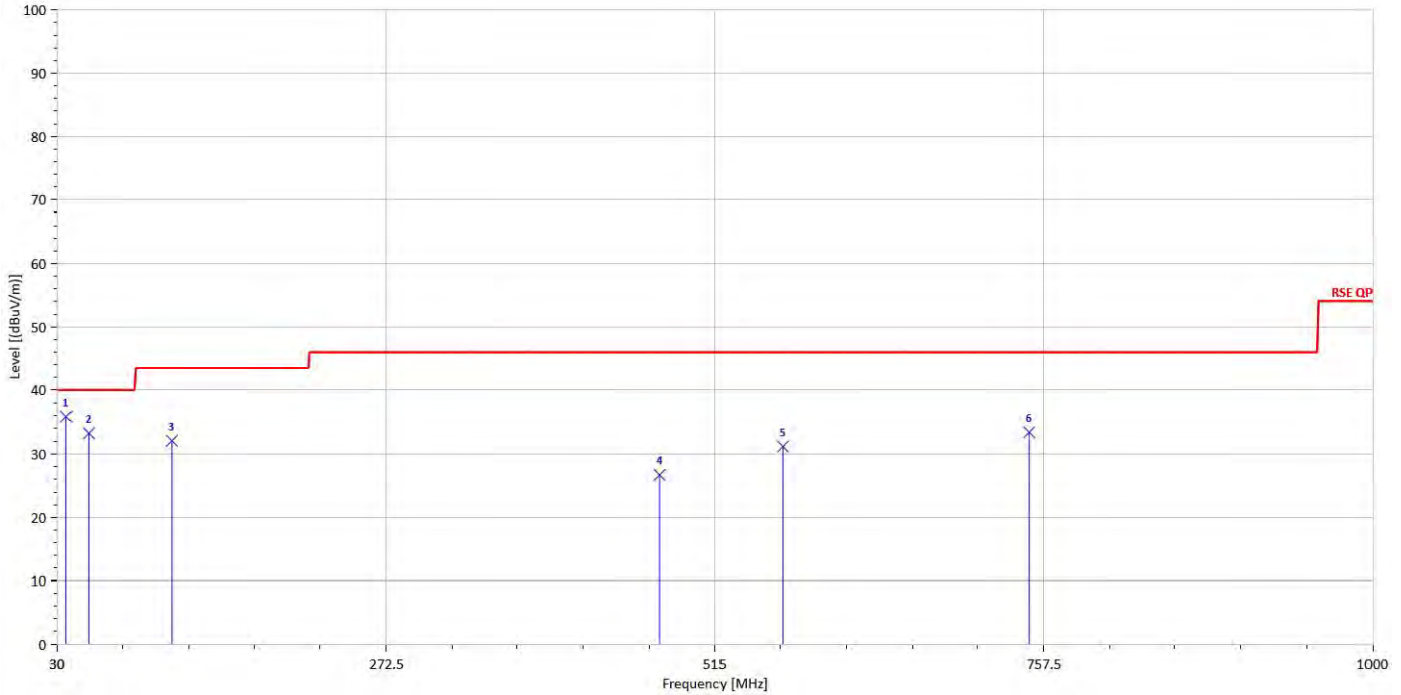
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### Radiated Spurious Emission Measurement Result Below 1GHz Worst-Case Data:

Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5220 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
36.79	S	Peak	46.84	-10.93	35.91	40	-4.09
53.28	S	Peak	53.79	-20.53	33.26	40	-6.74
114.39	S	Peak	48.28	-16.21	32.07	43.5	-11.43
474.26	S	Peak	34.72	-8.09	26.63	46	-19.37
565.44	S	Peak	37.64	-6.49	31.15	46	-14.85
746.83	S	Peak	37.64	-4.23	33.41	46	-12.59

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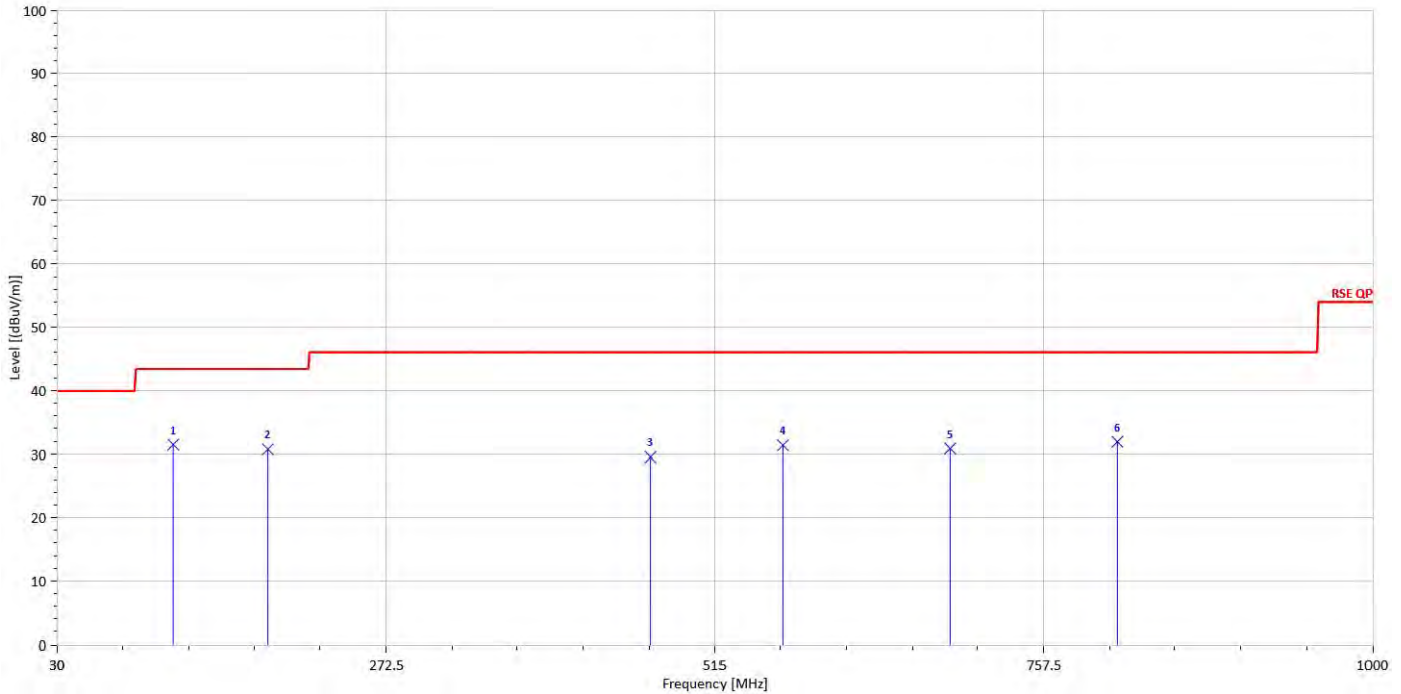
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Operation Mode : 802.11aB1      Test Date : 2017/10/2  
 Fundamental Frequency : 5220 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : Tx CH Mid      Test Engineer : Ashton  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
115.36	S	Peak	47.62	-16.15	31.47	43.5	-12.03
185.20	S	Peak	49.11	-18.39	30.72	43.5	-12.78
467.47	S	Peak	37.27	-7.73	29.53	46	-16.47
565.44	S	Peak	37.87	-6.49	31.38	46	-14.62
688.63	S	Peak	36.21	-5.37	30.85	46	-15.15
811.82	S	Peak	34.91	-3.00	31.91	46	-14.09

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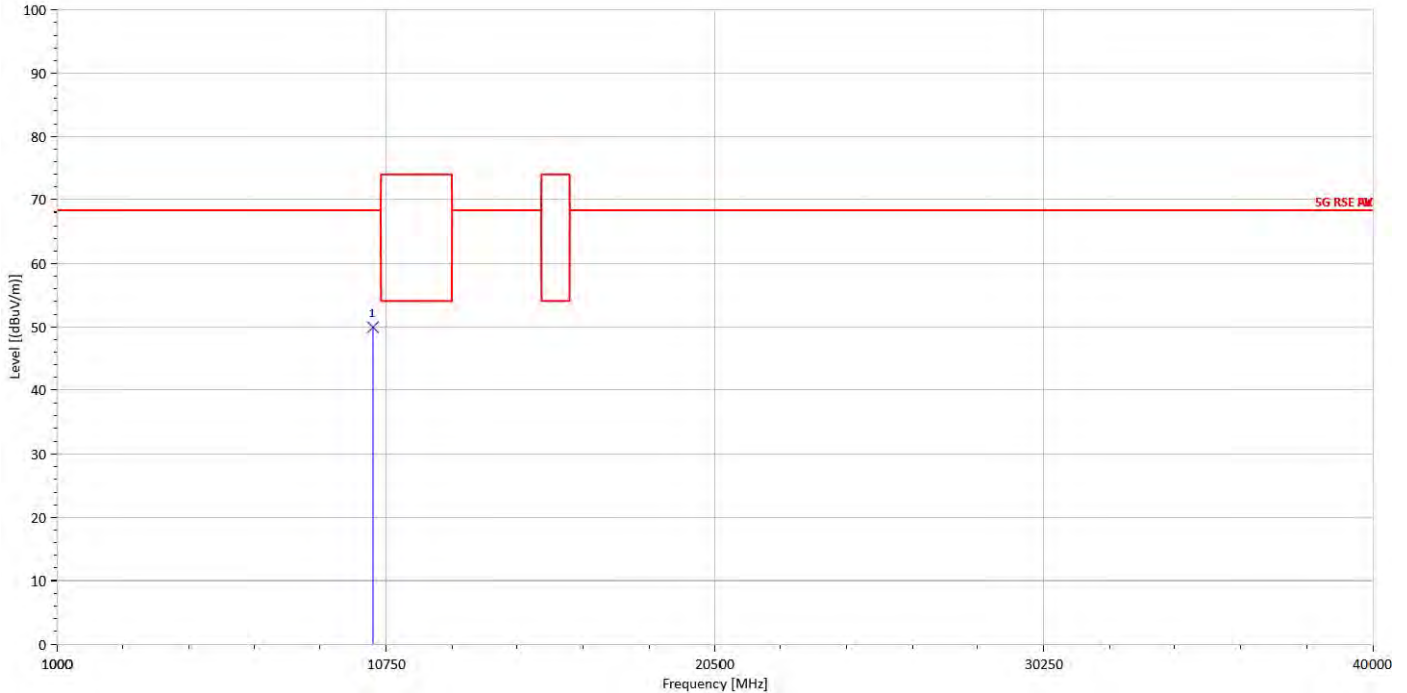
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**Above 1GHz Worst-Case Data:**

**Radiated Spurious Emission Measurement Result 802.11a, 5150~5250 MHz**

Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	TX CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
10360.00	H	Peak	29.82	20.18	50.00	68.3	-18.30

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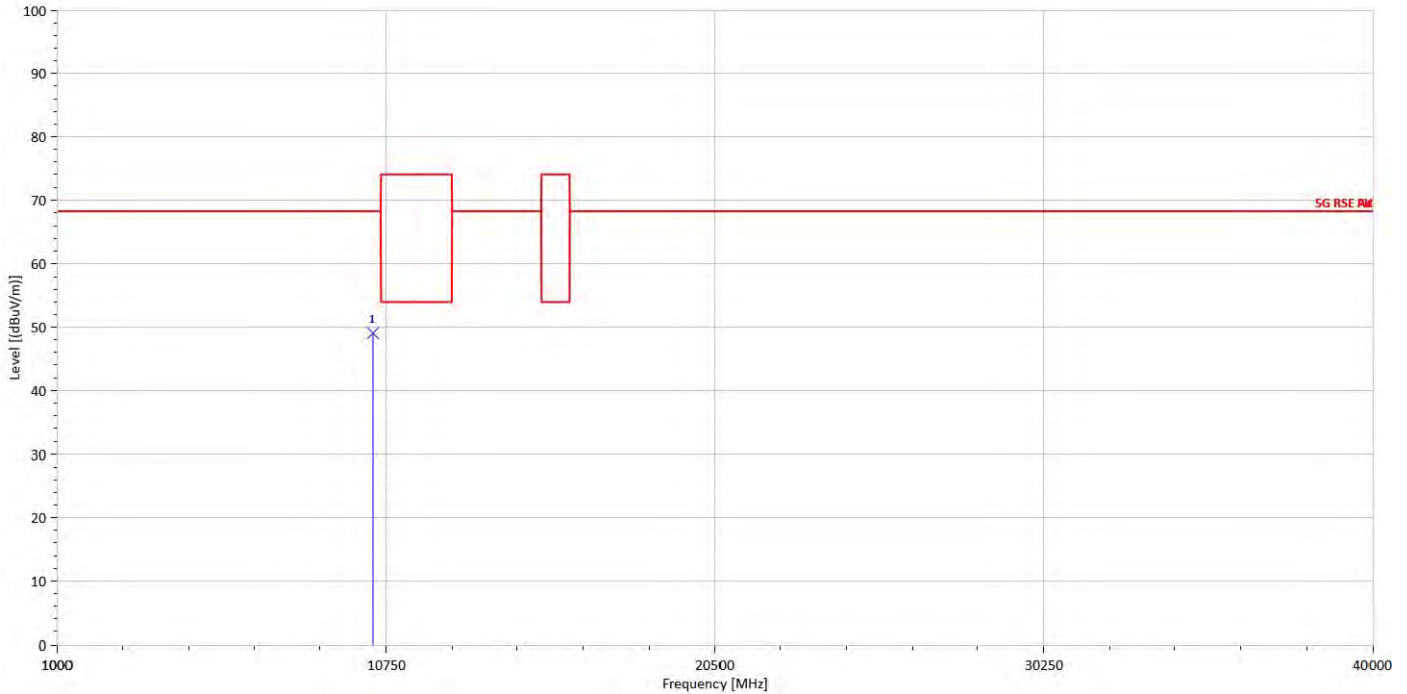
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Operation Mode : 802.11aB1      Test Date : 2017/10/2  
 Fundamental Frequency : 5180 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH LOW      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10360.00	H	Peak	28.88	20.18	49.06	68.3	-19.24

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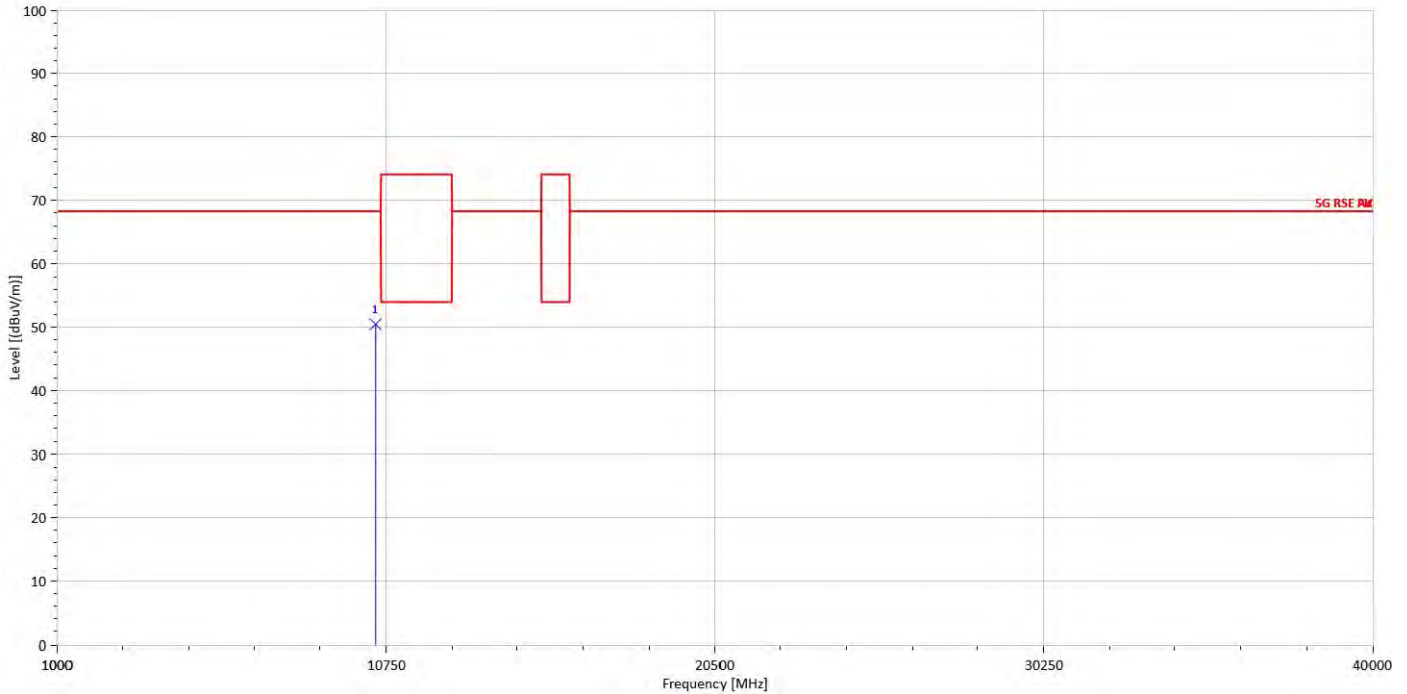
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f (886-2) 2298-0488

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Operation Mode : 802.11aB1 Test Date : 2017/10/2  
 Fundamental Frequency : 5220 MHz Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID Test Engineer : Enzo  
 EUT Pol. : H Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10440.00	H	Peak	30.18	20.29	50.48	68.3	-17.82

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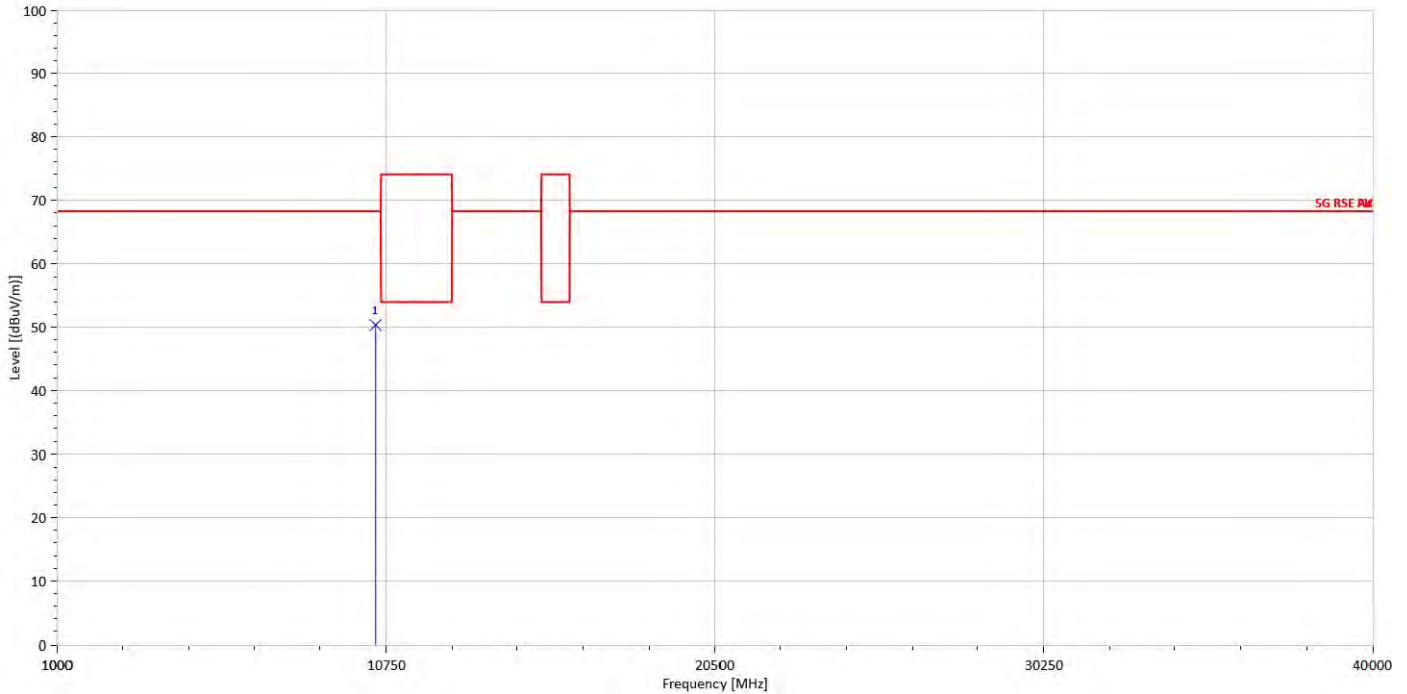
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Operation Mode : 802.11aB1 Test Date : 2017/10/2  
 Fundamental Frequency : 5220 MHz Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID Test Engineer : Enzo  
 EUT Pol. : H Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10440.00	H	Peak	30.05	20.29	50.34	68.3	-17.96

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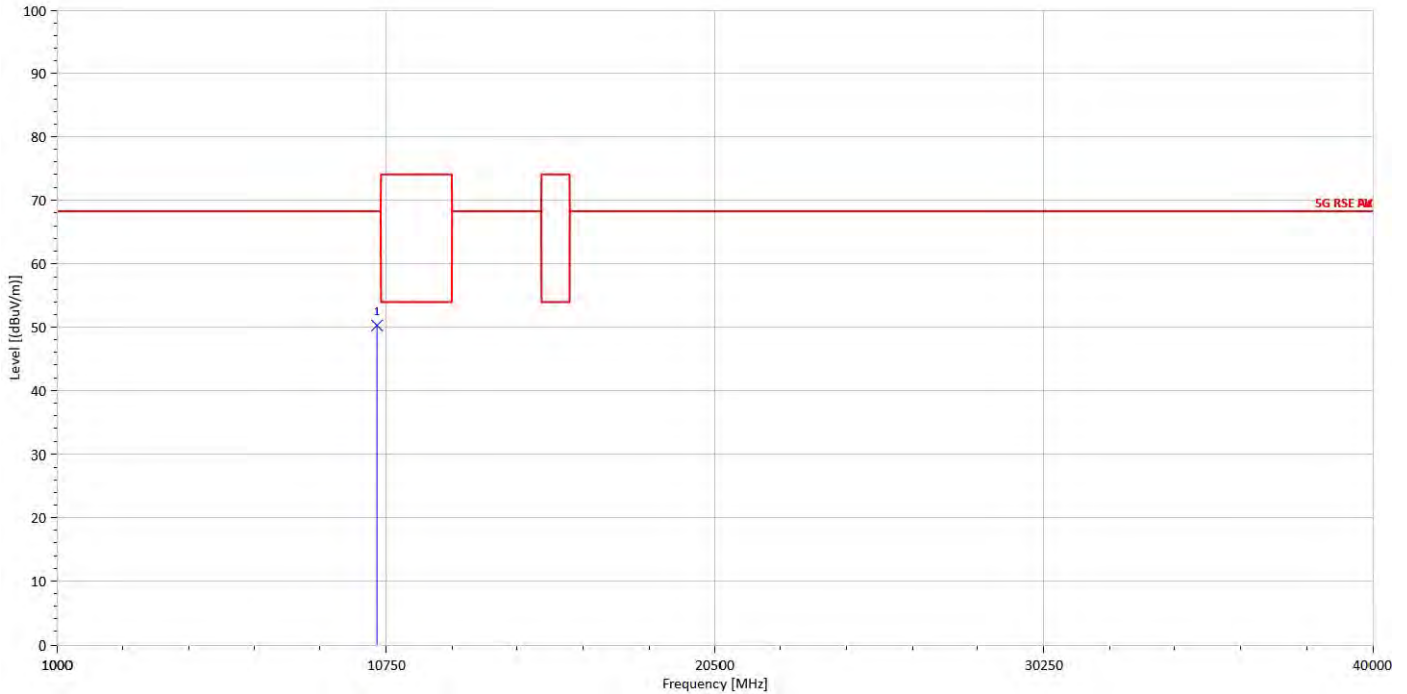
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Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5240 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	TX CH HIGH	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
10480.00	H	Peak	29.60	20.68	50.28	68.3	-18.02

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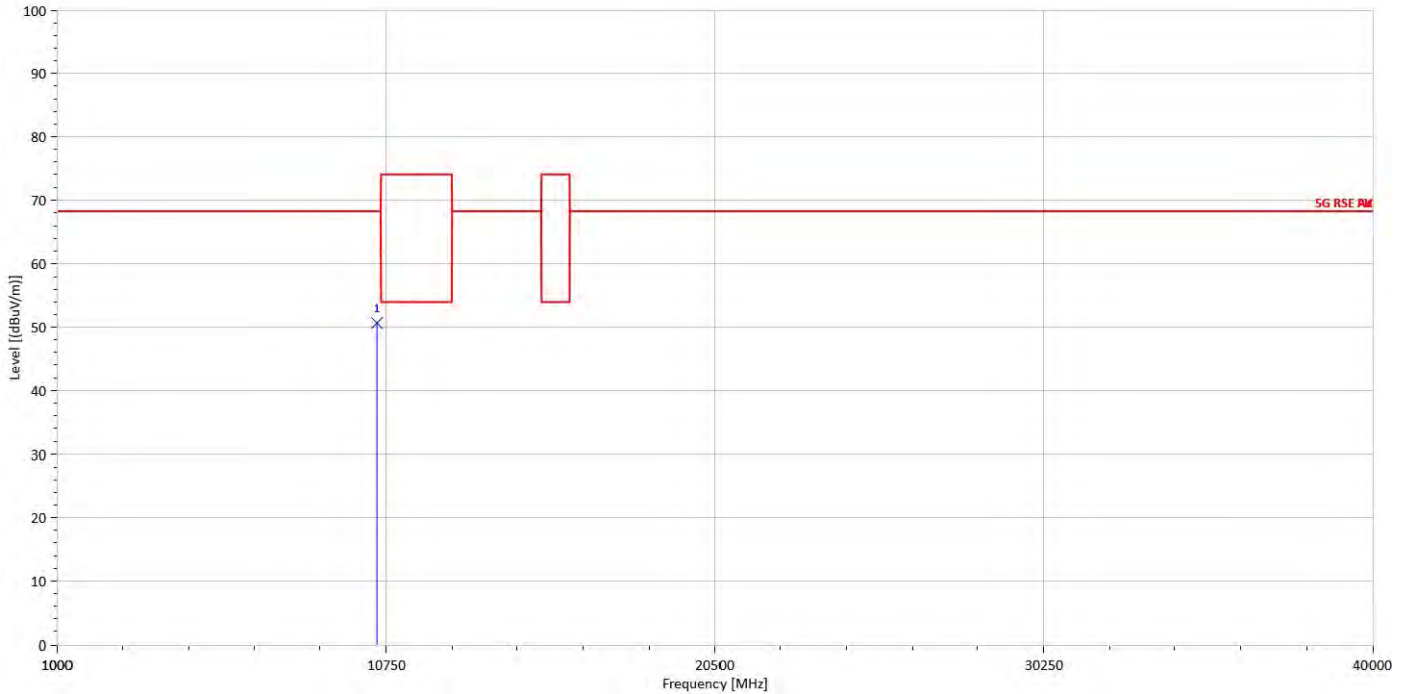
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Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5240 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	TX CH HIGH	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10480.00	H	Peak	29.97	20.68	50.65	68.3	-17.65

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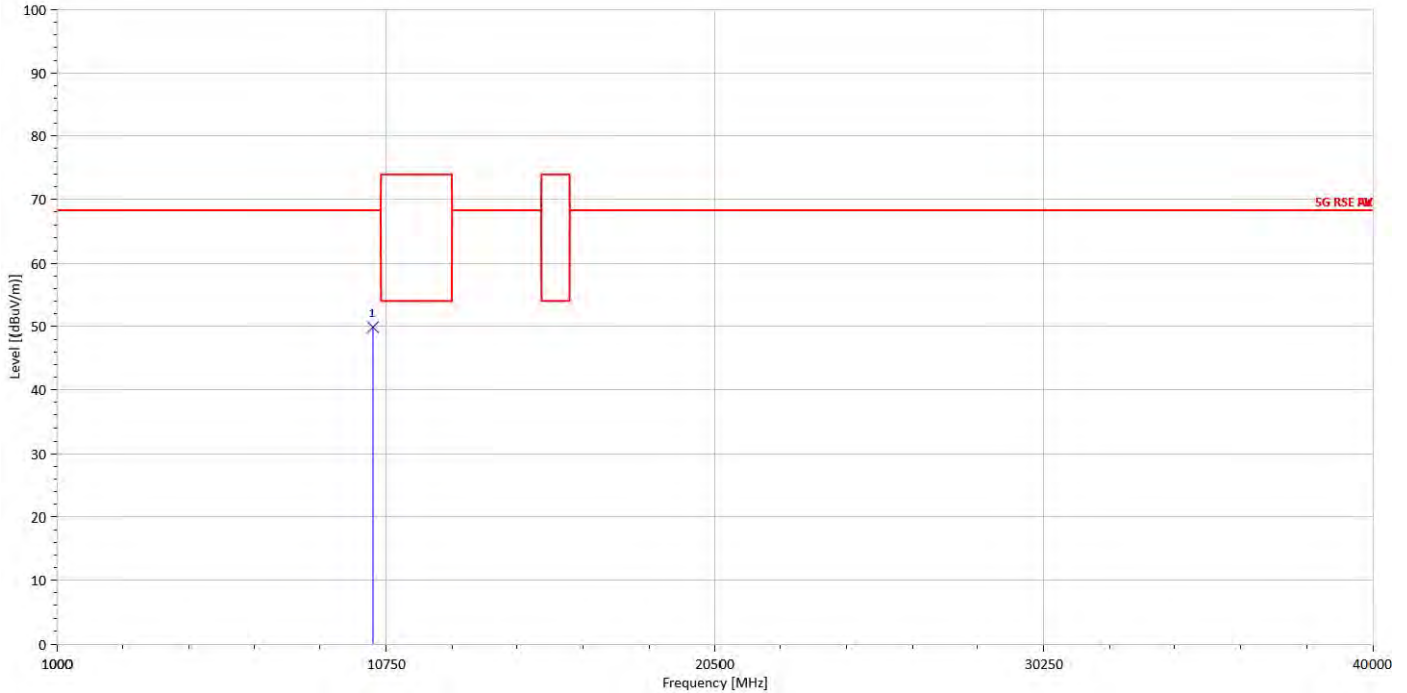
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**Radiated Spurious Emission Measurement Result 802.11n HT20, 5150~5250 MHz**

Operation Mode : 802.11n20B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5180 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH LOW      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
10360.00	H	Peak	29.66	20.18	49.83	68.3	-18.47

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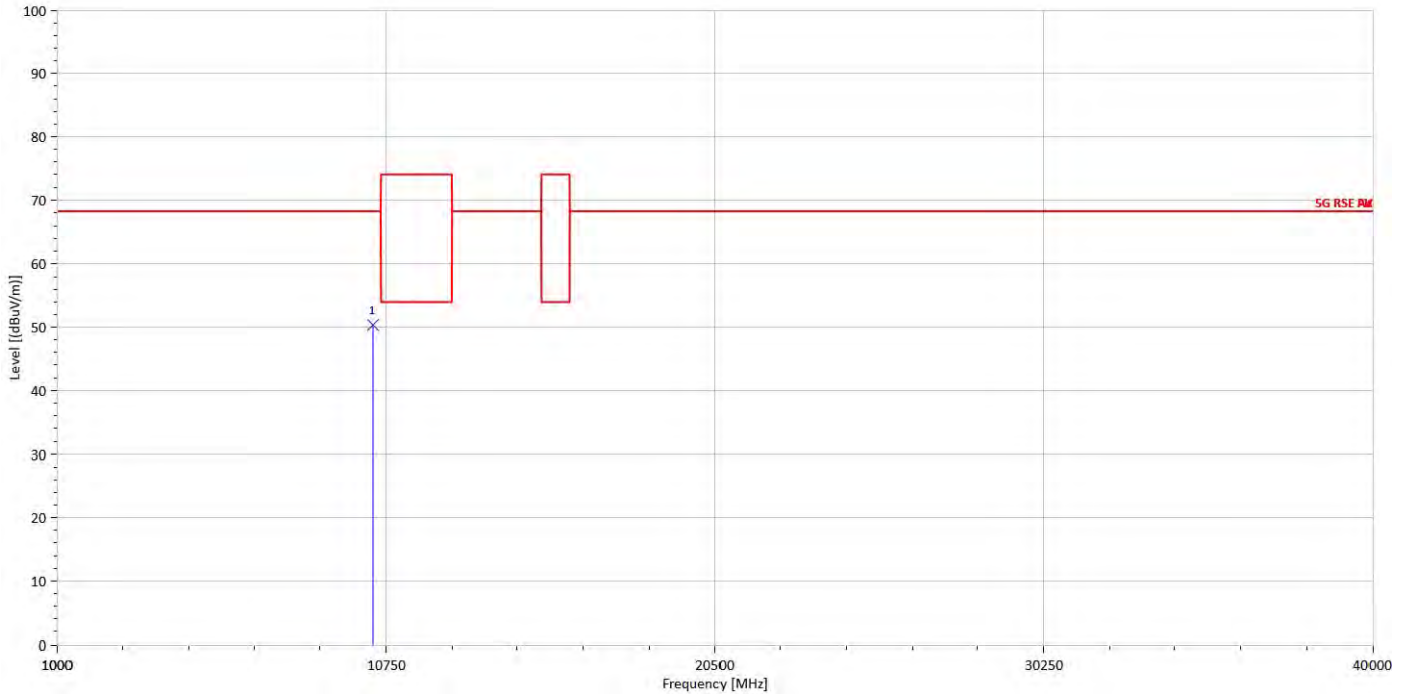
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Operation Mode : 802.11n20B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5180 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH LOW      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10360.00	H	Peak	30.18	20.18	50.35	68.3	-17.95

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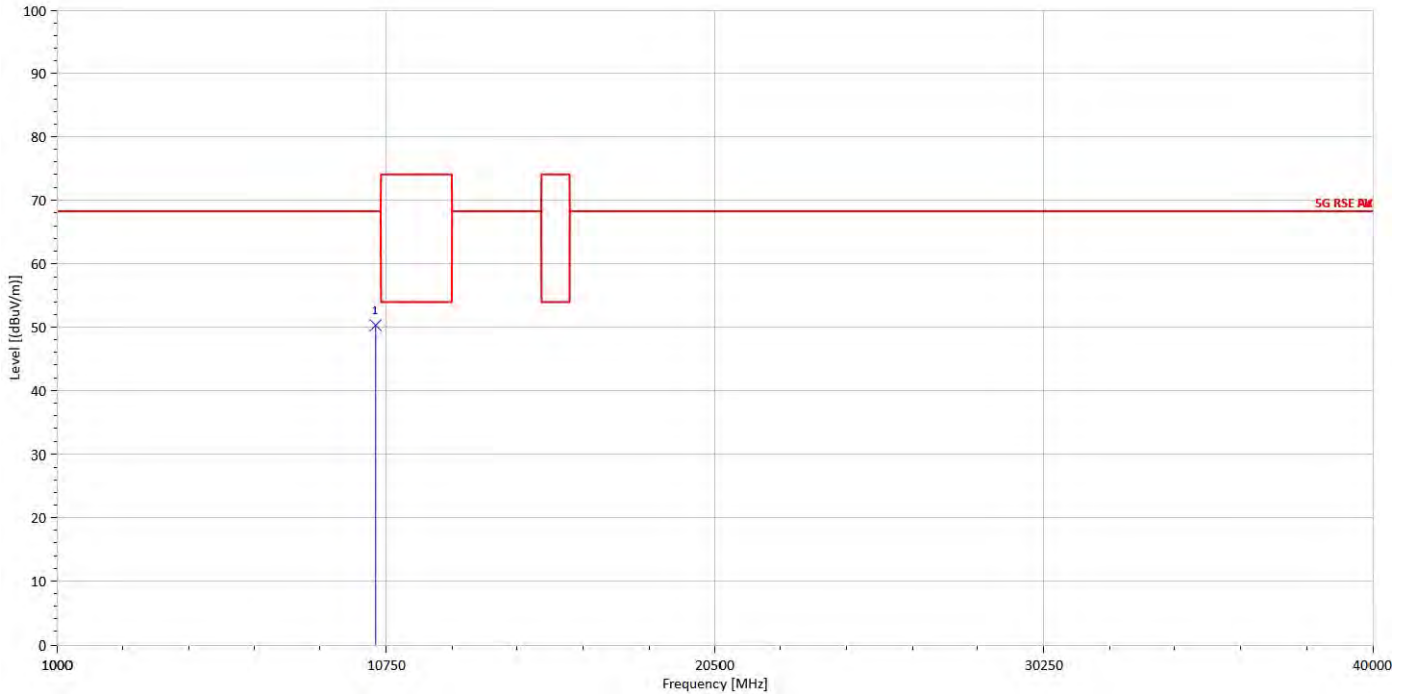
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Operation Mode : 802.11n20B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5220 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10440.00	H	Peak	30.02	20.29	50.31	68.3	-17.99

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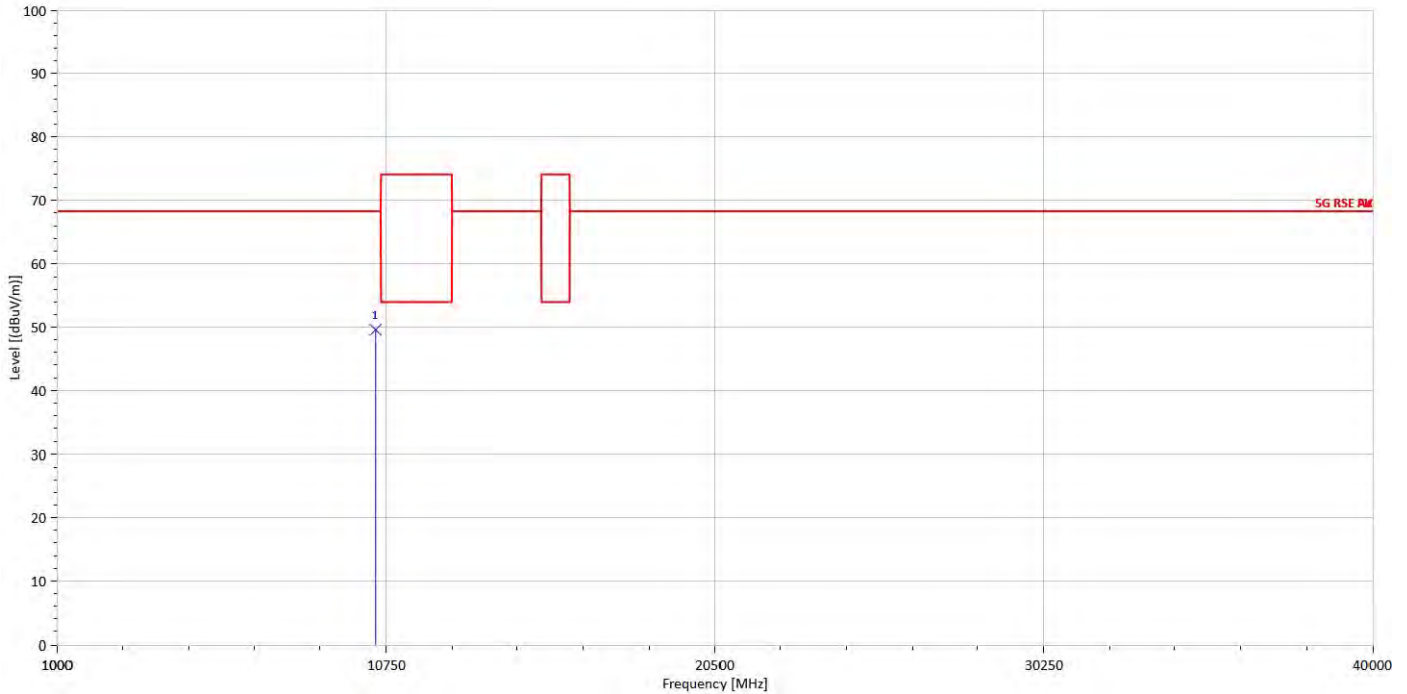
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Operation Mode : 802.11n20B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5220 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10440.00	H	Peak	29.30	20.29	49.59	68.3	-18.71

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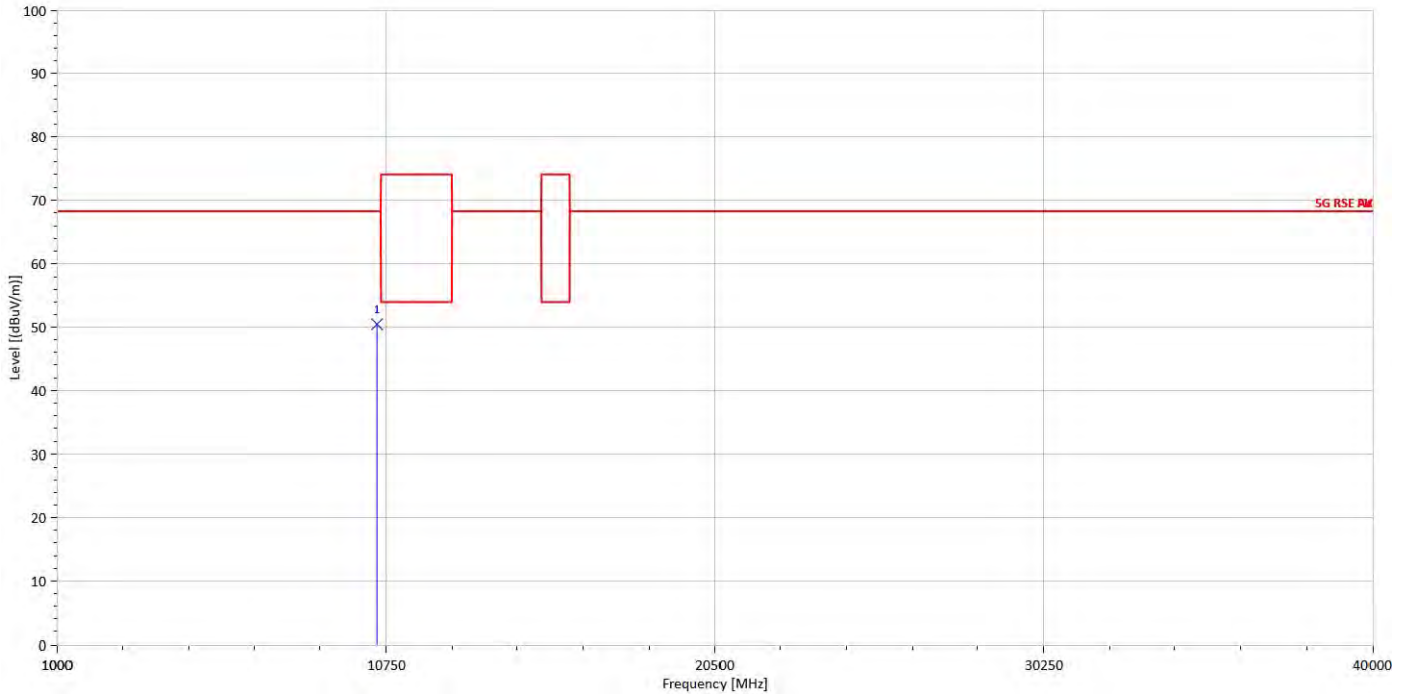
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Operation Mode : 802.11n20B1 Test Date : 2017/10/2  
 Fundamental Frequency : 5240 MHz Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH HIGH Test Engineer : Enzo  
 EUT Pol. : H Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10480.00	H	Peak	29.79	20.68	50.47	68.3	-17.83

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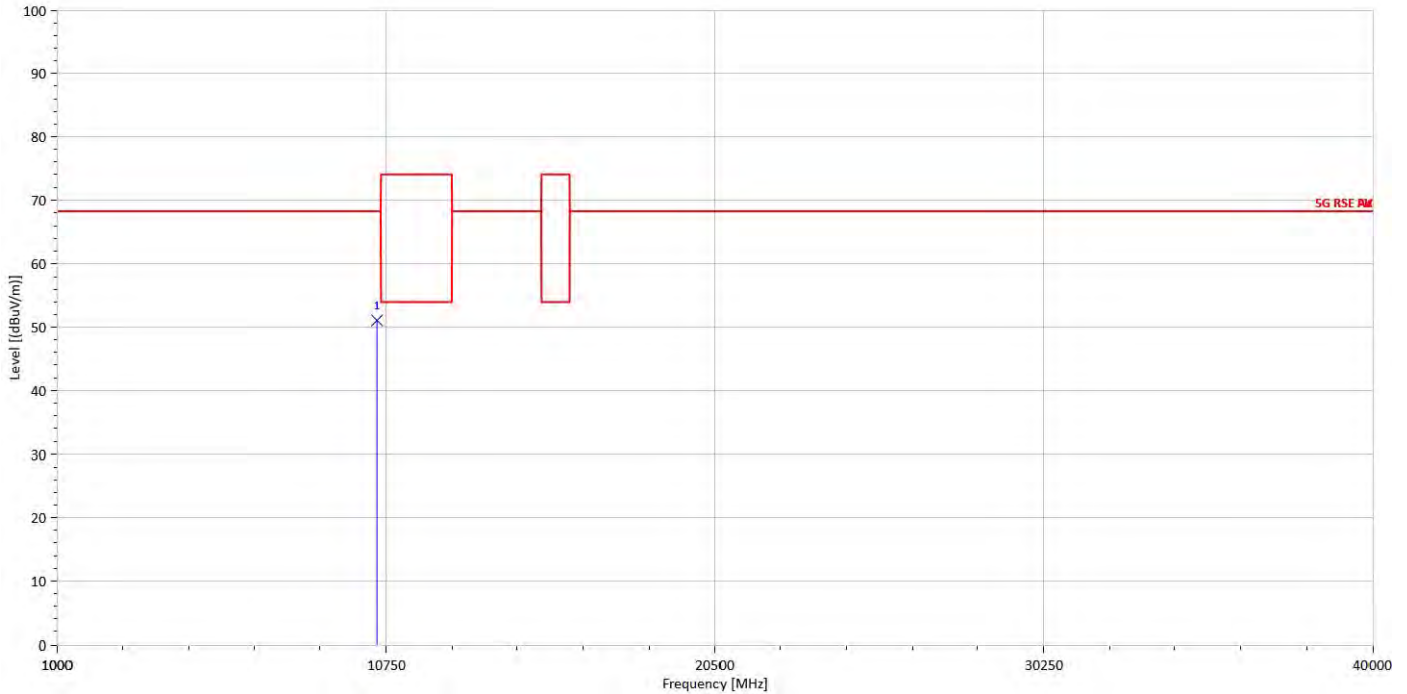
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Operation Mode :	802.11n20B1	Test Date :	2017/10/2
Fundamental Frequency :	5240 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	TX CH HIGH	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10480.00	H	Peak	30.40	20.68	51.08	68.3	-17.22

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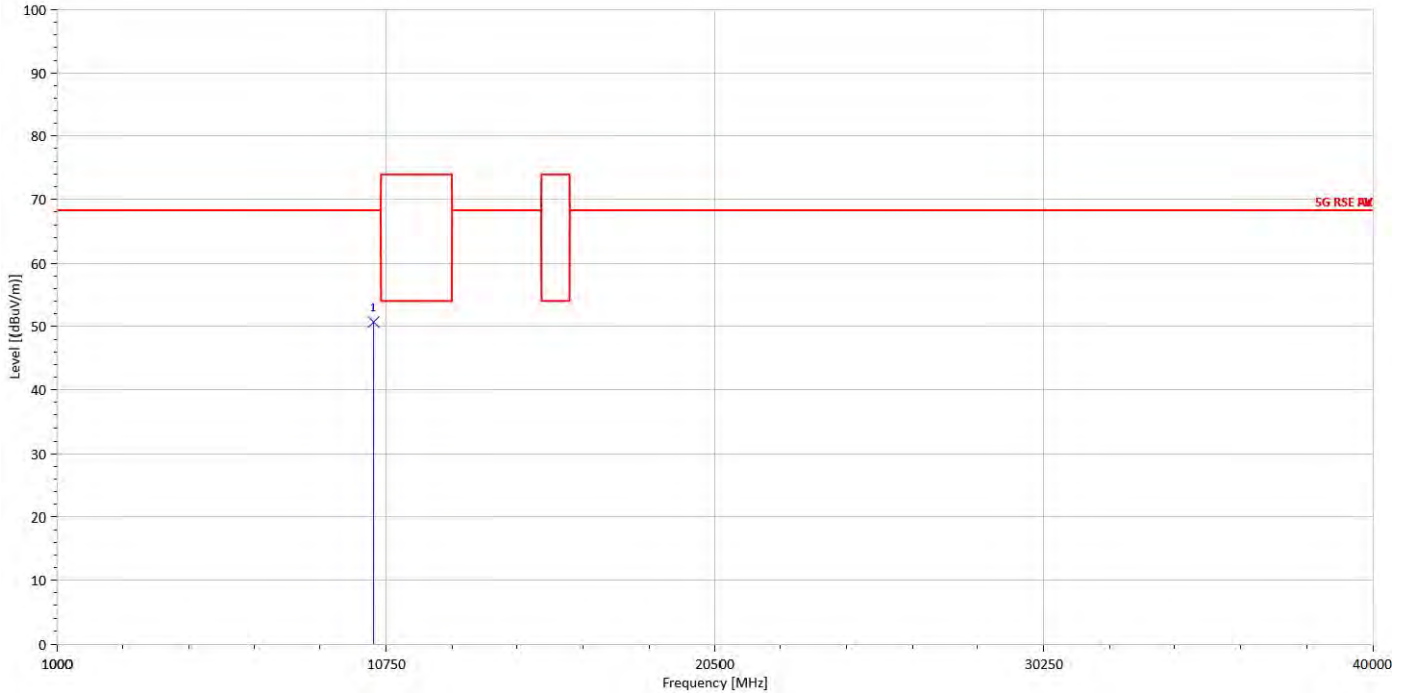
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### Radiated Spurious Emission Measurement Result 802.11n HT40, 5150~5250 MHz

Operation Mode :	802.11n40B1	Test Date :	2017/10/2
Fundamental Frequency :	5190 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	TX CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
10380.00	H	Peak	29.72	20.95	50.68	68.3	-17.62

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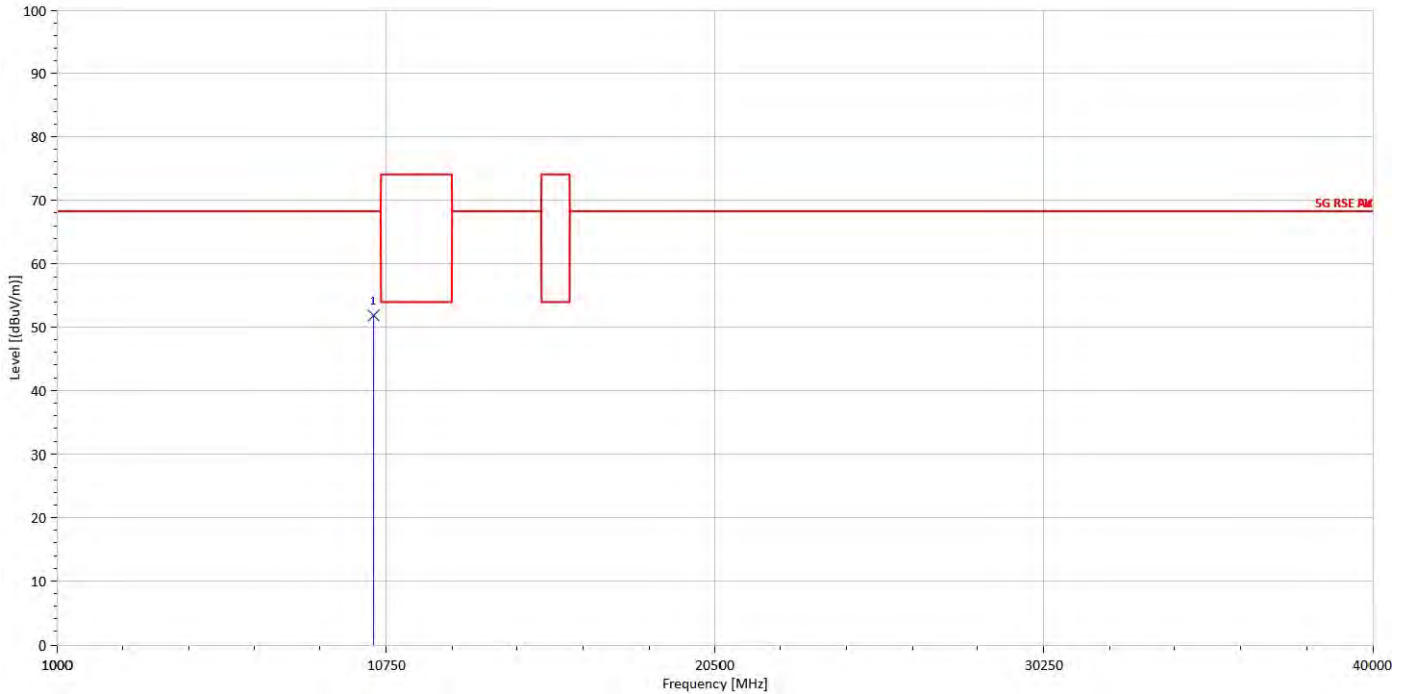
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Operation Mode : 802.11n40B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5190 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH LOW      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10380.00	H	Peak	30.91	20.95	51.87	68.3	-16.43

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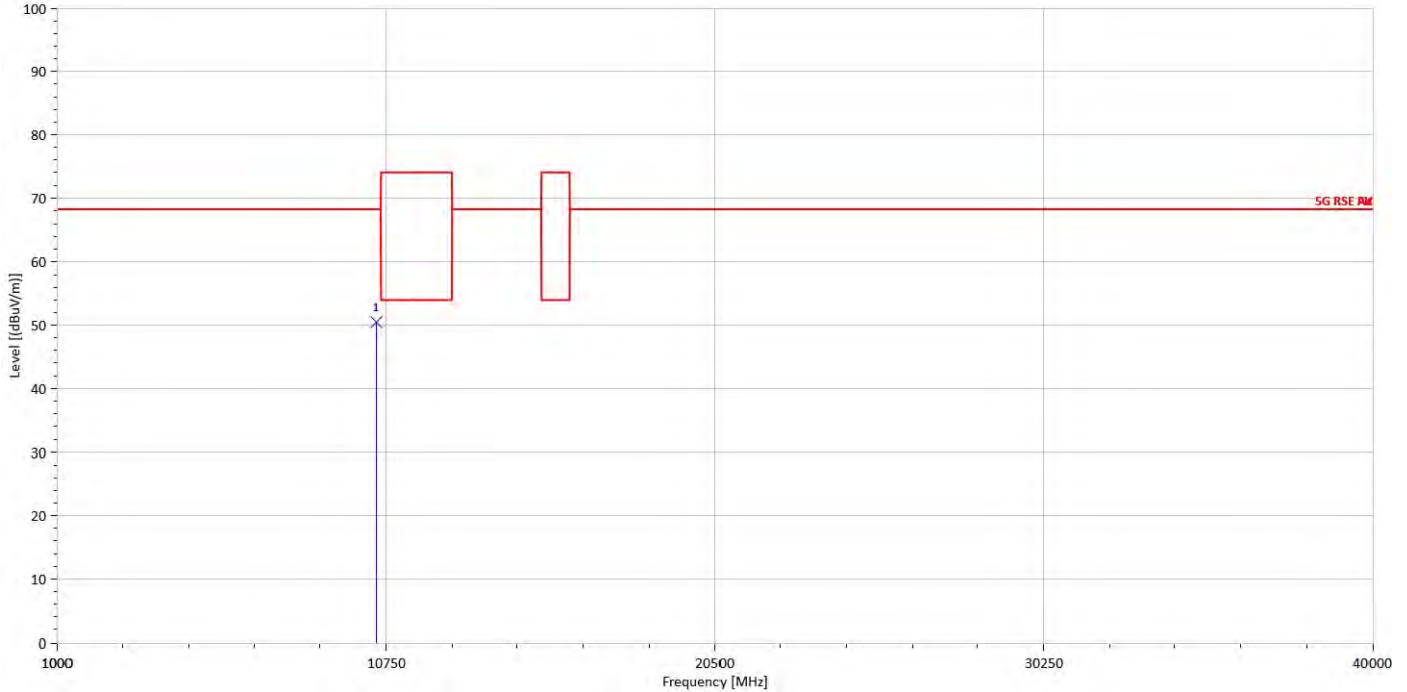
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Operation Mode : 802.11n40B1      Test Date : 2017/10/2  
 Fundamental Frequency : 5230 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH HIGH      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10460.00	H	Peak	29.54	20.95	50.49	68.3	-17.81

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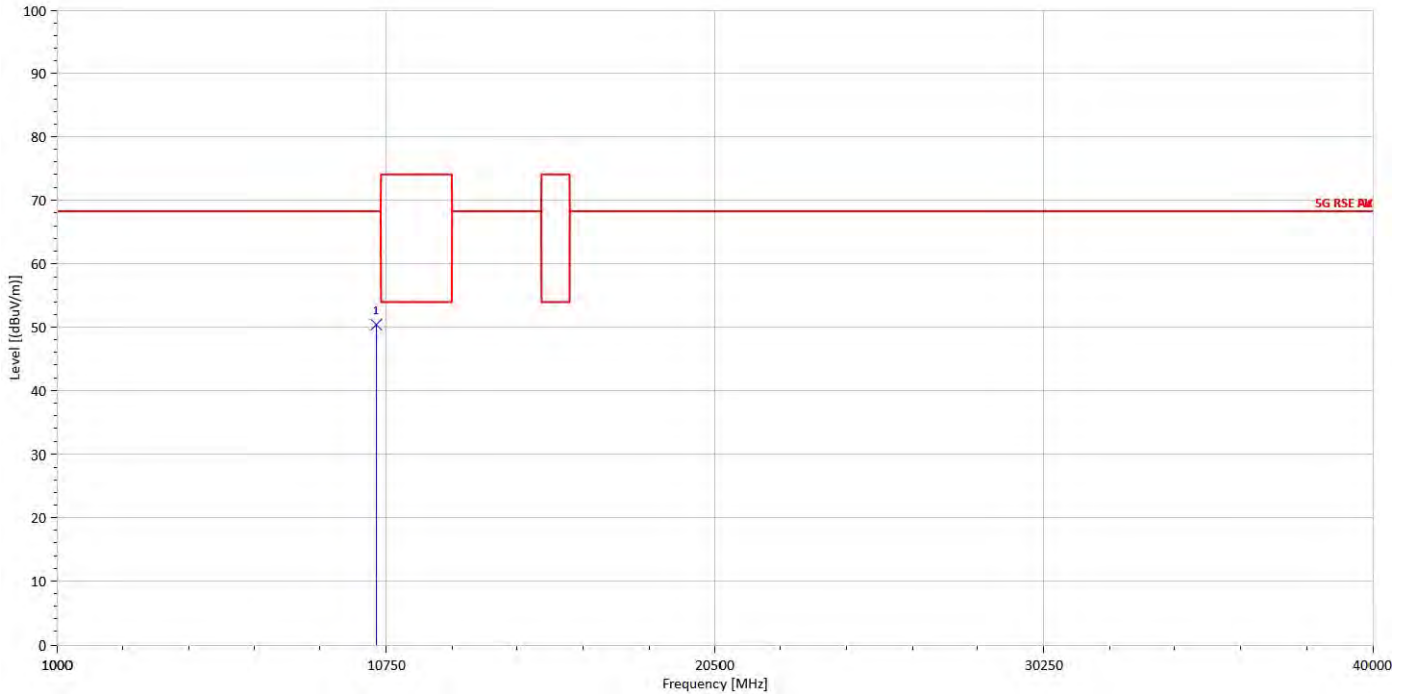
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 Fundamental Frequency : 5230 MHz      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH HIGH      Test Engineer : Enzo  
 EUT Pol. : H      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
10460.00	H	Peak	29.46	20.95	50.42	68.3	-17.88

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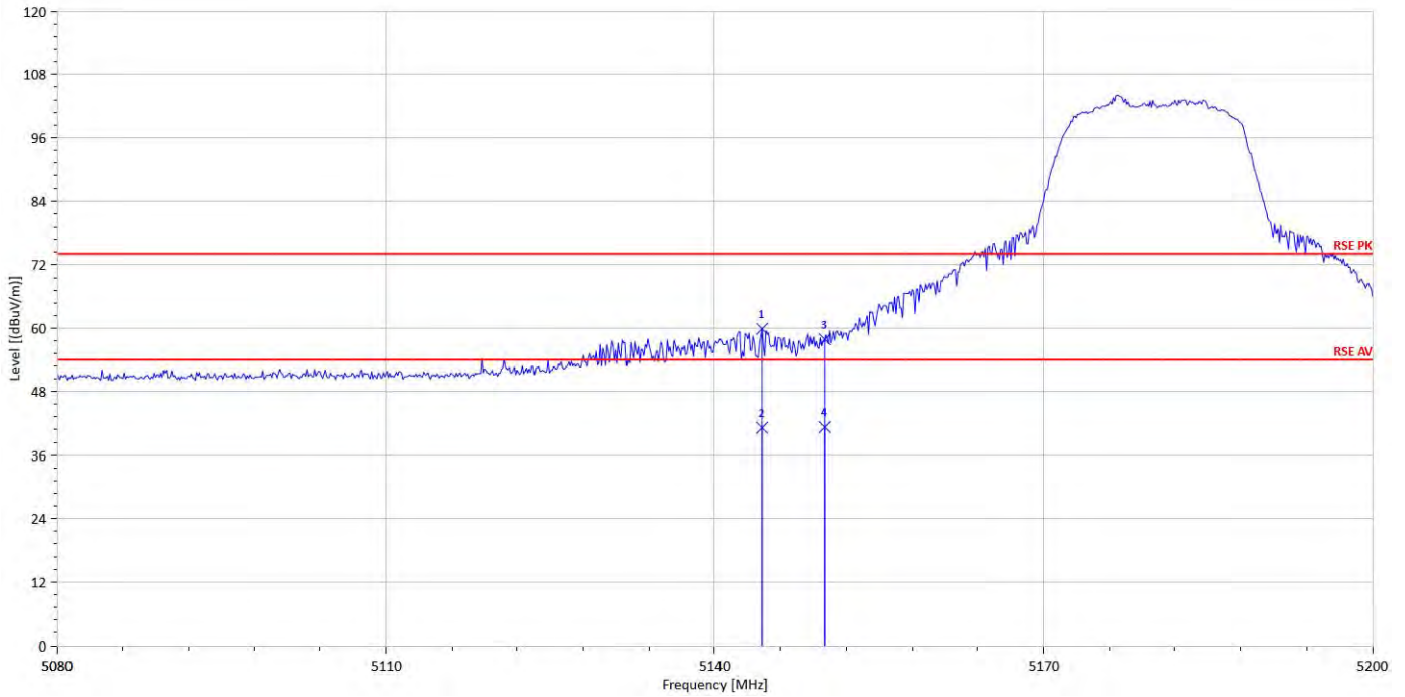
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**Band edge falling to restricted band  
802.11a mode**

Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
5144.32	S	Peak	51.73	8.16	59.89	74	-14.11
5144.32	S	Average	33.01	8.16	41.17	54	-12.83
5150.00	E	Peak	49.71	8.19	57.90	74	-16.10
5150.00	E	Average	33.11	8.19	41.30	54	-12.70

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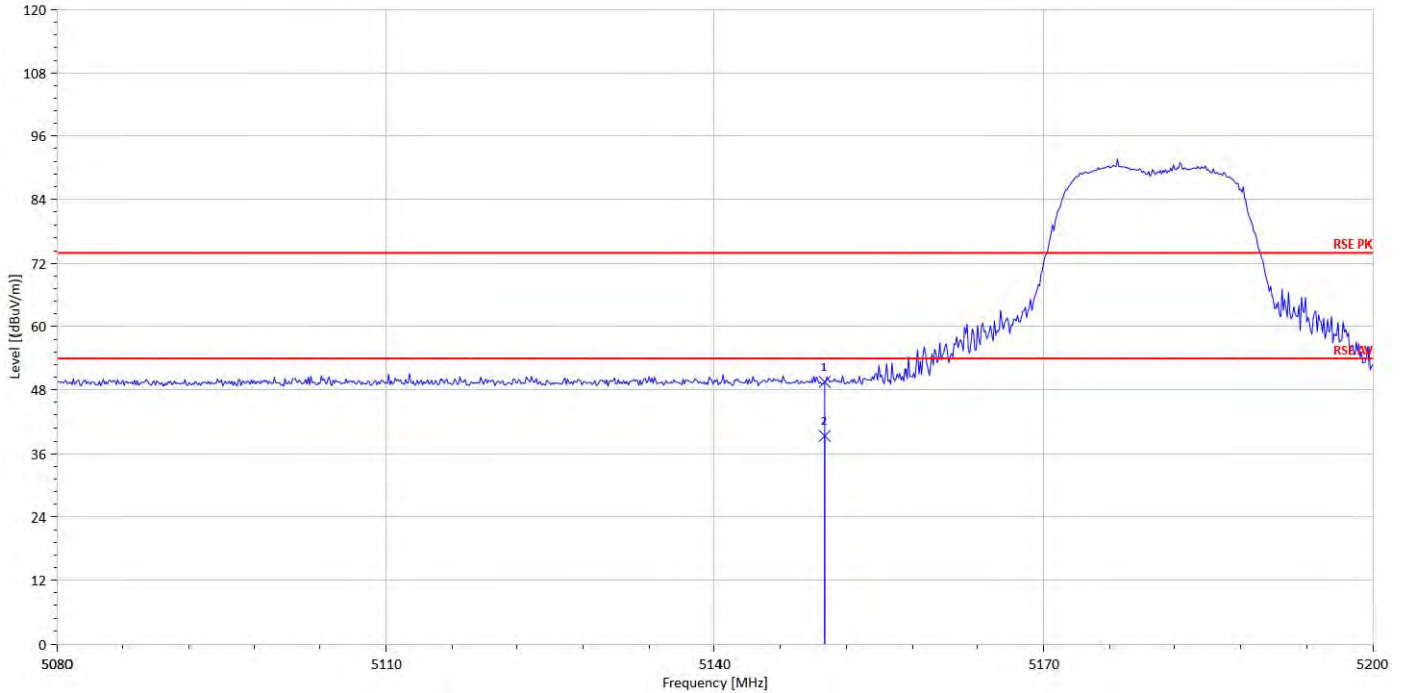
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Operation Mode :	802.11aB1	Test Date :	2017/10/2
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
5150.00	E	Peak	41.34	8.19	49.53	74	-24.47
5150.00	E	Average	31.21	8.19	39.40	54	-14.60

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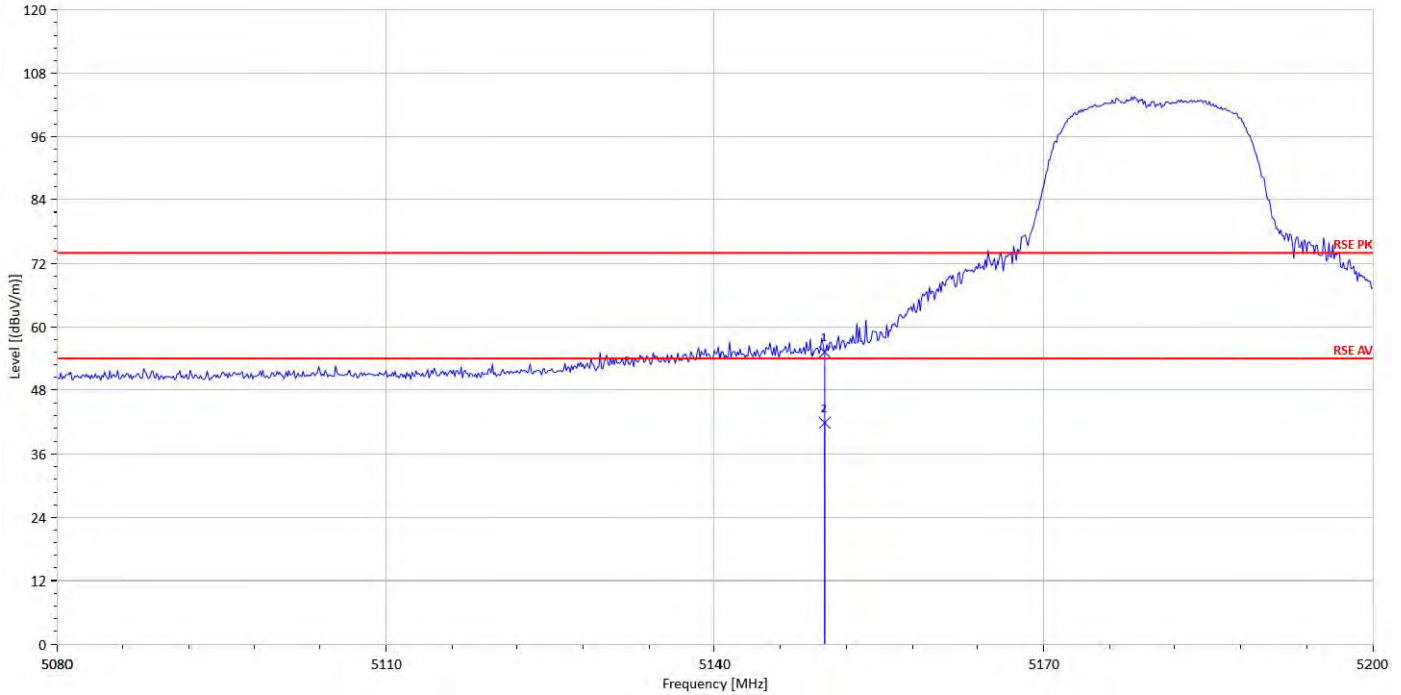
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**802.11n20 HT mode**

Operation Mode :	802.11n20B1	Test Date :	2017/10/2
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
5150.00	E	Peak	47.05	8.19	55.25	74	-18.75
5150.00	E	Average	33.71	8.19	41.90	54	-12.10

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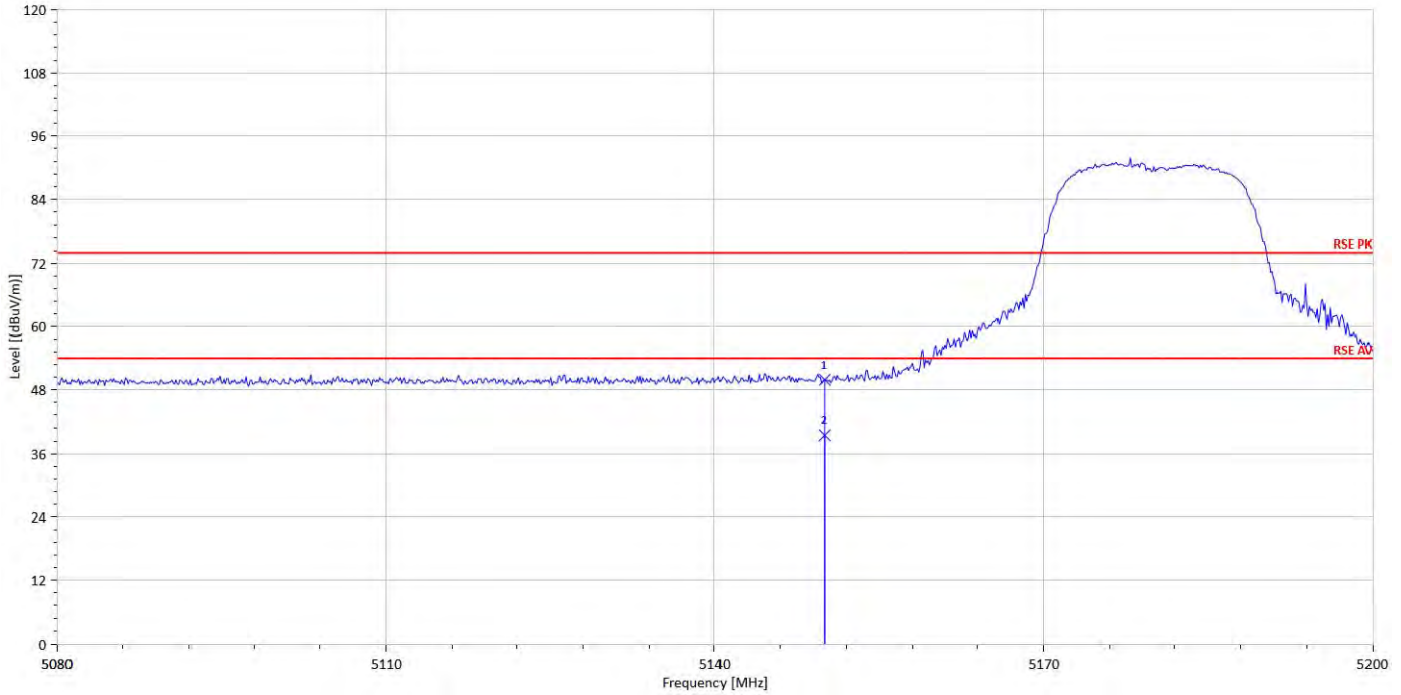
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Operation Mode :	802.11n20B1	Test Date :	2017/10/2
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
5150.00	E	Peak	41.75	8.19	49.94	74	-24.06
5150.00	E	Average	31.32	8.19	39.51	54	-14.49

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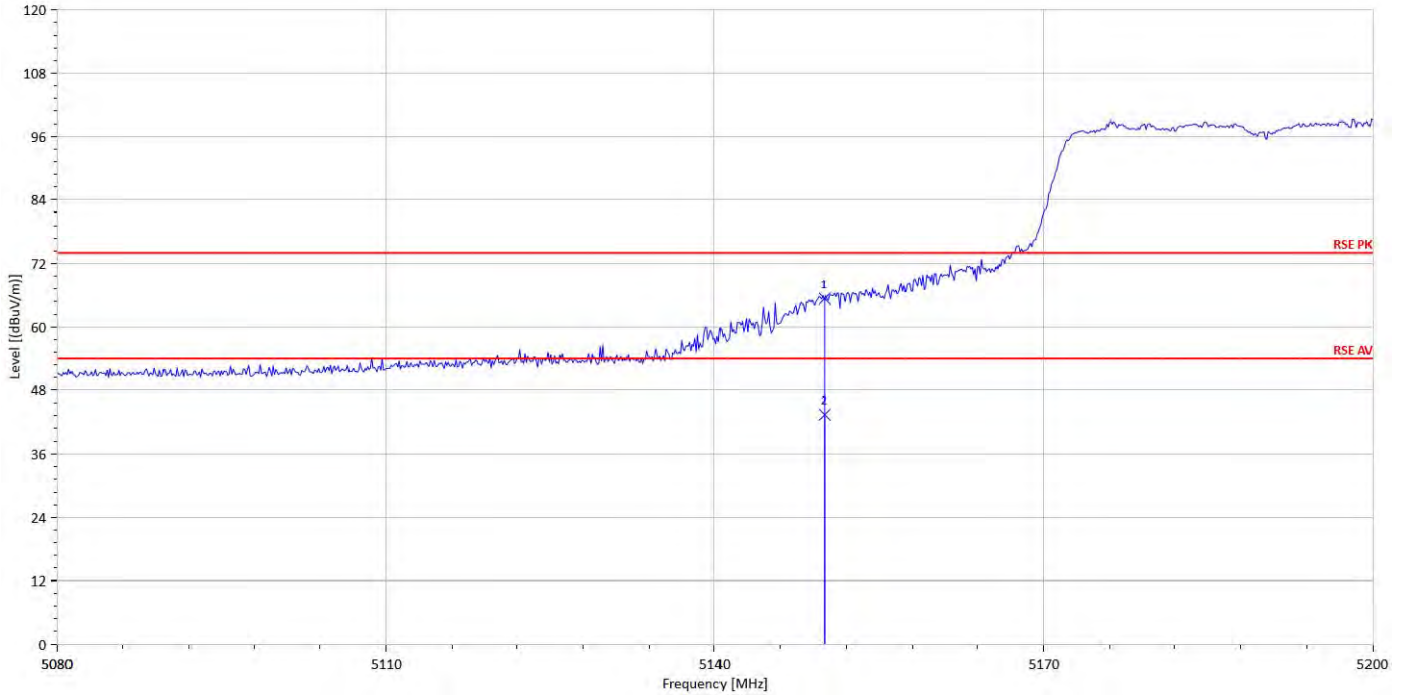
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### 802.11n40 HT mode

Operation Mode :	802.11n40B1	Test Date :	2017/10/2
Fundamental Frequency :	5190 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
5150.00	E	Peak	57.13	8.19	65.32	74	-8.68
5150.00	E	Average	35.25	8.19	43.44	54	-10.56

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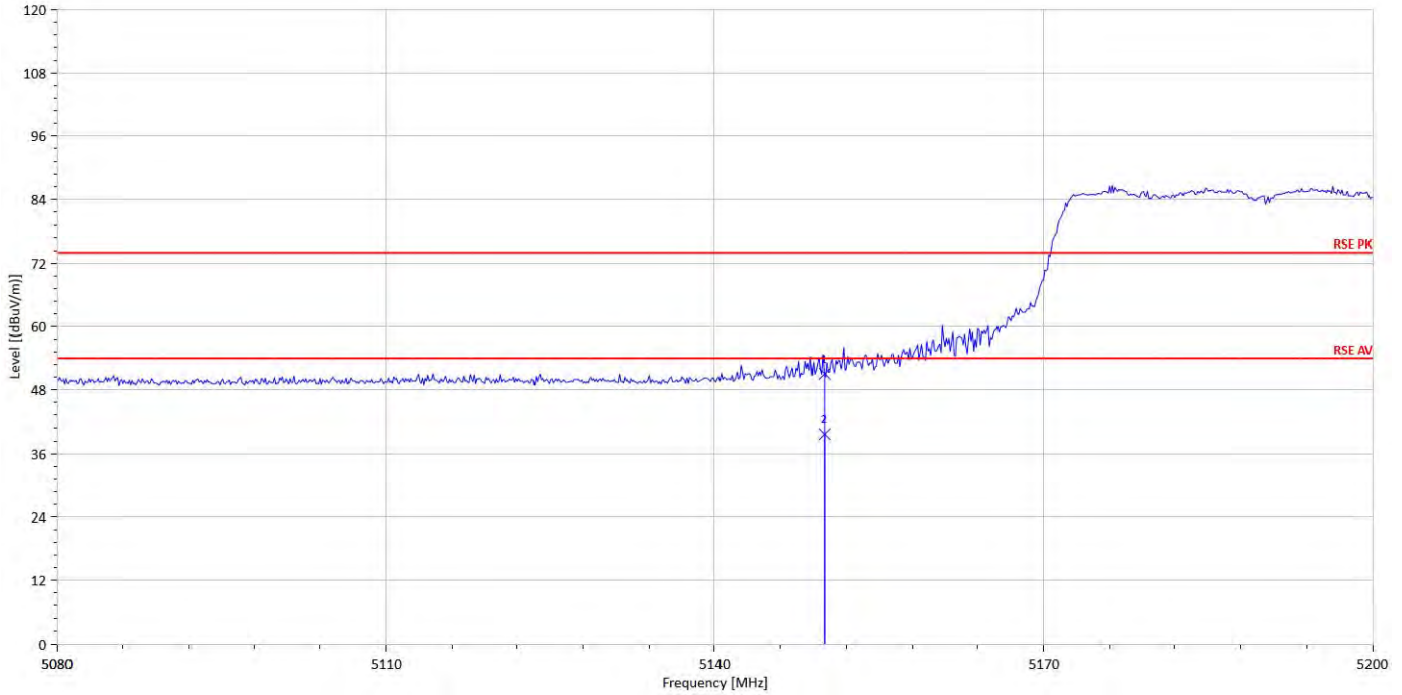
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Operation Mode :	802.11n40B1	Test Date :	2017/10/2
Fundamental Frequency :	5190 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
5150.00	E	Peak	42.88	8.19	51.07	74	-22.93
5150.00	E	Average	31.51	8.19	39.70	54	-14.30

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## 12 TRANSMISSION IN THE ABSENCE OF DATA

### 12.1 Standard Applicable

According to §15.407(c)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

### 12.2 Result

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ASK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

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## 13 FREQUENCY STABILITY

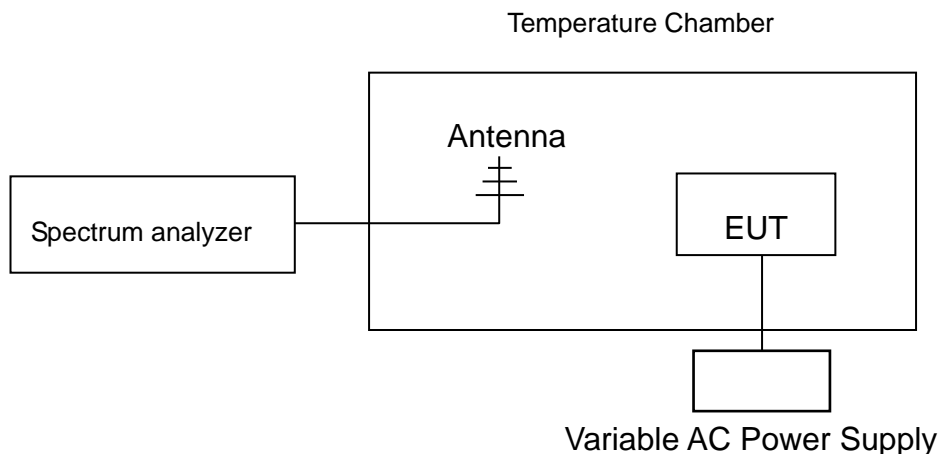
### 13.1 Standard Applicable

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 13.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

### 13.3 Test SET-UP



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### 13.4 Measurement Equipment Used:

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/13/2017	06/12/2018

### 13.5 Measurement Result

Operation Mode	802.11 a	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	36	5180	5,180.03000	-0.00000579
		44	5220	5,220.03000	-0.00000575
		48	5240	5,240.03000	-0.00000573
	11.4V	36	5180	5,180.03000	-0.00000579
		44	5220	5,220.03000	-0.00000575
		48	5240	5,240.03000	-0.00000573
25 °C	12V	36	5180	5,180.03000	-0.00000579
		44	5220	5,220.03000	-0.00000575
		48	5240	5,240.03000	-0.00000573
35 °C	12.6V	36	5180	5,180.03000	-0.00000579
		44	5220	5,220.03000	-0.00000575
		48	5240	5,240.03000	-0.00000573
	11.4V	36	5180	5,180.03000	-0.00000579
		44	5220	5,220.03000	-0.00000575
		48	5240	5,240.03000	-0.00000573

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Operation Mode	802.11 a	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	36	5180	5,179.92857	0.00001379
		44	5220	5,219.91310	0.00001665
		48	5240	5,239.92965	0.00001343
	11.4V	36	5180	5,179.92097	0.00001526
		44	5220	5,219.96431	0.00000684
		48	5240	5,239.99528	0.00000090
25 °C	12V	36	5180	5,179.90652	0.00001805
		44	5220	5,219.99865	0.00000026
		48	5240	5,239.99943	0.00000011
35 °C	12.6V	36	5180	5,179.94950	0.00000975
		44	5220	5,219.90776	0.00001767
		48	5240	5,239.92788	0.00001376
	11.4V	36	5180	5,179.92161	0.00001513
		44	5220	5,219.97491	0.00000481
		48	5240	5,239.93143	0.00001309

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Operation Mode	802.11 a	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	36	5180	5,179.91836	0.00001576
		44	5220	5,219.93683	0.00001210
		48	5240	5,239.93263	0.00001286
	11.4V	36	5180	5,179.95411	0.00000886
		44	5220	5,219.98948	0.00000202
		48	5240	5,239.98790	0.00000231
25 °C	12V	36	5180	5,179.90307	0.00001871
		44	5220	5,219.90295	0.00001859
		48	5240	5,239.96272	0.00000711
35 °C	12.6V	36	5180	5,179.98964	0.00000200
		44	5220	5,219.91318	0.00001663
		48	5240	5,239.95171	0.00000922
	11.4V	36	5180	5,179.90711	0.00001793
		44	5220	5,219.94932	0.00000971
		48	5240	5,239.97546	0.00000468

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Operation Mode	802.11 a	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	36	5180	5,179.96303	0.0000714
		44	5220	5,219.91144	0.0001697
		48	5240	5,239.93045	0.0001327
	11.4V	36	5180	5,179.99844	0.0000030
		44	5220	5,219.92198	0.0001495
		48	5240	5,239.99958	0.0000008
25 °C	12V	36	5180	5,179.90753	0.0001785
		44	5220	5,219.90318	0.0001855
		48	5240	5,239.93932	0.0001158
35 °C	12.6V	36	5180	5,179.98108	0.0000365
		44	5220	5,219.90424	0.0001834
		48	5240	5,239.92460	0.0001439
	11.4V	36	5180	5,179.93400	0.0001274
		44	5220	5,219.92537	0.0001430
		48	5240	5,239.95443	0.0000870

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Operation Mode	802.11 n_HT40	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	38	5190	5,190.05000	-0.00000963
		46	5230	5,230.05000	-0.00000956
	11.4V	38	5190	5,190.05000	-0.00000963
		46	5230	5,230.05000	-0.00000956
25 °C	12V	38	5190	5,190.05000	-0.00000963
		46	5230	5,230.05000	-0.00000956
35 °C	12.6V	38	5190	5,190.05000	-0.00000963
		46	5230	5,230.05000	-0.00000956
	11.4V	38	5190	5,190.05000	-0.00000963
		46	5230	5,230.05000	-0.00000956

Operation Mode	802.11 n_HT40	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	38	5190	5,189.92147	0.00001513
		46	5230	5,229.95426	0.00000875
	11.4V	38	5190	5,189.99217	0.00000151
		46	5230	5,229.98386	0.00000309
25 °C	12V	38	5190	5,189.97858	0.00000413
		46	5230	5,229.92957	0.00001347
35 °C	12.6V	38	5190	5,189.95505	0.00000866
		46	5230	5,229.92993	0.00001340
	11.4V	38	5190	5,189.93142	0.00001321
		46	5230	5,229.95937	0.00000777

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Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	38	5190	5,189.94141	0.00001129
		46	5230	5,229.93945	0.00001158
	11.4V	38	5190	5,189.96160	0.00000740
		46	5230	5,229.94749	0.00001004
25 °C	12V	38	5190	5,189.97038	0.00000571
		46	5230	5,229.92755	0.00001385
35 °C	12.6V	38	5190	5,189.95778	0.00000813
		46	5230	5,229.95086	0.00000940
	11.4V	38	5190	5,189.97935	0.00000398
		46	5230	5,229.94321	0.00001086

Operation Mode	802.11 n_HT40	Test Date	2017.09.22
Temperature	:23 °C	Test By	Anthony
Humidity	:68 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
5 °C	12.6V	38	5190	5,189.93737	0.00001207
		46	5230	5,229.96303	0.00000707
	11.4V	38	5190	5,189.94759	0.00001010
		46	5230	5,229.93356	0.00001270
25 °C	12V	38	5190	5,189.93827	0.00001189
		46	5230	5,229.98947	0.00000201
35 °C	12.6V	38	5190	5,189.97812	0.00000422
		46	5230	5,229.90324	0.00001850
	11.4V	38	5190	5,189.95868	0.00000796
		46	5230	5,229.92552	0.00001424

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## 14 ANTENNA REQUIREMENT

### 14.1 Standard Applicable

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

According to §15.407, If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 14.2 Antenna Connected Construction

PCB antenna designs are used.

The antenna is designed with permanent attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

*~ End of Report ~*

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