

Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 1 of 57

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

# INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Product Name: Mobile Tablet** 

**Brand Name:** DT Research Inc.

Model No.: DT395BV, Atlas 91i

**Different Exterior Color: Model Difference:** 

DT395BV-Black, Atlas 91i-Red

FCC ID: **YE3800E** 

**Report No.:** E2/2015/60047

**Issue Date:** Jul. 13, 2015

**FCC Rule Part:** §15.247, Cat: DTS

**DT** Research Inc. **Prepared for:** 

6F, NO.1, Ning-Po E. Street, Taipei 100, Taiwan

SGS Taiwan Ltd.

**Electronics & Communication Laboratory** Prepared by:

No.2, Keji 1st Rd., Guishan District, Taoyuan

City, Taiwan 333





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Page: 2 of 57

## VERIFICATION OF COMPLIANCE

**Applicant:** DT Research Inc.

6F, NO.1, Ning-Po E. Street, Taipei 100, Taiwan

**Product Name:** Mobile Tablet

**Brand Name:** DT Research Inc.

Model No.: DT395BV, Atlas 91i

**Model Difference:** Different Exterior Color: DT395BV-Black, Atlas 91i-Red

FCC ID: YE3800E

**Report Number:** E2/2015/60047

Date of test: Jun. 23, 2015 ~ Jul. 13, 2015

**Date of EUT Received:** Jun. 23, 2015

## We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2009 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:	Jerry	Lu	Date	Jul. 13, 2015	
Prepared By:	Jerry Lu/En Allen	egineer [saī	Date	Jul. 13, 2015	
Approved By:	Allen Tsai / E.	ngineer Lang	Date	Jul. 13, 2015	

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Jim Chang / Asst. Manager

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Page: 3 of 57

# **Revision History**

Report Number	Revision	Description	Issue Date
E2/2015/60047	Rev.00	Initial creation of document	Jul. 13, 2015

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 4 of 57

## **Table of Contents**

1	GEN	VERAL INFORMATION	6
	1.1	Product Description	6
	1.2	Product Feature of Equipment Under Test	7
	1.3	Test Methodology of Applied Standards	8
	1.4	Test Facility	8
	1.5	Special Accessories	8
	1.6	Equipment Modifications	8
2	SYS	TEM TEST CONFIGURATION	9
	2.1	EUT Configuration	9
	2.2	EUT Exercise	9
	2.3	Test Procedure	9
	2.4	Measurement Results Explanation Example	9
	2.5	Configuration of Tested System	10
3	SUM	IMARY OF TEST RESULTS	11
4	DES	CRIPTION OF TEST MODES	11
	4.1	Operated in 2400 ~ 2483.5MHz Band	11
	4.2	The Worst Test Modes and Channel Details	12
5	MEA	ASUREMENT UNCERTAINTY	13
6	CON	NDUCTED EMISSION TEST	14
	6.1	Standard Applicable:	14
	6.2	Measurement Equipment Used:	14
	6.3	EUT Setup:	14
	6.4	Test SET-UP (Block Diagram of Configuration)	
	6.5	Measurement Procedure:	
	6.6	Measurement Result:	
7	PEA	K OUTPUT POWER MEASUREMENT	18
	7.1	Standard Applicable:	18
	7.2	Measurement Equipment Used:	18
	7.3	Test Set-up:	18
	7.4	Measurement Procedure:	19
	7.5	Measurement Result:	20

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 5 of 57

8	6dB I	BANDWIDTH	21
	8.1	Standard Applicable	21
	8.2	Measurement Equipment Used	21
	8.3	Test Set-up:	21
	8.4	Measurement Procedure:	21
	8.5	Measurement Result:	22
9	CON	DUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT	24
	9.1	Standard Applicable	24
	9.2	Measurement Equipment Used:	24
	9.3	Test SET-UP:	24
10	RAD	IATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT	30
	10.1	Standard Applicable	30
	10.2	Measurement Equipment Used	31
	10.3	Test SET-UP	32
	10.4	Measurement Procedure	33
	10.5	Field Strength Calculation	34
	10.6	Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz	34
	10.7	Measurement Result:	34
11	PEAL	K POWER SPECTRAL DENSITY	49
	11.1	Standard Applicable:	49
	11.2	Measurement Equipment Used:	49
	11.3	Test Set-up:	49
	11.4	Measurement Procedure:	49
	11.5	Measurement Result:	50
12	ANT	ENNA REQUIREMENT	53
	12.1	Standard Applicable:	53
	12.2	Antenna Connected Construction:	53
PH	ото	GRAPHS OF SET UP	54
РΗ	OTO	FRAPHS OF EUT	57

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. 除非另有说明,此根告结果僅對测试之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。
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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 6 of 57

## **GENERAL INFORMATION**

## **Product Description**

### General:

Jeneral.			
Product Name:	Mobile Tablet		
Brand Name:	DT Resear	ch Inc.	
Model No.:	DT395BV	, Atlas 91i	
Model Difference:	Different I	Exterior Color: DT395BV-Black, Atlas 91i-Red	
Product SW/HW version:	WIN embe	edded 8.1 industry pro. / MB version 2.1	
Radio SW/HW version:	N/A		
Test SW Version:	DRTU version 1.7.4-1041		
RF power setting in TEST SW:	N/A		
	7.4Vdc from Rechargeable Li-ion Battery or 19V from AC/DC Adapter		
Power Supply:	Battery:	Model No.:ACC-006-18, Supplier: Formosa Electronic Industries INC	
	Adapter :	Model No.:A11-065N1A, Supplier: Chicony	

Bluetooth Low Energy:

Bidetooth Bow Energy.	
Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.0 dual mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	5.20dBm
Antenna Designation:	PIFA Antenna, Gain: 0.686dBi

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 7 of 57

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

The equipment under Test (Hereafter Called: EUT) is Mobile Tablet supporting, CDMA, LTE, Wi-Fi 802 11ahon & ac Rhietooth features and below is details of information

02.11abgn & ac, Bluetooth features, and below is details of information.  Product Feature			
Product Name:	Mobile Tablet		
Brand Name:	DT Research Inc.		
Model No.:	DT395BV, Atlas 91i		
Model Difference:	Different Exterior Color: DT395BV-Black, Atlas 91i-Red		
FCC ID:	YE3800E		
CDMA2000 / EVDO	BC0/BC1		
LTE	B4/B13		
Wi-Fi Specification	802.11a/b/g/n & ac		
Bluetooth Version	V4.0 dual mode		

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

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Page: 8 of 57

#### 1.3 **Test Methodology of Applied Standards**

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance V03r03

ANSI C63.10:2009

### 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 2. certification procedure.
- The EUT was placed 0.8m height for frequency above 1GHz in accordance with ANSI C63.10:2009.

#### 1.4 **Test Facility**

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

FCC Registration Numbers are: 628985

Canada Registration Number: 4620A-5.

#### 1.5 **Special Accessories**

There are no special accessories used while test was conducted.

#### **Equipment Modifications** 1.6

There was no modification incorporated into the EUT.

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 9 of 57

### SYSTEM TEST CONFIGURATION

#### 2.1 **EUT Configuration**

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

#### 2.2 **EUT Exercise**

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

#### 2.3 **Test Procedure**

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plan. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

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

## **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 0.6dB.

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Page: 10 of 57

## **Configuration of Tested System**

Fig. 2-1 Conducted (Antenna Port)

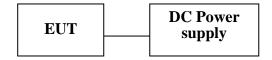
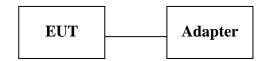


Fig. 2-2 Radiated Emission & AC Power Line Conducted Emission Configuration



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

Item	Equipment	Mfr/Brand	Model/Model No.	Series No.	Data Cable	Power Cord
1.	BT Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power supply	Agilent	E3640A	MY53140006	N/A	Unshielded

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 11 of 57

## SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
\$15.203 \$15.247(b)	Antenna Requirement	Compliant

## **DESCRIPTION OF TEST MODES**

## Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2402 MHz	14	2430 MHz	28	2458 MHz
1	2404 MHz	15	2432 MHz	29	2460 MHz
2	2406 MHz	16	2434 MHz	30	2462 MHz
3	2408 MHz	17	2436 MHz	31	2464 MHz
4	2410 MHz	18	2438 MHz	32	2466 MHz
5	2412 MHz	19	2440 MHz	33	2468 MHz
6	2414 MHz	20	2442 MHz	34	2470 MHz
7	2416MHz	21	2444 MHz	35	2472 MHz
8	2418 MHz	22	2446 MHz	36	2474 MHz
9	2420 MHz	23	2448 MHz	37	2476 MHz
10	2422 MHz	24	2450 MHz	38	2478 MHz
11	2424 MHz	25	2452 MHz	39	2480 MHz
12	2426 MHz	26	2454 MHz		
13	2428 MHz	27	2456 MHz		

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 12 of 57

### **The Worst Test Modes and Channel Details**

- 1. 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.

### **RADIATED EMISSION TEST:**

RADIATED EMISSION TEST (BELOW 1 GHz)							
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT		
Bluetooth LE	0 to 39	0,20,39	GFSK	1.0	MAIN		
	RADIATED	EMISSION TE	ST (ABOVE 1 GH	$(\mathbf{z})$			
MODE AVAILABLE TESTED CHANNEL MODULATION RATE (Mbps) PORT							
Bluetooth LE	0 to 39	0,20,39	GFSK	1.0	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 LE Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

### ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT	
Bluetooth LE	0 to 39	0,20,39	GFSK	1.0	MAIN	

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 13 of 57

## **MEASUREMENT UNCERTAINTY**

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
6dB Bandwidth	+/- 51.33 Hz
100 kHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Peak Power Density	+/- 1.3 dB
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

## **Radiated Spurious Emission:**

	30MHz - 180MHz: +/- 3.37dB
Management	180MHz -417MHz: +/- 3.19dB
Measurement uncertainty (Polarization : <b>Vertical</b> )	0.417GHz-1GHz: +/- 3.19dB
(1 olulization : Vertical)	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

	30MHz - 167MHz: +/- 4.22dB
Measurement uncertainty	167MHz -500MHz: +/- 3.44dB
(Polarization : <b>Horizontal</b> )	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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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 14 of 57

## CONDUCTED EMISSION TEST

#### 6.1 **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

#### 6.2 **Measurement Equipment Used:**

Conducted Emission Test Site							
EQUIPMENT	EQUIPMENT MFR MODE		SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2014	12/11/2015		
Coaxial Cables	N/A	N30N30-1042-150c m	N/A	01/06/2015	01/07/2016		
LISN	Schwarzbeck	NSLK 8127	8127-648	06/09/2015	06/08/2016		
LISN	Rolf-Heine	NNB-2/16Z	99012	03/04/2015	03/03/2016		
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.		

#### **EUT Setup:** 6.3

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2009.
- 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.

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<sup>1.</sup> The lower limit shall apply at the transition frequencies

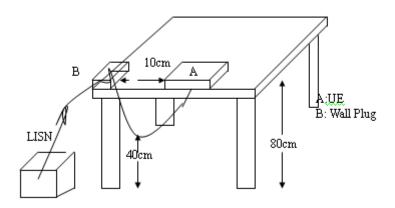
<sup>2.</sup> The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.



Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 15 of 57

## 6.4 Test SET-UP (Block Diagram of Configuration)



#### 6.5 **Measurement Procedure:**

- 1. The EUT was placed on a table which is 0.8m above ground plan.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all phases of power being supplied by given UE are completed

### **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.

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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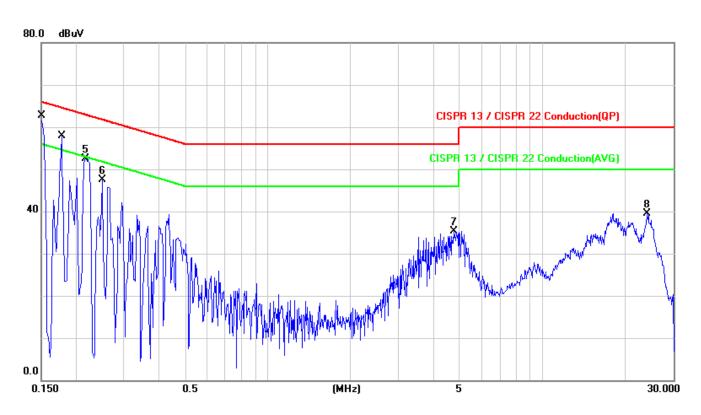


Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 16 of 57

## AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Jul. 03, 2015
Temperature:	26	Humidity:	52 %	Test By:	Ashton
Model No.:	Adapter: A11-065N1A			Phase:	L1



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1500	60.81	0.08	60.89	66.00	-5.11	QP	
2		0.1500	47.01	0.08	47.09	56.00	-8.91	AVG	
3		0.1780	56.70	0.08	56.78	64.58	-7.80	QP	
4		0.1780	42.40	0.08	42.48	54.58	-12.10	AVG	
5		0.2180	52.34	0.08	52.42	62.89	-10.47	peak	
6		0.2500	47.40	0.09	47.49	61.76	-14.27	peak	
7		4.7540	34.69	0.62	35.31	56.00	-20.69	peak	
8		24.1380	38.82	0.74	39.56	60.00	-20.44	peak	

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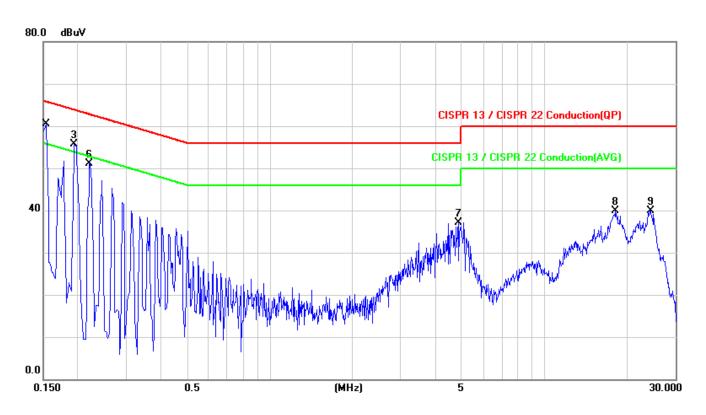
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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 17 of 57

Operation Mode:	Operation mode		Test Date:	Jul. 03, 2015
Temperature:	26	Humidity:	Test By:	Ashton
Model No.:	Adapter: A11-065N	1A	Phase:	N



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1540	55.40	0.14	55.54	65.78	-10.24	QP	
2		0.1540	36.40	0.14	36.54	55.78	-19.24	AVG	
3	*	0.1940	55.52	0.13	55.65	63.86	-8.21	peak	
4		0.1940	53.90	0.13	54.03	63.86	-9.83	QP	
5		0.1940	35.50	0.13	35.63	53.86	-18.23	AVG	
6		0.2220	50.98	0.14	51.12	62.74	-11.62	peak	
7		4.8660	36.39	0.67	37.06	56.00	-18.94	peak	
8		18.1500	39.21	0.61	39.82	60.00	-20.18	peak	
9		24.3820	39.14	0.78	39.92	60.00	-20.08	peak	

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Page: 18 of 57

### PEAK OUTPUT POWER MEASUREMENT

## **Standard Applicable:**

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

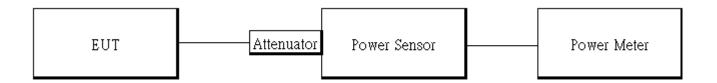
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

#### **Measurement Equipment Used:** 7.2

Conducted Emission Test Site							
EQUIPMENT	EQUIPMENT MFR MODEL SERIAL		LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2496A	1326001	06/23/2015	06/22/2016		
Power Sensor	Anritsu	MA2411B	1315048	06/23/2015	06/22/2016		
Power Sensor	Anritsu	MA2411B	1315049	06/23/2015	06/22/2016		
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015		
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015		

#### 7.3 **Test Set-up:**



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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 19 of 57

### **Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

#### **Power Meter:**

It is used as the auxiliary test equipment to conduct the output power measurement.

- 4. Record the max. Reading as observed from Power Meter.
- 5. Repeat above procedures until all test default channel measured was complete.

### **Duty Factor:**

	<b>Duty Cycle</b>	Duty Fator (dB)
Bluetooth LE	60.8%	2.16



Duty Cycle Factor:  $10 * \log (1/0.608) = 2.16$ 

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Page: 20 of 57

### **Measurement Result:**

### BT4.0 mode:

СН	Frequency	Peak Power Output(dBm)	Required Limit
	(MHz)		
0	2402	4.51	1  Watt = 30  dBm
20	2442	5.10	1  Watt = 30  dBm
39	2480	5.20	1  Watt = 30  dBm

CH Frequency (MHz)		Average Power Output(dBm)	Required Limit	
0	2402	2.47	1 Watt = 30 dBm	
20	2442	3.09	1  Watt = 30  dBm	
39	2480	3.20	1  Watt = 30  dBm	

\*Note: Measured by power meter, as cable loss+ Duty cycle factor that offsets on the power meter.

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Page: 21 of 57

### 6dB BANDWIDTH

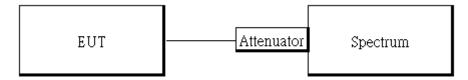
#### 8.1 **Standard Applicable**

The minimum 6 dB bandwidth shall be at least 500 kHz.

#### 8.2 **Measurement Equipment Used**

Conducted Emission Test Site									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
Spectrum Analyzer	Spectrum Analyzer Agilent		MY51100003	01/29/2015	01/28/2016				
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				

#### **Test Set-up:** 8.3



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

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 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 = 100 kHz, VBW = 3\*RBW, Span = 5MHz, Detector=Peak, Sweep=auto.
- 4. Mark the peak frequency and –6dB (upper and lower) frequency.
- 5. Repeat above procedures until all test default channel measured were complete.

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 22 of 57

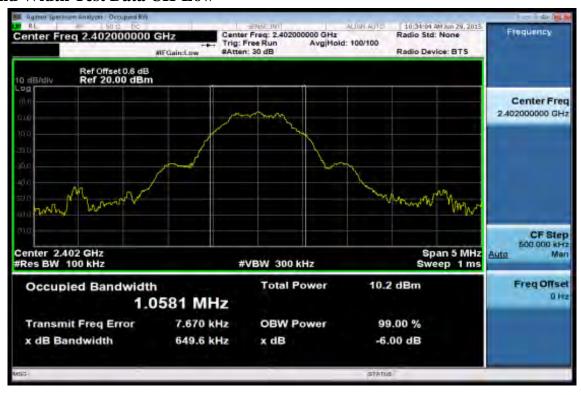
#### 8.5 **Measurement Result:**

**RT4.0** mode

Frequency (MHz)	Bandwidth (kHz)	Bandwidth (kHz)	Result	
2402	649.6	> 500	PASS	
2442	653.1	> 500	PASS	
2480	660.0	> 500	PASS	

*Note: Refer to next page for plots.* 

## BT4.0 mode 6dB Band Width Test Data CH-Low



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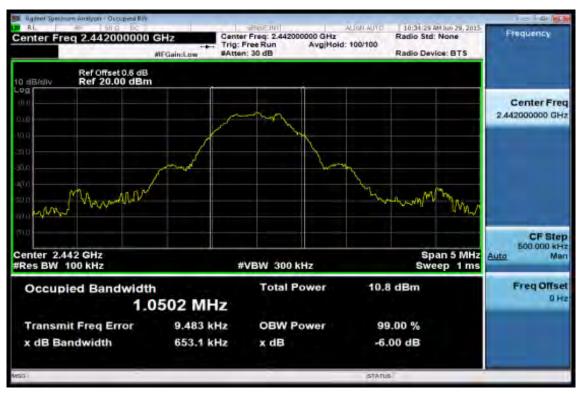
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Page: 23 of 57

### 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



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Page: 24 of 57

## CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

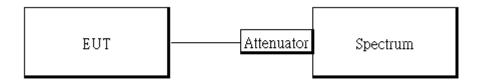
## **Standard Applicable**

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

9.2 **Measurement Equipment Used:** 

Wedstrement Equipment Obed.									
Conducted Emission Test Site									
EQUIPMENT MFR MODEL SERIAL LAST									
TYPE	ТҮРЕ		NUMBER	CAL.					
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016				
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				

#### **Test SET-UP:** 9.3



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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 25 of 57

### 9.3.1 Measurement Procedure

## **Conducted Band Edge:**

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 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 start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
- 5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
- 6. Mark the highest reading of the emission as the reference level measurement.
- 7. Set DL as the limit = reading on marker 1 20dBm
- 8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
- 9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

## **Conducted Spurious Emission:**

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 3. Set RBW = 100 kHz & VBW ≥300 kHz, Detector =Peak, Sweep = Auto
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- 6. Repeat above procedures until all default test channel measured were complete.

### 9.3.2 Measurement Result

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

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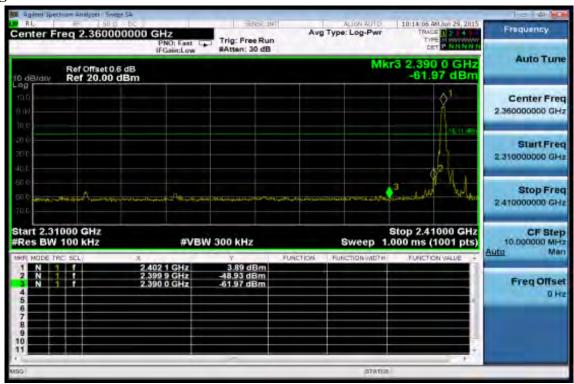
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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 26 of 57

# BT4.0 mode **Band Edges Test Data CH-Low**



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



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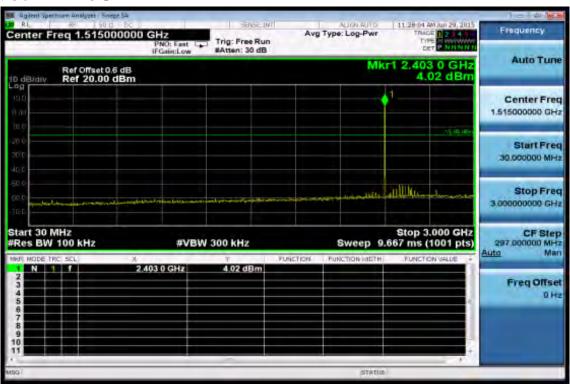
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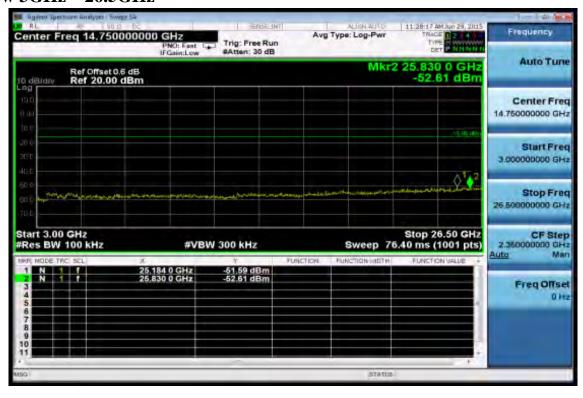
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 27 of 57

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



## CH-Low 3GHz – 26.5GHz



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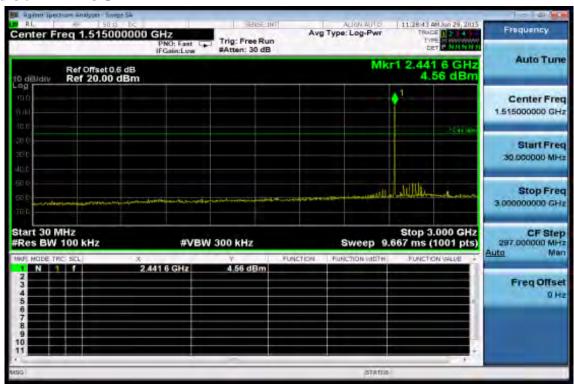
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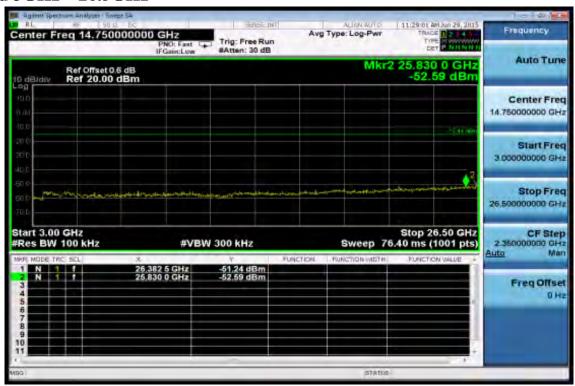
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Page: 28 of 57

### CH-Mid 30MHz – 3GHz



## CH-Mid 3GHz - 26.5GHz



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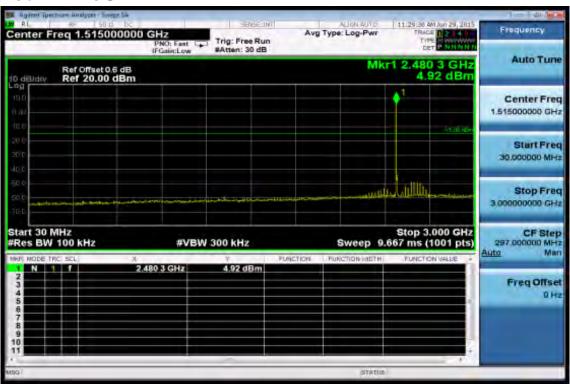
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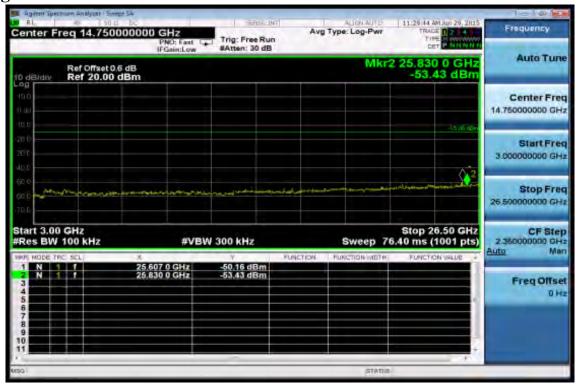
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 29 of 57

## CH-High 30MHz – 3GHz



## CH- High 3GHz - 26.5GHz



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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 30 of 57

## 10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## 10.1 Standard Applicable

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

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

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

### Note:

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

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 31 of 57

## 10.2 Measurement Equipment Used

966 Chamber							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
EMI Test Receiver	R&S	ESU 40	100363	04/09/2015	04/08/2016		
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		
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015		
Coaxial Cable	Coaxial Cable Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015		
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015		
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015		
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015		
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015		
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015		
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016		
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016		
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2015	05/03/2016		
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.		
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.		
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.		
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.		

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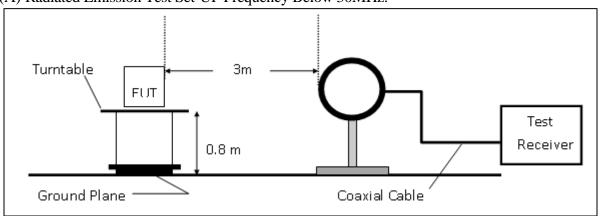
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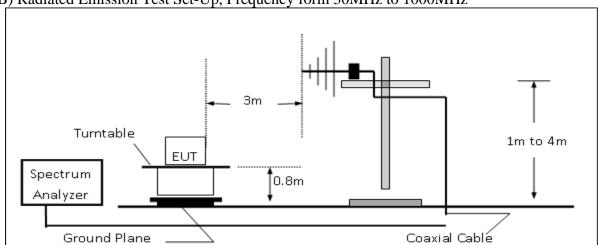
Page: 32 of 57

### 10.3 Test SET-UP

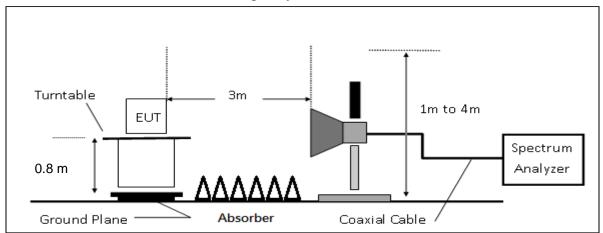
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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Page: 33 of 57

### 10.4 Measurement Procedure

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m for frequency> 1GHz above ground plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
- 6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 8. 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.
- 9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 11. Repeat above procedures until all default test channel measured were complete.

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 34 of 57

## 10.5 Field Strength Calculation

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

FS = RA + AF + CL - AG

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

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.

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

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

#### **10.7** Measurement Result:

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

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 35 of 57

## Radiated Band Edge Measurement Result (BT4.0 mode)

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency :2402 MHz Temp./Humi. :22.7 deg\_C /57 RH Operation Mode Engineer

:Band Edge LOW :Vito EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Peak	44.63	6.62	51.25	74	-22.75
2390.00	E	Average	33.16	6.62	39.78	54	-14.22

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency :2402 MHz Temp./Humi. :22.7 deg\_C /57 RH

Operation Mode :Band Edge LOW Engineer :Vito

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
2390.00	E	Peak	44.87	6.62	51.49	74	-22.51
2390.00	E	Average	33.04	6.62	39.66	54	-14.34

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 36 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency :2480 MHz Temp./Humi. :22.7 deg\_C /57 RH

Operation Mode : Band Edge HIGH Engineer :Vito

:VERTICAL EUT Pol. :E2 Plan Measurement Antenna Pol.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Peak	45.91	6.96	52.88	74	-21.12
2483.50	E	Average	36.22	6.96	43.18	54	-10.82

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency :2480 MHz Temp./Humi. :22.7 deg\_C /57 RH

Operation Mode : Band Edge HIGH Engineer :Vito

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.50	Е	Peak	48.68	6.96	55.65	74	-18.35
2483.50	E	Average	39.36	6.96	46.32	54	-7.68

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Page: 37 of 57

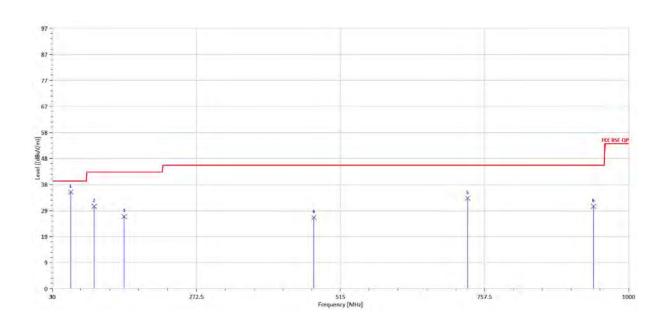
### Radiated Spurious Emission Measurement Result (BT4.0 mode) For Frequency form 30MHz to 1000MHz

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2402 MHz :22.7 deg\_C /57 RH

Operation Mode :TX LOW Engineer :Vito

EUT Pol. :VERTICAL :E2 Plan Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
61.04	S	Peak	64.41	-28.42	35.99	40.00	-4.01
100.81	S	Peak	54.40	-23.69	30.71	43.50	-12.79
151.25	S	Peak	49.69	-22.79	26.90	43.50	-16.60
470.38	S	Peak	40.72	-14.16	26.55	46.00	-19.45
729.37	S	Peak	44.35	-10.66	33.69	46.00	-12.31
940.83	S	Peak	38.34	-7.63	30.71	46.00	-15.29

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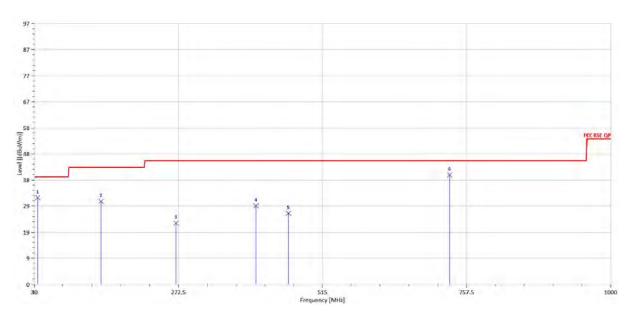
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 38 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2402 MHz :22.7 deg\_C /57 RH Operation Mode :TX LOW Engineer

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
35.82	S	Peak	48.53	-16.34	32.18	40.00	-7.82
142.52	S	Peak	52.73	-21.92	30.81	43.50	-12.69
268.62	S	Peak	42.38	-19.63	22.75	46.00	-23.25
403.45	S	Peak	44.93	-15.75	29.18	46.00	-16.82
457.77	S	Peak	41.09	-14.69	26.41	46.00	-19.59
729.37	S	Peak	51.38	-10.66	40.72	46.00	-5.28

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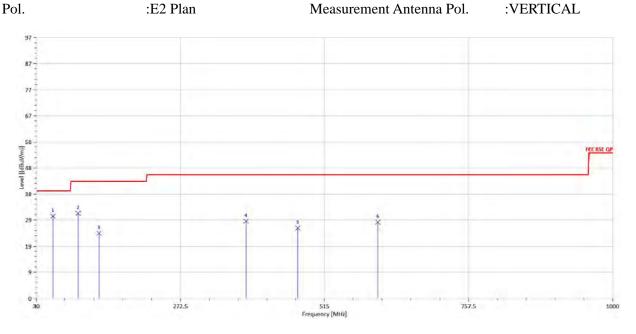
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 39 of 57

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2442 MHz :22.7 deg\_C /57 RH

Operation Mode :TX MID Engineer EUT Pol. :E2 Plan



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin	
		Mode	Reading Level		FS	@3m		
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB	
58.13	S	Peak	58.46	-27.92	30.55	40.00	-9.45	
100.81	S	Peak	55.23	-23.69	31.54	43.50	-11.96	
135.73	S	Peak	45.70	-21.50	24.20	43.50	-19.30	
383.08	S	Peak	45.02	-16.39	28.63	46.00	-17.37	
470.38	S	Peak	40.28	-14.16	26.12	46.00	-19.88	
605.21	S	Peak	40.92	-12.64	28.28	46.00	-17.72	

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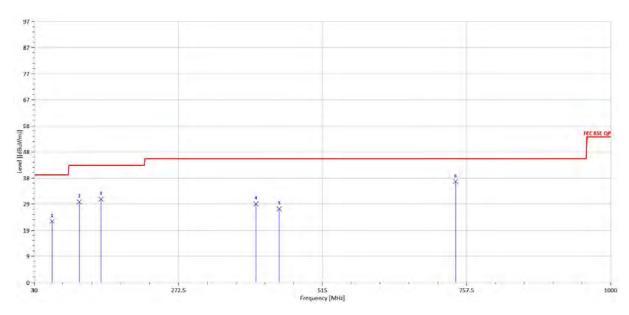
Page: 40 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2442 MHz :22.7 deg\_C /57 RH

Operation Mode :TX MID Engineer

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
60.07	S	Peak	51.19	-28.50	22.69	40.00	-17.31
105.66	S	Peak	52.82	-22.96	29.86	43.50	-13.64
142.52	S	Peak	52.77	-21.92	30.86	43.50	-12.64
403.45	S	Peak	44.88	-15.75	29.14	46.00	-16.86
442.25	S	Peak	42.56	-15.28	27.28	46.00	-18.72
739.07	S	Peak	47.66	-10.23	37.43	46.00	-8.57

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 41 of 57

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2480 MHz :22.7 deg\_C /57 RH

Operation Mode :TX HIGH Engineer EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL

272.5



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin	
		Mode	Reading Level		FS	@3m		
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB	
32.91	S	Peak	46.15	-14.69	31.46	40.00	-8.54	
73.65	S	Peak	61.67	-27.46	34.21	40.00	-5.79	
100.81	S	Peak	54.41	-23.69	30.72	43.50	-12.78	
136.70	S	Peak	46.38	-21.55	24.83	43.50	-18.67	
470.38	S	Peak	41.11	-14.16	26.95	46.00	-19.05	
605.21	S	Peak	41.01	-12.64	28.37	46.00	-17.63	

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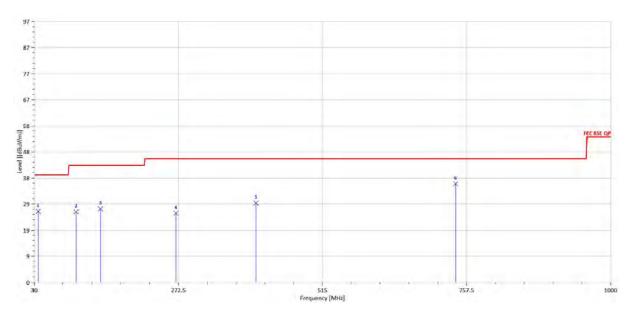
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 42 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2480 MHz :22.7 deg\_C /57 RH

Operation Mode :TX HIGH Engineer EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin	
		Mode	Reading Level		FS	@3m		
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB	
36.79	S	Peak	43.33	-16.96	26.37	40.00	-13.63	
100.81	S	Peak	49.92	-23.69	26.23	43.50	-17.27	
141.55	S	Peak	49.09	-21.81	27.28	43.50	-16.22	
268.62	S	Peak	45.32	-19.63	25.69	46.00	-20.31	
403.45	S	Peak	45.20	-15.75	29.45	46.00	-16.55	
739.07	S	Peak	46.74	-10.23	36.52	46.00	-9.48	

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Page: 43 of 57

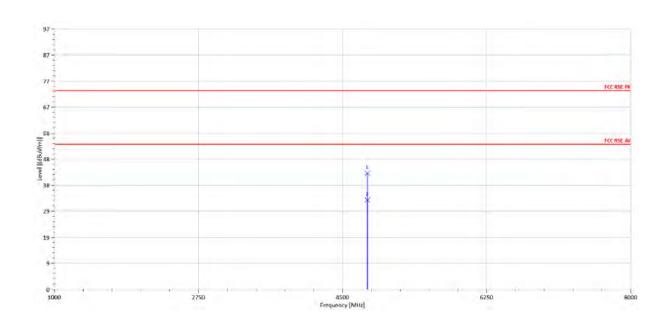
# Radiated Spurious Emission Measurement Result (BT4.0 mode) For Frequency above 1GHz

Operation Band :BT4.0 Test Date :2015-07-08

Fundamental Frequency :2402 MHz Temp./Humi. :22.7 deg\_C /57 RH

Operation Mode :TX LOW Engineer :Vito

EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{dB}\mu\mathrm{V}$	dB	dBμV/m	dBμV/m	dB
4804.00	Н	Peak	32.27	10.98	43.25	74.00	-30.75
4804.00	Н	Average	22.24	10.98	33.22	54.00	-20.78

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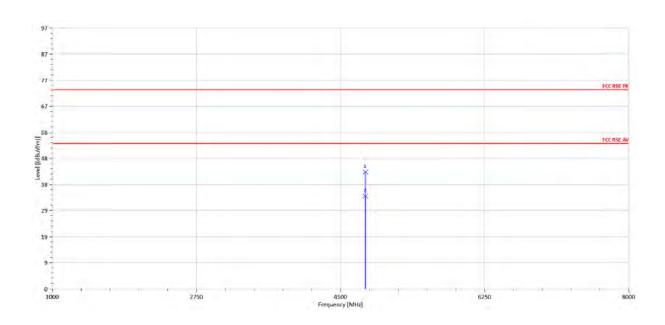
Page: 44 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2402 MHz :22.7 deg\_C /57 RH

Operation Mode Engineer :TX LOW

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
4804.00	Н	Peak	32.45	10.98	43.43	74.00	-30.57
4804.00	Н	Average	23.40	10.98	34.38	54.00	-19.62

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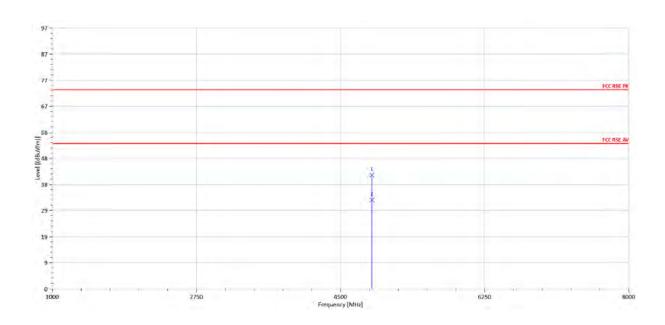
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 45 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2442 MHz :22.7 deg\_C /57 RH

Operation Mode Engineer :TX MID EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
4884.00	Н	Peak	31.39	10.91	42.30	74.00	-31.70
4884.00	Н	Average	22.05	10.91	32.96	54.00	-21.04

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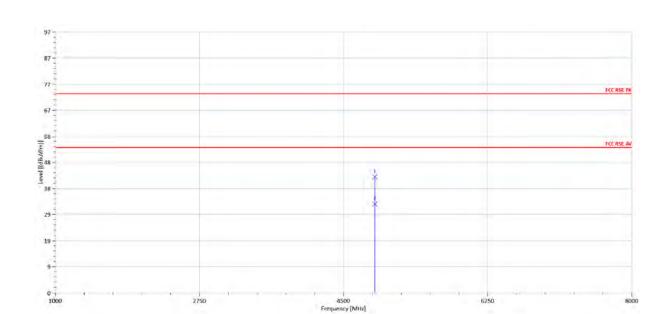
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 46 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2442 MHz :22.7 deg\_C /57 RH

Operation Mode :TX MID Engineer EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
4884.00	Н	Peak	32.23	10.91	43.15	74.00	-30.85
4884.00	Н	Average	22.07	10.91	32.98	54.00	-21.02

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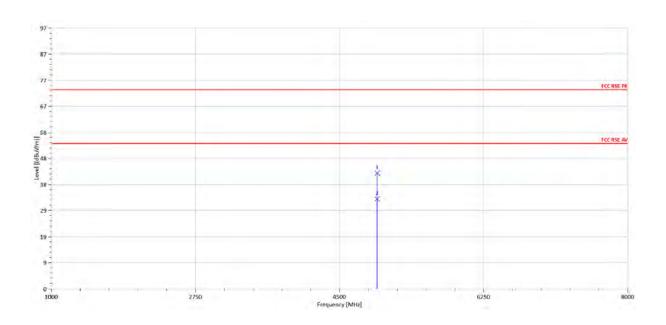
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 47 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2480 MHz :22.7 deg\_C /57 RH Operation Mode

Engineer :TX HIGH EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
4960.00	Н	Peak	32.08	10.99	43.07	74.00	-30.93
4960.00	Н	Average	22.36	10.99	33.35	54.00	-20.65

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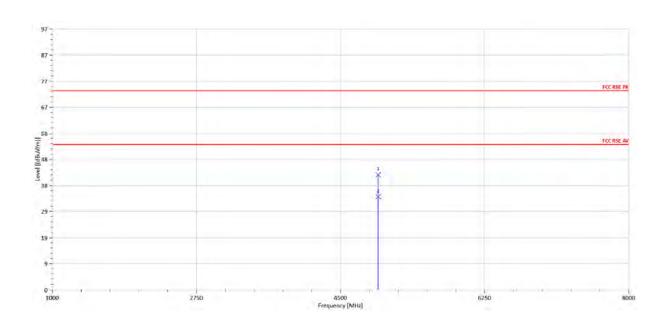
Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 48 of 57

**Operation Band** :BT4.0 Test Date :2015-07-08

Fundamental Frequency Temp./Humi. :2480 MHz :22.7 deg\_C /57 RH Operation Mode Engineer :TX HIGH

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	$\mathrm{d} B \mu V$	dB	dBμV/m	dBμV/m	dB
4960.00	Н	Peak	31.82	10.99	42.81	74.00	-31.19
4960.00	Н	Average	23.57	10.99	34.56	54.00	-19.44

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 49 of 57

### 11 PEAK POWER SPECTRAL DENSITY

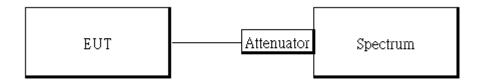
### 11.1 Standard Applicable:

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

### 11.2 Measurement Equipment Used:

	A A							
Conducted Emission Test Site								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016			
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			

## 11.3 Test Set-up:



#### 11.4 Measurement Procedure:

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4.Set the RBW = 3kHz.
- 5.Set the VBW = 10 kHz.
- 6. Detector = peak.
- 7. Sweep time = auto couple.
- 8. Trace mode = max hold.
- 9. Allow trace to fully stabilize.
- 10. Use the peak marker function to determine the maximum amplitude level.

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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 50 of 57

### 11.5 Measurement Result:

#### BT4.0 mode

Frequency MHz	RF Power Density (dBm)	Limit (dBm)	Result
2402	-11.21	8	PASS
2442	-10.80	8	PASS
2480	-10.29	8	PASS

Note: Refer to next page for plots.

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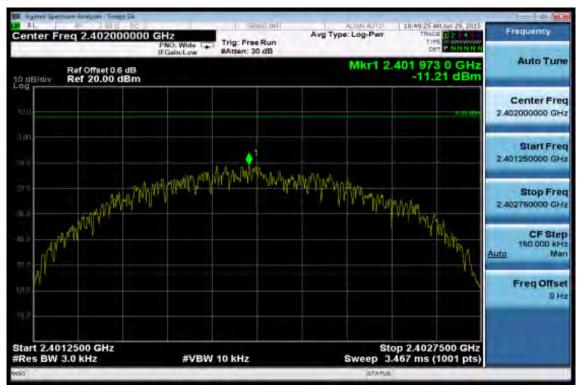


Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 51 of 57

#### BT4.0 mode

## **Power Spectral Density Test Plot (CH-Low)**



## **Power Spectral Density Test Plot (CH-Mid)**



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Page: 52 of 57

## **Power Spectral Density Test Plot (CH-High)**



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Report No.: E2/2015/60047 **Issue Date: Jul. 13, 2015** 

Page: 53 of 57

### 12 ANTENNA REQUIREMENT

## 12.1 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.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

### 12.2 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 6 dBi. Therefore, it is not necessary to reduce maximum output power limit.

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