

FCC Part15.247 Test Report

Industry Canada RSS-Gen Issue 3/RSS-210 Issue 8

FCC Part15 Subpart C

Product Name : Kreyos Meteor
Model No. : KM0001
FCC ID : 2ABLC-KM0001
IC : 11634A-KM0001

Applicant : Kreyos, Inc.

Address : 955 Benecia Avenue, Sunnyvale, CA 94085, United
States

Date of Receipt : Dec. 16, 2013
Test Date : Dec. 16, 2013~May. 19, 2014
Issued Date : May. 21, 2014
Report No. : 13C0429R-RF-US-P06V02
Report Version : V1.3



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 of the equipment and evaluated measurement uncertainty herein.

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

The test report shall not be reproduced without the written approval of QuieTek Corporation.

Test Report Certification

Issued Date : May. 21, 2014

Report No. : 13C0429R-RF-US-P06V02



Product Name : Kreyos Meteor
 Applicant : Kreyos, Inc.
 Address : 955 Benecia Avenue, Sunnyvale, CA 94085, United States
 Manufacturer : Kreyos, Inc.
 Address : 955 Benecia Avenue, Sunnyvale, CA 94085, United States
 Model No. : KM0001
 FCC ID : 2ABLC-KM0001
 IC : 11634A-KM0001
 EUT Voltage : DC: 3.7V
 Brand Name : Kreyos
 Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2012
 ANSI C63.4: 2009; ANSI C63.10: 2009
 KDB 558074 D01 DTS Meas Guidance v03r01
 Industry Canada RSS-Gen Issue 3/RSS-210 Issue 8
 Test Result : Complied
 Performed Location : Suzhou EMC Laboratory
 No.99 Hongye Rd., Suzhou Industrial Park Loufeng
 Hi-Tech Development Zone., Suzhou, China
 TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098
 FCC Registration Number: 800392; IC Lab Code: 4075B

Documented By : Alice Ni

Reviewed By : Dream Cao

Approved By : Jeff Chen

Laboratory Information

We, **QuieTek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	:	BSMI, NCC, TAF
Germany	:	TUV Rheinland
Norway	:	Nemko, DNV
USA	:	FCC
Japan	:	VCCI

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/tw/ctg/cts/accreditations.htm>
The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site :
<http://www.quietek.com/>
If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

HsinChu Testing Laboratory :

No.75-2, 3rd Lin, Wangye Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan, R.O.C.
TEL:+886-3-592-8858 / FAX:+886-3-592-8859 E-Mail : service@quietek.com

LinKou Testing Laboratory :

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 : service@quietek.com

Suzhou Testing Laboratory :

No.99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development Zone., SuZhou, China
TEL : +86-512-6251-5088 / FAX : 86-512-6251-5098 E-Mail : service@quietek.com

TABLE OF CONTENTS

Description	Page
1. General Information	6
1.1. EUT Description	6
1.2. Mode of Operation	8
1.3. Tested System Details	9
1.4. Configuration of Tested System	10
1.5. EUT Exercise Software	11
2. Technical Test	12
2.1. Summary of Test Result	12
2.2. Test Environment	14
3. Conducted Emission	15
3.1. Test Equipment	15
3.2. Test Setup	15
3.3. Limit	16
3.4. Test Procedure	16
3.5. Uncertainty	16
3.6. Test Result	17
4. Radiated Emission	19
4.1. Test Equipment	19
4.2. Test Setup	20
4.3. Limit	21
4.4. Test Procedure	21
4.5. Uncertainty	21
4.6. Test Result	22
5. RF Antenna Conducted Spurious	25
5.1. Test Equipment	25
5.2. Test Setup	25
5.3. Limit	25
5.4. Test Procedure	26
5.5. Uncertainty	26
5.6. Test Result	27
6. Radiated Emission Band Edge	28
6.1. Test Equipment	28
6.2. Test Setup	29
6.3. Limit	29
6.4. Test Procedure	29
6.5. Uncertainty	29
6.6. Test Result	30

7. Operation Frequency Range of 20dB Bandwidth.....	38
7.1. Test Equipment	38
7.2. Test Setup	38
7.3. Limit	38
7.4. Test Procedure	38
7.5. Uncertainty	38
7.6. Test Result	39
8. Occupied Bandwidth	40
8.1. Test Equipment	40
8.2. Test Setup	40
8.3. Limit	40
8.4. Test Procedure	40
8.5. Uncertainty	40
8.6. Test Result	41
9. Power Output	43
9.1. Test Equipment	43
9.2. Test Setup	43
9.3. Limit	43
9.4. Test Procedure	43
9.5. Uncertainty	44
9.6. Test Result	45
10. Power Spectral Density	46
10.1. Test Equipment	46
10.2. Test Setup	46
10.3. Limit	46
10.4. Test Procedure	46
10.5. Uncertainty	47
10.6. Test Result	48
Receiver Spurious Emission for Industry Canada RSS-Gen Requirement	50
13.1 Test Equipment	50
13.2 Test Setup	51
13.3 Limit	52
13.4 Test Procedure	53
13.5 Deviation from Test Standard	53
13.6 Test Result	54

1. General Information

1.1. EUT Description

Product Name	Kreyos Meteor
Brand Name	Kreyos
Model No.	KM0001
Working Voltage	DC: 3.7V
Bluetooth Specification	4.0
Frequency Range	2402- 2480 MHz
Channel Number	V2.1+EDR: 79 V4.0: 40
Channel Separation	V2.1+EDR: 1MHz V4.0: 2MHz
Type of Modulation	V2.1+EDR: GFSK, Pi/4 DQPSK, 8DPSK V4.0: GFSK
Data Rate	V2.1+EDR: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) V4.0: 1Mbps(GFSK)
Antenna Type	Chip-Antenna
Peak Antenna Gain	2.1dBi

Bluetooth Working Frequency of Each Channel: (For V4.0)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz	03	2408 MHz
04	2410 MHz	05	2412 MHz	06	2414 MHz	07	2416 MHz
08	2418 MHz	09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz	15	2432 MHz
16	2434 MHz	17	2436 MHz	18	2438 MHz	19	2440 MHz
20	2442 MHz	21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz	27	2456 MHz
28	2458 MHz	29	2460 MHz	30	2462 MHz	31	2464 MHz
32	2466 MHz	33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz	39	2480 MHz

1.2. Mode of Operation

QuieTek has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit-1Mbps(GFSK_BLE)

Note:

1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

1.3. Tested System Details

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

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

1.4. Configuration of Tested System

Connection Diagram	
	
Signal Cable Type	Signal cable Description

1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of equipment.
3	Select test mode and channel to test

2. Technical Test

2.1. Summary of Test Result

- ☒ No deviations from the test standards
- ☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.209	Yes	No
RF Antenna Conducted Spurious	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2012 15.247(d)	Yes	No
Operation Frequency Range of 20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2012 15.215(c)	Yes	No
Occupied Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(a)(2)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(b)(3)	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(e)	Yes	No

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 3 December 2010 Section 7.2.2	Yes	No
Radiated Emission	RSS-210 Issue 8 December 2010 Section 2.7 Table 2 and Table 3	Yes	No
RF Antenna Conducted Spurious	RSS-210 Issue 8 December 2010 Section A8.5	Yes	No
Radiated Emission Band Edge	RSS-210 Issue 8 December 2010 Section A8.5	Yes	No
Occupied Bandwidth	RSS-Gen Issue 3 December 2010 Section 4.6.1 and 4.6.2 RSS-210 Issue 8 December 2010 Section A8.2(1)	Yes	No
Power Output	RSS-210 Issue 8 December 2010 Section A8.4(4)	Yes	No
Power Spectral Density	RSS-210 Issue 8 December 2010 Section A8.2(2)	Yes	No

2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

3. Conducted Emission

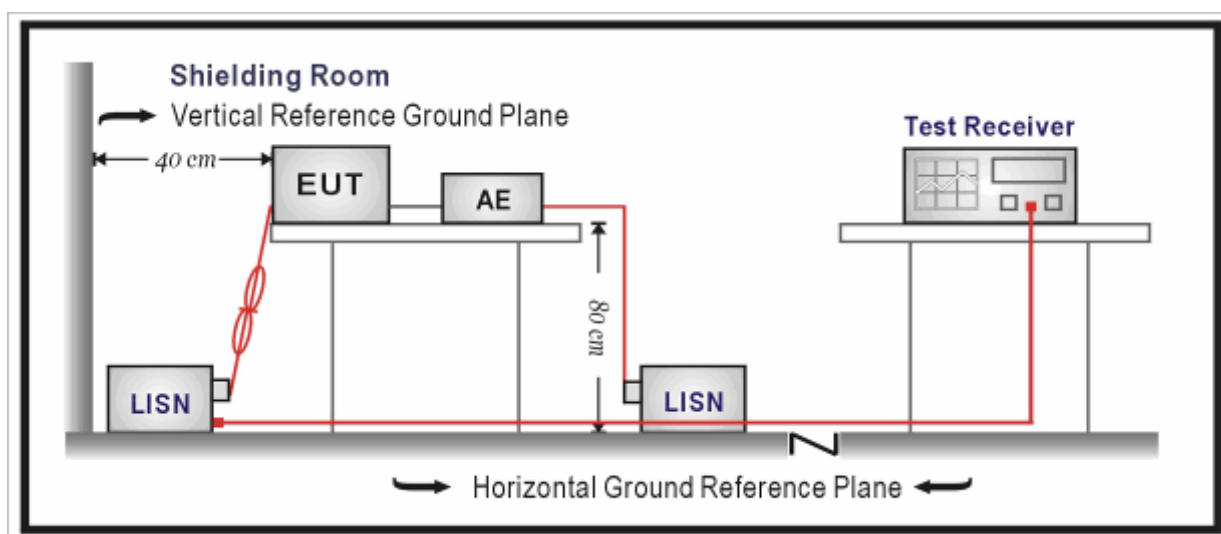
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2015.03.28
Two-Line V-Network	R&S	ENV216	100043	2015.03.28
Two-Line V-Network	R&S	ENV216	100044	2014.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2015.03.01
50ohm Termination	SHX	TF2	07081401	2014.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2015.01.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2. Test Setup



3.3. Limit

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

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

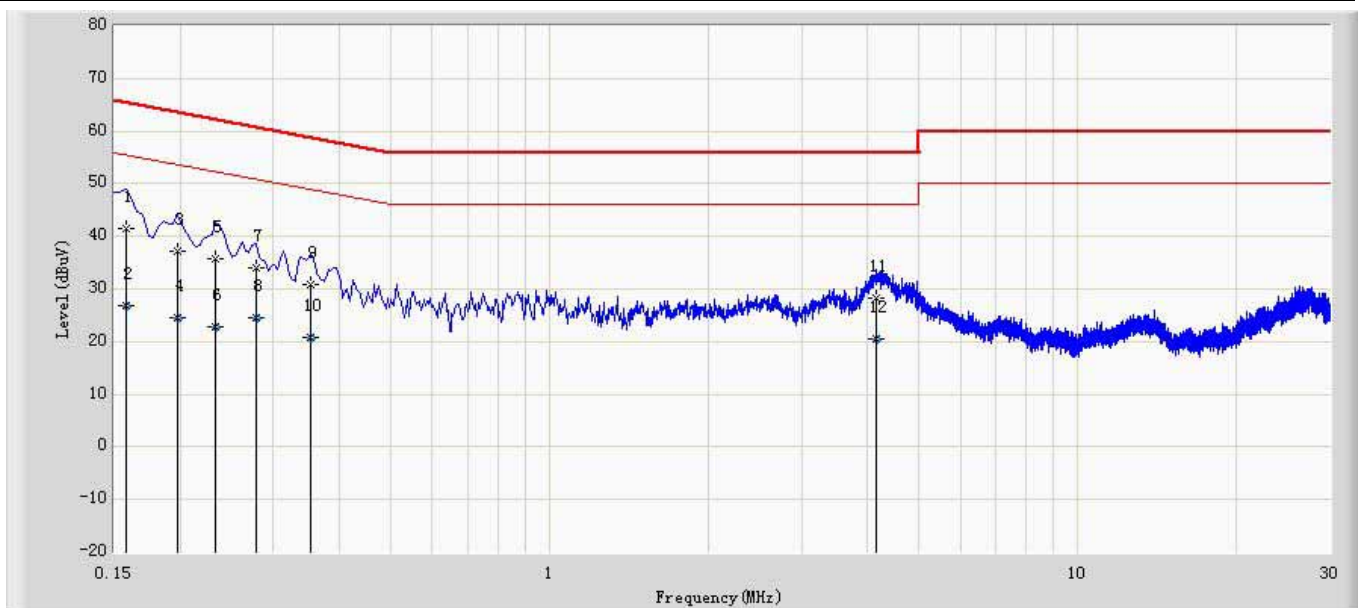
The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

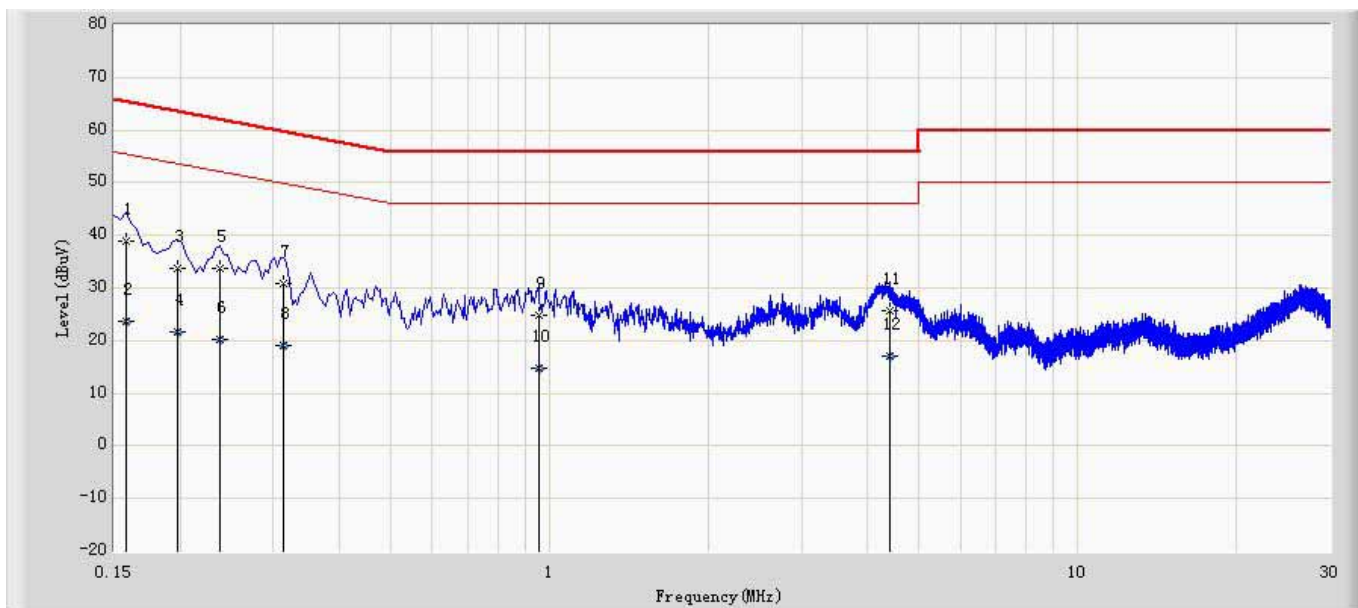
3.6. Test Result

Site: TR1	Time: 2014/05/10 - 09:12
Limit: FCC_Part15.207_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1	*	0.158	41.351	31.505	-24.218	65.568	9.846	QP
2		0.158	26.782	16.937	-28.786	55.568	9.846	AV
3		0.198	37.041	27.182	-26.653	63.694	9.860	QP
4		0.198	24.660	14.800	-29.034	53.694	9.860	AV
5		0.234	35.674	25.809	-26.632	62.307	9.865	QP
6		0.234	22.751	12.886	-29.556	52.307	9.865	AV
7		0.278	34.116	24.245	-26.760	60.875	9.871	QP
8		0.278	24.455	14.584	-26.421	50.875	9.871	AV
9		0.354	30.793	20.912	-28.076	58.868	9.881	QP
10		0.354	20.696	10.814	-28.173	48.868	9.881	AV
11		4.158	28.302	18.465	-27.698	56.000	9.837	QP
12		4.158	20.522	10.685	-25.478	46.000	9.837	AV

Site: TR1	Time: 2014/05/10 - 09:16
Limit: FCC_Part15.207_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1	*	0.158	38.884	28.893	-26.685	65.568	9.991	QP
2		0.158	23.791	13.801	-31.777	55.568	9.991	AV
3		0.198	33.875	23.953	-29.819	63.694	9.922	QP
4		0.198	21.789	11.867	-31.905	53.694	9.922	AV
5		0.238	33.817	23.898	-28.349	62.166	9.919	QP
6		0.238	20.294	10.375	-31.872	52.166	9.919	AV
7		0.314	30.941	20.985	-28.923	59.864	9.957	QP
8		0.314	19.076	9.119	-30.788	49.864	9.957	AV
9		0.954	24.770	14.754	-31.230	56.000	10.017	QP
10		0.954	14.874	4.857	-31.126	46.000	10.017	AV
11		4.394	25.813	15.741	-30.187	56.000	10.072	QP
12		4.394	17.037	6.965	-28.963	46.000	10.072	AV

4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

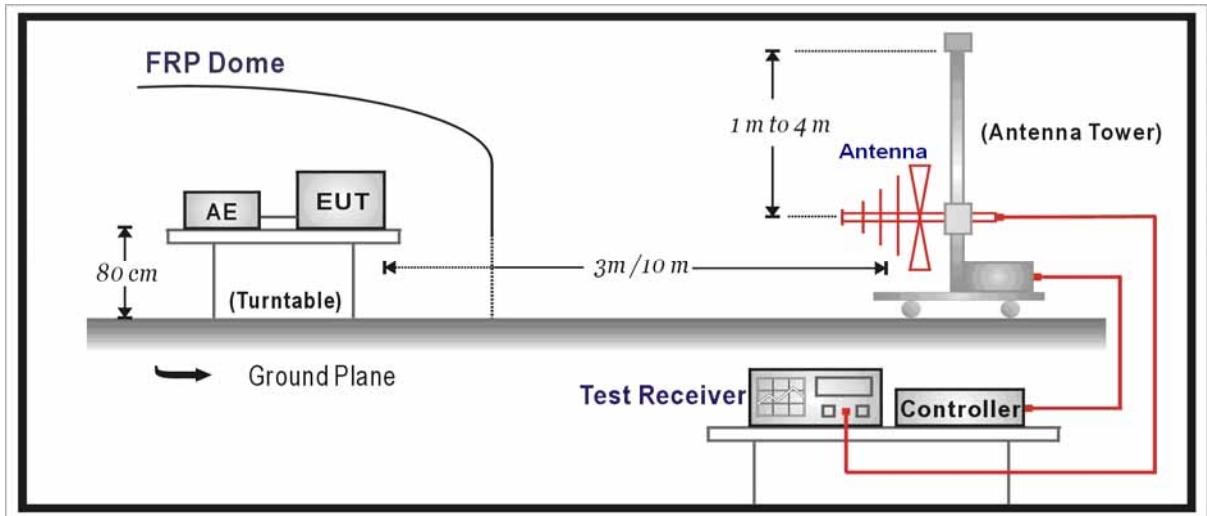
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2015.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2014.11.17
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2014.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2015.01.08

Radiated Emission / AC-5

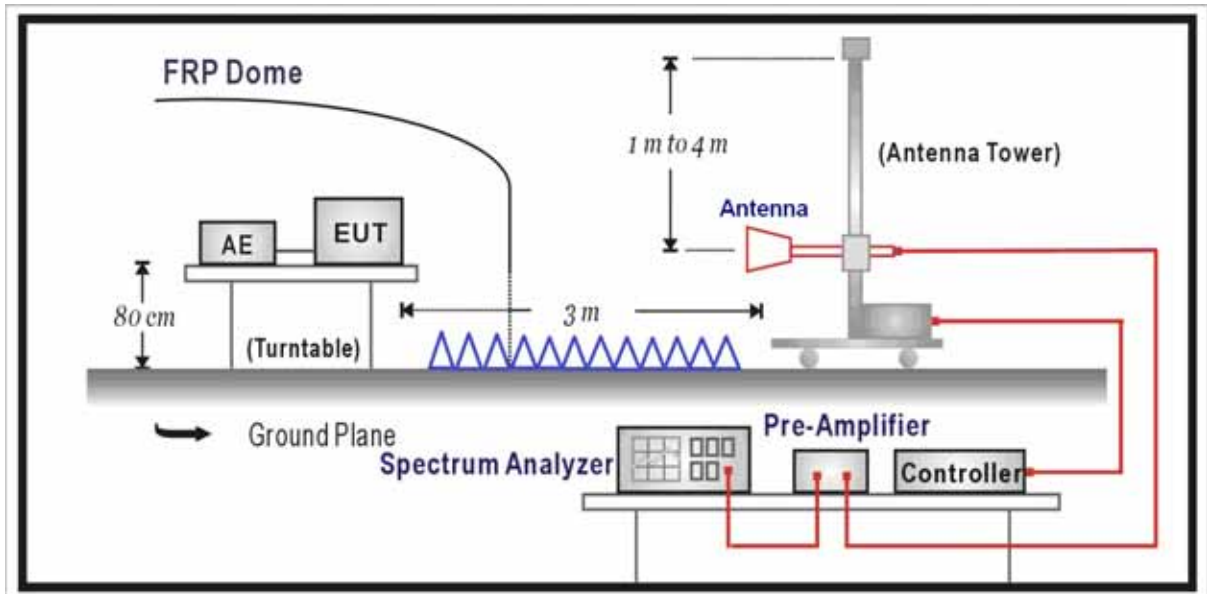
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2015.03.28
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2015.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2014.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2014.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2014.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2015.01.08

4.2. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

4.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 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 C63.4:2009 on radiated measurement.

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

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

4.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB
below 1G is defined as ± 3.8 dB

4.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

Mode 1: Transmitter-1Mbps(GFSK_BLE)

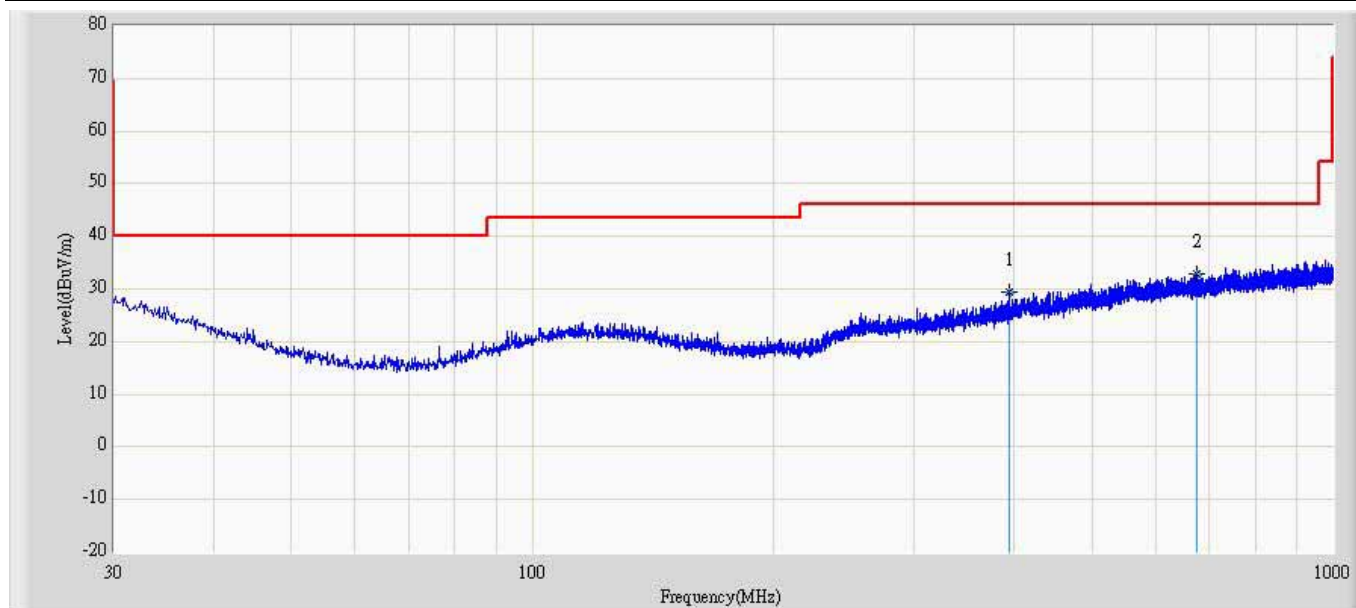
CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4808.0	37.2	7.9	45.1	54(Note2)	-8.9	PK
	V	4808.0	38.0	7.8	45.8	54(Note2)	-8.2	PK
	H	7205.0	31.4	10.6	42.0	54(Note2)	-12.0	PK
	V	7205.0	32.5	10.6	43.1	54(Note2)	-10.9	PK
	H	9608.0	29.1	12.5	41.6	54(Note2)	-12.4	PK
	V	9608.0	28.6	12.6	41.2	54(Note2)	-12.8	PK
19	H	4876.0	33.5	8.0	41.5	54(Note2)	-12.5	PK
	V	4876.0	35.6	8.0	43.6	54(Note2)	-10.4	PK
	H	7324.0	32.0	10.8	42.8	54(Note2)	-11.2	PK
	V	7324.0	32.2	10.8	43.0	54(Note2)	-11.0	PK
	H	9760.0	28.9	12.7	41.6	54(Note2)	-12.4	PK
	V	9760.0	28.1	12.8	40.9	54(Note2)	-13.1	PK
39	H	4961.0	36.3	8.2	44.5	54(Note2)	-9.5	PK
	V	4961.0	34.5	8.3	42.8	54(Note2)	-11.2	PK
	H	7443.0	32.1	10.9	43.0	54(Note2)	-11.0	PK
	V	7443.0	30.2	10.9	41.1	54(Note2)	-12.9	PK
	H	9920.0	27.4	13.2	40.6	54(Note2)	-13.4	PK
	V	9920.0	26.2	13.3	39.5	54(Note2)	-14.5	PK

Note 1: The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

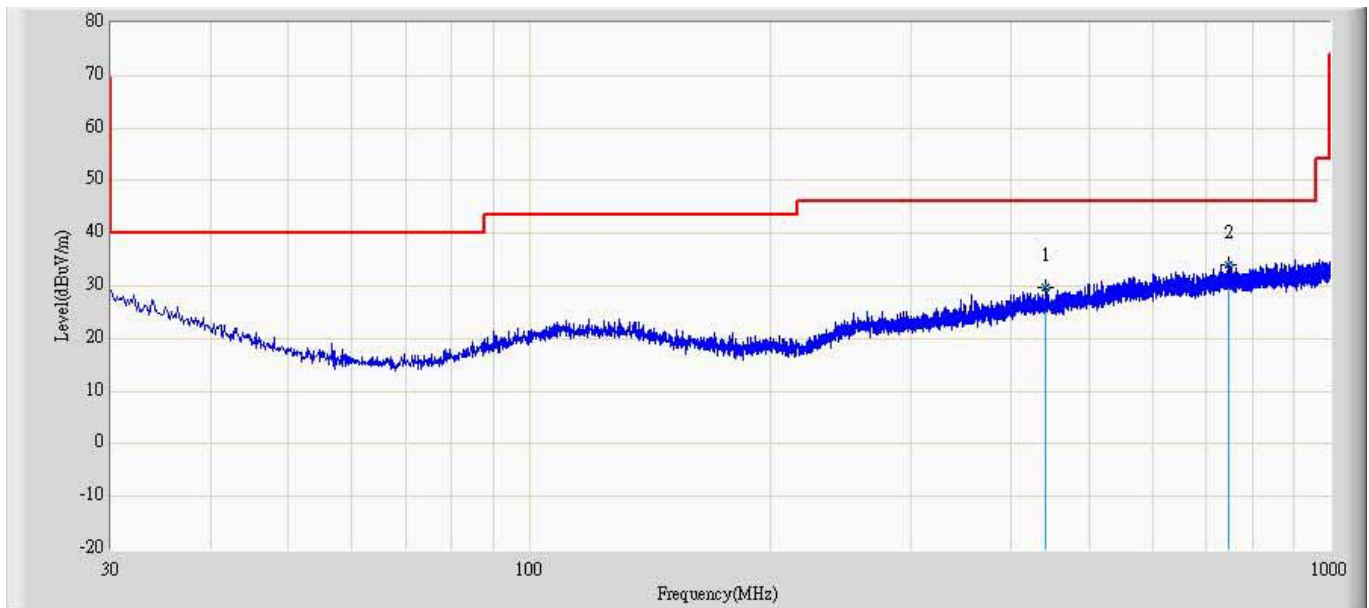
The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2014/05/19 - 20:20
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1: Transmit at channel 2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		393.386	29.309	5.896	-16.691	46.000	23.413	QP
2	*	675.171	32.831	5.389	-13.169	46.000	27.442	QP

Site: AC2	Time: 2014/05/19 - 20:22
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1: Transmit at channel 2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		441.886	29.686	5.452	-16.314	46.000	24.234	QP
2	*	748.042	33.959	5.413	-12.041	46.000	28.546	QP

5. RF Antenna Conducted Spurious

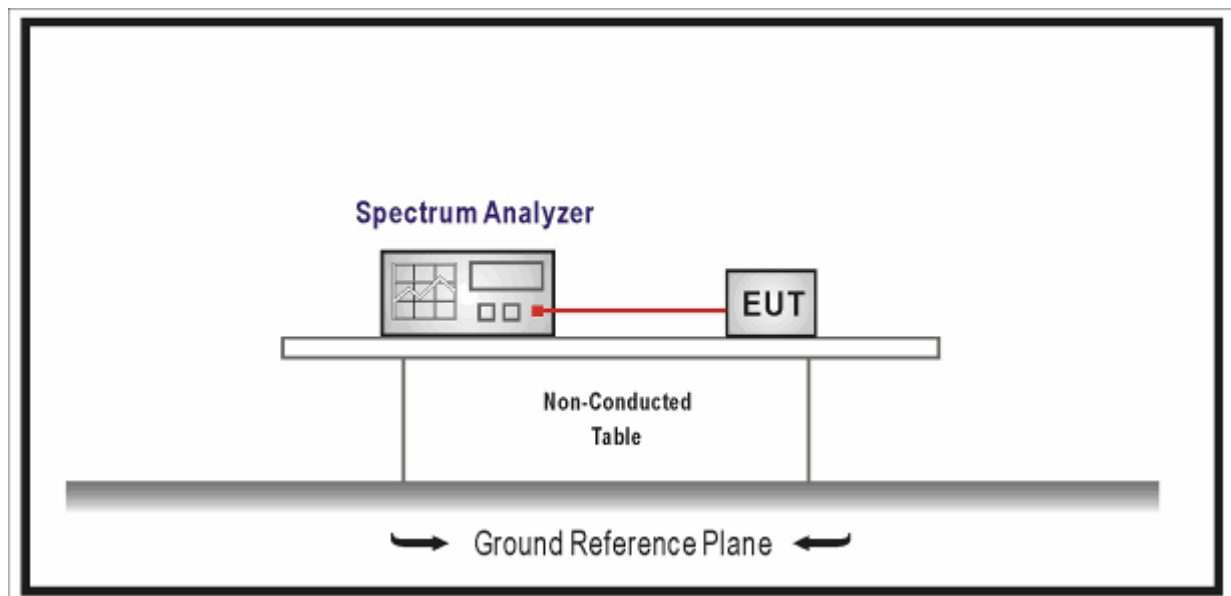
5.1. Test Equipment

RF Antenna Conducted Spurious / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

5.2. Test Setup



5.3. 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.

5.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

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

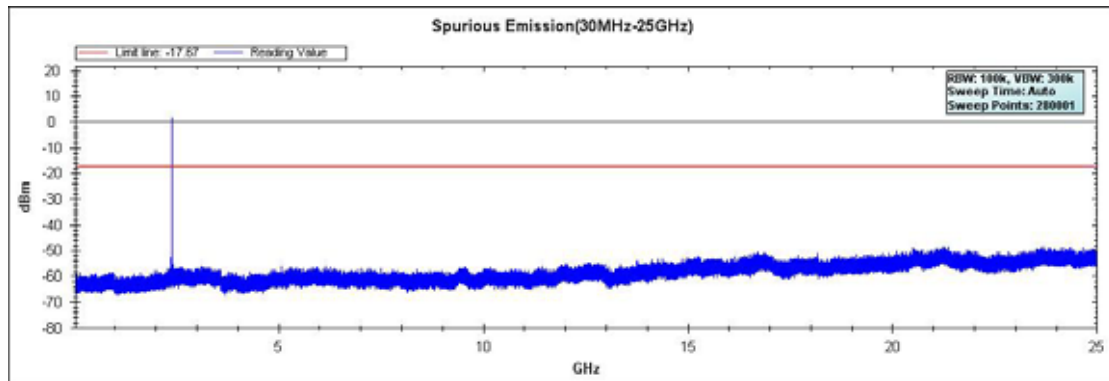
5.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

5.6. Test Result

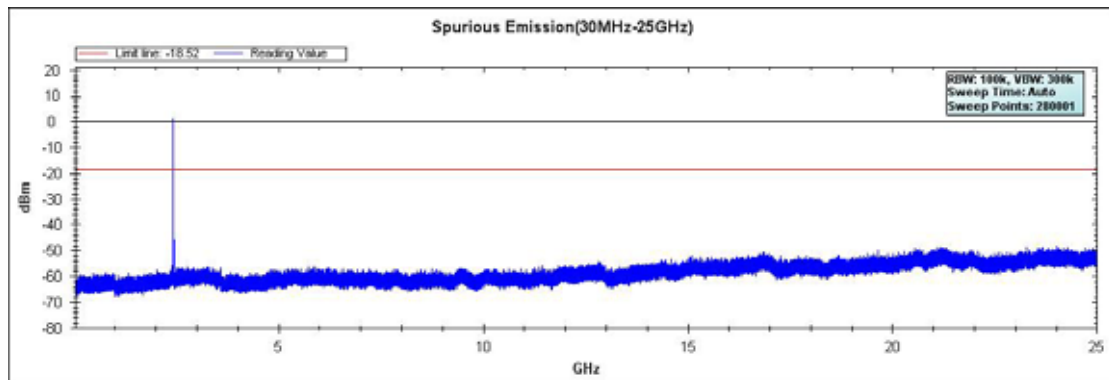
Product	:	Kreyos Meteor
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel 00 (2402MHz)



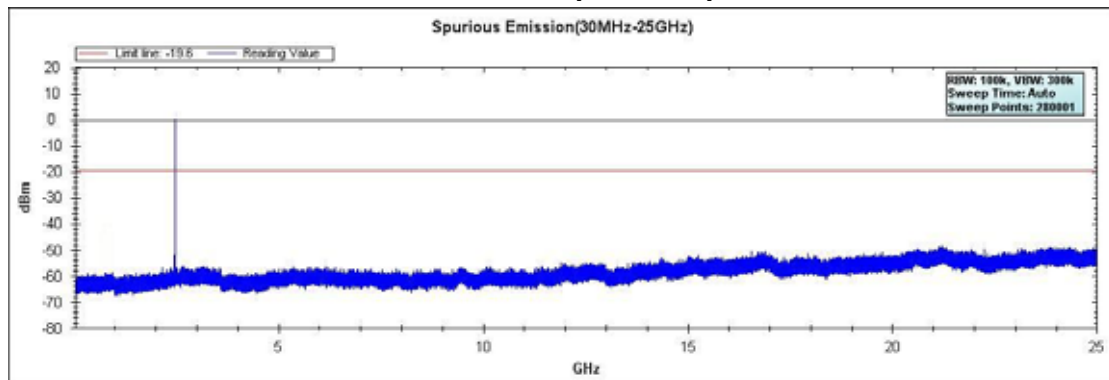
Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 19 (2440MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 39 (2480MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

6. Radiated Emission Band Edge

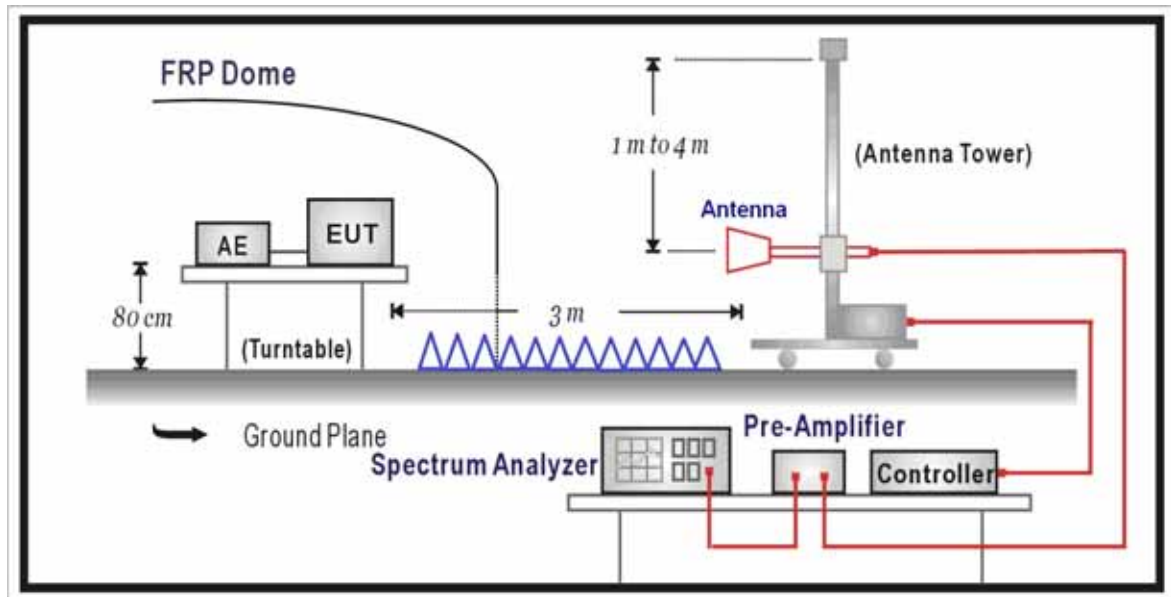
6.1. Test Equipment

☒ Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.28
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2015.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2014.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2015.01.07
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2014.06.09
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2015.01.08

Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

6.2. Test Setup



6.3. Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to ANSI C63.10 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 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.

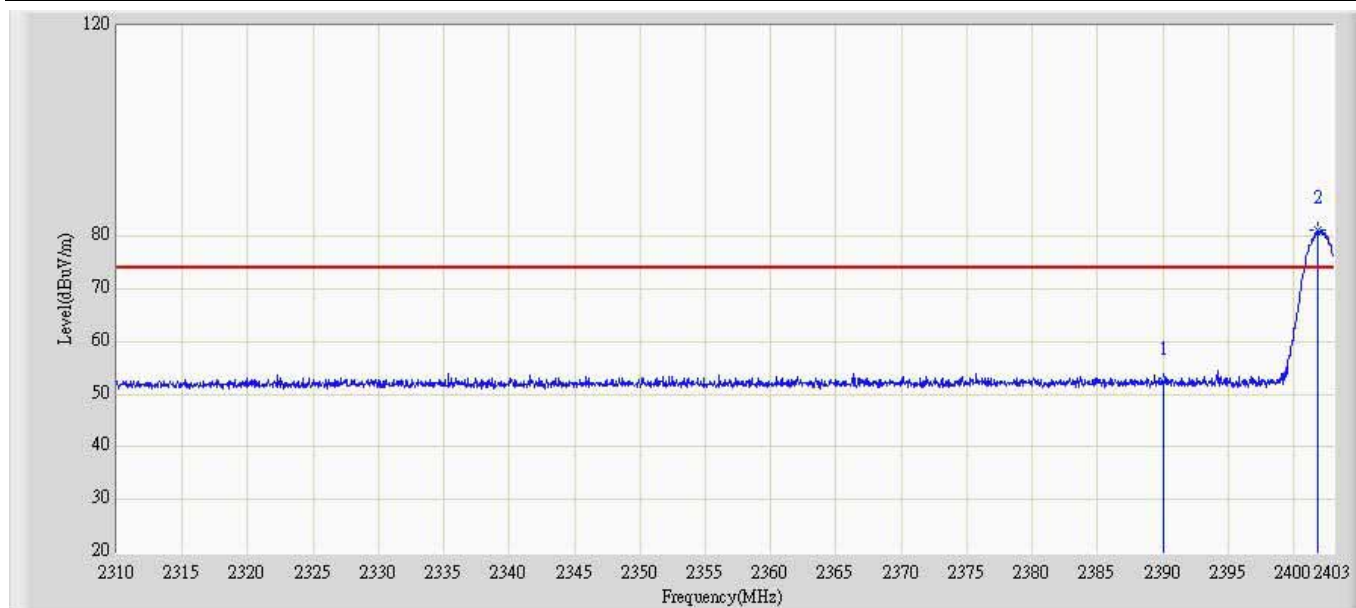
The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

6.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB

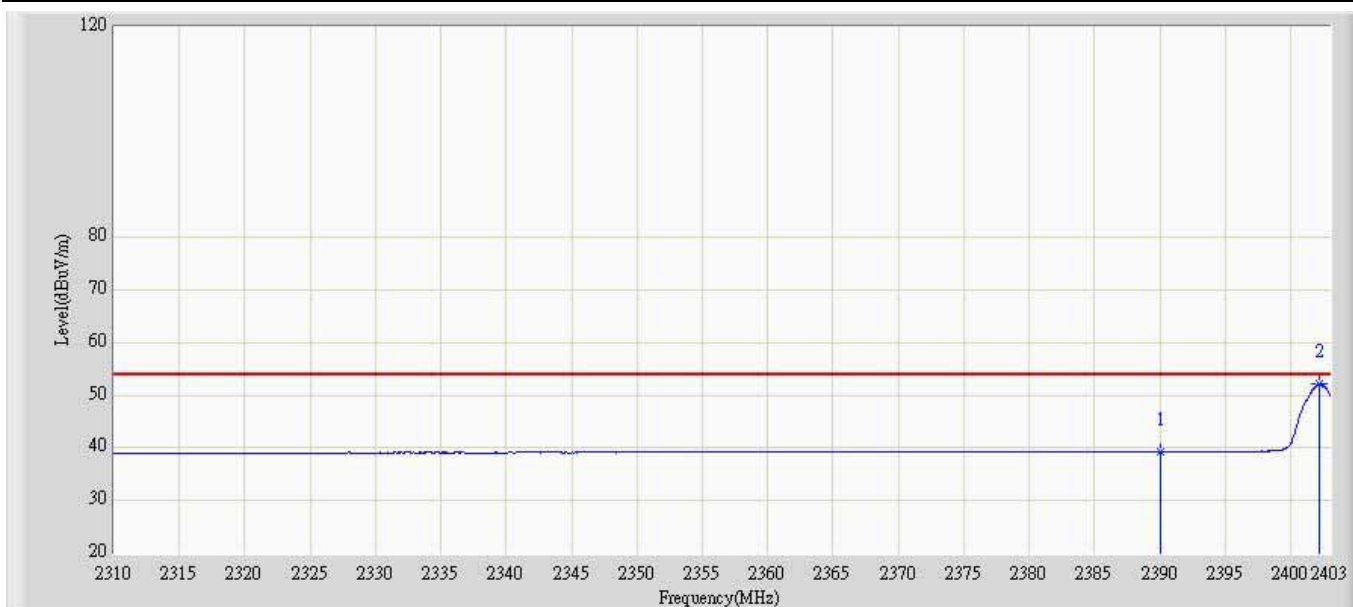
6.6. Test Result

Site: AC5	Time: 2014/05/19 - 19:52
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2402MHz by BLE	



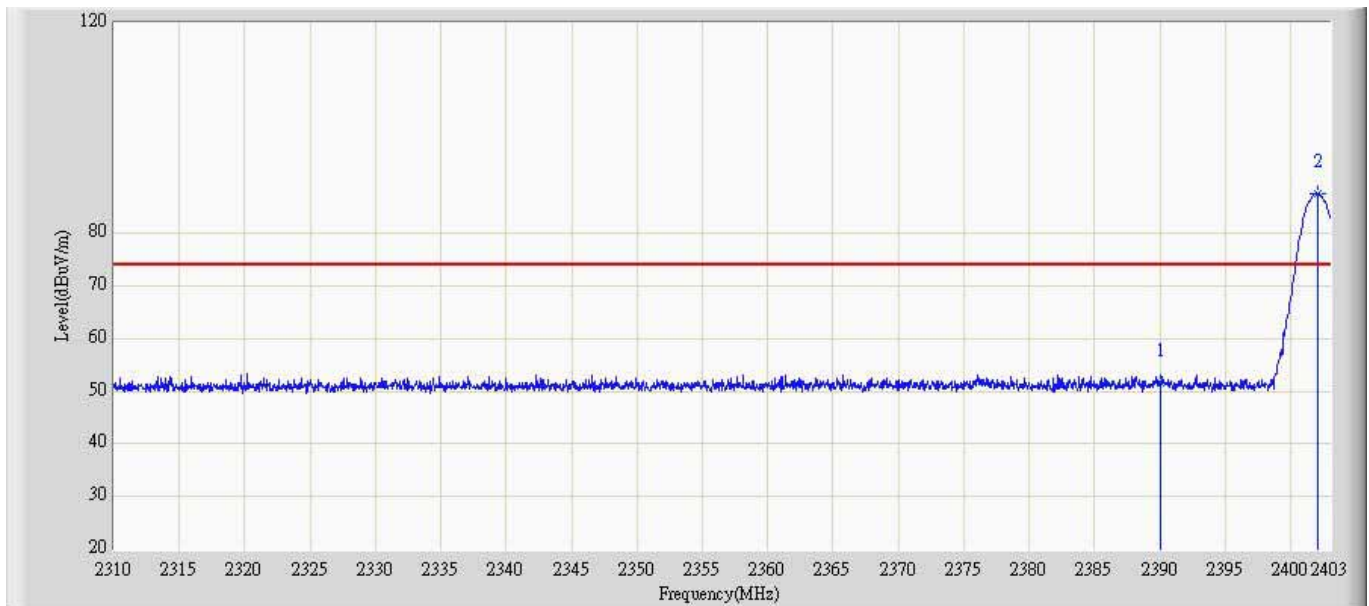
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	52.580	24.458	-21.420	74.000	28.122	PK
2	*	2401.884	81.342	53.172	N/A	N/A	28.170	PK

Site: AC5	Time: 2014/05/19 - 19:52
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2402MHz by BLE	



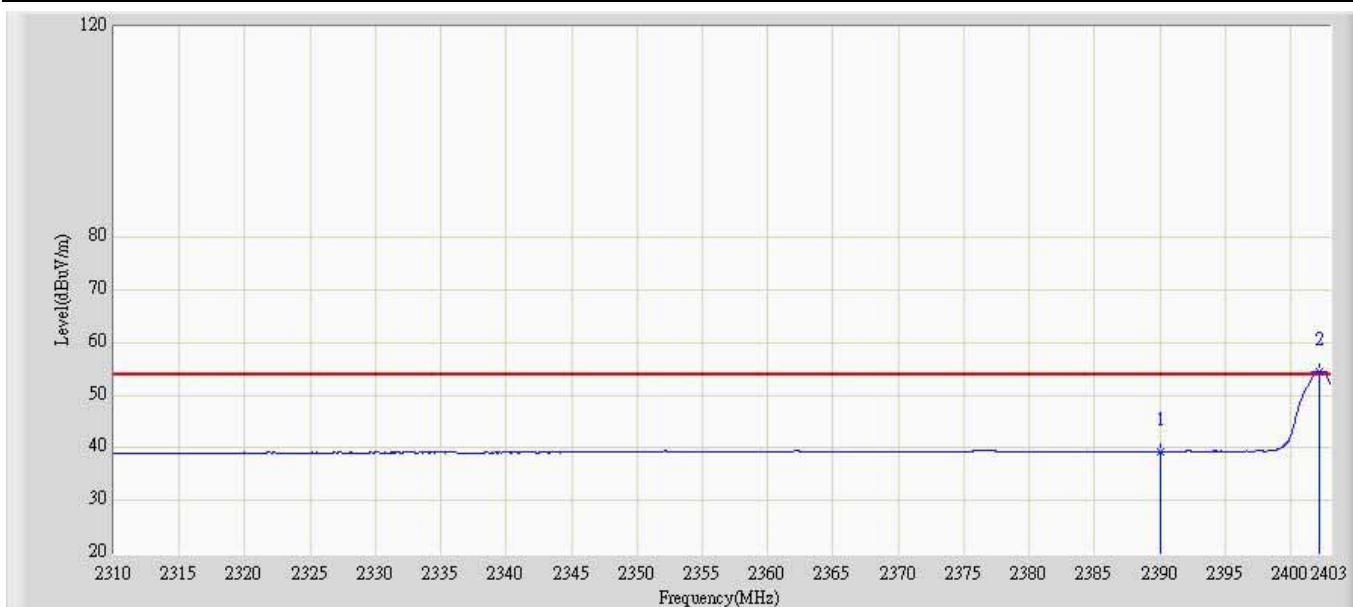
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	39.312	11.190	-14.688	54.000	28.122	AV
2	*	2402.209	52.183	24.011	N/A	N/A	28.171	AV

Site: AC5	Time: 2014/05/19 - 19:53
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2402MHz by BLE	



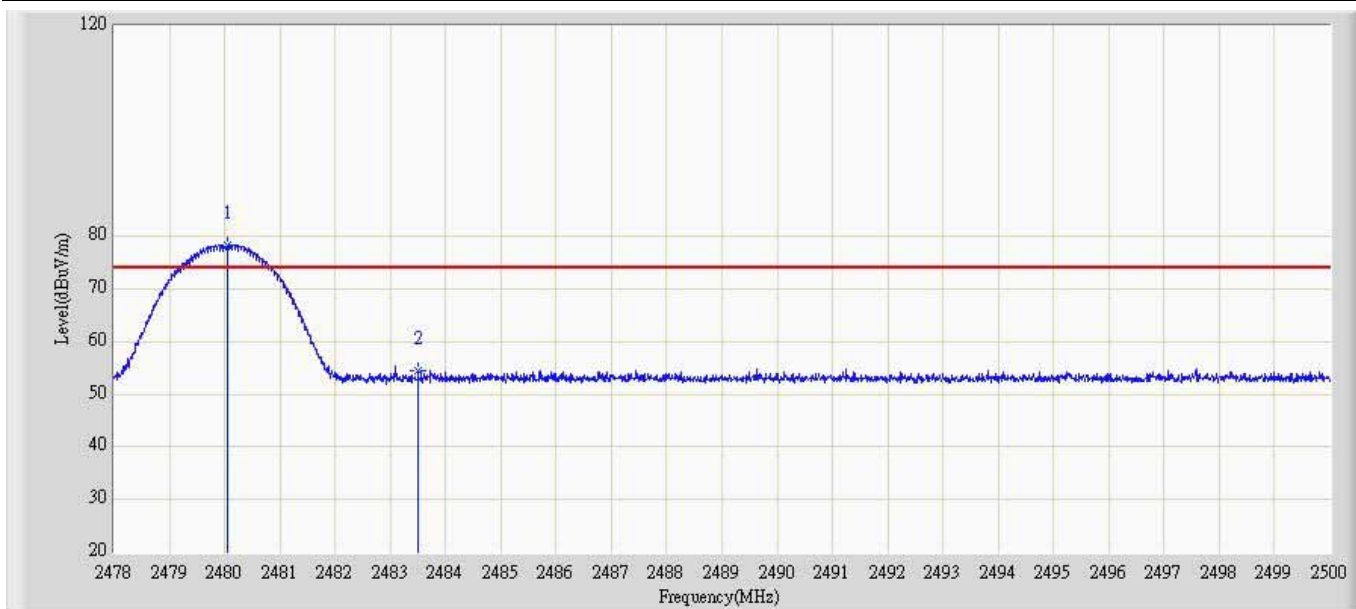
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	51.675	23.553	-22.325	74.000	28.122	PK
2	*	2402.116	87.615	59.444	N/A	N/A	28.171	PK

Site: AC5	Time: 2014/05/19 - 19:56
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2402MHz by BLE	



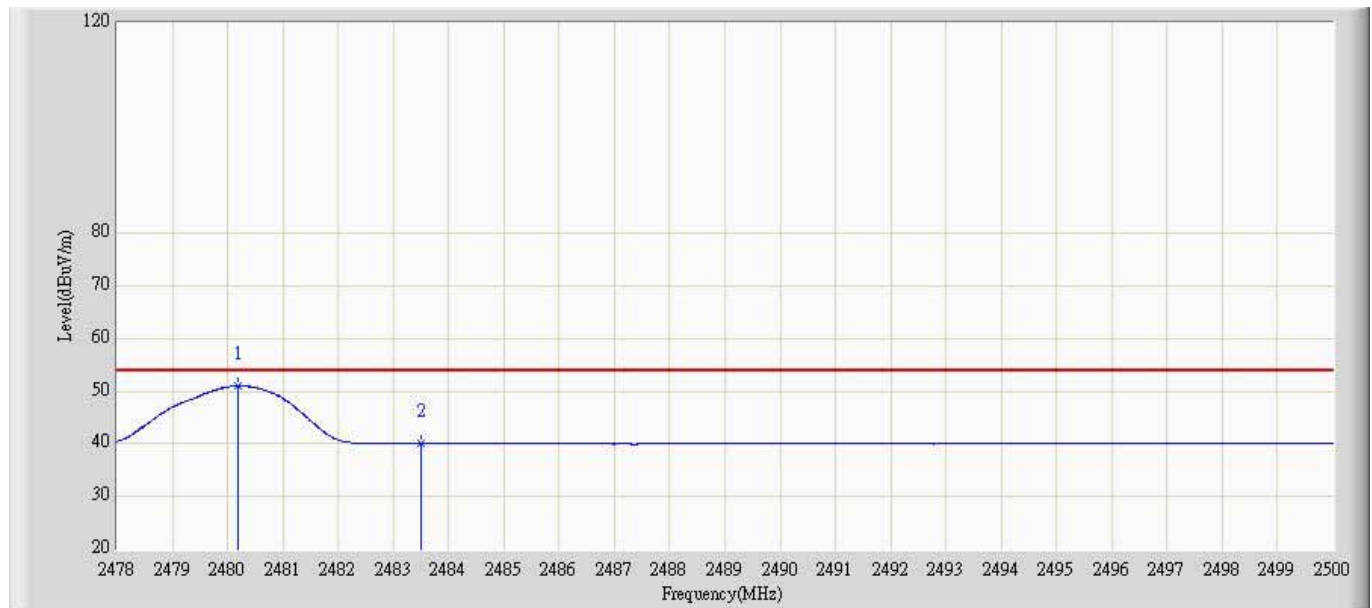
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	39.365	11.243	-14.635	54.000	28.122	AV
2	*	2402.209	54.620	26.448	N/A	N/A	28.171	AV

Site: AC5	Time: 2014/05/19 - 19:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2480MHz by BLE	



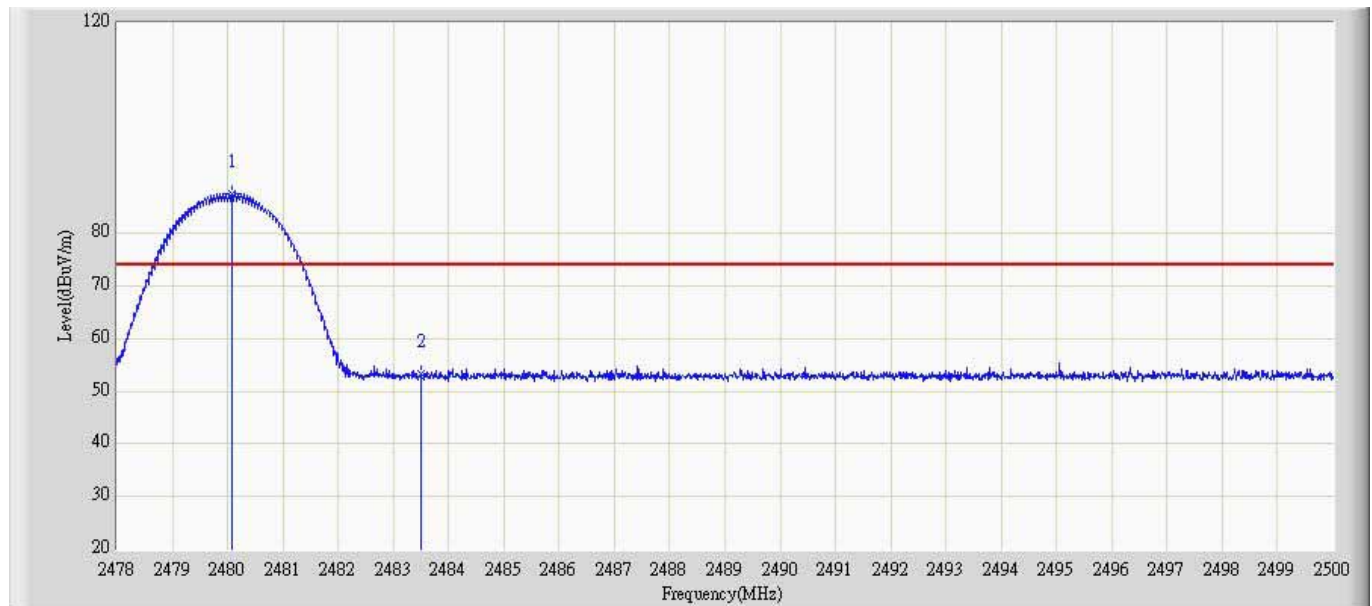
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.046	78.296	49.796	N/A	N/A	28.500	PK
2		2483.500	54.374	25.860	-19.626	74.000	28.514	PK

Site: AC6	Time: 2014/05/19 - 20:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2480MHz by BLE	



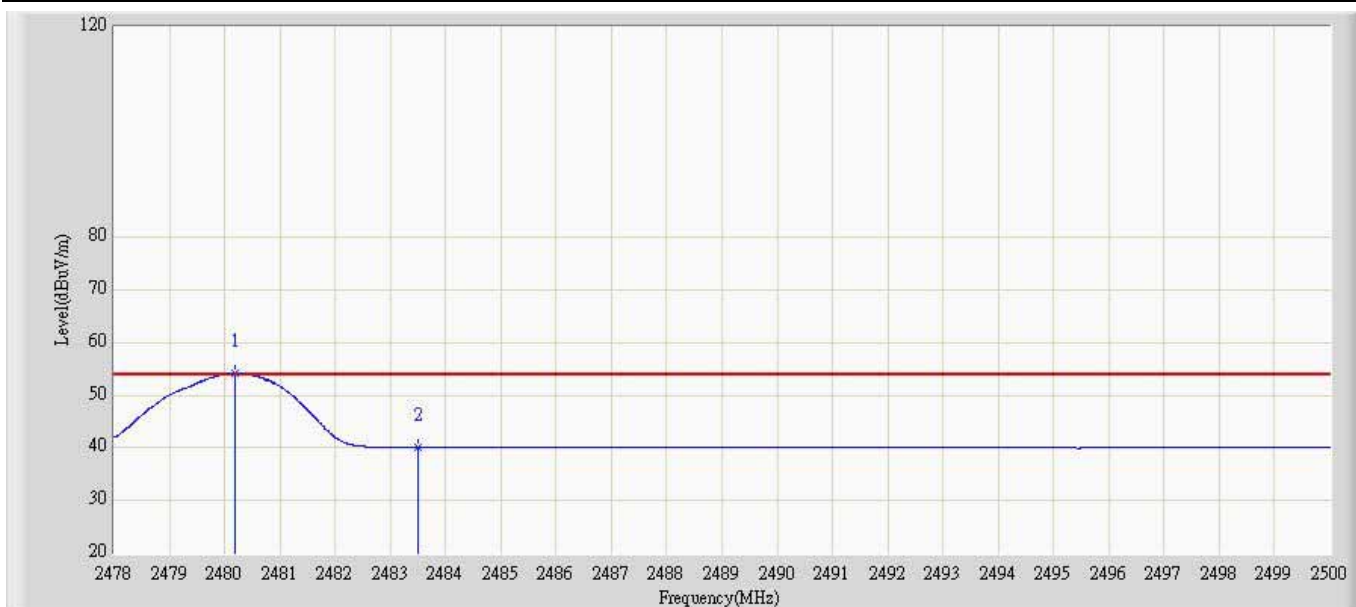
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.189	50.995	22.494	N/A	N/A	28.501	AV
2		2483.500	40.008	11.494	-13.992	54.000	28.514	AV

Site: AC5	Time: 2014/05/19 - 20:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2480MHz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.079	87.592	59.092	N/A	N/A	28.500	PK
2		2483.500	53.404	24.890	-20.596	74.000	28.514	PK

Site: AC5	Time: 2014/05/19 - 20:08
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode1: Transmit at channel 2480MHz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.189	54.169	25.668	N/A	N/A	28.501	AV
2		2483.500	40.077	11.563	-13.923	54.000	28.514	AV

7. Operation Frequency Range of 20dB Bandwidth

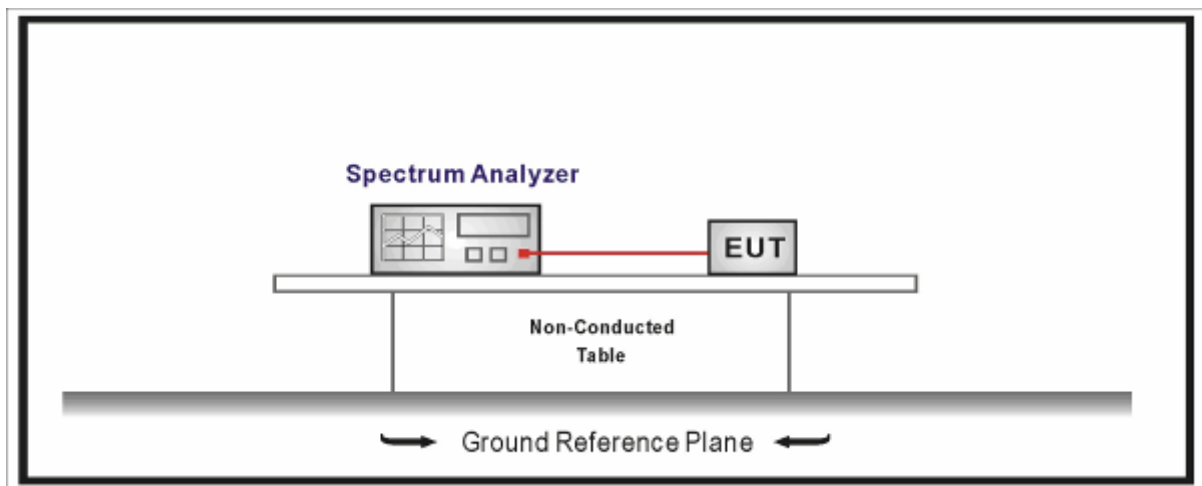
7.1. Test Equipment

Operation Frequency Range of 20dB Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

7.2. Test Setup



7.3. Limit

20 dB bandwidth of the emission is contained within the operation frequency band.

7.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

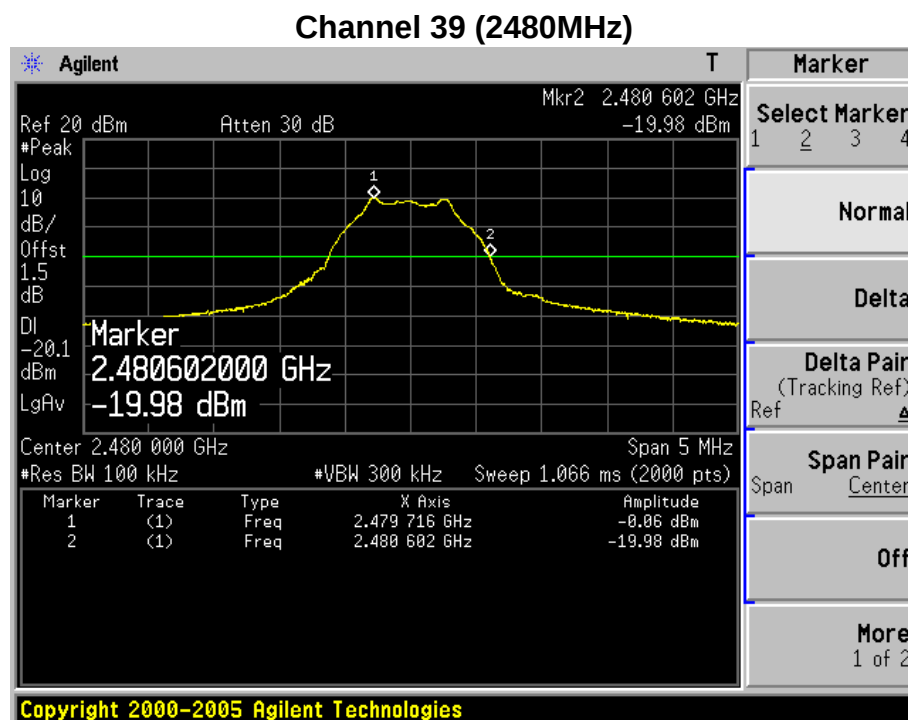
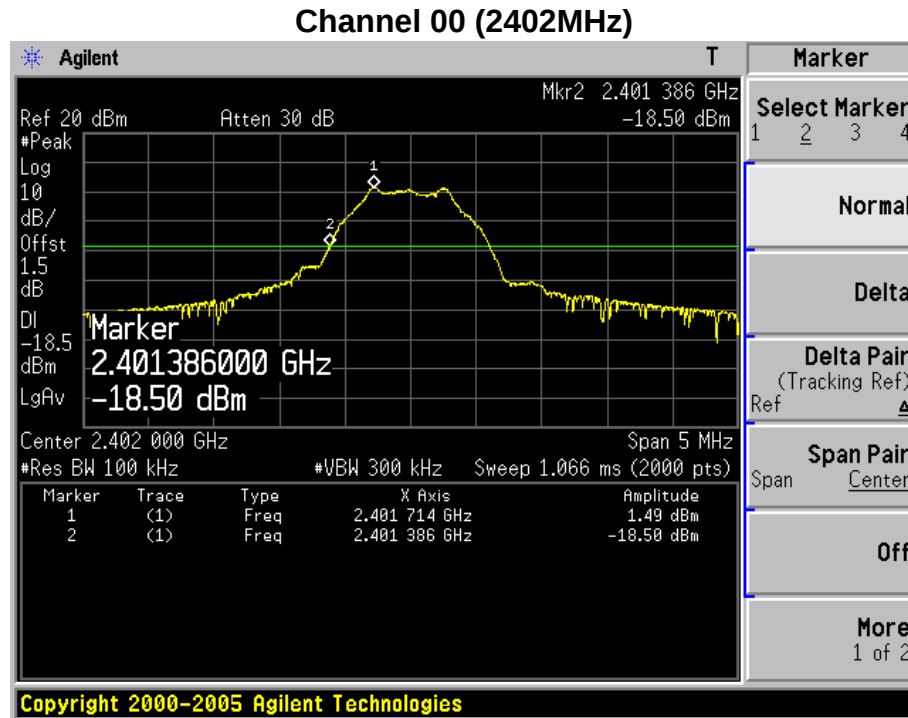
Set RBW = 100 kHz, Span greater than RBW.

7.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

7.6. Test Result

Product	:	Kreyos Meteor
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)



8. Occupied Bandwidth

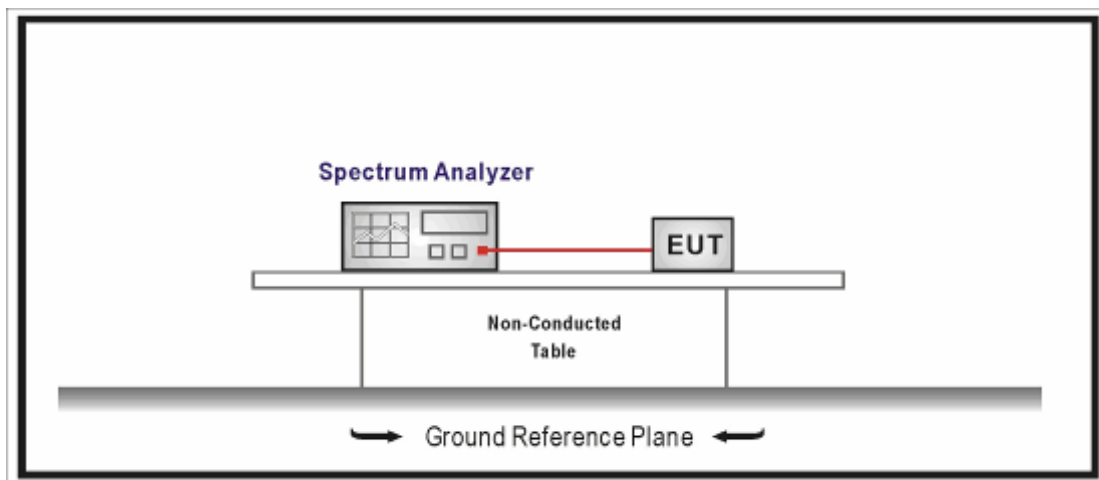
8.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.08
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

8.2. Test Setup



8.3. Limit

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

8.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

8.5. Uncertainty

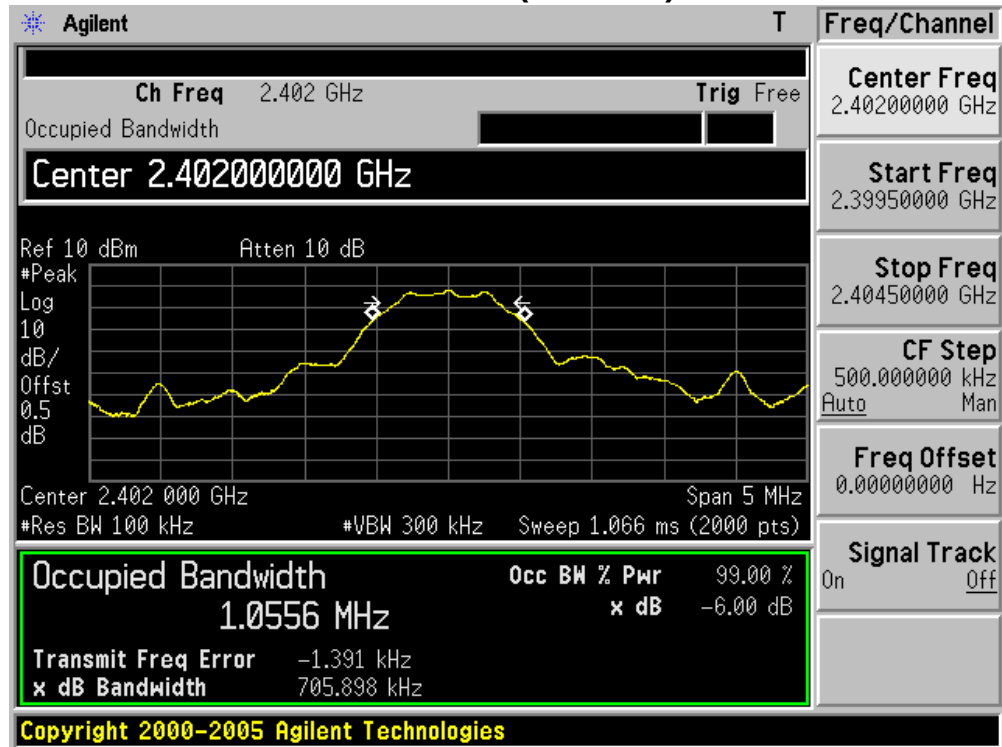
The measurement uncertainty is defined as ± 1 kHz

8.6. Test Result

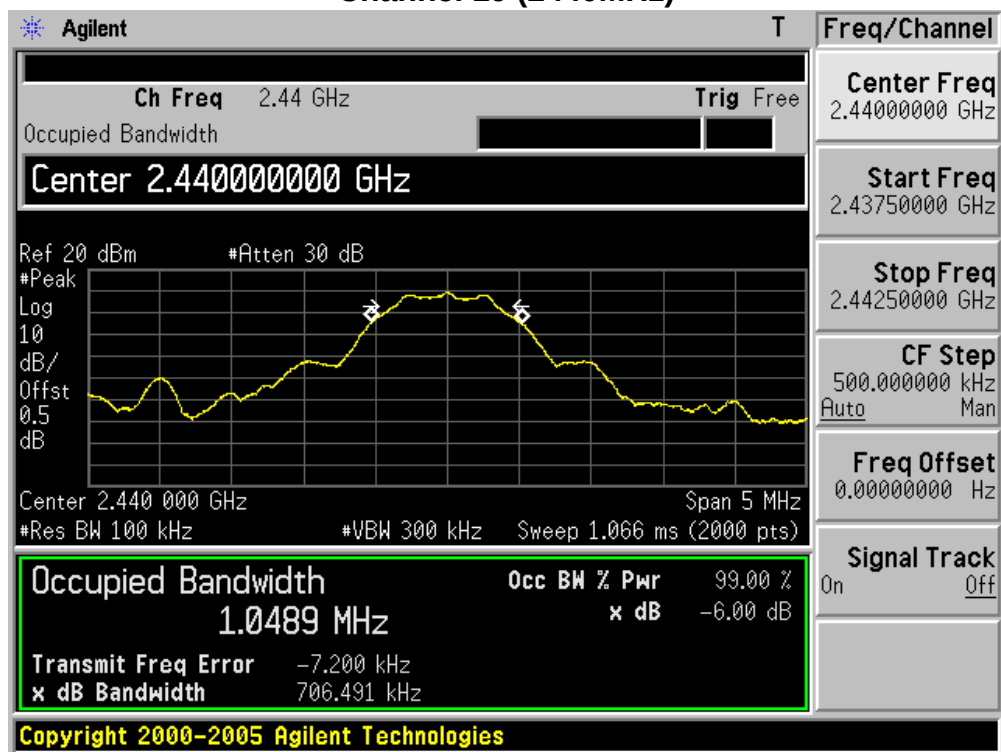
Product	:	Kreyos Meteor
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
00	2402	705.9	500	Pass
19	2440	706.5	500	Pass
39	2480	702.0	500	Pass

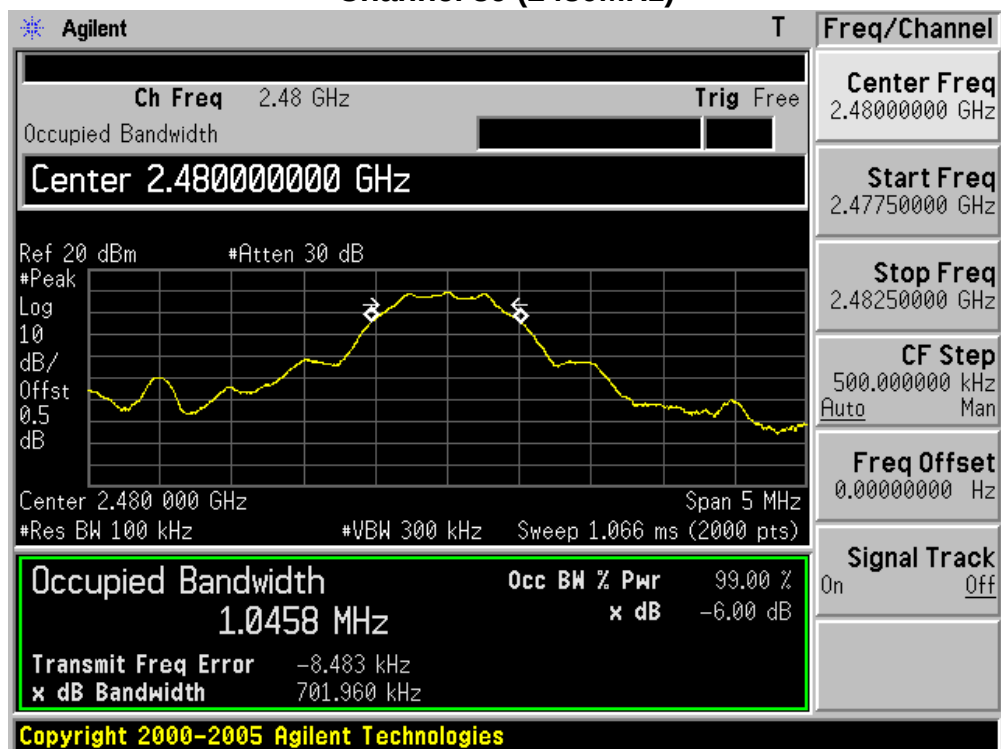
Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



9. Power Output

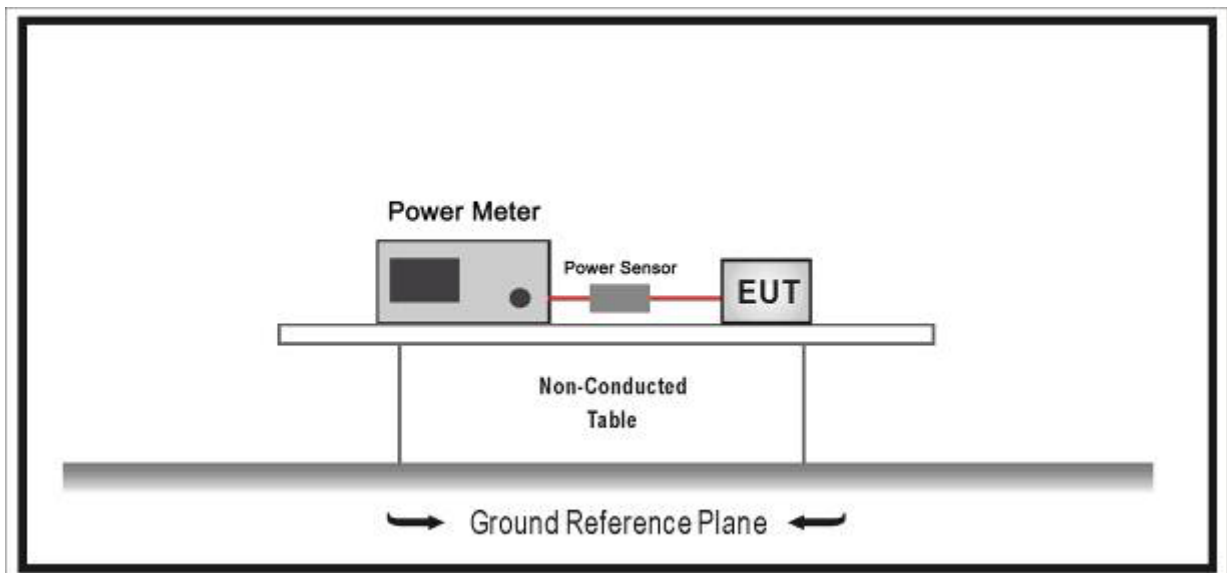
9.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Wideband Peak Power Meter	Anritsu	ML2495A	0905006	2014.11.10
Power Sensor	Anritsu	MA2411B	0846014	2014.11.10
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

9.2. Test Setup



9.3. Limit

The maximum peak power shall be less 1 Watt (30dBm).

Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

9.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Use the broadband peak RF power meter to test peak power and record the result.

9.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

9.6. Test Result

Product	:	Kreyos Meteor
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	Power Output (dBm)	Limit (dBm)	Result
00	2402	0.56	30.00	Pass
19	2440	0.76	30.00	Pass
39	2480	0.61	30.00	Pass

10. Power Spectral Density

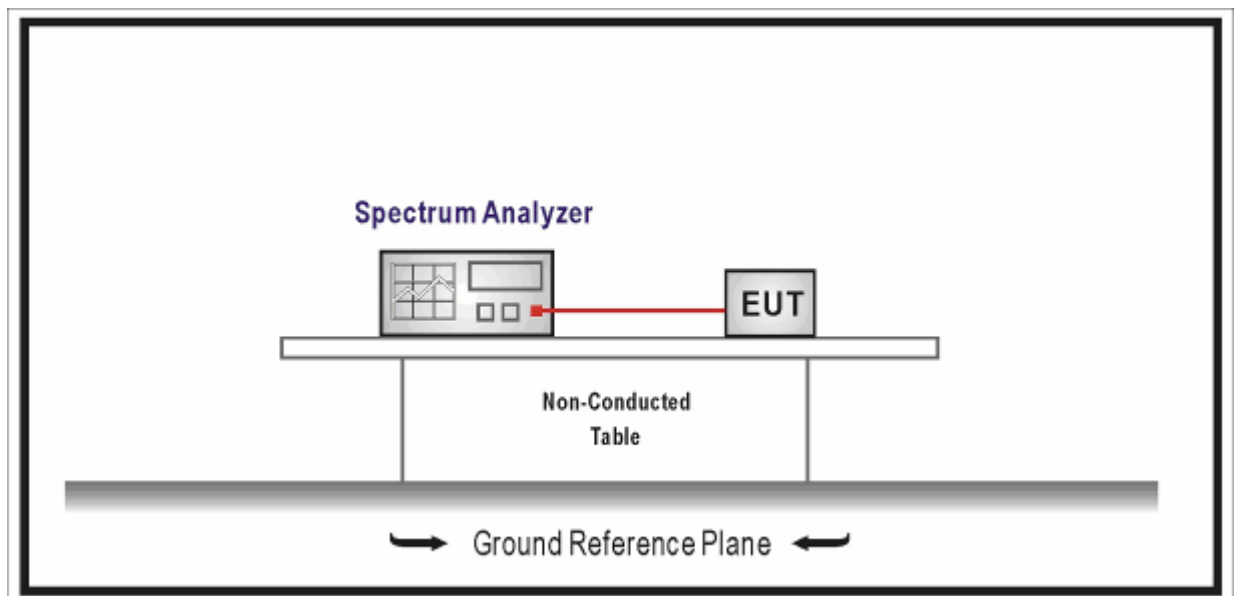
10.1. Test Equipment

Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

10.2. Test Setup



10.3. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiated to the Antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

10.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set analyzer center frequency to DTS channel center frequency, the span to 1.5 times the DTS channel bandwidth, $RBW \geq 3 \text{ kHz}$, Set $VBW \geq 3 * RBW$, Sweep time = auto couple, Detector = peak, Trace mode = max hold, Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level. If measured value exceed limit reduce

RBW (no less than 3kHz) and repeat.

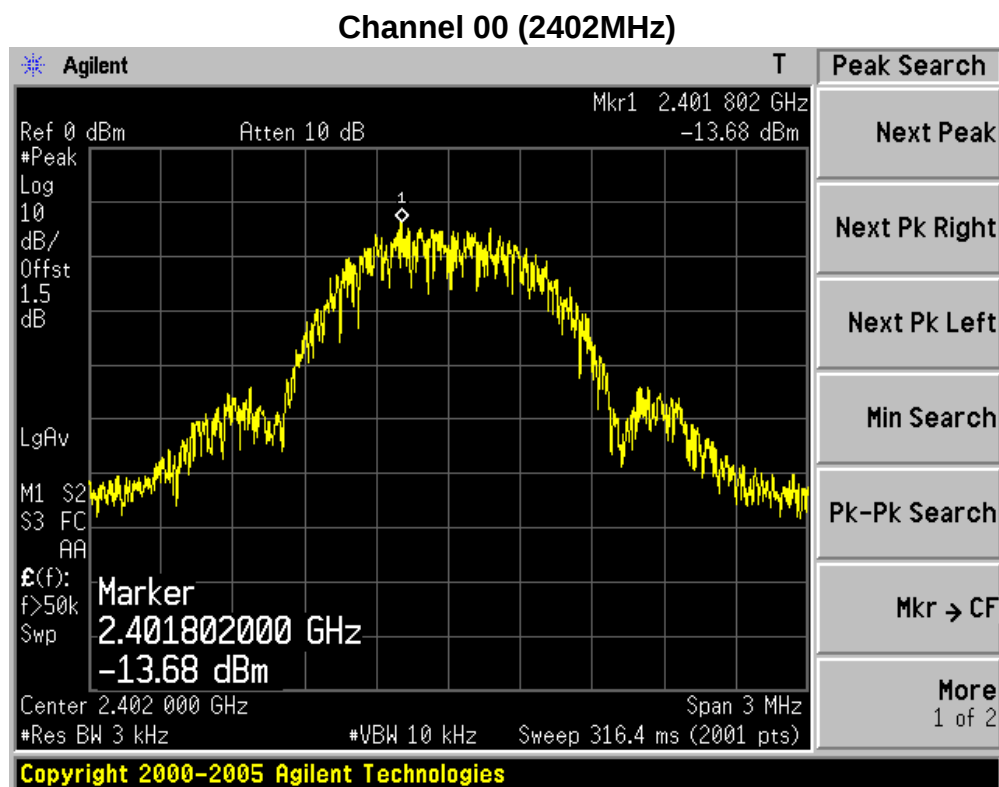
10.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

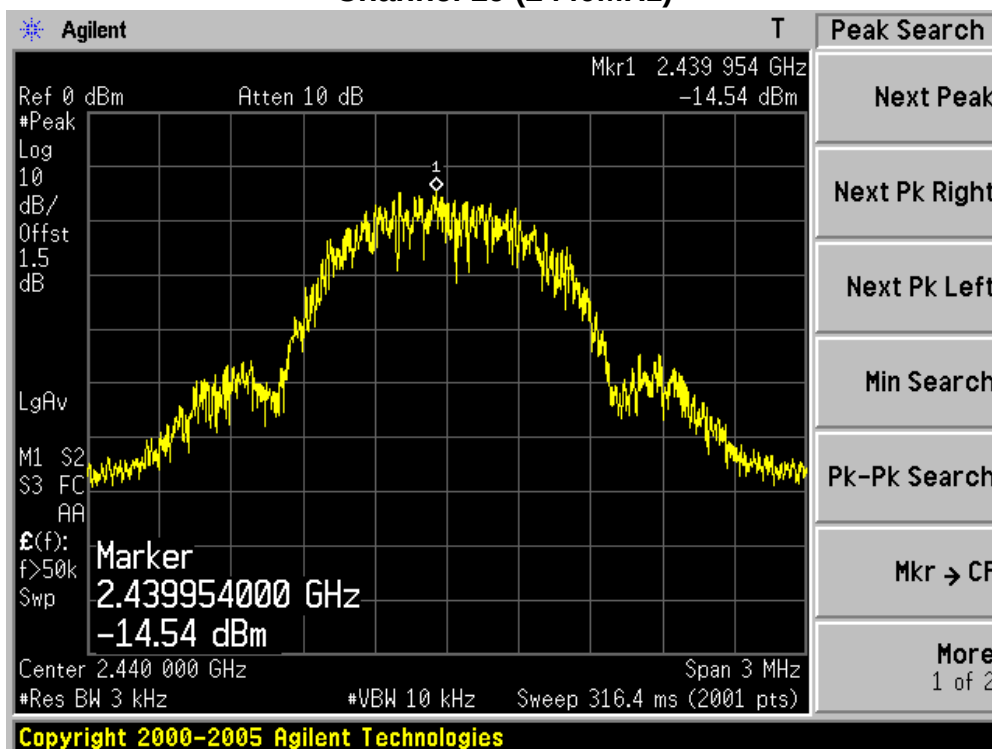
10.6. Test Result

Product	:	Kreyos Meteor
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

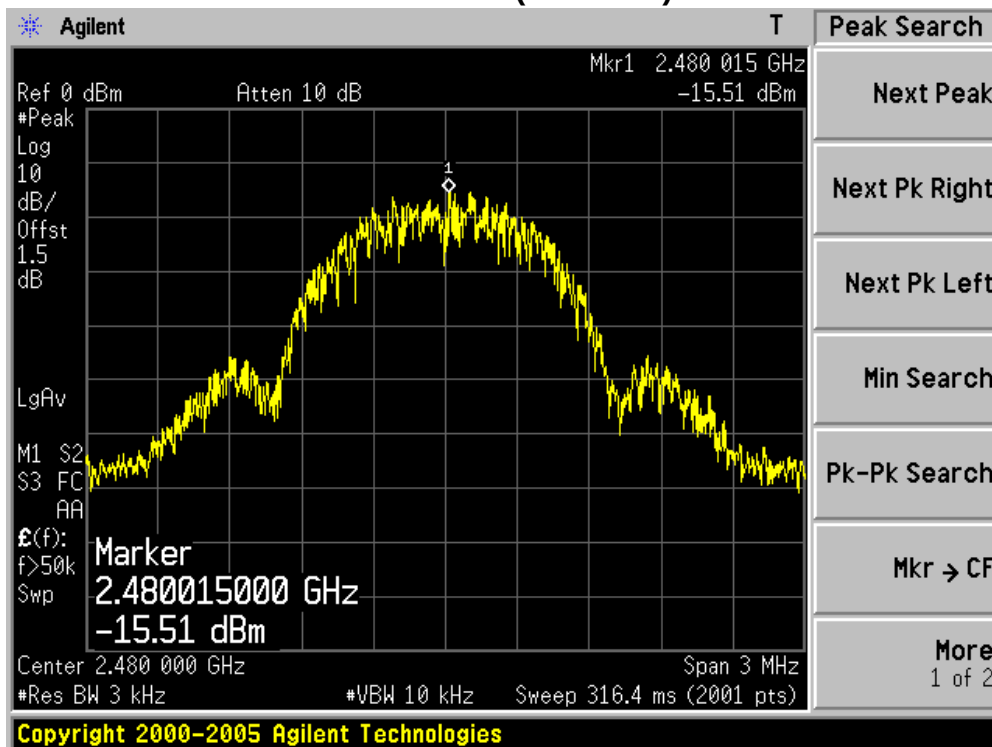
Channel No.	Frequency (MHz)	Measurement PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
00	2402	-13.68	-13.68	8	Pass
19	2440	-14.54	-14.54	8	Pass
39	2480	-15.51	-15.51	8	Pass



Channel 19 (2440MHz)



Channel 39 (2480MHz)



Receiver Spurious Emission for Industry Canada RSS-Gen Requirement

13.1 Test Equipment

Radiated Emission / AC-2

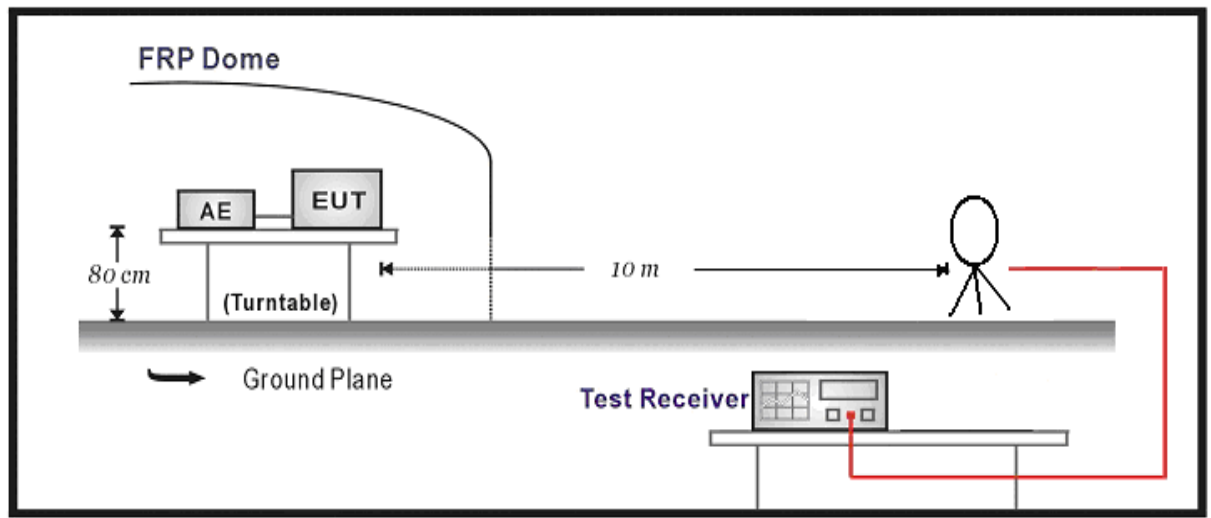
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2015.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2014.11.22
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2014.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2015.01.08

Radiated Emission / AC-5

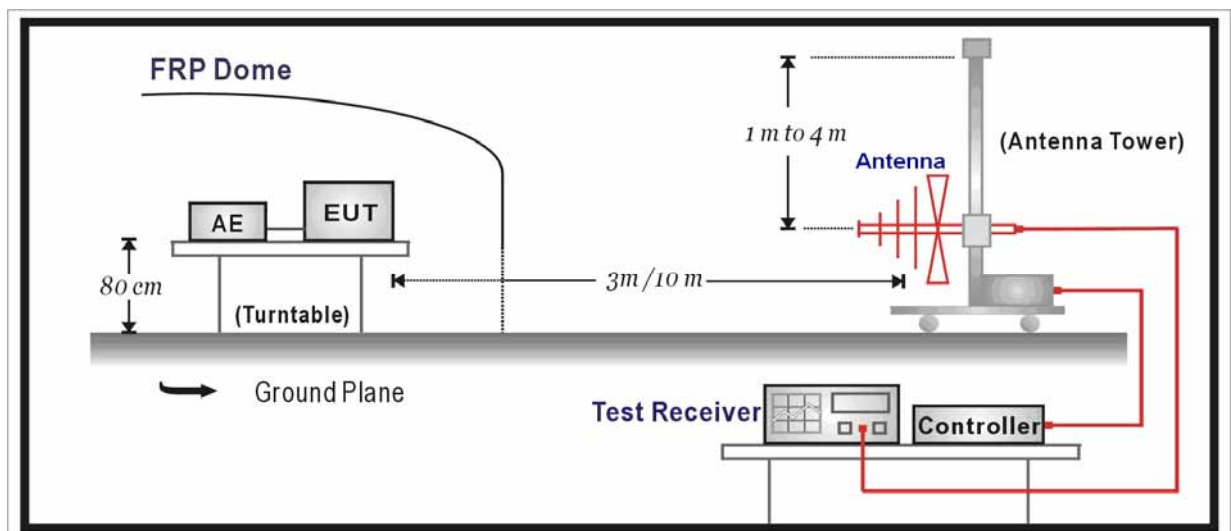
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2015.03.28
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	Quietek	AP-040G	CHM-0906001	2015.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2014.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2014.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2014.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2015.01.08

13.2 Test Setup

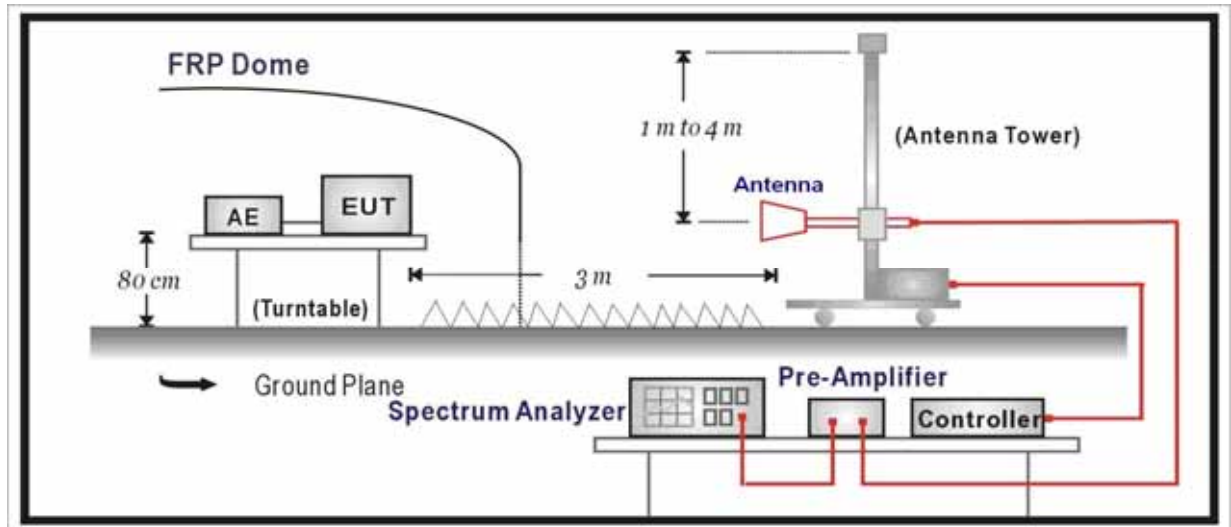
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



13.3 Limit

FCC Part 15 Subpart B Paragraph 15.109		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

13.4 Test Procedure

According to ANSI C63.10: 2009.

The EUT is placed on a turn table which is 0.8 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 C63.4: 2009 on radiated measurement.

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

The frequency range from 9kHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 60~10 degrees for H-plane and 90~10 degrees for E-plane.

13.5 Deviation from Test Standard

The measurement uncertainty above 1G is defined as ± 3.9 dB
below 1G is defined as ± 3.8 dB

13.6 Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

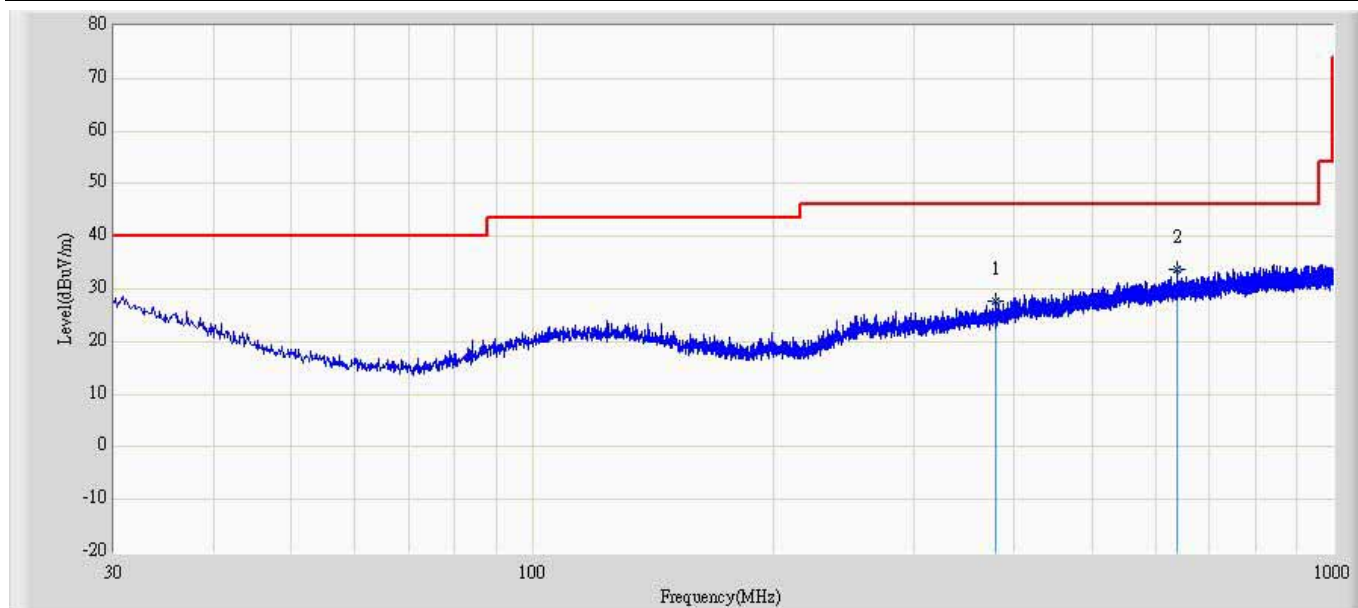
Mode 1: Receive-1Mbps (GFSK_BLE)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
00	H	1212.5	39.0	-5.4	33.6	54(Note)	-20.4	PK
	H	2181.5	37.7	-0.4	37.3	54(Note)	-16.7	PK
	V	1255.0	38.0	-5.3	32.7	54(Note)	-21.3	PK
	V	2309.0	36.0	0.6	36.6	54(Note)	-17.4	PK
39	H	1306.0	38.7	-5.2	33.5	54(Note)	-20.5	PK
	H	2402.5	36.7	1.4	38.1	54(Note)	-15.9	PK
	V	1348.5	39.2	-5.1	34.1	54(Note)	-19.9	PK
	V	2479.0	39.0	2.1	41.1	54(Note)	-12.9	PK
78	H	1212.5	39.0	-5.4	33.6	54(Note)	-20.4	PK
	H	2181.5	37.7	-0.4	37.3	54(Note)	-16.7	PK
	V	1255.0	38.0	-5.3	32.7	54(Note)	-21.3	PK
	V	2309.0	36.0	0.6	36.6	54(Note)	-17.4	PK

Note: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

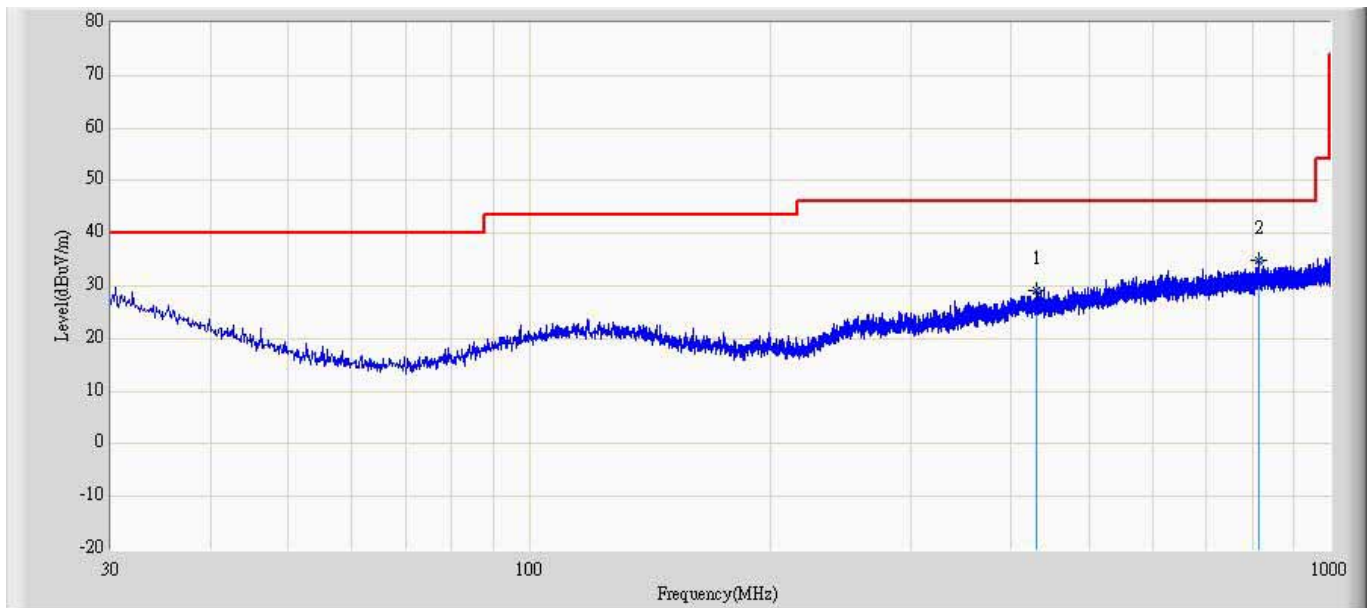
The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2014/05/19- 20:23
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1: Transmit at channel 2402MHz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		379.200	27.809	4.960	-18.191	46.000	22.849	QP
2	*	639.888	33.831	6.442	-12.169	46.000	27.389	QP

Site: AC2	Time: 2014/05/19 - 20:23
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: Kreyos Meteor	Power: By Battery
Note: Mode 1: Transmit at channel 2402MHz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		429.155	29.232	4.960	-16.768	46.000	24.272	QP
2	*	814.124	34.868	6.022	-11.132	46.000	28.845	QP

_____ The End _____