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# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

# INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

0F

**Product Name: Smart Watch** 

**Brand Name:** Nixon

**Marketing Name:** The Mission

Model No.: A1167

**Model Difference:** N/A

FCC ID: 2ADQ8-A1167

**Report No.:** ER/2016/60030-01

**Issue Date:** Sep. 02, 2019

**FCC Rule Part:** §15.247, Cat: DSS

Nixon, Inc. **Prepared for:** 

701 South Coast Hwy Encinitas, CA 92024

SGS Taiwan Ltd.

**Electronics & Communication Laboratory** No.134, Wu Kung Road, New Taipei Indus-

trial Park, Wuku District, New Taipei City,

Taiwan 24803



Prepared by:



Testing Laboratory 0513

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# VERIFICATION OF COMPLIANCE

Nixon. Inc. Applicant:

701 South Coast Hwy Encinitas, CA 92024

**Product Name: Smart Watch** 

**Brand Name:** Nixon

**Marketing Name:** The Mission

Model No.: A1167

**Model Difference:** N/A

FCC ID: 2ADQ8-A1167

**Report Number:** ER/2016/60030-01

Date of test: Jun. 04, 2016 ~ Jun. 17, 2016

Date of EUT Received: Jun. 04, 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:	Cooper Hsu	Date:	Sep. 02, 2019
	Cooper Hsu / Engineer	_	
Prepared By:	Yuri Tsou	Date:	Sep. 02, 2019
Approved By:	Yuri Tsai / Clerk  Jim Chang / Asst. Manager	Date:	Sep. 02, 2019

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# **Revision History**

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2016/60030	Rev.00	Initial creation of docu- ment	All	Jun. 24, 2016	Yuri Tsai
ER/2016/60030-01	Rev.01	Add section 1.7 remark and conduction data updated	7 & 17 & 18	Sep. 02, 2019	Yuri Tsai

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# **GENERAL INFORMATION**

# 1.1 Product description

#### General:

- Contrain	ocheral.		
Product Name:	Smart Watch		
Brand Name:	Nixon		
Marketing Name:	The Mission	n	
Model No.:	A1167		
Model Difference:	N/A		
Product SW/HW version:	N/A/ HWID	2000	
Radio SW/HW version:	N/A/ N/A		
Test SW Version:	N/A		
RF power setting in TEST SW:	N/A		
Charging Dock:	Model: N/A, Supplier: N/A		
Dower Supply	3.8Vdc Rechargeable Li-ion Battery		
Power Supply:	Battery:	Model: APP00169, Supplier: APACK	

### Bluetooth BR+EDR:

Bluetooth Version:	BT4.1 dual mode	
Channel number:	79 channels	
Modulation type:	GFSK + π/4DQPSK + 8DPSK	
Transmit Power:	12.43 dBm	
Frequency Range:	2.402GHz – 2.480GHz	
Dwell Time:	<= 0.4s	
Antenna Designation:	PIFA Antenna, Antenna Gain: -6.51dBi	

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# 1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting, Bluetooth and 802.11 b/g/n features, and below is details of information.

	Product Feature			
Product Name:	Smart Watch			
Brand Name:	Nixon			
Marketing Name:	The Mission			
Model No.:	A1167			
Model Difference:	N/A			
FCC ID:	2ADQ8-A1167			
Bluetooth Version	BT4.1 dual mode			
WLAN	802.11 b/g/n			

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 Public Notice DA 00-705 Measurement Guidelines

ANSI C63.10:2013

#### Note:

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

### 1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei In-dustrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Designation number is: TW0001

### 1.5 Special Accessories

There is no special accessory used while test was conducted.

#### 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

#### 1.7 Remarks

The original test report ER/2016/60030 will be withdrawn with this test report ER/2016/60030-01 and is no longer valid when the withdrawal occurred.

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#### 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 a placed on as turn table which is 0.8 m above ground plan. 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 plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this 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.

#### 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.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor. Following shows an offset computation example with cable loss 4.2dB and splitter 0dB splitter. Offset = RF cable loss (dB)+ splitter(dB) =4.2 + 0 = 4.2(dB)

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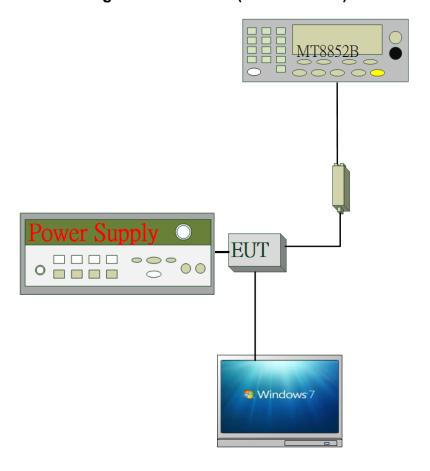


# 2.5 Configuration of Tested System

Fig. 2-1 Radiated & Conducted Emission



Fig. 2-2 Conducted (Antenna Port)



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

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	<b>Power Cord</b>
1	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L420	LR-7HXZA	Shielded	Un-Shielded
3.	DC Power Supply	Agilent	E3640A	KR93300208	N/A	Un-Shielded
4.	Bluetooth Test Set	Anritsu	MT8852B	6k00006107	N/A	Un-shielded

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### **UMMARY OF TEST RESULTS**

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB & 99% Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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

# 4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

CH	FREQUENCY	CH	FREQUENCY	СН	FREQUENCY	СН	FREQUENCY
0	2402 MHz	20	2422 MHz	40	2442 MHz	70	2462 MHz
1	2403 MHz	21	2423 MHz	41	2443 MHz	71	2463 MHz
2	2404 MHz	22	2424 MHz	42	2444 MHz	72	2464 MHz
3	2405 MHz	23	2425 MHz	43	2445 MHz	73	2465 MHz
4	2406 MHz	24	2426 MHz	44	2446 MHz	74	2466 MHz
5	2407 MHz	25	2427 MHz	45	2447 MHz	75	2467 MHz
6	2408 MHz	26	2428 MHz	46	2448 MHz	76	2468 MHz
7	2409 MHz	27	2429 MHz	47	2449 MHz	77	2469 MHz
8	2410 MHz	28	2430 MHz	48	2450 MHz	78	2470 MHz
9	2411 MHz	29	2431 MHz	49	2451 MHz	79	2471 MHz
10	2412 MHz	30	2432 MHz	50	2452 MHz	70	2472 MHz
11	2413 MHz	31	2433 MHz	51	2453 MHz	71	2473 MHz
12	2414 MHz	32	2434 MHz	52	2454 MHz	72	2474 MHz
13	2415 MHz	33	2435 MHz	53	2455 MHz	73	2475 MHz
14	2416 MHz	34	2436 MHz	54	2456 MHz	74	2476 MHz
15	2417 MHz	35	2437 MHz	55	2457 MHz	75	2477 MHz
16	2418 MHz	36	2438 MHz	56	2458 MHz	76	2478 MHz
17	2419 MHz	37	2439 MHz	57	2459 MHz	77	2479 MHz
18	2420 MHz	38	2440 MHz	58	2460 MHz	78	2480 MHz
19	2421 MHz	39	2441 MHz	59	2461 MHz		

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#### 4.2 The Worst Test Modes and Channel Details

- The EUT has been tested under operating condition.
- Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- 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	TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL	MODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	8-DPSK	DH5		
	RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE	TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL	MODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	8-DPSK	DH5		

#### Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth BR+EDR Transmitter for channel Low, Mid and High, the worst case H position was reported.

#### ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
	F	Peak Output Pov	ver, 20dB Band Wid	th	
MODE	AVAILABLE	TESTED	MODULATION	PACKET	
MODE	CHANNEL	CHANNEL	MODULATION	TYPE	
	0 to 78	0,39,78	GFSK	DH5	
Bluetooth	0 to 78	0,39,78	π/4-DQPSK	DH5	
	0 to 78	0,39,78	8-DPSK	DH5	
		Baı	nd Edge		
Bluetooth	0 to 78	0,78	8-DPSK	DH5	
		Frequen	cy Separation		
Bluetooth	0 to 78	0,1,2	8-DPSK	DH5	
		Number of h	opping frequency		
Bluetooth	0 to 78	0 to 78	8-DPSK	DH5	
Time of Occupancy (Dwell time)					
Bluetooth	0 to 78	0,39,78	GFSK	DH1/DH3/DH5	
Bluetooth	0 to 78	39	π/4-DQPSK	DH1/DH3/DH5	
Bluetooth	0 to 78	39	8-DPSK	DH1/DH3/DH5	

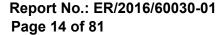
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MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty	9kHz - 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	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

# 6.1 Standard Applicable

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

Frequency range	Limits 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	11/26/2015	11/25/2016		

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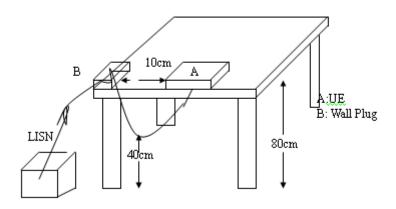
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# 6.4 Test SET-UP (Block Diagram of Configuration)



#### 6.5 Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plan.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

#### 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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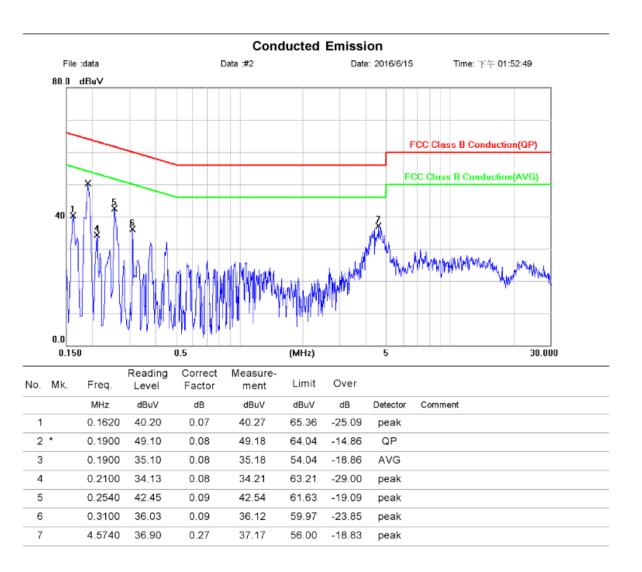
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	BT4.1			Test Date:	Jun. 15, 2016
Temperature:	24	Humidity:	70%	Test By:	JJ
Model No.:	N/A			Phase:	L1 / N

25 ℃ Site Conduction Room Phase: L1 Temperature: AC 120V/60Hz Limit: FCC Class B Conduction(QP) Power: Humidity: 85 %

Mode: Operation mode

Note:



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25 ℃ Temperature: Site Conduction Room Phase: AC 120V/60Hz Humidity: 85 % Limit: FCC Class B Conduction(QP) Power:

Mode: Operation mode

Note:

# Conducted Emission Data #1 Date: 2016/6/15 File :data Time: 下午 01:51:58 80.0 dBuV FCC Class B Conduction(QP) FCC Class B Conduction(AVG) 0.0 0.150 (MHz) 5 30.000

No. Mk	c. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1700	38.52	0.07	38.59	64.96	-26.37	peak	
2 *	0.1900	48.45	0.08	48.53	64.04	-15.51	peak	
3	0.2180	33.71	0.08	33.79	62.89	-29.10	peak	
4	0.2540	42.20	0.09	42.29	61.63	-19.34	peak	
5	0.3220	38.67	0.09	38.76	59.66	-20.90	peak	
6	4.4620	35.41	0.26	35.67	56.00	-20.33	peak	

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#### PEAK OUTPUT POWER MEASUREMENT

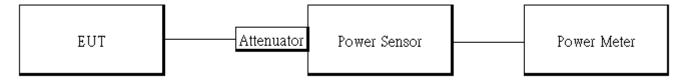
# 7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 -2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

# 7.2 Measurement Equipment Used

	Cond	lucted Emission	Test Site		
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
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	HU- BER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017
DC Power Supply	Agilent	E3640A	MY52410006	11/05/2015	11/04/2016
Temperature Chamber	TERCHY	MHG-120LF	911009	05/17/2016	05/16/2017

### 7.3 Test Set-up:



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#### 7.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
- 4. Record the max. reading.
- 5. Repeat above procedures until all default test channel is completed.

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#### 7.5 Measurement Result

### 1M BR mode (Peak):

Channel	Frequency (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	11.37	13.709	1000
39	2441	11.53	14.223	1000
78	2480	11.20	13.183	1000

### 1M BR mode (Average): Tune up tolerance ± dBm

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	9.99	9.977	1000
39	2441	10.34	10.814	1000
78	2480	9.67	9.268	1000

#### 2M EDR mode (Peak):

Channel	Frequency (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	12.23	16.711	125
39	2441	12.40	17.378	125
78	2480	12.10	16.218	125

### 2M EDR mode (Average): Tune up tolerance ± dBm

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	8.40	6.918	125
39	2441	8.70	7.413	125
78	2480	8.40	6.918	125

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# 3M EDR mode (Peak):

Channel	Frequency (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	12.26	16.827	125
39	2441	12.43	17.498	125
78	2480	12.11	16.255	125

# 3M EDR mode (Average): Tune up tolerance ± dBm

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	8.53	7.129	125
39	2441	8.88	7.727	125
78	2480	8.47	7.031	125

NOTE: cable loss as 4.2dB that offsets in the spectrum

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#### 20DB BANDWIDTH MEASUREMENT

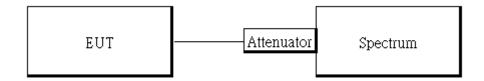
# 8.1 Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

#### 8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
EXA Spectrum Ana-	Agilent	N9030A	MY53120760	02/26/2016	02/25/2017
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017

#### 8.3 Test Set-up



#### 8.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 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 the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 5. Mark the peak frequency and -20dB (upper and lower) frequency
- 6. Repeat above procedures until all test default channel is completed

#### NOTE:

- 1. cable loss as 5.1dB that offsets in the spectrum
- For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark

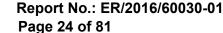
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#### 8.5 Measurement Result

#### **GFSK**

OI OIL					
	20 dB	2/3 Bandwidth			
Channel	Bandwidth				
	(MHz)	(MHz)			
Low	0.9244	0.62			
Mid	0.9238	0.62			
High	0.924	0.62			

#### π/4-DQPSK

Channel	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)	
Low	1.313	0.88	
Mid	1.313	0.88	
High	1.313	0.88	

#### 8-DPSK

Channel	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)
Low	1.267	0.84
Mid	1.263	0.84
High	1.262	0.84

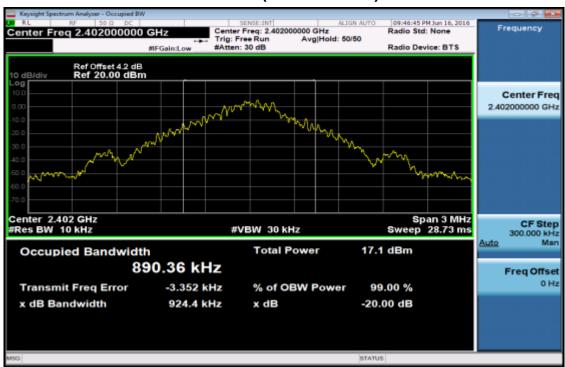
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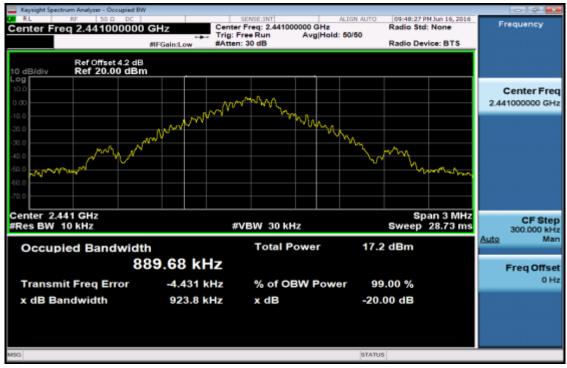
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# 20dB Band Width Test Data CH-Low (GFSK mode)



# 20dB Band Width Test Data CH-Mid (GFSK mode)



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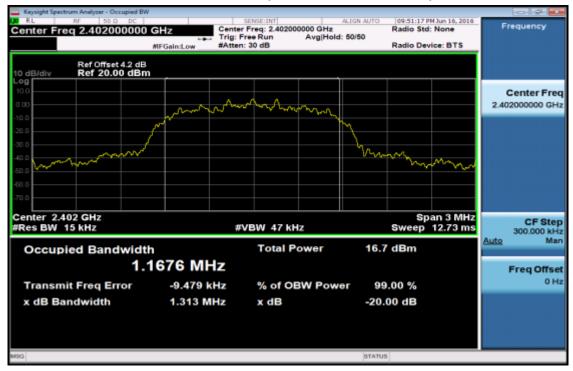
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# 20dB Band Width Test Data CH-High (GFSK mode)



# 20dB Band Width Test Data CH-Low (π/4-DQPSK mode)



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# 20dB Band Width Test Data CH-Mid (π/4-DQPSK mode)



# 20dB Band Width Test Data CH-High (π/4-DQPSK mode)



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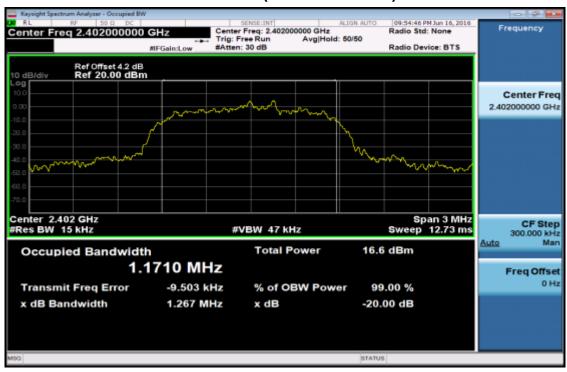
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# 20dB Band Width Test Data CH-Low (8-DPSK mode)



# 20dB Band Width Test Data CH-Mid (8-DPSK mode)



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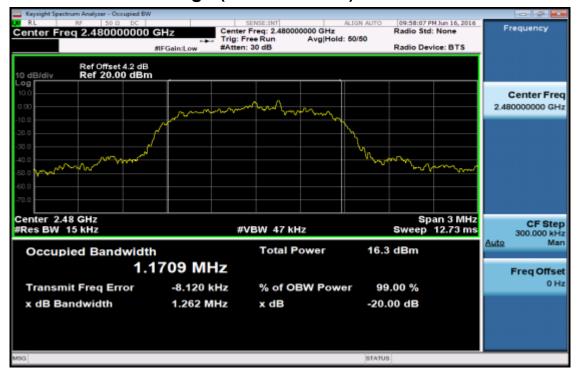
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# 20dB Width Test Data CH-High (8-DPSK mode)



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### CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

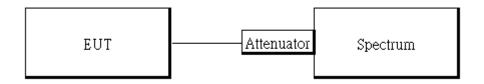
# 9.1 Standard Applicable

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).

### 9.2 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
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017

#### 9.3 Test SET-UP



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#### 9.4 Measurement Procedure

#### **Conducted Band Edge:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 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 center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
- 6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
- 7. Repeat above procedures until all frequency measured were complete.

### **Conducted Spurious Emission:**

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 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.
- Repeat above procedures until all default test channel measured were complete.

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	S .	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

#### 9.5 Measurement Result

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

- 1. Cable loss as 5.1dB that offsets in the spectrum
- 2. The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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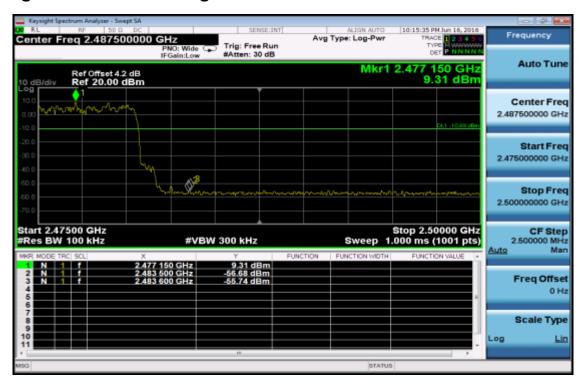
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# Band Edges Test Data CH-Low (Hopping mode)



# Band Edges Test Data CH-High



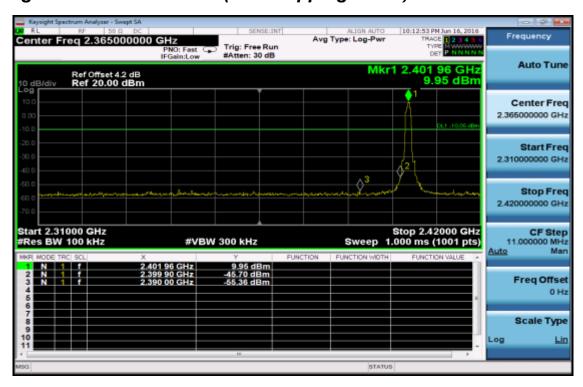
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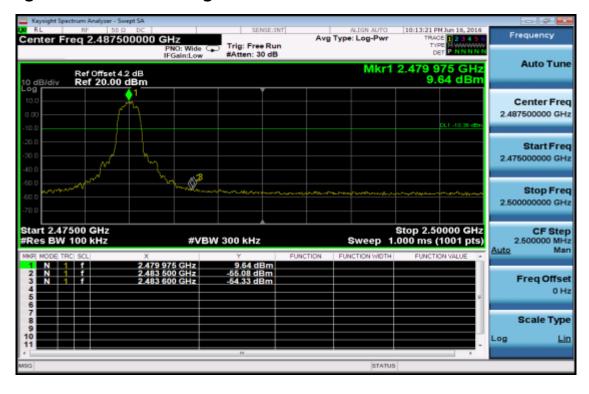
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# Band Edges Test Data CH-Low (Non-Hopping mode)



# Band Edges Test Data CH-High



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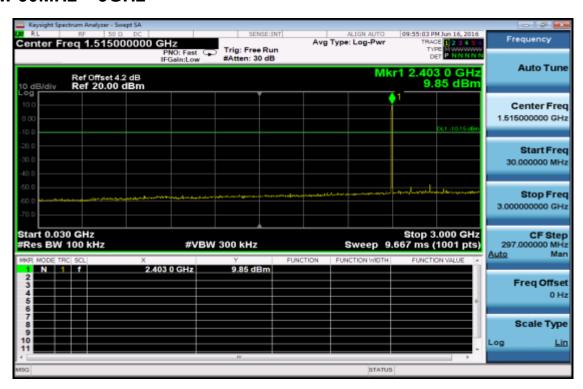
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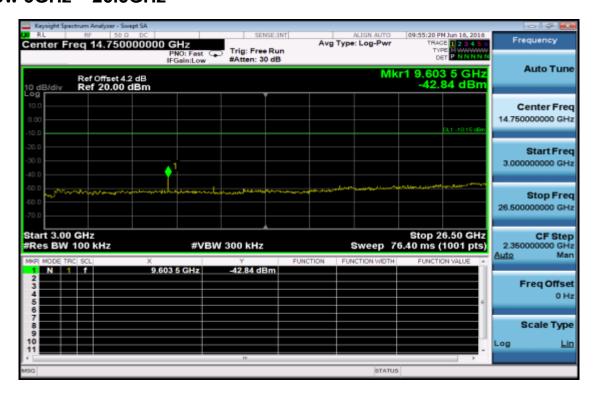
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# **Conducted Spurious Emission Measurement Result (8-DPSK mode)** Ch Low 30MHz - 3GHz



### Ch Low 3GHz - 26.5GHz



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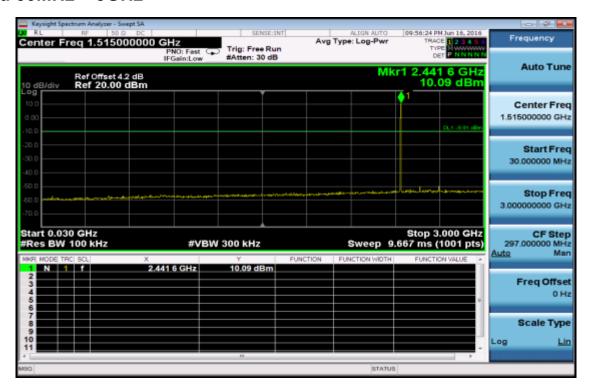
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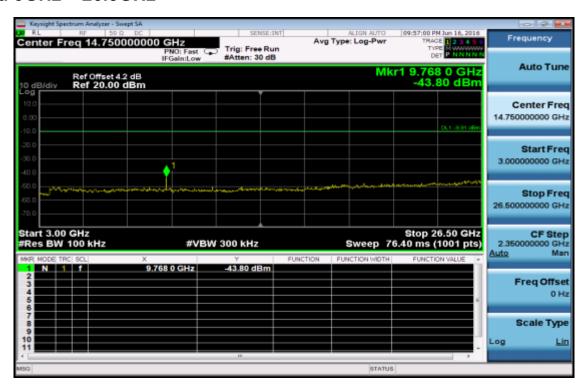
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### Ch Mid 30MHz - 3GHz



### Ch Mid 3GHz - 26.5GHz



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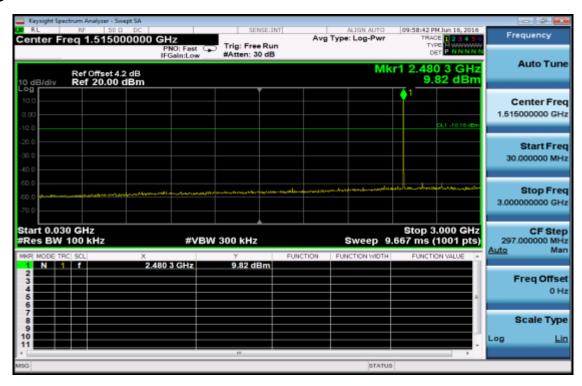
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t (886-2) 2299-3279

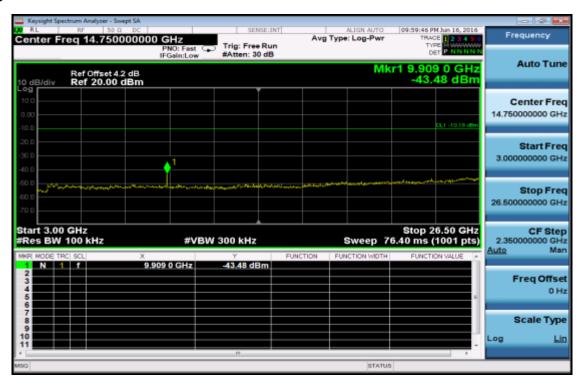
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# Ch High 30MHz - 3GHz



# Ch High 3GHz - 26.5GHz



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### 10 RADIATED BANDEDGE 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 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  $(dB\mu V/m) = 20 \log Emission level (dB\mu V/m)$

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## 10.2 Measurement Equipment Used

		966 Chambe	er		
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		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	148045	09/07/2015	09/06/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/10/2015	08/09/2016
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	07/02/2015	07/01/2016
Low Loss Cable	Huber Suhner	966 TX	1	01/02/2016	01/01/2017

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

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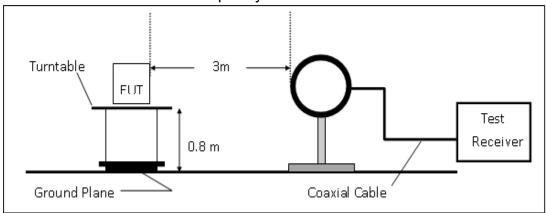
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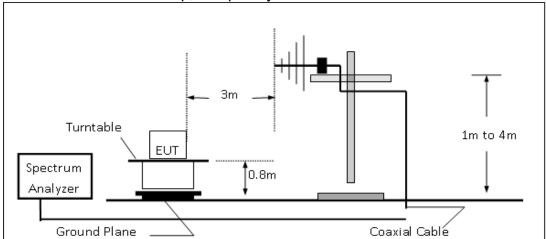


#### 10.3 Test SET-UP

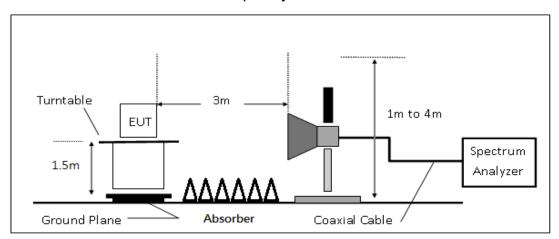
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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#### 10.4 Measurement Procedure

#### **Radiated Emission**

- 1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m for frequency> 1GHz above ground plan.
- 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. Use the follow spectrum analyzer setting:
  - (1) Span = wide enough to fully capture the emission being measured
  - (2) RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz, VBW  $\ge$  RBW, Sweep = auto, Detector function = peak, Trace = max hold
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c)

Duty Cycle = On time/100 milliseconds

On time = N1\*L1=N2\*L2+...+N(n-1)\*LN(n-1)+N(n)\*L(n)

Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20\*log (duty Cycle)

- 6. 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.
- 7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 8. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 9. Repeat above procedures until all frequency of the interest measured were complete.

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### 10.5 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	5	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

The limit of the emission level is expressed in dBuV/m, which converts 20\*log(uV/m)

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

## 10.6 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.

#### 10.7 Measurement Result

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

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## Radiated Band Edge Measurement Result: (Hopping Mode)

Operation Mode: **BR** Hopping Test Date: 06/14/2016 21:53:30 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H 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
2390.00	Е	Average	26.76	28.50	-1.74	54.00	-27.24
2390.00	Ε	Peak	38.54	40.28	-1.74	74.00	-35.46

Operation Mode: **BR** Hopping Test Date: 06/14/2016 22:03:00 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL

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
2390.00	Е	Average	27.05	28.79	-1.74	54.00	-26.95
2390 00	F	Peak	38 30	40 04	-1 74	74 00	-35 70

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06/14/2016 22:09:34 Operation Mode: **BR** Hopping Test Date:

Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer: Tin

EUT Pol.: H 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	
2483.50	Е	Average	28.49	30.11	-1.62	54.00	-25.51	
2483.50	E	Peak	42.09	43.71	-1.62	74.00	-31.91	

Operation Mode: **BR** Hopping Test Date: 06/14/2016 22:17:06 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer: Tin

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL

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	_
2483.50	Е	Average	27.48	29.10	-1.62	54.00	-26.52	_
2483.50	Е	Peak	40.51	42.12	-1.62	74.00	-33.49	

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Operation Mode: **EDR Hopping** Test Date: 06/14/2016 21:54:23 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H 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	
2390.00	Е	Average	27.49	29.23	-1.74	54.00	-26.51	
2390.00	Е	Peak	39.07	40.82	-1.74	74.00	-34.93	

Operation Mode: **EDR Hopping** Test Date: 06/14/2016 22:03:41 Temp. / Humi.: Fundamental Frequency: 2402 MHz 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer:

EUT Pol.: Measurement Antenna Pol.: HORIZONTAL H Plane

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
2390.00	Е	Average	27.17	28.91	-1.74	54.00	-26.83
2390.00	Е	Peak	38.75	40.50	-1.74	74.00	-35.25

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Operation Mode: **EDR Hopping** Test Date: 06/14/2016 22:10:41 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer: Tin

EUT Pol.: H 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	
2483.50	Е	Average	27.57	29.19	-1.62	54.00	-26.43	_
2483 50	F	Peak	43 33	44 95	-1 62	74 00	-30 67	

Operation Mode: **EDR Hopping** Test Date: 06/14/2016 22:18:11 Temp. / Humi.: Fundamental Frequency: 2480 MHz 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer:

EUT Pol.: Measurement Antenna Pol.: HORIZONTAL H Plane

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	_
2483.50	Е	Average	27.26	28.88	-1.62	54.00	-26.74	_
2483.50	Е	Peak	41.86	43.48	-1.62	74.00	-32.14	

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## Radiated Emission – Band Edge (Non-Hopping Mode):

06/14/2016 21:52:47 Operation Mode: BR(1M) Test Date: Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H Plane Measurement Antenna Pol.: VERTICAL

	Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin	
	MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBμV/m	dB	dBuV/m	dB	
•	2390.00	Е	Average	27.28	29.02	-1.74	54.00	-26.72	
	2390.00	Е	Peak	41.47	43.21	-1.74	74.00	-32.53	

Operation Mode: BR(1M) Test Date: 06/14/2016 22:01:26 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL

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	_
2390.00	Е	Average	27.14	28.88	-1.74	54.00	-26.86	_
2390.00	E	Peak	38.56	40.30	-1.74	74.00	-35.44	

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Operation Mode: BR(1M) Test Date: 06/14/2016 22:07:52 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer:

EUT Pol.: H Plane Measurement Antenna Pol.: VERTICAL

	Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin	
	MHz	F/H/E/S	QP/AV/PK	dBµV/m	dBµV/m	dB	dBuV/m	dB	_
•	2483.50	Е	Average	32.08	33.70	-1.62	54.00	-21.92	_
	2483.50	Е	Peak	53.56	55.18	-1.62	74.00	-20.44	

Operation Mode: BR(1M) Test Date: 06/14/2016 22:15:13 Temp. / Humi.: Fundamental Frequency: 2480 MHz 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer:

Measurement Antenna Pol.: HORIZONTAL EUT Pol.: H Plane

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
2483.50	Е	Average	30.34	31.96	-1.62	54.00	-23.66
2483 50	F	Peak	51 79	53 40	-1 62	74 00	-22 21

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Operation Mode: EDR(3M) Test Date: 06/14/2016 21:52:14 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer: Tin

EUT Pol.: H 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	
2390.00	Е	Average	26.99	28.73	-1.74	54.00	-27.01	_
2390.00	Е	Peak	42.46	44.20	-1.74	74.00	-31.54	

Operation Mode: EDR(3M) Test Date: 06/14/2016 22:02:13 Temp. / Humi.: Fundamental Frequency: 2402 MHz 22 deg C / 61 RH

Operation Band: Bandedge CH LOW Test Engineer:

EUT Pol.: Measurement Antenna Pol.: HORIZONTAL H Plane

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	
2390.00	Е	Average	26.91	28.65	-1.74	54.00	-27.09	_
2390.00	Е	Peak	38.57	40.31	-1.74	74.00	-35.43	

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Operation Mode: EDR(3M) Test Date: 06/14/2016 22:08:40 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer: Tin

EUT Pol.: H 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
2483.50	Е	Average	31.60	33.22	-1.62	54.00	-22.40
2483.50	Е	Peak	52.92	54.54	-1.62	74.00	-21.08

06/14/2016 22:15:54 Operation Mode: EDR(3M) Test Date: Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Bandedge CH HIGH Test Engineer: Tin

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL

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	
2483.50	Е	Average	29.93	31.55	-1.62	54.00	-24.07	
2483.50	Е	Peak	50.63	52.25	-1.62	74.00	-23.37	

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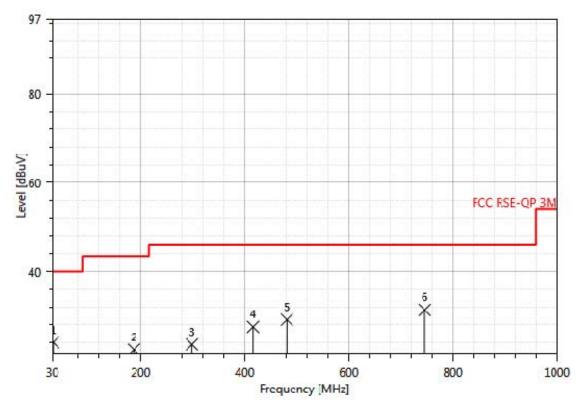
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## **Radiated Spurious Emission Measurement Result:** For Frequency form 30MHz to 1000MHz

Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:24 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Tx CH LOW Test Engineer:

EUT Pol.: H 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
31.94	S	Peak	24.03	33.14	-9.11	40.00	-15.97
187.14	S	Peak	22.38	31.52	-9.15	43.50	-21.12
298.69	S	Peak	23.55	29.50	-5.95	46.00	-22.45
416.06	S	Peak	27.53	30.79	-3.27	46.00	-18.47
481.05	S	Peak	29.15	31.52	-2.37	46.00	-16.85
745.86	S	Peak	31.33	29.03	2.30	46.00	-14.67

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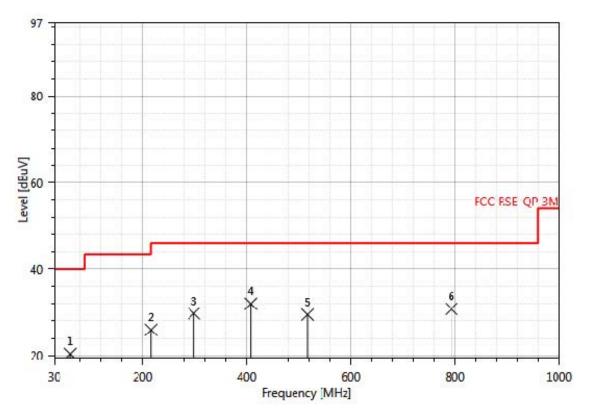


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Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:25 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH LOW Test Engineer:

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



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
61.04	S	Peak	20.37	28.62	-8.25	40.00	-19.63
216.24	S	Peak	25.96	35.39	-9.43	46.00	-20.04
298.69	S	Peak	29.73	35.69	-5.95	46.00	-16.27
408.30	S	Peak	31.99	35.52	-3.53	46.00	-14.01
516.94	S	Peak	29.45	31.39	-1.94	46.00	-16.55
793.39	S	Peak	30.78	27.92	2.86	46.00	-15.22

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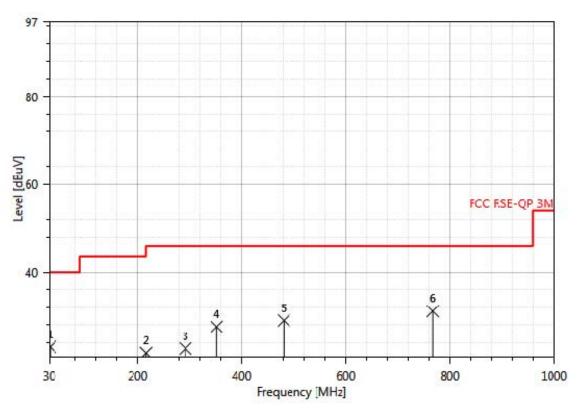


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Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:26 Fundamental Frequency: 2441 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH MID Test Engineer:

EUT Pol.: H 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
31.94	S	Peak	23.04	32.15	-9.11	40.00	-16.96
216.24	S	Peak	21.65	31.07	-9.43	46.00	-24.35
291.90	S	Peak	22.67	28.75	-6.08	46.00	-23.33
352.04	S	Peak	27.60	32.55	<b>-</b> 4.95	46.00	-18.40
481.05	S	Peak	29.03	31.40	-2.37	46.00	-16.97
767.20	S	Peak	31.15	28.01	3.14	46.00	-14.85

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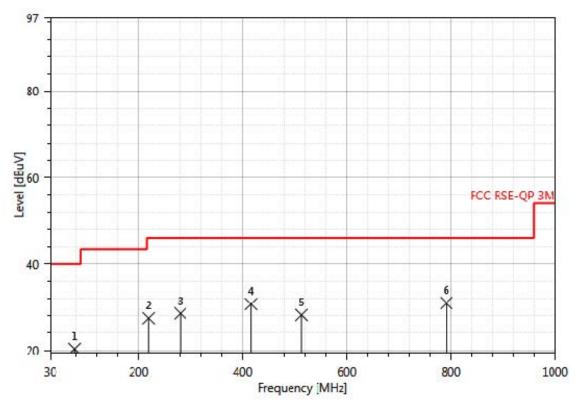


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Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:27 Fundamental Frequency: 2441 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH MID Test Engineer:

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



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
76.56	S	Peak	20.32	31.96	-11.64	40.00	-19.68
219.15	S	Peak	27.43	36.72	-9.28	46.00	-18.57
280.26	S	Peak	28.55	34.90	-6.35	46.00	-17.45
416.06	S	Peak	30.70	33.97	-3.27	46.00	-15.30
513.06	S	Peak	28.19	30.08	-1.90	46.00	-17.81
791.45	S	Peak	30.95	28.05	2.89	46.00	-15.05

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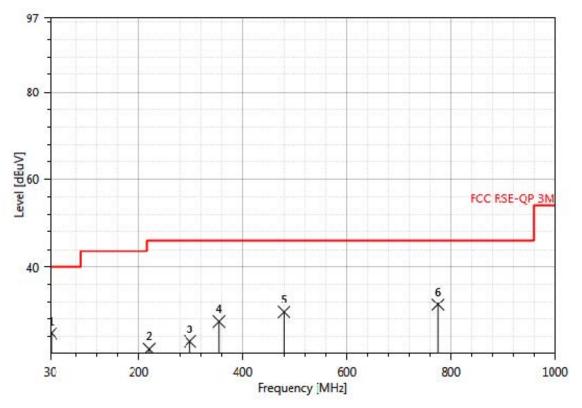


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Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:28 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH HIGH Test Engineer:

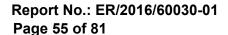
EUT Pol.: H Plane Measurement Antenna Pol.: VERTICAL



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
31.94	S	Peak	24.74	33.86	-9.11	40.00	-15.26
220.12	S	Peak	21.19	30.43	-9.24	46.00	-24.81
298.69	S	Peak	22.91	28.86	-5.95	46.00	-23.09
354.95	S	Peak	27.50	32.25	-4.76	46.00	-18.50
479.11	S	Peak	29.61	32.00	-2.39	46.00	-16.39
774.96	S	Peak	31.33	28.57	2.76	46.00	-14.67

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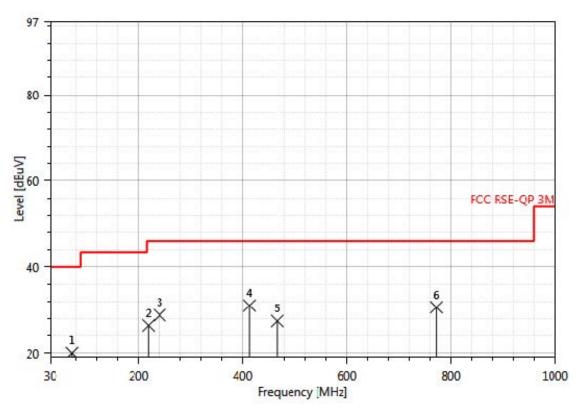




Operation Mode: EDR(3M) Test Date: 06/14/2016 20:51:29 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH HIGH Test Engineer:

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



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	20.03	30.64	-10.62	40.00	-19.97
219.15	S	Peak	26.43	35.72	-9.28	46.00	-19.57
240.49	S	Peak	28.81	36.84	-8.03	46.00	-17.19
413.15	S	Peak	31.02	34.41	-3.39	46.00	-14.98
466.50	S	Peak	27.47	30.02	-2.56	46.00	-18.53
772.05	S	Peak	30.64	27.94	2.69	46.00	-15.36

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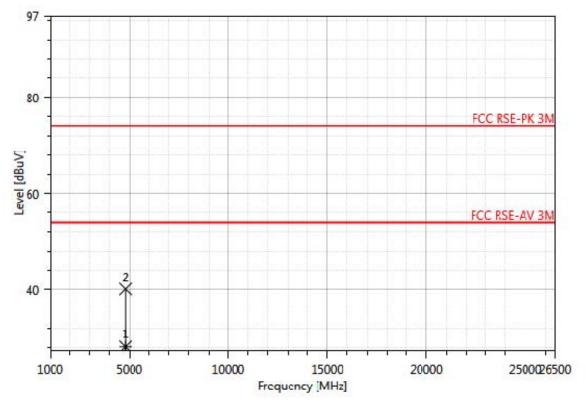
# **Radiated Spurious Emission Measurement Result:**

For Frequency above 1 GHz

Operation Mode: Test Date: 06/14/2016 22:27:04 EDR(3M) Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg C / 61 RH

Operation Band: Tx CH LOW Test Engineer:

EUT Pol.: H 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	
	4804.00	Н	Average	28.14	23.22	4.92	54.00	-25.86	
	4804.00	Н	Peak	40.12	35.19	4.92	74.00	-33.88	

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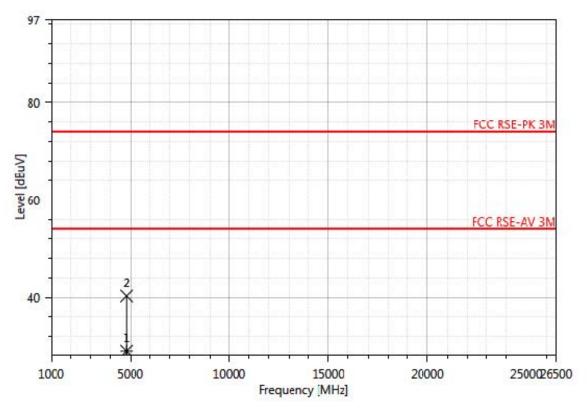




Operation Mode: EDR(3M) Test Date: 06/14/2016 22:27:11 Fundamental Frequency: 2402 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH LOW Test Engineer:

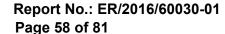
EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



	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	_
_	4804.00	Н	Average	29.01	24.09	4.92	54.00	-24.99	_
	4804.00	Н	Peak	40.32	35.40	4.92	74.00	-33.68	

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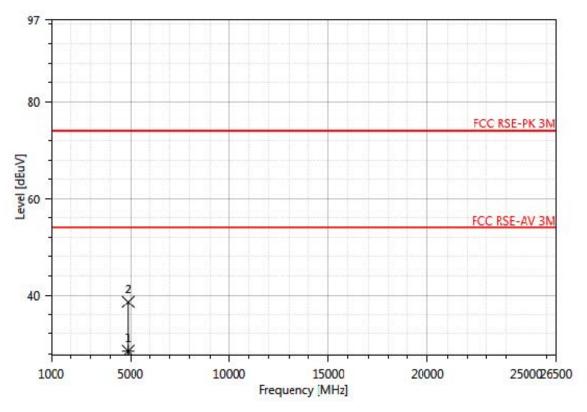




Operation Mode: EDR(3M) Test Date: 06/14/2016 22:35:34 Fundamental Frequency: 2441 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH MID Test Engineer:

EUT Pol.: H 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	
4882.00	Н	Average	28.50	23.32	5.18	54.00	-25.50	_
4882.00	Н	Peak	38.64	33.46	5.18	74.00	-35.36	

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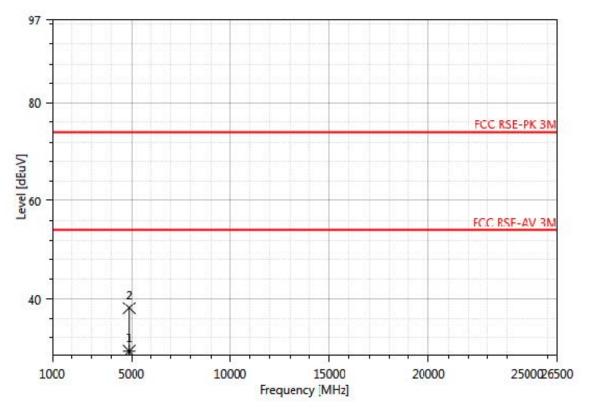


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Operation Mode: EDR(3M) Test Date: 06/14/2016 22:35:39 Fundamental Frequency: 2441 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH MID Test Engineer:

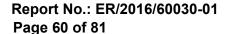
EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



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	_
4882.00	Н	Average	29.36	24.18	5.18	54.00	-24.64	_
4882.00	Н	Peak	38.10	32.92	5.18	74.00	-35.90	

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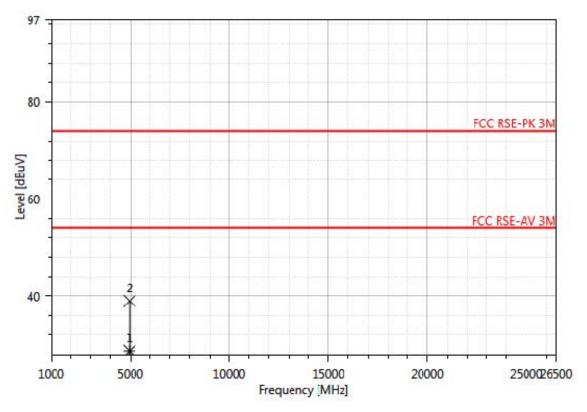




Operation Mode: EDR(3M) Test Date: 06/14/2016 22:37:17 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH HIGH Test Engineer:

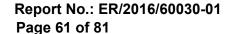
EUT Pol.: H Plane Measurement Antenna Pol.: VERTICAL



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	_
4960.00	Н	Average	28.70	23.41	5.29	54.00	-25.30	_
4960.00	Н	Peak	39.01	33.72	5.29	74.00	-34.99	

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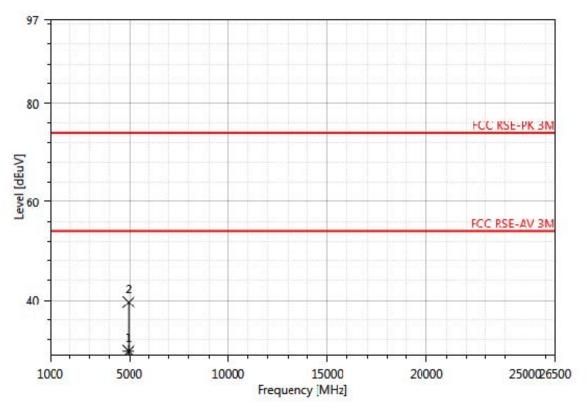




Operation Mode: EDR(3M) Test Date: 06/14/2016 22:37:22 Fundamental Frequency: 2480 MHz Temp. / Humi.: 22 deg\_C / 61 RH

Operation Band: Tx CH HIGH Test Engineer:

EUT Pol.: H Plane Measurement Antenna Pol.: HORIZONTAL



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	
4960.00	Н	Average	29.73	24.44	5.29	54.00	-24.27	
4960.00	Н	Peak	39.63	34.34	5.29	74.00	-34.37	

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### 11 FREQUENCY SEPARATION

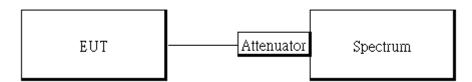
## 11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

## 11.2 Measurement Equipment Used

	Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
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				
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017				
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017				

## 11.3 Test Set-up



## 11.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 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 center frequency of spectrum analyzer = middle of hopping channel.
- 5. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
- 6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

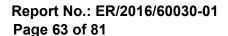
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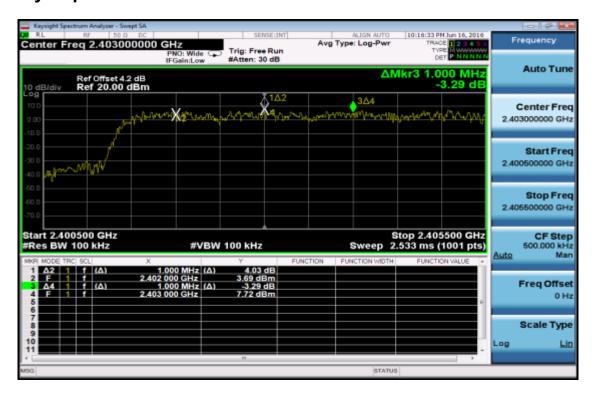




#### 11.5 Measurement Result

Channel separation (MHz)	Limit	Result
1	>=25 kHz or 2/3 times 20dB bandwidth	PASS

## **Frequency Separation Test Data**



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## 12 NUMBER OF HOPPING FREQUENCY

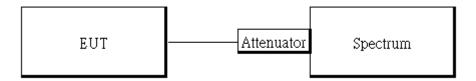
## 12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

## 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				
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017				
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017				

### 12.3 Test Set-up



#### 12.4 Measurement Procedure

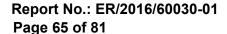
- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- 5. Set the spectrum analyzer as RBW=430 kHz, VBW=1.5MHz., Detector = Peak
- 6. Max hold, view and count how many channel in the band.

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12.5 Measurement Result

### **Tabular Data of Total Channel Number**

	Channel Number	Limit
2.4 GHz – 2.441GHz	40	
2.441 GHz – 2.4835GHz	39	>15
2.4GHz ~2.4835GHz	(40+39) = 79	

### **Channel Number**

#### 2.4GHz - 2.441GHz



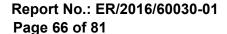
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### 2.441GHz - 2.4835GHz



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## TIME OF OCCUPANCY (DWELL TIME)

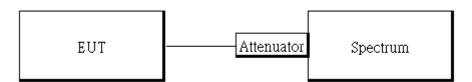
## 13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

## 13.2 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				
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017				
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017				

## 13.3 Test Set-up



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#### 13.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 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 center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep =  $2\sim8$ ms.
- 6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2 DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4 DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 \* 20 ) (S), Hop Over Occupancy Time comes to (800 / 6 / 20 )\*(0.4 \*20 ) =53.33

Note: the result of the complete test default channel at 1Mbps is recorded on the test report. 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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### 13.5 Tabular Result of the Measurement

## GESK (1Mhns)

GFSK (TMbps)				
Channel	PACKET TYPE	Measurement Result	Limit	
	.,,,,,,,,,	(ms)	(ms)	
	DH1	121.60	400ms	
0	DH3	260.64	400ms	
	DH5	307.95	400ms	
	DH1	123.20	400ms	
39	DH3	262.72	400ms	
	DH5	307.95	400ms	
	DH1	120.64	400ms	
78	DH3	260.64	400ms	
	DH5	307.95	400ms	

π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	DH1	123.20	400ms
39	DH3	262.72	400ms
	DH5	307.95	400ms

8-DPSK (3Mbps)

o bi oit (ombps)			
Channel	PACKET TYPE	Measurement Result	Limit
Gilaililei	PACKLITIFL	(ms)	(ms)
	DH1	122.88	400ms
39	DH3	262.72	400ms
	DH5	309.87	400ms

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A period time = 0.4 (s) \* 79 = 31.6 (s)

## GFSK (1Mbps):

01 011 (11110	(F - )-					
CH Low	DH1 time slot =	0.380 *	(1600/2/79) *	31.6 =	121.60 (ms	;)
	DH3 time slot =	1.629 *	(1600/4/79) *	31.6 =	260.64 (ms	;)
	DH5 time slot =	2.887 *	(1600/6/79) *	31.6 =	307.95 (ms	;)
CH Mid	DH1 time slot =	0.385 *	(1600/2/79) *	31.6 =	123.20 (ms	•
	DH3 time slot =	1.642 *	(1600/4/79) *	31.6 =	262.72 (ms	;)
	DH5 time slot =	2.887 *	(1600/6/79) *	31.6 =	307.95 (ms	;)
CH High	DH1 time slot = DH3 time slot = DH5 time slot =	0.377 * 1.629 * 2.887 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 =	120.64 (ms 260.64 (ms 307.95 (ms	s)
π/4 -DQPSI	K (2Mbps):					
CH Mid	2DH1 time slot=	0.385 *	(1600/2/79) *	31.6 =	123.20 (ms	;)
	2DH3 time slot=	1.642 *	` '	31.6 =	262.72 (ms	,
	2DH5 time slot=	2.887 *	(1600/6/79) *	31.6 =	307.95 (ms	;)
8-DPSK (3N	/lbps):					
CH Mid	3DH1 time slot= 3DH3 time slot= 3DH5 time slot=	0.384 * 1.642 * 2.905 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 = 31.6 = 31.6 =	122.88 (ms 262.72 (ms 309.87 (ms	s)

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GFSK (1Mbps) for AFH Mode				
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)	
20	DH5	153.97	400ms	
π/4 DQPSK (2Mbps) for Mode				
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)	
20	DH5	153.97	400ms	
8-DPSK (3Mbps) for AFH Mode				
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)	
20	DH5	154.93	400ms	

## GFSK (1Mbps):

DH5 time sl = 2.887 (ms) \* (800/6/20)\* 8 = 153.97 (ms)

π/4 -DQPSK (2Mbps

2DH5 time := 2.887 (800/6/20) \* 8 = 153.97(ms) \* (ms)

8-DPSK (3Mbps):

(ms) \* (800/6/20)\* 8 = 154.93 (ms) 3DH5 time := 2.905

### 13.6 Measurement Result

Note: Refer to next page for plots.

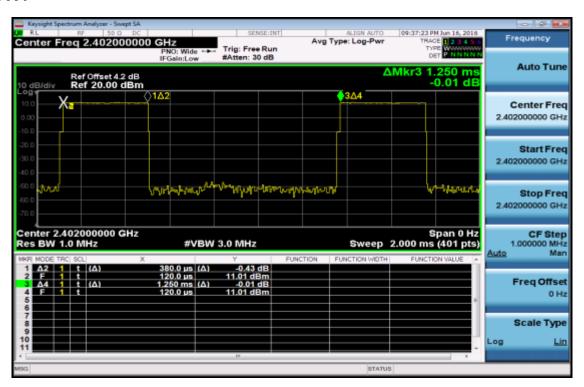
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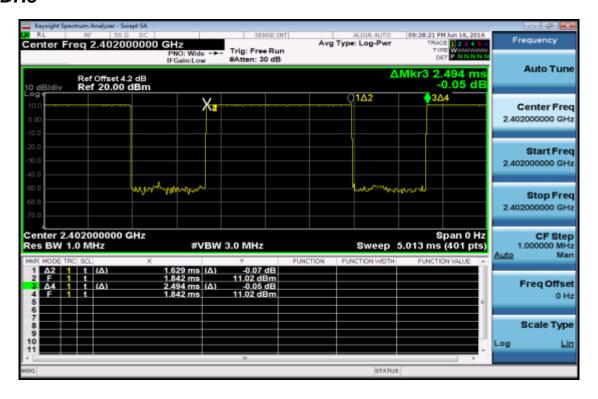
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## CH-Low DH1



## DH3

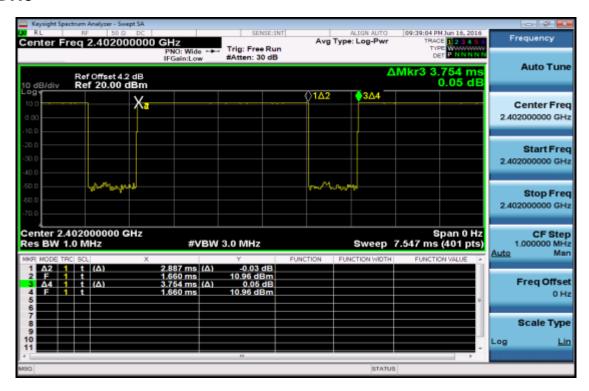


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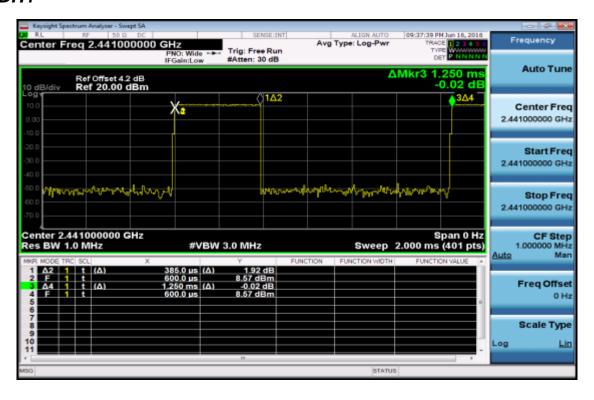
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## DH<sub>5</sub>



## **CH-Mid** DH1

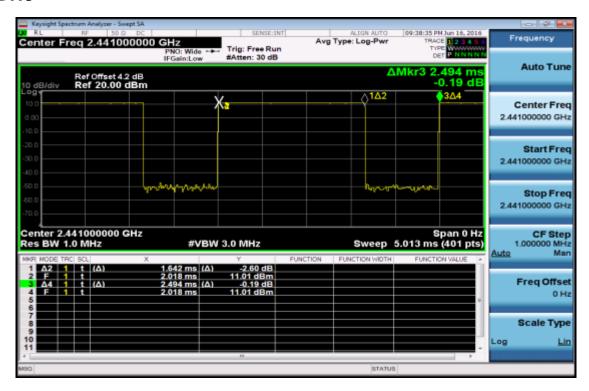


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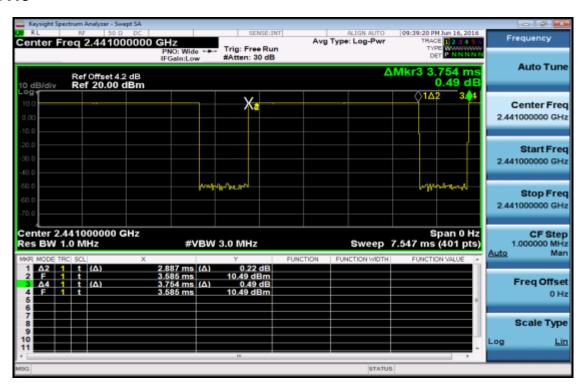
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### DH3



### DH<sub>5</sub>

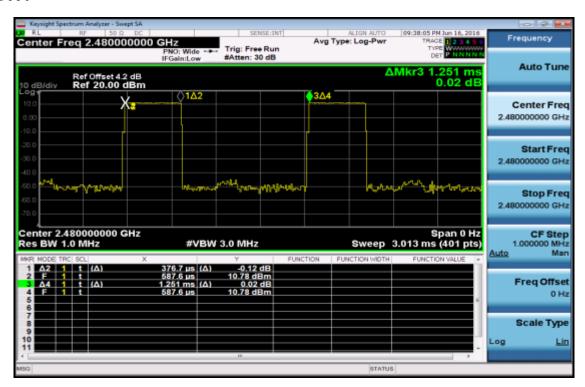


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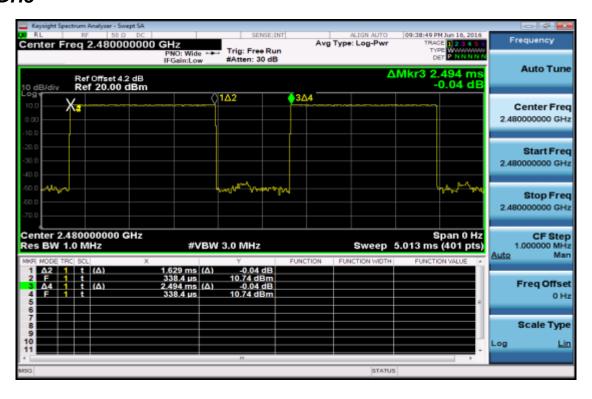
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## **CH-High** DH1



## DH3



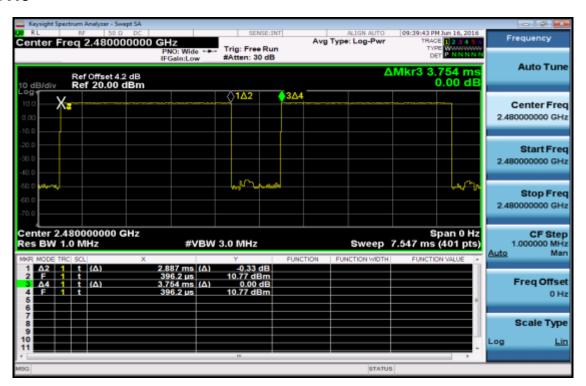
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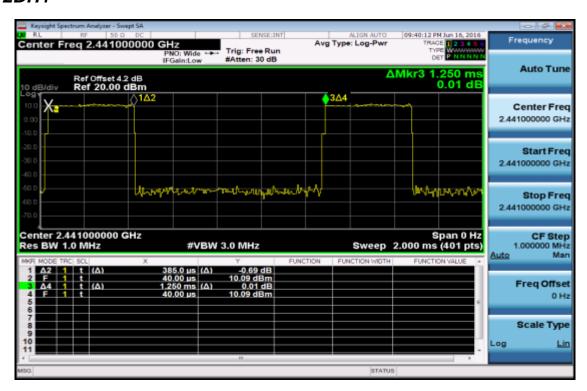
## DH<sub>5</sub>



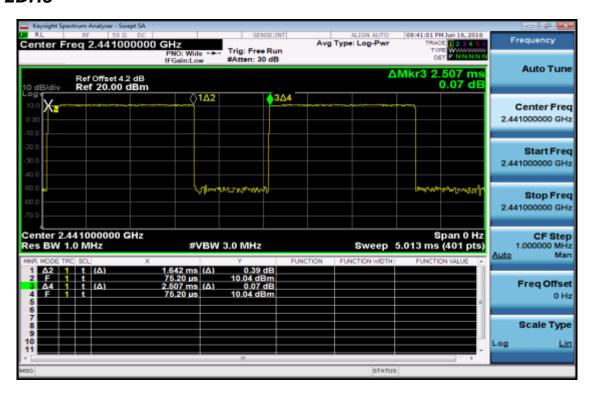
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## **CH-Mid 2DH1**



## **2DH3**



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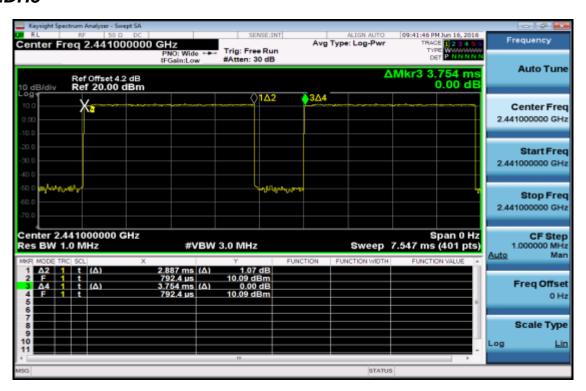
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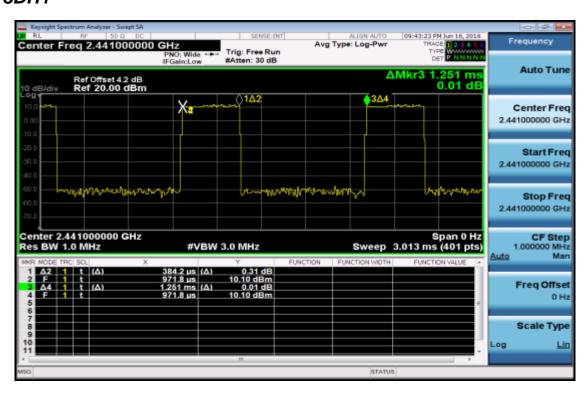
## **2DH5**



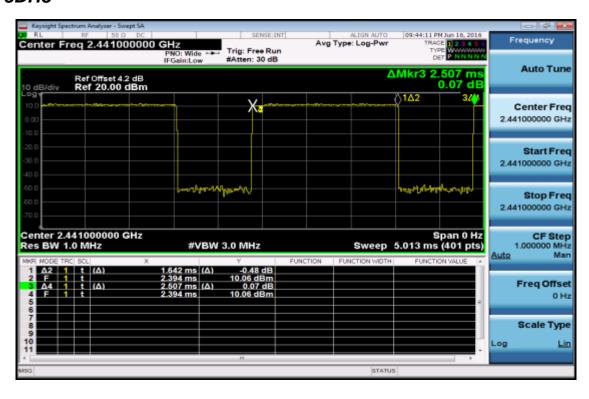
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## **CH-Mid 3DH1**



### **3DH3**



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### 14 ANTENNA REQUIREMENT

## 14.1 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.

### 14.2 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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