

# **ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**

**O**F

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

Product Name:	Tablet Computer
Brand Name:	acer
Marketing Name:	A3-A30
Model No.:	A5003
Model Difference:	N/A
FCC ID:	HLZA5003
IC:	1754F-A5003
Report No.:	E2/2015/20016
Issue Date:	Apr. 08, 2015
FCC Rule Part:	§15.247, Cat: DSS
IC Rule Part:	RSS-210 issue 8 :2010, Annex 8
Prepared for:	Acer Incorporated
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Report No.: E2/2015/20016 Issue Date: Apr. 08, 2015 Page: 2 of 88

# **VERIFICATION OF COMPLIANCE**

Applicant:	Acer Incorporated 8F., No.88, Sec. 1, Hsintai 5th Rd., Hsichih, New Taipei City 22181, Taiwan (R.O.C.)
Product Name:	Tablet Computer
Brand Name:	acer
Marketing Name:	A3-A30
Model No.:	A5003
Model Difference:	N/A
FCC ID:	HLZA5003
IC:	1754F-A5003
File Number:	E2/2015/20016
Date of test:	Feb. 25, 2015 ~ Apr. 08, 2015
Date of EUT Received:	Feb. 25, 2015
We hereby cortify the	at:

## 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:	Marcus Tseng	Date:	Apr. 08, 2015
Prepared By:	Marcus Tseng/Engineer Allon Tsai	Date:	Apr. 08, 2015
Approved By:	Allen Tsai / Engineer Jim Chang Jim Chang / Asst. Manager	Date:	Apr. 08, 2015

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# **Revision History**

Report Number	Revision	Description	Issue Date
E2/2015/20016 Rev.00		Initial creation of document	Apr. 08, 2015



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#### **GENERAL INFORMATION** 1.

## 1.1. Product description

#### General:

Product Name:	Tablet Computer		
Brand Name:	acer		
Marketing Name:	A3-A30		
Model No.:	A5003		
Model Difference:	N/A		
Product SW/HW version:	Acer_AV0L0_A3-A30_RV01RZ01_WW_CUS1 / E0		
Radio SW/HW version:	1.5.1.2 / WCN3620		
Test SW Version:	1.5.1.2		
USB Cable	Model No.: 3080199058, Supplier: 坤記		
	3.8Vdc from Rechargeable Li-polymer Battery or 5.35V from AC/DC Adapter		
Power Supply:	Battery: Model No.:AP14A4M, Supplier: SONY		
	Adapter :1. Model No.: PA-1100-25, Supplier: LITEON. 2. Model No.: ADP-10HW A, Supplier: DELTA.		

#### Bluetooth\_BR+EDR:

Bluetooth Version:	V4.0 dual mode
Channel number:	79 channels
Modulation type:	$GFSK + \pi/4DQPSK + 8DPSK$
Transmit Power:	7.97dBm
Frequency Range:	2.402GHz - 2.480GHz
Emission Designation:	1M21F1D
Antenna Designation:	PCB Wire Antenna, Gain: 1.9dBi Model No.: QTNKFWIPB01+A, Supplier: Wgt



#### **Product Feature of Equipment Under Test** 1.2

The equipment under Test (Hereafter Called: EUT) is mobile phone supporting, ,Wi-Fi 802.11abgn & ac, Bluetooth with NFC features, and below is details of information.

Product Feature		
Product Name:	Tablet Computer	
Brand Name:	acer	
Type No.:	A3-A30	
Model Difference:	A5003	
FCC ID	HLZA5003	
IC ID	1754F-A5003	
Wi-Fi Specification	802.11a/b/g/n/ac	
Bluetooth Version	V4.0 dual mode + HS	
NFC Specification	NFC	

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 KDB 558074 D01 DTS Meas. Guidance V03r02 ANSI C63.10:2013 IC RSS 210 issue 8:2010 Annex 8 RSS-Gen. issue 4

#### Note:

- 1. All test items have been performed and record as per the above standards.
- The composite system is compliance with FCC Subpart B is authorized under the certification 2. procedure.
- The EUT was placed 1.5m height for frequency above 1GHz in accordance with 3. ANSI C63. 10:2013

#### 1.4. Test Facility

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

FCC Registration Numbers are: 628985

Canada Registration Number: 4620A

#### 1.5. Special Accessories

There is no special accessory used while test was conducted.

#### **1.6.** Equipment Modifications

There was no modification incorporated into the EUT.

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#### SYSTEM TEST CONFIGURATION 2.

## 2.1. EUT Configuration

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

### 2.2. EUT Exercise

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

#### 2.3. Test Procedure

## 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. 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 §15.107. 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 which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

#### 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 4.8 dB.

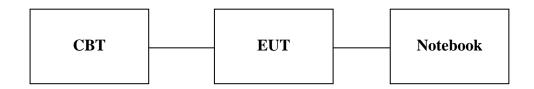
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## 2.5. Configuration of Tested System

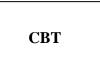
## Fig. 2-1 Conducted (Antenna Port) Configuration



## Fig. 2-2 Radiated Emission Configuration



## **Remote Side**

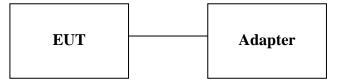


**Table 2-1 Equipment Used in Tested System** 

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 Test Set	R&S	CBT	101140	Shielded	Unshielded
3.	Notebook	Lenovo	L430	R9-YYG88	Shield	Un-shield



## Fig. 2-3 AC Power Line Conducted Emission



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

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	<b>Power Cord</b>
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A

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## 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
\$15.207(a) RSS-Gen \$8.8	AC Power Line Conducted Emission	Compliant
\$15.247(b) (3) RSS-210 issue 8,§A8.4(2)	Peak Output Power	Compliant
\$15.247(a)(2) RSS210 issue ,\$A8.1(a) RSS-Gen \$6.6	20dB Bandwidth & 99% Power Bandwidth	Compliant
§15.247(d) RSS-210 issue 8,§A8.5	Conducted Band Edge and Spurious Emission	Compliant
\$15.247(d) RSS-Gen \$8.9 RSS-210 issue 8,\$A8.5	Radiated Band Edge and Spurious Emission	Compliant
\$15.247(a)(1) RSS-210 issue 8,\$A8.1(b)	Frequency Separation	Compliant
\$15.247(a)(1)(iii) RSS-210 issue 8,\$A8.1(d)	Number of hopping frequency	Compliant
\$15.247(a)(1)(iii) RSS-210 issue 8,\$A8.1(d)	Time of Occupancy	Compliant
\$15.203 \$15.247(b) RSS- Gen 4 \$6.7 RSS- Gen 4 \$8.3	Antenna Requirement	Compliant



## 4. DESCRIPTION OF TEST MODES

#### 3.1. Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

CH	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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## 3.2. 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 case. 3

## **RADIATED EMISSION TEST:**

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

## 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	AVAILABLETESTED CHANNELMODULATION		PACKET TYPE	ANTENNA PORT				
	0 to 78	0,39,78	GFSK	DH5	MAIN			
Bluetooth	0 to 78	0,39,78	/4-DQPSK	DH5	MAIN			
	0 to 78	0,39,78	8-DPSK	DH5	MAIN			
Band Edge								
Bluetooth	0 to 78	0,78	GFSK	DH5	MAIN			
		<b>Frequency Sep</b>	aration					
Bluetooth	0 to 78	0,1,2	GFSK	DH5	MAIN			
	Nu	mber of hopping	g frequency					
Bluetooth	0 to 78	0 to 78	GFSK	DH5	MAIN			
	Tim	e of Occupancy	(Dwell time)					
Bluetooth	0 to 78	0,39,78	GFSK	DH1/DH3/DH5	MAIN			
Bluetooth	0 to 78	39	/4-DQPSK	DH1/DH3/DH5	MAIN			
Bluetooth	0 to 78	39	8-DPSK	DH1/DH3/DH5	MAIN			

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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/ 99% Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 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 : <b>Vertical</b> )	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

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

This uncertainty represents an expanded uncertainty expressed at approximately the

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

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#### **CONDUCTED EMISSION TEST** 6.

## 6.1. Standard Applicable

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	he 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 3	101311	06/20/2014	06/19/2015			
LISN	Schwarzbeck	NSLK 8127	8127-648	06/10/2014	06/09/2015			
LISN	Rolf-Heine	NNB-2/16Z	99012	03/04/2015	03/03/2016			
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	01/06/2015	01/07/2016			

## 6.3. EUT Setup

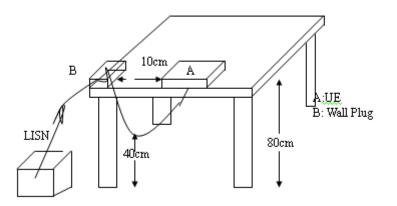
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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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 plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

#### 6.6. Measurement Result

Note: Refer to next page for measurement data and plots. Note2: The \* reveals the worst-case results that closet to the limit

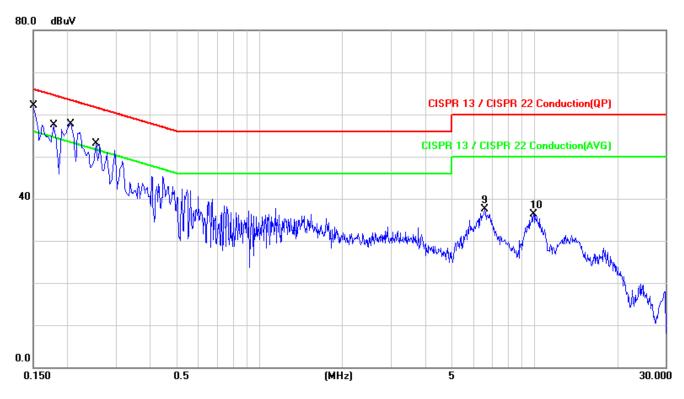
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# AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Mar. 26, 2015
Temperature:	21	Humidity:	70 %	Test By:	Vito
Model No.:	PA-1100-25	·		•	
Phase:	L1				

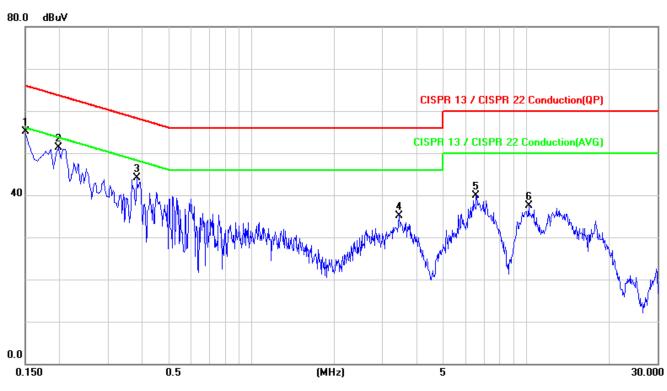


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1516	54.40	0.12	54.52	65.91	-11.39	QP	
2		0.1516	38.70	0.12	38.82	55.91	-17.09	AVG	
3		0.1780	49.90	0.12	50.02	64.58	-14.56	QP	
4		0.1780	35.40	0.12	35.52	54.58	-19.06	AVG	
5		0.2060	50.80	0.12	50.92	63.37	-12.45	QP	
6		0.2060	37.30	0.12	37.42	53.37	-15.95	AVG	
7		0.2540	45.20	0.12	45.32	61.63	-16.31	QP	
8		0.2540	30.40	0.12	30.52	51.63	-21.11	AVG	
9		6.6020	37.11	0.32	37.43	60.00	-22.57	peak	
10		9.9580	35.91	0.40	36.31	60.00	-23.69	peak	

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Operation Mode:	Operation mode			Test Date:	Mar. 26, 2015
Temperature:	21	Humidity:	70 %	Test By:	Vito
Model No.:	PA-1100-25				
Phase:	Ν				

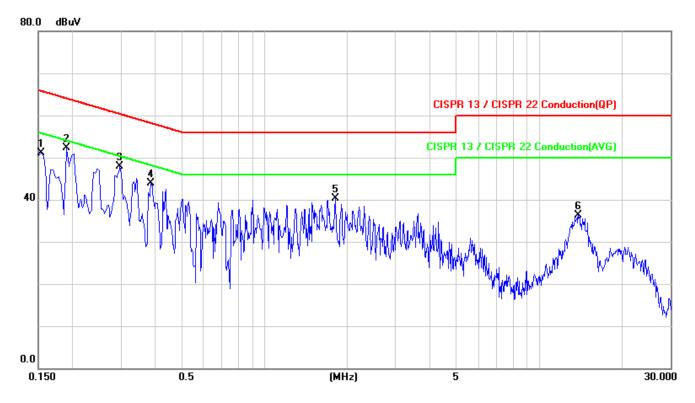


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1500	54.98	0.12	55.10	66.00	-10.90	peak	
2		0.1980	51.17	0.12	51.29	63.69	-12.40	peak	
3		0.3820	44.01	0.12	44.13	58.24	-14.11	peak	
4		3.4420	34.97	0.23	35.20	56.00	-20.80	peak	
5		6.5700	39.54	0.32	39.86	60.00	-20.14	peak	
6		10.2220	37.06	0.40	37.46	60.00	-22.54	peak	

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Operation Mode:	Operation mode			Test Date:	Mar. 26, 2015
Temperature:	21	Humidity:	70 %	Test By:	Vito
Model No.: ADP-10HW				•	
Phase:	L1				

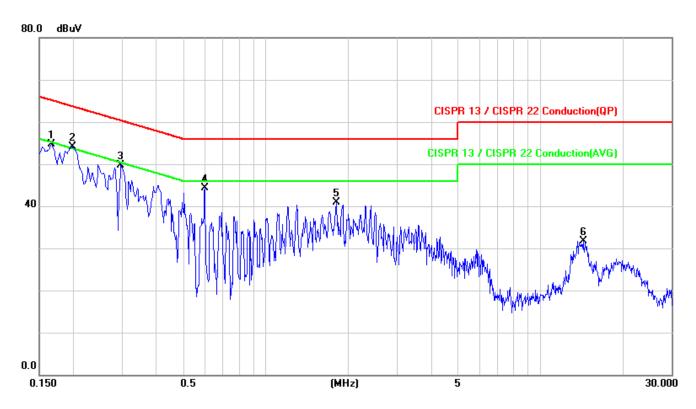


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1540	51.09	0.05	51.14	65.78	-14.64	peak	
2	*	0.1900	52.36	0.04	52.40	64.04	-11.64	peak	
3		0.2980	47.91	0.08	47.99	60.30	-12.31	peak	
4		0.3860	43.70	0.12	43.82	58.15	-14.33	peak	
5		1.8100	39.79	0.49	40.28	56.00	-15.72	peak	
6		13.8420	35.89	0.37	36.26	60.00	-23.74	peak	

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Operation Mode:	Operation mode			Test Date:	Mar. 26, 2015	
Temperature:	21	Humidity:	70 %	Test By:	Vito	
Model No.:	ADP-10HW					
Phase:	N					



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1660	54.71	0.05	54.76	65.16	-10.40	peak	
2	*	0.1980	54.01	0.04	54.05	63.69	-9.64	peak	
3		0.2980	49.53	0.08	49.61	60.30	-10.69	peak	
4		0.6020	44.17	0.21	44.38	56.00	-11.62	peak	
5		1.8100	40.47	0.49	40.96	56.00	-15.04	peak	
6		14.3260	31.45	0.35	31.80	60.00	-28.20	peak	

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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.

## 7.2. Measurement Equipment Used

Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL SERIA		LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015		
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015		
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015		
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015		

## 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

	GFSK (1 Mbps)					
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)		
0	2402.00	7.35	5.43000	1000		
39	2441.00	7.97	6.26470	1000		
78	8 2480.00 7.72		5.91970	1000		
		π/4-DQPSK	(2 Mbps)			
Channel	Frequency	<b>Output Power</b>	<b>Output Power</b>	Limit		
Channel	(MHz)	(dBm)	( <b>mW</b> )	(mW)		
0	2402.00	5.98	3.95913	125		
39	2441.00	6.43	4.39744	125		
78	2480.00	6.83	4.82059	125		
		8-DPSK (	3 Mbps)			
Channel	Frequency	<b>Output Power</b>	<b>Output Power</b>	Limit		
Channel	(MHz)	(dBm)	( <b>mW</b> )	(mW)		
0	2402.00	6.47	4.43200	125		
39	2441.00	6.93	4.92720	125		
78	2480.00	7.32	5.39635	125		

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

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# Peak Power Output Data Plot (CH Low) (GFSK mode)



## Peak Power Output Data Plot (CH Mid) (GFSK mode)



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



# Peak Power Output Data Plot (CH High) (GFSK mode)



#### Peak Power Output Data Plot (CH Low) ( /4-DQPSK mode)



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## Peak Power Output Data Plot (CH Mid) ( /4-DQPSK mode)



#### Peak Power Output Data Plot (CH High) ( /4-DQPSK mode)



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# Peak Power Output Data Plot (CH Low) (8-DPSK mode)



## Peak Power Output Data Plot (CH Mid) (8-DPSK mode)



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# Peak Power Output Data Plot (CH High) (8-DPSK mode)



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## 8. 20dB BANDWIDTH MEASUREMENT & 99% POWER BANDWIDTH

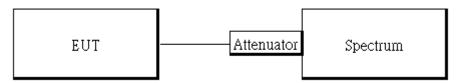
## 8.1. Standard Applicable

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	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015		
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015		
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015		
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015		

#### 8.3. Test Set-up



#### 8.4. Measurement Procedure

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

#### NOTE:

- 1. cable loss as 4.8dB that offsets in the spectrum
- 2. For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark

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#### 8.5. Measurement Result

GFSK							
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)				
0	2402	1.32	-				
39	2441	1.32	-				
78	2480	1.32	-				
	/4-DQPSK						
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)				
0	2402	1.32	0.88				
39	2441	1.33	0.89				
78	2480	1.34	0.89				
	8	-DPSK					
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	2/3 Bandwidth (MHz)				
0	2402	1.31	0.87				
39	2441	1.34	0.89				
78	2480	1.34	0.89				

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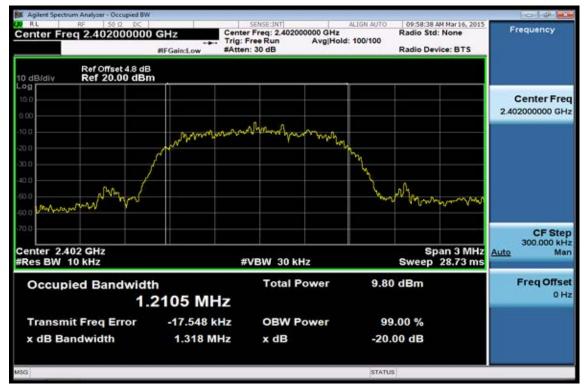
No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134 號 SGS Taiwan Ltd.



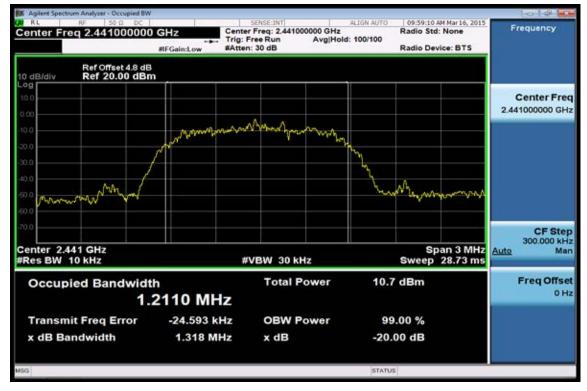
GFSK						
Channel	Frequency (MHz)	99% Power Bandwidth (MHz)				
0	2402	0.87				
39	2441	0.89				
78	2480	0.89				
/4-DQPSK						
Channel	Frequency (MHz)	99% Power Bandwidth (MHz)				
0	2402	1.20				
39	2441	1.20				
78	2480	1.20				
	8-D	PSK				
Channel	Frequency (MHz)	99% Power Bandwidth (MHz)				
0	2402	1.20				
39	2441	1.21				
78	2480	1.21				



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



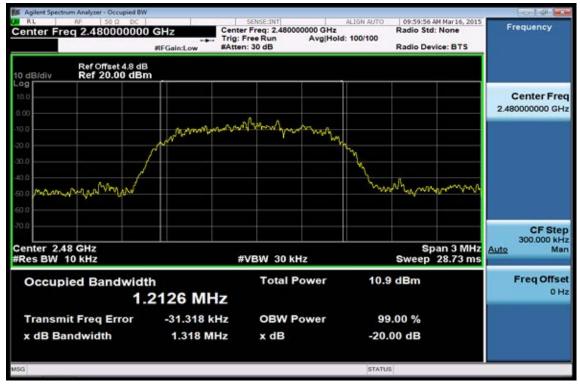
## 20dB Band Width Test Data CH-Mid (GFSK mode)



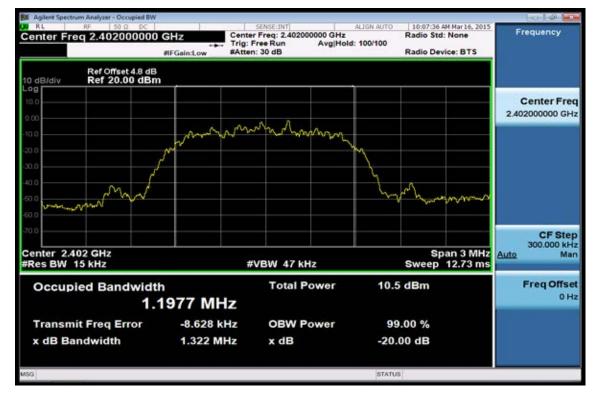
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# 20dB Band Width Test Data CH-High (GFSK mode)



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



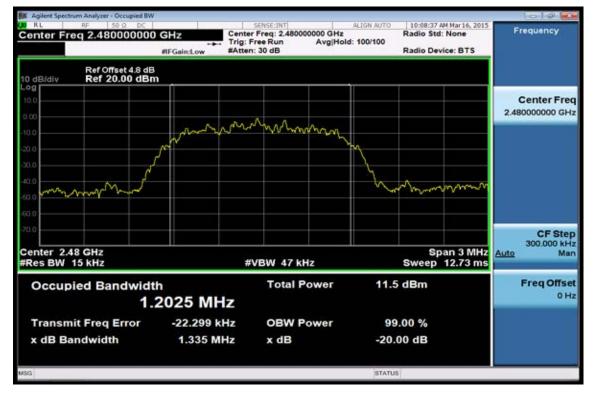
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.



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



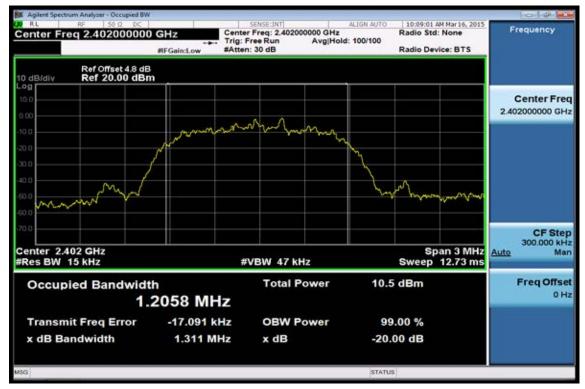
# 20dB Band Width Test Data CH-High ( /4-DQPSK mode)



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



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



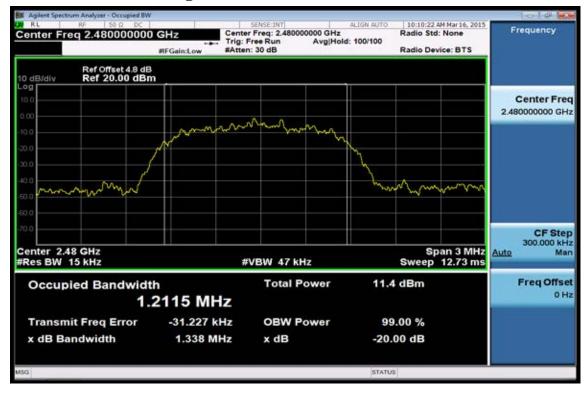
## 20dB Band Width Test Data CH-Mid (8-DPSK mode)



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



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





### 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)



### 99% Band Width Test Data CH-Low ( /4-DQPSK mode)



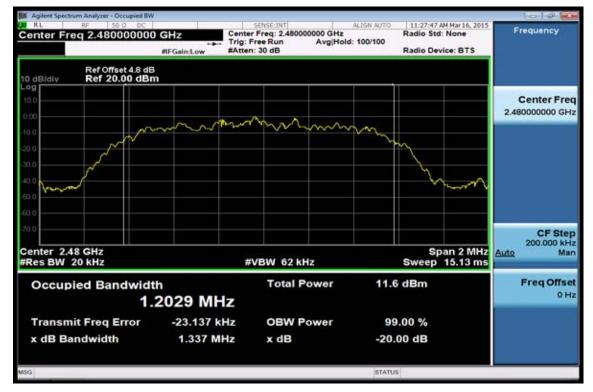
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.



### 99% Band Width Test Data CH-Mid ( /4-DQPSK mode)



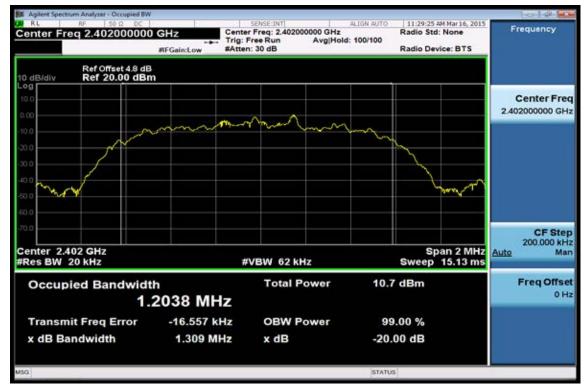
# 99% Band Width Test Data CH-High ( /4-DQPSK mode)



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



### 99% Band Width Test Data CH-Low (8-DPSK mode)



### 99% Band Width Test Data CH-Mid (8-DPSK mode)



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



### 99% Band Width Test Data CH-High (8-DPSK mode)





### 9. CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

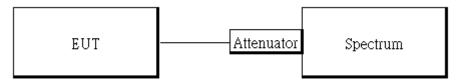
### 9.1. Standard Applicable

10. 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).

#### **10.1. Measurement Equipment Used**

Conducted Emission Test Site										
EQUIPMENT MFR		MODEL	SERIAL	LAST	CAL DUE.					
ТҮРЕ		NUMBER	NUMBER	CAL.						
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015					
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015					
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015					
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015					

#### 10.2. Test SET-UP



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### **10.3. 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 = 100K, VBW=300 kHz, Sweep = auto
- 6. Mark Peak, 2.390GHz and 2.4835GHz 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 = 100K & VBW = 300K, 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:

#### $\mathbf{FS} = \mathbf{RA} + \mathbf{AF} + \mathbf{CL} - \mathbf{AG}$

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

#### **10.4. Measurement Result**

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

#### NOTE:

- 1. Cable loss as 4.8dB that offsets in the spectrum
- 2. The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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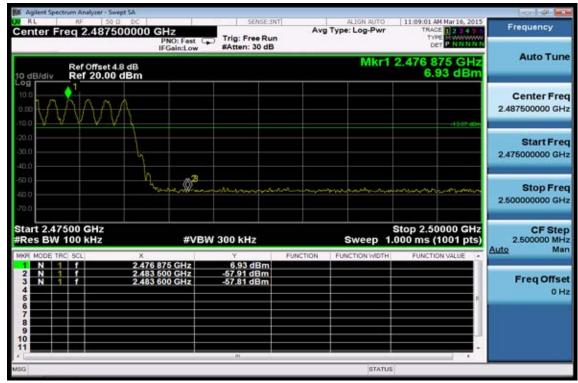
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### **BR Mode The Worst Case(Hopping mode) Band Edges Test Data CH-Low**

Agilent Spectrum Analyzer - Swept SA					0 0 *
RL RF 50 12 DC Center Freq 2.365000000	PNO: Fast C Trig:	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:03:25 AM Mar 16, 2015 TRACE 1 2 3 4 5 9 Type Museum DET P N N N N N	Frequency
Ref Offset 4.8 dB	IFGain:Low #Atte	n: 30 dB	Mkr	2.411 31 GHz 7.33 dBm	Auto Tune
10.0 0.00 10.0				MANNAMINAN	Center Fre 2.365000000 GH
20.0					Start Fre 2.310000000 GH
50.0 60.0 <mark></mark>	and a she with the she	and the former of the last second	\$ <sup>3</sup>	§ <sup>2</sup>	Stop Fre 2.420000000 GH
Start 2.31000 GHz Res BW 100 kHz	#VBW 300 k	Hz	Sweep 1.	Stop 2.42000 GHz 000 ms (1001 pts)	CF Ste 11.000000 MH Auto Ma
1 N 1 f 2.4 2 N 1 f 2.3	99 90 GHz -55.7	3 dBm 6 dBm 2 dBm		н Н	Freq Offs 0 H
7 8 9 10 11					
10			STATUS		

# **Band Edges Test Data CH-High**

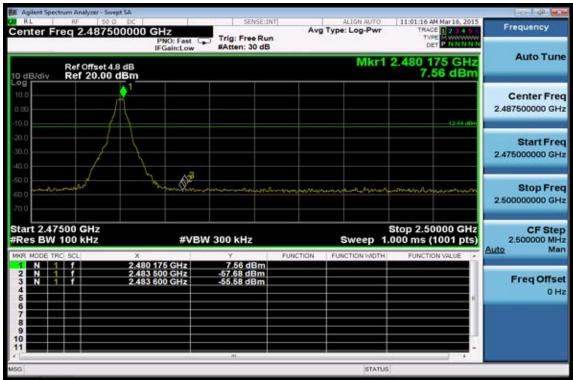




# **Band Edges Test Data CH-Low (Non-Hopping mode)**

M Agilent Spectrum Analyzer - Swept SA						0 0 8
Center Freq 2.3650000	PNO: Fast	Trig: Free Run #Atten: 30 dB	Avg	ALIGN AUTO	11:00:44 AM Mar 16, 2013 TRACE 1 2 3 4 5 TYPE 2000000000000000000000000000000000000	Frequency
Ref Offset 4.8 df		BAtten: 30 GB		Mkr	2.402 29 GHz 6.78 dBm	Auto Tune
10.0 0.00						Center Freq 2.365000000 GHz
-20.0						Start Freq 2.310000000 GHz
-50.0 -60.0 -70.0	ter the and the the termination	inaisedian ian	anthios parin.		2 monum	Stop Freq 2.420000000 GHz
Start 2.31000 GHz #Res BW 100 kHz	#VBW	V 300 kHz Y	FUNCTION		Stop 2.42000 GHz 000 ms (1001 pts) FUNCTION VALUE	
1 N 1 f 2 N 1 f 3 N 1 f 4 5 6 7	2.402 29 GHz 2.399 90 GHz 2.390 00 GHz	6.78 dBm -54.60 dBm -58.23 dBm				Freq Offset 0 Hz
8 9 10 11		m				
MSG				STATUS		

# **Band Edges Test Data CH-High**



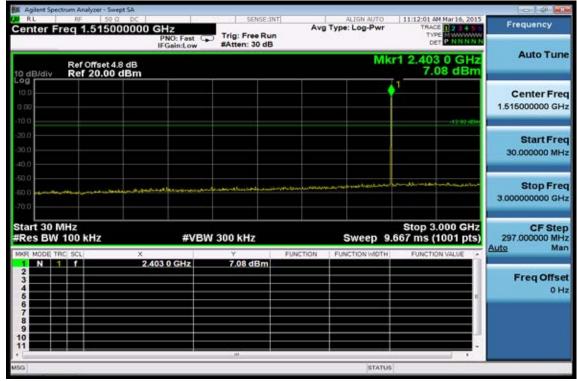
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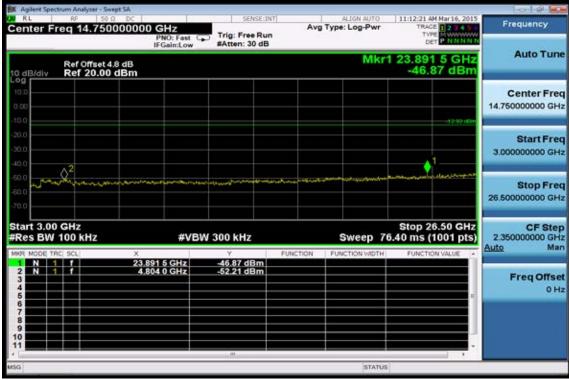
SGS Taiwan Ltd. No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134號



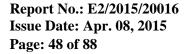
### **Conducted Spurious Emission Measurement Result** Ch Low 30MHz - 3GHz



# Ch Low 3GHz – 26.5GHz



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# Ch Mid 30MHz – 3GHz

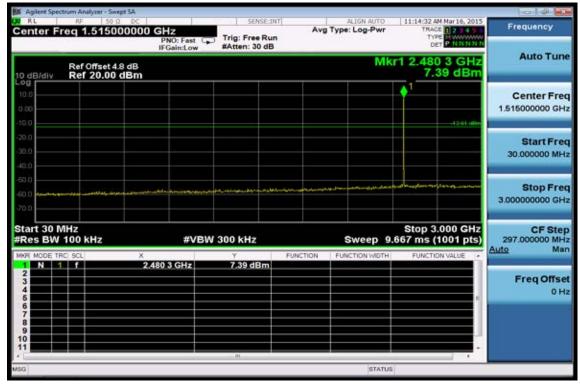
Agilent Spectre	um Analyzer - Swep	et SA					o d 💌
Center Fre	aq 1.51500		SENSE:I	Avg	ALIGN AUTO	11:12:45 AM Mar 16, 2 TRACE 1 2 4 TYPE	Frequency
10 dB/div	Ref Offset 4.8 Ref 20.00 c	IFGain:Low	#Atten: 30 dB		Mk	1 2.441 6 GH 7.90 dB	Auto Tune
10.0 0.00						-12:10	Center Freq 1.515000000 GHz
-20.0 -30.0 -40.0							Start Freq 30.000000 MHz
-50.0 -60.0			ه المراجع بين المراجع من م	kan kana di Araigen in w	an a		Stop Freq 3.000000000 GHz
Start 30 Mi #Res BW 1	00 kHz	#V	BW 300 kHz	FUNCTION	Sweep 9.	Stop 3.000 GH 667 ms (1001 pt FUNCTION VALUE	
1 N 1 2 3 4 5 6 7 8 9	<b>f</b>	2.441 6 GHz	7.90 dBm				Freq Offset 0 Hz
10 11 MSG			71		STATUS	,	

# Ch Mid 3GHz – 26.5GHz

Agilent Spectrum Analyzer - Swept SA						0 0 8
Center Freq 14.7500000	PNO: Fast	SENSE:INT		ALIGN AUTO	11:13:14 AM Mar 16, 201 TRACE 1 2 14 5 TYPE MUNICIPAL	Frequency
Ref Offset 4.8 dB	IFGain:Low	#Atten: 30 dB		Mkr	1 26.335 5 GH -45.78 dBn	Auto Tune
10.0 0.00					-12.10 49	Center Freq 14.750000000 GHz
-20.0 -30.0 -40.0						Start Freq 3.000000000 GHz
-50.0 -60.0 -70.0	a fara an	hand the second of	a the state of the	an share an a share an		Stop Freq 26.500000000 GHz
	x	300 kHz Y	FUNCTION	Sweep 7	Stop 26.50 GH 6.40 ms (1001 pts FUNCTION VALUE	CF Step 2.350000000 GHz Auto Man
1         N         1         f         3           3         4         -         -         -           6         -         -         -         -           7         -         -         -         -         -           9         -	26.335 5 GHz 4.882 0 GHz	-45.78 dBm -50.19 dBm				Freq Offset 0 Hz
MSG		(NI		STATUS		



# Ch High 30MHz - 3GHz



# Ch High 3GHz - 26.5GHz

<i>(1)</i>					r - Swept SA	um Analyzi	t Spectru	Agilent
	Aug Type: Log-P		Trig: Free R	PNO: Fast C	50 Ω DC 75000000	RF 9q 14.	r Fre	nte
Mkr1 26.194 5 GHz -46.01 dBm	Μ	dB	#Atten: 30 c	IFGain:Low	et 4.8 dB .00 dBm			dB/d
14.7								
3.0								
26.50	ang tanang tang tang tang tang tang tang	a frank a farana	kanan tahun din <sup>19</sup> kana <sup>kan</sup> ang kang din ka	to salawoo wasa	الاسرومية. الاسرومية	2. 	leve	
Stop 26.50 GHz eep 76.40 ms (1001 pts)	Sweep		W 300 kHz	#VB		00 kH		tes E
N WDTH FUNCTION VALUE	ON FUNCTION W		Y -46.01 dBn -52.38 dBn	5.194 5 GHz 4.960 0 GHz		f	DE TRO	N N
STATUS	ST		. 11	10				

# 11. RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 11.1. 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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#### **11.2.** Measurement Equipment Used

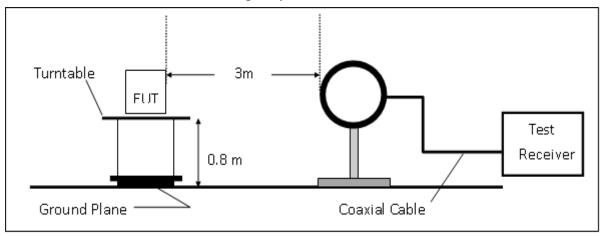
966 Chamber						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
TYPE		NUMBER	NUMBER	CAL.		
EMI Test Receiver	R&S	ESU 40	100363	04/12/2014	04/11/2015	
Loop Antenna	ETS-Lindgren	6502	00143303	12/09/2014	12/08/2015	
Broadband Antenna	TESEQ	CBL 6112D	35240	12/05/2014	12/04/2015	
Horn Antenna	ETS-Lindgren	3117	00143272	12/08/2014	12/07/2015	
Horn Antenna	ETS-Lindgren	3160-09	00117911	11/13/2014	11/12/2015	
Horn Antenna	ETS-Lindgren	3160-10	00117783	11/13/2014	11/12/2015	
Pre Amplifier	EMC Instruments	EMC330	980096	12/19/2014	12/18/2015	
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/19/2014	12/18/2015	
Pre Amplifier	R&S	SCU-18	10204	12/19/2014	12/18/2015	
Pre Amplifier	R&S	SCU-26	100780	12/19/2014	12/18/2015	
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015	
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.	
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.	
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.	
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015	
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015	
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015	
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015	
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015	
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015	

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

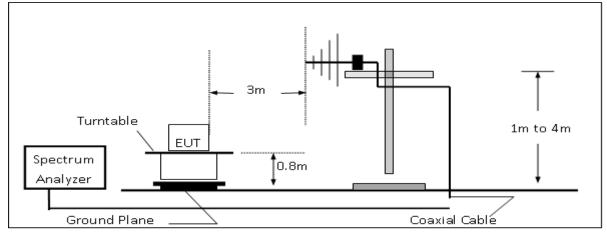


### 11.3. Test SET-UP

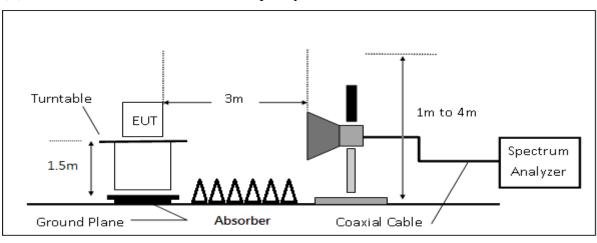
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



#### (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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### **11.4. 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 plane.
- 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.



#### **11.5. 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)

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

#### Note :

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

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

#### 11.6. 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.

#### **11.7. Measurement Result**

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

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

Operation Band	:BR+Hopping	Test Date	:2015-03-27
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Band Edge LOW	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
 MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	E	36.46	6.62	43.08	74.00	-30.92
2390.00	Average	E	23.06	6.62	29.68	54.00	-24.32

Operation Band	:BR+Hopping	Test Date	:2015-03-27
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Band Edge LOW	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	E	37.21	6.62	43.83	74.00	-30.17
2390.00	Average	E	23.10	6.62	29.72	54.00	-24.28



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Operation Band Fundamental Frequency	:BR+Hopping :2480 MHz	Test Date Temp./Humi.	:2015-03-27 :19.5 deg_C / 72 RH
Operation Mode	:Band Edge HIGH	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
 MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	Е	47.28	6.96	54.25	74.00	-19.75
2483.50	Average	Е	28.75	6.96	35.71	54.00	-18.29

Operation Band Fundamental Frequency Operation Mode EUT Pol.		:BR+Hoppin :2480 MHz :Band Edge :E2 Plane	HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2015-03-27 :19.5 deg_C / :Ashton :HORIZONTA	
Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Lev	el	FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	Е	53.12	6.96	60.08	74.00	-13.92
2483.50	Average	Е	30.41	6.96	37.37	54.00	-16.63



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

Operation Band	:BR	Test Date	:2015-03-27
Fundamental Frequency	:2402 MHz	Temp./Humi.	:19.5 deg_C / 72 RH
Operation Mode	:Band Edge LOW	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	E	36.94	6.62	43.55	74.00	-30.45
2390.00	Average	Е	23.13	6.62	29.75	54.00	-24.25

Operation Band	:BR	Test Date	:2015-03-27
Fundamental Frequency	:2402 MHz	Temp./Humi.	:19.5 deg_C / 72 RH
Operation Mode	:Band Edge LOW	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	Е	37.02	6.62	43.64	74.00	-30.36
2390.00	Average	E	23.43	6.62	30.05	54.00	-23.95



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Operation Band Fundamental Frequency	:BR :2480 MHz	Test Date Temp./Humi.	:2015-03-27 :19.5 deg_C / 72 RH
Operation Mode	:Band Edge HIGH	Engineer	:Ashton
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
 MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	E	47.77	6.96	54.74	74.00	-19.26
2483.50	Average	E	40.23	6.96	47.19	54.00	-6.81

Operation Band Fundamental Frequency Operation Mode EUT Pol.		:BR :2480 MHz :Band Edge :E2 Plane	HIGH	Test Date Temp./Humi. Engineer Measurement An	tenna Pol.	:2015-03-27 :19.5 deg_C / :Ashton :HORIZONTA	
Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Lev	vel	FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	Е	53.83	6.96	60.80	74.00	-13.20
2483.50	Average	Е	45.23	6.96	52.19	54.00	-1.81



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

Operation Ba Fundamental Operation M EUT Pol.	Frequency	:BR :2402 MHz :TX LOW :E2 Plane	T E	est Date emp./Humi. ngineer Ieasurement Ante	enna Pol.	:2015-03-27 :19.5 deg_C / 7 :Ashton :VERTICAL	72 RH
۹۶ ۱/- ۵۶ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲							
74 192 193 194 194 194 194 194 194 194 194 194 194	* *		×	× ×			
1	30 127	224 321		515 612 ency [MH/]	709 806	908	1000
Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV∕m	dBµV/m	dB
					·	·	
54.25	Peak	S	63.41	-26.79	36.61	40.00	-3.39
100.81	Peak	S	45.46	-23.69	21.77	43.50	-21.73
138.64	Peak	S	44.33	-21.60	22.72	43.50	-20.78
399.57	Peak	S	40.97	-15.88	25.09	46.00	-20.91
517.91	Peak	S	41.56	-13.60	27.96	46.00	-18.04

S

607.15

Peak

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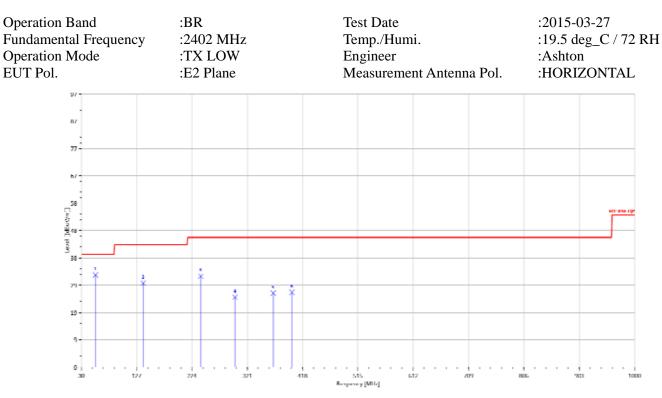
-12.50

25.18

46.00

-20.82

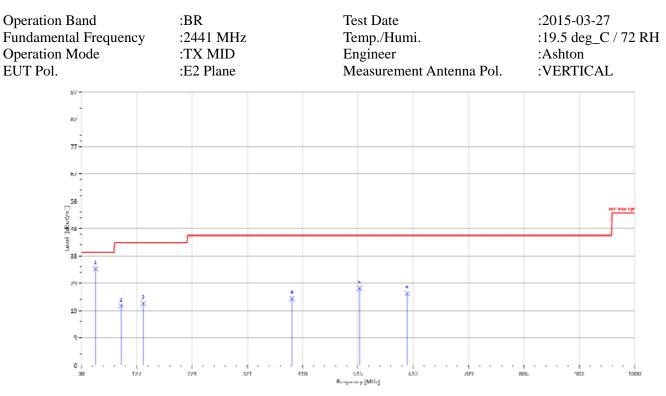




Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
55.22	Peak	S	59.77	-27.06	32.71	40.00	-7.29
138.64	Peak	S	51.39	-21.60	29.79	43.50	-13.71
239.52	Peak	S	53.42	-21.14	32.28	46.00	-13.72
299.66	Peak	S	44.08	-19.28	24.80	46.00	-21.20
366.59	Peak	S	43.15	-16.91	26.24	46.00	-19.76
399.57	Peak	S	42.37	-15.88	26.50	46.00	-19.50



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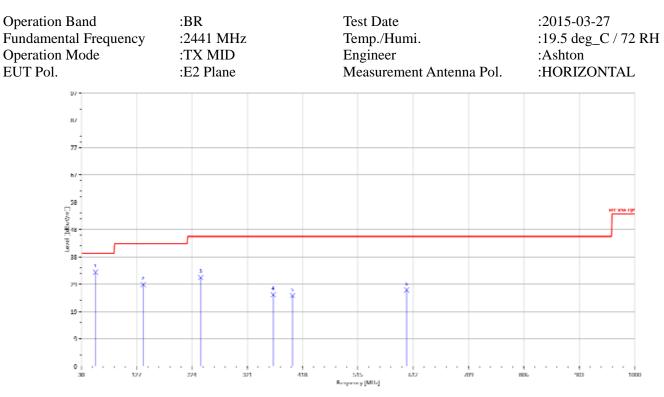


Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
55.22	Peak	S	61.27	-27.06	34.21	40.00	-5.79
99.84	Peak	S	44.94	-23.84	21.10	43.50	-22.40
138.64	Peak	S	43.45	-21.60	21.85	43.50	-21.65
399.57	Peak	S	39.51	-15.88	23.63	46.00	-22.37
517.91	Peak	S	40.86	-13.60	27.25	46.00	-18.75
601.33	Peak	S	37.95	-12.52	25.43	46.00	-20.57

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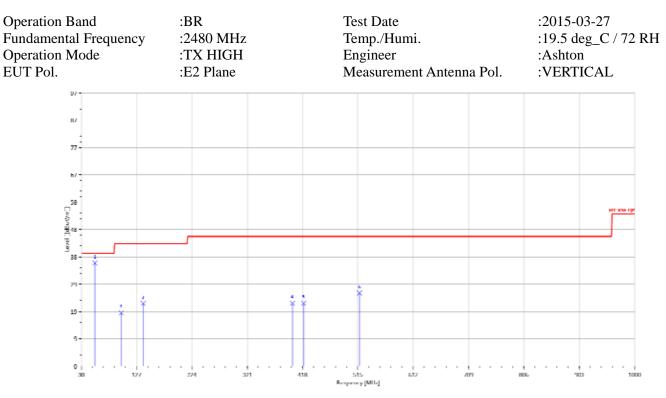
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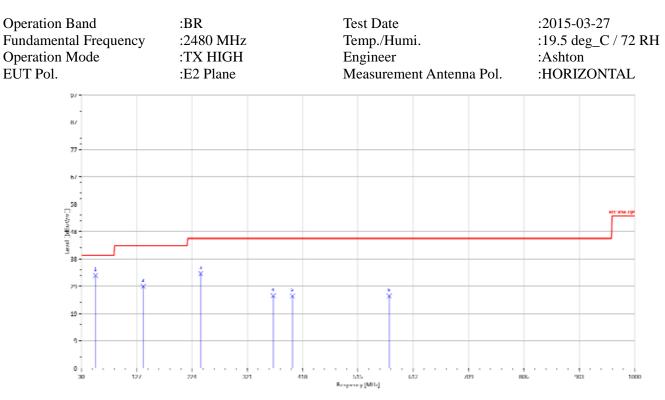
Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
55.22	Peak	S	60.32	-27.06	33.27	40.00	-6.73
138.64	Peak	S	50.54	-21.60	28.93	43.50	-14.57
239.52	Peak	S	52.54	-21.14	31.39	46.00	-14.61
366.59	Peak	S	42.24	-16.91	25.33	46.00	-20.67
400.54	Peak	S	40.77	-15.84	24.93	46.00	-21.07
600.36	Peak	S	39.47	-12.45	27.02	46.00	-18.98





Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
54.25	Peak	S	63.37	-26.79	36.58	40.00	-3.42
99.84	Peak	S	42.75	-23.84	18.91	43.50	-24.59
138.64	Peak	S	43.86	-21.60	22.25	43.50	-21.25
400.54	Peak	S	38.17	-15.84	22.32	46.00	-23.68
419.94	Peak	S	37.74	-15.40	22.34	46.00	-23.66
517.91	Peak	S	39.57	-13.60	25.96	46.00	-20.04





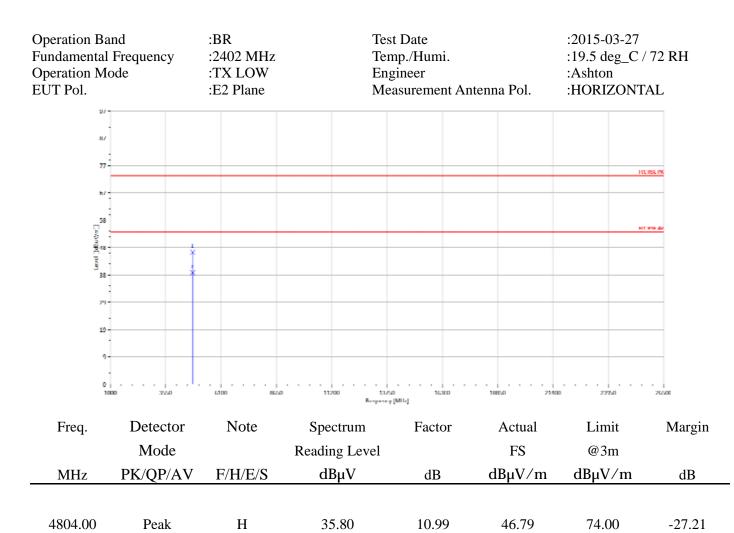
Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
55.22	Peak	S	59.94	-27.06	32.88	40.00	-7.12
138.64	Peak	S	50.61	-21.60	29.01	43.50	-14.49
239.52	Peak	S	54.66	-21.14	33.51	46.00	-12.49
366.59	Peak	S	42.57	-16.91	25.67	46.00	-20.33
400.54	Peak	S	41.42	-15.84	25.58	46.00	-20.42
570.29	Peak	S	38.05	-12.46	25.59	46.00	-20.41



# **Radiated Spurious Emission Measurement Result:** For Frequency over 1GHz

Operation Ba Fundamental Operation Mo EUT Pol.	Frequency	:BR :2402 MHz :TX LOW :E2 Plane	Tem Eng	Date p./Humi. ineer surement Ar	ntenna Pol.	:2015-03-27 :19.5 deg_C / :Ashton :VERTICAL	72 RH
47 8/ 						54	853 PK
 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전 전	- × - × - × - × - × - × - ×					na	<u>197 N</u>
74 14 9 0							
10		6100 8650	Inquency []		18850 21400	23950	26500
Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV∕m	dBµV/m	dB
4804.00	Peak	Н	34.39	10.98	45.37	74.00	-28.63
4804.00	Average	Н	29.66	10.98	40.64	54.00	-13.36





28.61

Η

Average

4804.00

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10.99

39.60

54.00

-14.40



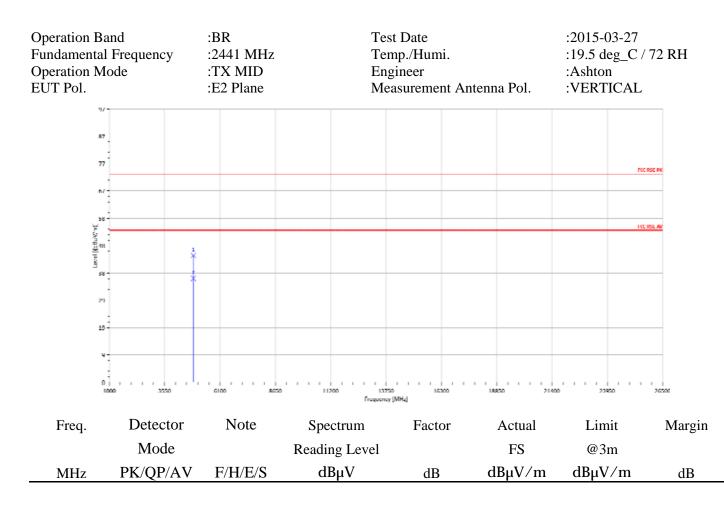
4882.00

4882.00

Peak

Average

#### FCC ID: HLZA5003 IC: 1754F-A5003



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10.93

10.93

44.94

36.86

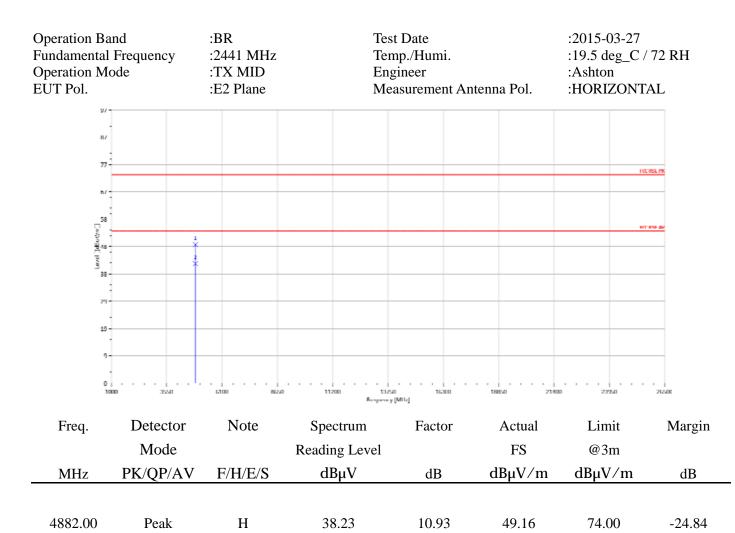
74.00

54.00

-29.06

-17.14





31.49

Η

Average

4882.00

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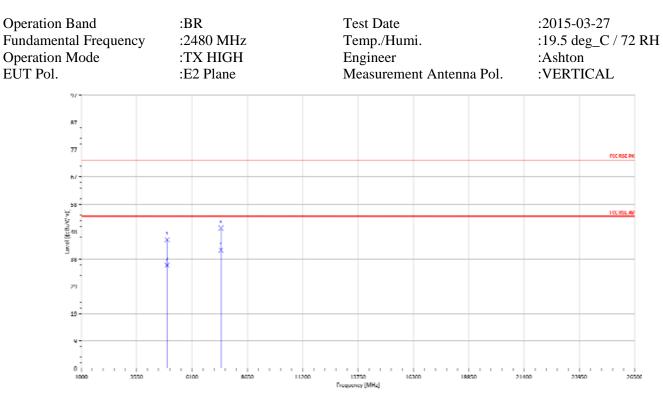
10.93

42.42

54.00

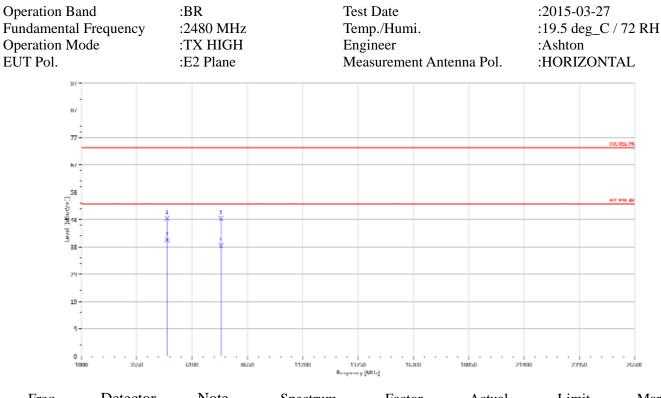
-11.58





Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Peak	Н	34.63	10.99	45.62	74.00	-28.38
4960.00	Average	Н	25.56	10.99	36.55	54.00	-17.45
7440.00	Peak	Н	34.09	15.67	49.76	74.00	-24.24
7440.00	Average	Н	26.29	15.65	41.94	54.00	-12.06





Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Peak	Н	37.94	10.99	48.93	74.00	-25.07
4960.00	Average	Н	30.22	10.99	41.21	54.00	-12.79
7440.00	Peak	Н	33.17	15.65	48.82	74.00	-25.18
7440.00	Average	Н	23.58	15.65	39.23	54.00	-14.77



### **12. FREQUENCY SEPARATION**

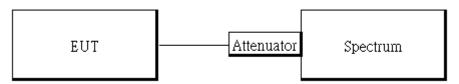
### 12.1. Standard Applicable

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.

#### 12.2. Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
ТҮРЕ		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015			
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015			
Splitter	RF-LAMBAD	RFLT2W1G18 G	RF35	12/19/2014	12/18/2015			
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015			

#### 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 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.

WeifS of all weights and the results and set the four result of the set and 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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#### 12.5. 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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# **13. NUMBER OF HOPPING FREQUENCY**

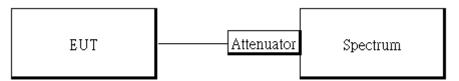
# 13.1. Standard Applicable

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

### 13.2. Measurement Equipment Used

Conducted Emission Test Site						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
ТҮРЕ		NUMBER	NUMBER	CAL.		
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015	
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015	
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015	
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015	

### 13.3. Test Set-up



### 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 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.

# 13.5. 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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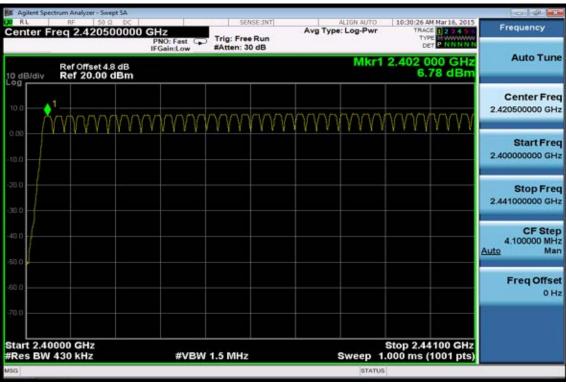
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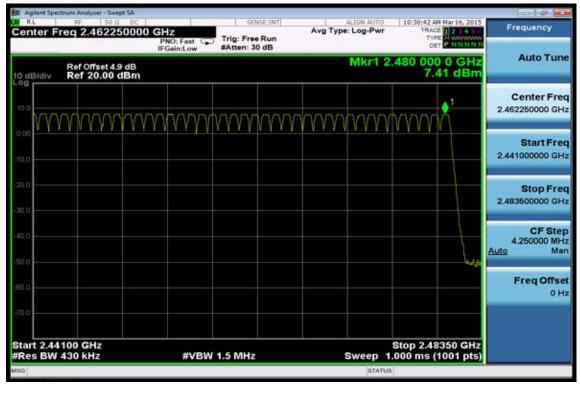


# **Channel Number**



2.4 GHz – 2.441GHz

# 2.441 GHz – 2.4835GHz



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#### 14. TIME OF OCCUPANCY (DWELL TIME)

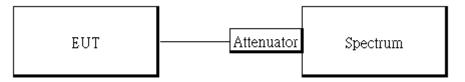
### 14.1. Standard Applicable

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.

### 14.2. Measurement Equipment Used

Conducted Emission Test Site						
EQUIPMENT MFR MODEL SERIAL L					CAL DUE.	
ТҮРЕ		NUMBER	NUMBER	CAL.		
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015	
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015	
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/19/2014	12/18/2015	
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015	

#### 14.3. Test Set-up





### 14.4. 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

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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### 14.5. Tabular Result of the Measurement

	GFSK	(1Mbps)	
Channel	PACKET TYPE	Measurement Result	Limit
Channel	PACKEITIPE	(ms)	(ms)
	DH1	123.52	400ms
0	DH3	261.92	400ms
	DH5	308.38	400ms
	DH1	122.88	400ms
39	DH3	262.08	400ms
	DH5	307.73	400ms
	DH1	123.52	400ms
78	DH3	262.72	400ms
	DH5	307.73	400ms
	/4 DQP	SK (2Mbps)	
<u>Channal</u>		Measurement Result	Limit
Channel	PACKET TYPE	(ms)	(ms)
	DH1	124.80	400ms
39	DH3	263.52	400ms
	DH5	306.45	400ms
	8-DPSK	K (3Mbps)	
		Measurement Result	Limit
Channel	PACKET TYPE	(ms)	( <b>ms</b> )
	DH1	124.80	400ms
39	DH3	262.72	400ms
	DH5	307.84	400ms

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

#### GFSK (1Mbps):

CH Low	DH1 time slot =	0.386 (ms) * (1600/2/79)	* 31.6 =	123.52 (	(ms)
	DH3 time slot =	1.637 (ms) * (1600/4/79)	* 31.6 =	261.92	(ms)
	DH5 time slot =	2.891 (ms) * (1600/6/79)	* 31.6 =	308.38	(ms)

CH Mid	DH1 time slot =	0.384 (ms) * (1600/2/79)	* 31.6 =	122.88	(ms)
	DH3 time slot =	1.638 (ms) * (1600/4/79)	* 31.6 =	262.08	(ms)
	DH5 time slot $=$	2.885 (ms) * (1600/6/79)	* 31.6 =	307.73	(ms)

CH High	DH1 time slot =	0.386 (ms) * (1600/2/79)	* 31.6 =	123.52	(ms)
	DH3 time slot =	1.642 (ms) * (1600/4/79)	* 31.6 =	262.72	(ms)
	DH5 time slot =	2.885 (ms) * (1600/6/79)	* 31.6 =	307.73	(ms)

#### /4 -DQPSK (2Mbps):

CH Mid	2DH1 time slot =	0.390 (ms) * (1600/2/79) * 31.6 =	124.80 (ms)
	2DH3 time slot =	1.631 (ms) * (1600/4/79) * 31.6 =	263.52 (ms)
	2DH5 time slot =	2.870 (ms) * (1600/6/79) * 31.6 =	306.45 (ms)
8-DPSK (3Mbps):			
CH Mid	3DH1 time slot =	0.390 (ms) * (1600/2/79) * 31.6 =	124.80 (ms)
	3DH3 time slot =	1.642 (ms) * (1600/4/79) * 31.6 =	262.72 (ms)
	3DH5 time slot =	2.886 (ms) * (1600/6/79) * 31.6 =	307.84 (ms)

### 14.6. Measurement Result

Note: Refer to next page for plots.

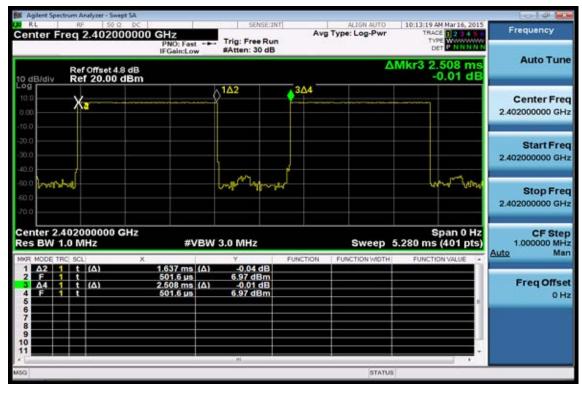
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CH-Low DH1



DH3



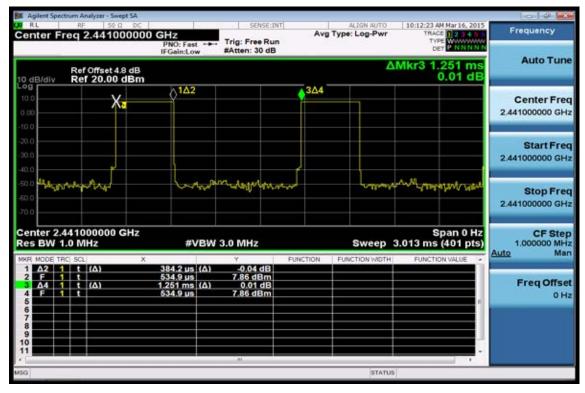


DH5

Agilent Spectrum Analyzer - Swept SA					1	00
Center Freq 2.40200000	PNO: Fast Tri	sense:INT g: Free Run tten: 30 dB	Avg Type: Lo		25 AM Mar 16, 2015 RACE 1 2 3 4 5 6 TYPE WOMMON N DET P. N.N.N.N.N.	Frequency
Ref Offset 4.8 dB	IFGain:Low #At	tten: 30 dB		∆Mkr3	3.750 ms 0.00 dB	Auto Tune
10.0 0.00		Δ <sup>1Δ2</sup>	3Δ4			Center Freq 2.402000000 GHz
-20.0						Start Freq 2.402000000 GHz
-50.0 - <b>1999 - 141 (Mar-1</b> -60.0		hest for her			L,	Stop Freq 2.402000000 GHz
Center 2.402000000 GHz Res BW 1.0 MHz	#VBW 3.0	MHz	S	weep 7.813 r		CF Step 1.000000 MHz Auto Man
MOR         MODE         TRC:         SCL         X           1         Δ2         1         t         (Δ)           2         F         1         t           3         Δ4         1         t         (Δ)           4         F         1         t         (Δ)           5         6         6         6         6           9         9         9         10         10         10	2.891 ms (Δ) 996.2 μs 6 3.750 ms (Δ)	r FUN -0.01 dB -95 dBm -0.00 dB -95 dBm	FUNCTI	DN WIDTH FUN	ICTION VALUE	Freq Offset 0 Hz
MSG				STATUS		

# CH-Mid

DH1





DH3



# DH5

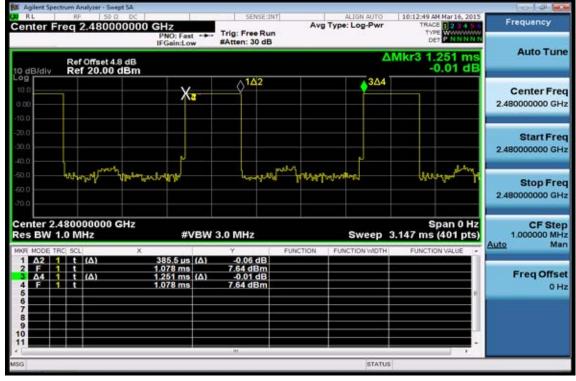


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# **CH-High**

# DH1



### DH3





DH5

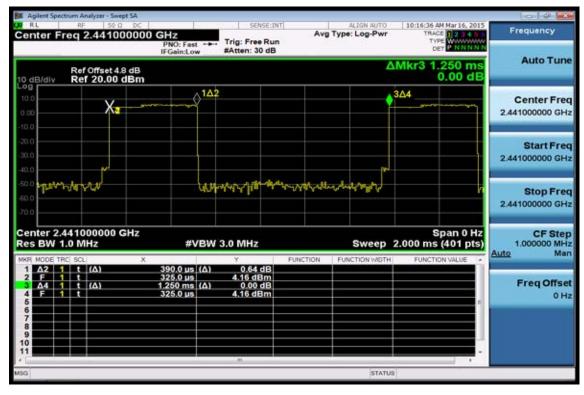


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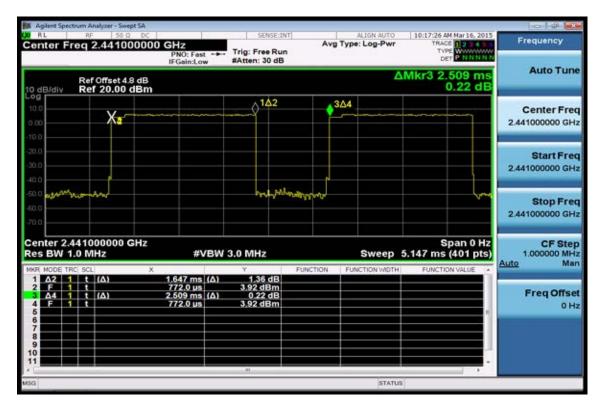
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# CH-Mid 2DH1

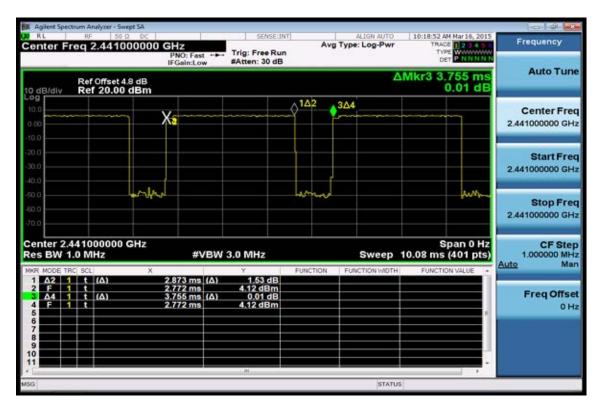


# **2DH3**





2DH5

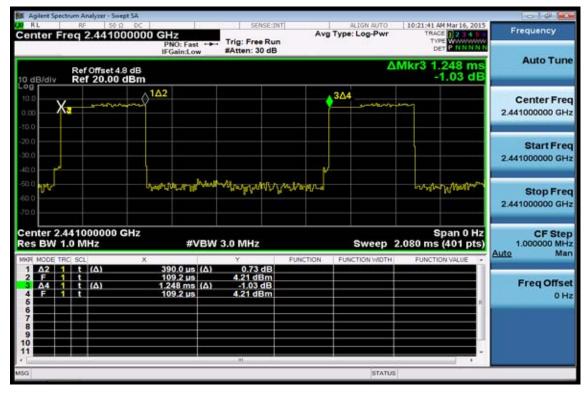


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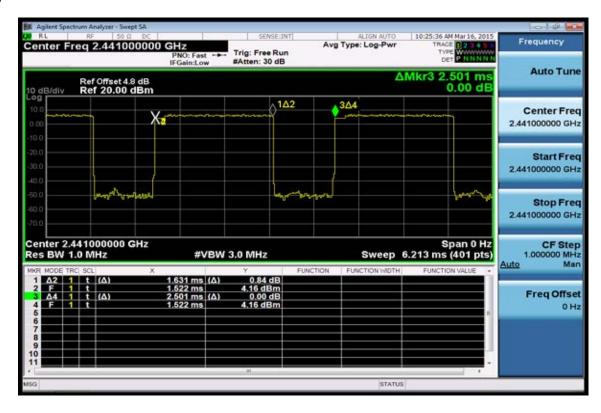
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# CH-Mid **3DH1**

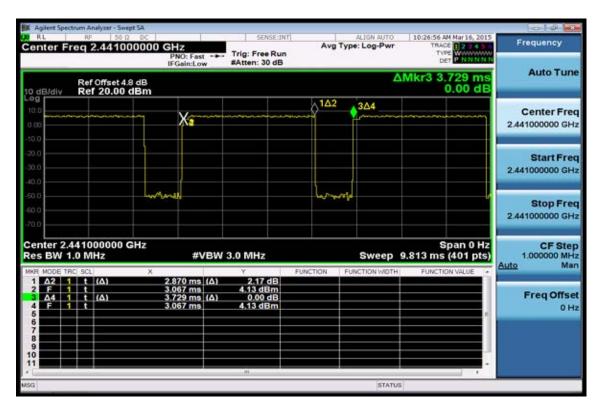


# 3DH3





3DH5



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# **15. ANTENNA REOUIREMENT**

# 15.1. 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.

### According to RSS-GEN 6.7

As per RSP-100, each applicant for equipment certification must provide a list of all antenna types that may be used with the transmitter, indicating the maximum permissible antenna gain (in dBi). When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements, including the antenna type used.

In addition, applicants shall perform RF power and spurious emission measurements with each antenna type supplied or specified by the manufacturer for use with the transmitter.

### According to RSS-GEN 8.3

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

# **15.2.** Antenna Connected Construction

An embedded-in antenna design is used.

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

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

~ End of Report ~

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