

### 7.4.2. Conducted Spurious Emissions

#### Low Band-edge

#### Lowest Channel & Modulation : GFSK



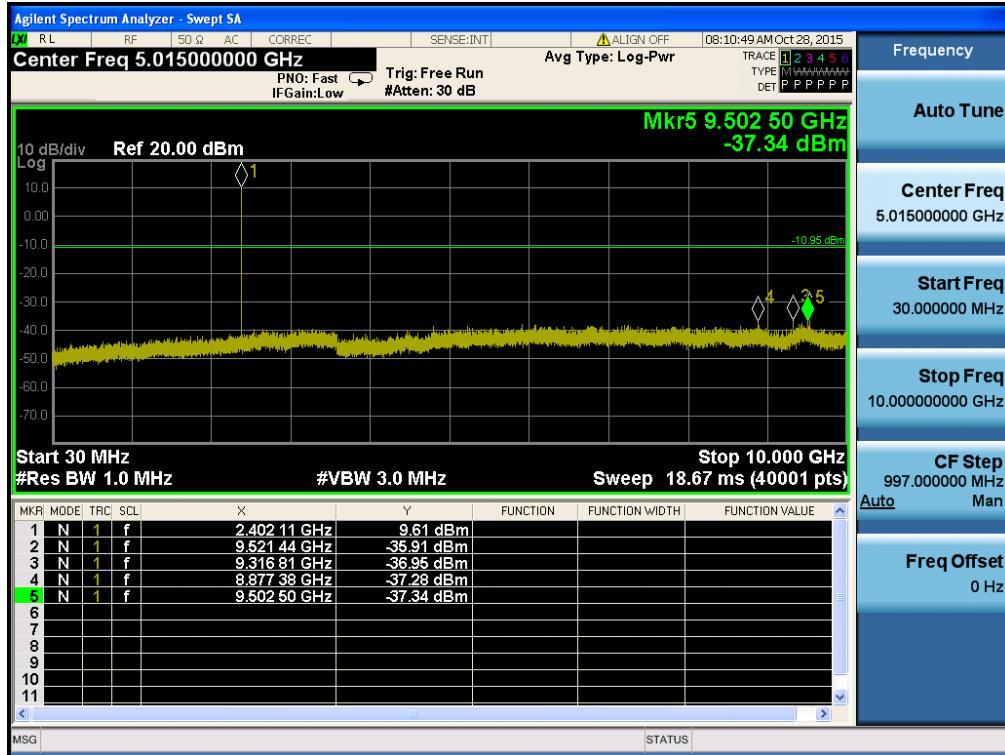
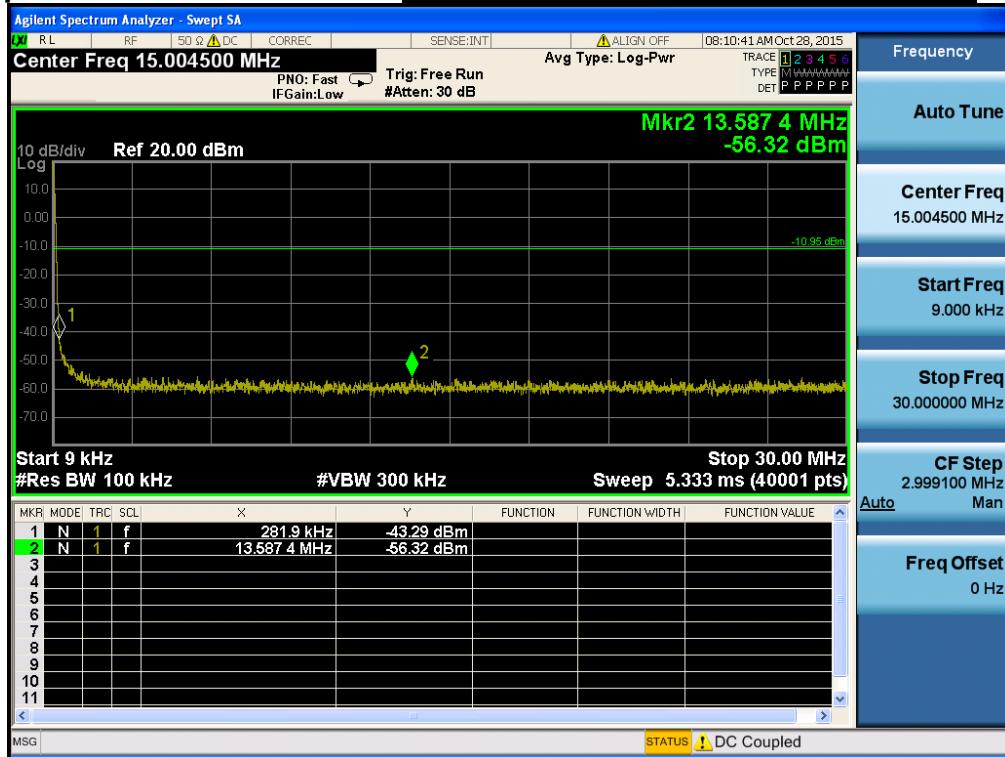
#### Low Band-edge

#### Hopping mode & Modulation : GFSK



## Conducted Spurious Emissions

## Lowest Channel &amp; Modulation : GFSK



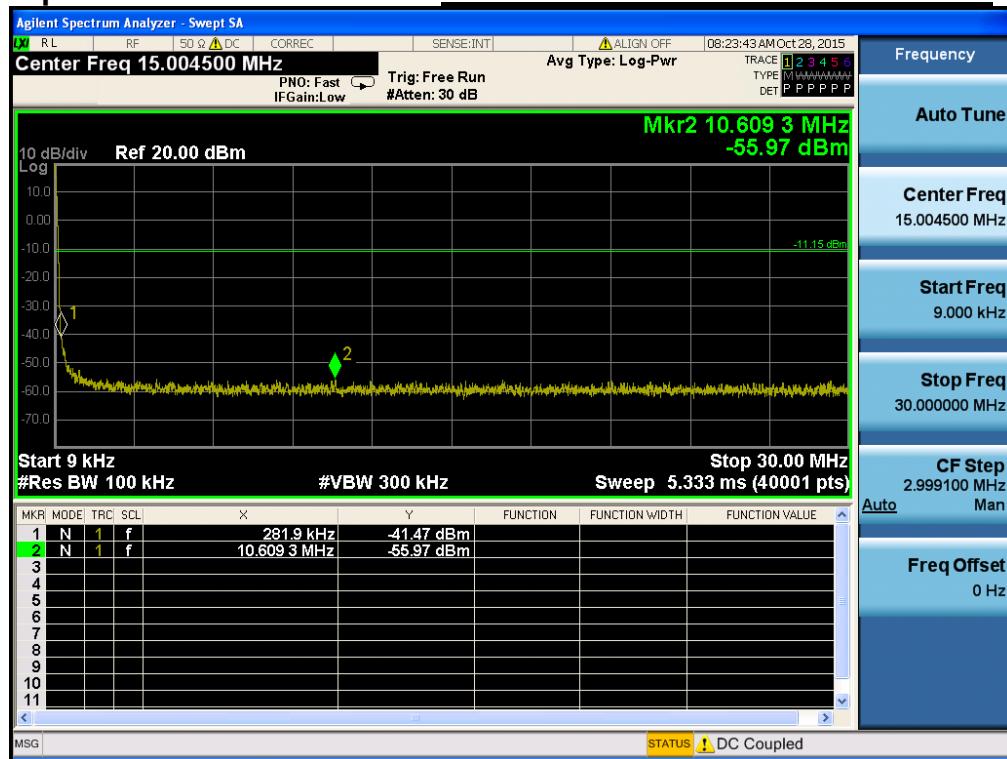
## Conducted Spurious Emissions

Lowest Channel & Modulation : GFSK

## Reference for limit

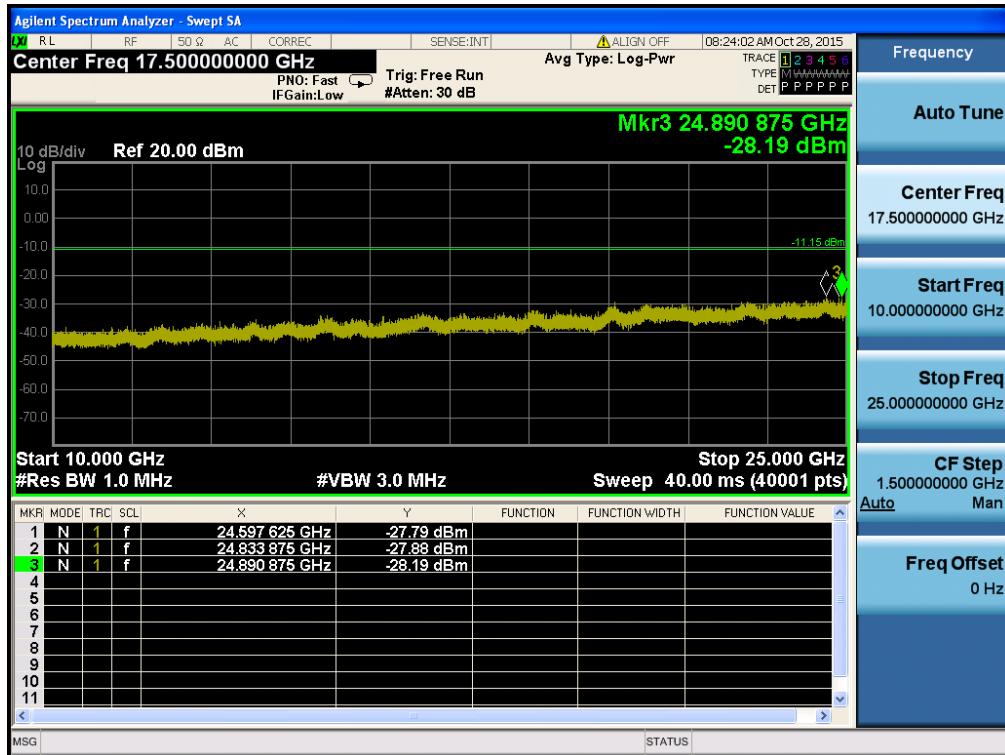
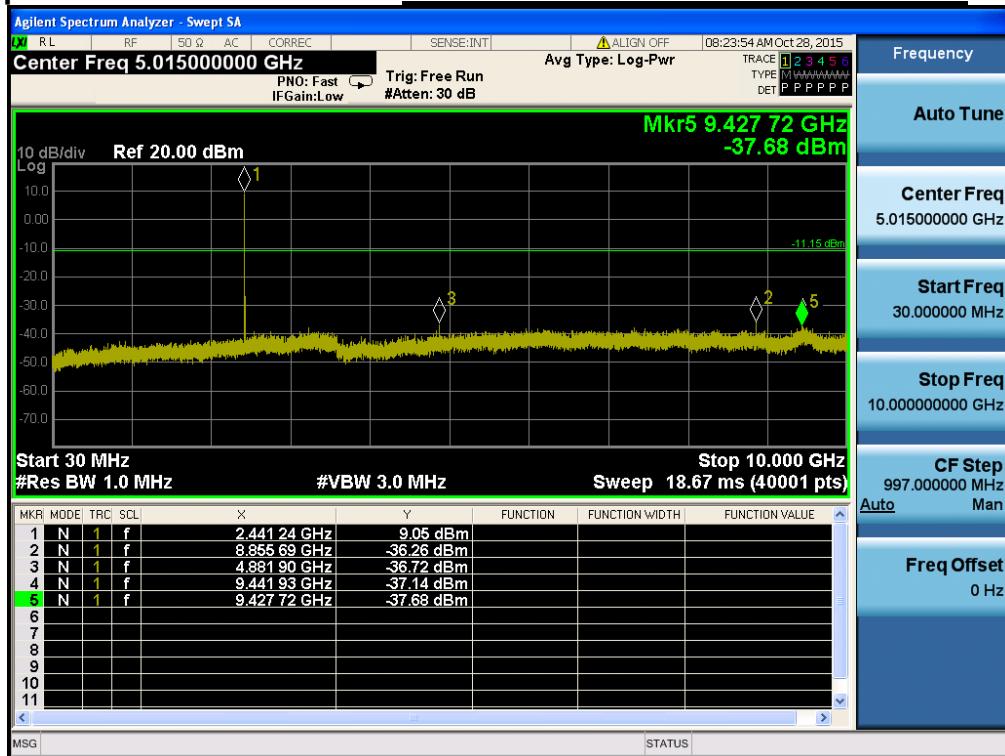
Middle Channel & Modulation : GFSK

## Conducted Spurious Emissions

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## Conducted Spurious Emissions

## Middle Channel & Modulation : GFSK



## High Band-edge

## Highest Channel &amp; Modulation : GFSK



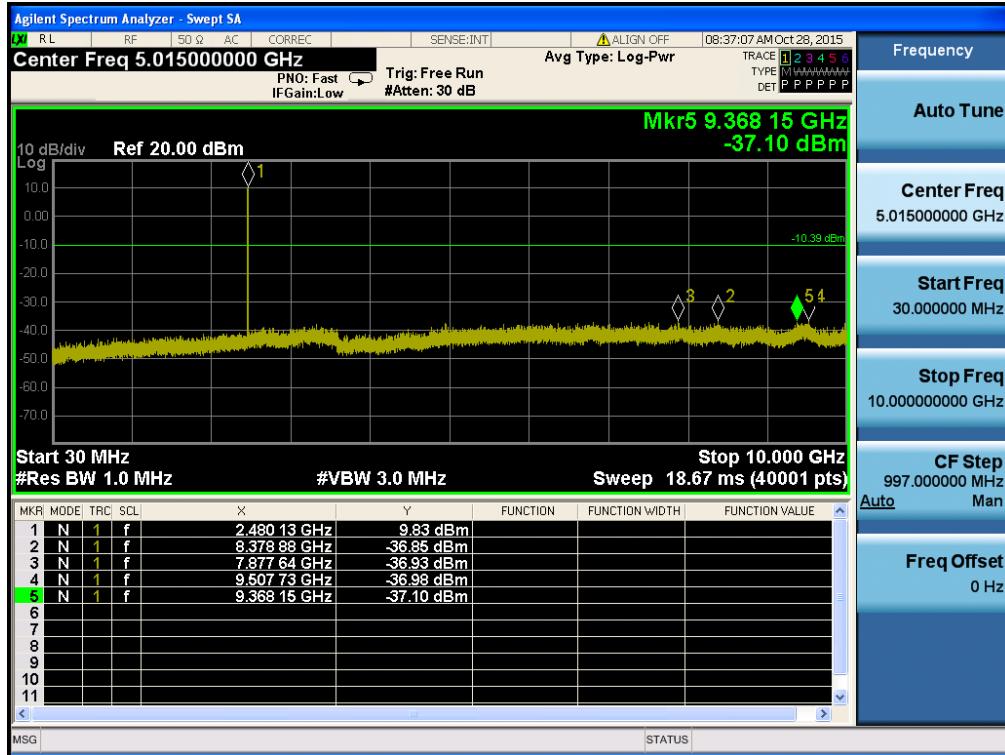
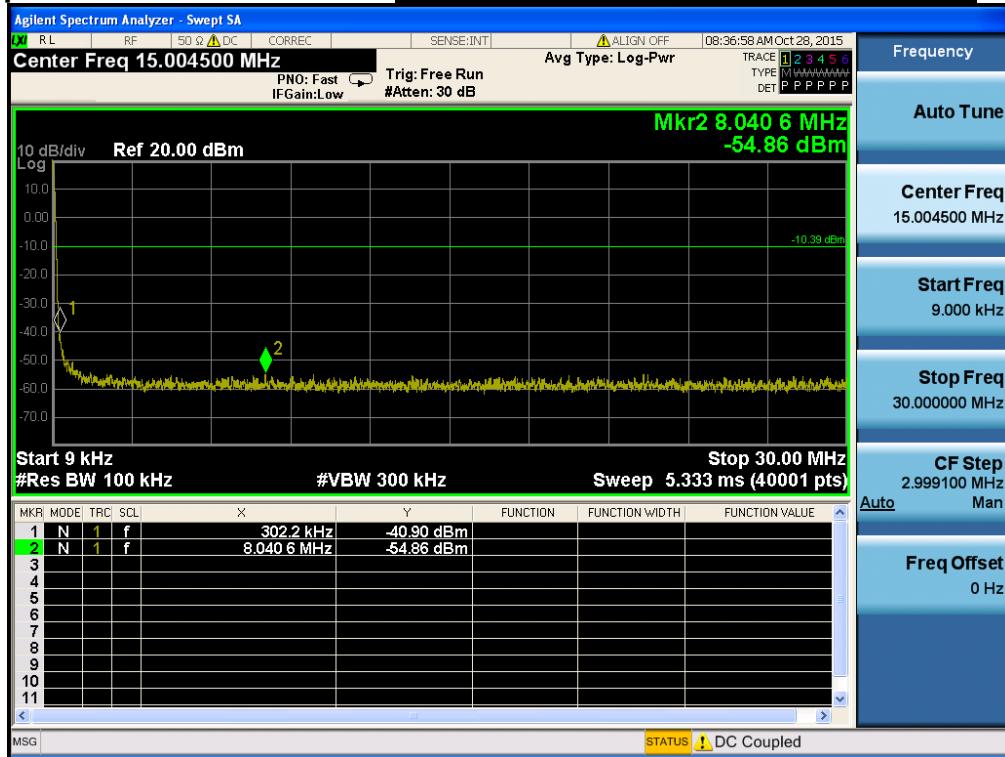
## High Band-edge

## Hopping mode &amp; Modulation : GFSK



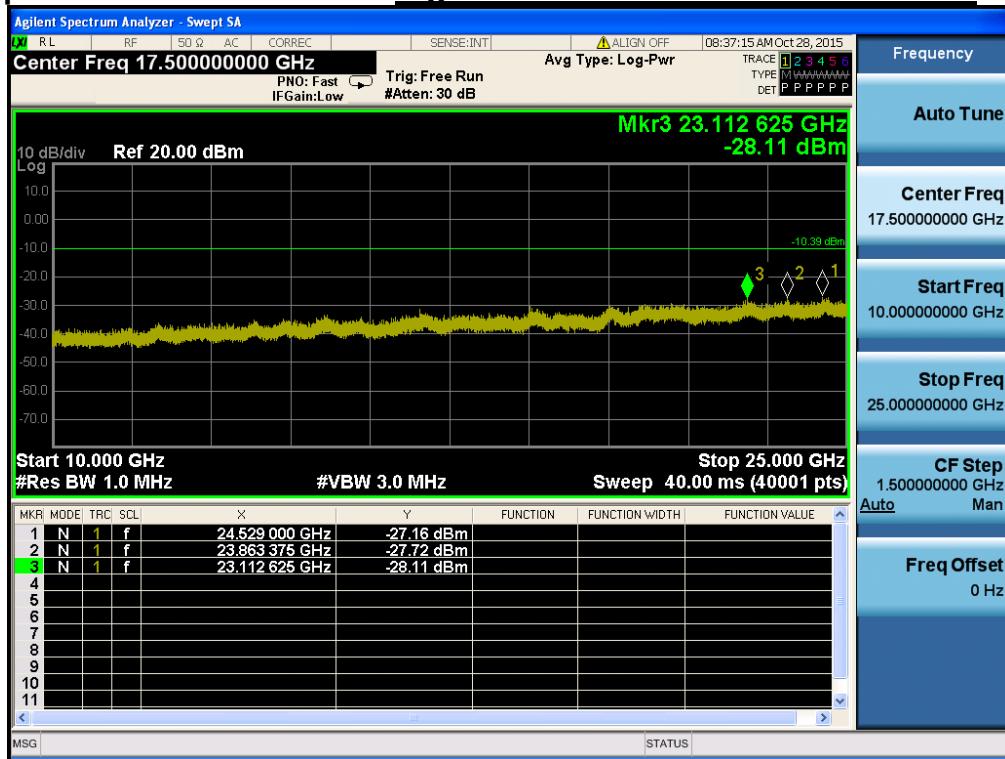
## Conducted Spurious Emissions

## Highest Channel &amp; Modulation : GFSK



## Conducted Spurious Emissions

## Highest Channel &amp; Modulation : GFSK



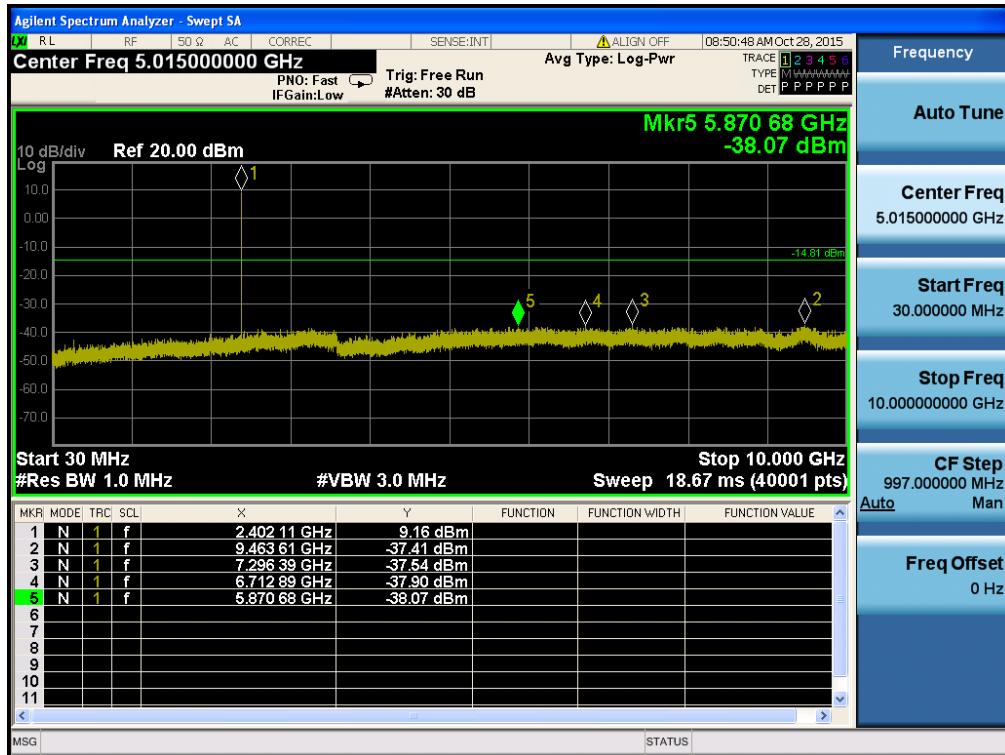
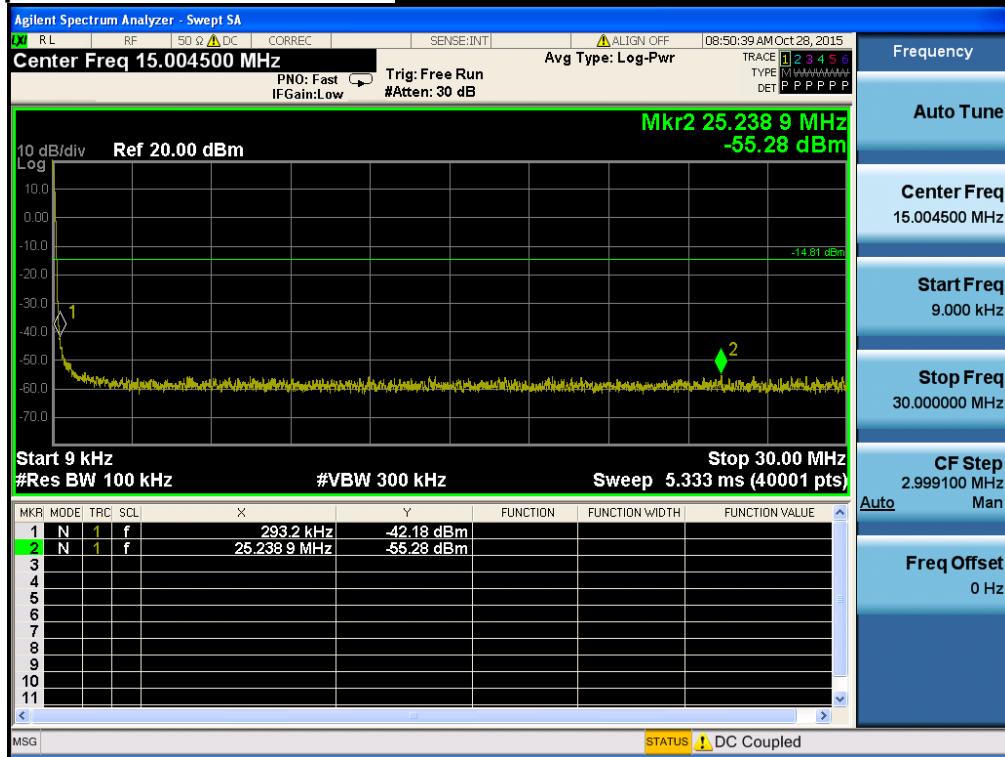
## Low Band-edge

Lowest Channel & Modulation :  $\pi/4$ DQPSK

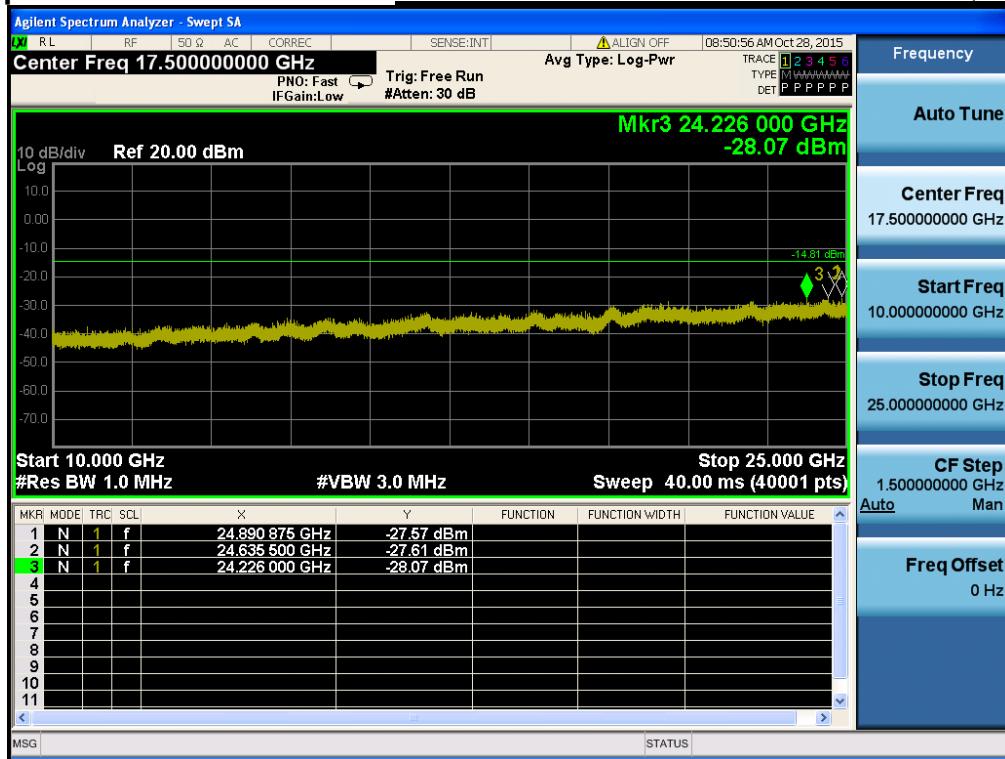
## Low Band-edge

Hopping mode & Modulation :  $\pi/4$ DQPSK

## Conducted Spurious Emissions

Lowest Channel & Modulation :  $\pi/4$ DQPSK

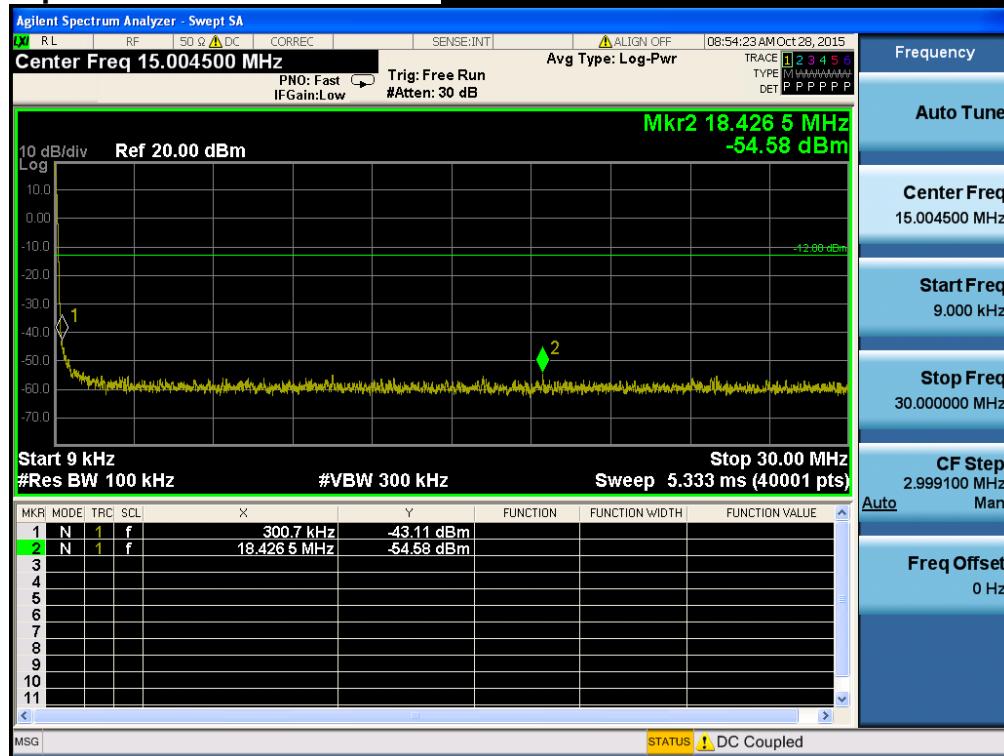
## Conducted Spurious Emissions

Lowest Channel & Modulation :  $\pi/4$ DQPSK

## Reference for limit

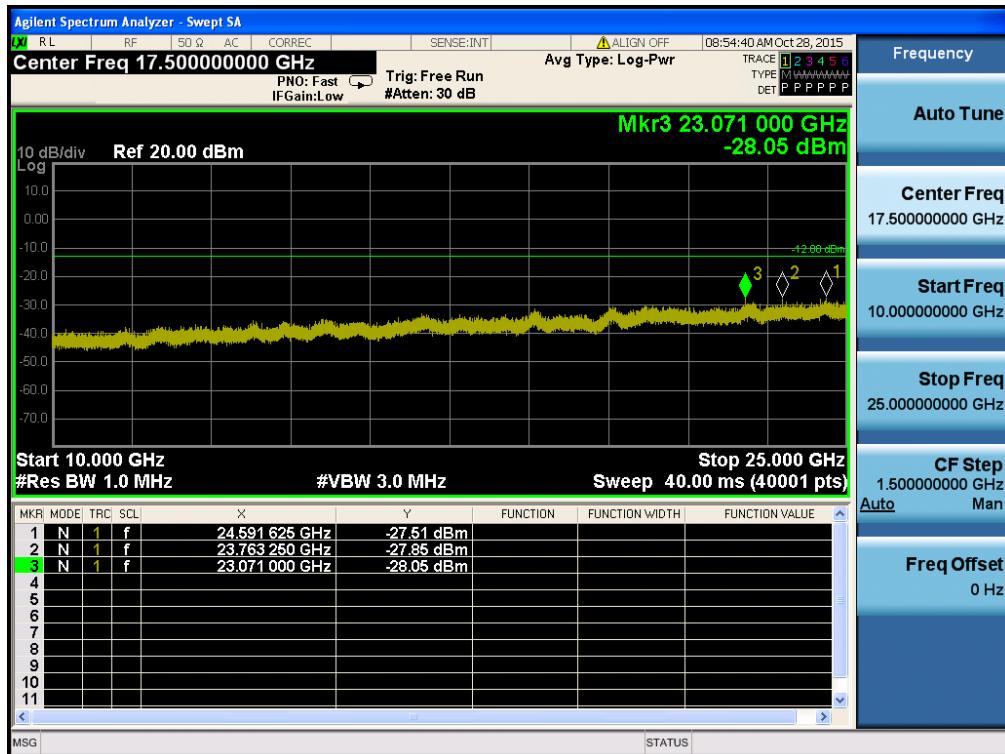
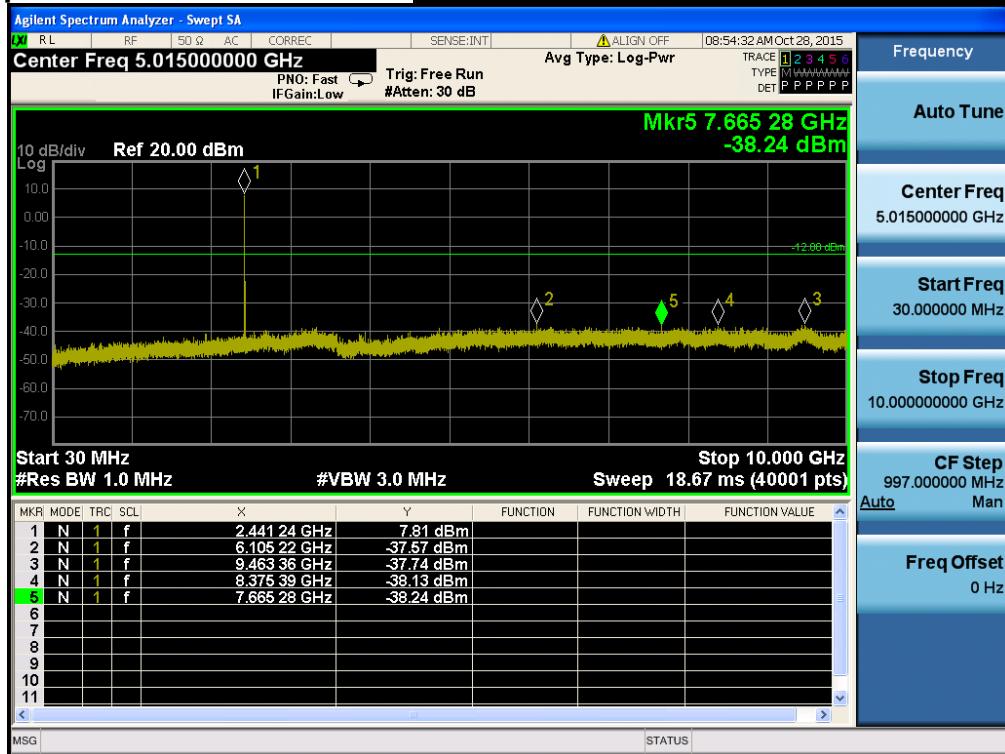
Middle Channel & Modulation :  $\pi/4$ DQPSK

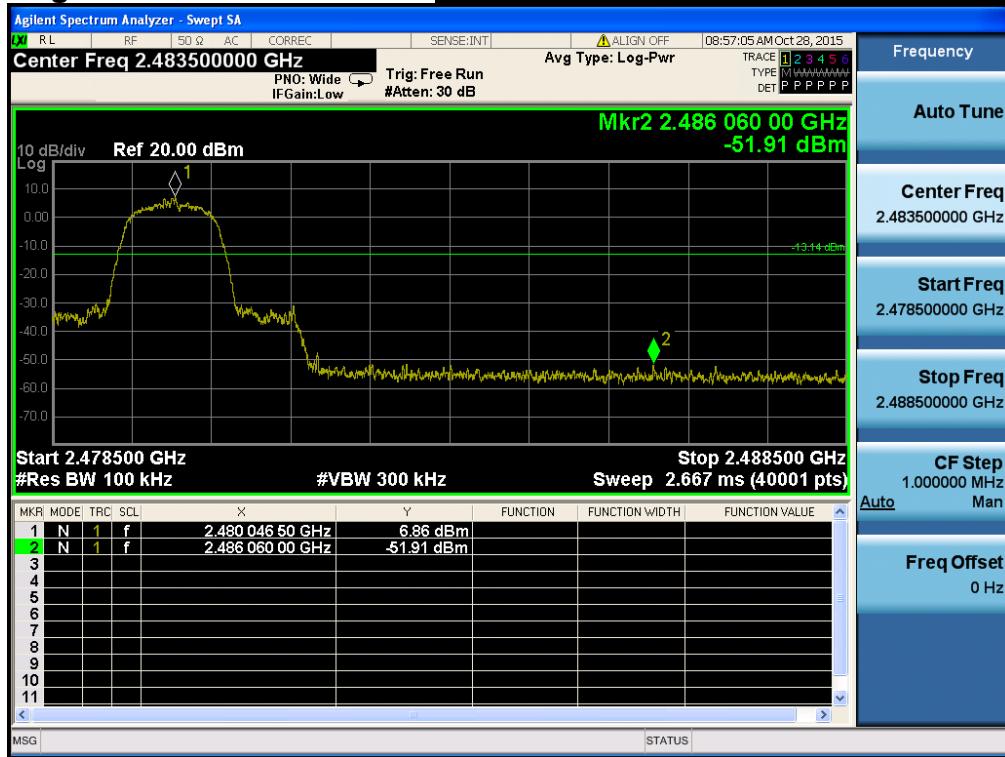
## Conducted Spurious Emissions

Middle Channel & Modulation :  $\pi/4$ DQPSK

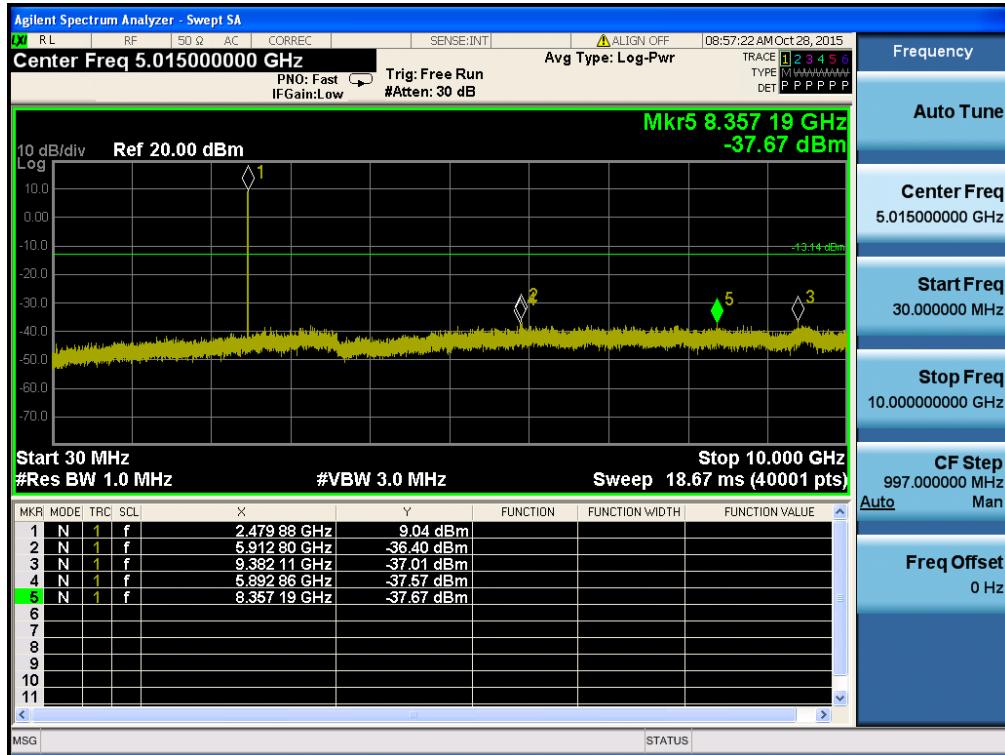
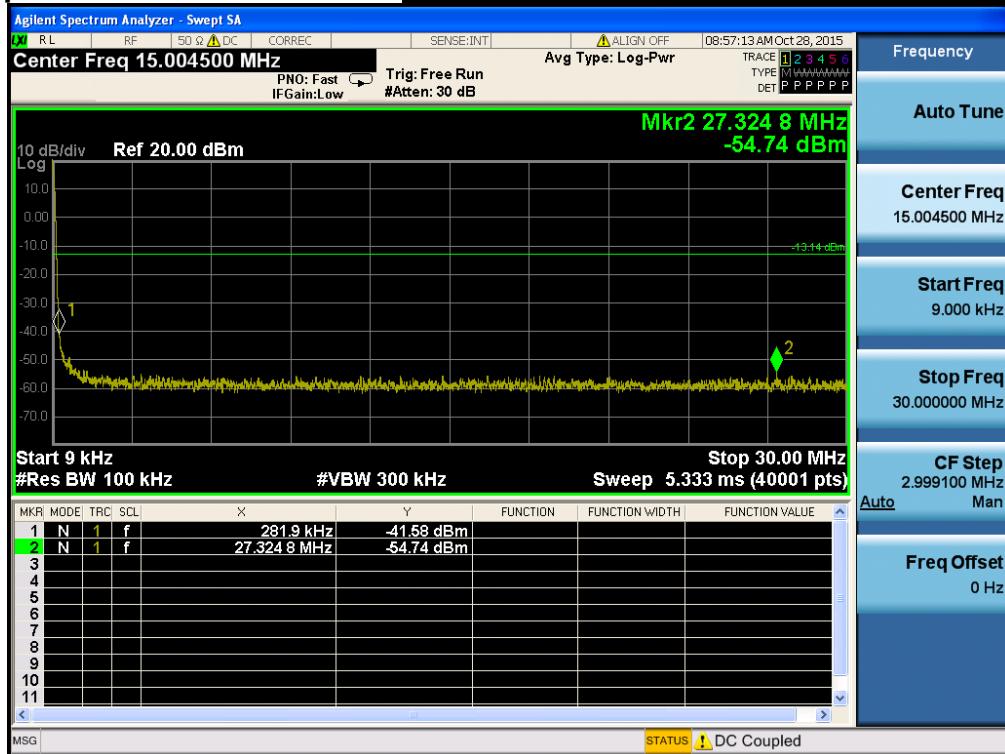
## Conducted Spurious Emissions

## Middle Channel & Modulation : $\pi/4$ DQPSK

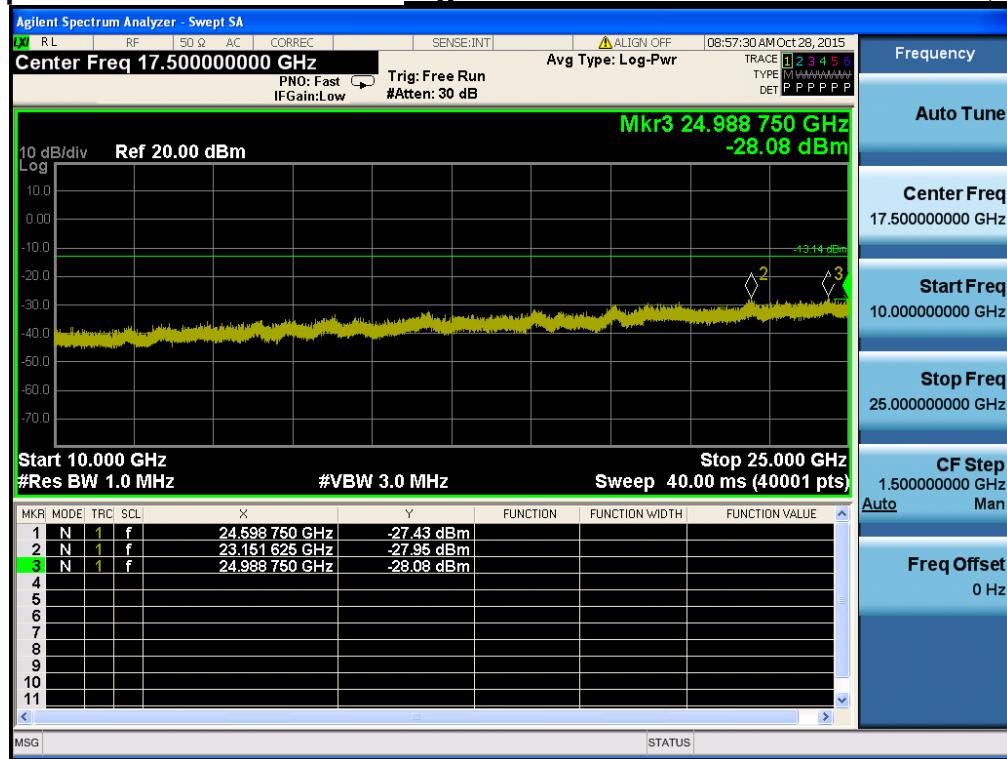


**High Band-edge****Highest Channel & Modulation :  $\pi/4$ DQPSK****High Band-edge****Hopping mode & Modulation :  $\pi/4$ DQPSK**

## Conducted Spurious Emissions

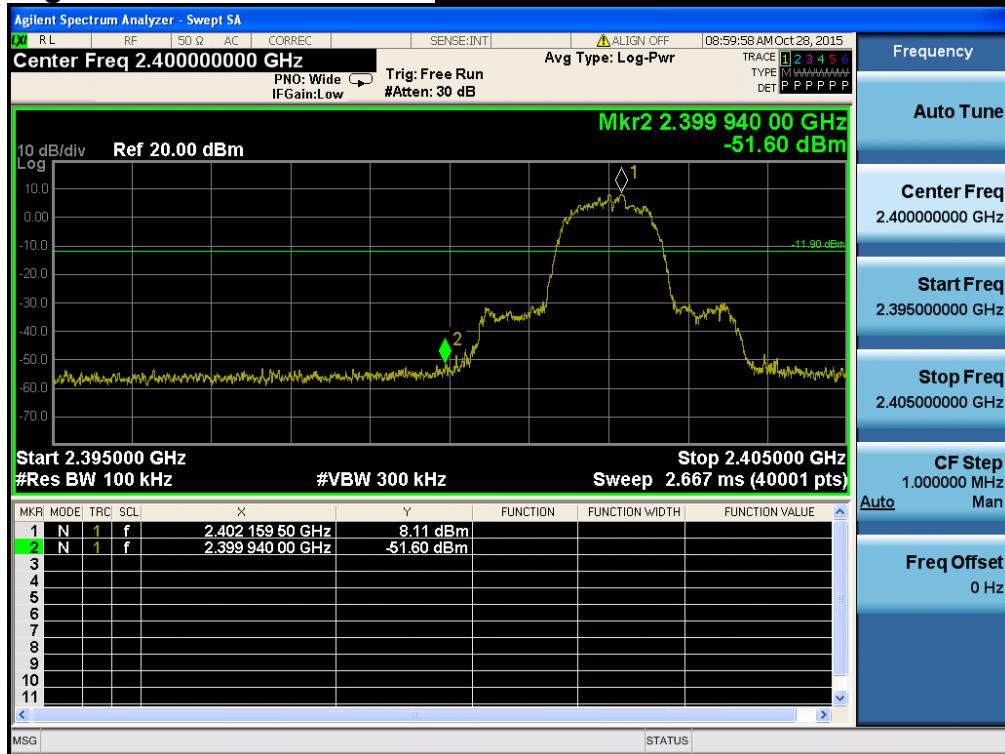
Highest Channel & Modulation :  $\pi/4$ DQPSK

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Highest Channel & Modulation :  $\pi/4$ DQPSK

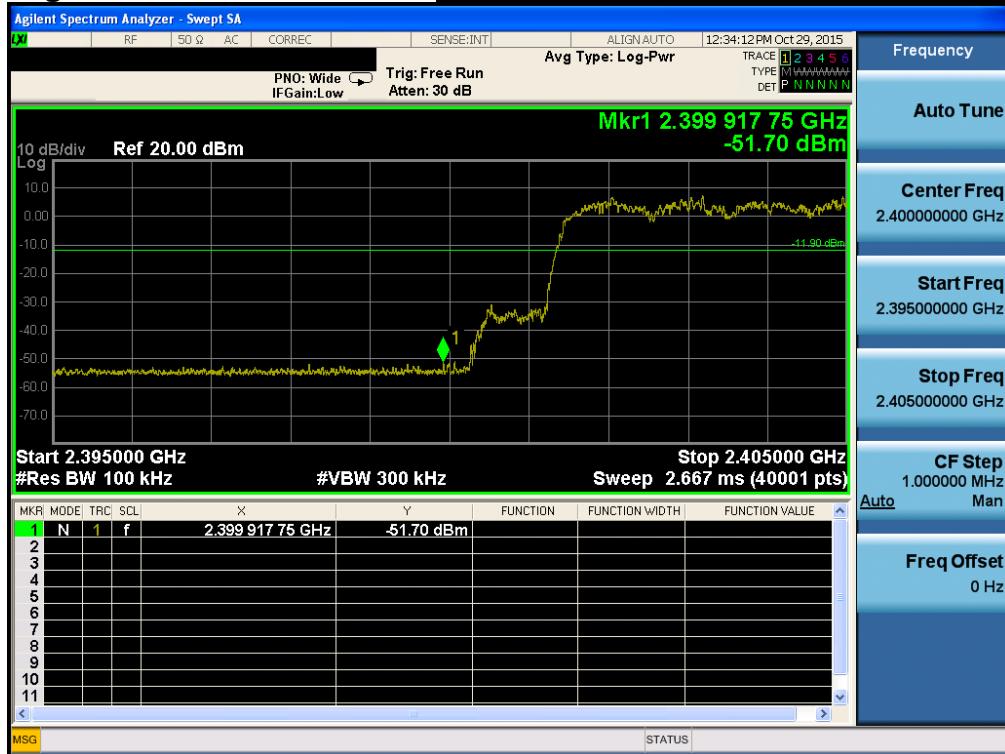
## Low Band-edge

## Lowest Channel &amp; Modulation : 8DPSK



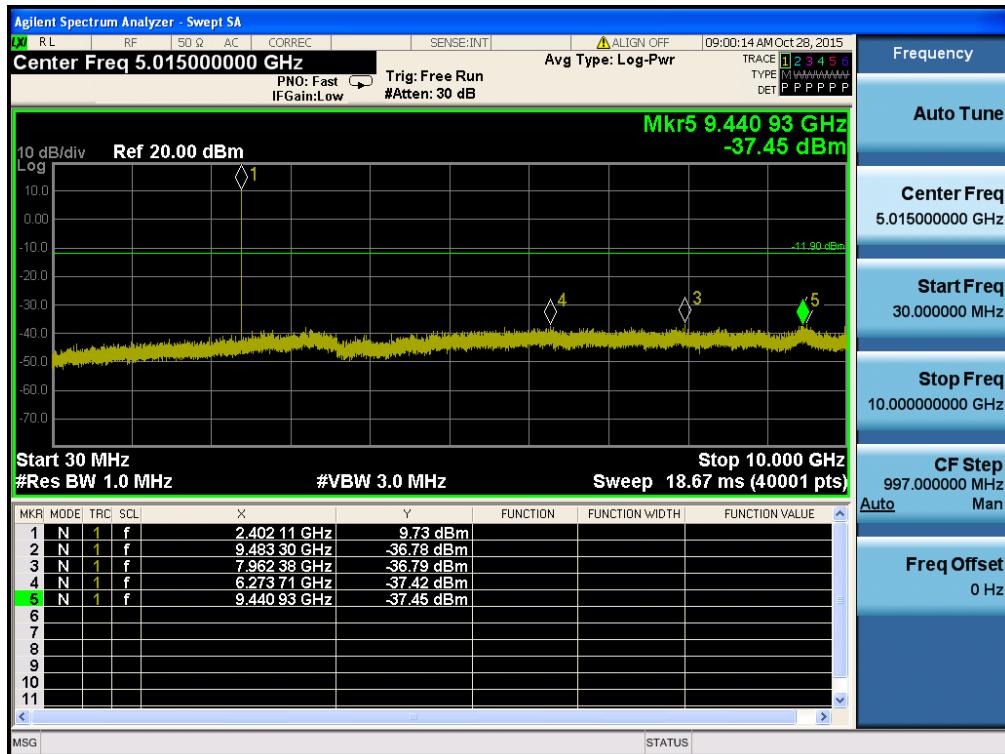
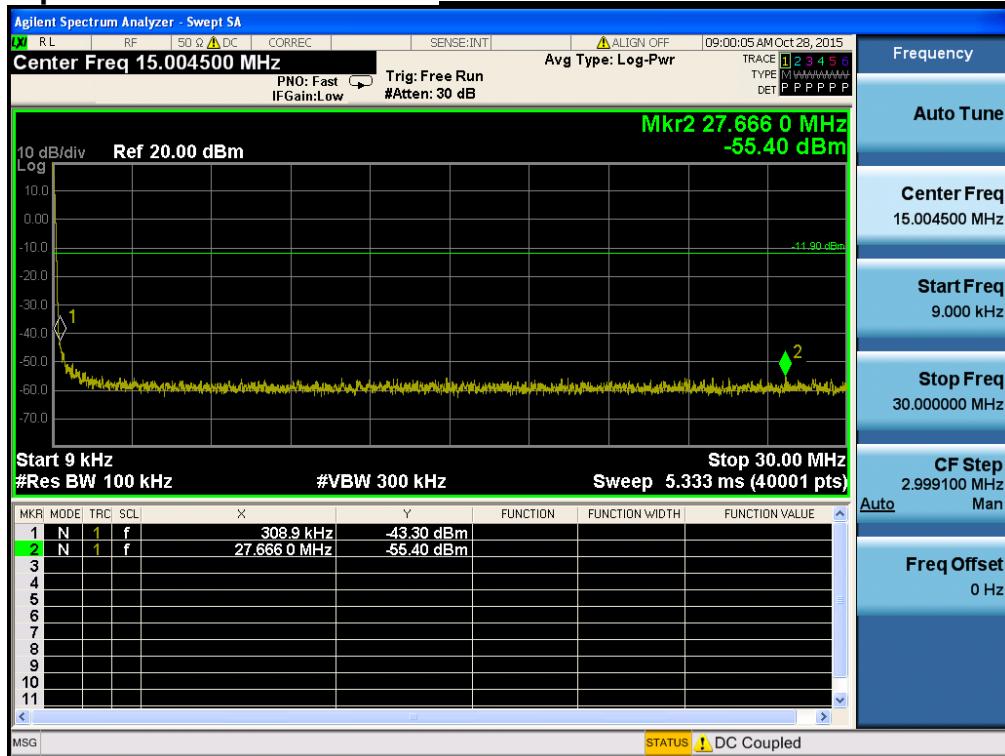
## Low Band-edge

## Hopping mode &amp; Modulation : 8DPSK



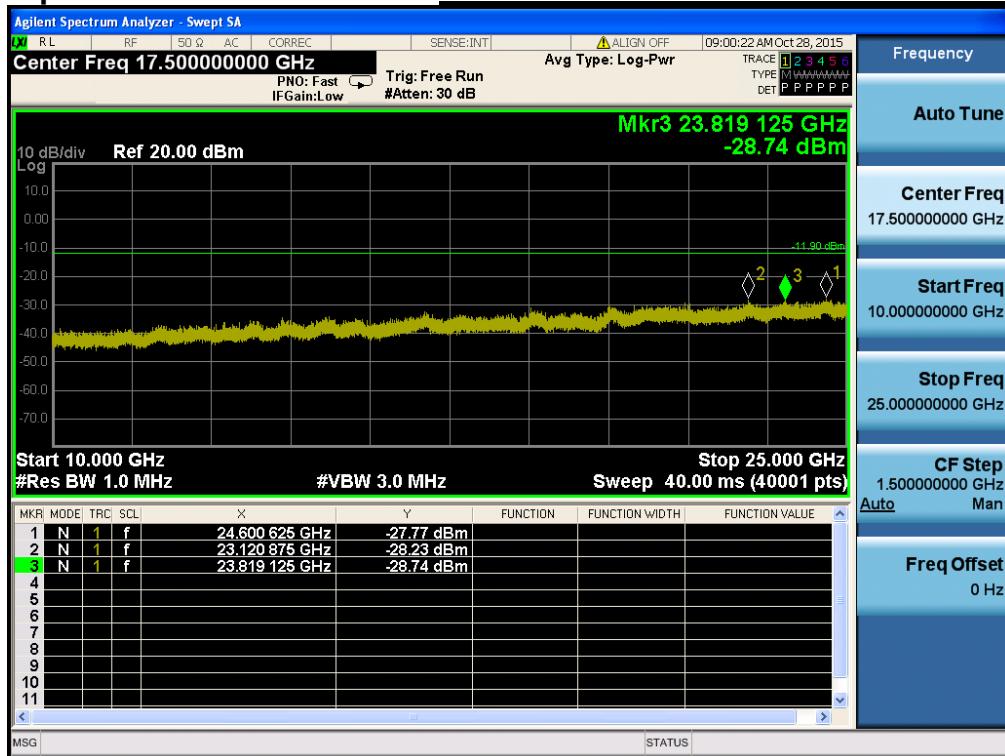
## Conducted Spurious Emissions

## Lowest Channel &amp; Modulation : 8DPSK



## Conducted Spurious Emissions

## Lowest Channel &amp; Modulation : 8DPSK



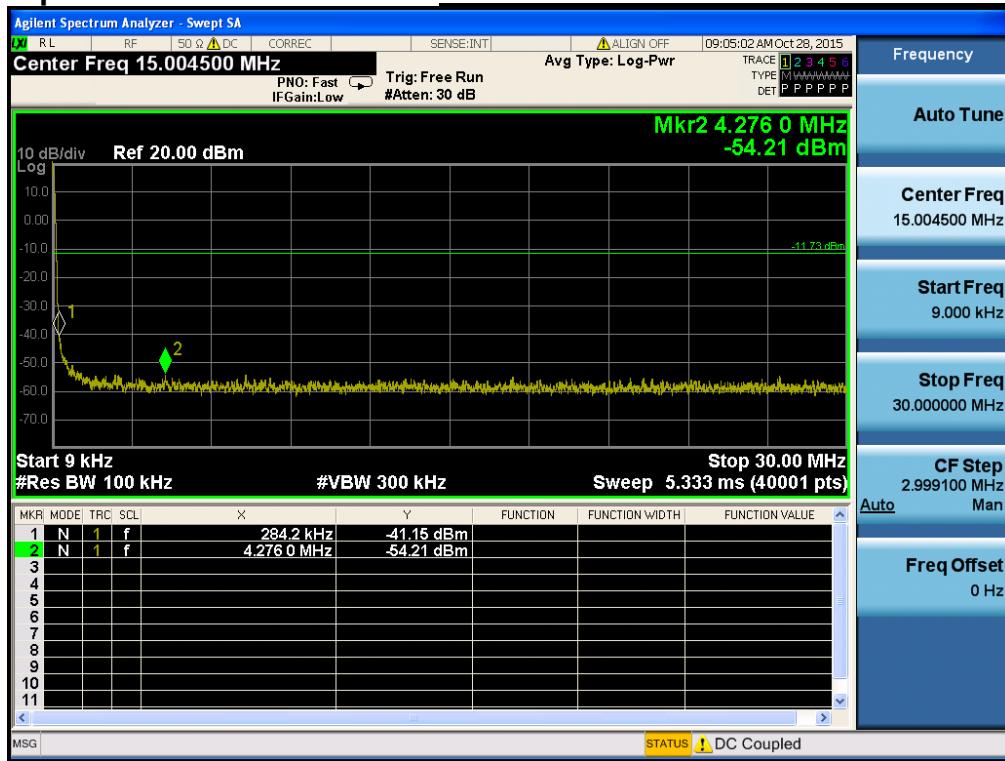
## Reference for limit

## Middle Channel &amp; Modulation : 8DPSK



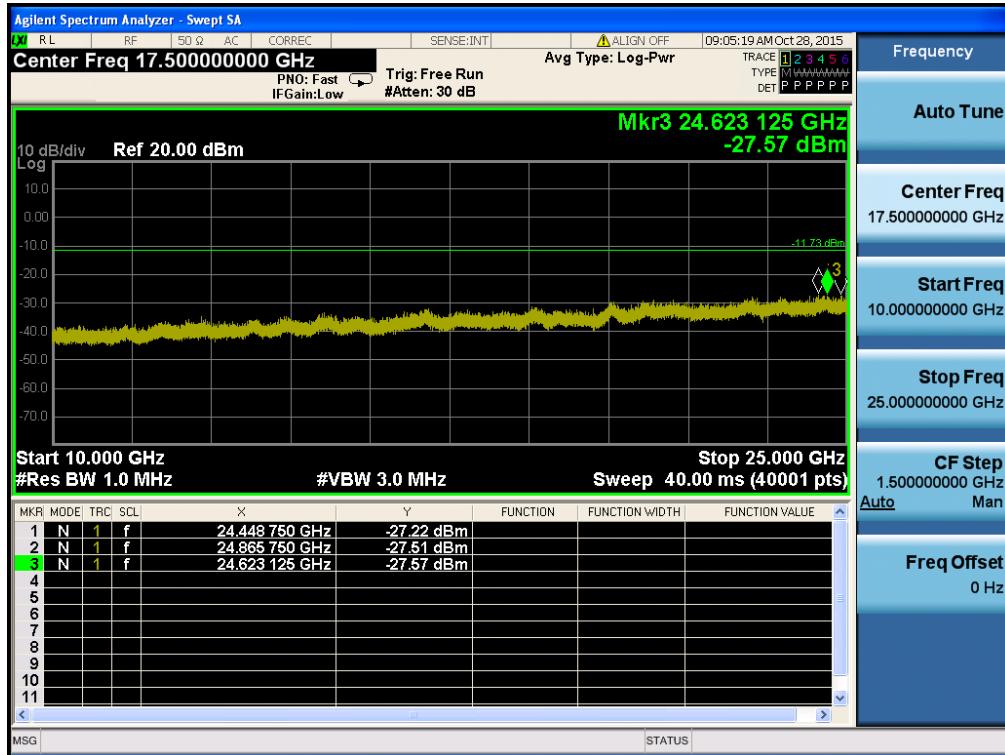
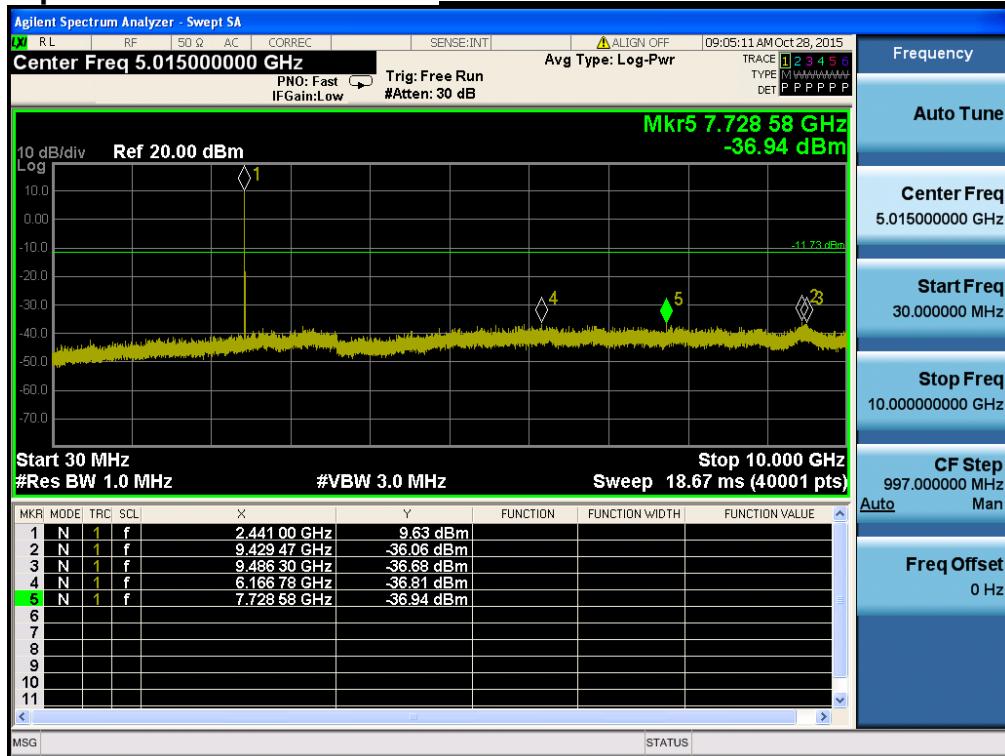
## Conducted Spurious Emissions

## Middle Channel &amp; Modulation : 8DPSK



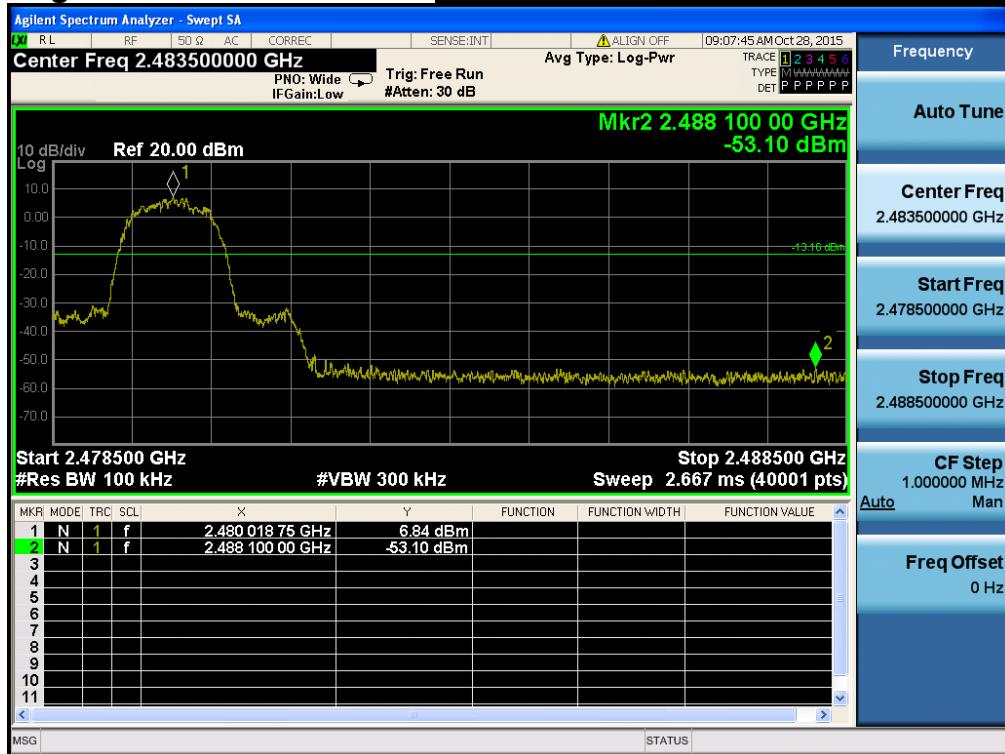
## Conducted Spurious Emissions

## Middle Channel &amp; Modulation : 8DPSK



## High Band-edge

## Highest Channel &amp; Modulation : 8DPSK



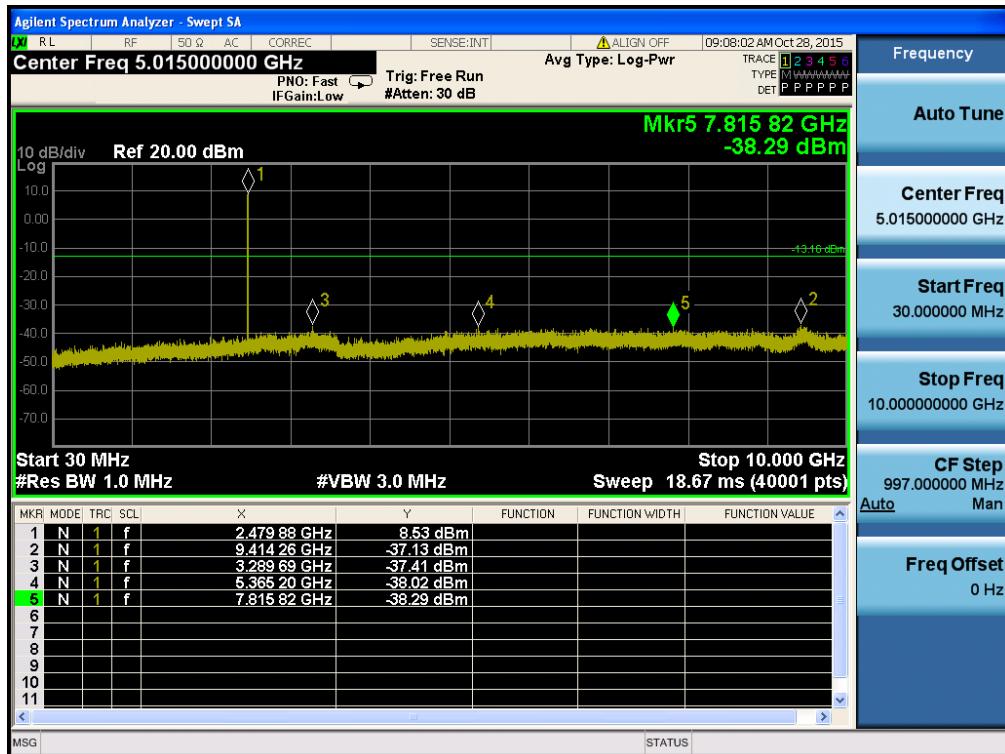
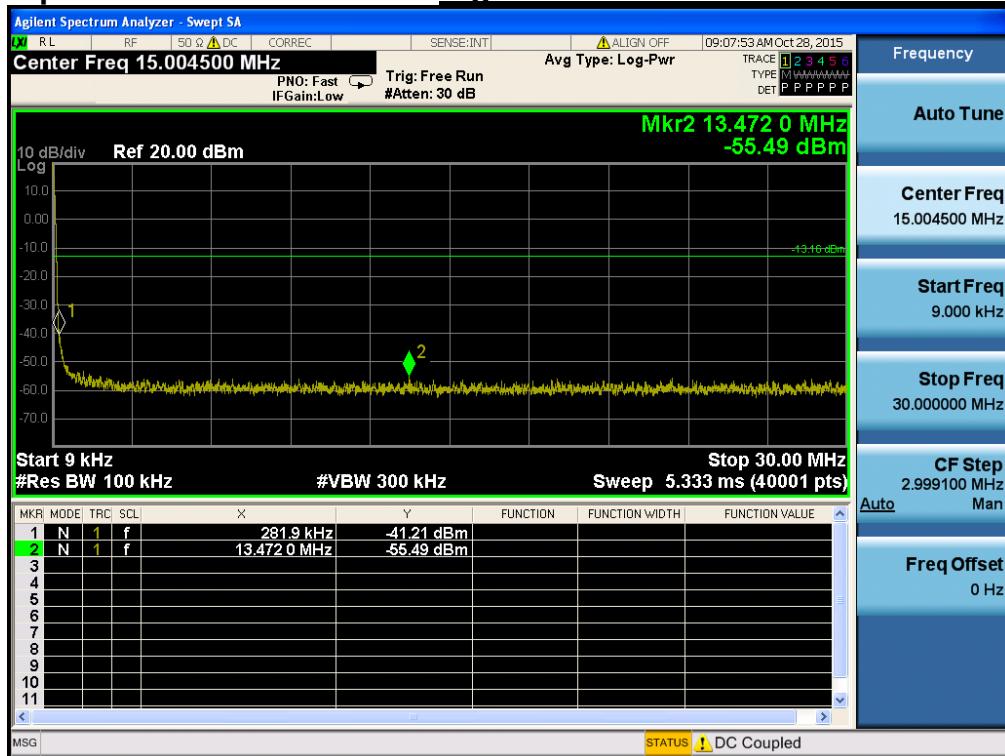
## High Band-edge

## Hopping mode &amp; Modulation : 8DPSK



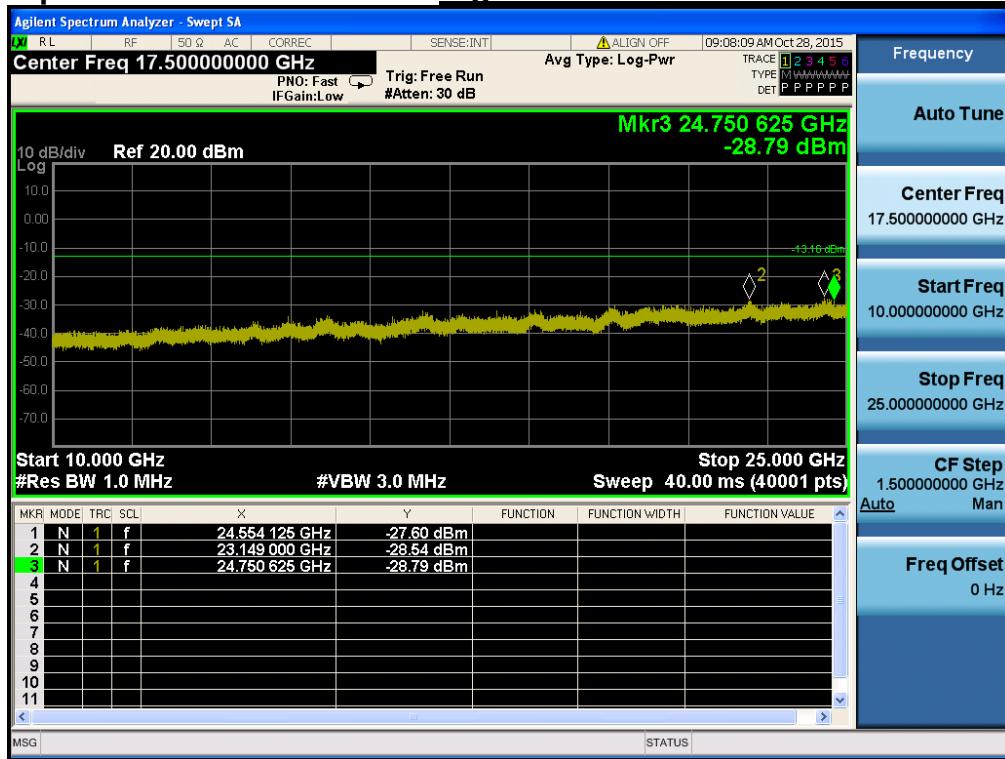
## Conducted Spurious Emissions

## Highest Channel &amp; Modulation : 8DPSK



## Conducted Spurious Emissions

## Highest Channel &amp; Modulation : 8DPSK



## 8. Transmitter AC Power Line Conducted Emission

### 8.1 Test Setup

Refer to test setup photo.

### 8.2 Limit

According to §15.207(a) for 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 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	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

### 8.3 Test Procedures

Conducted emissions from the EUT were measured according to the ANSI C63.10.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

## 8.4 Test Results

### AC Line Conducted Emissions (Graph) = Modulation : GFSK

#### Results of Conducted Emission

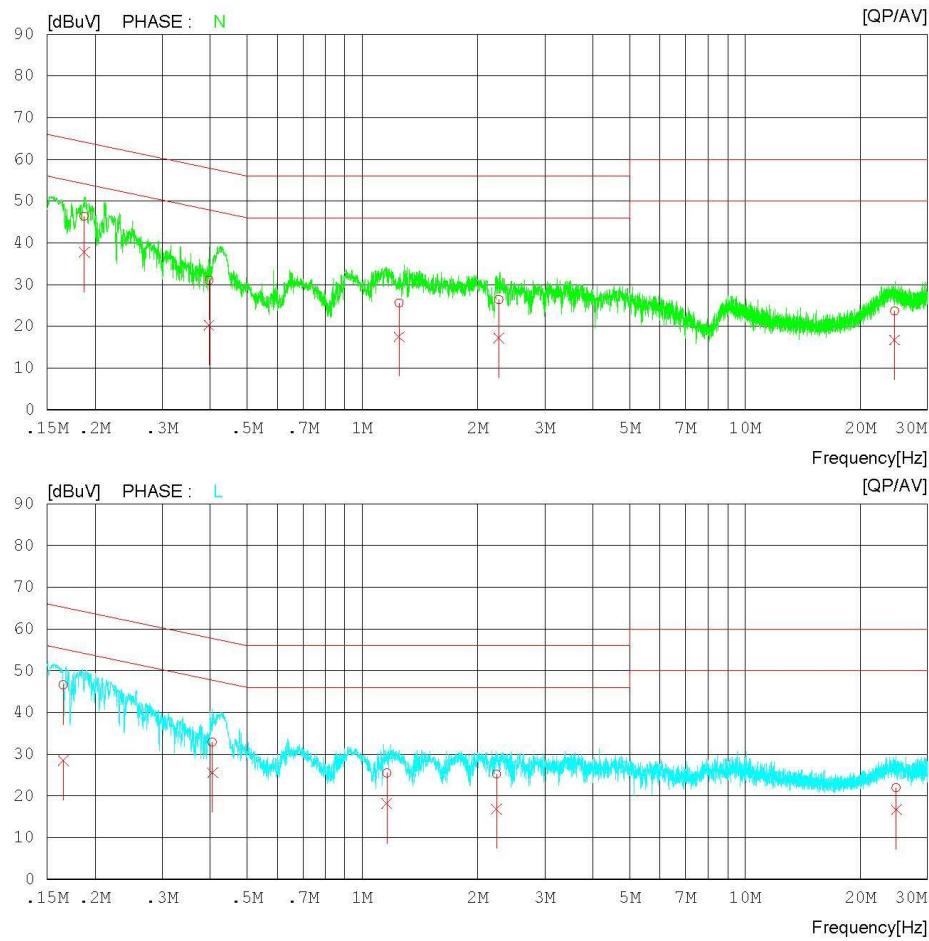
DTNC

Date : 2015-10-26

Order No. : PM80  
 Model No. : Identical prototype  
 Serial No. :  
 Test Condition : 2.4GHz\_BT

Reference No.  
 Power Supply : 120 V / 60 Hz  
 Temp/Humi. : 24 °C / 48 % R.H.  
 Operator : J. J. LEE

Memo : 1M\_HOP

LIMIT : FCC P15.207 QP  
 FCC P15.207 AV

**AC Line Conducted Emissions (List) = Modulation : GFSK**

## Results of Conducted Emission

DTNC

Date : 2015-10-26

Order No.	:		Referrence No.	:	
Model No.	:	PM80	Power Supply	:	120 V / 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C / 48 % R.H.
Test Condition	:	2.4GHz_BT	Operator	:	J. J. LEE
Memo :			1M_HOP		

LIMIT : FCC P15.207 QP  
FCC P15.207 AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.18748	36.3	27.7	10.1	46.4	37.8	64.1	54.1	17.7	16.3	N
2	0.39741	20.9	10.2	10.1	31.0	20.3	57.9	47.9	26.9	27.6	N
3	1.24820	15.4	7.3	10.2	25.6	17.5	56.0	46.0	30.4	28.5	N
4	2.27440	16.1	7.0	10.2	26.3	17.2	56.0	46.0	29.7	28.8	N
5	24.60100	12.7	5.8	10.9	23.6	16.7	60.0	50.0	36.4	33.3	N
6	0.16550	36.4	18.4	10.1	46.5	28.5	65.2	55.2	18.7	26.7	L
7	0.40552	22.7	15.4	10.1	32.8	25.5	57.7	47.7	24.9	22.2	L
8	1.15860	15.2	7.9	10.2	25.4	18.1	56.0	46.0	30.6	27.9	L
9	2.24120	14.9	6.7	10.2	25.1	16.9	56.0	46.0	30.9	29.1	L
10	24.85900	10.8	5.5	11.1	21.9	16.6	60.0	50.0	38.1	33.4	L

## 9. Antenna Requirement

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

### Conclusion: **Comply**

**The internal antenna is attached on the main PCB using the special spring tension. (Refer to Internal Photo file.)**

#### - Minimum Standard :

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

## 10. Occupied Bandwidth (99 %)

### 10.1 Test Setup

Refer to the APPENDIX I.

### 10.2 Limit

Limit : Not Applicable

### 10.3 Test Procedure

The 99 % power bandwidth was measured with a calibrated spectrum analyzer.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately  $3 \times$  RBW.

Spectrum analyzer plots are included on the following pages.

### 10.4 Test Results

Modulation	Tested Channel	99% BW (MHz)
<u>GFSK</u>	<b>Lowest</b>	0.894
	<b>Middle</b>	0.896
	<b>Highest</b>	0.899
<u><math>\pi/4</math>DQPSK</u>	<b>Lowest</b>	1.184
	<b>Middle</b>	1.186
	<b>Highest</b>	1.186
<u>8DPSK</u>	<b>Lowest</b>	1.182
	<b>Middle</b>	1.192
	<b>Highest</b>	1.185

Note 1 : See next pages for actual measured spectrum plots.

## 99% Bandwidth

## Lowest Channel &amp; Modulation : GFSK



## 99% Bandwidth

## Middle Channel &amp; Modulation : GFSK



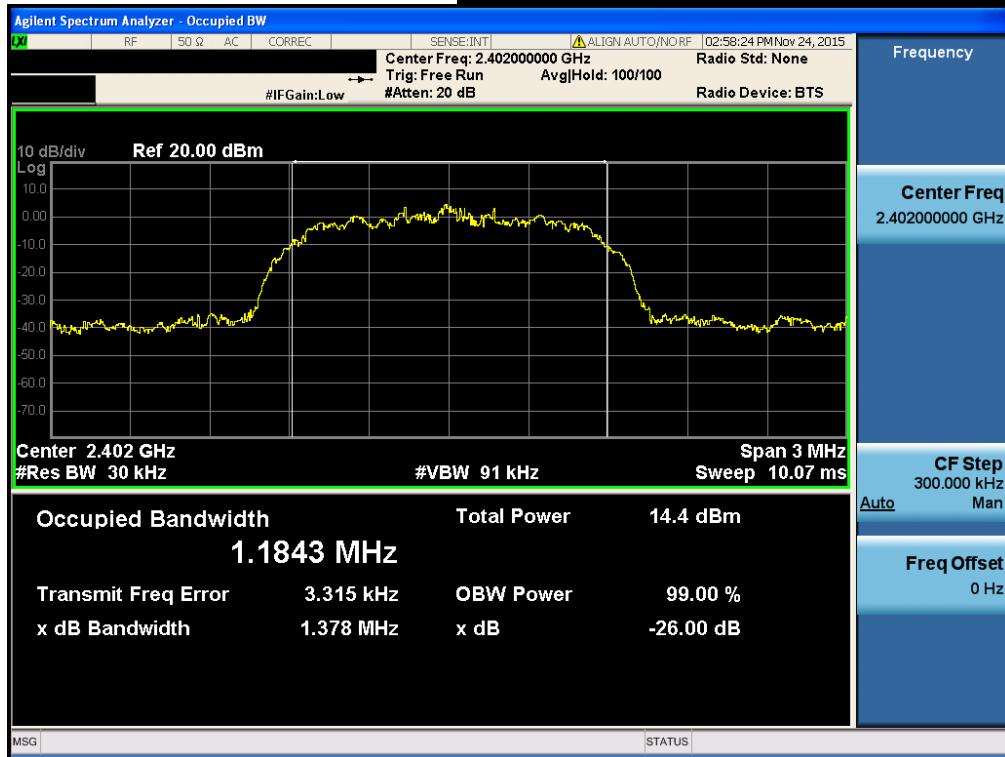
## 99% Bandwidth

## Highest Channel &amp; Modulation : GFSK



## 99% Bandwidth

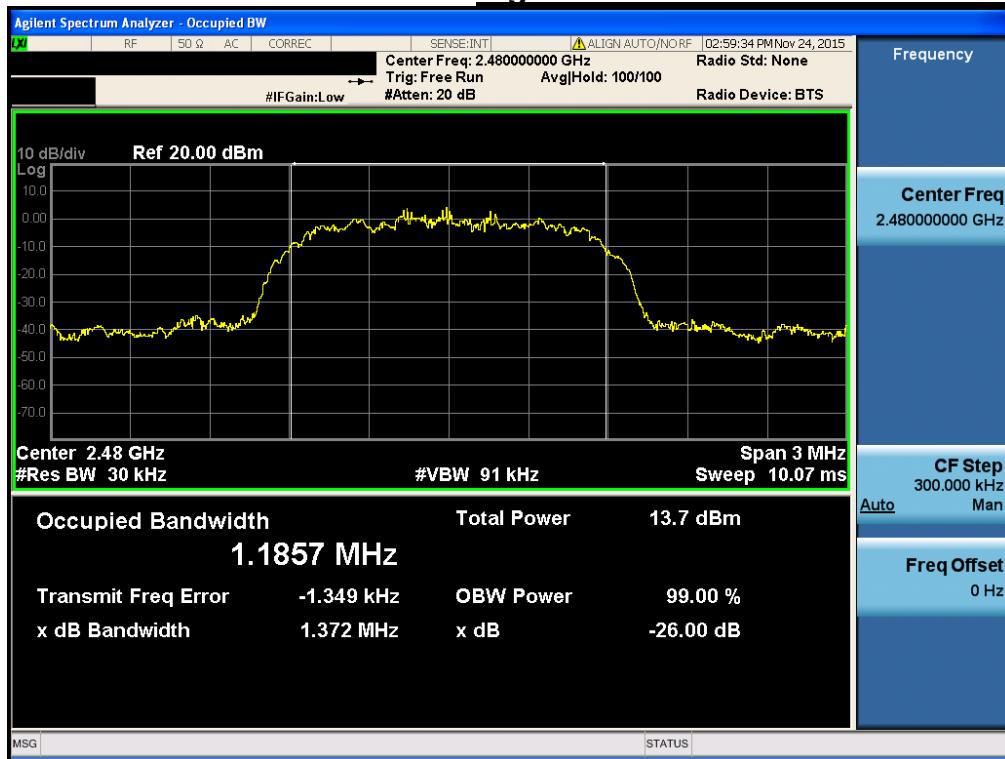
## Lowest Channel &amp; Modulation : π/4DQPSK



## 99% Bandwidth

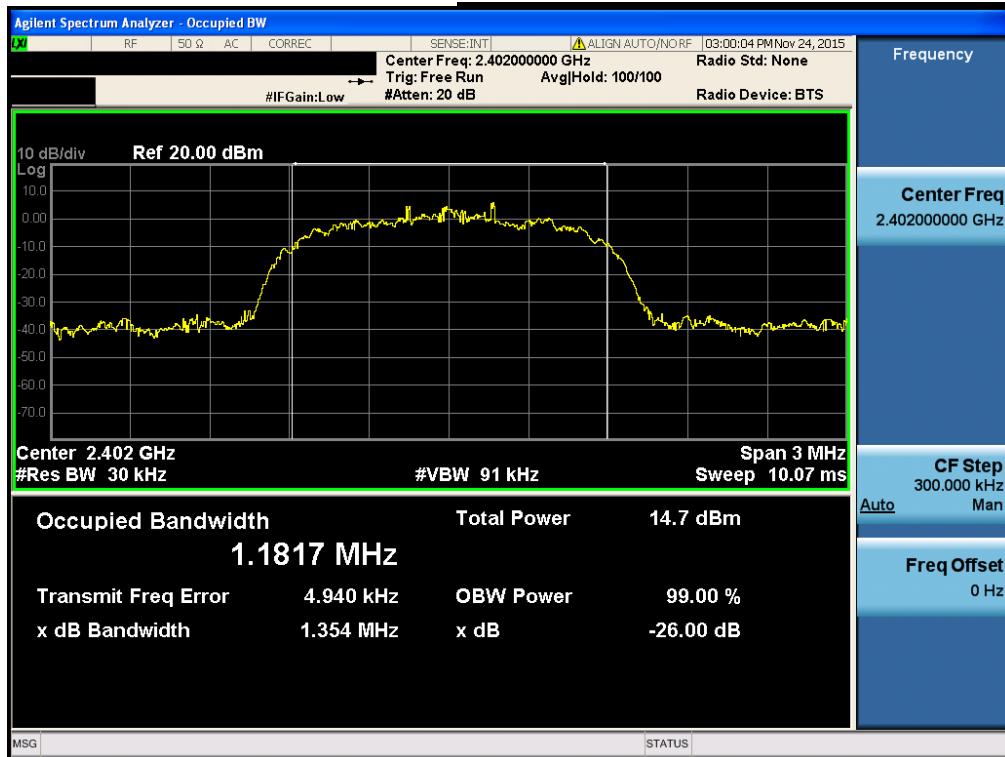
Middle Channel & Modulation :  $\pi/4$ DQPSK

## 99% Bandwidth

Highest Channel & Modulation :  $\pi/4$ DQPSK

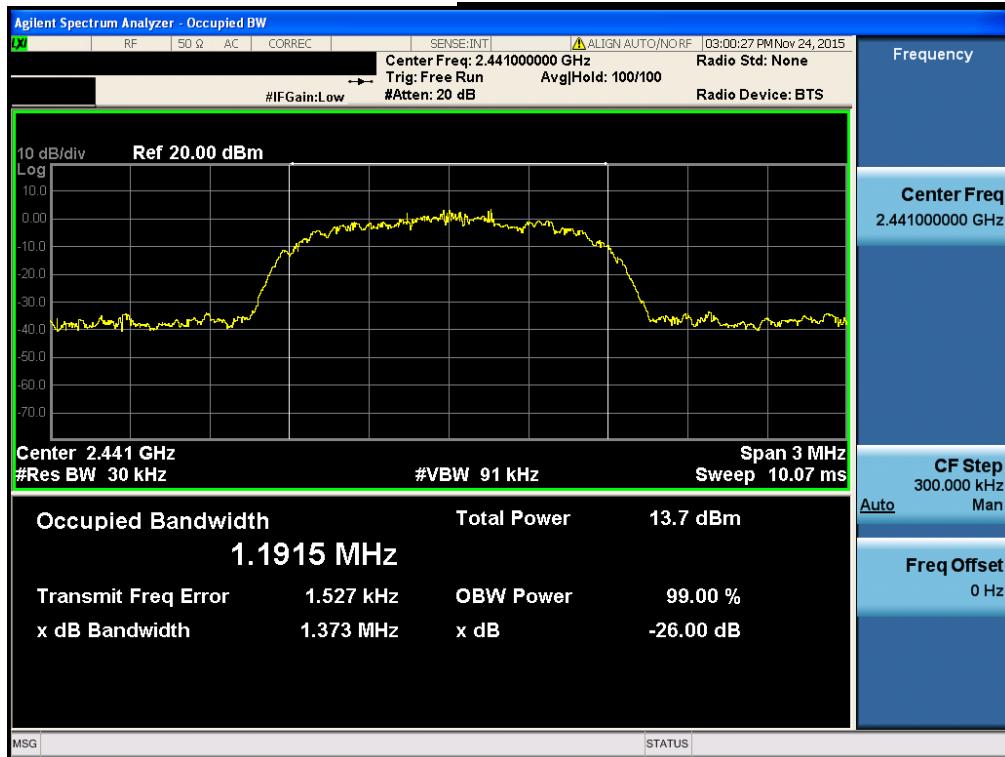
## 99% Bandwidth

## Lowest Channel &amp; Modulation : 8DPSK



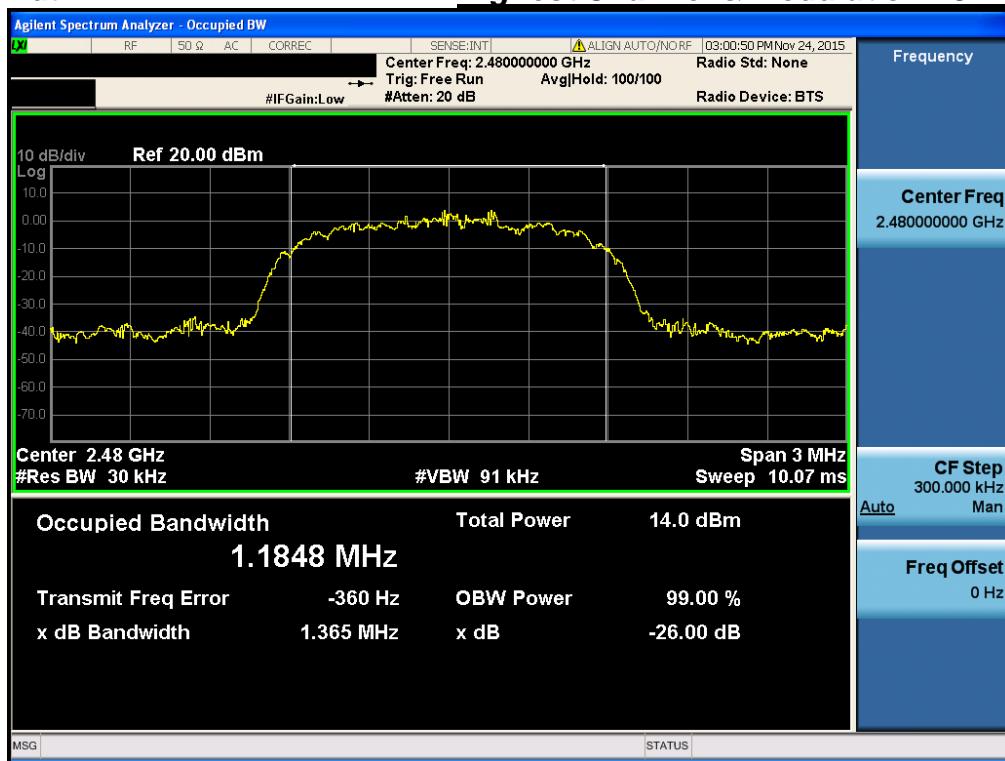
## 99% Bandwidth

## Middle Channel &amp; Modulation : 8DPSK



## 99% Bandwidth

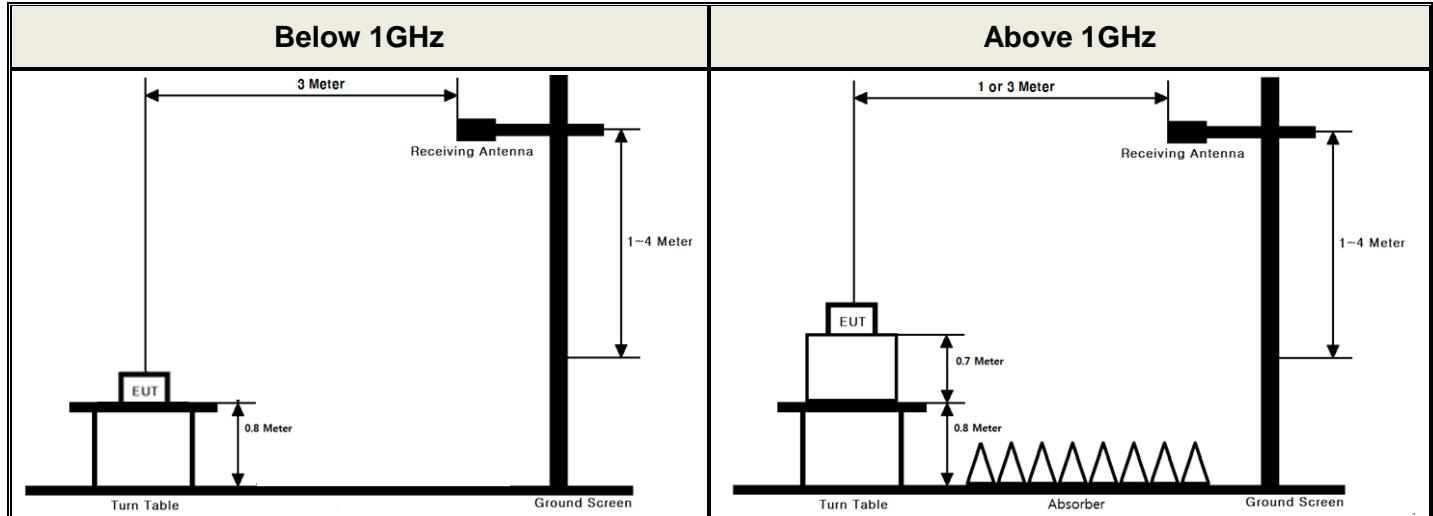
## Highest Channel &amp; Modulation : 8DPSK



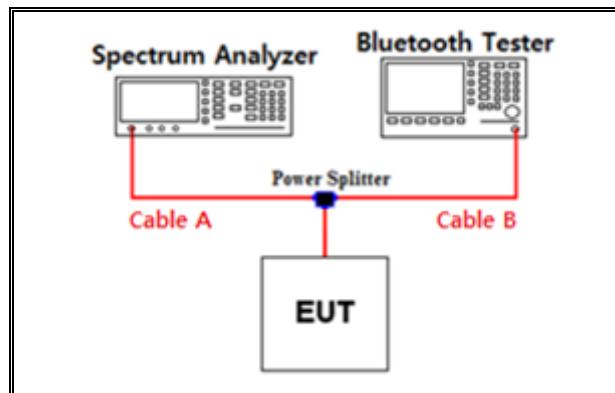
## APPENDIX I

### Test set up diagrams

#### ▪ Radiated Measurement



#### ▪ Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.30	15	10.63
1	7.35	20	11.94
2.402 & 2.440 & 2.480	7.85	25	13.22
5	9.75	-	-
10	10.35	-	-

Note 1 : The path loss from EUT to Spectrum analyzer were measured and used for test.

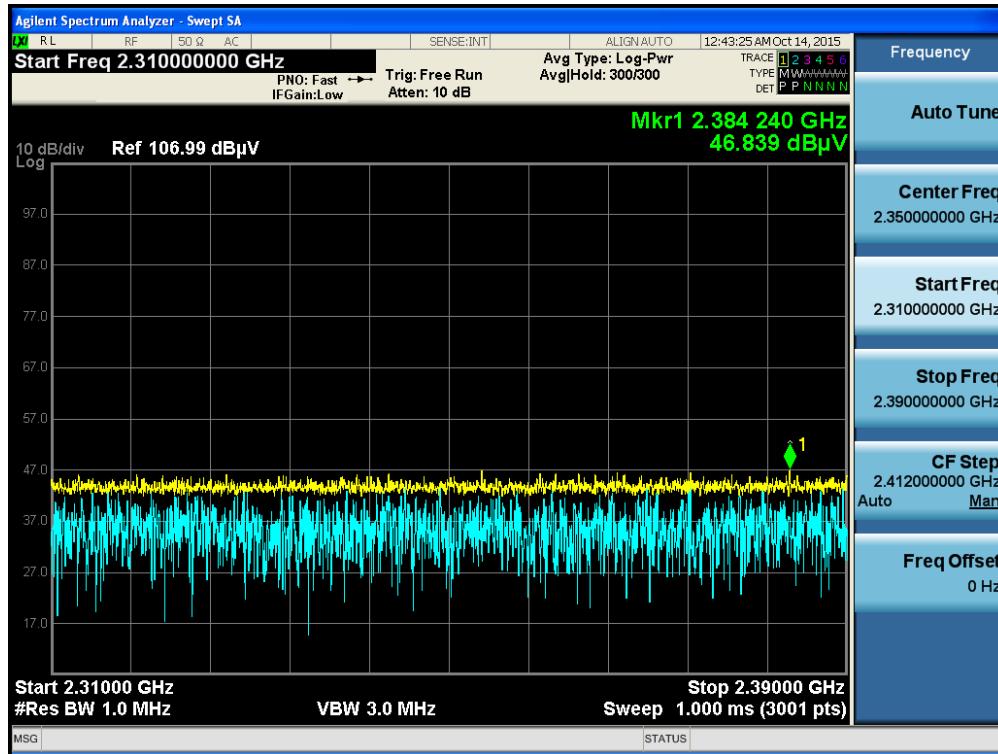
Path loss ( S/A's Correction factor) = Cable A + Power splitter

## APPENDIX II

### Unwanted Emissions (Radiated) Test Plot

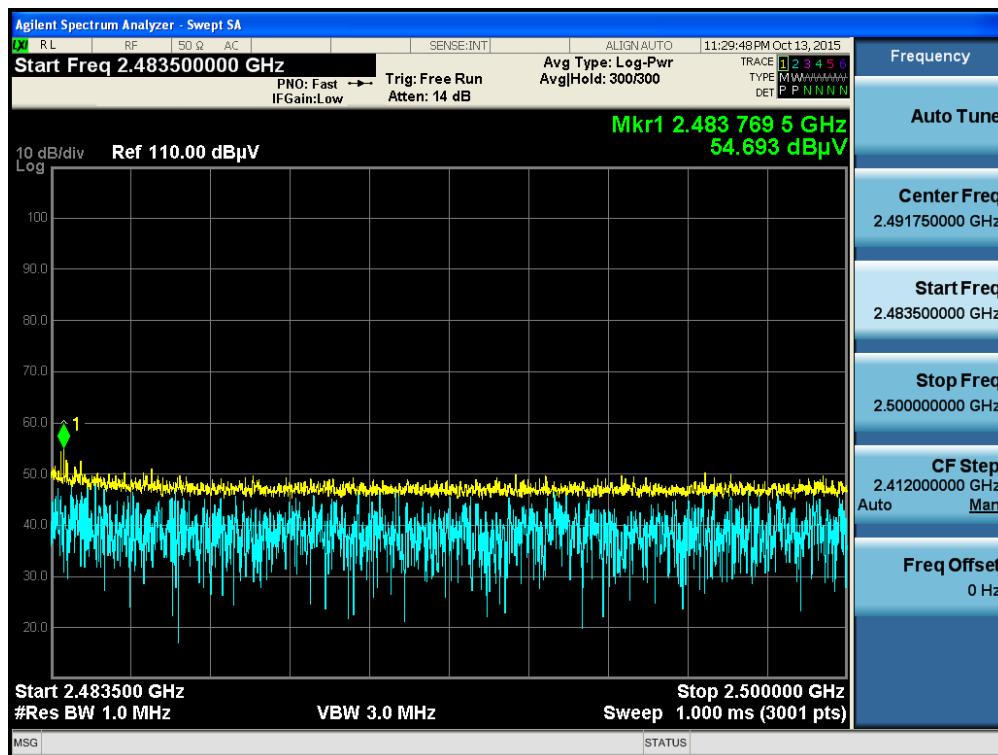
#### GFSK & Lowest & Edge

#### Detector Mode : PK



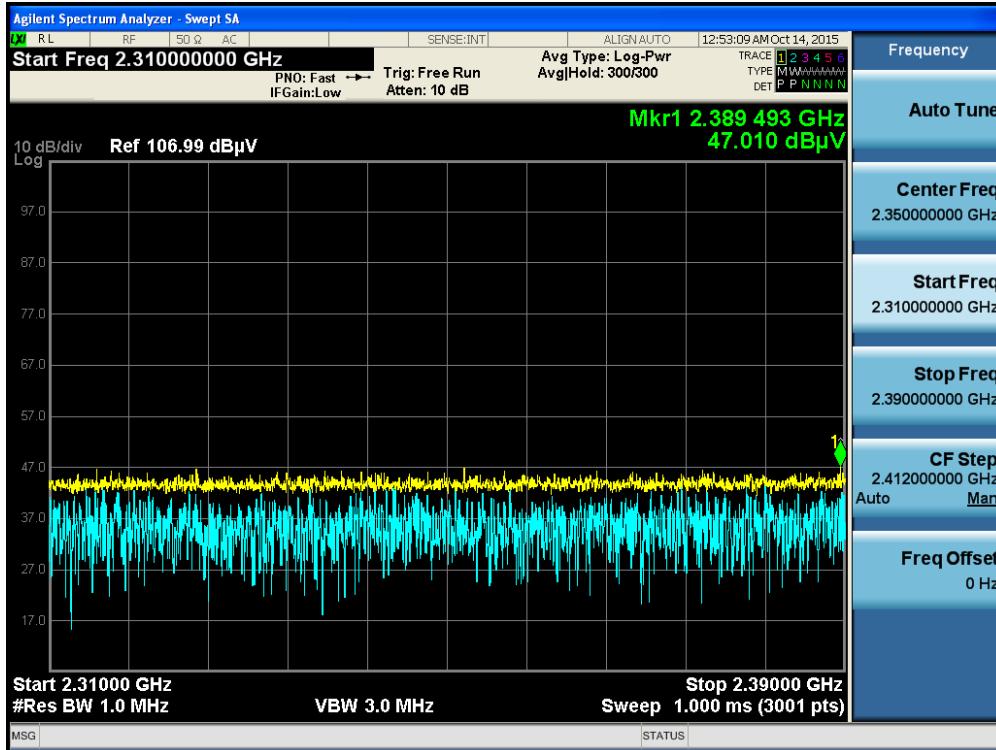
#### GFSK & Highest & Edge

#### Detector Mode : PK

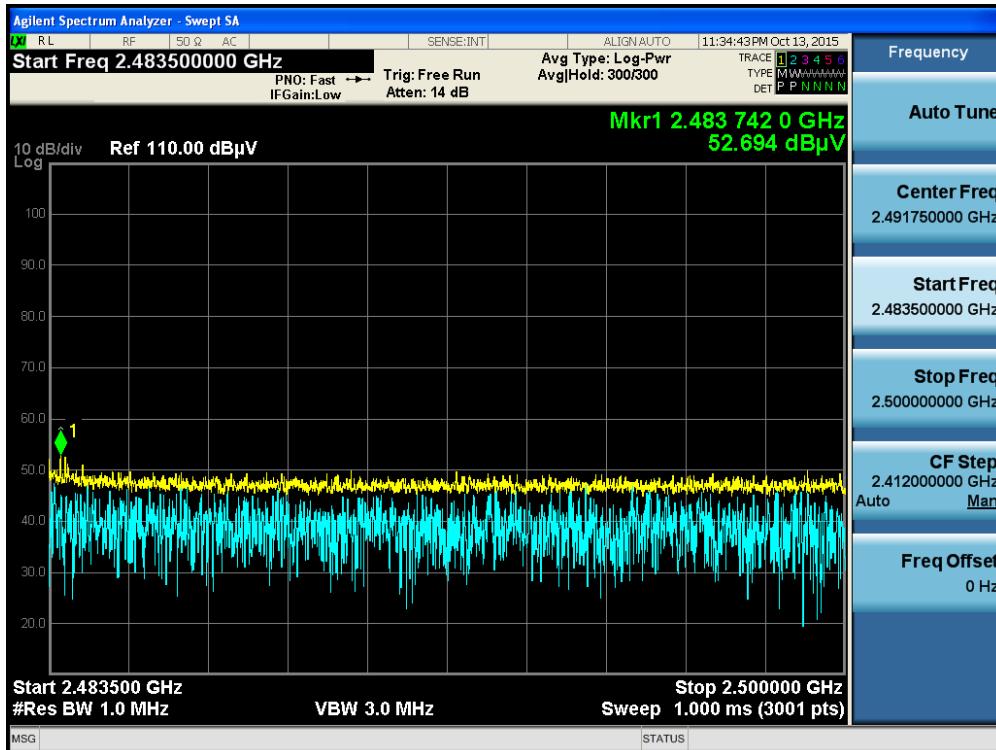


**π/4DQPSK & Lowest & Edge**

Detector Mode : PK

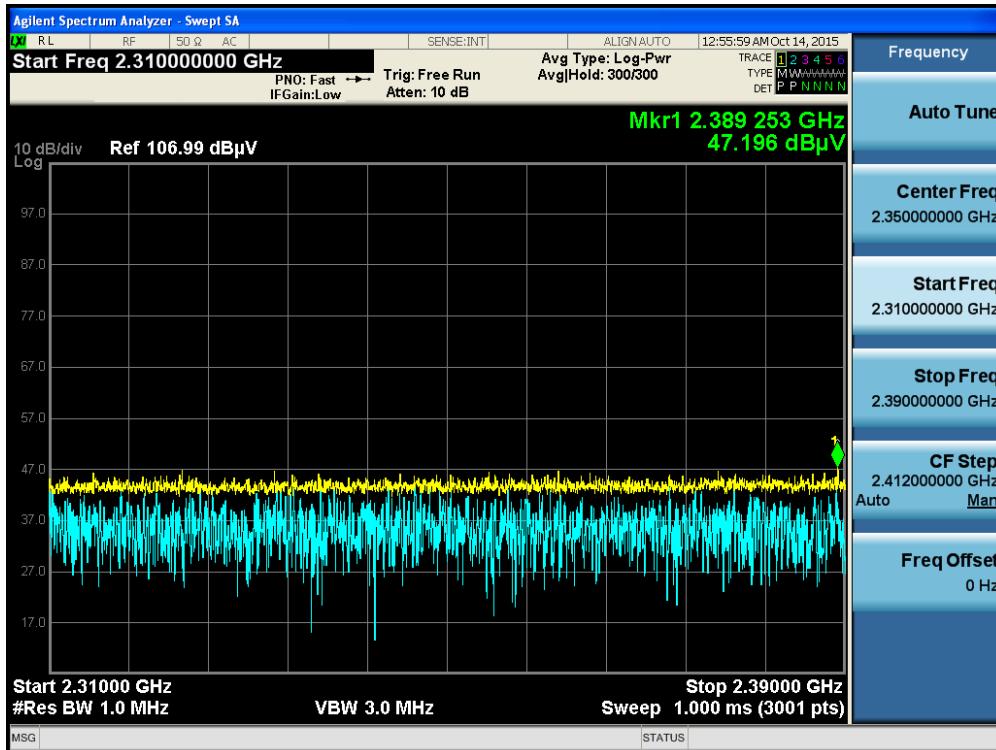
**π/4DQPSK & Highest & Edge**

Detector Mode : PK



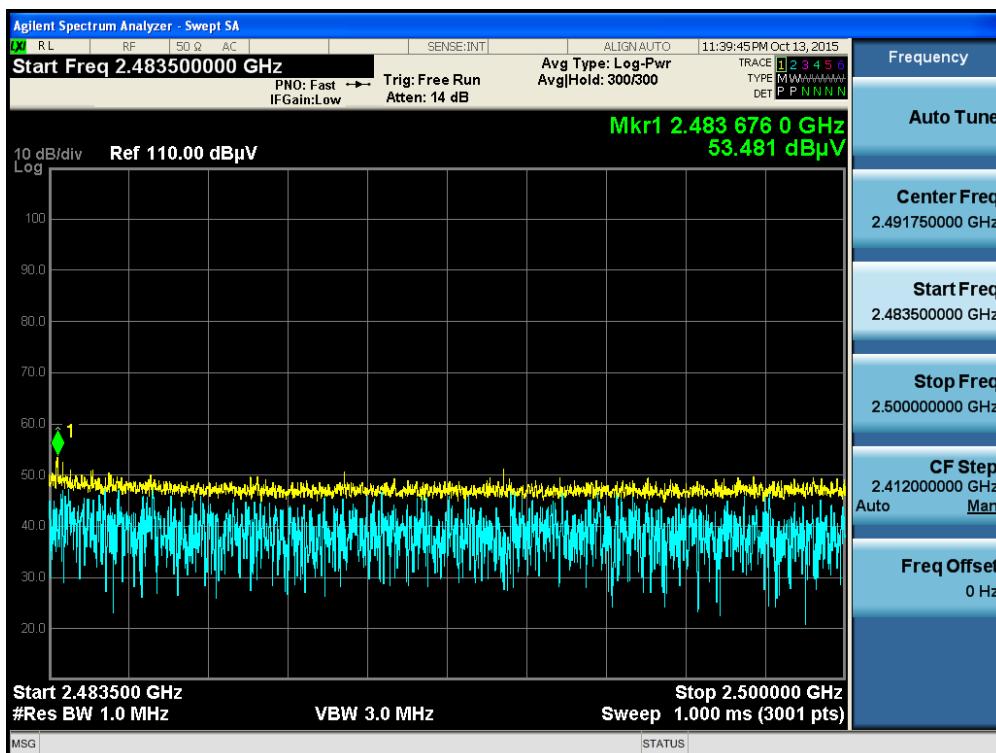
## 8DPSK &amp; Lowest &amp; Edge

Detector Mode : PK



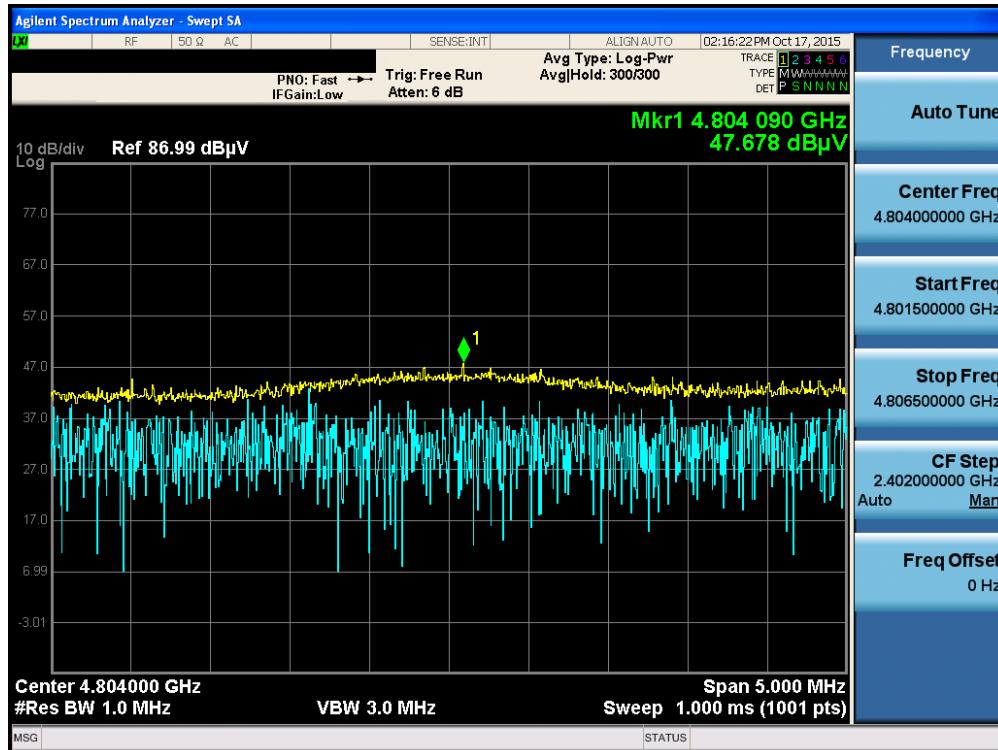
## 8DPSK &amp; Highest &amp; Edge

Detector Mode : PK



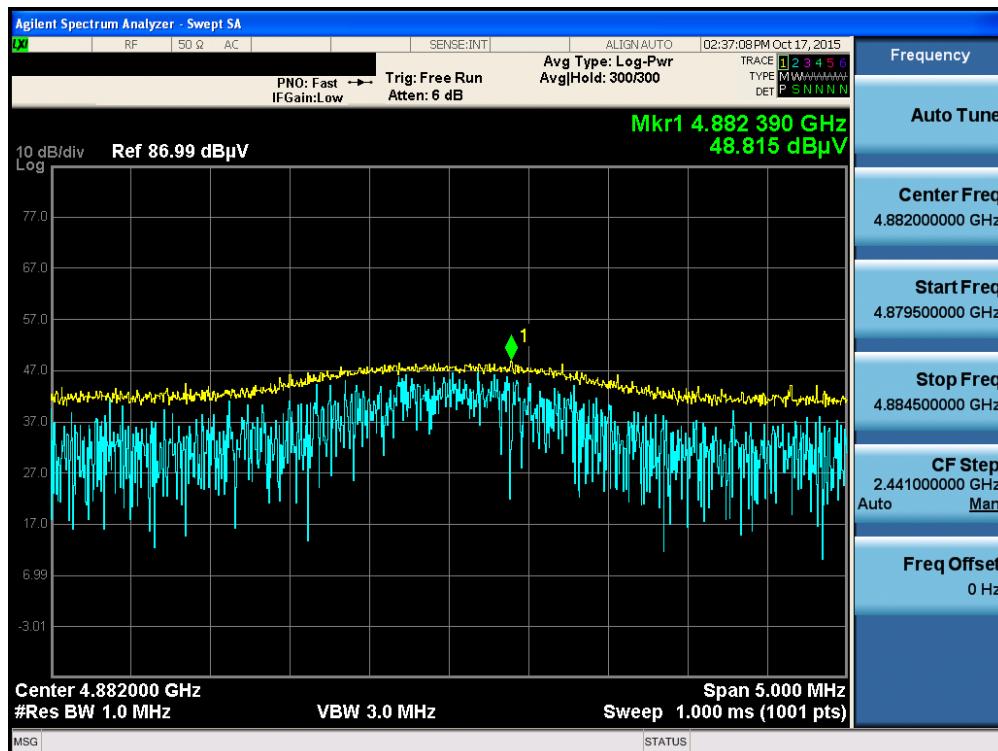
## GFSK &amp; Lowest &amp; Harmonic

Detector Mode : PK



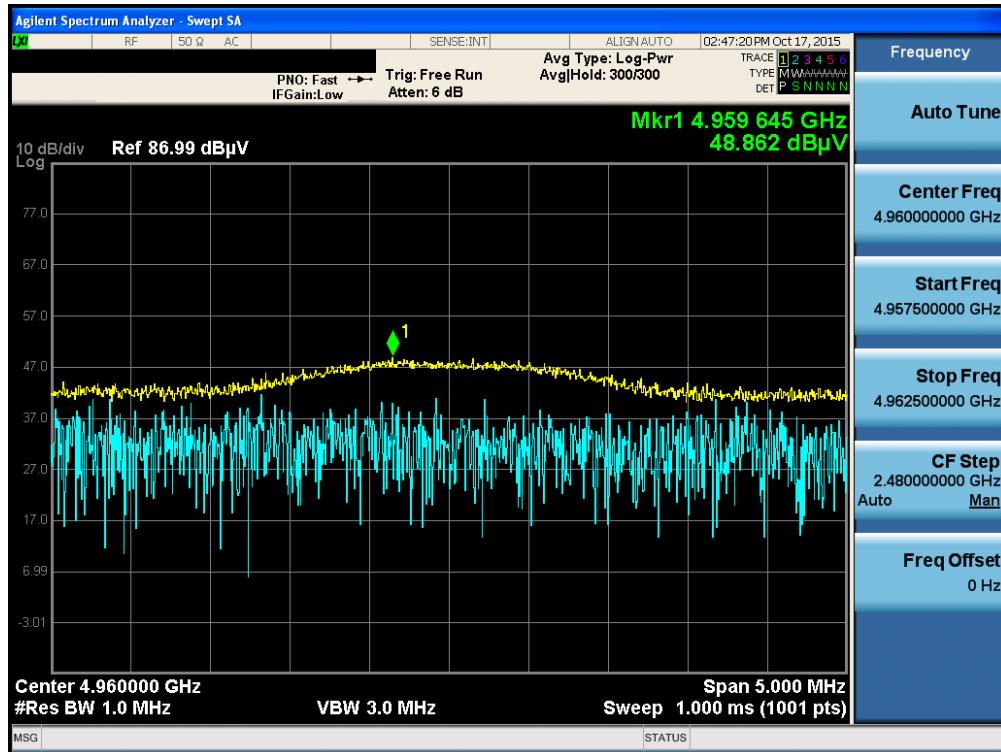
## GFSK &amp; Middle &amp; Harmonic

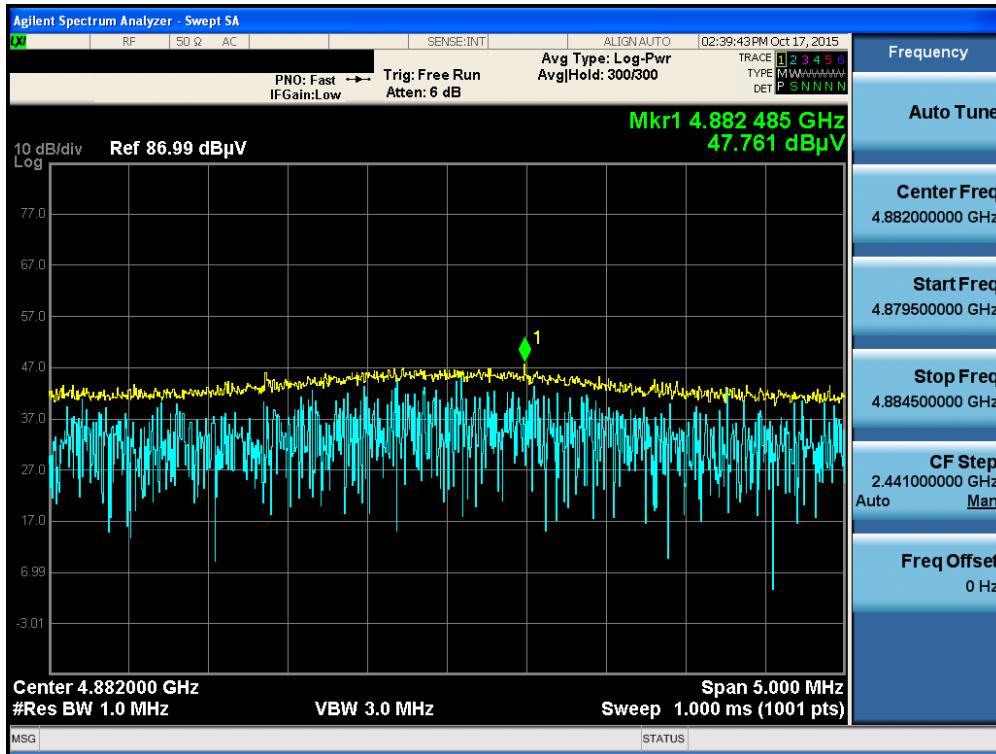
Detector Mode : PK

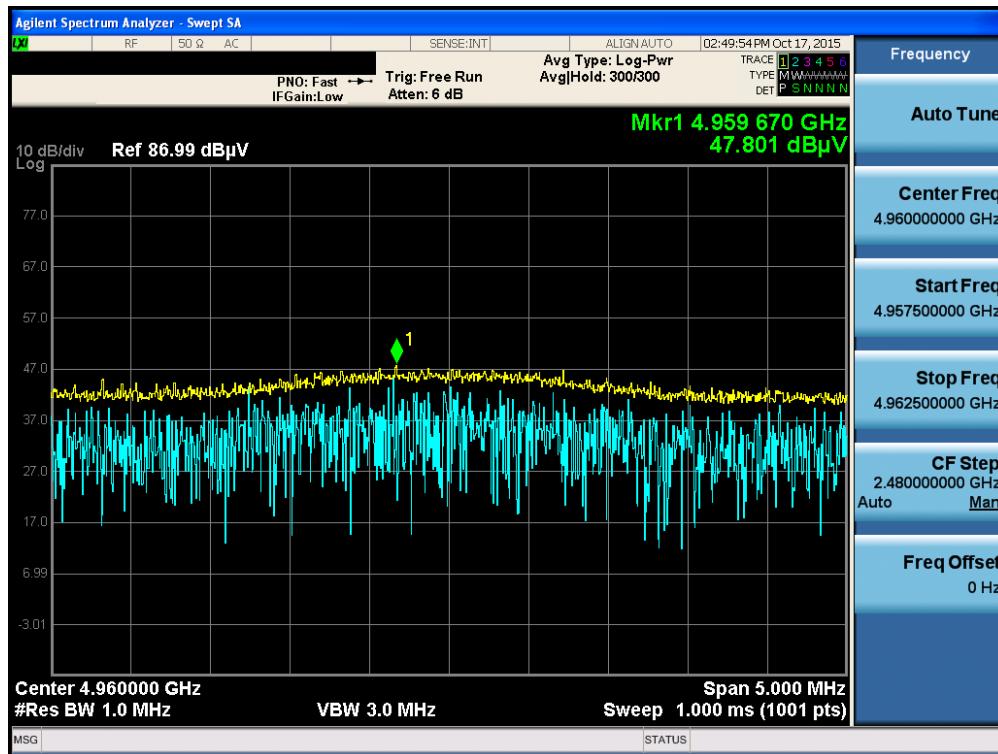


## GFSK &amp; Highest &amp; Harmonic

Detector Mode : PK

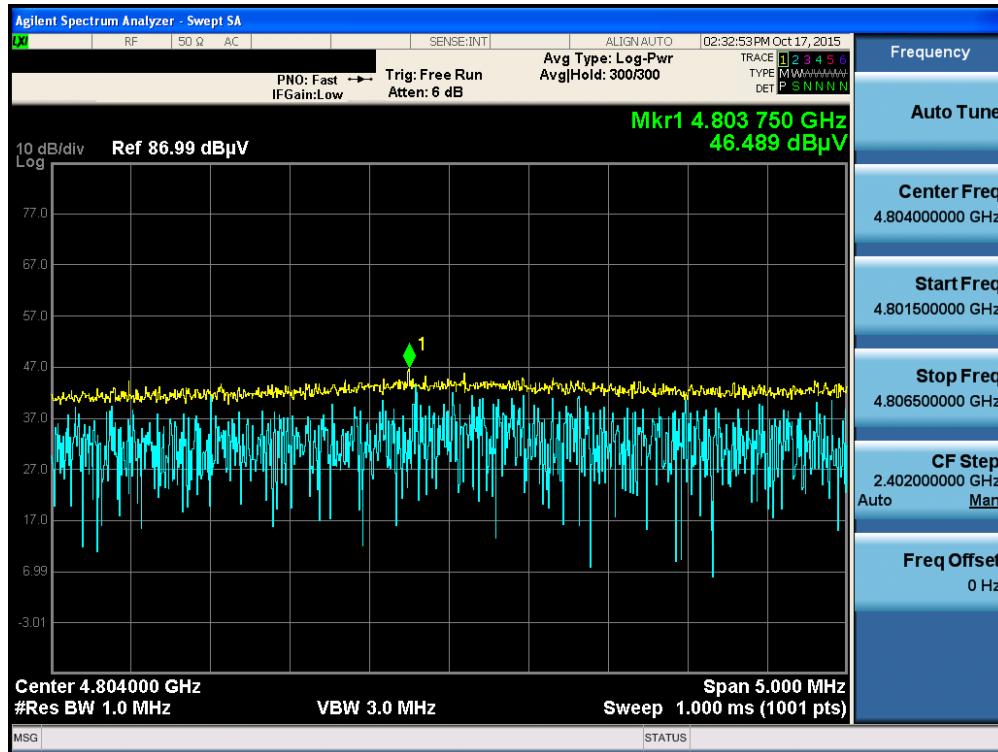


**π/4DQPSK & Lowest & Harmonic****Detector Mode : PK****π/4DQPSK & Middle & Harmonic****Detector Mode : PK**

**π/4DQPSK & Highest & Harmonic****Detector Mode : PK**

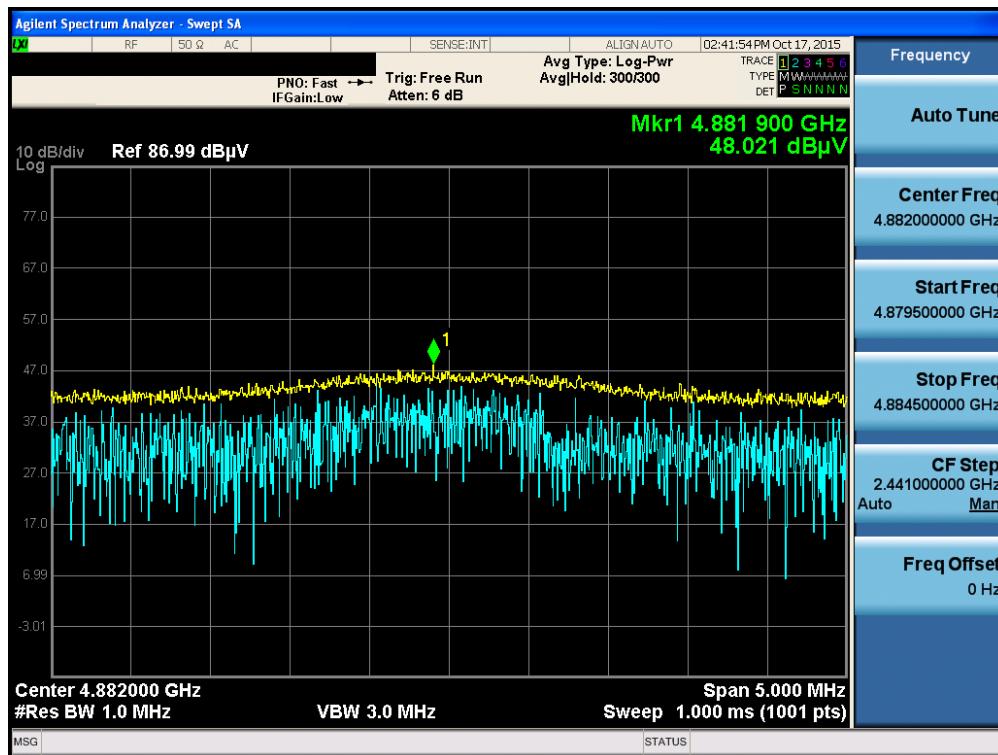
## 8DPSK &amp; Lowest &amp; Harmonic

Detector Mode : PK



## 8DPSK &amp; Middle &amp; Harmonic

Detector Mode : PK



## 8DPSK &amp; Highest &amp; Harmonic

Detector Mode : PK

