ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant:	Sharp Corporation, Mobile Communication B.U. 2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi, Hiroshima 739-0192, Japan
Manufacturer:	Sharp Corporation 1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan
Product Name:	Smart Phone
Report Number:	ER/2019/A0104
FCC ID:	APYHRO00280
FCC Rule Part:	§15.247, Cat: DTS
Issue Date:	Dec. 06, 2019
Date of Test:	Oct. 22, 2019 ~ Nov. 25, 2019
Date of EUT Received:	Oct. 22, 2019

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.

Approved By: Jay. Lin

Jay Lin / Asst. Supervisor

Testing Laboratory
0513

Revision History

Revision	Description	Issue Date	Remark
Rev.00	Original.	Nov. 28, 2019	Revised By: Karen Huang
Rev.01	Update information on section 1.2	Dec. 06, 2019	Revised By: Karen Huang

Contents

1. GENERAL INFORMATION

1.1 Product Description

Product Name:	Smart Phone
Hardware Version:	DVT
Software Version:	N/A
Power Supply:	3.85V from Rechargeable Li-ion Battery

Radio Technology:	Bluetooth LE dual mode
Frequency Range:	2.402GHz – 2.480GHz
Channel Number:	40 channels
Modulation Type:	GFSK
Transmit Power:	5.38dBm (BLE 1Mbps) 5.80dBm (BLE 2Mbps)
Antenna Designation:	Inverted-F Antenna, Gain: -2.7dBi

1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

KDB 558074 D01 v05r02 DTS Meas. Guidance

ANSI C63.10:2013

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

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Designation number: TW0001

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

1.6 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

1.7 Test data is referenced from cross authorization

Conducted measurement results in the original test report ER/2019/A0071 under FCC ID: APYHRO00279 are fully leveraged in this test report with spot check to demonstrate compliance.

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 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.

2.3.2 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.

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 Radiated Emission

Fig. 2-2 Conducted (Antenna Port) Emission

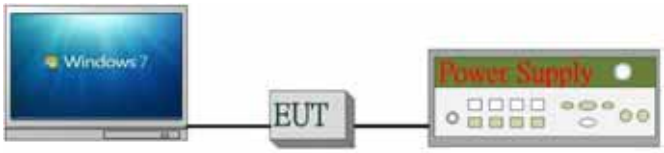


Fig. 2-2 AC Power Line Conducted Emission

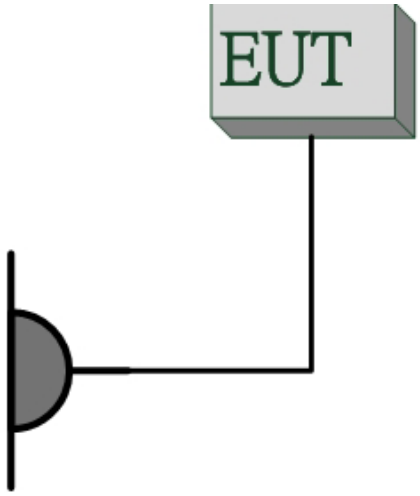


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	MY52410006	N/A	N/A
3.	Notebook	Lenovo	L430	R9-XFG0X	N/A	N/A
4.	Notebook	Lenovo	L430	R9-X11BG	N/A	N/A

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.205 §15.209 §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

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		

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.
3. Investigation has been done on all the possible configurations for searching the worst case.

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)
RADIATED EMISSION TEST (BELOW 1 GHz)				
Bluetooth LE	2402 to 2480	2440	GFSK	1
Bluetooth LE	2402 to 2480	2440	GFSK	2
RADIATED EMISSION TEST (ABOVE 1 GHz)				
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	2
Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth LE Transmitter for channel Low, Mid and High, the worst case E2 position was reported.				

ANTENNA PORT CONDUCTED MEASUREMENT:				
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	2

Spot Check

ANTENNA PORT CONDUCTED MEASUREMENT:				
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)
Peak Output Power				
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	2

5. MEASUREMENT UNCERTAINTY

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

Radiated Spurious Emission Measurement Uncertainty	
Polarization: Vertical	9kHz~30MHz: +-2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +-2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

6. CONDUCTED EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used:

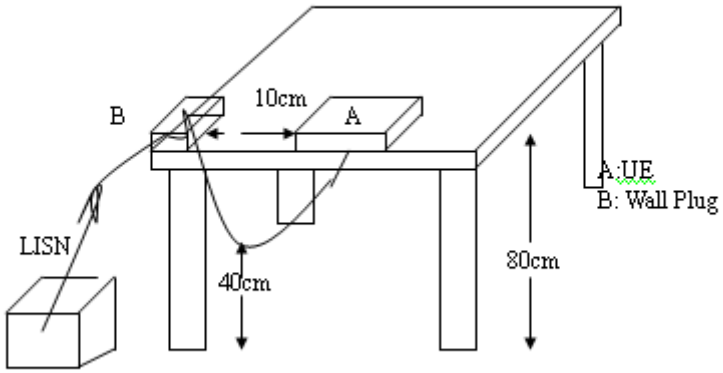
Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2018	11/25/2019
LISN	SCHWARZBECK	NSLK 8127	8127-649	04/02/2019	04/01/2020
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R	N.C.R

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

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.

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

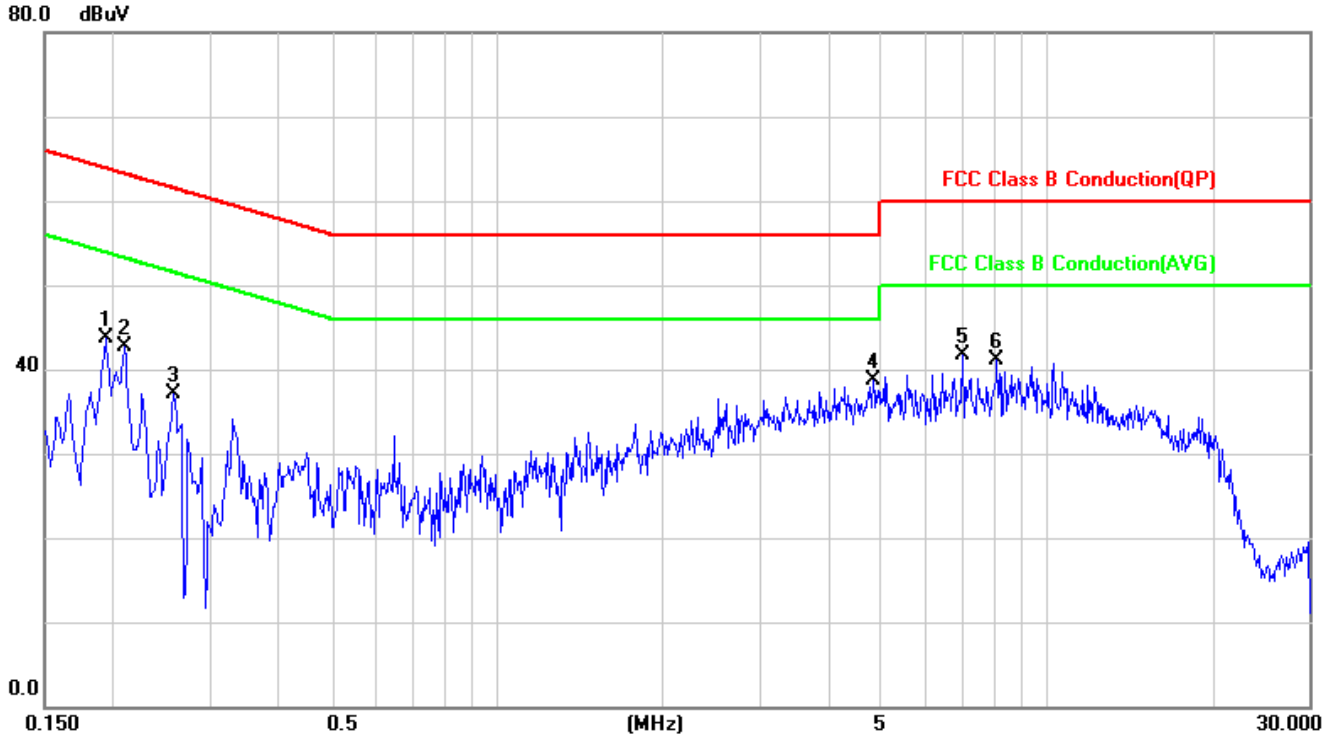
6.6 Measurement Result:

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

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

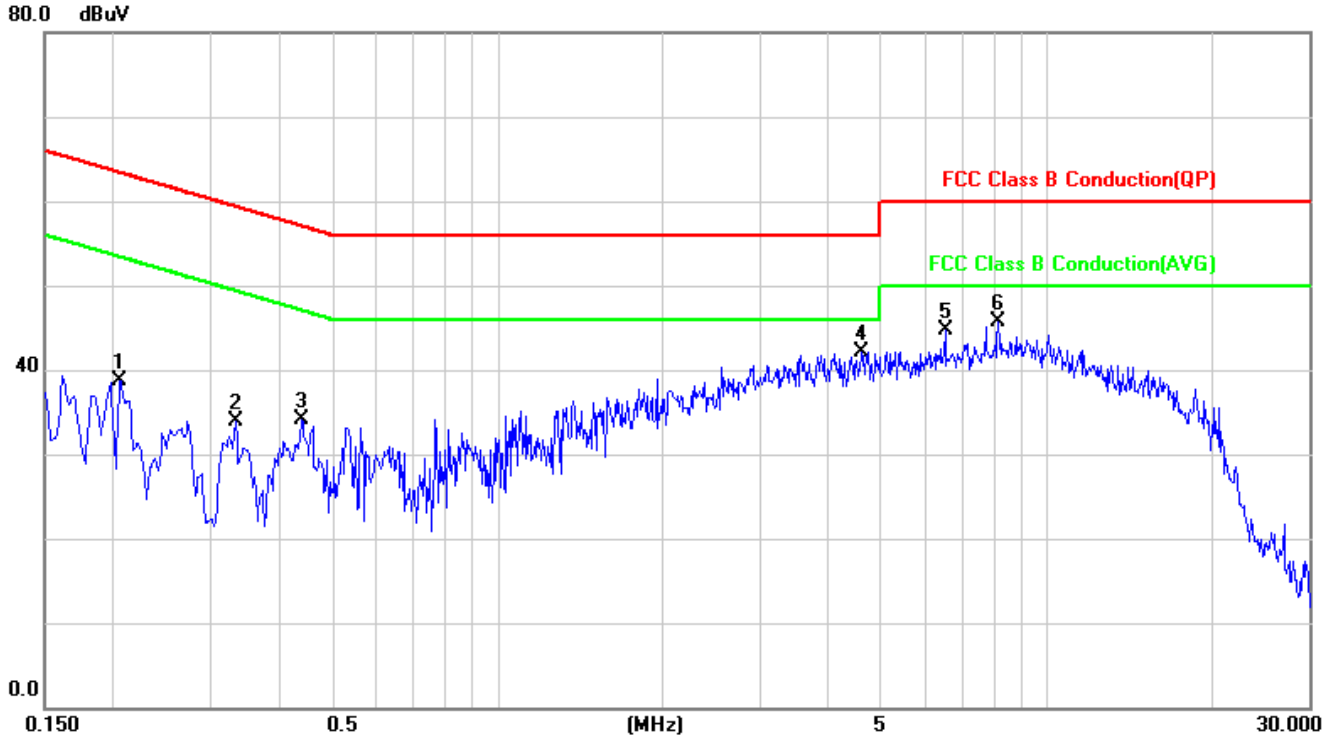
AC POWER LINE CONDUCTED EMISSION TEST DATA

Description:	**Operation (BLE 1Mbps)**	**Date:**	**2019/11/11**
Line:	**L1**	**Temp.(℃)/Hum.(%):**	**24.1(℃)/64%**
Test Voltage:	**AC 120V/60Hz**	**Test By:**	**Kane**



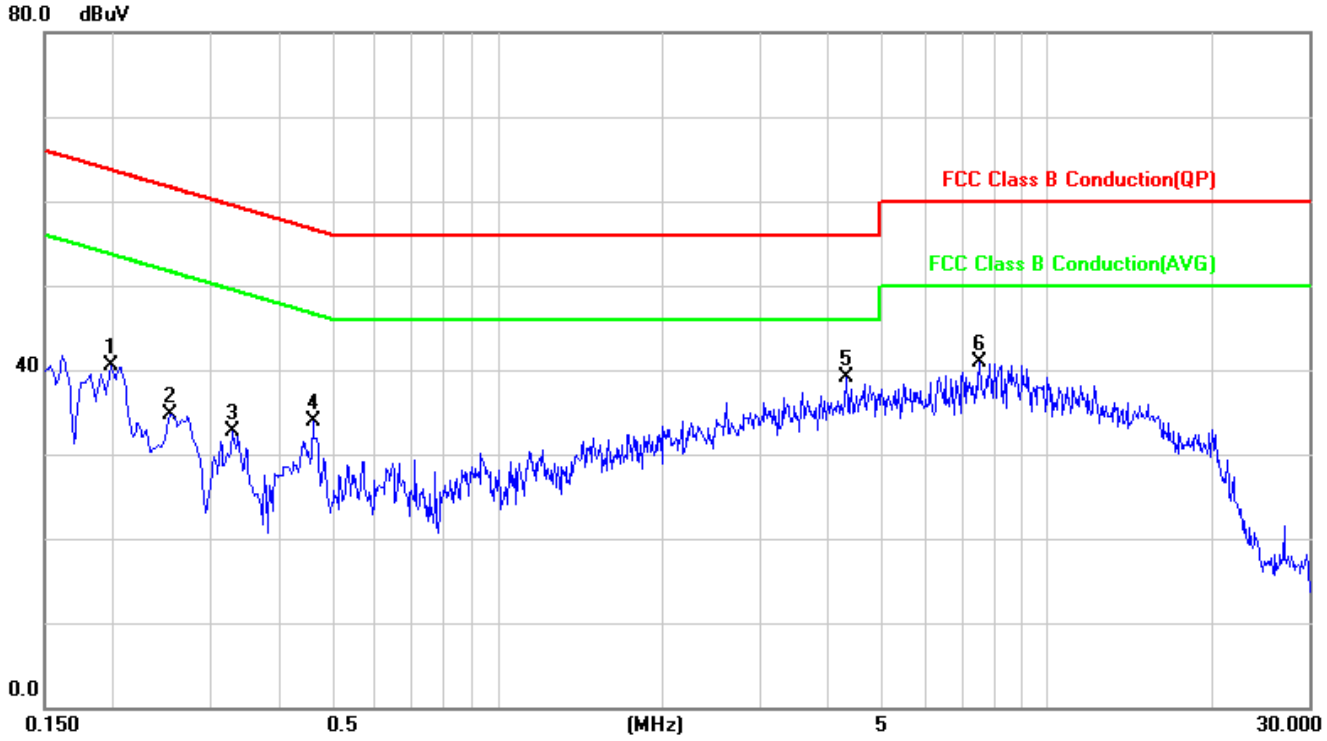
No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1940	43.68	0.03	43.71	63.86	-20.15	peak	
2		0.2100	42.77	0.03	42.80	63.21	-20.41	peak	
3		0.2580	37.12	0.03	37.15	61.50	-24.35	peak	
4	*	4.8460	38.46	0.20	38.66	56.00	-17.34	peak	
5		7.0260	41.42	0.24	41.66	60.00	-18.34	peak	
6		8.1060	40.94	0.26	41.20	60.00	-18.80	peak	

Description:	**Operation (BLE 1Mbps)**	**Date:**	**2019/11/11**
Line:	**N**	**Temp.(℃)/Hum.(%):**	**24.1(℃)/64%**
Test Voltage:	**AC 120V/60Hz**	**Test By:**	**Kane**



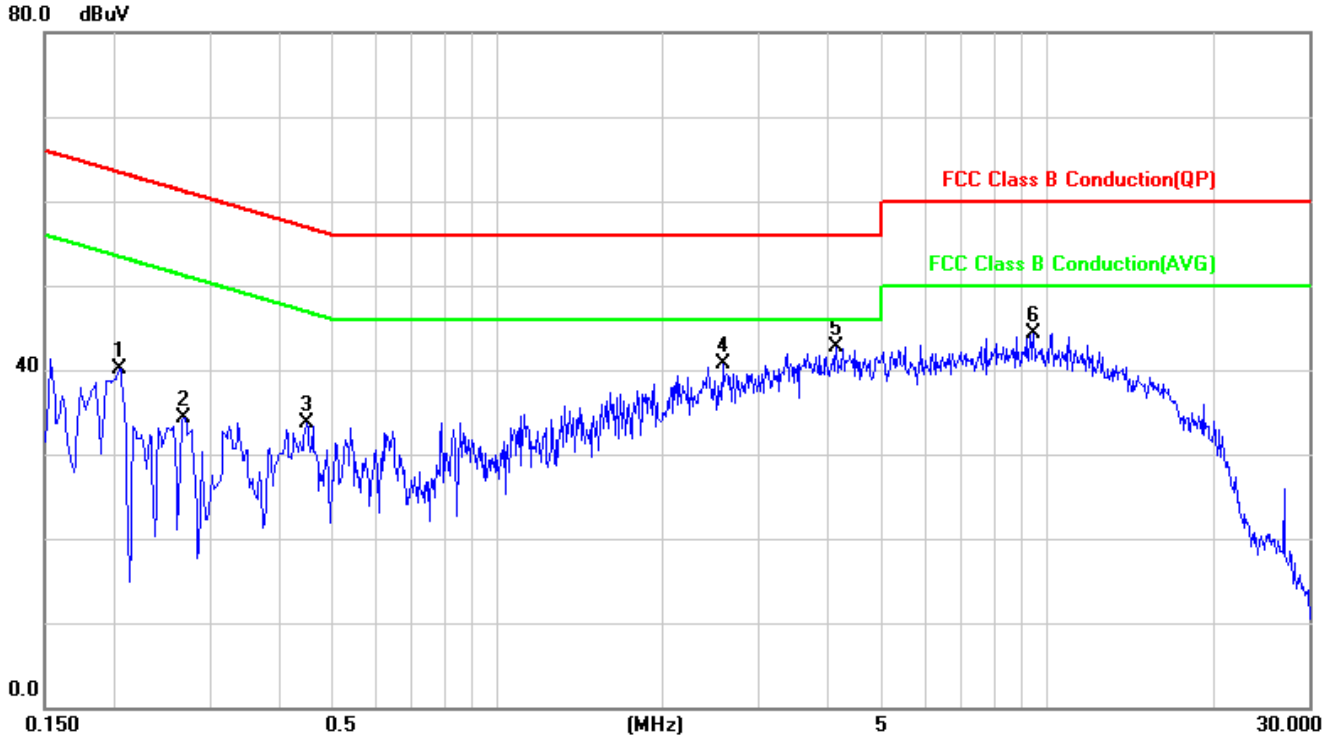
No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.2060	38.68	0.01	38.69	63.37	-24.68	peak	
2		0.3340	33.80	0.01	33.81	59.35	-25.54	peak	
3		0.4420	34.01	0.01	34.02	57.02	-23.00	peak	
4	*	4.6180	41.87	0.18	42.05	56.00	-13.95	peak	
5		6.5420	44.41	0.22	44.63	60.00	-15.37	peak	
6		8.1820	45.53	0.25	45.78	60.00	-14.22	peak	

Description:	**Operation (BLE 2Mbps)**	**Date:**	**2019/11/11**
Line:	**L1**	**Temp.(℃)/Hum.(%):**	**24.1(℃)/64%**
Test Voltage:	**AC 120V/60Hz**	**Test By:**	**Kane**



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1980	40.48	0.03	40.51	63.69	-23.18	peak	
2		0.2540	34.69	0.03	34.72	61.63	-26.91	peak	
3		0.3300	32.58	0.03	32.61	59.45	-26.84	peak	
4		0.4620	33.83	0.03	33.86	56.66	-22.80	peak	
5	*	4.3300	38.90	0.19	39.09	56.00	-16.91	peak	
6		7.5340	40.75	0.24	40.99	60.00	-19.01	peak	

Description:	**Operation (BLE 2Mbps)**	**Date:**	**2019/11/11**
Line:	**N**	**Temp.(℃)/Hum.(%):**	**24.1(℃)/64%**
Test Voltage:	**AC 120V/60Hz**	**Test By:**	**Kane**



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	dBuV	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.2060	40.18	0.01	40.19	63.37	-23.18	peak	
2		0.2700	34.33	0.01	34.34	61.12	-26.78	peak	
3		0.4500	33.78	0.01	33.79	56.88	-23.09	peak	
4		2.5780	40.62	0.15	40.77	56.00	-15.23	peak	
5	*	4.1500	42.63	0.17	42.80	56.00	-13.20	peak	
6		9.4700	44.00	0.27	44.27	60.00	-15.73	peak	

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.

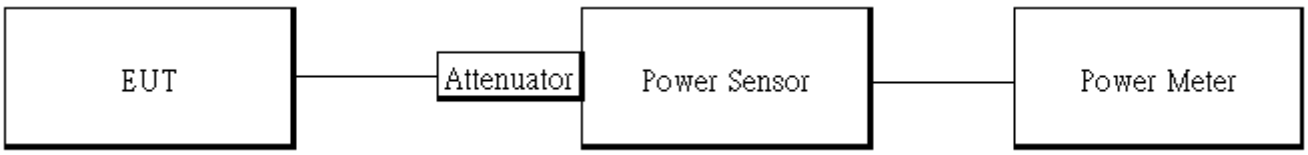
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1804001	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726104	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726107	02/13/2019	02/12/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/04/2018	12/03/2019
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2019	01/01/2020

7.3 Test Set-up:



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

Formula:

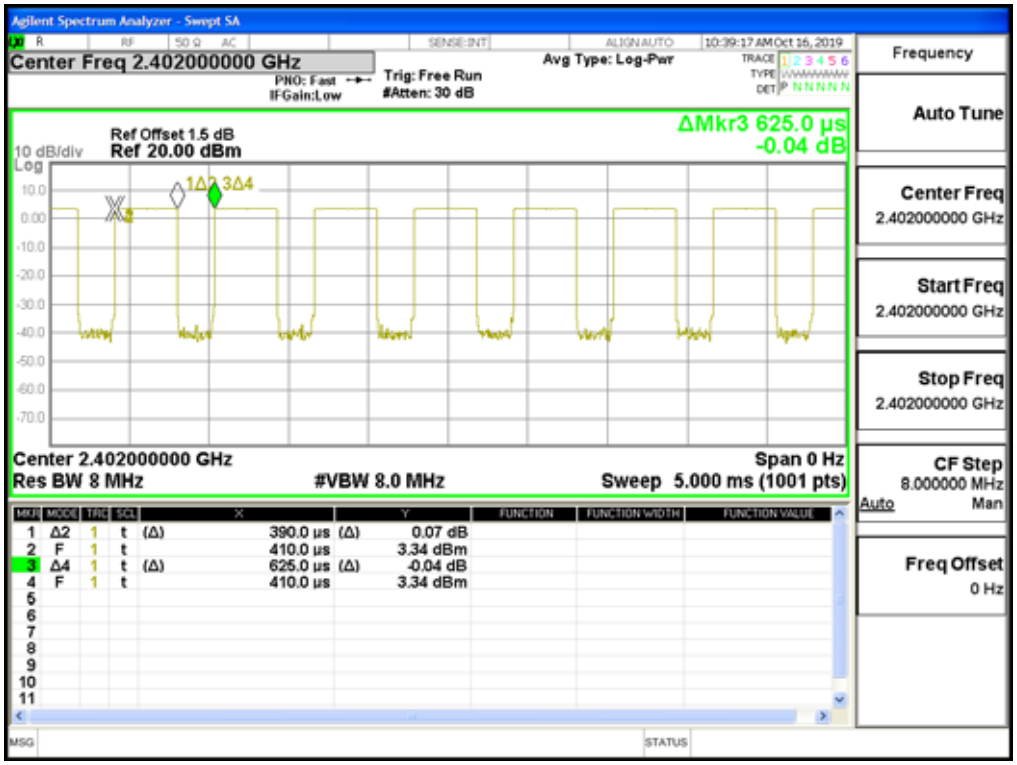
Duty Cycle = Ton / (Ton+Toff)

Duty Factor

DATA RATE 1 Mbps:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE	62.00	2.08	2.56	3.00

Duty Cycle_BLE_1M_LowCH00-2402

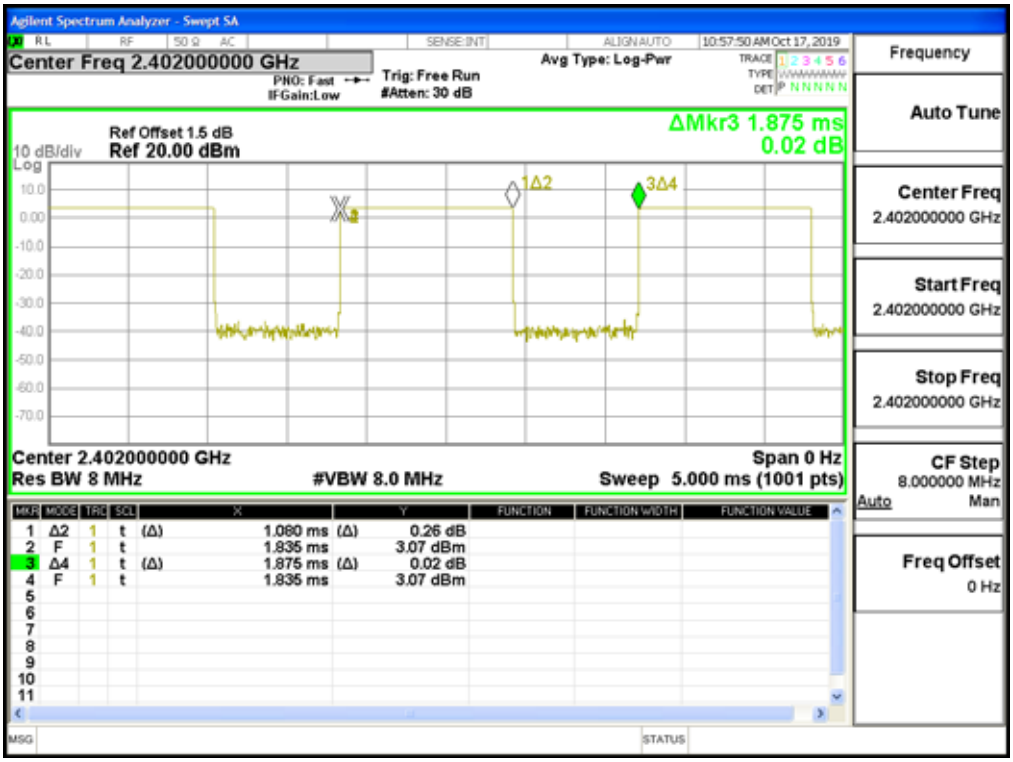


Duty Cycle Factor:10*log(1/(62/100))=2.08

DATA RATE 2 Mbps:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE	58.00	2.37	0.93	1.00

Duty Cycle_BLE_2M_LowCH00-2402



Duty Cycle Factor:10*log(1/(58/100))=2.37

7.5 Measurement Result:

DATA RATE 1 Mbps:

CH	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
Low	2402	3.48	1 Watt = 30 dBm
Mid	2440	**5.38**	1 Watt = 30 dBm
High	2480	3.97	1 Watt = 30 dBm
CH	**Frequency (MHz)**	**Max. Avg. Output include tune up tolerance Power (dBm)**	**Required Limit**
Low	2402	3.45	1 Watt = 30 dBm
Mid	2440	5.33	1 Watt = 30 dBm
High	2480	3.94	1 Watt = 30 dBm

**Note: Measured by power meter, cable loss as 1.5 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*

DATA RATE 2 Mbps:

CH	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
Low	2402	3.96	1 Watt = 30 dBm
Mid	2440	**5.80**	1 Watt = 30 dBm
High	2480	4.72	1 Watt = 30 dBm
CH	**Frequency (MHz)**	**Max. Avg. Output include tune up tolerance Power (dBm)**	**Required Limit**
Low	2402	3.82	1 Watt = 30 dBm
Mid	2440	5.65	1 Watt = 30 dBm
High	2480	4.64	1 Watt = 30 dBm

**Note: Measured by power meter, cable loss as 1.5 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*

Spot Check Data:

DATA RATE 1 Mbps:

FCC	by power meter		unit: dBm
BLE	2402	2442	2480
Avg	3.41	5.27	3.91
Peak	3.45	5.33	3.95

DATA RATE 2 Mbps:

FCC	by power meter		unit: dBm
BLE	2402	2442	2480
Avg	3.80	5.64	4.58
Peak	3.91	5.77	4.66

8. 6DB BANDWIDTH MEASUREMENT

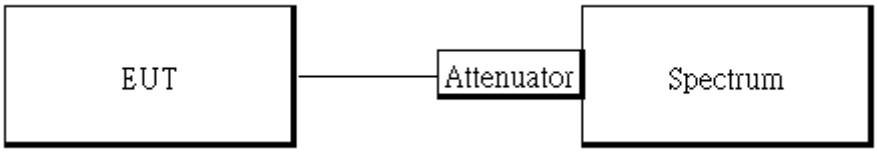
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/04/2018	12/03/2019
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2019	01/01/2020

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.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. For 6dB Bandwidth:

   Set the spectrum analyzer as RBW=100 kHz, VBW= 3*RBW, Span = 5MHz, Detector=Peak, Sweep=auto.
5. Mark the peak frequency and –6dB (upper and lower) frequency.
6. Repeat above procedures until all test default channel is completed

8.5 Measurement Result:

DATA RATE 1 Mbps:

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6885	> 0.5	PASS
2440	0.6856	> 0.5	PASS
2480	0.6909	> 0.5	PASS

DATA RATE 2 Mbps:

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.153	> 0.5	PASS
2440	1.17	> 0.5	PASS
2480	1.178	> 0.5	PASS

Note: Refer to next page for plots.

OBW 6dB_BLE_1M_LowCH00-2402

OBW 6dB_BLE_2M_LowCH00-2402

OBW 6dB_BLE_1M_MidCH19-2440

OBW 6dB_BLE_2M_MidCH19-2440

OBW 6dB_BLE_1M_HighCH39-2480

OBW 6dB_BLE_2M_HighCH39-2480

9. CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

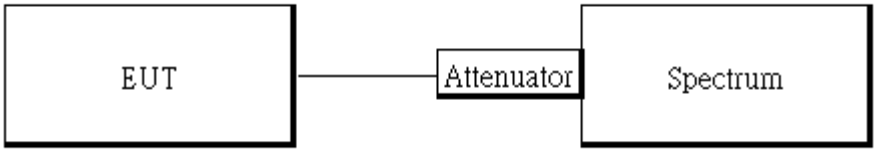
9.1 Standard Applicable

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

9.2 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/04/2018	12/03/2019
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2019	01/01/2020

9.3 Test SET-UP:



9.4 Measurement Procedure

9.4.1 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.

9.4.2 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 (2400~2483.5MHz) 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.

9.4.3 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:

DATA RATE 1 Mbps:

Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	3.14	-16.86
2440	4.90	-15.10
2480	3.84	-16.16

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

NOTE: Refer to next page for plots.

DATA RATE 2 Mbps:

Reference Level of Limit

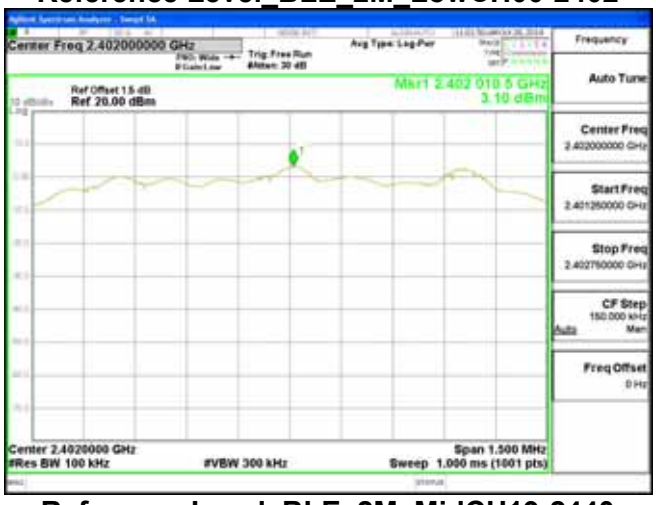
Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	3.10	-16.90
2440	4.86	-15.14
2480	3.74	-16.26

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

NOTE: Refer to next page for plots.

Reference Level_BLE_1M_LowCH00-2402

Reference Level_BLE_2M_LowCH00-2402

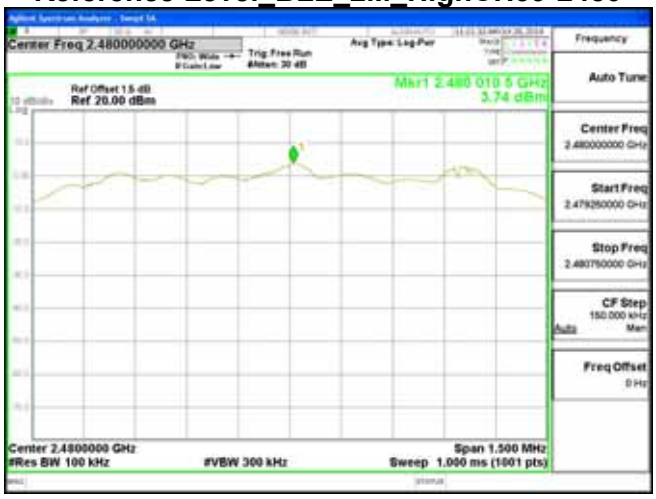


Reference Level_BLE_1M_MidCH19-2440

Reference Level_BLE_2M_MidCH19-2440

Reference Level_BLE_1M_HighCH39-2480

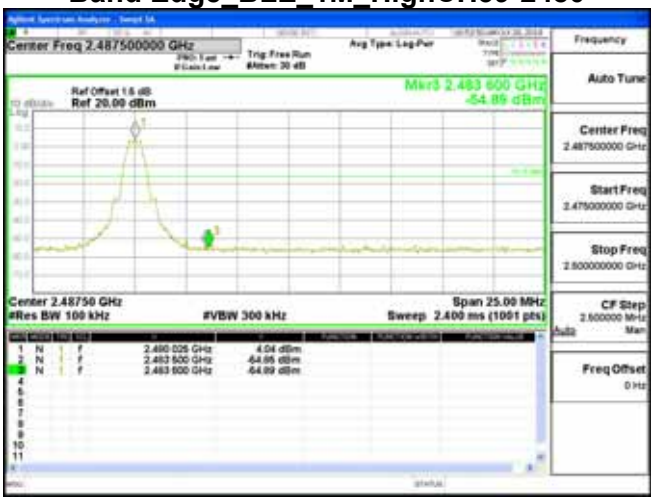
Reference Level_BLE_2M_HighCH39-2480



Band Edge_BLE_1M_LowCH00-2402

Band Edge_BLE_2M_LowCH00-2402

Band Edge_BLE_1M_HighCH39-2480



Band Edge_BLE_2M_HighCH39-2480

Spurious Emission_BLE_1M_LowCH00-2402

Spurious Emission_BLE_2M_LowCH00-2402

Spurious Emission_BLE_1M_MidCH19-2440

Spurious Emission_BLE_2M_MidCH19-2440

Spurious Emission_BLE_1M_HighCH39-2480

Spurious Emission_BLE_2M_HighCH39-2480

10. RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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

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

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

Note:

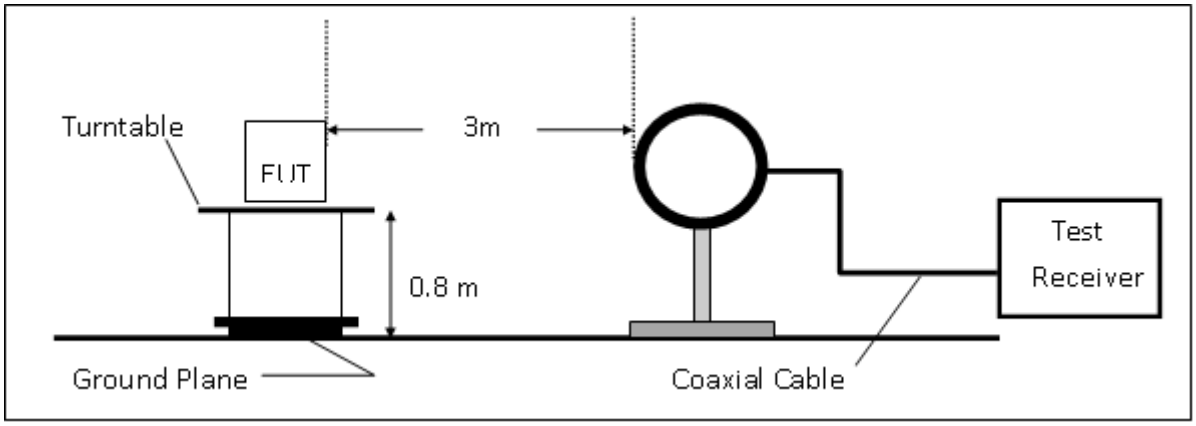
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

10.2 Measurement Equipment Used

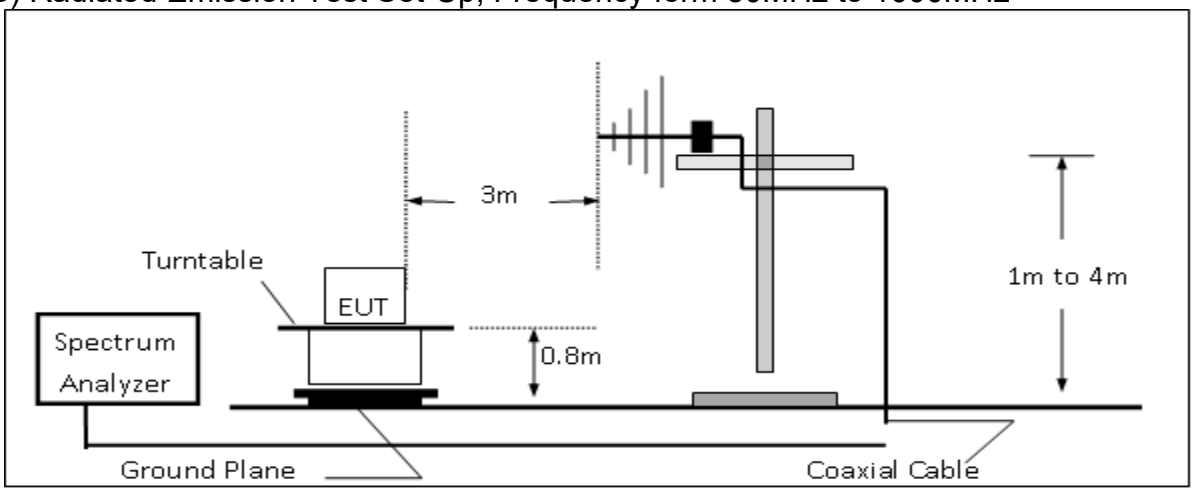
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	SCHWAZBECK	VULB9168	378	01/04/2019	01/03/2020
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/20/2019	08/19/2020
Horn Antenna	Schwarzbeck	BBHA9170	184	12/27/2018	12/26/2019
3m Site NSA	SGS	966 chamber	N/A	01/02/2019	01/01/2020
Loop Antenna	ETS.LINDGREN	6502	148045	10/15/2019	10/14/2020
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/22/2019	04/21/2020
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
Pre-Amplifier	HP	8449B	3008A00578	01/02/2019	01/01/2020
Pre-Amplifier	HP	8447D	2944A07676	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instru-ments	EMC184045B	980135	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2019	01/01/2020
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	01/02/2019	01/01/2020
High Pass Filter	WI	WHKX4.0/18G-10SS	22	01/01/2019	01/02/2020
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2019	01/01/2020

10.3 Test SET-UP

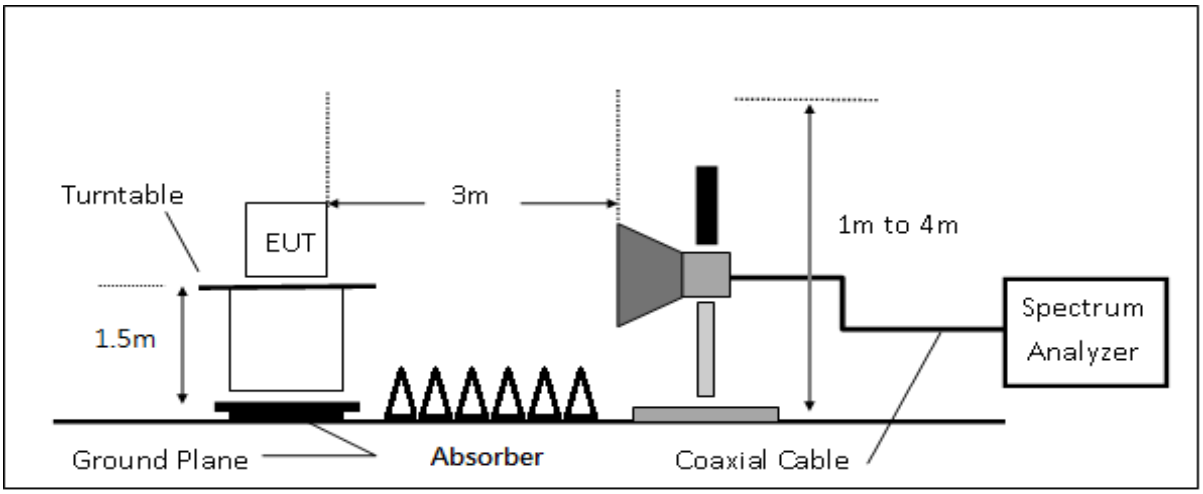
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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 0.8m for frequency> 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

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

*The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)*

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + 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.

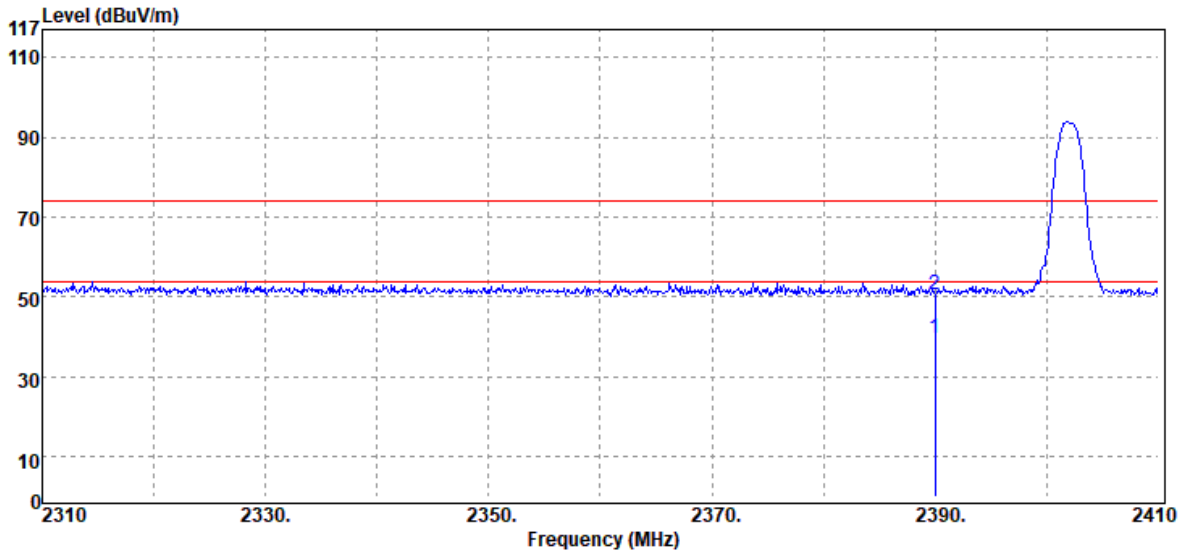
10.7 Measurement Result:

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

Radiated Band Edge Measurement Result (BLE mode)

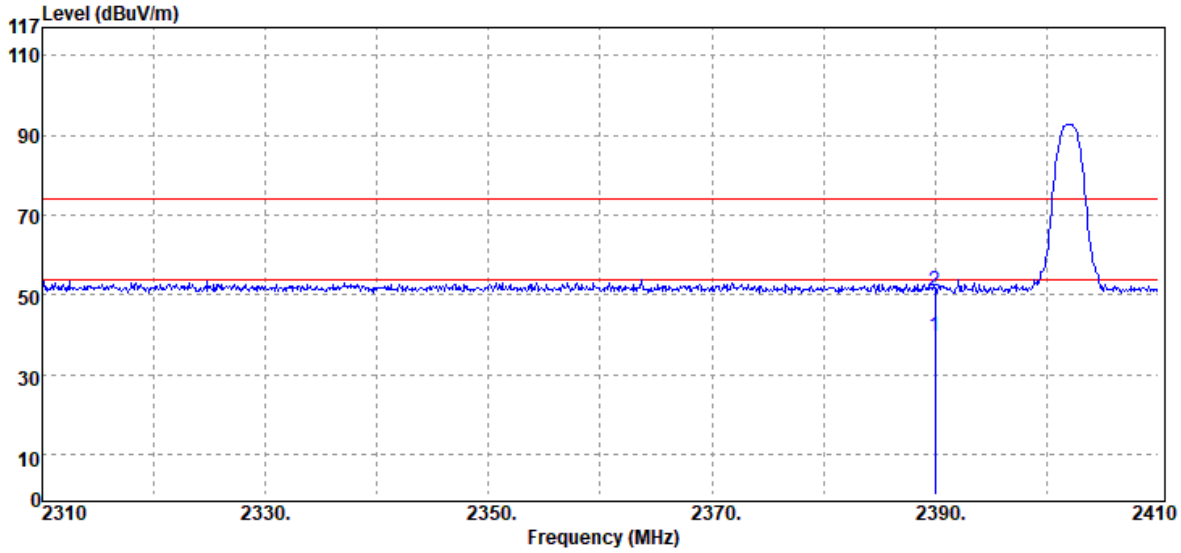
DATA RATE 1 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



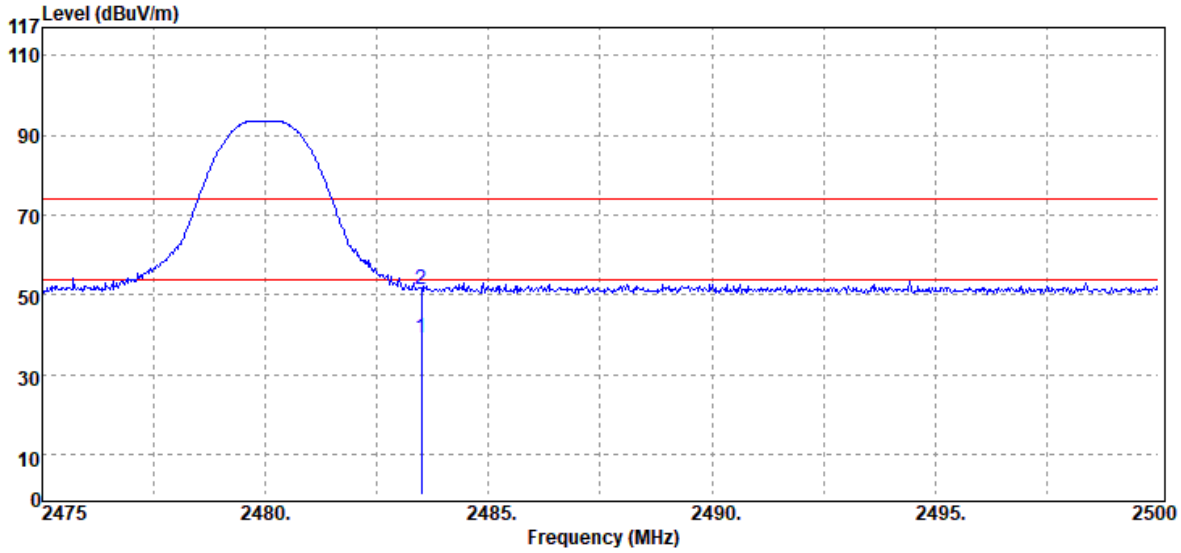
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	39.42	0.24	39.66	54.00	-14.34
2390.00	Peak	50.49	0.24	50.73	74.00	-23.27

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



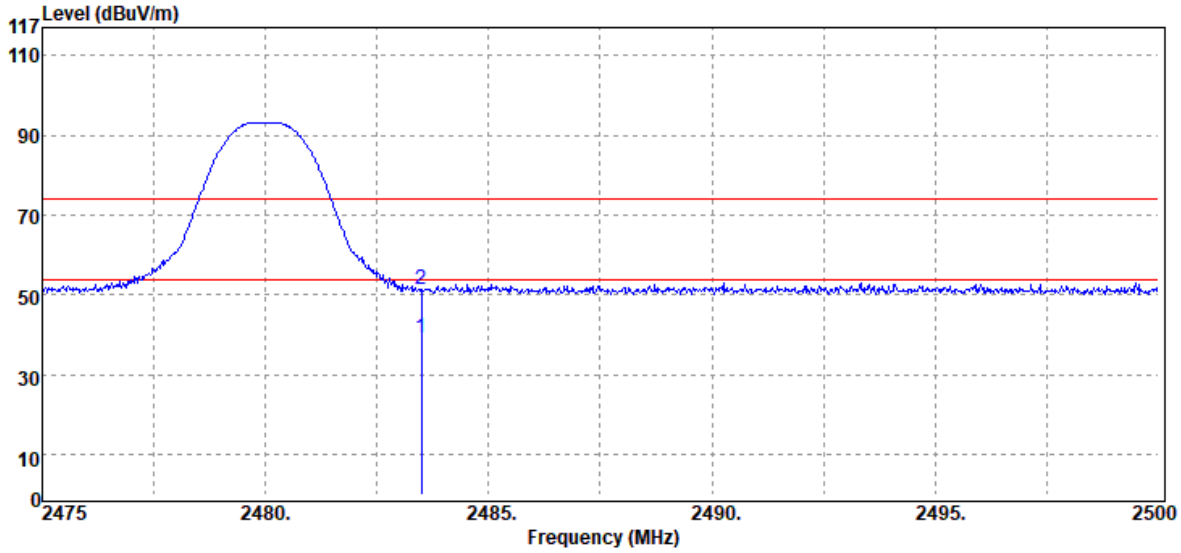
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	39.53	0.24	39.77	54.00	-14.23
2390.00	Peak	50.73	0.24	50.97	74.00	-23.03

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	39.52	-0.17	39.35	54.00	-14.65
2483.50	Peak	51.52	-0.17	51.35	74.00	-22.65

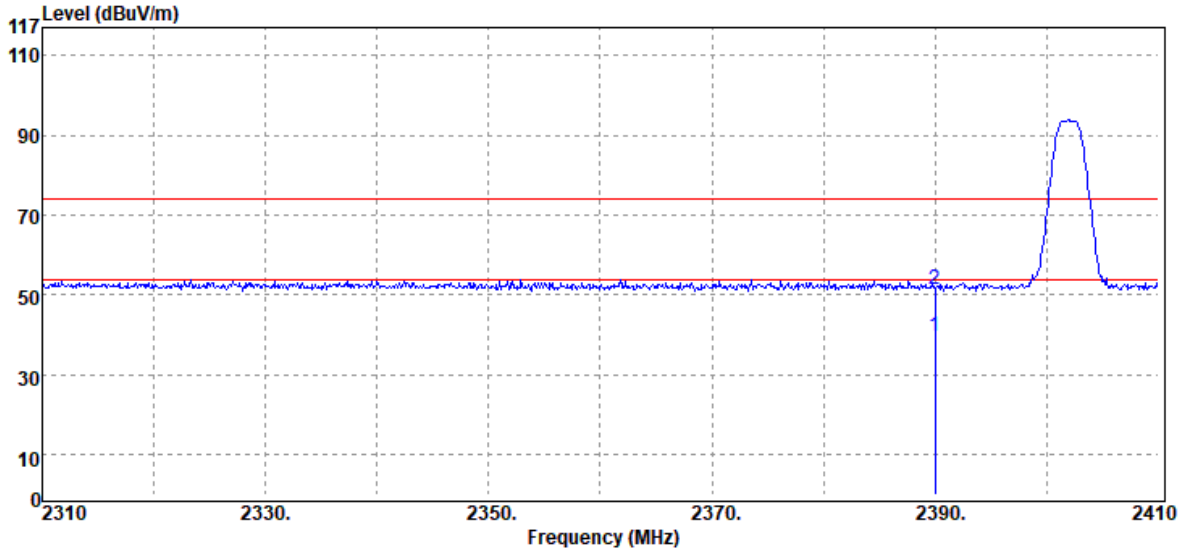
Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	39.47	-0.17	39.30	54.00	-14.70
2483.50	Peak	51.55	-0.17	51.38	74.00	-22.62

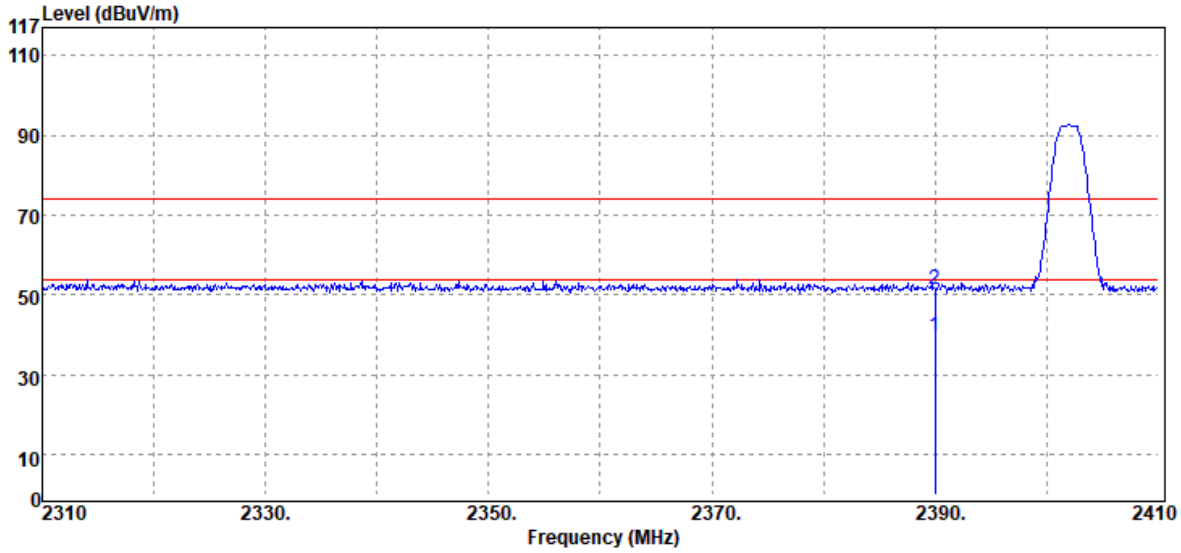
DATA RATE 2 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



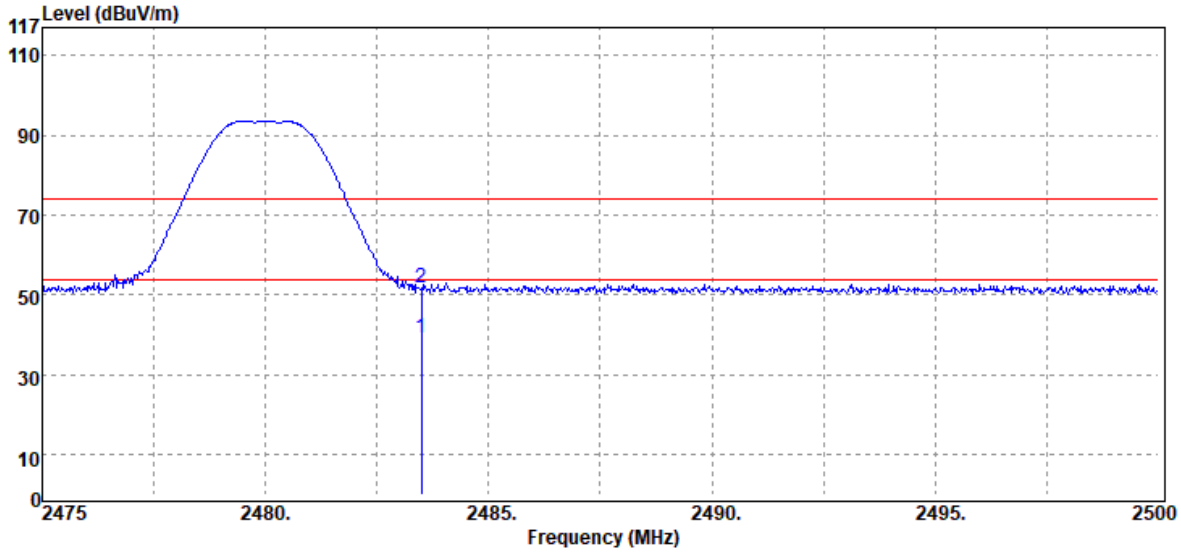
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	39.49	0.24	39.73	54.00	-14.27
2390.00	Peak	51.18	0.24	51.42	74.00	-22.58

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



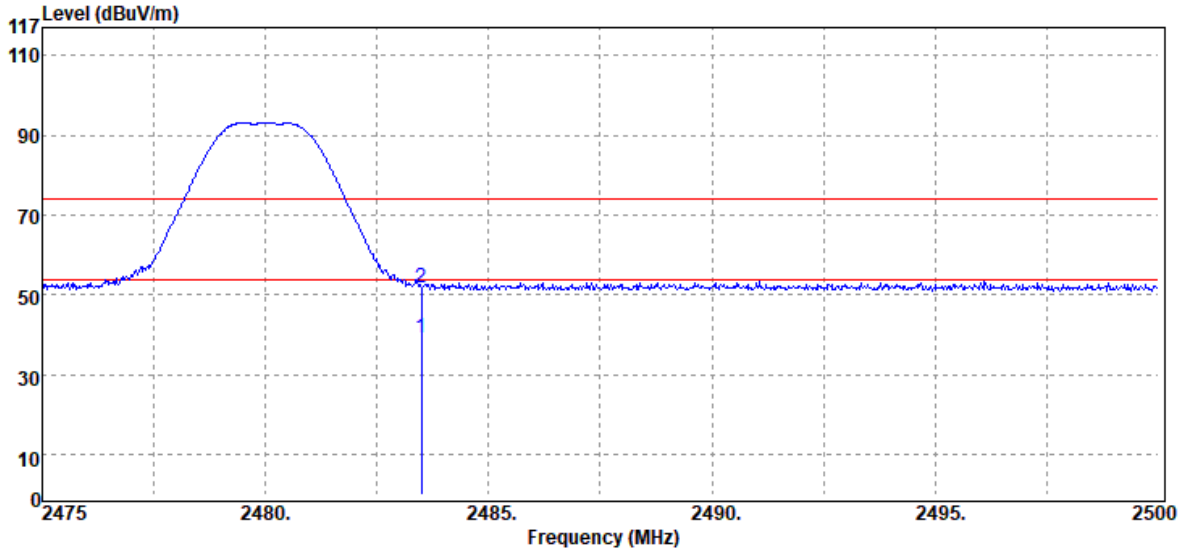
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	39.63	0.24	39.87	54.00	-14.13
2390.00	Peak	51.20	0.24	51.44	74.00	-22.56

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Bandedge CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	39.44	-0.17	39.27	54.00	-14.73
2483.50	Peak	51.80	-0.17	51.63	74.00	-22.37

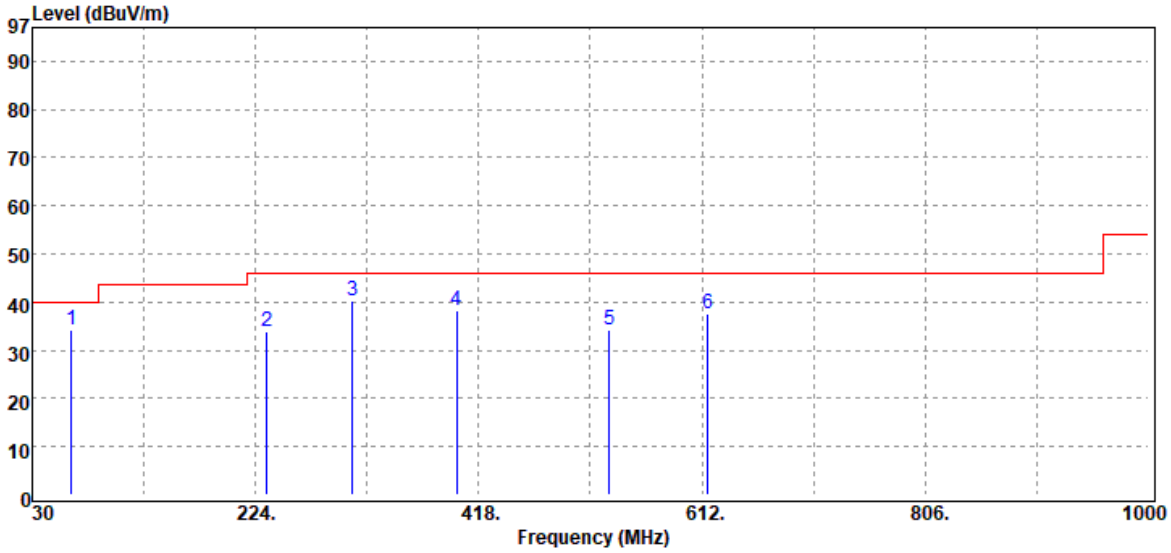
Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Bandedge CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	39.58	-0.17	39.41	54.00	-14.59
2483.50	Peak	52.10	-0.17	51.93	74.00	-22.07

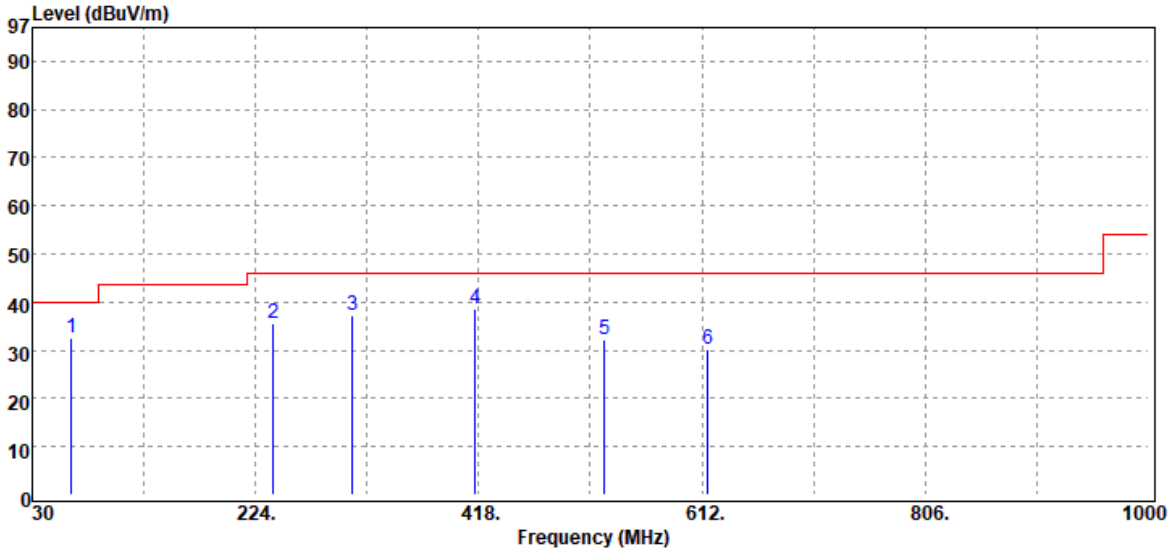
Radiated Spurious Emission Measurement Result: (BLE mode)
For Frequency from 30MHz to 1000MHz
DATA RATE 1 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
63.95	Peak	43.12	-8.97	34.15	40.00	-5.85
233.70	Peak	42.39	-8.56	33.83	46.00	-12.17
308.39	Peak	46.08	-5.93	40.15	46.00	-5.85
398.60	Peak	42.12	-3.93	38.19	46.00	-7.81
531.49	Peak	36.43	-2.11	34.32	46.00	-11.68
616.85	Peak	38.22	-0.51	37.71	46.00	-8.29

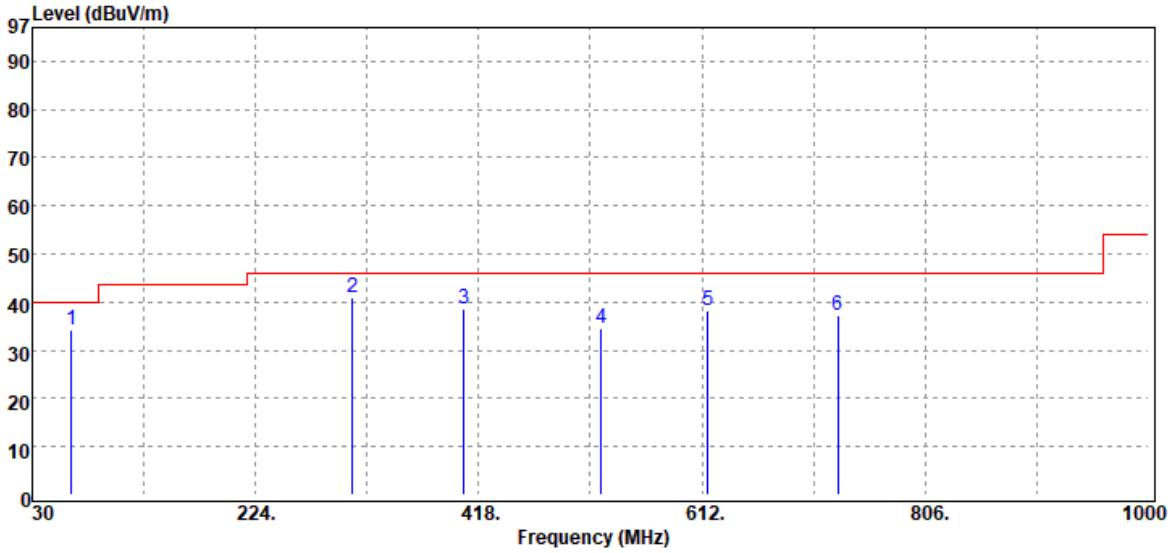
Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
63.95	Peak	41.43	-8.97	32.46	40.00	-7.54
239.52	Peak	43.64	-8.13	35.51	46.00	-10.49
308.39	Peak	43.27	-5.93	37.34	46.00	-8.66
415.09	Peak	42.14	-3.71	38.43	46.00	-7.57
527.61	Peak	34.26	-2.09	32.17	46.00	-13.83
616.85	Peak	30.56	-0.51	30.05	46.00	-15.95

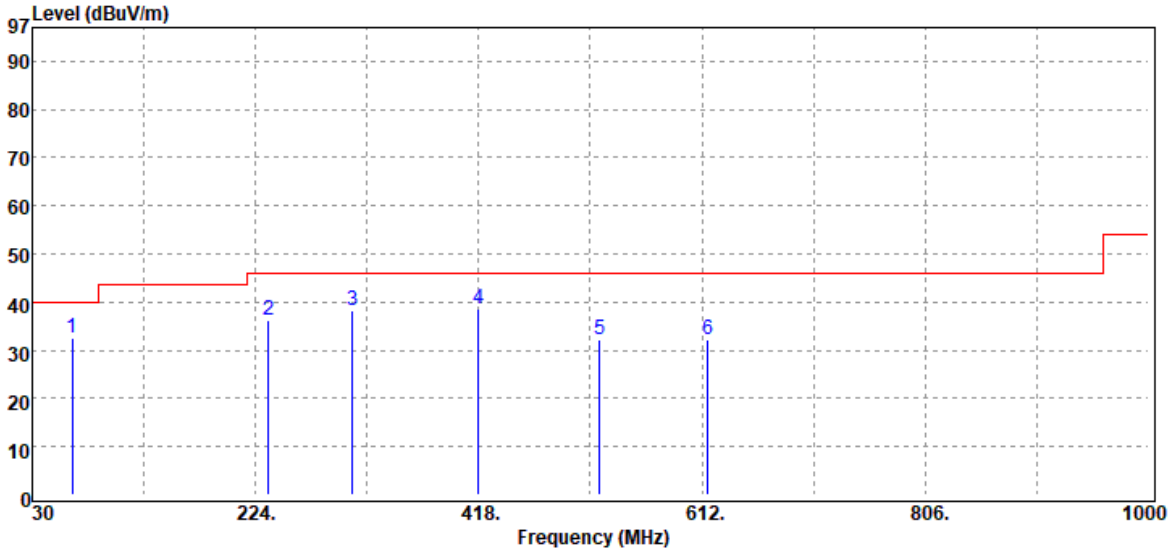
DATA RATE 2 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
63.95	Peak	43.19	-8.97	34.22	40.00	-5.78
308.39	Peak	46.78	-5.93	40.85	46.00	-5.15
405.39	Peak	42.16	-3.71	38.45	46.00	-7.55
524.70	Peak	36.49	-2.08	34.41	46.00	-11.59
616.85	Peak	38.89	-0.51	38.38	46.00	-7.62
730.34	Peak	35.84	1.48	37.32	46.00	-8.68

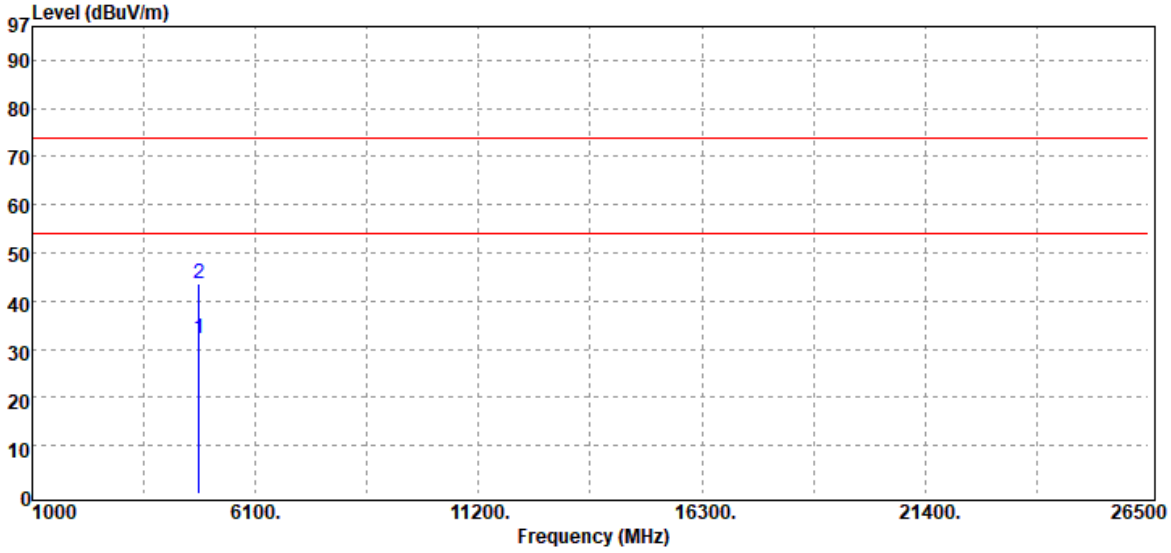
Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
64.92	Peak	41.65	-9.04	32.61	40.00	-7.39
235.64	Peak	44.83	-8.44	36.39	46.00	-9.61
308.39	Peak	44.09	-5.93	38.16	46.00	-7.84
418.00	Peak	42.45	-3.72	38.73	46.00	-7.27
522.76	Peak	34.34	-2.04	32.30	46.00	-13.70
616.85	Peak	32.90	-0.51	32.39	46.00	-13.61

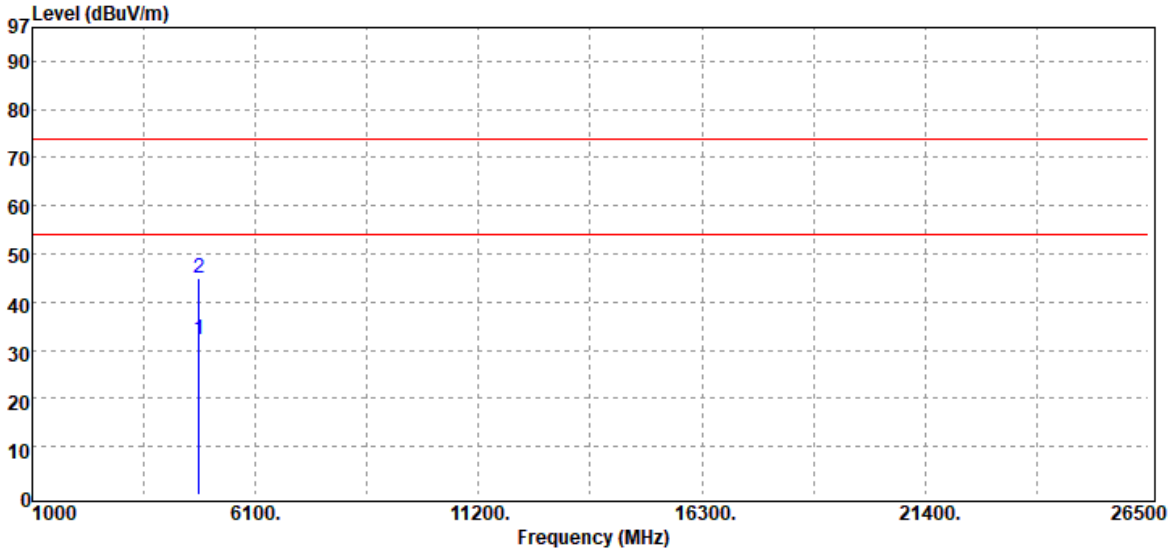
Radiated Spurious Emission Measurement Result: (BLE mode)
For Frequency above 1 GHz
DATA RATE 1 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



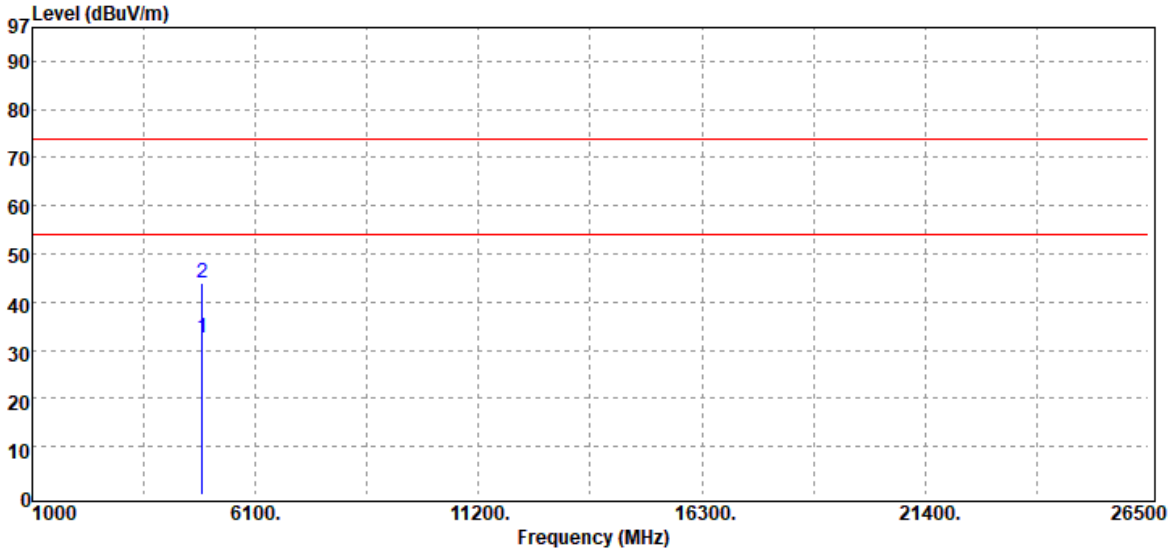
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	25.84	6.41	32.25	54.00	-21.75
4804.00	Peak	37.34	6.41	43.75	74.00	-30.25

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



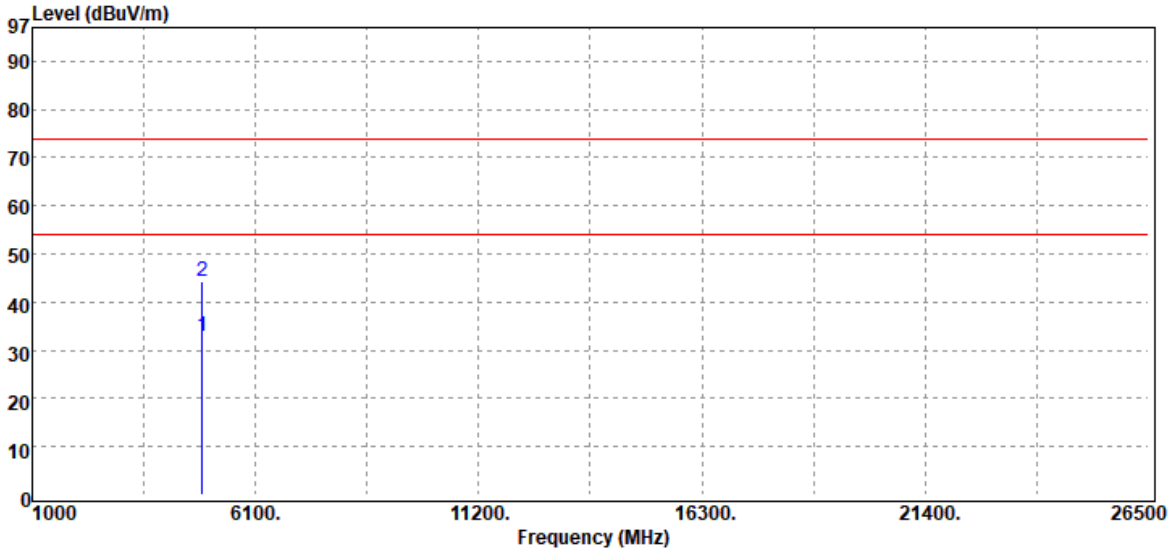
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	25.76	6.41	32.17	54.00	-21.83
4804.00	Peak	38.70	6.41	45.11	74.00	-28.89

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



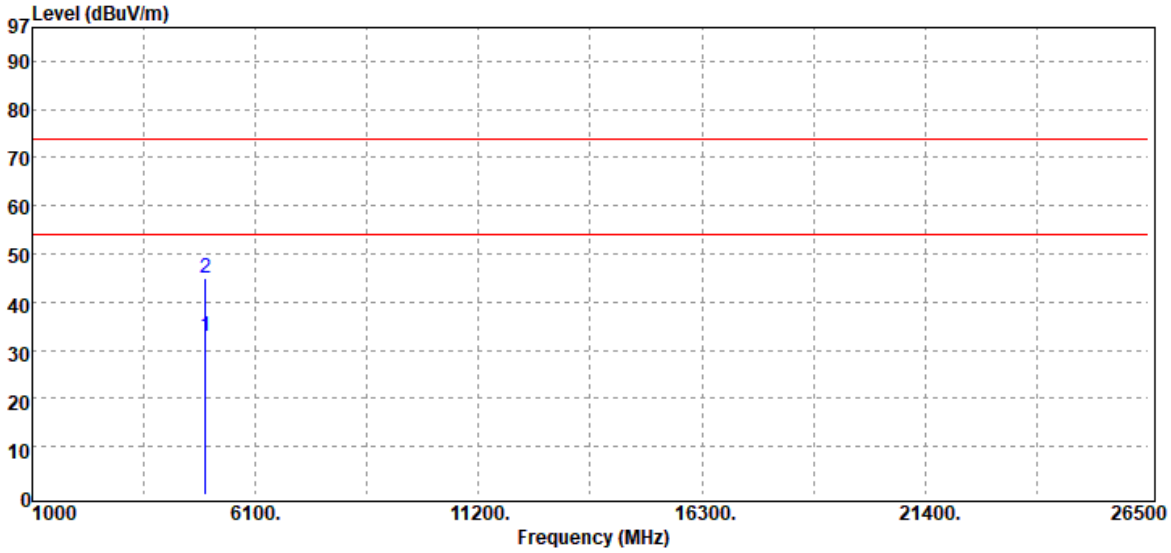
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4880.00	Average	25.94	6.70	32.64	54.00	-21.36
4880.00	Peak	37.31	6.70	44.01	74.00	-29.99

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



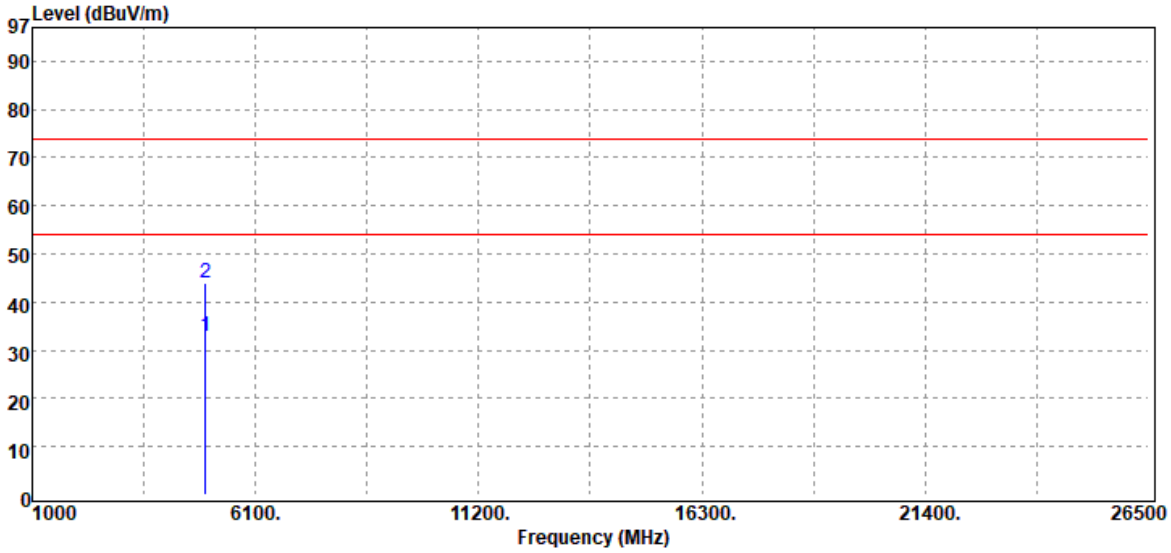
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4880.00	Average	26.11	6.70	32.81	54.00	-21.19
4880.00	Peak	37.61	6.70	44.31	74.00	-29.69

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Average	25.92	6.95	32.87	54.00	-21.13
4960.00	Peak	37.98	6.95	44.93	74.00	-29.07

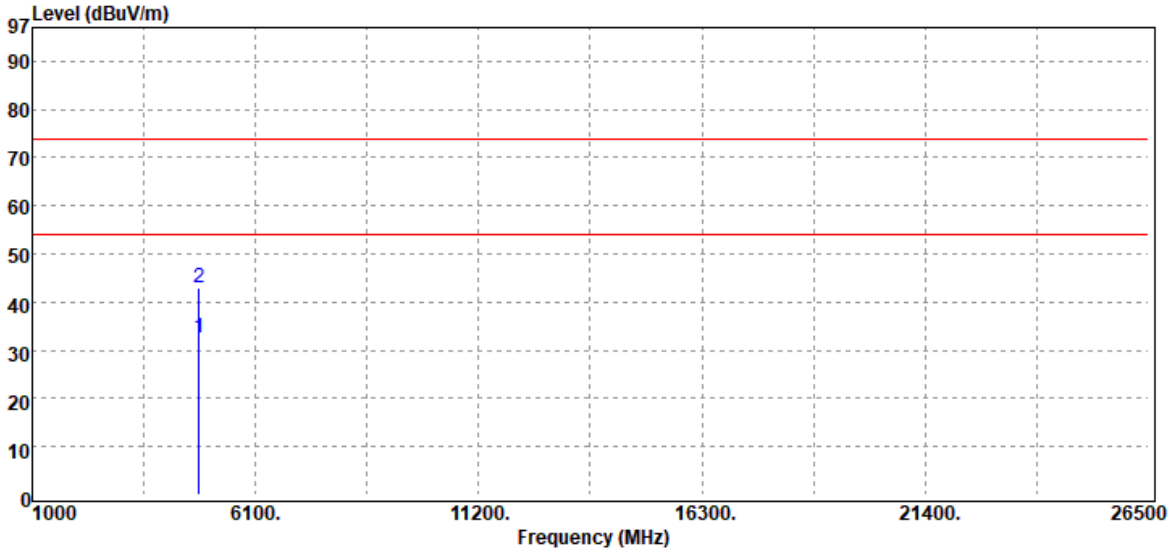
Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(1M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Average	25.85	6.95	32.80	54.00	-21.20
4960.00	Peak	36.90	6.95	43.85	74.00	-30.15

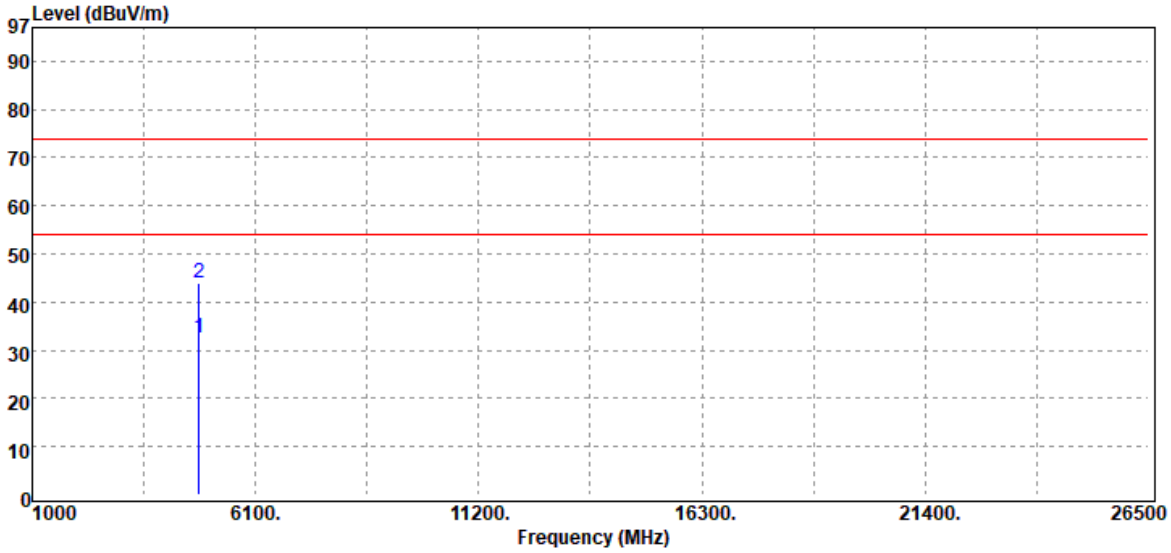
DATA RATE 2 Mbps:

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



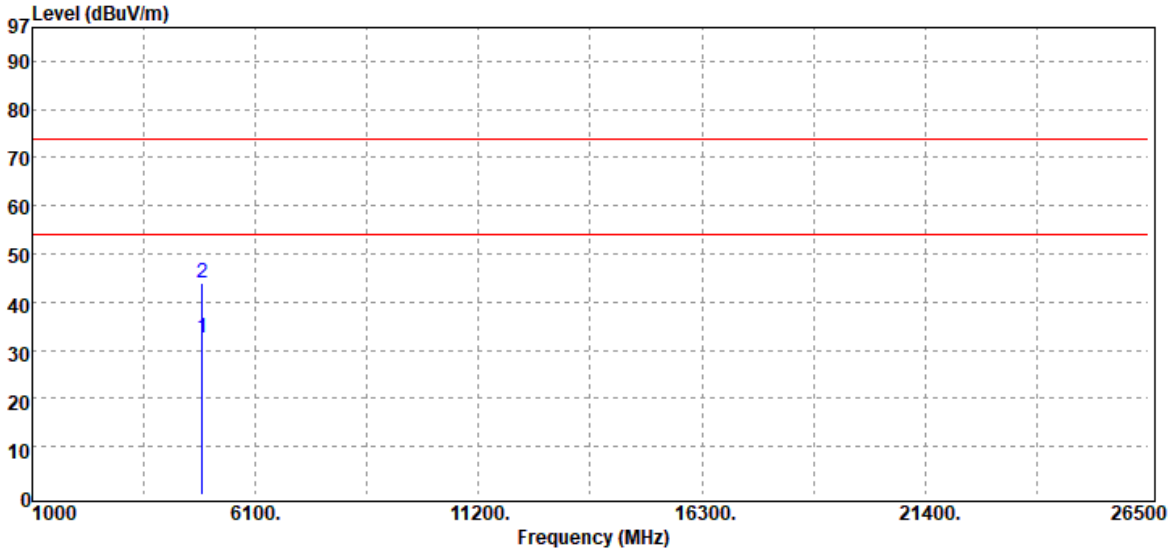
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	26.22	6.41	32.63	54.00	-21.37
4804.00	Peak	36.65	6.41	43.06	74.00	-30.94

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2402 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Low	Engineer	:Kane
EUT Pol	:E1 Plane		



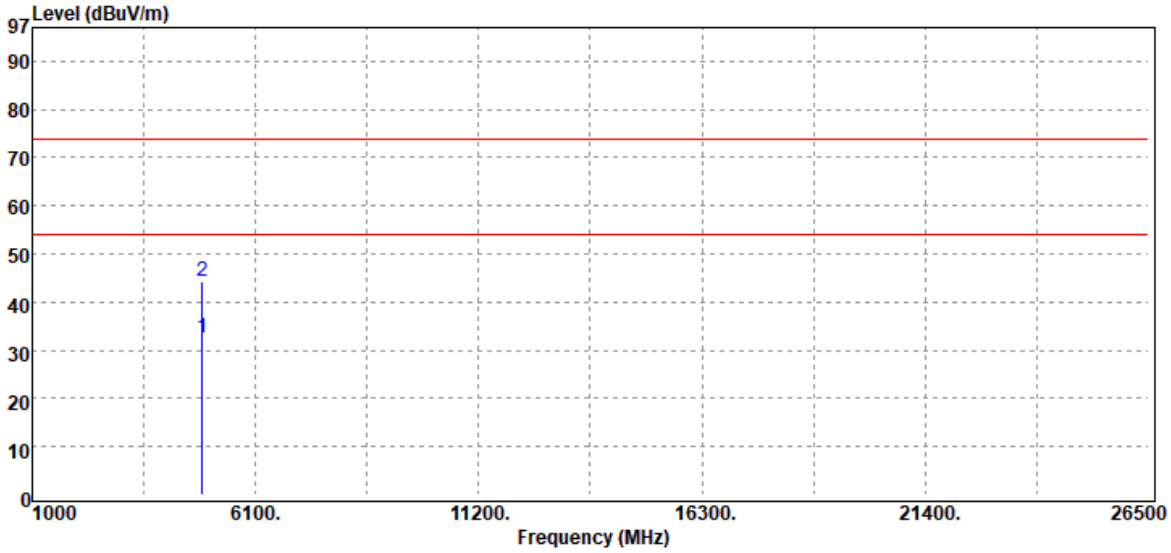
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	26.09	6.41	32.50	54.00	-21.50
4804.00	Peak	37.60	6.41	44.01	74.00	-29.99

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



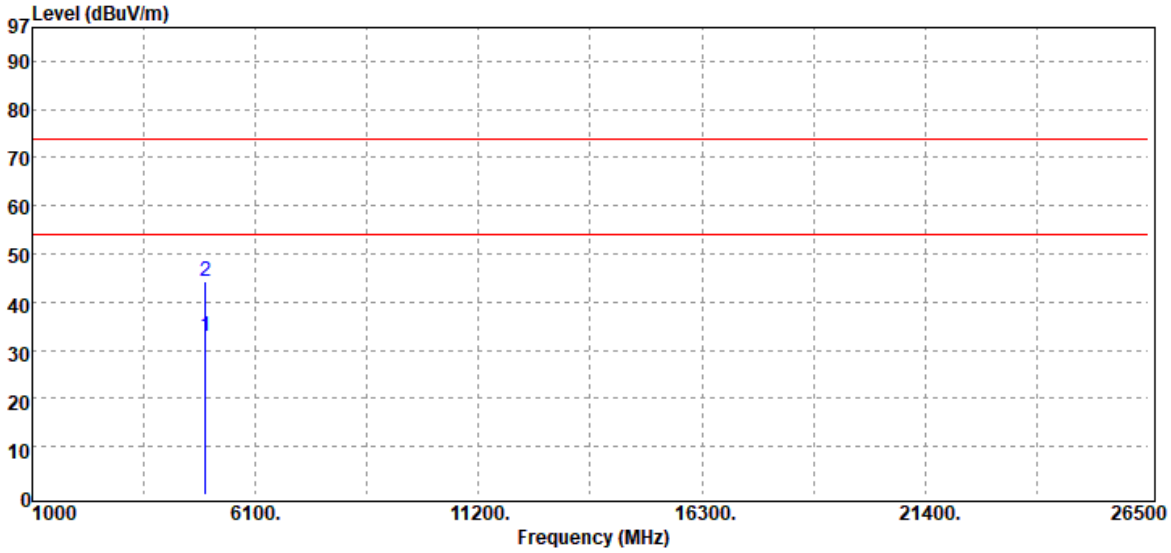
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4880.00	Average	25.92	6.70	32.62	54.00	-21.38
4880.00	Peak	37.35	6.70	44.05	74.00	-29.95

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2440 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Mid	Engineer	:Kane
EUT Pol	:E1 Plane		



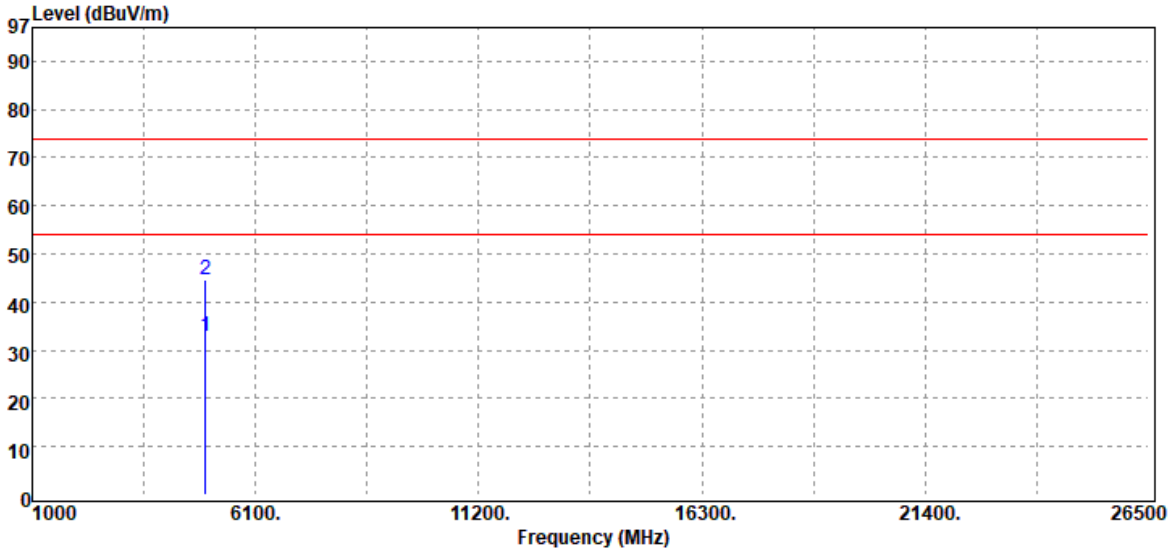
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4880.00	Average	25.96	6.70	32.66	54.00	-21.34
4880.00	Peak	37.58	6.70	44.28	74.00	-29.72

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Average	25.86	6.95	32.81	54.00	-21.19
4960.00	Peak	37.23	6.95	44.18	74.00	-29.82

Report Number	:ER/2019/A0104	Test Date	:2019-11-13
Operation Mode	:BLE(2M)	Temp./Humi.	:24.2/64
Test Channel	:2480 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH High	Engineer	:Kane
EUT Pol	:E1 Plane		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Average	25.91	6.95	32.86	54.00	-21.14
4960.00	Peak	37.75	6.95	44.70	74.00	-29.30

11. PEAK POWER SPECTRAL DENSITY

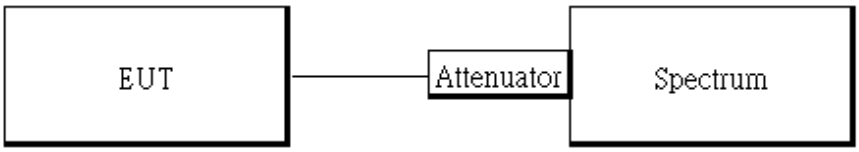
11.1 Standard Applicable:

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:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/04/2018	12/03/2019
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2019	01/01/2020

11.3 Test Set-up:



11.4 Measurement Procedure:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & 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.

11.5 Measurement Result:

DATA RATE 1 Mbps:

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-11.31	8	PASS
2440	-9.55	8	PASS
2480	-10.64	8	PASS

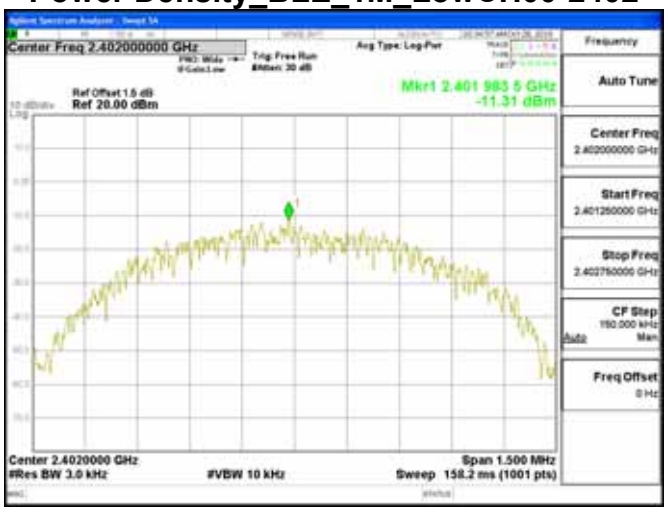
NOTE: cable loss as 1.5dB that offsets in the spectrum

DATA RATE 2 Mbps:

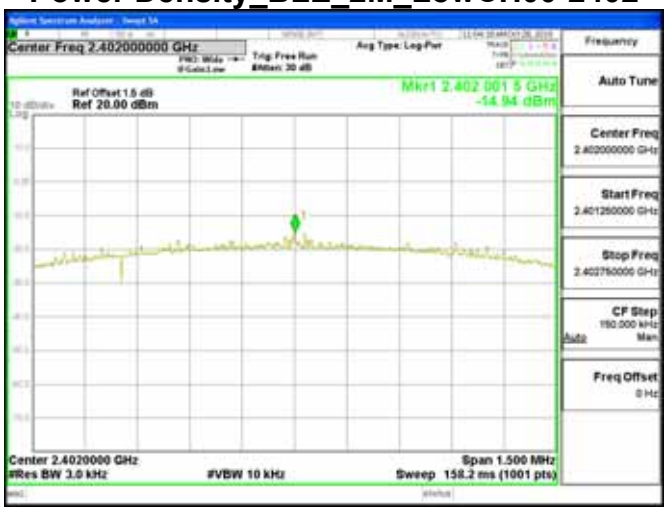
Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-14.94	8	PASS
2440	-13.19	8	PASS
2480	-14.40	8	PASS

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

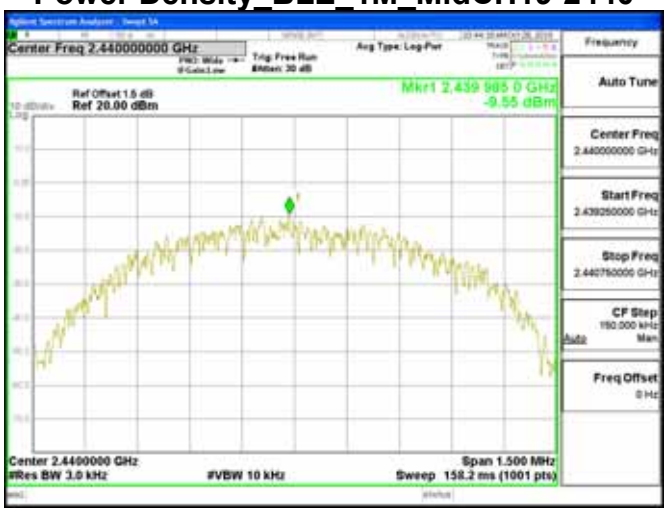
Power Density_BLE_1M_LowCH00-2402



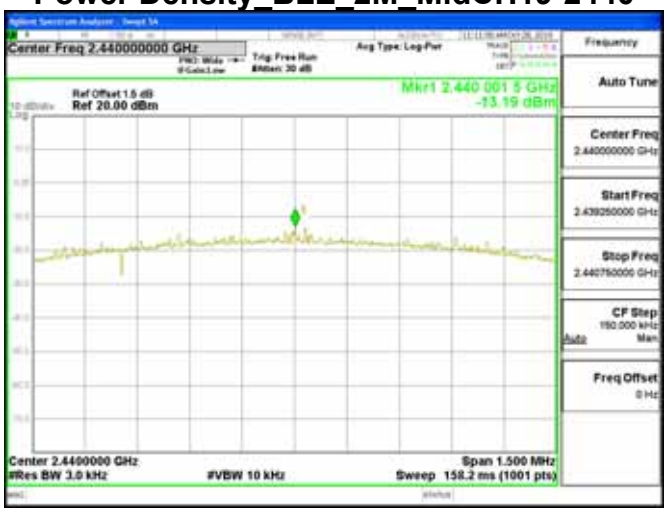
Power Density_BLE_2M_LowCH00-2402



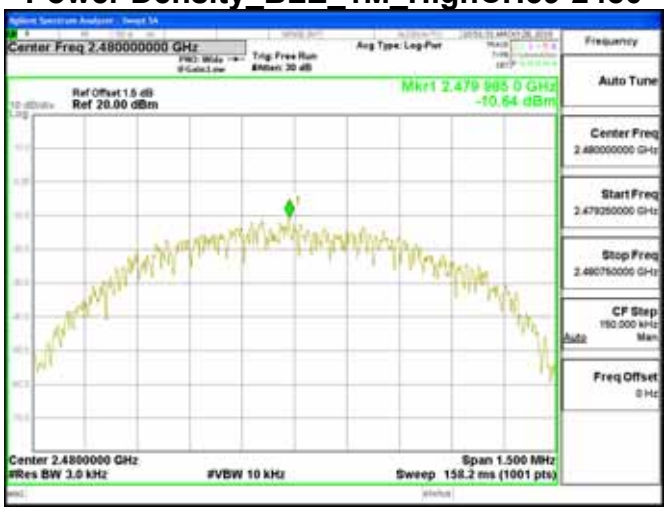
Power Density_BLE_1M_MidCH19-2440



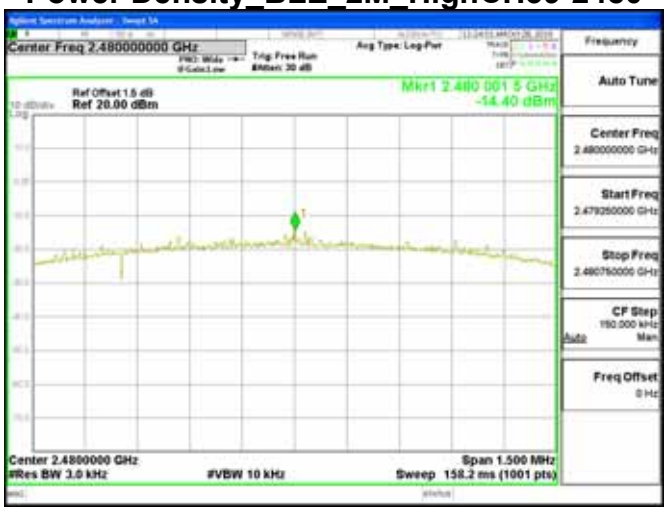
Power Density_BLE_2M_MidCH19-2440



Power Density_BLE_1M_HighCH39-2480



Power Density_BLE_2M_HighCH39-2480



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.

12.2 Antenna Connected Construction:

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

~ End of Report ~