

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

# INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

	OF	
Product Name:	Mobile Phone	
Brand Name:	FUJITSU	
Model No.:	F-04J	
Model Difference:	N/A	
FCC ID:	VQK-F04J	
Report No.:	ER/2016/B0020	
Issue Date:	Dec. 14, 2016	
FCC Rule Part:	§15.247, Cat: DTS	
Prepared for:	Fujitsu Limited 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki 211-8588, Japan	
Prepared by:	SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803	
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# VERIFICATION OF COMPLIANCE

Applicant:	Fujitsu Limited 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki 211-8588, Japan
Product Name:	Mobile Phone
Brand Name:	FUJITSU
Model No.:	F-04J
Model Difference:	N/A
FCC ID:	VQK-F04J
Report Number:	ER/2016/B0020
Date of test:	Nov. 07, 2016 ~ Dec. 01, 2016
Date of EUT Received:	Nov. 07, 2016

# 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	Dec. 14, 2016	
Prepared By:		ng/Engineer Huang	Date	Dec. 14, 2016	
Approved By:	Tim	ang / Clerk Ch ang Asst. Manager	Date	Dec. 14, 2016	

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# **Revision History**

Report Number	Revision	Description	Issue Date
ER/2016/B0020	Rev.00	Initial creation of document	Dec. 14, 2016

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### **GENERAL INFORMATION** 1

### Product description 1.1

General:

Product Name:	Mobile Ph	ione		
Brand Name:	FUJITSU	FUJITSU		
Model No.:	F-04J			
Model Difference:	N/A			
Hardware Version:	V2.1.0			
Software Version:	R028.1e			
Cradle:	Model No.: F46, Supplier: FUJITSU LIMITED			
Power Supply:	3.8Vdc from Rechargeable Li-ion Battery or 5Vdc from AC/DC Adapter / Cradle   Battery: Model No.: F35, Supplier: FUJITSU CONNECTED TECHNOLOGIES LIMITED			
	Adapter:	Model No.: FMV-AC346, Supplier: FUJITSU LIMITED		

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### WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology		
11b/g	2412-2462	11	b: 15.61dBm g: 21.20dBm	DSSS, OFDM		
11n	HT20 2412-2462	11	HT20: 21.25dBm	OFDM		
Antenna Designation: $\lambda/4$ Monopole Antenna, Gain: -5.5dBi			pole Antenna, Gain: -5.5dBi			
Modulation type:   CCK, DQPSK, DBPSK for DSSS     64QAM, 16QAM, QPSK, BPSK for OFDM						
Transi	tion Rate:	802.11 g: ι	up to 11 Mbps; up to 54 Mbps 20MHz: up to 72.2Mbps			

# 1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting below features.

Product Feature		
GSM Operating Band(s)	GSM 850/1900MHz	
GPRS Multi Slot Class	GPRS Class 11	
WCDMA Operating Band(s)	FDD Band V	
WCDMA Rel. Version	Rel.9	
Bluetooth Version	V4.2 dual mode	
Wi-Fi Specification	802.11 a/b/g/n/ac	
NFC Specification	NFC	

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

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 a DoC procedure.
- 3. The EUT was placed 1.5m height for frequency above 1GHz in accordance with ANSI C63, 10 :2013.

### 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 24803. (TAF code 0513)

FCC Registration Numbers are: 509634

### 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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### SYSTEM TEST CONFIGURATION 2

### **EUT Configuration** 2.1

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

### 2.3.2 Radiated Emissions

The EUT is a placed on as 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.

### **Measurement Results Explanation Example** 2.4

### 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. Following shows an offset computation example with cable loss 2.3dB and 10dB attenuator.

offset = RF cable loss (dB)+ attenuation factor(dB)=12.3(dB)

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## 2.5 Configuration of Tested System

## Fig. 2-1 Radiated Emission Configuration



## Fig. 2-2 Conducted Emission Configuration

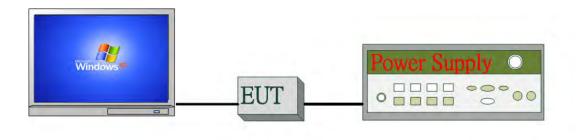
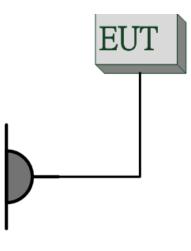


Fig. 2-3 Configuration of Conducted Tested System



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ltem	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L430	N/A	Shielded	Unshielded
3.	DC Power Supply	Agilent	E3640A	KR93300208	N/A	Unshielded

### Table 2-1 Equipment Used in Tested System

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### SUMMARY OF TEST RESULTS 3

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 Emission 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

### **DESCRIPTION OF TEST MODES** 4

### Operated in 2400 ~ 2483.5MHz Band 4.1

11 channels are provided for 802.11b, 802.11g and 802.11n HT20

۰.								
	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY				
F	1	2412 MHz	7	2442 MHz				
	2	2417 MHz	8	2447 MHz				
	3	2422 MHz	9	2452 MHz				
F	4	2427 MHz	10	2457 MHz				
	5	2432 MHz	11	2462 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.

ADIATED EMISSION TEST:								
RADIATED EMISSION TEST (BELOW 1 GHz)								
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT			
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			
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	MCS 0	MAIN			

# **BADIATED EMISSION TEST:**

## 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 E1 position was reported.

# ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST							
MODE	AVAILABLE CHANNEL			ODULATION RATE (Mbps)			
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	MCS 0	MAIN		

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### **MEASUREMENT UNCERTAINTY** 5

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:

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

	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
Measurement uncertainty	167MHz -500MHz: +/- 3.44dB
(Polarization : <b>Horizontal</b> )	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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### CONDUCTED EMISSION TEST 6

# 6.1 Standard Applicable

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

_	Limits					
Frequency range	dB(	uv)				
MHz	Quasi-peak	Average				
0.15 to 0.50	66 to 56	56 to 46				
0.50 to 5	56	46				
5 to 30	60	50				
Note						
1. The lower limit shall apply at the transition frequencies						
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50						
MHz.						

## 6.2 Measurement Equipment Used

Conducted Emission Test Site									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
EMI Test Receiver	R&S	ESCI7	100760	05/10/2016	05/09/2017				
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/16/2016	05/15/2017				
LISN	MESS TEC	FCC-LISN-50/250 -25-2-01	4034	05/16/2016	05/15/2017				
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017				

# 6.3 EUT Setup

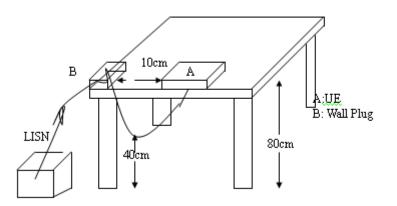
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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# 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

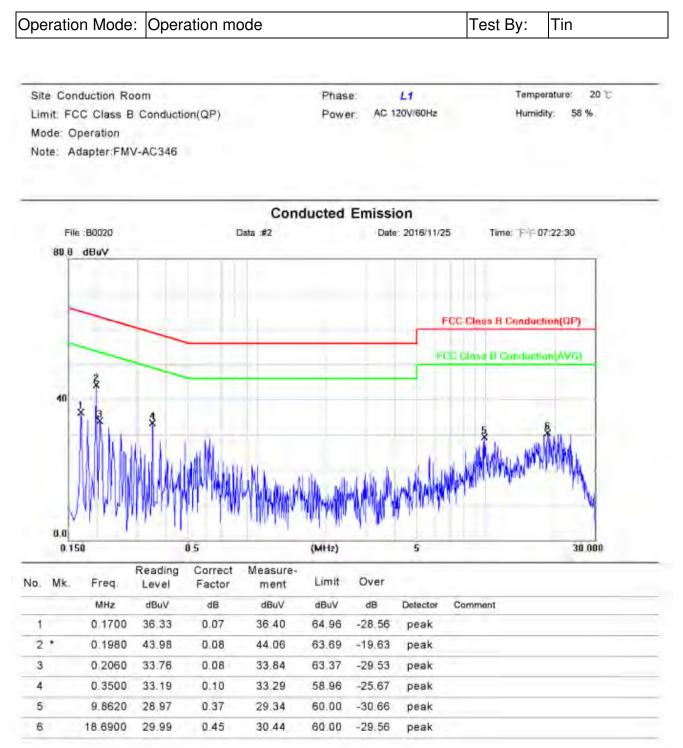
Note: Refer to next page for measurement data and plots. Note2: The \* reveals the worst-case results that closet to the limit

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# AC POWER LINE CONDUCTED EMISSION TEST DATA

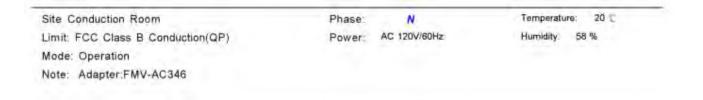


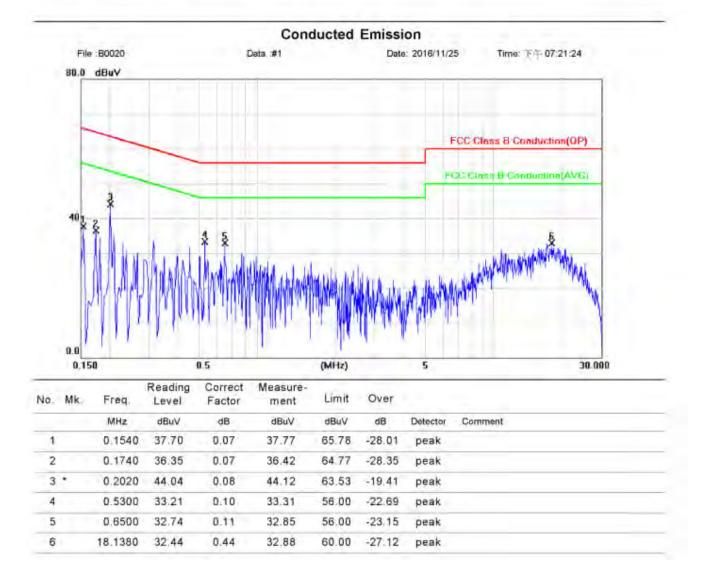
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### DUTY CYCLE OF TEST SIGNAL 7

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:

Duty Cycle = Ton / (Ton+Toff)

## **Measurement Procedure:**

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

# **Duty Cycle:**

	Duty Cycle (%)	Duty Factor (dB)
802.11b	99.99	0.00
802.11g	99.99	0.00
802.11n_20	99.99	0.00

Duty Cycle Factor:  $10 * \log(1/0.9999) = 0$ Duty Cycle Factor:  $10 * \log(1/0.9999) = 0$ Duty Cycle Factor:  $10 * \log(1/0.9999) = 0$ 

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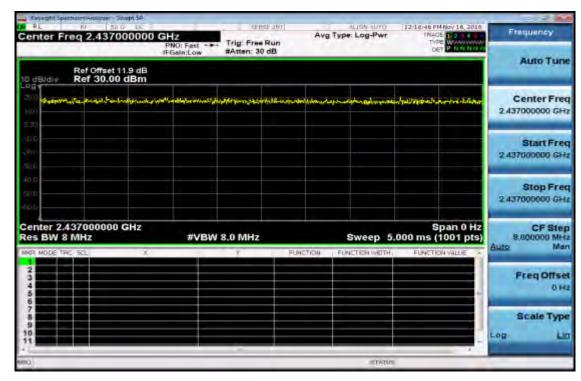


# 7.1 DUTY CYCLE TEST SIGNAL Measurement Result

### 802.11 b



### 802.11 g



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### 802.11 n\_20 MHz

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### PEAK OUTPUT POWER MEASUREMENT 8

# 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 form 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.

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### 8.2 Measurement Equipment Used

Conducted Emission Test Site									
EQUIPMENT	EQUIPMENT MFR		SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017				
Power Meter	Anritsu	ML2496A	1326001	06/23/2016	06/22/2017				
Power Sensor	Anritsu	MA2411B	1315048	06/23/2016	06/22/2017				
Power Sensor	Anritsu	MA2411B	1315049	06/23/2016	06/22/2017				
Coaxial Cable 30cm	WOKEN	00100A1F1A195 C	RF01	12/12/2015	12/11/2016				
DC Block	PASTERNACK	PE8210	RF29	12/12/2015	12/11/2016				

## 8.3 Test Set-up

Power Meter:

EUT	Attenuator	Power Sensor		Power Meter
-----	------------	--------------	--	-------------

## 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.
- 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.

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### 8.5 Measurement Result

802.11	b Main							
СН	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit		RESULT	
1	2412	1	15.58	36.14	1 Watt =	30.00	dBm	PASS
6	2437	1	14.69	29.44	1 Watt =	30.00	dBm	PASS
11	2462	1	15.61	36.39	1 Watt =	30.00	dBm	PASS
802.11	b Main							
СН	Frequency (MHz)	Data Rate	Avg. Output include tune up tolerance Power (dBm)	Avg. Output include tune up tolerance Power (mW)	Limit		RESULT	
1	2412	1	13.01	20.00	1 Watt =	30.00	dBm	PASS
6	2437	1	12.22	16.67	1 Watt =	30.00	dBm	PASS
11	2462	1	13.12	20.51	1 Watt =	30.00	dBm	PASS
802.11 CH	g Main Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit		RESULT	
1	2412	6	21.13	129.72	1 Watt =	30.00	dBm	PASS
6	2437	6	20.68	1 16.95	1 Watt =	30.00	dBm	PASS
11	2462	6	21.2	131.83	1 Watt =	30.00	dBm	PASS
802.11	g Main							
СН	Frequency (MHz)	Data Rate	Avg. Output include tune up tolerance Power (dBm)	Avg. Output include tune up tolerance Power (mW)	Limit		RESULT	
				10.01	1 Watt =	30.00	al Duna	PASS
1	2412	6	12.75	18.84	T wall =	30.00	dBm	PASS
1 6	2412 2437	6 6	12.75 12.65	18.84 18.41	1 Watt =	30.00	dBm dBm	PASS

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802.11n_HT20M Main								
СН	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	I	_imit		RESULT
1	2412	MCS0	21.25	133.35	1 Watt =	30.00	dBm	PASS
6	2437	MCS0	20.75	118.85	1 Watt =	30.00	dBm	PASS
11	2462	MCS0	21.11	129.12	1 Watt =	30.00	dBm	PASS
802.11	802.11n_HT20M Main							
сн	Frequency (MHz)	Data Rate	Avg. Output include tune up tolerance Power (dBm)	Avg. Output include tune up tolerance Power (mW)	I	_imit		RESULT
1	2412	MCS0	12.8	19.05	1 Watt =	30.00	dBm	PASS
6	2437	MCS0	12.66	18.45	1 Watt =	30.00	dBm	PASS
11	2462	MCS0	12.7	18.62	1 Watt =	30.00	dBm	PASS

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

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### 6dB BANDWIDTH MEASUREMENT 9

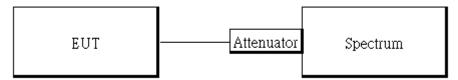
## 9.1 Standard Applicable

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

### **Measurement Equipment Used** 9.2

Conducted Emission Test Site						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
TYPE		NUMBER	NUMBER	CAL.		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	02/26/2016	02/25/2017	
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017	
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017	
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017	

### 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.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. For 6dB Bandwidth:

Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.

5. Mark the peak frequency and –6dB (upper and lower) frequency.

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#### 9.5 **Measurement Result**

### 6dB Bandwidth

### 802.11b Main

Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
2412	8564	> 500	PASS
2437	8564	> 500	PASS
2462	8576	> 500	PASS

### 802.11g Main

Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
2412	16360	> 500	PASS
2437	16370	> 500	PASS
2462	15960	> 500	PASS

### 802.11 n HT20 Main

Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
2412	17580	> 500	PASS
2437	17350	> 500	PASS
2462	16580	> 500	PASS

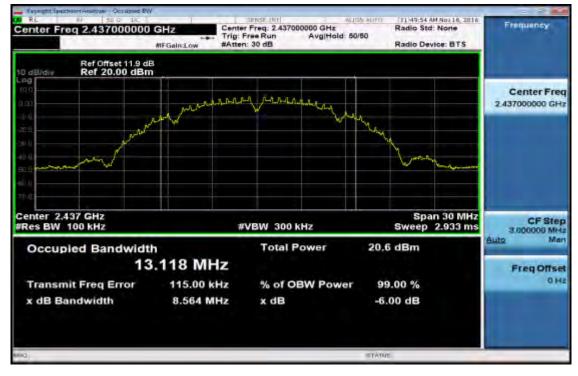
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# 802.11b 6dB Band Width Test Data CH-Low



# 6dB Band Width Test Data CH-Mid

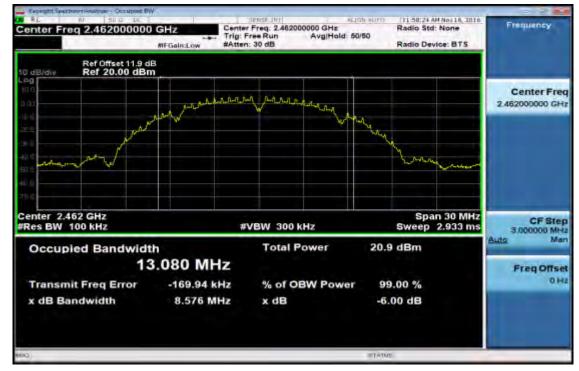


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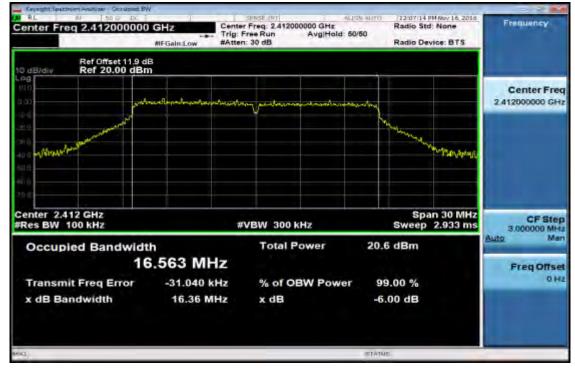
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# 6dB Band Width Test Data CH-High

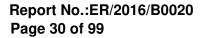


# 802.11g 6dB Band Width Test Data CH-Low



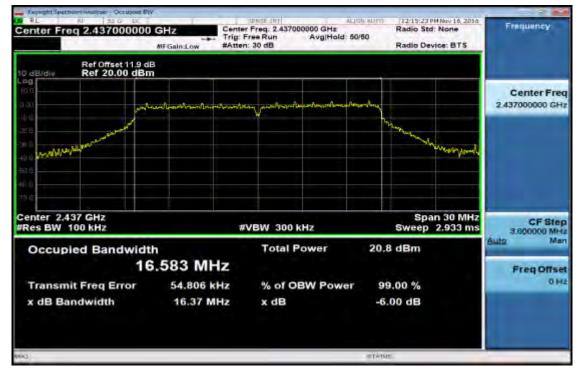
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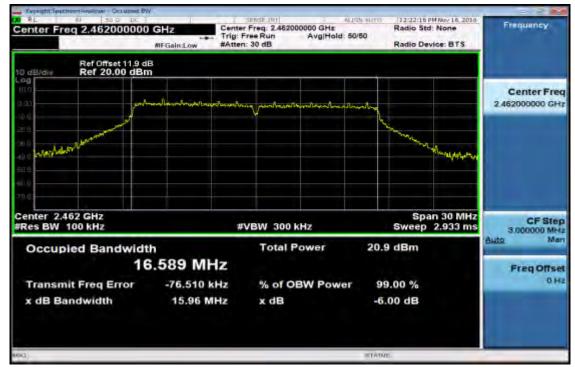




# 6dB Band Width Test Data CH-Mid



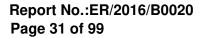
# 6dB Band Width Test Data CH-High



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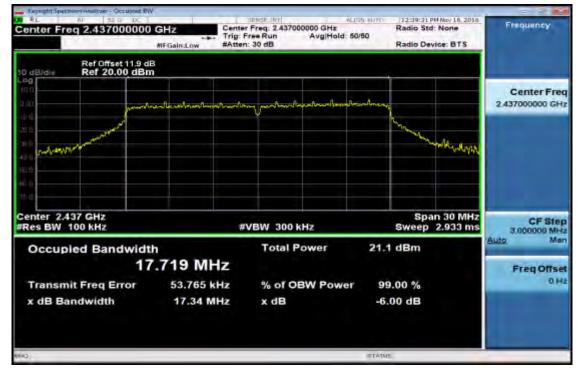




# 802.11n 20M 6dB Band Width Test Data CH-Low



# 6dB Band Width Test Data CH-Mid

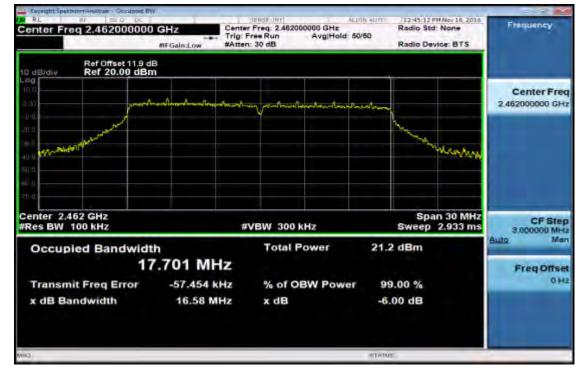


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# 6dB Band Width Test Data CH-High



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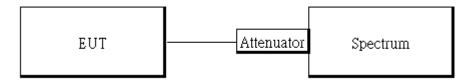
# **10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT 10.1 Standard Applicable**

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).

#### **Conducted Emission Test Site** EQUIPMENT MFR MODEL SERIAL LAST CAL DUE. TYPE NUMBER NUMBER CAL. EXA Spectrum N9030A MY53120760 02/26/2016 02/25/2017 Agilent Analyzer BLK-18-S+ DC Block Mini-Circuits 1 01/02/2016 01/01/2017 SUCOFLEX **Coaxial Cable** HUBER+SUHNER 23670/2 01/02/2016 01/01/2017 102 BW-S10W2+ 2 Attenuator Mini-Circuit 01/02/2016 01/01/2017

## **10.2 Measurement Equipment Used**

## 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.
- 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:**

- To connect Antenna Port of EUT to Spectrum
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 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.

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### **10.4 Measurement Result**

Bandedge Limit 802.11b MODE					
Frequency (MHz)	<b>RF</b> Power	Bandedge			
	Density	Limit			
	(dBm)	(dBm)			
2412	5.67	-14.33			
2462	5.55	-14.45			

Bandedge Limit 802.11g MODE				
Frequency	RF Power	Bandedge		
(MHz)	Density	Limit		
	(dBm)	(dBm)		
2412	2.92	-17.08		
2462	3.37	-16.63		

Bandedge Limit 802.11 n20 MODE				
Frequency	RF Power	Bandedge		
(MHz)	Density	Limit		
	(dBm)	(dBm)		
2412	3.04	-16.96		
2462	3.58	-16.42		

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# 802.11b Power Spectral Density for Bandedge Limit (CH-Low)



# Power Spectral Density for Bandedge Limit (CH-High)



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### 802.11q Power Spectral Density for Bandedge Limit (CH-Low)



#### Power Spectral Density for Bandedge Limit (CH-High)

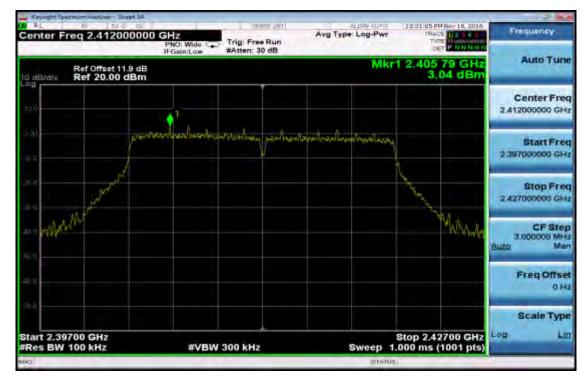


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### 802.11 n HT20 Power Spectral Density for Bandedge Limit (CH-Low)



#### Power Spectral Density for Bandedge Limit (CH-High)



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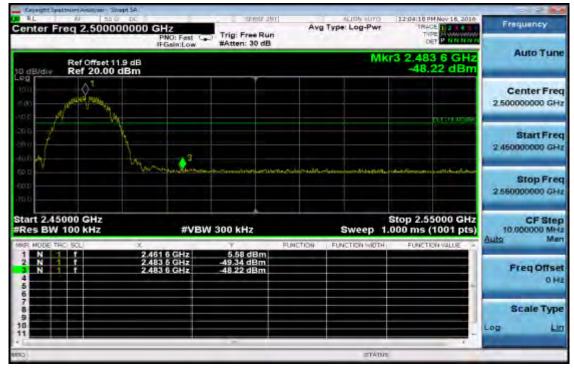
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### 802.11b **Band Edges Test Data CH-Low**



### **Band Edges Test Data CH-High**



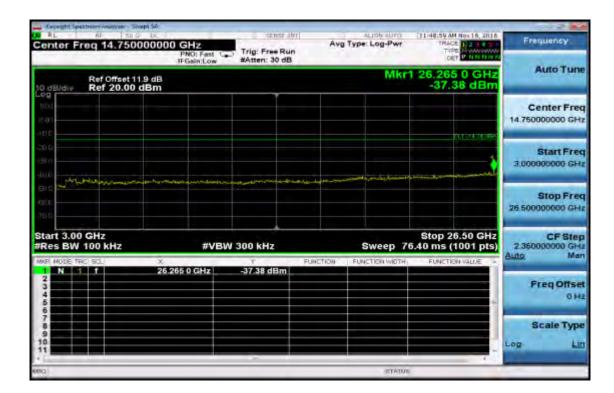
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# 802.11b **Spurious Emission Test Data CH-Low**

Keynight Space	AV 1 State		SURSU -	well.	CTUR 4014	31:48:04 AM Nos 16, 20	
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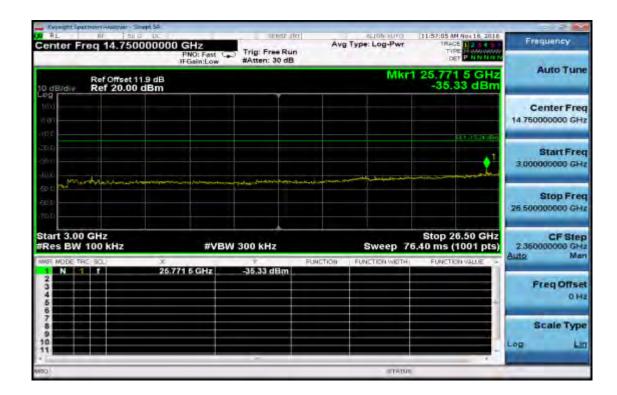
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### **Spurious Emission Test Data CH-Mid**

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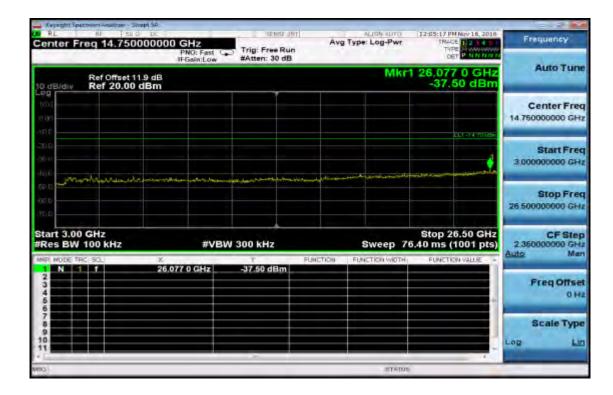
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### **Spurious Emission Test Data CH-High**

Keyeight Spectreen Analyzer - Skept SA					
RL III 15000000 Center Freq 1.515000000	PNO: East ( In	ig: Free Run tten: 30 dB	Avg Type: Log-Pwr	12:04:40 PM Nov 16, 2016 TRACE 1 2 14 TVPE PHONE PM Nov 16, 2016	Frequency
Ref Offset 11.9 dB	H CARLEON		Mk	r1 2,462 4 GHz 5,30 dBm	Auto Tune
.eg 1011 0 01				<b>1</b>	Center Free 1.515000000 GH
10.0				CLT OF A 705056	Start Free 30,000000 MH
50 D 60 D 70 D			an a	4	Stop Free 3.000000000 GH
Start 0.030 GHz #Res BW 100 kHz	#VBW 300		Sweep 9	Stop 3.000 GHz 667 ms (1001 pts)	CF Step 297.000000 MH Auto Mar
1 N 1 f 2 2 3 4 5	462 4 GHz	5.30 dBm	Cros Poscionalos	FORCHOWNEDE	Freq Offse 0 H
6 7 8 9 10					Scale Type
(Ce		-	STATUS	-	



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### 802.11g **Band Edges Test Data CH-Low**



### **Band Edges Test Data CH-High**



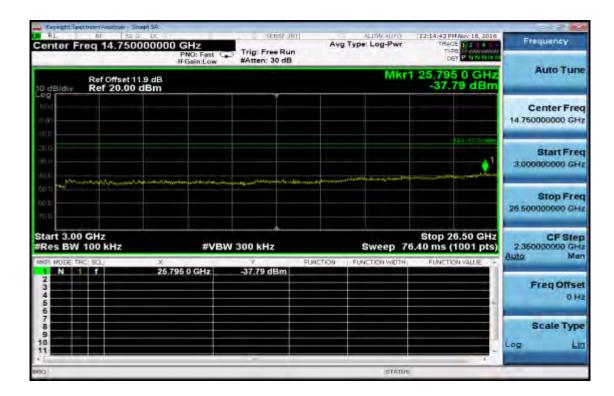
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# 802.11g **Spurious Emission Test Data CH-Low**

RL	RF 511 GP		TWL: USH US	ALIGN ADTO	12:13:37 PM Nov 16, 2016	Frequency
enter Fr	eq 1.51500	PNO: Fest C IFGain:Low	Trig: Free Run	Avg Type: Log-Pwr	TYPE MUMMUM DET P NNNNN	
dB/div	Ref Offset 11. Ref 20.00 d	9 dB	HICKNEY, VY COD	MI	(r1 2.406 0 GHz 2.77 dBm	Auto Tune
01 01					1	Center Free 1.515000000 GH
					74.4 (17.22) effer	Start Free 30,000000 MH
0 <mark>, </mark>			and and a second se	and the second	الجنوز ميسنا مراشي بالعناج بالمجهوم الما	Stop Fre 3,000000000 GH
	100 kHz	#VB	W 300 kHz	and the second second division in the second second	Stop 3.000 GHz 9.667 ms (1001 pts)	CF Ster 297,000000 MH Auto Ma
R MODE TR 1 N 1 2 3 4 5 6		2.406 0 GHz	2.77 dBm	INCTION : FUNCTION WIGTH	FUNCTION VALUE	Freq Offse 0 H
						Scale Type
3				ETÁTU	5	-



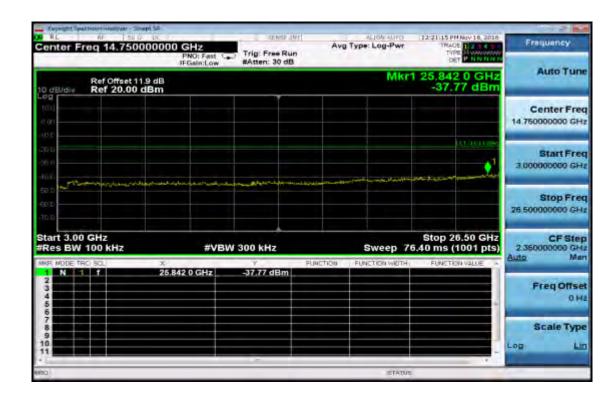
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#### **Spurious Emission Test Data CH-Mid**

Keynight Spectrom Analyzer - Skript SA			S. 20
Center Freq 1.515000000	CHZ PNO: Fast IFGain: Low #Atten: 30 dB	Aug Type: Log-Pwr TRACE TIZ 4 TYPE: Log-Pwr TRACE TIZ 4 TYPE TYPE TRACE TIZ 4	Frequency
Ref Offset 11.9 dB	T CONTLOUR	Mkr1 2,444 6 GH 1.86 dBr	Z Auto Tuni
1001 1001		•1	Center Fre 1.515000000 GH
19 E			Start Fre 30.000000 MH
50 0	randa a serie a serie a serie da serie de la serie	مرين من المرين من الم المرين من المرين من ال	Stop Fre 3.00000000 GH
Start 0.030 GHz Res BW 100 kHz	#VBW 300 kHz	Stop 3.000 GH Sweep 9.667 ms (1001 pts FUNCTION I FUNCTION WIDTH: FUNCTION VALUE	
	444 6 GHz 1.86 dBm		Freq Offse 0 H
6 7 8 9 10			Scale Typ
	-	STATUS	Contraction of the



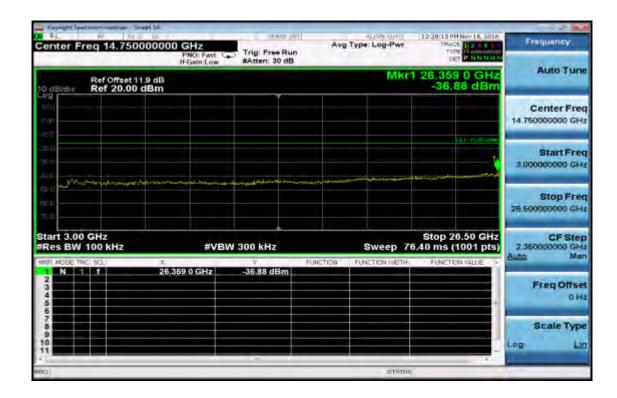
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### **Spurious Emission Test Data CH-High**

Keynight Spectram Analyzer - Skrept SA	-	and the second	and the second second	La sonte des des des des des des des des des de	
Center Freq 1.51500000	PNO: Fast	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr	12:28:49 PM Nov 16, 2016 TRACE 1 2 14 9 TYPE PLOTON NOV P	Frequency
Ref Offset 11.9 dB Ref 20.00 dBm	Ref Offset 11.9 dB MKr1 2.456 5 GHz				
001 (01)				<b>2</b> <sup>1</sup>	Center Fre 1.515000000 GH
900 000 000				Ext-results	Start Fre 30,000000 MH
50 0 <b>0 0000000000000000000000000000000</b>	a harrow waar da iyo ah ya ya ya ya waxaa Maasaa Maasaa Maasaa Maasaa Maasaa Maasaa Maasaa Maasaa Maasaa Maasa		and the second state of th	n <sup>f I</sup> manipa (nev 21.4 historia da indensis)	Stop Fre 3.000000000 GH
Start 0.030 GHz Res BW 100 kHz	#VBW 3		Sweep 9	Stop 3.000 GHz .667 ms (1001 pts)	CF Ste 297,000000 MH Auto Ma
1 N 1 1 7	2.456 5 GHz	3.44 dBm			Freq Offse 0 H
6 7 8 9 10					Scale Typ
11 <b>1</b>		-	STATUS	-	



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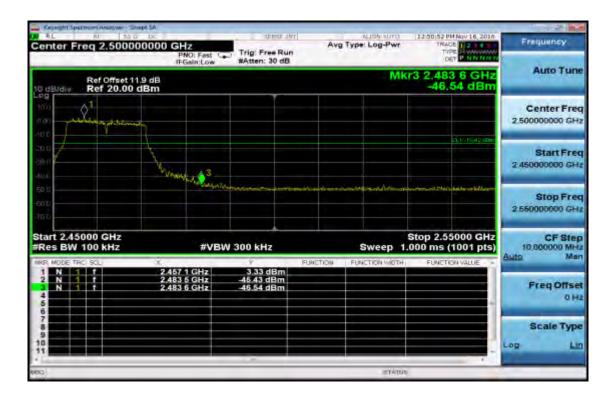
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#### 802.11n HT20 **Band Edges Test Data CH-Low**



## **Band Edges Test Data CH-High**



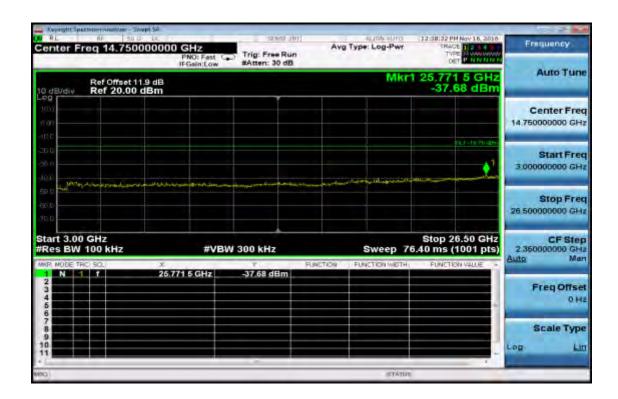
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# 802.11n HT20 **Spurious Emission Test Data CH-Low**

Keynight Spectreen Analyzer - Skept SA RL RF 50 G DC	STREE JUI			S. 20		
enter Freg 1.51500000	PNO: Fast	Avg Type: Log-Pwr	12-37:44 PM Nov 16, 2018 TRADE 1, 2, 4 TYPE, November 16, 2018 DET P, NO MOUTO	Frequency		
IFGein:Low   #Atten: 30 dB   Mkr1 2.406 0 GHz     Ref Offset 11.9 dB   3.24 dBm						
(0.1 (0.1			1	Center Fre 1.51500000 GH		
			78.3 - 15 78 albu	Start Fre 30.000000 MH		
50 D 10 D 10 D	ويحين المسترين المسترين		Langendarie (M. 1994) harden jag jannen serten	Stop Fre 3.000000000 GH		
tart 0.030 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep 9.	Stop 3.000 GHz 667 ms (1001 pts) FUNCTION VALUE	CF Ste 297.000000 Mit Auto Mit		
	2.406 0 GHz 3.24 dBm		PORCHON VALUE	Freq Offs 01		
6 7 8 9 9 10				Scale Typ		
83		STATUS				



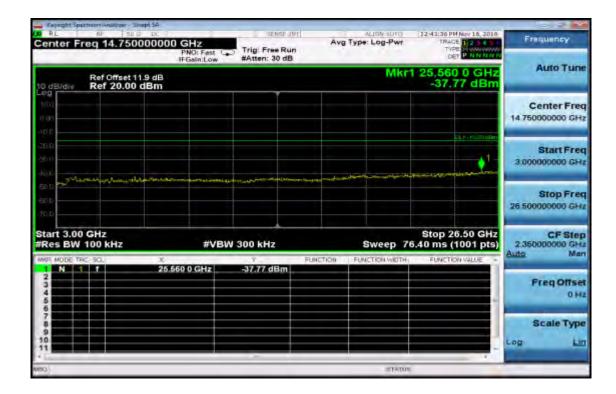
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### **Spurious Emission Test Data CH-Mid**

Separate Spectral - Shapt SA			S-1.20 2		
Center Freq 1.515000000	PNO: Fast IFGainLow #Atten: 30 dB	Avg Type: Log-Pwr Trite: Distance OFT Physics	Frequency		
Ref Offset 11.9 dB Ref 20.00 dBm	Ref Offset 11.9 dB Mkr1 2,444 6 GHz 3,41 dBm 3,41 dBm				
00 (01 (07)		••••••	Center Free 1.515000000 GH		
10 C		21, 15, 15, 25 miler	Start Free 30,000000 MH		
60 D	an panapang kanang k	مىرىتىنىڭ ئۆلىرىكى ئىسىرىكى <sup>1</sup> 94-يىرىكى ئەرىپىلىرىكى ئەرىپىلىرىكى ئەرىپىلىرىكى ئەرىپىلىرىكى ئەرىپىلىرىكى ئەرىپىلىرىكى	Stop Fre 3.000000000 GH		
Start 0.030 GHz #Res BW 100 kHz	#VBW 300 kHz	Stop 3.000 GHz Sweep 9.667 ms (1001 pts)			
1 N 1 f 2 3 4 5 5	444 6 GHz 3.41 dBm		Freq Offse 0 H		
6 7 8 9 9 10			Scale Type		
ec)		STATUS			



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### **Spurious Emission Test Data CH-High**

RL AF Ship Dc		-1010121-0101	4104 1010	12:51:11 PM Nov 16, 2016	- 20
enter Freq 1.51500000	PNO: Fast ( ) Trig: I	ree Run	Avg Type: Log-Pwr	TYPE DET P NN HOT	Frequency
Ref Offset 11.9 dB	T CONTLOW		Mk	r1 2.456 5 GHz 3.16 dBm	Auto Tuni
1001 1001				<b>1</b>	Center Fre 1.515000000 GH
1915				D. P.	Start Fre 30.000000 MH
50 U U 50 U U U U U U U U U U U U U U U U U U	a de enconocione de la construcción		And the first state of particular descent state of the second state of	al Manana and Samana day	Stop Fre 3,000000000 GH
Start 0.030 GHz #Res BW 100 kHz	#VBW 300 k		the second s	Stop 3.000 GHz .667 ms (1001 pts)	CF Ste 297.000000 MH Auto Ma
MKR MODE TRC SQL X 1 N 1 7 2 3 4 5	466 5 GHz 3.16	FUNCT	IDN' I FUNCTION WIDTH	FUNCTION VALUE	Freq Offse 0 H
6 7 8 9 10					Scale Typ
50)			STATUS		

RL AN Ship DC	A day of the later	SENSE JUT	ALTON HUTO	12:51:34 PM Nov 16, 2010	
enter Freg 14.75000000	PNO: Fast C	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr		Frequency
Ref Offset 11.9 dB			Mkr	1 26.030 0 GHz -37.30 dBm	Auto Tun
00 01 07					Center Fre 14.750000000 GF
			and a second second second second		Start Fre 3,00000000 GH
50		and a second			Stop Fr 26 50000000 G
art 3.00 GHz Res BW 100 kHz	#VBW	300 kHz	Sweep 7	Stop 26.50 GHz 5.40 ms (1001 pts)	CF Str 2.350000000 G Auto M
	030 0 GHz	-37.30 dBm	RETION FUNCTION WOTH	FUNCTION VALUE .	Europa Internet
					Freq Offs 0
					Scale Typ



## 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.

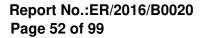
Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

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

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#### **11.2 Measurement Equipment Used:**

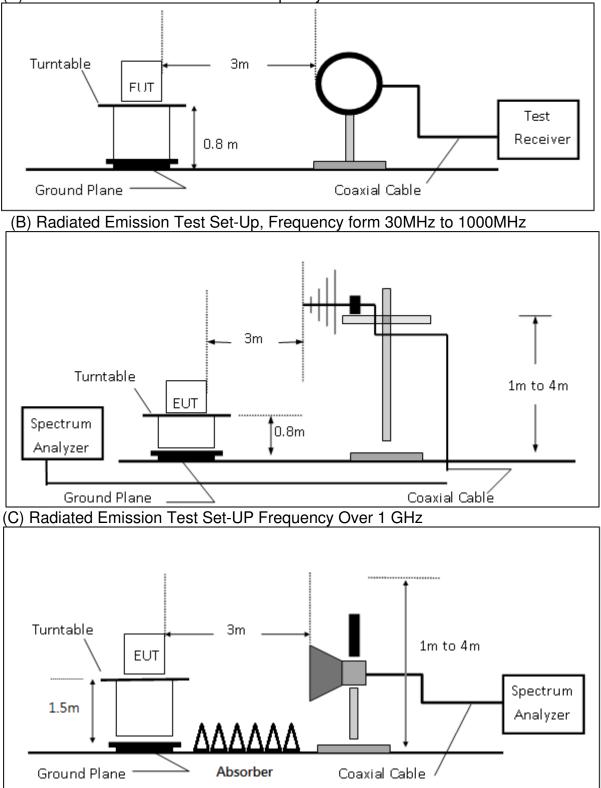
966 Chamber									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
ТҮРЕ		NUMBER	NUMBER	CAL.					
EMI Test Receiver	R&S	ESCI7	100760	05/10/2016	05/09/2017				
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2016	01/28/2017				
Loop Antenna	ETS-Lindgren	6502	143303	12/23/2015	12/22/2016				
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016				
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017				
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017				
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017				
Turn Table	HD	DT420	N/A	N.C.R	N.C.R				
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R				
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R				
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017				
3m Site NSA	SGS	966 chamber	N/A	07/01/2016	06/30/2017				
Low Loss Cable	Huber Suhner	966 TX	1	01/02/2016	01/01/2017				
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2015	12/11/2016				
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/02/2016	01/01/2017				

NOTE: N.C.R refers to Not Calibrated Required.



#### 11.3 Test SET-UP

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



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#### **11.4 Measurement Procedure**

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 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  $\geq$  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	6	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

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

Factor(dB) = Antenna Factor(dB $\mu$ V/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 form 9 kHz to 30 MHz

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

#### **11.7 Measurement Result**

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

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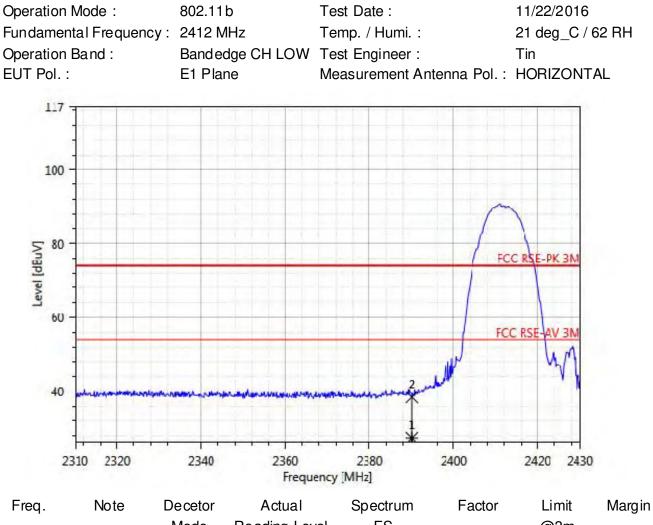
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#### Radiated Band Edge Measurement Result (802.11b)

Operatio	n Moc	de :	802.111	b	, Test Date :		11/22/2016	
Fundame	ental I	Frequer	ncy: 2412 M	Hz	Temp. / Humi	. :	21 deg_C / 6	2 RH
Operatio	n Bar	nd :	Bandeo	lge CH LOW	Test Engineer	· :	Tin	
EUT Pol	.:		E1 Plar	ne	Measurement	Antenna Pol. :	VERTICAL	
11	71							
10	0		_					
	-	-				1		
[Aud]	0					T	CC RSE-PK 3M	
Level [dEuV] ∞	-							
6	0					FC	C RSF-AV RM	
4	0-	And Alle	la bura da da kata bila ar	and before her startlifts -	has a little and a large strong	2 mill	34	
						*		
	2310	2320	2340	2360 Frequ	2380 ency [MHz]	2400	2420 2430	
Freq.		Note	Decetor	Actual	Spectrun	n Factor	Limit	Margin
-			Mode	Reading Lev	/el FS		@3m	-
MHz	F/	/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
2390.00		Е	Average	28.64	30.39	-1.74	54.00	-25.36
2390.00		Е	Peak	40.32	42.07	-1.74	74.00	-33.68

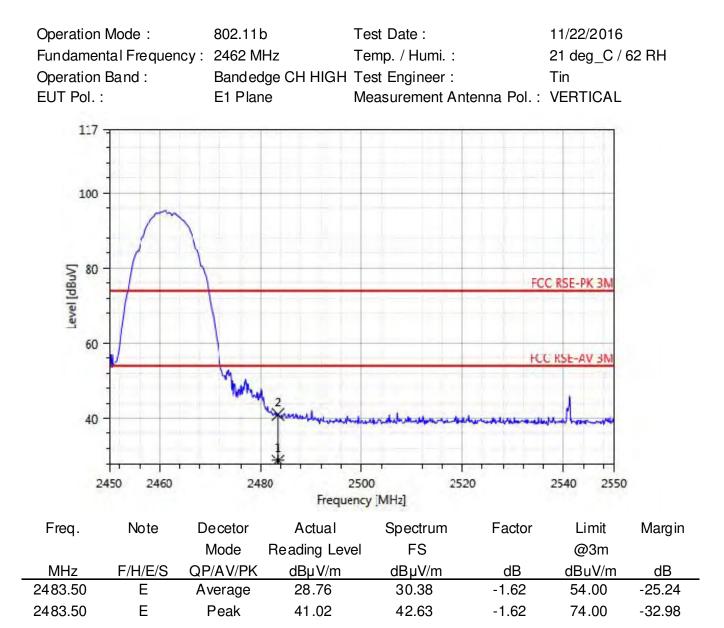




		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
2390.00	Е	Average	27.45	29.19	-1.74	54.00	-26.55
2390.00	Е	Peak	38.47	40.21	-1.74	74.00	-35.53

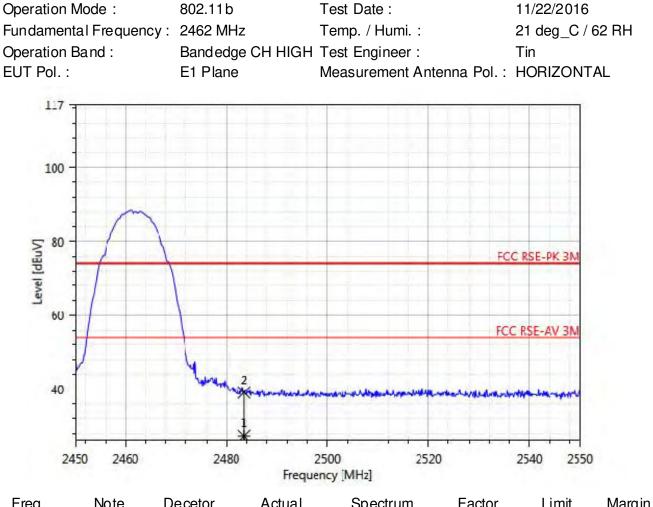
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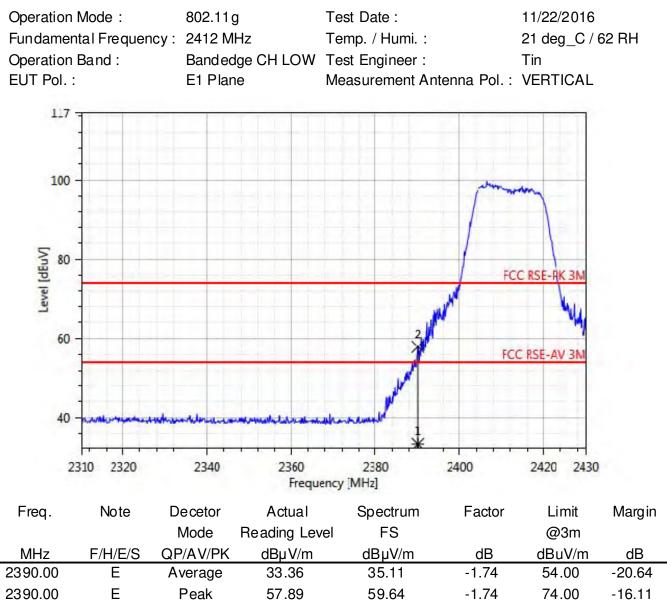


	Fieq.	NOLE	Deceloi	Actual	Spectrum	Facili		iviaryiri	
			Mode	Reading Level	FS		@3m		
_	MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB	_
-	2483.50	Е	Average	27.40	29.02	-1.62	54.00	-26.60	-
	2483.50	E	Peak	39.15	40.77	-1.62	74.00	-34.85	

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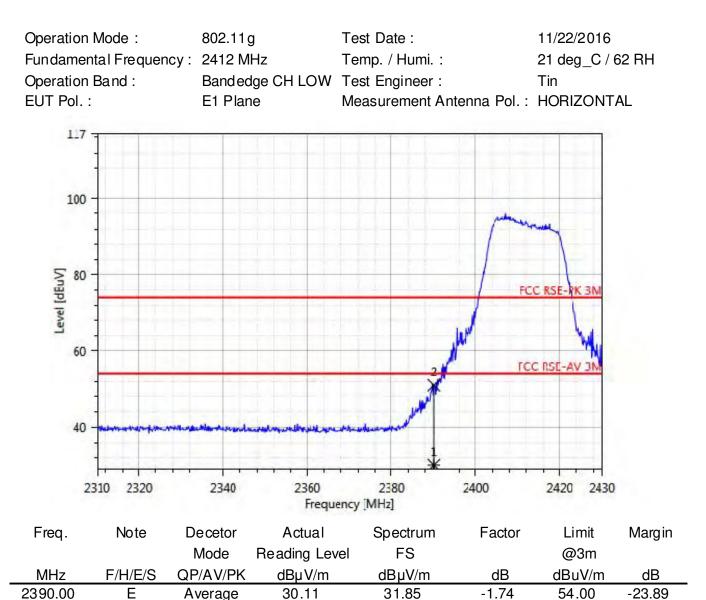
#### Radiated Band Edge Measurement Result (802.11g)



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Peak

51.08

Е

2390.00

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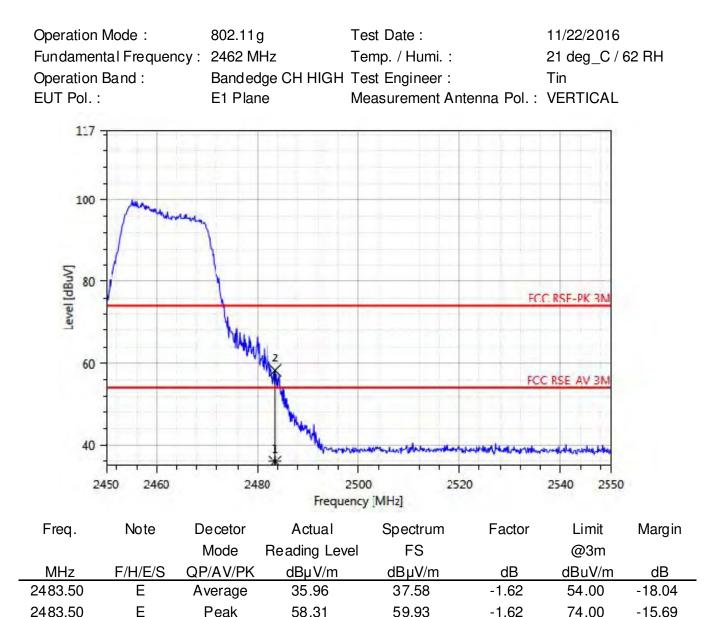
52.82

-1.74

74.00

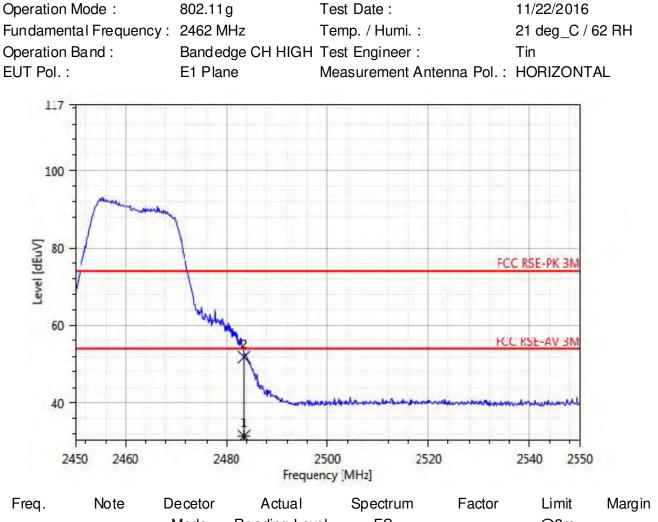
-22.92





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		Mode	Reading Level	FS		@3m		
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB	
2483.50	Е	Average	31.47	33.09	-1.62	54.00	-22.53	
2483.50	E	Peak	51.89	53.51	-1.62	74.00	-22.11	

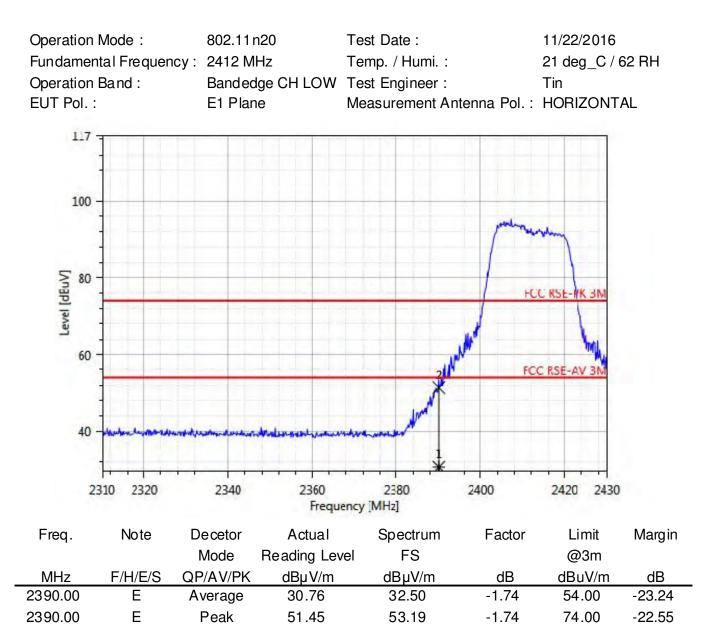
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#### Radiated Band Edge Measurement Result (802.11\_HT20)

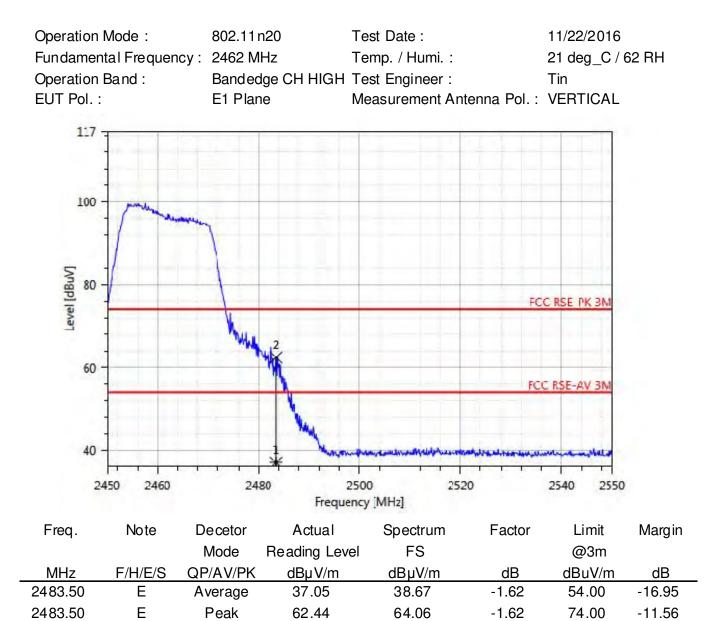
Operation Fundamer Operation EUT Pol.	ntal Frequenc Band :	-	Hz lge CH LOW	Test Date : Temp. / Humi. : Test Engineer : Measurement Ar	ntenna Pol. :	11/22/2016 21 deg_C / 6 Tin VERTICAL	2 RH
117	11111					THE	
	-						
100	-				June	man	
	-			- de la la la		-	
08 dEuv	-				-	C RSE-PK 3M	
Level [dEuV]					Alle	C KSE-PK SM	
60	1			2	r	~~~	
				1	FCC	C RSE-AV 3M	
	-			1			
10		nglatherne were	strategies and a second second	wathant 1			
2	2310 2320	2340	2360 Frequ	2380 ency [MHz]	2400	2420 2430	
Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Lev			@3m	
MHz	F/H/E/S	QP/AV/PK	dBµ V/m	dBµV/m	dB	dBuV/m	dB
2390.00	E	Average	34.43	36.18	-1.74	54.00	-19.57
2390.00	E	Peak	61.05	62.79	-1.74	74.00	-12.95





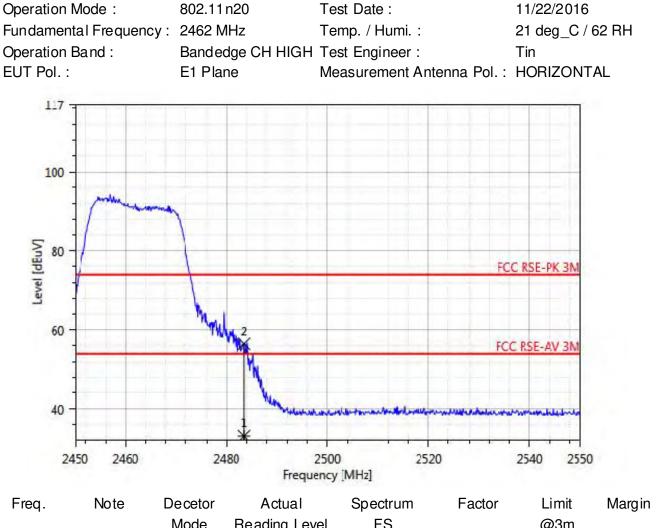
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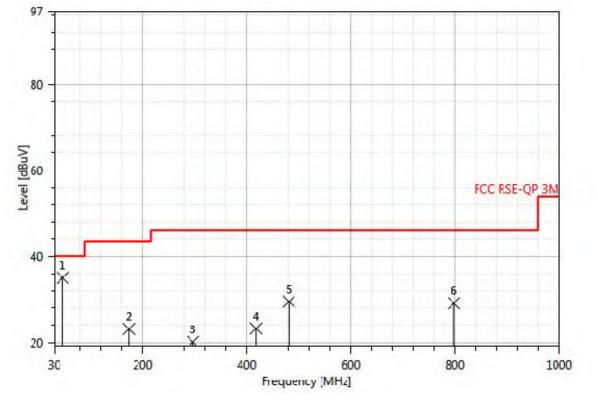
		Mode	Reading Level	FS		@3m		
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB	
2483.50	E	Average	33.18	34.79	-1.62	54.00	-20.82	
2483.50	E	Peak	56.43	58.05	-1.62	74.00	-17.57	

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### **Below 1GHz Worst-Case Data:** Radiated Spurious Emission Measurement Result (802.11 g)

Operation Mode :	802.11g	Test Date :	11/22/2016
Fundamental Frequency :	2412 MHz	Temp. / Humi. :	21 deg_C / 62 RH
Operation Band :	Tx CH LOW	Test Engineer :	Tin
EUT Pol. :	E1 Plane	Measurement Antenna Pol. :	VERTICAL

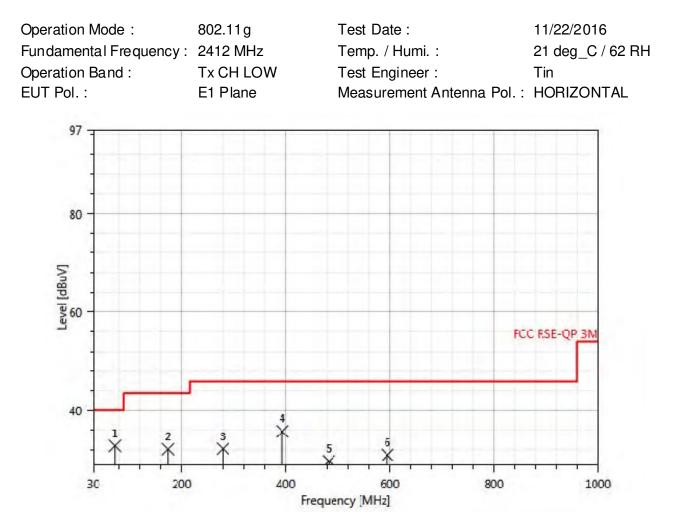


Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
46.49	S	Peak	35.01	42.91	-7.91	40.00	-4.99
173.56	S	Peak	23.13	31.09	-7.96	43.50	-20.37
296.75	S	Peak	20.08	26.06	-5.98	46.00	-25.92
418.00	S	Peak	23.25	26.63	-3.38	46.00	-22.75
481.05	S	Peak	29.49	31.86	-2.37	46.00	-16.51
798.24	S	Peak	29.11	26.00	3.11	46.00	-16.89

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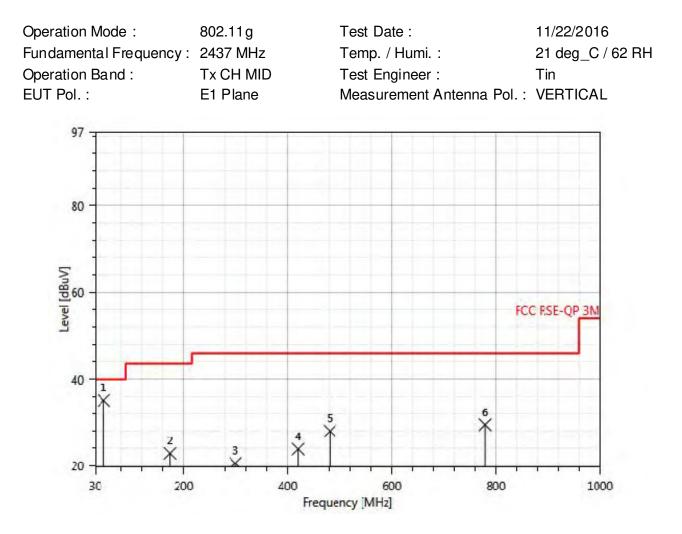




Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
71.71	S	Peak	32.81	43.43	-10.62	40.00	-7.19
173.56	S	Peak	32.14	40.10	-7.96	43.50	-11.36
279.29	S	Peak	32.24	38.66	-6.42	46.00	-13.76
393.75	S	Peak	35.75	39.92	-4.18	46.00	-10.25
482.99	S	Peak	29.70	32.18	-2.48	46.00	-16.30
595.51	S	Peak	30.96	30.92	0.04	46.00	-15.04

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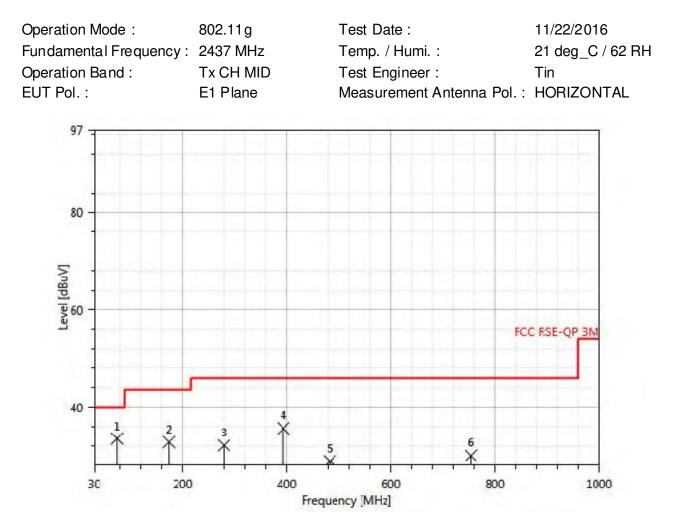




Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
46.49	S	Peak	35.10	43.00	-7.91	40.00	-4.90
173.56	S	Peak	22.89	30.85	-7.96	43.50	-20.61
299.66	S	Peak	20.61	26.53	-5.93	46.00	-25.39
419.94	S	Peak	23.87	27.25	-3.39	46.00	-22.13
481.05	S	Peak	28.03	30.40	-2.37	46.00	-17.97
778.84	S	Peak	29.46	26.98	2.48	46.00	-16.54

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Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
73.65	S	Peak	33.51	44.53	-11.02	40.00	-6.49
173.56	S	Peak	32.79	40.75	-7.96	43.50	-10.71
279.29	S	Peak	32.12	38.53	-6.42	46.00	-13.88
393.75	S	Peak	35.61	39.79	-4.18	46.00	-10.39
482.99	S	Peak	28.86	31.33	-2.48	46.00	-17.14
754.59	S	Peak	30.03	27.32	2.70	46.00	-15.97

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**Operation Mode :** 802.11g Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 Level [dBuV] FCC RSE-QP 3M 40 1 6 5 2 3 200 400 600 800 1000 30 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
46.49	S	Peak	35.51	43.41	-7.91	40.00	-4.49
172.59	S	Peak	23.72	31.58	-7.86	43.50	-19.78
294.81	S	Peak	20.78	26.80	-6.02	46.00	-25.22
413.15	S	Peak	23.41	26.80	-3.39	46.00	-22.59
479.11	S	Peak	28.09	30.49	-2.39	46.00	-17.91
774.96	S	Peak	30.28	27.52	2.76	46.00	-15.72

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**Operation Mode :** 802.11g Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg\_C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : Measurement Antenna Pol. : HORIZONTAL E1 Plane 97 80 Level [dBuV] FCC ESE QP 3M 40 1 3 2 6 400 600 800 30 200 1000 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
71.71	S	Peak	32.96	43.58	-10.62	40.00	-7.04
165.80	S	Peak	31.95	39.35	-7.39	43.50	-11.55
280.26	S	Peak	32.28	38.63	-6.35	46.00	-13.72
393.75	S	Peak	34.95	39.12	-4.18	46.00	-11.05
481.05	S	Peak	28.16	30.53	-2.37	46.00	-17.84
595.51	S	Peak	29.85	29.81	0.04	46.00	-16.15

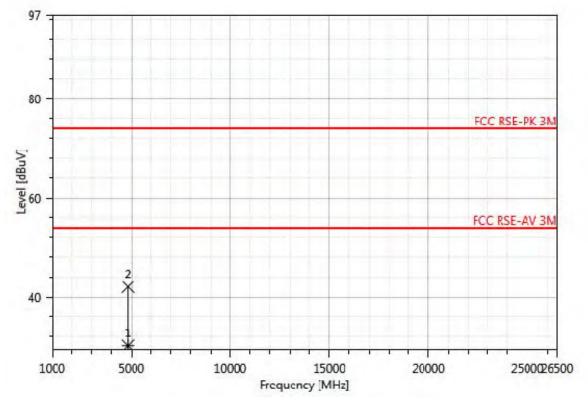
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## Above 1GHz Data: Radiated Spurious Emission Measurement Result (802.11 b)

Operation Mode :	802.11b	Test Date :	11/22/2016
Fundamental Frequency :	2412 MHz	Temp. / Humi. :	21 deg_C / 62 RH
Operation Band :	Tx CH LOW	Test Engineer :	Tin
EUT Pol. :	E1 Plane	Measurement Antenna Pol. :	VERTICAL

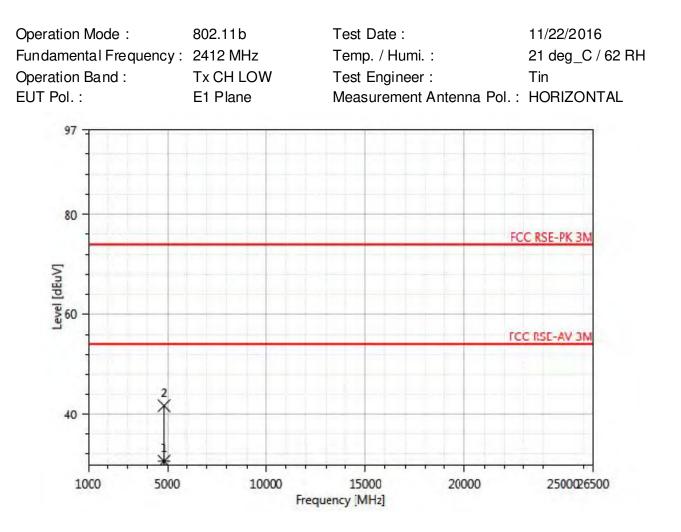


Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	30.17	25.23	4.94	54.00	-23.83
4824.00	Н	Peak	42.07	37.12	4.94	74.00	-31.93

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Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	30.62	25.68	4.94	54.00	-23.38
4824.00	Н	Peak	41.72	36.77	4.94	74.00	-32.28

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**Operation Mode :** 802.11b Test Date : 11/22/2016 Fundamental Frequency: 2437 MHz Temp. / Humi. : 21 deg C / 62 RH **Operation Band :** Tx CH MID Test Engineer : Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 FCC RSE-PK 3M Level [dBuV] FCC RSE-AV 3M 2 40 10000 20000 2500@6500 1000 5000 15000 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµ V/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	30.27	25.14	5.13	54.00	-23.73
4874.00	Н	Peak	42.51	37.38	5.13	74.00	-31.49

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**Operation Mode :** 802.11b Test Date : 11/22/2016 Fundamental Frequency: 2437 MHz Temp. / Humi. : 21 deg C / 62 RH Tx CH MID **Operation Band : Test Engineer :** Tin EUT Pol. : E1 Plane Measurement Antenna Pol. : HORIZONTAL 97 80 FCC RSE-PK 3M Level [dBuV] FCC RSE-AV 3N 2 X 40 10000 20000 2500@6500 1000 5000 15000 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	30.47	25.34	5.13	54.00	-23.53
4874.00	Н	Peak	42.19	37.06	5.13	74.00	-31.81

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Test Date : **Operation Mode :** 802.11b 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg C / 62 RH Test Engineer : **Operation Band : Tx CH HIGH** Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 FCC RSE-PK 3M Level [dBuV] FCC RSE-AV 3N 2 40 10000 20000 2500@6500 1000 5000 15000 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4924.00	Н	Average	30.44	25.19	5.25	54.00	-23.56
4924.00	Н	Peak	41.19	35.93	5.25	74.00	-32.81

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Test Date : **Operation Mode :** 802.11b 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg C / 62 RH Test Engineer : **Operation Band : Tx CH HIGH** Tin EUT Pol. : E1 Plane Measurement Antenna Pol. : HORIZONTAL 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3M 2 40 10000 2500@6500 1000 5000 15000 20000 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin	
		Mode	Reading Level	FS		@3m		
MHz	F/H/E/S	QP/AV/PK	dBµ V/m	dBµV/m	dB	dBuV/m	dB	
4924.00	Н	Average	31.02	25.77	5.25	54.00	-22.98	
4924.00	Н	Peak	40.40	35.15	5.25	74.00	-33.60	

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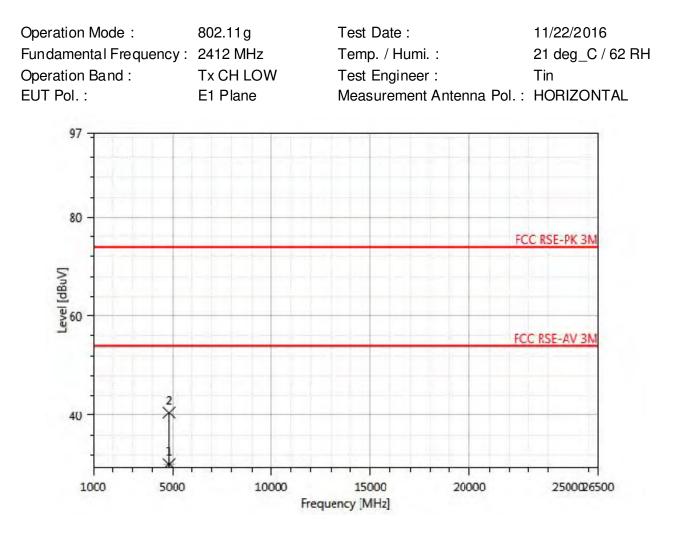


### Radiated Spurious Emission Measurement Result (802.11 g)

Operation Mode : Fundamental Frequency Operation Band : EUT Pol. :		802.11g 2412 MHz Tx CH LOW E1 Plane	Test Dat Temp. / Test Eng Measure	Humi. : gineer :	11/22/2016 21 deg_C / 62 RH Tin Pol. : VERTICAL
97					
80 -					FCC RSE-PK 3M
Level [dBuV]					
-					FCC RSE-AV 3M
40	2 X				
1000	5000	10000	15000 Frequency [MHz]	20000	2500026500

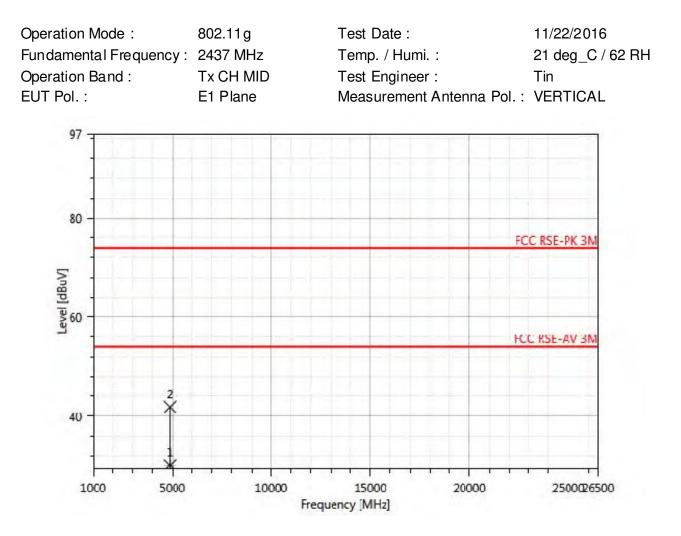
Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	29.89	24.95	4.94	54.00	-24.11
4824.00	Н	Peak	40.27	35.33	4.94	74.00	-33.73





Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	30.13	25.19	4.94	54.00	-23.87
4824.00	Н	Peak	40.55	35.61	4.94	74.00	-33.45

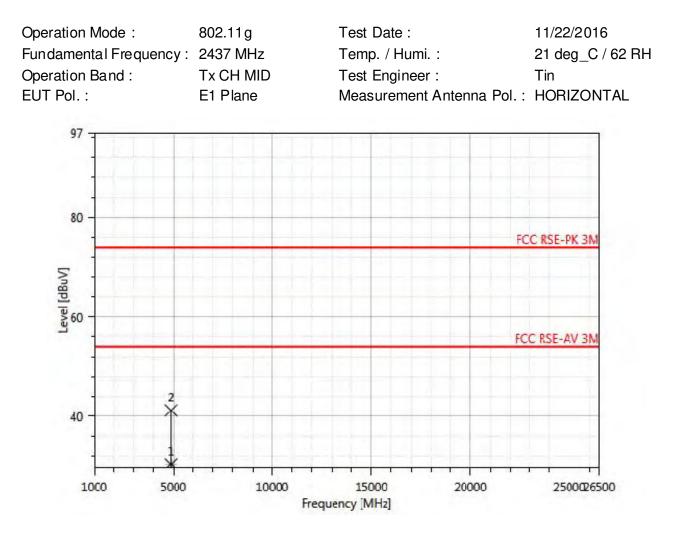




Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	30.08	24.95	5.13	54.00	-23.92
4874.00	Н	Peak	41.85	36.72	5.13	74.00	-32.15

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Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	30.37	25.24	5.13	54.00	-23.63
4874.00	Н	Peak	41.20	36.06	5.13	74.00	-32.80



**Operation Mode :** 802.11g Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 40 10000 20000 1000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4924.00	Н	Average	30.53	25.28	5.25	54.00	-23.47
4924.00	Н	Peak	40.46	35.21	5.25	74.00	-33.54

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**Operation Mode :** 802.11g Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg\_C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : Measurement Antenna Pol. : HORIZONTAL E1 Plane 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 2 40 10000 20000 1000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4924.00	Н	Average	30.91	25.66	5.25	54.00	-23.09
4924.00	Н	Peak	40.82	35.56	5.25	74.00	-33.18

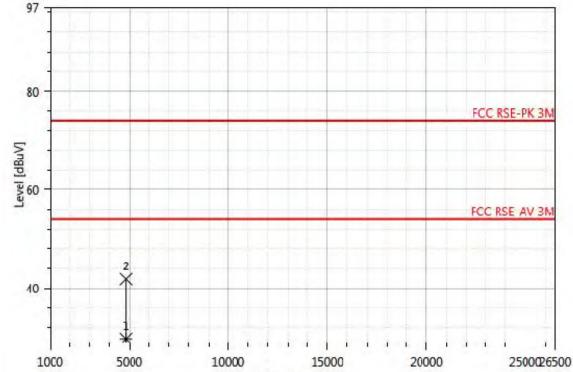
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### Radiated Spurious Emission Measurement Result (802.11\_HT20)

Operation Mode :	802.11n20	Test Date :	11/22/2016
Fundamental Frequency :	2412 MHz	Temp. / Humi. :	21 deg_C / 62 RH
Operation Band :	Tx CH LOW	Test Engineer :	Tin
EUT Pol. :	E1 Plane	Measurement Antenna Pol. :	VERTICAL



Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	29.70	24.76	4.94	54.00	-24.30
4824.00	Н	Peak	41.86	36.92	4.94	74.00	-32.14

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**Operation Mode :** 802.11n20 Test Date : 11/22/2016 Fundamental Frequency: 2412 MHz Temp. / Humi. : 21 deg\_C / 62 RH **Operation Band : Tx CH LOW** Test Engineer : Tin EUT Pol. : Measurement Antenna Pol.: HORIZONTAL E1 Plane 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 2 40 10000 20000 1000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4824.00	Н	Average	30.15	25.21	4.94	54.00	-23.85
4824.00	Н	Peak	41.41	36.46	4.94	74.00	-32.59

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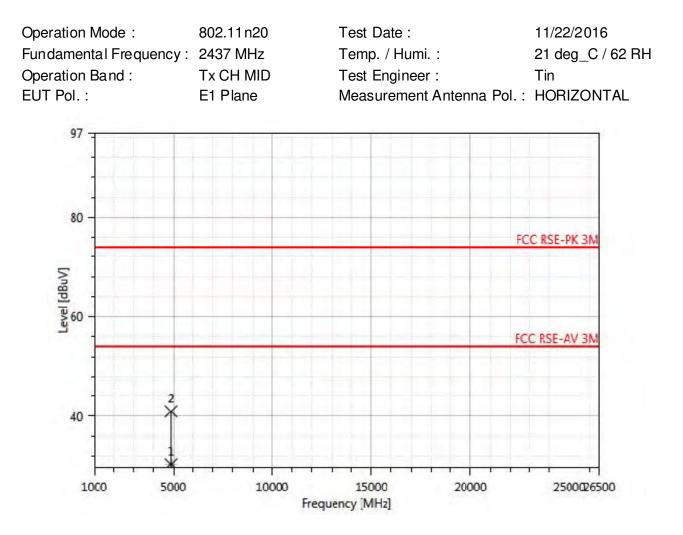


**Operation Mode :** 802.11n20 Test Date : 11/22/2016 Fundamental Frequency: 2437 MHz Temp. / Humi. : 21 deg C / 62 RH **Operation Band :** Tx CH MID Test Engineer : Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 FCC RSE-PK 3M Level [dBuV] FCC RSE-AV 3N 2 40 1000 10000 20000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	29.94	24.81	5.13	54.00	-24.06
4874.00	Н	Peak	40.66	35.52	5.13	74.00	-33.34

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Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4874.00	Н	Average	30.32	25.19	5.13	54.00	-23.68
4874.00	Н	Peak	40.96	35.83	5.13	74.00	-33.04



**Operation Mode :** 802.11n20 Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : E1 Plane Measurement Antenna Pol.: VERTICAL 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 2 40 10000 20000 1000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4924.00	Н	Average	30.32	25.07	5.25	54.00	-23.68
4924.00	Н	Peak	40.13	34.87	5.25	74.00	-33.87

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**Operation Mode :** 802.11n20 Test Date : 11/22/2016 Fundamental Frequency: 2462 MHz Temp. / Humi. : 21 deg\_C / 62 RH **Operation Band : Tx CH HIGH** Test Engineer : Tin EUT Pol. : Measurement Antenna Pol. : HORIZONTAL E1 Plane 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 40 10000 20000 1000 5000 15000 2500@6500 Frequency [MHz]

Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
		Mode	Reading Level	FS		@3m	
MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB
4924.00	Н	Average	30.80	25.55	5.25	54.00	-23.20
4924.00	Н	Peak	40.57	35.32	5.25	74.00	-33.43

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# **12 PEAK POWER SPECTRAL DENSITY**

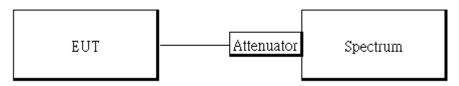
## 12.1 Standard Applicable

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	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	02/26/2016	02/25/2017				
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017				
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017				
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017				

### 12.3 Test Set-up



### **12.4 Measurement Procedure**

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 3 kHz. & the VBW = 10 kHz
- 5. For defining Restricted Band Edge Limit: Set the RBW = 100kHz & VBW = 300 kHz.
- 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.

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#### **12.5 Measurement Result**

POWER DENSITY 802.11b MODE								
Frequency (MHz)	RF Power	Maximum						
	Density	Limit	Result					
	(dBm)	(dBm)						
2412	-6.82	8.00	PASS					
2437	-8.76	8.00	PASS					
2462	-8.01	8.00	PASS					

POWER DENSITY 802.11g MODE				
Frequency (MHz)	RF Power	Maximum		
	Density	Limit	Result	
	(dBm)	(dBm)		
2412	-9.87	8.00	PASS	
2437	-10.22	8.00	PASS	
2462	-8.78	8.00	PASS	

POWER DENSITY 802.11n HT20 MODE				
Frequency (MHz)	RF Power	Maximum		
	Density	Limit	Result	
	(dBm)	(dBm)		
2412	-10.64	8.00	PASS	
2437	-9.18	8.00	PASS	
2462	-8.31	8.00	PASS	

\*Refer to next page for plots

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# 802.11b 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)

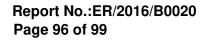


# 802.11q

# Power Spectral Density Test Plot (CH-Low)



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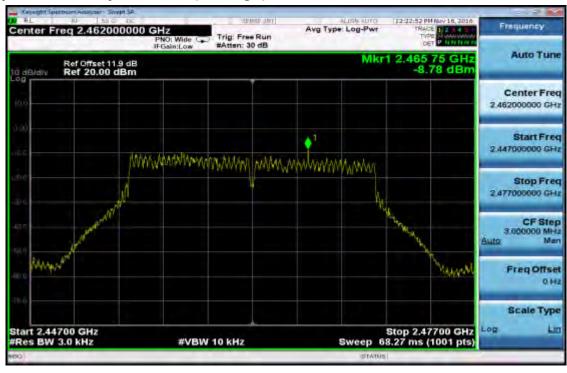




## **Power Spectral Density Test Plot (CH-Mid)**



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



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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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## **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.

## **13.2 Antenna Connected Construction**

An embedded-in 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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