Korea Technology Institute Co., Ltd.

Test Report

Test Report No.:	**KTI17EF07001**		
Registration No.:	**KR0023**		
Applicant:	**KingStone**		
Applicant Address:	**68-10, Godeok-ro 355 beon-gil, Yangju-si, Gyeonggi-do, 11480 SOUTH KOREA**		
Product:	**Bluetooth**		
FCC ID:	**2AMTE-POWER-SUPPLY**	**Model No.**	**HEXKO DC POWER SUPPLY**
Receipt No.:	**KTI17EK07001**	**Date of Incoming:**	**Jun 26, 2017**
Date of Issue:	**Jul 03, 2017**		
Testing location	**Korea Technology Institute Co., Ltd. 58-10, Sagiso-gil, Docheok-myeon, Gwangju-si, Gyeonggi-do, Korea**		
Test Standards:	**FCC PART 15 SUBPART C Section 15.247**		
Method of Measurement	**FCC Public Notice DA 00-705**		
Test Result:	**The above-mentioned product has been tested with compliance.**		

Tested by: W. J. Yun.
/ Engineer

Signature Date Jul 03, 2017

Approved by: S. H. Song
/Technical Manager

Signature Date Jul 03, 2017

Other Aspects:	
Abbreviations:	*** OK, Pass=passed * Fail=failed * N/A=not applicable**

☞ **- This test report is not permitted to copy partly without our permission.**

- This test result is dependent on only equipment to be used.

- This test result is based on a single evaluation of one sample of the above mentioned.

- We certify this test report has been based on the measurement standards that is traceable to the national or international standards.

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1. Verification of compliance

Applicant : KingStone

Address : 68-10, Godeok-ro 355beon-gil,
Yangju-si, Gyeonggi-do, 11480 SOUTH KOREA

FCC ID : 2AMTE-POWER-SUPPLY

Model Name : HEXKO DC POWER SUPPLY

Brand Name : HEXKO

Serial Number : N/A

Test Date : Jun 26, 2017

Equipment Class	DTS – DIGITAL TRNSMISSION SYSTEM
Kind of Equipment	Bluetooth
Measurement Procedures	ANSI C63.10: 2014
Type of Equipment Tested	Pre-Production
Kind of Equipment Authorization Requested	Certification
Equipment Will Be Operated Under FCC Rules Part(s)	FCC PART 15 SUBPART C Section 15.247
Modifications On The Equipment To Achieve Compliance	None
Final Test was Conducted On	10m Open area test site

- The above equipment was tested by Korea Technology Institute Co., Ltd. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanation from equipment are within the compliance requirements.

2. General Information

2.1 Product Description

BPAY-CAG-01 (referred to in this report as EUT) is used as a Power Supply.

The product specification described herein was obtained from product data sheet or user's manual.

Equipment Name	HEXKO DC POWER SUPPLY
Operating Frequency	2402 MHz ~ 2480 MHz
RF Output Power	-1.81 dBm
Number of Channel	40 Channels
Modulation Type	GFSK
Antenna Type / Gain	Dielectric Chip Antenna / -2.68 dBi (Max)
List of Each OSC. Or Crystal. Freq.	180 MHz
Rated Supply Voltage	DC 19.0 V

3. Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 440 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XZ" axis, but the worst data was recorded in this report.

4.Configuration of Test System

4.1 Radiated Emission Test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2014 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

4.2 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The antenna of the EUT is a Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

5. Test Summary

5.1 Test Items and results

SECTION	TEST ITEMS	RESULT
15.247 (a) (2)	Minimum 6 dB Bandwidth	Pass
15.247 (b) (3)	Maximum Peak Conducted Output Power	Pass
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Pass
15.247 (d)	Radiated Emission which fall in the Restricted Band	Pass
15.247 (e)	Peak Power Spectral Density	Pass
15.209	Radiated Emission Limits	Pass
15.203	Antenna Requirement	Pass
15.207 (a)	Conducted Emission	Pass

Notes: The EUT complies with the essential requirements in the standard.

N/A : The test was not applicable in the standard.

5.2 Additions, deviations, exclusions from standard

No additions, deviations or exclusions have been made from standard.

5.3 Related Submittal(s) / Grant(s)

Original submittal only

5.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

5.5 Test Methodology

The radiated testing was performed according to the procedures in ANSI C63.4:2014 at a distance of 3 m from EUT to the antenna

5.6 Test Facility

The open area test site and conducted measurement facilities are located on at 58-10, Sagiso-gil, Docheok-myeon, Gwangju-si, Gyeonggi-do, Korea

6. System test Configuration

6.1 Characteristics of equipment

This is a Bluetooth device that uses only BLE(Bluetooth Low Energy) mode.

Frequency band is 2 402 ㎒ - 2 480 ㎒ Power source is supplied DC 19 V.

6.2 Used Peripherals list

DEVICE TYPE	Manufacturer	Model	S/N
Notebook PC	SAMSUNG	NT905S3G	0E3X91IF900193P
Notebook PC Adapter	SAMSUNG	A13-040N2A	AD-4019A
Power Supply	Agilent Technology	E3634A	MY40000983
Jig Board	N / A	N / A	-

6.3 Mode of operation during the test

For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel(2 402 MHz), Middle Channel(2 440 MHz), and High Channel(2 480 MHz) with each data transfer rate. To get a maximum radiated emission levels from EUT, the EUT was moved throughout the XY, XZ, and YZ planes and rotated.

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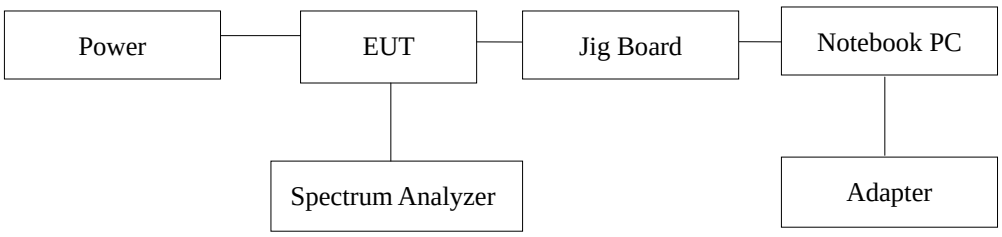
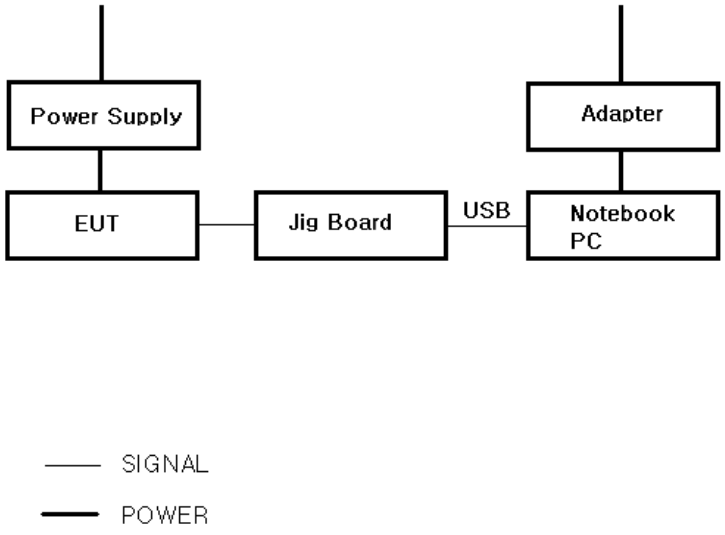
6.5 Test setup of EUT

6.5.1 Except Radiated Emissions and Emissions measurement, all measurements were taken in continuous transmit / receive mode using the TEST MODE.
For controlling the EUT as TEST MODE, the test program was provided by the applicant.
The jig board controlled EUT by Notebook PC in TEST MODE.



6.5.2 Radiated Emission and Conducted Emissions measurement Setup



7. Measurement results

7.1 MINIMUM 6 dB BANDWIDTH

Temperature : 20℃

Relative Humidity 42 % R.H.

Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.

Test equipment used

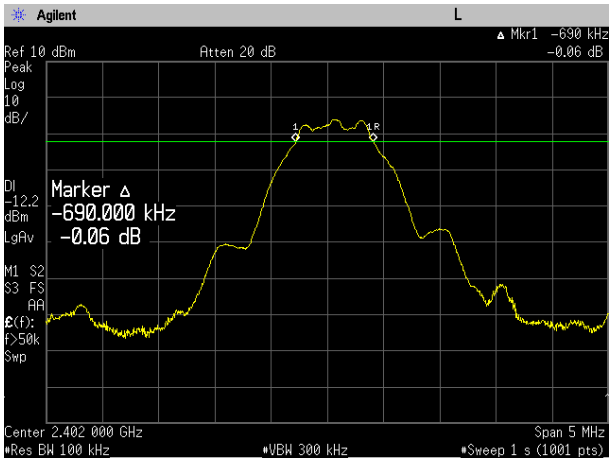
Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
E4440A	Agilent Technology	3 ㎐ – 26.5 ㎓	US40420682	2017.05.31	1 Year

Measurement Result

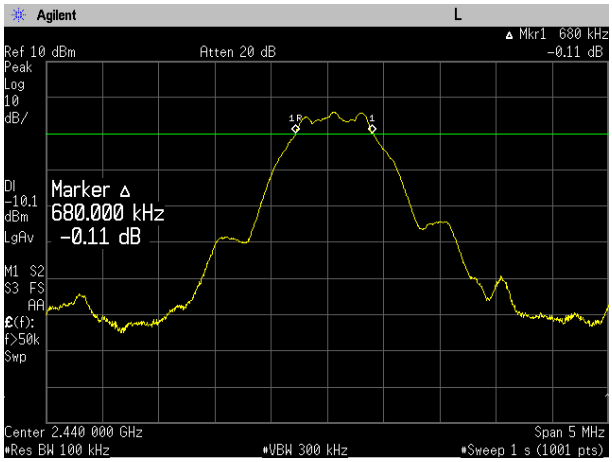
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (kHz)	MIN LIMIT (kHz)
Low	2 402.0	690	500
Middle	2 440.0	680	500
High	2 480.0	695	500

-See next pages for actual measured spectrum plots.

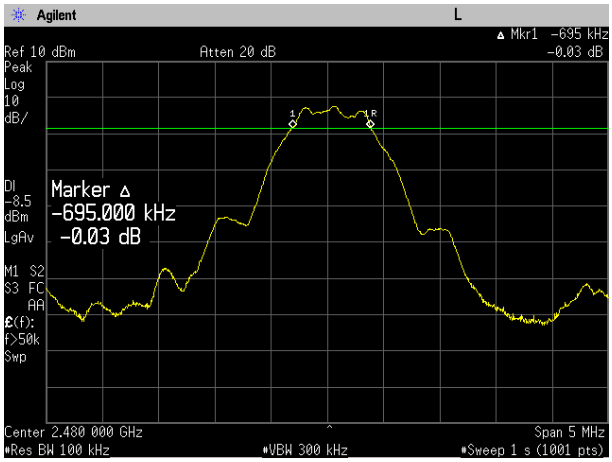
BLE Mode, 2402 MHz



BLE Mode, 2440 MHz



BLE Mode, 2480 MHz



7.2 MAXIMUM PEAK OUTPUT POWER

Temperature : 20℃

Relative Humidity : 42 % R.H.

Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.

Test equipment used

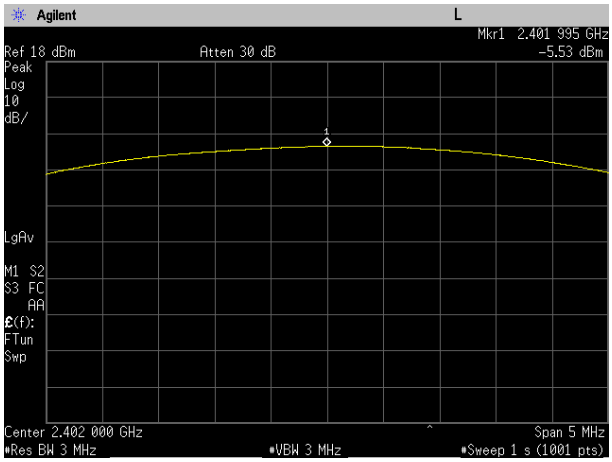
Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
E4440A	Agilent Technology	3 ㎐ – 26.5 ㎓	US40420682	2017.05.31	1 Year

Measurement Result

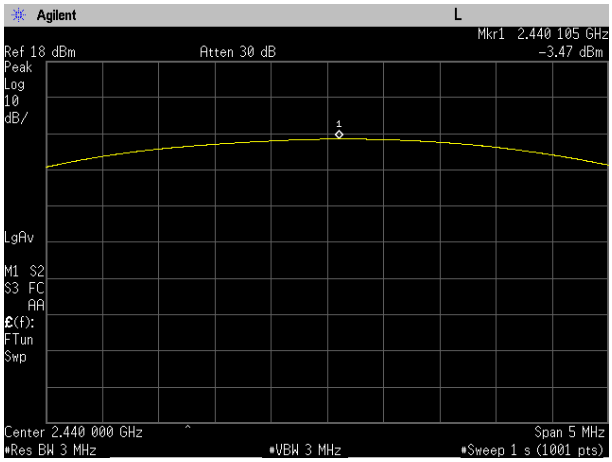
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)
Low	2 402.0	-5.53	30.00
Middle	2 440.0	-3.47	30.00
High	2 480.0	-1.81	30.00

-See next pages for actual measured spectrum plots.

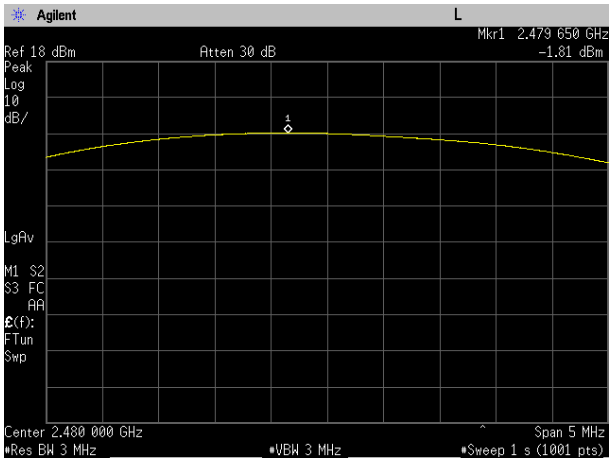
BLE Mode, 2402 MHz



BLE Mode, 2440 MHz



BLE Mode, 2480 MHz



7.3 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

Temperature : 20℃

Relative Humidity : 42 % R.H.

Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used

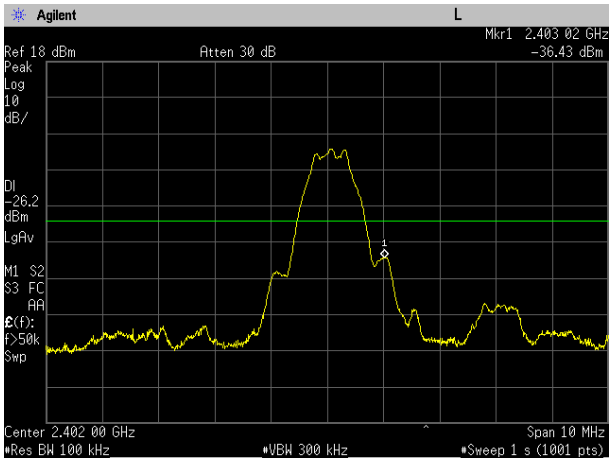
Test equipment used

Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
E4440A	Agilent Technology	3 ㎐ – 26.5 ㎓	US40420682	2017.05.31	1 Year

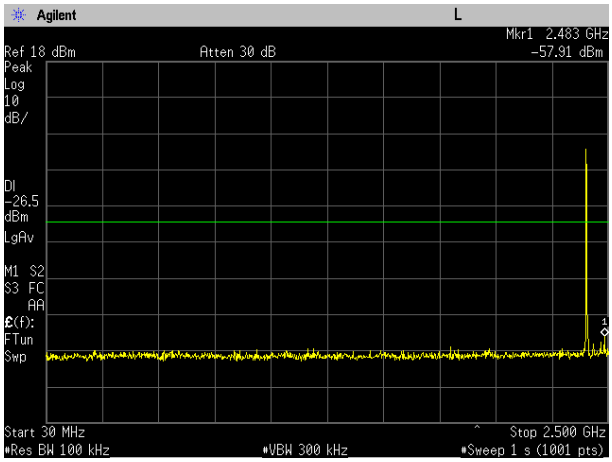
Measurement Data:

See next pages for actual measured spectrum plots.

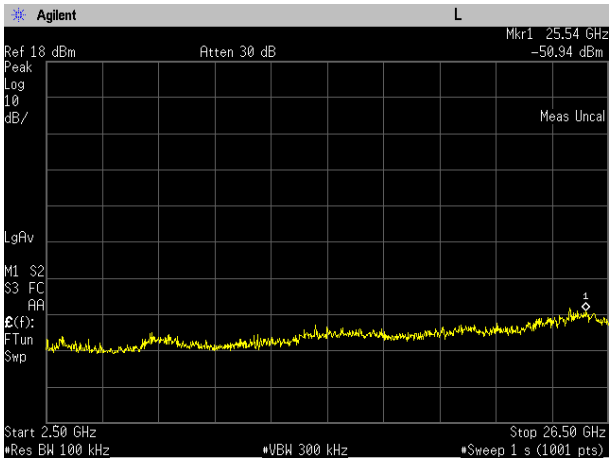
BLE Mode, 2402 MHz, Center



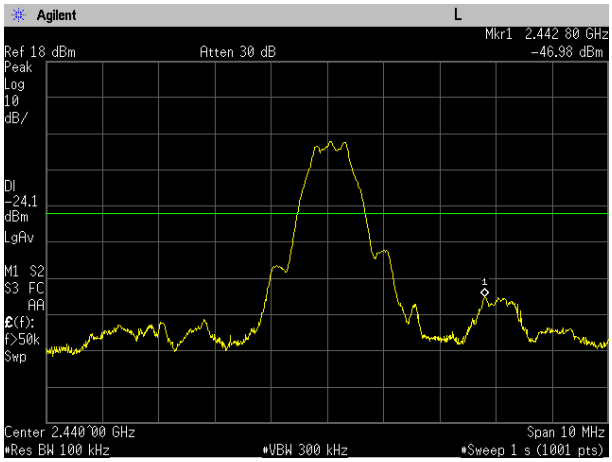
BLE Mode, 2402 MHz, 30 MHz ~ 2.5 GHz



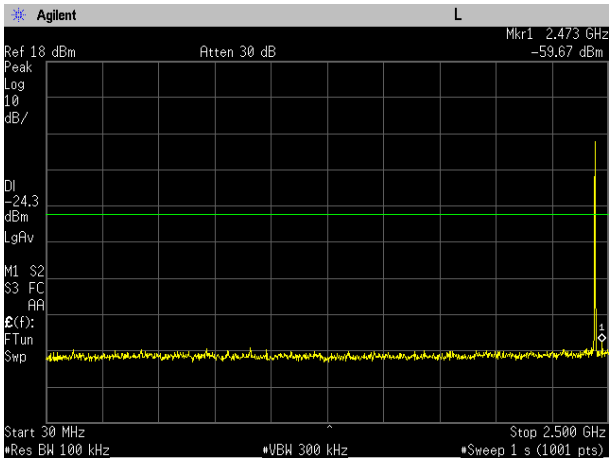
BLE Mode, 2402 MHz, 2.5 GHz ~ 26.5 GHz



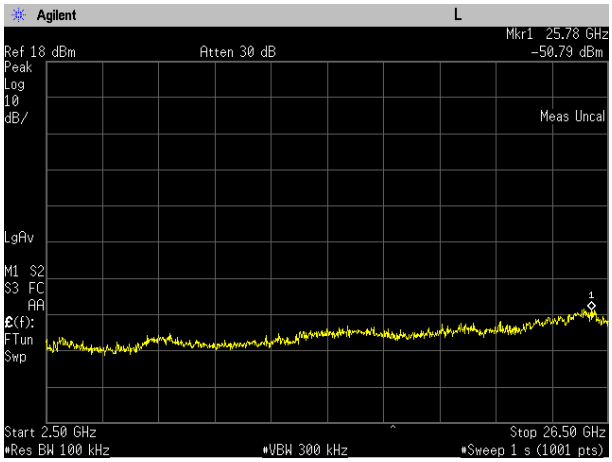
BLE Mode, 2440 MHz, Center



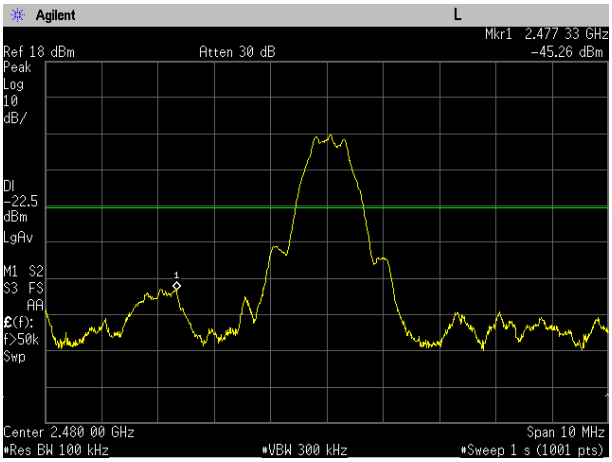
BLE Mode, 2440 MHz, 30 MHz ~ 2.5 GHz



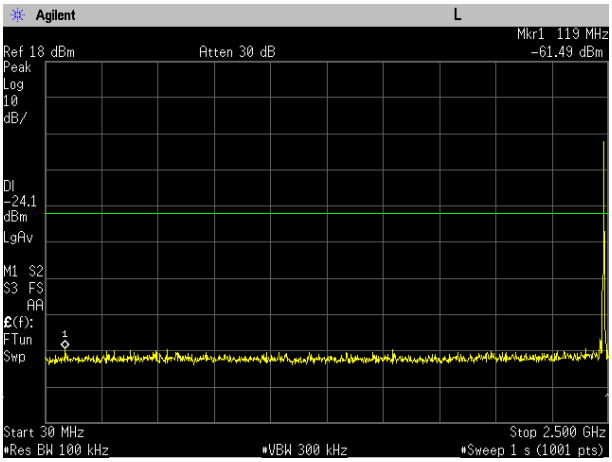
BLE Mode, 2440 MHz, 2.5 GHz ~ 26.5 GHz



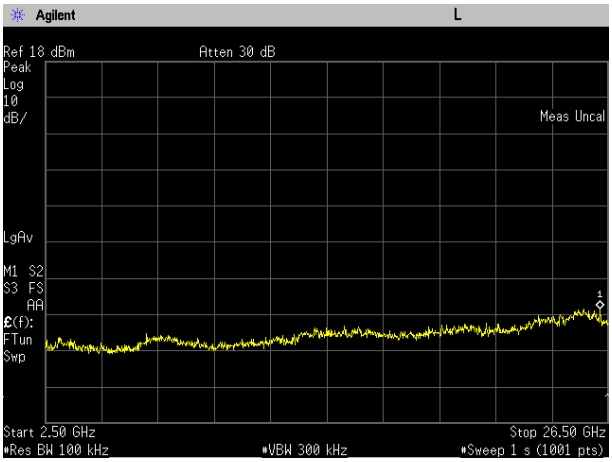
BLE Mode, 2480 MHz, Center



BLE Mode, 2480 MHz, 30 MHz ~ 2.5 GHz



BLE Mode, 2480 MHz, 2.5 GHz ~ 26.5 GHz



7.4 PEAK POWER SPECTRAL DENSITY

Temperature : 20℃

Relative Humidity : 42 % R.H

Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to 3 kHz ≤ RBW ≤100 kHz , the video bandwidth is set to 3 times the resolution bandwidth.

Test equipment used

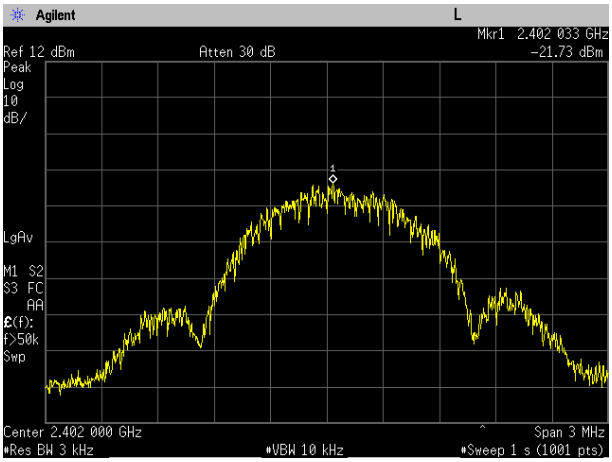
Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
E4440A	Agilent Technology	3 ㎐ – 26.5 ㎓	US40420682	2017.05.31	1 Year

Measurement Data:

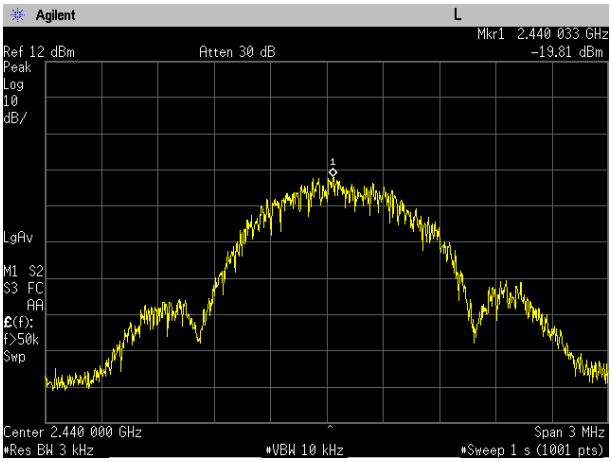
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)
Low	2 402.00	-21.73	8.00
Middle	2 440.00	-19.81	8.00
High	2 480.00	-18.04	8.00

- See next pages of actual measured spectrum plots.

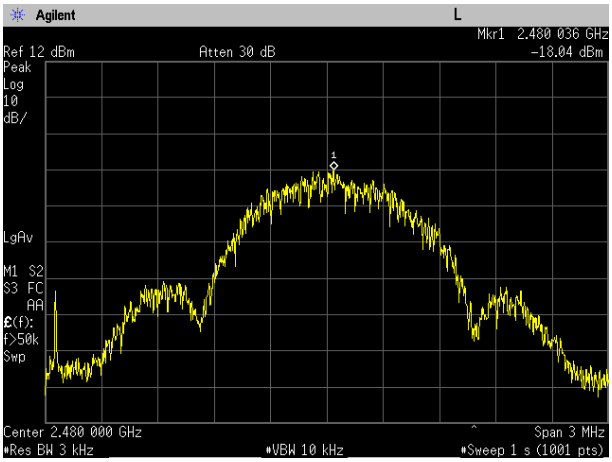
BLE Mode, 2402 MHz



BLE Mode, 2440 MHz



BLE Mode, 2480 MHz



7.5 Radiated Emission which fall in the Restricted Band

Temperature : 24℃

Relative Humidity : 53 % R.H

Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
EMI RECEIVER	ESIB40	Rohde & chwarz	100093	2016.07.11	1 Year
Horn Antenna	KTI-HD-1080	KTI	130003	2016.11.14	2 Year
Biconic Logarithmic Periodic Antenna	VULB9163	Schwarzbeck	9163-281	2016.11.21	2 Year
Loop Antenna	6502	EMCO	3434	2016.11.07	2 Year
PREAMPLIFIER	8449B	AGILENT	3008A02104	2016.08.05	1 Year
TURNTABLE	K401	KTI	K100	-	-
ANTENNA MAST	K402	KTI	K200	-	-
CONTORLLER	K401OS	KTI	K300	-	-

-

7.5.1 Spurious Radiated Emission above 1 GHz

TestData

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Cable Loss	Ant. Factor	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)
Test Data for Low Channel								
2388.0	37.84	Peak	H	13.03	28.58	27.05	52.4	74.00
	25.04	Average	H				39.6	54.00
2389.6	38.44	Peak	V	13.03	28.58	27.05	53.0	74.00
	25.24	Average	V				39.8	54.00
Test Data for Middle Channel								
2427.2	38.51	Peak	H	13.14	28.70	27.05	53.3	74.00
	25.21	Average	H				40.0	54.00
2436.8	37.75	Peak	V	13.17	28.73	27.05	52.6	74.00
	24.85	Average	V				39.7	54.00
Test Data for High Channel								
2467.6	37.39	Peak	H	13.25	28.82	27.06	52.4	74.00
	24.79	Average	H				39.8	54.00
2475.2	36.53	Peak	V	13.28	28.85	27.06	51.6	74.00
	24.93	Average	V				40.0	54.00

7.5.2 Spurious Radiated Emission below 1 GHz

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Cable Loss	Ant. Factor	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)
Test Data for Low Channel								
56.68	17.21	Peak	H	1.12	12.69	27.63	3.39	40.00
159.72	32.52	Peak	H	2.07	8.47	27.60	15.46	43.50
360.96	32.17	Peak	H	3.96	14.84	27.97	23.00	46.00
49.60	31.73	Peak	V	0.87	13.33	27.63	18.30	40.00
182.08	34.69	Peak	V	2.46	9.56	27.63	19.08	43.50
376.92	18.34	Peak	V	4.13	15.25	28.00	9.72	46.00
Test Data for Middle Channel								
49.32	14.85	Peak	H	0.86	13.38	27.63	1.46	40.00
165.80	30.45	Peak	H	2.18	8.75	27.61	13.77	43.50
360.80	31.77	Peak	H	3.96	14.84	27.97	22.60	46.00
65.64	20.44	Peak	V	1.34	10.40	27.62	4.56	40.00
129.92	28.07	Peak	V	1.68	8.38	27.59	10.54	43.50
252.24	28.07	Peak	V	2.85	12.62	27.71	15.83	46.00
Test Data for High Channel								
74.12	29.20	Peak	H	1.43	8.23	27.62	11.24	40.00
160.64	32.39	Peak	H	2.09	8.52	27.61	15.39	43.50
360.68	28.67	Peak	H	3.96	14.84	27.97	19.50	46.00
64.48	20.06	Peak	V	1.30	11.08	27.62	4.82	40.00
175.68	30.87	Peak	V	2.37	9.21	27.63	14.82	43.50
321.48	20.83	Peak	V	3.43	13.82	27.83	10.25	46.00

7.5.3 Spurious Radiated Emission below 30 MHz

Frequency (MHz)	Ant. Pol. (H/V)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dBμV/m)
It was not observed any emissions from the EUT				

7.6 Conducted Emissions

Temperature : 20℃

Relative Humidity : 42 % R.H

Test set-up for radiated measurement

AC power line conducted emissions from the EUT were measured according to the dictates ANSI C63.4:2014.

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold.

While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m).

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Last Cal	Cal Interval
Field Strength Meter	ESIB40	Rohde & Schwarz	100093	2016.07.11	1 Year
LISN	AFJ LS16C	AFJ INSTRUMENTS	16011328326	2016.12.06	1 Year
LISN	ESH2-Z5	Rohde & Schwarz	100017	2016.07.21	1 Year

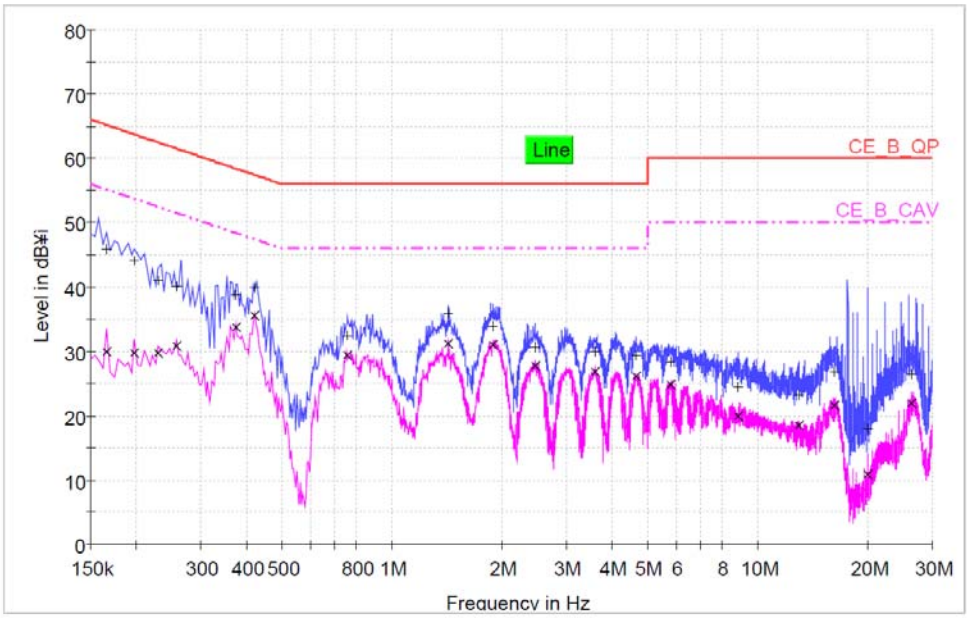
Measurement Data

Frequency (MHz)	(1) Reading (dBμV)		Line	(2) Limit (dBμV)		(3) Margin (dB)	
	QP	AV		QP	AV	QP	AV
0.23	41.1	29.8	L1	62.4	52.4	21.4	22.6
1.89	33.9	31.1	L1	56	46	22.1	14.9
12.95	23.3	18.5	L1	60	50	36.7	31.5
0.42	40.2	36.7	L2	57.4	47.4	17.2	10.7
1.88	34.2	31.3	L2	56.0	46.0	21.8	14.7
15.96	27.0	21.3	L2	60	50.0	33.0	28.7

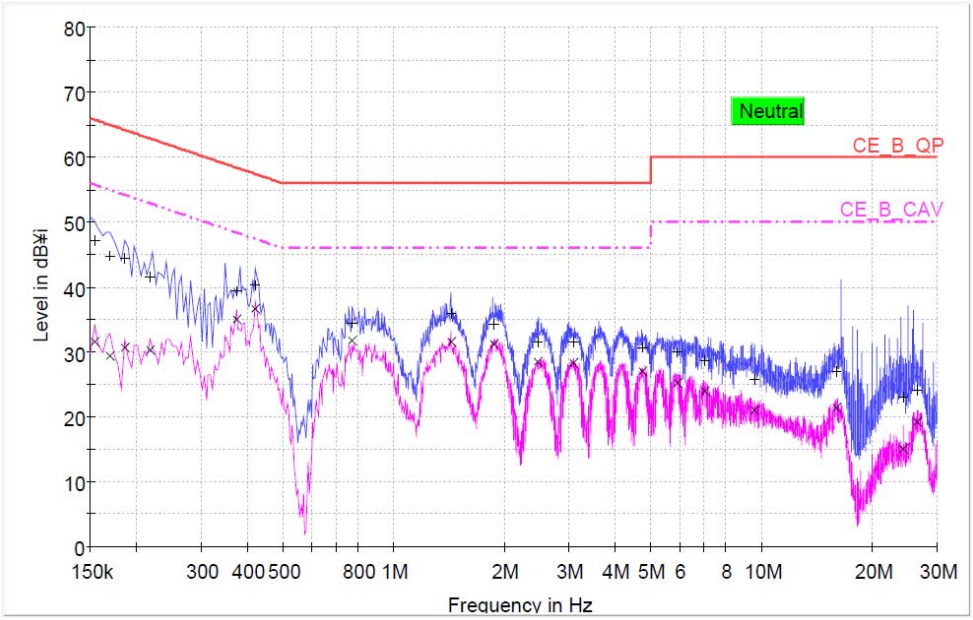
NOTES:

1. **All modes of operation were investigated and the worst-case emissions are reported.**
2. **All other emissions are non-significant.**
3. **All readings are calibrated by self-mode in receiver.**
4. **Measurements using CISPR quasi-peak mode.**
5. **L1 = LINE-PE, L2 = NEUTRAL-PE**
6. **The limit for Class B digital device is 66dBuV to 56dBuV from 150KHz to 500KHz, 56dBuV from 500KHz to 5MHz, 60dBuV Above 5MHz.**

Line



Neutral



7.8 Antenna Requirement

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit So that broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(4)(1), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi

Frequency Band	Gain (dBi)	Limit (dBi)	Results
2400 ~ 2484 MHz	-2.68	≤ 6.00	Pass