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

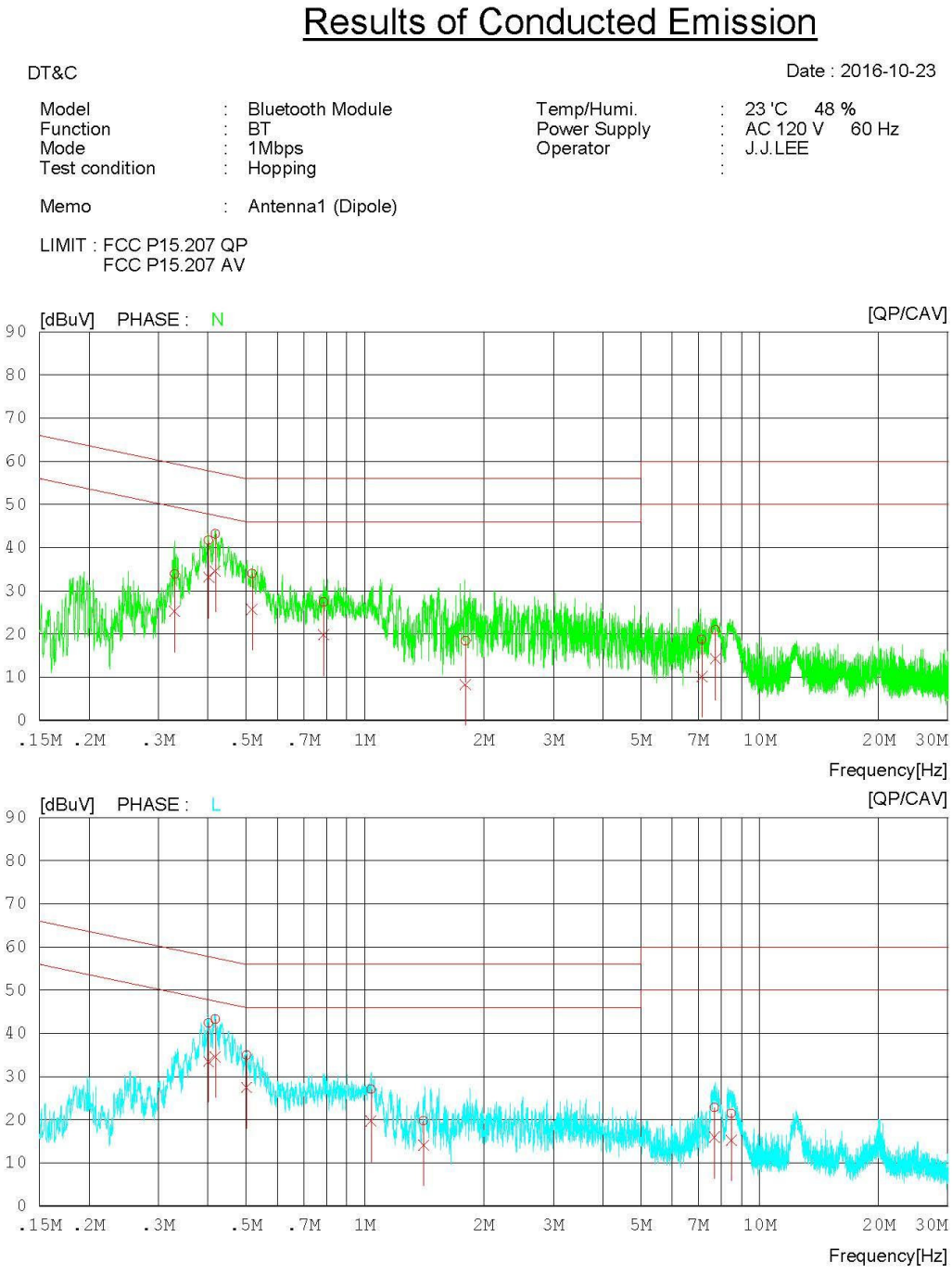
8.3 Test Procedures

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 / Dipole Antenna*



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

Results of Conducted Emission

DT&C

Date : 2016-10-23

Model	:	Bluetooth Module	Temp/Humi.	:	23 'C 48 %
Function	:	BT	Power Supply	:	AC 120 V 60 Hz
Mode	:	1Mbps	Operator	:	J.J.LEE
Test condition	:	Hopping		:	
Memo	:	Antenna1 (Dipole)			

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

NO	FREQ	READING		C.FACTOR	RESULT		LIMIT		MARGIN		PHASE
		QP	CAV		QP	CAV	QP	CAV	QP	CAV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.32970	32.71	24.21	1.10	33.81	25.31	59.46	49.46	25.65	24.15	N
2	0.40217	40.86	32.23	0.87	41.73	33.10	57.81	47.81	16.08	14.71	N
3	0.41829	42.31	33.72	0.84	43.15	34.56	57.48	47.48	14.33	12.92	N
4	0.51748	33.31	25.08	0.67	33.98	25.75	56.00	46.00	22.02	20.25	N
5	0.78561	26.88	19.36	0.47	27.35	19.83	56.00	46.00	28.65	26.17	N
6	1.79920	18.04	7.95	0.34	18.38	8.29	56.00	46.00	37.62	37.71	N
7	7.13900	18.36	9.85	0.36	18.72	10.21	60.00	50.00	41.28	39.79	N
8	7.73520	20.59	13.89	0.37	20.96	14.26	60.00	50.00	39.04	35.74	N
9	0.40186	41.46	32.57	0.90	42.36	33.47	57.81	47.81	15.45	14.34	L
10	0.41799	42.37	33.72	0.87	43.24	34.59	57.49	47.49	14.25	12.90	L
11	0.50183	34.29	26.75	0.71	35.00	27.46	56.00	46.00	21.00	18.54	L
12	1.03600	26.56	19.27	0.42	26.98	19.69	56.00	46.00	29.02	26.31	L
13	1.40940	19.36	13.72	0.38	19.74	14.10	56.00	46.00	36.26	31.90	L
14	7.67940	22.42	15.52	0.41	22.83	15.93	60.00	50.00	37.17	34.07	L
15	8.46720	21.08	14.87	0.41	21.49	15.28	60.00	50.00	38.51	34.72	L

AC Line Conducted Emissions (Graph) = Modulation : *GFSK / Chip Antenna*

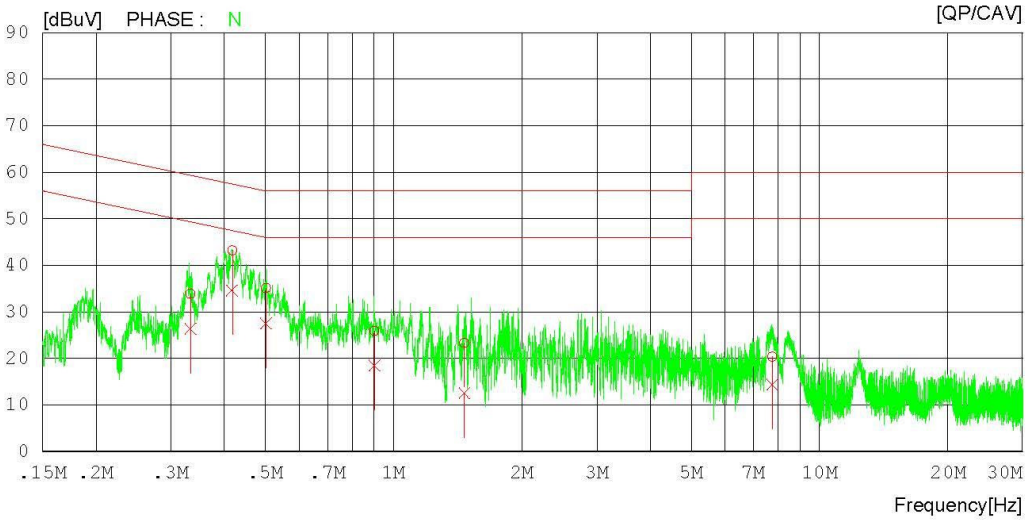
Results of Conducted Emission

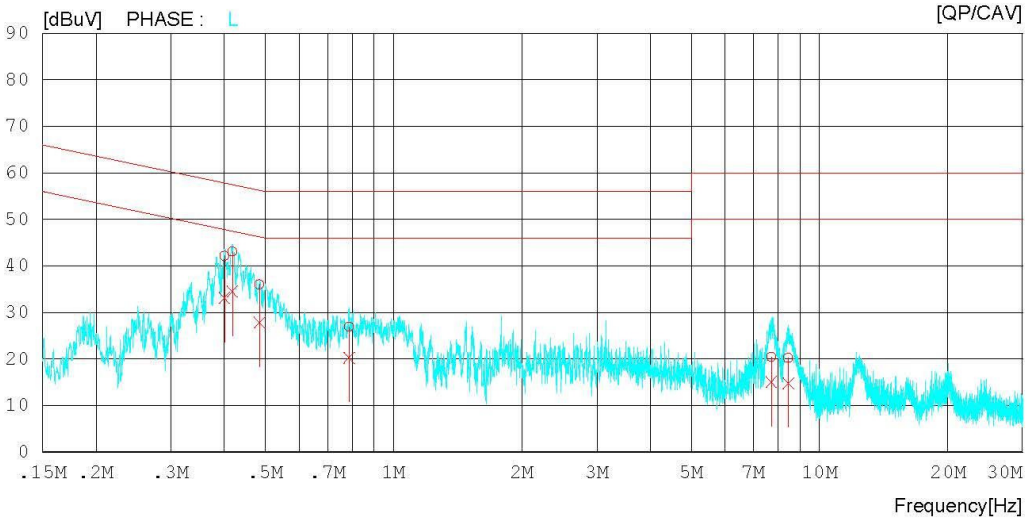
DT&C

Date : 2016-10-23

Model	:	Bluetooth Module	Temp/Humi.	:	23 'C 48 %
Function	:	BT	Power Supply	:	AC 120 V 60 Hz
Mode	:	1Mbps	Operator	:	J.J.LEE
Test condition	:	Hopping		:	
Memo	:	Chip Antenna			

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





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

Results of Conducted Emission

DT&C

Date : 2016-10-23

Model	:	Bluetooth Module	Temp/Humi.	:	23 'C 48 %
Function	:	BT	Power Supply	:	AC 120 V 60 Hz
Mode	:	1Mbps	Operator	:	J.J.LEE
Test condition	:	Hopping		:	
Memo	:	Chip Antenna			

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

NO	FREQ	READING		C.FACTOR	RESULT		LIMIT		MARGIN		PHASE
		QP	CAV		QP	CAV	QP	CAV	QP	CAV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.33327	32.77	25.26	1.08	33.85	26.34	59.37	49.37	25.52	23.03	N
2	0.41803	42.33	33.78	0.84	43.17	34.62	57.49	47.49	14.32	12.87	N
3	0.50178	34.44	26.83	0.69	35.13	27.52	56.00	46.00	20.87	18.48	N
4	0.90138	25.50	18.03	0.43	25.93	18.46	56.00	46.00	30.07	27.54	N
5	1.46500	23.01	12.23	0.34	23.35	12.57	56.00	46.00	32.65	33.43	N
6	7.73860	20.02	14.02	0.37	20.39	14.39	60.00	50.00	39.61	35.61	N
7	0.40058	41.19	32.17	0.90	42.09	33.07	57.84	47.84	15.75	14.77	L
8	0.41823	42.17	33.62	0.87	43.04	34.49	57.48	47.48	14.44	12.99	L
9	0.48435	35.27	27.12	0.74	36.01	27.86	56.26	46.26	20.25	18.40	L
10	0.78642	26.39	19.77	0.50	26.89	20.27	56.00	46.00	29.11	25.73	L
11	7.70360	20.04	14.59	0.41	20.45	15.00	60.00	50.00	39.55	35.00	L
12	8.44720	19.82	14.40	0.41	20.23	14.81	60.00	50.00	39.77	35.19	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 dipole antenna type employs a unique antenna connector(SMA male reverse type).
And the Chip antenna type is attached on PCB.

- **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.

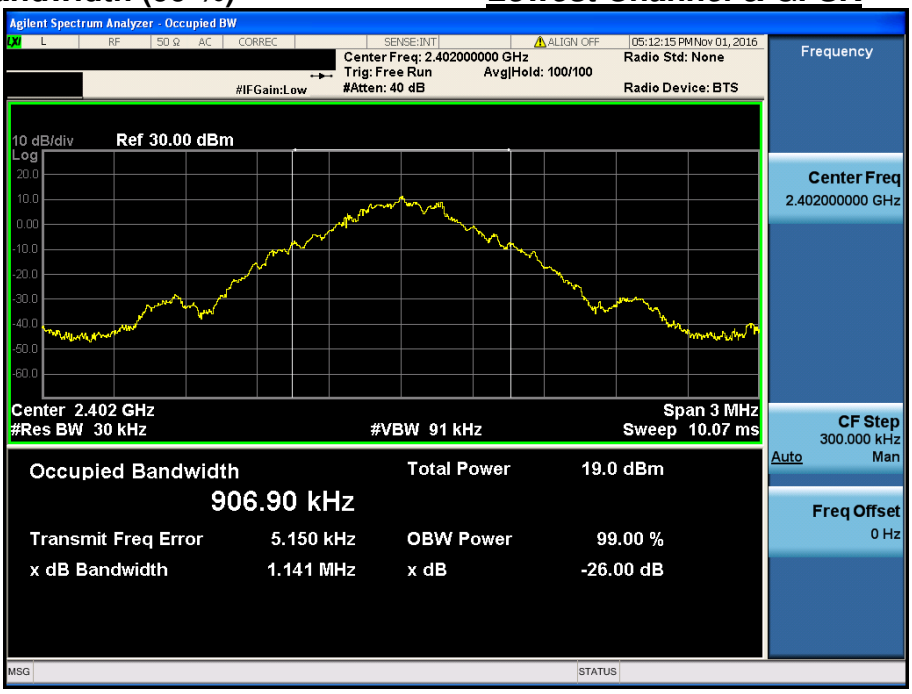
The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 × RBW.

Spectrum analyzer plots are included on the following pages.

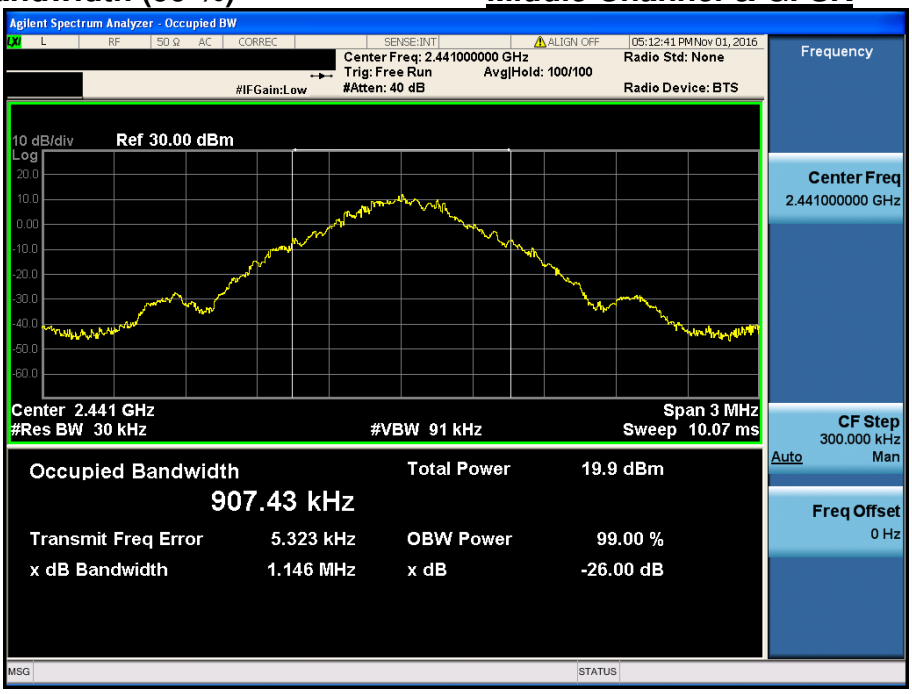
10.4 Test Results

Modulation	Tested Channel	Test Results (MHz)
GFSK	**Lowest**	**0.907**
	Middle	0.907
	Highest	0.899
π/4DQPSK	**Lowest**	**1.195**
	Middle	1.188
	Highest	1.184
8DPSK	**Lowest**	**1.203**
	Middle	1.191
	Highest	1.187

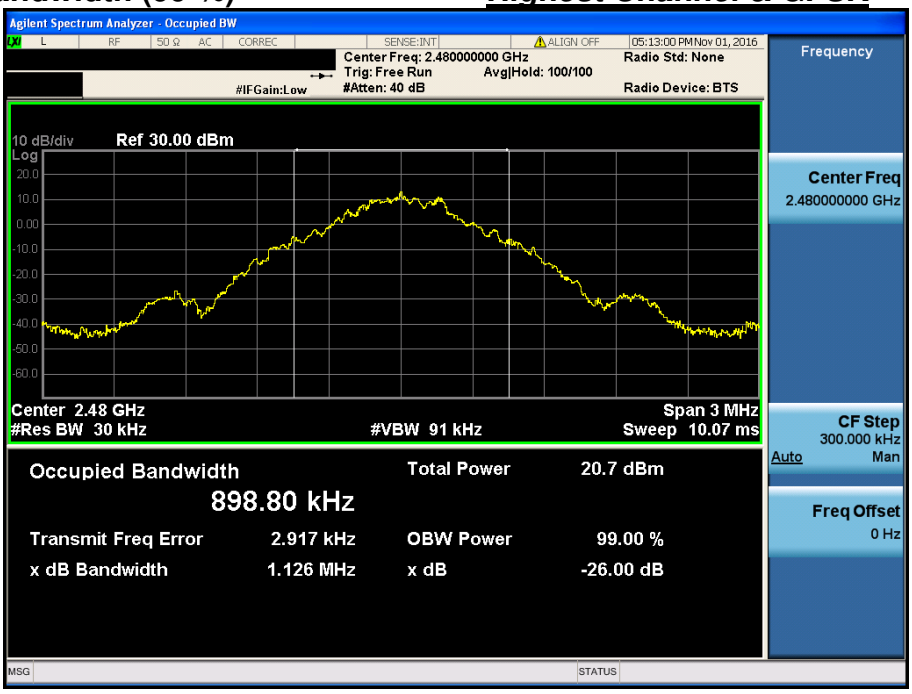
Occupied Bandwidth (99 %) ***Lowest Channel & GFSK***



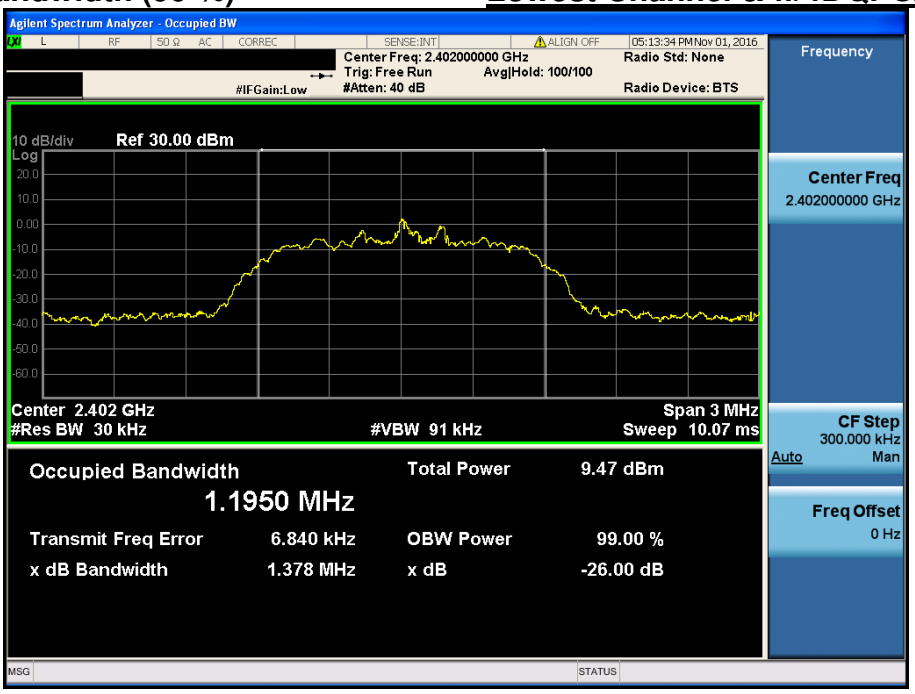
Occupied Bandwidth (99 %) ***Middle Channel & GFSK***



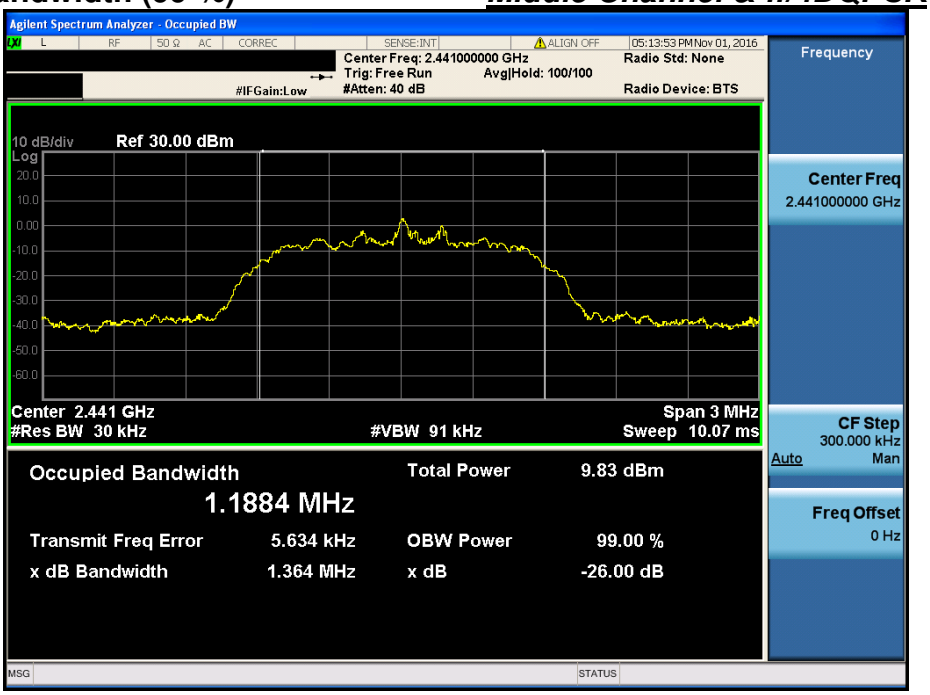
Occupied Bandwidth (99 %) ***Highest Channel & GFSK***



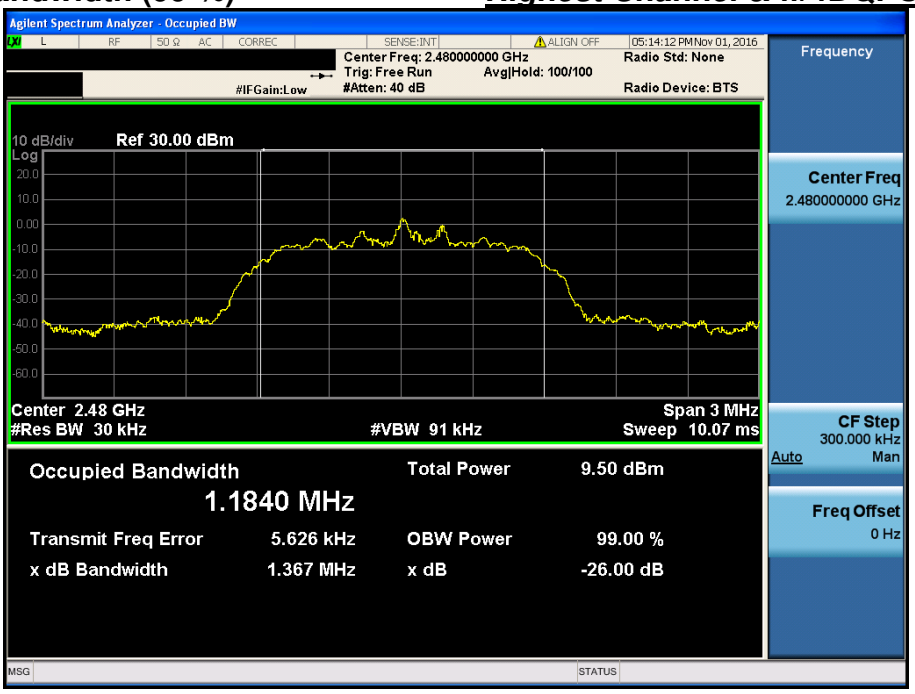
Occupied Bandwidth (99 %) ***Lowest Channel & π/4DQPSK***



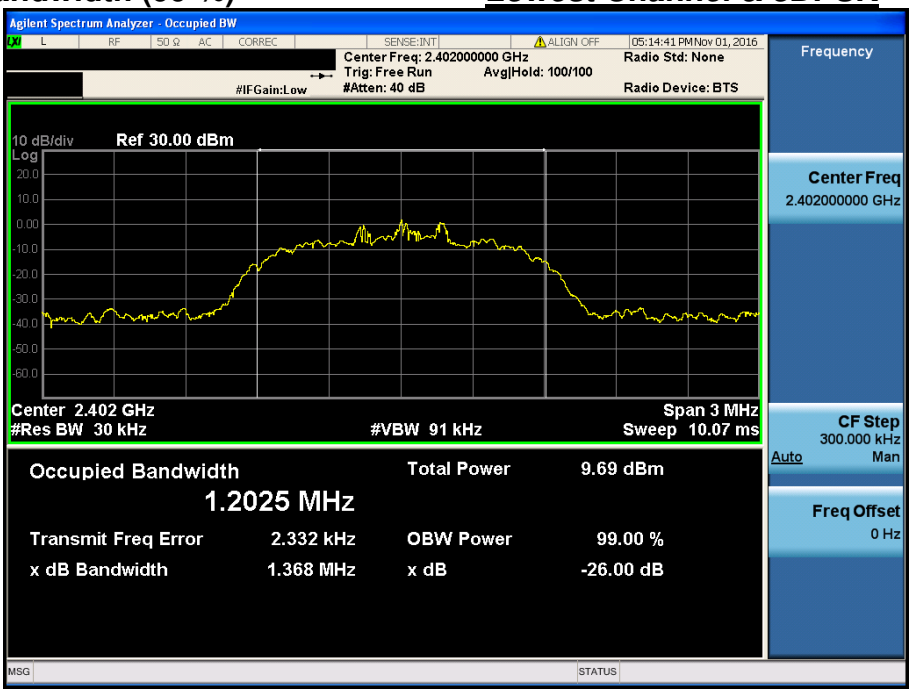
Occupied Bandwidth (99 %) ***Middle Channel & π/4DQPSK***



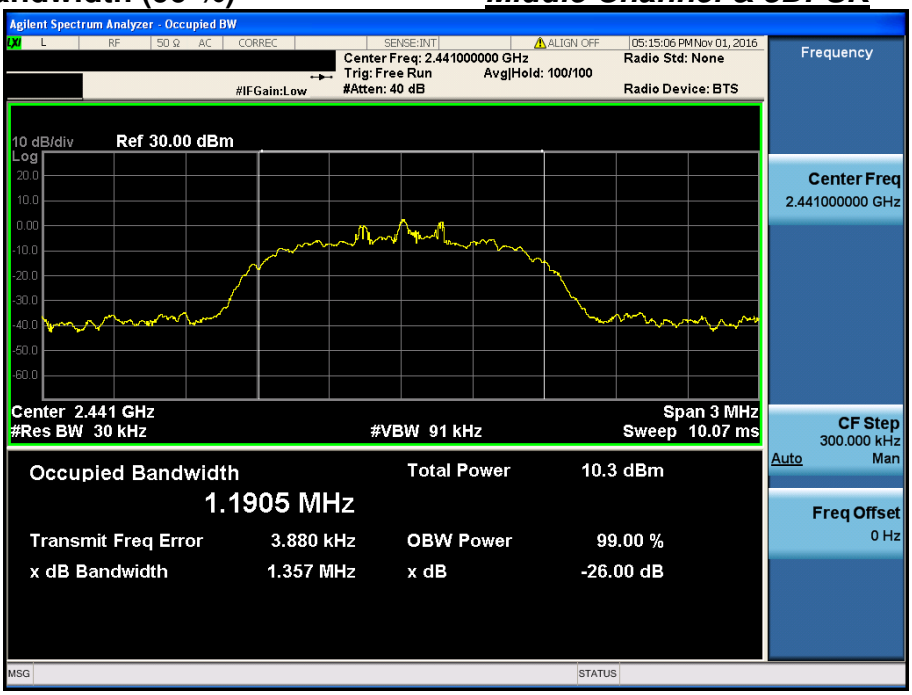
Occupied Bandwidth (99 %) ***Highest Channel & π/4DQPSK***



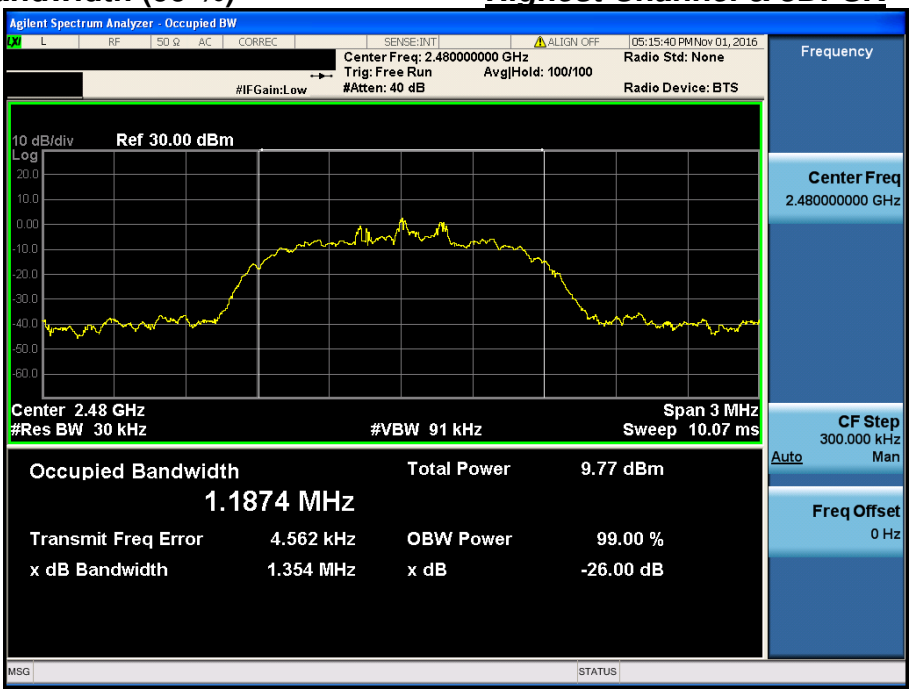
Occupied Bandwidth (99 %) ***Lowest Channel & 8DPSK***



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



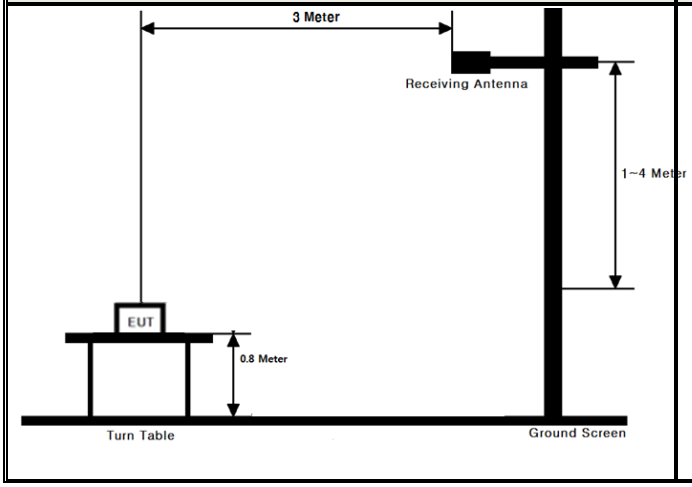
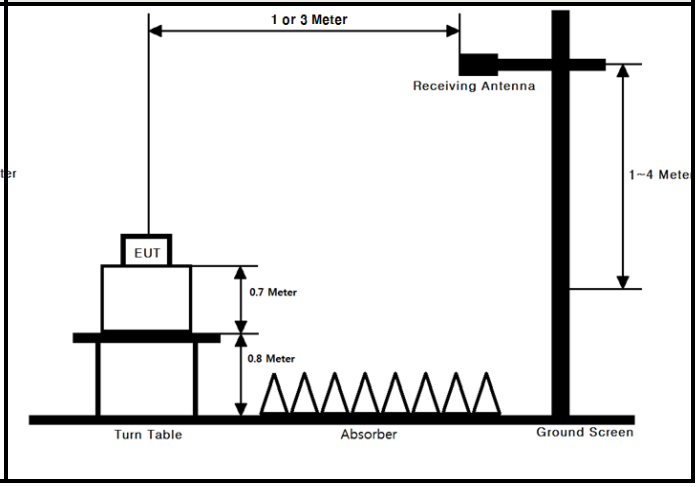
Occupied Bandwidth (99 %) ***Highest Channel & 8DPSK***



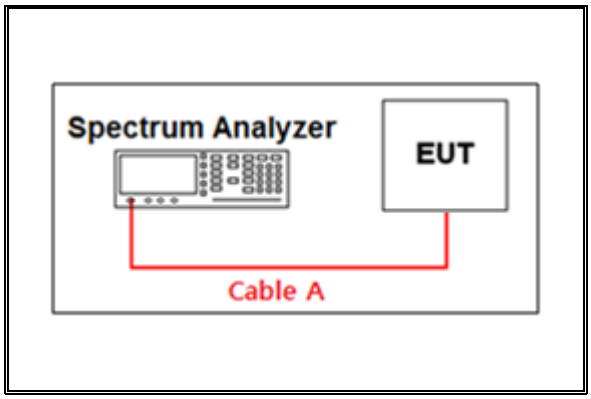
APPENDIX I

Test set up diagrams

- **Radiated Measurement**

Below 1GHz	Above 1GHz
	

- **Conducted Measurement**



Path loss information

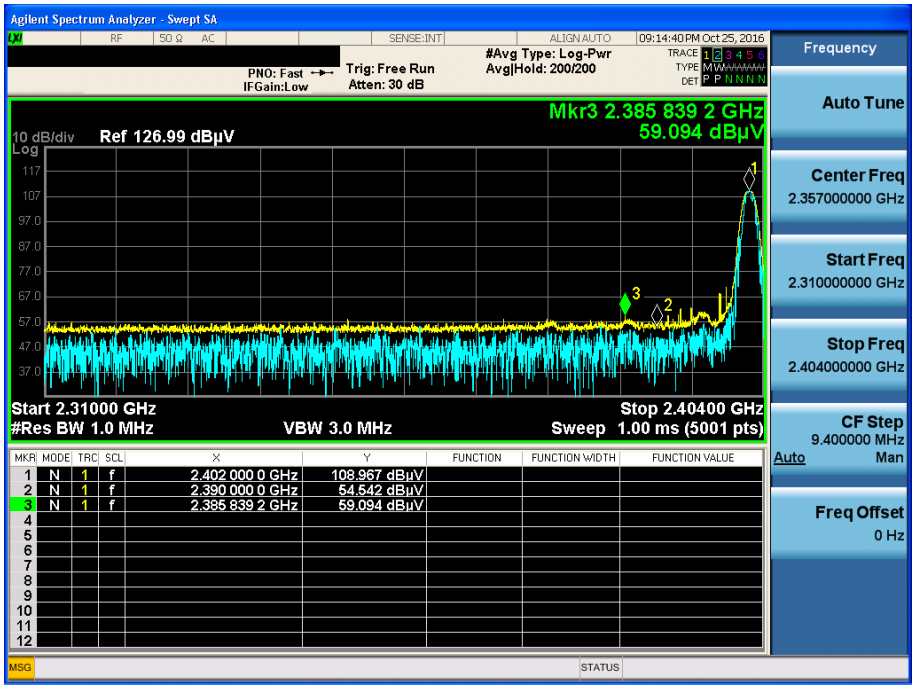
Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.18	15	5.16
1	1.08	20	5.61
2.402 & 2.440 & 2.480	1.75	25	7.00
5	2.57	-	-
10	4.13	-	-

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

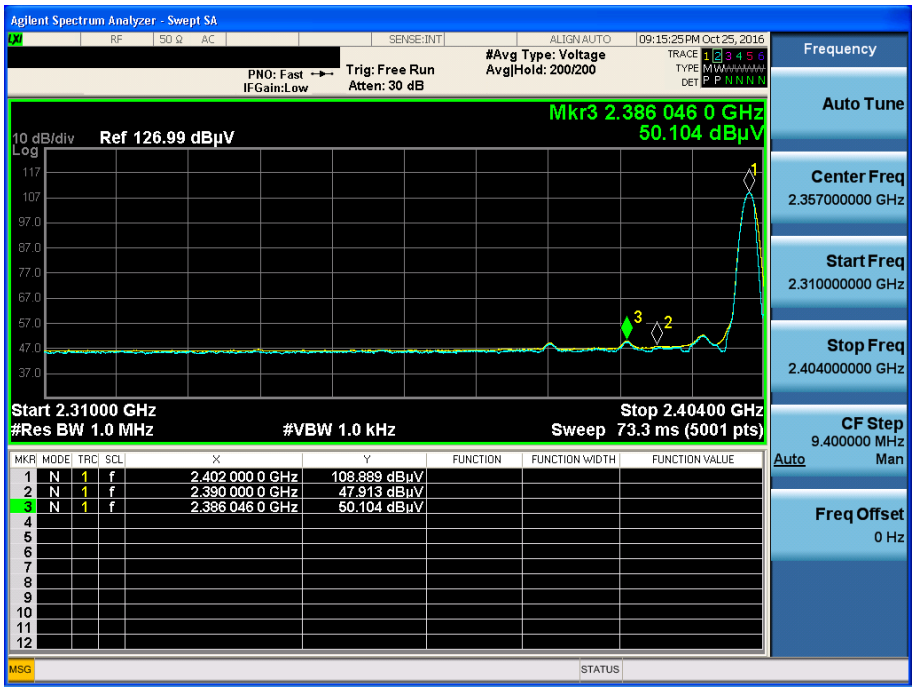
APPENDIX II

Unwanted Emissions (Radiated) Test Plot / Dipole Antenna

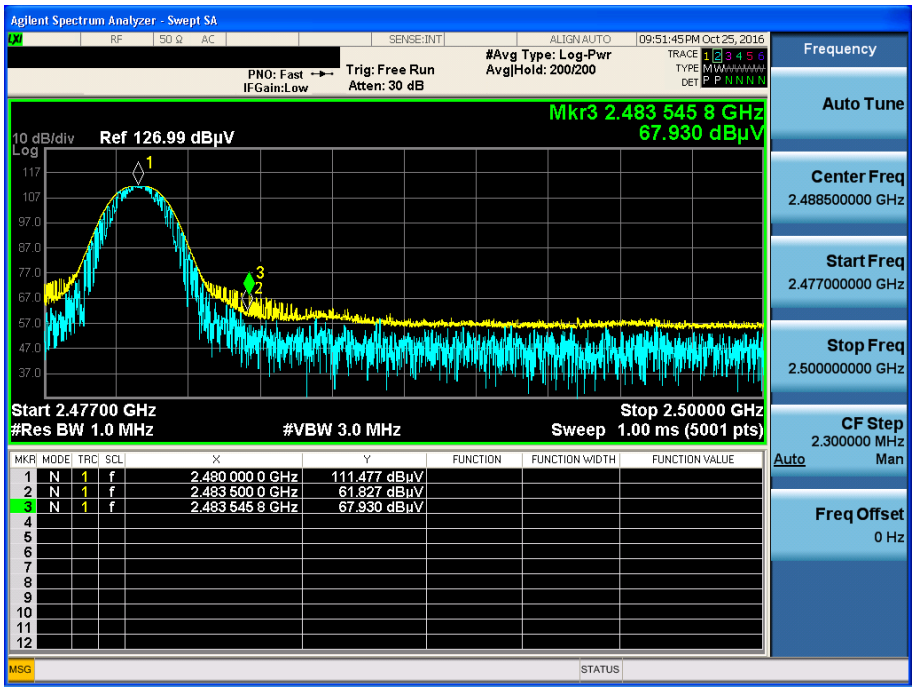
GFSK & Lowest Channel & Y & Ver — Detector Mode : PK



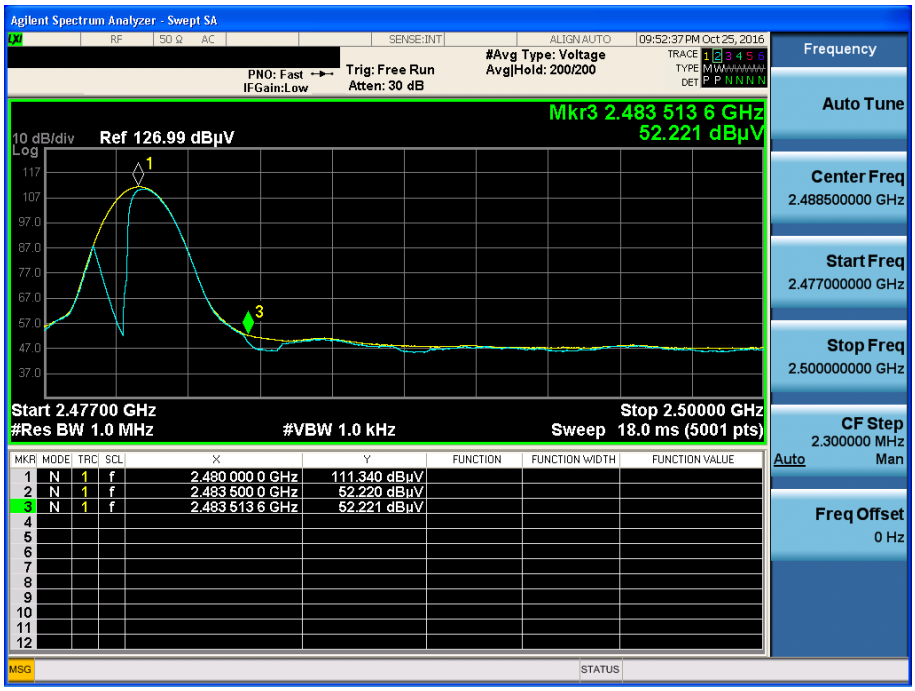
GFSK & Lowest Channel & Y & Ver — Detector Mode : AV



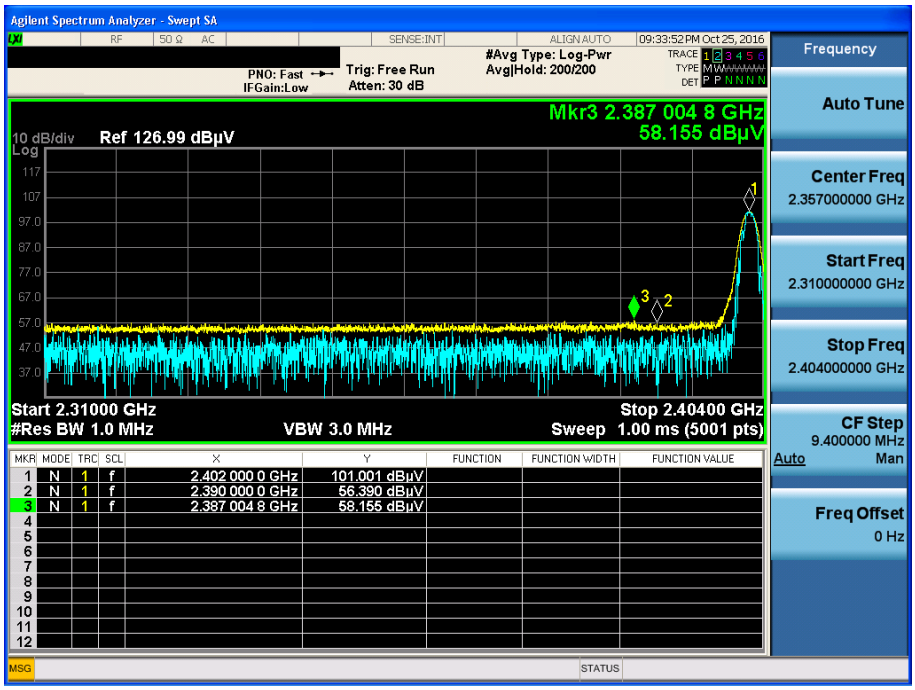
GFSK & Highest Channel & Z & Hor — Detector Mode : PK



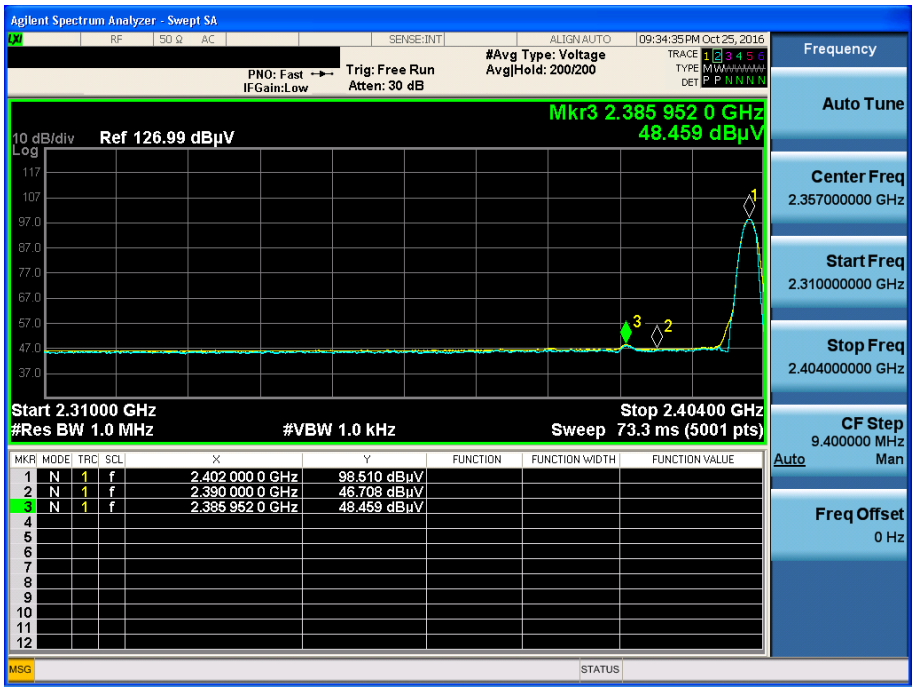
GFSK & Highest Channel & Z & Hor — Detector Mode : AV



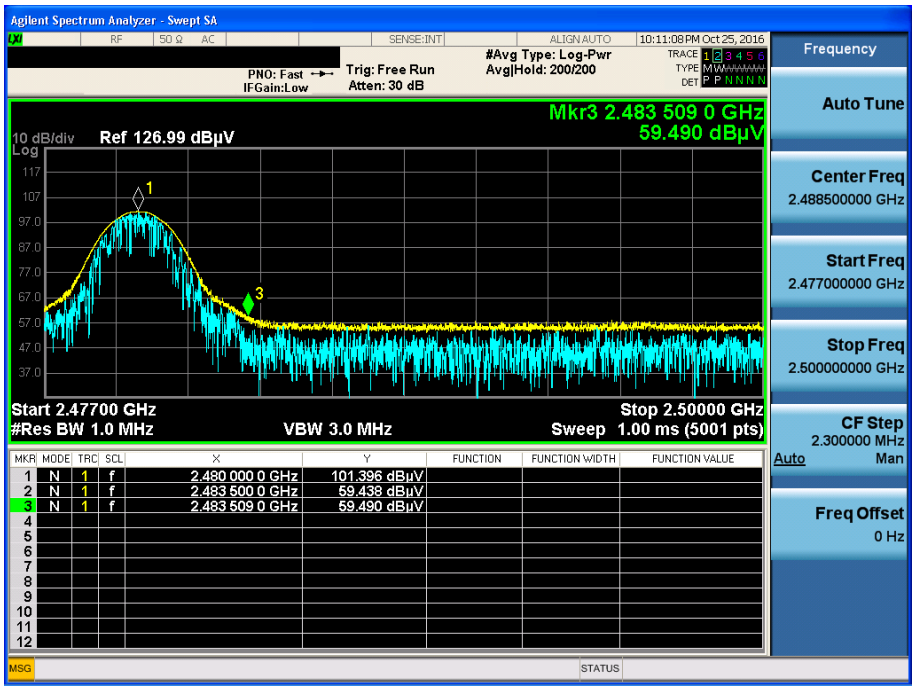
π/4DQPSK & Lowest Channel & Z & Hor — Detector Mode : PK



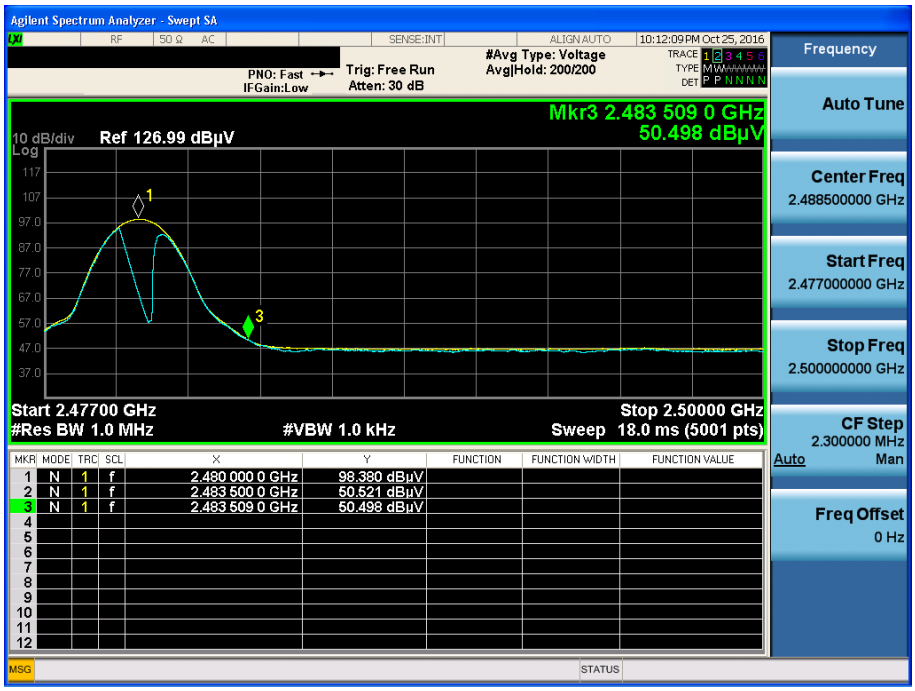
π/4DQPSK & Lowest Channel & Z & Hor — Detector Mode : AV



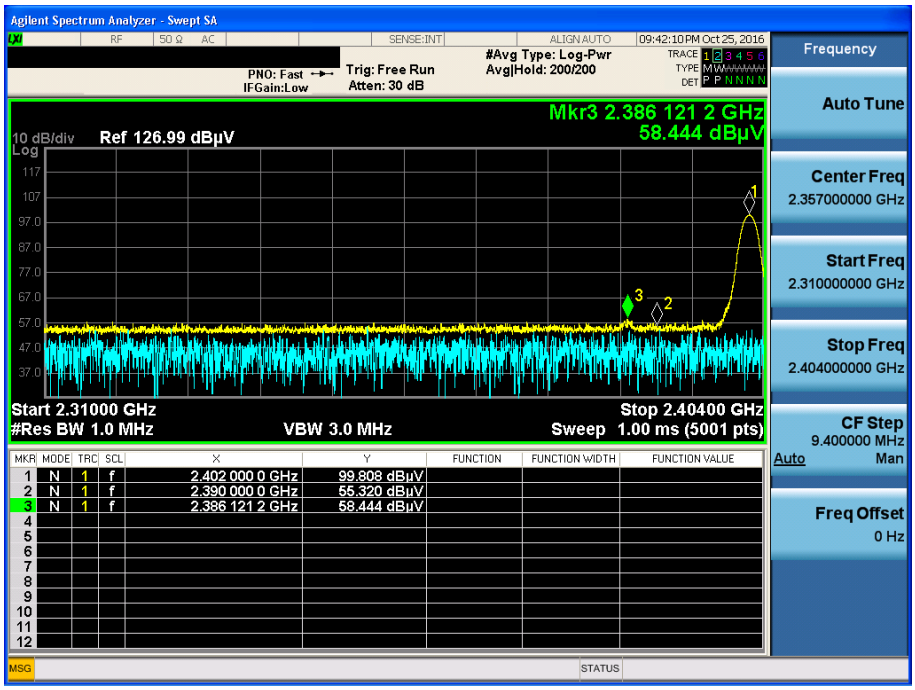
π/4DQPSK & Highest Channel & Y & Ver — Detector Mode : PK



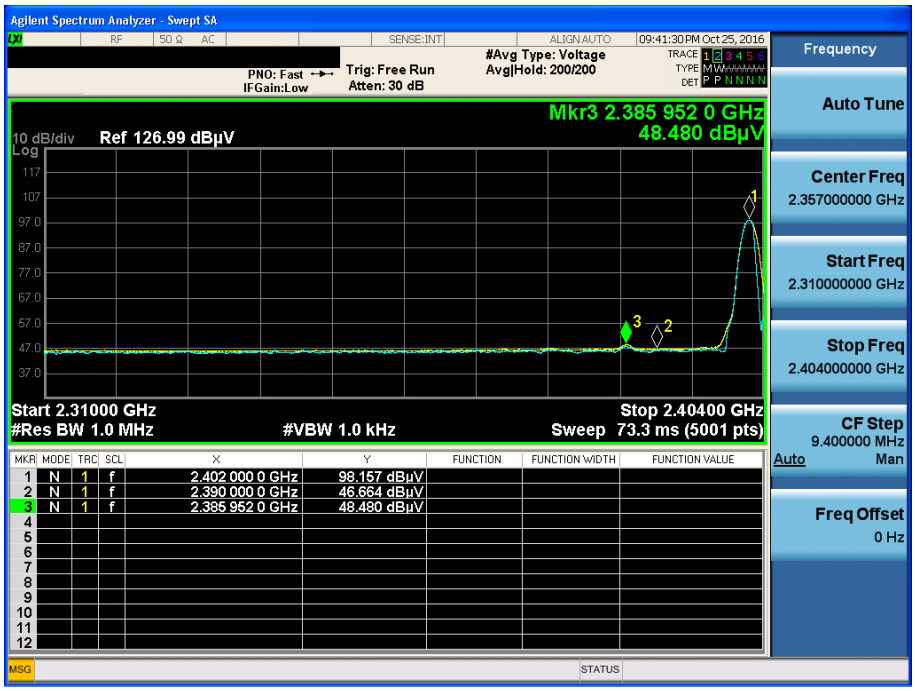
π/4DQPSK & Highest Channel & Y & Ver — Detector Mode : AV



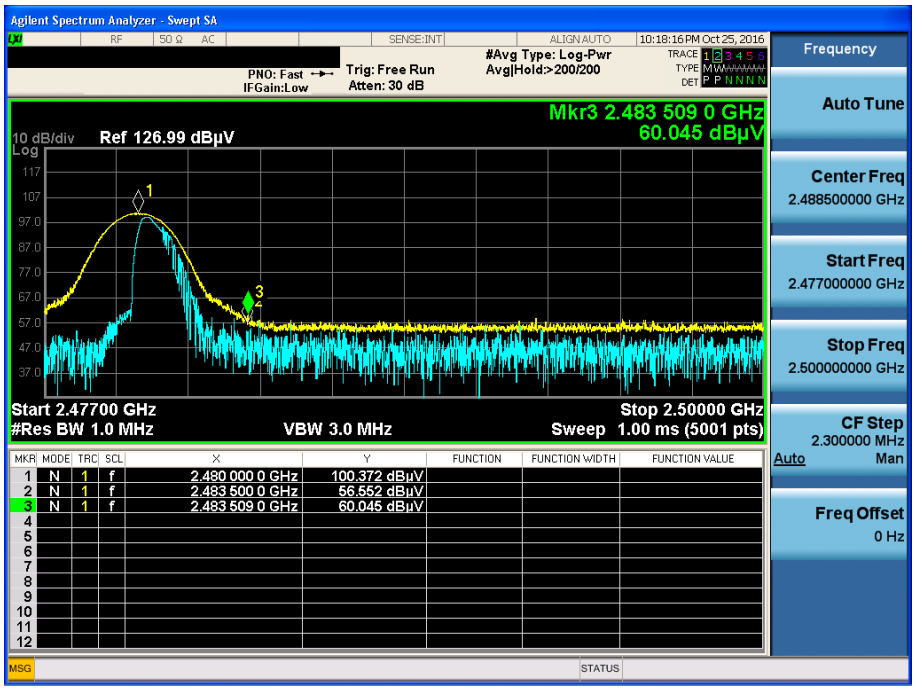
8DPSK & Lowest Channel & Y & Ver — Detector Mode : PK



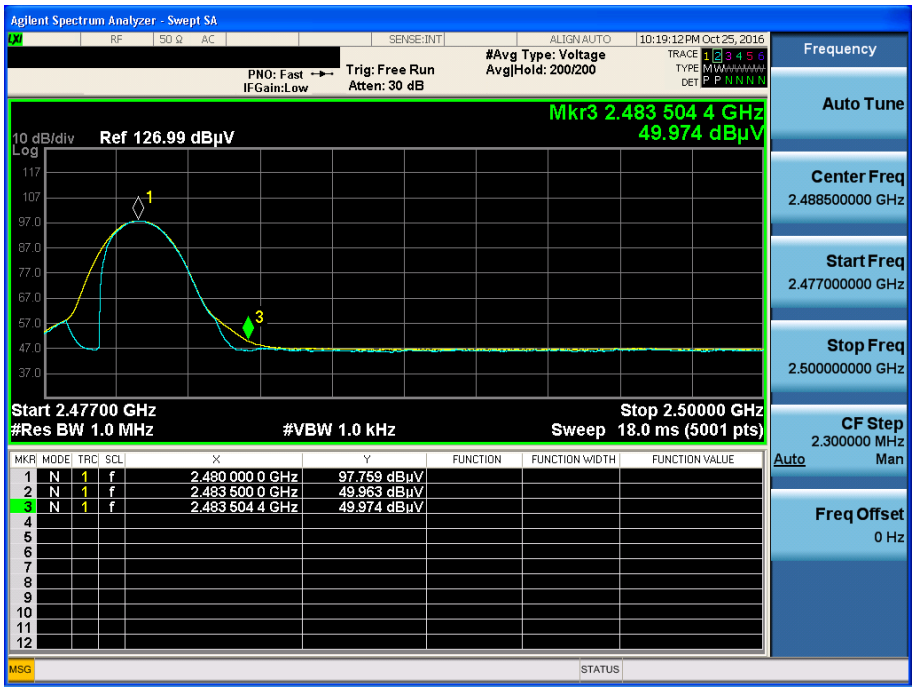
8DPSK & Lowest Channel & Y & Ver — Detector Mode : AV



8DPSK & Highest Channel & Z & Hor — Detector Mode : PK

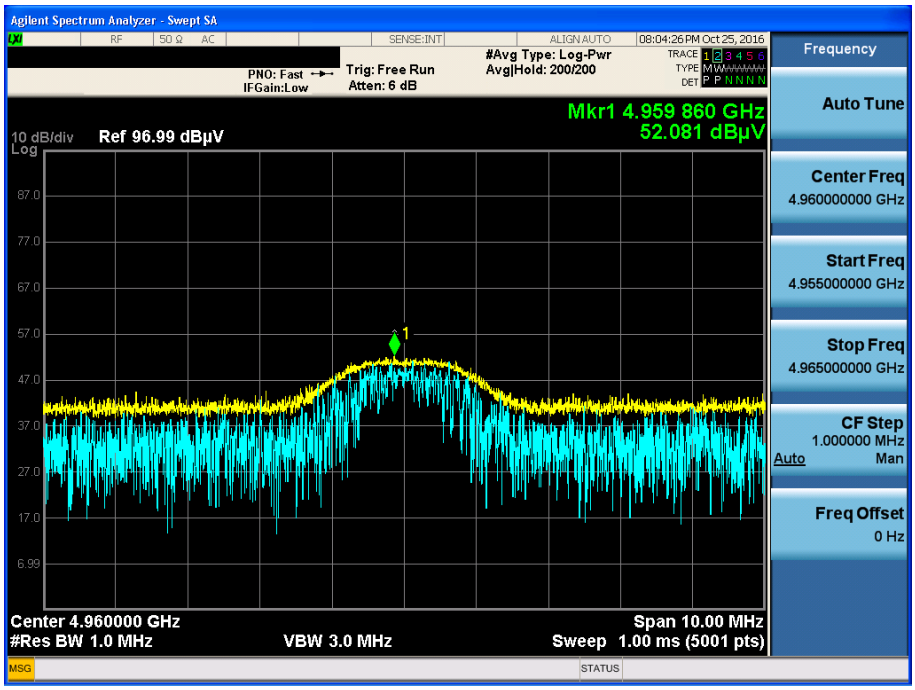


8DPSK & Highest Channel & Z & Hor — Detector Mode : AV



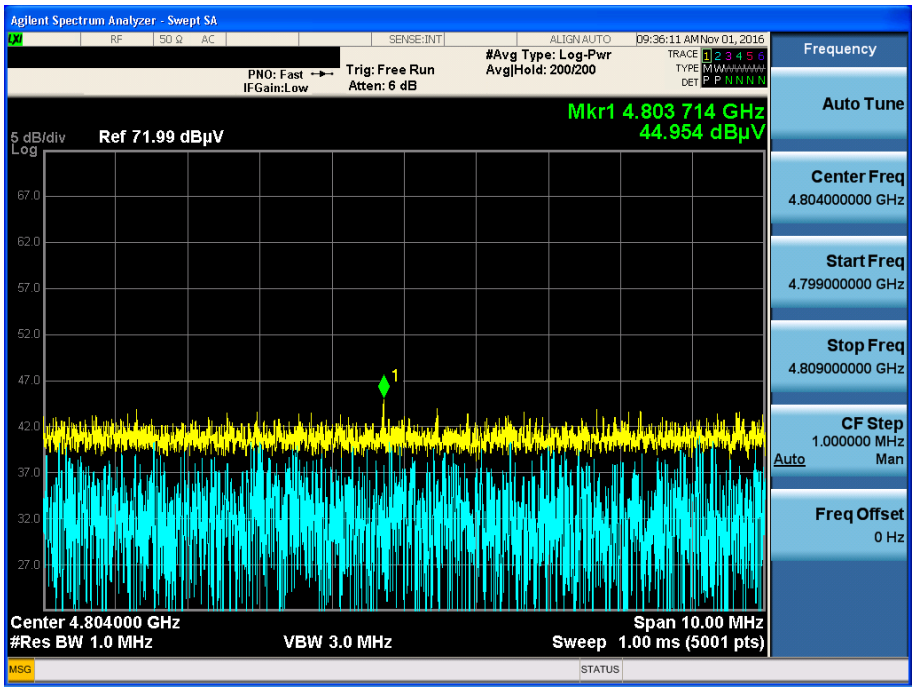
GFSK & Highest Channel & Y & Ver

Detector Mode : PK

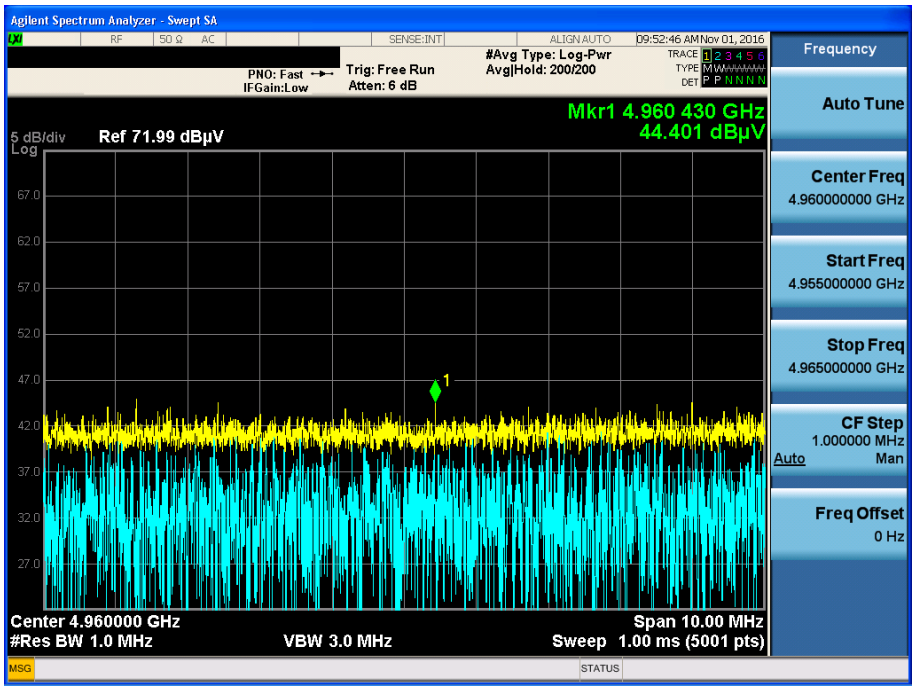


π/4DQPSK & Lowest Channel & Y & Ver

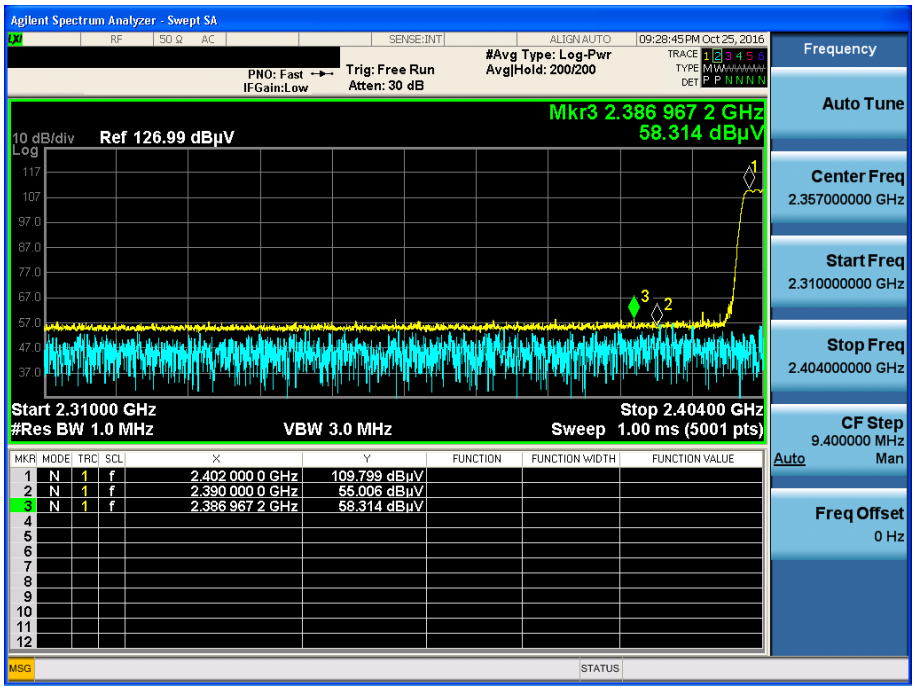
Detector Mode : PK



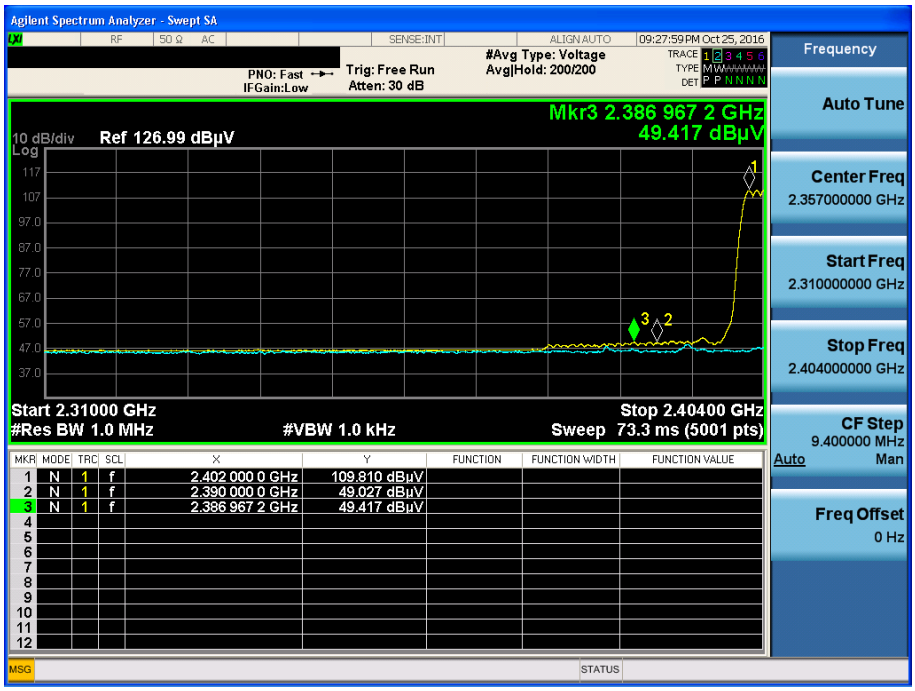
8DPSK & Highest Channel& Y & Ver **Detector Mode : PK**



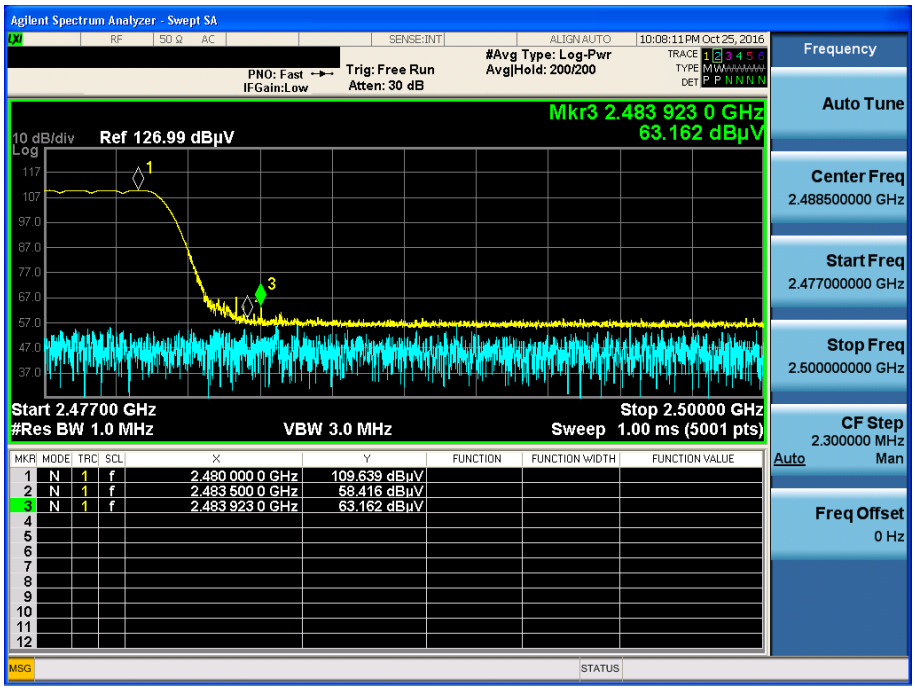
GFSK & Hopping mode & Y & Ver — Detector Mode : PK



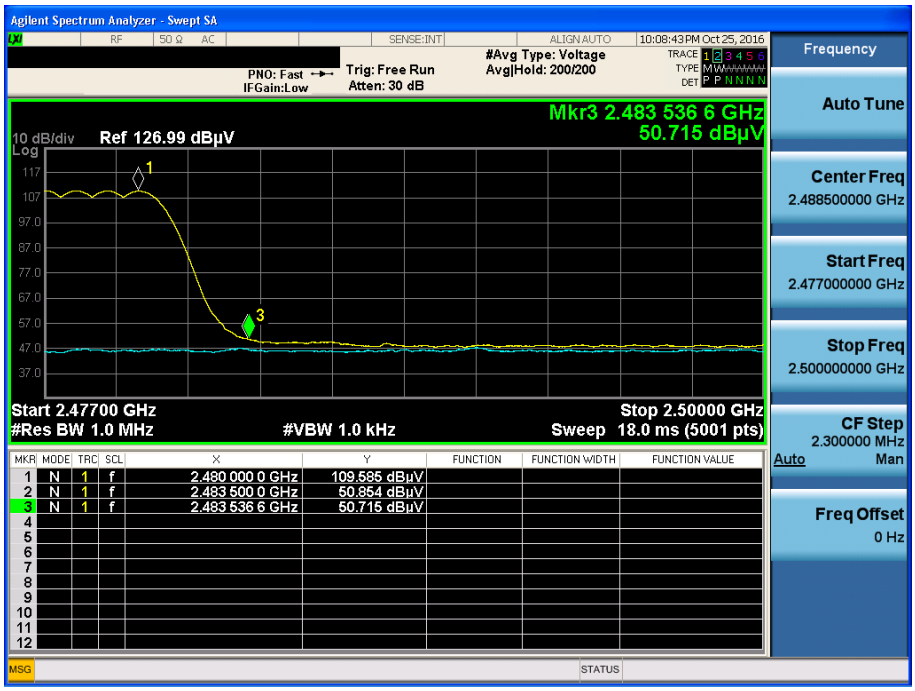
GFSK & Hopping mode & Y & Ver — Detector Mode : AV



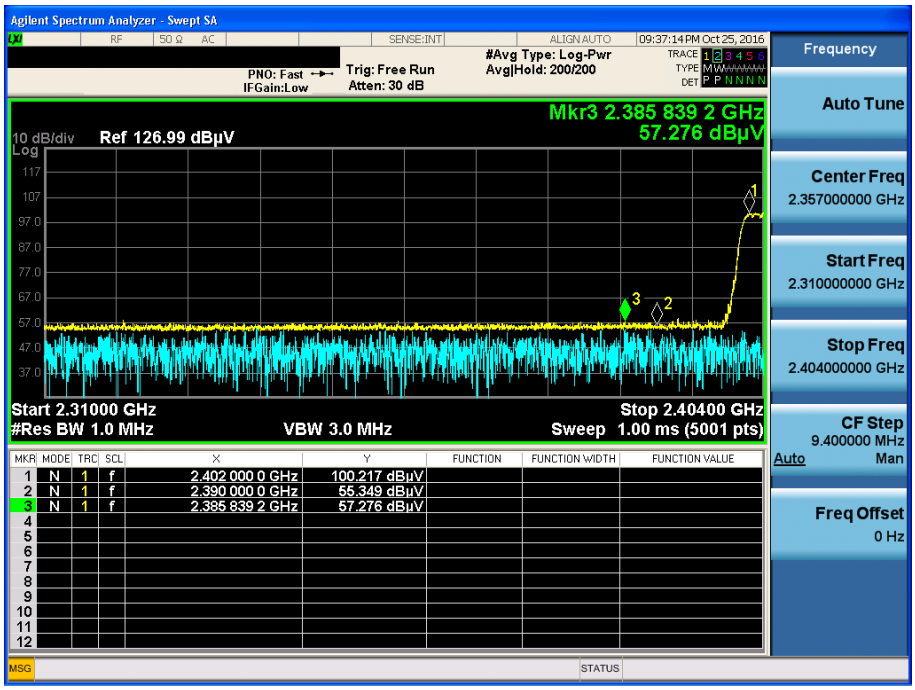
GFSK & Hopping mode & Z & Hor — Detector Mode : PK



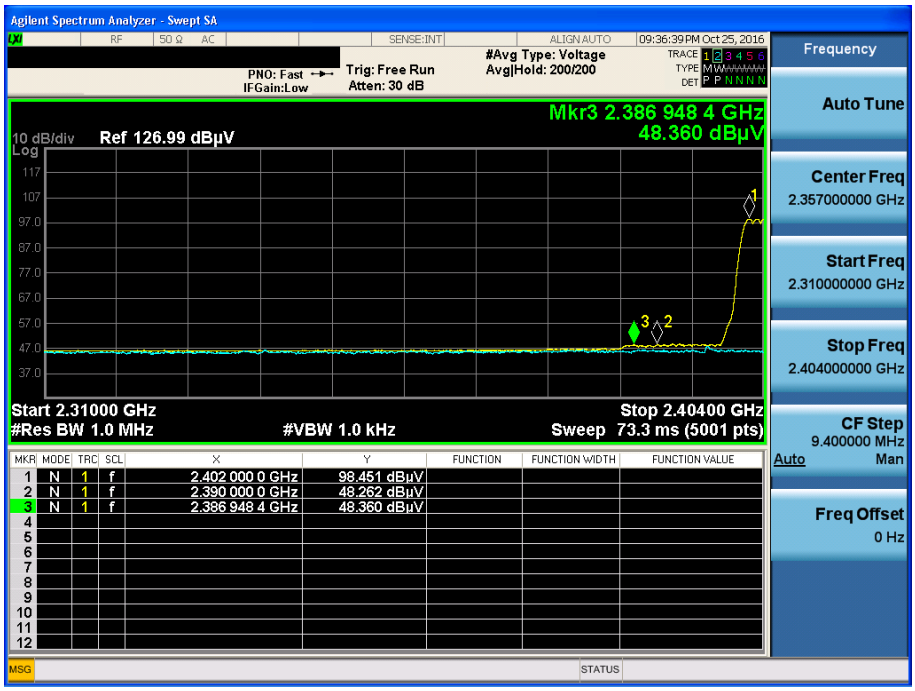
GFSK & Hopping mode & Z & Hor — Detector Mode : AV



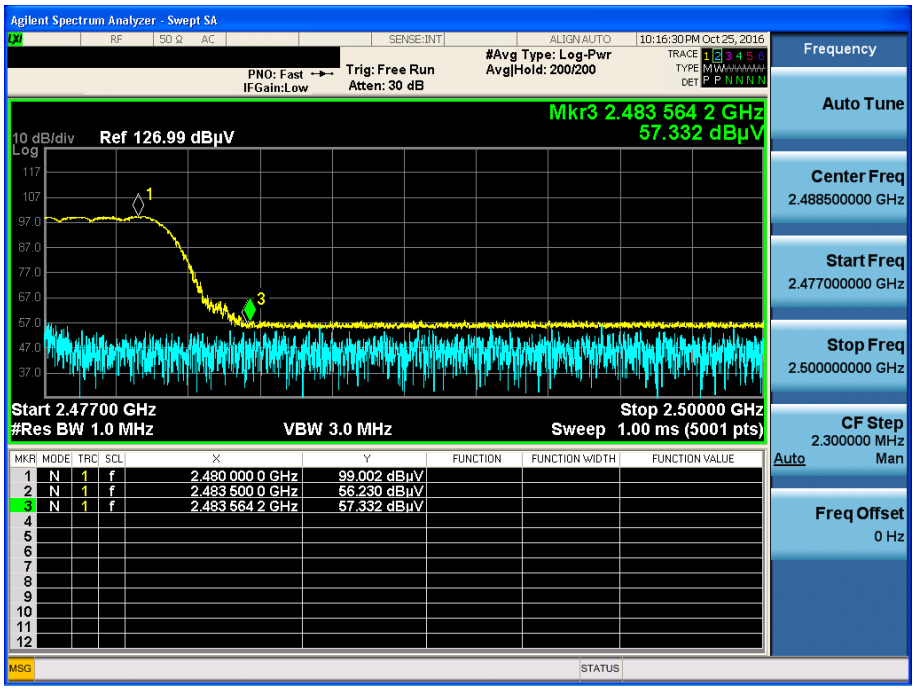
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : PK



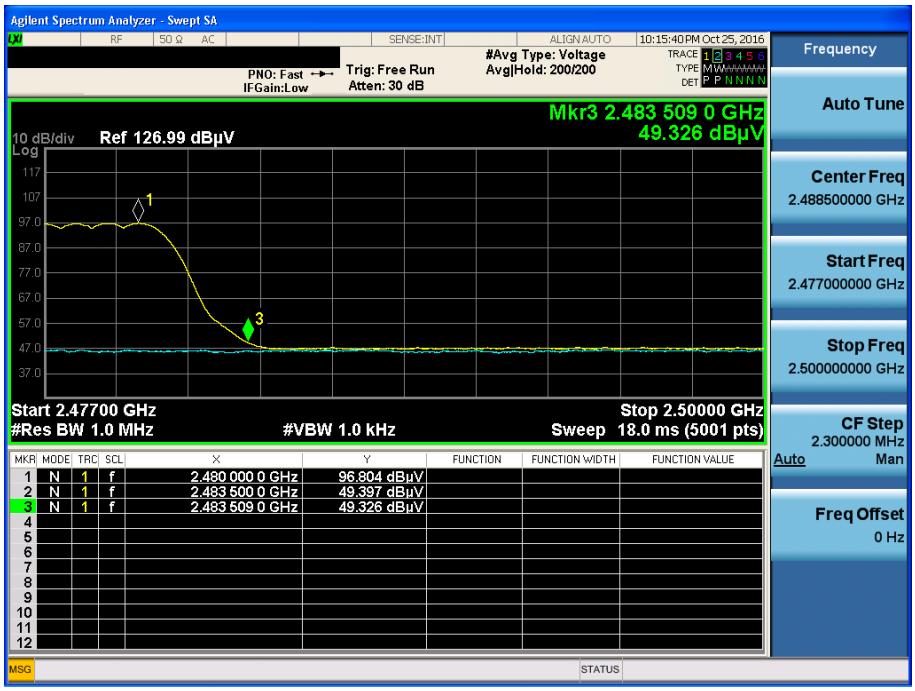
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : AV



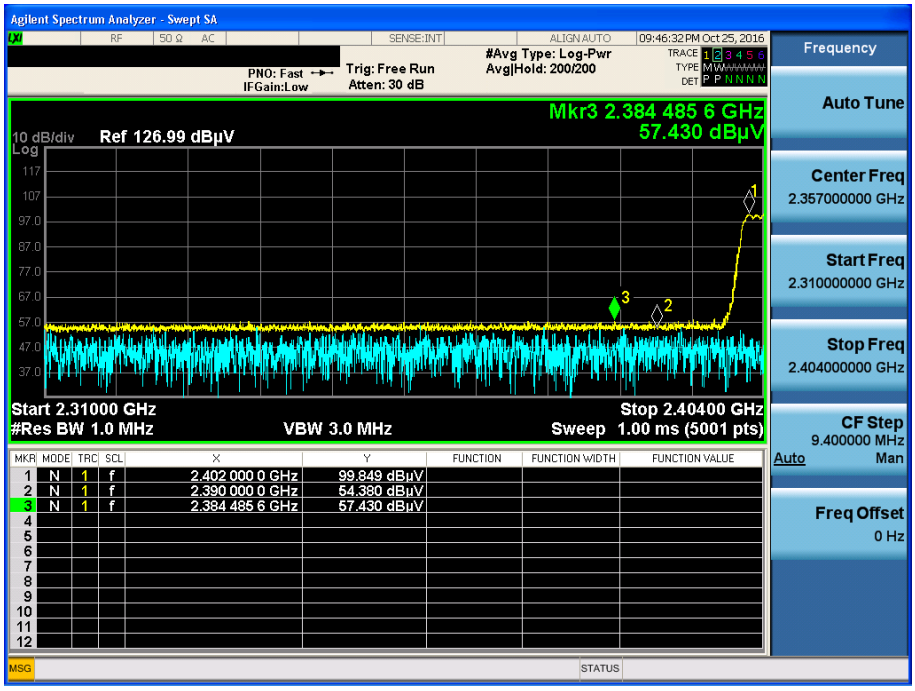
π/4DQPSK & Hopping mode & Y & Ver — Detector Mode : PK



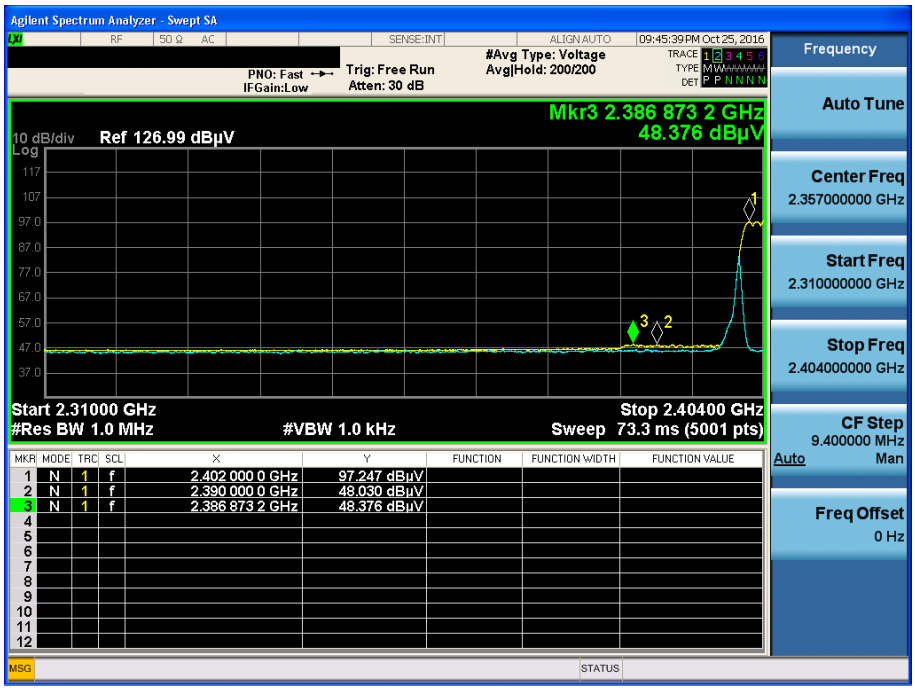
π/4DQPSK & Hopping mode & Y & Ver — Detector Mode : AV



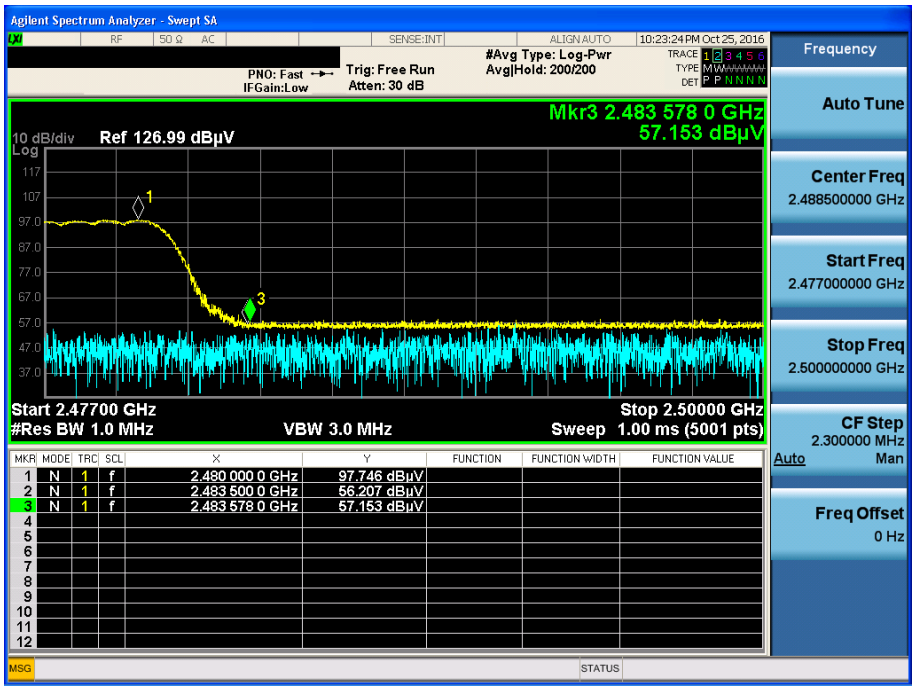
8DPSK & Hopping mode & Y & Ver — Detector Mode : PK



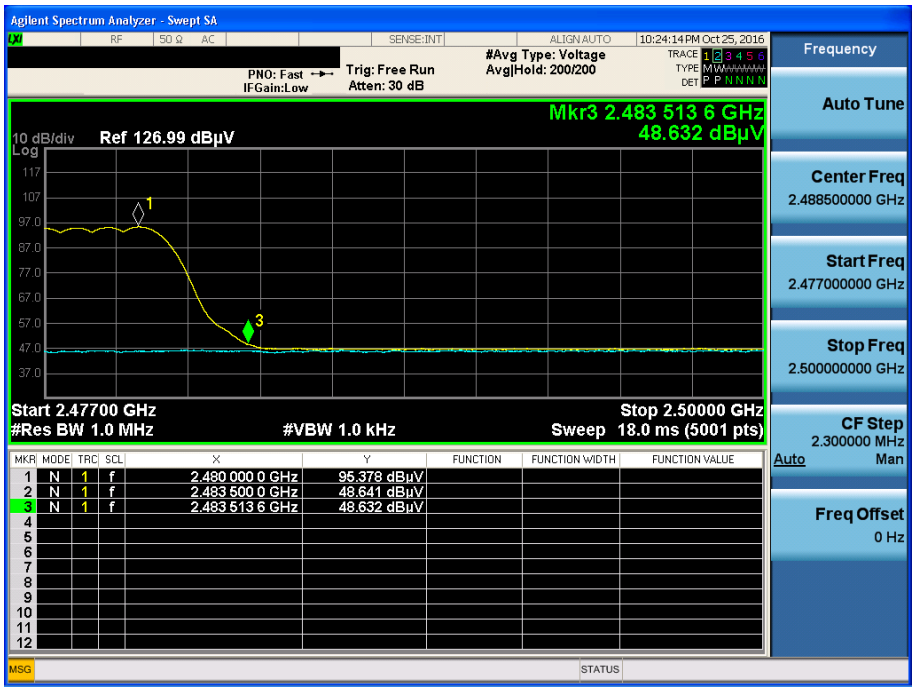
8DPSK & Hopping mode & Y & Ver — Detector Mode : AV



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

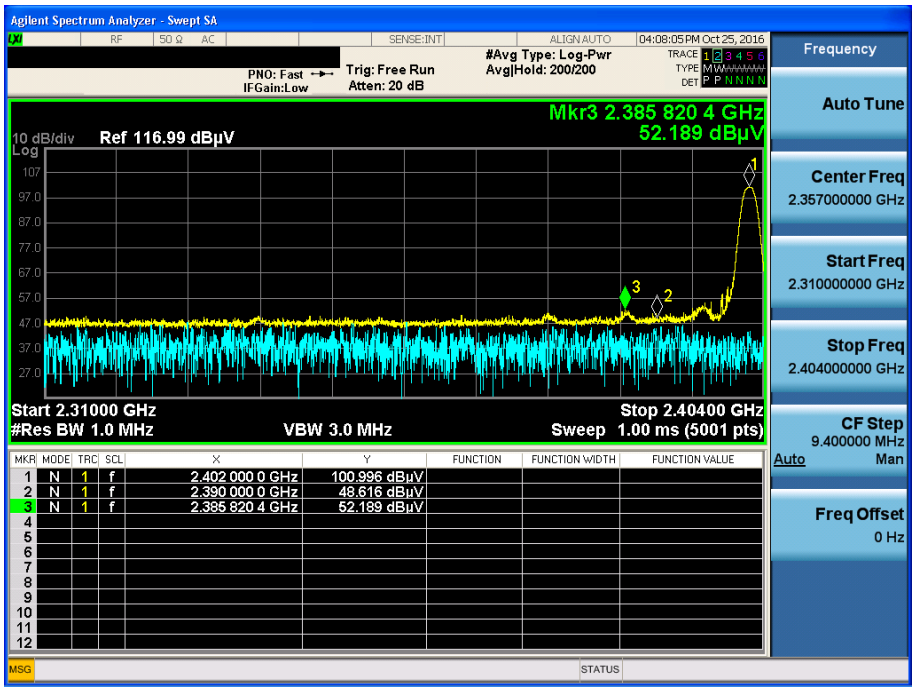


8DPSK & Hopping mode & Z & Hor — Detector Mode : AV

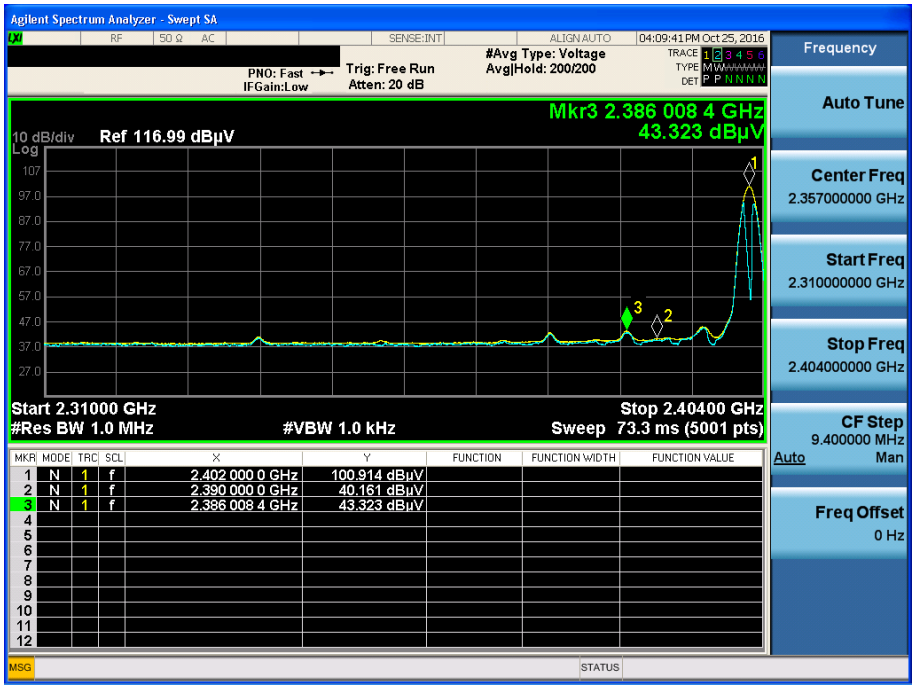


Unwanted Emissions (Radiated) Test Plot / Chip Antenna

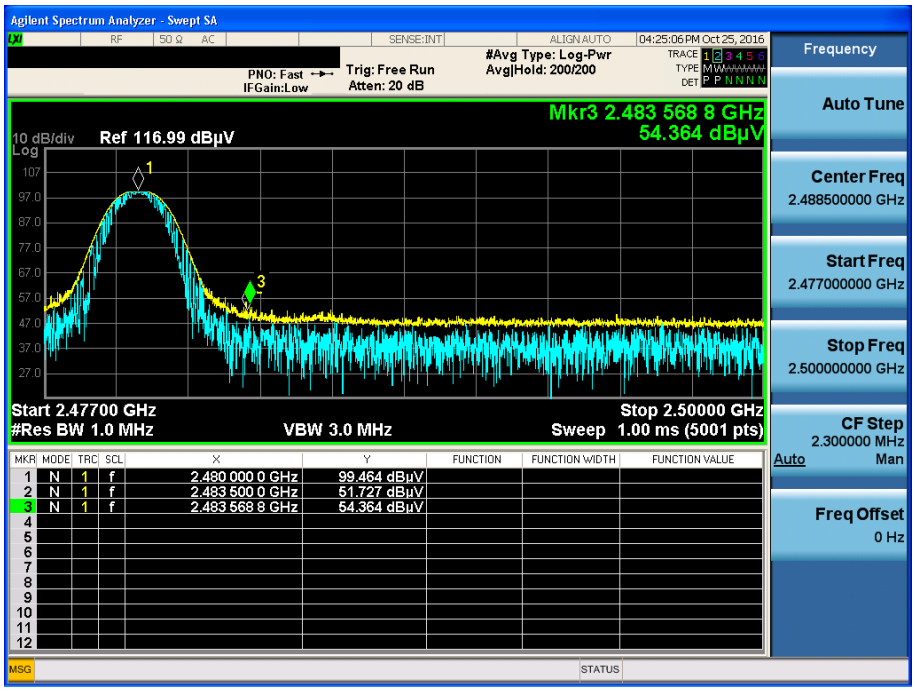
GFSK & Lowest Channel & Z & Hor — Detector Mode : PK



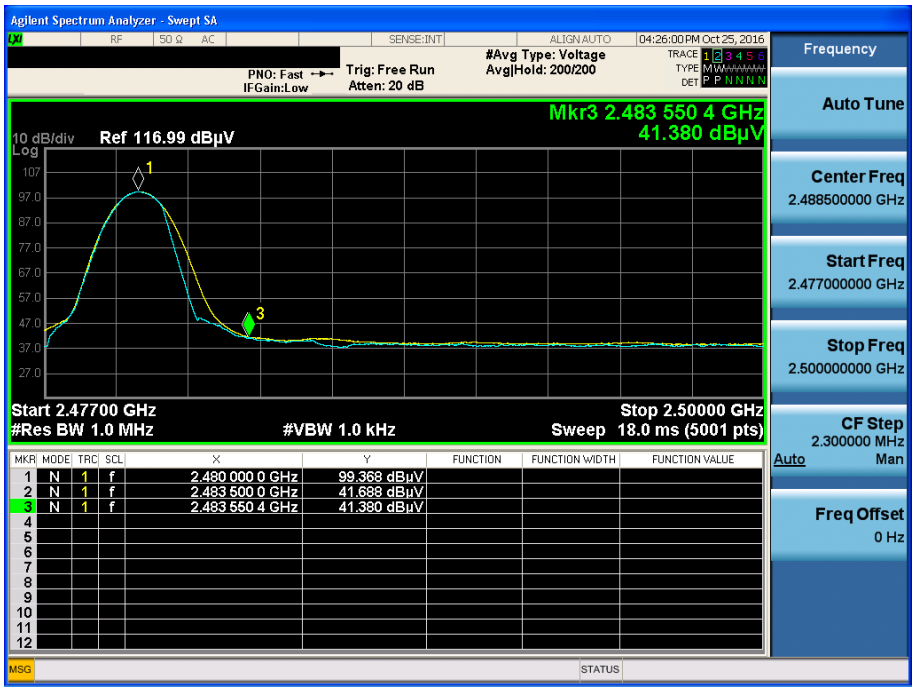
GFSK & Lowest Channel & Z & Hor — Detector Mode : AV



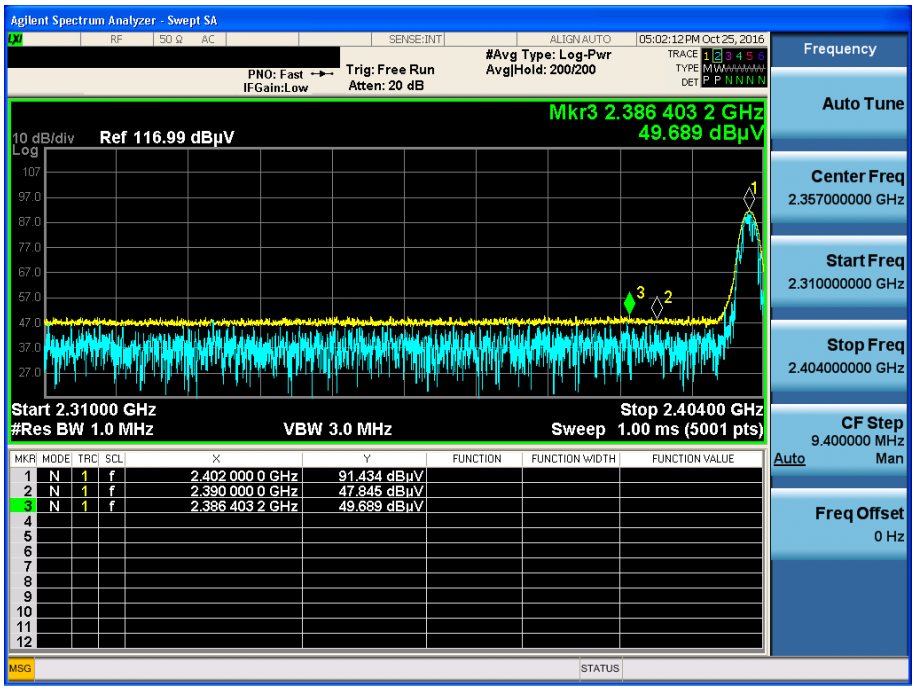
GFSK & Highest Channel & Z & Hor — Detector Mode : PK



GFSK & Highest Channel & Z & Hor — Detector Mode : AV



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



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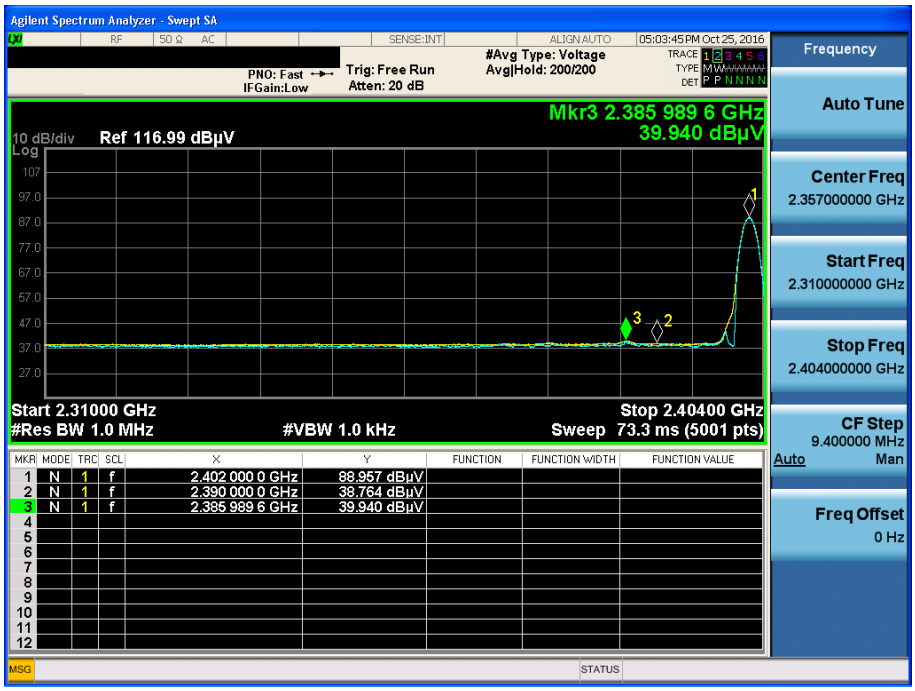
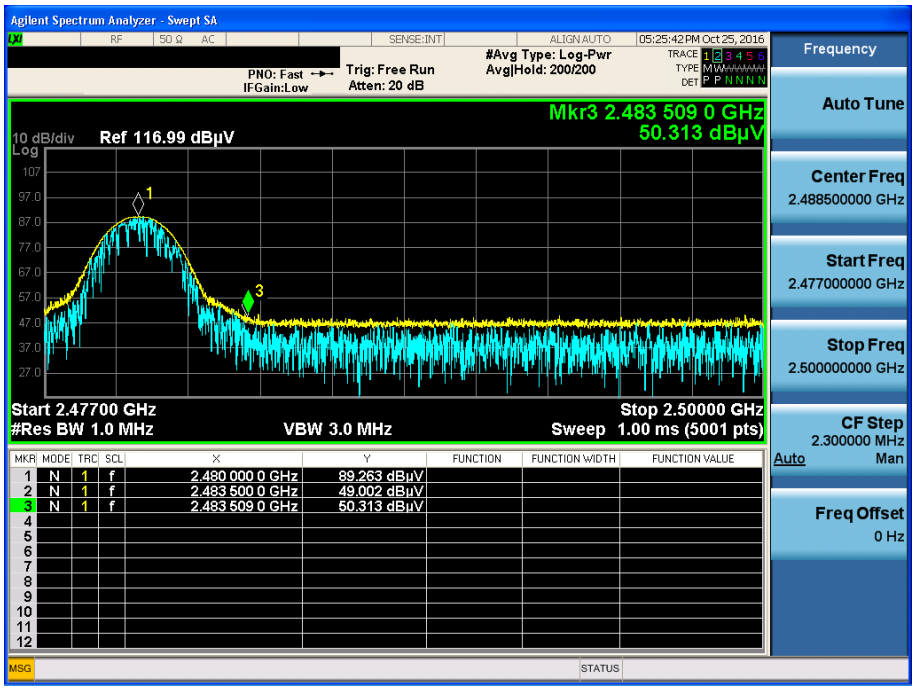


π/4DQPSK & Highest Channel & Z & Hor — Detector Mode : PK



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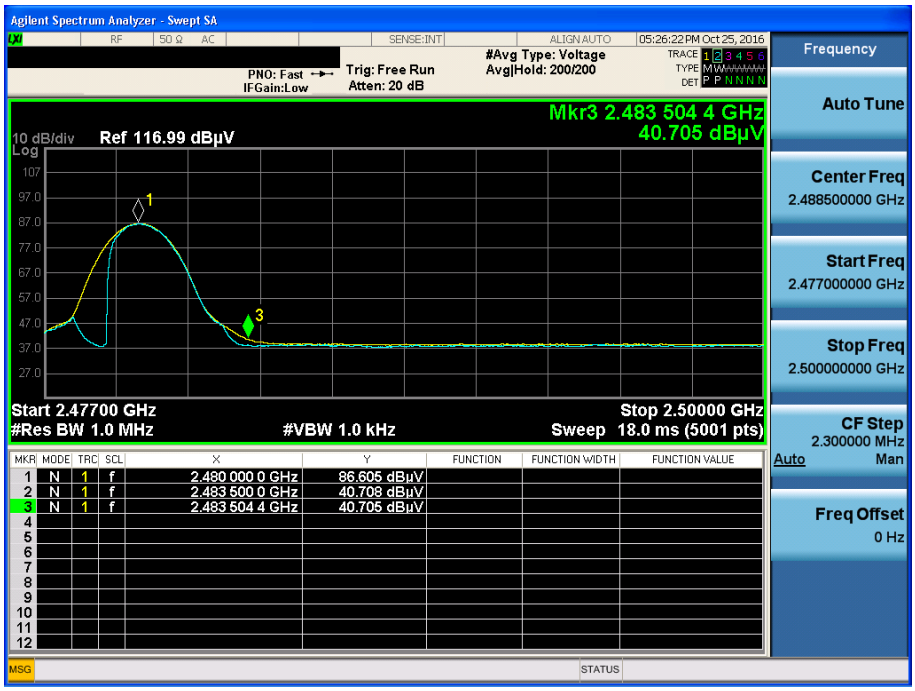
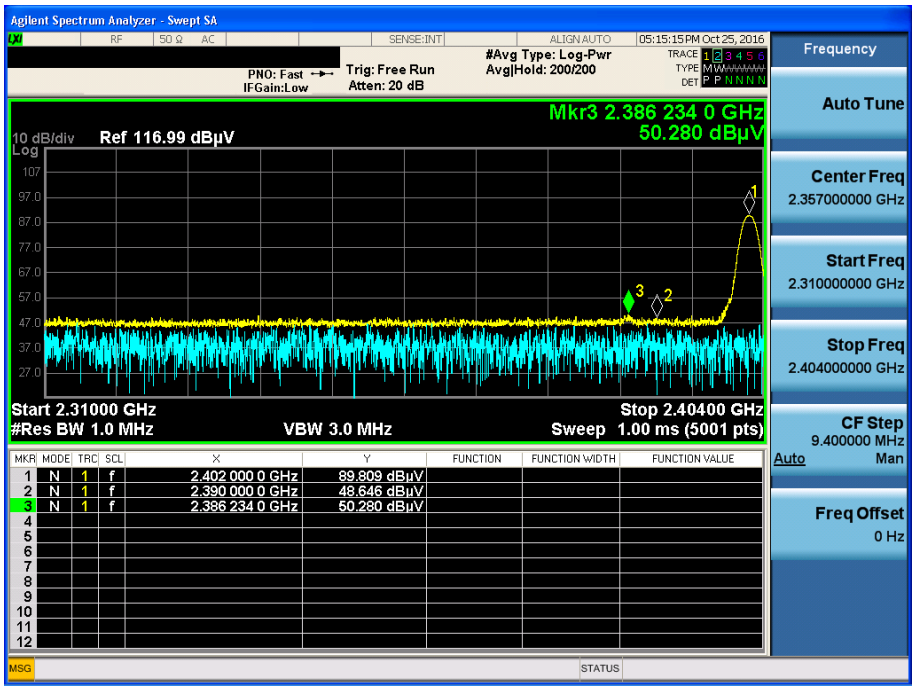
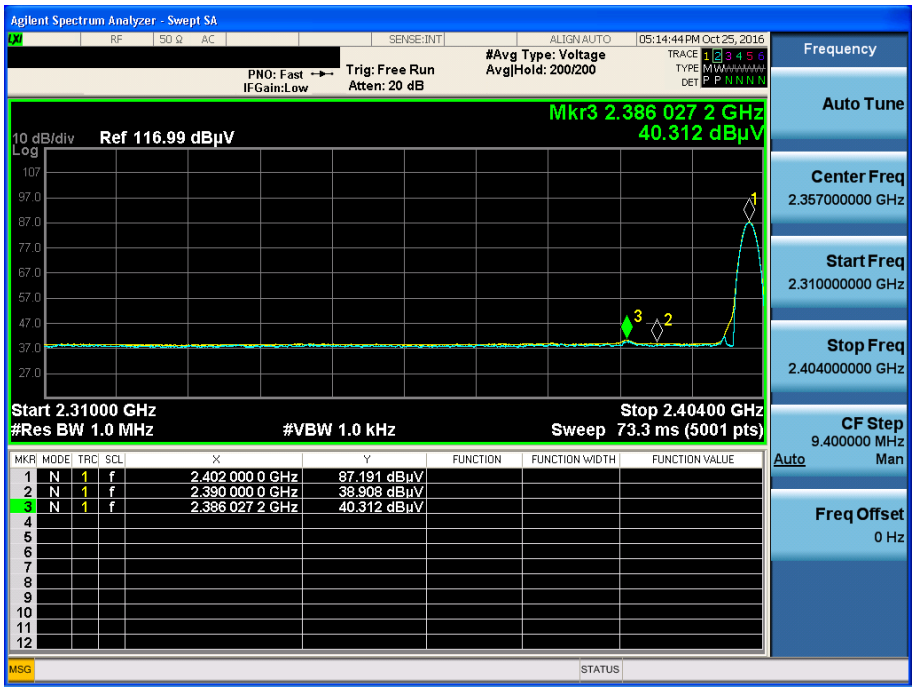


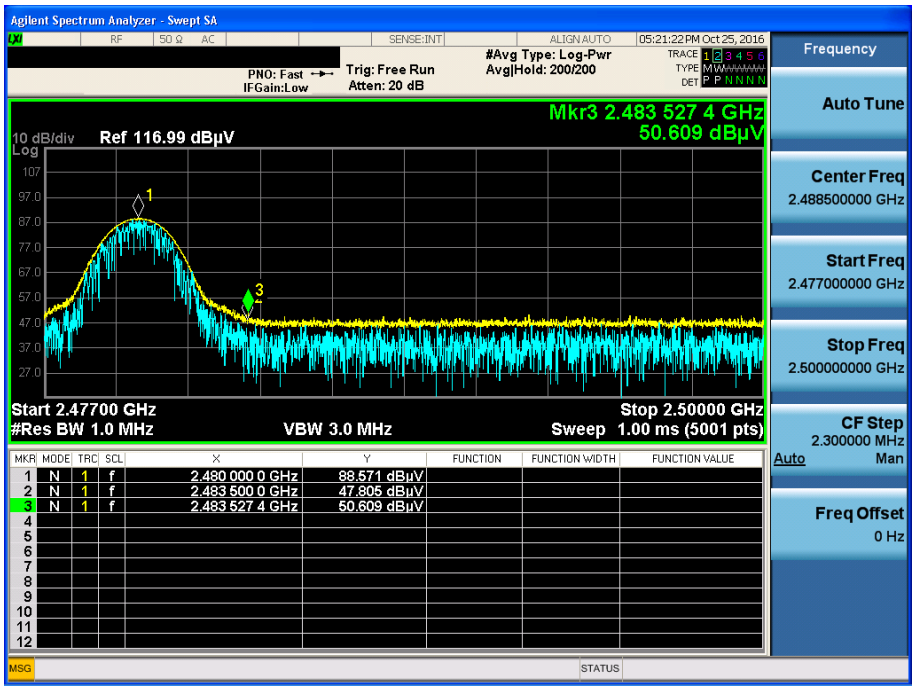
8DPSK & Lowest Channel & Z & Hor — Detector Mode : PK



8DPSK & Lowest Channel & Z & Hor — Detector Mode : AV



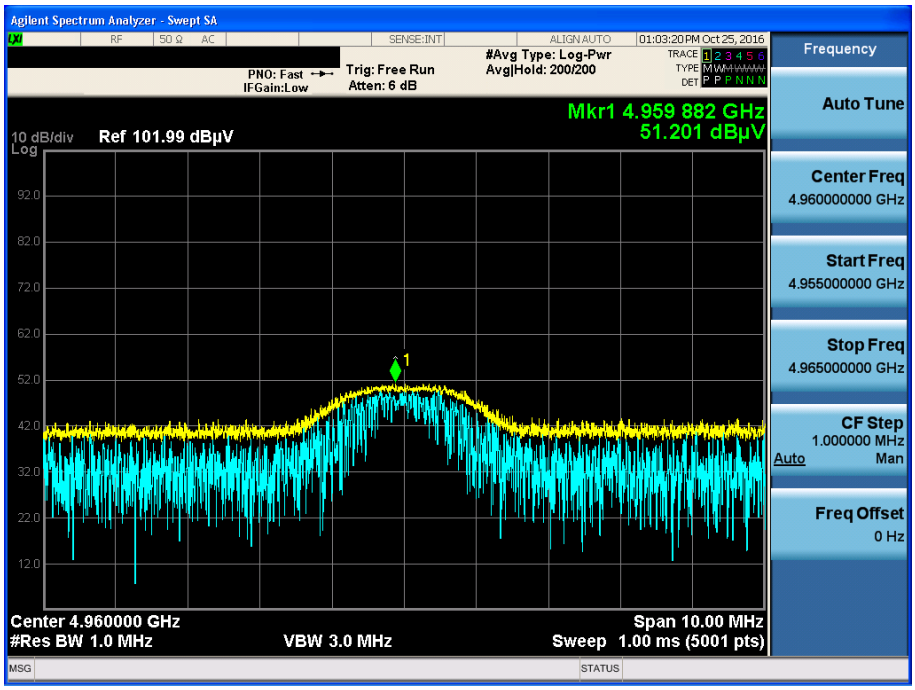
8DPSK & Highest Channel & Y & Ver — Detector Mode : PK



8DPSK & Highest Channel & Y & Ver — Detector Mode : AV

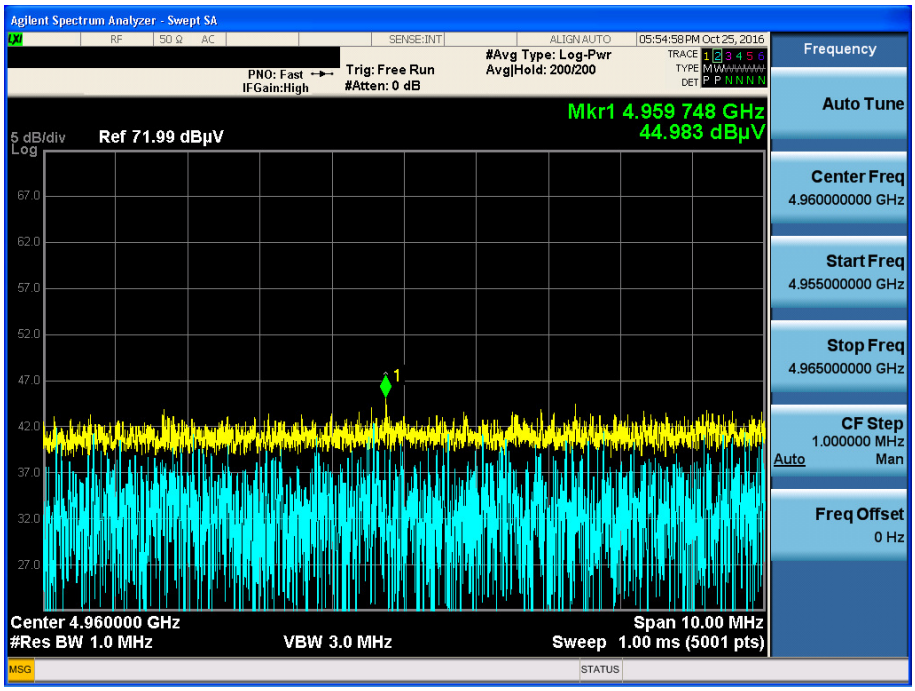
GFSK & Highest Channel & Y & Hor

Detector Mode : PK

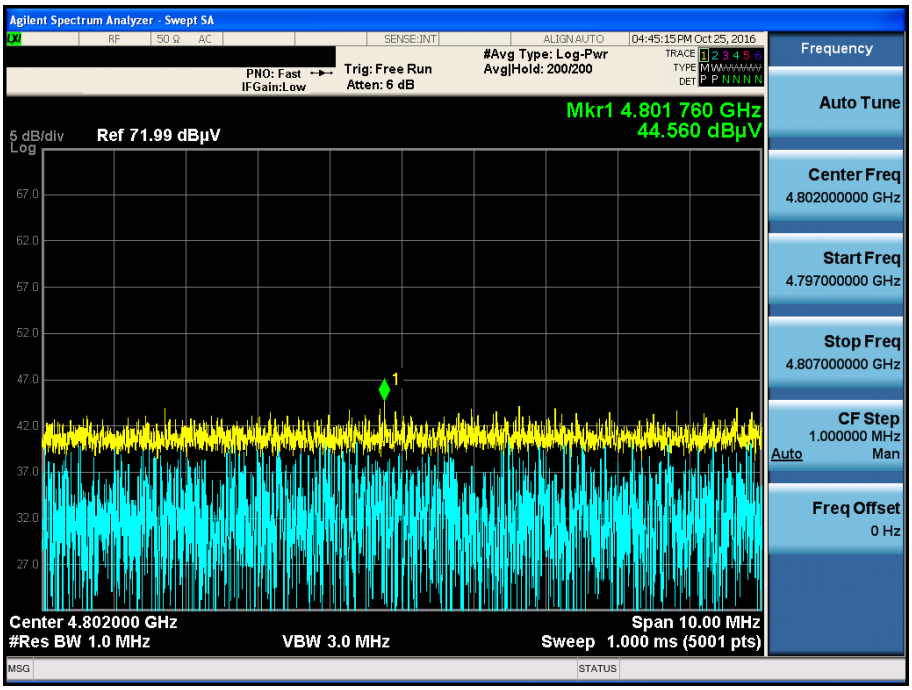


π/4DQPSK & Highest Channel & Y & Hor

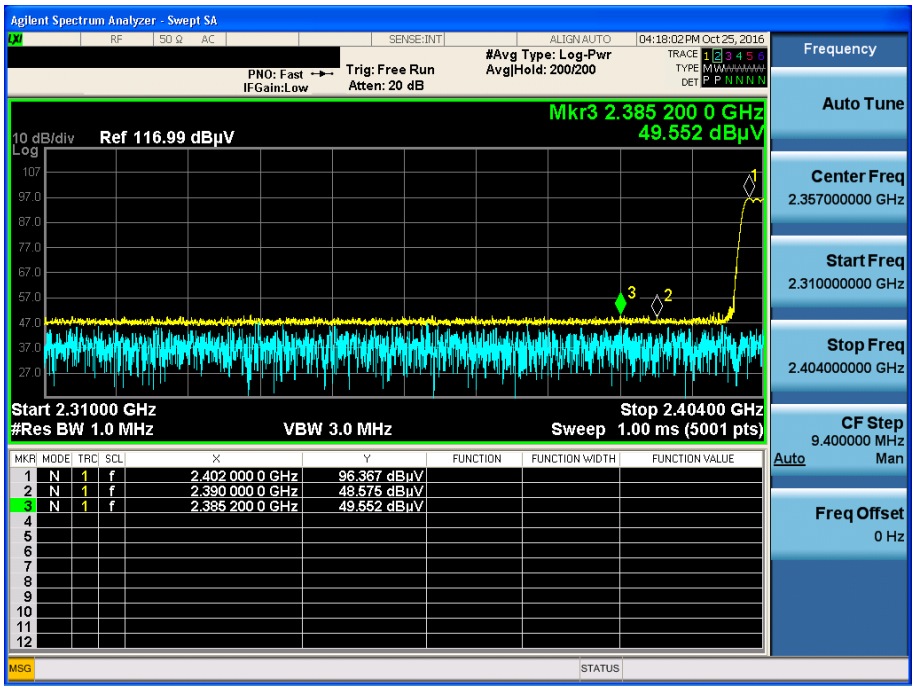
Detector Mode : PK



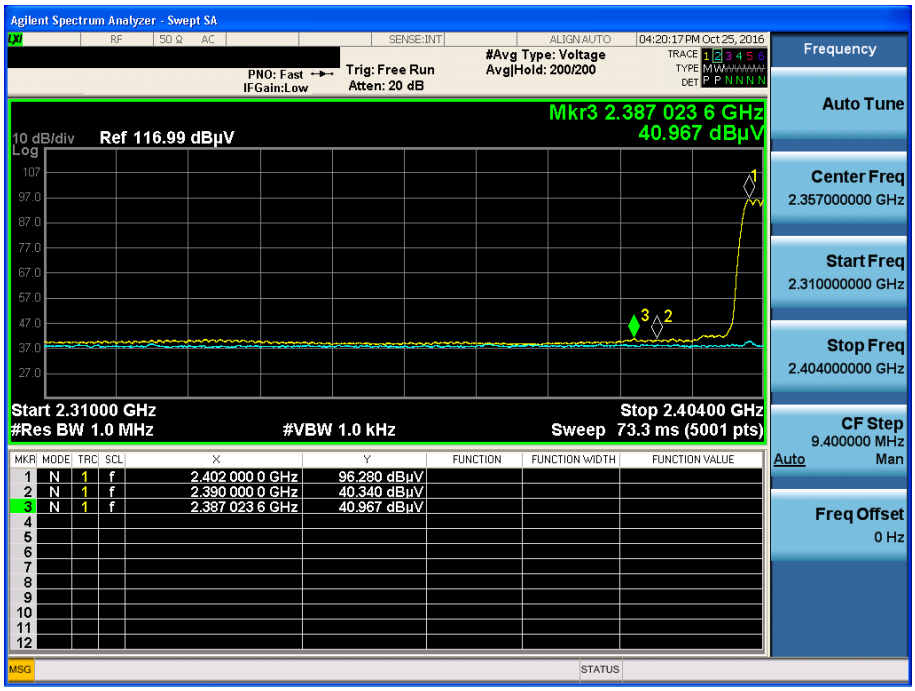
8DPSK & Lowest Channel& Y & Hor **Detector Mode : PK**



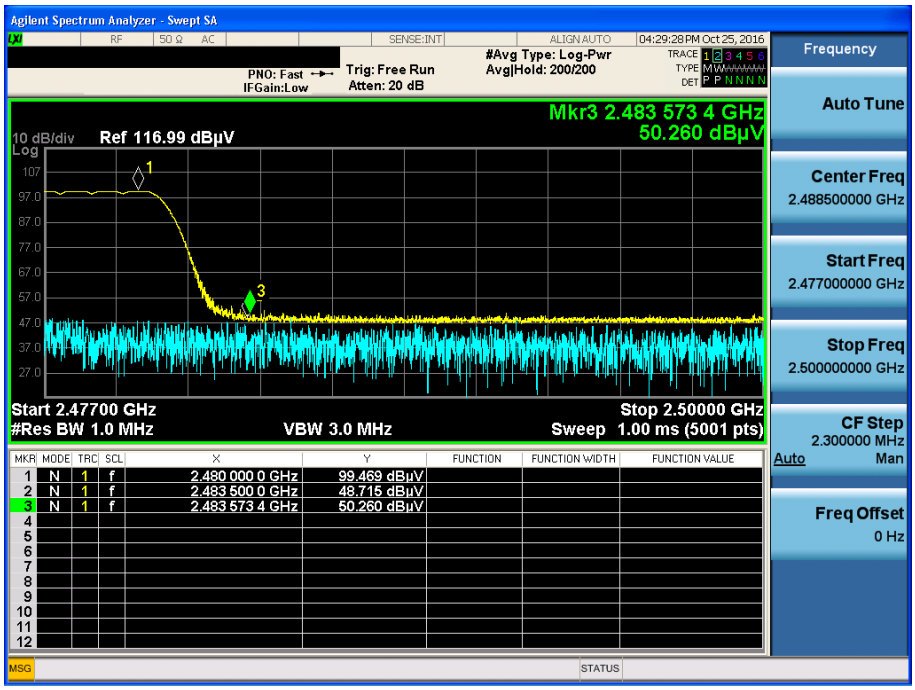
GFSK & Hopping mode & Z & Hor — Detector Mode : PK



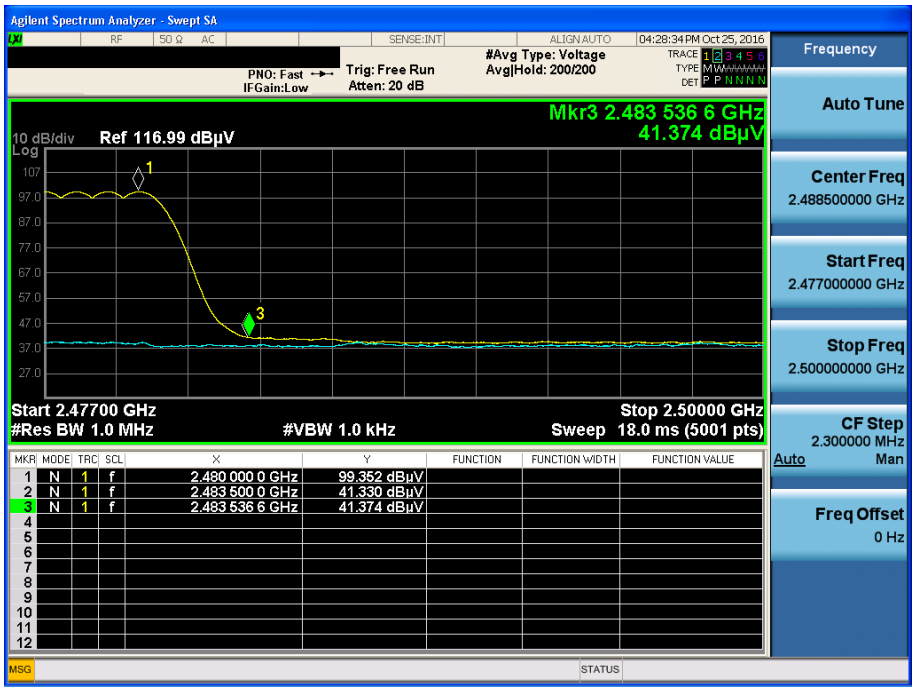
GFSK & Hopping mode & Z & Hor — Detector Mode : AV



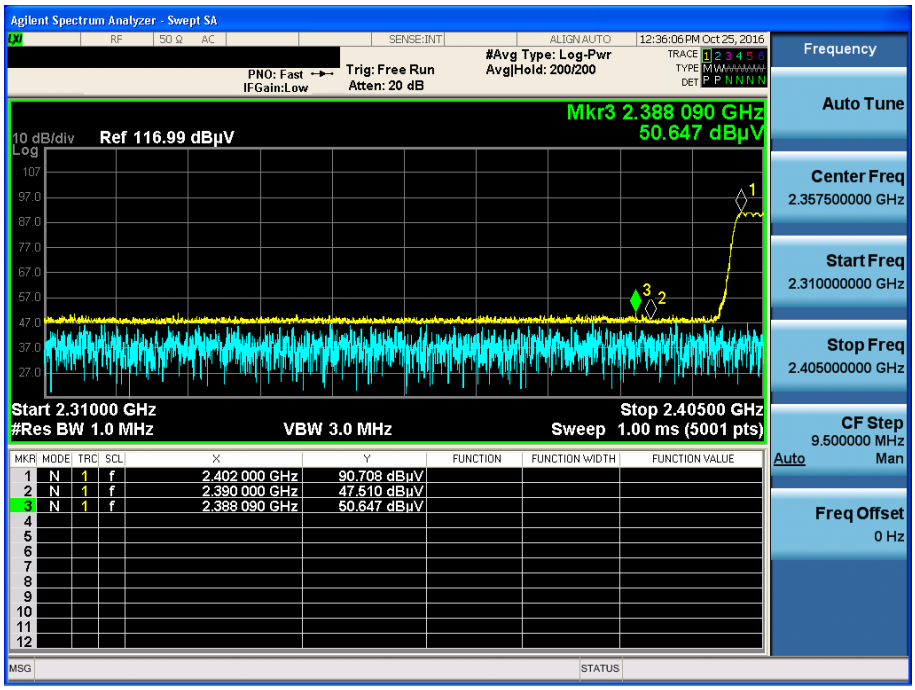
GFSK & Hopping mode & Z & Hor — Detector Mode : PK



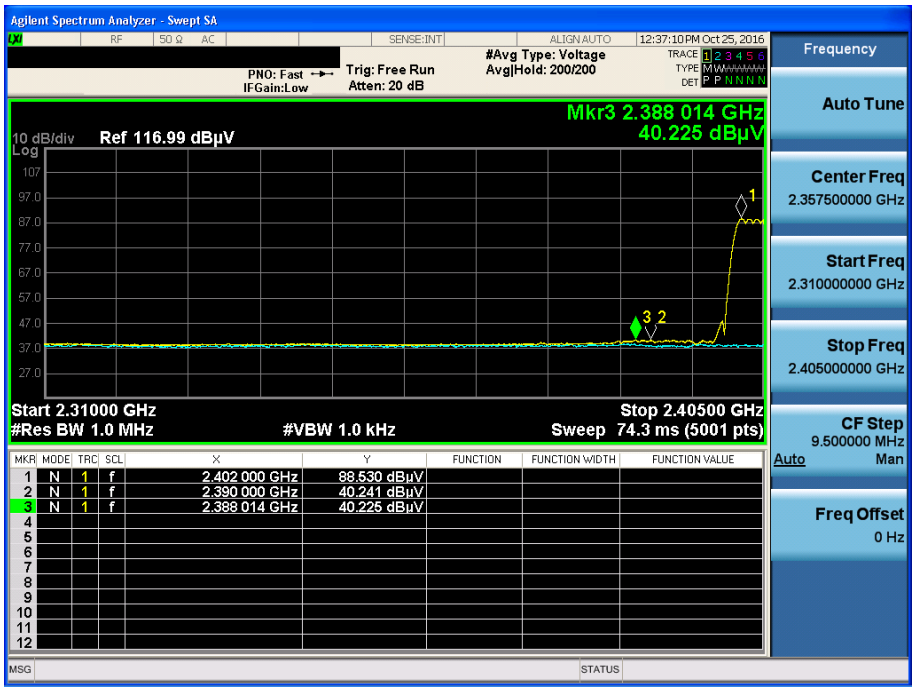
GFSK & Hopping mode & Z & Hor — Detector Mode : AV



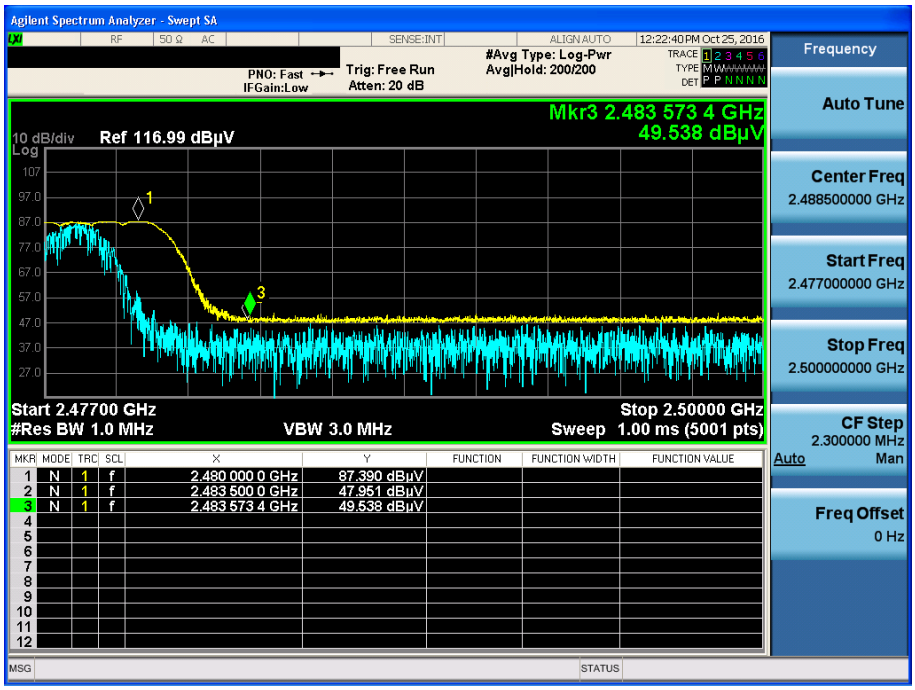
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : PK



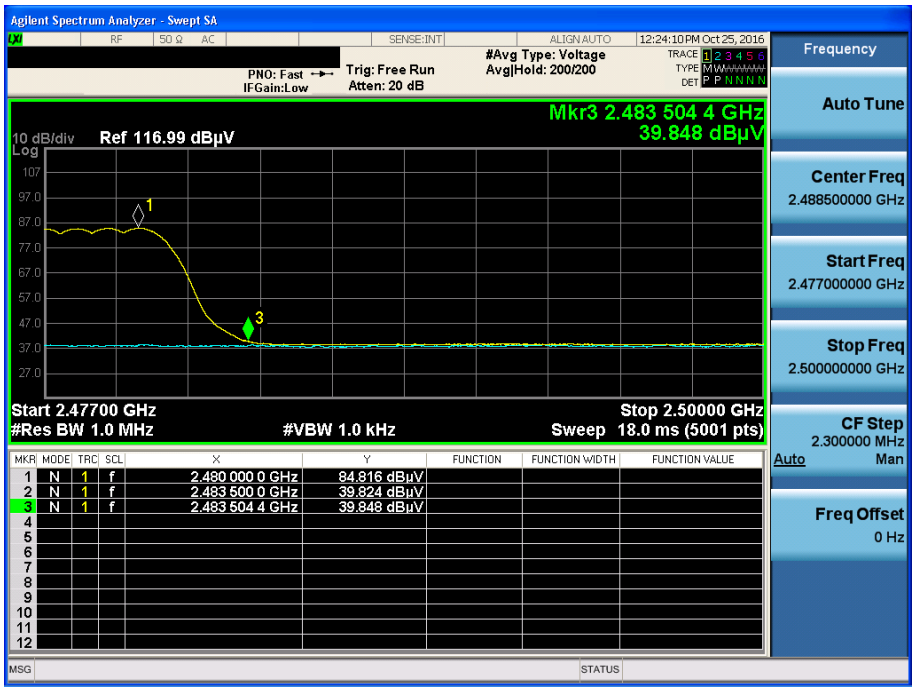
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : AV



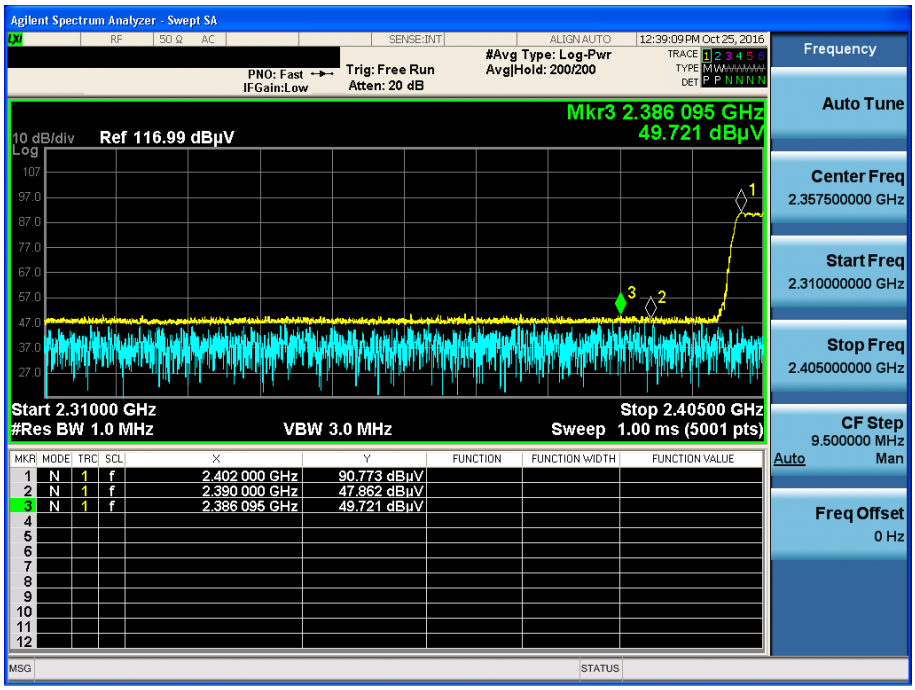
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : PK



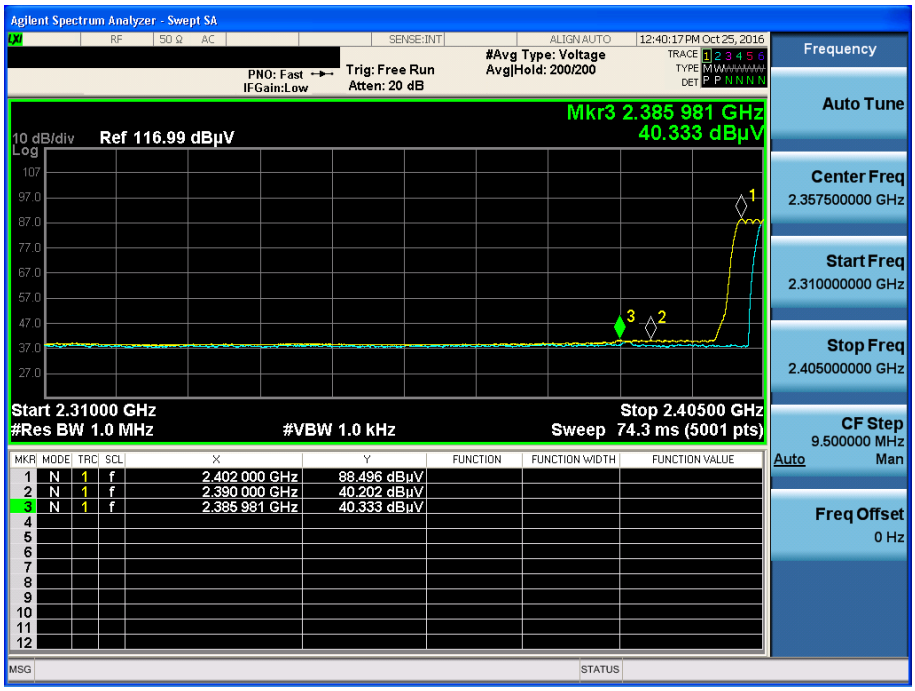
π/4DQPSK & Hopping mode & Z & Hor — Detector Mode : AV



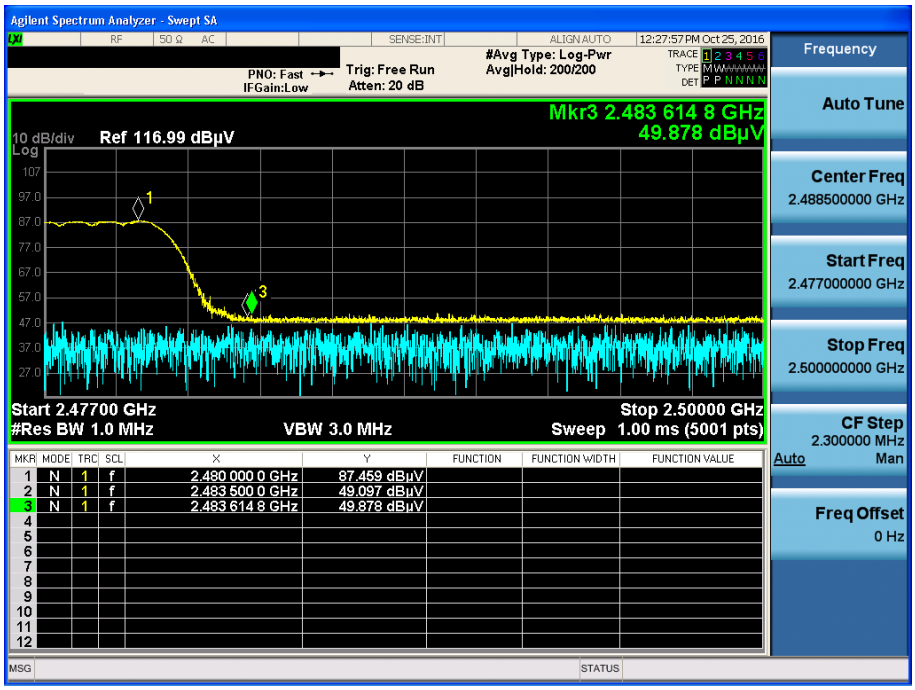
8DPSK & Hopping mode & Z & Hor — Detector Mode : PK



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



8DPSK & Hopping mode & Y & Ver — Detector Mode : PK



8DPSK & Hopping mode & Y & Ver — Detector Mode : AV