

Test Report

FCC Part15 Subpart C

Product Name : Cassia Hub
Model No. : C1000
FCC ID : 2AGF9C1000
IC : 20842-C1000

Applicant : Beijing Cassia Networks Technology Co.,Ltd
Address : Room 206,District B,2/F,No.12,Xinxi Road,Haidian
District,Beijing

Date of Receipt : Oct. 27, 2015
Test Date : Dec. 3, 2015~ Dec. 3, 2015
Issued Date : Dec. 03, 2015
Report No. : 15A0076R -RF-US-P06V02
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 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.

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Test Report Certification

Issued Date : Dec. 03, 2015
Report No. : 15A0076R-RF-US-P06V02

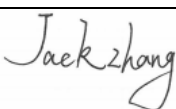


Product Name : Cassia Hub
Applicant : Beijing Cassia Networks Technology Co.,Ltd
Address : Room 206,District B,2/F,No.12,Xinxi Road,Haidian
District,Beijing
Manufacturer : Beijing Cassia Networks Technology Co.,Ltd
Address : Room 206,District B,2/F,No.12,Xinxi Road,Haidian
District,Beijing
Model No. : C1000
FCC ID : 2AGF9C1000
IC : 20842-C1000
EUT Voltage : DC 12V
Brand Name : Cassia
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2014
ANSI C63.4: 2014; ANSI C63.10: 2013
Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1
Test Result : Complied
Performed Location : Suzhou EMC Laboratory
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou,
215006, Jiangsu, China
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098

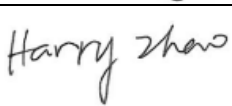
Documented By

: 

Reviewed By

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Approved By

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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
USA	:	FCC
Japan	:	VCCI
China	:	CNAS

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/>

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
15A0076R-RF-US-P06V02	V1.0	Initial Issued Report	Dec. 03, 2015

1. General Information

1.1. EUT Description

Product Name	Cassia Hub
Brand Name	Cassia
Model No.	C1000
Working Voltage	DC 12V
Bluetooth Specification	V3.0+V4.0
Frequency Range	2402- 2480 MHz
Channel Number	V3.0: 79 V4.0: 40
Channel Separation	V3.0: 1MHz V4.0: 2MHz
Type of Modulation	V3.0: GFSK, Pi/4 DQPSK, 8DPSK V4.0: GFSK
Data Rate	V3.0: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) V4.0: 1Mbps(GFSK)
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List

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

Bluetooth Antenna List

Antenna	Manufacturer	Model No.	Peak Gain	Directional Gain
directional antenna 1	SUNPARL	SPDB-2400-9V120	7.96dBi for 2.4GHz	12.73dBi for 2.4GHz
directional antenna 2	SUNPARL	SPDB-2400-9V120	7.96dBi for 2.4GHz	
directional antenna 3	SUNPARL	SPDB-2400-9V120	7.96dBi for 2.4GHz	

Not: Directional gain = GANT + 10 log(NANT) dBi

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:

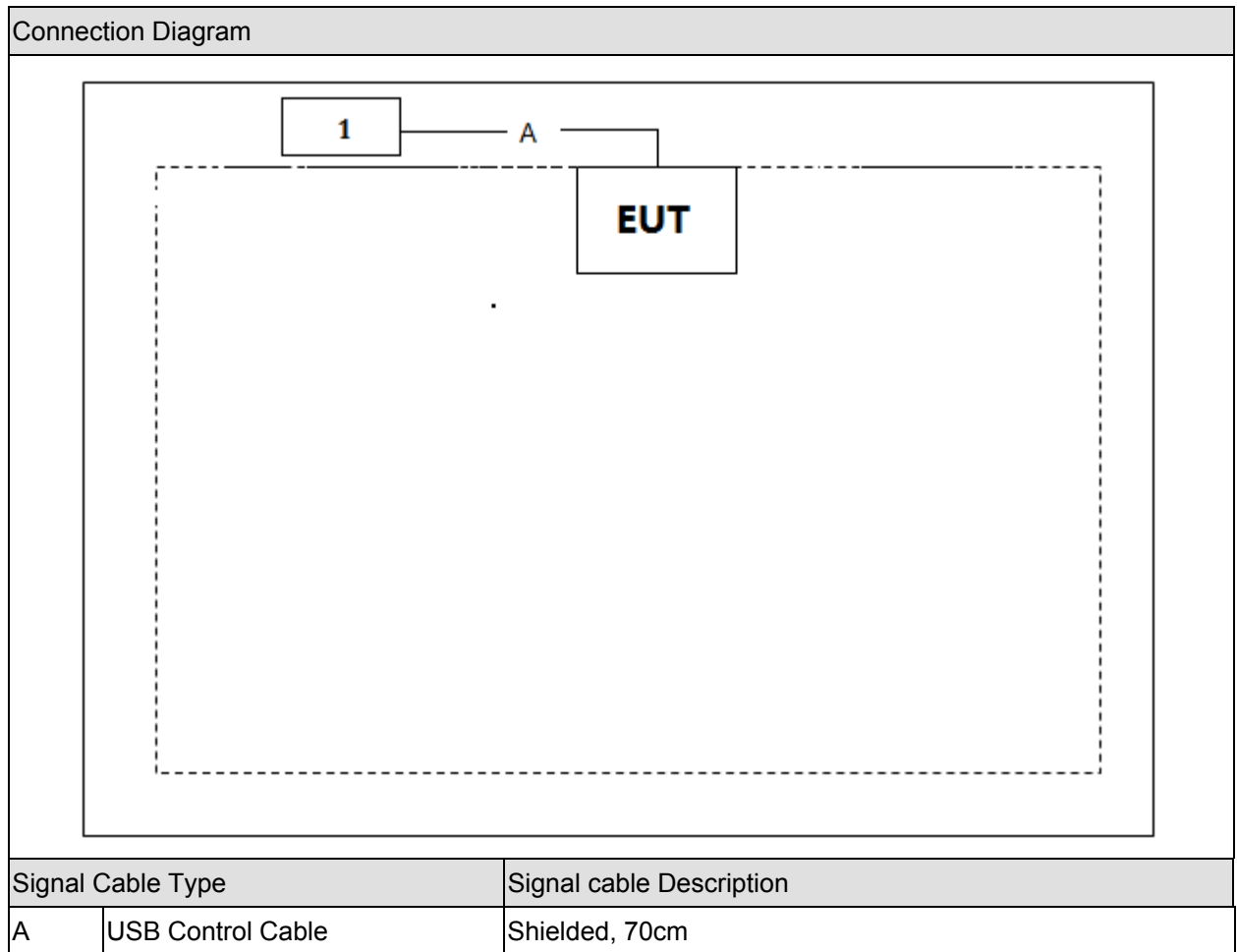
1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

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	Notebook	Asus	N80V	8BN0AS226971468	N/A

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment.
3	Run the RF test software, and set the test mode and channel, then press OK to start continue Transmit.

2. Technical Test

2.1. Summary of Test Result

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

For FCC

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.209	Yes	No
RF Antenna Conducted Spurious	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No
Operation Frequency Range of 20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 15.215(c)	Yes	No
6dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(2)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(b)(3)	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(e)	Yes	No

For IC

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 4 November 2014 Section 8.8	Yes	No
Radiated Emission	RSS-247 Issue 1 May 2015 Section 5.5	Yes	No
RF Antenna Conducted Spurious	RSS-247 Issue 1 May 2015 Section 5.5	Yes	No
Radiated Emission Band Edge	RSS-Gen Issue 4 November 2014 Section 8.10	Yes	No
Occupied Bandwidth	RSS-Gen Issue 4 November 2014 Section 6.6 RSS-247 Issue 1 May 2015 Section 5.2	Yes	No
Power Output	RSS-247 Issue 1 May 2015 Section 5.4	Yes	No
Power Spectral Density	RSS-247 Issue 1 May 2015 Section 5.2	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

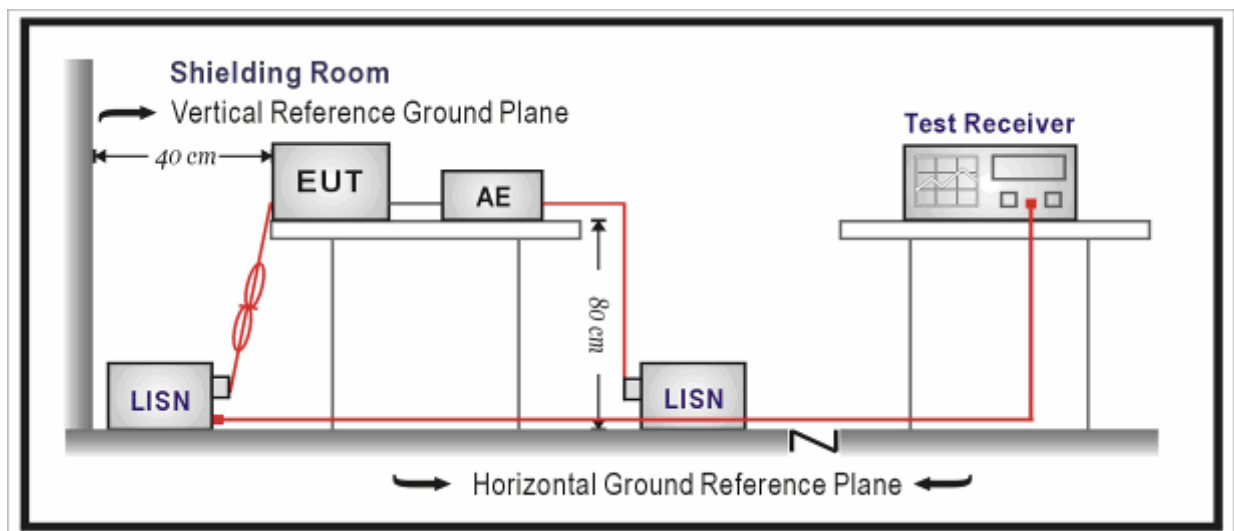
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2016.03.30
Two-Line V-Network	R&S	ENV216	100043	2016.03.30
Two-Line V-Network	R&S	ENV216	100044	2016.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2016.03.01
50ohm Termination	SHX	TF2	07081401	2016.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2016.01.08

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

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

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.

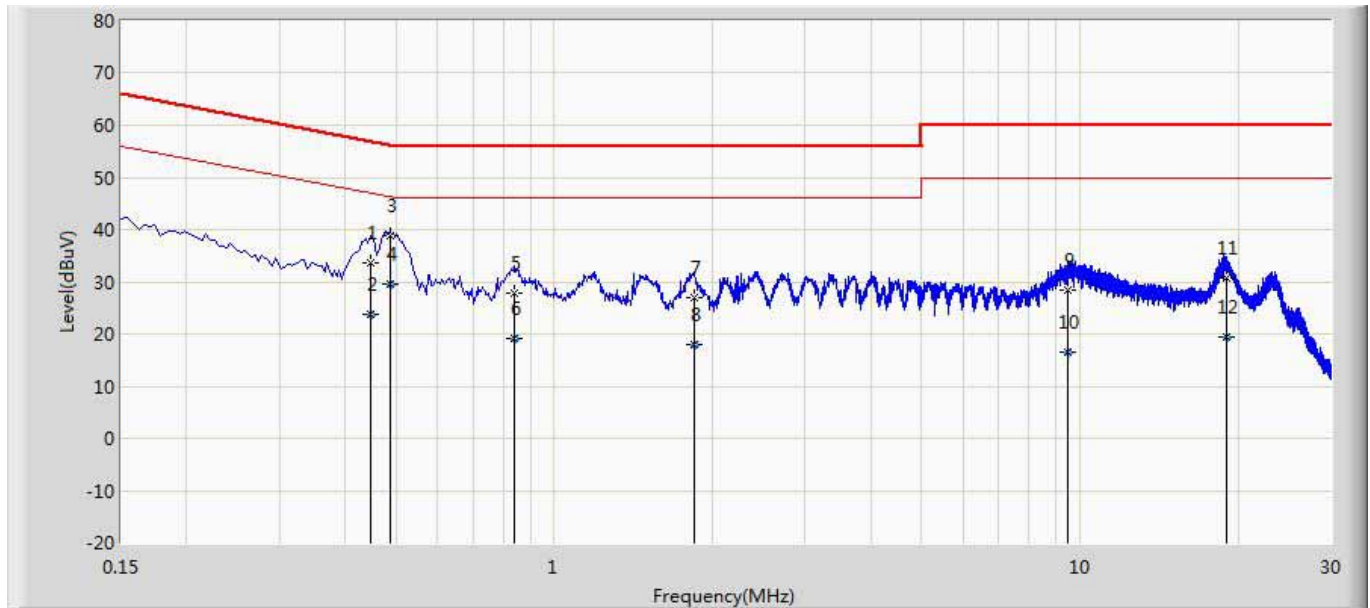
Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

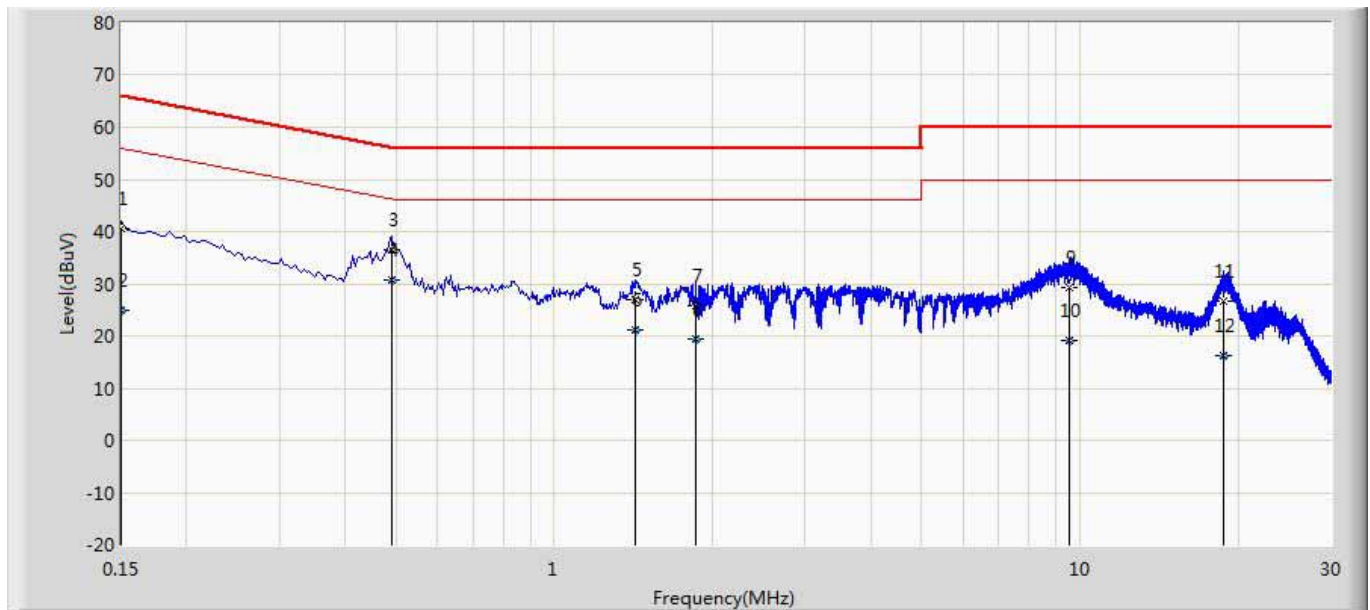
3.6. Test Result

Site: SR8	Time: 2015/10/30
Limit: FCC_Part15.107_CE_AC Power_ClassC	Margin: 0
Probe: ENV216-L1	Polarity: Line
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.446	33.578	23.878	-23.371	56.949	9.630	0.070	0.000	QP
2		0.446	23.873	14.173	-23.076	46.949	9.630	0.070	0.000	AV
3		0.486	38.920	29.220	-17.316	56.236	9.630	0.070	0.000	QP
4	*	0.486	29.561	19.861	-16.675	46.236	9.630	0.070	0.000	AV
5		0.842	27.872	18.182	-28.128	56.000	9.620	0.070	0.000	QP
6		0.842	19.195	9.505	-26.805	46.000	9.620	0.070	0.000	AV
7		1.842	27.080	17.343	-28.920	56.000	9.640	0.097	0.000	QP
8		1.842	17.966	8.229	-28.034	46.000	9.640	0.097	0.000	AV
9		9.498	28.418	18.444	-31.582	60.000	9.724	0.250	0.000	QP
10		9.498	16.480	6.506	-33.520	50.000	9.724	0.250	0.000	AV
11		18.978	30.807	20.597	-29.193	60.000	9.760	0.450	0.000	QP
12		18.978	19.432	9.222	-30.568	50.000	9.760	0.450	0.000	AV

Site: SR8	Time: 2015/10/30
Limit: FCC_Part15.107_CE_AC Power_ClassC	Margin: 0
Probe: ENV216-N	Polarity: Neutral
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.150	40.454	30.718	-25.546	66.000	9.676	0.060	0.000	QP
2		0.150	24.935	15.199	-31.065	56.000	9.676	0.060	0.000	AV
3		0.490	36.555	26.855	-19.613	56.168	9.630	0.070	0.000	QP
4	*	0.490	30.749	21.049	-15.419	46.168	9.630	0.070	0.000	AV
5		1.426	27.054	17.334	-28.946	56.000	9.630	0.090	0.000	QP
6		1.426	21.103	11.383	-24.897	46.000	9.630	0.090	0.000	AV
7		1.862	25.918	16.178	-30.082	56.000	9.640	0.100	0.000	QP
8		1.862	19.452	9.712	-26.548	46.000	9.640	0.100	0.000	AV
9		9.554	29.249	19.259	-30.751	60.000	9.730	0.260	0.000	QP
10		9.554	19.034	9.044	-30.966	50.000	9.730	0.260	0.000	AV
11		18.718	26.770	16.480	-33.230	60.000	9.840	0.450	0.000	QP
12		18.718	16.346	6.056	-33.654	50.000	9.840	0.450	0.000	AV

Note: All the low ,middle and high channels of all different modes are investigated, and only report the worst case.

4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

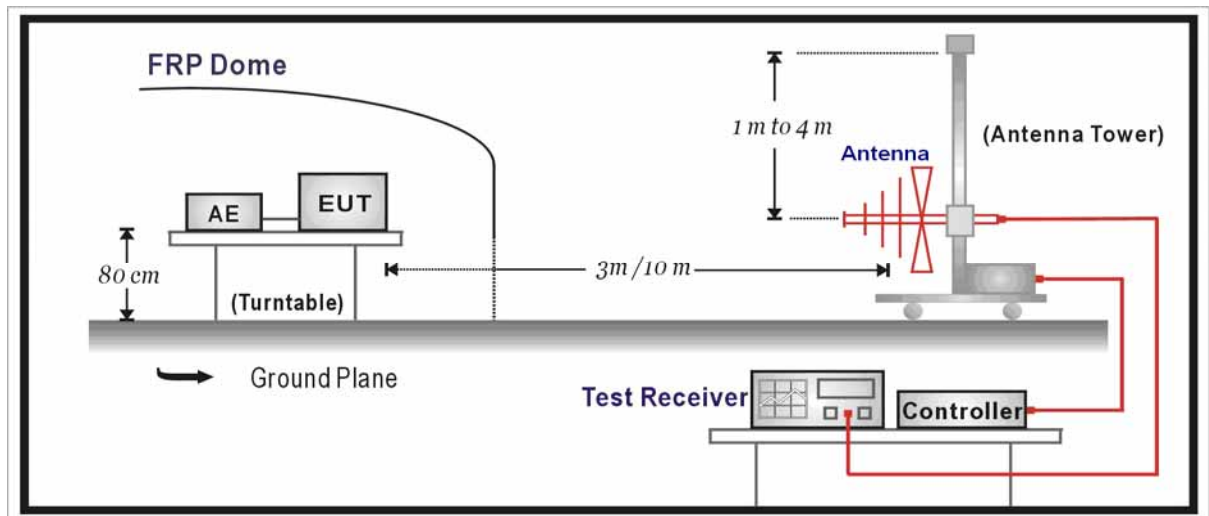
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2016.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2016.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2016.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2016.01.08

Radiated Emission / AC-5

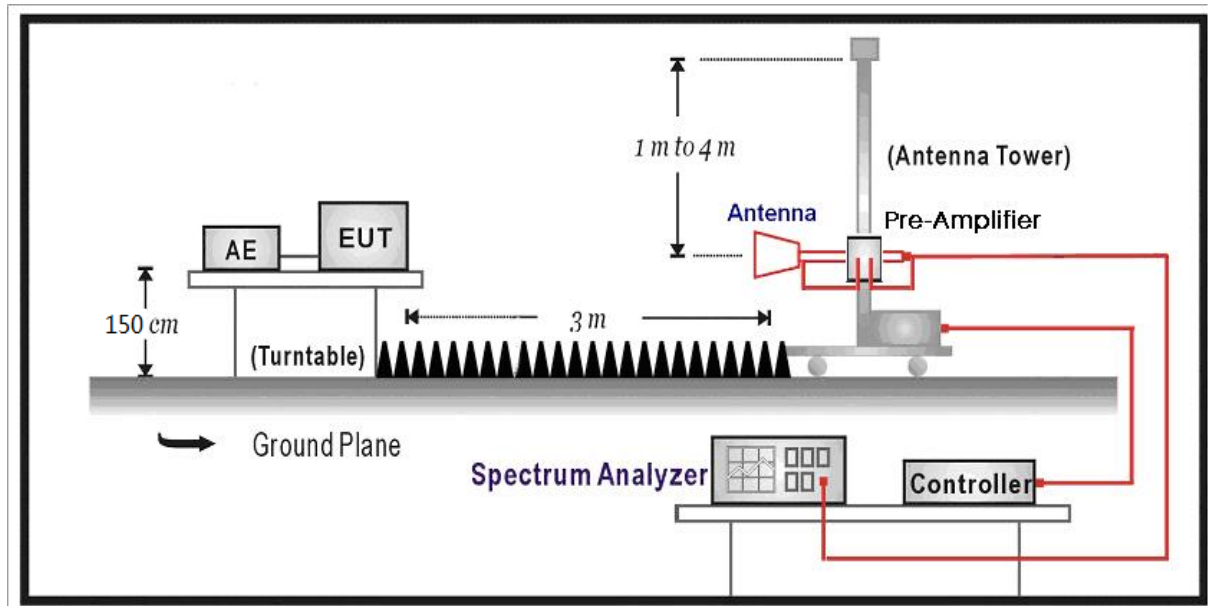
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	Quietek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2016.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.08

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

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

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 C63.4:2014 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 1GHz is defined as ± 3.9 dB
 below 1GHz 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)

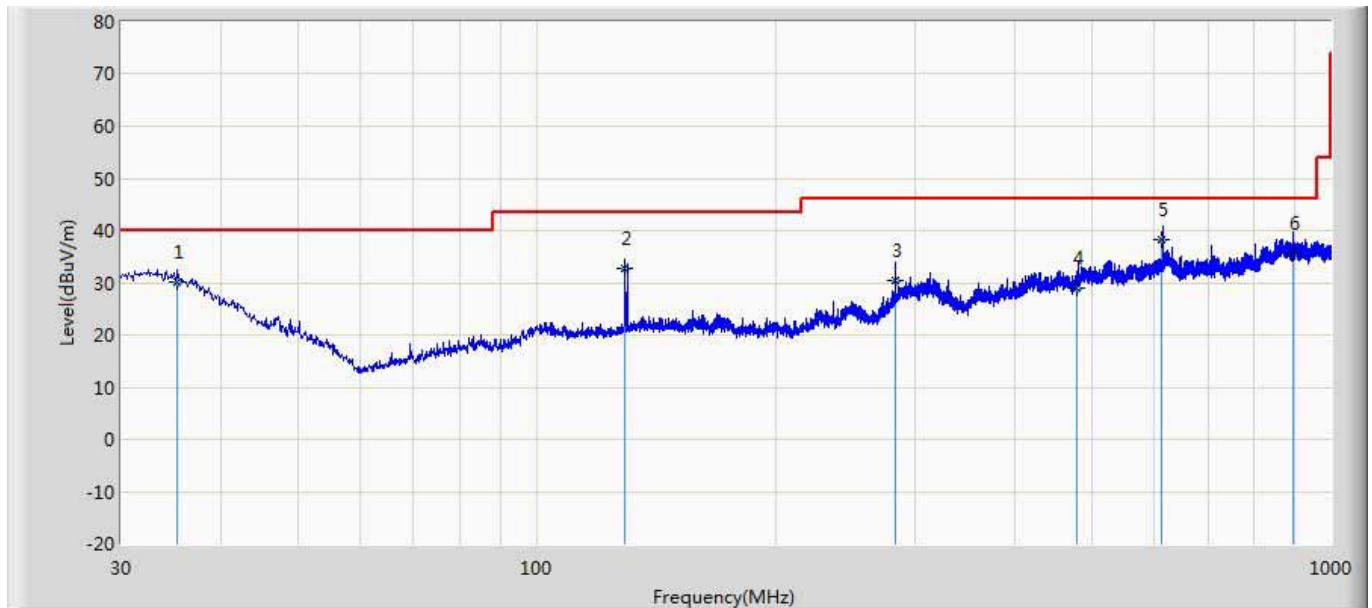
CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	47.2	-6.7	40.5	54(Note2)	-13.5	PK
	V	4804.0	48.8	-6.7	42.1	54(Note2)	-11.9	PK
	H	7206.0	46.1	-2.9	43.2	54(Note2)	-10.8	PK
	V	7206.0	45.8	-2.9	42.9	54(Note2)	-11.1	PK
	H	9608.0	44.8	0.9	45.7	54(Note2)	-8.3	PK
	V	9608.0	44.0	0.9	44.9	54(Note2)	-9.1	PK
19	H	4880.0	47.9	-6.6	41.3	54(Note2)	-12.7	PK
	V	4880.0	48.5	-6.6	41.9	54(Note2)	-12.1	PK
	H	7320.0	47.5	-2.8	44.7	54(Note2)	-9.3	PK
	V	7320.0	47.6	-2.8	44.8	54(Note2)	-9.2	PK
	H	9760.0	44.0	1.3	45.3	54(Note2)	-8.7	PK
	V	9760.0	44.2	1.2	45.4	54(Note2)	-8.6	PK
39	H	4960.0	48.6	-6.3	42.3	54(Note2)	-11.7	PK
	V	4960.0	47.8	-6.3	41.5	54(Note2)	-12.5	PK
	H	7440.0	47.1	-2.6	44.5	54(Note2)	-9.5	PK
	V	7440.0	47.9	-2.6	45.3	54(Note2)	-8.7	PK
	H	9920.0	44.4	0.9	45.3	54(Note2)	-8.7	PK
	V	9920.0	44.6	0.8	45.4	54(Note2)	-8.6	PK

Note: 1. Measure Level = Reading Level + Factor.

- The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.
- 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.

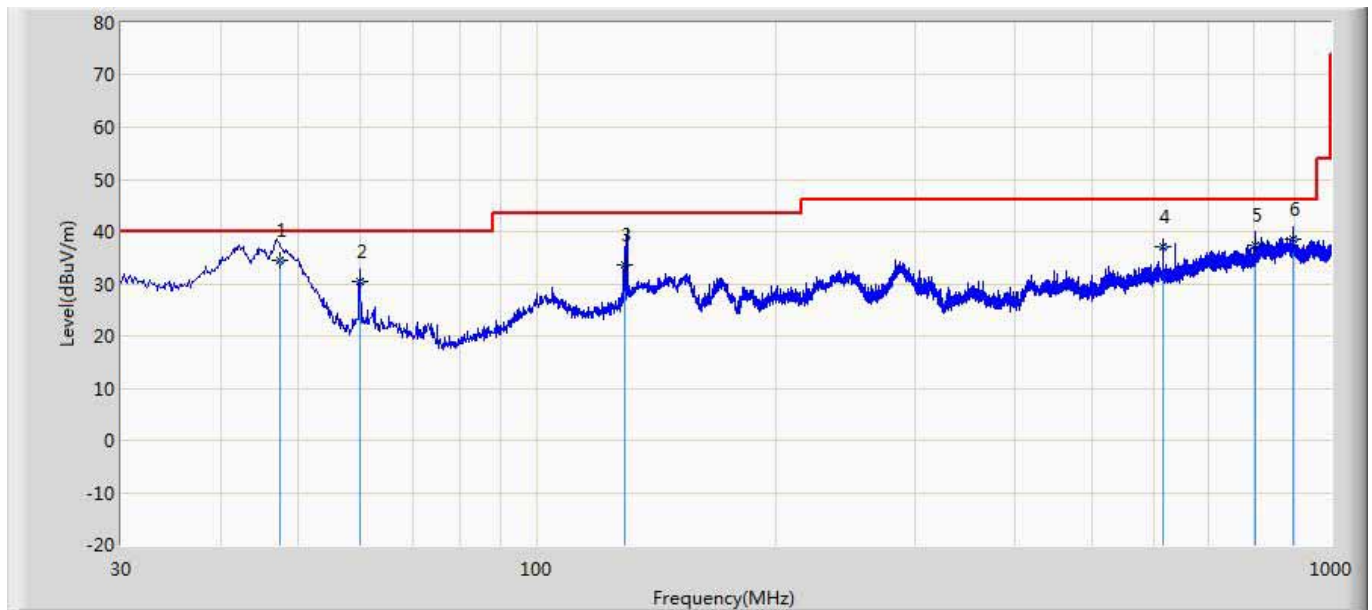
The worst case of Radiated Emission below 1GHz:

Site: CB7	Time: 2015/10/30
Limit: FCC_Part15.109_RE(3m)_ClassC	Margin: 0
Probe: CB7_CBL6112_0726	Polarity: Horizontal
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1		35.218	30.055	36.812	-9.945	40.000	15.773	0.644	23.174	136	360	QP
2		129.252	32.632	42.527	-10.868	43.500	11.945	1.230	23.070	200	194	QP
3		283.520	30.501	38.797	-15.499	46.000	12.970	1.810	23.076	100	154	QP
4		479.218	29.127	32.039	-16.873	46.000	17.468	2.380	22.760	100	151	QP
5	*	613.218	38.267	39.224	-7.733	46.000	19.000	2.710	22.667	200	102	QP
6		897.101	35.693	34.679	-10.307	46.000	20.494	3.300	22.780	100	259	QP

Site: CB7	Time: 2015/10/30
Limit: FCC_Part15.109_RE(3m)_ClassC	Margin: 0
Probe: CB7_CBL6112_0726	Polarity: Vertical
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402 by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	*	47.521	34.407	47.603	-5.593	40.000	9.192	0.751	23.138	100	141	QP
2		59.871	30.449	46.118	-9.551	40.000	6.531	0.838	23.038	100	3	QP
3		128.961	33.713	43.590	-9.787	43.500	11.963	1.230	23.070	100	306	QP
4		613.875	37.109	38.060	-8.891	46.000	19.000	2.710	22.661	100	38	QP
5		802.218	37.516	36.689	-8.484	46.000	20.018	3.120	22.311	200	14	QP
6		897.180	38.469	37.455	-7.531	46.000	20.494	3.300	22.780	100	343	QP

5. RF Antenna Conducted Spurious

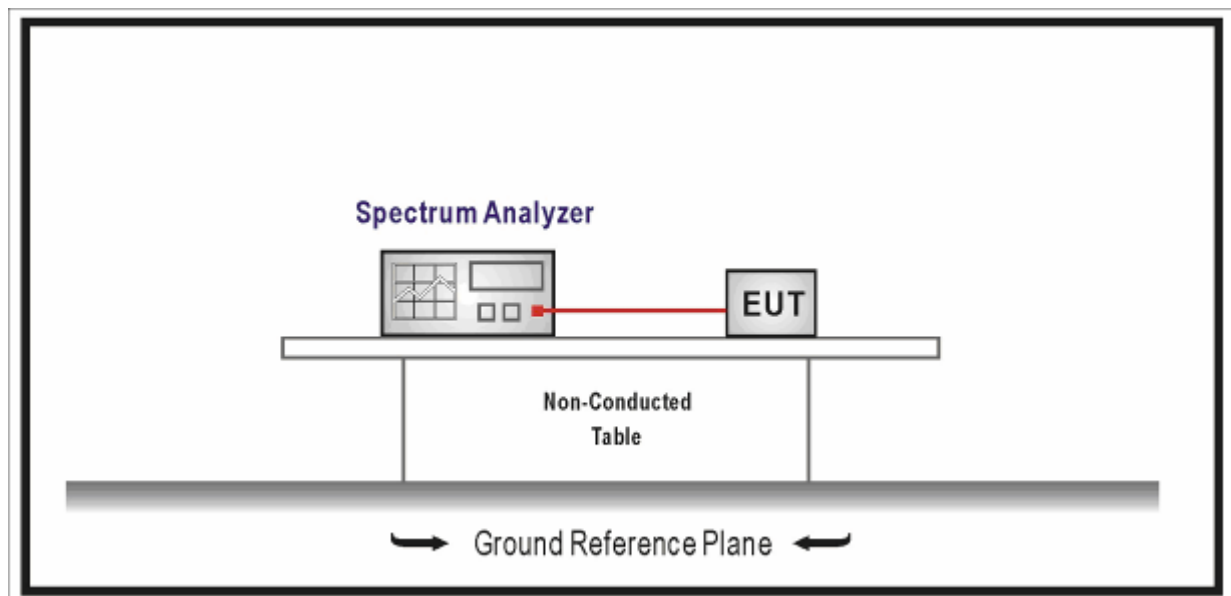
5.1. Test Equipment

RF Antenna Conducted Spurious / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

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

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20dB bandwidth

RBW \geq 1% of the 20dB bandwidth

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-Cassia Hub function to measure 20 dB down one side of the emission. Reset the marker-Cassia Hub function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-Cassia Hub reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

5.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

5.6. Test Result

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

Ant 1 Channel 00 (2402MHz)





Channel 19 (2440MHz)





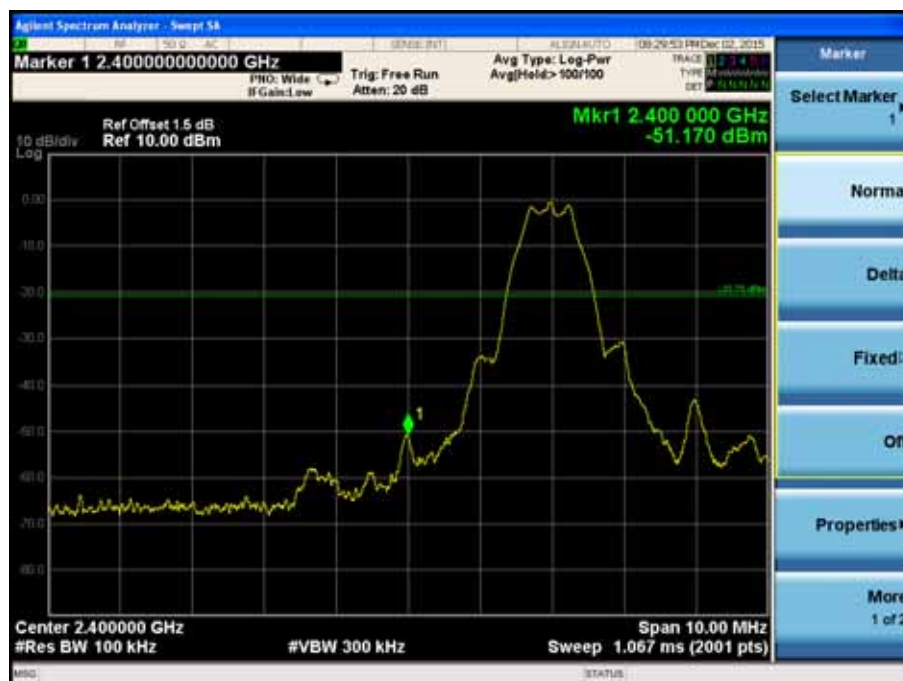
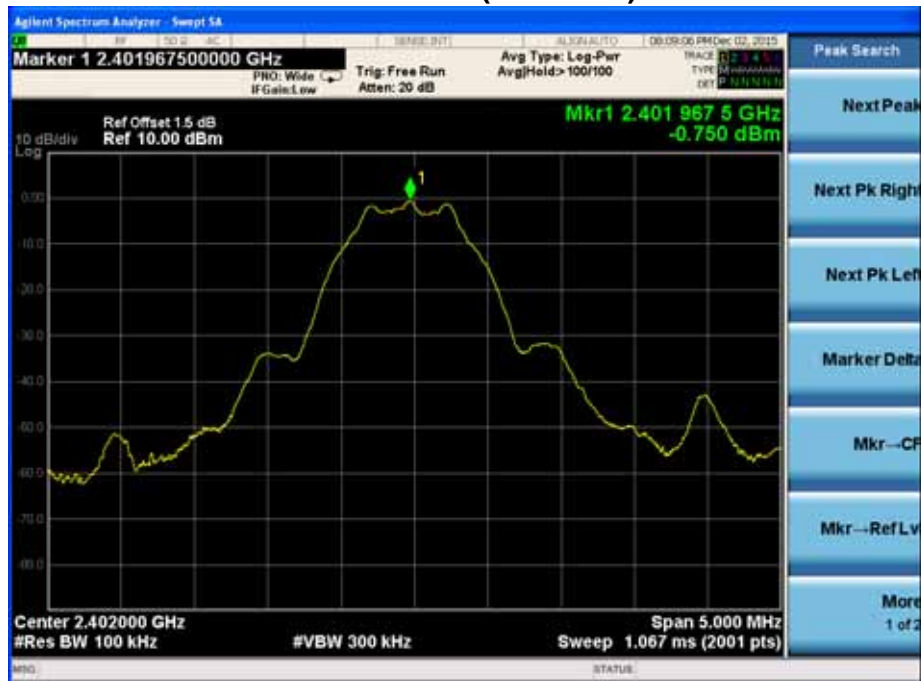
Channel 39 (2480MHz)





Ant 2

Channel 00 (2402MHz)



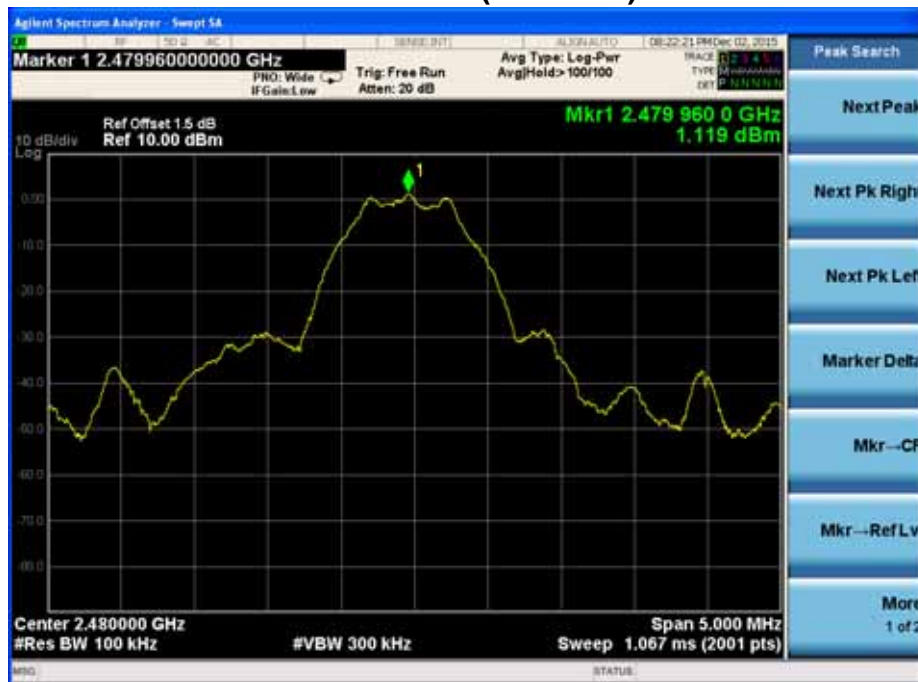


Channel 19 (2440MHz)



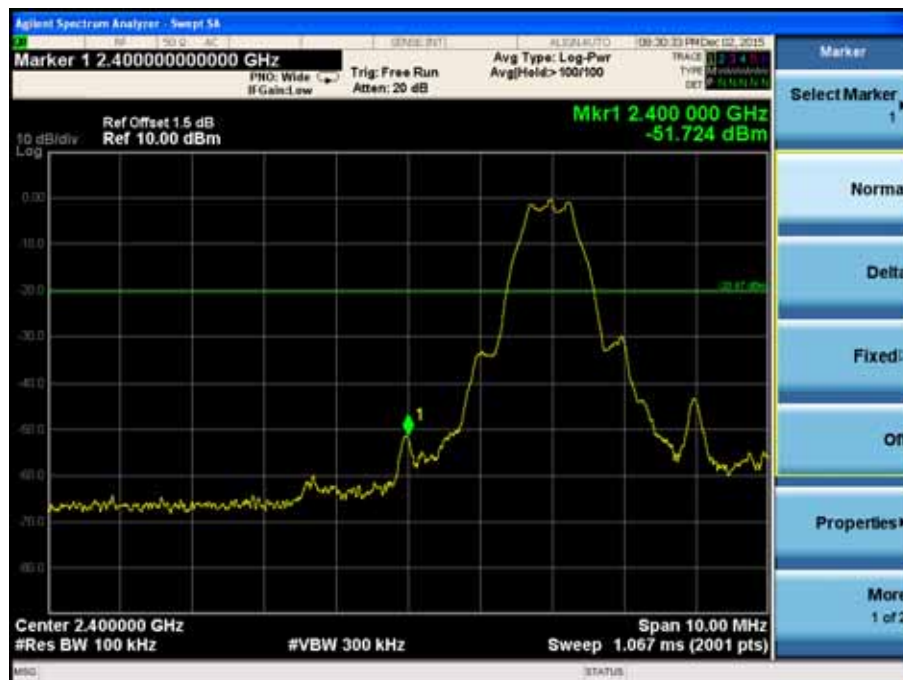


Channel 39 (2480MHz)





Ant 3 Channel 00 (2402MHz)





Channel 19 (2440MHz)





Channel 39 (2480MHz)





6. Radiated Emission Band Edge

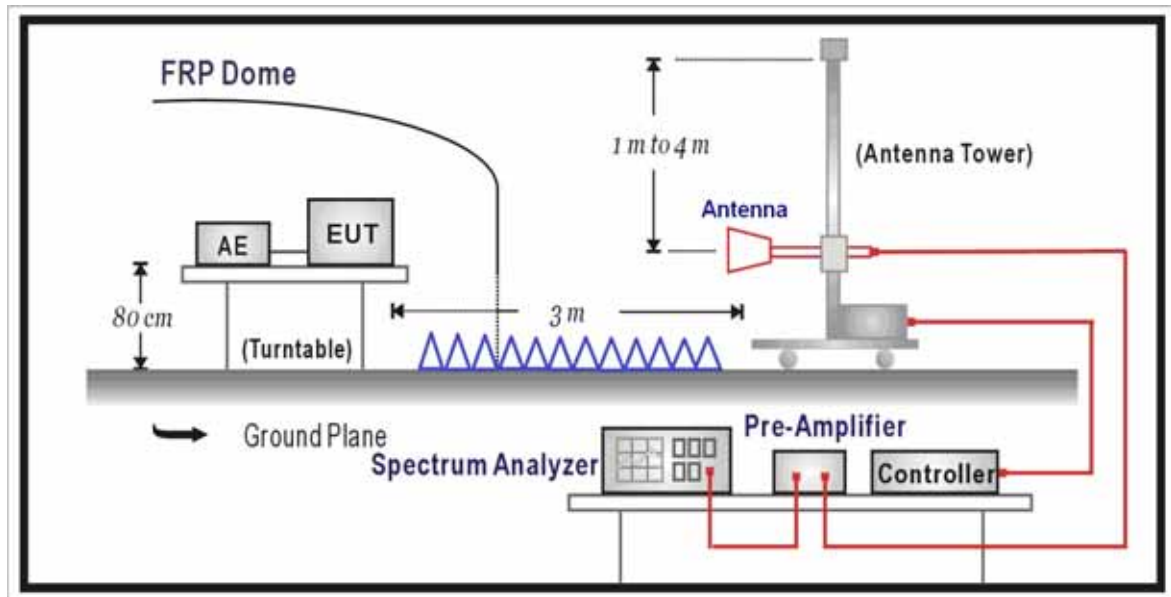
6.1. Test Equipment

☒ Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2016.03.30
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2016.01.05
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2016.08.07
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.08

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

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205 of FCC part 15. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.4 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if

appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b) of FCC part 15.

Now set the $VBW \geq 1 / T$ (the minimum transmission duration), while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209 of FCC Part 15.

If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-Cassia Hub” method may be employed.

6.5. Uncertainty

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

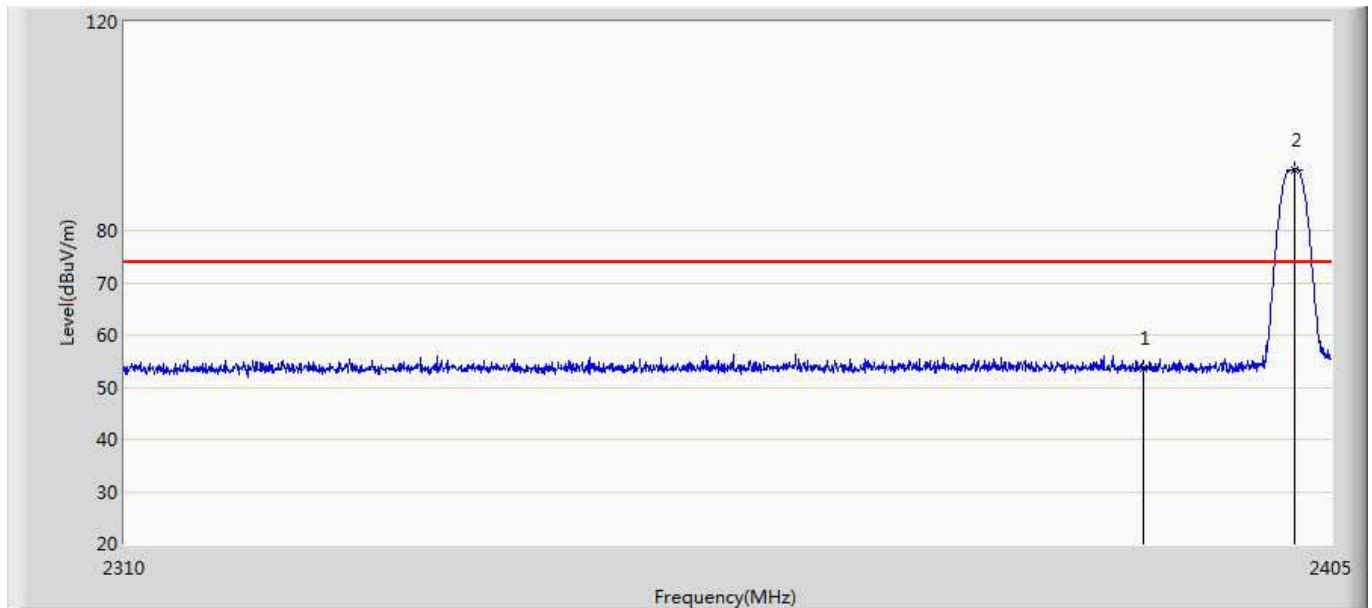
Duty cycle



$$Vbw = 1/0.398 = 2.51 \text{ KHz}$$

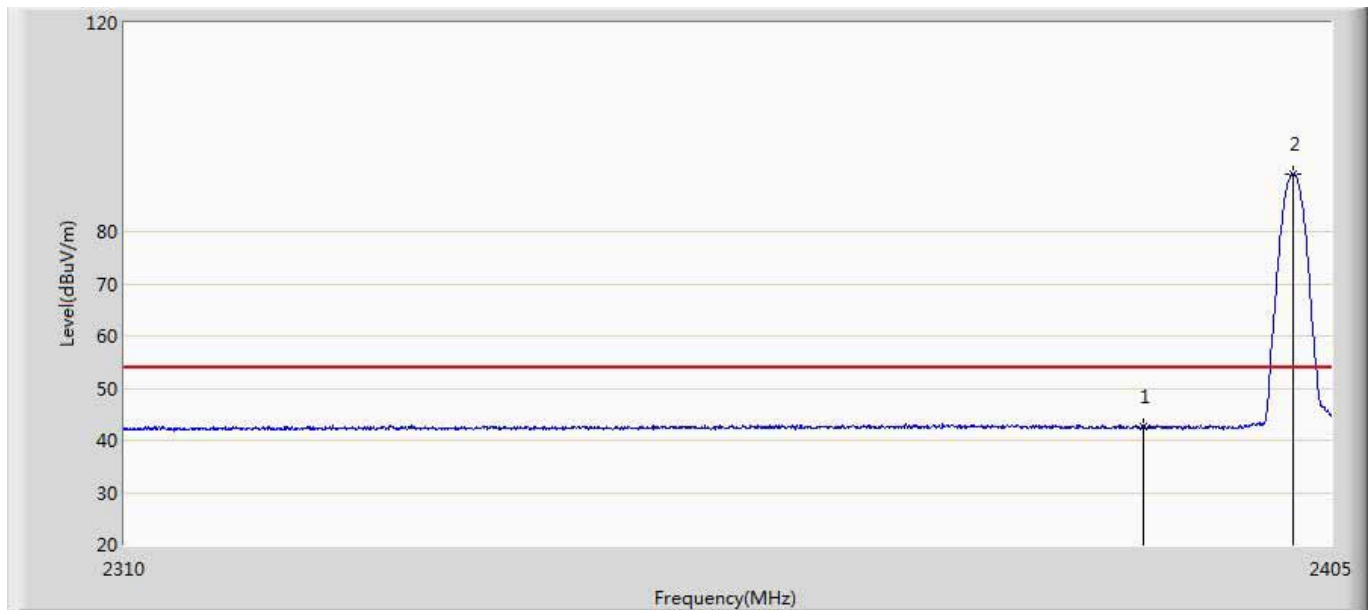
6.6. Test Result

Site: AC5	Time: 2015/12/03 - 13:22
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402	



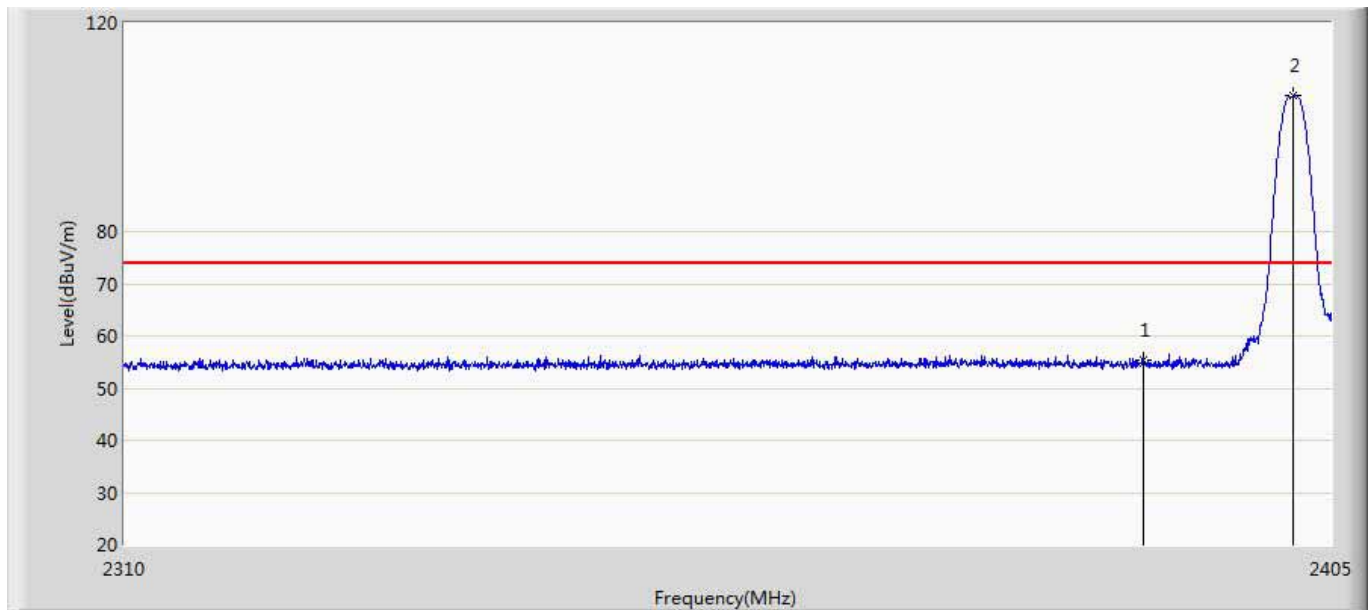
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	53.499	15.636	-20.501	74.000	37.863	PK
2	*	2402.055	91.736	53.896	N/A	N/A	37.840	PK

Site: AC5	Time: 2015/12/03 - 13:24
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402	



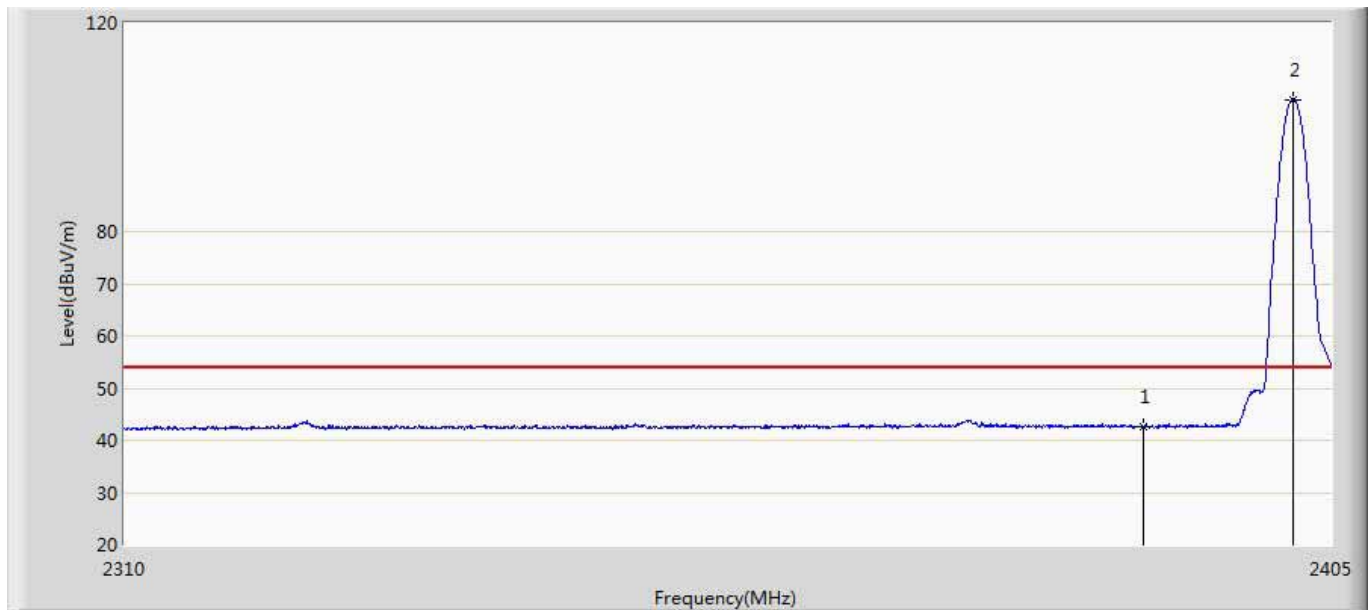
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	42.691	4.828	-11.309	54.000	37.863	AV
2	*	2401.913	91.058	53.218	N/A	N/A	37.840	AV

Site: AC5	Time: 2015/12/03 - 13:29
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402	



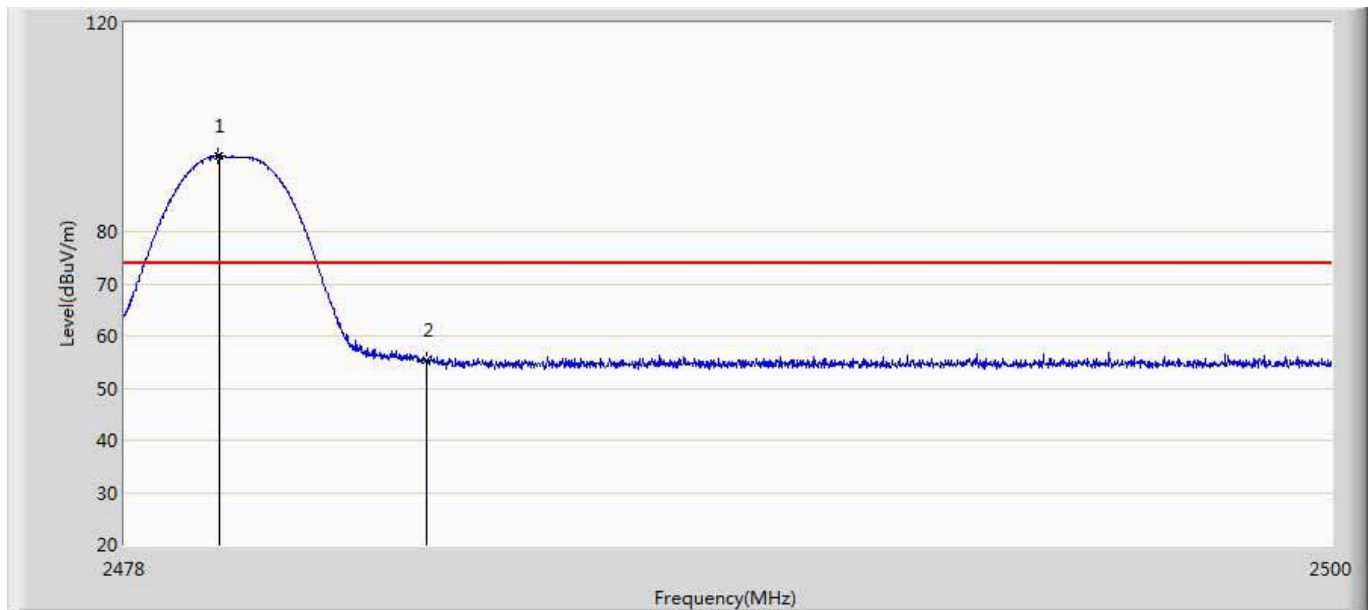
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	55.433	17.570	-18.567	74.000	37.863	PK
2	*	2401.913	105.977	68.137	N/A	N/A	37.840	PK

Site: AC5	Time: 2015/12/03 - 13:32
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2402	



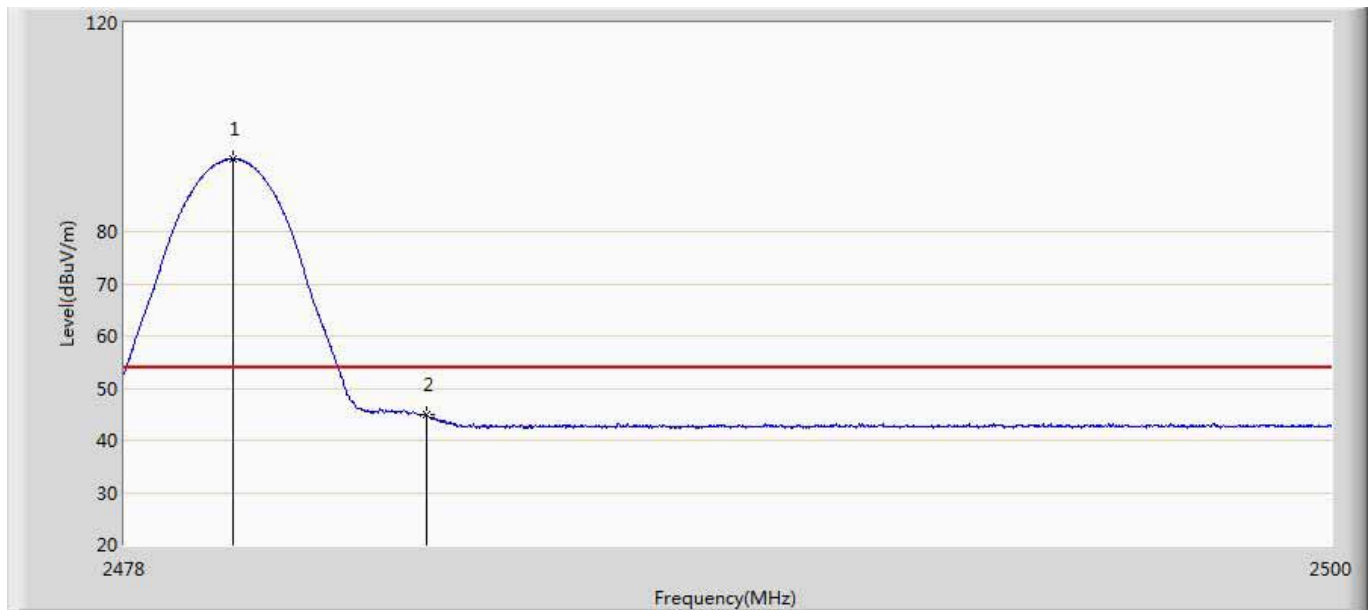
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	42.584	4.721	-11.416	54.000	37.863	AV
2	*	2401.913	105.356	67.516	N/A	N/A	37.840	AV

Site: AC5	Time: 2015/12/03 - 13:41
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2480	



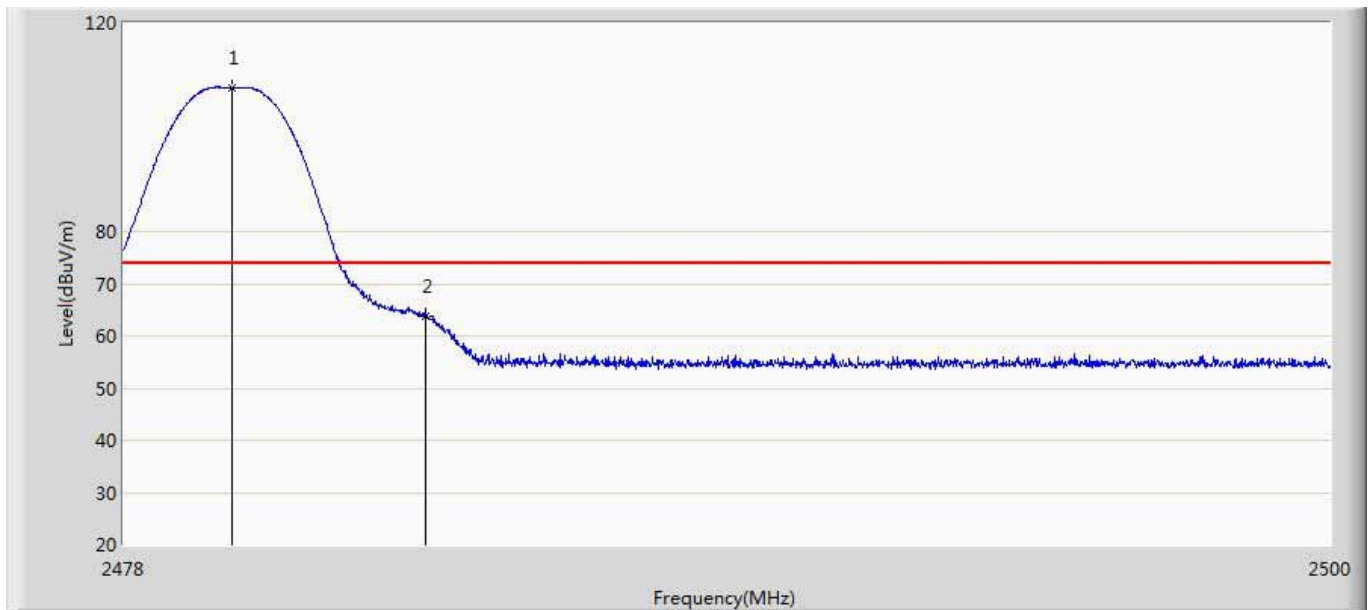
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.716	94.435	56.424	N/A	N/A	38.012	PK
2		2483.500	55.451	17.413	-18.549	74.000	38.038	PK

Site: AC5	Time: 2015/12/03 - 13:42
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2480	



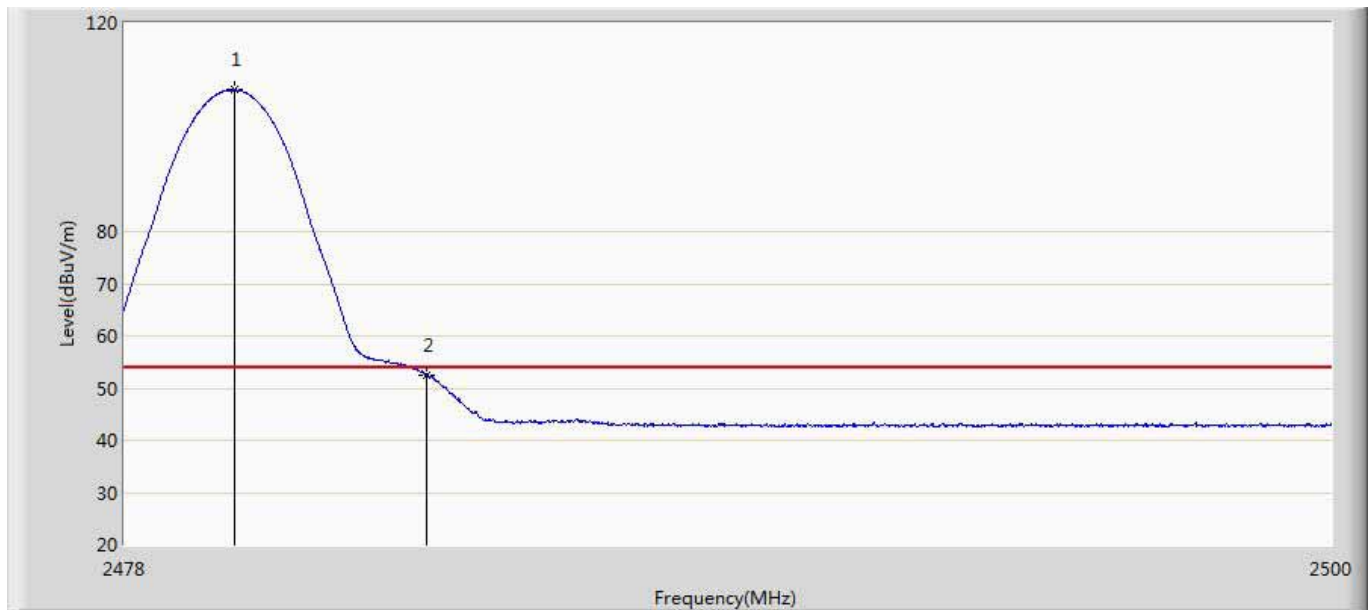
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.980	93.857	55.844	N/A	N/A	38.013	AV
2		2483.500	44.785	6.747	-9.215	54.000	38.038	AV

Site: AC5	Time: 2015/12/03 - 13:43
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2480	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.980	107.567	69.554	N/A	N/A	38.013	PK
2		2483.500	63.765	25.727	-10.235	74.000	38.038	PK

Site: AC5	Time: 2015/12/03 - 13:44
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Cassia Hub	Power: AC 120V/60Hz
Note: Mode 1 Transmit at CH2480	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.991	107.131	69.118	N/A	N/A	38.013	AV
2		2483.500	52.558	14.520	-1.442	54.000	38.038	AV

7. 6dB Bandwidth and Occupied Bandwidth

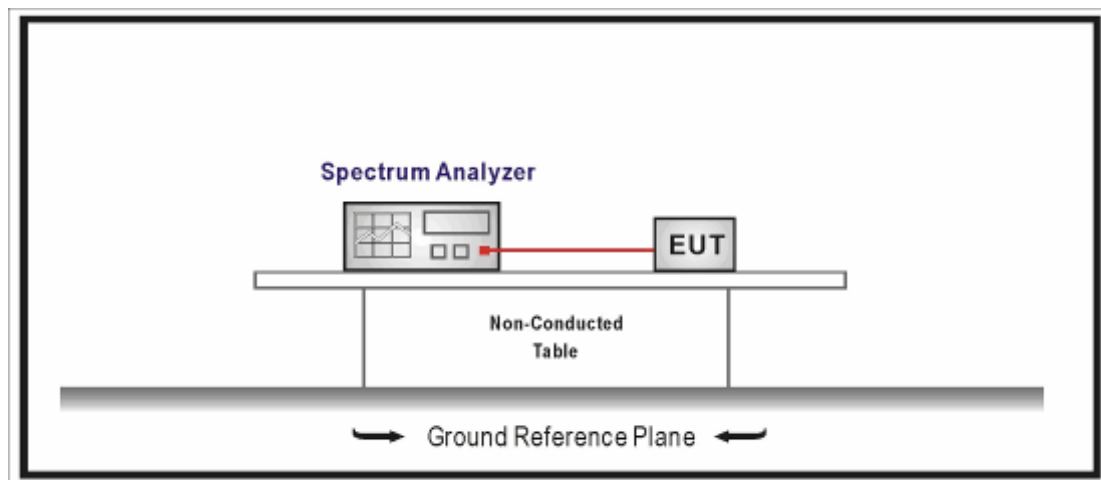
7.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

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

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

7.4. Test Procedure

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

When the average power is exercised, the measured power is to be referenced to the OBW (99% occupied bandwidth) rather than to the DTS bandwidth according to Clause 11.9.2.1 of ANSI C63.10.

The 99% bandwidth test is using ANSI C63.10 Section 6.9.3 method.

- Set RBW = in the range of 1% to 5% of the OBW.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.

- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

7.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

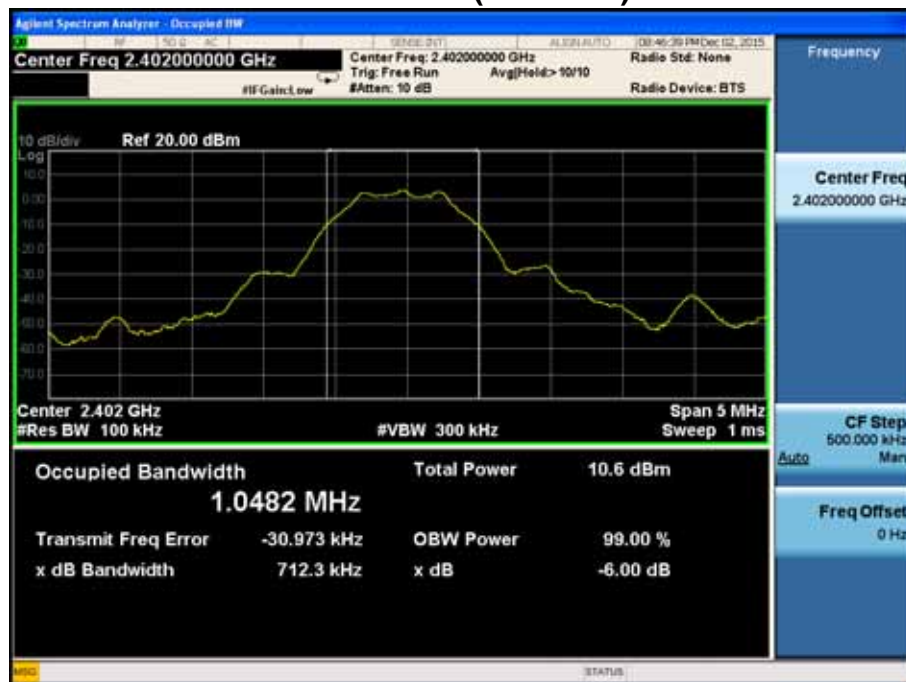
7.6. Test Result

Product	:	Cassia Hub
Test Item	:	6dB Bandwidth & 99% Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Ant 1

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
00	2402	712.3	1077.0	>500	Pass
19	2440	707.9	1070.6	>500	Pass
39	2480	709.0	1069.0	>500	Pass

Channel 00 (2402MHz)



Channel 19 (2440MHz)



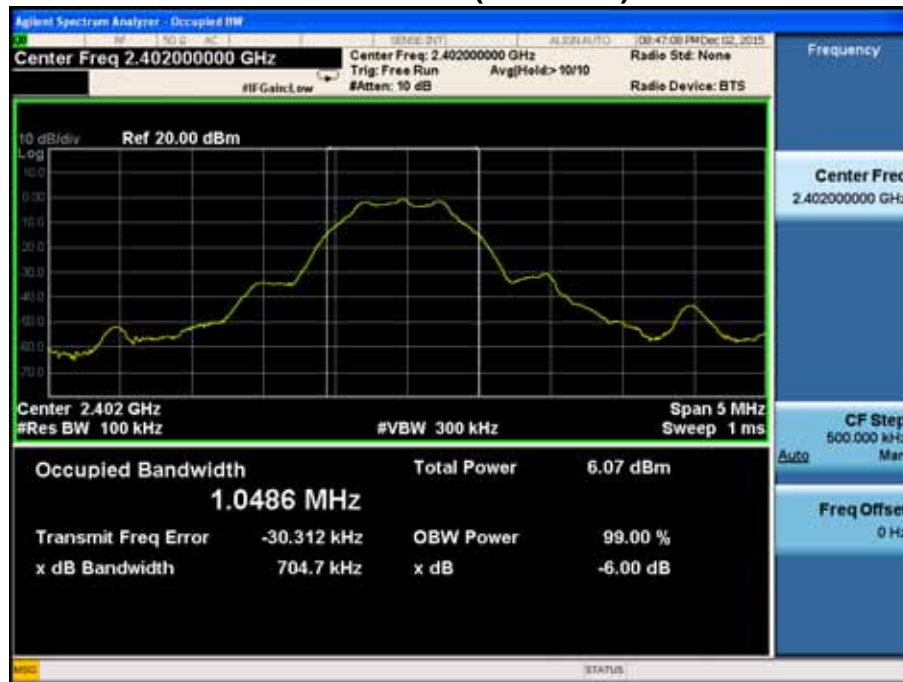
Channel 39 (2480MHz)



Ant 2

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
00	2402	704.7	1077.0	>500	Pass
19	2440	711.4	1070.6	>500	Pass
39	2480	704.6	1069.0	>500	Pass

Channel 00 (2402MHz)



Channel 19 (2440MHz)



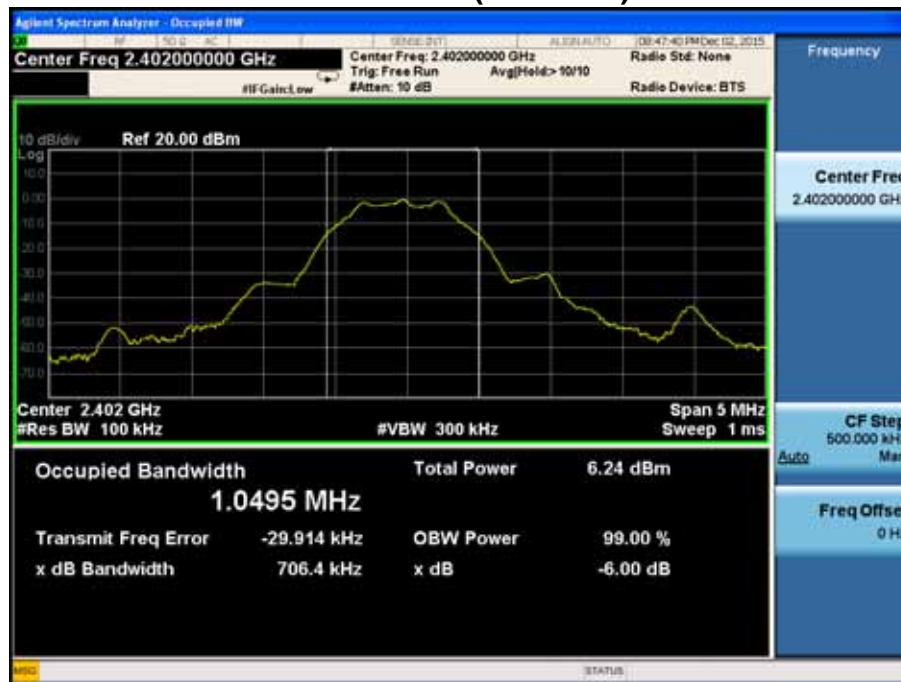
Channel 39 (2480MHz)



Ant 3

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
00	2402	706.4	1077.0	>500	Pass
19	2440	704.3	1070.6	>500	Pass
39	2480	712.2	1069.0	>500	Pass

Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



8. Power Output

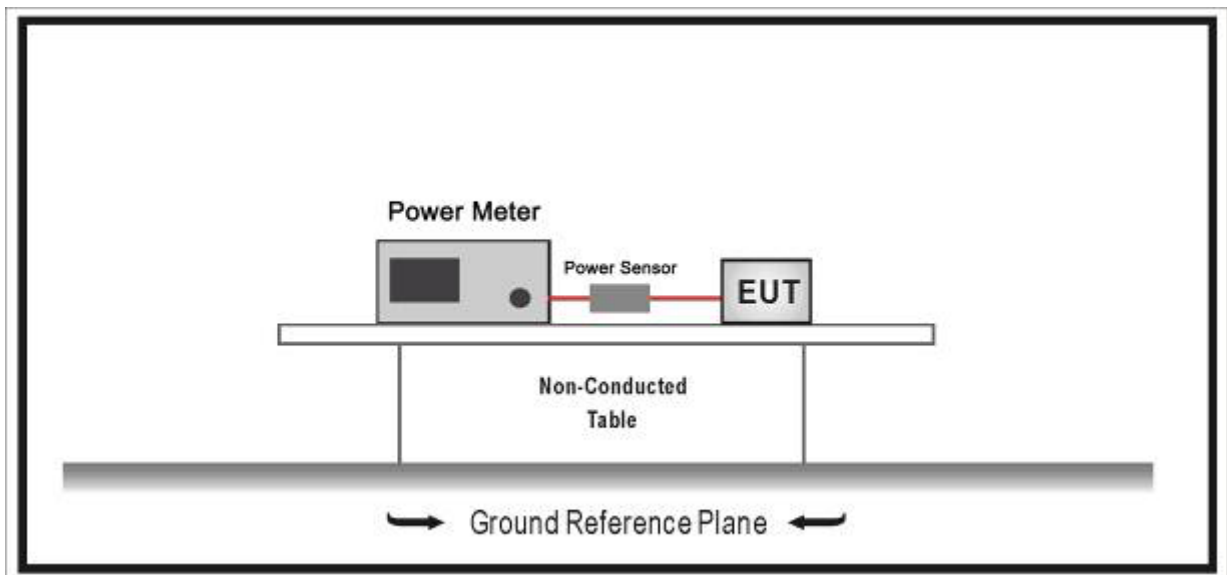
8.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Wideband Peak Power Meter	Anritsu	ML2495A	0905006	2016.11.10
Power Sensor	Anritsu	MA2411B	0846014	2016.11.10
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

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 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.

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

8.4. Test Procedure

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

1. Power meter and sensor's minimum video bandwidth is 50MHz, larger than occupied bandwidth;
2. Fast responding diode sensors respond immediately to changes in power level to reduce total test time.
3. Use peak detector to test.

8.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

8.6. Test Result

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

Channel No.	Frequency (MHz)	Ant1	Ant2	Ant3	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	5.40	0.87	1.18	7.78	23.30	Pass
39	2441	7.78	4.16	4.64	10.61	23.30	Pass
78	2480	7.61	2.85	2.36	9.74	23.30	Pass

9. Power Spectral Density

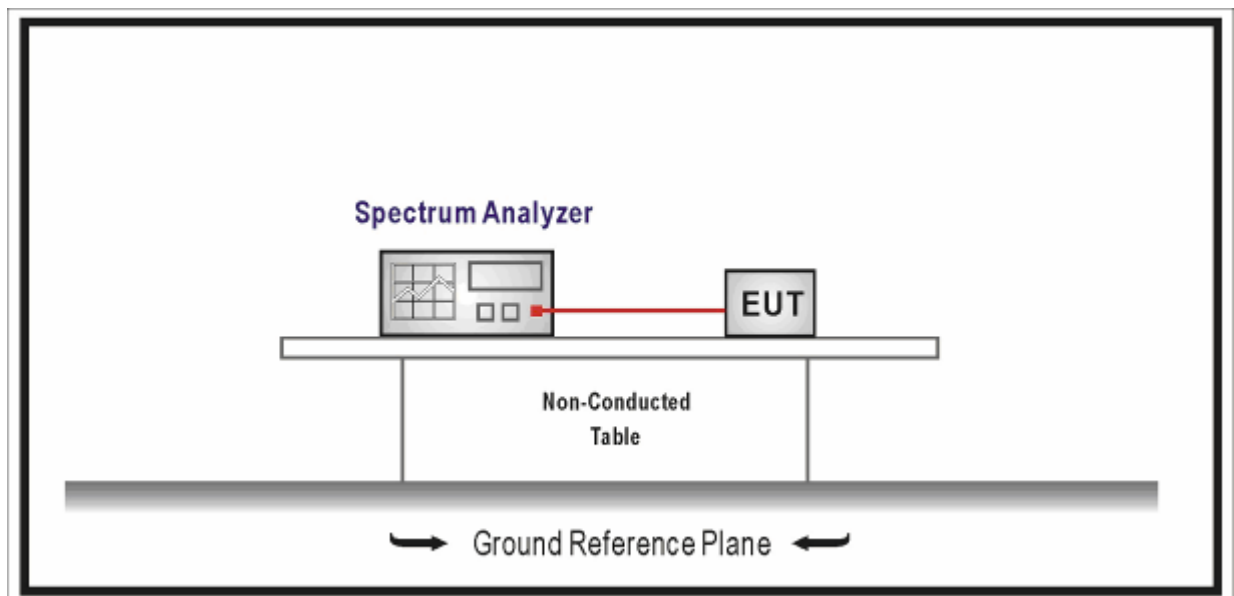
9.1. Test Equipment

Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

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

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.

9.4. Test Procedure

According to FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014; ANSI C63.10: 2013 Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1.

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. (Actually we use 3kHz RBW)

- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the band.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

9.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

9.6. Test Result

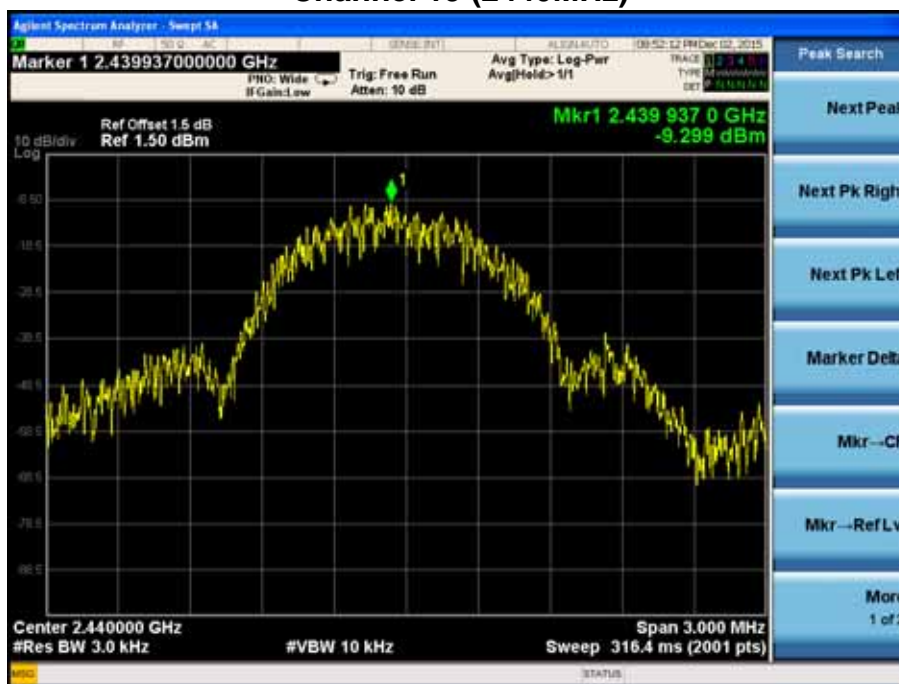
Product	:	Cassia Hub
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	Ant1	Ant2	Ant3	Measurement PPSD (dBm)	Limit (dBm)	Result
00	2402	-11.77	-16.215	-15.904	-9.35	8	Pass
19	2440	-9.299	-12.704	-12.383	-6.40	8	Pass
39	2480	-9.447	-14.330	-14.658	-7.34	8	Pass

Ant 1
Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



Ant 2

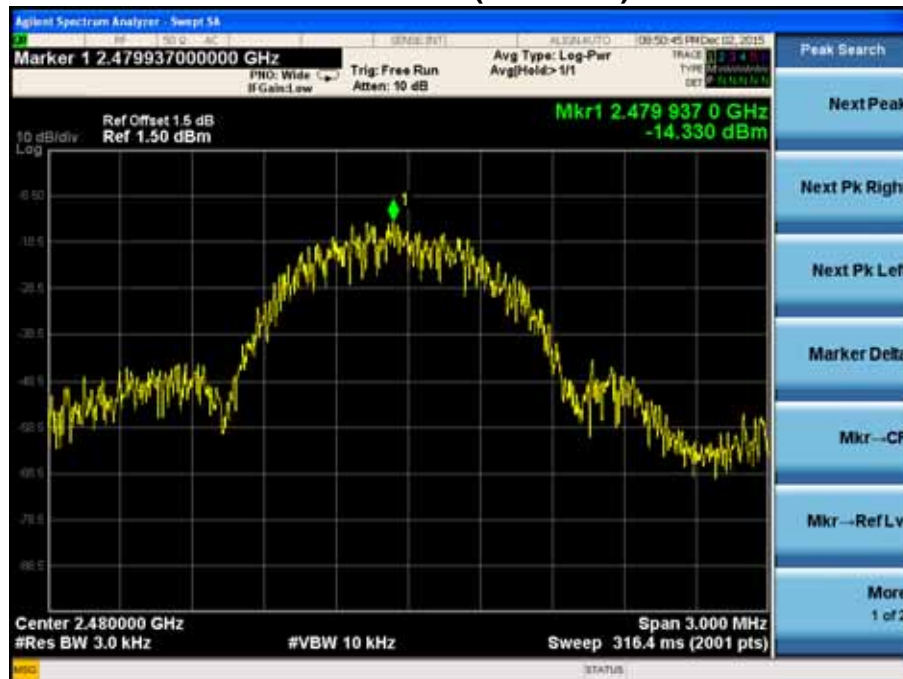
Channel 00 (2402MHz)



Channel 19 (2440MHz)

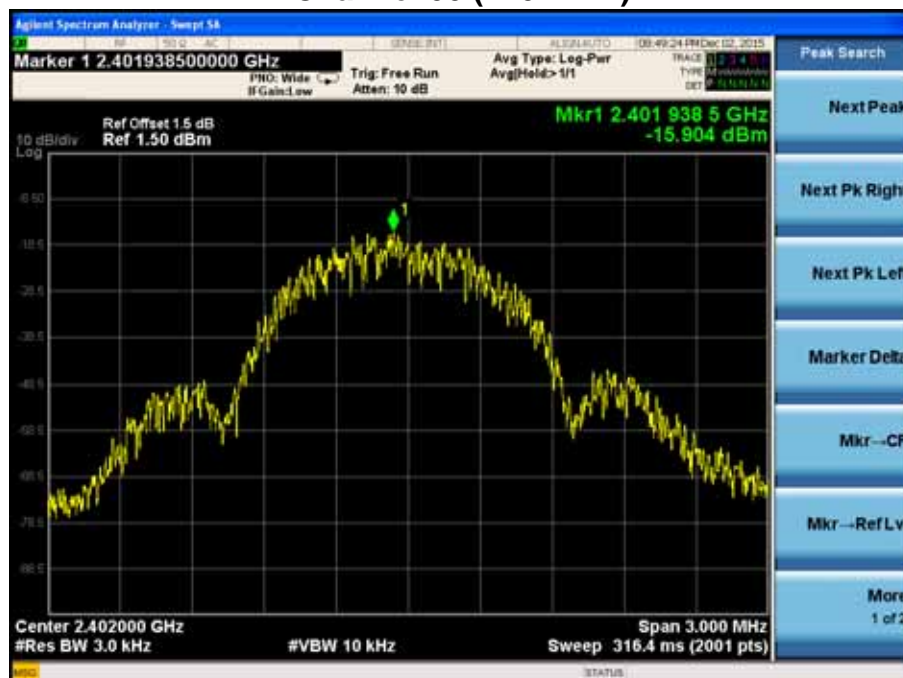


Channel 39 (2480MHz)

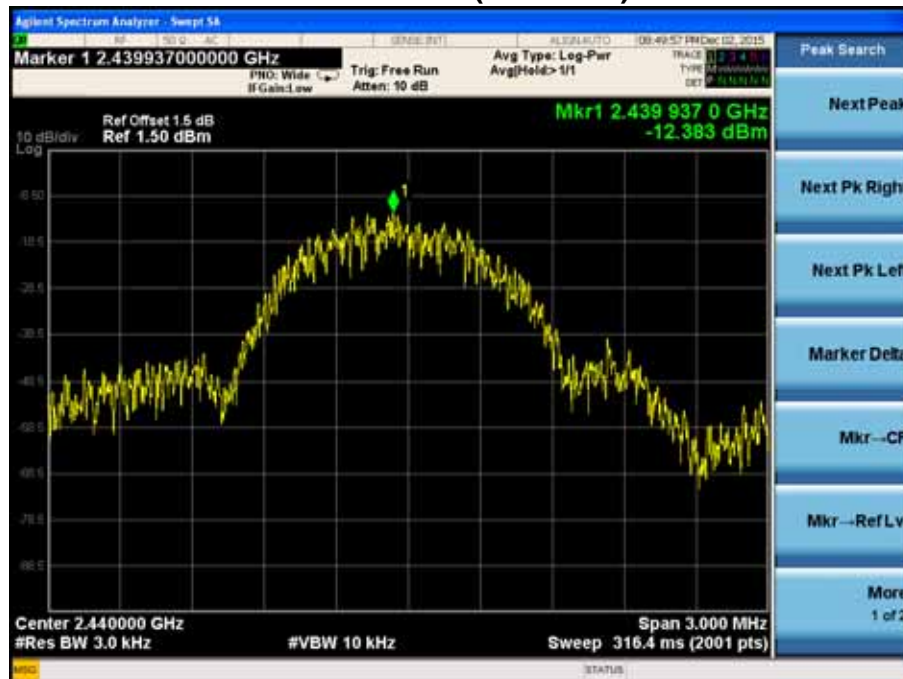


Ant 3

Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



The End