

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

**Product Name:** E-Pos mini

**Brand Name:** e-taxfree

**Model No.:** TF1

**Model Difference:** N/A

**FCC ID:** 2AF3A-TF1

**Report No.:** ER/2015/90087

**Issue Date:** Oct. 08, 2015

**FCC Rule Part:** §15.247, Cat: DTS

**Prepared for:** e-Taxfree Nordic Oy  
Tammasaarenlaituri 3, 00180 Helsinki,  
Finland

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
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## VERIFICATION OF COMPLIANCE

**Applicant:** e-Taxfree Nordic Oy  
Tammasaarenlaituri 3, 00180 Helsinki, Finland

**Product Name:** E-Pos mini

**Brand Name:** e-taxfree

**Model No.:** TF1

**Model Difference:** N/A

**FCC ID:** 2AF3A-TF1

**File Number:** ER/2015/90087

**Date of test:** Sep. 21, 2015 ~ Oct. 08, 2015

**Date of EUT Received:** Sep. 21, 2015

### 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.

**Test By:**

*Marcus Tseng*

**Date**

Oct. 08, 2015

*Marcus Tseng / Engineer*

**Prepared By:**

*Karen Huang*

**Date**

Oct. 08, 2015

*Karen Huang / Clerk*

**Approved By:**

*Jim Chang*

**Date**

Oct. 08, 2015

*Jim Chang / Asst. Manager*

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## Revision History

Report Number	Revision	Description	Issue Date
ER/2015/90087	Rev.00	Initial creation of document	Oct. 08, 2015

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## 1 GENERAL INFORMATION

### 1.1 Product description

General:

Product Name:	E-Pos mini	
Brand Name:	e-taxfree	
Model No.:	TF1	
Model Difference:	N/A	
Product SW/HW version:	4.4 / 4.0	
Radio SW/HW version:	N/A	
Test SW Version:	N/A	
RF power setting in TEST SW:	N/A	
Power Supply:	5V from AC/DC Adapter	
	Adapter:	Model No.: FSP015-DPAN2, Supplier: FSP GROUP INC.

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### Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.0 Single mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	-2.82dBm (Peak)
Antenna Designation:	PCB Antenna, Gain:2dBi

### WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11b/g	2412-2462	11	b: 18.65dBm g: 21.14dBm	DSSS, OFDM
11n	HT20 2412-2462	11	HT20: 21.21dBm	OFDM
11n	HT40 2422-2452	7	HT40: 21.16dBm	OFDM
Antenna Designation:		PCB Antenna, Gain: 2dBi		
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM		
Transition Rate:		802.11 b: up to 11 Mbps; 802.11 g: up to 54 Mbps 802.11 n_20MHz: up to 72.2Mbps 802.11 n_40MHz: up to 135Mbps		

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## 1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is E-Pos mini supporting, GPRS / WCDMA, Wi-Fi 802.11abgn, Bluetooth features, and below is details of information

Product Feature	
Product Name:	E-Pos mini
Brand Name:	e-taxfree
Model No.:	TF1
Model Difference:	N/A
FCC ID	2AF3A-TF1
GPRS / EGPRS Multi Slot Class	Class 12
WCDMA Operating Band(s)	FDD Band V
WCDMA Rel. Version	Release 8
Wi-Fi Specification	802.11a/b/g/n
Bluetooth Version	V4.0 Single mode

**Note:** The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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### 1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance V03r03

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the certification procedure.

### 1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 990257

### 1.5 Special Accessories

There are no special accessories used while test was conducted.

### 1.6 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 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. 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 plane. 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 hand-held 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.

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## 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.

For BLE:

Following shows an offset computation example with cable loss 0.5 dB

For WLAN:

Following shows an offset computation example with cable loss 0.5 dB and 10 dB attenuator.

Offset = RF cable loss (dB)+ attenuation factor(dB) =0.5 +10=10.5(dB)

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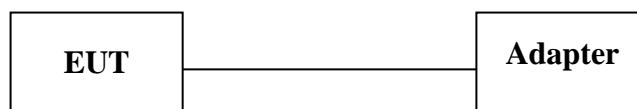
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## 2.5 Configuration of Tested System

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



**Fig. 2-2 Conduction Configuration**



**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.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2402 MHz	14	2430 MHz	28	2458 MHz
1	2404 MHz	15	2432 MHz	29	2460 MHz
2	2406 MHz	16	2434 MHz	30	2462 MHz
3	2408 MHz	17	2436 MHz	31	2464 MHz
4	2410 MHz	18	2438 MHz	32	2466 MHz
5	2412 MHz	19	2440 MHz	33	2468 MHz
6	2414 MHz	20	2442 MHz	34	2470 MHz
7	2416MHz	21	2444 MHz	35	2472 MHz
8	2418 MHz	22	2446 MHz	36	2474 MHz
9	2420 MHz	23	2448 MHz	37	2476 MHz
10	2422 MHz	24	2450 MHz	38	2478 MHz
11	2424 MHz	25	2452 MHz	39	2480 MHz

11 channels are provided for 802.11b, 802.11g and 802.11n\_HT20

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

7 channels are provided for 802.11n\_HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422 MHz	7	2442 MHz
4	2427 MHz	8	2447 MHz
5	2432 MHz	9	2452 MHz
6	2437 MHz		

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## 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 and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

### RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
Bluetooth LE	0 to 39	0,20,39	GFSK	1	MAIN
802.11g	1 to 11	1,6,11	OFDM	6	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
Bluetooth LE	0 to 39	0,20,39	GFSK	1	MAIN
802.11b	1 to 11	1, 6, 11	DSSS	1	MAIN
802.11g	1 to 11	1, 6, 11	OFDM	6	MAIN
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	6.5	MAIN
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	13.5	MAIN

#### Note:

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

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**ANTENNA PORT CONDUCTED MEASUREMENT:**

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
Bluetooth LE	0 to 39	0,20,39	GFSK	1	MAIN
802.11b	1 to 11	1, 6, 11	DSSS	1	MAIN
802.11g	1 to 11	1, 6, 11	OFDM	6	MAIN
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	6.5	MAIN
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	13.5	MAIN

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
6dB Bandwidth	+/- 51.33 Hz
100 kHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Peak Power Density	+/- 1.3 dB
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> )	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> )	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

According to §15.207, frequency range within 150kHz to 30MHz 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
<b>Note</b> 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	ESCI7	100760	05/04/2015	05/03/2016
LISN	SCHWARZ BECK	NSLK 8127	8127-649	05/15/2015	05/14/2016
LISN	FCC	FCC-LISN-50 /250-25-2-01	04034	03/13/2015	03/12/2016
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2014	11/25/2015

### 6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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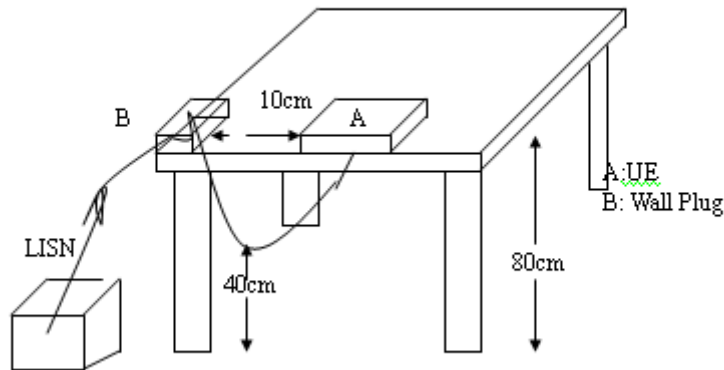
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## 6.4 Test SET-UP (Block Diagram of Configuration)



## 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

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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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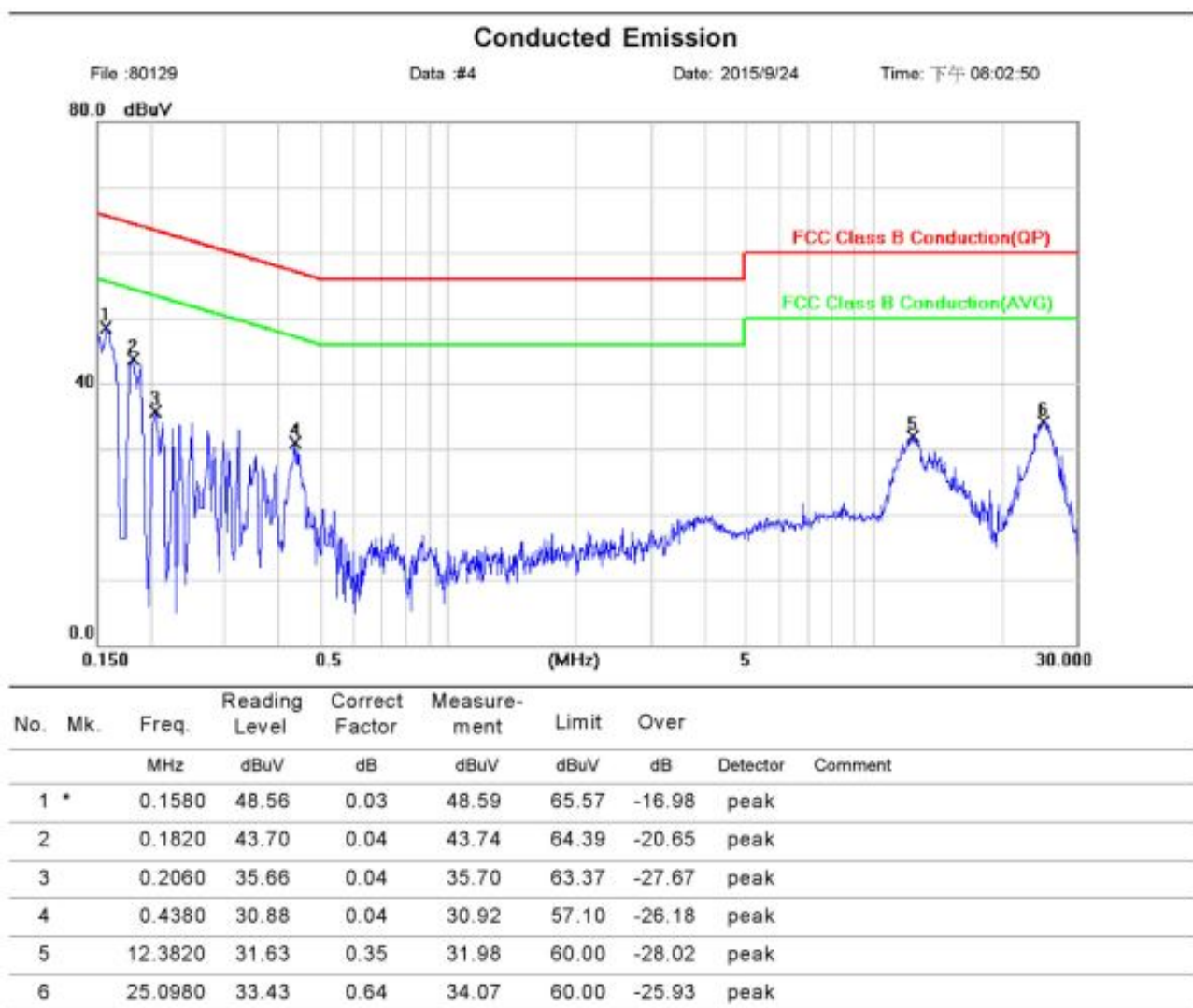
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## AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation			Test Date:	Sep. 24, 215
Temperature:	25	Humidity:	60%	Test By:	JJ
Adapter Model No.:	FSP015-DPAN2			Phase:	L1



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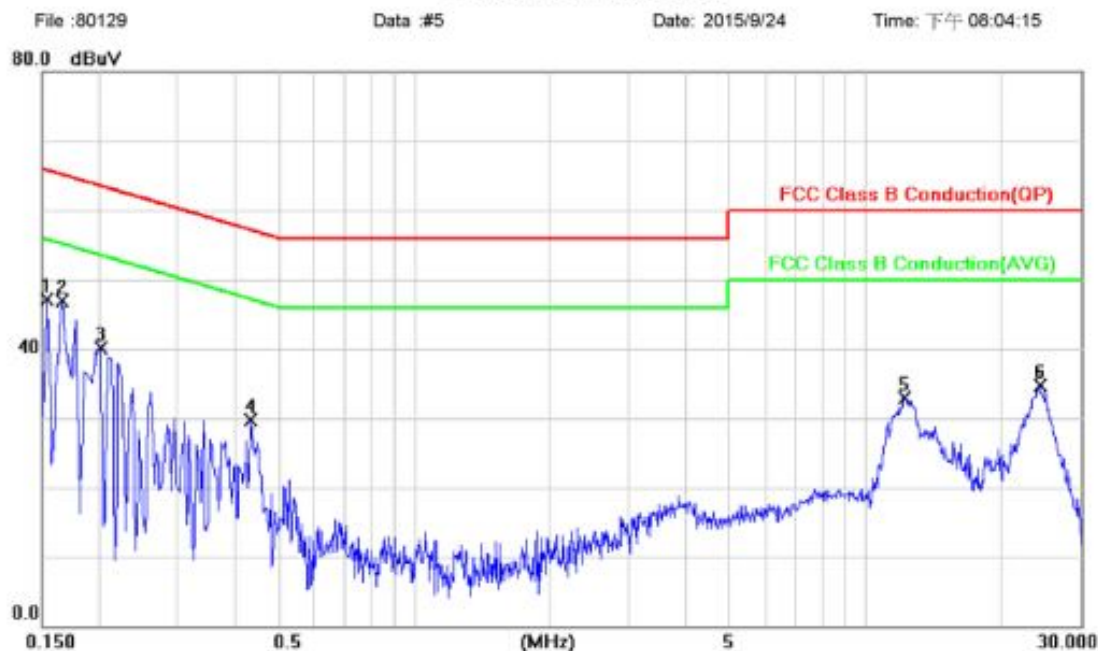
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Operation Mode:	Operation			Test Date:	Sep. 24, 215
Temperature:	25	Humidity:	60%	Test By:	JJ
Adapter Model No.:	FSP015-DPAN2			Phase:	N

## Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1540	46.97	0.06	47.03	65.78	-18.75	peak	
2	*	0.1660	46.85	0.06	46.91	65.16	-18.25	peak	
3		0.2020	39.97	0.06	40.03	63.53	-23.50	peak	
4		0.4340	29.56	0.06	29.62	57.18	-27.56	peak	
5		12.1900	32.67	0.31	32.98	60.00	-27.02	peak	
6		24.3620	34.24	0.46	34.70	60.00	-25.30	peak	

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## 7 DUTY CYCLE OF 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:

	Duty Cycle	Duty Factor (dB)
Bluetooth LE	60.55%	2.18
802.11b	99.99%	0
802.11g	88.89%	0.51
802.11n_20	88.27%	0.54
802.11n_40	79.11%	1.02

Duty Cycle Factor:  $10 * \log (0.6055/\text{Duty cycle}) = 2.18$

$10 * \log (0.9999/\text{Duty cycle}) = 0$

$10 * \log (0.8889/\text{Duty cycle}) = 0.51$

$10 * \log (0.8827/\text{Duty cycle}) = 0.54$

$10 * \log (0.7911/\text{Duty cycle}) = 1.02$

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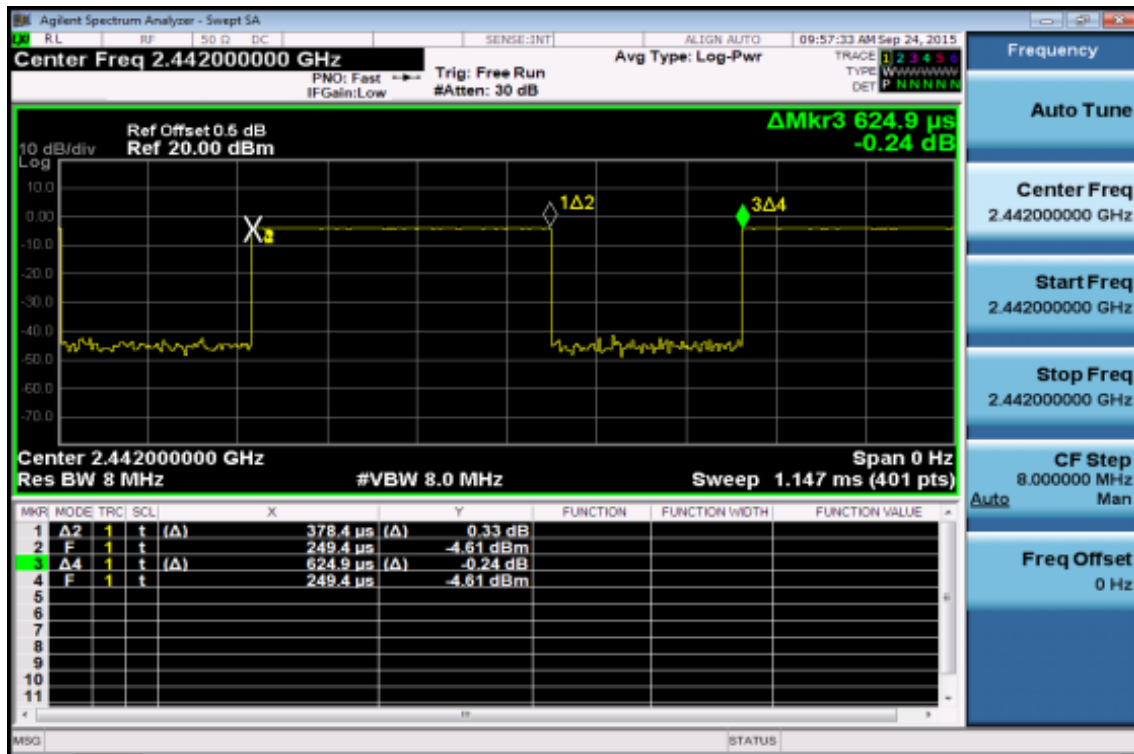
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## DUTY CYCLE TEST SIGNAL Measurement Result

### Bluetooth LE



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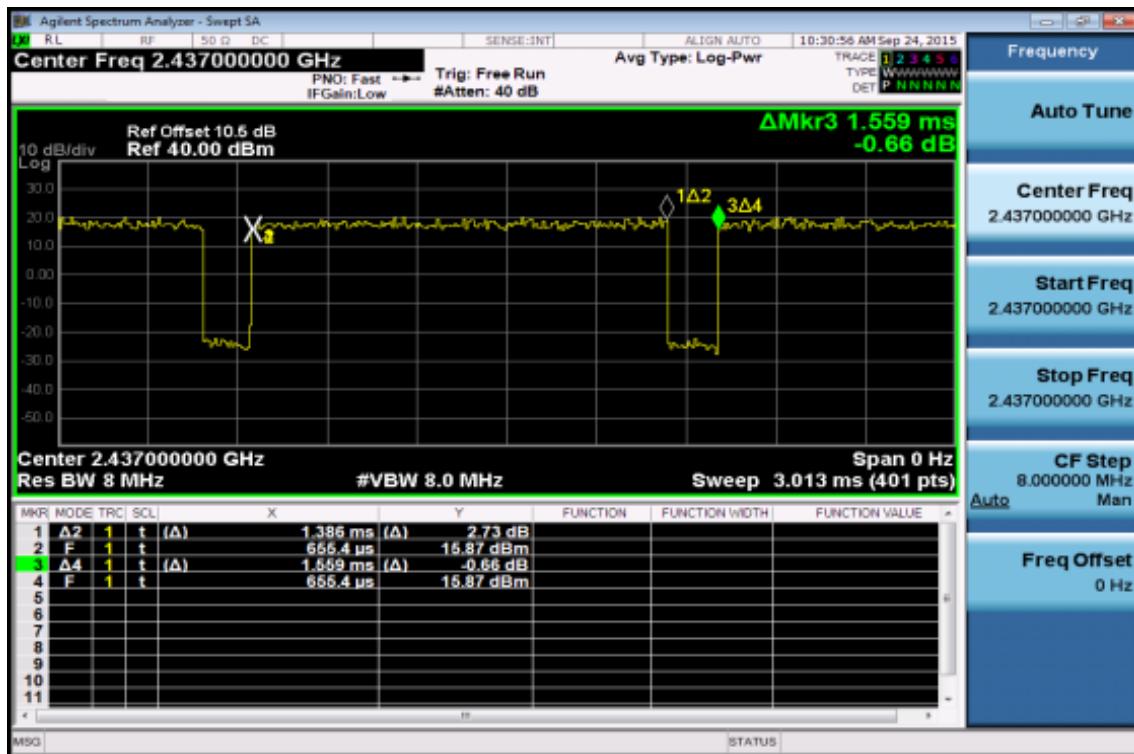
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## 802.11 b



## 802.11 g



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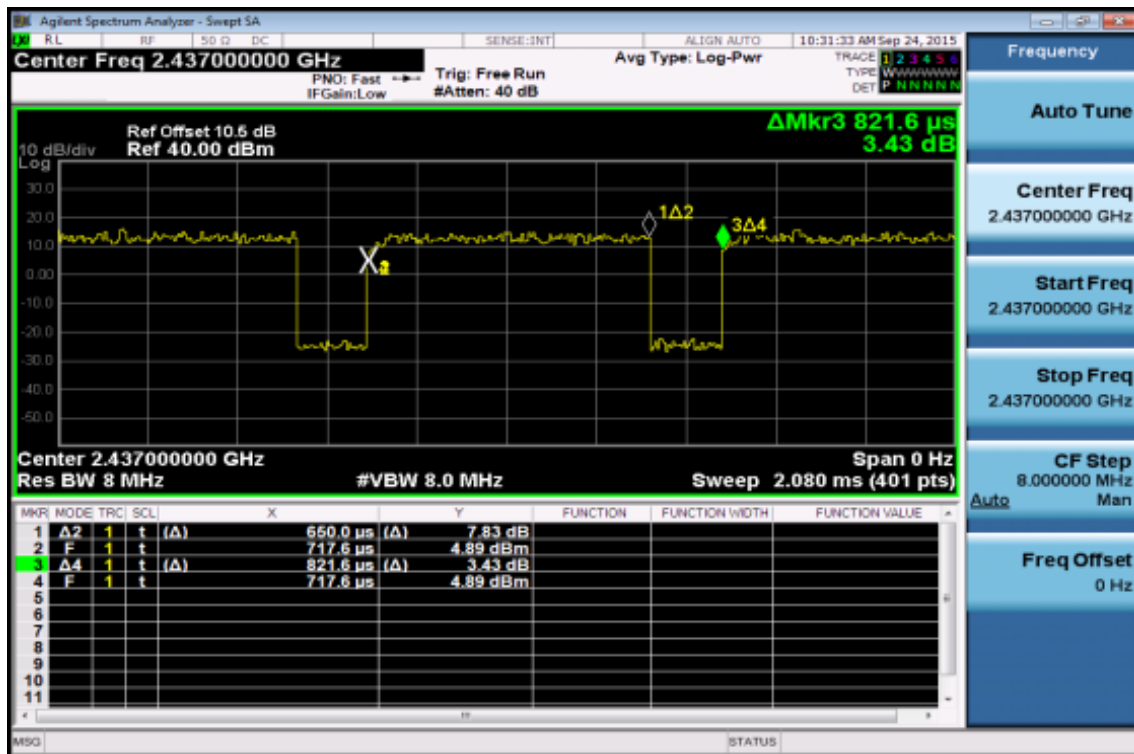
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## 802.11 n\_20 MHz



## 802.11 n\_40 MHz



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## 8 PEAK OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

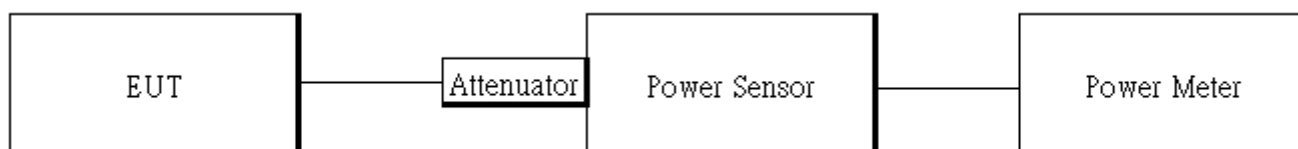
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

### 8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015
DC Block	PASTERNAK	PE8210	RF29	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015

### 8.3 Test Set-up

Power Meter:



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## 8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter .

### Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Spectrum or Power Meter.
5. Repeat above procedures until all frequency of interest measured was complete.

## 8.5 Measurement Result

### BLE mode:

CH	Frequency (MHz)	Peak Power Output(dBm)	Required Limit
0	2402	-2.82	1 Watt = 30 dBm
20	2442	-2.94	1 Watt = 30 dBm
39	2480	-3.52	1 Watt = 30 dBm

### Max. Rated Avg. Power + Max. Tolerance ( $\pm 0.02$ dBm): -5.55 dBm

CH	Frequency (MHz)	Average Power Output(dBm)	Required Limit
0	2402	-5.55	1 Watt = 30 dBm
20	2442	-5.67	1 Watt = 30 dBm
39	2480	-6.29	1 Watt = 30 dBm

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### 802.11b

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit
1	2412	1	18.65	73.28	1 Watt = 30 dBm
6	2437	1	18.5	70.79	1 Watt = 30 dBm
11	2462	1	18.45	69.98	1 Watt = 30 dBm

### Max. Rated Avg. Power + Max. Tolerance ( $\pm 0.02$ dBm): 16.04 dBm

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit
1	2412	1	16.04	40.18	1 Watt = 30 dBm
6	2437	1	15.81	38.11	1 Watt = 30 dBm
11	2462	1	15.61	36.39	1 Watt = 30 dBm

### 802.11g

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit
1	2412	6	20.91	123.31	1 Watt = 30 dBm
6	2437	6	21.14	130.02	1 Watt = 30 dBm
11	2462	6	21.01	126.18	1 Watt = 30 dBm

### Max. Rated Avg. Power + Max. Tolerance ( $\pm 0.02$ dBm): 12.7 dBm

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit
1	2412	6	11.96	15.70	1 Watt = 30 dBm
6	2437	6	12.7	18.62	1 Watt = 30 dBm
11	2462	6	11.58	14.39	1 Watt = 30 dBm

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### 802.11n\_HT20

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit
1	2412	MCS0	20.87	122.18	1 Watt = 30 dBm
6	2437	MCS0	<b>21.21</b>	132.13	1 Watt = 30 dBm
11	2462	MCS0	21.06	127.64	1 Watt = 30 dBm

### Max. Rated Avg. Power + Max. Tolerance ( $\pm 0.02$ dBm): 12.67 dBm

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit
1	2422	MCS0	11.85	15.31	1 Watt = 30 dBm
6	2437	MCS0	12.67	18.49	1 Watt = 30 dBm
11	2452	MCS0	11.46	14.00	1 Watt = 30 dBm

### 802.11n\_HT40

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit
1	2422	MCS0	20.75	118.85	1 Watt = 30 dBm
6	2437	MCS0	<b>21.16</b>	130.62	1 Watt = 30 dBm
11	2452	MCS0	20.77	119.40	1 Watt = 30 dBm

### Max. Rated Avg. Power + Max. Tolerance ( $\pm 0.01$ dBm): 11.17 dBm

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit
1	2422	MCS0	9.17	8.26	1 Watt = 30 dBm
6	2437	MCS0	11.17	13.09	1 Watt = 30 dBm
11	2452	MCS0	8.97	7.89	1 Watt = 30 dBm

**\* Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.**

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## 9 6dB BANDWIDTH

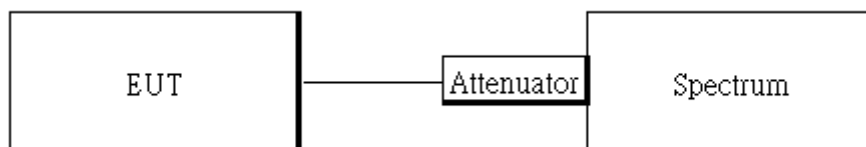
### 9.1 Standard Applicable

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

### 9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015
DC Block	PASTERNAK	PE8210	RF29	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015

### 9.3 Test Set-up



### 9.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detec=Peak, Sweep=auto.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency of interest measured was complete.

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## 9.5 Measurement Result

### BLE mode

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (MHz)	Result
2402	0.70	> 0.5	PASS
2442	0.67	> 0.5	PASS
2480	0.67	> 0.5	PASS

### 802.11 b/g/n

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
802.11b			
2412	8160	> 500	PASS
2437	8620	> 500	PASS
2462	8590	> 500	PASS
802.11g			
2412	15040	> 500	PASS
2437	15060	> 500	PASS
2462	14460	> 500	PASS
802.11n_HT20			
2412	14960	> 500	PASS
2437	14320	> 500	PASS
2462	16900	> 500	PASS
802.11n_HT40			
2412	35170	> 500	PASS
2437	35070	> 500	PASS
2462	33760	> 500	PASS

*\*Refer to next page for plots*

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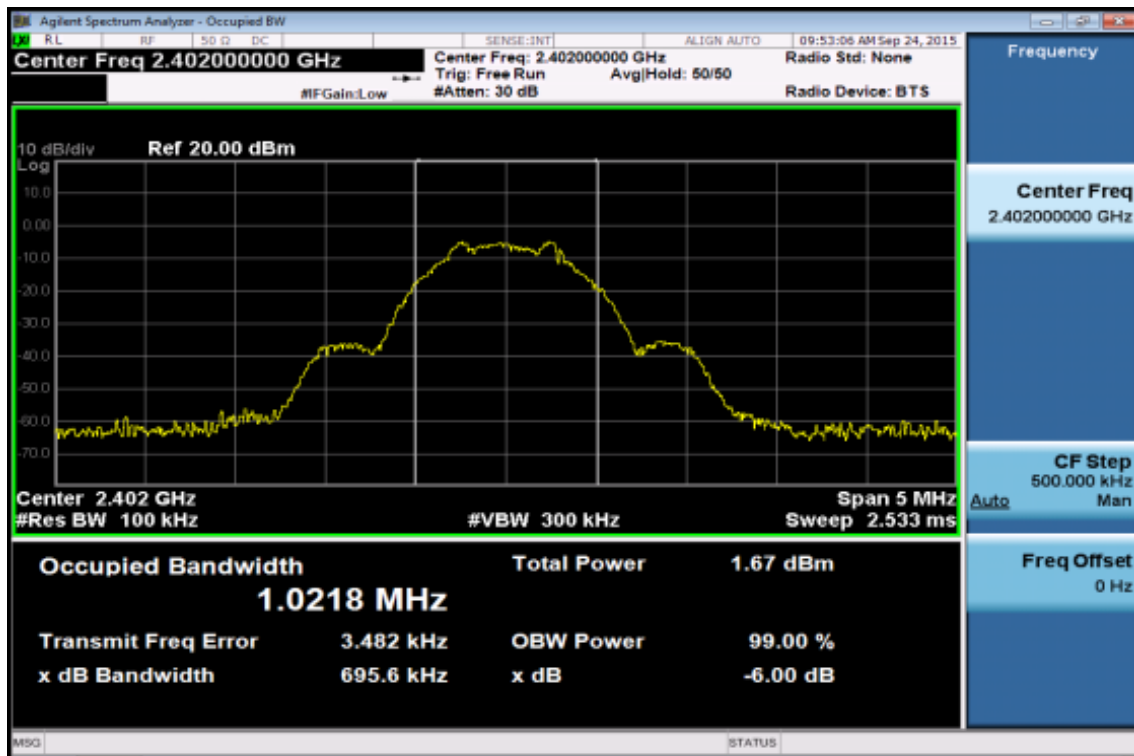
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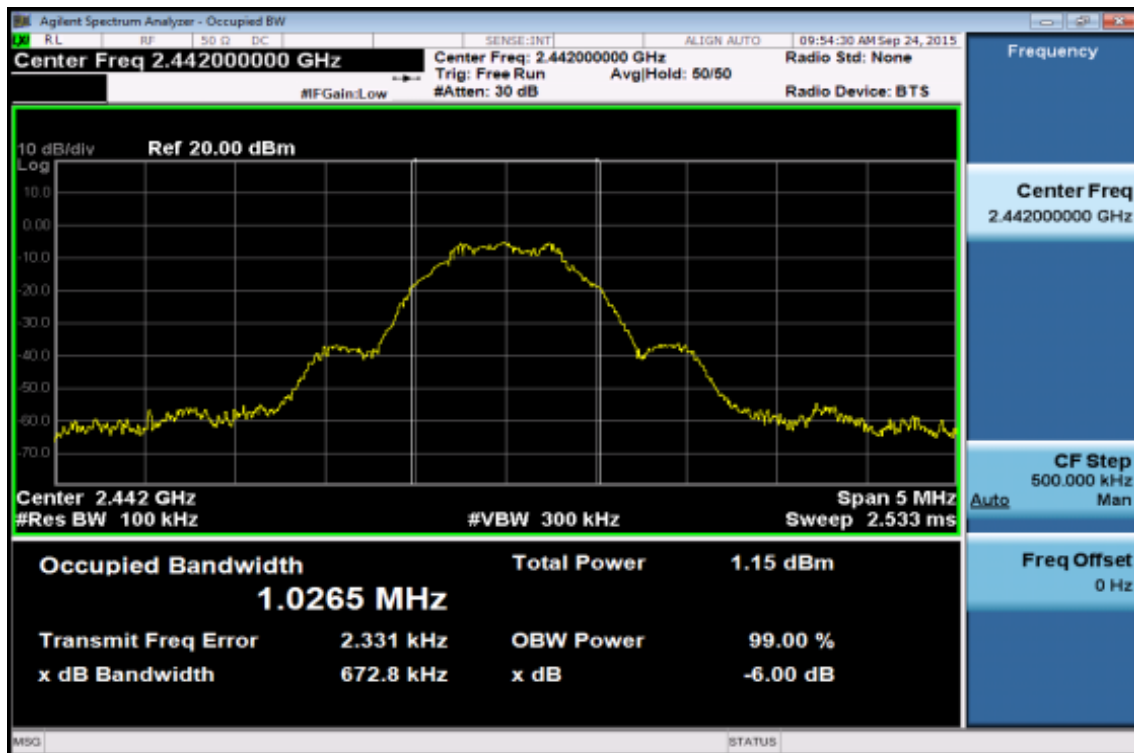
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## BLE mode

## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid



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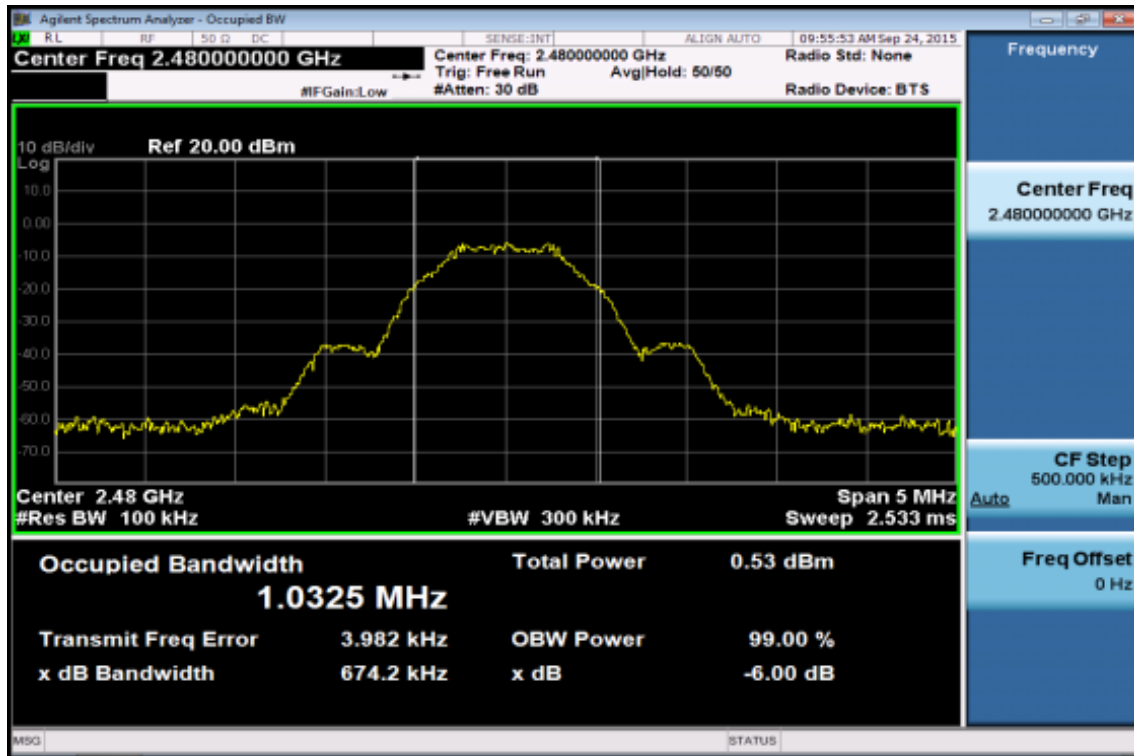
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## 6dB Band Width Test Data CH-High



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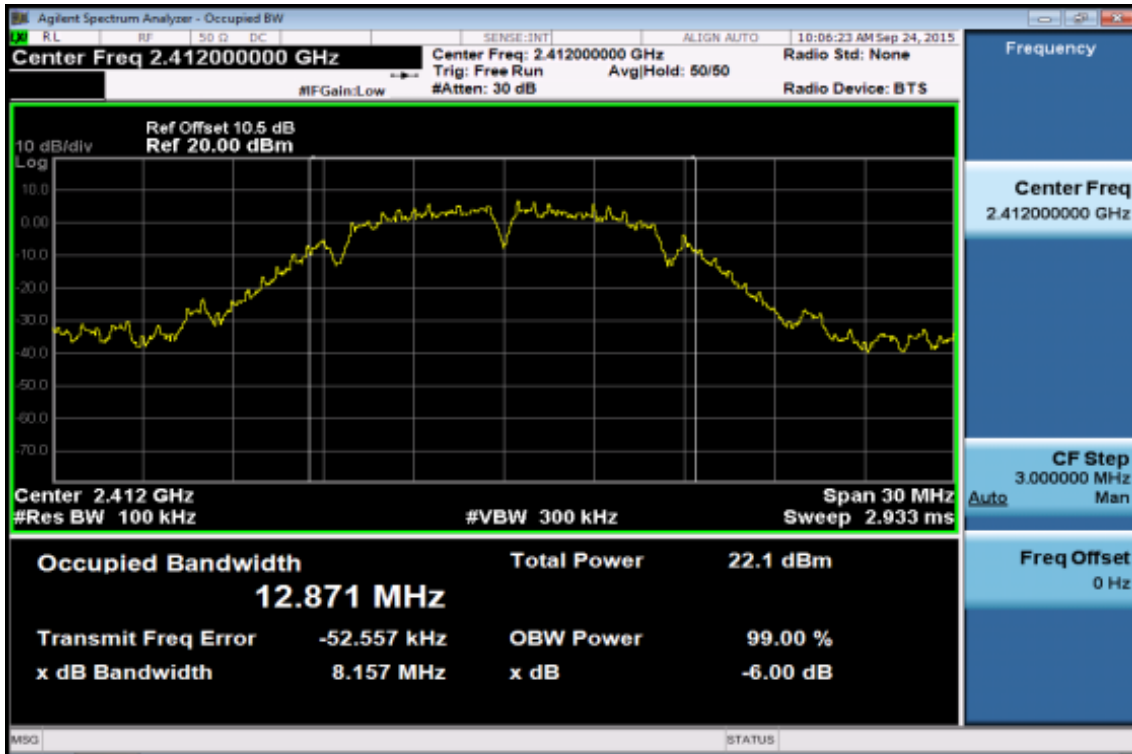
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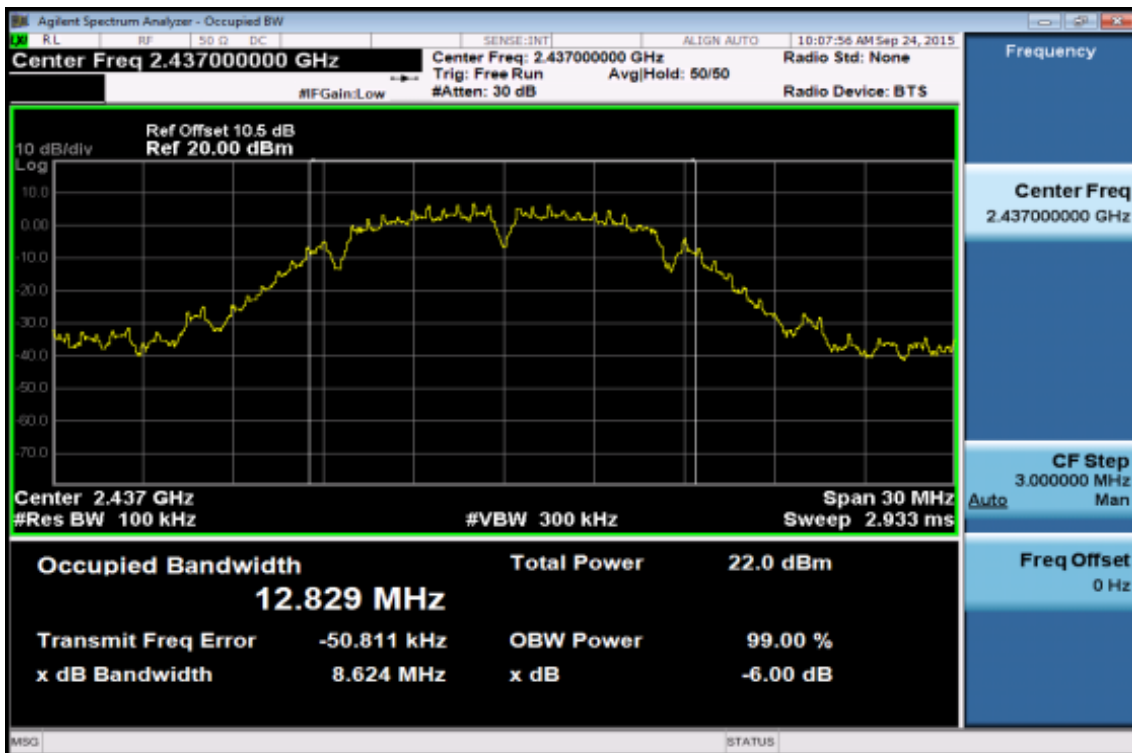
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## 802.11b

### 6dB Band Width Test Data CH-Low



### 6dB Band Width Test Data CH-Mid



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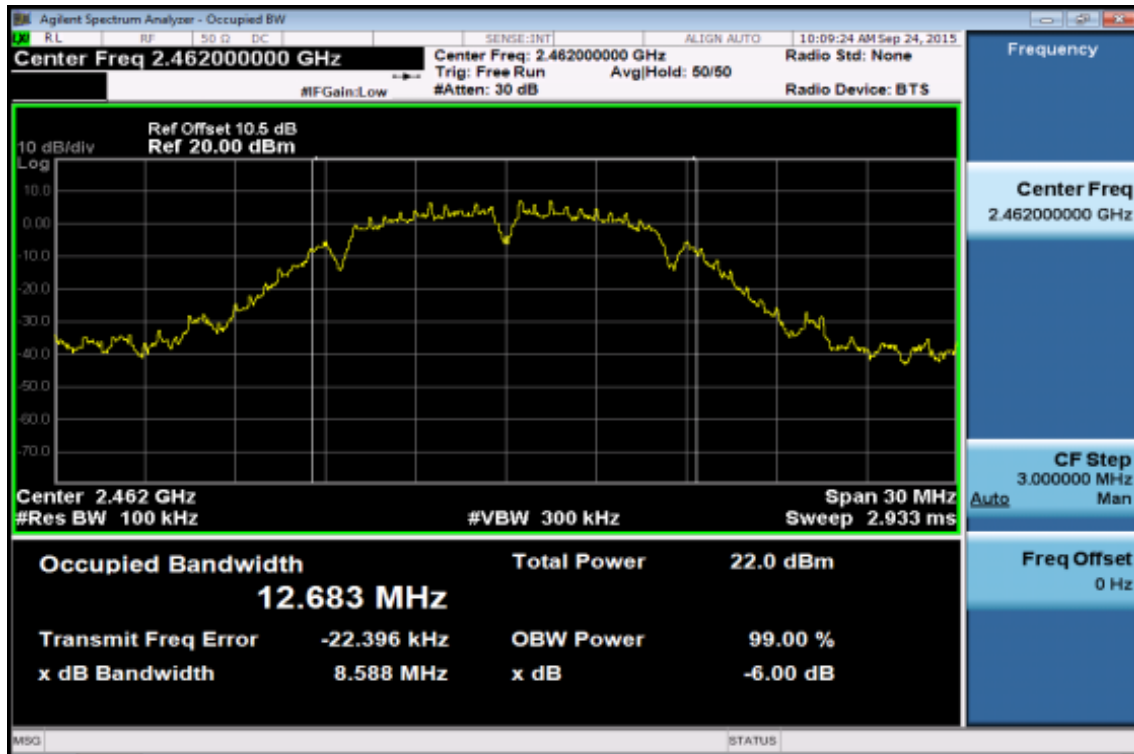
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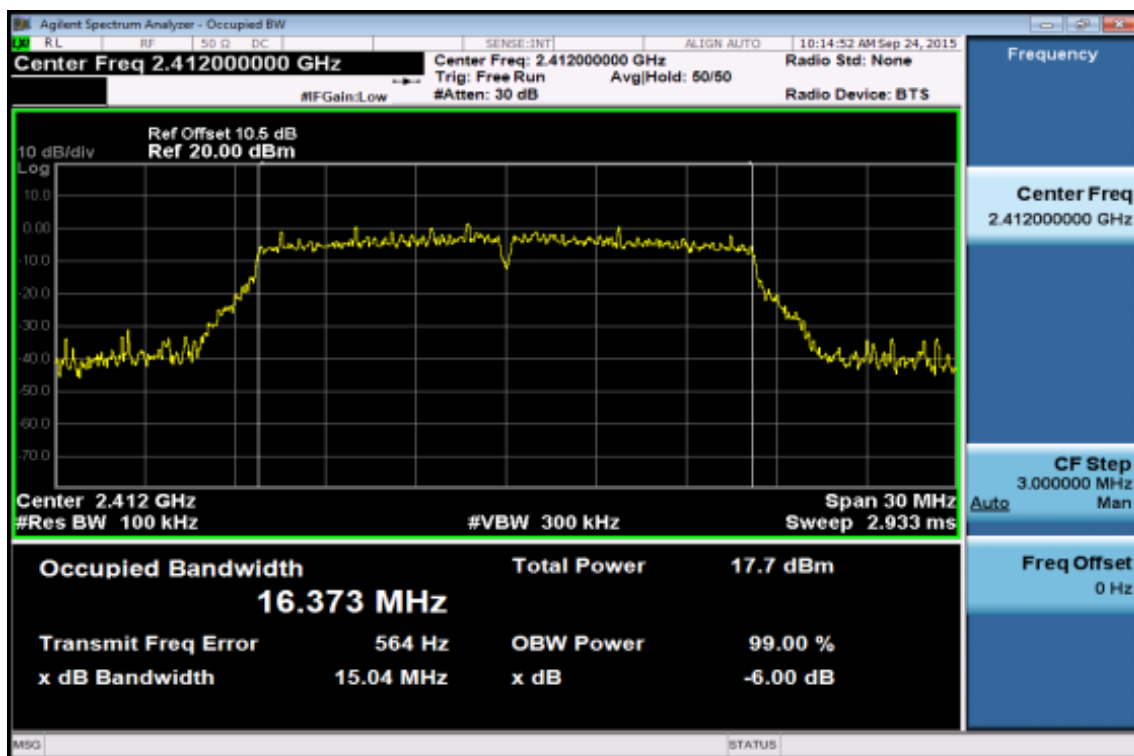
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## 6dB Band Width Test Data CH-High



802.11g

## 6dB Band Width Test Data CH-Low



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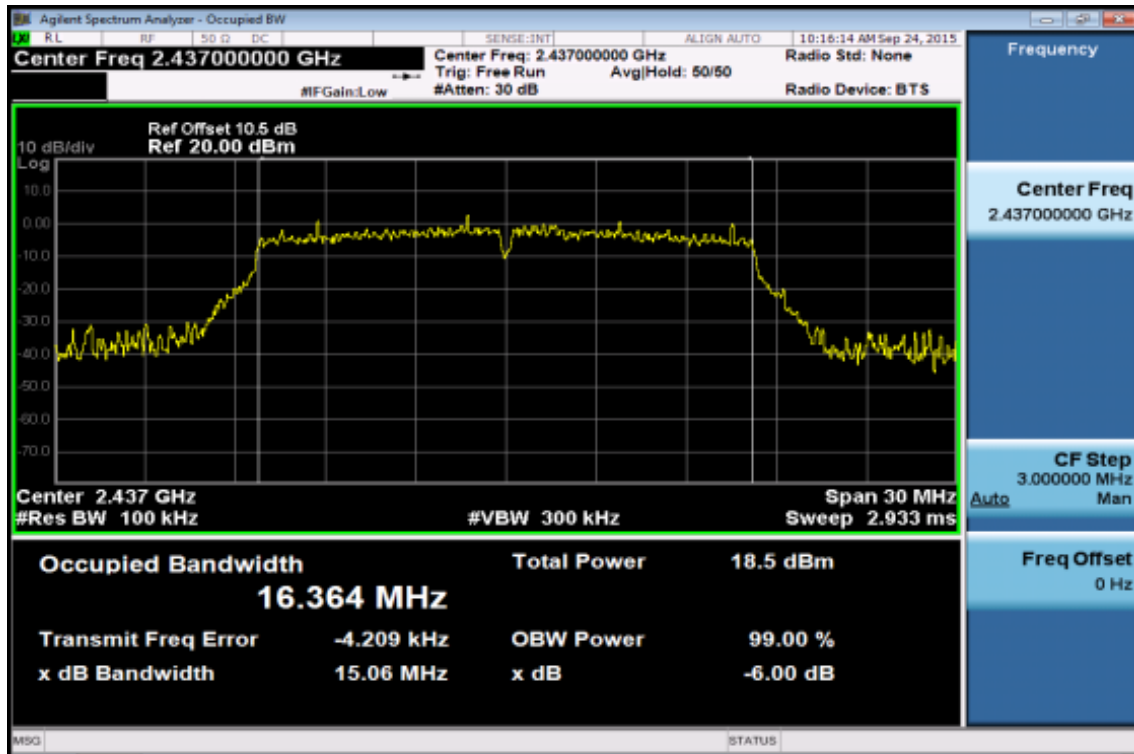
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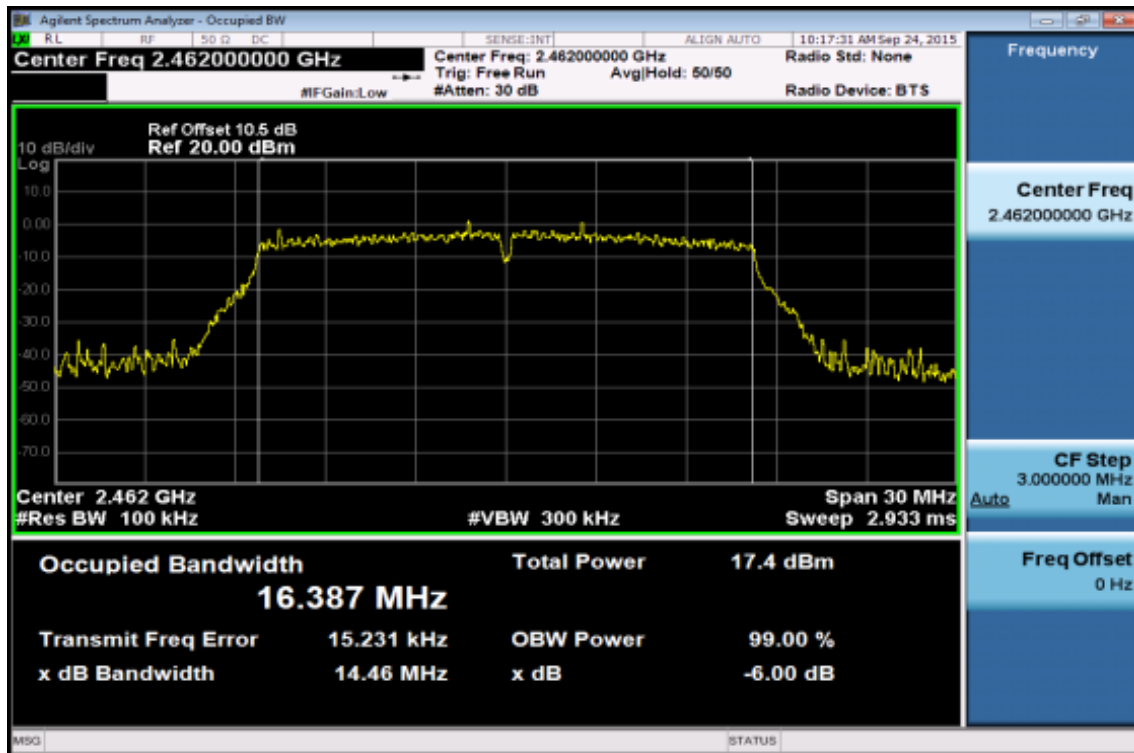
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## 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



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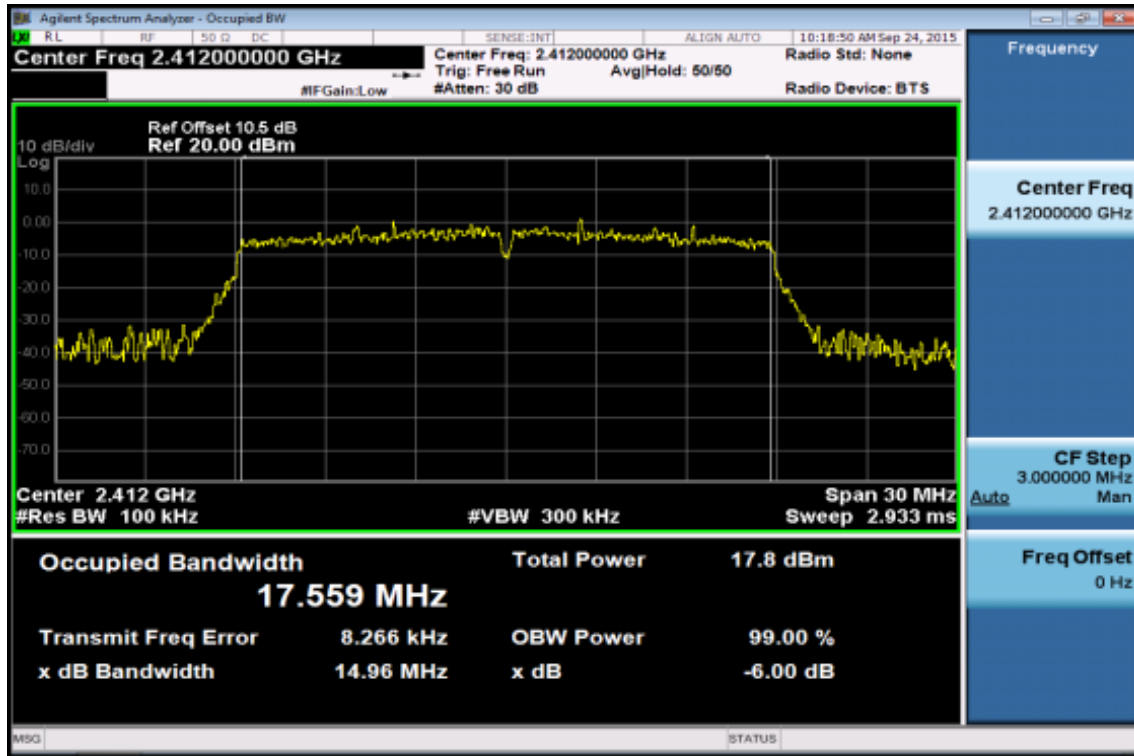
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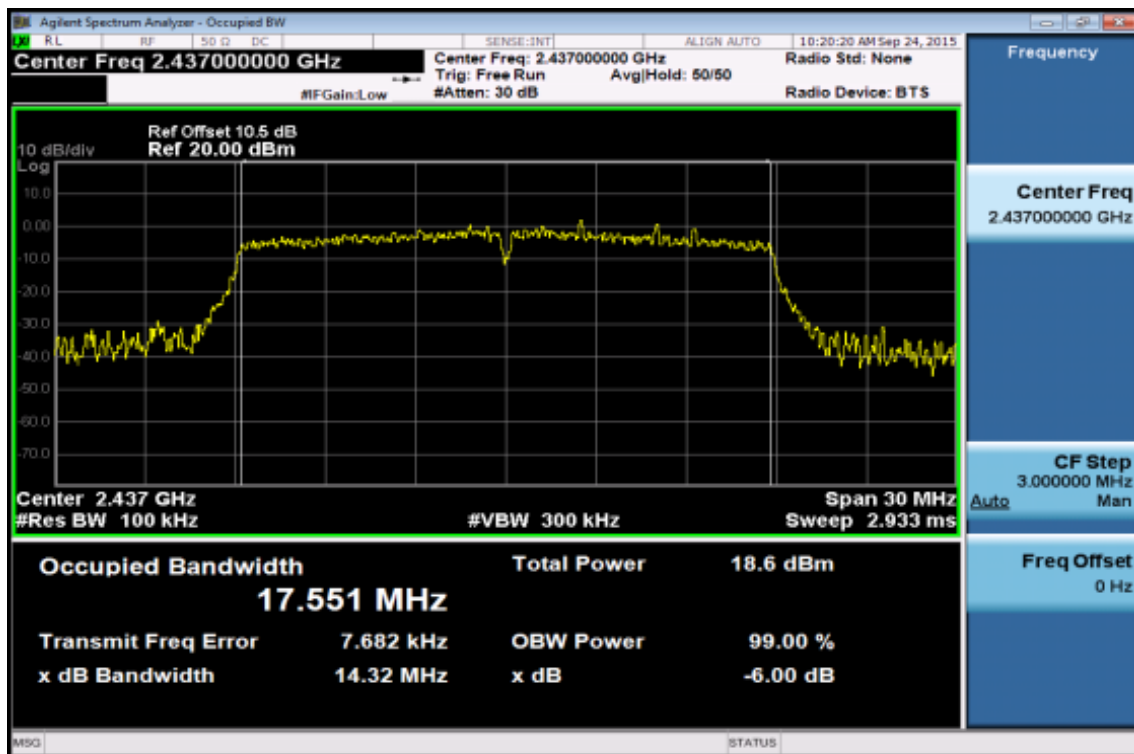
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## 802.11n\_20M

### 6dB Band Width Test Data CH-Low



### 6dB Band Width Test Data CH-Mid



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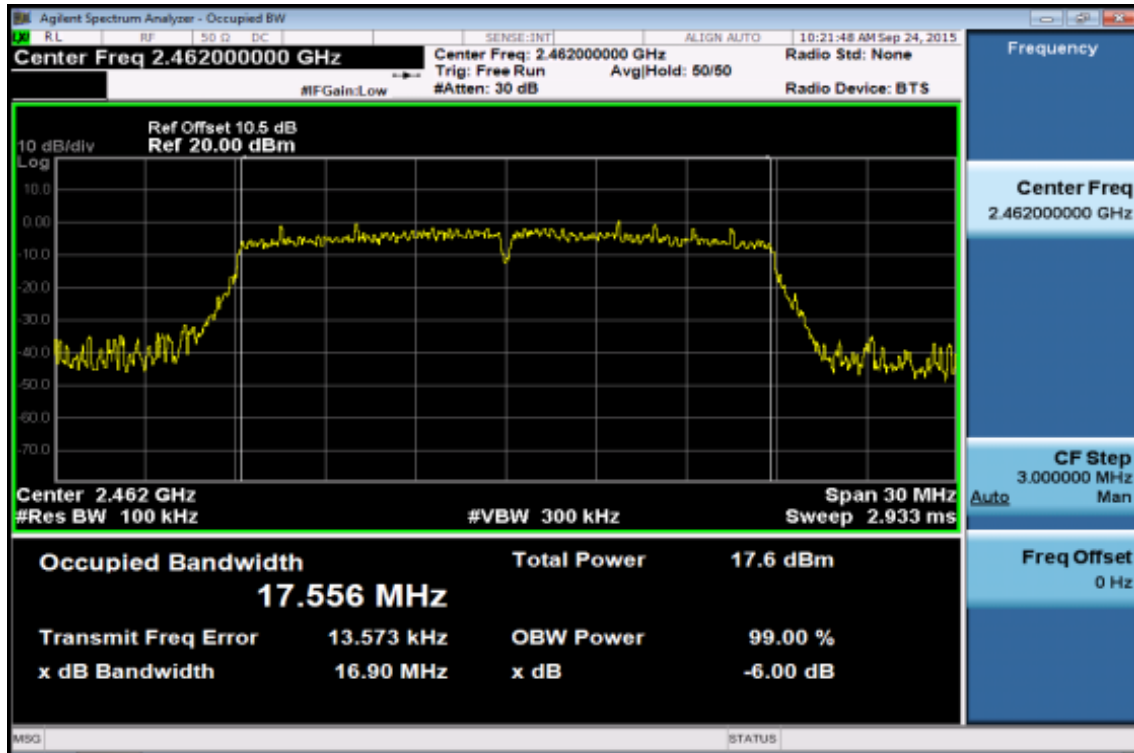
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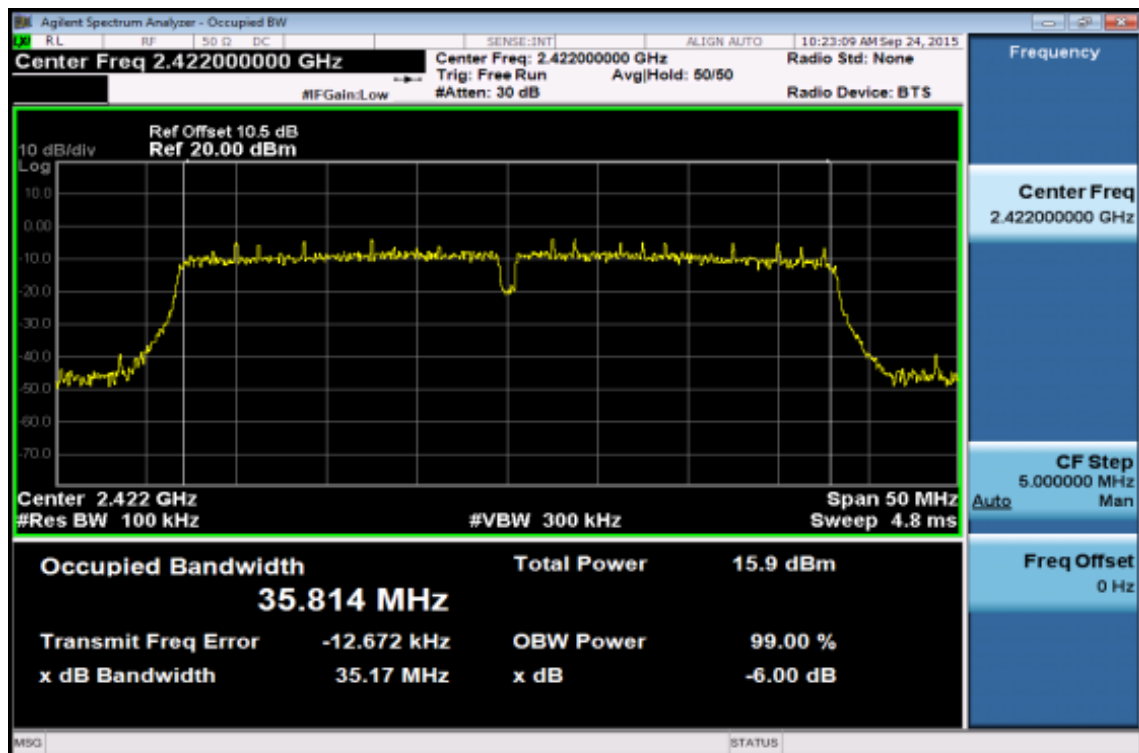
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## 6dB Band Width Test Data CH-High



## 802.11 n\_40M

## 6dB Band Width Test Data CH-Low



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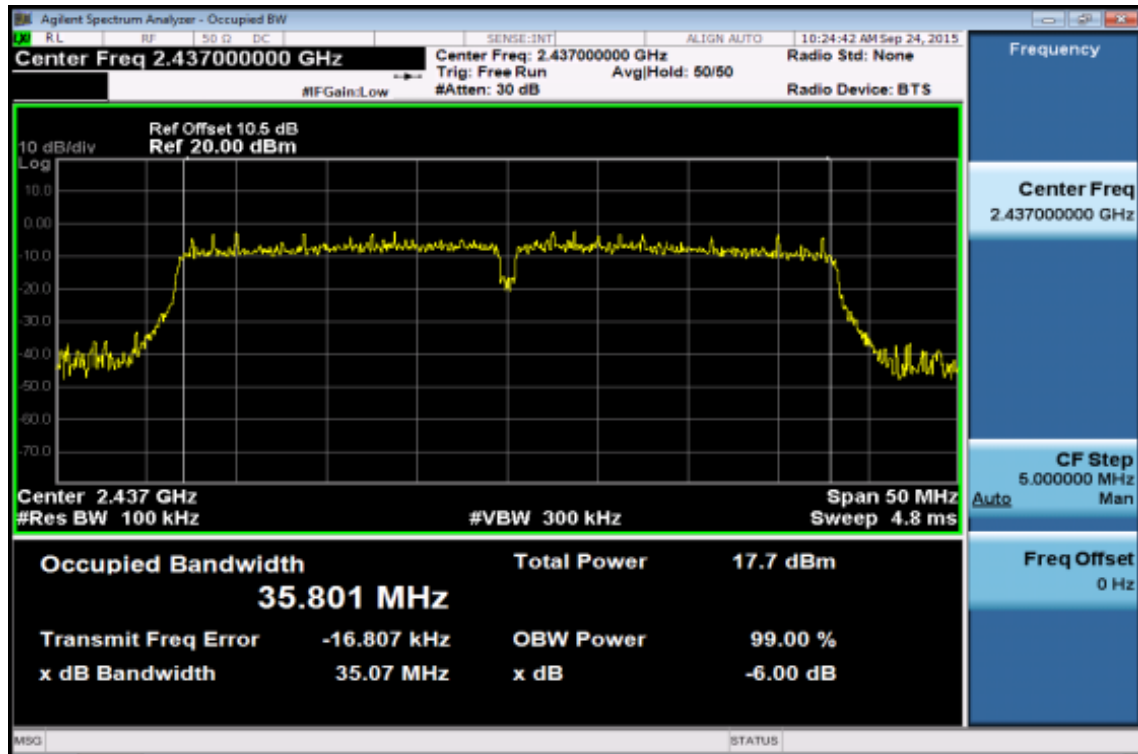
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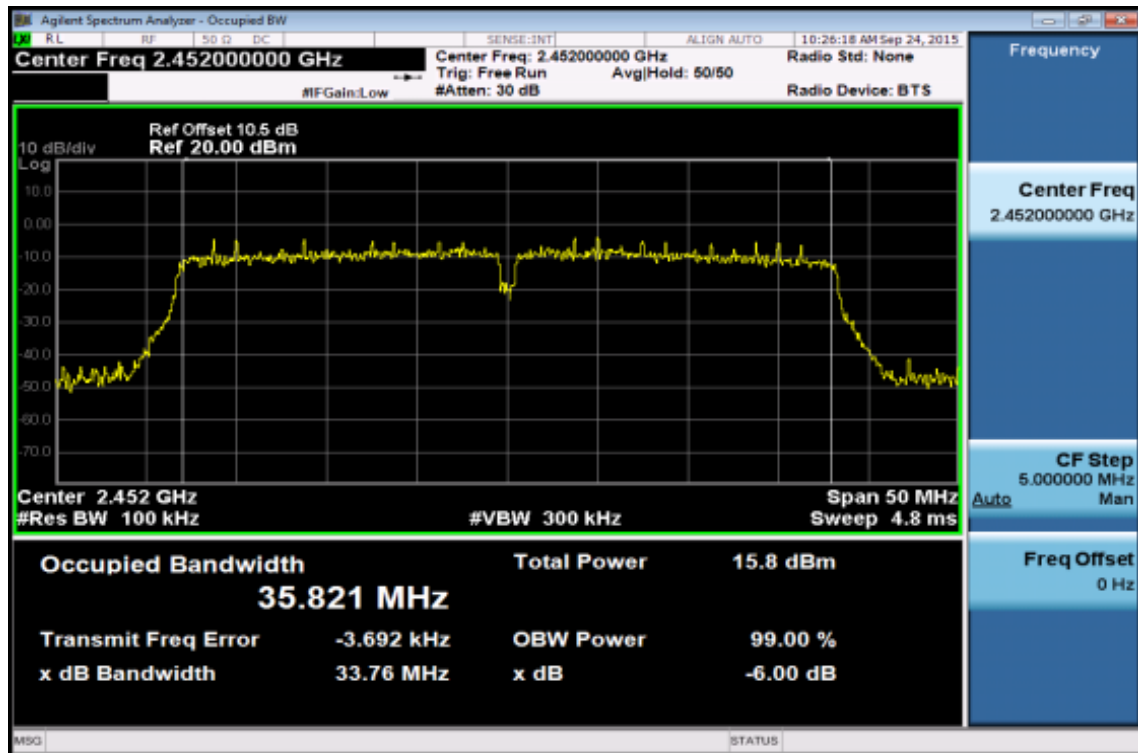
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## 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

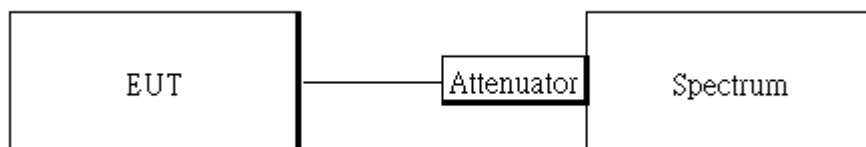
### 10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 10.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015
DC Block	PASTERNAK	PE8210	RF29	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015

### 10.3 Test SET-UP



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### 10.3.1 Measurement Procedure

#### Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker 1 – 20dBm
8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

#### Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Set RBW = 100 kHz & VBW ≥300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

### 10.4 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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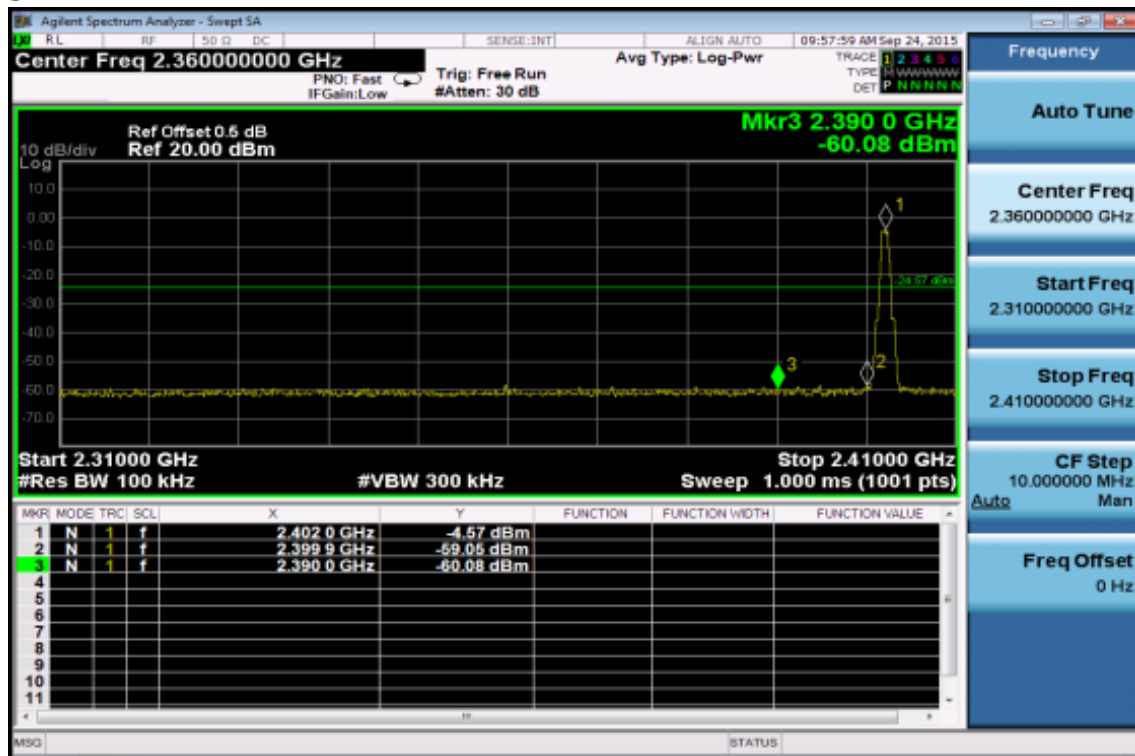
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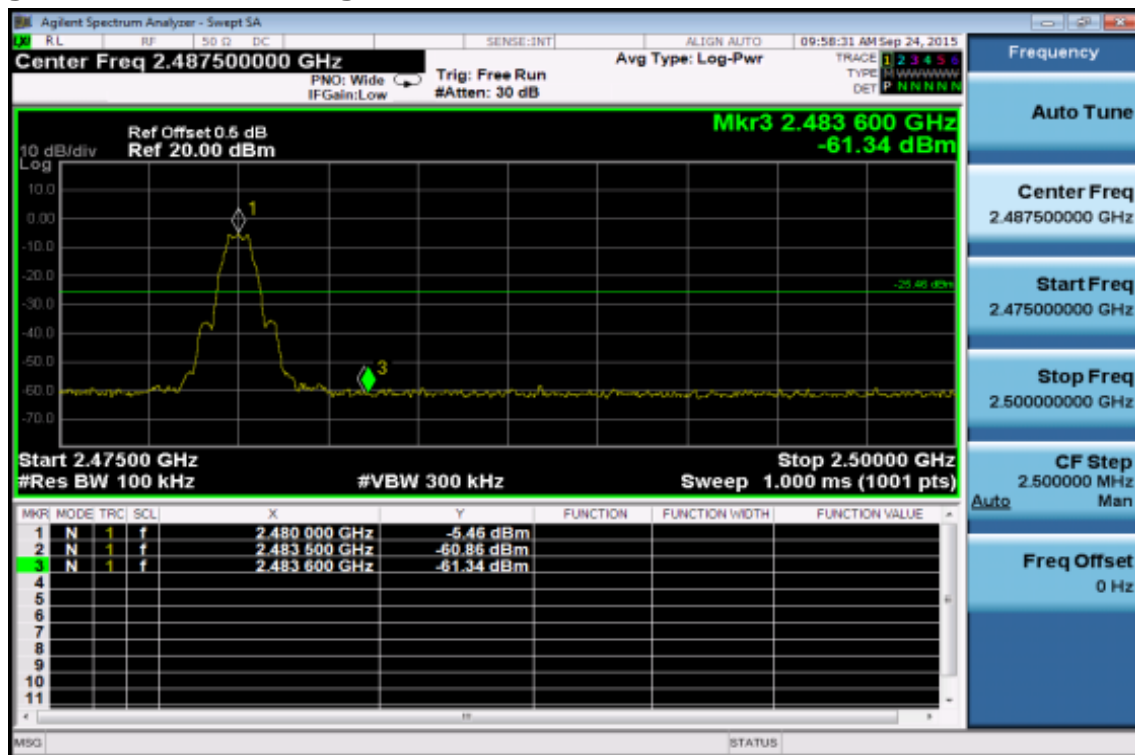
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## BLE mode

### Band Edges Test Data CH-Low



### Band Edges Test Data CH-High



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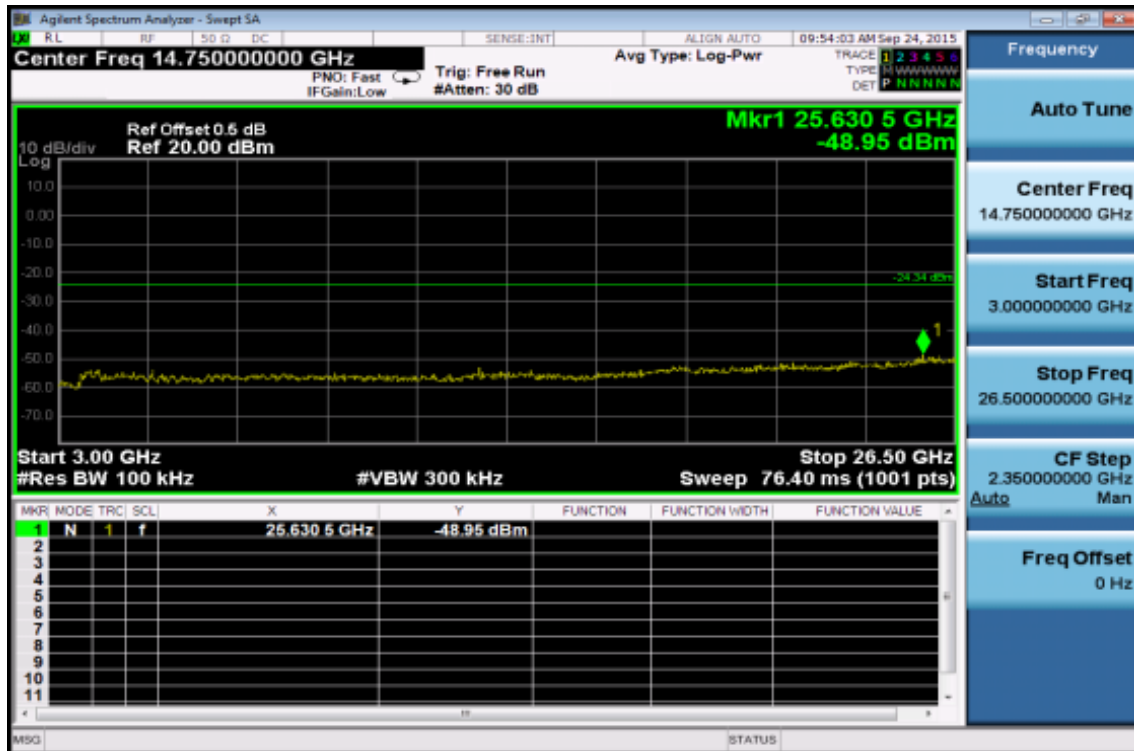
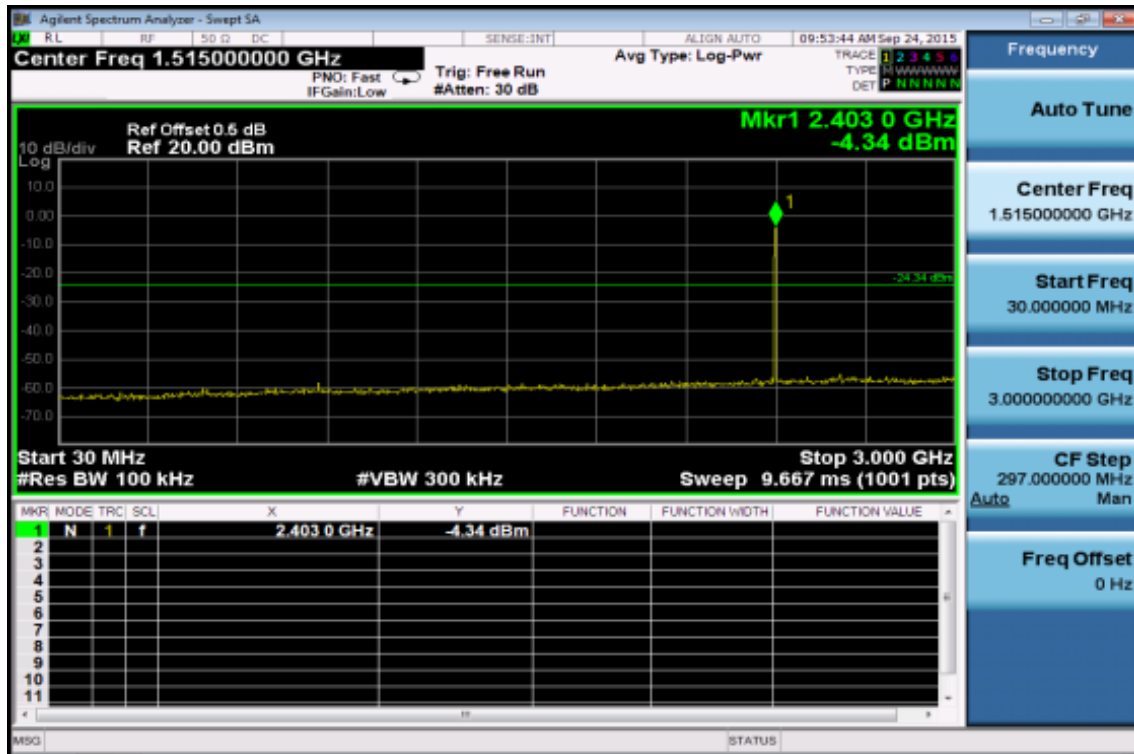
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## Spurious Emission Test Data CH-Low



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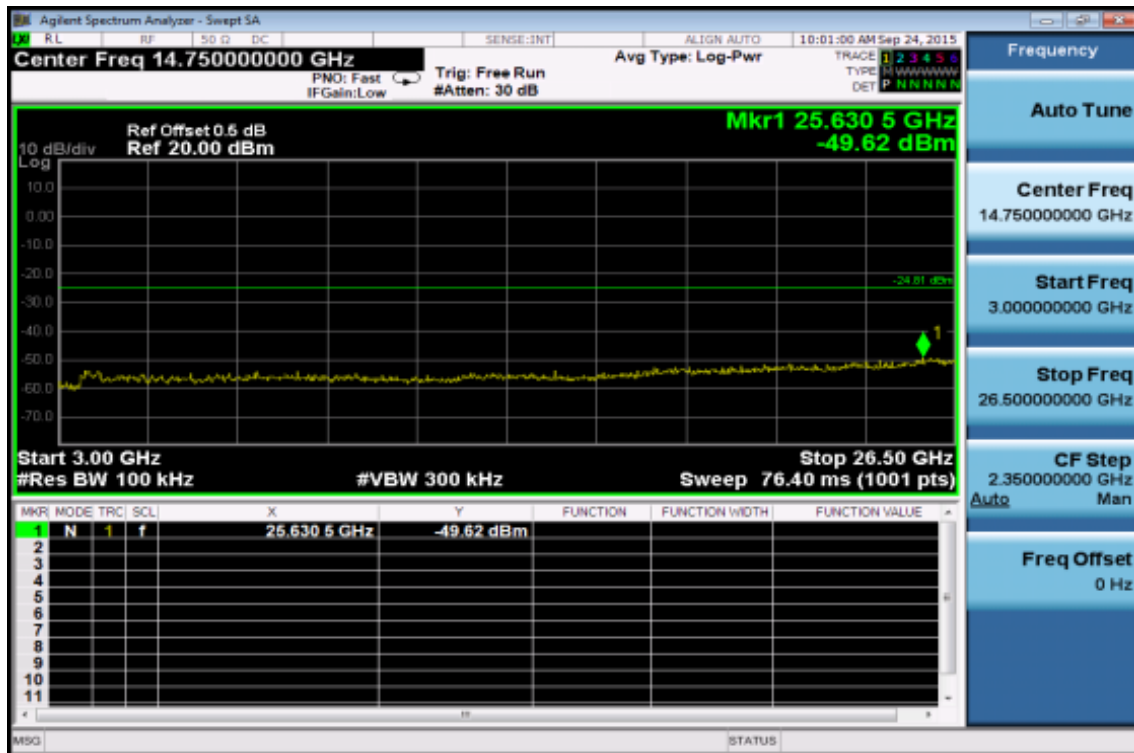
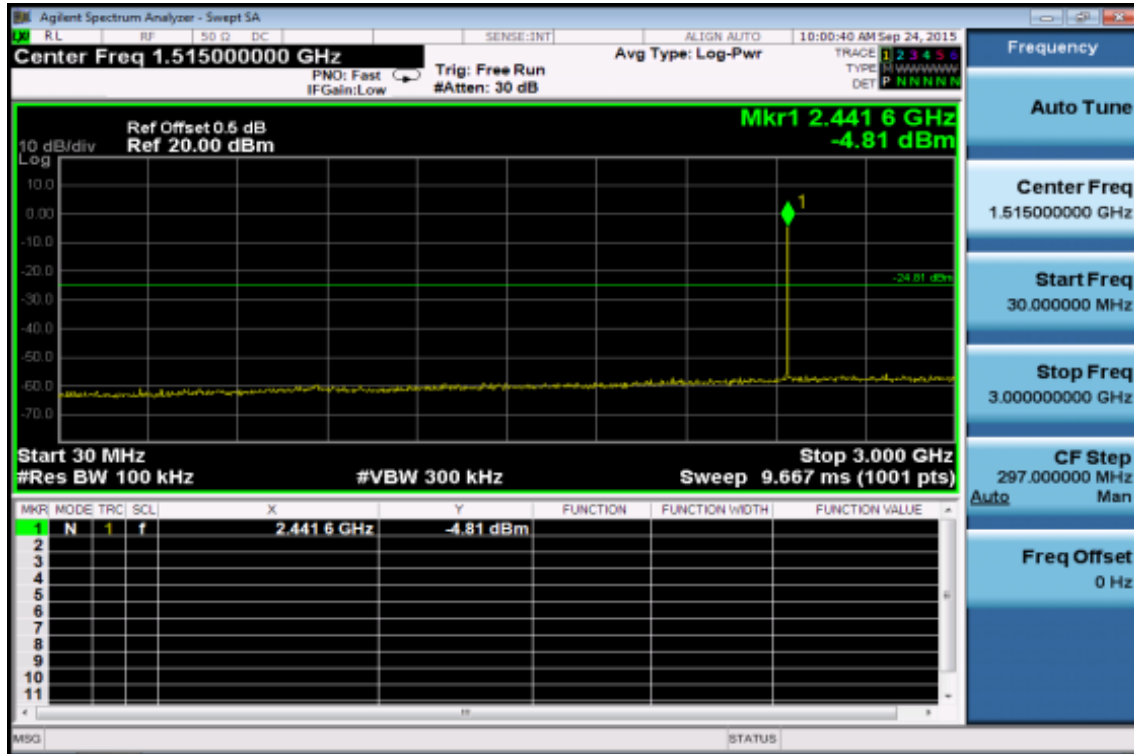
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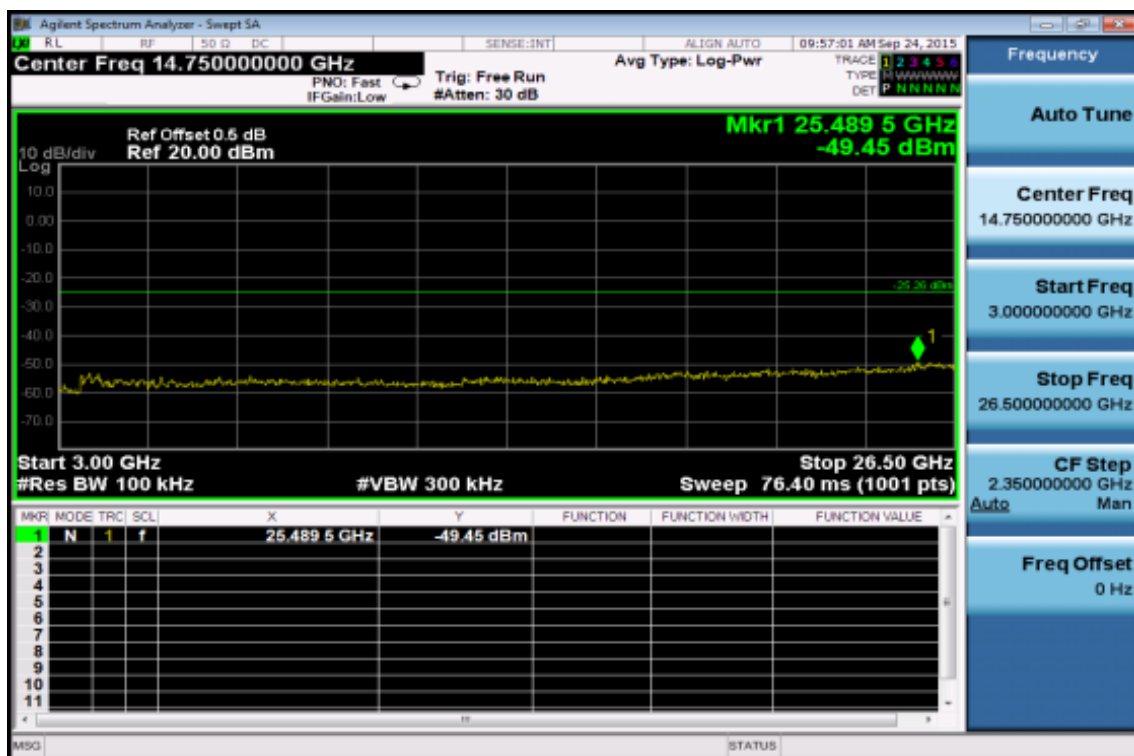
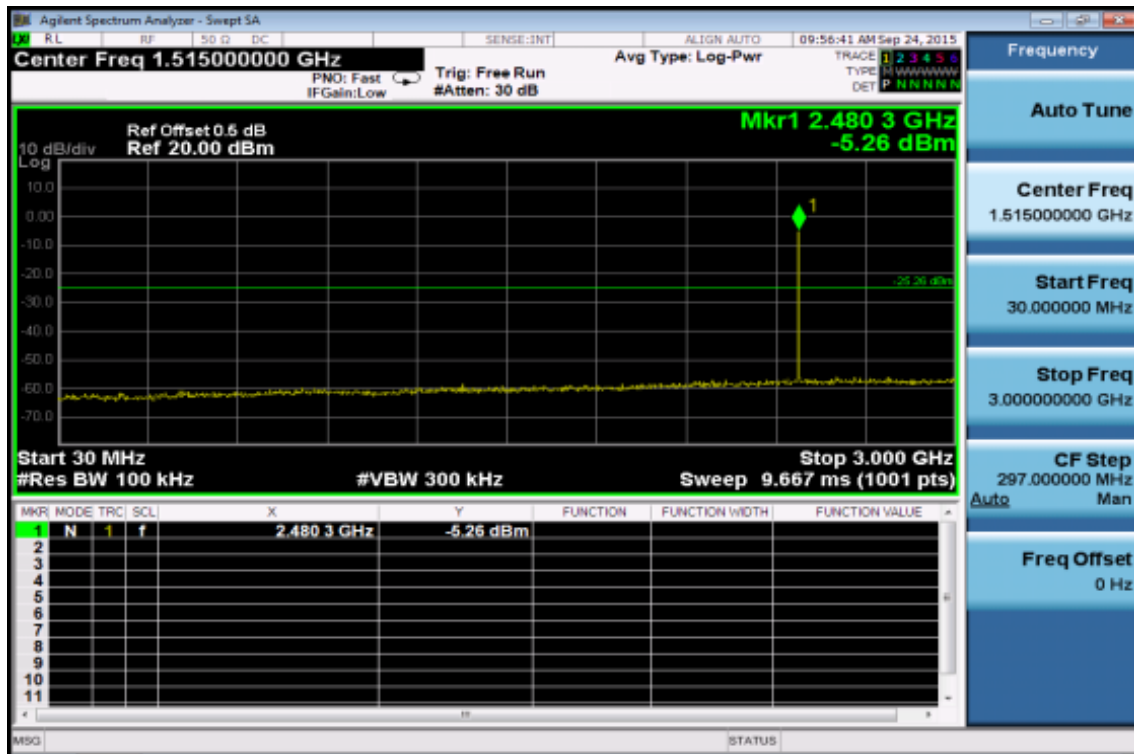
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## Spurious Emission Test Data CH-High



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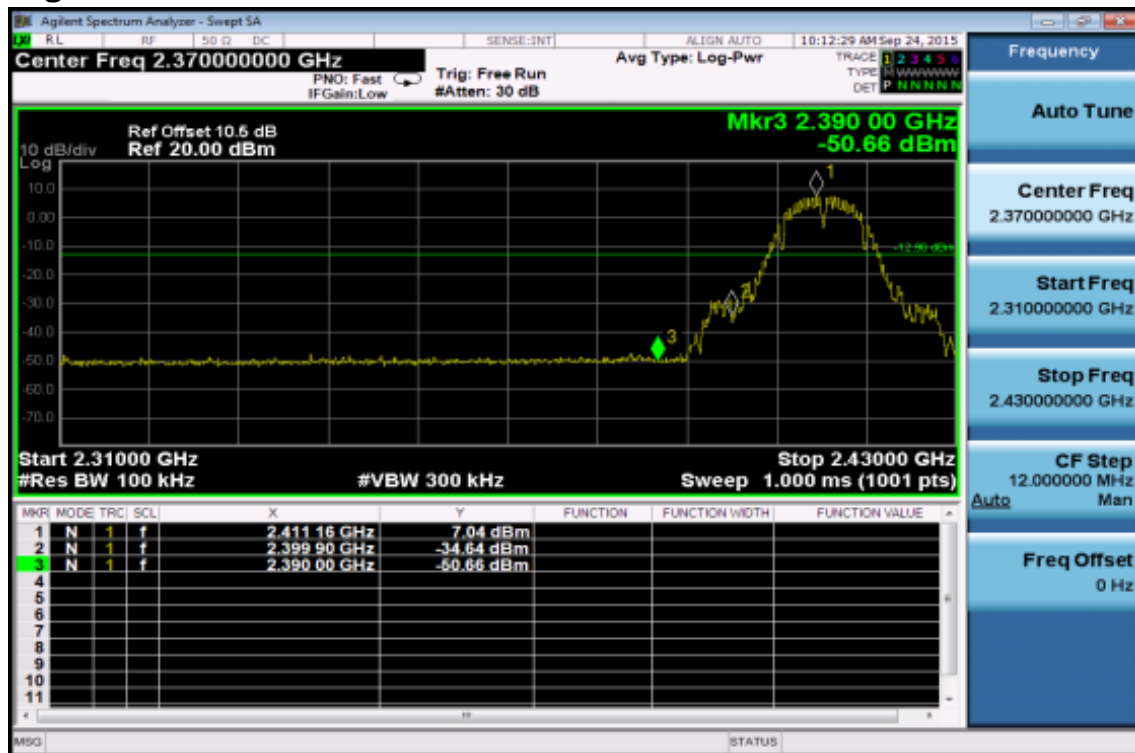
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## 802.11b

### Band Edges Test Data CH-Low



### Band Edges Test Data CH-High



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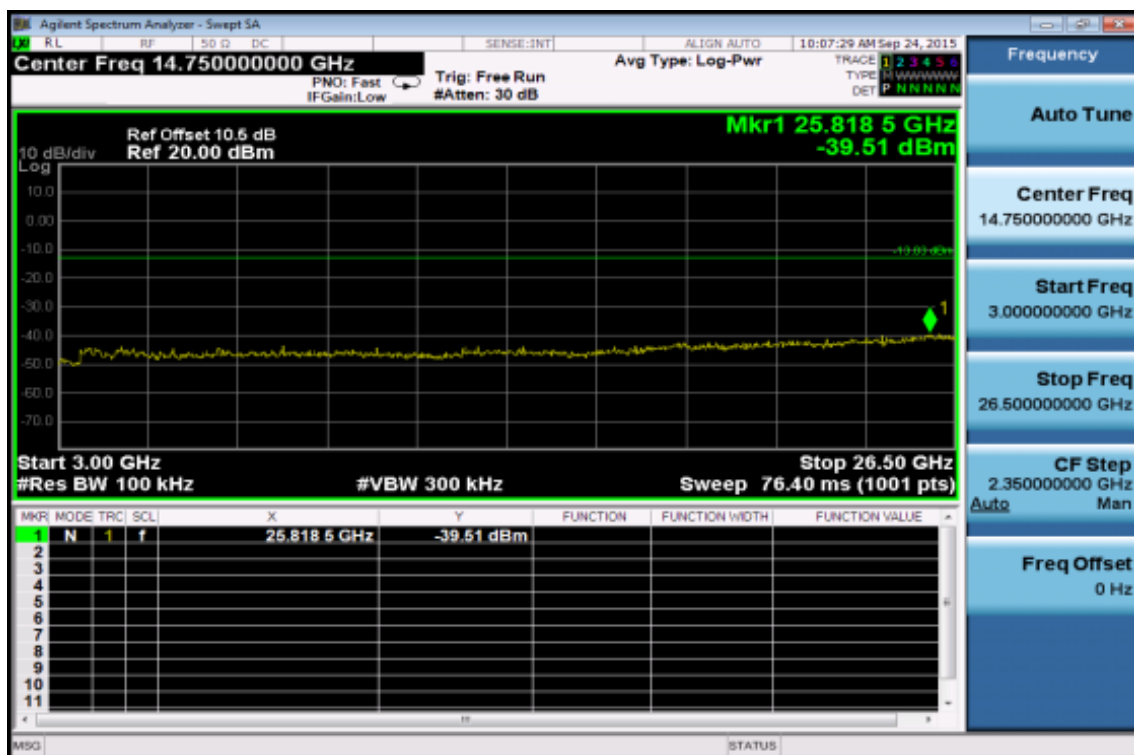
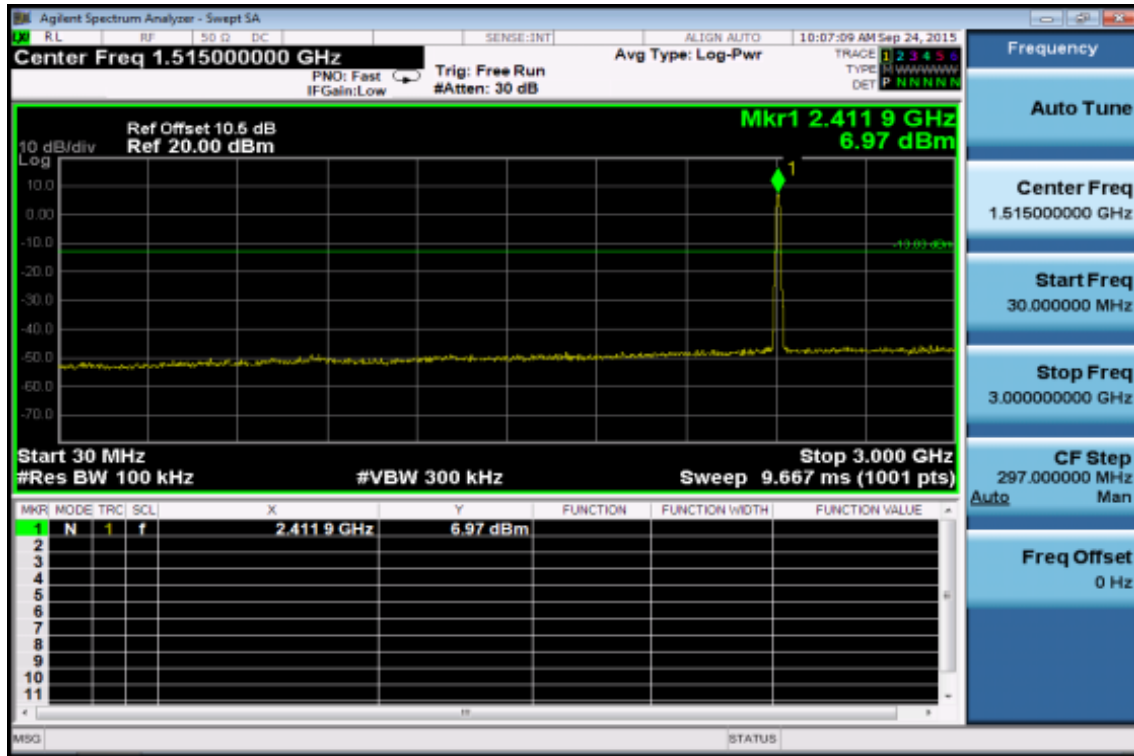
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## 802.11b

### Spurious Emission Test Data CH-Low



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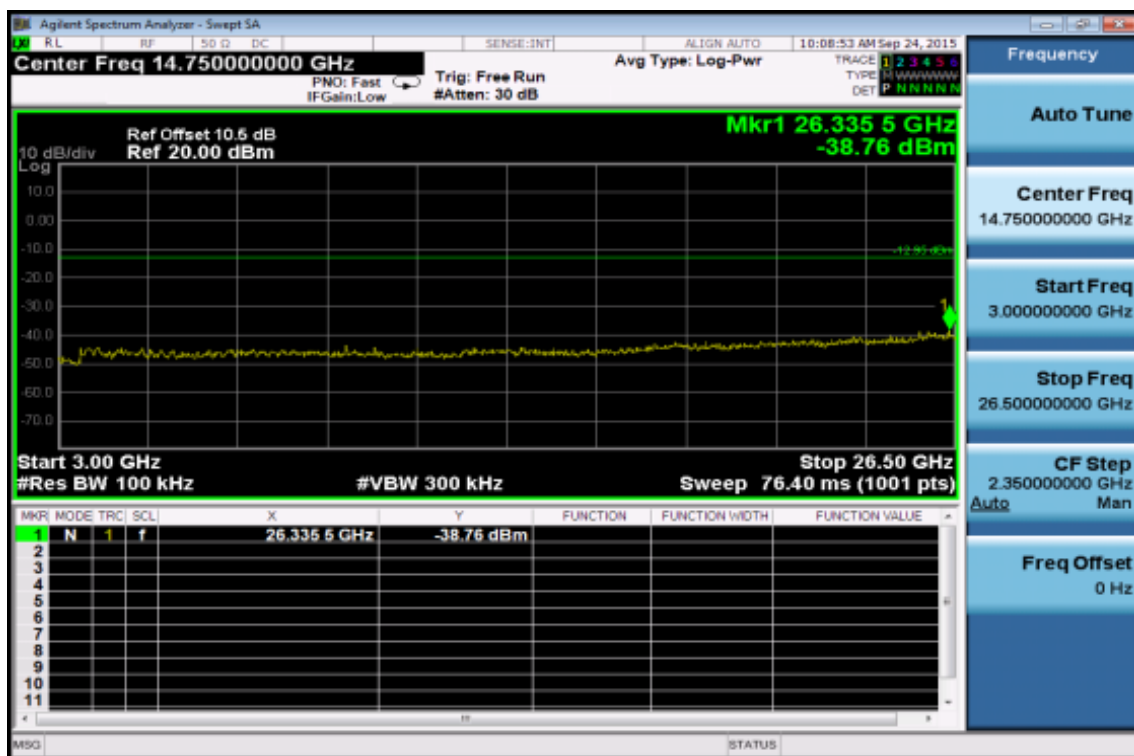
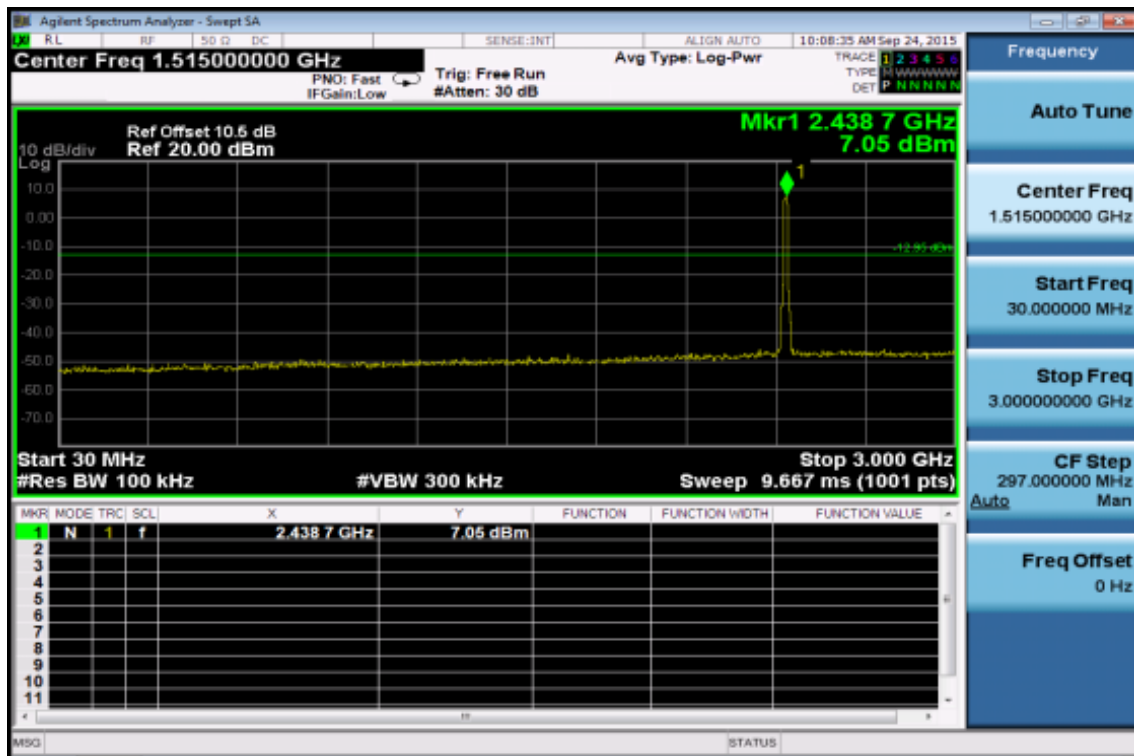
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## Spurious Emission Test Data CH-Mid



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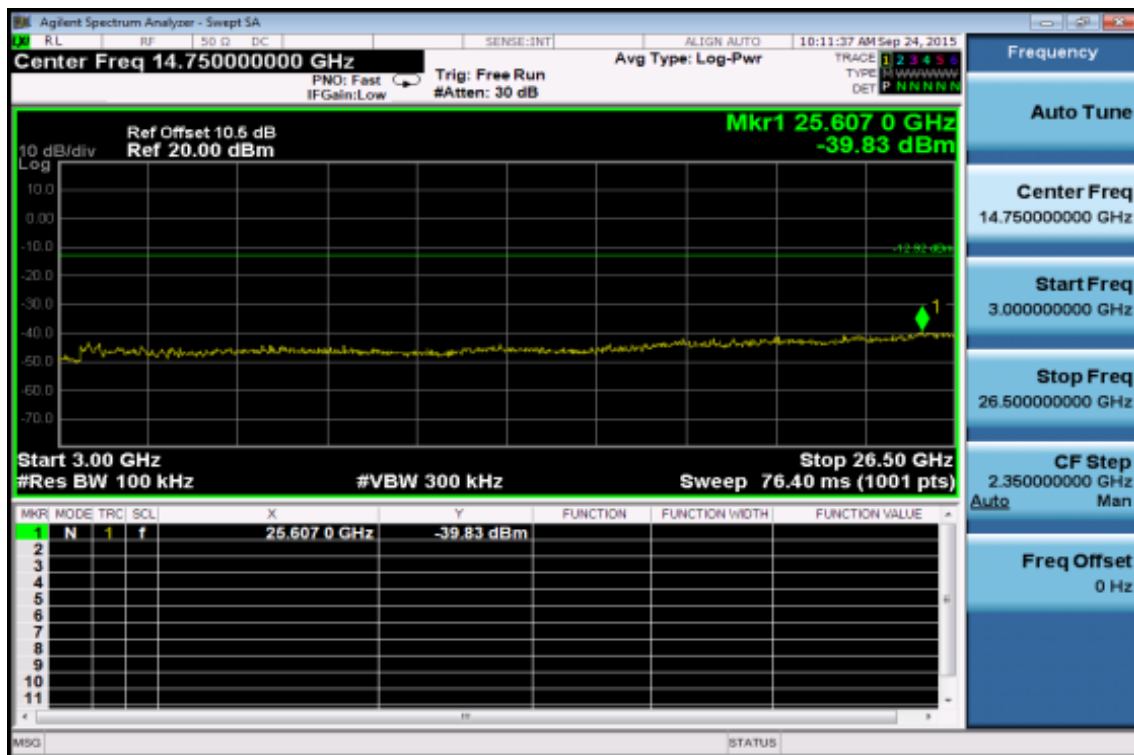
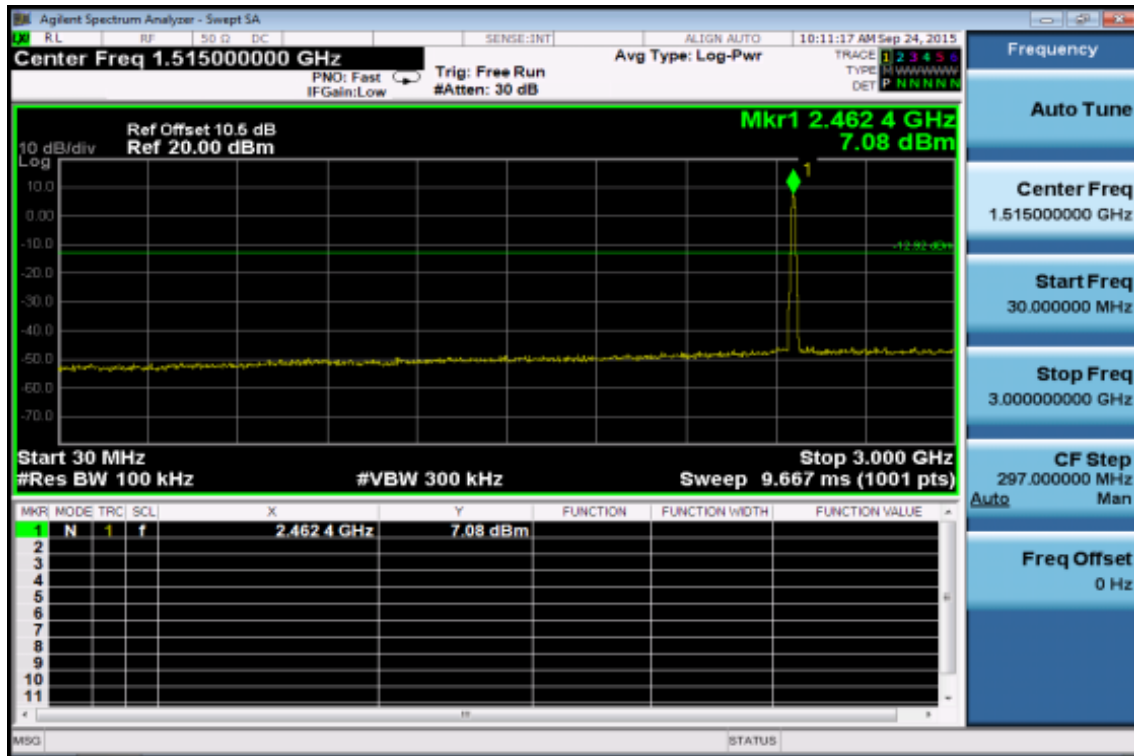
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## Spurious Emission Test Data CH-High



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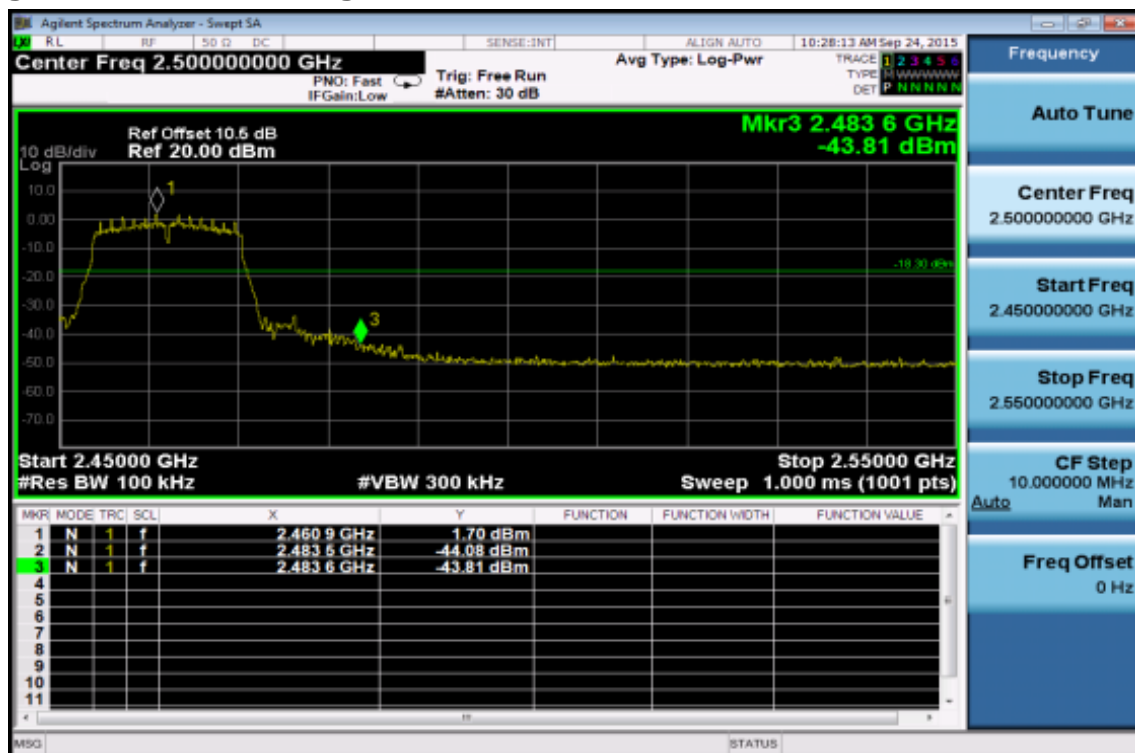
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802.11g

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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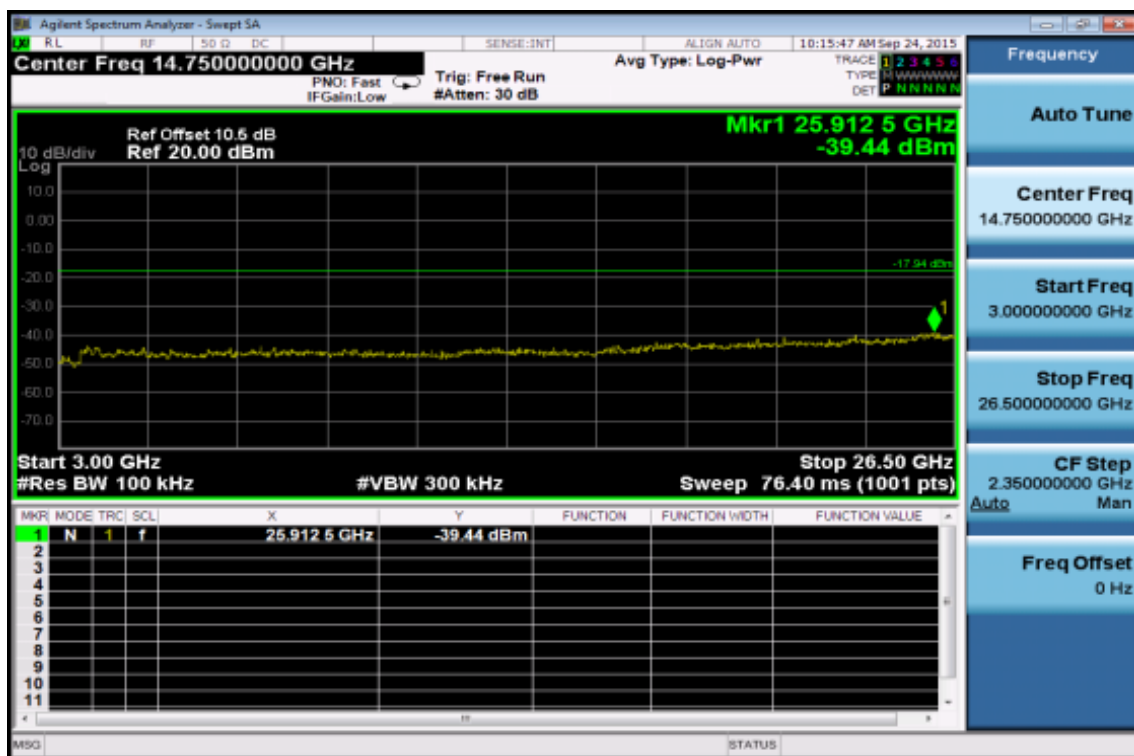
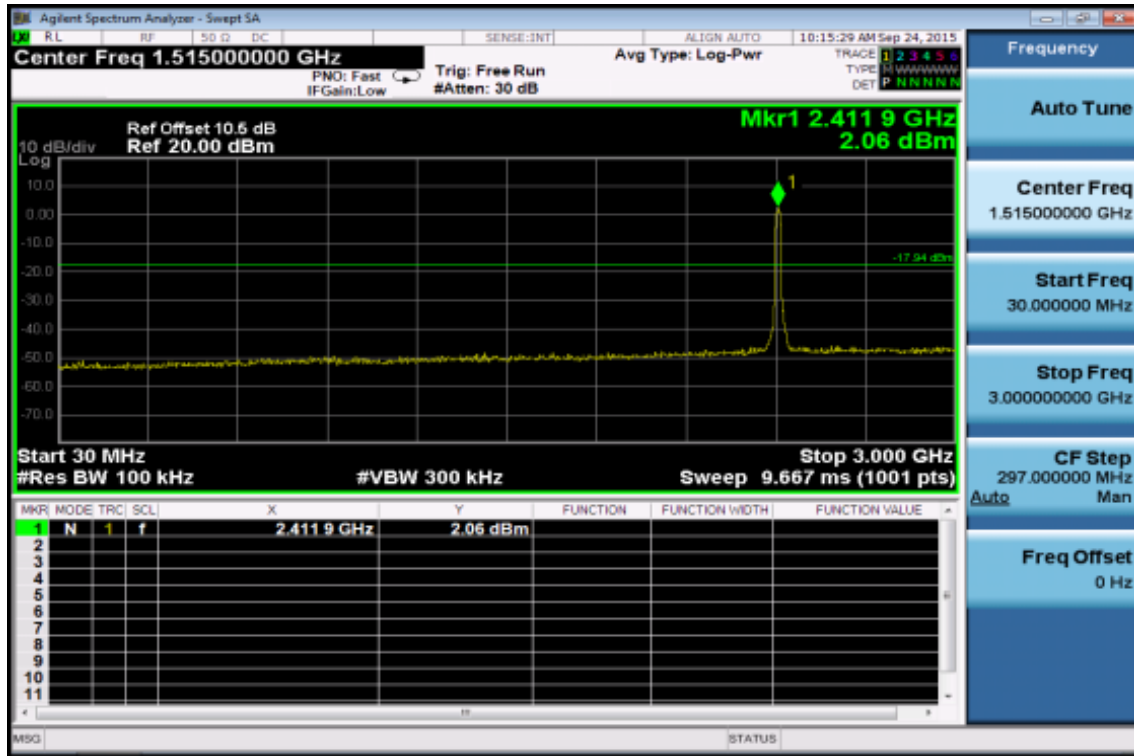
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Spurious Emission Test Data CH-Low



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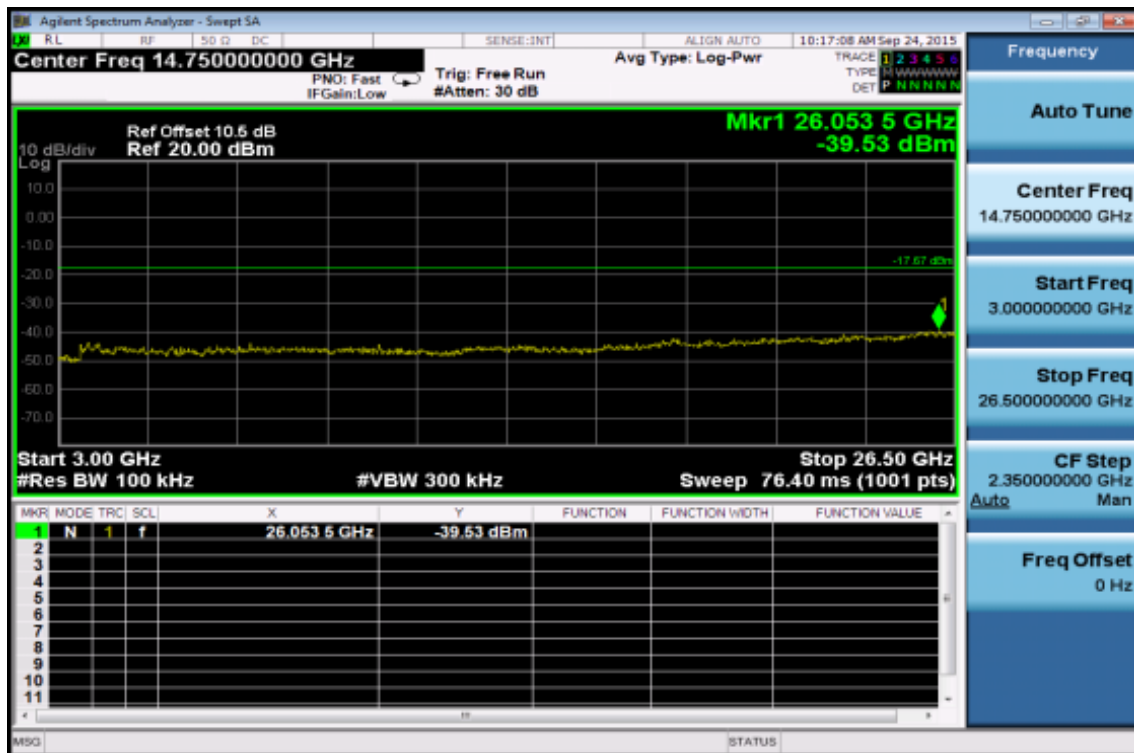
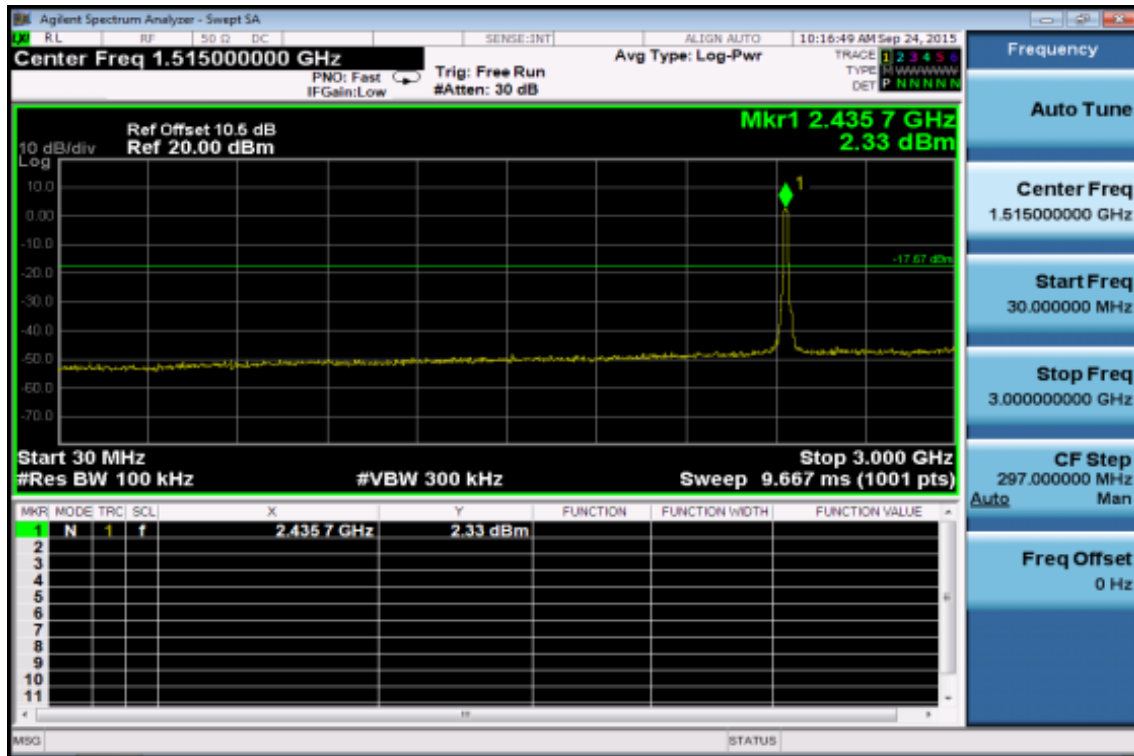
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## Spurious Emission Test Data CH-Mid



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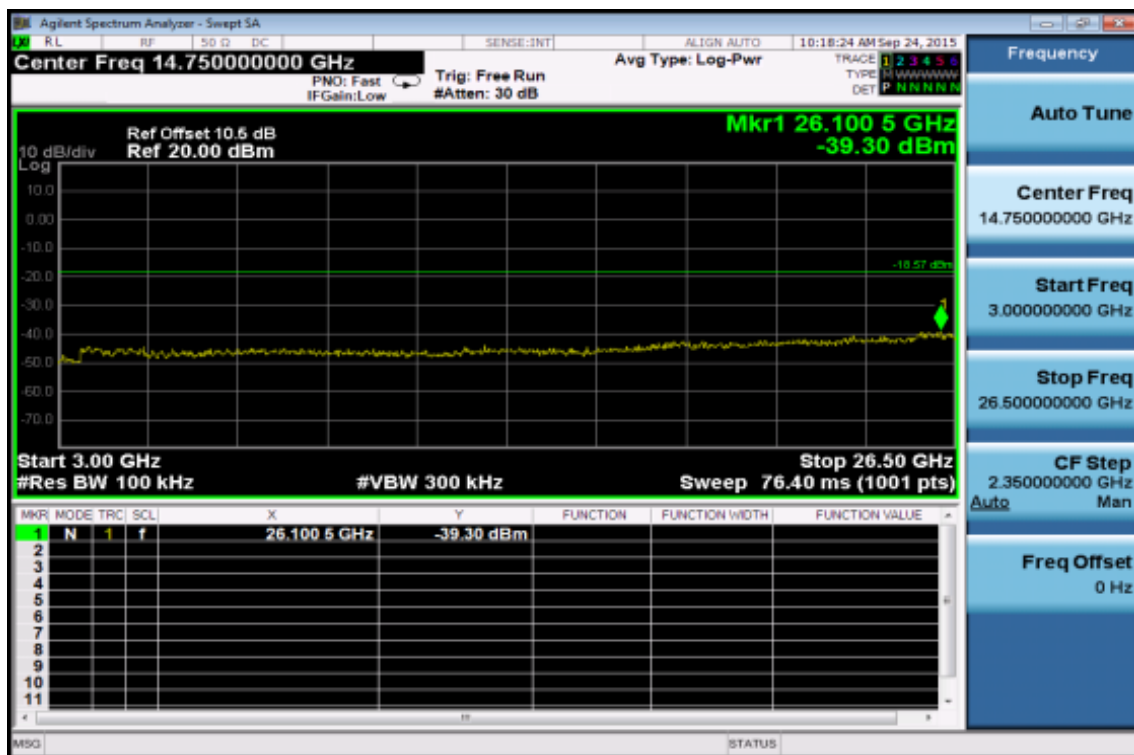
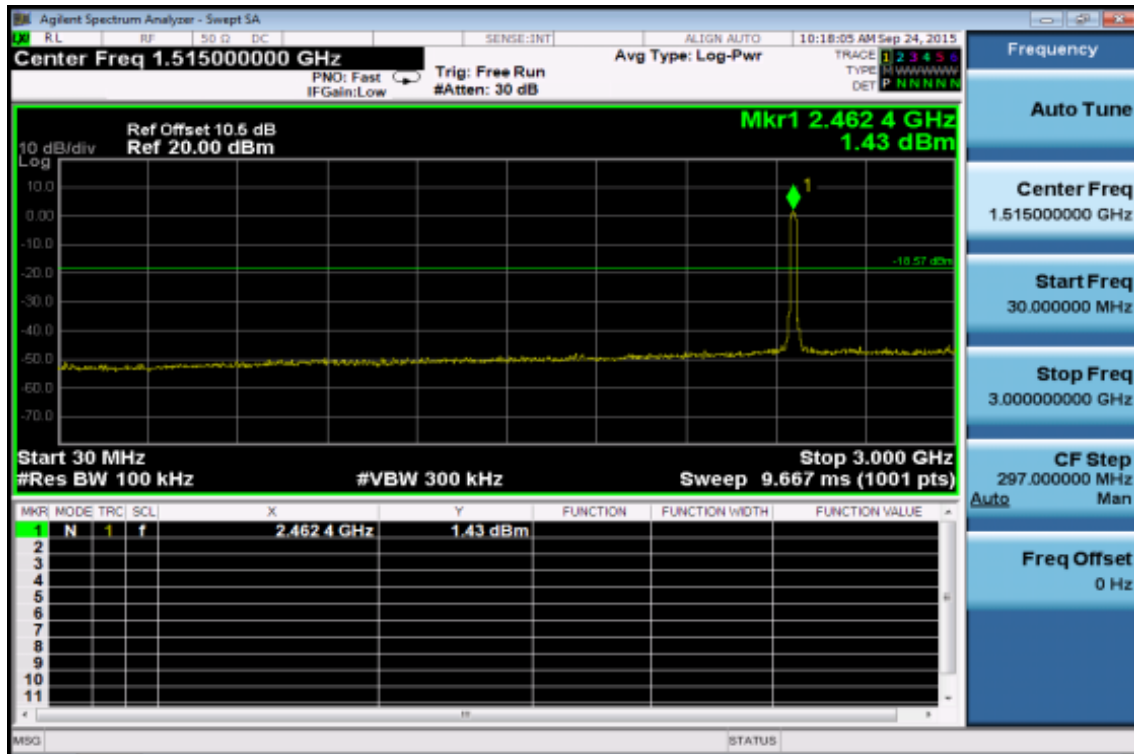
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## Spurious Emission Test Data CH-High



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## 802.11n\_HT20

## Band Edges Test Data CH-Low



## Band Edges Test Data CH-High



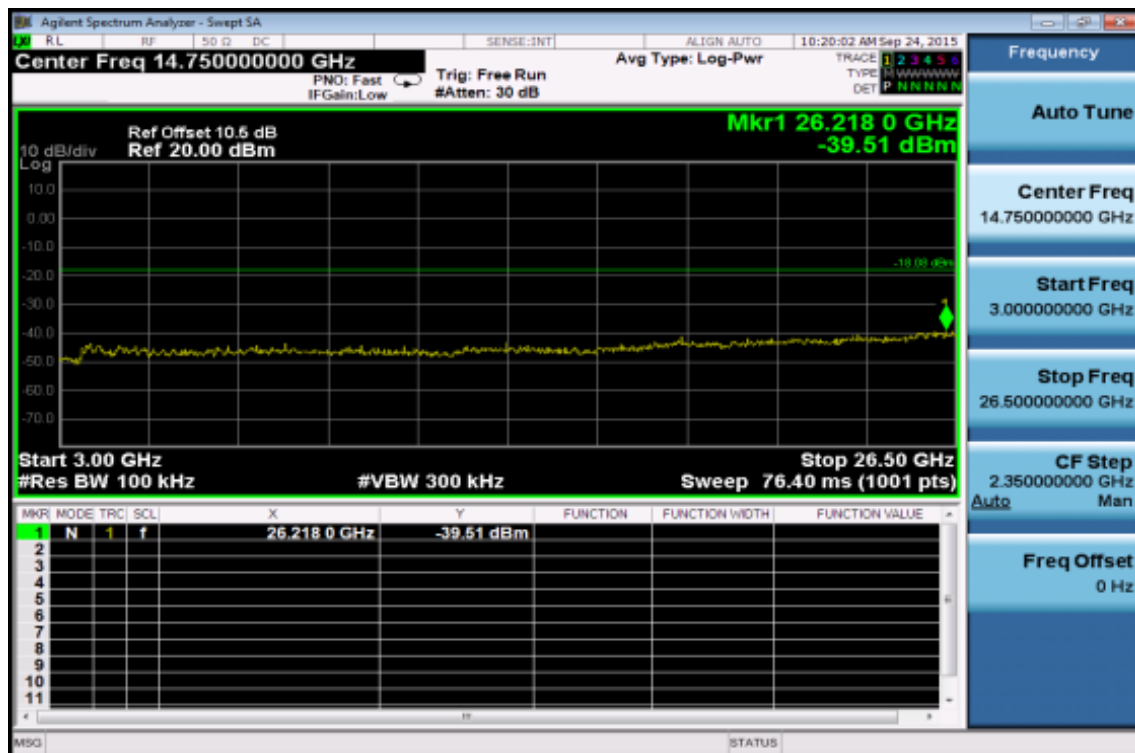
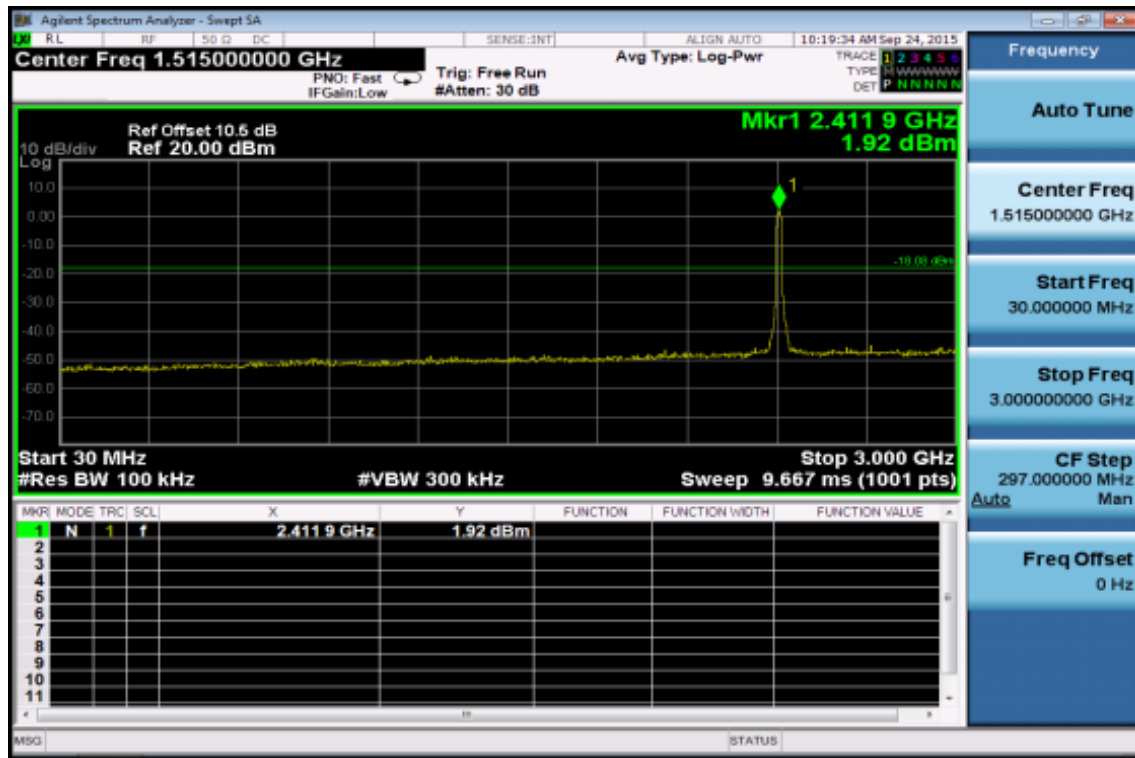
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## 802.11n\_HT20

### Spurious Emission Test Data CH-Low



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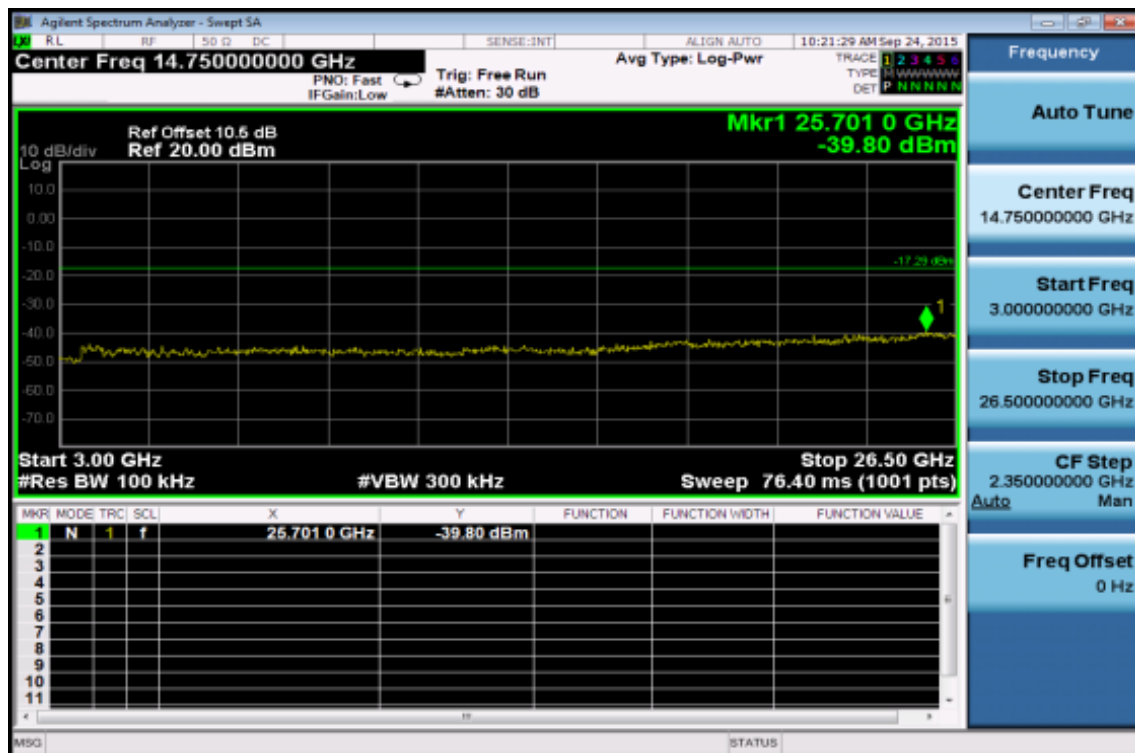
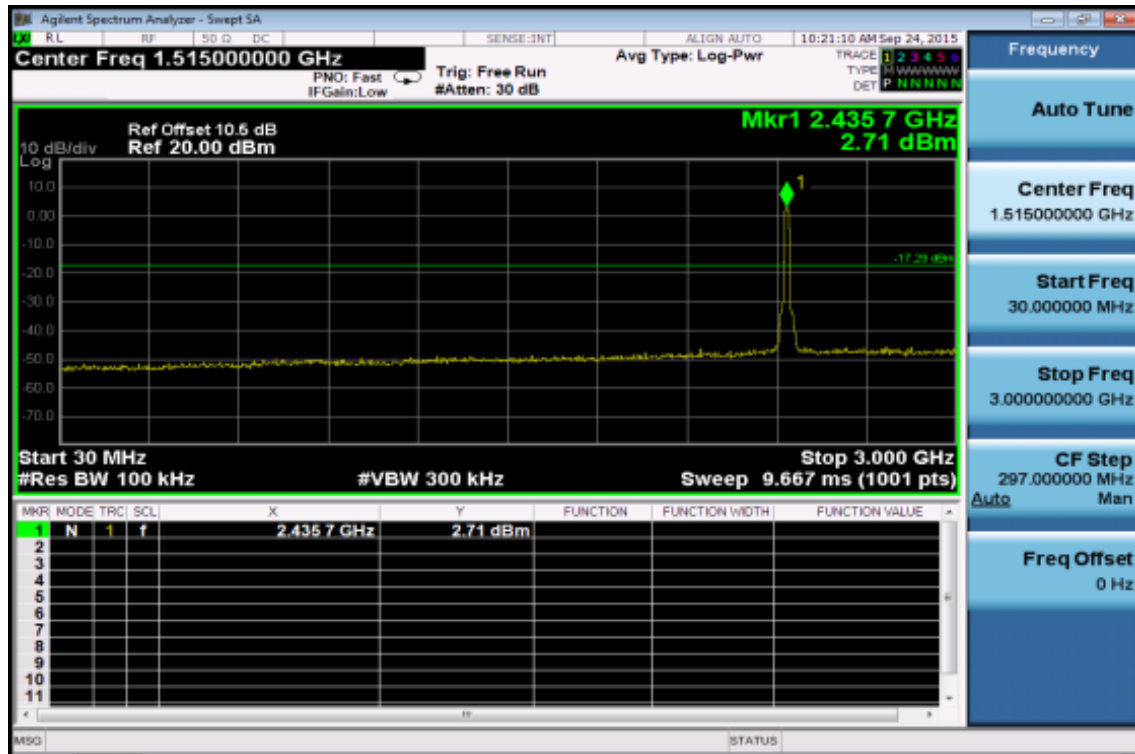
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## Spurious Emission Test Data CH-Mid



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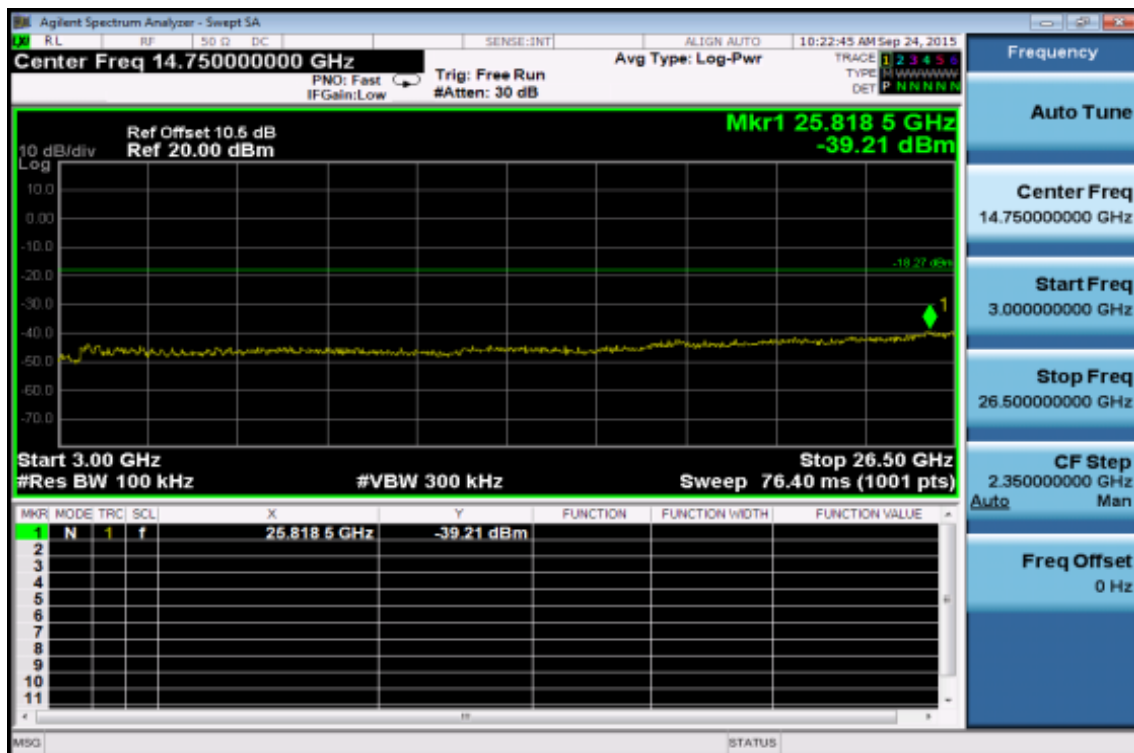
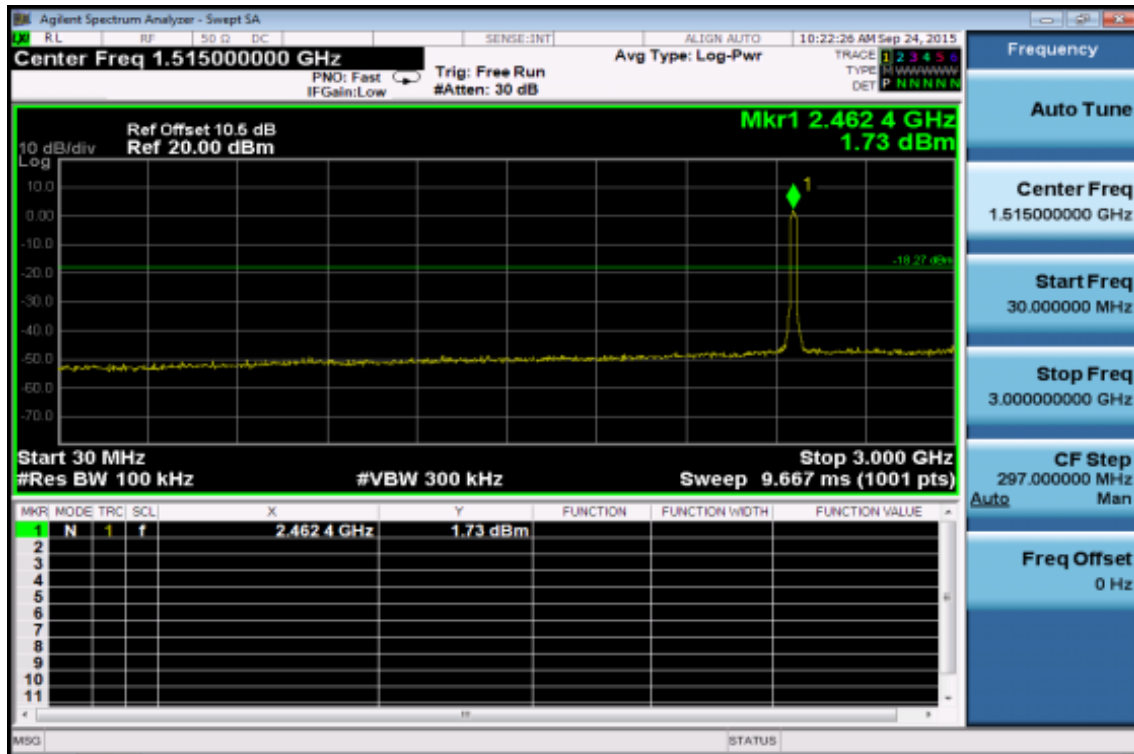
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## Spurious Emission Test Data CH-High



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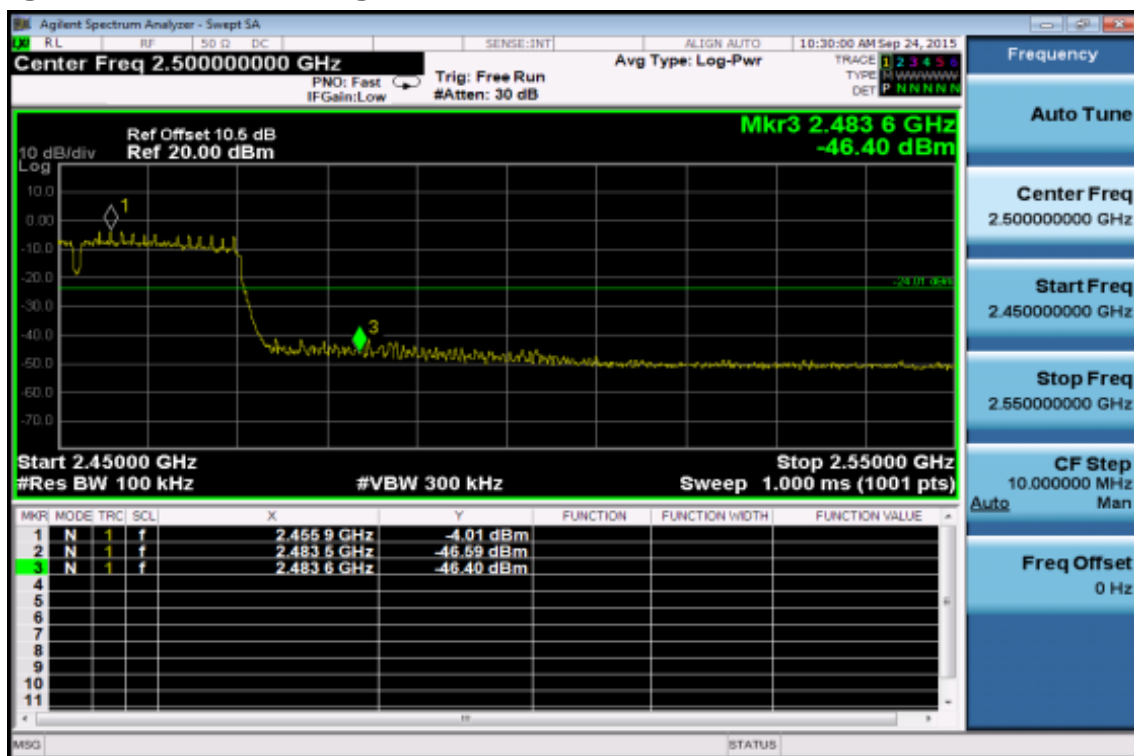
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## 802.11n\_HT40

## Band Edges Test Data CH-Low



## Band Edges Test Data CH-High



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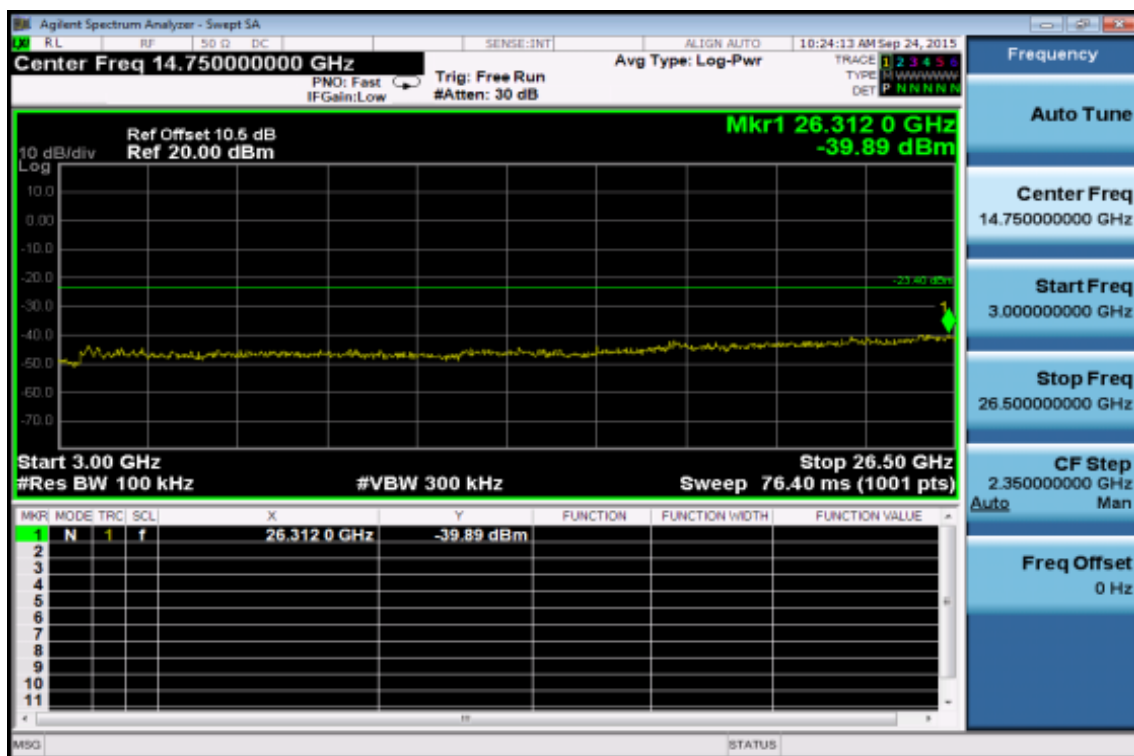
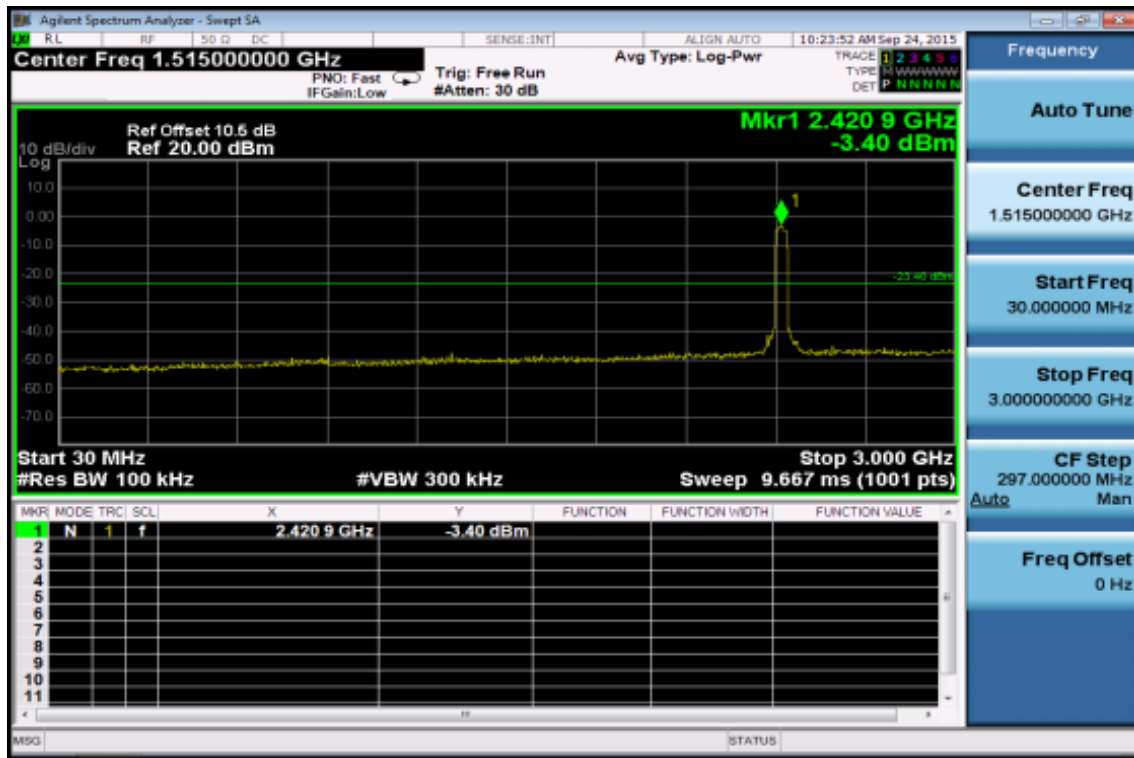
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## 802.11n\_HT40

### Spurious Emission Test Data CH-Low



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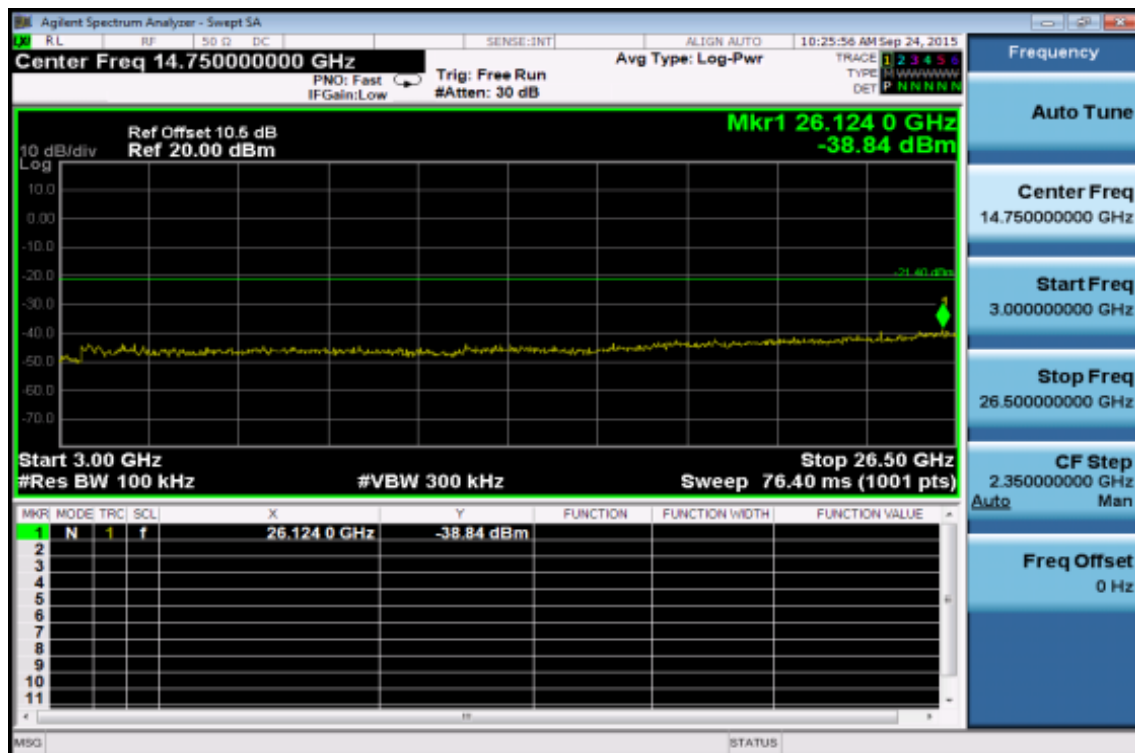
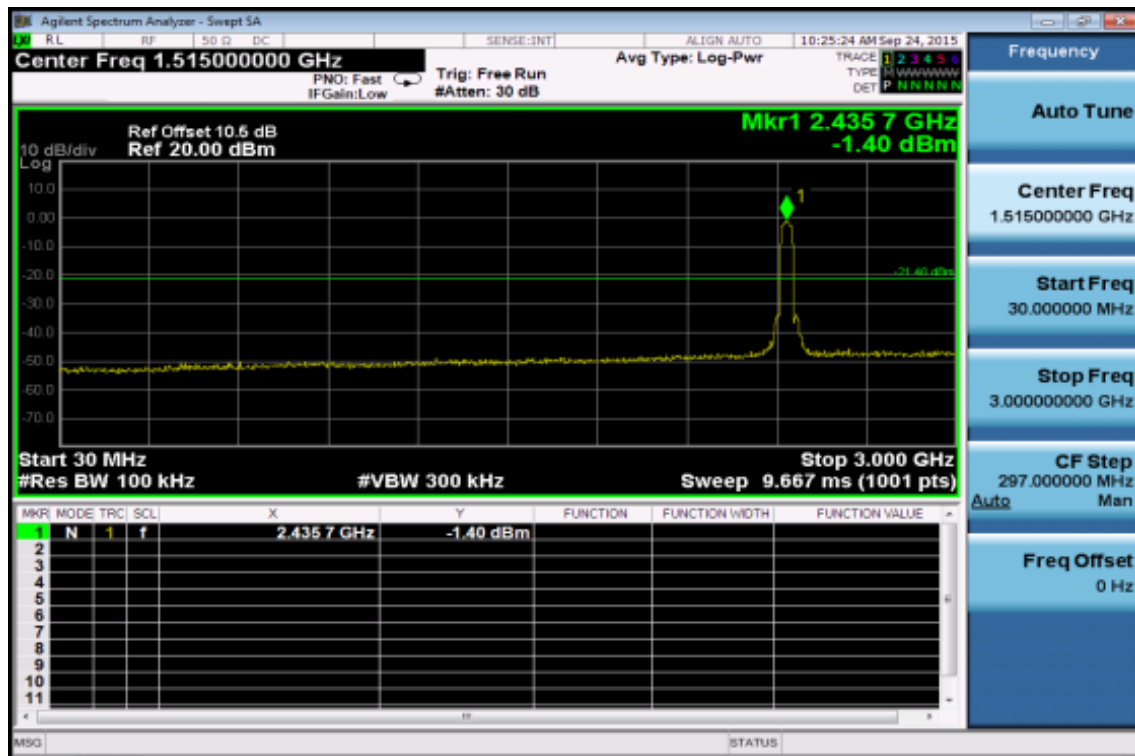
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## Spurious Emission Test Data CH-Mid



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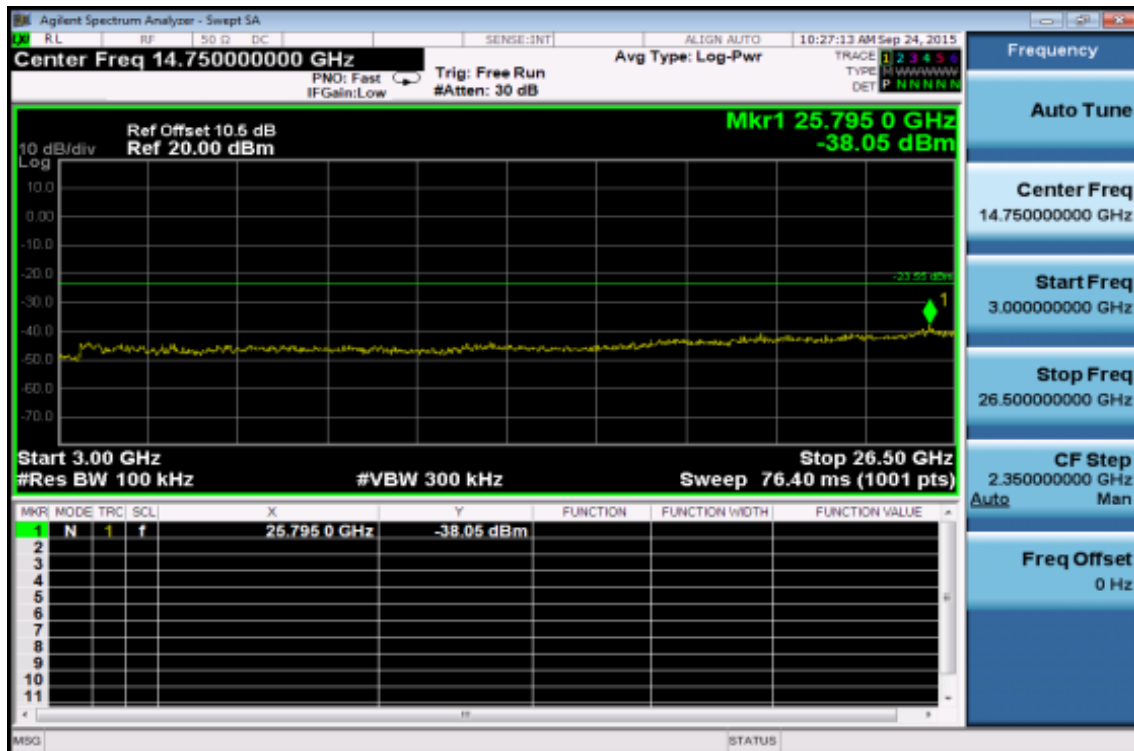
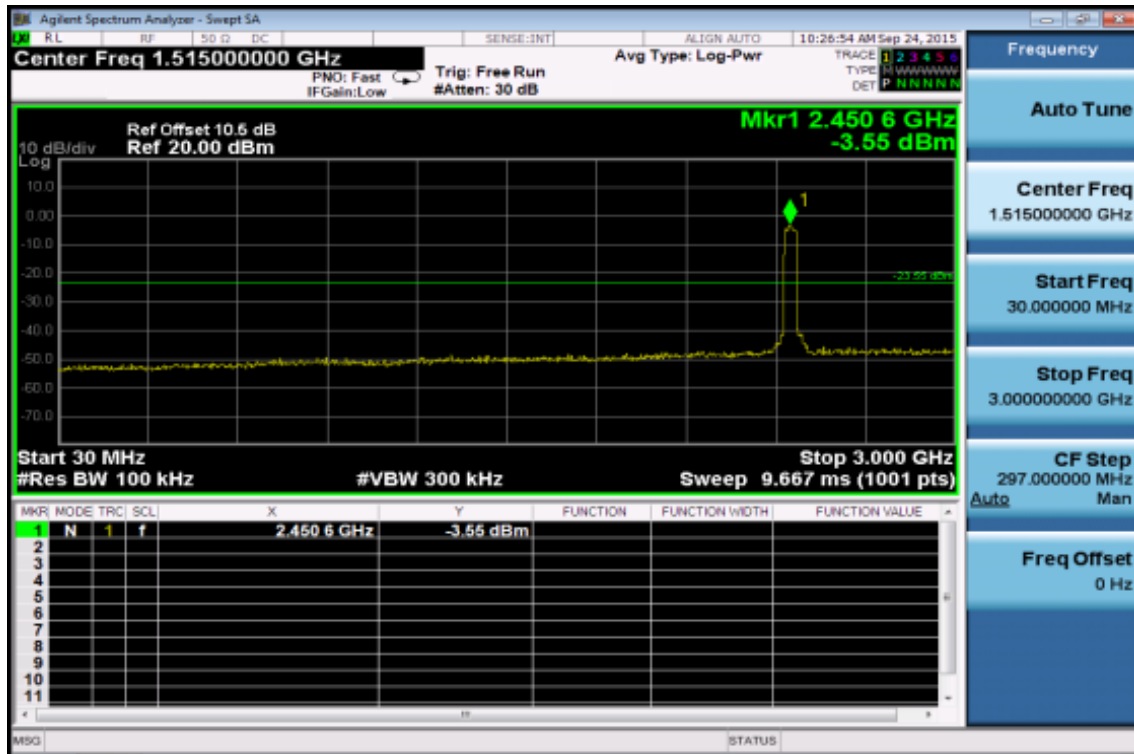
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## Spurious Emission Test Data CH-High



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## 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 11.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESU 40	100363	04/09/2015	04/08/2016
Loop Antenna	ETS-Lindgren	6502	00143303	12/09/2014	12/08/2015
Broadband Antenna	TESEQ	CBL 6112D	35240	12/05/2014	12/04/2015
Horn Antenna	ETS-Lindgren	3117	00143272	12/08/2014	12/07/2015
Horn Antenna	ETS-Lindgren	3160-09	00117911	11/13/2014	11/12/2015
Pre Amplifier	EMC Instruments	EMC330	980096	12/19/2014	12/18/2015
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-18	10204	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-26	100780	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2015	05/03/2016
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.

## 11.3 Test SET-UP

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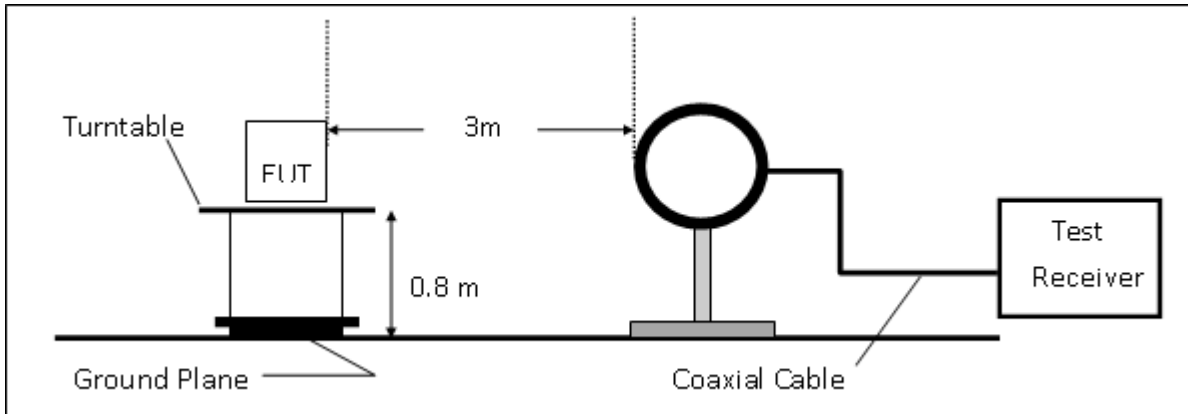
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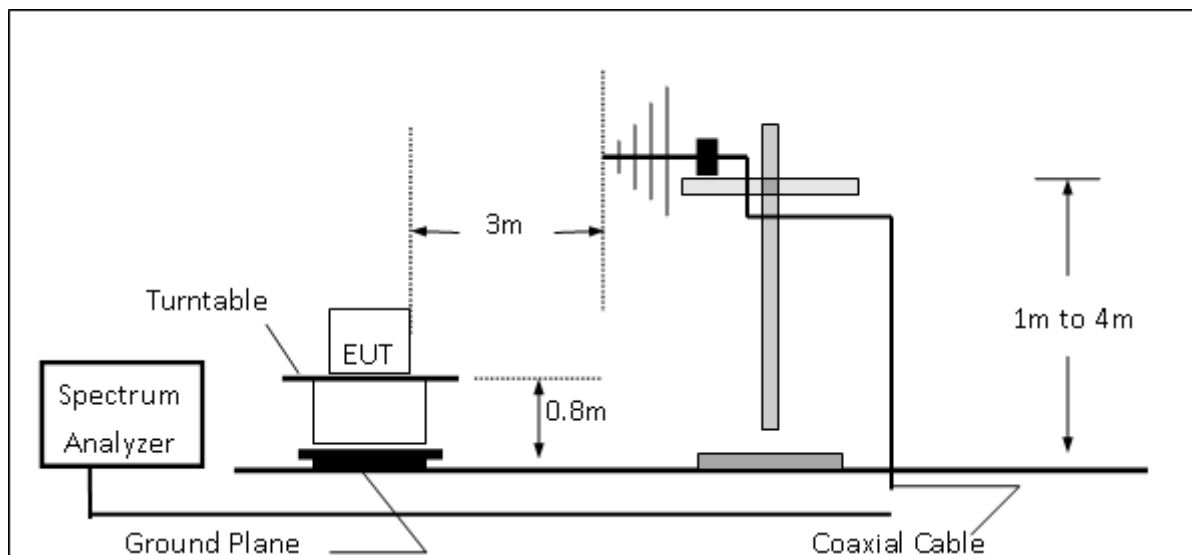
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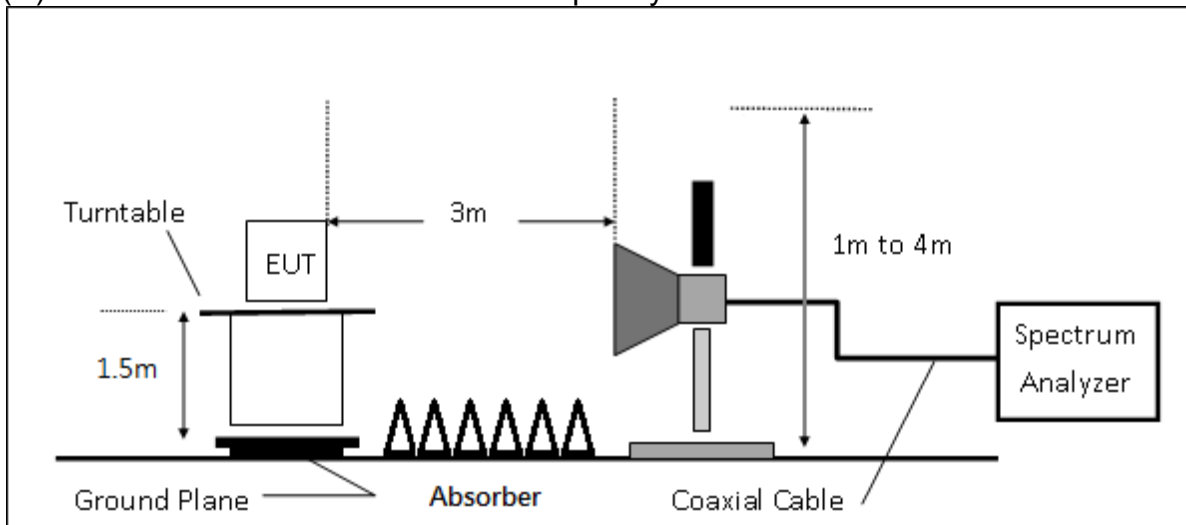
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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#### 11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When 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.
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.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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## 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	

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

### 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 from 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

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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# Radiated Band Edge Measurement Result (BLE mode)

Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2390.00	E	Average	28.12	5.16	33.28	54.00	-20.72
2390.00	E	Peak	39.68	5.16	44.84	74.00	-29.16

Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	27.98	5.16	33.14	54.00	-20.86
2390.00	E	Peak	39.88	5.16	45.04	74.00	-28.96

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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2483.50	E	Average	29.12	6.01	35.13	54.00	-18.87
2483.50	E	Peak	43.37	6.01	49.38	74.00	-24.62

Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	28.47	6.01	34.48	54.00	-19.52
2483.50	E	Peak	41.86	6.01	47.87	74.00	-26.13

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## Radiated Band Edge Measurement Result (802.11b)

Operation Band	:802.11 b	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2390.00	E	Average	36.54	5.16	41.70	54.00	-12.30
2390.00	E	Peak	51.22	5.16	56.38	74.00	-17.62

Operation Band	:802.11 b	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2390.00	E	Average	31.07	5.16	36.23	54.00	-17.77
2390.00	E	Peak	45.19	5.16	50.35	74.00	-23.65

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Operation Band	:802.11 b	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2483.50	E	Average	36.60	6.01	42.61	54.00	-11.39
2483.50	E	Peak	50.72	6.01	56.73	74.00	-17.27

Operation Band	:802.11 b	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	35.43	6.01	41.44	54.00	-12.56
2483.50	E	Peak	46.13	6.01	52.14	74.00	-21.86

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## Radiated Band Edge Measurement Result (802.11g)

Operation Band	:802.11 g	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2390.00	E	Average	43.13	5.16	48.29	54.00	-5.71
2390.00	E	Peak	65.19	5.16	70.35	74.00	-3.65

Operation Band	:802.11 g	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	38.89	5.16	44.05	54.00	-9.95
2390.00	E	Peak	60.34	5.16	65.50	74.00	-8.50

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Operation Band	:802.11 g	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2483.50	E	Average	42.31	6.01	48.32	54.00	-5.68
2483.50	E	Peak	67.26	6.01	73.27	74.00	-0.73

Operation Band	:802.11 g	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	39.11	6.01	45.12	54.00	-8.88
2483.50	E	Peak	65.99	6.01	72.00	74.00	-2.00

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## Radiated Band Edge Measurement Result (802.11\_HT20)

Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2390.00	E	Average	43.66	5.16	48.82	54.00	-5.18
2390.00	E	Peak	66.84	5.16	72.00	74.00	-2.00

Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	39.38	5.16	44.54	54.00	-9.46
2390.00	E	Peak	65.34	5.16	70.50	74.00	-3.50

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Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2483.50	E	Average	42.66	6.01	48.67	54.00	-5.33
2483.50	E	Peak	66.59	6.01	72.60	74.00	-1.40

Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	37.64	6.01	43.65	54.00	-10.35
2483.50	E	Peak	63.28	6.01	69.29	74.00	-4.71

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**Radiated Band Edge Measurement Result (802.11\_HT40)**

Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2422 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2390.00	E	Average	40.33	5.16	45.49	54.00	-8.51
2390.00	E	Peak	67.13	5.16	72.29	74.00	-1.71

Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2422 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	27.23	5.16	32.39	54.00	-21.61
2390.00	E	Peak	63.59	5.16	68.75	74.00	-5.25

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Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2452 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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
2483.50	E	Average	40.69	6.01	46.70	54.00	-7.30
2483.50	E	Peak	65.73	6.01	71.74	74.00	-2.26

Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2452 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:Band Edge HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	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	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	36.48	6.01	42.49	54.00	-11.51
2483.50	E	Peak	59.32	6.01	65.33	74.00	-8.67

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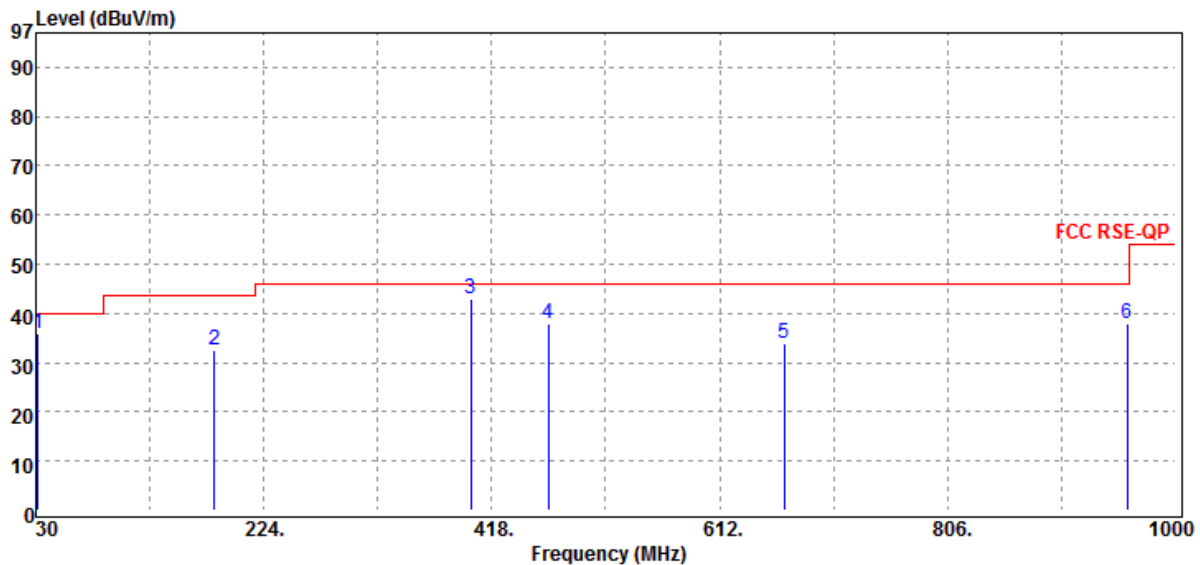
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## Radiated Spurious Emission Measurement Result (BLE mode)

### Below 1GHz Worst-Case Data:

Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
31.94	S	Peak	46.24	-10.22	36.02	40.00	-3.98
182.29	S	Peak	43.39	-10.81	32.58	43.50	-10.92
400.54	S	Peak	48.87	-6.00	42.87	46.00	-3.13
466.50	S	Peak	43.16	-5.26	37.90	46.00	-8.10
667.29	S	Peak	35.21	-1.20	34.01	46.00	-11.99
959.26	S	Peak	34.34	3.65	37.99	46.00	-8.01

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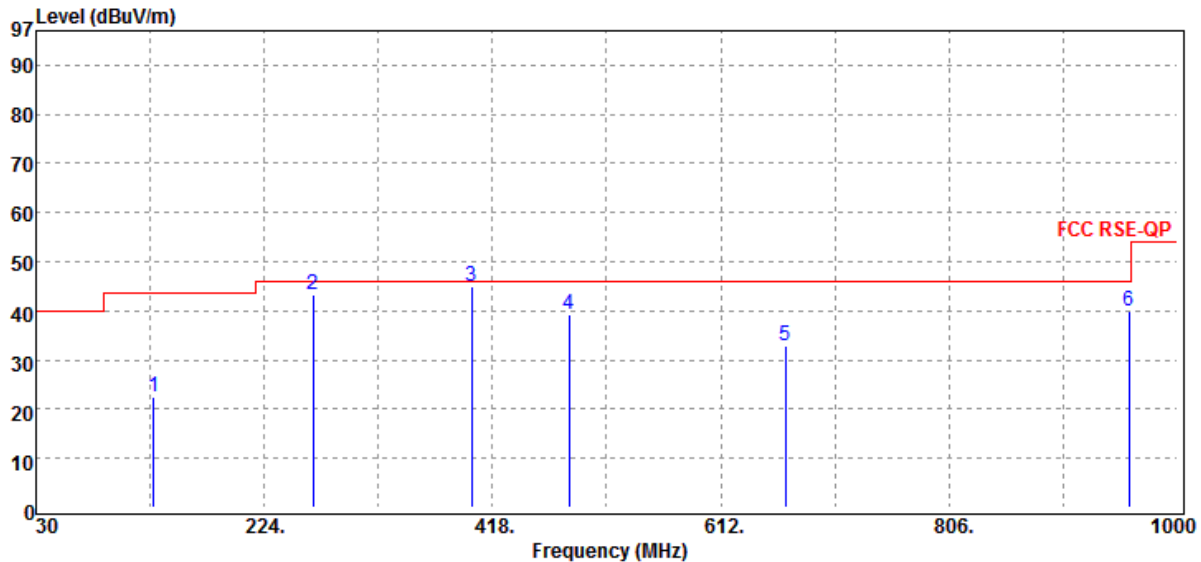
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Operation Band :BT4.0  
Fundamental Frequency :2402 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C / 60 RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
129.91	S	Peak	32.89	-10.51	22.38	43.50	-21.12
265.71	S	Peak	52.39	-9.23	43.16	46.00	-2.84
400.54	S	Peak	50.97	-6.00	44.97	46.00	-1.03
482.99	S	Peak	43.69	-4.46	39.23	46.00	-6.77
667.29	S	Peak	33.99	-1.20	32.79	46.00	-13.21
959.26	S	Peak	36.30	3.65	39.95	46.00	-6.05

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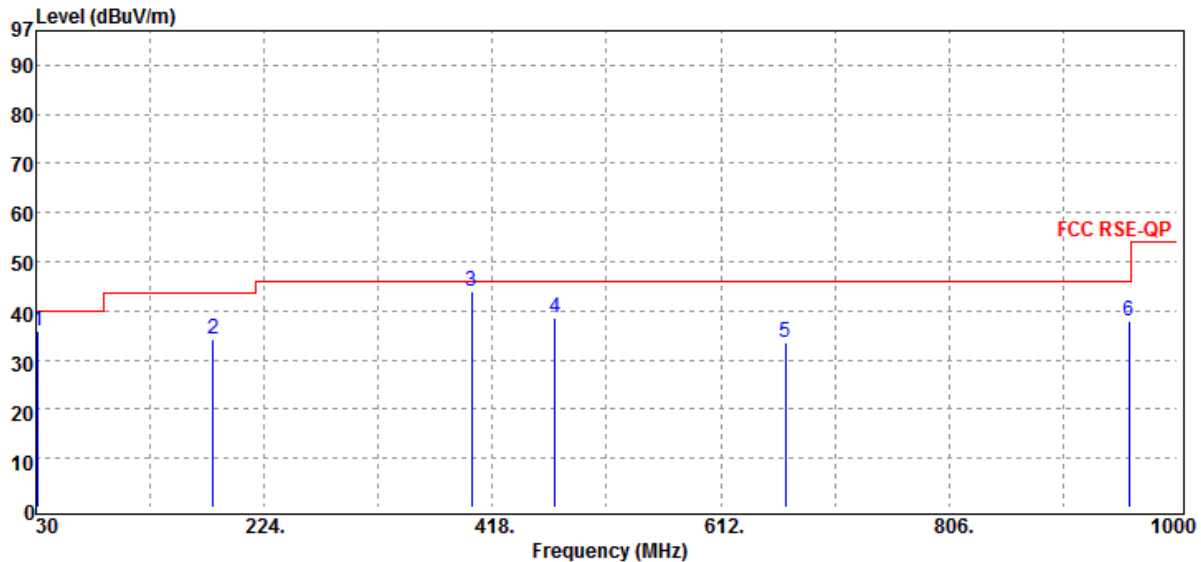
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2442 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX MID	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
31.94	S	Peak	46.19	-10.22	35.97	40.00	-4.03
180.35	S	Peak	44.90	-10.59	34.31	43.50	-9.19
400.54	S	Peak	49.93	-6.00	43.93	46.00	-2.07
471.35	S	Peak	43.64	-5.04	38.60	46.00	-7.40
667.29	S	Peak	34.63	-1.20	33.43	46.00	-12.57
959.26	S	Peak	34.42	3.65	38.07	46.00	-7.93

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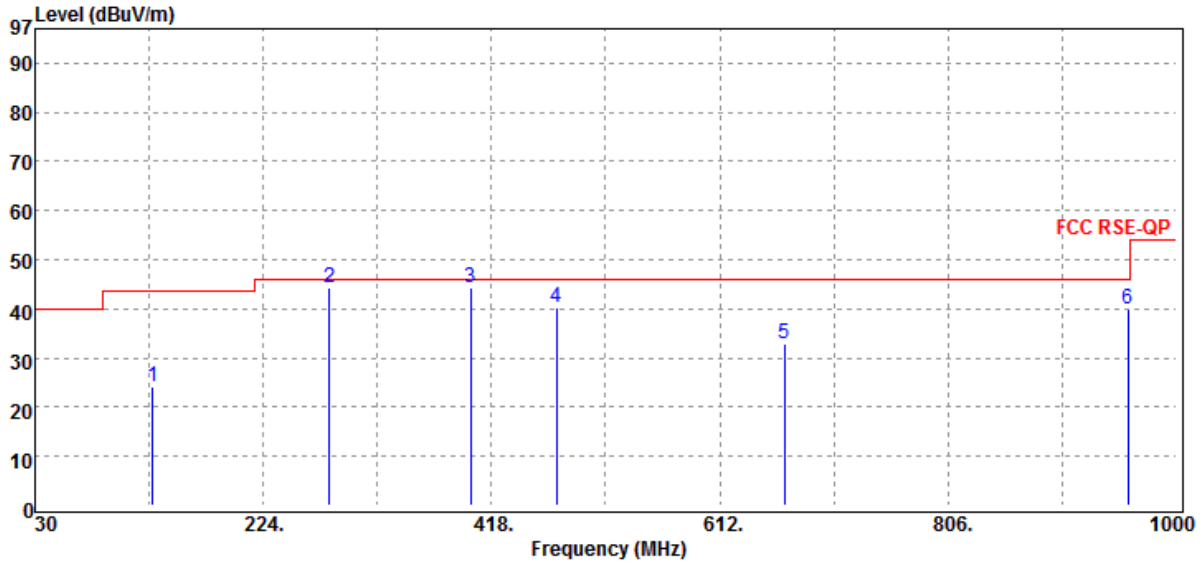
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Operation Band :BT4.0  
Fundamental Frequency :2442 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C / 60 RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
129.91	S	Peak	34.82	-10.51	24.31	43.50	-19.19
280.26	S	Peak	52.84	-8.38	44.46	46.00	-1.54
400.54	S	Peak	50.29	-6.00	44.29	46.00	-1.71
473.29	S	Peak	45.28	-4.93	40.35	46.00	-5.65
667.29	S	Peak	34.01	-1.20	32.81	46.00	-13.19
959.26	S	Peak	36.31	3.65	39.96	46.00	-6.04

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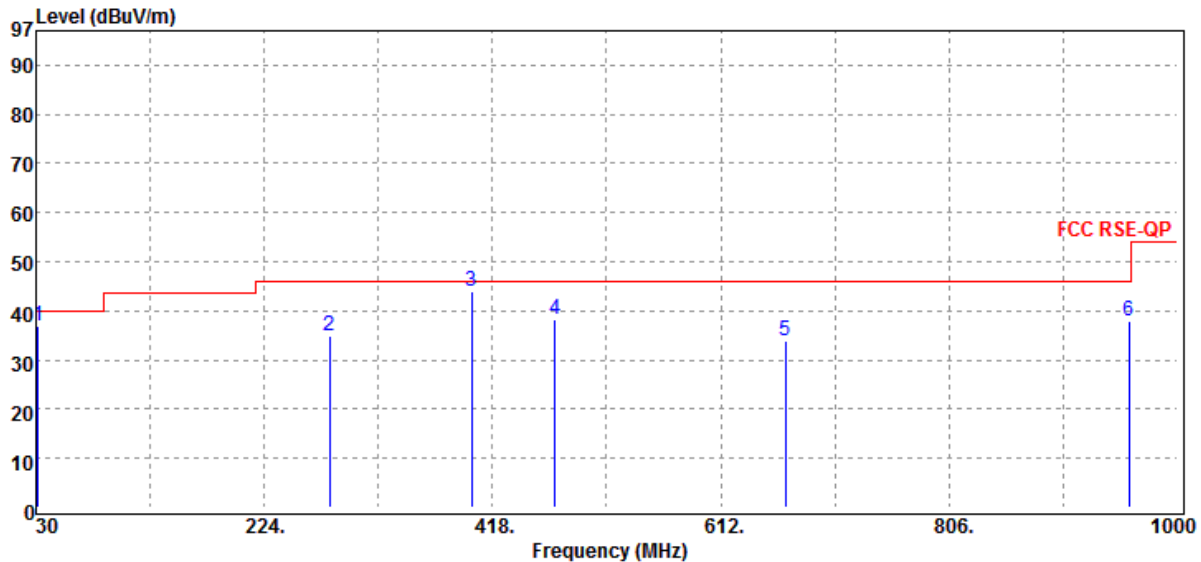
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
31.94	S	Peak	47.30	-10.22	37.08	40.00	-2.92
279.29	S	Peak	43.49	-8.42	35.07	46.00	-10.93
400.54	S	Peak	49.88	-6.00	43.88	46.00	-2.12
471.35	S	Peak	43.19	-5.04	38.15	46.00	-7.85
667.29	S	Peak	34.98	-1.20	33.78	46.00	-12.22
959.26	S	Peak	34.15	3.65	37.80	46.00	-8.20

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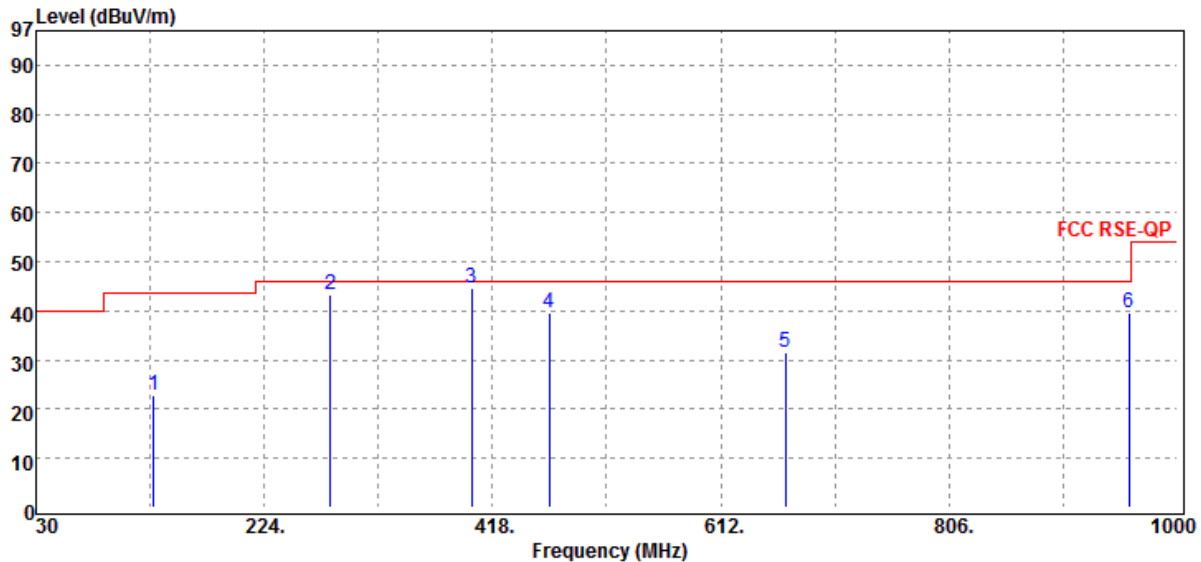
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Operation Band :BT4.0  
Fundamental Frequency :2480 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C / 60 RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
129.91	S	Peak	33.45	-10.51	22.94	43.50	-20.56
280.26	S	Peak	51.79	-8.38	43.41	46.00	-2.59
400.54	S	Peak	50.49	-6.00	44.49	46.00	-1.51
466.50	S	Peak	44.77	-5.26	39.51	46.00	-6.49
667.29	S	Peak	32.72	-1.20	31.52	46.00	-14.48
959.26	S	Peak	36.12	3.65	39.77	46.00	-6.23

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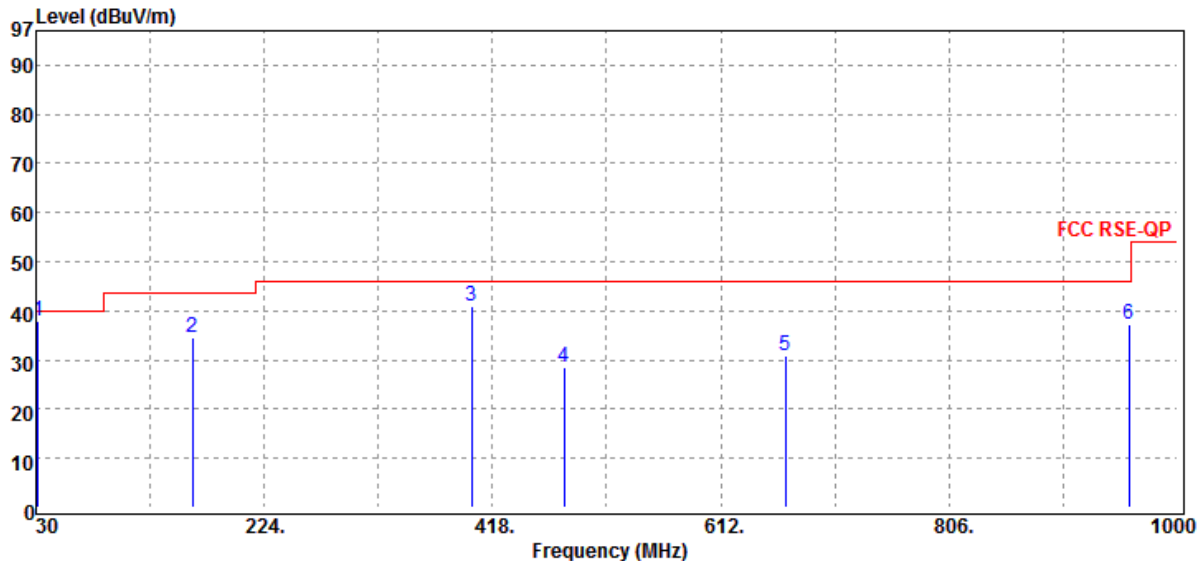
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## Radiated Spurious Emission Measurement Result (802.11 b/g/n mode)

### Below 1GHz Worst-Case Data:

Operation Band	:802.11 g	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
31.94	S	Peak	48.17	-10.22	37.95	40.00	-2.05
162.89	S	Peak	43.55	-8.88	34.67	43.50	-8.83
400.54	S	Peak	47.08	-6.00	41.08	46.00	-4.92
479.11	S	Peak	33.29	-4.63	28.66	46.00	-17.34
667.29	S	Peak	32.23	-1.20	31.03	46.00	-14.97
959.26	S	Peak	33.49	3.65	37.14	46.00	-8.86

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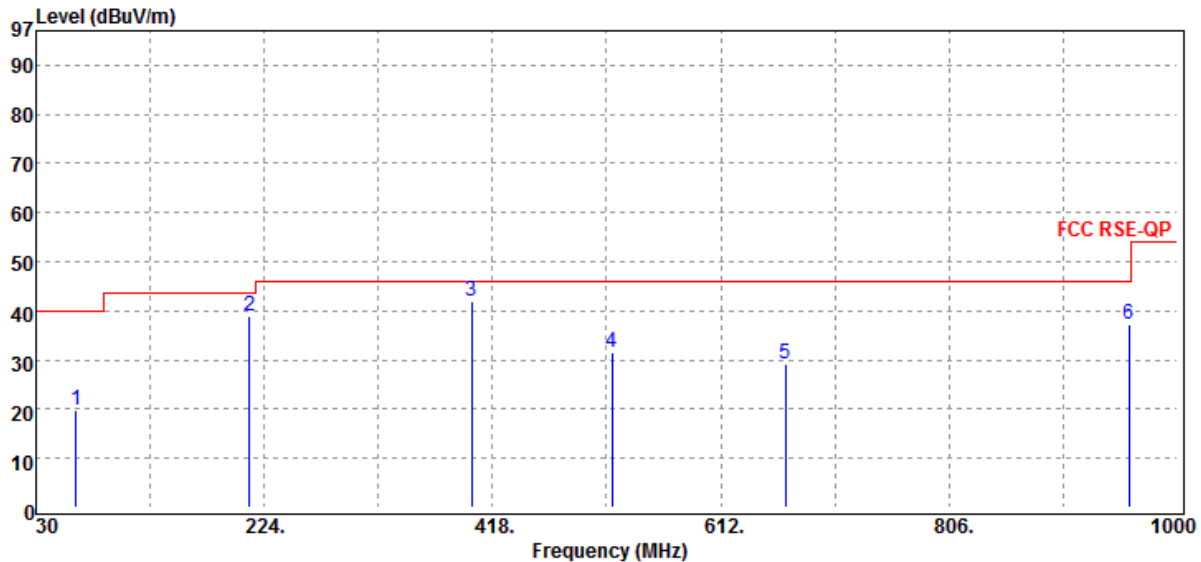
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Operation Band :802.11 g  
Fundamental Frequency :2412 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer : Ashton  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
63.95	S	Peak	30.56	-10.79	19.77	40.00	-20.23
211.39	S	Peak	50.10	-11.16	38.94	43.50	-4.56
400.54	S	Peak	47.92	-6.00	41.92	46.00	-4.08
519.85	S	Peak	36.11	-4.42	31.69	46.00	-14.31
667.29	S	Peak	30.44	-1.20	29.24	46.00	-16.76
959.26	S	Peak	33.67	3.65	37.32	46.00	-8.68

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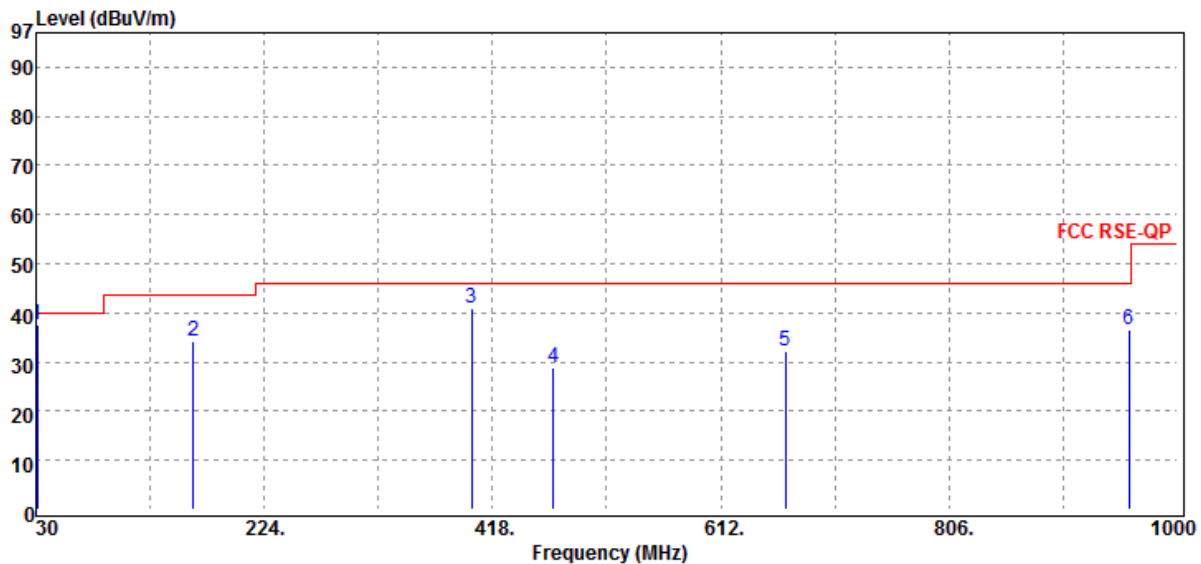
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Operation Band :802.11 g  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
30.97	S	Peak	47.67	-10.24	37.43	40.00	-2.57
163.86	S	Peak	43.19	-8.92	34.27	43.50	-9.23
400.54	S	Peak	46.94	-6.00	40.94	46.00	-5.06
469.41	S	Peak	34.02	-5.14	28.88	46.00	-17.12
667.29	S	Peak	33.34	-1.20	32.14	46.00	-13.86
959.26	S	Peak	32.83	3.65	36.48	46.00	-9.52

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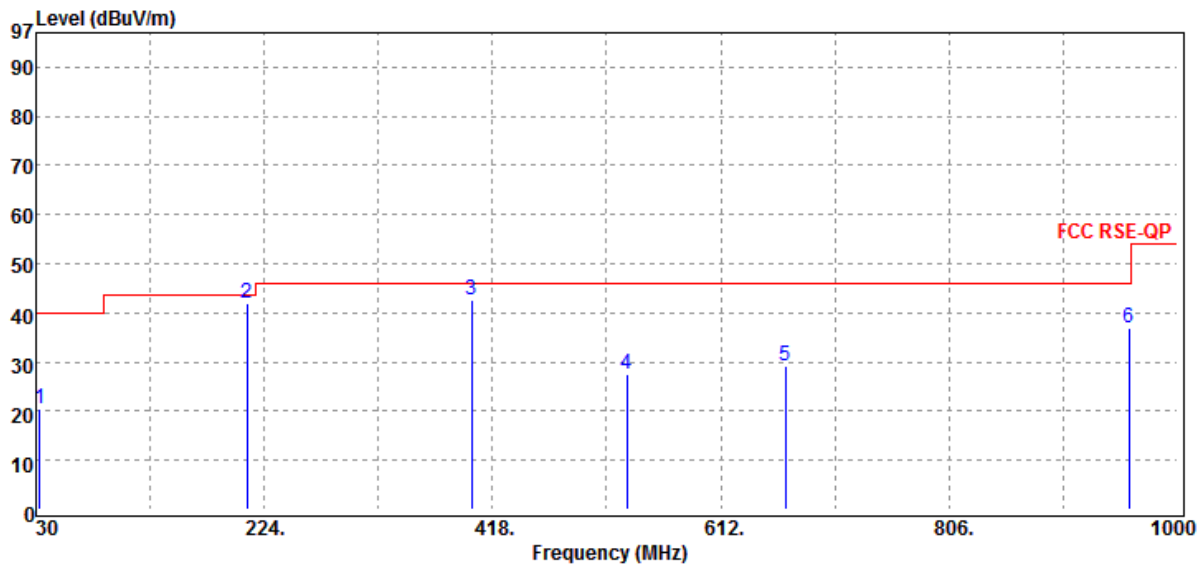
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Operation Band :802.11 g  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
32.91	S	Peak	30.55	-10.20	20.35	40.00	-19.65
209.45	S	Peak	53.09	-11.21	41.88	43.50	-1.62
400.54	S	Peak	48.71	-6.00	42.71	46.00	-3.29
532.46	S	Peak	31.42	-4.03	27.39	46.00	-18.61
667.29	S	Peak	30.38	-1.20	29.18	46.00	-16.82
959.26	S	Peak	33.43	3.65	37.08	46.00	-8.92

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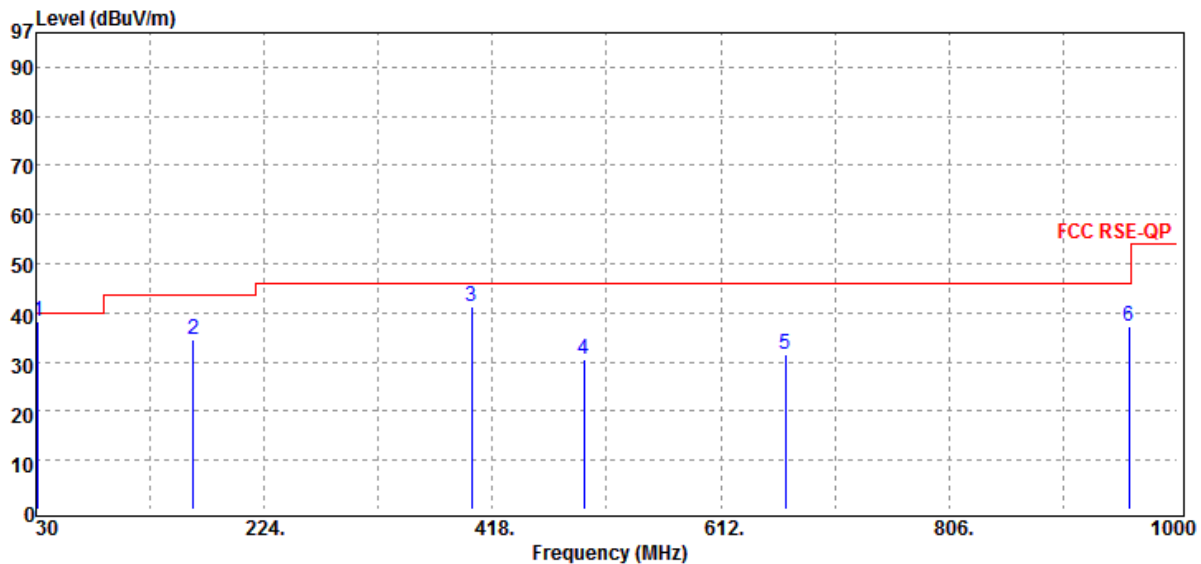
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Operation Band :802.11 g  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
31.94	S	Peak	48.44	-10.22	38.22	40.00	-1.78
163.86	S	Peak	43.39	-8.92	34.47	43.50	-9.03
400.54	S	Peak	47.44	-6.00	41.44	46.00	-4.56
495.60	S	Peak	34.77	-4.31	30.46	46.00	-15.54
667.29	S	Peak	32.69	-1.20	31.49	46.00	-14.51
959.26	S	Peak	33.55	3.65	37.20	46.00	-8.80

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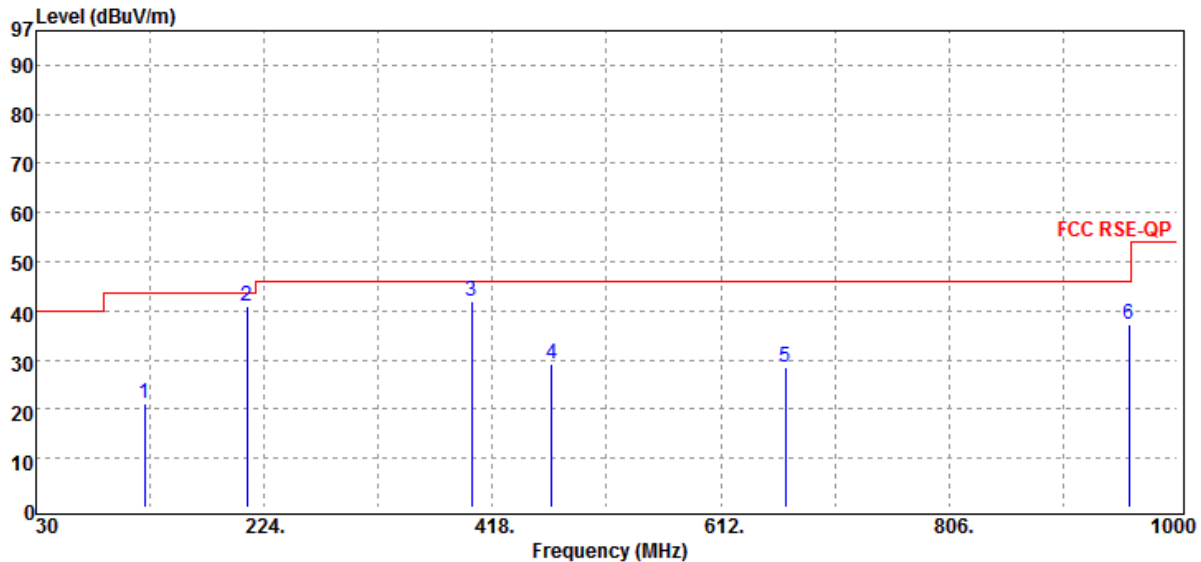
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Operation Band :802.11 g  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
122.15	S	Peak	32.40	-11.16	21.24	43.50	-22.26
209.45	S	Peak	52.17	-11.21	40.96	43.50	-2.54
400.54	S	Peak	48.10	-6.00	42.10	46.00	-3.90
468.44	S	Peak	34.28	-5.18	29.10	46.00	-16.90
667.29	S	Peak	29.58	-1.20	28.38	46.00	-17.62
959.26	S	Peak	33.49	3.65	37.14	46.00	-8.86

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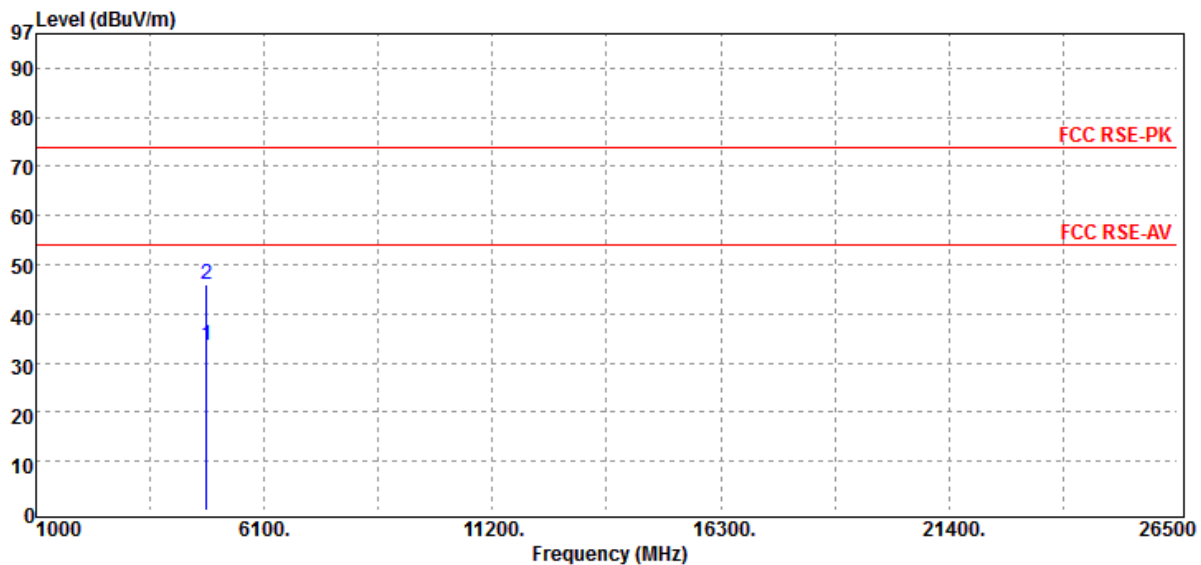
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## Radiated Spurious Emission Measurement Result (BLE mode)

### Above 1GHz Worst-Case Data:

Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4804.00	H	Average	23.86	9.56	33.42	54.00	-20.58
4804.00	H	Peak	36.39	9.56	45.95	74.00	-28.05

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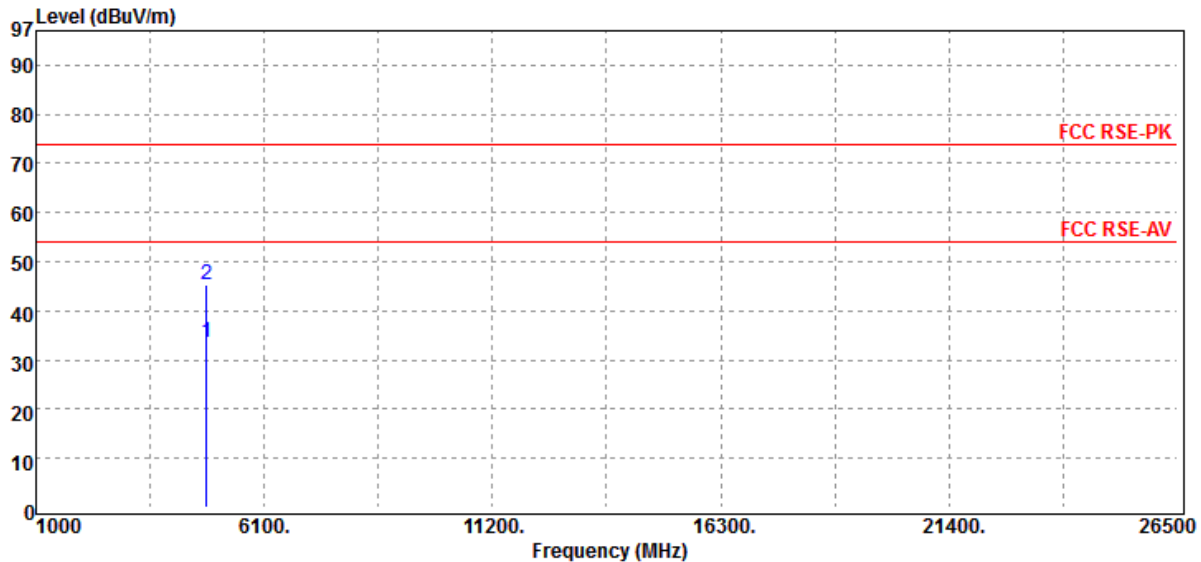
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4804.00	H	Average	23.86	9.56	33.42	54.00	-20.58
4804.00	H	Peak	35.65	9.56	45.21	74.00	-28.79

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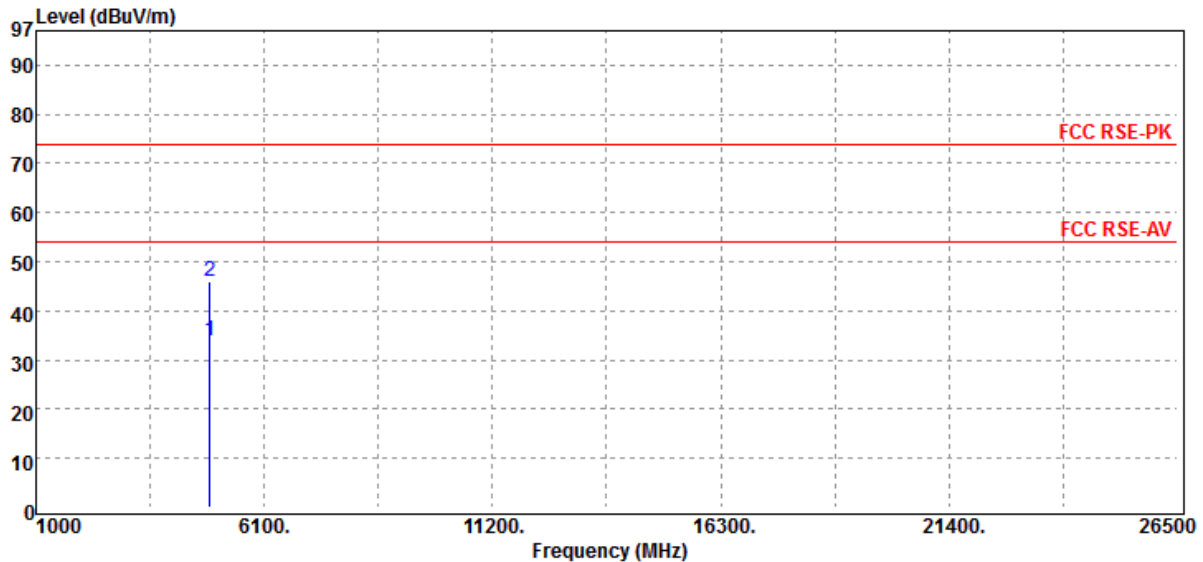
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2442 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX MID	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	23.99	9.85	33.84	54.00	-20.16
4884.00	H	Peak	36.17	9.85	46.02	74.00	-27.98

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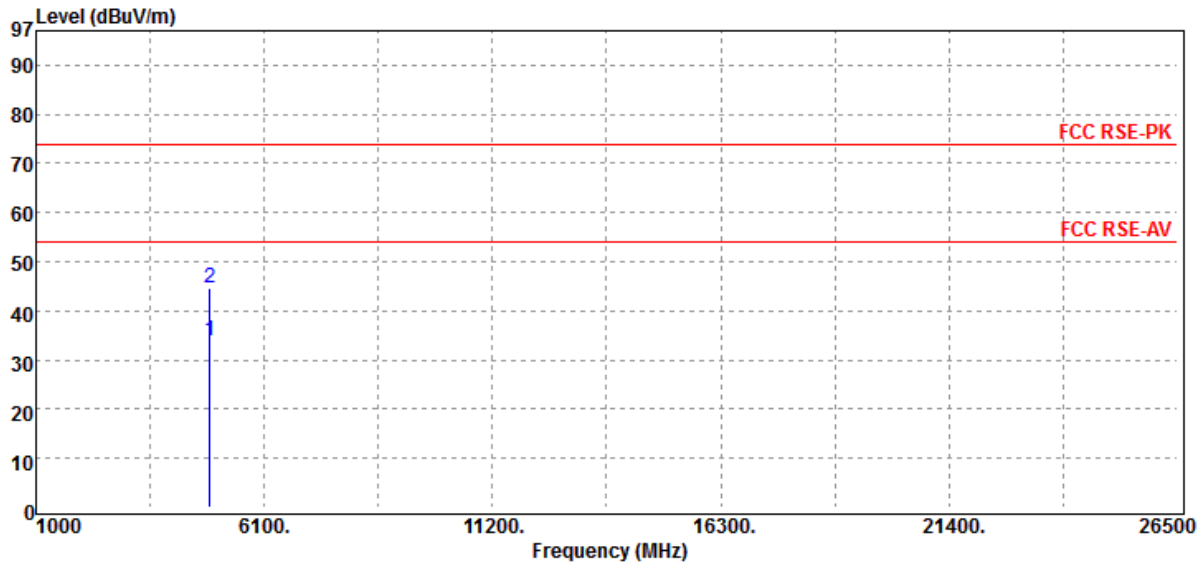
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2442 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX MID	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	23.91	9.85	33.76	54.00	-20.24
4884.00	H	Peak	34.76	9.85	44.61	74.00	-29.39

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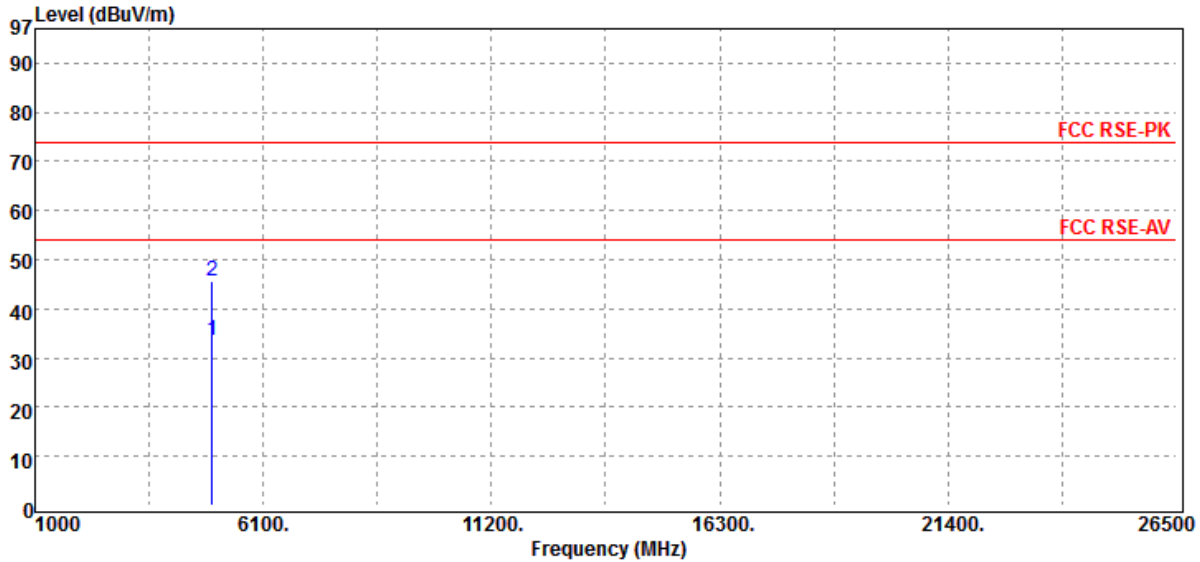
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4960.00	H	Average	23.62	9.86	33.48	54.00	-20.52
4960.00	H	Peak	35.63	9.86	45.49	74.00	-28.51

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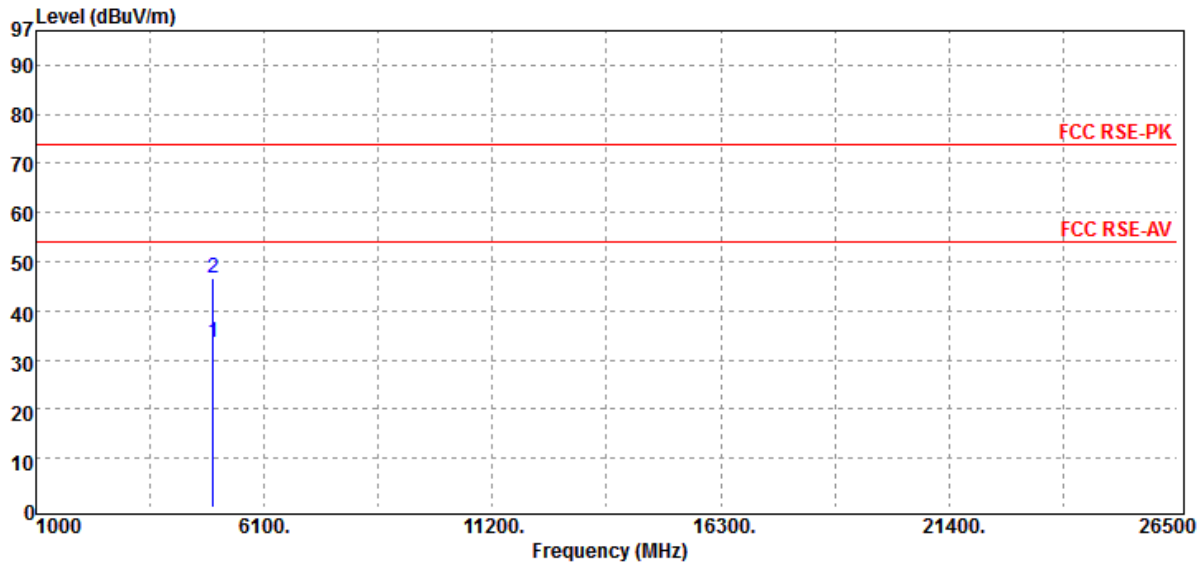
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Operation Band	:BT4.0	Test Date	:2015-09-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	23.64	9.86	33.50	54.00	-20.50
4960.00	H	Peak	36.83	9.86	46.69	74.00	-27.31

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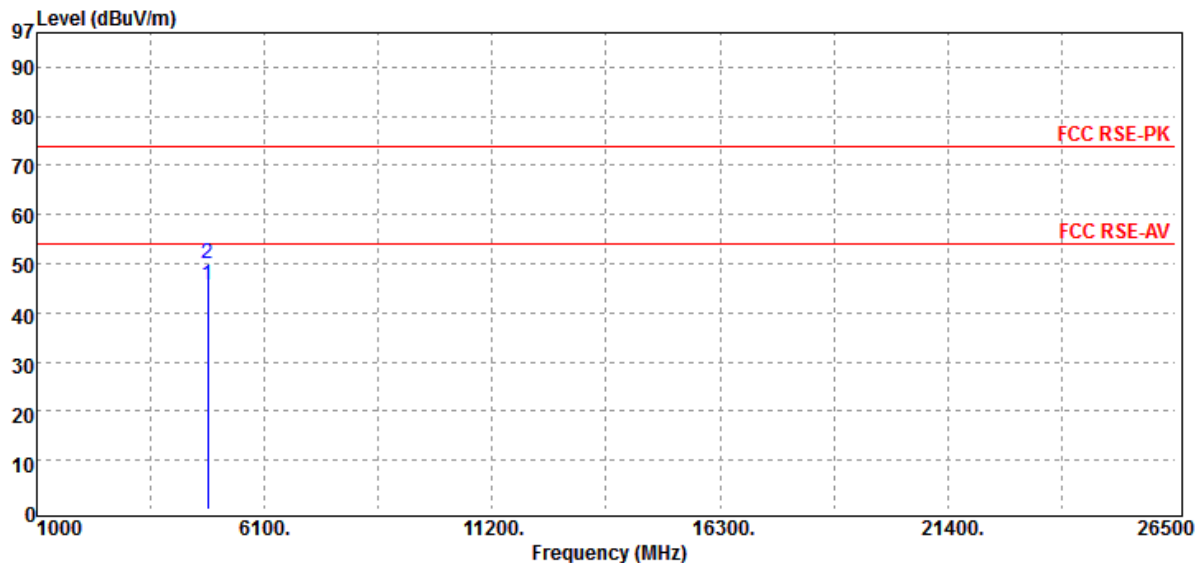
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## Radiated Spurious Emission Measurement Result (802.11 b/g/n mode)

### Above 1GHz Worst-Case Data:

Operation Band	:802.11 b	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	H	Average	35.97	9.63	45.60	54.00	-8.40
4824.00	H	Peak	40.54	9.63	50.17	74.00	-23.83

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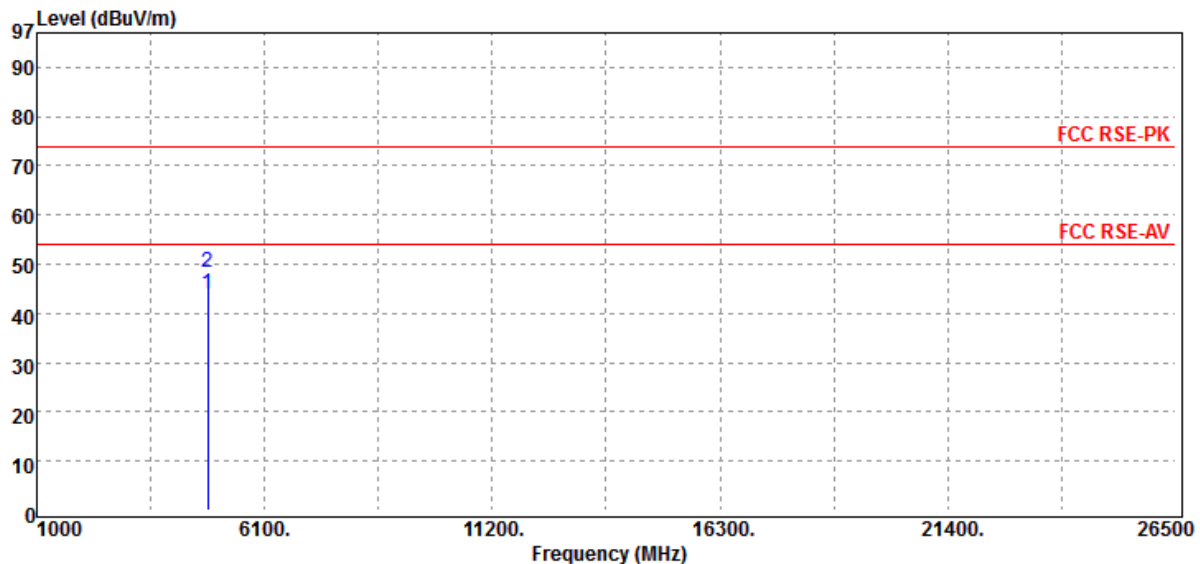
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Operation Band :802.11 b  
Fundamental Frequency :2412 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4824.00	H	Average	34.37	9.63	44.00	54.00	-10.00
4824.00	H	Peak	38.80	9.63	48.43	74.00	-25.57

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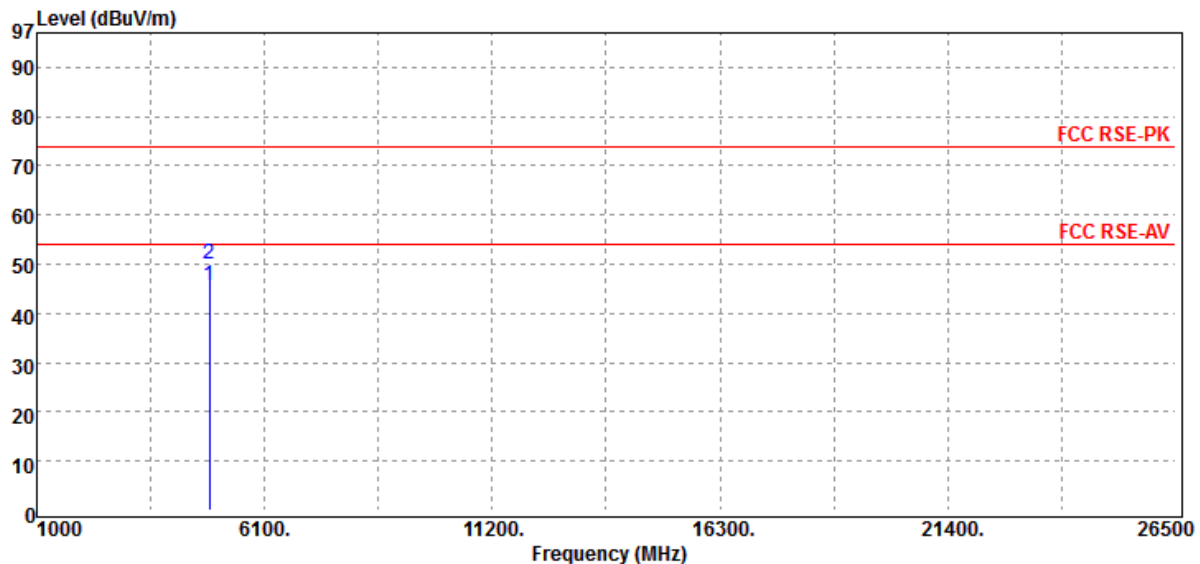
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Operation Band :802.11 b  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	35.73	9.85	45.58	54.00	-8.42
4874.00	H	Peak	40.05	9.85	49.90	74.00	-24.10

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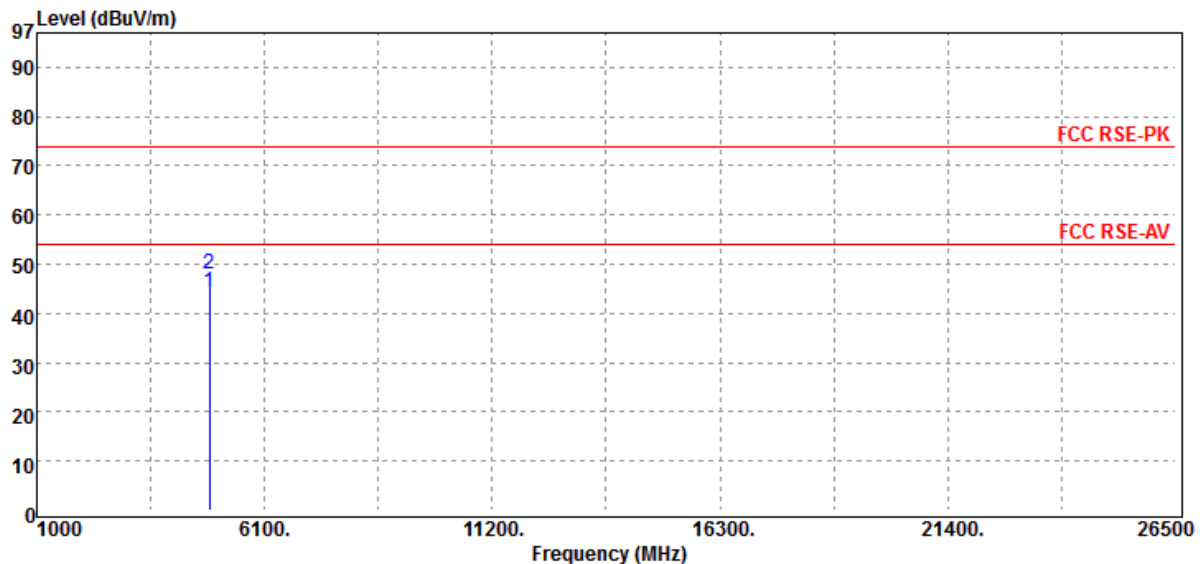
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Operation Band :802.11 b  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	34.55	9.85	44.40	54.00	-9.60
4874.00	H	Peak	38.05	9.85	47.90	74.00	-26.10

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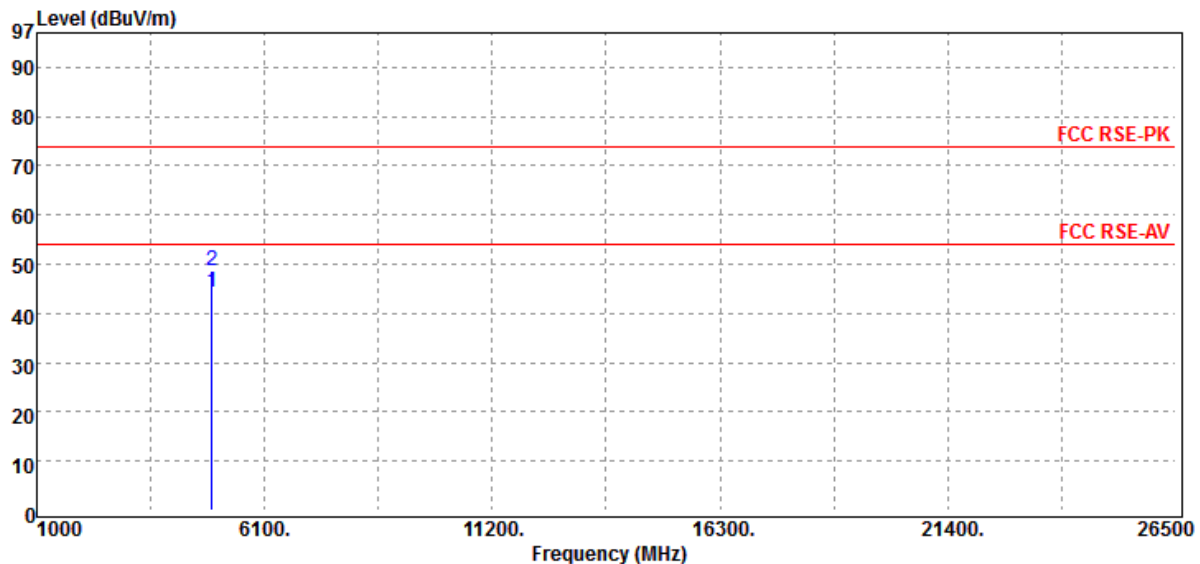
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Operation Band :802.11 b  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4924.00	H	Average	34.42	9.86	44.28	54.00	-9.72
4924.00	H	Peak	38.66	9.86	48.52	74.00	-25.48

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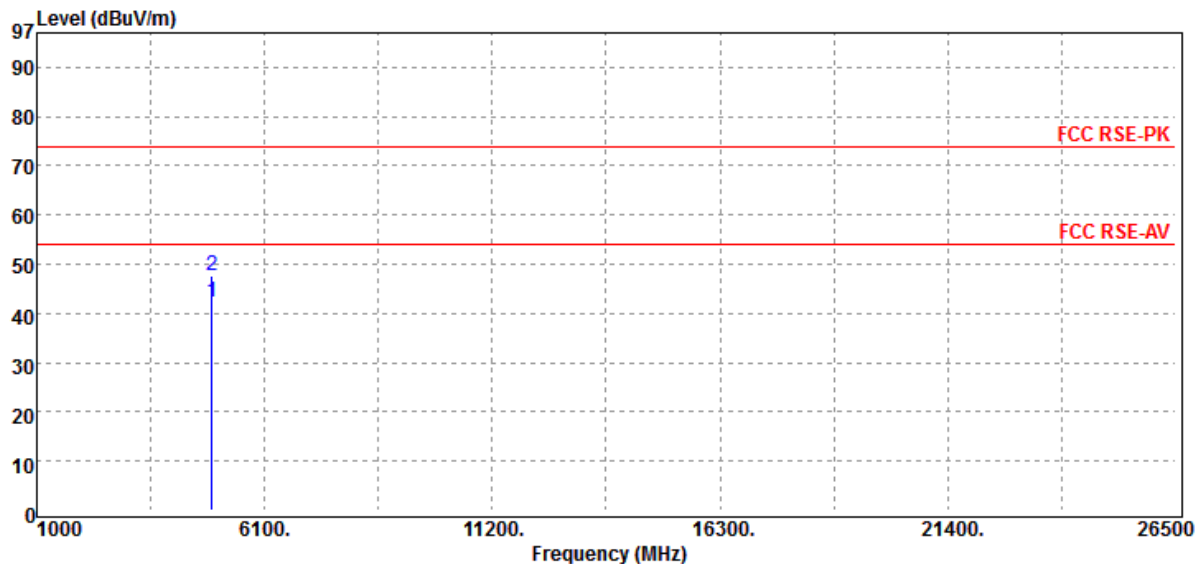
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Operation Band :802.11 b  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	32.33	9.86	42.19	54.00	-11.81
4924.00	H	Peak	37.66	9.86	47.52	74.00	-26.48

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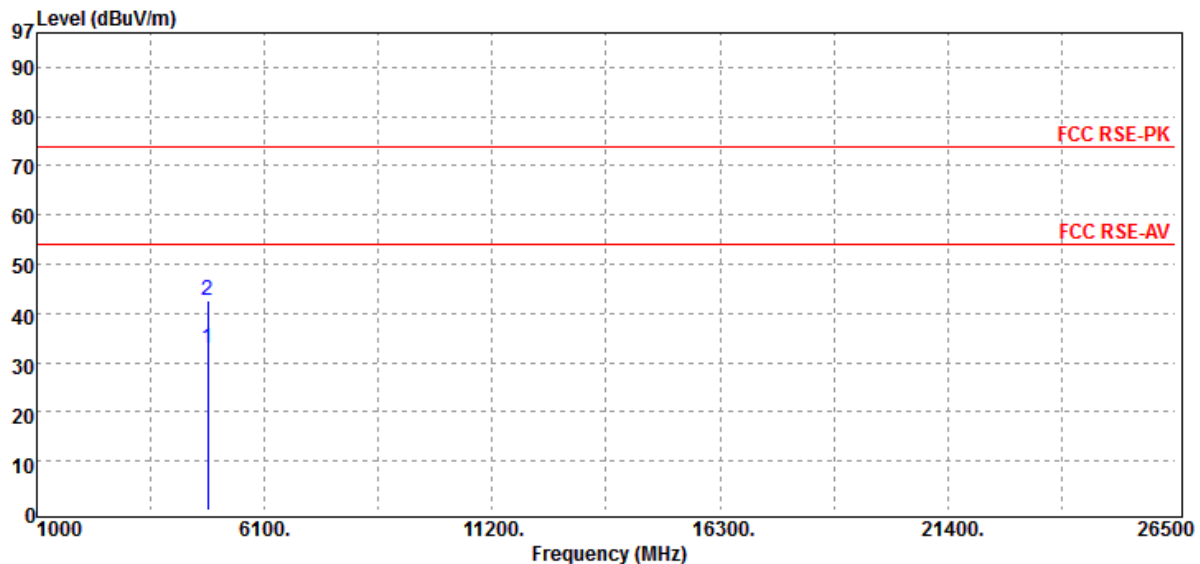
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Operation Band :802.11 g  
Fundamental Frequency :2412 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	H	Average	23.41	9.63	33.04	54.00	-20.96
4824.00	H	Peak	33.03	9.63	42.66	74.00	-31.34

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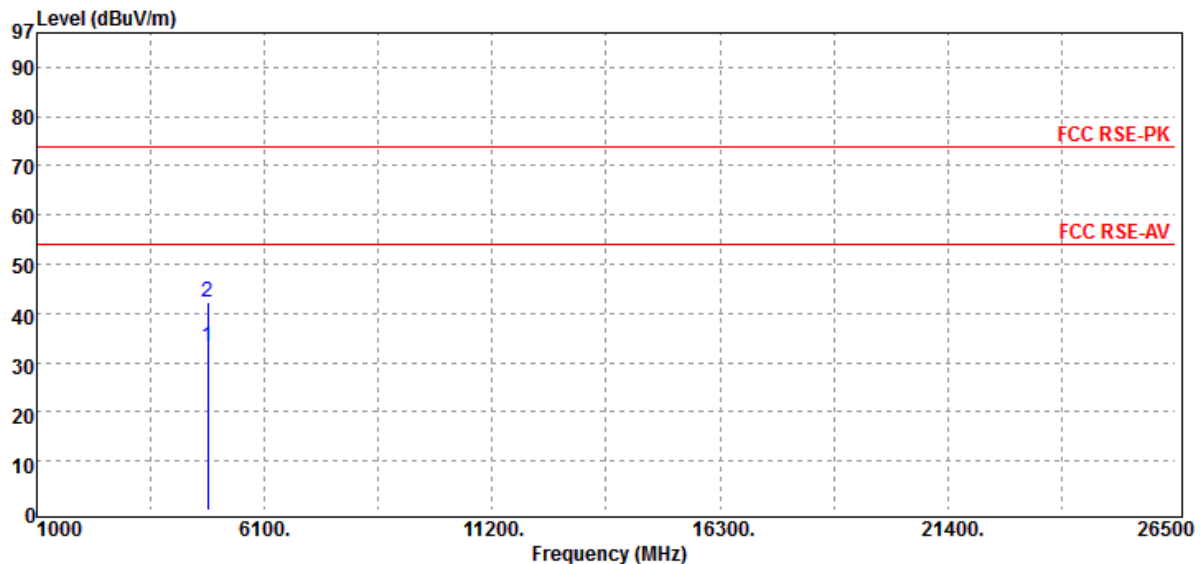
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Operation Band :802.11 g  
Fundamental Frequency :2412 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	H	Average	23.51	9.63	33.14	54.00	-20.86
4824.00	H	Peak	32.53	9.63	42.16	74.00	-31.84

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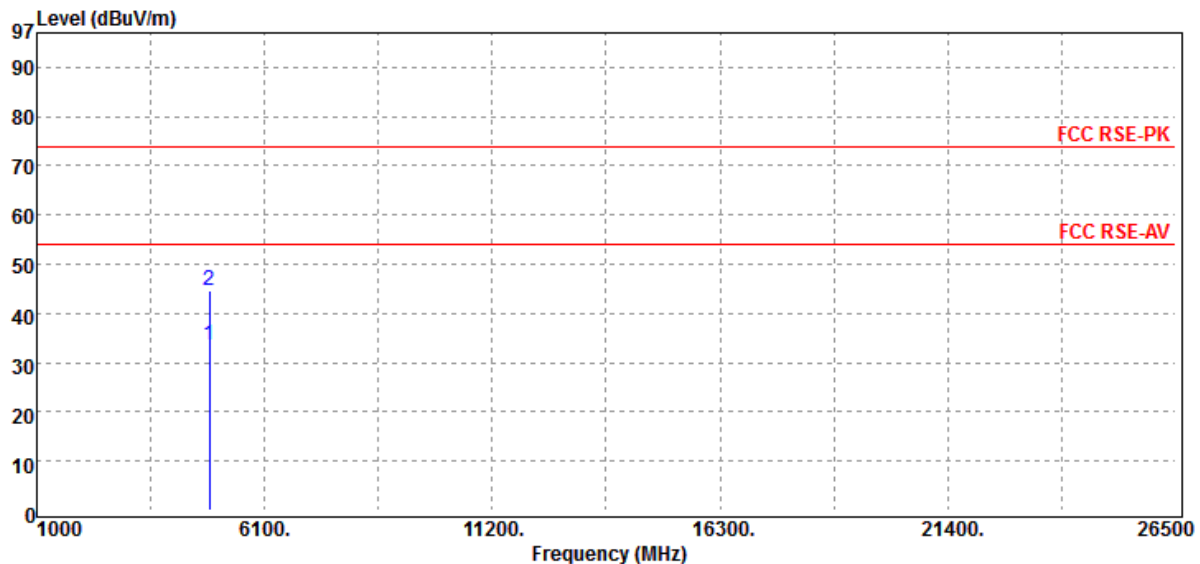
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Operation Band :802.11 g  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	23.61	9.85	33.46	54.00	-20.54
4874.00	H	Peak	34.84	9.85	44.69	74.00	-29.31

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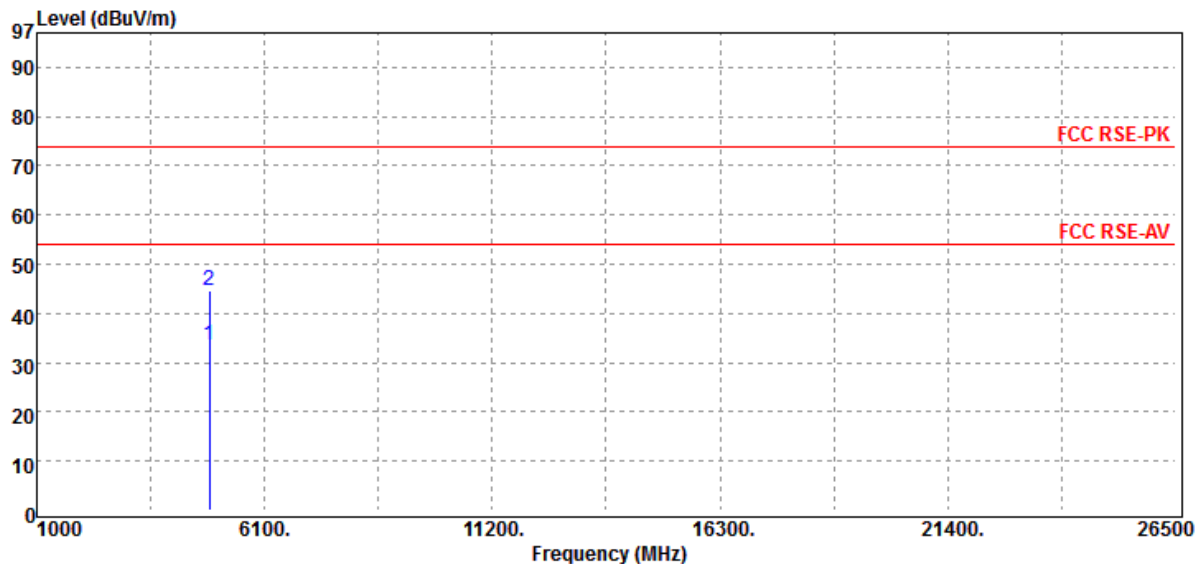
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Operation Band :802.11 g  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	23.55	9.85	33.40	54.00	-20.60
4874.00	H	Peak	34.84	9.85	44.69	74.00	-29.31

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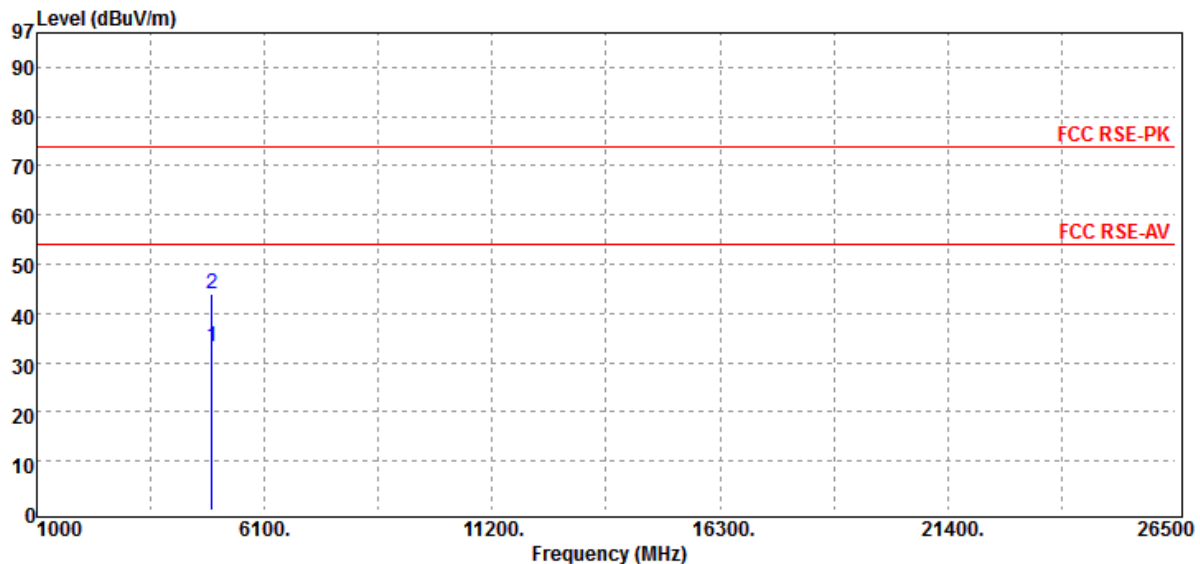
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Operation Band :802.11 g  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4924.00	H	Average	23.35	9.86	33.21	54.00	-20.79
4924.00	H	Peak	33.95	9.86	43.81	74.00	-30.19

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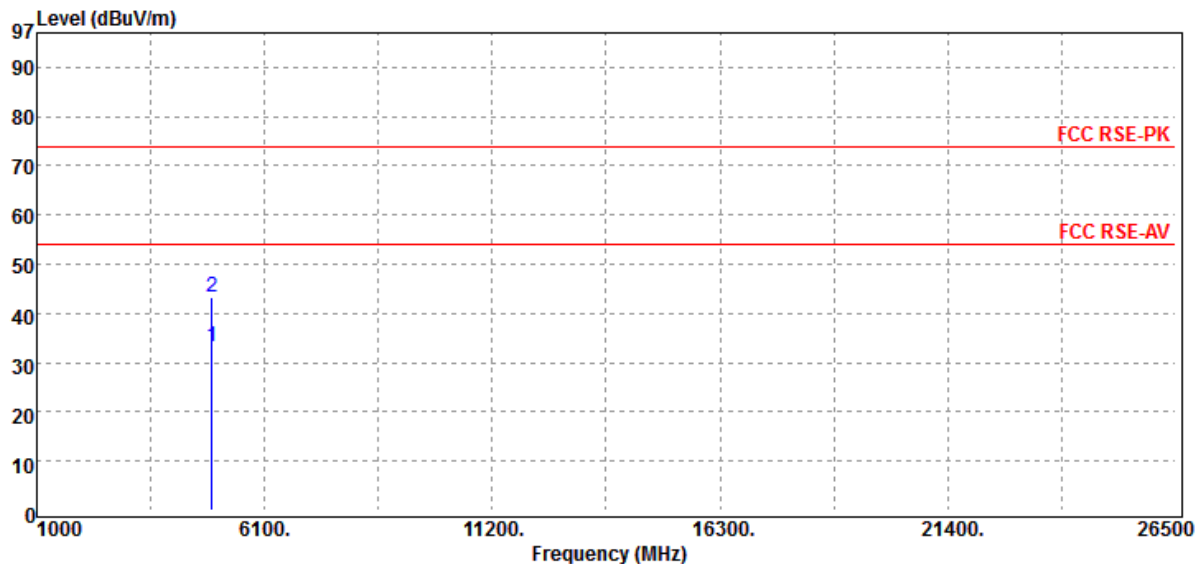
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Operation Band :802.11 g  
Fundamental Frequency :2462 MHz  
Operation Mode :TX HIGH  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4924.00	H	Average	23.49	9.86	33.35	54.00	-20.65
4924.00	H	Peak	33.52	9.86	43.38	74.00	-30.62

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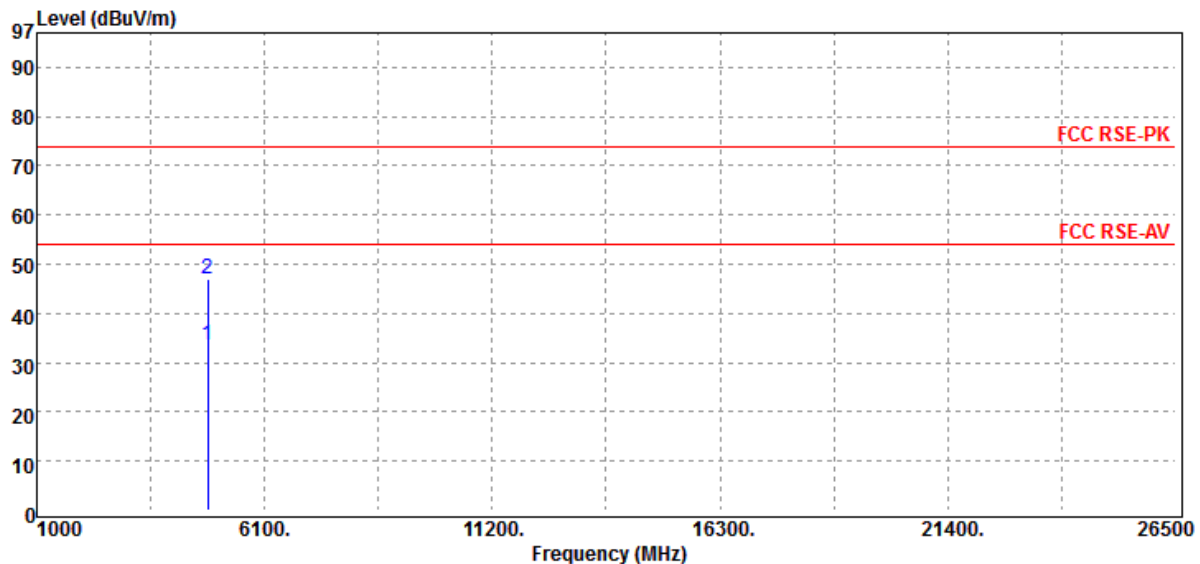
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Operation Band :802.11 n20M  
Fundamental Frequency :2412 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4824.00	H	Average	23.78	9.63	33.41	54.00	-20.59
4824.00	H	Peak	37.38	9.63	47.01	74.00	-26.99

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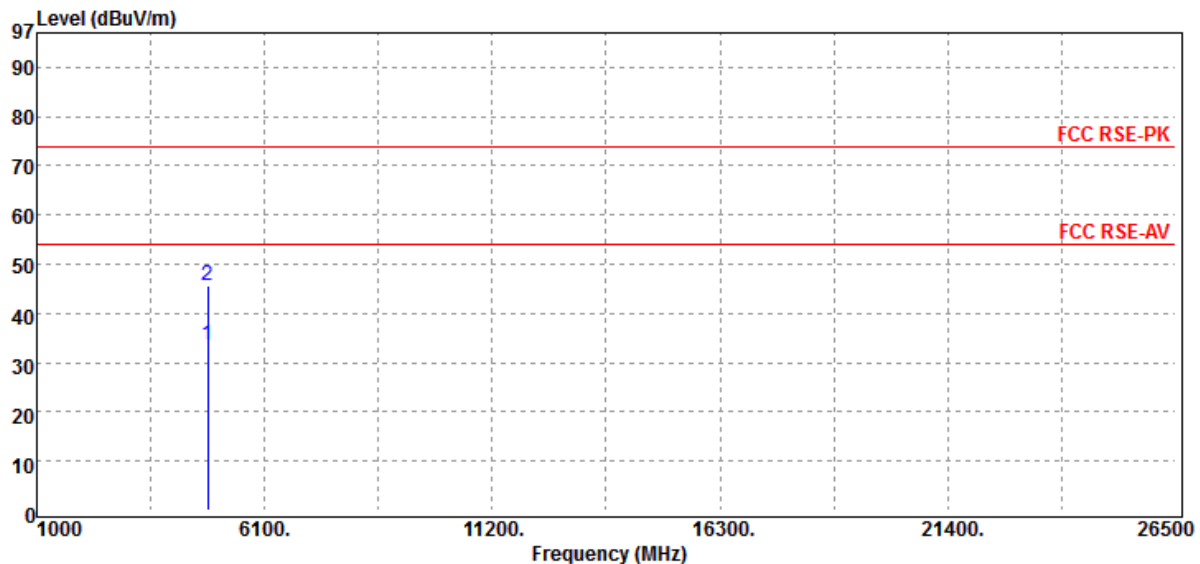
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Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2412 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4824.00	H	Average	23.84	9.63	33.47	54.00	-20.53
4824.00	H	Peak	36.16	9.63	45.79	74.00	-28.21

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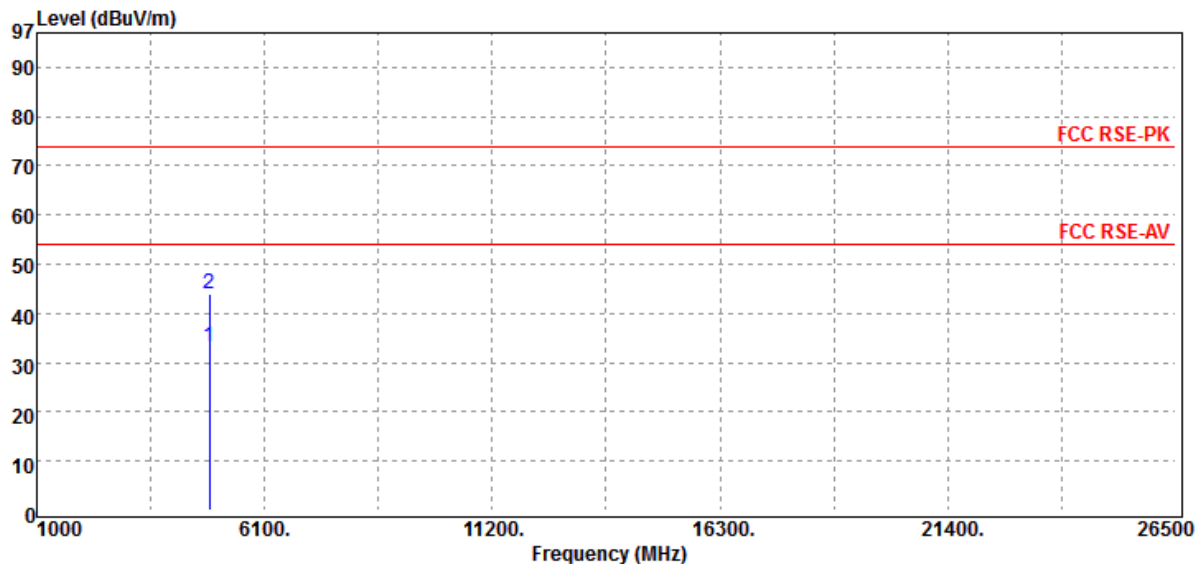
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Operation Band :802.11 n20M  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	H	Average	23.52	9.85	33.37	54.00	-20.63
4874.00	H	Peak	34.24	9.85	44.09	74.00	-29.91

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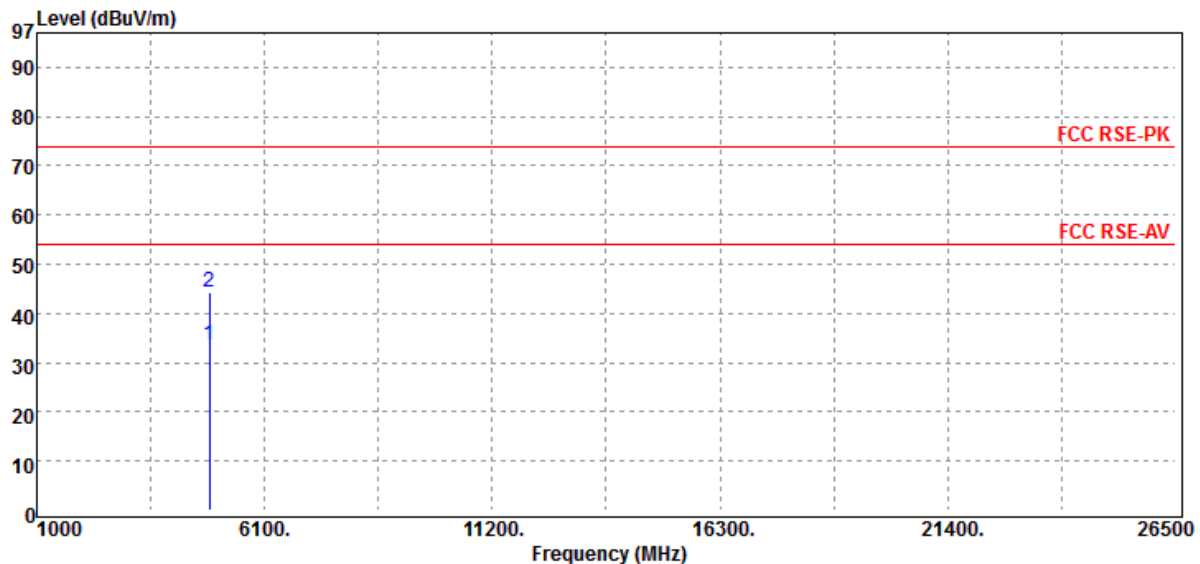
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Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2437 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX MID	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	23.62	9.85	33.47	54.00	-20.53
4874.00	H	Peak	34.38	9.85	44.23	74.00	-29.77

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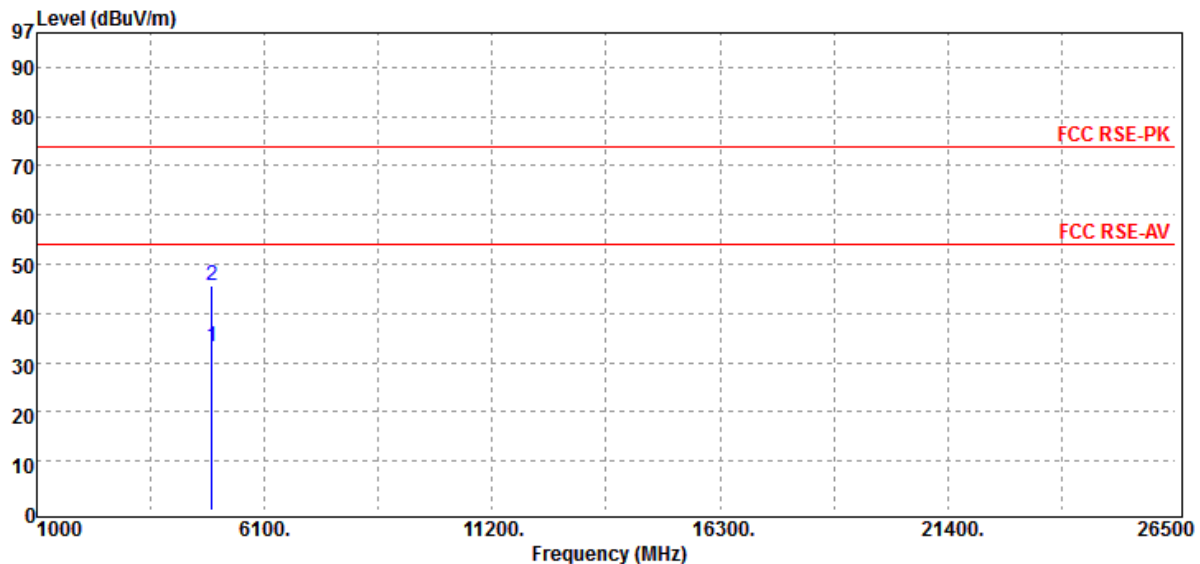
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Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	23.22	9.86	33.08	54.00	-20.92
4924.00	H	Peak	35.86	9.86	45.72	74.00	-28.28

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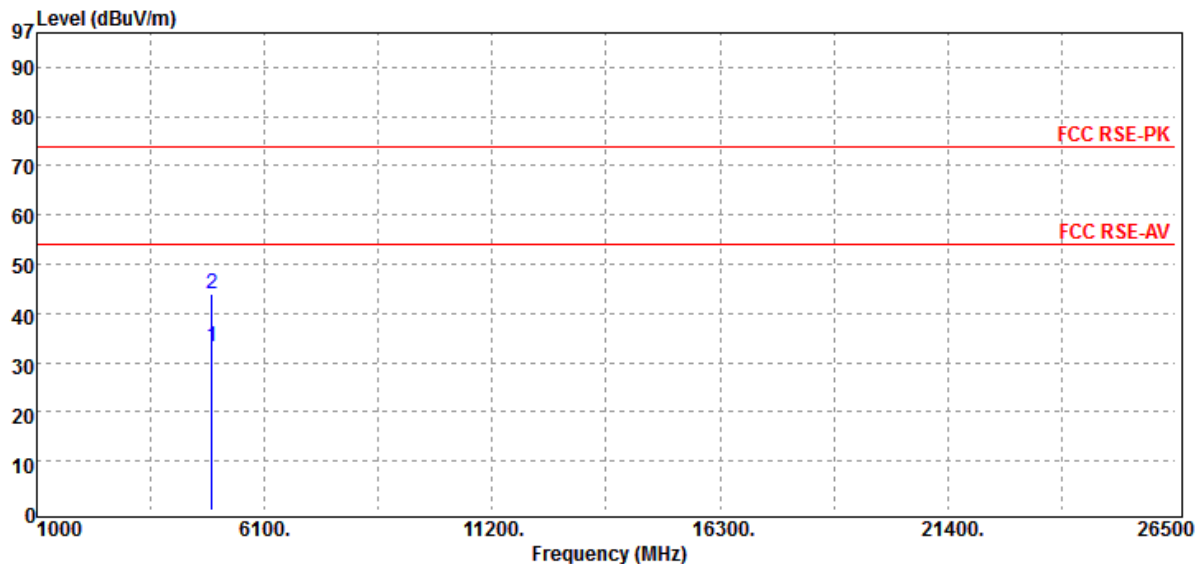
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Operation Band	:802.11 n20M	Test Date	:2015-09-30
Fundamental Frequency	:2462 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4924.00	H	Average	23.35	9.86	33.21	54.00	-20.79
4924.00	H	Peak	34.12	9.86	43.98	74.00	-30.02

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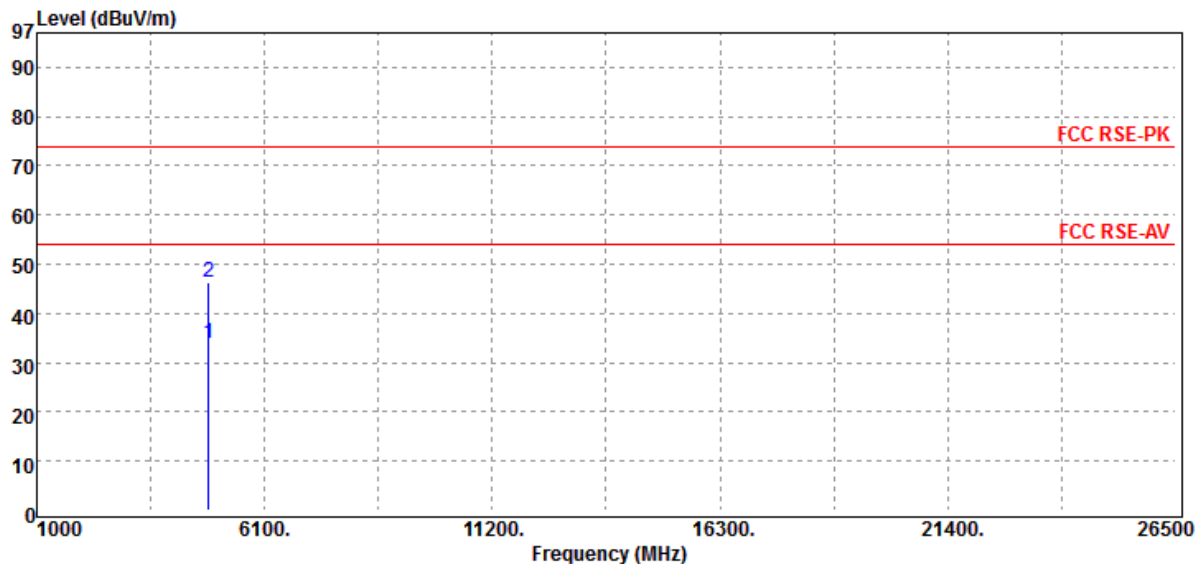
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Operation Band :802.11 n40M  
Fundamental Frequency :2422 MHz  
Operation Mode :TX LOW  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4844.00	H	Average	24.11	9.74	33.85	54.00	-20.15
4844.00	H	Peak	36.49	9.74	46.23	74.00	-27.77

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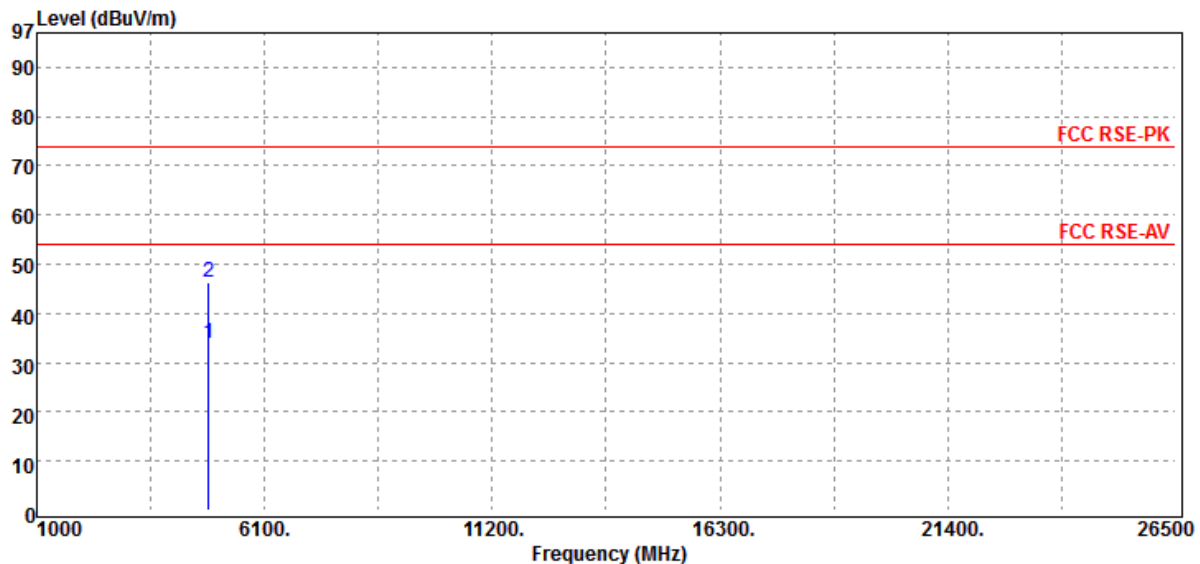
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Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2422 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX LOW	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4844.00	H	Average	24.19	9.74	33.93	54.00	-20.07
4844.00	H	Peak	36.51	9.74	46.25	74.00	-27.75

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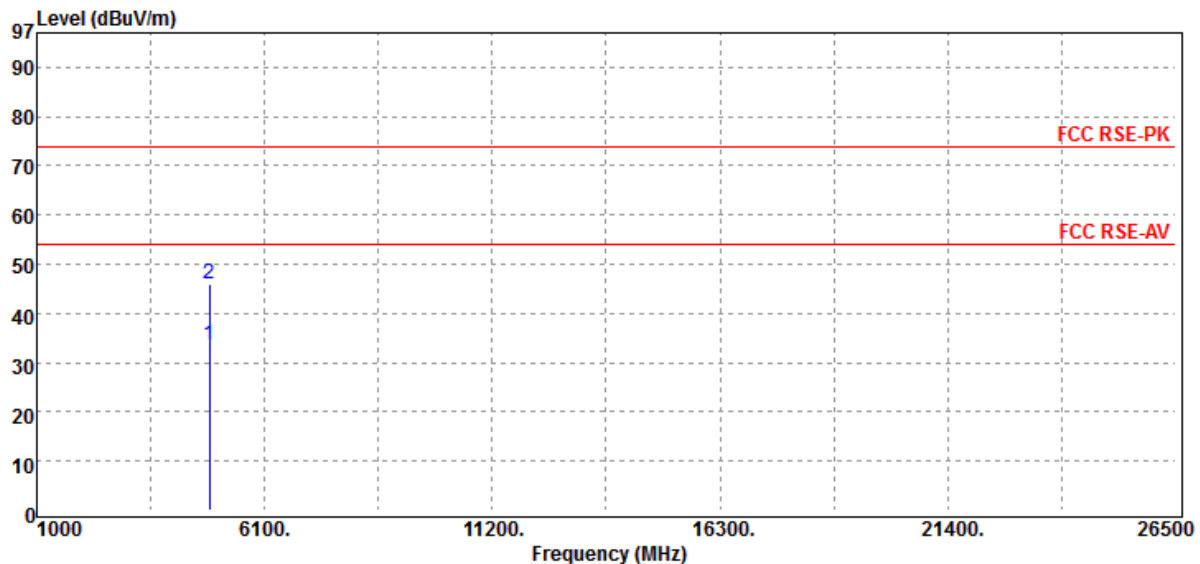
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Operation Band :802.11 n40M  
Fundamental Frequency :2437 MHz  
Operation Mode :TX MID  
EUT Pol. :E2 Plan

Test Date :2015-09-30  
Temp./Humi. :26 deg\_C/60RH  
Engineer :JJ  
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4874.00	H	Average	23.84	9.85	33.69	54.00	-20.31
4874.00	H	Peak	36.12	9.85	45.97	74.00	-28.03

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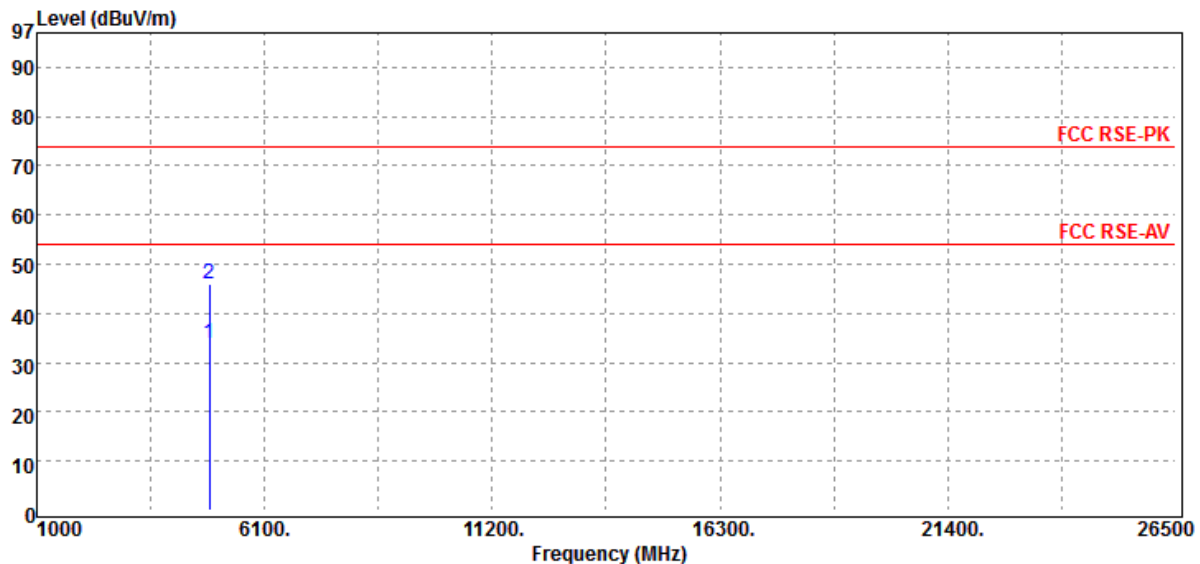
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Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2437 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX MID	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
4874.00	H	Average	23.91	9.85	33.76	54.00	-20.24
4874.00	H	Peak	36.25	9.85	46.10	74.00	-27.90

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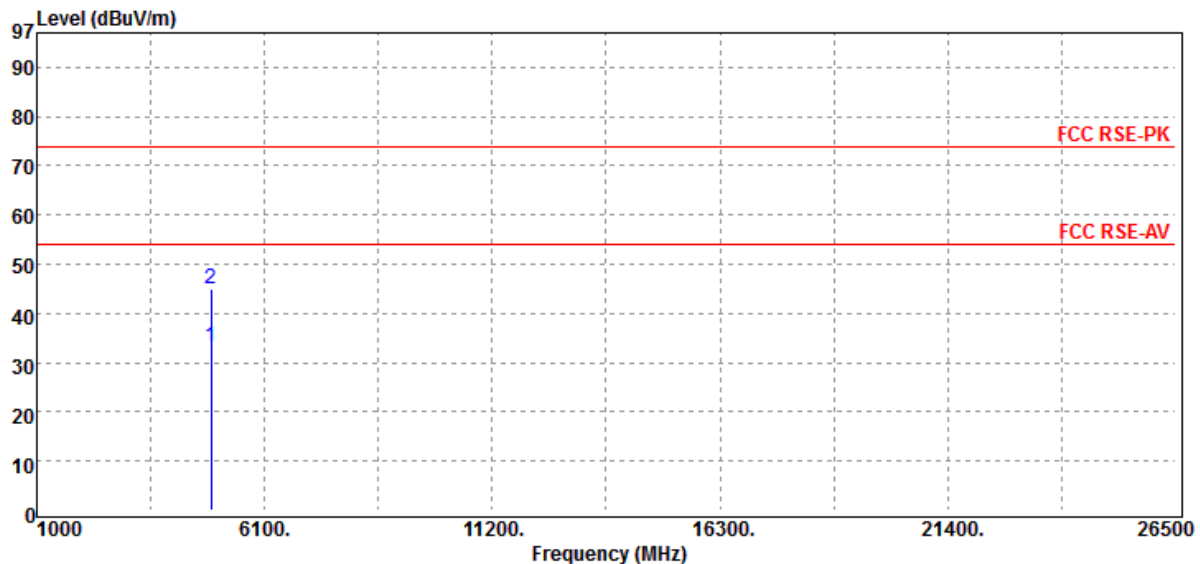
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Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2452 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
4904.00	H	Average	23.44	9.84	33.28	54.00	-20.72
4904.00	H	Peak	35.14	9.84	45.03	74.00	-28.97

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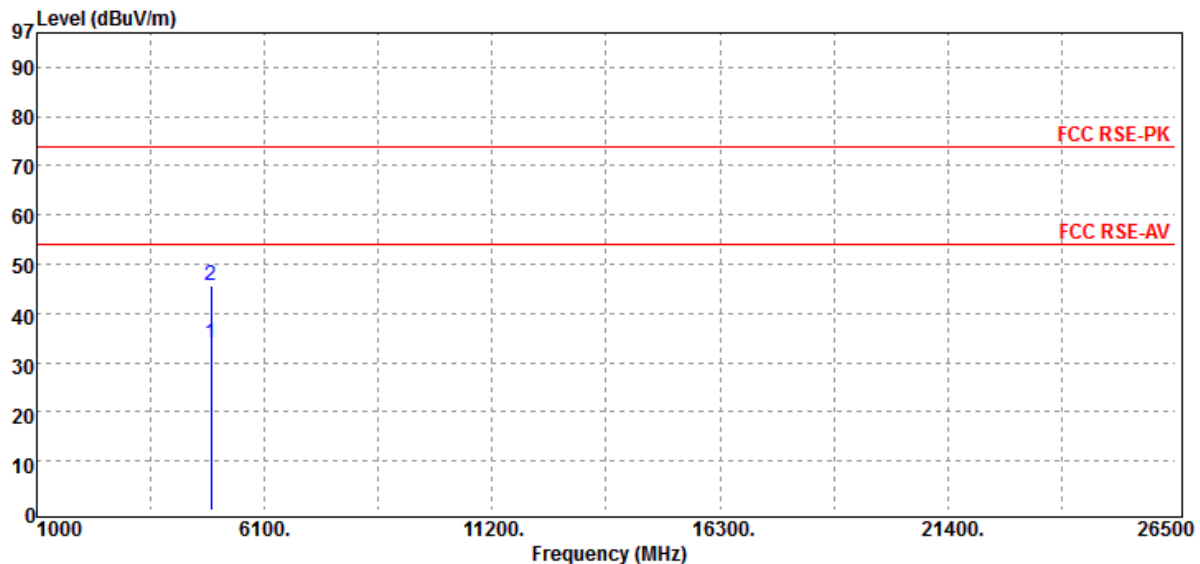
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Operation Band	:802.11 n40M	Test Date	:2015-09-30
Fundamental Frequency	:2452 MHz	Temp./Humi.	:26 deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:JJ
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
4904.00	H	Average	24.05	9.84	33.89	54.00	-20.11
4904.00	H	Peak	35.96	9.84	45.80	74.00	-28.20

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## 12 PEAK POWER SPECTRAL DENSITY

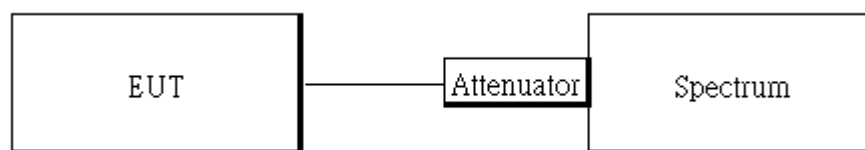
### 12.1 Standard Applicable

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

### 12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015
DC Block	PASTERNAK	PE8210	RF29	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015

### 12.3 Test Set-up



### 12.4 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. The tesAshtong follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW  $\geq 3$  kHz.
5. Set the VBW  $\geq 3 \times$  RBW.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.
11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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## 12.5 Measurement Result

### BT4.0 mode

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-19.07	8	PASS
2442	-19.51	8	PASS
2480	-20.06	8	PASS

### 802.11 b/g/n mode

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
802.11b			
2412	-6.19	8	PASS
2437	-4.00	8	PASS
2462	-7.47	8	PASS
802.11g			
2412	-11.45	8	PASS
2437	-11.08	8	PASS
2462	-11.90	8	PASS
802.11n_HT20			
2412	-10.24	8	PASS
2437	-10.03	8	PASS
2462	-11.65	8	PASS
802.11n_HT40			
2422	-16.96	8	PASS
2437	-15.89	8	PASS
2452	-16.48	8	PASS

*\*Refer to next page for plots*

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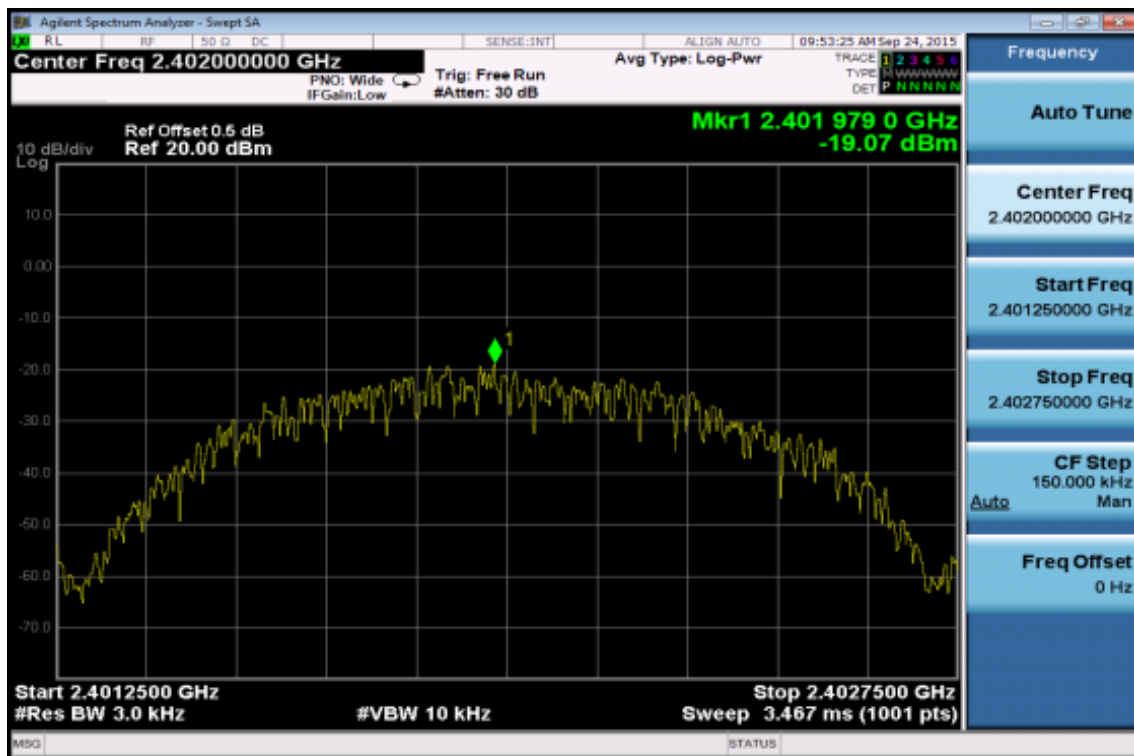
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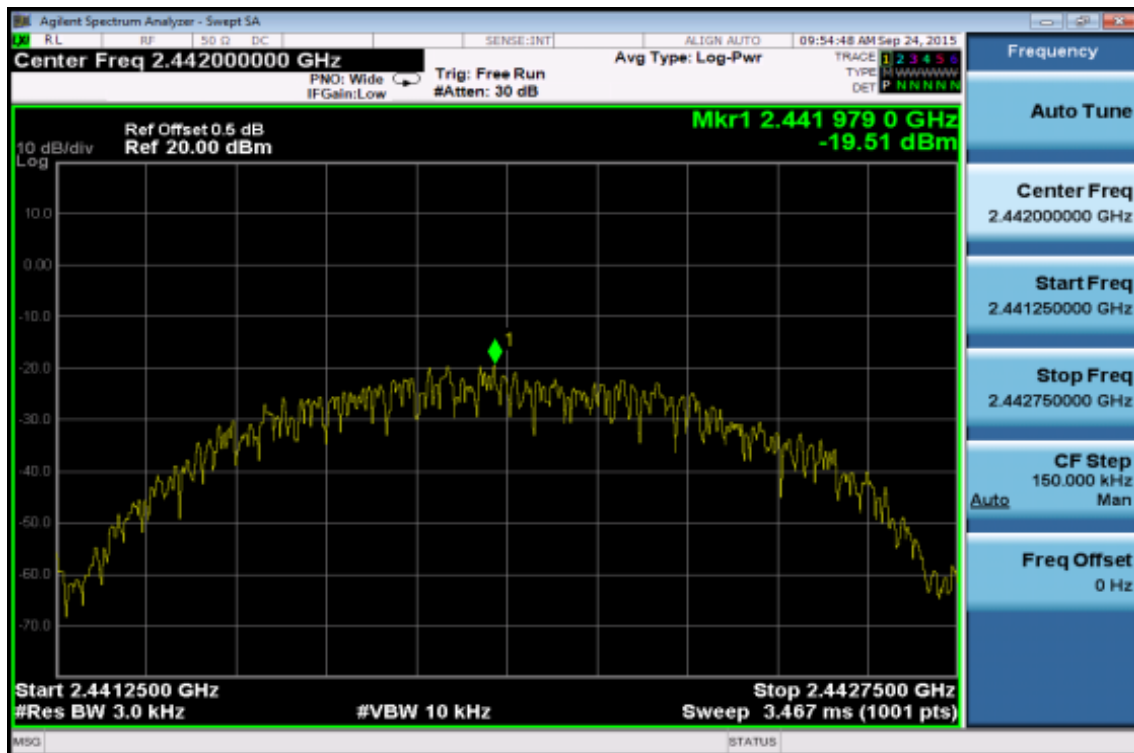
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## BLE mode

### Power Spectral Density Test Plot (CH-Low)



### Power Spectral Density Test Plot (CH-Mid)



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## Power Spectral Density Test Plot (CH-High)



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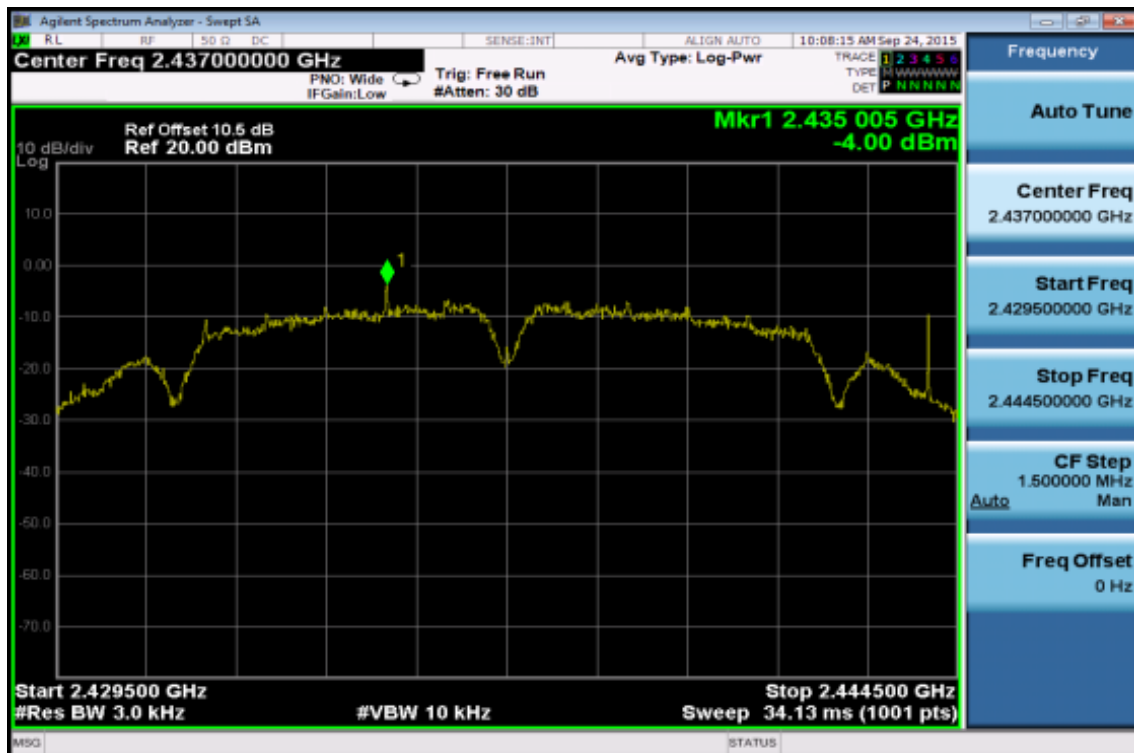
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802.11b

## Power Spectral Density Test Plot (CH-Low)



## Power Spectral Density Test Plot (CH-Mid)



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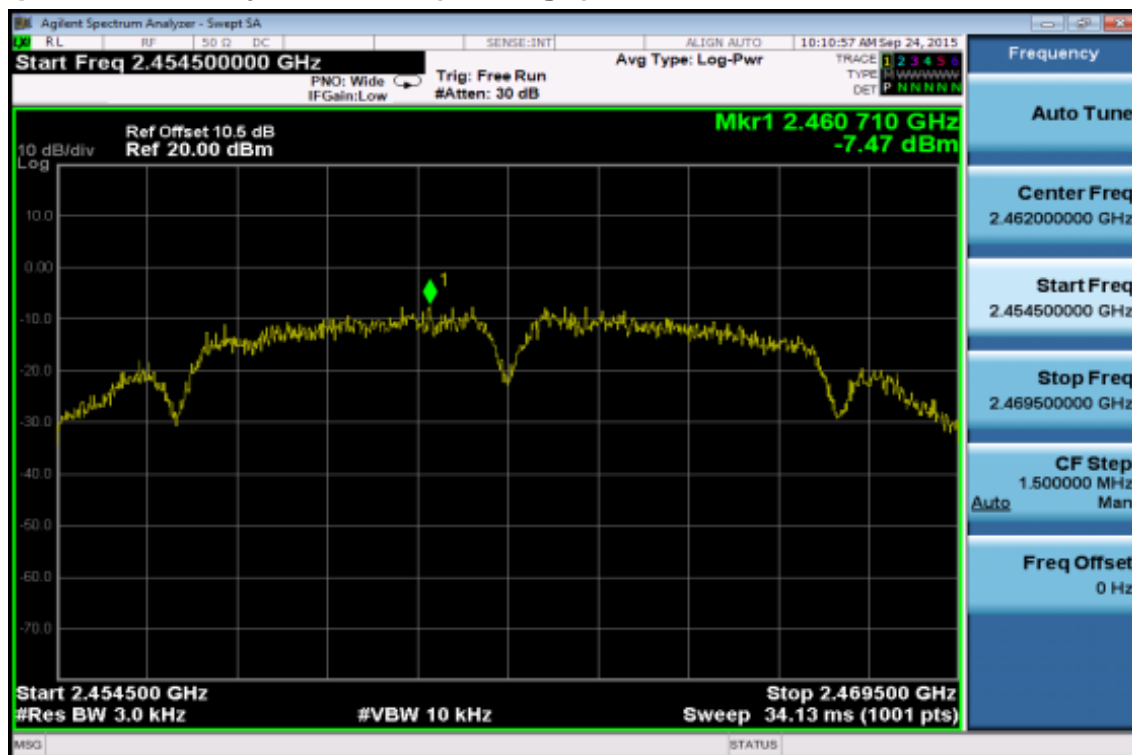
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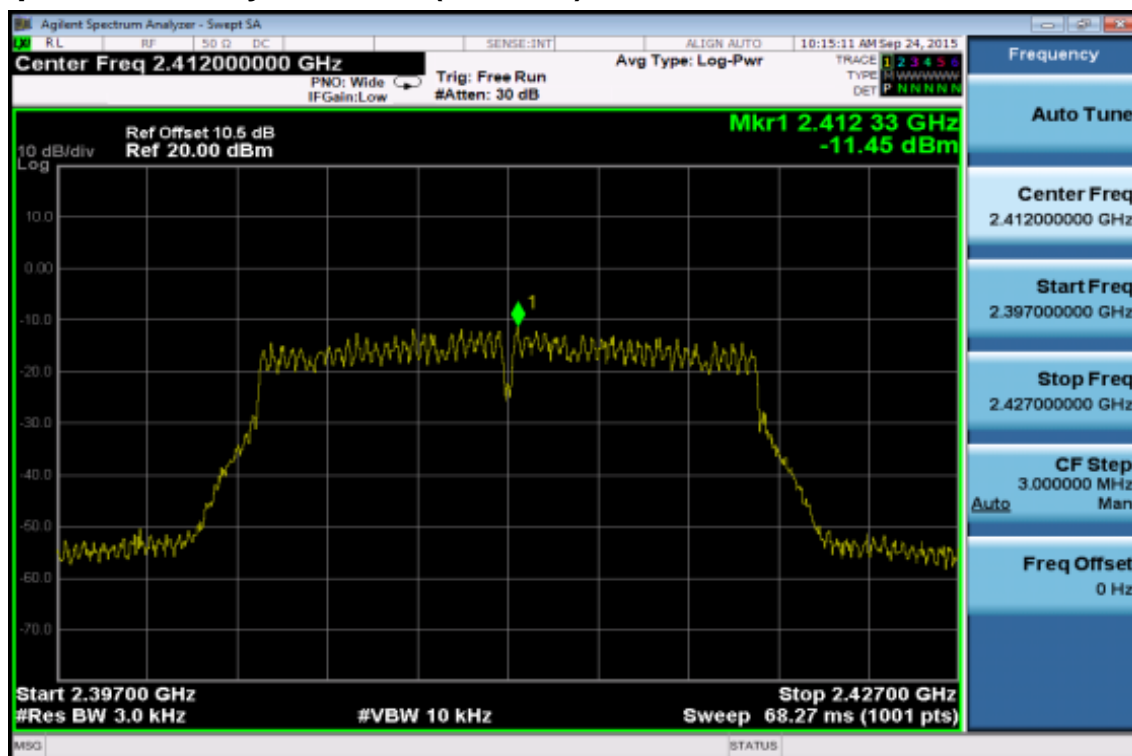
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### Power Spectral Density Test Plot (CH-High)



**802.11g**

### Power Spectral Density Test Plot (CH-Low)



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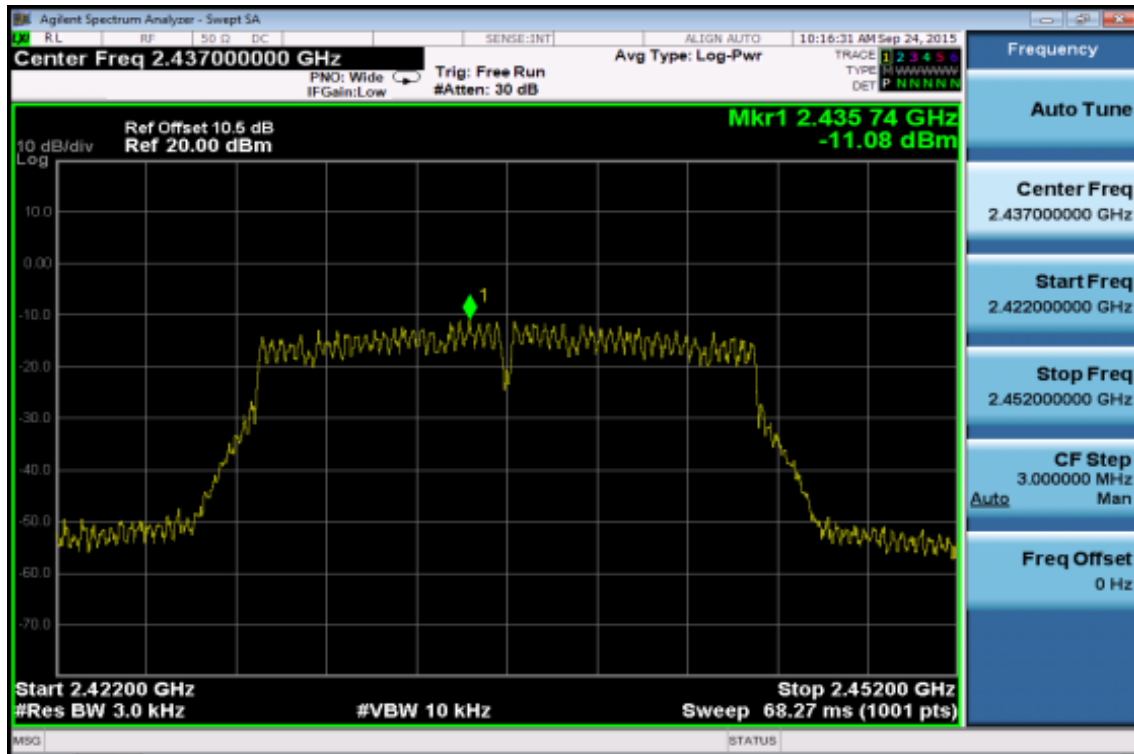
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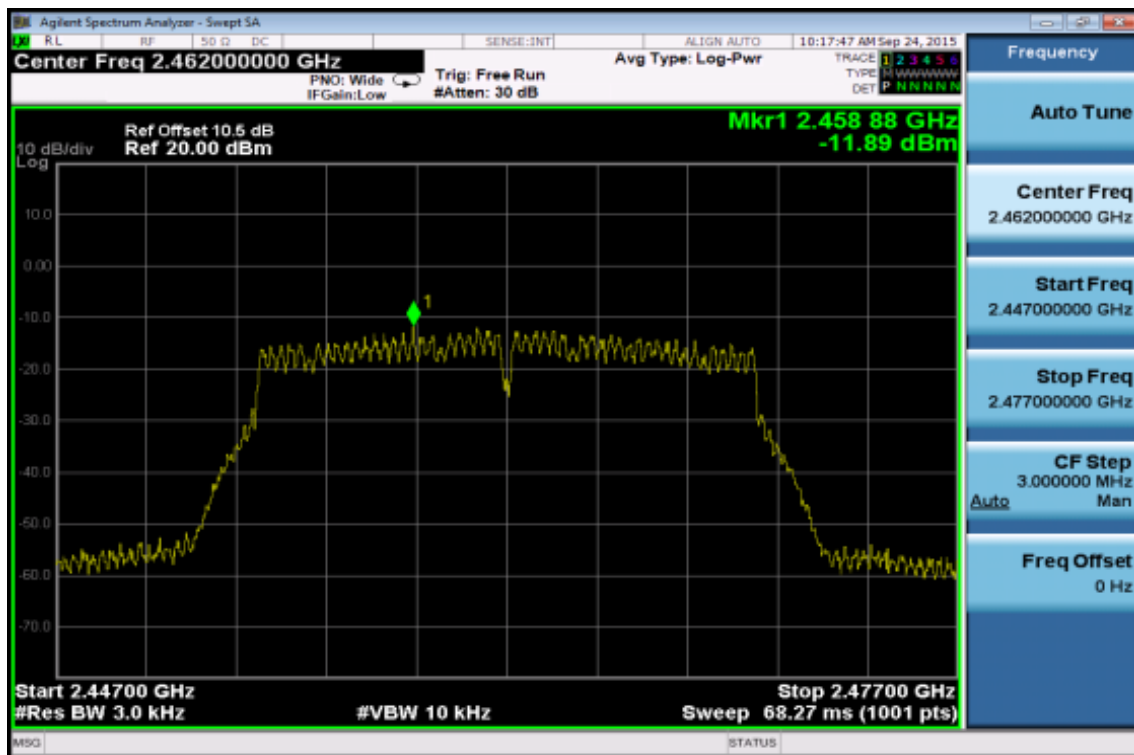
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## Power Spectral Density Test Plot (CH-Mid)



## Power Spectral Density Test Plot (CH-High)



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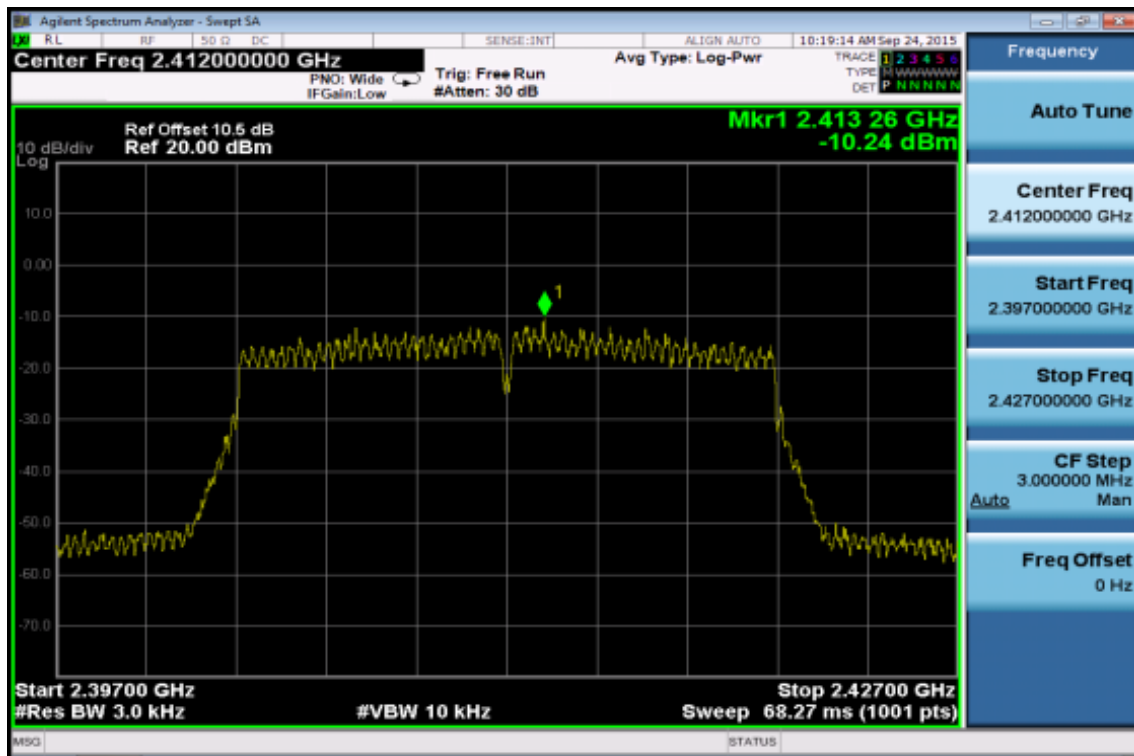
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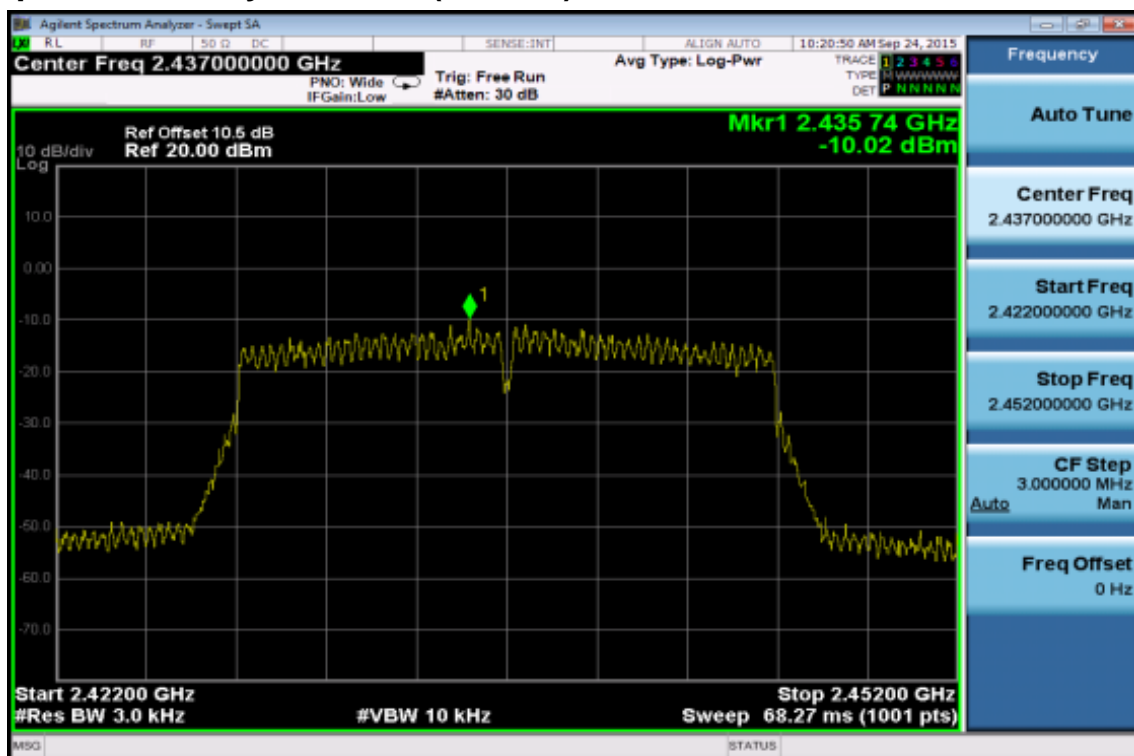
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802.11n\_HT20

## Power Spectral Density Test Plot (CH-Low)



## Power Spectral Density Test Plot (CH-Mid)



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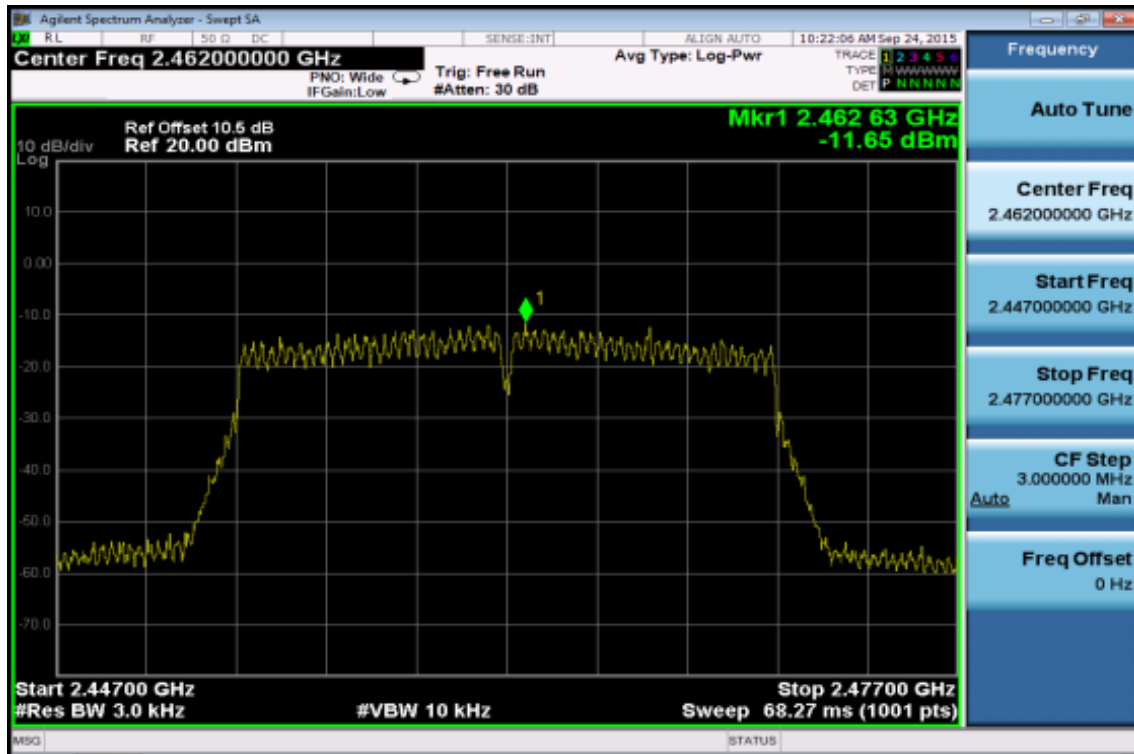
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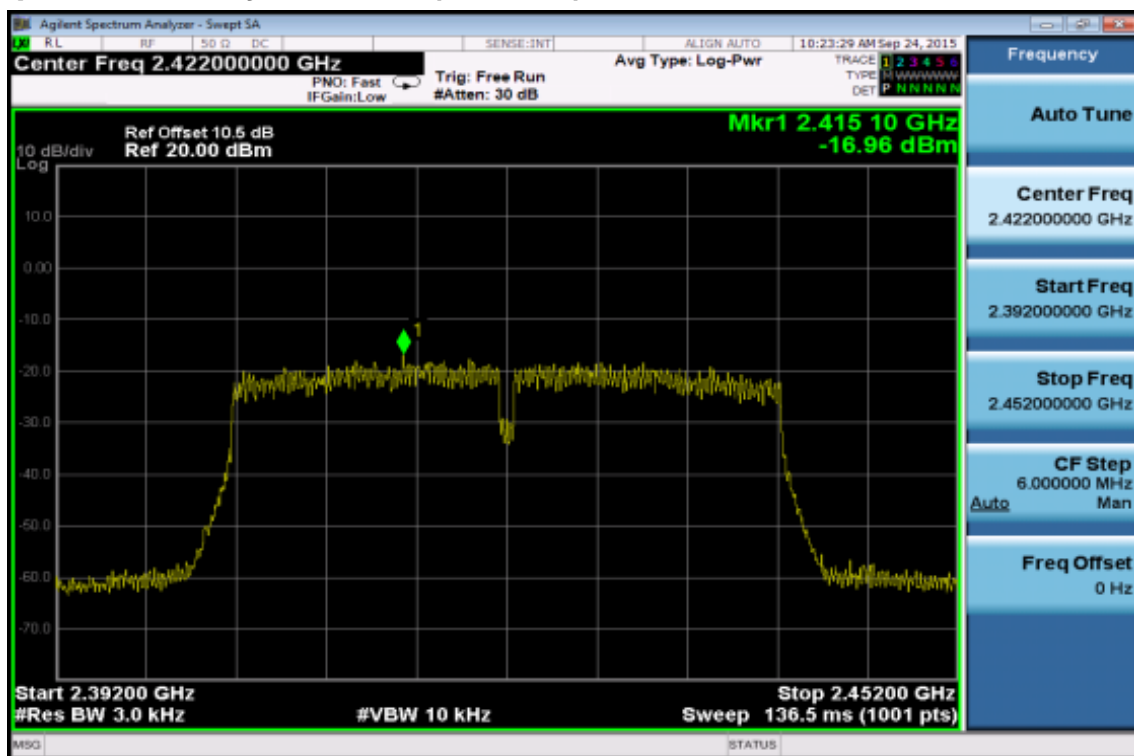
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## Power Spectral Density Test Plot (CH-High)



## 802.11n\_HT40

## Power Spectral Density Test Plot (CH-Low)



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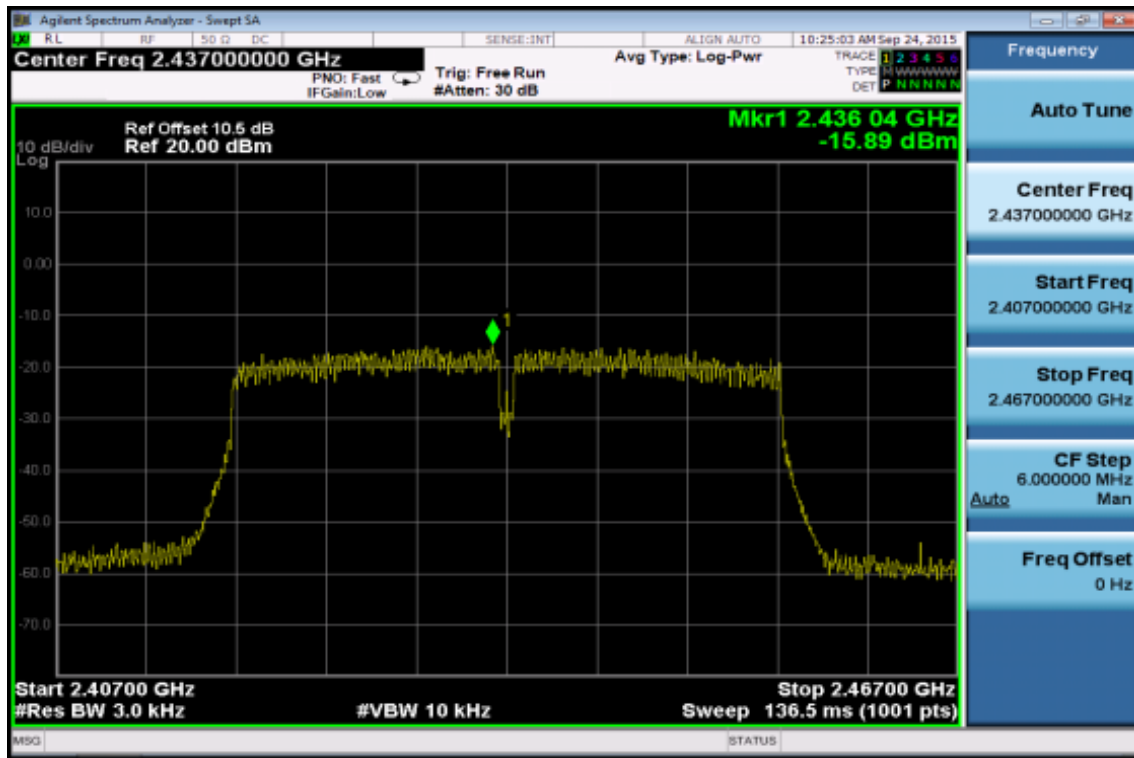
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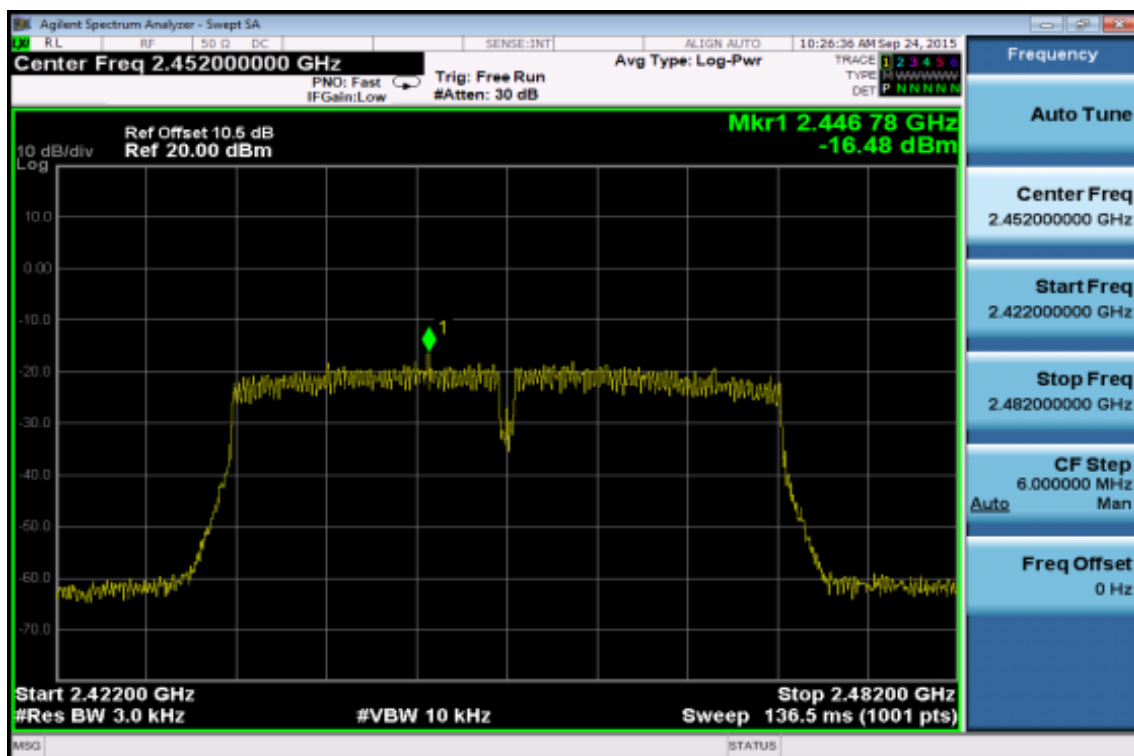
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## Power Spectral Density Test Plot (CH-Mid)



## Power Spectral Density Test Plot (CH-High)



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## 13 ANTENNA REQUIREMENT

### 13.1 Standard Applicable

For intentional device, 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.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

### 13.2 Antenna Connected Construction

An external antenna design is used.

The antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

*~ End of Report ~*

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