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### ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO **FCC PART 15 SUBPART C REQUIREMENT**

**Product Name: Smart Phone** 

FCC ID: APYHRO00258

**Report No.:** ER/2017/A0173

Nov. 06, 2017 **Issue Date:** 

**FCC Rule Part:** §15.247, Cat: DTS

Sharp Corporation, IoT Communication B.U.

2-13-1, Hachihonmatsu-lida, Hi-**Prepared for:** 

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**Sharp Corporation** 

1 Takumi-cho, Sakai-ku, Sakai-Shi, Osaka Manufacturer:

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**Electronics & Communication Laboratory** 

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24803





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### VERIFICATION OF COMPLIANCE

Sharp Corporation, IoT Communication B.U.

**Applicant:** 2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi, Hiroshima

739-0192. Japan

**Sharp Corporation** Manufacturer:

1 Takumi-cho, Sakai-ku, Sakai-Shi, Osaka 590-8522, Japan

**Product Name:** FCC ID: APYHRO00258 **Report Number:** ER/2017/A0173

Date of test: Oct. 16, 2017 ~ Oct. 30, 2017

Date of EUT Received: Oct. 16 2017

### We hereby certify that:

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

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

Test By:	On L.	Date:	Nov. 06, 2017	
Prepared By:	Tin Lin / Enginee	r <a>O</a> Date:	Nov. 06, 2017	
Approved By:	Tiffany Kao / Cler	ng Date:	Nov. 06, 2017	

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# **Revision History**

Report Number	Revision	Description	Issue Date
ER/2017/A0173	Rev.00	Initial creation of document	Nov. 06, 2017

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#### 1. GENERAL INFORMATION

### 1.1 Product Description

#### General:

***************************************			
Product Name:	Smart Phone		
Hardware Version:	DVT		
Software Version:	N/A		
	3.85V fr	from Rechargeable Li-ion Battery	
Power Supply:	Patton	Mode No.: UBATIA284AFN2,	
	Battery:	Supplier: SCUD(Fujian) Electronics Co., Ltd.	

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version	BT V5.0 (dual mode)
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	3.64dBm (BT 4.0) 2.96dBm (BT 5.0)
Antenna Designation:	Inverted-L, Gain: -2.5dBi

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### 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

KDB 558074 D01 v04 DTS Meas. Guidance

ANSI C63.10:2013

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

#### 1.3 Test Facility

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

(TAF code 0513)

FCC Registration Numbers are: 509634 / TW0001

#### 1.4 Special Accessories

There are no special accessories used while test was conducted.

#### 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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#### 2. SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

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

#### 2.2 EUT Exercise

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

#### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

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

#### 2.3.2 Radiated Emissions

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

### 2.4 Measurement Results Explanation Example

#### For all conducted test items:

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

#### Note:

The spectrum analyzer offset is derived from RF cable loss 1.5dB.

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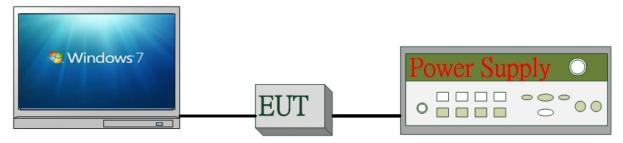
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### 2.5 Configuration of Tested System

Fig. 2-1 Radiated & AC Power Line Conducted Emission



Fig. 2-2 Conducted (Antenna Port) Emission



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

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	<b>Power Cord</b>
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	MY40000811	N/A	Unshielded
3.	Notebook	Lenovo	L430	P0000081	Shielded	Unshielded

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### 3. SUMMARY OF TEST RESULTS

FCC Rules	FCC Rules Description Of Test	
§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

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### 4. DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

CHANNEL	FREQUENCY		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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#### 4.2 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)	
Bluetooth LE	0 to 39	19	GFSK	1	
Bluetooth LE	0 to 39	19	GFSK	2	
	RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	0 to 39	0,19,39	GFSK	1	
Bluetooth LE	0 to 39	0,19,39	GFSK	2	

#### 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 H position was reported.

#### ANTENNA PORT CONDUCTED MEASUREMENT:

	CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	0 to 39	0,19,39	GFSK	1	
Bluetooth LE	0 to 39	0,19,39	GFSK	2	

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5. 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:

Measurement uncertainty (Polarization : <b>Vertical</b> )	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

	9kHz – 30MHz: +/- 2.87 dB
Na an una manat una antainte	30MHz - 167MHz: +/- 4.22dB
Measurement uncertainty (Polarization : <b>Horizontal</b> )	167MHz -500MHz: +/- 3.44dB
(1 Glarization : Florizontal)	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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#### 6. CONDUCTED EMISSION TEST

#### 6.1 Standard Applicable:

Frequency 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.

#### 6.2 Measurement Equipment Used:

Conducted Emission Test Site									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018				
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018				
LISN	MESS TEC	FCC-LISN-50/250- 25-2-01	4034	03/19/2017	03/18/2018				
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017				

#### 6.3 EUT Setup:

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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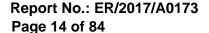
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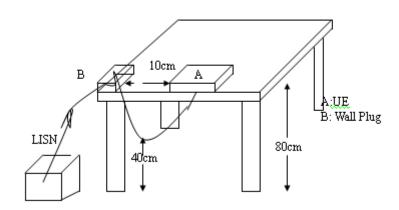
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6.4 Test SET-UP (Block Diagram of Configuration)



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

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

#### 6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closet to the limit

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Humidity:

### AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode		Test Date:	Oct. 30, 2017	
Temperature:	<b>20</b> ℃	Humidity:	56 %	Test By:	Tin
				Phase:	L1

Site Conduction Room Phase: Temperature: 20 °C

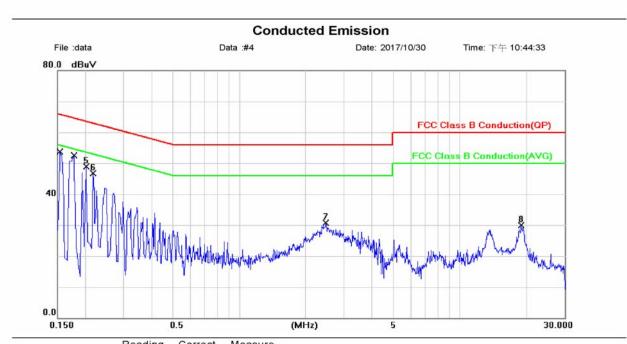
Power:

AC 120V/60Hz

Limit: FCC Class B Conduction(QP)

Mode: Operation

Note:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1540	55.40	0.07	55.47	65.78	-10.31	QP	
2		0.1540	36.00	0.07	36.07	55.78	-19.71	AVG	
3		0.1780	51.10	0.07	51.17	64.58	-13.41	QP	
4		0.1780	33.80	0.07	33.87	54.58	-20.71	AVG	
5		0.2020	48.75	0.07	48.82	63.53	-14.71	peak	
6		0.2180	46.55	0.07	46.62	62.89	-16.27	peak	
7		2.4740	30.64	0.14	30.78	56.00	-25.22	peak	
8		19.0300	29.39	0.49	29.88	60.00	-30.12	peak	

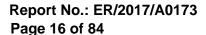
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Site Conduction Room

Limit: FCC Class B Conduction(QP)

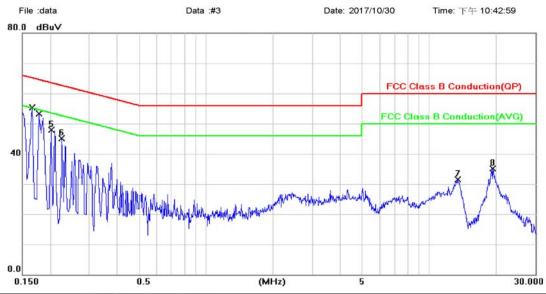
Mode: Operation

Note:

Temperature: Phase: N

AC 120V/60Hz Humidity: 58 % Power:

# Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment	
1	*	0.1660	54.40	0.07	54.47	65.16	-10.69	QP		
2		0.1660	29.70	0.07	29.77	55.16	-25.39	AVG		
3		0.1780	51.40	0.07	51.47	64.58	-13.11	QP		
4		0.1780	34.30	0.07	34.37	54.58	-20.21	AVG		
5		0.2020	47.76	0.07	47.83	63.53	-15.70	peak		
6		0.2260	45.02	0.07	45.09	62.60	-17.51	peak		
7		13.4100	31.11	0.40	31.51	60.00	-28.49	peak		
8		19.3340	34.64	0.49	35.13	60.00	-24.87	peak		

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#### 7. PEAK OUTPUT POWER MEASUREMENT

### 7.1 Standard Applicable:

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

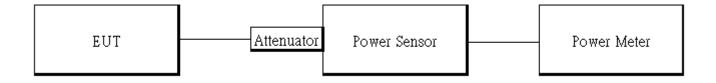
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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.

### 7.2 Measurement Equipment Used:

	SGS Conducted Room									
Name of Equipment	Manufacturer	Model	Serial Num- ber	Calibration Date	Calibration Due					
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017					
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017					
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018					
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018					
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018					
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018					
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018					
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017					
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018					

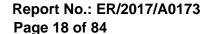
#### 7.3 Test Set-up:



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7.4 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.
- 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**

### **DATA RATE 1 Mbps:**

	Duty Cycle (%)	Duty Factor (dB)
BLE	62.82	2.02



Duty Cycle Factor:10\*log(1/(62.82/100))=2.02

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### DATA RATE 2 Mbps (BT 5.0):

	Duty Cycle (%)	Duty Factor (dB)
BLE	56.77	2.46



Duty Cycle Factor:10\*log(1/(56.77/100))=2.46

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#### 7.5 Measurement Result:

### **DATA RATE 1 Mbps:**

BLE mode:			
СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
0	2402	2.24	1 Watt = 30 dBm
19	2440	2.56	1 Watt = 30 dBm
39	2480	3.64	1 Watt = 30 dBm
BLE mode:			
СН	Frequency (MHz)	Avg. Output Power (dBm)	Required Limit
0	2402	2.14	1 Watt = 30 dBm
19	2440	2.46	1 Watt = 30 dBm
39	2480	3.56	1 Watt = 30 dBm

\*Note: Measured by power meter, cable loss as 1.5 dB that offsets on the power meter

\*Note: Measured by power meter, as Duty cycle factor that offsets on the power meter in Peak.

\*Note: Max. Output include tune up tolerance Power is average power

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### DATA RATE 2 Mbps (BT 5.0):

#### BI F mode:

BLL IIIOUE.								
СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit					
0	2402	2.49	1 Watt = 30 dBm					
19	2440	1.99	1 Watt = 30 dBm					
39	2480	2.96	1 Watt = 30 dBm					
BLE mode:	BLE mode:							
СН	Frequency (MHz)	Avg. Outpu Power (dBm)	Required Limit					
0	2402	2.35	1 Watt = 30 dBm					
19	2440	1.94	1 Watt = 30 dBm					
39	2480	2.71	1 Watt = 30 dBm					

\*Note: Measured by power meter, cable loss as 1.5 dB that offsets on the power meter

\*Note: Measured by power meter, as Duty cycle factor that offsets on the power meter in Peak.

\*Note: Max. Output include tune up tolerance Power is average power

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#### 8. 6DB BANDWIDTH MEASUREMENT

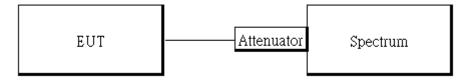
#### 8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Medsarement Eq	neasurement Equipment Oseu								
SGS Conducted Room									
Name of Equipment	Manutacturer   Model		Serial Num- ber	Calibration Date	Calibration Due				
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017				
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017				
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018				
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018				
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018				
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018				
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018				
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017				
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018				

#### 8.3 Test Set-up:



### 8.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guid-
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. For 6dB Bandwidth:
  - Set the spectrum analyzer as RBW=100 kHz, VBW= 3\*RBW, Span = 5MHz, Detector=Peak, Sweep=auto.
- 5. Mark the peak frequency and -6dB (upper and lower) frequency.
- 6. Repeat above procedures until all test default channel is completed

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#### 8.5 Measurement Result:

#### **DATA RATE 1 Mbps:**

#### BI F mode

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result	
2402	0.6842	> 0.5	PASS	
2440	0.68239	> 0.5	PASS	
2480	0.68368	> 0.5	PASS	

#### DATA RATE 2 Mbps (BT 5.0):

#### **BLE** mode

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result	
2402	1.1758	> 0.5	PASS	
2440	1.1728	> 0.5	PASS	
2480	1.1781	> 0.5	PASS	

Note: Refer to next page for plots.

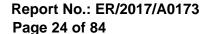
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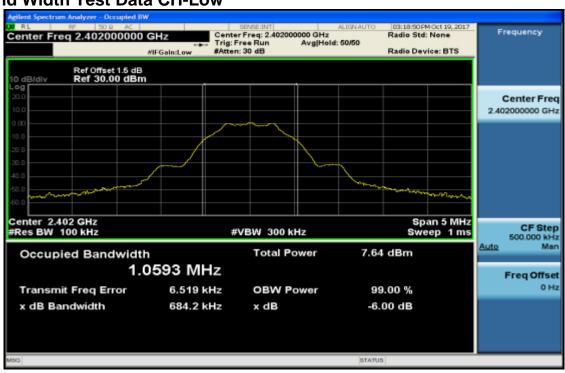




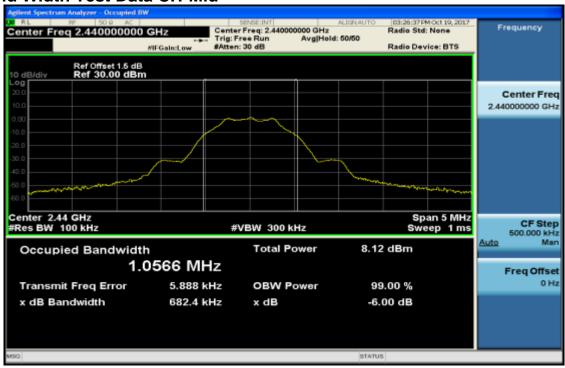
#### **BLE** mode

### **DATA RATE 1 Mbps:**

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



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



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6dB Band Width Test Data CH-High



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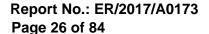
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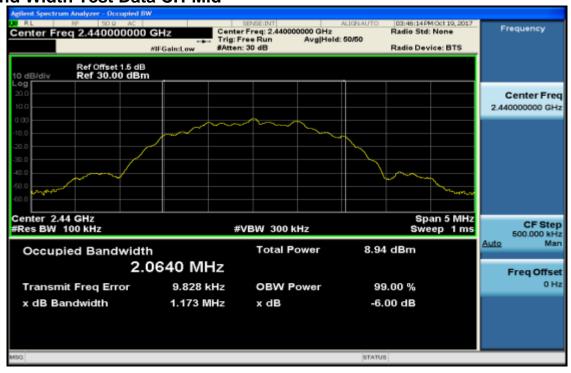




### DATA RATE 2 Mbps (BT 5.0): 6dB Band Width Test Data CH-Low



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



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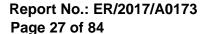
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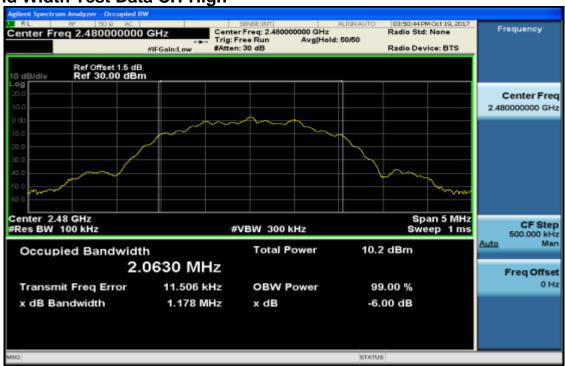
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6dB Band Width Test Data CH-High



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

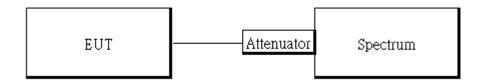
#### 9.1 Standard Applicable

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

### 9.2 Measurement Equipment Used:

SGS Conducted Room								
Name of Equipment	Manufacturer	Model	Serial Num- ber	Calibration Date	Calibration Due			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017			
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017			
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018			
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018			
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018			
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018			
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018			
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017			
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018			

#### 9.3 Test SET-UP:



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#### 9.4 Measurement Procedure

### **Conducted Band Edge:**

- To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 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 =
- 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:**

- To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 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.

#### 9.5 Measurement Result

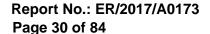
- 1. Refer to next page spectrum analyzer data chart and tabular data sheets.
- 2. For restricted Band Edge Limit, please refer to section 12.5 of this report for measurement result.

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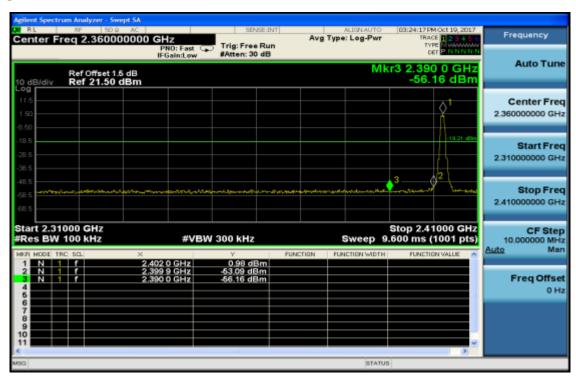
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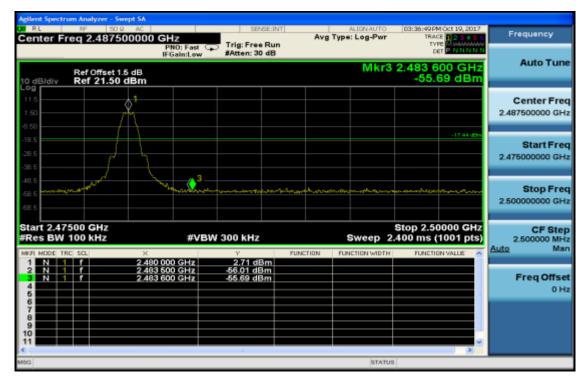




### **BLE** mode **DATA RATE 1 Mbps: Band Edges Test Data CH-Low**



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



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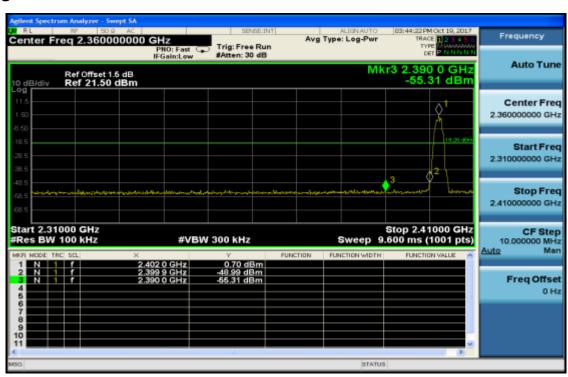
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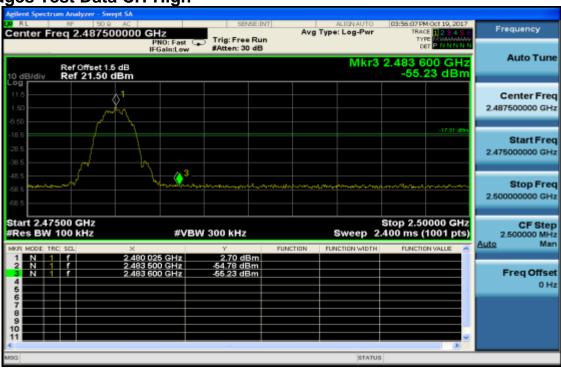
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### DATA RATE 2 Mbps (BT 5.0): **Band Edges Test Data CH-Low**



**Band Edges Test Data CH-High** 



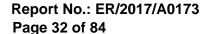
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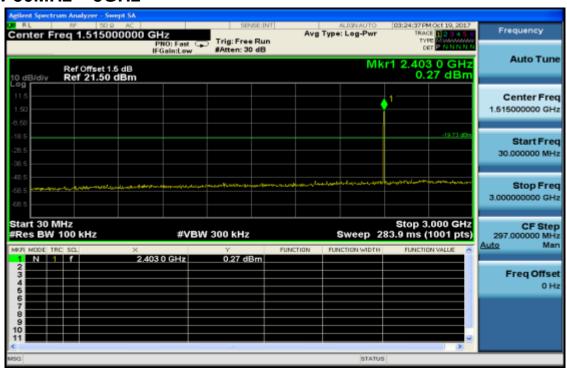
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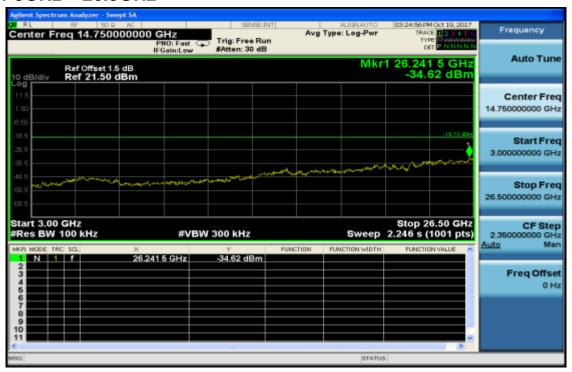




### **Conducted Spurious Emission Measurement Result DATA RATE 1 Mbps:** CH-Low 30MHz - 3GHz



#### CH-Low 3GHz - 26.5GHz



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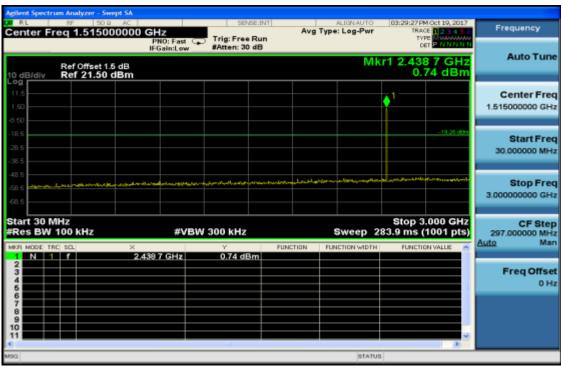
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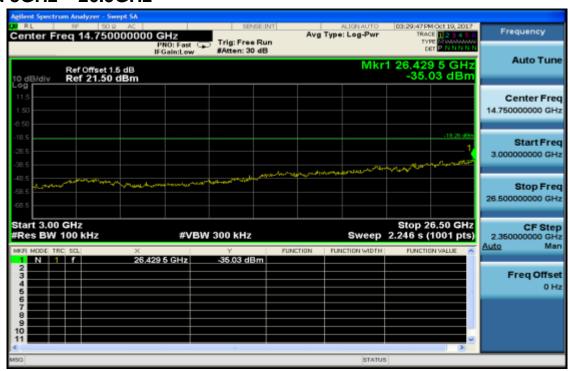
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#### CH-Mid 30MHz – 3GHz



### CH-Mid 3GHz - 26.5GHz



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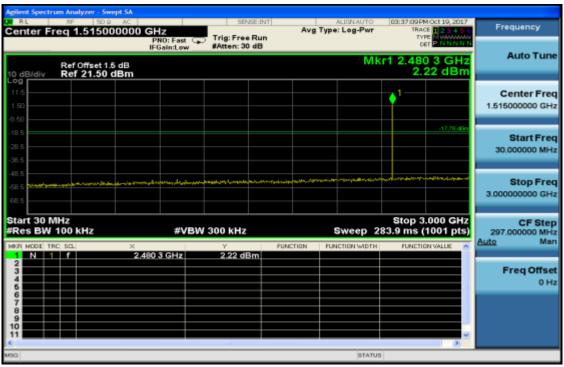
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### CH-High 30MHz – 3GHz



# CH- High 3GHz – 26.5GHz



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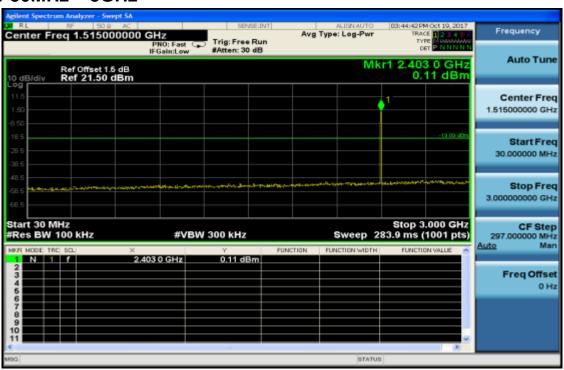
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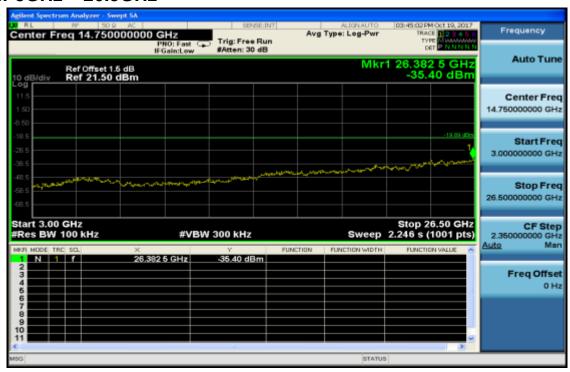
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### DATA RATE 2 Mbps (BT 5.0): CH-Low 30MHz - 3GHz



#### CH-Low 3GHz - 26.5GHz



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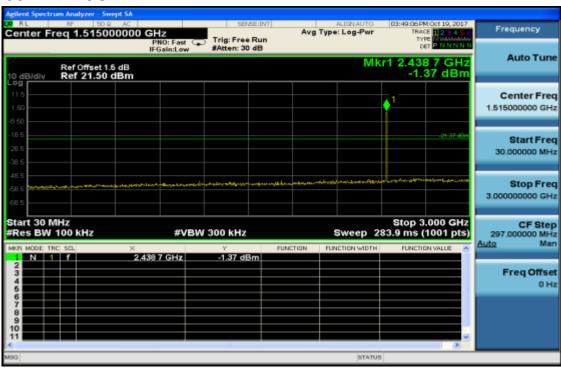
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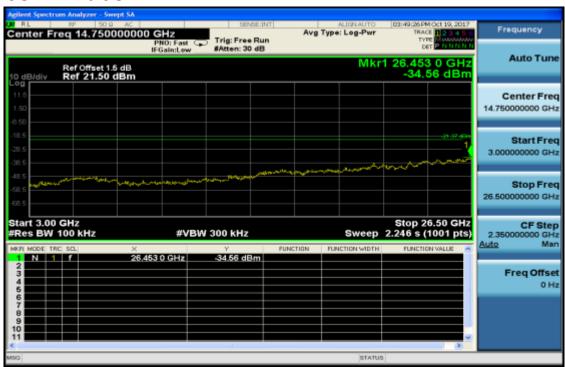
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#### CH-Mid 30MHz – 3GHz



### CH-Mid 3GHz - 26.5GHz



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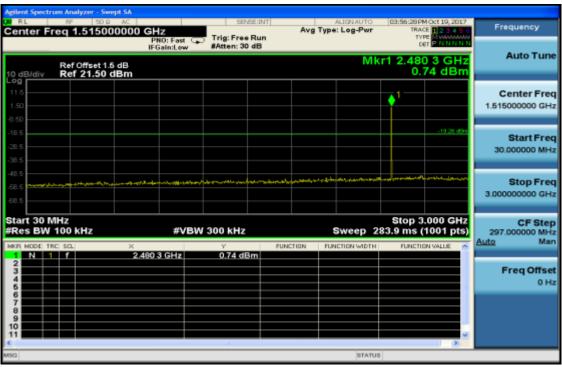
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# CH-High 30MHz – 3GHz



# CH- High 3GHz – 26.5GHz



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#### 10. RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

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

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

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

#### Note:

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

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### 10.2 Measurement Equipment Used

	SGS SAC-III											
Name of Equip- ment	Manufacturer	Model	Serial Num- ber	Calibration Date	Calibration Due							
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018							
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018							
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2017	09/19/2018							
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017							
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/04/2017	08/03/2018							
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2017	01/02/2018							
Pre-Amplifier	EMC Instru- ments Corp.	EMC0126530	980038	01/03/2017	01/02/2018							
Turn Table	HD	DT420	N/A	N.C.R	N.C.R							
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R							
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R							
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018							
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018							
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018							
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017							
Pre-Amplifier	EMC Instru- ments Corp.	EMC184045	980135	01/05/2017	01/04/2018							

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

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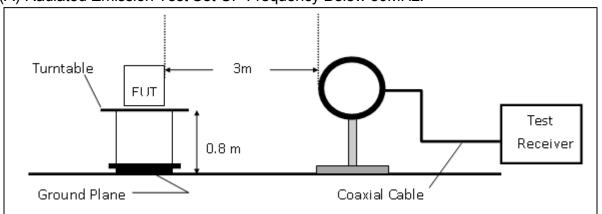
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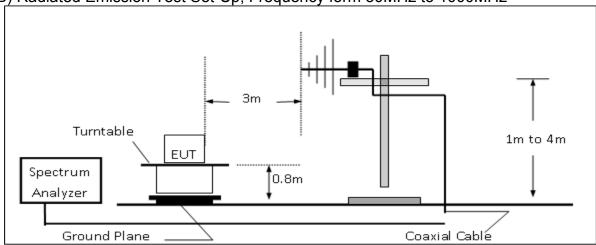


10.3 Test SET-UP

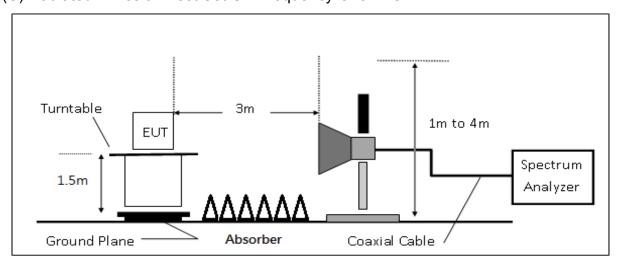
### (A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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#### **10.4 Measurement Procedure**

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m for frequen-2. cy> 1GHz above ground plan.
- 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 4. 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 compli-
- 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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# 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	<u> </u>	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(dBµV/m) + Cable Loss(dB) – Pre Amplifier Gain(dB)

#### Note:

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

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

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

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

#### 10.7 Measurement Result:

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

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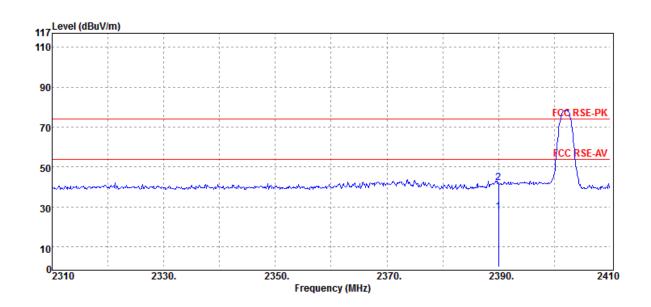
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# Radiated Band Edge Measurement Result (BLE mode) **DATA RATE 1 Mbps:**

**Operation Band Test Date** :BLE :2017-10-24

Fundamental Frequency :2402 MHz Temp./Humi. :21 deg C / 61 RH **Operation Mode** Engineer :Bandedge CH LOW :Tin

EUT Pol. :H Plane :VERTICAL 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
2390.00	E	Average	29.26	-1.74	27.52	54.00	-26.48
2390.00	Е	Peak	44.02	-1.74	42.28	74.00	-31.72

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**Operation Band** Fundamental Frequency **Operation Mode** 

:BLE :2402 MHz

:Bandedge CH LOW

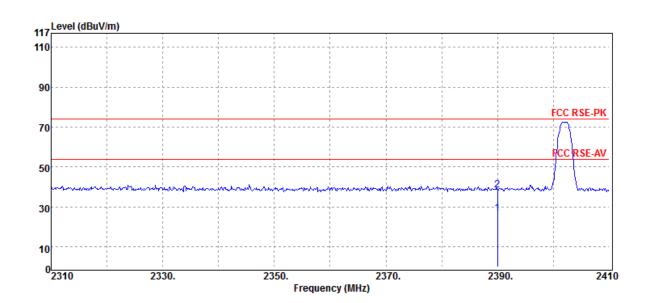
EUT Pol.

:H Plane

**Test Date** :2017-10-24 :21 deg\_C / 61 RH

Temp./Humi. Engineer

:HORIZONTAL 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
2390.00	Е	Average	28.56	-1.74	26.82	54.00	-27.18
2390.00	Е	Peak	40.26	-1.74	38.52	74.00	-35.48

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**Operation Band** Fundamental Frequency **Operation Mode** 

:BLE :2480 MHz

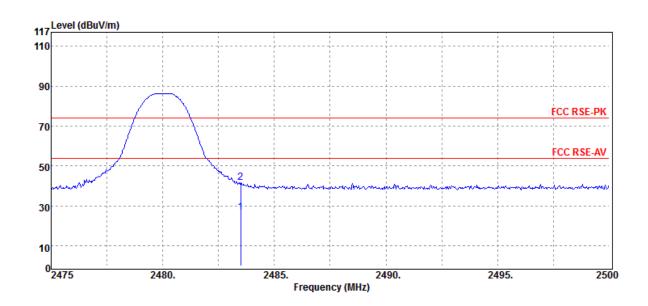
:Bandedge CH HIGH

EUT Pol. :H Plane **Test Date** :2017-10-24

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL 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	Average	28.29	-1.62	26.67	54.00	-27.33
2483.50	Е	Peak	43.30	-1.62	41.68	74.00	-32.32

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**Operation Band** Fundamental Frequency **Operation Mode** 

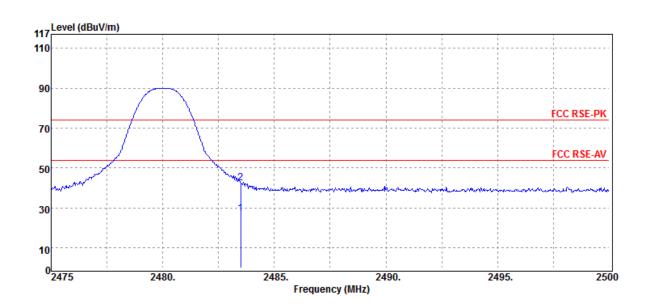
:BLE :2480 MHz

:Bandedge CH HIGH

EUT Pol. :H Plane **Test Date** :2017-10-24 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL 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	Average	28.68	-1.62	27.06	54.00	-26.94	
	2483.50	Е	Peak	44.02	-1.62	42.40	74.00	-31.60	

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## DATA RATE 2 Mbps (BT 5.0):

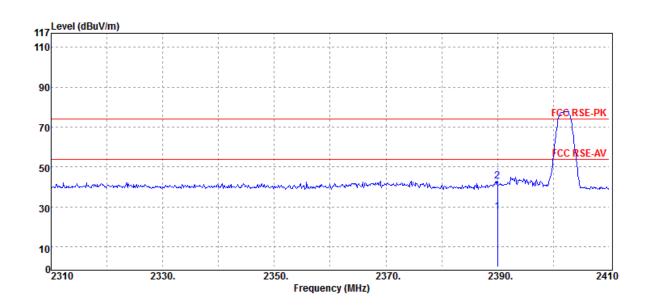
**Operation Band** :BT5.0 Fundamental Frequency :2402 MHz

**Operation Mode** :Bandedge CH LOW

EUT Pol. :H Plane **Test Date** :2017-10-24 Temp./Humi. :21 deg C / 61 RH

Engineer :Tin

:VERTICAL 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
2390.00	E	Average	29.12	-1.74	27.38	54.00	-26.62
2390.00	Е	Peak	44.47	-1.74	42.73	74.00	-31.27

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**Operation Band** Fundamental Frequency **Operation Mode** 

:BT5.0 :2402 MHz

:Bandedge CH LOW

EUT Pol.

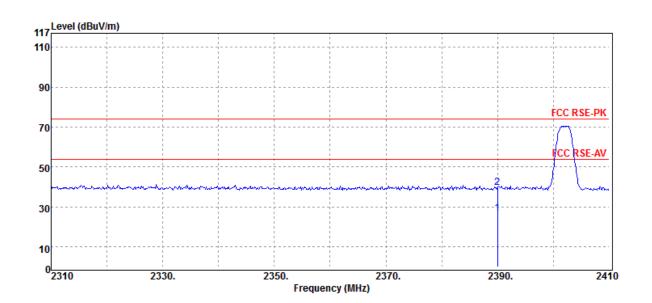
:H Plane

**Test Date** :2017-10-24

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL 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
	2390.00	Е	Average	28.29	-1.74	26.55	54.00	-27.45
	2390.00	Е	Peak	41.45	-1.74	39.71	74.00	-34.29

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**Operation Band** Fundamental Frequency **Operation Mode** 

:BT5.0 :2480 MHz

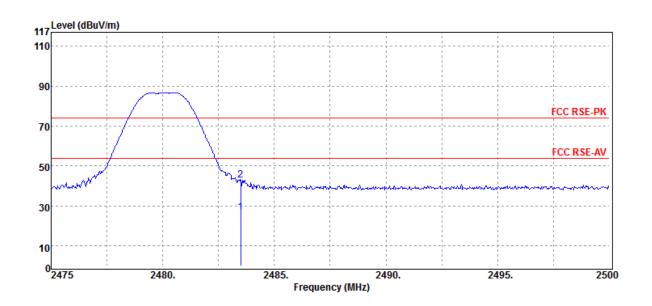
:Bandedge CH HIGH

EUT Pol. :H Plane **Test Date** :2017-10-24

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL 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	Е	Average	28.38	-1.62	26.76	54.00	-27.24
2483.50	Е	Peak	44.55	-1.62	42.93	74.00	-31.07

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**Operation Band** Fundamental Frequency **Operation Mode** 

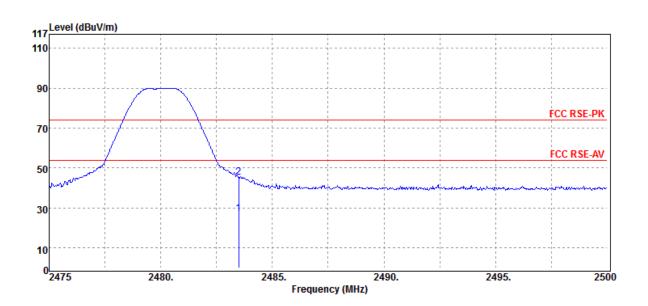
:BT5.0 :2480 MHz

:Bandedge CH HIGH

EUT Pol. :H Plane **Test Date** :2017-10-24 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL 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	Е	Average	28.77	-1.62	27.15	54.00	-26.85
2483.50	Е	Peak	46.93	-1.62	45.31	74.00	-28.69

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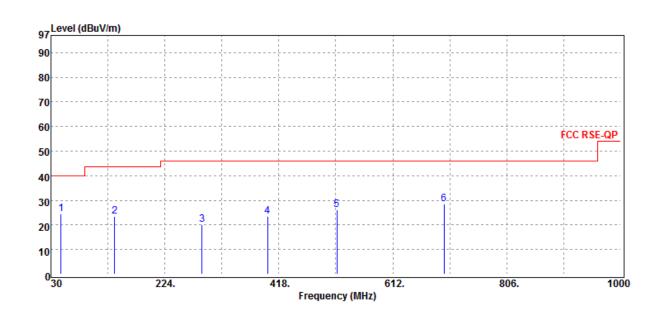
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### Radiated Spurious Emission Measurement Result: (BLE mode) For Frequency from 30MHz to 1000MHz **DATA RATE 1 Mbps:**

**Operation Band** :BLE **Test Date** :2017-10-24

:21 deg\_C / 61 RH Fundamental Frequency :2402 MHz Temp./Humi. Operation Mode :Tx CH LOW Engineer

EUT Pol. :H Plane :VERTICAL 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
47.46	S	Peak	32.36	-7.85	24.51	40.00	-15.49
138.64	S	Peak	31.86	-8.49	23.37	43.50	-20.13
287.05	S	Peak	26.47	-6.19	20.28	46.00	-25.72
398.60	S	Peak	27.47	-3.97	23.50	46.00	-22.50
516.94	S	Peak	28.10	-1.94	26.16	46.00	-19.84
699.30	S	Peak	27.22	1.44	28.66	46.00	-17.34

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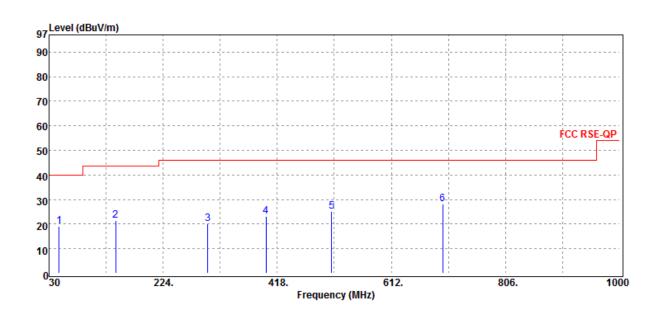
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BLE :2402 MHz :Tx CH LOW :H Plane

:2017-10-24 **Test Date** Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
47.46	S	Peak	27.02	-7.85	19.17	40.00	-20.83
143.49	S	Peak	29.50	-8.09	21.41	43.50	-22.09
299.66	S	Peak	25.99	-5.93	20.06	46.00	-25.94
398.60	S	Peak	27.00	-3.97	23.03	46.00	-22.97
510.15	S	Peak	27.51	-2.19	25.32	46.00	-20.68
699.30	S	Peak	26.61	1.44	28.05	46.00	-17.95

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

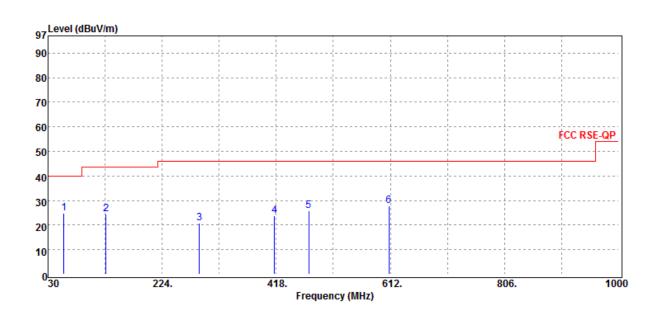
:BLE :2440 MHz :Tx CH MID :H Plane

**Test Date** :2017-10-24

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL 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
57.16	S	Peak	32.75	-7.98	24.77	40.00	-15.23
128.94	S	Peak	34.14	-9.57	24.57	43.50	-18.93
287.05	S	Peak	26.98	-6.19	20.79	46.00	-25.21
415.09	S	Peak	26.91	-3.21	23.70	46.00	-22.30
473.29	S	Peak	28.41	-2.51	25.90	46.00	-20.10
609.09	S	Peak	28.24	-0.32	27.92	46.00	-18.08

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

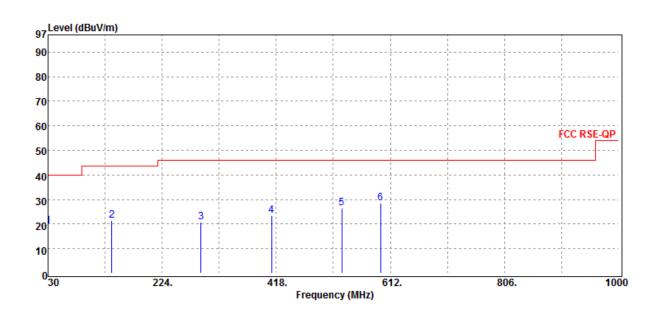
:BLE :2440 MHz :Tx CH MID :H Plane

:2017-10-24 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
30.00	S	Peak	28.38	-9.19	19.19	40.00	-20.81
138.64	S	Peak	30.00	-8.49	21.51	43.50	-21.99
289.96	S	Peak	26.77	-6.07	20.70	46.00	-25.30
410.24	S	Peak	27.11	-3.62	23.49	46.00	-22.51
529.55	S	Peak	27.66	-1.25	26.41	46.00	-19.59
595.51	S	Peak	28.45	0.05	28.50	46.00	-17.50

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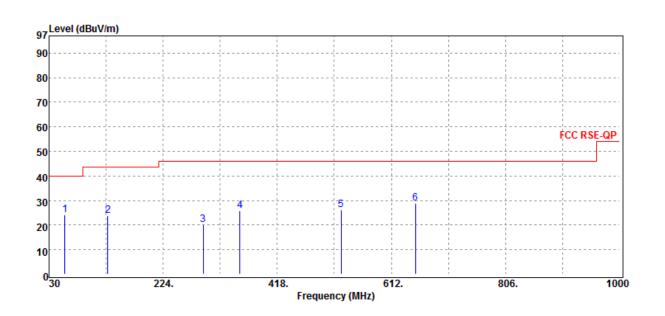
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol. :H Plane

:BLE :2480 MHz :Tx CH HIGH **Test Date** Temp./Humi. Engineer

:2017-10-24

:21 deg\_C / 61 RH

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
57.16	S	Peak	32.18	-7.98	24.20	40.00	-15.80
129.91	S	Peak	33.45	-9.50	23.95	43.50	-19.55
291.90	S	Peak	26.11	-6.08	20.03	46.00	-25.97
354.95	S	Peak	30.48	-4.75	25.73	46.00	-20.27
526.64	S	Peak	27.65	-1.44	26.21	46.00	-19.79
652.74	S	Peak	28.25	0.53	28.78	46.00	-17.22

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

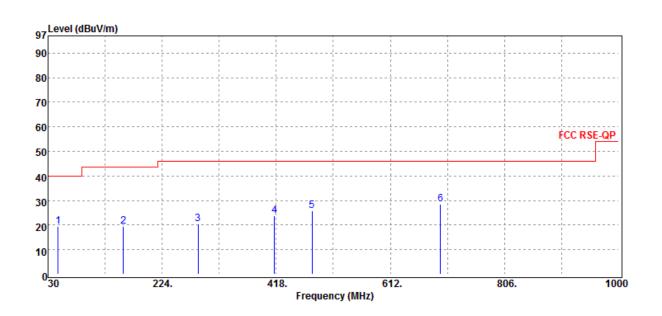
:BLE :2480 MHz :Tx CH HIGH :H Plane

**Test Date** Temp./Humi. Engineer

:2017-10-24

:21 deg\_C / 61 RH

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
47.46	S	Peak	27.40	-7.85	19.55	40.00	-20.45
158.04	S	Peak	27.01	-7.45	19.56	43.50	-23.94
285.11	S	Peak	26.55	-6.24	20.31	46.00	-25.69
415.09	S	Peak	27.14	-3.21	23.93	46.00	-22.07
479.11	S	Peak	28.17	-2.39	25.78	46.00	-20.22
697.36	S	Peak	27.01	1.36	28.37	46.00	-17.63

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### DATA RATE 2 Mbps (BT5.0):

**Operation Band** :BT5.0

Fundamental Frequency :2402 MHz **Operation Mode** :Tx CH LOW

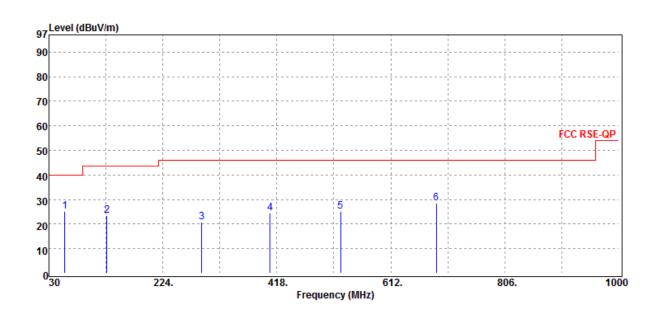
EUT Pol. :H Plane

:2017-10-24 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



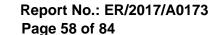
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
57.16	S	Peak	33.07	-7.98	25.09	40.00	-14.91
128.94	S	Peak	32.94	-9.57	23.37	43.50	-20.13
289.96	S	Peak	26.89	-6.07	20.82	46.00	-25.18
406.36	S	Peak	28.13	-3.59	24.54	46.00	-21.46
526.64	S	Peak	26.61	-1.44	25.17	46.00	-20.83
689.60	S	Peak	27.33	1.27	28.60	46.00	-17.40

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**Operation Band** Fundamental Frequency **Operation Mode** 

EUT Pol.

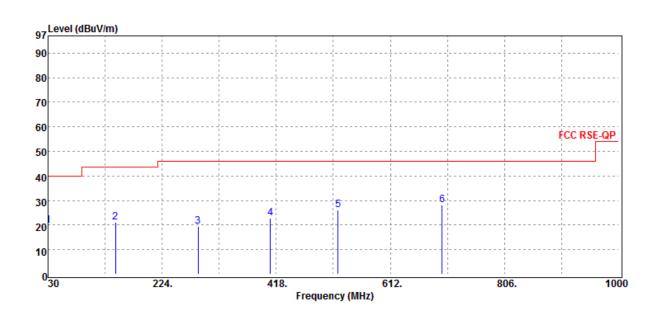
:BT5.0 :2402 MHz :Tx CH LOW :H Plane

:2017-10-24 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
30.00	S	Peak	29.10	-9.19	19.91	40.00	-20.09
144.46	S	Peak	29.14	-8.07	21.07	43.50	-22.43
285.11	S	Peak	25.83	-6.24	19.59	46.00	-26.41
408.30	S	Peak	26.48	-3.53	22.95	46.00	-23.05
522.76	S	Peak	27.87	-1.66	26.21	46.00	-19.79
700.27	S	Peak	26.59	1.44	28.03	46.00	-17.97

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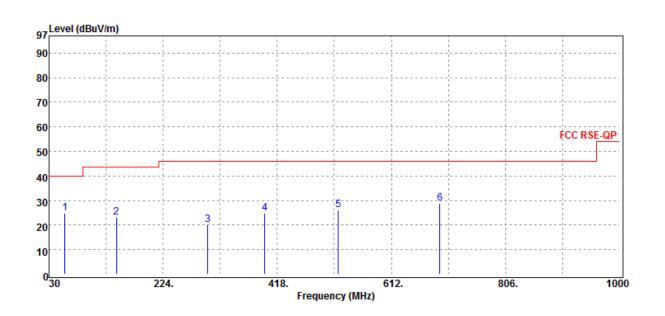
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**Operation Band** :BT5.0 Fundamental Frequency :2440 MHz **Operation Mode** :Tx CH MID EUT Pol. :H Plane

**Test Date** :2017-10-24 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



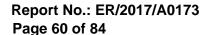
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
57.16	S	Peak	32.87	-7.98	24.89	40.00	-15.11
144.46	S	Peak	31.16	-8.07	23.09	43.50	-20.41
299.66	S	Peak	26.00	-5.93	20.07	46.00	-25.93
396.66	S	Peak	29.04	-4.11	24.93	46.00	-21.07
521.79	S	Peak	27.81	-1.61	26.20	46.00	-19.80
694.45	S	Peak	27.60	1.36	28.96	46.00	-17.04

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**Operation Band** Fundamental Frequency **Operation Mode** 

EUT Pol.

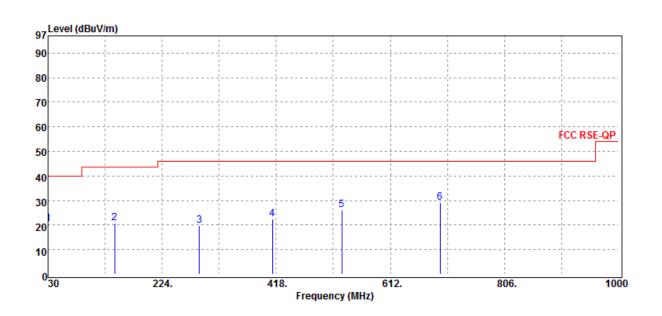
:BT5.0 :2440 MHz :Tx CH MID :H Plane

:2017-10-24 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
30.00	S	Peak	29.74	-9.19	20.55	40.00	-19.45
143.49	S	Peak	28.85	-8.09	20.76	43.50	-22.74
287.05	S	Peak	25.91	-6.19	19.72	46.00	-26.28
411.21	S	Peak	26.03	-3.63	22.40	46.00	-23.60
529.55	S	Peak	27.55	-1.25	26.30	46.00	-19.70
696.39	S	Peak	27.72	1.35	29.07	46.00	-16.93

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol. :H Plane

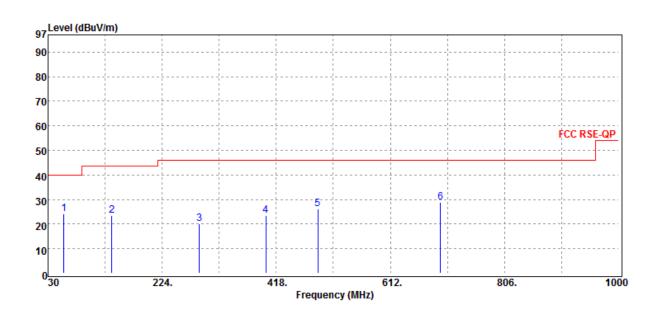
:BT5.0 :2480 MHz :Tx CH HIGH

**Test Date** Temp./Humi. :2017-10-24

:21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
57.16	S	Peak	32.03	-7.98	24.05	40.00	-15.95
138.64	S	Peak	31.85	-8.49	23.36	43.50	-20.14
287.05	S	Peak	26.37	-6.19	20.18	46.00	-25.82
400.54	S	Peak	27.38	-3.94	23.44	46.00	-22.56
488.81	S	Peak	28.49	-2.38	26.11	46.00	-19.89
697.36	S	Peak	27.55	1.36	28.91	46.00	-17.09

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**Operation Band** :BT5.0 Fundamental Frequency **Operation Mode** 

:2480 MHz :Tx CH HIGH

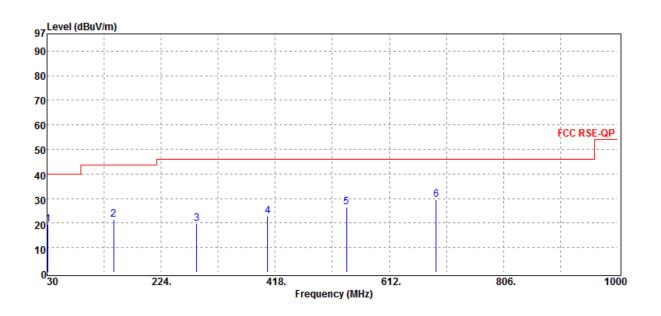
EUT Pol. :H Plane

:2017-10-24 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	<b>@</b> 3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
31.94	S	Peak	28.51	-9.11	19.40	40.00	-20.60
143.49	S	Peak	29.73	-8.09	21.64	43.50	-21.86
284.14	S	Peak	25.87	-6.22	19.65	46.00	-26.35
405.39	S	Peak	26.63	-3.70	22.93	46.00	-23.07
539.25	S	Peak	27.99	-1.58	26.41	46.00	-19.59
691.54	S	Peak	27.94	1.47	29.41	46.00	-16.59

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### Radiated Spurious Emission Measurement Result: (BLE mode)

# For Frequency above 1 GHz

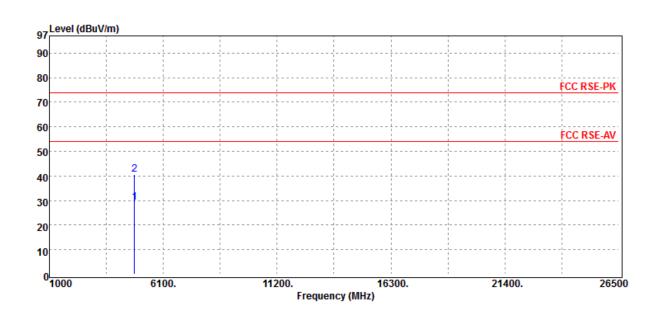
**DATA RATE 1 Mbps:** 

**Operation Band Test Date** :2017-10-25 :BLE

Fundamental Frequency Temp./Humi. :2402 MHz :21 deg\_C / 61 RH

**Operation Mode** :Tx CH LOW Engineer :Tin

EUT Pol. :H Plane :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe	
		Mode	Reading Level		FS	@3m	Margin	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB	
4804.00	Н	Average	24.44	4.92	29.36	54.00	-24.64	
4804.00	Н	Peak	35.68	4.92	40.60	74.00	-33.40	

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

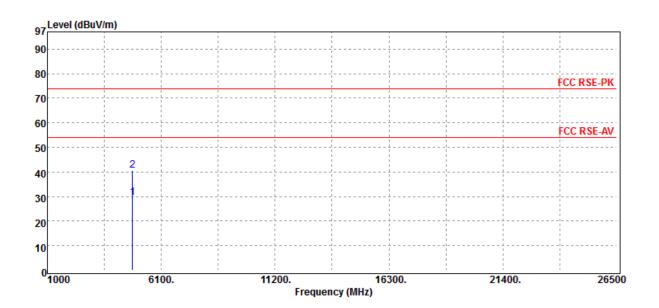
:BLE :2402 MHz :Tx CH LOW :H Plane

**Test Date** Temp./Humi. :2017-10-25

:21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.00	Н	Average	24.55	4.92	29.47	54.00	-24.53
4804.00	Н	Peak	35.55	4.92	40.47	74.00	-33.53

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台灣檢驗科技股份有限公司

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

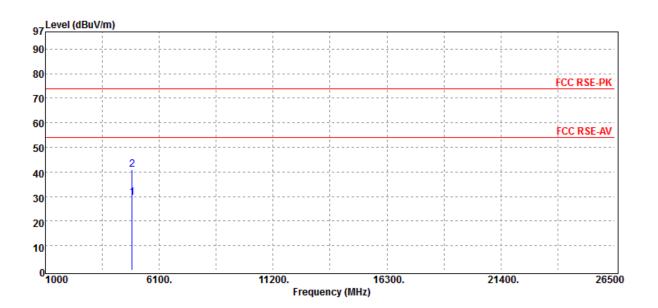
:BLE :2440 MHz :Tx CH MID :H Plane

**Test Date** :2017-10-25

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4880.00	Н	Average	24.50	5.17	29.67	54.00	-24.33
4880.00	Н	Peak	35.75	5.17	40.92	74.00	-33.08

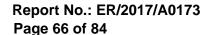
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**Operation Band** Fundamental Frequency **Operation Mode** 

EUT Pol.

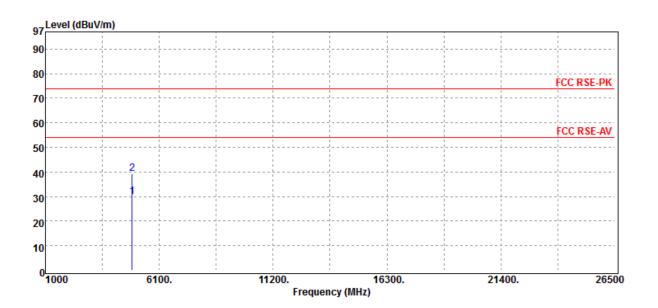
:BLE :2440 MHz :Tx CH MID :H Plane

:2017-10-25 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4880.00	Н	Average	24.63	5.17	29.80	54.00	-24.20
4880.00	Н	Peak	34.00	5.17	39.17	74.00	-34.83

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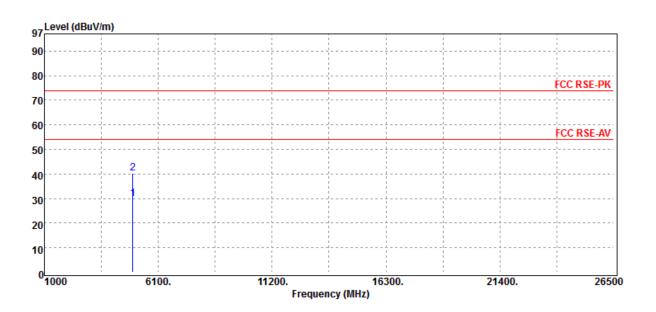
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BLE :2480 MHz :Tx CH HIGH :H Plane

**Test Date** :2017-10-25 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
4960.00	Н	Average	24.49	5.29	29.78	54.00	-24.22
4960.00	Н	Peak	34.84	5.29	40.13	74.00	-33.87

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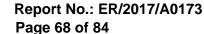
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**Operation Band** Fundamental Frequency **Operation Mode** 

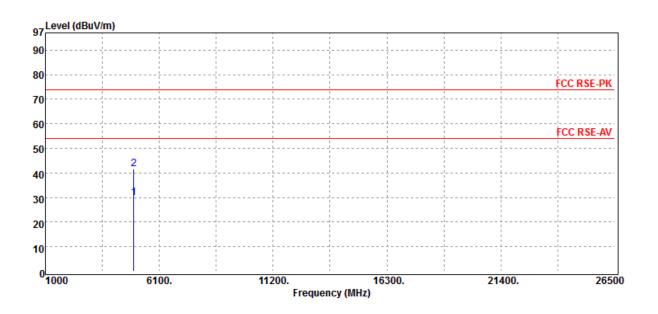
EUT Pol.

:BLE :2480 MHz :Tx CH HIGH :H Plane

:2017-10-25 **Test Date** Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4960.00	Н	Average	24.59	5.29	29.88	54.00	-24.12
4960.00	Н	Peak	36.27	5.29	41.56	74.00	-32.44

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### DATA RATE 2 Mbps (BT5.0):

**Operation Band** :BT5.0

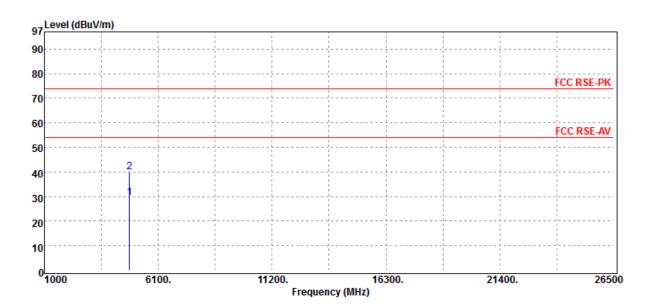
Fundamental Frequency :2402 MHz **Operation Mode** :Tx CH LOW

EUT Pol. :H Plane **Test Date** :2017-10-25

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4804.00	Н	Average	24.62	4.92	29.54	54.00	-24.46
4804.00	Н	Peak	34.88	4.92	39.80	74.00	-34.20

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BT5.0 :2402 MHz :Tx CH LOW

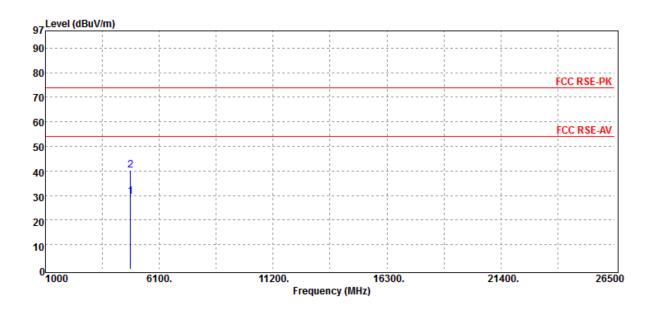
:H Plane

:2017-10-25 **Test Date** 

Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4804.00	Н	Average	24.71	4.92	29.63	54.00	-24.37
4804.00	Н	Peak	35.44	4.92	40.36	74.00	-33.64

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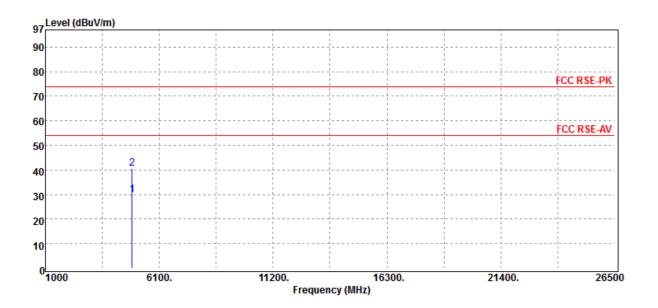
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BT5.0 :2440 MHz :Tx CH MID :H Plane

**Test Date** :2017-10-25 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
4880.00	Н	Average	24.57	5.17	29.74	54.00	-24.26
4880.00	Н	Peak	35.34	5.17	40.51	74.00	-33.49

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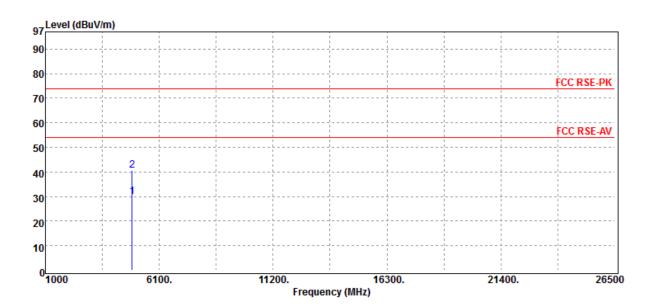
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BT5.0 :2440 MHz :Tx CH MID :H Plane

:2017-10-25 **Test Date** Temp./Humi. :21 deg\_C / 61 RH

Engineer

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4880.00	Н	Average	24.74	5.17	29.91	54.00	-24.09
4880.00	Н	Peak	35.42	5.17	40.59	74.00	-33.41

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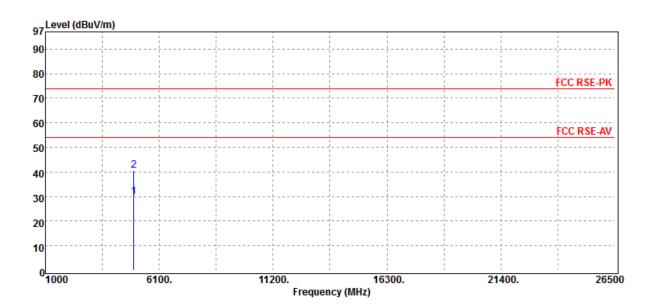
**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BT5.0 :2480 MHz :Tx CH HIGH :H Plane

**Test Date** :2017-10-25 Temp./Humi. :21 deg\_C / 61 RH

Engineer

:VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
4960.00	Н	Average	24.59	5.29	29.88	54.00	-24.12
4960.00	Н	Peak	35.22	5.29	40.51	74.00	-33.49

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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

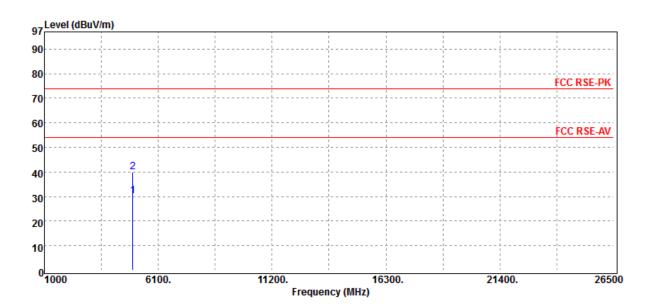
:BT5.0 :2480 MHz :Tx CH HIGH :H Plane

**Test Date** Temp./Humi. Engineer

:2017-10-25

:21 deg\_C / 61 RH

:HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4960.00	Н	Average	24.78	5.29	30.07	54.00	-23.93
4960.00	Н	Peak	34.74	5.29	40.03	74.00	-33.97

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### 11. PEAK POWER SPECTRAL DENSITY

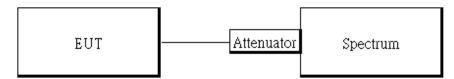
### 11.1 Standard Applicable:

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:

SGS Conducted Room						
Name of Equipment	Manufacturer	Model	Serial Num- ber	Calibration Date	Calibration Due	
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017	
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017	
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018	
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018	
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018	
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018	
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018	
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017	
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018	

### 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.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 3 kHz & VBW = 10 kHz.
- 5. For defining Restricted Band Edge Limit: Set the RBW = 100kHz & VBW = 300 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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# 11.5 Measurement Result: **DATA RATE 1 Mbps:**

#### **BLE** mode

Frequenc y (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result		
2402	-13.74	8	PASS		
2442	-13.22	8	PASS		
2480	-11.98	8	PASS		

NOTE: cable loss as 1.5dB that offsets in the spectrum

#### **Band Edge Limit**

Frequenc y (MHz)	RF Power Density (dBm)	Bandedge Limit = PSD - 20dB (dBm)
2402	0.79	-19.21
2480	2.56	-17.44

NOTE: cable loss as 1.5dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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### DATA RATE 2 Mbps (BT 5.0):

#### **BLE** mode

Frequenc y (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result		
2402	-17.68	8	PASS		
2442	-17.18	8	PASS		
2480	-16.48	8	PASS		

NOTE: cable loss as 1.5dB that offsets in the spectrum

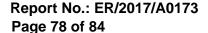
### **Band Edge Limit**

Frequenc y (MHz)	RF Power Density (dBm)	Bandedge Limit = PSD - 20dB (dBm)
2402	0.74	-19.26
2480	2.49	-17.51

NOTE: cable loss as 1.5dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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**DATA RATE 1 Mbps:** 

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



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



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



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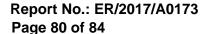
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Power Spectral Density for Bandedge Limit (CH-Low)



Power Spectral Density for Bandedge Limit (CH-High)



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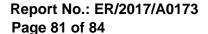
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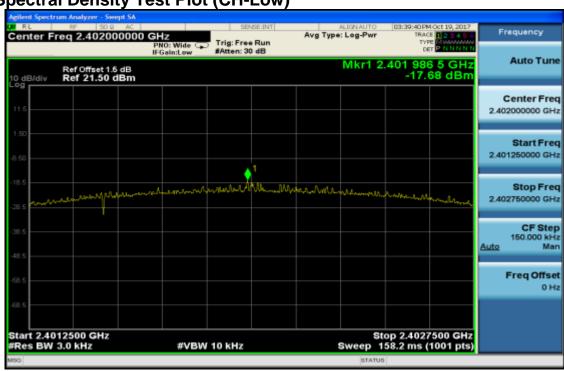
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DATA RATE 2 Mbps (BT5.0):

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



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



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



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Power Spectral Density for Bandedge Limit (CH-Low)



Power Spectral Density for Bandedge Limit (CH-High)



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### 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 is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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

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