

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND RSS 247 REQUIREMENT

	OF
Product Name:	BTF6
Brand Name:	Supertooth, Interphone
Model No.:	BTF6
Model Difference:	N/A
FCC ID:	2AE5MBTF6
IC:	20468-BTF6
Report No.:	ER/2016/30020
Issue Date:	Apr. 08, 2016
FCC Rule Part:	§15.247, Cat: DSS
IC Rule:	RSS-247 issue 1 May 2015
Prepared for: Prepared by:	Euro-CB (Phils.) Inc. SFB No 2, MEZ 1, Lapu Lapu City, 6015 Cebu, Philippines SGS Taiwan Ltd.
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VERIFICATION OF COMPLIANCE

Applicant: Product Name:	Euro-CB (Phils.) Inc. SFB No 2, MEZ 1, Lapu Lapu City, 6015 Cebu, Philippines BTF6
Flouuct Name.	DIFU
Brand Name:	Supertooth, Interphone
Model No.:	BTF6
Model Difference:	N/A
FCC ID:	2AE5MBTF6
IC :	20468-BTF6
Report Number:	ER/2016/30020
Date of test:	Mar. 10, 2016 ~ Apr. 01, 2015
Date of EUT Received:	Mar. 10, 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:	Jay Lin	Date:	Apr. 08, 2016
Prepared By:	Jay Lin/Sr. Engineer Allon Tsai	Date:	Apr. 08, 2016
Approved By: _	Allen Tsai / Engineer Jim Chang Jim Chang / Asst. Manager	Date:	Apr. 08, 2016

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Revision History

Report Number	Revision	Description	Issue Date
ER/2016/30020 Rev.00		Initial creation of document	Apr. 08, 2016

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GENERAL INFORMATION 1

1.1 Product description

General:

Product Name:	BTF6		
Brand Name:	Supertoot	h, Interphone	
Model No.:	BTF6		
Model Difference:	N/A		
Product SW/HW version:	R1/V1		
Radio SW/HW version:	N/A / N/A		
Test SW Version:	N/A		
RF power setting in TEST SW:	N/A		
	3.7Vdc from lithium polymer battery.		
Power Supply:	Battery:	Model No.: 922543P; Supplier: Shenzhen BAK Technology Co., Ltd.	

Bluetooth_BR+EDR:

Bluetooth Version:	V4.2 Dual mode + BR
Channel number:	79 channels
Modulation type:	GFSK
Transmit Power:	16.32 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	PCB Printed Antenna, Gain: 2.5 dBi

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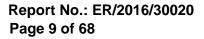
1.2 Product Feature of Equipment Under Test

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

Product Feature		
Product Name: BTF6		
Brand Name: Supertooth, Interphone		
Model No.: BTF6		
Model Difference:	N/A	
FCC ID: 2AE5MBTF6		
IC: 20468-BTF6		
Bluetooth Version V4.2 Dual mode + BR		

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

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1.3 Test Methodology of Applied Standards

Canada RSS-247 issue 1: 2015

RSS-Gen Issue 4:2014

FCC Part 15, Subpart C §15.247

FCC Public Notice DA 00-705 Measurement Guidelines

ANSI C63.10:2013

Note:

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

1.4 Test Facility

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

FCC Registration Numbers are: 990257

Canada Registration Number: 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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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground 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 (1dB) + Attenuator (10dB) =11dB.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration



Fig. 2-2 Conducted (Antenna Port) Configuration

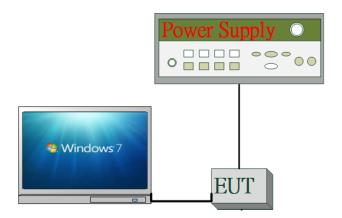


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Data Cable	Power Cord
1	Bluetooth Test Software	N/A	N/A	N/A	N/A
2.	Notebook	DELL	D505	Shielded	Un-shielded
3.	DC Power Supply	HP	E3640A	N/A	Un-shielded

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SUMMARY OF TEST RESULTS 3

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	N/A
§15.247(b)(1)	RSS-247 §5.4 (2)	Peak Output Power	Compliant
§15.247(a)(1)	RSS-247 §5.1 (1) RSS-Gen §6.6	20dB & 99% Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	RSS-247 §5.1 (2)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Time of Occupancy	Compliant
§15.203 §15.247(b)	RSS- Gen §8.3	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

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

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE	TESTED	MODULATION	PACKET	
NODE	CHANNEL	CHANNEL	MODULATION	TYPE	
Bluetooth	0 to 78	0,39,78	GFSK	DH5	
	RAI	DIATED EMISSIC	ON TEST (ABOVE 1	GHz)	
MODE	AVAILABLE	TESTED	MODULATION	PACKET	
NODE	CHANNEL	CHANNEL	MODULATION	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 BR+EDR 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				
	CHANNEL	CHANNEL		TYPE				
Bluetooth	0 to 78	0,39,78	GFSK	DH5				
	Band Edge							
Bluetooth	0 to 78	0,78	GFSK	DH5				
		Frequen	cy Separation					
Bluetooth	0 to 78	0,1,2	GFSK	DH5				
		Number of h	opping 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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EASUREMENT 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)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

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

This uncertainty represents an expanded uncertainty expressed at approximately the

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

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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	EQUIPMENT MFR MODEL SERIAL LAST CAL D							
TYPE		NUMBER	NUMBER	CAL.				
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016			
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/15/2015	05/14/2016			
LISN	FCC	FCC-LISN-50/250-25 -2-01	4034	03/13/2016	03/12/2017			
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2015	11/25/2016			

6.3 EUT Setup

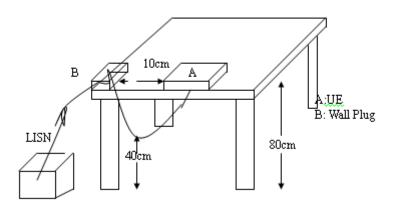
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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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

N/A, This device is powered by battery.

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7 PEAK OUTPUT POWER MEASUREMENT

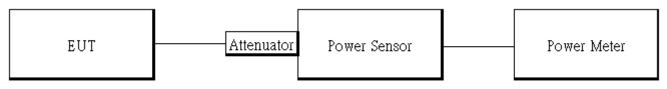
7.1 Standard Applicable

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

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016			
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016			
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2016	01/27/2017			
Coaxial Cable	Huber Suhner	SUCOFLEX 102EPA	MY2616/2	01/02/2016	01/01/2017			
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017			
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017			

7.2 Measurement Equipment Used

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):

Channel	Frequency (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402.00	15.14	32.659	1000
39	2441.00	16.18	41.495	1000
78	2480.00	16.32	42.855	1000

1M BR mode (Average):

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402.00	13.74	23.659	1000
39	2441.00	14.72	29.648	1000
78	2480.00	15.03	31.842	1000

NOTE: cable loss as 11dB that offsets in the spectrum

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20dB & 99%BANDWIDTH MEASUREMENT 8

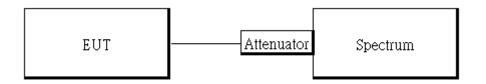
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Conducted Emission Test Site						
EQUIPMENT MFR MODEL SERIAL LAST CAL DUE						
TYPE		NUMBER	NUMBER	CAL.		
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016	
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017	
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017	

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.
- 4. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 5. For 99% Bandwidth: Set the spectrum analyzer as RBW=1%, VBW=3*RBW, Span = 2MHz, Detector=Sample, Sweep=auto.
- 6. Mark the peak frequency and -20dB (upper and lower) frequency
- 7. Repeat above procedures until all test default channel is completed

NOTE:

cable loss as 11dB that offsets in the spectrum

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8.5 Measurement Result

GFSK			GFSK		
Channel	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)	Cł	1	99% Bandwidth (MHz)
Low	0.9234	0.62	Lo	w	0.85539
Mid	0.9222	0.61	Mi	d	0.85274
High	0.921	0.61	Hig	h	0.86117

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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99% Band Width Test Data CH-Low (GFSK mode)



99% Band Width Test Data CH-Mid (GFSK mode)



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99% Band Width Test Data CH-High (GFSK mode)



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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION

MEASUREMENT

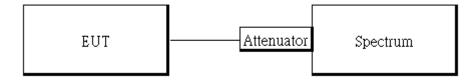
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

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.
- 6. 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.

- 1. Cable loss as 11dB that offsets in the spectrum
- 2. The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

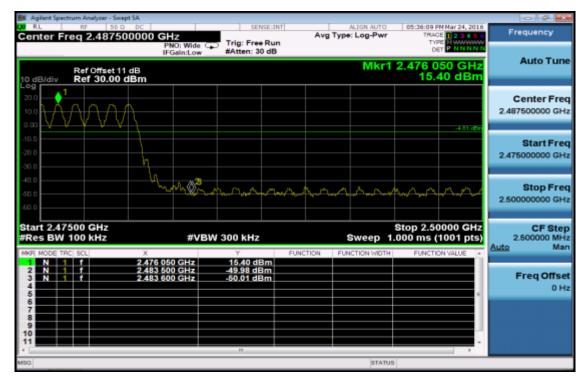
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Band Edges Test Data CH-Low (Hopping mode)

M Agilent Spectrum Analyzer - Swept SA				
Center Freq 2.365000000	GHz SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:35:40 PM Mar 24, 2016 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 11 dB	PNO: Fast Trig: Free Run IFGain:Low #Atten: 30 dB	Mkr	1 2.413 29 GHz 15.73 dBm	Auto Tune
20.0 10.0 0.00			, MANUAL AND A STATE OF A STATE O	Center Freq 2.365000000 GHz
-10.0				Start Freq 2.310000000 GHz
-40.0 (50.0 (60.0	หญิติกฏิภูมิที่มีหลายสารเป็นหมู่มีหลายการ	4	ý ²	Stop Freq 2.420000000 GHz
Start 2.31000 GHz #Res BW 100 kHz			Stop 2.42000 GHz .000 ms (1001 pts) FUNCTION VALUE	CF Step 11.000000 MHz Auto Man
2 N 1 f 2.39	3 29 GHz 15.73 dBm 99 90 GHz -47.66 dBm 10 00 GHz -60.72 dBm			Freq Offset 0 Hz
7 8 9 10 11 11				
MSG		STATUS	3	

Band Edges Test Data CH-High

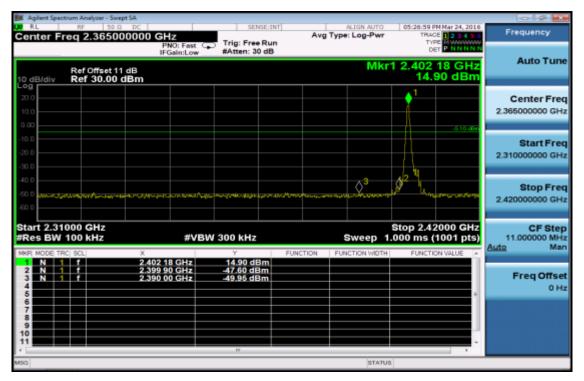


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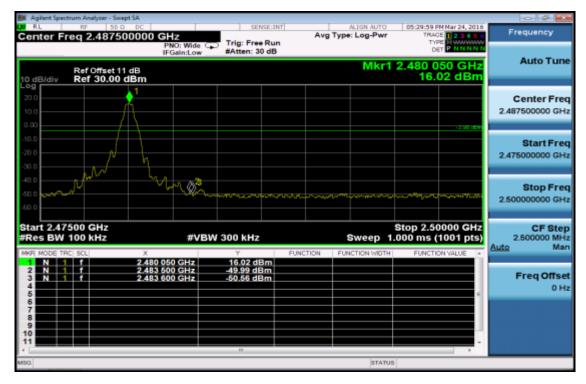
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Band Edges Test Data CH-Low (Non-Hopping mode)

Band Edges Test Data CH-High



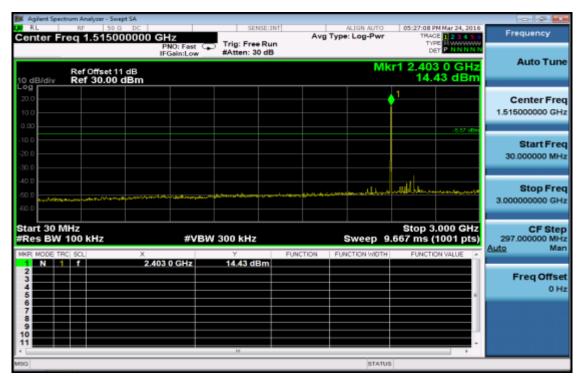
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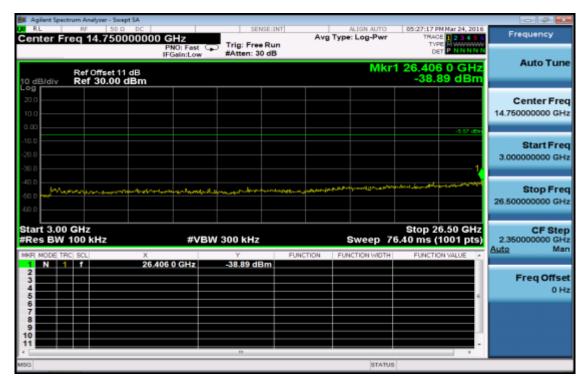
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Conducted Spurious Emission Measurement Result Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz



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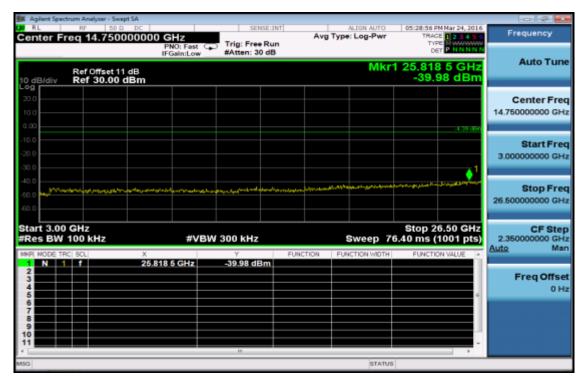
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Ch Mid 30MHz – 3GHz

Agilent Spectrum Analyzer - Swept SA					
Center Freq 1.515000000	GHz		ALIGN AUTO Avg Type: Log-Pwr	05:28:46 PM Nar 24, 2016 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 11 dB	PNO: East () Trig	g: Free Run ten: 30 dB	Mk	r1 2.441 6 GHz 15.61 dBm	Auto Tune
20.0 10.0				↑1	Center Free 1.51500000 GHz
-10.0					Start Free 30.000000 MHz
-40.0 -50.0 -60.0	ىرىلۇنلەر ^{يىلى} تەروپىلىرىدىنى بەر يەر يەر يەر يەر يەر يەر يەر يەر يەر ي	and a second			Stop Free 3.000000000 GH2
Start 30 MHz #Res BW 100 kHz MKR MODE TRC SCL X	#VBW 300	kHz FUNCTIO	-	Stop 3.000 GHz 667 ms (1001 pts)	CF Step 297.000000 MHz <u>Auto</u> Mar
1 N 1 f 2, 2 3 4 5	141 6 GHz 15	61 dBm			Freq Offset 0 Hz
6 7 8 9 10					
4 MSG			STATUS	Þ	

Ch Mid 3GHz – 26.5GHz



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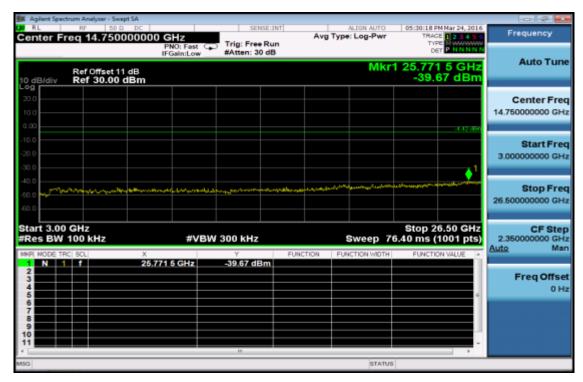
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Ch High 30MHz – 3GHz

	m Analyzer - Swept SA							
Center Free	q 1.5150000		SENSE:1N	Avg 1	ALIGN AUTO	TRACE	Mar 24, 2016	Frequency
10 dB/div	Ref Offset 11 dE Ref 30.00 dB	PNO: Fast G IFGain:Low	Trig: Free Run #Atten: 30 dB		Mk	r1 2.480	3 GHz 8 dBm	Auto Tune
20.0 10.0						↑ ¹	-4.42184	Center Free 1.51500000 GHz
-10.0 -20.0 -30.0								Start Free 30.000000 MHz
-40.0 -50.0 -60.0	an a lan an a	s page and an and a standard		-4		سألدووالد	ak-dyterator	Stop Free 3.000000000 GH
Start 30 MH #Res BW 10	00 kHz	#VB\ ×	V 300 kHz	FUNCTION	Sweep 9.	Stop 3. 667 ms (1		CF Step 297.000000 MH: Auto Mar
1 N 1 2 3 4 5 6 7 8 9 9		2,480 3 GHz	15.58 dBm	PONCTION	POINT HOM WHOTH	FUNCTIO	H VALUE	Freq Offset 0 Hz
11			17		STATUS		, .	

Ch High 3GHz – 26.5GHz



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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASURE-

MENT

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.
TYPE		NUMBER	NUMBER	CAL.	
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2016	01/27/2017
Loop Antenna	ETS.LINDGREN	6502	148045	09/07/2015	09/06/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn antenna	ETS.LINDGREN	3117	123995	05/05/2015	05/04/2016
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017
3m Site NSA	SGS	966 chamber	N/A	07/02/2015	07/01/2016
Low Loss Cable	Huber Suhner	966 TX	1	01/02/2016	01/01/2017

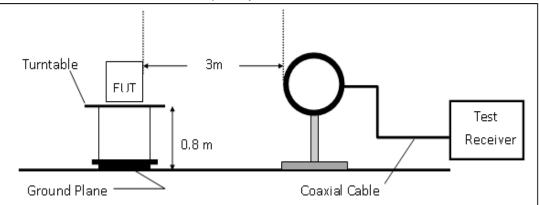
NOTE: N.C.R refers to Not Calibrated Required.

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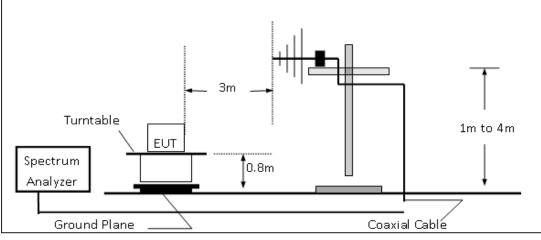


10.3 Test SET-UP

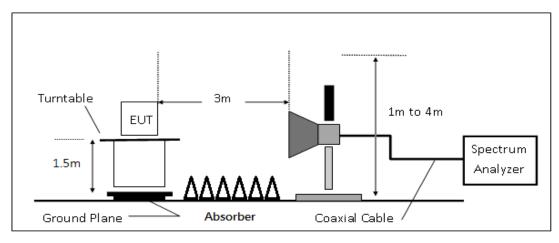
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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

Factor(dB) = Antenna Factor(dBµV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note :

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

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

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

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

10.7 Measurement Result

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

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Radiated Band Edge Measurement Result: (Hopping Mode)

Opera	tion Mode :		BR Hopping	Test Date	:	03/1	7/2016 19:46:28		
Fundamental Frequency:		iency :	2402 MHz	Temp. / H	umi. :	22 d	leg_C / 63 RH		
Opera	ition Band :		Bandedge CH	LOW Test Engi	neer:	Tin			
EUT F	Pol.:		E2 Plane	Measuren	nent Antenna	Pol. : VER	TICAL		
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin		
			Level	Reading Level		@ 3m			
	MHz	F/H/E/	S dBuV/m	dBuV	dB	dBuV/m	dB		
	2321.00	S	27.45	28.85	-1.40	54.00	-26.55		
	2321.00	S	48.49	49.89	-1.40	74.00	-25.51		
	2390.00	Н	26.84	28.58	-1.74	54.00	-27.16		
	2390.00	Н	40.76	42.51	-1.74	74.00	-33.24		
Opera	tion Mode :		BR Hopping	Test Date	:	03/1	7/2016 19:49:05		
Funda	amental Frequ	iency :	2402 MHz	Temp. / H	umi. :	22 d	03/17/2016 19:49:05 22 deg_C / 63 RH		
Opera	tion Band :		Bandedge CH	LOW Test Engi	neer:	Tin			
EUT F	Pol.:		E2 Plane	Measuren	nent Antenna	Pol. : HOF	RIZONTAL		
	_		<u> </u>		- (
	Freq.	Note		Spectrum	Factor	Limit	Margin		
			Level	Reading Level		@ 3m			
	MHz	F/H/E/	S dBuV/m	dBuV	dB	dBuV/m	dB		
	2320.20	S	27.69	29.09	-1.40	54.00	-26.31		
	2320.20	S	50.98	52.38	-1.40	74.00	-23.02		
	2390.00	Н	26.95	28.69	-1.74	54.00	-27.05		
	2390.00	Н	41.45	43.19	-1.74	74.00	-32.55		

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Operation Mode : Fundamental Frequency : Operation Band : EUT Pol. :		uency : 24 Ba	Hopping 80 MHz ndedge CH Plane	Test Date Temp. / Hu HIGH Test Engin Measurem	ımi. : eer :		17/2016 19:: deg_C / 63 F RTICAL			
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin			
			Level	Reading Level		@ 3m				
	MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB			
	2483.50	Н	26.71	28.33	-1.62	54.00	-27.29			
	2483.50	Н	49.95	51.57	-1.62	74.00	-24.05			
Operation Mode :		BR	Hopping	Test Date	:	03/1	7/2016 19:	53:44		
Funda	amental Frequ	uency: 24	80 MHz	Temp. / Hu	umi. :	22 c	leg_C / 63 F	۲H		
Opera	ation Band :	Ba	ndedge CH	HIGH Test Engin	eer:	Tin		Margin dB -27.29 -24.05 7/2016 19:53:44 eg_C / 63 RH		
EUT Pol. :		E2	Plane	Measurem	ent Antenna	a Pol.:HOF	RIZONTAL			
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin			
			Level	Reading Level		@ 3m				
	MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB			
	2483.50	Н	28.48	30.10	-1.62	54.00	-25.52			
	2483.50	Н	56.84	58.46	-1.62	74.00	-17.16			

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

Operation Mode : Fundamental Frequency : Operation Band : EUT Pol. :		uency: 2 E	BR(1M) 2402 MHz Bandedge CH E2 Plane	-	umi. :	22 d Tin	7/2016 19:22:59 leg_C / 63 RH RTICAL			
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin			
			Level	Reading Level		@ 3m				
	MHz	F/H/E/S	6 dBuV/m	dBuV	dB	dBuV/m	dB			
	2376.30	S	27.19	28.88	-1.69	54.00	-26.81			
	2376.30	S	42.50	44.19	-1.69	74.00	-31.50			
	2390.00	Н	26.66	28.40	-1.74	54.00	-27.34			
	2390.00	Н	40.26	42.01	-1.74	74.00	-33.74			
Opera	ition Mode :	E	BR(1M)	Test Date	:	03/1	7/2016 19:22:29			
Funda	amental Frequ	uency: 2	402 MHz	Temp. / H	umi. :	22 d	22 deg_C / 63 RH			
Opera	tion Band :	E	Bandedge CH	LOW Test Engir	neer:	Tin				
EUT F	Pol.:	E	2 Plane	Measurem	nent Antenna	a Pol. : HOF	-			
	Freq.	Note	Emission Level	Spectrum Reading Level	Factor	Limit @3m	Margin			
	MHz	F/H/E/S	6 dBuV/m	dBuV	dB	dBuV/m	dB			
	2376.30	S	30.17	31.86	-1.69	54.00	-23.83			
	2376.30	S	45.69	47.38	-1.69	74.00	-28.31			
	2390.00	Н	27.68	29.42	-1.74	54.00	-26.32			
	2390.00	Н	41.10	42.85	-1.74	74.00	-32.90			

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Operation Mode : BR(1M)		(1M)	Test Date	:	03/1	03/17/2016 19:34:13 22 deg_C / 63 RH Tin Pol. : VERTICAL Limit Margin @ 3m <u>dBuV/m dB</u> 54.00 -23.73 74.00 -22.43		
Fundamental Frequency :		uency: 248	30 MHz	Temp. / Hu	umi. :	22 c	leg_C / 63 RI	-
Opera	ation Band :	Bai	ndedge CH	HIGH Test Engin	eer:	Tin		
EUT I	Pol.:	E2	Plane	Measurem	ent Antenna	a Pol. : VEF	RTICAL	
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin	
			Level	Reading Level		@ 3m	-	
	MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB	
	2483.50	Н	30.27	31.89	-1.62	54.00	-23.73	
	2483.50	Н	51.57	53.18	-1.62	74.00	-22.43	
Opera	ation Mode :	BR	(1M)	Test Date	:	03/1	7/2016 19:41	1:50
Funda	amental Frequ	uency: 248	30 MHz	Temp. / Hu	umi. :	22 c	leg_C / 63 RI	-
Opera	ation Band :	Bai	ndedge CH	HIGH Test Engin	eer:	Tin		
EUT I	Pol.:	E2	Plane	Measurem	ent Antenna	a Pol. : HOF	RIZONTAL	
	Freq.	Note	Emission	Spectrum	Factor	Limit	Margin	
			Level	Reading Level		@ 3m		
	MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB	
	2483.50	Н	33.10	34.72	-1.62	54.00	-20.90	
	2483.50	Н	59.17	60.79	-1.62	74.00	-14.83	

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

Operation Mode : Fundamental Freque Operation Band : EUT Pol. :	Tx C		Test Date : Temp. / Humi. : Test Engineer : Measurement Antenna Pol. :			03/24/2016 23:11:37 22 deg_C / 63 RH Tin VERTICAL	
97							
- 08							
Level [dBu/					FCC RSF	E-QP 3M	
40	2 3 2 X	4 X	5 *	۴ ۲			
30	200	400 Fro	600 equency [MHz]		800	1000	
Freq.	Note	Emission	Spectrum eading Level	Factor	Limit @3m	Margin	
MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB	
30.00	S	35.09	44.28	-9.19	40.00	-4.91	
199.75	S	28.62	38.23	-9.60	43.50	-14.88	
257.95	S	29.67	37.05	-7.38	46.00	-16.33	
347.19	S	34.94	39.89	-4.96	46.00	-11.06	
500.45	S	32.55	35.24	-2.69	46.00	-13.45	
701.24	S	34.73	33.30	1.43	46.00	-11.27	

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Operation Mode : BR(1M) Test Date : 03/17/2016 21:55:30 Fundamental Frequency: 2402 MHz Temp. / Humi. : 22 deg_C / 63 RH **Operation Band :** Tx CH LOW Test Engineer : Tin E2 Plane EUT Pol. : Measurement Antenna Pol. : HORIZONTAL 97 80 Level [dBuV] FCC RSE-QP 3N 4 6 40 5 400 800 30 200 600 1000 Frequency [MHz] Freq. Note Emission Spectrum Factor Limit Margin Level Reading Level @3m dBuV/m F/H/E/S dBuV dBuV/m MHz dB dB 85.29 S 45.70 -13.05 -7.35 32.65 40.00 S 199.75 36.80 46.40 -9.60 43.50 -6.70S 245.34 37.33 45.36 -8.03 46.00 -8.67 347.19 S 41.50 46.45 -4.96 46.00 -4.50 S 498.51 33.74 36.26 -2.52 46.00 -12.26S 652.74 41.44 40.90 0.54 46.00 -4.56

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Operation Mode : Fundamental Frequency Operation Band : EUT Pol. :	BR(1M) : 2441 MHz Tx CH MID E2 Plane	Test Date : Temp. / Hur Test Engine Measureme		03/17/2016 21:55:31 22 deg_C / 63 RH Tin : VERTICAL
97				
80 -				
evel [dBuy]				CC RSE-QP <u>3M</u>
40	3 4 X X	5 *	6 *	
30 20	00 400	600 Frequency [MHz]	800	1000
Freq. No		Spectrum		mit Margin
MHz F/H/	Level /E/S dBuV/m	Reading Level dBuV		3m JV/m dB
	S 35.17	44.36		.00 -4.83
131.85	S 31.33	40.60	-9.26 43	.50 -12.17
259.89	S 30.09	37.38	-7.28 46	.00 -15.91
333.61 \$	S 33.05	38.33	-5.28 46	.00 -12.95
479.11 \$	S 33.15	35.54	-2.39 46	.00 -12.85
701.24 5	S 34.69	33.26	1.43 46	.00 -11.31

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Operation Mode : Fundamental Frequency : Operation Band : EUT Pol. :	BR(1M) 2441 MHz Tx CH MID E2 Plane	Test Date : Temp. / Hu Test Engine Measureme	mi. : eer :		17/2016 21:55:32 deg_C / 63 RH RIZONTAL
97					
80 -					
evel [dBuy]					
				FCC RSE	-QP 3M
	3 ×	5	\$ *		
30 20	o <u>4</u> 00	600 Frequency [MHz]		800	1000
Freq. No	te Emission Level	Spectrum	Factor	Limit @3m	Margin
MHz F/H/		Reading Level dBuV	dB	dBuV/m	dB
86.26 S		45.93	-13.20	40.00	-7.27
138.64 S	34.68	43.17	-8.49	43.50	-8.82
270.56 S	34.54	41.43	-6.89	46.00	-11.46
347.19 S	38.99	43.94	-4.96	46.00	-7.01
498.51 S	32.93	35.45	-2.52	46.00	-13.07
696.39 S	39.02	37.66	1.36	46.00	-6.98

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Operation Mode : Fundamental Frequency : Operation Band : EUT Pol. :		1M) 0 MHz CH HIGH Plane	Test Date Temp. / Hu Test Engin Measurem	umi. : 1eer :	22 (Tin	03/24/2016 23:12:00 22 deg_C / 63 RH Tin VERTICAL		
97								
80								
evel [dBuV]					FCC RSE	-QP 3M		
40	2 3 X X	¥	5 *	6 *				
30	200	400	600 Frequency [MHz]		800	1000		
Freq.	Note	Emission	Spectrum	Factor	Limit	Margin		
		Level	Reading Level		@ 3m			
MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB		
30.00	S	35.86	45.05	-9.19	40.00	-4.14		
199.75	S S	28.05	37.65 36.05	-9.60 7.28	43.50	-15.45		
259.89 332.64	S S	28.77 32.47		-7.28	46.00 46.00	-17.23 -13.53		
332.64 500.45	S	32.47 32.28	37.77 34.97	-5.30 -2.69	46.00 46.00	-13.53		
500.45 701.24	S	32.28 34.03	34.97 32.60	-2.69 1.43	46.00 46.00	-13.72 -11.97		
701.24	0	54.05	52.00	1.45	40.00	-11.37		

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Operation Mode : BR(1M) Test Date : 03/24/2016 23:12:05 Fundamental Frequency: 2480 MHz Temp. / Humi. : 22 deg_C / 63 RH **Operation Band :** Tx CH HIGH Test Engineer : Tin EUT Pol. : E2 Plane Measurement Antenna Pol. : HORIZONTAL 97 80 Level [dBuV] FCC RSE-OP 3M 6 4 40 2 3 5 400 800 30 200 600 1000 Frequency [MHz] Freq. Note Emission Spectrum Factor Limit Margin Level Reading Level @3m dBuV/m F/H/E/S dBuV dBuV/m MHz dB dB 93.05 S 43.97 -13.35 -12.88 30.62 43.50 134.76 S 44.16 35.32 -8.84 43.50 -8.18 S 251.16 -7.88 46.00 35.18 43.06 -10.82 354.95 S 40.92 45.67 -4.76 46.00 -5.08 S 498.51 33.25 35.77 -2.52 46.00 -12.75S 663.41 41.55 41.31 0.24 46.00 -4.45

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Radiated Spurious Emission Measurement Result:

For Frequency above 1 GHz

Operation Mode : Fundamental Freque Operation Band : EUT Pol. :	ency: 240 Tx (1M) 2 MHz CH LOW Plane	Test Date : Temp. / Hu Test Engin Measurem	ımi. :	22 Tir	
97						
80 -					FCC RS	Е-РК ЗМ
Level [dBuV.	×					E-AV 3M
40 -	¥					
1000	5000	10000	15000 Frequency [MHz]	20000		2500026500
Freq.	Note	Emission Level	Spectrum Reading Level	Factor	Limit @3m	Margin
MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB
4804.00	Н	34.81	29.89	4.92	54.00	-19.19
4804.00	Н	51.76	46.84	4.92	74.00	-22.24

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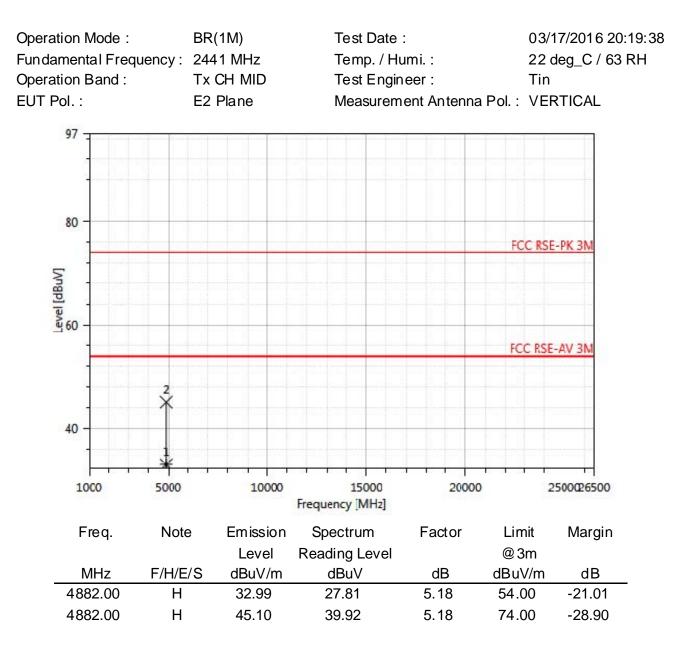
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Operation Mode : Fundamental Frequ Operation Band : EUT Pol. :	ency: 240 Tx	(1M) 02 MHz CH LOW Plane	Test Date Temp. / Hu Test Engin Measurem	ımi. :	22 Tin	
97 -						
-						
80 -					_	
					FCC RS	F-PK BM
Mag						
00 Forel						
					FCC RSE	- AV 2M
	¥				100 101	
40 -						
-	,¥,,,					
1000	5000	10000	15000 Frequency [MHz]	20000	8	2500@6500
Freq.	Note	Emission	Spectrum	Factor	Limit	Margin
		Level	Reading Level		@ 3m	
MHz	F/H/E/S	dBuV/m	dBuV	dB	dBuV/m	dB
4804.00	Н	35.14	30.21	4.92	54.00	-18.86
4804.00	Н	51.80	46.88	4.92	74.00	-22.20

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Operation Mode : BR(1M) Test Date : 03/17/2016 20:23:38 Fundamental Frequency: 2441 MHz Temp. / Humi. : 22 deg_C / 63 RH **Operation Band :** Tx CH MID Test Engineer : Tin Measurement Antenna Pol. : HORIZONTAL EUT Pol. : E2 Plane 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 2 ж 40 10000 1000 5000 15000 20000 2500@6500 Frequency [MHz] Freq. Note Emission Spectrum Factor Limit Margin Level Reading Level @3m dBuV/m F/H/E/S dBuV dBuV/m MHz dB dB 4882.00 Н 27.28 5.18 -21.54 32.46 54.00 39.78 4882.00 Н 44.96 74.00 5.18 -29.04

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Operation Mode : BR(1M) Test Date : 03/17/2016 20:38:10 Fundamental Frequency: 2480 MHz Temp. / Humi. : 22 deg_C / 63 RH **Operation Band :** Tx CH HIGH Test Engineer : Tin Measurement Antenna Pol. : VERTICAL EUT Pol. : E2 Plane 97 80 FCC RSE-PK 3M Level [dBuV] FCC RSE-AV 3M 2 40 10000 2500@6500 1000 5000 15000 20000 Frequency [MHz] Freq. Note Emission Spectrum Factor Limit Margin Level Reading Level @3m dBuV/m F/H/E/S dBuV dBuV/m MHz dB dB 4960.00 Н 31.88 5.29 -22.12 26.60 54.00 4960.00 Н 39.36 74.00 44.65 5.29 -29.35

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Operation Mode : BR(1M) Test Date : 03/17/2016 20:49:17 Fundamental Frequency: 2480 MHz Temp. / Humi. : 22 deg_C / 63 RH **Operation Band :** Tx CH HIGH Test Engineer : Tin Measurement Antenna Pol. : HORIZONTAL EUT Pol. : E2 Plane 97 80 FCC RSE-PK 3N Level [dBuV] FCC RSE-AV 3N 2 40 10000 20000 2500@6500 1000 5000 15000 Frequency [MHz] Freq. Note Emission Spectrum Factor Limit Margin Level Reading Level @3m dBuV/m F/H/E/S dBuV dBuV/m MHz dB dB 4960.00 Н 32.75 5.29 -21.25 27.46 54.00 4960.00 Н 46.78 41.49 74.00 5.29 -27.22

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11 FREQUENCY SEPARATION

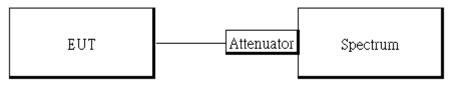
11.1 Standard Applicable

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

11.2 Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016			
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017			
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017			

11.3 Test Set-up



11.4 Measurement Procedure

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

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11.5 Measurement Result

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

Frequency Separation Test Data



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12 NUMBER OF HOPPING FREQUENCY

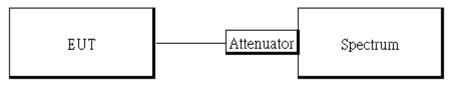
12.1 Standard Applicable

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

12.2 Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT MFR MODEL SERIAL LAST CAL D								
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016			
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017			
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017			

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.

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	

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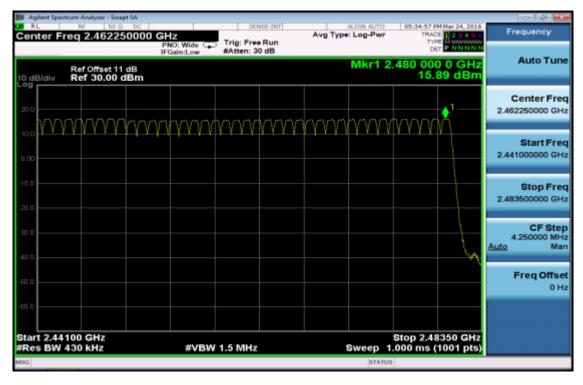


Channel Number



2.4GHz - 2.441GHz

2441 GHz - 2.4835GHz



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13 TIME OF OCCUPANCY (DWELL TIME)

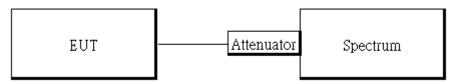
13.1 Standard Applicable

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

13.2 Measurement Equipment Used

Conducted Emission Test Site							
EQUIPMENT MFR MODEL SERIAL LAST CAL D							
TYPE		NUMBER	NUMBER	CAL.			
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016		
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017		

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	128.00	400ms
0	DH3	264.64	400ms
	DH5	309.87	400ms
	DH1	129.60	400ms
39	DH3	264.64	400ms
	DH5	309.87	400ms
	DH1	127.68	400ms
78	DH3	266.72	400ms
	DH5	309.87	400ms

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

GFSK (1Mbps):

CH Low	DH1 time slot = DH3 time slot = DH5 time slot =	1.654 *	(1600/4/79) *	31.6 =	128.00 (ms) 264.64 (ms) 309.87 (ms)
CH Mid	DH1 time slot = DH3 time slot = DH5 time slot =	1.654 *	(1600/4/79) *	31.6 =	129.60 (ms) 264.64 (ms) 309.87 (ms)
CH High	DH1 time slot = DH3 time slot = DH5 time slot =	1.667 *	(1600/2/79) * (1600/4/79) * (1600/6/79) *	31.6 =	127.68 (ms) 266.72 (ms) 309.87 (ms)

GFSK (1Mbps) for AFH Mode Hopping Channel **Measurement Result** Limit PACKET TYPE Number (ms) (ms) DH5 400ms 20 154.93

GFSK (1Mbps):

 $(800/6/20)^* 8 = 154.93$ (ms) DH5 time slot = 2.905 (ms) *

13.6 Measurement Result

Note: Refer to next page for plots.

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CH-Low DH1

M Agilent Spectrum Analyzer - Swept SA				- 3
Center Freq 2.402000000	GHz	ALIGN AUTO Avg Type: Log-Pwr	05:39:18 PM Nar 24, 2016 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 11 dB	PNO: Wide Trig: Free Run IFGein:Low #Atten: 30 dB	۵	Mkr3 1.250 ms 0.02 dB	Auto Tune
Log 20.0 10.0 20.0 10.0 20.0 20.0 20.0 20.0		3∆4		Center Freq 2.402000000 GHz
-10.0				Start Freq 2.402000000 GHz
-60.0	yA Jowennessey have by a start of the start	<u>∧</u> m	where	Stop Freq 2.402000000 GHz
Center 2.402000000 GHz Res BW 1.0 MHz MKR MODE TRC SCL X		Sweep 2	Span 0 Hz .000 ms (401 pts)	CF Step 1.000000 MHz Auto Man
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	400.0 μs (Δ) 7.56 dB 5.000 μs 4.25 dBm 1.250 ms (Δ) 0.02 dB 5.000 μs 4.25 dBm		÷	Freq Offset 0 Hz
7 8 9 10 11				
MBG	17	STATUS	,	

DH3



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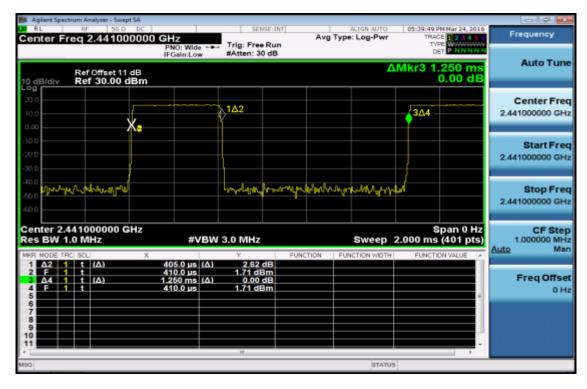


DH5

100 2.402000000 GHz 200 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 300 40.0 2.4020000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 7.547 ms (401 pts) 1.000000 MHz 40.0 3.764 ms (Δ) 3.18 dB 41 t (Δ) 3.764 ms (Δ) 3.18 dB 4.1 t (Δ) 3.764 ms (Δ) 3.18 dB 41 1 t (Δ) 4.1 t (Δ) 3.764 ms (Δ) 5.6 11.87 dBm 6 11.87 dBm 6 11.187 dBm 6 100000 MHz 924.5 μs 11.87 dBm	🛤 Agilent Spectrum Analyzer - Swept SA					
Ref Offset 11 dB Auto Tune 10 dB/div Ref 30.00 dBm 3.18 dB 200 100 100 100 100 100 100 100 100 100 11187 dBm 11187 dBm 11187 dBm		000 GHz			TRACE 1 2 3 4 5 6	Frequency
200 1∆2 3∆4 Center Freq 100 1∆2 3∆4 Center Freq 2.402000000 GHz Start Freq 2.402000000 GHz 200 100 100 100 100 100 100 100 200 100 100 100 100 200 100 100 100 100 200 100 100 100 100 200 100 100 100 100 200 100 100 100 100 200 100 100 100 100 400 100 100 100 100 400 100 11.87 dBm 11.87 dBm 11.00000 MHz 401 1 11.87 dBm 11.87 dBm 11.87 dBm 100 30 11 11.87 dBm 11.87 dBm 100 100 4 F 1 1 11.87 dBm 100 100 30 11 11.87 dBm 100 100 100 100	10 dB/div Ref 30.00 dB	IFGain:Low 3			Mkr3 3.754 ms	Auto Tune
200 3	20.0 10.0		01∆2	3∆4		
Center 2.402000000 GHz Span 0 Hz Stop Freq CF Step Center 2.402000000 GHz #VBW 3.0 MHz Sweep 7.547 ms (401 pts) 1.000000 MHz MRR MODE TRCISCL X Y FUNCTION WIDTH FUNCTION WIDTH FUNCTION WIDTH 1 A2 1 t 924.5 µs 11.87 dBm Freq Offset 3 A4 1 t 924.5 µs 11.87 dBm Freq Offset 6 - - - - - - -	-20.0					
Res BW 1.0 MHz #VBW 3.0 MHz Sweep 7.547 ms (401 pts) MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 Δ2 1 t (Δ) 3.28 dB FUNCTION WIDTH FUNCTION VALUE Man 2 F t 924.5 μs 11.87 dBm Function Function Value Freq Offset 3 Δ4 1 t 924.5 μs 11.87 dBm Function Function Value Freq Offset 5 -	-50.0		ปมะเทศ	A		Stop Freq 2.402000000 GHz
2 F 1 t 924.6 μs 11.87 dBm F F F T (Δ) 3.764 ms (Δ) 3.18 dB F F T S O Hz O Hz <t< td=""><td>Res BW 1.0 MHz</td><td>#VBW 3</td><td>Y FUNCT</td><td>-</td><td>7.547 ms (401 pts)</td><td>1.000000 MHz</td></t<>	Res BW 1.0 MHz	#VBW 3	Y FUNCT	-	7.547 ms (401 pts)	1.000000 MHz
	2 F 1 t 3 Δ4 1 t (Δ) 4 F 1 t (Δ) 5 1 t (Δ) (Δ) 6 - - - - 7 - - - - 8 - - - - - 9 - <th< td=""><td>924.5 μs 3.754 ms (Δ)</td><td>11.87 dBm 3.18 dB</td><td></td><td></td><td></td></th<>	924.5 μs 3.754 ms (Δ)	11.87 dBm 3.18 dB			
MSG STATUS	MSG			STATU	\$	

CH-Mid

DH1



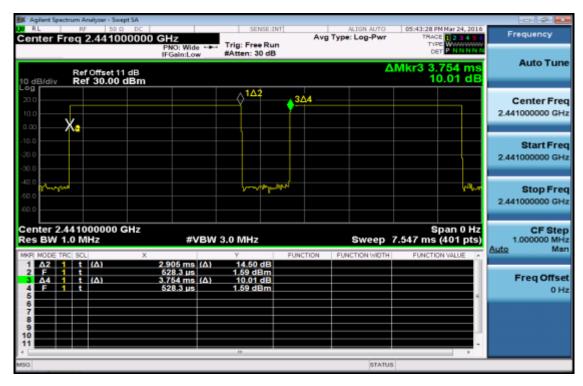
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DH3

M Agilent Spectrum Analyzer						
Center Freq 2.44	50 Q DC	SENSE:	Avg	ALIGN AUTO Type: Log-Pwr	05:42:18 PM Mar 24, 2016 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref Offs	PNO: Wide IFGain:Low et 11 dB 00 dBm			Δ	Mkr3 2.494 ms -8.26 dB	Auto Tune
20.0 10.0 0.00		1∆2	∮ 3∆4			Center Freq 2.441000000 GHz
-10.0 -20.0 -30.0						Start Freq 2.441000000 GHz
-40.0 -50.0 -60.0		hogenedensed	ļ 		furning	Stop Freq 2.441000000 GHz
Center 2.4410000 Res BW 1.0 MHz		BW 3.0 MHz	FUNCTION	Sweep {	Span 0 Hz 5.013 ms (401 pts)	CF Step 1.000000 MHz Auto Man
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.654 ms 200.5 µs 2.494 ms 200.5 µs	14.92 dBm				Freq Offset 0 Hz
7 8 9 10 11		17			•	
MSG				STATUS		

DH5



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CH-High DH1

B Agilent Spectrum Analyzer - Swept SA				
Center Freq 2.480000000 0	GHz	ALIGN AUTO Avg Type: Log-Pwr	05:40:33 PM Mar 24, 2016 TRACE 2 3 4 5 6	Frequency
Ref Offset 11 dB 10 dB/div Ref 30.00 dBm	PNO: Wide Trig: Free Run IFGein:Low #Atten: 30 dB	Δ	Mkr3 1.251 ms 0.59 dB	Auto Tune
20.0 10.0 0.00	X ₂	304		Center Freq 2.48000000 GHz
-10.0				Start Freq 2.480000000 GHz
40.0 .50.0 .60.0	l Curve Proge	alamay a	Wintprtract	Stop Freq 2.48000000 GHz
Center 2.480000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep	Span 0 Hz 3.013 ms (401 pts)	CF Step 1.000000 MH: <u>Auto</u> Mar
2 F 1 t 3 Δ4 1 t (Δ)	399.3 μs (Δ) 2.10 dB 861.3 μs 11.38 dBm 1.251 ms (Δ) 0.59 dB 851.3 μs 11.38 dBm		6	Freq Offset 0 Hz
0 7 8 9 10 11				
MSG		STATUS		

DH3



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DH5

Agilent Spec	trum Analyzer - S								
1.166	req 2.480	000000 0	GHz PNO: Wide	Trig: Free Ru	Avg	Type: Log-Pwr	TYPE	123456	Frequency
dB/div	Ref Offset Ref 30.0		IFGain:Low	#Atten: 30 dB		Δ	Mkr3 3.7	36 ms 89 dB	Auto Tur
			X.			142	3∆4		Center Fr 2.480000000 G
									Start Fr 2.480000000 G
		40-14	whilen			all wards	~		Stop Fr 2.480000000 G
	480000000 I.0 MHz) GHz	#VB	W 3.0 MHz	FUNCTION	Sweep	Sp 7.547 ms (4 FUNCTION		CF St 1.000000 M Auto M
Δ2 F Δ4 F	t (Δ) t t (Δ) t		2.905 ms (Δ 2.528 ms 3.736 ms (Δ 2.528 ms	16.12 dBm	POINCTION		Poncilion	-	Freq Off 0
								- · ·	
						STATUS	1		

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14 ANTENNA REQUIREMENT

14.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

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

14.2 Antenna Connected Construction

An embedded-in antenna design is used.

The antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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

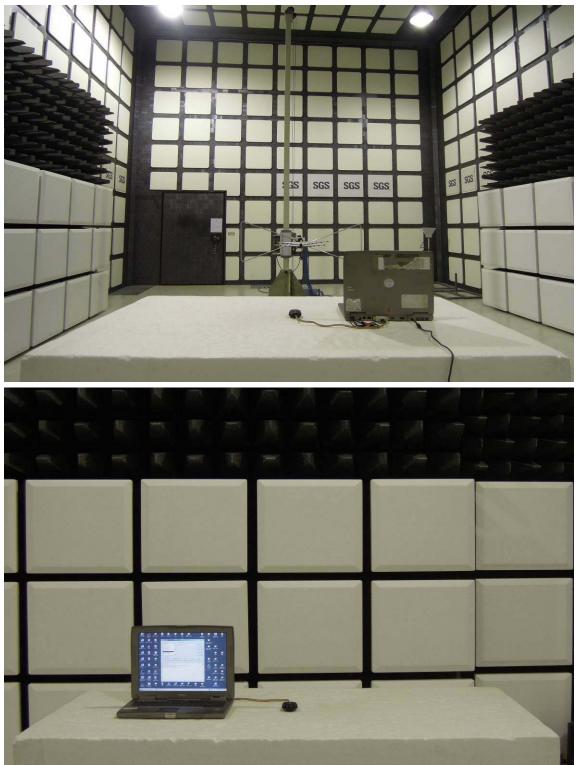
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PHOTOGRAPHS OF SET UP

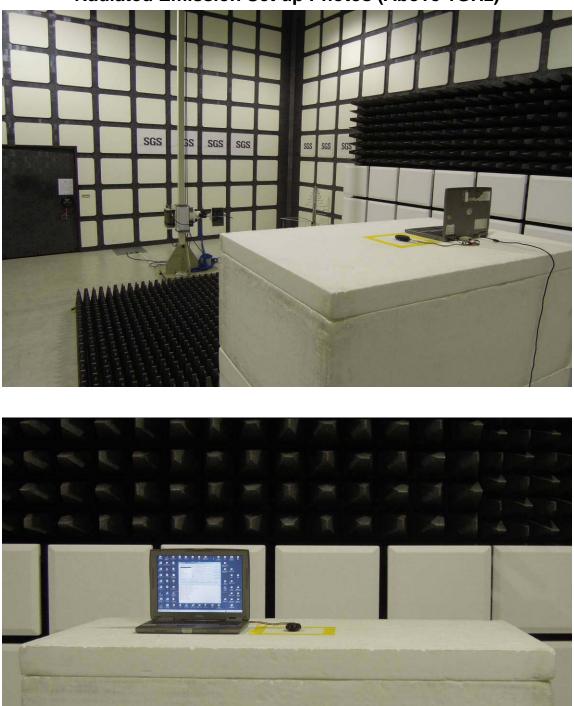
Radiated Emission Set up Photos (Below 1GHz)



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Radiated Emission Set up Photos (Above 1GHz)

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Conducted Setup Photo (Measurement at Antenna Port)



PHOTOGRAPHS OF EUT

Please refer to the attached file(EUT Photo)

~ End of Report ~

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