

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 : Nov. 10, 2015~ Nov.13, 2015
Issued Date : Nov. 26, 2015
Report No. : 15A0076R-RF-US-P06V01
Report Version : V 1.0

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.

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Test Report Certification

Issued Date : Nov. 26, 2015

Report No. : 15A0076R-RF-US-P06V01



Product Name : Cassia Hub
Applicant : Beijing Cassia Networks Technology Co.,Ltd
Address : Room 206,Distrit B,2/F,No.12,Xinxi Road,Haidian
District,Beijing
Manufacturer : Beijing Cassia Networks Technology Co.,Ltd
Address : Room 206,Distrit 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
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FCC Registration Number: 800392; IC Lab Code: 4075B

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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>
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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
15A0076R-RF-US-P06V01	V1.0	Initial Issued Report	Nov. 26, 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
Frequency Range	2402- 2480 MHz
Channel Number	V3.0: 79
Channel Separation	V3.0: 1MHz
Type of Modulation	V3.0: GFSK, Pi/4 DQPSK, 8DPSK
Data Rate	V3.0: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK)
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List

Bluetooth Working Frequency of Each Channel: (For V3.0)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2403 MHz	02	2404 MHz	03	2405 MHz
04	2406 MHz	05	2407 MHz	06	2408 MHz	07	2409 MHz
08	2410 MHz	09	2411 MHz	10	2412 MHz	11	2413 MHz
12	2414 MHz	13	2415 MHz	14	2416 MHz	15	2417 MHz
16	2418 MHz	17	2419 MHz	18	2420 MHz	19	2421 MHz
20	2422 MHz	21	2423 MHz	22	2424 MHz	23	2425 MHz
24	2426 MHz	25	2427 MHz	26	2428 MHz	27	2429 MHz
28	2430 MHz	29	2431 MHz	30	2432 MHz	31	2433 MHz
32	2434 MHz	33	2435 MHz	34	2436 MHz	35	2437 MHz
36	2438 MHz	37	2439 MHz	38	2440 MHz	39	2441 MHz
40	2442 MHz	41	2443 MHz	42	2444 MHz	43	2445 MHz
44	2446 MHz	45	2447 MHz	46	2448 MHz	47	2449 MHz
48	2450 MHz	49	2451 MHz	50	2452 MHz	51	2453 MHz
52	2454 MHz	53	2455 MHz	54	2456 MHz	55	2457 MHz
56	2458 MHz	57	2459 MHz	58	2460 MHz	59	2461 MHz
60	2462 MHz	61	2463 MHz	62	2464 MHz	63	2465 MHz
64	2466 MHz	65	2467 MHz	66	2468 MHz	67	2469 MHz
68	2470 MHz	69	2471 MHz	70	2472 MHz	71	2473 MHz
72	2474 MHz	73	2475 MHz	74	2476 MHz	75	2477 MHz
76	2478 MHz	77	2479 MHz	78	2480 MHz	N/A	N/A

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: Transmitter-1Mbps(GFSK_DH5)
Mode 2: Transmitter-2Mbps(Pi/4 DQPSK_DH5)
Mode 3: Transmitter-3Mbps(8DPSK_DH5)

Note:

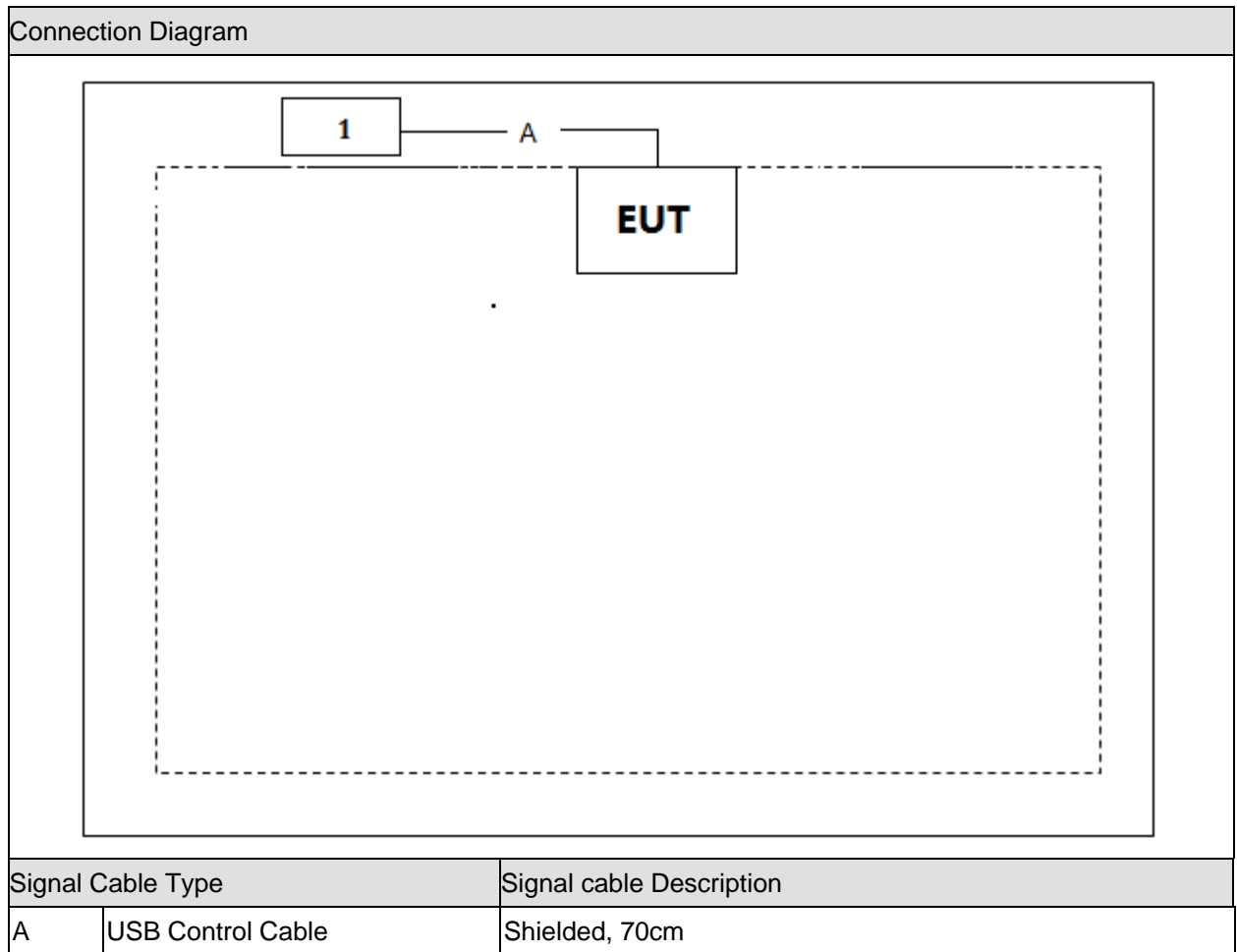
1. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.
2. Regards to the frequency band operation for systems using FHSS modulation: normal operation (hopping) was selected to test for conducted, and the lowest, highest frequency channel for radiation spurious test.
3. The extreme test condition for voltage and temperature were declared by the manufacturer.
4. The reading values of all the test items contain cable loss.

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



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 "Blue Test 3", 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
20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)	Yes	No
Carrier Frequency Separation	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)	Yes	No
Number of Hopping Frequencies	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)(iii)	Yes	No
Time of Occupancy (Dwell Time)	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)(iii)	Yes	No
Peak Output Power	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(b)(1)	Yes	No
Band-edge Compliance of RF Conducted Emissions	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.215(c), 15.247(d)	Yes	No
Spurious RF Conducted Emissions	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No

For IC

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 4 Section 8.8	Yes	No
Radiated Emission	RSS-Gen Issue 4 Section 8.9	Yes	No
20dB Bandwidth	RSS-247 Issue 1 Section 5.1	Yes	No
Carrier Frequency Separation	RSS-247 Issue 1 Section 5.1	Yes	No
Number of Hopping Frequencies	RSS-247 Issue 1 Section 5.1	Yes	No
Time of Occupancy (Dwell Time)	RSS-247 Issue 1 Section 5.1	Yes	No
Peak Output Power	RSS-247 Issue 1 Section 5.4	Yes	No
Band-edge Compliance of RF Conducted Emissions	RSS-247 Issue 1 Section 5.5	Yes	No
Spurious RF Conducted Emissions	RSS-247 Issue 1 Section 5.5	Yes	No
Radiated Emission Band Edge	RSS-Gen Issue 4 Section 8.10	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

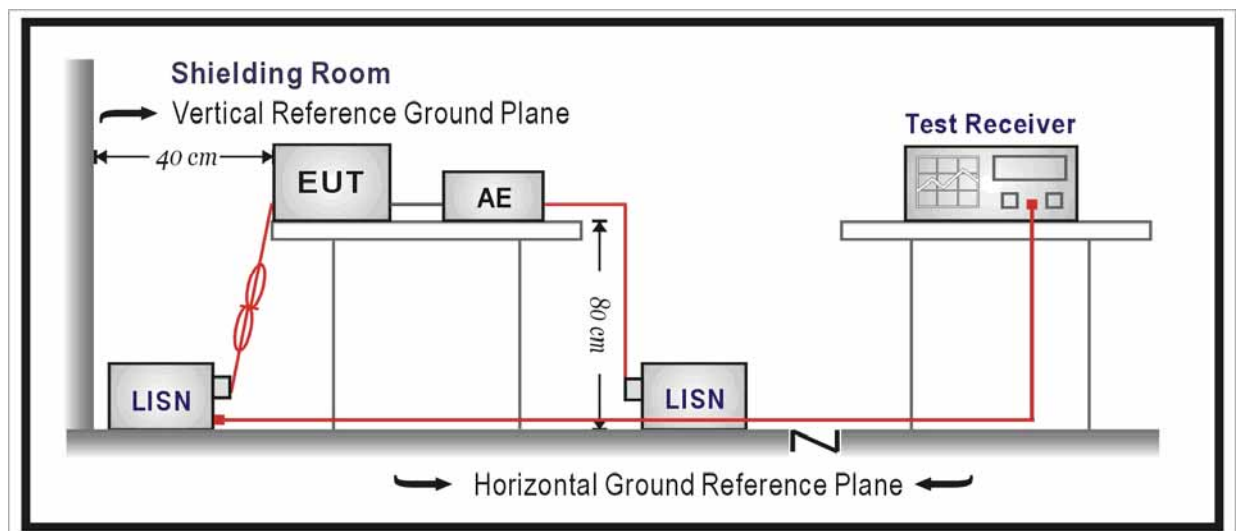
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2016.03.10
Two-Line V-Network	R&S	ENV216	100043	2016.03.10
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	2016.01.07

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 ANSI C63.4: 2014 & ANSI C63.10: 2013.

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.

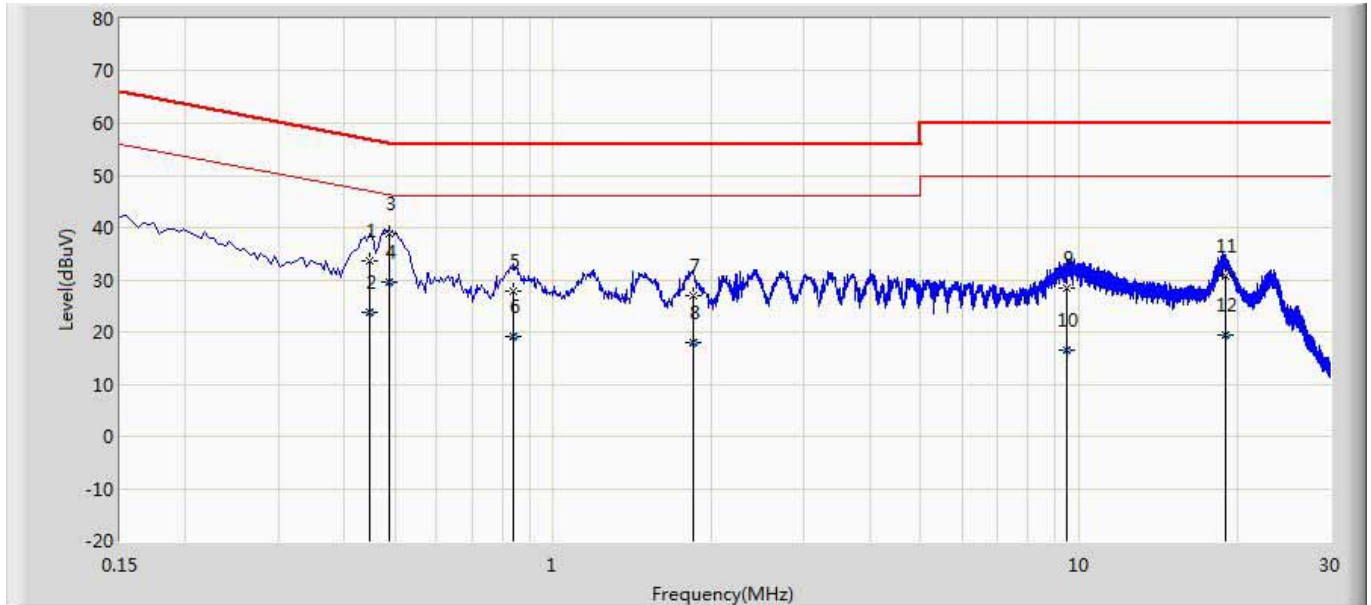
Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

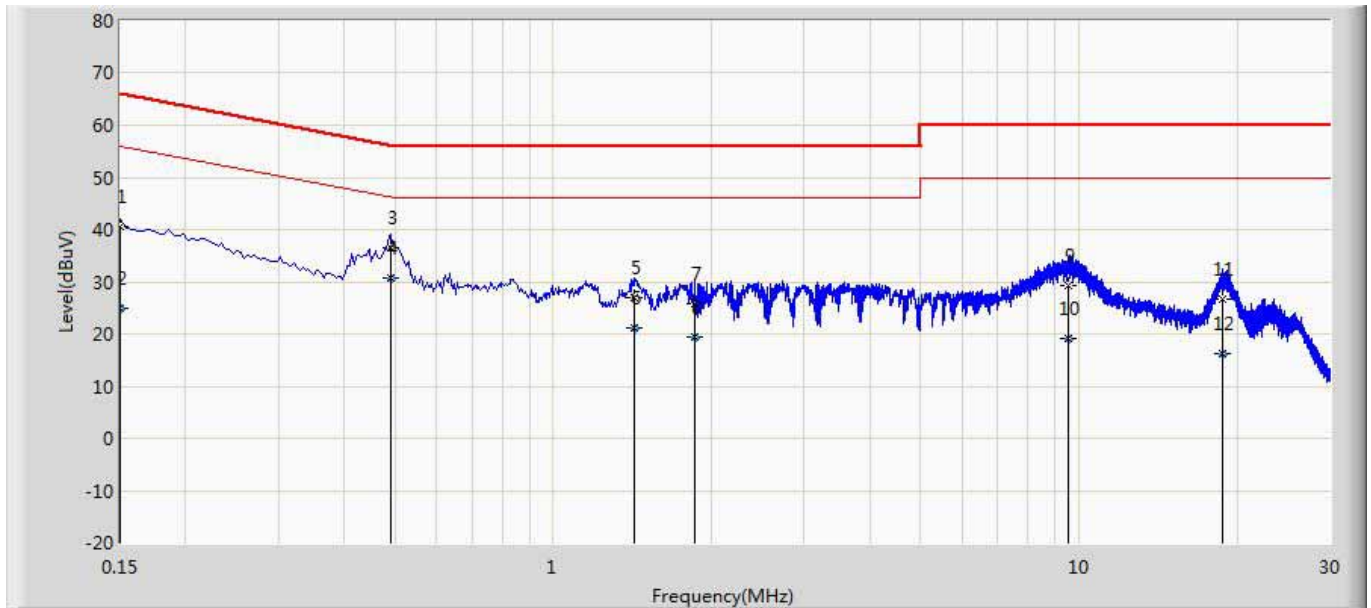
3.6. Test Result

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 DH5	



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 DH5	



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

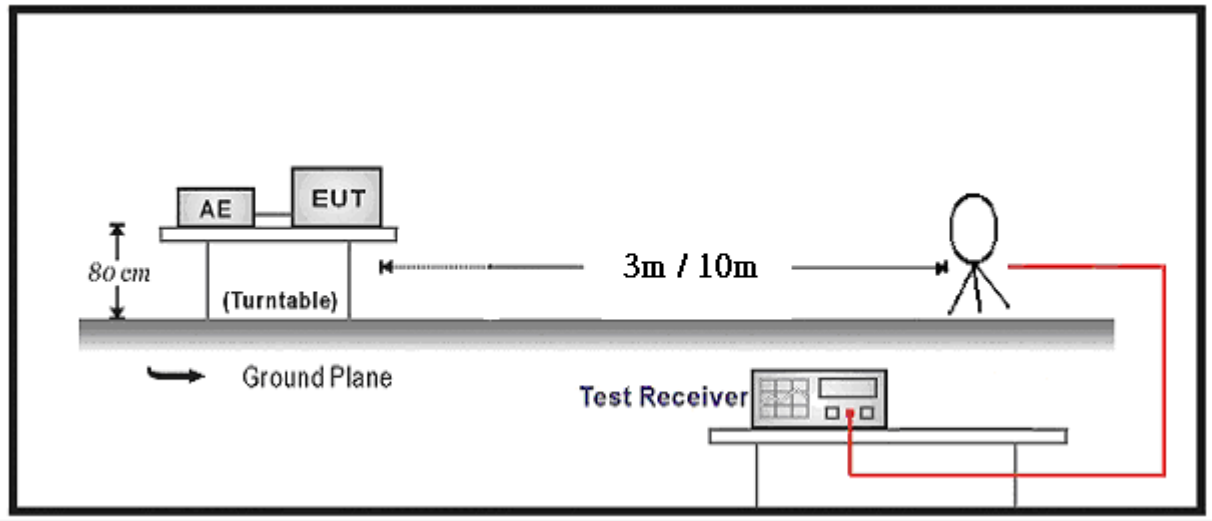
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2016.03.10
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2016.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2016.01.07

Radiated Emission / AC-5

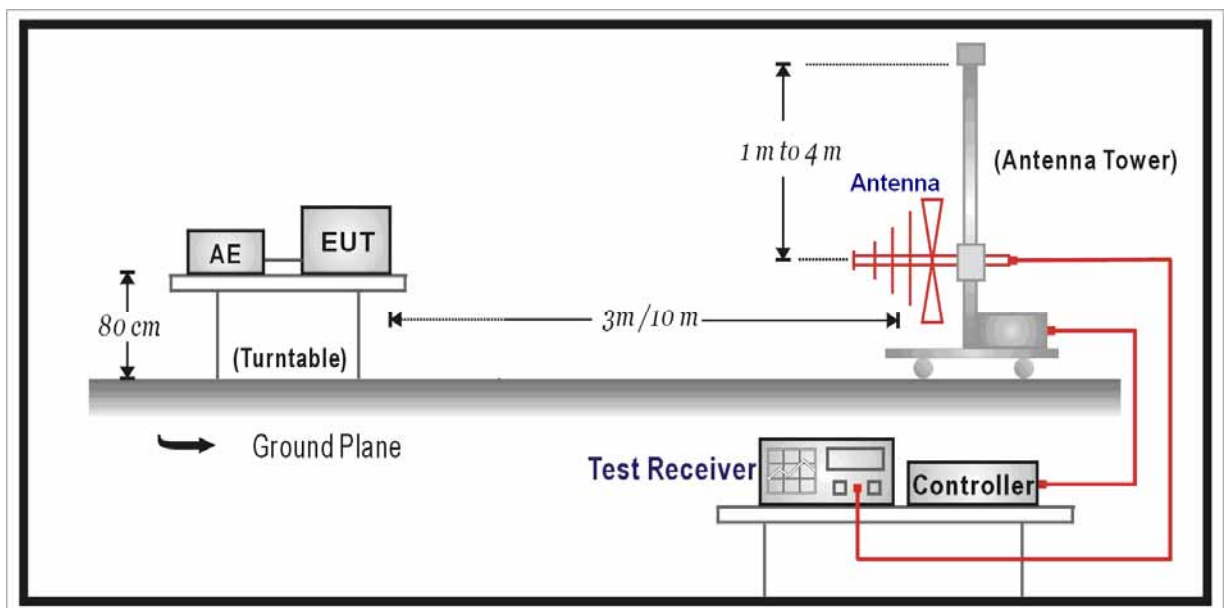
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
Broad-Band Horn Antenna	Schwarzbeck	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	2016.01.07

4.2. Test Setup

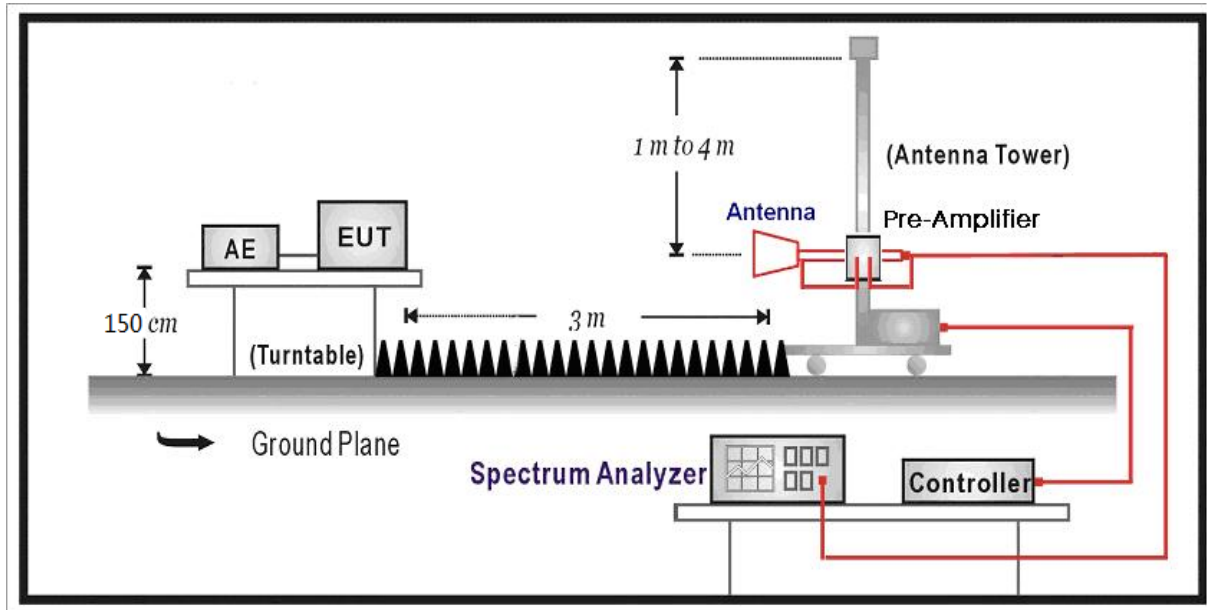
Below 30MHz Test Setup:



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 ANSI C63.4: 2014; ANSI C63.10: 2013.

The EUT is placed on a turn table which is 1.5 meter for above 1G and 0.8 meter for below 1G 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 60~10 degrees for H-plane and 90~10 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_DH5) Ant(1+2+3)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4808.0	45.4	8.0	53.4	54(Note3)	-0.6	PK
	V	7206.0	30.3	12.8	43.1	54(Note3)	-10.9	PK
	H	9608.0	26.3	16.1	42.4	54(Note3)	-11.6	PK
	V	4808.0	45.4	8.0	53.4	54(Note3)	-0.6	PK
	H	7206.0	30.3	12.8	43.1	54(Note3)	-10.9	PK
	V	9608.0	26.3	16.1	42.4	54(Note3)	-11.6	PK
39	H	4884.5	43.8	8.2	52.0	54(Note3)	-2.0	PK
	V	7323.0	31.9	13.0	44.9	54(Note3)	-9.1	PK
	H	9764.0	26.3	16.3	42.6	54(Note3)	-11.4	PK
	V	4884.5	42.0	8.2	50.2	54(Note3)	-3.8	PK
	H	7323.0	30.3	13.0	43.3	54(Note3)	-10.7	PK
	V	9764.0	25.9	16.3	42.2	54(Note3)	-11.8	PK
78	H	4961.0	44.4	8.5	52.9	54(Note3)	-1.1	PK
	V	7440.0	32.3	13.2	45.5	54(Note3)	-8.5	PK
	H	9920.0	27.0	16.1	43.1	54(Note3)	-10.9	PK
	V	4961.0	41.0	8.5	49.5	54(Note3)	-4.5	PK
	H	7440.0	30.4	13.2	43.6	54(Note3)	-10.4	PK
	V	9920.0	26.9	16.1	43.0	54(Note3)	-11.0	PK

Note 1: 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.

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.

3: Measure Level = Reading Level + Factor.

Mode 2: Transmitter-2Mbps(Pi/4 DQPSK _DH5) Ant(1+2+3)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4808.0	41.2	8.0	49.2	54(Note3)	-4.8	PK
	V	7206.0	28.2	12.8	41.0	54(Note3)	-13.0	PK
	H	9608.0	25.6	16.1	41.7	54(Note3)	-12.3	PK
	V	4799.5	39.1	8.0	47.1	54(Note3)	-6.9	PK
	H	7206.0	28.9	12.8	41.7	54(Note3)	-12.3	PK
	V	9608.0	26.2	16.1	42.3	54(Note3)	-11.7	PK
39	H	4884.5	41.4	8.2	49.6	54(Note3)	-4.4	PK
	V	7323.0	29.5	13.0	42.5	54(Note3)	-11.5	PK
	H	9764.0	26.7	16.3	43.0	54(Note3)	-11.0	PK
	V	4884.5	39.5	8.2	47.7	54(Note3)	-6.3	PK
	H	7323.0	28.6	13.0	41.6	54(Note3)	-12.4	PK
	V	9764.0	26.8	16.3	43.1	54(Note3)	-10.9	PK
78	H	4961.0	41.7	8.5	50.2	54(Note3)	-3.8	PK
	V	7440.0	30.5	13.2	43.7	54(Note3)	-10.3	PK
	H	9920.0	26.2	16.1	42.3	54(Note3)	-11.7	PK
	V	4961.0	38.6	8.5	47.1	54(Note3)	-6.9	PK
	H	7440.0	28.7	13.2	41.9	54(Note3)	-12.1	PK
	V	9920.0	25.9	16.1	42.0	54(Note3)	-12.0	PK

Note 1: 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.

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.

3: Measure Level = Reading Level + Factor.

Mode 3: Transmitter-3Mbps(8DPSK_DH5) Ant(1+2+3)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4799.5	41.5	8.0	49.5	54(Note3)	-4.5	PK
	V	7206.0	28.1	12.8	40.9	54(Note3)	-13.1	PK
	H	9608.0	26.2	16.1	42.3	54(Note3)	-11.7	PK
	V	4808.0	39.9	8.0	47.9	54(Note3)	-6.1	PK
	H	7206.0	28.1	12.8	40.9	54(Note3)	-13.1	PK
	V	9608.0	26.2	16.1	42.3	54(Note3)	-11.7	PK
39	H	4884.5	40.9	8.2	49.1	54(Note3)	-4.9	PK
	V	7323.0	30.5	13.0	43.5	54(Note3)	-10.5	PK
	H	9764.0	27.4	16.3	43.7	54(Note3)	-10.3	PK
	V	4884.5	37.3	8.2	45.5	54(Note3)	-8.5	PK
	H	7323.0	29.4	13.0	42.4	54(Note3)	-11.6	PK
	V	9764.0	26.0	16.3	42.3	54(Note3)	-11.7	PK
78	H	4961.0	42.7	8.5	51.2	54(Note3)	-2.8	PK
	V	7440.0	30.3	13.2	43.5	54(Note3)	-10.5	PK
	H	9920.0	26.8	16.1	42.9	54(Note3)	-11.1	PK
	V	4961.0	40.0	8.5	48.5	54(Note3)	-5.5	PK
	H	7440.0	28.6	13.2	41.8	54(Note3)	-12.2	PK
	V	9920.0	26.5	16.1	42.6	54(Note3)	-11.4	PK

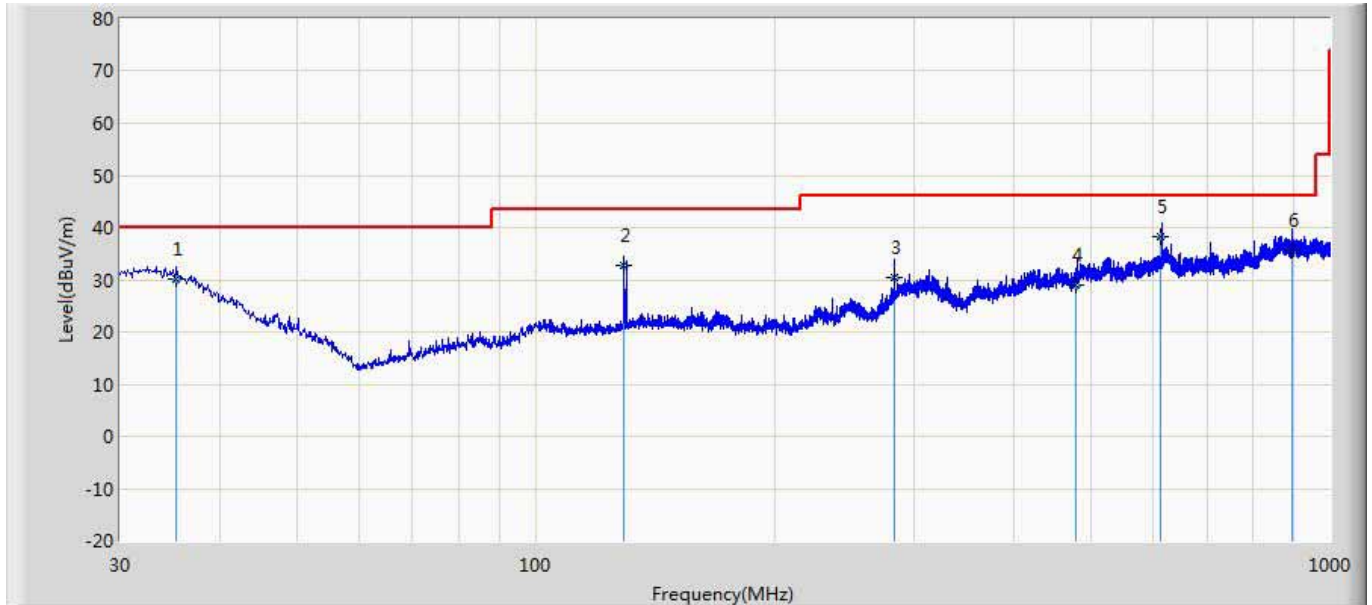
Note 1: The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.

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.

3: Measure Level = Reading Level + Factor.

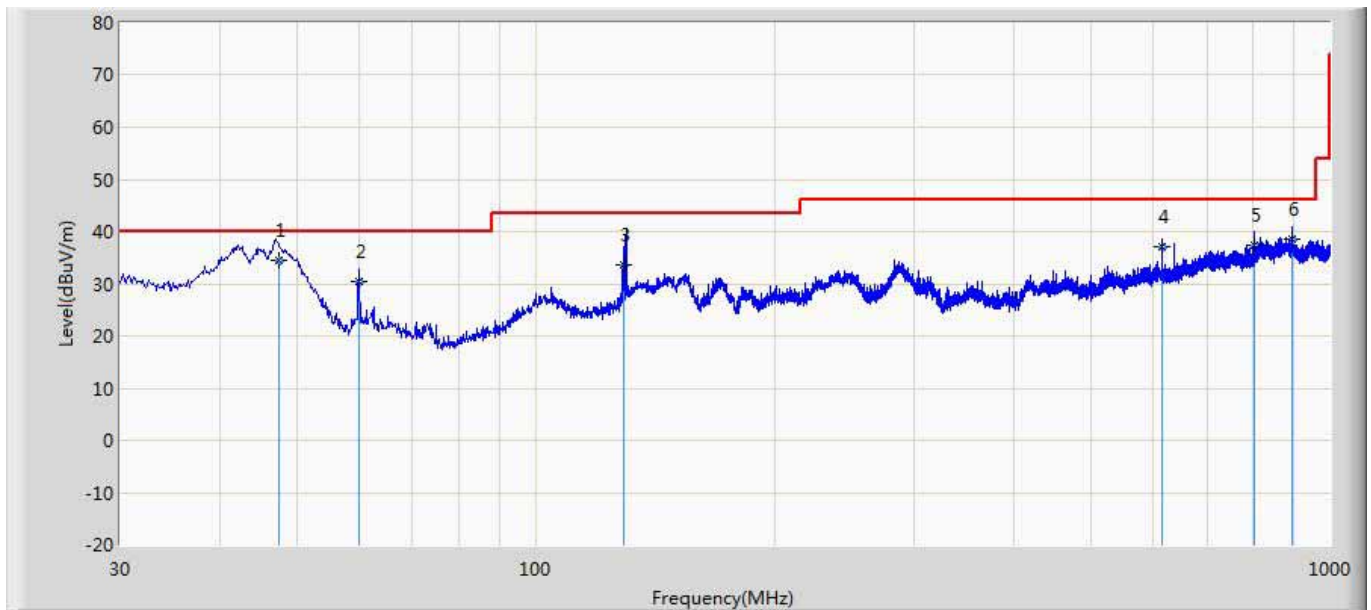
The worst case of Radiated Emission below 1GHz:

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 DH5	



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 DH5	



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. 20dB Bandwidth

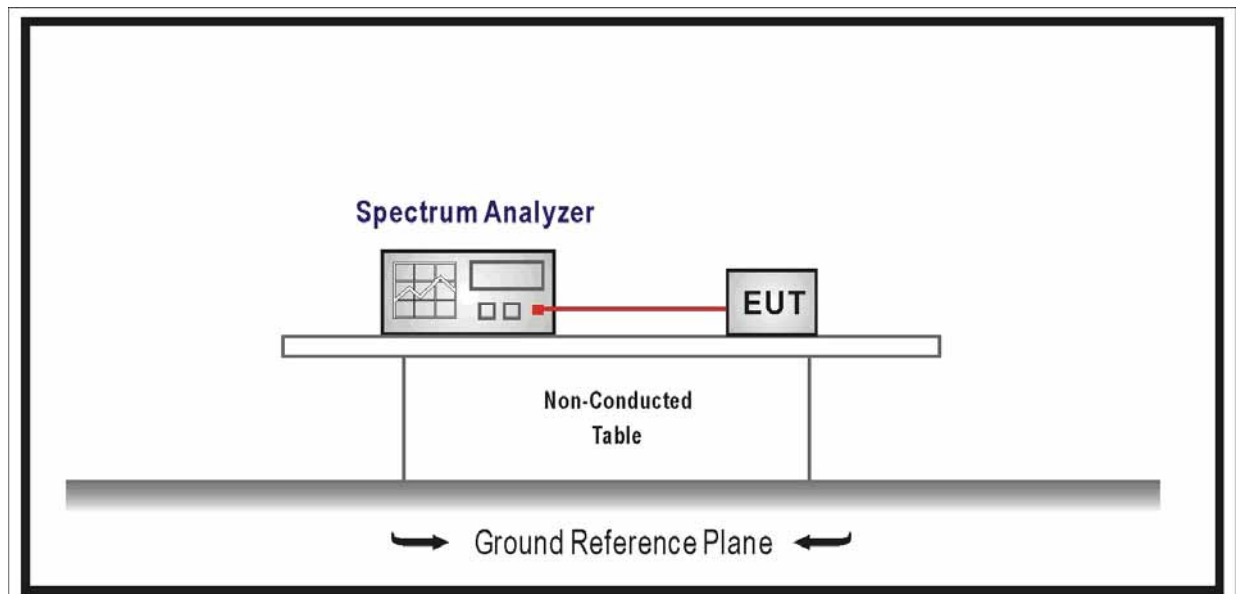
5.1 Test Equipment

20dB Bandwidth / TR8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
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.

5.2 Test Setup



5.3 Limit

- For frequency hopping systems operating in 2400-2483.5 MHz band, no limitation.
- For frequency hopping systems operating in 902-928 MHz band, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- For frequency hopping systems operating in 5725-5850 MHz band, the maximum 20 dB bandwidth of the hopping channel is 1 MHz.

5.4 Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

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-delta function to measure 20 dB down one side of the emission. Reset the marker-delta 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-delta 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 kHz

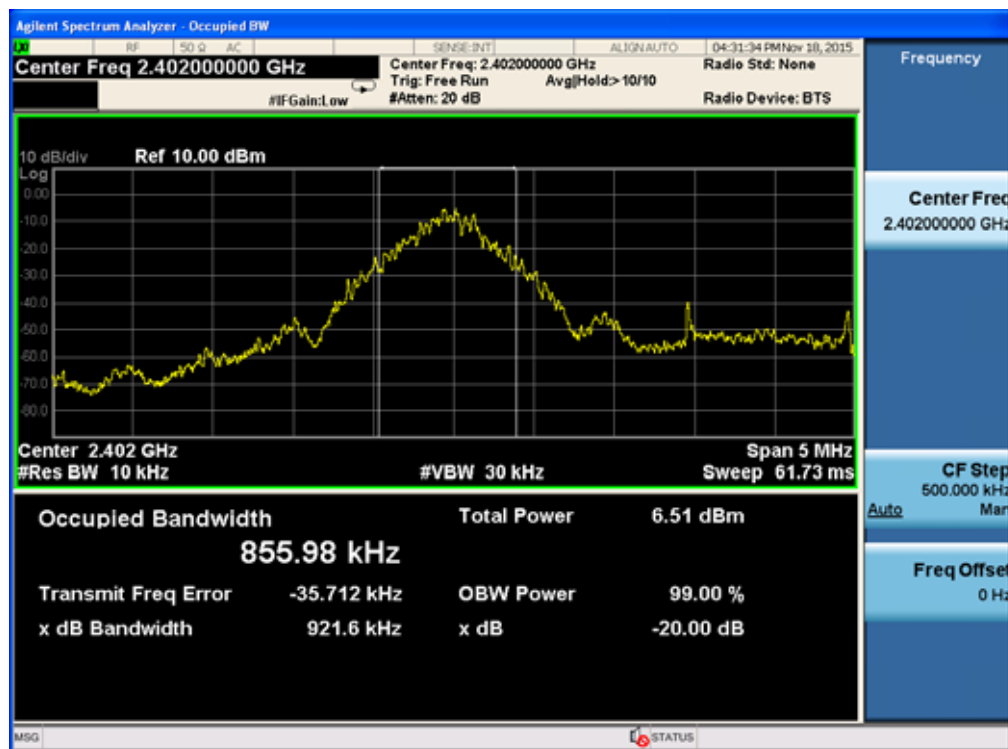
5.6 Test Result

Product	:	Cassia Hub
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5) Ant(1+2+3)

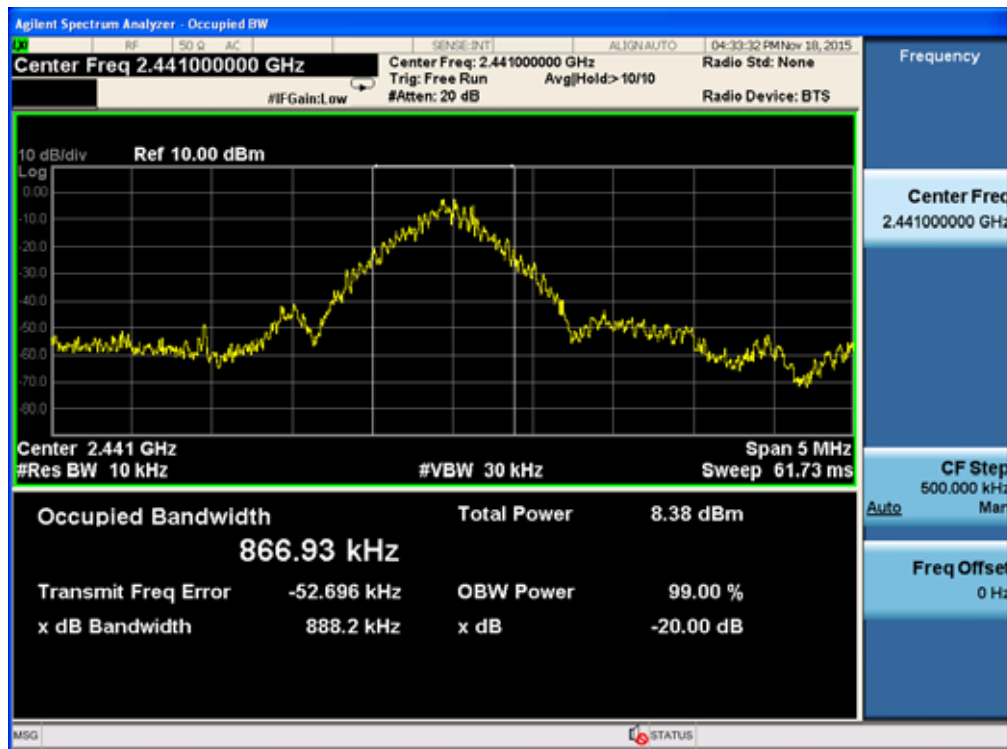
Antenna	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Ant1	00	2402	921.6	855.98
	39	2441	888.2	866.93
	78	2480	849.6	864.15
Ant2	00	2402	885.3	878.87
	39	2441	874.6	860.28
	78	2480	916.7	862.94
Ant3	00	2402	917.3	860.51
	39	2441	920.4	859.50
	78	2480	926.2	878.36

Ant 1

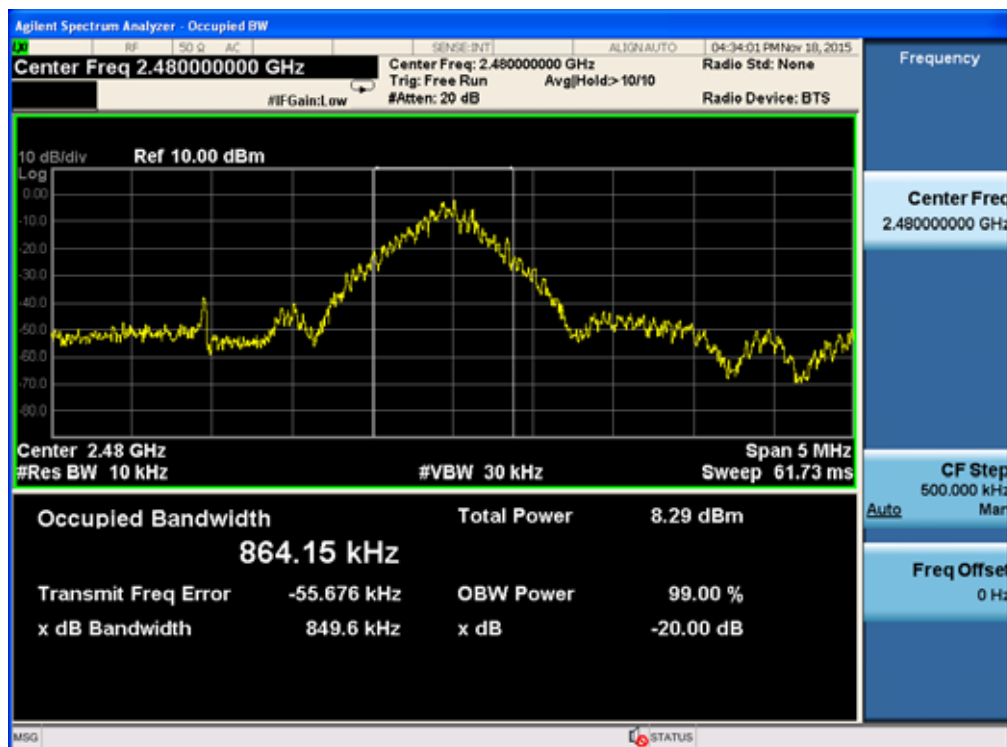
Channel 00 (2402MHz)



Channel 39 (2441MHz)

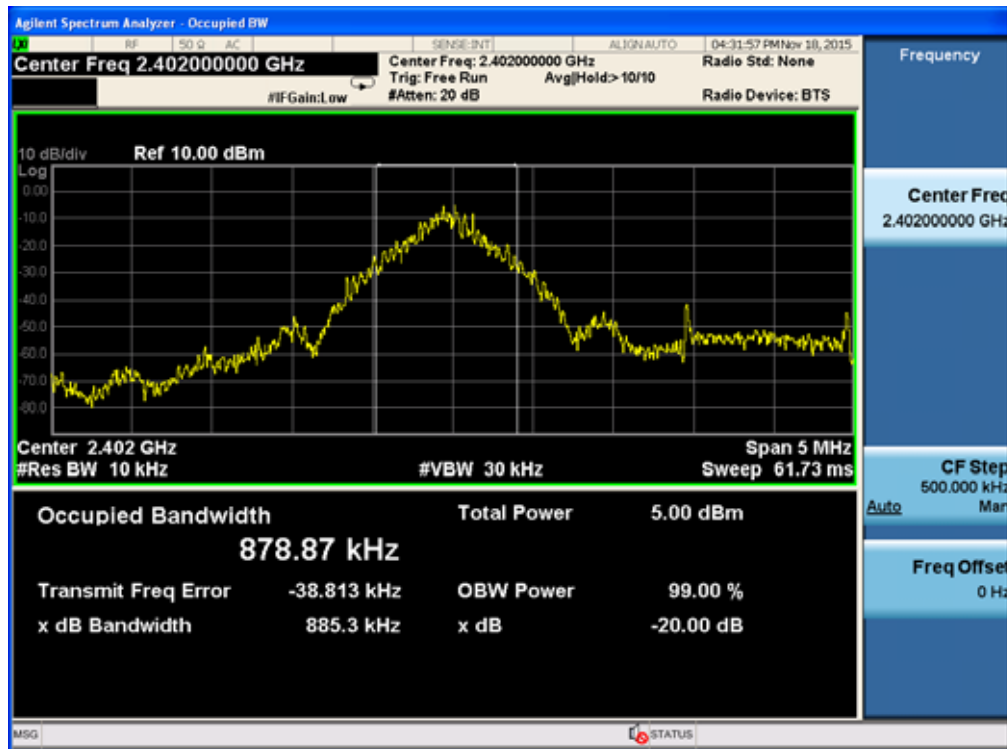


Channel 78 (2480MHz)

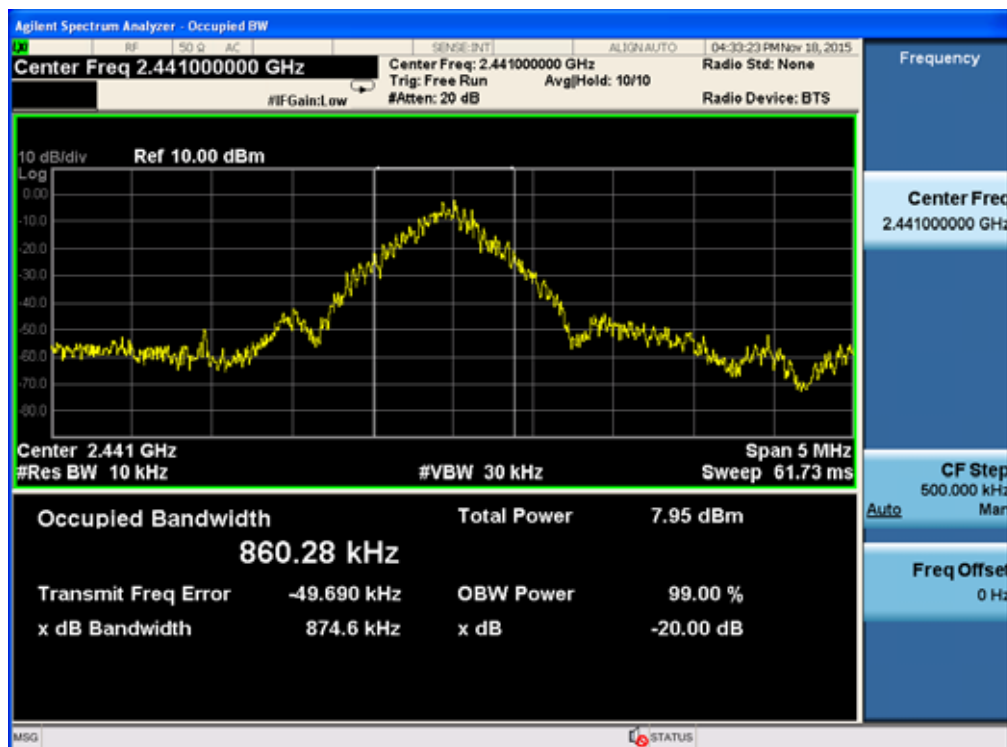


Ant 2

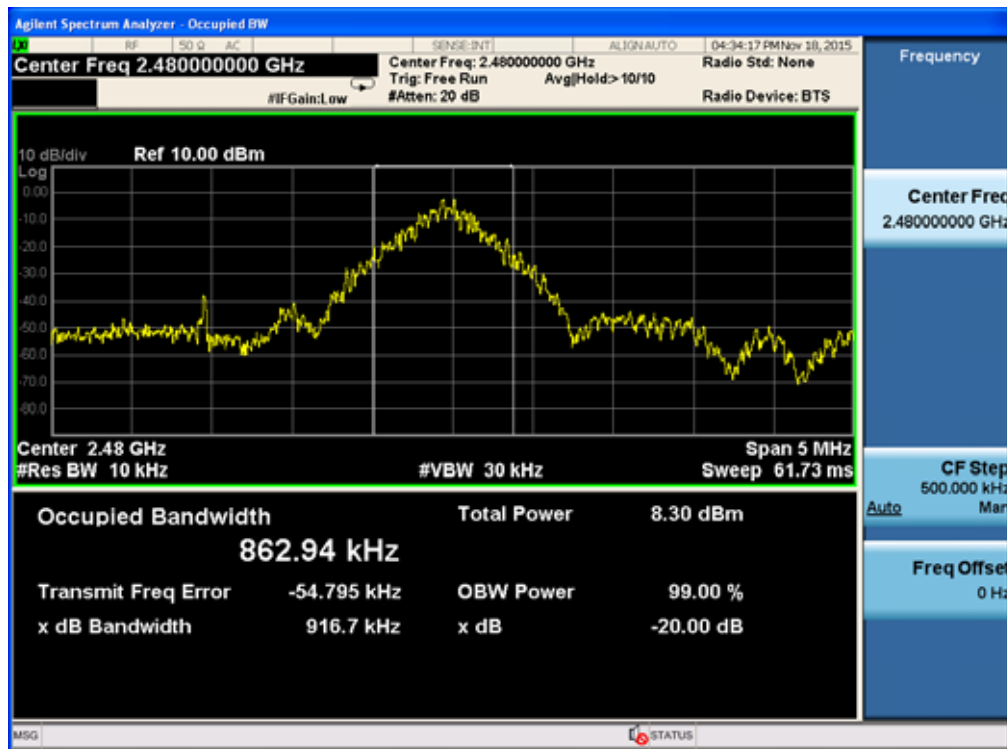
Channel 00 (2402MHz)



Channel 39 (2441MHz)

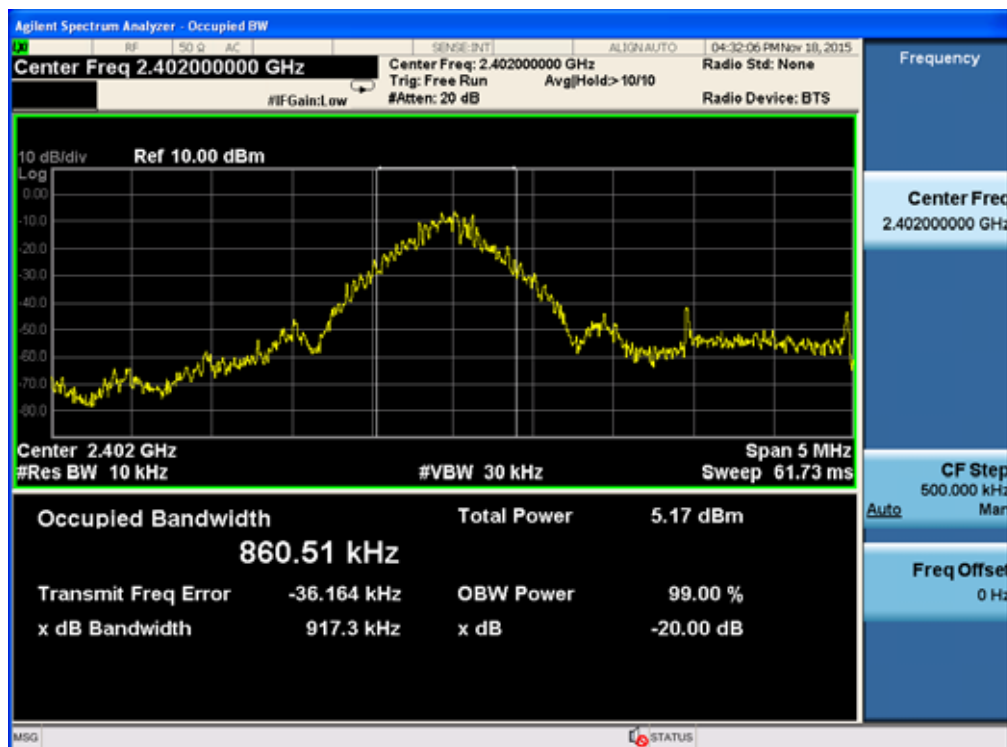


Channel 78 (2480MHz)

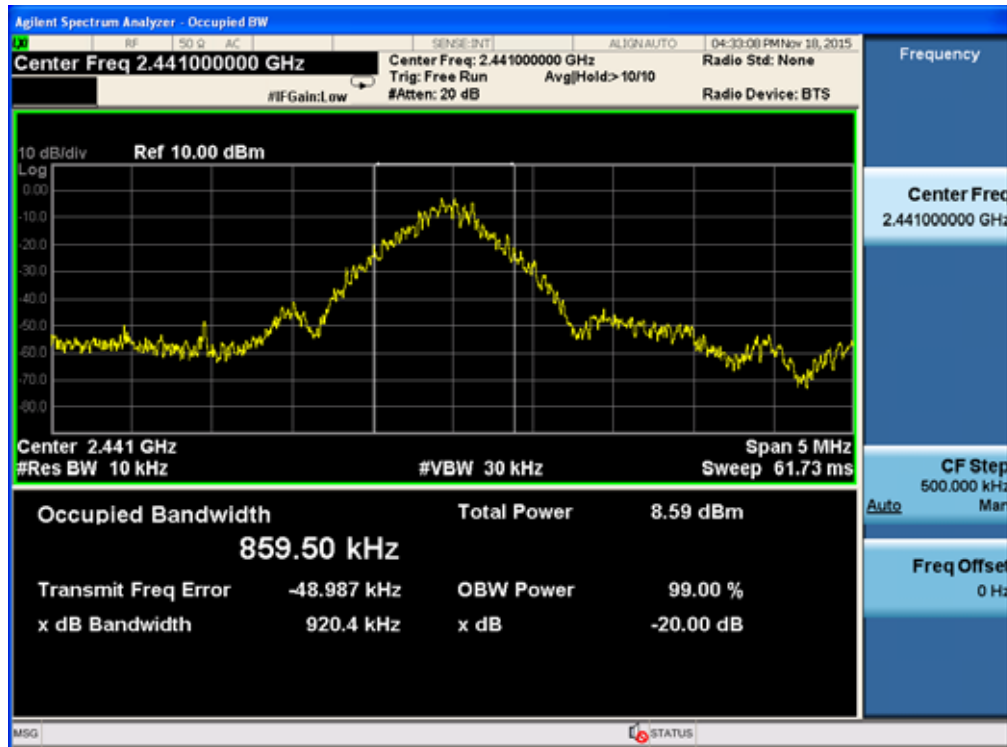


Ant 3

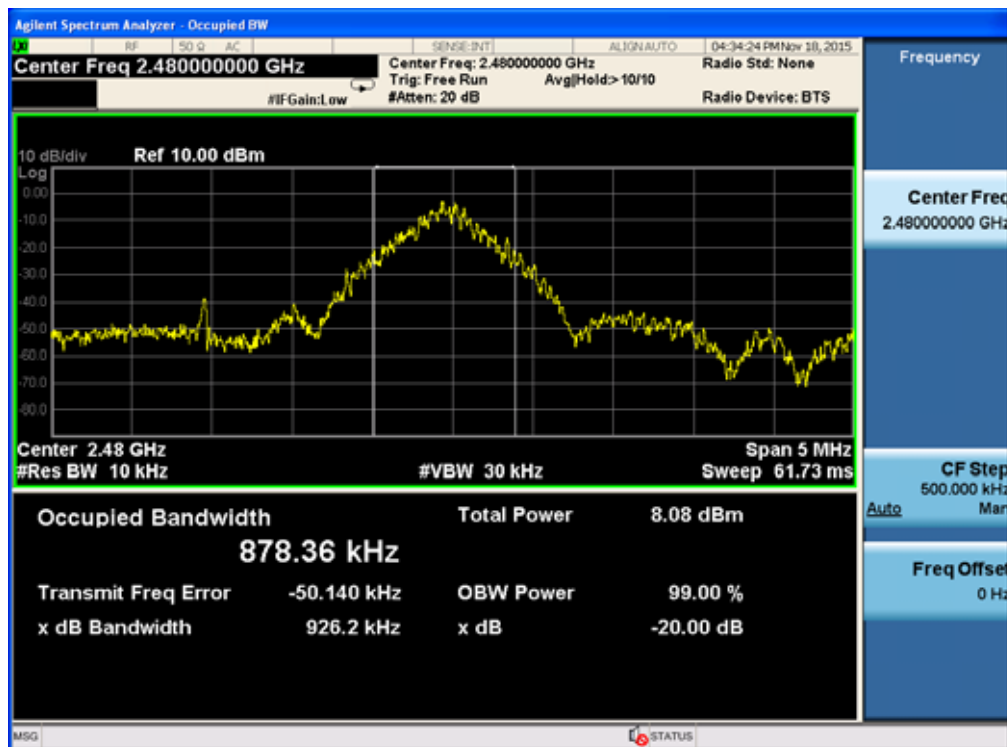
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

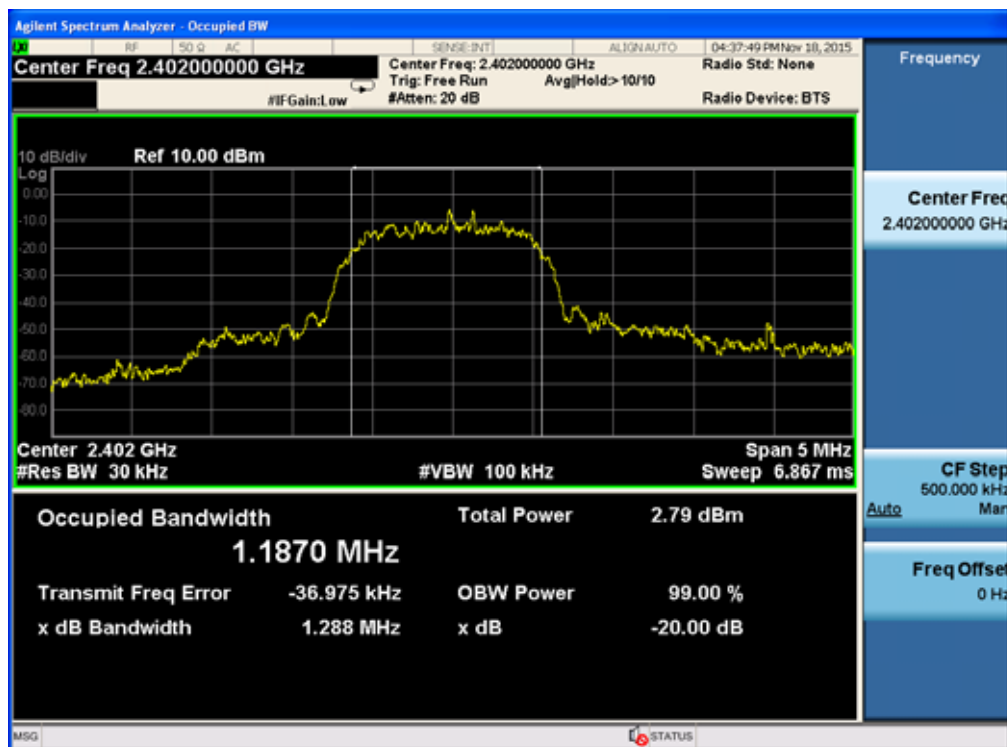


Product	:	Cassia Hub
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5) Ant(1+2+3)

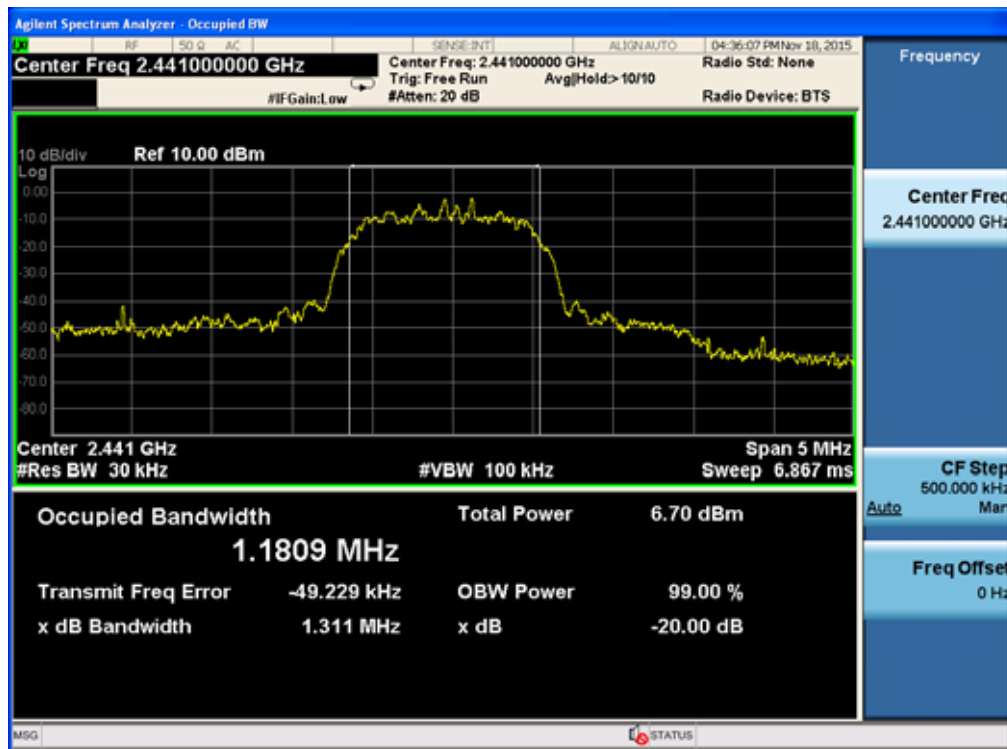
Antenna	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Ant1	00	2402	1288	1187.0
	39	2441	1311	1180.9
	78	2480	1278	1175.8
Ant2	00	2402	1276	1177.7
	39	2441	1315	1179.8
	78	2480	1315	1178.7
Ant3	00	2402	1284	1175.0
	39	2441	1271	1177.1
	78	2480	1314	1179.1

Ant 1

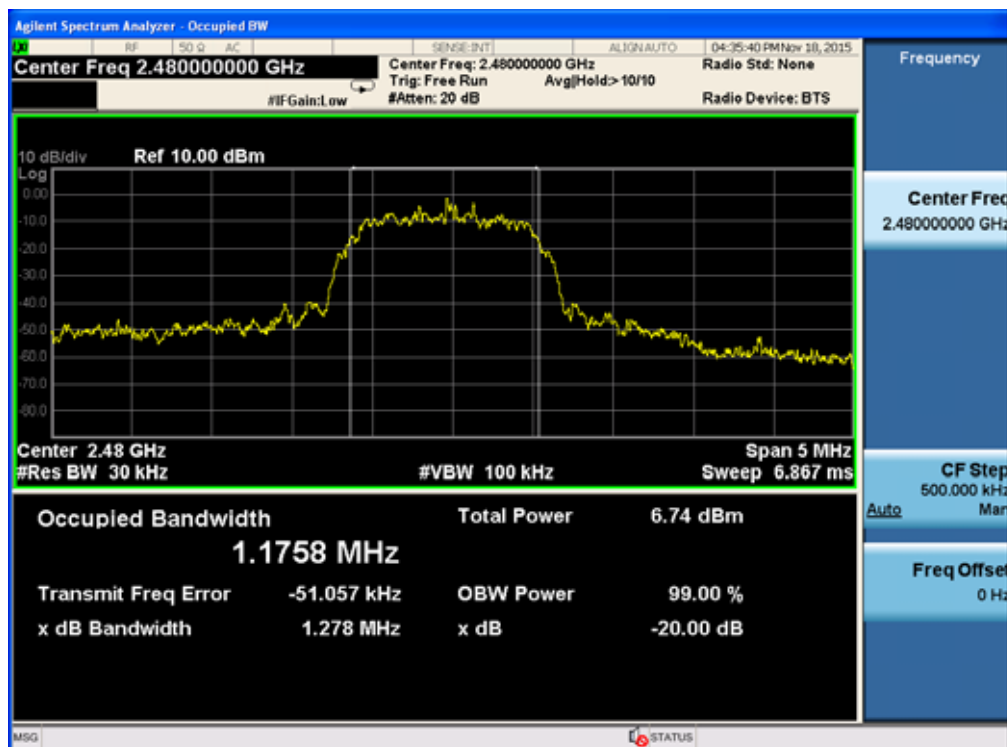
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

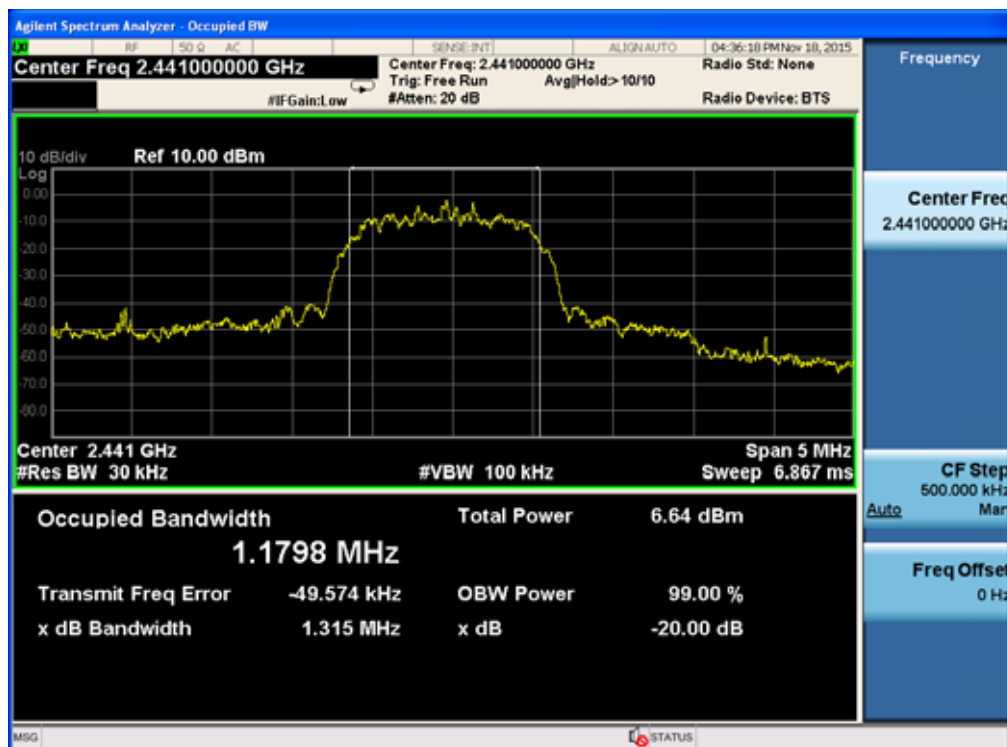


Ant 2

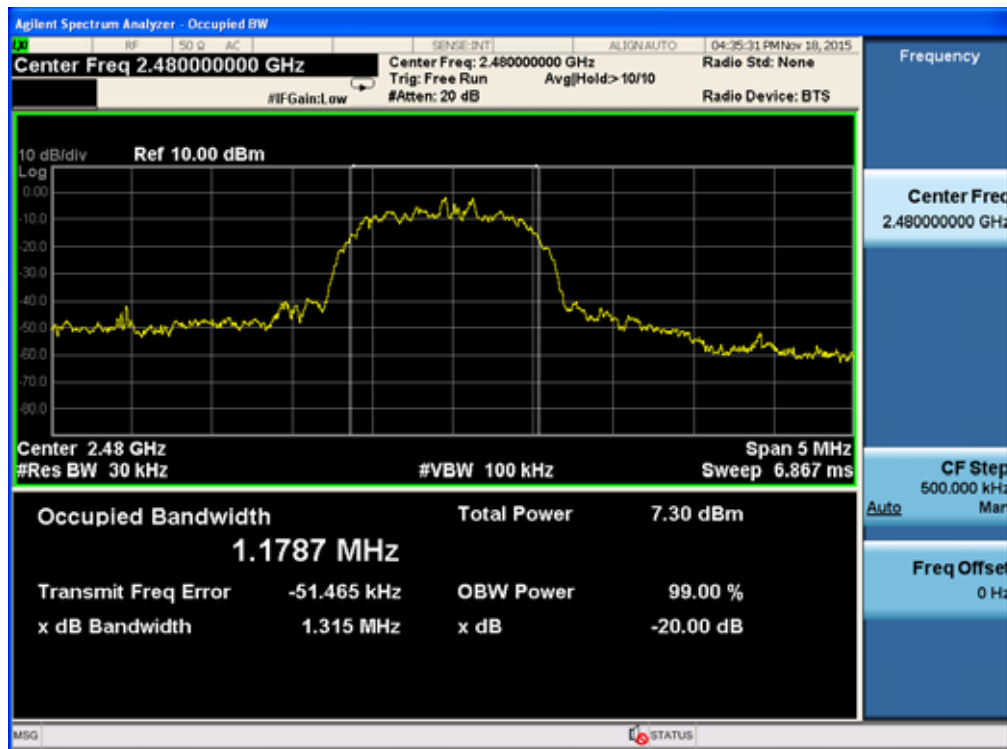
Channel 00 (2402MHz)



Channel 39 (2441MHz)

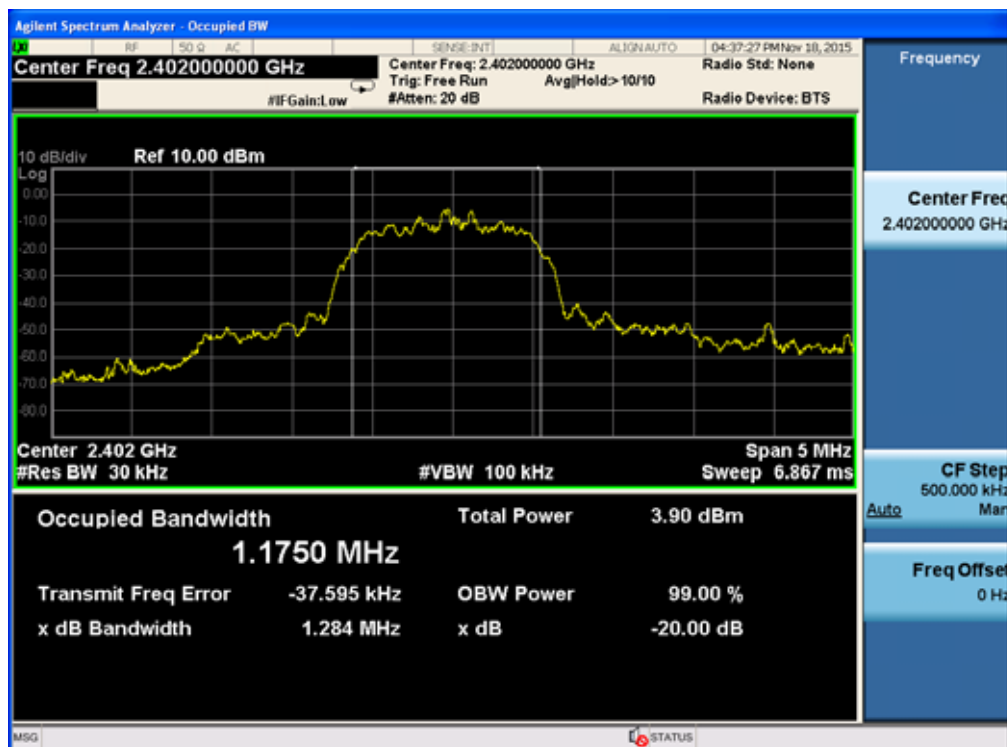


Channel 78 (2480MHz)

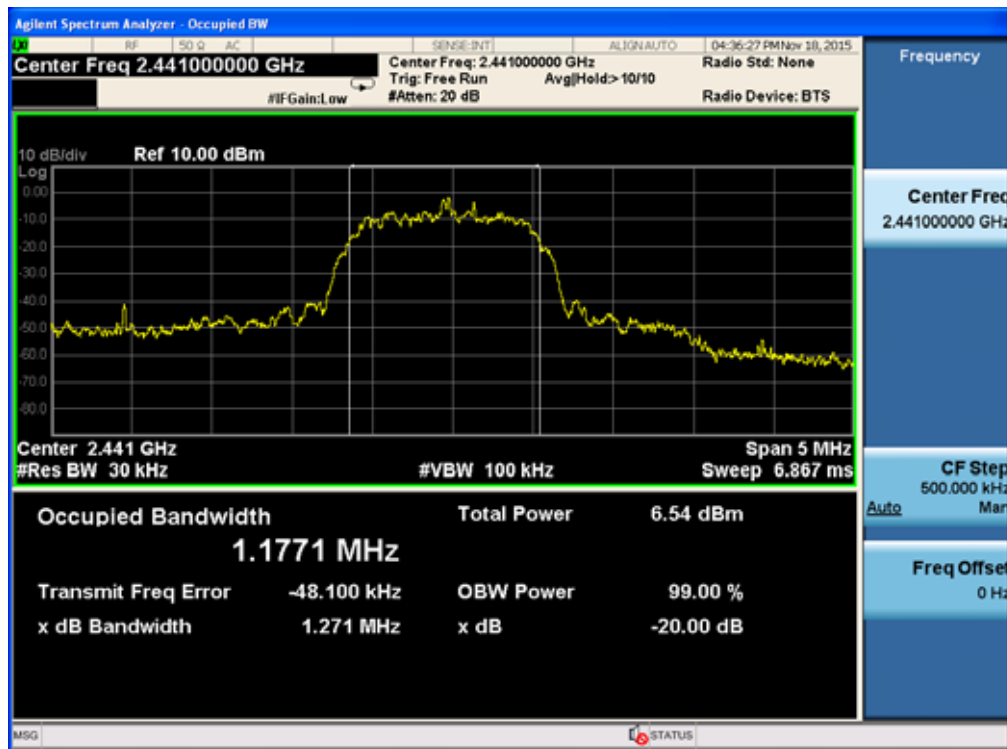


Ant 3

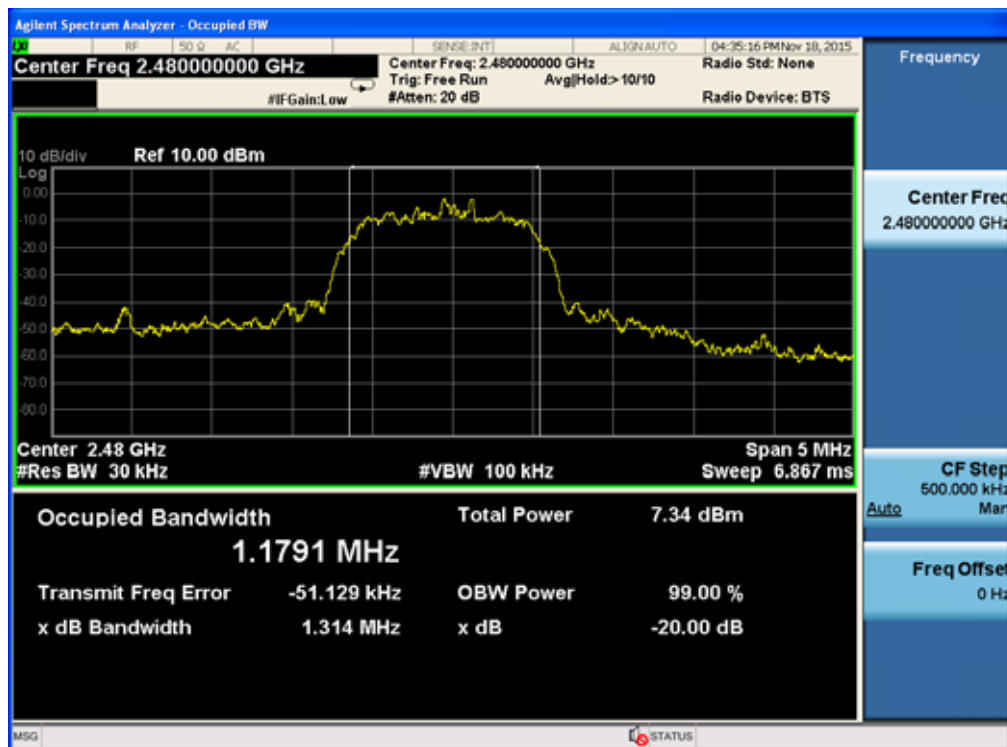
Channel 00 (2402MHz)



Channel 39 (2441MHz)



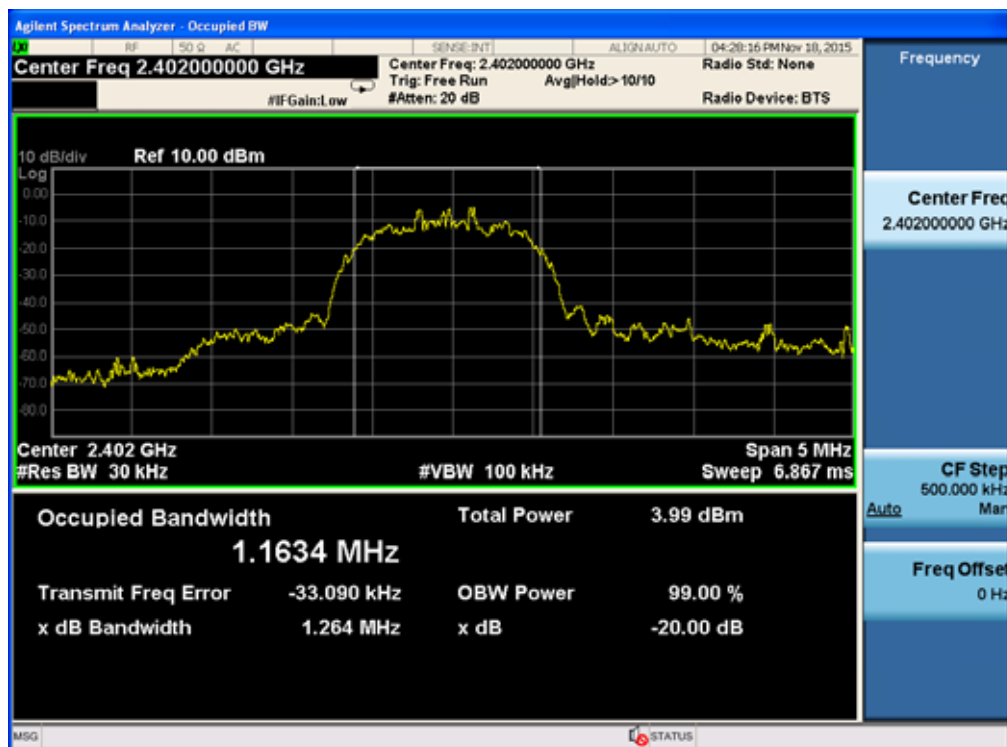
Channel 78 (2480MHz)



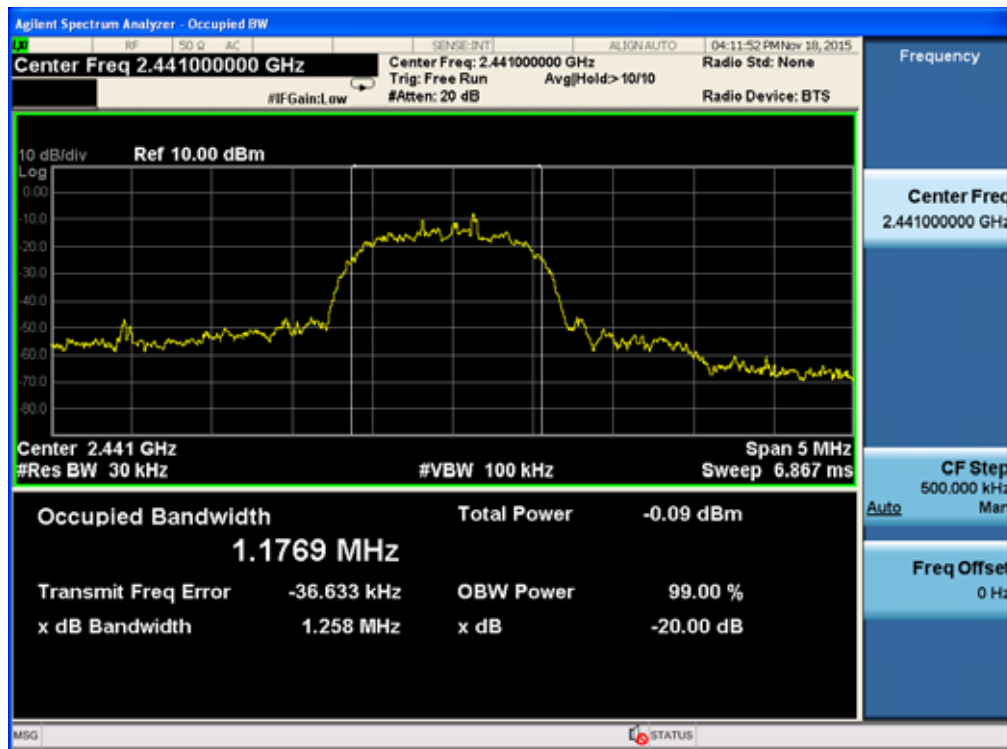
Product	:	Cassia Hub
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5) Ant(1+2+3)

Antenna	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Ant1	00	2402	1264	1163.4
	39	2441	1258	1176.9
	78	2480	1265	1182.8
Ant2	00	2402	1256	1171.9
	39	2441	1278	1192.2
	78	2480	1258	1174.7
Ant3	00	2402	1288	1160.8
	39	2441	1252	1172.9
	78	2480	1278	1175.8

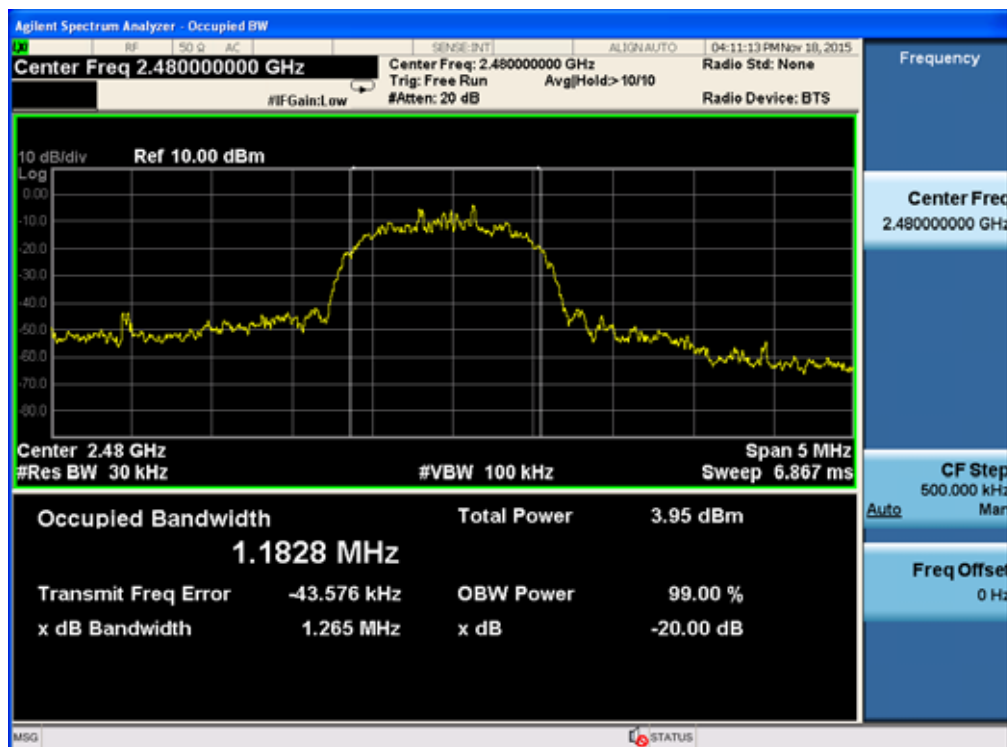
Ant 1
Channel 00 (2402MHz)



Channel 39 (2441MHz)

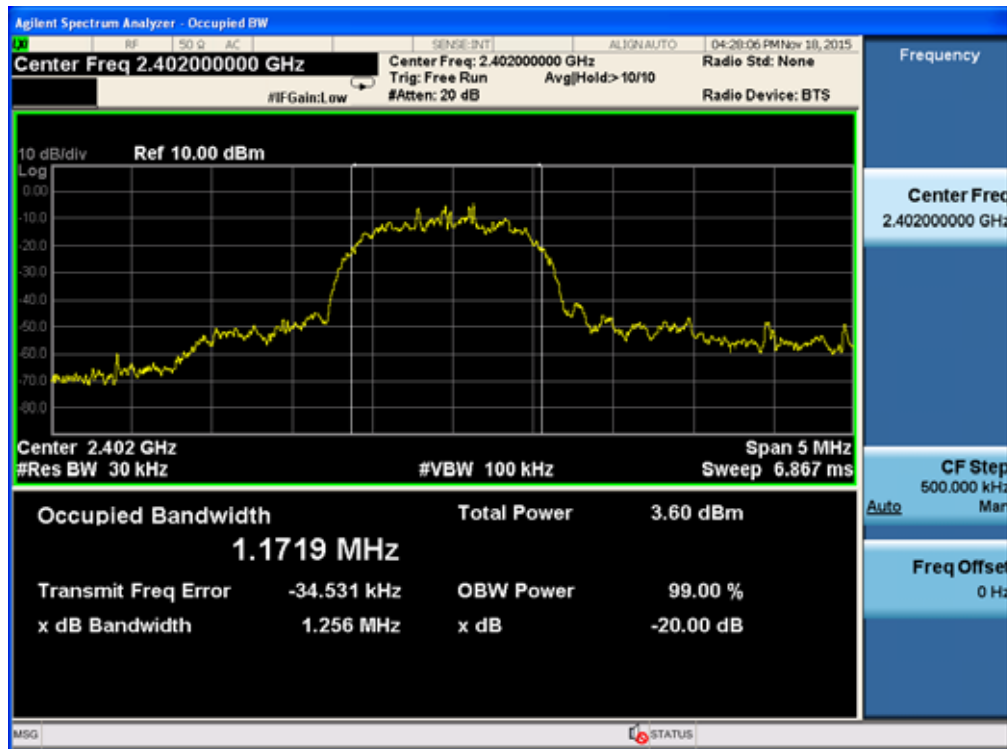


Channel 78 (2480MHz)

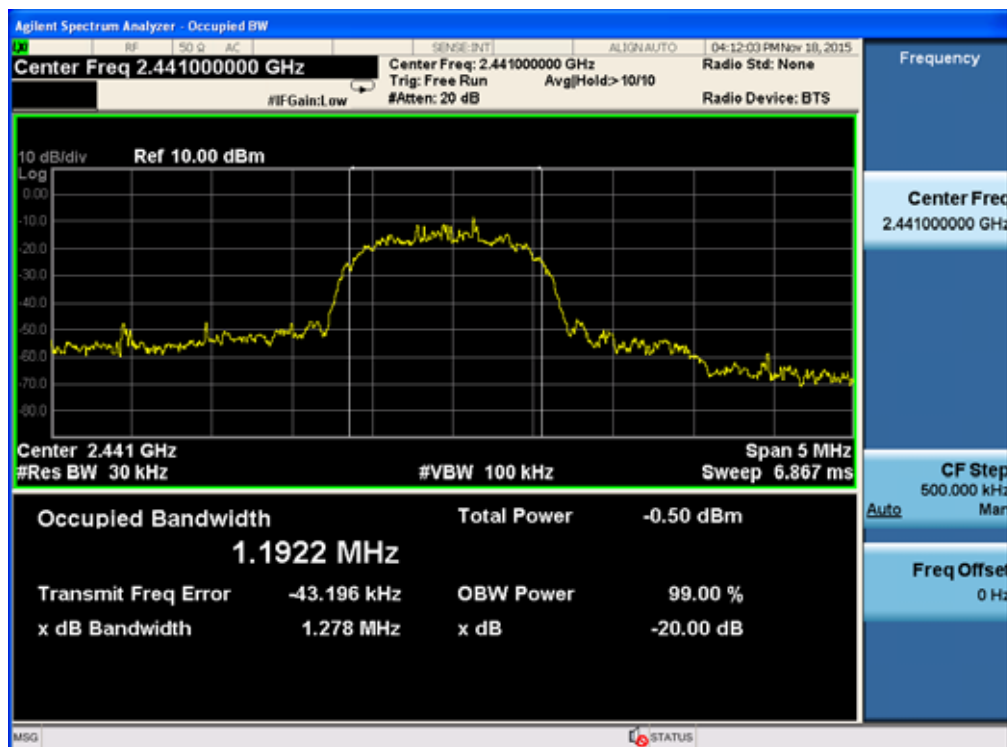


Ant 2

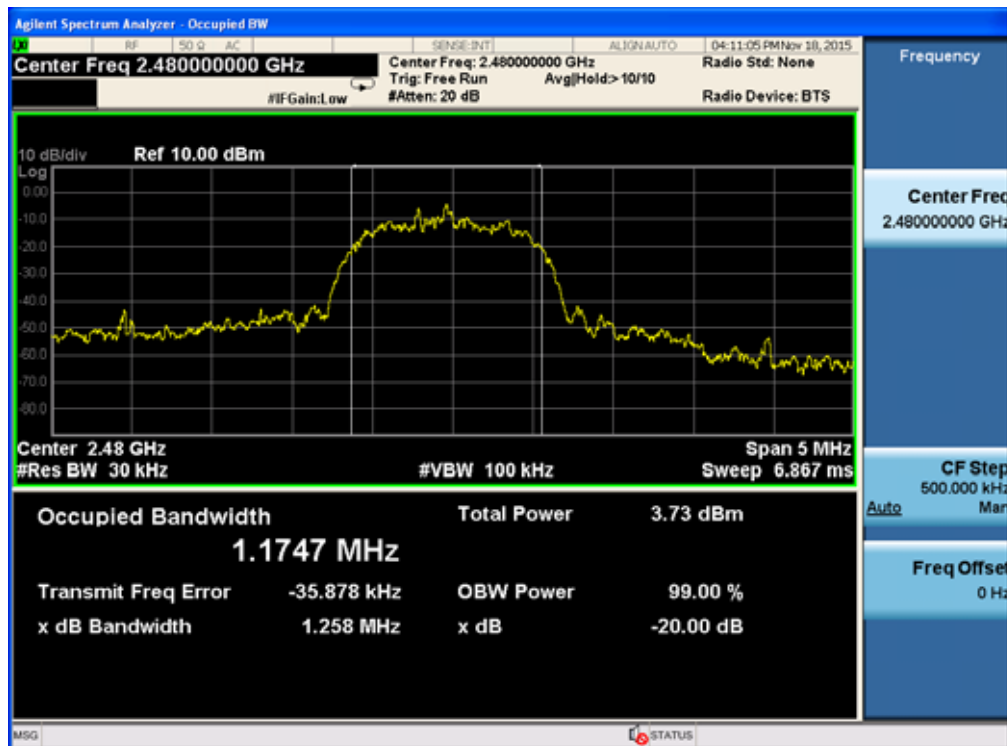
Channel 00 (2402MHz)



Channel 39 (2441MHz)

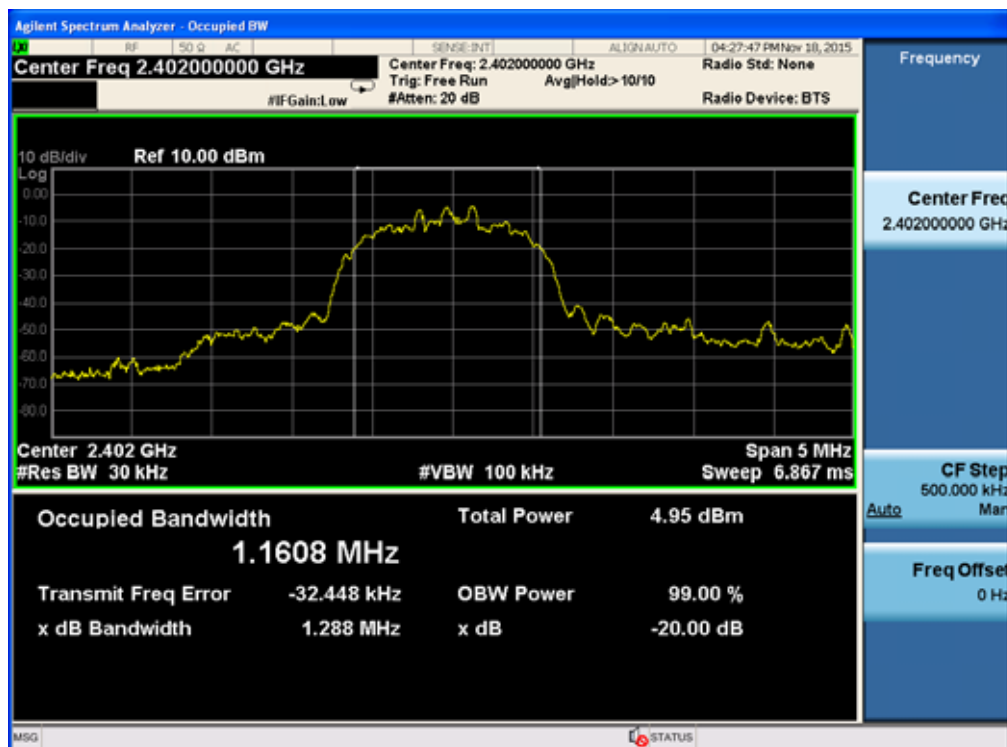


Channel 78 (2480MHz)

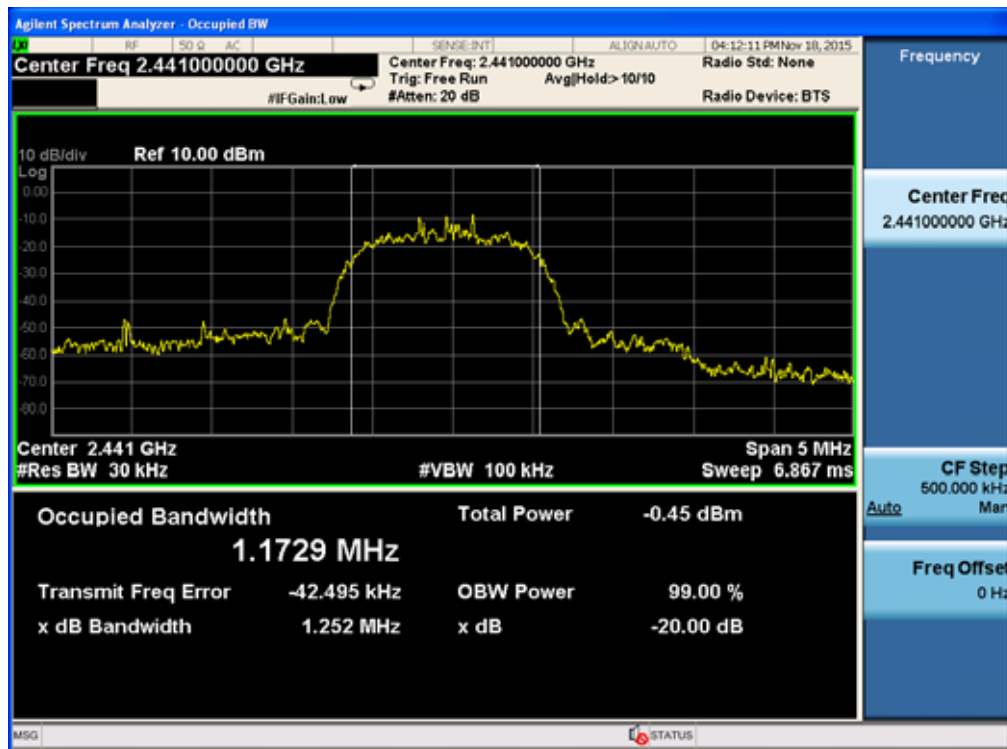


Ant 3

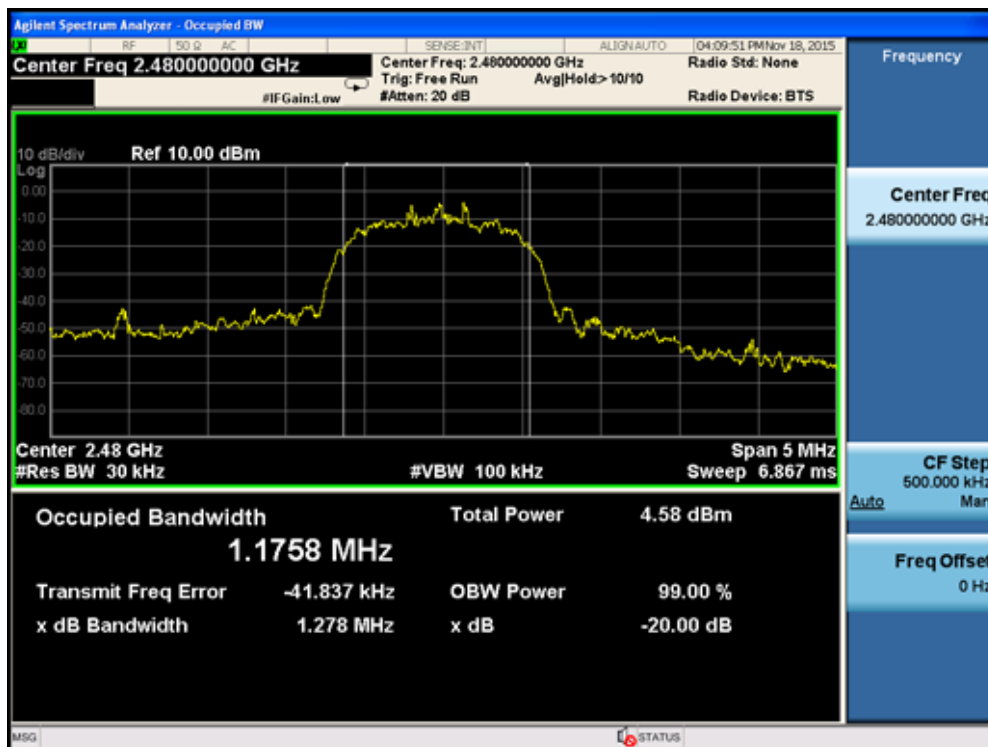
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



6. Carrier Frequency Separation

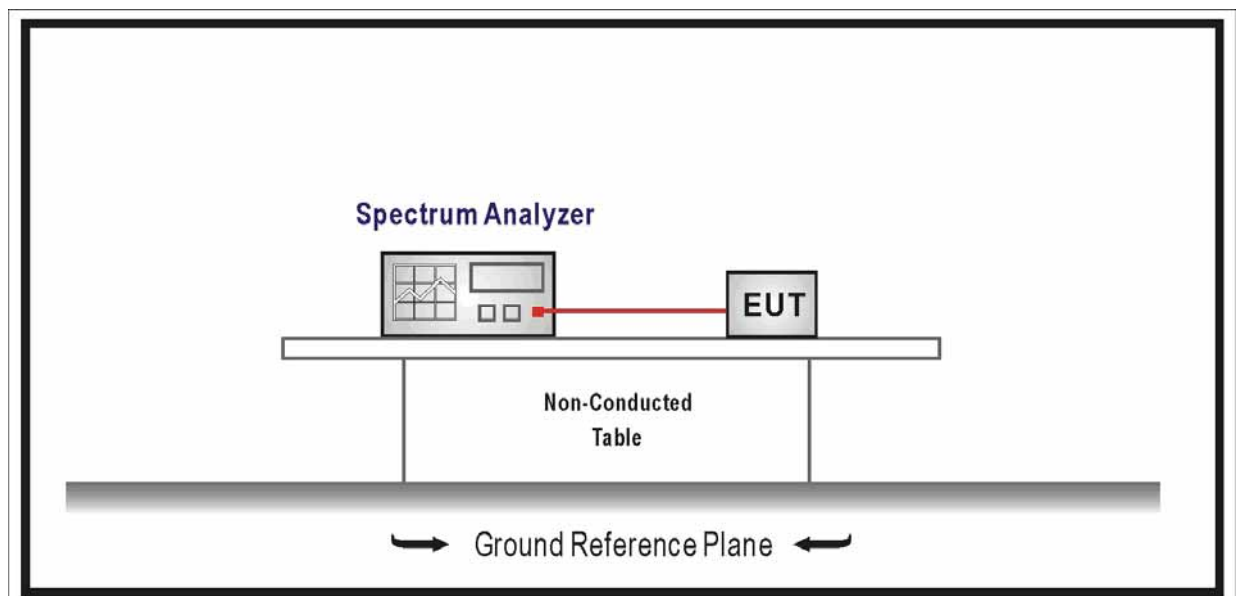
6.1. Test Equipment

Carrier Frequency Separation / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
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.

6.2. Test Setup



6.3. Limit

- Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping

channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

6.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) \geq 1% of the span

Video (or Average) Bandwidth VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

6.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

6.6. Test Result

Product	:	Cassia Hub
Test Item	:	Carrier Frequency Separation
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)Ant(1+2+3)

Antenna	Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
Ant 1	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 2	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 3	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

Ant 1
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



Ant 2

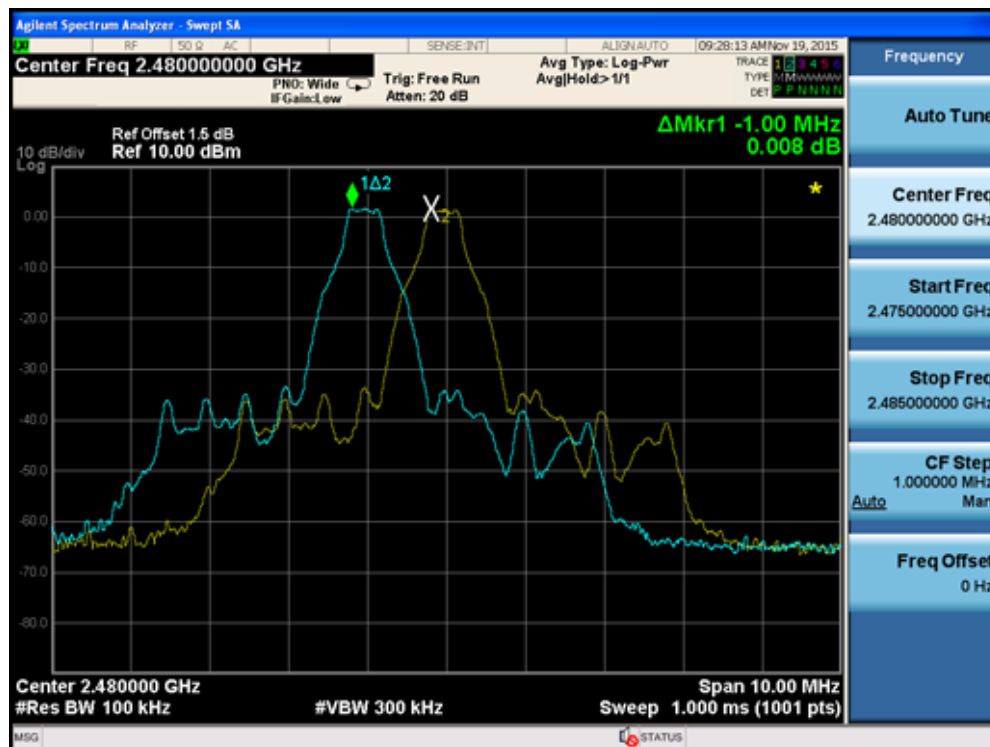
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



Ant 3

Channel 00 (2402MHz)



Channel 39 (2441MHz)



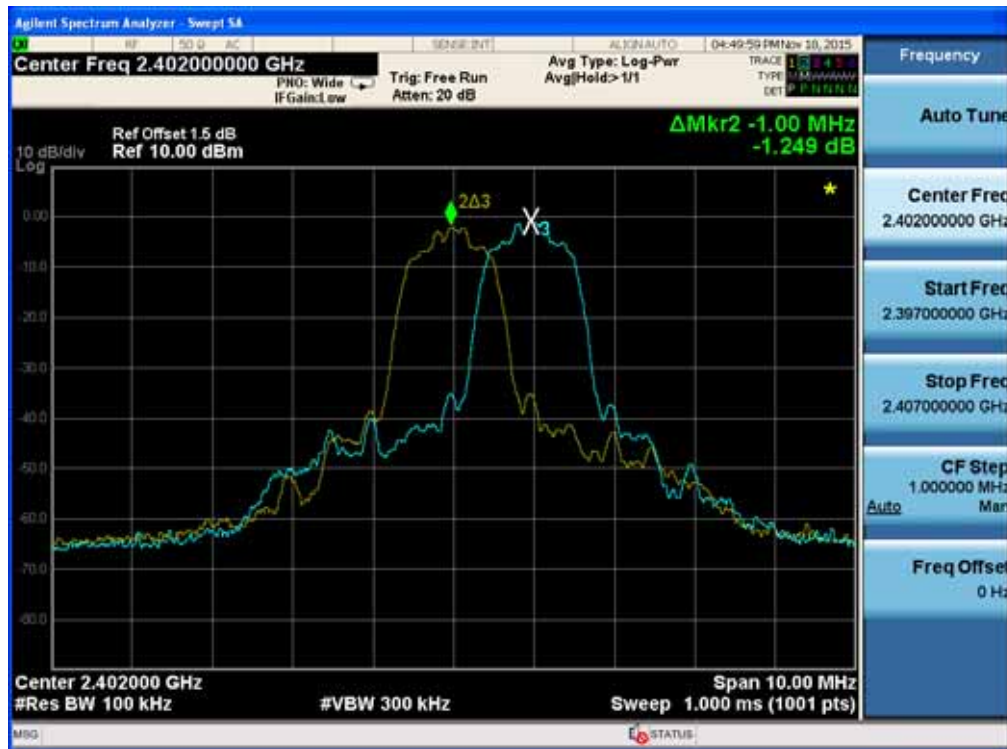
Channel 78 (2480MHz)



Product	:	Cassia Hub
Test Item	:	Carrier Frequency Separation
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

Antenna	Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
Ant 1	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 2	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 3	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

Ant 1
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

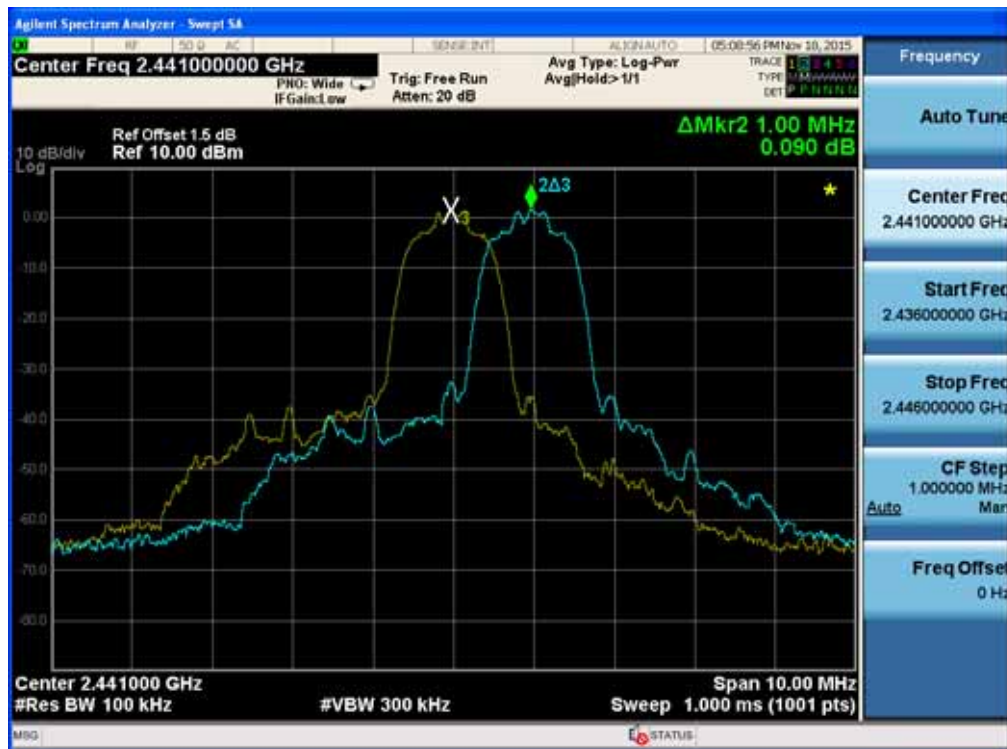


Ant 2

Channel 00 (2402MHz)



Channel 39 (2441MHz)



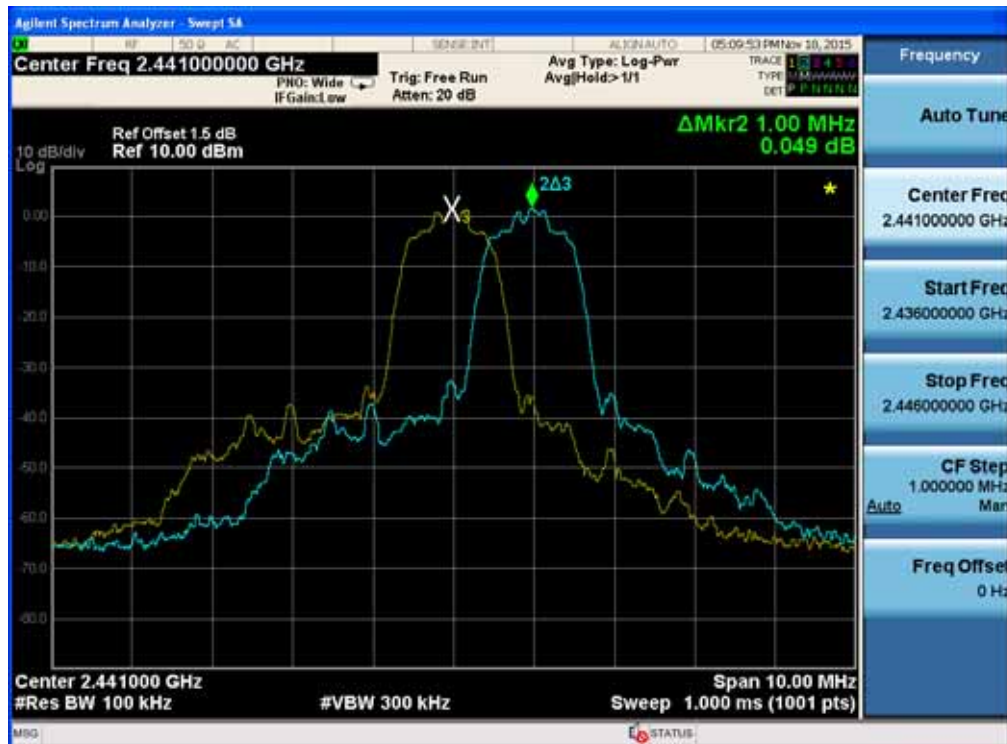
Channel 78 (2480MHz)



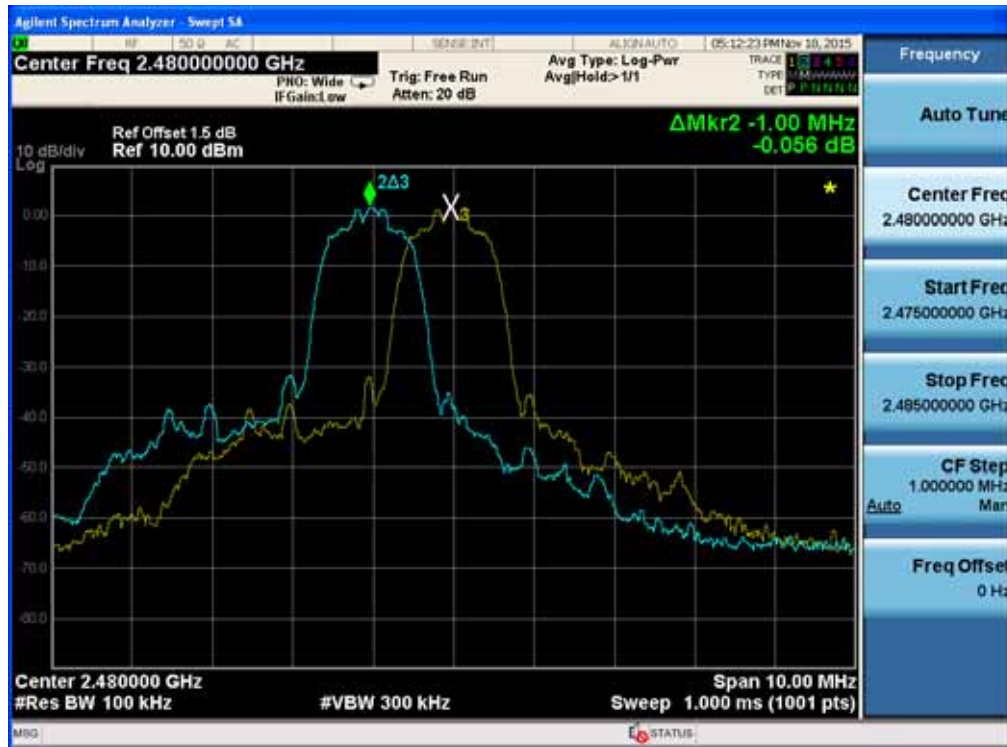
Ant 3
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



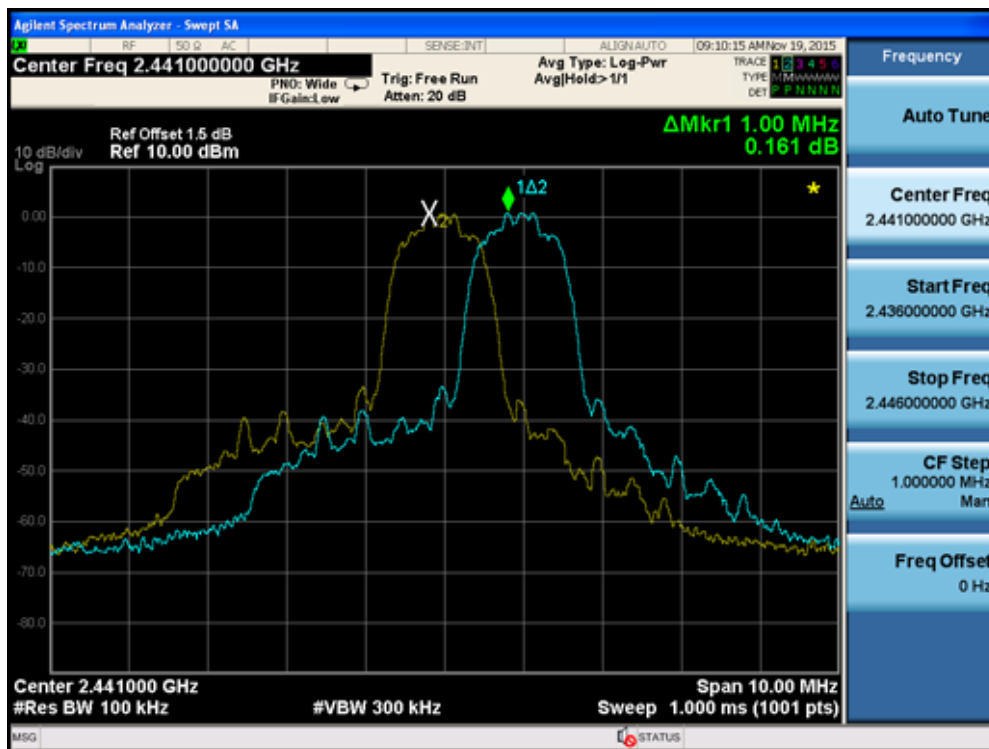
Product	:	Cassia Hub
Test Item	:	Carrier Frequency Separation
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

Antenna	Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
Ant 1	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 2	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass
Ant 3	00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
	78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

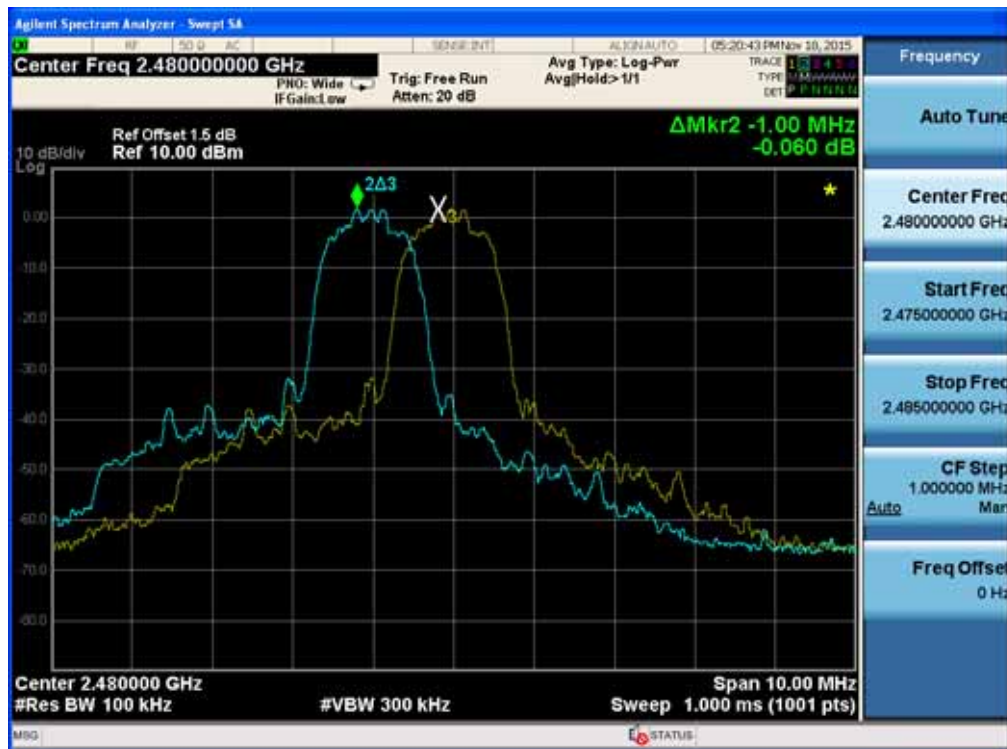
Ant 1
Channel 00 (2402MHz)



Channel 39 (2441MHz)

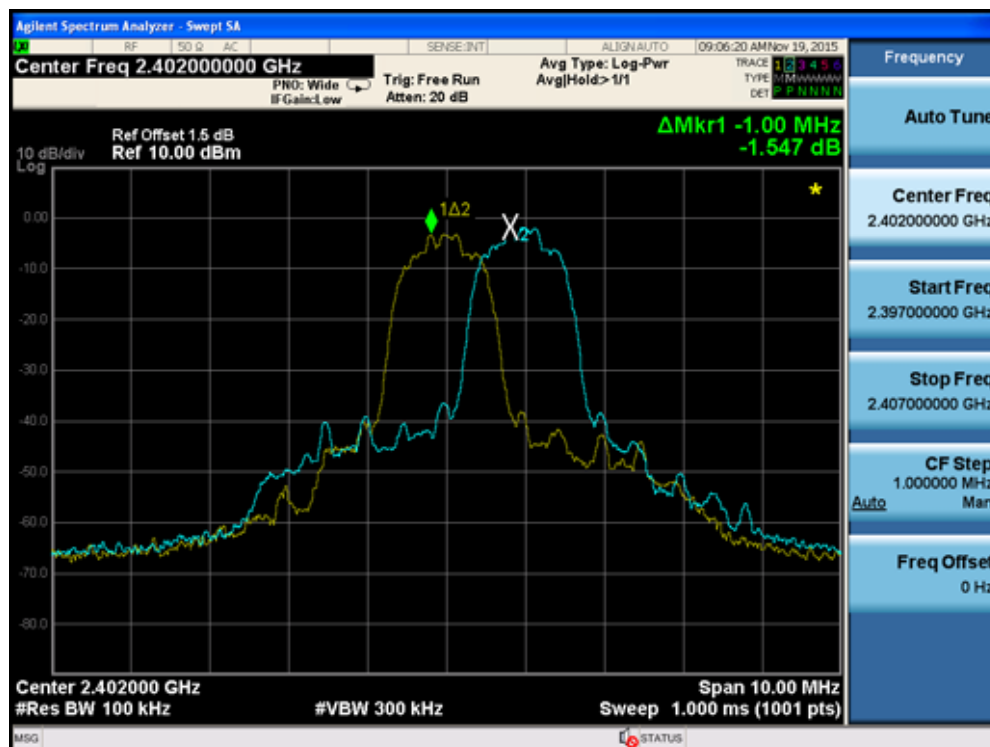


Channel 78 (2480MHz)

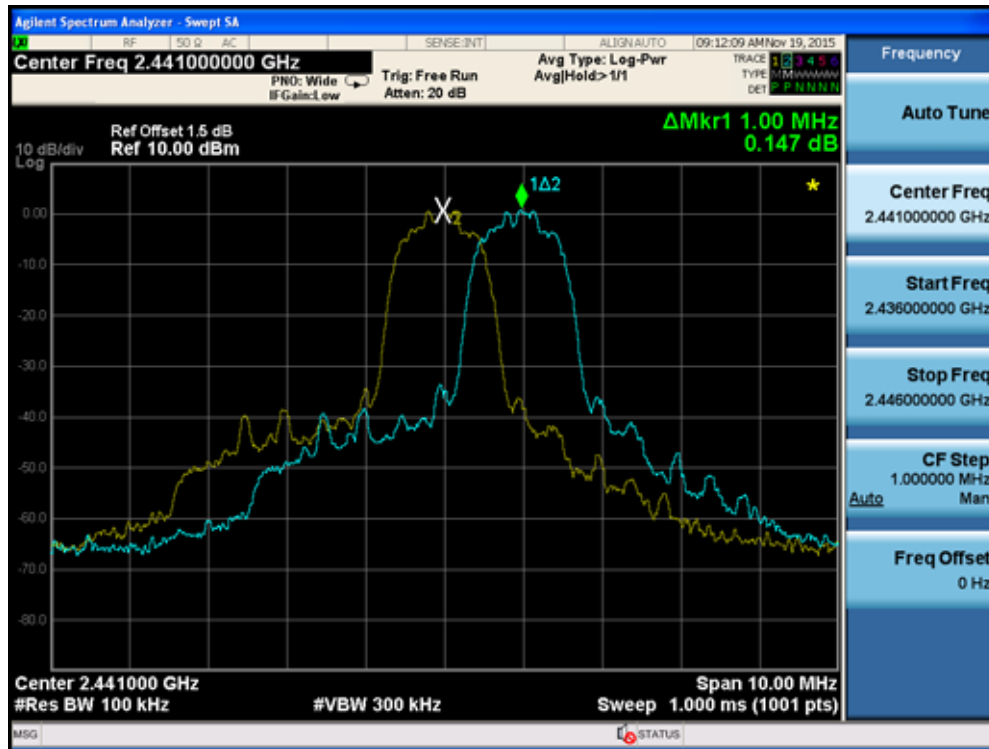


Ant 2

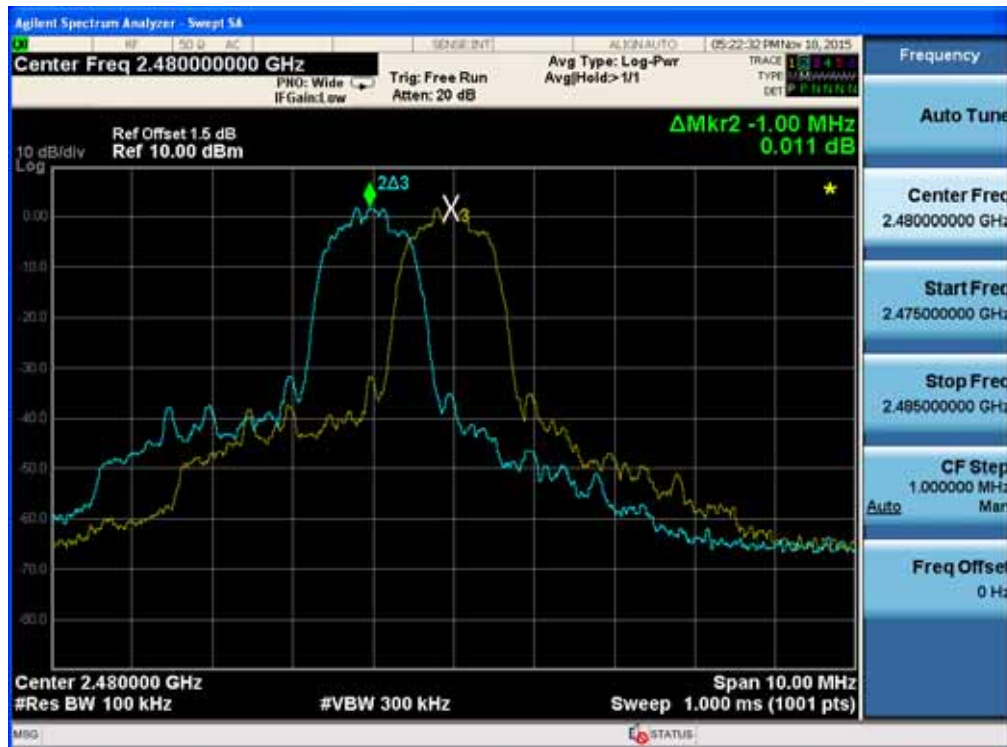
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

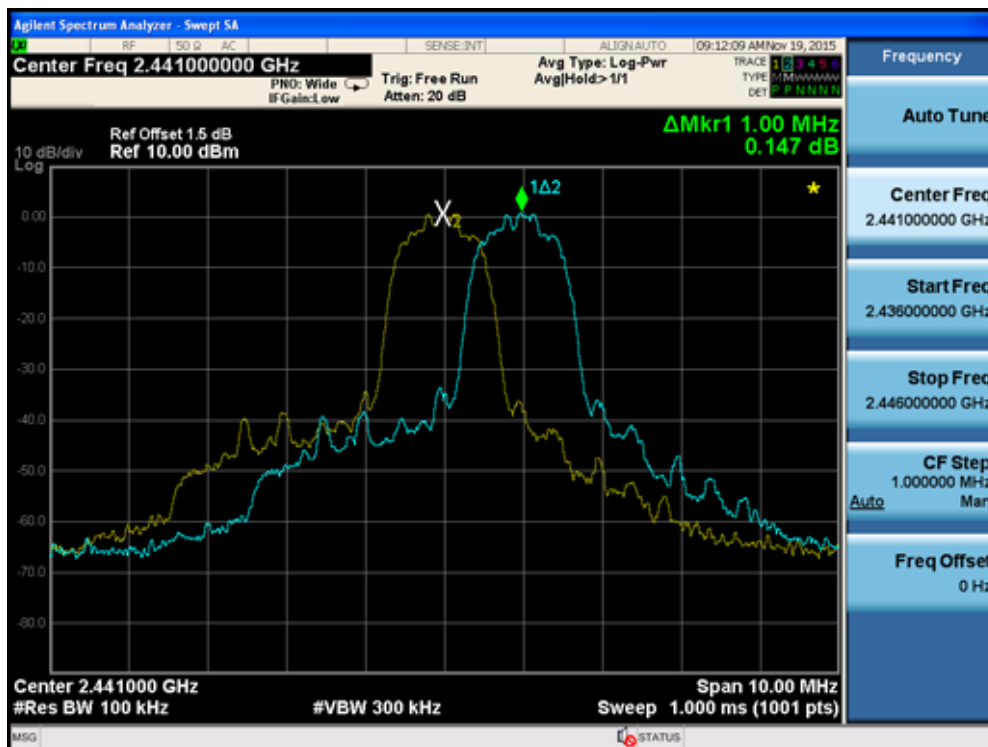


Ant 3

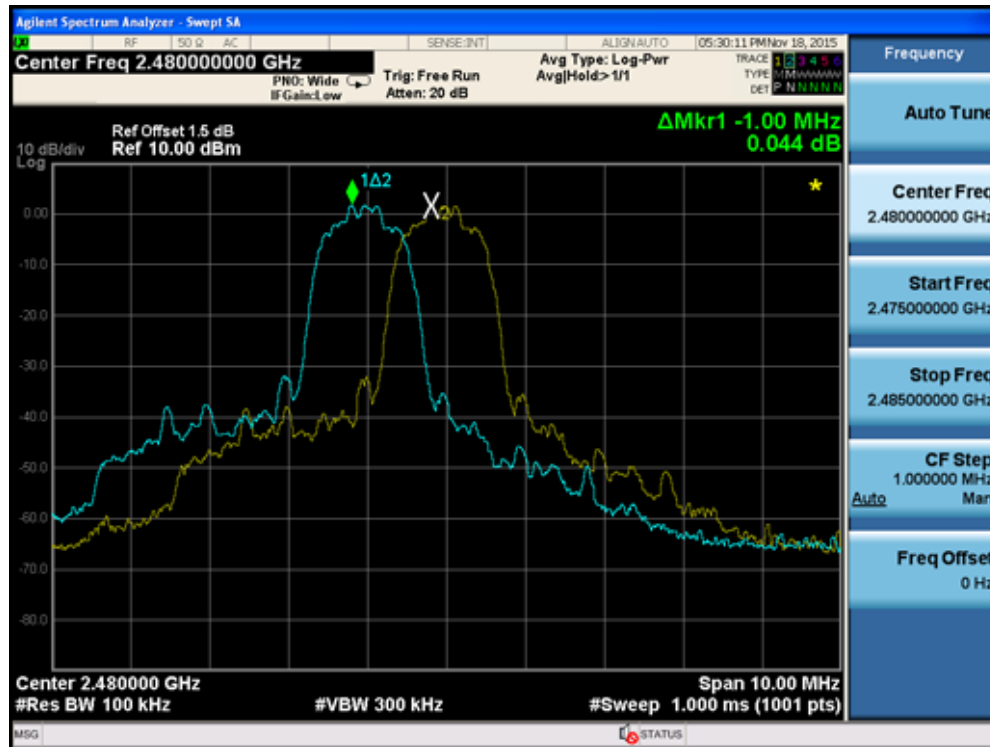
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



7. Number of Hopping Frequencies

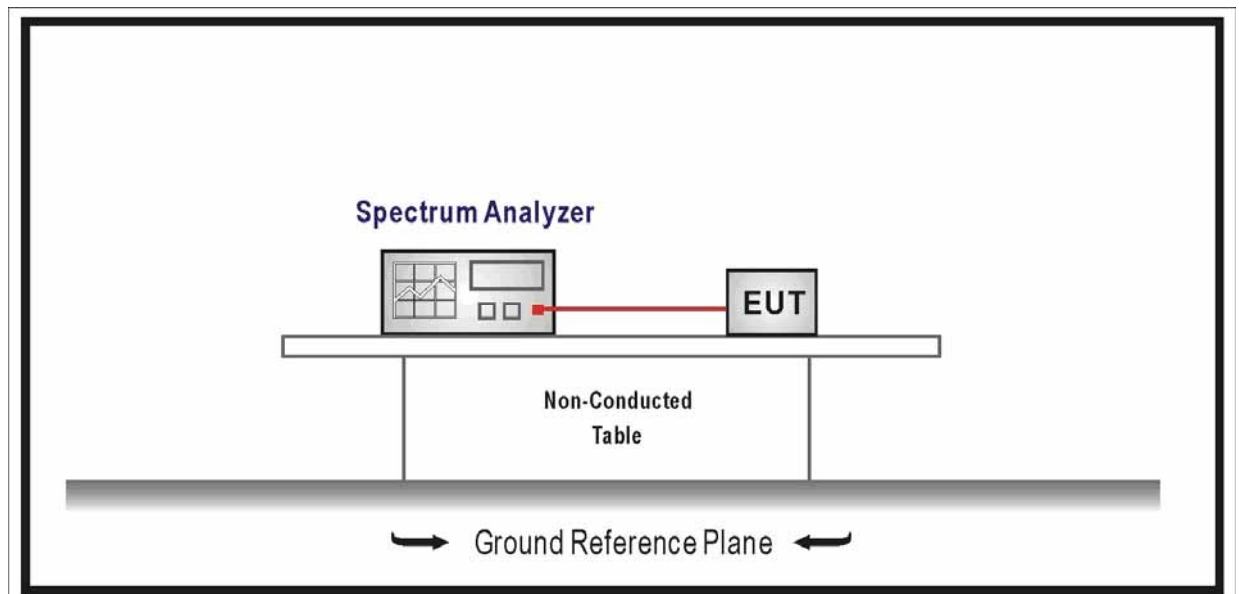
7.1. Test Equipment

Number of Hopping Frequencies / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
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.

7.2. Test Setup



7.3. Limit

- For frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping frequencies.
- For frequency hopping systems operating in 902-928 MHz band shall use at least 50 hopping frequencies.
- For frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies.

7.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW \geq 1% of the span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. It may prove necessary to bread the span up to sections, in order to clearly show all of the hopping frequencies.

7.5. Uncertainty

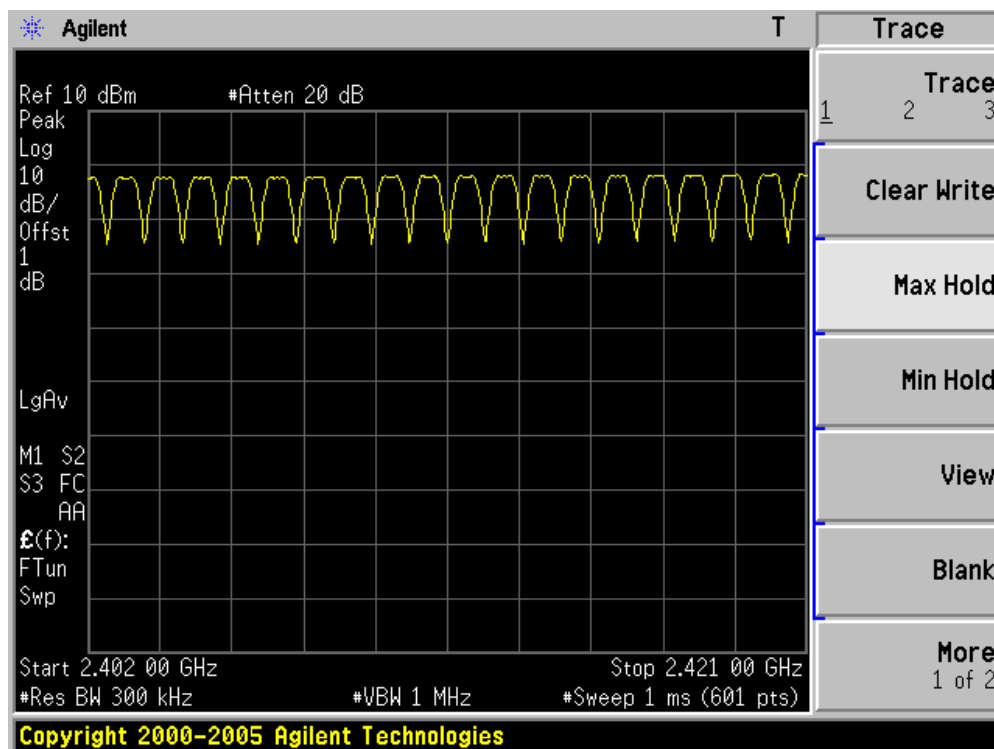
The measurement uncertainty is defined as ± 1 kHz

7.6. Test Result

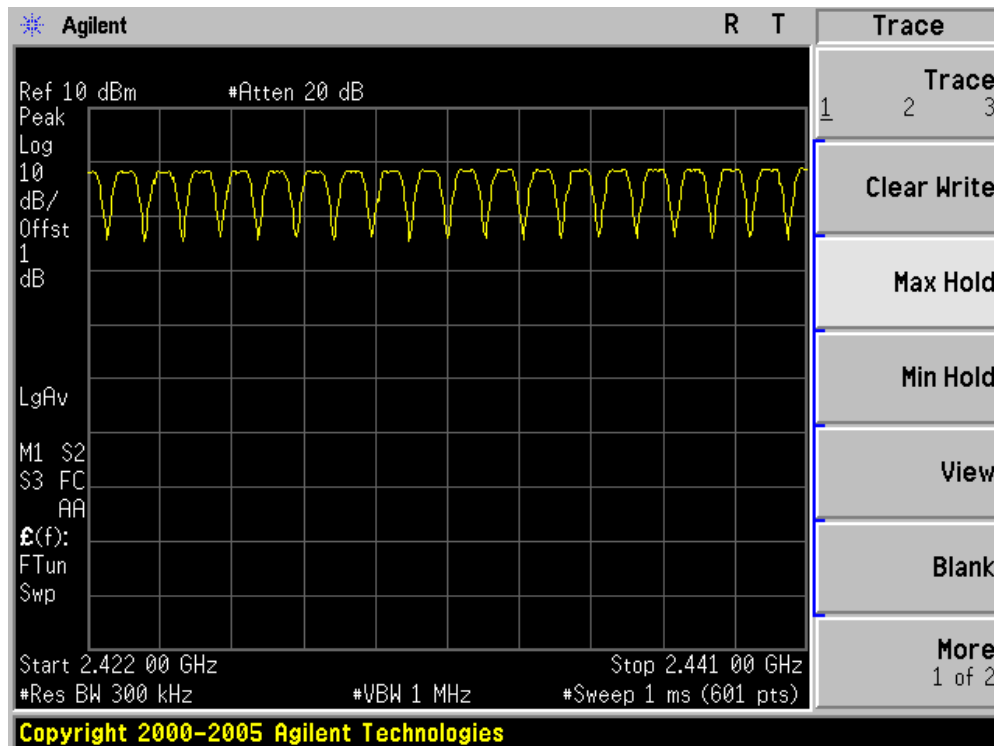
Product	:	Cassia Hub
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

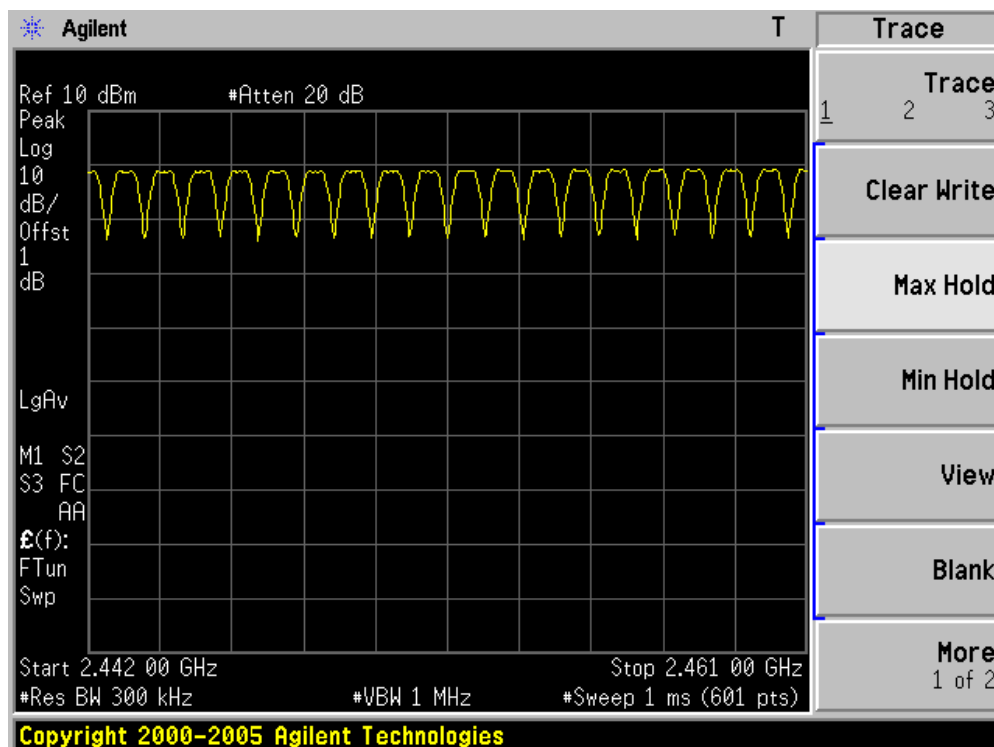
2402 - 2421 MHz



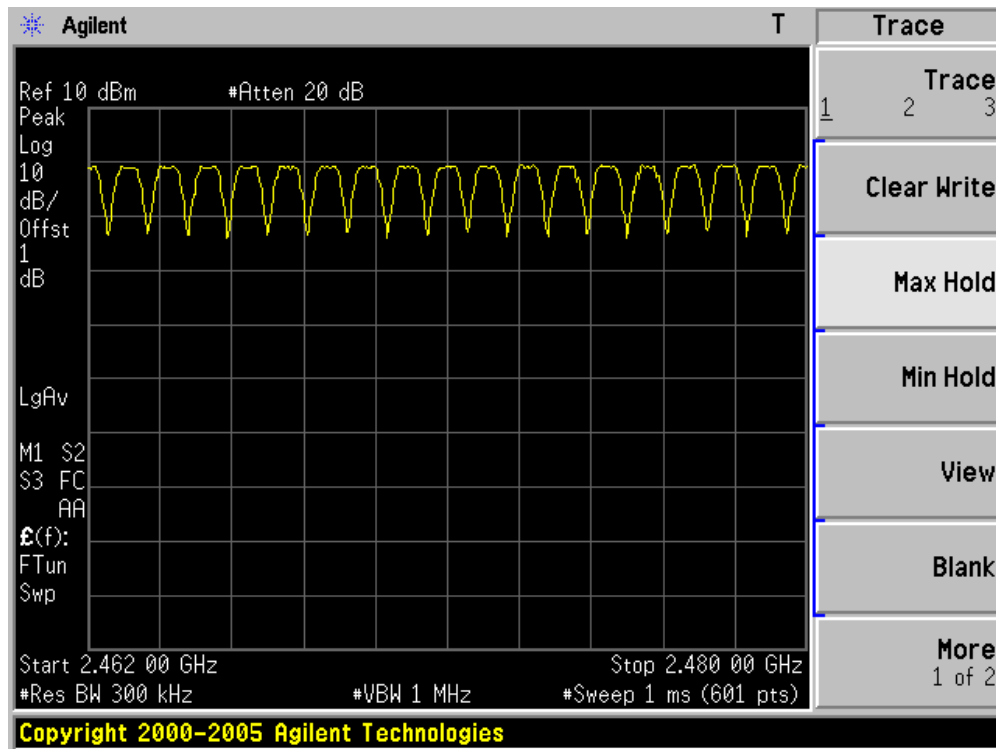
2422 - 2441 MHz



2442 - 2461 MHz



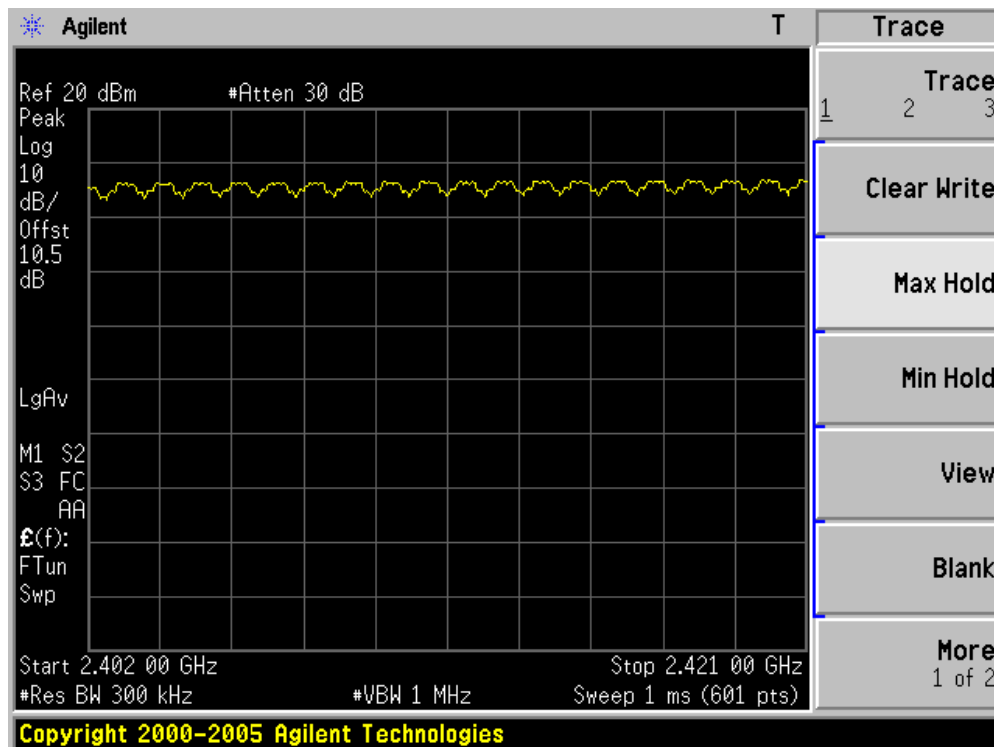
2462 - 2480 MHz



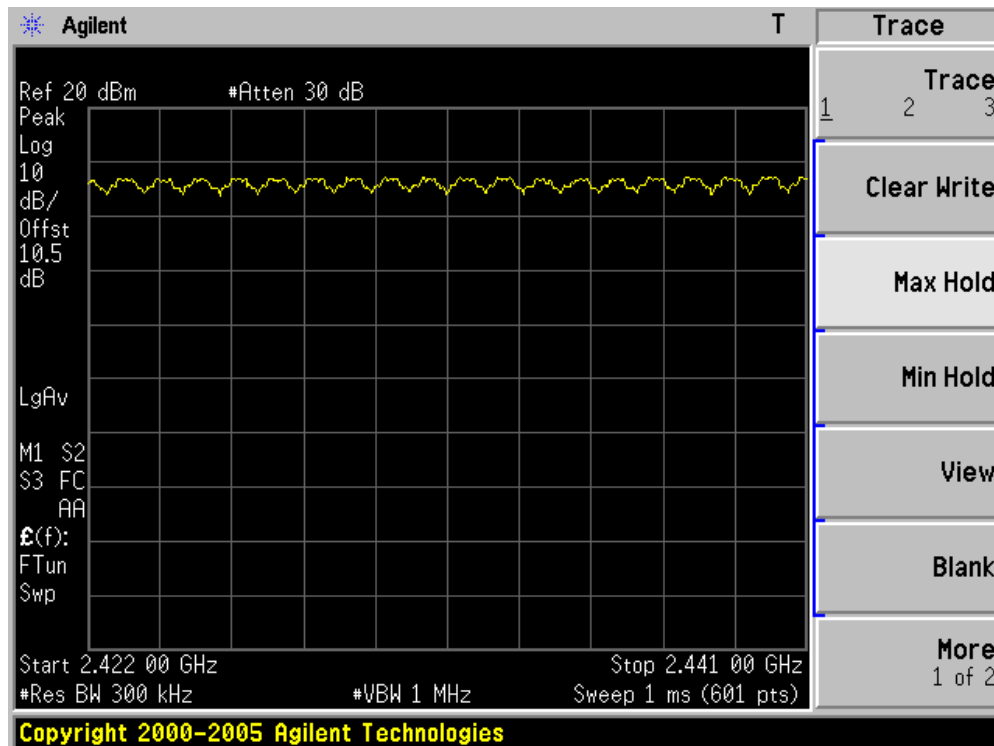
Product	:	Cassia Hub
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

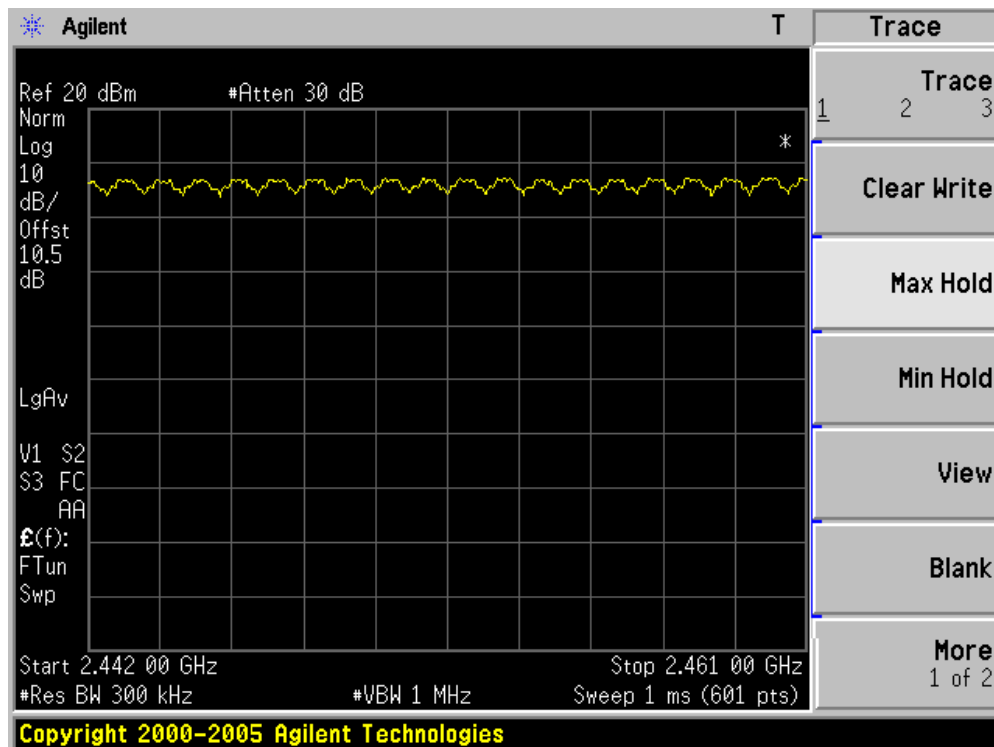
2402 - 2421 MHz



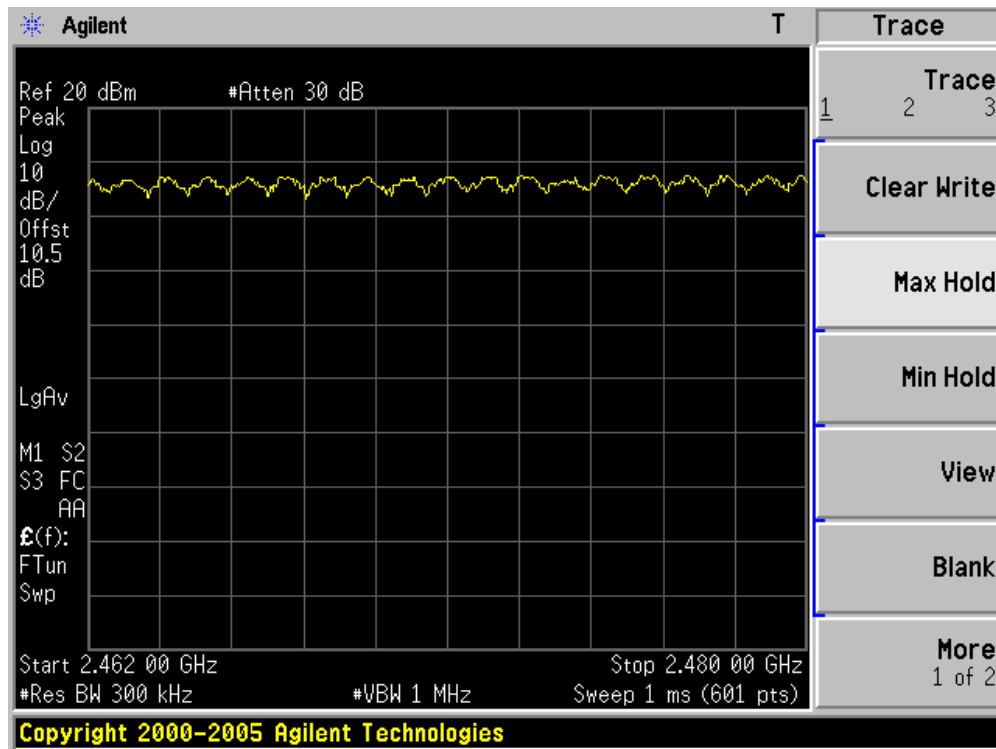
2422 - 2441 MHz



2442 - 2461 MHz



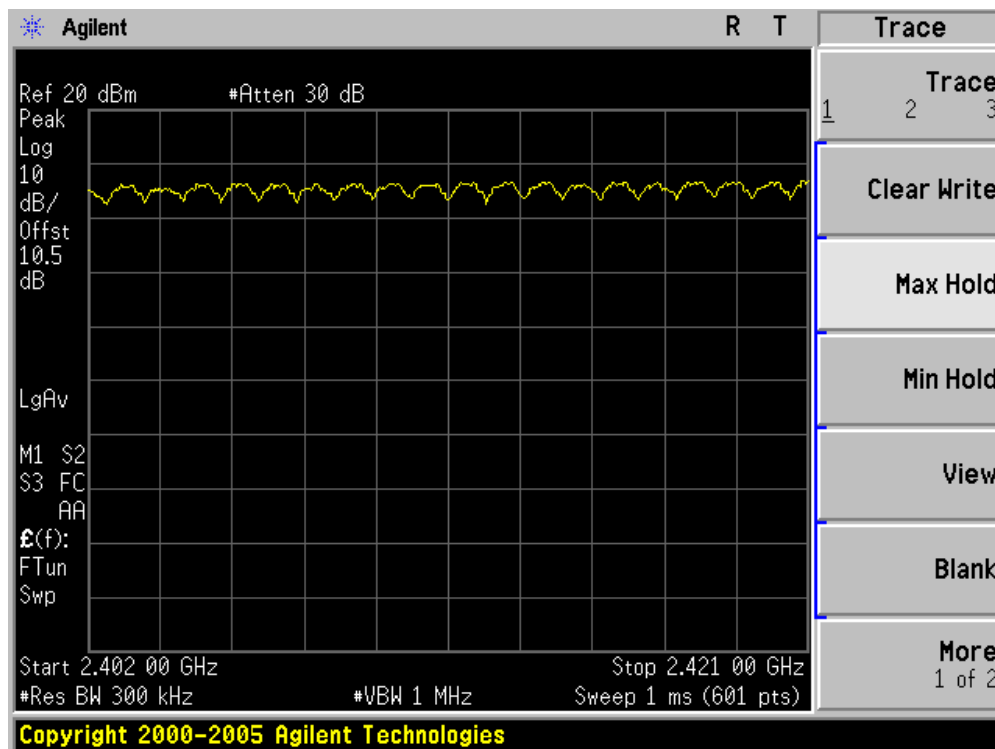
2462 - 2480 MHz



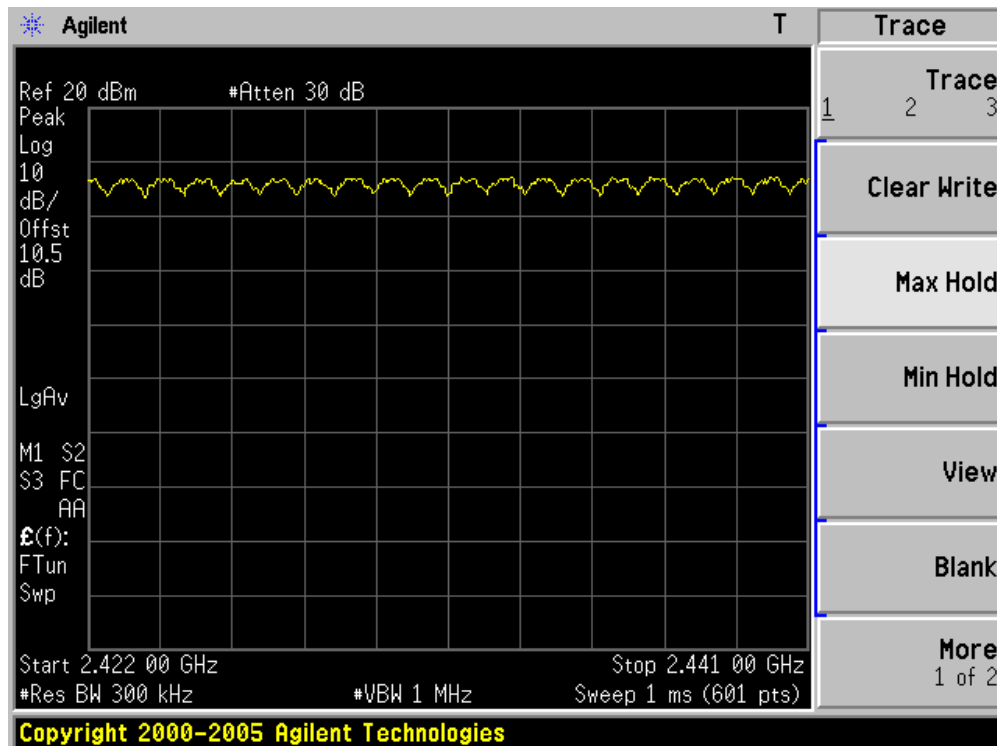
Product	:	Cassia Hub
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

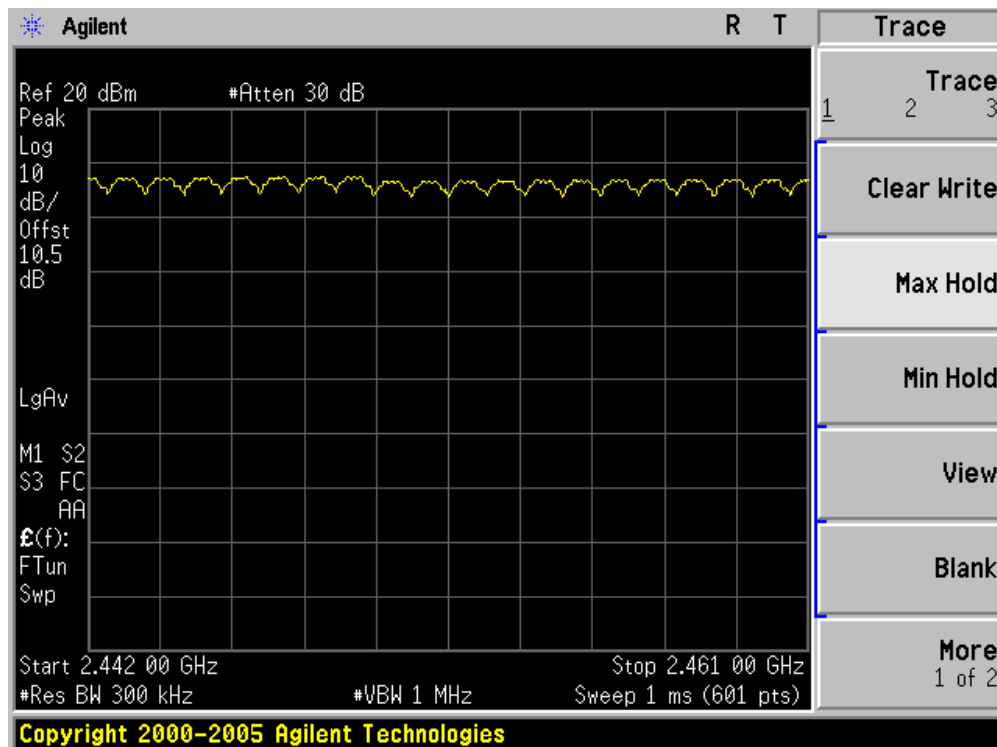
2402 - 2421 MHz



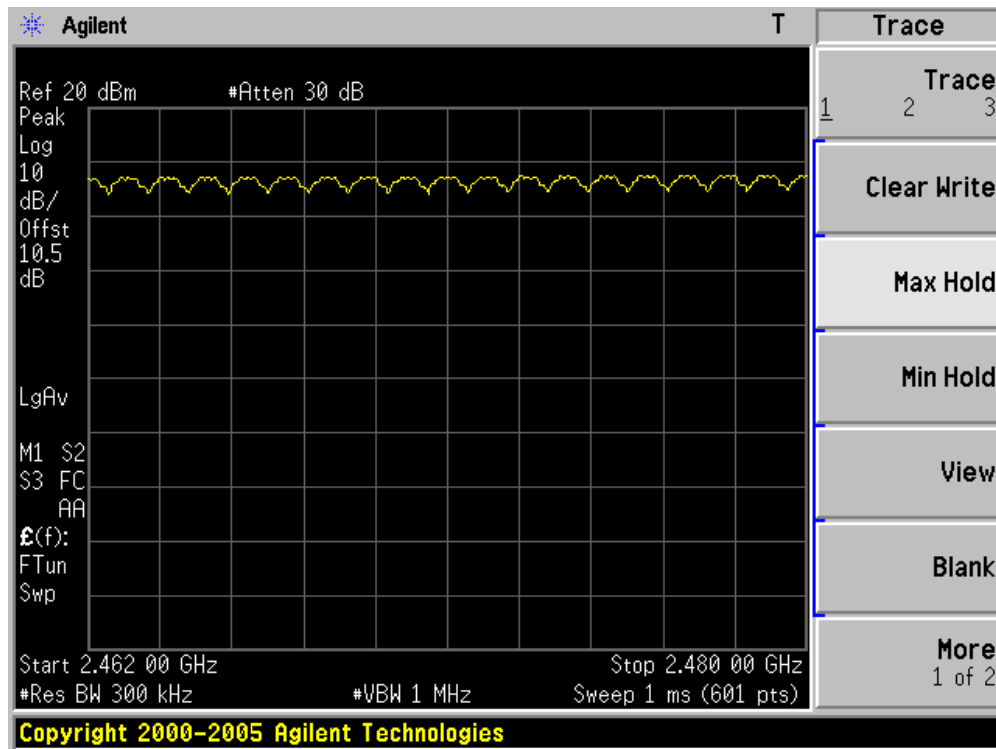
2422 - 2441 MHz



2442 - 2461 MHz



2462 - 2480 MHz



8. Time of Occupancy (Dwell Time)

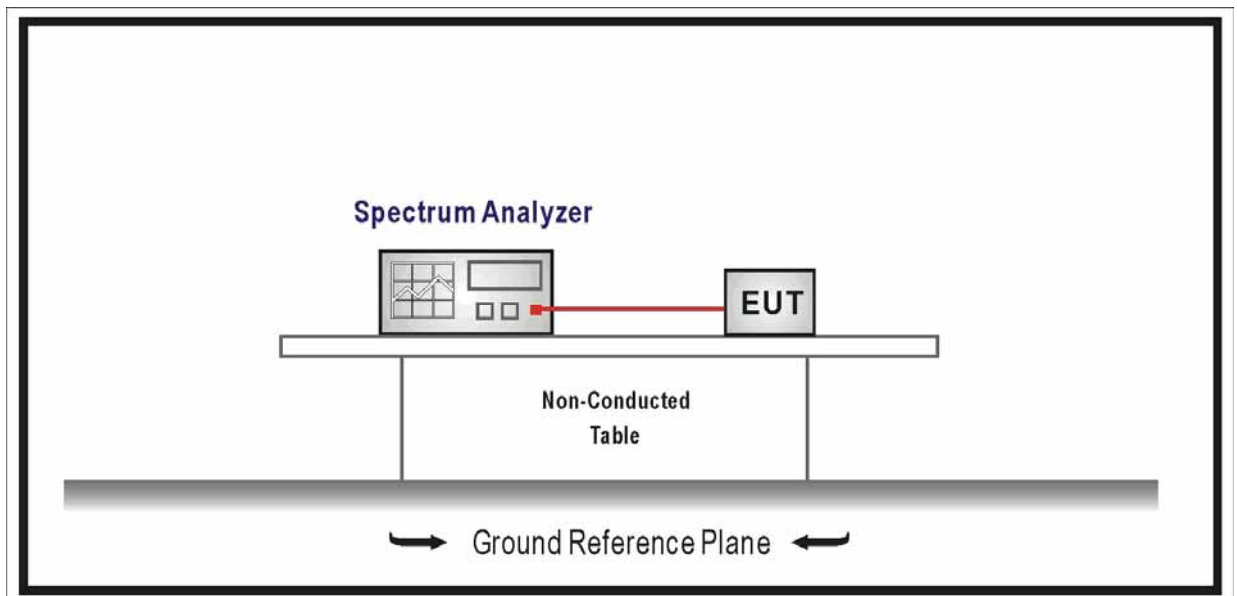
8.1. Test Equipment

Time of Occupancy (Dwell Time) / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
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

- For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75

hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

- Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

8.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW \geq RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

8.5. Uncertainty

The measurement uncertainty is defined as ± 0.1 us

8.6. Test Result

Product	:	Cassia Hub
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	TR-8
Test Mode	:	Transmitter-1Mbps (GFSK_DH1)

Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	135.014	< 400	Pass

Test Time Period: $0.4 \times 79 = 31.6 \text{ sec}$.

- 2441MHz, The Maximum Occupancy Time Within 31.6sec: $0.374 \text{ ms} \times 361 = 135.014 \text{ msec}$

Channel 39 (2441MHz)-(DH1)

