8. Transmitter AC Power Line Conducted Emission

8.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

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

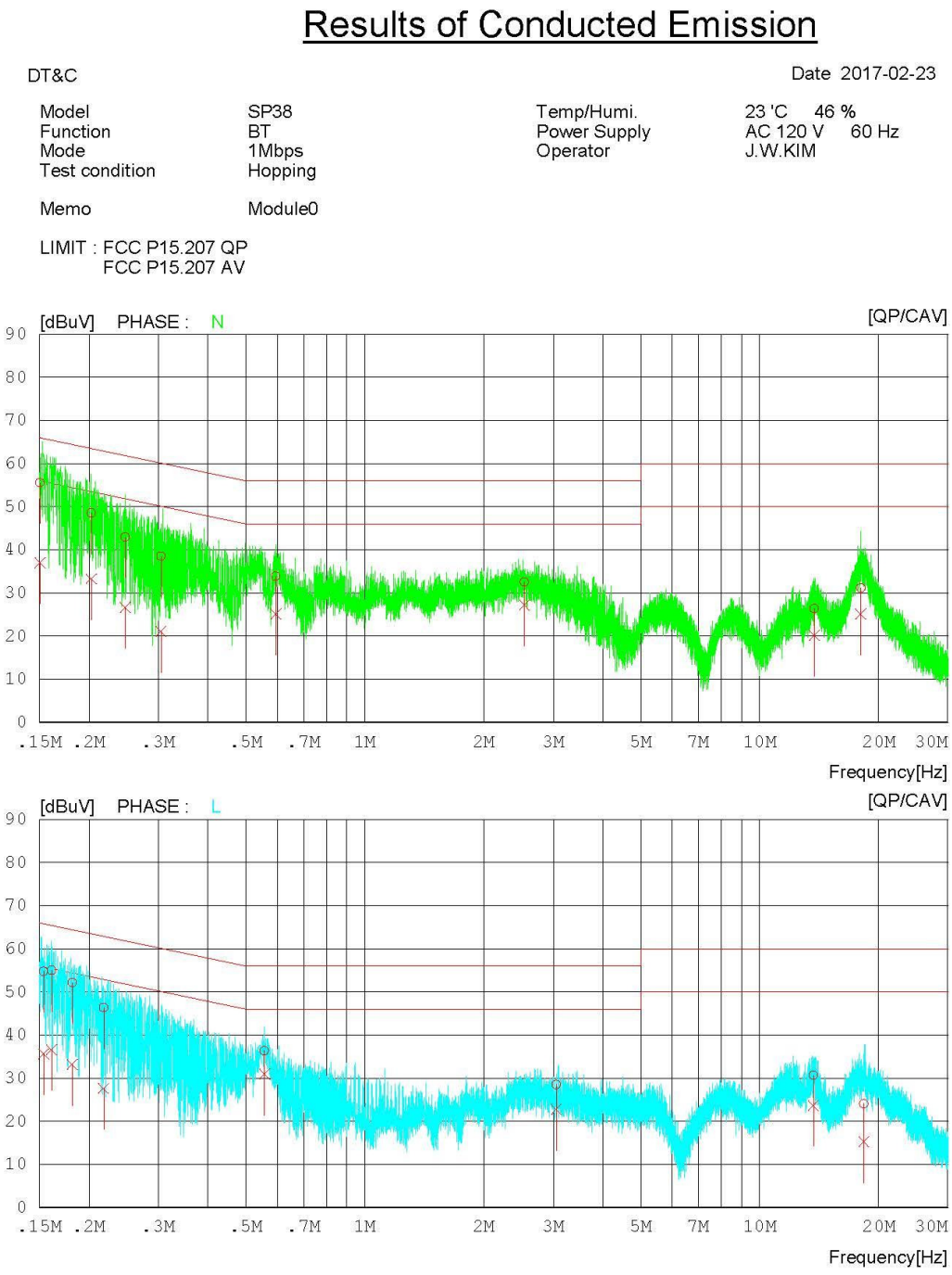
8.3 Test Procedures

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_Module 0***



AC Line Conducted Emissions (List) = Modulation : ***GFSK_Module 0***

Results of Conducted Emission

DT&C Date 2017-02-23

Model	SP38	Temp/Humi.	23 'C 46 %
Function	BT	Power Supply	AC 120 V 60 Hz
Mode	1Mbps	Operator	J.W.KIM
Test condition	Hopping		
Memo	Module0		

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	0.15062	52.31	33.65	3.34	55.65	36.99	65.97	55.97	10.32	18.98	N
2	0.20283	46.47	31.29	2.02	48.49	33.31	63.49	53.49	15.00	20.18	N
3	0.24729	41.47	25.10	1.54	43.01	26.64	61.85	51.85	18.84	25.21	N
4	0.30450	37.31	19.89	1.19	38.50	21.08	60.12	50.12	21.62	29.04	N
5	0.59425	33.24	24.60	0.59	33.83	25.19	56.00	46.00	22.17	20.81	N
6	2.53580	32.22	26.86	0.33	32.55	27.19	56.00	46.00	23.45	18.81	N
7	13.75820	25.83	19.71	0.47	26.30	20.18	60.00	50.00	33.70	29.82	N
8	18.02920	30.60	24.70	0.49	31.09	25.19	60.00	50.00	28.91	24.81	N
9	0.15350	51.45	32.32	3.27	54.72	35.59	65.81	55.81	11.09	20.22	L
10	0.16100	51.91	33.55	3.02	54.93	36.57	65.41	55.41	10.48	18.84	L
11	0.18145	49.68	30.61	2.47	52.15	33.08	64.42	54.42	12.27	21.34	L
12	0.21780	44.38	25.68	1.89	46.27	27.57	62.90	52.90	16.63	25.33	L
13	0.55668	35.74	30.24	0.65	36.39	30.89	56.00	46.00	19.61	15.11	L
14	3.05320	28.15	22.39	0.35	28.50	22.74	56.00	46.00	27.50	23.26	L
15	13.68120	30.19	23.13	0.46	30.65	23.59	60.00	50.00	29.35	26.41	L
16	18.35380	23.48	14.70	0.54	24.02	15.24	60.00	50.00	35.98	34.76	L

AC Line Conducted Emissions (Graph) = Modulation : ***GFSK_Module 1***

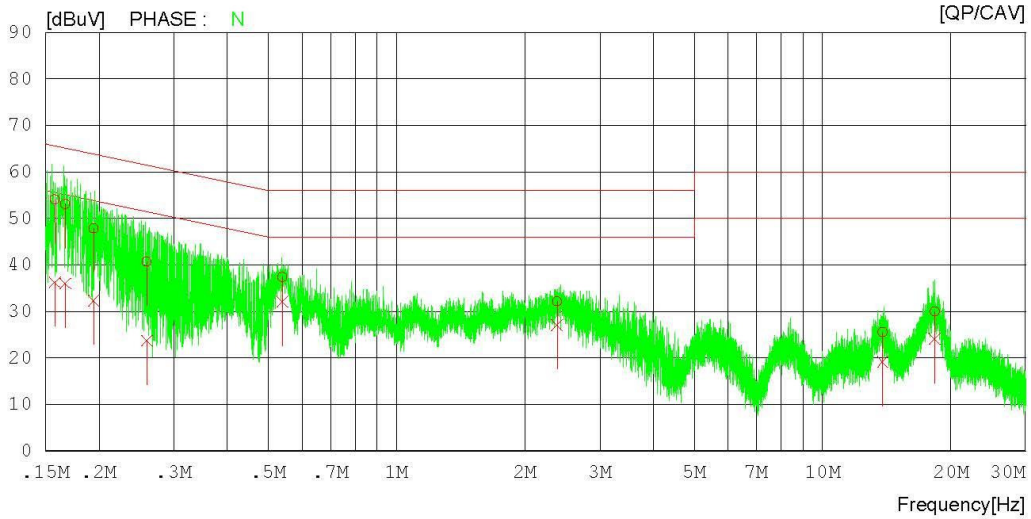
Results of Conducted Emission

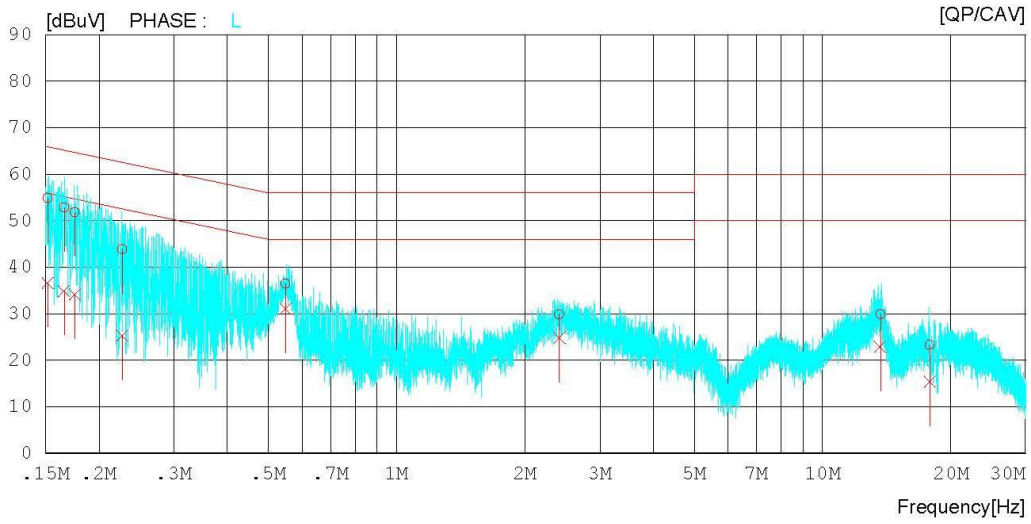
DT&C

Date 2017-02-23

Model	SP38	Temp/Humi.	23 'C 46 %
Function	BT	Power Supply	AC 120 V 60 Hz
Mode	1Mbps	Operator	J.W.KIM
Test condition	Hopping		
Memo	Module1		

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





AC Line Conducted Emissions (List) = Modulation : ***GFSK_Module 1***

Results of Conducted Emission

DT&C Date 2017-02-23

Model	SP38	Temp/Humi.	23 'C 46 %
Function	BT	Power Supply	AC 120 V 60 Hz
Mode	1Mbps	Operator	J.W.KIM
Test condition	Hopping		
Memo	Module1		

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	0.15750	51.01	33.17	3.10	54.11	36.27	65.59	55.59	11.48	19.32	N
2	0.16686	50.31	33.26	2.77	53.08	36.03	65.12	55.12	12.04	19.09	N
3	0.19454	45.71	30.21	2.16	47.87	32.37	63.84	53.84	15.97	21.47	N
4	0.25898	39.24	22.29	1.46	40.70	23.75	61.46	51.46	20.76	27.71	N
5	0.53857	36.71	31.48	0.65	37.36	32.13	56.00	46.00	18.64	13.87	N
6	2.37820	31.81	26.82	0.33	32.14	27.15	56.00	46.00	23.86	18.85	N
7	13.83560	25.10	18.66	0.47	25.57	19.13	60.00	50.00	34.43	30.87	N
8	18.32900	29.50	23.65	0.50	30.00	24.15	60.00	50.00	30.00	25.85	N
9	0.15166	51.47	33.25	3.33	54.80	36.58	65.91	55.91	11.11	19.33	L
10	0.16565	50.01	31.99	2.85	52.86	34.84	65.18	55.18	12.32	20.34	L
11	0.17567	49.20	31.49	2.58	51.78	34.07	64.69	54.69	12.91	20.62	L
12	0.22716	41.99	23.44	1.79	43.78	25.23	62.55	52.55	18.77	27.32	L
13	0.54918	35.81	30.34	0.66	36.47	31.00	56.00	46.00	19.53	15.00	L
14	2.40940	29.53	24.46	0.36	29.89	24.82	56.00	46.00	26.11	21.18	L
15	13.66200	29.40	22.37	0.46	29.86	22.83	60.00	50.00	30.14	27.17	L
16	17.84620	22.72	14.83	0.53	23.25	15.36	60.00	50.00	36.75	34.64	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 antenna is printed to the internal PCB (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 × RBW.

Spectrum analyzer plots are included on the following pages.

10.4 Test Results

<Module 0>

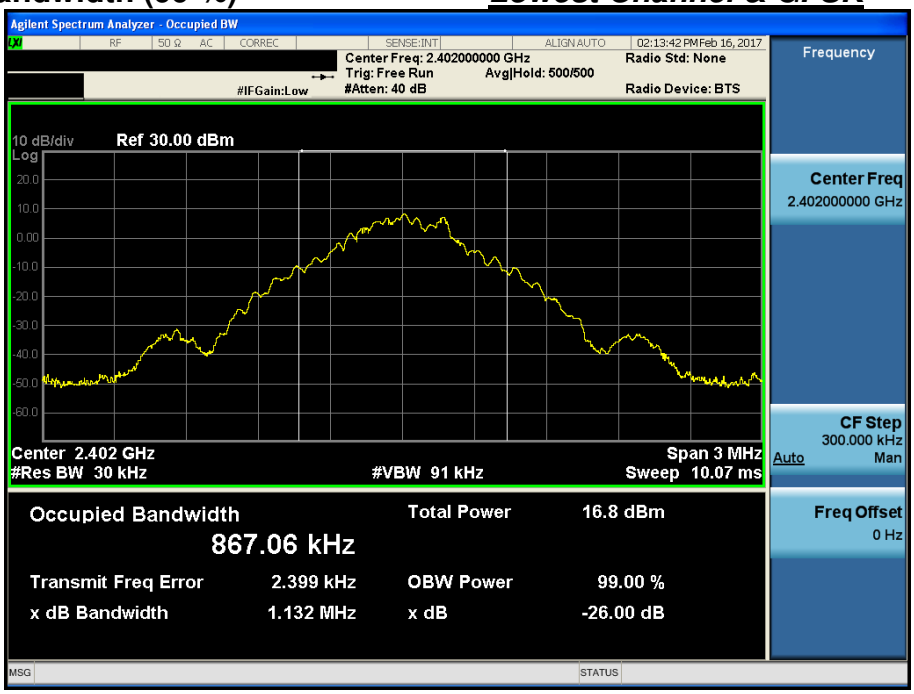
Modulation	Tested Channel	Test Results (MHz)
GFSK	**Lowest**	0.867
	Middle	**0.868**
	Highest	**0.868**
π/4DQPSK	**Lowest**	1.167
	Middle	**1.169**
	Highest	1.168
8DPSK	**Lowest**	1.154
	Middle	1.153
	Highest	**1.156**

<Module 1>

Modulation	Tested Channel	Test Results (MHz)
GFSK	**Lowest**	0.863
	Middle	0.872
	Highest	**0.876**
π/4DQPSK	**Lowest**	1.154
	Middle	**1.156**
	Highest	1.154
8DPSK	**Lowest**	**1.155**
	Middle	1.155
	Highest	1.154

<Module 0>

Occupied Bandwidth (99 %) *Lowest Channel & GFSK*



Occupied Bandwidth (99 %) *Middle Channel & GFSK*

Occupied Bandwidth (99 %) ***Highest Channel & GFSK***

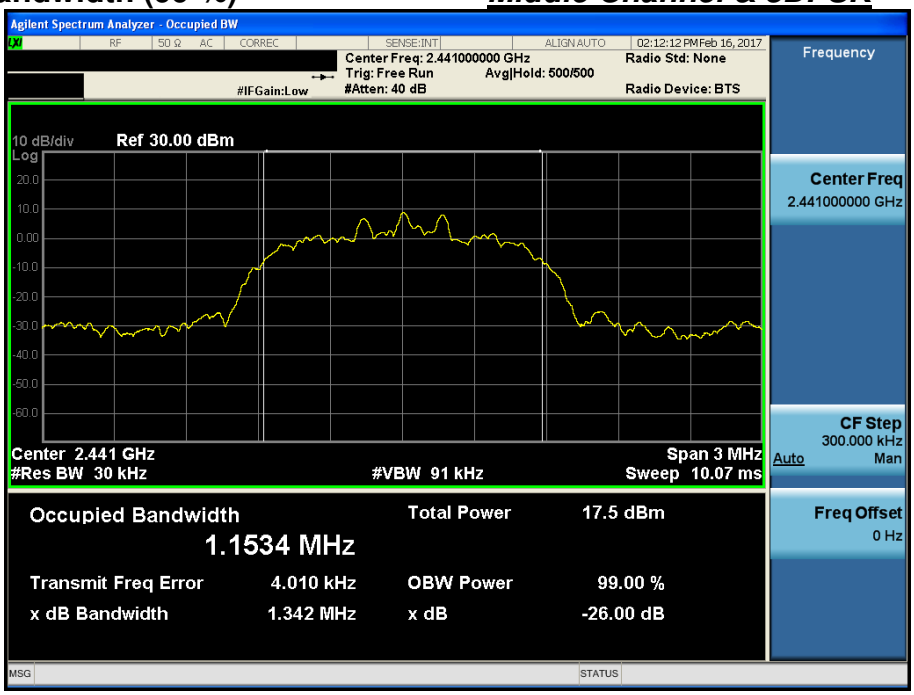
Occupied Bandwidth (99 %) ***Lowest Channel & π/4 DQPSK***

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

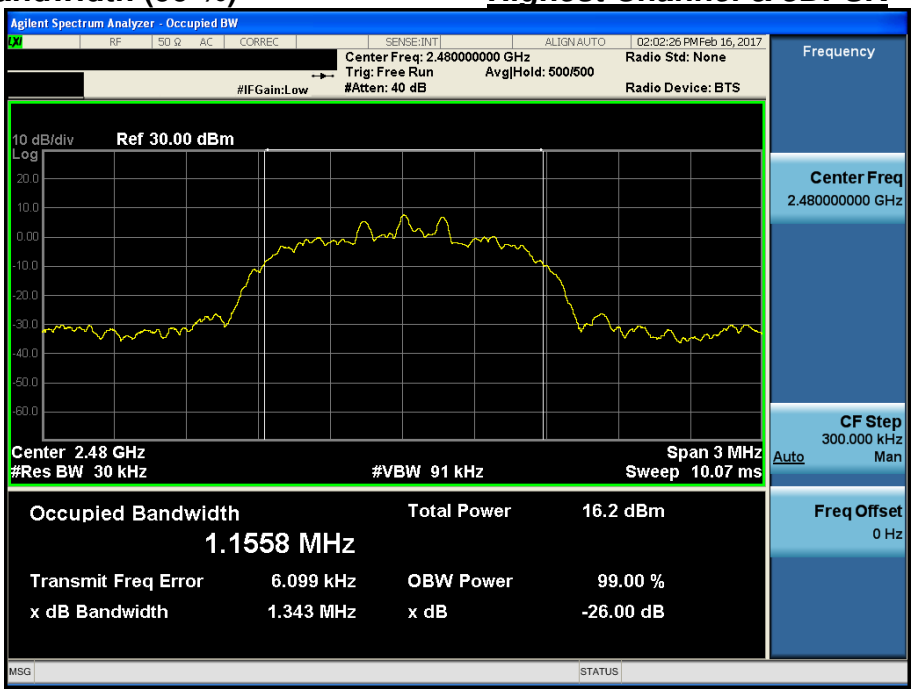
Occupied Bandwidth (99 %) ***Highest Channel & π/4 DQPSK***

Occupied Bandwidth (99 %) ***Lowest Channel & 8DPSK***

Occupied Bandwidth (99 %) ***Middle Channel & 8DPSK***

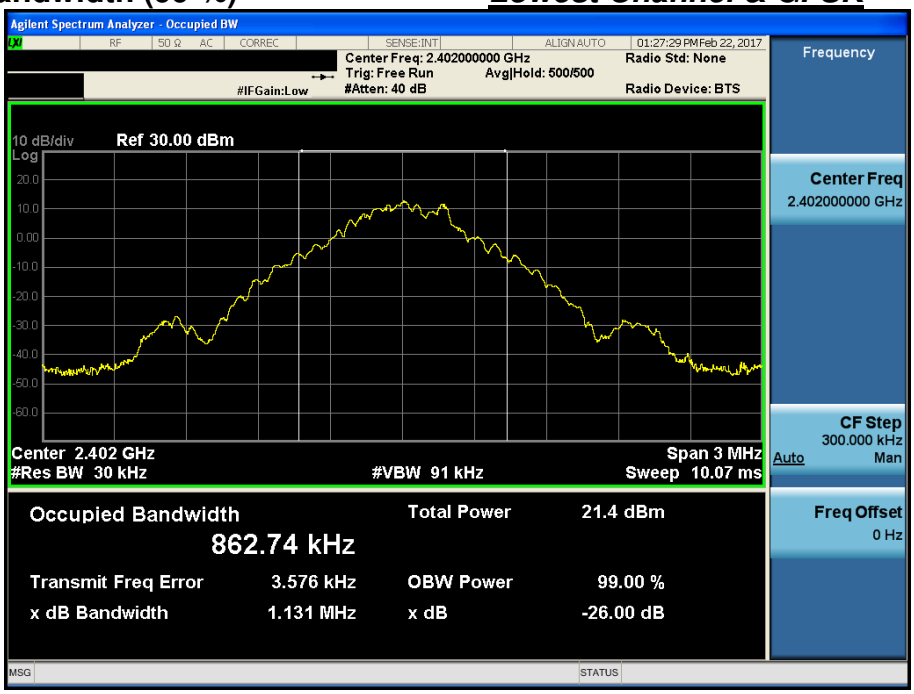


Occupied Bandwidth (99 %) ***Highest Channel & 8DPSK***

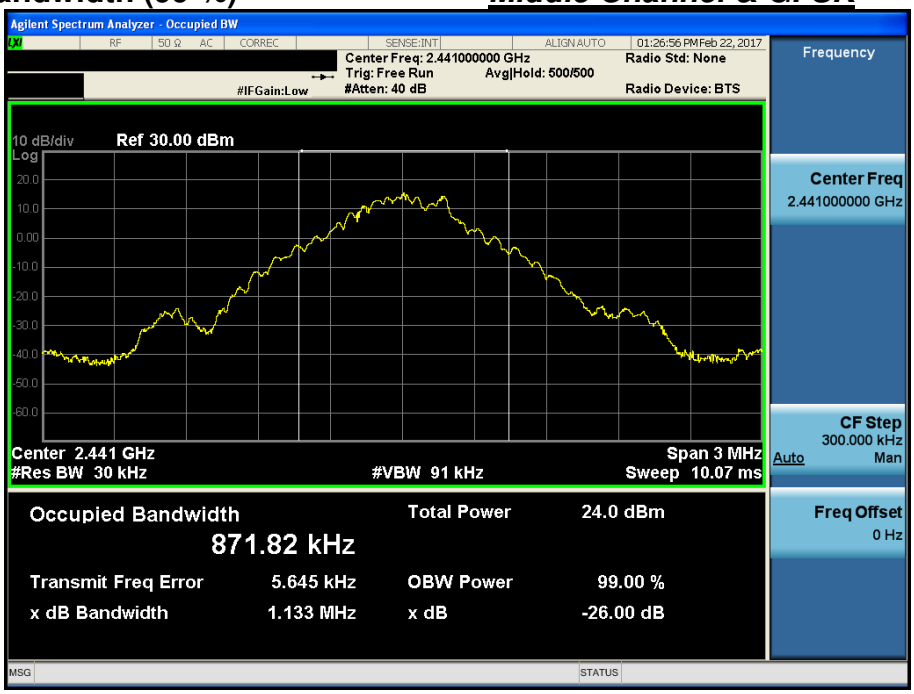


<Module 1>

Occupied Bandwidth (99 %) *Lowest Channel & GFSK*



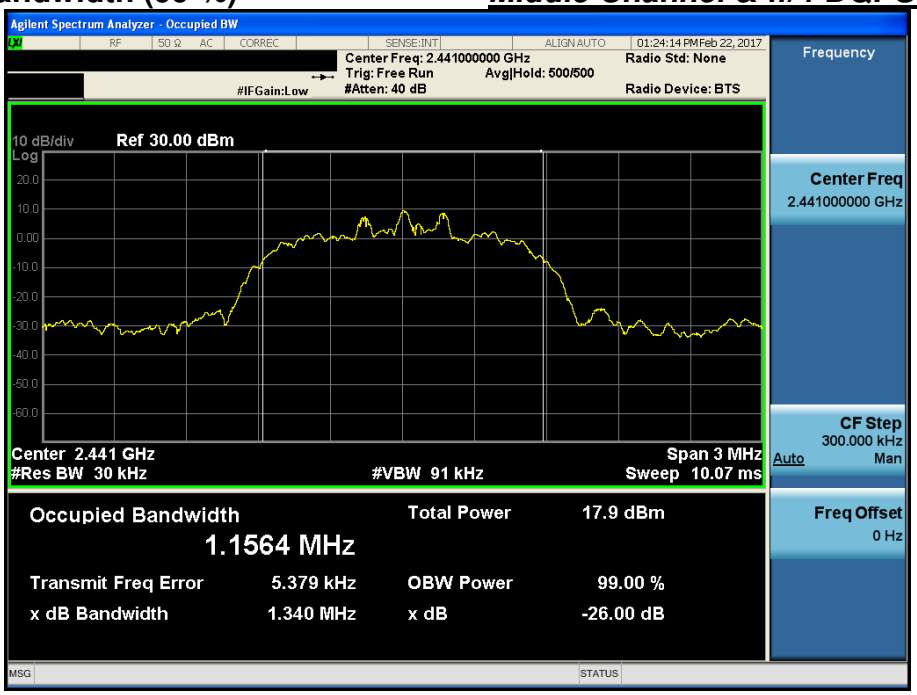
Occupied Bandwidth (99 %) *Middle Channel & GFSK*



Occupied Bandwidth (99 %) ***Highest Channel & GFSK***

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

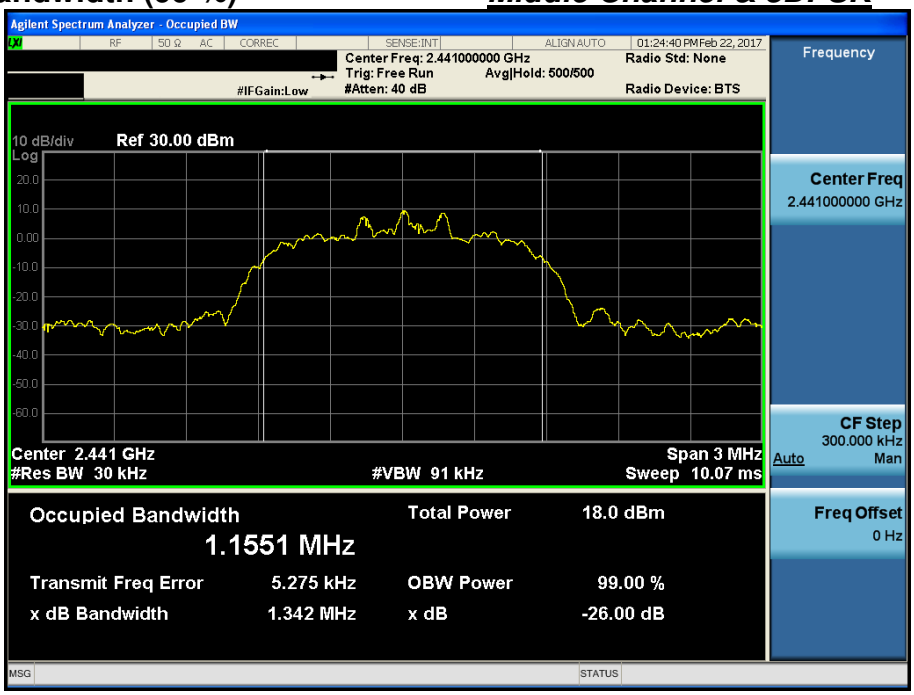
Occupied Bandwidth (99 %) ***Middle Channel & π/4 DQPSK***



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

Occupied Bandwidth (99 %) ***Lowest Channel & 8DPSK***

Occupied Bandwidth (99 %) ***Middle Channel & 8DPSK***

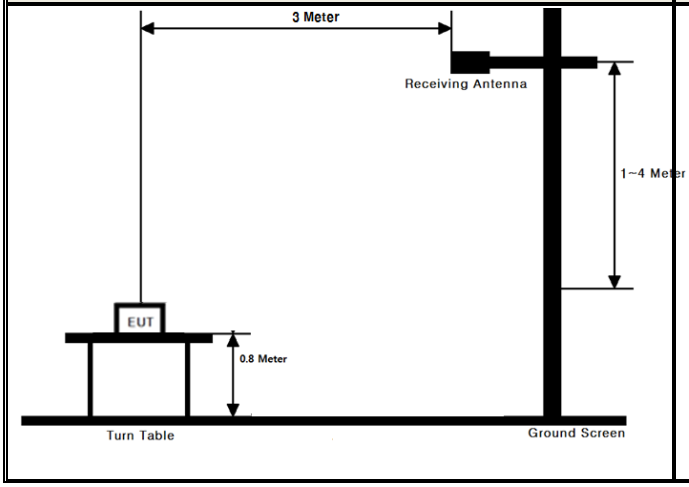
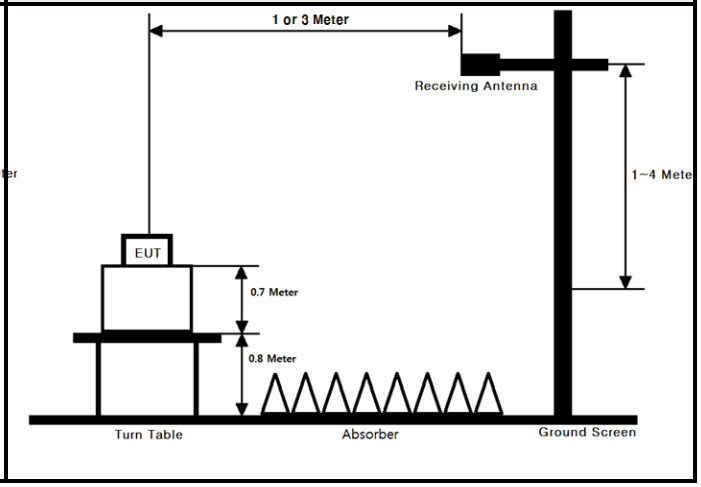


Occupied Bandwidth (99 %) ***Highest Channel & 8DPSK***

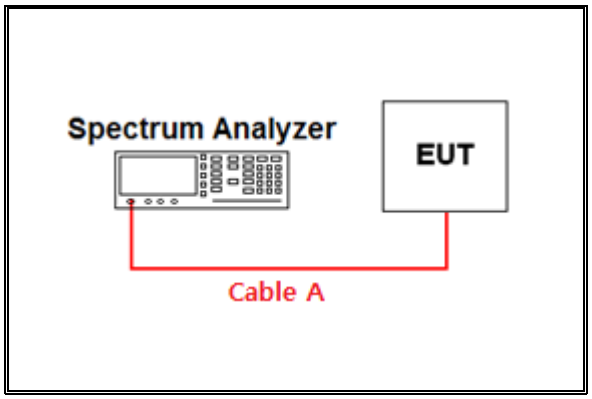
APPENDIX I

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	0.18	15	3.50
1	0.80	20	4.86
2.402 & 2.441 & 2.480	1.30	25	5.35
5	1.82	-	-
10	2.70	-	-

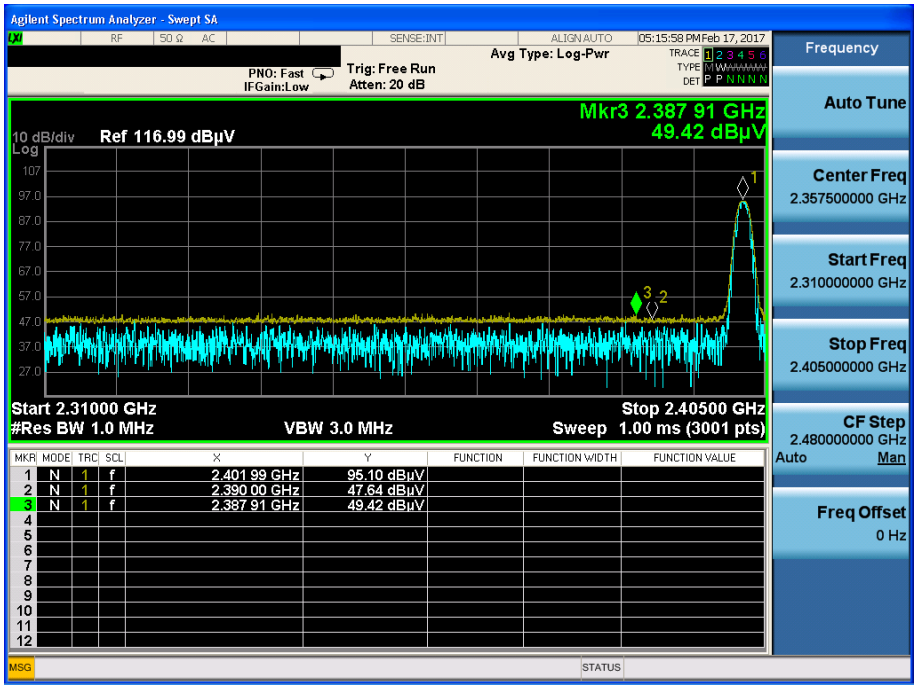
Note 1 : The path loss from EUT to Spectrum analyzer were measured and used for test.

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

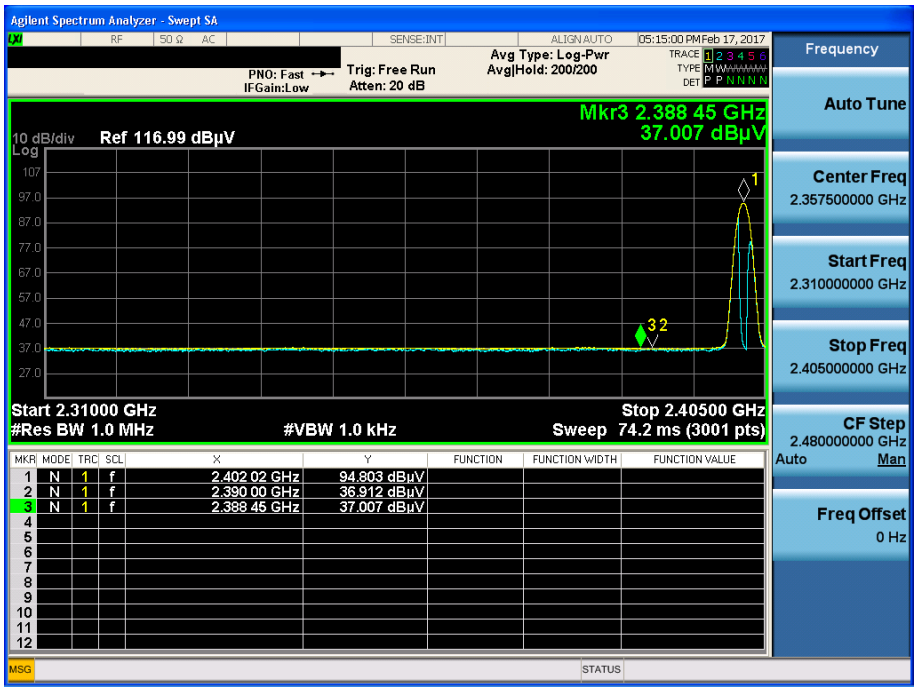
APPENDIX II

Unwanted Emissions (Radiated) Test Plot_Module 0

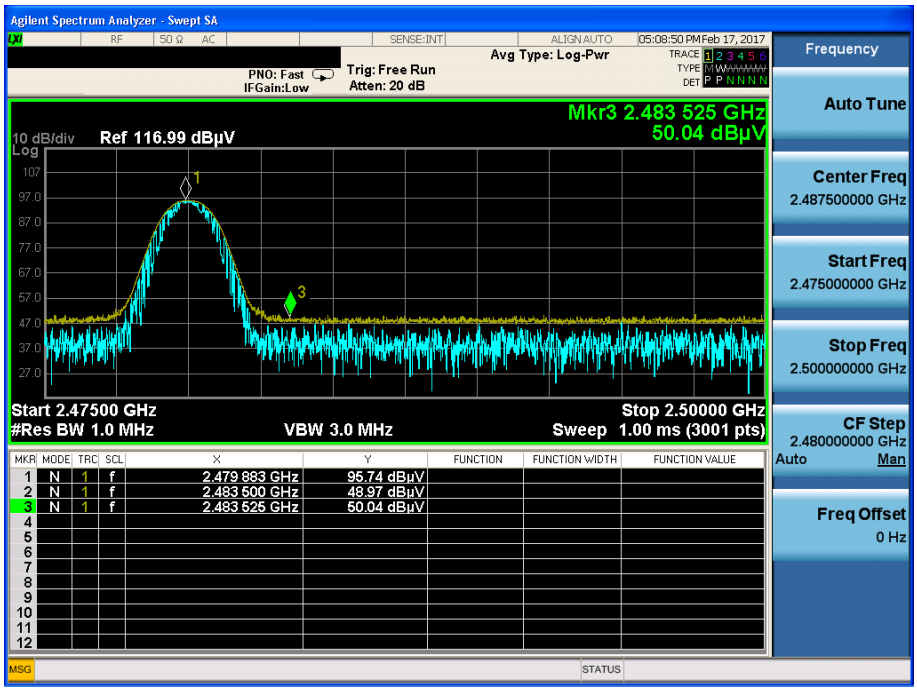
GFSK & Lowest & X & Hor Detector Mode : PK



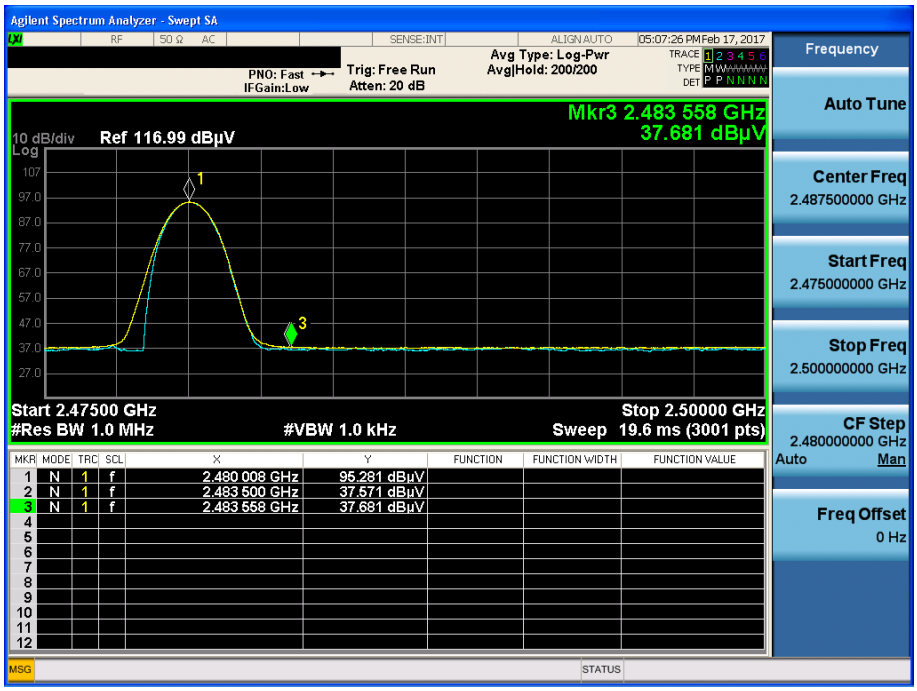
GFSK & Lowest & X & Hor Detector Mode : AV



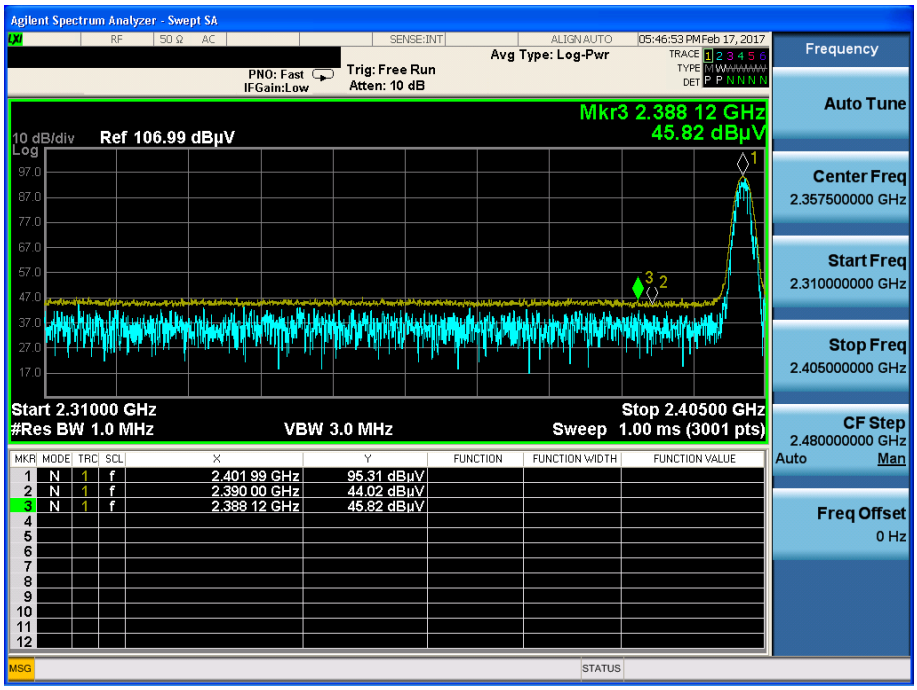
GFSK & Highest & X & Hor — Detector Mode : PK



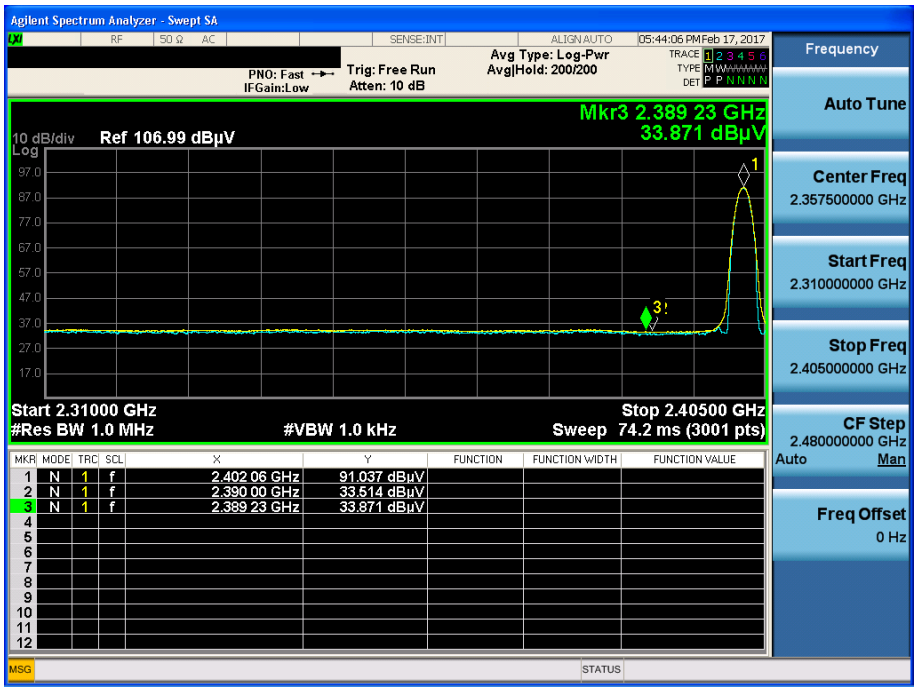
GFSK & Highest & X & Hor — Detector Mode : AV



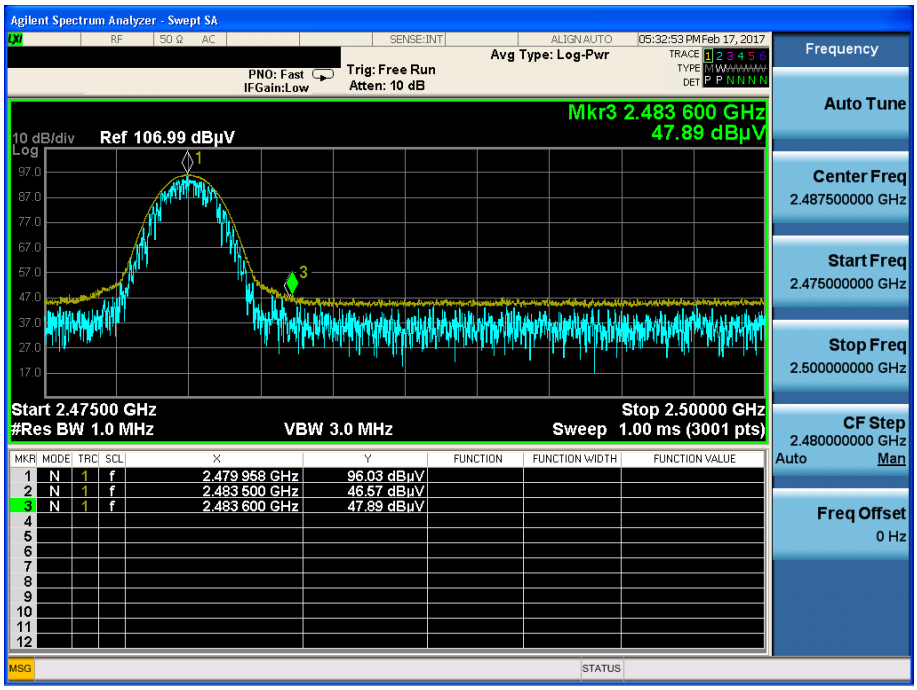
π/4DQPSK & Lowest & X & Hor **Detector Mode : PK**



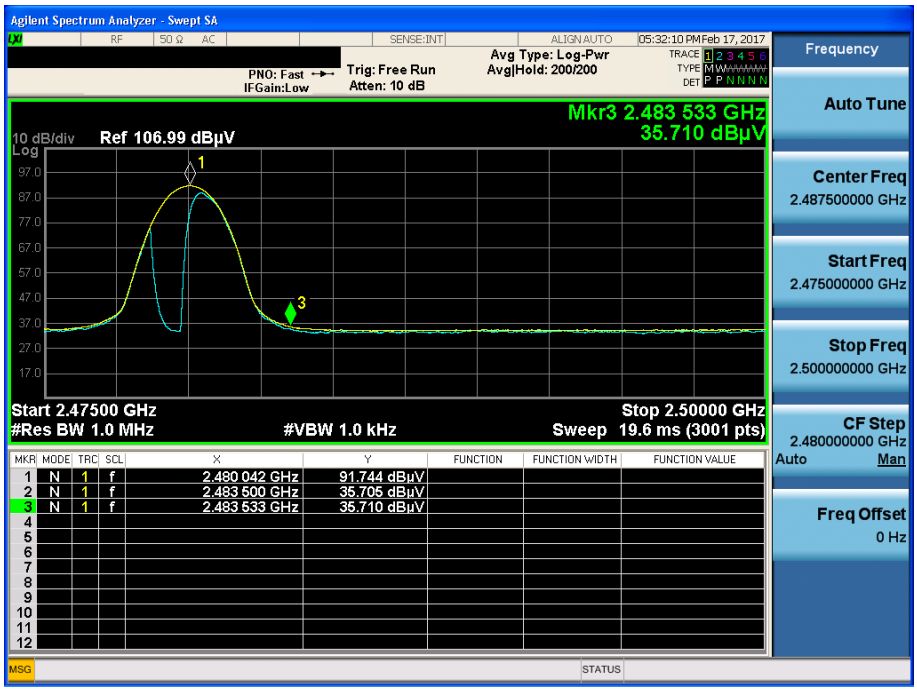
π/4DQPSK & Lowest & X & Hor **Detector Mode : AV**



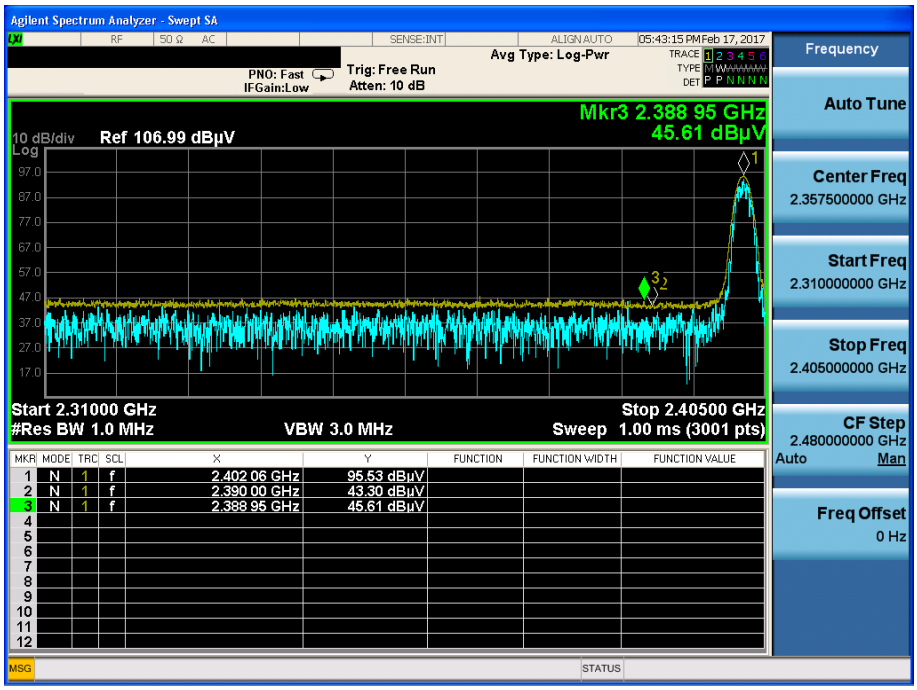
π/4DQPSK & Highest & X & Hor — Detector Mode : PK



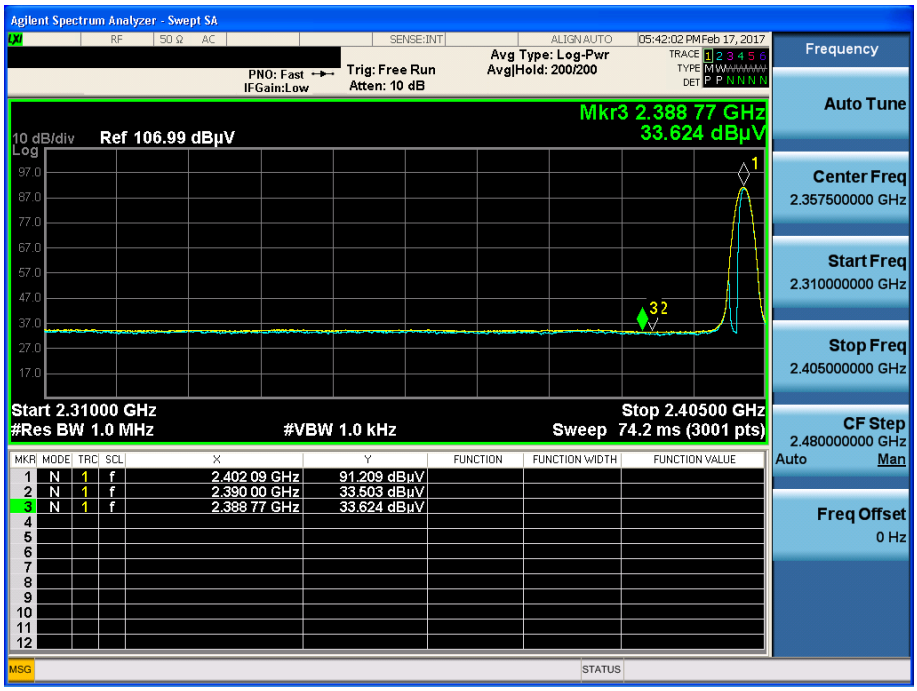
π/4DQPSK & Highest & X & Hor — Detector Mode : AV



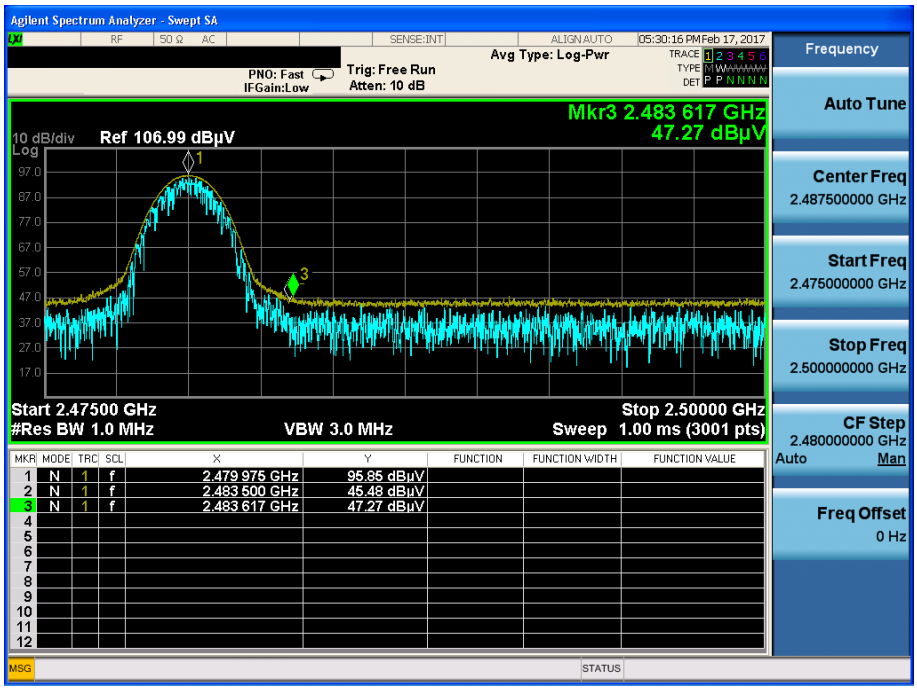
8DPSK & Lowest & X & Hor — Detector Mode : PK



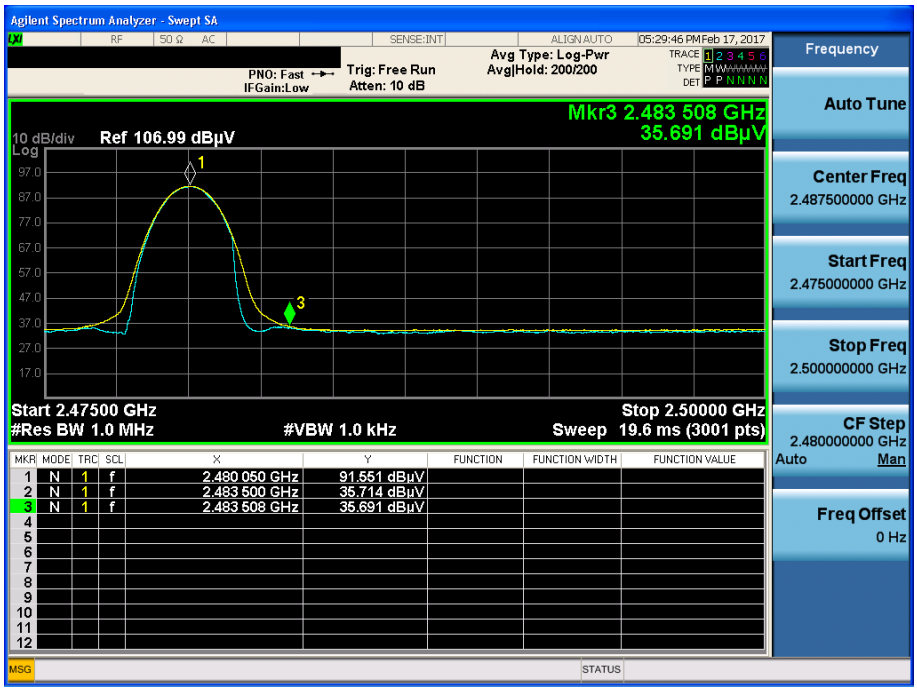
8DPSK & Lowest & X & Hor — Detector Mode : AV



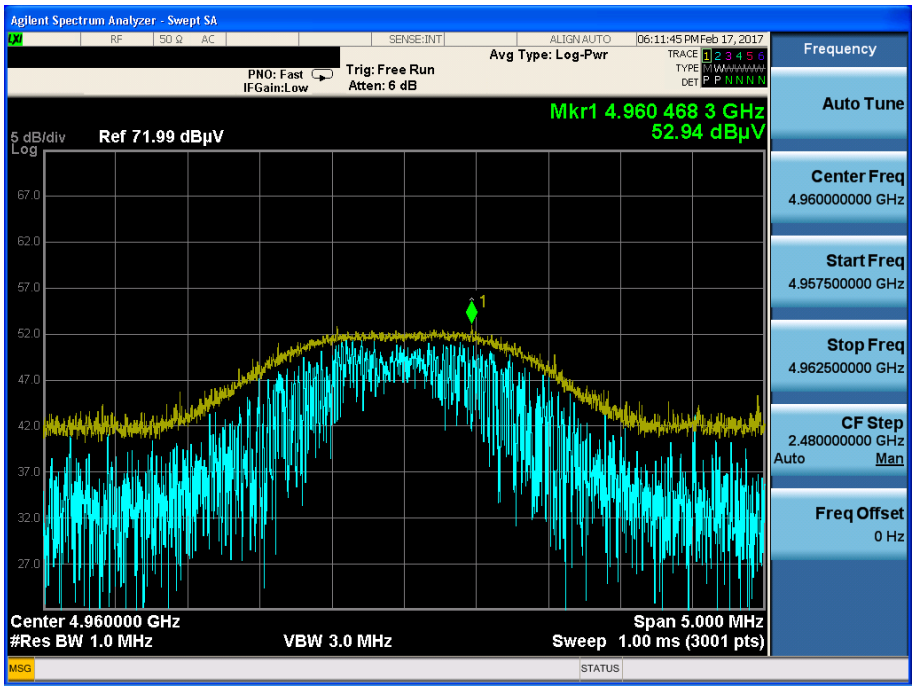
8DPSK & Highest & X & Hor — Detector Mode : PK



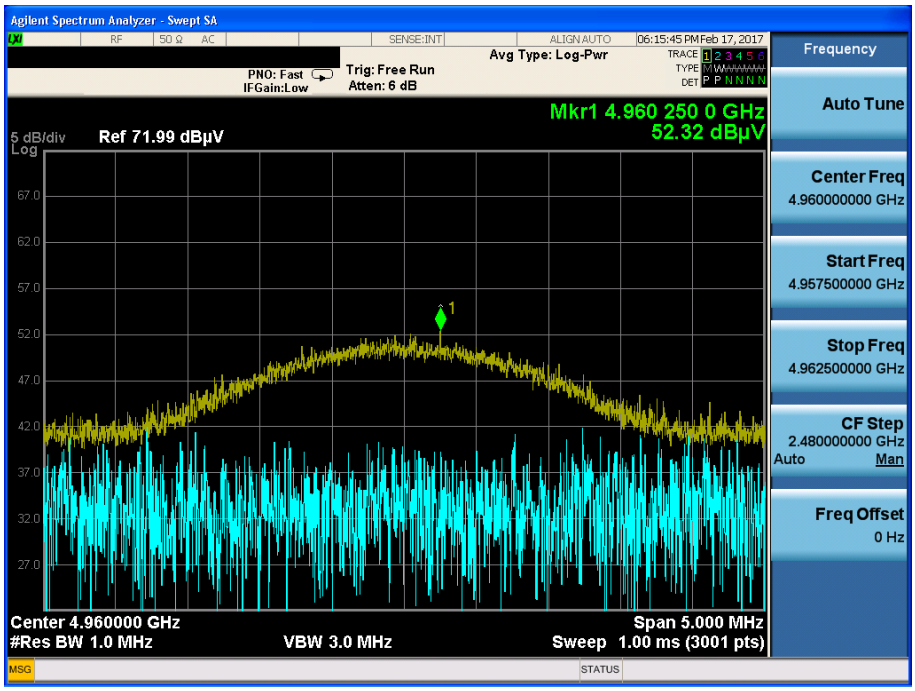
8DPSK & Highest & X & Hor — Detector Mode : AV



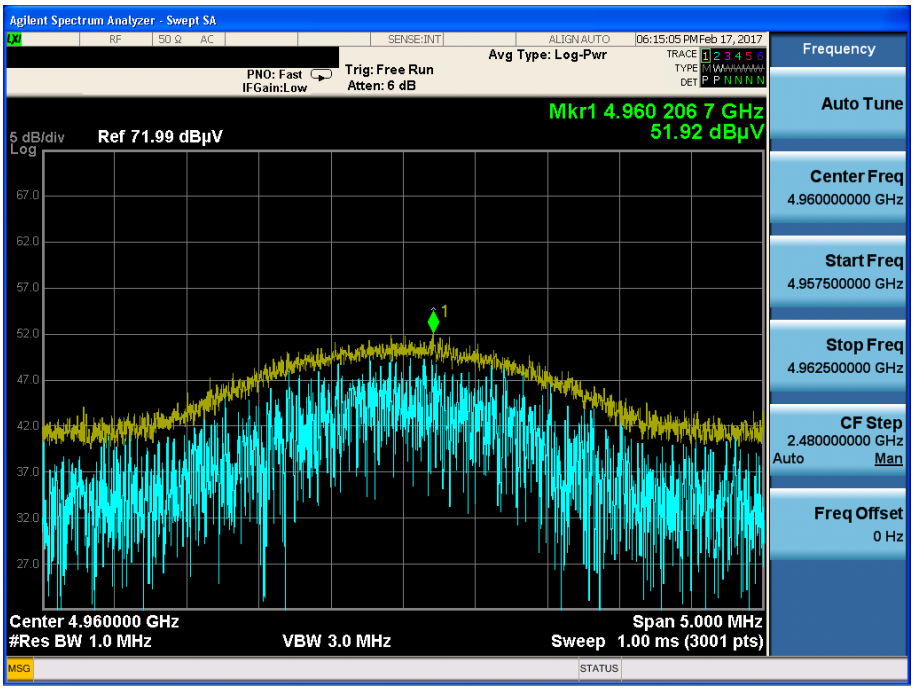
GFSK & Highest & Y & Hor — Detector Mode : PK



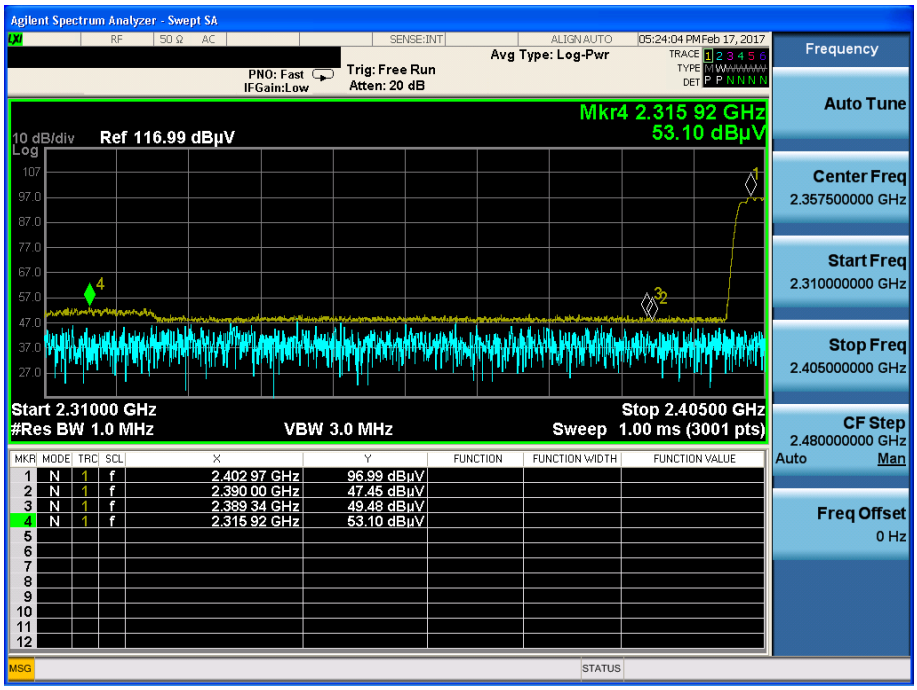
π/4DQPSK & Highest & Y & Hor — Detector Mode : PK



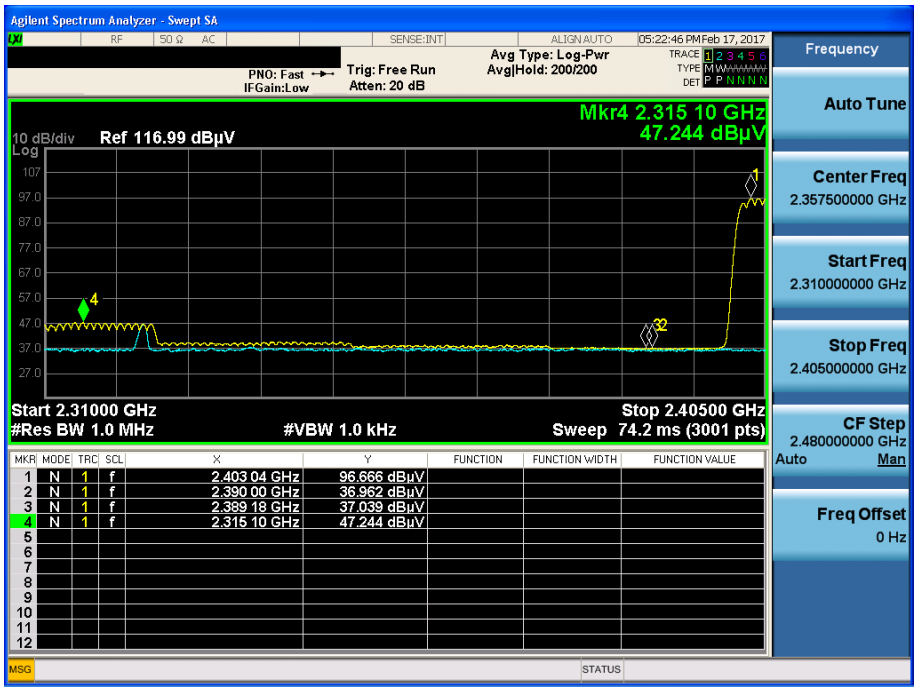
8DPSK & Highest & Y & Hor **Detector Mode : PK**



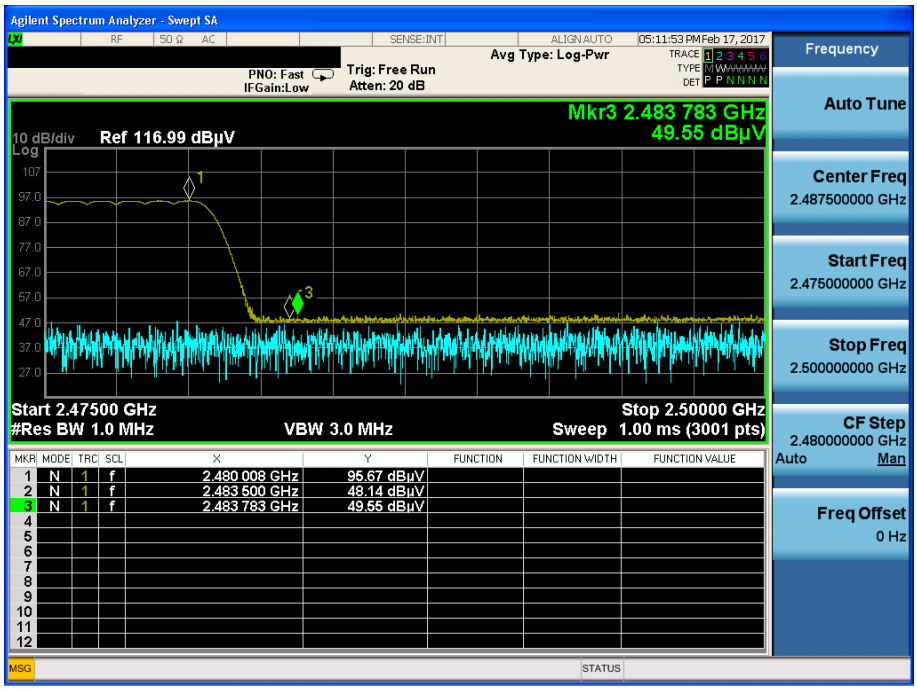
GFSK & Hopping mode & X & Hor — Detector Mode : PK



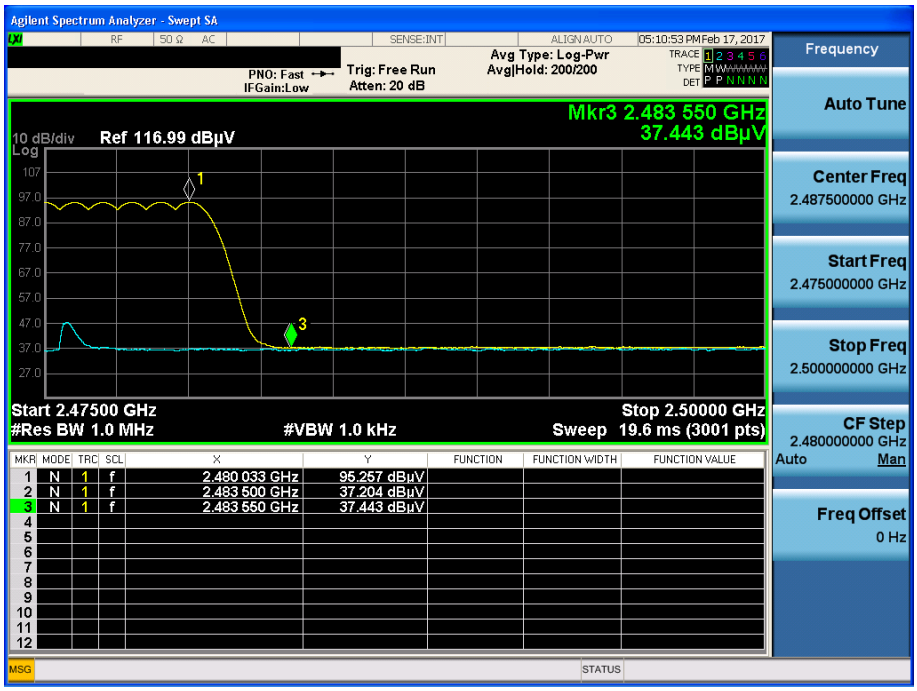
GFSK & Hopping mode & X & Hor — Detector Mode : AV



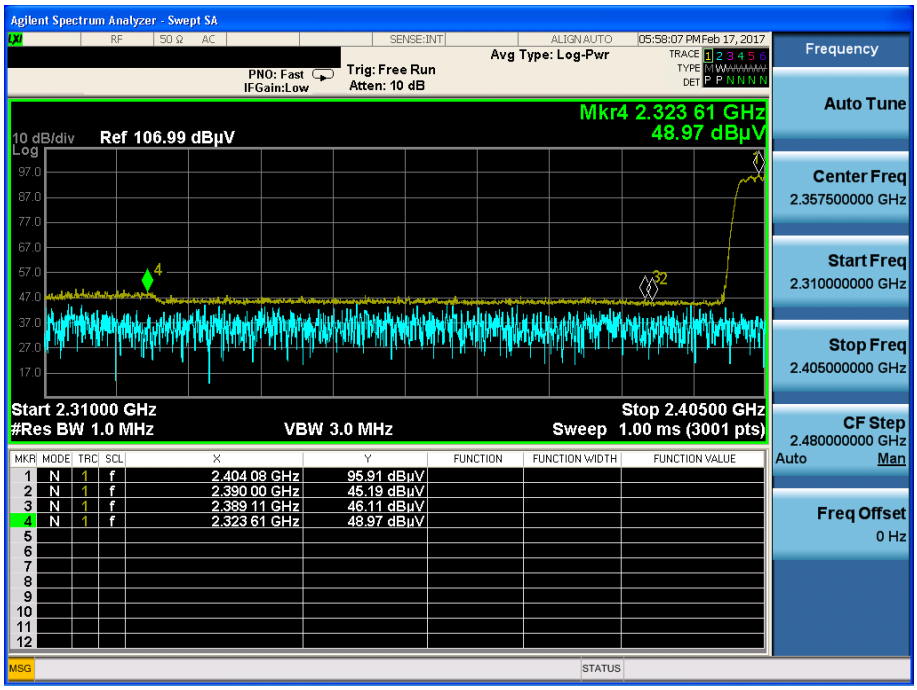
GFSK & Hopping mode & X & Hor — Detector Mode : PK



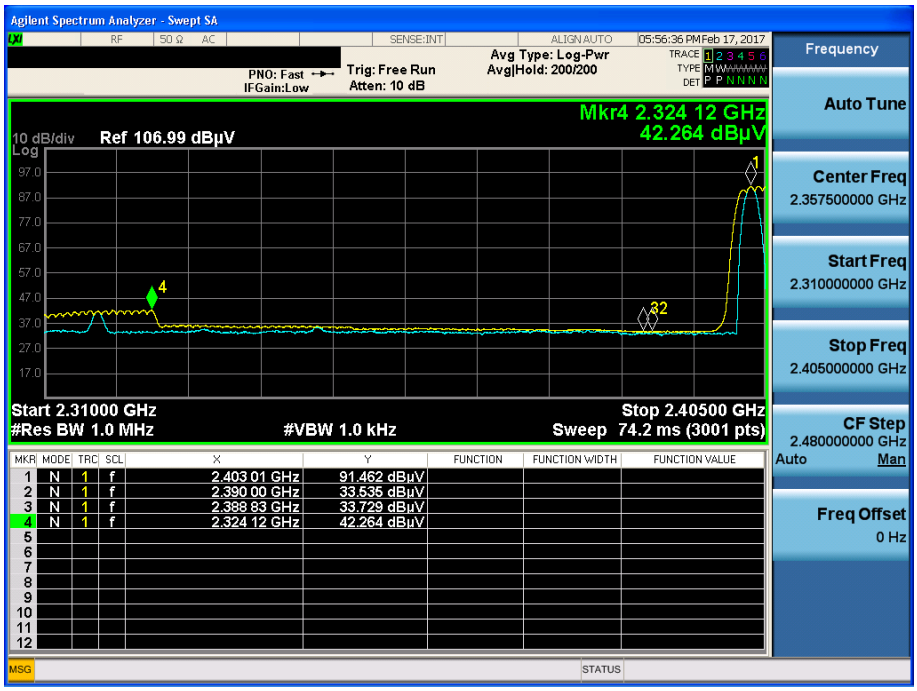
GFSK & Hopping mode & X & Hor — Detector Mode : AV



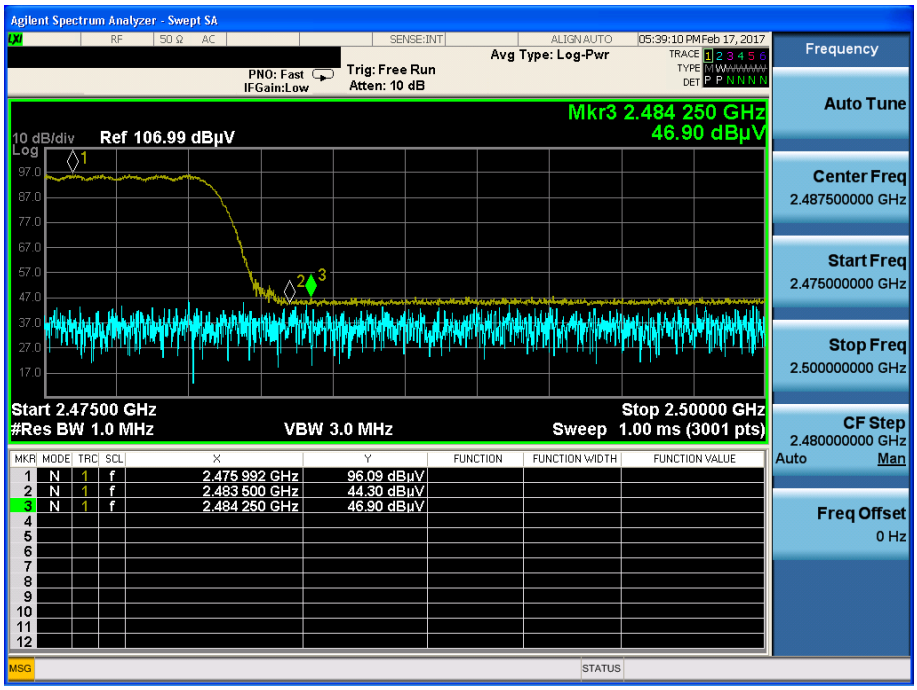
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK



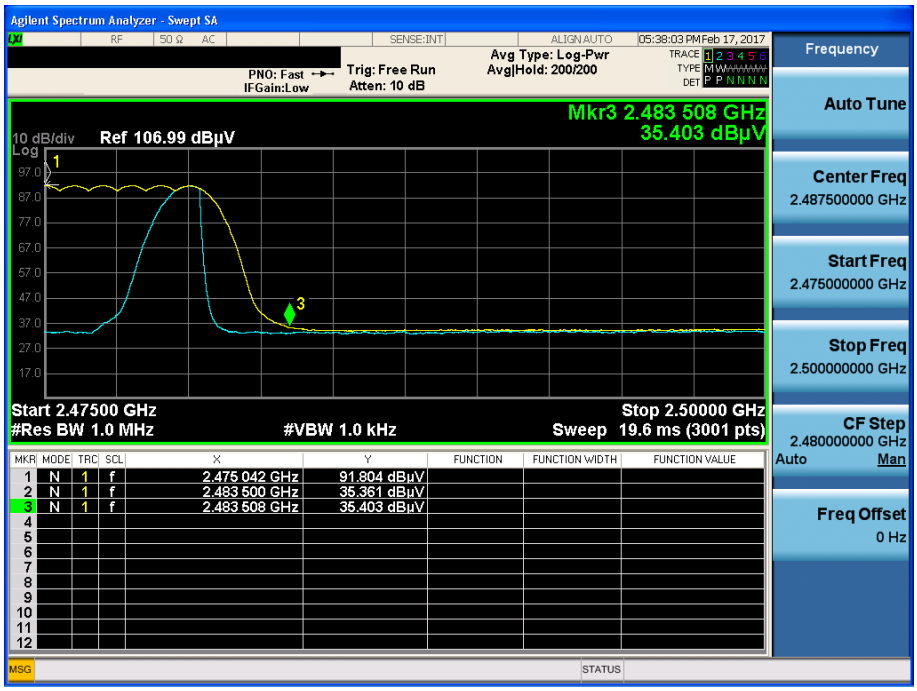
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV



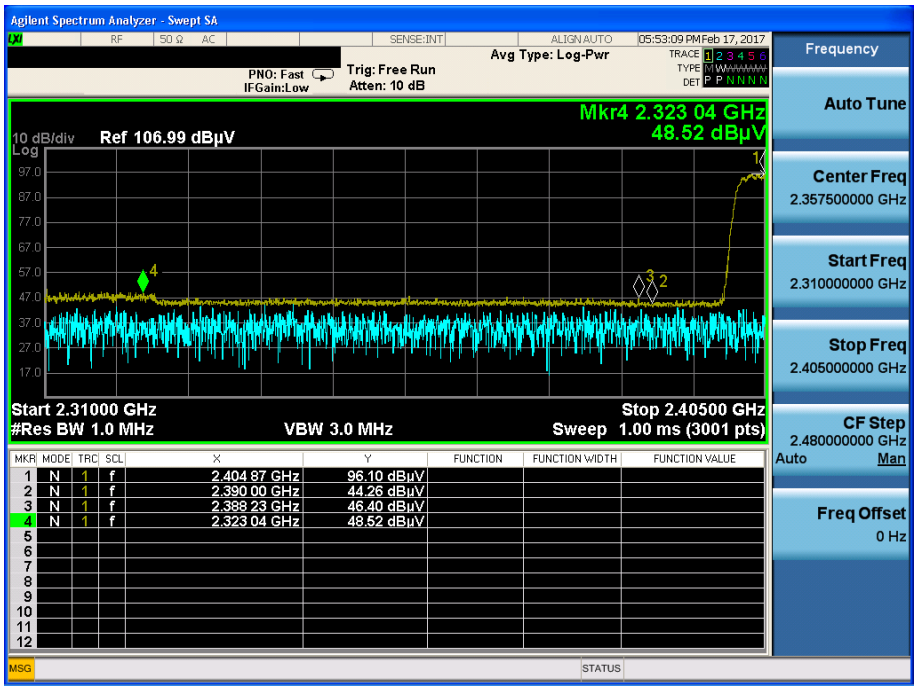
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK



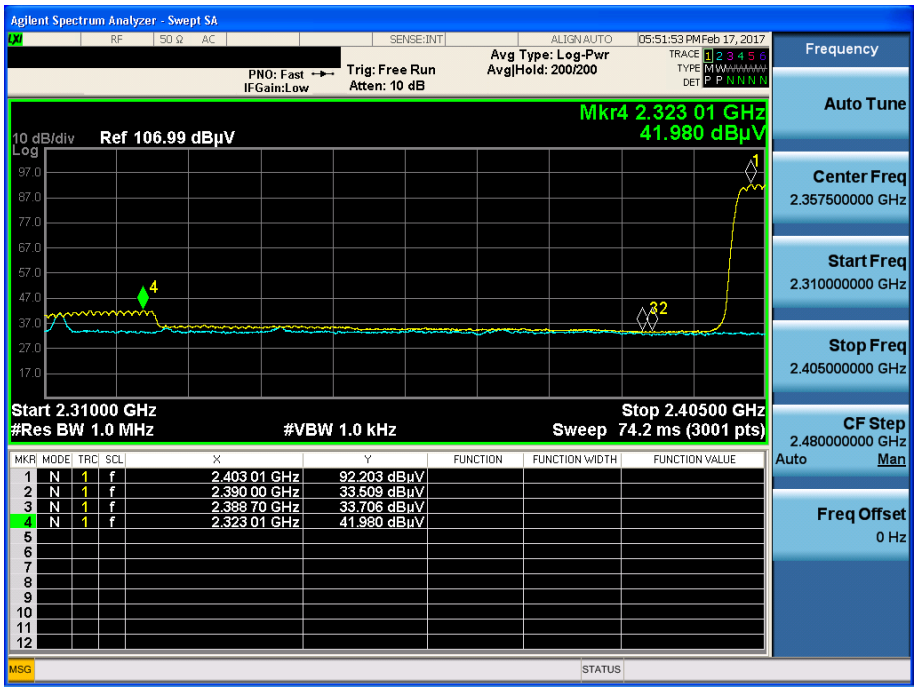
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV



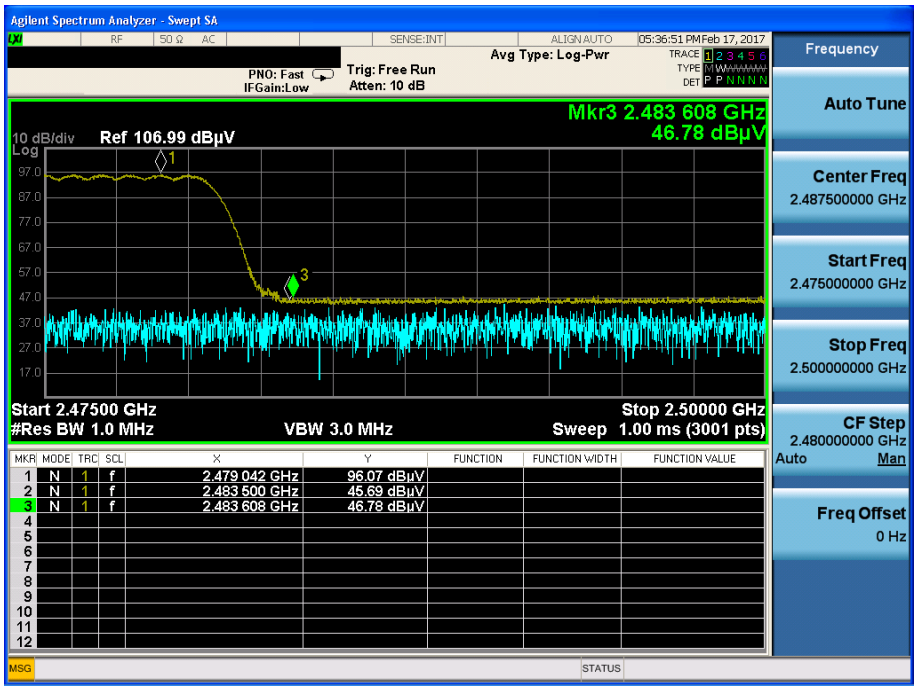
8DPSK & Hopping mode & X & Hor — Detector Mode : PK



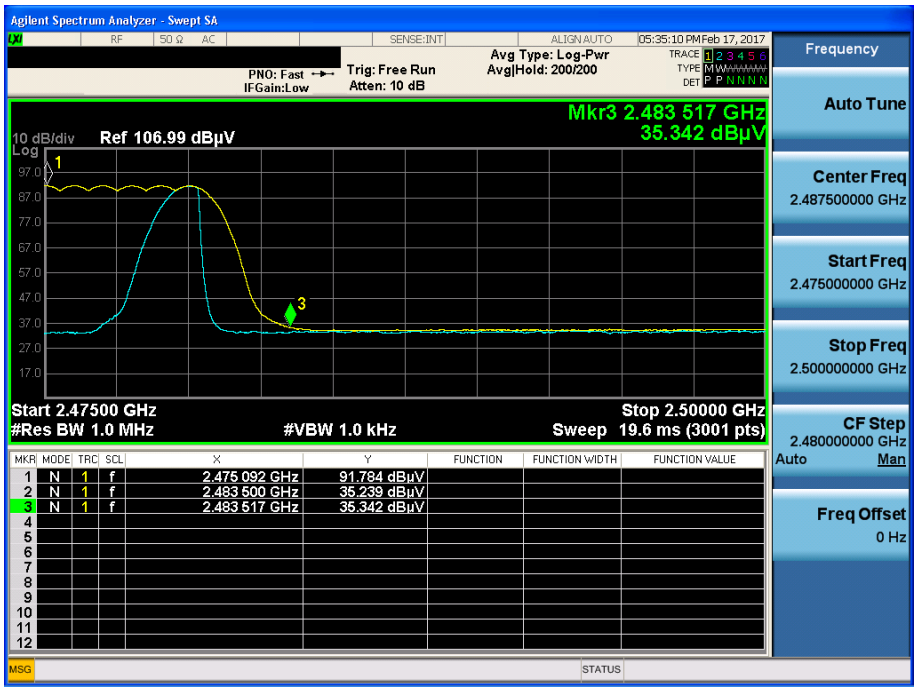
8DPSK & Hopping mode & X & Hor — Detector Mode : AV



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

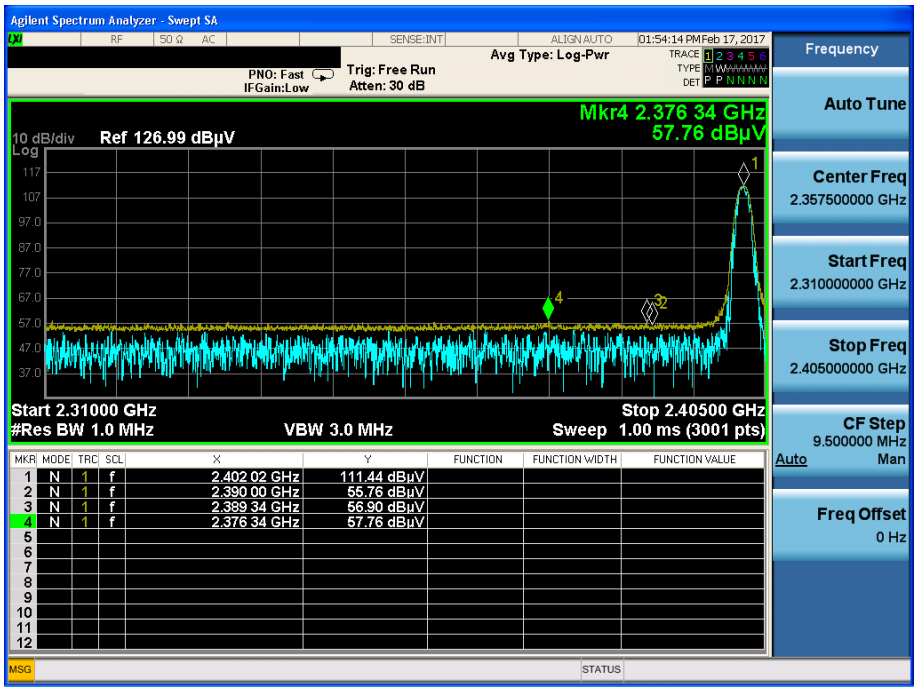


8DPSK & Hopping mode & X & Hor Detector Mode : AV

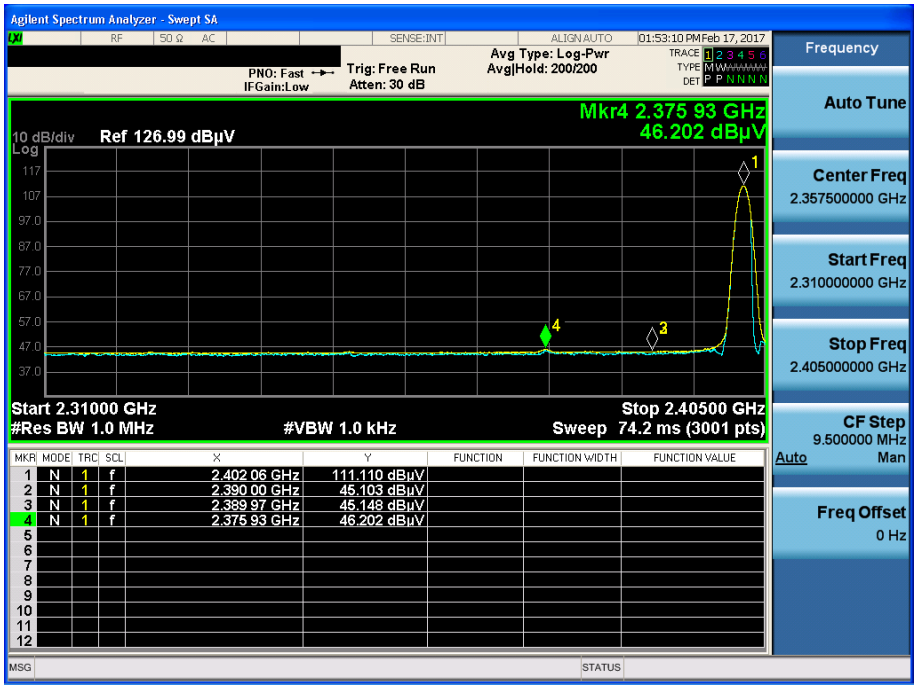


Unwanted Emissions (Radiated) Test Plot_Module 1

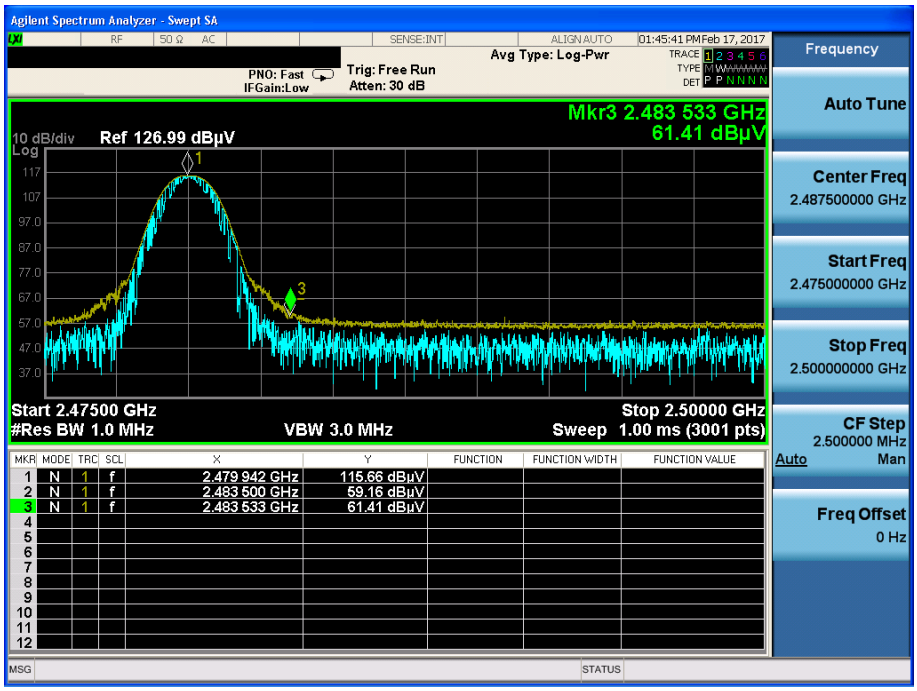
GFSK & Lowest & X & Hor — Detector Mode : PK



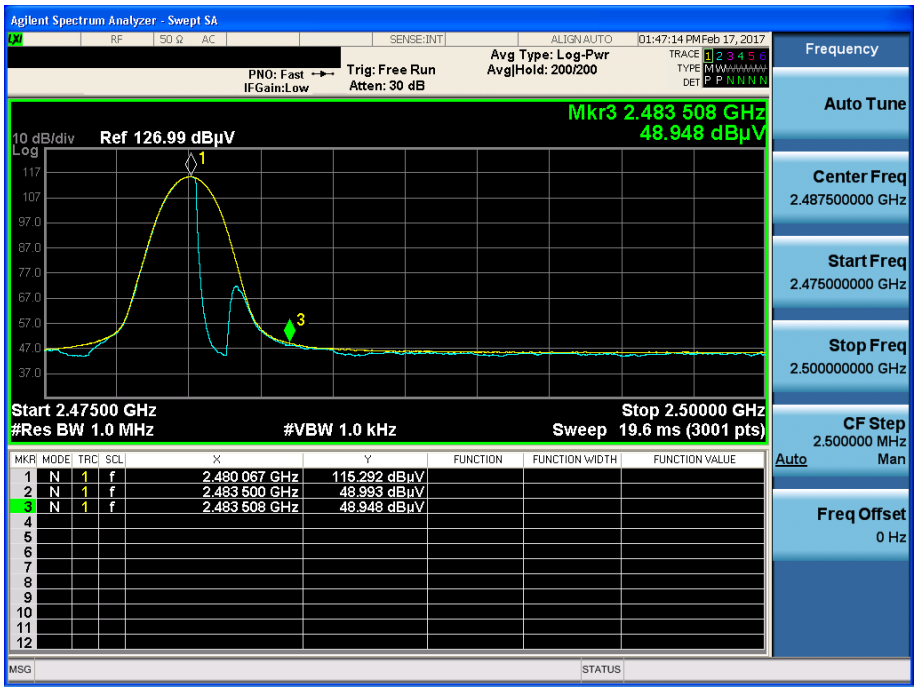
GFSK & Lowest & X & Hor — Detector Mode : AV



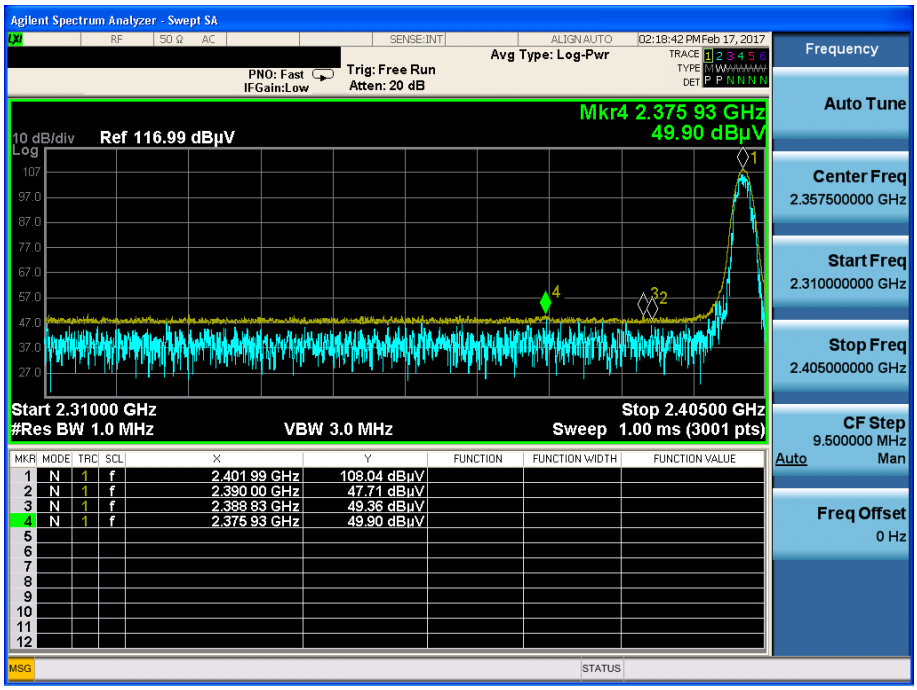
GFSK & Highest & X & Hor Detector Mode : PK



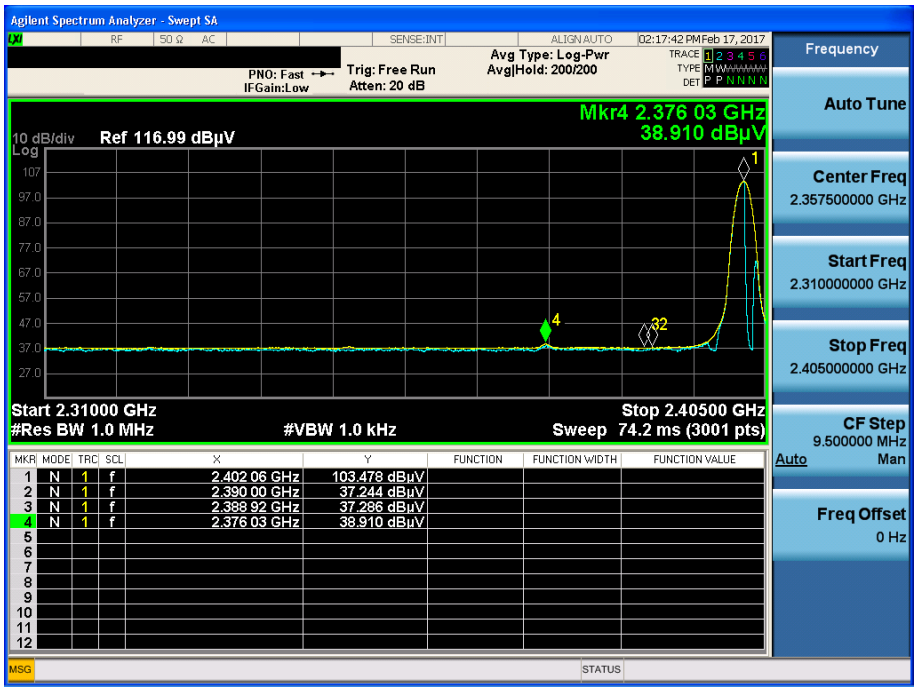
GFSK & Highest & X & Hor Detector Mode : AV



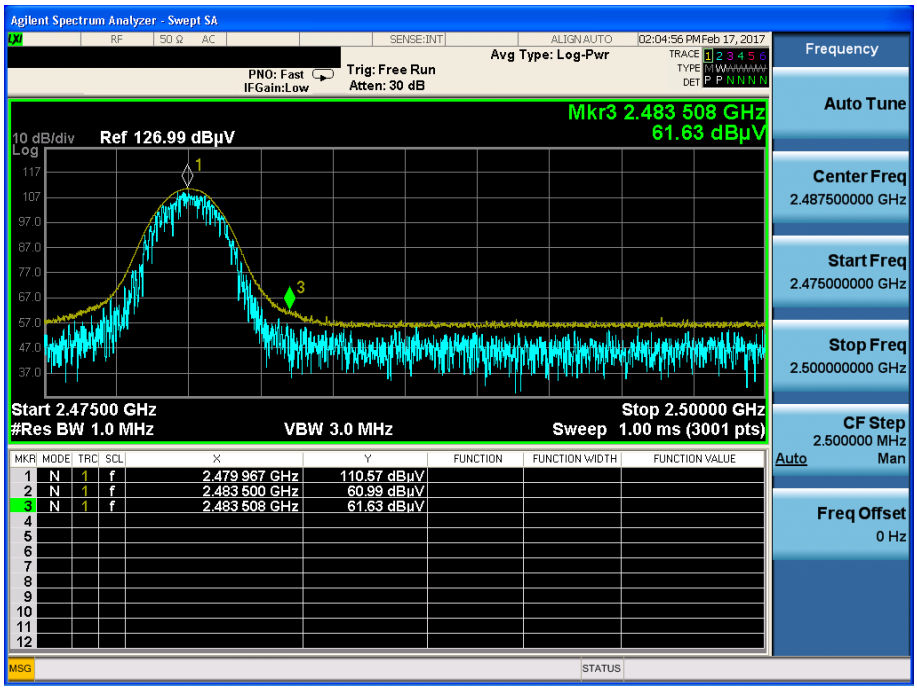
π/4DQPSK & Lowest & X & Hor **Detector Mode : PK**



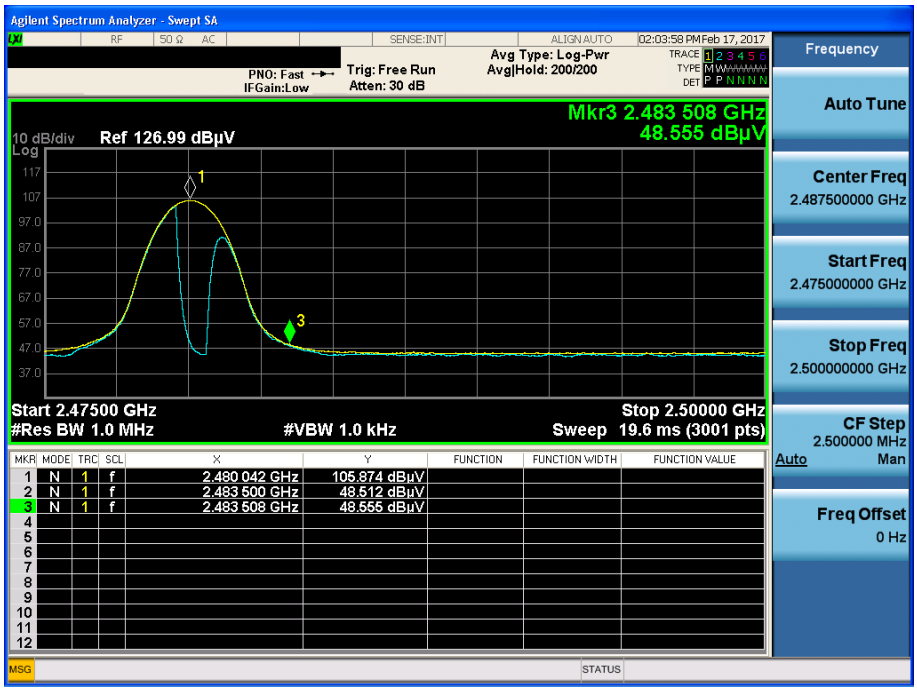
π/4DQPSK & Lowest & X & Hor **Detector Mode : AV**



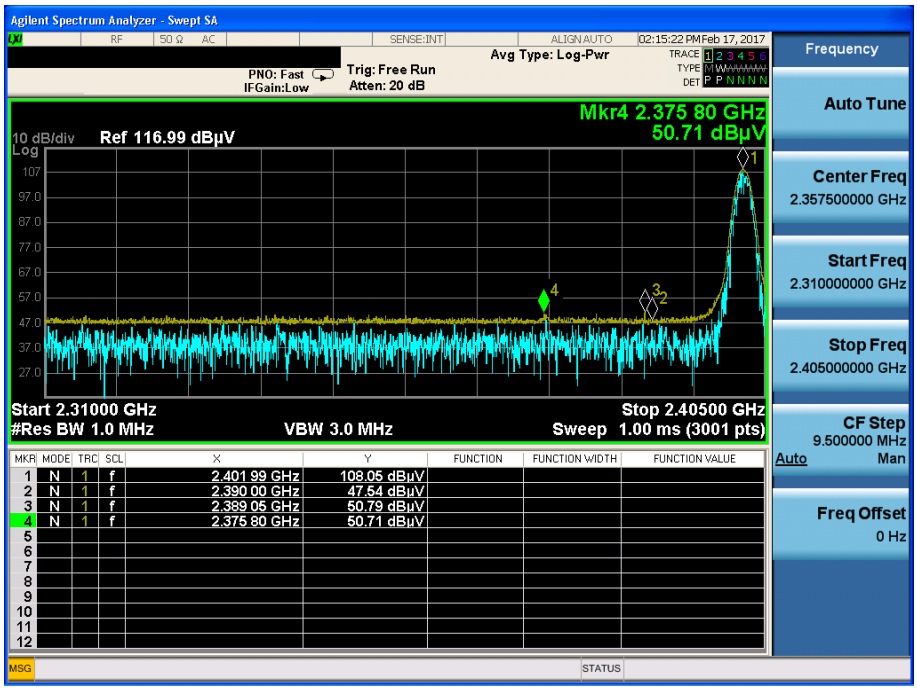
π/4DQPSK & Highest & X & Hor — Detector Mode : PK



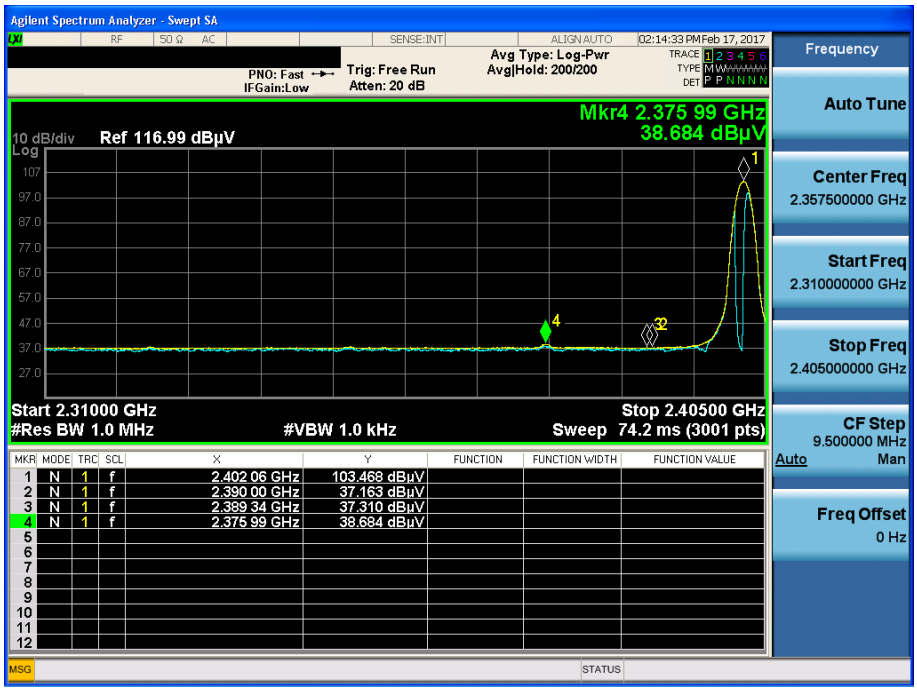
π/4DQPSK & Highest & X & Hor — Detector Mode : AV



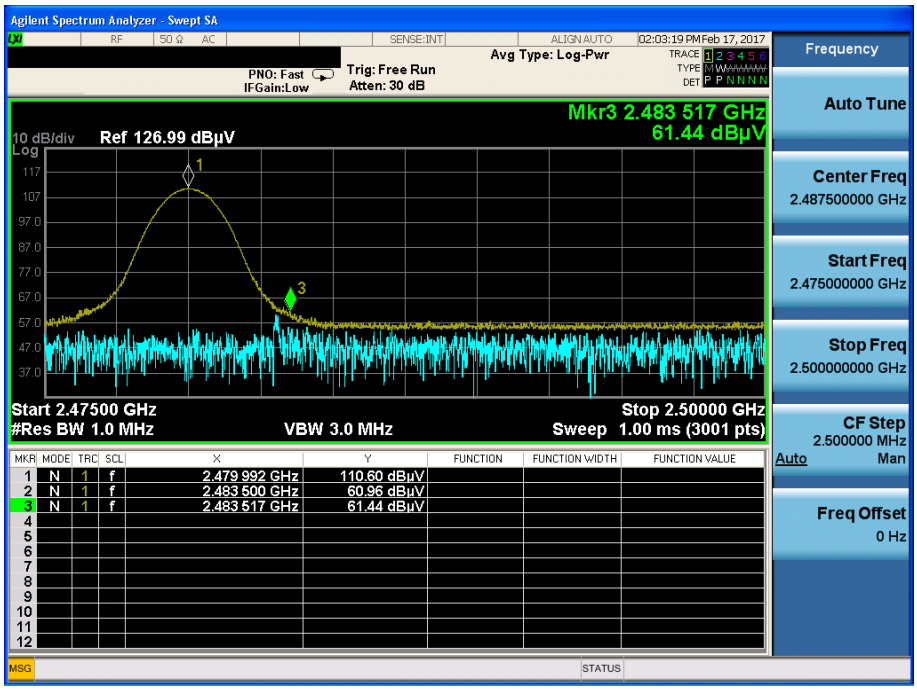
8DPSK & Lowest & X & Hor — Detector Mode : PK



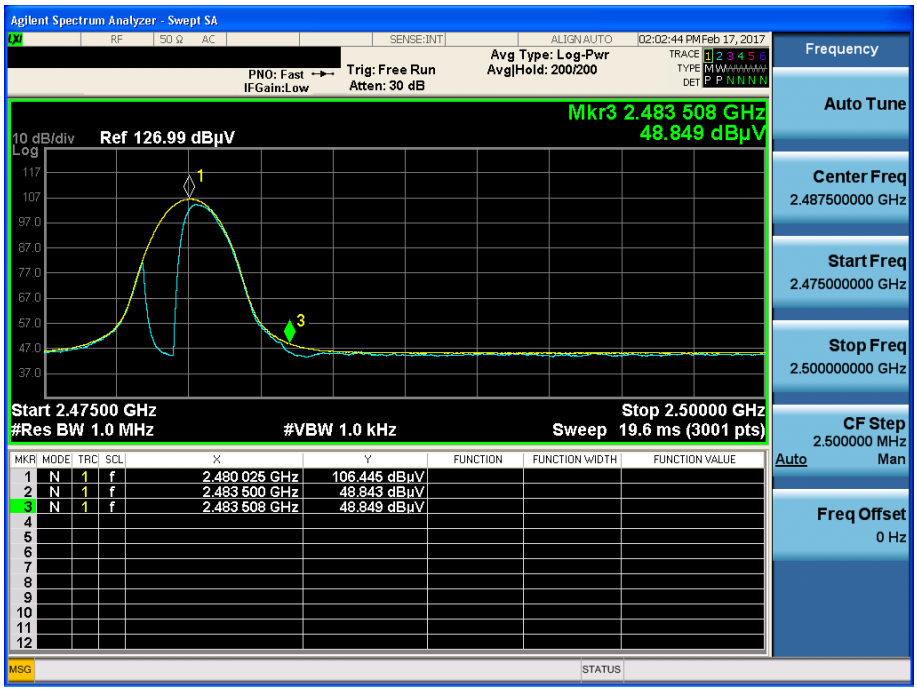
8DPSK & Lowest & X & Hor — Detector Mode : AV



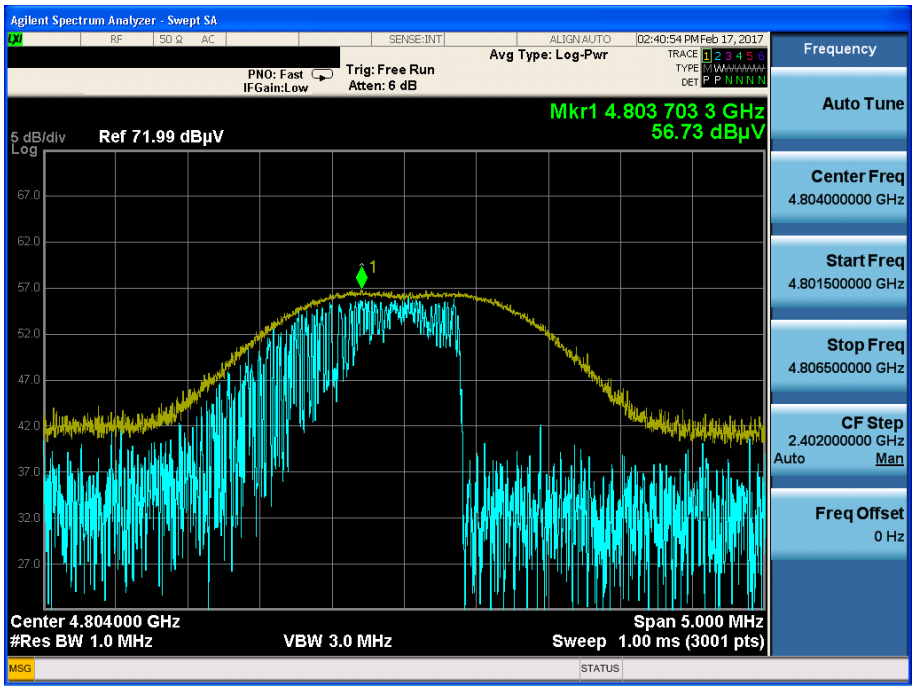
8DPSK & Highest & X & Hor — Detector Mode : PK



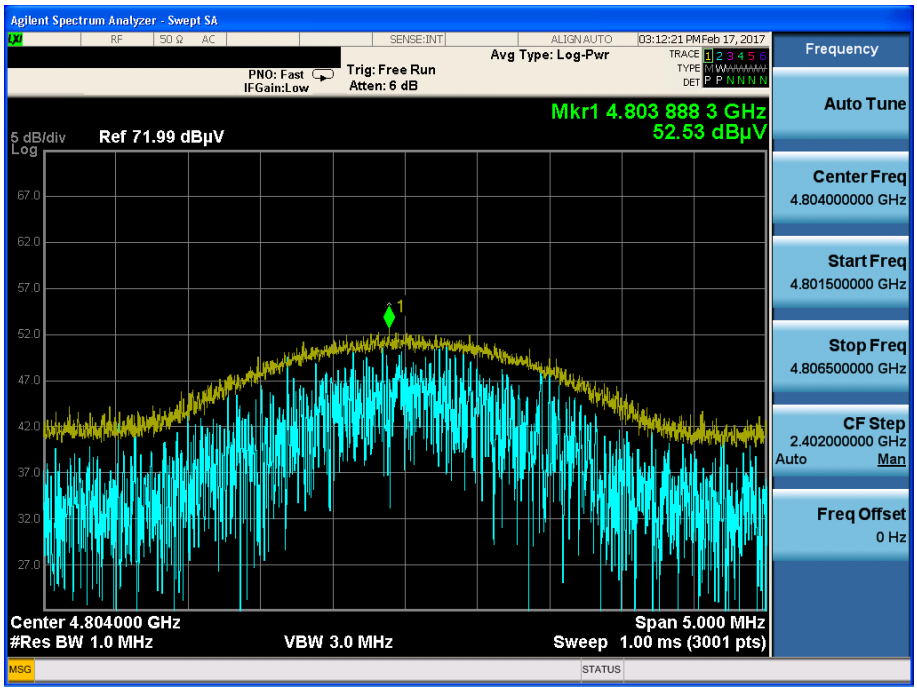
8DPSK & Highest & X & Hor — Detector Mode : AV



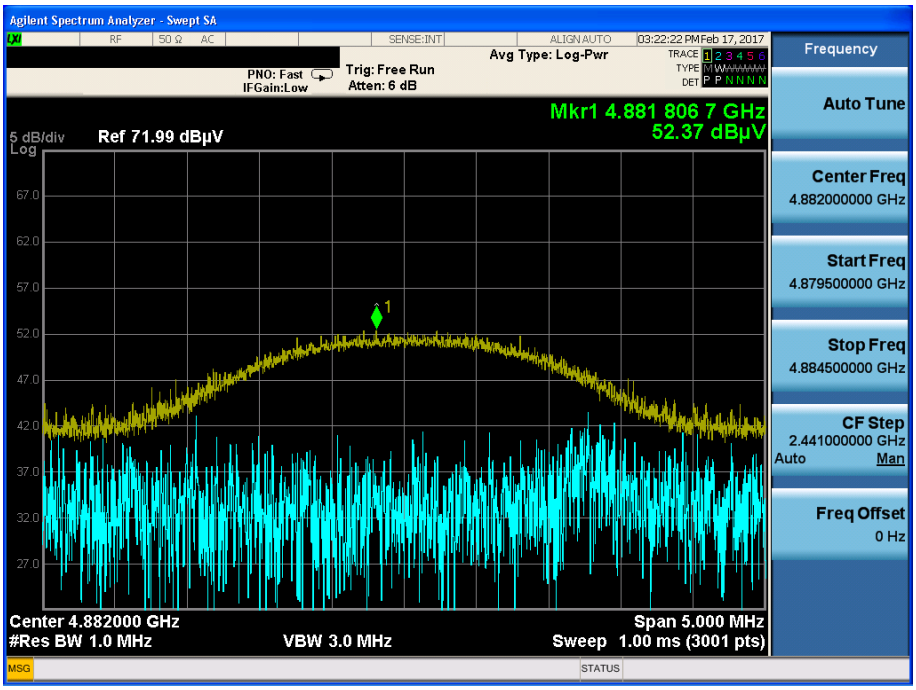
GFSK & Lowest & Z & Ver — Detector Mode : PK



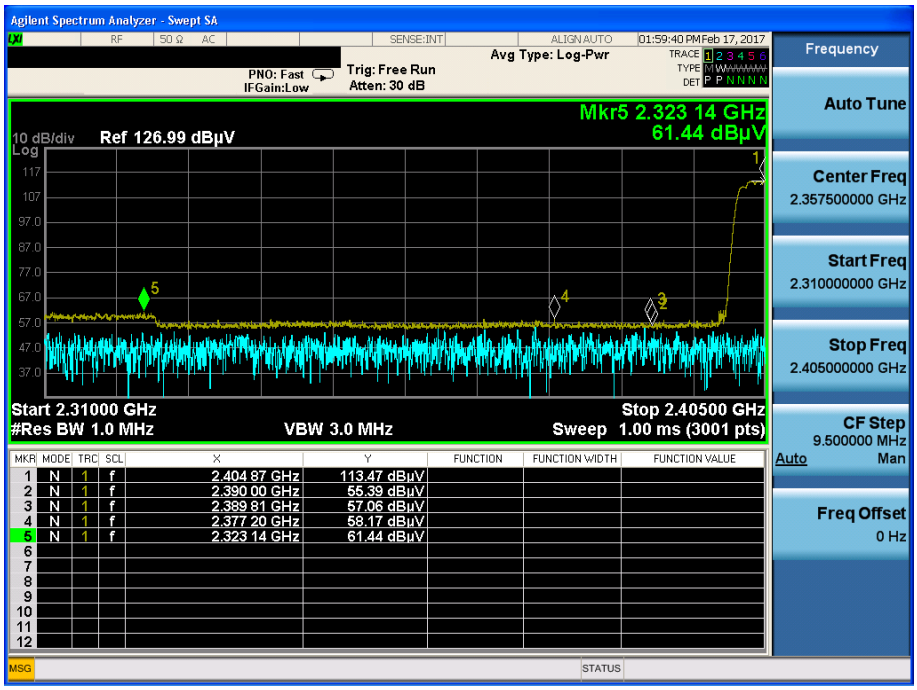
π/4DQPSK & Lowest & Z & Ver — Detector Mode : PK



8DPSK & Middle & Z & Ver **Detector Mode : PK**

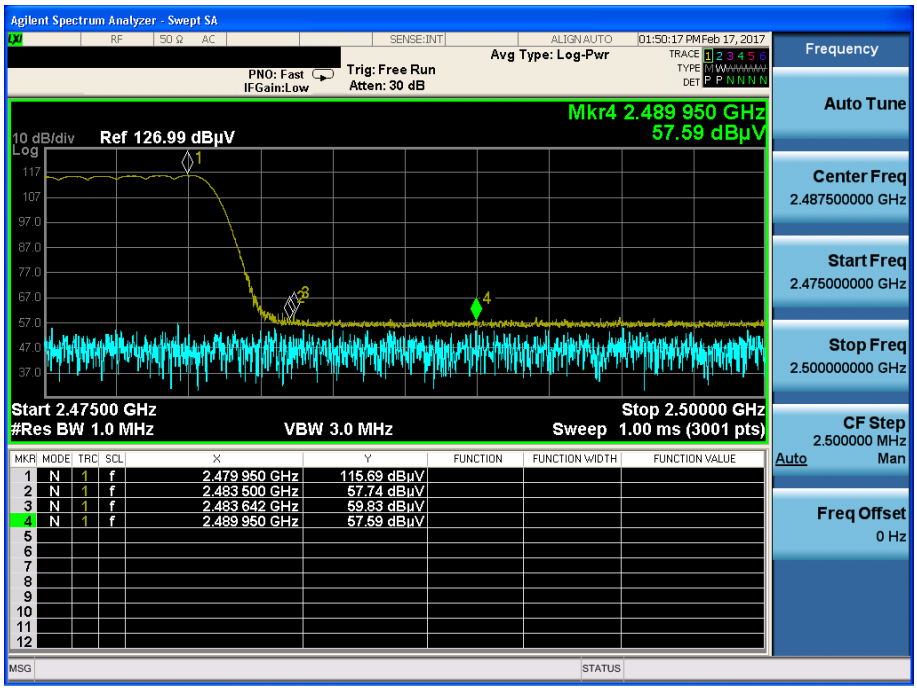


GFSK & Hopping mode & X & Hor Detector Mode : PK

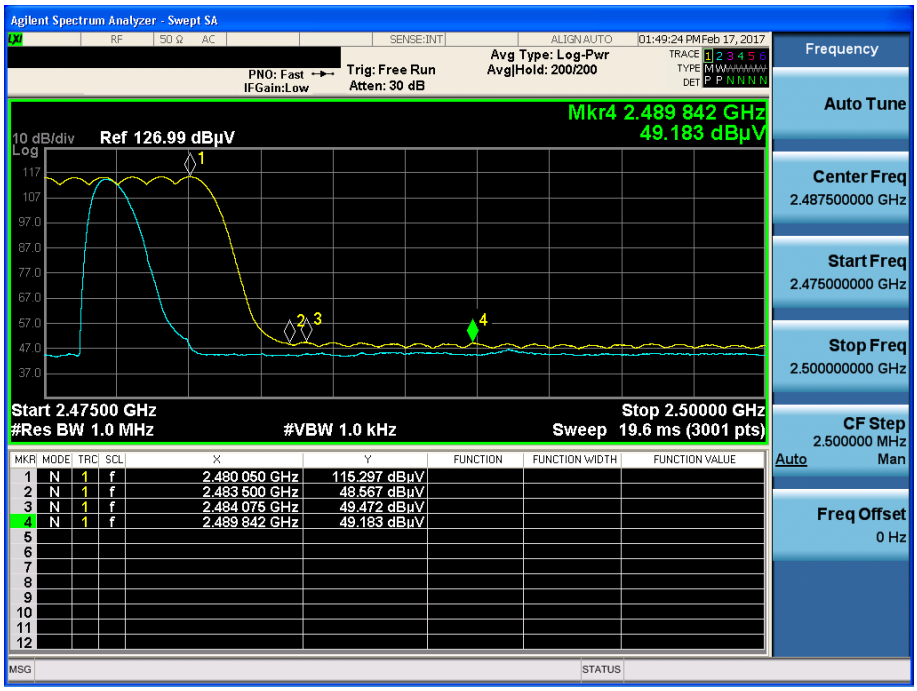


GFSK & Hopping mode & X & Hor Detector Mode : AV

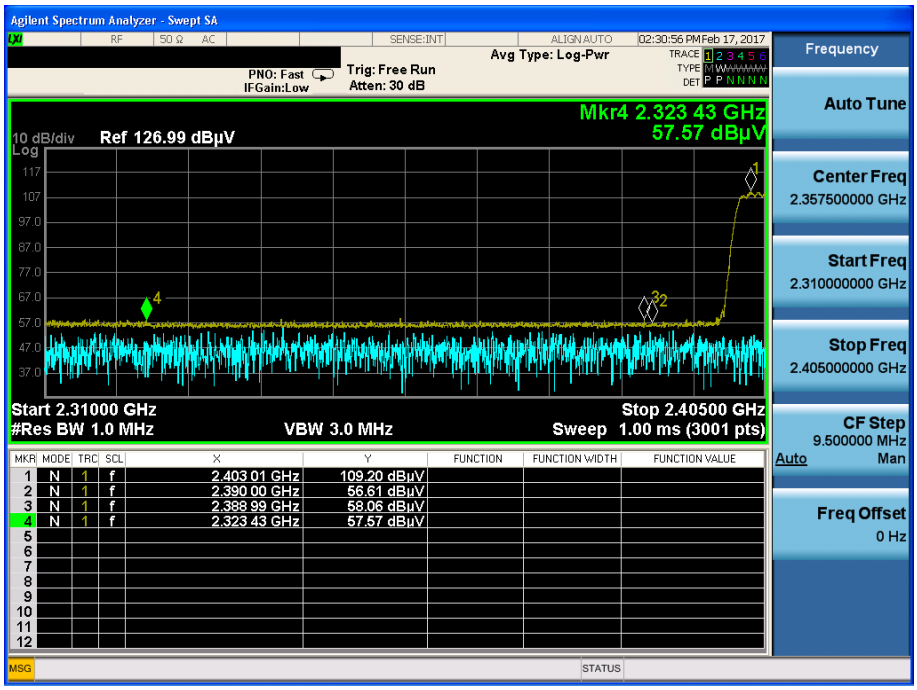
GFSK & Hopping mode & X & Hor Detector Mode : PK



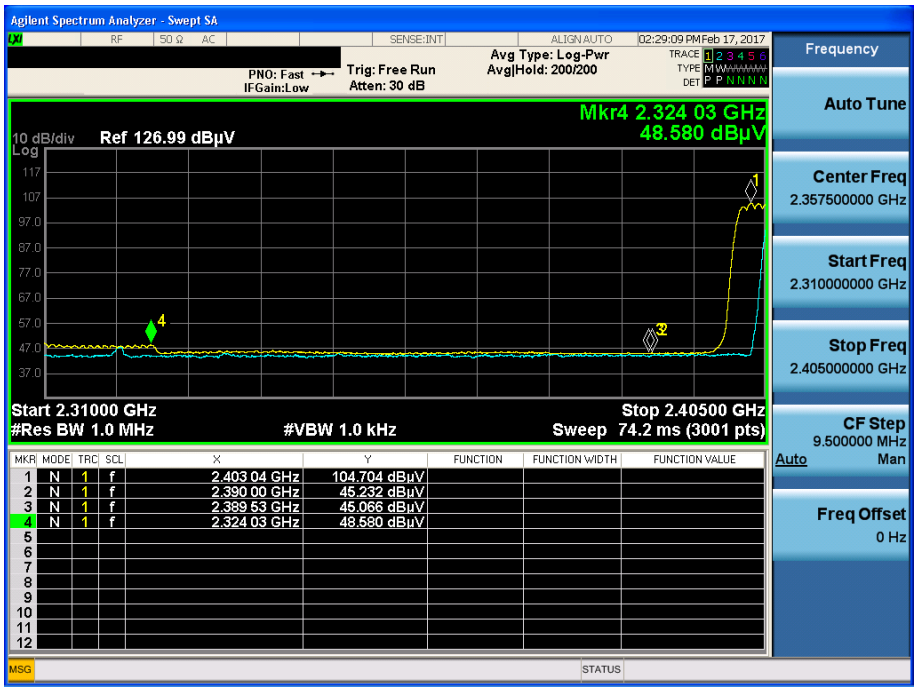
GFSK & Hopping mode & X & Hor Detector Mode : AV



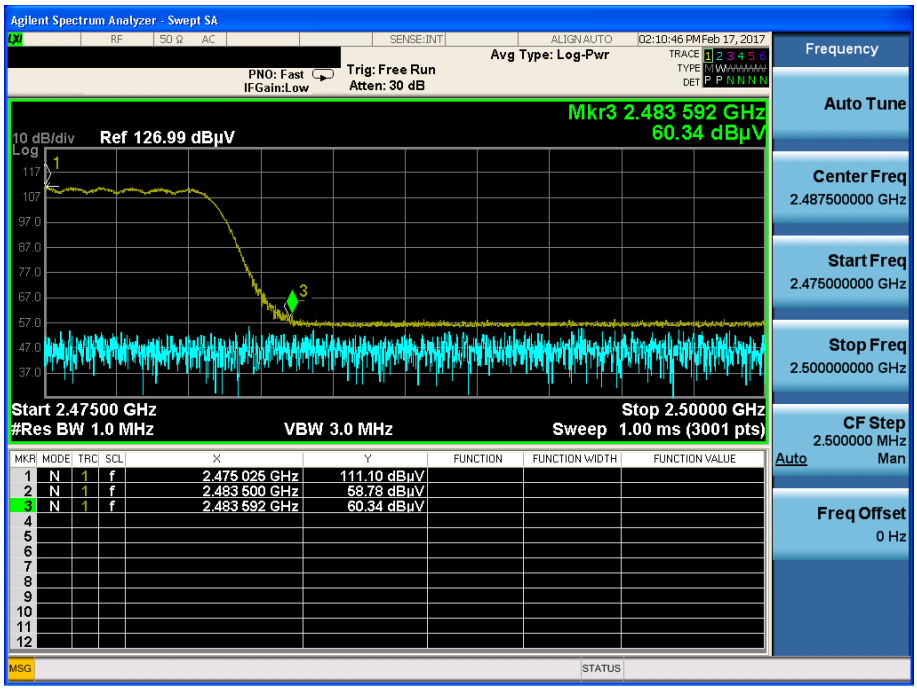
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK



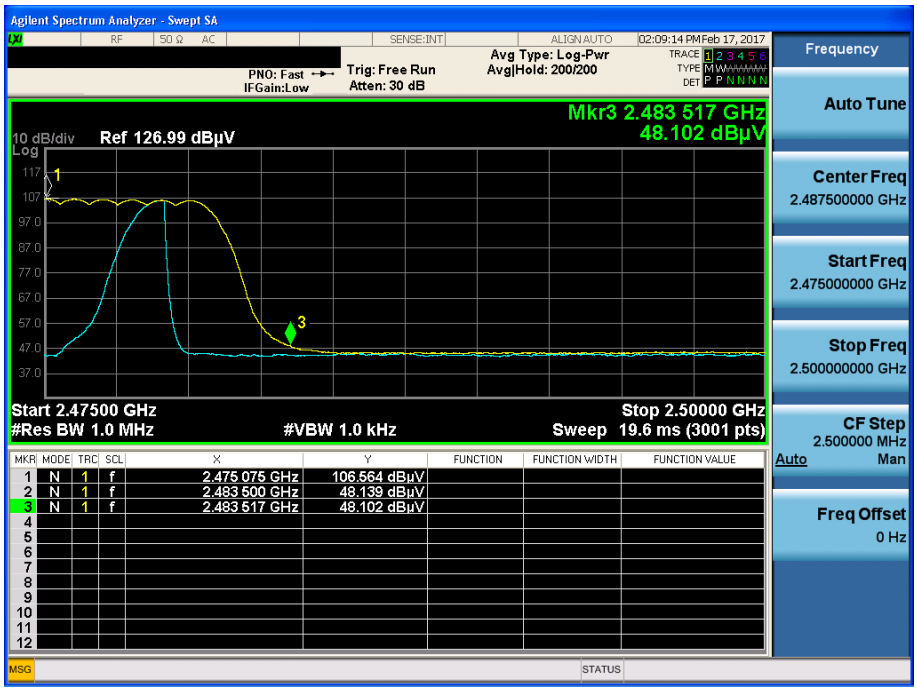
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV



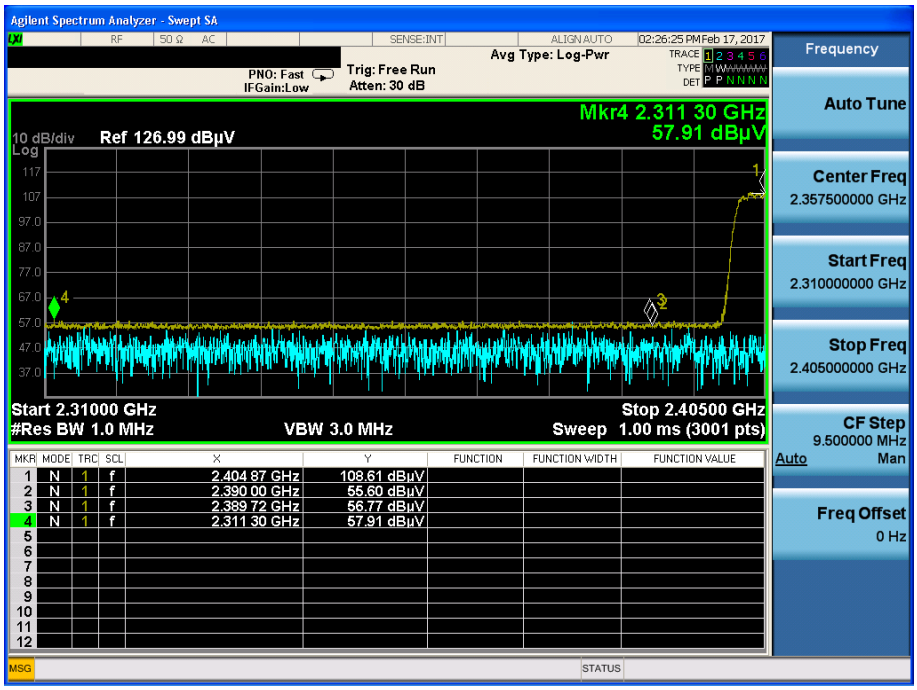
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : PK



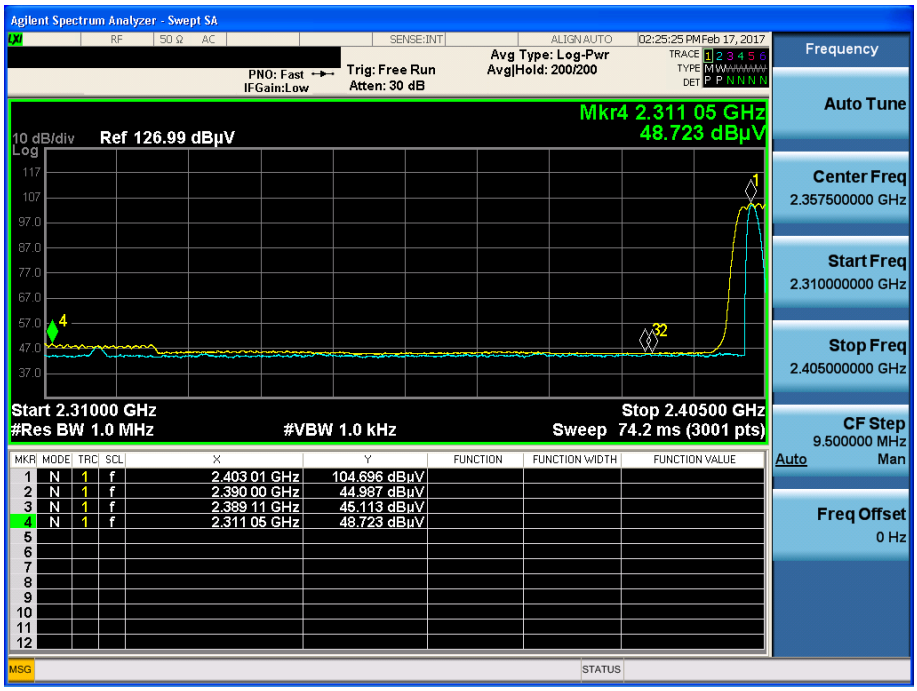
π/4DQPSK & Hopping mode & X & Hor — Detector Mode : AV



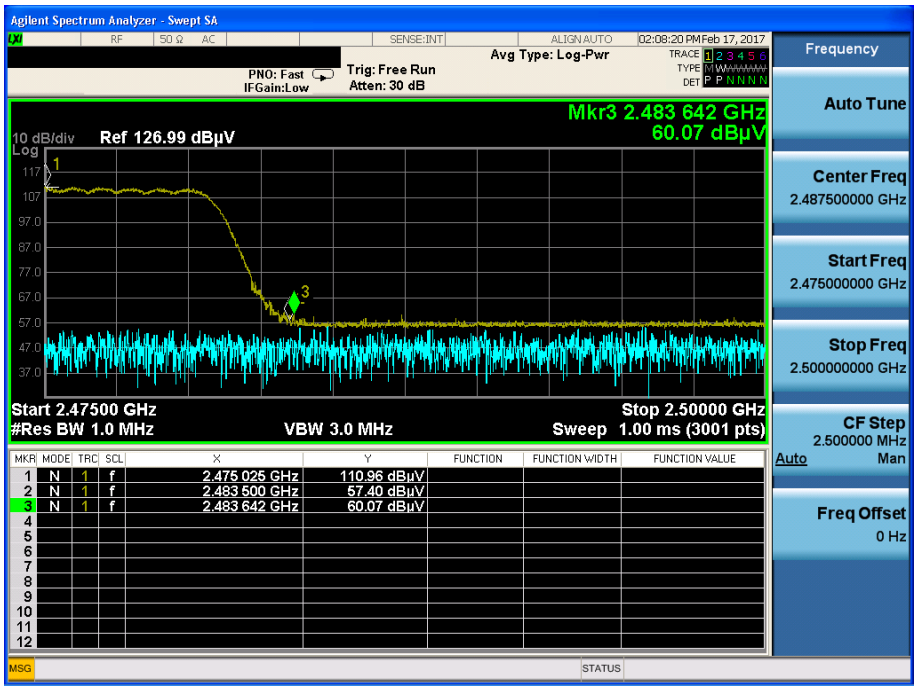
8DPSK & Hopping mode & X & Hor Detector Mode : PK



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



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



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