

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

# INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND INDUSTRY CANADA RSS 247 REQUIREMENT

	OF
Applicant:	Pioneer Corporation
	28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo, Japan
Product Name:	GPS Cycle Computer
Brand Name:	Pioneer
Model No.:	SGX-CA600
Model Difference:	N/A
FCC ID:	AJDK110
IC:	775E-K110
Report Number:	E2/2018/B0001
FCC Rule Part:	§15.247, Cat: DTS
IC Rule Part:	RSS-247 issue 2 Feb 2017
Issue Date:	Nov. 27, 2018
Date of Test:	Oct. 22, 2018 ~ Nov. 08, 2018
Date of EUT Received:	Oct. 22, 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:

Aken Huang / Engineer

Approved By:

Jay Lin / Asst. Supervisor



0513

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# **Revision History**

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/B0001	Rev.00	Initial creation of docu- ment	All	Nov. 27, 2018	Stefanie Yu / Clerk

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#### **GENERAL INFORMATION** 1

### **1.1 Product Description**

General:

Product Name:	GPS Cycle Computer		
Brand Name:	Pioneer		
Model No.:	SGX-CA600		
Model difference:	N/A		
Hardware Version:	N/A		
Software Version:	N/A		
	3.7Vdc from Rechargeable Li-ion Battery		
Power Supply:	Battery: Model No.: BP-N463-11/1500 MX, Supplier: PIONEER CORPORATION		

#### Bluetooth Low Energy:

Bluetooth Version:	Bluetooth V4.1 LE Single mode	
Channel number:	40 channels	
Modulation type:	GFSK	
Transmit Power:	3.45 dBm	
Frequency Range:	2402 – 2480MHz	

#### **Antenna Designation**

Antenna Type	Part Number	Supplier	Peak Gain (dBi)
PCB	N/A	N/A	-2.8

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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 v05.

RSS-Gen. issue 5 Apr. 2018

RSS-247 issue 2 Feb. 2017

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 and Designation number are: 735305 / TW 0002

Canada Registration Number: 4620A-5

#### **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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#### SYSTEM TEST CONFIGURATION 2

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

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

#### 2.3 Test Procedure

#### 2.3.1 **Conducted Emissions**

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50uH/50 ohm 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 **Conducted Test (RF)**

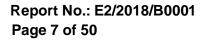
The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

#### 2.3.3 **Radiated Emissions**

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. 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.

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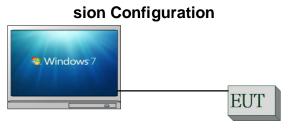
### 2.4 Measurement Results Explanation Example

#### 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.

#### 2.5 Configuration of Tested System

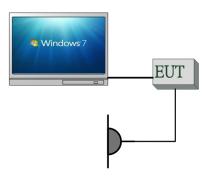
### Fig. 2-1 Conducted (Antenna Port) Emis-



### Fig 2-2 Radiated Emission



# Fig 2-3 Conduction (AC Power Line) 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	L420	S0011721	N/A	N/A

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#### SUMMARY OF TEST RESULTS 3

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	RSS-247 §5.4(4)	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.1 (1) RSS-Gen §6.7	6dB & 99% Emission Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5 RSS-Gen §8.10	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 RSS-Gen §6.13	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2(2)	Peak Power Density	Compliant
§15.203 §15.247(b)	RSS- Gen §6.8	Antenna Requirement	Compliant



#### **DESCRIPTION OF TEST MODES** 4

### 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 strength of radiation emission was measured as EUT stand-up position (H mode) and						

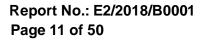
lie down position (E1, E2 mode) for Bluetooth LE Transmitter for channel Low, Mid and High, the worst case H position was reported.

#### 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 : <b>Horizontal</b> )	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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#### 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 th 2.The limit decreases linearly wit MHz.	e transition frequencies h the logarithm of the frequency ir	the range 0.15 MHz to 0.50			

### 6.2 Measurement Equipment Used:

Conducted Emission Test Site									
EQUIPMENT	LAST	CAL DUE.							
TYPE		NUMBER	NUMBER	CAL.					
LISN	TESEQ	NNB 51	36076	2018/02/14	2019/02/13				
EMI Test Receiver	R&S	ESCI	101343	2018/07/31	2019/07/30				
Notebook	Lenovo	L420	S0012467	N/A	N/A				

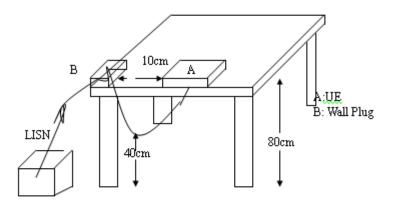
### 6.3 EUT Setup:

- 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.
- 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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5

6

14.3380

18,4340

17.17

18.47

19.99

20.04

37.16

38.51

60.00

60.00

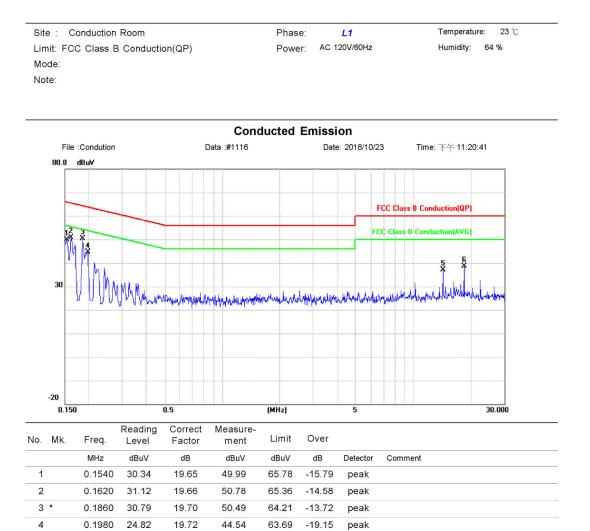
-22.84

-21.49

peak

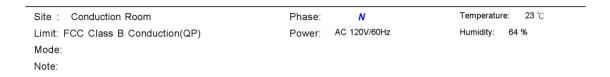
peak

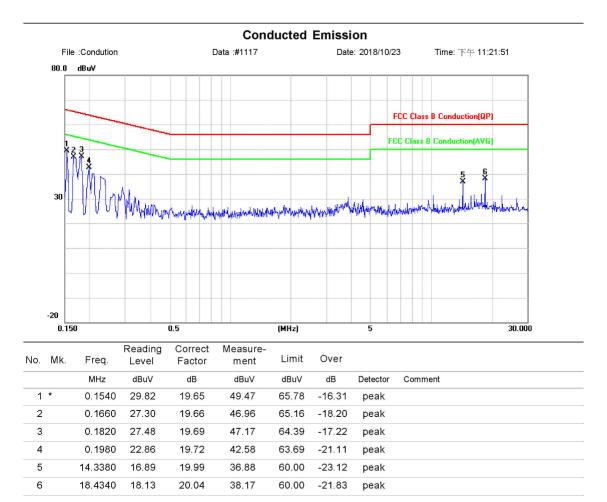
# AC POWER LINE CONDUCTED EMISSION TEST DATA



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#### PEAK OUTPUT POWER MEASUREMENT 7

## 7.1 Standard Applicable:

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

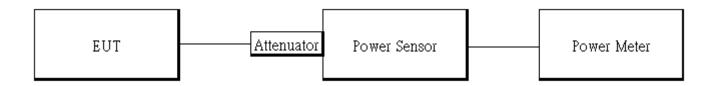
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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 TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
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			

### 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 & ANSI C63.10..
- 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.

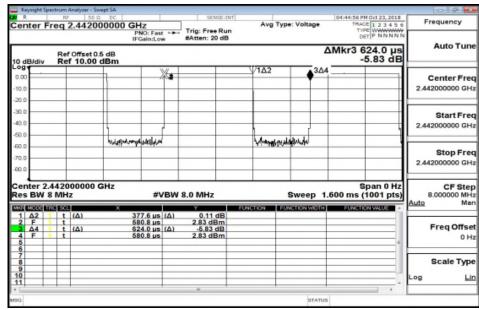
### Formula:

Duty Cycle = Ton / (Ton+Toff)

### **Duty Factor:**

	Duty Cycle (%)	Duty Factor (dB)	1/T (kHz)	VBW setting (kHz)
BLE	60.51	2.18	2.65	3.00

Duty Cycle\_BLE\_1M\_LowCH00-2402



Duty Cycle Factor:10\*log(1/(60.51/100))=2.18

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#### 7.5 **Measurement Result:**

BLE mo	de:		
СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
0	2402	2.90	1 Watt = 30 dBm
20	2442	3.45	1 Watt = 30 dBm
39	2480	3.35	1 Watt = 30 dBm
BLE mo	de:		
СН	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	2.79	1 Watt = 30 dBm
20	2442	3.33	1 Watt = 30 dBm
39	2480	3.22	1 Watt = 30 dBm

\*Note: Measured by power meter, cable loss as 0.5 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 & 99% BANDWIDTH MEASUREMENT

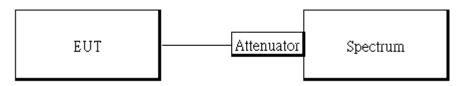
### 8.1 Standard Applicable

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	MY5144011 3	2018/06/20	2019/06/19			
DC Block	PASTERNACK	PE8210	RF81	2017/12/26	2018/12/25			
Notebook	Lenovo	L420	S0011721	N/A	N/A			

#### 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. Guidance & ANSI C63.10.
- 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

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#### 8.5 Measurement Result:

#### BLE mode

Frequency	6dB BW	BW	Booult	BLE mode		
(MHz)	(MHz)	(MHz)	Result	Frequency (MHz)	99%Bandwidth (MHz)	
2402	0.715	> 0.5	PASS			
				2402	1.0349	
2442	0.7117	> 0.5	PASS	2442	1.0354	
2480	0.7118	> 0.5	PASS	2480	1.0364	

Note: Refer to next page for plots.

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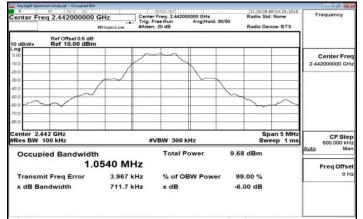
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# OBW 6dB BLE 1M LowCH00-2402

Frequency	adio Std: None adio Device: BTS	50/50	50 D DC SENSE:INT		Center Freq 2.402000000 GH		
						Ref Offset 0.5 dB Ref 10.00 dBm	10 dB/div
Center Fre 2.402000000 GH				~			0.00 10.0 20.0
		1			$\sim$		40.0
	~~~~						0.0
							0.0
CF Ste 500.000 ki	Span 5 MHz Sweep 1 ms		00 kHz	#VBW			enter 2.4 Res BW
Auto Ma	Bm	9.00	I Power	то	ı	ed Bandwidth	Occup
Freq Offs				Iz	0543 MH	1.0	
01	0 %	r 99	OBW Pow	Hz %	4.192	t Freq Error	Transm
	dB	-6.	3	Hz x	715.0	ndwidth	x dB Ba

# OBW 6dB BLE 1M MidCH20-2442



# OBW 6dB\_BLE\_1M\_HighCH39-2480

R 10	50 12 DC		SENSE:1NT		11:31:40 AM Oct 2	
Center Freq 2	2.480000000	Trig	ter Freq: 2.480000000 GHz : Free Run Avg Hol	d: 50/50	Radio Std: None	
		tFGain:Low #Att	en: 20 dB		Radio Device: B	TS
10 dB/div F	Ref Offset 0.5 dB Ref 10.00 dBm					
0.00						Center Free
10.0						2.480000000 GH
-20.0						
30.0	/			1		
40.0	m			1		
60.0	~~~~					~
70.0						
-60.0				-		_
Center 2.48 G					Span 5	
#Res BW 100	kHz		#VBW 300 kHz			1 ms 500.000 kH
Occupied Bandwidth			Total Power	9.52	dBm	Auto Mar
	1.0	546 MHz				Freq Offse
Transmit F	req Error	3.716 kHz	% of OBW Pow	ver 99	.00 %	0 H
x dB Band	width	711.8 kHz	x dB	-6.	00 dB	
150				STATU		

# IC OBW 99%\_BLE\_1M\_LowCH00-2402

Center Fre	D GHz #IFGain:Low	Trig: Free Run Avg Hold: 50/50			one BTS	Frequency	
10 dB/div	Ref Offset 0.5 dB Ref 10.00 dBr						
• 00 0.00 20.0 20.0 30.0 40.0 50.0 50.0 70.0		~~~				2	Center Freq 2.402000000 GHz
enter 2.4 Res BW			#	VBW 62 kHz	Spar Sweep		CF Ste 200.000 kH
Occup	ied Bandwid 1.	<sup>th</sup> .0349 N	IHz	Total Power	8.24 dBm	Aut	Freq Offse
	it Freq Error Indwidth	9.630 655.6		% of OBW Power x dB	99.00 % -6.00 dB	-	0 H

# IC OBW 99% BLE\_1M MidCH20-2442

Ref Offset 0.5		RF  39 D2  Sense:surfl    q 2.442000000 GHz  Center Freq: 2.442000000 GHz    MFGaind.ow  #Atten: 20 dB				Radio De	vice: BTS			
Ref 10.00 d										
	~	~~~	~~~	~~~.	~~~	~	-		Cent 2.442000	er Free
	++						~~	$\sim$		
2 GHz kHz			#VB	62 kH	łz				200.	CF Ster 200.000 kH
Occupied Bandwidth 1.0354 MH					ower	8.9	9 dBm		_	Mar
Freq Error dwidth				% of Of x dB	BW Powe					он
	kHz d Bandwi Freq Error	kHz d Bandwidth 1.035 Freq Error	kHz d Bandwidth 1.0354 MH Freq Error 9.352 kH	kHz #VB d Bandwidth 1.0354 MHz Freq Error 9.352 kHz	kHz #VBW 62 kH d Bandwidth Total P 1.0354 MHz Freq Error 9.352 kHz % of Of	kHz #VBW 62 kHz d Bandwidth Total Power 1.0354 MHz Freq Error 9.352 kHz % of OBW Power	kHz  #VBW  62 kHz    d Bandwidth  Total Power  8.9    1.0354 MHz      Freq Error  9.352 kHz  % of OBW Power  9	kHz  #VBW  62 kHz  Sweet    d Bandwidth  Total Power  8.99 dBm    1.0354 MHz  Freq Error  9.352 kHz  % of OBW Power  99.00 %	kHz  #VBW 62 kHz  Sweep 4.8 ms    d Bandwidth  Total Power  8.99 dBm    1.0354 MHz  Freq Error  9.352 kHz  % of OBW Power  99.00 %	2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 2442000 200 2

# IC OBW 99%\_BLE\_1M\_HighCH39-2480

R R	RF 55 D DC		SENSE:INT	11:40:35 AM Oct 24, 2018	
Center Fre	eq 2.480000000	Trip	ter Freq: 2.480000000 GHz :: Free Run Avg Hold: 50/5 ten: 20 dB	Radio Std: None	Frequency
10 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm				
10.00					Center Free 2.48000000 GH
40.0				m	
60.0 70.0 80.0					
Center 2.4 Res BW			#VBW 62 kHz	Span 2 MH Sweep 4.8 m	200.000 kH
Occup	ied Bandwidti 1.(	) 364 MHz	Total Power	8.86 dBm	Auto Ma
	it Freq Error Indwidth	9.139 kHz 655.8 kHz	% of OBW Power x dB	99.00 % -6.00 dB	он
50				STATUS	

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

#### 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.

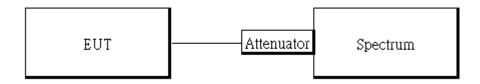
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

#### 9.2 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	PASTERNACK	PE8210	RF81	2017/12/26	2018/12/25						
Notebook	Lenovo	L420	S0011721	N/A	N/A						

#### 9.3 Test SET-UP:



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### 9.4 Measurement Procedure

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

- Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 100kHz & VBW = 300 kHz.
- 5. Detector = peak.
- 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 & ANSI C63.10.
- 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.

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### **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 & ANSI C63.10.
- 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	RF Power	Reference Level of Limit = PSD - 20dB
(MHz)	Density (dBm)	(dBm)
2402	1.63	-18.37
2442	2.35	-17.65
2480	2.18	-17.82

#### Reference Level of Limit

NOTE: cable loss as 0.5dB that offsets in the spectrum NOTE: Refer to next page for plots.

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#### Reference Level\_BLE\_1M\_LowCH00-2402

-0- 4- 🛋					Keysight Spectrum Analyze
Frequency	11:12:48 AN Oct 24, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN	Avg Type: Log-Pwr	SENSE:INT	2.402000000 GHz	
Auto Tun	401 992 5 GHz 1.63 dBm	Mkr1 2.4	#Atten: 20 dB	ef Offset 0.5 dB ef 10.00 dBm	Ref Offs 0 dB/div Ref 10.
Center Fre 2.402000000 GH			-		1.00
Start Fre 2.401250000 GH					20.0
Stop Fre 2.402750000 GH					0.0
CF Ste 150.000 kH Auto Ma					0.0
Freq Offse 0 H	[				70.0
Scale Typ					80.0
Log Li	p 2.4027500 GHz		300 kHz		tart 2.4012500 G Res BW 100 kHz

### Reference Level\_BLE\_1M\_MidCH20-2442

Keysight Spe	ectrum Analyzer - Swept SA					
Center Fi	req 2.44200000	0 GHz	Trig: Free Run	Avg Type: Log-Pwr	11:21:20 AN Oct 24, 2018 TRACE 1 2 3 4 5 6 TVPE MWWWW DET P NNNNN	Frequency
10 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm	IFGain:Low	#Atten: 20 dB	Mkr1 2	441 995 5 GHz 2.35 dBm	Auto Tune
0.00		$\sim$				Center Free 2.442000000 GH
-10.0						Start Fre 2.441250000 GH
40.0						Stop Fre 2.442750000 GH
60.0						CF Ste 150.000 kH Auto Ma
70.0						Freq Offse 0 H
80.0	12500 GHz				op 2.4427500 GHz	Scale Typ
#Res BW		#VBW	300 kHz	Sweep 1.	.000 ms (1001 pts)	

# Reference Level\_BLE\_1M\_HighCH39-2480

			SENSE:INT		ctrum Analyzer - Swept S	Keysight Sp
Frequency	11:31:52 AM Oct 24, 2018 TRACE 1 2 3 4 5 6 TVPE MWWWW DET P NNNNN	Avg Type: Log-Pwr	Trig: Free Run	PNO: Wide Ca	eq 2.4800000	Center F
Auto Tune	479 994 0 GHz 2.18 dBm	Mkr1 2.	#Atten: 20 dB	IFGain:Low	Ref Offset 0.5 dE Ref 10.00 dBr	10 dB/div
Center Free 2.480000000 GH						0.00
Start Free 2.479250000 GH						20.0
Stop Fre 2.480750000 GH						30.0
CF Ste 150.000 kH Auto Ma						50.0
Freq Offse 0 H						70.0
Scale Typ						80.0
Log <u>Lir</u>	op 2.4807500 GHz 000 ms (1001 pts)	Sweep 1.	300 kHz	#VBW	92500 GHz 100 kHz	Start 2.47 Res BW
		STATUS				450

## Band Edge\_BLE\_1M\_LowCH00-2402

PHOL Flat  Thile Fire Run Battern: 20 dB  Mixr3 2.390 0 GHz  Auto Tur    0 dBiddiv  Ref 00fset 0.5 dB  Mixr3 2.390 0 GHz  69.99 dBm  2.30000000 GH    0 dBiddiv  Ref 10.00 dBm  69.99 dBm  2.30000000 GH  2.30000000 GH    0 dBiddiv  Ref 10.00 dBm  69.99 dBm  2.30000000 GH  2.30000000 GH    0 dBiddiv  Ref 10.00 dHz  Ref 10.00 GHz  8.0000 GHz  8.000 GHz  8.0000 GHz    10 dBiddiv  Ref 2.31000 GHz  Rotation  1.0000 GHz  1.0000 GHz  1.00000 GHz  1.000000 GHz    10 dBiddiv  2.401 3 GHz  1.00000 GHz  1.000000 GHz  1.000000 GHz  1.000000 GHz  1.0000000 GHz  1.0000000 GHz  1.0000000 GHz  1.0000000 GHz  1.0000000 GHz  1.0000000 GHz  1.000000 GHz  1.000000 GHz  1.000000 GHz  1.000000 GHz  1.0000000 GHz  1.000000 GHz  1.0000000 GHz  1.0000000 GHz  1.0000000 GHz  1.000000 GHz  1.0000000 GHz  1.00000000 GHz  1.00000000 GHz  1.00	Center Freq 2.360000000 GH2 PBO Fast Productory Productory Productory Productory Productory Productory Ref Offset 0.5 dB 0 dBddy Ref 10.000 dBm 						
Ref Offset 0.5 dB  Mkr3 2.300 0 GHz    0.0	Control of the section of the s	o Tun					
Ref Offset 0.5 dB  Mikr3 2.390 0 GHZ    0 Biddiv  e69.99 dBm    0 Biddiv  e60.90 dBm    0 Biddiv  e60.90 dBm    0 Biddiv  e60.90 dBm    0 Biddiv  e70.80 dBm	Ref 0ffset 0.5 dB 66.99 0 GHZ -69.99 0 GHZ -69.99 0 GHZ	oTur					
0.00  0.01  0.02  0.01  0.01  0.01  0.01  0.01  0.01  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000 <th colspan="7">odB/div Ref 0.00 dBm -69.99 dBm</th>	odB/div Ref 0.00 dBm -69.99 dBm						
100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100  100 <td></td> <td></td>							
200  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  201  2010000000  201  200000000  201  200000000  201  200000000  201  200000000  201  200000000  201  200000000  201  201000  000  Stop Fri  2410000000  201  24100000000  201  000  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500  500<	Cento						
30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0 <td< td=""><td>the state</td><td>~~ 0</td></td<>	the state	~~ 0					
400  3  12  3  12  10000000 GI    500  500  3  12  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1							
80  3  22  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1	Sta						
CED  CED <td>2310004</td> <td>000 G</td>	2310004	000 G					
N  f  2.399 0 GHz  360 0 GHz <td>- h</td> <td></td>	- h						
Image: Construction of the second s	Store Store						
Sart 2.31 000 GHz  #VBW 300 kHz  Stop 2.41000 GHz  CF 5tr.    vRes BW 100 kHz  #VBW 300 kHz  Sweep 9.600 ms (1001 pts)  Auto  Multiple Stop 2.41000 GHz	2.410000						
KRes BW 100 kHz  #VBW 300 kHz  Sweep 9.600 ms (1001 pts)  10.000000 MA    Mod (2000 Hz) Excit  X  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y							
KRes BW 100 kHz  #VBW 300 kHz  Sweep 9.600 ms (1001 pts)  10.000000 MA    Mod (2000 Hz) Excit  X  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y  Y	Start 2,31000 GHz Stop 2,41000 GHz C	FSte					
Norm  F  2.4018  GHz  7.77  AUXILIDE  FUNICIPATION  FUNICIPATION <th< td=""><td>#Res BW 100 kHz #VBW 300 kHz Sweep 9.600 ms (1001 pts) 10.000</td><td>000 MI</td></th<>	#Res BW 100 kHz #VBW 300 kHz Sweep 9.600 ms (1001 pts) 10.000	000 MI					
2  N  1  f  2.399 0 CHz  -59.40 dBm  -59.40 dBm <td>MRR MODE[TRC] SO.] X Y FUNCTION FUNCTION WATH FUNCTION VALUE A</td> <td>M</td>	MRR MODE[TRC] SO.] X Y FUNCTION FUNCTION WATH FUNCTION VALUE A	M					
N  1  f  2390.0 GHz  49.99 dBm  6  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01  01	1 N 1 1 24018 GHz 1.77 dBm						
S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S	3 N 1 f 2.390 0 GHz -69.99 dBm Freq	Offs					
6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	4	01					
8 Scale Tyr 9 Scale Tyr 10 Log L							
10 Log L	8 Scal	le Typ					
11							
19 · · · · · · · · · · · · · · · · · · ·	11						
ETATUS .							

# Band Edge\_BLE\_1M\_HighCH39-2480

								Analyzar - Sv		right Spec	Key
Frequency	11:39:17 AM Oct 24, 2018 TRACE 1 2 3 4 5 6	Log-Pwr	Avg Typ	NSE:1NT	1	7	00000 GH		eq 2	ter Fr	R.
	PNO: Fast PNO: Fast Trig: Free Run Trig: PNO: NNN N IFGeIn:Low #Atten: 20 dB DET P N NNN N										
Auto Tur	483 600 GHz -62.76 dBm	Mkr3						Offset 0.		3/div	
Center Fre				<u> </u>			4	- 1			.og
2.487500000 GH	DL1-17.82-(89)						)	(			10.0
Start Fr							4	-r	_		0.0
2.475000000 G								1			40.0 50.0
01 F-						<b>3</b>	N	V	n	~~~	50.0
Stop Fre 2.500000000 G	محاديد المحادية المراسية المحاد	مر میں	mman	and the	www.www.a				-		70.0 60.0
CF St 2.500000 M	op 2.50000 GHz 00 ms (1001 pts)	weep 2.4	-		300 kHz	#VBW				2.47	
Auto M	FUNCTION WALVE	nowwone	CTION FU		2.37 di		2.480 000				
Freq Offs 01				Bm	-63.14 di -62.76 di	GHz	2.483 500 2.483 600		1	N 1 N 1	2 3 4 5
Scale Typ				-						+	6 7 8 9
og L											10 11
		STATUS			- 19						50

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.

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

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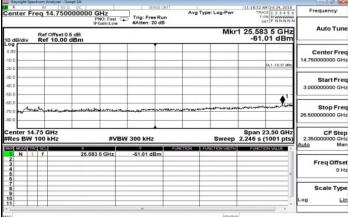
f (886-2) 2298-0488



#### Spurious Emission BLE\_1M\_ CH-Low 30MHz – 3GHz

Keysight Spectrum Analyzer - Swept SA				
R IF 50 D DC	GHz PNO: Fast	Avg Type: Log-Pwr	18:31 AM Oct 24, 2018 TRACE 1 2 3 4 5 6 TYPE NWWWW DET P NNNNN	Frequency
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm	IFGeiniLow #Atten: 20 dB	Mkr1 2	2.403 0 GHz 1.29 dBm	Auto Tun
0.00 10.0 20.0		•1	DL1 -16.37 dBn	Center Fre 1.515000000 GF
30 D 40 D 50 D				Start Fre 30.000000 MH
60.0 70.0 60.0	مر به رست الار العالم والي المراجع بعنها، وروز العالي العالم والي العالية المراجع بعنها، وروز العالية العالية ا	margination and the		Stop Fre 3.000000000 GP
enter 1.515 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep 283.9	oan 2.970 GHz ms (1001 pts)	CF Ste 297.000000 Mi Auto Mi
2 3 4 5	403 0 GHz 1.29 dBm			Freq Offs 01
6 7 8 9 10				Scale Typ

## BLE\_1M\_ CH-Low 3GHz - 26.5GHz



#### CH-Mid 30MHz – 3GHz BLE 1M

	0:30 AM Oct 24, 2018			SENSE:INT		ID ID DC	117 4		
Frequency	TRACE 1 2 3 4 5 6	e: Log-Pwr	Avg	Trig: Free Run	GHz	6000000 G		ter Fr	Cen
Auto Tun	.441 6 GHz 2.41 dBm	Mkr1 2		#Atten: 20 dB	PNO: Fast G	1 10.5 dB	Ref Offset	Vdiv	10 di
Center Fre 1.515000000 GH	DL1 -17.65 dBn	<b>•</b> 1							0.00 -10.0
Start Fre 30.000000 MH									-30.0 -40.0 -50.0
Stop Fre 3.000000000 GH	Lumonarias Urbanias	humanalum			progent for the second	والموادين وروار			60.0 -70.0 -80.0
CF Ste 297.000000 Mi <u>Auto</u> Mi	an 2.970 GHz ms (1001 pts)	Sweep 283.9	FUNCTION	300 kHz	#VBV	×	515 GHz 100 kHz		Re
Freq Offs 01	6			2.41 dBm	41 6 GHz	2.44	1	N 1	12345
Scale Typ									6 7 8 9 10
		STATUS						-	450

#### BLE\_1M\_ CH-Mid 3GHz – 26.5GHz

Ref Offset 0.5 dB  MKR 20.600 0 GBm    Cog  -60.84 dBm    Cog  -60.84 dBm    10.0  -60.84 dBm    10.0<	
Ref Offset 0.6 dB  Mkr1 25.560 0 GHz  Aut    10 dBidiu  -60.84 dBm  -60.84 dBm  Cent    10 dDidu  -60.84 dBm  -60.84 dBm <td< th=""><th>ncy</th></td<>	ncy
0-0  0-0  Cent    000  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0	o Tur
000 000 000 000 000 000 000 000 000 00	
00 0 of the output of the second of the seco	nt Fre
	p Fr
Res BW 100 kHz #VBW 300 kHz Sweep 2.246 s (1001 pts)	F Sto
V  Y  FUNCTION  FUNCTION  FUNCTION WOUTH  FUNCTION WOUT	Offs
6	le Typ

### BLE\_1M\_ CH-High 30MHz - 3GHz

enter Fr		D D DC							AM Oct 24, 2018		
	oq noro	P	NO: Fast Ca	Trig: Free					Frequency		
0 dB/div	Ref Offset Ref 10.0	1F 0.5 dB	Gain:Low	#Atten: 20	dB		Mk	r1 2.4	80 3 GHz .36 dBm		Auto Tun
0.0								•1	DL1 -17.82 (tbn		enter Fre
										30	Start Fre
0.0 0.0	annin southerne	- An all a law also	manne			and an also also also also also	مەرىپ مەرمەيلى 1990-يىلى مەرمەيلى	hun	teritari dan ak	3.000	Stop Fre
enter 1.5 Res BW	100 kHz		#VBV	V 300 kHz				83.9 ms	2.970 GHz (1001 pts)	297 Auto	CF Ste .000000 Mi
28 12000 HB 1 N 1 2 3 4	f	2.480	3 GHz	2.36 dB		TION	CTION WOTH	FUNC	TION WILLIE	-	Freq Offs
4 5 6 7 8 9										H	Scale Typ
10										Log	L

#### BLE\_1M\_ CH- High 3GHz - 26.5GHz

Keysight Spectrum Analyzer - Swept SA					
R 10 50 D DC	0 GHz	Free Run	Avg Type: Log-Pwr	11:40:00 AM Oct 24, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
Ref Offset 0.5 dB	PNO: Fast  Trig IFGain:Low #Att	en: 20 dB	Mkr1	26.241 5 GHz -61.40 dBm	Auto Tune
0.00 10.0				DL1-17.82-etbn	Center Fre 14.750000000 GH
0 0 0 0 0 0 0 0 0					Start Fre 3.000000000 GH
		annaisealthe an Alas an State		and the second	Stop Fre 26.50000000 GH
Center 14.75 GHz Res BW 100 kHz	#VBW 300			Span 23.50 GHz 246 s (1001 pts)	CF Ste 2.350000000 GH Auto Ma
1 N 1 f 26	.241 5 GHz -61.	10 dBm			F 0#
4 5					
4					Freq Offse 0 H Scale Type Log Li

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

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# 10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

#### **Standard Applicable** 10.1

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 RSS-Gen §8.10 Table 7.

And according to 15.33(a)(1) & RSS-Gen §6.13(a) 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.

According to RSS-Gen §8.9 Table 5 & 6 Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

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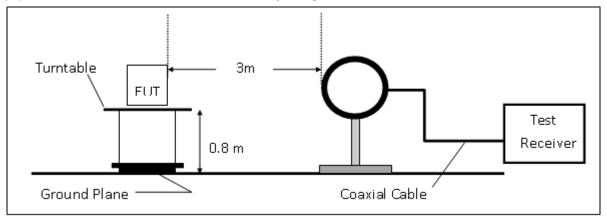
#### 10.2 **Measurement Equipment Used**

		966 Chamber			
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	2017/10/27	2018/10/26
Horn Antenna	Schwarzbeck	BBHA9120D	1341	2018/06/07	2019/06/06
Horn Antenna	SCHWAZBECK	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2018/04/19	2019/04/18
3m Site NSA	SGS	966 chamber D	N/A	2018/07/06	2019/07/05
EMI Test Receiver	R&S	ESU 40	100363	2018/04/11	2019/04/10
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	2017/10/27	2018/10/26
Pre-Amplifier	EMC Instru- ments	EMC9135	980234	2017/12/26	2018/12/25
Pre-Amplifier	EMC Instru- ments	EMC12630SE	980271	2017/12/26	2018/12/25
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	EMC106-SM-SM -7200	150703	2017/12/26	2018/12/25
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0012467	N/A	N/A

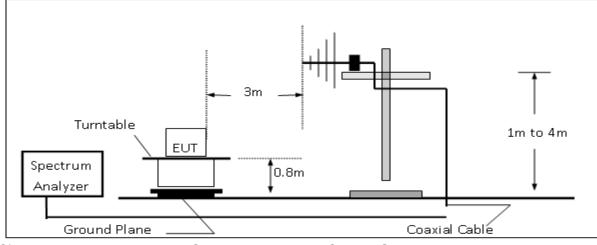


### 10.3 Test SET-UP

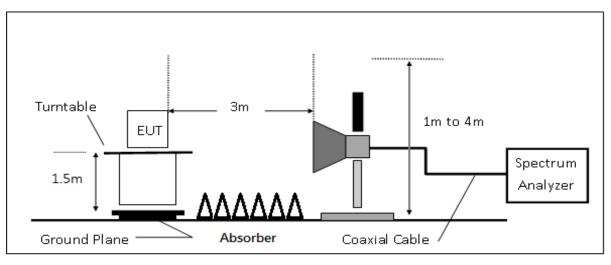
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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.



#### 10.4 Measurement Procedure

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
- 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.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 8. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 11. Repeat above procedures until all default test channel measured were complete.

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#### Field Strength Calculation 10.5

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

(Cable

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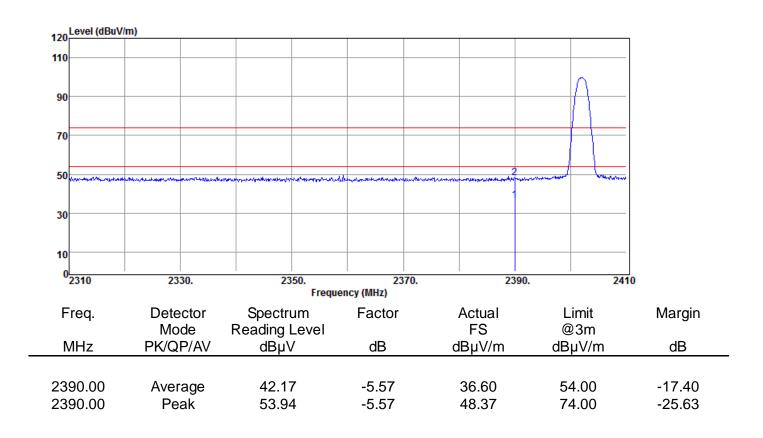
#### **Radiated Band Edge Measurement Result**

<b>Operation Mode</b>
Test Mode
EUT Pol
Test Channel

:BLE :BE CH Low :H Plan :2402 MHz

Test Date Temp./Humi. Antenna Pol. Engineer

:2018-10-22 :25/60 :VERTICAL :Jerry



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.

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Operation I Test Mode EUT Pol Test Chanr	:B :H	LE E CH Low I Plan 402 MHz		Test Date Temp./Humi. Antenna Pol. Engineer					
120 Level (dE	3uV/m)					_			
110						-			
90					Λ	_			
70						=			
50	he and the four and the product of the other states			ver under and the second second	where we have a second	~			
30						-			
10						-			
0 <sup>L</sup> 2310	2330.	2350. Freque	2370. ency (MHz)	239	90. 24	410			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin			
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB			
2390.00 2390.00	Average Peak			36.68 48.34	54.00 74.00	-17.32 -25.66			

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Operation Mo Test Mode EUT Pol Test Channel		:H Pla	:BLE :BE CH High :H Plan :2480 MHz			Ti Ti A E	:2018-10-22 :25/60 :VERTICAL :Jerry			
120 Level (dBuV	/m)									
110										
90		$\rightarrow$								
70	/									
50			- 2 minutes	an a		and the second second	and the second second second	and the second	and the state of t	
30										
10										
0 <mark>0</mark>	2480		24	85.	24	90.	2/	495.	250	0
2415	2400		24		ncy (MHz)	50.	2-		250	0
Freq.	Detect		Spectru		Factor		Actual		_imit	Margin
	Mode		eading l				FS		2)3m	
MHz	PK/QP/	/AV	dBµ∖	/	dB		dBµV/m	dE	βµV/m	dB
				_				_		
2483.50	Avera		44.19		-4.90		39.29		4.00	-14.71
2483.50	Peal	k	56.86	5	-4.90		51.96	7	4.00	-22.04

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Operation Mo Test Mode EUT Pol Test Channe		:BLETest Date:BE CH HighTemp./Humi.:H PlanAntenna Pol.:2480 MHzEngineer						:2018-10-22 :25/60 :HORIZONTAL :Jerry		
120 Level (dBuV	//m)									_
110										_
90										_
70										-
50	/	`	Marine Company	and the second	la opposition and approximately	and at the analysis of the second	nghan an kanad		and the second section of	-
30										-
10										-
0 2475	24	80.	24	485. Freque	24 ency (MHz)	90.	24	495.	25	 00
Freq.	Detector Spectrur			Factor		Actual		_imit ⊉3m	Margin	
MHz		Mode Reading Level PK/QP/AV dBµV			dB	(	FS dBµV/m		₽sm 8µV/m	dB
2483.50 2483.50	Aver Pe		42.5 54.8		-4.90 -4.90		37.69 49.98		4.00 4.00	-16.31 -24.02



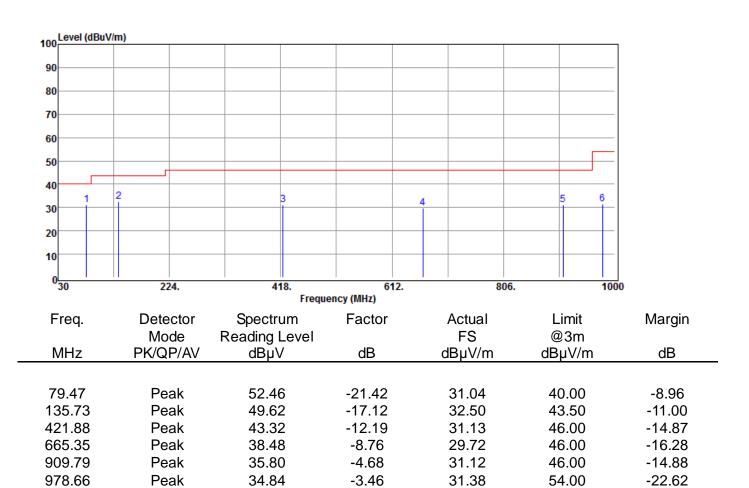
#### **Radiated Spurious Emission Measurement Result** For Frequency form 30MHz to 1000MHz

**Operation Mode** Test Mode EUT Pol **Test Channel** 

:BLE :Tx CH Low :H Plan :2402 MHz

Test Date
Temp./Humi.
Antenna Pol.
Engineer

:2018-10-22 :25/60 :VERTICAL :Jerry



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Test M EUT F		de	:H	.E CH Low Plan 02 MHz	,			Test Date Temp./H Antenna Enginee	lumi. a Pol.		:2018-10-22 :25/60 :HORIZONTAL :Jerry
100	.evel (dBuV/i	m)									7
90											_
80-											_
70-											_
60											_
50											-
40					4						_
30	1	2	3				5			6	_
20											_
10											_
03											
3	50	2	24.		418. Frequ	61 Iency (MHz)	2.		806.	10	000
Fr	req.		ector		ctrum	Factor		Actual		Limit	Margin
Γ.	1Hz		ode P/AV		ng Level 8µV	dB		FS dBµV/n	n d	@3m IBµV/m	dB
	11 12	FIVG	(F/AV	UL	νμν	uВ		ubµv/ii		ωμν/π	ub
80	).44	Pe	ak	53	8.42	-21.76		31.66		40.00	-8.34
	6.54		eak		.06	-18.68		32.38		43.50	-11.12
	1.90		eak		0.24	-16.49		32.75		46.00	-13.25
	8.90		ak		3.34	-13.07		35.27		46.00	-10.73
	6.32		eak		.41	-8.72		32.69		46.00	-13.31
98	8.36	Pe	eak	36	5.81	-3.80		33.01		54.00	-20.99

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Operation Mo Test Mode EUT Pol Test Channe	:T :H   :2	LE x CH Mid I Plan 442 MHz		Test Date Temp./Hum Antenna Po Engineer		:2018-10-22 :25/60 :VERTICAL :Jerry
100 Level (dBuV	//m)					7
90						_
80						_
70						_
60						_
50						-
40						_
30 1	2 3	4			5 6	_
20						_
10						_
0						
30	224.	418. Freque	612. ency (MHz)	806	5. 10	00
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
	FNQF/AV	υσμν	UD	αвμνлп	ασμν/π	UD
79.47	Peak	52.99	-21.42	31.57	40.00	-8.43
140.58	Peak	47.78	-16.48	31.30	43.50	-12.20
226.91	Peak	47.10	-18.20	28.90	46.00	-17.10
421.88	Peak	43.09	-12.19	30.90	46.00	-15.10
841.89	Peak	35.70	-6.17	29.53	46.00	-16.47
982.54	Peak	35.52	-3.57	31.95	54.00	-22.05

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Operation Mode Test Mode EUT Pol Test Channel	:BLE :Tx CH Mid :H Plan :2442 MHz	ר 4	ēst Date ēmp./Humi. Antenna Pol. Engineer		:2018-10-22 :25/60 :HORIZONTAL :Jerry
100 Level (dBuV/m)					
90					
80					
70					
60					
50					
40 1 2	3	4	5	6	
30					
20					
10					
0 <mark>30 224.</mark>		612. ncy (MHz)	806.	100	0
Freq. Detect		Factor	Actual	Limit	Margin
Mode	•	1 40101	FS	@3m	Margin
MHz PK/QP/	/AV dBµV	dB	dBµV/m	dBµV/m	dB
81.41 Peak		-22.24	30.08	40.00	-9.92
209.45 Peak 388.90 Peak		-18.69 -13.07	32.28 35.36	43.50 46.00	-11.22 -10.64
666.32 Peak		-13.07 -8.72	32.66	46.00 46.00	-10.64 -13.34
832.19 Peak		-6.37	30.32	46.00	-15.68
994.18 Peak		-3.83	34.38	54.00	-19.62

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Operation Mo Test Mode EUT Pol Test Channel	:T: :H	LE x CH High Plan 480 MHz		Test Date Temp./Humi Antenna Pol Engineer		:2018-10-22 :25/60 :VERTICAL :Jerry
100 Level (dBuV/	/m)					7
90						_
80						
70						-
60						-
50						
40 1	2	4		5	6	-
30	3					-
20						-
10						-
030	224.	418.	612.	806.	10	
50	224.		ency (MHz)	000.	10	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
N 41 1	Mode	Reading Level	ī	FS	@3m	ID.
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
82.38	Peak	53.14	-21.87	31.27	40.00	-8.73
140.58	Peak	48.90	-16.48	32.42	43.50	-11.08
216.24	Peak	47.40	-18.68	28.72	46.00	-17.28
421.88	Peak	43.72	-12.19	31.53	46.00	-14.47
666.32	Peak	38.88	-8.72	30.16	46.00	-15.84
957.32	Peak	36.57	-4.25	32.32	46.00	-13.68

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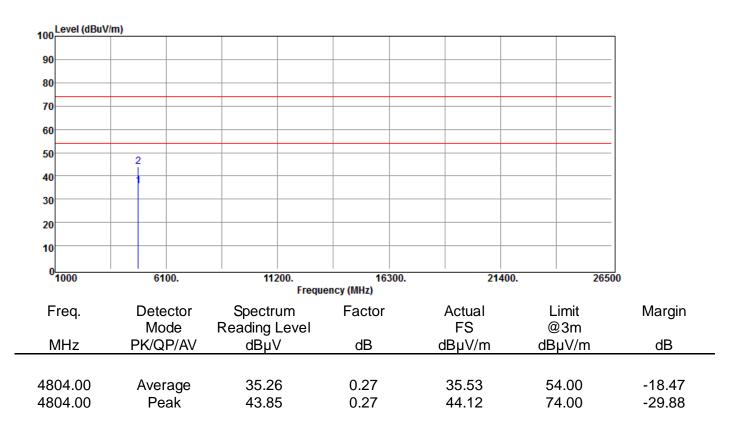


Operation Test Mod EUT Pol Test Cha	le	de	:H F	E CH Higl Plan 80 MHz	ı			Ten Ant	t Date np./Hur tenna F gineer					:2018-10-22 :25/60 :HORIZONTAL :Jerry
100 Level	(dBuV/m	1)								1				
90														
80														
70														
60												Г		
50														
40	1	2			3		4				5		6	
30														
20														
10														
0 <mark></mark>		2	24.	I	418.		12.	I	8	<b>06.</b>			100	)
				-		ency (MHz)		_						
Freq.			ector ode		ctrum	Factor		F	Actual FS			imit 23m		Margin
MHz			P/AV		ng Level 3µV	dB		dE	го ЗµV/m		-	μV/m		dB
81.41		Pe	eak	53	3.63	-22.24		3	31.39		4(	0.00		-8.61
208.4			eak		2.29	-18.69			33.60			3.50		-9.90
388.9			eak		7.77	-13.07			34.70			6.00		-11.30
664.3			eak		.97	-8.78			33.19			6.00		-12.81
868.0			eak		5.02	-4.95			30.07			6.00		-15.93
973.8	1	Pe	eak	35	5.73	-3.36		3	32.37		54	4.00		-21.63



## **Radiated Spurious Emission Measurement Result**

For Frequency above	ve 1GHz		
Operation Mode	:BLE	Test Date	:2018-10-22
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2402 MHz	Engineer	:Jerry



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Opera Test N	ation Mo Mode	de	:BLE :Tx CH Low		Test Date Temp./Hu	ımi.	:2018-10-22 :25/60
EUT			:H Plan		Antenna		:HORIZONTAL
Test C	Channel		:2402 MHz		Engineer		:Jerry
					-		
	Level (dBuV/r	n)					
100		,					
90							—
80							—
70							_
60							
50							_
40		2					_
30							
20							
10							—
0	1000	6100.	11200	). 163 Frequency (MHz)	300. 2	1400. 2	6500
F	req.	Detecto			Actual	Limit	Margin
		Mode	Reading Le		FS	@3m	
N	ЛНz	PK/QP/A	V dBµV	dB	dBµV/m	dBµV/m	dB
404	04.00	Averen	22.00	0.07	22.40	E4 00	20 51
	04.00 04.00	Average Peak	33.22 41.29	0.27 0.27	33.49 41.56	54.00 74.00	-20.51 -32.44
40	04.00	FEdK	41.29	0.27	41.00	74.00	-32.44

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Operation Mo Test Mode EUT Pol Test Channel	:T: :H :24	LE x CH Mid Plan 442 MHz		Test Date Temp./Humi Antenna Pol Engineer		:2018-10-22 :25/60 :VERTICAL :Jerry
100 Level (dBuV/	m)					7
90						_
80						_
70						-
60						_
50	2					-
40						_
30						_
20						-
10						-
0 <mark></mark>	6100.	11200. Freque	16300. ency (MHz)	21400	). 265	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	37.52	0.71	38.23	54.00	-15.77
4884.00	Peak	45.11	0.71	45.82	74.00	-28.18

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Test M EUT P		de	:BLE :Tx CH Mid :H Plan :2442 MHz		Ten Ant	t Date np./Humi. tenna Pol. gineer		:2018-10-22 :25/60 :HORIZONTAL :Jerry
100	.evel (dBuV/n	n)						
90								
80								
70								
60								
50		2						
40								
30								
20								
10								
0	000	6100.	11	I200. Frequency (MHz)	16300. )	21400.	2650	0
Fr	req.	Detect			or A	Actual	Limit	Margin
M	lHz	Mode PK/QP/	0		di di	FS BµV/m	@3m dBµV/m	dB
488	34.00	Averag	ye 35.0	0.7	1 3	35.74	54.00	-18.26
488	34.00	Peak		.7 0.7	1 4	44.10	74.00	-29.90

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Operation Mo Test Mode EUT Pol Test Channel	:T ⊦	LE x CH High I Plan 480 MHz		Test Date Temp./Humi. Antenna Pol. Engineer		:2018-10-22 :25/60 :VERTICAL :Jerry
100 Level (dBuV/	m)				1	7
90						_
80						_
70						-
60						-
50	2					-
40	1					-
30						-
20						-
10						-
0 <mark></mark> 1000	6100.	11200. Freque	16300. ency (MHz)	21400.	265	 600
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
4960.00 4960.00	Average Peak	38.72 47.28	1.24 1.24	39.96 48.52	54.00 74.00	-14.04 -25.48
1000.00	i oun			10:02	7 1.00	20110

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Test M EUT F		de	:T) :H	LE < CH High Plan 480 MHz			Te A	est Date emp./Hu ntenna F ngineer			:2018-10-22 :25/60 :HORIZONTAL :Jerry
100	evel (dBuV/m	1)							1		
90											_
80											_
70											_
60											_
50		2									_
40		-									—
30											_
20											—
10											-
0 <mark>_</mark> 1	1000	61	00.	112	200. Freque	163 ency (MHz)	800.	21	400.	26	500
Fr	req.		ector	Spectr		Factor		Actual		Limit	Margin
M	1Hz	Mo PK/Q	ede P/AV	Reading l dBµ\		dB		FS dBµV/m		@3m 3µV/m	dB
400	20.00	A		27.0	r	1.04		20.26	,	4 00	15 74
	60.00 60.00	Aveı Pe	age ak	37.02 46.13		1.24 1.24		38.26 47.37		54.00 74.00	-15.74 -26.63



# 11 PEAK POWER SPECTRAL DENSITY

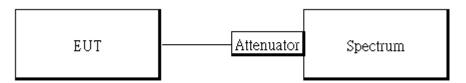
## 11.1 Standard Applicable:

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 TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.							
Spectrum Analyzer	Agilent	N9010A	MY5144011 3	2018/06/20	2019/06/19							
DC Block	PASTERNACK	PE8210	RF81	2017/12/26	2018/12/25							
Notebook	Lenovo	L420	S0011721	N/A	N/A							

## 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 & ANSI C63.10.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 3 kHz. & the 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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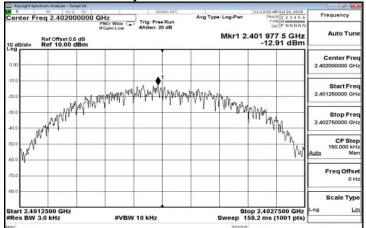
#### 11.5 **Measurement Result:**

### **BLE mode**

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result	
2402	-12.91	8	PASS	
2442	-12.17	8	PASS	
2480	-12.34	8	PASS	

NOTE: cable loss as 0.5dB that offsets in the spectrum

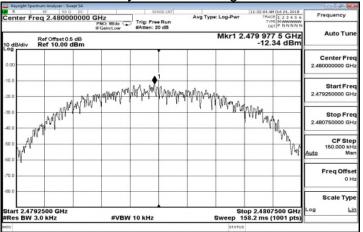
#### Power Density\_BLE\_1M\_LowCH00-2402



### Power Density\_BLE\_1M\_MidCH20-2442

								pectrum Analyzer -	Keynight S
Frequency	6 AM Oct 24, 2018 RACE 1 2 3 4 5 6 TYPE MWWWW	TRA	e: Log-Pwr	Avg Typ	Trig: Free Run	GHz PNO: Wide	0000000	req 2.442	enter l
Auto Tur	IFGainLow #Atten: 20 dB CEIT IN AND Ref Offset 0.5 dB Mkr1 2.441 9775 G GHz JB/div Ref 10.00 dBm -12.17 dBm								0 dB/div
Center Fre 2.442000000 GP									1,00
Start Fre 2.441250000 GH		<u> </u>	Allan	handra	hand	un un un	.a. Ma		0.0
Stop Fre 2.442750000 Gi	1/M	With	1 W.Y. W.W				Ar MA	www	0.0
CF Ste 150.000 ki Auto M	- MA							1 <sup>11</sup>	a MA
Freq Offs 01							-		0.0
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0 H: Scale Type	127500 GHz s (1001 pts)	158.2 ms	Status Sweep 1		10 kHz	#VBW	Iz		41250 / 3.0 k

### Power Density\_BLE\_1M\_HighCH39-2480



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.



# **12 ANTENNA REQUIREMENT**

#### Standard Applicable: 12.1

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 ~

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.

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