

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

0F

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

Product Name:	PeopleNet Connected Tablet	
Brand Name:	PeopleNet	
Model No.:	MS5	
Model Difference:	N/A	
FCC ID:	NKS-MS5	
Report No.:	E2/2015/10033	
Issue Date:	Mar. 11, 2015	
FCC Rule Part:	§15.247, Cat: DSS	
Prepared for:	PEOPLENET 4400 Baker Road, Minnetonka, MN 55343, USA	
Prepared by:	SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	
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VERIFICATION OF COMPLIANCE

Applicant:	PEOPLENET 4400 Baker Road, Minnetonka, MN 55343, USA
Product Name:	PeopleNet Connected Tablet
Brand Name:	PeopleNet
Model No.:	MS5
Model Difference:	N/A
FCC ID:	NKS-MS5
File Number:	E2/2015/10033
Date of test: Date of EUT Received:	Jan. 30, 2015 ~ Mar. 11, 2015 Jan. 30, 2015

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2014 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:	Marcus Tseng	Date:	Mar. 11, 2015	
- Prepared By:	Marcus Tseng / Engineer Allon Tsai	Date:	Mar. 11, 2015	_
Approved By:	Allen Tsai /Engineer Jim Chang Jim Chang / Supervisor	Date:	Mar. 11, 2015	_

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Version

Version No.	Date	Description
00	Mar. 11, 2015	Initial creation of document



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GENERAL INFORMATION 1.

1.1. Product description

General:

Product Name:	PeopleNet Connected Tablet			
Brand Name:	PeopleNet	PeopleNet		
Model No.:	MS5			
Model Difference:	N/A			
Hardware Version:	N/A			
Software Version:	N/A			
Tablet Docking Station	Model No.: MS-57602, Supplier: MSI			
Power Cable	P/N: L016-0576, Supplier: ELECTRI-CORD MFG.CO.			
Power Supply:	7.4Vdc from LITHIUM-ION rechargeable battery or 12/24Vdc from DC Car battery			
	Battery:	Model No.: MS5760 , Supplier: Getac		

Bluetooth:

Bluetooth Version:	Bluetooth V4.0 (dual mode) + HS
Channel number: 79 channels	
Modulation type:	GFSK +π/4DQPSK+8DPSK
Transmit Power:	2 dBm (Peak)
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	PIFA Antenna, Gain: 0.76dBi

The report applied for Bluetooth BR+EDR.

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

This submittal(s) (test report) is intended for FCC ID: <u>NKS-MS5</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 a Doc procedure.

1.3. Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2014 and ANSI C63.10:2013. 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.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan, which is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014 & ANSI C63.10:2013. FCC Registration Numbers are: 628985, 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. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 455997.

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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SYSTEM TEST CONFIGURATION 2.

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 C63.4:2014 & 6.2 ANSI C63.10:2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI C63.4:2014 & 6.2.2, and 6.2.3 in ANSI C63.10:2013 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 C63.4:2014, & Section 6.3, 6.4, 6.5, and 6.6 of ANSI C63.10:2013.

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2.4. Configuration of Tested System

Fig. 2-1 Radiated & Conducted Emission

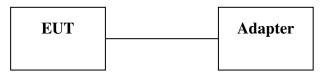


Fig. 2-2 Conducted (Antenna Port)

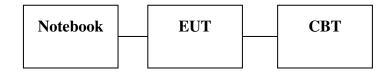


Table 2-1 Equipment Used in Tested System

Item	Equipment Mfr/Brand		Model/	Series No.	Data Cable	
item		Will/Druike	Type No.	Series 100	Duta Cubic	Power Cord
1	Bluetooth Test Software	Tera Term	N/A	N/A	N/A	N/A
2.	Bluetooth Test Set	R&S	CBT	101140	N/A	unshielded
3.	Notebook	Lenovo	L430	R9-YYG88	N/A	Unshielded

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3. SUMMARY OF TEST RESULTS

FCC/IC 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



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

In comparison with BR and EDR mode, emission carried out by EDR is chosen as the most representative measurement to perform measurement of radiated spurious emission pursuant to Part 15C.Modulation, EDR, 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 2DH1/2DH3/2DH5 (∏/4 DQPSK) with 2Mbps 3DH1/3DH3/3DH5 (8DPSK) with 3Mbps

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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 & 99% Power 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

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

This uncertainty represents an expanded uncertainty expressed at approximately the

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

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CONDUCTED EMISSION TEST 6.

6.1. Standard Applicable

According to §15.207, 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:**

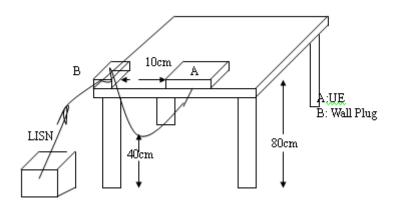
	SGS Conducted Emission Test Site No.A								
Name of Equipment	Manufacturer	Model	Serial Number	Calibration	Calibration				
Name of Equipment		WIUUCI	Serial Number	Date	Due				
EMI Test Receiver	R&S	ESCI 3	101311	06/20/2014	06/19/2015				
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	01/06/2015	01/07/2016				
LISN	Schwarzbeck	NSLK 8127	8127-648	06/10/2014	06/09/2015				
LISN	Rolf-Heine	NNB-2/16Z	99012	03/26/2014	03/25/2015				
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.				



6.3. EUT Setup

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2014.
- 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.

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.

Measurement Result 6.6.

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

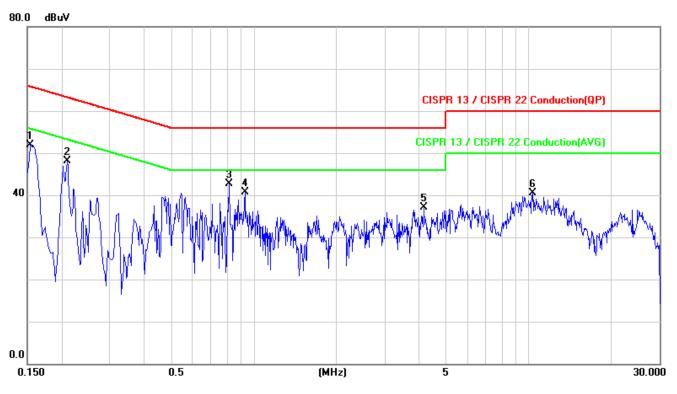
(Operation Mode:	Operation Mode			Test Date:	Feb. 26, 2015
'	Temperature:	23 °C	Humidity:	58 %	Test By:	Vito
]	Probe:	L1				
80.	0 dBuV					
				CISPR	13 / CISPR 22 Cond	luction(QP)
	X 2			CISPR 1	3 / CISPR 22 Condu	ction(AVG)
40			h Min M.	\$	MANNA MANA	MANY MAY AN AND MANY IN
		1911 Mar - An - E Frither, 1964.	WW YW IN			AABA P

0.0				
0.150	0.5	(MHz)	5	30.000

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1660	52.15	0.05	52.20	65.16	-12.96	peak	
2		0.2260	47.72	0.05	47.77	62.60	-14.83	peak	
- 3	*	0.5580	45.17	0.20	45.37	56.00	-10.63	peak	
4		1.6140	38.24	0.45	38.69	56.00	-17.31	peak	
- 5		2.3180	36.43	0.51	36.94	56.00	-19.06	peak	
6		4.2860	41.89	0.50	42.39	56.00	-13.61	peak	



Operation Mode:	Operation Mode		Test Date:	Feb. 26, 2015	
Temperature: 23 °C Humid		Humidity:	58 %	Test By:	Vito
Probe:	Ν			·	



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1540	51.84	0.05	51.89	65.78	-13.89	peak	
2		0.2100	48.04	0.04	48.08	63.21	-15.13	peak	
- 3	*	0.8140	42.47	0.30	42.77	56.00	-13.23	peak	
4		0.9300	40.35	0.34	40.69	56.00	-15.31	peak	
- 5		4.1660	36.51	0.51	37.02	56.00	-18.98	peak	
6		10.3620	39.97	0.47	40.44	60.00	-19.56	peak	

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PEAK OUTPUT POWER MEASUREMENT 7.

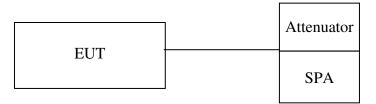
7.1. Standard Applicable

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

SGS Conducted Room(ALL)								
EQUIPMENT	MFR	MODEL	MODEL SERIAL		CAL DUE.			
ТҮРЕ		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015			
Power Meter	Anritsu	ML2496A	1326001	06/21/2014	06/20/2015			
Power Sensor	Anritsu	MA2411B	1315048	06/21/2014	06/20/2015			
Power Sensor	Anritsu	MA2411B	1315049	06/21/2014	06/20/2015			
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/19/2014	12/18/2015			
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015			
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015			
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015			
DC Power Supply	Agilent	E3640A	MY53140006	05/31/2014	05/30/2015			

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 4.43dB that offsets in the spectrum

7.5. Measurement Result

1M BR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	-2.63	0.00055	1
2441.00	-0.64	0.00086	1
2480.00	-1.22	0.00075	1

2M EDR mode (π /4DQPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	-0.27	0.00094	0.125
2441.00	1.44	0.00139	0.125
2480.00	0.97	0.00125	0.125

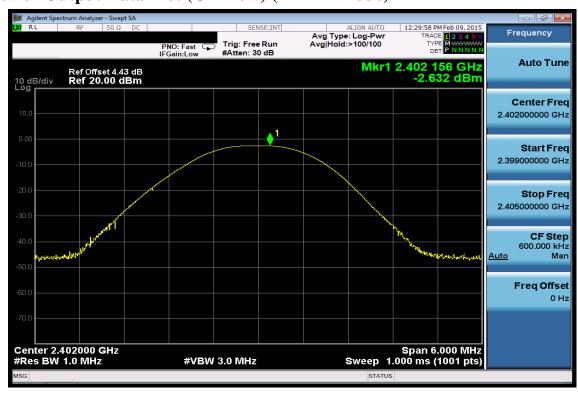
3M EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	0.32	0.00108	0.125
2441.00	2.00	0.00159	0.125
2480.00	1.53	0.00142	0.125

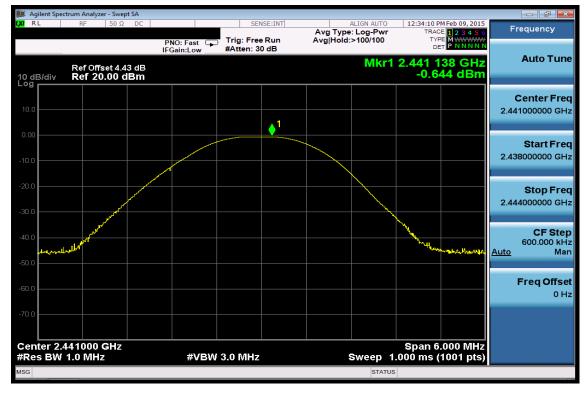
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Peak Power Output Data Plot (CH Low) (1M BR mode)



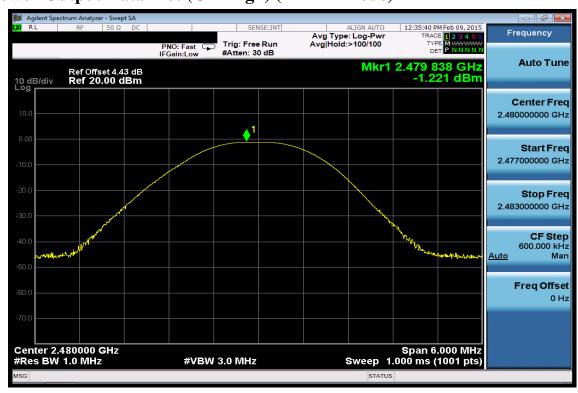
Peak Power Output Data Plot (CH Mid) (1M BR mode)



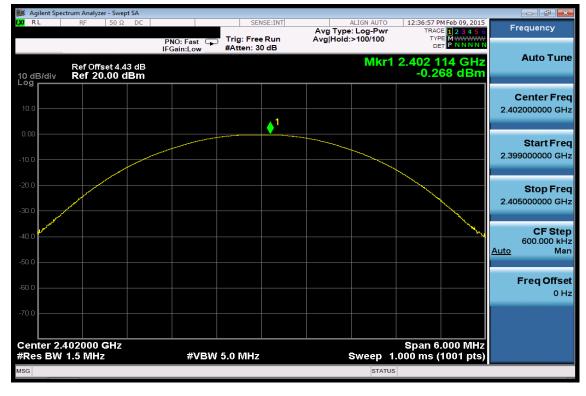
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Peak Power Output Data Plot (CH High) (1M BR mode)



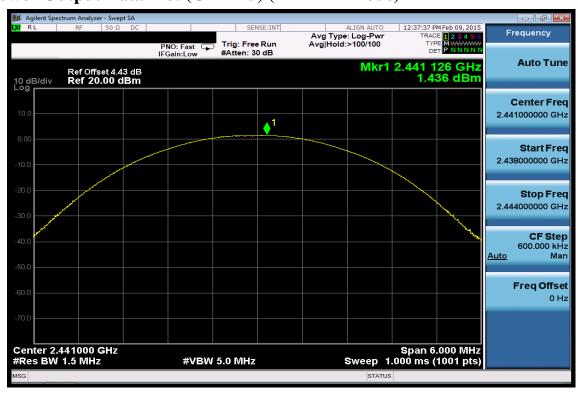
Peak Power Output Data Plot (CH Low) (2M EDR mode)



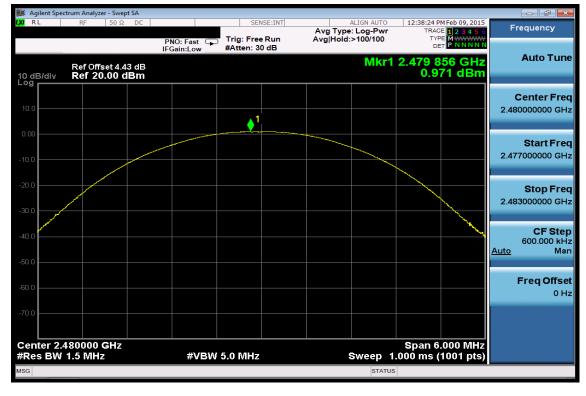
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Peak Power Output Data Plot (CH Mid) (2M EDR mode)



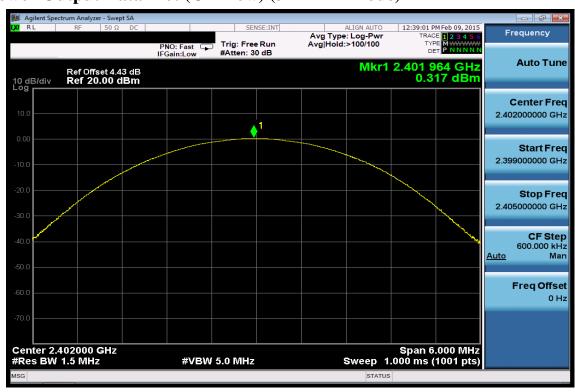
Peak Power Output Data Plot (CH High) (2M EDR mode)



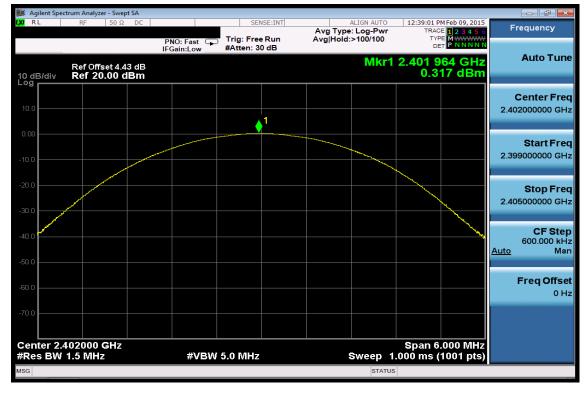
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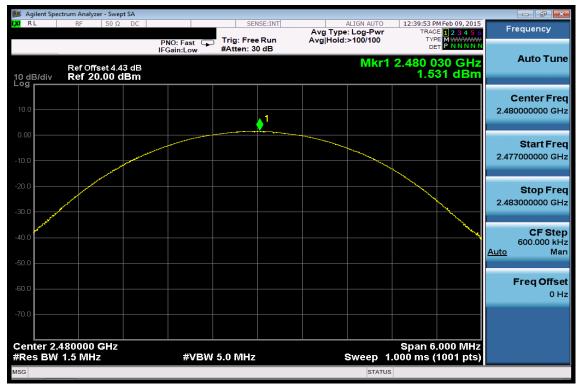
Peak Power Output Data Plot (CH Mid) (3M EDR mode)



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Peak Power Output Data Plot (CH High) (3M EDR mode)



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20dB BANDWIDTH 8.

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.

Measurement Equipment Used 8.2.

Refer to section 7.2 for details.

8.3. Test Set-up

Refer to section 7.3 for details.

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
- 5. Repeat above procedures until all test default channel is completed

NOTE: cable loss as 4.43dB that offsets in the spectrum

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8.5. Measurement Result:

1M BR mode:

СН	Bandwidth
	(MHz)
Low	0.92
Mid	0.92
High	0.92

2M EDR mode:

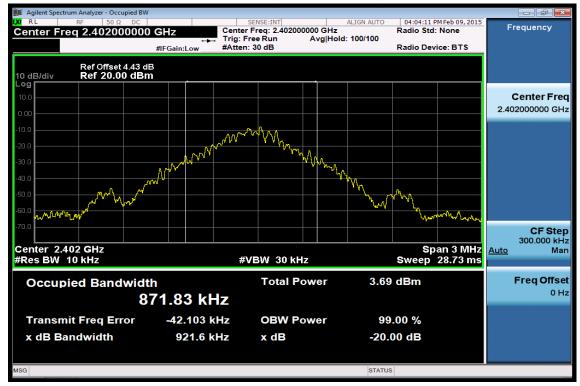
СН	Bandwidth	2/3 Bandwidth
	(MHz)	(MHz)
Low	1.32	0.88
Mid	1.33	0.89
High	1.33	0.89

3M EDR mode:

СН	Bandwidth	2/3 Bandwidth	
	(MHz)	(MHz)	
Lower	1.34	0.89	
Mid	1.31	0.87	
High	1.31	0.87	



20dB Band Width Test Data CH-Low (1M BR mode)



20dB Band Width Test Data CH-Mid (1M BR mode)

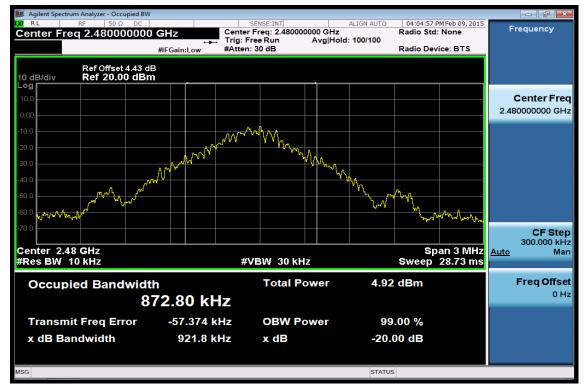


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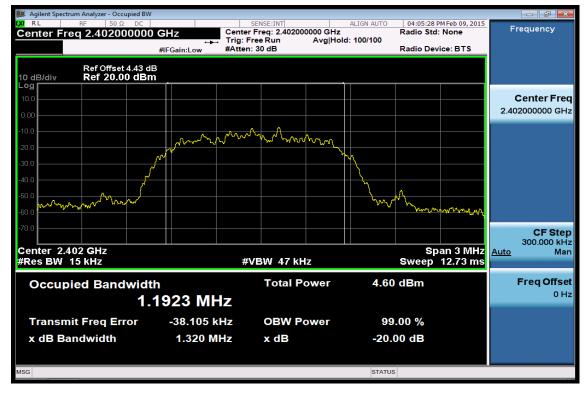
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20dB Width Test Data CH-High (1M BR mode)



20dB Band Width Test Data CH-Low (2M EDR mode)



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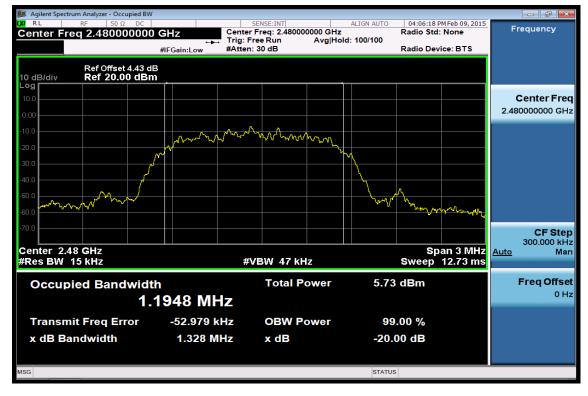
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20dB Band Width Test Data CH-Mid (2M EDR mode)



20dB Band Width Test Data CH-High (2M EDR mode)

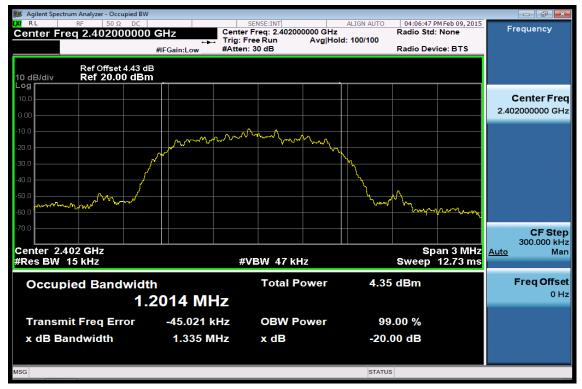


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20dB Band Width Test Data CH-Low (3M EDR mode)



20dB Band Width Test Data CH-Mid (3M EDR mode)

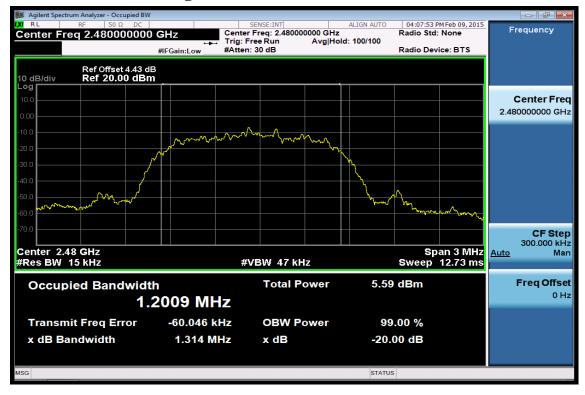


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20dB Width Test Data CH-High (3M EDR mode)



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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:

Refer to section 7.2 for details.

9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:

Refer to section 7.3 for details.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.



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.

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 4.43dB that offsets in the spectrum

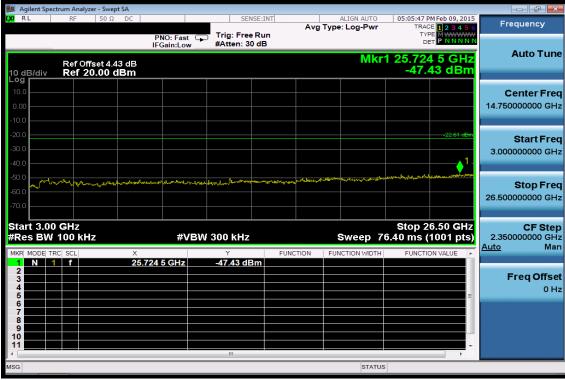
NOTE: the occurrence of the spike on the conducted emission is the signal of the fundamental emission.



9.7 Measurement Result -1 Conducted Spurious Emission Measurement Result (Worst: EDR mode) Ch Low 30MHz - 3GHz

Milent Spectrum Analyzer - Swept S 05:05:23 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N LIGN AUTO Frequency Avg Type: Log-Pwr Center Freq 1.515000000 GHz Trig: Free Run #Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.403 0 GHz Ref Offset 4.43 dB Ref 20.00 dBm 10 dB/div .og -2.61 dBm **Center Freq** 1.515000000 GHz Start Freq 30.000000 MHz Stop Freq 3.000000000 GHz Start 30 MHz #Res BW 100 kHz Stop 3.000 GHz Sweep 9.667 ms (1001 pts) **CF** Step #VBW 300 kHz 297.000000 M Auto Man FUNCTION 2.403 0 GHz -2.61 dBm N f Freq Offset 0 Hz 10

Ch Low 3GHz - 26.5GHz



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Ch Mid 30MHz – 3GHz

	ctrum Analyzer - Sv	wept SA							
Center F	^{RF} 50 req 1.5150	000000 GHz		SENSE	Avg	ALIGN AUTO g Type: Log-Pwr	TRA	PM Feb 09, 2015 DE 1 2 3 4 5 6 PE M WWWWW	Frequency
10 dB/div Log	Ref Offset	IFGa 4.43 dB):Fast ⊂⊾ in:Low	Trig: Free R #Atten: 30 c		MI	□ (r1 2.44	1 6 GHz 07 dBm	Auto Tune
10.0 0.00 -10.0							↓ ¹		Center Freq 1.515000000 GHz
-20.0 -30.0 -40.0								-21.07 dBm	Start Freq 30.000000 MHz
-50.0 -60.0	Annan Landerstein besch	ىر يەر يەر يەر يەر يەر يەر يەر يەر يەر يە	yksynger och förstanden	مهيديات المربية مريدهم		Al male and a set of the set	ter law when a	ามีคาราสีกระบ	Stop Freq 3.000000000 GHz
Start 30 F #Res BW	100 kHz	X		300 kHz	FUNCTION	Sweep 9	.667 ms (.000 GHz 1001 pts) ^{ON VALUE}	CF Step 297.000000 MHz <u>Auto</u> Man
1 N 2 3 3 4 5 6 6 7 8 9 10		2.441 6	GHZ	-1.07 dBn					Freq Offset 0 Hz
A MSG				III		STATU	5	*	

Ch Mid 3GHz - 26.5GHz

🎉 Agilent Spec	ctrum Analyzer - Swept SA						
LXI RL	RF 50 Ω DC		SENSE:I		ALIGN AUTO Type: Log-Pwr	05:06:31 PM Feb 09, 201 TRACE 1 2 3 4 5	
	Ref Offset 4.43 dB	PNO: Fast IFGain:Low	Trig: Free Ru #Atten: 30 dB	n		1 26.241 5 GHz -47.08 dBm	Auto Tune
10 dB/div Log 10.0 -10.0	Ref 20.00 dBm					-47.08 GBH	Center Freq 14.750000000 GHz
-20.0 -30.0 -40.0 -50.0						-21.07 dBr	Start Freq 3.000000000 GHz
-60.0		the algeon of the American Strength and the	- Porryshy and Marshamph	ingentel aller and a second			Stop Freq 26.500000000 GHz
Start 3.00 #Res BW	100 kHz RC SCL X	#VBW	/ 300 kHz Y -47.08 dBm	FUNCTION	Sweep 7	Stop 26.50 GHz 6.40 ms (1001 pts FUNCTION VALUE	
2 3 4 5 6		241 J GH2	-47.00 UDIII			=	Freq Offset 0 Hz
/ 8 9 10 11			m				
MSG					STATUS		



Ch High 30MHz – 3GHz

Agilent Spectrum Analyzer - Swept SA				
IX RL RF 50 Ω DC Center Freq 1.515000000 DC <thdc< th=""> DC <thdc< th=""> DC<td></td><td>ALIGN AUTO 05 Avg Type: Log-Pwr</td><td>:08:00 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE M WWWWW</td><td>Frequency</td></thdc<></thdc<>		ALIGN AUTO 05 Avg Type: Log-Pwr	:08:00 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
Ref Offset 4.43 dB 10 dB/div Ref 20.00 dBm	PNO: Fast Free Run IFGain:Low #Atten: 30 dB	Mkr1 2	2.480 3 GHz -1.60 dBm	Auto Tune
Log		• • • • • • • • • • • • • • • • • • •		Center Freq 1.515000000 GHz
-20.0			-21.60.dBm	Start Freq 30.000000 MHz
-50.0 -60.0	ynhann fry yn rhyfernau felige yn raenwyhdyn fref afwrgantau		مىسىيەر يوروامىلى ^ب ىمەلچىرىم	Stop Freq 3.000000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 9.667		CF Step 297.000000 MHz <u>Auto</u> Man
	480 3 GHz -1.60 dBm		E F	Freq Offset 0 Hz
MSG		STATUS		

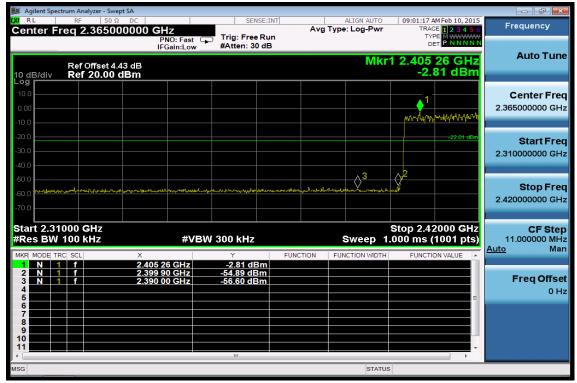
Ch High 3GHz - 26.5GHz

	trum Analyzer - Swept S	A					
LXI RL	RF 50 Ω	DC	SENSE	Avg	ALIGN AUTO Type: Log-Pwr	05:08:22 PM Feb 09, 201 TRACE 1 2 3 4 5 TYPE M WWWWW	Frequency
10 dB/div Log	Ref Offset 4.43 Ref 20.00 dB				Mkr	1 25.560 0 GHz -47.16 dBm	Auto Tune
10.0 0.00 -10.0							Center Freq 14.750000000 GHz
-20.0 -30.0 -40.0							Start Freq 3.000000000 GHz
-50.0 -60.0 -70.0	ghang again again an	nglessafternasterätternest	Managerine party reported and	and Shaphing and an and an	n ya an	an a	Stop Freq 26.500000000 GHz
Start 3.00 #Res BW	100 kHz	#V	BW 300 kHz Y	FUNCTION	Sweep 7	Stop 26.50 GHz 6.40 ms (1001 pts)	
1 N 1 2 3 4 5 6 7 7 8 9 9 10 11		* 25.560 0 GHz	, 47.16 dBm -47.16 dBm				Freq Offset 0 Hz
MSG					STATUS	3	

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



Band Edges Test Data CH-High



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Band Edges Test Data CH-Low (Worst: EDR mode)(Non-Hopping)

AM Feb 10, 2015 ALIGN AUTO Avg Type: Log-Pwr Frequency Center Freq 2.365000000 GHz 2345 Trig: Free Run #Atten: 30 dB TYP PNO: Fast IFGain:Low Auto Tune Mkr1 2.402 29 GHz -2.84 dBm Ref Offset 4.43 dB Ref 20.00 dBm I0 dB/div _og **Center Freq** 2 365000000 GHz Start Freq 2.310000000 GHz \Diamond^3 Stop Freq 2.420000000 GHz Stop 2.42000 GHz 1.000 ms (1001 pts) Start 2.31000 GHz **CF** Step #VBW 300 kHz 11.000000 MHz #Res BW 100 kHz Sweep Auto Man 56.83 dBm 56.90 dBm Freq Offset 0 Hz STATUS

Band Edges Test Data CH-High

IGN AUTC 08:47:17 AM Feb 10, 2015 Frequency Avg Type: Log-Pwr ACE 1 2 3 4 5 Center Freq 2.487500000 GHz Trig: Free Run #Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.480 125 GHz Ref Offset 4.43 dB Ref 20.00 dBm -1.52 dBm 0 dB/div Center Frea 2.487500000 GHz Start Freq 2.475000000 GHz \Diamond^2 Stop Freq 2.50000000 GHz Stop 2.50000 GHz 1.000 ms (1001 pts) Start 2.47500 GHz **CF** Step #VBW 300 kHz BW 100 kHz Sweep 2.500000 MHz #Res Auto Man -57.22 dBm -57.80 dBm Freq Offset N 0 Hz 10

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Chiefy Source stated the results shown in this test report refer only to the sample(s) tarte relation for 90 days only. 除非另有说明:此報告結果僅對測試之樣品負責、同時此樣品僅保留的人気。本報告未經本公司書面許可,不可部份複製。 This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <u>www.sgs.com/terms and conditions.htm</u> and, for elec-tronic format documents, subject to Terms and Conditions for Electronic Documents at <u>www.sgs.com/terms e-document.htm</u>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document is unproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or ap-transaction documents is unproved in the particulated to the fullow to the particulate to the formation. pearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



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:

SGS 966 Chamber No.C										
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due					
EMI Test Receiver	R&S	ESU 40	100363	04/12/2014	04/11/2015					
Loop Antenna	ETS-Lindgren	6502	00143303	12/09/2014	12/08/2015					
Broadband Antenna	TESEQ	CBL 6112D	35240	12/05/2014	12/04/2015					
Horn Antenna	ETS-Lindgren	3117	00143272	12/08/2014	12/07/2015					
Horn Antenna	ETS-Lindgren	3160-09	3160-09 00117911		11/12/2015					
Horn Antenna	ETS-Lindgren	3160-10	00117783	11/13/2014	11/12/2015					
Pre Amplifier	EMC Instruments	EMC330	980096	12/19/2014	12/18/2015					
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/19/2014	12/18/2015					
Pre Amplifier	R&S	SCU-18	10204	12/19/2014	12/18/2015					
Pre Amplifier	R&S	SCU-26	100780	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015					
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015					
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015					
Site NSA	SGS	966 Chamber C	SAC-C	03/05/2014	03/05/2015					
Site VSWR	SGS	966 Chamber C	SAC-C	04/10/2014	04/09/2015					
DC Power Supply	HOLA	DP-3003	D7070035	05/31/2014	05/30/2015					
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.					
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.					
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.					
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.					

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

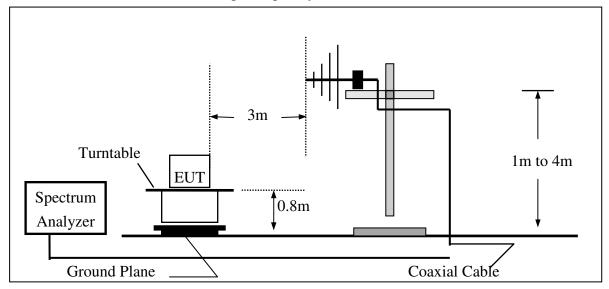
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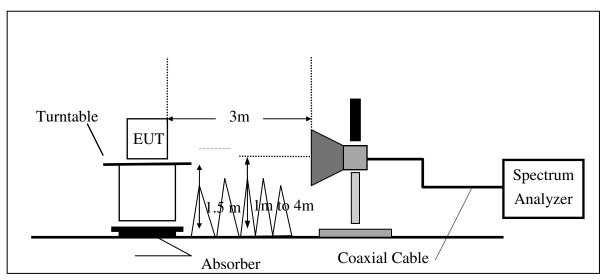
10.3. Test SET-UP:

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 measurement plot of radiation revealing the compliance of 15.209, please refer to Appendix I.

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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10.6.1 Radiated Emission Band Edge: (Worst: EDR mode)(Hopping)

Operation Ban Fundamental I Operation Mo EUT Pol.	Frequency	:EDR :2402 MHz :BANDEDG :E2 Plane	Test Date Temp./Humi. GE LOW Engineer Measurement Antenna Pol.		:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :VERTICAL		
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Peak	39.82	6.36	46.18	74	-27.82
2390.00	Е	Average	26.99	6.36	33.35	54	-20.65
Operation Band Fundamental Frequency Operation Mode EUT Pol.		:EDR :2402 MHz :BANDEDG :E2 Plane	E LOW	Test Date Temp./Humi. Engineer Measurement Ar	ntenna Pol.	:2015-02-22 :18.5 deg_C/ : : Ashton :HORIZONT.	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Peak	39.80	6.36	46.16	74	-27.84
2390.00	E	Average	26.96	6.36	33.32	54	-20.68



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Operation Ban Fundamental I Operation Mo EUT Pol.	Frequency	:EDR :2480 MHz :BANDEDG :E2 Plane	EDGE HIGH Engineer		:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :VERTICAL		
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Peak	42.70	7.14	49.83	74	-24.17
2483.50	E	Average	28.65	7.14	35.79	54	-18.21
Fundamental Frequency Operation Mode		:EDR :2480 MHz :BANDEDG :E2 Plane		Test Date Temp./Humi. Engineer Measurement Ar	itenna Pol.	:2015-02-22 :18.5 deg_C/ : Ashton :HORIZONT.	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Peak	46.89	7.14	54.03	74	-19.97
2483.50	Е	Average	30.51	7.14	37.65	54	-16.35



Band Edge: (Worst: EDR mode)(Non-Hopping)

Operation Ban Fundamental H Operation Mod EUT Pol.	mental Frequency:2402 MHzTemp./Humi.tion Mode:BANDEDGE LOWEngineer		:2015-02-22 :18.5 deg_C/ 56 RH : Ashton : VERTICAL				
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
2390.00	Е	Peak	41.13	6.36	47.49	74	-26.51
2390.00	Е	Average	26.76	6.36	33.12	54	-20.88
Operation Band Fundamental Frequency Operation Mode EUT Pol.		:EDR :2402 MHz :BANDEDG :E2 Plane	E LOW	Test Date Temp./Humi. Engineer Measurement Ar	ntenna Pol.	:2015-02-22 :18.5 deg_C/ : Ashton :HORIZONT.	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Peak	40.69	6.36	47.05	74	-26.95
2390.00	E	Average	29.06	6.36	35.42	54	-18.58



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Operation Ban Fundamental I Operation Mo EUT Pol.	Frequency	:EDR :2480 MHz :BANDEDG :E2 Plane	MHzTemp./Humi.DEDGE HIGHEngineer		:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :VERTICAL		
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Peak	42.33	7.14	49.46	74	-24.54
2483.50	Е	Average	31.85	7.14	38.99	54	-15.01
Operation Band Fundamental Frequency Operation Mode EUT Pol.		:EDR :2480 MHz :BANDEDG :E2 Plane	E HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2015-02-22 :18.5 deg_C/ : Ashton :HORIZONT.	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Peak	47.84	7.14	54.98	74	-19.02
2483.50	Е	Average	38.27	7.14	45.41	54	-8.59



10.6.2 Radiated Spurious Emission Measurement Result (worst case EDR mode)										
Operation Ban Fundamental F Operation Moo EUT Pol.	amental Frequency:2402 MHzTemp./Humi.ation Mode:TX LOWEngineer		itenna Pol.	:2015-02-22 :18.5 deg_C/ 56 RH : Ashton						
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			
33.88	S	Peak	48.15	-15.22	32.93	40	-7.07			
47.46	S	Peak	49.41	-23.95	25.46	40	-14.54			
100.81	S	Peak	52.76	-23.69	29.08	43.5	-14.42			
352.04	S	Peak	39.27	-17.31	21.96	46	-24.04			
452.92	S	Peak	39.10	-14.83	24.27	46	-21.73			
503.36	S	Peak	38.99	-14.15	24.85	46	-21.15			
4804.00	Н	Peak	37.47	10.98	48.45	74	-25.55			
4804.00	Н	Average	25.72	10.98	36.70	54	-17.30			
7206.00	Н	Peak	-	-	-	-	-			
9608.00	Н	Peak	-	-	-	-	-			
12010.00	Н	Peak	-	-	-	-	-			
14412.00	Н	Peak	-	-	-	-	-			
16814.00	Н	Peak	-	-	-	-	-			
19216.00	Н	Peak	-	-	-	-	-			
21618.00	Н	Peak	-	-	-	-	-			
24020.00	Н	Peak	-	-	-	-	-			



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Operation Ban Fundamental F Operation Mod EUT Pol.	Frequency	:EDR :2402 MHz :TX LOW :E2 Plane	Test Date Temp./Humi. Engineer Measurement Antenna Pol.			:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :HORIZONTAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
101.78	S	Peak	54.26	-23.54	30.72	43.5	-12.78
172.59	S	Peak	52.55	-23.96	28.59	43.5	-14.91
503.36	S	Peak	43.61	-14.15	29.46	46	-16.54
576.11	S	Peak	41.93	-12.45	29.48	46	-16.52
672.14	S	Peak	40.40	-11.68	28.71	46	-17.29
720.64	S	Peak	38.80	-10.77	28.03	46	-17.97
4804.00	Н	Peak	36.52	10.98	47.50	74	-26.50
4804.00	Н	Average	26.30	10.98	37.28	54	-16.72
7206.00	Н	Peak	-	-	-	-	-
9608.00	Н	Peak	-	-	-	-	-
12010.00	Н	Peak	-	-	-	-	-
14412.00	Н	Peak	-	-	-	-	-
16814.00	Н	Peak	-	-	-	-	-
19216.00	Н	Peak	-	-	-	-	-
21618.00	Н	Peak	-	-	-	-	-
24020.00	Н	Peak	-	-	-	-	-



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Operation Ban Fundamental F Operation Mod EUT Pol.	Frequency	:EDR :2441 MHz :TX MID :E2 Plane	Test Date Temp./Humi. Engineer Measurement Antenna Pol.		:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :VERTICAL		
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
50.37	S	Peak	59.60	-25.65	33.95	40	-6.05
103.72	S	Peak	53.36	-23.24	30.12	43.5	-13.38
352.04	S	Peak	42.38	-17.31	25.07	46	-20.93
503.36	S	Peak	39.51	-14.15	25.36	46	-20.64
576.11	S	Peak	37.10	-12.45	24.64	46	-21.36
720.64	S	Peak	35.06	-10.77	24.29	46	-21.71
4882.00	Н	Peak	36.65	10.91	47.56	74	-26.44
4882.00	Н	Average	26.31	10.91	37.22	54	-16.78
7323.00	S	Peak	-	-	-	-	-
9764.00	Н	Peak	-	-	-	-	-
12205.00	Н	Peak	-	-	-	-	-
14646.00	Н	Peak	-	-	-	-	-
17087.00	Н	Peak	-	-	-	-	-
19528.00	Н	Peak	-	-	-	-	-
21969.00	Н	Peak	-	-	-	-	-
24410.00	Н	Peak	-	-	-	-	-



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Operation Ban Fundamental F Operation Mod EUT Pol.	Frequency	:EDR :2441 MHz :TX MID :E2 Plane	Test Date Temp./Humi. Engineer Measurement Antenna Pol.			:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :HORIZONTAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
33.88	S	Peak	39.64	-15.22	24.42	40	-15.58
100.81	S	Peak	55.71	-23.69	32.02	43.5	-11.48
172.59	S	Peak	52.29	-23.96	28.33	43.5	-15.17
503.36	S	Peak	42.71	-14.15	28.56	46	-17.44
576.11	S	Peak	41.71	-12.45	29.25	46	-16.75
720.64	S	Peak	39.16	-10.77	28.38	46	-17.62
4882.00	Н	Peak	37.45	10.91	48.36	74	-25.64
4882.00	Н	Average	26.83	10.91	37.74	54	-16.26
7323.00	Н	Peak	-	-	-	-	-
9764.00	Н	Peak	-	-	-	-	-
12205.00	Н	Peak	-	-	-	-	-
14646.00	Н	Peak	-	-	-	-	-
17087.00	Н	Peak	-	-	-	-	-
19528.00	Н	Peak	-	-	-	-	-
21969.00	Н	Peak	-	-	-	-	-
24410.00	Н	Peak	-	-	-	-	-



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Operation Ban Fundamental F Operation Mod EUT Pol.	Frequency	:EDR :2480 MHz :TX HIGH :E2 Plane	Test Date Temp./Humi. Engineer Measurement Antenna Pol.			:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :VERTICAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
61.04	S	Peak	64.19	-28.42	35.77	40	-4.23
96.93	S	Peak	54.30	-24.36	29.94	43.5	-13.56
352.04	S	Peak	42.81	-17.31	25.50	46	-20.50
503.36	S	Peak	40.06	-14.15	25.91	46	-20.09
576.11	S	Peak	38.21	-12.45	25.75	46	-20.25
672.14	S	Peak	36.33	-11.68	24.65	46	-21.35
4960.00	Н	Peak	36.91	10.99	47.90	74	-26.10
4960.00	Н	Average	26.62	10.99	37.61	54	-16.39
7440.00	S	Peak	-	-	-	-	-
9920.00	Н	Peak	-	-	-	-	-
12400.00	Н	Peak	-	-	-	-	-
14880.00	Н	Peak	-	-	-	-	-
17360.00	Н	Peak	-	-	-	-	-
19840.00	Н	Peak	-	-	-	-	-
22320.00	Н	Peak	-	-	-	-	-
24800.00	Н	Peak	-	-	-	-	-



Report No.: E2/2015/10033 Issue Date: Mar. 11, 2015 Page: 52 of 69

Operation Ban Fundamental F Operation Mod EUT Pol.	Frequency	:EDR :2480 MHz :TX HIGH :E2 Plane	Test Date Temp./Humi. Engineer Measurement Antenna Pol.			:2015-02-22 :18.5 deg_C/ 56 RH : Ashton :HORIZONTAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
100.81	S	Peak	54.18	-23.69	30.49	43.5	-13.01
166.77	S	Peak	51.17	-23.63	27.53	43.5	-15.97
352.04	S	Peak	42.60	-17.31	25.29	46	-20.71
503.36	S	Peak	42.30	-14.15	28.15	46	-17.85
576.11	S	Peak	40.98	-12.45	28.53	46	-17.47
672.14	S	Peak	41.07	-11.68	29.39	46	-16.61
4960.00	Н	Peak	36.96	10.99	47.96	74	-26.04
4960.00	Н	Average	26.06	10.99	37.05	54	-16.95
7440.00	Н	Peak	-	-	-	-	-
9920.00	Н	Peak	-	-	-	-	-
12400.00	Н	Peak	-	-	-	-	-
14880.00	Н	Peak	-	-	-	-	-
17360.00	Н	Peak	-	-	-	-	-
19840.00	Н	Peak	-	-	-	-	-
22320.00	Н	Peak	-	-	-	-	-
24800.00	Н	Peak	-	-	-	-	-



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:

Refer to section 7.2 for details.

11.3. Test Set-up:

Refer to section 7.3 for details.

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.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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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:

Refer to section 7.2 for details.

12.3. Test Set-up:

Refer to section 7.3 for details.

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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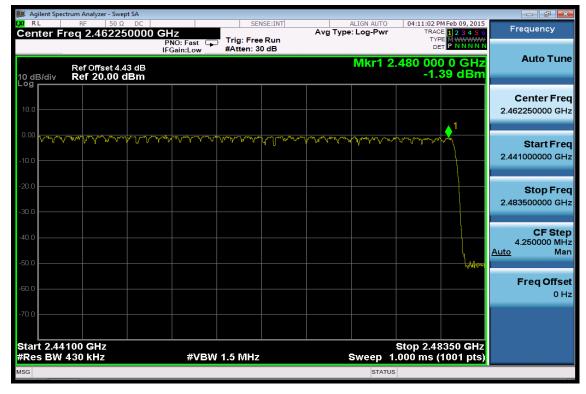


Channel Number

nt Spectrum Analyzer - Swept SA ALIGN AUTO Avg Type: Log-Pwr Frequency Center Freq 2.420500000 GHz 234 Trig: Free Run #Atten: 30 dB PNO: Fast PNNN DE Mkr1 2.402 000 GHz -2.22 dBm Auto Tune Ref Offset 4.43 dB Ref 20.00 dBm 10 dB/div Log **Center Freq** 2.420500000 GHz Start Freq 2.40000000 GHz Stop Freq 2.441000000 GHz CF Step 4.100000 MHz Man Auto Freq Offset 0 Hz Start 2.40000 GHz #Res BW 430 kHz Stop 2.44100 GHz Sweep 1.000 ms (1001 pts) #VBW 1.5 MHz

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:

Refer to section 7.2 for details.

13.3. Test Set-up:

Refer to section 7.3 for details.

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 (ms):	Limit (ms):
Low:	DH1	0.382	400ms
	DH3	1.64	400ms
	DH5	2.885	400ms
Middle:	DH1	0.382	400ms
	DH3	1.64	400ms
	DH5	2.885	400ms
High:	DH1	0.382	400ms
	DH3	1.64	400ms
	DH5	2.885	400ms

2Mbps (Π /4 DQPSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Middle:	2DH1	0.382	400ms
	2DH3	1.64	400ms
	2DH5	2.885	400ms

3Mbps (8DPSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Middle:	3DH1	0.382	400
	3DH3	1.64	400
	3DH5	2.885	400

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

1Mbps:

CH Low	DH1 time slot	= 0.382	(ms) * (1600/2/79)	* 31.6 = 122.24	(ms)
	DH3 time slot	= 1.64	(ms) * (1600/4/79)	* 31.6 = 262.40	(ms)
	DH5 time slot	= 2.885	(ms) * (1600/6/79)	* 31.6 = 307.73	(ms)

CH Mid DH1 time slot =
$$0.382$$
 (ms) * (1600/2/79) * 31.6 = 122.24 (ms)
DH3 time slot = 1.64 (ms) * (1600/4/79) * 31.6 = 262.40 (ms)
DH5 time slot = 2.885 (ms) * (1600/6/79) * 31.6 = 307.73 (ms)

CH High DH1 time slot =
$$0.382$$
 (ms) * (1600/2/79) * 31.6 = 122.24 (ms)
DH3 time slot = 1.64 (ms) * (1600/4/79) * 31.6 = 262.40 (ms)
DH5 time slot = 2.885 (ms) * (1600/6/79) * 31.6 = 307.73 (ms)

2Mbps:

	CH Mid	2DH1 time slot = 0.382	(ms) * (1600/2/79)	* 31.6 = 122.24	(ms)
		2DH3 time slot = 1.64	(ms) * (1600/4/79)	* 31.6 = 262.40	(ms)
		2DH5 time slot = 2.885	(ms) * (1600/6/79)	* 31.6 = 307.73	(ms)
3Mbps:					
	CH Mid	3DH1 time slot = 0.382	(ms) * (1600/2/79)	* 31.6 = 122.24	(ms)
		3DH3 time slot = 1.64	(ms) * (1600/4/79)	* 31.6 = 262.40	(ms)
		3DH5 time slot = 2.885	(ms) * (1600/6/79)	* 31.6 = 307.73	(ms)

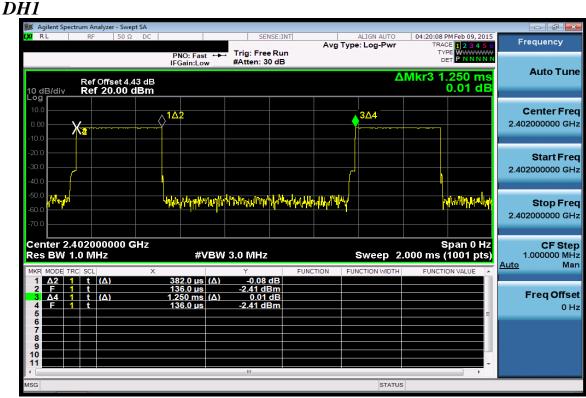
13.6. Measurement Result:

Note: Refer to next page for plots.

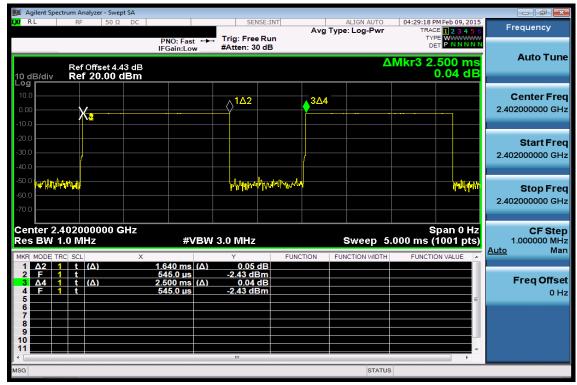
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CH-Low



DH3



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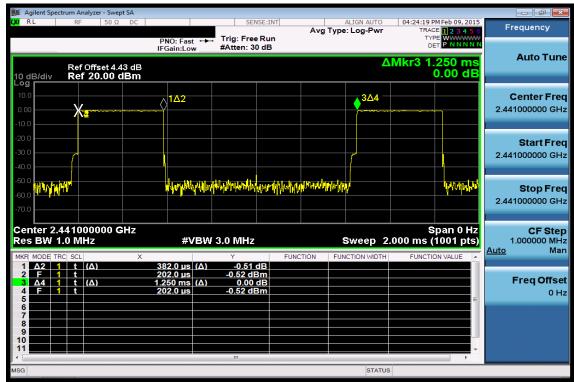


DH5

Agilent Spectrum Analyzer - Swept SA					
IX RL RF 50Ω DC		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	04:36:41 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE WWWWWWW	Frequency
Ref Offset 4.43 dB 10 dB/div Ref 20.00 dBm		g: Free Run tten: 30 dB	Ľ	Mkr3 3.752 ms -0.01 dB	Auto Tune
10.0 0.00 -10.0		1Δ2	.4 		Center Freq 2.402000000 GHz
-20.0					Start Freq 2.402000000 GHz
-60.0 (Marcal -60.0		ppArtent Appendix		vik.tymetry	Stop Freq 2.402000000 GHz
Center 2.402000000 GHz Res BW 1.0 MHz	#VBW 3.0		Sweep 7	Span 0 Hz 2.533 ms (1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Mar
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	3.752 ms (A)	-0.06 dB 2.28 dBm -0.01 dB 2.28 dBm			Freq Offset 0 Hz
6 7 8 9 10					
.∢ [MSG		m	STATU	S	

CH-Mid

DH1

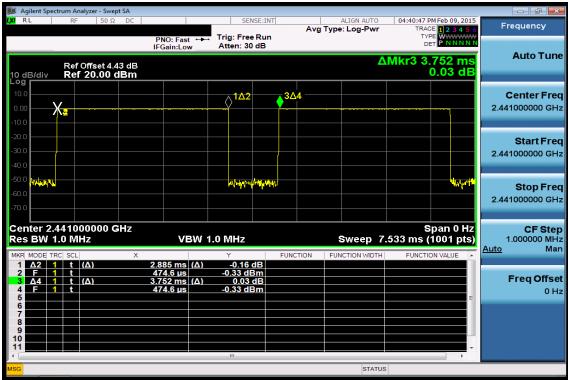




DH3

📁 Agilent Spectrum Analyzer - Swept SA				
LXI RE 50 Ω DC	SENSE:	Avg Type: Log-Pwr	04:32:57 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE WWWWW	Frequency
Ref Offset 4.43 dB 10 dB/div Ref 20.00 dBm	PNO: Fast + I rig: Free Rt IFGain:Low #Atten: 30 db	3	Mkr3 2.500 ms 0.00 dB	Auto Tune
10.0 0.00 -10.0	1∆2	3Δ4		Center Freq 2.441000000 GHz
-20.0				Start Freq 2.441000000 GHz
-60.0	south in the second sec	dWenderhald	ntwenter New Texa	Stop Freq 2.441000000 GHz
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 5.	Span 0 Hz 000 ms (1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Man
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.640 ms (Δ) 0.01 dB 670.0 μs -0.47 dBm 2.500 ms (Δ) 0.00 dB 670.0 μs -0.47 dBm			Freq Offset 0 Hz
8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	m	STATUS		

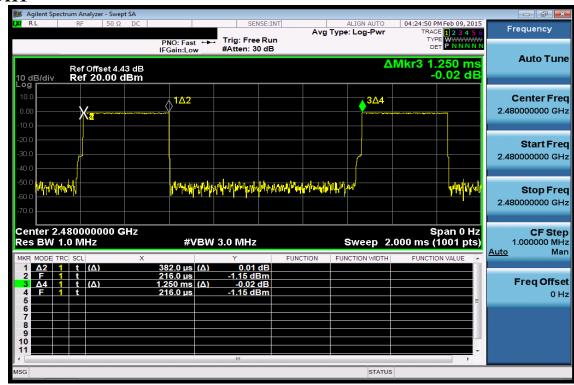
DH5



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CH-High DH1



DH3

	trum Analyzer - Swept	SA				
IXI RL	RF 50 Ω	DC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	04:33:56 PM Feb 09, 2015 TRACE 1 2 3 4 5 6 TYPE WWWWWW	Frequency
10 dB/div	Ref Offset 4.43 Ref 20.00 dl		#Atten: 30 dB	Δ	Mkr3 2.500 ms -0.01 dB	Auto Tune
10.0 0.00			2 ▲3△	4		Center Freq 2.480000000 GHz
-20.0						Start Freq 2.48000000 GHz
-50.0 +++++++++++++++++++++++++++++++++++			onnt-annihandan		with an all and	Stop Freq 2.480000000 GHz
Center 2.4 Res BW 1		#VBW	3.0 MHz		Span 0 Hz .000 ms (1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Man
1 <u>A2</u> 2 F 1 3 <u>A4</u> 1 4 F 1 5	t (Δ) t (Δ) t (Δ) t	× 1.640 ms (Δ) 200.0 μs 2.500 ms (Δ) 200.0 μs	0.00 dB -1.07 dBm -0.01 dB -1.07 dBm	INCTION FUNCTION WIDTH		Freq Offset 0 Hz
6 7 8 9 10 11						
MSG 🗼 File •	<1234.PNG> sav	red	m	STATUS	5	

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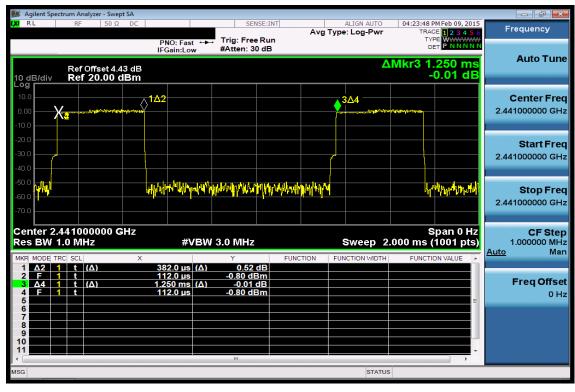


DH5

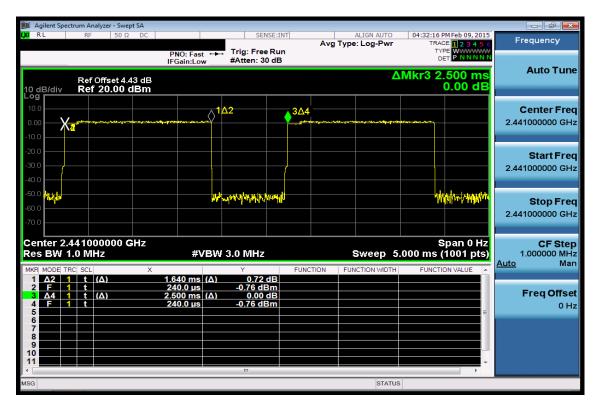
	ilent Spect				SA														
l <mark>XI</mark> R	L	RF	5	50 Ω	DC				SEI	NSE:IN	Т	Ava		LIGN AUTO			eb 09, 20		Frequency
		Ref	Offse	t 4 43	dB	PNO: IFGair	Fast ⊷ n:Low		Frig: Free Atten: 30				.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1	DET	52 m		Auto Tune
10 di	B/div		f 20.0													0.0	02 dl	В	
Log 10.0 0.00	-x	22							\		<mark>∮</mark> 3∆4]		Center Freq 2.480000000 GHz
-20.0 -30.0 -40.0																			Start Freq 2.480000000 GHz
-50.0 -60.0 -70.0	milit								MAN AT	letoph 18							¥ 4 ,/*\	д	Stop Freq 2.480000000 GHz
Res	ter 2.4 BW 1	.0 M	Hz	0 GI			VBW	1.0	MHz		FUNC	TION		Sweep 7	.533 ms	Spa (10		5) 	CF Step 1.000000 MHz <u>Auto</u> Man
MKR 1 2 3 4 5 6 7 8 9 10 11 <	MODE TR A2 1 F 1 A4 1 F 1 F 1	t	(Δ) (Δ)		X	2.885 391.7 3.752 391.7	′us ms (∆		Y -0.11 -0.97 dl 0.02 -0.97 dl	Bm dB	FUNC	TION	FUN	CTION WIDTH	FUNC		ALUE	4 III +	Freq Offset 0 Hz
MSG														STATUS	3				



CH-Mid 2DH1

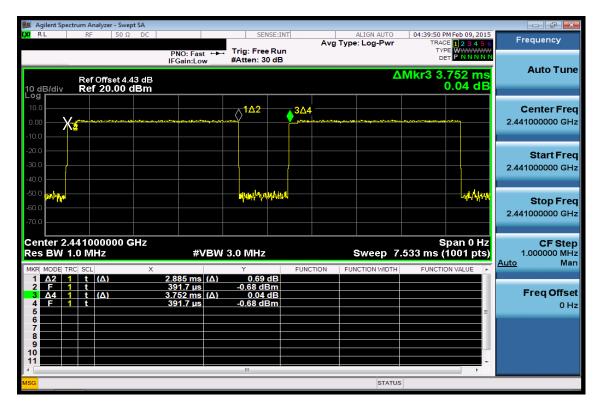


2DH3





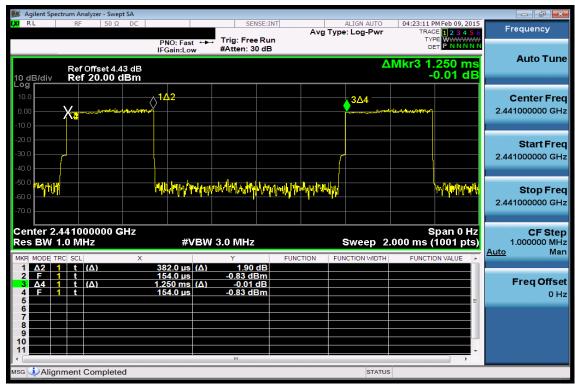
2DH5



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CH-Mid 3DH1



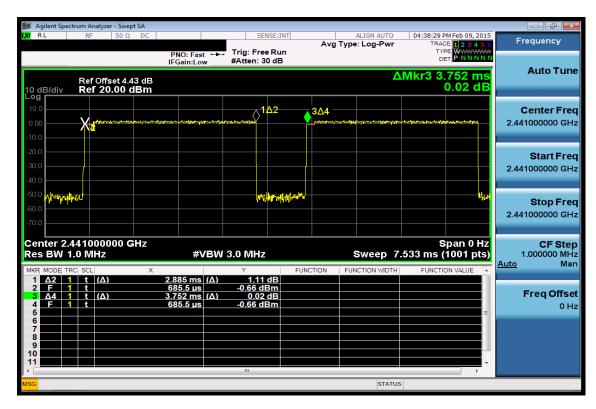
3DH3

🎉 Agilent Sp	pectrum A	nalyzer - Sv	vept SA										
LXI RL	RF	50	Ω DC		_	SE	NSE:INT		Ave	ALIGN AUTO Type: Log-Pwr	04:31:28 PM F	eb 09, 2015	Frequency
				PNO: Fast IFGain:Lov		Trig: Fre #Atten: 3			Avg	Type. Log-F wi	TYPE	23450 WWWWWW PNNNNN	
10 dB/div Log		f Offset 4 f 20.00								Δ	Mkr3 2.5 -0.	00 ms 02 dB	Auto Tune
10.0	X²	NedifyeedPress	the state of the s	Pouriesidulations	••••••••••••	∆2		344	Weitigset	marchandigtowthysparetimescaler			Center Freq 2.441000000 GHz
-20.0 -30.0 -40.0													Start Freq 2.441000000 GHz
-50.0 -60.0 -70.0	w				- with	vinder ¹ 01/101	1 7 90/10/11					der-titlerft	Stop Freq 2.441000000 GHz
Center 2 Res BW			GHz	#V	'BW 3	3.0 MHz				Sweep 5	Spa 000 ms (10.	an 0 Hz 101 pts)	CF Step 1.000000 MHz Auto Man
MKR MODE	TRC SCL	(A)	Х	1.640 ms	()	Y 0.99		FUNC	TION	FUNCTION WIDTH	FUNCTION	VALUE 🔺	<u>Auto</u> Mari
2 F 3 <u>Δ4</u> 4 F 5	1 t 1 t 1 t	(Δ) (Δ)		295.0 µs 2.500 ms 295.0 µs		-0.69 dl -0.02 -0.69 dl	Bm dB						Freq Offset 0 Hz
6 7 8 9 10 11													
						III						•	
мsg 🗼 Ali	gnment	Comple	ted							STATUS	5		

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3DH5





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 0.76 dBi, 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.

~ End of Report ~

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