# **TEST REPORT**

## of FCC Part 15 Subpart C

 $\boxtimes$  New Application;  $\square$  Class I PC;  $\square$  Class II PC

Product :	RIVA Turbo X
Brand:	RIVA
Model:	RTX01B
Series Model:	RTX01S
Model Difference:	Color Difference
FCC ID:	PU5TX8670
FCC Rule Part:	§15.247, Cat: DSS
Applicant:	Wistron Corporation
Address:	21F., No. 88, Sec. 1, HsinTai 5th Rd., Hsichih Dist, New Taipei City 221, Taiwan

## **Test Performed by: International Standards Laboratory**

<Lung-Tan LAB> \*Site Registration No. BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3; \*Address: No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd. Lung-Tan Hsiang, Tao Yuan County 325, Taiwan \*Tel: 886-3-407-1718; Fax: 886-3-407-1738 Report No.: ISL-14LR155FCDSS Issue Date : 2014/06/23



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory.



## **VERIFICATION OF COMPLIANCE**

Applicant:	Wistron Corporation
Product Description:	RIVA Turbo X
Brand Name:	RIVA
Model No.:	RTX01B
Series Model Number:	RTX01S
Model Difference:	Color Difference
FCC ID:	PU5TX8670
Date of test:	$2014/06/16 \sim 2014/06/20$
Date of EUT Received:	2014/06/16

## We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:	DinoChen	Date:	2014/06/23
Prepared By:	Dion Chang / Engineer Gigi Jeh	Date:	2014/06/23
Approved By:	Gigi Yeh / Specialist Jinent In Vincent Su / Technical Manager	Date:	2014/06/23



# Version

Version No.	Date	Description
00	2014/06/23	Initial creation of document



# **Table of Contents**

1.	GEN	ERAL INFORMATION	7
	1.1.	Product Description	7
	1.2.	Related Submittal(s) / Grant (s)	8
	1.3.	Test Methodology	8
	1.4.	Test Facility	8
	1.5.	Special Accessories	8
	1.6.	Equipment Modifications	8
2.	SYST	FEM TEST CONFIGURATION	9
	2.1.	EUT Configuration	9
	2.2.	EUT Exercise	9
	2.3.	Test Procedure	9
	2.4.	Configuration of Tested System	
3.	SUM	IMARY OF TEST RESULTS	
4.	DES	CRIPTION OF TEST MODES	
5.	AC P	<b>POWER LINE CONDUCTED EMISSION TEST</b>	
	5.1.	Standard Applicable:	
	5.2.	Measurement Equipment Used:	
	5.3.	EUT Setup:	
	5.4.	Measurement Procedure:	
	5.5.	Measurement Result:	
6.	PEA	K OUTPUT POWER MEASUREMENT	
	6.1.	Standard Applicable:	
	6.2.	Measurement Equipment Used:	
	6.3.	.Test Set-up:	
	6.4.	Measurement Procedure:	
	6.5.	Measurement Result:	
7.	100K	<b>KHz BANDWIDTH OF BAND EDGES MEASUREMENT</b>	
	7.1.	Standard Applicable:	
	7.2.	Measurement Equipment Used:	19
	7.3.	Test SET-UP:	
	7.4.	Measurement Procedure:	21
	7.5.	Field Strength Calculation	21
	7.6.	Measurement Result:	21
8.	SPUI	RIOUS EMISSION TEST	
	8.1.	Standard Applicable:	
	8.2.	Measurement Equipment Used:	
	8.3.	Test SET-UP:	
	8.4.	Measurement Procedure:	
	8.5.	Field Strength Calculation	
	8.6.	Measurement Result:	



9.	FREG	QUENCY SEPARATION	
	9.1.	Standard Applicable:	
	9.2.	Measurement Equipment Used:	
	9.3.	Test Set-up:	
	9.4.	Measurement Procedure:	
	9.5.	Measurement Result:	
10.	NUM	BER OF HOPPING FREQUENCY	
	10.1.	Standard Applicable:	
	10.2.	Measurement Equipment Used:	
	10.3.	Test Set-up:	
	10.4.	Measurement Procedure:	
	10.5.	Measurement Result:	
11.	TIMI	E OF OCCUPANCY (DWELL TIME)	
	11.1.		
	11.2.	Measurement Equipment Used:	44
	11.3.	Test Set-up:	44
	11.4.	Measurement Procedure:	44
	11.5.	Measurement Result:	
12.	20dB	Bandwidth & 99% Bandwidth	
	12.1.	Standard Applicable:	
	12.2.	Measurement Equipment Used:	51
	12.3.	Test Set-up:	51
	12.4.	Measurement Procedure:	51
	12.5.	Measurement Result:	
13.	ANT	ENNA REQUIREMENT	
	13.1.	Standard Applicable:	
	13.2.	Antenna Connected Construction:	
14.	RF E	XPOSURE	
	14.1.	Standard Applicable	60
	14.2.	Measurement Result:	60



## 1. GENERAL INFORMATION

## **1.1. Product Description**

#### General:

Product Name	RIVA Turbo X		
Brand Name	RIVA		
Model Name	RTX01B		
Series Model Name:	RTX01S		
Model Difference	Color Difference		
	100~240VAC form AC/DC Adapter or 15V re-chargeable ba		
Power Supply	Adaptor: 1. Model: DA-65A19, Supplier: APD		
	Battery:	1. Model: 4ICR18/65, Supplier: SIMPLO	

#### Bluetooth:

Frequency Range:	2402 – 2480MHz		
Bluetooth Version:	V2.1 + EDR	V4.0	
Channel number:	79 channels	40 channels, 2MHz step	
Modulation type	Frequency Hopping Spread Spectrum	Digital Modulation	
Modulation type:	$GFSK + \pi / 4 DQPSK + 8DPSK$	GFSK	
Transmit Power:	8.36 dBm (Peak)	7.81 dBm Peak	
Dwell Time:	<= 0.4s	N/A	
Antenna Designation:	PIFA Antenna -0.62dBi		

The EUT is compliance with Bluetooth EDR V2.1 + 4.0 Standard.

The report applies for BT 2.1 mode.

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





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

This submittal(s) (test report) is intended for **FCC ID:** <u>**PU5TX8670**</u> filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules.

### 1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

#### 1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd., Lung-Tan Hsiang, Tao Yuan County 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number is: TW1036, Canada Registration Number: 4067B-3.

#### **1.5.** Special Accessories

Not available for this EUT intended for grant.

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

Not available for this EUT intended for grant.



## 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**

The EUT (Transmitter) was tested with a test program to fix the Tx/RX frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

#### 2.3. Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 13 of ANSI C63.4-2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

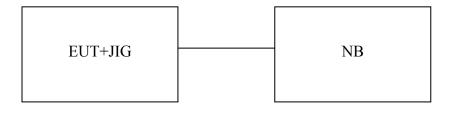
#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 of ANSI C63.4-2009 and DA 00-705.



## 2.4. Configuration of Tested System

## Fig. 2-1 Configuration of Tested System (Fixed channel)



## Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	NB	Dell	P19G	6LCQCT1	Non-Shield	No- Shielding



## 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.203, §15.247(c)	Antenna Requirement	Compliant
§2.1093	RF EXPOSURE	Compliant

## 4. DESCRIPTION OF TEST MODES

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz), mid (2441MHz) and high (2480MHz) with each modulation were chosen for full testing.

The worst case BDR mode was reported for Radiated Emission.



# 5. AC POWER LINE CONDUCTED EMISSION TEST

### 5.1. Standard Applicable:

According to \$15.207, frequency range within 150KHz 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.

### 5.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE	MIFK	NUMBER	NUMBER	CAL.	CAL DUE.
Conduction 04-1 Cable	WOKEN	CFD 300-NL	Conduction 04 -1	09/24/2013	09/23/2014
EMI Receiver 16	Rohde & Schwarz	ESCI	101221	06/13/2014	06/12/2015
LISN 18	ROHDE & SCHWARZ	ENV216	101424	03/13/2014	03/12/2015
LISN 19	ROHDE & SCHWARZ	ENV216	101425	03/13/2014	03/12/2015

## 5.3. EUT Setup:

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





### **5.4. 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.

## 5.5. Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

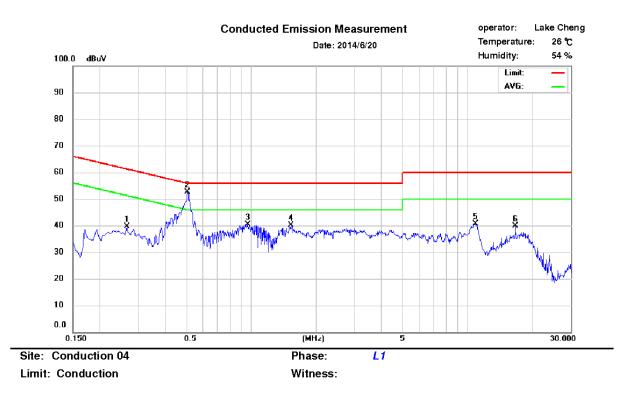




## AC POWER LINE CONDUCTED EMISSION TEST DATA

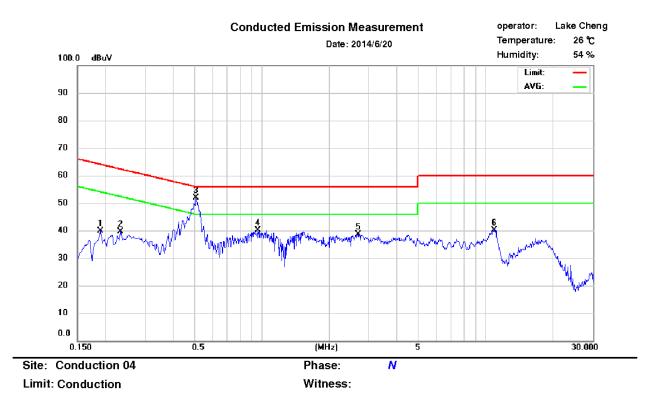
-14 of 60-

Operation Mode:	Operation Mode	Test Date:	2014/06/20
Test By:	Dino		



No.	Frequency	Correct Factor	QP Emission	QP Limit	QP Margin	AVG Emission	AVG Limit	AVG Margin	Note
	(MHz)	(dB)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.266	9.58	37.08	61.24	-24.16	29.79	51.24	-21.45	
2	0.510	9.59	50.70	56.00	-5.30	43.96	46.00	-2.04	
3	0.966	9.60	38.76	56.00	-17.24	31.73	46.00	-14.27	
4	1.530	9.61	36.59	56.00	-19.41	28.68	46.00	-17.32	
5	10.934	9.77	38.75	60.00	-21.25	31.94	50.00	-18.06	
6	16.714	9.90	33.10	60.00	-26.90	26.15	50.00	-23.85	





No.	Frequency (MHz)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)	Note
1	0.190	9.60	36.78	64.04	-27.26	30.30	54.04	-23.74	
2	0.234	9.60	36.51	62.31	-25.80	29.41	52.31	-22.90	
3	0.510	9.60	50.67	56.00	-5.33	43.67	46.00	-2.33	
4	0.962	9.61	38.35	56.00	-17.65	29.42	46.00	-16.58	
5	2.702	9.64	36.20	56.00	-19.80	27.03	46.00	-18.97	
6	10.862	9.79	38.15	60.00	-21.85	31.17	50.00	-18.83	



## 6. PEAK OUTPUT POWER MEASUREMENT

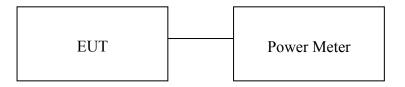
### 6.1. Standard Applicable:

According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

#### 6.2. Measurement Equipment Used:

Conducted Emission Test Site										
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.					
ТҮРЕ		NUMBER	NUMBER	CAL.						
Power Meter 05	Anritsu	ML2495A	1116010	04/19/2014	04/18/2015					
Power Sensor 07	DARE	RPR3006W	13I00030SN O34	10/18/2013	10/17/2014					
Temperature Chamber	KSON	THS-B4H100	2287	03/17/2014	03/16/2015					
DC Power supply	ABM	51850	N/A	08/16/2013	08/15/2014					
AC Power supply	EXTECH	CFC105W	NA	12/19/2013	12/18/2014					
Attenuator	Woken	Watt-65m3502	11051601	NA	NA					
Splitter	MCLI	PS4-199	12465	12/27/2013	12/26/2014					
Spectrum analyzer	Agilent	N9030A	MY51360021	05/02/2014	05/01/2015					

#### 6.3. .Test Set-up:



#### **6.4. Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
- 3. Record the max. reading.
- 4. Repeat above procedures until all frequency measured were complete.



#### 6.5. Measurement Result:

### **BDR Mode**

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	8.13	0.00	8.13	0.00650	1
2441.00	8.13	0.00	8.13	0.00650	1
2480.00	8.36	0.00	8.36	0.00685	1

## EDR 2M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	7.61	0.00	7.61	0.00577	1
2441.00	7.70	0.00	7.70	0.00589	1
2480.00	8.01	0.00	8.01	0.00632	1

#### EDR 3M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	7.75	0.00	7.75	0.00596	1
2441.00	7.82	0.00	7.82	0.00605	1
2480.00	8.09	0.00	8.09	0.00644	1

Offset: 0.5dB



## 7. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

#### 7.1. Standard Applicable:

According to §15.247(d), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).



## 7.2. Measurement Equipment Used:

## 7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 7.2.2. Radiated emission:

	Ch	amber 14(966)	)		
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
ТҮРЕ		NUMBER	NUMBER	CAL.	
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY49060537	07/18/2013	07/17/2014
Spectrum Analyzer 20(6.5GHz)	Agilent	E4443A	MY48250315	05/26/2014	05/25/2015
Spectrum Analyzer 22(43GHz)	R&S	FSU43	100143	05/03/2014	05/02/2015
Dipole antenna	SCHWARZBECK	VHAP,30-300	919	12/03/2013	12/02/2015
Dipole antenna	SCHWARZBECK	UHAP,300-100 0	1195	12/03/2013	12/02/2015
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	03/07/2013	03/06/2015
Bilog Antenna30-1G	Schaffner	CBL 6112B	2756	01/08/2014	01/07/2015
Horn antenna1-18G(06)	EMCO	3117	0006665	11/04/2013	11/03/2014
Horn antenna18-26G(04)	Com-power	AH-826	081001	05/15/2013	05/14/2015
Preamplifier9-1000M	HP	8447D	NA	02/20/2014	02/19/2015
Preamplifier1-18G	MITEQ	AFS44-001018 00-25-10P-44	1329256	07/18/2013	07/17/2014
Preamplifier1-26G	EM	EM01M26G	NA	02/20/2014	02/19/2015
Cable1-18G	HUBER SUHNER	Sucoflex 106	NA	02/17/2014	02/16/2015
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	10/14/2013	10/13/2014
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&3742 1/2	10/03/2013	10/02/2015
Signal Generator	R&S	SMU200A	102330	02/19/2014	02/18/2015
Signal Generator	Anritsu	MG3692A	20311	10/30/2013	10/29/2014
2.4G Filter	Micro-Tronics	Brm50702	76	12/27/2013	12/26/2014



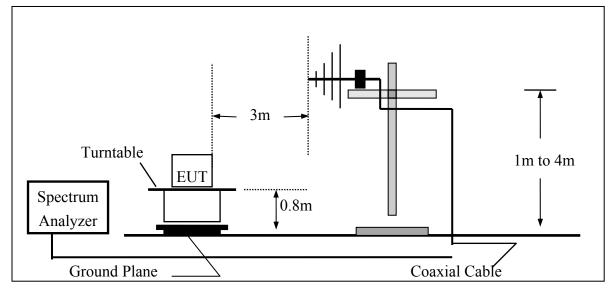
## 7.3. Test SET-UP:

## 7.3.1. Conducted Emission at antenna port:

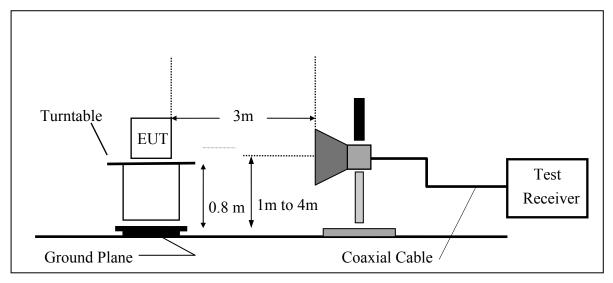
Refer to section 6.3 for details.

## 7.3.2. Radiated emission:

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



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





### 7.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
- 5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
- 6. Repeat above procedures until all frequency measured were complete.

#### 7.5. 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:

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

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

#### 7.6. Measurement Result:

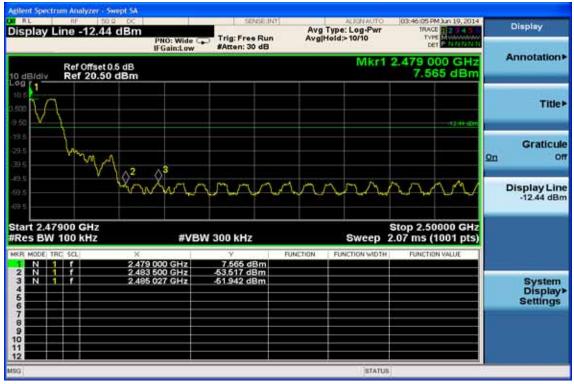
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.



# BDR Mode Band Edges Test Data CH-Low

arker 3 2.317050	0000000 GHz PNO: Fast IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg[Hold>10/10	03:44:34 PM Jun 19, 2014 TRACE 2 2 3 4 3 TYPE MUMMMM DET P MININ 3	Peak Search			
Ref Offset 0.5 dB Mkr3 2.317 050 GHz 10 dB/div Ref 20.50 dBm -45.617 dBm								
9 ) 5 					Next Pk Righ			
05 05 05 <b>0</b> 3					Next Pk Lei			
	MANAMANANAN	<u>Marana ana ana ana ana ana ana ana ana an</u>	MMMMM		Marker Delt			
art 2.31000 GHz tes BW 100 kHz R MODE TRC SCL	#VE	W 300 kHz	Sweep 9	Stop 2.40400 GHz 0.00 ms (1001 pts)	Mkr→C			
tes BW 100 kHz			Sweep 9	).00 ms (1001 pts)	Mkr→C Mkr→RefLv			
Res BW 100 kHz R MODE TRC SCL N 1 f N 1 f	× 2.402 026 GHz 2.390 000 GHz	7 7.238 dBm -54.093 dBm	Sweep 9	).00 ms (1001 pts)	_			

Band Edges Test Data CH-High





### -23 of 60-

VERTICAL

### **Radiated Emission: (BDR mode)**

Fundamental Frequency 2402 MHz						Tes	st By	2014/06/17 Dino 60 %	
	No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H

							0	
2	2390.00	27.21	31.40	58.61	74.00	-15.39	Peak	VERTICAL
1	2389.40	15.56	31.39	46.95	54.00	-7.05	Average	HORIZONTAL
2	2389.40	29.57	31.39	60.96	74.00	-13.04	Peak	HORIZONTAL
3	2390.00	15.57	31.40	46.97	54.00	-7.03	Average	HORIZONTAL
4	2390.00	28.02	31.40	59.42	74.00	-14.58	Peak	HORIZONTAL

2390.00 15.57 31.40 46.97 54.00 -7.03 Average

Operation Mode TX CH High Fundamental Frequency 2480 MHz Temperature 25

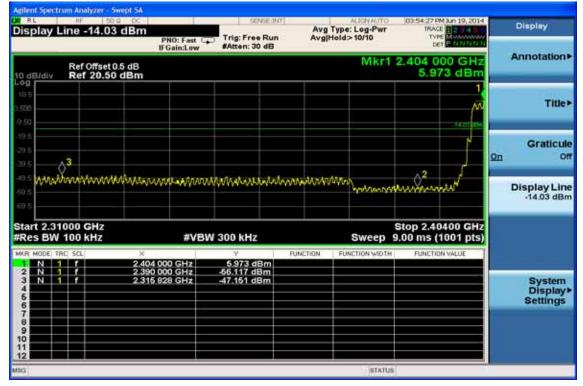
2014/06/17 Test Date Test By Dino Humidity 60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	2483.50	16.10	31.56	47.66	54.00	-6.34	Average	VERTICAL
2	2483.50	28.17	31.56	59.73	74.00	-14.27	Peak	VERTICAL
3	2486.54	15.94	31.56	47.50	54.00	-6.50	Average	VERTICAL
4	2486.54	29.02	31.56	60.58	74.00	-13.42	Peak	VERTICAL
1	2483.50	16.08	31.56	47.64	54.00	-6.36	Average	HORIZONTAL
2	2483.50	27.97	31.56	59.53	74.00	-14.47	Peak	HORIZONTAL

- Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequen-1 cv
- Field strength limits for frequency above 1000MHz are based on average limits. However, 2 Peak mode field strength shall not exceed the average limits specified plus 20dB.
- "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious 3 frequency.
- Measurement of data within this frequency range shown "-" in the table above means the 4 reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, 6 Sweep time= 200 ms.



# EDR 2M Mode Band Edges Test Data CH-Low



Band Edges Test Data CH-High





#### **Radiated Emission (EDR 2M mode):**

	tion Mode	TX	CH Low			2014/06/17					
	imental Fred erature	quency 240 25	)2 MHz				5	Dino 60 %			
No.	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol			
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H			
1	2385.72	15.61	31.39	47.00	54.00	-7.00	Average	VERTICAL			
2	2385.72	29.17	31.39	60.56	74.00	-13.44	Peak	VERTICAL			
3	2390.00	15.94	31.40	47.34	54.00	-6.66	Average	VERTICAL			
4	2390.00	27.79	31.40	59.19	74.00	-14.81	Peak	VERTICAL			
1	2364.10	15.94	31.35	47.29	54.00	-6.71	Average	HORIZONTAL			
2	2364.10	29.99	31.35	61.34	74.00	-12.66	Peak	HORIZONTAL			
3	2390.00	16.13	31.40	47.53	54.00	-6.47	Average	HORIZONTAL			
4	2390.00	27.18	31.40	58.58	74.00	-15.42	Peak	HORIZONTAL			
_	Operation ModeTX CH HighTest Date2014/06/17Fundamental Frequency2480 MHzTest ByDino										
Funda	mental Free		•	1		Te	st By				
Funda	mental Free	quency 248	•	Level	Limit	Te	st By	Dino			
Funda Temp	umental Fred erature	quency 248 25	30 MHz		Limit dBuV/m	Te: Hu Over	st By midity	Dino 60 %			
Funda Temp	imental Fred erature Freq	quency 248 25 Reading	30 MHz Factor	Level		Te Hu Over Limit	st By midity	Dino 60 % Pol			
Funda Tempo No.	erature Freq MHz	quency 248 25 Reading dBuV	30 MHz Factor dB	Level dBuV/m	dBuV/m	Te: Hu Over Limit dB	st By midity Remark	Dino 60 % Pol V/H			
Funda Tempo No.	erature Freq MHz 2483.50	quency 248 25 Reading dBuV 16.15	Factor dB 31.56	Level dBuV/m 47.71	dBuV/m 54.00	Te: Hu Over Limit dB -6.29	st By midity Remark Average	Dino 60 % Pol V/H VERTICAL			
Funda Tempo No.	reature Freq MHz 2483.50 2483.50	quency  248    25  Reading    dBuV  16.15    27.26  1000000000000000000000000000000000000	80 MHz Factor dB 31.56 31.56	Level dBuV/m 47.71 58.82	dBuV/m 54.00 74.00	Te: Hu Over Limit dB -6.29 -15.18	st By midity Remark Average Peak	Dino 60 % Pol V/H VERTICAL VERTICAL			
Funda Tempo No.	mental Freq Freq MHz 2483.50 2483.50 2484.46	quency  248    25    Reading    dBuV    16.15    27.26    16.26	80 MHz Factor dB 31.56 31.56 31.56	Level dBuV/m 47.71 58.82 47.82	dBuV/m 54.00 74.00 54.00	Te: Hu Over Limit dB -6.29 -15.18 -6.18	st By midity Remark Average Peak Average	Dino 60 % Pol V/H VERTICAL VERTICAL VERTICAL			
Funda Tempo No.	mental Freq Freq MHz 2483.50 2483.50 2484.46	quency  248    25    Reading    dBuV    16.15    27.26    16.26	80 MHz Factor dB 31.56 31.56 31.56	Level dBuV/m 47.71 58.82 47.82	dBuV/m 54.00 74.00 54.00	Te: Hu Over Limit dB -6.29 -15.18 -6.18	st By midity Remark Average Peak Average	Dino 60 % Pol V/H VERTICAL VERTICAL VERTICAL			
Funda Tempo No.	req Freq MHz 2483.50 2483.50 2484.46 2484.46	quency  248    25  Reading    dBuV  16.15    27.26  16.26    28.93	80 MHz Factor dB 31.56 31.56 31.56 31.56	Level dBuV/m 47.71 58.82 47.82 60.49	dBuV/m 54.00 74.00 54.00 74.00	Te: Hu Over Limit dB -6.29 -15.18 -6.18 -13.51	st By midity Remark Average Peak Average Peak	Dino 60 % Pol V/H VERTICAL VERTICAL VERTICAL VERTICAL			

Remark:

2494.04

30.04

31.57

4

Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency 1

61.61

74.00

-12.39

Peak

HORIZONTAL

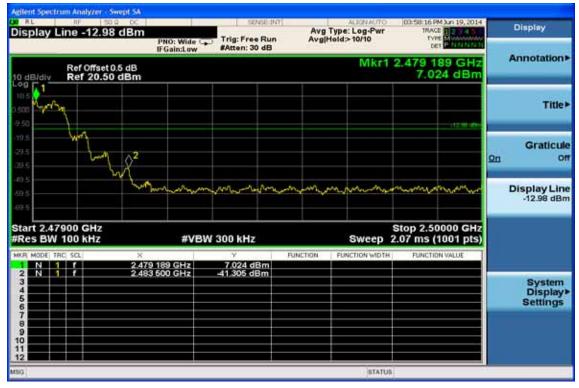
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- <sup>4</sup> Measurement of data within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.



# EDR 3M Mode Band Edges Test Data CH-Low

isplay l	ine -13.9	3 dBm	PNO: Fast C			Avg Type Avg Hold:		TRAC	M Jun 19, 2014		Display
0 dB/div	Ref Offset Ref 20.5		I Game ow				Mkr1		26 GHz 74 dBm		Annotation
.0g 10.5 .500 9.50									Å		Title
19.5 29.5 29.5	3								ļ	Qn	Graticul
49.5 <b>www.W</b> 99.5 99.5	minnim	vrround V	mmm	nin words	whinter.	inn-view	hum	etropenty	nas <sup>1</sup>		Display Lin -13.93 dBi
Res BW	000 GHz 100 kHz		#VB	W 300 kHz			Sweep	9.00 ms (	0400 GHz 1001 pts)		
	1	2.390	026 GHz 000 GHz 160 GHz	6,074 dB -56,435 dB -47,634 dB	m m	CTION FU	ICTION WIDTH	FUNCTIO	IN VALUE		System Display Settings
7 9 10 11											

Band Edges Test Data CH-High





### Radiated Emission (EDR 3M mode):

Opera	tion Mode	TX	CH Low			Te	st Date	2014/06/17				
Funda	imental Free	quency 240	)2 MHz			Te	st By	Dino				
Temp	erature	25				Hu	midity	60 %				
No.	Freq	Reading	Factor	Level	Limit Over Limit Remark		Pol					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H				
1	2389.67	16.57	31.39	47.96	54.00	-6.04	Average	VERTICAL				
2	2389.67	29.20	31.39	60.59	74.00	-13.41	Peak	VERTICAL				
3	2390.00	16.14	31.40	47.54	54.00	-6.46	Average	VERTICAL				
4	2390.00	27.52	31.40	58.92	74.00	-15.08	Peak	VERTICAL				
1	2346.98	16.02	31.33	47.35	54.00	-6.65	Average	HORIZONTAL				
2	2346.98	29.23	31.33	60.56	74.00	-13.44	Peak	HORIZONTAL				
3	2390.00	16.24	31.40	47.64	54.00	-6.36	Average	HORIZONTAL				
4	2390.00	27.90	31.40	59.30	74.00	-14.70	Peak	HORIZONTAL				

Operation ModeTX CH HighFundamental Frequency2480 MHzTemperature25

Test Date2014/06/17Test ByDinoHumidity60 %

No.	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	2483.50	16.10	31.56	47.66	54.00	-6.34	Average	VERTICAL
2	2483.50	27.50	31.56	59.06	74.00	-14.94	Peak	VERTICAL
3	2498.98	16.05	31.58	47.63	54.00	-6.37	Average	VERTICAL
4	2498.98	29.44	31.58	61.02	74.00	-12.98	Peak	VERTICAL
1	2483.50	16.23	31.56	47.79	54.00	-6.21	Average	HORIZONTAL
2	2483.50	27.21	31.56	58.77	74.00	-15.23	Peak	HORIZONTAL
3	2486.08	16.31	31.56	47.87	54.00	-6.13	Average	HORIZONTAL
4	2486.08	29.00	31.56	60.56	74.00	-13.44	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- <sup>2</sup> Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

#### **International Standards Laboratory**

#### **Report Number: ISL-14LR155FCDSS**



## 8. SPURIOUS EMISSION TEST

#### 8.1. Standard Applicable:

According to §15.247(d), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). 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.

#### 8.2. Measurement Equipment Used:

#### 8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 8.2.2. Radiated emission:

Refer to section 7.2 for details.

#### **8.3. Test SET-UP:**

#### 8.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

#### 8.3.2. Radiated emission:

Refer to section 7.3 for details.

-29 of 60-



### **8.4. Measurement Procedure:**

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7. Repeat above procedures until all frequency measured were complete.

## 8.5. 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	

#### 8.6. Measurement Result:

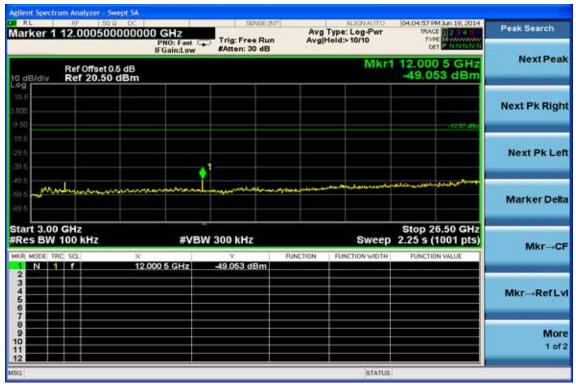
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.



Conducted Spurious Emission Measurement Result (Worst case: BDR Mode) Ch Low 30MHz – 3GHz

splay Line -12.8	7 dBm	SENSE INT	Avg Type: Log-Pwr	04:02:20 PM Jun 19, 2014 TRACE	Display
	PNO: Fast C IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold>10/10	DET P ANNUM	
dBidiv Ref 20.5			MI	r1 2.402 0 GHz 7.132 dBm	Annotation
9 15					Title
50				17.07.45	
학 · · · · · · · · · · · · · · · · · · ·				Å <sup>2</sup>	Graticu On C
5 5 5 5		Langung Barran January - Stade-Stade		ullu	Display Li -12.87 dB
art 10 MHz tes BW 100 kHz	#VB	W 300 kHz	Sweep	Stop 3.000 GHz 286 ms (1001 pts)	
R MODE TRC SCL	× 2.402.0 GHz	γ 7.132 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
N 1 f	2,606 7 GHz	45.509 dBm			System Display Settings
			STATU	31	

# Ch Low 3GHz – 26.5GHz







## Ch Mid 30MHz – 3GHz

splay L		509 oc 04 dBm	PNO: Fast C IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg	Type: Log-Pwr Hold>10/10	04:06:27 PM Jun 19, 2014 TRACE 27 PM Jun 19, 2014 TRACE 27 PM Jun 19, 2014 Trine Museum Det P Jun 1921	Display
dB/div		et 0.5 dB 50 dBm				Mkr	1 2.440 9 GHz 6.961 dBm	Annotation
5 5 0								Title
							2 <sup>2</sup>	Graticule On Of
5	Anna ann ann ann ann ann ann ann ann ann		1.1. m		البديدة والمرجعه		willin	Display Line -13.04 dBm
rt 10 N es BW	1Hz 100 kHz		#VB	W 300 kHz		Sweep 2	Stop 3.000 GHz 286 ms (1001 pts)	
MODE TR	1	× 2	440 9 GHz	ې 6.961 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
N 1		.2,	545 6 GHz	-45.247 dBm				System Display Settings
						STATUS		

# Ch Mid 3GHz – 26.5GHz

arker 1	4.8800000	00000 GHz	Fast 😱	Trig: Free Run #Atten: 30 dB	Avg	Type: Log-Pwr Hold: 10/10	04:07:09 PM Jun 19, 2014 TRACE 22 4 5 TYPE MUMONING DET PANNING	Peak Search
0 dB/div	Ref Offset 0. Ref 20.50	5 dB dBm				Mk	-48.929 dBm	Next Peak
0 5 500 50								Next Pk Right
	- <u>/1</u>							Next Pk Lef
5 <b>M</b>	al account	an a	~~~		ar and and seal of the	- « ياداس <sub>ت</sub> ، دوب خمر ماند		Marker Delta
- 101 K	100 kHz		#VBW :	300 kHz		Sweep	Stop 26.50 GHz 2.25 s (1001 pts)	Mkr⊸CF
R MODE TP		× 4.880 0 G	Hz	∀ -48.929 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
3 4 5 6 7								Mkr→RefLv
								More 1 of 2
0						STATUS	1	

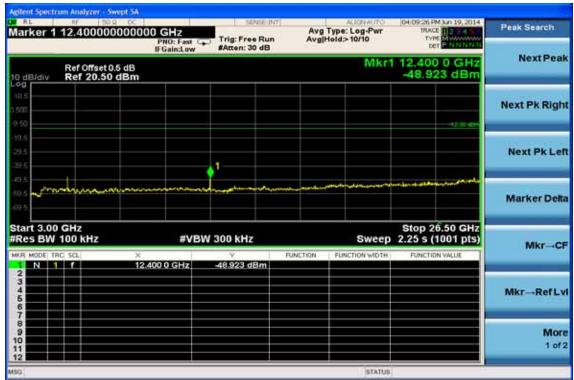


## Ch High 30MHz – 3GHz

	rum Analyzer - S	5230.Wis-171-						
Display I	Line -12.38		Trig: Free Run	Avg	Type: Log-Pwr Hold>10/10	04:00:20 PM Az TRACE TYPE		Display
10 dB/div	Ref Offset	IFGain:Low	#Atten: 30 dB	a de la companya de l	Mk	r1 2.479 7 7.619	GHz	Annotation
10.5 0.500 -9.50							12.001404	Title
-19.5 -29.5 -29.5						2 <sup>2</sup>	Qu	Graticule
-49.5 -69.5 -69.5		Umphalanana Marana Marana Barabet A	9	An galanda a da	الليم	wulling		Display Line -12.38 dBn
Start 10 f #Res BW	VIHz 100 kHz	#VB	W 300 kHz		Sweep	Stop 3.00 286 ms (100		
	11	× 2.479 7 GHz	7 7.619 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VA	LUE	
23456789		2,584 4 GHz	-45.933 dBm					System Display Settings
10 11 12					STATUS			

-32 of 60-

# Ch High 3GHz – 26.5GHz





#### Radiated Spurious Emission Measurement Result: (below 1GHz) (Worst case: BDR Mode)

Operation Mode	TX CH Low	Test Date	2014/06/17
Fundamental Frequency	2402MHz	Test By	Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	48.43	46.69	-12.19	34.50	40.00	-5.50	Peak	VERTICAL
2	157.07	47.47	-12.01	35.46	43.50	-8.04	Peak	VERTICAL
3	182.29	47.24	-13.90	33.34	43.50	-10.16	Peak	VERTICAL
4	292.87	50.76	-11.33	39.43	46.00	-6.57	Peak	VERTICAL
5	444.19	42.67	-8.34	34.33	46.00	-11.67	Peak	VERTICAL
6	870.99	26.67	-1.39	25.28	46.00	-20.72	Peak	VERTICAL
1	48.43	47.68	-12.19	35.49	40.00	-4.51	Peak	HORIZONTAL
2	140.58	42.69	-12.44	30.25	43.50	-13.25	Peak	HORIZONTAL
3	187.14	49.55	-14.30	35.25	43.50	-8.25	Peak	HORIZONTAL
4	322.94	49.70	-10.70	39.00	46.00	-7.00	Peak	HORIZONTAL
5	444.19	41.30	-8.34	32.96	46.00	-13.04	Peak	HORIZONTAL
6	886.51	25.86	-1.09	24.77	46.00	-21.23	Peak	HORIZONTAL

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.



### **Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH Mid		2014/06/17
Fundamental Frequency	2441MHz		Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	141.55	39.48	-12.38	27.10	43.50	-16.40	Peak	VERTICAL
2	176.47	41.20	-13.30	27.90	43.50	-15.60	Peak	VERTICAL
3	239.52	40.31	-13.24	27.07	46.00	-18.93	Peak	VERTICAL
4	352.04	39.21	-10.19	29.02	46.00	-16.98	Peak	VERTICAL
5	422.85	39.48	-8.78	30.70	46.00	-15.30	Peak	VERTICAL
6	749.74	27.70	-2.95	24.75	46.00	-21.25	Peak	VERTICAL
1	48.43	49.46	-12.19	37.27	40.00	-2.73	Peak	HORIZONTAL
2	84.32	54.23	-17.70	36.53	40.00	-3.47	Peak	HORIZONTAL
3	121.18	54.15	-14.42	39.73	43.50	-3.77	Peak	HORIZONTAL
4	143.49	53.98	-12.30	41.68	43.50	-1.82	Peak	HORIZONTAL
5	168.71	51.54	-12.49	39.05	43.50	-4.45	Peak	HORIZONTAL
6	803.09	30.79	-2.48	28.31	46.00	-17.69	Peak	HORIZONTAL

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.



### **Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH High	Test Date	2014/06/17
Fundamental Frequency	2480MHz	Test By	Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	31.94	39.32	-13.15	26.17	40.00	-13.83	Peak	VERTICAL
2	141.55	40.58	-12.38	28.20	43.50	-15.30	Peak	VERTICAL
3	240.49	39.33	-13.20	26.13	46.00	-19.87	Peak	VERTICAL
4	352.04	38.69	-10.19	28.50	46.00	-17.50	Peak	VERTICAL
5	422.85	39.82	-8.78	31.04	46.00	-14.96	Peak	VERTICAL
6	792.42	29.24	-2.59	26.65	46.00	-19.35	Peak	VERTICAL
1	48.43	42.51	-12.19	30.32	40.00	-9.68	Peak	HORIZONTAL
2	147.37	51.98	-12.12	39.86	43.50	-3.64	Peak	HORIZONTAL
3	283.17	39.48	-11.54	27.94	46.00	-18.06	Peak	HORIZONTAL
4	359.80	43.22	-10.04	33.18	46.00	-12.82	Peak	HORIZONTAL
5	444.19	37.90	-8.34	29.56	46.00	-16.44	Peak	HORIZONTAL
6	817.64	27.05	-2.26	24.79	46.00	-21.21	Peak	HORIZONTAL

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.



### **Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH Low	Test Date	2014/06/17
Fundamental Frequency	2402 MHz	Test By	Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	1679.00	61.07	-14.12	46.95	74.00	-27.05	Peak	VERTICAL
2	4804.00	51.57	-1.90	49.67	74.00	-24.33	Peak	VERTICAL
1	1994.00	52.76	-12.09	40.67	74.00	-33.33	Peak	HORIZONTAL
2	4804.00	49.51	-1.90	47.61	74.00	-26.39	Peak	HORIZONTAL

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- <sup>2</sup> Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.



### **Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH Mid	Test Date	2014/06/17
Fundamental Frequency	2441 MHz	Test By	Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	1994.00	60.32	-12.09	48.23	74.00	-25.77	Peak	VERTICAL
2	4882.00	53.27	-1.61	51.66	74.00	-22.34	Peak	VERTICAL
1	1798.00	52.67	-13.34	39.33	74.00	-34.67	Peak	HORIZONTAL
2	4882.00	51.28	-1.61	49.67	74.00	-24.33	Peak	HORIZONTAL

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- <sup>2</sup> Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.



#### **Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH High	Test Date	2014/06/17
Fundamental Frequency	2480 MHz	Test By	Dino
Temperature	25	Humidity	60 %

No	Freq	Reading	Factor	Level	Limit	Over Limit	Remark	Pol
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB		V/H
1	4960.00	49.58	-1.30	48.28	74.00	-25.72	Peak	VERTICAL
2	7440.00	45.60	5.38	50.98	74.00	-23.02	Peak	VERTICAL
1	4960.00	51.80	-1.30	50.50	74.00	-23.50	Peak	HORIZONTAL
2	7440.00	44.96	5.38	50.34	74.00	-23.66	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- <sup>2</sup> Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.



# 9. FREQUENCY SEPARATION

#### 9.1. Standard Applicable:

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

#### 9.2. Measurement Equipment Used:

Refer to section 6.2 for details.

#### 9.3. Test Set-up:

Refer to section 6.3 for details.

## 9.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = middle of hopping channel.
- 4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 3.0 MHz, Sweep = auto.
- 5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

#### 9.5. Measurement Result:

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

Note: Refer to next page for plots.



# **Frequency Separation Test Data**

## Low



#### Mid





# High





# **10. NUMBER OF HOPPING FREQUENCY**

#### **10.1. Standard Applicable:**

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

## 10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

## 10.3. Test Set-up:

Refer to section 6.3 for details.

## **10.4. Measurement Procedure:**

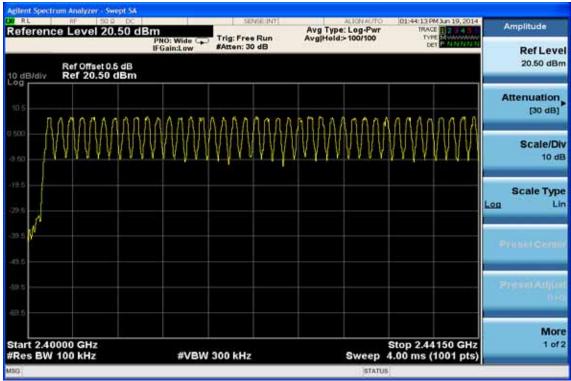
- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set spectrum analyzer Start=2400MHz, Stop = 2441MHz and Start=2441MHz, Stop = 2483.5MHz, Sweep = auto.
- 4. Set the spectrum analyzer as RBW=300KHz, VBW=1MHz
- 5. Max hold, view and count how many channel in the band.

#### **10.5. Measurement Result:**

Note: Refer to next page for plots.



## Channel Number 2.4 GHz – 2.441GHz



# 2.441 GHz – 2.4835GHz





# 11. TIME OF OCCUPANCY (DWELL TIME)

## **11.1. Standard Applicable:**

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

#### 11.2. Measurement Equipment Used:

Refer to section 6.2 for details.

## 11.3. Test Set-up:

Refer to section 6.3 for details.

## **11.4. Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW / VBW =1MHz, Span = 0Hz , Adjust Sweep = 2.5ms.
- 5. Repeat above procedures until all frequency measured were complete.



## **11.5. Measurement Result:**

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

CH Low	DH1 time slot	=	0.393 (ms)	* (1600/2/79) * 31.6 =	125.76	(ms)
	DH3 time slot	=	1.642 (ms)	* (1600/4/79) * 31.6 =	262.72	(ms)
	DH5 time slot	=	2.890 (ms)	* (1600/6/79) * 31.6 =	308.27	(ms)
CH Mid	DH1 time slot	=	0.396 (ms)	* (1600/2/79) * 31.6 =	126.72	(ms)
	DH3 time slot	=	1.650 (ms)	* (1600/4/79) * 31.6 =	264.00	(ms)
	DH5 time slot	=	2.890 (ms)	* (1600/6/79) * 31.6 =	308.27	(ms)
CH High	DH1 time slot	=	0.396 (ms)	* (1600/2/79) * 31.6 =	126.72	(ms)
	DH3 time slot	=	1.657 (ms)	* (1600/4/79) * 31.6 =	265.12	(ms)
	DH5 time slot	=	2.890 (ms)	* (1600/6/79) * 31.6 =	308.27	(ms)

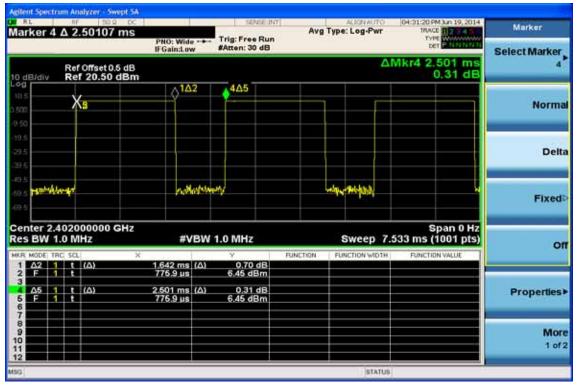
Note: Refer to next page for plots.



# Low Channel



arker	44	A 1	2510	0 ms				Trig: Free	Run	Avg	Type: Log-Pwr	TRAC		Marker
in one lead						PNO: Wid FGain:Lov		#Atten: 30		100		DE	E PANNINI	Select Marker
dB/di		Ref Re	Offset	0.5 dB	n						Δ		251 ms 0.40 dB	4
9g		V		0	1Δ2				4 <u>∆</u> 5					
		X	}											Norma
0														
15		Ţ												Delt
5		1												
15 seles	ana an				March	haranalis		and the second			ANA COMPANY	a na dieth		
9.5 <b>1124</b> ) 9.5	140				a tailed		In ella	And Address			and a start	Also de la construction		Fixed
enter	2.4	020	00000	) GHz		_	_					s	pan 0 Hz	
es BW						#\	BW	1.0 MHz			Sweep 3.			01
R MODE					×	393.0 us	(A)	γ 0.35		NCTION	FUNCTION WIDTH	FUNCTIO	IN VALUE	
	1					270.0 µs	1000	6.03 dE						
Δ2 F		ł	( <u>(</u> )		1	251 ms	(Δ)	0.40 6.03 dE						Properties
Δ2 F Δ5	1													
Δ2 2 F	1													
Δ2 F Δ5 F δ F δ F δ F δ F δ F δ F δ F δ F δ F δ F δ F δ δ F δ δ δ δ δ δ δ δ δ δ δ δ δ	1													Mor
Δ2 F Δ5 F														Mor 1 of





## -47 of 60-

## DH5

Marker	24:11 PM Jun 19, 2014 TRACE 12, 7, 4, 5 TYPE DET PALAINIMIN	Type: Log-Pwr		Trig: Free Run #Atten: 30 dB	Vide		7400	Δ 3	4 4	(er
Select Marker	4 3.740 ms -0.20 dB	Δħ			C.UW	5 dB	Offset ( 20.50			17di
Norm				4Δ5	1Δ2	A			K9	
Del										
Fixed		dist which it			vintrahlin					, bul
o	Span 0 Hz ms (1001 pts) FUNCTION VALUE	Sweep 10.	PUNCTION	1.0 MHz		×		O M	V 1.0	BW KODE
Properties				-0.58 dB 7.18 dBm -0.20 dB 7.18 dBm	μs ms (Δ)	2,890 n 350,0 i 3,740 n 350,0 i		22		Δ2 F Δ5 F
Mo 1 of										

# Mid Channel

IFGain:Low	#Atten: 30 dB		ype: Log-Pwr	TYPE WOMMONY DET P 44 N N N N	Marker Select Marker
			ΔΛ	/kr4 1.251 ms 0.53 dB	Selectimarker
		445			Norma
					Delt
rahan	ikongotisisadajartakal	pundud	signalize	weepphisprochappe	Fixed
and the second	1.0 MHz	BINETION		and the second	o
396.0 μs (Δ) 606.0 μs	0.21 dB 5.77 dBm	Tokenow .	resentes another	TUNCTURY TREDE	_
1.251 ms (Δ) 606.0 μs	0.53 dB 5.77 dBm				Properties
					Mor 1 of
	1Δ2 1Δ2 μμμμμ #VBW × 396.0 μs 606.0 μs 1.251 ms (Δ)	1Δ2 1Δ2 1Δ2 μμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμμ	1Δ2 4Δ5 4Δ5 4Δ5 4Δ5 4Δ5 4Δ5 4Δ5 4Δ5	1 Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ	0.53 dB 0.53 dB 0.55 dB



#### DH3

ker	4 A 3	2.508	100.00		NO: Wide	Tri	: Free Run	Avg	Type: Log-Pwr	04:29:51 PM Jun 19, 2014 TRACE	Marker
	_				Gain:Low		ten: 30 dB			DET PHANNES	Select Marker
B/div		ef Offse ef 20.							Δ	Mkr4 2.509 ms 2.87 dB	4
						∆1∆2	4Δ5				
	1		Ks			Ť.					Norma
											Deita
	dias.	(Infinal				ALMANN A	Nate		-	m-	
											Fixed
		00000	0 GH	z	-					Span 0 Hz	
BW	1.0	MHz			#V	BW 1.0	MHz		Sweep 7.	533 ms (1001 pts)	of
ADDE A2	TRC SI	α. (Δ)		× 1.	650 ms		2.95 dB	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
F	1				213 ms		.28 dBm				
∆5 F	1 1			2:	509 ms 213 ms	(A) 4	2.87 dB				Properties
											More
	-										1 of 2
			_	_					STATUS		

-48 of 60-





# High Channel

# DH1

arker	4 L	1			S					NE-INT	Avg	Type: L	og-Pwr	T	LO PM Jun RACE	345	Marker
					~	PNO	D: Wide ain:Lov	-	Trig: Free #Atten: 30						DET	INNNN	Select Marker
dB/div	, B	Ref Ref	Offset	0.5 c 0 dE	iB Sm								Δ	Mkr4		4 ms 2 dB	4
°.							_ (	142				4Δ5					
a					Xs												Norm
5																	Delt
5 5 5	<b>m</b>	nye	er lige	ullight	Y			yahaya	regelimanilyst	h. A.	wyrita		W	elysey	le Marian	whe	Fixed
enter 2 s BW				GH	z		#V	BW	1.0 MHz			Sw	eep 3	.000 m:	Spar s (100	n 0 Hz 1 pts)	0
R MODE	1		( <u>A</u> )		×		5.0 µs	( <b>Δ</b> )	γ 0.55 (	B	NCTION	FUNCT	ION WIDTH	FUN	CTION VAL	LUE	
2 F Δ5		-	(Δ)				7.0 µs		6.23 dE								-
F	1	t	(4)			687	54 ms 7.0 µs		6.23 dE								Properties
																	Mor 1 of
																	1.01

la	ker	4.	Δ 2	5161	3 ms	0: Wide ·		Trig: Free Ru	m	Avg Typ	e: Log-Pwr	TRAC	M Jun 19, 2014	Marker
	_				IFO	Gain:Low	1650	#Atten: 30 dE			Δ	_	516 ms	Select Marker
	B/div	į.		Offset ( 20.50	0.5 dB ) dBm								2.46 dB	
0g						V-			142	4∆:	5	-		
						Xa								Norma
19.5 19.5														Delt
	_													
					Aghantagen				and a most	unil		and a	manger	
995 695					Coloradition					adda.		-		Fixed
	L.	2.4	800	00000	CHA		_						pan 0 Hz	
	BW				GHZ	#VE	W	1.0 MHz			Sweep 7.			0
KR	MODE				×			Ŷ	FUNCT	rion F	UNCTION WIDTH	FUNCTIO	IN VALUE	
12	Δ2 F		ł	(Δ)		57 ms () 43 ms	<u> </u>	1.56 dB 5.28 dBm						
3 4 5	∆5 F	1	1	(Δ)	2.5	16 ms (/	۵)	2.46 dB 5.28 dBm						Properties
		-	-		4.5	45 ms		9.20 QBM						
6						_				_				Mor
678			-											
67			$\vdash$											1 of



## -50 of 60-

anke	r 4	Δ3	74000	ms	PNO: Wid		Trig: Free #Atten: 30		Av	Type: Log-Pwr	TRA	PM Jun 19, 2014 CE 12 24 5 PE Westerney	Marker
0 d8/d		Ref	Offset 0.5	dB	IFGain:Lov	v	BAtten: 30	dB		Δ	Mkr4 3	.740 ms	Select Marker 4
0 g 10 5 500	14	Ke		Xs			^	1Δ2	4∆5				Norm
9.50													Dei
95			elineerolei					hamoy			Ļ	hour	Fixed
enter es Bl	N 1	.0 M		Hz	#V	вw	1.0 MHz		PUNCTION	Sweep 1	0.00 ms	Span 0 Hz (1001 pts)	c
CO MOD		1		~	2.890 ms 2.060 ms	(Δ)	-0.24 c 7.72 dB	B	GACTION	Policion wibin	Ponici	UN VALUE	
1 42 2 F 3	1	t	(Δ)		3.740 ms 2.060 ms	(Δ)	-0.23 dB 7.72 dB	dB 3m					Properties





# 12. 20dB Bandwidth

## 12.1. Standard Applicable:

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

## 12.2. Measurement Equipment Used:

Refer to section 6.2 for details.

## 12.3. Test Set-up:

Refer to section 6.3 for details.

## **12.4. Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
- 4. Mark the peak frequency and –20dB (upper and lower) frequency.
- 5. Repeat above procedures until all frequency measured were complete.



#### 12.5. Measurement Result:

#### **BDR Mode**

СН	20dB Bandwidth
	(MHz)
Lower	0.9244
Mid	0.9250
Higher	0.9251

#### EDR 2M Mode

СН	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.244	0.829
Mid	1.248	0.832
Higher	1.275	0.850

#### EDR 3M Mode

СН	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.268	0.845
Mid	1.285	0.857
Higher	1.297	0.865

Note: Refer to next page for plots.



## BDR Mode 20dB Bandwidth Test Data CH-Low



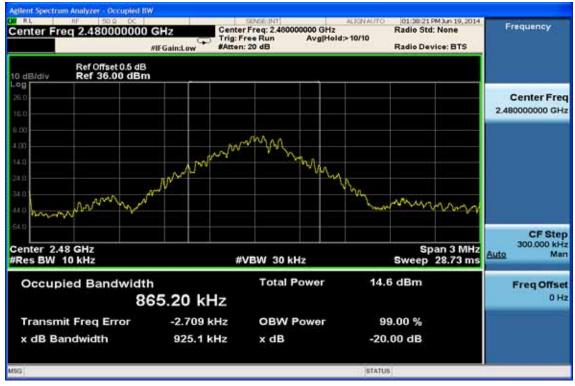
20dB Bandwidth Test Data CH-Mid





#### -54 of 60-

# 20dB Bandwidth Test Data CH-High





# EDR 2M Mode

# 20dB Bandwidth Test Data CH-Low



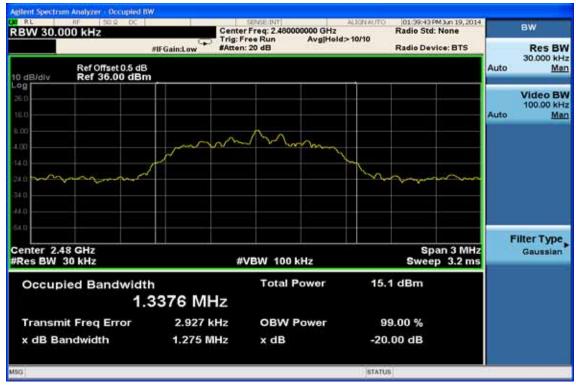
20dB Bandwidth Test Data CH-Mid





#### -56 of 60-

# 20dB Bandwidth Test Data CH-High





# EDR 3M Mode

# 20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid





#### -58 of 60-

# 20dB Bandwidth Test Data CH-High





# **13. ANTENNA REQUIREMENT**

## **13.1. Standard Applicable:**

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.

And according to §15.247(c), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 13.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is -0.62dBi, and the antenna type is printed antenna which is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.



# **14. RF EXPOSURE**

## 14.1. Standard Applicable

According to §2.1093 this is a Portable device.

According to KDB 447498 D01 V5, Appendix A SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and  $\leq$  50 mm, the power level 10mW at 5 mm.

This is a Portable device.

#### 14.2. Measurement Result:

This is a portable device and the Max. peak output power is 8.36dBm (6.85 mW) lower than low threshold 10 mW (24.48mW), d at 5mm in general population category.

The SAR measurement is not necessary.