

# **ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**

# INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

Applicant:	Quanta Computer Inc.
	No. 188, Wenhua 2nd Road, Guishan District,
	Taoyuan City 33377, Taiwan
Product Name:	7 inch POS Terminal
Brand Name:	Quanta, CASTLES
Model No.:	KI1, SATURN7000
Model Difference:	Marketing Purpose
FCC ID:	HFS-KI1
Report Number:	E2/2018/70100
FCC Rule Part:	§15.247, Cat: DTS
Issue Date:	Oct. 24, 2018
Date of Test:	Aug. 08, 2018 ~ Oct. 19, 2018
Date of EUT Received:	Aug. 08, 2018

#### 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.

Tested By:

Vito Pei / Sr. Engineer

Jim Chang / Manager

Approved By:



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# **Revision History**

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/70100	Rev.00	Initial creation of docu- ment	All	Oct. 24, 2018	Elle Chang

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#### **GENERAL INFORMATION** 1

# **1.1 Product Description**

General:

Product Name:	7 inch POS Terminal			
Brand Name:	Quanta, C	Quanta, CASTLES		
Model No.:	KI1, SATU	RN7000		
Model difference:	Marketing	Purpose		
Hardware Version:	B2			
Software Version:	01.000			
	3.8V from Rechargeable Li-ion Battery or 5V from AC/DC Adapter			
Power Supply:	Battery: Model no.: KI1 Supplier: Ningbo Veken Battery Co., Ltd.			
	Adapter:	Model No.: CYSF12G-050200U, Supplier: JIANGSU CHENYANG ELECTRON Co., LTI		

### Bluetooth Low Energy:

Bluetooth Version:	Bluetooth V4.1 LE dual mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	3.72 dBm
Frequency Range:	2402 – 2480MHz

### **Antenna Designation**

Antenna Type	Part Number	Supplier	Peak Gain (dBi)
PIFA	L64RF019-CS-H	Luxshare-ICT	2.10

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#### **1.2 Test Methodology of Applied Standards**

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v04.

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.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Number and Designation number are: 735305 / TW0002

#### **1.4 Special Accessories**

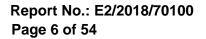
There are no special accessories used while test was conducted.

#### **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 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.

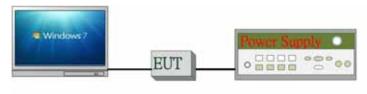
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# 2.5 Configuration of Tested System Fig. 2-1 Conducted (Antenna Port) Emission Configuration



# Fig 2-3 Conduction (AC Power Line) Radiated Emission

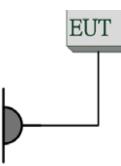


Fig 2-2 Radiated Emission



# Table 2-1 Equipment Used in Tested System

ltem	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Ca- ble	Power Cord
1	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L430	R9-WR6X4	Shielded	Unshielded
3.	DC Power Sup- ply	Agilent	E3640A	MY53140006	N/A	Unshielded

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#### SUMMARY OF TEST RESULTS 3

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

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# 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2402 MHz	15	2430 MHz	29	2458 MHz
2	2404 MHz	16	2432 MHz	30	2460 MHz
3	2406 MHz	17	2434 MHz	31	2462 MHz
4	2408 MHz	18	2436 MHz	32	2464 MHz
5	2410 MHz	19	2438 MHz	33	2466 MHz
6	2412 MHz	20	2440 MHz	34	2468 MHz
7	2414 MHz	21	2442 MHz	35	2470 MHz
8	2416MHz	22	2444 MHz	36	2472 MHz
9	2418 MHz	23	2446 MHz	37	2474 MHz
10	2420 MHz	24	2448 MHz	38	2476 MHz
11	2422 MHz	25	2450 MHz	39	2478 MHz
12	2424 MHz	26	2452 MHz	40	2480 MHz
13	2426 MHz	27	2454 MHz		
14	2428 MHz	28	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:

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)		
	RADIATED EMISSION TEST (BELOW 1 GHz)					
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	1		
	RADIATED EMISSION TEST (ABOVE 1 GHz)					
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	1		
Note: The field stre	ngth of radiation e	emission was measured	as EUT stand-up pos	ition (H mode) and		

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 FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	1	

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#### **MEASUREMENT UNCERTAINTY** 5

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:

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

	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
Measurement uncertainty	167MHz -500MHz: +/- 3.44dB
(Polarization : Horizontal)	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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# 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 wit	h the logarithm of the frequency ir	the range 0.15 MHz to 0.50					
MHz.	-						

### 6.2 Measurement Equipment Used:

Conducted Emission Test Site								
EQUIPMENT MFR MODEL SERIAL LAST CAL								
TYPE		NUMBER	NUMBER	CAL.				
LISN	TESEQ	NNB 51	36076	2018/02/14	2019/02/13			
EMI Test Receiver	R&S	ESCI	101300	2017/11/02	2018/11/01			

# 6.3 EUT Setup:

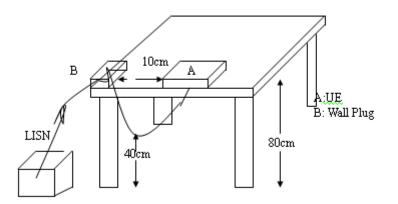
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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# 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.
- 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

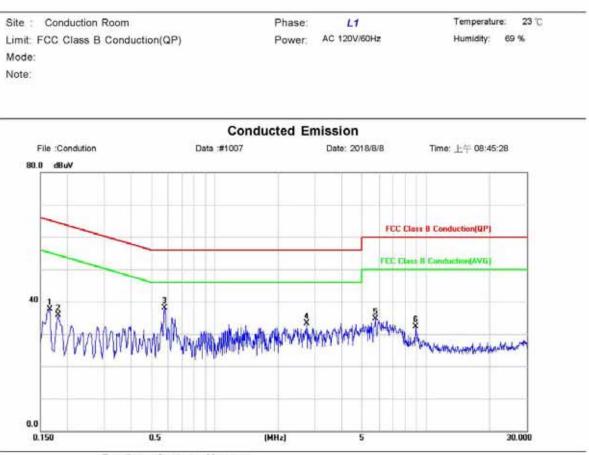
### 6.6 Measurement Result:

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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# AC POWER LINE CONDUCTED EMISSION TEST DATA



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment	
1		0.1660	18.02	19.68	37.70	65.16	-27.46	peak		
2		0.1820	16.23	19.70	35.93	64.39	-28.46	peak		
3	•	0.5820	18.00	20,16	38.16	56.00	-17.84	peak		
4		2.7220	12.87	20.43	33.30	56.00	-22.70	peak		
5		5.7540	14.63	19.98	34.61	60.00	-25.39	peak		
6		8.9380	12.40	19.96	32.36	60.00	-27.64	peak		

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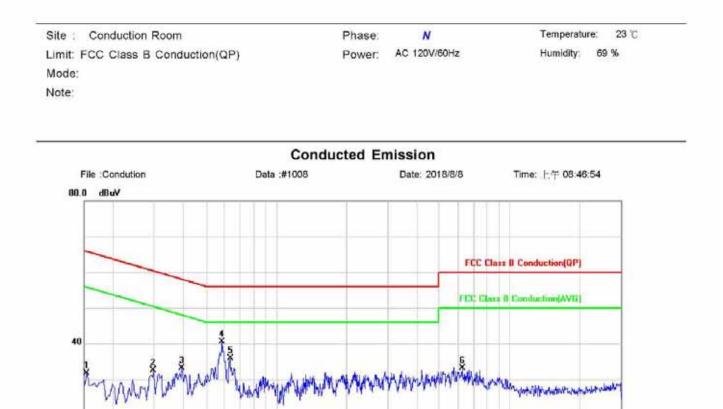
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0.0

0.150

30.000



Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment	
	0.1540	12.09	19.65	31.74	65.78	-34.04	peak		
	0.2980	12.54	19.88	32.42	60.30	-27.88	peak		
	0.3940	13.02	20.04	33.06	57.98	-24.92	peak		
•	0.5860	20.42	20.15	40.57	56.00	-15.43	peak		
	0.6340	15.71	20.11	35.82	56.00	-20.18	peak		
	6.2820	13.15	19.96	33.11	60.00	-26.89	peak		
		MHz 0.1540 0.2980 0.3940 * 0.5860 0.6340	Mk.         Freq.         Level           MHz         dBuV           0.1540         12.09           0.2980         12.54           0.3940         13.02           *         0.5860         20.42           0.6340         15.71	Mk.         Freq.         Level         Factor           MHz         dBuV         dB           0.1540         12.09         19.65           0.2980         12.54         19.88           0.3940         13.02         20.04           *         0.5860         20.42         20.15           0.6340         15.71         20.11	Mk.         Freq.         Level         Factor         ment           MHz         dBuV         dB         dBuV           0.1540         12.09         19.65         31.74           0.2980         12.54         19.88         32.42           0.3940         13.02         20.04         33.06           *         0.5860         20.42         20.15         40.57           0.6340         15.71         20.11         35.82	Mk.         Freq.         Level         Factor         ment         Limit           MHz         dBuV         dB         dBuV         d	Mk.         Freq.         Level         Factor         ment         Limit         Over           MHz         dBuV         dB         dBuV         dBuV         dB         dB         dBuV         dB         dB         dBuV         dB         d	Mk.         Freq.         Level         Factor         ment         Limit         Over           MHz         dBuV         dB         dBuV         dBuV         dB         Detector           0.1540         12.09         19.65         31.74         65.78         -34.04         peak           0.2980         12.54         19.88         32.42         60.30         -27.88         peak           0.3940         13.02         20.04         33.06         57.98         -24.92         peak           *         0.5860         20.42         20.15         40.57         56.00         -15.43         peak           0.6340         15.71         20.11         35.82         56.00         -20.18         peak	Mk.         Freq.         Level         Factor         ment         Limit         Over           MHz         dBuV         dB         dBuV         dBuV         dB         Detector         Comment           0.1540         12.09         19.65         31.74         65.78         -34.04         peak           0.2980         12.54         19.88         32.42         60.30         -27.88         peak           0.3940         13.02         20.04         33.06         57.98         -24.92         peak           *         0.5860         20.42         20.15         40.57         56.00         -15.43         peak           0.6340         15.71         20.11         35.82         56.00         -20.18         peak

(MHz)

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ボチカオ 就切 \* 近れずきね 不僅 オガ(私く体) 使見 \* ロッサレ (本の主体 ものえ \* みん すみ 生み なの きゅ マ コ \* イ う い か なん \* This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <u>www.sgs.com/terms\_and\_conditions.htm</u> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <u>www.sgs.com/terms\_e-document.htm</u>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

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# 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.

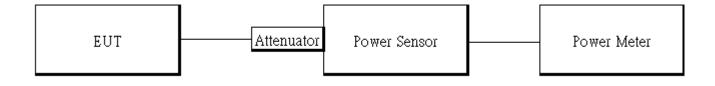
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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:

Conducted Emission Test Site								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02			
Notebook	Lenovo	L420	S0011721	N/A	N/A			
DC Power Supply	Agilent	E3640A	MY53140006	2018/05/30	2019/05/29			
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25			

# 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.

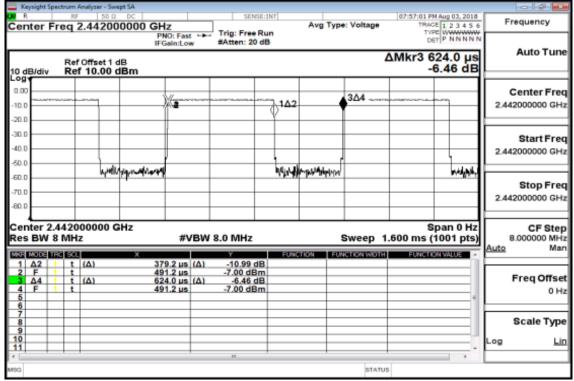
# Formula:

Duty Cycle = Ton / (Ton+Toff)

# **Duty Factor:**

	Duty Cycle (%)	Duty Factor (dB)	1/T (kHz)	VBW setting (kHz)
BLE	60.77	2.16	1.65	2.00

Duty Cycle Factor:10\*log(1/(60.77/100))=2.16



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# 7.5 Measurement Result:

#### BLE mode:

СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
0	2402	2.82	1 Watt = 30 dBm
20	2442	3.72	1 Watt = 30 dBm
39	2480	2.67	1 Watt = 30 dBm
BLE mo	de:		
СН	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	2.72	1 Watt = 30 dBm
20	2442	3.62	1 Watt = 30 dBm
39	2480	2.57	1 Watt = 30 dBm

\*Note: Measured by power meter, cable loss as 0.4 dB that offsets on the power meter in Peak \*Note: Measured by power meter, **as cable loss+ Duty cycle factor that offsets on the power meter** \*Note: Max. Output include tune up tolerance Power is average power

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# 8 6DB BANDWIDTH MEASUREMENT

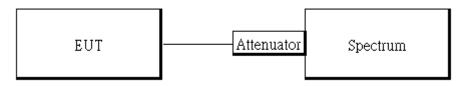
#### 8.1 Standard Applicable

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

#### 8.2 Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19			
DC Block	PASTER- NACK	PE8210	RF29	2017/12/26	2018/12/25			
Notebook	Lenovo	L420	S0011721	N/A	N/A			
DC Power Supply	Agilent	E3640A	MY53140006	2018/05/30	2019/05/29			
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25			
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02			

#### 8.3 Test Set-up:



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#### **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.
- 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. For 99% Bandwidth:

Set the spectrum analyzer as RBW=1%, VBW=3\*RBW, Span = 2MHz, Detector=Sample, Sweep=auto.

- 7. Turn on the 99% bandwidth function, max reading.
- 8. Repeat above procedures until all test default channel is completed

**BLE mode** 

#### 8.5 Measurement Result:

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result
2402	0.709	> 0.5	PASS
2442	0.71	> 0.5	PASS
2480	0.71	> 0.5	PASS

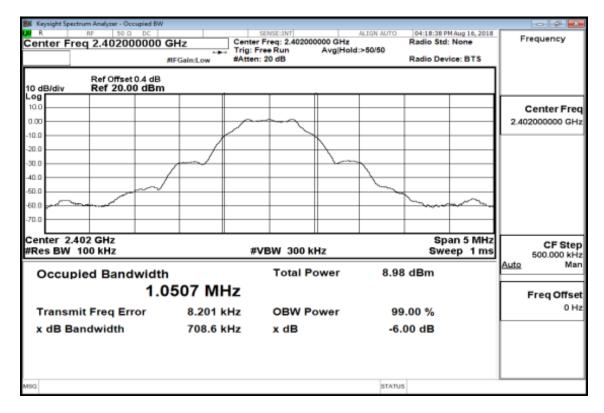
Note: Refer to next page for plots.

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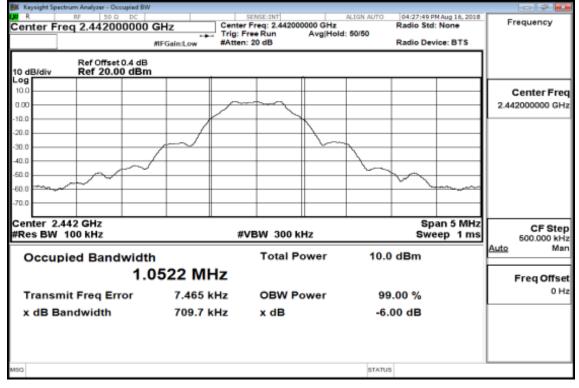
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# 6dB Band Width Test Data CH-Low



# 6dB Band Width Test Data CH-Mid



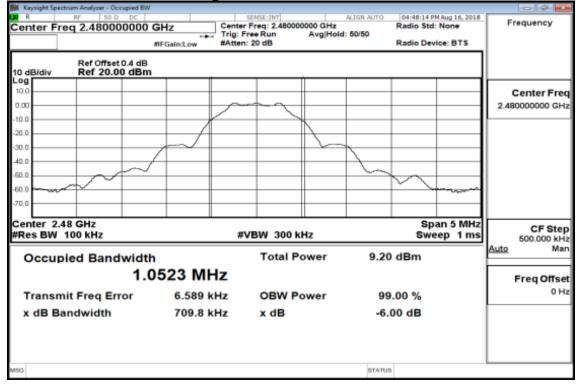
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# 6dB Band Width Test Data CH-High



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# 9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

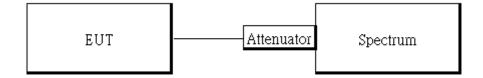
#### 9.1 Standard Applicable

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).

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19			
DC Block	PASTERNACK	PE8210	RF29	2017/12/26	2018/12/25			
Notebook	Lenovo	L420	S0011721	N/A	N/A			
DC Power Supply	Agilent	E3640A	MY53140006	2018/05/30	2019/05/29			
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25			
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02			
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02			

#### 9.2 Measurement Equipment Used:

#### 9.3 Test SET-UP:



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### 9.4 Measurement Procedure

### **Reference Level of Emission Limit:**

- 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 = 100kHz & VBW = 300 kHz.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.

## 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.
- 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. 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.
- 8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

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



# **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.
- 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

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	1.78	-18.22
2442	2.76	-17.24
2480	1.72	-18.28

#### **Reference Level of Limit**

*NOTE: cable loss as dB that offsets in the spectrum NOTE: Refer to next page for plots.* 

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#### **Reference Level of Emission Limit (CH-Low)**

R	num Analyzer - Swept SA RF 50 Ω DC 2.402000000	CHa	SENSE:INT	ALIGN AUTO	04:18:55 PM Aug 16, 2018 TRACE 1 2 3 4 5 6	Frequency
enter Fre	sq 2.40200000	PNO: Wide G	Trig: Free Run #Atten: 20 dB	ing type court in	DET P NNNNN	
0 dB/div	Ref Offset 0.4 dB Ref 10.40 dBm			Mkr1 2	401 992 5 GHz. 1.78 dBm	Auto Tur
g			1			Center Fre
400		-				2.402000000 GF
60			+			Start Fre
9.6						2.401250000 G
9.6						Stop Fr 2.402750000 G
						CF Ste
9.6						150.000 k Auto M
9.6						Freq Offs
						0
9.6						
tart 2.401 Res BW 1	2500 GHz	#VB	W 300 kHz	Sween 1	op 2.4027500 GHz .000 ms (1001 pts)	

#### Reference Level of Emission Limit (CH-Mid)

art Freq 2.441250000 GHz	THE FUEL PLAT	Avg Type Lop Per Avg Hold >5050	74-41-11 Printing 18, 2018 74-41-11 2 3 4 5 5	Frequency
int offset 0.4 db (Blain Ref 10.40 dBm	Ganiline * AAttan 20 dB	12	41 997 0 GHz 2.765 dBm	Auto Tune
20		-		Center Fred 2.44200000 GHz
				Start Fred 2.441250000 GHz
				Stop Free 2.442750000 GH
				CF Step 150.000 kH duda Me
				Freq Offset 0 Ho
art 2.4412500 GHz			2.4427500 GHz	
es BW 100 kHz	FVBW 300 KHz		00 ms (1001 pts)	

#### **Reference Level of Emission Limit (CH-High)**

🐹 Keysight Sp	ectrum Analyzer - Swep					_				
Center F	req 2.480000	000 GH	z	1	SE:INT		LIGN AUTO	TRAC	E 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 0.4 d Ref 10.40 dE	IFC 1B	Ю:Wide ⊂ Sain:Low	#Atten: 20	) dB		Mkr1 2	2.479 99	5 5 GHz 72 dBm	Auto Tun
0.400					1					Center Free 2.480000000 GH
9.60										Start Fre 2.479250000 GH
29.6										Stop Fre 2.480750000 GH
49.6										CF Ste 150.000 kH Auto Ma
69.6										Freq Offse
-79.6	92500 GHz							top 2.480	7500 CH2	
#Res BW			#VBW	300 kHz			Sweep	1.000 ms (	1001 pts)	
193							STATL	18		

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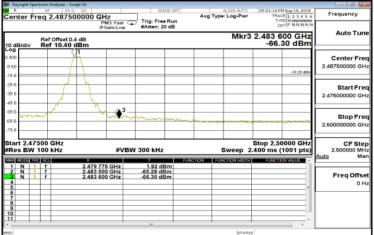
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#### **Band Edges Test Data CH-Low**

🎒 Keysight Spi	ectrum Analyzer - Si					
Center F	req 2.3600	00000 GHz	Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr	04:25:40 PM Aug 16, 2018 TRACE 1 2 3 4 5 6 TUPE NWWWW	Frequency
10 dB/div	Ref Offset 0 Ref 10.40		#Atten: 20 dB	м	kr3 2.390 0 GHz -69.53 dBm	Auto Tune
-9.60 -19.6					-18.22.091	Center Free 2.360000000 GH
-29.6 -39.6 -49.6					2	Start Fre 2.310000000 GH
-59.6 -69.6					and the	Stop Fre 2.410000000 GH
#Res BW		x		Sweep (	Stop 2.41000 GHz 9.600 ms (1001 pts)	CF Ste 10.000000 MH Auto Ma
1 N 1 2 N 1 3 N 1 4 5 6 7 8	f f	2.402 0 GHz 2.399 9 GHz 2.390 0 GHz	1.95 dBm -68.04 dBm -69.53 dBm			Freq Offse 0 H
9 10 11 4				STATU		

#### Band Edges Test Data CH-High





Conducted Spurious Emission Measurement Result

### CH-Low 30MHz – 3GHz

🐹 Keysight Spectrum Analy					
R R R Center Freq 1.5	15000000 GHz	SENSE:INT	Aug Type: Log-Pwr	04:25:58 PM Aug 16, 2018 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 1	PNO: Fast IFGain:Low Set 0.4 dB 0.40 dBm	Trig: Free Run #Atten: 20 dB	Mk	r1 2.403 0 GHz 1.78 dBm	Auto Tune
- 0g 0.400 9.60				-18.22 dBm	Center Fre 1.515000000 GH
29.6 39.6 49.6					Start Fre 30.000000 MH
59.6 59.6 79.6				la distance and a strange of the state	Stop Fre 3.000000000 GH
start 30 MHz Res BW 100 kH	z #V	BW 300 kHz	Sweep 2	Stop 3.000 GHz 83.9 ms (1001 pts)	CF Ste 297.000000 MH Auto Ma
1 N 1 f 2 3 4 5 6 7 7 8	2.403 0 GHz	1.78 dBm			Freq Offs 0 ⊦
9 10 11					

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

	ectrum Analyzer									
Center F		00000000 G	iHz		NSE:INT	Avg T	ype: Log-Pwr	TRA	MAug 16, 2018 CE 1 2 3 4 5 6 PE M WWWWW	Frequency
10 dB/div	Ref Offset Ref 10.4	1F	NO: Fast G Gain:Low	#Atten: 2			Mkr	» 1 25.88	9 0 GHz 41 dBm	Auto Tune
-9.60 -19.6									-18.22 d9n	Center Freq 14.75000000 GHz
-29.6 -39.6 -49.6									1	Start Free 3.000000000 GH2
-59.6 -69.6 -79.6		-	a section of the sect	Concernation property and	ter-sal-sage	سورميني	mbarlunadak		and the second second	Stop Free 26.500000000 GHz
Start 3.00 #Res BW	100 kHz	×	#VB\	N 300 kHz			Sweep	2.246 s	6.50 GHz (1001 pts)	CF Step 2.35000000 GH Auto Mar
1 N 1 2 3 4 5 6 7 7 8 9 9 10 11		25.889	0 GHZ	-59.41 di						Freq Offse 0 H
*							STATU	5		L

#### CH-Mid 30MHz – 3GHz

😹 Keysight S		Analyzer - Swe									
Center F	req		0000 GH	z		VSE:ONT	Avg Ty	ALIGN AUTO	TRA	MAug 16, 2018 CE 1 2 3 4 5 6	Frequency
10 dB/div		f Offset 0.4 f 10.40 d	dB	Ю: Fast G Sain:Low	#Atten: 2	0 dB		м	kr1 2.44	1 6 GHz 90 dBm	Auto Tune
-19.60									•1	-17 23 dDn	Center Freq 1.515000000 GHz
-29.6 -39.6 -49.6											Start Freq 30.000000 MHz
-59.6 -69.6 -79.6	~	الإمرار ويطعلوه وترمع	14-100,000,000,000,000,000	han an a					here	and the state of the	Stop Freq 3.00000000 GHz
Center 1 #Res BW	100	kHz	×		V 300 kHz			Sweep 2	283.9 ms	2.970 GHz (1001 pts)	CF Step 297.000000 MHz Auto Man
1 N 2 3 4 5 6 7 8 9	1 1		2.441 (	5 GHz	2.90 di	3m				6	Freq Offset 0 Hz
10					17				ļ		

#### CH-Mid 3GHz – 26.5GHz

M Keysight S		nalyzer - Swept SA							×
Center I	Freq 1	4.75000000	PNO; Fast	Trig: Free F	Avg	Type: Log-Pwr	04:47:13 PM Aug TRACE 1 TYPE M	2 3 4 5 6 NNNNN	Frequency
10 dB/div		Offset 0.4 dB 10.40 dBm	IFGain:Low	#Atten: 20 (	iB	Mkr	₀er ¤ 1 26.006 5 -60.08	GHz	Auto Tune
-og .400 9.60								-17 23 dDn	Center Fre 14.750000000 GH
29.6 -39.6 -49.6									Start Free 3.000000000 GH
59.6 69.6 🛁 🗠 79.6	- ala		warden Sung		and the second second	-	an marked and and and and and and and and and an		Stop Fre 26.500000000 GH
enter 1 Res BV	100		#VB	W 300 kHz	FUNCTION	Sweep	Span 23.5 2.246 s (100	01 pts)	CF Ste 2.35000000 GH Auto Ma
1 N 2 3 4 5 6 7 8	1 1	26	.006 5 GHz	-60.08 dBn	n				Freq Offse 0 H
9 10 11									

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#### CH-High 30MHz – 3GHz

									Analyzer - Swe		ysight S	M Ke
Frequency	01:59 PM Aug 16, 2018 TRACE 1 2 3 4 5 6		ALIGN AUTO	Ave	NSE:INT	SE	7	0000 GH	50 G	rea	ter F	R
Auto Tun	DET P NNNN		-			#Atten: 2	NO: Fast G	p	101000	Toq		
	2.480 3 GHz 1.66 dBm		MI						Offset 0.4 10.40 c		B/div	0 d
Center Fre		•1										9 <b>g</b>
1.515000000 GH												60
	-18.90 dBm			-						-		9.6
Start Fre		++-		+								9.6
30.000000 MF				+						-		9.6
												9.6 9.6
Stop Fre	- Andrew - A	multi						a the state of the space of the				9.6
3.000000000 GH		_						1 Carlor Colorestee	Land and a start of the start o	and a start	and the second	9.6
CF Ste	oan 2.970 GHz	Spz							3Hz	.515 (	ter 1	en
297.000000 MH	ms (1001 pts)		Sweep 2			300 kHz	#VBV			/ 100		
<u>Auto</u> Ma	FUNCTION VALUE	H FL	NOTION WOTH	INCTION		1.66 d		X	_	RC SCU	NODE	
Freq Offs					BM	1.66 d	3 GHZ	2.480		1	N	2
01												4
	*									_		5
												6 7
		-			-						-	8 9
							_				-	0
					-					-	-	삼
		US	STATU									3

#### CH- High 3GHz – 26.5GHz

👪 Keysight Spectrum Analyzer - Swept SA				
Center Freq 14.7500000	000 GHz	ALIGN AUTO Avg Type: Log-Pwr	05:02:31 PM Aug 16, 2018 TR4CE 1 2 3 4 5 6	Frequency
Ref Offset 0.4 dB	PN0: Fast 😱 Trig: Free Run IFGain:Low #Atten: 20 dB	Mkr	1 26.006 5 GHz -58.33 dBm	Auto Tune
0.400 -19.6			-18.28.08%	Center Freq 14.750000000 GHz
29.6				Start Freq 3.000000000 GHz
59.5 69.6 79.6		an hard a second and a second	and a state of the	Stop Free 26.50000000 GHz
Center 14.75 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep	Span 23.50 GHz 2.246 s (1001 pts)	CF Step 2.350000000 GH Auto Mar
N         1         f         3           3         -         -         -         -           4         -         -         -         -         -           5         -         -         -         -         -         -           6         -	26.006 5 GHz -58.33 dBm			Freq Offse 0 H
	17			

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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 30 3		
1.705-30	30			
30-88	100			
88-216	150	3		
216-960	200	3		
Above 960	500	3		

#### Note:

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

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#### 10.2 **Measurement Equipment Used**

966 Chamber						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.	
Broadband Antenna	TESEQ	CBL 6112D	35243	2017/11/10	2018/11/09	
Horn Antenna	Schwarzbeck	BBHA9120D	1187	2018/01/04	2019/01/03	
Horn Antenna	SCHWAZBECK	BBHA9170	184	2017/12/12	2018/12/11	
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25	
EMI Test Receiver	R&S	ESU 40	100363	2018/04/11	2019/04/10	
Pre-Amplifier	<b>EMC</b> Instruments	EMC330	980096	2017/12/26	2018/12/25	
Pre-Amplifier	<b>EMC Instruments</b>	EMC0011830	980199	2017/12/26	2018/12/25	
Pre-Amplifier	EMC Instruments	EMC184045B	980135	2017/10/27	2018/10/26	
Attenuator	Marvelous	WATT-218FS-10	RF246	2017/12/26	2018/12/25	
Highpass Filter	Micro Tronics	BRM50701-01	G008	2017/12/26	2018/12/25	
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	2017/12/26	2018/12/25	
Coaxial Cable	Huber Suhner	EMC106-SM-SM-7 200	150703	2017/12/26	2018/12/25	
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	2017/12/26	2018/12/25	
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	2017/12/26	2018/12/25	
Notebook	Lenovo	T470	P0001293	N/A	N/A	

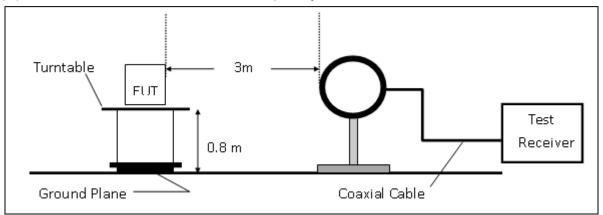
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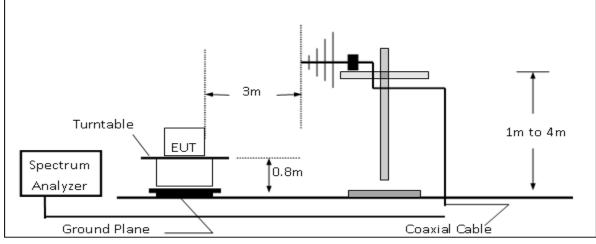


### 10.3 Test SET-UP

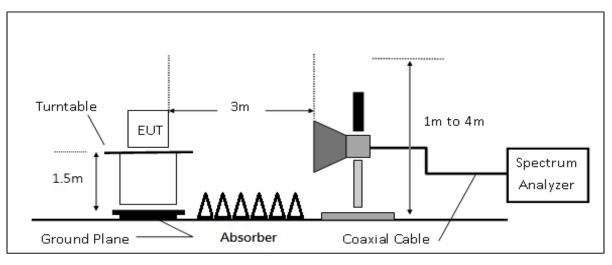
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



## (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.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. 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.
- 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.</li>
- 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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# 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	
A . 1		

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)

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

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

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

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

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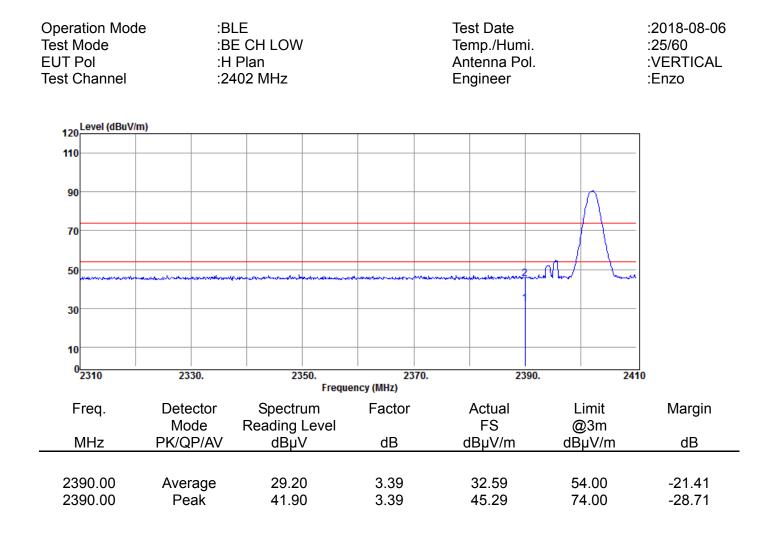
#### **Radiated Band Edge Measurement Result**

Test N EUT F		:B :H	LE E CH LOW Plan 402 MHz	Test Date Temp./Humi. Antenna Pol. Engineer			:2018-08-06 :25/60 :HORIZONTAL :Enzo		
420	Level (dBuV/m	1)							
120									
110								_	
90								$\bigwedge$	
70									
50									
50	angen-town in coloran al ale		alus walange factor was a walar walar walar	remethet was a set of the set of	consider to be according	and the second	and a second	Mun	
30							1		
10									
C	2310	2330.	2350.	237	70.	23	390.	241	0
	Frequency (MHz)								
F	req.	Detector	Spectrum	Factor	1	Actual		.imit	Margin
ſ	MHz	Mode PK/QP/AV	Reading Level dBµV	dB	d	FS BµV/m		⊉3m µV/m	dB
				-				1	-
23	90.00	Average	29.02	3.39		32.41	54	4.00	-21.59
23	90.00	Peak	42.41	3.39		45.80	74	4.00	-28.20

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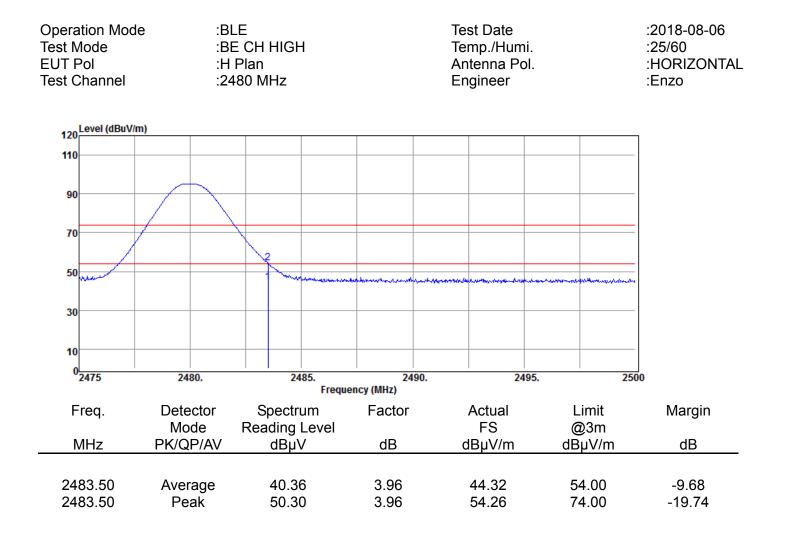


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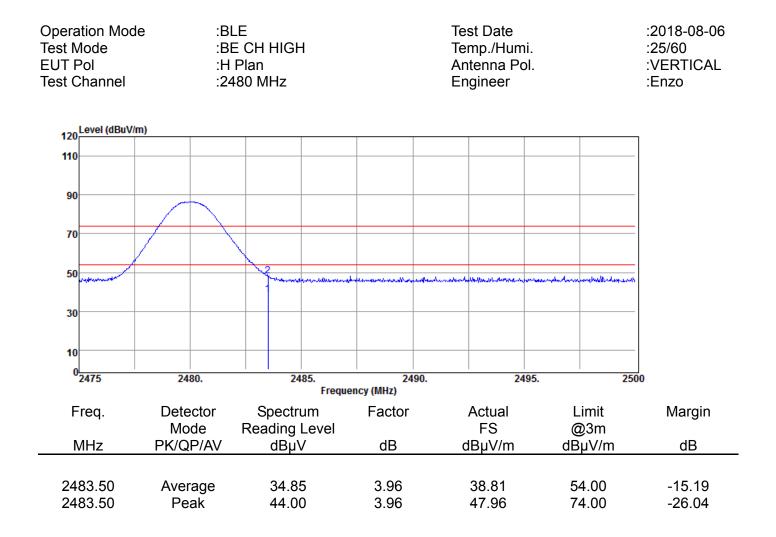


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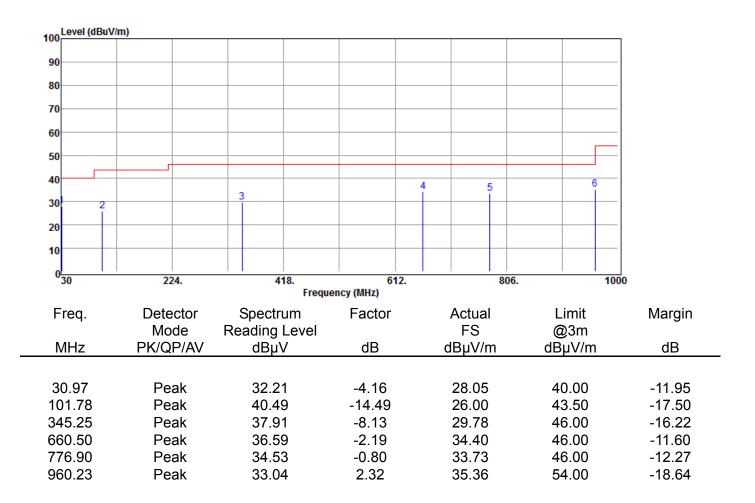
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#### Radiated Spurious Emission Measurement Result For Frequency form 30MHz to 1000MHz

Operation Mode Test Mode EUT Pol Test Channel

:BLE :TX CH LOW :H Plan :2402 MHz Test Date Temp./Humi. Antenna Pol. Engineer :2018-08-07 :24/64 :VERTICAL :Ashton



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Operation Mode Test Mode EUT Pol Test Channel	:TX :H I	E CH LOW Plan 02 MHz		Test Date Temp./Humi. Antenna Pol. Engineer				
100 Level (dBuV/m	n)					1		
90								
80								
70								
60								
50								
40					6			
30	2	3 4		5				
20								
10								
0 <mark>30</mark>	224.	418. Frequ	612. ency (MHz)	806.	100	0		
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin		
N 41 1	Mode	Reading Level		FS	@3m	10		
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB		
30.97	Peak	32.58	-4.16	28.42	40.00	-11.58		
231.76	Peak	43.22	-12.32	30.90	46.00	-15.10		
345.25	Peak	38.04	-8.13	29.91	46.00	-16.09		
402.48	Peak	36.25	-5.99	30.26	46.00	-15.74		
770.11	Peak	34.32	-0.95	33.37	46.00	-12.63		
960.23	Peak	37.42	2.32	39.74	54.00	-14.26		

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Operation Mod Test Mode EUT Pol Test Channel	:T :H	LE X CH MID I Plan 442 MHz		:2018-08-07 :24/64 :VERTICAL :Ashton		
100 Level (dBuV/	m)					l
90						
80						
70						
60						
50						
40		3	4	5	6	
30		2				
20						
10						
0 <mark></mark>	224.	418.	612.	806.	100	0
			ency (MHz)			
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
30.97	Peak	31.48	-4.16	27.32	40.00	-12.68
345.25	Peak	36.17	-8.13	28.04	46.00	-17.96
398.60	Peak	38.97	-6.07	32.90	46.00	-13.10
660.50	Peak	36.28	-2.19	34.09	46.00	-11.91
769.14	Peak	34.41	-0.96	33.45	46.00	-12.55
935.01	Peak	33.21	1.79	35.00	46.00	-11.00

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Operation Mode Test Mode EUT Pol Test Channel	:T) :H	LE K CH MID Plan 442 MHz		Test Date Temp./Humi. Antenna Pol. Engineer		:2018-08-07 :24/64 :HORIZONTAL :Ashton
100 Level (dBuV/n	n)					1
90						
80						
70						
60						
50						
40		4	5		6	
30	2 3	4				
20						
10						
0 <mark></mark>	224.	418.	612.	806.	100	
50	224.		ncy (MHz)	000.	100	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
		ασμν	<u>ub</u>	ασμνλιί	ασμν/m	
30.97	Peak	32.09	-4.16	27.93	40.00	-12.07
231.76	Peak	42.09	-12.32	29.77	46.00	-16.23
287.05	Peak	39.86	-10.15	29.71	46.00	-16.29
399.57	Peak	38.73	-6.03	32.70	46.00	-13.30
598.42	Peak	36.48	-3.22	33.26	46.00	-12.74
961.20	Peak	37.69	2.34	40.03	54.00	-13.97

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Test M EUT F			BLE TX CH HIGH H Plan 2480 MHz	4	Test Date Temp./Humi. Antenna Pol. Engineer					:2018-08-07 :24/64 :VERTICAL :Ashton
100	Level (dBuV/m	1)		1	1		1			٦
90										_
80										-
70										-
60										-
<mark>50</mark>										-
40						3	4		56	-
30	2									-
20										-
10										-
0	30	224.	4	18.	61	12.		806.	10	 00
					ency (MHz)					
F	req.	Detector	Spectr		Factor		Actual		.imit	Margin
N	/IHz	Mode PK/QP/A\	Reading dBµ		dB		FS dBµV/m		⊉3m ⊮µV/m	dB
			άθμ	v	<u>ub</u>		μυμινητή	40	μν/Π	
30	0.00	Peak	61.4	8	-31.11		30.37	4	0.00	-9.63
	7.16	Peak	45.9		-18.73		27.19		0.00	-12.81
	60.50	Peak	36.2		-2.19		34.10		6.00	-11.90
	5.19	Peak	37.7		-1.44		36.27		6.00	-9.73
	5.01	Peak	33.0		1.79		34.82		6.00	-11.18
96	60.23	Peak	32.8	2	2.32		35.14	5	4.00	-18.86

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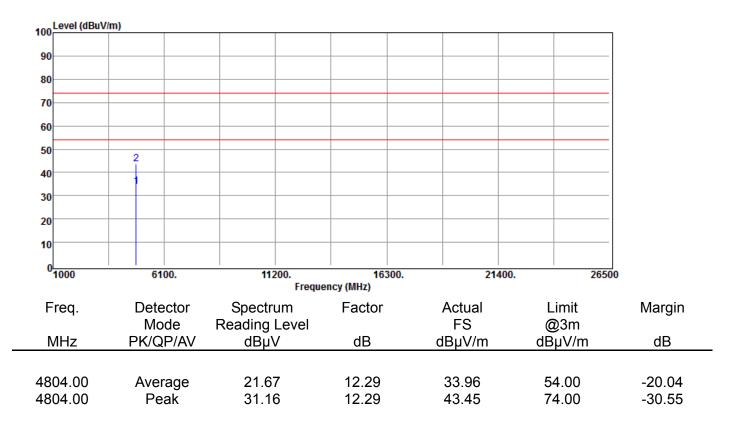
Operation Mod Test Mode EUT Pol Test Channel	:TX :H	LE ( CH HIGH Plan 80 MHz		Test Date Temp./Humi. Antenna Pol. Engineer				
100 <mark>Level (dBuV/</mark>	m)		1			1		
90								
80								
70								
60								
50								
40				5	6			
30	2	4						
20								
10								
0 <mark></mark>								
30	224.	418. Freque	612. ency (MHz)	806.	100	JU		
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin		
MHz	Mode	Reading Level	dD	FS	@3m	dB		
	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	uв		
30.97	Peak	31.19	-4.16	27.03	40.00	-12.97		
165.80	Peak	37.75	-13.67	24.08	43.50	-19.42		
231.76	Peak	42.36	-12.32	30.04	46.00	-15.96		
398.60	Peak	37.81	-6.07	31.74	46.00	-14.26		
777.87	Peak	35.34	-0.78	34.56	46.00	-11.44		
960.23	Peak	37.46	2.32	39.78	54.00	-14.22		



### **Radiated Spurious Emission Measurement Result**

#### For Frequency above 1GHz

Operation Mode	:BLE	Test Date	:2018-08-07
Test Mode	:TX CH LOW	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2402 MHz	Engineer	:Enzo



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Operation Mo Test Mode EUT Pol Test Channel	:T :H :2	ELE X CH LOW I Plan 402 MHz		:2018-08-07 :25/60 :VERTICAL :Enzo		
100 Level (dBu)	//m)				1	Г
90						_
80						-
70						-
60						-
50	2					-
40						-
30						-
20						-
10						-
0 <mark>0</mark> 0	6100.	11200. Freque	16300. ency (MHz)	21400	). 265	00
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
	_					
4804.00	Average	20.17	12.29	32.46	54.00	-21.54
4804.00	Peak	31.31	12.29	43.60	74.00	-30.40

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Test EUT	ration Moc Mode Pol Channel	le	:H	₋E K CH MID Plan I42 MHz		Test Date Temp./Humi. Antenna Pol. Engineer				:2018-08-07 :25/60 :HORIZONTAL :Enzo	
10	0 Level (dBuV/	m)	1		1				1		-
ç	0										-
8	30										_
7	0										-
(	50										_
:	50	2									-
	10										-
:	0										_
1	20										-
1	0										_
	0										
	0 <mark>1000</mark>	61	00.	11	200. Freque	163 ncy (MHz)	500.	214	400.	265	00
	Freq.	Dete		Spectr		Factor		Actual		Limit	Margin
	N 41 1_	Mo		Reading				FS		@3m	
	MHz	PK/Q	P/AV	dBµ'	V	dB		dBµV/m	d	BµV/m	dB
Л	884.00	Aver	200	20.9	6	12.63		33.59		54.00	-20.41
	884.00 884.00		aye ak	31.1		12.03		43.78		54.00 74.00	-20.41 -30.22

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Operation Me Test Mode EUT Pol Test Channe	:T :H	LE X CH MID I Plan 442 MHz		:2018-08-07 :25/60 :VERTICAL :Enzo		
100 Level (dBi	JV/m)					
90						_
80						_
70						_
60						_
50	2					_
40						_
30						_
20						—
10						—
0 <mark></mark> 1000	6100.	11200. Freque	16300. ency (MHz)	214	400. 26	\$500
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
				-		
4884.00	Average	21.15	12.63	33.78	54.00	-20.22
4884.00	Peak	31.02	12.63	43.65	74.00	-30.35

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Test M EUT P Test C	ol hannel		:BLETest Date:TX CH HIGHTemp./Humi.:H PlanAntenna Pol.:2480 MHzEngineer				:2018-08-07 :25/60 :HORIZONTAL :Enzo				
100	Level (dBuV/m	)									Г
90											_
80											_
70											-
60											-
50		2									-
40											-
30											-
20											-
10											-
0	1000	61	00.	11	200.	163	300.	21/	400.	265	
						ency (MHz)		21	100.	203	
F	req.	Dete		Spectr		Factor		Actual		Limit	Margin
Ν	1Hz	Mo PK/Q		Reading dBµ		dB		FS dBµV/m		@3m BµV/m	dB
		-				-		r			-
	60.00	Aver		22.3		12.93		35.25		54.00	-18.75
496	60.00	Pe	ak	31.4	7	12.93		44.40		74.00	-29.60

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Operation Moo Test Mode EUT Pol Test Channel	:T. :H :24	LE X CH HIGH ⊨Plan 480 MHz		:2018-08-07 :25/60 :VERTICAL :Enzo		
100 Level (dBuV	(m)		1			7
90						_
80						_
70						-
60						_
50	2					-
40						_
30						-
20						_
10						_
0 <mark></mark>	6100.	11200.	16300.	2140	0. 265	
1000	6100.		ncy (MHz)	2140	0. 200	00
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level	dB	FS dBu\//m	@3m dBu\//m	dB
	FNQF/AV	dBµV	UD	dBµV/m	dBµV/m	UD
4960.00	Average	23.06	12.93	35.99	54.00	-18.01
4960.00	Peak	33.80	12.93	46.73	74.00	-27.27

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# 11 PEAK POWER SPECTRAL DENSITY

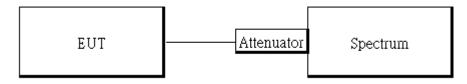
## **11.1 Standard Applicable:**

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:

	Conducted Emission Test Site											
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.							
TYPE		NUMBER	NUMBER	CAL.								
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19							
DC Block	PASTERNACK	PE8210	RF29	2017/12/26	2018/12/25							
Notebook	Lenovo	L420	S0011721	N/A	N/A							
DC Power Supply	Agilent	E3640A	MY53140006	2018/05/30	2019/05/29							
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25							
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02							
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02							
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02							

## 11.3 Test Set-up:



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## **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. & the VBW = 10 kHz
- 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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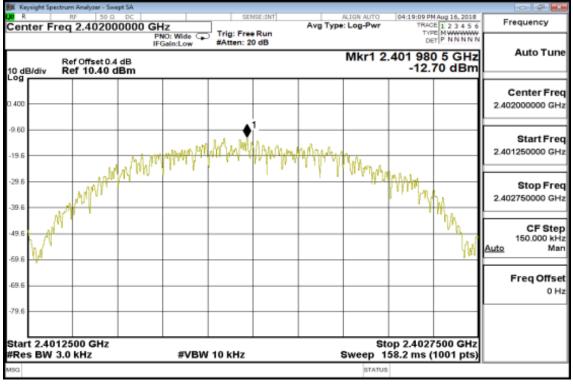


### 11.5 Measurement Result:

BLE mode			
Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-12.70	8	PASS
2442	-11.87	8	PASS
2480	-12.80	8	PASS

NOTE: cable loss as 0.4dB that offsets in the spectrum

## BLE mode Power Spectral Density Test Plot (CH-Low)

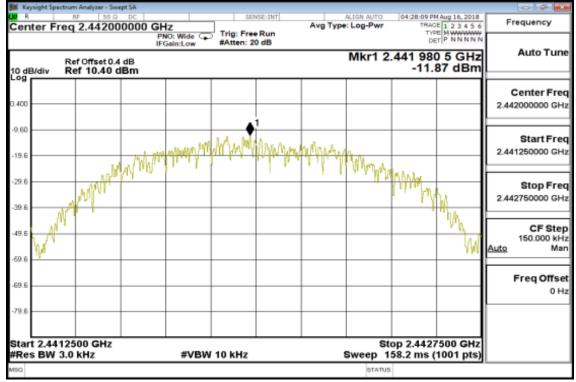


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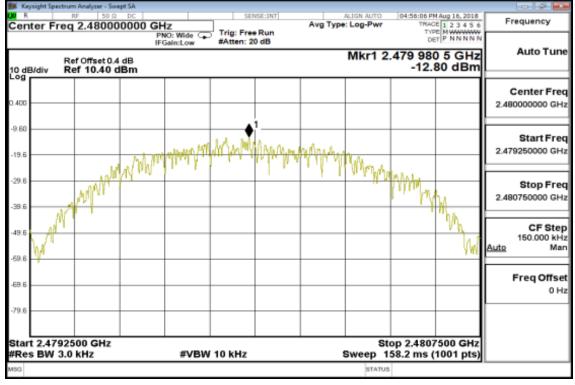
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## **Power Spectral Density Test Plot (CH-Mid)**



## Power Spectral Density Test Plot (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:

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

~ End of Report ~

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