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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

	OF		
Product Name:	Mouse		
Brand Name:	hp		
Model No.:	HSA-D002M		
Model Difference:	N/A		
FCC ID:	O62-HSAD002M		
Report No.:	E2/2016/B0058		
Issue Date:	Dec. 23, 2016		
FCC Rule Part:	§15.247, Cat: DSS		
Prepared for:	Darfon Electronics Corp. 167, Shanying Road, Gueishan, Taoyuan 33341, Taiwan, R.O.C.		
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:	Darfon Electronics Corp. 167, Shanying Road, Gueishan, Taoyuan 33341, Taiwan, R.O.C.
Product Name:	Mouse
Brand Name:	hp
Model No.:	HSA-D002M
Model Difference:	N/A
FCC ID:	O62-HSAD002M
Report Number:	E2/2016/B0058
Date of test:	Nov. 30, 2016 ~ Dec. 23, 2016
Date of EUT Received:	Nov. 30, 2016

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Test By:	Aken Huang	Date:	Dec. 23, 2016
Prepared By:	Aken Huang / Engineer Karen Huang	Date:	Dec. 23, 2016
Approved By:	Karen Huang / Clerk Jim Chang Jim Chang / Asst. Manager	Date:	Dec. 23, 2016

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Revision History

Report Number	Revision	Description	Issue Date	
E2/2016/B0058	Rev.00	Initial creation of document	Dec. 23, 2016	

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GENERAL INFORMATION 1

1.1 Product description

General:

Product Name:	Mouse
Brand Name:	hp
Model No.:	HSA-D002M
Model Difference:	N/A
Product SW/HW version:	N/A/ N/A
Radio SW/HW version:	N/A/ N/A
Test SW Version:	N/A
RF power setting in TEST SW:	N/A
Power Supply:	3Vdc form 1.5Vdc AAA battery * 2

Bluetooth BR:

Bluetooth Version:	V3.0	
Channel number:	79 channels	
Modulation type:	GFSK	
Transmit Power:	1.43dBm	
Frequency Range:	2.402GHz – 2.480GHz	
Dwell Time:	<= 0.4s	
Antenna Designation:	Internal Antenna, Gain: 3.42dBi	

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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting, Bluetooth feature, and below is details of information.

Product Feature			
Bluetooth Version	V3.0		

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

1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 FCC Public Notice DA 00-705 Measurement Guidelines ANSI C63.10:2013

Note:

All test items have been performed and record as per the above standards.

1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Numbers are: 735305

IC Registration Numbers are: 4620A-5

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

2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated

emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation. with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level. Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor. Following shows an offset computation example with cable loss 4.8dB.

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2.5 Configuration of Tested System



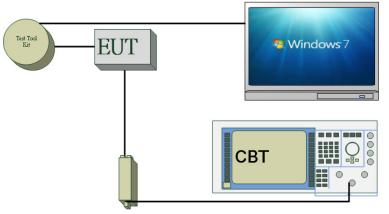


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2	Bluetooth Tester	N/A	CBT	N/A	Shield	Un-shield
3	Notebook	Lenovo	L420	LR-7HXZA	Shielded	Unshielded

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UMMARY OF TEST RESULTS 3

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

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DESCRIPTION OF TEST MODES 4

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

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

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4.2 The Worst Test Modes and Channel Details

- The EUT has been tested under operating condition. 1
- Test program used to control the EUT for staying in continuous transmitting and receiving 2 mode is programmed.
- Investigation has been done on all the possible configurations for searching the worst 3 case.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	AVAILABLE	TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL	MODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	GFSK	DH5		
RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE AVAILABLE T		TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL	WODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	GFSK	DH5		

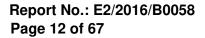
Note:

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

ANTENNA PORT CONDUCTED MEASUREMENT:

	CONDUCTED TEST					
Peak Output Power, 20dB Band Width						
MODE	AVAILABLE	TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL		TYPE		
Bluetooth	0 to 78	0,39,78	GFSK	DH5		
Band Edge						
Bluetooth 0 to 78 0,78 GFSK DH5				DH5		
Frequency Separation						
Bluetooth	0 to 78	0,1,2	GFSK	DH5		
Number of hopping frequency						
Bluetooth	0 to 78	0 to 78	GFSK	DH5		
Time of Occupancy (Dwell time)						
Bluetooth	0 to 78	0,39,78	GFSK	DH1/DH3/DH5		

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MEASUREMENT UNCERTAINTY 5

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

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz – 30MHz: +/- 2.87 dB	
	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)	9kHz – 30MHz: +/- 2.87 dB
	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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CONDUCTED EMISSION TEST 6

6.1 Standard Applicable

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

Frequency range	Limits dB(uV)				
MHz	Quasi-peak	Average			
0.15 to 0.50	66 to 56	56 to 46			
0.50 to 5	56	46			
5 to 30	60	50			
Note					
1. The lower limit shall apply at the transition frequencies					

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT MFR		MODEL	SERIAL	LAST	CAL DUE.
ТҮРЕ		NUMBER	NUMBER	CAL.	
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-150 cm	N/A	02/07/2016	02/06/2017
LISN	Schwarzbeck	NSLK 8127	8127-648	03/11/2016	03/10/2017
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3 EUT Setup

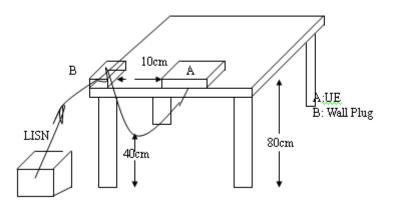
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

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

6.6 Measurement Result

NA, the EUT is powered by 1.5Vdc AAA battery * 2

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PEAK OUTPUT POWER MEASUREMENT 7

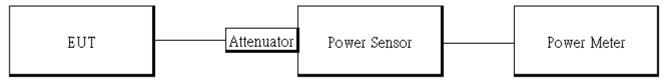
7.1 Standard Applicable

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

7.2 Measurement Equipment Used

	Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
ТҮРЕ		NUMBER	NUMBER	CAL.		
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017	
Power Meter	Anritsu	ML2496A	1326001	06/23/2016	06/22/2017	
Power Sensor	Anritsu	MA2411B	1315048	06/23/2016	06/22/2017	
Power Sensor	Anritsu	MA2411B	1315049	06/23/2016	06/22/2017	
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017	
DC Block	PASTERNACK	PE8210	RF29	12/12/2016	12/11/2017	
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017	
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017	
DC Power Supply	Agilent	E3640A	MY53140006	05/04/2016	05/03/2017	

7.3 Test Set-up:



7.4 Measurement Procedure:

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

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7.5 Measurement Result

1M BR mode (Peak):

СН	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	1.43	1.390	125
39	2441	1.19	1.315	125
78	2480	0.92	1.236	125

1M BR mode (Average):

СН	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	0.22	1.052	125
39	2441	0.09	1.021	125
78	2480	-0.16	0.964	125

NOTE: cable loss as 4.8dB that offsets in the spectrum

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8 20DB BANDWIDTH MEASUREMENT

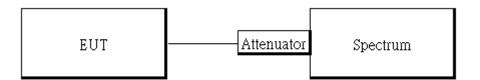
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
ТҮРЕ		NUMBER	NUMBER	CAL.	
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
DC Block	PASTERNACK	PE8210	RF29	12/11/2015	12/10/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/11/2015	12/10/2016
Attenuator	WOKEN	218FS-10	RF23	12/11/2015	12/10/2016

8.3 Test Set-up



8.4 Measurement Procedure

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

NOTE:

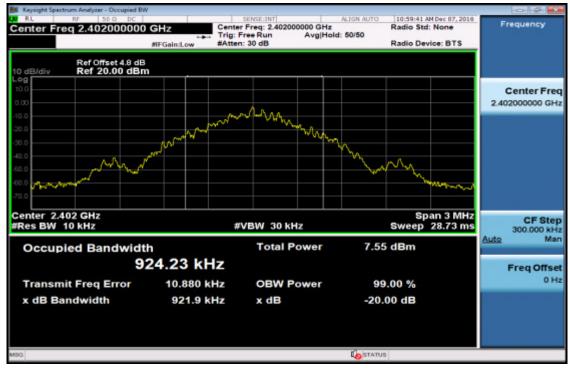
1. For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark



8.5 Measurement Result

GFSK				
	20 dB	2/3		
СН	BW	BW		
	(MHz)	(MHz)		
Low	0.922	0.61		
Mid	0.923	0.62		
High	0.920	0.61		

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



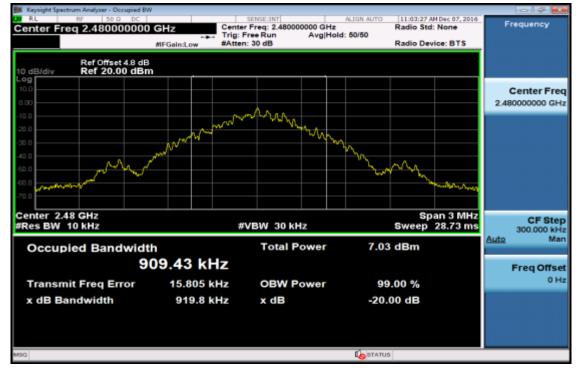
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20dB Band Width Test Data CH-Mid (GFSK mode)



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



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CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT 9

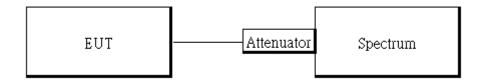
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

Conducted Emission Test Site						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
TYPE		NUMBER	NUMBER	CAL.		
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017	
DC Block	PASTERNACK	PE8210	RF29	12/11/2015	12/10/2016	
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/11/2015	12/10/2016	
Attenuator	WOKEN	218FS-10	RF23	12/11/2015	12/10/2016	

9.3 Test SET-UP



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9.4 Measurement Procedure

Conducted Band Edge:

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

Conducted Spurious Emission:

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Set RBW = 100 kHz & VBW = 300 kHz, Detector = Peak, Sweep = Auto
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- Repeat above procedures until all default test channel measured were complete.

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

FS = RA + AF + CL - AG

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

9.5 Measurement Result

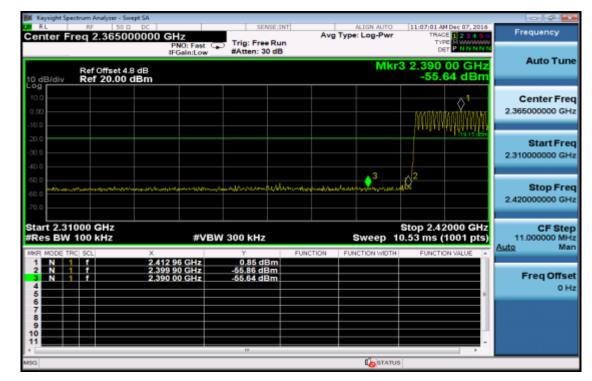
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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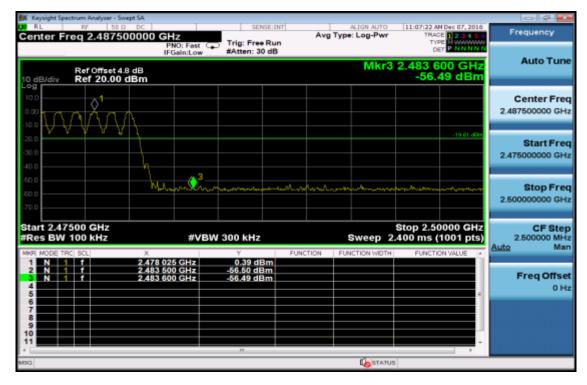
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Band Edges Test Data CH-Low (Hopping mode) (GFSK mode)

Band Edges Test Data CH-High



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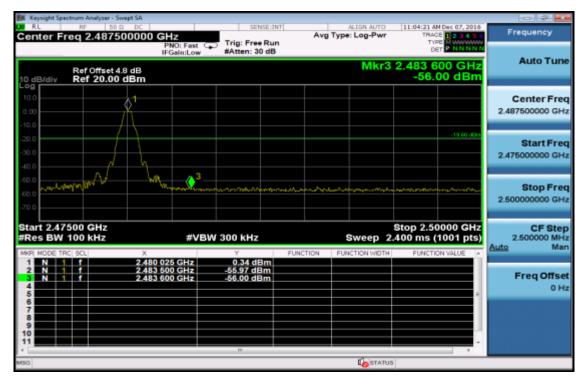
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11:00:14 AM Dec 07, 201 Frequency Avg Type: Log-Pwr Center Freq 2.365000000 GHz Trig: Free Run #Atten: 30 dB DE PNO: Fast 😱 IFGain:Low Auto Tune Mkr3 2.390 00 GHz -56.97 dBm Ref Offset 4.8 dB Ref 20.00 dBm Center Freq \Diamond 2.365000000 GHz Start Freq 2.310000000 GH; 13 Stop Freq 2.42000000 GHz Start 2.31000 GHz #Res BW 100 kHz Stop 2.42000 GHz Sweep 10.53 ms (1001 pts) CF Step 11.000000 MHz Mar #VBW 300 kHz Auto 2.399 90 2.93 dBm 6.97 dBm Freq Offset 0 H2 **Ko**STATUS

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

Band Edges Test Data CH-High



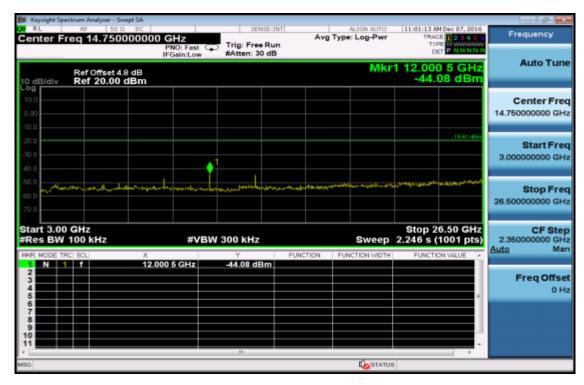
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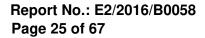
Conducted Spurious Emission Measurement Result (GFSK mode) Ch Low 30MHz – 3GHz

	ctrum Analyzer - Swept SA							- 2 🛋
Center Fr	eq 1.51500000		SENSE:	Ave	Type: Log-Pwr	11:00:53 AM I TRACE	123456	Frequency
	Ref Offset 4.8 dB	PNO: Fast C IFGain:Low	 Trig: Free Ru #Atten: 30 dl 		Mk	r1 2.403	0 GHz 9 dBm	Auto Tune
10.0B/div 10.0 0.00	Ref 20.00 dBm					1		Center Freq 1.515000000 GHz
-20.0							-19.81 diğin	Start Freq 30.000000 MHz
-50.0 -60.0	مەمەللەركىتى _{يەم} ىي	وهرميل الله معارضي	ารู้เข้ _า สถาราชาวร _า ยแกรมสารไปสารไป	LL-A-MANLALAM (PA	parane and a second of the	مىلومەرى مۇل _{ار} ىزىرى	*****	Stop Freq 3.000000000 GHz
Start 30 M #Res BW	100 kHz		W 300 kHz Y 0.39 dBm	FUNCTION	Sweep 2	Stop 3.0 83.9 ms (1) FUNCTION	001 pts)	CF Step 297.000000 MHz Auto Man
1 N 1 2 3 4 5 5 7 8 9 10 11		2.403 0 GH2	0.39 gBW					Freq Offset 0 Hz
MSG						6		

Ch Low 3GHz – 26.5GHz



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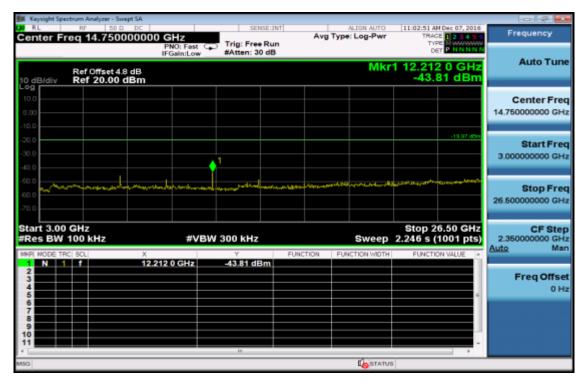




Ch Mid 30MHz – 3GHz

Keysight Spectrum Analyzer - Swe							
Center Freq 1.51500		SENSE:INT	Avg 1	ALIGN AUTO	11:02:35 AM Dec TRACE	23456	Frequency
Ref Offset 4.8		Trig: Free Run #Atten: 30 dB		Mk	r1 2.441 6	GHz dBm	Auto Tune
10.0 -10.0					↓1		Center Free 1.515000000 GH
-20.0						-19.97 dBn	Start Free 30.000000 MH
-50.0 -60.0 -70.0	ار مور وداور رواز به الاسلون الحراري الم	ا «دواهی آوردو قود در باید « مرور او	لاحداد الم المارين الم المارين المارين	and the second		a decent	Stop Free 3.000000000 GH
Start 30 MHz #Res BW 100 kHz	#VBV	/ 300 kHz			Stop 3.00 83.9 ms (100	01 pts)	CF Stej 297.000000 MH Auto Ma
MKR MODE TRC SCL 1 N 1 7 2 3 4 5 6 6 7 8	× 2.441 6 GHz	Υ 0.03 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION V	ALUE +	Freq Offse 0 H
9 10 11 *		17			-	, .	

Ch Mid 3GHz – 26.5GHz



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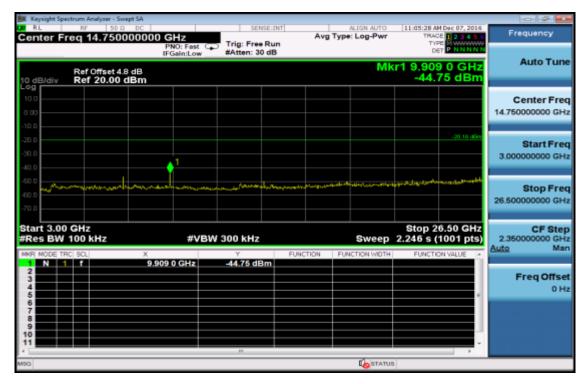
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Ch High 30MHz – 3GHz

🗱 Keysight Spectrum Analyzer - Swept SA					_		
Center Freq 1.515000000	GHz	SENSE:INT		ALIGN AUTO Type: Log-Pwr	TRAC	Dec 07, 2016	Frequency
Ref Offset 4.8 dB	PNO: Fast IFGain:Low	Trig: Free Run #Atten: 30 dB		Mk	r1 2.480	3 GHz 5 dBm	Auto Tune
10.0 0.00					• ¹		Center Freq 1.51500000 GHz
-20.0						-20.16 484	Start Freq 30.000000 MHz
-50.0 -60.0	angungagan dalamangnan	a tha tha an		الم ^ر مين فالمعالي المريكي		unan shaha shar	Stop Freq 3.000000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBW	300 kHz		Sweep 2	83.9 ms (1		CF Step 297.000000 MHz Auto Man
NR NODE TRC SCL X 1 N 1 f 2, 2 3 5 5 5 4 4 5 5 5 6 7 8 9 9 10 11 1 1 1	180 3 GHz	-0.15 dBm	FUNCTION	, FUNCTION WIDTH	FUNCTIO	N VALUE	Freq Offset 0 Hz
к И93					ł	,	

Ch High 3GHz – 26.5GHz



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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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

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

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

Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level ($dB\mu V/m$) = 20 log Emission level ($dB\mu V/m$)

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10.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
ТҮРЕ		NUMBER	NUMBER	CAL.	
EMI Test Receiver	R&S	ESU 40	100363	04/12/2016	04/11/2017
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2015	12/22/2016
Broadband An- tenna	TESEQ	CBL 6112D	35240	11/03/2016	11/02/2017
Horn Antenna	ETS-Lindgren	3117	00143272	12/16/2015	12/15/2016
Horn Antenna	Schwarzbeck	BBHA9170	185	07/24/2016	07/23/2017
Pre Amplifier	EMC Instru- ments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instru- ments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-26	100780	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017

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EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
		NOWDER	NONDLN	CAL.	
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2016	05/03/2017
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.

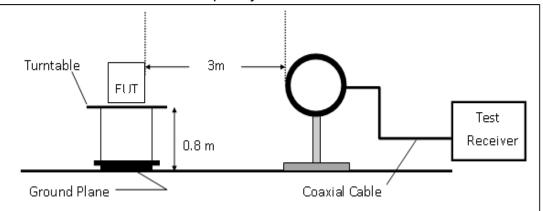
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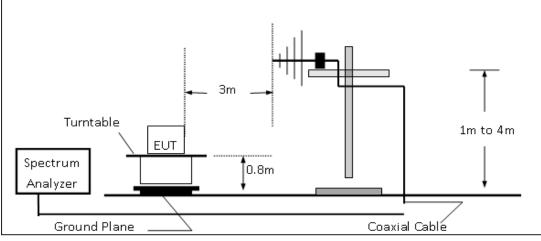


10.3 Test SET-UP

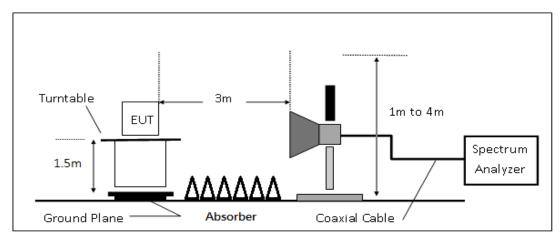
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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10.4 Measurement Procedure

Radiated Emission

- 1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. Use the follow spectrum analyzer setting:
 - (1) Span = wide enough to fully capture the emission being measured
 - (2) RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz, VBW \ge RBW, Sweep = auto, Detector function = peak, Trace = max hold
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c)

Duty Cycle = On time/100 milliseconds

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

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

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

- 6. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 8. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 9. Repeat above procedures until all frequency of the interest measured were complete.

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10.5 Field Strength Calculation

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

FS = RA + AF + CL - AG

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

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

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

Factor(dB) = Antenna Factor(dB μ 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.

10.6 Test Results of Radiated Spurious Emissions form 9 KHz to 30 MHz

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

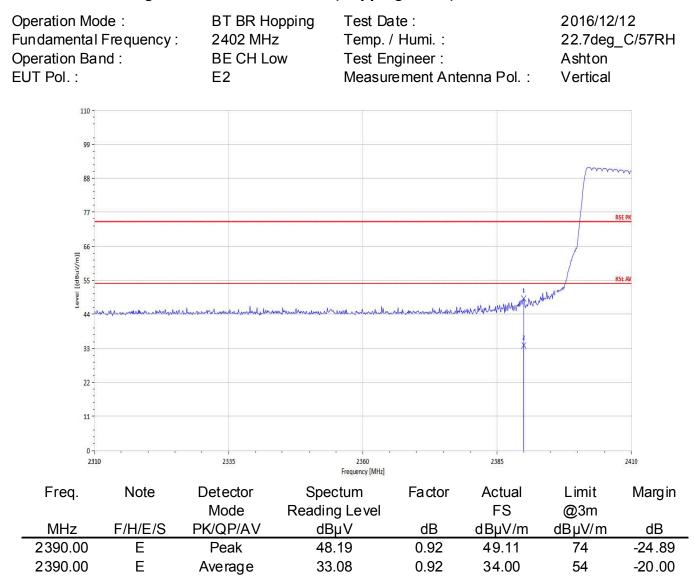
10.7 Measurement Result

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

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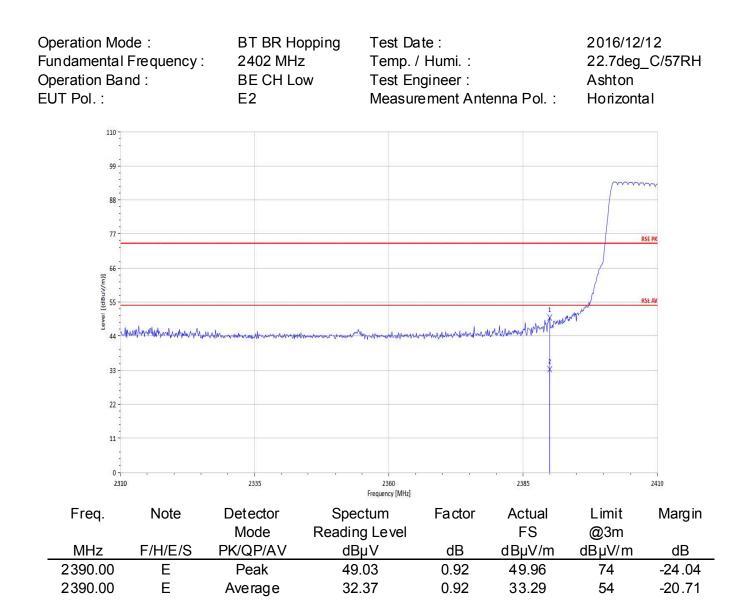
Radiated Band Edge Measurement Result: (Hopping Mode)



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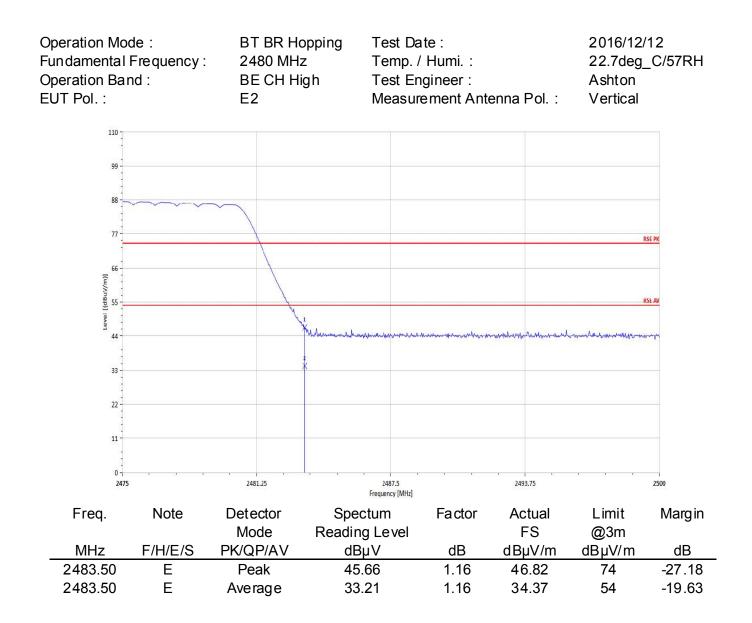
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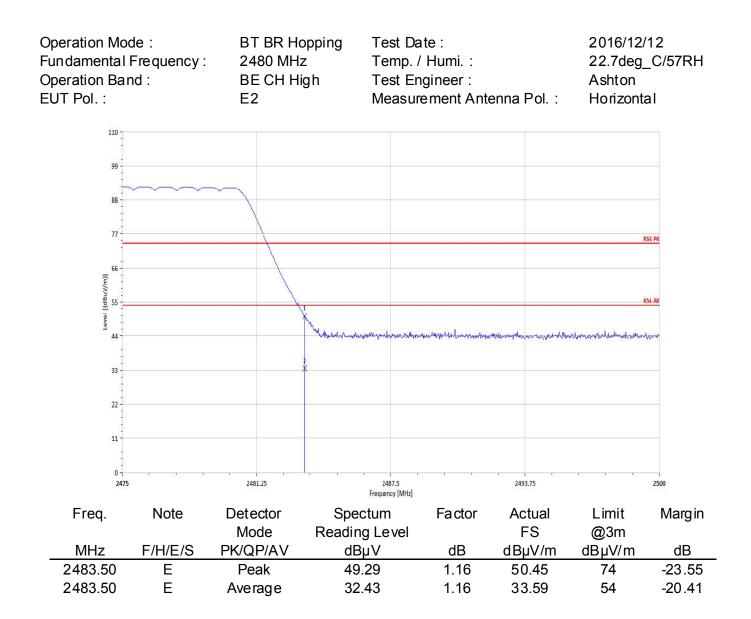
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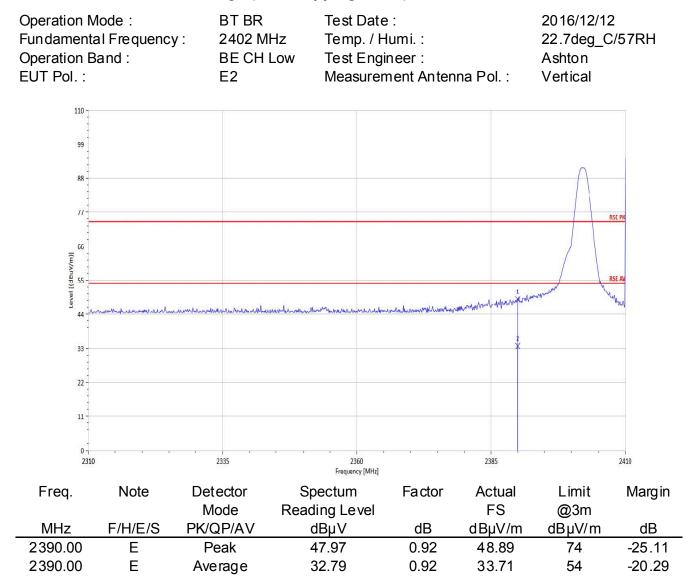




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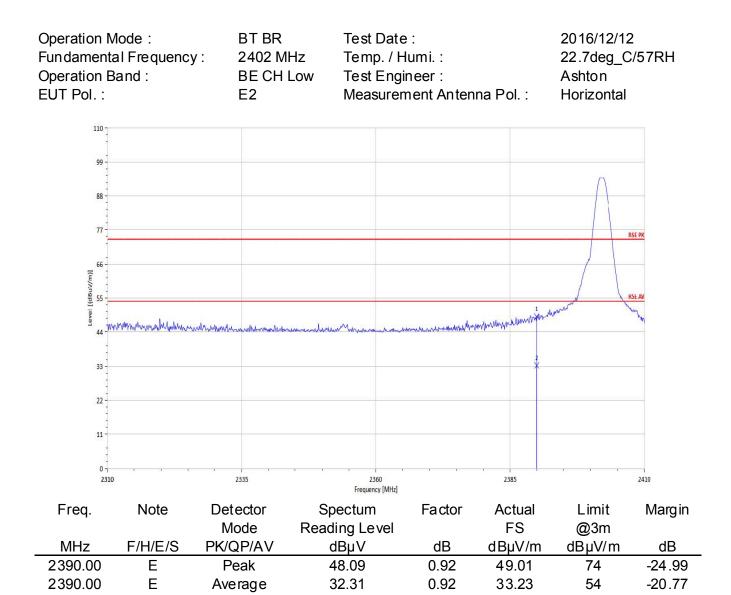
Radiated Emission – Band Edge (Non-Hopping Mode):



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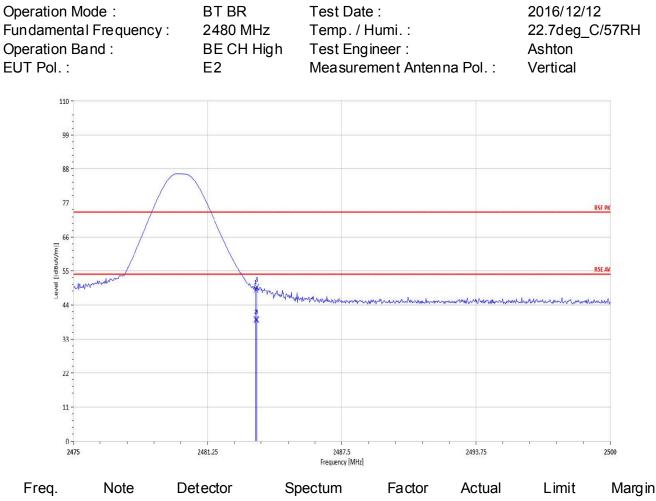
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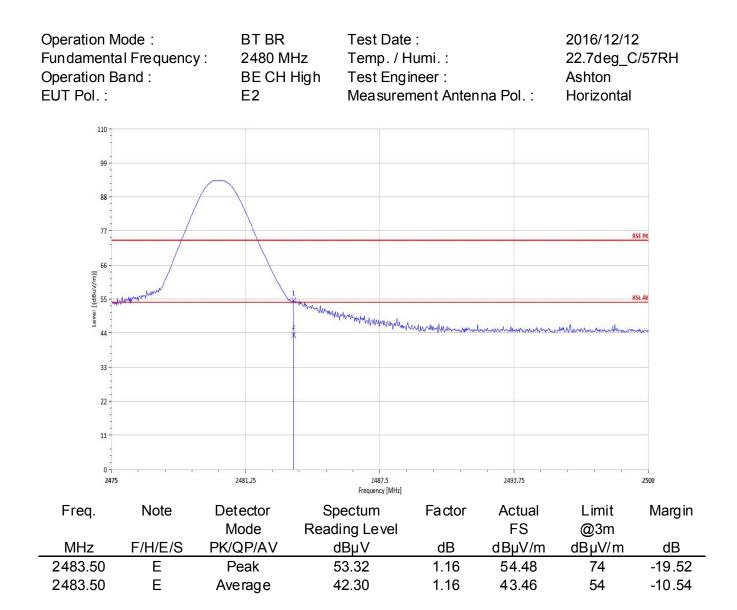




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			Mode	Reading Level		FS	@3m		
_	MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
	2483.50	E	Peak	47.76	1.16	48.92	74	-25.08	
	2483.50	E	Average	38.17	1.16	39.33	54	-14.67	
	2483.55	S	Peak	48.61	1.16	49.77	74	-24.23	
	2483.55	S	Average	38.08	1.16	39.24	54	-14.76	

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Radiated Spurious Emission Measurement Result:

For Frequency form 30MHz to 1000MHz

S

S

S

S

S

191.99

312.27

408.30

504.33

747.80

Fu Op	eration I ndamen eration I IT Pol. :	tal Frequen	BT BF cy: 2402 Tx CF E2	MHz	Test Date Temp. / H Test Engi Measurem	umi. :	na Pol. :	2016/12/12 22.7deg_C Ashton Vertical	
90									
20									RSE QP
40 40 30		2 X	3 ×	4	5		6 ×]
20 10									
30			272.5		515 Frequency [MHz]	757.		1000
F	Freq.	Note	Detector	-	ectum	Factor	Actual	Limit	Margin
1	MHz	F/H/E/S	Mode PK/QP/AV		ng Level BµV	dB	FS dBµV/m	@3m dBµV/m	dB
	8.73	S	Peak		3.70	-12.04	31.66	40	-8.34

48.95

43.77

36.83

40.76

35.59

Peak

Peak

Peak

Peak

Peak

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-18.13

-12.52

-9.25

-7.86

-4.16

30.83

31.25

27.58

32.90

31.43

43.5

46

46

46

46

-12.67

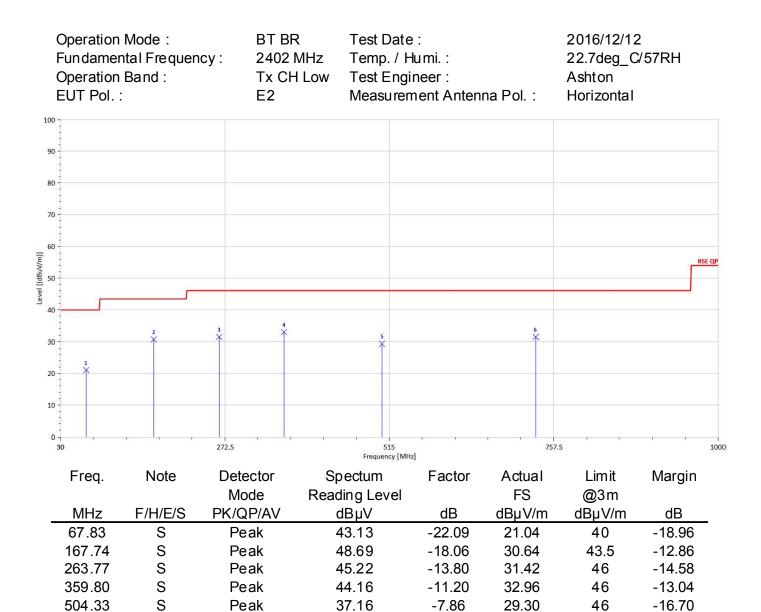
-14.75

-18.42

-13.10

-14.57





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Peak

S

731.31

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36.09

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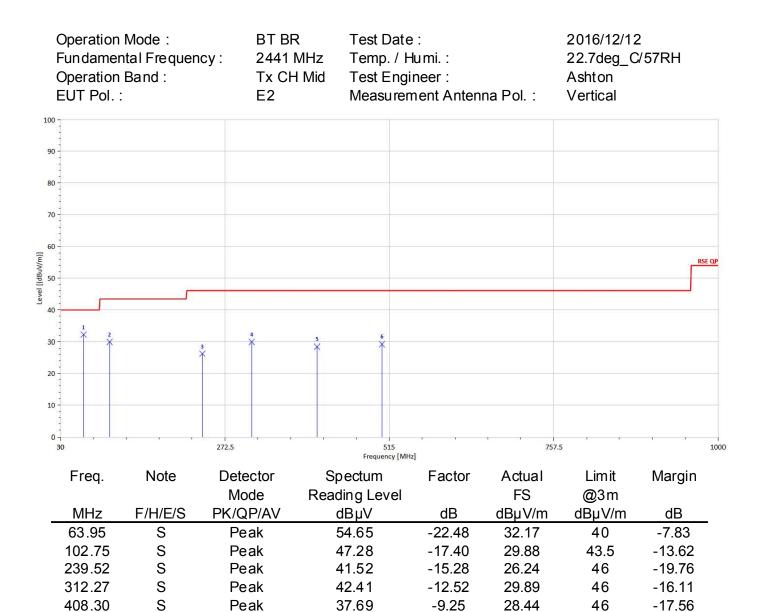
-4.67

31.42

-14.58

46





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Peak

S

504.33

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37.05

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-7.86

-16.81

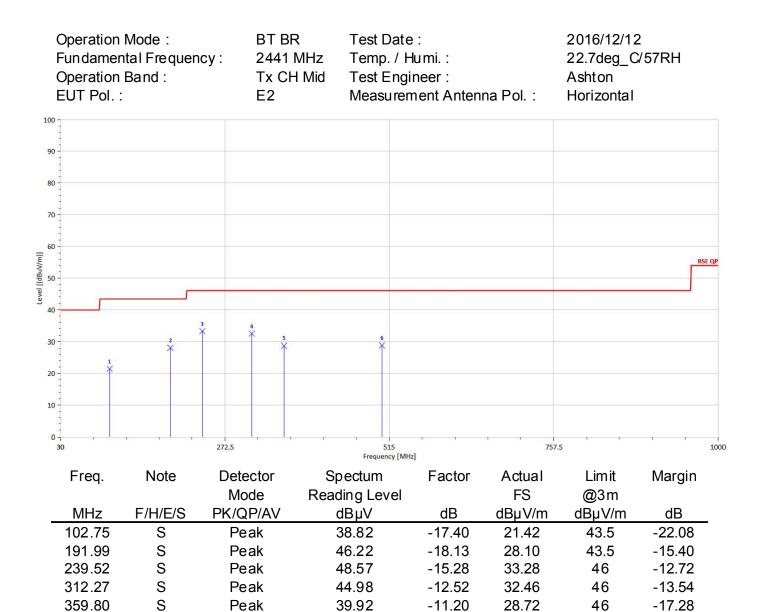
46

29.19



504.33

S



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Peak

Peak

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39.92

36.67

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-11.20

-7.86

28.72

28.82

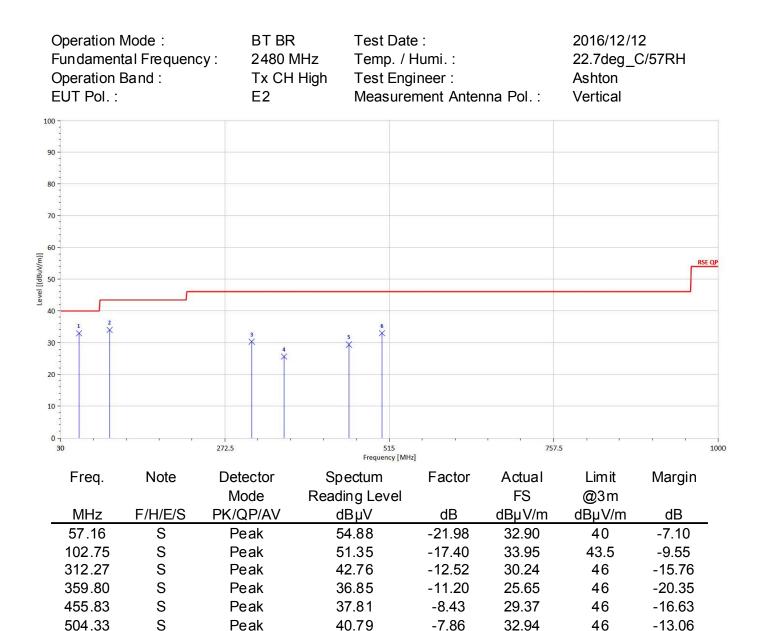
-17.28

-17.18

46

46

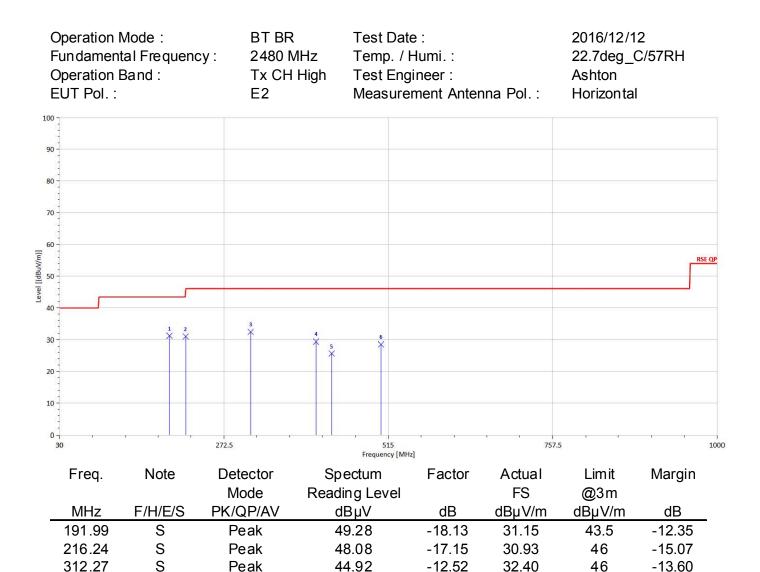




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35.04

36.38

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Peak

Peak

Peak

S

S

S

408.30

431.58

504.33

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-9.25

-9.39

-7.86

29.36

25.64

28.53

46

46

46

-16.64

-20.36

-17.47



Radiated Spurious Emission Measurement Result:

For Frequency above 1 GHz

12010.00

14412.00

14412.00

Н

Н

Н

•		BT BR cy : 2402 M Tx CH E2	1Hz Ten Low Tes	t Date : np. / Hu t Engine asureme			2016/12/12 22.7deg_C/ Ashton Vertical	57RH
100 -								
90 -								
-								
80 -								
-								RSE PK
70 -								
60 -				9				
Level [[dBuV/m]]		3	7 X					RSE AV
89) 50 -	ĩ		8	10				
a : 40 -	Ť	* *	*					
	*							
30 -								
-								
20 -								
10 -								
-								
1000		7375	Free	13750 quency [MHz]		20125	E E	26500
Freq.	Note	Detector	Spectu	um	Factor	Actual	Limit	Margin
•		Mode	Reading	Level		FS	@3m	-
MHz	F/H/E/S	PK/QP/AV	dBµ\	/	dB	dBµV/m	dBµV/m	dB
4804.00	Н	Peak	35.8	0	7.66	43.46	74	-30.54
4804.00		Average	27.6		7.66	35.33	54	-18.67
7206.00		Peak	36.0	7	14.95	51.02	74	-22.98
7206.00		Average	27.4		14.95	42.41	54	-11.59
9608.00		Peak	35.8		19.11	55.00	74	-19.00
9608.00		Average	25.2		19.11	44.34	54	-9.66
12010.00) Н	Peak	34.9	6	20.27	55.23	74	-18.77

Average

Peak

Average

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24.49

33.43

23.11

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20.27

25.25

25.25

44.76

58.68

48.36

-9.24

-15.32

-5.64

54

74

54



Fundar	ion Mode: nental Frequ ion Band: ol.:	uency :	BT BF 2402 Tx CH E2	MHz	Test Da Temp. / Test En Measur	Hum		a Pol. :	22 A	016/12/12 2.7deg_C/ shton orizontal	57RH
100 -											
90 -											
80											
-											RSE PK
70 -											
60 - 		3	5	;	7 Y	9 X					
Level [(dBuV/m)]	Į.	Ť	*		\$ *	10 ×					RSE AV
	2	×	×								
40	Î										
30 -											
20 -											
20											
10 -											
0		_,							_	- I. I.	
1000		7375			13750 Frequency			2	0125		26500
Freq.	. Not	e [Detector		pectum		Factor	Actua	I	Limit	Margin
			Mode		ding Lev	el		FS		@3m	
MHz		S P	K/QP/AV		dBµV		dB	dBµV/r	n	dBµV/m	dB
4804.0			Peak		40.65		7.66	48.31		74	-25.69
4804.0		ŀ	Verage		33.51		7.66	41.17		54	-12.83
7206.0			Peak		39.64		14.95	54.59		74 54	-19.41
7206.0		F	Verage		31.21		14.95	46.16		54	-7.84
9608.0			Peak		35.01		19.11	54.12		74	-19.88
9608.0		ŀ	Verage		25.73		19.11	44.84		54	-9.16
12010.0			Peak		38.96		20.27	59.23		74 54	-14.77
12010.0		F	Average		29.18		20.27	49.45		54	-4.55
14412.0 14412.0		,	Peak		33.75 24.47		25.25 25.25	59.00 49.72		74 54	-15.00 -4.28
14412.0	оо п	F	Verage		24.47		20.20	49.72		54	-4.20

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Н

Operation E EUT Pol. :	al Frequenc	BT BR 2441 M Tx CH E2	Mid Test E	./Hur Engine			2016/12/12 22.7deg_C/ Ashton Vertical	57RH
100								
90 -								
80 -								RSE PK
70 -								
60 - E		5	×	×				RSE AV
Level [(dBu//m])		× ×	8	10 ×				RSE AV
	×	* *	×	22235				
40 -	2							
30 -	1							
20 -								
10 -								
0		7375		3750		20125		26500
			Frequer	ncy [MHz]				
Freq.	Note	Detector	Spectun		Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode PK/QP/AV	Reading Le dBµV	evel	dB	FS dBµV/m	@3m dBµV/m	dB
4882.00	<u> </u>	Peak	<u>авру</u> 35.64		7.70	43.34	<u>ивµ v/ш</u> 74	-30.66
4882.00	Н	Average	25.26		7.70	32.96	54	-21.04
7323.00	Н	Peak	36.57		14.79	51.36	74	-22.64
7323.00	Н	Average	28.39		14.79	43.18	54	-10.82
9764.00	Н	Peak	35.35		18.83	54.18	74	-19.82
9764.00	Н	Average	25.50		18.83	44.33	54	-9.67
12205.00	Н	Peak	36.32		20.92	57.24	74	-16.76
12205.00	Н	Average	25.14		20.92	46.06	54	-7.94
14646.00	Н	Peak	35.13		25.63	60.76	74	-13.24

Average

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23.53

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25.63

49.16

54

-4.84



Н

Operation I EUT Pol. :	tal Frequenc	BT BR 2441 M Tx CH E2	lHz Te Mid Te	est Date : emp. / Hu est Engine easureme			2016/12/12 22.7deg_C/ Ashton Horizontal	57RH
90								
80								
			14 14 14					RSE PK
70 -			7	9				
e0 -		a 5	×	9 ×				
Level [(dBu//m])	1	3 ×	×	10 ×				RSE AV
evel [((Ť	* *						
40	*							
30 -								
20 -								
10 -								
0		7375		13750		20125	1. 1	26500
F ire a	Niete	Detector	C a a	Frequency [MHz]	Fastar	A stual	L ine if	Manain
Freq.	Note	Detector Mode		ctum g Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV		μV	dB	dBµV/m	dBµV/m	dB
4882.00	H	Peak		.84	7.70	47.54	74	-26.46
4882.00	Н	Average	32	.28	7.70	39.98	54	-14.02
7323.00	Н	Peak	39	.32	14.79	54.11	74	-19.89
7323.00	Н	Average	31	.40	14.79	46.19	54	-7.81
9764.00	Н	Peak	37	.08	18.83	55.91	74	-18.09
9764.00	Н	Average		.13	18.83	46.96	54	-7.04
12205.00	Н	Peak		.96	20.92	61.88	74	-12.12
12205.00	Н	Average		.50	20.92	51.42	54	-2.58
14646.00	Н	Peak	35	.81	25.63	61.44	74	-12.56

Average

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25.63

50.53

54

-3.47



Н

Operation M Fundamenta Operation B EUT Pol. :	al Frequency	BT BR 2480 M Tx CH F E2		Test Date Temp. / H Test Engi Measuren	umi. :	na Pol. :	2016/12/12 22.7deg_C/ Ashton Vertical	
100								
90 -								
80 -								
70 -								RSE PK
				_	9			
60 - [[3		×				RSE AV
Level [(dBuV/m)]		× î		8) X	0 K			
	1	* *						
40 -	Ĵ							
30 -	*							
20 -								
10 -								
0								
1000		7375	I	13750 Frequency [MHz]	· · ·	20125		26500
Freq.	Note	Detector	S	pectum	Factor	Actual	Limit	Margin
		Mode		ding Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV		dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Н	Peak		33.16	7.69	40.85	74	-33.15
4960.00	Н	Average		24.30	7.69	31.99	54	-22.01
7440.00	Н	Peak		36.81	15.43	52.24	74	-21.76
7440.00	Н	Average		28.28	15.43	43.71	54	-10.29
9920.00	Н	Peak		35.56	18.74	54.30	74	-19.70
9920.00	Н	Average		25.51	18.74	44.25	54	-9.75
12400.00	Н	Peak		35.10	22.32	57.43	74	-16.57
12400.00	Н	Average		25.53	22.32	47.85	54	-6.15
14880.00	Н	Peak		35.77	25.44	61.21	74	-12.79

Average

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24.13

25.44

49.57

54

-4.43



Н

Operation M Fundamenta Operation B EUT Pol. :	al Frequency	BT BR 2480 M Tx CH F E2		Test Date Temp. / He Test Engir Measurem	umi. : neer :	na Pol. :	2016/12/12 22.7deg_C/ Ashton Horizontal	
100 -								
90 -								
]								
80								
70 -								RSE PK
1				7 9				
60 -		5		X X				
[(m//mg/)		* 1		* 19 * X				RSE AV
ep] 50 -	1 *	* *						
ے لیے 40 -	2							
30 -								
20 -								
10 -								
0 - 1000		7375	I	13750 Frequency [MHz]	. , ,	20125	r r	26500
Freq.	Note	Detector	Sp	ectum	Factor	Actual	Limit	Margin
		Mode	•	ling Level		FS	@3m	0
MHz	F/H/E/S	PK/QP/AV		dΒμV	dB	dBµV/m	dBµV/m	dB
4960.00	Н	Peak	3	37.87	7.69	45.56	74	-28.44
4960.00	Н	Average	3	30.10	7.69	37.79	54	-16.21
7440.00	Н	Peak		38.87	15.43	54.30	74	-19.70
7440.00	Н	Average		31.05	15.43	46.48	54	-7.52
9920.00	Н	Peak		38.14	18.74	56.88	74	-17.12
9920.00	Н	Average		29.15	18.74	47.89	54	-6.11
12400.00	Н	Peak		40.39	22.32	62.71	74	-11.29
12400.00	Н	Average		31.23	22.32	53.55	54	-0.45
14880.00	Н	Peak	3	37.17	25.44	62.61	74	-11.39

Average

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25.44

51.70

54

-2.30



11 FREQUENCY SEPARATION

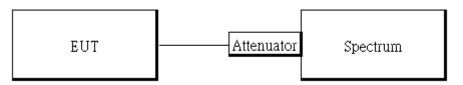
11.1 Standard Applicable

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

11.2 Measurement Equipment Used

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017			
DC Block	PASTERNACK	PE8210	RF29	12/11/2015	12/10/2016			
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/11/2015	12/10/2016			
Attenuator	WOKEN	218FS-10	RF23	12/11/2015	12/10/2016			

11.3 Test Set-up



11.4 Measurement Procedure

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

Weif S date was stated the results stated the results state to the state of the s 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 cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law

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11.5 Measurement Result

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

Frequency Separation Test Data



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12 NUMBER OF HOPPING FREQUENCY

12.1 Standard Applicable

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

12.2 Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
ТҮРЕ		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017			
DC Block	PASTERNACK	PE8210	RF29	12/11/2015	12/10/2016			
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/11/2015	12/10/2016			
Attenuator	WOKEN	218FS-10	RF23	12/11/2015	12/10/2016			

12.3 Test Set-up



12.4 Measurement Procedure

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

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12.5 Measurement Result

Tabular Data of Total Channel Number

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

Channel Number

2.4 GHz - 2.441 GHz

Keysight Spectrum Analyzer - Swept SA				
RL RF 50 0 DC		Avg Type: Log-Pwr	11:06:12 AM Dec 07, 2016 TRACE 1 2 3 4 5 6 TYPE	Frequency
Ref Offset 4.8 dB	PN0: Fast Trig: Free Run IFGain:Low #Atten: 30 dB	Mkr1	2.402 000 GHz 0.67 dBm	Auto Tune
10.0				Center Free 2.420500000 GHz
0.00		mm		Start Free 2.400000000 GH:
20.0				Stop Free 2.441000000 GH
40.0				CF Ste 4.100000 MH <u>Auto</u> Ma
50.0				Freq Offse 0 H
Start 2.40000 GHz Res BW 430 kHz	#VBW 1.5 MHz	Sweep 1	Stop 2.44100 GHz .000 ms (1001 pts)	
90				

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2.441GHz - 2.4835GHz

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TIME OF OCCUPANCY (DWELL TIME) 13

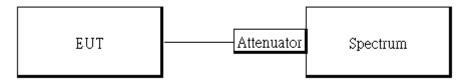
13.1 Standard Applicable

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

13.2 Measurement Equipment Used

Conducted Emission Test Site							
EQUIPMENT	MFR MODEL SERIAL LA			LAST	CAL DUE.		
ТҮРЕ		NUMBER	NUMBER	CAL.			
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017		
DC Block	PASTERNACK	PE8210	RF29	12/11/2015	12/10/2016		
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/11/2015	12/10/2016		
Attenuator	WOKEN	218FS-10	RF23	12/11/2015	12/10/2016		

13.3 Test Set-up



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13.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~8ms.

6. Repeat above procedures until all frequency of the interest measured were complete.

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

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

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

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

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

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13.5 Tabular Result of the Measurement

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	DH1	134.40	400ms
0	DH3	265.44	400ms
	DH5	306.77	400ms
	DH1	133.76	400ms
39	DH3	266.08	400ms
	DH5	308.16	400ms
	DH1	133.76	400ms
78	DH3	264.64	400ms
	DH5	308.16	400ms

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

GFSK (1Mbps):

CH Low	DH1 time slot = DH3 time slot = DH5 time slot =	1.659 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 = 31.6 = 31.6 =	265.44 (ms)
CH Mid	DH1 time slot = DH3 time slot = DH5 time slot =	1.663 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 = 31.6 = 31.6 =	()
CH High	DH1 time slot = DH3 time slot = DH5 time slot =	1.654 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 = 31.6 = 31.6 =	133.76 (ms) 264.64 (ms) 308.16 (ms)

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GFSK (1Mbps) for AFH Mode					
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)		
20	DH5	154.08	400ms		

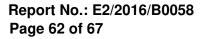
GFSK (1Mbps):

2.889 (ms) * (800/6/20)*8 = 154.08 (ms) DH5 time sl =

13.6 Measurement Result

Note: Refer to next page for plots.

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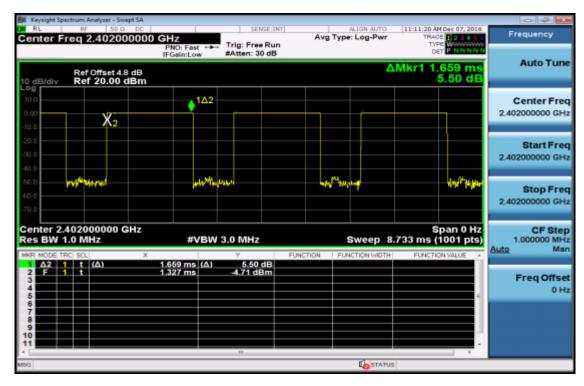




CH-Low DH1

Keysight Spectrum Analyzer - Swept SA			
Center Freg 2,402000000	GHz		123456 Frequency
Ref Offset 4.8 dB	PN0: Fast Trig: Free Run IFGain:Low #Atten: 30 dB		9.9 µs 53 dB
			Center Freq 2.402000000 GHz
-20.0			Start Freq 2.402000000 GHz
-50.0 444 - 4444	riged lands and lands	uld hope many and	Stop Freq 2.402000000 GHz
Center 2.402000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sp. Sweep 4.467 ms (10 FUNCTION FUNCTION WOTH FUNCTION	Auto Man
Δ2 1 t (Δ) 2 F 1 t 3 - - - 4 - - - 5 - - -	419.9 μs (Δ) 4.53 dB 156.3 μs -3.74 dBm		Freq Offset
7 8 9 10 11			
4 MSG	17	I ostatus	,

DH3



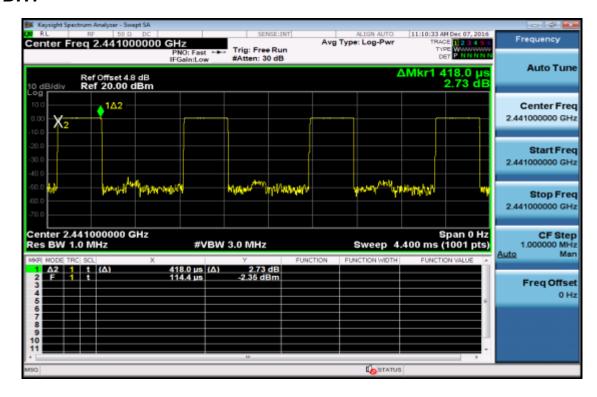
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DH5

	ectrum Analyzer - Swept SA						
Center Fi	reg 2.40200000	0 GHz	SENSE:IN	Avg Typ	e: Log-Pwr	10:59:56 AM Dec 07, 2016 TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 4.8 dB Ref 20.00 dBm	PN0: Fast IFGain:Low	#Atten: 30 dB		Δ	Mkr1 2.876 ms -0.02 dB	Auto Tune
10.0 0.00 -10.0		2	1∆2				Center Freq 2.402000000 GHz
-20.0 -30.0 -40.0							Start Free 2.402000000 GHz
-60.0 -60.0 -70.0	ht of		hand		- Laterard		Stop Free 2.402000000 GHz
Center 2. Res BW 1			/ 3.0 MHz		Sweep 13	Span 0 Hz 3.13 ms (1001 pts)	CF Step 1.000000 MH: Auto Mar
	1 t (Δ)	2.876 ms (Δ) 2.955 ms	-0.02 dB 0.79 dBm			-	Freq Offse 0 Hi
0 7 8 9 10 11						-	
MSG					STATUS	•	

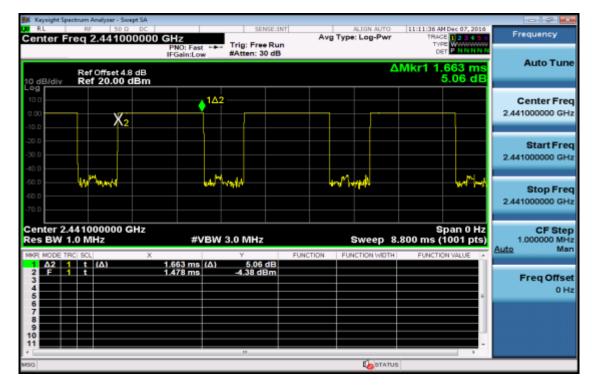
CH-Mid DH1



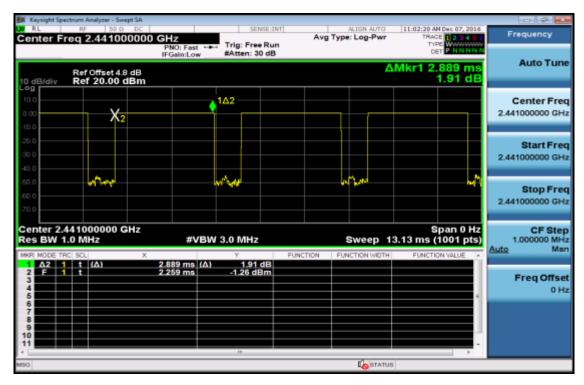
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DH3



DH5

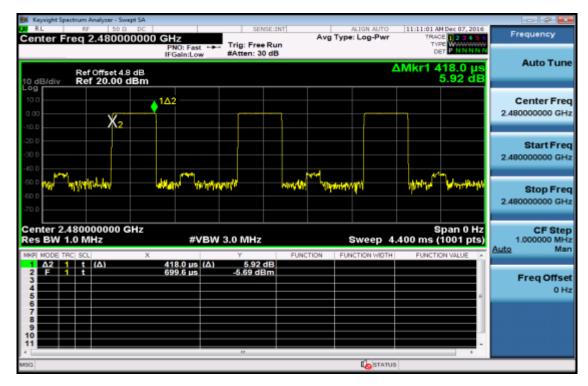


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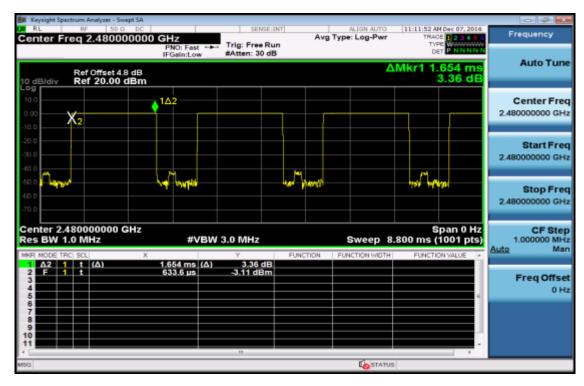
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CH-High DH1



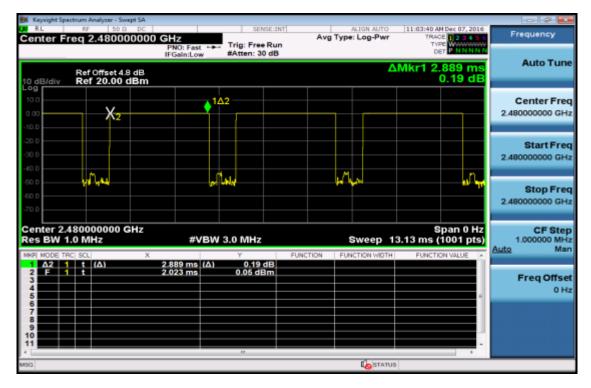
DH3



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

14.2 Antenna Connected Construction

An embedded-in antenna design is used.

Please see EUT photo and antenna spec. for details.

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

~ End of Report ~

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