



# FCC Test Report - EDR

**Product Name: LTE/HSUPA/HSDPA/UMTS/GSM/GPRS/EDGE  
Mobile Phone with Bluetooth**

**Model Number: HW-01E**

**Report No: SYBH(Z-RF)011082012-2004  
FCC ID: QISU9501L**

**Reliability Laboratory of Huawei Technologies Co., Ltd.**

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,  
Shenzhen, 518129, P.R.C

Tel: +86 755 28780808 Fax: +86 755 89652518



## Notice

1. The laboratory has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L0310.
2. The laboratory has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements. The site recognition number is 97456.
3. The laboratory has been listed by industry Canada to perform electromagnetic emission measurement. The site recognition number is 6369A-2.
4. The test report is invalid if not marked with "exclusive stamp for the test report".
5. The test report is invalid if not marked with the stamps or the signatures of the persons responsible for performing, revising and approving the test report.
6. The test report is invalid if there is any evidence of erasure and/or falsification.
7. If there is any dissidence for the test report, please file objection to the test centre within 15 days from the date of receiving the test report.
8. Normally, the test report is only responsible for the samples that have undergone the test.
9. Context of the test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of the laboratory.





## Contents

<b>1</b>	<b><u>Summary</u></b> .....	<b>5</b>
<b>2</b>	<b><u>Product Description</u></b> .....	<b>6</b>
2.1	PRODUCTION INFORMATION .....	6
2.2	MODIFICATION INFORMATION.....	6
<b>3</b>	<b><u>Test Site Description</u></b> .....	<b>7</b>
<b>4</b>	<b><u>General Setup Description</u></b> .....	<b>7</b>
<b>5</b>	<b><u>Product Description</u></b> .....	<b>8</b>
5.1	TECHNICAL CHARACTERISTICS .....	8
5.2	EUT IDENTIFICATION LIST .....	10
<b>6</b>	<b><u>Main Test Instruments</u></b> .....	<b>11</b>
<b>7</b>	<b><u>Transmitter Measurements</u></b> .....	<b>12</b>
7.1	BANDWIDTH MEASUREMENT .....	12
7.2	CARRIER FREQUENCY SEPARATION MEASUREMENT .....	14
7.3	NUMBER OF HOPPING CHANNEL .....	16
7.4	TIME OF OCCUPANCY .....	18
7.5	PEAK OUTPUT POWER .....	20
7.6	BAND EDGE SPURIOUS EMISSION .....	22
7.7	CONDUCTED RF SPURIOUS .....	24
7.8	RADIATED SPURIOUS EMISSION & SPURIOUS IN RESTRICTED BAND .....	26
7.9	CONDUCTED EMISSION AT POWER PORT .....	28
<b>8</b>	<b><u>System Measurement Uncertainty</u></b> .....	<b>30</b>
<b>9</b>	<b><u>Appendices List</u></b> .....	<b>31</b>



# 1 Summary

The table below summarizes the measurements and results for the EUT. Detailed results and descriptions are shown in the following pages.

Table 1 Summary of results

<b>FCC Measurement Specification</b>	<b>Description</b>	<b>Result</b>
15.247 (a) (1)	Bandwidth measurement	PASS
15.247 (a) (1)	Carrier frequency separation measurement	PASS
15.247 (a) (1) III	Number of hopping channel	PASS
15.247 (a) (1) III	Time of occupancy	PASS
15.247 (b) (1)	Peak output power	PASS
15.247 (d)	Band edge compliance measurement	PASS
15.247 (d)	Conducted RF spurious	PASS
15.247 (d) / 15.205 & 15.209	Radiated spurious emission & Radiated restricted band measurement	PASS
15.207	Conducted emission test for power port	PASS



## 2 Product Description

### 2.1 Production Information

#### 2.1.1 General Description

HW-01E is subscriber equipment in the LTE/WCDMA/GSM system. The LTE frequency band is Band I. The HSUPA/HSDPA/UMTS frequency band is Band I, Band V, Band VI, Band XIX. The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/HSUPA/HSDPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video, MMS service, GPS, AGPS, Felica and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

**Note: Only the Bluetooth test data included in this report.**

#### 2.1.2 Support function and Service

The EUT support the Bluetooth's function and service as follows:

Table 2 Service and Test mode List

Service Name	Characteristic	Corresponding Test Mode	Note
Data and Voice	Modulation: $\pi/4$ -DQPSK	TM1	/
Data and Voice	Modulation: 8DPSK	TM2	/

### 2.2 Modification Information

For original equipment, following table is not application.

Table 3 Modification Information

Model Number	Board/Module	Original Version	New Version	Modify Information
Not applicable!				



### **3 Test Site Description**

The test site of:

***Huawei Technologies Co. Ltd.***

***P.O. Box 518129***

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

### **4 General Setup Description**

The Bluetooth hopping frequency system of EUT can Support 2.4GHz Band. For compliance with FCC regulation 47CFR part15 subpart C, we set the EUT as in the following test mode to do all compliance tests.

**Bluetooth MODE:**

**TM1:**  $\pi$  /4-DQPSK Modulation

**TM2:** 8DPSK Modulation



## 5 Product Description

### 5.1 Technical Characteristics

#### 5.1.1 Frequency Range

Table 4 Frequency Range

Uplink band:	2400 to 2483.5 MHz	
Downlink band:	2400 to 2483.5 MHz	
Hop frequency support:	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO

#### 5.1.2 Channel Spacing / Separation

Table 5 Channel Spacing / Separation

Channel spacing:	1 MHz
Channel separation:	1 MHz

#### 5.1.3 Antenna Information

Table 6 Antenna Information

Type:	Integrated / Internal
Maximum Gain(dBi):	-0.3(from 2400MHz to 2500MHz)



### 5.1.4 Environmental Requirements

Table 7 Environmental Requirements

Minimum temperature:	- 10 °C
Maximum temperature:	+ 55 °C
Relative Humidity:	5%-95%

### 5.1.5 Power Source

Table 8 Power Source

AC voltage nominal:	~120V
AC voltage range	~100V-240V

### 5.1.6 Tune-up Procedure

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.



## 5.2 EUT Identification List

### 5.2.1 Board Information

Table 9 Board Information

LTE/HSUPA/HSDPA/UMTS/GSM/GPRS/EDGE Mobile Phone with Bluetooth		
HW-01E		
Board and Module		
Equipment Designation / Description	Hardware Version	Software Version
MAINBOARD	U9501L_VB	U9501LV100R001C341B126

### 5.2.2 Battery Technical Data

Name	Manufacture	Description
Rechargeable Li-ion	Huawei Technologies Co., Ltd.	Battery Model: HB4T1HV Rated capacity: 1800mAh Nominal Voltage:  +3.8V Charging Voltage:  +4.35V



## 6 Main Test Instruments

Table 10 Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until
Power supply	KEITHLEY	2303	1288003	Sept., 27, 2012
Wireless Communication Test set	Agilent	N4010A	MY49081592	Nov., 26, 2012
Spectrum Analyzer	Agilent	E4440A	MY48250119	Jul., 17, 2013
Signal Analyzer	R&S	FSQ31	200021	Sept., 27, 2012
Spectrum Analyzer	Agilent	N9030A	MY49431698	Oct., 16, 2012
Temperature Chamber	WEISS	WKL64	24600294	Feb., 13, 2013
Signal generator	Agilent	E8257D	MY49281095	Jul., 09, 2013
Test receiver	R&S	ESU26	100150	May, 29, 2013
Spectrum analyzer	R&S	FSU3	200474	Mar., 05, 2013
Spectrum analyzer	R&S	FSU43	100144	Mar., 05, 2013
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100304	Apr., 05, 2013
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100391	Apr., 05, 2013
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-521	Jul., 07, 2013
Pyramidal Horn Antenna(26GHz-40GHz)	ETS-Lindgren	3160-10	00123940	Feb., 27, 2013
Pyramidal Horn Antenna(18GHz-26.5GHz)	ETS-Lindgren	3160-09	00125912	Feb.,27, 2013

Note: All the equipments are calibrated once a year. When it's almost due, we will arrange calibration again before the calibration deadline.



## 7 Transmitter Measurements

### 7.1 Bandwidth measurement

#### 7.1.1 Test Conditions

Table 11 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at channel No.0, 40, 78

#### 7.1.2 Test Specifications and Limits

##### 7.1.2.1 Specification

CFR 47 (FCC) part 15.247 (a) (1) and DA 00-705

##### 7.1.2.2 Supporting Standards

Table 12 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

##### 7.1.2.3 Limits

Not Applicable.

#### 7.1.3 Test Method and Setup

- (a) Connect EUT test port to universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function, then set the measured frequency number and test the bandwidth with universal communication tester.

## Test setup

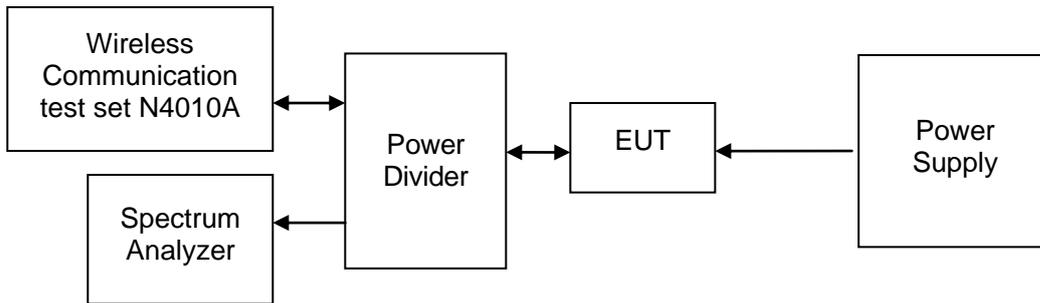


Figure 1. Test Set-up

### 7.1.4 Measurement Results

Table 13 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Channel Position	Channel Number	Frequency [MHz]	Bandwidth Type	Measured Bandwidth [MHz]	Result
L	0	2402	20dB	1.324	Pass
			99%	1.207	Pass
M	40	2442	20dB	1.330	Pass
			99%	1.196	Pass
H	78	2480	20dB	1.340	Pass
			99%	1.197	Pass

Table 14 Measurement Results TM2 (Modulation: 8DPSK)

Channel Position	Channel Number	Frequency [MHz]	Bandwidth Type	Measured Bandwidth [MHz]	Result
L	0	2402	20dB	1.311	Pass
			99%	1.194	Pass
M	40	2442	20dB	1.305	Pass
			99%	1.201	Pass
H	78	2480	20dB	1.310	Pass
			99%	1.200	Pass

### 7.1.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix A.

## 7.2 Carrier frequency separation measurement

### 7.2.1 Test Conditions

Table 15 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at channel No.39, 40, 41

### 7.2.2 Test Specifications and Limits

#### 7.2.2.1 Specification

CFR 47 (FCC) part 15.247 (a) (1) and DA 00-705

#### 7.2.2.2 Supporting Standards

Table 16 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.2.2.3 Limits

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.

Table 17 Limits TM1 (Modulation:  $\pi/4$ -DQPSK)

Regulation:	$\geq 0.025$ or $2/3$ of the 20 dB bandwidth
Limit:	$\geq 2/3 \times 1.330M = 0.887$ MHz

Table 18 Limits TM2 (Modulation: 8DPSK)

Regulation:	$\geq 0.025$ or $2/3$ of the 20 dB bandwidth
Limit:	$\geq 2/3 \times 1.305M = 0.870$ MHz

### 7.2.3 Test Method and Setup

- (a) Connect EUT test port to spectrum analyzer and universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function, then set the measured frequency number to two adjacent channels separately and test the carrier frequency separation with spectrum analyzer.

## Test setup

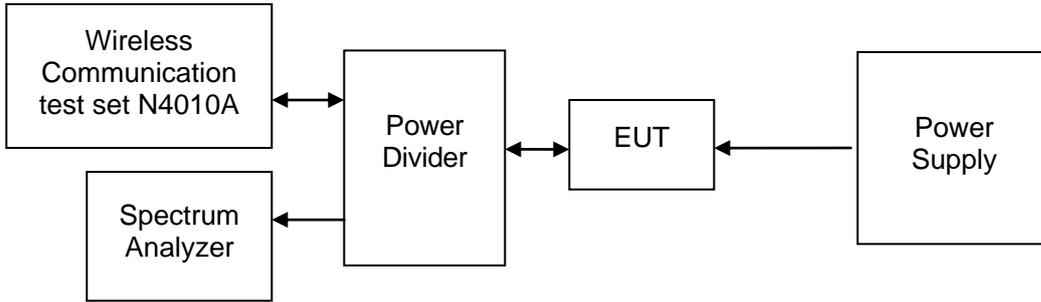


Figure 2. Test Set-up

### 7.2.4 Measurement Results

Table 19 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Channel No.	Frequency [MHz]	Channel No.	Frequency [MHz]	Measured frequency separation [MHz]	Limit [MHz]	Result
40	2442	39	2441	1.016	$\geq 0.887$	Pass
40	2442	41	2443	0.959	$\geq 0.887$	Pass

Table 20 Measurement Results TM2 (Modulation: 8DPSK)

Channel No.	Frequency [MHz]	Channel No.	Frequency [MHz]	Measured frequency separation [MHz]	Limit [MHz]	Result
40	2442	39	2441	1.067	$\geq 0.870$	Pass
40	2442	41	2443	0.991	$\geq 0.870$	Pass

### 7.2.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix B.



## 7.3 Number of hopping channel

### 7.3.1 Test Conditions

Table 21 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at hopping frequency state

### 7.3.2 Test Specifications and Limits

#### 7.3.2.1 Specification

CFR 47 (FCC) part 15.247 (a) (1) iii and DA 00-705

#### 7.3.2.2 Supporting Standards

Table 22 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.3.2.3 Limits

Number of hopping channel should be compliance with the requirements in part15.247 (a) (1) iii.

Table 23 Limits

Limits	$\geq 15$ hopping frequency channel
--------	-------------------------------------

### 7.3.3 Test Method and Setup

- (a) Connect EUT test port to spectrum analyzer and universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch on frequency hopping function, then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.
- (c) Count the quantity of peaks to get the number of hopping channels.

## Test setup

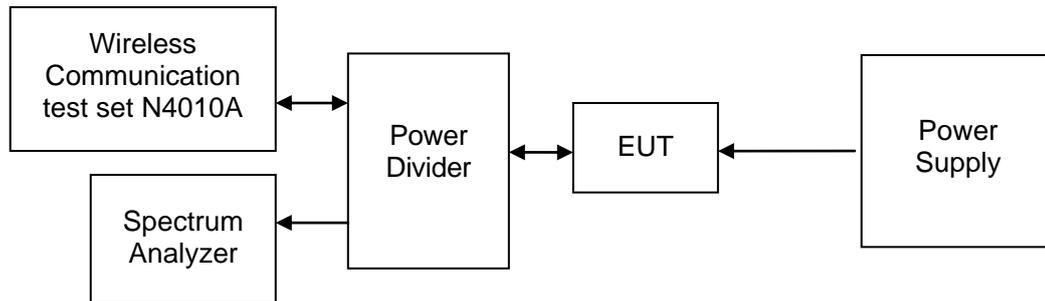


Figure 3. Test Set-up

### 7.3.4 Measurement Results

Table 24 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Measured frequency range [MHz]	Channel No. range	Measured Channel No.	Limit	Result
2400 to 2483.5	0-78	79	$\geq 15$	Pass

Table 25 Measurement Results TM2 (Modulation: 8-DPSK)

Measured frequency range [MHz]	Channel No. range	Measured Channel No.	Limit	Result
2400 to 2483.5	0-78	79	$\geq 15$	Pass

### 7.3.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix C.

## 7.4 Time of occupancy

### 7.4.1 Test Conditions

Table 26 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25°C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at hopping frequency state

### 7.4.2 Test Specifications and Limits

#### 7.4.2.1 Specification

CFR 47 (FCC) part 15.247 (a) (1) iii and DA 00-705

#### 7.4.2.2 Supporting Standards

Table 27 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.4.2.3 Limits

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.

Table 28 Limits

Limits for time of occupancy	$\leq 0.4s$
------------------------------	-------------

### 7.4.3 Test Method and Setup

- Connect EUT test port to spectrum analyzer and universal communication tester.
- Set the EUT to transmit maximum output power at 2.4GHz and switch on frequency hopping function.
- Set the span of spectrum analyzer to 0 Hz, and set the resolution bandwidth to 1 MHz and the video bandwidth to 1 MHz, then get the time domain measured diagram. Set sweep time to 2 times of one burst occupancy time, and measure the time of occupancy of one burst.
- Set the resolution bandwidth to 1 MHz and the video bandwidth to 3 MHz, and set the sweep time to a period (0.4 seconds multiplied by the number of hopping channels employed), and count the number of the bursts.
- Calculate the time of occupancy in a period with time occupancy of a burst and quantity of bursts.

## Test setup

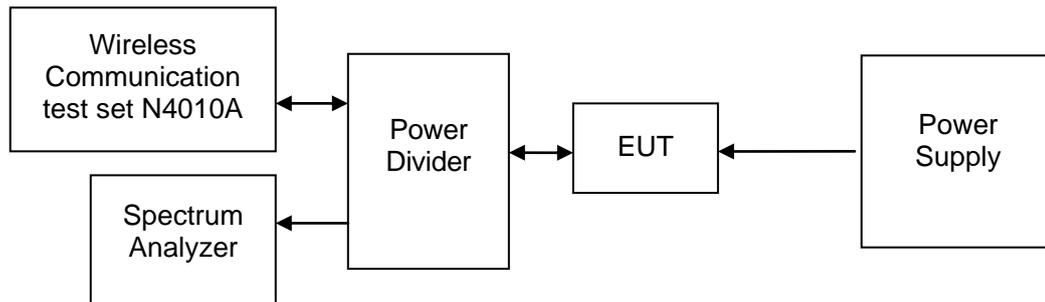


Figure 4. Test Set-up

### 7.4.4 Measurement Results

Table 29 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Time of Single Slot [ms]	Numbers of slots in a period	Time of occupied in a period [s]	Limit [s]	Result
3.0	106.7	0.32010	$\leq 0.4$	Pass

Table 30 Measurement Results TM2 (Modulation: 8DPSK)

Time of Single Slot [ms]	Numbers of slots in a period	Time of occupied in a period [s]	Limit [s]	Result
2.9	106.7	0.30943	$\leq 0.4$	Pass

Note: The result is measured at 2-DH5\3-DH5 mode in  $\pi/4$ -DQPSK\8DPSK modulation, which has the longest time in one transmission burst.

### 7.4.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix D.

## 7.5 Peak output power

### 7.5.1 Test Conditions

Table 31 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at channel No.0, 40, 78

### 7.5.2 Test Specifications and Limits

#### 7.5.2.1 Specification

CFR 47 (FCC) part 15.247 (b) (1) and DA 00-705

#### 7.5.2.2 Supporting Standards

Table 32 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.5.2.3 Limits

Comply with part 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 watt.

Table 33 Limits

2.4GHz and 5.8GHz hopping frequency system	1 Watt (=30 dBm)
--	------------------

### 7.5.3 Test Method and Setup

- (a) Connect EUT test port to universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function.
- (c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted output power separately.

## Test setup

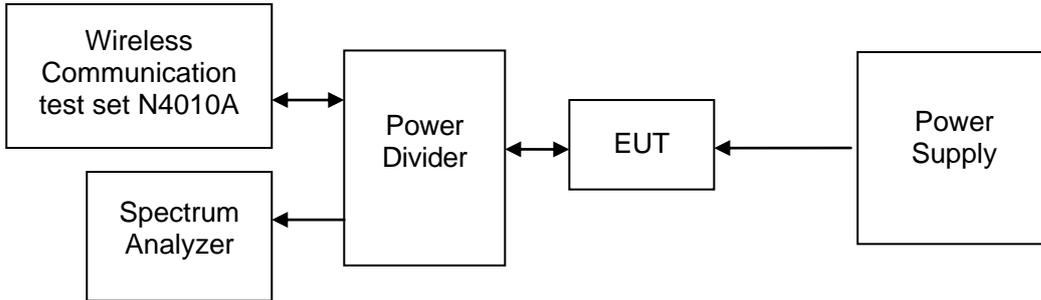


Figure 5. Test Set-up

### 7.5.4 Measurement Results

Table 34 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Channel	Channel No.	Center Freq.[MHz]	Meas. Level (Cond.) [dBm]	Limit [dBm]	Result
L	0	2402	1.07	< 30	Pass
M	40	2442	2.60	< 30	Pass
H	78	2480	2.61	< 30	Pass

Table 35 Measurement Results TM2 (Modulation: 8DPSK)

Channel	Channel No.	Center Freq.[MHz]	Meas. Level (Cond.) [dBm]	Limit [dBm]	Result
L	0	2402	1.09	< 30	Pass
M	40	2442	2.55	< 30	Pass
H	78	2480	2.60	< 30	Pass

### 7.5.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix E.

## 7.6 Band edge spurious emission

### 7.6.1 Test Conditions

Table 36 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25°C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at channel No. 0, 78 and frequency hopping state

### 7.6.2 Test Specifications and Limits

#### 7.6.2.1 Specification

CFR 47 (FCC) part 15.247 (d) and DA 00-705

#### 7.6.2.2 Supporting Standards

Table 37 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.6.2.3 Limits

Comply with part 15.247 (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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

Table 38 Limits

Band edge spurious:	20 dBc/100kHz
---------------------	---------------

### 7.6.3 Test Method and Setup

- (a) Connect EUT test port to spectrum analyzer and universal communication tester
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function.
- (c) Then set the EUT to transmit at high, low frequency and measure the conducted band edge spurious separately.
- (d) Switch on the frequency hopping function, and repeat above measurement.

## Test setup

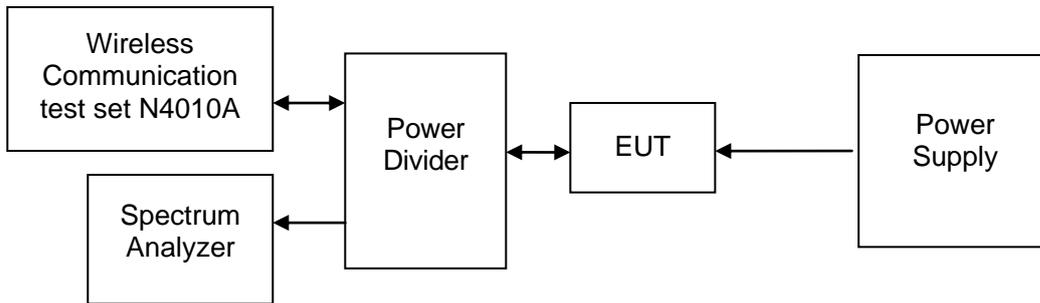


Figure 6. Test Set-up

### 7.6.4 Measurement Results

Table 39 Measurement Results for Band Edge immediately outside the 2.4GHz Band

Table 40TM1 (Modulation:  $\pi/4$ -DQPSK)

	Channel No.	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max. Spurious Level [dBm]	Limit [dBm]	Result
Low Edge	0	2402	-1.16	Off	-53.10	-21.16	Pass
	-	-	-1.26	On	-54.66	-21.26	Pass
High Edge	78	2480	0.32	Off	-54.35	-19.68	Pass
	-	-	0.28	On	-54.52	-19.72	Pass

Table 41 Measurement Results for Band Edge immediately outside the 2.4GHz Band

Table 42TM2 (Modulation: 8DPSK)

	Channel No.	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max. Spurious Level [dBm]	Limit [dBm]	Result
Low Edge	0	2402	-1.21	Off	-55.34	-21.21	Pass
	-	-	-2.70	On	-55.24	-22.70	Pass
High Edge	78	2480	0.32	Off	-54.82	-19.68	Pass
	-	-	0.14	On	-54.49	-19.86	Pass

### 7.6.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix F.

## 7.7 Conducted RF Spurious

### 7.7.1 Test Conditions

Table 43 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55%
Test Configurations:	TM1/TM2 at channel No.0, 40, 78

### 7.7.2 Test Specifications and Limits

#### 7.7.2.1 Specification

CFR 47 (FCC) part 15.247 (d) and DA 00-705

#### 7.7.2.2 Supporting Standards

Table 44 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.7.2.3 Limits

Comply with part 15.247 (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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

Table 45 Limits

Band edge spurious:	20 dBc/100kHz
---------------------	---------------

### 7.7.3 Test Method and Setup

- Connect EUT test port to spectrum analyzer and universal communication tester
- Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function.
- Then set the EUT to transmit at high, middle and low frequency and measure the conducted band edge spurious separately.
- Switch on the frequency hopping function, and repeat the above measurement.

## Test setup

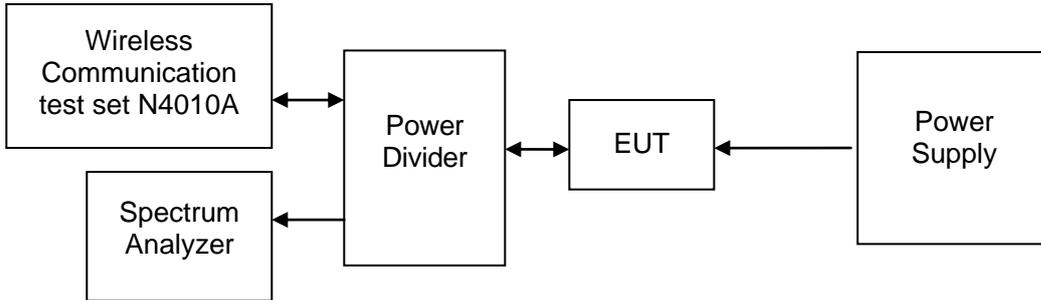


Figure 7. Test Set-up

### 7.7.4 Measurement Results

Table 46 Measurement Results TM1 (Modulation:  $\pi/4$ -DQPSK)

Test Frequency Range	Channel No.	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max. Spurious Level [dBm]	Limit [dBm]	Result
9kHz-25GHz	0	2402	-3.24	Off	-44.40	-23.24	Pass
9kHz-25GHz	40	2442	-1.77	Off	-45.60	-21.77	Pass
9kHz-25GHz	78	2480	-0.71	Off	-46.57	-20.71	Pass

Table 47 Measurement Results TM2 (Modulation: 8DPSK)

Test Frequency Range	Channel No.	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max. Spurious Level [dBm]	Limit [dBm]	Result
9kHz-25GHz	0	2402	-1.23	Off	-44.52	-21.23	Pass
9kHz-25GHz	40	2442	-2.31	Off	-45.30	-22.31	Pass
9kHz-25GHz	78	2480	-2.47	Off	-45.84	-22.47	Pass

### 7.7.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix G.

## 7.8 Radiated spurious emission & spurious in restricted band

### 7.8.1 Test Conditions

Table 48 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Enclosure
Ambient temperature:	25 °C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at channel No.0, 40, 78

### 7.8.2 Test Specifications and Limits

#### 7.8.2.1 Specification

CFR 47 (FCC) part 15.247 (d), 15.205 & 15.209 and DA 00-705

#### 7.8.2.2 Supporting Standards

Table 49 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.8.2.3 Limits

According to part 15.247 (d) / 15.205 & 15.209, all spurious emission in the frequency range from 30MHz to 10<sup>th</sup> harmonics of carrier frequency should be meet the requirement of following table.

Table 50 Limits

Frequency (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)	Detector
30 - 88	100	40	3	QP
88 - 216	150	43.5	3	QP
216 - 960	200	46	3	QP
960 -1000	500	54	3	QP
Above 1000	500	54	3	AV
Above 1000	500	74	3	PK

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a) (see above table).

### 7.8.3 Test Method and Setup

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2009. The Radiated Disturbance measurements were made using a Rohde and Schwarz Test Receiver and control software.

A preliminary scan and a final scan of the emissions were made by using test script of software; the emissions were measured using a Quasi-Peak Detector below 1GHz, Peak Detector and AV detector above 1GHz. The maximal emission value was acquired by adjusting the antenna height, polarisation and turntable azimuth in accordance with the software setup. Normally, the height range of antenna was 1m to 4m, and the azimuth range of turntable was 0°to 360°. The receive antenna has two polarizations V and H.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other nonmetallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z) axis positions such that emissions from the EUT are maximized.

The EUT communicates with the BTS simulator through Air interface. The EUT transmits maximum output power at 2.4GHz and switch off frequency hopping function.

Measurement bandwidth: 30 MHz - 1000 MHz: 120 kHz  
Measurement bandwidth: 1000 MHz - 10<sup>th</sup> Carrier Frequency: 1 MHz

### Test set up

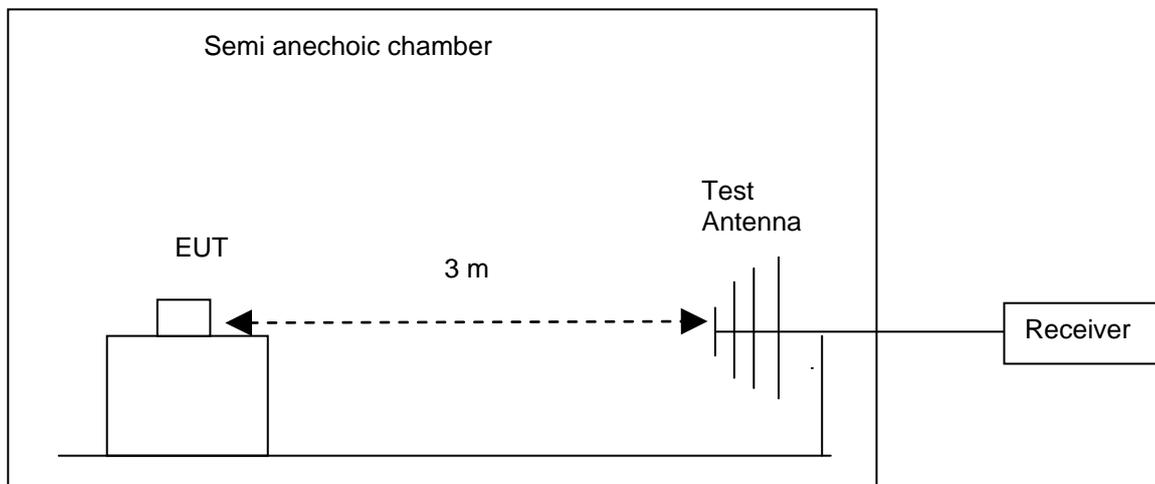


Figure 8. Test Set up

### 7.8.4 Measurement Results

Note 1: The following measurement results exceed the limit line is the carrier frequency.

Note 2: This test was carried out in all test modes, here only the worst test result was shown.

Test Frequency Range	Channel No.	Carrier Frequency [MHz]	Measured	Result
30MHz-26.5GHz	0	2402	Refer to Appendix H	Pass
30MHz-26.5GHz	40	2442	Refer to Appendix H	Pass
30MHz-26.5GHz	78	2480	Refer to Appendix H	Pass

### 7.8.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix H.



## 7.9 Conducted Emission at Power Port

### 7.9.1 Test Conditions

Table 51 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Power port
Ambient temperature:	25°C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at channel No. 40

### 7.9.2 Test Specifications and Limits

#### 7.9.2.1 Specification

CFR 47 (FCC) part 15.207 and DA 00-705

#### 7.9.2.2 Supporting Standards

Table 52 Supporting Standards:

ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices
------------------	--

#### 7.9.2.3 Limits

Comply with part15.207, conducted emission must meet the requirement of following table.

Table 53 Limits

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

Note: \* Decreases with the logarithm of the frequency.

### 7.9.3 Test Method and Setup

The Table-top EUT was placed upon a non-metallic table 0.8 m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2009.

Conducted Disturbance at AC Port measurements were undertaken on the L and N Lines. The emissions were measured using a Quasi-Peak Detector and Average Detector.

The EUT communicates with the BTS simulator through Air interface, the BTS simulator controls the EUT to transmitter the maximum power which defined in specification of product. The EUT operated on the typical channel.

Measurement bandwidth (RBW) for 150kHz to 30 MHz: 9 kHz;

### Test Set-up

The EUT was set in the screened chamber and operated under nominal conditions.

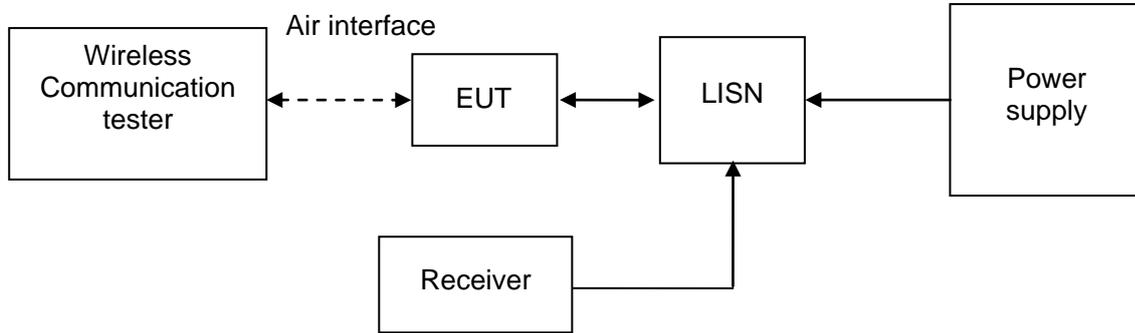


Figure 9. Test Set-up

### 7.9.4 Measurement Results

Table 54 MEASUREMENT RESULT:QP DECTER

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.150000	39.0	9.7	66.0	27.0	L1	FLO
0.552000	41.9	9.7	56.0	14.1	N	FLO
1.016000	39.7	9.7	56.0	16.3	N	FLO
2.296000	38.5	9.7	56.0	17.5	N	FLO
5.540000	38.5	9.8	60.0	21.5	N	FLO
9.588000	43.0	9.9	60.0	17.0	N	FLO

Table 55 MEASUREMENT RESULT:AV DECTER

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.150000	29.0	9.7	56.0	27.0	L1	FLO
0.512000	33.0	9.7	46.0	13.0	N	FLO
1.028000	30.4	9.7	46.0	15.6	N	FLO
2.352000	29.6	9.7	46.0	16.4	N	FLO
5.460000	28.8	9.8	50.0	21.2	N	FLO
9.500000	34.2	9.9	50.0	15.8	N	FLO

### 7.9.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix I.



## 8 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Table 56 System Measurement Uncertainty

Items		Extended Uncertainty
Bandwidth measurement	Magnitude (%)	U=0.2%; k=2
Carrier frequency separation measurement	Magnitude (%)	U=0.2%; k=2
Time of occupancy	Magnitude (%)	U=0.2%; k=2
Peak output power	Power(dBm)	U=0.39dB; k=2
Band edge compliance measurement	Disturbance Power(dBm)	U=2.0dB; k=2
Conducted RF spurious	Disturbance Power(dBm)	U=2.0dB; k=2
Radiated spurious emission & Radiated restricted band measurement	Field strength (dB $\mu$ V/m)	U=2.2dB; k=2 U=5dB; k=2
Conducted emission test for power port	Disturbance Voltage(dB $\mu$ V)	U=4dB; k=2



## 9 Appendices List

Appendix A	Measurement Results Bandwidth measurement
Appendix B	Measurement Results Carrier frequency separation measurement
Appendix C	Measurement Results Number of hopping channel
Appendix D	Measurement Results Time of occupancy
Appendix E	Measurement Results Peak output power
Appendix F	Measurement Results Band edge compliance measurement
Appendix G	Measurement Results Conducted RF spurious
Appendix H	Measurement Results Radiated spurious emission
Appendix I	Measurement Results Conducted emission test for power port
Appendix J	Photos of Test Setup

-----The END-----



# **Appendix A**

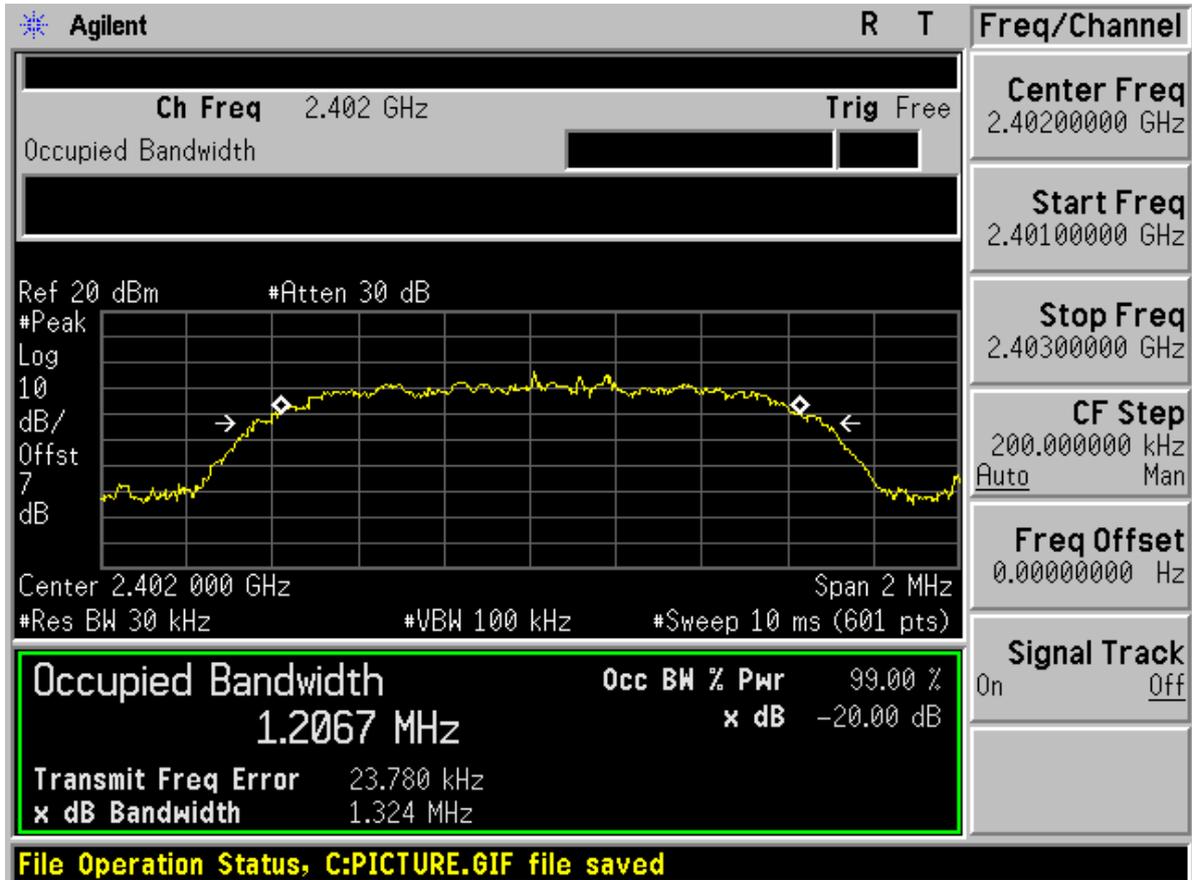
## Bandwidth measurement

According to FCC Part 15.247 (a) (1)



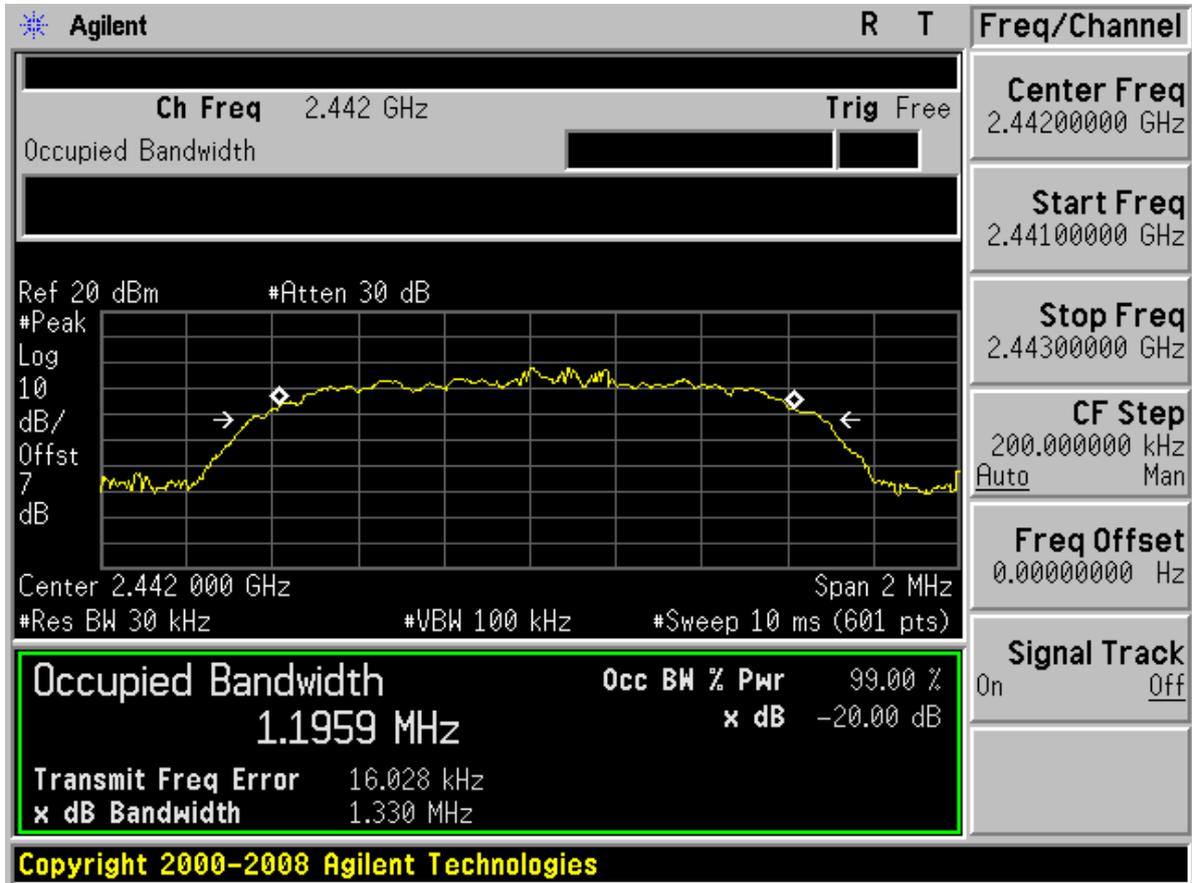
# Modulation: $\pi/4$ -DQPSK

## Channel 0 (2402MHz)



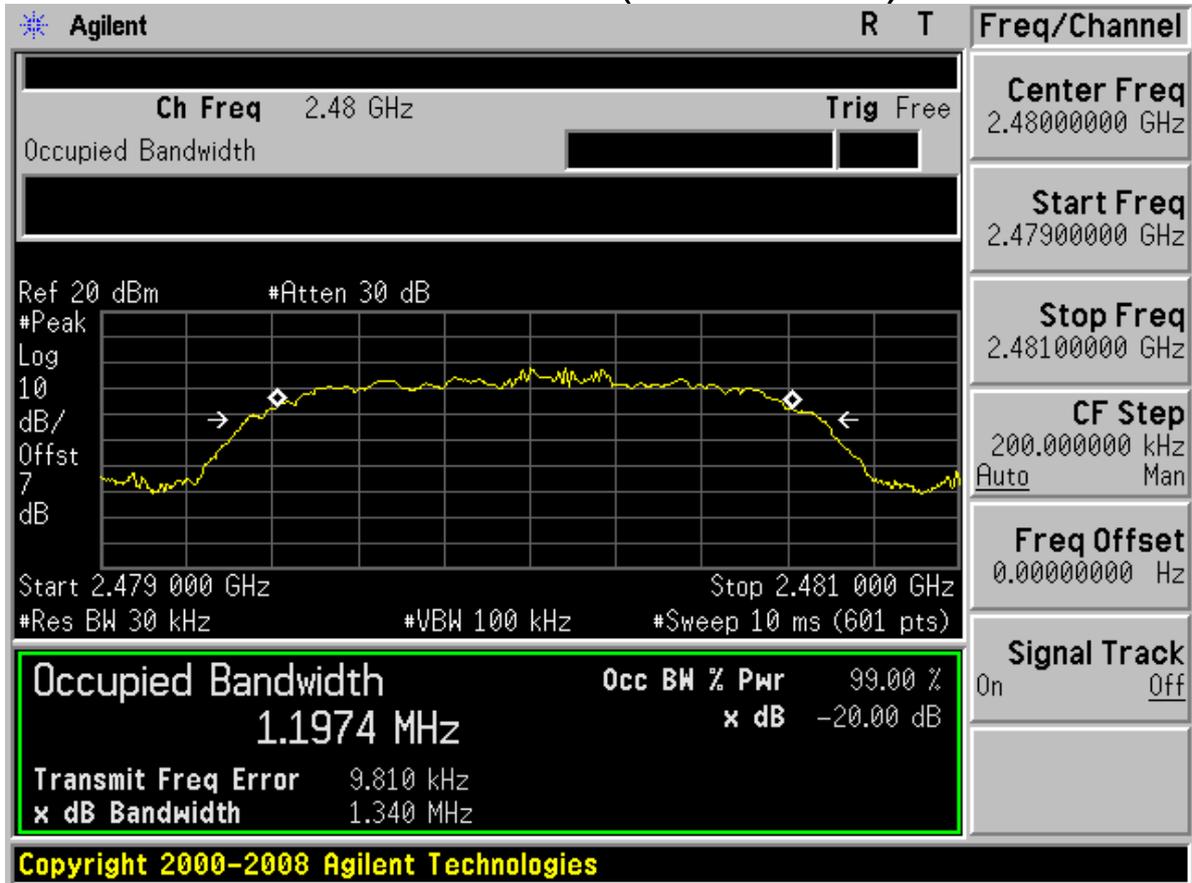


# Channel 40 (2442MHz)



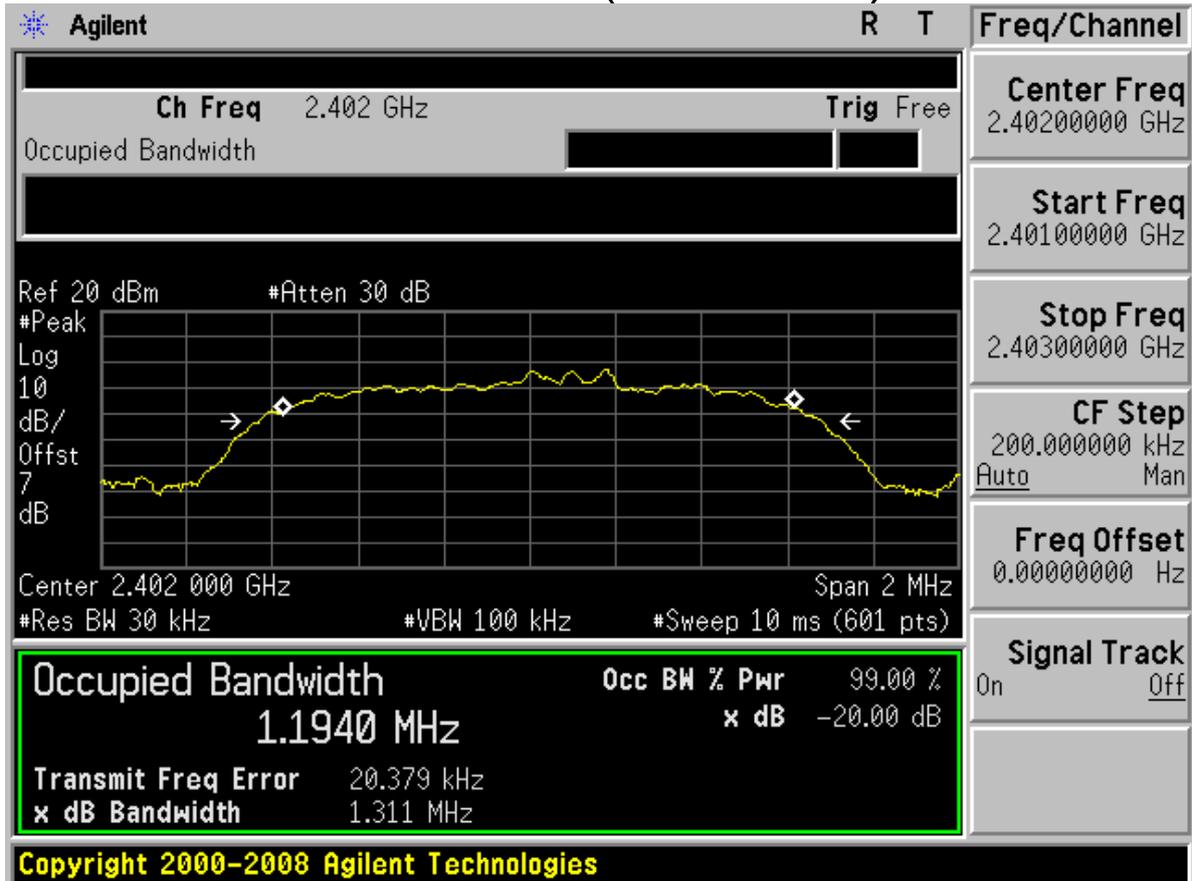


## Channel 78 (2480MHz)



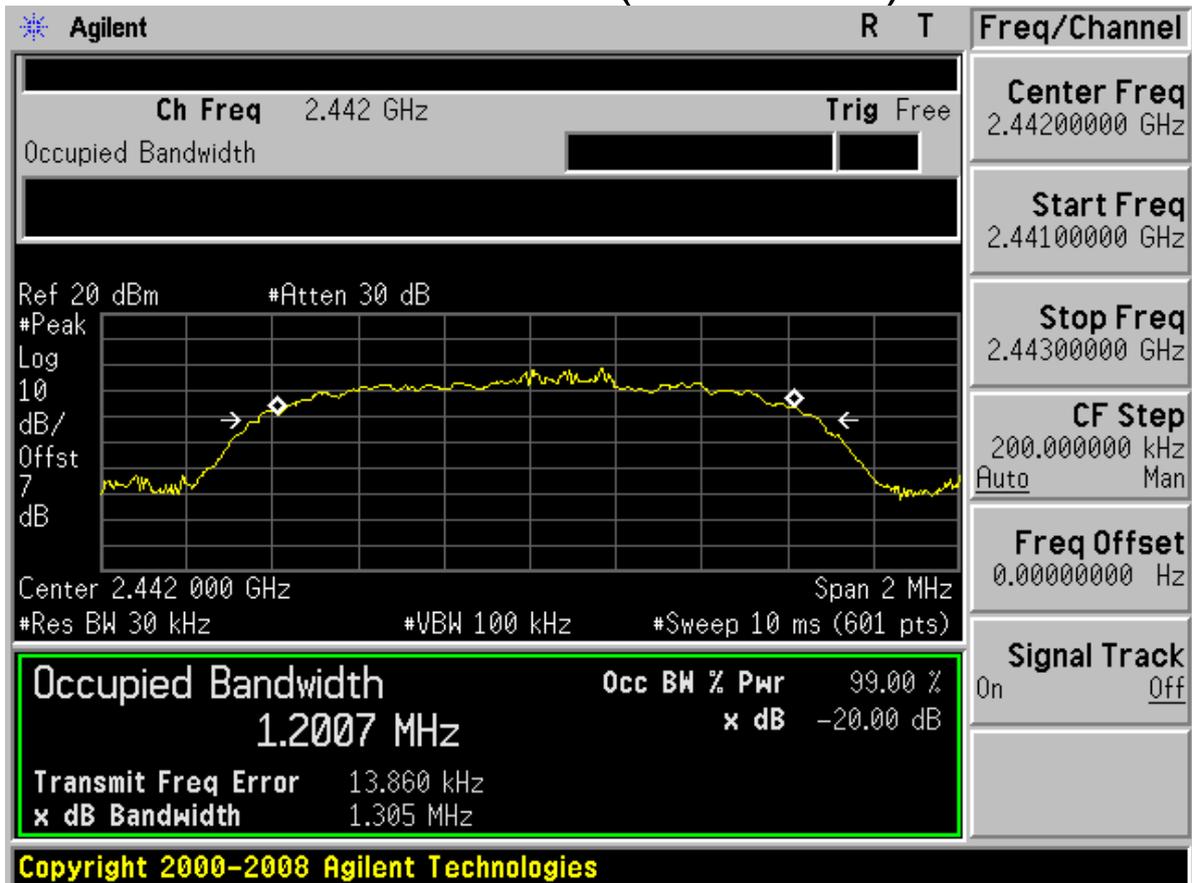


# Modulation:8DPSK Channel 0 (2402MHz)



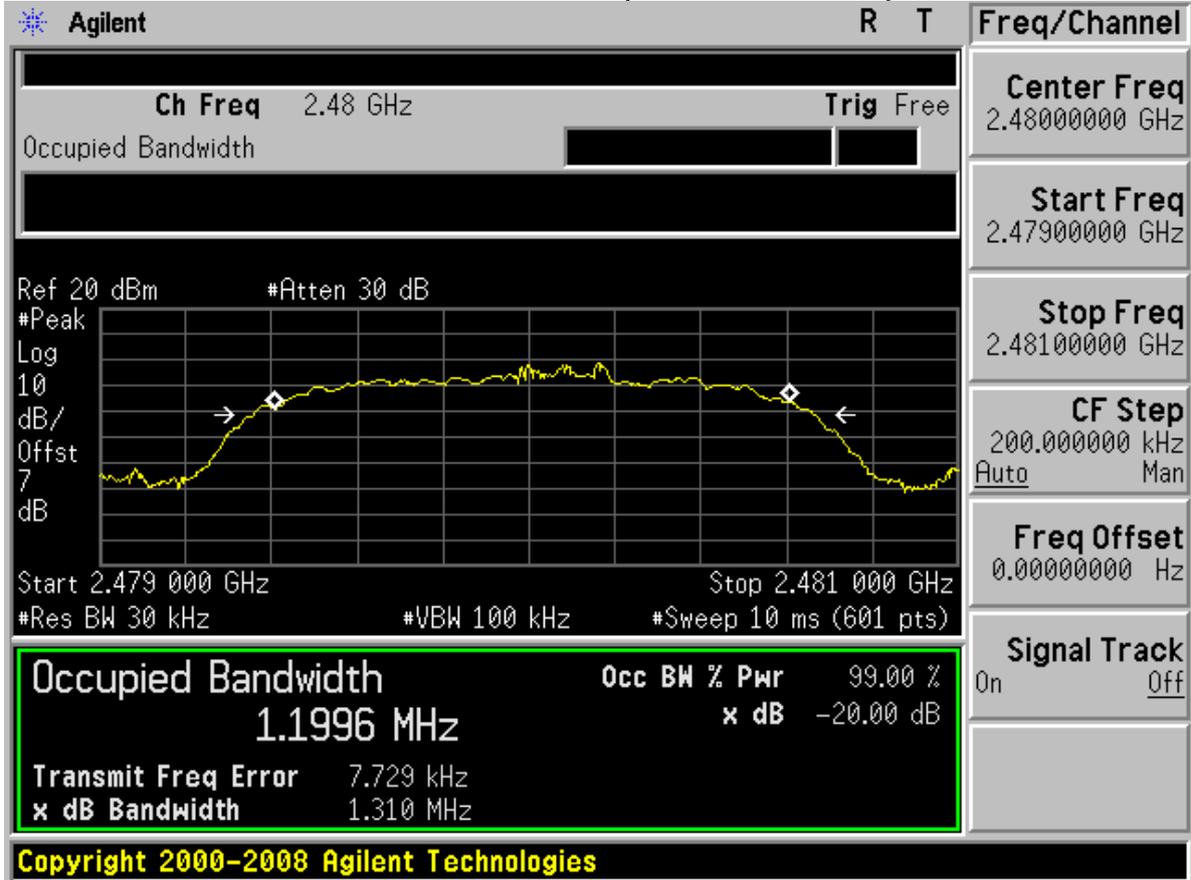


## Channel 40 (2442MHz)





## Channel 78 (2480MHz)



-----The End -----



## **Appendix B**

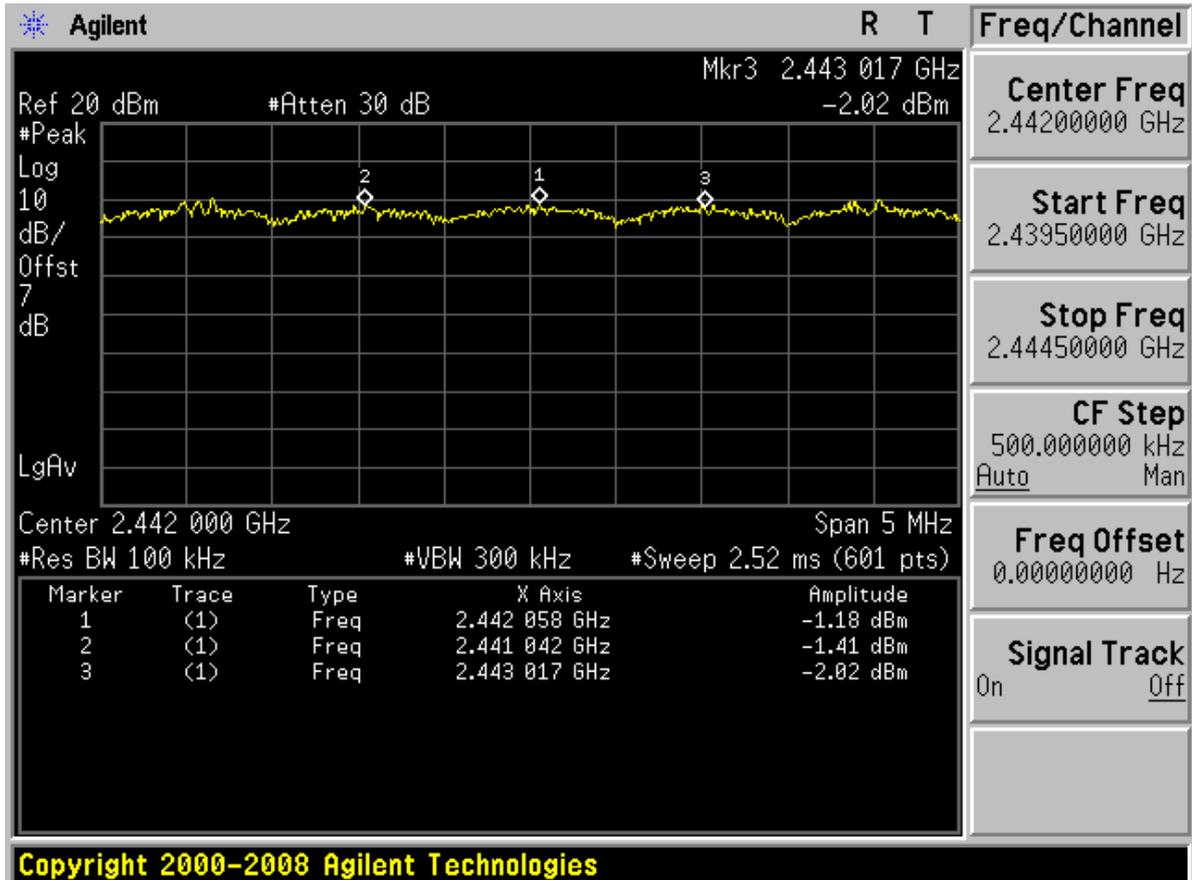
# Carrier frequency separation measurement

According to FCC Part 15.247 (a) (1)



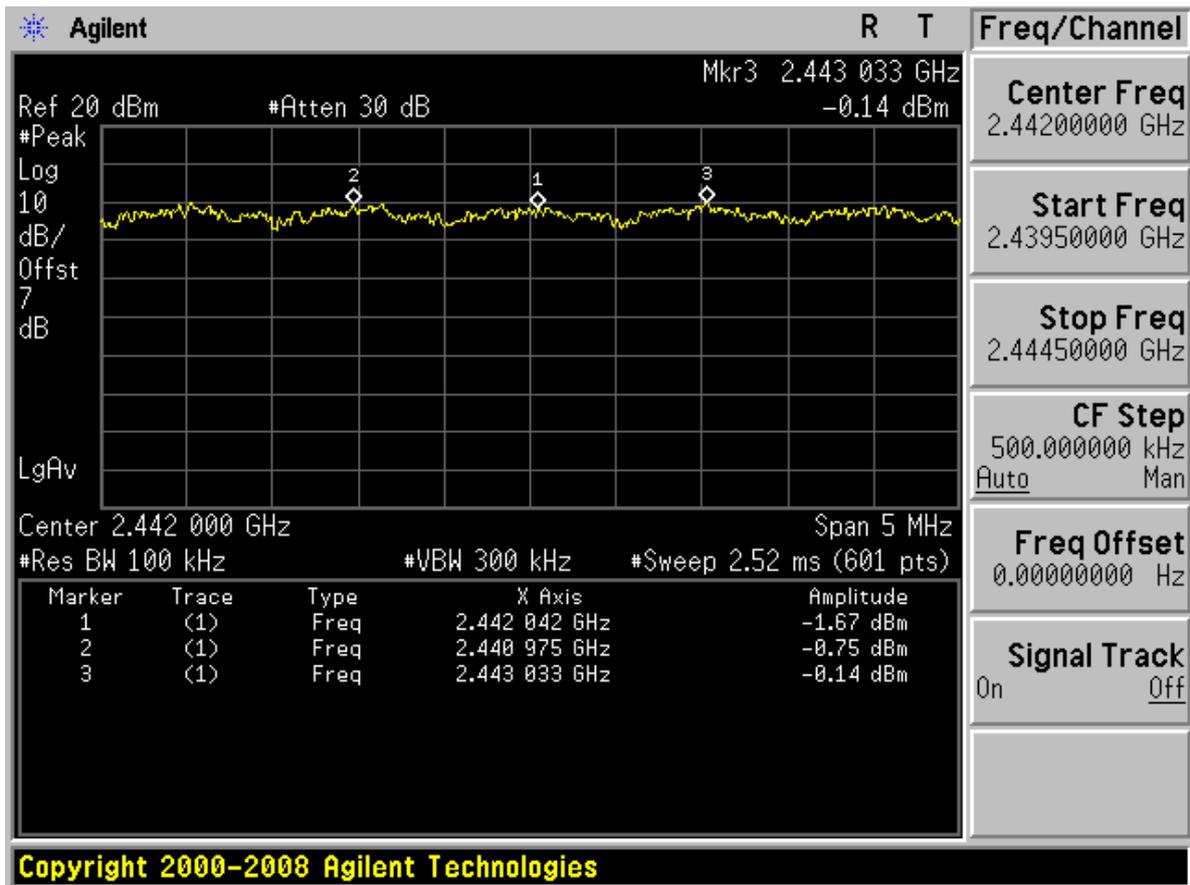
# Modulation: $\pi/4$ -DQPSK

## Centred at Channel 40





## Modulation: 8DPSK Centred at Channel 40



-----The End -----



## Appendix C

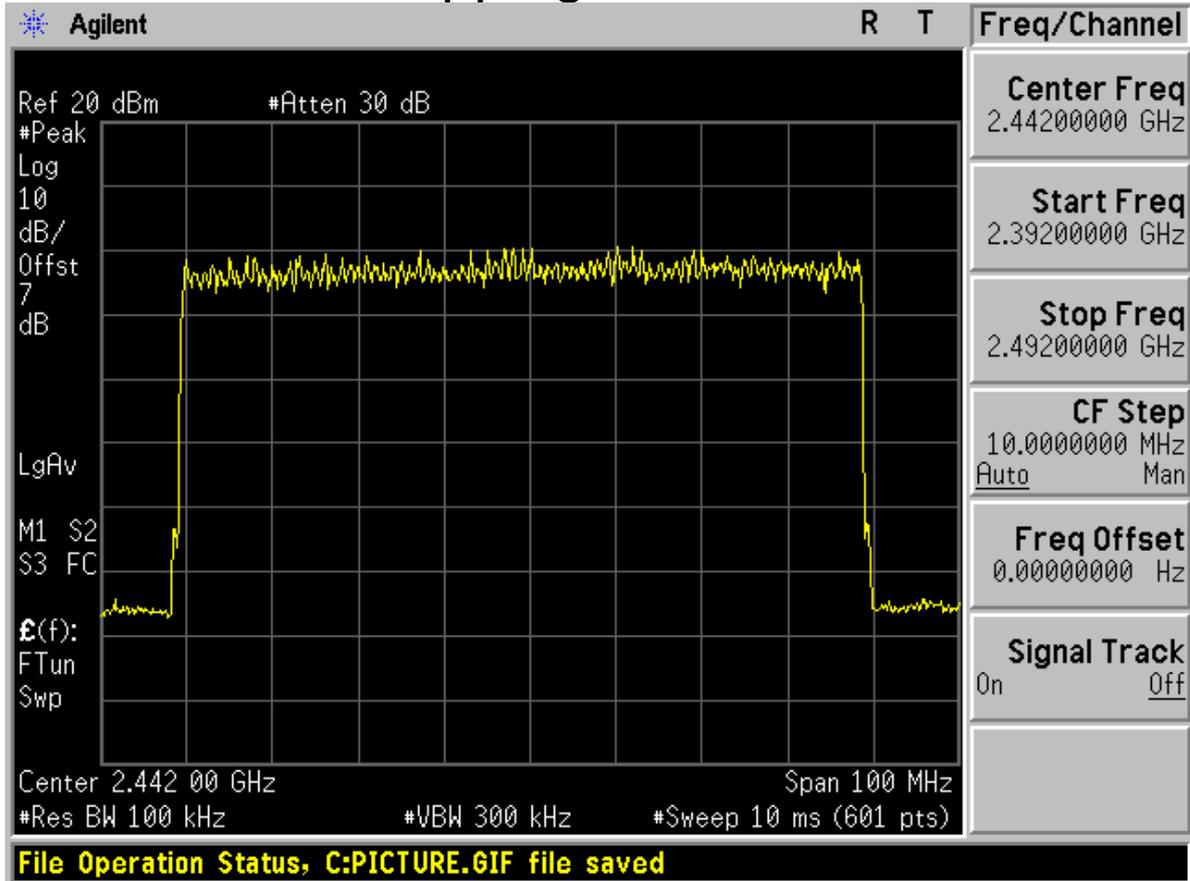
# Number of hopping channel

According to FCC Part 15.247 (a) (1) iii



# Modulation: $\pi/4$ -DQPSK

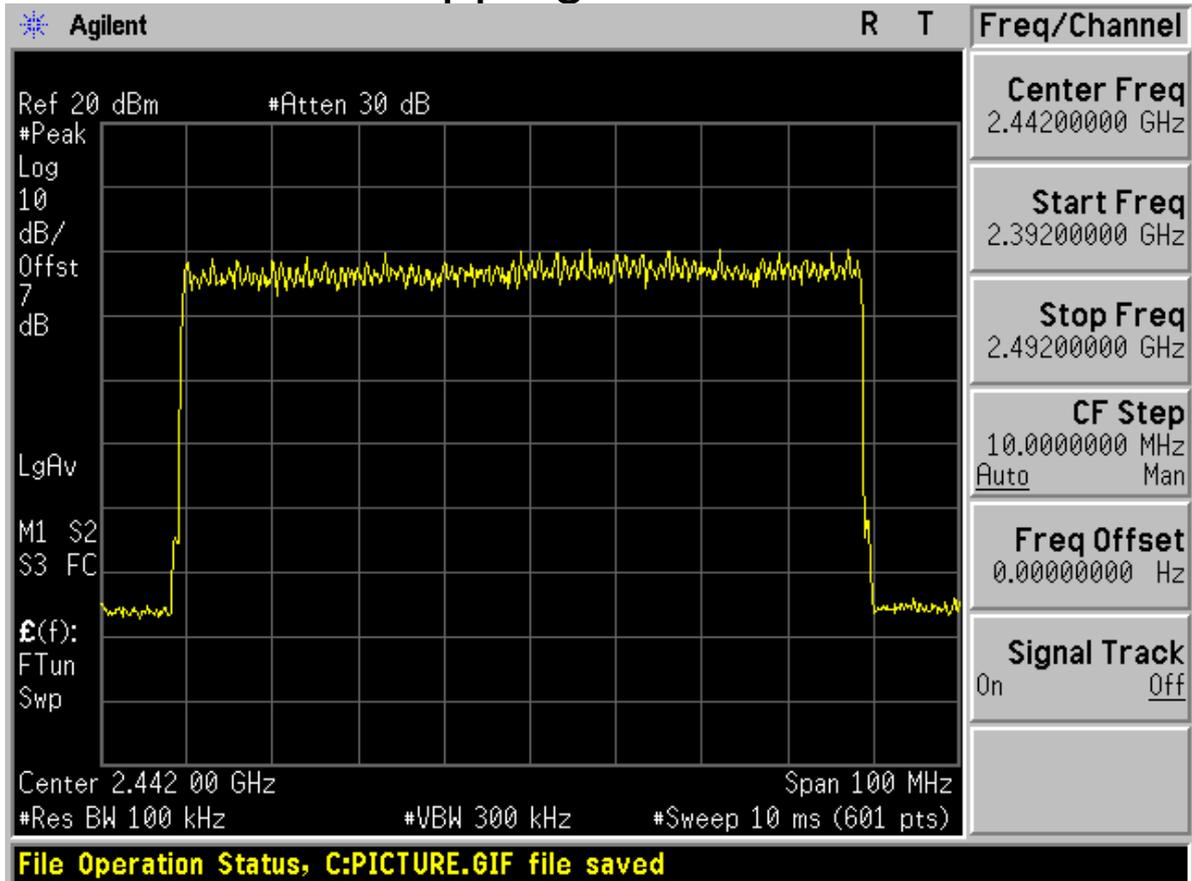
## Total hopping channels = 79





# Modulation:8DPSK

## Total hopping channels = 79



-----The End -----



# Appendix D

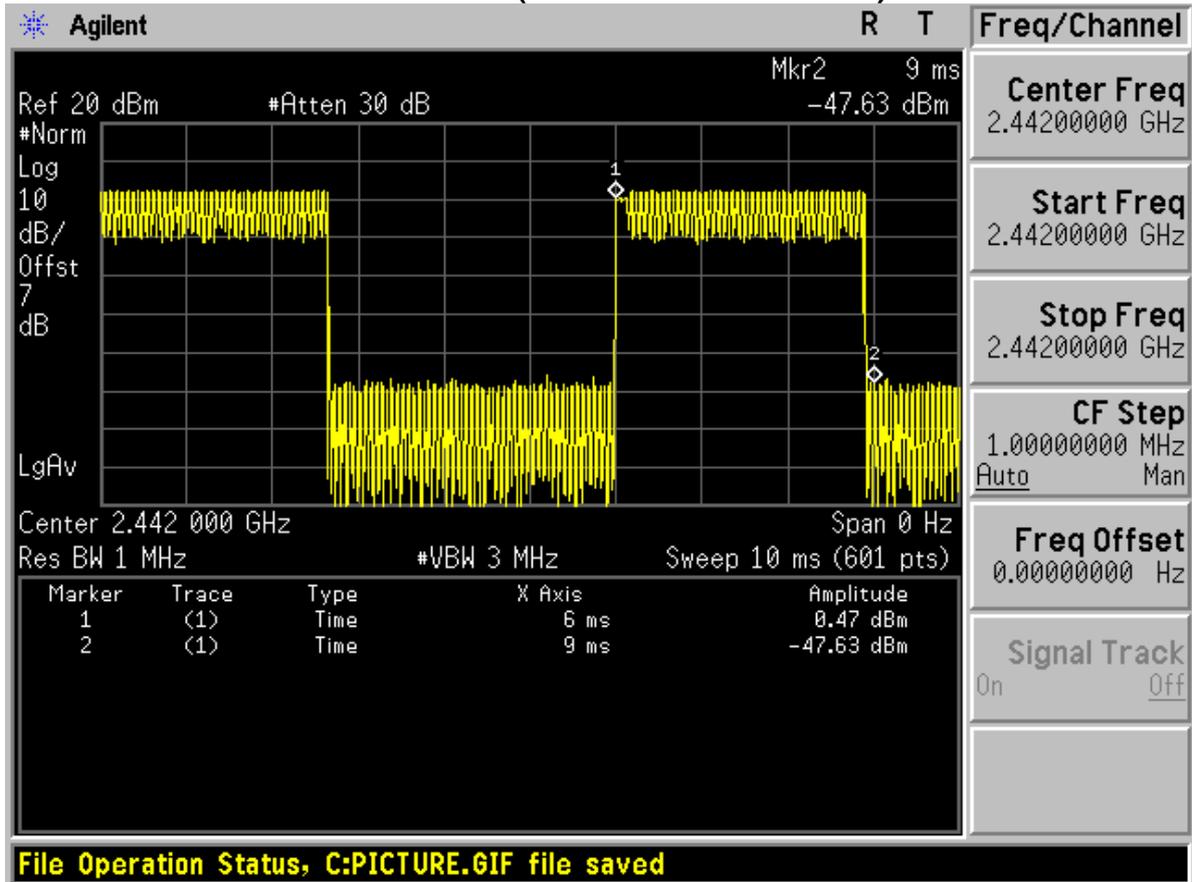
## Time of occupancy

According to FCC Part 15.247 (a) (1) iii



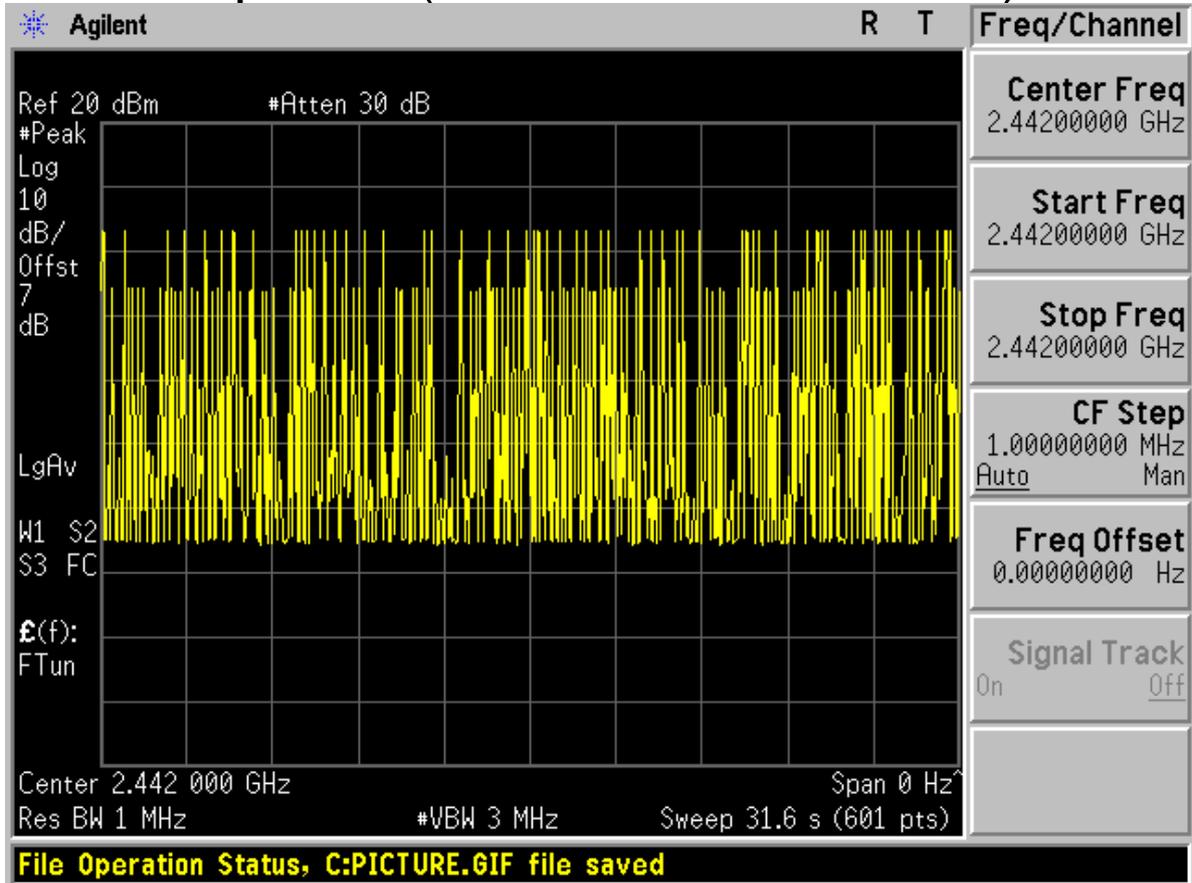
# Modulation: $\pi/4$ -DQPSK

## A burst (One time slot)





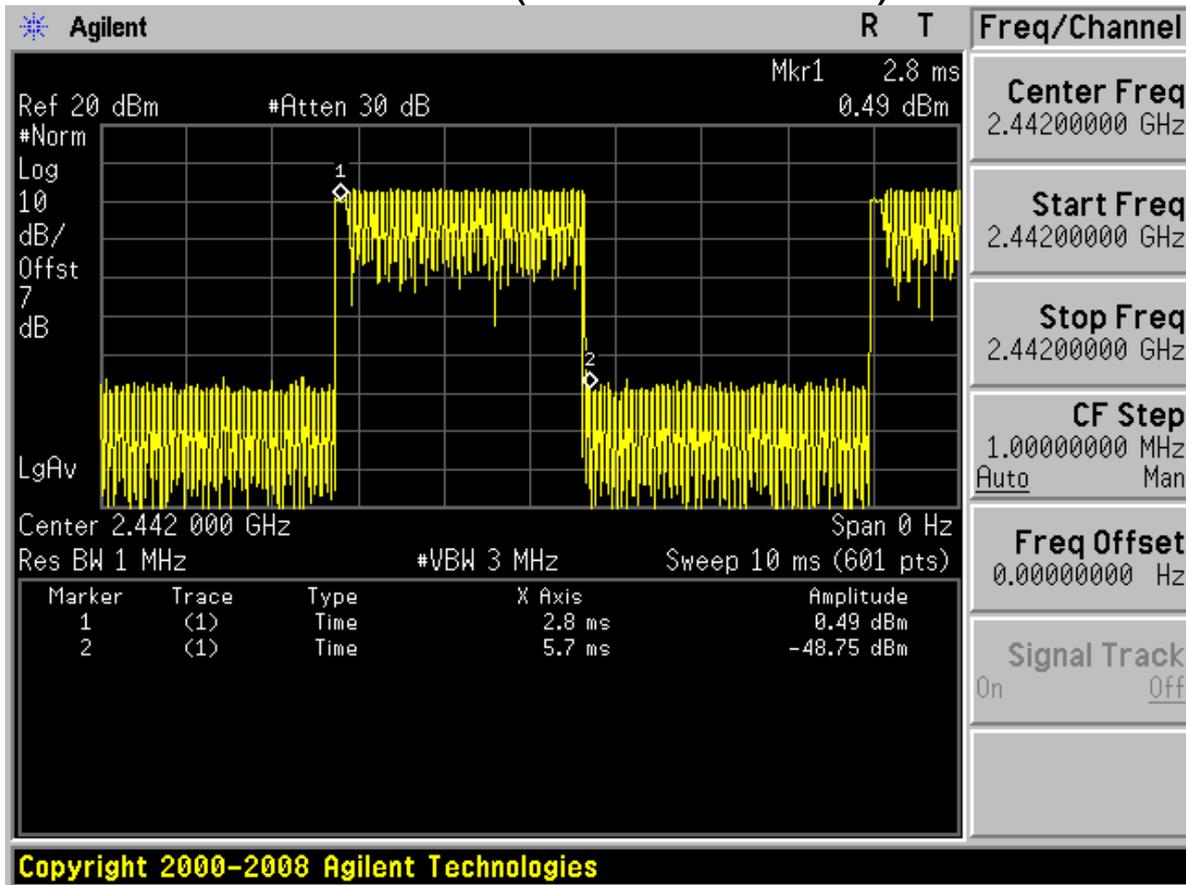
# A period (Less than 106.7 burst)





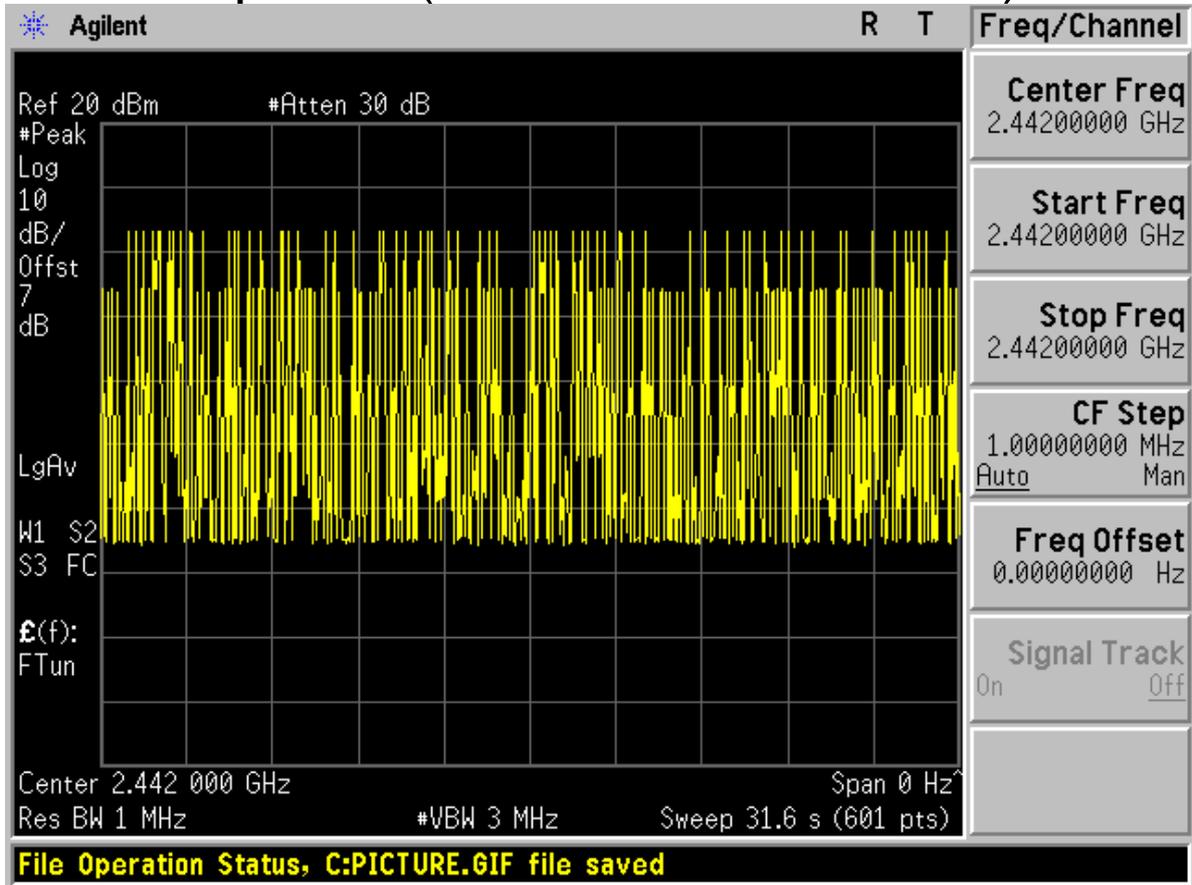
# Modulation: 8DPSK

## A burst (One time slot)





## A period (Less than 106.7 burst)



-----The End -----



# Appendix E

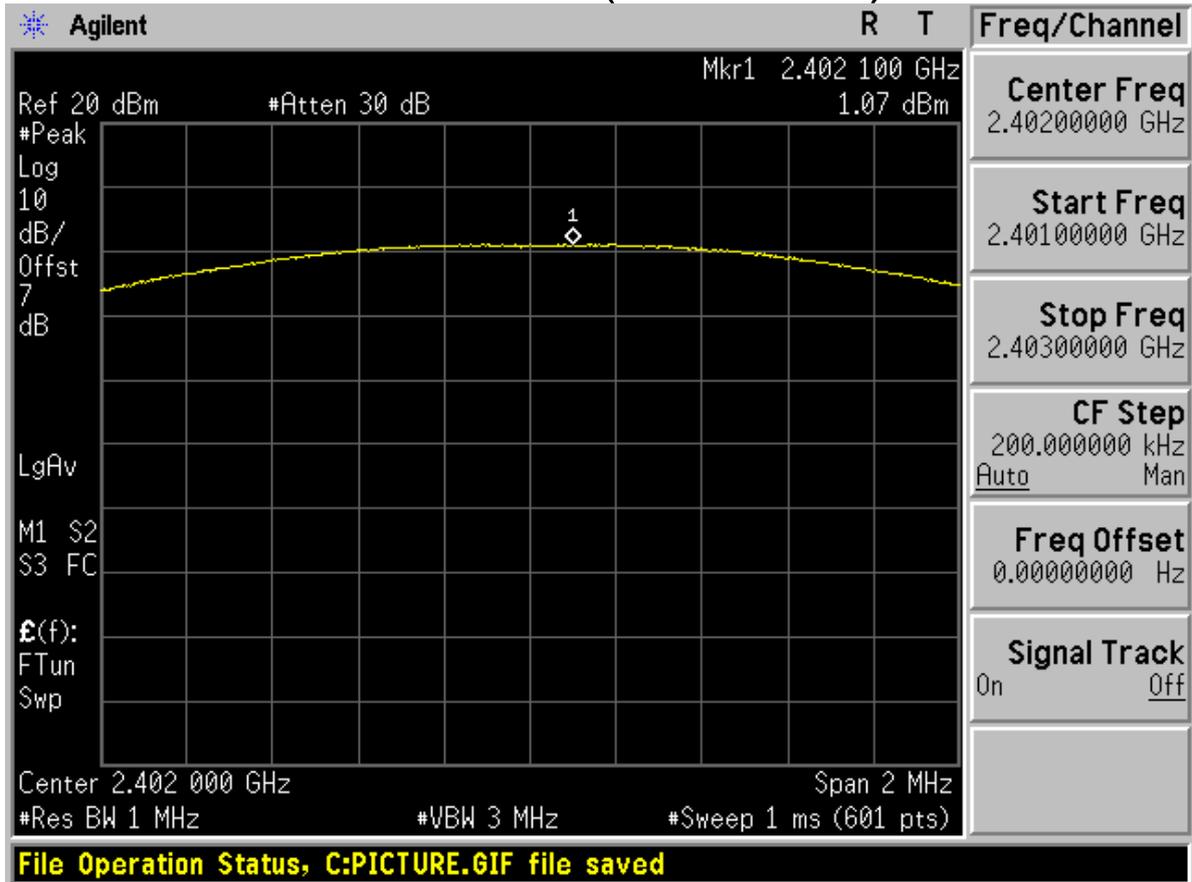
## Peak output power

According to FCC Part 15.247 (b) (1)



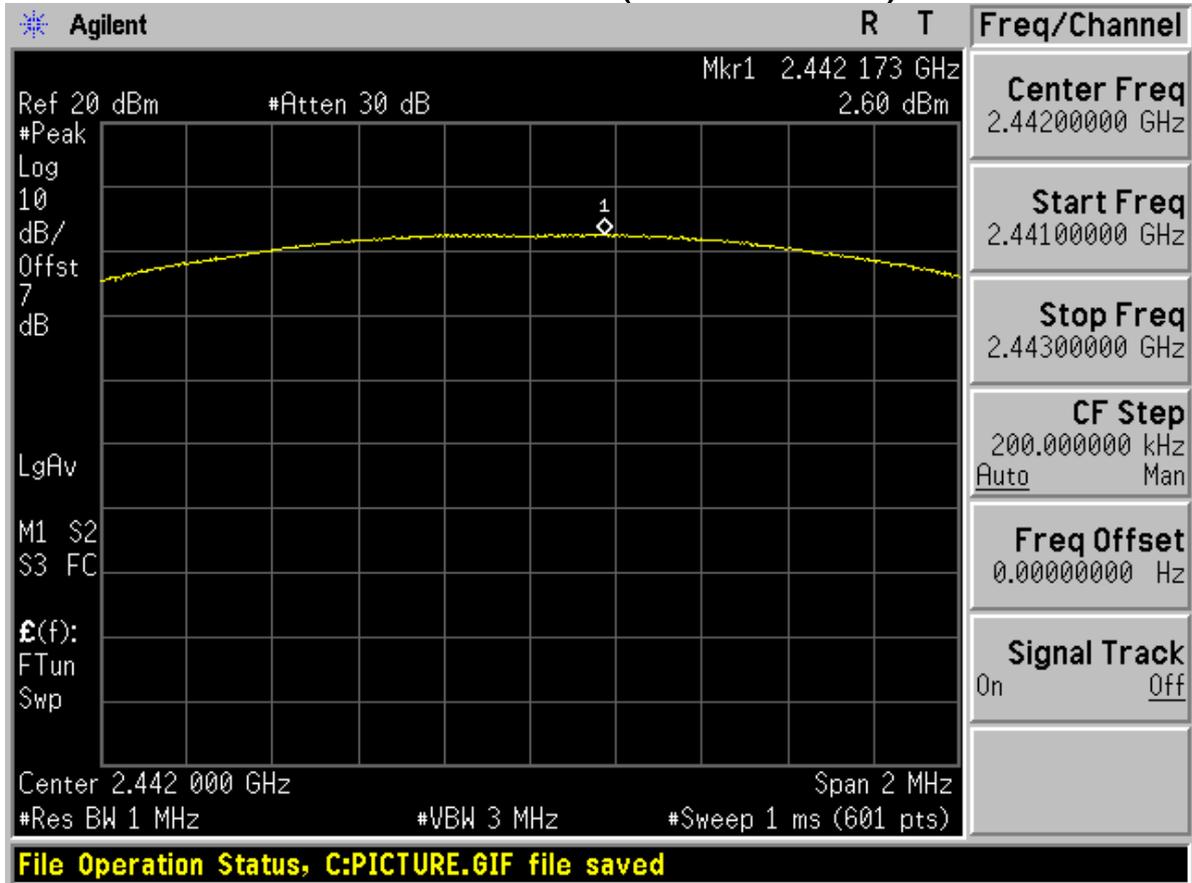
# Modulation: $\pi/4$ -DQPSK

## Channel 0 (2402MHz)



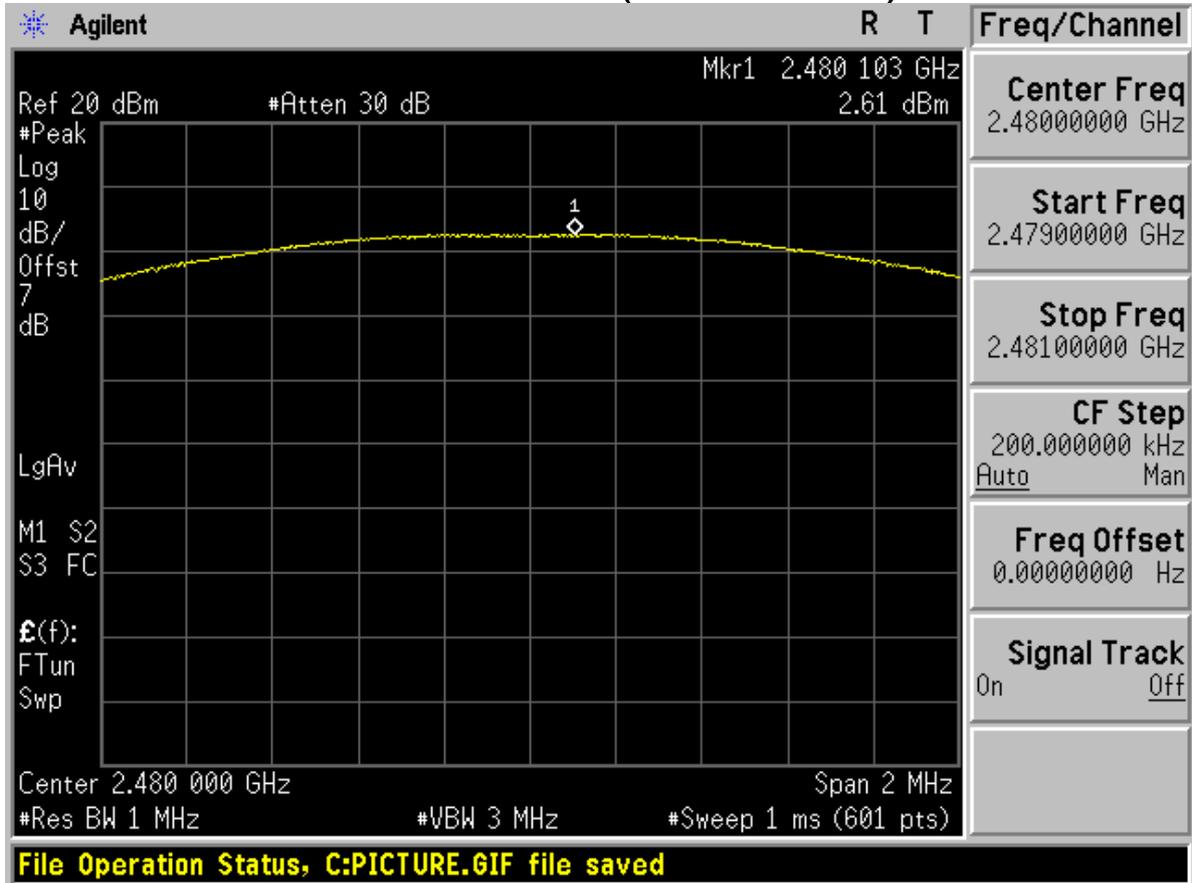


# Channel 40 (2442MHz)



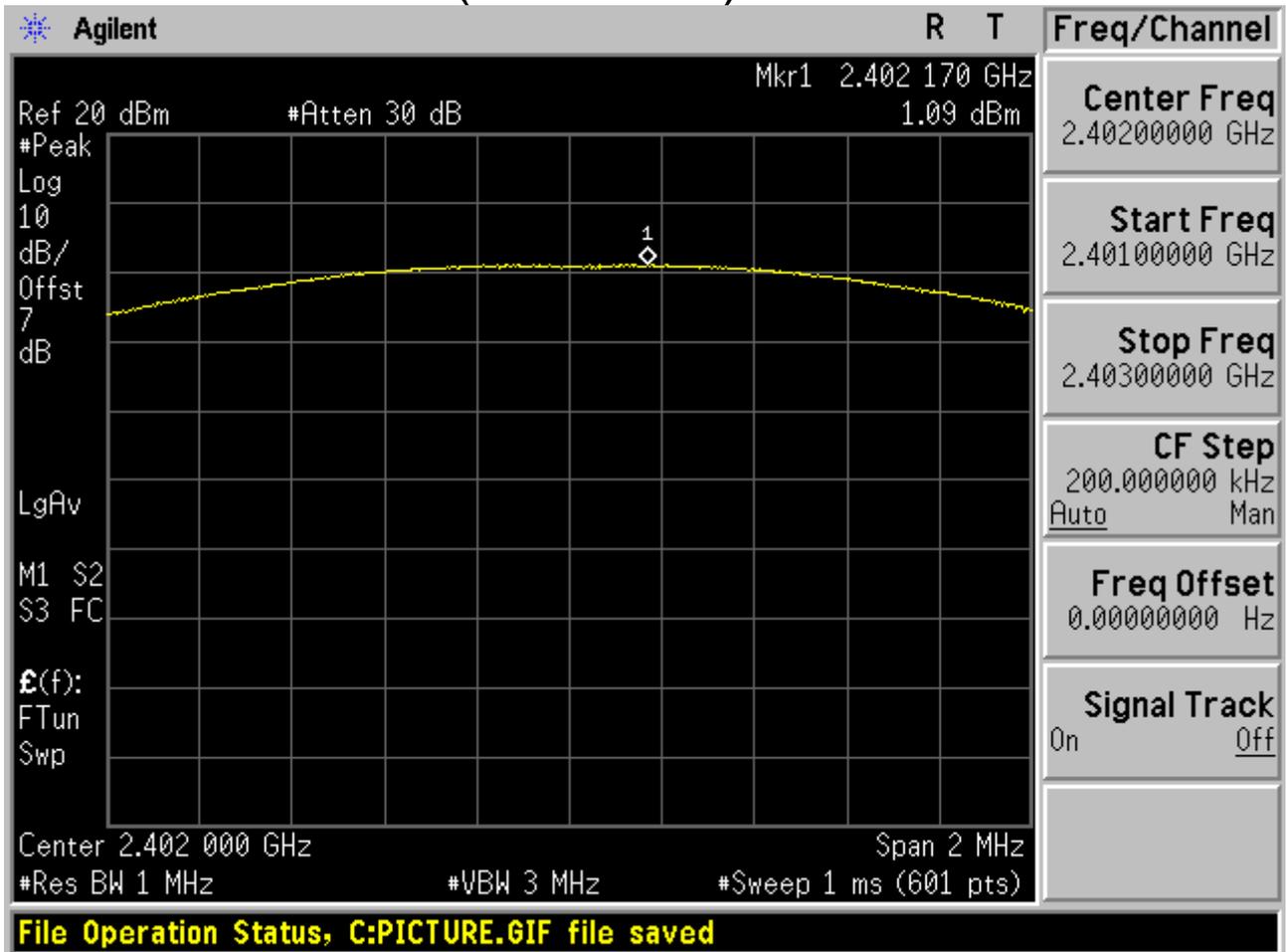


# Channel 78 (2480MHz)



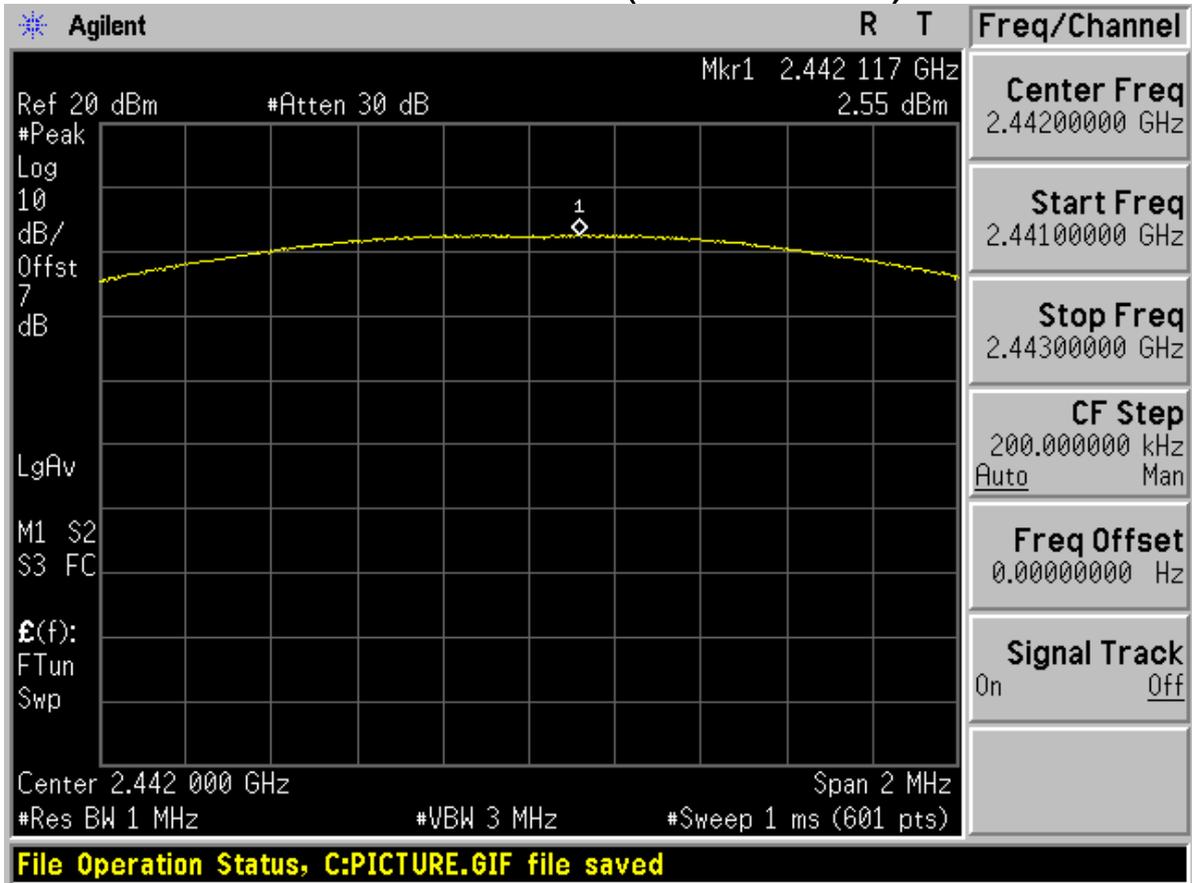


# Modulation: 8DPSK Channel 0 (2402MHz)



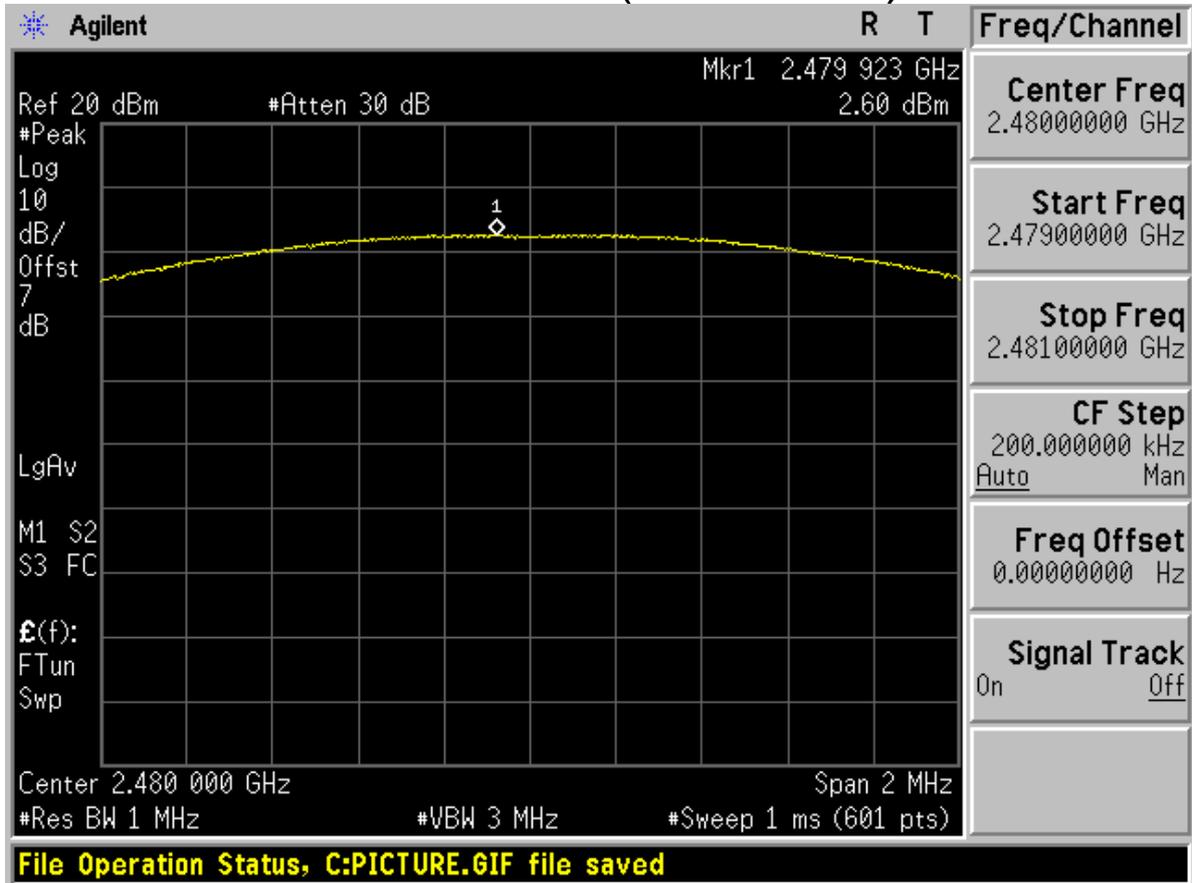


## Channel 40 (2442MHz)





# Channel 78 (2480MHz)



-----The End -----



# Appendix F

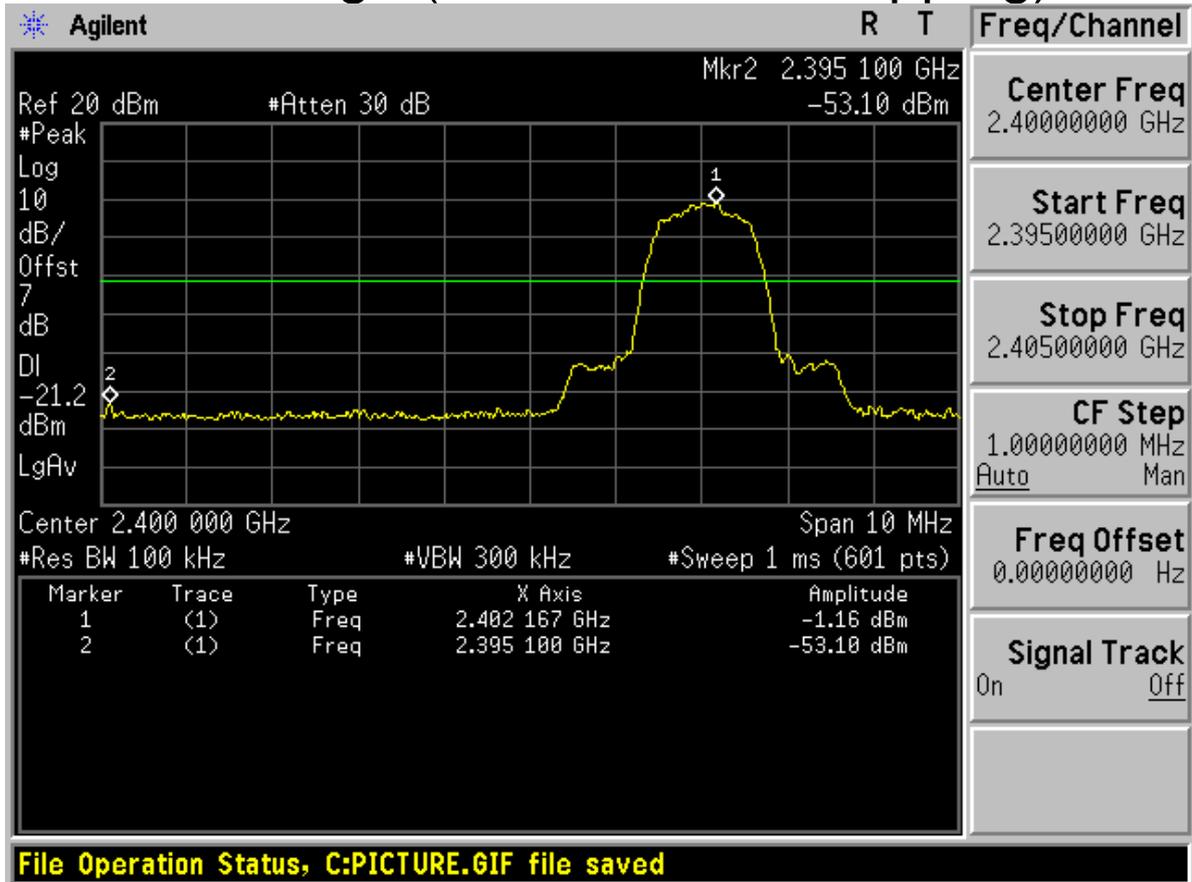
## Band edge spurious emission

According to FCC Part 15.247 (d)



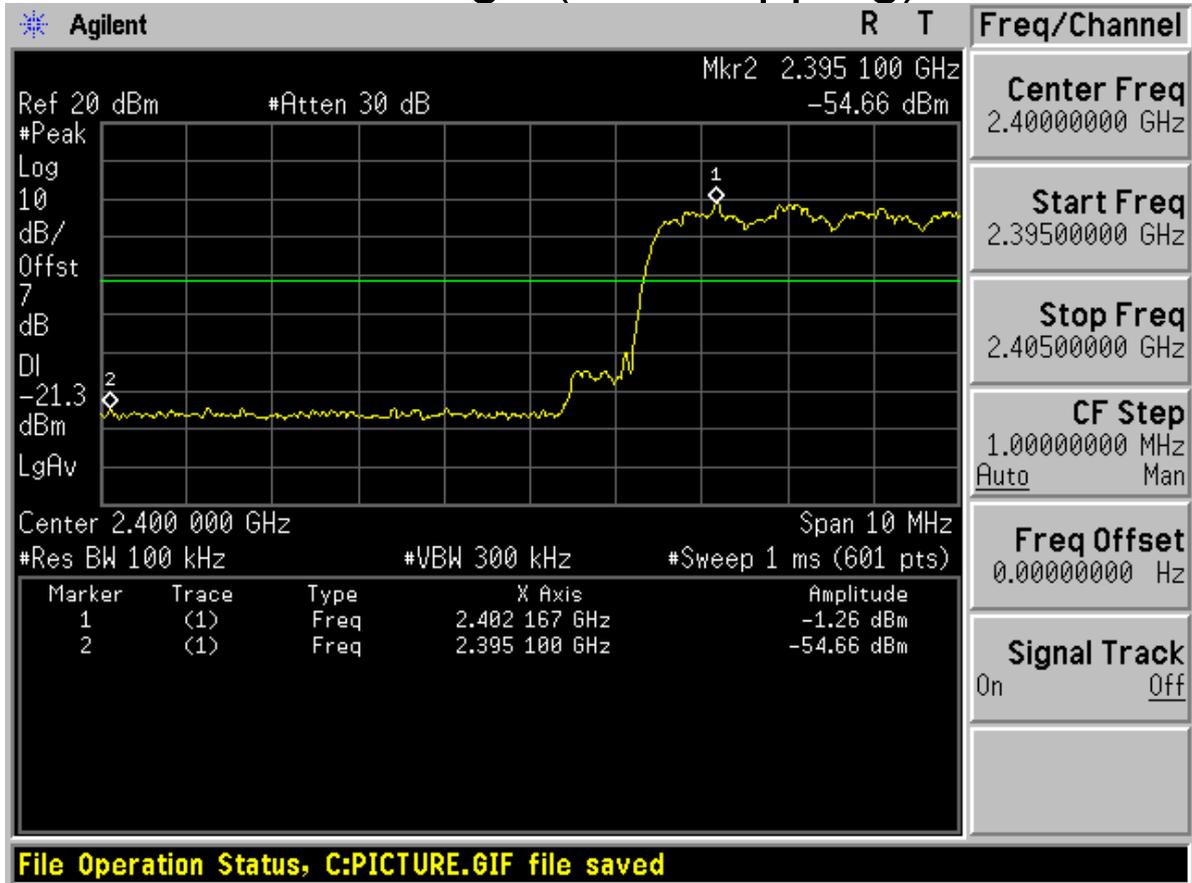
# Modulation: $\pi/4$ -DQPSK

## Low edge (Channel 0, no hopping)



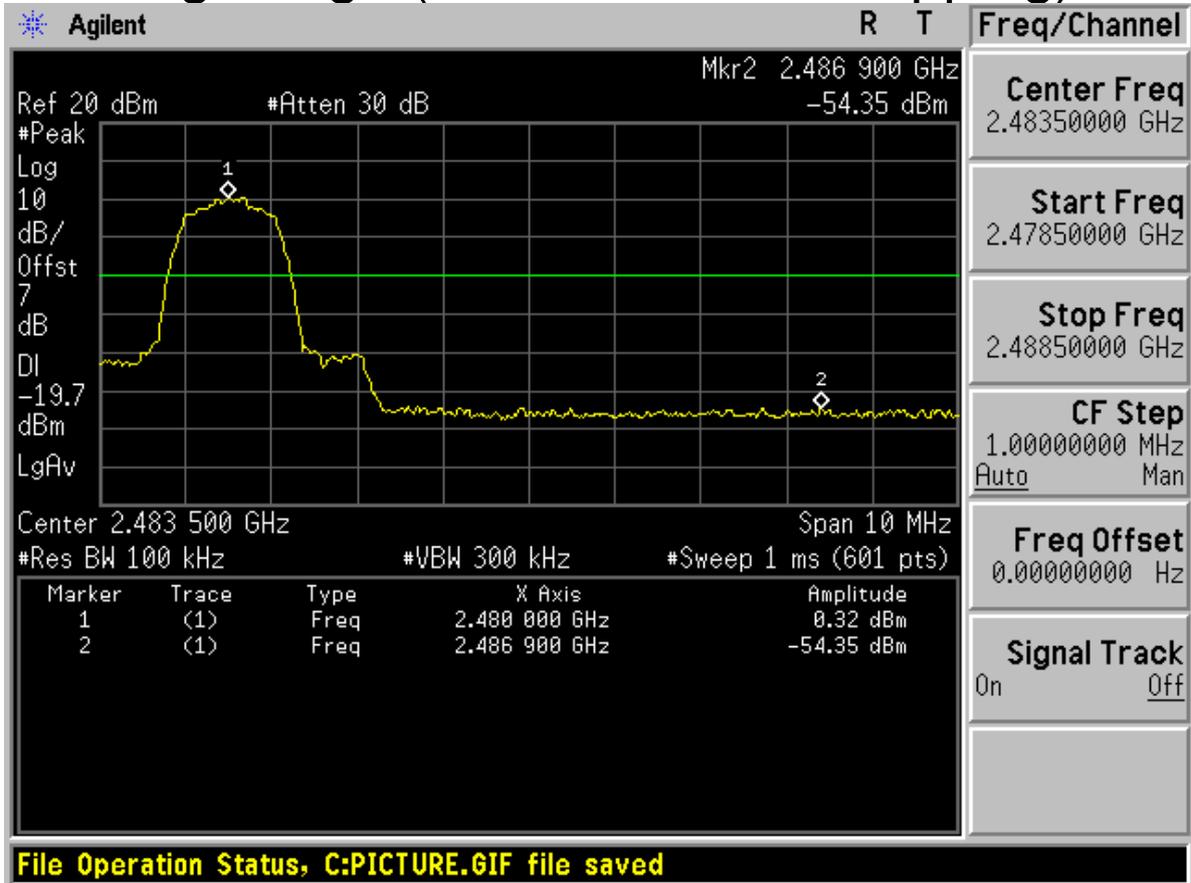


# Low edge (with hopping)



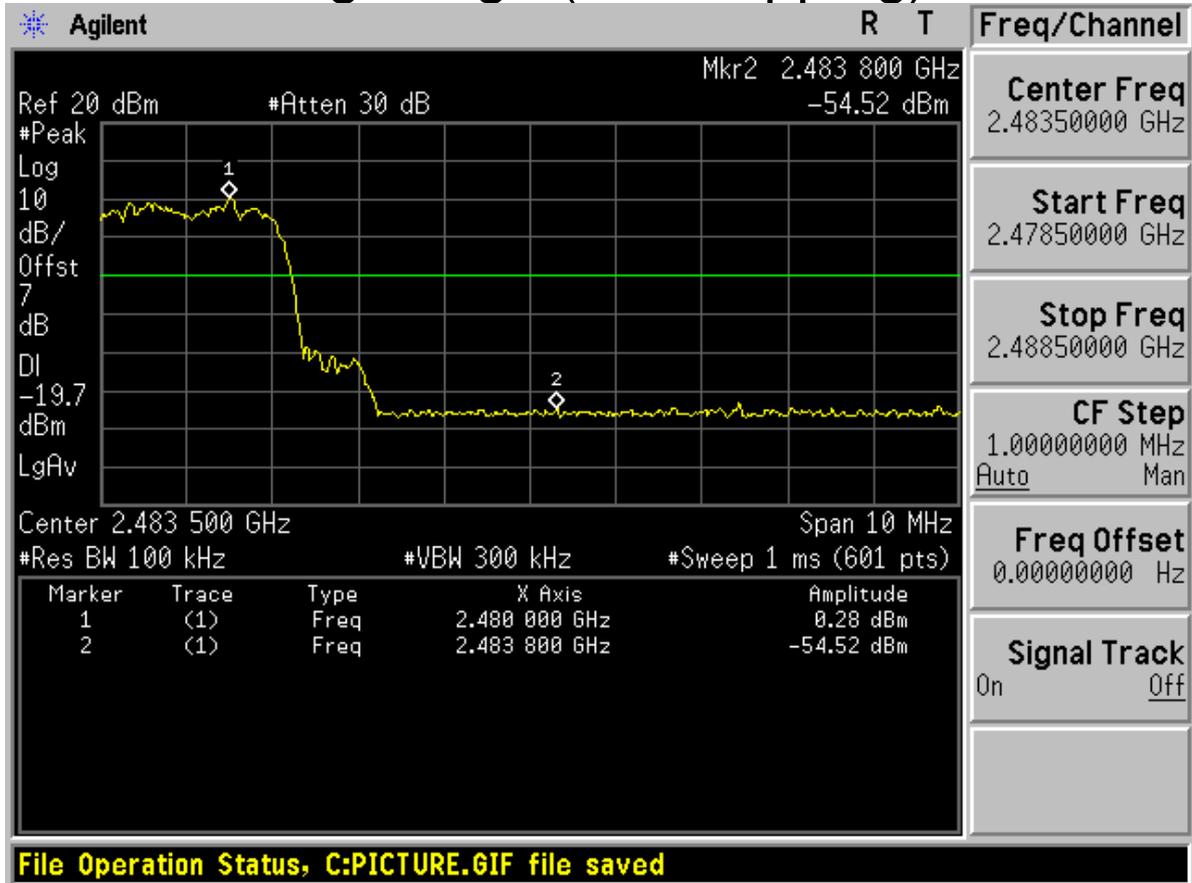


# High edge (Channel 78, no hopping)





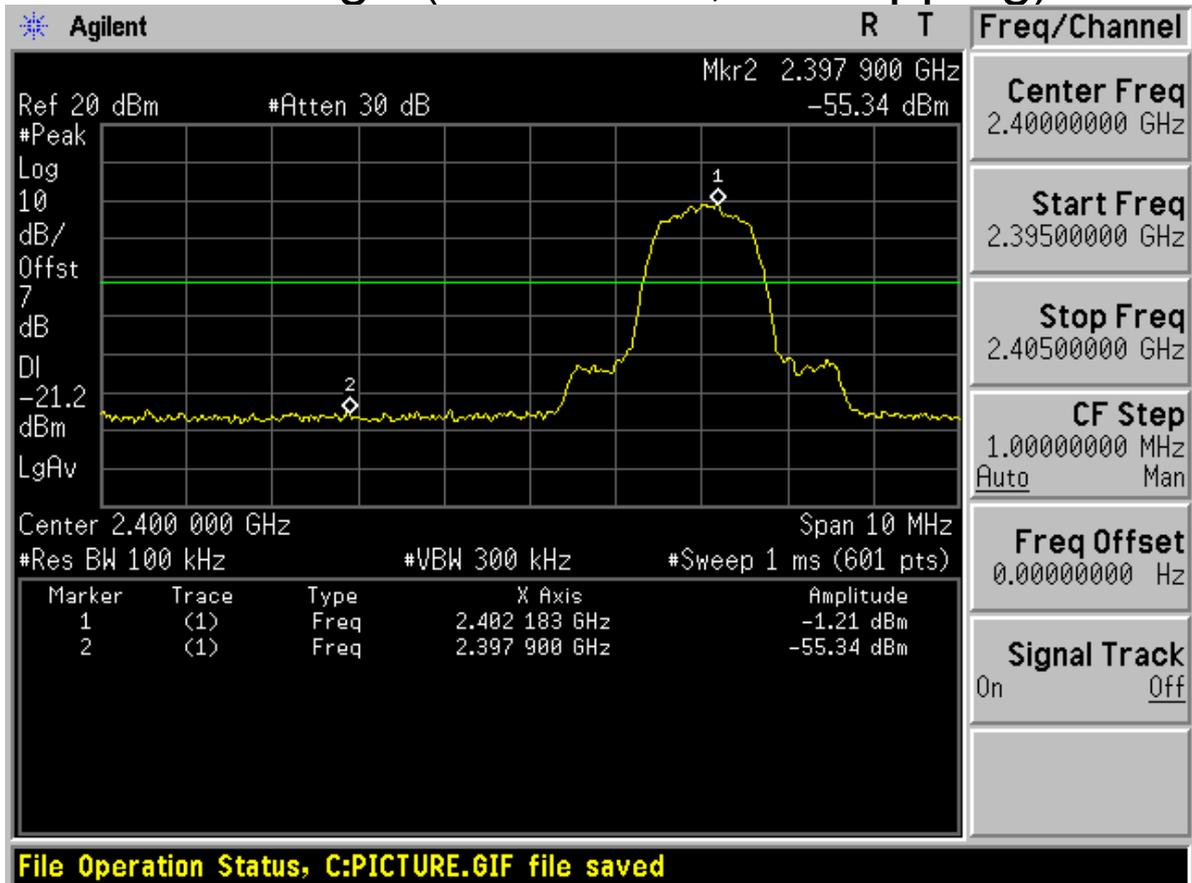
# High edge (with hopping)





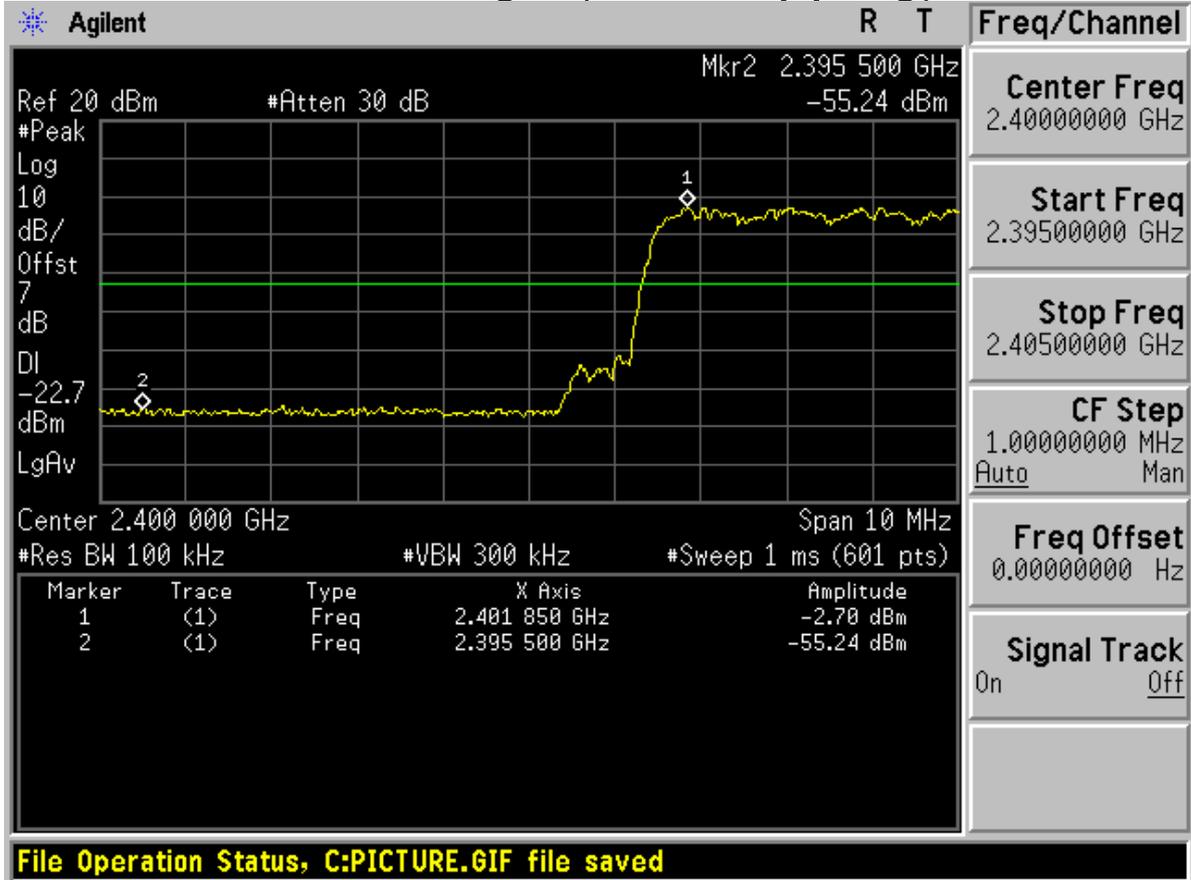
# Modulation: 8DPSK

## Low edge (Channel 0, no hopping)



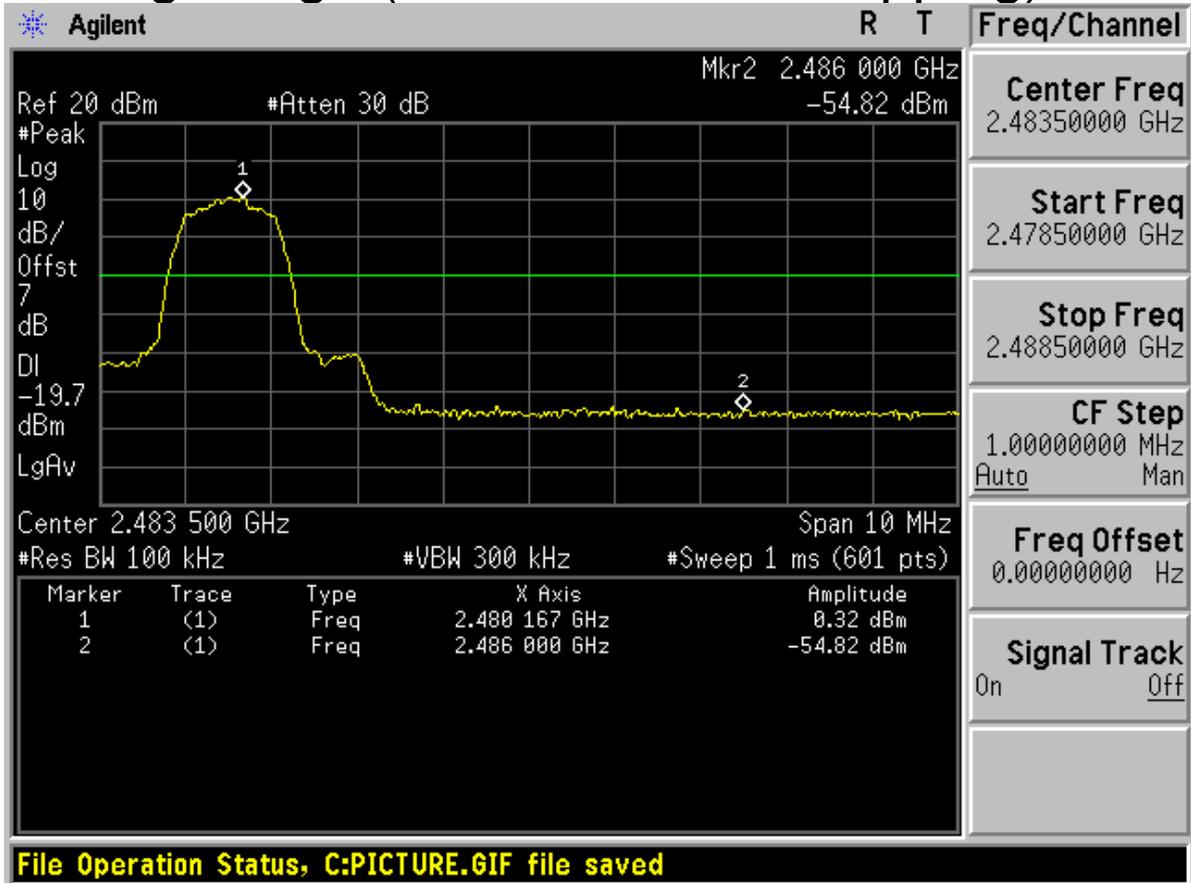


## Low edge (with hopping)



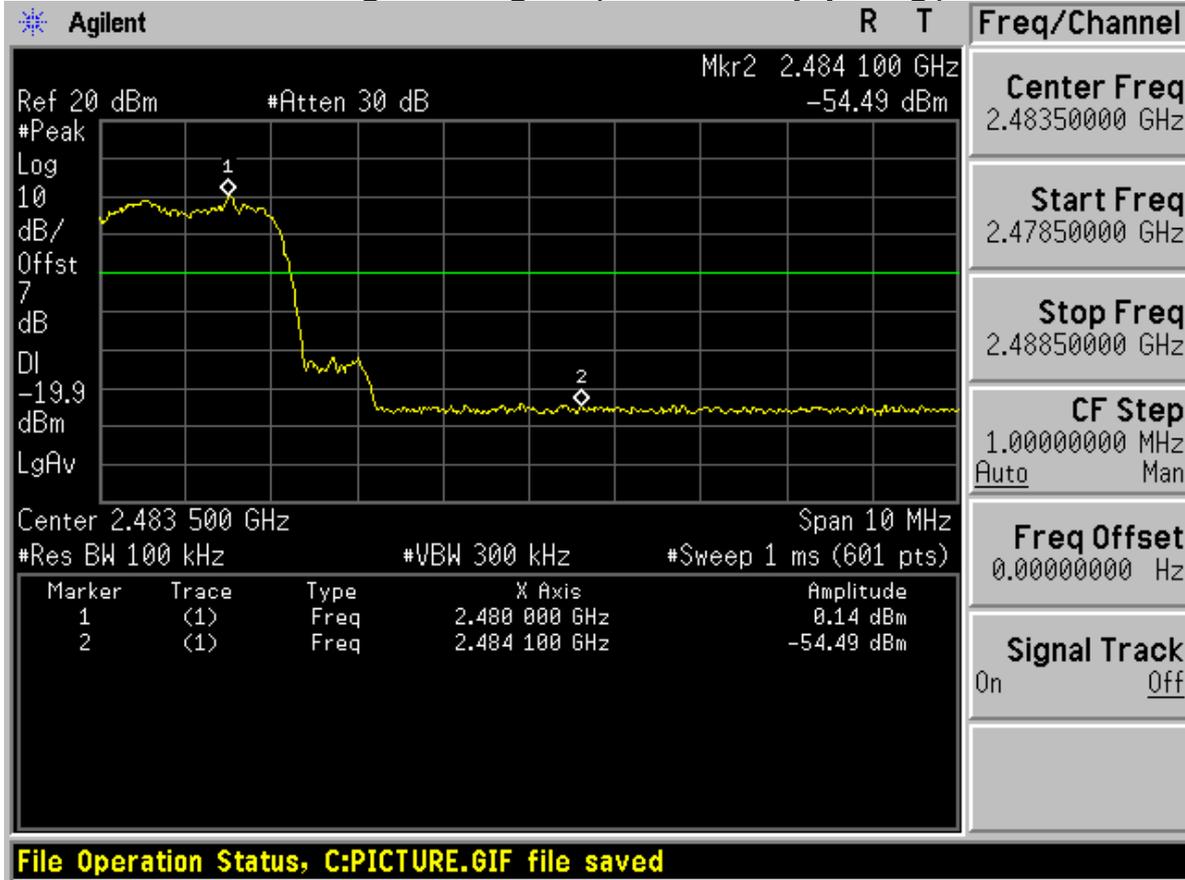


# High edge (Channel 78, no hopping)





## High edge (with hopping)



-----The End -----



# **Appendix G**

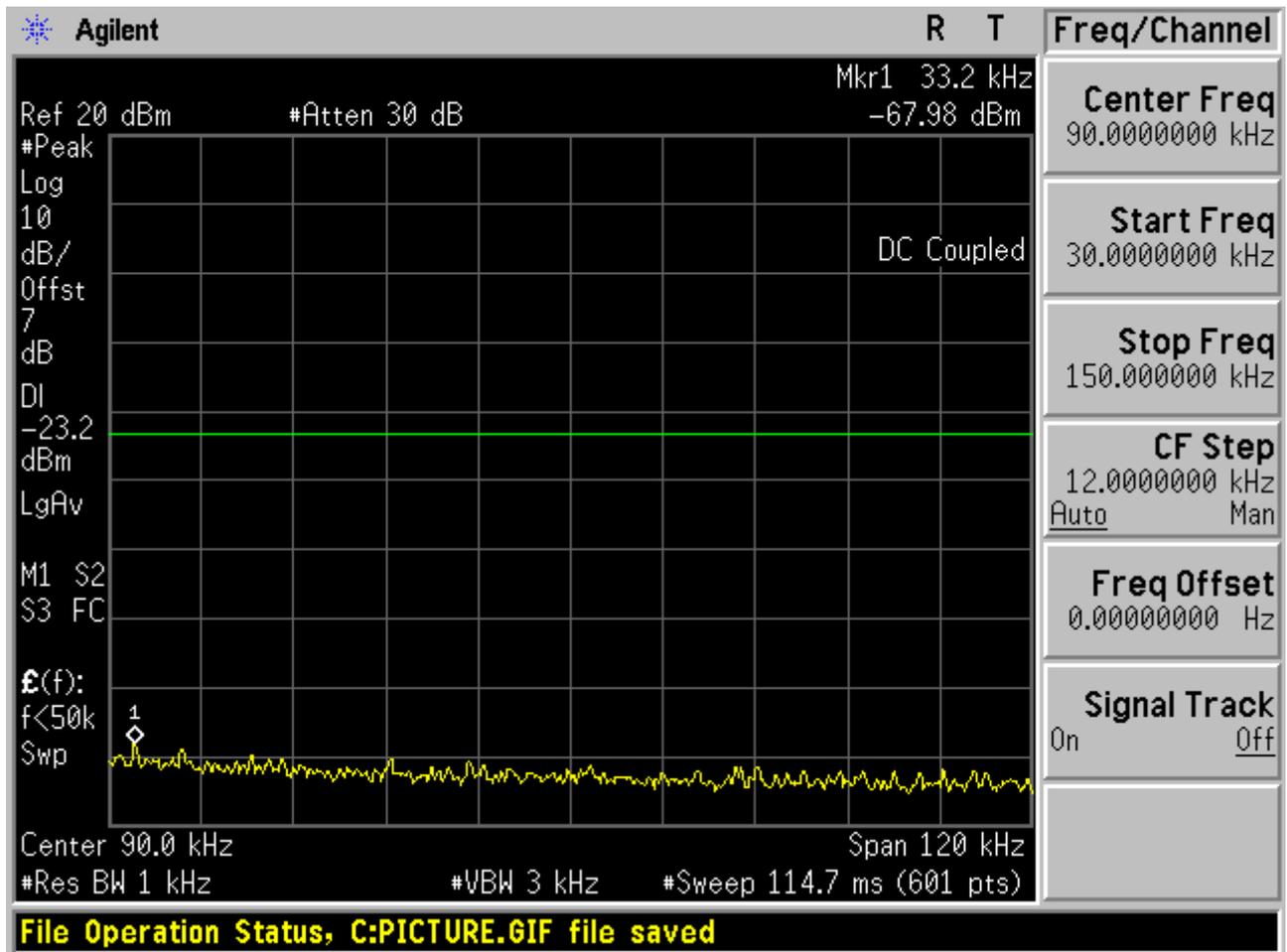
## Conducted RF spurious

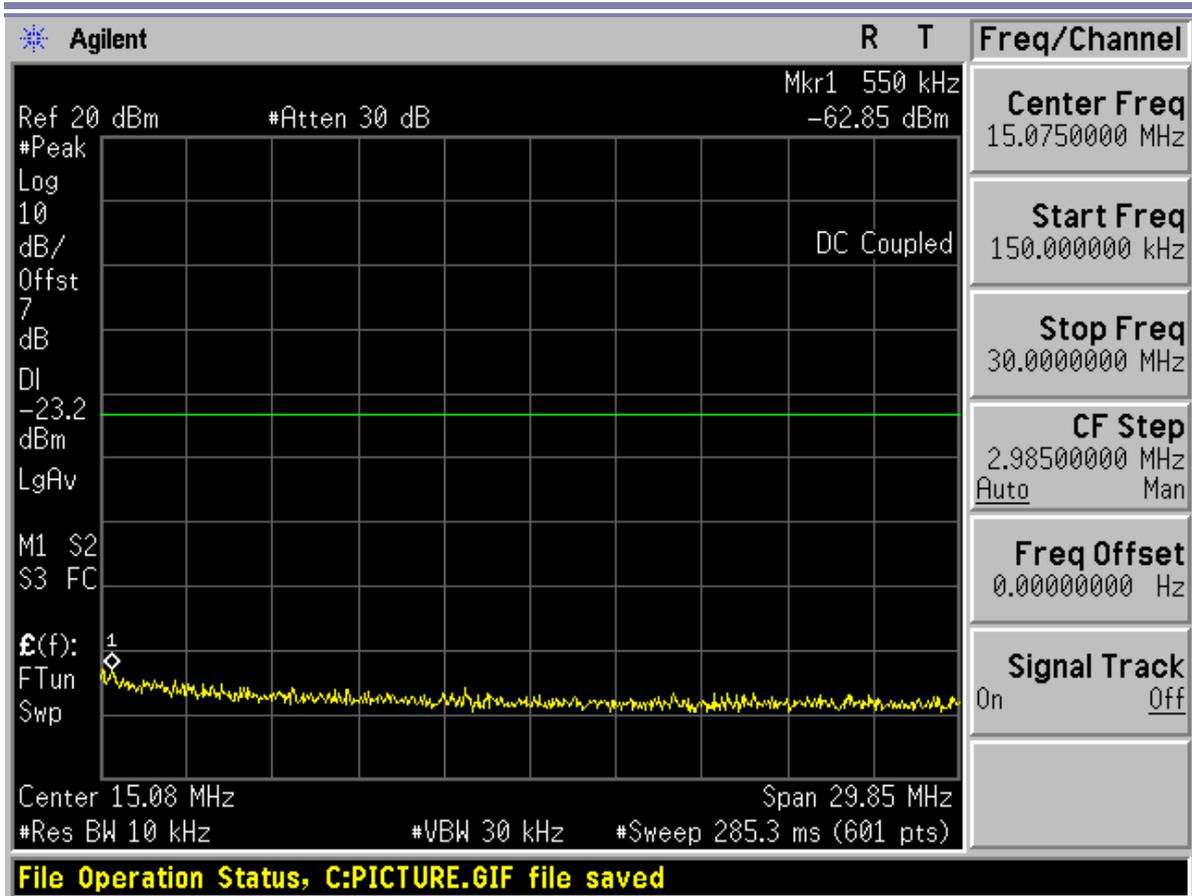
According to FCC Part 15.247 (d)

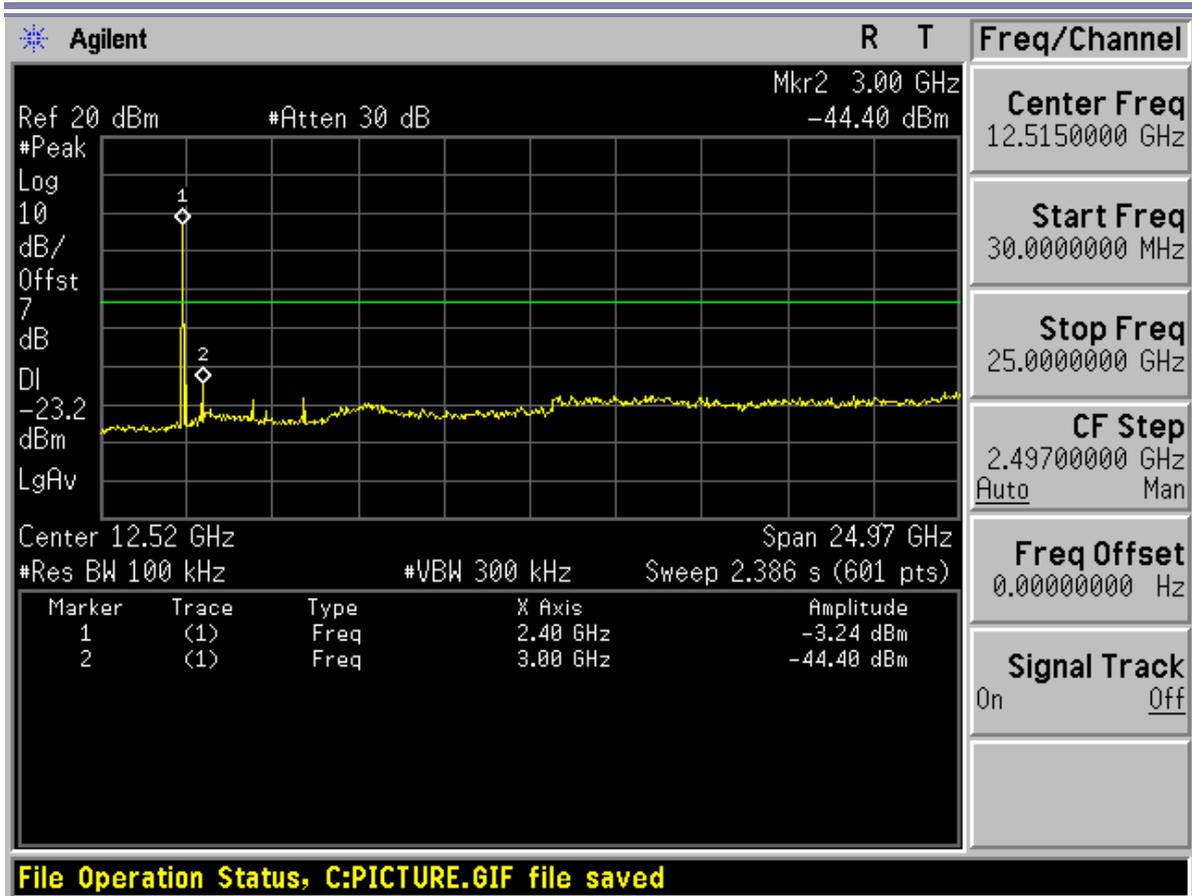


# Modulation: $\pi/4$ -DQPSK

## Channel0

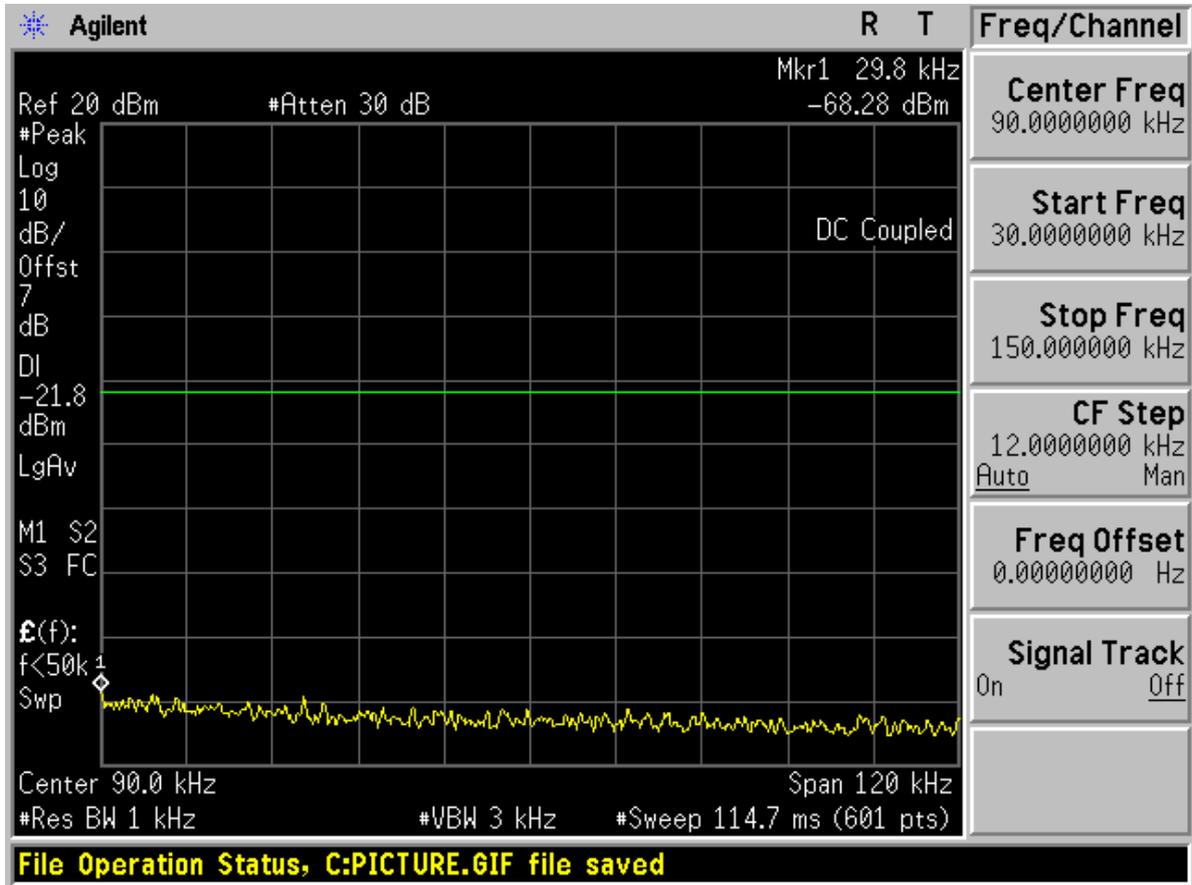


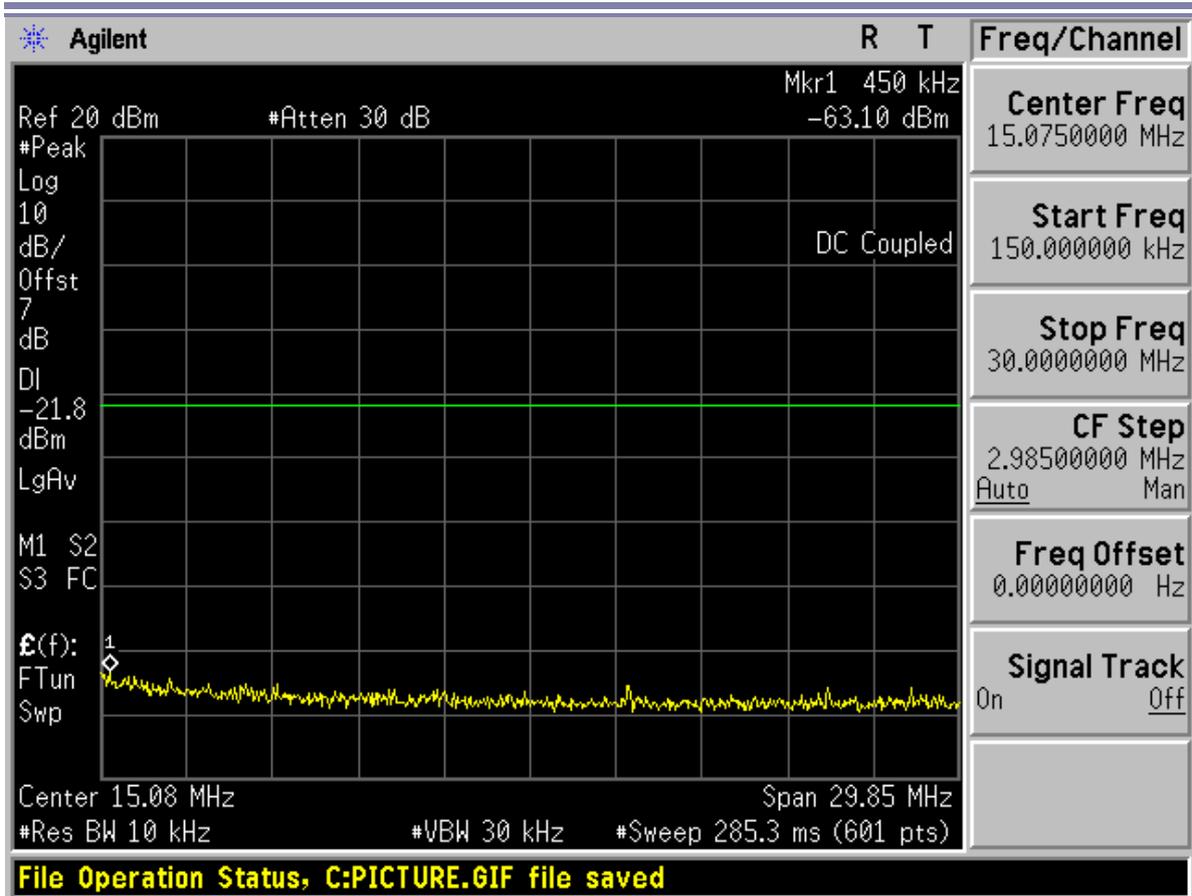


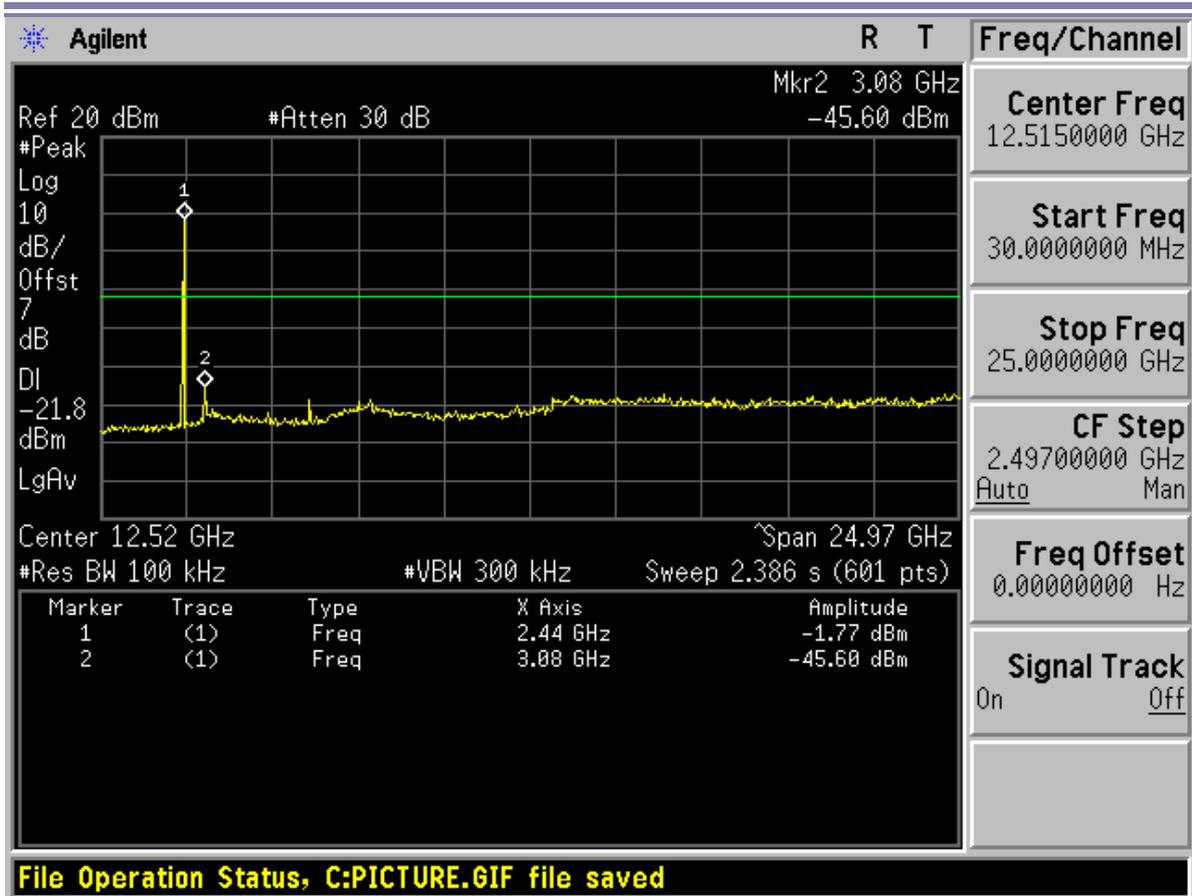




# Channel 40

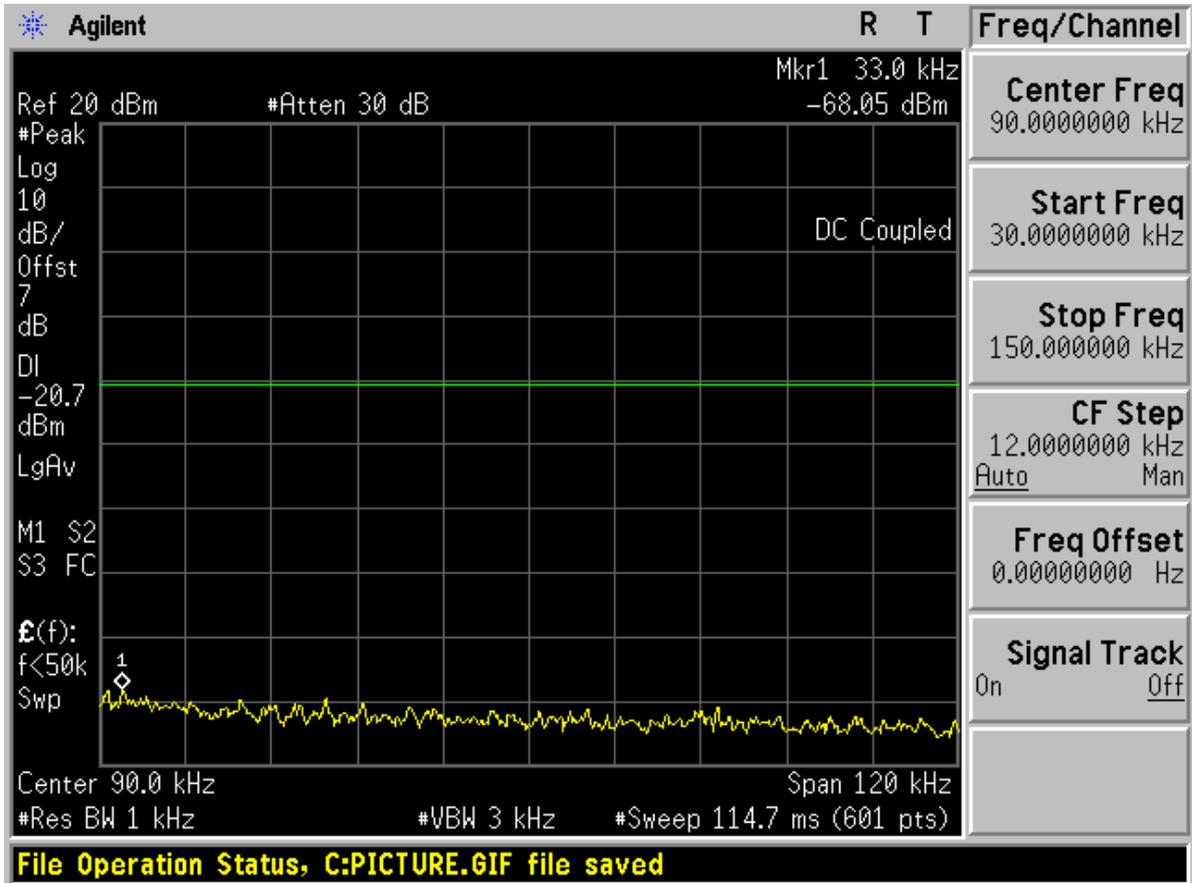


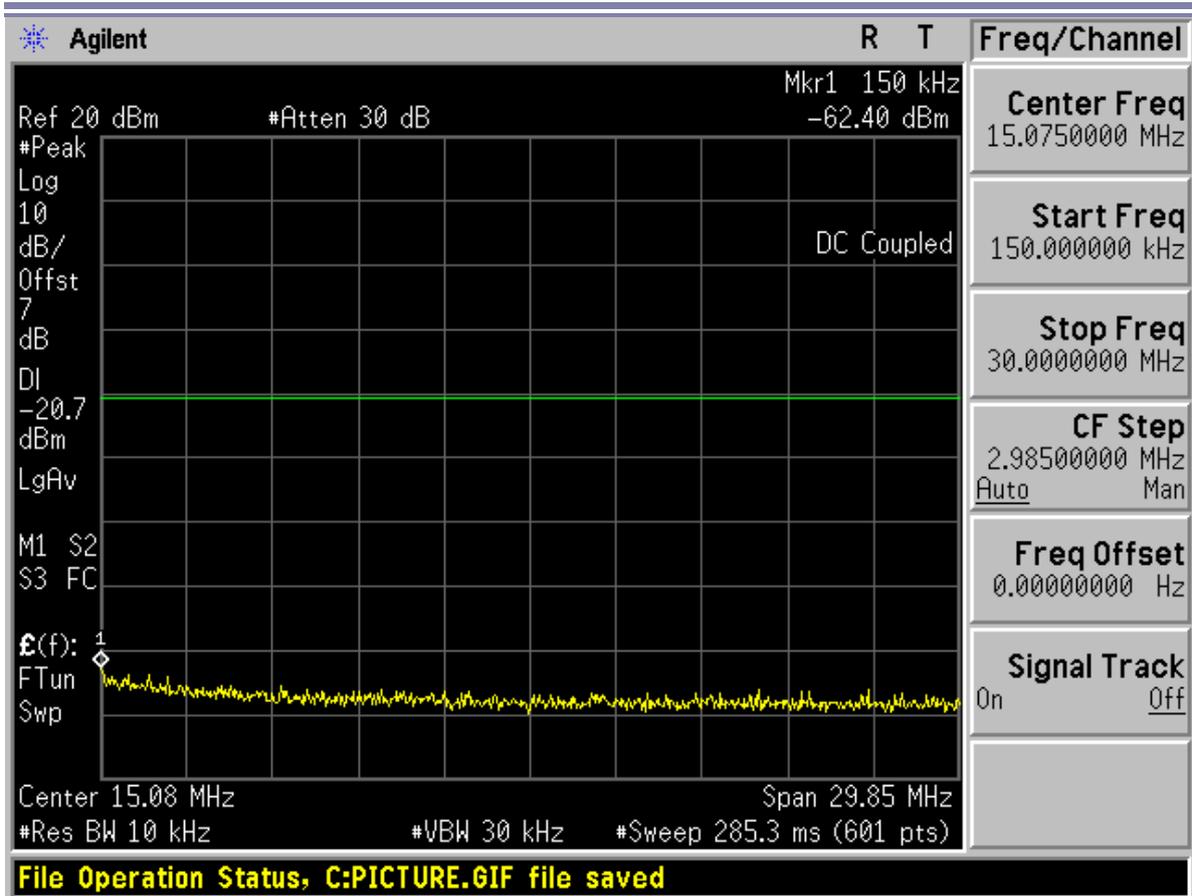


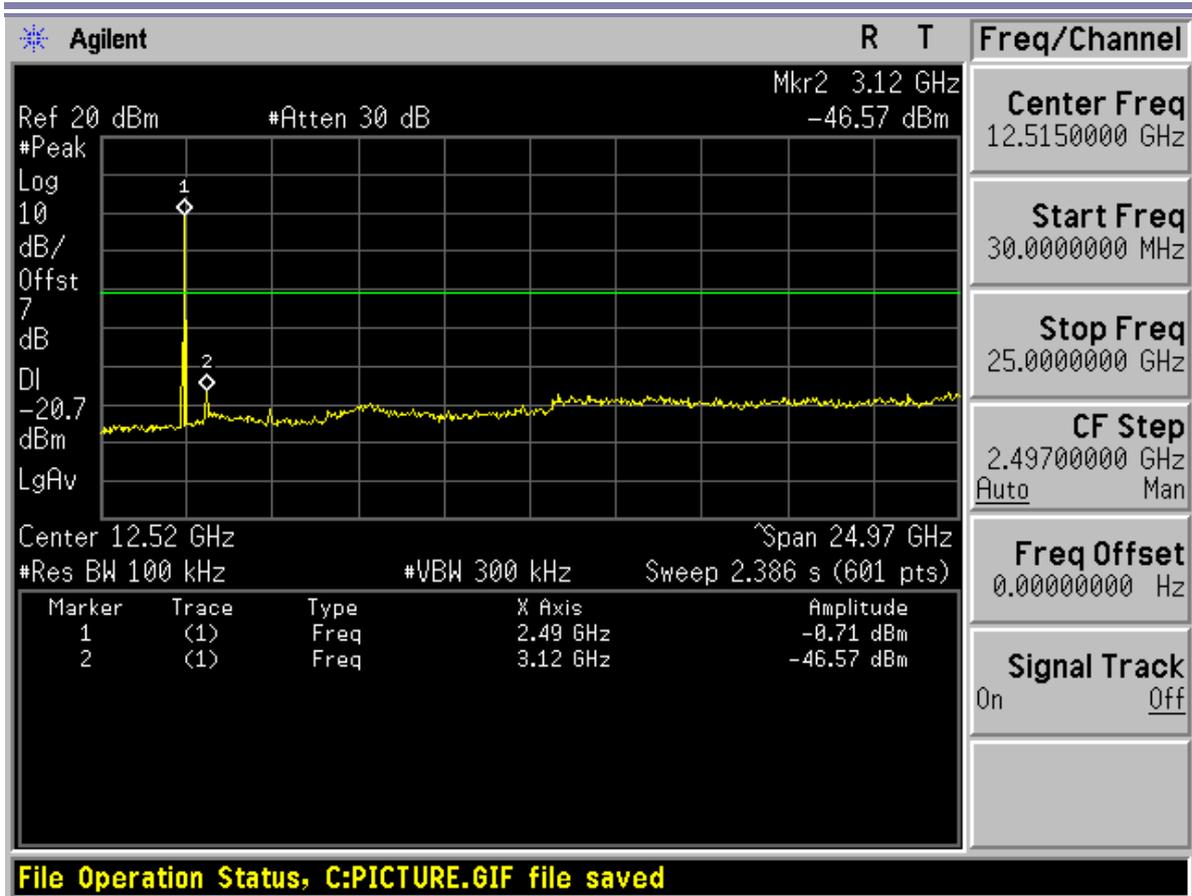




# Channel 78

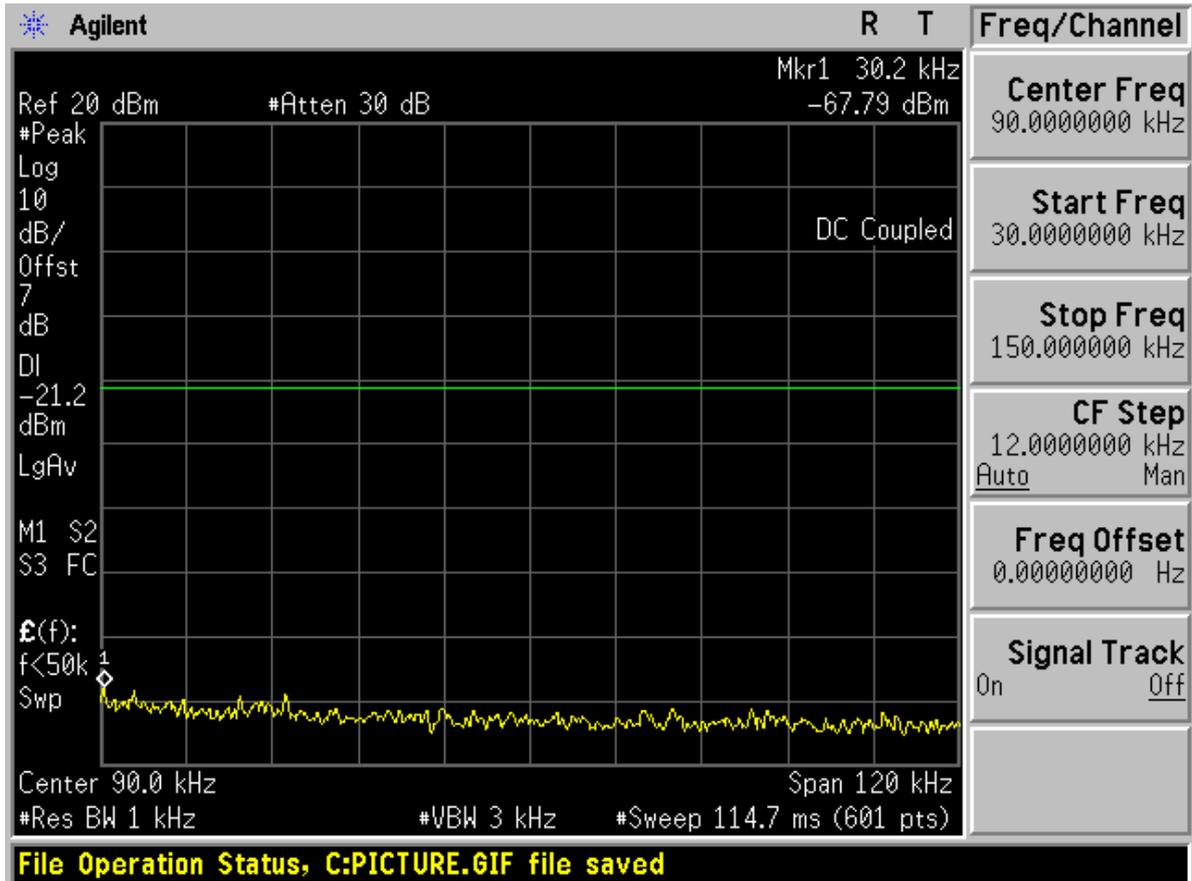


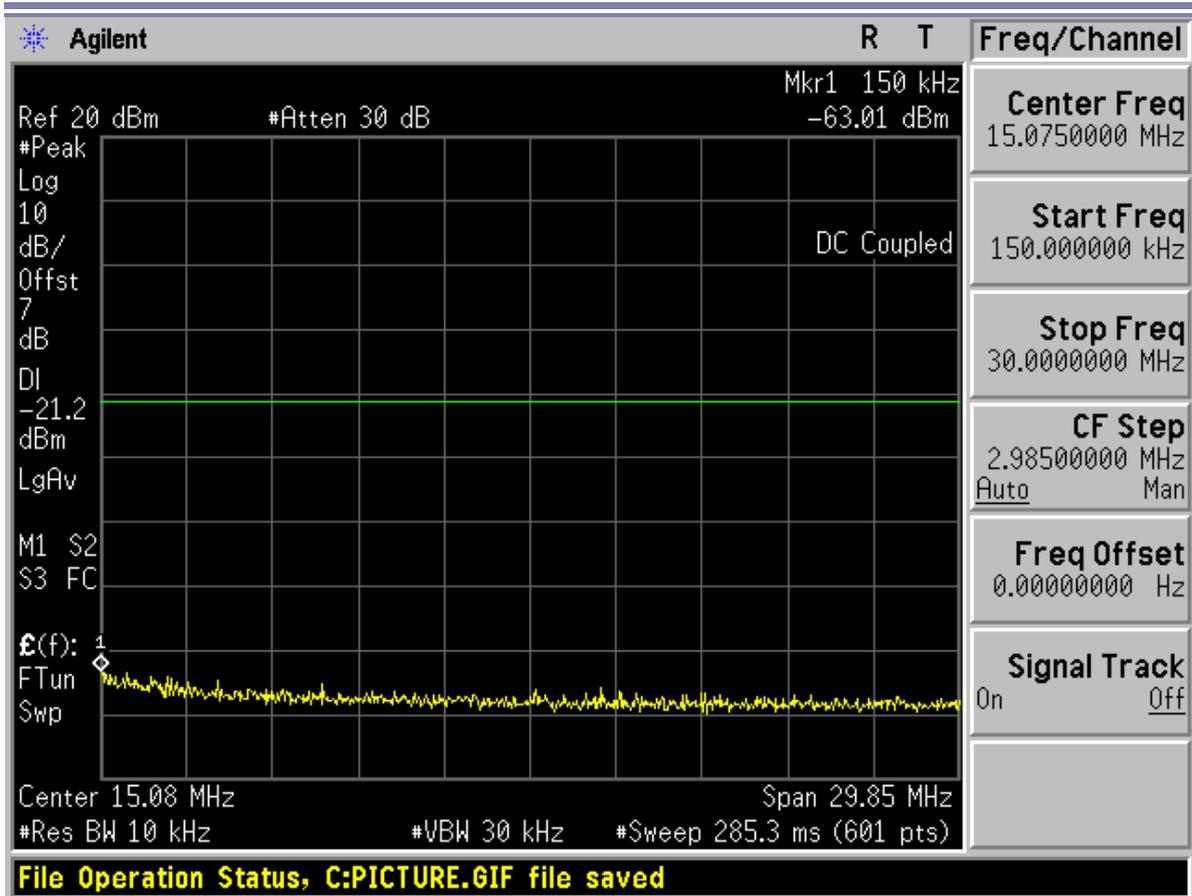


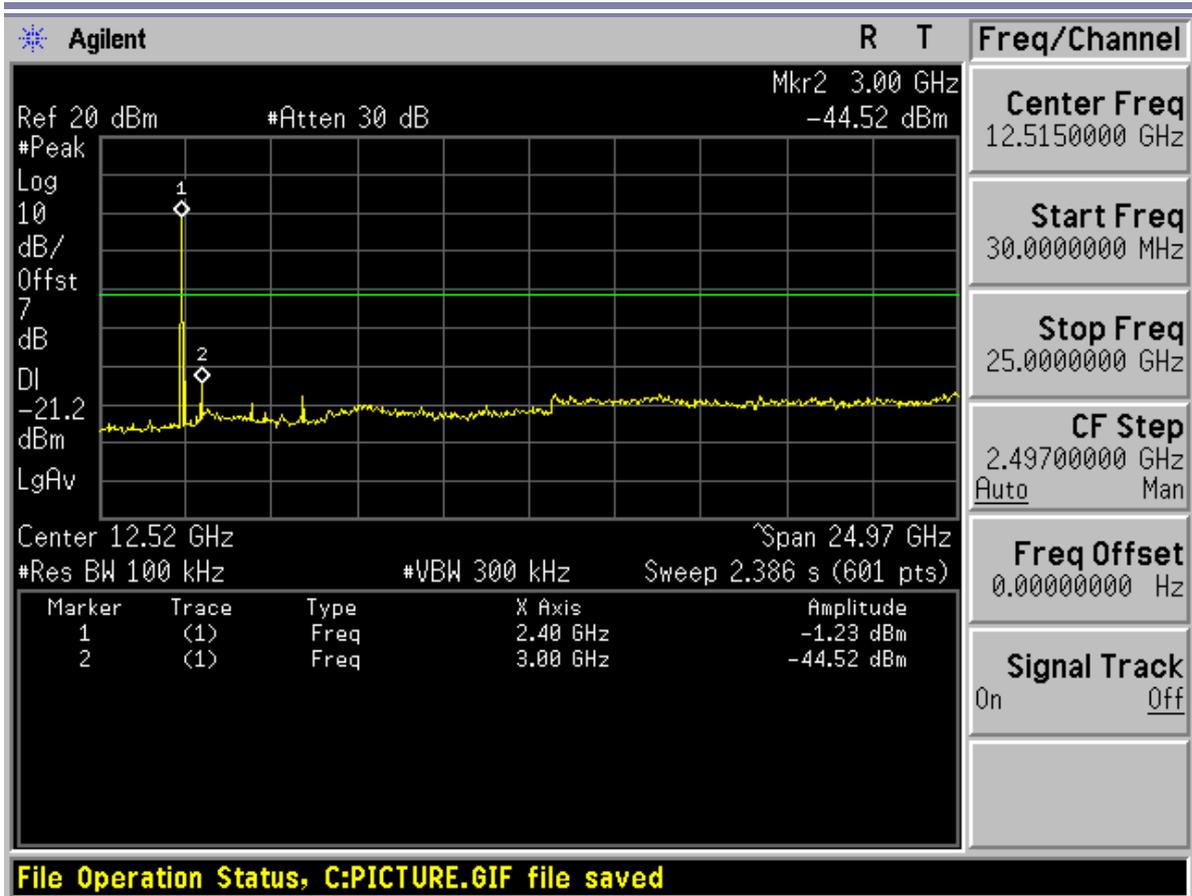




# Modulation:8DPSK Channel 0

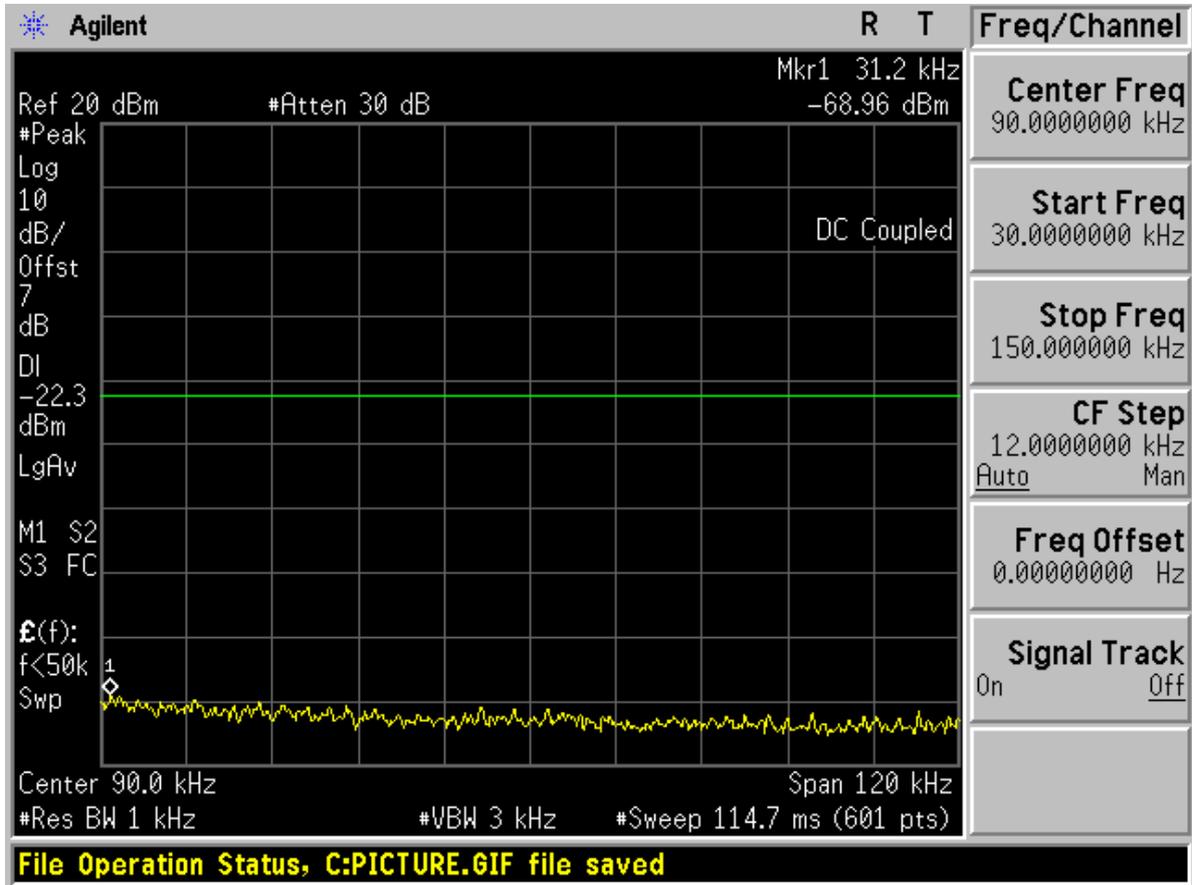


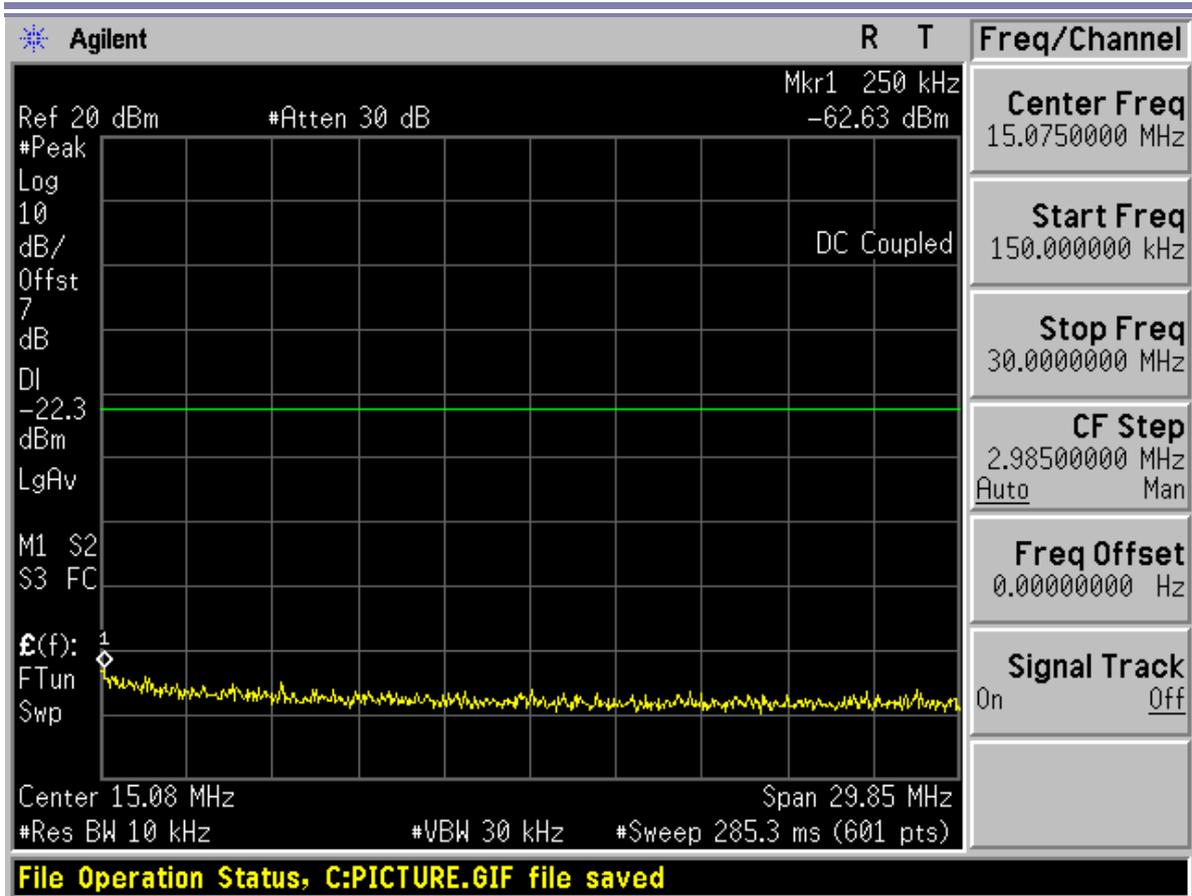


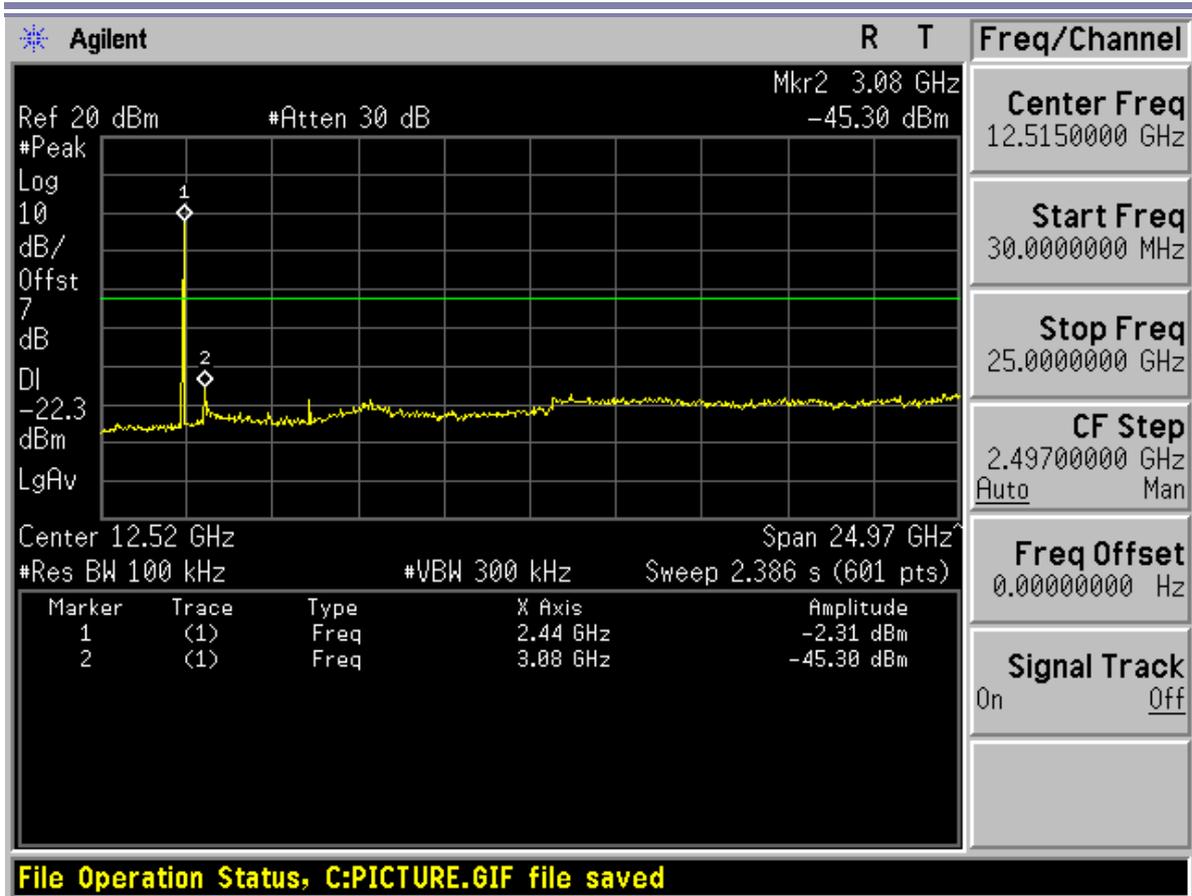




# Channel 40

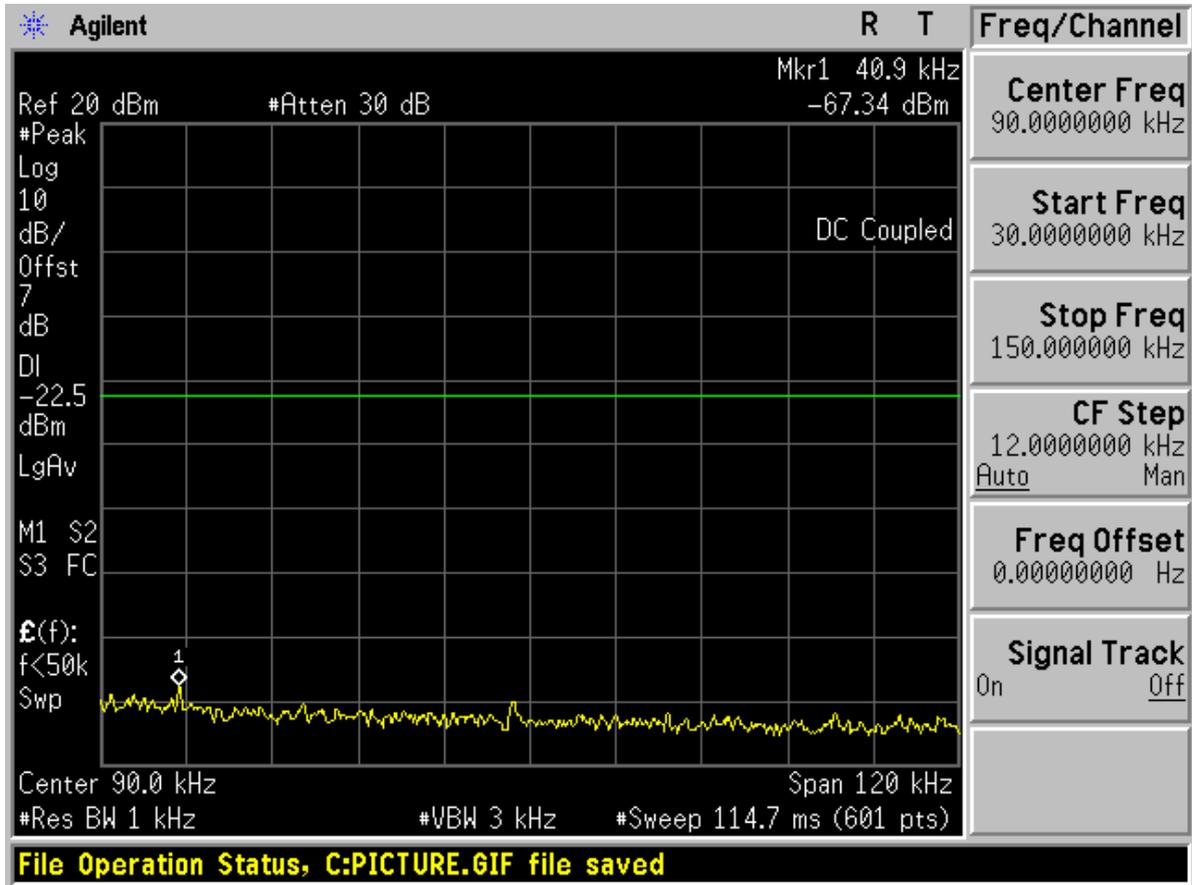


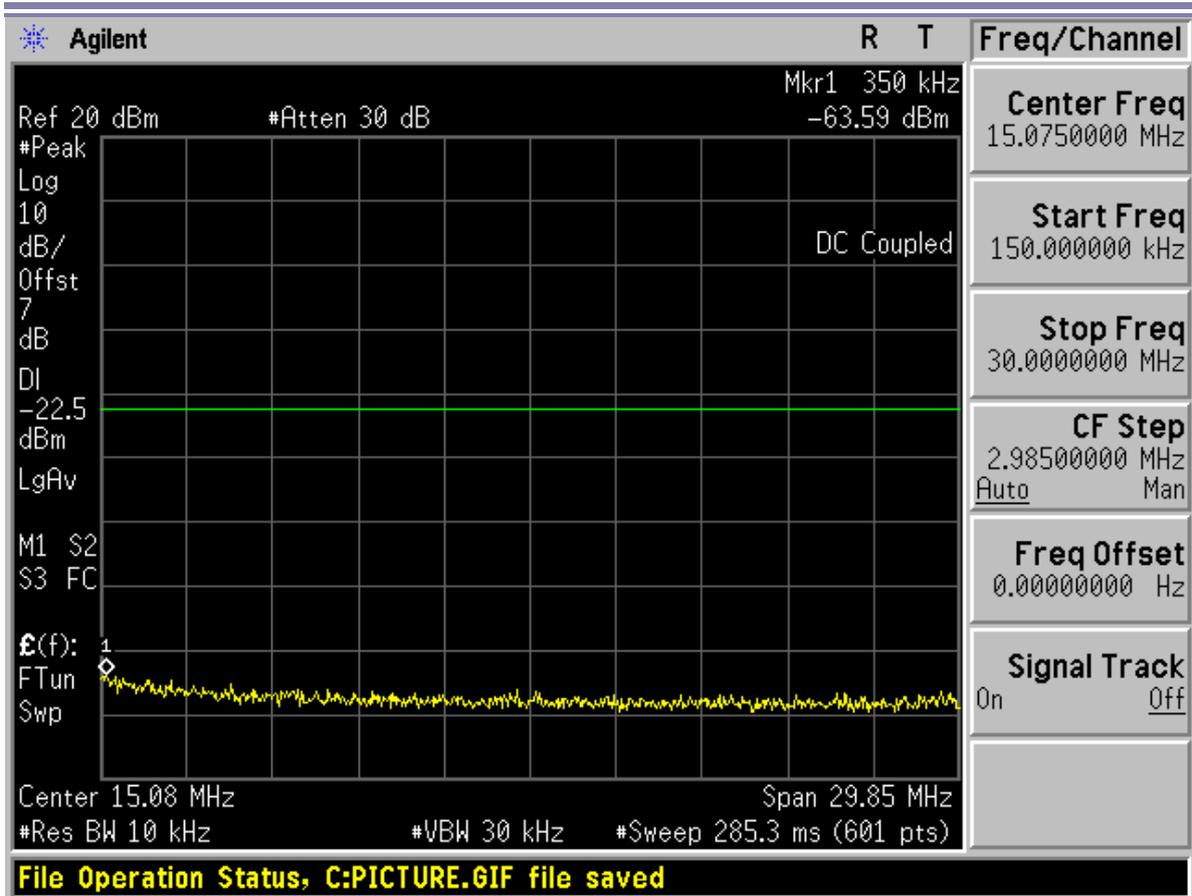


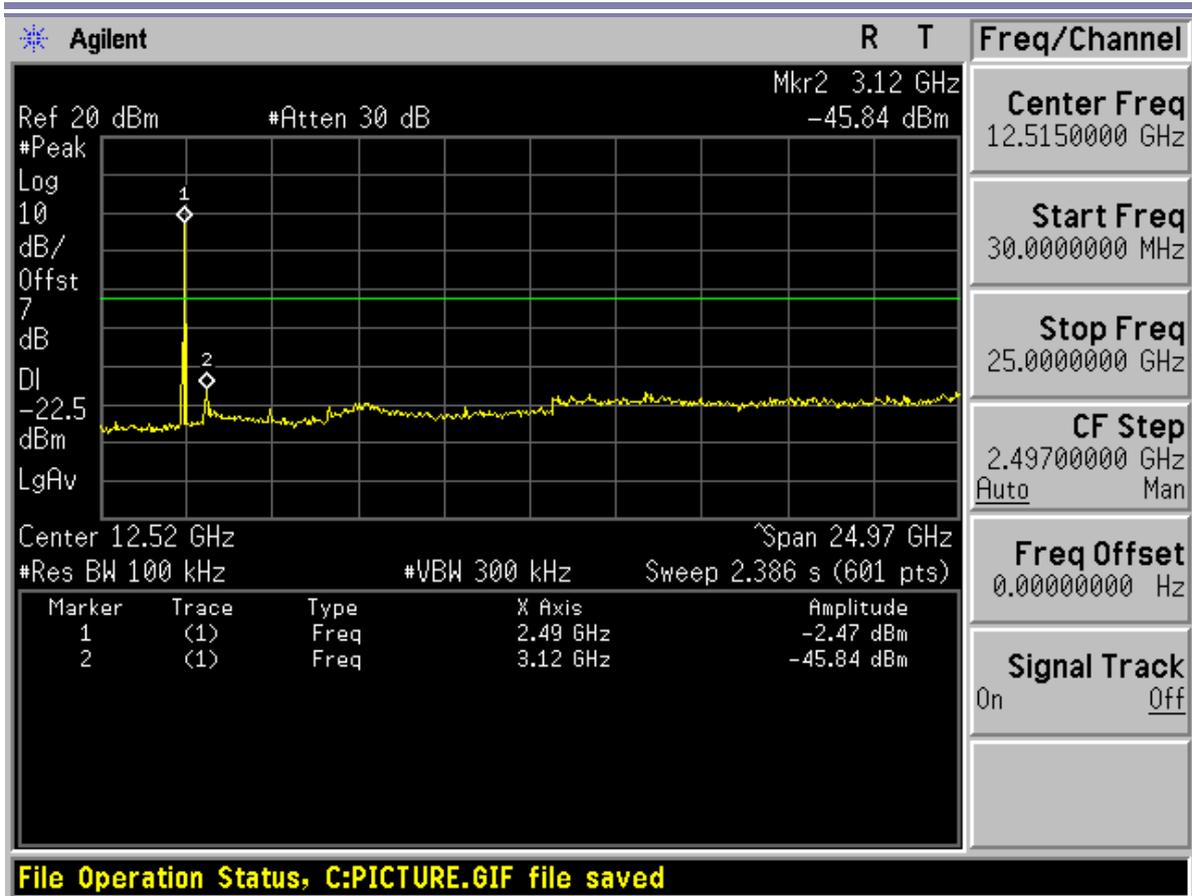




# Channel 78







-----The End -----



# Appendix H

## Radiated spurious emission

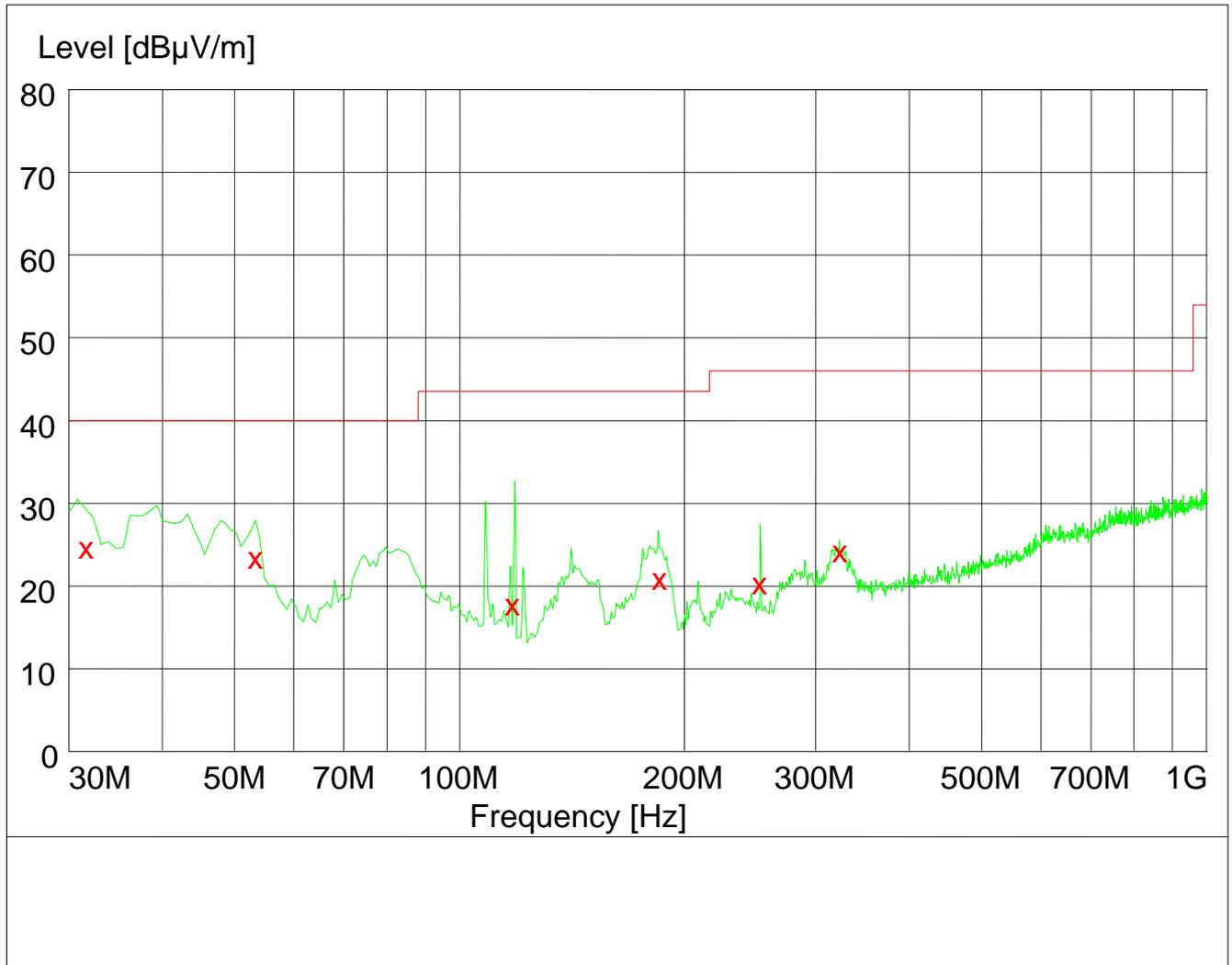
According to FCC Part 15.247 (d) & 15.205 & 15.209

Note: Simultaneous transmission was investigated and no new emissions were found.

**Part 1: Testing Range of “30 MHz to 1 GHz”**

Note 1: The test results and plot for testing range of “30 MHz to 1 GHz” showed as below is the WORST case for all Test Modes and Channels. This range will not be presented for each Test Mode and each Channel.

Note 2: The emissions in this range are mainly from the Platform Device (Notepad PC and its ancillary components).



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Plarization
31.620000	25.30	14.6	40.0	14.7	100.0	147.00	VERTICAL
53.280000	24.10	14.7	40.0	15.9	100.0	322.00	VERTICAL
117.600000	18.40	11.8	43.5	25.1	100.0	102.00	VERTICAL
185.160000	21.50	11.7	43.5	22.0	100.0	343.00	VERTICAL
252.120000	21.00	14.0	46.0	25.0	109.0	333.00	HORIZONTAL



---

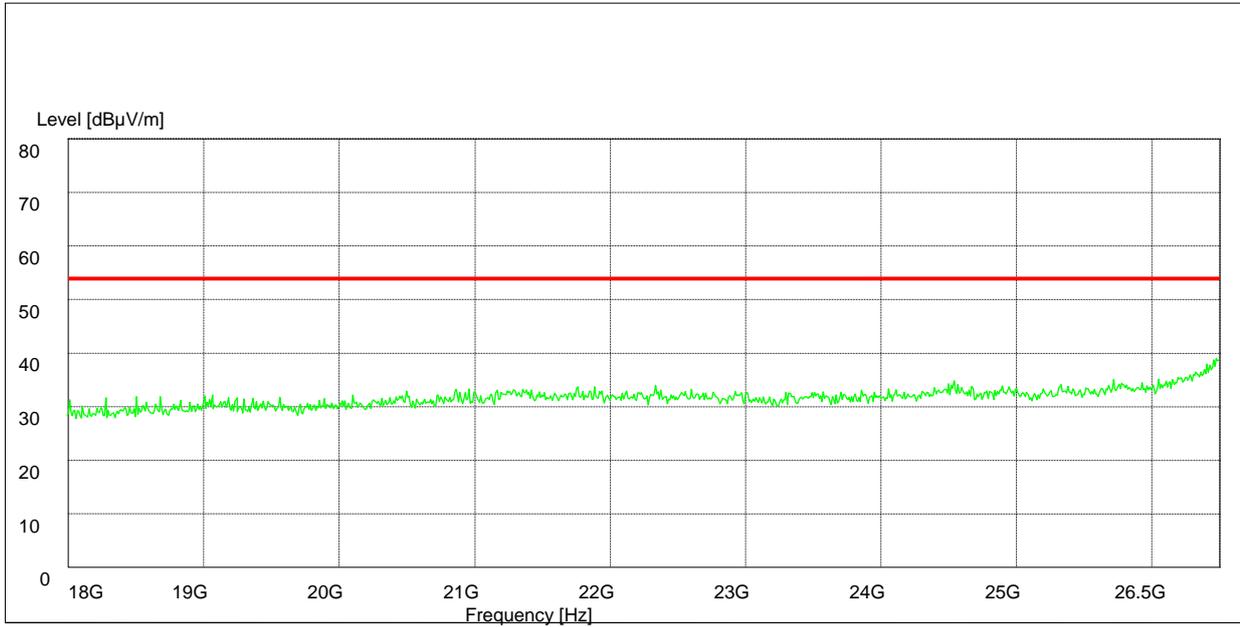
---

322.620000	24.90	15.7	46.0	21.1	100.0	315.00	HORIZONTAL
------------	-------	------	------	------	-------	--------	------------



**Part 2: Testing Range of “18 GHz to 26.5 GHz”**

Note: No peak found in pre- test.

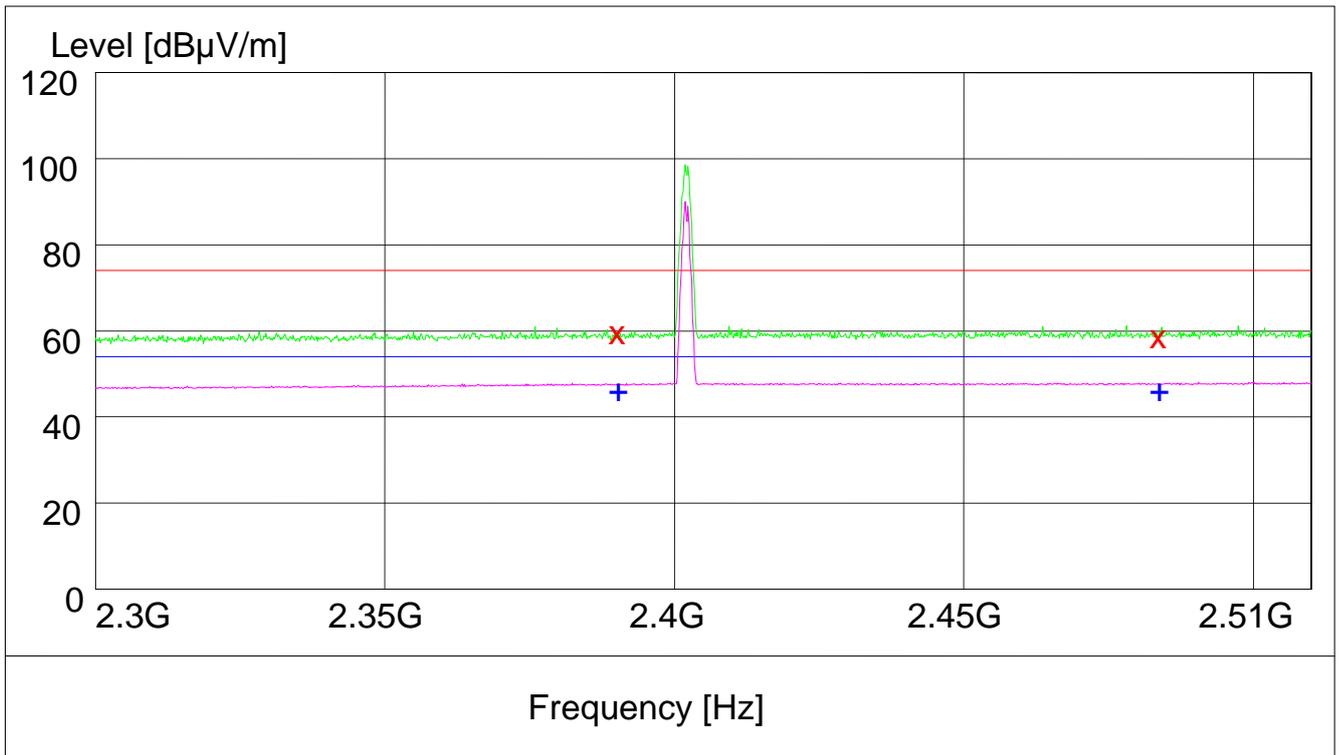


**Part 3: Testing Range of “2.3GHz to 2.5GHz”**

- Note 1: The testing range of “2.3 GHz to 2.5 GHz” is for checking radiated emissions located in restricted bands near the EUT operating bands.
- Note 2: Two limits are required in the testing range above 1 GHz, that is Peak limit (74 dB $\mu$ V/m) and Average Limit (54 dB $\mu$ V/m).
- Note 3: The peak spike exceeds the limit line is EUT’s operating frequency.

**1 Test Mode:**

**1.1 Channel 00**



Note: The peak exceeds the limit line is carrier frequency.

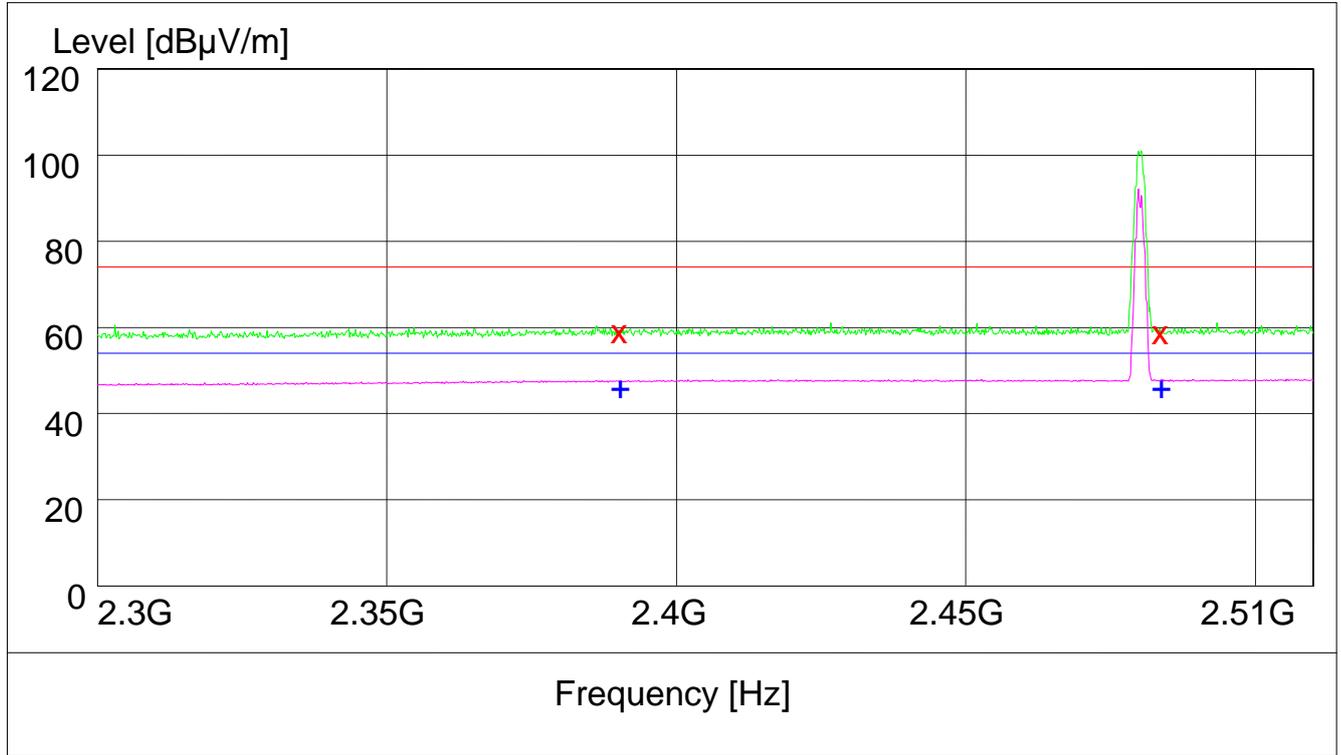
MEASUREMENT RESULT: PK Detector

Frequency MHz	Level dB $\mu$ V/m	Transd dB	Limit dB $\mu$ V/m	Margin dB	Height cm	Azimuth deg	Polarization
2390.000000	59.80	33.5	74.0	14.2	100.0	194.00	HORIZONTAL
2483.500000	58.90	33.8	74.0	15.1	200.0	226.00	VERTICAL

MEASUREMENT RESULT: AVDetector

Frequency MHz	Level dB $\mu$ V/m	Transd dB	Limit dB $\mu$ V/m	Margin dB	Height cm	Azimuth deg	Polarization
2390.000000	46.40	33.5	54.0	7.6	200.0	292.00	HORIZONTAL
2483.500000	46.50	33.8	54.0	7.5	100.0	305.00	HORIZONTAL

### 1.2 Channel 78



Note: The peak exceeds the limit line is carrier frequency.

MEASUREMENT RESULT: PK Detector

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarization
2390.000000	59.20	33.5	74.0	14.8	135.0	331.00	VERTICAL
2483.500000	59.00	33.8	74.0	15.0	197.0	43.00	HORIZONTAL

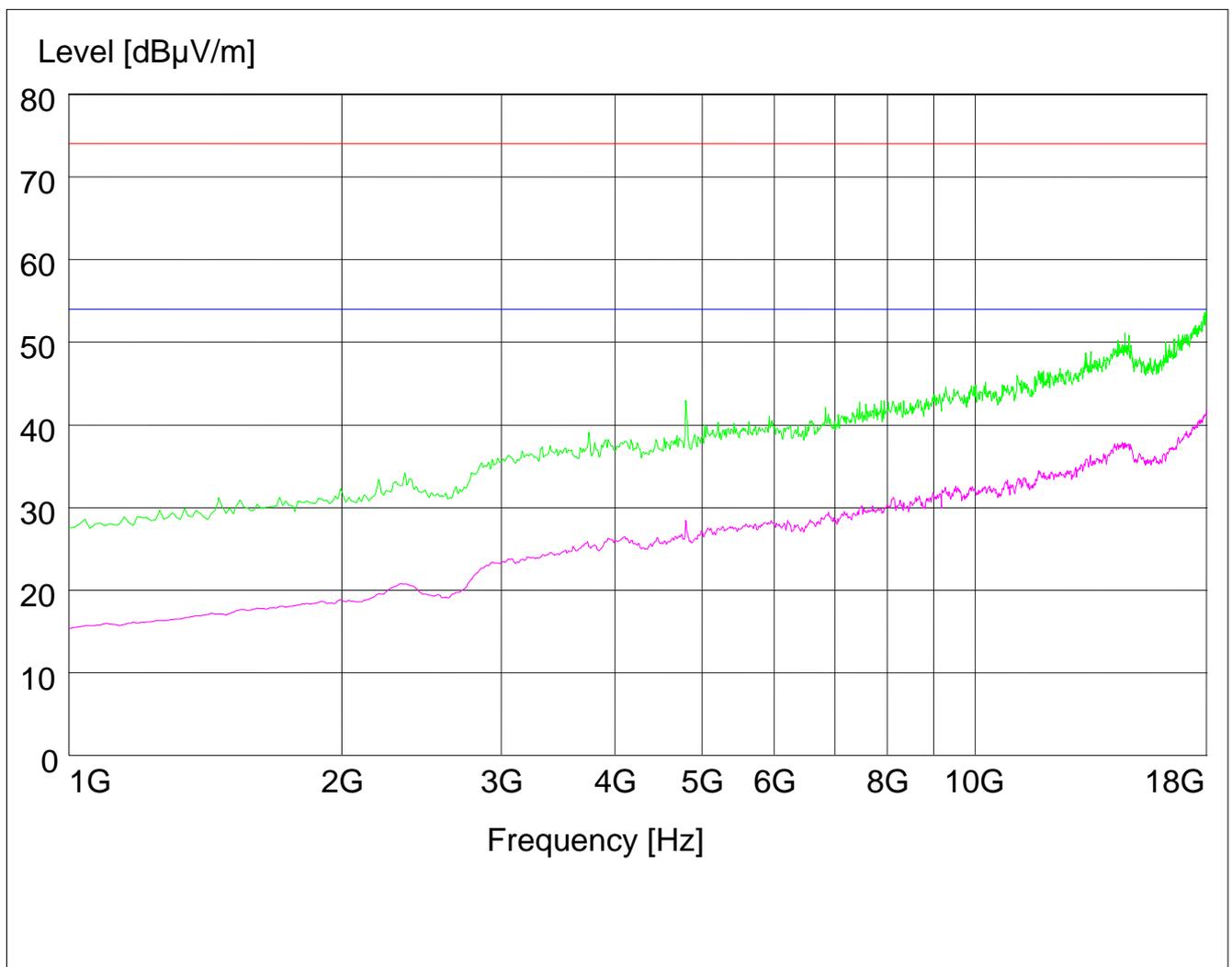
MEASUREMENT RESULT: AVDetector

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarization
2390.000000	46.40	33.5	54.0	7.6	158.0	36.00	VERTICAL
2483.500000	46.50	33.8	54.0	7.5	100.0	292.00	VERTICAL

### 1.3

#### **Part 4: Testing Range of “1 GHz to 18 GHz”**

- Note 1: The test results and plot for testing range of “1 GHz to 18 GHz” showed as below is the WORST case for all Test Modes and Channels. This range will not be presented for each Test Mode and each Channel.
- Note 2: The testing range of “1 GHz to 18 GHz” is for checking radiated emissions located in restricted bands faraway from the EUT operating bands.
- Note 3: Two limits are required in the testing range above 1 GHz, that is Peak limit (74 dB $\mu$ V/m) and Average Limit (54 dB $\mu$ V/m).



-----The End -----



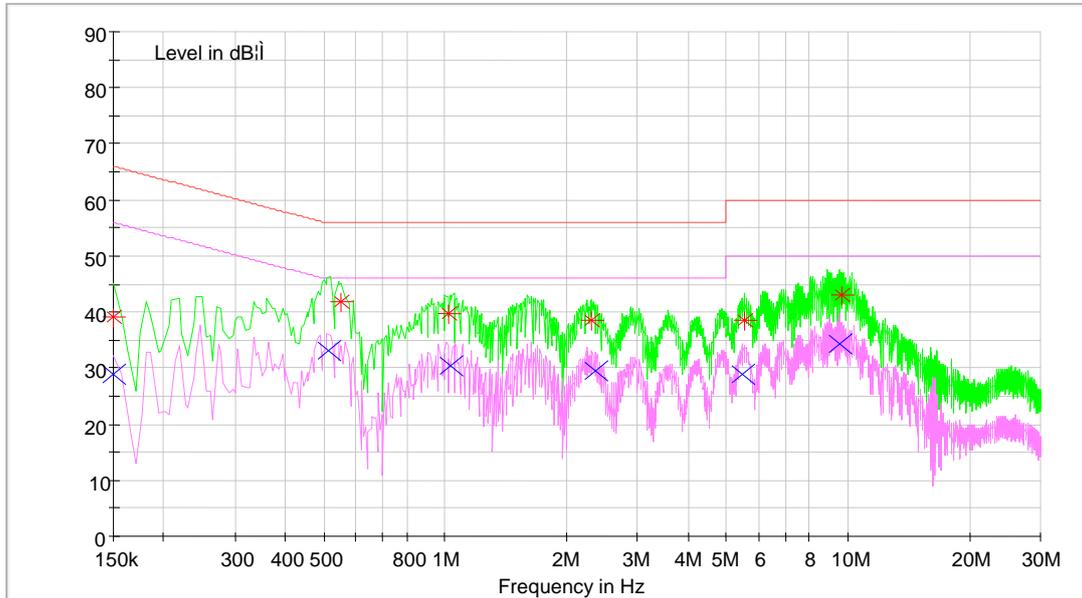
# Appendix I

## Conducted Emission at Power Port

According to FCC Part 15.207



## Channel 40



### MEASUREMENT RESULT: QP Detector

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.150000	39.0	9.7	66.0	27.0	L1	FLO
0.552000	41.9	9.7	56.0	14.1	N	FLO
1.016000	39.7	9.7	56.0	16.3	N	FLO
2.296000	38.5	9.7	56.0	17.5	N	FLO
5.540000	38.5	9.8	60.0	21.5	N	FLO
9.588000	43.0	9.9	60.0	17.0	N	FLO

### MEASUREMENT RESULT: AV Detector

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.150000	29.0	9.7	56.0	27.0	L1	FLO
0.512000	33.0	9.7	46.0	13.0	N	FLO
1.028000	30.4	9.7	46.0	15.6	N	FLO
2.352000	29.6	9.7	46.0	16.4	N	FLO
5.460000	28.8	9.8	50.0	21.2	N	FLO
9.500000	34.2	9.9	50.0	15.8	N	FLO

-----The End -----