

Test Report

FCC Part15 Subpart C & Industry Canada RSS-247 Issue 1

Product Name : UMA
Model No. : UMA
FCC ID : 2AGV2UMA
IC : 20979-UMA

Applicant : Pablo Inc.

Address : 888 Marin St. San Francisco, CA 94124, USA

Date of Receipt : Apr. 19, 2016
Issued Date : Jun. 02, 2016
Report No. : 1642074R-RF-US-P06V01
Report Version : V 1.1



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

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Model No. : UMA
FCC ID : 2AGV2UMA
IC : 20979-UMA
Brand Name : Pablo
EUT Voltage : AC 100-240V,50Hz/60Hz
(Power adaptor Voltage)
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2015
ANSI C63.4: 2014; ANSI C63.10: 2013
Industry Canada RSS-Gen Issue 4/RSS-247 Issue 1
Test Result : Complied
Performed Location : Quietek Corporation (Linkou Laboratory)
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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

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/english/about/certificates.aspx?bval=5>
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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1642074R-RF-US-P06V01	V1.0	Initial Issued Report	May. 25, 2016
1642074R-RF-US-P06V01	V1.1	Added RSS 247 in the title	Jun. 02, 2016

1. General Information

1.1. EUT Description

Product Name	UMA
Model No.	UMA
EUT Voltage (Power adaptor Voltage)	AC 100-240V,50Hz/60Hz
Bluetooth Specification	V3.0+V4.1
Frequency Range	2402- 2480 MHz
Channel Number	V3.0: 79 V4.1: 40
Channel Separation	V3.0: 1MHz V4.1: 2MHz
Type of Modulation	V3.0: GFSK, Pi/4 DQPSK, 8DPSK V4.1: GFSK
Data Rate	V3.0: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) V4.1: 1Mbps(GFSK)
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
PCB Antenna	N/A	N/A	0 dBi for 2.4GHz

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:

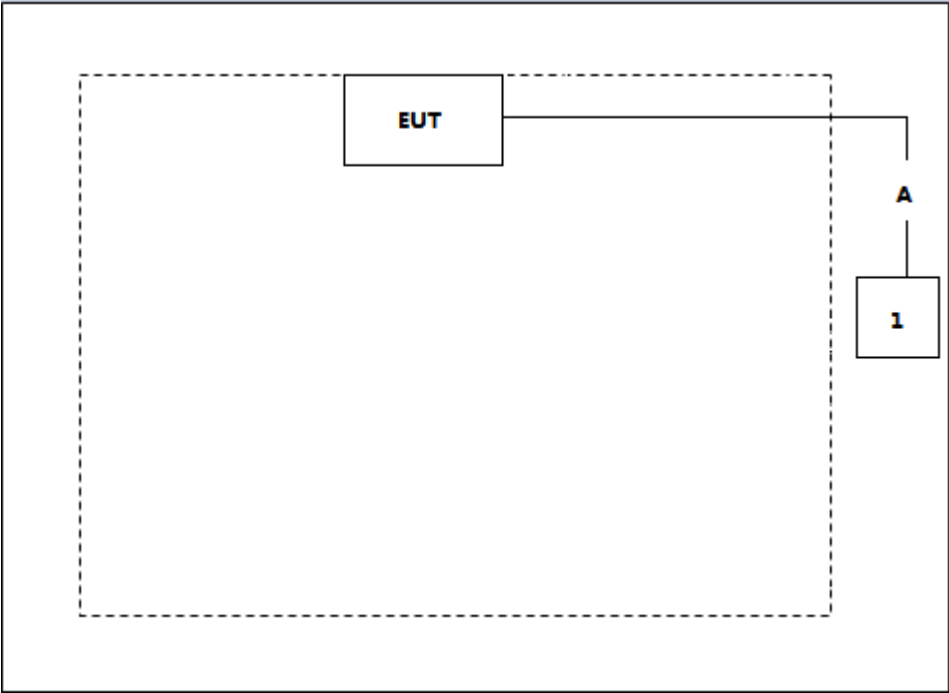
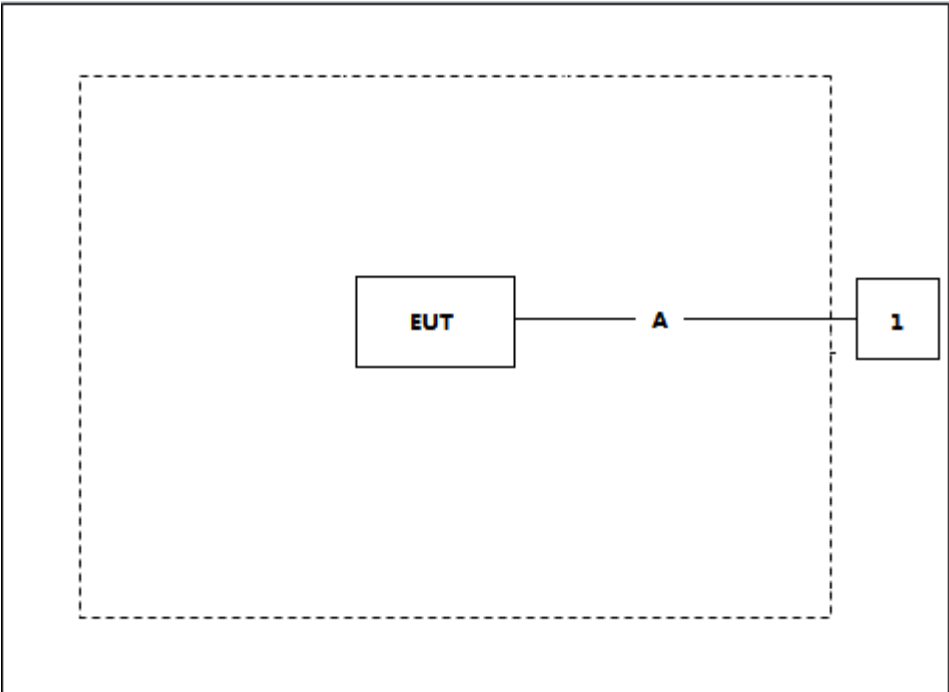
1. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.
2. Regards to the frequency band operation for systems using FHSS modulation: normal operation (hopping) was selected to test for conducted, and the lowest, highest frequency channel 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	Notebook	lenovo	U430	N/A	Power by adapter

1.4 Configuration of Tested System

Connection Diagram(Conducted Emission)		
		
Connection Diagram(Radiated Emission)		
		
Signal Cable Type		Signal cable Description
A	USB Control Cable	Shielded, 1.0m

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 V5.4), 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: 2015 Section 15.207	Yes	No
Emissions in restricted frequency bands	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.209	Yes	No
20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.247(a)(1)	Yes	No
Carrier Frequency Separation	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.247(a)(1)	Yes	No
Number of Hopping Frequencies	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.247(a)(1)(iii)	Yes	No
Time of Occupancy (Dwell Time)	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.247(a)(1)(iii)	Yes	No
Peak Output Power	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.247(b)(1)	Yes	No
Emissions in non-restricted frequency bands	FCC CFR Title 47 Part 15 Subpart C: 2015 Section 15.215(c), 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2015 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
Emissions in non-restricted frequency bands	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

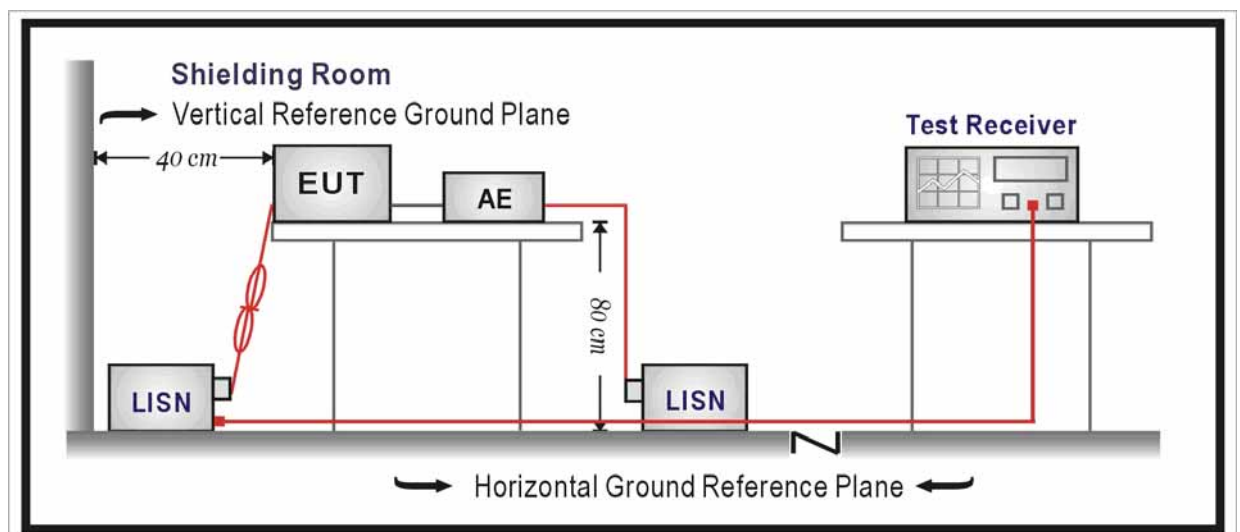
3.1. Test Equipment

Conducted Emission / SR8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Test Receiver	R & S	ESCS 30 / 825442/018	825442/018	2017.03.05
Artificial Mains Network	R & S	ENV4200 / 848411/10	848411/10	2017.03.05
LISN	R & S	ESH3-Z5 / 825562/002	825562/002	2016.09.16
DC LISN	Schwarzbeck	8226 / 176	6200464462	2017.03.01
Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	07081401	2016.09.16

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.

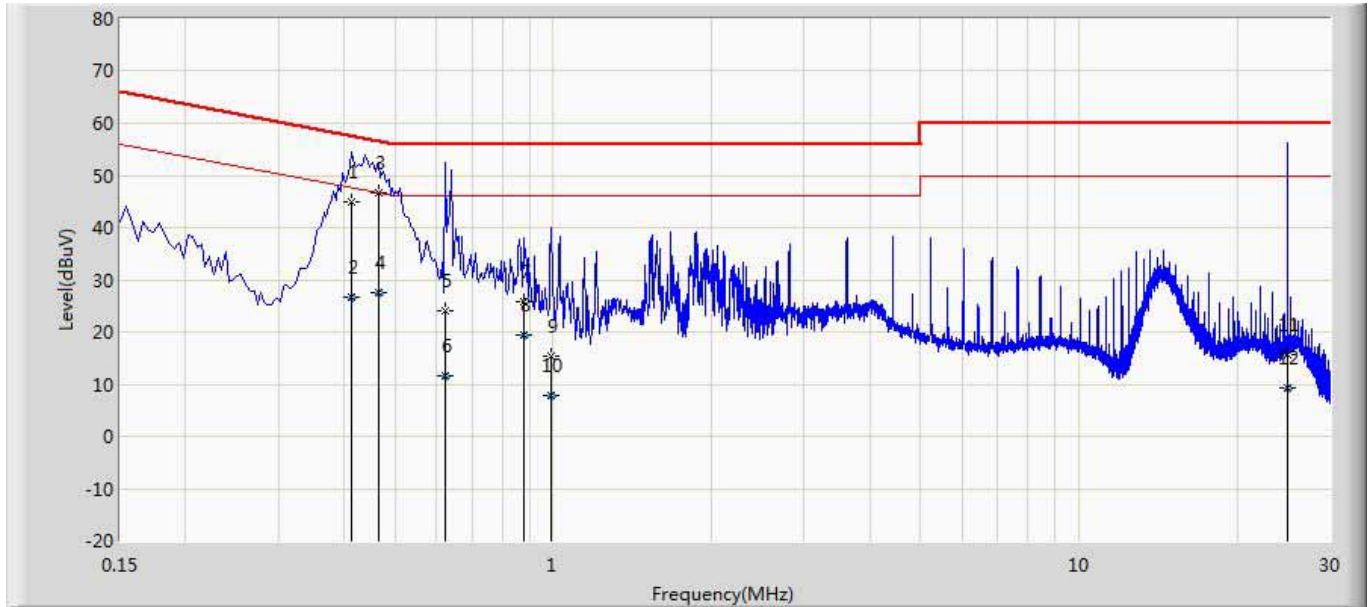
Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

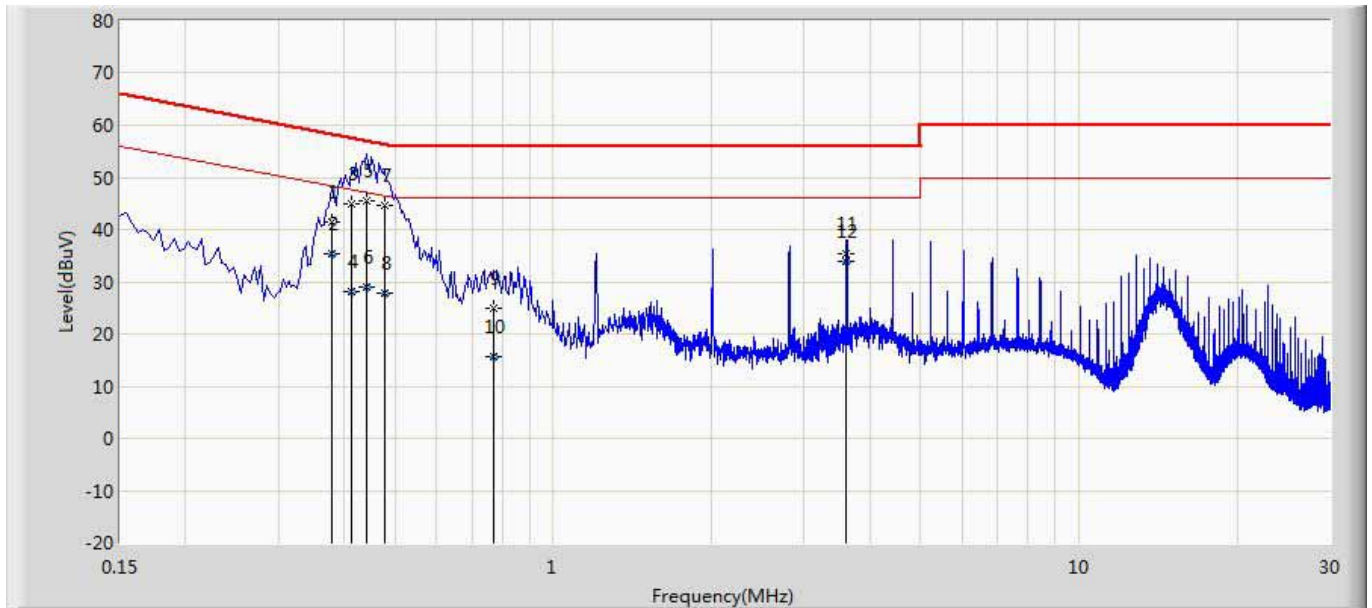
3.6. Test Result

Site: SR8	Time: 2016/05/04
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: UMA	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.414	45.038	35.335	-12.530	57.568	9.635	0.068	0.000	QP
2		0.414	26.531	16.828	-21.037	47.568	9.635	0.068	0.000	AV
3	*	0.466	46.745	37.045	-9.840	56.585	9.630	0.070	0.000	QP
4		0.466	27.440	17.740	-19.145	46.585	9.630	0.070	0.000	AV
5		0.622	24.014	14.324	-31.986	56.000	9.620	0.070	0.000	QP
6		0.622	11.644	1.954	-34.356	46.000	9.620	0.070	0.000	AV
7		0.878	25.755	16.051	-30.245	56.000	9.630	0.074	0.000	QP
8		0.878	19.414	9.710	-26.586	46.000	9.630	0.074	0.000	AV
9		0.990	15.302	5.592	-40.698	56.000	9.630	0.080	0.000	QP
10		0.990	7.829	-1.881	-38.171	46.000	9.630	0.080	0.000	AV
11		24.926	15.567	5.107	-44.433	60.000	9.890	0.570	0.000	QP
12		24.926	9.327	-1.133	-40.673	50.000	9.890	0.570	0.000	AV

Site: SR8	Time: 2016/05/04
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: UMA	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Probe (dB)	Cable (dB)	Amp (dB)	Type
1		0.378	41.365	31.665	-16.958	58.323	9.640	0.060	0.000	QP
2		0.378	35.239	25.539	-13.084	48.323	9.640	0.060	0.000	AV
3		0.414	44.931	35.223	-12.637	57.568	9.640	0.068	0.000	QP
4		0.414	28.173	18.465	-19.395	47.568	9.640	0.068	0.000	AV
5	*	0.442	45.483	35.777	-11.541	57.024	9.636	0.070	0.000	QP
6		0.442	28.905	19.199	-18.119	47.024	9.636	0.070	0.000	AV
7		0.478	44.517	34.817	-11.857	56.374	9.630	0.070	0.000	QP
8		0.478	27.686	17.986	-18.688	46.374	9.630	0.070	0.000	AV
9		0.770	25.038	15.328	-30.962	56.000	9.640	0.070	0.000	QP
10		0.770	15.636	5.926	-30.364	46.000	9.640	0.070	0.000	AV
11		3.614	35.305	25.515	-20.695	56.000	9.660	0.130	0.000	QP
12		3.614	33.973	24.183	-12.027	46.000	9.660	0.130	0.000	AV

4. Emissions in restricted frequency bands

4.1. Test Equipment

Emissions in restricted frequency bands / CB7

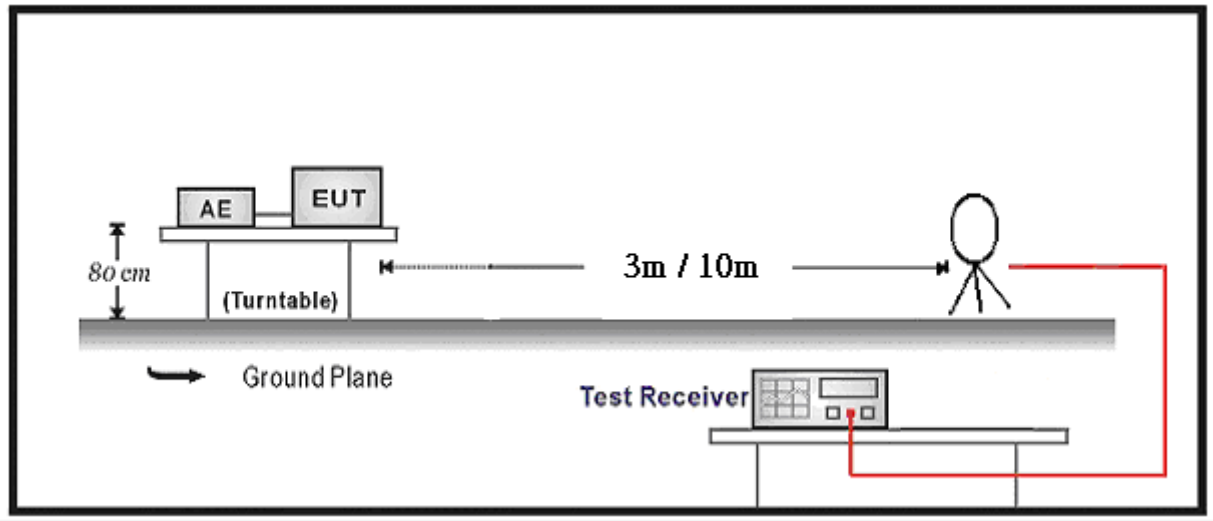
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2017.03.05
Loop Antenna	R&S	HFH2-Z2	833799/003	2016.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2016.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2017.02.28

Emissions in restricted frequency bands / CB7

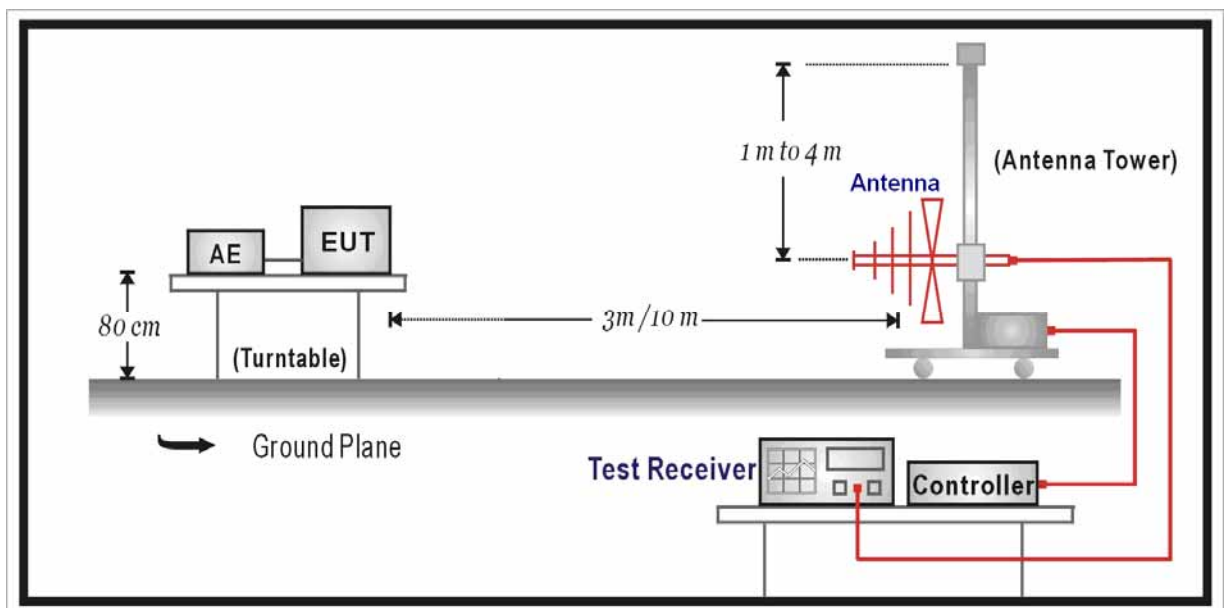
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04
Preamplifier	Miteq	NSP1800-25	1364185	2017.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2017.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2017.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2017.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2017.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2017.02.28
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2017.02.28

4.2. Test Setup

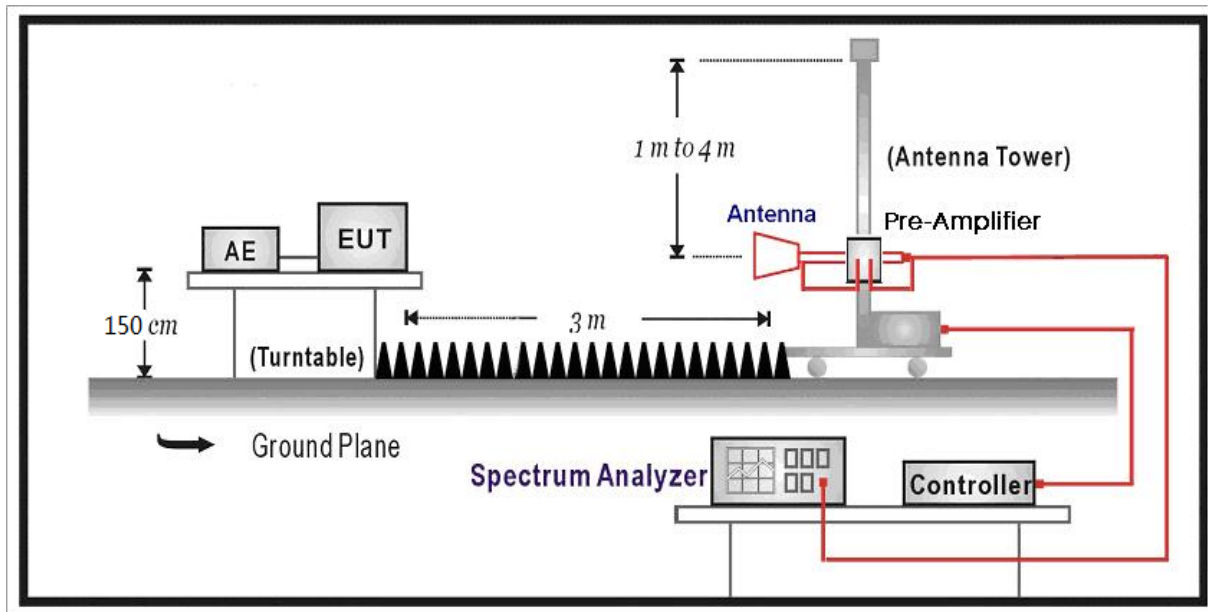
Below 30MHz Test Setup:



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.

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

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 to 10 Hz, 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 dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit 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-delta” method may be employed.

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

Mode 1: Transmitter-1Mbps(GFSK_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	31.4	8.0	39.4	54(Note3)	14.8	PK
	V	4804.0	31.8	8.0	39.8	54(Note3)	14.1	PK
	H	7206.0	29.4	12.8	42.2	54(Note3)	11.5	PK
	V	7206.0	29.7	12.8	42.5	54(Note3)	11.7	PK
	H	9608.0	28.3	16.1	44.4	54(Note3)	9.5	PK
	V	9608.0	28.4	16.0	44.4	54(Note3)	9.8	PK
39	H	4882.0	30.8	8.2	39.0	54(Note3)	15.0	PK
	V	4882.0	31.1	8.2	39.3	54(Note3)	14.6	PK
	H	7324.0	29.8	13.0	42.8	54(Note3)	11.2	PK
	V	7323.1	29.3	13.0	42.3	54(Note3)	11.9	PK
	H	9764.0	26.4	16.2	42.6	54(Note3)	11.2	PK
	V	9764.0	27.0	16.3	43.3	54(Note3)	10.4	PK
78	H	4960.0	30.0	8.5	38.5	54(Note3)	15.5	PK
	V	4960.0	30.0	8.5	38.5	54(Note3)	15.6	PK
	H	7443.0	28.2	13.2	41.4	54(Note3)	12.6	PK
	V	7440.0	29.5	13.2	42.7	54(Note3)	11.1	PK
	H	9920.0	26.9	16.1	43.0	54(Note3)	11.0	PK
	V	9920.0	26.9	16.1	43.0	54(Note3)	10.7	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)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	31.0	7.9	38.9	54(Note3)	15.1	PK
	V	4804.0	32.3	8.0	40.3	54(Note3)	13.7	PK
	H	7206.0	28.8	12.8	41.6	54(Note3)	12.4	PK
	V	7206.0	32.0	12.8	44.8	54(Note3)	9.2	PK
	H	9608.0	26.9	16.1	43.0	54(Note3)	11.0	PK
	V	9608.0	28.9	16.1	45.0	54(Note3)	9.0	PK
39	H	4882.0	30.5	8.2	38.7	54(Note3)	15.3	PK
	V	4882.0	30.5	8.2	38.7	54(Note3)	15.3	PK
	H	7324.0	28.7	13.0	41.7	54(Note3)	12.3	PK
	V	7323.0	28.1	13.0	41.1	54(Note3)	12.9	PK
	H	9764.0	28.1	16.3	44.4	54(Note3)	9.6	PK
	V	9764.0	27.1	16.3	43.4	54(Note3)	10.6	PK
78	H	4960.0	30.5	8.5	39.0	54(Note3)	15.0	PK
	V	4960.0	30.1	8.6	38.7	54(Note3)	15.3	PK
	H	7443.0	29.2	13.2	42.4	54(Note3)	11.6	PK
	V	7440.0	29.0	13.2	42.2	54(Note3)	11.8	PK
	H	9920.0	27.1	16.1	43.2	54(Note3)	10.8	PK
	V	9920.0	28.1	16.1	44.2	54(Note3)	9.8	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)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4808.0	31.5	8.0	39.2	54(Note3)	14.8	PK
	V	4808.0	31.6	7.9	39.4	54(Note3)	14.6	PK
	H	7206.0	29.1	12.8	42.0	54(Note3)	12.0	PK
	V	7206.0	29.3	12.8	41.9	54(Note3)	12.1	PK
	H	9608.0	28.2	16.1	44.5	54(Note3)	9.5	PK
	V	9608.0	27.8	16.0	43.9	54(Note3)	10.1	PK
39	H	4882.0	30.6	8.2	38.8	54(Note3)	15.2	PK
	V	4882.0	30.9	8.2	39.1	54(Note3)	14.9	PK
	H	7323.0	28.7	13.0	41.9	54(Note3)	12.1	PK
	V	7323.0	29.5	12.9	42.1	54(Note3)	11.9	PK
	H	9764.0	27.7	16.3	44.0	54(Note3)	10.0	PK
	V	9764.0	28.1	15.9	43.9	54(Note3)	10.1	PK
78	H	4960.0	29.4	8.5	37.8	54(Note3)	16.2	PK
	V	4960.0	30.6	8.6	39.0	54(Note3)	15.0	PK
	H	7440.0	29.1	13.2	42.2	54(Note3)	11.8	PK
	V	7440.0	28.8	13.2	42.1	54(Note3)	11.9	PK
	H	9920.0	26.8	16.0	42.9	54(Note3)	11.1	PK
	V	9920.0	28.4	16.0	44.4	54(Note3)	9.6	PK

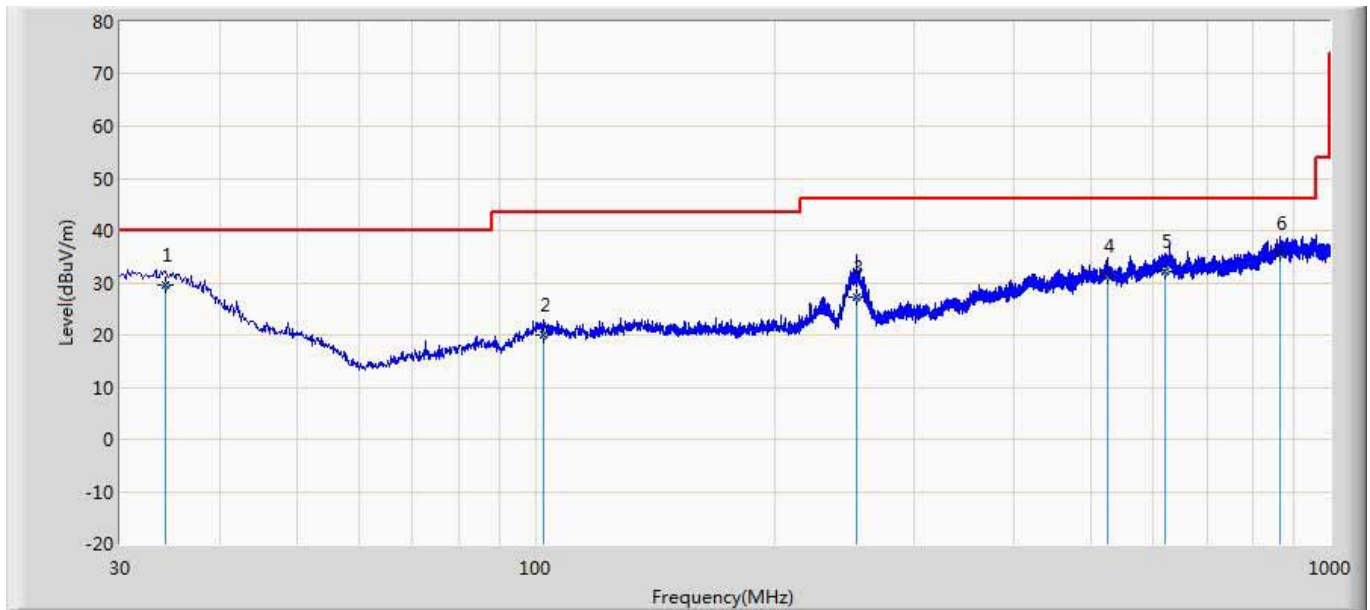
Note 1: The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.

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.

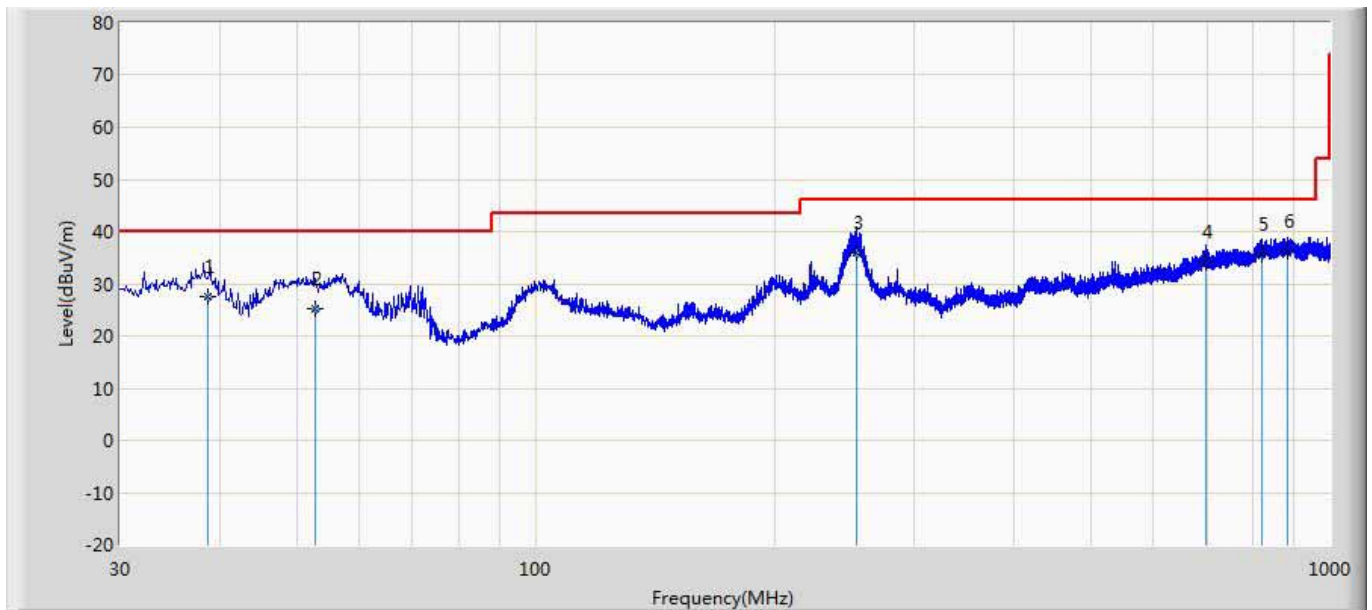
The worst case of Radiated Emission below 1GHz:

Site: CB7	Time: 2016/05/04
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode 1	



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		34.260	29.454	35.648	-10.546	40.000	16.329	0.634	23.158	100	90	QP
2		102.565	19.879	30.586	-23.621	43.500	11.357	1.098	23.162	100	265	QP
3		253.865	27.160	35.573	-18.840	46.000	13.179	1.710	23.302	200	360	QP
4		524.236	31.231	33.139	-14.769	46.000	18.382	2.480	22.770	200	38	QP
5		620.235	32.235	33.100	-13.765	46.000	19.000	2.730	22.595	100	315	QP
6	*	865.155	35.778	34.708	-10.222	46.000	20.430	3.240	22.600	200	56	QP

Site: AC2	Time: 2016/05/04
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode 1	



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		38.632	27.666	36.422	-12.334	40.000	13.794	0.679	23.229	100	155	QP
2		52.875	25.249	39.764	-14.751	40.000	7.711	0.790	23.016	100	159	QP
3		253.955	35.973	44.371	-10.027	46.000	13.193	1.710	23.301	200	47	QP
4		699.366	34.287	34.976	-11.713	46.000	18.901	2.940	22.530	200	254	QP
5		819.388	35.513	34.598	-10.487	46.000	20.155	3.150	22.390	200	345	QP
6	*	882.861	36.140	35.107	-9.860	46.000	20.465	3.270	22.702	100	56	QP

5. 20dB Bandwidth

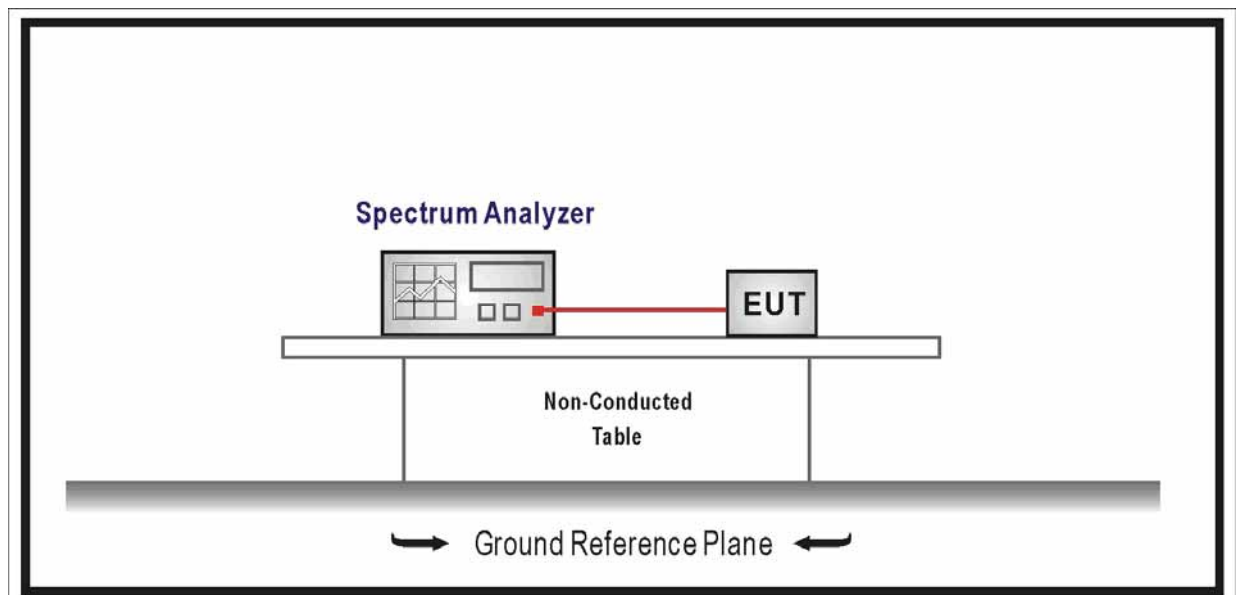
5.1 Test Equipment

20dB Bandwidth / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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.

The 20dB bandwidth must be contained within the frequency band designated in the rule section under which the equipment is operated.

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

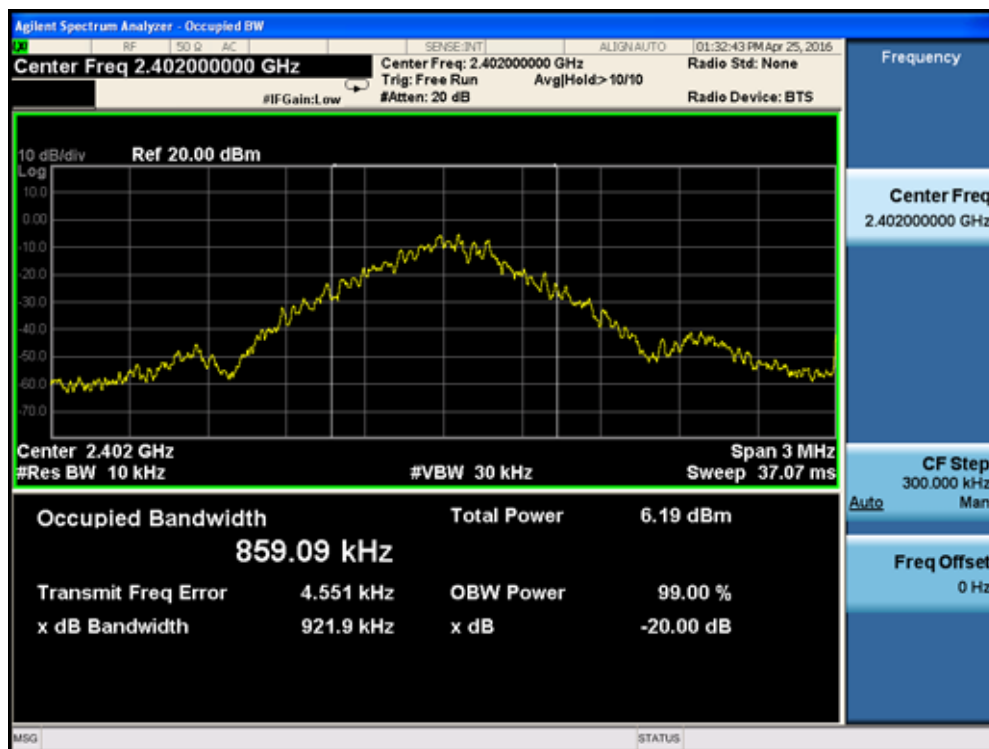
The measurement uncertainty is defined as ± 1 kHz

5.6 Test Result

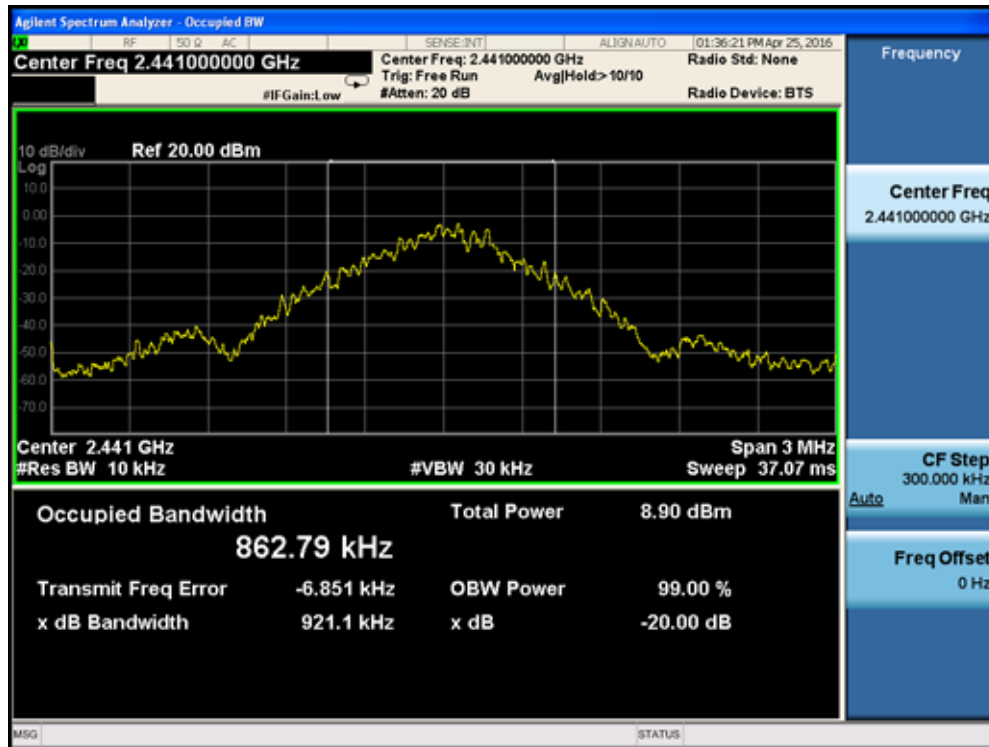
Product	:	UMA
Test Item	:	Occupied Bandwidth
Test Site	:	NO.3
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	921.9	859.09
39	2441	921.1	862.79
78	2480	921.6	862.79

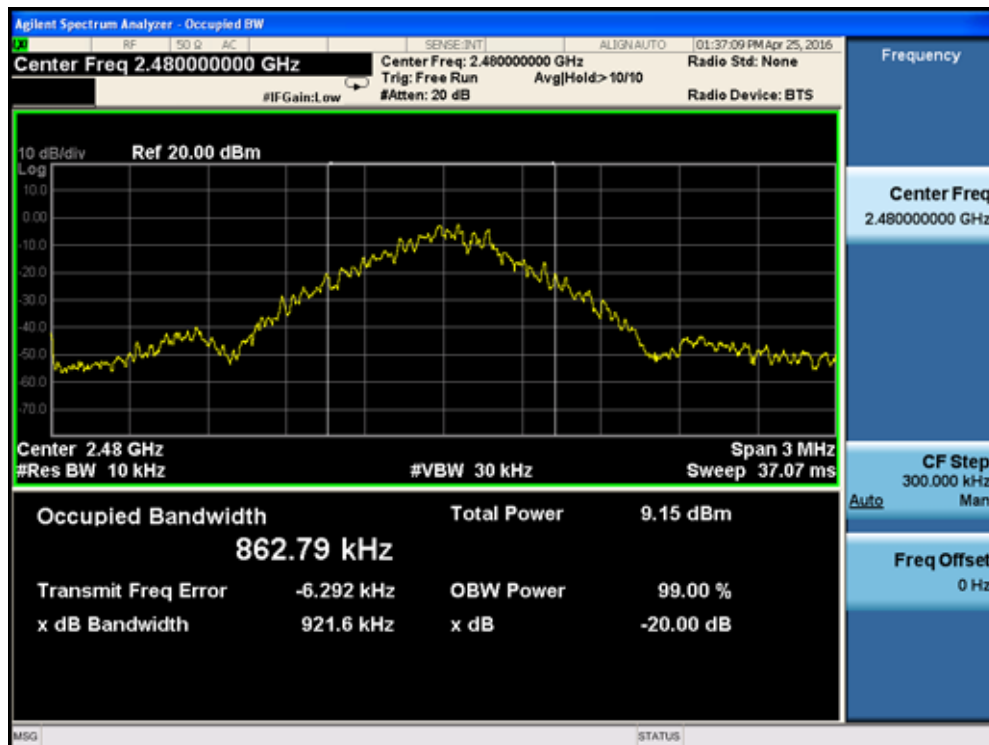
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



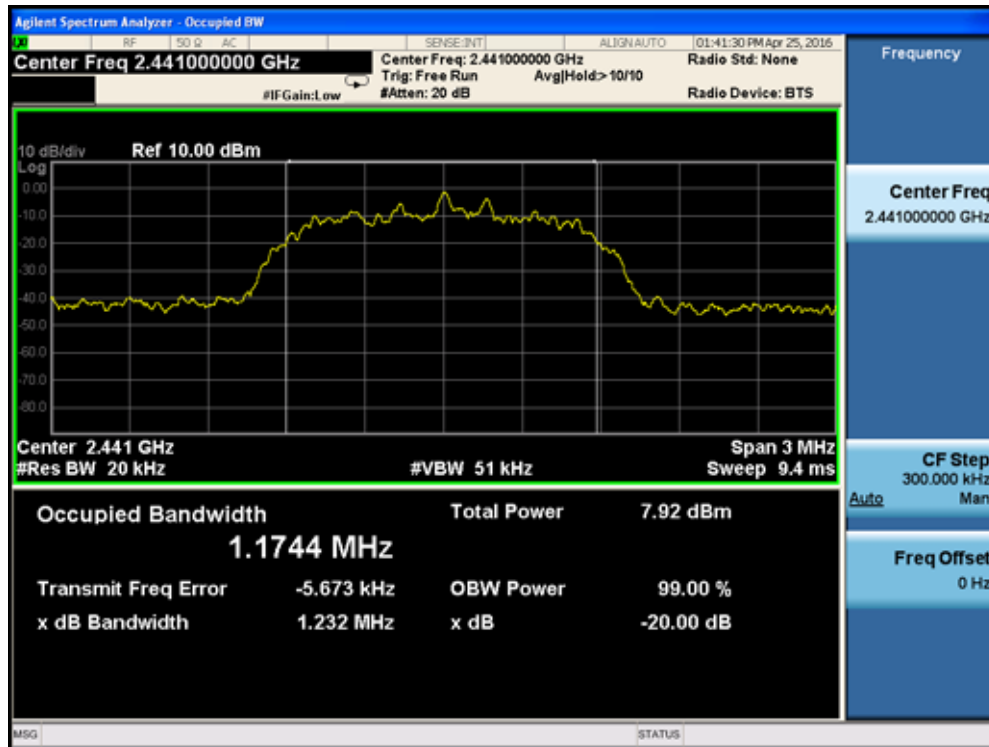
Product	:	UMA
Test Item	:	Occupied Bandwidth
Test Site	:	NO.3
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	1233	1178.0
39	2441	1232	1174.4
78	2480	1276	1181.5

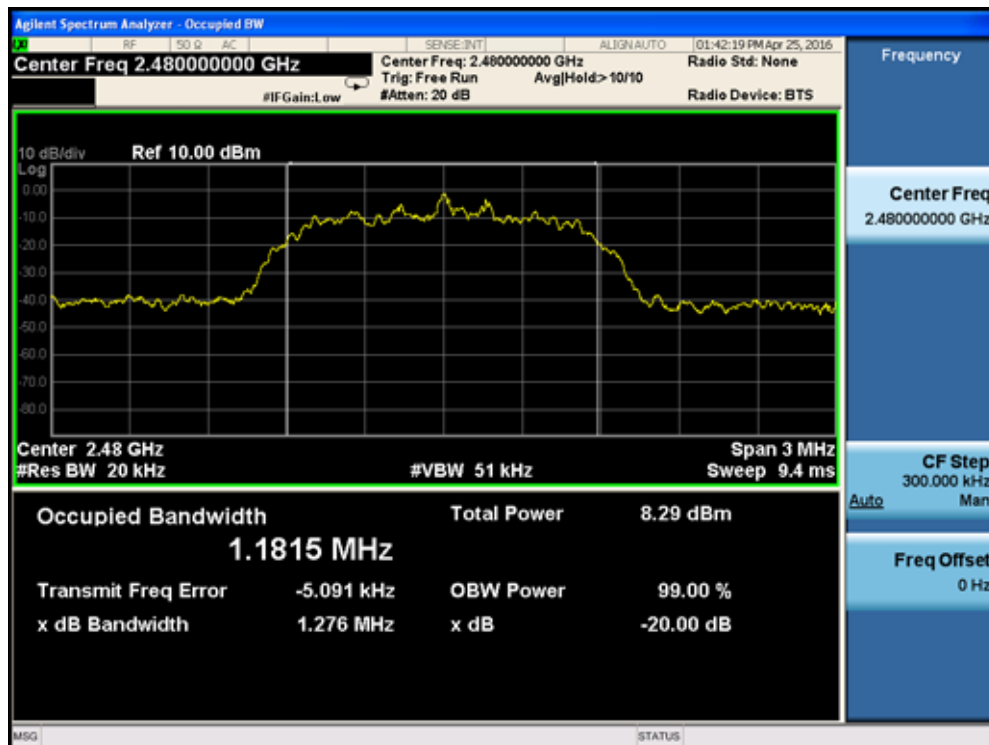
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



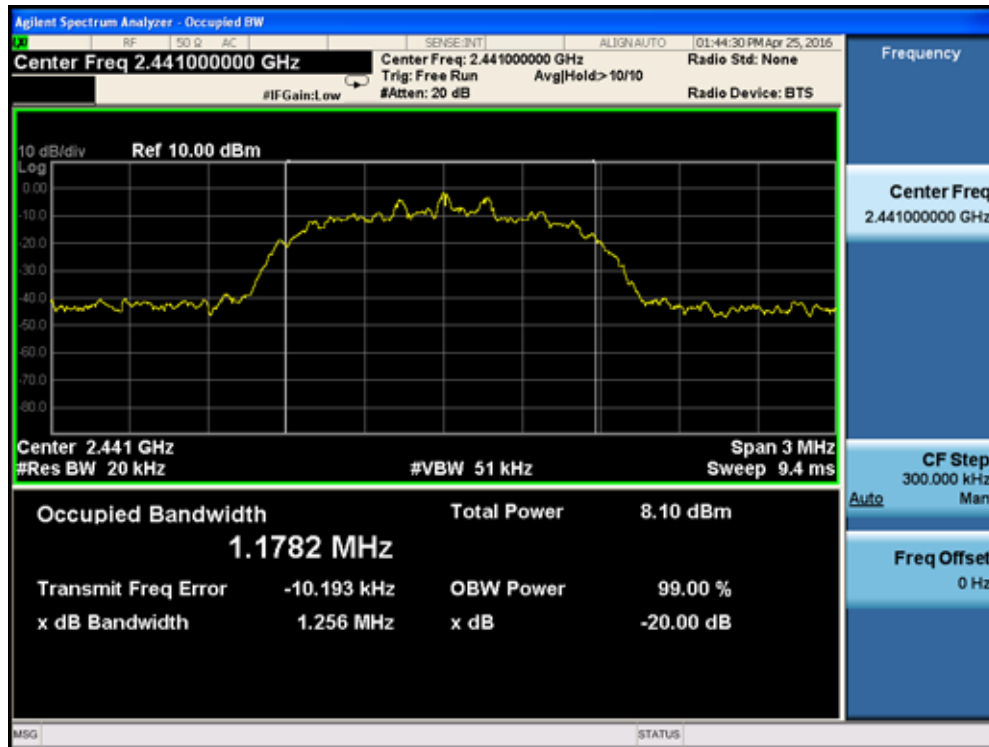
Product	:	UMA
Test Item	:	Occupied Bandwidth
Test Site	:	NO.3
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	1250	1165.9
39	2441	1256	1178.7
78	2480	1256	1181.4

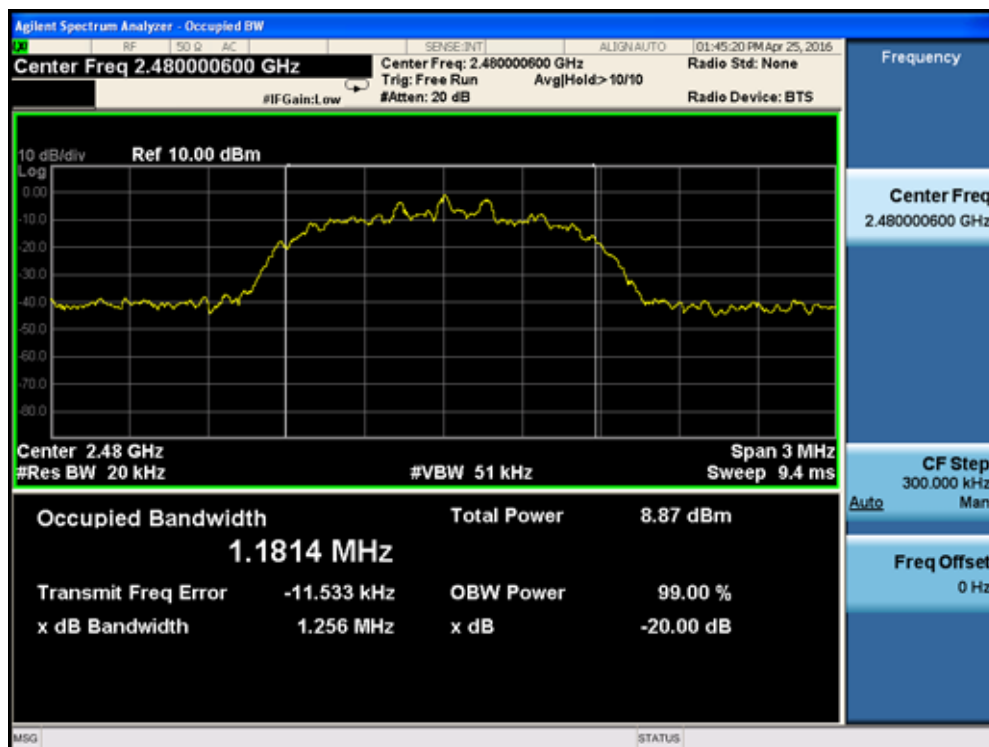
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



6. Carrier Frequency Separation

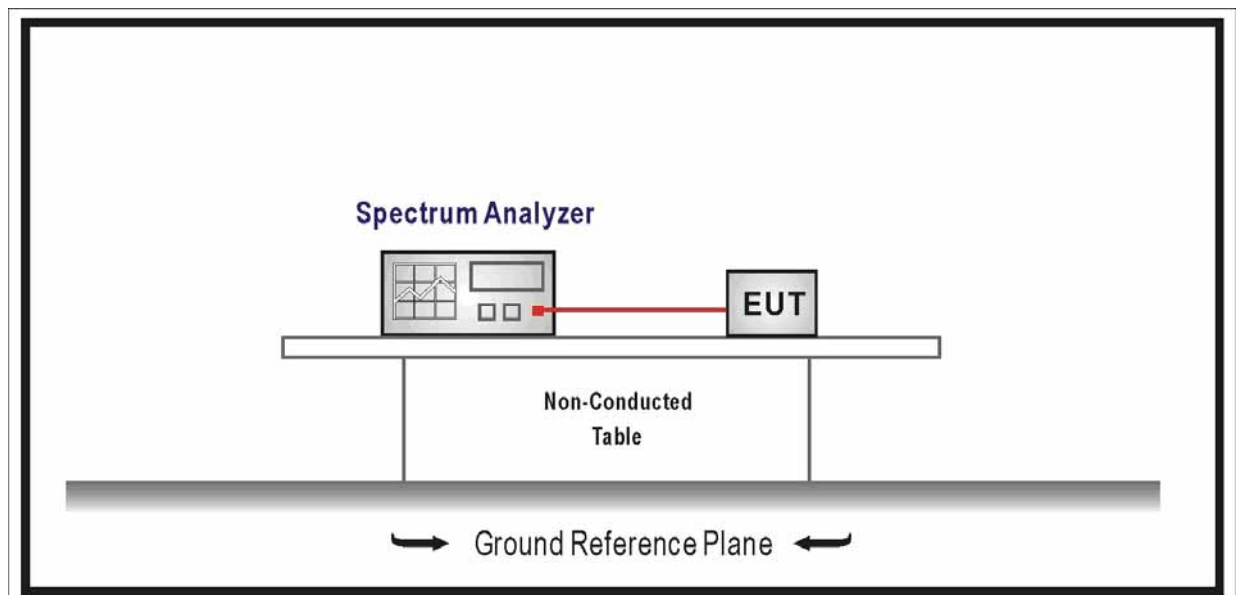
6.1. Test Equipment

Carrier Frequency Separation / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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

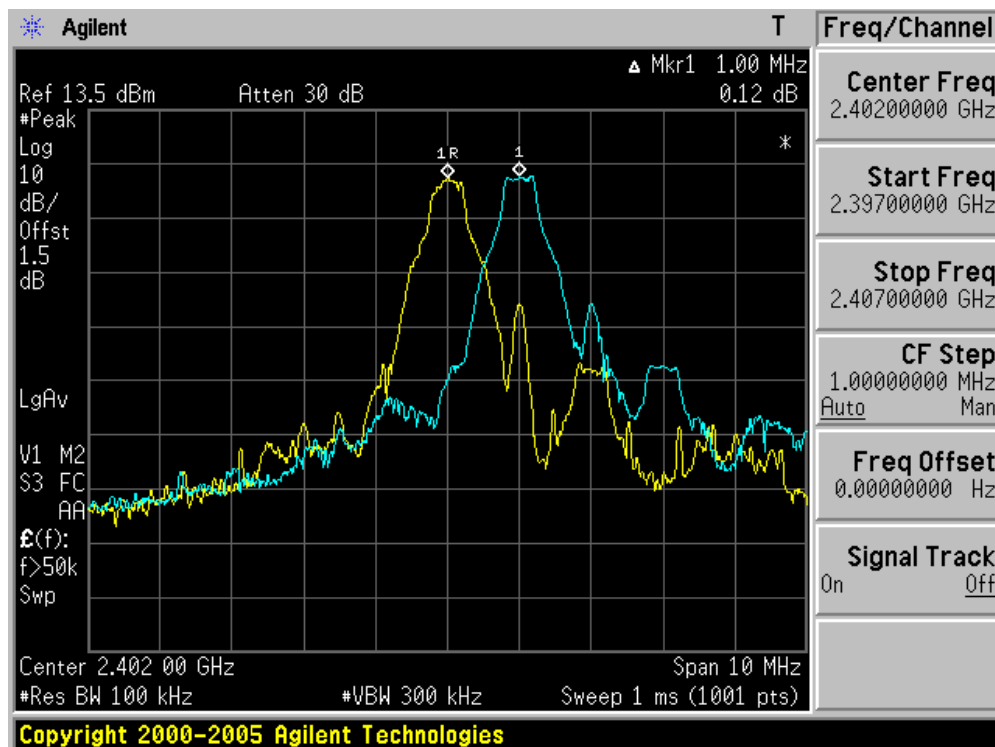
The measurement uncertainty is defined as ± 1 kHz

6.6. Test Result

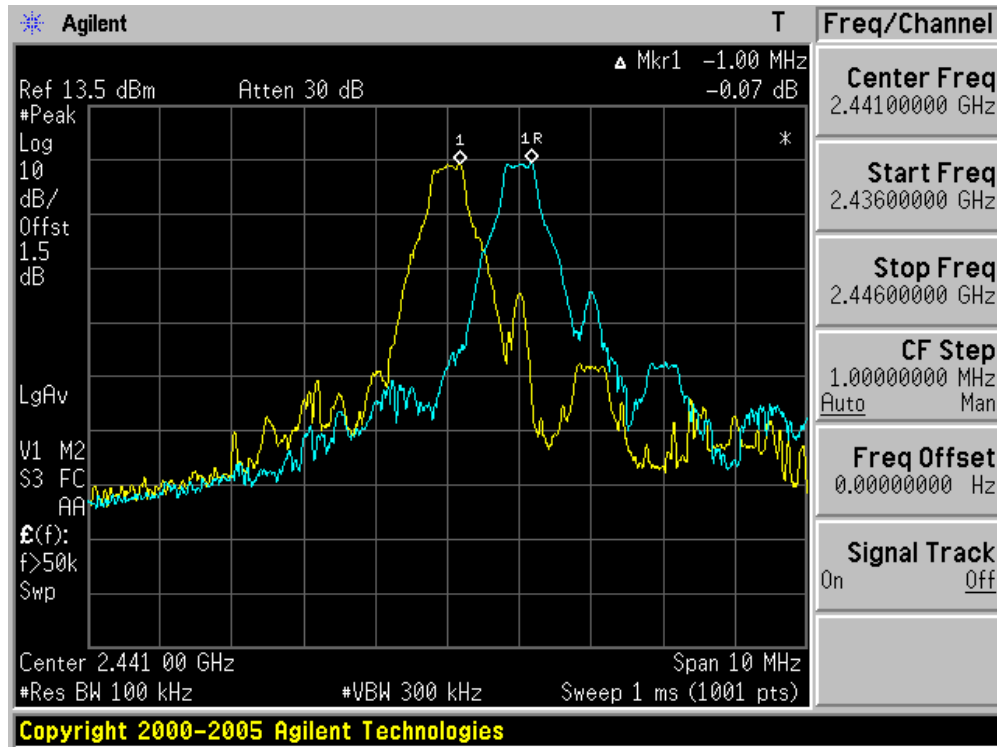
Product	:	UMA
Test Item	:	Carrier Frequency Separation
Test Site	:	NO.3
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
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

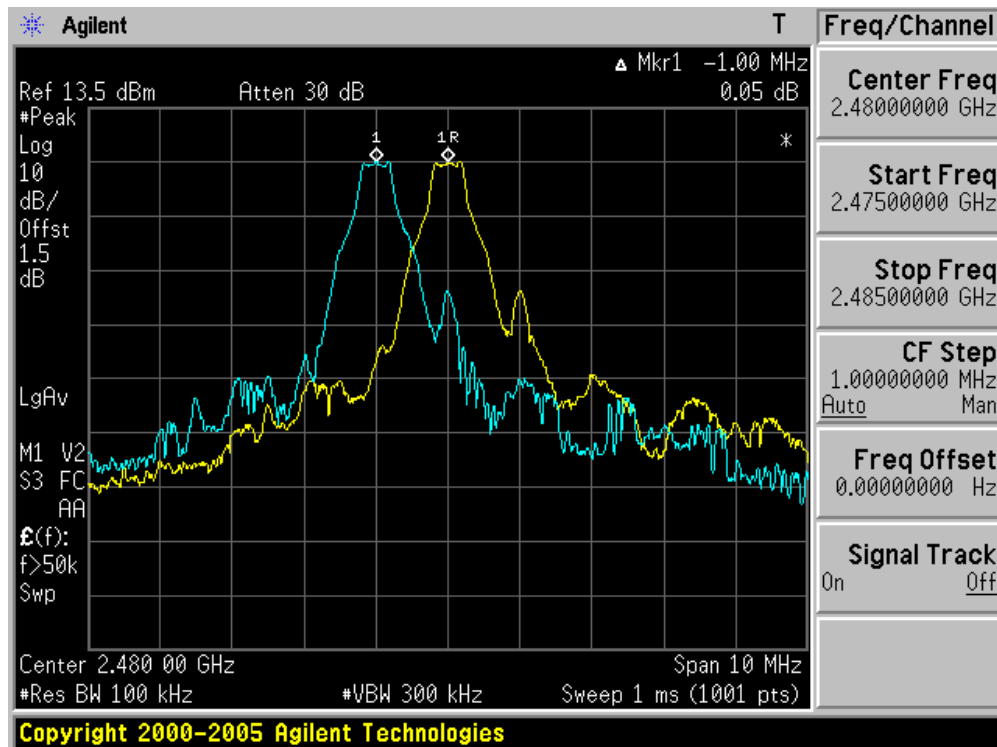
Channel 00 (2402MHz)



Channel 39 (2441MHz)



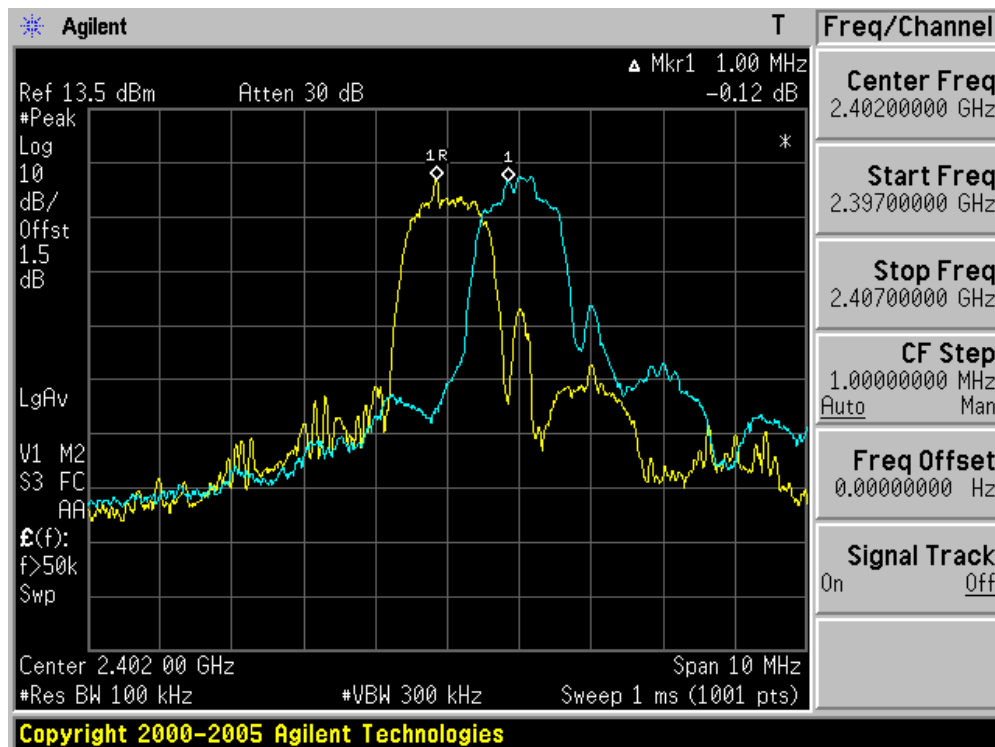
Channel 78 (2480MHz)



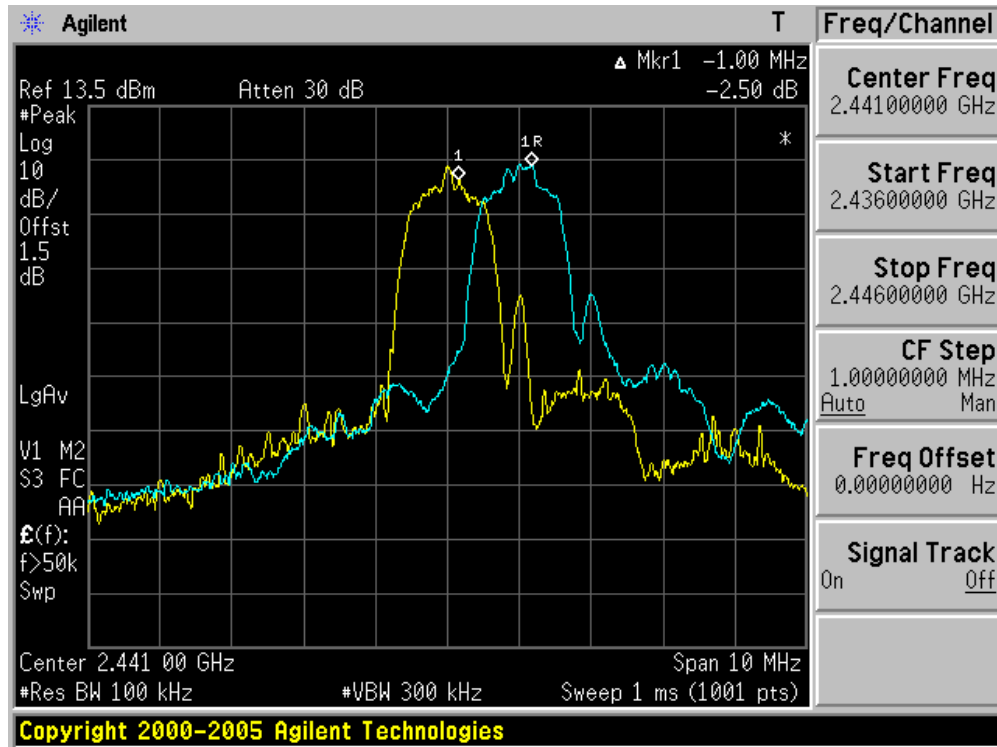
Product	:	UMA
Test Item	:	Carrier Frequency Separation
Test Site	:	NO.3
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
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

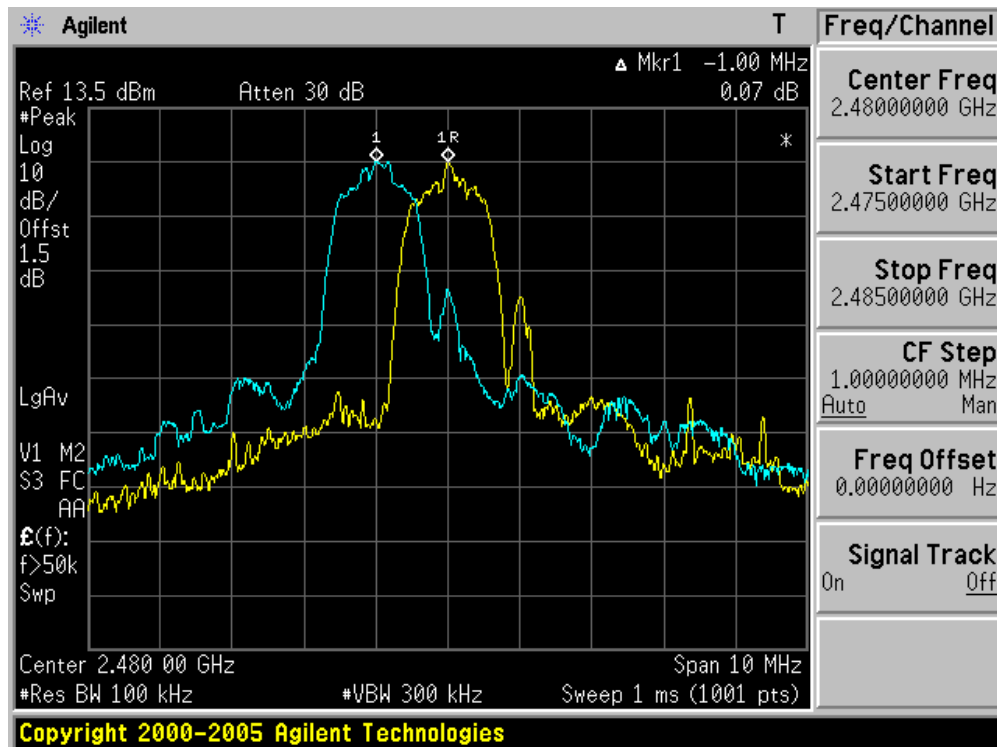
Channel 00 (2402MHz)



Channel 39 (2441MHz)



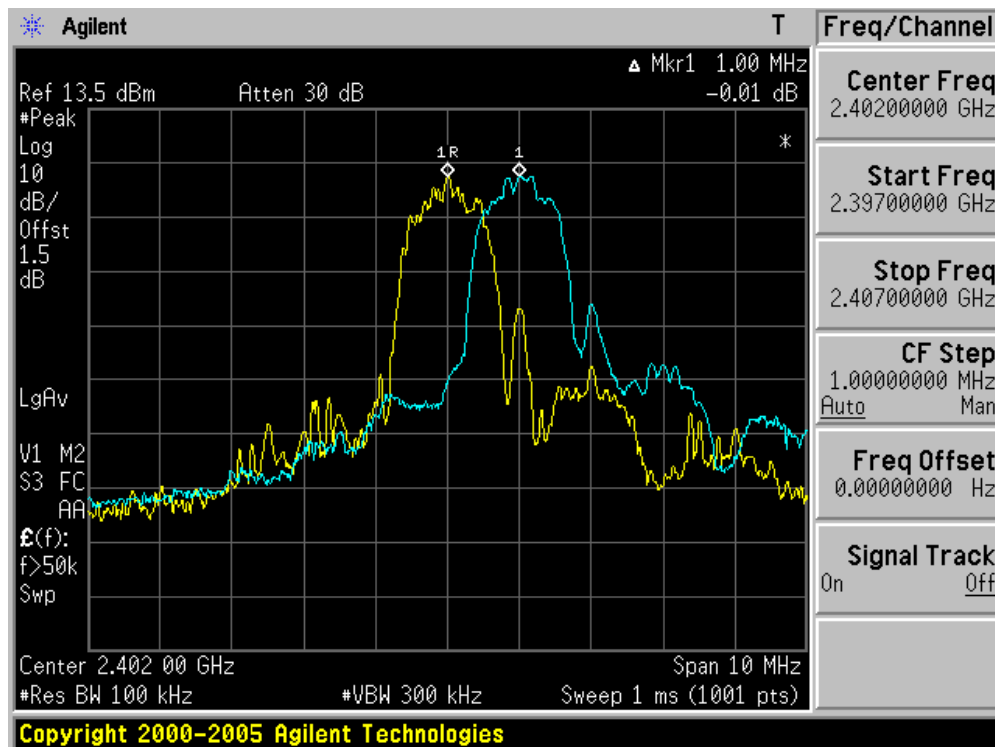
Channel 78 (2480MHz)



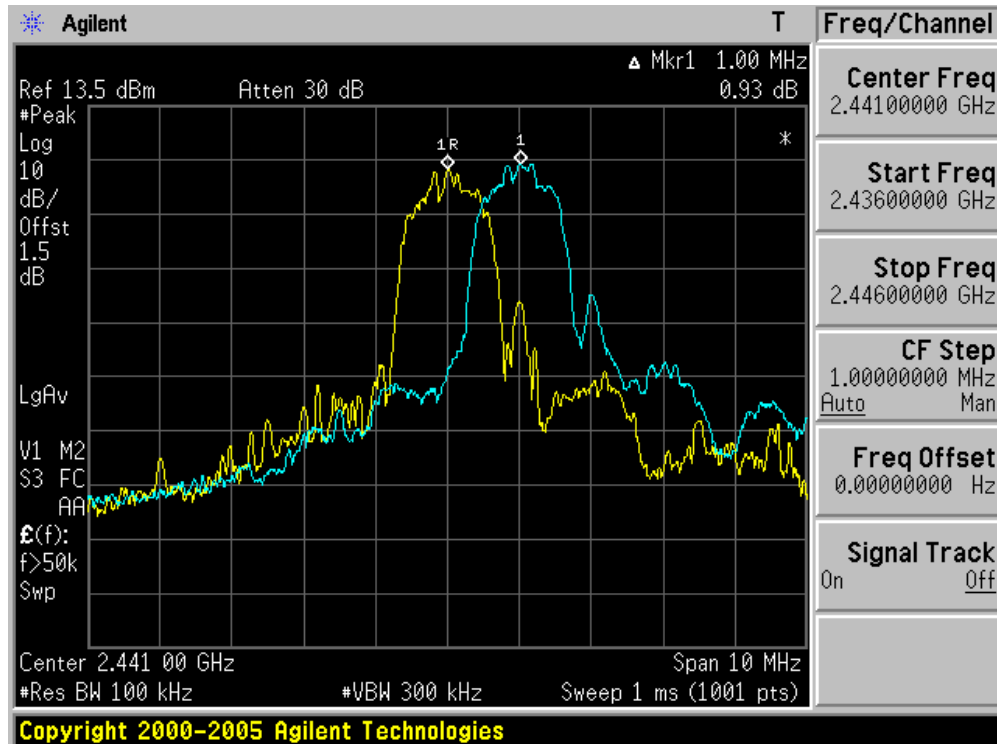
Product	:	UMA
Test Item	:	Carrier Frequency Separation
Test Site	:	NO.3
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
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

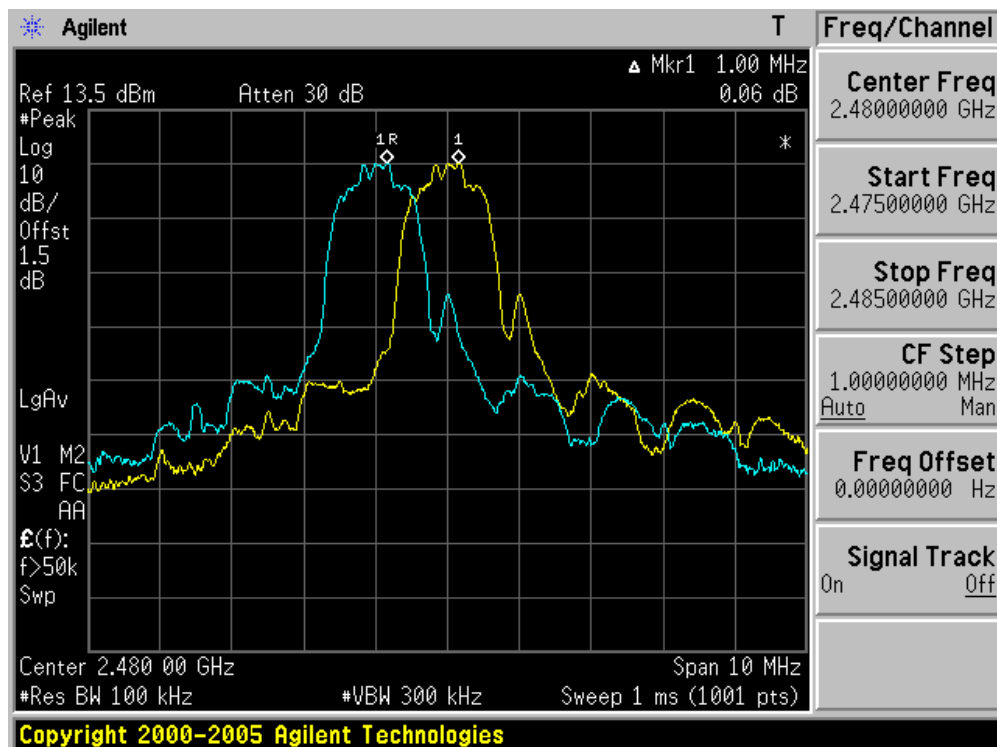
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



7. Number of Hopping Frequencies

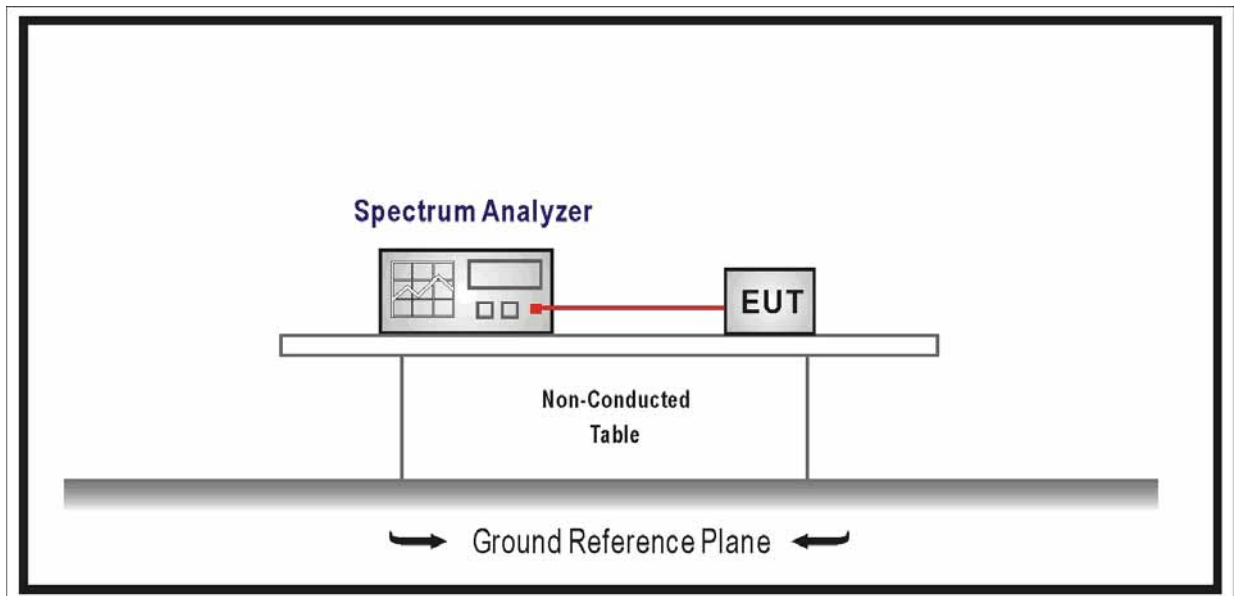
7.1. Test Equipment

Number of Hopping Frequencies / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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

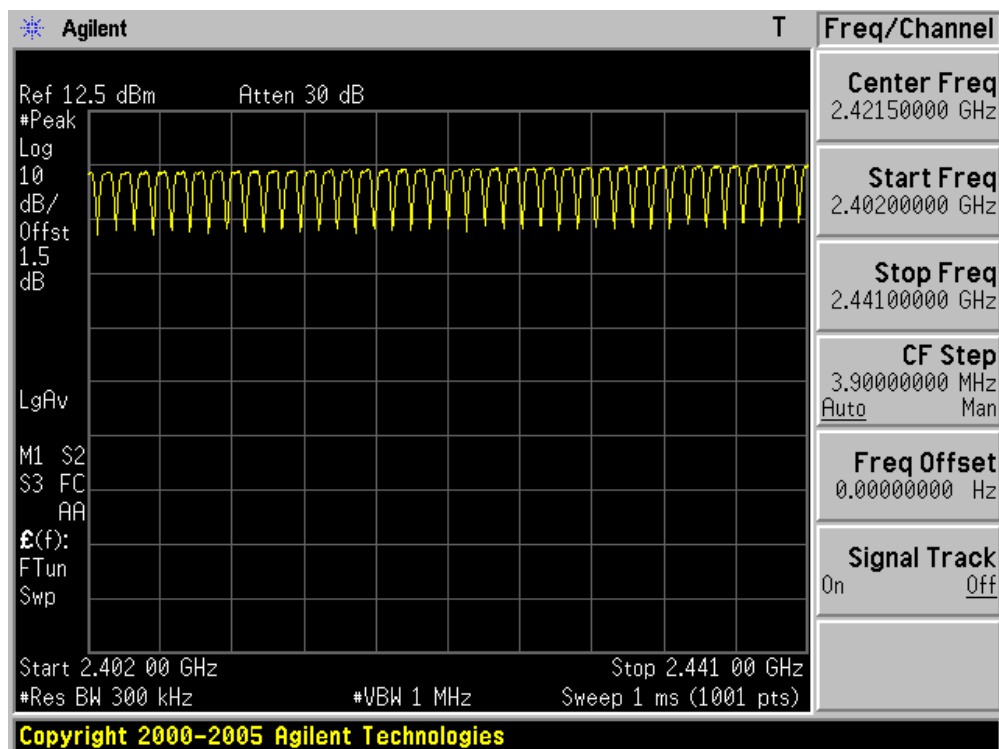
The measurement uncertainty is defined as ± 1 kHz

7.6. Test Result

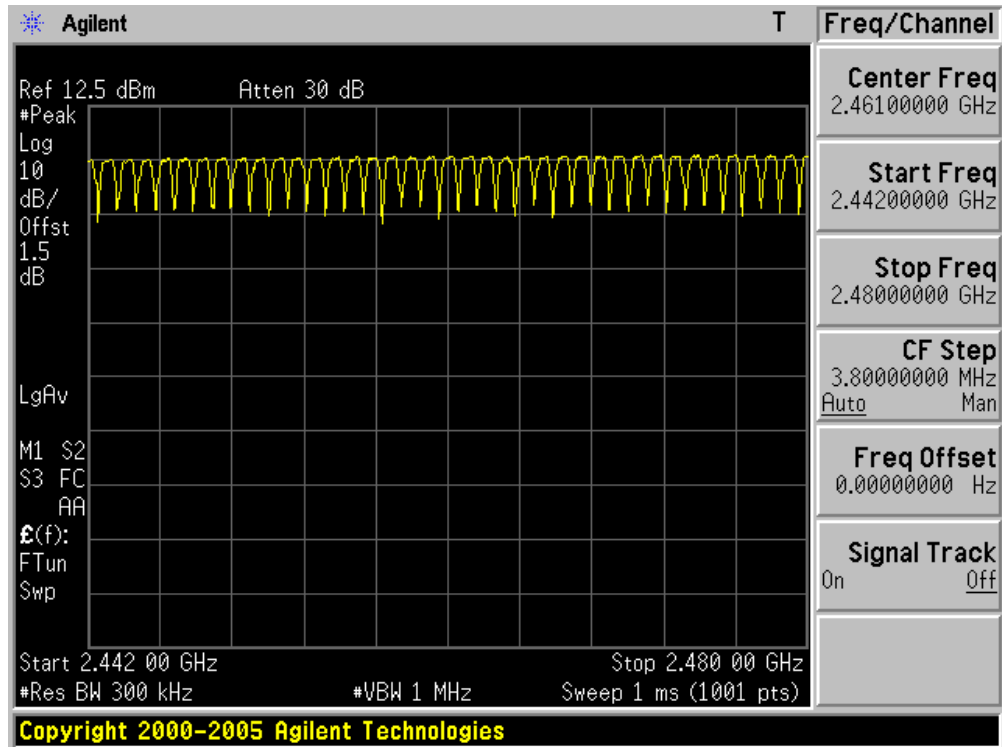
Product	:	UMA
Test Item	:	Number of Hopping Frequencies
Test Site	:	NO.3
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)

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

2402 - 2441 MHz



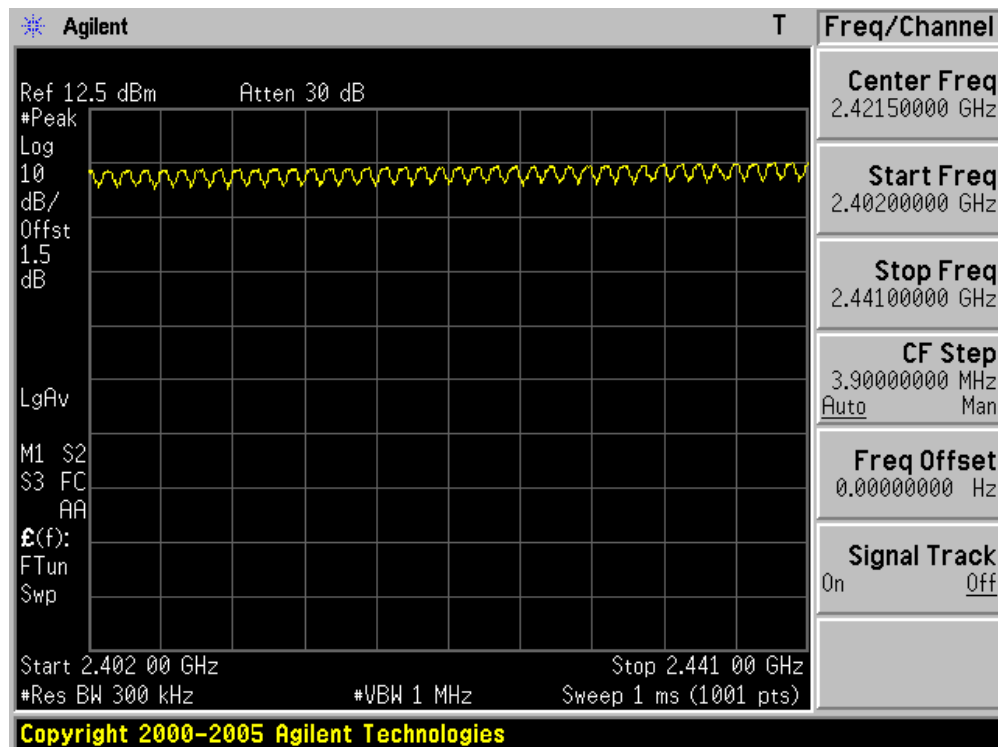
2442 - 2480 MHz



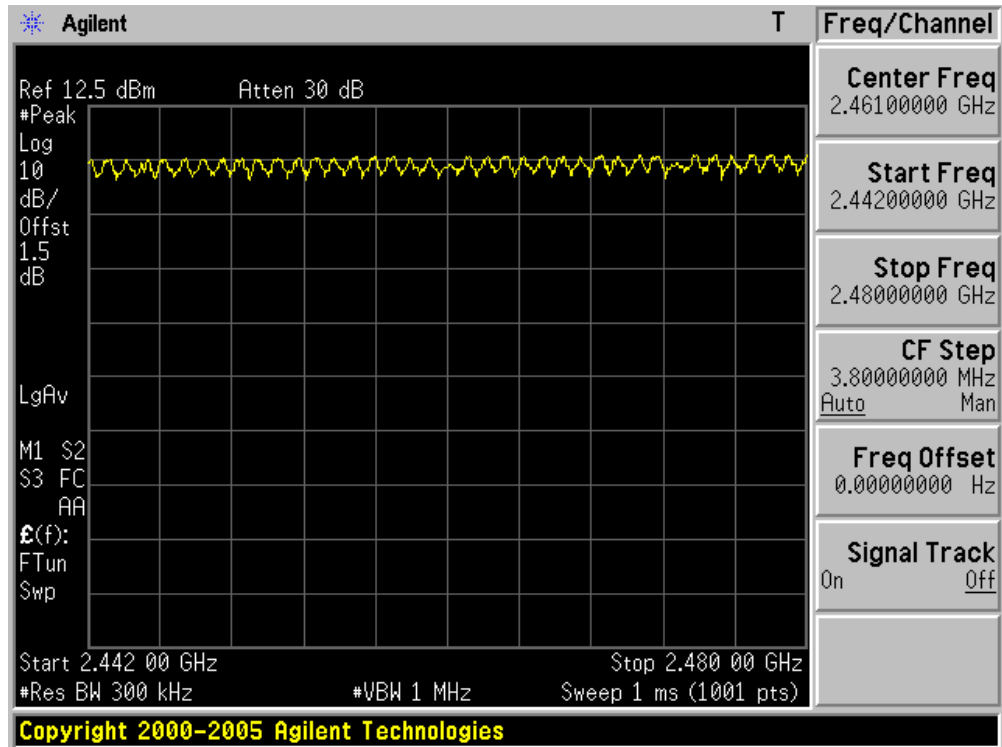
Product	:	UMA
Test Item	:	Number of Hopping Frequencies
Test Site	:	NO.3
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

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

2402 - 2441 MHz



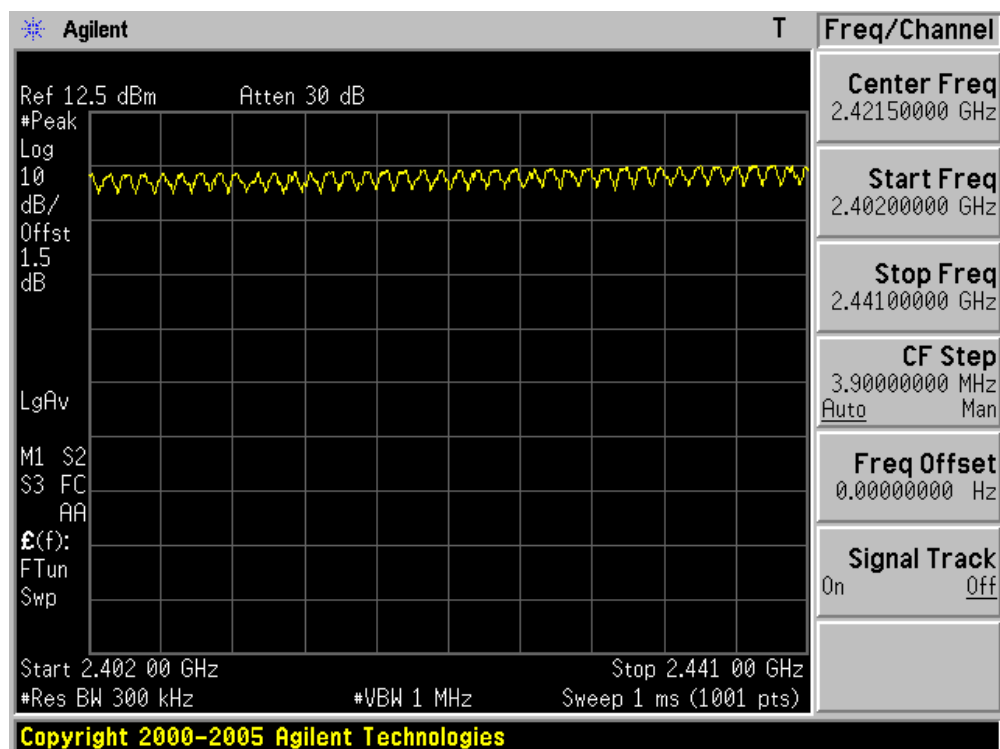
2442 - 2480 MHz



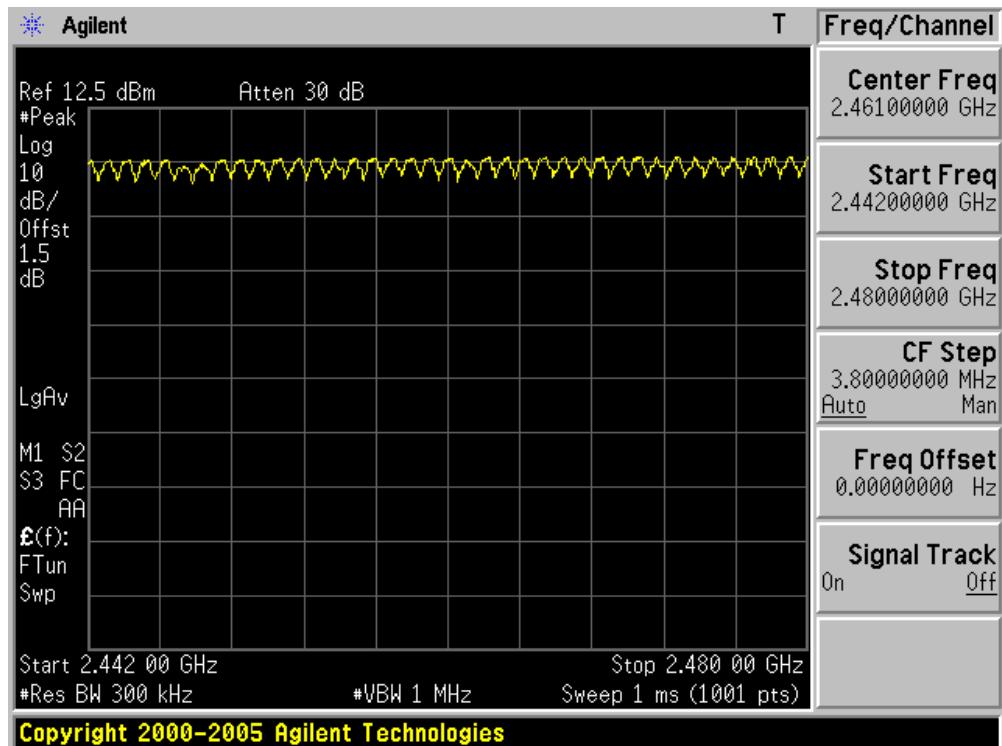
Product	:	UMA
Test Item	:	Number of Hopping Frequencies
Test Site	:	NO.3
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

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

2402 - 2441 MHz



2442 - 2480 MHz



8. Time of Occupancy (Dwell Time)

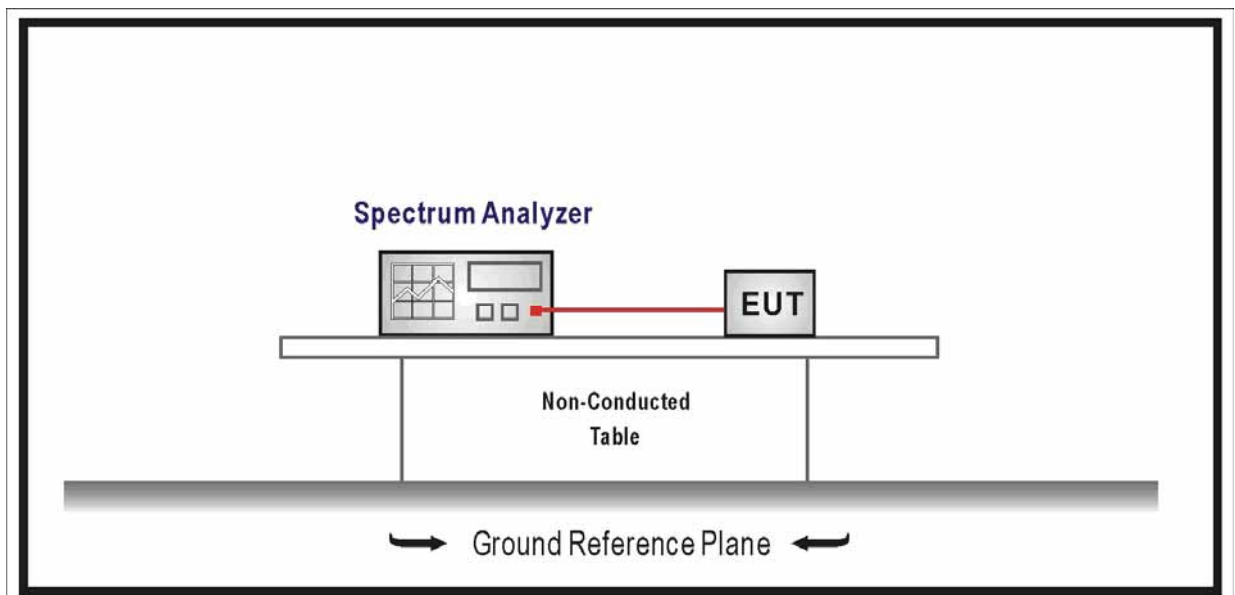
8.1. Test Equipment

Time of Occupancy (Dwell Time) / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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

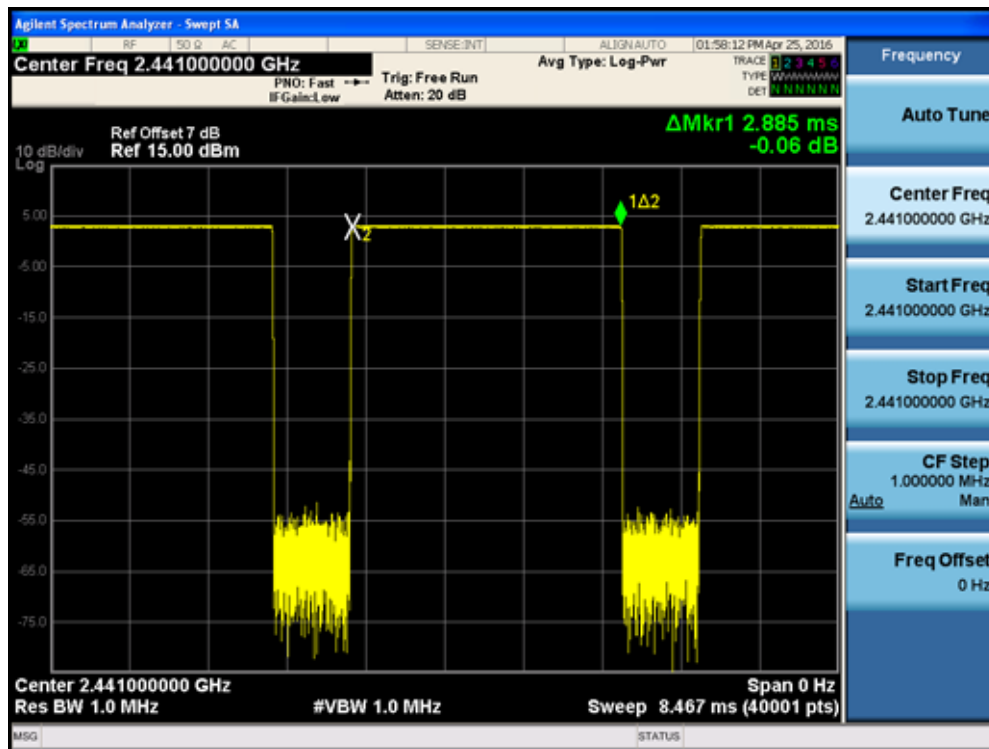
Product	:	UMA
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	NO.3
Test Mode	:	Transmitter-1Mbps (GFSK_DH1)

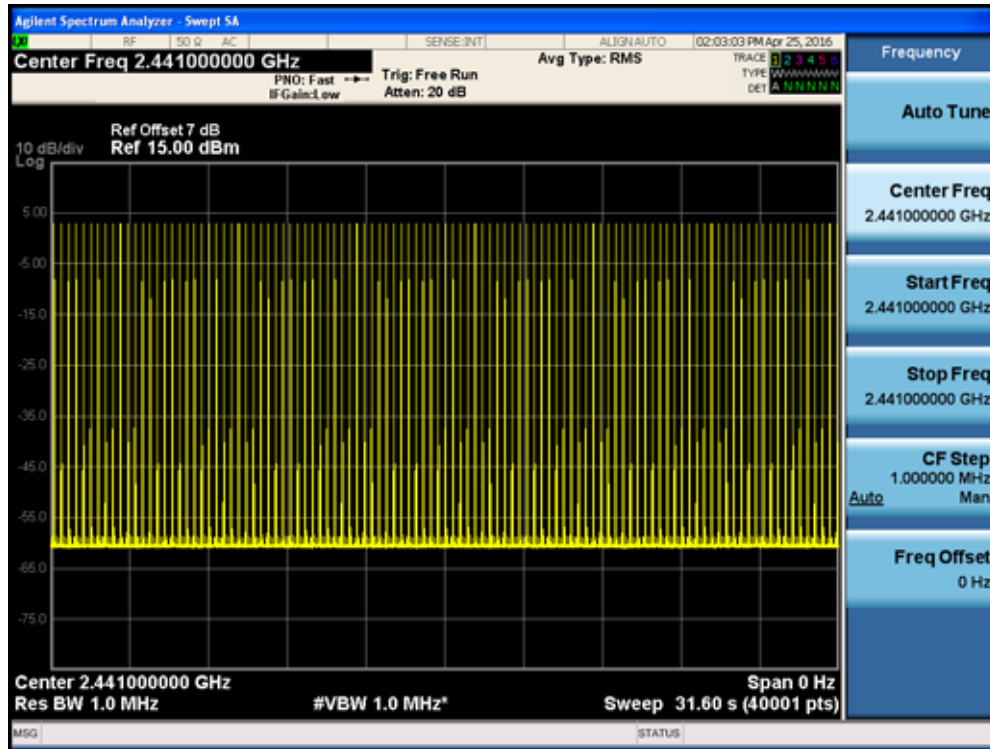
Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	363.51	< 400	Pass

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

- 2441MHz, The Maximum Occupancy Time Within 31.6sec: $2.885 \text{ ms} \times 126 = 363.51 \text{ msec}$

Channel 39 (2441MHz)-(DH1)





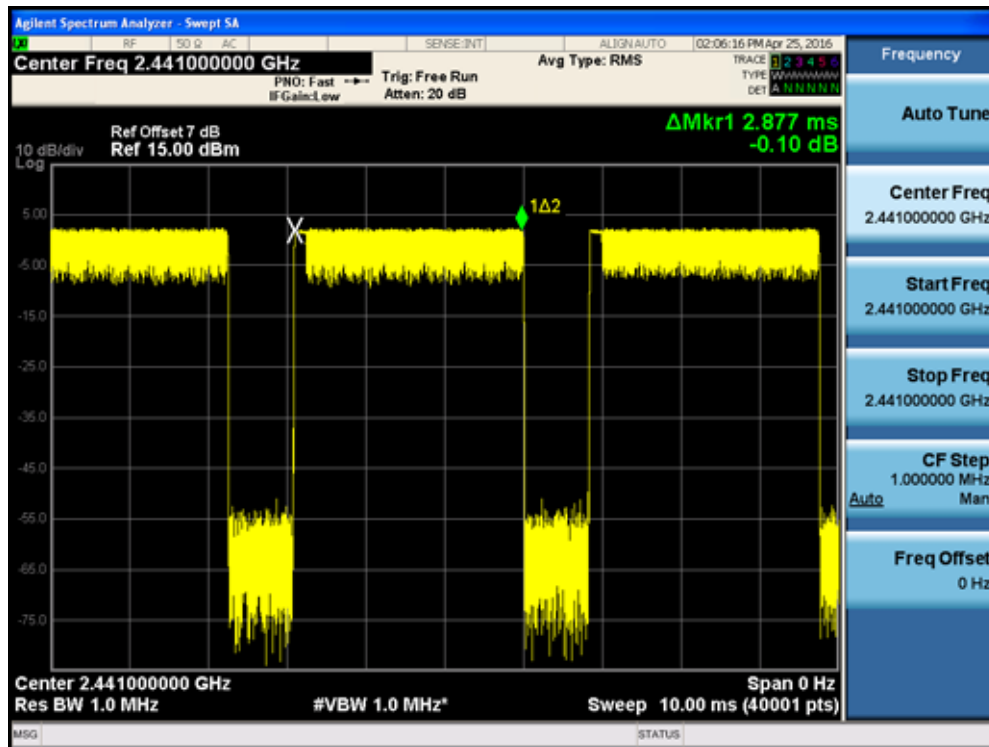
Product	:	UMA
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	NO.3
Test Mode	:	Transmitter-1Mbps (GFSK_DH3)

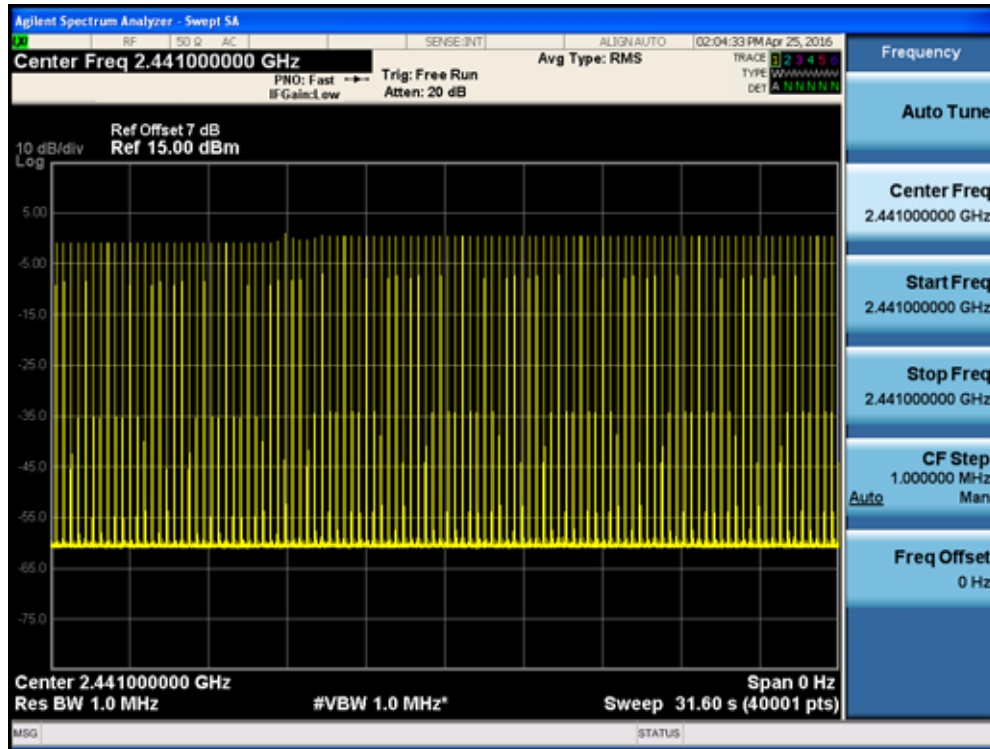
Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	327.978	< 400	Pass

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

- 2441MHz, The Maximum Occupancy Time Within 31.6sec: $2.877 \text{ ms} \times 114 = 327.978 \text{ msec}$

Channel 39 (2441MHz) - (DH3)





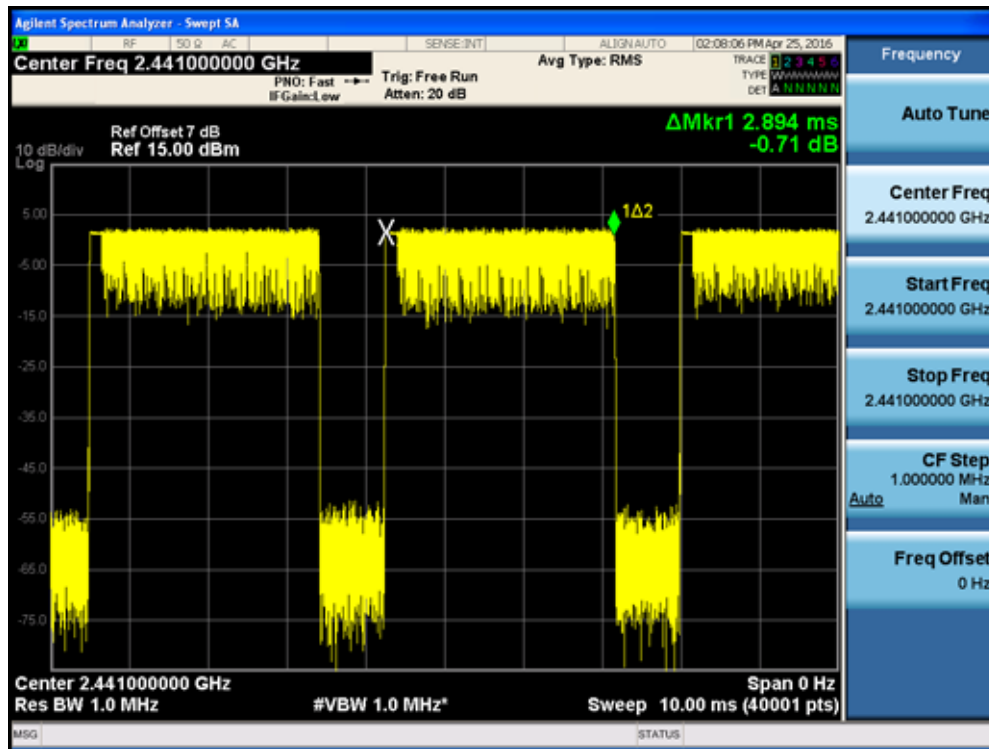
Product	:	UMA
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	NO.3
Test Mode	:	Transmitter-1Mbps (GFSK_DH5)

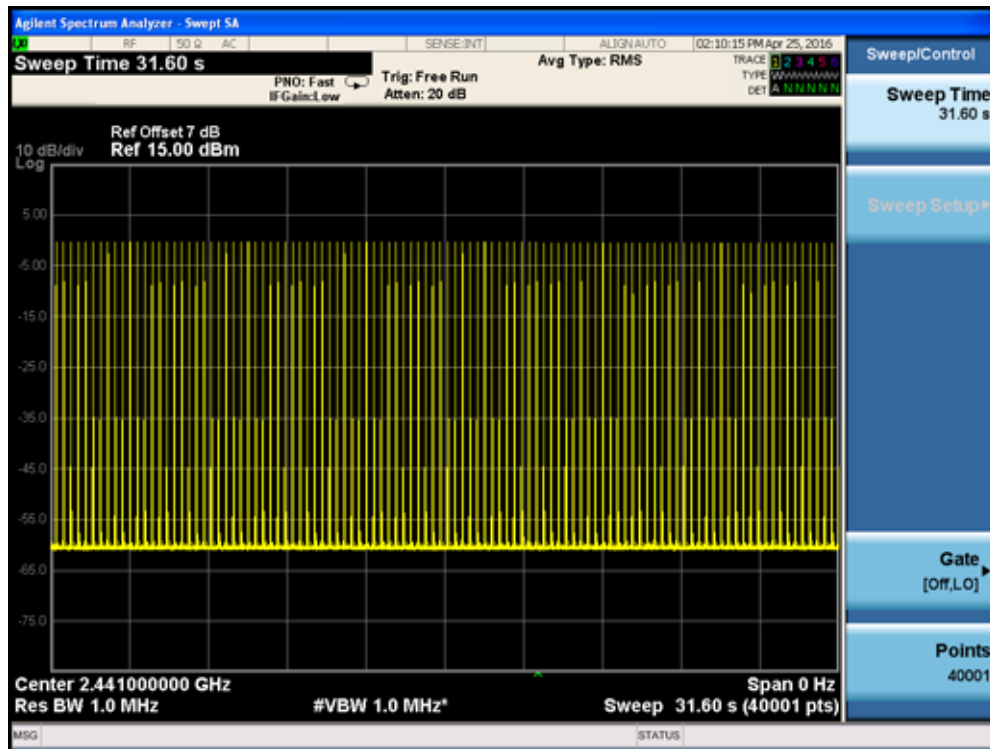
Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	321.23	< 400	Pass

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

- 2441MHz, The Maximum Occupancy Time Within 31.6sec: $2.894\text{ms} \times 111 = 321.23\text{msec}$

Channel 39 (2441MHz) - (DH5)





9. Peak Output Power

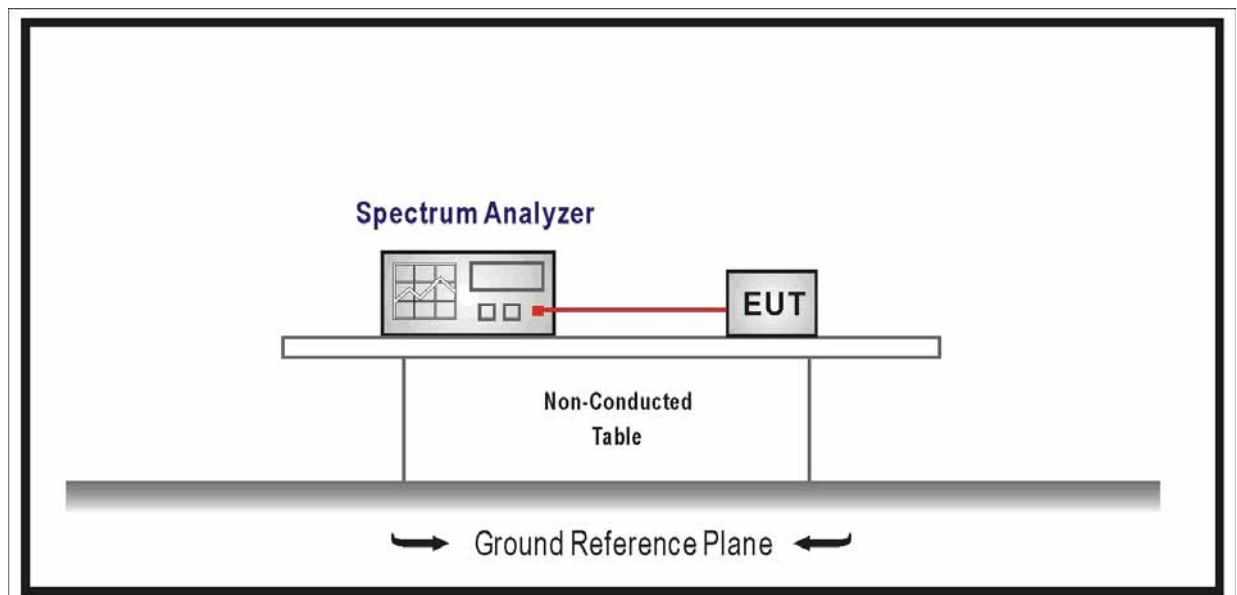
9.1. Test Equipment

Peak Output Power / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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 frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
- For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

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

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

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel

RBW $>$ the 20 dB bandwidth of the emission being measured.

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don't forget added the external attenuation and cable loss).

9.5. Uncertainty

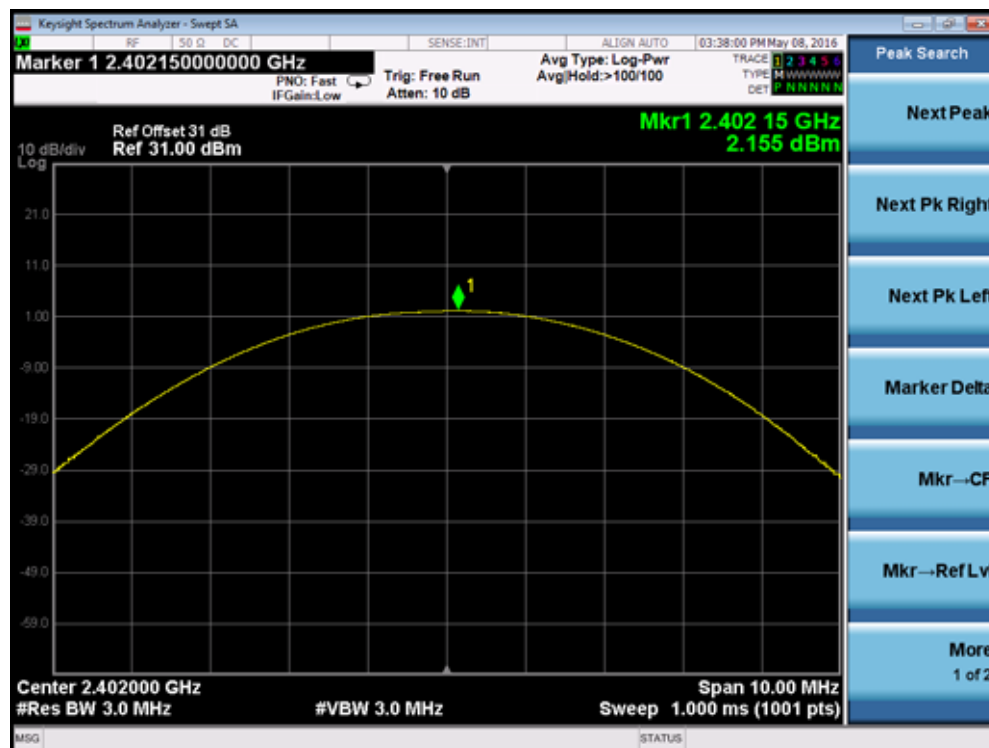
The measurement uncertainty is defined as ± 1.0 dB

9.6. Test Result

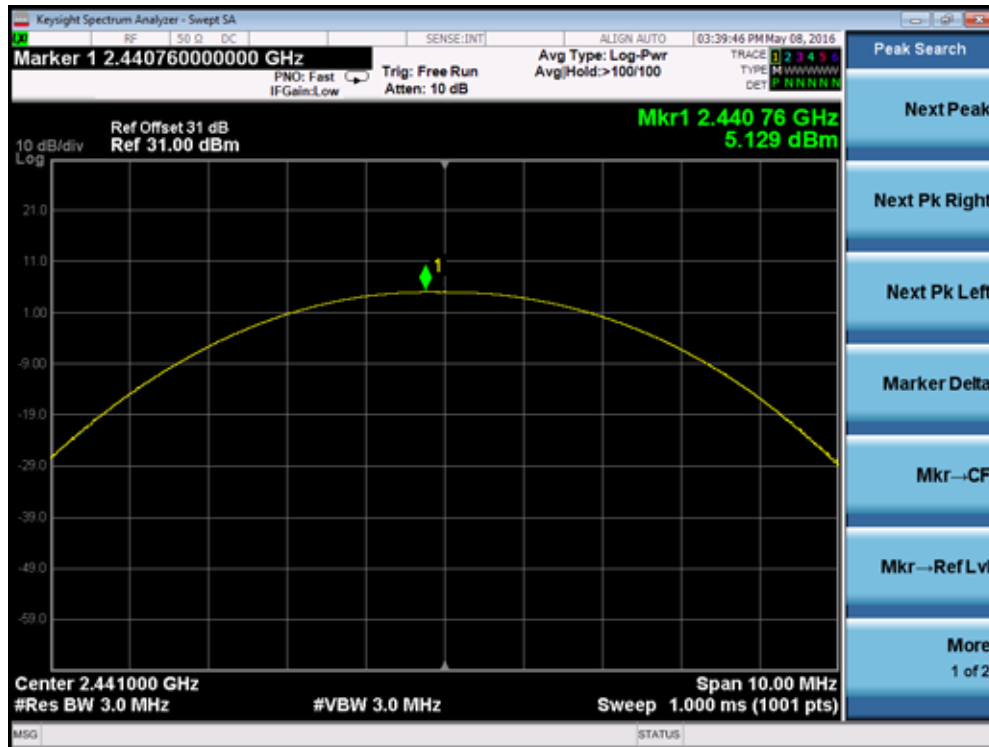
Product	:	UMA
Test Item	:	Power Output
Test Site	:	NO.3
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	2.155	30.00	Pass
39	2441	5.129	30.00	Pass
78	2480	6.467	30.00	Pass

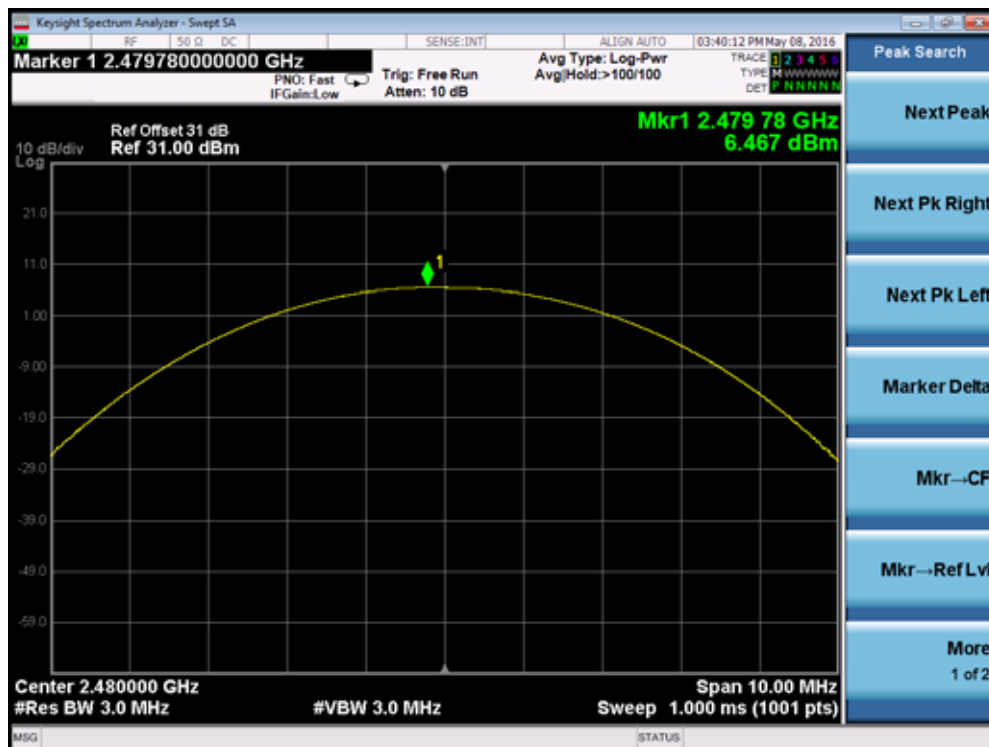
DH5 2402MHz



DH5 2441MHz



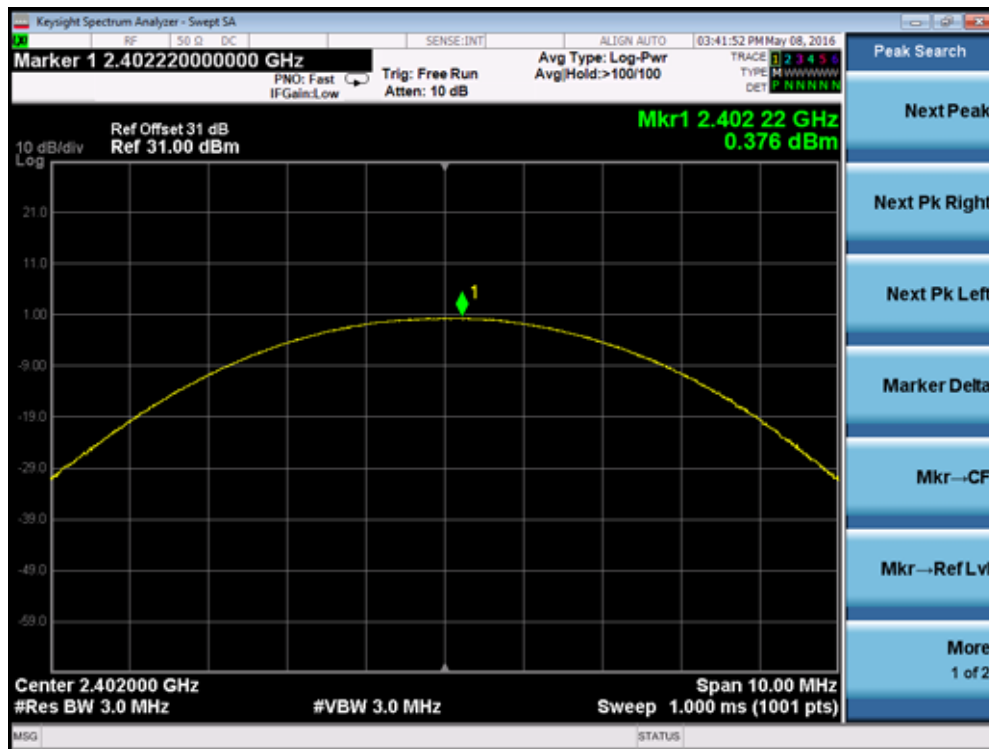
DH5 2480MHz



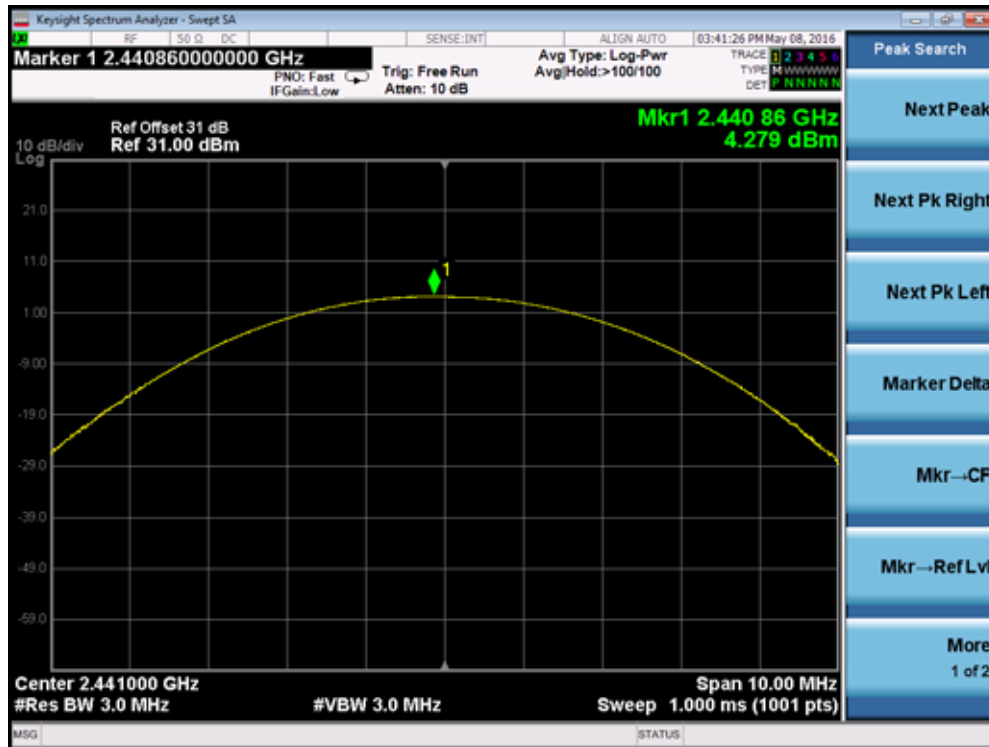
Product	:	UMA
Test Item	:	Power Output
Test Site	:	NO.3
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	0.376	30.00	Pass
39	2441	4.279	30.00	Pass
78	2480	5.645	30.00	Pass

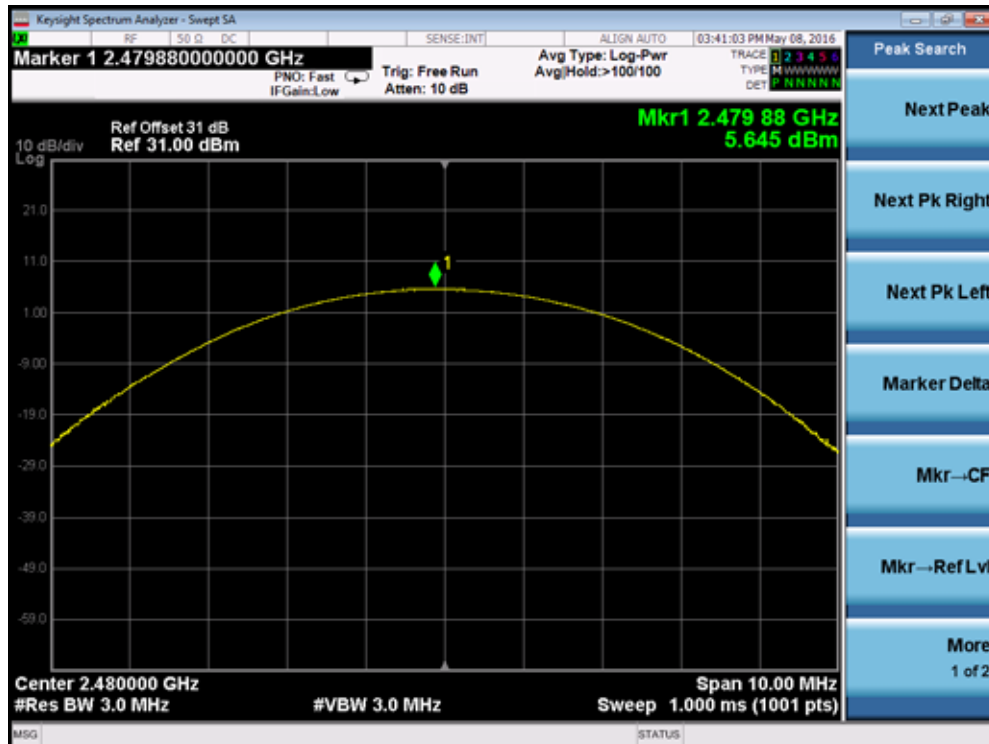
2DH5 2402MHz



2DH5 2441MHz



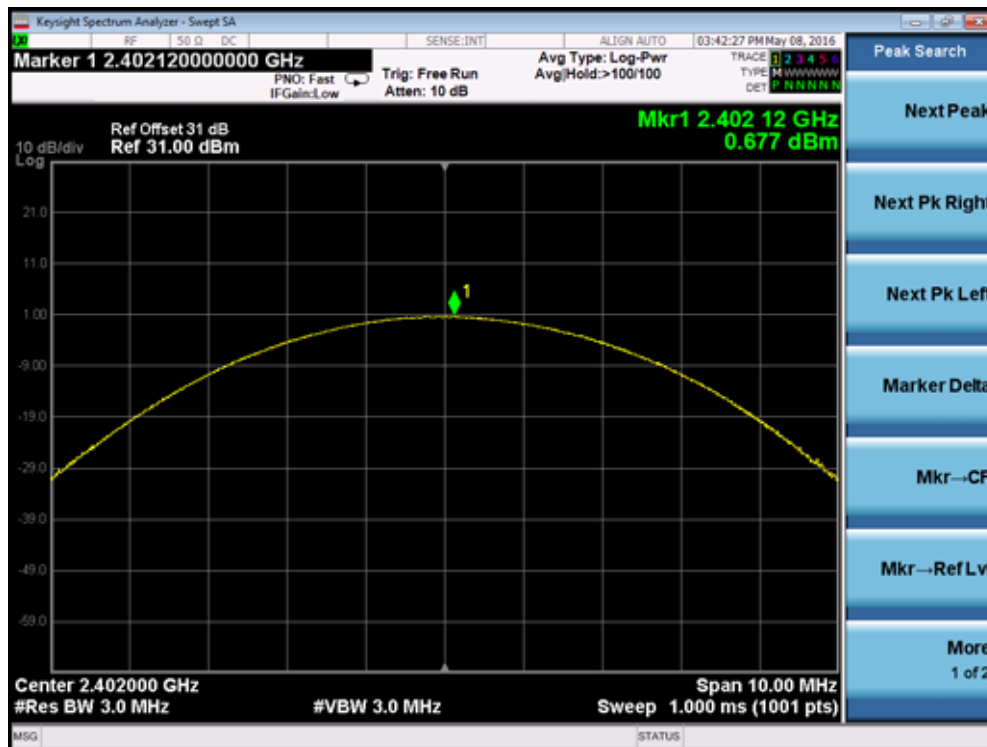
2DH5 2480MHz



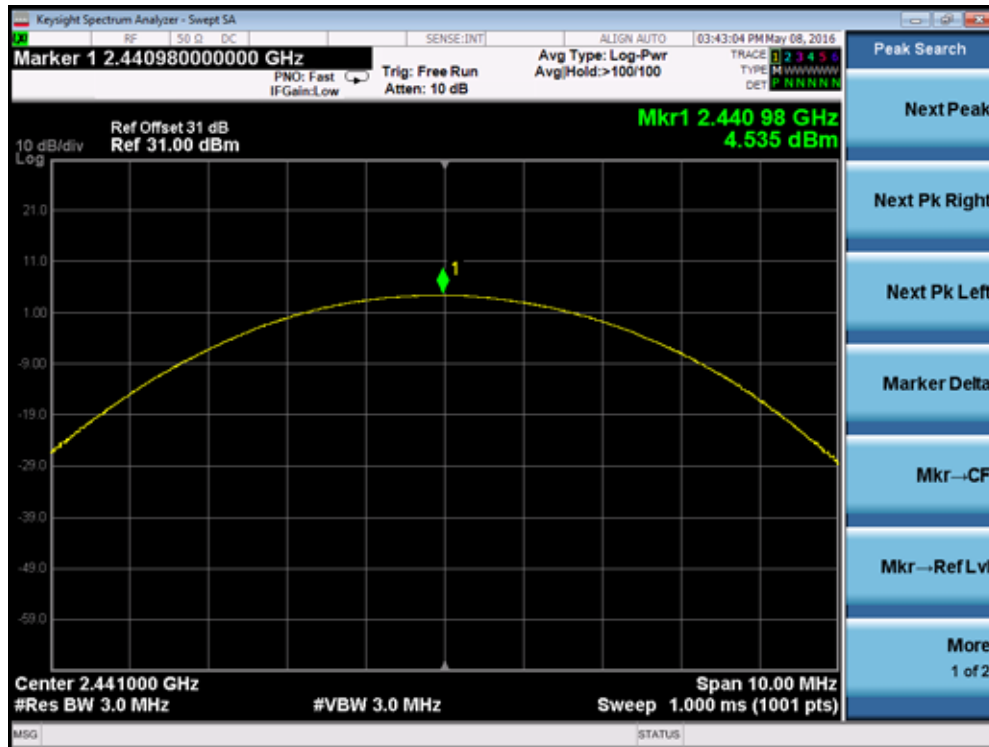
Product	:	UMA
Test Item	:	Power Output
Test Site	:	NO.3
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	0.677	30.00	Pass
39	2441	4.535	30.00	Pass
78	2480	5.887	30.00	Pass

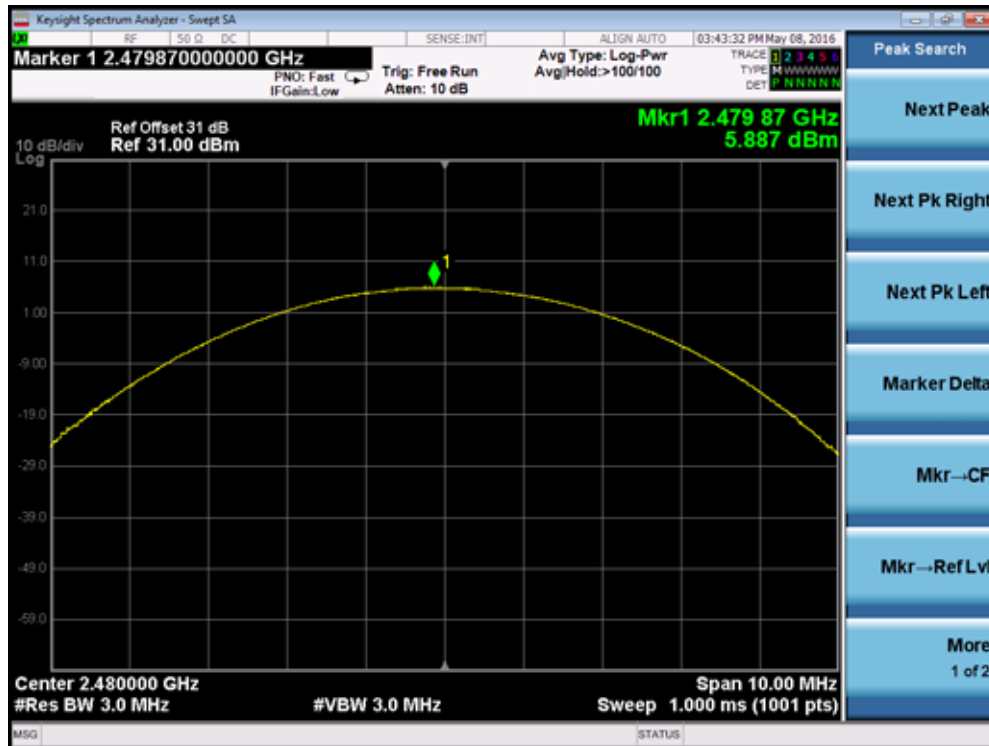
3DH5 2402MHz



3DH5 2441MHz



3DH5 2480MHz



10. Emissions in non-restricted frequency bands

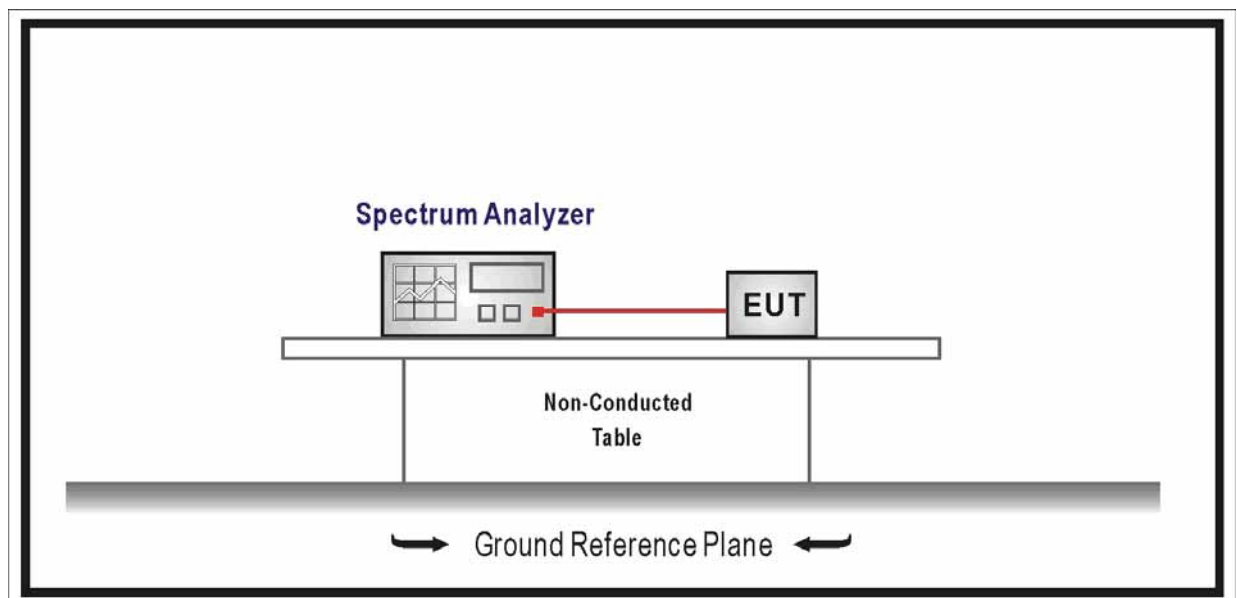
10.1 Test Equipment

Emissions in non-restricted frequency bands / NO.3

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04

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

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) of FCC part 15 is not required.

10.4 Test Procedure

According to ANSI C63.10: 2013.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

The level displayed must comply with the limit specified in this section.

10.5 Uncertainty

The measurement uncertainty is defined as ± 1.0 dB

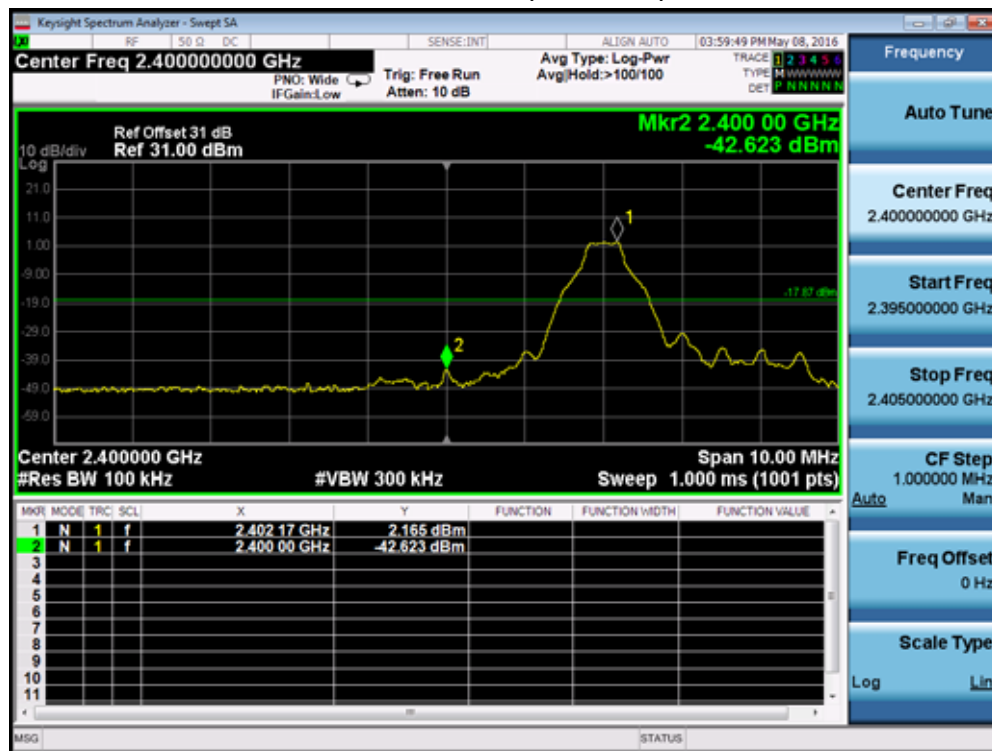
10.6 Test Result

Product	:	UMA
Test Item	:	Emissions in non-restricted frequency bands
Test Site	:	NO.3

Mode	Channel	Test Frequency (MHz)	In-Band PSD[a] (dBm/100kHz)	Frequency (MHz)	Out-Band PSD[b] (dBm/100kHz)	[a]-[b] (dB)	Limit (dB)	Result
1	00	2402	2.17	2400.00	-42.62	44.79	>20	Pass
1	78	2480	6.46	2483.50	-49.06	55.52	>20	Pass
2	00	2402	-1.09	2400.00	-46.91	45.82	>20	Pass
2	78	2480	4.78	2483.50	-48.37	53.15	>20	Pass
3	00	2402	-1.02	2400.00	-47.69	46.67	>20	Pass
3	78	2480	4.86	2483.50	-48.58	53.44	>20	Pass

Note: The worst case of Emissions in non-restricted frequency bands as below:

Mode 1 CH00(2402MHz)



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

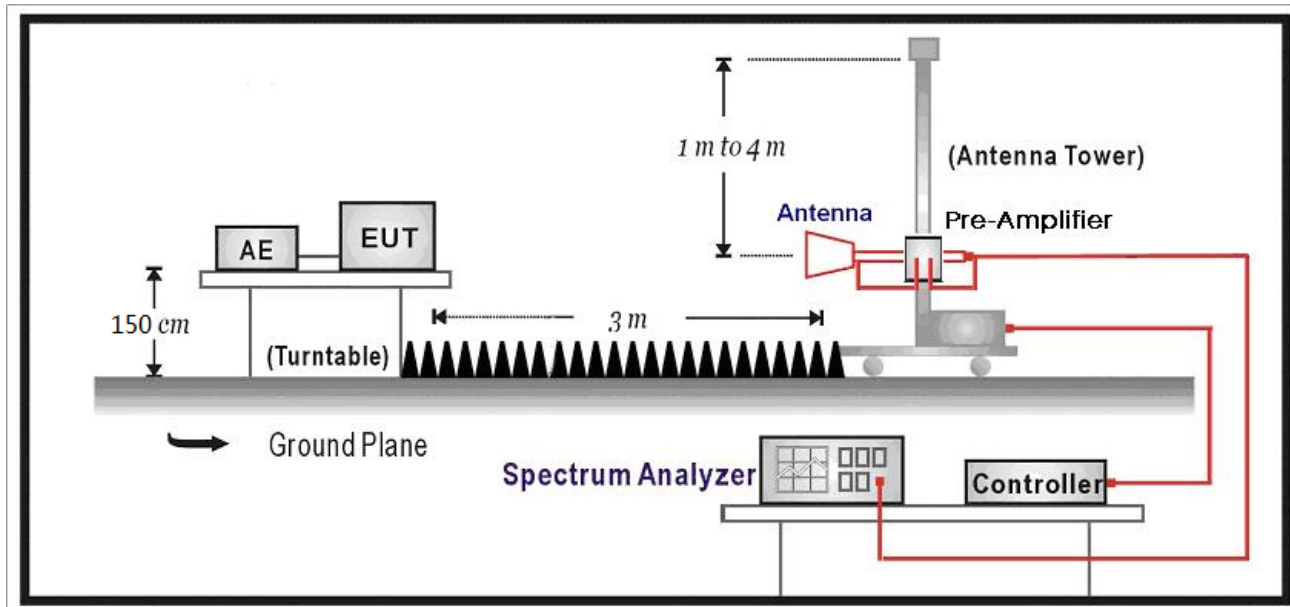
11 Radiated Emission Band Edge

11.1 Test Equipment

☒ Radiated Emission Band Edge / CB7

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2017.02.04
Preamplifier	Miteq	NSP1800-25	1364185	2017.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2017.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2017.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2016.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2017.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2017.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2017.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.08.07

11.2 Test Setup



11.3 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) of FCC part 15.

11.4 Test Procedure

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

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 to 10 Hz, 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 dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit 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-delta” method may be employed.

11.5 Uncertainty

The measurement uncertainty above 1G is defined as $\pm 3.9 \text{ dB}$
 below 1G is defined as $\pm 3.8 \text{ dB}$

11.6 Test Result

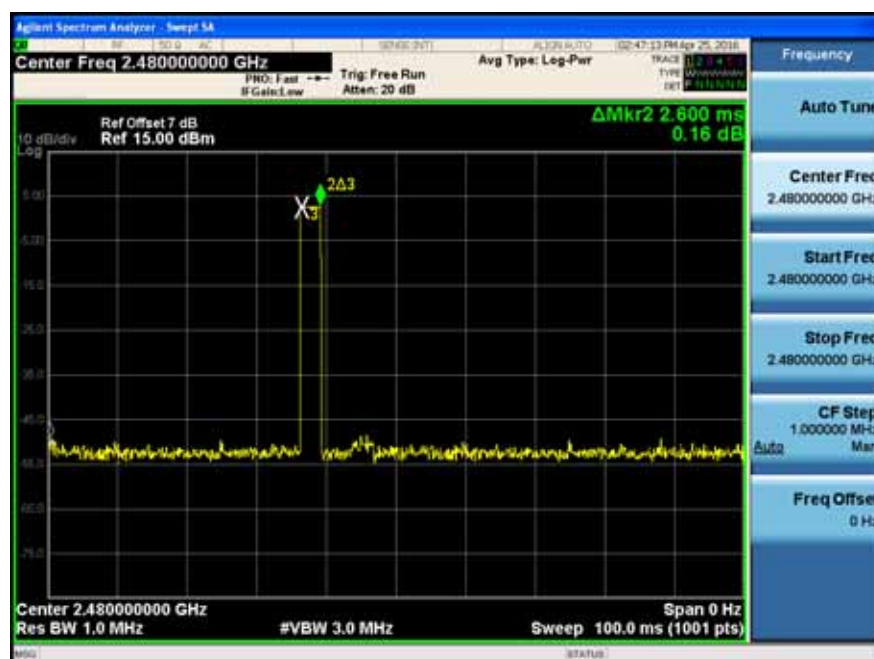
All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

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

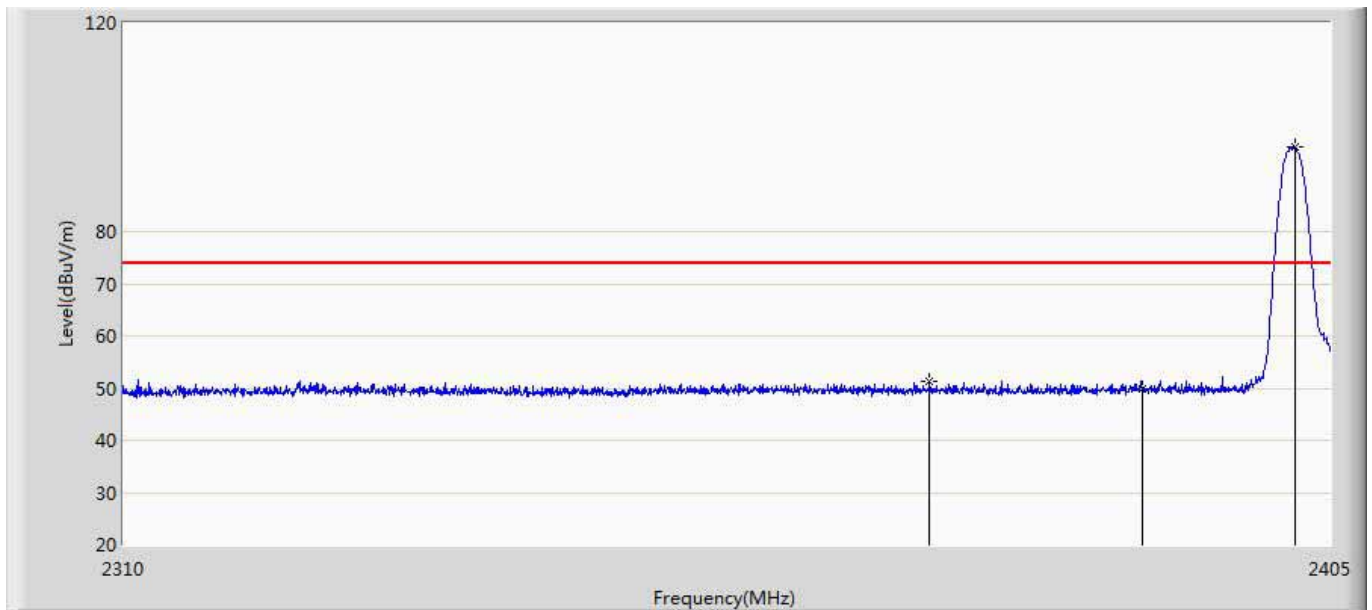
Average = Peak Measure Level+ Duty Factor

Duty Factor= $20 \cdot \text{LOG}(\text{Pulse Number} \cdot \text{On Time}/100) = -31.7 \text{ dB}$ in worst condition in normal use.

Pulse Number



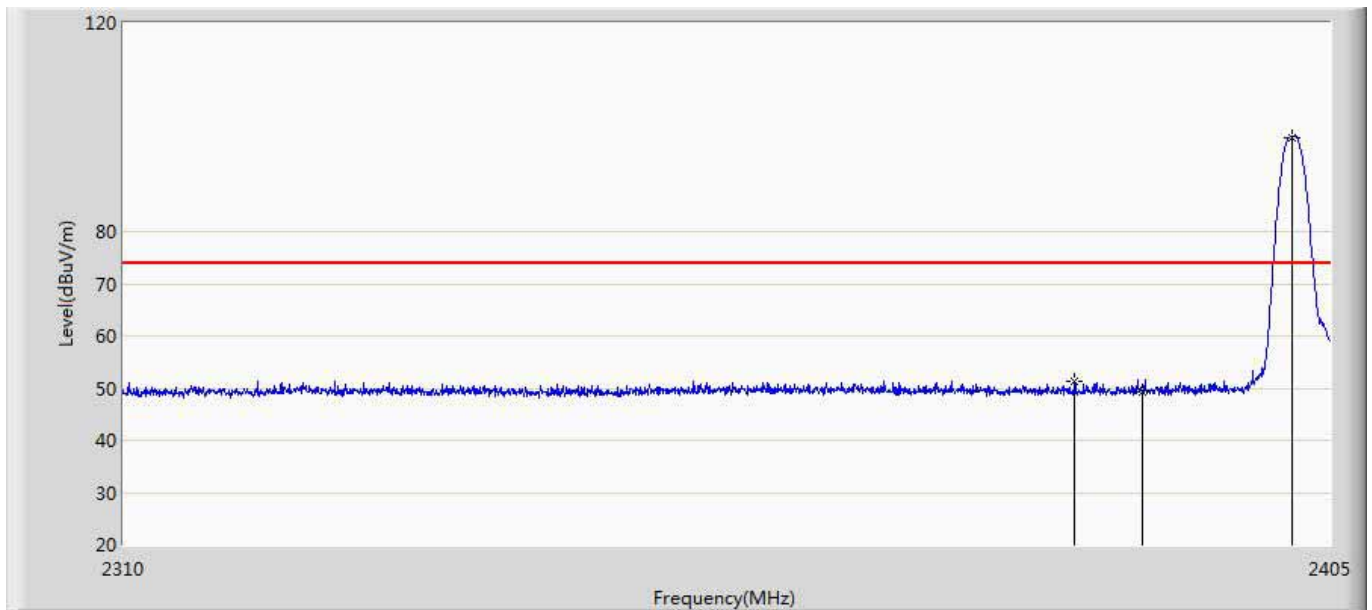
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2373.080	51.403	13.513	-22.597	74.000	37.890	PK
2		2390.000	49.805	11.942	-24.195	74.000	37.863	PK
3	*	2402.198	96.207	58.367	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2373.080	51.403	19.703	-34.297	54.000	-31.70	AV
2		2390.000	49.805	18.105	-35.895	54.000	-31.70	AV
3	*	2402.198	96.207	64.507	N/A	N/A	-31.70	AV

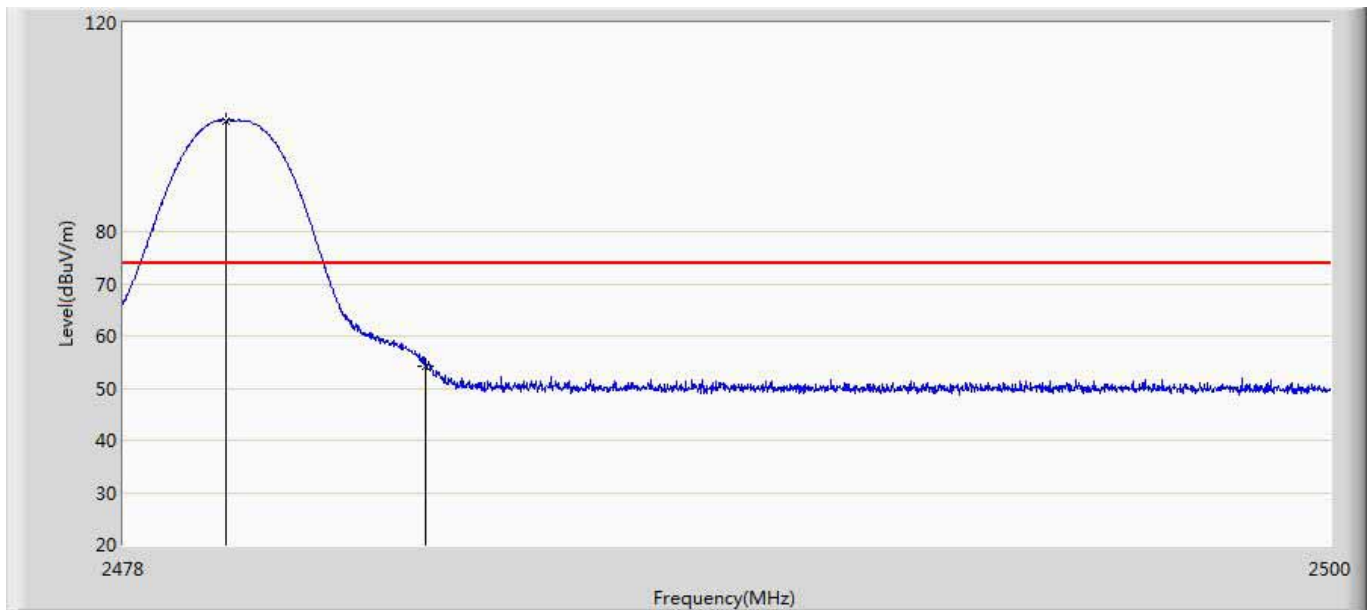
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2384.575	51.219	13.335	-22.781	74.000	37.883	PK
2		2390.000	49.178	11.315	-24.822	74.000	37.863	PK
3	*	2401.913	98.107	60.267	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2384.575	51.219	19.519	-34.481	54.000	-31.70	AV
2		2390.000	49.178	17.478	-36.522	54.000	-31.70	AV
3	*	2401.913	98.107	66.407	N/A	N/A	-31.70	AV

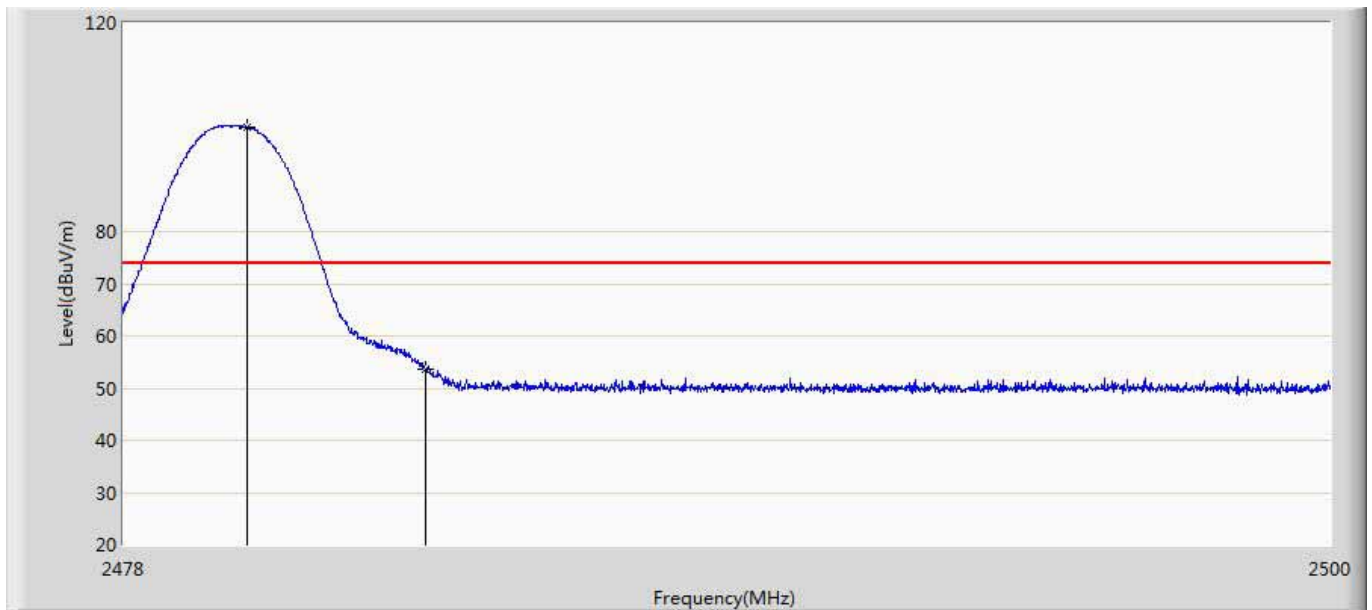
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.870	101.263	63.250	N/A	N/A	38.013	PK
2		2483.500	54.072	16.034	-19.928	74.000	38.038	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2479.870	101.263	69.563	N/A	N/A	-31.70	AV
2	*	2483.500	54.072	22.372	-31.628	54.000	-31.70	AV

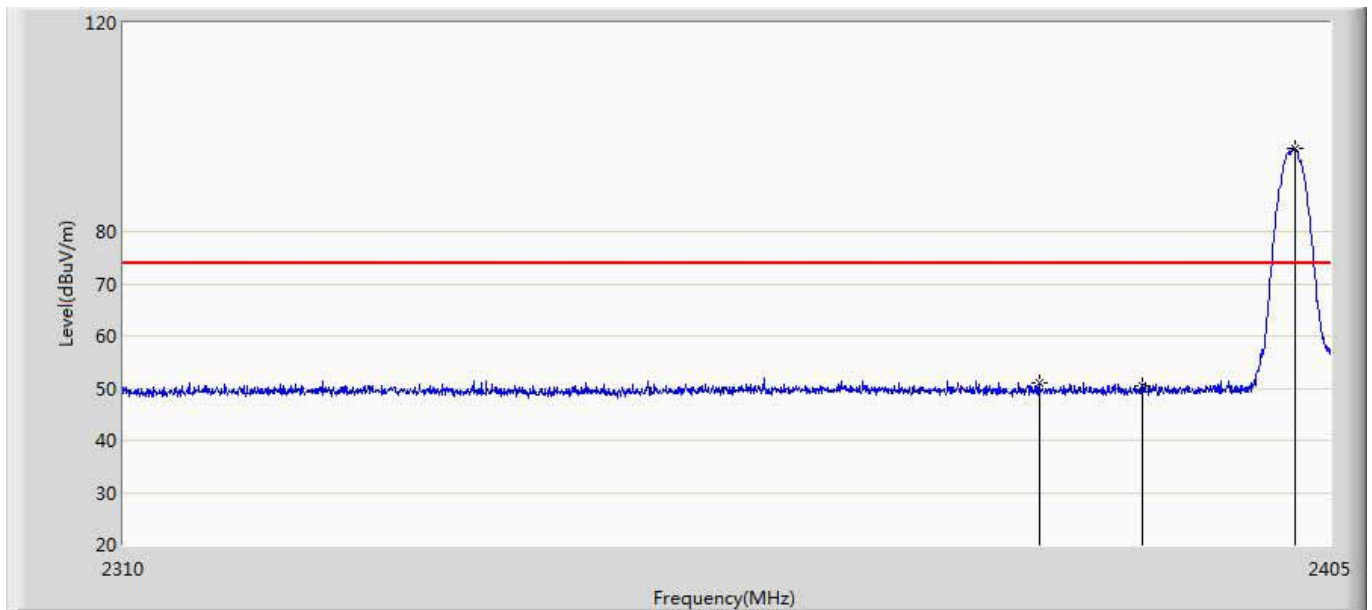
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.255	100.038	62.023	N/A	N/A	38.015	PK
2		2483.500	53.482	15.444	-20.518	74.000	38.038	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2480.255	100.038	68.338	N/A	N/A	-31.70	AV
2		2483.500	53.482	21.782	-32.218	54.000	-31.70	AV

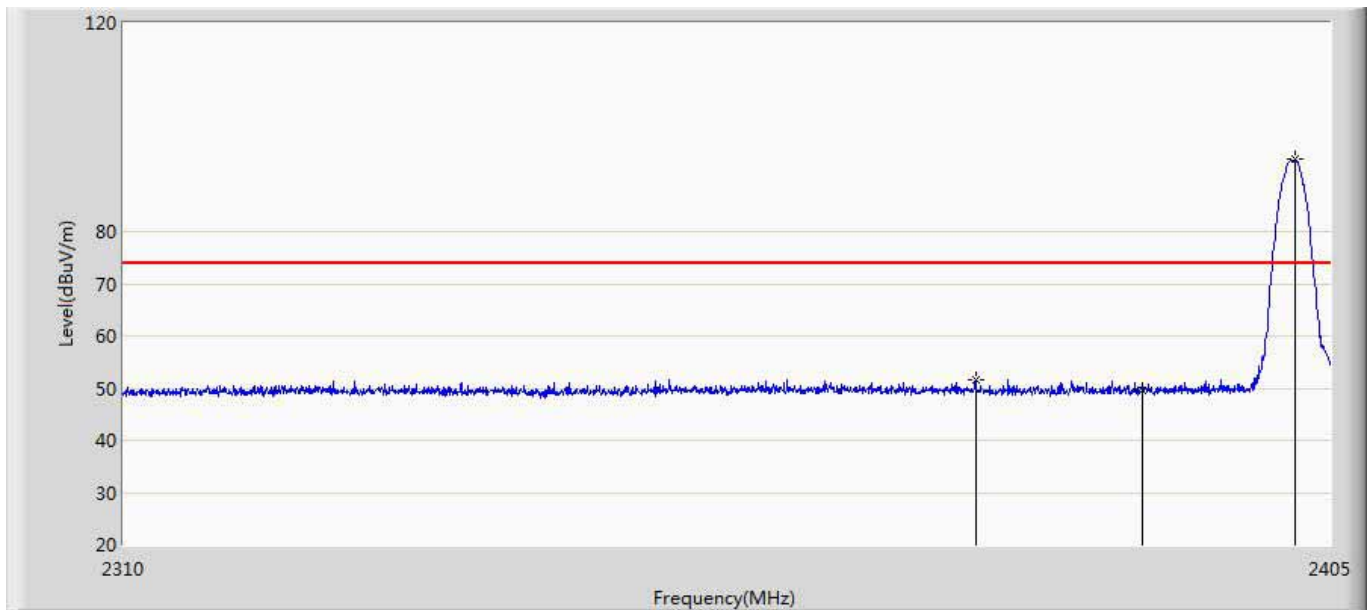
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2381.772	50.916	13.022	-23.084	74.000	37.894	PK
2		2390.000	50.461	12.598	-23.539	74.000	37.863	PK
3	*	2402.198	96.030	58.190	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2381.772	50.916	19.216	-34.784	54.000	-31.70	AV
2		2390.000	50.461	18.761	-35.239	54.000	-31.70	AV
3	*	2402.198	96.030	64.33	N/A	N/A	-31.70	AV

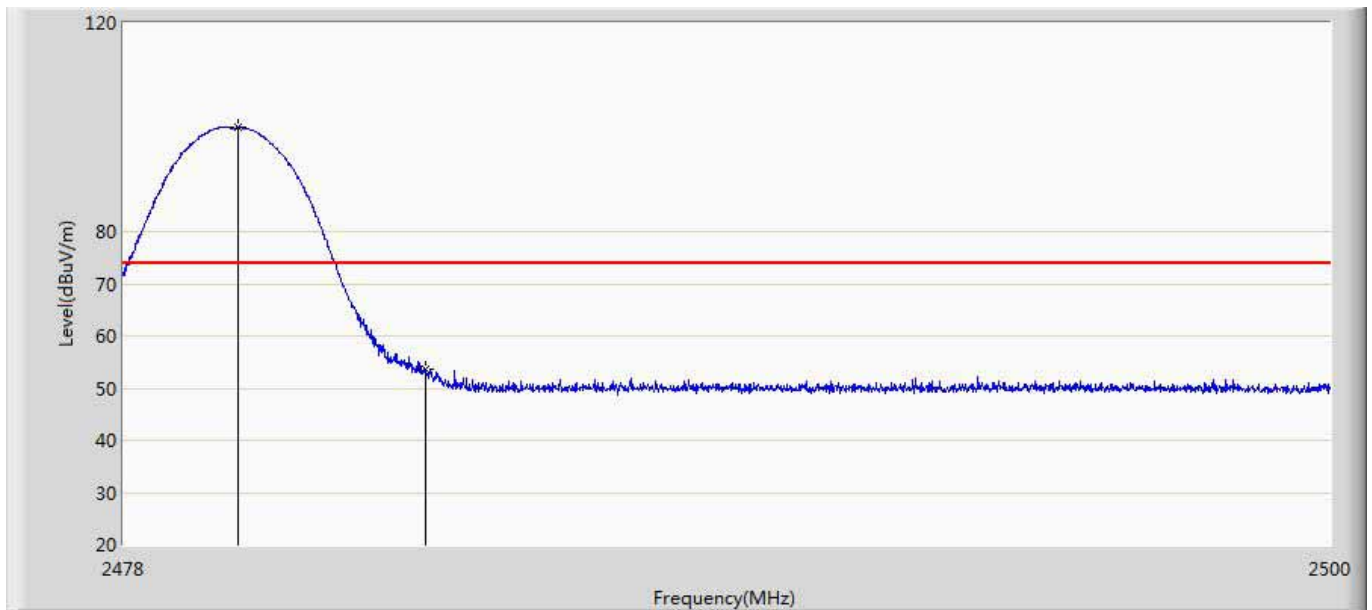
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2376.690	51.610	13.700	-22.390	74.000	37.911	PK
2		2390.000	49.659	11.796	-24.341	74.000	37.863	PK
3	*	2402.198	93.924	56.084	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2376.690	51.610	19.91	-34.09	54.000	-31.70	AV
2		2390.000	49.659	17.959	-36.041	54.000	-31.70	AV
3	*	2402.198	93.924	62.224	N/A	N/A	-31.70	AV

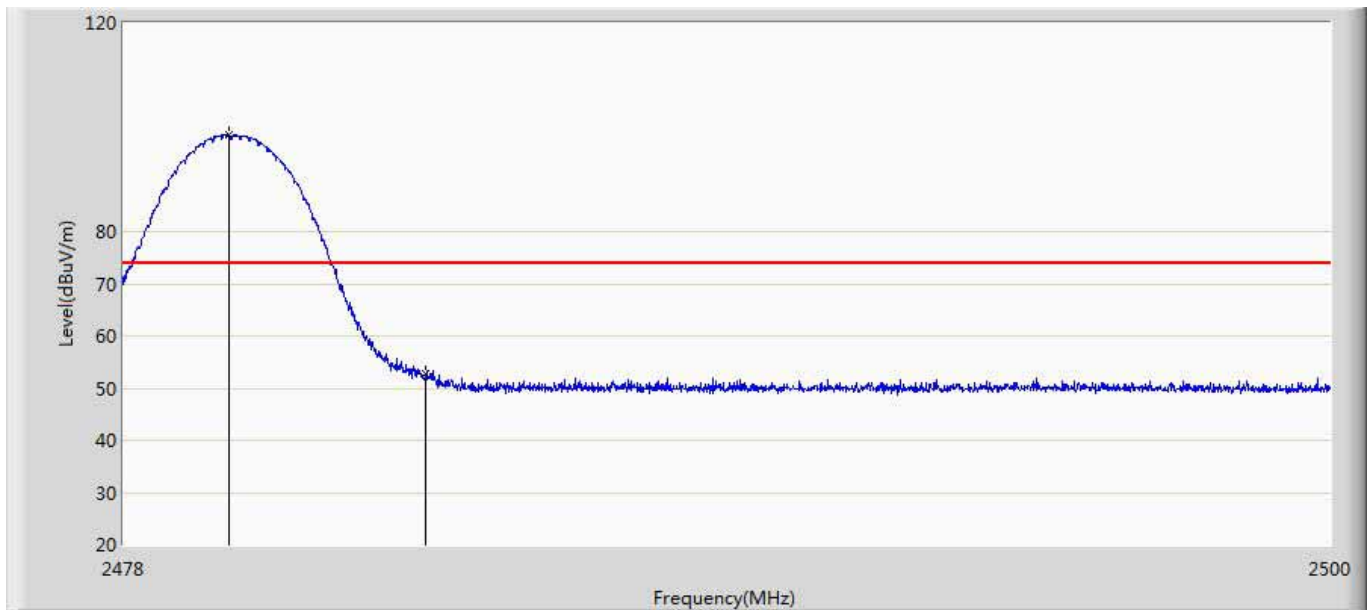
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.079	99.949	61.935	N/A	N/A	38.014	PK
2		2483.500	53.499	15.461	-20.501	74.000	38.038	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2480.079	99.949	68.249	N/A	N/A	-31.70	AV
2		2483.500	53.499	21.799	-32.201	54.000	-31.70	AV

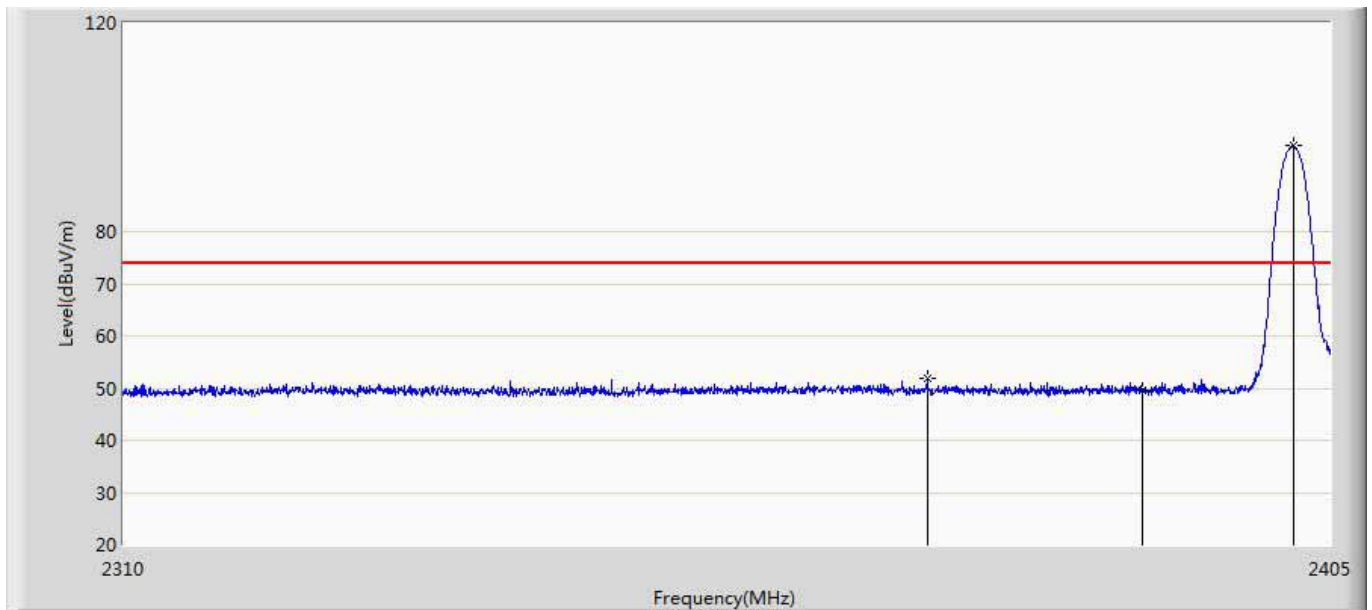
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.914	98.419	60.406	N/A	N/A	38.013	PK
2		2483.500	52.793	14.755	-21.207	74.000	38.038	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.914	98.419	66.719	N/A	N/A	-31.70	AV
2		2483.500	52.793	21.093	-32.907	54.000	-31.70	AV

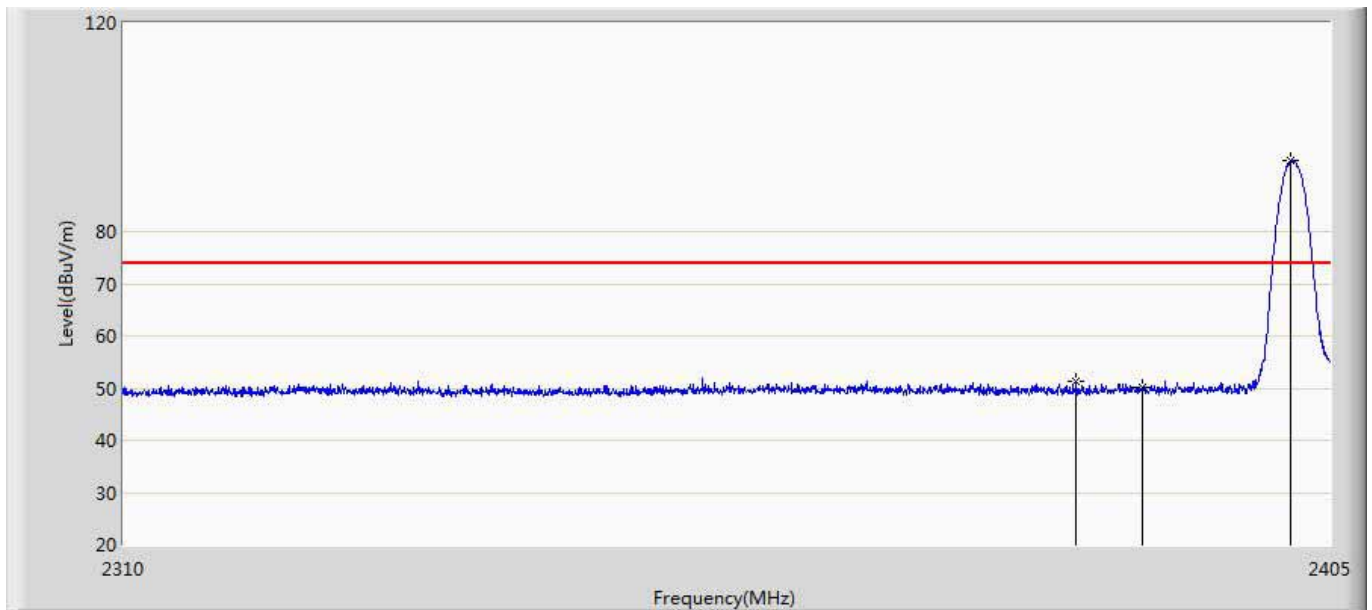
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2372.890	51.796	13.907	-22.204	74.000	37.889	PK
2		2390.000	49.633	11.770	-24.367	74.000	37.863	PK
3	*	2402.055	96.567	58.727	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2372.890	51.796	20.096	-33.904	54.000	-31.70	AV
2		2390.000	49.633	17.933	-36.067	54.000	-31.70	AV
3	*	2402.055	96.567	64.867	N/A	N/A	-31.70	AV

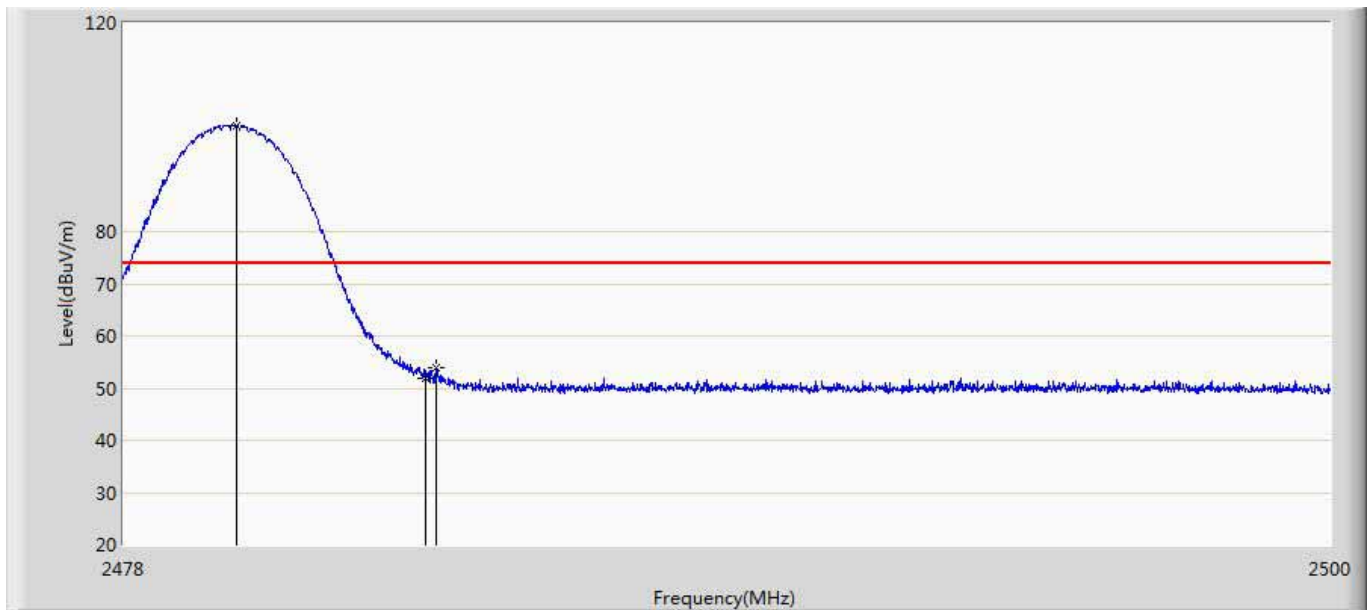
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2402Mhz by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2384.718	51.312	13.429	-22.688	74.000	37.883	PK
2		2390.000	50.044	12.181	-23.956	74.000	37.863	PK
3	*	2401.865	93.506	55.666	N/A	N/A	37.840	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2384.718	51.312	19.612	-34.388	54.000	-31.70	AV
2		2390.000	50.044	18.344	-35.656	54.000	-31.70	AV
3	*	2401.865	93.506	61.806	N/A	N/A	-31.70	AV

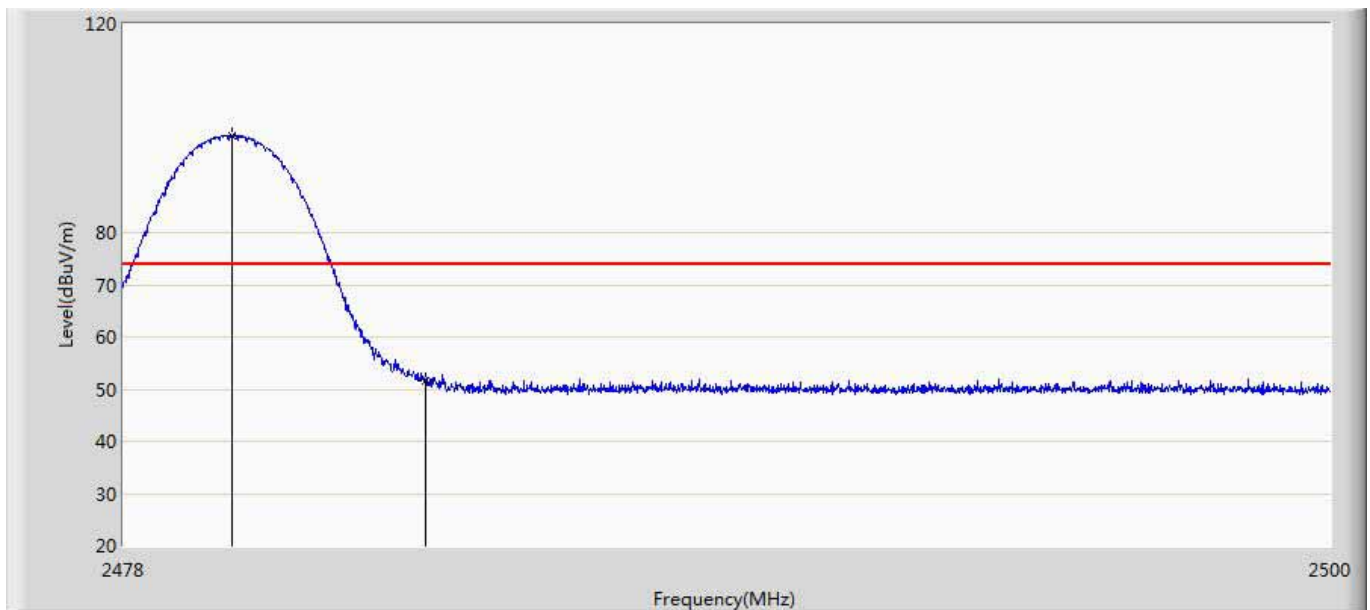
Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.046	100.377	62.363	N/A	N/A	38.014	PK
2		2483.500	51.994	13.956	-22.006	74.000	38.038	PK
3		2483.676	54.014	15.975	-19.986	74.000	38.040	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2480.046	100.377	68.677	N/A	N/A	-31.70	AV
2		2483.500	51.994	20.294	-33.706	54.000	-31.70	AV
3		2483.676	54.014	22.314	-31.686	54.000	-31.70	AV

Site: CB7	Time: 2016/04/20
Limit: FCC_Part15.209_RE(3m)_ClassB	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: UMA	Power: AC 120V/60Hz
Note: Mode1 Transmit at channel 2480Mhz by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.980	98.515	60.502	N/A	N/A	38.013	PK
2		2483.500	51.508	13.470	-22.492	74.000	38.038	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.980	98.515	66.815	N/A	N/A	-31.70	AV
2		2483.500	51.508	19.808	-34.192	54.000	-31.70	AV