

8. SPURIOUS EMISSION AT ANTENNA TERMINAL

8.1. Applicable Standard Requirements:

CFR 47§2.1051, §27.53

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1051

8.2. Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Due Date
ADVANTEST	Spectrum Analyzer	R3273	J004821	05/02/2008
WEINSCHL	Attenuator	67-30-33	BR0530	01/22/2008

8.3. Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

The EUT provides the MIMO function which is able to transmit on the same channel with same data simultaneously therefore a combiner is used to sum the individual transmitter output power.

The test data is shown as a combined output in the report.

8.3.1 Environmental Conditions:

Temperature:	25 °C
Relative Humidity:	59 %

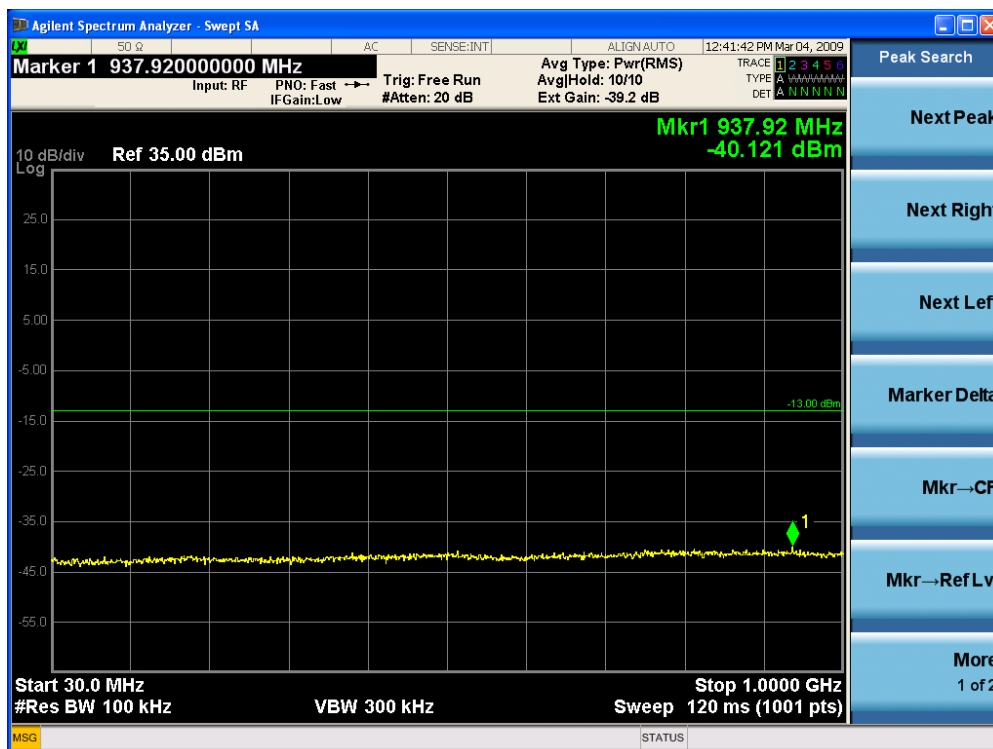
8.4. Test Result

: Pass

HCT PT.27 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
Test Report No. HCT-RF09-0310	Test Dates: March 11, 2009	EUT Type: Mobile WiMAX Outdoor RAS	FCC ID: A3LSPI-2213282501	Page 54 of 91

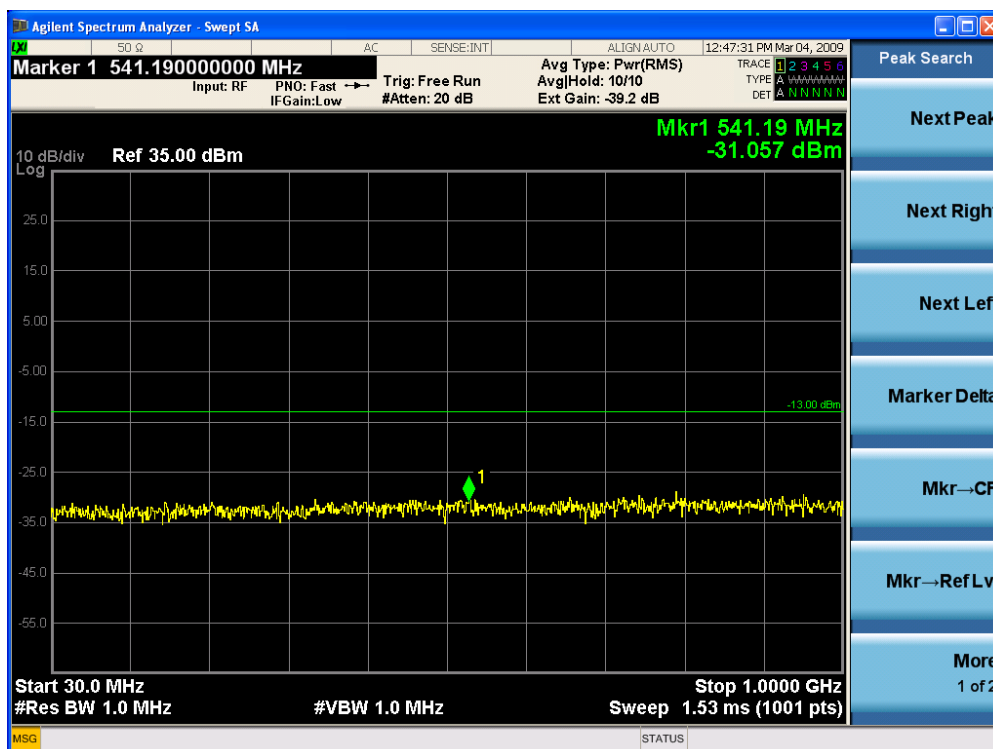
8.4.1. Plot Data at Output 0

(QPSK Low Channel)



(30 MHz ~ 1 GHz)

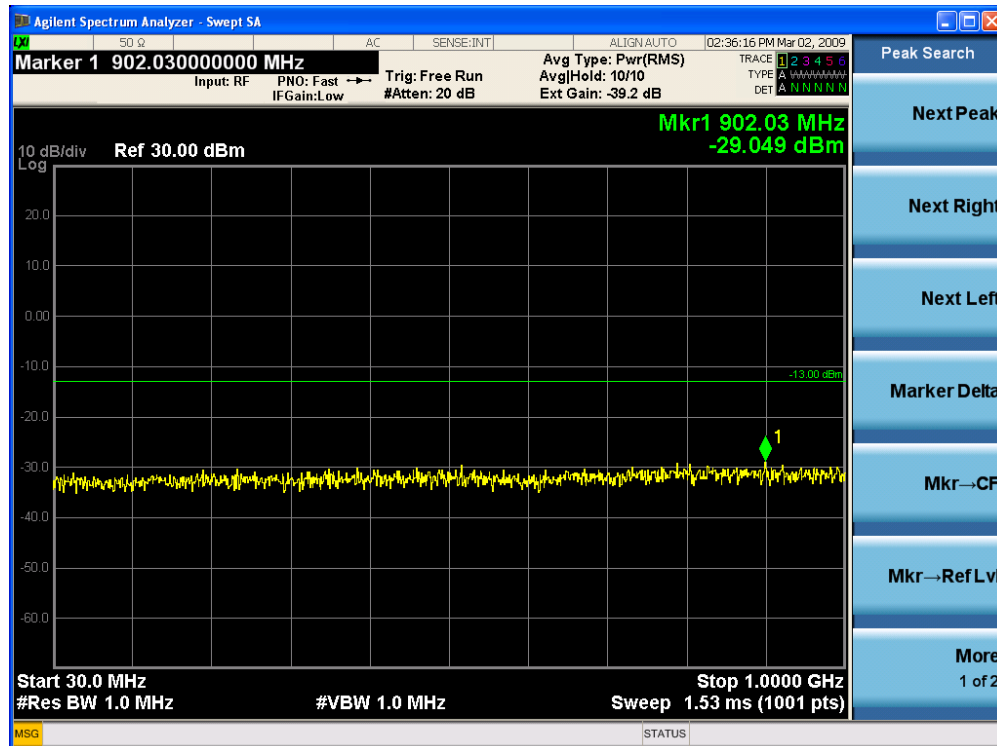
(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

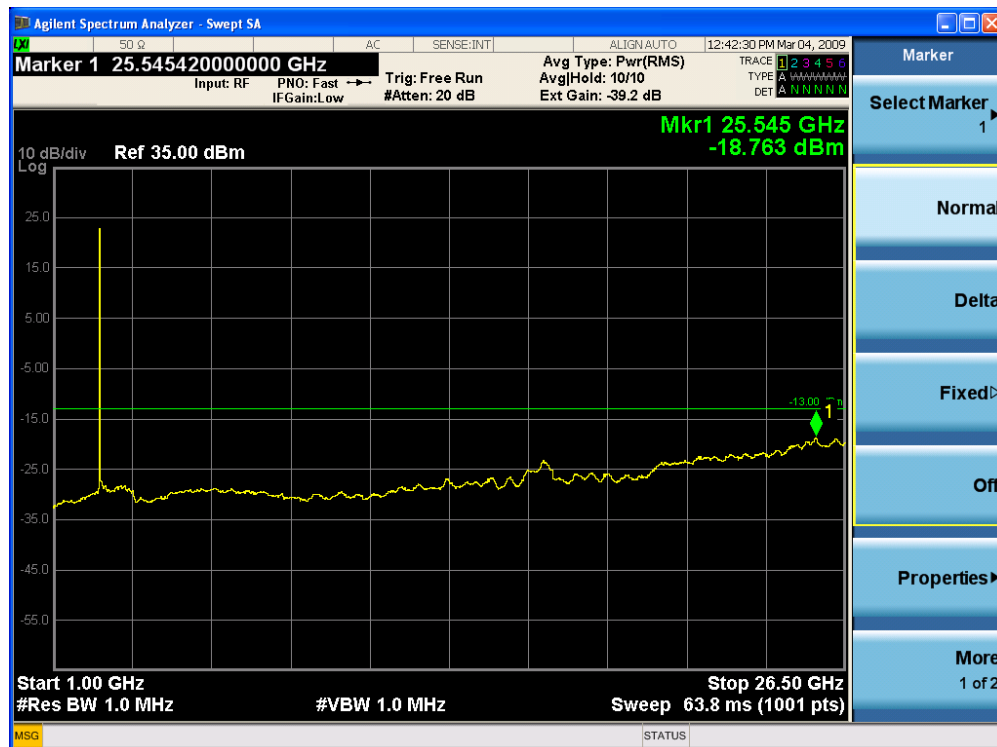
HCT PT.27 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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(QPSK High Channel)



(30 MHz ~ 1 GHz)

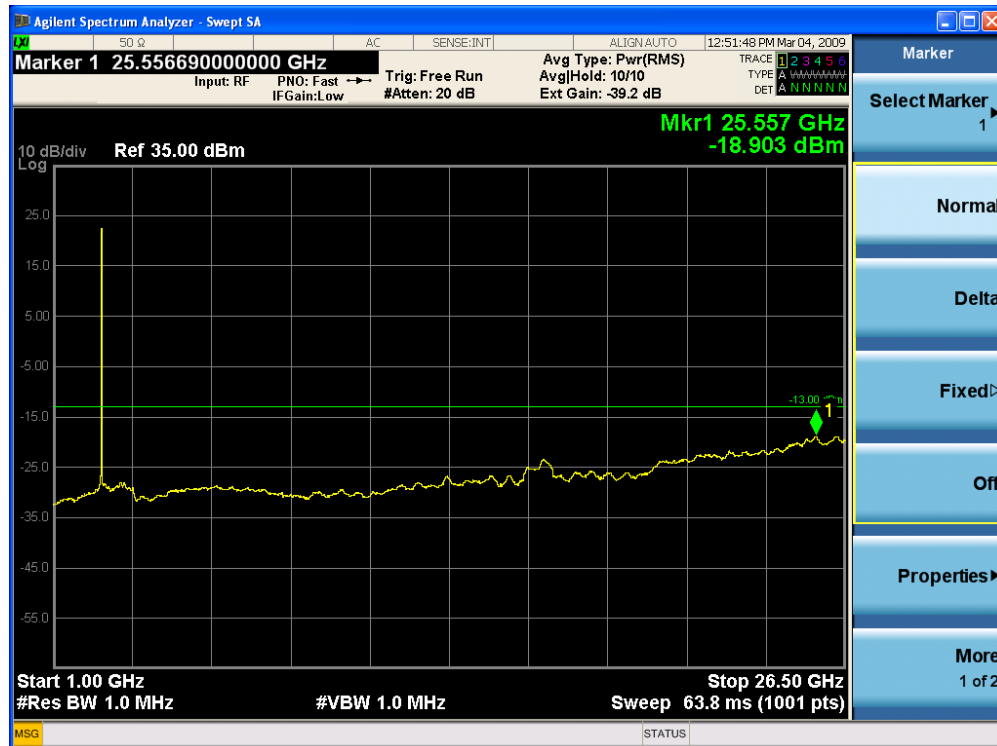
(QPSK Low Channel)



(1 GHz ~ 26.5 GHz)

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(QPSK Middle Channel)



(1 GHz ~ 26.5 GHz)

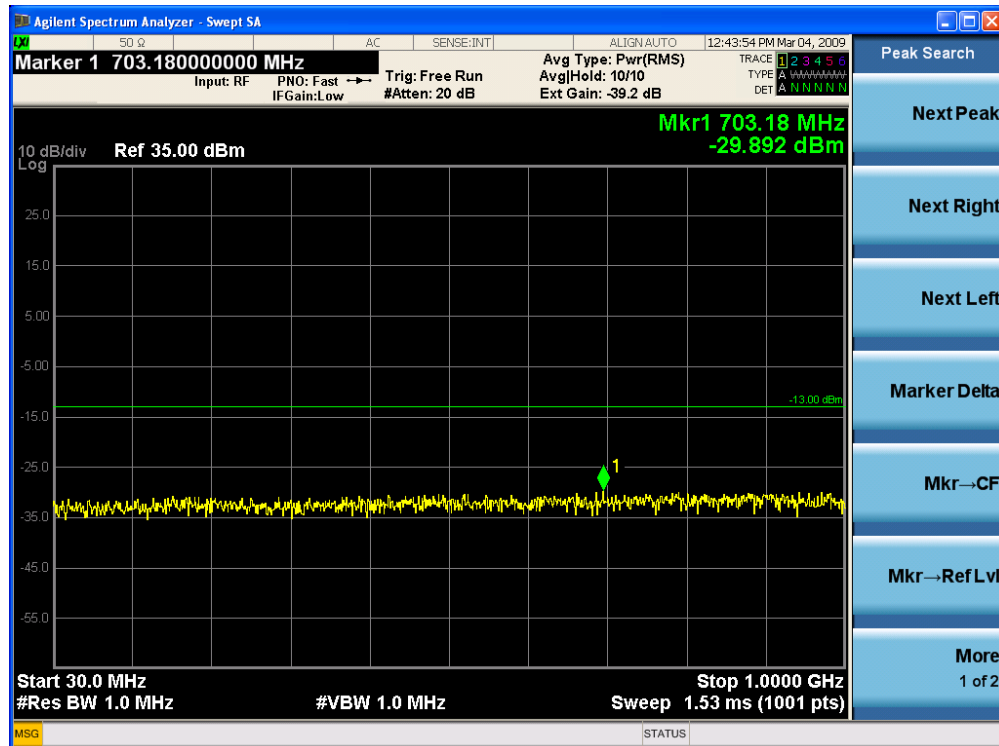
(QPSK High Channel)



(1 GHz ~ 26.5 GHz)

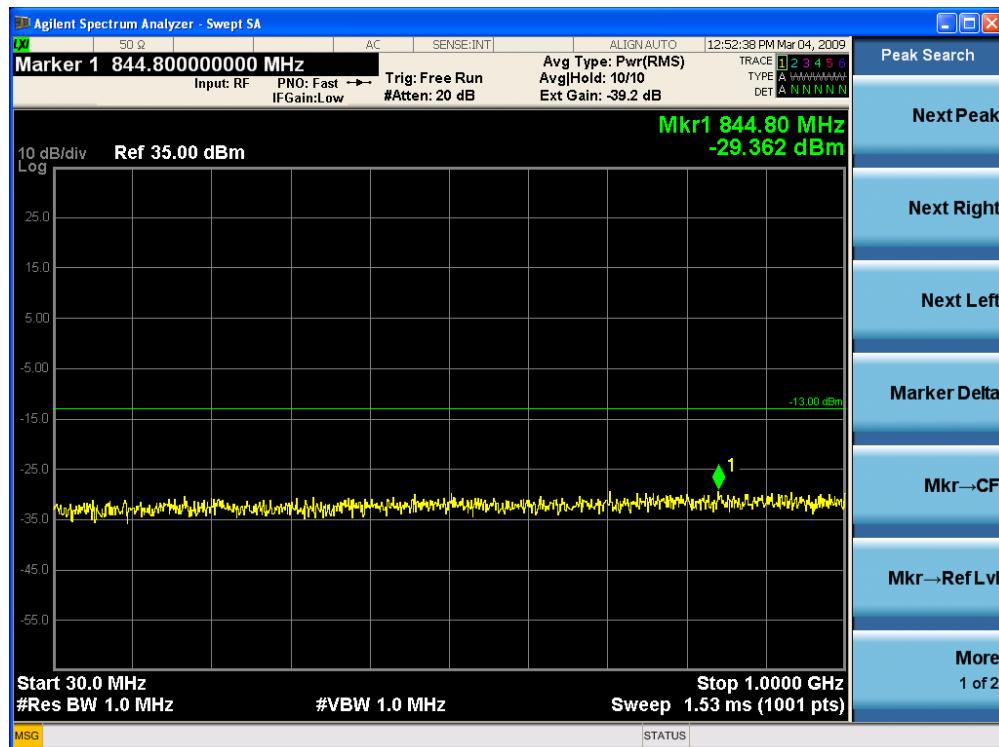
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(16QAM LOW Channel)



(30 MHz ~ 1 GHz)

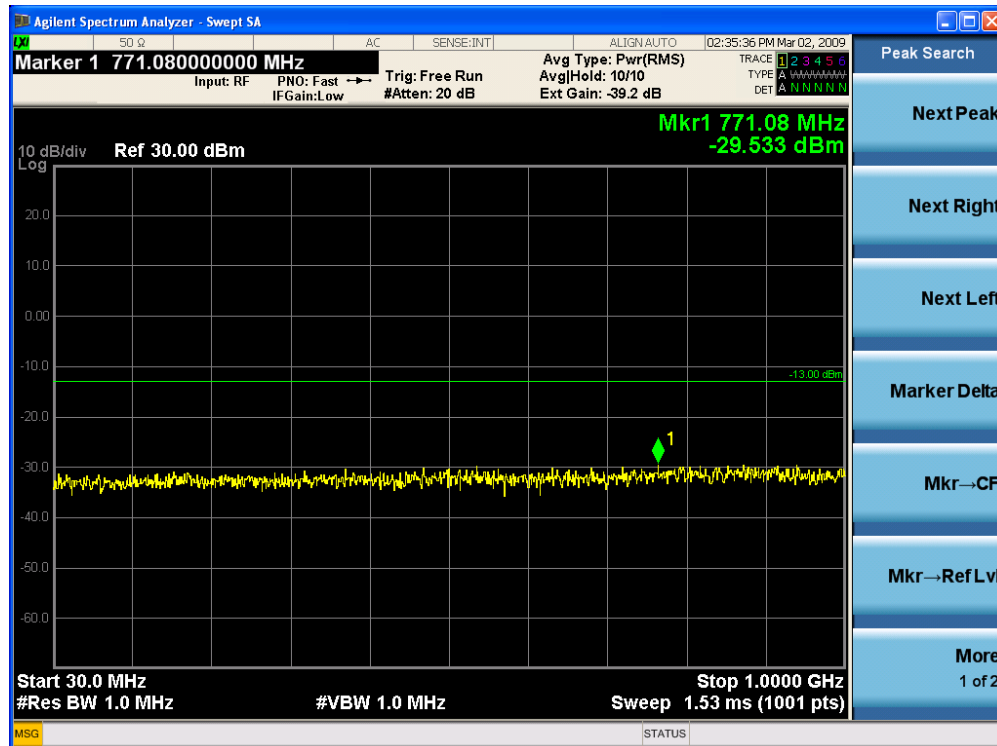
(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

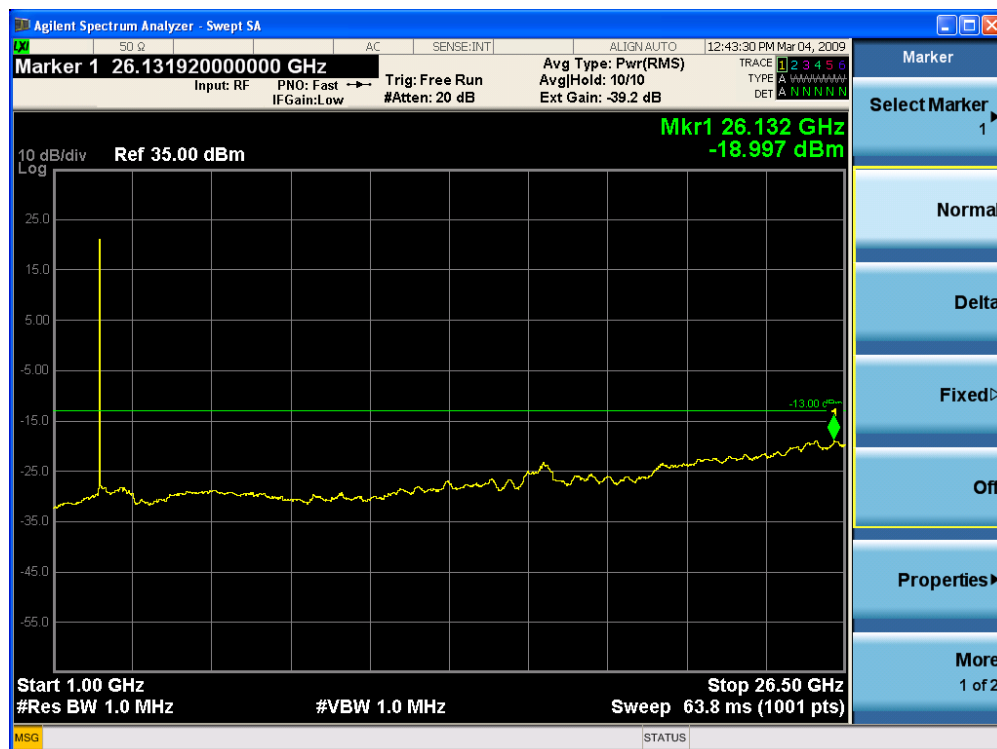
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(16QAM High Channel)



(30 MHz ~ 1 GHz)

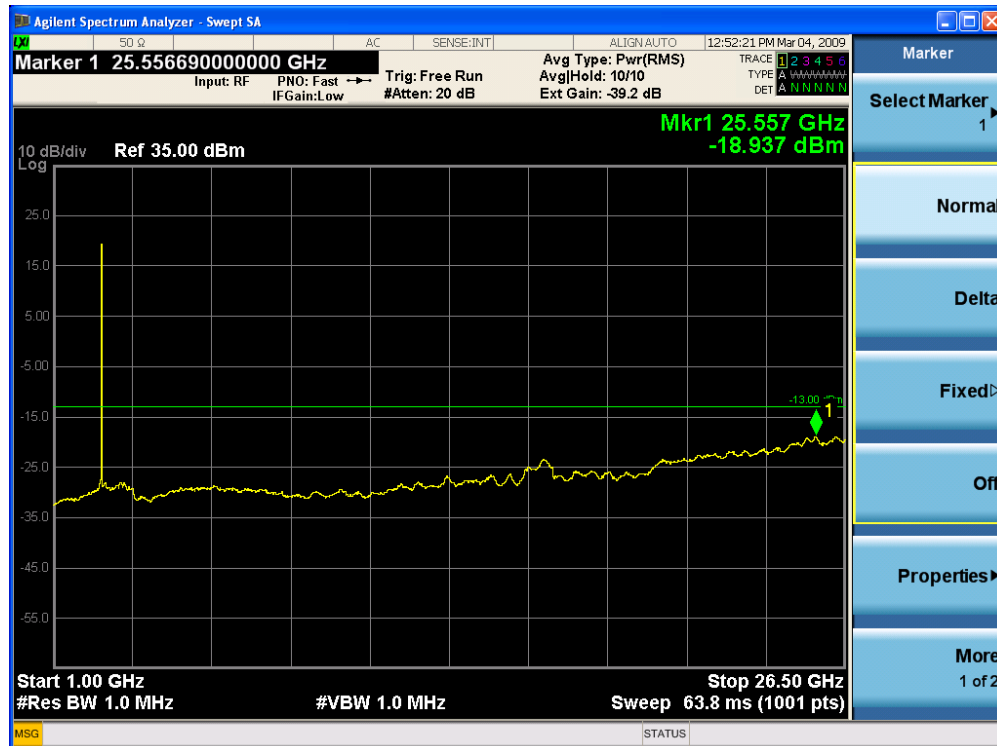
16QAM LOW Channel)



(1 GHz ~ 26.5 GHz)

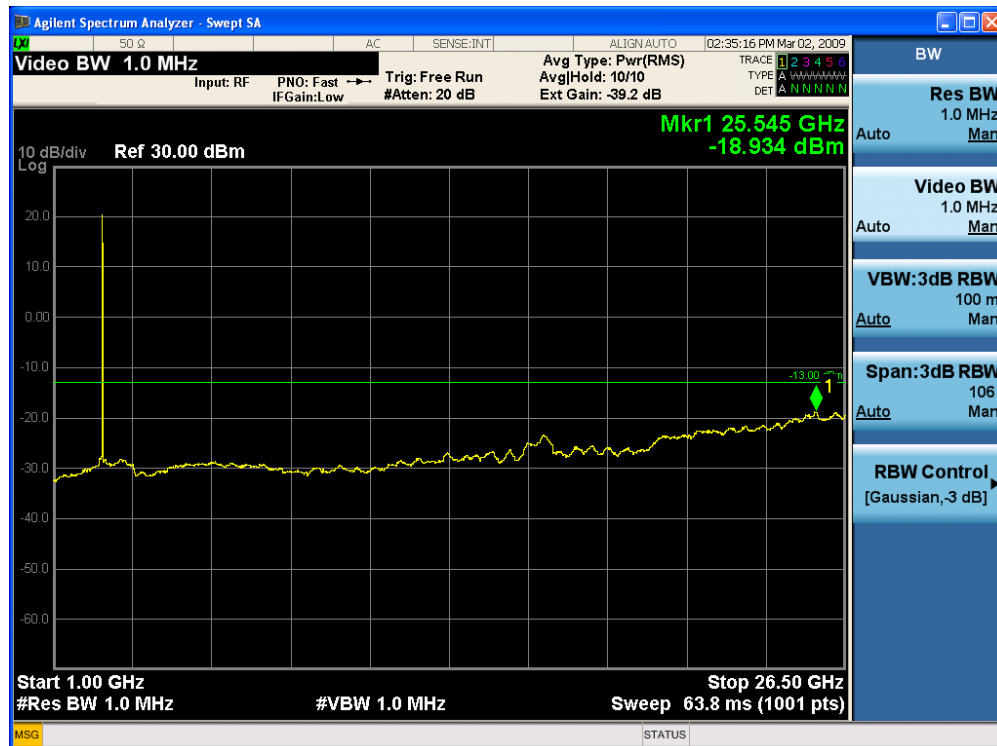
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(16QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

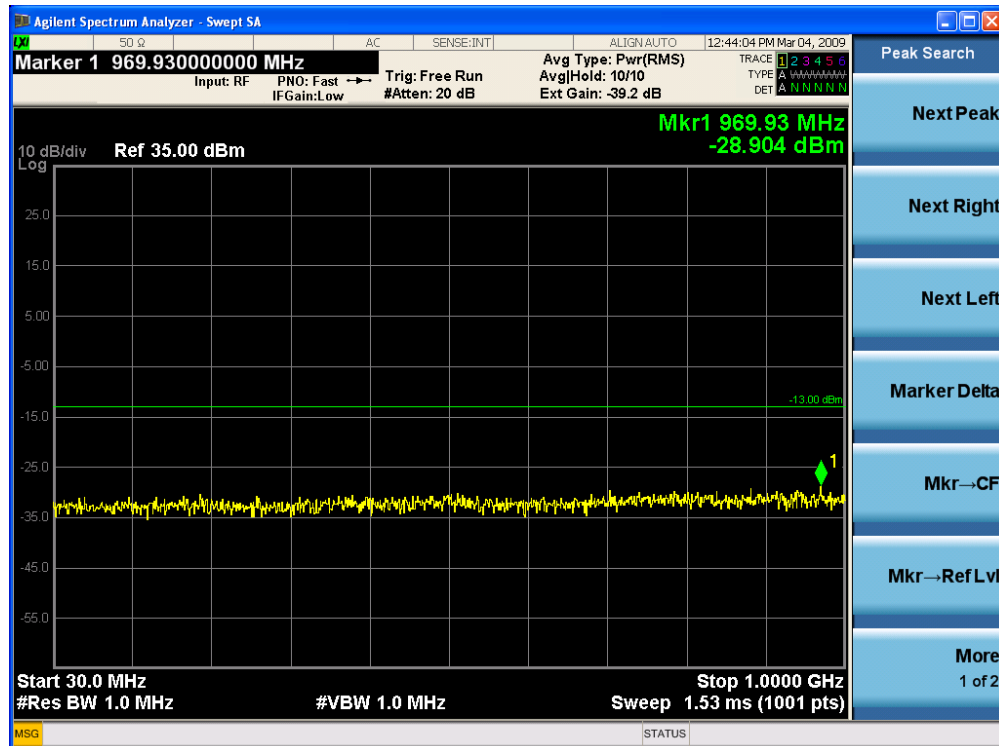
(16QAM High Channel)



(1 GHz ~ 26.5 GHz)

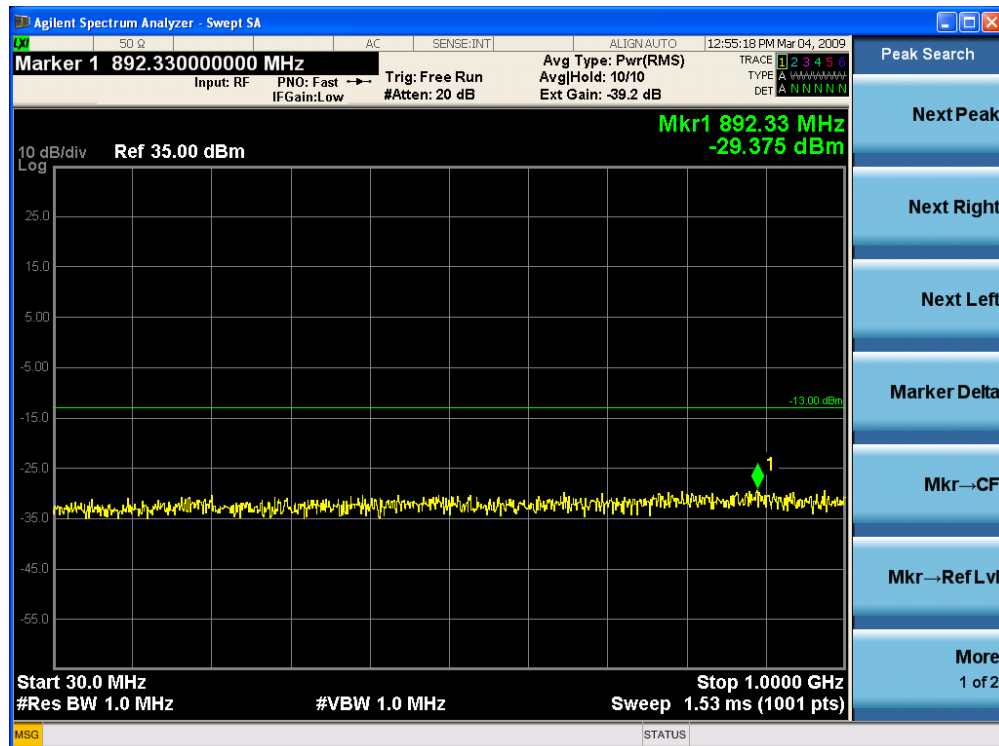
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(64QAM Low Channel)



(30 MHz ~ 1 GHz)

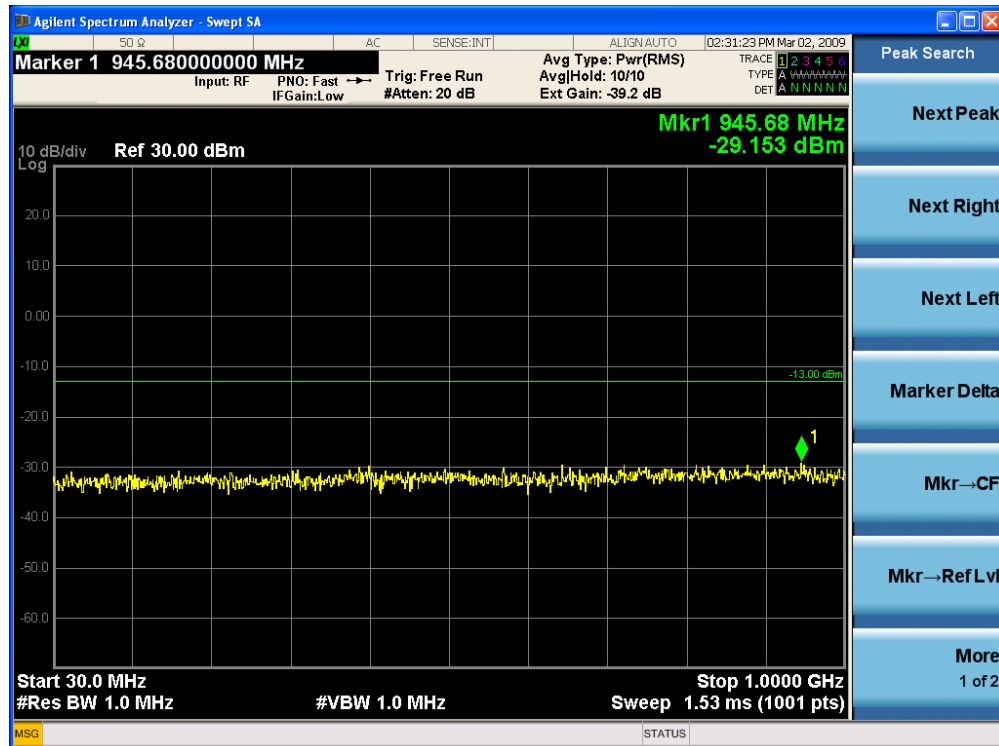
(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

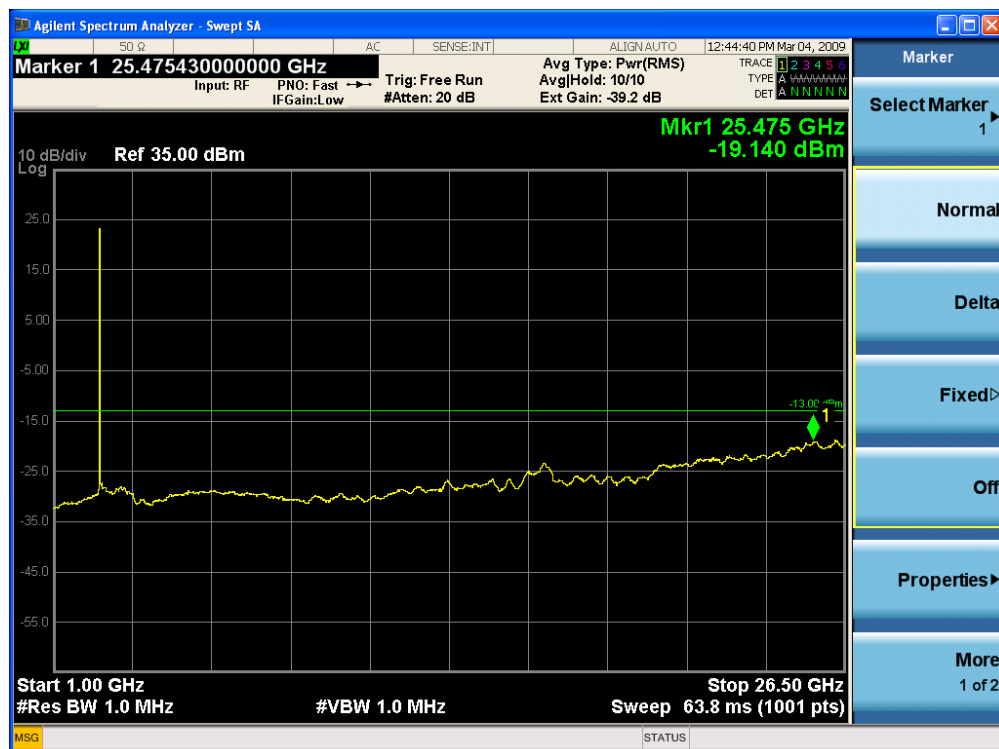
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(64QAM High Channel)



(30 MHz ~ 1 GHz)

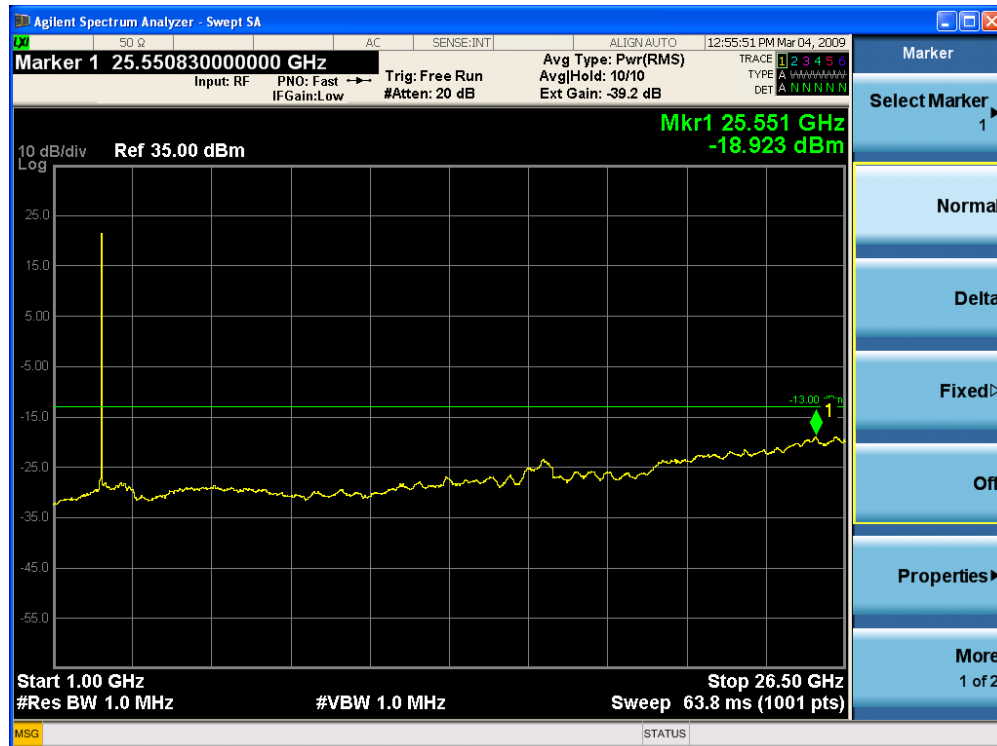
(64QAM Low Channel)



(1 GHz ~ 26.5 GHz)

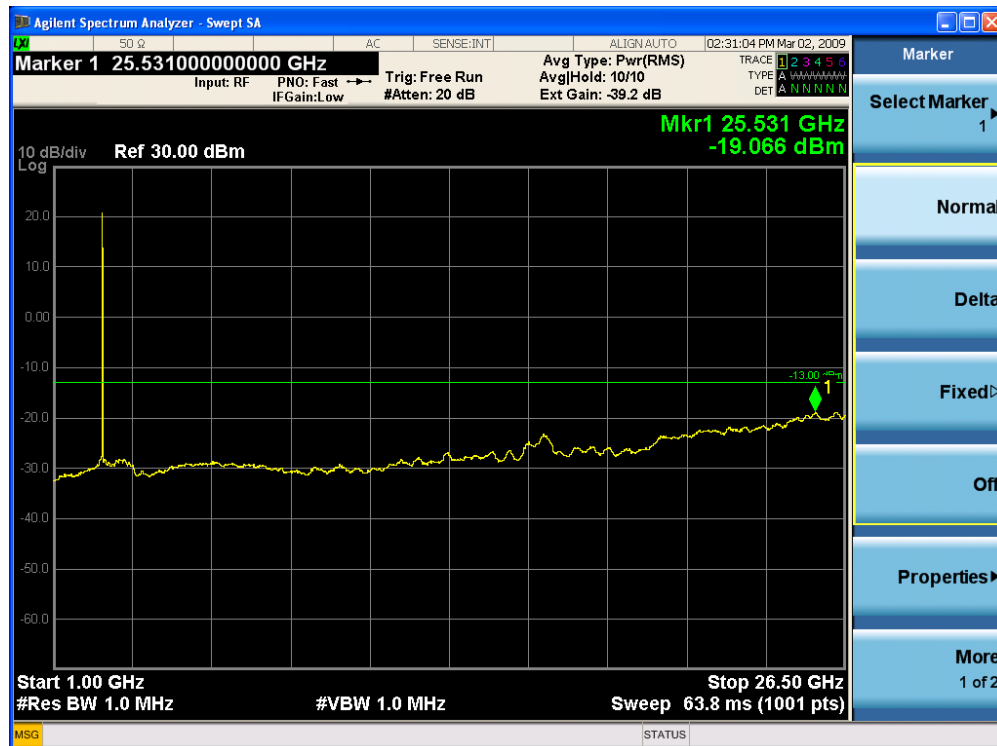
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(64QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

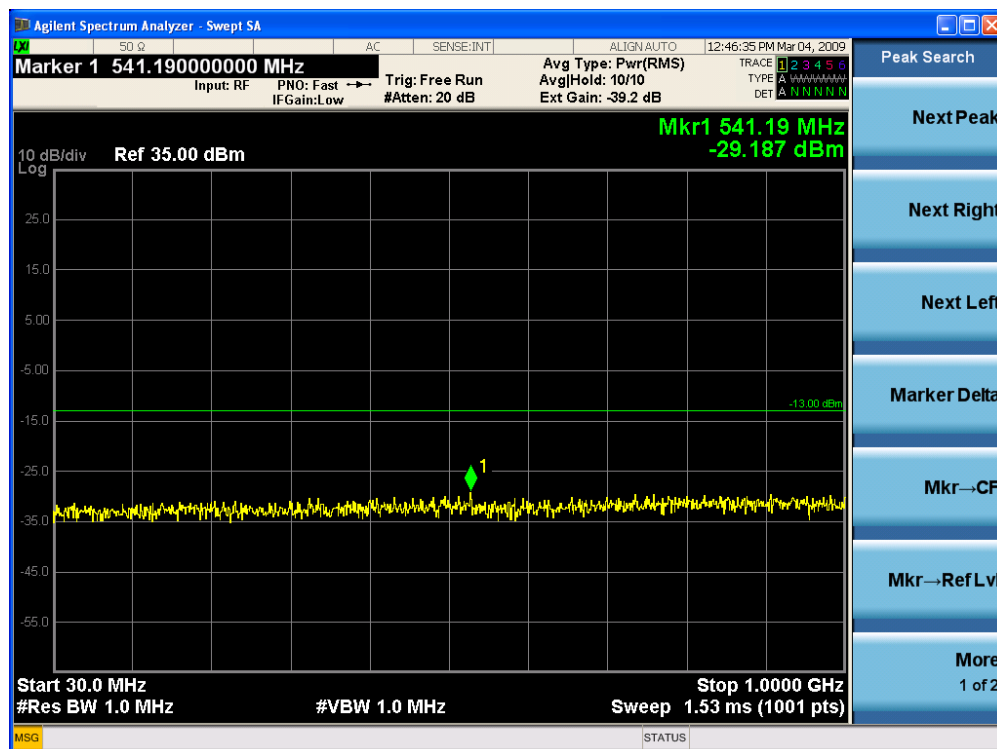


(1 GHz ~ 26.5 GHz)

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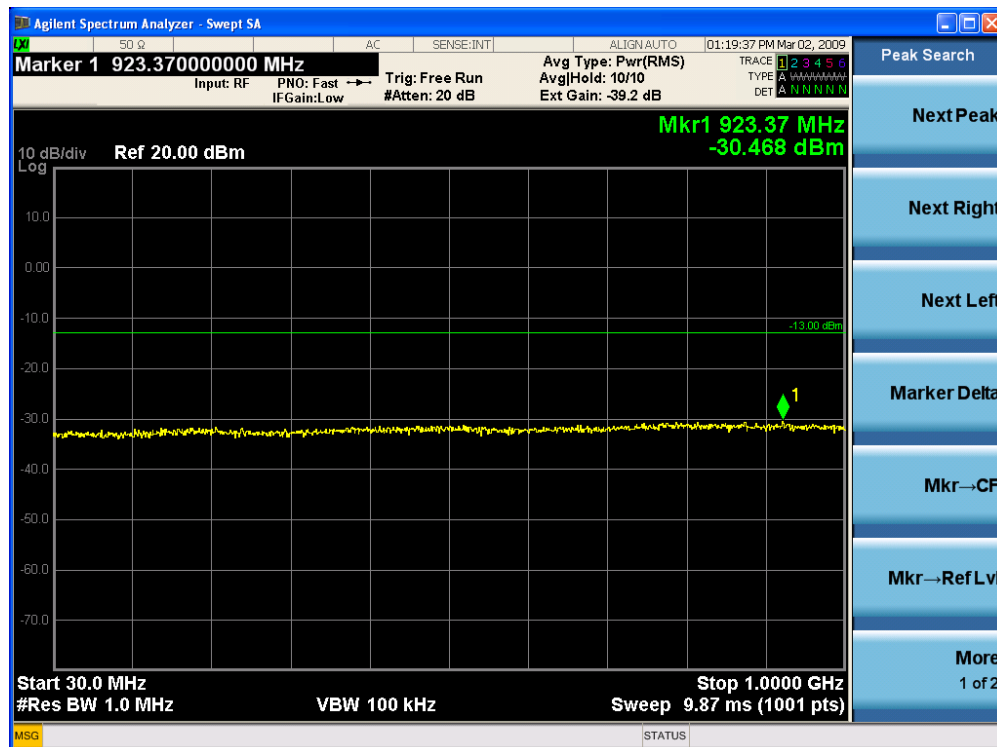
8.4.2. Plot Data at Output 1

(QPSK Low Channel)



(30 MHz ~ 1 GHz)

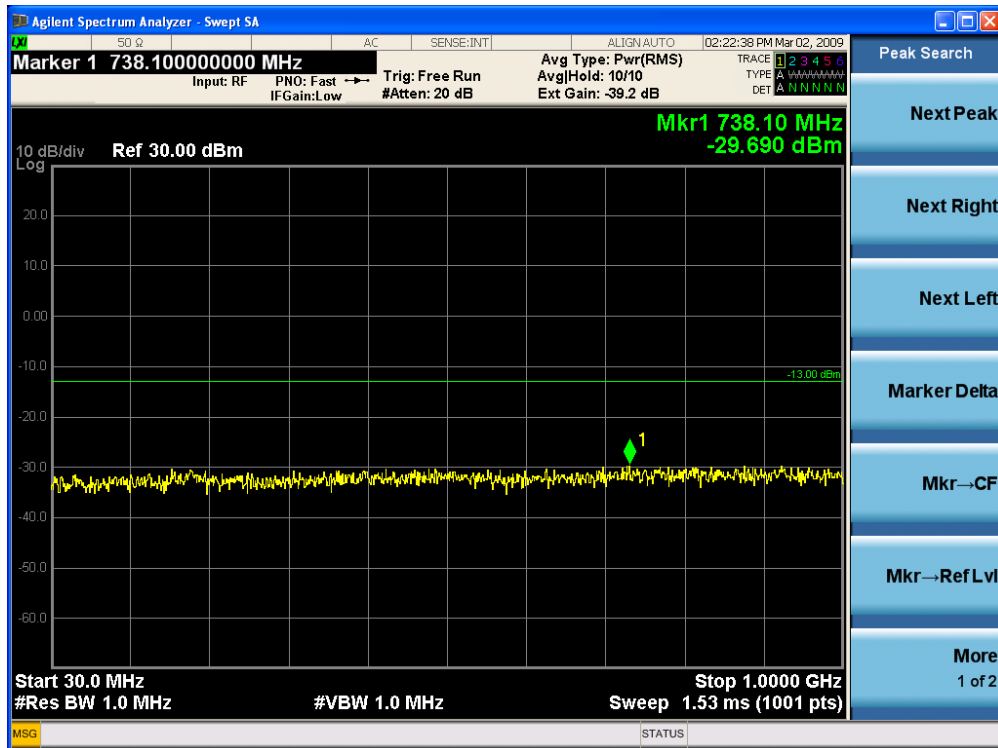
(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

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(QPSK High Channel)

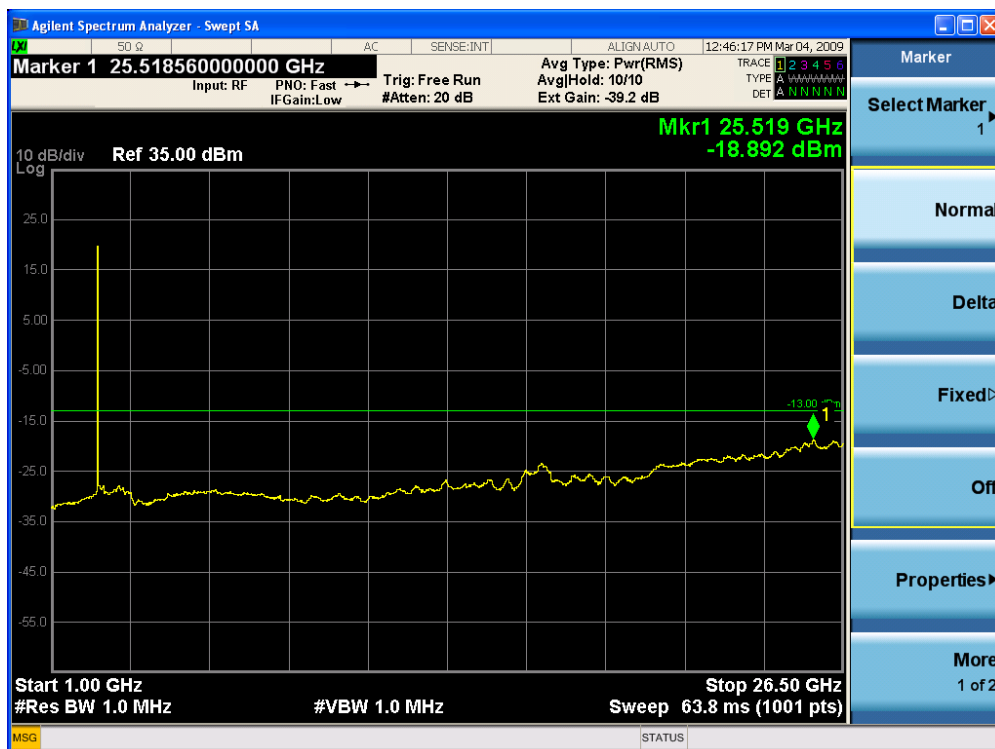


(30 MHz ~ 1 GHz)

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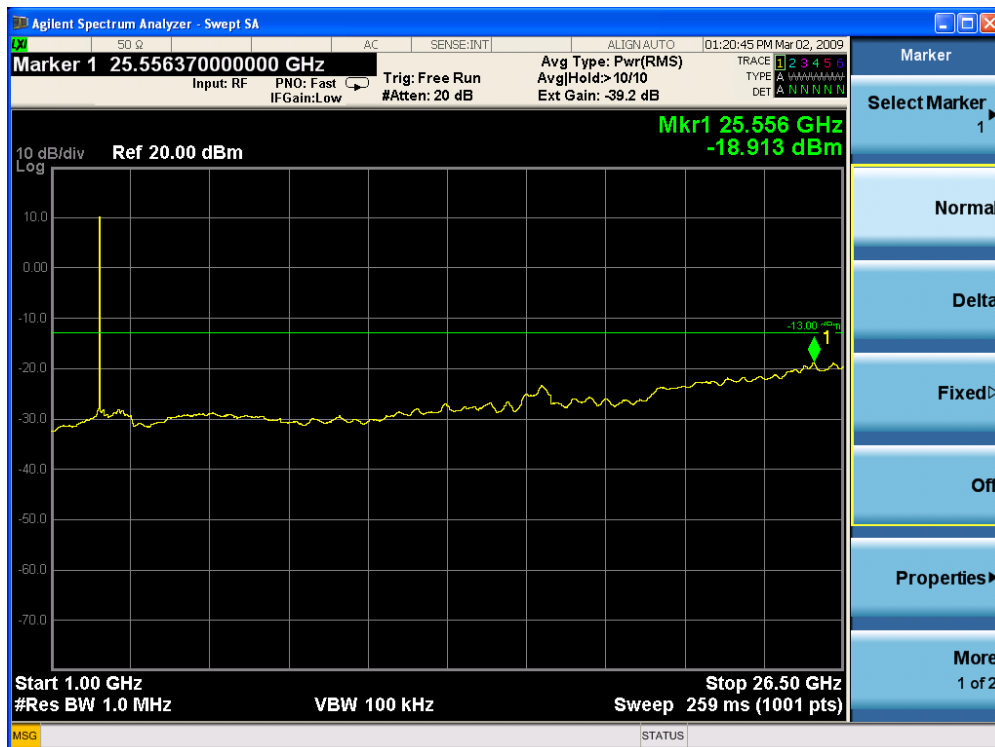
8.4.3. Plot Data at Output 1

(QPSK Low Channel)



(1 GHz ~ 26.5 GHz)

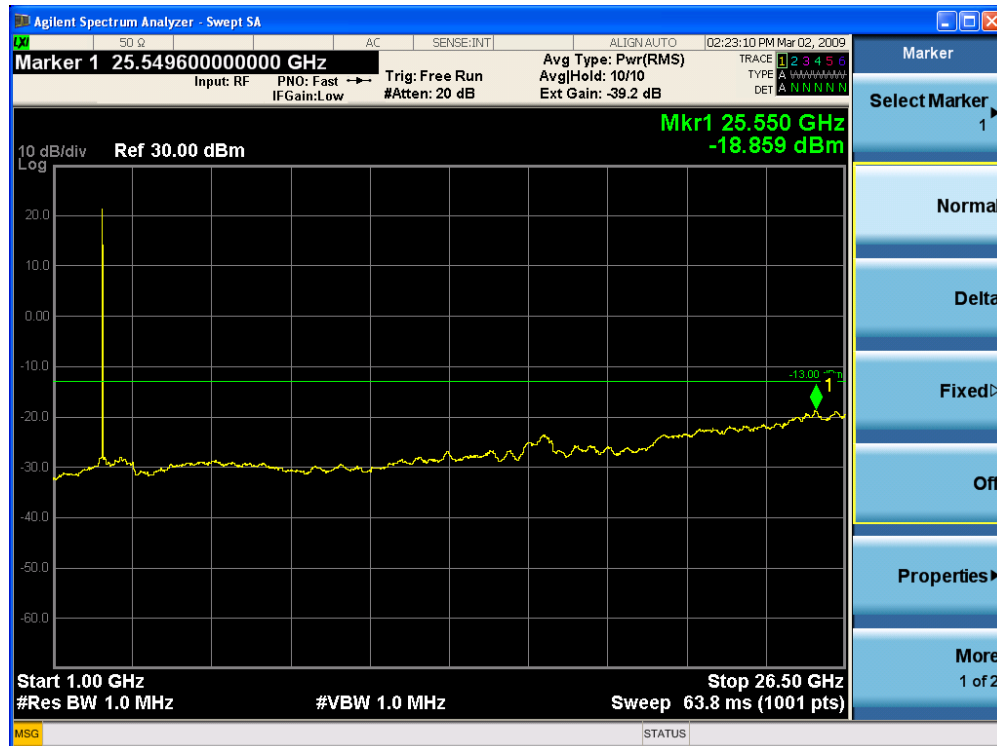
(QPSK Middle Channel)



(1 GHz ~ 26.5 GHz)

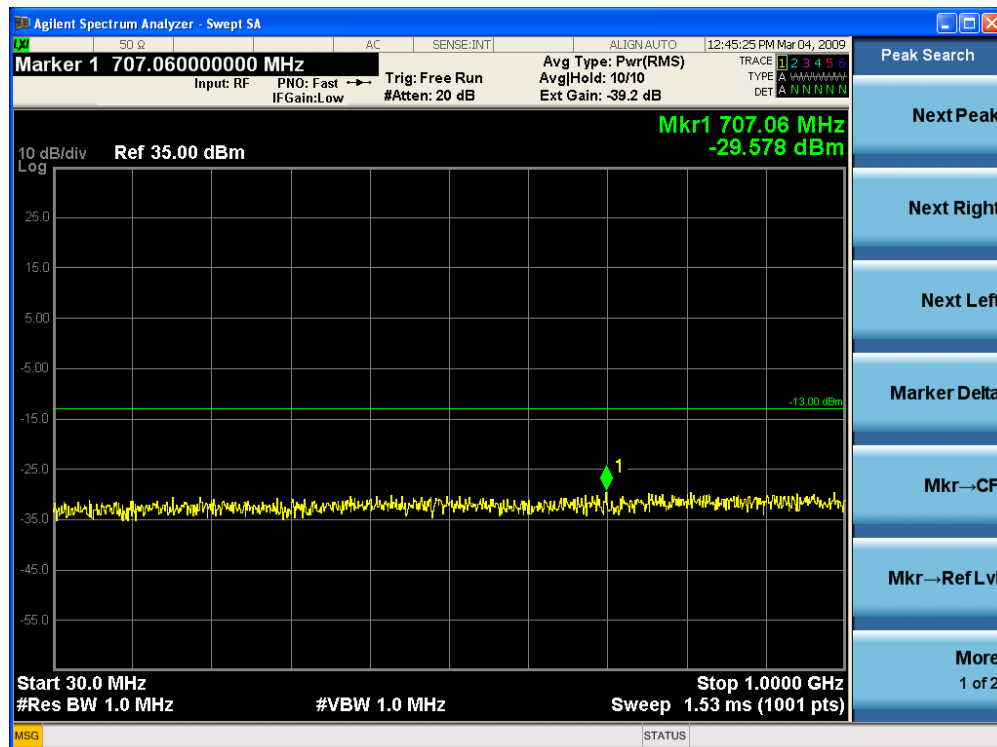
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(QPSK High Channel)



(1 GHz ~ 26.5 GHz)

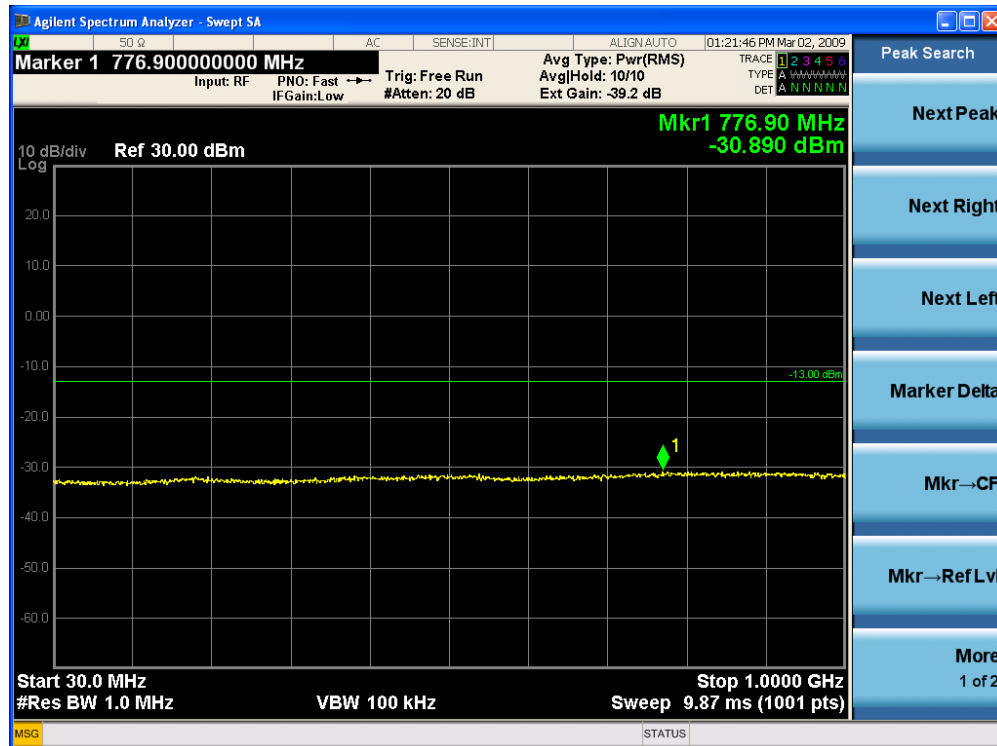
(16QAM Low Channel)



(30 MHz ~ 1 GHz)

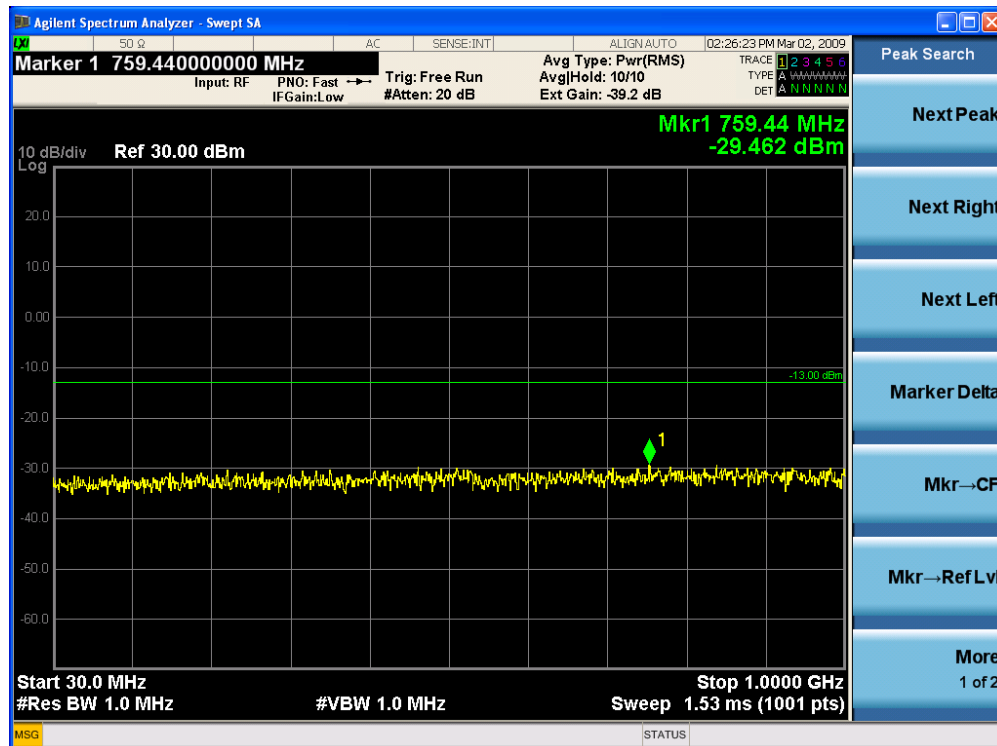
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(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

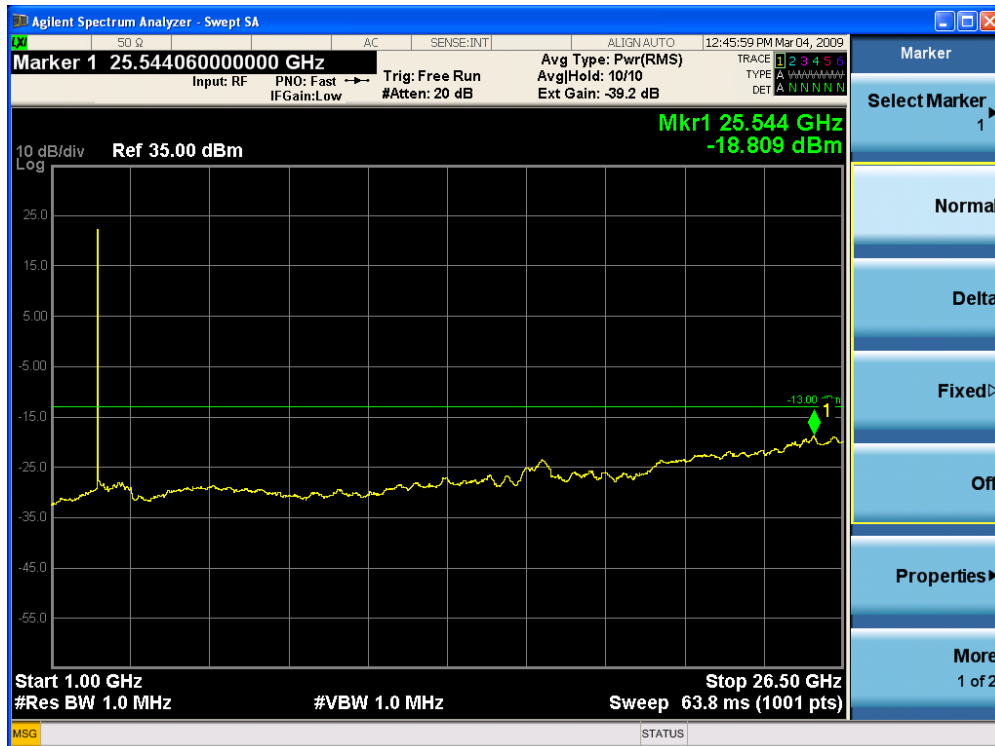
(16QAM High Channel)



(30 MHz ~ 1 GHz)

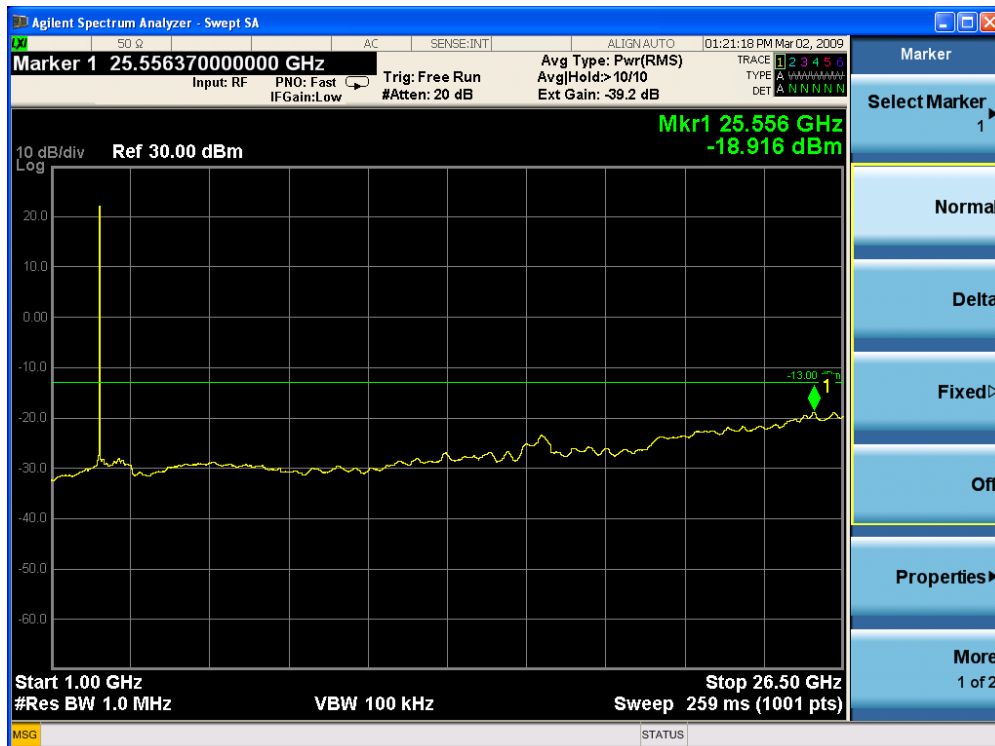
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(16QAM Low Channel)



(1 GHz ~ 26.5 GHz)

(16QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

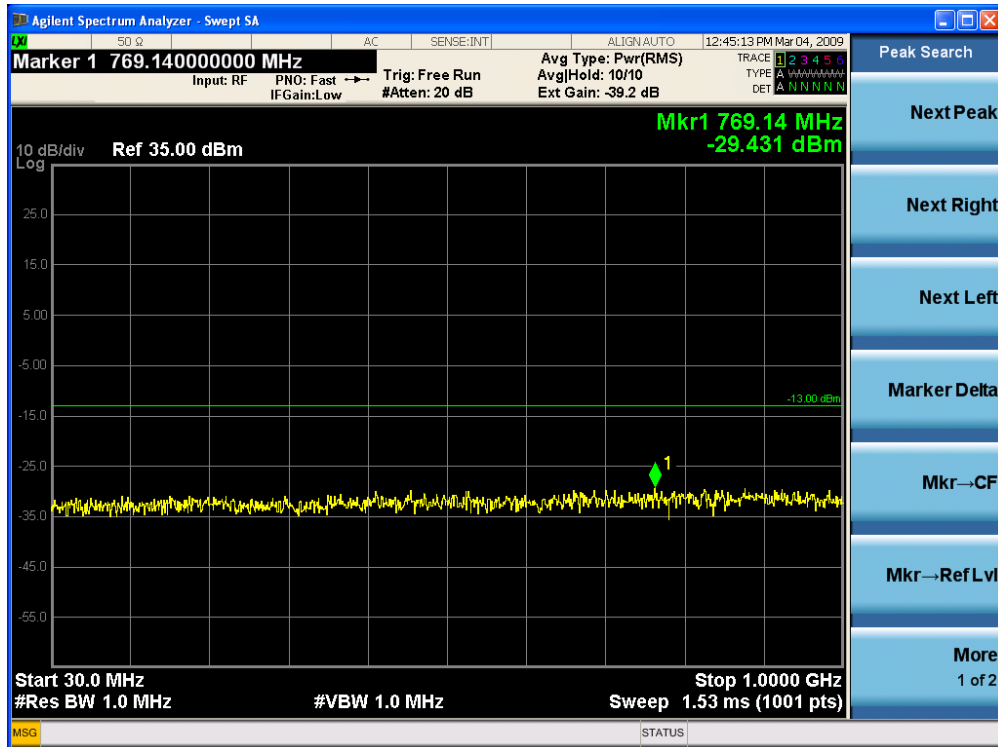
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(16QAM High Channel)



(1 GHz ~ 26.5 GHz)

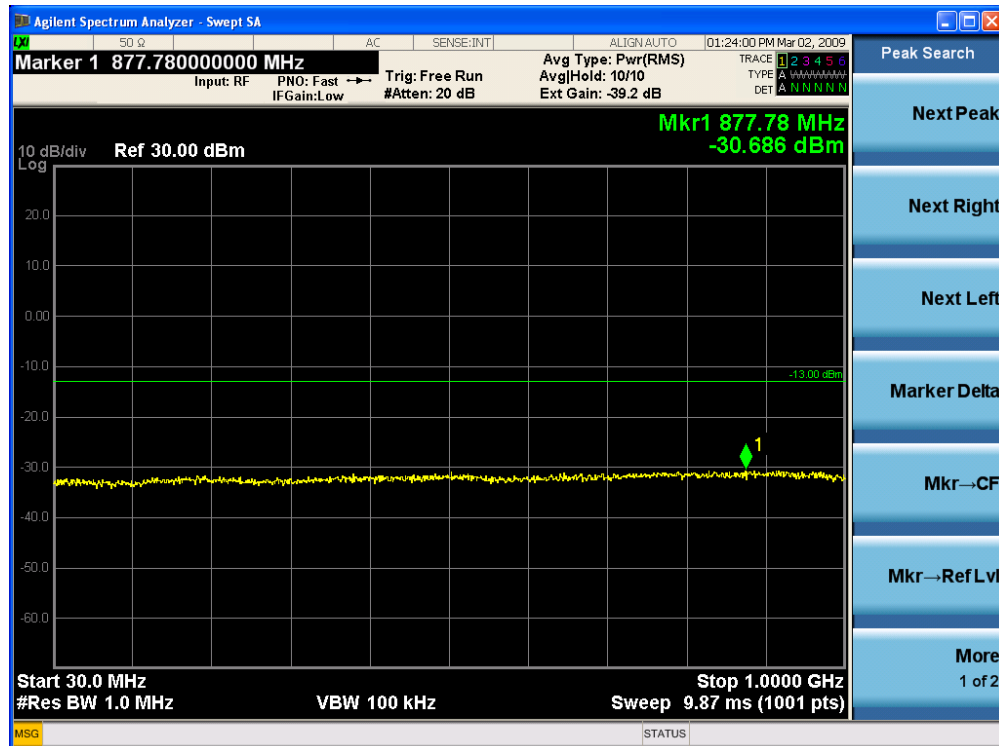
(64QAM Low Channel)



(30 MHz ~ 1 GHz)

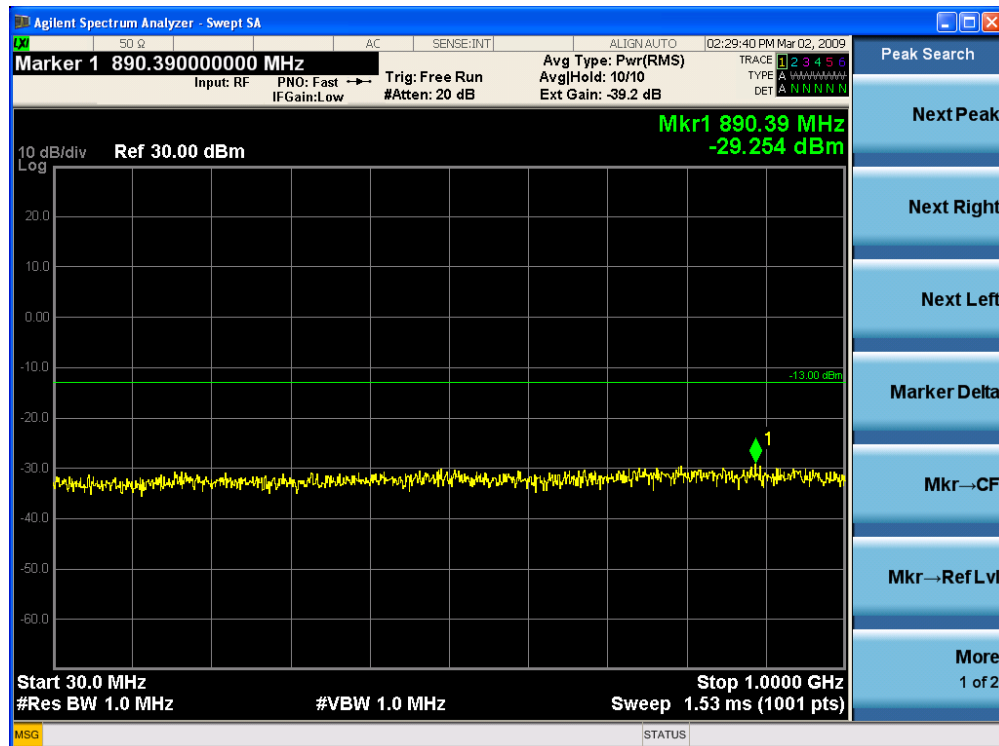
HCT PT.27 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

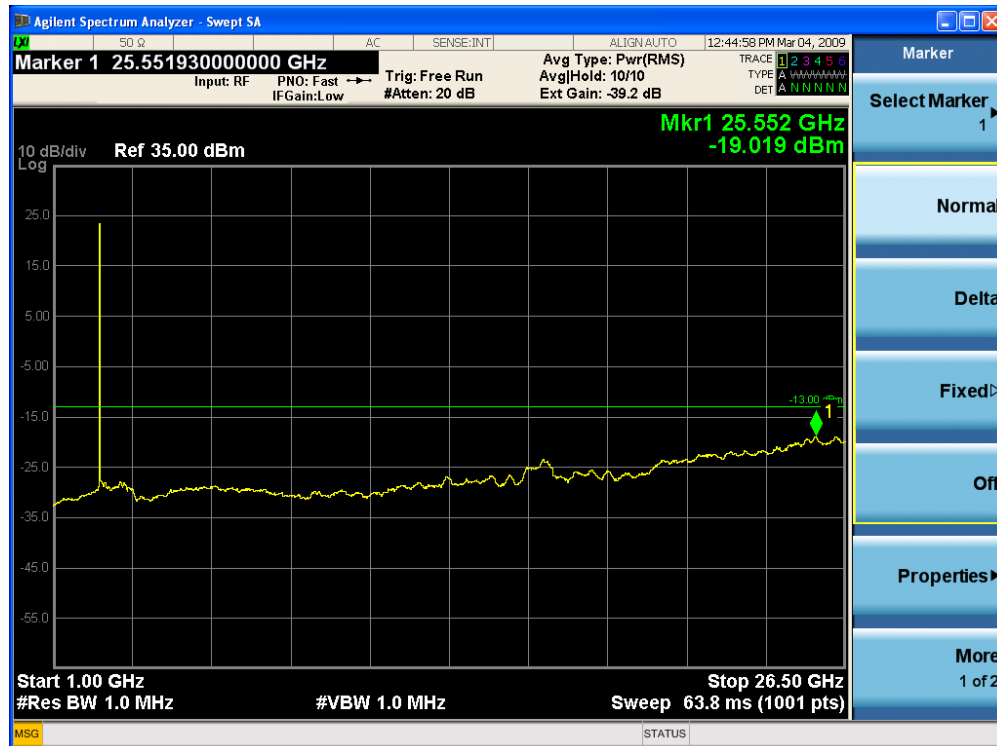
(64QAM High Channel)



(30 MHz ~ 1 GHz)

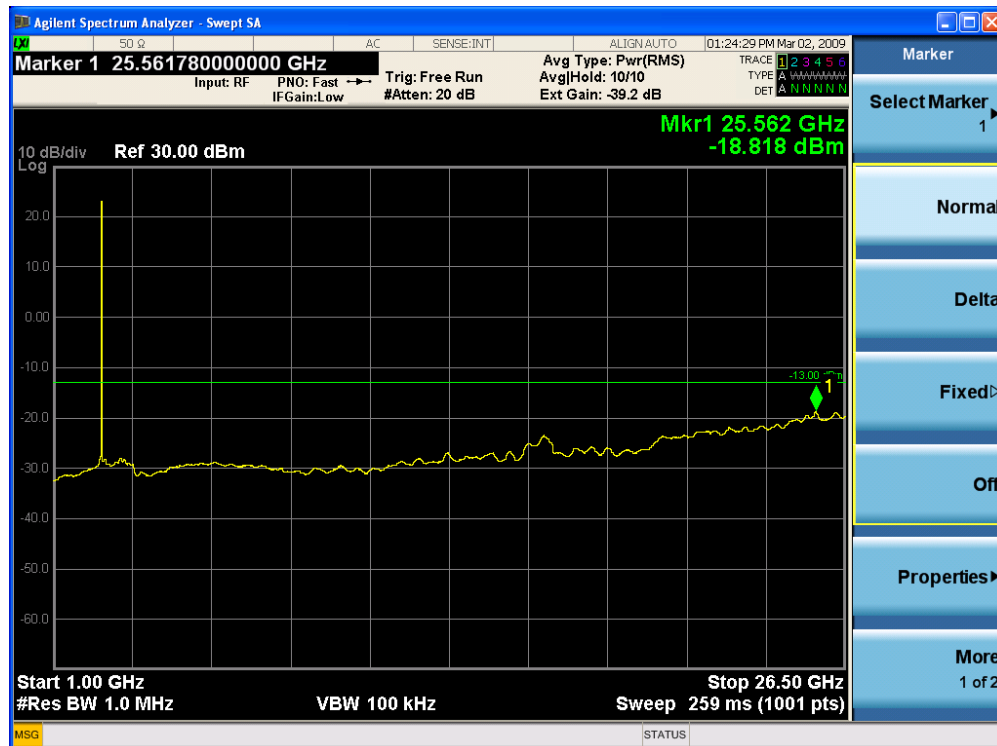
HCT PT.27 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
Test Report No. HCT-RF09-0310	Test Dates: March 11, 2009	EUT Type: Mobile WiMAX Outdoor RAS	FCC ID: A3LSPI-2213282501	Page 71 of 91

(64QAM Low Channel)



(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

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(64QAM High Channel)

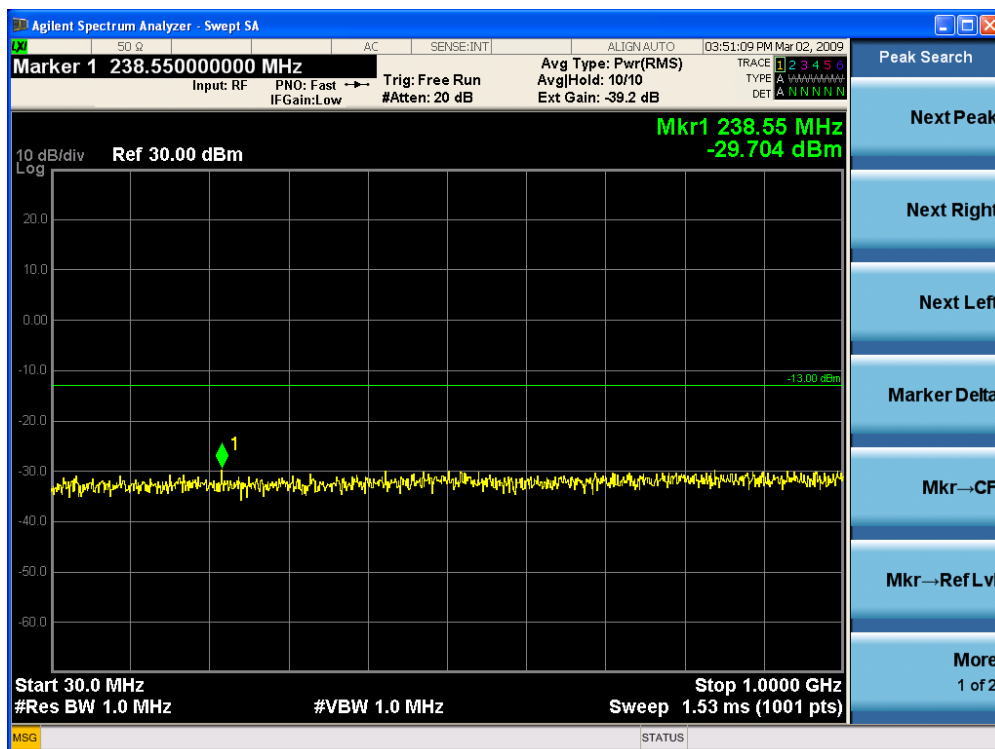


(1 GHz ~ 26.5 GHz)

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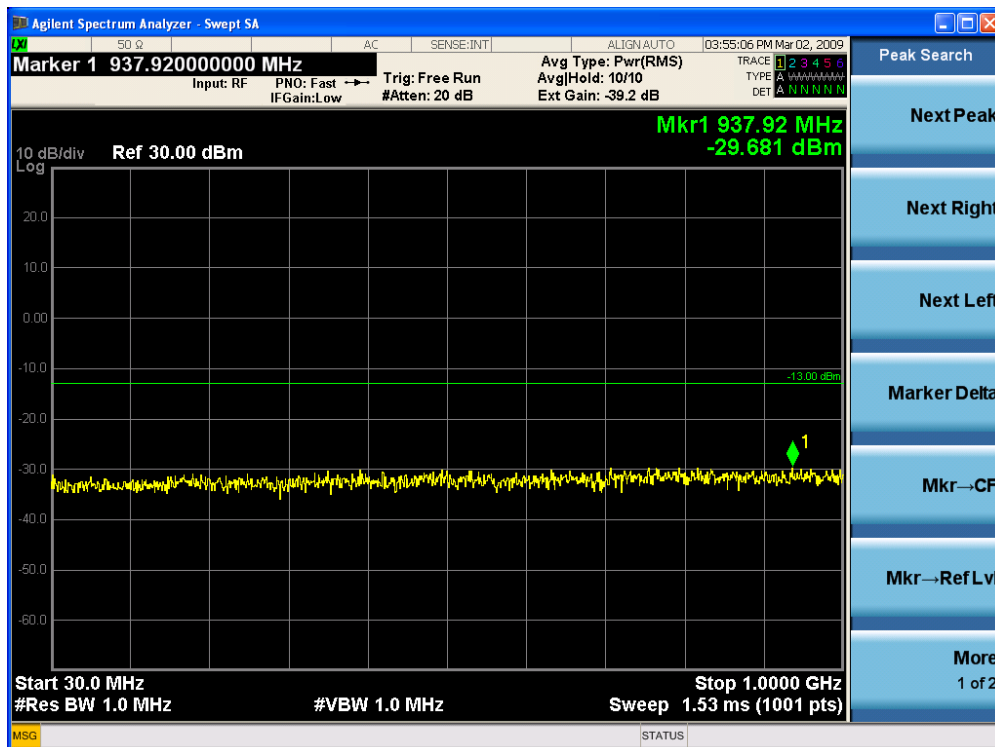
8.4.4 Plot Data at Combined Output

(QPSK Low Channel)



(30 MHz ~ 1 GHz)

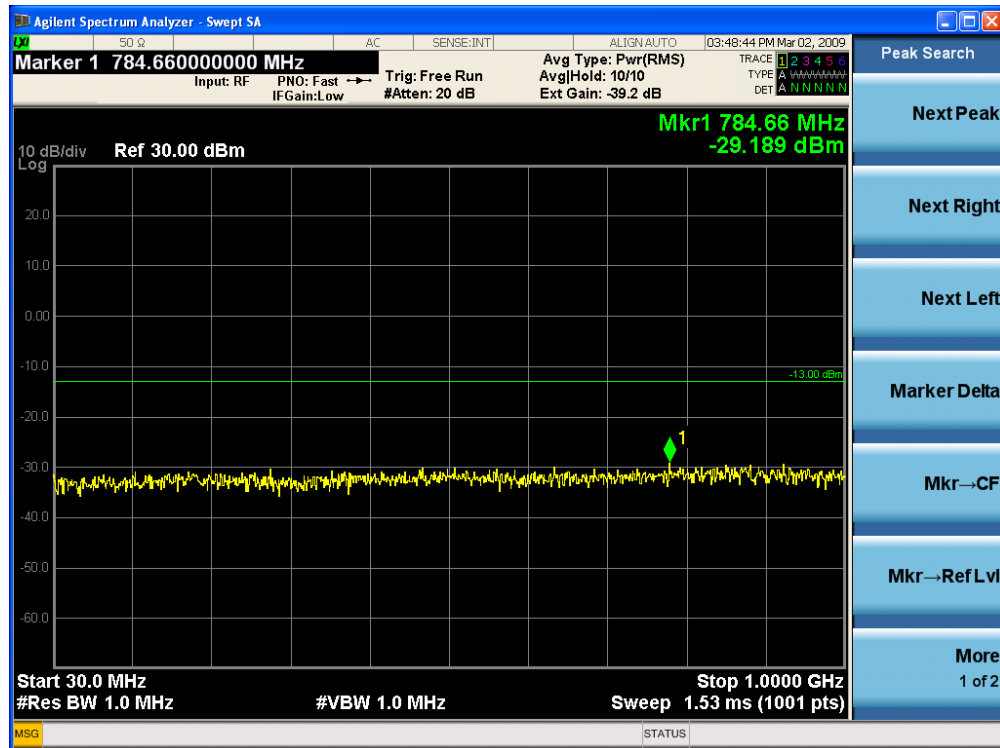
(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

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(QPSK High Channel)

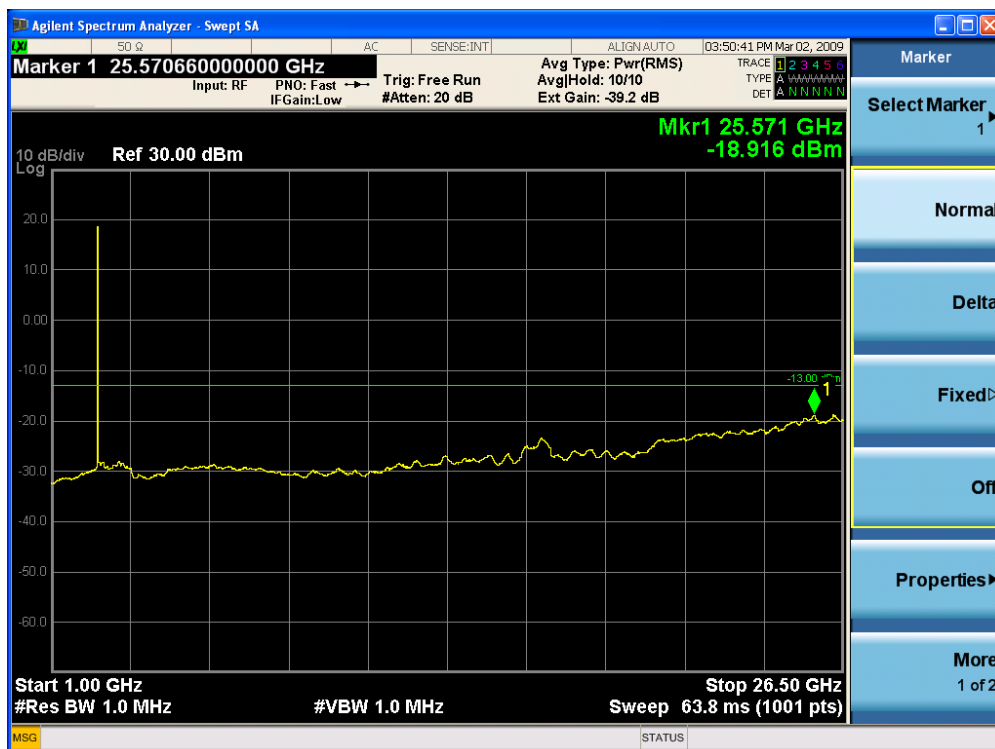


(30 MHz ~ 1 GHz)

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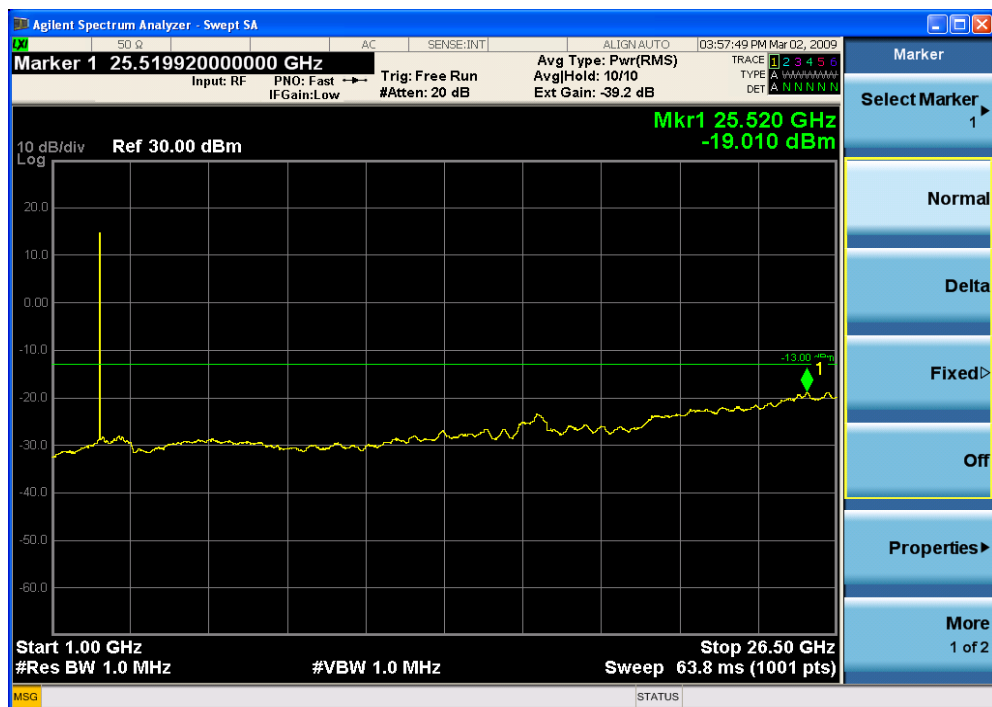
8.4.5 Plot Data at Combined Output

(QPSK Low Channel)



(1 GHz ~ 26.5 GHz)

(QPSK Middle Channel)



(1 GHz ~ 26.5 GHz)

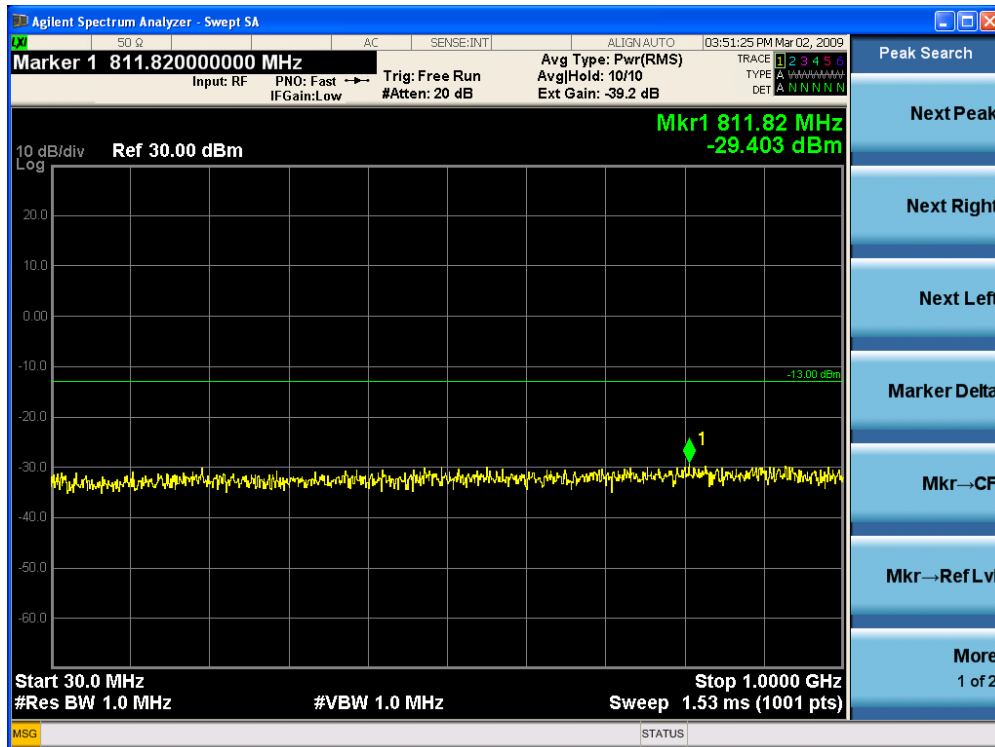
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(QPSK High Channel)



(1 GHz ~ 26.5 GHz)

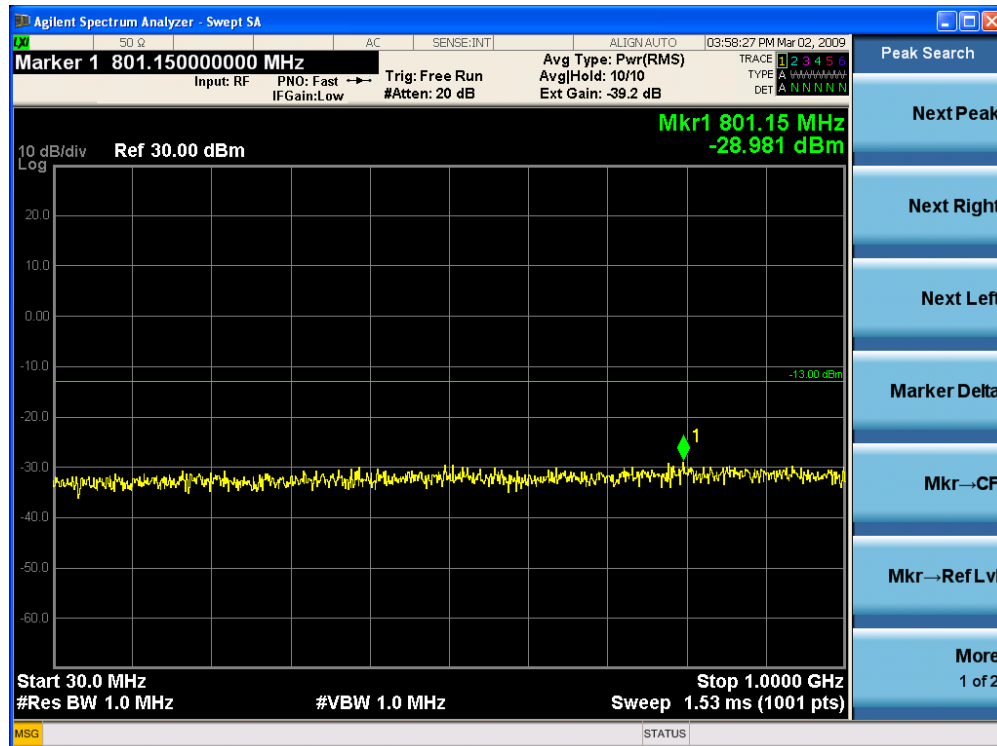
(16QAM Low Channel)



(30 MHz ~ 1 GHz)

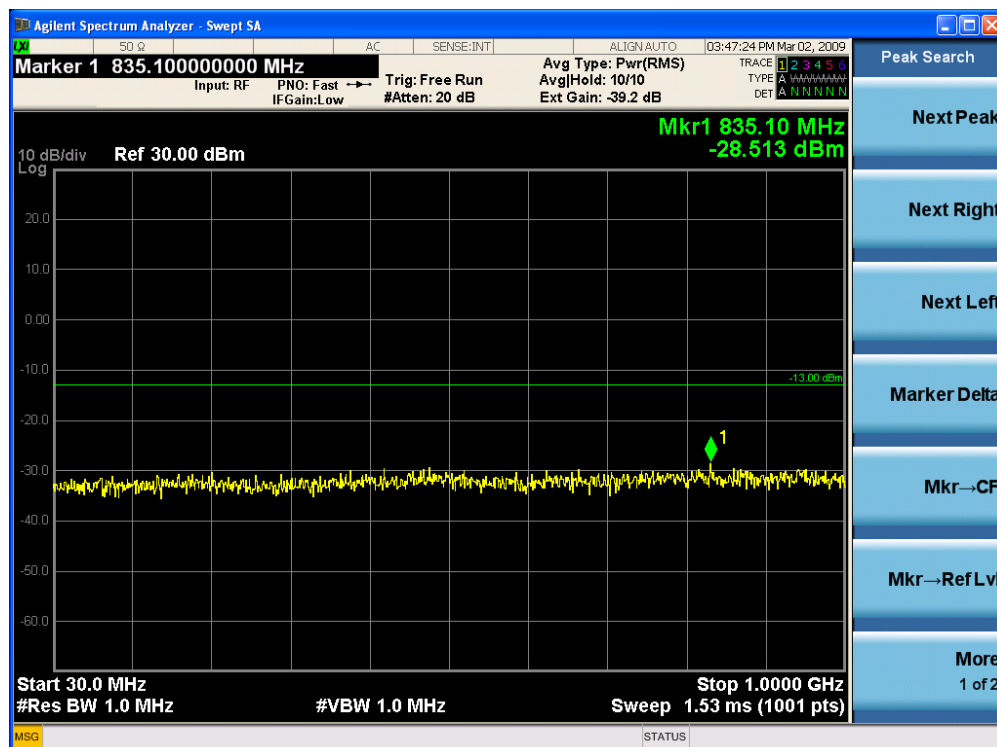
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(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

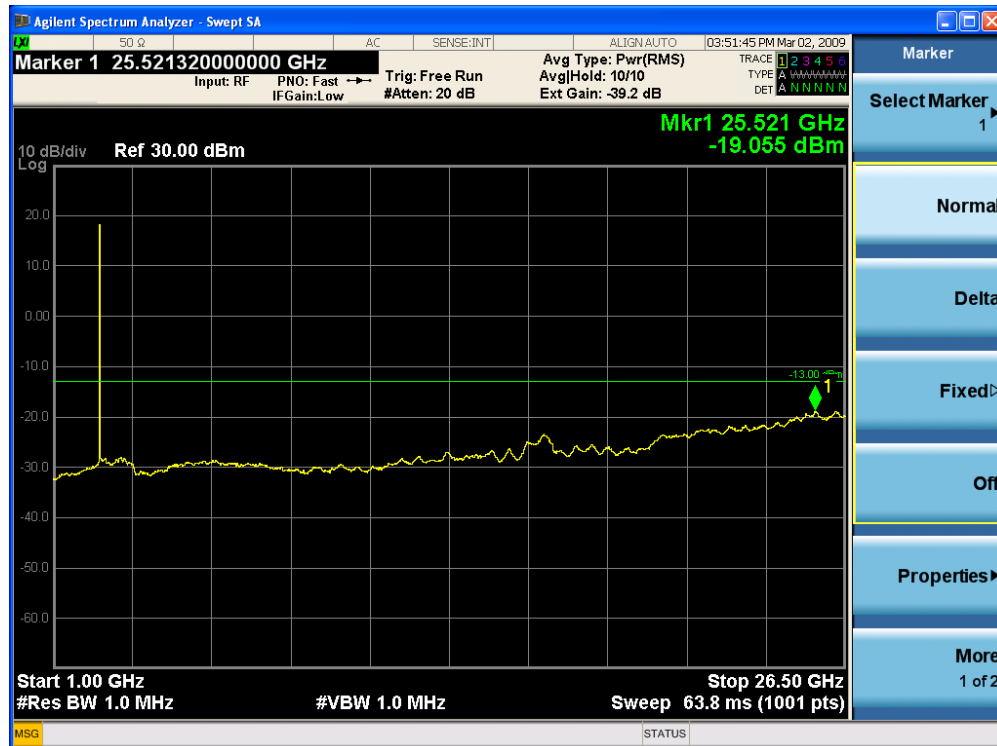
(16QAM High Channel)



(30 MHz ~ 1 GHz)

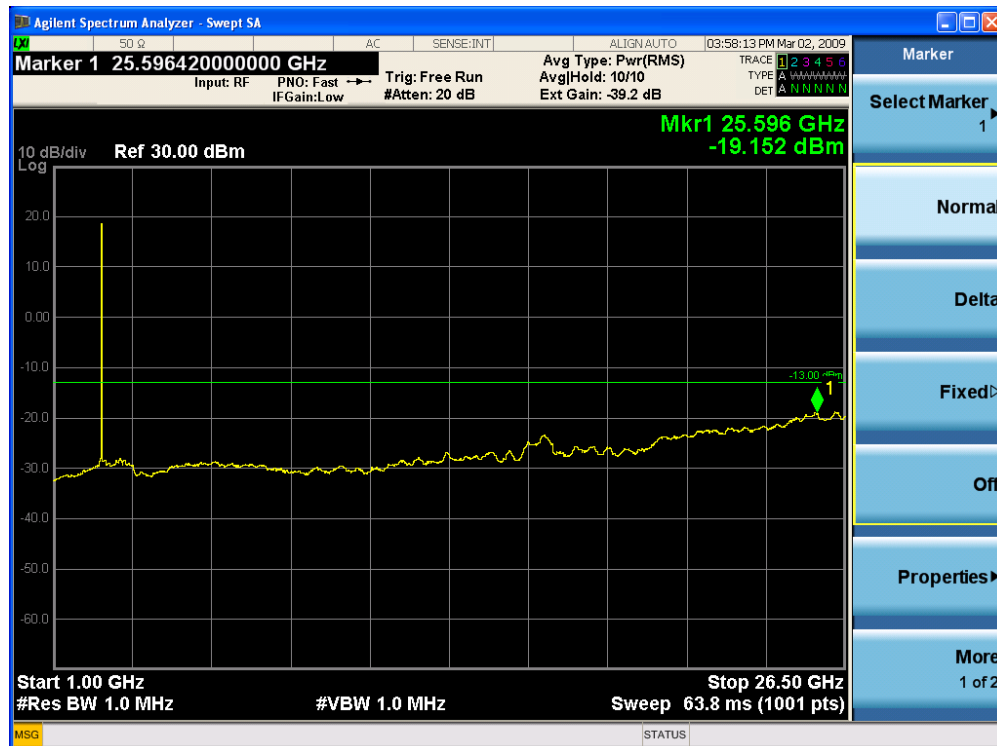
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(16QAM Low Channel)



(1 GHz ~ 26.5 GHz)

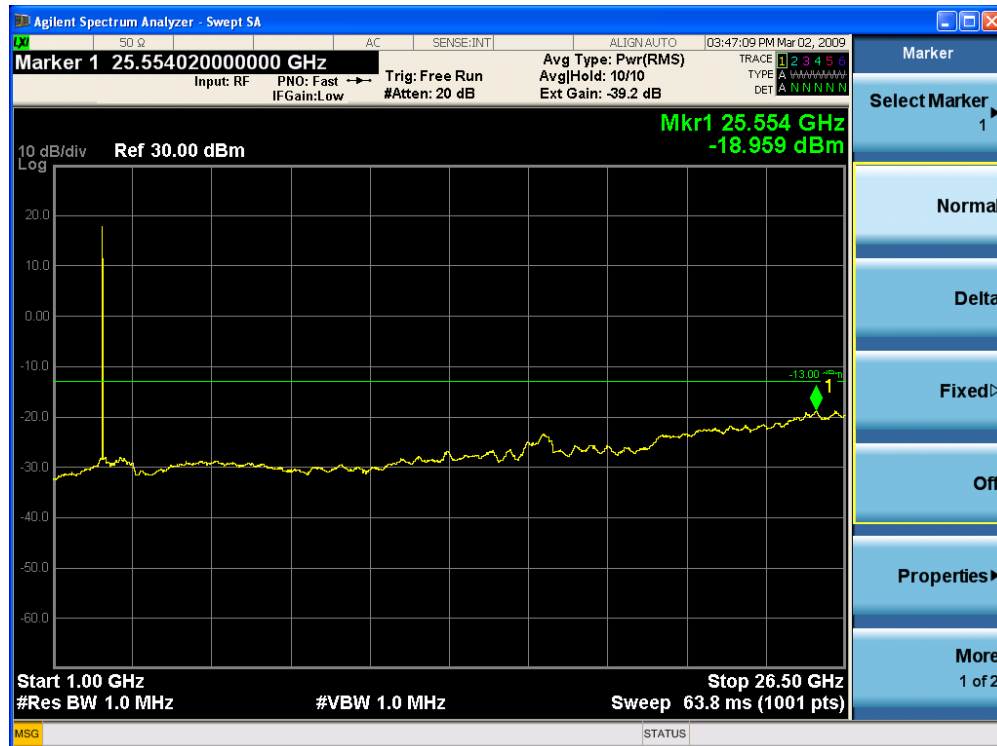
(16QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

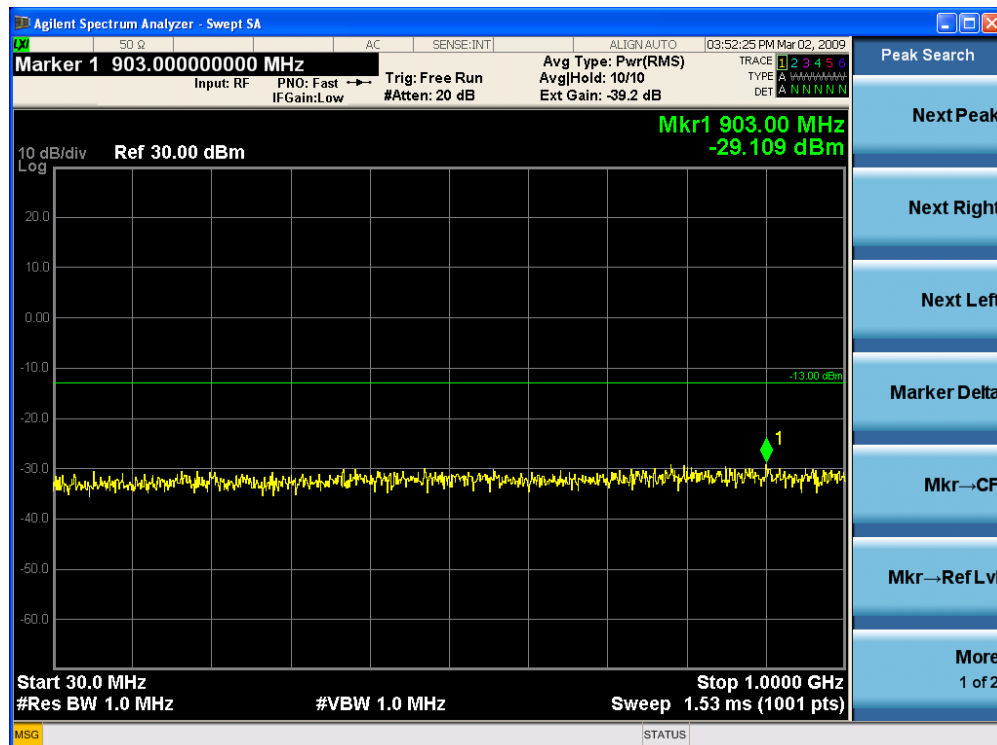
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(16QAM High Channel)



(1 GHz ~ 26.5 GHz)

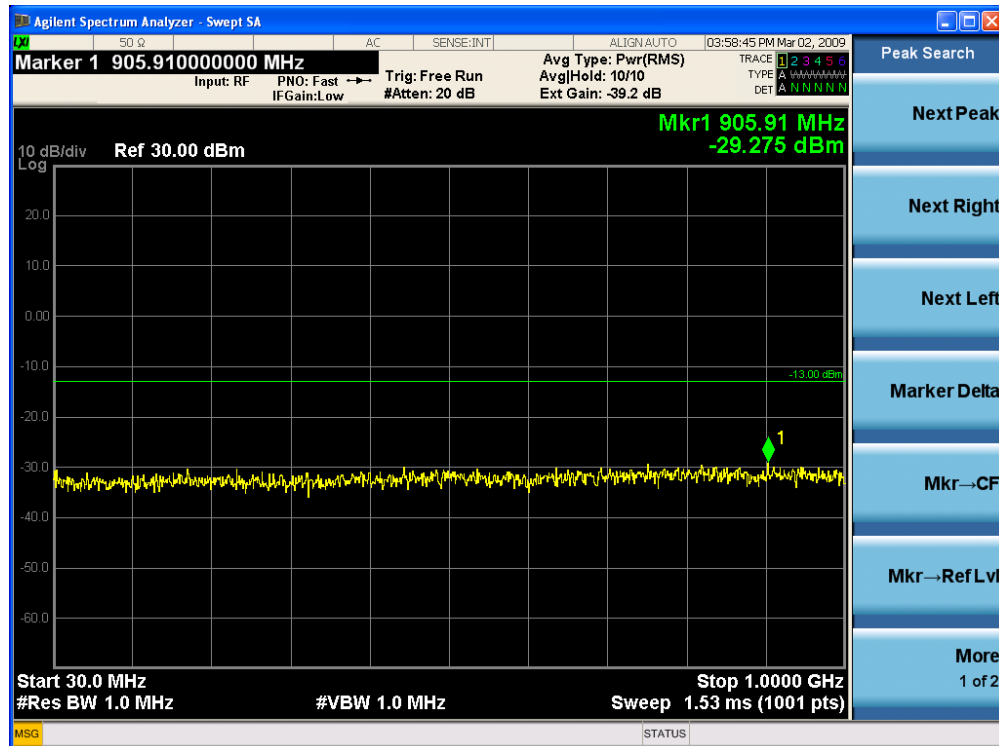
(64QAM Low Channel)



(30 MHz ~ 1 GHz)

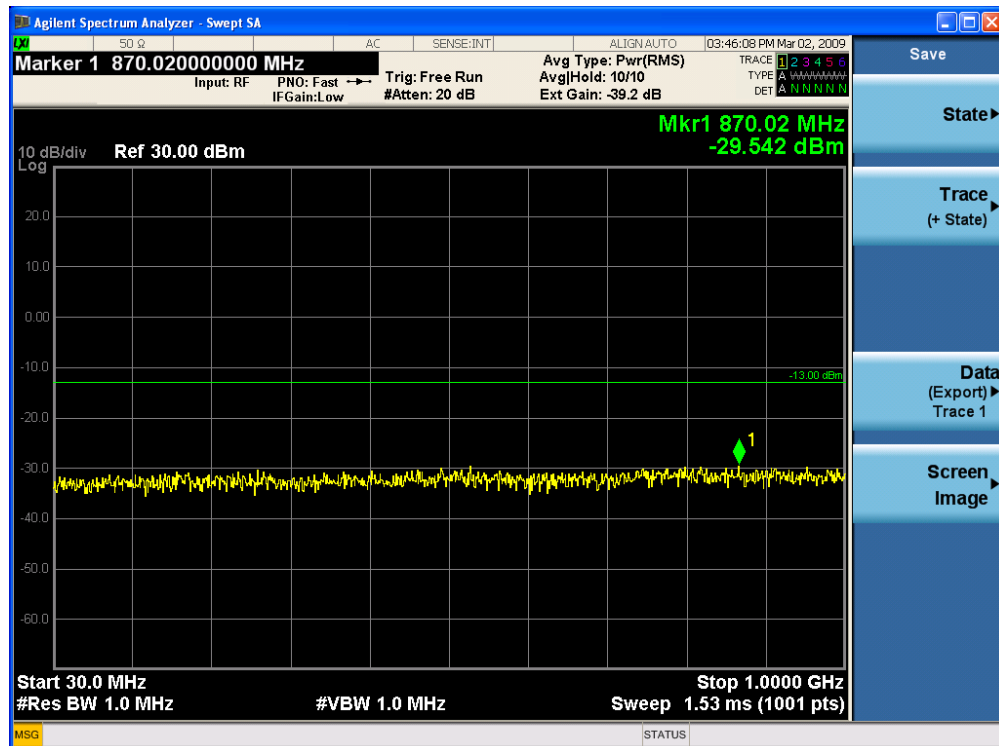
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(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

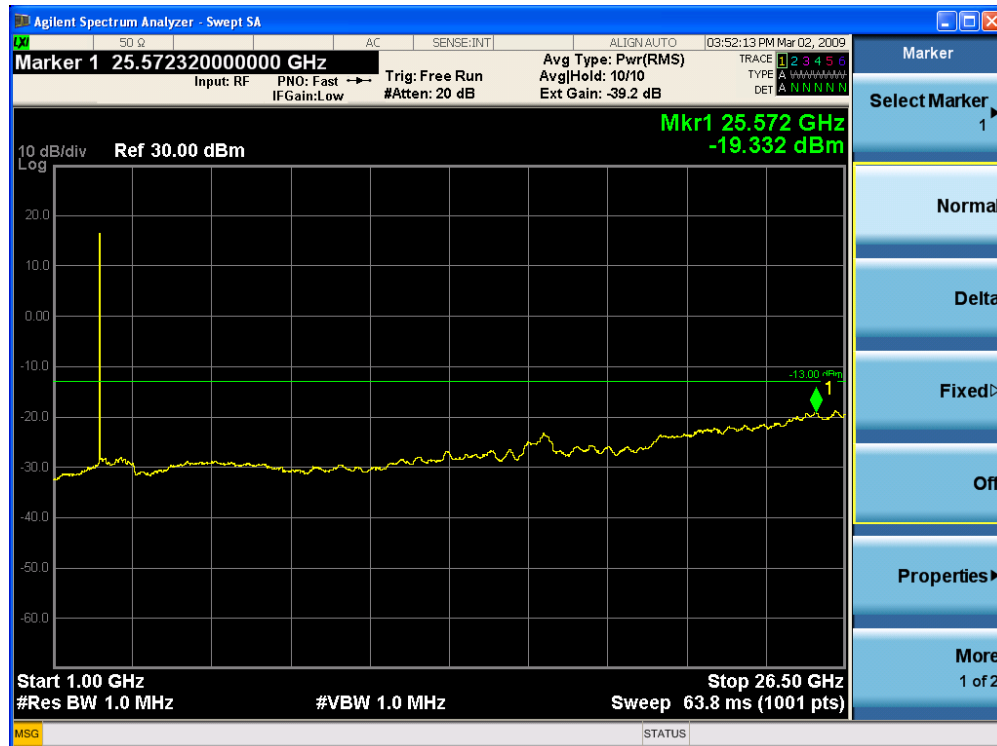
(64QAM High Channel)



(30 MHz ~ 1 GHz)

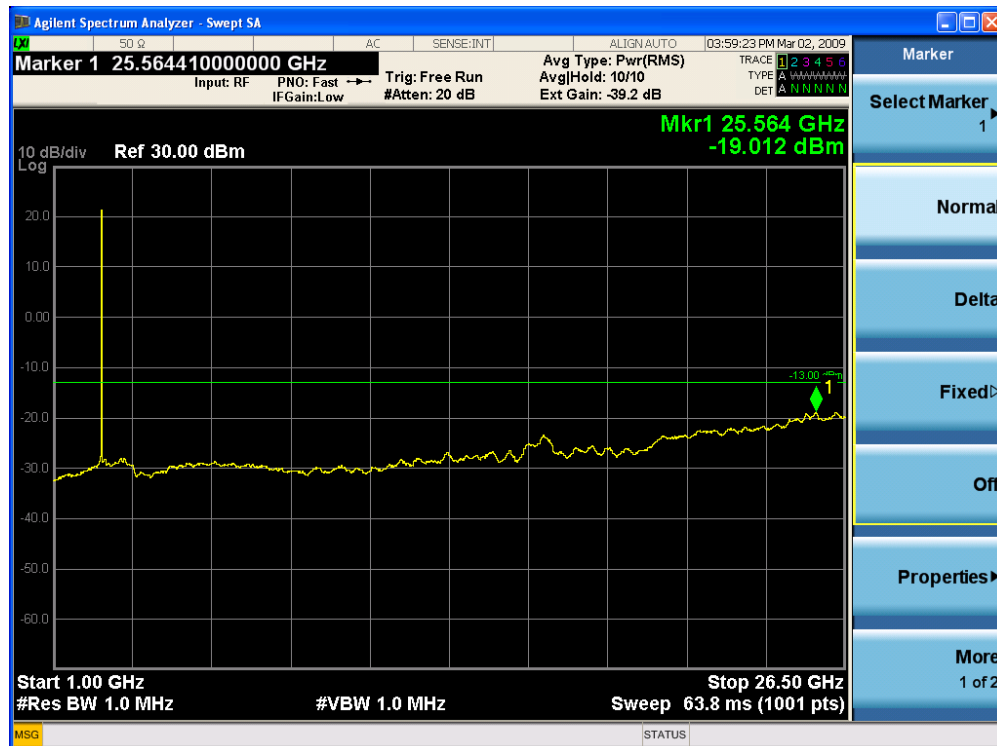
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(64QAM Low Channel)



(1 GHz ~ 26.5 GHz)

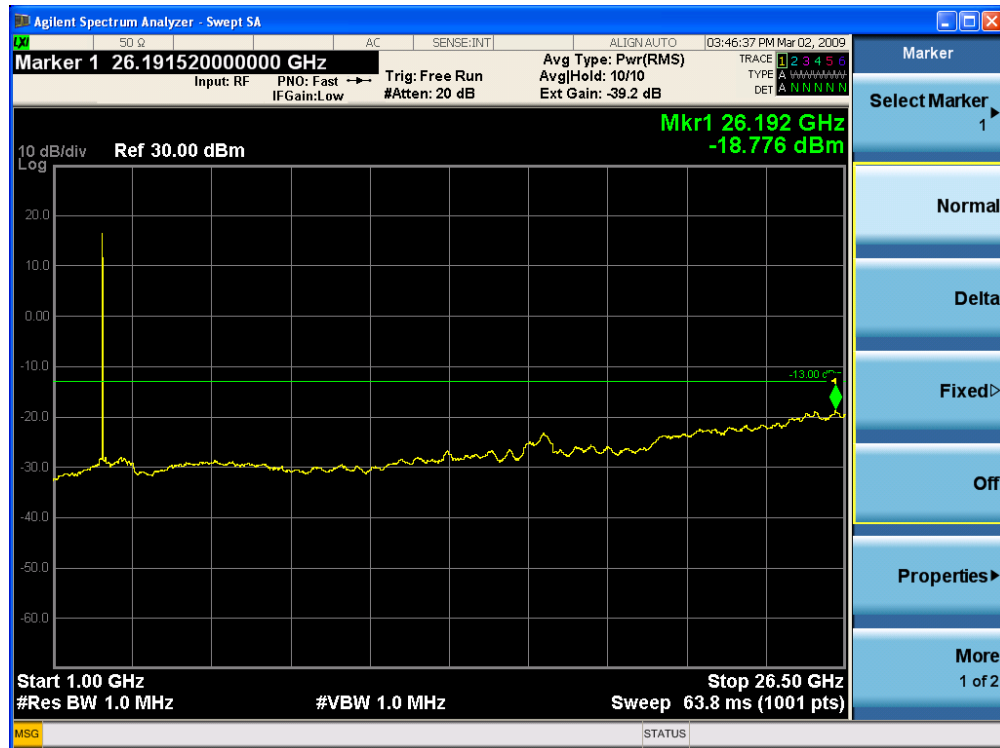
(64QAM Middle Channel)



(1 GHz ~ 26.5 GHz)

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(64QAM High Channel)



(1 GHz ~ 26.5 GHz)

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9. RADIATED SPURIOUS EMISSION

9.1 Applicable Standard:

Requirements: CFR 47, §2.1053

9.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D /Double Ridged Horn Antenna	296	03/30/2009
Schwarzbeck	BBHA 9120D /Double Ridged Horn Antenna	147	03/26/2010
Schwarzbeck	VULB 9160/ TRILOG Antenna	9160-3150	12/18/2010
Schwarzbeck	VULB 9160/ TRILOG Antenna	3125	05/16/2009
HD	MA240/ Antenna Position Tower	556	N/A
EMCO	1050/ Turn Table	114	N/A
HD GmbH	HD 100/ Controller	13	N/A
HD GmbH	KMS 560/ SlideBar	12	N/A
MITEQ	AMF-60-0010 1800-35-20P	1200937	05/20/2009
Schwarzbeck	BBHA9170/ SHF-EHF Horn Antenna	BBHA9170342	03/20/2009
Agilent	E7405A/EMI Receiver	US40240209	12/10/2009

9.3 Test Procedure

Radiated emission measurements were performed at an open Site.

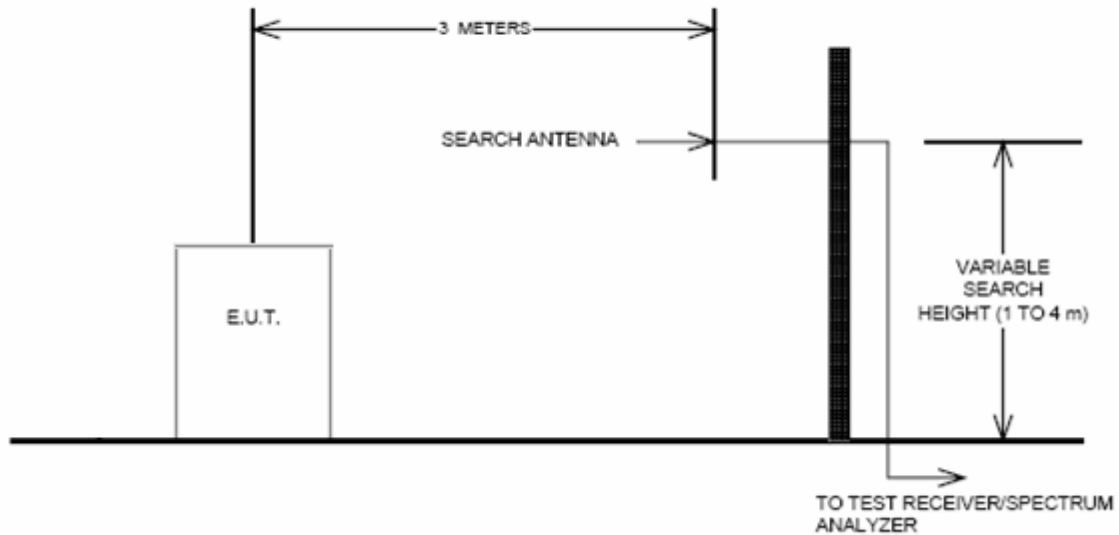
The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission.

A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated.

The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

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9.3.1 Radiated Spurious Emissions Test Setup



9.3.2 Environmental Conditions:

Temperature:	23 °C
Relative Humidity:	59 %

9.4 Test Result

: PASS (There were no emissions detected above the noise floor which was at least 20 dB below the limit.)

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10. FREQUENCY STABILITY

10.1 Applicable Standard

Requirements: FCC § 2.1055 (a), Part 27.54 following: The frequency stability shall be sufficient to ensure that the fundamental emissions stay

10.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Due Date
Agilent	Signal Analyzer	N9020A	US46220219	02/19/2010

10.3 Test Procedure

Frequency Stability over Temperature variation:

The equipment under test was connected to an external AC-DC power supply and the RF output was connected to a Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 30 minutes, the frequency output was recorded from the VSA8960 S/W via MXA Signal Analyzer.

Frequency stability over Voltage variation:

An external variable AC-DC power supply Source. The voltage was set to 85% and 115% of the nominal value.

The output frequency was recorded for each voltage.

10.3.1. Environmental conditions

Temperature:	25° C
Relative Humidity:	57 %

10.4. Test Result

: Pass

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10.4.1. Frequency Stability over Temperature and Voltage variation

Modulation: QPSK**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,083	0.0992
40	2,551,000,048	0.0574
30	2,551,000,072	0.0861
20	Reference	
10	2,551,000,029	0.0347
0	2,550,999,942	0.0693
-10	2,551,000,062	0.0741
-20	2,551,000,096	0.1148
-30	2,551,000,073	0.0873

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,551,000,071	0.0849
55.2	2,551,000,085	0.1016

(Output Port0 Middle CH)**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,064	0.0765
40	2,551,000,068	0.0813
30	2,550,999,912	0.1052
20	Reference	
10	2,551,000,073	0.0873
0	2,551,000,089	0.1064
-10	2,551,000,045	0.0538
-20	2,551,000,055	0.0657
-30	2,551,000,083	0.0992

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,550,999,937	0.0753
55.2	2,550,999,955	0.0657

(Output Port1 Middle CH)

Modulation: 16QAM**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,069	0.0825
40	2,551,000,082	0.0980
30	2,551,000,036	0.0430
20	Reference	
10	2,551,000,074	0.0885
0	2,550,999,890	0.1315
-10	2,551,000,054	0.1172
-20	2,551,000,061	0.0825
-30	2,551,000,058	0.1016

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,551,000,072	0.0169
55.2	2,550,999,015	0.1016

(Output Port0 Middle CH)**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,058	0.0861
40	2,551,000,083	0.0992
30	2,551,000,069	0.0825
20	Reference	
10	2,551,000,032	0.0383
0	2,551,000,087	0.1040
-10	2,551,000,067	0.0801
-20	2,551,000,076	0.0909
-30	2,551,000,047	0.0562

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,551,000,058	0.0693
55.2	2,551,000,048	0.0574

(Output Port1 Middle CH)

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Modulation: 64QAM**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,052	0.0622
40	2,551,000,058	0.0693
30	2,551,000,072	0.0861
20	Reference	
10	2,551,000,018	0.0215
0	2,551,000,051	0.0610
-10	2,551,000,076	0.0909
-20	2,551,000,068	0.0813
-30	2,551,000,046	0.0550

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,550,999,946	0.0646
55.2	2,551,000,073	0.0873

(Output Port0 Middle CH)**Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz**

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,551,000,058	0.0693
40	2,551,000,026	0.0311
30	2,551,000,060	0.0717
20	Reference	
10	2,551,000,038	0.0454
0	2,551,000,086	0.1028
-10	2,551,000,099	0.1183
-20	2,551,000,074	0.0885
-30	2,551,000,048	0.0574

Reference: - 48 Vdc at 20°C Freq. = 2551,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,551,000,060	0.0717
55.2	2,551,000,025	0.0299

(Output Port1 Middle CH)

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11. RF Exposure Statement

1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

(B) Limits for General Population/Uncontrolled Exposures

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
0.3 - 1.34.....	614	1.63	*(100)	30
1.34 - 30.....	824/f	2.19/f	*(180/ f ²)	30
30 - 300.....	27.5	0.073	0.2	30
300 - 1500.....			f/1500	30
1500 - 100.000.....			1.0	30

F = frequency in MHz

* = Plane-wave equivalent power density

2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

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Max Peak output Power at antenna input terminal	36.20000	dBm
Max Peak output Power at antenna input terminal	4168.69383	mW
Prediction distance	30.00000	cm
Prediction frequency	2501.00000	MHz
Antenna Gain(typical)	4.00000	dBi
Antenna Gain(numeric)	2.51189	–
Power density at prediction frequency (S)	0.92586	mW/cm ²
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm ²

3. RESULTS

The power density level at 30 cm is 0.92586 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at 2501 MHz.

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