

# FCC Test Report

FCC EVALUATION REPORT FOR VERIFICATION	
Project Reference No.	199219
Product	Multi-Link Bluetooth Headphone
Brand Name	N/A
Model	ES2
Alternate Model	N/A
Tested according to	FCC Rules and Regulations Part 15 Subpart C 2012 15.247, ANSI C63.4-2003

Tested in period	2011.12.30 to 2012.02.29	
Issued date	2012.02.29	
Name and address of the Test House	 Nemko Shanghai Ltd. 9A No. 528 Ruiqing Road, PuDong New Area, Shanghai, China P.C. Phone : +86 21 5072 0988 Fax : +86 21 5072 0950	
Tested by	<i>Zone Peng</i>	
	<b>Zone Peng</b>	2012/02/29 <b>date</b>
Verified by	<i>Daria Liu</i>	
	<b>Daria Liu</b>	2012/02/29 <b>date</b>

This form is only for use by Nemko, or by others according to special agreement with Nemko. The report may be reproduced in full. Partial reproduction may only be made with the written content of Nemko Shanghai. This report applies only to the sample(s) tested. It is the manufacturer's responsibility to assure the additional production units of this product are manufactured with identical electrical and mechanical components.

## Contents of This Report

1. Client Information .....	4
1.1 Applicant .....	4
1.2 Manufacturer.....	4
1.3 Scope.....	4
2. Equipment under Test (EUT) .....	5
2.1 Identification of EUT .....	5
2.2 Detail spec: .....	5
2.3 Additional Information Related to Testing .....	5
3. General Test Conditions.....	6
3.1 Location .....	6
3.2 Operating Environment.....	6
3.3 Operating During Test.....	6
3.4 Test Equipment .....	6
4. Measurement Uncertainty .....	6
5. Radiated Electromagnetic Disturbances.....	7
5.1 Test Procedure.....	7
5.2 Measurement Equipment.....	7
5.3 Test Result .....	7
5.3.1 Diagram 5-1 .....	10
5.3.1 Diagram 5-1 .....	10
5.3.2 Diagram 5-2 .....	11
5.3.3 Diagram 5-3 .....	12
5.3.8 Diagram 5-8 .....	16
5.3.9 Diagram 5-9 .....	17
5.3.10 Diagram 5-10 .....	18
5.3.11 Diagram 5-11.....	19
5.3.12 Diagram 5-12 .....	19
5.3.13 Diagram 5-13 .....	20
5.3.14 Diagram 5-14 .....	21
5.3.15 Diagram 5-15 .....	22
5.3.16 Diagram 5-16 .....	23
5.3.17 Diagram 5-17 .....	24
5.3.18 Diagram 5-18 .....	24
5.3.19 Diagram 5-19 .....	25
5.3.20 Diagram 5-20 .....	26
6. 20 dB bandwidth Test.....	27
6.1 Test Procedure.....	27
6.2 Measurement Equipment.....	27
6.3 Test Result: .....	27
7. Band Edge Compliance Test.....	33
7.1 Test Procedure.....	33
7.2 Measurement Equipment.....	33
7.3 Test Result .....	33

8. Carrier Frequency Separation Test .....	63
8.1 Test Procedure .....	63
8.2 Measurement Equipment.....	63
8.3 Test Result .....	63
8.3.1 Diagram 8-1 .....	64
8.3.2 Diagram 8-2 .....	65
8.3.3 Diagram 8-3 .....	66
9. Output Power Test.....	67
9.1 Test Procedure.....	67
9.2 Measurement Equipment.....	67
9.3 Test Result .....	67
10. NUMBER OF HOPPING FREQUENCY TEST .....	74
10.1 Test Procedure.....	74
10.2 Measurement Equipment.....	74
10.3 Test Result .....	74
10.3.1 Diagram .....	74
11. DWELL TIME TEST .....	75
11.1 Test Procedure .....	75
11.2 Measurement Equipment.....	75
11.3 Test Result .....	75
11.3.1 Diagram 11-1.....	76
11.3.2 Diagram 11-2.....	77
11.3.3 Diagram 11-3.....	78
12 POWER LINE CONDUCTED EMISSION TEST .....	79
12.1 Test Procedure.....	79
12.2 Measurement Equipment.....	79
12.3 Test Result .....	79
12.3.1 Diagram 12-1 .....	80
12.3.2 Diagram 12-2 .....	81
12.3.1 Diagram 12-3 .....	82
12.3.2 Diagram 12-4 .....	83
13 Antenna requirement.....	84
13.1 Requirement.....	84
13.2 Result.....	84
14.MPE .....	85
Appendix A Duty cycle .....	86
Appendix B Sample Label.....	87

## 1. Client Information

### 1.1 Applicant

Company Name: **Alford Industries Ltd**  
Company Address: **Unit 201, 2/F, Park Building 476 Castle Peak Road ,Kowloon,Hong Kong**

### 1.2 Manufacturer

Company Name: **Foshan Shunde Alford Electronics Co. Ltd.**  
Company Address: **Xinjiao Industrial Park, Daliang, Shunde Foshan City, Guangdong Province China**

### 1.3 Scope

- Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.



## 2. Equipment under Test (EUT)

### 2.1 Identification of EUT

Category: Multi-Link Bluetooth Headphone  
Model Name: ES2  
Alternate model: N/A  
Brand name: N/A  
Technical data (Rating, etc.): As below

### 2.2 Detail spec:

Carrier Frequency : 2402MHz~2480MHz

Number of Channel : 79

Output Power : 7.10 dBm

Modulation Type : Bluetooth( GFSK,  $\pi/4$  DQPSK, 8DPSK )

Mode of operation (duplex, simplex, half duplex) : duplex

Antenna Type : Intergral Antenna

Antenna gain : 0 dBi

Input : 2.4VDC ( 1.2VDC rechargeable battery 2pcs)

Adapter 1:

Model : BLJ5W050050U-U

Input: 100V-240VAC 50/60Hz 150mA

Output:5VDC 500mA

Adapter 2:

Model: HK-U-050A050-US

Input: 100V-240VAC 50/60Hz 0.2A

Output:5VDC 0.5A

### 2.3 Additional Information Related to Testing

**CHL : CH 1 2402MHz**

**CHM : CH 39 2441MHz**

**CHH : CH 79 2480MHz**

### 3. General Test Conditions

#### 3.1 Location

Global United Technology Services Co., Ltd. -- Nemko ELA 632  
2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road Baoan District, Shenzhen, China  
FCC Registration No.:600491  
IC Registration No.9079A-1

Note: all test are witnessed by NEMKO engineer

#### 3.2 Operating Environment

All tests and measurements were performed in a shielded enclosure or a controlled environment suitable for the tests conducted. The climatic conditions in the test area are automatically controlled and recorded continuously.

Parameters	Recording during test	Accepted deviation
Ambient temperature	20-25°C	15 – 35 °C
Relative humidity	45-55%	30 - 60%
Atmospheric pressure	101.2 kPa -101.3kPa	86-106kPa

#### 3.3 Operating During Test

Test mode:120V 60Hz

TM1 : continuance TX MODE GFSK CH 1

TM2 : continuance TX MODE GFSK CH 39

TM3: continuance TX MODE GFSK CH 79

TM4: continuance TX MODE 8DPSK CH 1

TM5: continuance TX MODE 8DPSK CH 39

TM6: continuance TX MODE 8DPSK CH 79

TM7: continuance TX MODE  $\pi/4$  DQPSK CH 1

TM8: continuance TX MODE  $\pi/4$  DQPSK CH 39

TM9: continuance TX MODE  $\pi/4$  DQPSK CH 79

TM10: Hopping on CH 1

TM11: Hopping on CH 79

Remark : When measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, have been performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. No findable change appear.

X,Y,Z these 3 axial direction have been tested and only choose the worse mode to be reported.

#### 3.4 Test Equipment

The test equipments used in testing are calibrated on a regular basis. For most of the testing equipments accredited calibration is conducted once a year. For certain equipment the calibration interval is longer. Between the calibrations all test equipment are controlled and verified on a regular basis. The test equipments used are defined in each test section of this report.

### 4. Measurement Uncertainty

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95 %.

Conducted Emission : 0.15~30MHz 3.45dB

Radiated Emission: 30MHz~1000MHz 4.50dB

1GHz-18GHz 4.70dB

## 5. Radiated Electromagnetic Disturbances

### 5.1 Test Procedure

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 3m from the EUT on an adjustable mast.

The EUT were rotated 0 to 360 degree and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. The test result are reported as below.

For below 1GHz

RBW=120 kHz; VBW=300KHz. The frequency range from 30MHz to 1000MHz is checked using QP detector .

For above 1GHz. The frequency range from 1GHz to 25GHz(10<sup>th</sup> harmonics) is checked.

RBW=1MHz ; VBW=1MHz, PK detector for peak emissions measurement above 1GHz

RBW=1MHz ; VBW=10Hz, PK detector for average emissions measure above 1GHz ( for CW mode only) .

**The duty cycle factor is  $20\log 1/0.359=8.9\text{dB}$ , the duty cycle is referred to Appendix A**

**So AV value should be Peak value subtract the duty cycle factor .**

### 5.2 Measurement Equipment

Equipment	Model No.	Serial No.	Last Cal.	Manufacturer
EMI Test Receiver	ESU26	GTS203	Jul. 04 2011	R&S
BiConiLog Antenna	VULB9163	GTS214	Feb. 26 2012	SCHWARZBECK
Horn Antenna	BBHA9120D	GTS215	Feb. 26 2012	SCHWARZBECK
Horn Antenna	BBHA9170	GTS216	Feb. 26 2012	SCHWARZBECK
Coaxial Cable	N/A	GTS213	Apr. 01 2011	GTS
Coaxial Cable	N/A	GTS211	Apr. 01 2011	GTS
Coaxial cable	N/A	GTS210	Apr. 01 2011	GTS
Coaxial Cable	N/A	GTS212	Apr. 01 2011	GTS
Amplifier	8347A	GTS204	Jul. 04 2011	HP

### 5.3 Test Result

Connect mode	Antenna Polarity	Remark	Test Data	Test Result
TX mode	Horizontal	30-1000MHz	Diagram 5-1	Pass
	Vertical	30-1000MHz	Diagram 5-2	Pass
GFSK CHL	Horizontal	1GHz-18GHz	Diagram 5-3	Pass
	Vertical	1GHz-18GHz	Diagram 5-4	Pass
GFSK CHM	Horizontal	1GHz-18GHz	Diagram 5-5	Pass
	Vertical	1GHz-18GHz	Diagram 5-6	Pass
GFSK CHH	Horizontal	1GHz-18GHz	Diagram 5-7	Pass
	Vertical	1GHz-18GHz	Diagram 5-8	Pass
8DPSK CHL	Horizontal	1GHz-18GHz	Diagram 5-9	Pass
	Vertical	1GHz-18GHz	Diagram 5-10	Pass
8DPSK CHM	Horizontal	1GHz-18GHz	Diagram 5-11	Pass
	Vertical	1GHz-18GHz	Diagram 5-12	Pass
8DPSK CHH	Horizontal	1GHz-18GHz	Diagram 5-13	Pass

	Vertical	1GHz-18GHz	Diagram 5-14	Pass
π/4 DQPSK CHL	Horizontal	1GHz-18GHz	Diagram 5-15	Pass
	Vertical	1GHz-18GHz	Diagram 5-16	Pass
π/4 DQPSK CHM	Horizontal	1GHz-18GHz	Diagram 5-17	Pass
	Vertical	1GHz-18GHz	Diagram 5-18	Pass
π/4 DQPSK CHH	Horizontal	1GHz-18GHz	Diagram 5-19	Pass
	Vertical	1GHz-18GHz	Diagram 5-20	Pass

**Remark:**

The 2 adapter have been respectively used to be tested,Adapter 1 is the worse case,Only the worse case reported.

If PK value is lower than AV limit , then Both PK and AV deem to comply their own limit .

- 1) All modes of operation were investigated and the worst -case emission are reported.
- 2) And for 30-1000MHz , GFSK CHL is the worse case and reported .
- 3) Because no spurious found at 18-25GHz, so no diagram and reading record of it listed.
- 4) All restriction band have been tested at both CHL,M and H with GFSK ,8DPSK andπ/4 DQPSK modulation , only reported the worse case .

NOTES:

1. All modes were measured and the worst case emission was reported.
2. H =Horizontal V=Vertical
3. Emission = Reading +Antenna Factor + Cable Loss –Amp Factor(if exist)
4. Emission level dBµV = 20 log Emission level µV/m
5. The lower limit shall apply at the transition frequencies
6. All the emissions appearing within 15.205 Restricted bands shall not exceed the limits shown in 15.209,all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

Remark :

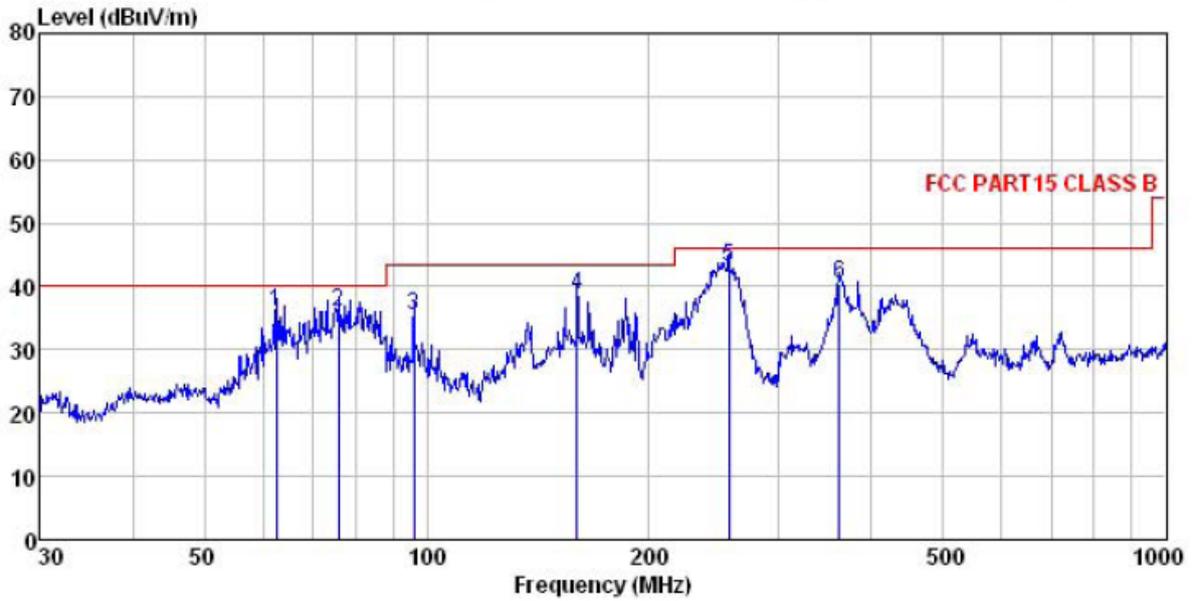
The limit of 15.209(a) of 3 meter distance is

Frequency MHz	Distance m	Field strength		Distance m	Field strength dBµV/m(QP)
		µV/m	dBµV/m(QP)		
30-88	3	100	40.0	10	30.0
88-216	3	150	43.5	10	33.5
216-960	3	200	46.0	10	36.0
960-1000	3	500	54.0	10	44.0
Above 1000	3	74.0 dBµV/m (PK) 54.0 dBµV/m (AV)		/	/

15.205 Restricted bands of operation:

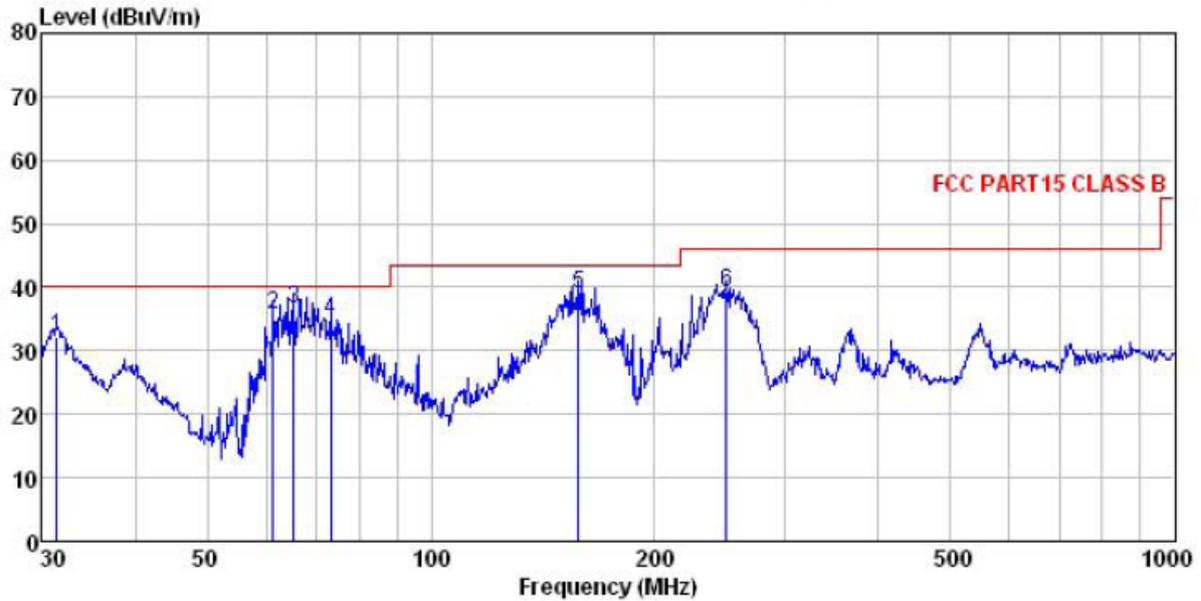
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>3</sup> )

5.3.1 Diagram 5-1



	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit	
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	62.65	52.91	14.63	0.37	31.93	35.98	40.00	-4.02 QP
2	75.98	56.63	10.97	0.41	31.85	36.16	40.00	-3.84 QP
3	96.10	53.34	13.29	0.47	31.71	35.39	43.50	-8.11 QP
4	159.78	61.31	8.63	0.63	32.03	38.54	43.50	-4.96 QP
5	256.52	62.26	12.13	0.93	32.29	43.03	46.00	-2.97 QP
6	361.71	57.04	14.41	1.19	32.31	40.33	46.00	-5.67 QP

5.3.2 Diagram 5-2

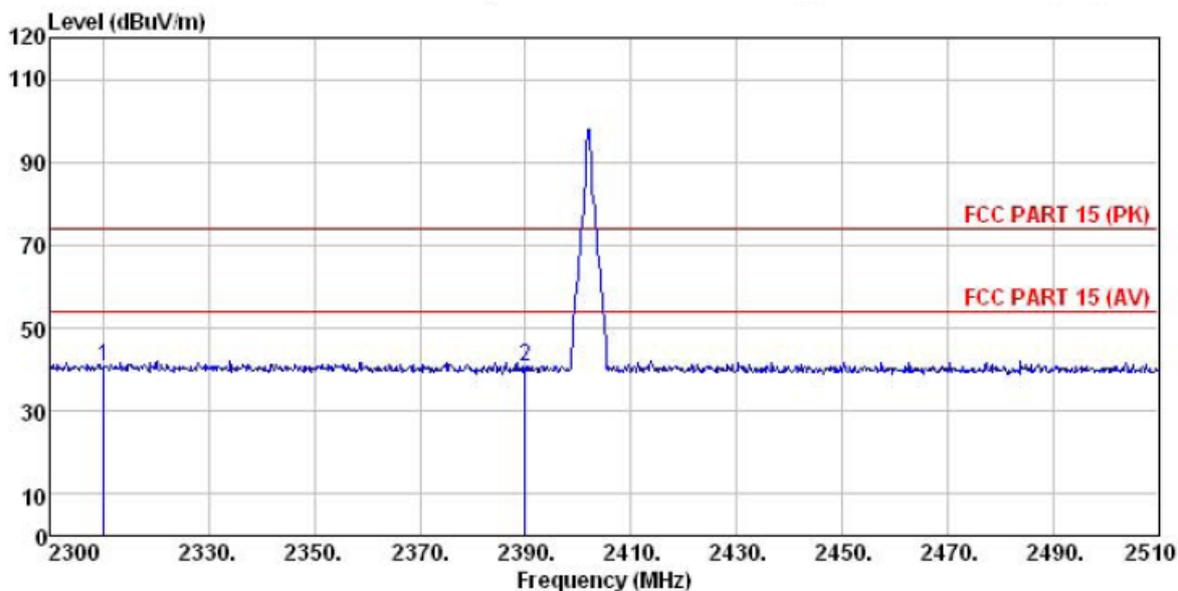


	ReadAntenna	Cable Preamp	Limit	Over					
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	31.40	51.96	12.32	0.21	32.27	32.22	40.00	-7.78	QP
2	61.35	52.24	15.16	0.36	31.95	35.81	40.00	-4.19	QP
3	65.34	54.62	13.57	0.38	31.91	36.66	40.00	-3.34	QP
4	73.36	55.15	11.06	0.41	31.87	34.75	40.00	-5.25	QP
5	158.11	61.80	8.57	0.63	32.03	38.97	43.50	-4.53	QP
6	249.43	58.46	12.07	0.91	32.28	39.16	46.00	-6.84	QP

5.3.3 Diagram 5-3

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.95	31.53	5.87	35.46	45.89	74	-28.11	Peak
7206	43.95	36.47	7.08	35.32	52.18	74	-21.82	Peak
9608	43.41	38.1	9.01	35.72	54.8	74	-19.2	Peak
9608	/	/	/	/	45.9	54	/	Average
12010	43.49	39.3	10.15	35.8	57.14	74	-16.86	Peak
12010	/	/	/	/	48.24	54	/	Average

AV value = PK value- 8.9dB

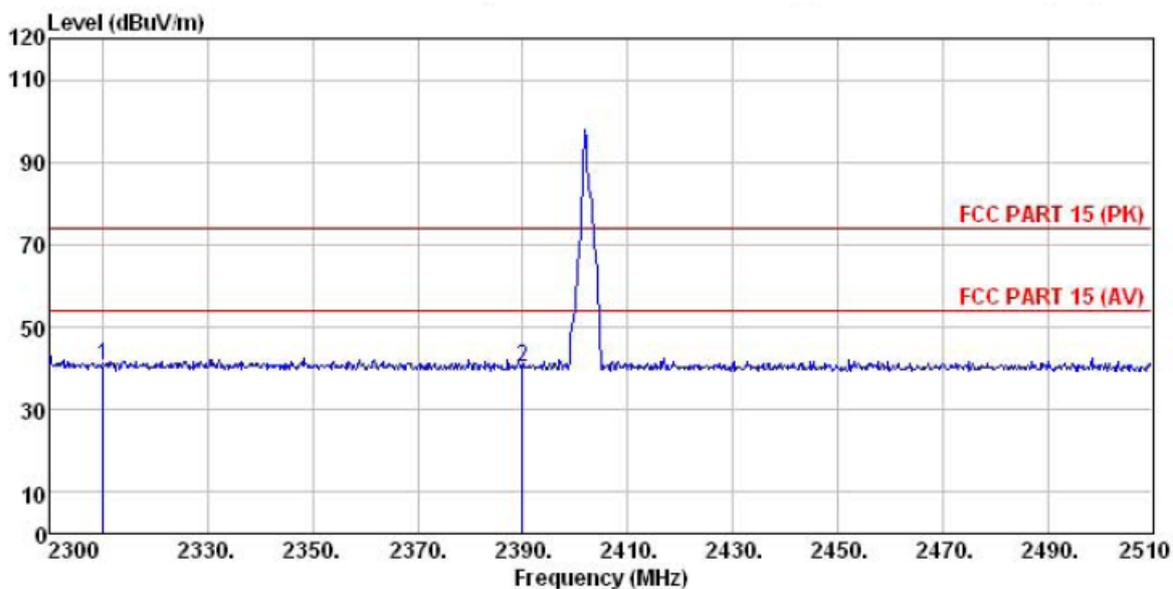


	Read Freq	Antenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.00	43.89	27.98	3.75	34.81	40.81	74.00	-33.19	Peak
2	2390.00	44.11	27.58	3.81	34.83	40.67	74.00	-33.33	Peak

5.3.4 Diagram 5-4

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.82	31.53	5.87	35.46	45.76	74	-28.24	Peak
7206	43.54	36.47	7.08	35.32	51.77	74	-22.23	Peak
9608	43.32	38.1	9.01	35.72	54.71	74	-19.29	Peak
9608	/	/	/	/	45.81	54	/	Average
12010	42.59	39.3	10.15	35.8	56.24	74	-17.76	Peak
12010	/	/	/	/	47.34	54	/	Average

AV value = PK value- 8.9dB



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.00	44.02	27.98	3.75	34.81	40.94	74.00	-33.06	Peak
2	2390.00	43.53	27.58	3.81	34.83	40.09	74.00	-33.91	Peak

**5.3.5 Diagram 5-5**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	43.54	31.58	5.91	35.48	45.55	74	-28.45	Peak
7323	43.78	36.47	7.14	35.27	52.12	74	-21.88	Peak
9764	42.92	38.45	9.06	35.75	54.68	74	-19.32	Peak
9764	/	/	/	/	45.78	54	/	Average
12205	43.27	39.29	10.26	35.69	57.13	74	-16.87	Peak
12205	/	/	/	/	48.23	54	/	Average

**AV value = PK value- 8.9dB**
**5.3.6 Diagram 5-6**

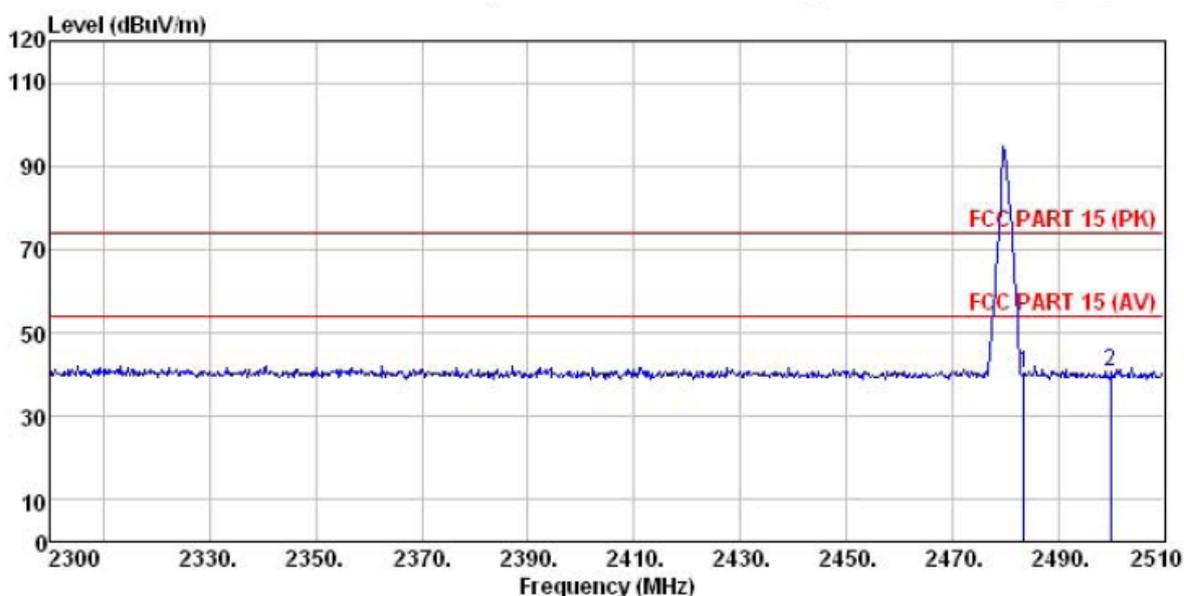
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	43.62	31.58	5.91	35.48	45.63	74	-28.37	Peak
7323	43.64	36.47	7.14	35.27	51.98	74	-22.02	Peak
9750	42.8	38.45	9.06	35.75	54.56	74	-19.44	Peak
9750	/	/	/	/	45.66	54	/	Average
12210	42.68	39.25	10.26	35.69	56.5	74	-17.5	Peak
12210	/	/	/	/	47.6	54	/	Average

**AV value = PK value- 8.9dB**

5.3.7 Diagram 5-7

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	43.08	31.69	5.97	35.49	45.25	74	-28.75	Peak
7440	43.13	36.6	7.18	35.23	51.68	74	-22.32	Peak
9920	42.34	38.66	9.11	35.78	54.33	74	-19.67	Peak
9920	/	/	/	/	45.43	54	/	Average
12400	42.51	38.73	10.37	35.6	56.01	74	-17.99	Peak
12400	/	/	/	/	47.11	54	/	Average

AV value = PK value- 8.9dB

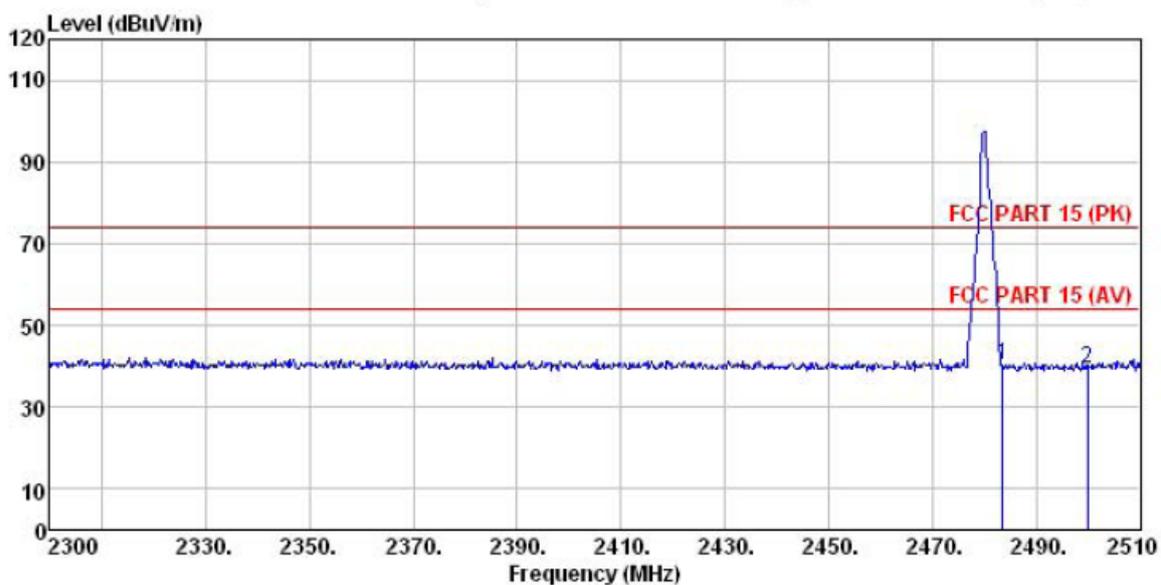


	Read Freq	Antenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.50	43.85	27.52	3.89	34.86	40.40	74.00	-33.60	Peak
2	2500.00	44.27	27.55	3.90	34.87	40.85	74.00	-33.15	Peak

5.3.8 Diagram 5-8

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	43.76	31.69	5.97	35.49	45.93	74	-28.07	Peak
7440	44.95	36.6	7.18	35.23	53.5	74	-20.5	Peak
9920	43.29	38.66	9.11	35.78	55.28	74	-18.72	Peak
9920	/	/	/	/	46.38	54	/	Average
12400	42.82	38.73	10.37	35.6	56.32	74	-17.68	Peak
12400	/	/	/	/	47.42	54	/	Average

AV value = PK value- 8.9dB

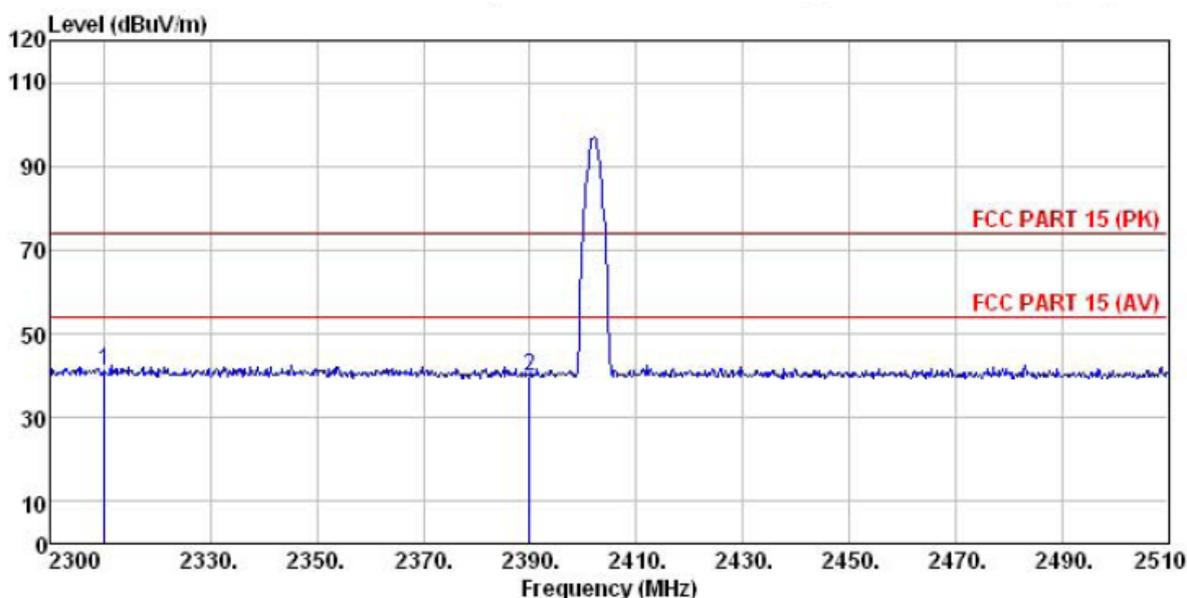


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.50	43.64	27.52	3.89	34.86	40.19	74.00	-33.81	Peak
2	2500.00	42.96	27.55	3.90	34.87	39.54	74.00	-34.46	Peak

5.3.9 Diagram 5-9

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.95	31.53	5.87	35.46	45.89	74	-28.11	Peak
7206	43.95	36.47	7.08	35.32	52.18	74	-21.82	Peak
9600	43.43	38.08	9.01	35.72	54.8	74	-19.2	Peak
9600	/	/	/	/	45.9	54	/	Average
12045	43.14	39.33	10.15	35.78	56.84	74	-17.16	Peak
12045	/	/	/	/	47.94	54	/	Average

AV value = PK value- 8.9dB

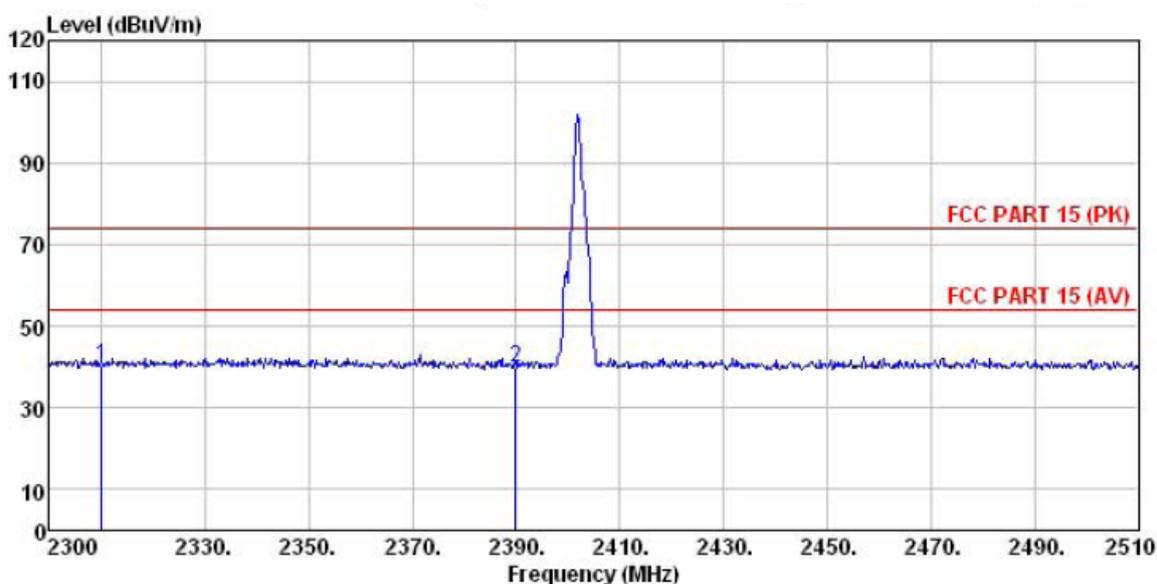


	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Level	Limit	Over	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2310.00	44.20	27.98	3.75	34.81	41.12	74.00	-32.88 Peak
2	2390.00	43.17	27.58	3.81	34.83	39.73	74.00	-34.27 Peak

5.3.10 Diagram 5-10

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.82	31.53	5.87	35.46	45.76	74	-28.24	Peak
7206	43.29	36.47	7.08	35.32	51.52	74	-22.48	Peak
9608	43.32	38.1	9.01	35.72	54.71	74	-19.29	Peak
9608	/	/	/	/	45.81	54	/	Average
12010	42.59	39.3	10.15	35.8	56.24	74	-17.76	Peak
12010	/	/	/	/	47.34	54	/	Average

AV value = PK value- 8.9dB



	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.00	43.37	27.98	3.75	34.81	40.29	74.00	-33.71	Peak
2	2390.00	43.46	27.58	3.81	34.83	40.02	74.00	-33.98	Peak

**5.3.11 Diagram 5-11**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	43.99	31.58	5.91	35.48	46	74	-28	Peak
7323	43.78	36.47	7.14	35.27	52.12	74	-21.88	Peak
9764	42.92	38.45	9.06	35.75	54.68	74	-19.32	Peak
9764	/	/	/	/	45.78	54	/	Average
12205	43.27	39.29	10.26	35.69	57.13	74	-16.87	Peak
12205	/	/	/	/	48.23	54	/	Average

**AV value = PK value- 8.9dB**

**5.3.12 Diagram 5-12**

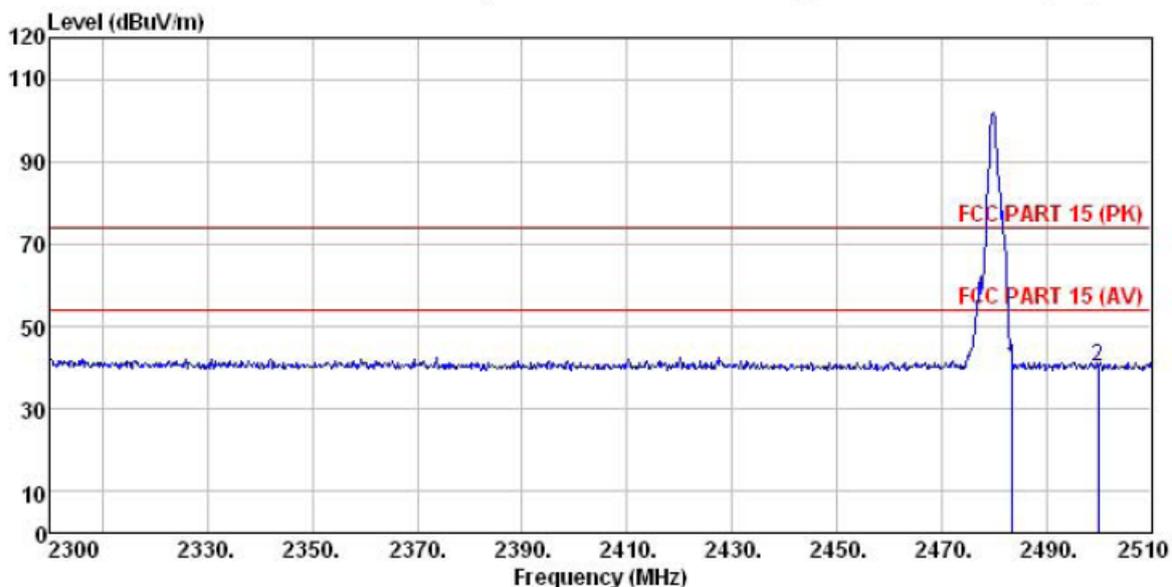
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	43.62	31.58	5.91	35.48	45.63	74	-28.37	Peak
7323	43.64	36.47	7.14	35.27	51.98	74	-22.02	Peak
9764	42.8	38.45	9.06	35.75	54.56	74	-19.44	Peak
9764	/	/	/	/	45.66	54	/	Average
12205	42.64	39.29	10.26	35.69	56.5	74	-17.5	Peak
12205	/	/	/	/	47.6	54	/	Average

**AV value = PK value- 8.9dB**

5.3.13 Diagram 5-13

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	45.16	31.69	5.97	35.49	47.33	74	-26.67	Peak
7440	45.46	36.6	7.18	35.23	54.01	74	-19.99	Peak
7440	/	/	/	/	45.11	54	/	Average
9920	42.34	38.66	9.11	35.78	54.33	74	-19.67	Peak
9920	/	/	/	/	45.43	54	/	Average
12400	41.81	38.73	10.37	35.6	55.31	74	-18.69	Peak
12400	/	/	/	/	46.41	54	/	Average

AV value = PK value- 8.9dB

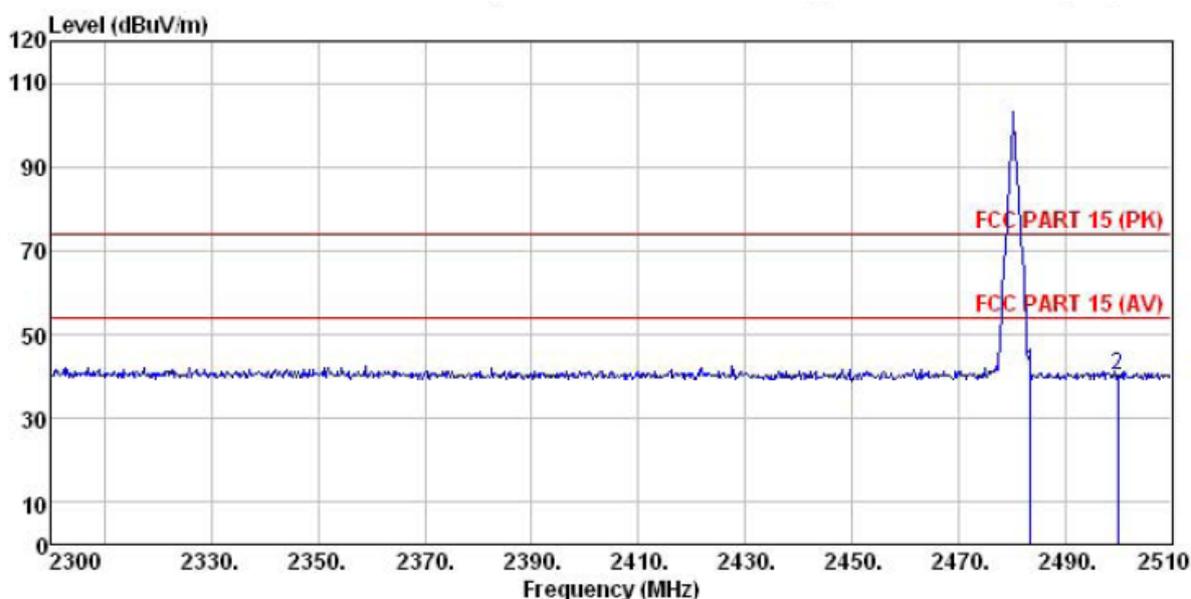


	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Preamp Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2483.50	43.58	27.52	3.89	34.86	40.13	74.00	-33.87 Peak
2	2500.00	43.75	27.55	3.90	34.87	40.33	74.00	-33.67 Peak

5.3.14 Diagram 5-14

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	44.12	31.69	5.97	35.49	46.29	74	-27.71	Peak
7440	44.75	36.6	7.18	35.23	53.3	74	-20.7	Peak
9920	43.29	38.66	9.11	35.78	55.28	74	-18.72	Peak
9920	/	/	/	/	46.38	54	/	Average
12400	42.82	38.73	10.37	35.6	56.32	74	-17.68	Peak
12400	/	/	/	/	47.42	54	/	Average

AV value = PK value- 8.9dB

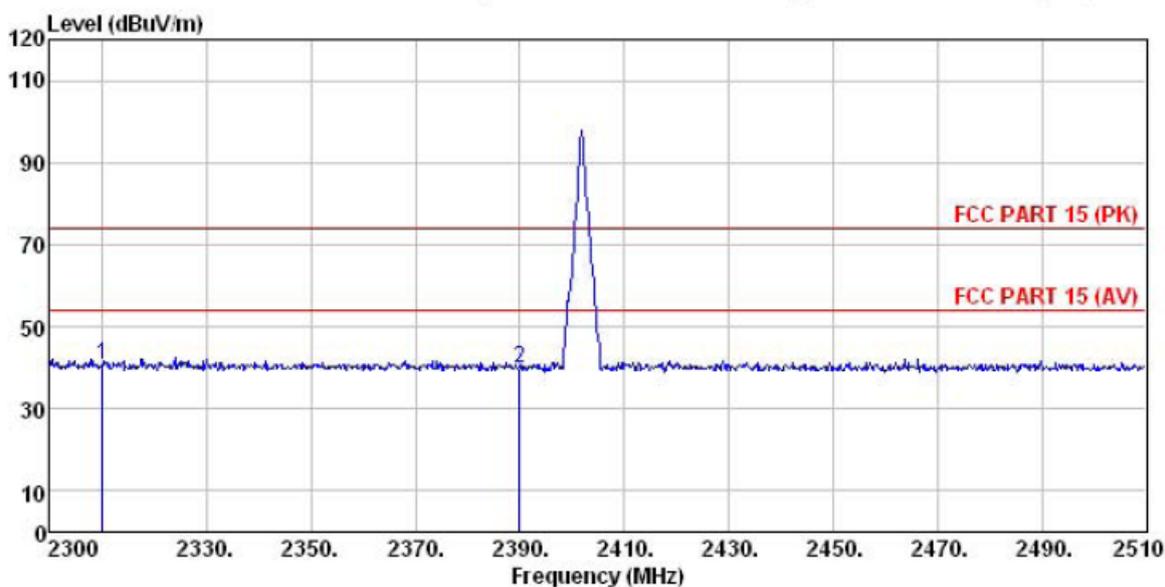


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.50	44.50	27.52	3.89	34.86	41.05	74.00	-32.95	Peak
2	2500.00	43.55	27.55	3.90	34.87	40.13	74.00	-33.87	Peak

5.3.15 Diagram 5-15

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.95	31.53	5.87	35.46	45.89	74	-28.11	Peak
7206	43.95	36.47	7.08	35.32	52.18	74	-21.82	Peak
9608	45.65	38.1	9.01	35.72	57.04	74	-16.96	Peak
9608	/	/	/	/	48.14	54	/	Average
12010	43.15	39.3	10.15	35.8	56.8	74	-17.2	Peak
12010	/	/	/	/	47.9	54	/	Average

AV value = PK value- 8.9dB

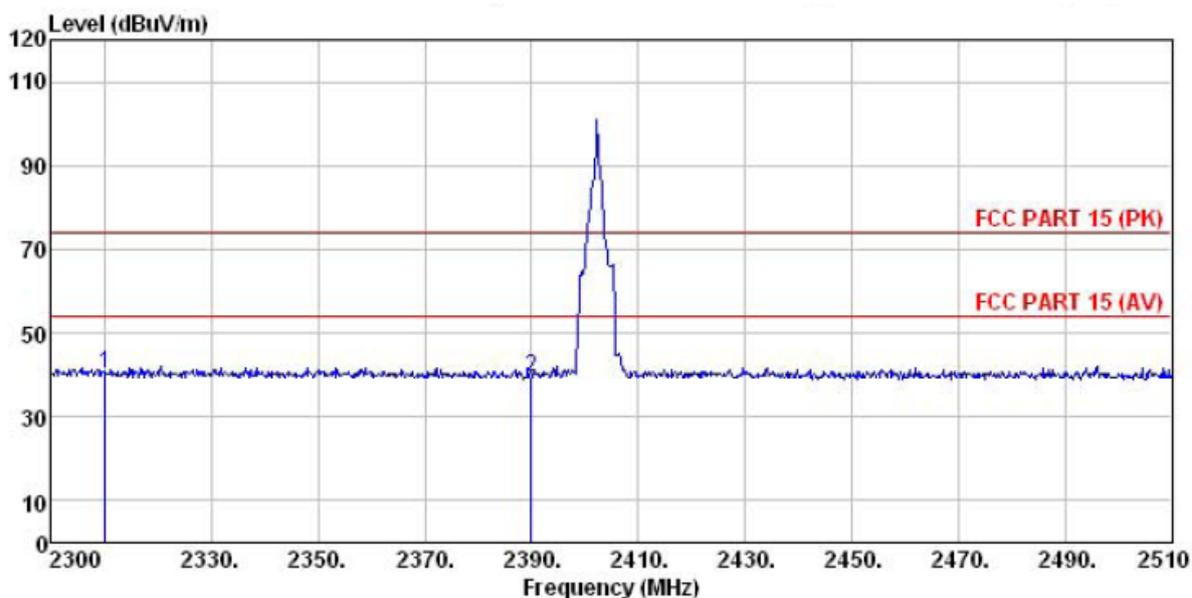


	Read Freq	Antenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.00	43.78	27.98	3.75	34.81	40.70	74.00	-33.30	Peak
2	2390.00	43.27	27.58	3.81	34.83	39.83	74.00	-34.17	Peak

5.3.16 Diagram 5-16

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4804	43.81	31.53	5.87	35.46	45.75	74	-28.25	Peak
7206	43.54	36.47	7.08	35.32	51.77	74	-22.23	Peak
9608	43.32	38.1	9.01	35.72	54.71	74	-19.29	Peak
9608	/	/	/	/	45.81	54	/	Average
12010	42.2	39.3	10.15	35.8	55.85	74	-18.15	Peak
12010	/	/	/	/	46.95	54	/	Average

AV value = PK value- 8.9dB



	Read Freq	Antenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2310.00	43.29	27.98	3.75	34.81	40.21	74.00	-33.79	Peak
2	2390.00	42.79	27.58	3.81	34.83	39.35	74.00	-34.65	Peak

**5.3.17 Diagram 5-17**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	43.54	31.58	5.91	35.48	45.55	74	-28.45	Peak
7323	43.78	36.47	7.14	35.27	52.12	74	-21.88	Peak
9764	45.31	38.45	9.06	35.75	57.07	74	-16.93	Peak
9764	/	/	/	/	48.17	54	/	Average
12205	42.74	39.29	10.26	35.69	56.6	74	-17.4	Peak
12205	/	/	/	/	47.7	54	/	Average

**AV value = PK value- 8.9dB**
**5.3.18 Diagram 5-18**

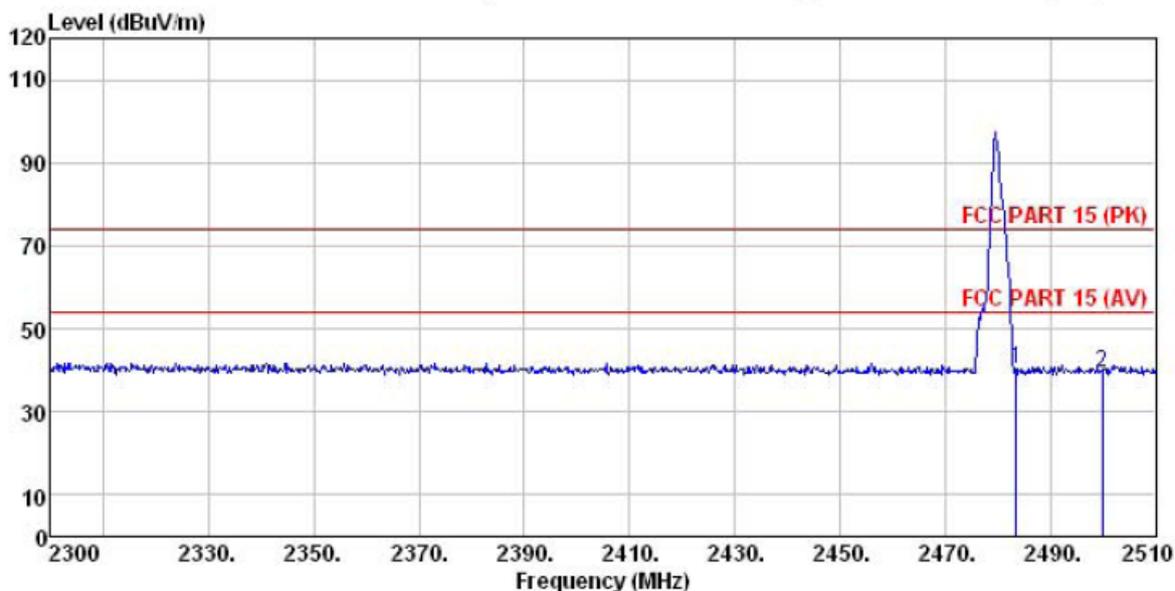
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4882	44.34	31.58	5.91	35.48	46.35	74	-27.65	Peak
7323	43.64	36.47	7.14	35.27	51.98	74	-22.02	Peak
9764	42.8	38.45	9.06	35.75	54.56	74	-19.44	Peak
9764	/	/	/	/	45.66	54	/	Average
12205	42.64	39.29	10.26	35.69	56.5	74	-17.5	Peak
12205	/	/	/	/	47.6	54	/	Average

**AV value = PK value- 8.9dB**

5.3.19 Diagram 5-19

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	43.08	31.69	5.97	35.49	45.25	74	-28.75	Peak
7440	45.46	36.6	7.18	35.23	54.01	74	-19.99	Peak
7440	/	/	/	/	45.11	54	/	Average
9920	42.34	38.66	9.11	35.78	54.33	74	-19.67	Peak
9920	/	/	/	/	45.43	54	/	Average
12400	42.51	38.73	10.37	35.6	56.01	74	-17.99	Peak
12400	/	/	/	/	47.11	54	/	Average

AV value = PK value- 8.9dB

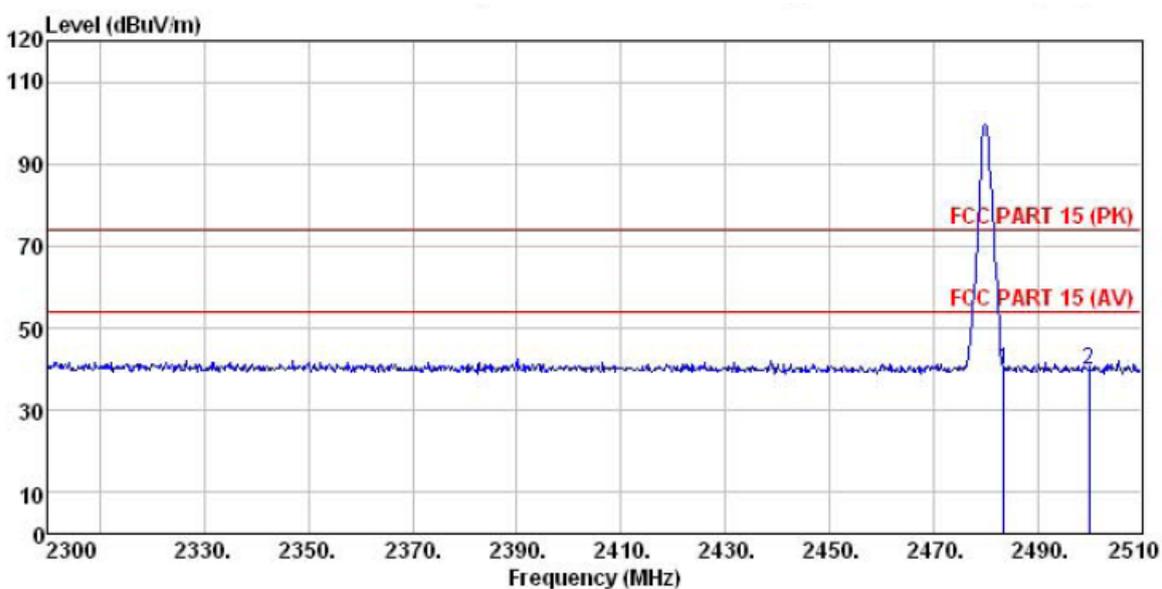


	Read Freq	Antenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.50	43.74	27.52	3.89	34.86	40.29	74.00	-33.71	Peak
2	2500.00	43.02	27.55	3.90	34.87	39.60	74.00	-34.40	Peak

5.3.20 Diagram 5-20

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4960	43.76	31.69	5.97	35.49	45.93	74	-28.07	Peak
7440	44.75	36.6	7.18	35.23	53.3	74	-20.7	Peak
9920	43.55	38.66	9.11	35.78	55.54	74	-18.46	Peak
9920	/	/	/	/	46.64	54	/	Average
12400	42.82	38.73	10.37	35.6	56.32	74	-17.68	Peak
12400	/	/	/	/	47.42	54	/	Average

AV value = PK value- 8.9dB



	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Level	Limit	Over	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2483.50	43.52	27.52	3.89	34.86	40.07	74.00	-33.93 Peak
2	2500.00	43.21	27.55	3.90	34.87	39.79	74.00	-34.21 Peak

## 6. 20 dB bandwidth Test

### 6.1 Test Procedure

#### Clause 15.215(c) 20dB Bandwidth:

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

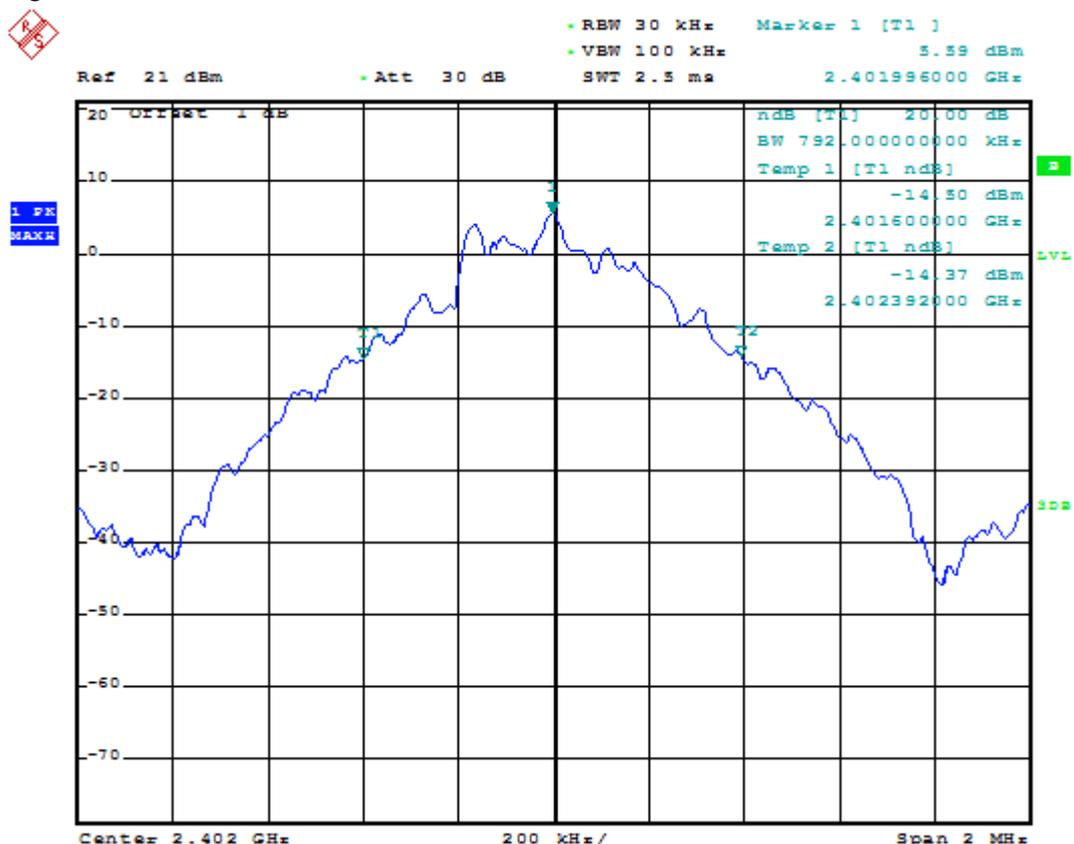
### 6.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

### 6.3 Test Result:

Modulation	Channel	20dB bandwidth
GFSK	CHL	792kHz
	CHM	804kHz
	CHH	812kHz

GFSK diagrams are as below:

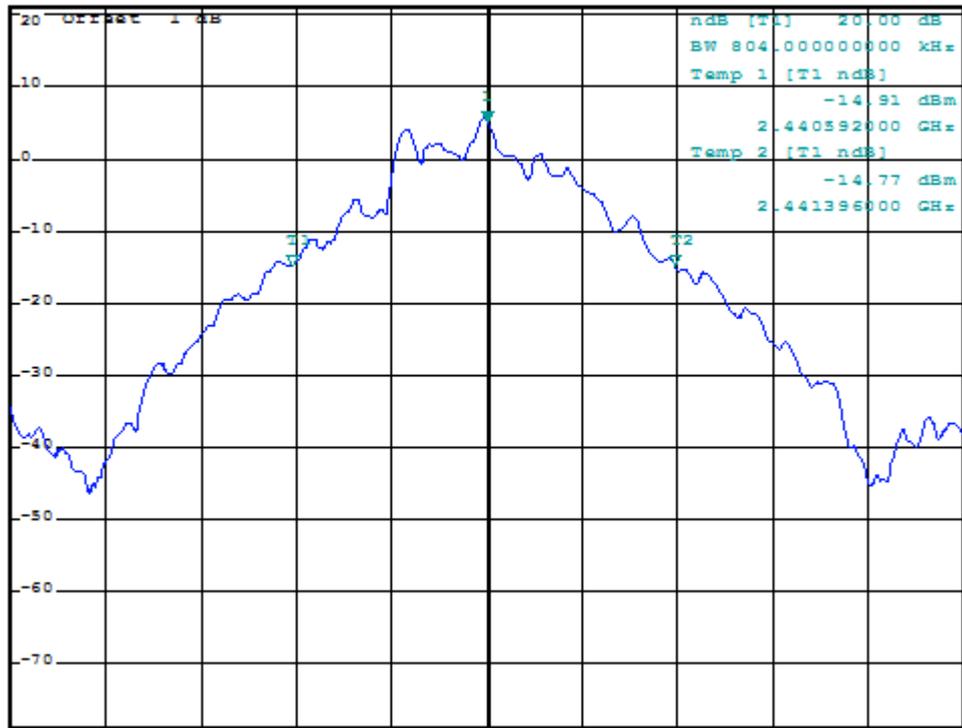




• RBW 30 kHz Marker 1 [T1 ]  
 • VBW 100 kHz 5.17 dBm  
 • Att 30 dB  
 • SWT 2.5 ms 2.441000000 GHz

Ref 21 dBm

1 PK  
MAXH



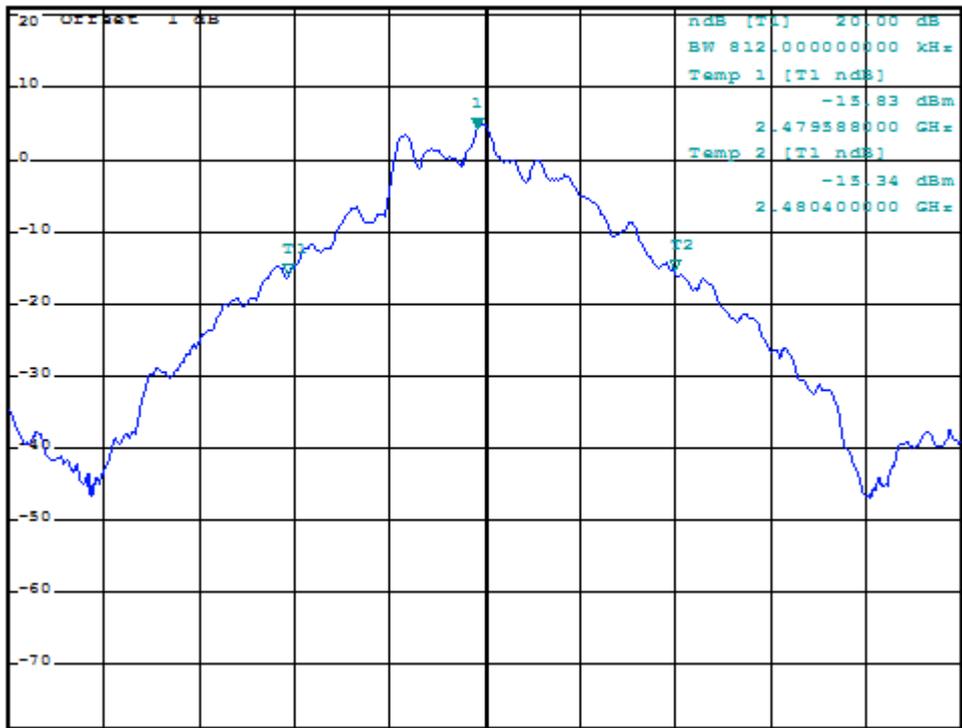
Center 2.441 GHz 200 kHz/ Span 2 MHz



• RBW 30 kHz Marker 1 [T1 ]  
 • VBW 100 kHz 4.30 dBm  
 • Att 30 dB  
 • SWT 2.5 ms 2.479984000 GHz

Ref 21 dBm

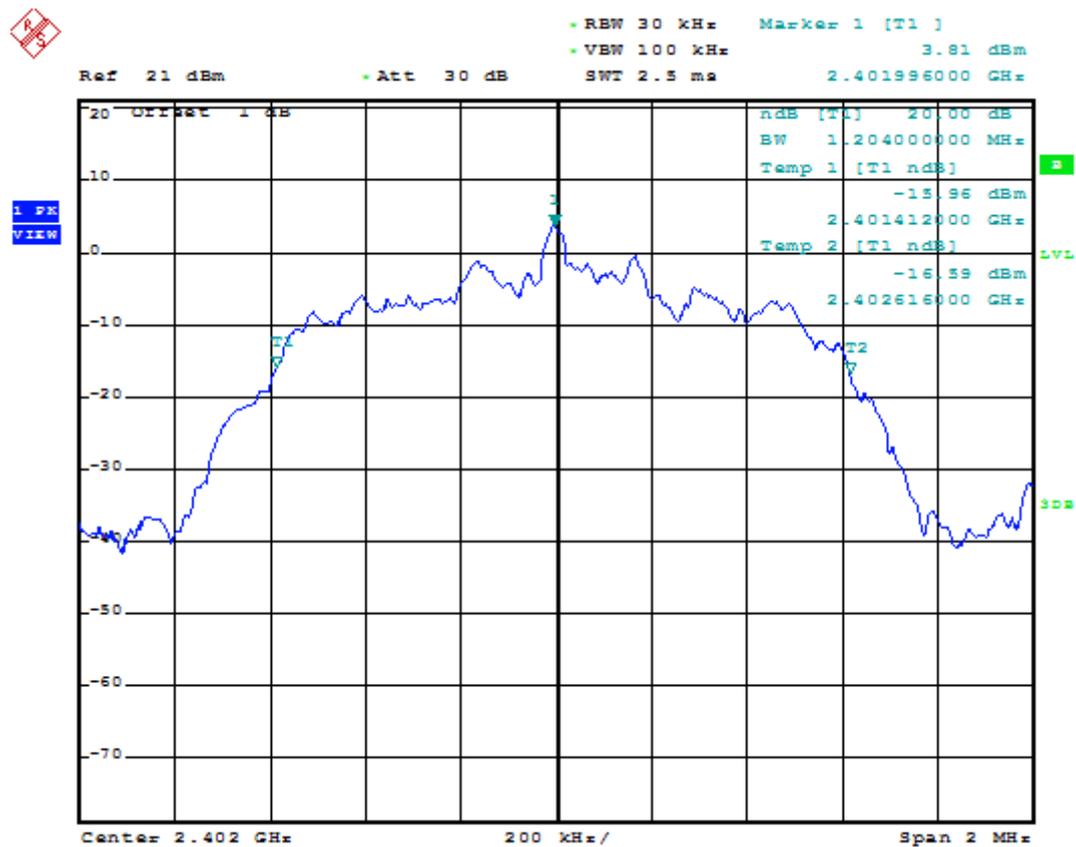
1 PK  
MAXH



Center 2.48 GHz 200 kHz/ Span 2 MHz

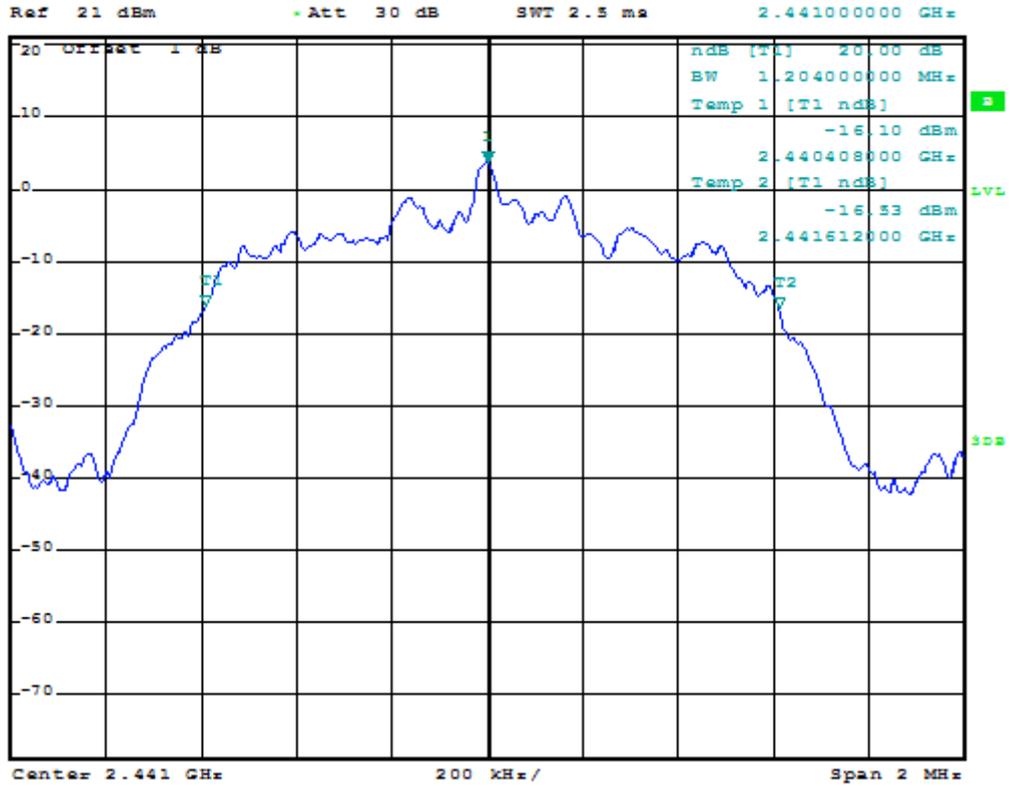
Modulation	Channel	20dB bandwidth
8DPSK	CHL	1204kHz
	CHM	1204kHz
	CHH	1204kHz

8DPSK diagrams are as below:

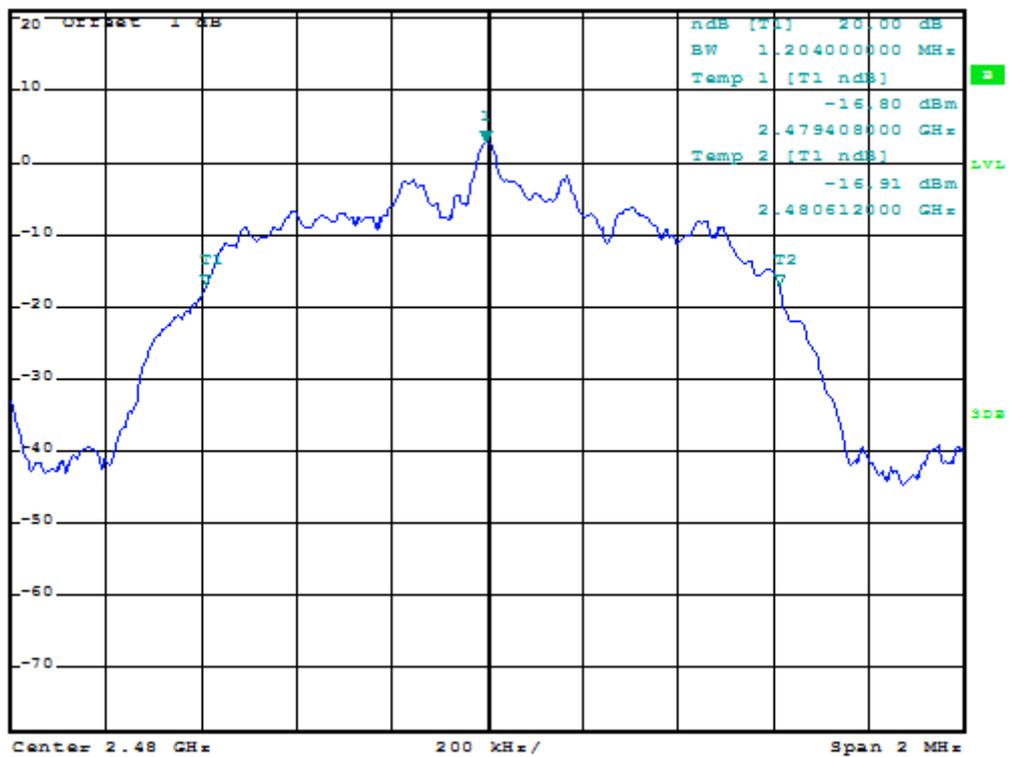




-RBW 30 kHz Marker 1 [T1 ]  
 -VBW 100 kHz 3.79 dBm  
 -Att 30 dB  
 -SWT 2.5 ms 2.441000000 GHz

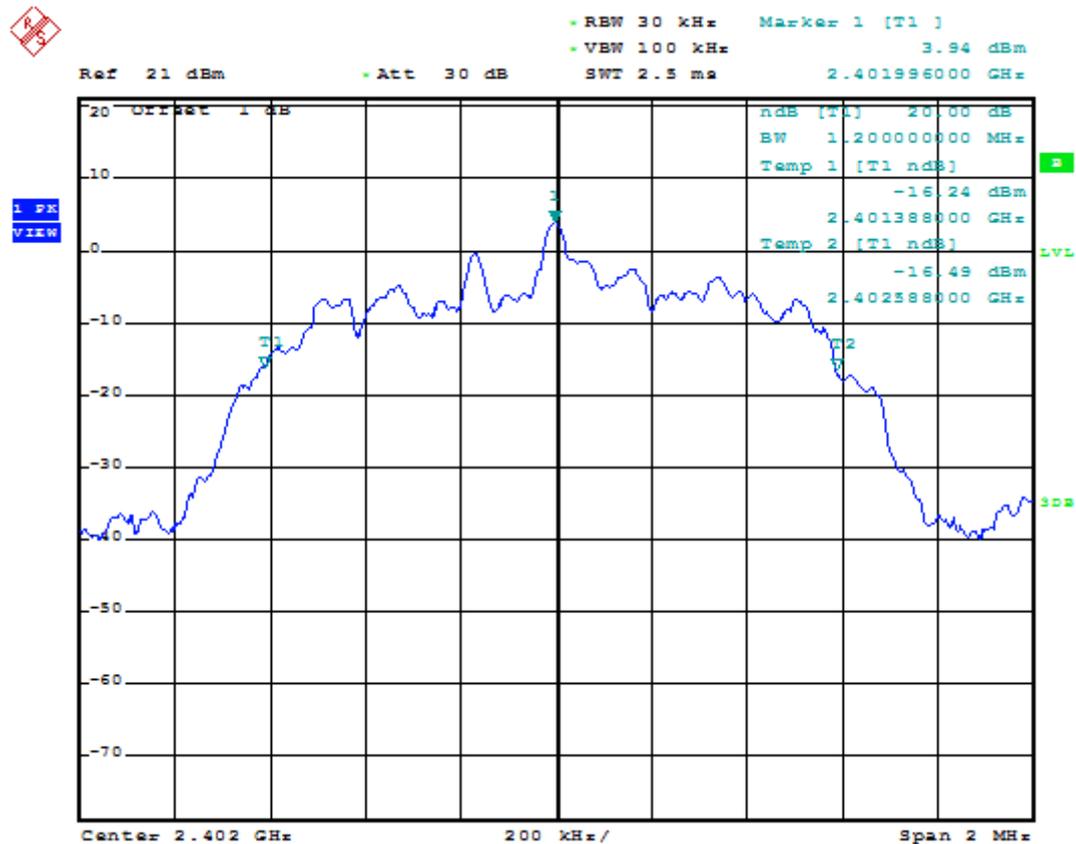


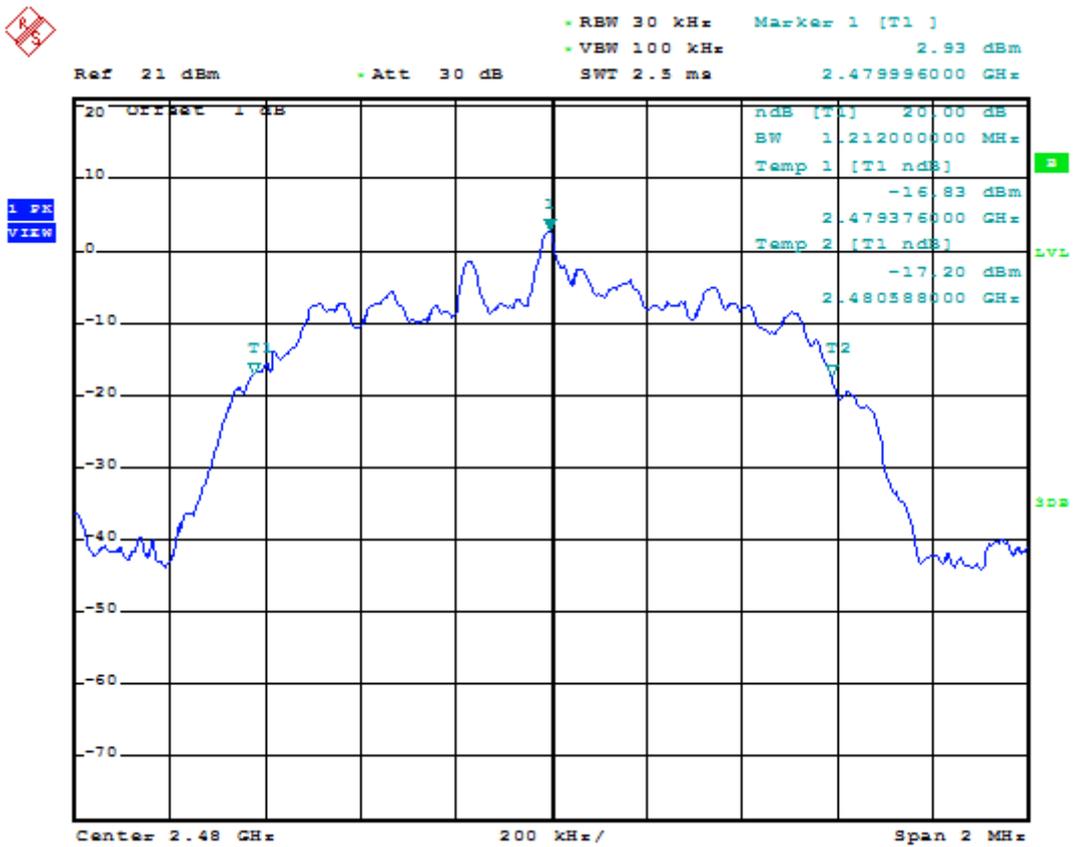
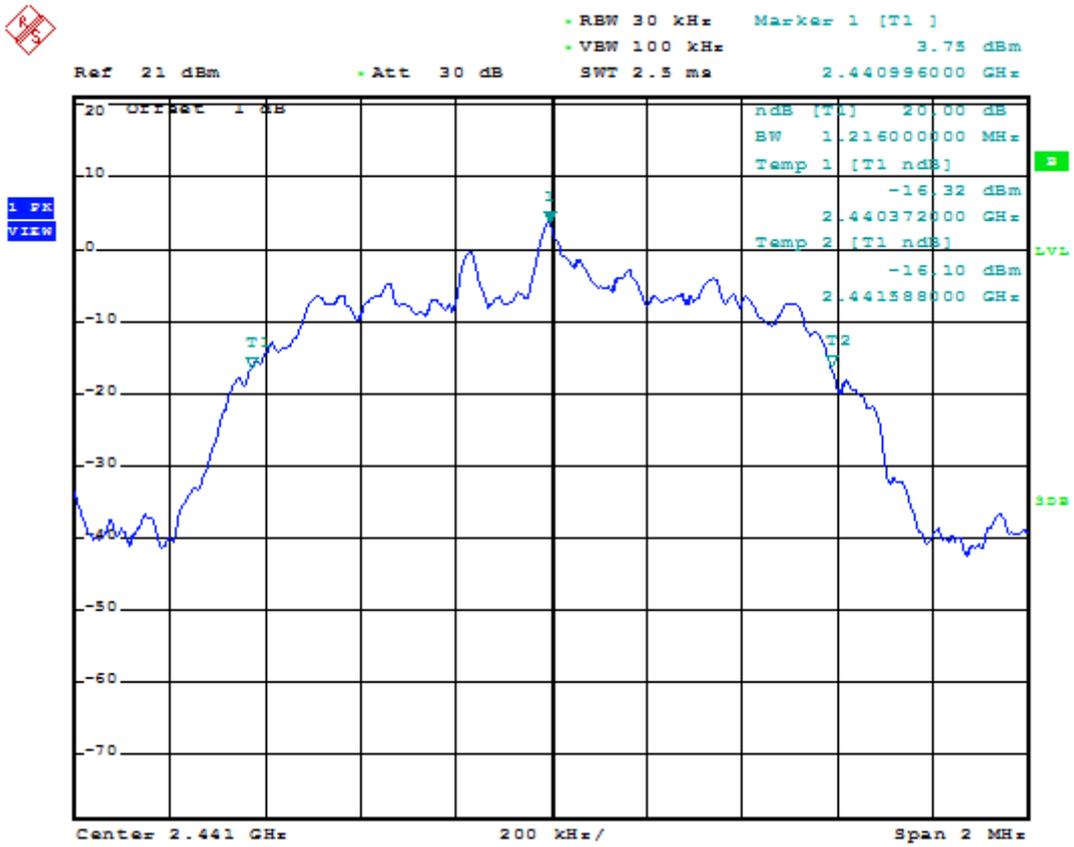
-RBW 30 kHz Marker 1 [T1 ]  
 -VBW 100 kHz 2.97 dBm  
 -Att 30 dB  
 -SWT 2.5 ms 2.479996000 GHz



Modulation	Channel	20dB bandwidth
π/4 DQPSK	CHL	1200kHz
	CHM	1216kHz
	CHH	1212kHz

π/4 DQPSK diagrams are as below:





## 7. Band Edge Compliance Test

### 7.1 Test Procedure

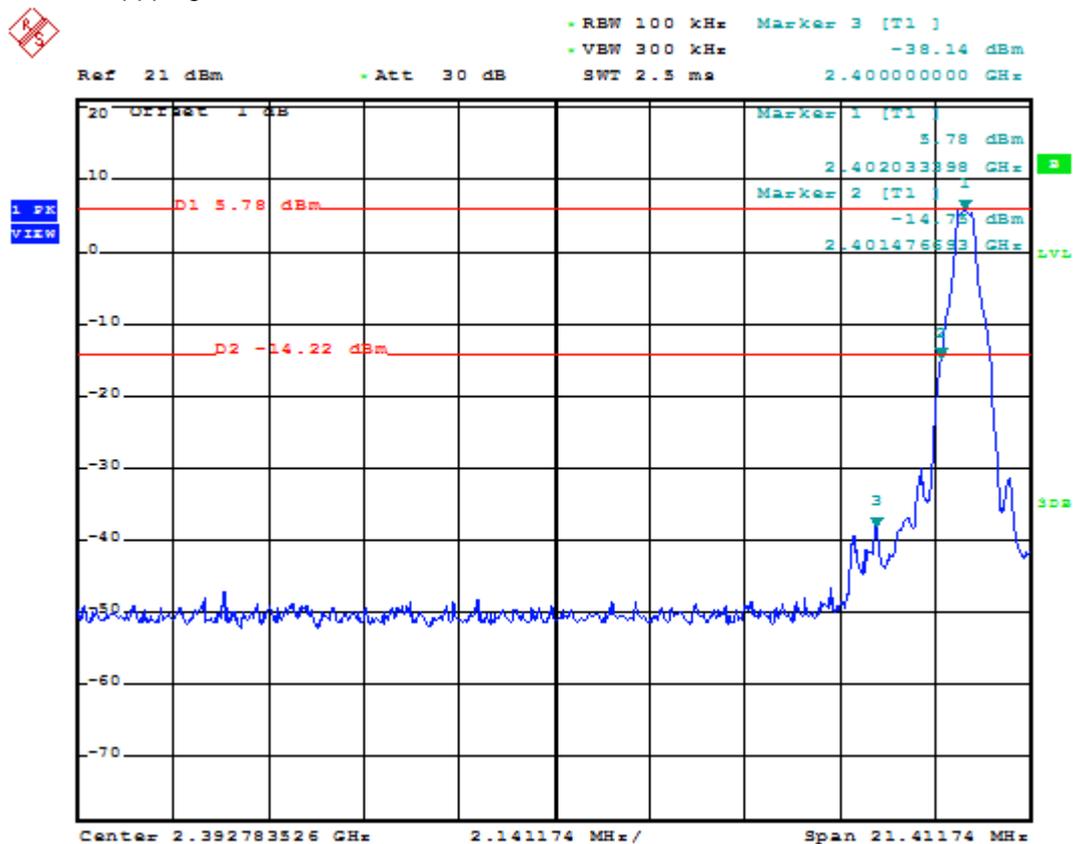
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

### 7.2 Measurement Equipment

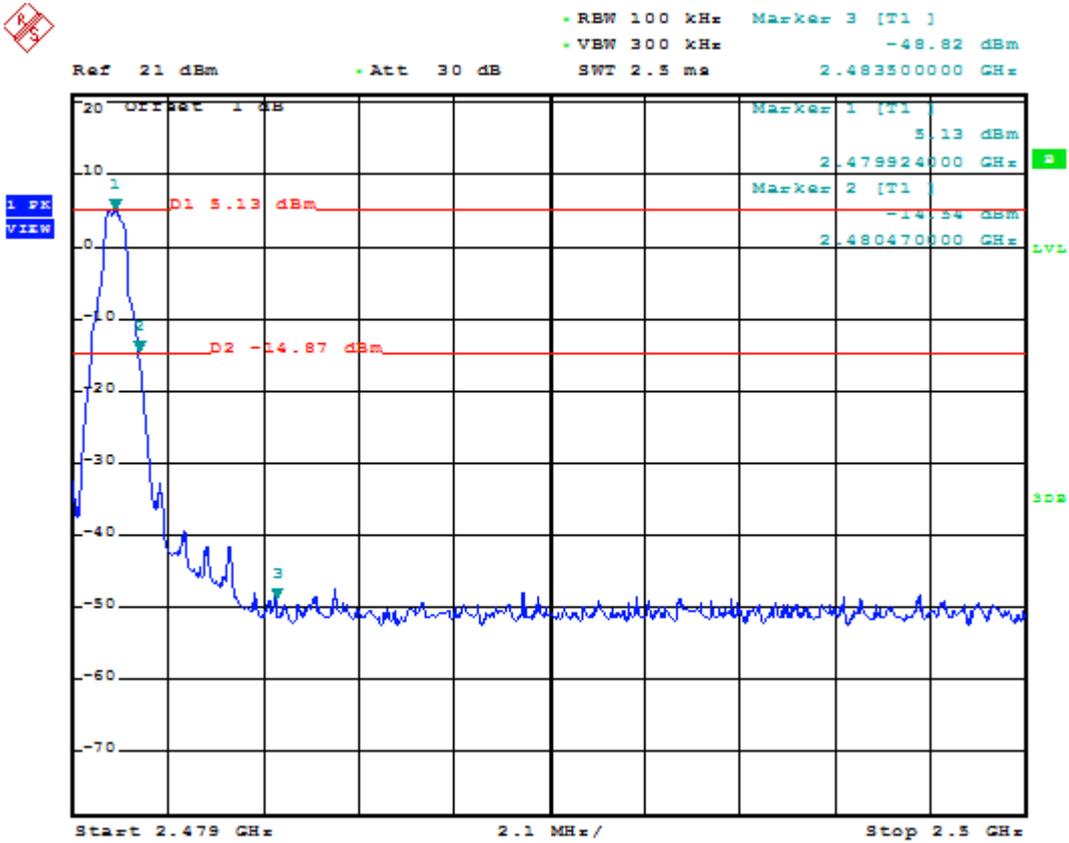
	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

### 7.3 Test Result

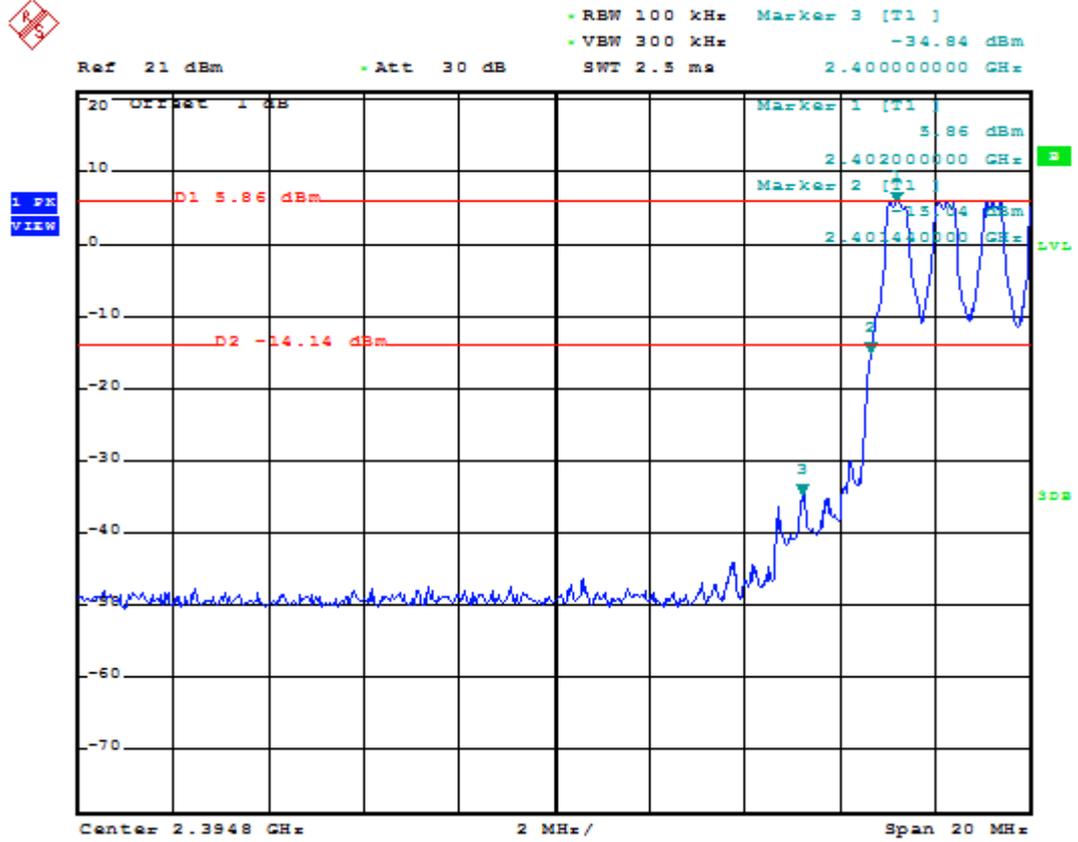
GFSK Hopping off CHL :



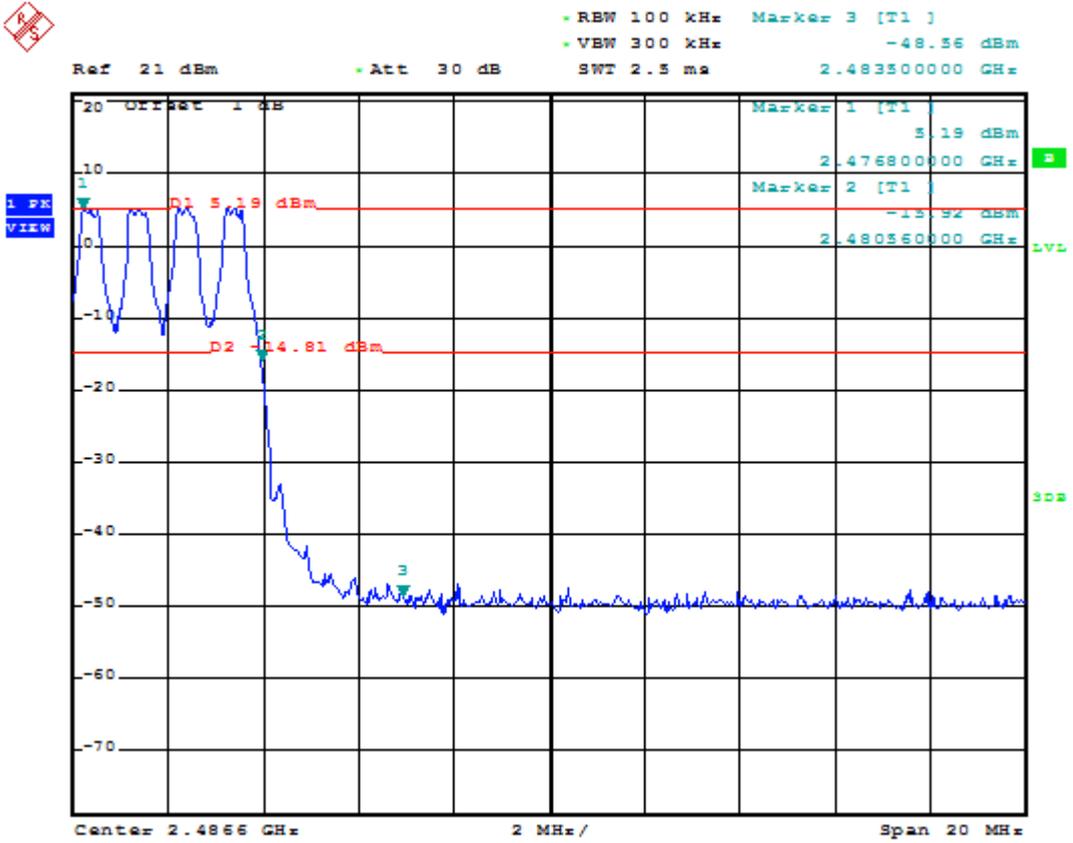
GFSK Hopping off CHH :



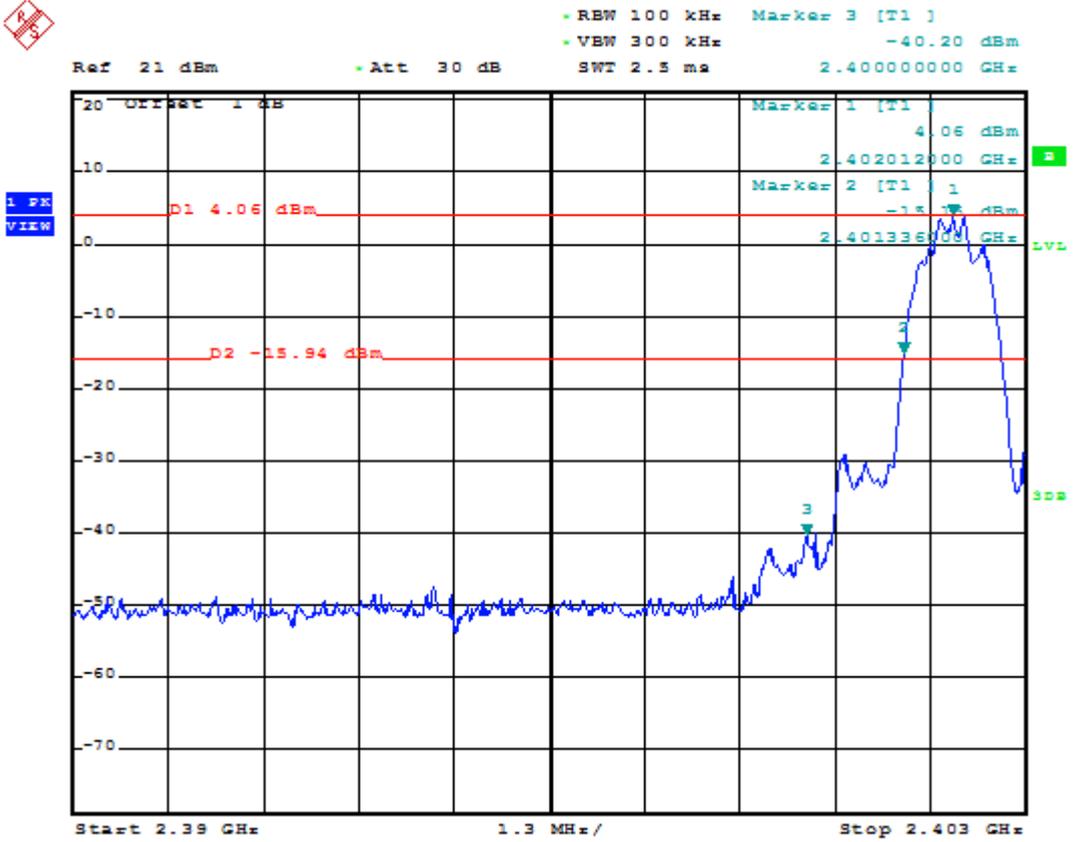
GFSK Hopping on CHL:



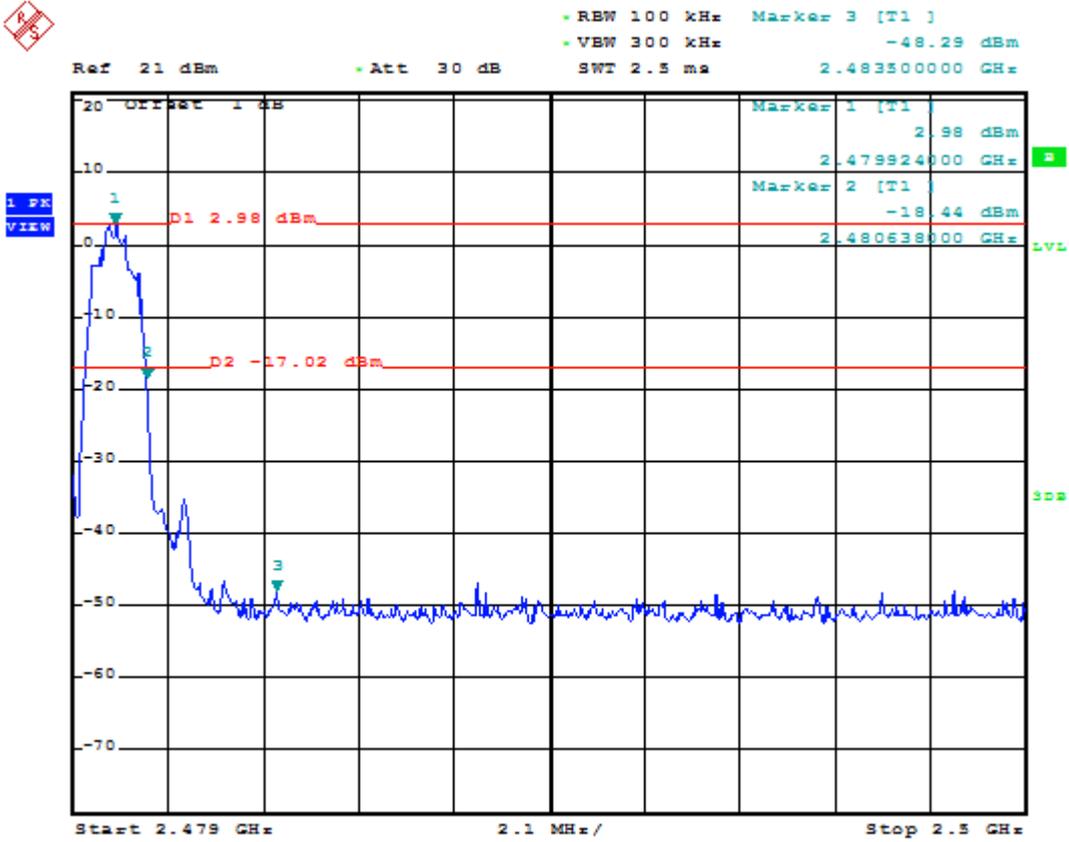
GFSK Hopping on CHH:



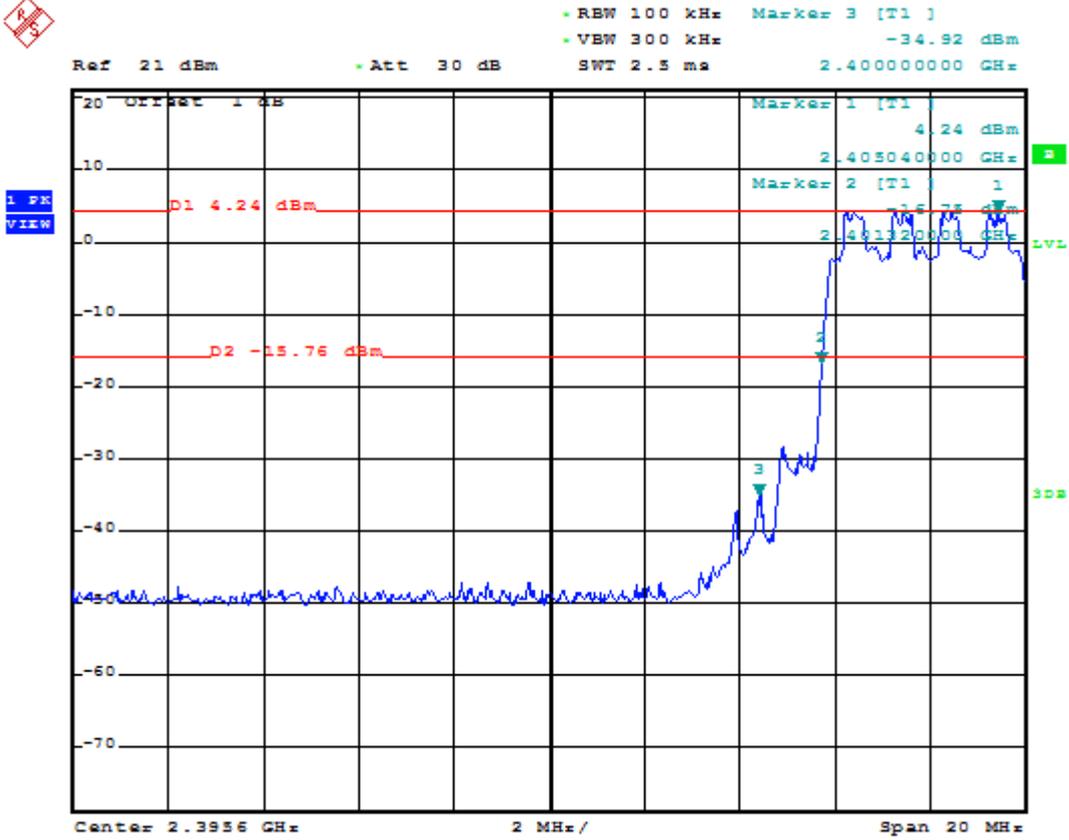
8DPSK Hopping off CHL :



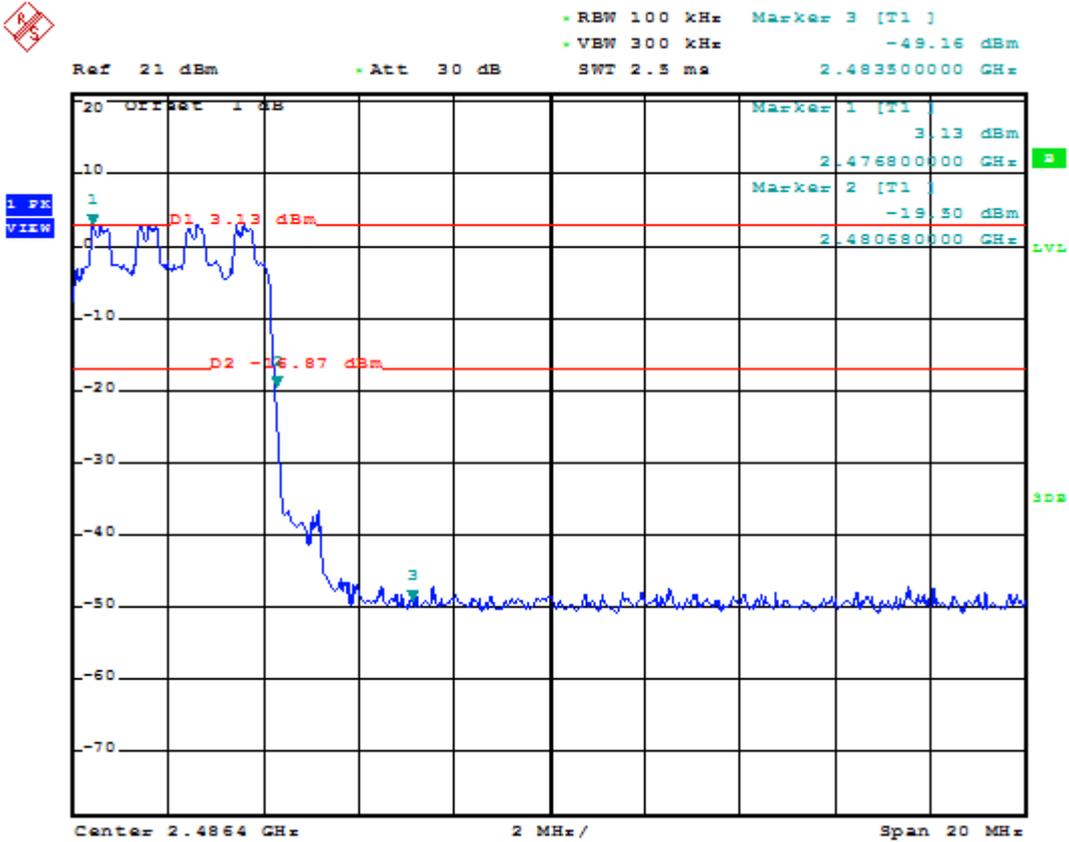
8DPSK Hopping off CHH :



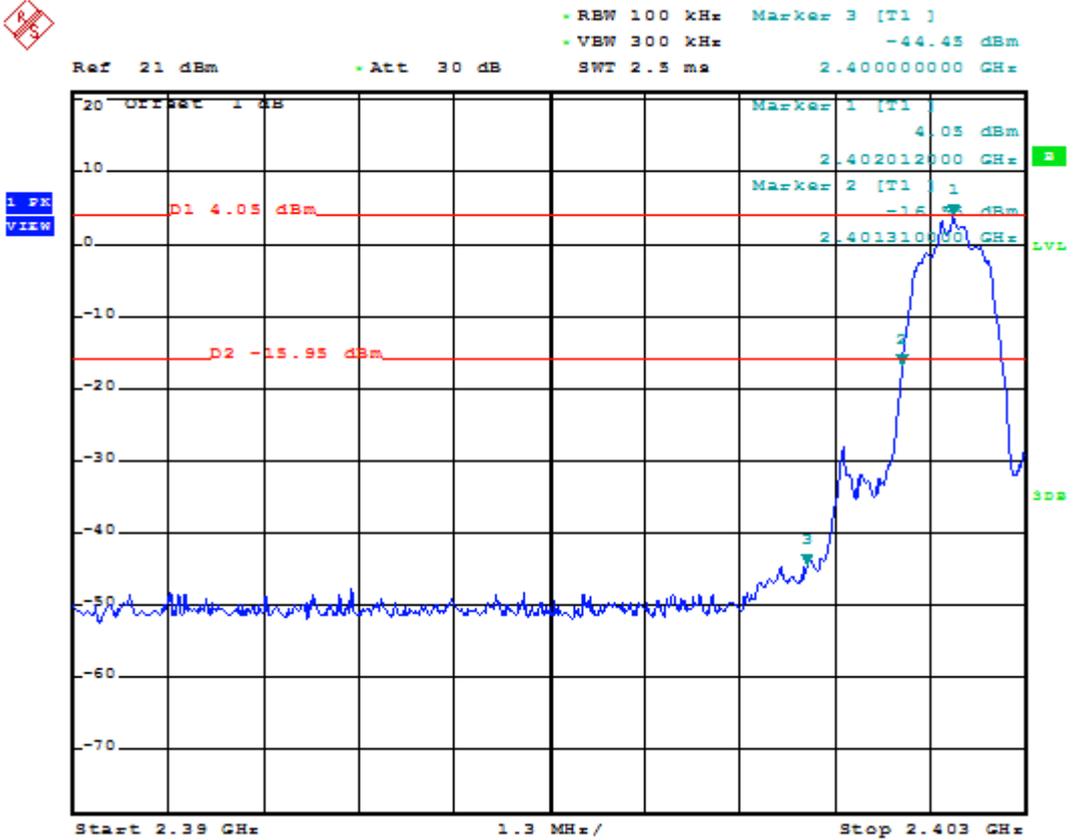
8DPSK Hopping on CHL :



8DPSK Hopping on CHH :

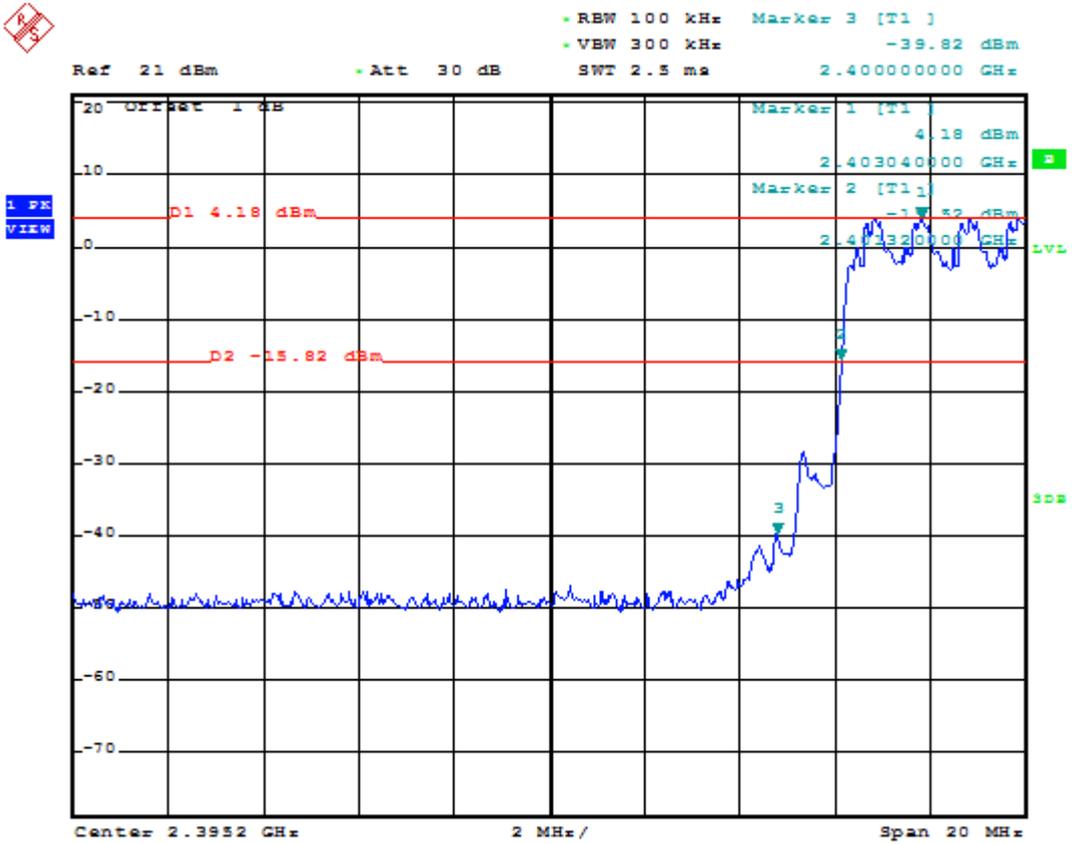


$\pi/4$  DQPSK Hopping off CHL :



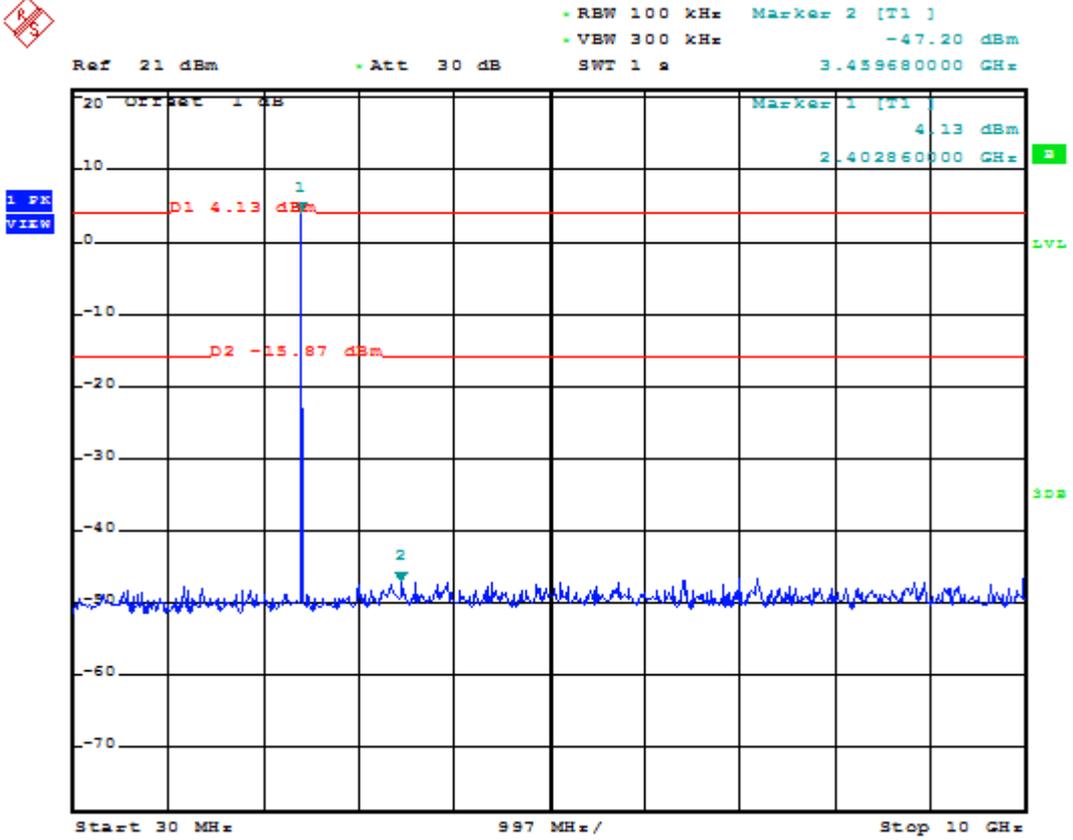


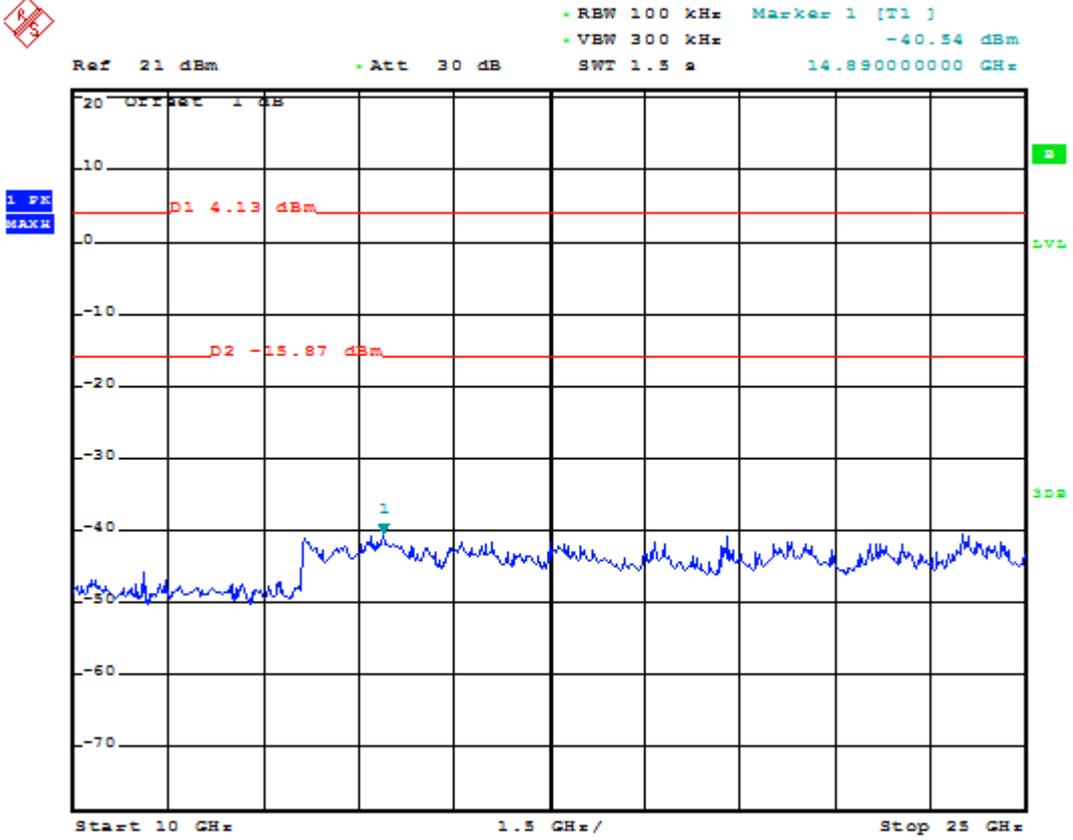
$\pi/4$  DQPSK Hopping on CHL :



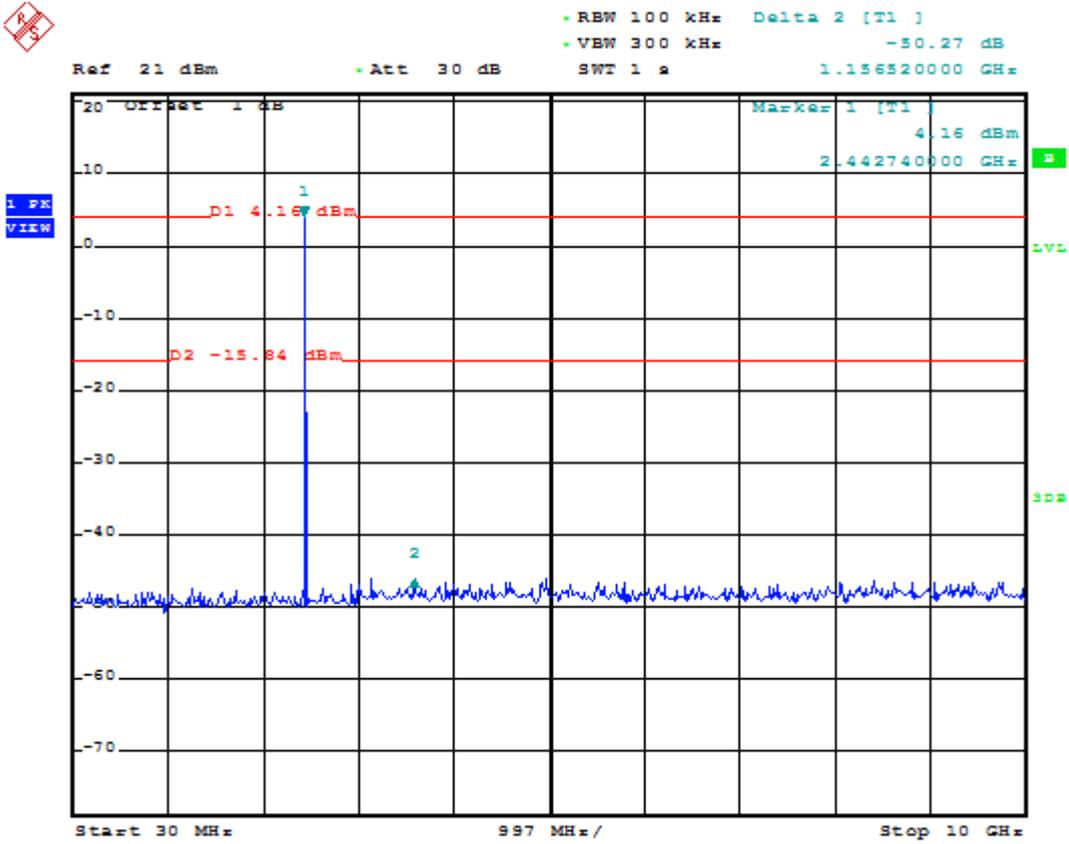


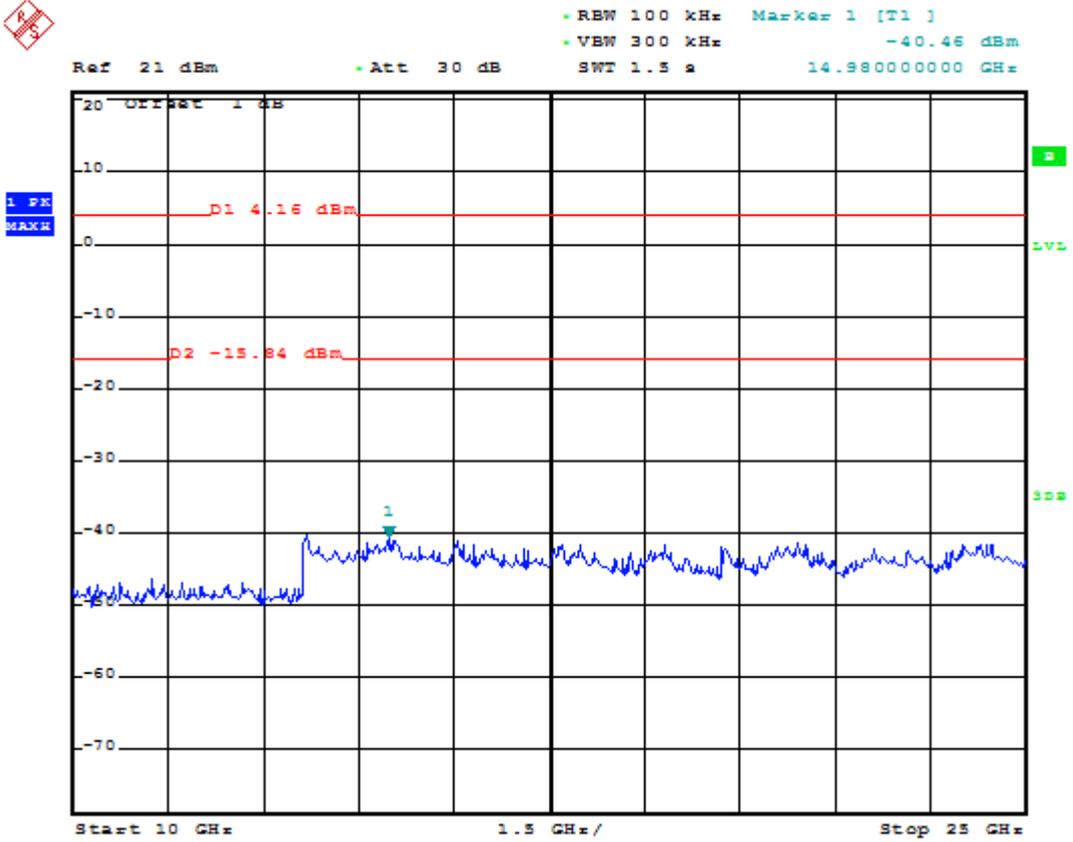
GFSK CHL :



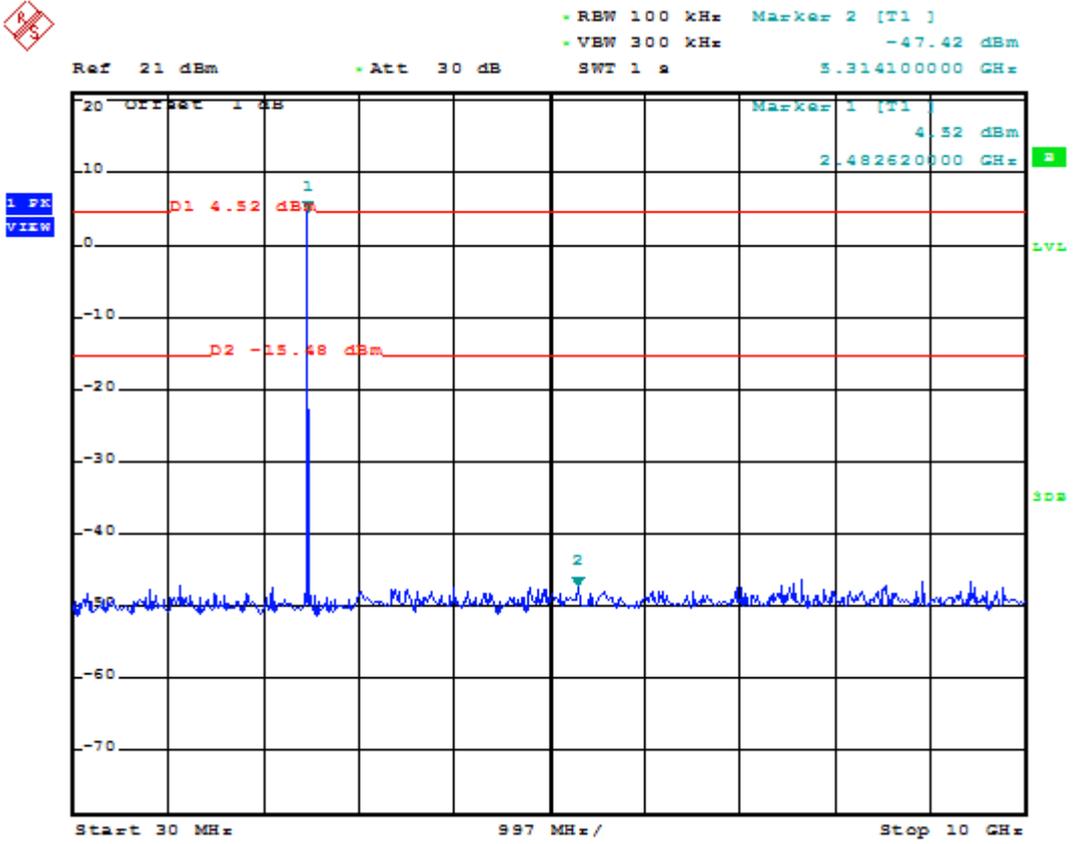


GFSK CHM:





GFSK CHH:



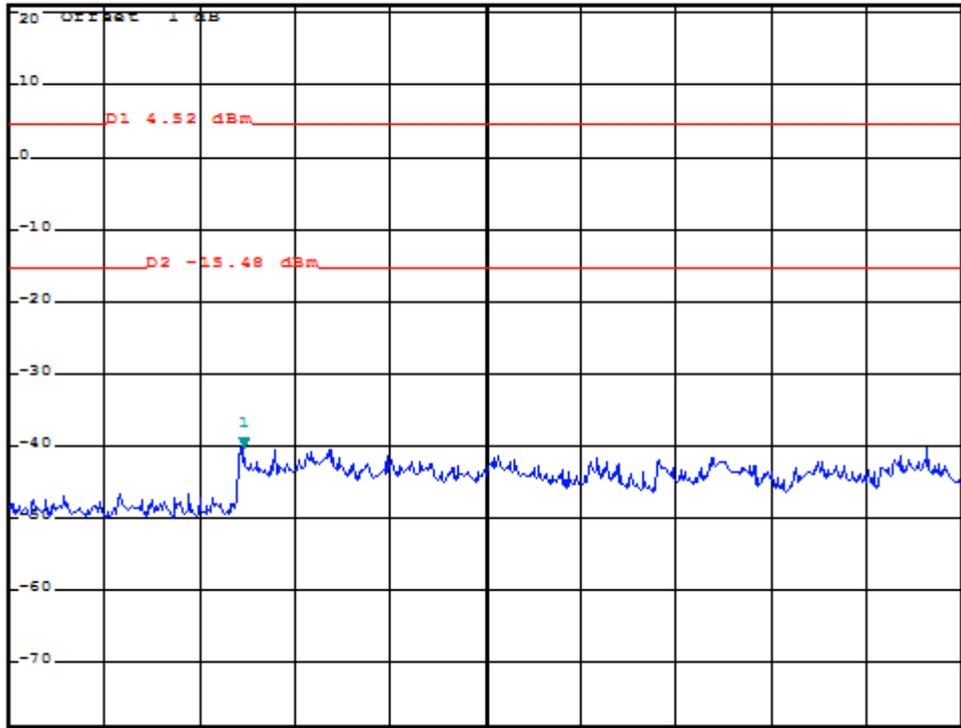


RBW 100 kHz Marker 1 [T1 ]  
VBW 300 kHz -40.29 dBm  
SWT 1.5 s 13.690000000 GHz

Ref 21 dBm

Att 30 dB

1 PK  
MAXH

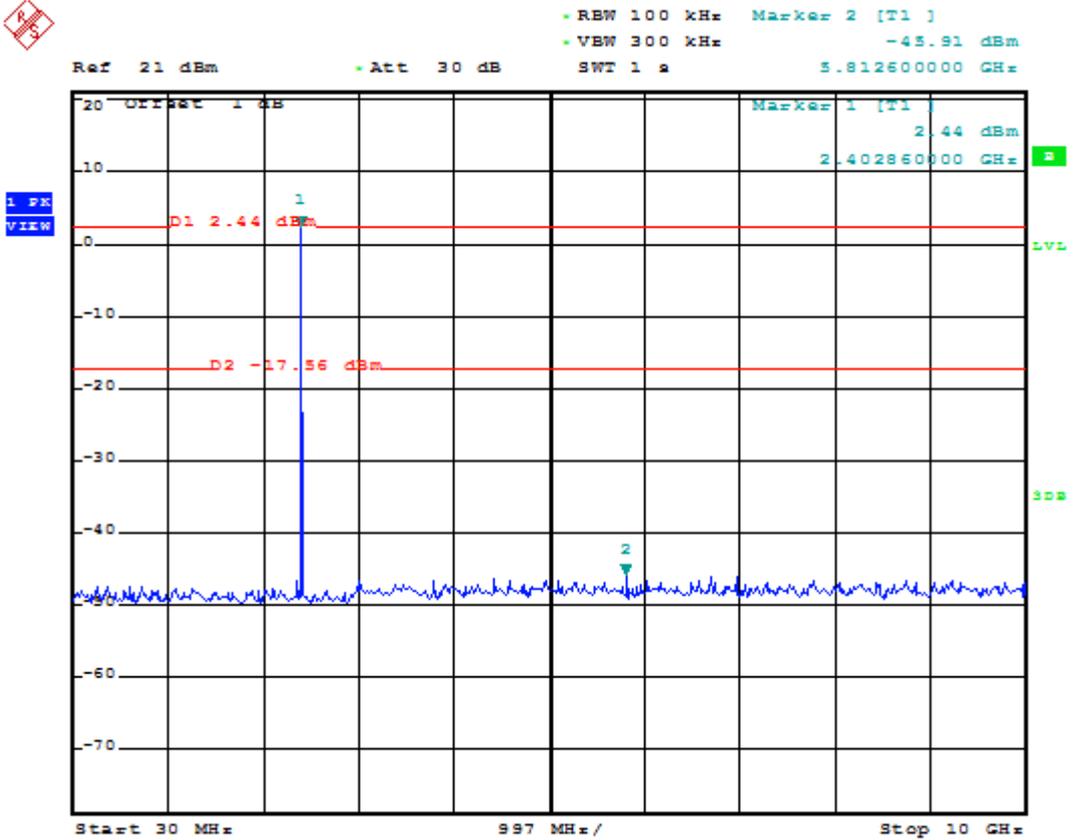


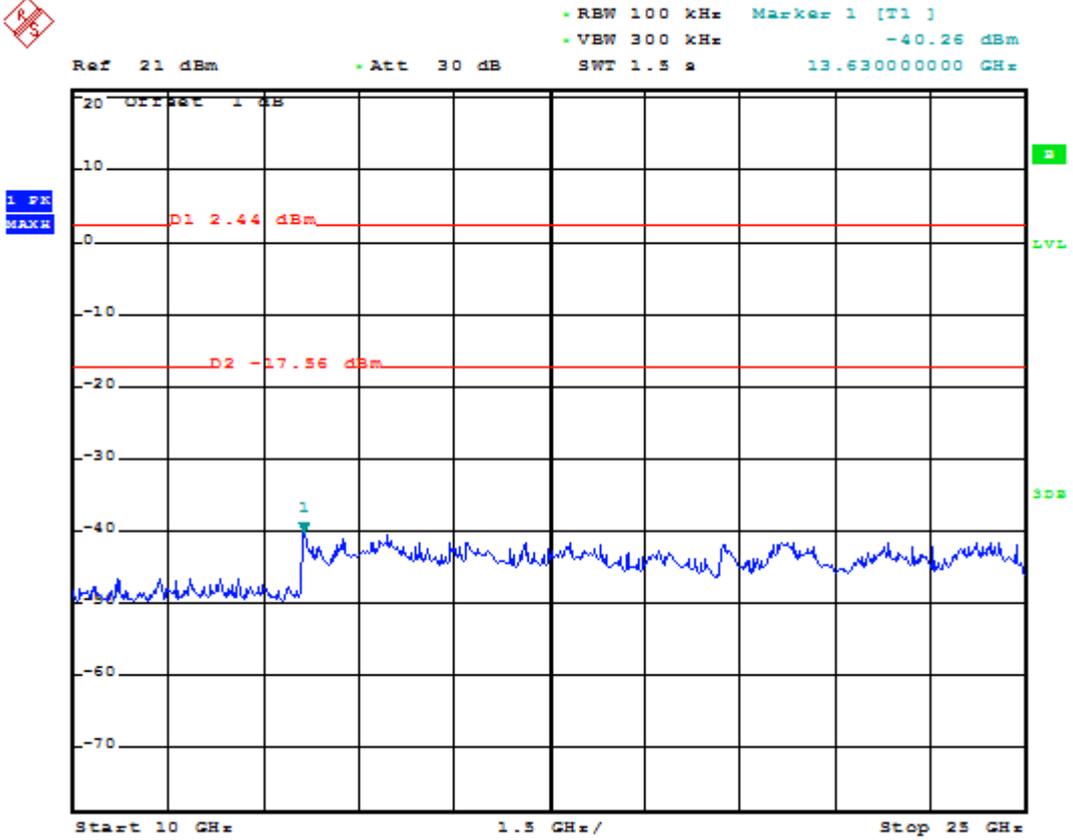
Start 10 GHz

1.5 GHz/

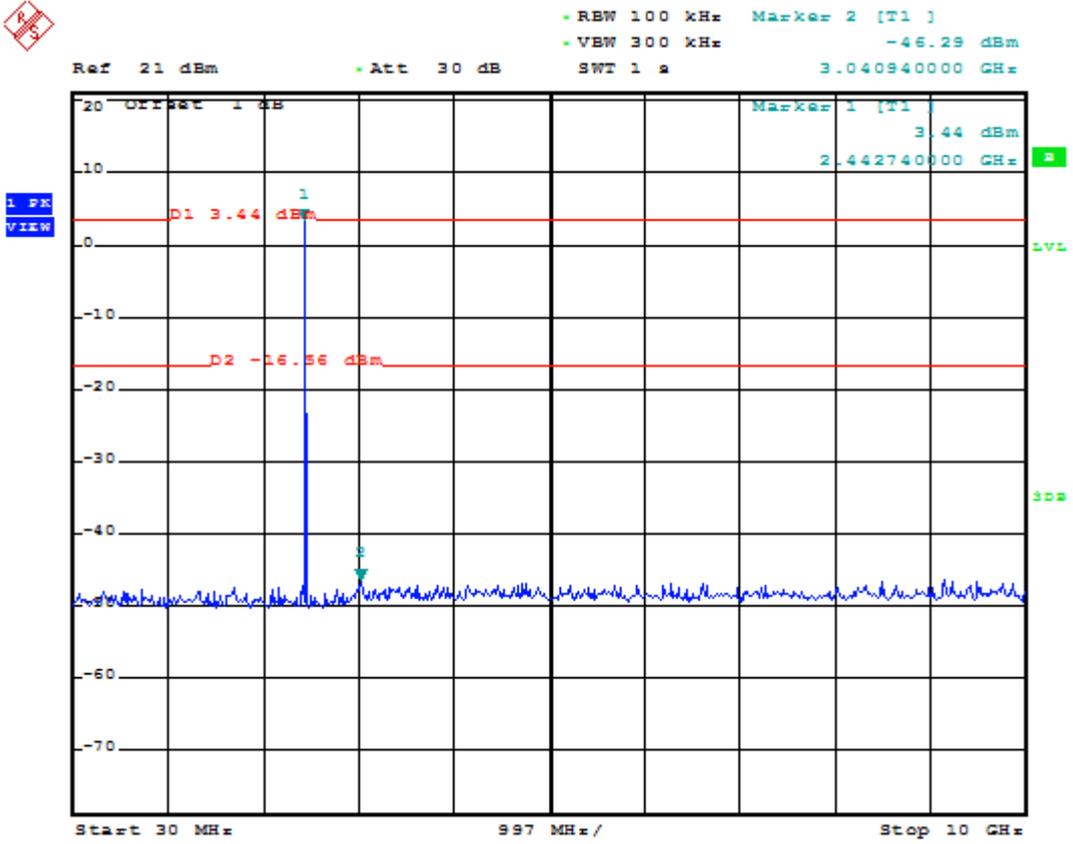
Stop 25 GHz

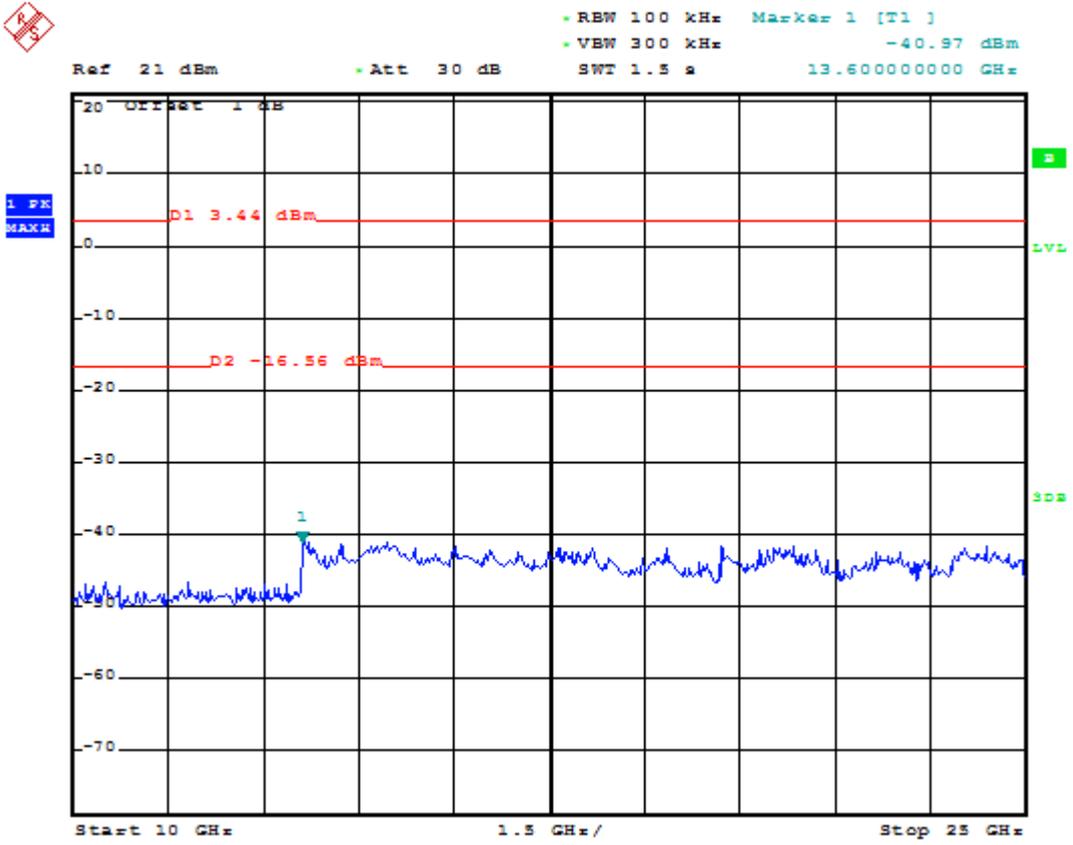
8DPSK CHL:



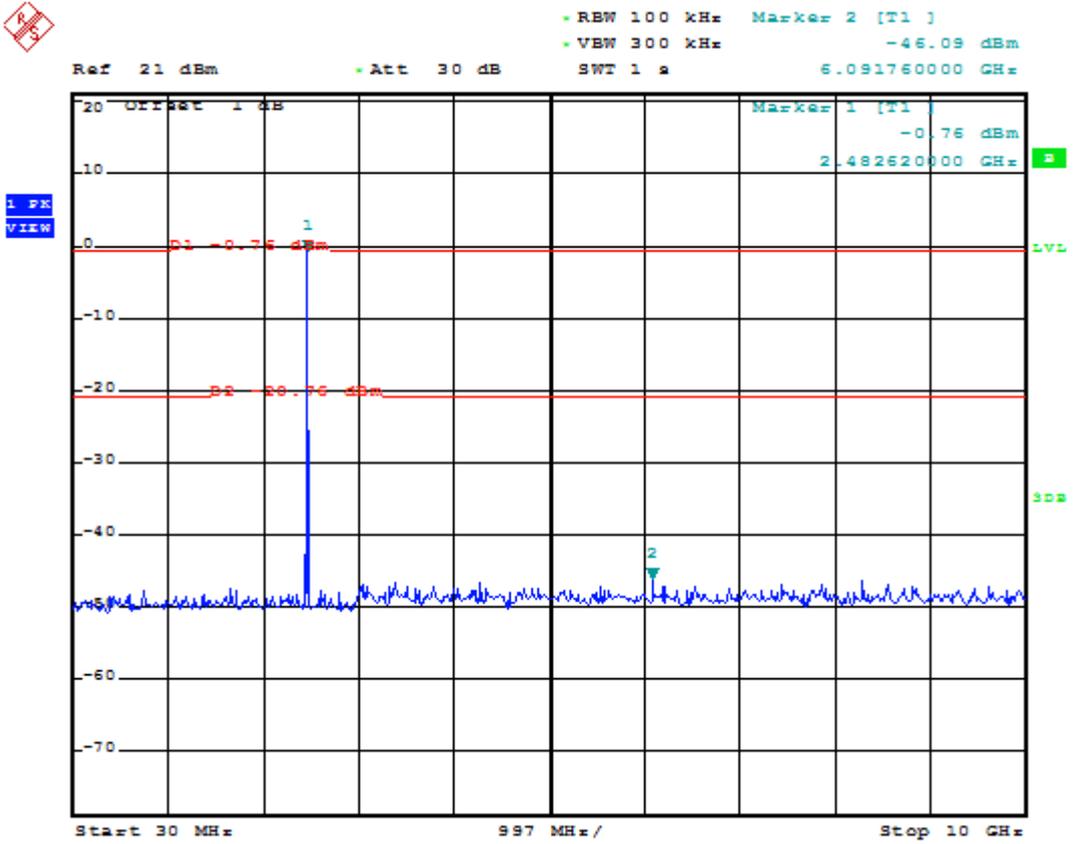


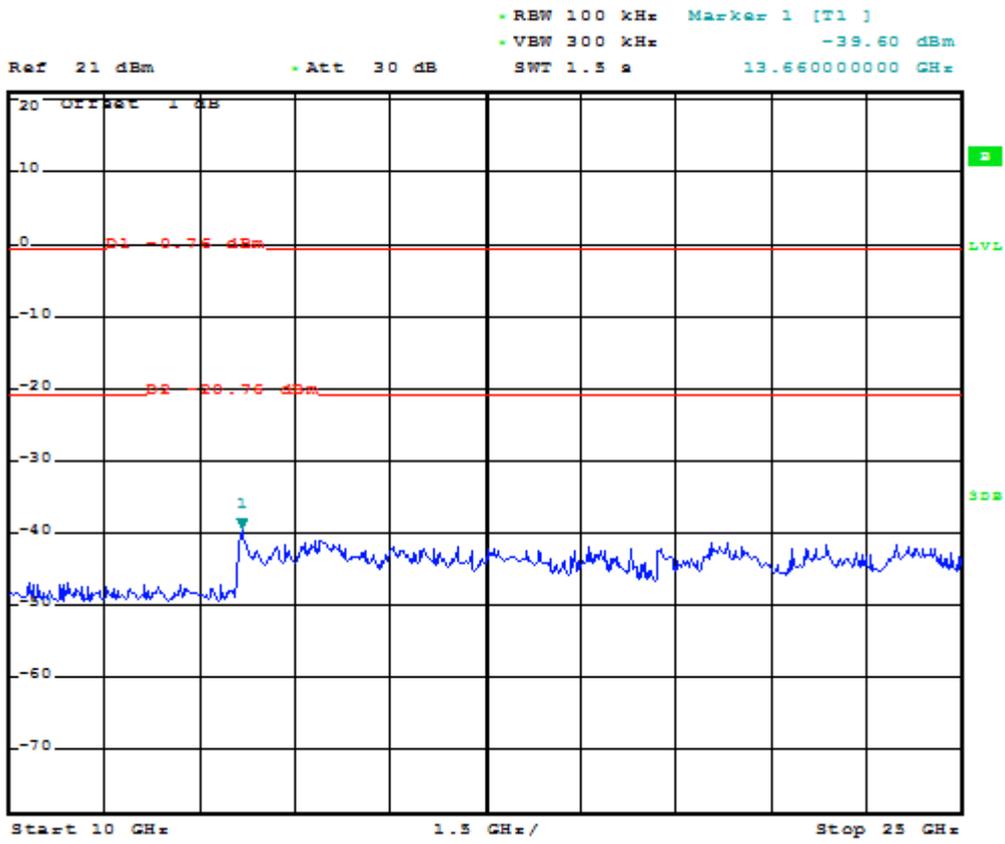
8DPSK CHM:



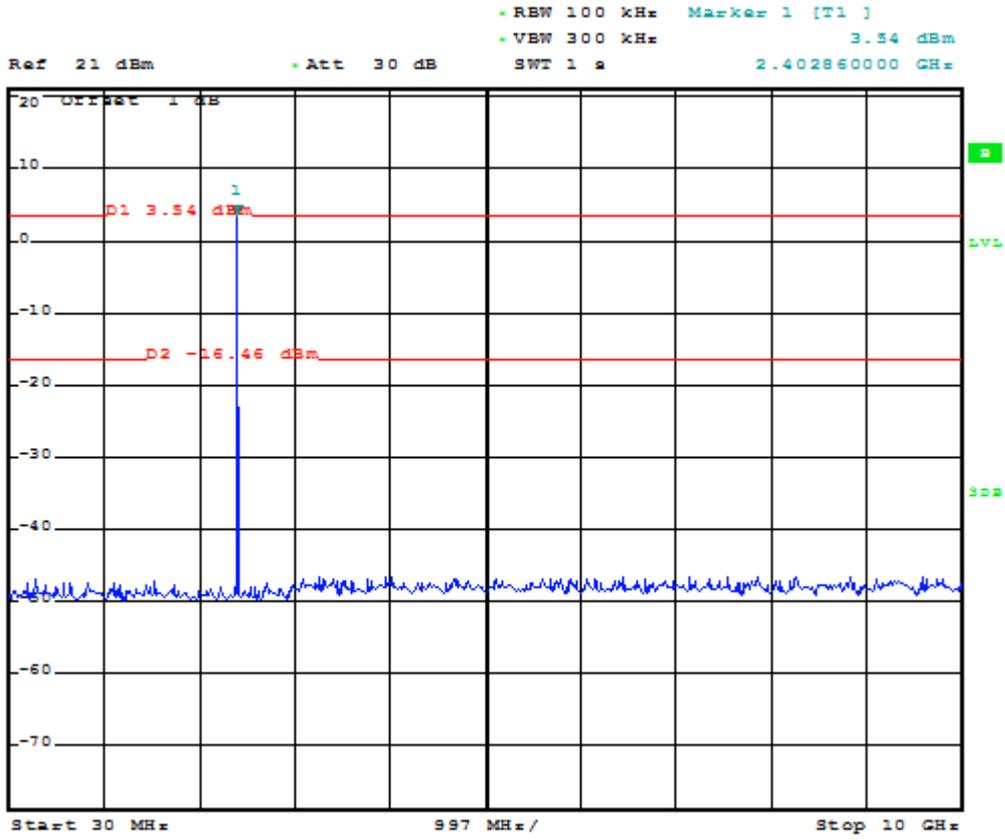


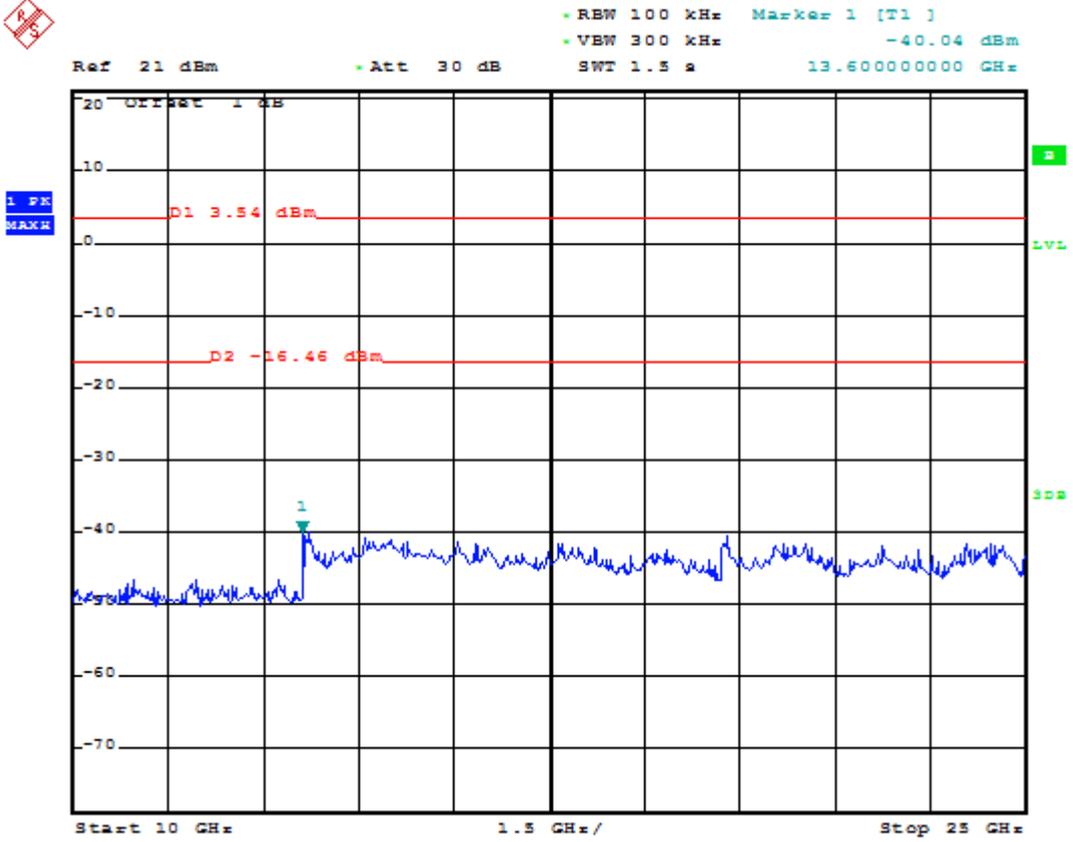
8DPSK CHH:



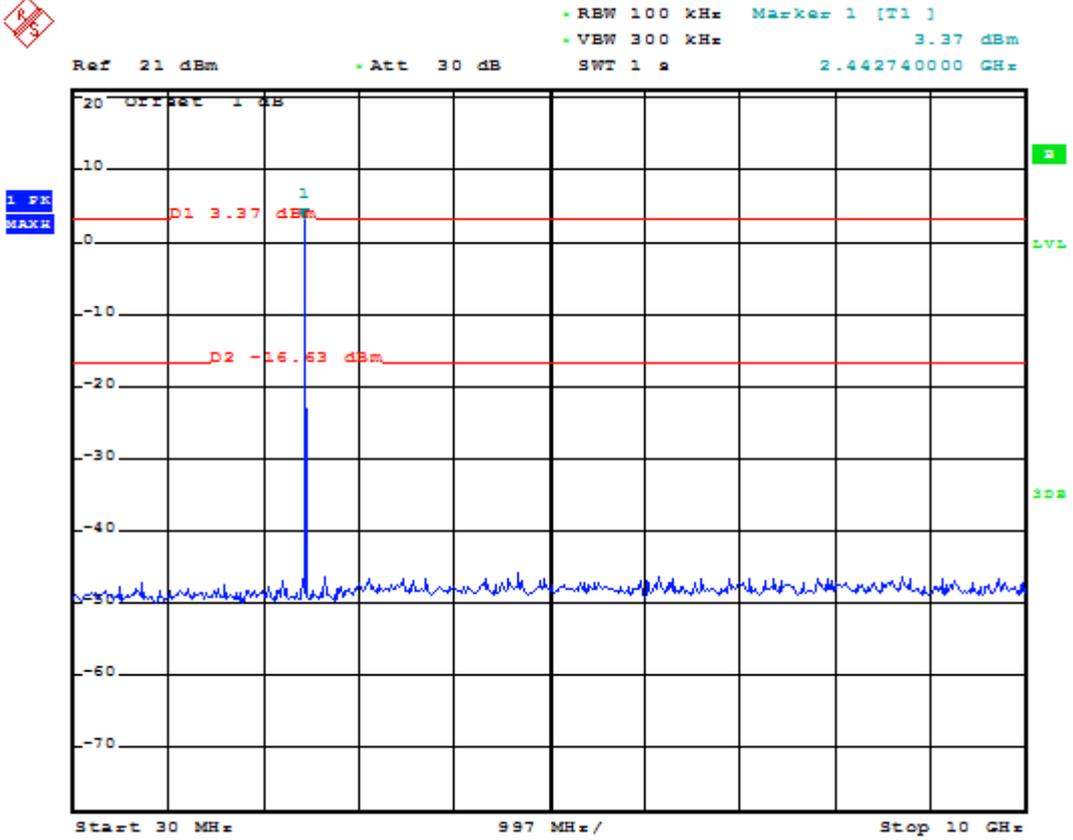


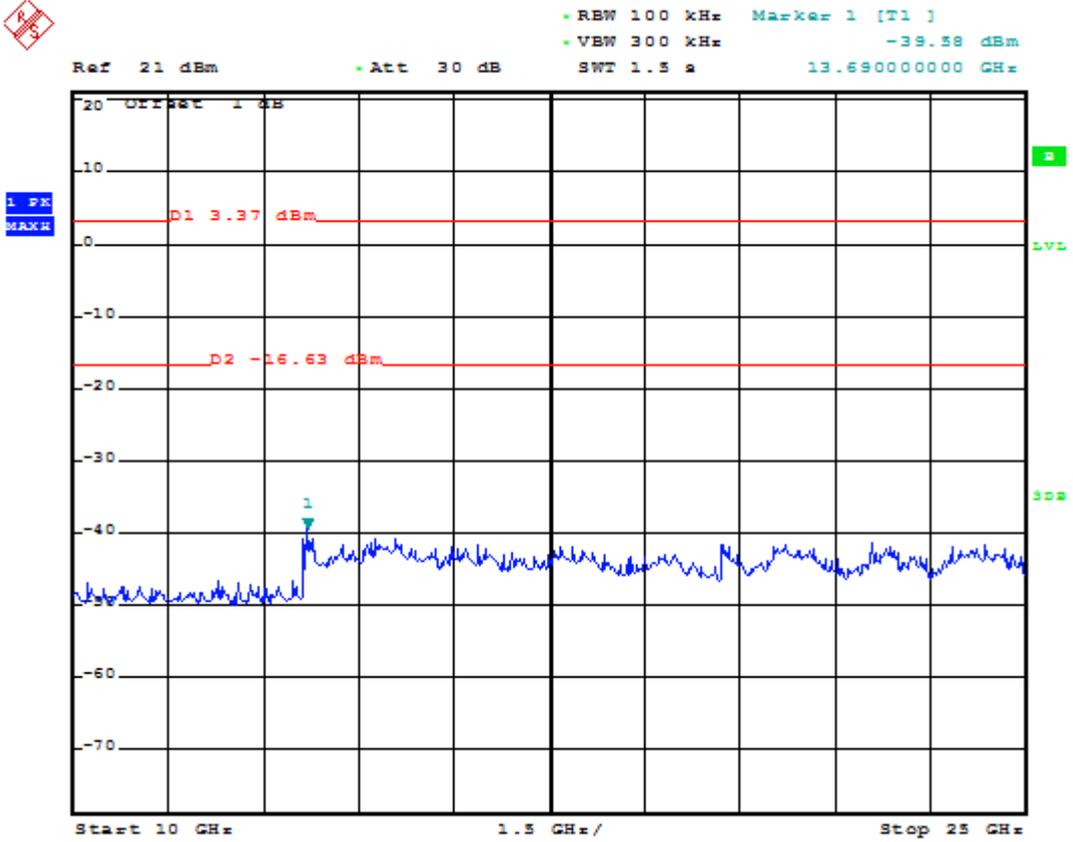
$\pi/4$  DQPSK CHL:



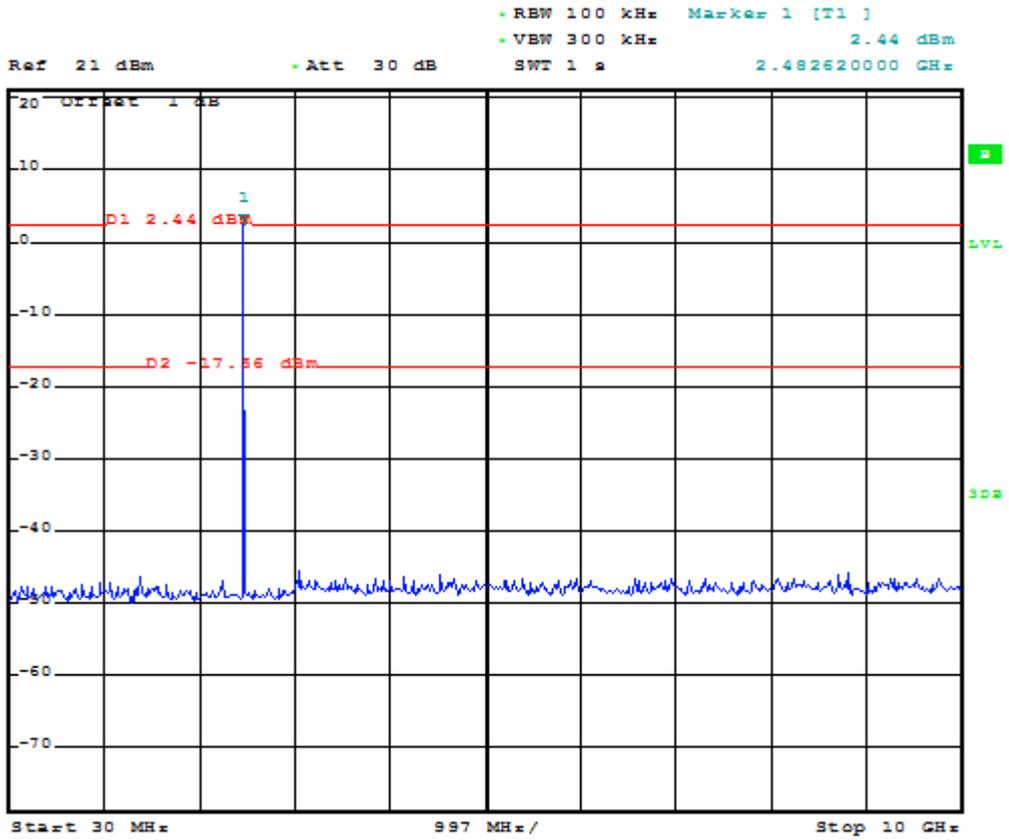


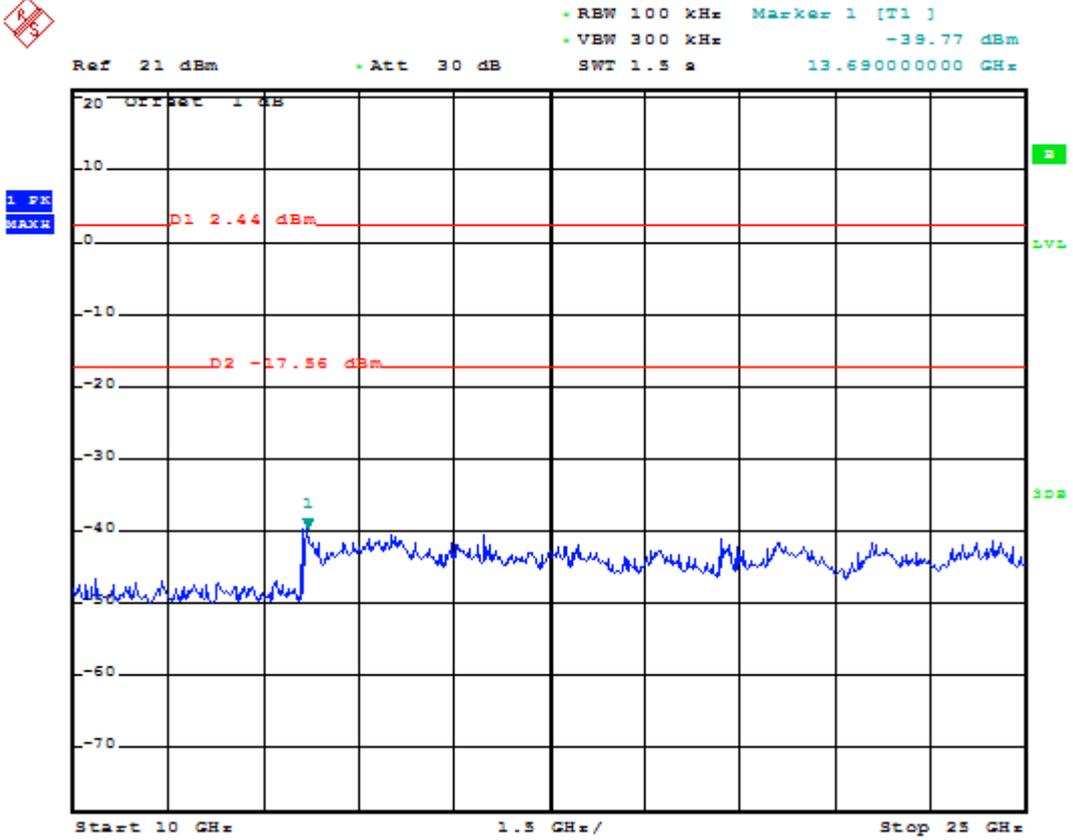
$\pi/4$  DQPSK CHM:





$\pi/4$  DQPSK CHH :





## 8. Carrier Frequency Separation Test

### 8.1 Test Procedure

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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly 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.

The peak detector was used with 100 kHz/300 kHz RBW/VBW

### 8.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

### 8.3 Test Result

Channel separation is referred to 8.3.1 to 8.3.3

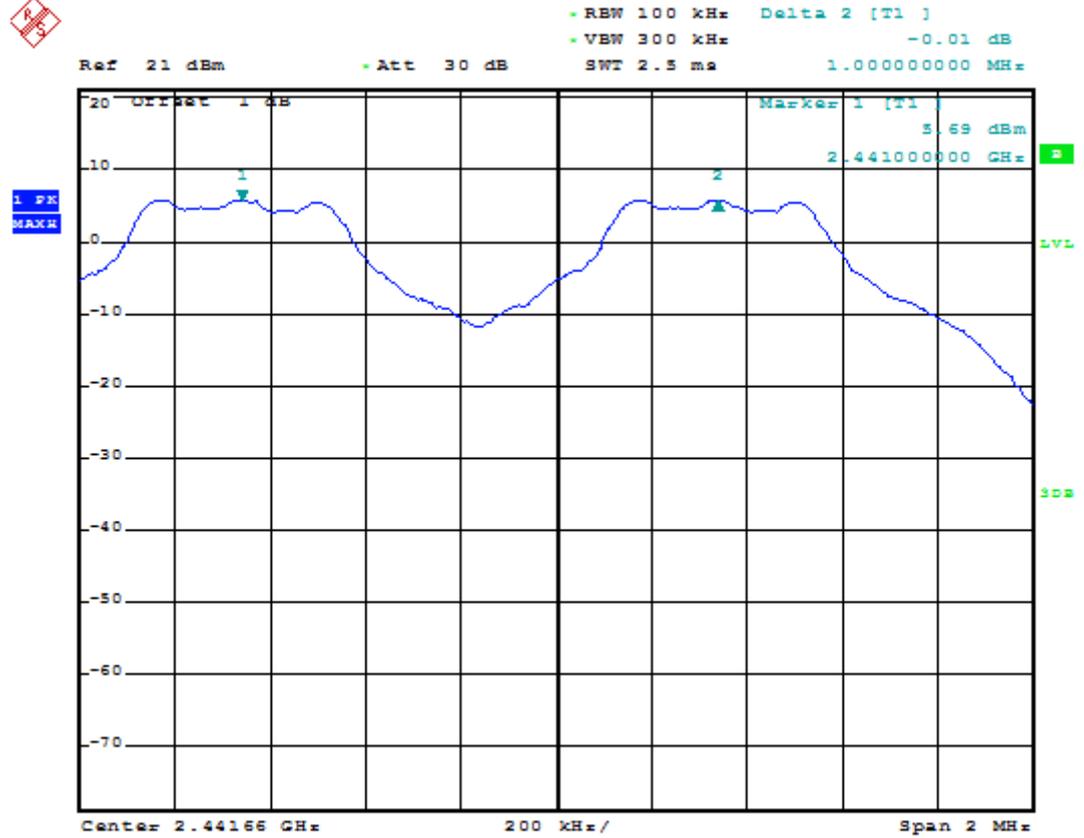
Widest channel bandwidth was 1216kHz.

Two-thirds is 810.6kHz and greater than 25kHz .

Modulation	Channel separation, kHz	Minimum limit, kHz	Result
GFSK	1000kHz	810.6kHz	Pass
8DPSK	1000kHz	810.6kHz	Pass
$\pi/4$ DQPSK	1000kHz	810.6kHz	Pass

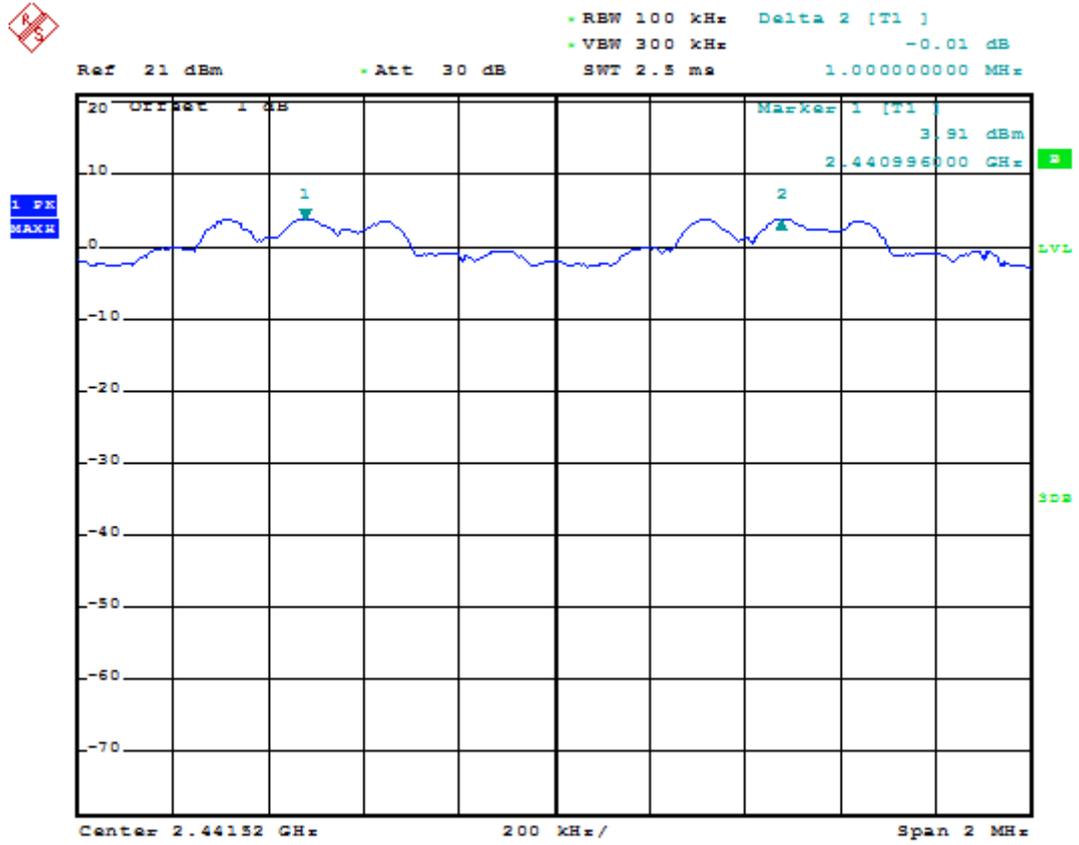
8.3.1 Diagram 8-1

GFSK :



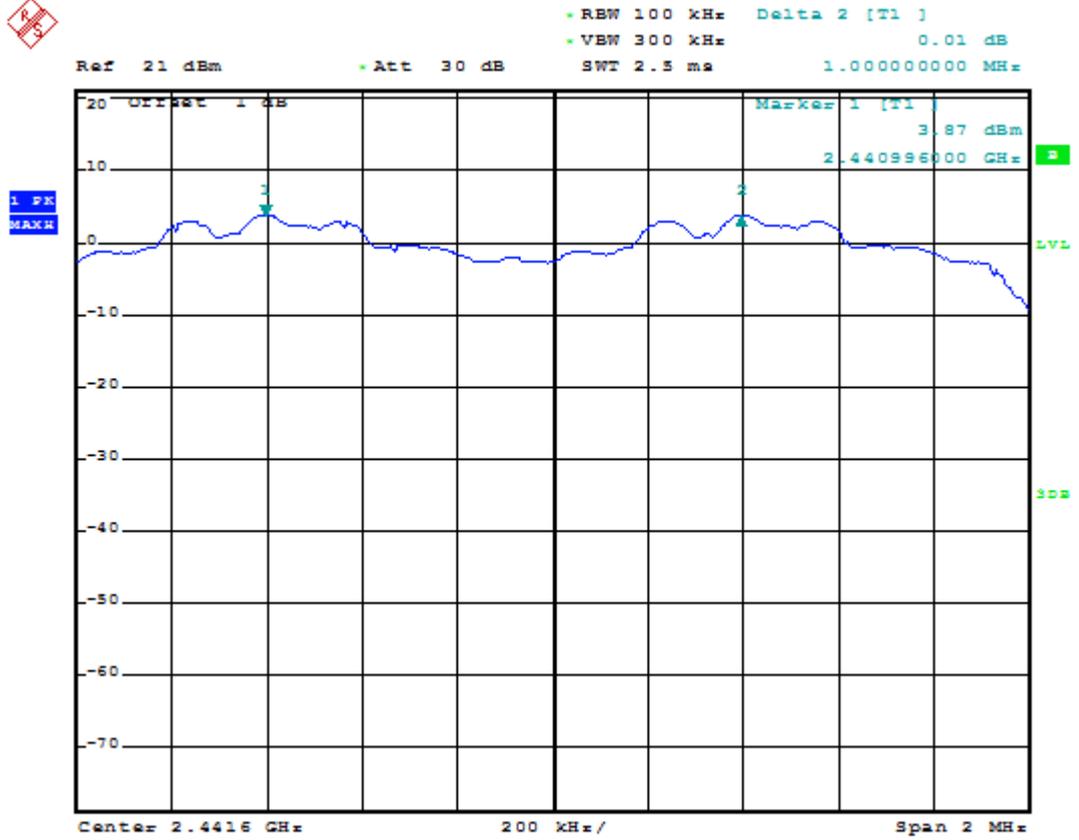
### 8.3.2 Diagram 8-2

8DPSK :



**8.3.3 Diagram 8-3**

$\pi/4$  DQPSK :



## 9. Output Power Test

### 9.1 Test Procedure

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(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 W. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 W.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 9.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

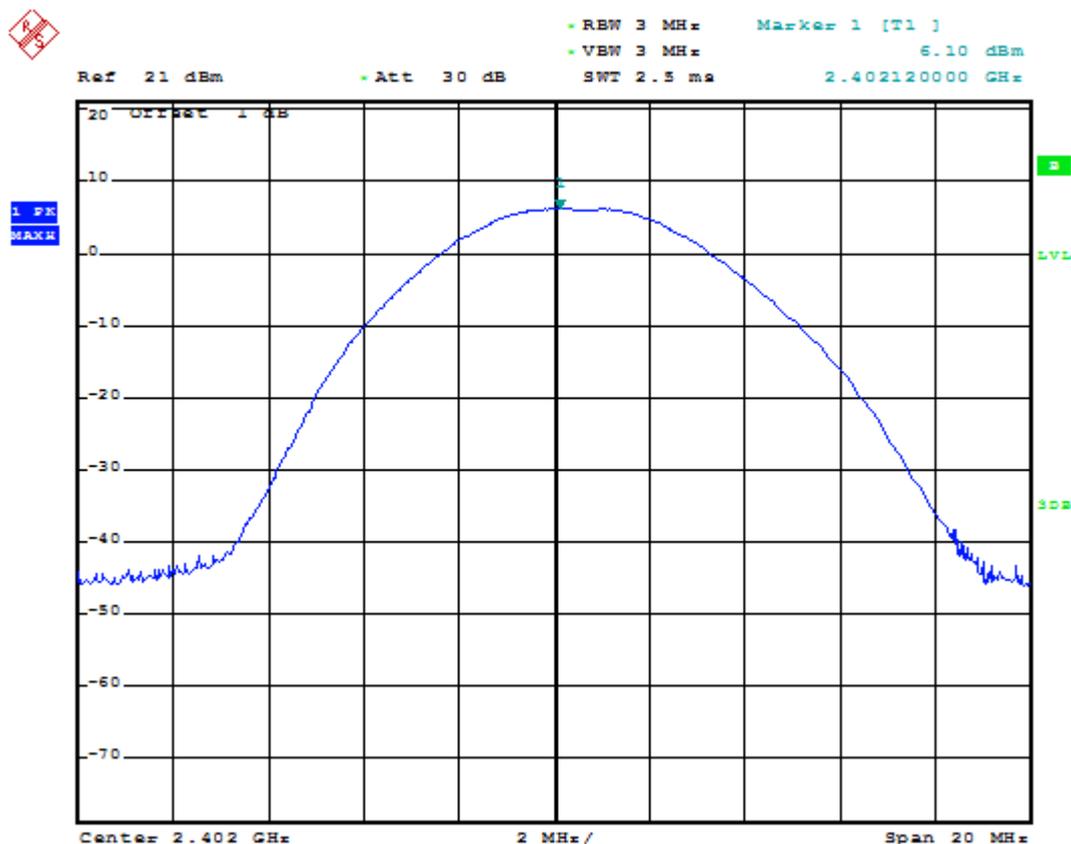
### 9.3 Test Result

Remark : 1:RBW=3MHz VBW=3MHz PK detector

GFSK:

Frequency, MHz	Reading dBm	Cable loss dB	Output power, dBm	Power Limit, dBm
2402	6.10	1	7.10	30.00
2441	6.06	1	7.06	30.00
2480	5.43	1	6.43	30.00

Diagram of GFSK is as below:

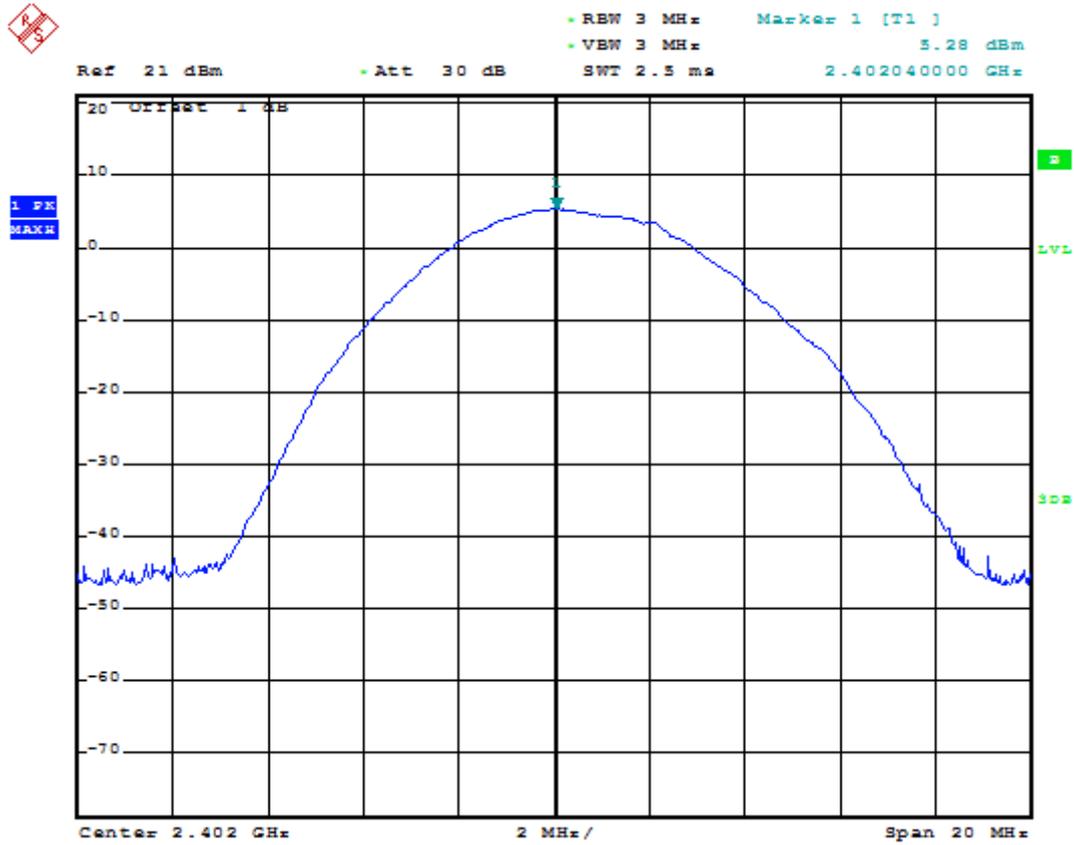




8DPSK:

Frequency, MHz	Reading	Cable loss	Output power, dBm	Power Limit, dBm
2402	5.28	1	6.28	30.00
2441	5.21	1	6.21	30.00
2480	4.38	1	5.38	30.00

Diagram of 8DPSK is as below:

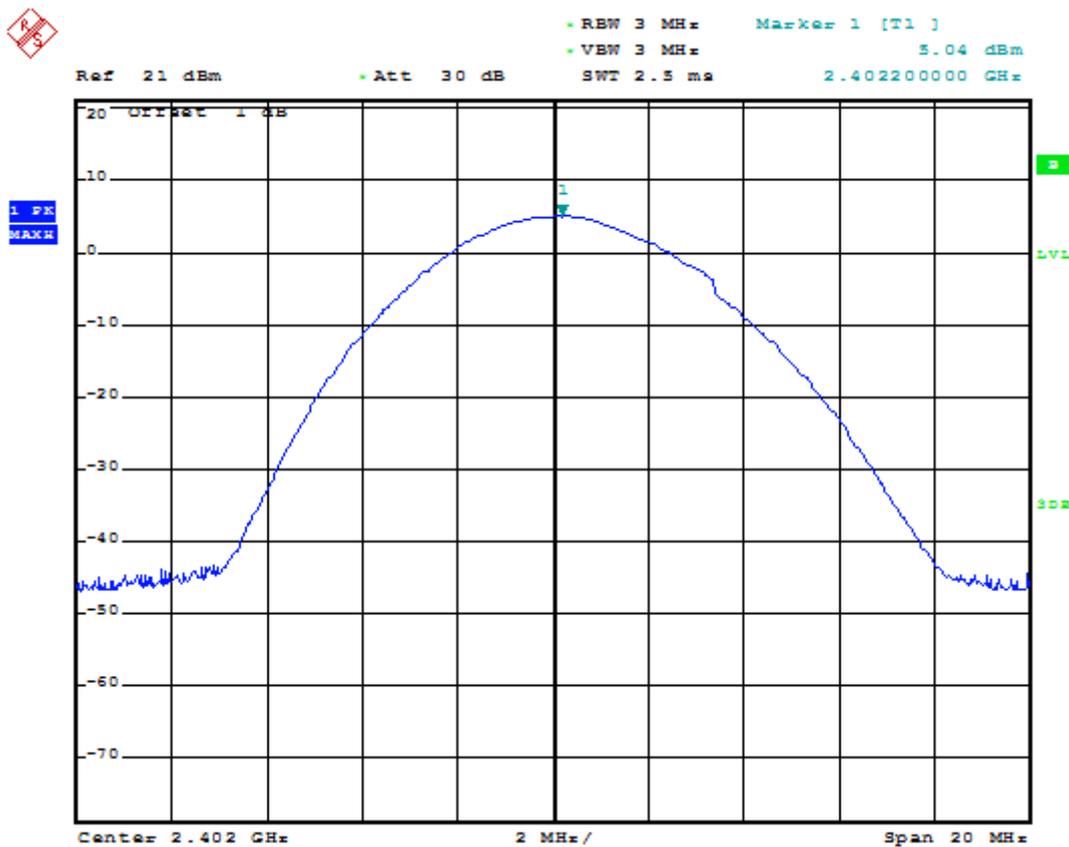




$\pi/4$  DQPSK:

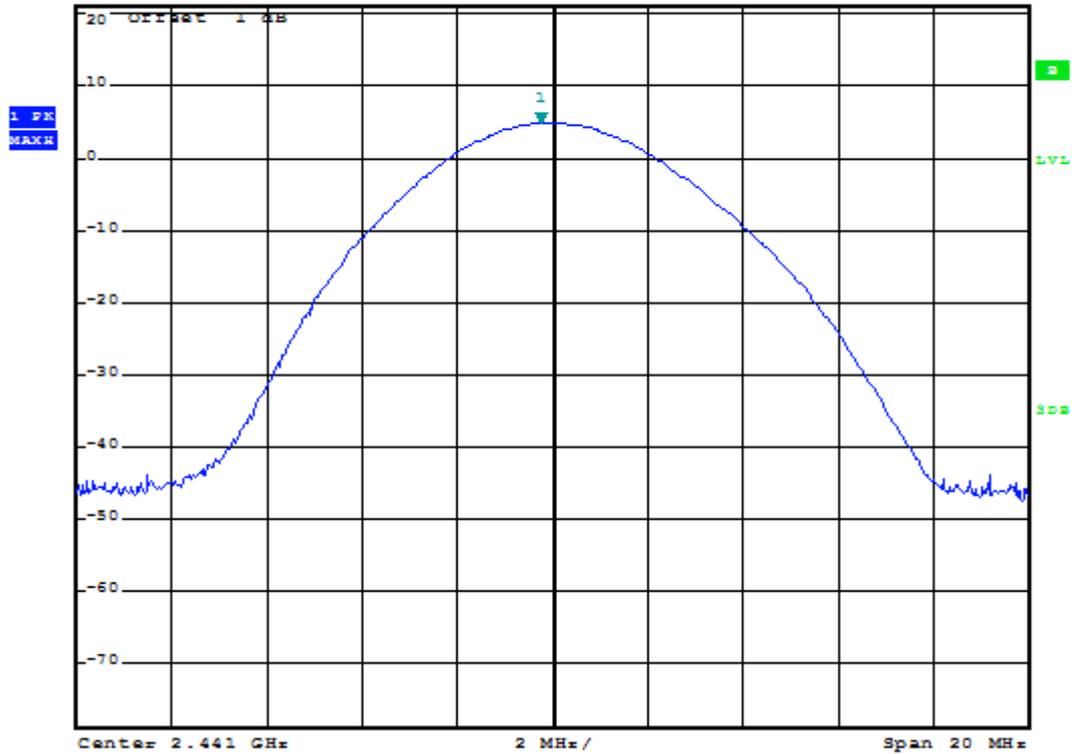
Frequency, MHz	Reading	Cable loss	Output power, dBm	Power Limit, dBm
2402	5.04	1	6.04	30.00
2441	4.84	1	5.84	30.00
2480	3.99	1	4.99	30.00

Diagram of  $\pi/4$  DQPSK is as below:

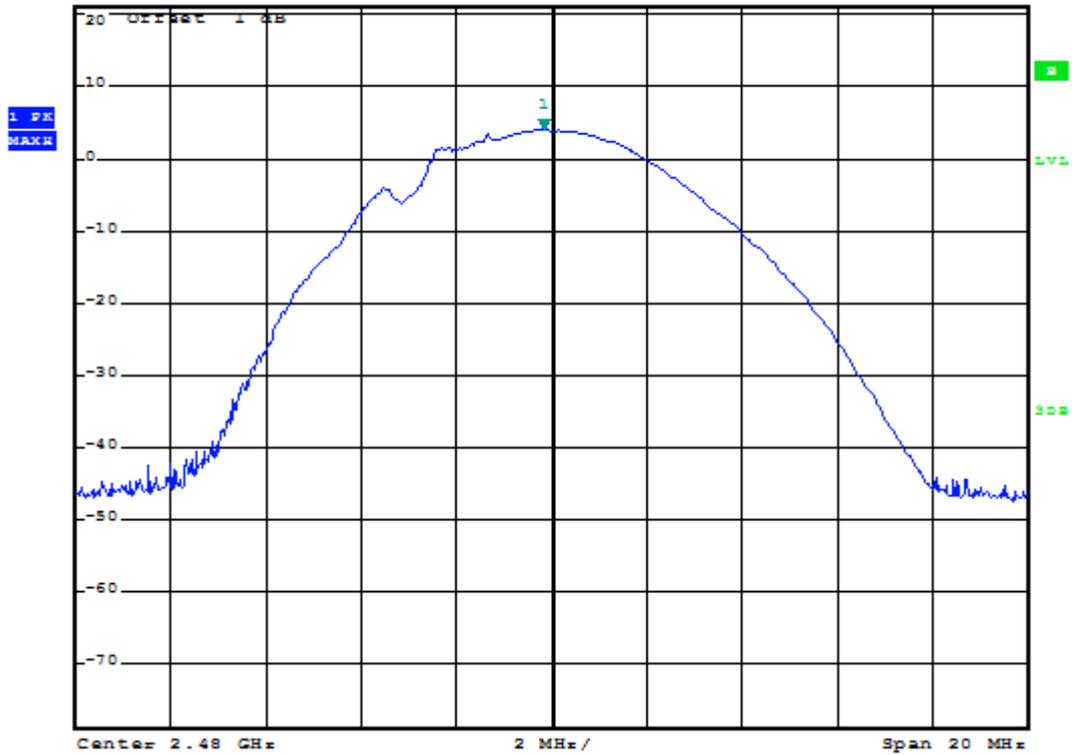




Ref 21 dBm      Att 30 dB      RBW 3 MHz      Marker 1 [T1]      4.84 dBm  
 VBW 3 MHz      2.440760000 GHz



Ref 21 dBm      Att 30 dB      RBW 3 MHz      Marker 1 [T1]      3.99 dBm  
 VBW 3 MHz      2.479840000 GHz





**EIRP measurement**

**GFSK:**

Frequency, MHz	Output power dBm	Antenna gain, dBi	EIRP dBm	EIRP Limit, dBm
2402	7.10	0	7.10	36.00

$EIRP [dBm] = Output\ power [dBm]_{max} + antenna\ gain [dBi]$

## 10. NUMBER OF HOPPING FREQUENCY TEST

### 10.1 Test Procedure

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.

### 10.2 Measurement Equipment

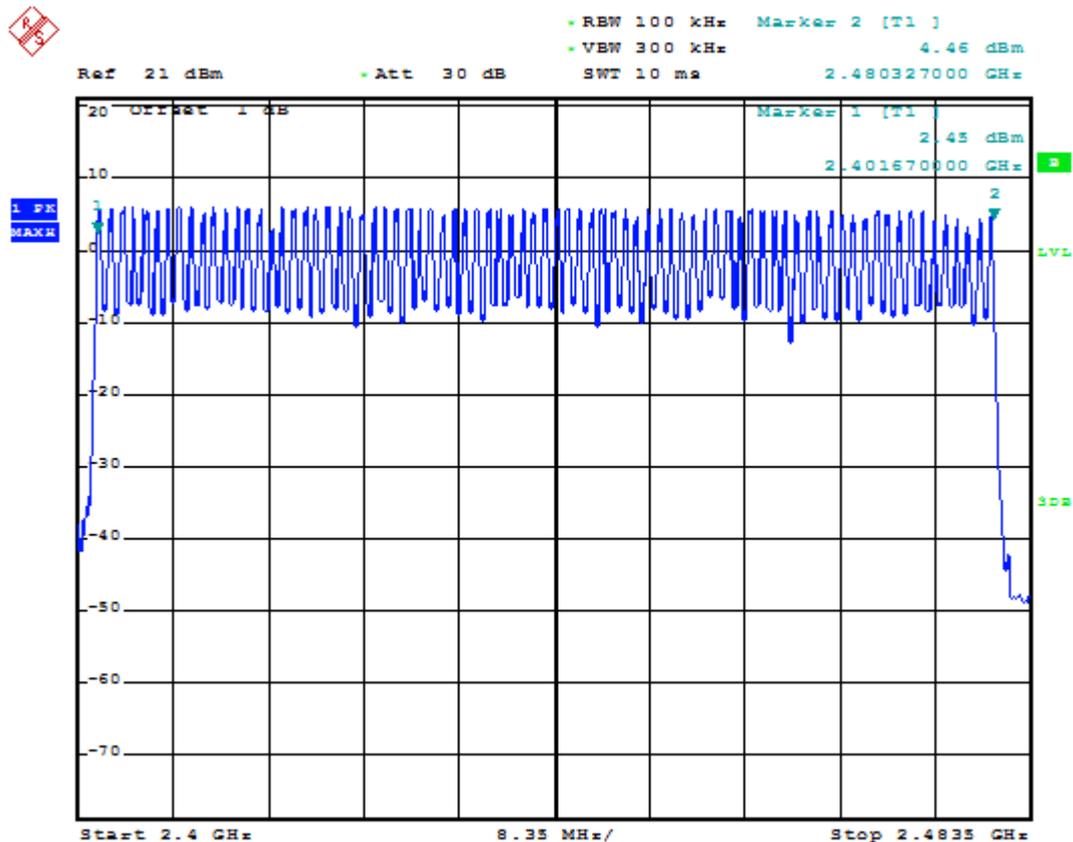
	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

### 10.3 Test Result

Test mode: Transmitter Hopping on

Number of channels used	Minimum number of channels limit	Margin
79	15	64

#### 10.3.1 Diagram



## 11. DWELL TIME TEST

### 11.1 Test Procedure

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.

### 11.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Spectrum	Jul. 04 2011	FSP30	GTS208	RS

### 11.3 Test Result

Limit:

Total time of occupancy is 0.4 s within a period of time equals number of hopping channels employed multiplied by 0.4 s, which is 0.4 s within the period of time  $0.4 \times 79 = 31.6$  s

Remark :

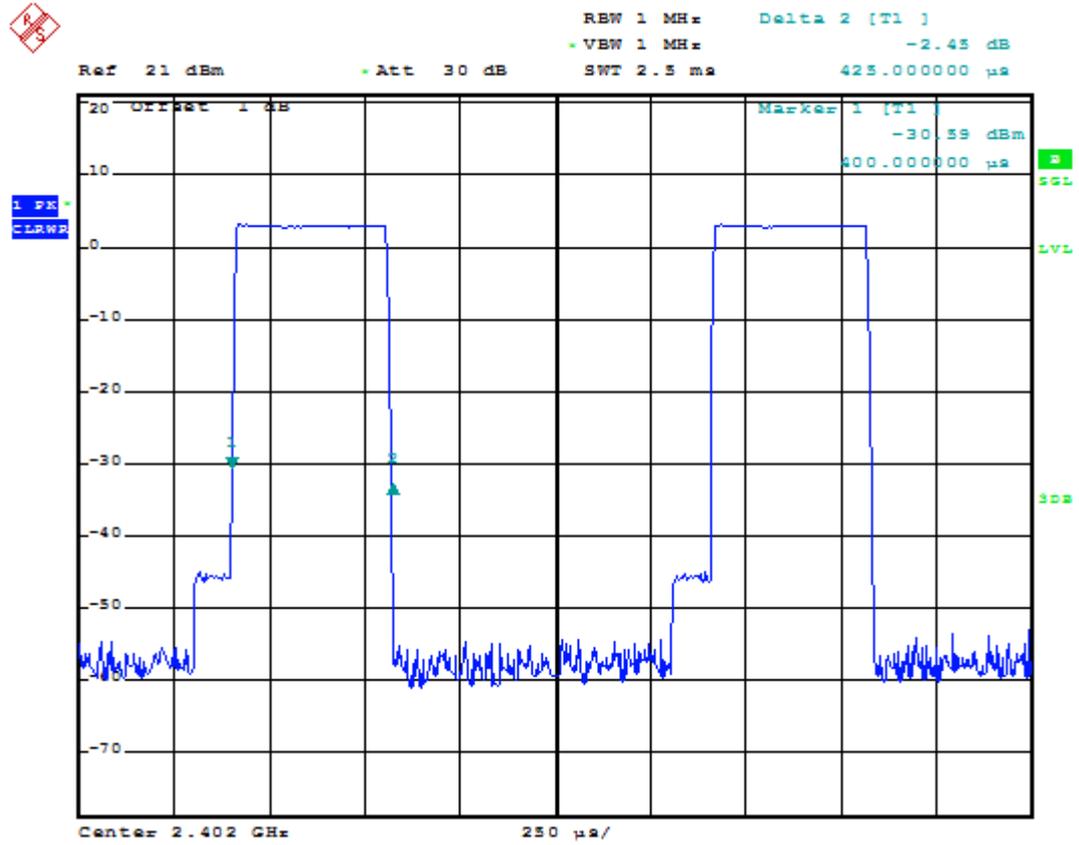
DH1 Packet permit maximum  $1600 / 79 / 2 = 10.12$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, total hops is  $10.12 \times 31.6 = 320$

DH3 Packet permit maximum  $1600 / 79 / 4 = 5.06$  hops per second in each channel (3 time slots RX, 1 time slot TX). So, total hops is  $5.06 \times 31.6 = 160$

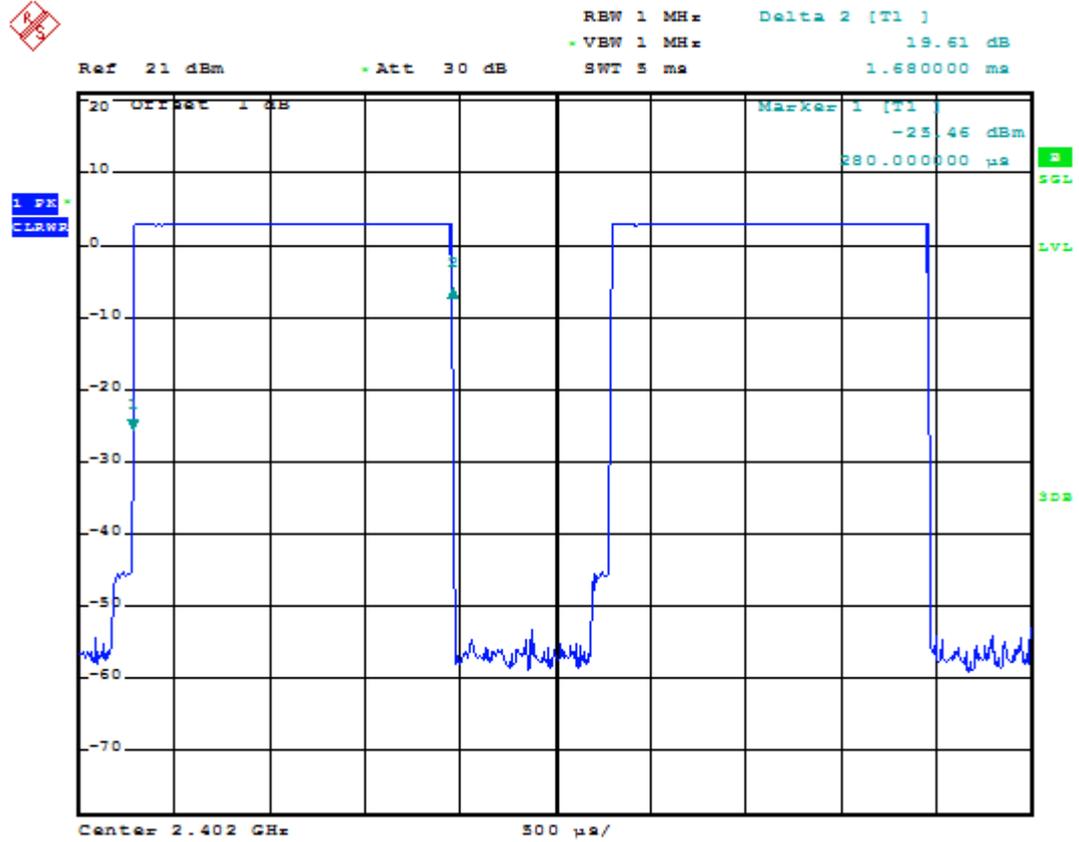
DH5 Packet permit maximum  $1600 / 79 / 6 = 3.37$  hops per second in each channel (5 time slots RX, 1 time slot TX). So, total hops is  $3.37 \times 31.6 = 106.6$

Grouping	Diagram	Time of occupancy ms	Limit ms	Remark
DH1	11-1	136	400	320x 0.425
DH3	11-2	269	400	160x 1.68
DH5	11-3	312	400	106.6x 2.928

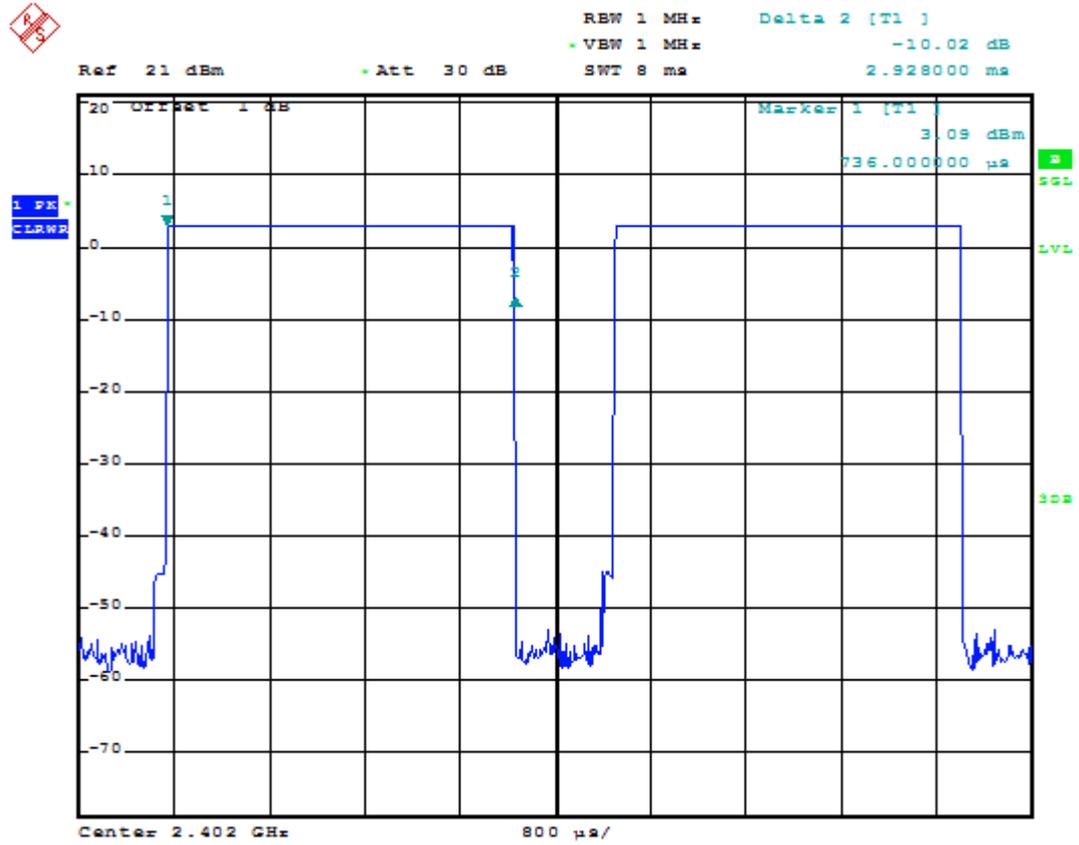
11.3.1 Diagram 11-1



**11.3.2 Diagram 11-2**



11.3.3 Diagram 11-3



## 12 POWER LINE CONDUCTED EMISSION TEST

### 12.1 Test Procedure

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

\*-Decreases with the logarithm of the frequency.

### 12.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
<input checked="" type="checkbox"/>	Shielding Room	Jul. 04 2011	7.0(L)x3.0(W)x3.0(H)	GTS252	ZhongYu Electron
<input checked="" type="checkbox"/>	EMI Test Receiver	Jul. 04 2011	ESCS30	1102.4500K30	Rohde & Schwarz
<input checked="" type="checkbox"/>	10dB Pulse Limita	Jul. 04 2011	N/A	GTS224	Rohde & Schwarz
<input checked="" type="checkbox"/>	LISN	Jul. 04 2011	NSLK 8127	8127549	SCHWARZBECK MESS-ELEKTRONIK
<input checked="" type="checkbox"/>	Coaxial Cable	Apr. 01 2011	N/A	N/A	GTS

### 12.3 Test Result

The EUT was placed on a non-metallic table, 80cm above the ground plane. The other peripheral devices power cord connected to the power mains through another line impedance stabilization network. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4-2003 on conducted Emission test.

#### Preview measurements:

0.15 MHz to 30 MHz

Receiver settings: PK&AV detector

RBW:9 kHz

TX MODE

#### Final measurement:

0.15 MHz to 30 MHz

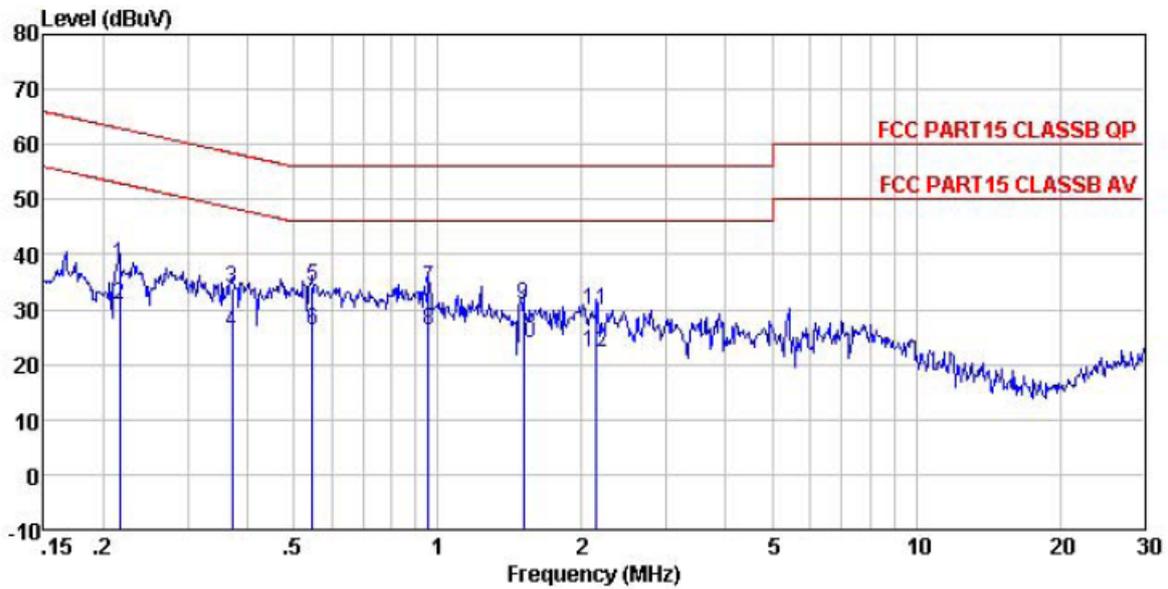
Receiver settings:QP&AV detector

Adapter used	Power Line	Test Data	Test Result
BLJ5W050050 U-U	Line	Diagram 12-1	Pass
	Neutral	Diagram 12-2	Pass
HK-U- 050A050-US	Line	Diagram 12-3	Pass
	Neutral	Diagram 12-4	Pass

#### NOTES:

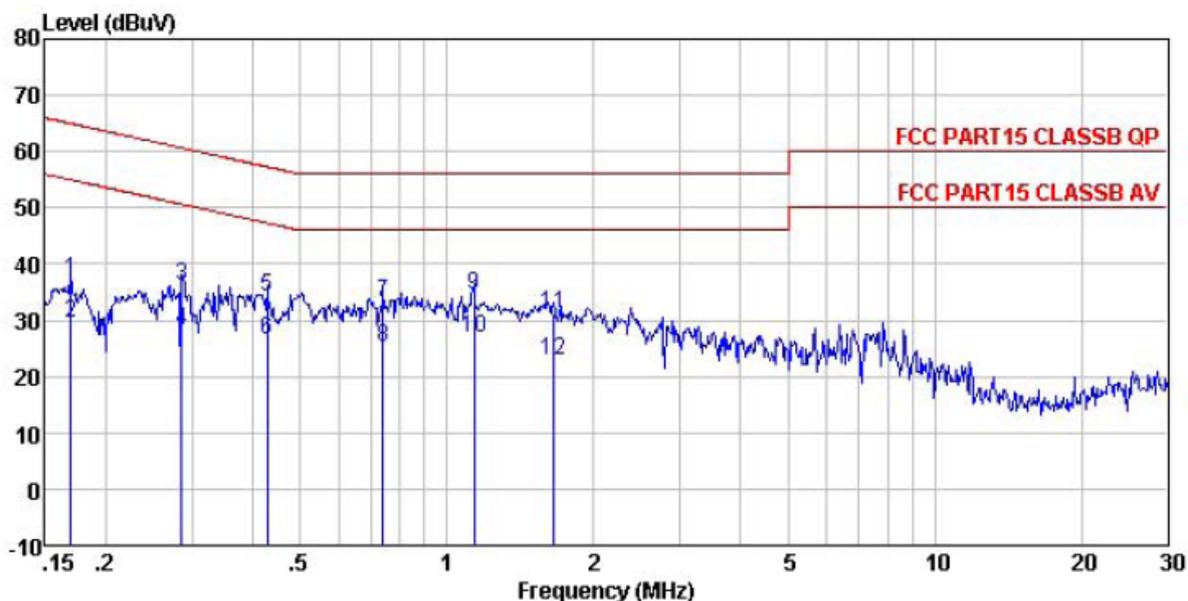
1. Measurements using CISPR quasi-peak mode & average mode.
2. All modes of operation were investigated and the worst -case emission are reported.
- 3: If PK value is lower than AV limit then no reading value listed in report .If QP value is Lower than AV limit ,then AV value don't listed in report.

12.3.1 Diagram 12-1



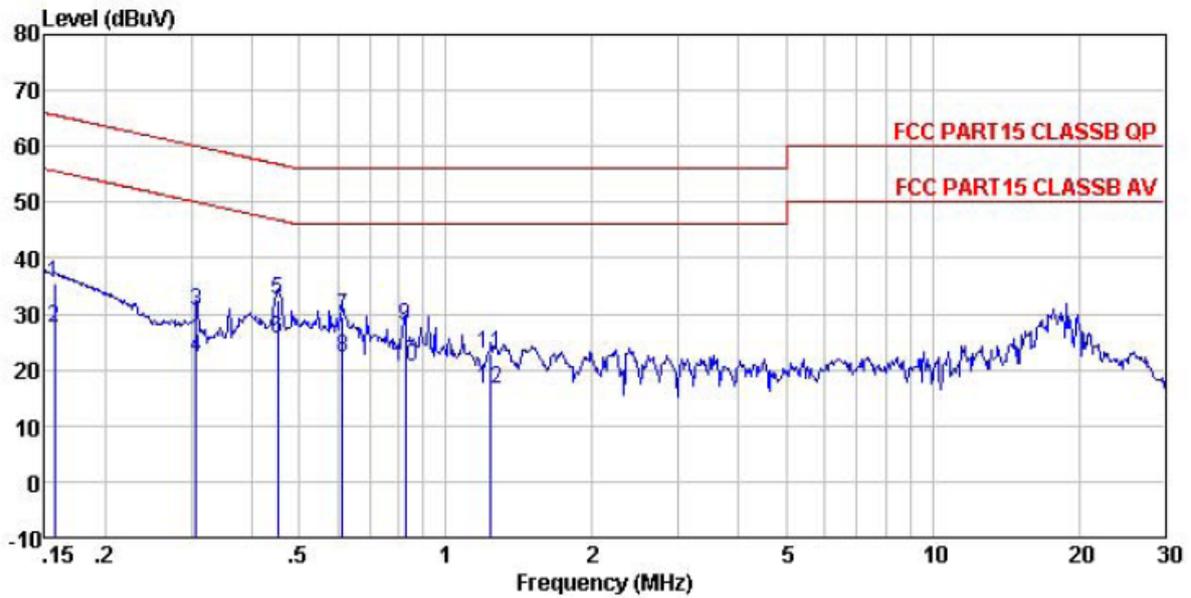
	Read Freq	LISN Level	Cable Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.216	37.35	0.65	0.10	38.10	62.96	-24.86	QP
2	0.216	30.17	0.65	0.10	30.92	52.96	-22.04	Average
3	0.371	33.02	0.59	0.10	33.71	58.47	-24.76	QP
4	0.371	25.18	0.59	0.10	25.87	48.47	-22.60	Average
5	0.546	33.60	0.54	0.10	34.24	56.00	-21.76	QP
6	0.546	25.67	0.54	0.10	26.31	46.00	-19.69	Average
7	0.958	33.16	0.48	0.10	33.74	56.00	-22.26	QP
8	0.958	25.64	0.48	0.10	26.22	46.00	-19.78	Average
9	1.511	30.37	0.43	0.10	30.90	56.00	-25.10	QP
10	1.511	23.41	0.43	0.10	23.94	46.00	-22.06	Average
11	2.144	29.41	0.39	0.10	29.90	56.00	-26.10	QP
12	2.144	21.57	0.39	0.10	22.06	46.00	-23.94	Average

12.3.2 Diagram 12-2



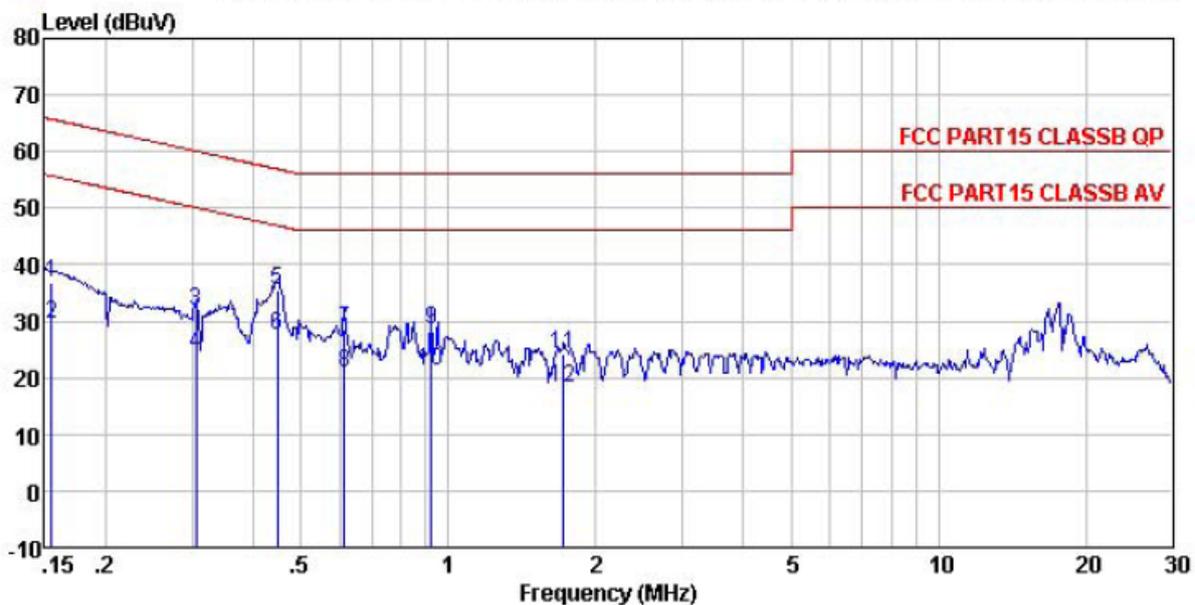
	Read Freq	LISN Level	Cable Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.169	36.31	0.67	0.10	37.08	64.99	-27.91	QP
2	0.169	28.67	0.67	0.10	29.44	54.99	-25.55	Average
3	0.286	35.31	0.62	0.10	36.03	60.63	-24.60	QP
4	0.286	27.59	0.62	0.10	28.31	50.63	-22.32	Average
5	0.428	33.61	0.57	0.10	34.28	57.29	-23.01	QP
6	0.428	25.89	0.57	0.10	26.56	47.29	-20.73	Average
7	0.739	32.57	0.51	0.10	33.18	56.00	-22.82	QP
8	0.739	24.68	0.51	0.10	25.29	46.00	-20.71	Average
9	1.135	33.78	0.46	0.10	34.34	56.00	-21.66	QP
10	1.135	26.31	0.46	0.10	26.87	46.00	-19.13	Average
11	1.654	30.76	0.42	0.10	31.28	56.00	-24.72	QP
12	1.654	22.48	0.42	0.10	23.00	46.00	-23.00	Average

12.3.1 Diagram 12-3



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.157	34.66	0.68	0.10	35.44	65.60	-30.16	QP
2	0.157	26.79	0.68	0.10	27.57	55.60	-28.03	Average
3	0.307	29.72	0.61	0.10	30.43	60.06	-29.63	QP
4	0.307	21.58	0.61	0.10	22.29	50.06	-27.77	Average
5	0.452	31.79	0.57	0.10	32.46	56.85	-24.39	QP
6	0.452	24.87	0.57	0.10	25.54	46.85	-21.31	Average
7	0.614	28.99	0.53	0.10	29.62	56.00	-26.38	QP
8	0.614	21.58	0.53	0.10	22.21	46.00	-23.79	Average
9	0.826	27.17	0.50	0.10	27.77	56.00	-28.23	QP
10	0.826	20.08	0.50	0.10	20.68	46.00	-25.32	Average
11	1.236	22.44	0.45	0.10	22.99	56.00	-33.01	QP
12	1.236	15.89	0.45	0.10	16.44	46.00	-29.56	Average

12.3.2 Diagram 12-4



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.155	36.18	0.68	0.10	36.96	65.74	-28.78	QP
2	0.155	28.59	0.68	0.10	29.37	55.74	-26.37	Average
3	0.305	31.27	0.61	0.10	31.98	60.10	-28.12	QP
4	0.305	23.59	0.61	0.10	24.30	50.10	-25.80	Average
5	0.447	34.91	0.57	0.10	35.58	56.93	-21.35	QP
6	0.447	26.97	0.57	0.10	27.64	46.93	-19.29	Average
7	0.614	27.77	0.53	0.10	28.40	56.00	-27.60	QP
8	0.614	20.14	0.53	0.10	20.77	46.00	-25.23	Average
9	0.923	27.93	0.49	0.10	28.52	56.00	-27.48	QP
10	0.923	20.54	0.49	0.10	21.13	46.00	-24.87	Average
11	1.716	23.66	0.42	0.10	24.18	56.00	-31.82	QP
12	1.716	17.58	0.42	0.10	18.10	46.00	-27.90	Average

## **13 Antenna requirement**

### **13.1 Requirement**

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **13.2 Result**

The antenna used for this product is Internal Patch antenna that no antenna other than that furnished by the responsible party shall be used with the device, The maximum peak gain of this antenna is 0dBi.



## 14.MPE

### Applicable Standard

According to §1.1307(b)(5), 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.

This is a Portable device. **KDB616217 was used as the guidance.**

According to §1.1310 and §2.1093 RF exposure is calculated.

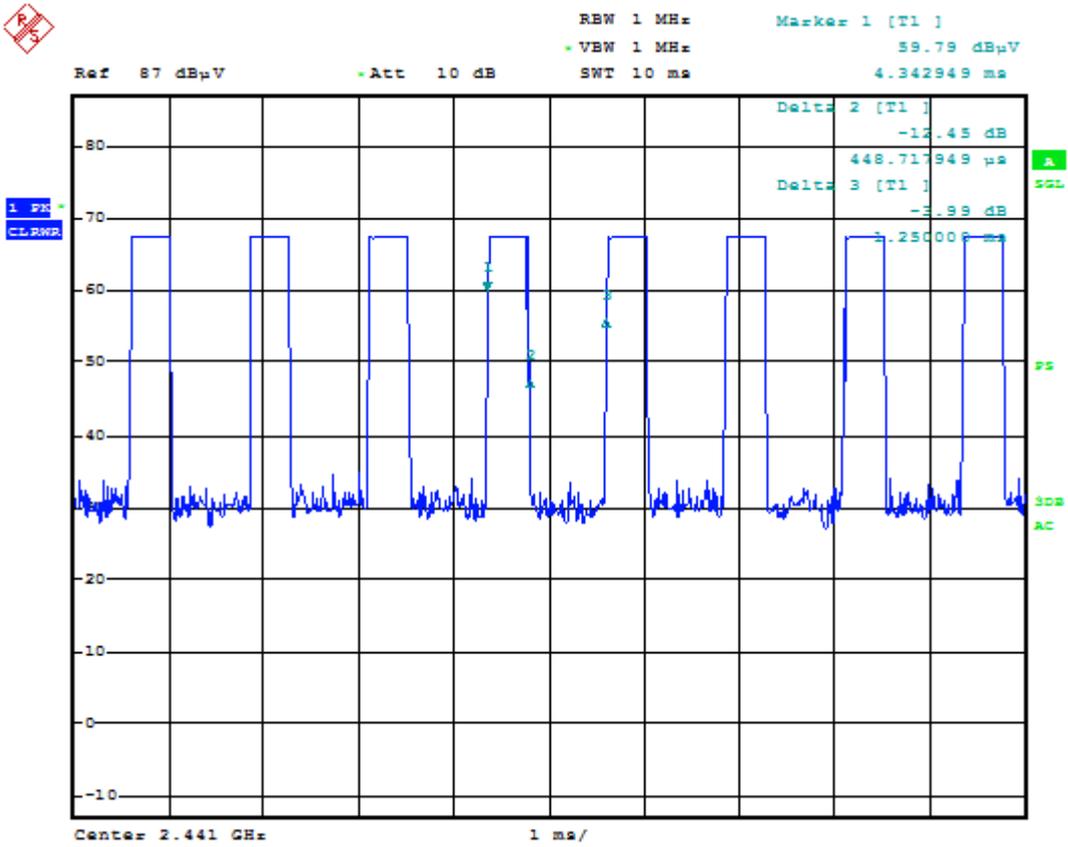
### Measurement Result

This device's EIRP is 7.10dBm ( 5.13mW) , which is lower than low threshold 60/fGHz mW (60/2.441GHz=24.58mW), and the antenna is 0dBi which is less than 6dBi.

The SAR measurement is not necessary.

### Appendix A Duty cycle

So the duty cycle is  $(0.4487 \times 8) \times 10 / 100 = 35.9\%$



## **Appendix B Sample Label**

### **Labelling Requirements**

The sample label shown shall be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

\*\*\* The following paragraph specified in the label.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**END OF REPORT**