

FCC TEST REPORT

FCC ID : RF8-HS8086III
Applicant : Hansun Technologies Inc.
Address : 209 Zhuyuan Road, Suzhou New District, Jiangsu, China
Manufacturer : The same as above
Address : The same as above

Equipment Under Test (EUT) :

Product Name : AnjoyTV Bar&TurboTV Bar&Smart IP Set Top Box
Model No. : HS8086III, HS8066
Rules : FCC CFR47 Part15 C Section 15.247:2010

Date of Test : Jan. 17 ~ Apr. 01, 2013

Date of Issue : Apr. 02, 2013

Test Result : PASS*

Remark:

* The sample detailed above has been tested to the requirements of FCC rules mentioned above.

The test results have been reviewed against the directives above and found to meet their essential requirements.

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

PERPARED BY:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West of Baima Road., Songgang Street, Bao'an District,
Shenzhen, China

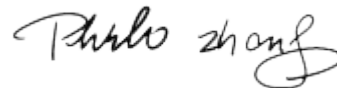
Tel: +86-755-83551033 Fax: +86-755-83552400

Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

Report No.: WTU13S0100457E

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

3 Contents

	Page
1 COVER PAGE	1
2 TEST SUMMARY.....	2
3 CONTENTS.....	3
4 GENERAL INFORMATION	5
4.1 GENERAL DESCRIPTION OF E.U.T.....	5
4.2 DETAILS OF E.U.T.....	5
4.3 CHANNEL LIST	6
4.4 TEST FACILITY	6
4.5 TEST LOCATION.....	6
4.6 GENERAL CONDITION.....	6
4.6.1 <i>Environmental condition of test site</i>	7
4.6.2 <i>Test Mode</i>	7
5 EQUIPMENT USED DURING TEST.....	8
5.1 EQUIPMENTS LIST.....	8
5.2 MEASUREMENT UNCERTAINTY.....	8
5.3 TEST EQUIPMENT CALIBRATION	8
6 CONDUCTED EMISSIONS	9
6.1 E.U.T. TEST CONDITION.....	9
6.2 EUT SETUP	9
6.3 CONDUCTED EMISSION TEST RESULT.....	9
7 RADIATED EMISSIONS	12
7.1 EUT OPERATION:.....	12
7.2 TEST SETUP	13
7.3 SPECTRUM ANALYZER SETUP.....	14
7.4 TEST PROCEDURE.....	14
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	14
7.6 SUMMARY OF TEST RESULTS	15
8 BAND EDGE MEASUREMENTS	20
8.1 TEST PROCEDURE:.....	20
8.2 TEST RESULT:	21
9 20 DB BANDWIDTH MEASUREMENT.....	29
9.1 TEST PROCEDURE:.....	29
9.2 TEST RESULT:	29
10 MAXIMUM PEAK OUTPUT POWER.....	34
10.1 TEST PROCEDURE:.....	34
10.2 TEST RESULT:	34
11 HOPPING CHANNEL SEPARATION	35
11.1 TEST PROCEDURE:.....	35
11.2 TEST RESULT:	35
12 NUMBER OF HOPPING FREQUENCY	41
12.1 TEST PROCEDURE:.....	41
12.2 TEST RESULT:	41
13 DWELL TIME.....	43
13.1 TEST PROCEDURE:.....	43

Report No.: WTU13S0100457E

13.2	TEST RESULT:	43
14	EMISSIONS FROM OUT OF BAND	59
14.1	TEST PROCEDURE:	59
14.2	TEST RESULT:	59
15	ANTENNA REQUIREMENT	65
16	RF EXPOSURE	66
16.1	REQUIREMENTS:	66
16.2	MEASUREMENT RESULT:	66
17	PHOTOGRAPHS –TEST SETUP	67
18	PHOTOGRAPHS - CONSTRUCTIONAL DETAILS	68
18.1	EUT – EXTERNAL VIEW	68
18.2	EUT- INTERNAL VIEW	68

4 General Information

4.1 General Description of E.U.T.

Product Name	: AnjoyTV Bar&TurboTV Bar&Smart IP Set Top Box
Model No.	: HS8086III, HS8066
Model Description	: only model name is different, the other circuit principle and PCB wiring are all the same.
Frequency Range	: 2402-2480MHz
Oscillator	: Clock 32.768kHz, 24MHz and 26MHz
Antenna installation	: Integrated Antenna
Type of Modulation	: GFSK, Pi/4DQPSK, 8DQPSK
Note	: All the modulation modes were tested, all the test data deeply conform to the rules and the worst data were recorded in the following pages. That all modulation methods do not exceed the above mentioned limits.
Remark	: This device working with two kinds of remote: IR remote(Exempted device) RF remote(Contains two granted FCC ID QZVCZ-SRC-AF100 and QZVCZ-DG-AF100)

4.2 Details of E.U.T.

Technical Data	: DC12V, 1A powered from adapter
Remark	: This device can use with 3 kinds of adapter optionally. Only the worst data when using with adapter 2 were shown in this report.
Adapter1	: Ktec Model: KSAS0101200100HU INPUT: 100-240V~50/60Hz 0.4A
Adapter2	: Mass Power Model: SEF1200100A1BA INPUT: 100-240V~50/60Hz 0.3A
Adapter3	: APD Model: WA-12L12FU INPUT: 100-240V~50/60Hz 0.5A Max.

Report No.: WTU13S0100457E

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A**

Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

4.5 Test Location

All the tests were performed at:

Waltek Services (Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, China

4.6 General condition

Ambient Condition: 25.5 °C 51 %RH

4.6.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is applicable for adapter:

Test Voltage	Input voltage
Rated voltage-15%	AC 108V
normal	AC 120V
Rated voltage+15%	AC 138V

The follow condition is not applicable.

Test voltage	Test Voltage
Rated voltage	New Battery

4.6.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	2402MHz	2441MHz	2480MHz
Receiving	2402MHz	2441MHz	2480MHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	Aug. 13,2012	Aug. 13,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 13,2013
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	2230300	Aug.14,2012	Aug. 14,2013
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 13,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Aug. 13,2012	Aug. 13,2013
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Feb .23,2013	Feb .23,2014
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
8.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 13,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 13,2012	Aug. 13,2013
Associated Equipment						
1	LCD TV	Skyworth	22S11HR	-	-	-

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emissions

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Test Condition

Operating Environment:

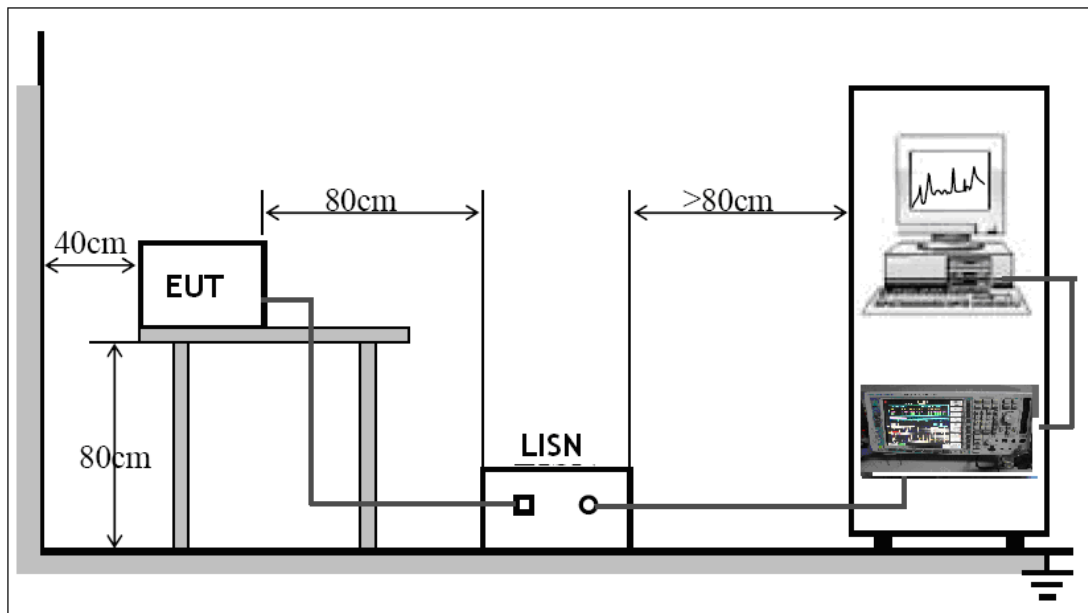
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	1012 mbar

Operation Mode and Spectrum Setup:

The EUT was tested in Normal linking(BT) mode. The worst data were shown as follow.

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, the specification used in this report was the FCC Part15.207 limits.



The EUT was placed on the test table in shielding room

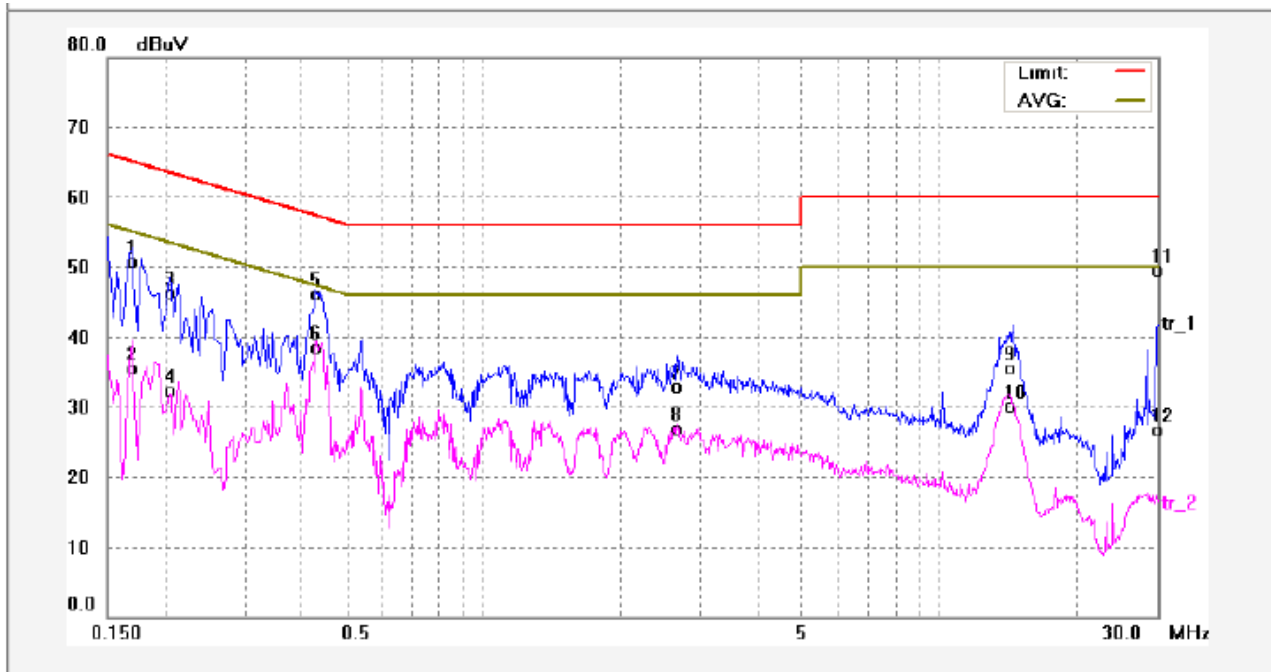
6.3 Conducted Emission Test Result

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

Report No.: WTU13S0100457E

Test Mode: Normal linking(BT)

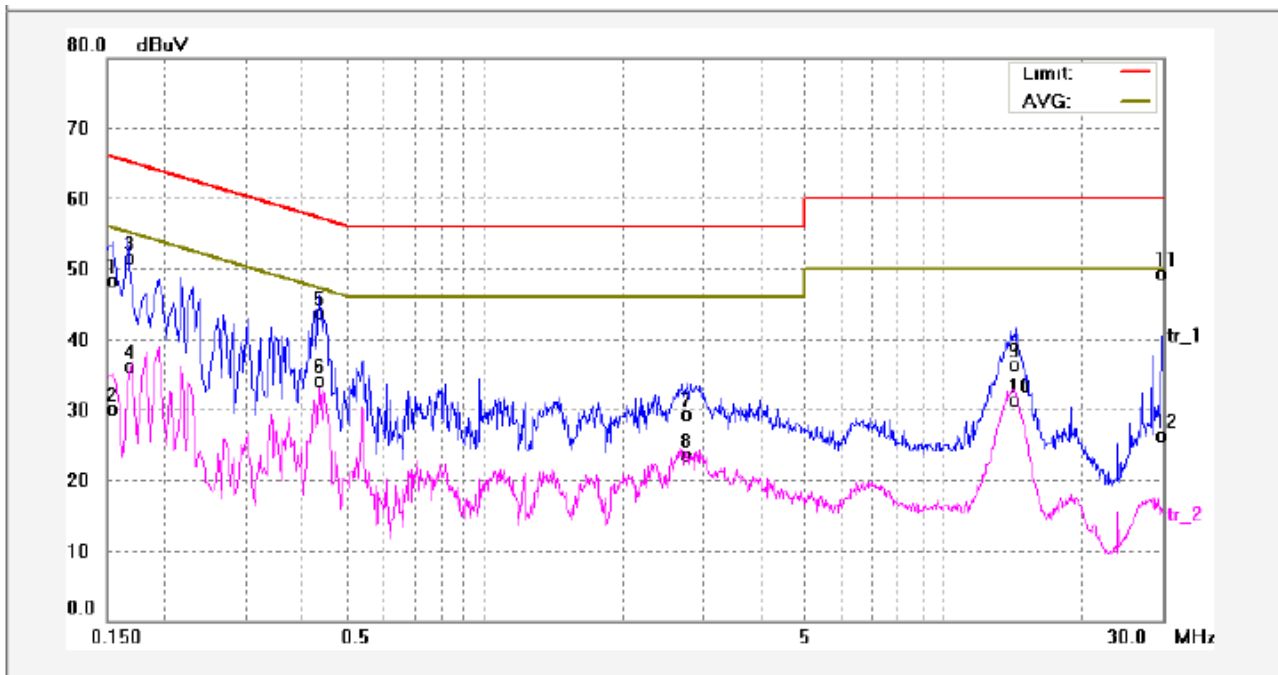
Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1700	40.17	9.82	49.99	64.96	-14.97	QP	
2	0.1700	24.92	9.82	34.74	54.96	-20.22	AVG	
3	0.2060	35.70	9.84	45.54	63.36	-17.82	QP	
4	0.2060	21.72	9.84	31.56	53.36	-21.80	AVG	
5	0.4300	35.48	9.91	45.39	57.25	-11.86	QP	
6	0.4300	27.82	9.91	37.73	47.25	-9.52	AVG	
7	2.6580	21.99	10.02	32.01	56.00	-23.99	QP	
8	2.6580	16.07	10.02	26.09	46.00	-19.91	AVG	
9	14.4700	23.75	10.86	34.61	60.00	-25.39	QP	
10	14.4700	18.49	10.86	29.35	50.00	-20.65	AVG	
11	30.0000	36.31	12.31	48.62	60.00	-11.38	QP	
12	30.0000	13.58	12.31	25.89	50.00	-24.11	AVG	

Report No.: WTU13S0100457E

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	37.65	9.80	47.45	65.78	-18.33	QP	
2	0.1539	19.43	9.80	29.23	55.78	-26.55	AVG	
3	0.1660	40.97	9.81	50.78	65.15	-14.37	QP	
4	0.1660	25.40	9.81	35.21	55.15	-19.94	AVG	
5	0.4340	33.09	9.91	43.00	57.18	-14.18	QP	
6	0.4340	23.31	9.91	33.22	47.18	-13.96	AVG	
7	2.7620	18.39	10.03	28.42	56.00	-27.58	QP	
8	2.7620	12.60	10.03	22.63	46.00	-23.37	AVG	
9	14.3820	24.71	10.85	35.56	60.00	-24.44	QP	
10	14.3820	19.59	10.85	30.44	50.00	-19.56	AVG	
11	30.0000	36.22	12.31	48.53	60.00	-11.47	QP	
12	30.0000	13.28	12.31	25.59	50.00	-24.41	AVG	

Report No.: WTU13S0100457E

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: DA 00-705
 Test Result: PASS
 Frequency Range: 32.768 KHz to 25 GHz
 Measurement Distance: 3m
 15.209 Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.247 (d) Limit:

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.1 EUT Operation:

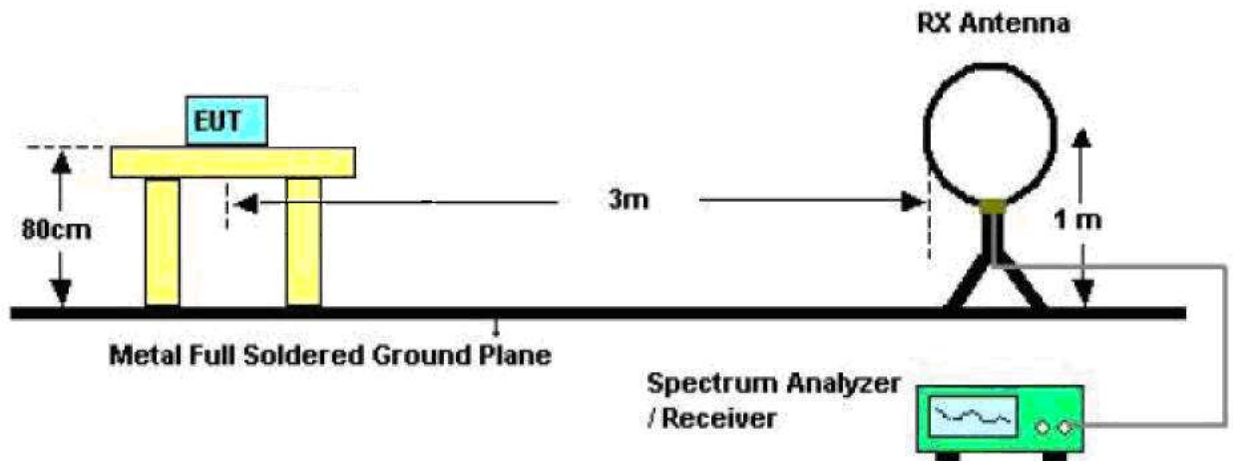
Operating Environment:

Temperature: 25.5 °C
 Humidity: 51 % RH
 Atmospheric Pressure: 1012 mbar

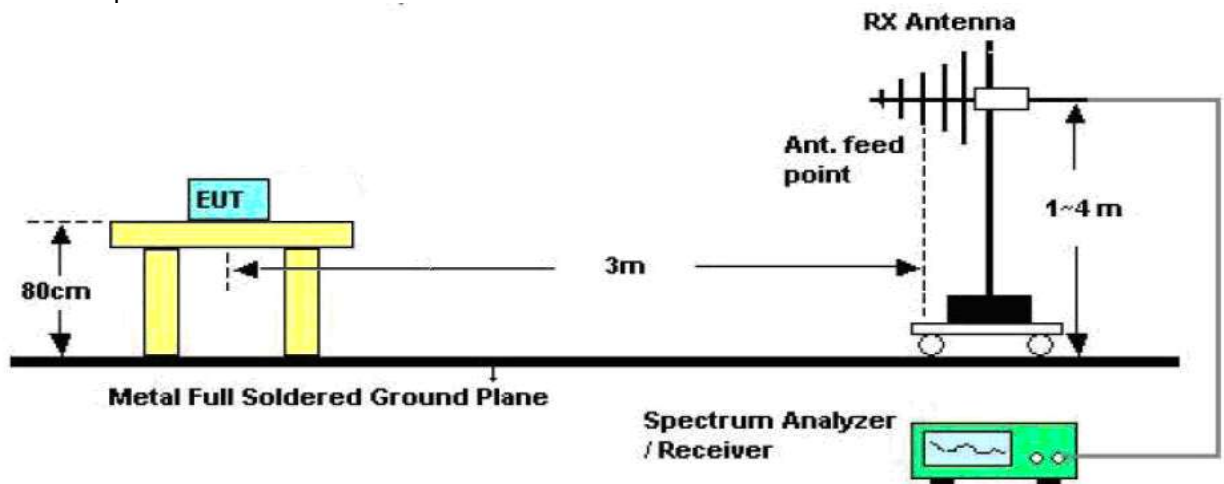
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

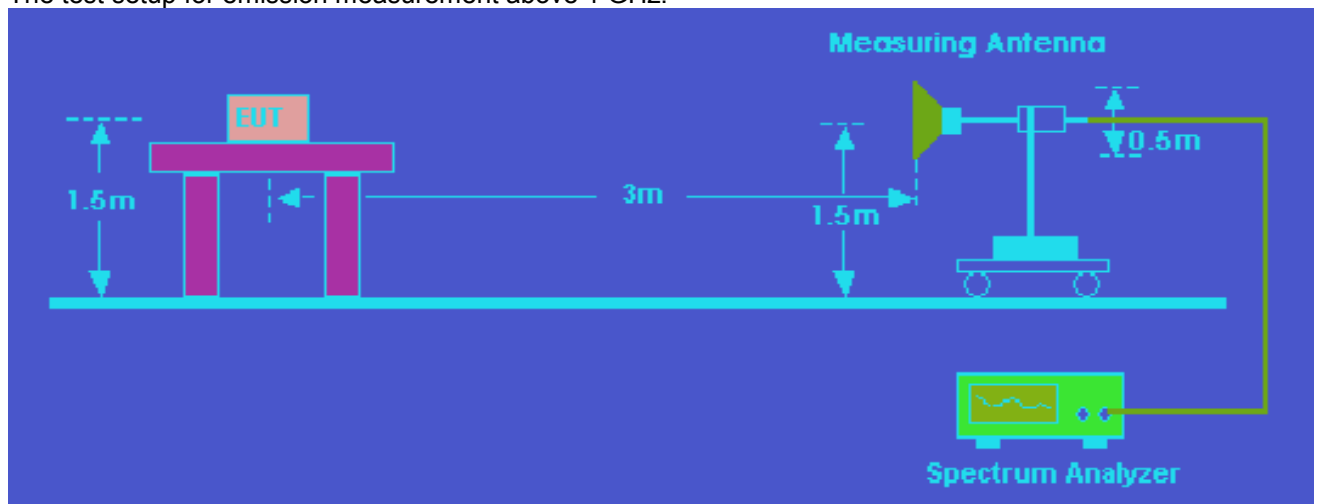
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 32.768 KHz to 25 GHz.

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth.....10KHz
 Video Bandwidth.....10KHz
 Resolution Bandwidth.....10KHz

30MHz ~ 1GHz

Sweep SpeedAuto
 IF Bandwidth.....120 KHz
 Video Bandwidth.....100KHz
 Quasi-Peak Adapter Bandwidth120 KHz
 Quasi-Peak Adapter ModeNormal
 Resolution Bandwidth.....100KHz

Above 1GHz

Sweep SpeedAuto
 IF Bandwidth.....120 KHz
 Video Bandwidth.....3MHz
 Quasi-Peak Adapter Bandwidth120 KHz
 Quasi-Peak Adapter ModeNormal
 Resolution Bandwidth.....1MHz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand). After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:
 Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain the “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

Report No.: WTU13S0100457E

7.6 Summary of Test Results

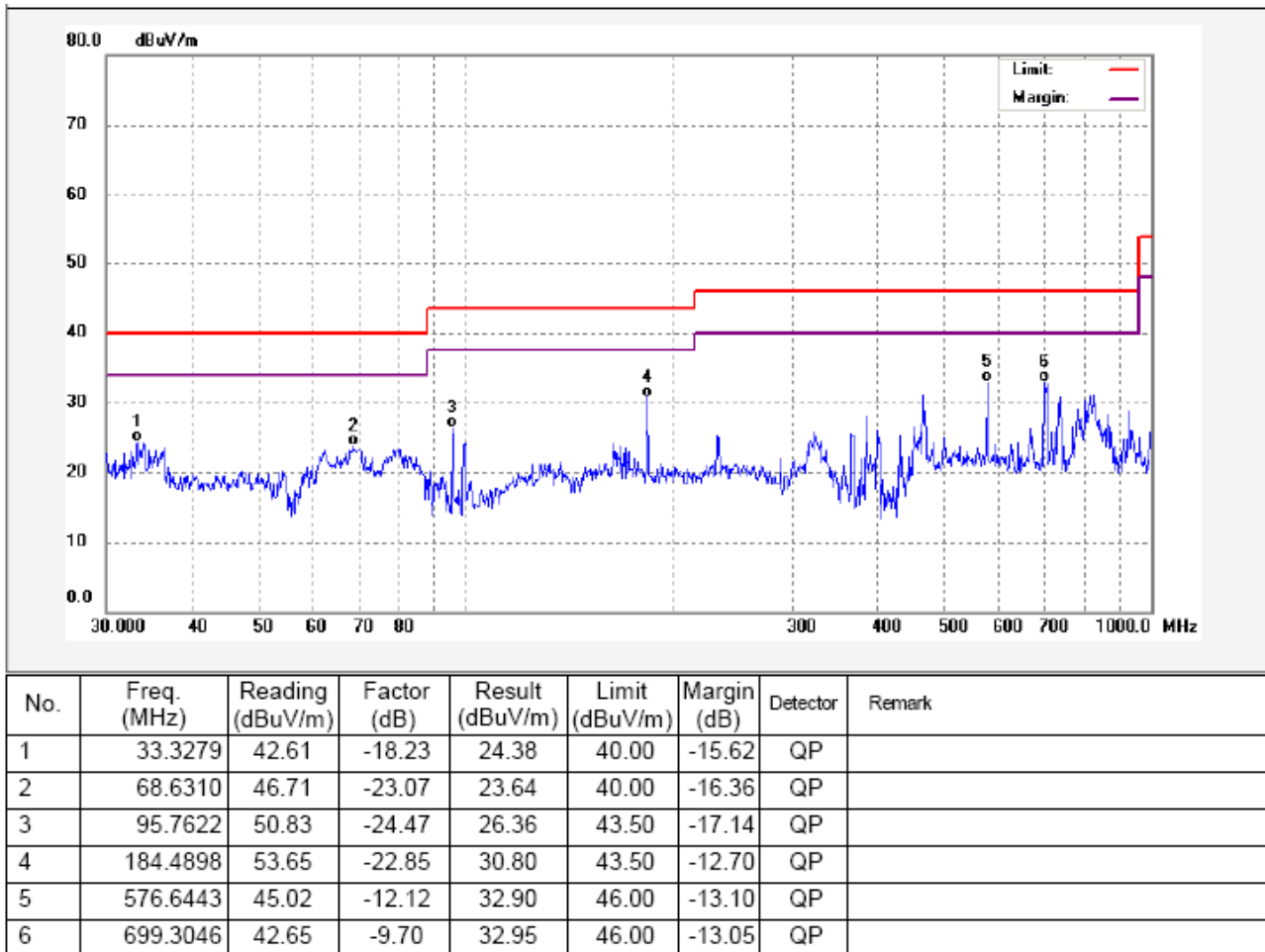
Test Frequency : Below 30MHz

All emissions were more than 20 dB below the limit and therefore not reported.

Test Frequency : 30MHz ~ 1000MHz

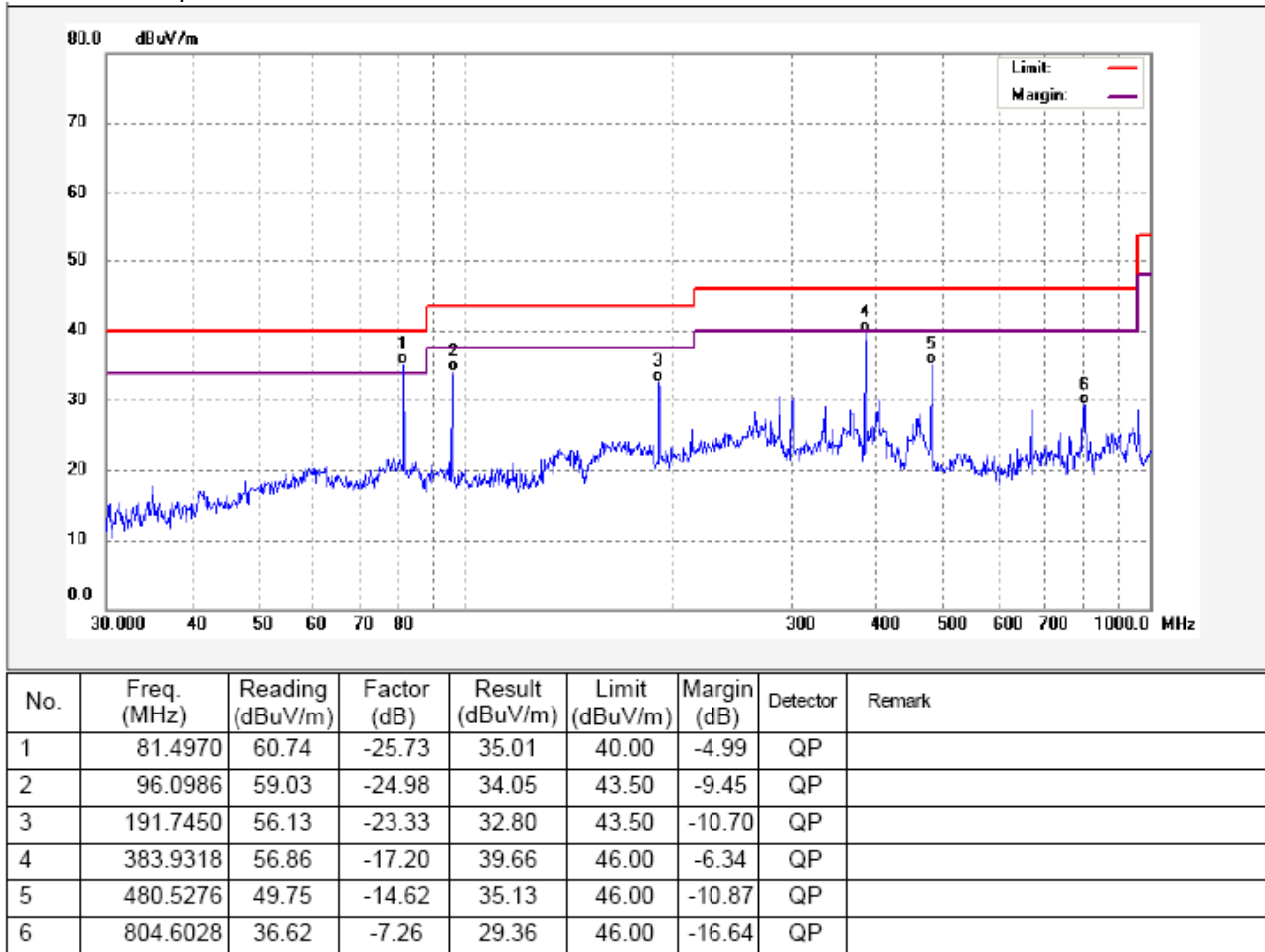
Test Mode:normal link(BT)

Antenna polarization: Vertical



Report No.: WTU13S0100457E

Antenna polarization: Horizontal



Report No.: WTU13S0100457E

Test Frequency: 1GHz ~ 25GHz

Modulation:GFSK(The worst data)

And the below is the Fundamental and Harmonic

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Lower frequency							
2402.00	AV	Vertical	76.52	N/A	(Fund.)	1.1	110
4804.00	AV	Vertical	41.02	54.00	13.98	1.4	140
7206.00	AV	Vertical	35.23	54.00	19.73	1.6	170
9608.00	AV	Vertical	32.52	54.00	21.48	1.4	130
12010.00	AV	Vertical	31.25	54.00	22.75	1.8	185
14412.00	AV	Vertical	31.01	54.00	22.99	1.2	195
16814.00	AV	Vertical	30.02	54.00	23.98	1.9	160
19216.00	AV	Vertical	30.67	54.00	23.33	1.4	140
21618.00	AV	Vertical	29.63	54.00	24.34	1.4	30
24020.00	AV	Vertical	29.01	54.00	24.99	1.1	145
2402.00	AV	Horizontal	75.23	N/A	(Fund.)	1.7	70
4804.00	AV	Horizontal	41.12	54.00	12.88	1.2	180
7206.00	AV	Horizontal	36.21	54.00	17.79	1.4	100
9608.00	AV	Horizontal	34.25	54.00	19.75	1.4	195
12010.00	AV	Horizontal	33.21	54.00	20.79	1.6	110
14412.00	AV	Horizontal	31.25	54.00	22.75	1.2	190
16814.00	AV	Horizontal	30.74	54.00	23.26	1.7	150
19216.00	AV	Horizontal	32.01	54.00	21.99	1.6	175
21618.00	AV	Horizontal	31.53	54.00	22.47	1.4	160
24020.00	AV	Horizontal	30.01	54.00	23.99	1.4	90
2402.00	PK	Vertical	86.41	N/A	(Fund.)	1.3	30
4804.00	PK	Vertical	45.21	74.00	29.64	1.7	145
7206.00	PK	Vertical	40.01	74.00	33.99	2.1	160
9608.00	PK	Vertical	37.42	74.00	36.58	1.2	240
12010.00	PK	Vertical	36.21	74.00	37.79	1.1	100
14412.00	PK	Vertical	32.01	74.00	41.99	1.4	155
16814.00	PK	Vertical	33.21	74.00	40.79	1.5	185
19216.00	PK	Vertical	30.10	74.00	43.90	1.1	190
21618.00	PK	Vertical	29.01	74.00	44.99	1.9	110
24020.00	PK	Vertical	29.01	74.00	44.99	1.2	165
2402.00	PK	Horizontal	85.32	N/A	(Fund.)	2.0	120
4804.00	PK	Horizontal	41.24	74.00	32.76	1.7	170
7206.00	PK	Horizontal	38.25	74.00	35.75	1.6	90
9608.00	PK	Horizontal	36.98	74.00	37.02	1.1	85
12010.00	PK	Horizontal	35.69	74.00	38.31	1.7	205
14412.00	PK	Horizontal	35.62	74.00	38.38	1.0	60
16814.00	PK	Horizontal	33.35	74.00	40.65	1.7	220
19216.00	PK	Horizontal	33.01	74.00	40.99	1.7	155
21618.00	PK	Horizontal	30.21	74.00	43.79	1.3	170

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Report No.: WTU13S0100457E

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
24020.00	PK	Horizontal	30.01	74.00	43.99	1.5	140
Middle frequency							
2441.00	AV	Vertical	77.21	N/A	(Fund.)	1.7	70
4882.00	AV	Vertical	39.02	54.00	14.98	1.4	185
7323.00	AV	Vertical	35.21	54.00	18.71	1.1	140
9764.00	AV	Vertical	33.33	54.00	20.67	1.5	70
12205.00	AV	Vertical	32.02	54.00	21.98	1.7	50
14646.00	AV	Vertical	32.01	54.00	21.99	1.4	225
17087.00	AV	Vertical	30.26	54.00	23.74	1.6	60
19528.00	AV	Vertical	30.01	54.00	23.99	1.5	80
21969.00	AV	Vertical	29.02	54.00	24.98	1.9	210
24410.00	AV	Vertical	28.23	54.00	25.77	1.7	175
2441.00	AV	Horizontal	76.96	N/A	(Fund.)	1.5	190
4882.00	AV	Horizontal	35.69	54.00	18.31	1.7	150
7323.00	AV	Horizontal	34.25	54.00	19.75	1.7	310
9764.00	AV	Horizontal	33.52	54.00	20.48	1.0	215
12205.00	AV	Horizontal	31.21	54.00	22.79	1.2	200
14646.00	AV	Horizontal	30.25	54.00	23.75	1.7	250
17087.00	AV	Horizontal	29.25	54.00	24.75	2.1	185
19528.00	AV	Horizontal	28.36	54.00	25.64	1.3	165
21969.00	AV	Horizontal	28.02	54.00	25.98	1.3	210
24410.00	AV	Horizontal	28.02	54.00	25.98	1.7	200
2441.00	PK	Vertical	87.52	N/A	(Fund.)	1.3	30
4882.00	PK	Vertical	44.21	74.00	29.79	1.7	175
7323.00	PK	Vertical	38.25	74.00	35.75	1.8	170
9764.00	PK	Vertical	37.94	74.00	36.06	1.4	180
12205.00	PK	Vertical	37.87	74.00	36.13	1.9	220
14646.00	PK	Vertical	36.10	74.00	38.90	1.0	95
17087.00	PK	Vertical	32.03	74.00	41.97	1.4	50
19528.00	PK	Vertical	30.21	74.00	43.79	1.9	190
21969.00	PK	Vertical	28.30	74.00	45.70	2.0	185
24410.00	PK	Vertical	28.30	74.00	45.70	1.4	195
2441.00	PK	Horizontal	83.45	N/A	(Fund.)	1.7	60
4882.00	PK	Horizontal	43.56	74.00	30.44	1.7	125
7323.00	PK	Horizontal	41.51	74.00	32.49	1.7	120
9764.00	PK	Horizontal	40.14	74.00	33.86	1.7	145
12205.00	PK	Horizontal	39.36	74.00	34.64	1.8	220
14646.00	PK	Horizontal	37.44	74.00	36.56	1.1	210
17087.00	PK	Horizontal	34.21	74.00	39.79	1.3	160
19528.00	PK	Horizontal	38.86	74.00	35.14	1.3	245
21969.00	PK	Horizontal	34.21	74.00	39.79	1.1	50
24410.00	PK	Horizontal	33.33	74.00	40.67	1.3	215

Report No.: WTU13S0100457E

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Upper frequency							
2480.00	AV	Vertical	73.42	N/A	(Fund.)	1.2	220
4960.00	AV	Vertical	36.25	54.00	17.75	1.4	95
7440.00	AV	Vertical	32.25	54.00	21.75	1.3	170
9920.00	AV	Vertical	30.26	54.00	23.74	1.1	130
12400.00	AV	Vertical	30.55	54.00	23.45	2.0	140
14880.00	AV	Vertical	30.34	54.00	23.66	1.5	195
17360.00	AV	Vertical	30.62	54.00	23.38	1.2	160
19840.00	AV	Vertical	30.13	54.00	23.87	1.1	260
22320.00	AV	Vertical	30.27	54.00	23.73	1.5	150
24800.00	AV	Vertical	28.25	54.00	25.75	1.0	220
2480.00	AV	Horizontal	72.51	N/A	(Fund.)	1.5	190
4960.00	AV	Horizontal	34.56	54.00	19.44	2.3	210
7440.00	AV	Horizontal	30.35	54.00	23.65	1.4	160
9920.00	AV	Horizontal	31.47	54.00	22.53	1.3	275
12400.00	AV	Horizontal	31.89	54.00	22.11	1.2	185
14880.00	AV	Horizontal	32.42	54.00	21.58	1.5	190
17360.00	AV	Horizontal	31.17	54.00	22.83	1.9	230
19840.00	AV	Horizontal	32.55	54.00	21.45	1.5	135
22320.00	AV	Horizontal	32.86	54.00	21.14	1.4	150
24800.00	AV	Horizontal	30.25	54.00	22.75	2.4	170
2480.00	PK	Vertical	87.53	N/A	(Fund.)	1.3	210
4960.00	PK	Vertical	44.21	74.00	29.79	1.0	115
7440.00	PK	Vertical	35.62	74.00	38.38	2.5	180
9920.00	PK	Vertical	35.35	74.00	38.65	1.1	160
12400.00	PK	Vertical	35.56	74.00	38.44	1.6	130
14880.00	PK	Vertical	34.21	74.00	39.79	1.0	155
17360.00	PK	Vertical	33.54	74.00	40.46	1.2	140
19840.00	PK	Vertical	36.26	74.00	37.74	1.6	190
22320.00	PK	Vertical	36.73	74.00	37.27	2.1	170
24800.00	PK	Vertical	30.21	74.00	43.99	1.0	210
2480.00	PK	Horizontal	83.64	N/A	(Fund.)	1.8	240
4960.00	PK	Horizontal	42.58	74.00	31.42	1.4	140
7440.00	PK	Horizontal	38.64	74.00	35.36	1.6	150
9920.00	PK	Horizontal	35.37	74.00	38.63	1.5	265
12400.00	PK	Horizontal	35.52	74.00	38.48	1.6	160
14880.00	PK	Horizontal	35.26	74.00	38.74	1.6	150
17360.00	PK	Horizontal	36.41	74.00	37.59	2.1	190
19840.00	PK	Horizontal	32.41	74.00	41.59	1.3	245
22320.00	PK	Horizontal	31.11	74.00	42.89	1.9	170
24800.00	PK	Horizontal	28.21	74.00	45.79	1.6	260

8 Band Edge Measurements

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. As defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz

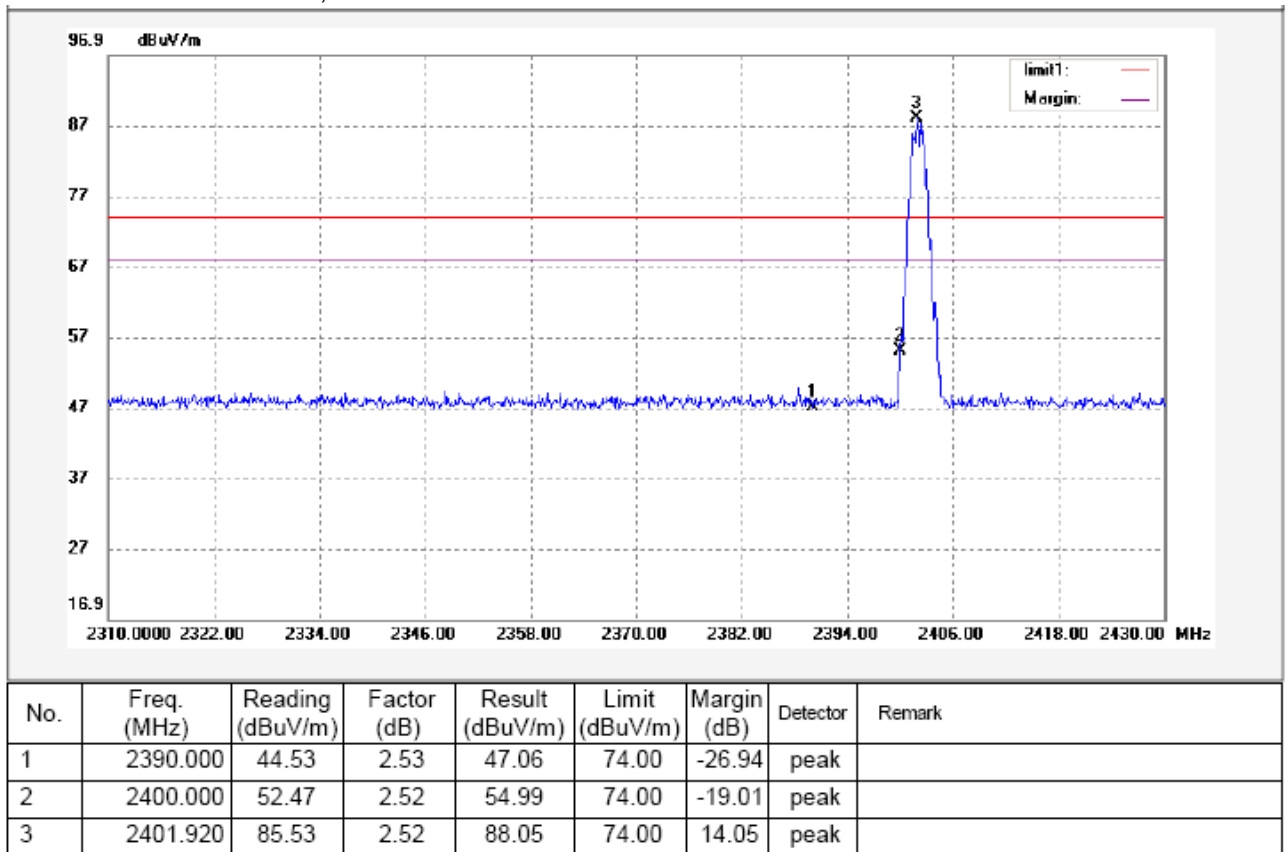
8.1 Test Procedure:

Detector:	For Peak value: RBW = 1 MHz for $f \geq 1$ GHz VBW $\geq$ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for $f \geq 1$ GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold
Test mode:	Test in fixing operating frequency at lower and upper channel.

Report No.: WTU13S0100457E

8.2 Test Result:

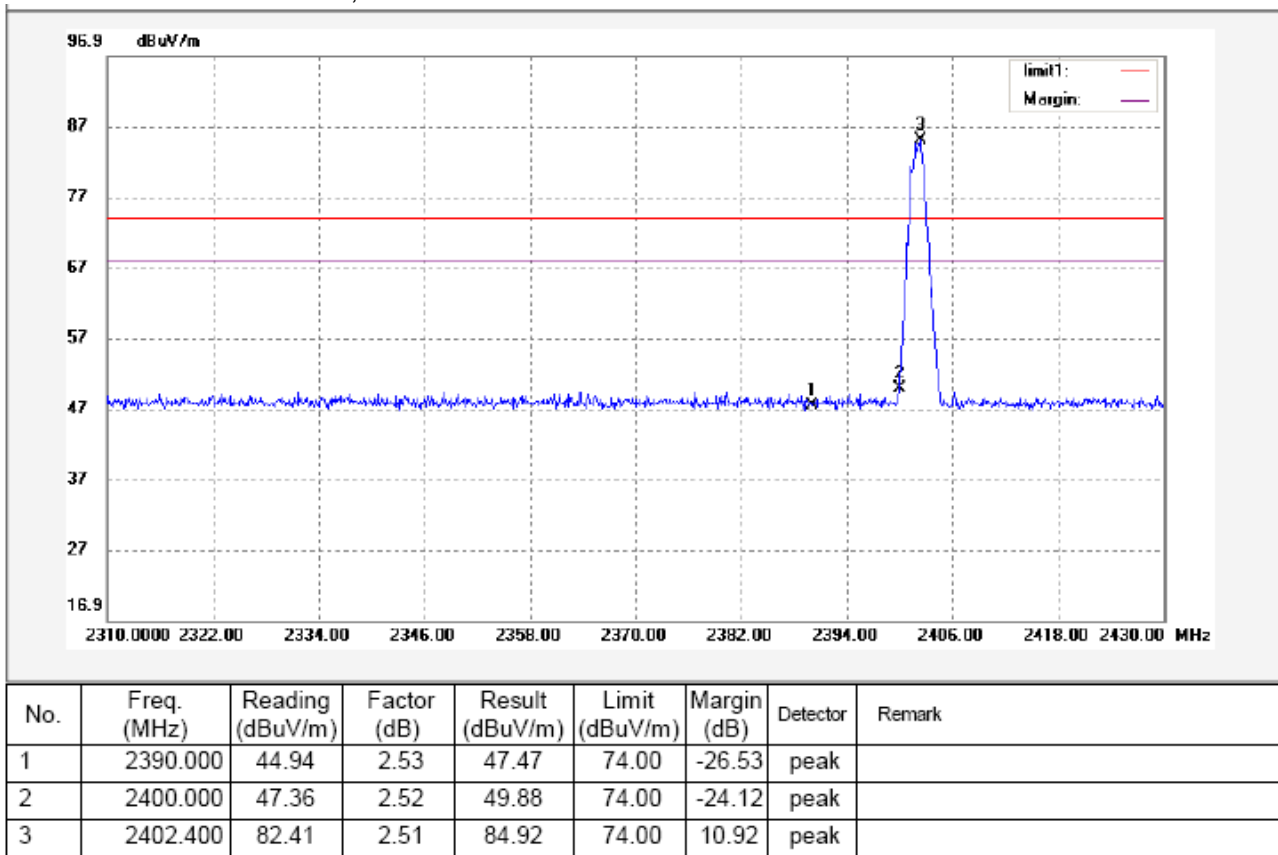
Lower Channel – Peak, Vertical



Remark: Mark3 is fundamental wave.

Report No.: WTU13S0100457E

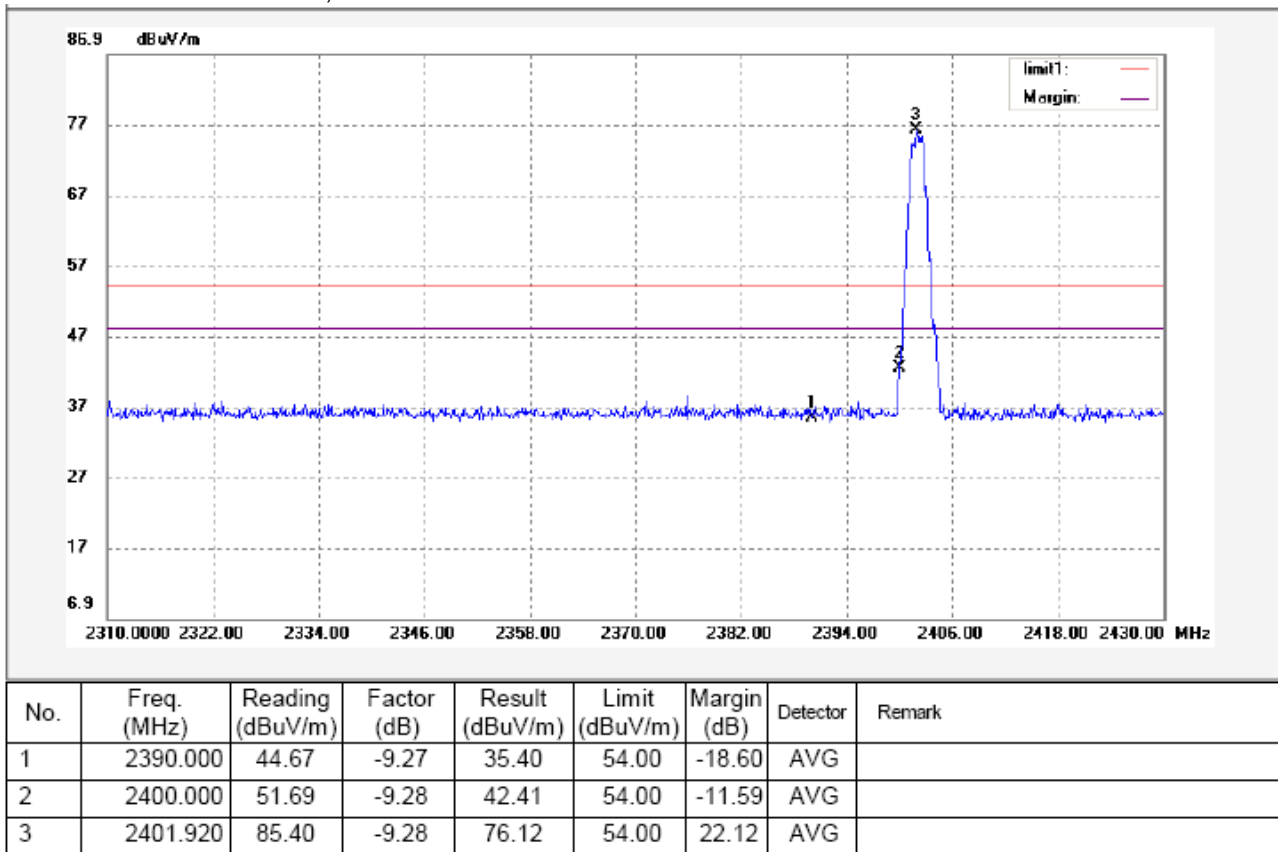
Lower Channel – Peak, Horizontal



Remark: Mark3 is fundamental wave.

Report No.: WTU13S0100457E

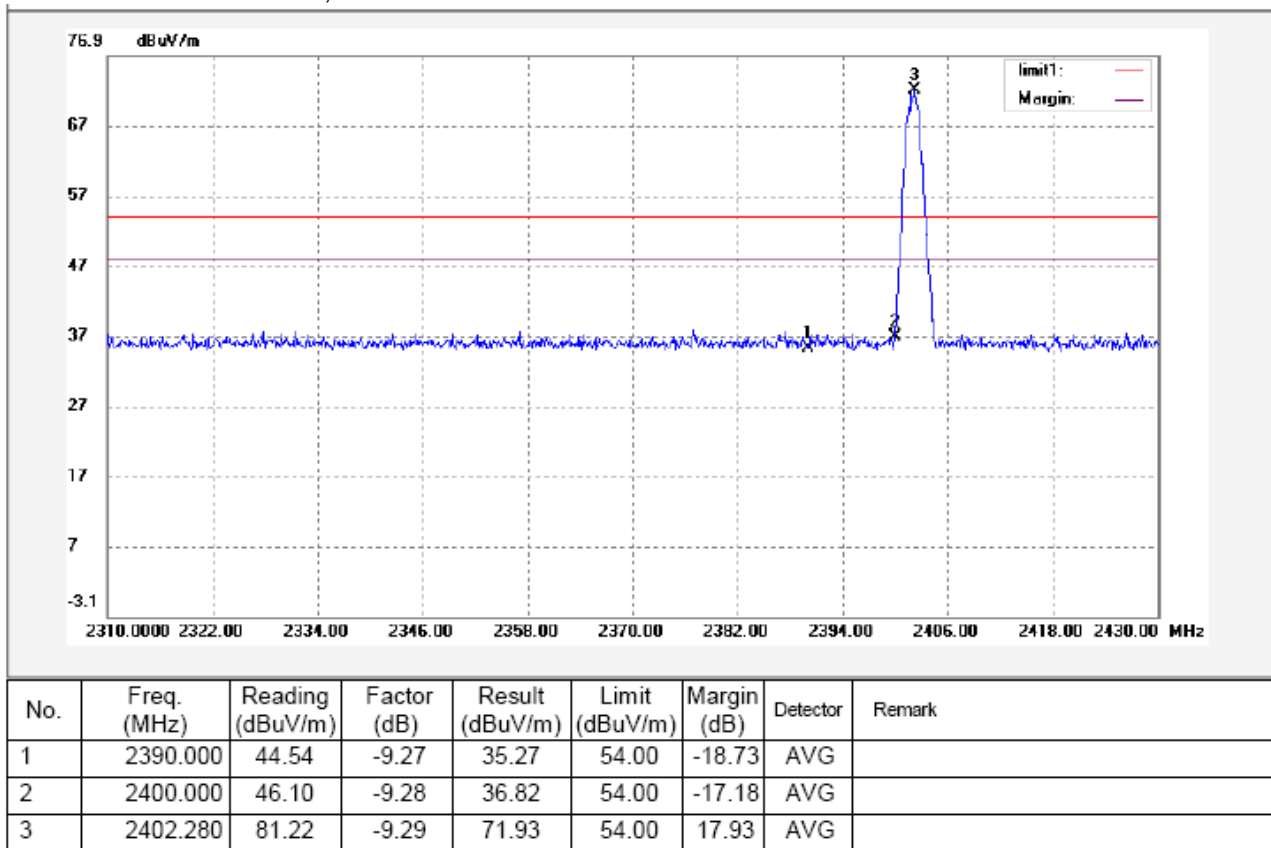
Lower Channel – AV, Vertical



Remark: Mark3 is fundamental wave.

Report No.: WTU13S0100457E

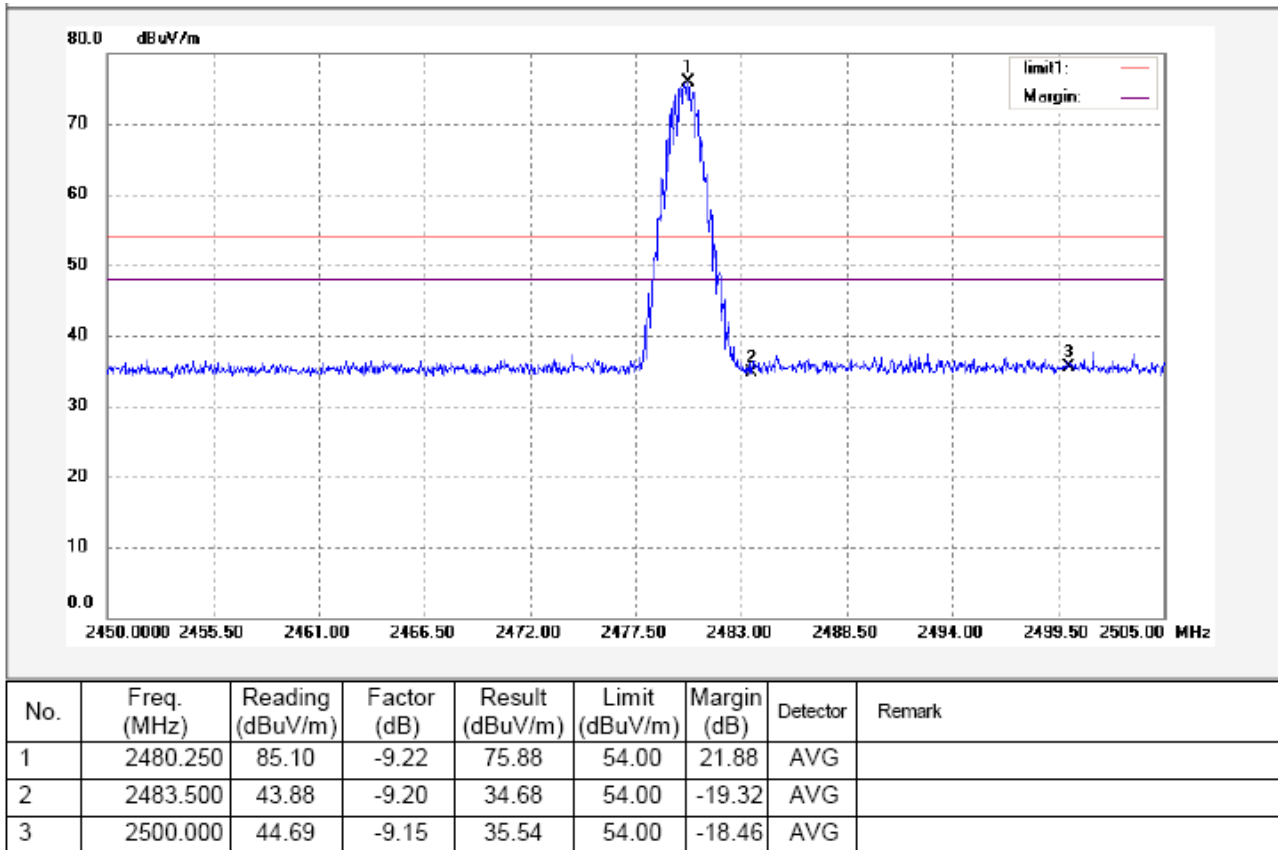
Lower Channel – AV, Horizontal



Remark: Mark3 is fundamental wave.

Report No.: WTU13S0100457E

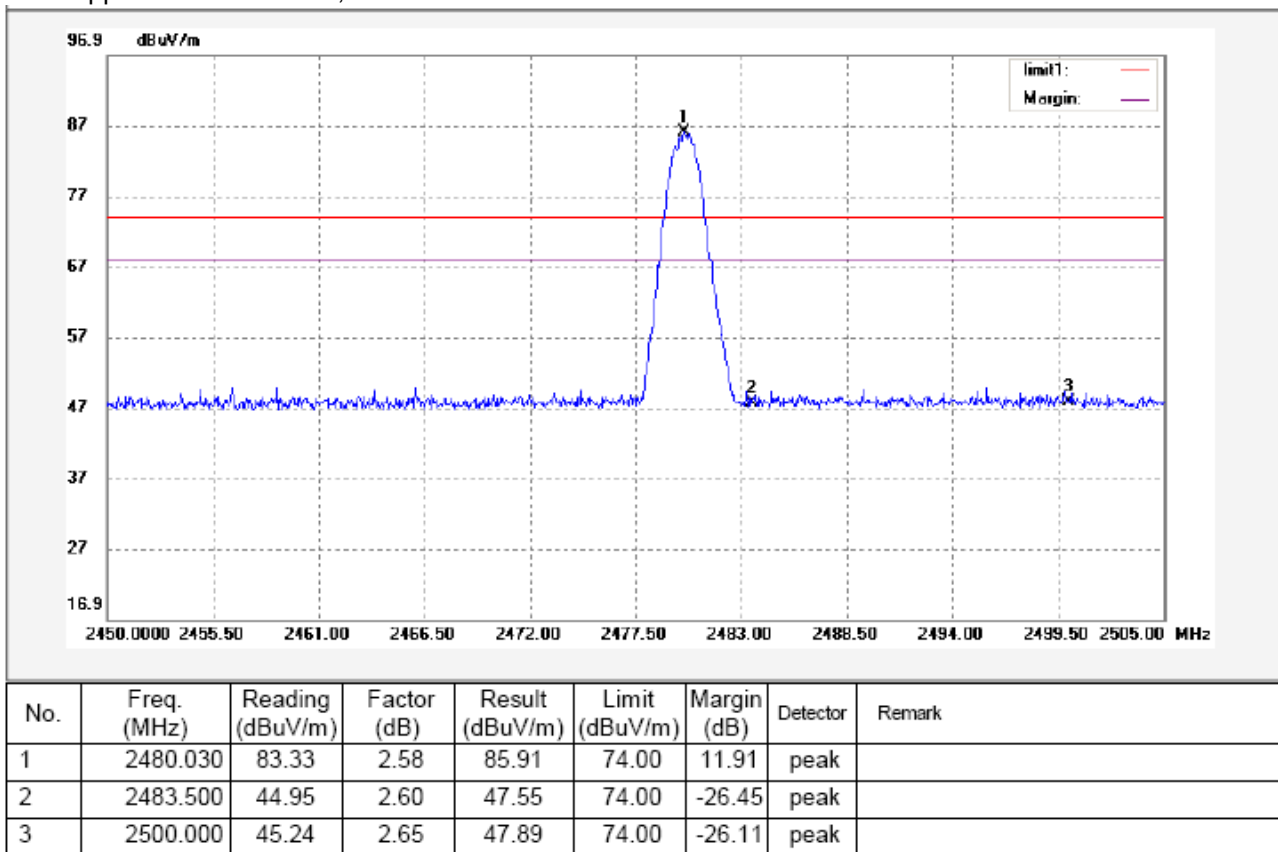
Upper Channel – Peak, Vertical



Remark: Mark1 is fundamental wave.

Report No.: WTU13S0100457E

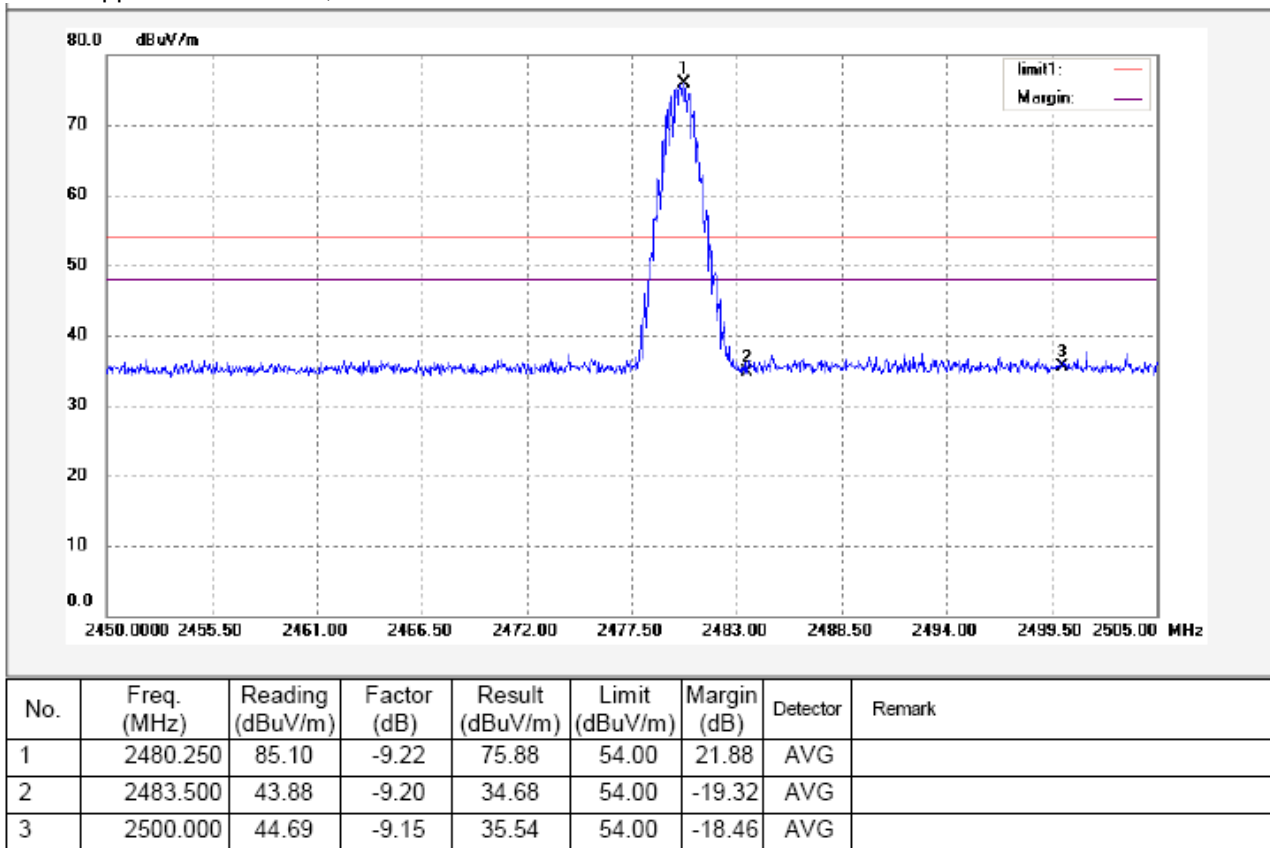
Upper Channel – Peak, Horizontal



Remark: Mark1 is fundamental wave.

Report No.: WTU13S0100457E

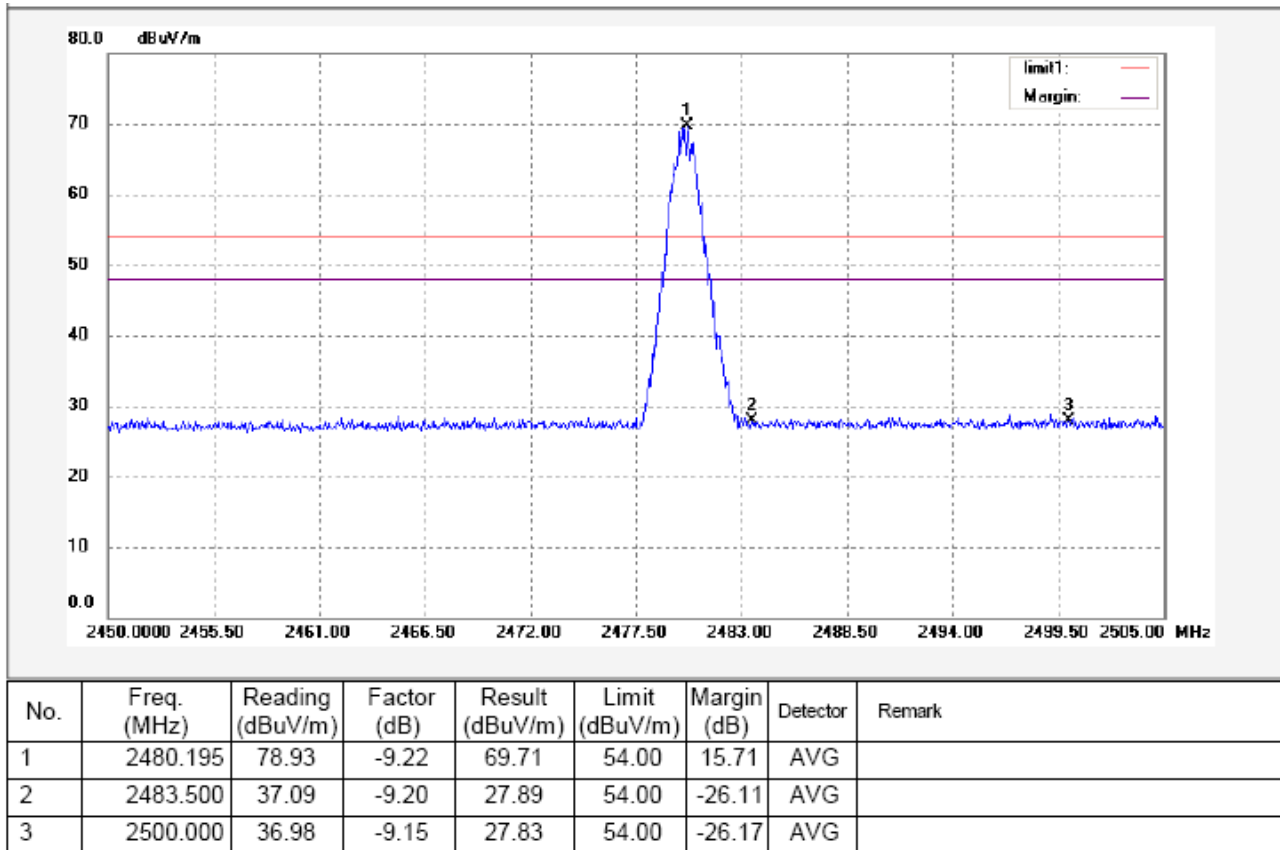
Upper Channel – AV, Vertical



Remark: Mark1 is fundamental wave.

Report No.: WTU13S0100457E

Upper Channel – AV, Horizontal



Remark: Mark1 is fundamental wave.

Report No.: WTU13S0100457E

9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: DA 00-705
 Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

9.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

9.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Lower	1.3749
	Middle	1.3665
	Upper	1.3749
Pi/4DQPSK	Lower	1.4461
	Middle	1.4551
	Upper	1.4551
8DPSK	Lower	1.4451
	Middle	1.4501
	Upper	1.4641

Test result plot as follows:

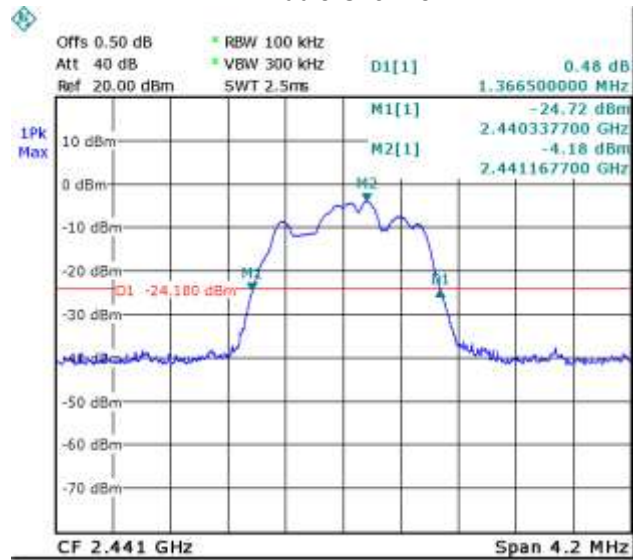
Modulation:GFSK

Lower Channel

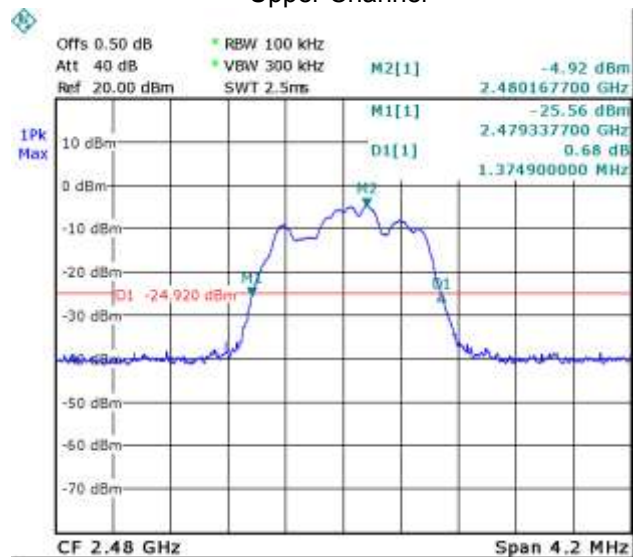


Report No.: WTU13S0100457E

Middle Channel



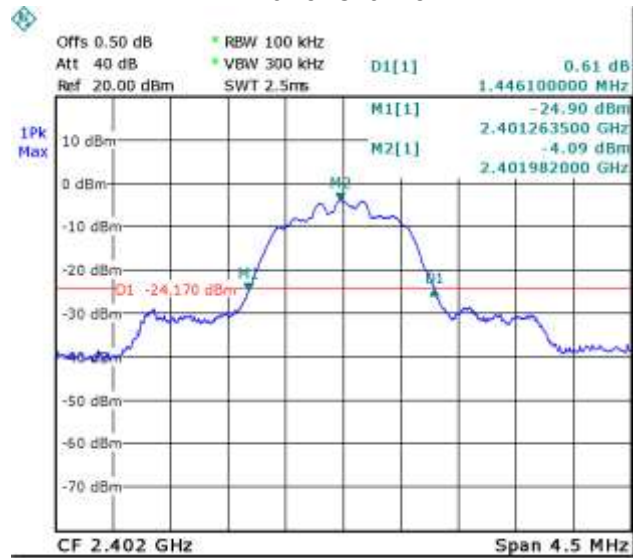
Upper Channel



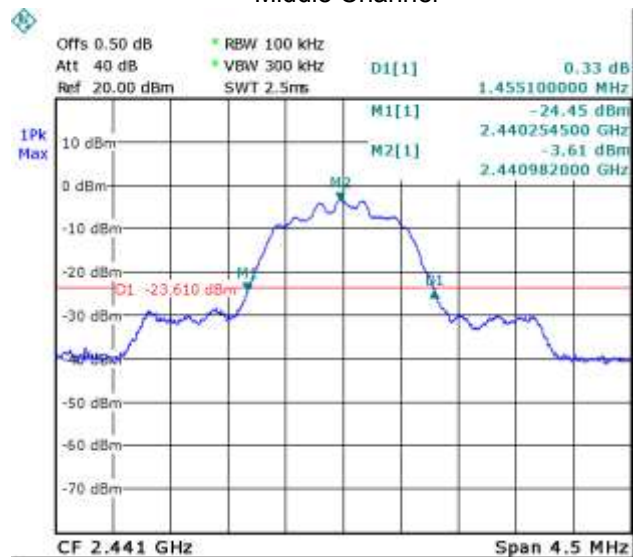
Report No.: WTU13S0100457E

Modulation: Pi/4DQPSK

Lower Channel

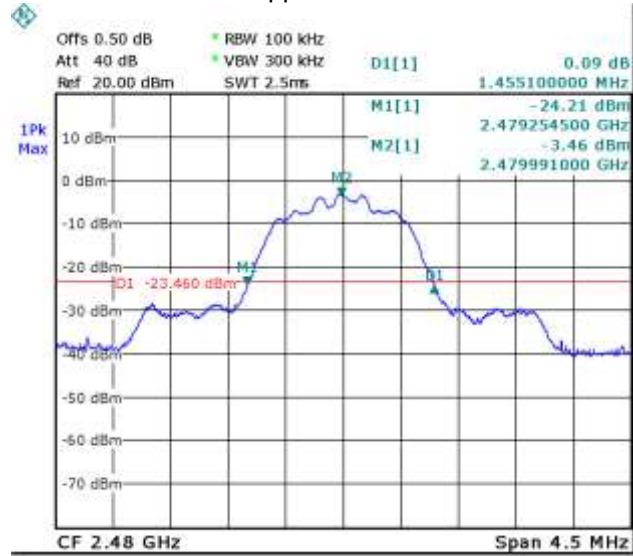


Middle Channel



Report No.: WTU13S0100457E

Upper Channel



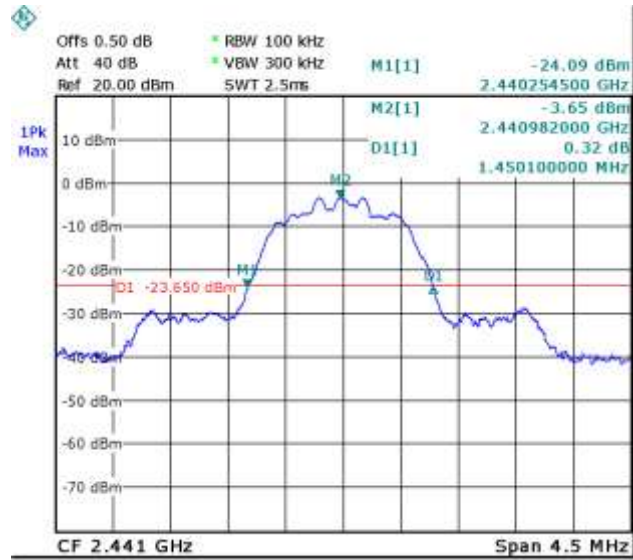
Modulation: 8DPSK

Lower Channel

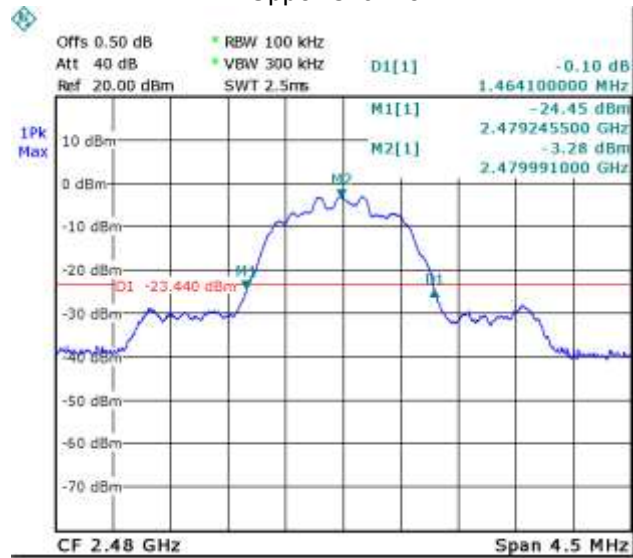


Report No.: WTU13S0100457E

Middle Channel



Upper Channel



Report No.: WTU13S0100457E

10 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: ANSI C63.4:2003
 Test Limit: Regulation 15.247 (b)(1) 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.
 Refer to the result "Number of Hopping Frequency" of this document.
 The 1watts (30 dBm) limit applies.
 Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 10 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Lower	-0.35	30
	Middle	-0.49	30
	Upper	-0.22	30
Pi/4DQPSK	Lower	-1.42	30
	Middle	-1.98	30
	Upper	-1.86	30
8DPSK	Lower	-2.40	30
	Middle	-2.82	30
	Upper	-2.66	30

11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a) (1) 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 125 mW.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz , Span = 5MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

11.2 Test Result:

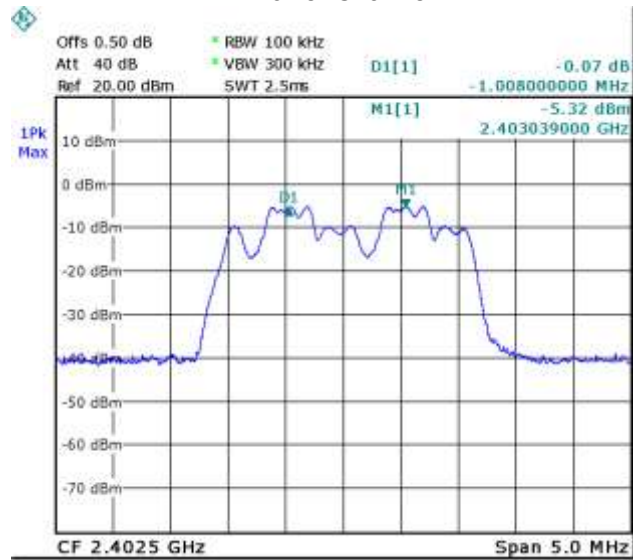
Modulation	Test Channel	Separation (MHz)
GFSK	Lower	1.008
	Middle	1.008
	Upper	1.008
Pi/4DQPSK	Lower	1.008
	Middle	1.018
	Upper	1.005
8DPSK	Lower	1.008
	Middle	1.008
	Upper	1.008

Test result plot as follows:

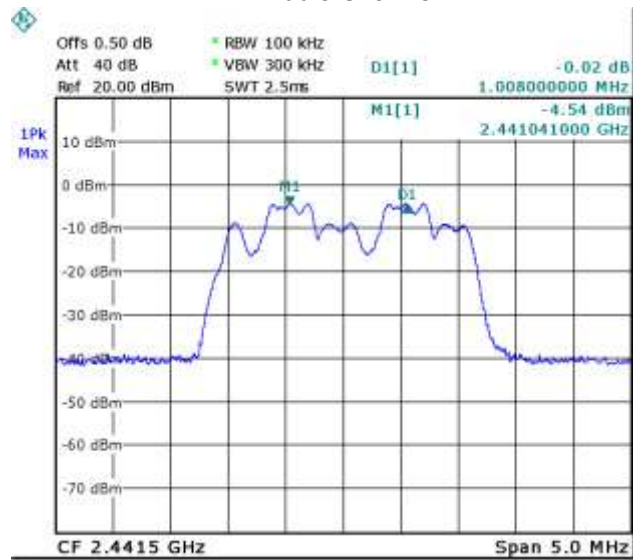
Report No.: WTU13S0100457E

Modulation:GFSK

Lower Channel

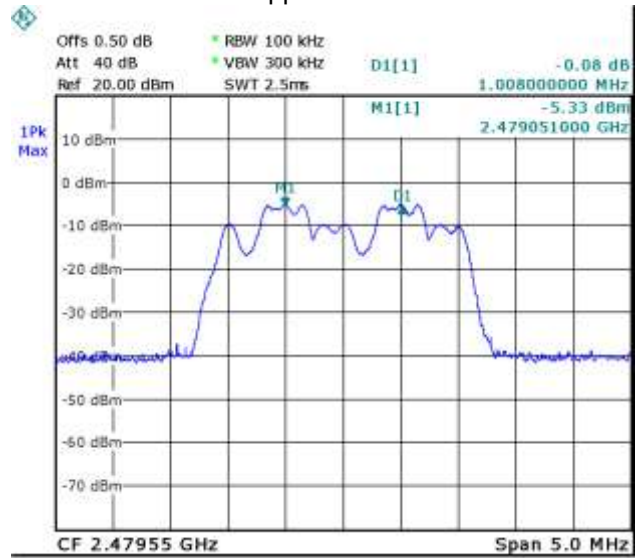


Middle Channel



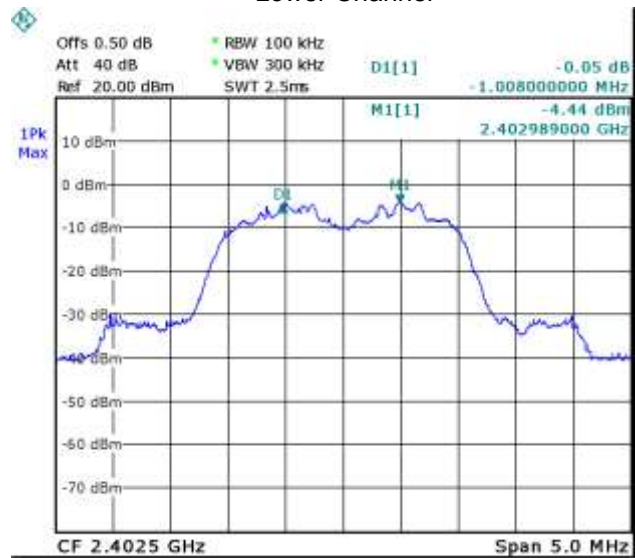
Report No.: WTU13S0100457E

Upper Channel



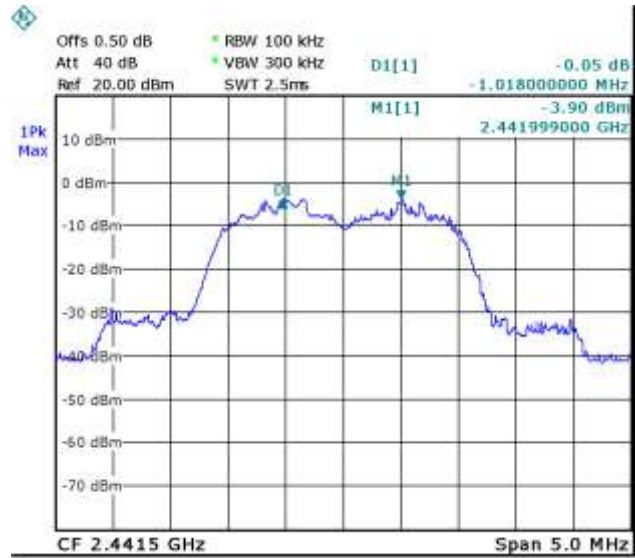
Modulation: Pi/4DQPSK

Lower Channel

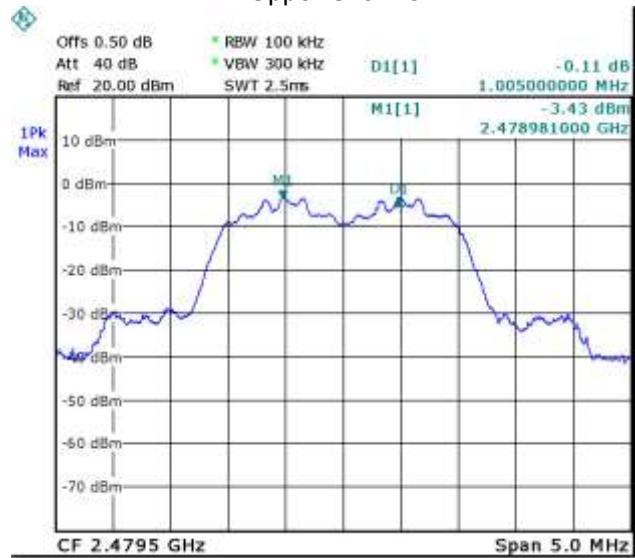


Report No.: WTU13S0100457E

Middle Channel



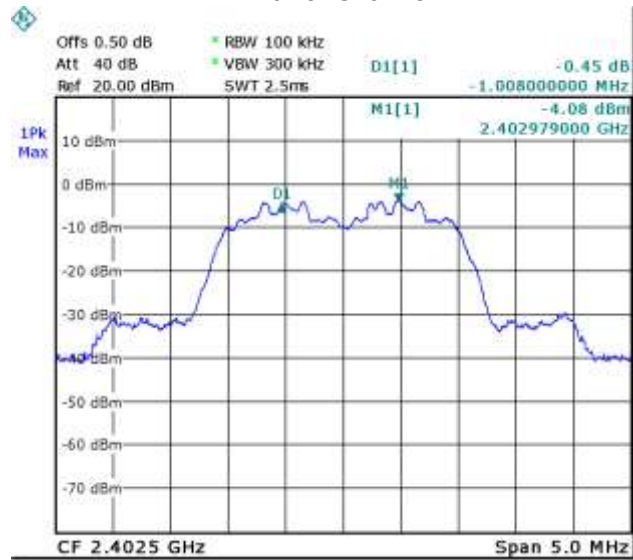
Upper Channel



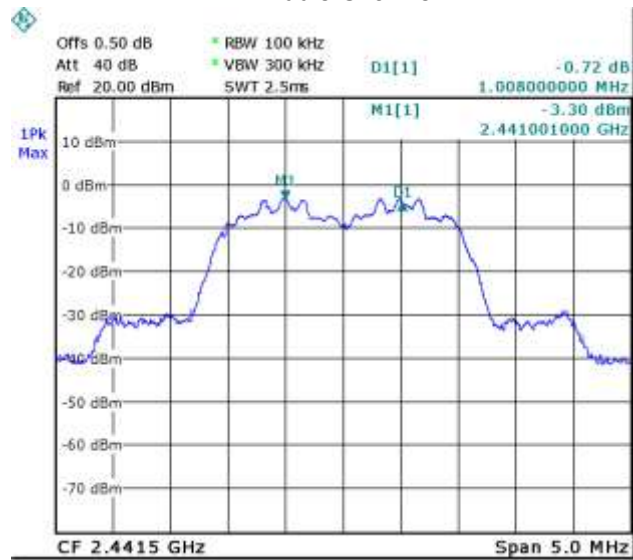
Report No.: WTU13S0100457E

Modulation: 8DPSK

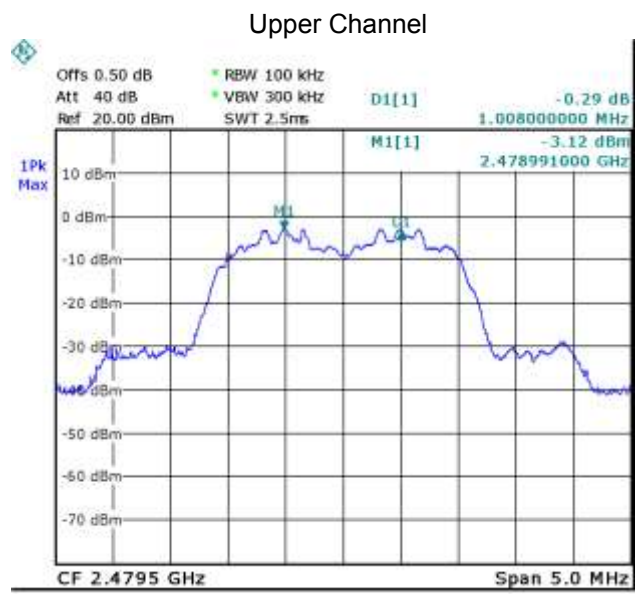
Lower Channel



Middle Channel



Report No.: WTU13S0100457E



Report No.: WTU13S0100457E

12 Number of Hopping Frequency

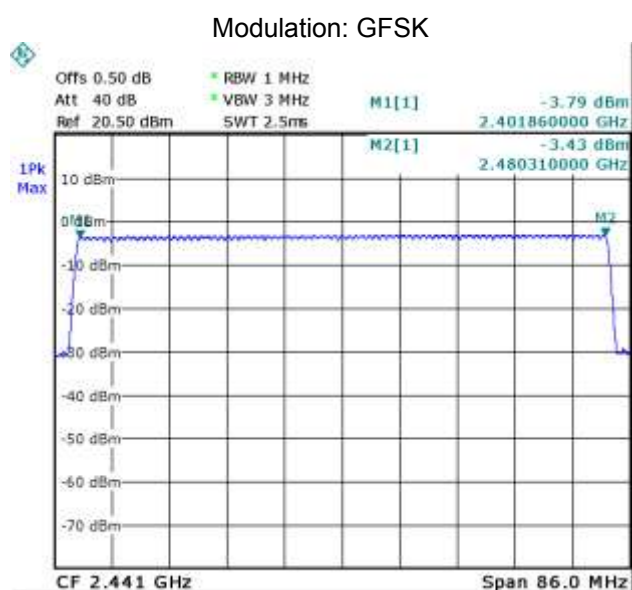
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Center Frequency = 2441MHz, Span = 86MHz. Submit the test result graph.

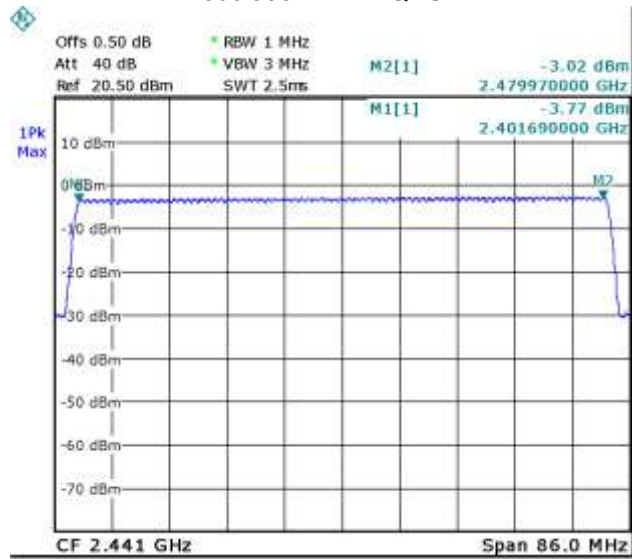
12.2 Test Result:

Total Channels are 79 Channels

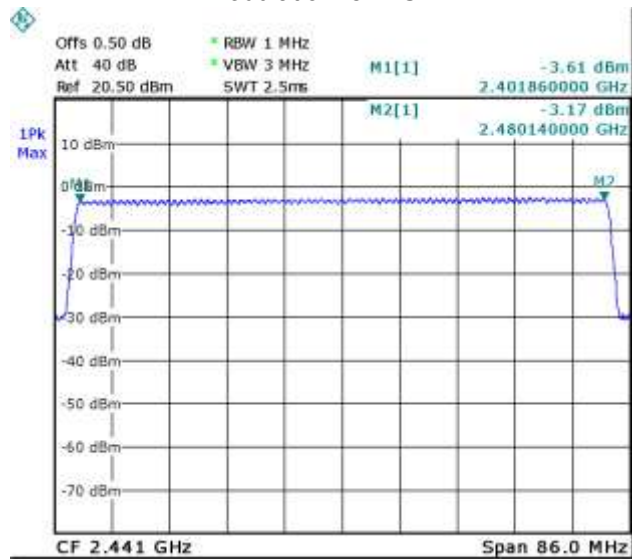


Report No.: WTU13S0100457E

Modulation: Pi/4DQPSK



Modulation: 8DPSK



Report No.: WTU13S0100457E

13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a) (1) (iii) 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.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

13.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centered on a hopping channel;
3. Set RBW = 1MHz and VBW = 1MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.
4. 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. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

13.2 Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period: $T = 0.4(s) * 79 = 31.6 (s)$

DH5 Packet permit maximum $1600 / 79 / 6$ hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
DH5	$1600/79/6*31.6*(MkrDelta)/1000$
DH3	$1600/79/4*31.6*(MkrDelta)/1000$
DH1	$1600/79/2*31.6*(MkrDelta)/1000$
Remark	Mkr Delta is single pulse time.

Note: Mkr Delta is once pulse time.

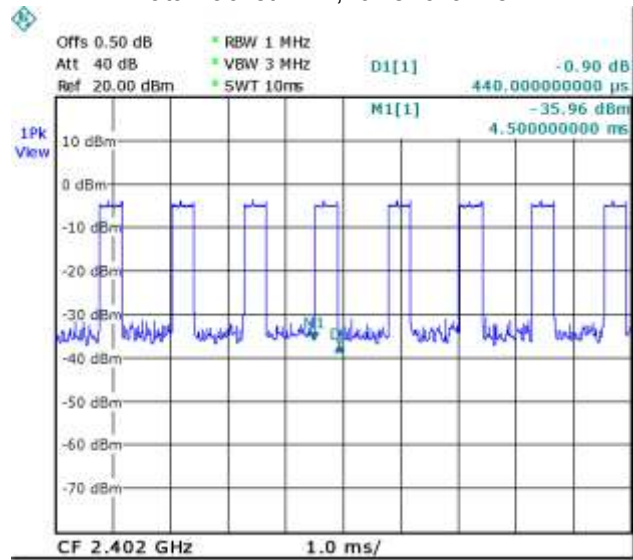
Report No.: WTU13S0100457E

Modulation	Frequency	Data Packet	Mkr Delta(ms)	Dwell Time(s)	Limits(s)
GFSK	Lower channel	DH1	0.440	0.1408	0.400
	Middle channel		0.420	0.1344	0.400
	Upper channel		0.440	0.1408	0.400
	Lower channel	DH3	1.680	0.2688	0.400
	Middle channel		1.680	0.2688	0.400
	Upper channel		1.700	0.2720	0.400
	Lower channel	DH5	2.940	0.3136	0.400
	Middle channel		2.980	0.3179	0.400
	Upper channel		2.940	0.3136	0.400
Pi/4DQPSK	Lower channel	DH1	0.480	0.1536	0.400
	Middle channel		0.520	0.1664	0.400
	Upper channel		0.480	0.1536	0.400
	Lower channel	DH3	1.720	0.2752	0.400
	Middle channel		1.740	0.2784	0.400
	Upper channel		1.740	0.2784	0.400
	Lower channel	DH5	2.960	0.3157	0.400
	Middle channel		3.020	0.3221	0.400
	Upper channel		3.000	0.3200	0.400
8DPSK	Lower channel	DH1	0.460	0.1472	0.400
	Middle channel		0.460	0.1472	0.400
	Upper channel		0.440	0.1408	0.400
	Lower channel	DH3	1.820	0.2912	0.400
	Middle channel		1.760	0.2816	0.400
	Upper channel		1.700	0.2720	0.400
	Lower channel	DH5	3.020	0.3221	0.400
	Middle channel		3.020	0.3221	0.400
	Upper channel		2.980	0.3179	0.400

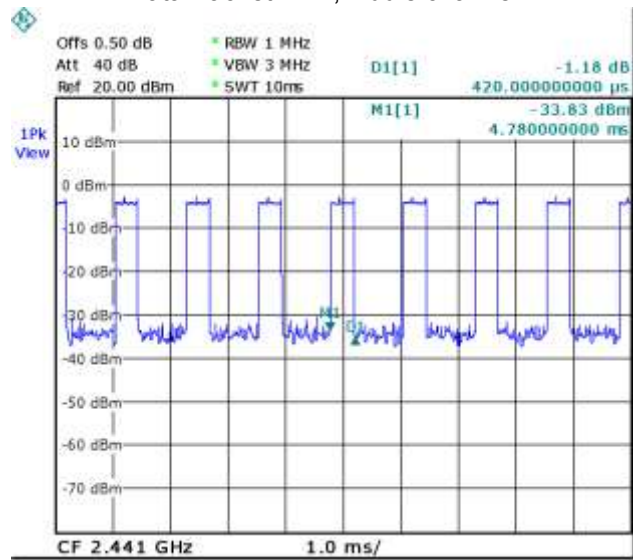
Report No.: WTU13S0100457E

Modulation:GFSK

Data Packet:DH1,Lower channel

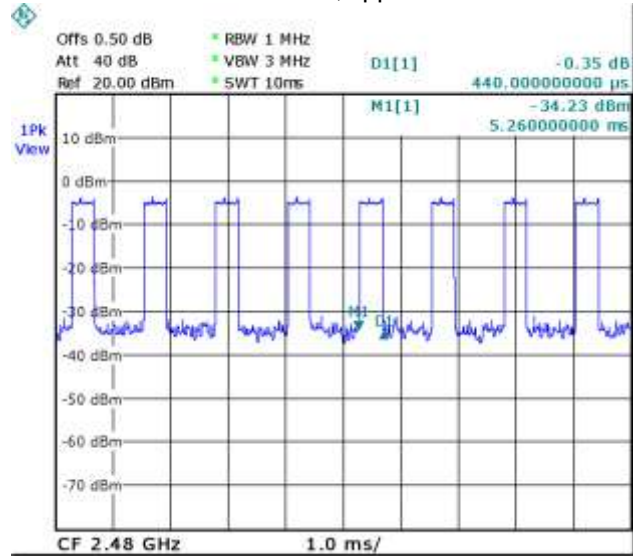


Data Packet:DH1,Middle channel

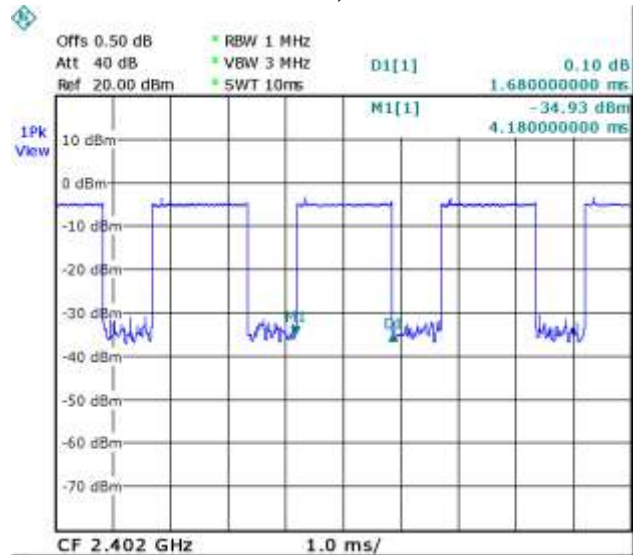


Report No.: WTU13S0100457E

Data Packet:DH1,Upper channel

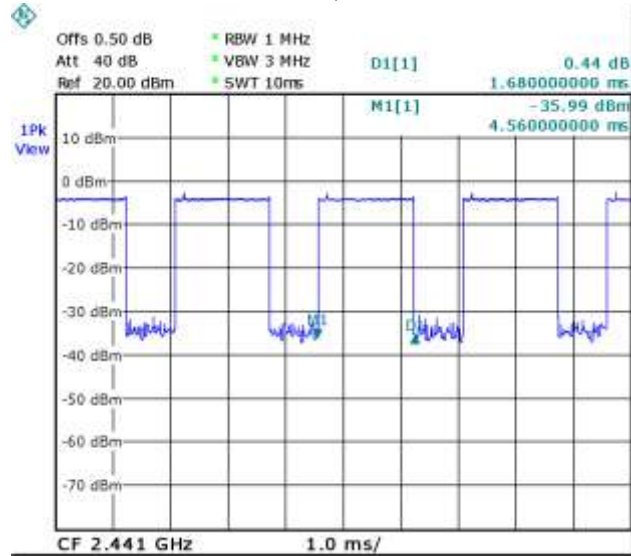


Data Packet:DH3,Lower channel

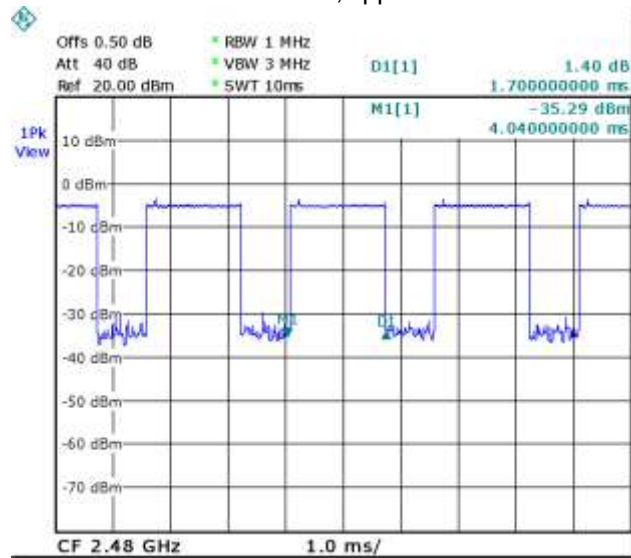


Report No.: WTU13S0100457E

Data Packet:DH3,Middle channel

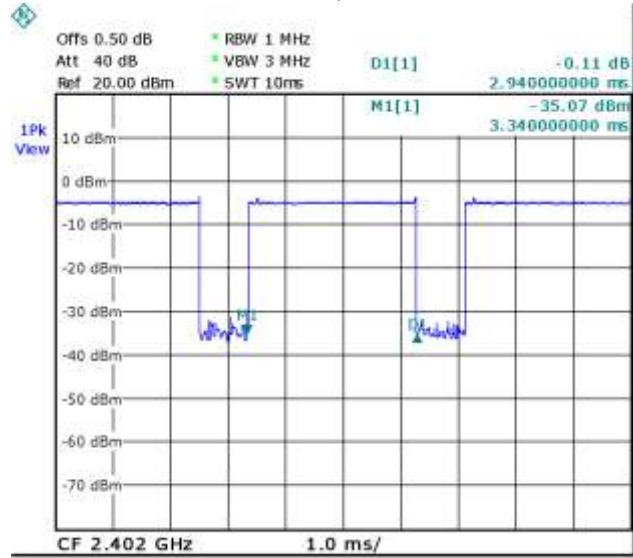


Data Packet:DH3,Upper channel

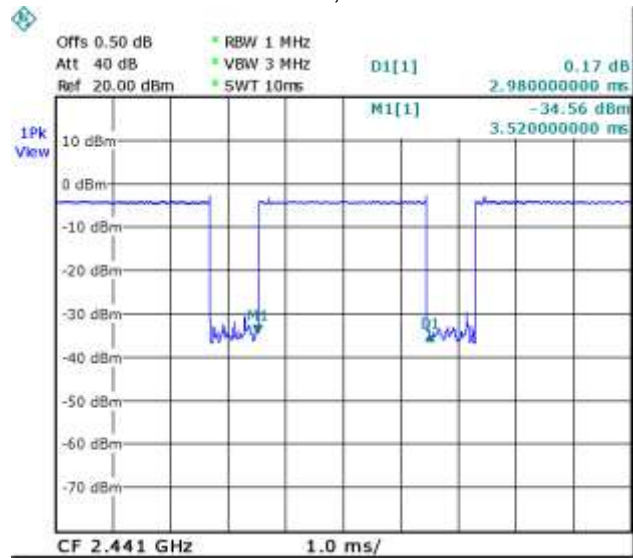


Report No.: WTU13S0100457E

Data Packet:DH5,Lower channel

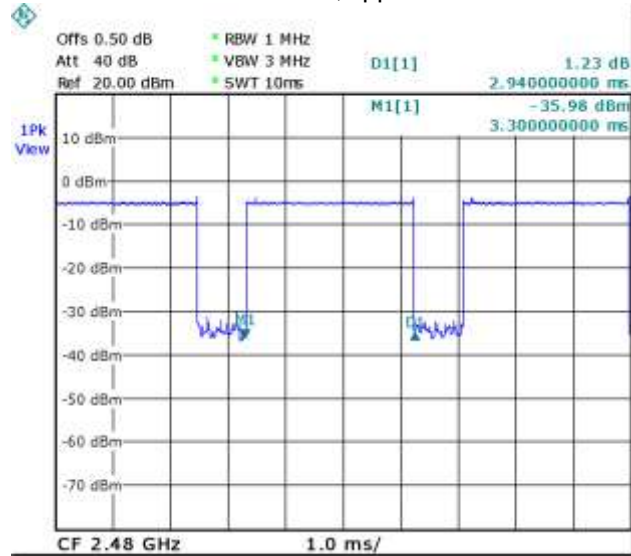


Data Packet:DH5,Middle channel



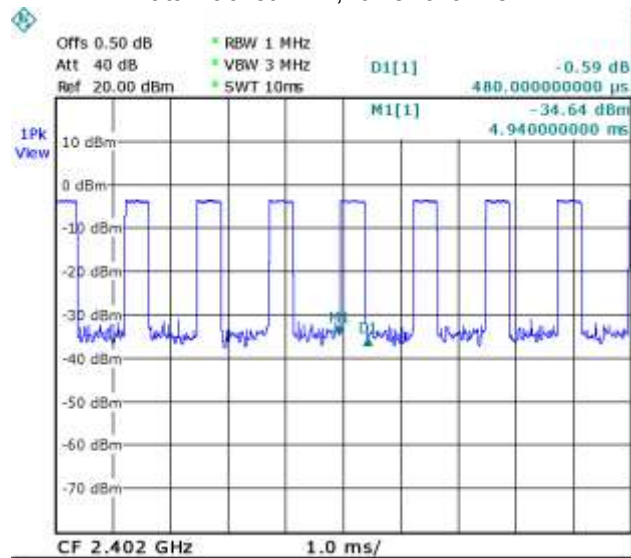
Report No.: WTU13S0100457E

Data Packet:DH5,Upper channel



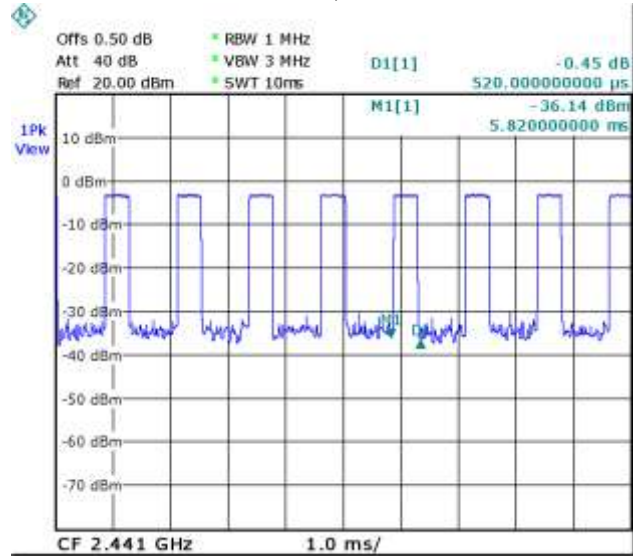
Modulation: Pi/4DQPSK

Data Packet:DH1,Lower channel

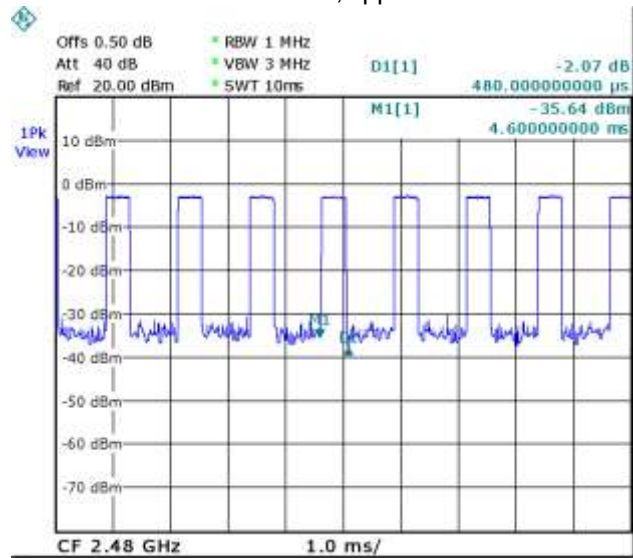


Report No.: WTU13S0100457E

Data Packet:DH1,Middle channel

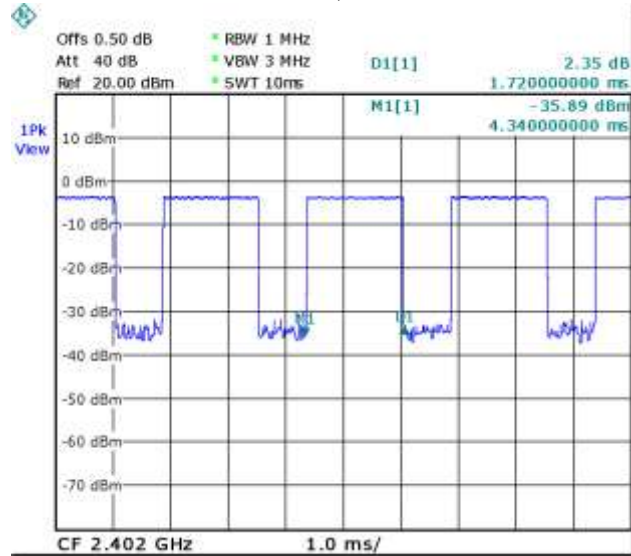


Data Packet:DH1,Upper channel

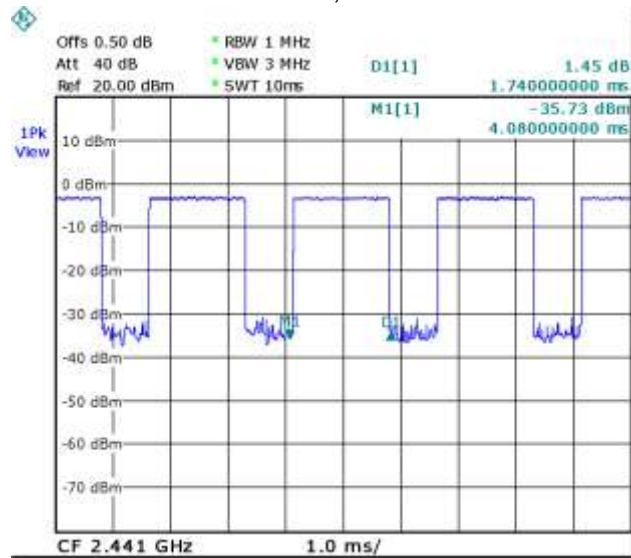


Report No.: WTU13S0100457E

Data Packet:DH3,Lower channel

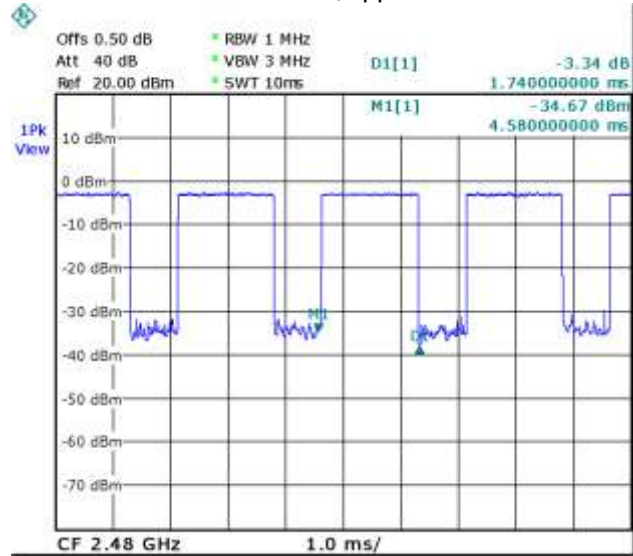


Data Packet:DH3,Middle channel

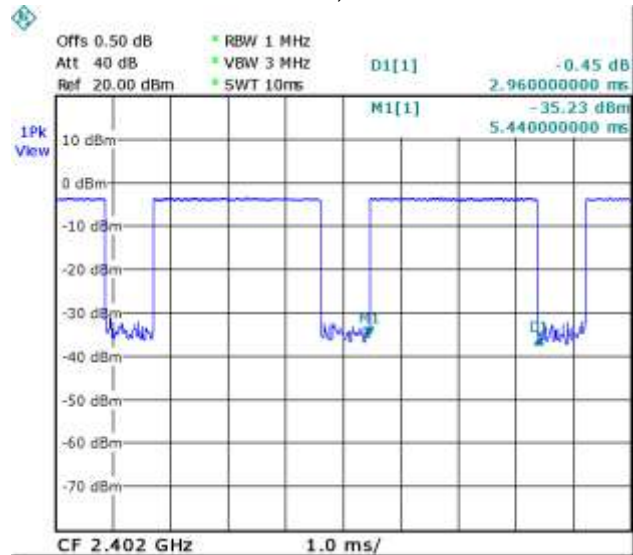


Report No.: WTU13S0100457E

Data Packet:DH3,Upper channel

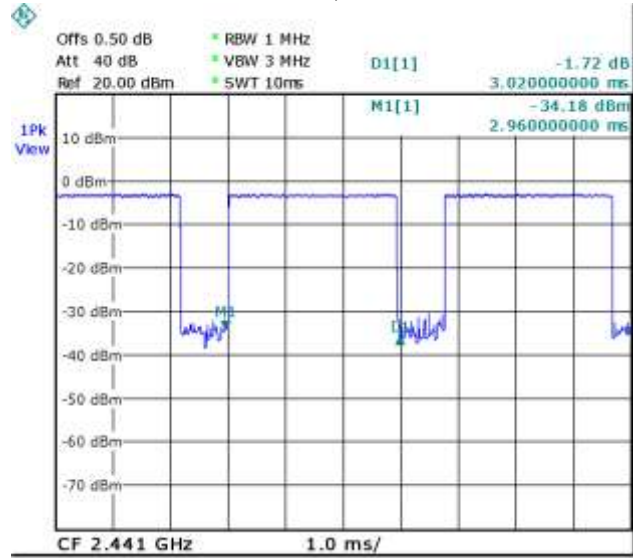


Data Packet:DH5,Lower channel

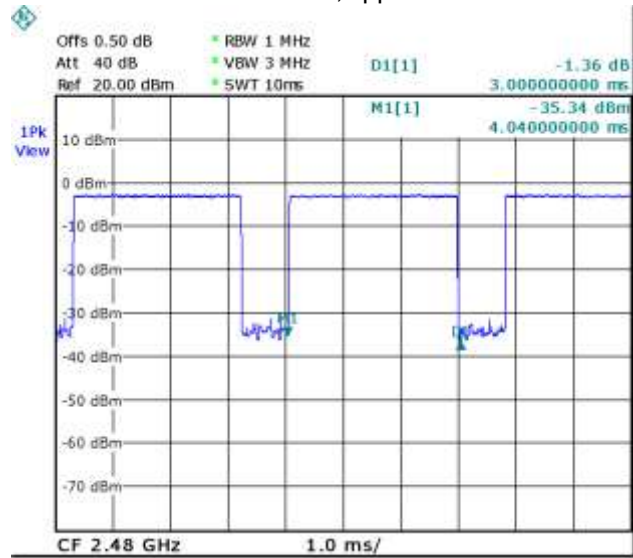


Report No.: WTU13S0100457E

Data Packet:DH5,Middle channel



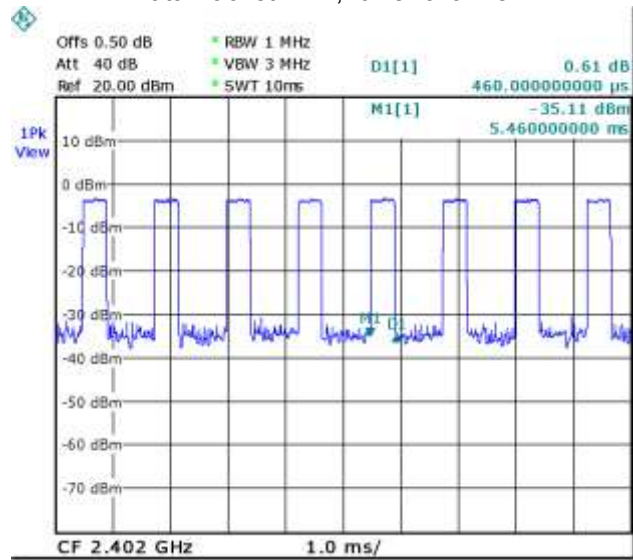
Data Packet:DH5,Upper channel



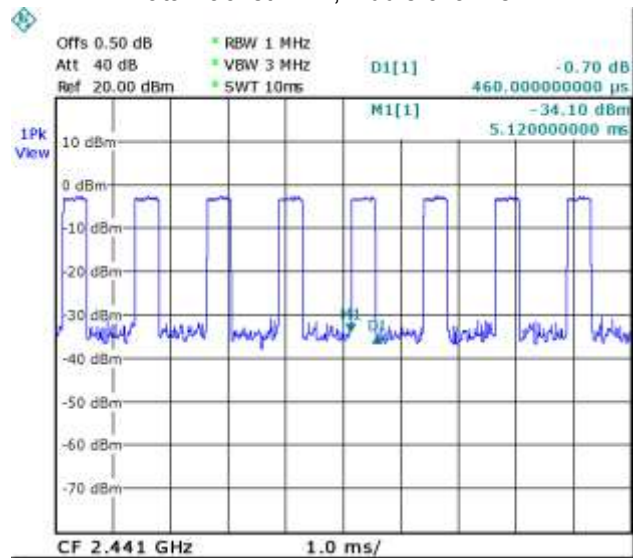
Report No.: WTU13S0100457E

Modulation: 8DPSK

Data Packet:DH1,Lower channel

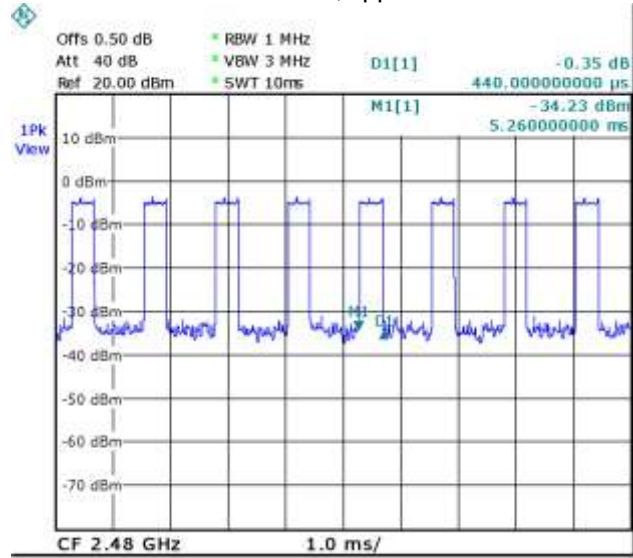


Data Packet:DH1,Middle channel

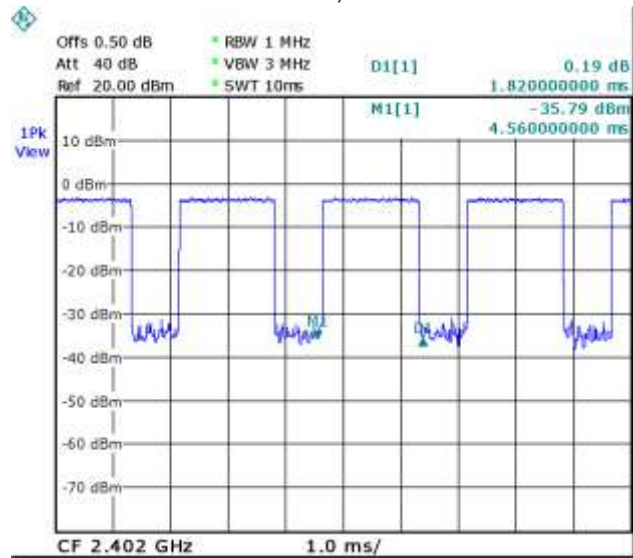


Report No.: WTU13S0100457E

Data Packet:DH1,Upper channel

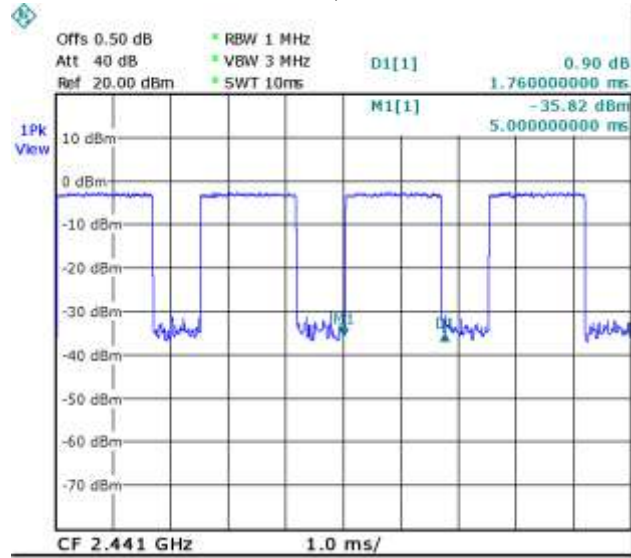


Data Packet:DH3,Lower channel

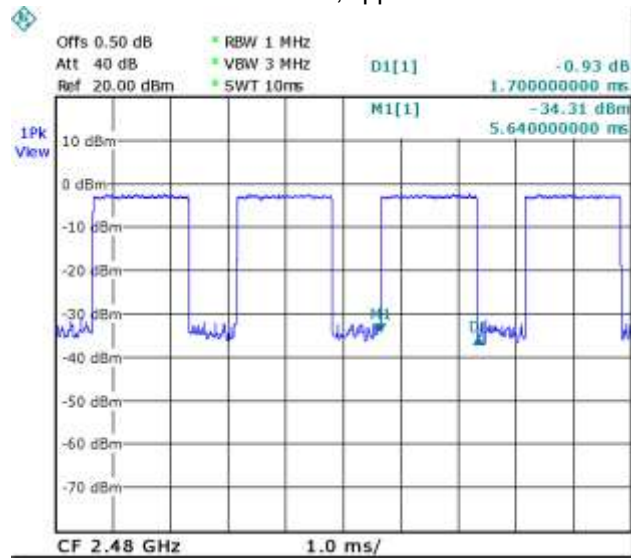


Report No.: WTU13S0100457E

Data Packet:DH3,Middle channel

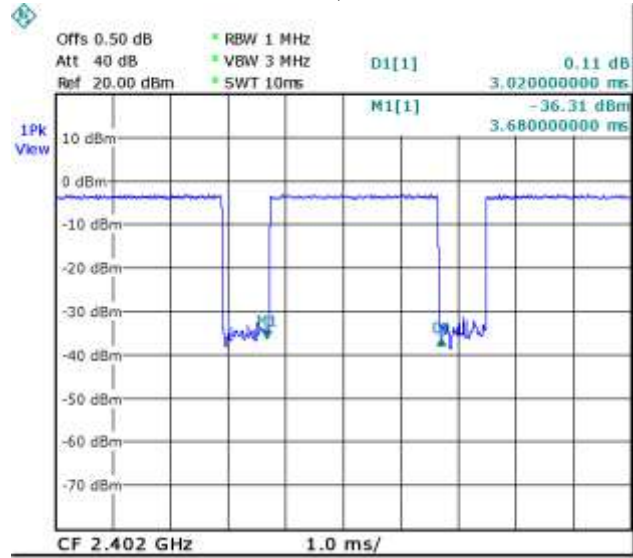


Data Packet:DH3,Upper channel

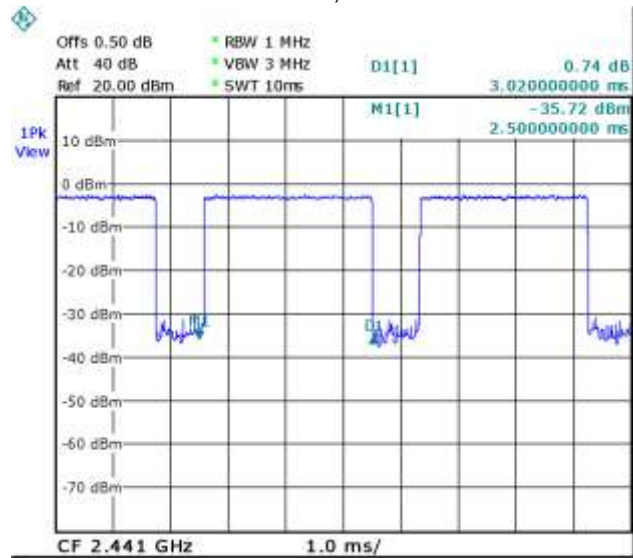


Report No.: WTU13S0100457E

Data Packet:DH5,Lower channel

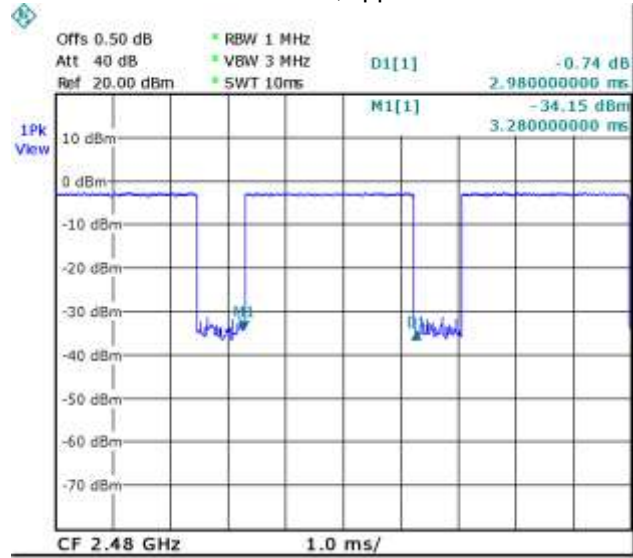


Data Packet:DH5,Middle channel



Report No.: WTU13S0100457E

Data Packet:DH5,Upper channel



Report No.: WTU13S0100457E

14 Emissions from out of band

Test Requirement: FCC CFR47 Part 15 Section 15.247(d)
 Test Method: DA 00-705
 Test Limit: Emissions produced by the device outside the authorized frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the fundamental.
 Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

14.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4. mark the worst point and record.

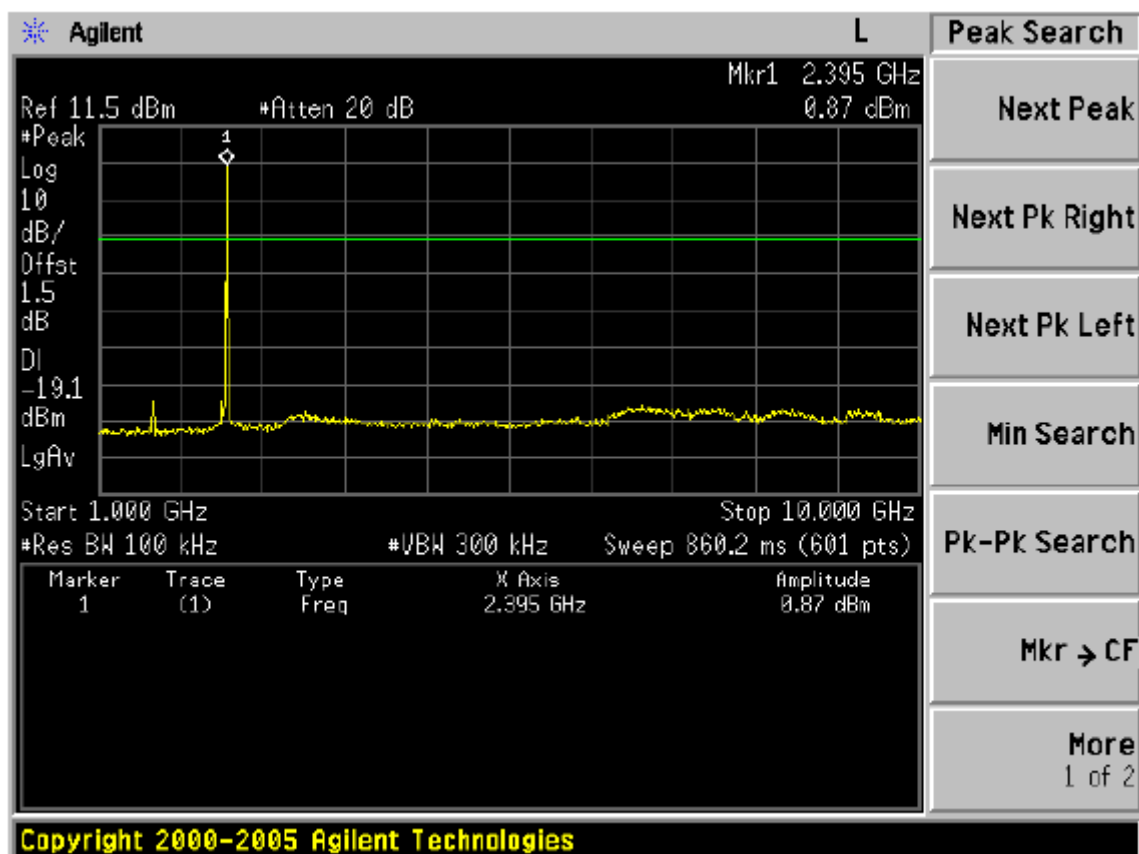
14.2 Test Result:

Test Frequency:below 30MHz

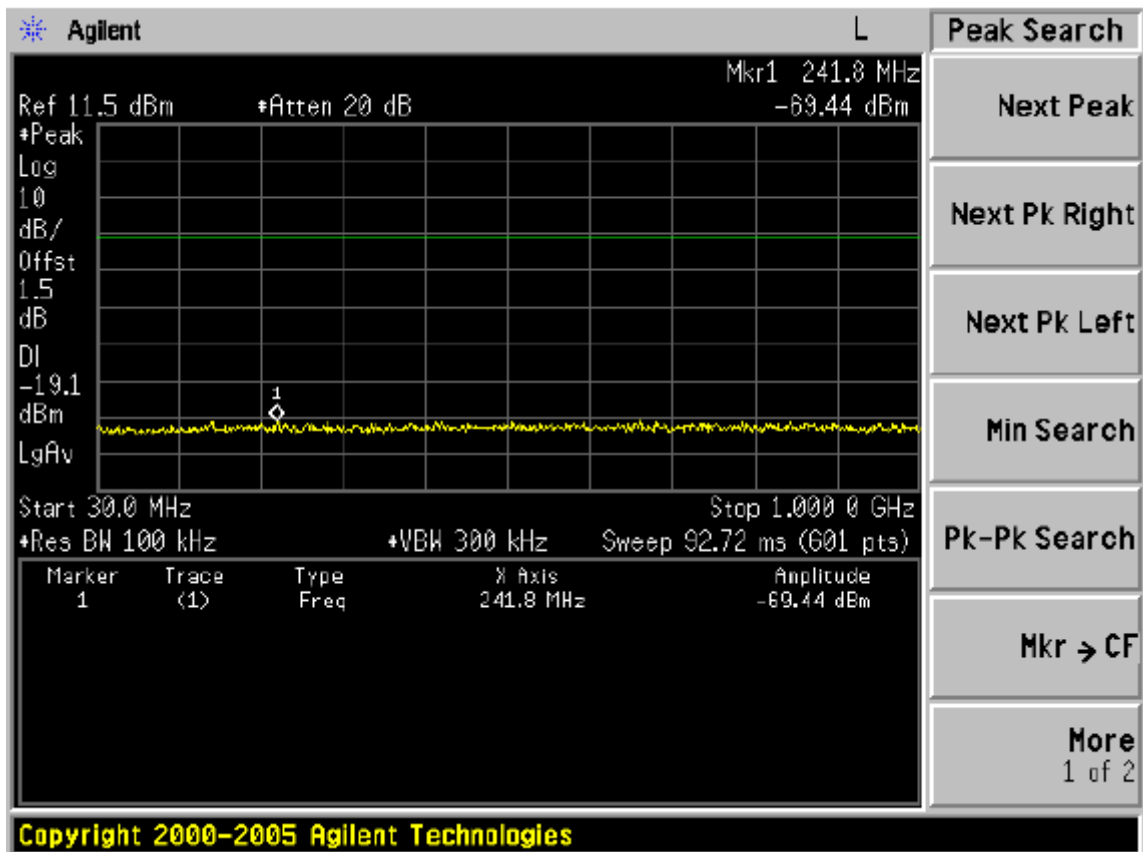
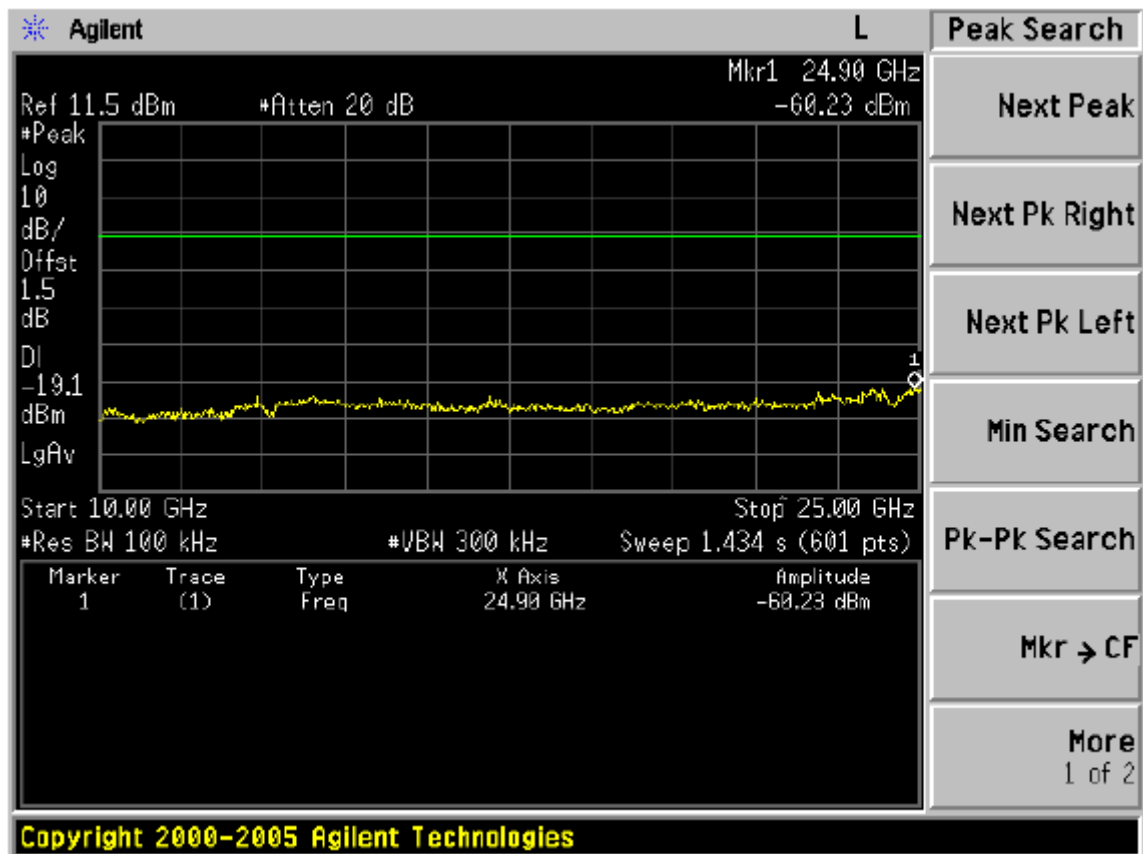
All emissions were more than 20 dB below the limit and therefore not reported.

Test Frequency:Above 30MHz

Lower Channel

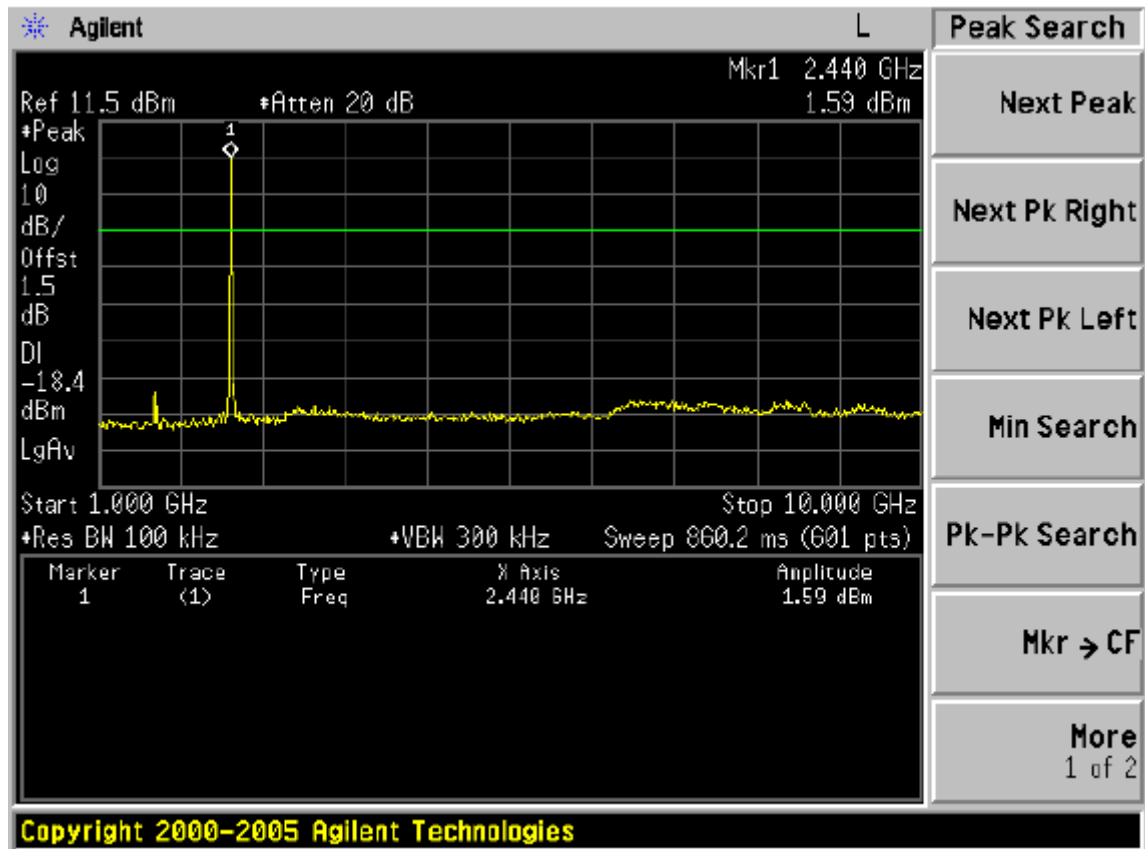


Report No.: WTU13S0100457E

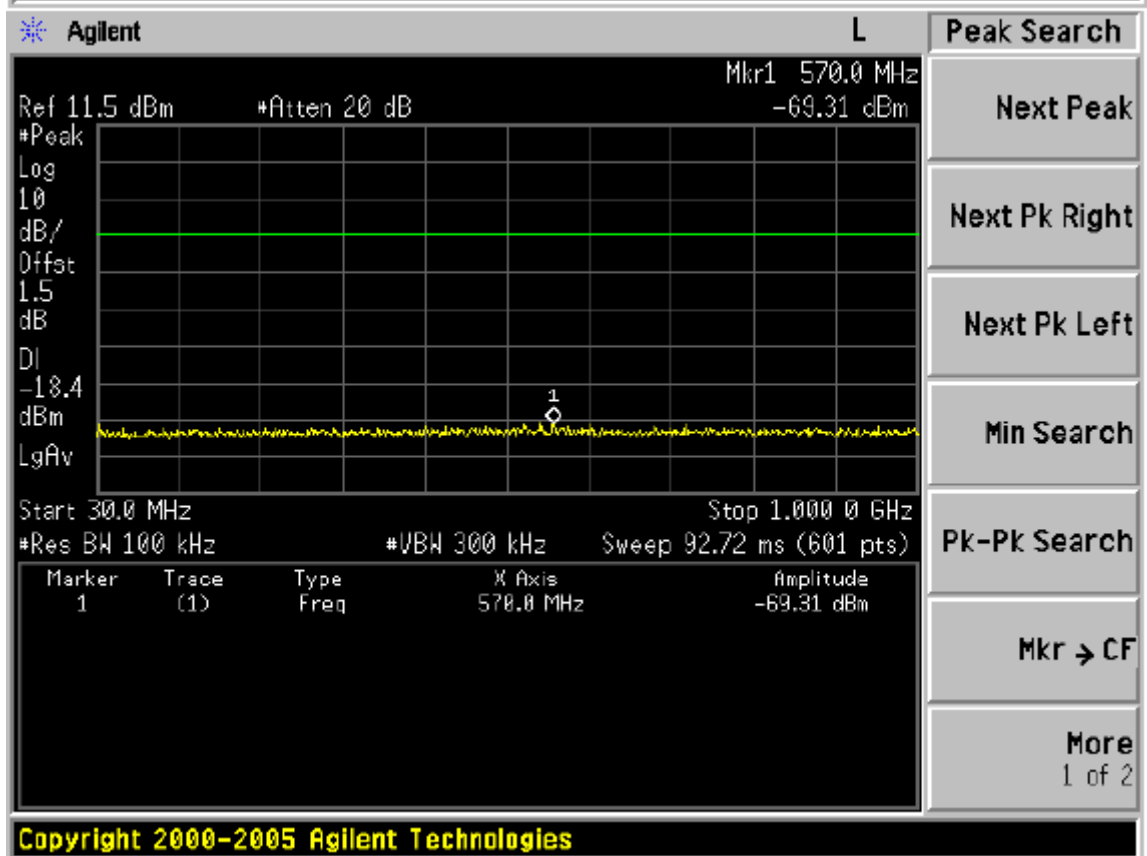
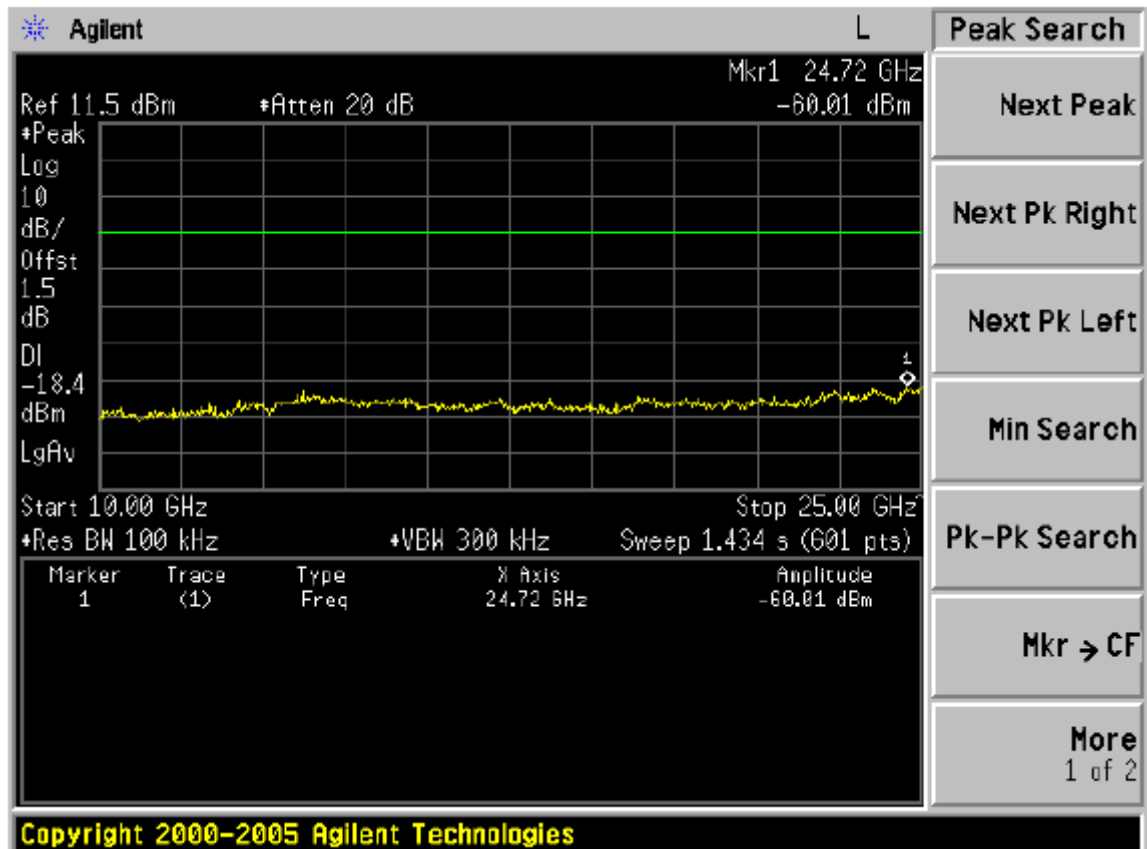


Report No.: WTU13S0100457E

Middle channel

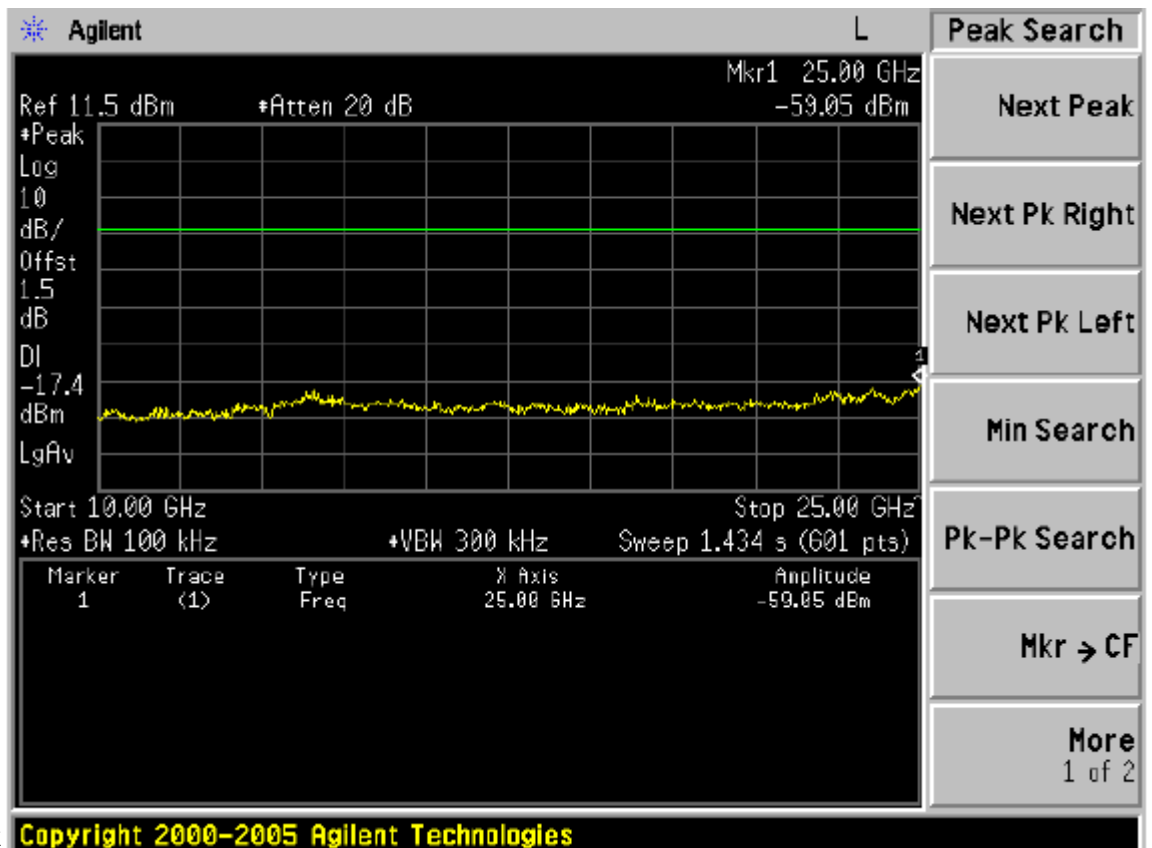
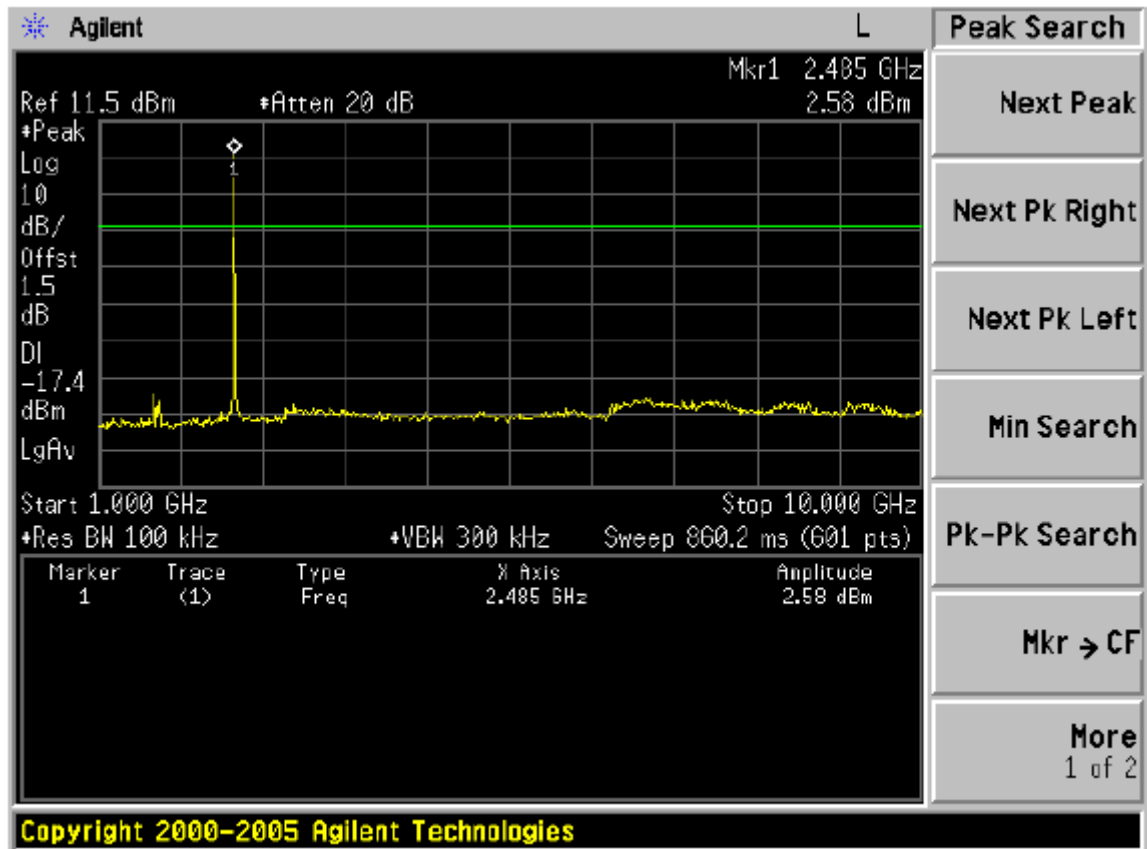


Report No.: WTU13S0100457E

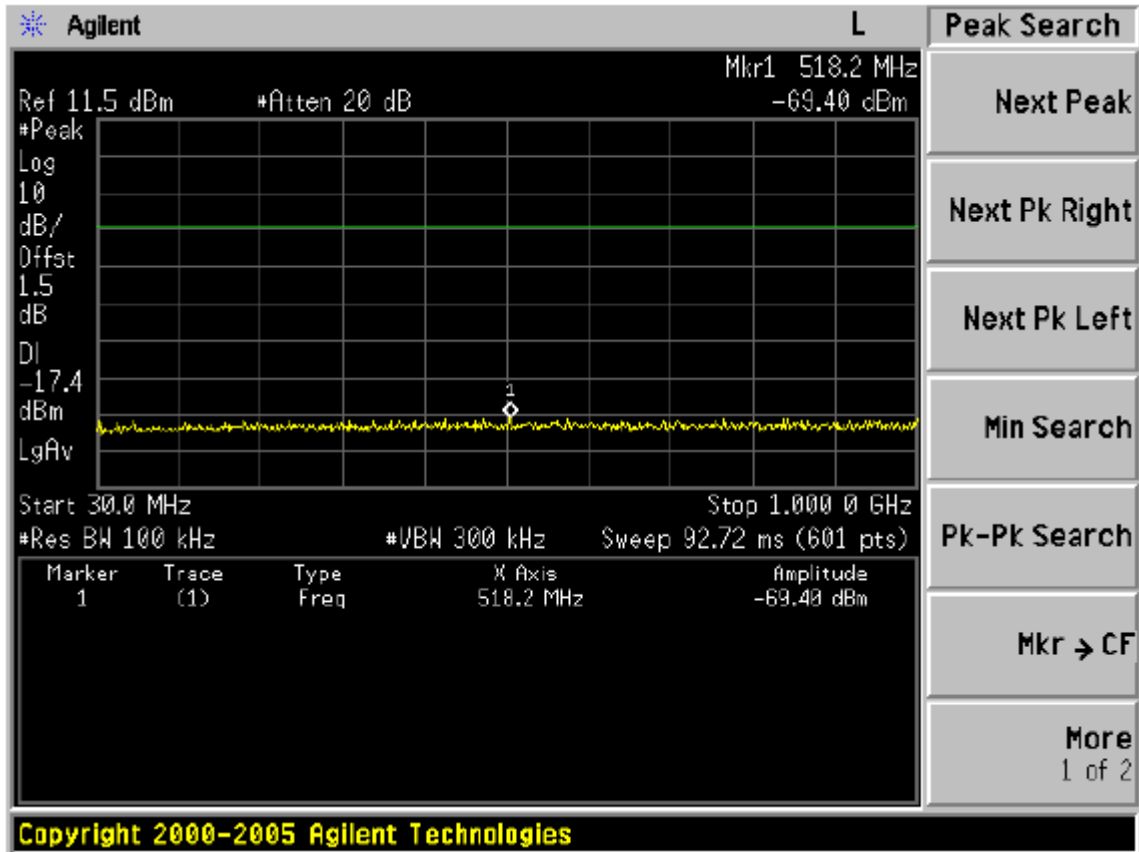


Report No.: WTU13S0100457E

Upper channel



Report No.: WTU13S0100457E



15 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a integrated antenna, fulfil the requirement of this section.

16 RF Exposure

16.1 Requirements:

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

16.2 Measurement Result:

Channel	Antenna Gain (dBi)	Antenna Gain (numeric)	Conducted Power (dBm)	Conducted Power (mW)
Lower	0	1	-0.22	0.95
Middle	0	1	-1.42	0.72
Upper	0	1	-2.40	0.58

Formula: $\text{dBm} = 10 \lg(\text{mw})$, $\text{Gain}_{\text{numeric}} = 10^{(\text{dBi}/10)}$

The EUT works on the 2.4GHz ISM band, and the max output power (conducted) of which is 0.95mW lower than low threshold 60/f (GHz) mW (25mW), $d < 2.5\text{cm}$ in general population category.

The SAR evaluation is not required.

Report No.: WTU13S0100457E

17 Photographs –Test Setup

Refer to test report No.: WTU13S0100456E

Report No.: WTU13S0100457E

18 Photographs - Constructional Details

18.1 EUT – External View

Refer to test report No.: WTU13S0100456E

18.2 EUT- Internal View

Refer to test report No.: WTU13S0100456E

==End of test report==