

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS 210

OF

Product Name:	Bluetooth Keypad
Brand Name:	ORtek
Model No.:	WKP-3290M; WKP-3290BT; IMAC-A201W
Model Difference:	WKP-3290M and IMAC-A201W for MAC op- erational system(IMAC-A201W for market segmentation);WKP-3290BT for windows op- erational system
FCC ID:	GM8WKP3290M
Report No.:	ER/2014/50028
Issue Date:	May 27, 2014
Prepared for:	ORtek Technology, Inc. 13F, Number 150, Jian-Yi Rd., Zhonghe Dist., New Taipei City, Taiwan, R.O.C.
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:	ORtek Technology, Inc.			
	13F, Number 150, Jian-Yi Rd., Zhonghe Dist., New Taipei City, Taiwan,			
	R.O.C.			
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FCC ID:	GM8WKP3290M			
File Number:	ER/2014/50028			
Date of test:	May 09, 2014 ~ May 27, 2014			
Date of EUT Received:	May 09, 2014			
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 C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247. The test results of this report relate only to the tested sample identified in this report.

Test By:	Louis	Chen	Date:	May 27, 2014	
Prepared By:	Louis Chen Judy	Fengineer Hfn	Date:	May 27, 2014	
Approved By:	Judy Hsu Time	/Clerk Ch ang	Date:	May 27, 2014	

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	May 27, 2014	Initial creation of document

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Table of Contents

1.	GEN	ERAL INFORMATION	7
	1.3.	Test Methodology	
	1.4.	Test Facility	
	1.5.	Special Accessories	
	1.6.	Equipment Modifications	
2.	SYST	FEM TEST CONFIGURATION	9
	2.1.	EUT Configuration	9
	2.2.	EUT Exercise	9
	2.3.	Test Procedure	9
	2.4.	Configuration of Tested System	
3.	SUM	IMARY OF TEST RESULTS	
4.	DES	CRIPTION OF TEST MODES	
5.	MEA	ASUREMENT UNCERTAINTY	
6.	CON	DUCTED EMISSION TEST	14
	6.1.	Standard Applicable	14
	6.2.	Measurement Equipment Used:	14
	6.3.	EUT Setup	
	6.4.	Test SET-UP (Block Diagram of Configuration)	
	6.5.	Measurement Procedure	
	6.6.	Measurement Result	
7.	PEA	K OUTPUT POWER MEASUREMENT	
	7.1.	Standard Applicable	16
	7.2.	Measurement Equipment Used	16
	7.3.	Test Set-up:	
	7.4.	Measurement Procedure:	
	7.5.	Measurement Result	
8.	20dB	BANDWIDTH	
	8.1.	Standard Applicable	
	8.2.	Measurement Equipment Used	
	8.3.	Test Set-up	
	8.4.	Measurement Procedure:	
	8.5.	Measurement Result:	21

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9.	BANI	DEDGES EMISSION MEASUREMENT	24
	9.1.	Standard Applicable	24
	9.2.	Measurement Equipment Used	24
	9.3.	Test SET-UP:	25
	9.4.	Measurement Procedure	25
	9.5.	Field Strength Calculation	26
	9.6.	Measurement Result -1 Out-Of-Band EMISSION:	26
10.	SPUR	IOUS RADIATED EMISSION TEST	32
	10.1.	Standard Applicable	32
	10.2.	Measurement Equipment Used:	33
	10.3.	Test SET-UP:	34
	10.4.	Measurement Procedure:	35
	10.5.	Field Strength Calculation	36
	10.6.	Measurement Result:	36
11.	FREQ	UENCY SEPARATION	47
	11.1.	Standard Applicable	47
	11.2.	Measurement Equipment Used:	47
	11.3.	Test Set-up:	47
	11.4.	Measurement Procedure:	48
	11.5.	Measurement Result:	48
12.	NUM	BER OF HOPPING FREQUENCY	50
	12.1.	Standard Applicable	50
	12.2.	Measurement Equipment Used:	50
	12.3.	Test Set-up:	51
	12.4.	Measurement Procedure:	51
	12.5.	Measurement Result:	51
13.	TIME	C OF OCCUPANCY (DWELL TIME)	53
	13.1.	Standard Applicable	53
	13.2.	Measurement Equipment Used:	53
	13.3.	Test Set-up:	53
	13.4.	Measurement Procedure:	54
	13.5.	Tabular Result of the Measurement:	55
	13.6.	Measurement Result:	56

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Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 6 of 62

14.	ANTE	INNA REQUIREMENT	62
	14.1.	Standard Applicable	62
	14.2.	Antenna Connected Construction	62

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GENERAL INFORMATION 1.

1.1. Product description

General:

Product Name:	Bluetooth Keypad
Brand Name:	ORtek
Model No.:	WKP-3290M; WKP-3290BT; IMAC-A201W
Model difference:	WKP-3290M and IMAC-A201W for MAC operational sys- tem(IMAC-A201W for market segmentation);WKP-3290BT for win- dows operational system
Hardware Version:	1.0
Software Version:	1.0
Power Supply:	1.5Vdc Alkaline Battery *1

Bluetooth:

Bluetooth Version:	V3.0
Channel number:	79 channels
Modulation type:	GFSK
Transmit Power:	0.273dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	Internal Antenna; Gain:4.55dBi

The report applied for Bluetooth.

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1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: <u>GM8WKP3290M</u> filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with FCC part 15; Subpart B is authorized under Doc procedure.

1.3. Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2009. Radiated testing was performed at an antenna to EUT distance 3 meters. Tested in accordance with FCC Public Notice DA 00-705 – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. FCC Registration Number is: 990257. Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. FCC Registration Number: 455997. The address of SGS Taiwan Ltd. Electronics & Communication Laboratory 1F, No.134, Wukung Road New Taipei City TAIWAN 24803, IC Registration Number: 4620A-6.

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.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

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

2.2. EUT Exercise

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

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. 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 according to the requirements in Section 8 and 13 and of ANSI C63.4:2009 and DA 00-705.

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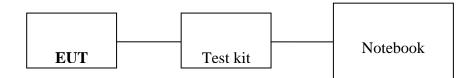
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2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission and AC Power Line Conducted Emission



Remote Side



Table 2-1 Equipment Used in Tested System

Ite m	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Set	Anritsu	MT8852B	6k00006107	N/A	N/A
2.	Notebook	DELL	D505	34056609472	shielding	Un-shielding
3.	Test kit	N/A	N/A	N/A	N/A	N/A

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(d)	100 kHz Bandwidth Of Frequency Band Edges	Compliant
\$15.247(d) \$15.209(a) (f)	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	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

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.

Channel Low, Mid and High with highest rated data rate were chosen as worst case for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case E2 position was reported.

Channel Low: channel 1 at 2402MHz Channel Mid: channel 39 at 2441MHz Channel High: channel 78 at 2480MHz

Emission carried out by BR is chosen as the most representative measurement to perform measurement of radiated spurious emission pursuant to Part 15C.Modulation, BR, is selected to be performed for 100 kHz Bandwidth Band Edge, Conducted Spurious Emission, Frequency Separation, Number of hopping frequency due to its characteristics of wider bandwidth.

Data type being used to conduct the measurement: DH1/DH3/DH5 (GFSK) with 1Mbps

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5. **MEASUREMENT UNCERTAINTY**

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55 dB
20dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

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

This uncertainty represents an expanded uncertainty expressed at approximately the

95% confidence level using a coverage factor of k=2.

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207, frequency within 150 kHz 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 TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
EMI Test Receiver	R&S	ESCI7	100760	05/27/2013	05/26/2014		
LISN	Rolf-Heine	NNB-2/16Z	99012	03/26/2014	03/25/2015		
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/19/2014	03/18/2015		
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2013	11/25/2014		

6.3. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2009.

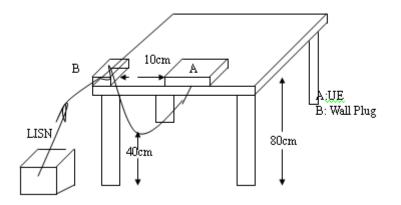
3. The LISN was connected with 120Vac/60Hz power source.

^{2.} The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.

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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 frequency measured were complete.

6.6. Measurement Result

N/A, the device is powered by battery.

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7. PEAK OUTPUT POWER MEASUREMENT

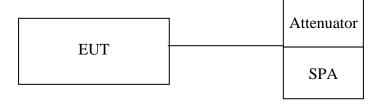
7.1. Standard Applicable

According to §15.247(b)(1), 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.

7.2. Measurement Equipment Used

Conducted Emission Test Site							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015		
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015		
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014		
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015		
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015		
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015		
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015		
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015		

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. 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)
- 3. Record the max. reading.
- 4. Repeat above procedures until all default test channel is completed.

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

7.5. Measurement Result

BR mode:			
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	0.273	0.00106	1
2441.00	-0.394	0.00091	1
2480.00	-0.679	0.00086	1

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Peak Power Output Data Plot (CH Low) (BR mode)



Peak Power Output Data Plot (CH Mid) (BR mode)



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Peak Power Output Data Plot (CH High) (BR mode)



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8. 20dB BANDWIDTH

8.1. Standard Applicable

For 20dB Bandwidth

According to §15.247(a)(1) for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2. Measurement Equipment Used

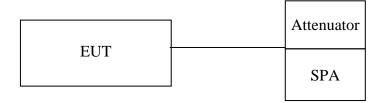
Conducted Emission Test Site						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.	
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015	
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015	
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014	
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015	
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015	
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015	
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015	
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015	

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8.3. Test Set-up



8.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 4. Mark the peak frequency and -20dB (upper and lower) frequency a
- 5. Repeat above procedures until all test default channel is completed

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

8.5. Measurement Result:

20dB Bandwidth:

1M BR mode:

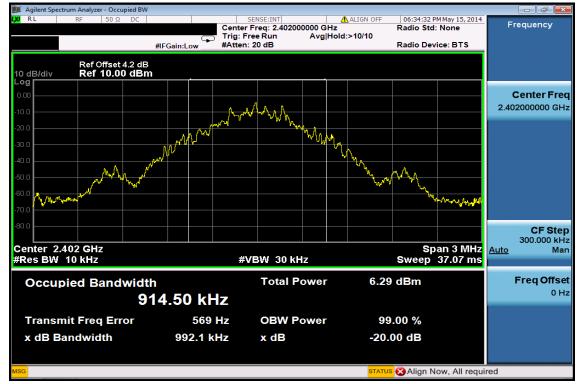
СН	Bandwidth
	(MHz)
Low	0.992
Mid	0.913
High	0.873

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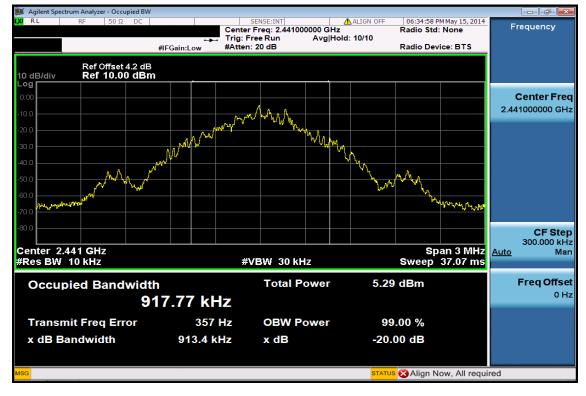
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20dB Band Width Test Data CH-Low (BR mode)



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

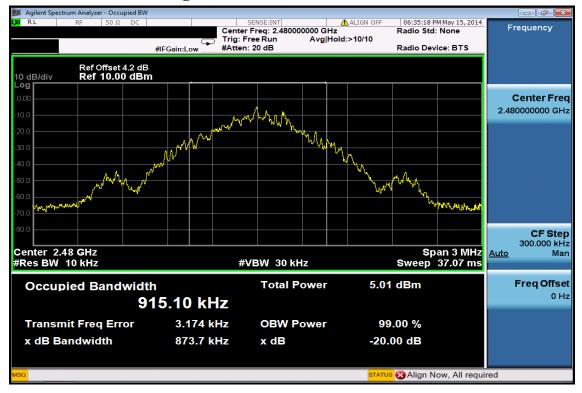


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20dB Width Test Data CH-High (BR mode)



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9. BAND EDGES EMISSION MEASUREMENT

9.1. Standard Applicable

According to \$15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, 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 in15.209(a).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

Conducted Emission Test Site							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015		
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015		
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014		
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015		
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015		
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015		
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015		
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015		

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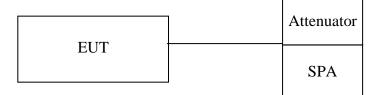
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9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:



9.4. Measurement Procedure

100 kHz BANDWIDTH OF BAND EDGES:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=300 kHz, Sweep = auto
- 5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
- 6. Repeat above procedures until all frequency measured were complete.

Out-Of-Band EMISSION

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. Set RBW = 100K & VBW = 300K on Spectrum.
- 3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30MHz to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz
- 4. Via Software, combine 5 spans of frequency range into two plots containing the range of 30MHz to 3GHz, and 3GHz to 26.5GHz.

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9.5. Field Strength Calculation

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

FS = RA + AF + CL - AG

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

9.6. Measurement Result -1 Out-Of-Band EMISSION:

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

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

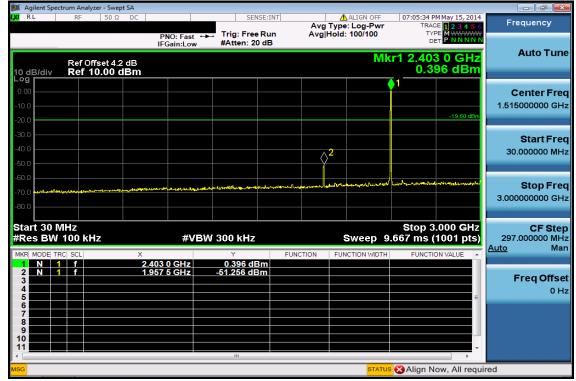
NOTE: the occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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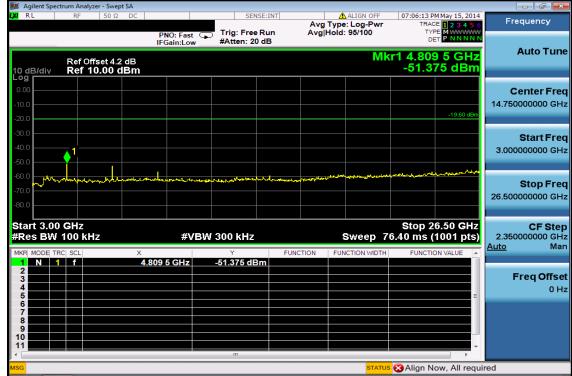
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9.7 Measurement Result -1 Conducted Spurious Emission Measurement Result (BR mode) Ch Low 30MHz – 3GHz



Ch Low 3GHz - 26.5GHz



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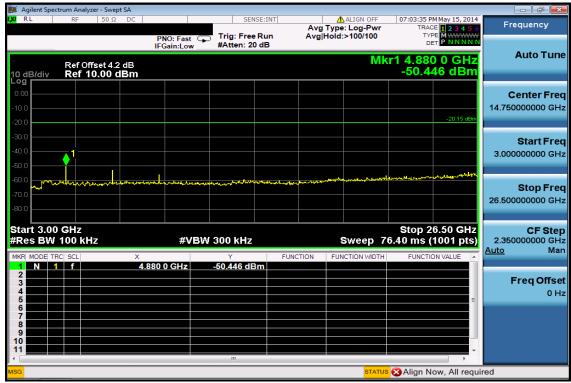
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Ch Mid 30MHz – 3GHz

鱦 Agilent Spectrum Analyzer - Swept SA					
LX/ RL RF 50Ω DC	Т		ALIGN OFF Avg Type: Log-Pwr Avg Hold: 100/100	07:01:56 PM May 15, 2014 TRACE 1 2 3 4 5 6 TYPE M MAAAAAAAA	Frequency
Ref Offset 4.2 dB 10 dB/div Ref 10.00 dBm		ttten: 20 dB		TYPE DET PNNNNN r1 2.441 6 GHz -0.154 dBm	Auto Tune
				↓1 	Center Freq 1.515000000 GHz
-30.0				 ⊘ ²	Start Freq 30.000000 MHz
-60.0 -70.0 	na Walan, agawa ay sa ja ba ay ka a Parapara	an a	and a state of the second s	Henrodyn med statemer.	Stop Freq 3.000000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBW 30		-	Stop 3.000 GHz 667 ms (1001 pts)	CF Step 297.000000 MHz Auto Man
1 N 1 f 2.4	141 6 GHz -0 180 3 GHz -60	154 dBm 801 dBm		======================================	Freq Offset 0 Hz
7 8 9 10 11		m			
MSG			STATUS	🔇 Align Now, All requi	red

Ch Mid 3GHz – 26.5GHz



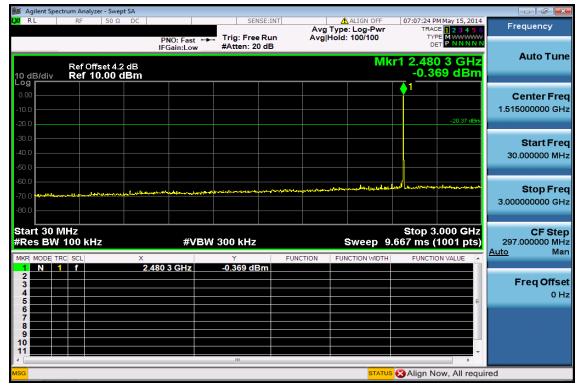
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Ch High 30MHz - 3GHz



Ch High 3GHz - 26.5GHz

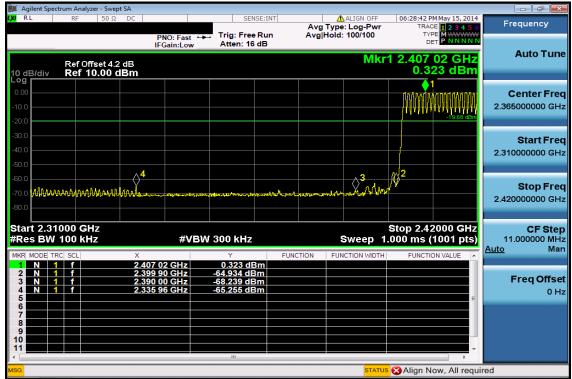
Agilent Spectrum Analyzer - Swept SA						
LX/ RL RF 50 Ω DC			ALIGN OFF pe: Log-Pwr ld: 65/100	07:08:20 PM May 15, 2 TRACE 1 2 3 4 TYPE MWWW	56	Frequency
Ref Offset 4.2 dB 10 dB/div Ref 10.00 dBm	PNO: Fast + Trig: Free IFGain:Low #Atten: 2			DET <mark>₽ NNN</mark> 1 4.950 5 GI -49.741 dB		Auto Tune
-10.0				-20.37		Center Freq 14.750000000 GHz
-30.0						Start Freq 3.000000000 GHz
-60.0 -70.0 -80.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	۹۹۰٬۹۹۹ میلوروم میلوروم میلوروم میلوروم میلوروم و ۱۹۹۹ میلوروم و ۱۹۹۹ میلوروم و ۱۹۹۹ میلوروم و ۱۹۹۹ میلوروم و ۱	and a second	and the second		Stop Freq 26.50000000 GHz
Start 3.00 GHz #Res BW 100 kHz	#VBW 300 kHz	FUNCTION F	Sweep 76	Stop 26.50 G 5.40 ms (1001 p FUNCTION VALUE	ts)	CF Step 2.350000000 GHz Auto Man
1 N 1 f 4.5 2 - - - - 3 - - - - 4 - - - - - 5 - - - - - - 6 -	950 5 GHz -49.741 dE	3m			=	Freq Offset 0 Hz
7 8 9 10 11					•	
MSG			STATUS	SAlign Now, All r	equire	d

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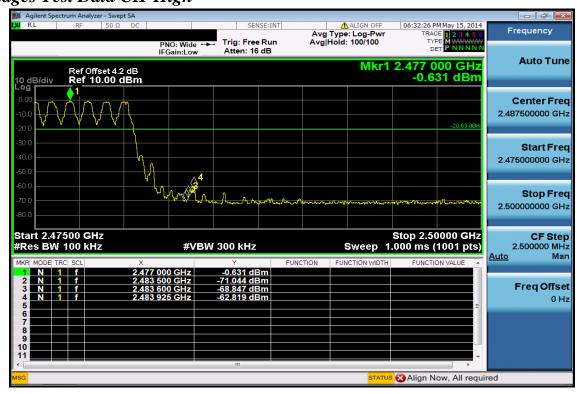
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9.7 Measurement Result -2 100 kHz BANDWIDTH OF BAND EDGE: Band Edges Test Data CH-Low (Hopping mode) (BR mode)



Band Edges Test Data CH-High

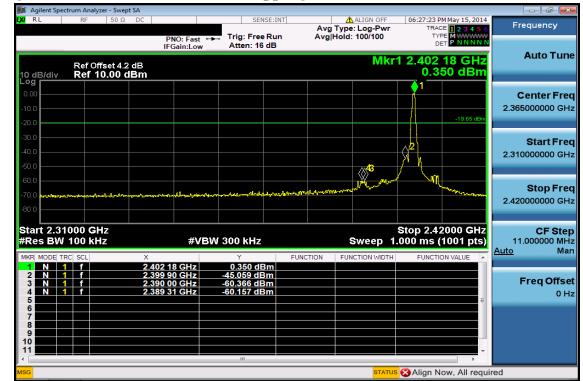


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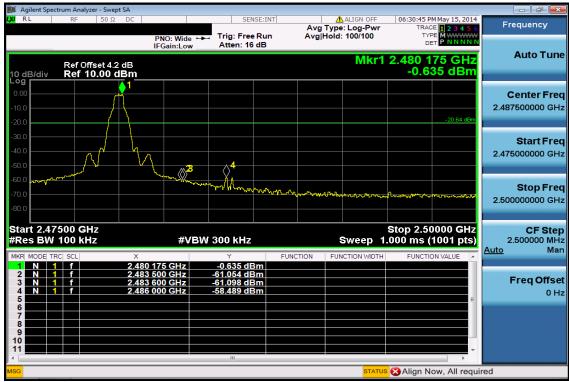
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Band Edges Test Data CH-Low (Non-Hopping mode) (BR mode)

Band Edges Test Data CH-High



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10. SPURIOUS RADIATED EMISSION TEST

10.1. Standard Applicable

According to §15.247(d),

Emission at antenna port:

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. 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) (see § 15.205(c)).

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.

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10.2. Measurement Equipment Used:

10.2.1. Radiated emission:

966 Chamber						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
ТҮРЕ		NUMBER	NUMBER	CAL.		
EMI Test Receiver	R&S	ESCI7	100760	05/27/2013	05/26/2014	
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014	
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	01/20/2014	01/19/2015	
Spectrum Analyzer	R&S	FSV-30	101398	10/22/2013	10/21/2014	
Loop Antenna	ETS.LINDGREN	6502	00148045	07/05/2013	07/04/2014	
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/02/2014	01/01/2015	
Horn antenna	ETS.LINDGREN	3117	123995	05/31/2013	05/30/2014	
Horn Antenna	Schwarzbeck	BBHA9170	184	01/23/2014	01/22/2015	
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2014	01/02/2015	
Pre-Amplifier	Agilent	8449B	3008A00578	01/03/2014	01/02/2015	
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/24/2014	01/23/2015	
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/27/2014	02/26/2015	
Attenuator	Mini-Circuit	BW-S10W2+	004	02/27/2014	02/26/2015	
Turn Table	HD	DT420	N/A	N.C.R	N.C.R	
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R	
Controller	HD	HD100	N/A	N.C.R	N.C.R	
Low Loss Cable	Huber Suhner	966_Rx	9	01/03/2014	01/02/2015	
3m Site NSA	SGS	966 chamber	N/A	07/15/2013	07/14/2014	

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

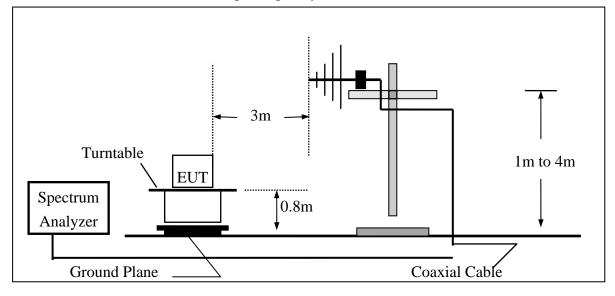
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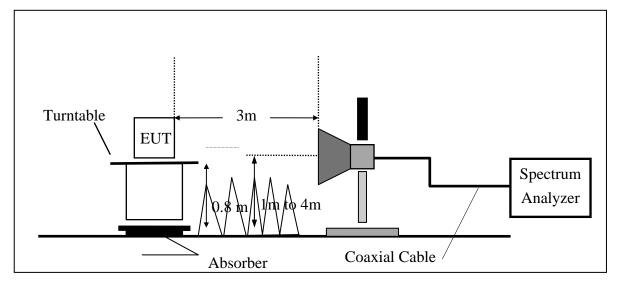
10.3. Test SET-UP:

10.3.1. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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



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10.4. Measurement Procedure:

Radiated Emission:

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 4. 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.
- 5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7. Repeat above procedures until all frequency of the interest measured were complete.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured 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

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

Remark:

- 1. The limit of the emission level is expressed in dBuV/m, which converts $20*\log(uV/m)$
- 2. Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) Pre Amplifier Gain(dB)

10.6. Measurement Result:

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

Note: For the tabular table as presents below, "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. "E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---": denotes Noise Floor

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Report No.: ER/2014/50028 **Issue Date: May 27, 2014** Page: 37 of 62

10.6.1 Radiated Emission - Band Edge: (Hopping Mode) (BR mode)

Operation Band	:BR+Hopping	Test Date	:2014-05-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	el	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	32.09	2.42	34.51	54.00	-19.49
2390.00	Е	Peak	45.94	2.42	48.36	74.00	-25.64
One of the Deep	1					2014 05 14	
Operation Ban		:BR+Hoppin	•	Test Date		:2014-05-14	
Fundamental F	Frequency	:2402 MHz		Temp./Humi.		:23 deg_C / 6	1 RH
Operation Mod	le	:Band Edge I	LOW	Engineer		:Tin	
EUT Pol.		:E2 Plan		Measurement A	ntenna Pol.	:HORIZON	ΓAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	31.34	2.42	33.76	54.00	-20.24
2390.00	E	Peak	45.60	2.42	48.02	74.00	-25.98



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 38 of 62

Operation Bar Fundamental D Operation Mo	Frequency	:BR+Hopping :2480 MHz :Band Edge H		Test Date Temp./Humi. Engineer		:2014-05-14 :23 deg_C / 6 :Tin	1 RH
EUT Pol.		:E2 Plane		Measurement An	tenna Pol.	:VERTICAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	rel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	29.81	2.74	32.55	54.00	-21.45
2483.50	Е	Peak	41.60	2.74	44.34	74.00	-29.66
Operation Bar Fundamental I Operation Mo EUT Pol.	Frequency	:BR+Hopping :2480 MHz :Band Edge F :E2 Plane	HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2014-05-14 :23 deg_C / 6 :Tin :HORIZONTA	
Freq.	Note	Detector Mode	Spectrum Reading Lev	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	29.84	2.74	32.58	54.00	-21.42
2483.50	Е	Peak	40.67	2.74	43.41	74.00	-30.59



2390.00

2390.00

E

E

Average

Peak

FCC ID: GM8WKP3290M

10.6.2 Radiated Emission - Band Edge: (Non-Hopping Mode) (BR mode) **Operation Band** :BR Test Date :2014-05-14 **Fundamental Frequency** :2402 MHz Temp./Humi. :23 deg_C / 61 RH **Operation Mode** :Band Edge LOW Engineer :Tin EUT Pol. :E2 Plane :VERTICAL Measurement Antenna Pol. Spectrum Freq. Note Detector Factor Actual Limit Margin FS **Reading Level** @3m Mode F/H/E/S PK/QP/AV dBµV dB dBµV/m $dB\mu V/m$ dB MHz 2390.00 33.13 2.42 35.55 54.00 -18.45 Е Average 2390.00 E Peak 46.23 2.42 48.65 74.00 -25.35 **Operation Band** :BR Test Date :2014-05-14 Fundamental Frequency :2402 MHz Temp./Humi. :23 deg_C / 61 RH **Operation Mode** :Band Edge LOW Engineer :Tin EUT Pol. :E2 Plane :HORIZONTAL Measurement Antenna Pol. Note Detector Spectrum Factor Actual Limit Margin Freq. **Reading Level** FS @3m Mode dBµV/m dBuV dBµV/m MHz F/H/E/S PK/QP/AV dB dB

31.39

44.73

2.42

2.42

33.81

47.15

54.00

74.00

-20.19

-26.85

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Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 40 of 62

Operation Bar Fundamental I Operation Mo EUT Pol.	Frequency	:BR :2480 MHz :Band Edge I :E2 Plane	HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2014-05-14 :23 deg_C / 6 :Tin :VERTICAL	1 RH
Freq.	Note	Detector Mode	Spectrum Reading Lev		Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	30.24	2.74	32.98	54.00	-21.02
2483.50	Е	Peak	49.00	2.74	51.74	74.00	-22.26
Operation Bar Fundamental I Operation Mo EUT Pol.	Frequency	:BR :2480 MHz :Band Edge I :E2 Plane	HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2014-05-14 :23 deg_C / 6 :Tin :HORIZONTA	
Freq.	Note	Detector Mode	Spectrum Reading Lev		Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	30.00	2.74	32.74	54.00	-21.26
2483.50	Е	Peak	47.41	2.74	50.15	74.00	-23.85



Report No.: ER/2014/50028 **Issue Date: May 27, 2014** Page: 41 of 62

10.6.3 Radiated Spurious Emission Measurement Result (BR mode)

Operation Band	:BR	Test Date	:2014-05-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

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.

"---": denotes Noise Floor.

24020.00

Η

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	41.25	-13.77	27.48	40.00	-12.52
160.95	S	Peak	34.65	-12.66	21.99	43.50	-21.51
387.93	S	Peak	30.90	-9.43	21.47	46.00	-24.53
558.65	S	Peak	28.57	-6.78	21.79	46.00	-24.21
672.14	S	Peak	28.78	-3.95	24.83	46.00	-21.17
912.70	S	Peak	28.36	-0.44	27.92	46.00	-18.08
4804.00	Н	Average	27.95	6.79	34.74	54.00	-19.26
4804.00	Н	Peak	38.12	6.79	44.91	74.00	-29.09
7206.00	Н						
9608.00	Н						
12010.00	Н						
14412.00	Н						
16814.00	Н						
19216.00	Н						
21618.00	Н						



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 42 of 62

Operation Band Fundamental Frequency	:BR :2402 MHz	Test Date Temp./Humi.	:2014-05-14 :23 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

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

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. Note :

"E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	30.94	-13.77	17.17	40.00	-22.83
151.25	S	Peak	27.62	-12.77	14.85	43.50	-28.65
439.34	S	Peak	28.15	-8.83	19.32	46.00	-26.68
555.74	S	Peak	28.74	-6.98	21.76	46.00	-24.24
685.72	S	Peak	28.01	-3.69	24.32	46.00	-21.68
953.44	S	Peak	27.97	0.19	28.16	46.00	-17.84
4804.00	Н	Average	25.52	6.79	32.31	54.00	-21.69
4804.00	Н	Peak	38.15	6.79	44.94	74.00	-29.06
7206.00	Н						
9608.00	Н						
12010.00	Н						
14412.00	Н						
16814.00	Н						
19216.00	Н						
21618.00	Н						
24020.00	Н						



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 43 of 62

Operation Band	:BR	Test Date	:2014-05-14
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

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

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. Note :

"E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	41.28	-13.77	27.51	40.00	-12.49
165.80	S	Peak	34.27	-12.81	21.46	43.50	-22.04
386.96	S	Peak	30.65	-9.44	21.21	46.00	-24.79
558.65	S	Peak	28.79	-6.78	22.01	46.00	-23.99
689.60	S	Peak	28.63	-3.70	24.93	46.00	-21.07
960.23	S	Peak	28.21	0.21	28.42	54.00	-25.58
4882.00	Н	Average	27.35	6.96	34.31	54.00	-19.69
4882.00	Н	Peak	38.59	6.96	45.55	74.00	-28.45
7323.00	Н						
9764.00	Н						
12205.00	Н						
14646.00	Н						
17087.00	Н						
19528.00	Н						
21969.00	Н						
24410.00	Н						



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 44 of 62

Operation Band	:BR	Test Date	:2014-05-14
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

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

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. Note :

"E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	30.85	-13.77	17.08	40.00	-22.92
161.92	S	Peak	27.91	-12.69	15.22	43.50	-28.28
424.79	S	Peak	27.92	-8.96	18.96	46.00	-27.04
558.65	S	Peak	28.30	-6.78	21.52	46.00	-24.48
683.78	S	Peak	29.24	-3.67	25.57	46.00	-20.43
946.65	S	Peak	27.74	0.14	27.88	46.00	-18.12
4882.00	Н	Average	25.23	6.96	32.19	54.00	-21.81
4882.00	Н	Peak	36.98	6.96	43.94	74.00	-30.06
7323.00	Н						
9764.00	Н						
12205.00	Н						
14646.00	Н						
17087.00	Н						
19528.00	Н						
21969.00	Н						
24410.00	Н						



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 45 of 62

Operation Band	:BR	Test Date	:2014-05-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

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

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. Note :

"E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	41.27	-13.77	27.50	40.00	-12.50
159.98	S	Peak	34.35	-12.63	21.72	43.50	-21.78
389.87	S	Peak	31.19	-9.39	21.80	46.00	-24.20
555.74	S	Peak	28.56	-6.98	21.58	46.00	-24.42
680.87	S	Peak	28.89	-3.66	25.23	46.00	-20.77
930.16	S	Peak	28.84	-0.13	28.71	46.00	-17.29
4960.00	Н	Average	25.36	7.09	32.45	54.00	-21.55
4960.00	Н	Peak	38.00	7.09	45.09	74.00	-28.91
7440.00	Н						
9920.00	Н						
12400.00	Н						
14880.00	Н						
17360.00	Н						
19840.00	Н						
22320.00	Н						
24800.00	Н						



Report No.: ER/2014/50028 Issue Date: May 27, 2014 Page: 46 of 62

Operation Band	:BR	Test Date	:2014-05-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

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

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency. Note :

"E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
34.85	S	Peak	30.91	-13.77	17.14	40.00	-22.86
280.26	S	Peak	27.58	-11.52	16.06	46.00	-29.94
446.13	S	Peak	27.79	-8.57	19.22	46.00	-26.78
559.62	S	Peak	27.99	-6.72	21.27	46.00	-24.73
685.72	S	Peak	28.38	-3.69	24.69	46.00	-21.31
939.86	S	Peak	27.47	0.05	27.52	46.00	-18.48
4960.00	Н	Average	24.19	7.09	31.28	54.00	-22.72
4960.00	Н	Peak	36.68	7.09	43.77	74.00	-30.23
7440.00	Н						
9920.00	Н						
12400.00	Н						
14880.00	Н						
17360.00	Н						
19840.00	Н						
22320.00	Н						
24800.00	Н						



11. FREQUENCY SEPARATION

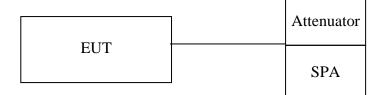
11.1. Standard Applicable

According to §15.247(a)(1), 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.	
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015	
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015	
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014	
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015	
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015	
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015	
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015	
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015	

11.3. Test Set-up:



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11.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = middle of hopping channel.
- 4. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
- 5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

11.5. Measurement Result:

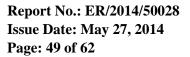
Channel separation (MHz)	Limit	Result
1	>=25 kHz or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

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Frequency Separation Test Data



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12. NUMBER OF HOPPING FREQUENCY

12.1. Standard Applicable

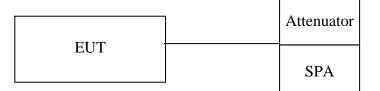
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2. Measurement Equipment Used:

Conducted Emission Test Site						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.	
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015	
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015	
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014	
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015	
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015	
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015	
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015	
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015	



12.3. Test Set-up:



12.4. Measurement Procedure:

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

12.5. Measurement Result:

Note: Refer to next page for plots.

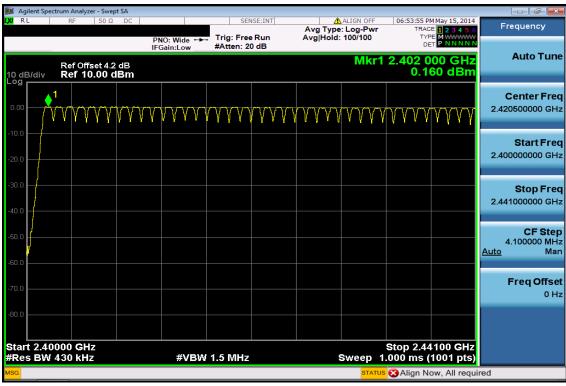
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Channel Number



2.4 GHz – 2.441GHz

2.441 GHz - 2.4835GHz



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13. TIME OF OCCUPANCY (DWELL TIME)

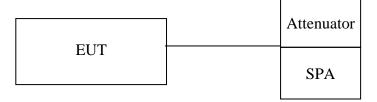
13.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. 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 TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.	
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015	
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015	
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014	
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015	
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015	
Low Loss Cable	HUBER+SUHN ER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015	
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015	
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015	

13.3. Test Set-up:





13.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~7ms.
- 5. 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

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:

1Mbps (GFSK):

Test Channel:	Mode:	Measurement Result	Limit (ms):
		(ms):	
Low:	DH1	134.40	400ms
	DH3	266.40	400ms
	DH5	310.19	400ms
Middle:	DH1	134.40	400ms
	DH3	266.40	400ms
	DH5	310.19	400ms
High:	DH1	134.40	400ms
	DH3	266.40	400ms
	DH5	310.19	400ms

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

1Mbps:

CH Low	DH1 time slot =	0.420 (ms) * (1600/2/79)	* 31.6 =	134.40 (ms)
	DH3 time slot =	1.665 (ms) * (1600/4/79)	* 31.6 =	266.40 (ms)
	DH5 time slot =	2.908 (ms) * (1600/6/79)	* 31.6 =	310.19 (ms)
CH Mid	DH1 time slot =	0.420 (ms) * (1600/2/79)	* 31.6 =	134.40 (ms)

DH3 time slot =
$$1.665 \text{ (ms)} * (1600/4/79) * 31.6 = 266.40 \text{ (ms)}$$

DH5 time slot =
$$2.908 \text{ (ms)} * (1600/6/79) * 31.6 = 310.19 \text{ (ms)}$$

CH High DH1 time slot =
$$0.420 \text{ (ms)} * (1600/2/79) * 31.6 = 134.40 \text{ (ms)}$$

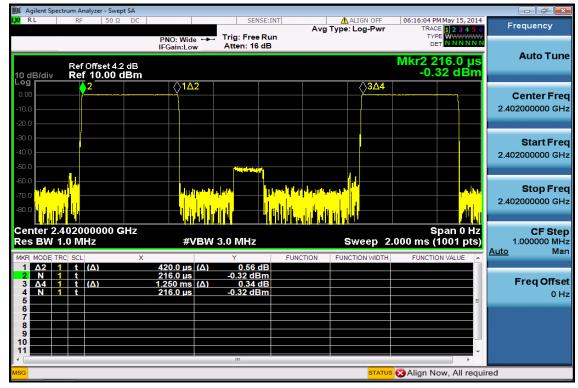
DH3 time slot = $1.665 \text{ (ms)} * (1600/4/79) * 31.6 = 266.40 \text{ (ms)}$
DH5 time slot = $2.908 \text{ (ms)} * (1600/6/79) * 31.6 = 310.19 \text{ (ms)}$

13.6. Measurement Result:

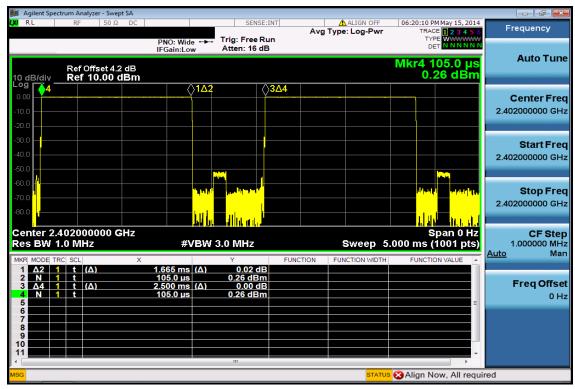
Note: Refer to next page for plots.



CH-Low DH1

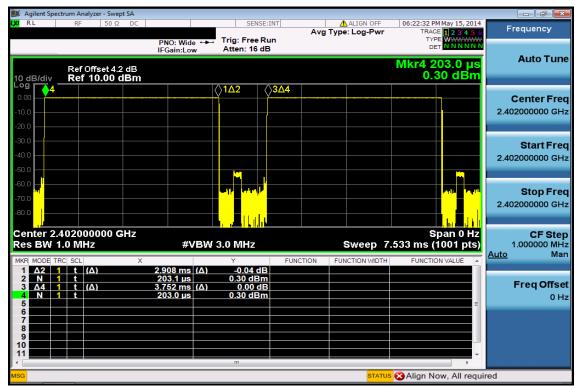


DH3



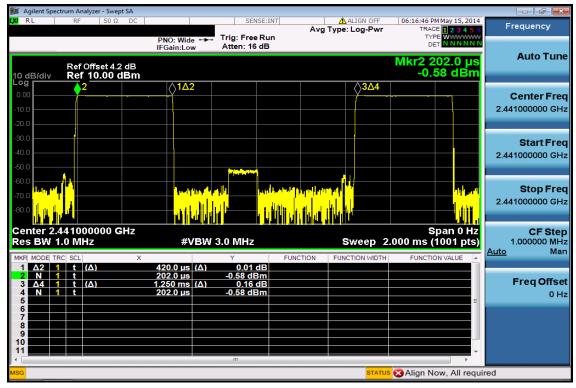


DH5



CH-Mid

DH1

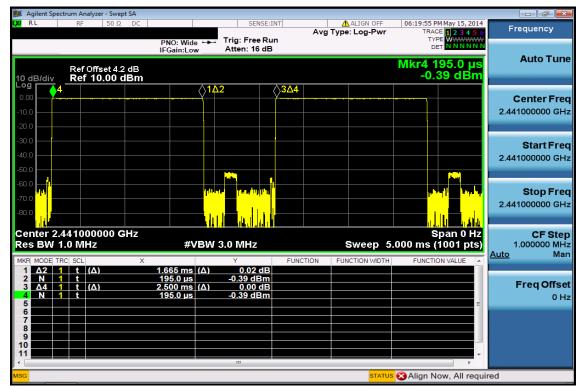


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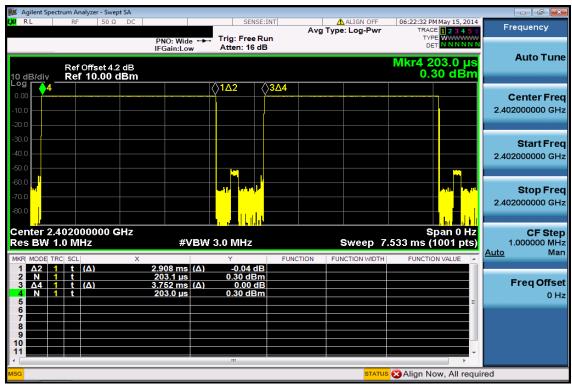
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DH3



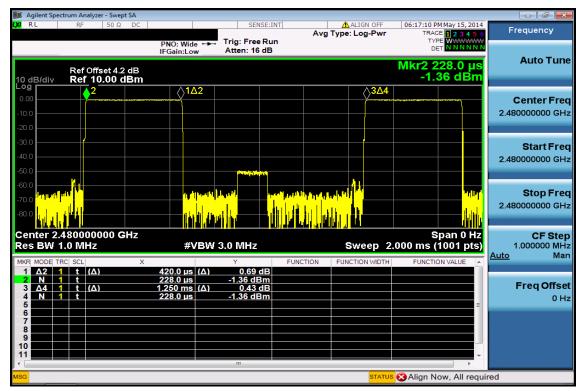
DH5



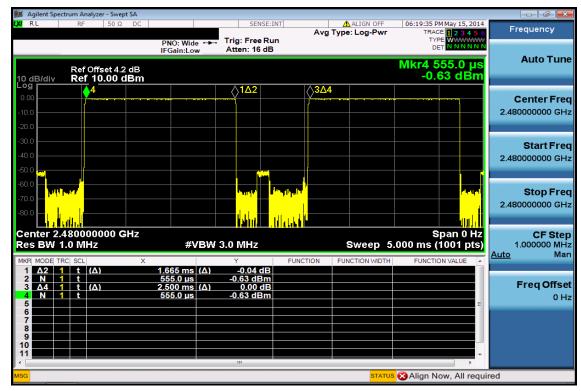
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CH-High DH1



DH3

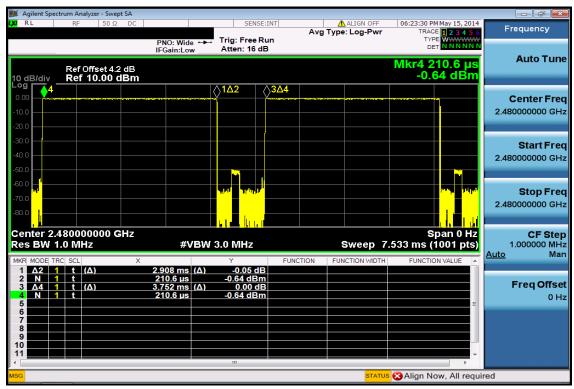


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DH5



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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.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 4.55dBi, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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