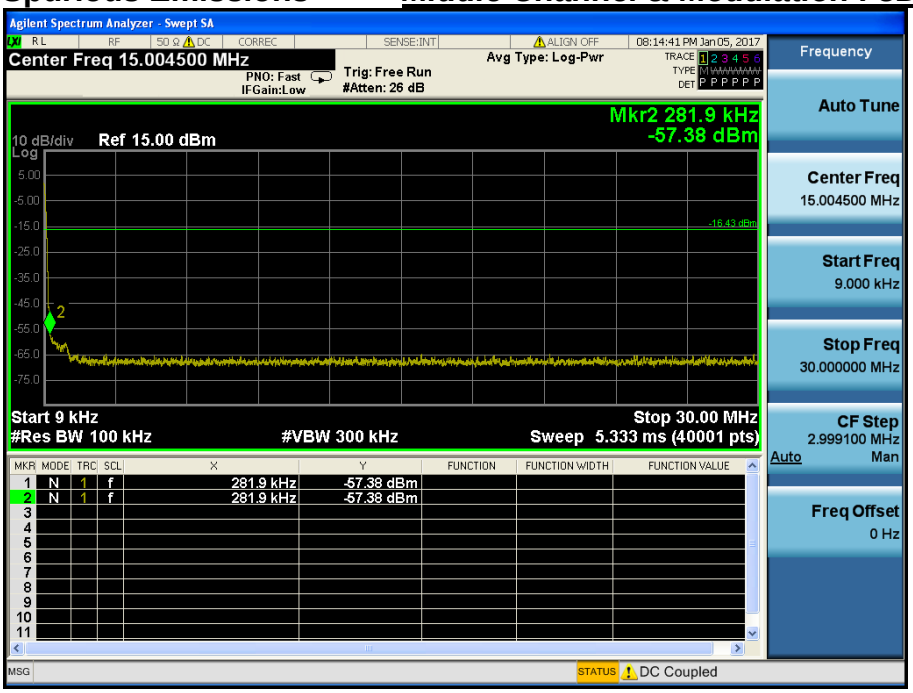
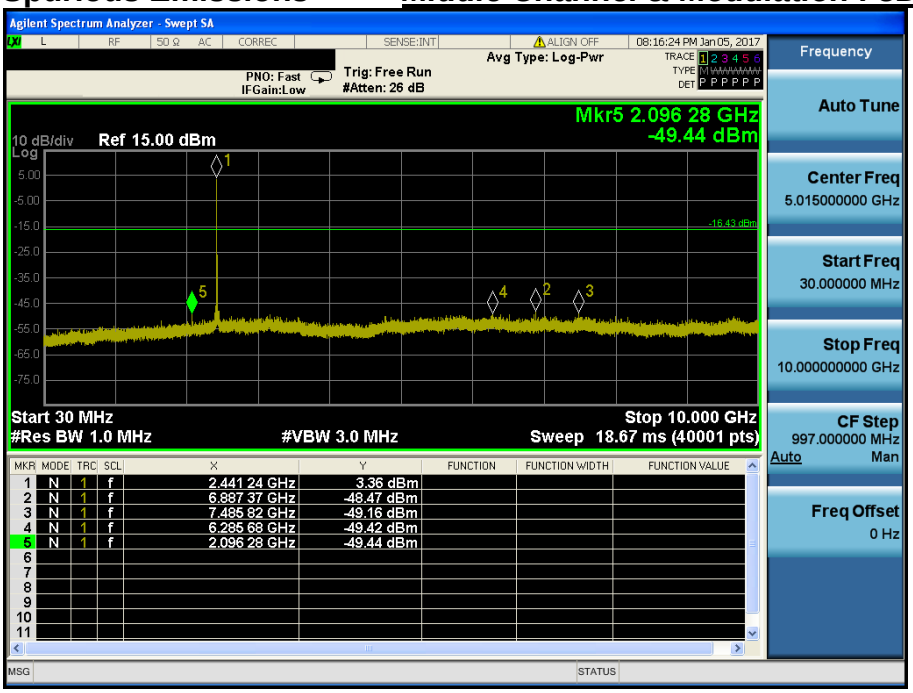
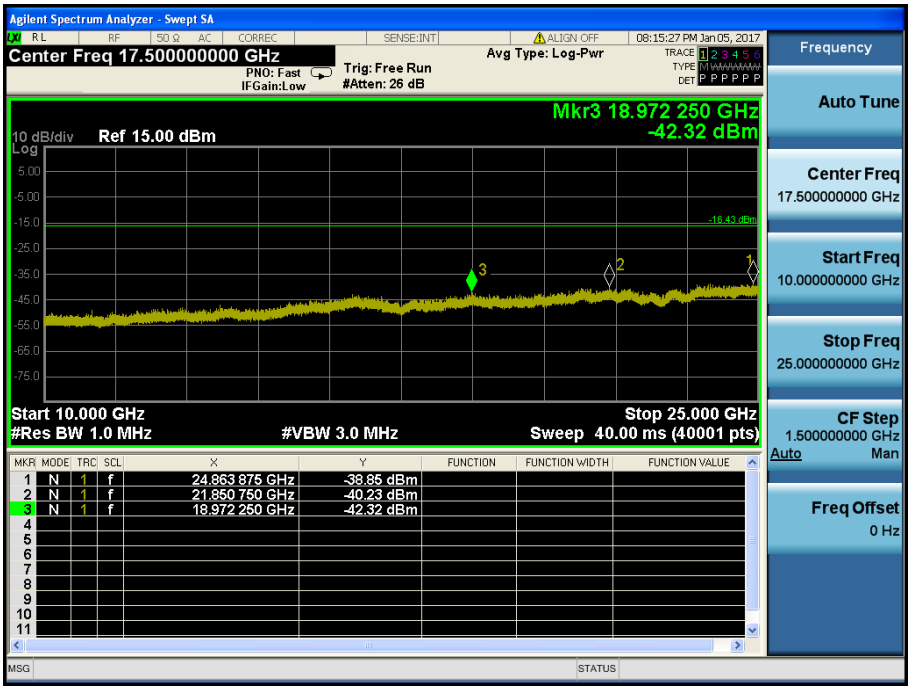
## Reference for limit ***Middle Channel & Modulation : 8DPSK***


## Conducted Spurious Emissions ***Middle Channel & Modulation : 8DPSK***



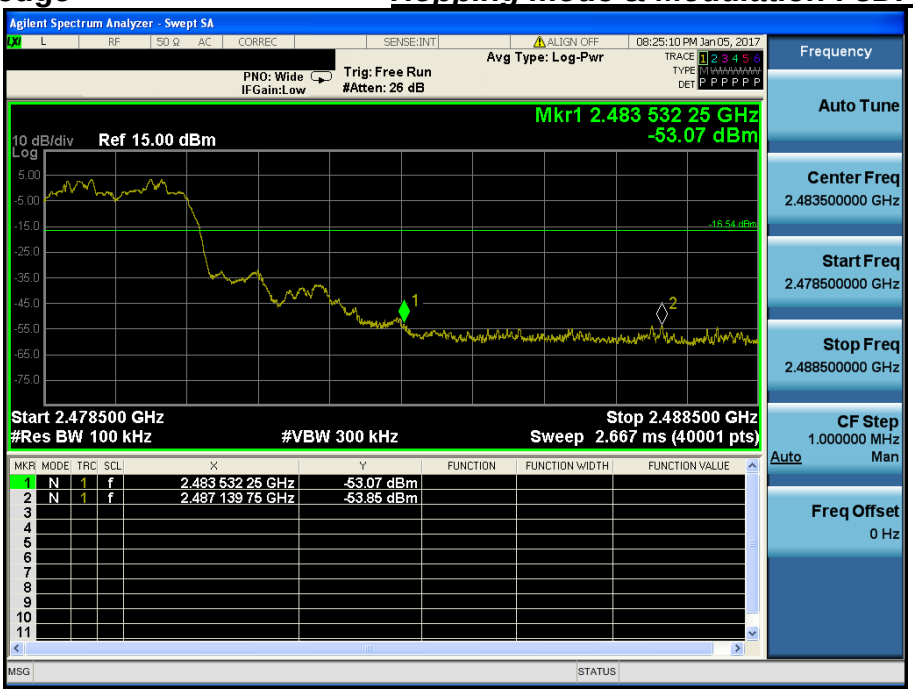
## Conducted Spurious Emissions *Middle Channel & Modulation : 8DPSK*



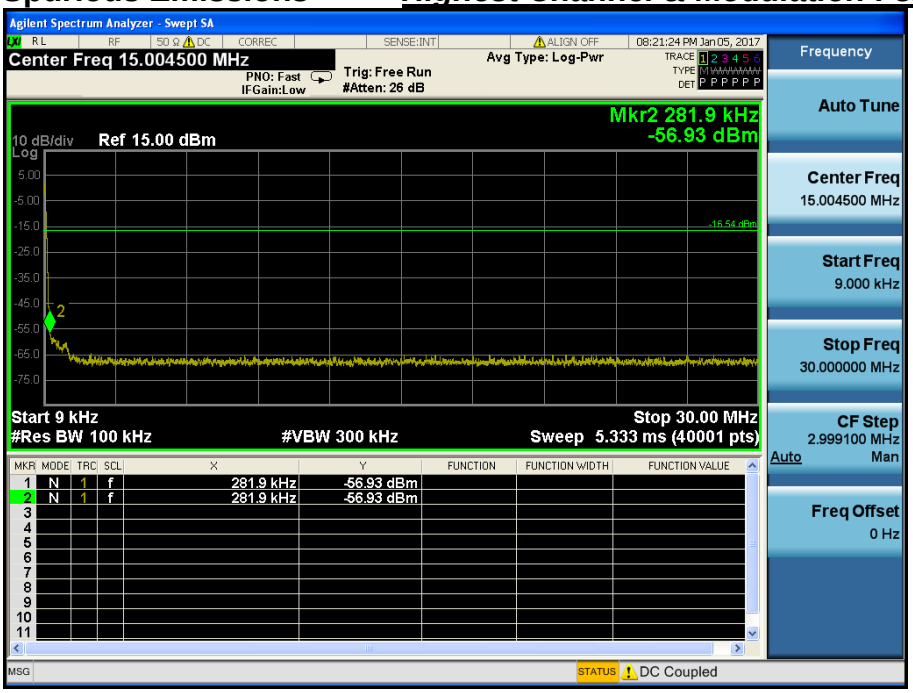



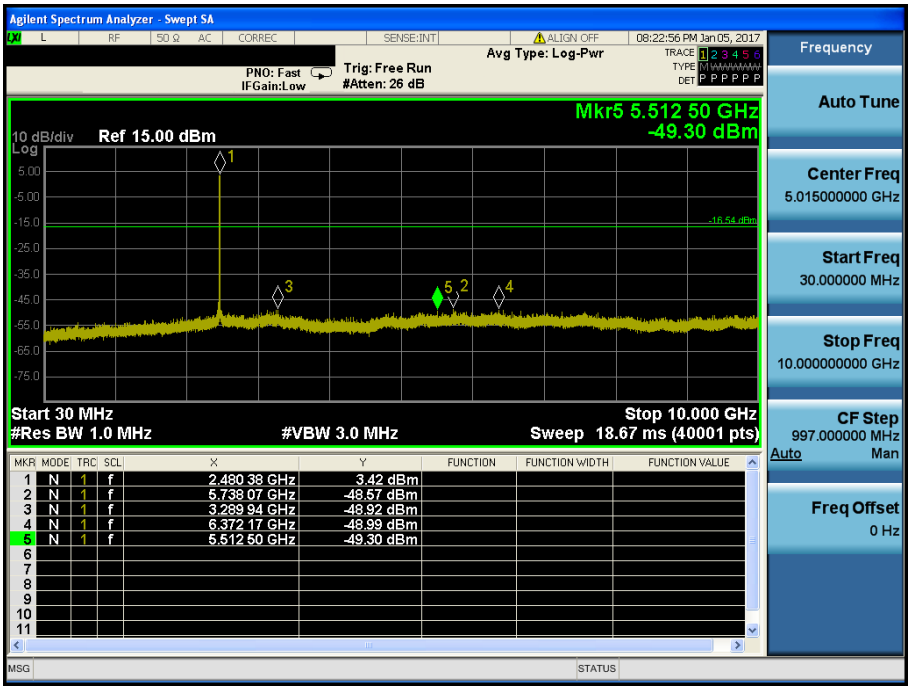
**High Band-edge** ***Highest Channel & Modulation : 8DPSK***


**High Band-edge** ***Hopping mode & Modulation : 8DPSK***

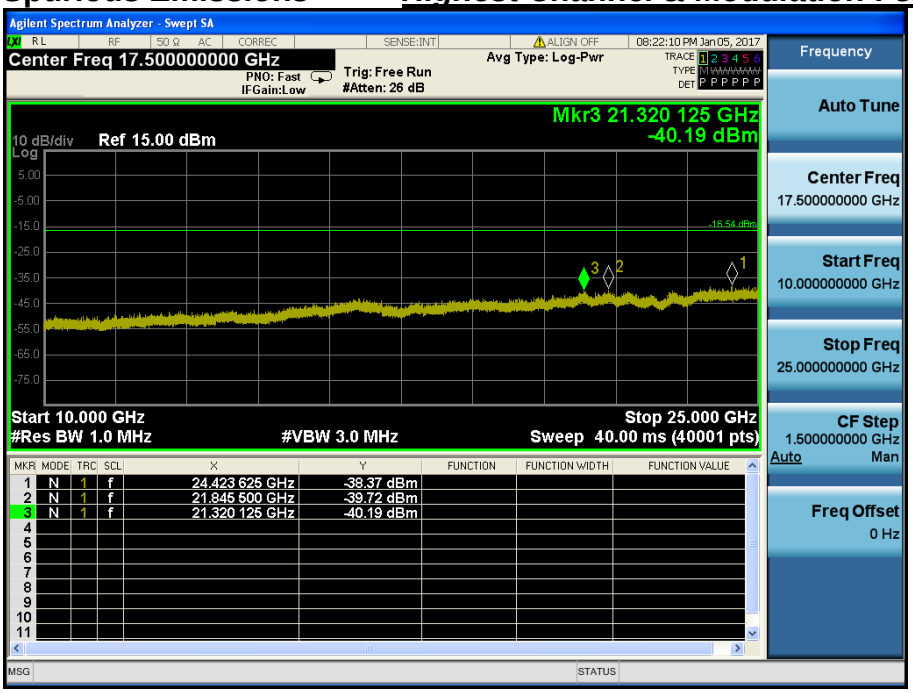


## Conducted Spurious Emissions ***Highest Channel & Modulation : 8DPSK***



## Conducted Spurious Emissions ***Highest Channel & 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

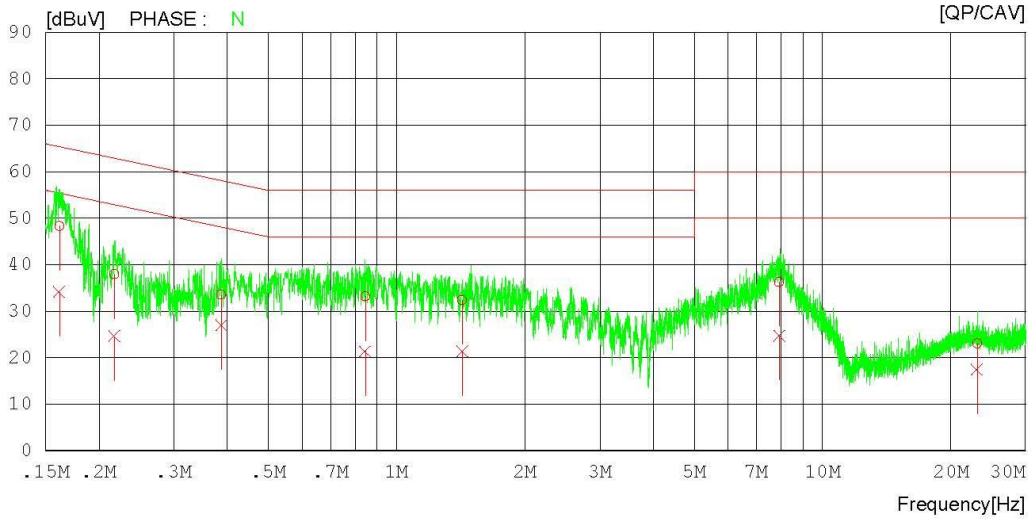
### AC Line Conducted Emissions (Graph) = Modulation : ***GFSK*** *Antenna 1*

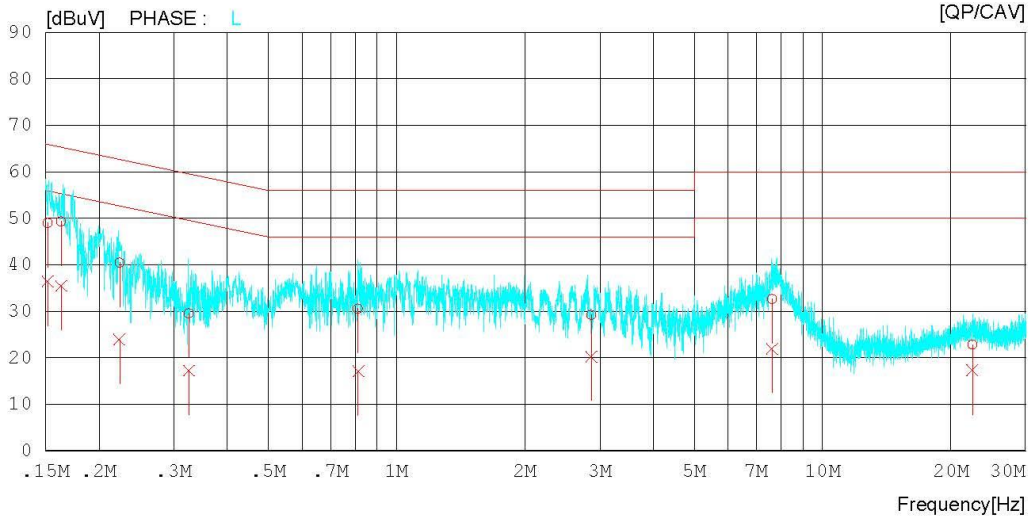
Results of Conducted Emission

DT&C Date 2017-02-09

| | | | |
|---|---|---|---|
| Model | IW09 | Temp/Humi. | 23 'C 48 % |
| Function | BT | Power Supply | AC 120 V 60 Hz |
| Mode | 1Mbps | Operator | J.W.Kim |
| Test condition | Hopping | | |
| Memo | Antenna-1 | | |

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



## AC Line Conducted Emissions (List) = Modulation : ***GFSK*** *Antenna 1*

# Results of Conducted Emission

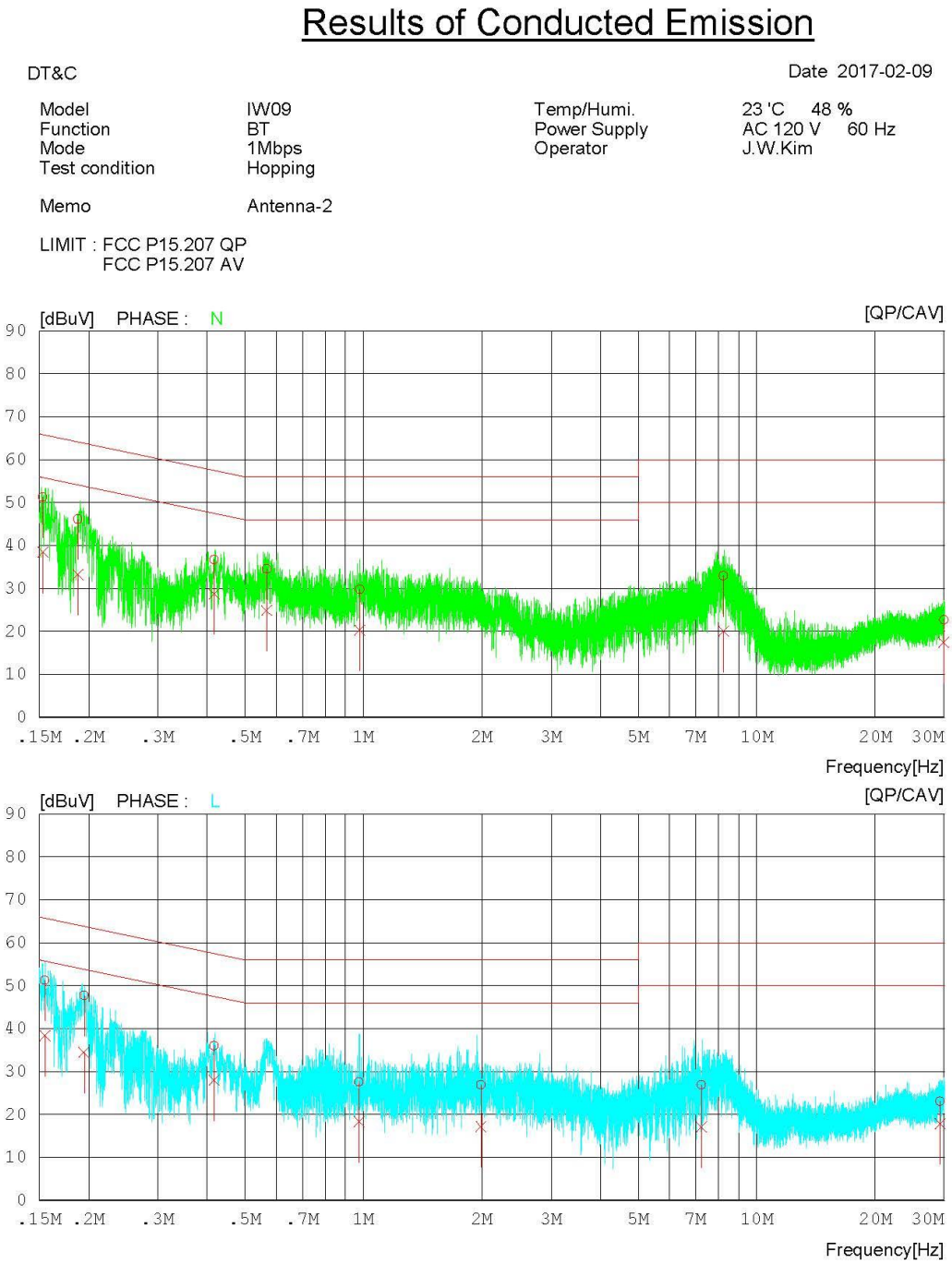
DT&C Date 2017-02-09

| | | | |
|---|---|---|---|
| Model | IW09 | Temp/Humi. | 23 'C 48 % |
| Function | BT | Power Supply | AC 120 V 60 Hz |
| Mode | 1Mbps | Operator | J.W.Kim |
| Test condition | Hopping | | |
| Memo | Antenna-1 | | |

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

| NO | FREQ | READING QP | READING CAV | C.FACTOR | RESULT QP | RESULT CAV | LIMIT QP | LIMIT CAV | MARGIN QP | MARGIN CAV | PHASE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | |
| 1 | 0.16144 | 45.31 | 31.17 | 2.97 | 48.28 | 34.14 | 65.39 | 55.39 | 17.11 | 21.25 | N |
| 2 | 0.21713 | 36.07 | 22.69 | 1.86 | 37.93 | 24.55 | 62.93 | 52.93 | 25.00 | 28.38 | N |
| 3 | 0.38723 | 32.61 | 26.04 | 0.91 | 33.52 | 26.95 | 58.12 | 48.12 | 24.60 | 21.17 | N |
| 4 | 0.84415 | 32.68 | 20.91 | 0.45 | 33.13 | 21.36 | 56.00 | 46.00 | 22.87 | 24.64 | N |
| 5 | 1.42500 | 32.04 | 21.09 | 0.35 | 32.39 | 21.44 | 56.00 | 46.00 | 23.61 | 24.56 | N |
| 6 | 7.91000 | 35.92 | 24.30 | 0.37 | 36.29 | 24.67 | 60.00 | 50.00 | 23.71 | 25.33 | N |
| 7 | 23.03320 | 22.49 | 16.88 | 0.54 | 23.03 | 17.42 | 60.00 | 50.00 | 36.97 | 32.58 | N |
| 8 | 0.15155 | 45.57 | 33.06 | 3.34 | 48.91 | 36.40 | 65.91 | 55.91 | 17.00 | 19.51 | L |
| 9 | 0.16313 | 46.35 | 32.49 | 2.93 | 49.28 | 35.42 | 65.30 | 55.30 | 16.02 | 19.88 | L |
| 10 | 0.22357 | 38.60 | 22.02 | 1.83 | 40.43 | 23.85 | 62.69 | 52.69 | 22.26 | 28.84 | L |
| 11 | 0.32528 | 28.38 | 16.07 | 1.14 | 29.52 | 17.21 | 59.57 | 49.57 | 30.05 | 32.36 | L |
| 12 | 0.81176 | 30.07 | 16.55 | 0.49 | 30.56 | 17.04 | 56.00 | 46.00 | 25.44 | 28.96 | L |
| 13 | 2.86520 | 28.76 | 19.89 | 0.35 | 29.11 | 20.24 | 56.00 | 46.00 | 26.89 | 25.76 | L |
| 14 | 7.60760 | 32.21 | 21.48 | 0.41 | 32.62 | 21.89 | 60.00 | 50.00 | 27.38 | 28.11 | L |
| 15 | 22.45320 | 22.13 | 16.68 | 0.63 | 22.76 | 17.31 | 60.00 | 50.00 | 37.24 | 32.69 | L |

## AC Line Conducted Emissions (Graph) = Modulation : ***GFSK*** *Antenna 2*



## AC Line Conducted Emissions (List) = Modulation : ***GFSK*** *Antenna 2*

# Results of Conducted Emission

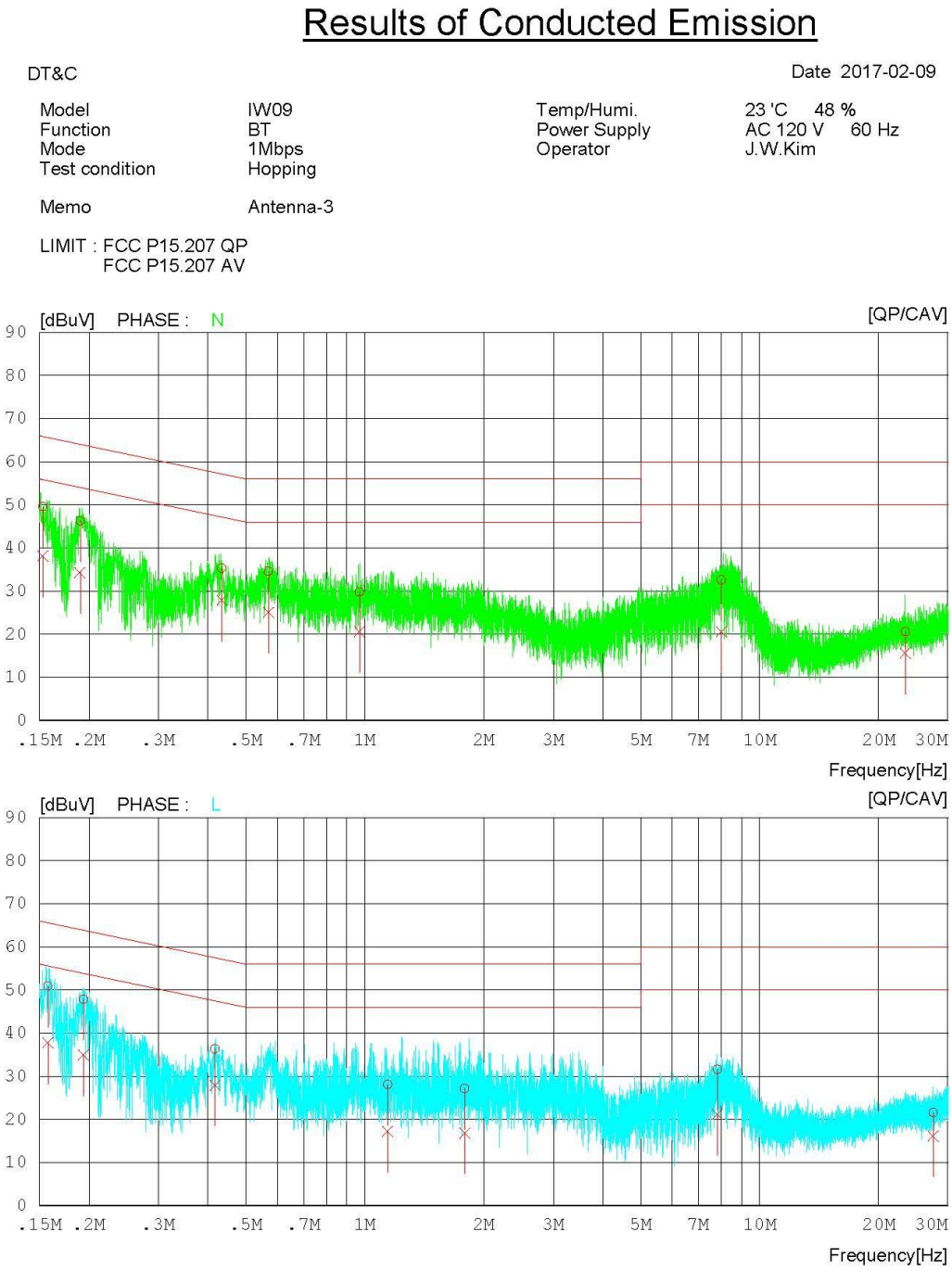
DT&C Date 2017-02-09

| | | | |
|---|---|---|---|
| Model | IW09 | Temp/Humi. | 23 'C 48 % |
| Function | BT | Power Supply | AC 120 V 60 Hz |
| Mode | 1Mbps | Operator | J.W.Kim |
| Test condition | Hopping | | |
| Memo | Antenna-2 | | |

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

| NO | FREQ | READING QP | READING CAV | C.FACTOR | RESULT QP | RESULT CAV | LIMIT QP | LIMIT CAV | MARGIN QP | MARGIN CAV | PHASE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | |
| 1 | 0.15316 | 48.05 | 35.21 | 3.25 | 51.30 | 38.46 | 65.83 | 55.83 | 14.53 | 17.37 | N |
| 2 | 0.18814 | 43.89 | 30.94 | 2.29 | 46.18 | 33.23 | 64.12 | 54.12 | 17.94 | 20.89 | N |
| 3 | 0.41707 | 35.88 | 27.90 | 0.84 | 36.72 | 28.74 | 57.51 | 47.51 | 20.79 | 18.77 | N |
| 4 | 0.56702 | 33.97 | 24.26 | 0.62 | 34.59 | 24.88 | 56.00 | 46.00 | 21.41 | 21.12 | N |
| 5 | 0.97845 | 29.31 | 19.87 | 0.42 | 29.73 | 20.29 | 56.00 | 46.00 | 26.27 | 25.71 | N |
| 6 | 8.23100 | 32.59 | 19.72 | 0.37 | 32.96 | 20.09 | 60.00 | 50.00 | 27.04 | 29.91 | N |
| 7 | 29.89500 | 22.17 | 16.86 | 0.62 | 22.79 | 17.48 | 60.00 | 50.00 | 37.21 | 32.52 | N |
| 8 | 0.15494 | 48.02 | 35.05 | 3.22 | 51.24 | 38.27 | 65.73 | 55.73 | 14.49 | 17.46 | L |
| 9 | 0.19498 | 45.51 | 32.25 | 2.18 | 47.69 | 34.43 | 63.82 | 53.82 | 16.13 | 19.39 | L |
| 10 | 0.41668 | 35.09 | 27.08 | 0.87 | 35.96 | 27.95 | 57.51 | 47.51 | 21.55 | 19.56 | L |
| 11 | 0.97494 | 27.09 | 17.89 | 0.44 | 27.53 | 18.33 | 56.00 | 46.00 | 28.47 | 27.67 | L |
| 12 | 1.98900 | 26.56 | 16.82 | 0.36 | 26.92 | 17.18 | 56.00 | 46.00 | 29.08 | 28.82 | L |
| 13 | 7.22740 | 26.50 | 16.67 | 0.40 | 26.90 | 17.07 | 60.00 | 50.00 | 33.10 | 32.93 | L |
| 14 | 29.27060 | 22.28 | 17.02 | 0.79 | 23.07 | 17.81 | 60.00 | 50.00 | 36.93 | 32.19 | L |

## AC Line Conducted Emissions (Graph) = Modulation : ***GFSK*** *Antenna 3*



## AC Line Conducted Emissions (List) = Modulation : ***GFSK*** *Antenna 3*

# Results of Conducted Emission

DT&C Date 2017-02-09

| | | | |
|---|---|---|---|
| Model | IW09 | Temp/Humi. | 23 'C 48 % |
| Function | BT | Power Supply | AC 120 V 60 Hz |
| Mode | 1Mbps | Operator | J.W.Kim |
| Test condition | Hopping | | |
| Memo | Antenna-3 | | |

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

| NO | FREQ | READING QP | READING CAV | C.FACTOR | RESULT QP | RESULT CAV | LIMIT QP | LIMIT CAV | MARGIN QP | MARGIN CAV | PHASE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | |
| 1 | 0.15289 | 46.29 | 34.90 | 3.26 | 49.55 | 38.16 | 65.84 | 55.84 | 16.29 | 17.68 | N |
| 2 | 0.18996 | 44.01 | 32.03 | 2.25 | 46.26 | 34.28 | 64.04 | 54.04 | 17.78 | 19.76 | N |
| 3 | 0.43450 | 34.58 | 27.12 | 0.81 | 35.39 | 27.93 | 57.17 | 47.17 | 21.78 | 19.24 | N |
| 4 | 0.56947 | 33.95 | 24.42 | 0.61 | 34.56 | 25.03 | 56.00 | 46.00 | 21.44 | 20.97 | N |
| 5 | 0.96843 | 29.30 | 20.20 | 0.42 | 29.72 | 20.62 | 56.00 | 46.00 | 26.28 | 25.38 | N |
| 6 | 7.99680 | 32.23 | 20.27 | 0.37 | 32.60 | 20.64 | 60.00 | 50.00 | 27.40 | 29.36 | N |
| 7 | 23.38440 | 20.05 | 15.06 | 0.54 | 20.59 | 15.60 | 60.00 | 50.00 | 39.41 | 34.40 | N |
| 8 | 0.15757 | 47.72 | 34.59 | 3.13 | 50.85 | 37.72 | 65.59 | 55.59 | 14.74 | 17.87 | L |
| 9 | 0.19387 | 45.60 | 32.66 | 2.20 | 47.80 | 34.86 | 63.87 | 53.87 | 16.07 | 19.01 | L |
| 10 | 0.41754 | 35.43 | 27.02 | 0.87 | 36.30 | 27.89 | 57.50 | 47.50 | 21.20 | 19.61 | L |
| 11 | 1.14180 | 27.65 | 16.75 | 0.41 | 28.06 | 17.16 | 56.00 | 46.00 | 27.94 | 28.84 | L |
| 12 | 1.79140 | 26.78 | 16.46 | 0.37 | 27.15 | 16.83 | 56.00 | 46.00 | 28.85 | 29.17 | L |
| 13 | 7.80780 | 31.08 | 20.73 | 0.41 | 31.49 | 21.14 | 60.00 | 50.00 | 28.51 | 28.86 | L |
| 14 | 27.51860 | 20.83 | 15.45 | 0.74 | 21.57 | 16.19 | 60.00 | 50.00 | 38.43 | 33.81 | 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**

**Antenna 1, 2, 3**

**The External antenna employs a unique antenna connector.**

- **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.

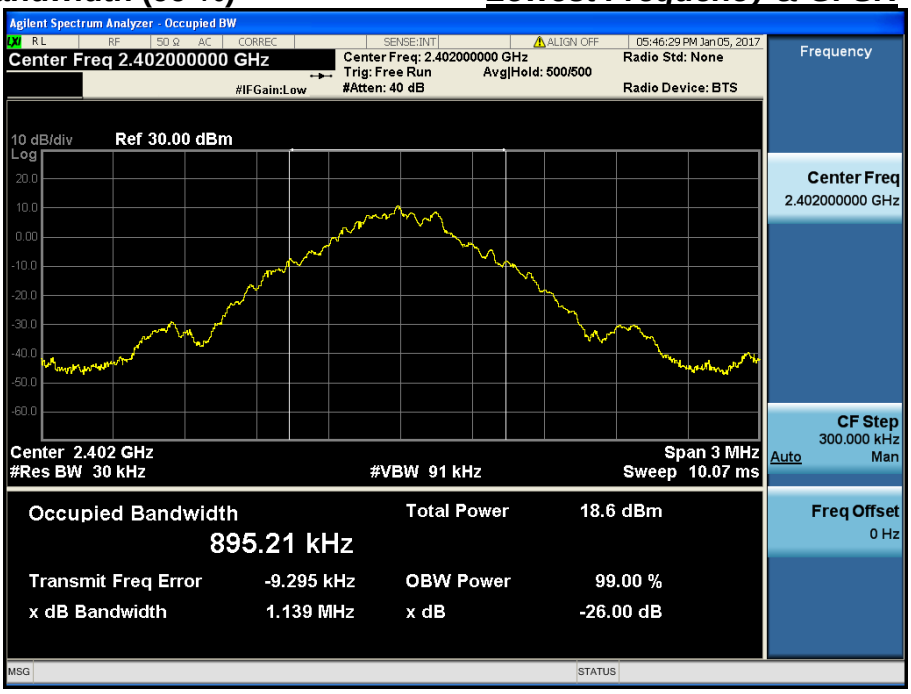
The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 × RBW.

Spectrum analyzer plots are included on the following pages.

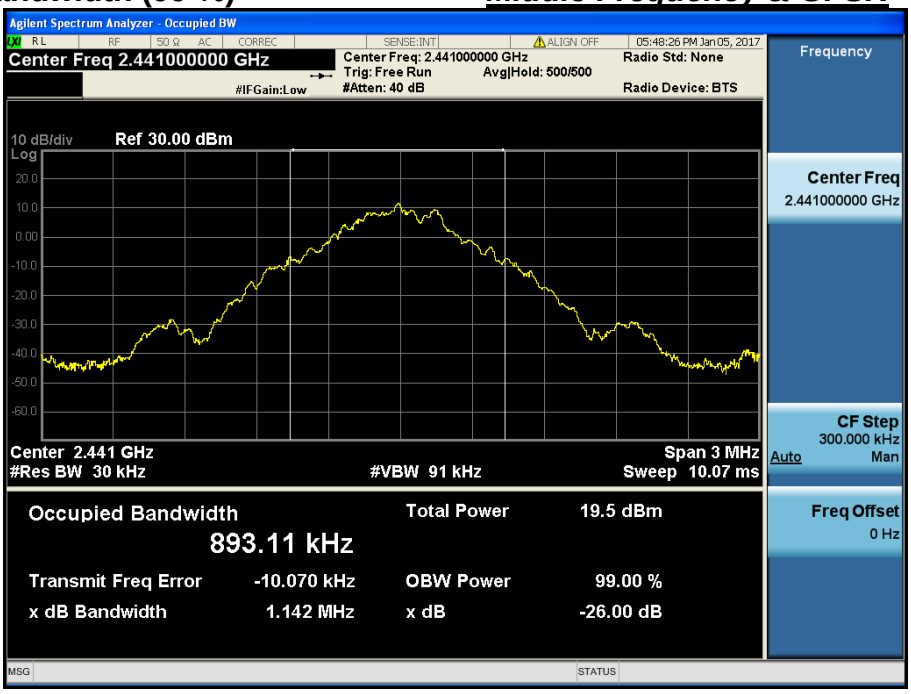
## 10.4 Test Results

| Test Mode | Tested Channel | Test Results (MHz) |
|---|---|---|
| ***GFSK*** | **Lowest** | 0.895 |
| | **Middle** | 0.893 |
| | **Highest** | 0.902 |
| ***π/4DQPSK*** | **Lowest** | 1.177 |
| | **Middle** | 1.180 |
| | **Highest** | 1.179 |
| ***8DPSK*** | **Lowest** | 1.172 |
| | **Middle** | 1.172 |
| | **Highest** | 1.166 |

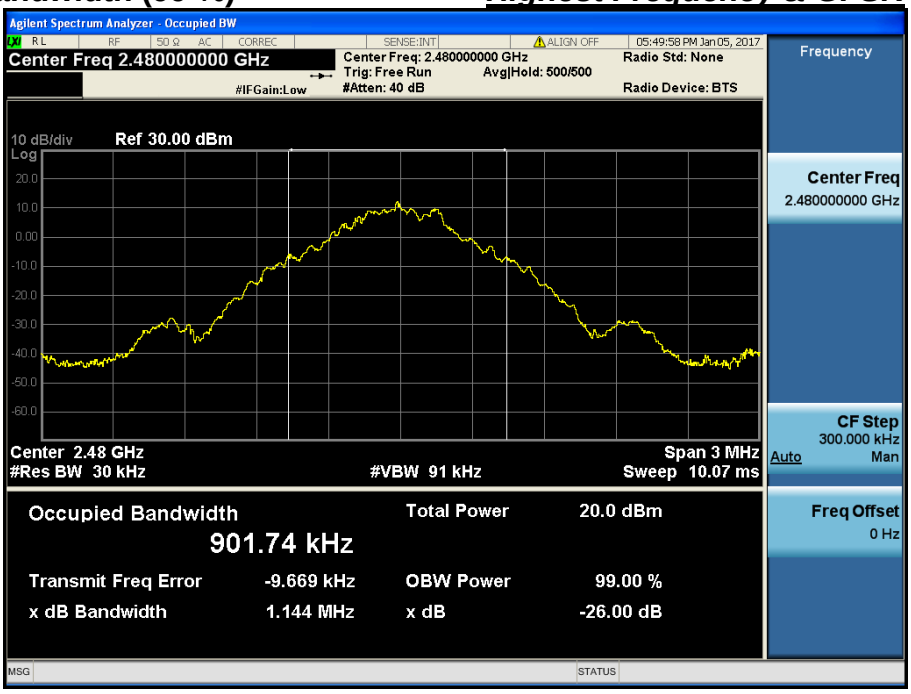
## Occupied Bandwidth (99 %) *Lowest Frequency & GFSK*



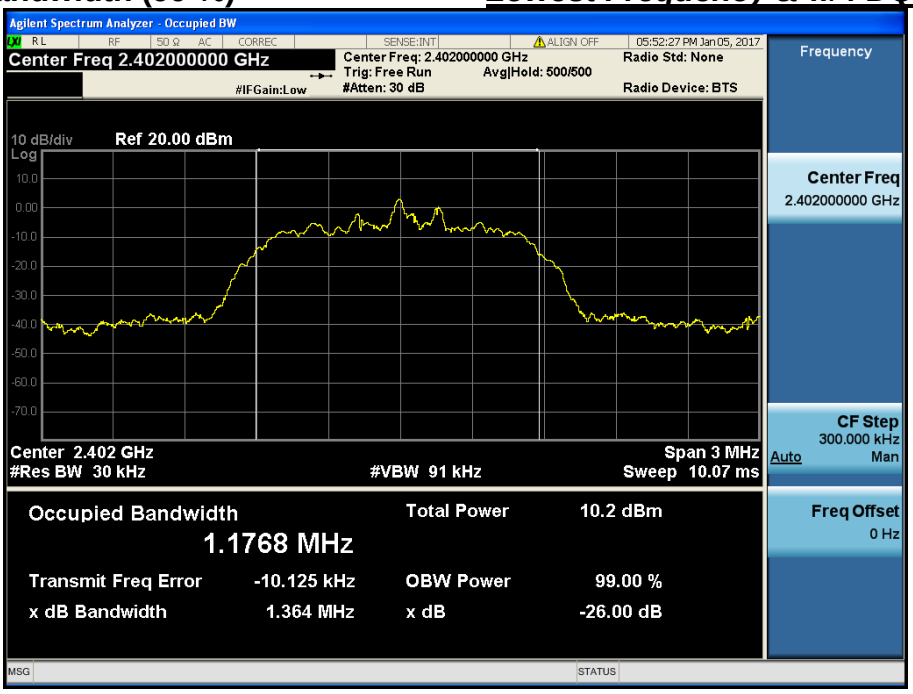

## Occupied Bandwidth (99 %) *Middle Frequency & GFSK*



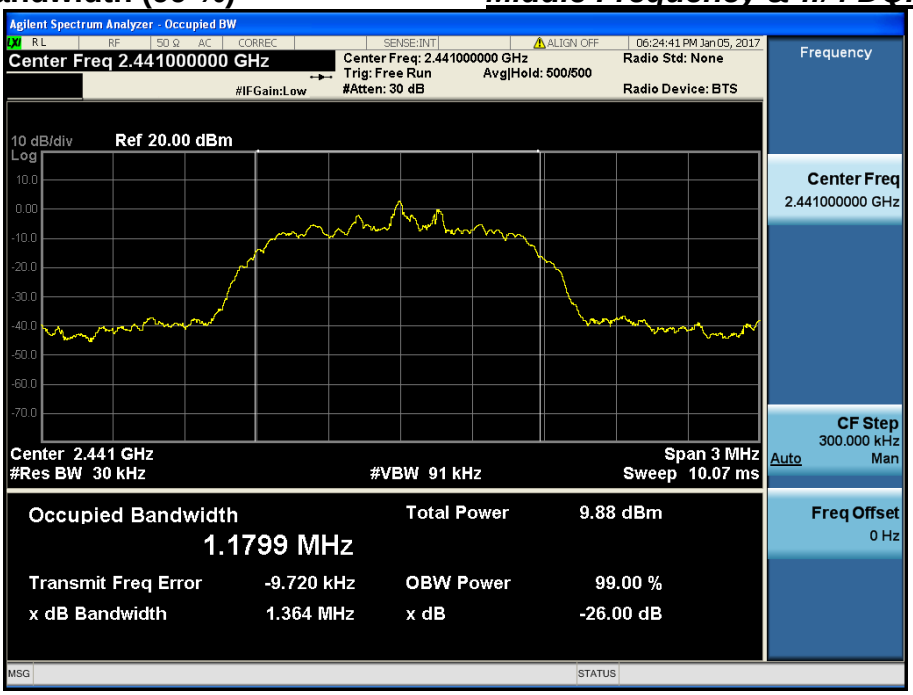
## Occupied Bandwidth (99 %) ***Highest Frequency & GFSK***



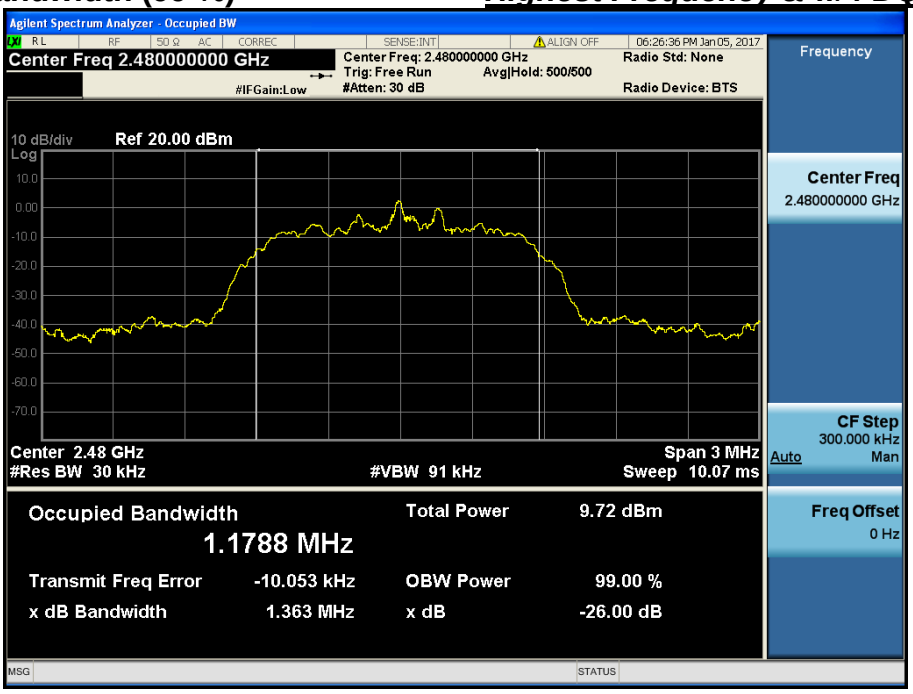
## Occupied Bandwidth (99 %) ***Lowest Frequency & π/4 DQPSK***



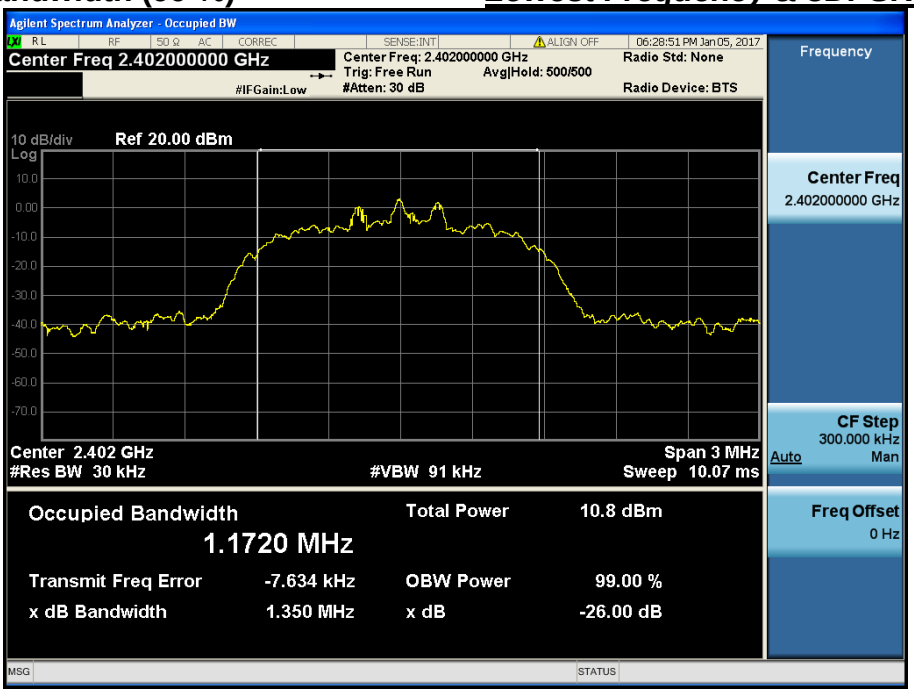

## Occupied Bandwidth (99 %) ***Middle Frequency & π/4 DQPSK***



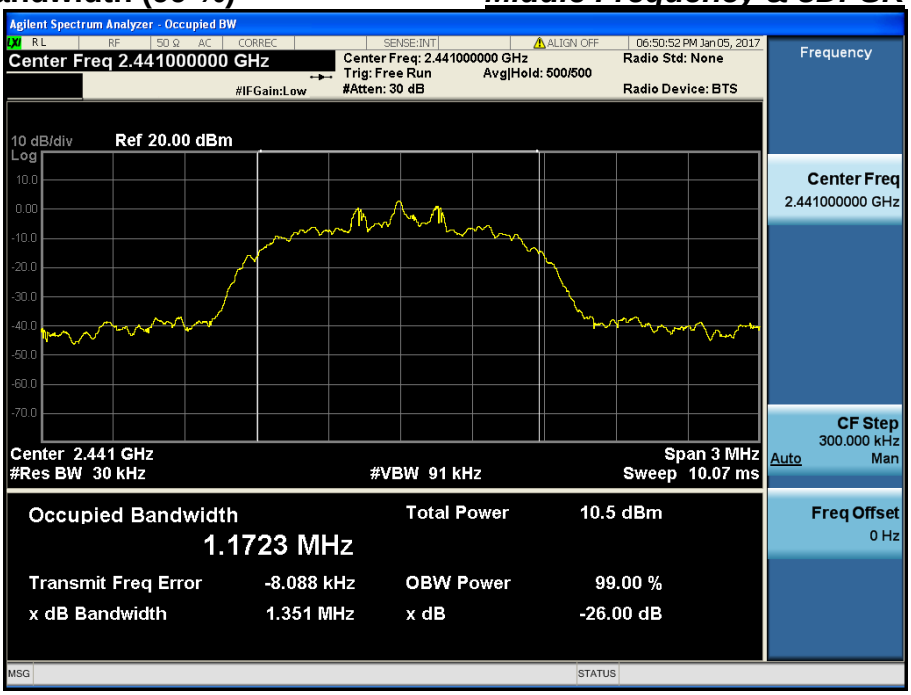
## Occupied Bandwidth (99 %) ***Highest Frequency & π/4 DQPSK***



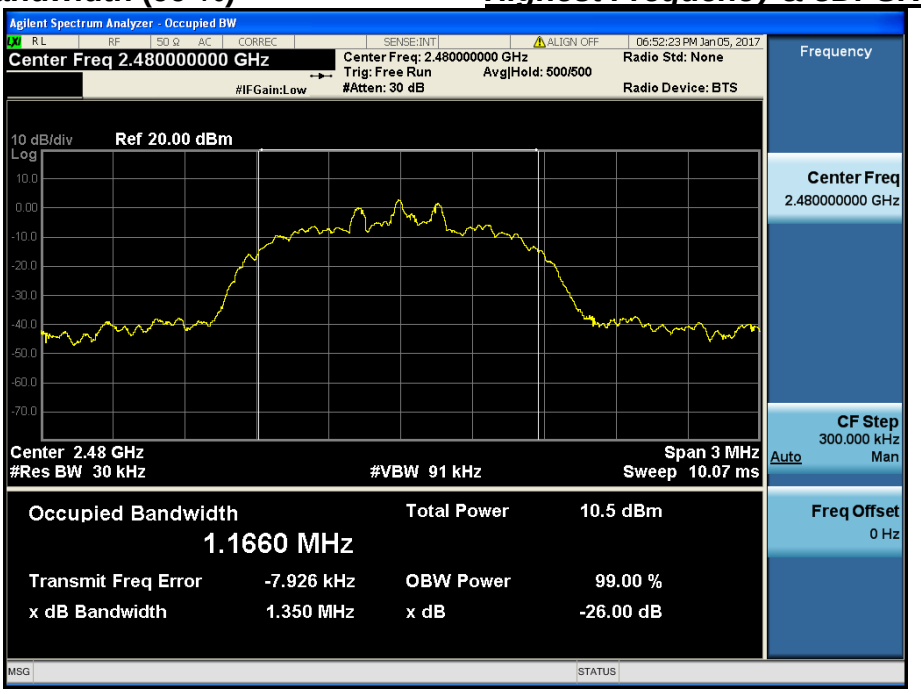
## Occupied Bandwidth (99 %) ***Lowest Frequency & 8DPSK***




## Occupied Bandwidth (99 %) ***Middle Frequency & 8DPSK***



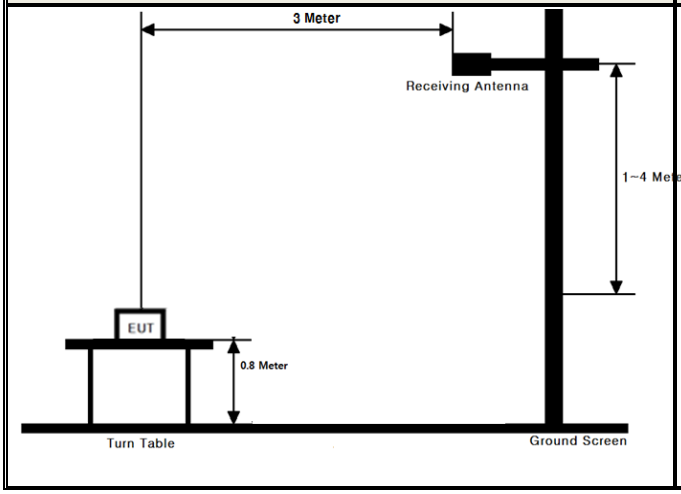
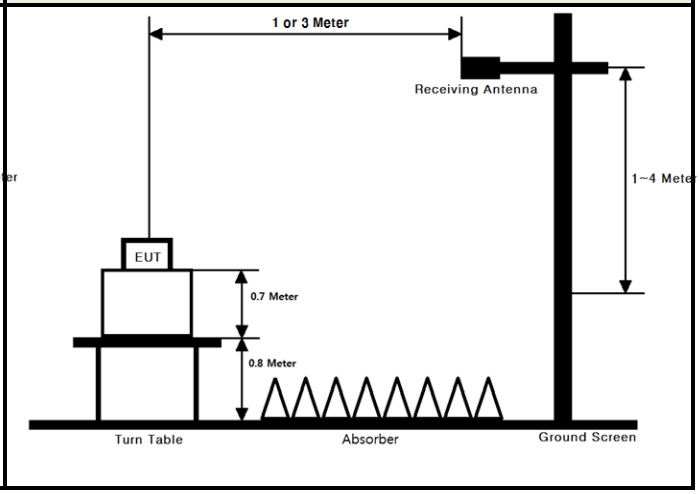
## Occupied Bandwidth (99 %) ***Highest Frequency & 8DPSK***



# APPENDIX I

## Test set up diagrams

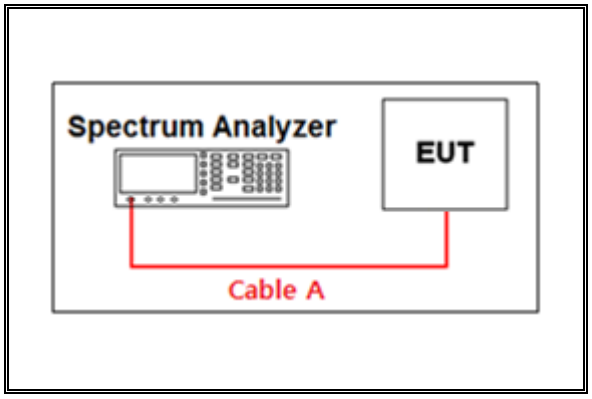
- **Radiated Measurement**

| Below 1GHz | Above 1GHz |
|---|---|
|  |  |





- **Conducted Measurement**





**Path loss information**

| Frequency (GHz) | Path Loss (dB) | Frequency (GHz) | Path Loss (dB) |
|---|---|---|---|
| 0.03 | 0.19 | 15 | 3.50 |
| 1 | 0.80 | 20 | 4.86 |
| 2402 & 2441 & 2480 | 1.30 | 25 | 5.35 |
| 5 | 1.82 | - | - |
| 10 | 2.70 | - | - |

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

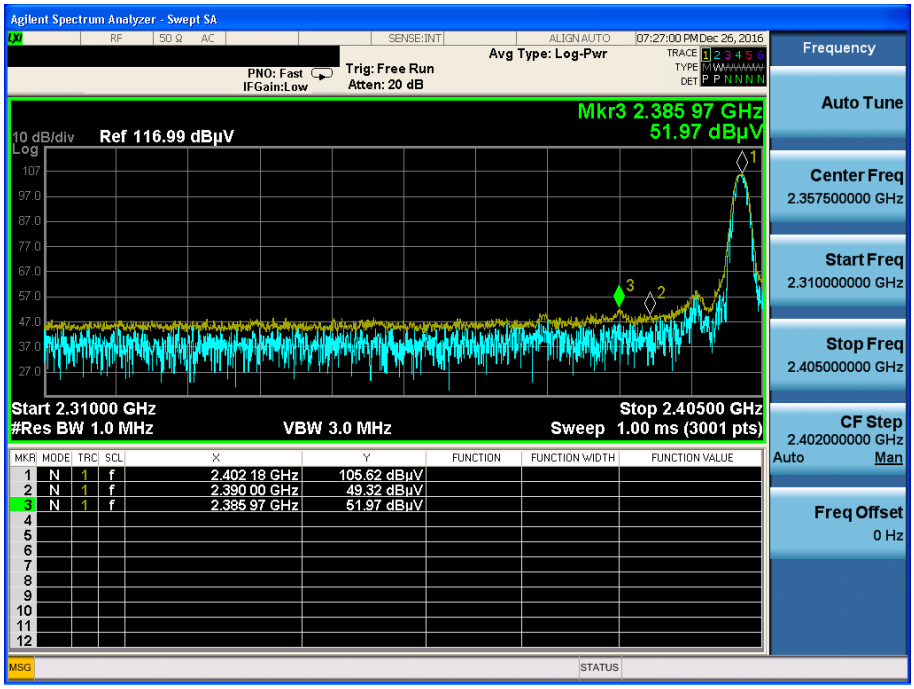
Path loss ( S/A's Correction factor) = Cable A

# APPENDIX II

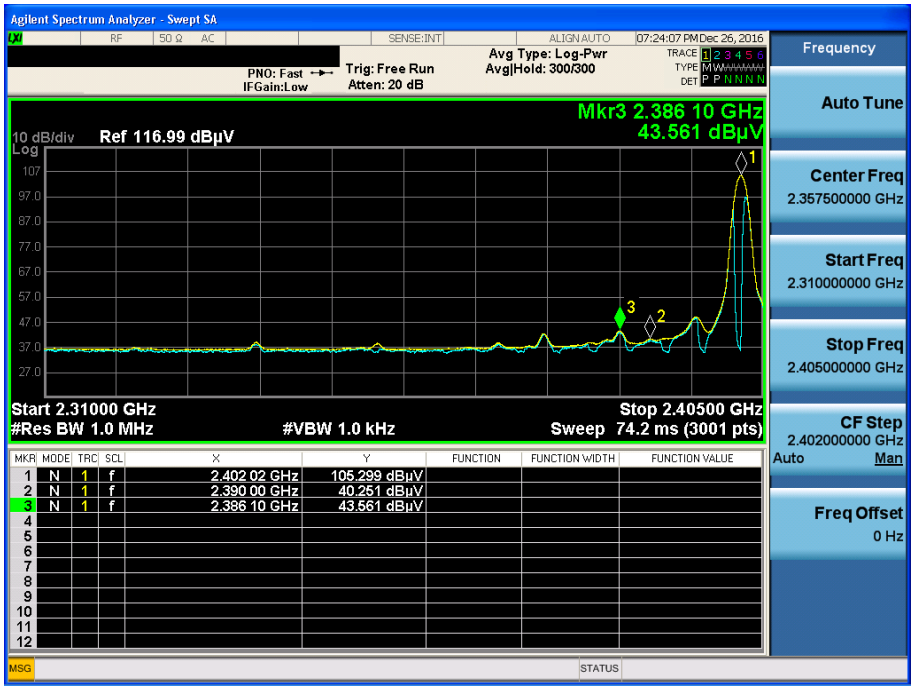
## Unwanted Emissions (Radiated) Test Plot

### Antenna 1

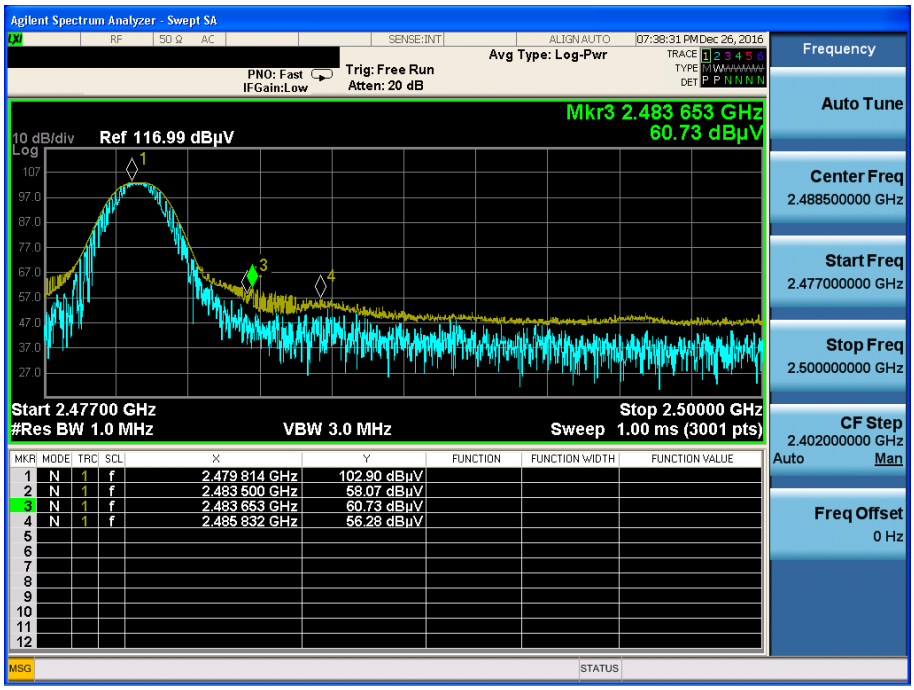
**GFSK & Lowest & X & Hor** **Detector Mode : PK**




**GFSK & Lowest & X & Hor** **Detector Mode : AV**

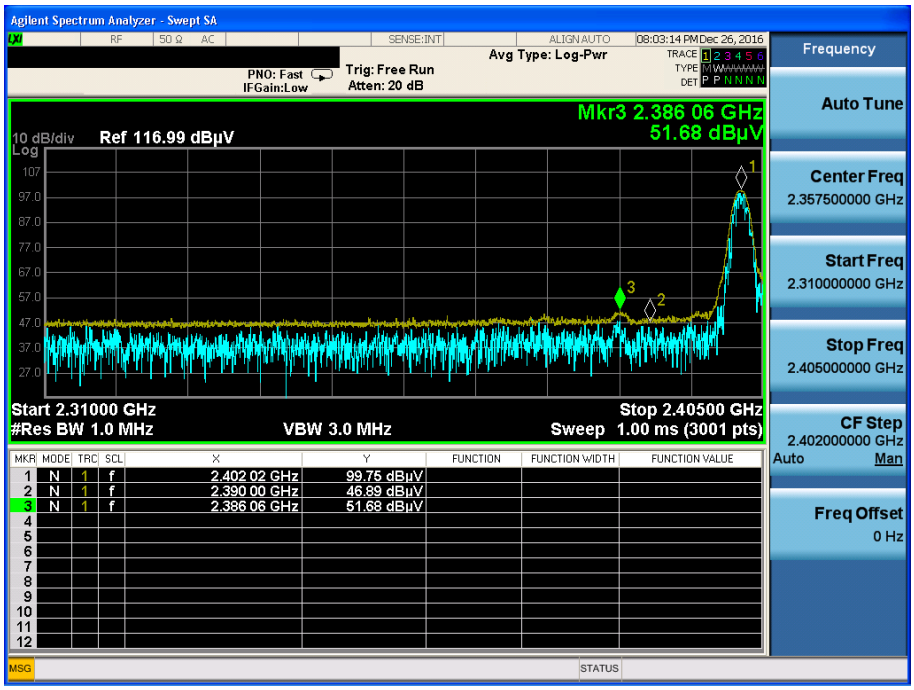


**GFSK & Highest & X & Hor** **Detector Mode : PK**

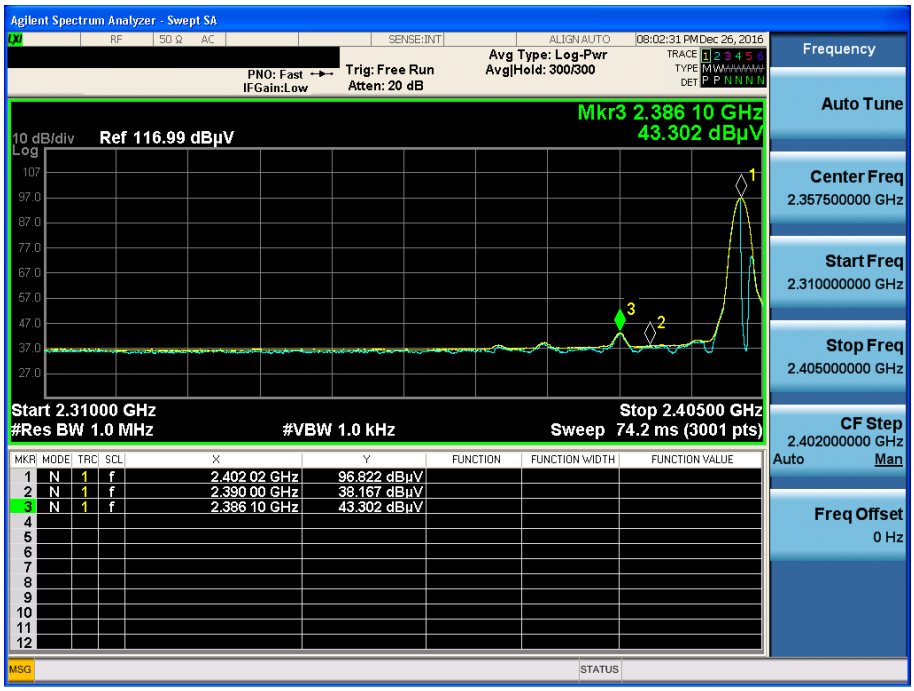



**GFSK & Highest & X & Hor** **Detector Mode : AV**

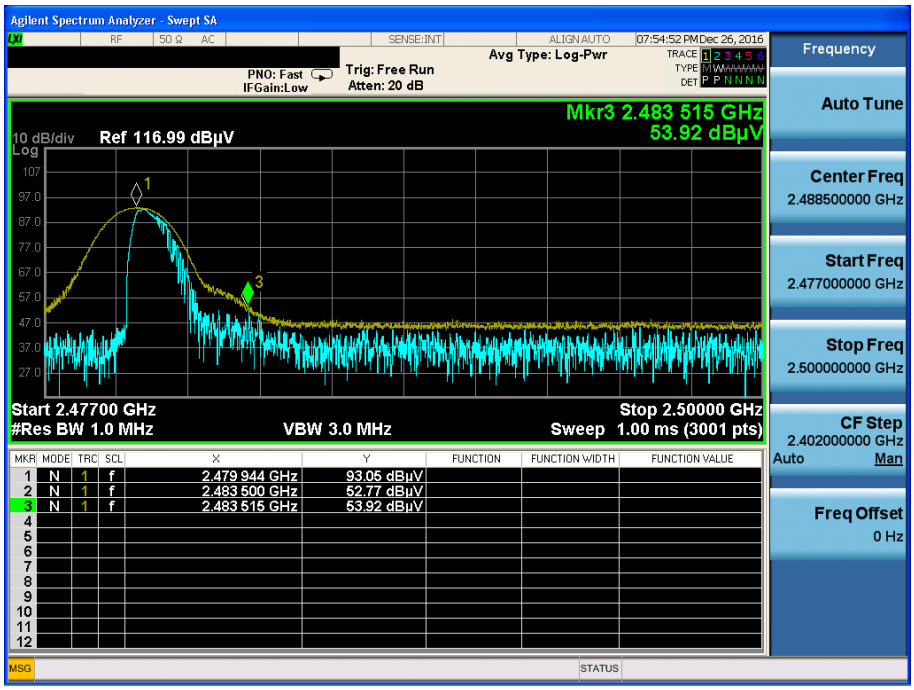
**π/4DQPSK & Lowest & X & Hor** **Detector Mode : PK**



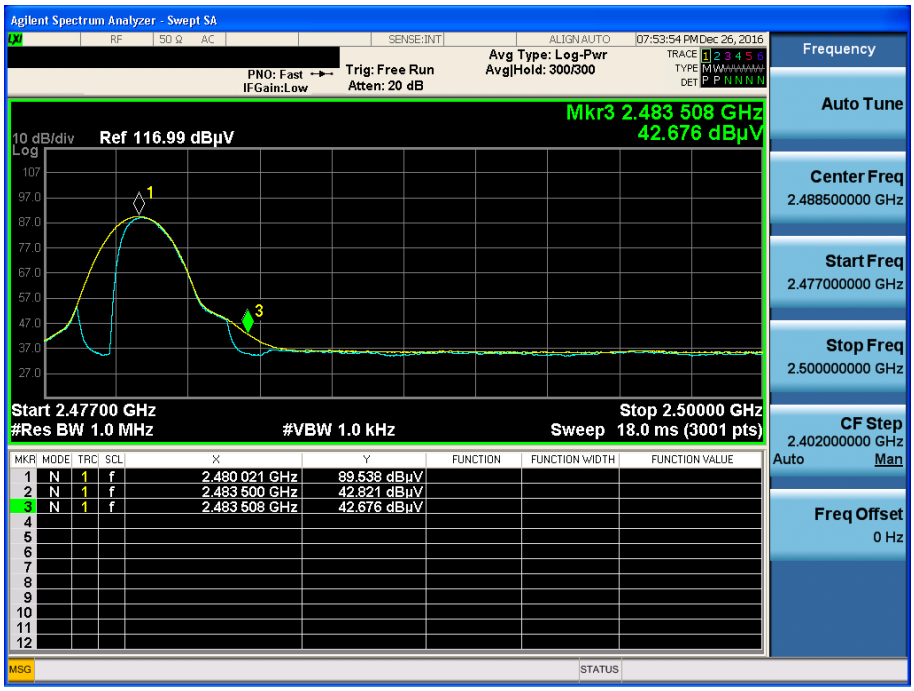

**π/4DQPSK & Lowest & X & Hor** **Detector Mode : AV**



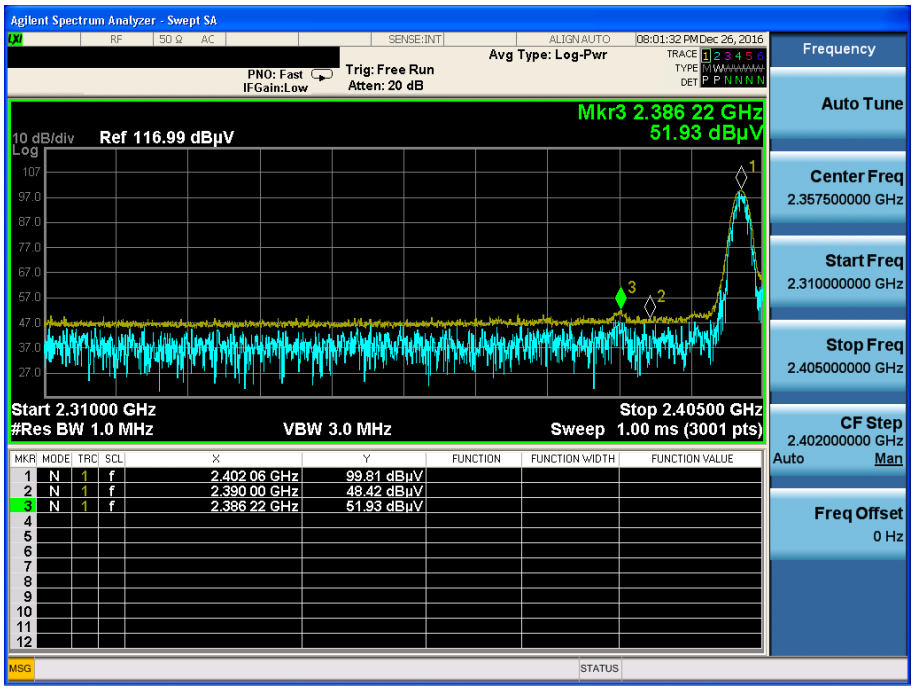
## π/4DQPSK & Highest & X & Hor — Detector Mode : PK



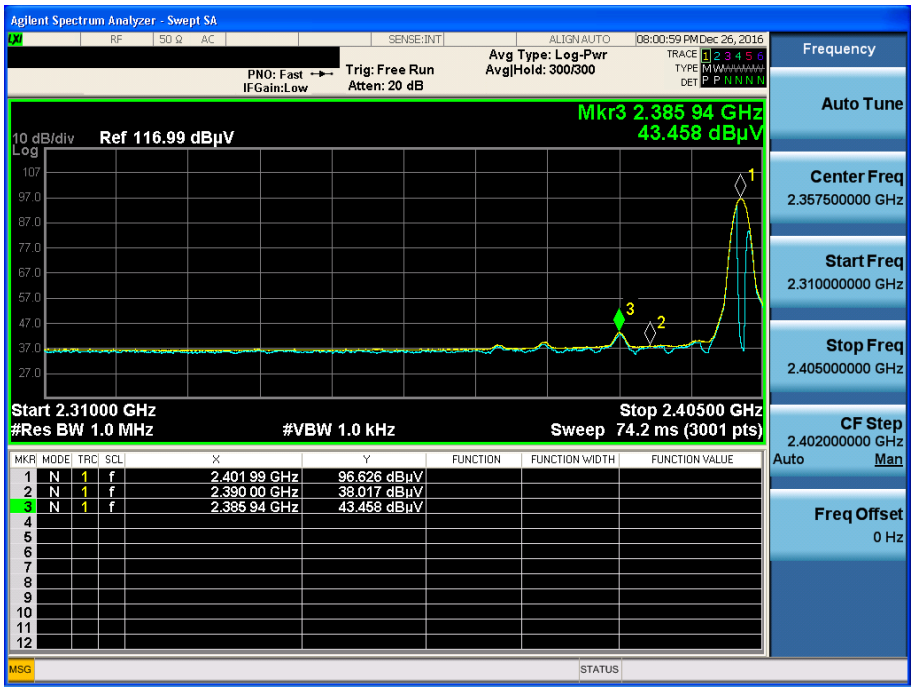

## π/4DQPSK & Highest & X & Hor — Detector Mode : AV



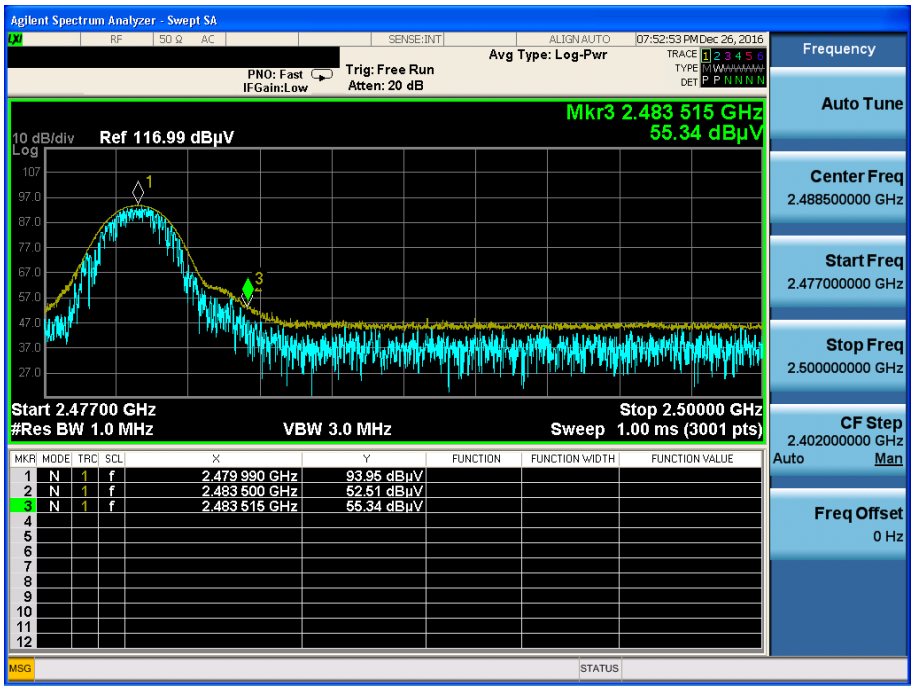
## 8DPSK & Lowest & X & Hor — Detector Mode : PK



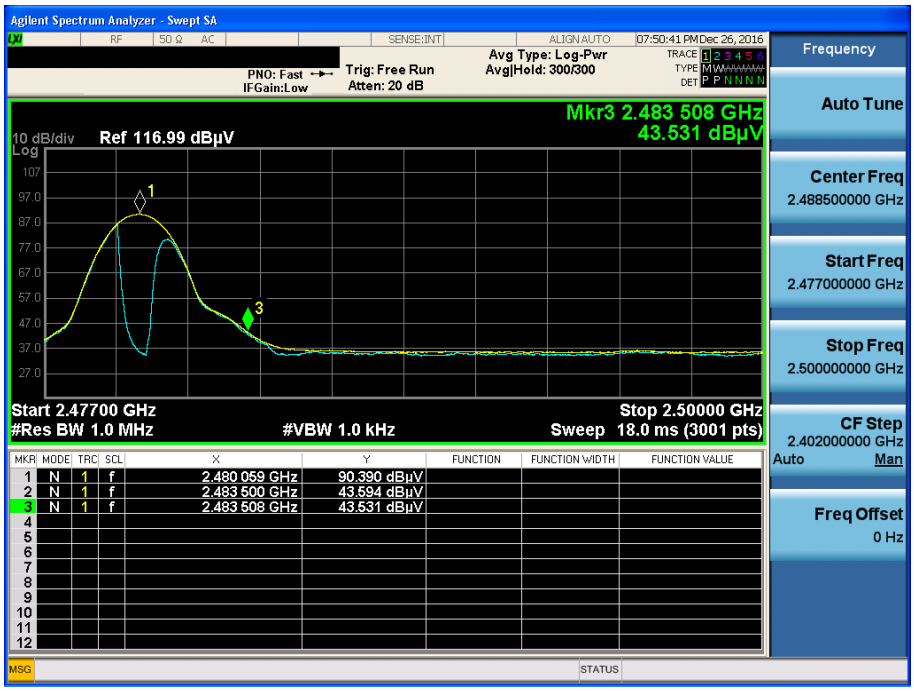

## 8DPSK & Lowest & X & Hor — Detector Mode : AV



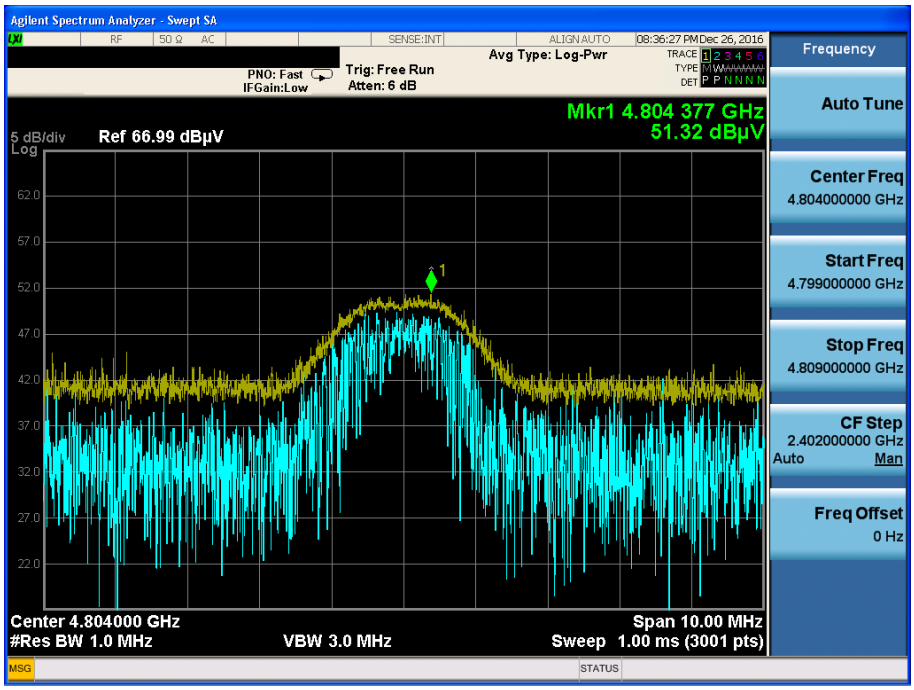
## 8DPSK & Highest & X & Hor — Detector Mode : PK



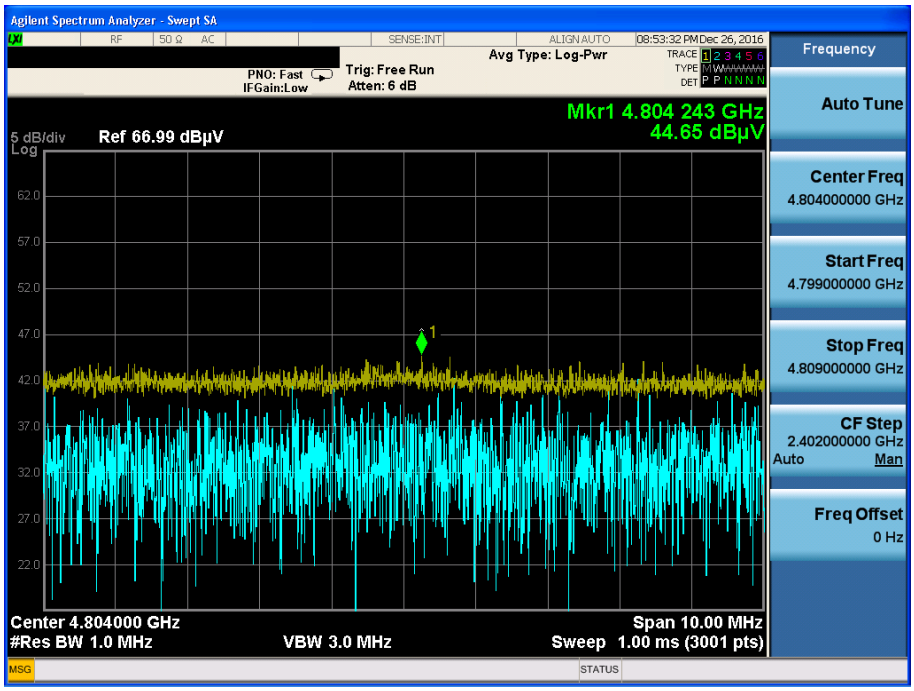

## 8DPSK & Highest & X & Hor — Detector Mode : AV



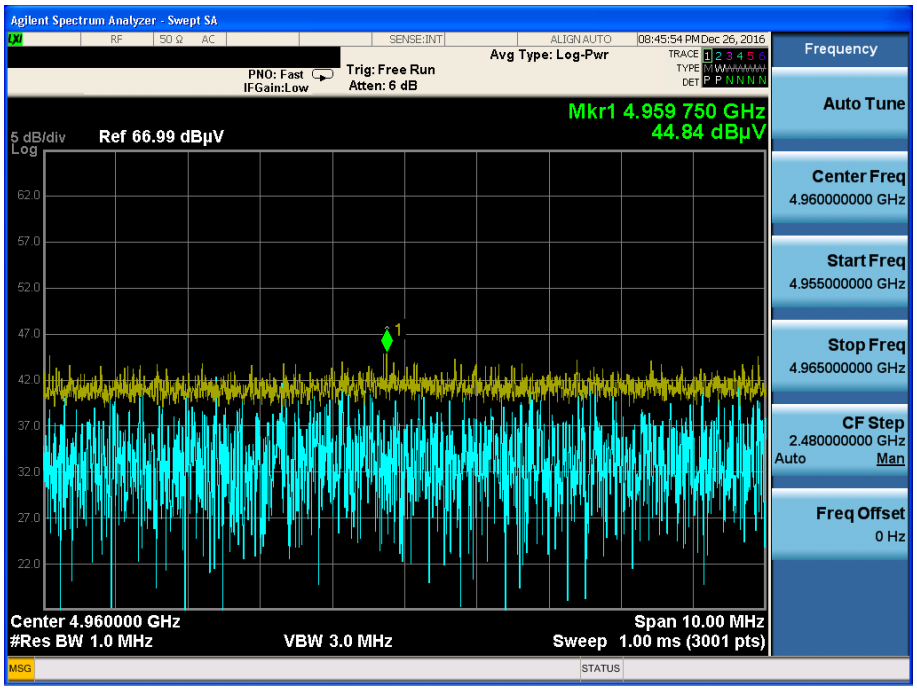
**GFSK & Lowest & Y & Hor** **Detector Mode : PK**



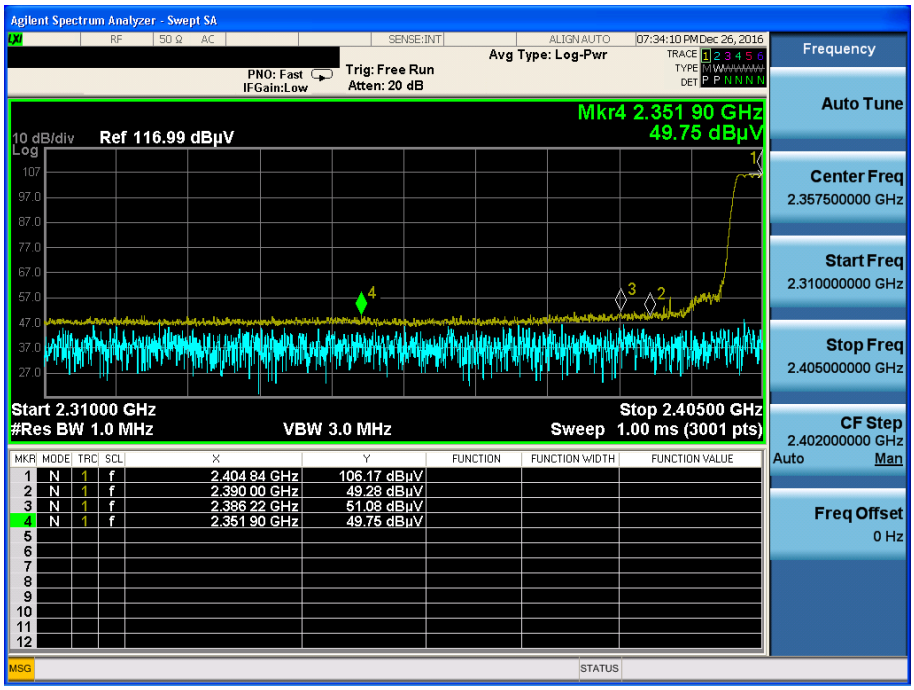

**π/4DQPSK & Lowest & Y & Hor** **Detector Mode : PK**



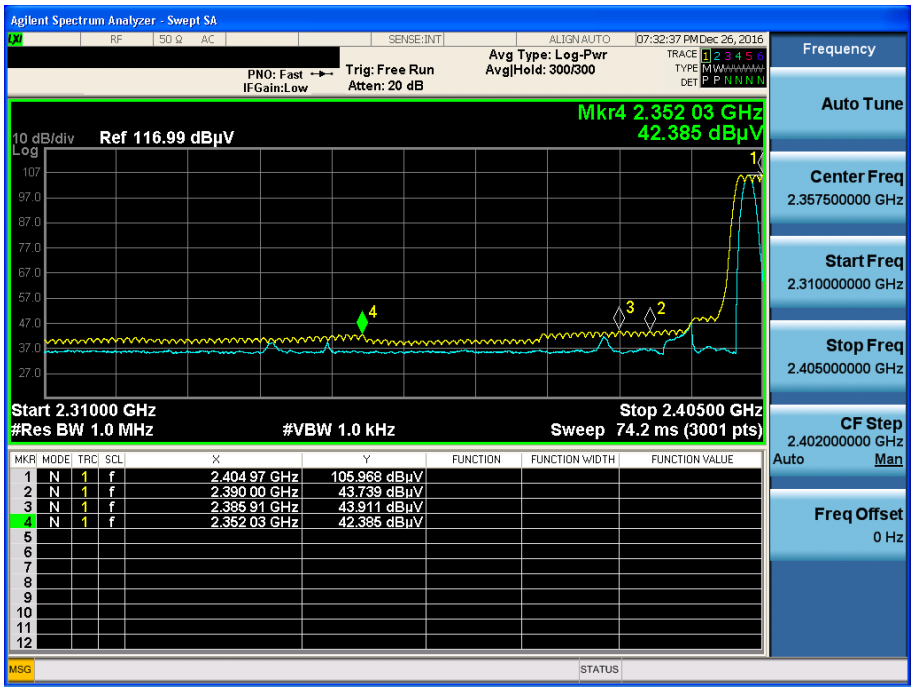
**8DPSK & Highest & Y & Hor** **Detector Mode : PK**



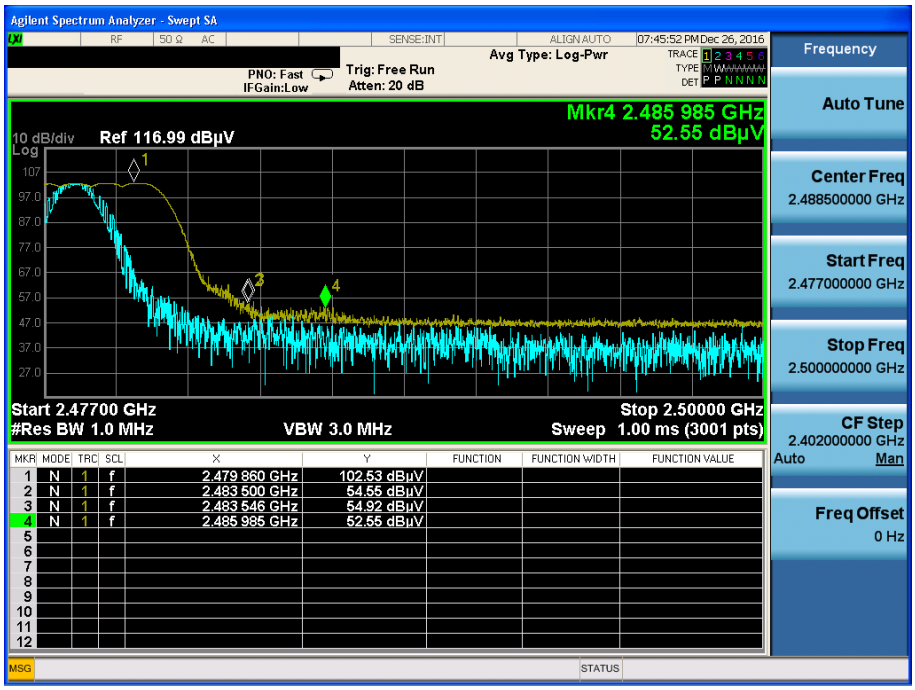
## GFSK & Hopping mode & X & Hor — Detector Mode : PK



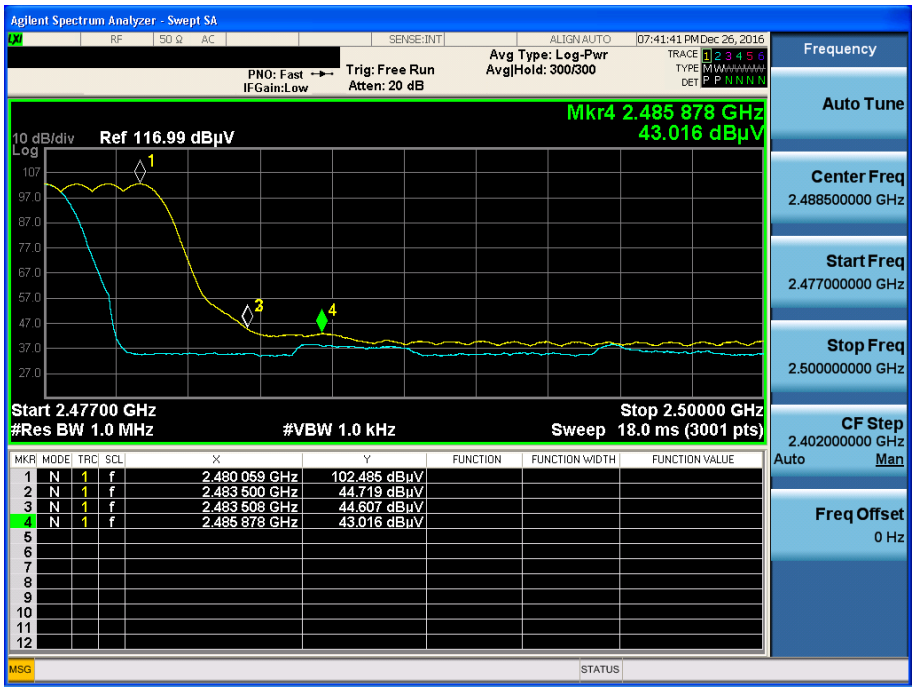

## GFSK & Hopping mode & X & Hor — Detector Mode : AV



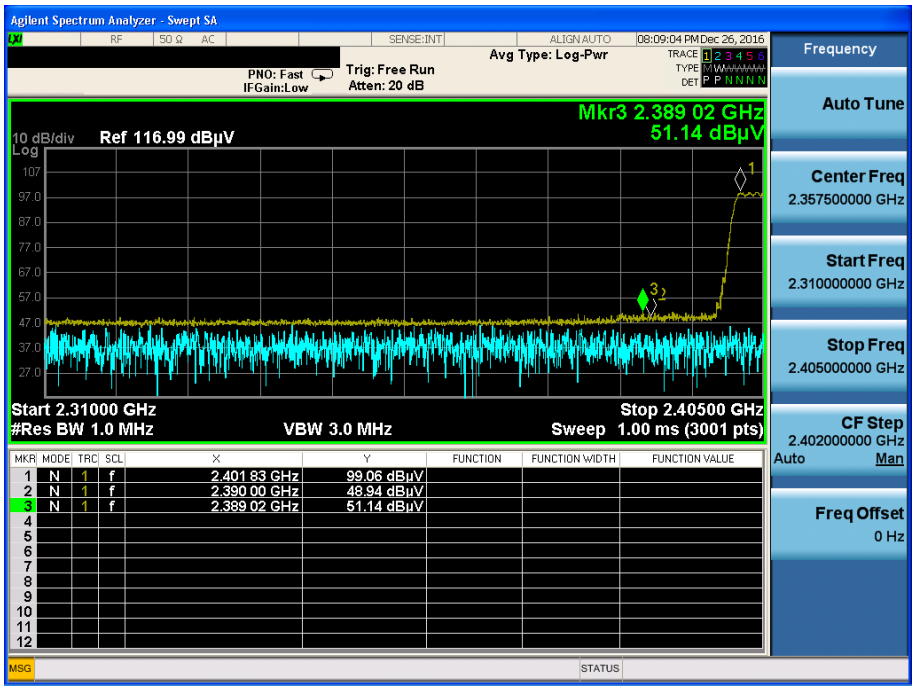
## GFSK & Hopping mode & X & Hor — Detector Mode : PK



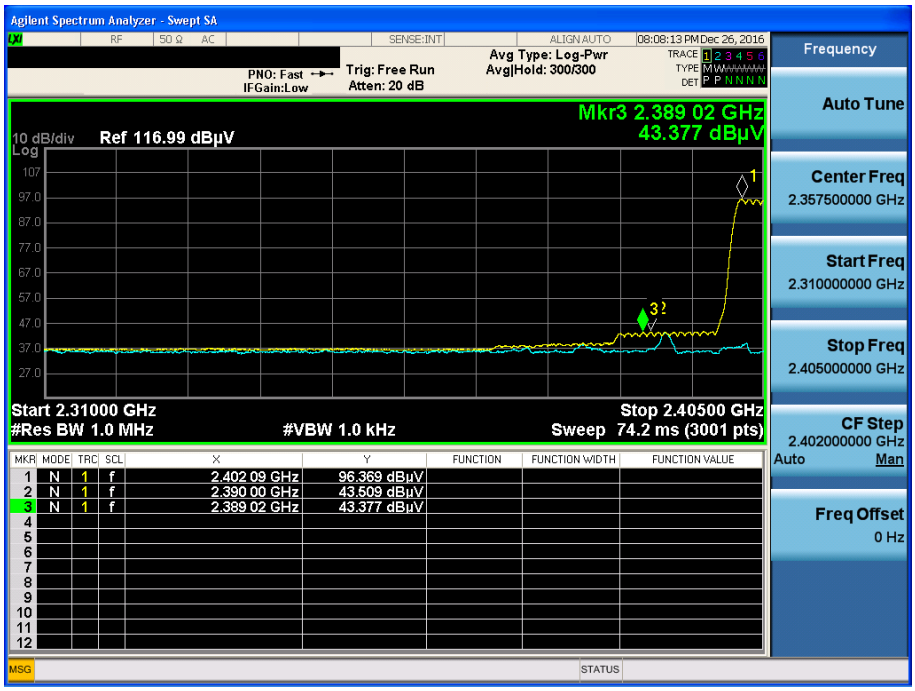

## GFSK & Hopping mode & X & Hor — Detector Mode : AV



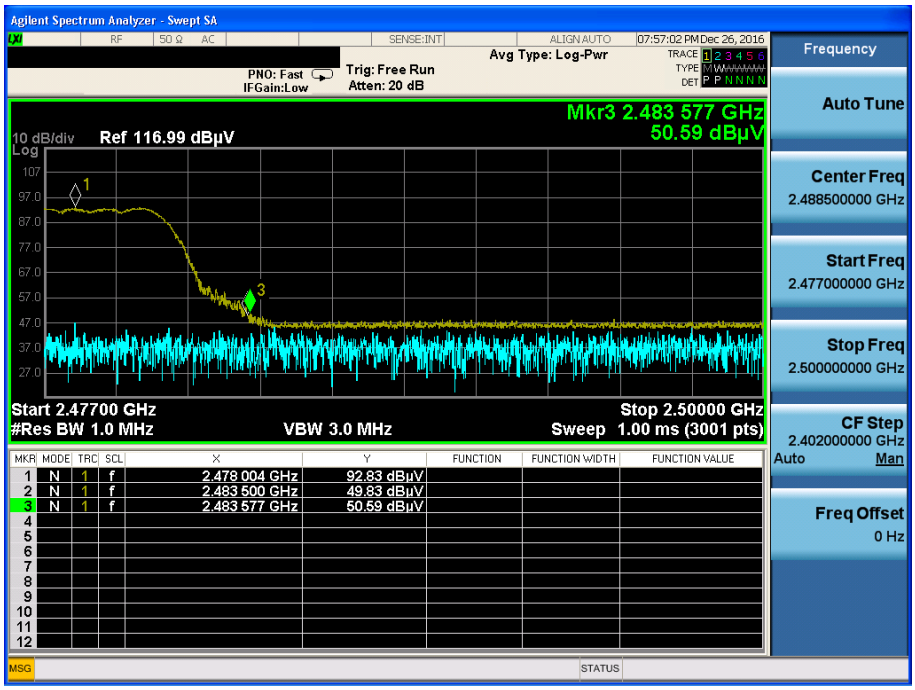
**π/4DQPSK & Hopping mode & X & Hor** **Detector Mode : PK**



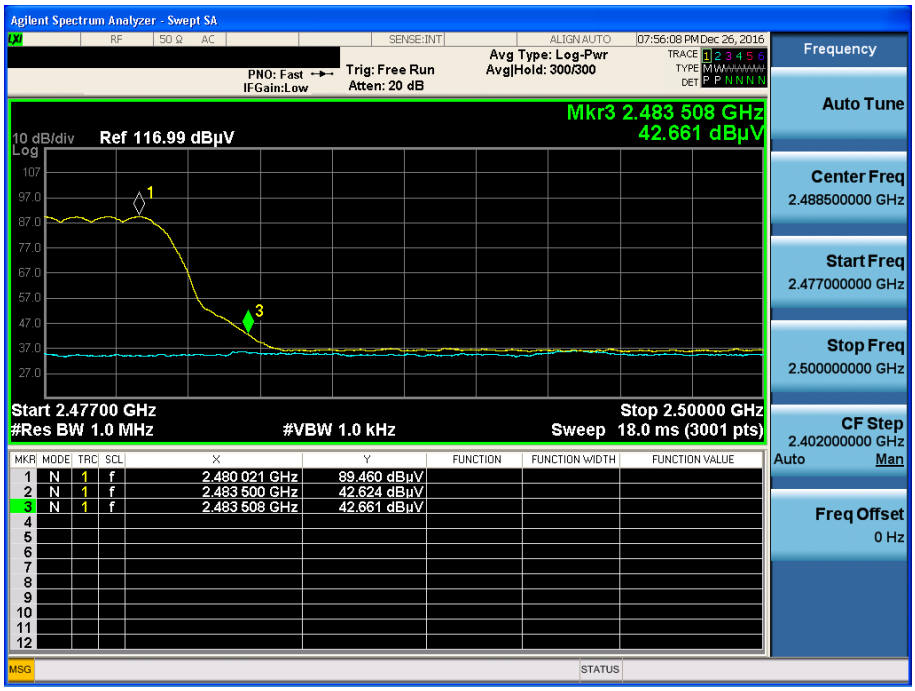

**π/4DQPSK & Hopping mode & X & Hor** **Detector Mode : AV**



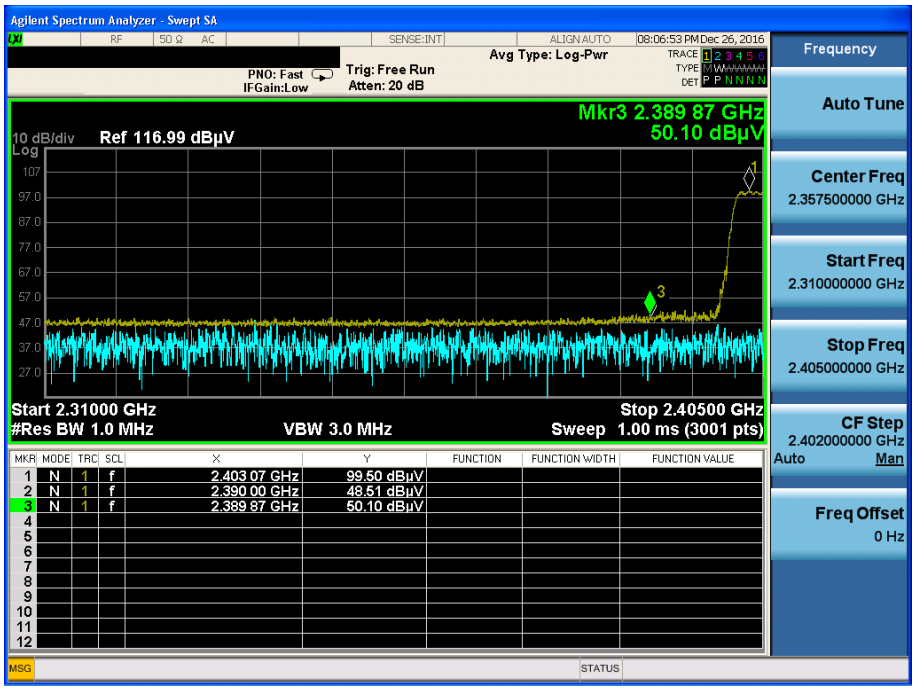
## π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK



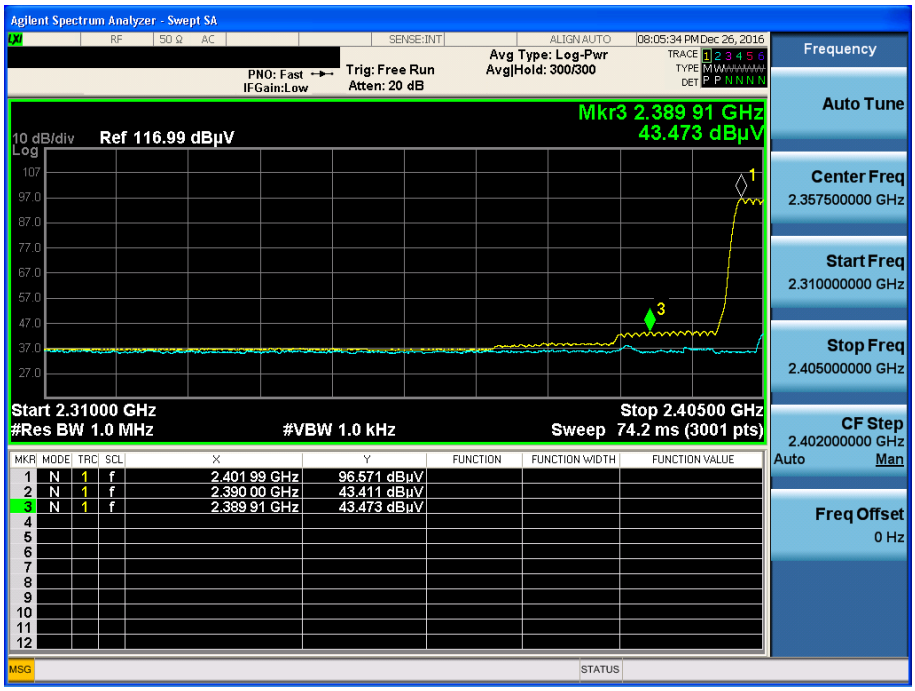

## π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV



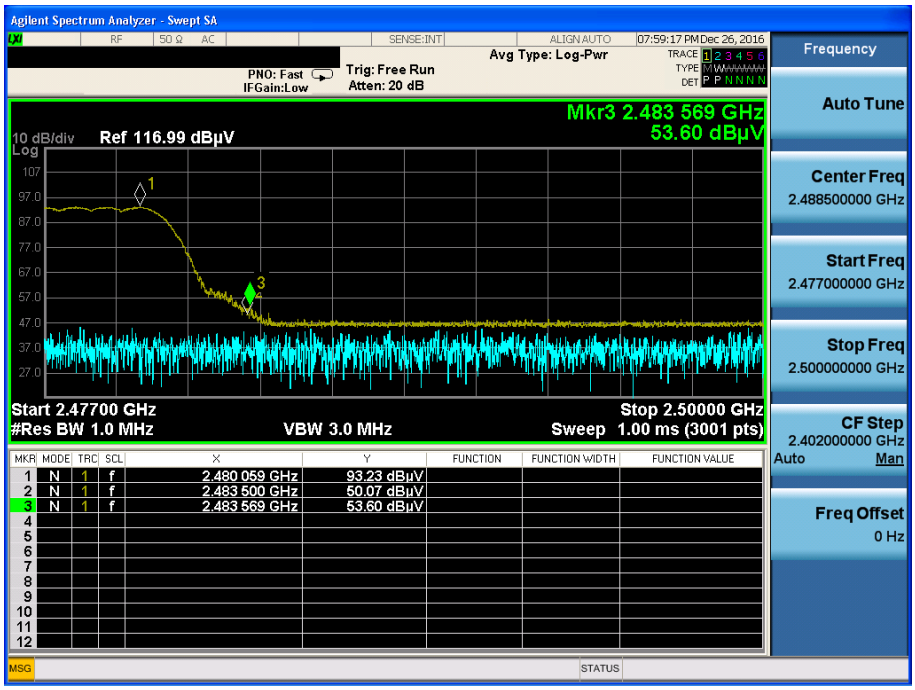
## 8DPSK & Hopping mode & X & Hor — Detector Mode : PK



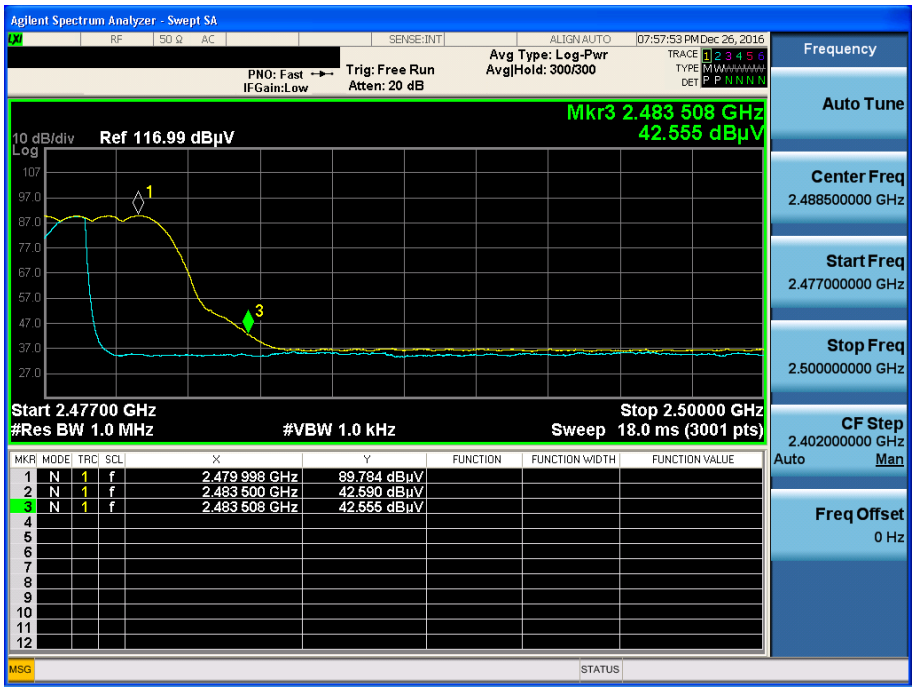

## 8DPSK & Hopping mode & X & Hor — Detector Mode : AV



## 8DPSK & Hopping mode & X & Hor — Detector Mode : PK

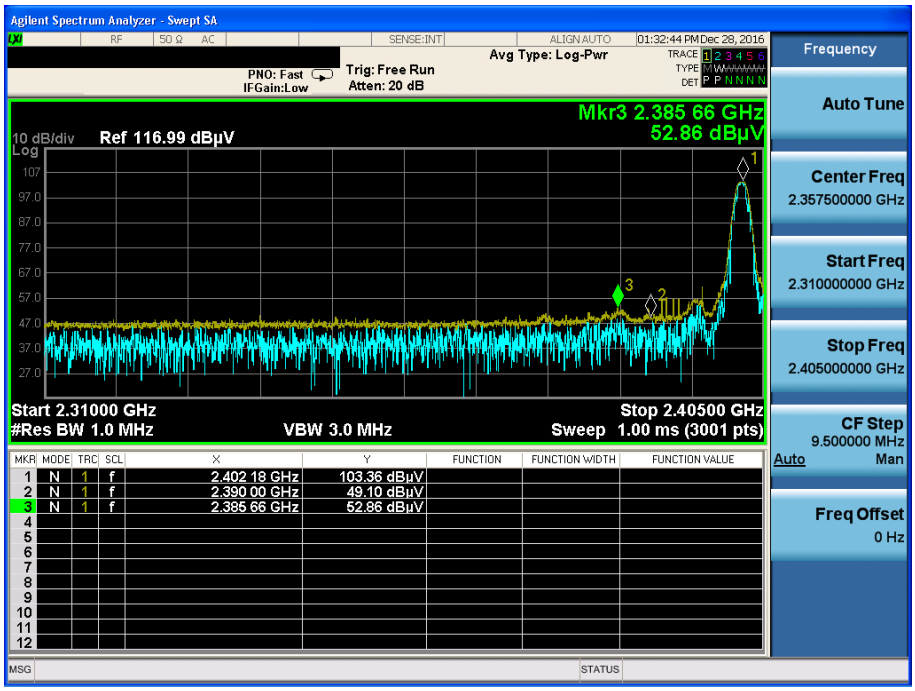



## 8DPSK & Hopping mode & X & Hor — Detector Mode : AV

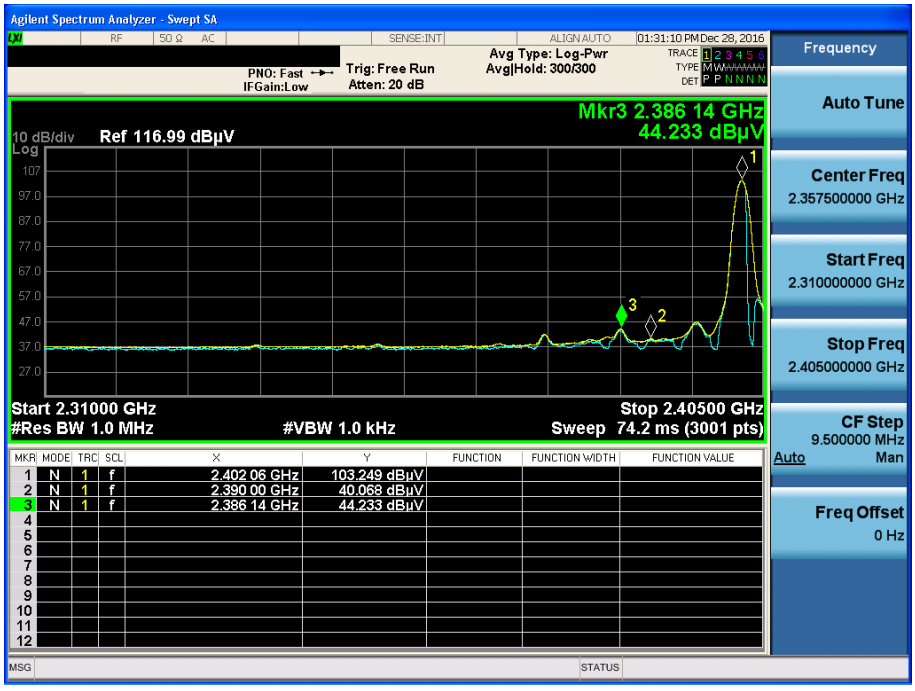


## Antenna 2

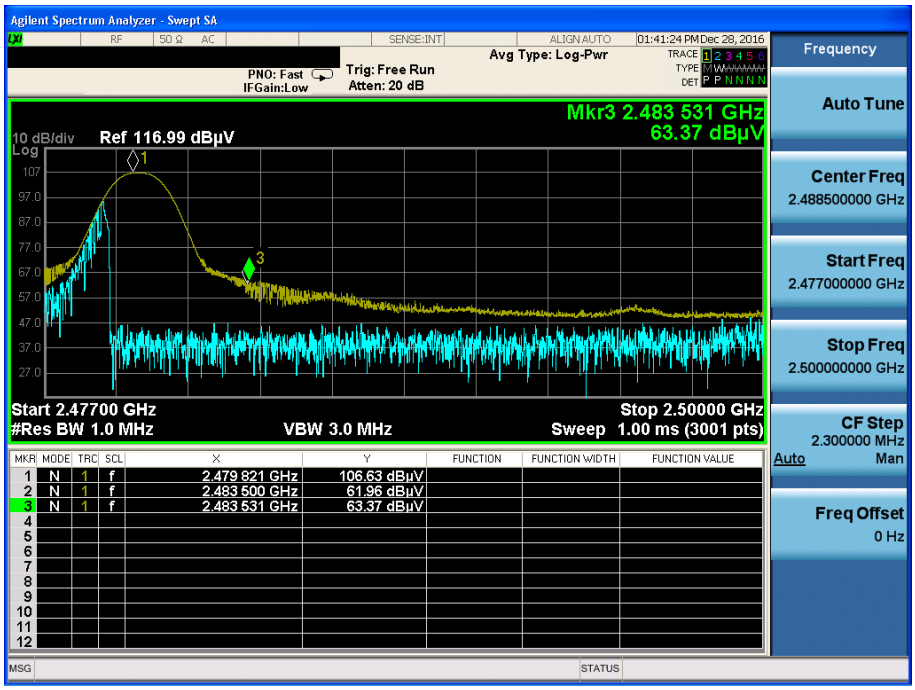
### GFSK & Lowest & X & Hor — Detector Mode : PK




### GFSK & Lowest & X & Hor — Detector Mode : AV

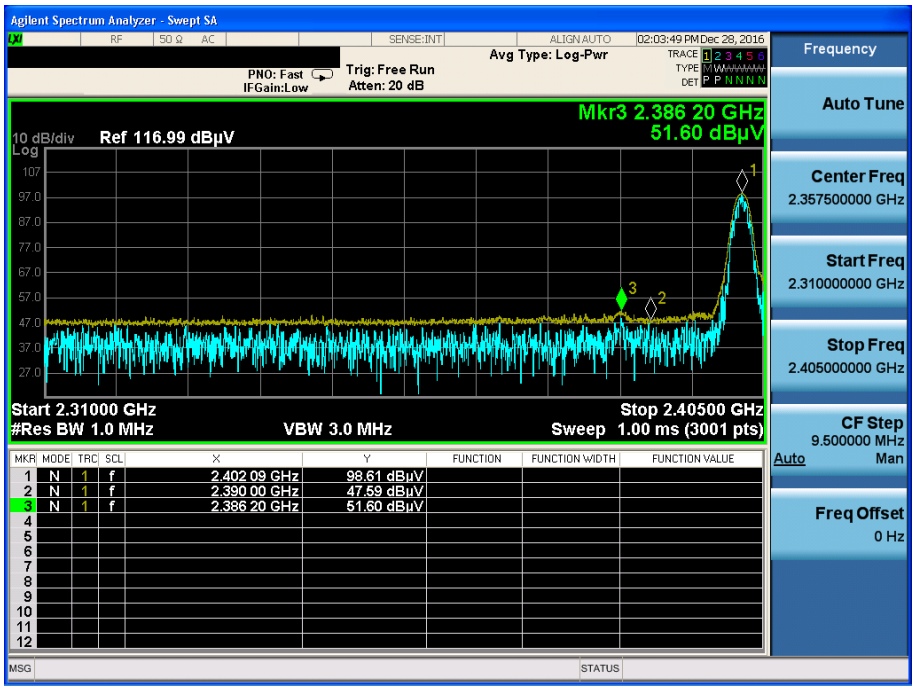


**GFSK & Highest & X & Hor** **Detector Mode : PK**

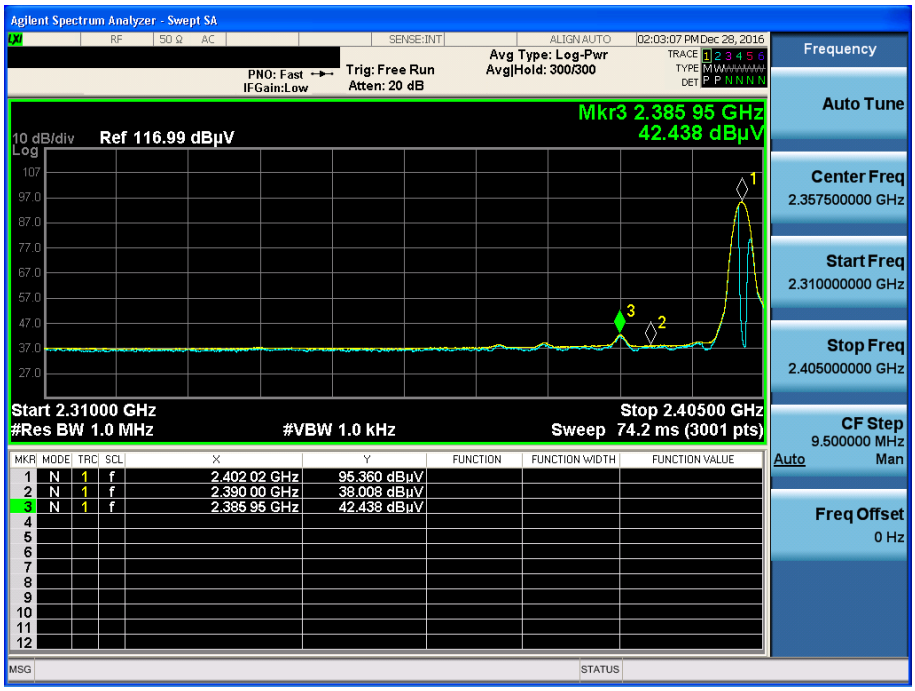



**GFSK & Highest & X & Hor** **Detector Mode : AV**

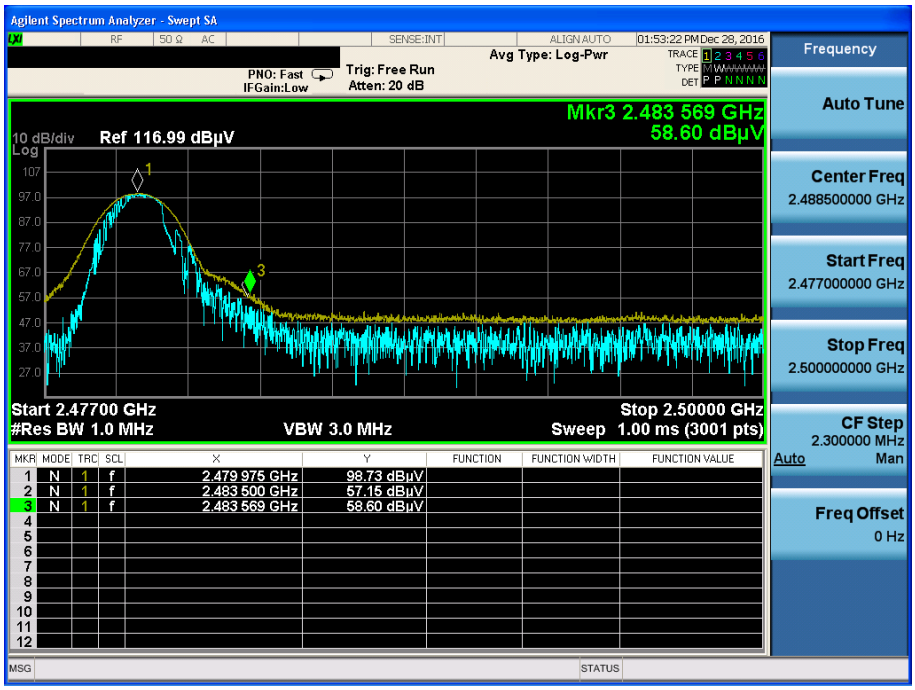
## π/4DQPSK & Lowest & X & Hor — Detector Mode : PK




## π/4DQPSK & Lowest & X & Hor — Detector Mode : AV

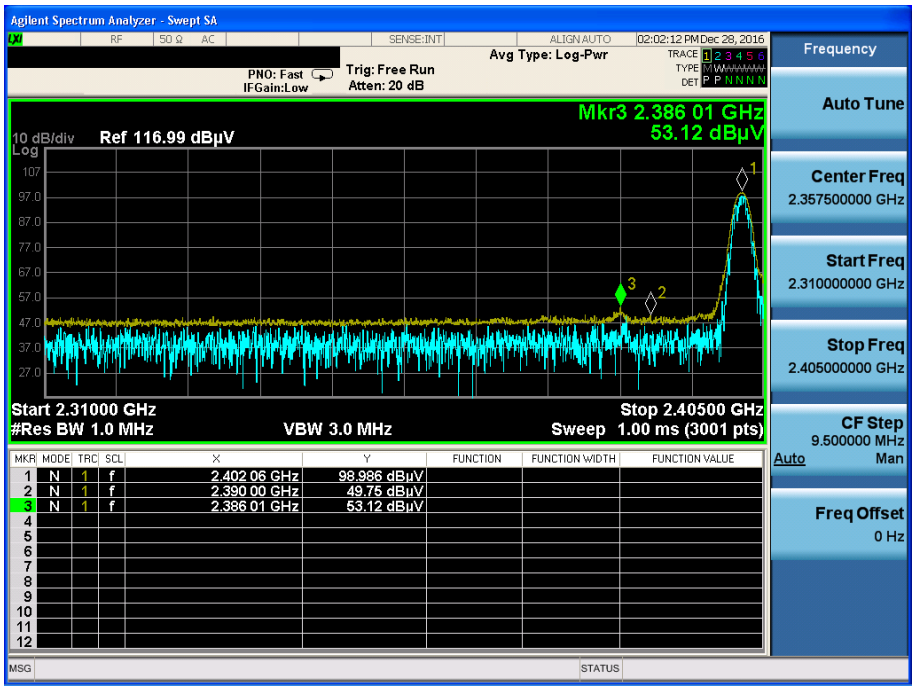


## π/4DQPSK & Highest & X & Hor — Detector Mode : PK

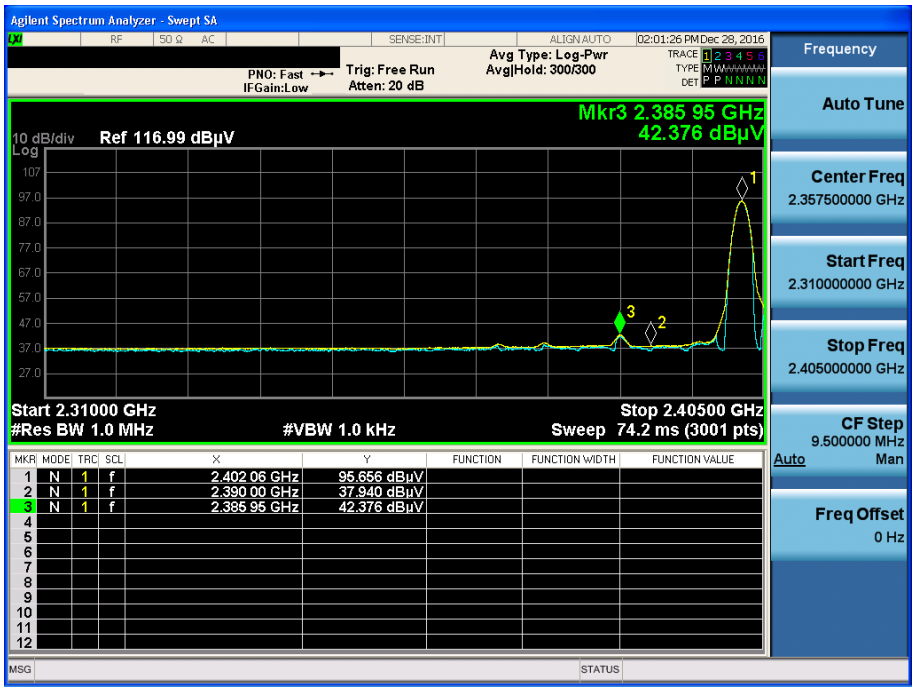



## π/4DQPSK & Highest & X & Hor — Detector Mode : AV

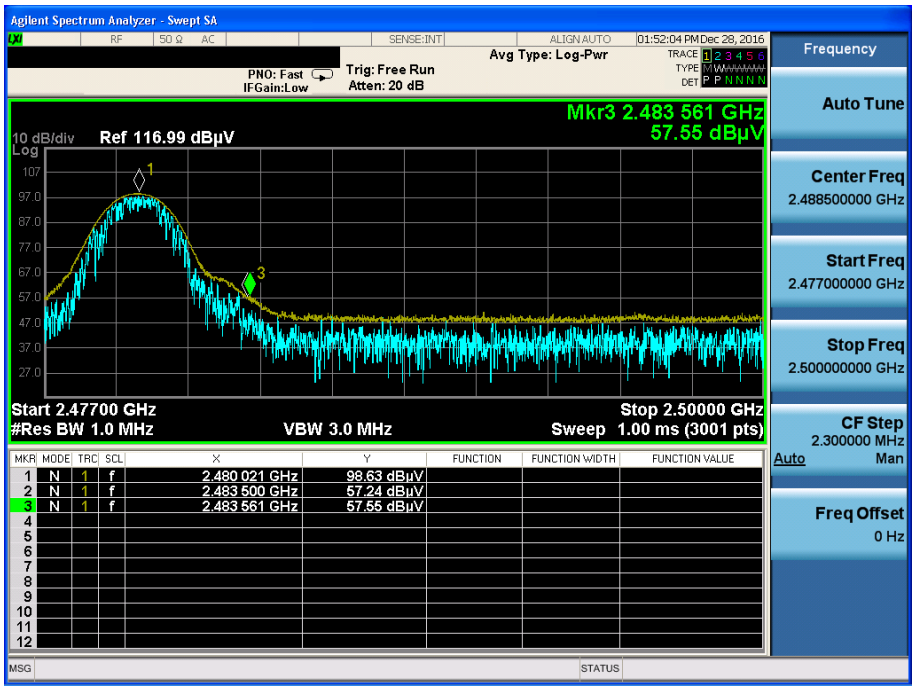
**8DPSK & Lowest & X & Hor** **Detector Mode : PK**



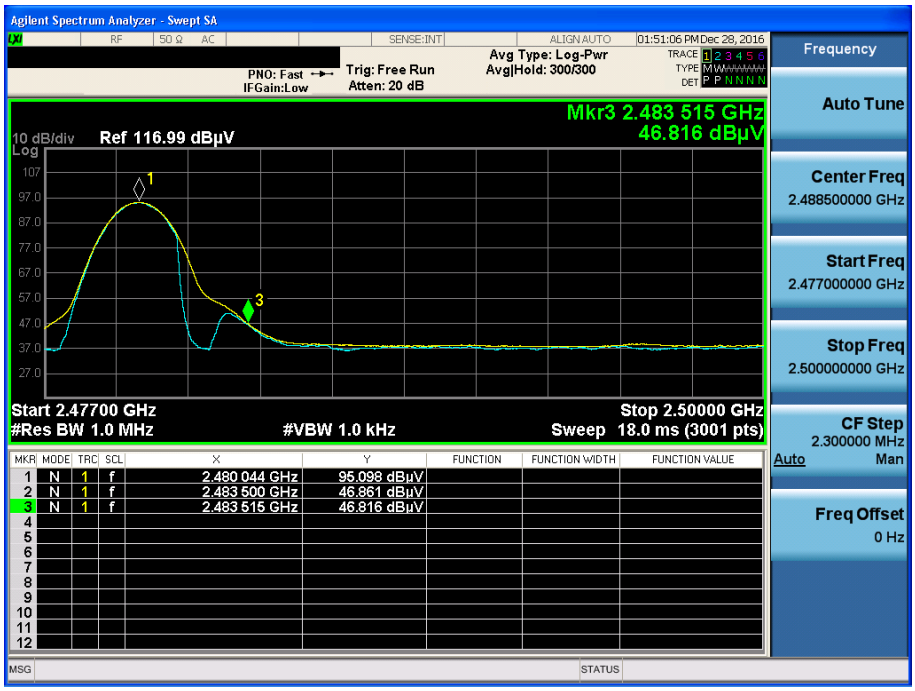

**8DPSK & Lowest & X & Hor** **Detector Mode : AV**



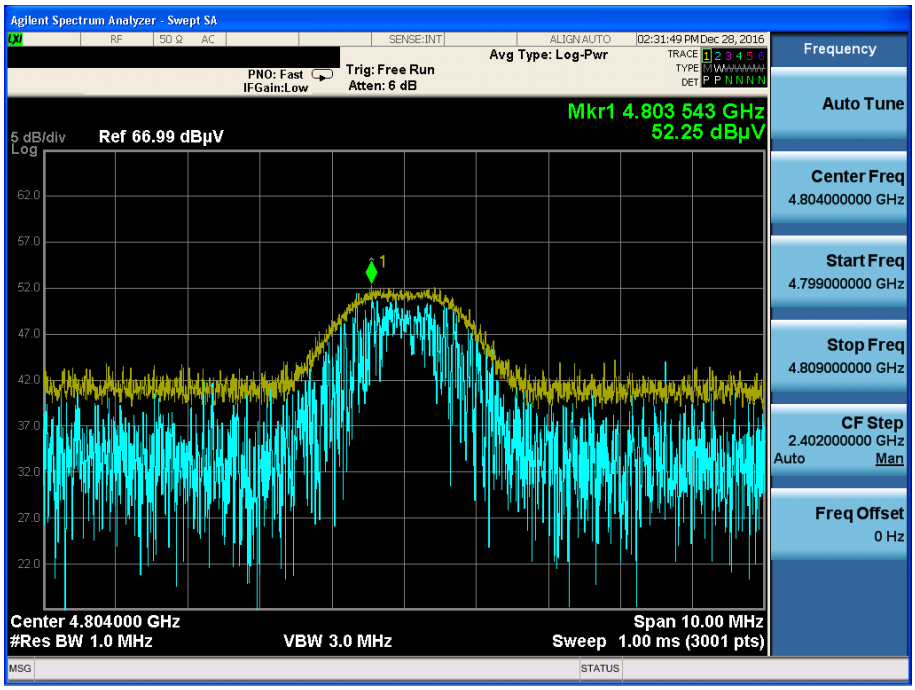
## 8DPSK & Highest & X & Hor — Detector Mode : PK



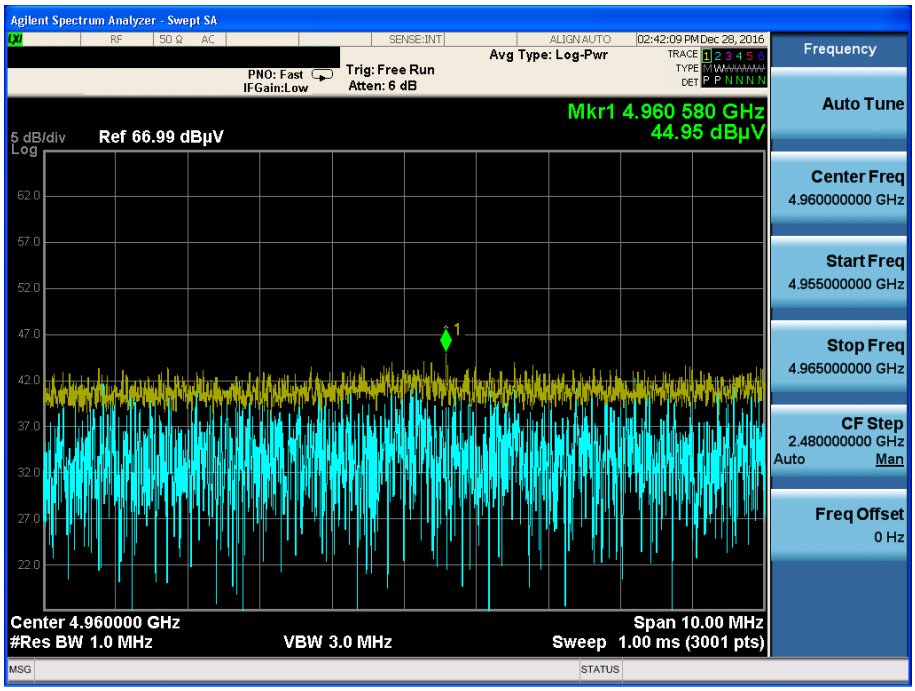

## 8DPSK & Highest & X & Hor — Detector Mode : AV



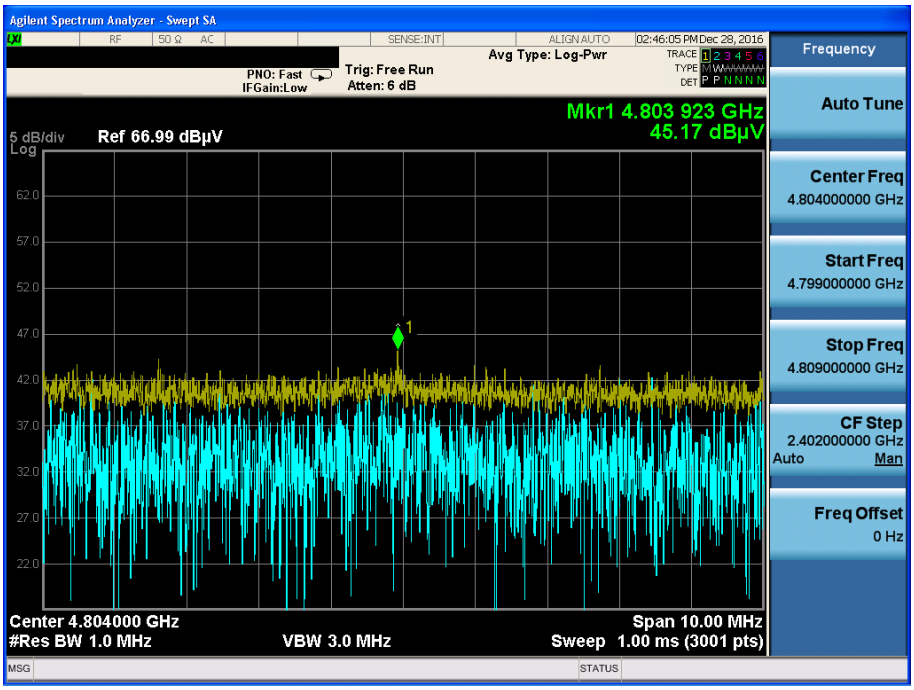
**GFSK & Lowest & Y & Hor** **Detector Mode : PK**



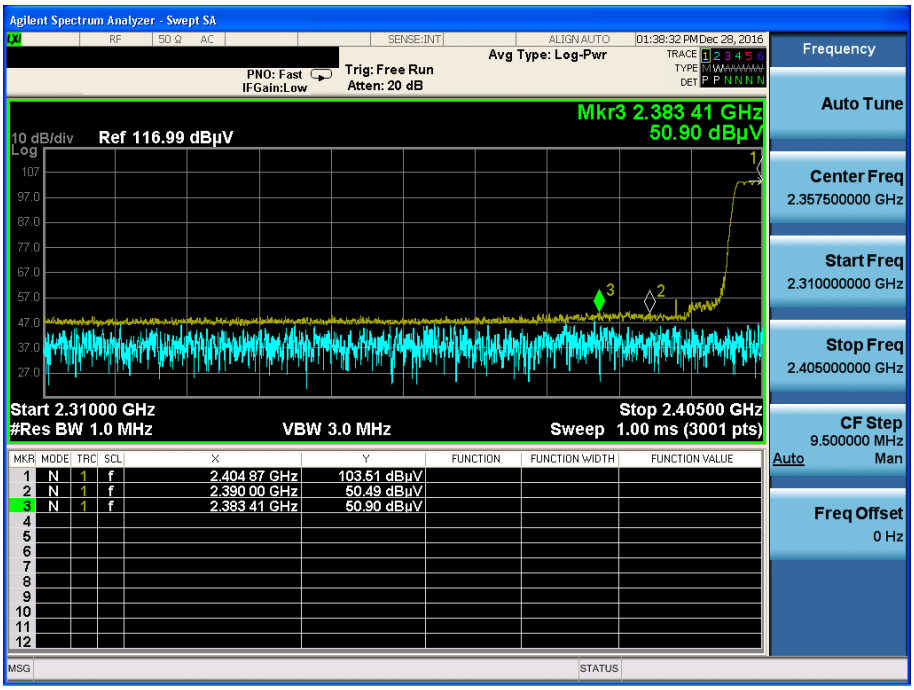

**π/4DQPSK & Highest & Y & Hor** **Detector Mode : PK**



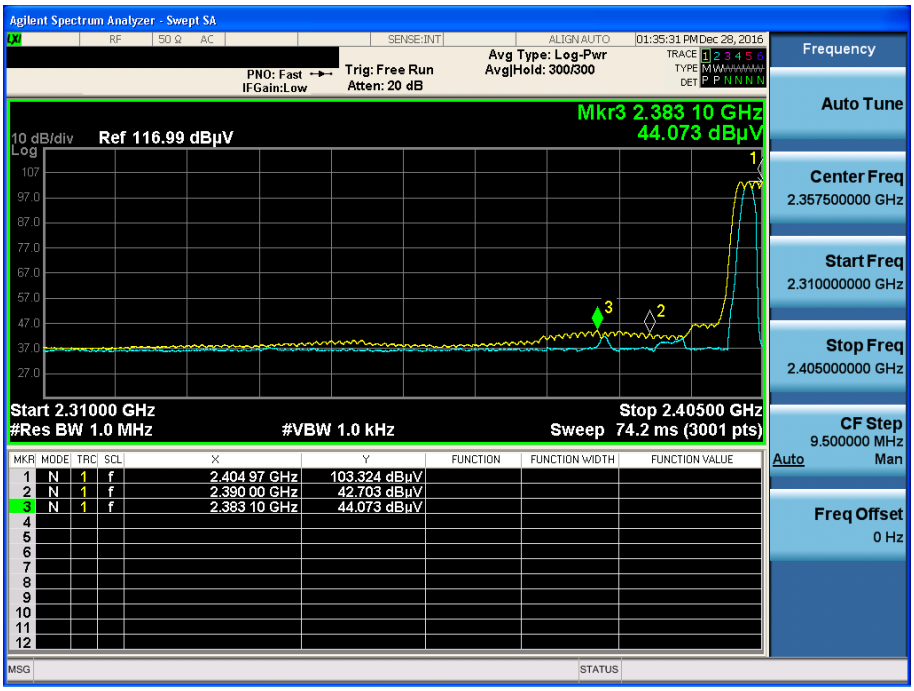
**8DPSK & Lowest & Y & Hor** **Detector Mode : PK**



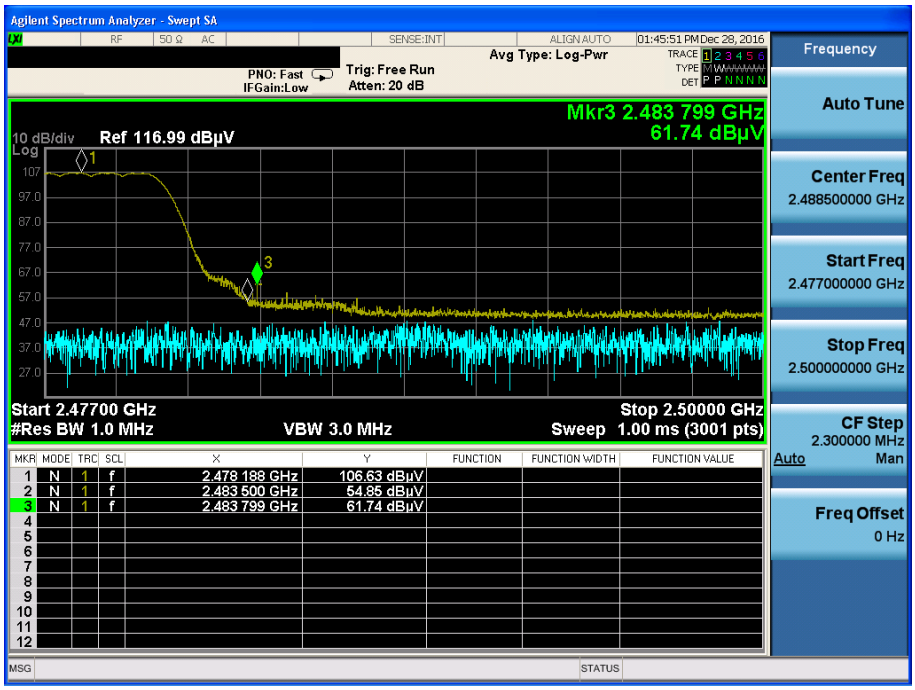
## GFSK & Hopping mode & X & Hor — Detector Mode : PK



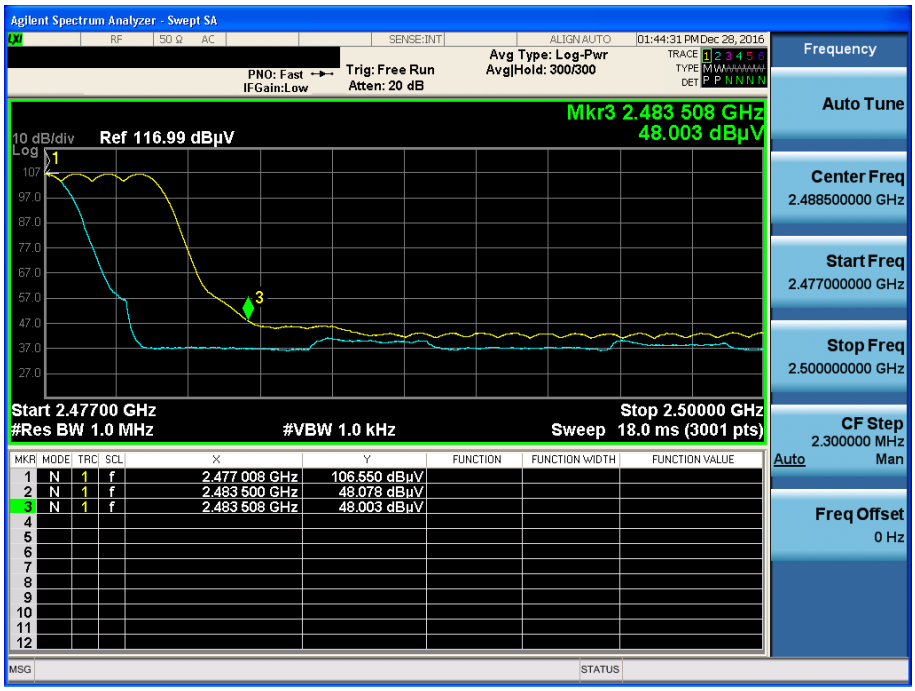

## GFSK & Hopping mode & X & Hor — Detector Mode : AV



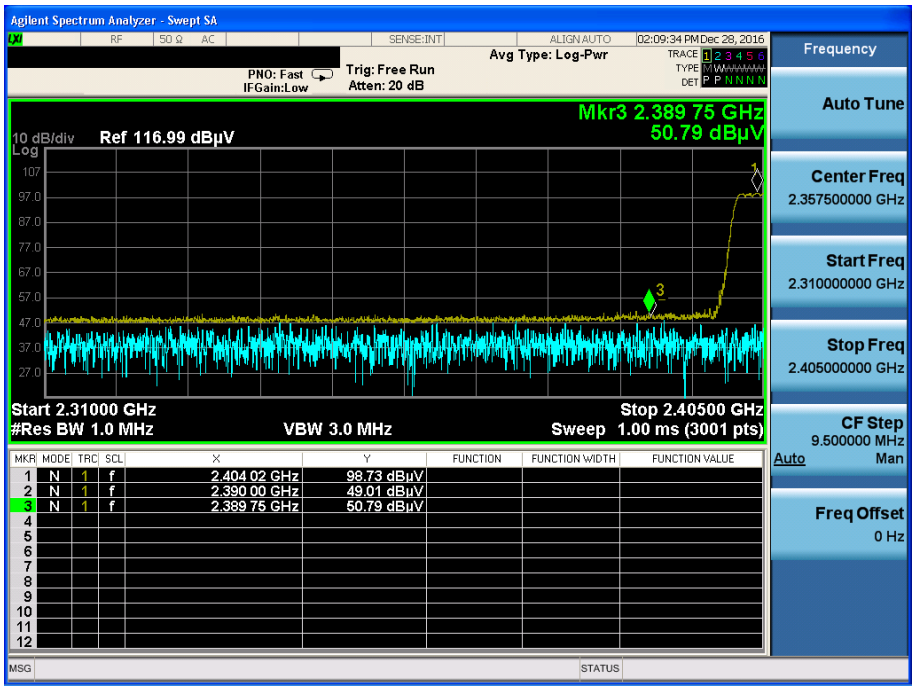
## GFSK & Hopping mode & X & Hor — Detector Mode : PK



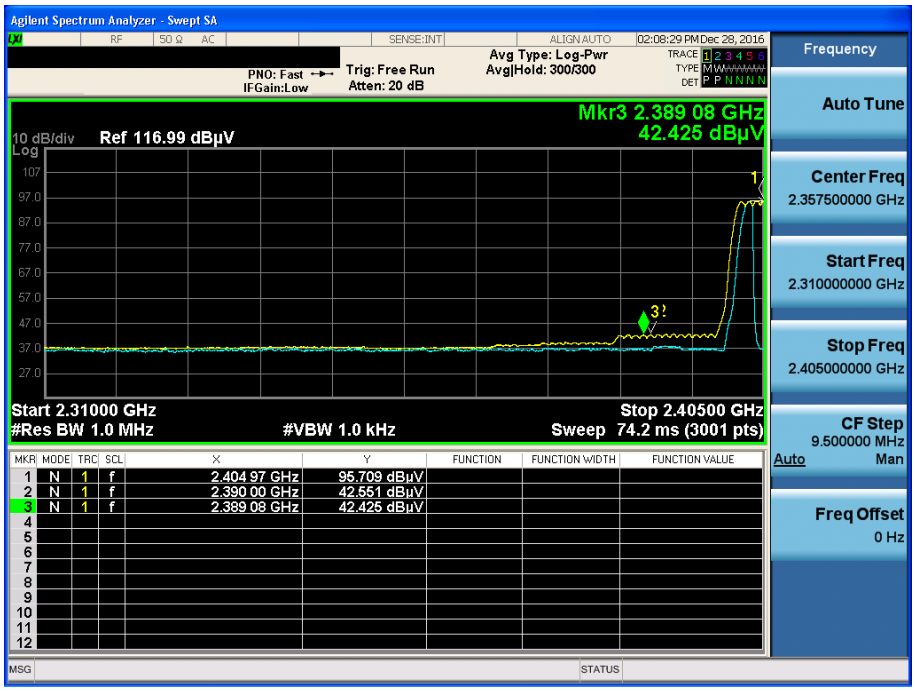

## GFSK & Hopping mode & X & Hor — Detector Mode : AV



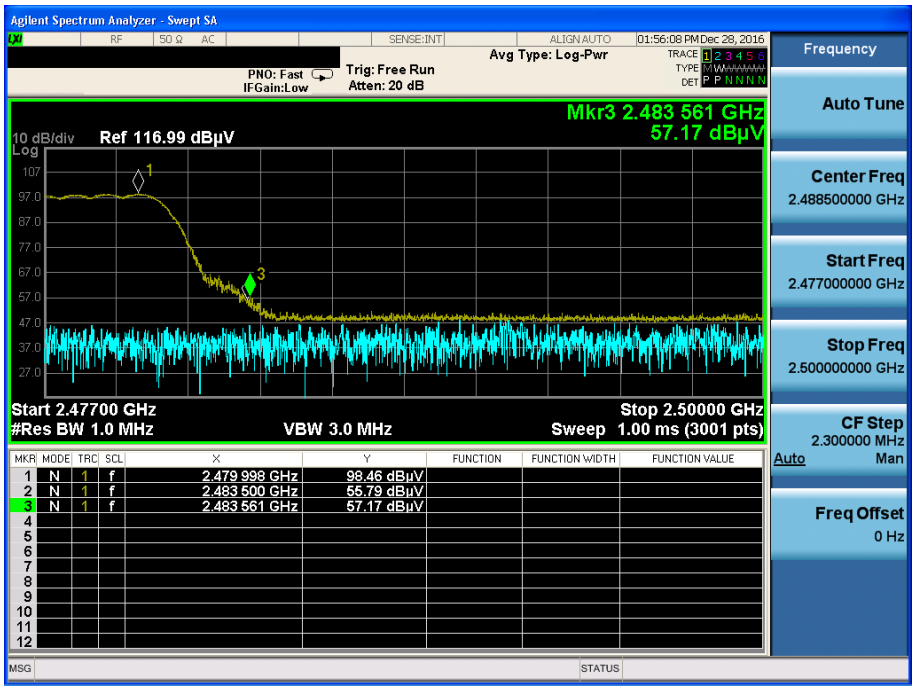
**π/4DQPSK & Hopping mode & X & Hor** **Detector Mode : PK**




**π/4DQPSK & Hopping mode & X & Hor** **Detector Mode : AV**



## π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK




## π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV