FCC Test Report

Product Name	Qrio Smart Lock
Model No.	Q-SL1
FCC ID.	2AJJZ-000001

Applicant	Qrio, Inc.
Address	Toshin Sangyo Bld.3F,2-3-4 Ebisunishi,Shibuya-ku Tokyo, 150-0021,Japan

Date of Receipt	Sep. 05, 2016
Issued Date	Sep. 26, 2016
Report No.	1690120R-RFUSP23V00
Report Version	V1.0

Testing Laboratory
3023

Test Report

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Report No.: 1690120R-RFUSP23V00

Product Name	Qrio Smart Lock
Applicant	Qrio, Inc.
Address	Toshin Sangyo Bld.3F,2-3-4 Ebisunishi,Shibuya-ku Tokyo, 150-0021,Japan
Manufacturer	Qrio, Inc.
Model No.	Q-SL1
FCC ID.	2AJJZ-000001
EUT Rated Voltage	DC 6V (Power by Battery)
EUT Test Voltage	DC 6V (Power by Battery)
Trade Name	Qrio
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 : Genie Chang

(Senior Adm. Specialist / Genie Chang)

Tested By : Tim Chen

(Engineer / Tim Chen)

Approved By :

(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Qrio Smart Lock
Trade Name	Qrio
Model No.	Q-SL1
FCC ID.	2AJJZ-000001
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	PCB antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Broadcom	N/A	PCB antenna	-1.5dBi for 2.4 GHz

Note: 1 The antenna is included in the BCM20737S RF SIPs.

2 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 Qrio Smart Lock with a built-in Bluetooth 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

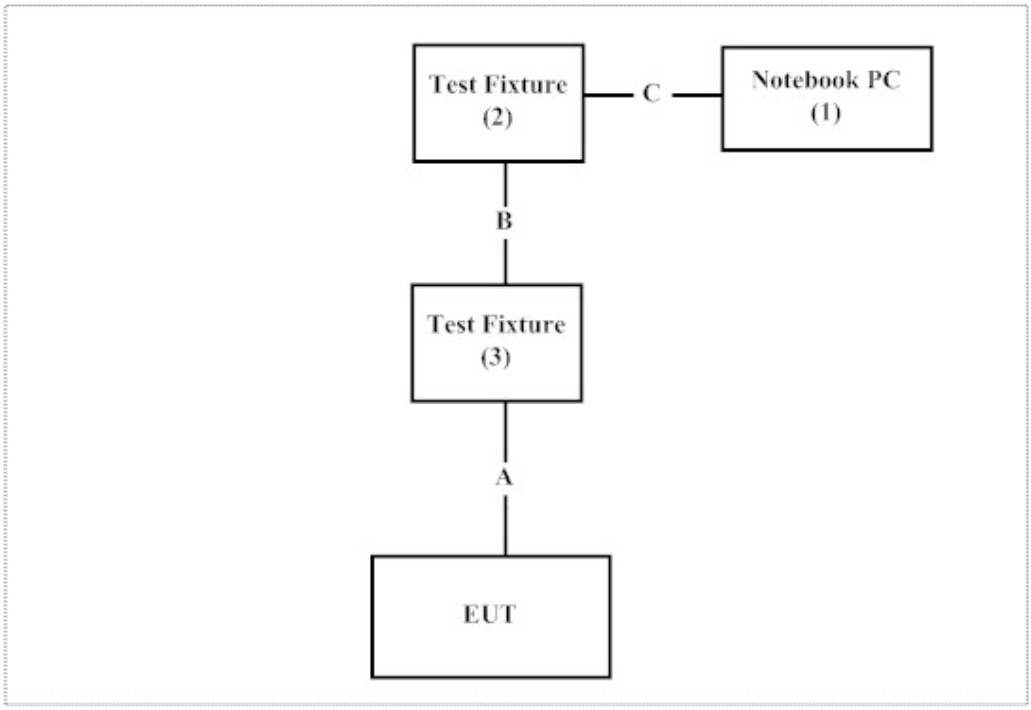
1.3. Tested System Details

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	DELL	P62G	CY9FJC2	Non-Shielded, 0.8m
2	Test Fixture	N/A	N/A	N/A	N/A
3	Test Fixture	yokowo	MO050-15005FRC-S	TFX-001	N/A

Signal Cable Type		Signal cable Description
A	Signal Card	Non-Shielded, 0.05m
B	Signal Card	Non-Shielded, 0.2m
C	USB Cable	Non-Shielded, 1.2m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

(1) Setup the EUT as shown in Section 1.4.

(2) Execute software “Broadcom Blue Tool v1.8.7.2” 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	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site: http://www.quietek.com/chinese/about/certificates.aspx?bval=5

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site: http://www.quietek.com/

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.159, Sec. 2, Wunhua 1st Rd., Linkou Dist.,
New Taipei City 244, Taiwan (R.O.C.)
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

1.7. List of Test Equipment

For Conduction measurements /ASR1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	EMI Test Receiver	R&S	ESR7	161601	2015.12.17	2016.12.16
	Two-Line V-Network	R&S	ENV216	101306	2016.02.09	2017.02.08
	Two-Line V-Network	R&S	ENV216	101307	2016.02.09	2017.02.08
	Coaxial Cable	Quietek	RG400_BNC	RF001	2016.05.25	2017.05.24

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

For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	Spectrum Analyzer	R&S	FSV30	103464	2015.12.04	2016.12.03
	Power Meter	Anritsu	ML2496A	1548003	2015.12.04	2016.12.03
	Power Sensor	Anritsu	MA2411B	1531024	2015.12.10	2016.12.09
	Power Sensor	Anritsu	MA2411B	1531025	2015.12.09	2016.12.08
	Bluetooth Tester	R&S	CBT	101238	2015.12.18	2016.12.17

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 Conduction Test System V8.0.110

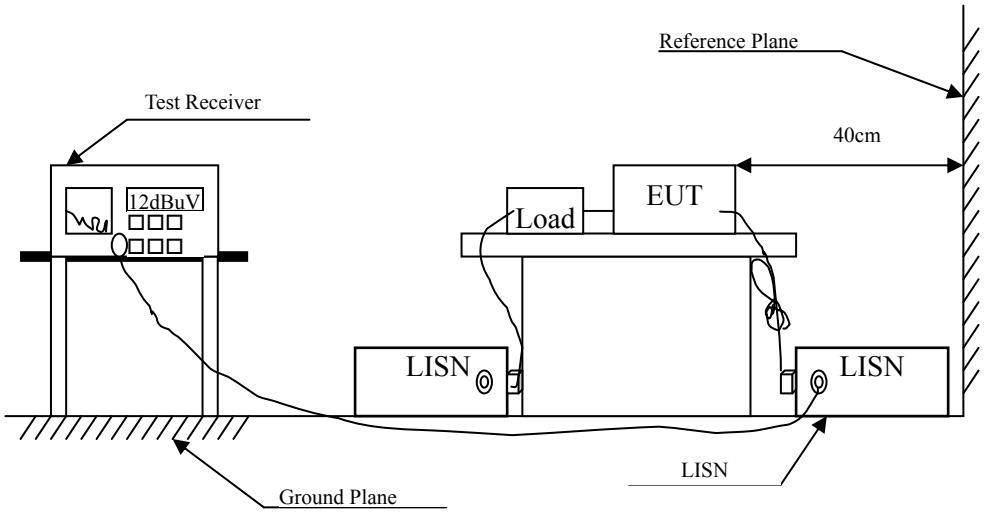
For Radiated measurements /ACB1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	A.H.	SAS-562B	272	2016.07.21	2017.07.20
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2016.02.20	2017.02.19
X	Horn Antenna	ETS-Lindgren	3117	00203799	2015.10.15	2016.10.14
X	Horn Antenna	Com-Power	AH-840	101087	2016.05.03	2017.05.02
X	Pre-Amplifier	EMCI	EMC001330	980316	2016.04.27	2017.04.26
X	Pre-Amplifier	EMCI	EMC051835SE	980311	2016.04.27	2017.04.26
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2016.04.28	2017.04.27
X	Pre-Amplifier	EMCI	EMC184045SE	980314	2016.05.12	2017.05.11
X	Filter	MICRO TRONICS	BRM50702	G251	2016.08.11	2017.08.10
	Filter	MICRO TRONICS	BRM50716	G188	2016.08.11	2017.08.10
X	EMI Test Receiver	R&S	ESR7	101602	2015.12.16	2016.12.15
X	Spectrum Analyzer	R&S	FSV40	101149	2015.12.04	2016.12.03
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	2016.05.25	2017.05.24
X	Mircoflex Cable	HUBER SUHNER	SUCOFLEX 102	MY3381/2	2016.08.11	2017.08.10

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 (dBuV) 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

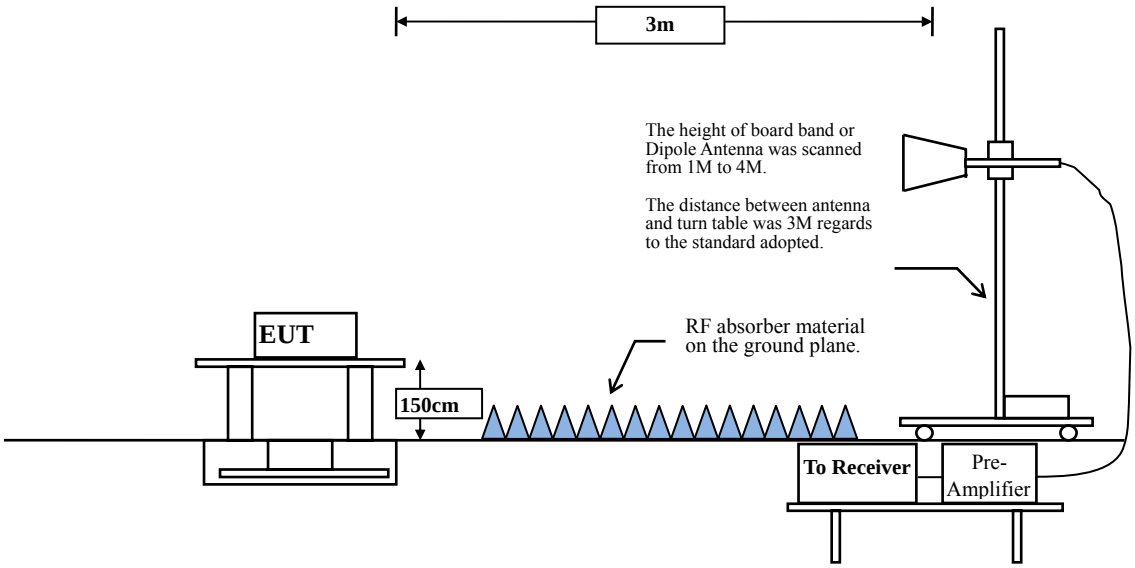
±2.35dB

2.5. Test Result of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. 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.

Field Strength measurement were converted to EIRP using formula:

$$eirp = p_t \times g_t = (E \times d)^2/30$$

where:

pt = transmitter output power in watts,

gt = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

(This is from Section 1.1 of KDB 412172 D01 Determining ERP and EIRP v01r01)

3.4. Uncertainty

Radiated:

Horizontal polarization：1-18GHz: ±3.77dB

Vertical polarization：1-18GHz : ±3.83dB

3.5. Test Result of Peak Power Output

Product : Qrio Smart Lock
Test Item : Peak Power Output
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

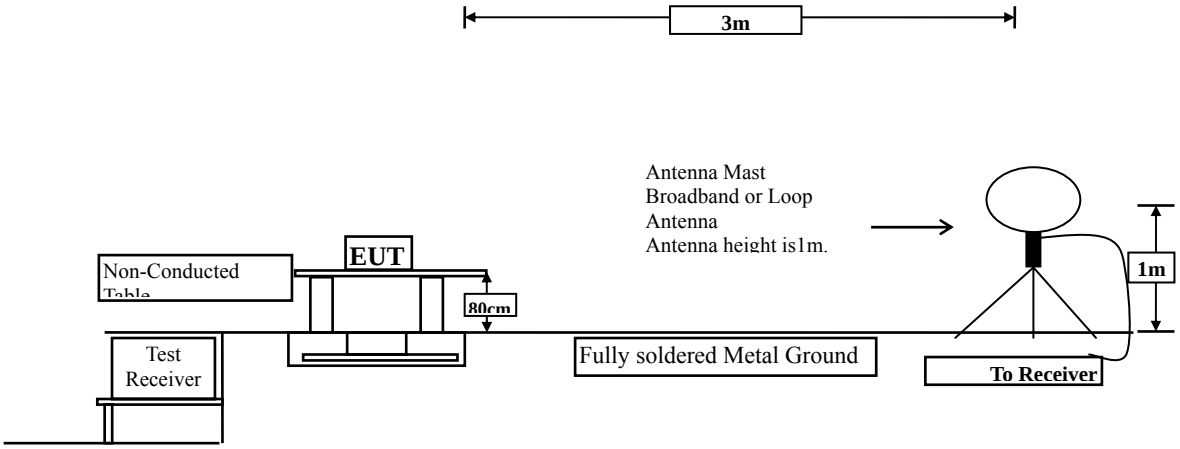
Channel No.	Frequency (MHz)	Measure Level (dBuV/m)	EIRP (dBm)	Antenna (dBi)	Output Power (dBm)	Required Limit (dBm)
Channel 00	2402.00	79.155	-16.07	-1.5	-14.57	<30dBm
Channel 19	2440.00	80.036	-15.19	-1.5	-13.69	<30dBm
Channel 39	2480.00	81.651	-13.58	-1.5	-12.08	<30dBm

Note:
1. Field Strength measurement are performed in Horizontal、Vertical polarization. Only the Maximum measure level is shown in the report.
2. Field Strength measurement were converted to EIRP by formula.
3. Output Power = EIRP - Antenna Gain.

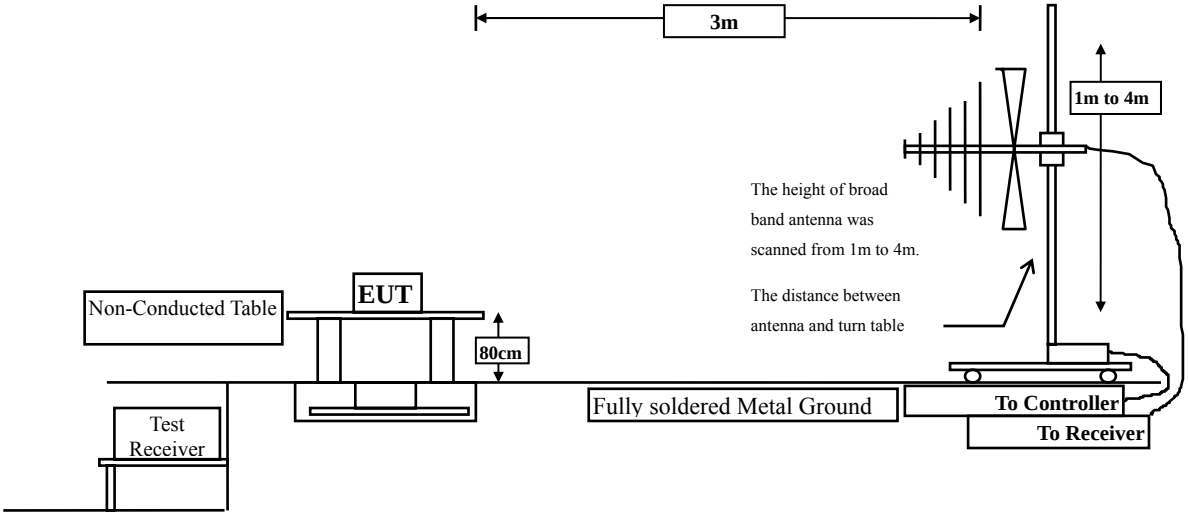
4. Radiated Emission

4.1. Test Setup

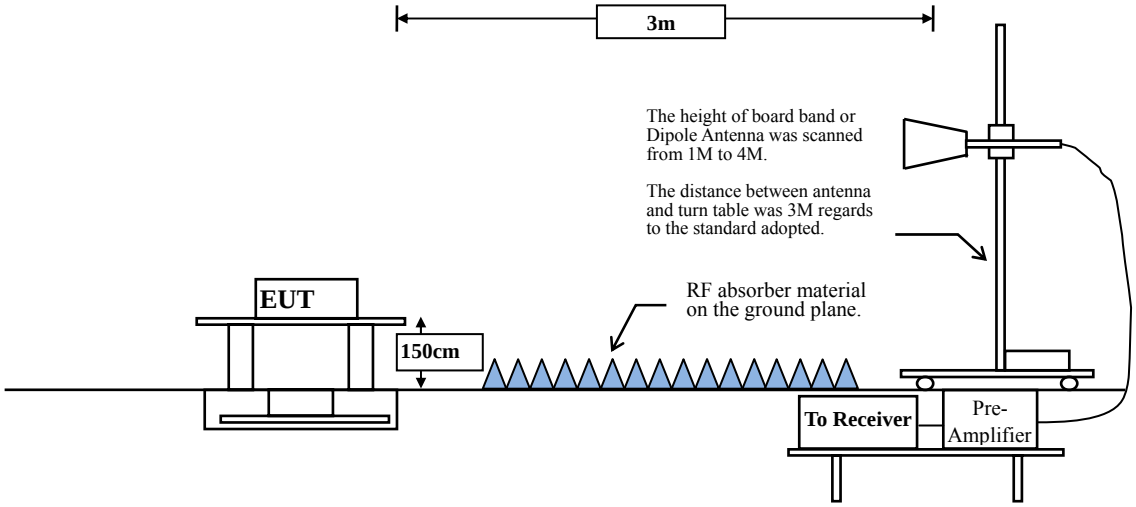
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission 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 (dBuV) = 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 measurement frequency range form 9kHz - 10th Harmonic of fundamental was investigated.

4.4. Uncertainty

Horizontal：
30-300MHz: ±4.08dB；300M-1GHz: ±3.86dB；1-18GHz: ±3.77dB；18-40GHz: ±3.98dB。
Vertical：
30-300MHz: ±4.81dB；300M-1GHz: ±3.87dB；1-18GHz: ±3.83dB；18-40GHz: ±3.98dB。

4.5. Test Result of Radiated Emission

Product : Qrio Smart Lock
Test Item : Harmonic Radiated Emission
Test Mode : Mode 1: Transmit - BLE(2402MHz)
Test Date : 2016/09/09

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4804.000	-4.632	47.590	42.958	-31.042	74.000
7206.000	-1.054	57.290	56.236	-17.764	74.000
9608.000	1.393	44.370	45.764	-28.236	74.000
Average					
Detector:					
7206.000	-1.054	45.870	44.816	-9.184	54.000
Vertical					
Peak Detector:					
4804.000	-4.632	49.180	44.548	-29.452	74.000
7206.000	-1.054	56.260	55.206	-18.794	74.000
9608.000	1.393	44.120	45.514	-28.486	74.000
Average					
Detector:					
7206.000	-1.054	44.980	43.926	-10.074	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.

Product : Qrio Smart Lock
Test Item : Harmonic Radiated Emission
Test Mode : Mode 1: Transmit - BLE (2440MHz)
Test Date : 2016/09/09

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4880.000	-4.542	48.360	43.818	-30.182	74.000
7320.000	-0.947	51.500	50.553	-23.447	74.000
9760.000	1.659	44.940	46.599	-27.401	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4880.000	-4.542	49.190	44.648	-29.352	74.000
7320.000	-0.947	52.720	51.773	-22.227	74.000
9760.000	1.659	44.920	46.579	-27.421	74.000
Average					
Detector:					
--					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.

Product : Qrio Smart Lock
Test Item : Harmonic Radiated Emission
Test Mode : Mode 1: Transmit - BLE (2480MHz)
Test Date : 2016/09/09

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4960.000	-4.430	47.470	43.041	-30.959	74.000
7440.000	-0.828	49.040	48.211	-25.789	74.000
9920.000	1.836	43.760	45.596	-28.404	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4960.000	-4.430	48.740	44.311	-29.689	74.000
7440.000	-0.828	48.910	48.081	-25.919	74.000
9920.000	1.836	44.350	46.186	-27.814	74.000
Average					
Detector:					
--					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.

Product : Qrio Smart Lock
Test Item : General Radiated Emission
Test Mode : Mode 1: Transmit - BLE (2440MHz)
Test Date : 2016/09/09

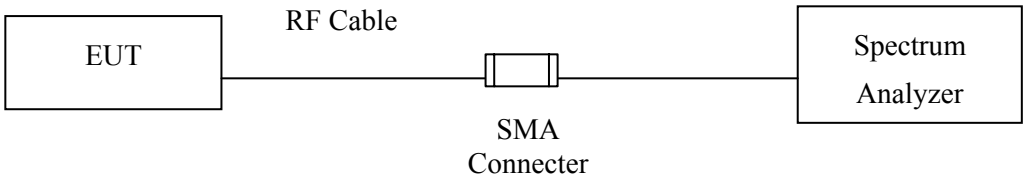
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
101.696	-15.747	55.527	39.780	-3.720	43.500
263.362	-11.573	46.722	35.148	-10.852	46.000
382.855	-8.200	42.828	34.628	-11.372	46.000
529.058	-5.327	41.311	35.984	-10.016	46.000
672.449	-2.877	38.657	35.780	-10.220	46.000
911.435	0.551	37.723	38.274	-7.726	46.000
Vertical					
101.696	-15.747	49.763	34.016	-9.484	43.500
215.565	-13.207	44.412	31.205	-12.295	43.500
382.855	-8.200	40.704	32.504	-13.496	46.000
503.754	-5.787	40.195	34.408	-11.592	46.000
718.841	-2.065	33.264	31.199	-14.801	46.000
949.391	0.963	33.918	34.881	-11.119	46.000

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.
Set RBW = 100 kHz, Set VBW> RBW, scan up through 10th harmonic.

5.4. Uncertainty

±1.23dB

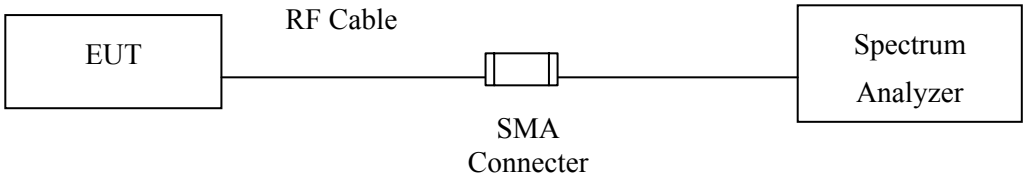
5.5. Test Result of RF Antenna Conducted Test

According KDB 558074 Section 11.1,c) attenuation to levels below the 15.209 general radiated emissions limits is not required, this test item is not performed.

6. Band Edge

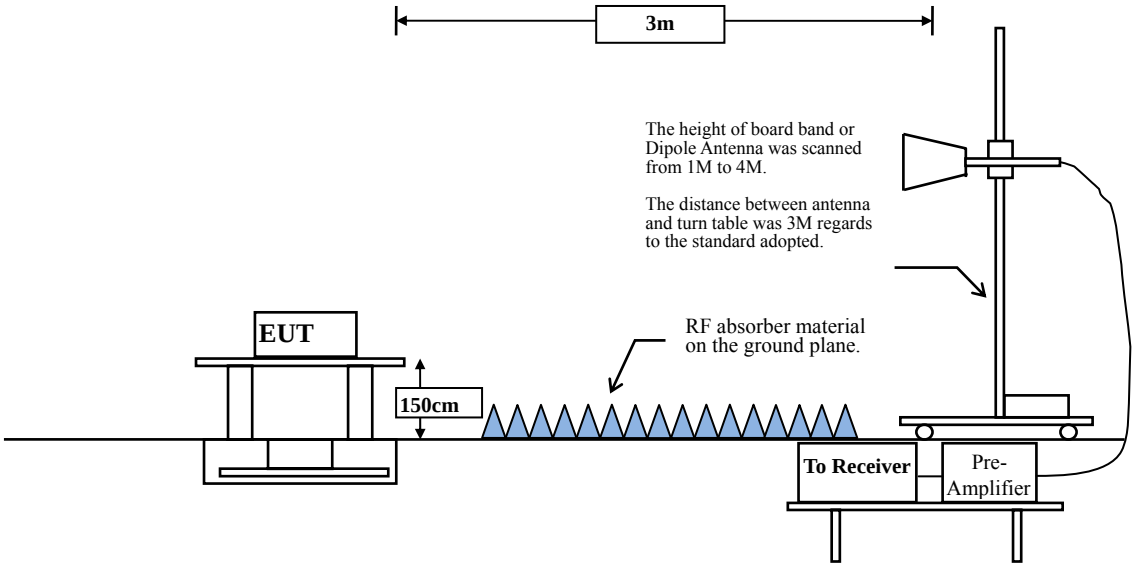
6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1GHz



6.2. Limit

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. 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

Conducted: ±1.23dB
Radiated:
Horizontal polarization：1-18GHz: ±3.77dB
Vertical polarization：1-18GHz : ±3.83dB

6.5. Test Result of Band Edge

Product : Qrio Smart Lock
Test Item : Band Edge
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Arerage Limit (dBuV/m)	Result
00 (Peak)	2362.609	11.770	37.666	49.437	74.00	54.00	Pass
00 (Peak)	2390.000	11.897	35.785	47.682	74.00	54.00	Pass
00 (Peak)	2398.696	11.929	58.473	70.403	--	--	--
00 (Peak)	2400.000	11.935	58.022	69.957	--	--	--
00 (Peak)	2402.029	11.943	63.131	75.073	--	--	--
00 (Average)	2390.000	11.897	23.609	35.506	74.00	54.00	Pass
00 (Average)	2400.000	11.935	24.168	36.103	--	--	--
00 (Average)	2402.029	11.943	48.189	60.131	--	--	--

Figure Channel 00: Horizontal (Peak)

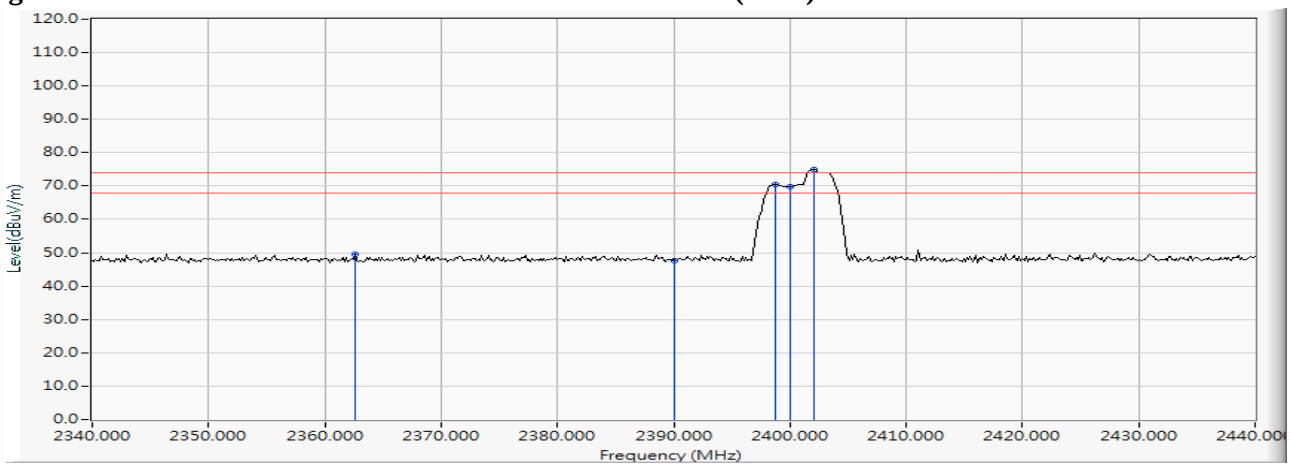
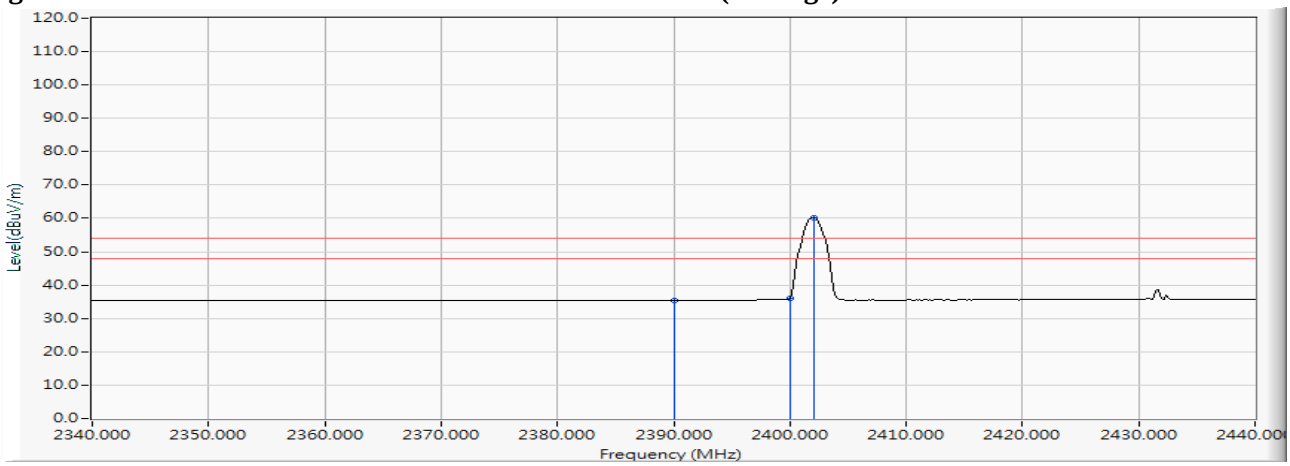


Figure Channel 00: Horizontal (Average)



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 : Qrio Smart Lock
Test Item : Band Edge
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Arerage Limit (dBuV/m)	Result
00 (Peak)	2353.043	11.728	37.557	49.286	74.00	54.00	Pass
00 (Peak)	2390.000	11.897	36.449	48.346	74.00	54.00	Pass
00 (Peak)	2398.551	11.929	61.165	73.094	--	--	--
00 (Peak)	2400.000	11.935	60.771	72.706	--	--	--
00 (Peak)	2402.029	11.943	66.129	78.071	--	--	--
00 (Average)	2390.000	11.897	23.656	35.553	74.00	54.00	Pass
00 (Average)	2400.000	11.935	24.903	36.838	--	--	--
00 (Average)	2402.029	11.943	50.917	62.859	--	--	--

Figure Channel 00: Vertical (Peak)

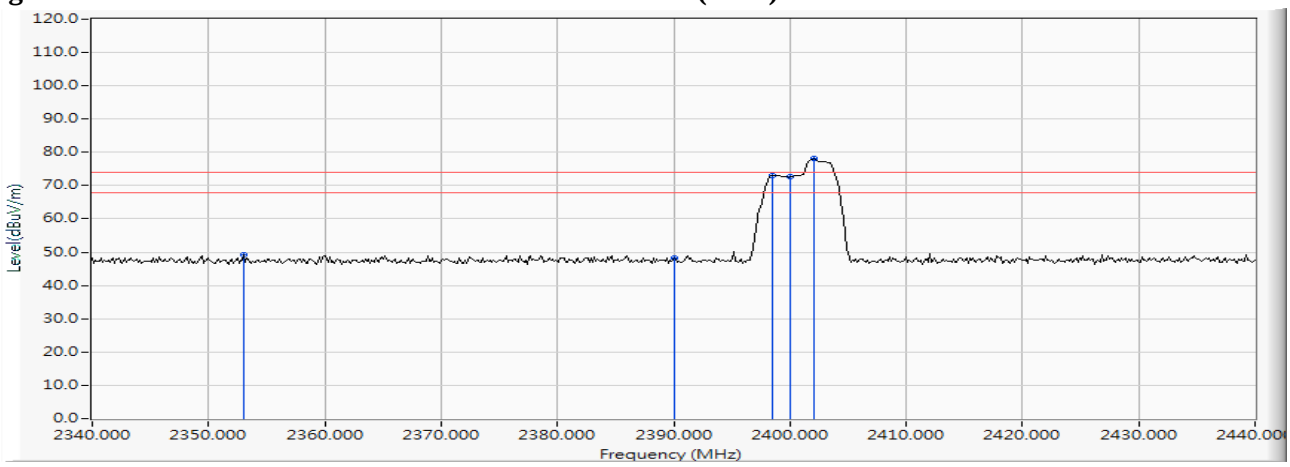
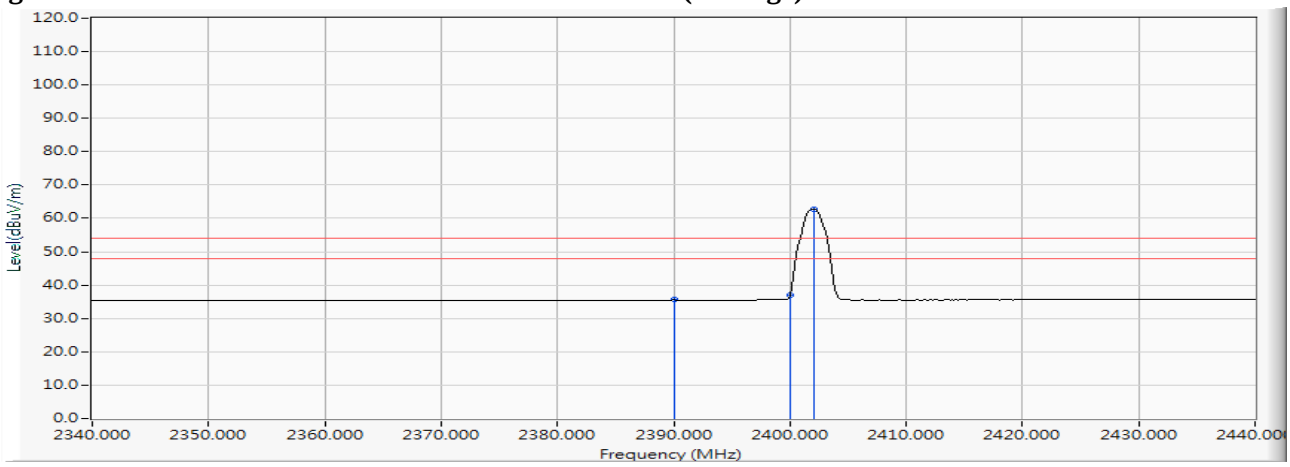


Figure Channel 00: Vertical (Average)



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 : Qrio Smart Lock
Test Item : Band Edge
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Arerage Limit (dBuV/m)	Result
39 (Peak)	2480.022	12.258	66.797	79.055	--	--	--
39 (Peak)	2483.500	12.272	36.040	48.312	74.00	54.00	Pass
39 (Peak)	2493.935	12.312	38.502	50.814	74.00	54.00	Pass
39 (Average)	2480.022	12.258	50.854	63.112	--	--	--
39 (Average)	2483.500	12.272	23.761	36.033	74.00	54.00	Pass

Figure Channel 39: Horizontal (Peak)

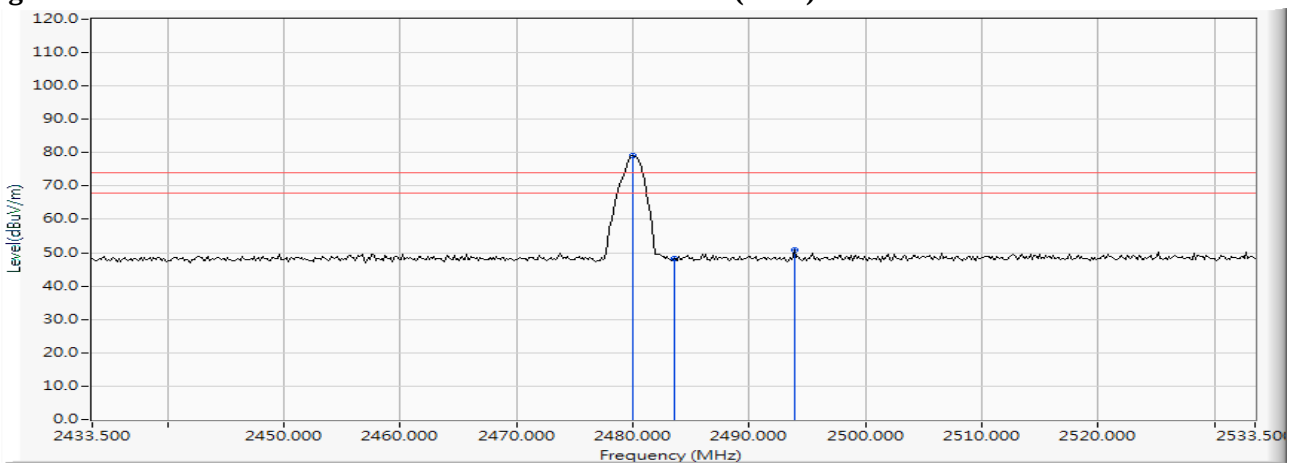
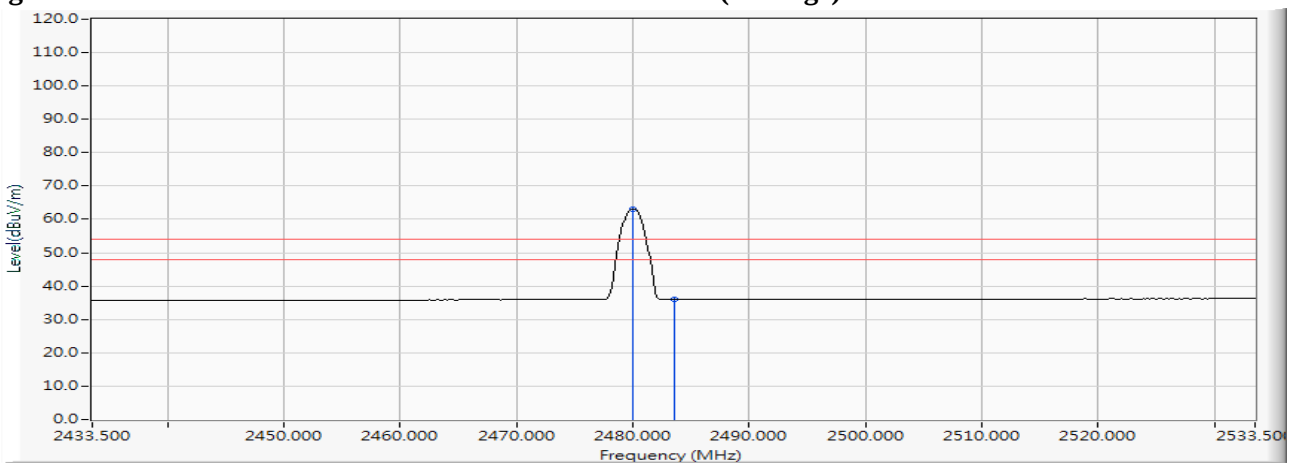


Figure Channel 39: Horizontal (Average)



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 : Qrio Smart Lock
Test Item : Band Edge
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Arerage Limit (dBuV/m)	Result
39 (Peak)	2480.022	36.397	70.600	82.858	--	--	--
39 (Peak)	2483.500	36.409	35.974	48.246	74.00	54.00	Pass
39 (Peak)	2533.210	36.523	37.872	50.278	74.00	54.00	Pass
39 (Average)	2480.022	12.258	53.296	65.554	--	--	--
39 (Average)	2483.500	12.272	23.772	36.044	74.00	54.00	Pass

Figure Channel 39: Vertical (Peak)

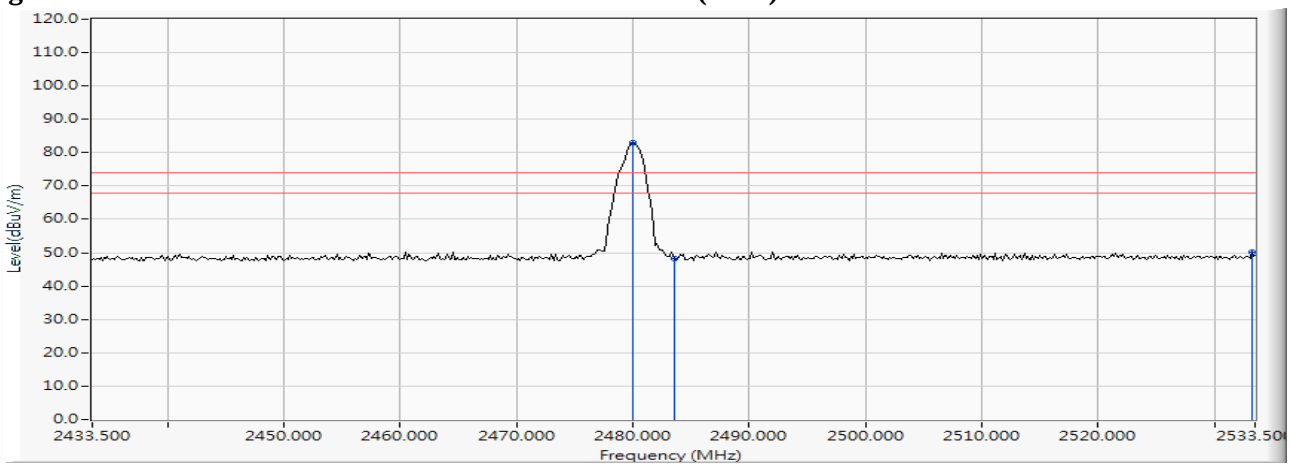
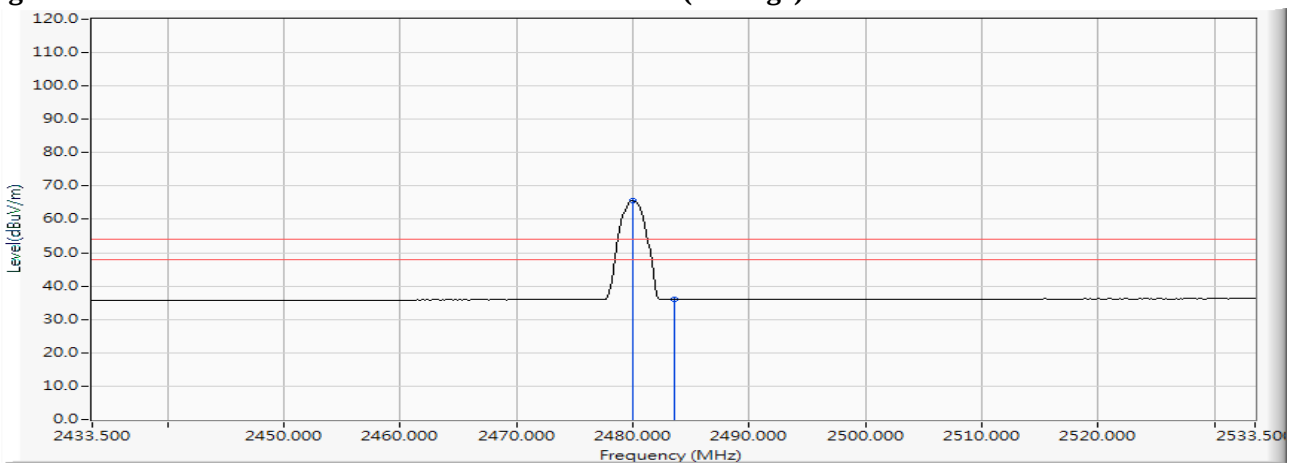


Figure Channel 39: Vertical (Average)

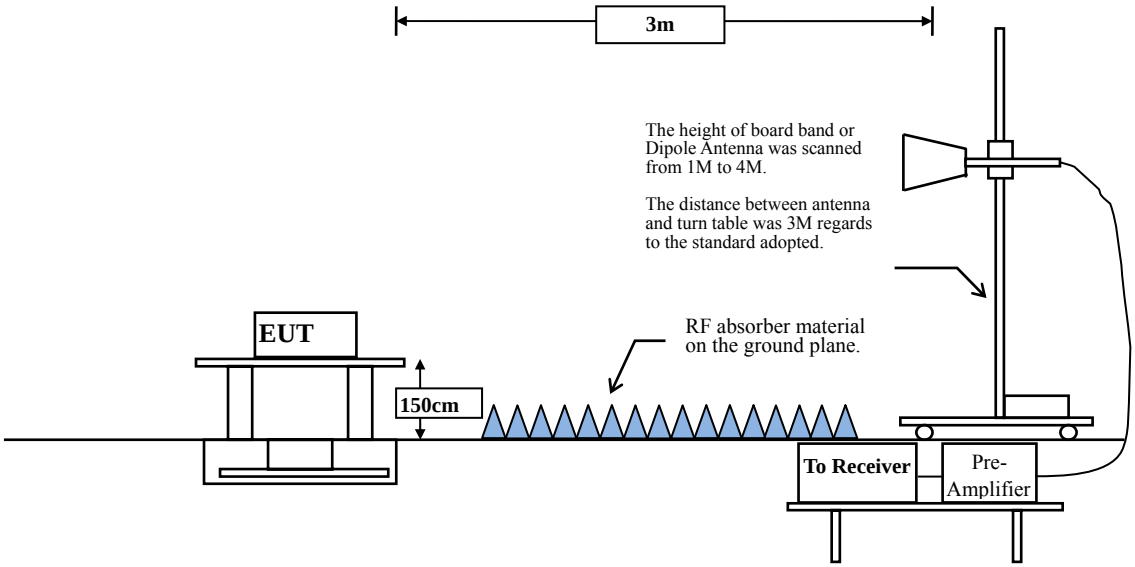


Note:

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≥3*RBW

7.4. Uncertainty

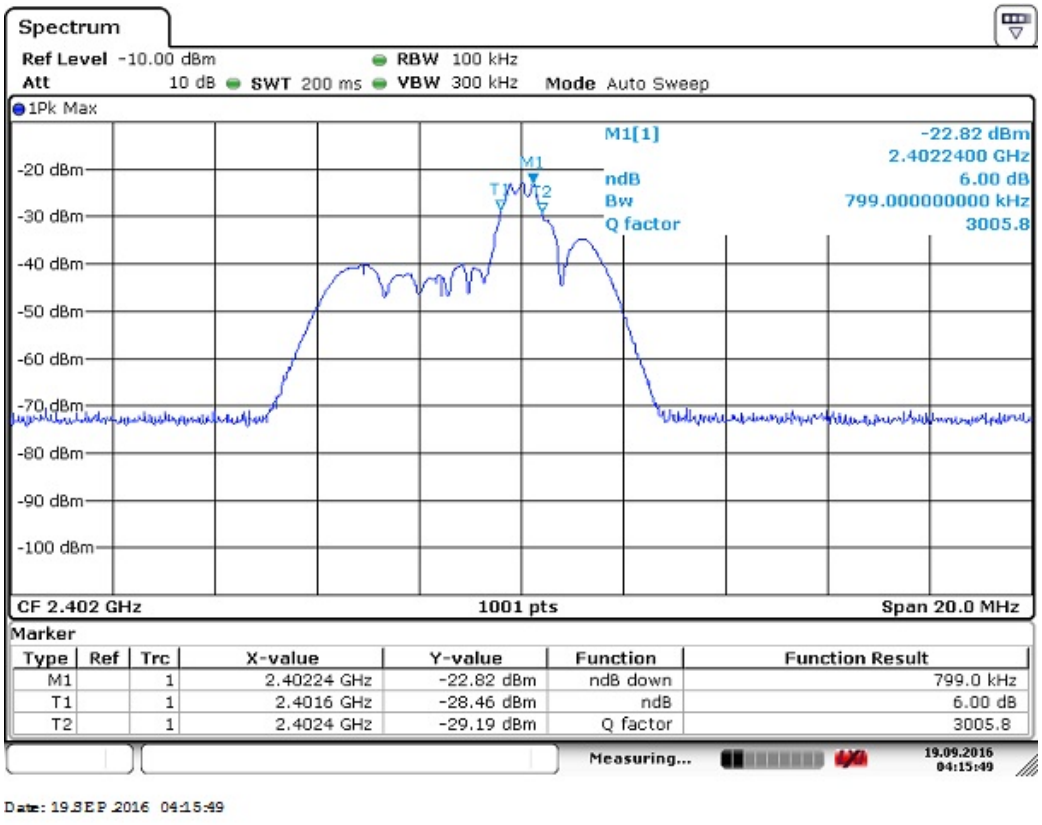
±279.2Hz

7.5. Test Result of 6dB Bandwidth

Product : Qrio Smart Lock
Test Item : 6dB Bandwidth Data
Test Mode : Mode 1: Transmit - BLE (2402MHz)
Test Date : 2016/09/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	799	>500	Pass

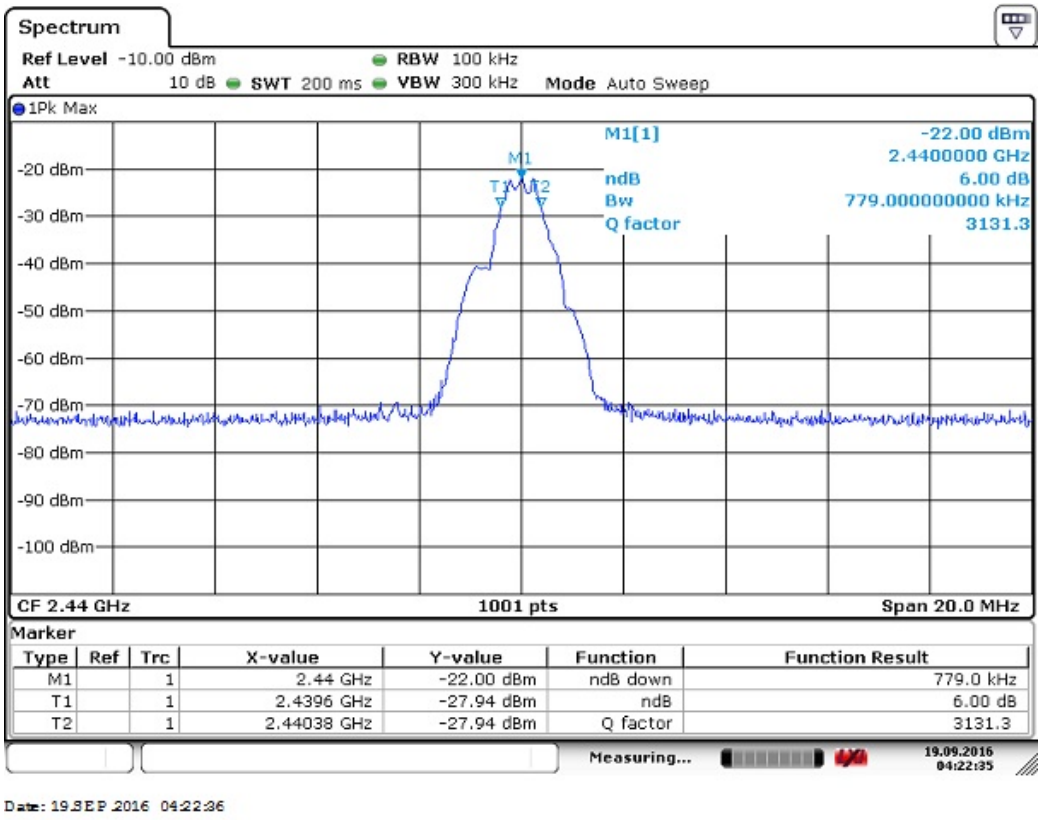
Figure Channel 00:



Product : Qrio Smart Lock
Test Item : 6dB Bandwidth Data
Test Mode : Mode 1: Transmit - BLE (2440MHz)
Test Date : 2016/09/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	779	>500	Pass

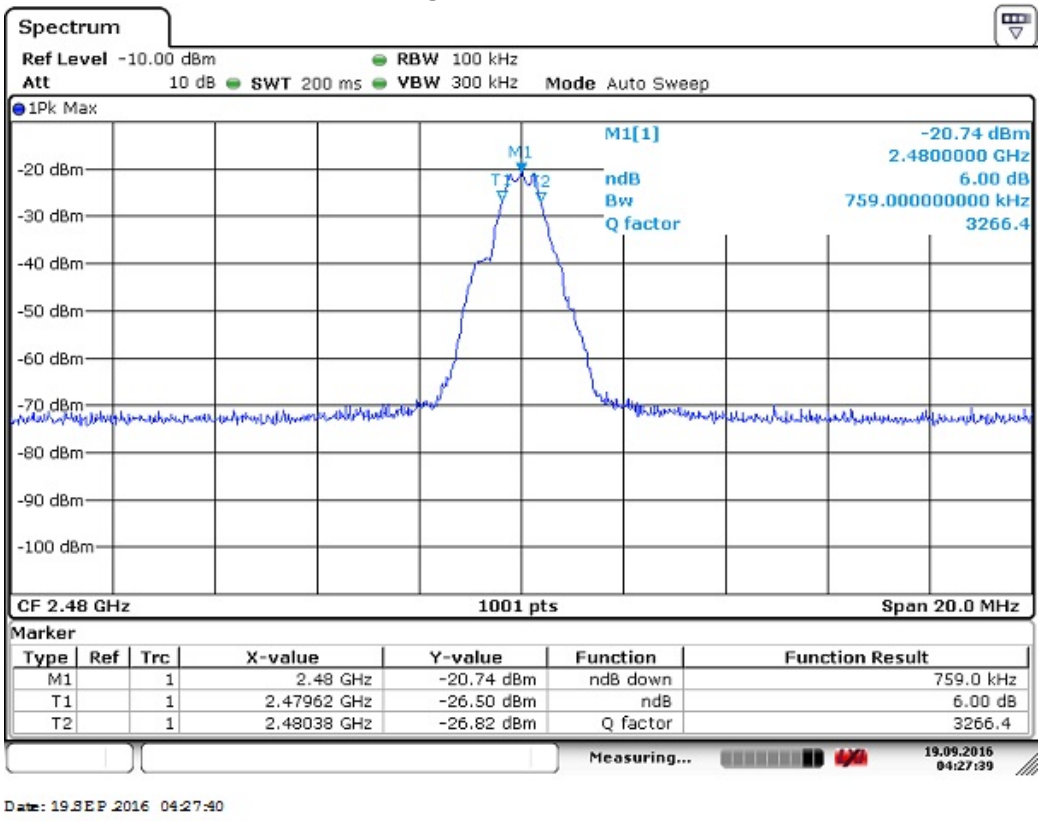
Figure Channel 19:



Product : Qrio Smart Lock
Test Item : 6dB Bandwidth Data
Test Mode : Mode 1: Transmit - BLE (2480MHz)
Test Date : 2016/09/19

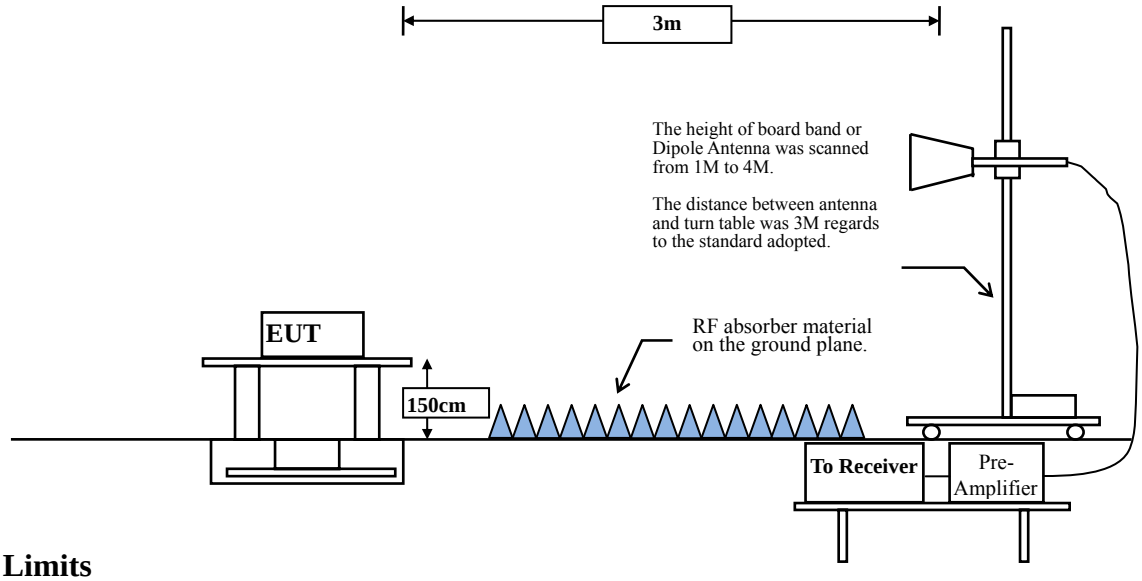
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	759	>500	Pass

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 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.

Field Strength measurement were converted to EIRP using formula:

$$eirp = p_t \times g_t = (E \times d)^2/30$$

where:

pt = transmitter output power in watts,

gt = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

(This is from Section 1.1 of KDB 412172 D01 Determining ERP and EIRP v01r01)

8.4. Uncertainty

Radiated:

Horizontal polarization：1-18GHz: ±3.77dB

Vertical polarization：1-18GHz : ±3.83dB

8.5. Test Result of Power Density

Product : Qrio Smart Lock
Test Item : Power Density Data
Test Mode : Mode 1: Transmit - BLE
Test Date : 2016/09/09

Channel No.	Frequency (MHz)	Measure Level (dBuV/m)	Power Density EIRP (dBm)	Antenna (dBi)	Power Density (dBm)	Required Limit (dBm)
Channel 00	2402.00	78.385	-16.84	-1.5	-15.34	≤8dBm
Channel 19	2440.00	79.576	-15.65	-1.5	-14.15	≤8dBm
Channel 39	2480.00	80.761	-14.47	-1.5	-12.97	≤8dBm

Note:
1. Field Strength measurement are performed in Horizontal、Vertical polarization. Only the Maximum measure level is shown in the report.
2. Field Strength measurement were converted to Power Density EIRP by formula.
3. Power Density = Power Density EIRP - Antenna Gain.

9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs