

FCC Test Report

Product Name	Key programming device
Model No.	KeyReader Plus
FCC ID.	QLXKRP

Applicant	TeraTron GmbH
Address	Bunsenstr. 10, 51647 Gummersbach, Germany

Date of Receipt	Aug. 02, 2016
Issued Date	Jan. 06, 2017
Report No.	1680089R-RFUSP25V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

Test Report

Issued Date: Jan. 06, 2017

Report No.: 1680089R-RFUSP25V00



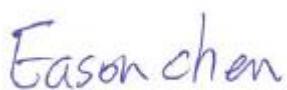
Product Name	Key programming device
Applicant	TeraTron GmbH
Address	Bunsenstr. 10, 51647 Gummersbach, Germany
Manufacturer	TeraTron GmbH
Model No.	KeyReader Plus
FCC ID.	QLXKRP
EUT Rated Voltage	DC 3.6V (Power by Battery)
EUT Test Voltage	DC 3.6V (Power by Battery)
Trade Name	TeraTron
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2015 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v03r05
Test Result	Complied

Documented By :



(Senior Adm. Specialist / Leven Huang)

Tested By :



(Engineer / Eason Chen)

Approved By :



(Director / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	4
1.1. EUT Description	4
1.2. Operational Description	6
1.3. Tested System Details	7
1.4. Configuration of Tested System	7
1.5. EUT Exercise Software	7
1.6. Test Facility	8
1.7. List of Test Equipment	9
2. CONDUCTED EMISSION	10
2.1. Test Setup	10
2.2. Limits	11
2.3. Test Procedure	11
2.4. Uncertainty	11
2.5. Test Result of Conducted Emission	12
3. PEAK POWER OUTPUT	14
3.1. Test Setup	14
3.2. Limit	14
3.3. Test Procedure	14
3.4. Uncertainty	14
3.5. Test Result of Peak Power Output	15
4. RADIATED EMISSION	16
4.1. Test Setup	16
4.2. Limits	17
4.3. Test Procedure	18
4.4. Uncertainty	18
4.5. Test Result of Radiated Emission	19
5. RF ANTENNA CONDUCTED TEST	23
5.1. Test Setup	23
5.2. Limits	23
5.3. Test Procedure	23
5.4. Uncertainty	23
5.5. Test Result of RF Antenna Conducted Test	24
6. BAND EDGE	25
6.1. Test Setup	25
6.2. Limit	26
6.3. Test Procedure	26
6.4. Uncertainty	26
6.5. Test Result of Band Edge	27
7. 6DB BANDWIDTH	31
7.1. Test Setup	31
7.2. Limits	31
7.3. Test Procedure	31
7.4. Uncertainty	31
7.5. Test Result of 6dB Bandwidth	32
8. POWER DENSITY	35
8.1. Test Setup	35
8.2. Limits	35
8.3. Test Procedure	35
8.4. Uncertainty	35
8.5. Test Result of Power Density	36
9. EMI REDUCTION METHOD DURING COMPLIANCE TESTING	39

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Key programming device
Trade Name	TeraTron
Model No.	KeyReader Plus
FCC ID.	QLXKRP
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	Printed on PCB Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”
USB Cable	Shielded, 2m
Contain Module	u-blox / ODIN-W16

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	PROANT AB	432	Printed on PCB Antenna	3.0dBi for 2.4 GHz

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel: (For V4.0)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz
Channel 04:	2410 MHz	Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz
Channel 08:	2418 MHz	Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz
Channel 12:	2426 MHz	Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz
Channel 16:	2434 MHz	Channel 17:	2436 MHz	Channel 18:	2438 MHz	Channel 19:	2440 MHz
Channel 20:	2442 MHz	Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz
Channel 24:	2450 MHz	Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz
Channel 28:	2458 MHz	Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz
Channel 32:	2466 MHz	Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz
Channel 36:	2474 MHz	Channel 37:	2476 MHz	Channel 38:	2478 MHz	Channel 39:	2480 MHz

Note:

1. The EUT is a Key programming device with a built-in WLAN 、Bluetooth V3.0, V2.1+EDR,V4.0 transceiver, this report for Bluetooth V4.0.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit - BLE (GFSK)
-----------	-------------------------------

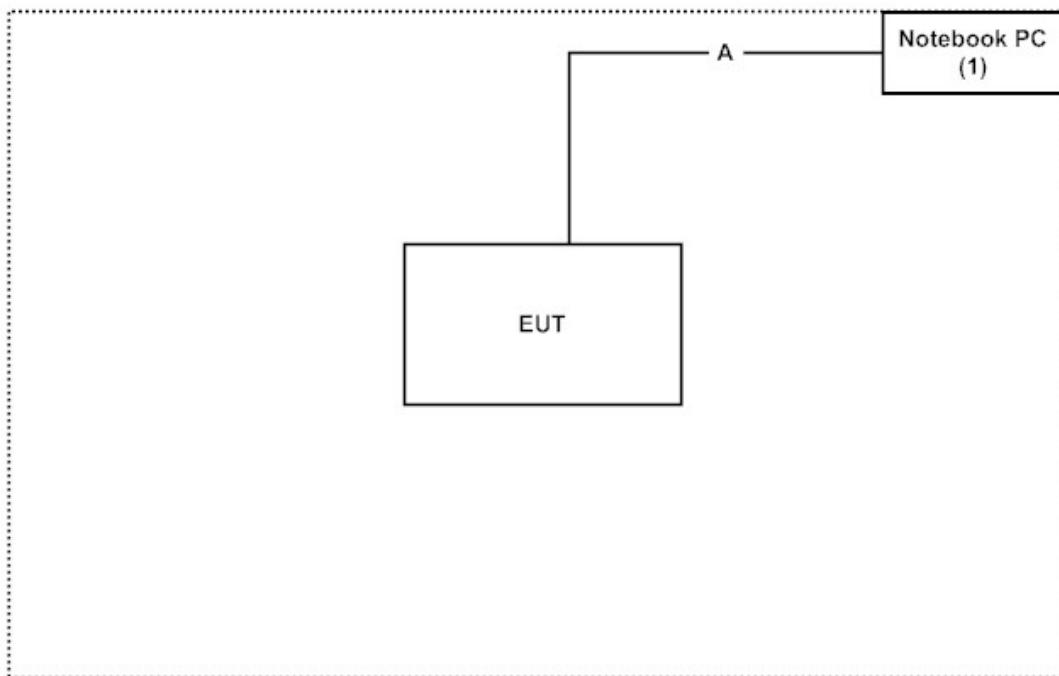
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook PC	ASUS	X206H	X206HA	Non-Shielded, 1.8m

Signal Cable Type	Signal cable Description
A USB Cable	Shielded, 2m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software "Firefox for keyReaderPlus.lnk (Ver2015.08.1-21C /01.25)" on the Notebook PC.
3. Configure the test mode, the test channel, and the data rate.
4. Press "OK" to start the continuous Transmit.
5. Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/chinese/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: <http://www.dekra.com.tw>

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451,
Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW1014

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2016/7/22	2017/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2016/6/23	2017/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2016/10/13	2017/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2017/1/7	2018/1/6
X	LISN	R&S	ENV216	100097	2017/1/7	2018/1/6
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2016/6/25	2017/6/24

For Radiated measurements /Site3/CB8

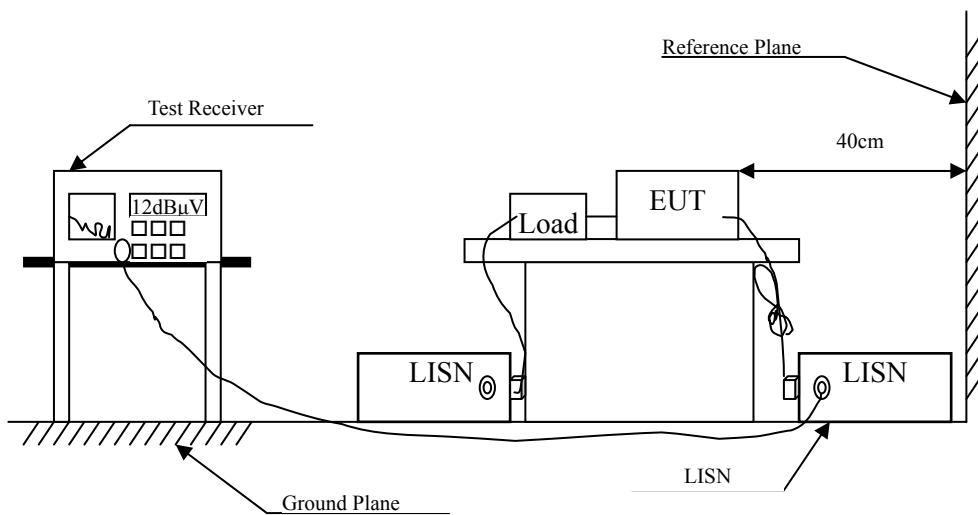
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSP40	100170	2017/1/5	2018/1/4
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2016/9/10	2017/9/9
X	Horn Antenna	ETS-Lindgren	3117	00135205	2016/4/6	2017/4/5
	Horn Antenna	Schwarzbeck	BBHA9170	9170430	2016/1/11	2017/1/10
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2016/6/28	2017/6/27
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2016/1/27	2017/1/26
	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2016/9/30	2017/9/29
X	Filter	MicroTRON	BRM50701	019	2016/10/20	2017/10/19
	Filter	Microwave Circuits	N0257881	36681	2016/12/7	2017/12/6
X	EMI Test Receiver	R&S	ESR26	101385	2016/9/29	2017/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2016/6/25	2017/6/24
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2016/7/21	2017/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2016/6/21	2017/6/20
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2016/6/16	2017/6/15

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dB μ V) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

2.4. Uncertainty

± 2.26 dB

2.5. Test Result of Conducted Emission

Product : Key programming device
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dB μ V	dB μ V	dB	dB μ V
LINE 1					
Quasi-Peak					
0.154	9.687	34.810	44.496	-21.390	65.886
0.170	9.681	32.760	42.442	-22.987	65.429
0.466	9.675	31.220	40.895	-16.076	56.971
1.279	9.710	15.350	25.060	-30.940	56.000
4.451	9.781	19.800	29.581	-26.419	56.000
7.334	9.840	16.680	26.520	-33.480	60.000
Average					
0.154	9.687	25.820	35.506	-20.380	55.886
0.170	9.681	25.540	35.222	-20.207	55.429
0.466	9.675	24.210	33.885	-13.086	46.971
1.279	9.710	9.050	18.760	-27.240	46.000
4.451	9.781	10.720	20.501	-25.499	46.000
7.334	9.840	11.370	21.210	-28.790	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " **■** " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Key programming device
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

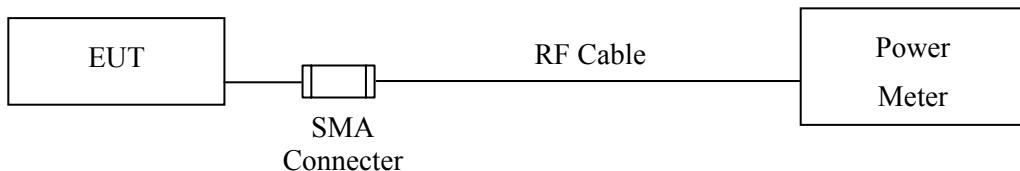
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dB μ V	dB μ V	dB	dB μ V
LINE 2					
Quasi-Peak					
0.205	9.736	28.180	37.916	-26.513	64.429
0.287	9.739	23.280	33.019	-29.067	62.086
0.470	9.745	30.810	40.555	-16.302	56.857
1.162	9.767	12.510	22.277	-33.723	56.000
2.728	9.825	10.830	20.655	-35.345	56.000
4.740	9.865	17.470	27.335	-28.665	56.000
Average					
0.205	9.736	15.410	25.146	-29.283	54.429
0.287	9.739	15.510	25.249	-26.837	52.086
0.470	9.745	24.070	33.815	-13.042	46.857
1.162	9.767	5.800	15.567	-30.433	46.000
2.728	9.825	5.120	14.945	-31.055	46.000
4.740	9.865	9.090	18.955	-27.045	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " █ " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak power meter method.

3.4. Uncertainty

± 1.19 dB

3.5. Test Result of Peak Power Output

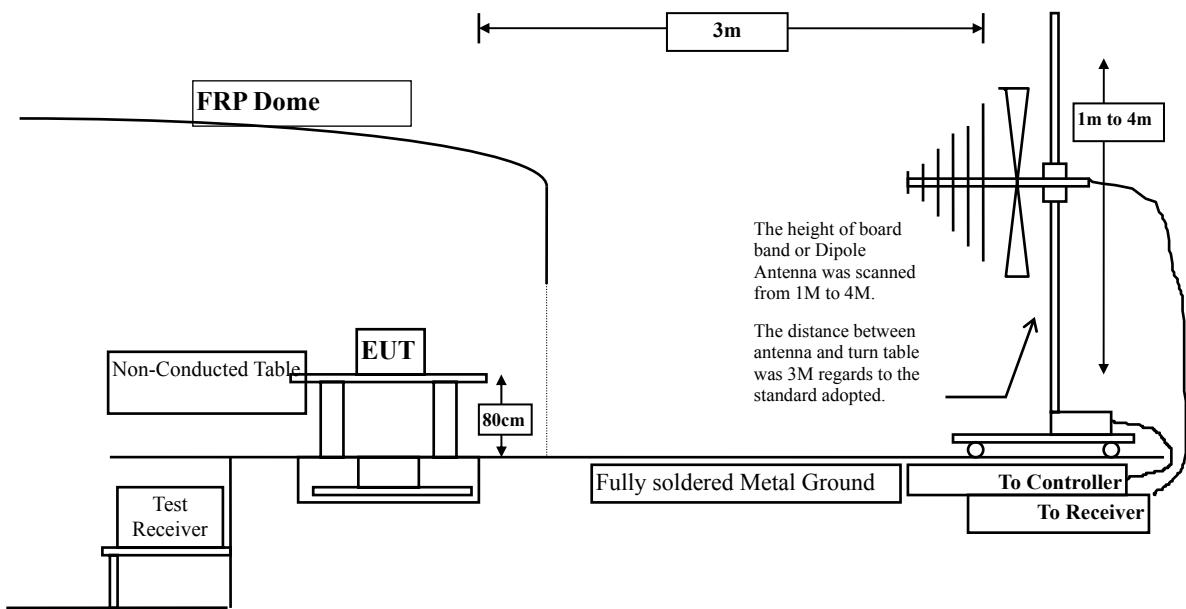
Product : Key programming device
Test Item : Peak Power Output
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	5.91	1 Watt= 30 dBm	Pass
Channel 19	2440.00	6.14	1 Watt= 30 dBm	Pass
Channel 39	2480.00	6.32	1 Watt= 30 dBm	Pass

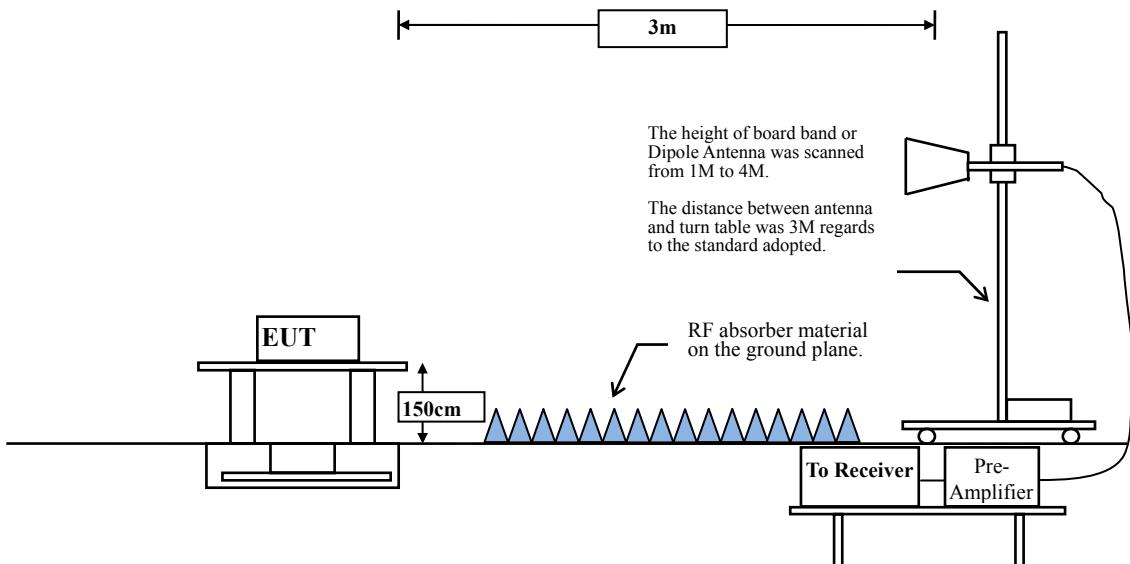
4. Radiated Emission

4.1. Test Setup

Below 1GHz



Above 1GHz



4.2. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
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

Remarks:

1. RF Voltage (dB μ V) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

4.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

4.5. Test Result of Radiated Emission

Product : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

Frequency MHz	Correct Factor dB	Reading Level dB μ V	Measurement Level dB μ V/m	Margin dB	Limit dB μ V/m
Horizontal					
Peak Detector:					
4804.000	2.511	51.130	53.640	-20.360	74.000
7206.000	9.511	40.600	50.111	-23.889	74.000
9608.000	10.394	38.540	48.934	-25.066	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4804.000	2.923	48.430	51.352	-22.648	74.000
7206.000	9.988	39.040	49.029	-24.971	74.000
9608.000	10.847	38.330	49.177	-24.823	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dB μ V	dB μ V/m	dB	dB μ V/m

Horizontal

Peak Detector:

4880.000	2.038	51.320	53.358	-20.642	74.000
7320.000	9.699	39.240	48.939	-25.061	74.000
9760.000	9.665	38.300	47.965	-26.035	74.000

Average

Detector:

--

Vertical

Peak Detector:

4880.000	2.499	50.350	52.849	-21.151	74.000
7320.000	10.303	38.980	49.283	-24.717	74.000
9760.000	10.299	37.650	47.950	-26.050	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Frequency MHz	Correct Factor	Reading Level dB	Measurement Level dB μ V/m	Margin dB	Limit dB μ V/m
------------------	-------------------	------------------------	--------------------------------------	--------------	-----------------------

Horizontal

Peak Detector:

4960.000	2.582	50.610	53.192	-20.808	74.000
7440.000	10.555	38.710	49.265	-24.735	74.000
9920.000	10.206	38.660	48.866	-25.134	74.000

Average

Detector:

--

Vertical

Peak Detector:

4960.000	3.398	49.680	53.079	-20.921	74.000
7440.000	11.214	38.700	49.914	-24.086	74.000
9920.000	11.245	38.880	50.125	-23.875	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Key programming device
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

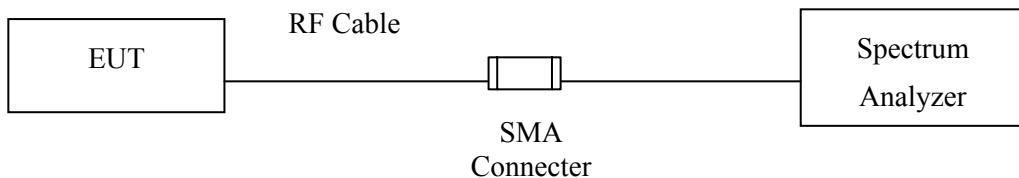
Frequency MHz	Correct Factor	Reading dB μ V	Measurement dB μ V/m	Margin dB	Limit dB μ V/m
Horizontal					
146.400	-10.318	38.290	27.972	-15.528	43.500
311.300	-4.026	35.986	31.960	-14.040	46.000
352.040	-2.403	39.451	37.048	-8.952	46.000
503.360	0.138	33.705	33.843	-12.157	46.000
699.300	2.875	36.316	39.191	-6.809	46.000
949.560	6.695	23.789	30.484	-15.516	46.000
Vertical					
103.720	-0.151	24.091	23.939	-19.561	43.500
371.440	-2.737	25.823	23.086	-22.914	46.000
524.700	-0.379	23.247	22.868	-23.132	46.000
699.300	0.695	25.830	26.525	-19.475	46.000
883.600	2.566	23.080	25.645	-20.355	46.000
970.900	7.302	22.954	30.256	-23.744	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. Limits

According to FCC Section 15.247(d). 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 measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

5.4. Uncertainty

± 1.20dB

5.5. Test Result of RF Antenna Conducted Test

Product : Key programming device
Test Item : RF Antenna Conducted Test
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 1: Transmit - BLE (GFSK)

Figure Channel 00:

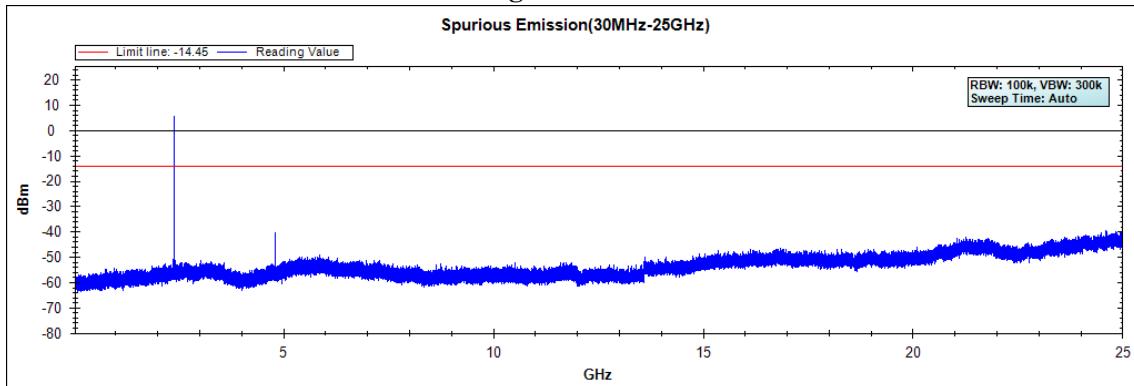


Figure Channel 19:

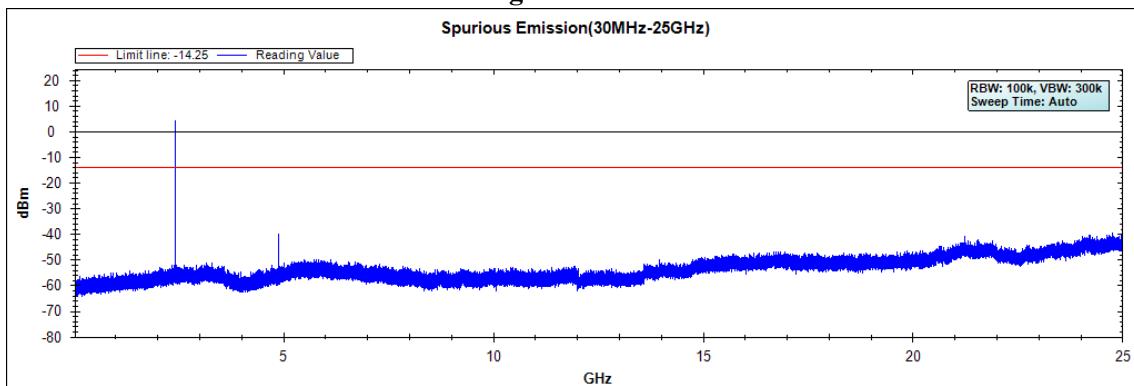
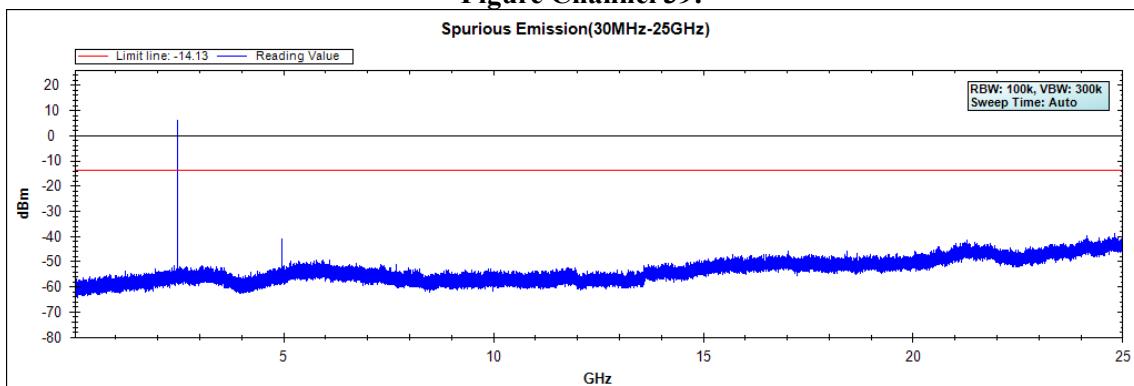


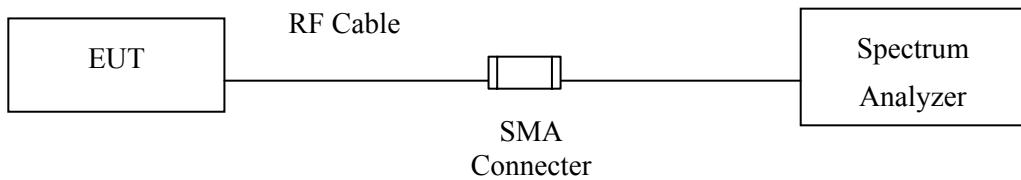
Figure Channel 39:



6. Band Edge

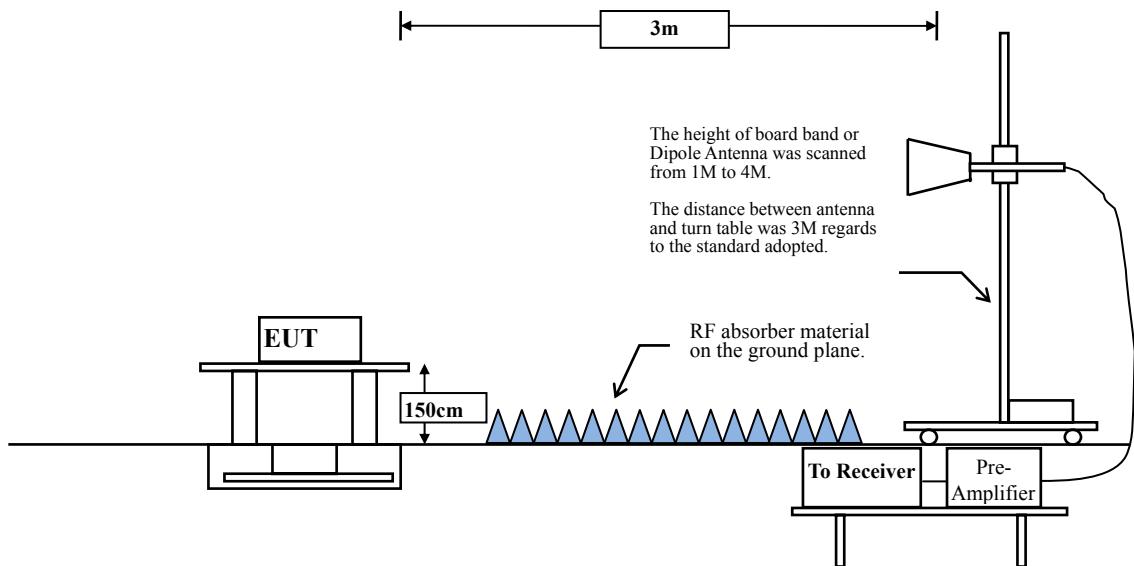
6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1GHz



6.2. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

6.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

6.5. Test Result of Band Edge

Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
00 (Peak)	2377.246	-2.743	60.052	57.309	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	50.436	47.749	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	82.501	79.841	--	--	--
00 (Peak)	2402.174	-2.657	107.675	105.018	--	--	--
00 (Average)	2390.000	-2.687	35.499	32.812	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	51.332	48.672	--	--	--
00 (Average)	2402.029	-2.657	81.928	79.271	--	--	--

Figure Channel 00:

Horizontal (Peak)

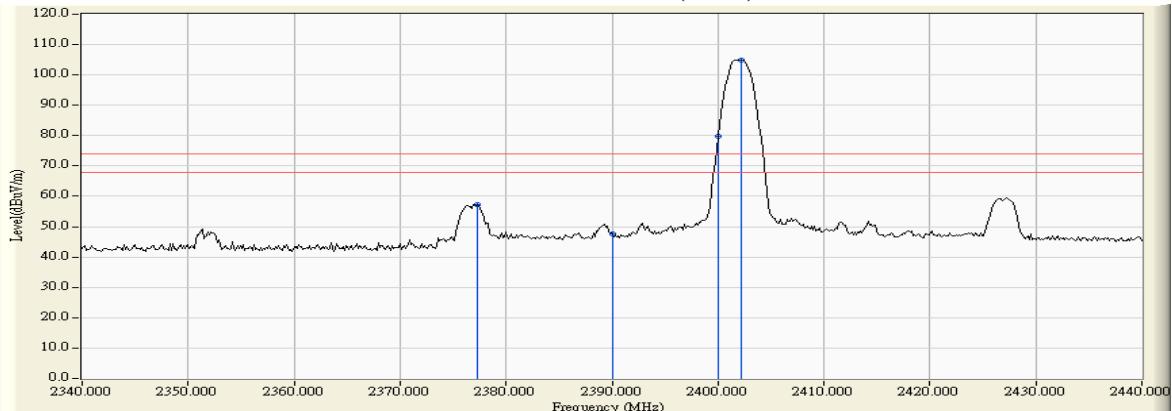
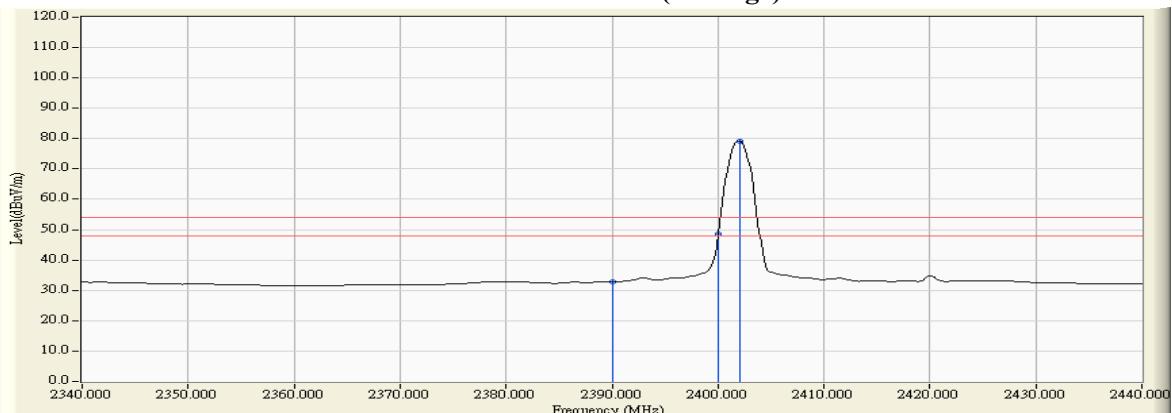


Figure Channel 00:

Horizontal (Average)



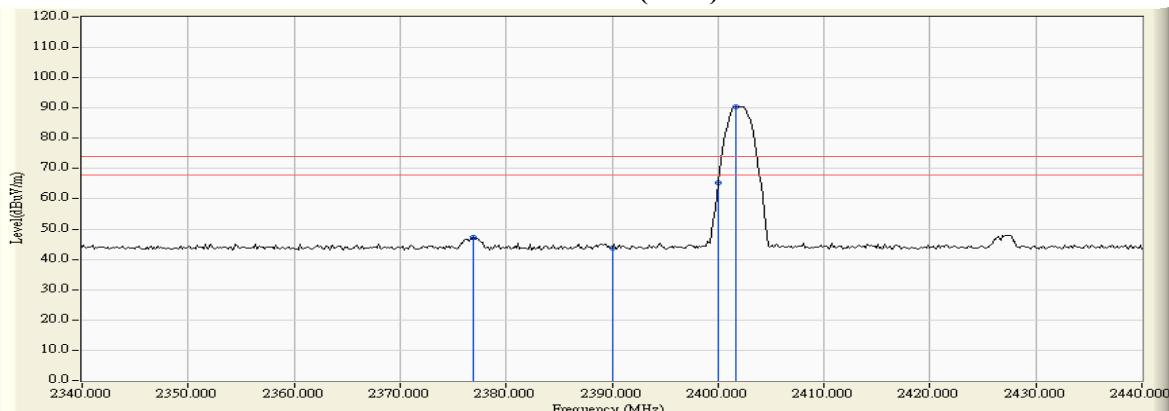
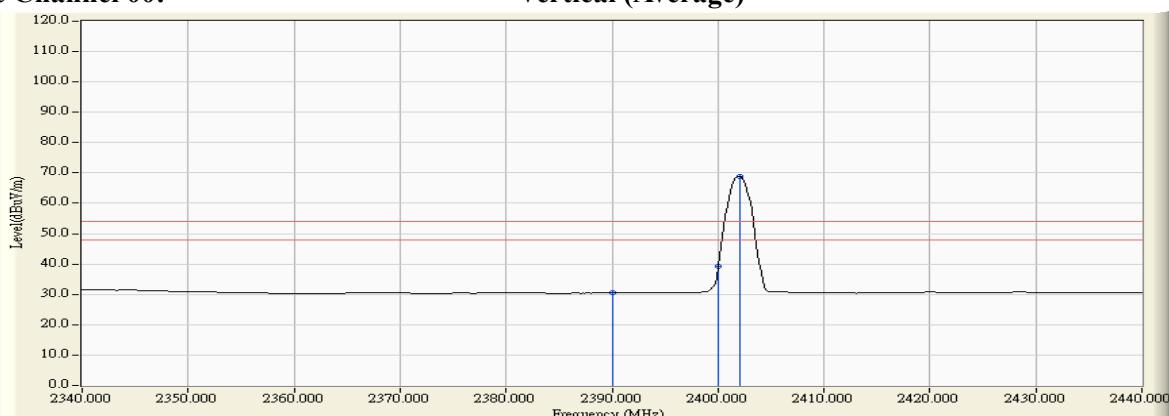
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “*”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
00 (Peak)	2376.957	-4.116	51.301	47.186	74.00	54.00	Pass
00 (Peak)	2390.000	-4.159	47.776	43.617	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	69.625	65.454	--	--	--
00 (Peak)	2401.739	-4.171	94.627	90.456	--	--	--
00 (Average)	2390.000	-4.159	34.701	30.542	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	43.359	39.188	--	--	--
00 (Average)	2402.029	-4.171	73.130	68.959	--	--	--

Figure Channel 00:**Vertical (Peak)****Figure Channel 00:****Vertical (Average)**

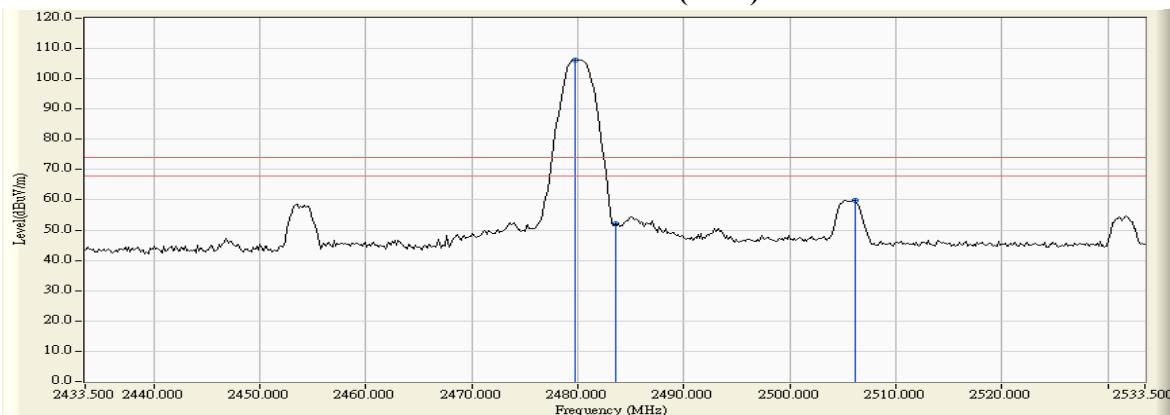
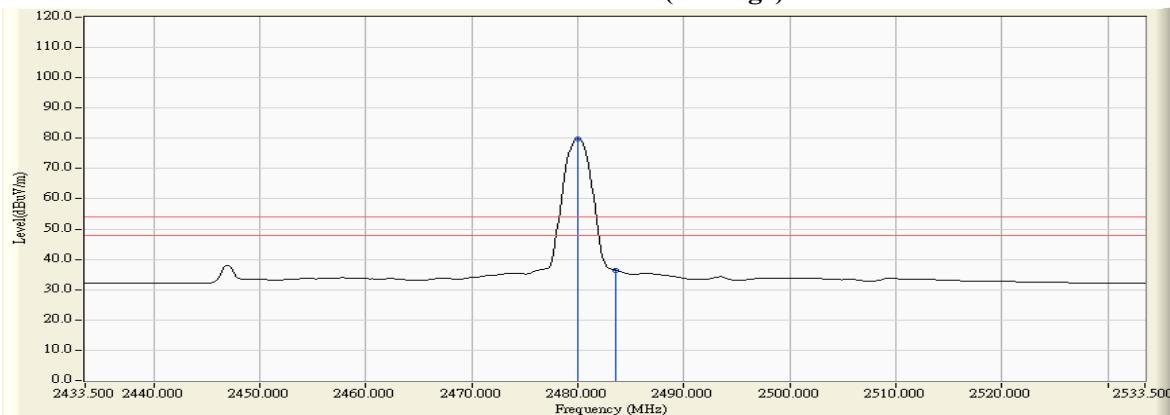
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “*”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
39 (Peak)	2479.732	-2.605	108.697	106.092	--	--	--
39 (Peak)	2483.500	-2.601	54.725	52.123	74.00	54.00	Pass
39 (Peak)	2506.109	-2.643	62.398	59.755	74.00	54.00	Pass
39 (Average)	2480.022	-2.605	82.518	79.913	--	--	--
39 (Average)	2483.500	-2.601	39.030	36.428	74.00	54.00	Pass

Figure Channel 39:**Horizontal (Peak)****Figure Channel 39:****Horizontal (Average)**

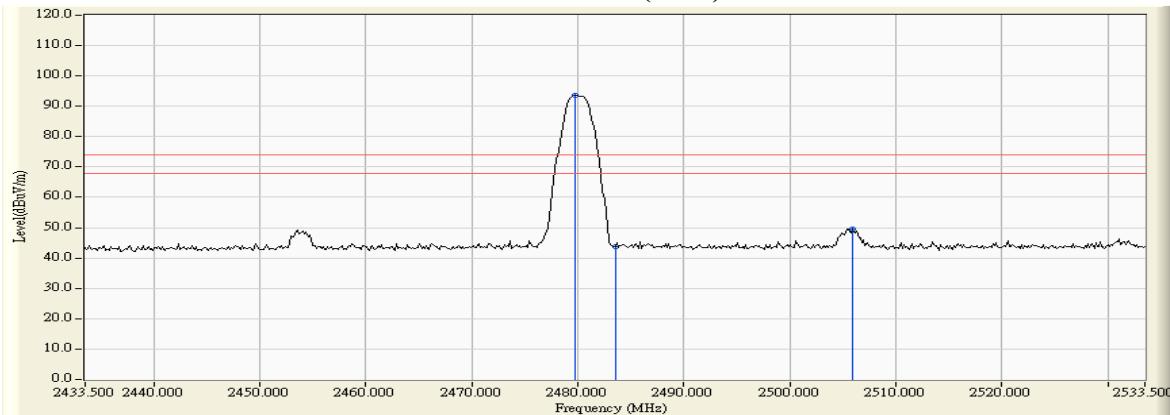
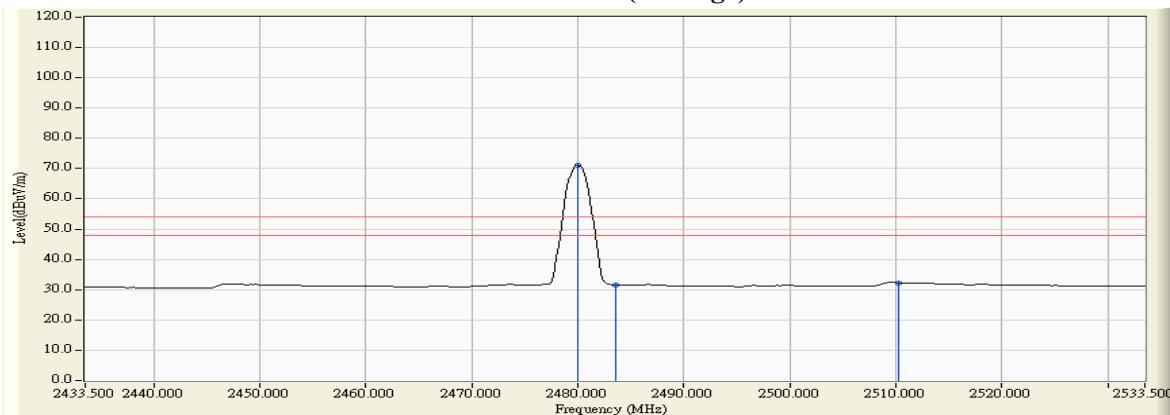
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “*”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
39 (Peak)	2479.732	-3.979	97.462	93.483	--	--	--
39 (Peak)	2483.500	-3.966	47.664	43.697	74.00	54.00	Pass
39 (Peak)	2505.964	-3.881	53.372	49.490	74.00	54.00	Pass
39 (Average)	2480.022	-3.978	75.045	71.067	--	--	--
39 (Average)	2483.500	-3.966	35.566	31.599	74.00	54.00	Pass
39 (Average)	2510.312	-3.862	36.121	32.260	74.00	54.00	Pass

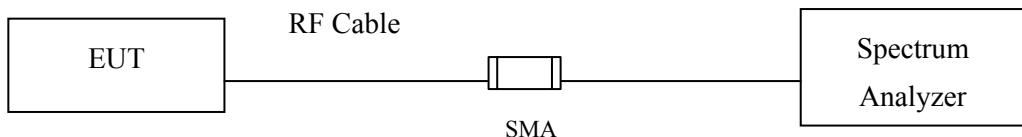
Figure Channel 39:**Vertical (Peak)****Figure Channel 39:****Vertical (Average)**

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “*”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

7. **6dB Bandwidth**

7.1. **Test Setup**



7.2. **Limits**

The minimum bandwidth shall be at least 500 kHz.

7.3. **Test Procedure**

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, $VBW \geq 3 * RBW$

7.4. **Uncertainty**

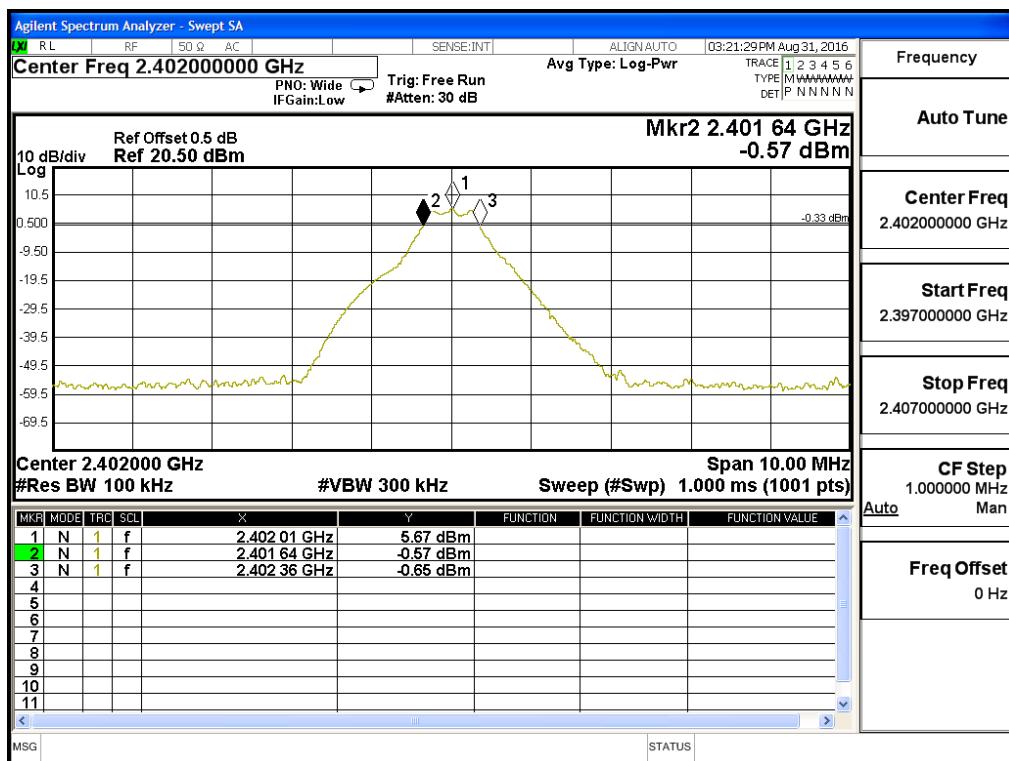
$\pm 283\text{Hz}$

7.5. Test Result of 6dB Bandwidth

Product : Key programming device
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	720	>500	Pass

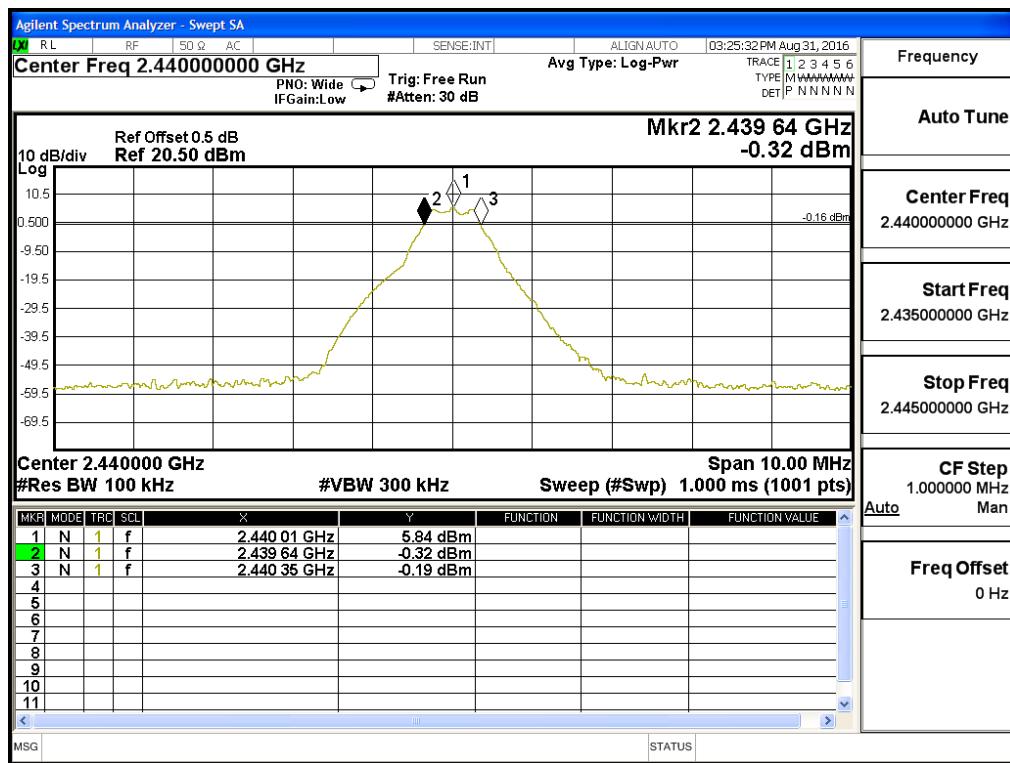
Figure Channel 00:



Product : Key programming device
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	710	>500	Pass

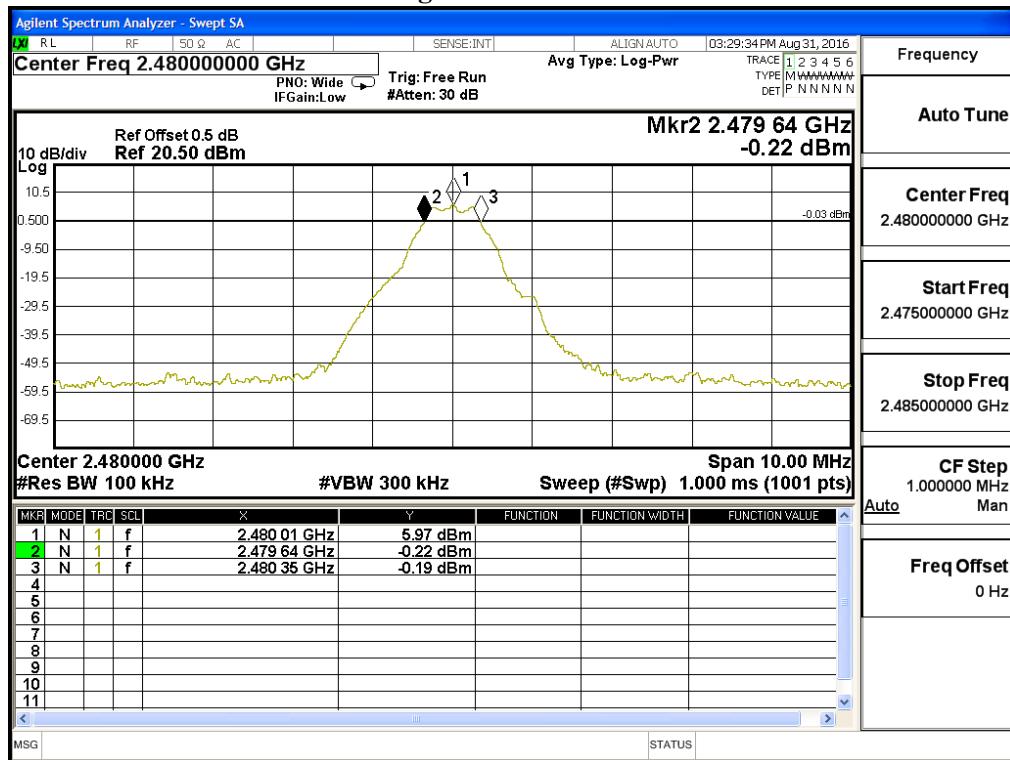
Figure Channel 19:



Product : Key programming device
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

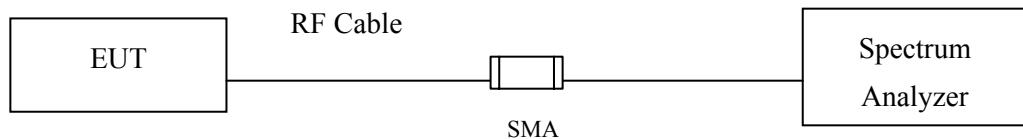
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	710	>500	Pass

Figure Channel 39:



8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

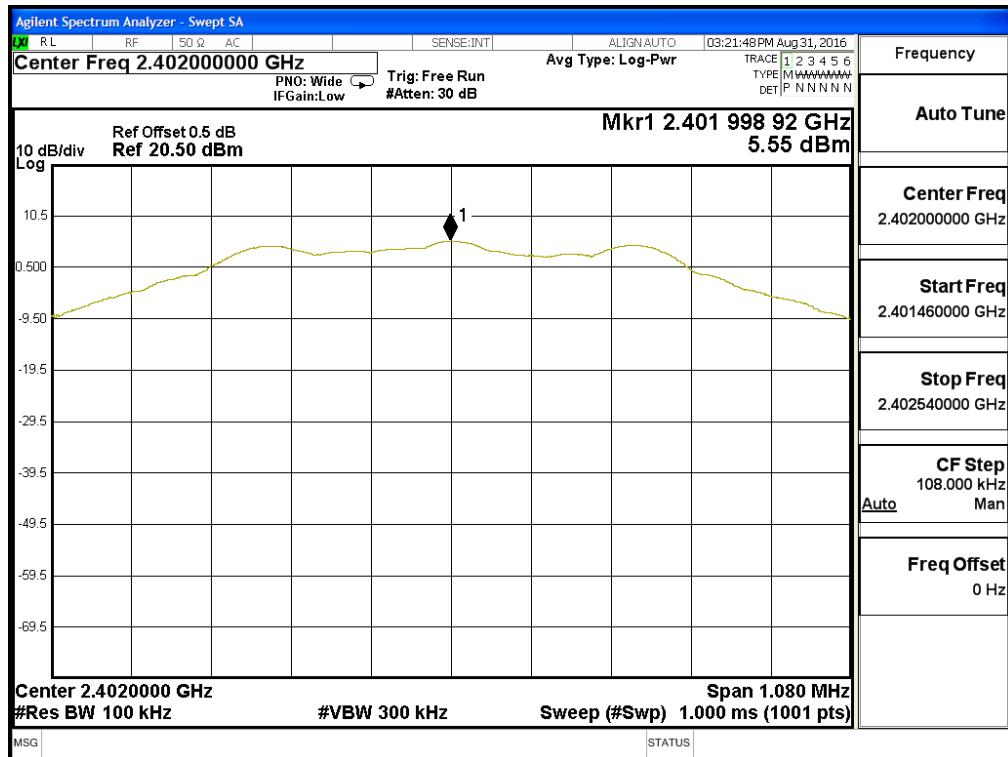
± 1.20 dB

8.5. Test Result of Power Density

Product : Key programming device
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	5.550	≤8dBm	Pass

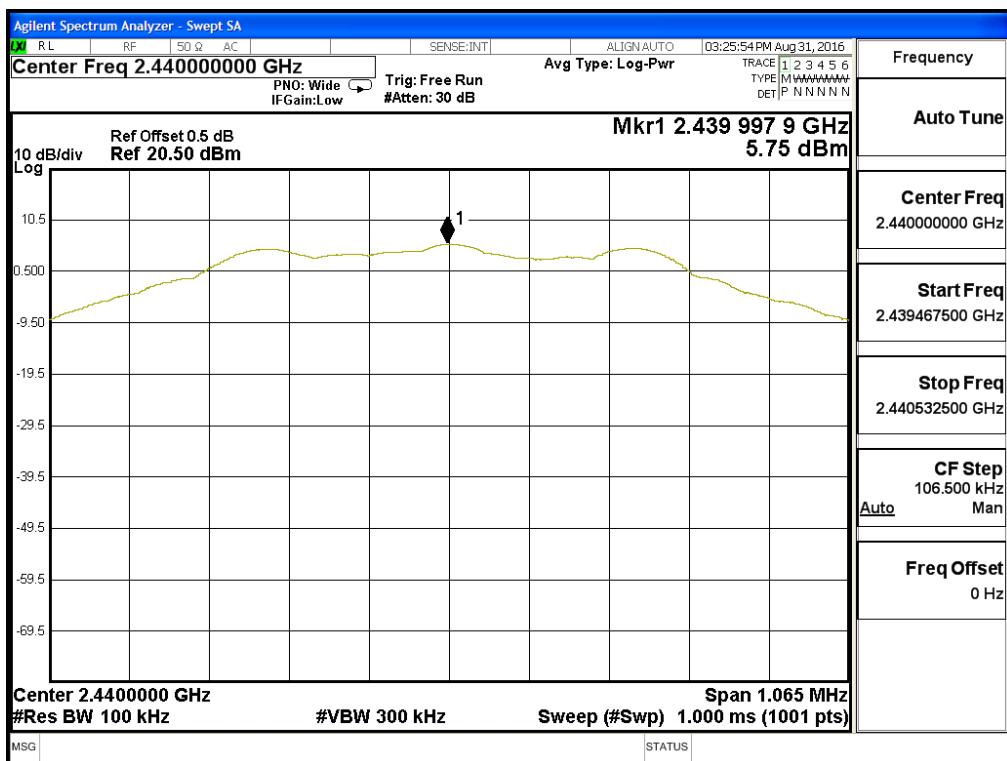
Figure Channel 00:



Product : Key programming device
 Test Item : Power Density Data
 Test Site : No.3OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	5.750	≤8dBm	Pass

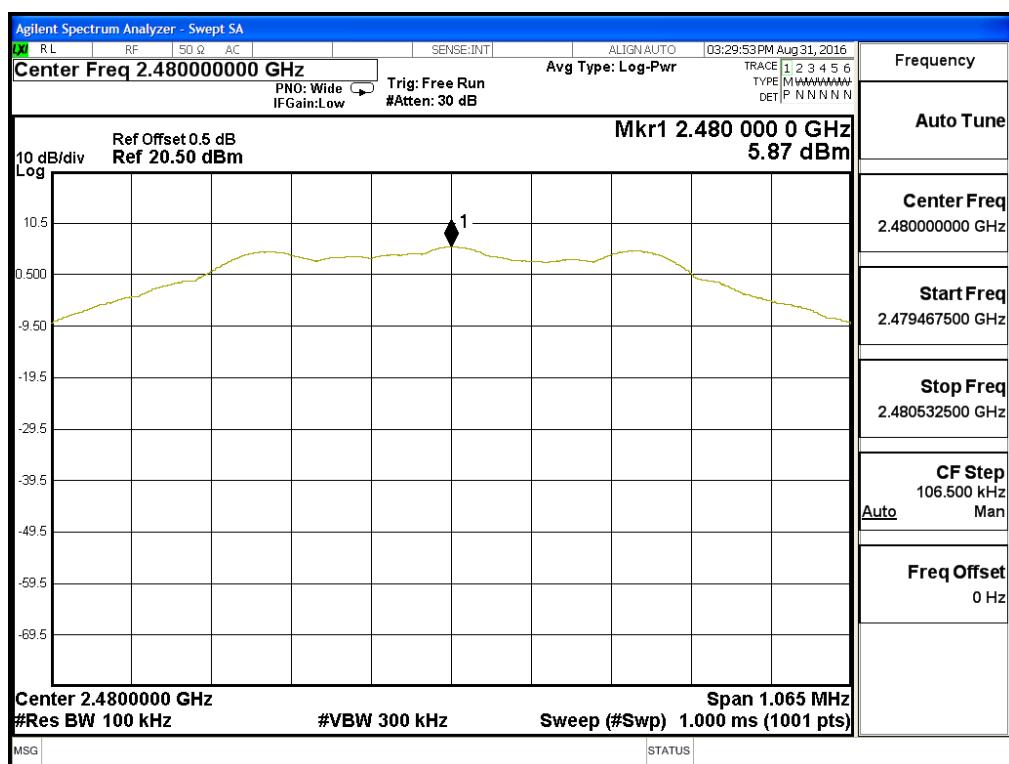
Figure Channel 19:



Product : Key programming device
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	5.870	≤8dBm	Pass

Figure Channel 39:



9. EMI Reduction Method During Compliance Testing

No modification was made during testing.