

EMISSION TEST REPORT

Report Number: 3134983BOX-001a

Project Number: 3134983

Testing performed on the

MeshNode

Model: MG-5424L-200-R

To


FCC Part 15 Subpart C 15.247

For


Millennial Net, Inc.

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
Millennial Net, Inc.
23 Third Avenue
Burlington, MA 01803

Prepared by: 
Kouma Sinn

Date: 11/26/07

Reviewed by: 
Jeff Goulet

Date: 11/26/07

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1.0 Job Description**1.1 Client Information:**

This equipment under test (EUT) has been tested at the request of:

Company: Millennial Net, Inc.
23 Third Avenue
Burlington, MA 01803
Contact: Sokwoo Rhee
Telephone: 781-222-1030 ext. 236
Fax: 781-723-7774
Email: sokwoo@millennialnet.com

1.2 Equipment Under Test:

Equipment Type: MeshNode
Model Number(s): MG-5424L-200-R
Serial number(s): 0307371805
Manufacturer: Millennial Net, Inc.
EUT receive date: October 1, 2007
EUT received condition: A production unit was received with no visible damage.
Test start date: October 1, 2007
Test end date: November 20, 2007

1.3 Test Plan Reference:

Tested according to the standards listed and ANSI C63.4:2003

1.4 Test Configuration:**1.4.1 EUT Voltage Range:**

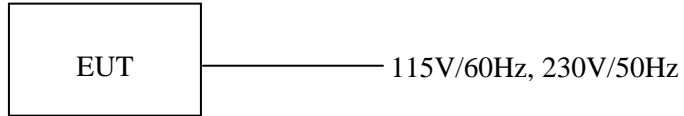
The EUT operates at a voltage range of 100-240V 50Hz/60Hz

Description	Shielding	Connector	Length (m)	Qty.
AC Adapter Cable	None	Plastic	2.0	1

1.4.2 Support Equipment:

Description	Manufacturer	Model	Serial No.
AC Adapter	Unifive	UL305-0905	405-0131487
Serial Cable	AMP	None	None

1.4.3 Block Diagram:



1.5 Mode(s) of Operation:

The EUT was transmitting continuously throughout testing.

1.6 Modifications Required For Compliance:

None

2.0 Test Summary:

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C 15.247		
SUB-TEST	TEST PARAMETER	COMMENT
Occupied Bandwidth FCC 15.247(a)(2)	The 6 dB bandwidth must be at least 500 kHz.	Pass
Maximum Peak Conducted Output Power FCC 15.247(b)(3-5)	The output power must not exceed 1 Watt (30 dBm) and 36 dBm EIRP.	Pass
Antenna Port Conducted Spurious Emissions FCC 15.209, 15.247(d)	The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc.	Pass
Radiated Spurious Emissions FCC 15.205, 15.209, 15.247(d)	The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209.	Pass
Peak Power Spectral Density FCC 15.247(e)	The peak power spectral density must not exceed 8 dBm / 3 kHz.	Pass
Band Edge Compliance FCC 15.215	The fundamental frequency must stay within the assigned frequency band.	Pass
AC Line-Conducted Emissions FCC 15.207	The AC line-conducted emissions must not exceed the limits of 15.207.	Pass

The channels selected for test were channels 11, 18, and 26.

Channel 11: 2405 MHz

Channel 18: 2440 MHz

Channel 26: 2480 MHz

REVISION SUMMARY – The following changes have been made to this Report:

<u>Date</u>	<u>Project</u>	<u>Project</u>	<u>Page(s)</u>	<u>Item</u>	Description of Change
	<u>No.</u>	<u>Handler</u>			

3.0 Sample Calculations:

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m}$$

4.0 Measurement Uncertainty:

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:
 ± 3.5 dB at 10m and ± 3.8 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

The expanded uncertainty ($k = 2$) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 3.2 for ISN and voltage probe measurements

± 3.1 for current probe measurements

5.0 Site Description:

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

Test Results: Pass

Test Standard: FCC 15.247(a)(2)

Test: Occupied Bandwidth

Performance Criterion: The 6 dB bandwidth must be at least 500 kHz.

EUT Operating Voltage: 115V/60Hz

Test Environment:

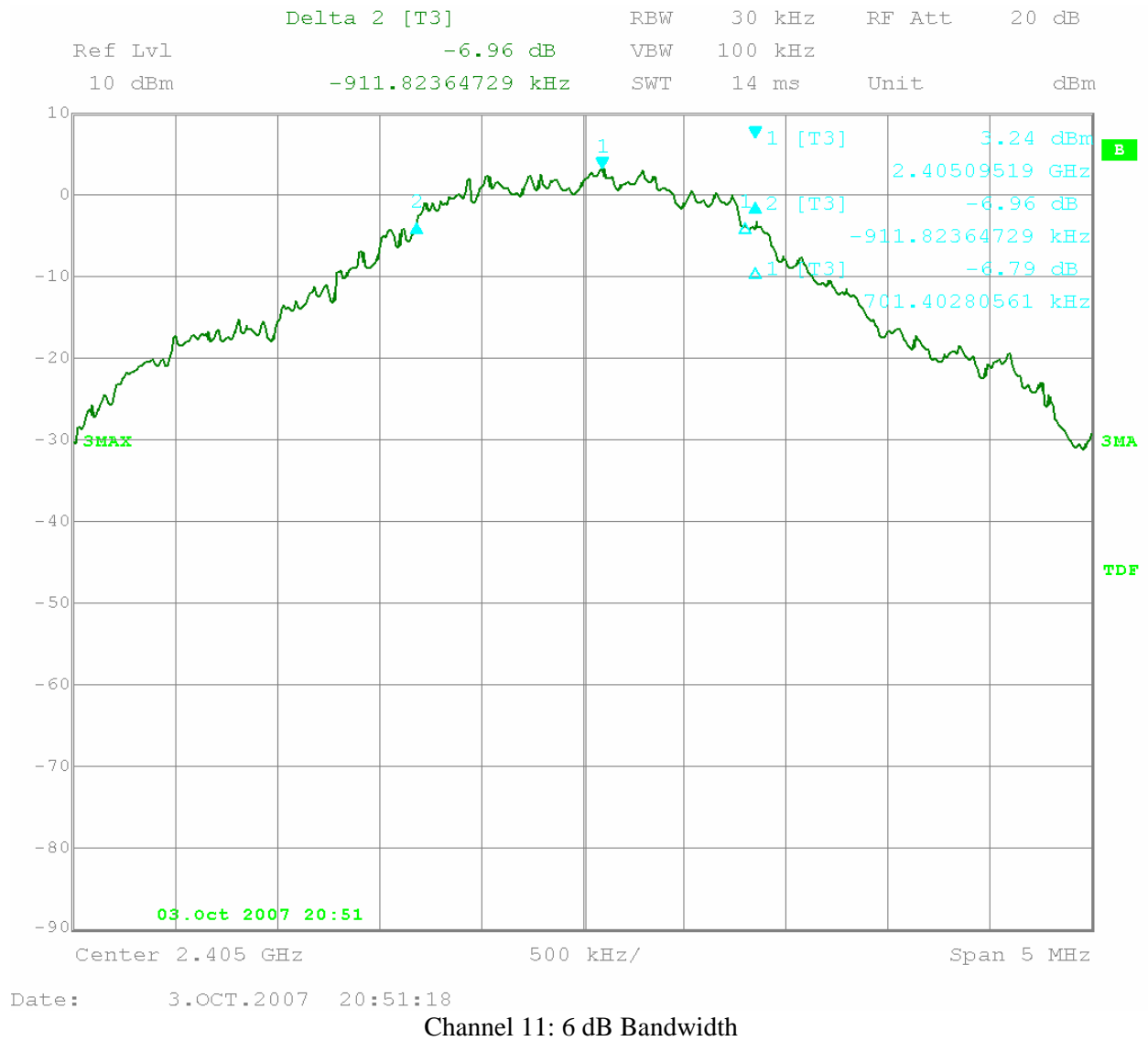
Environmental Conditions During Testing:	Humidity (%):	60	Pressure (hPa):	1050	Ambient (°C):	17
Pretest Verification Performed:		Yes		Equipment under Test:		MG-5424L-200-R

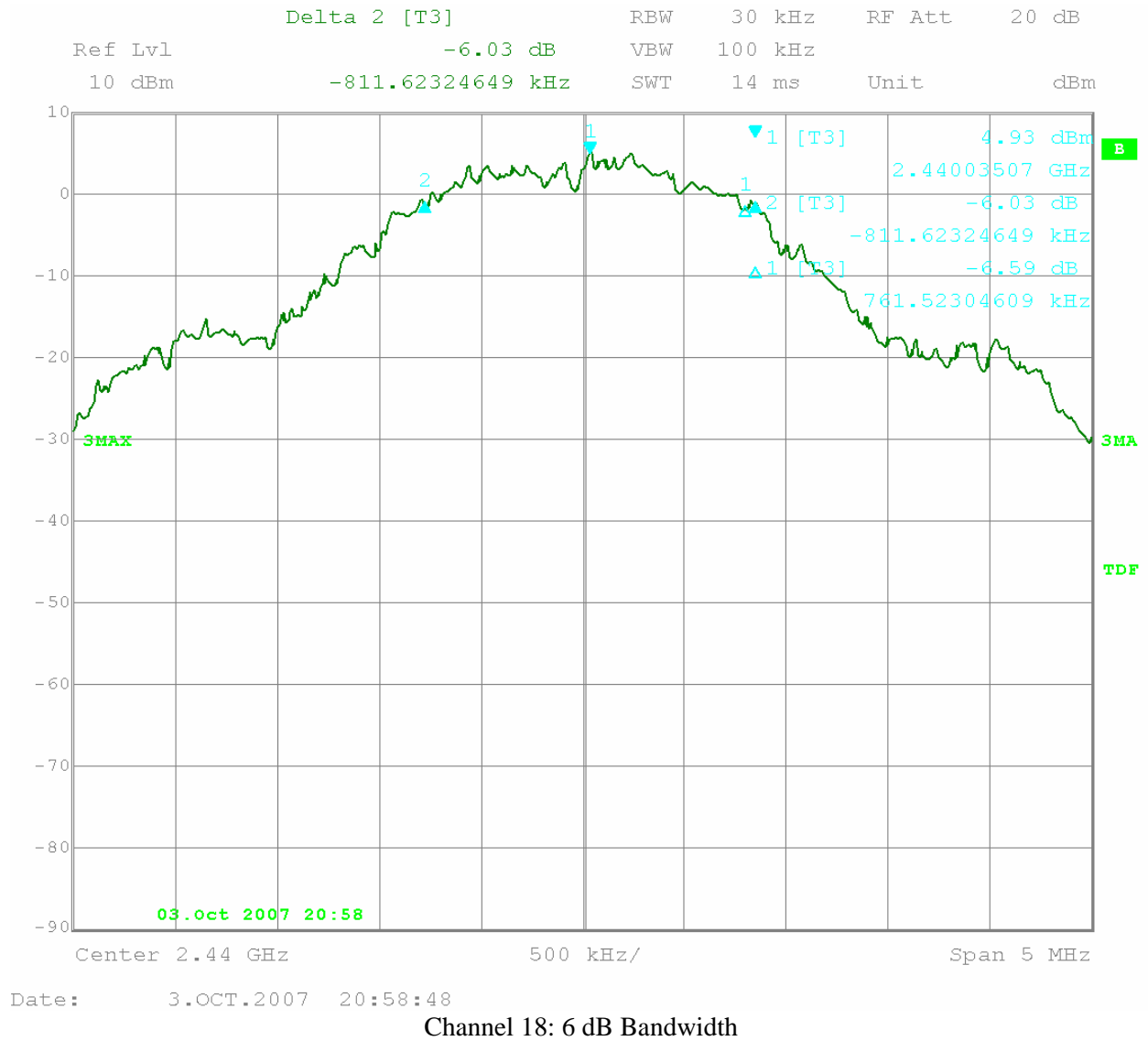
Test Equipment Used:

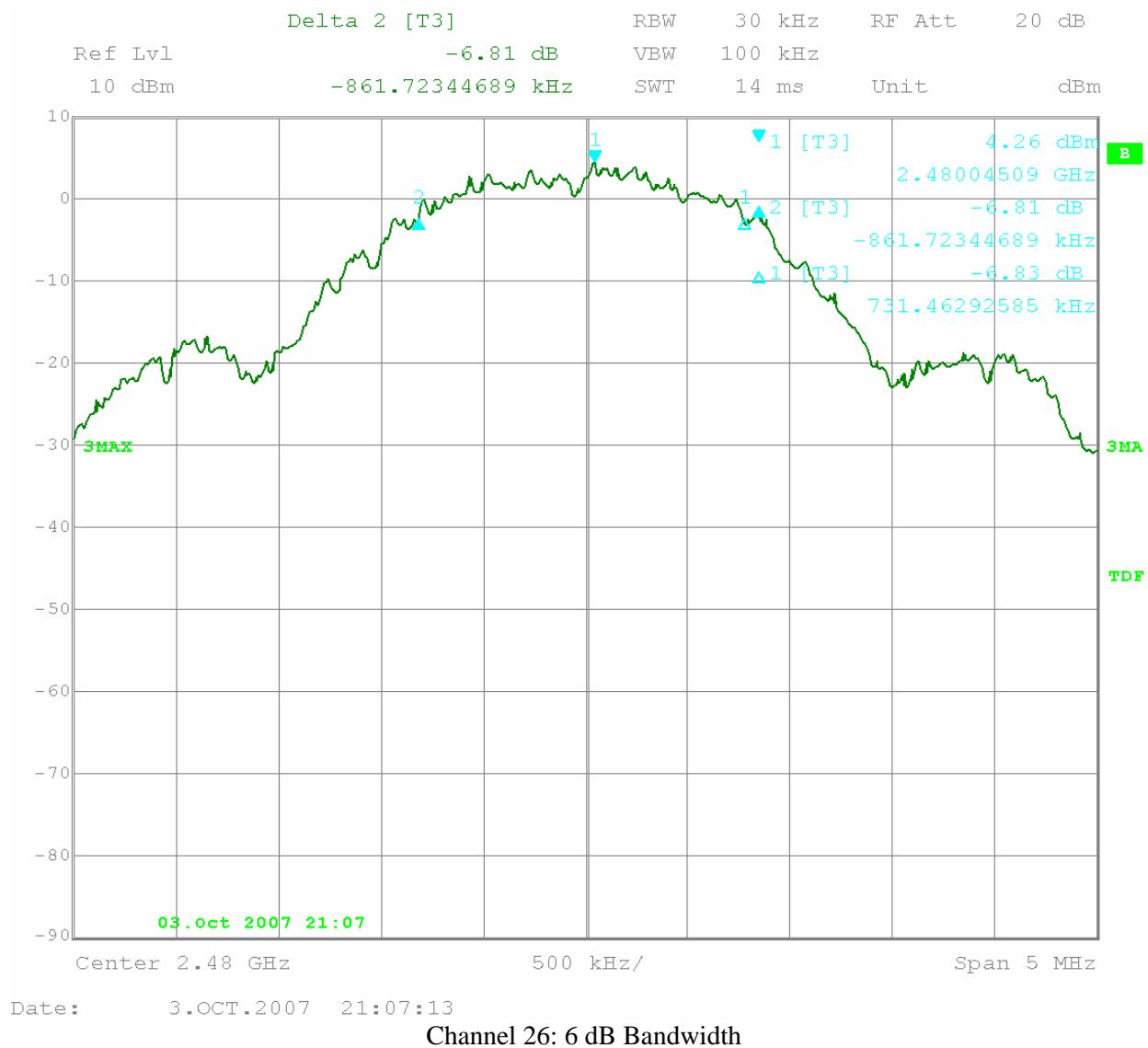
TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	OABA116	BAR2	05/20/2008
2	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	12/19/2007
3	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/04/2007

Test Details:

Channel	Frequency	6 dB Bandwidth
11	2405 MHz	1.613 MHz
18	2440 MHz	1.573 MHz
26	2480 MHz	1.593 MHz







Test Results: Pass

Test Standard: FCC 15.247(b)(3-5)

Test: Maximum Peak Conducted Output Power

Performance Criterion: The output power must not exceed 1 Watt (30 dBm) and 36 dBm EIRP.

EUT Operating Voltage: 115V/60Hz

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	65	Pressure (hPa):	1050	Ambient (°C):	20
Pretest Verification Performed:	Yes		Equipment under Test:	MG-5424L-200-R		

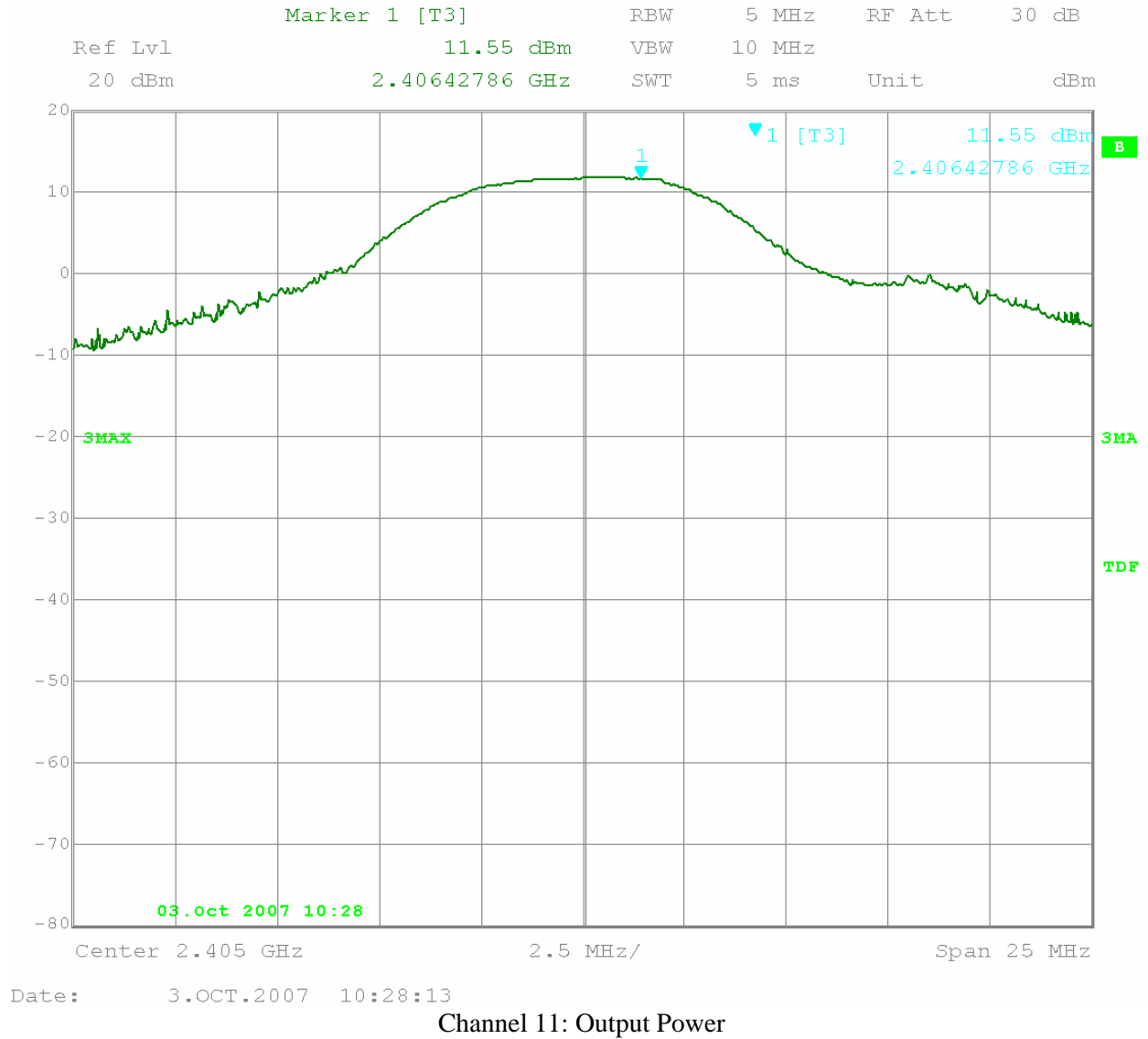
Test Equipment Used:

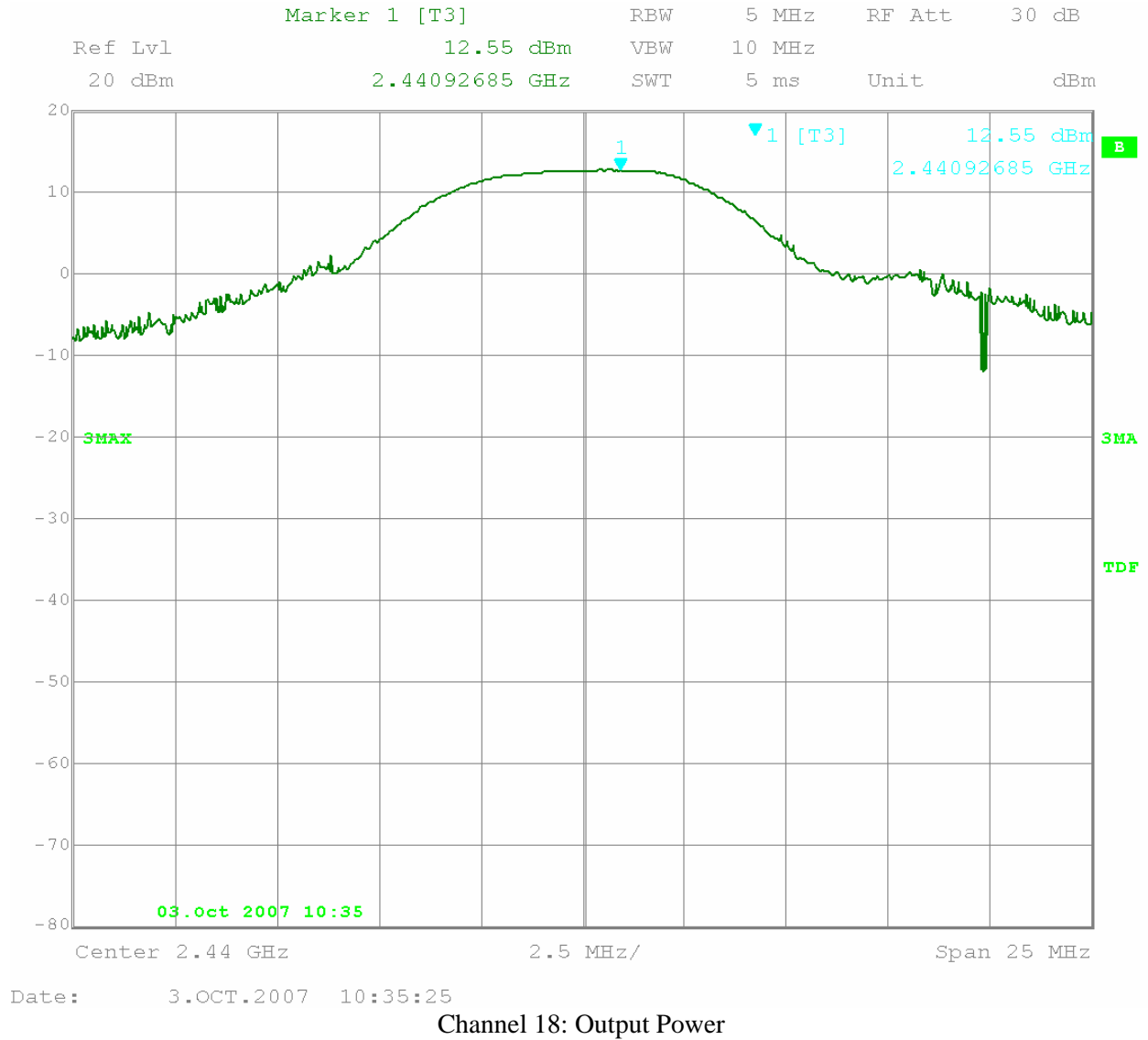
TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/04/2007
3	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007

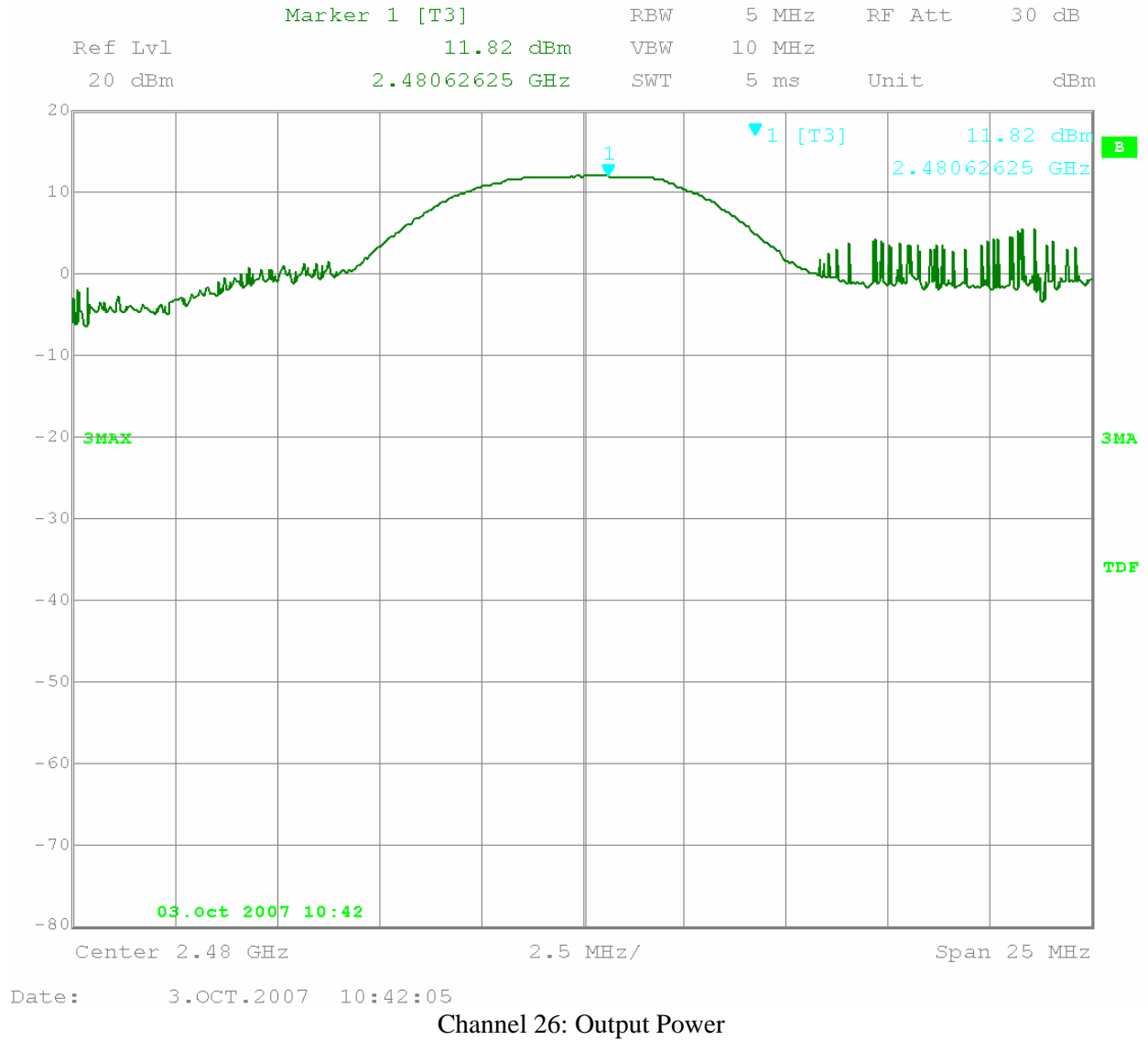
Test Details:

Notes: The cable loss was compensated for in the spectrum analyzer.

Channel	Frequency	Power	Limit	EIRP	EIRP Limit
11	2405 MHz	11.55 dBm	30.0 dBm	13.55 dBm	36.0 dBm
18	2440 MHz	12.55 dBm	30.0 dBm	14.55 dBm	36.0 dBm
26	2480 MHz	11.82 dBm	30.0 dBm	13.82 dBm	36.0 dBm







Test Results: Pass

Test Standard: FCC 15.209, 15.247(d)

Test: Antenna Port Conducted Spurious Emissions

Performance Criterion: The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc.

EUT Operating Voltage: 115V/60Hz

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	60	Pressure (hPa):	1050	Ambient (°C):	17
		26		1050		25
Pretest Verification Performed:	Yes		Equipment under Test:		MG-5424L-200-R	

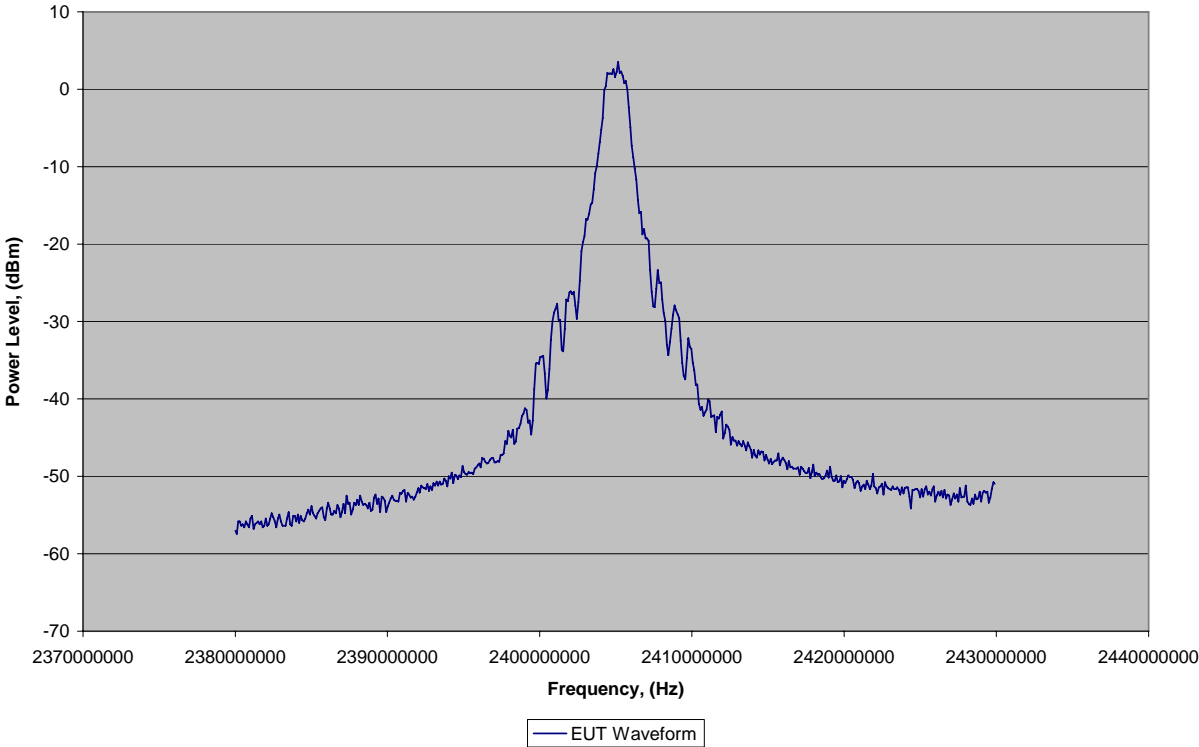
Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/04/2007
3	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007
4	Spectrum Analyzer	Hewlett Packard	8593A	3009A00659	10/08/2008

Test Details:

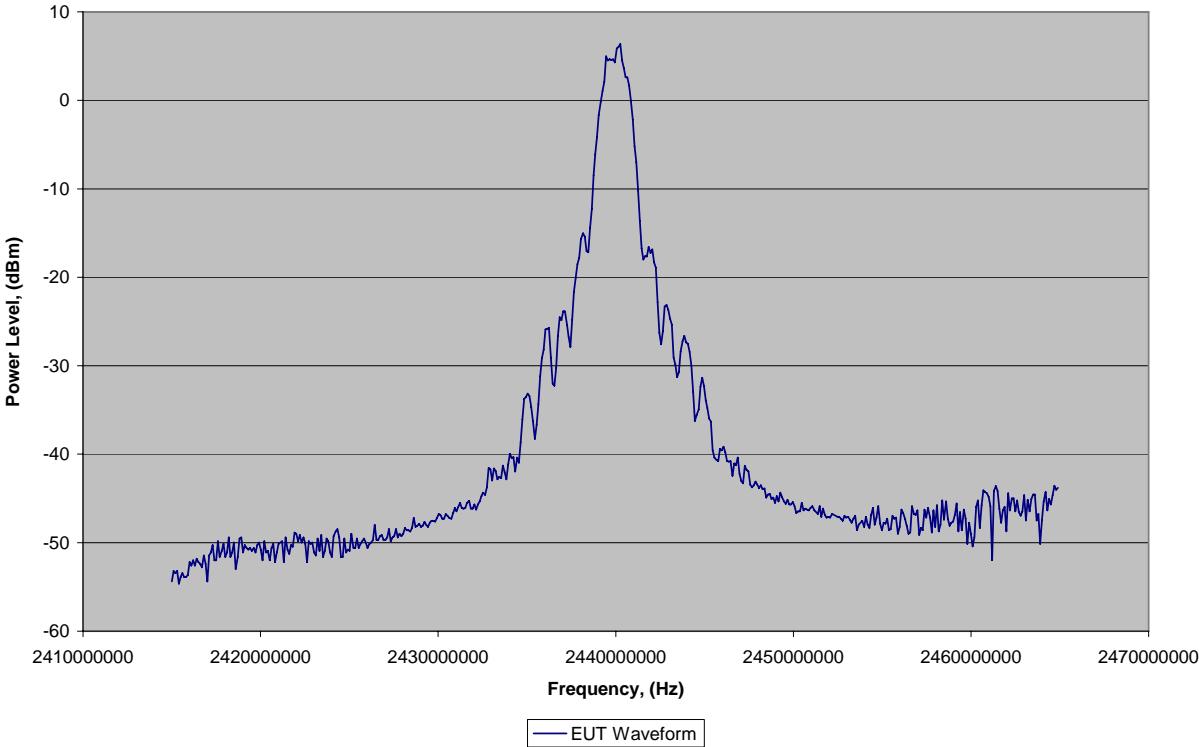
It can be seen from the plots that the spurious emissions are within the specified limits.

RF Power Trace, Channel 11, 27.036mW, 14.319dBm



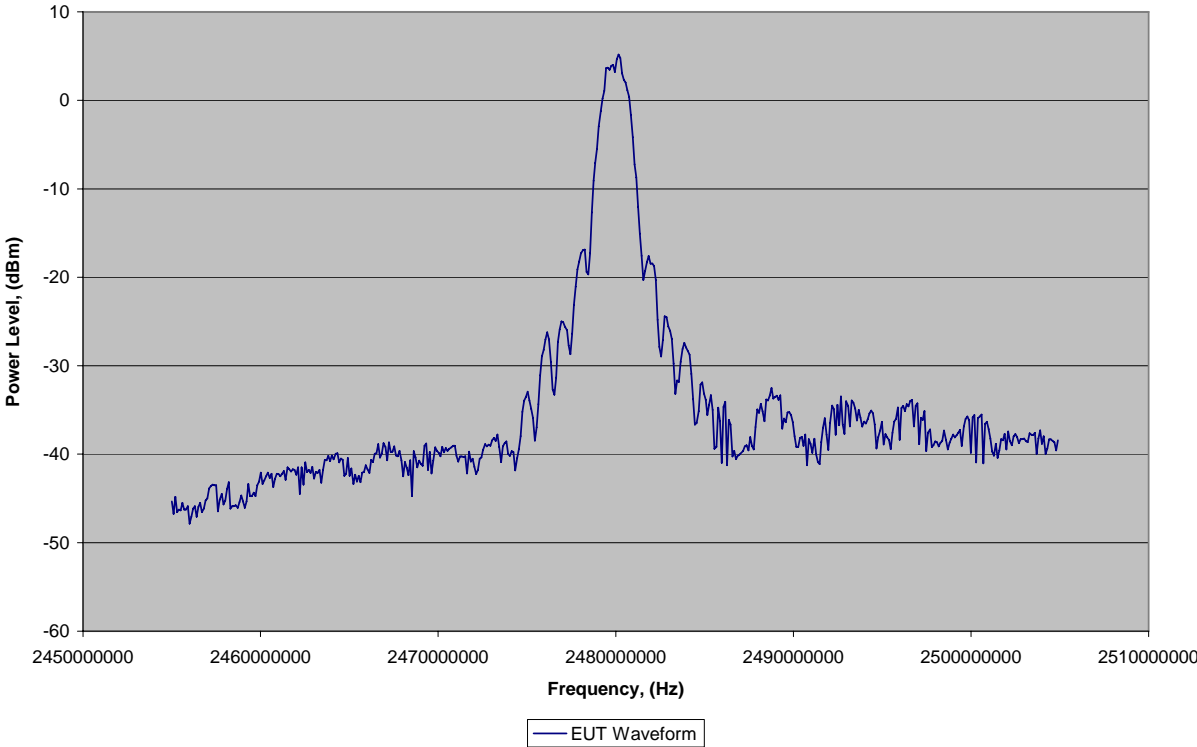
Channel 11: Maximum power with 100kHz ResBW

RF Power Trace, Channel 18, 47.922mW, 16.805dBm

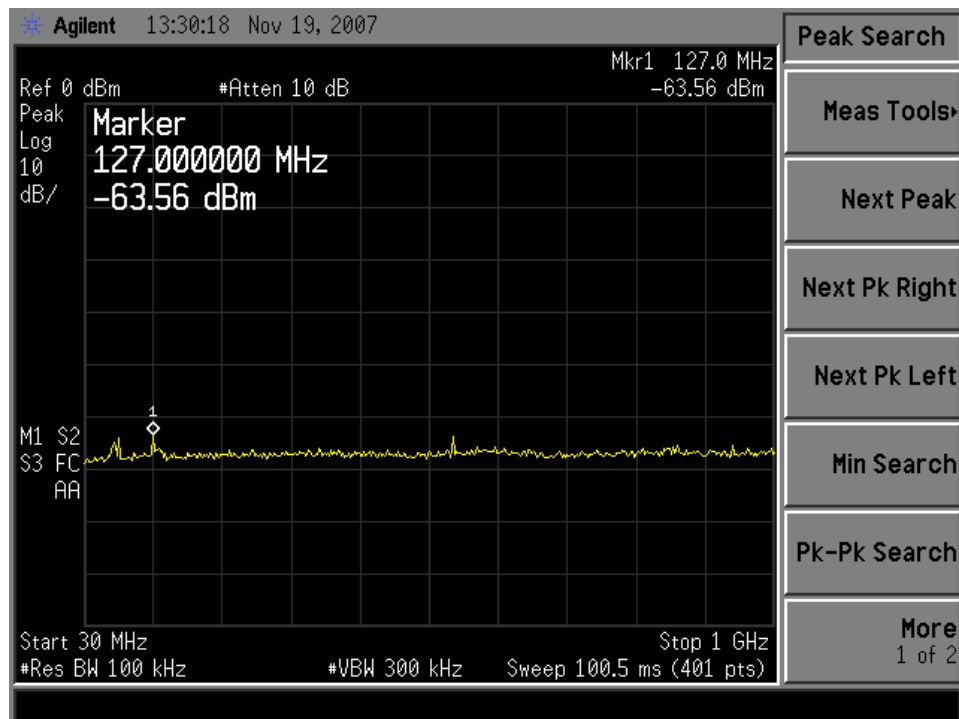


Channel 18: Maximum power with 100kHz ResBW

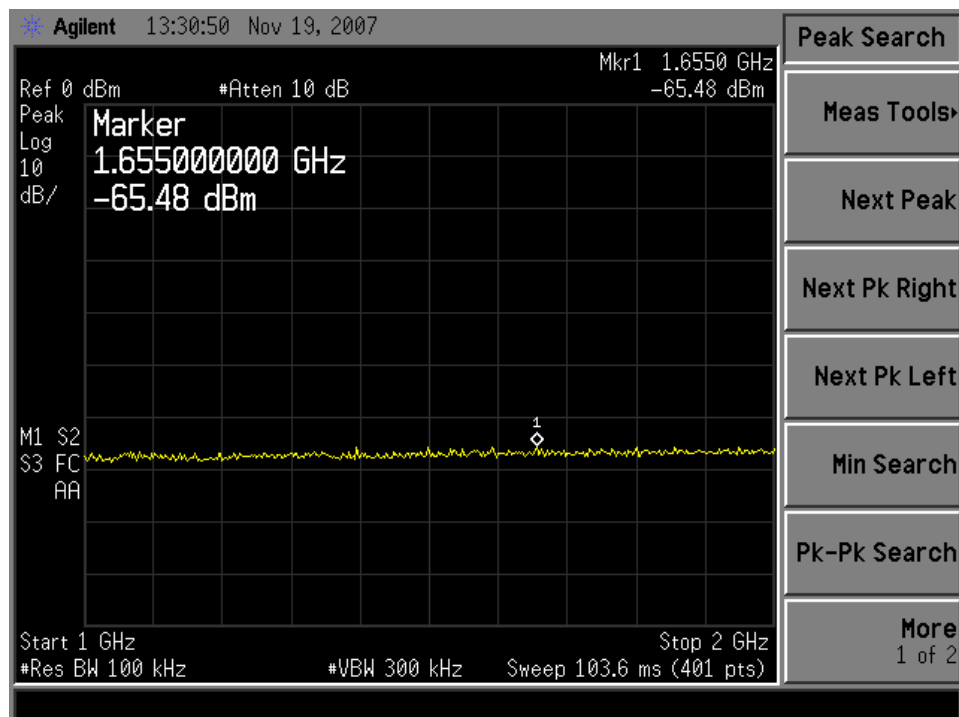
RF Power Trace, Channel 26, 36.993mW, 15.681dBm



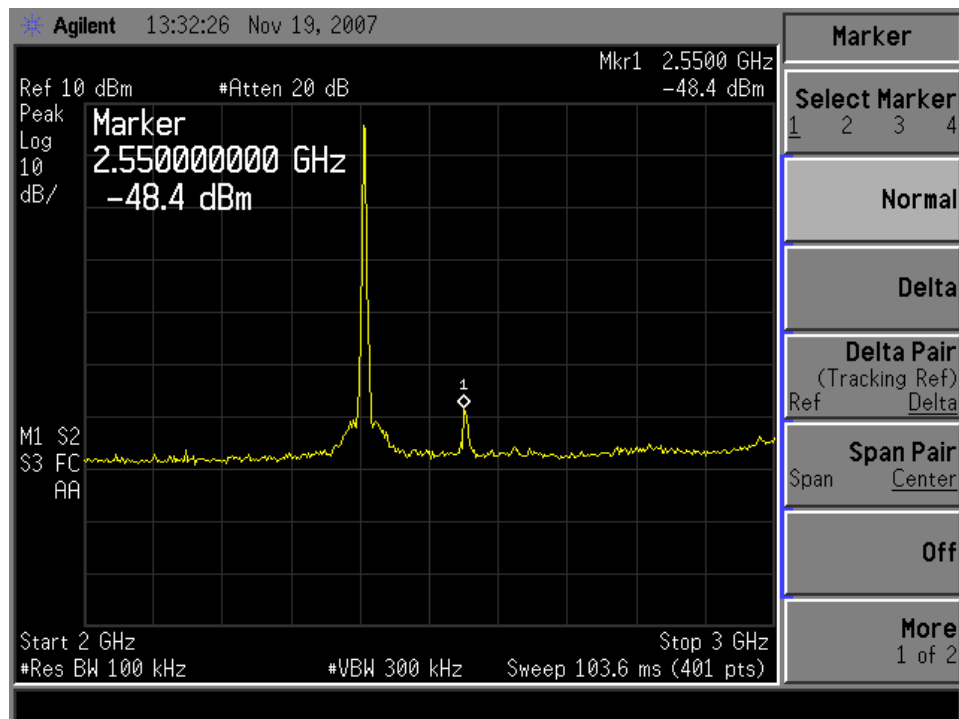
Channel 26: Maximum power with 100kHz ResBW



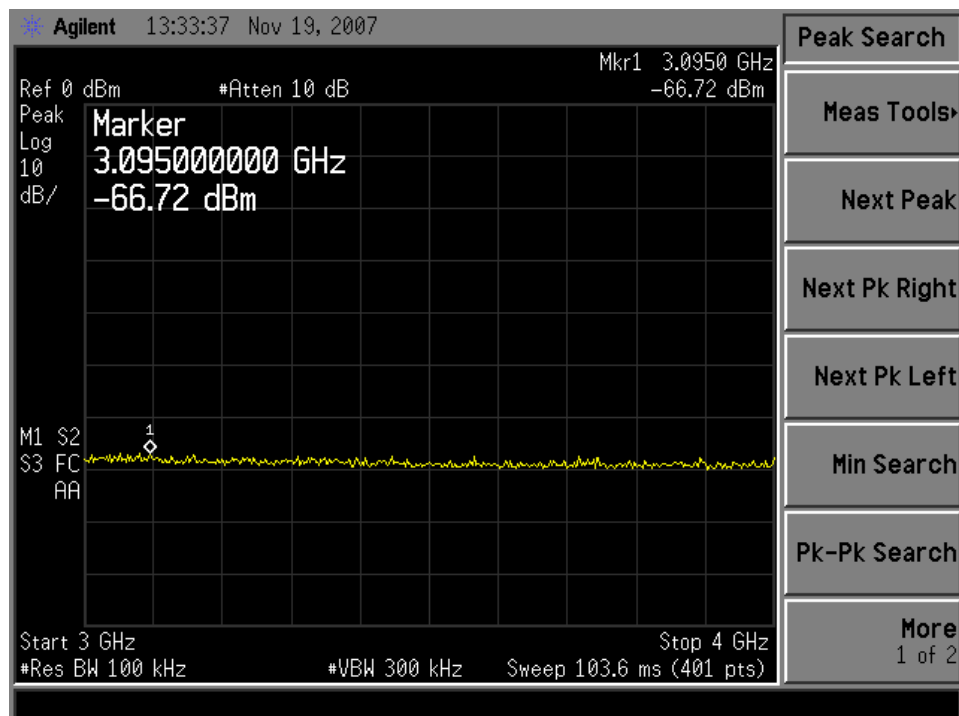
Channel 11: 30MHz -1GHz, Net reading with cable loss at 127.000MHz is -63.26dBm



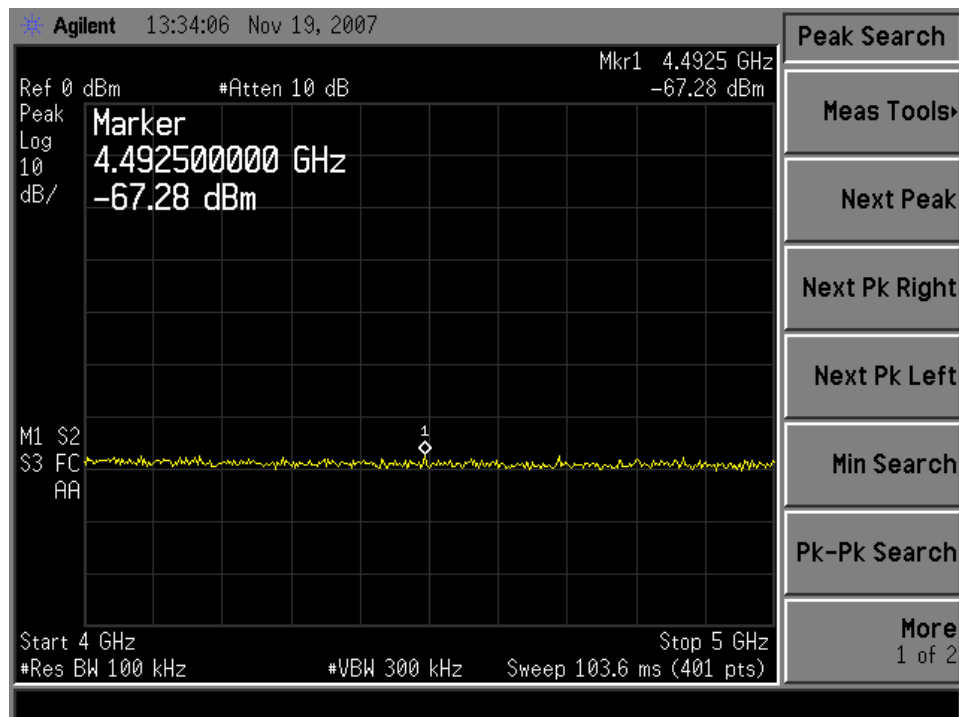
Channel 11: 1-2 GHz, Net reading with cable loss at 1.6550GHz is -64.48dBm



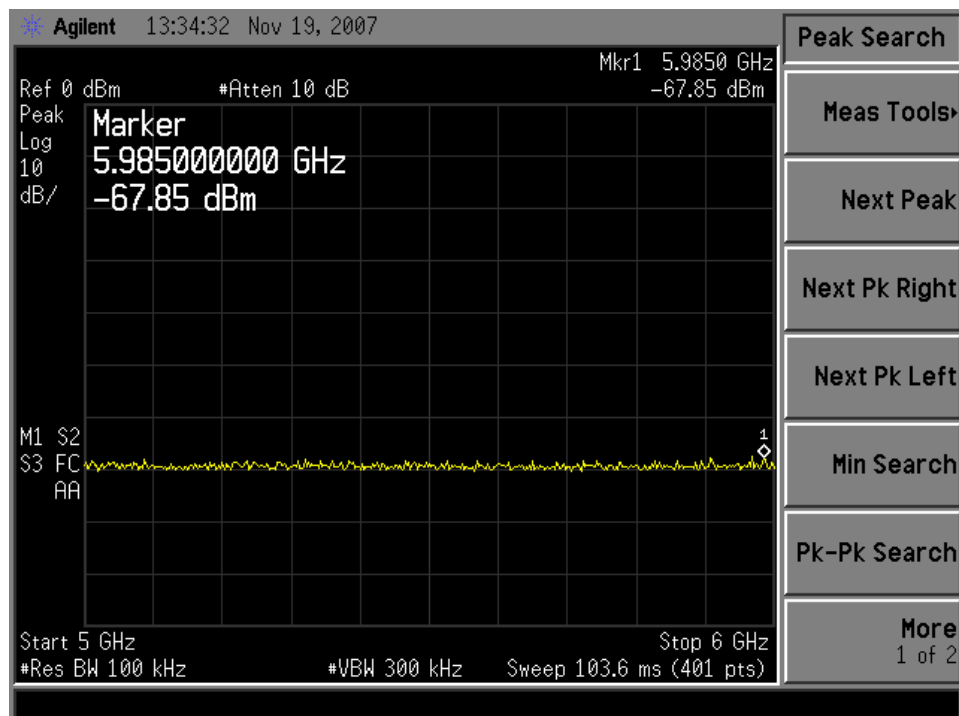
Channel 11: 2-3 GHz, Net reading with cable loss at 2.5500GHz is -46.8dBm



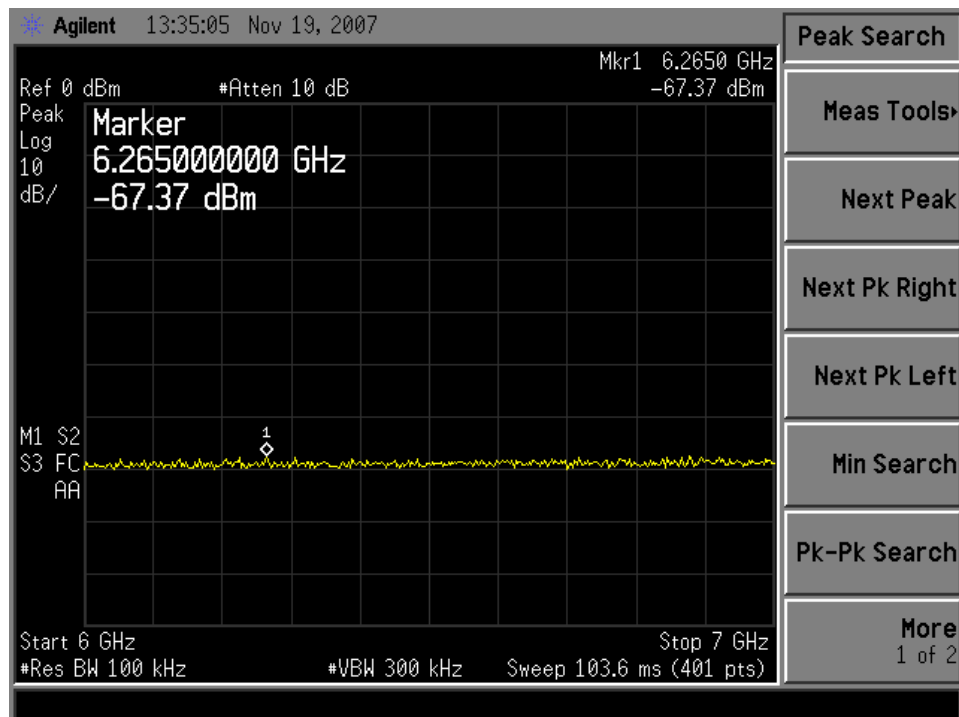
Channel 11: 3-4 GHz, Net reading with cable loss at 3.0950GHz is -65.22dBm



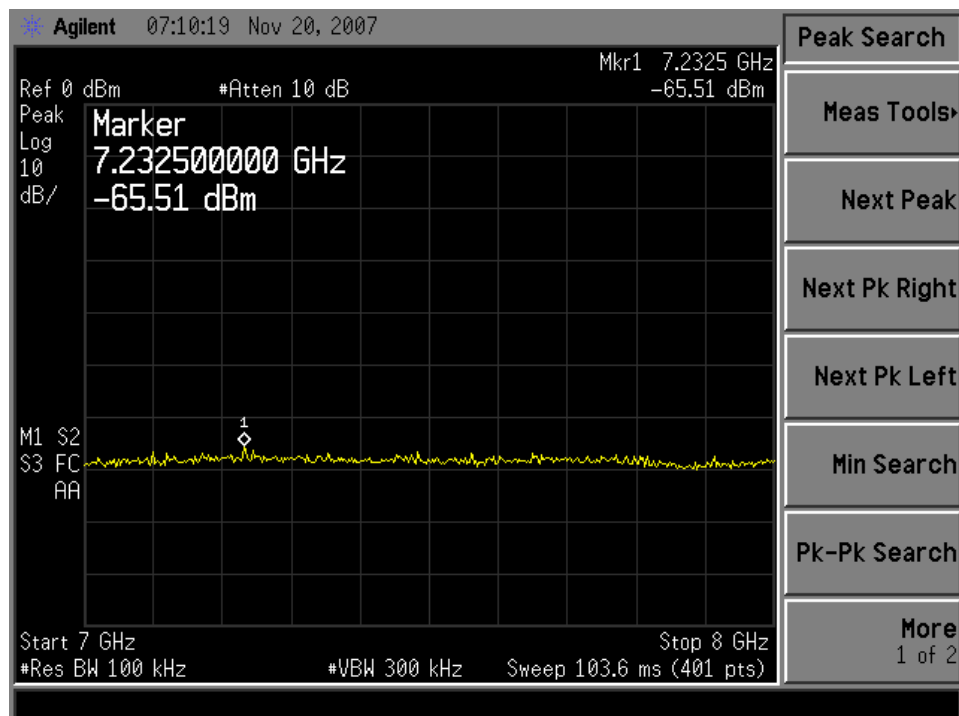
Channel 11: 4-5 GHz, Net reading with cable loss at 4.4925GHz is -65.48dBm



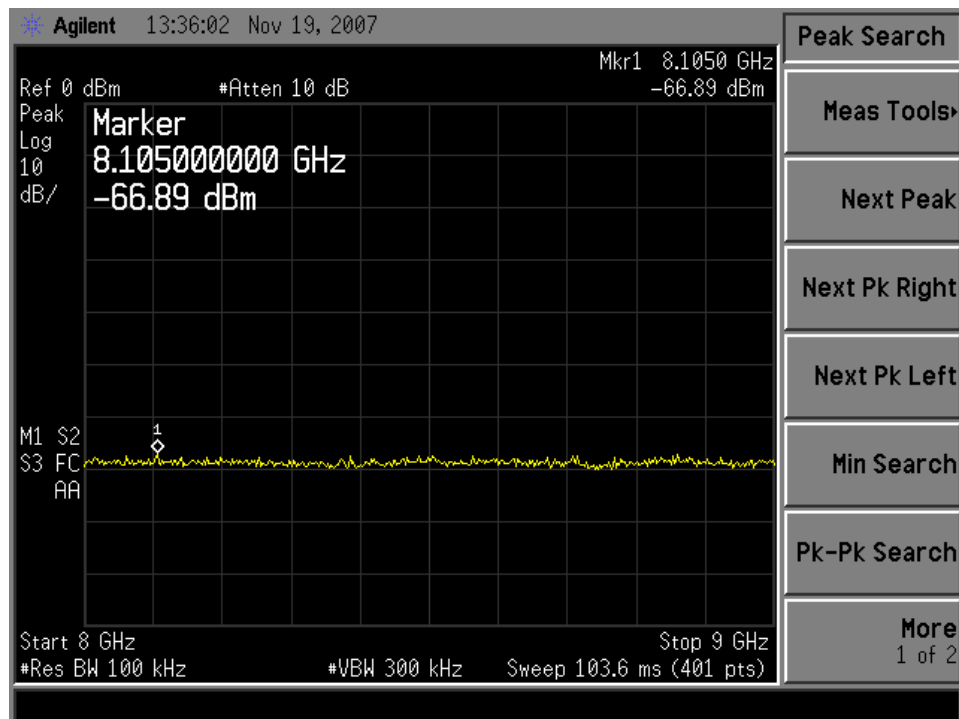
Channel 11: 5-6 GHz, Net reading with cable loss at 5.985GHz is -65.65dBm



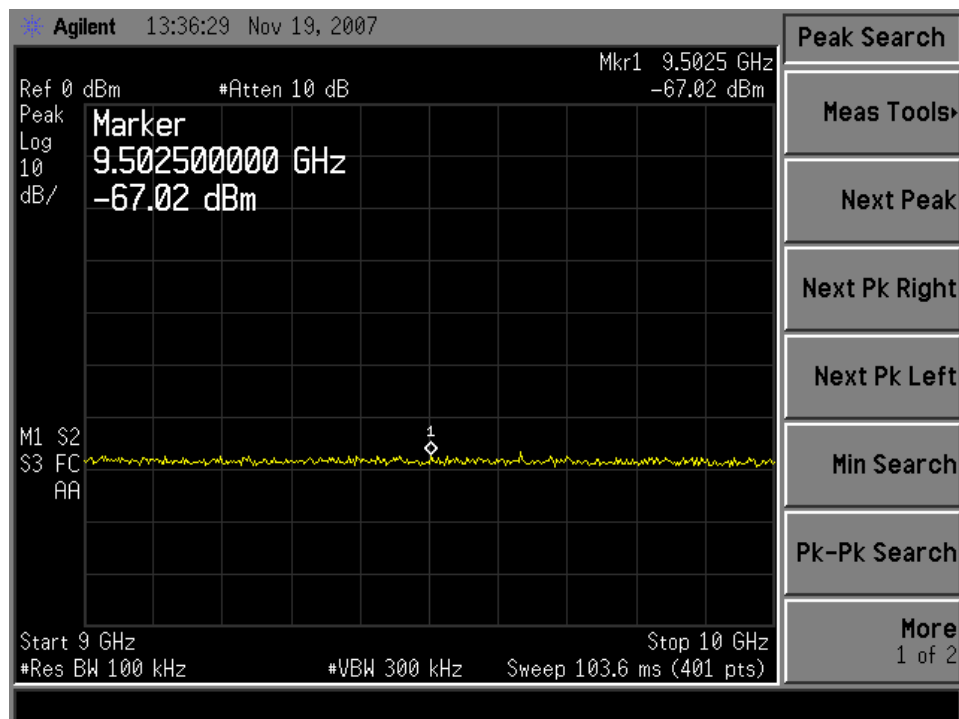
Channel 11: 6-7 GHz, Net reading with cable loss at 6.2650GHz is -65.17dBm



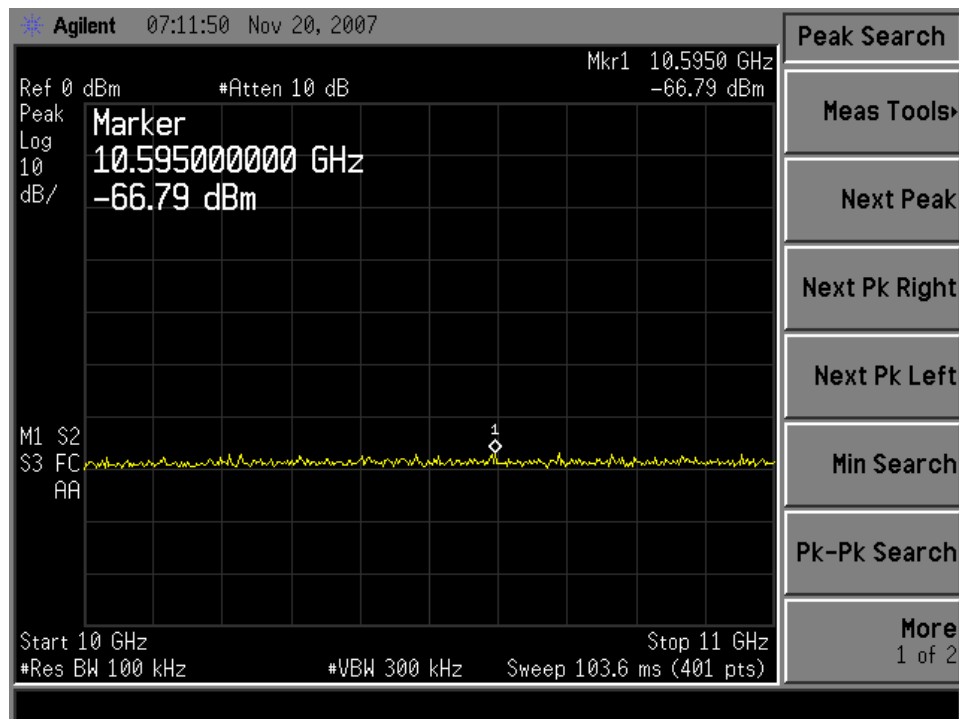
Channel 11: 7-8 GHz, Net reading with cable loss at 7.2325GHz is -63.11dBm



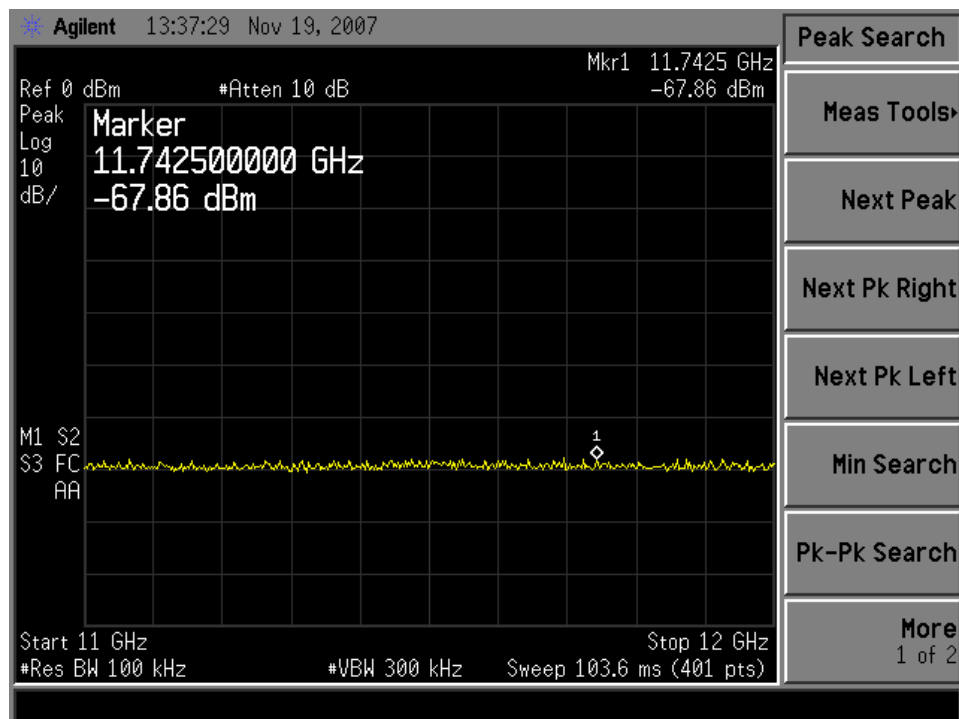
Channel 11: 8-9 GHz, Net reading with cable loss at 8.1050GHz is -64.29dBm



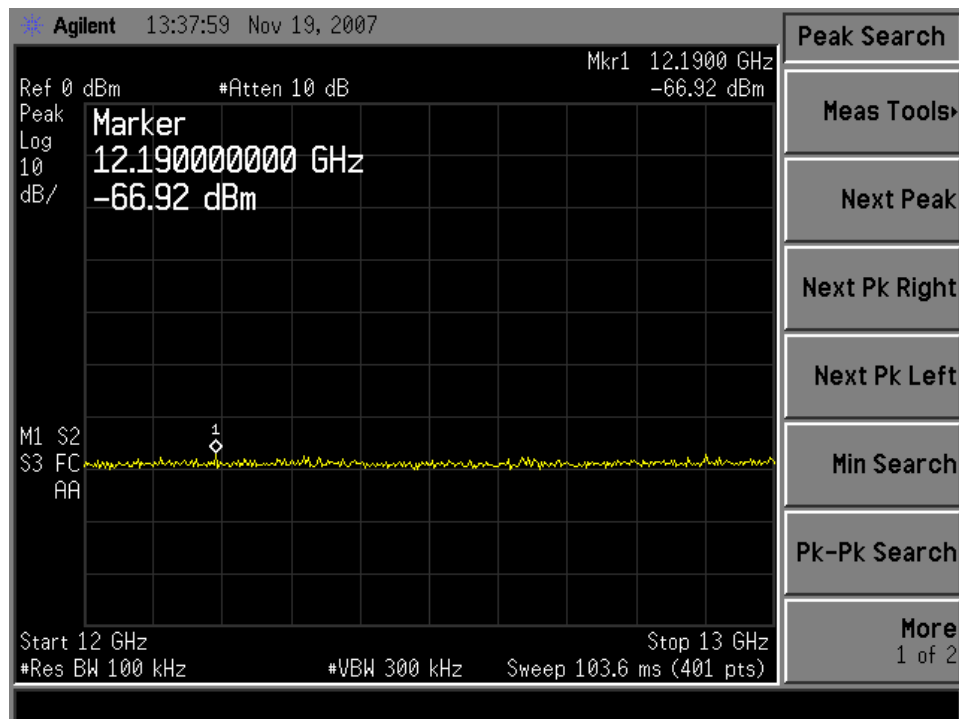
Channel 11: 9-10 GHz, Net reading with cable loss at 9.5025GHz is -64.22dBm



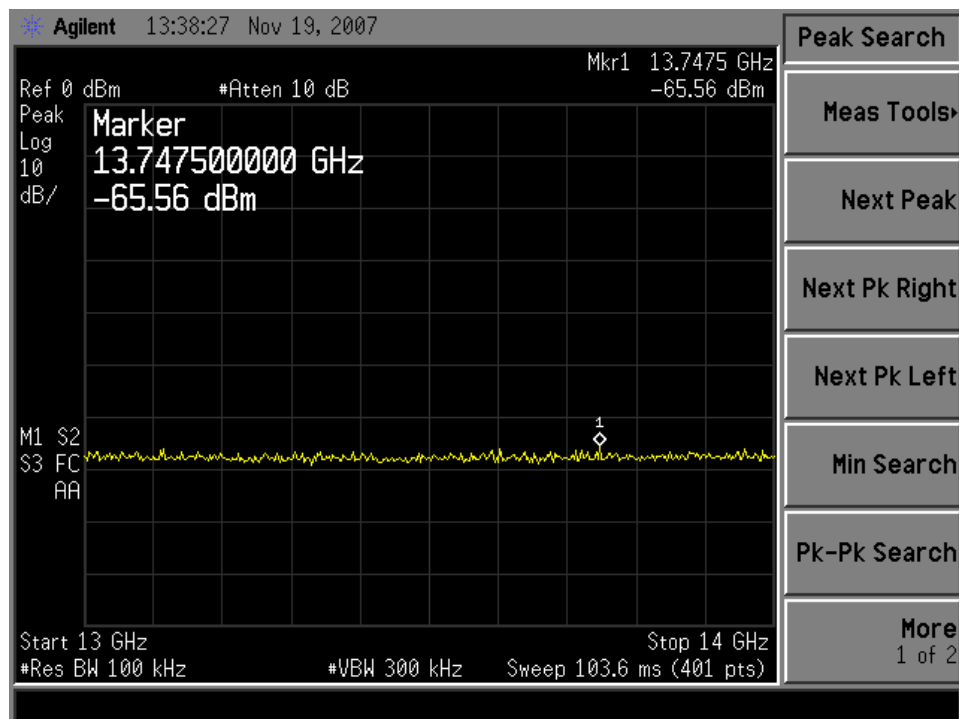
Channel 11: 10-11 GHz, Net reading with cable loss at 10.5950GHz is -63.79dBm



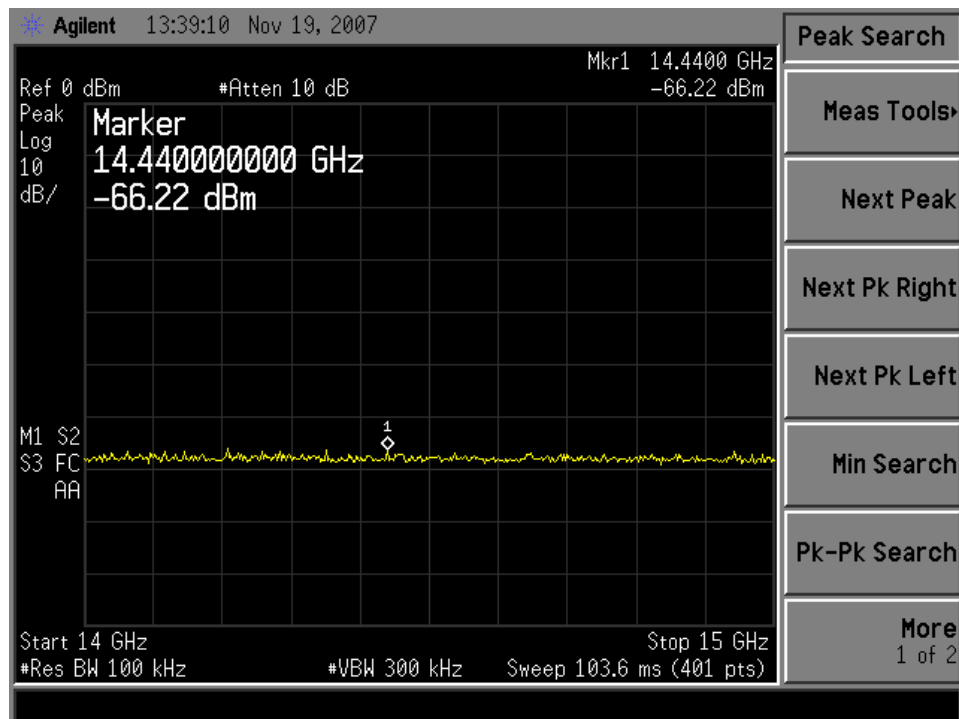
Channel 11: 11-12 GHz, Net reading with cable loss at 11.7425GHz is -64.66dBm



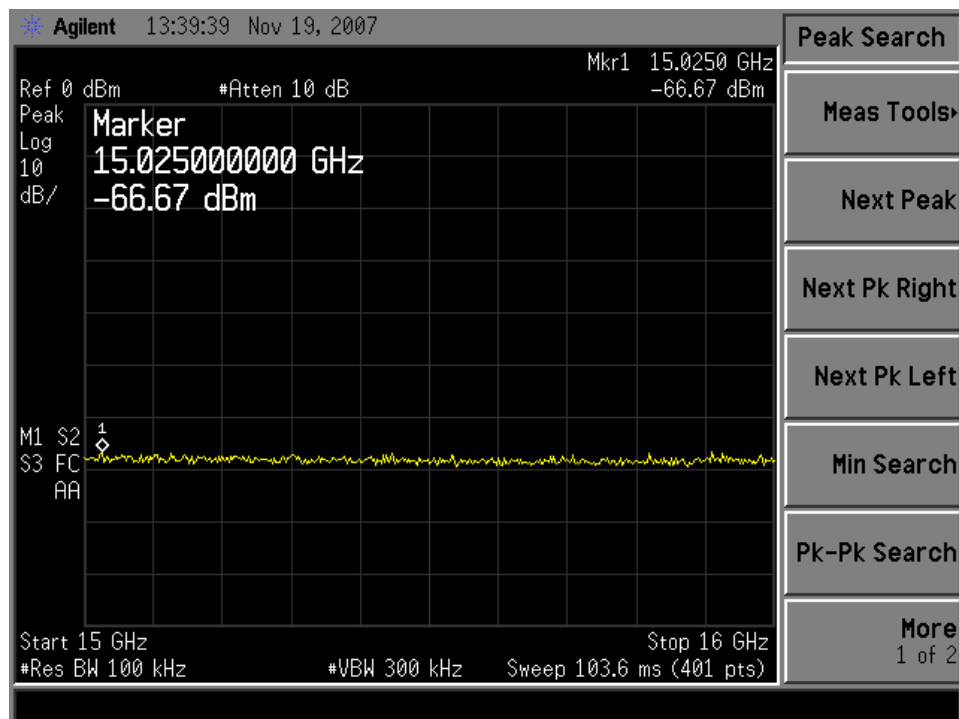
Channel 11: 12-13 GHz, Net reading with cable loss at 12.1900GHz is -63.62dBm



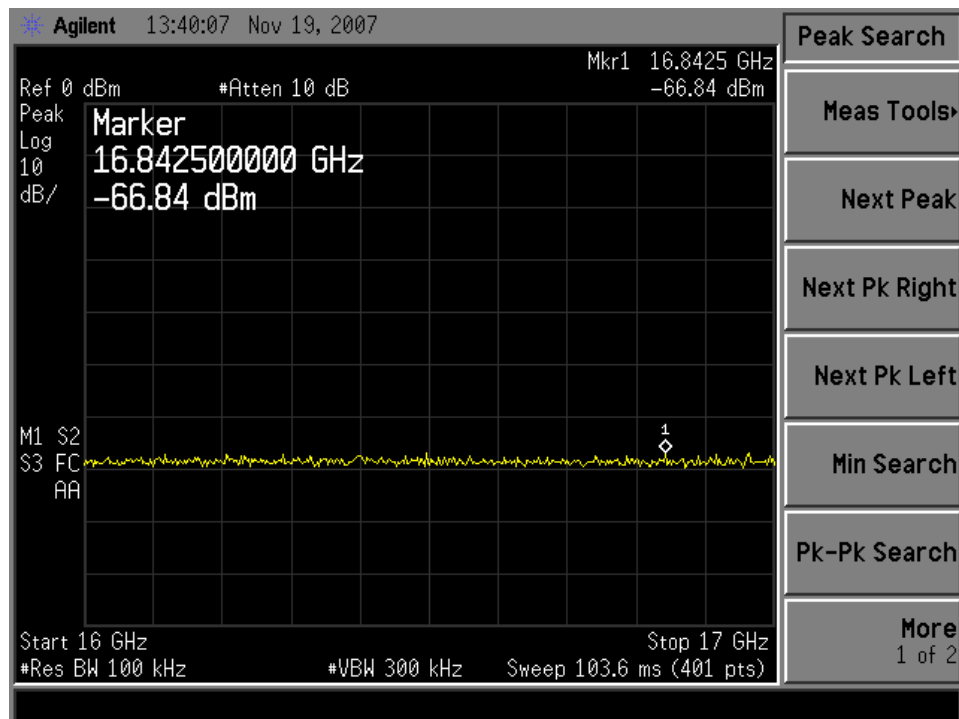
Channel 11: 13-14 GHz, Net reading with cable loss at 13.7475GHz is -62.06dBm



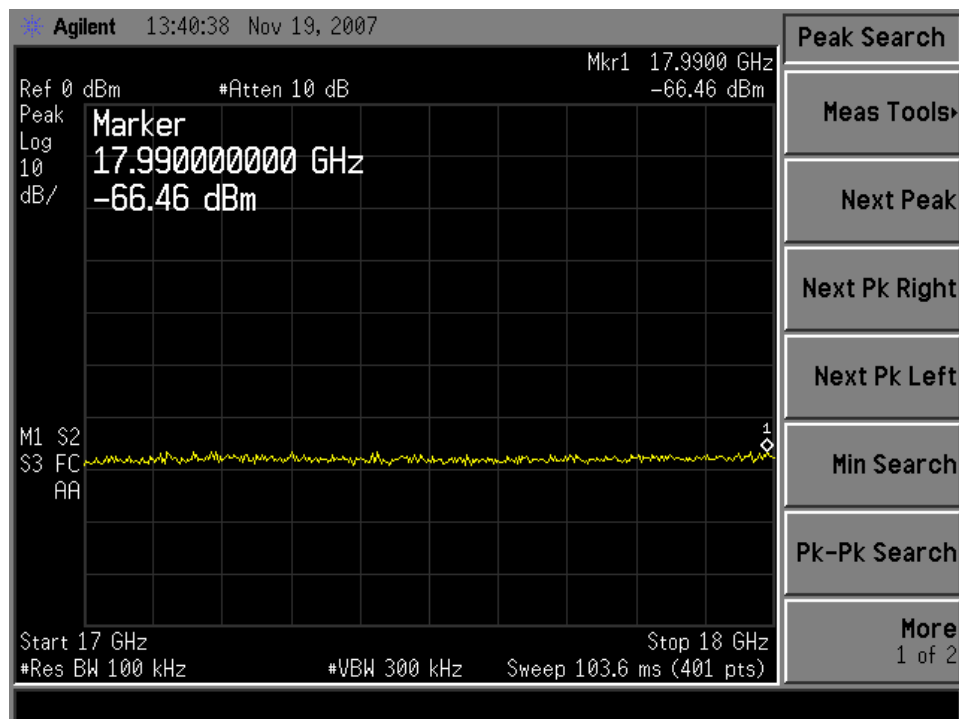
Channel 11: 14-15 GHz, Net reading with cable loss at 14.4400GHz is -62.62dBm



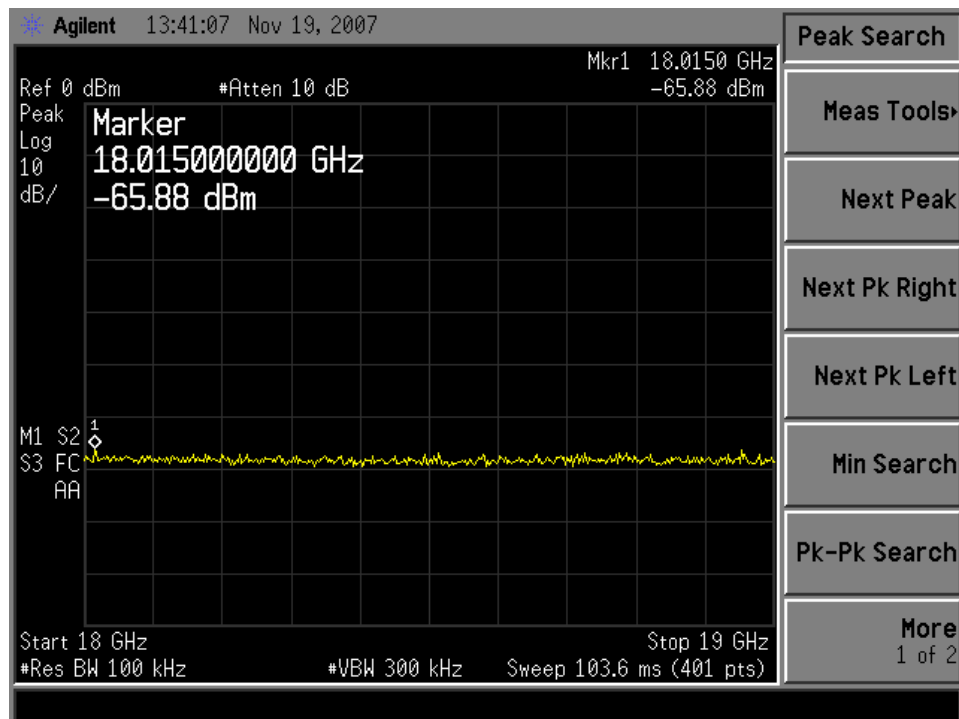
Channel 11: 15-16 GHz, Net reading with cable loss at 15.0250GHz is -62.97dBm



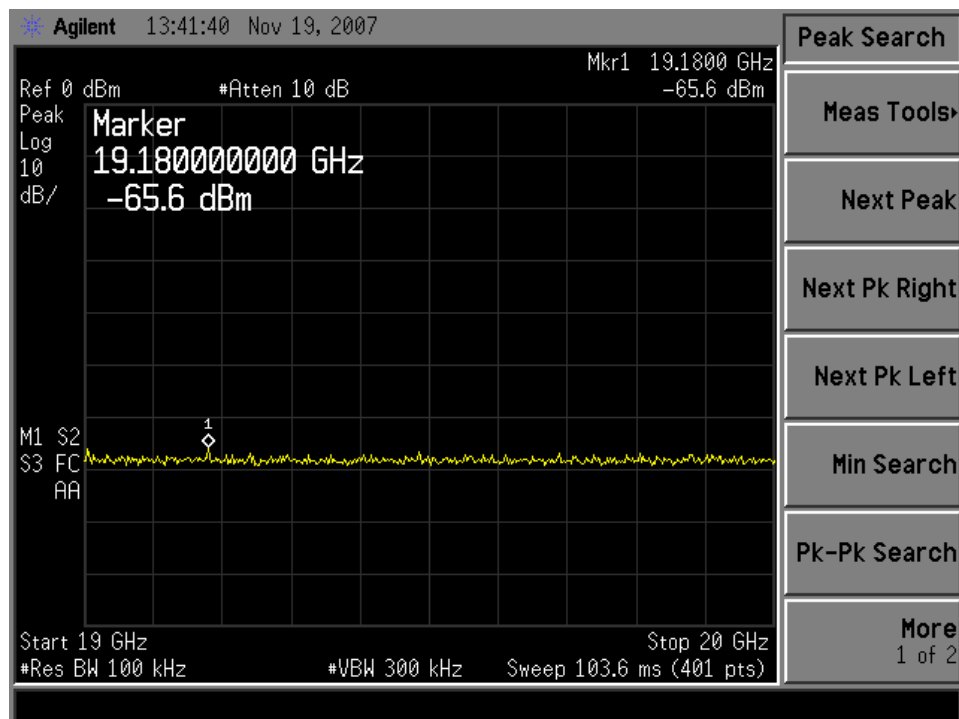
Channel 11: 16-17 GHz, Net reading with cable loss at 16.8425GHz is -62.84dBm



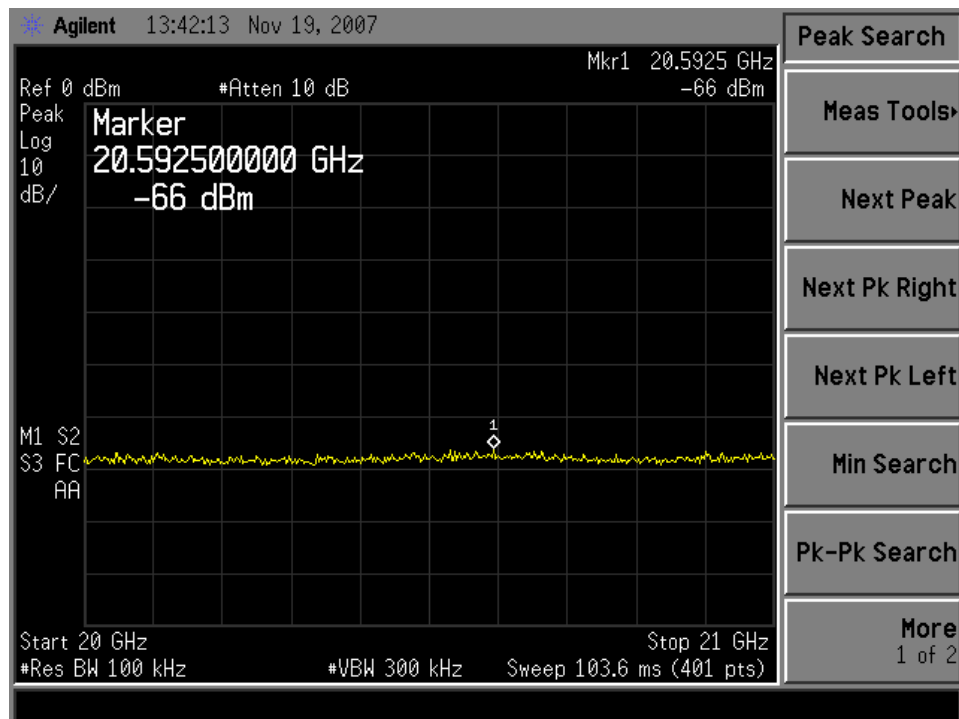
Channel 11: 17-18GHz, Net reading with cable loss at 17.9900GHz is -62.46dBm



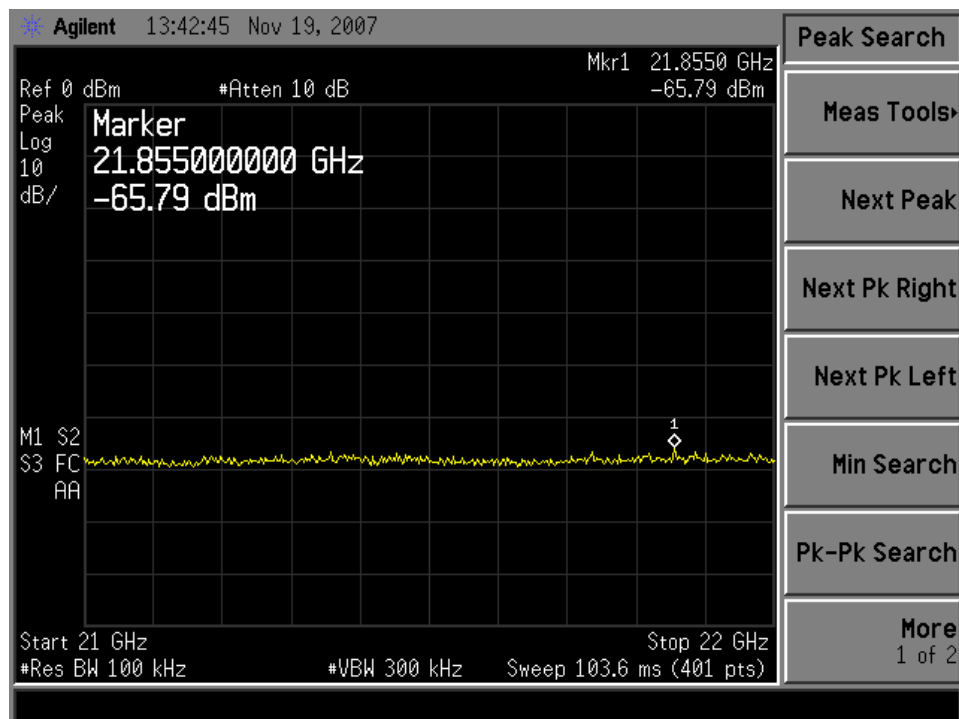
Channel 11: 18-19GHz, Net reading with cable loss at 18.0150GHz is -61.88dBm



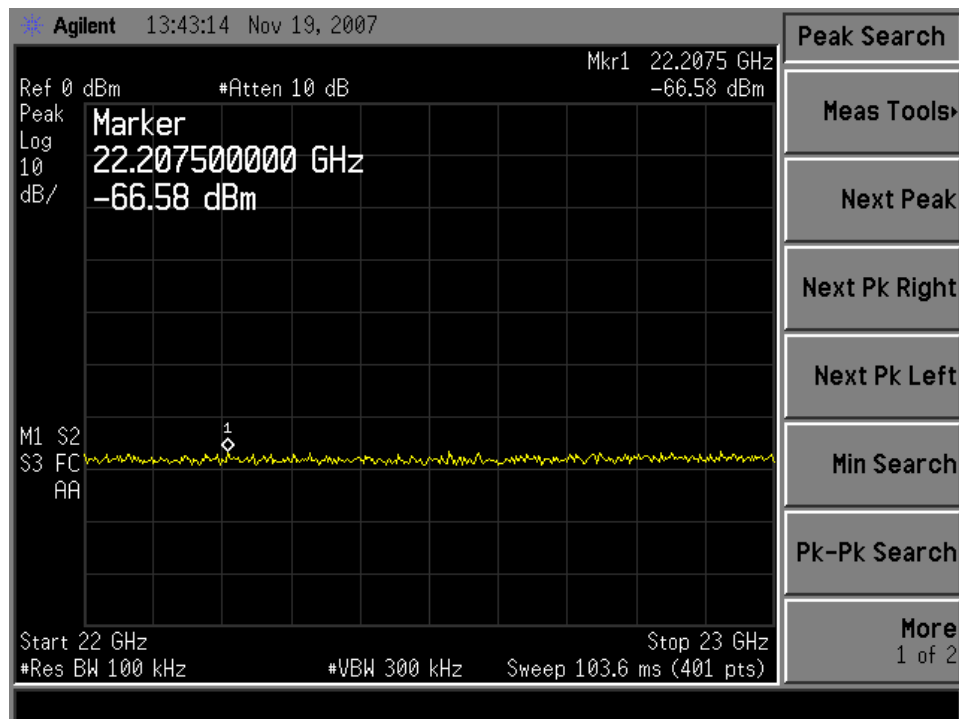
Channel 11: 19-20GHz, Net reading with cable loss at 19.1800GHz is -61.3dBm



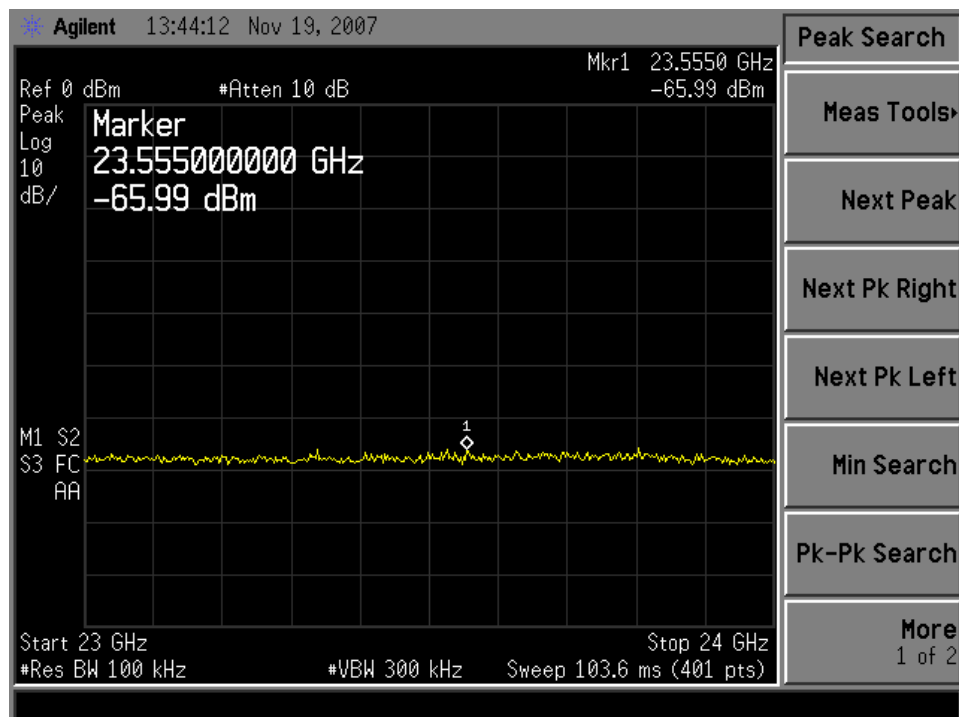
Channel 11: 20-21GHz, Net reading with cable loss at 20.5925GHz is -61.4dBm



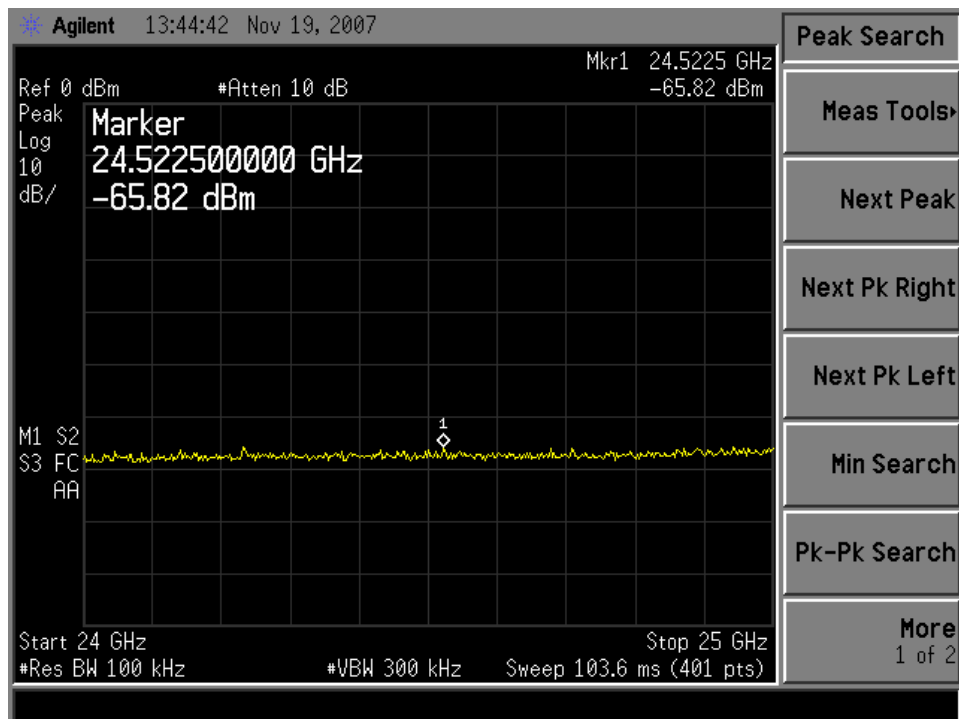
Channel 11: 21-22GHz, Net reading with cable loss at 21.8550GHz is -60.99dBm



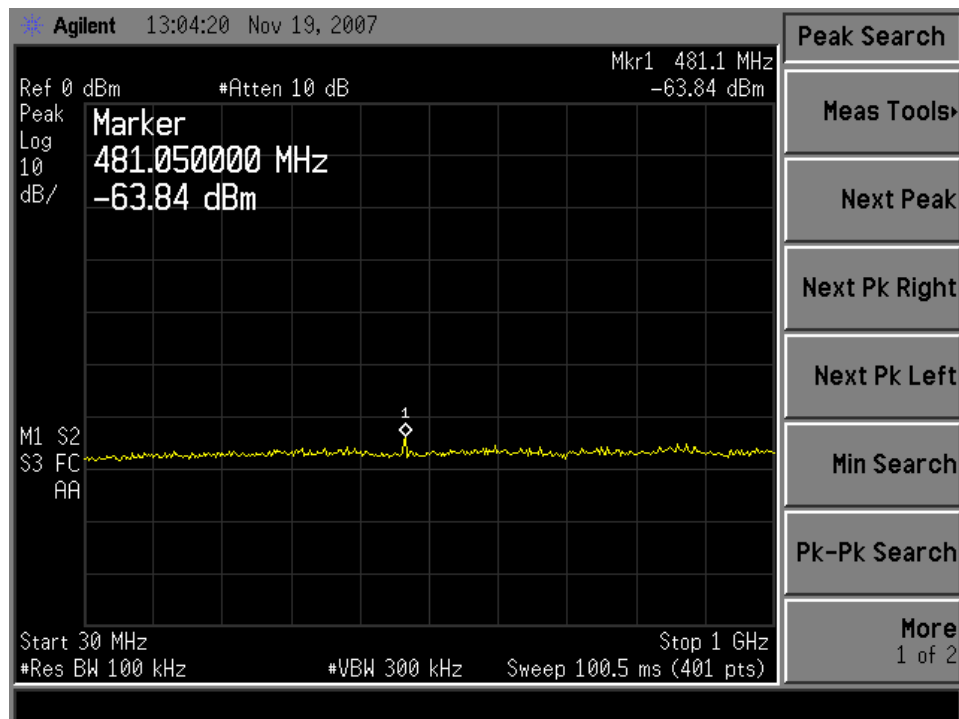
Channel 11: 22-23GHz, Net reading with cable loss at 22.2070GHz is -61.68dBm



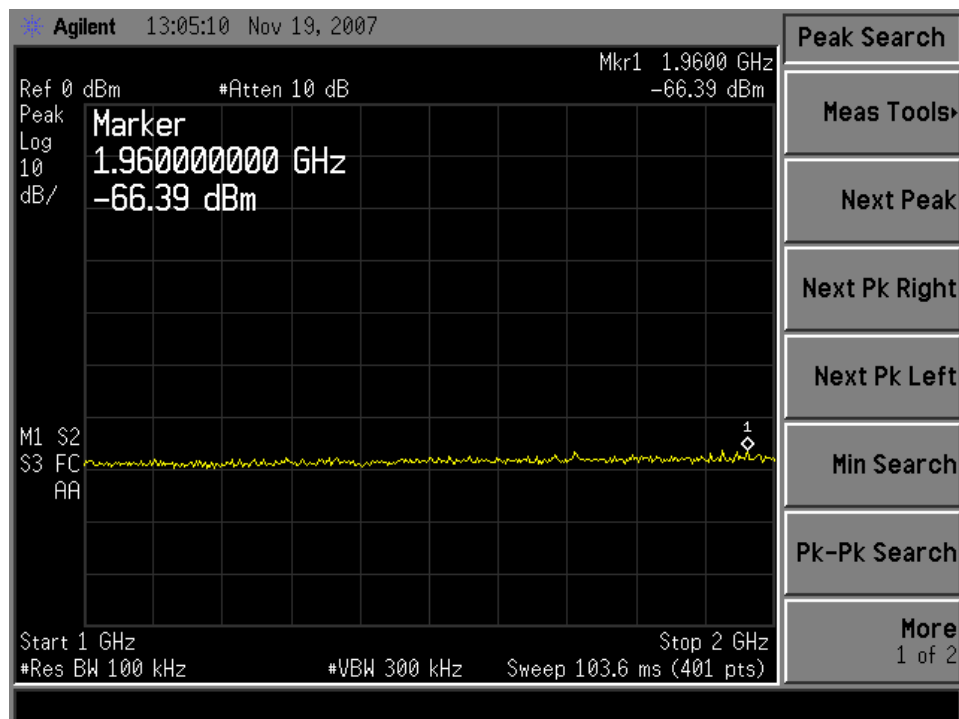
Channel 11: 23-24GHz, Net reading with cable loss at 23.5550GHz is -60.99dBm



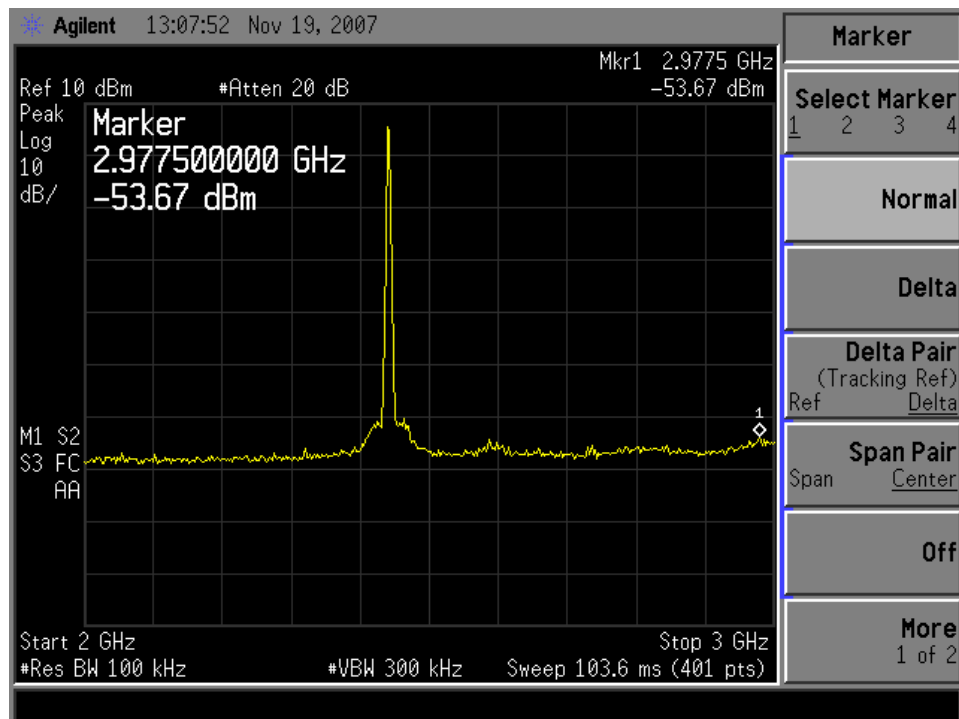
Channel 11: 24-25GHz, Net reading with cable loss at 24.5225GHz is -60.72dBm



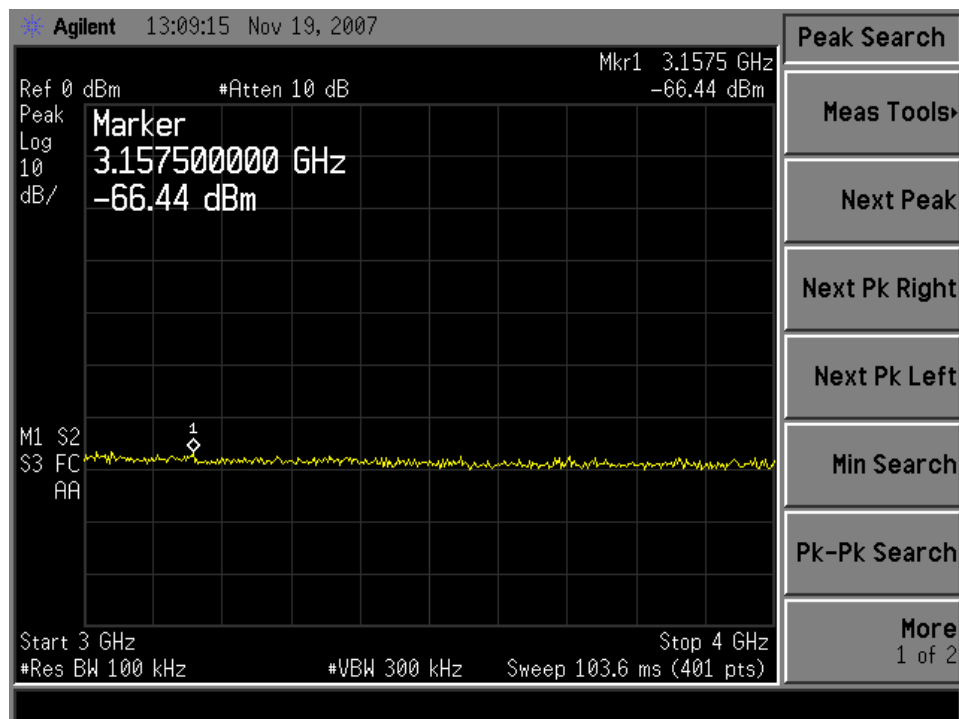
Channel 18: 30MHz -1GHz, Net reading with cable loss at 481.0500MHz is -63.34dBm



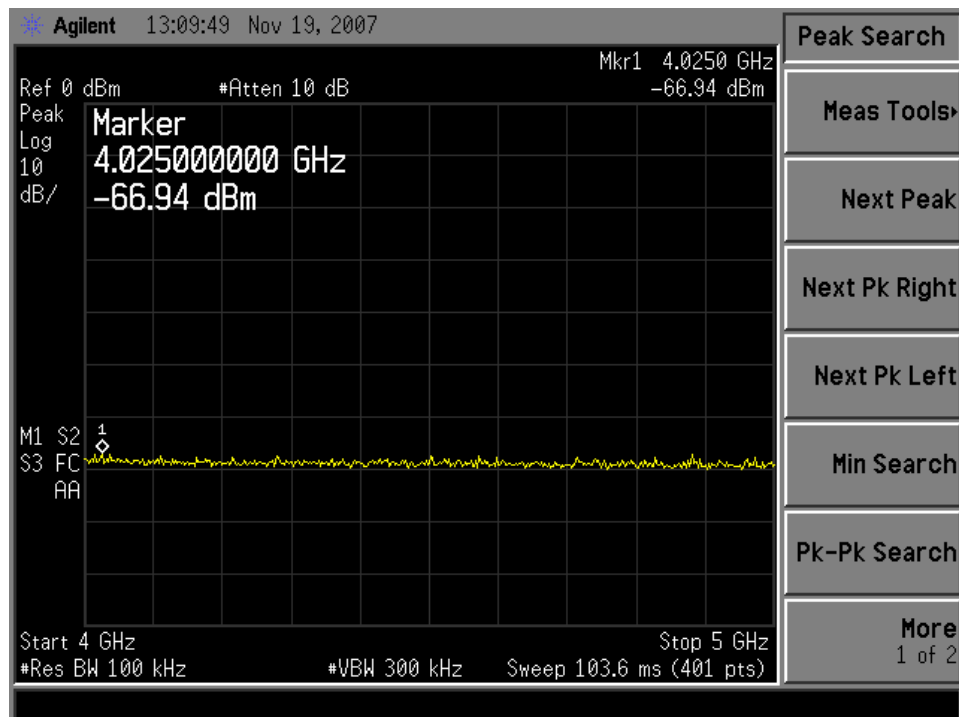
Channel 18: 1-2 GHz, Net reading with cable loss at 1.9600GHz is -62.29dBm



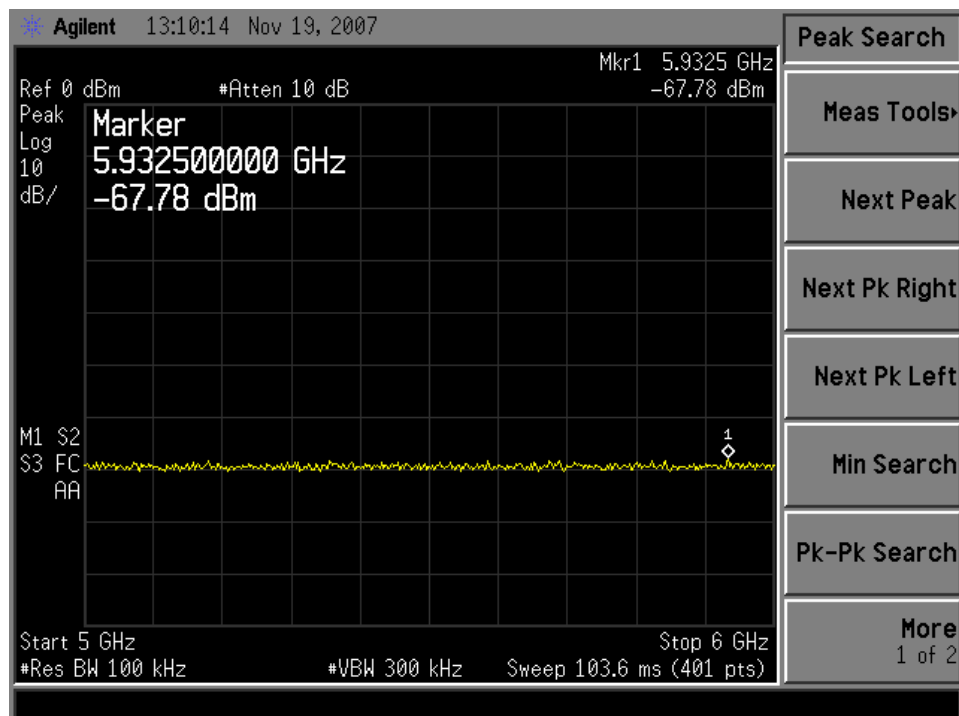
Channel 18: 2-3 GHz, Net reading with cable loss at 2.9775GHz is -52.17dBm



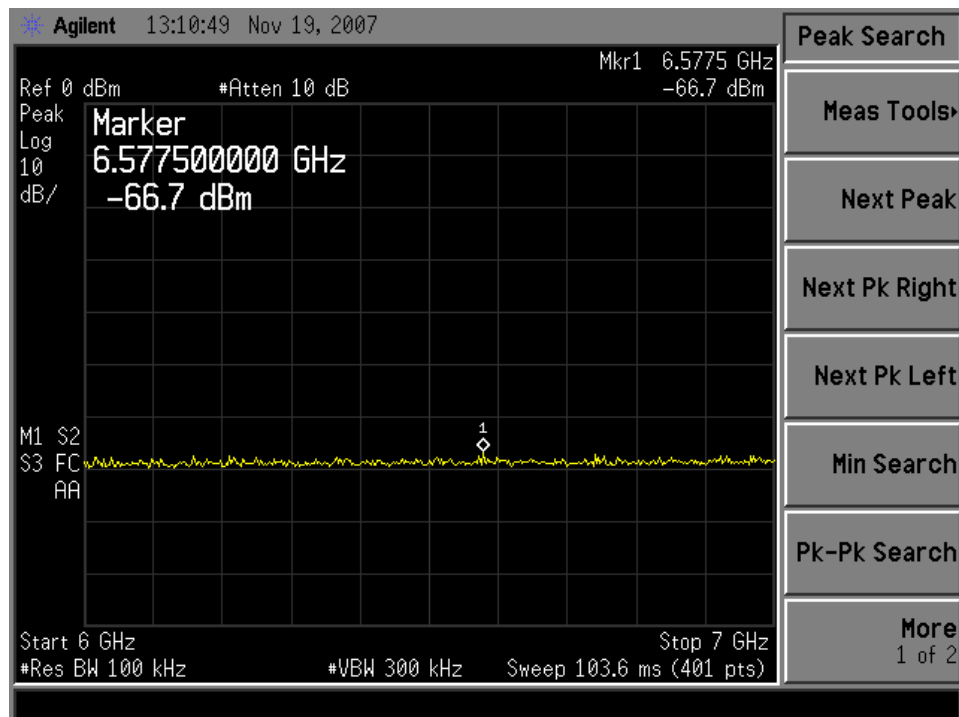
Channel 18: 3-4 GHz, Net reading with cable loss at 3.1575GHz is -64.94dBm



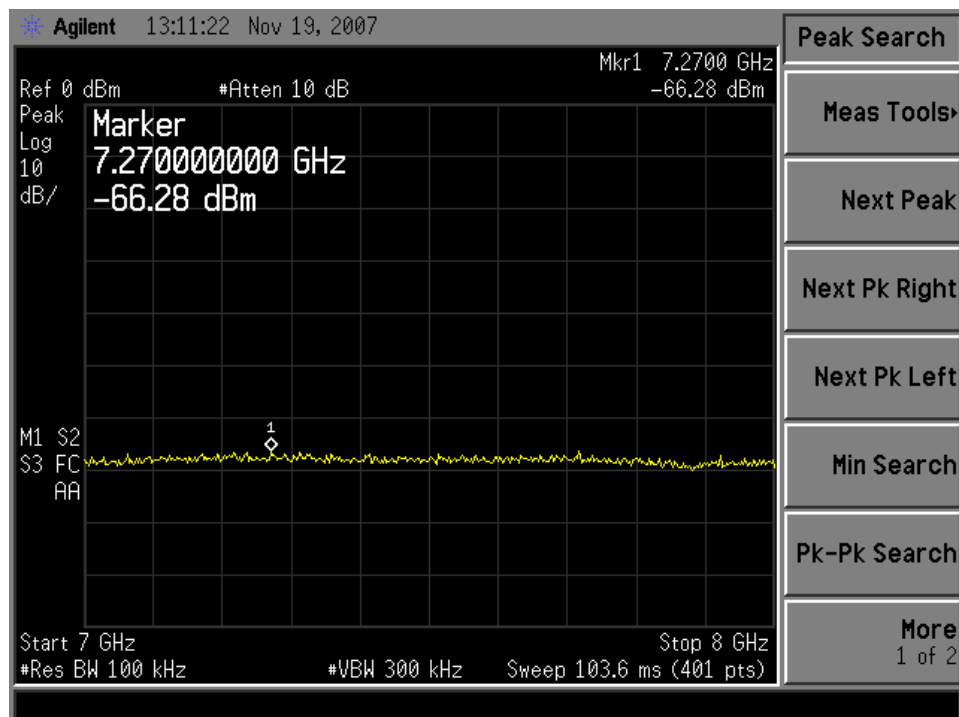
Channel 18: 4-5 GHz, Net reading with cable loss at 4.0250GHz is -65.24dBm



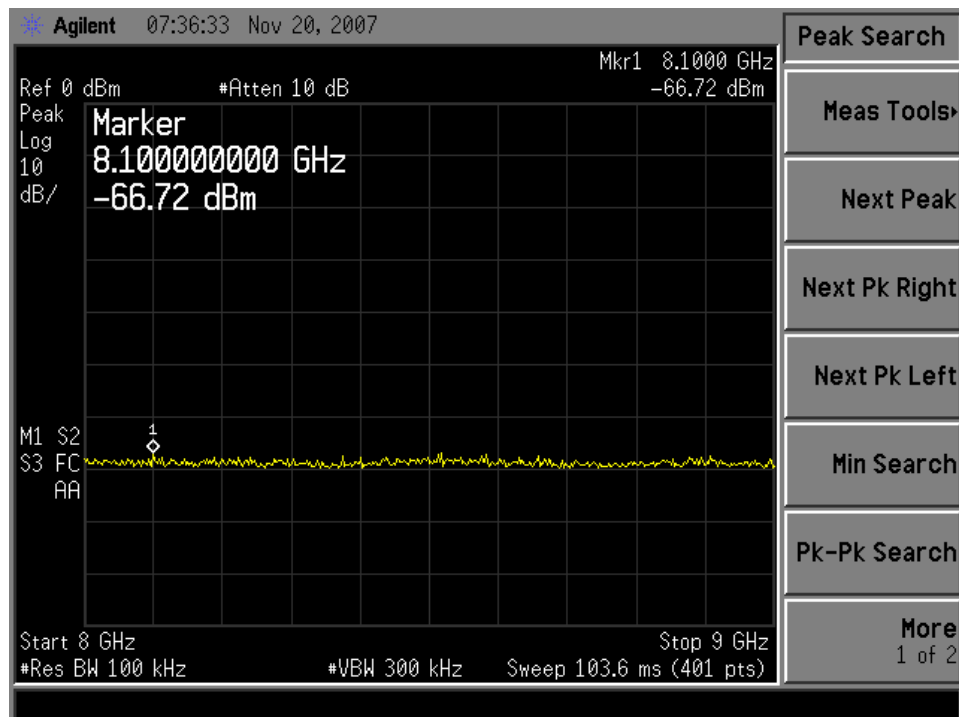
Channel 18: 5-6 GHz, Net reading with cable loss at 5.9325GHz is -65.68dBm



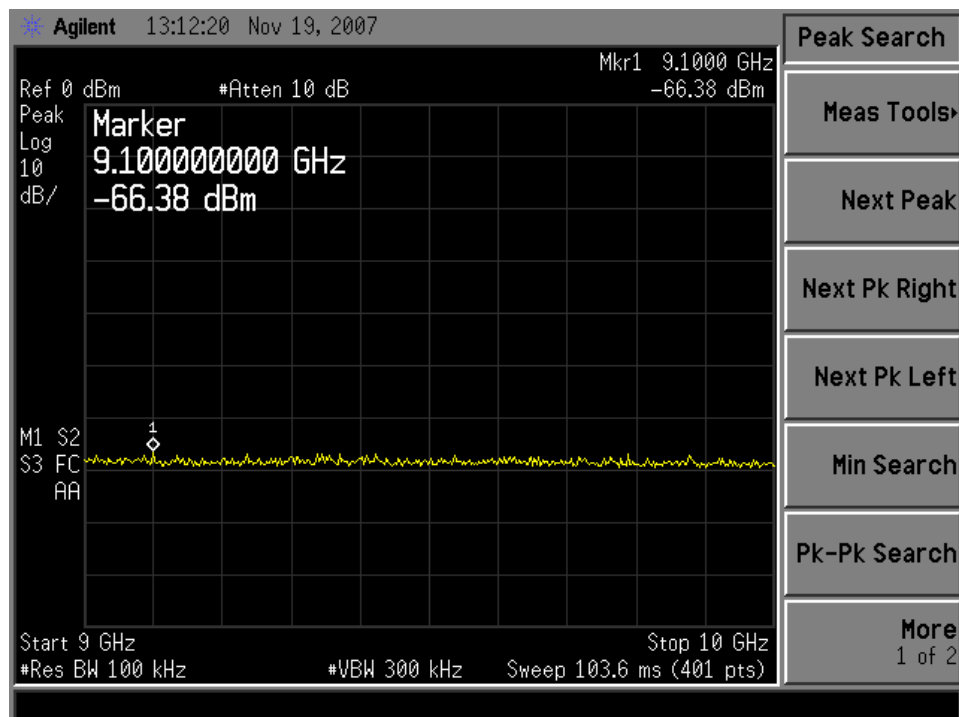
Channel 18: 6-7 GHz, Net reading with cable loss at 6.5775GHz is -64.4dBm



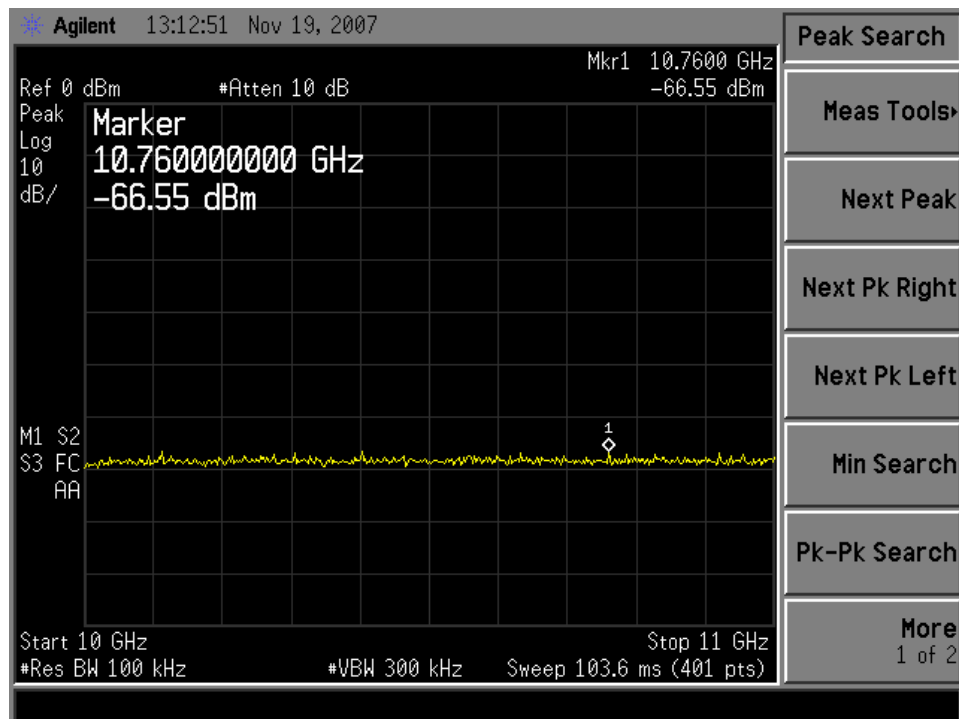
Channel 18: 7-8 GHz, Net reading with cable loss at 7.2700GHz is -63.88dBm



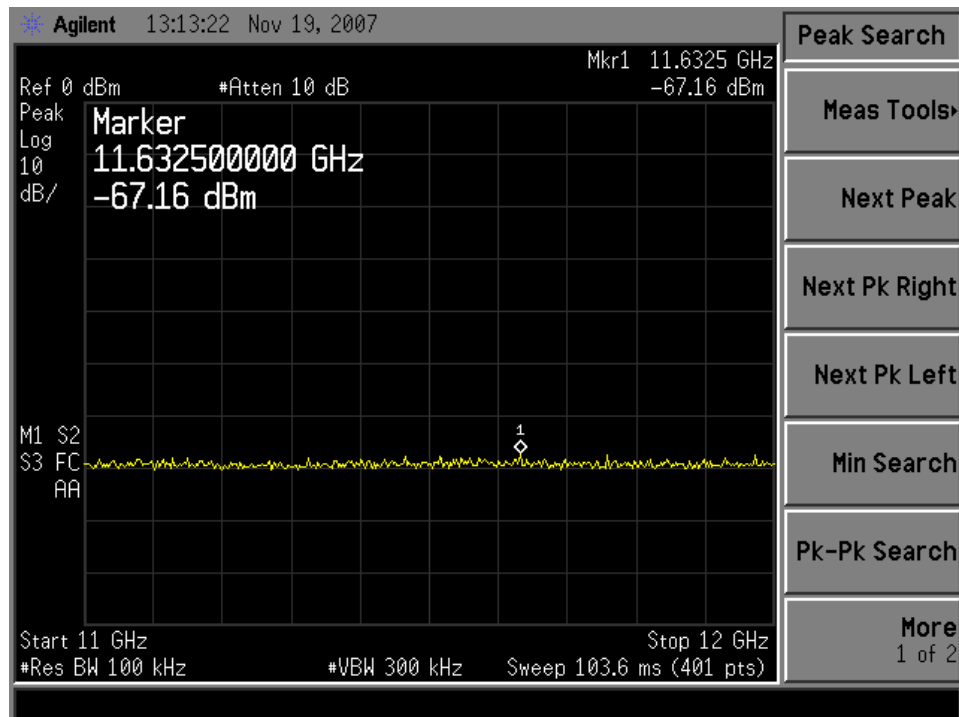
Channel 18: 8-9 GHz, Net reading with cable loss at 8.1000GHz is -64.12dBm



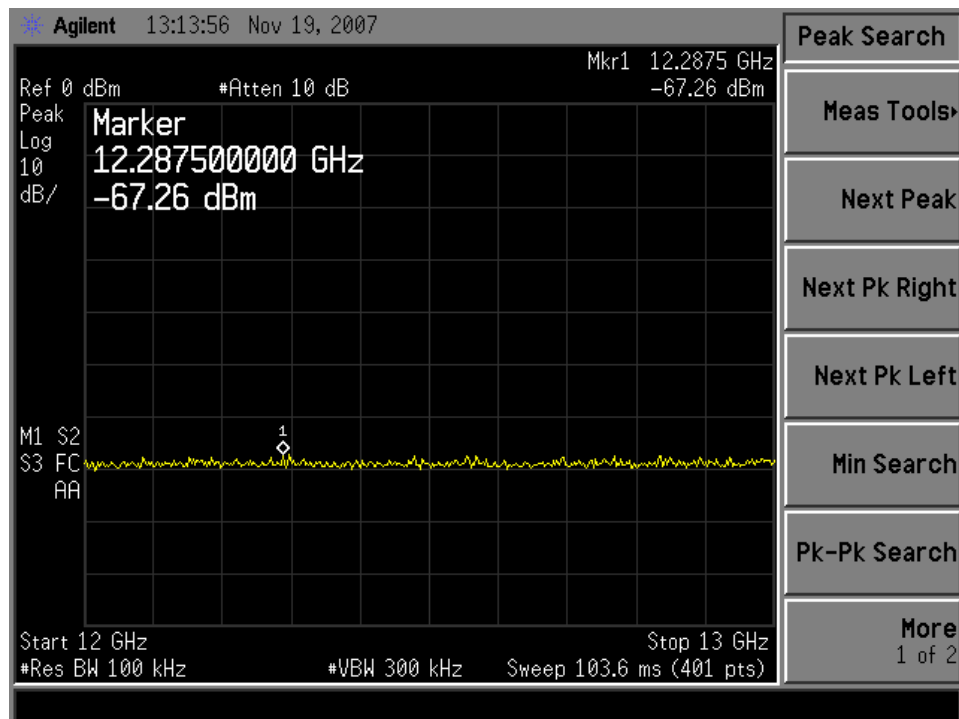
Channel 18: 9-10 GHz, Net reading with cable loss at 9.1000GHz is -63.68dBm



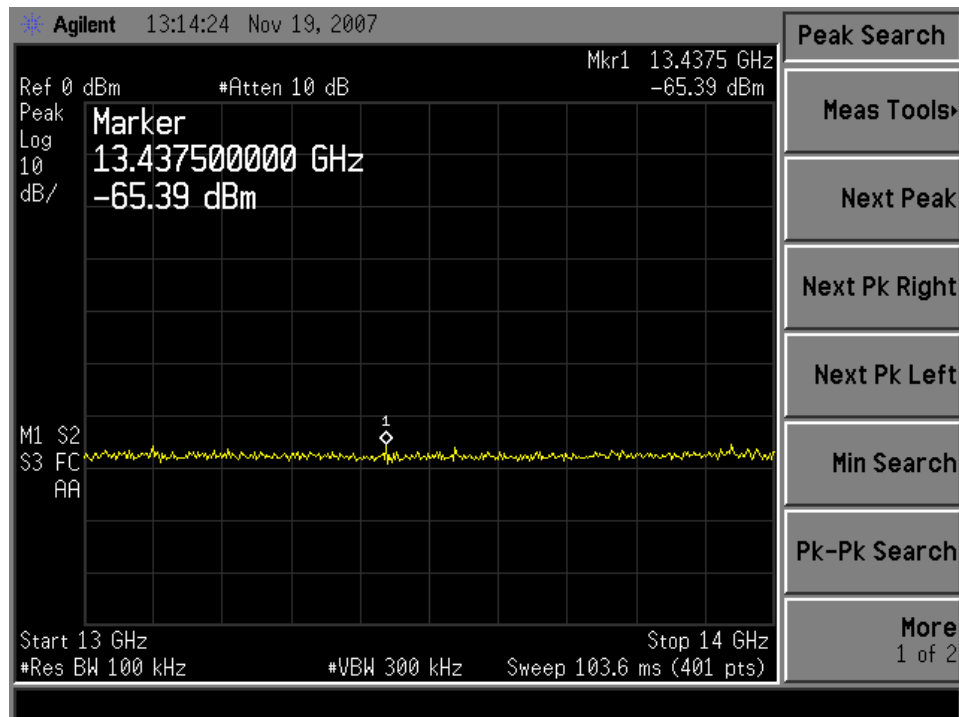
Channel 18: 10-11 GHz, Net reading with cable loss at 10.7600GHz is -63.55dBm



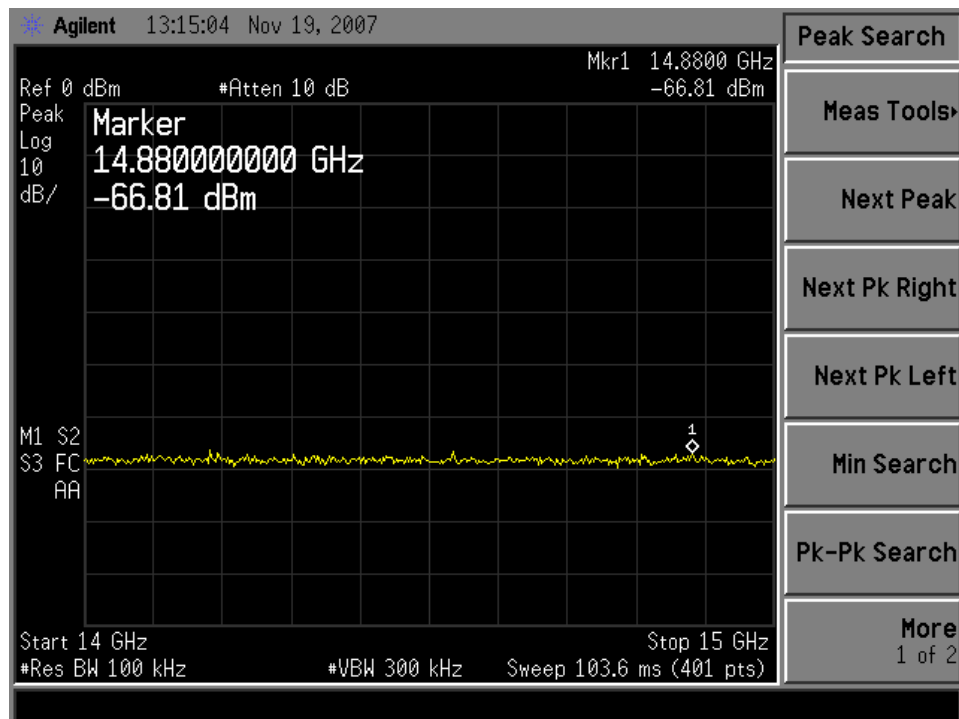
Channel 18: 11-12 GHz, Net reading with cable loss at 11.6325GHz is -64.06dBm



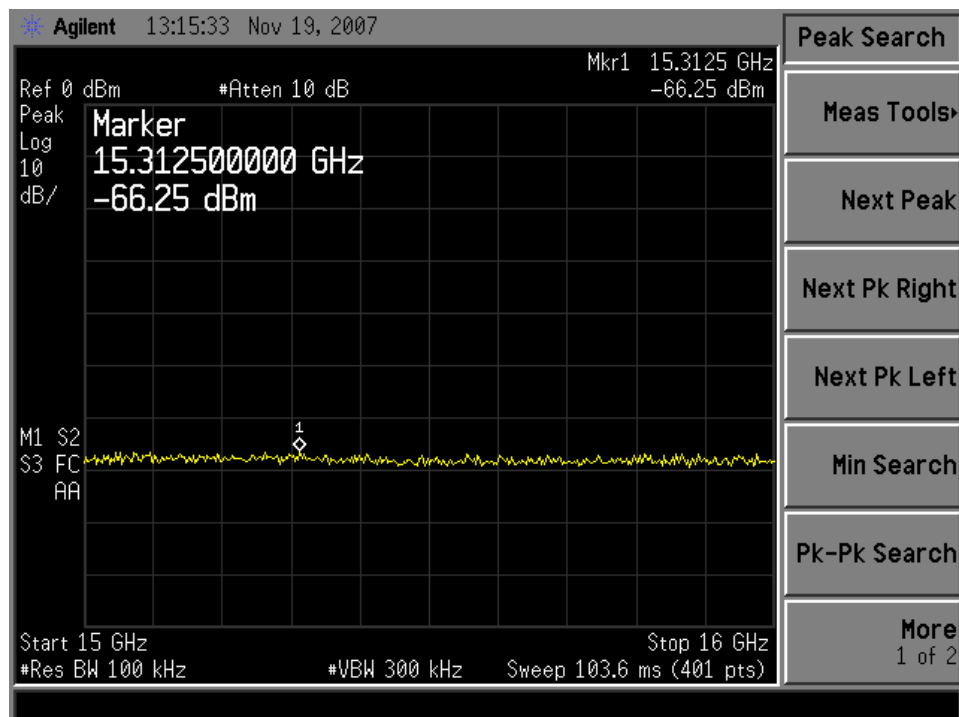
Channel 18: 12-13 GHz, Net reading with cable loss at 12.2875GHz is -63.96dBm



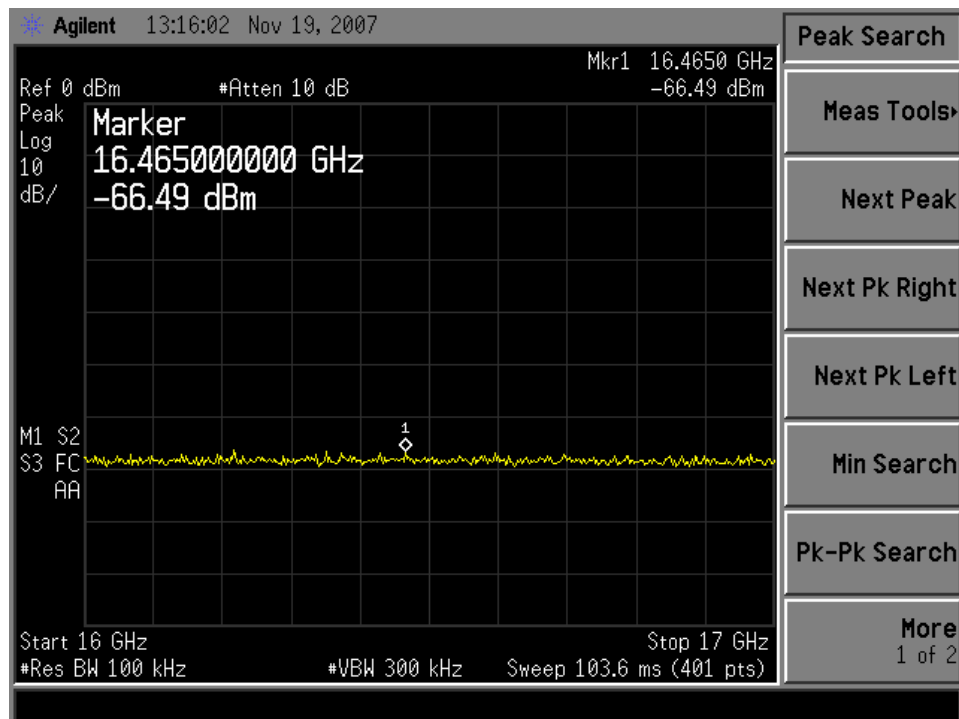
Channel 18: 13-14 GHz, Net reading with cable loss at 13.4375GHz is -61.99dBm



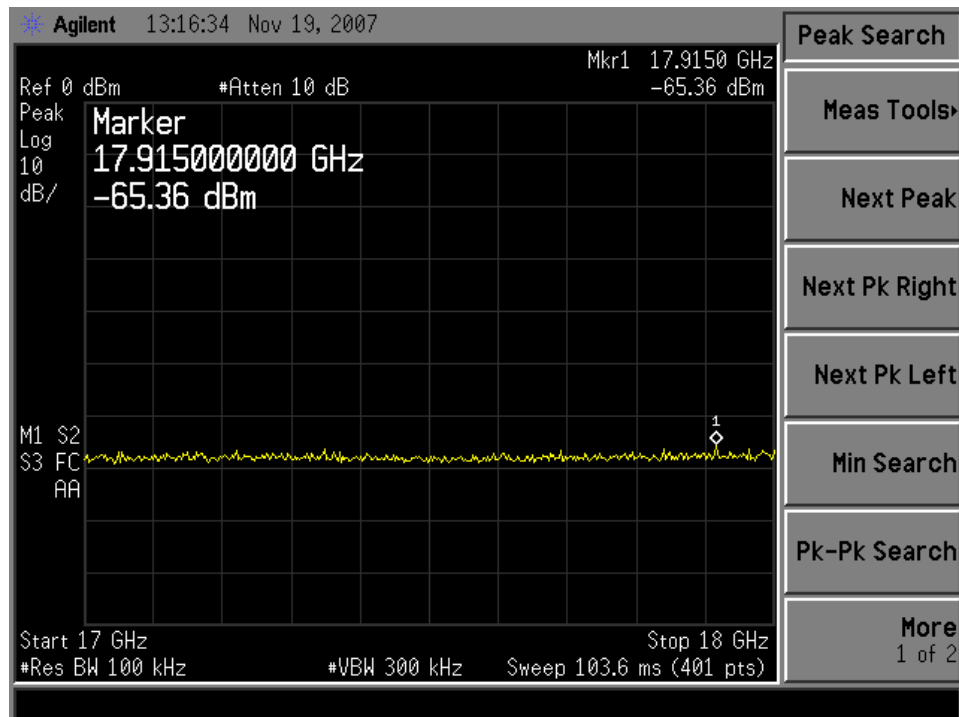
Channel 18: 14-15 GHz, Net reading with cable loss at 14.8800GHz is -63.11dBm



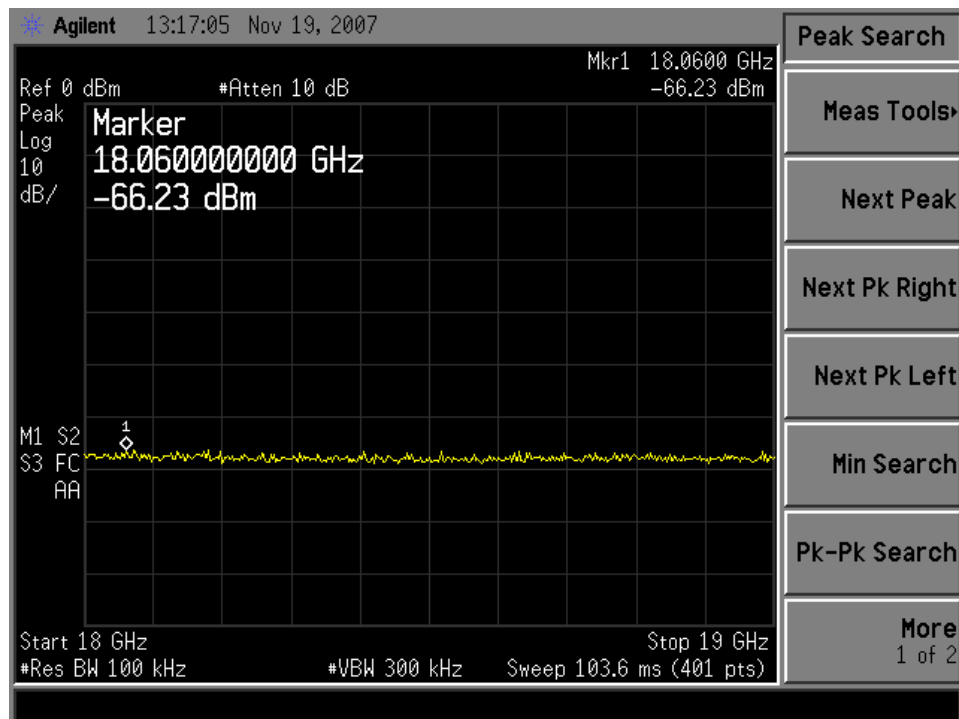
Channel 18: 15-16 GHz, Net reading with cable loss at 15.3125GHz is -62.55dBm



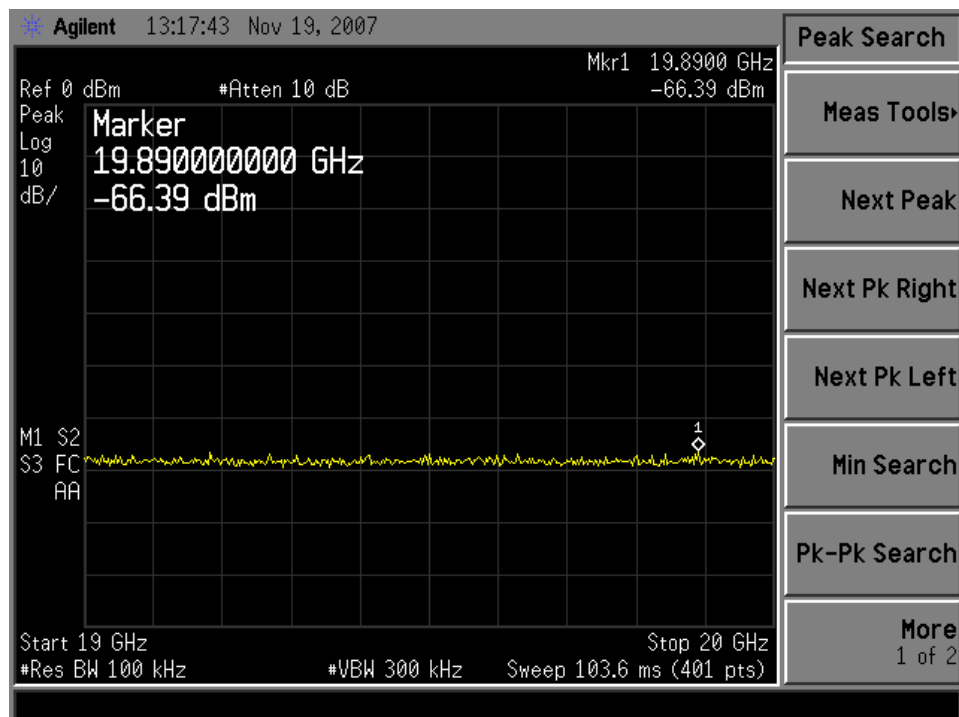
Channel 18: 16-17 GHz, Net reading with cable loss at 16.4650GHz is -62.59dBm



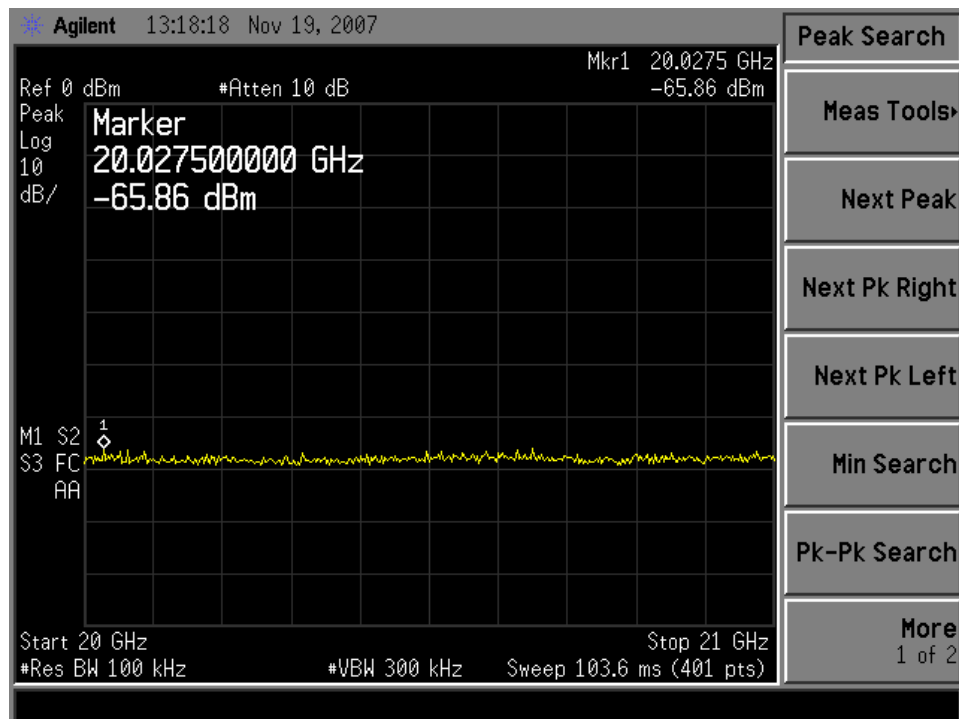
Channel 18: 17-18GHz, Net reading with cable loss at 17.9150GHz is -61.36dBm



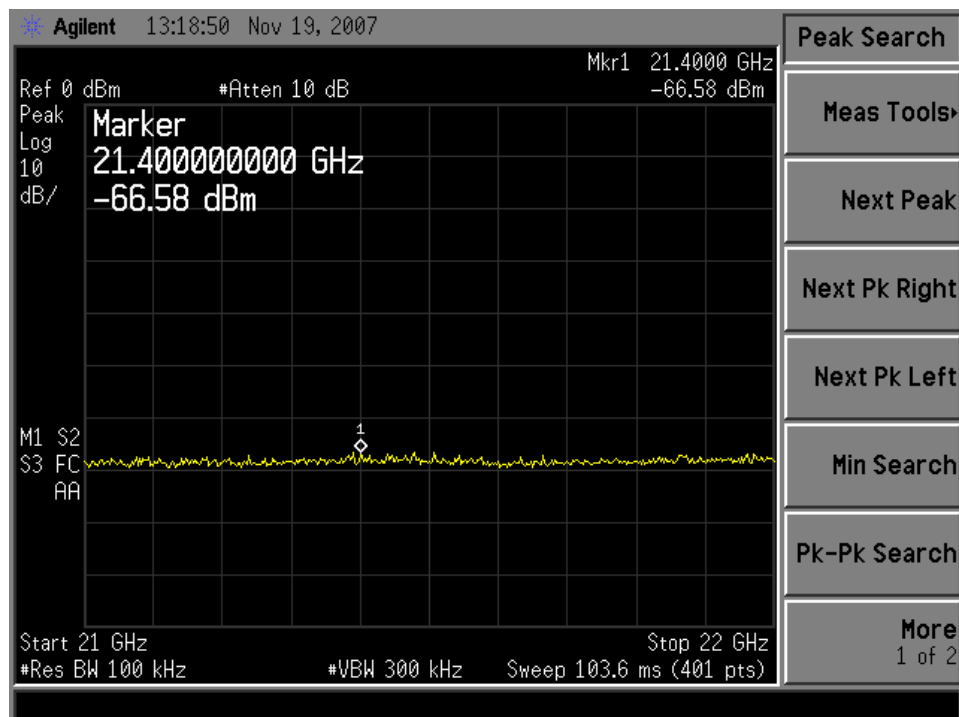
Channel 18: 18-19GHz, Net reading with cable loss at 18.0600GHz is -62.23dBm



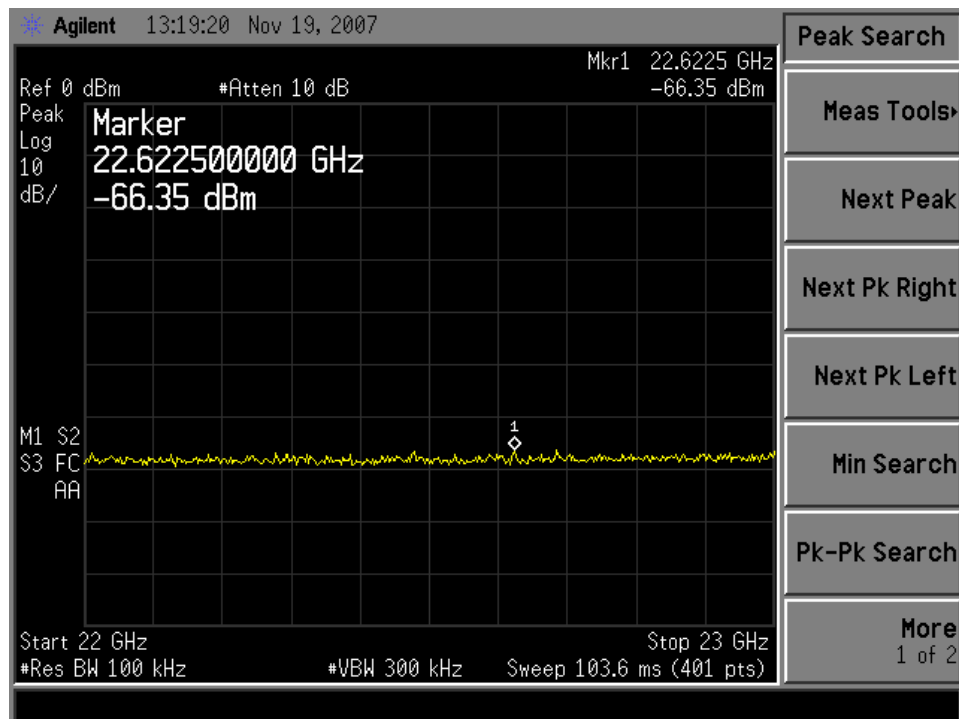
Channel 18: 19-20GHz, Net reading with cable loss at 19.8900GHz is -61.99dBm



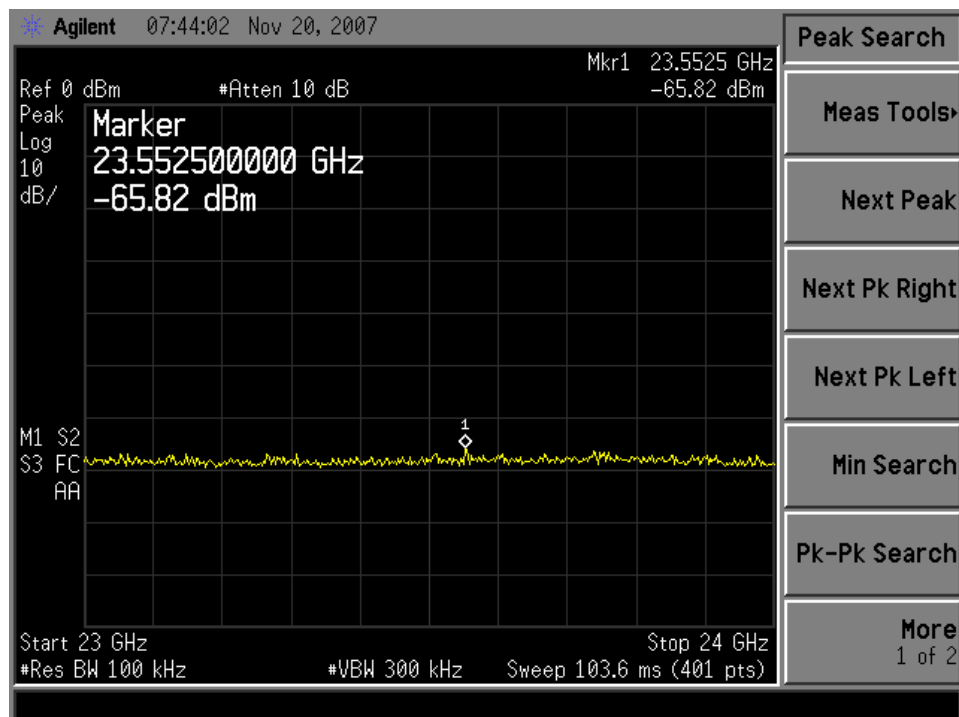
Channel 18: 20-21GHz, Net reading with cable loss at 20.0275GHz is -61.46dBm



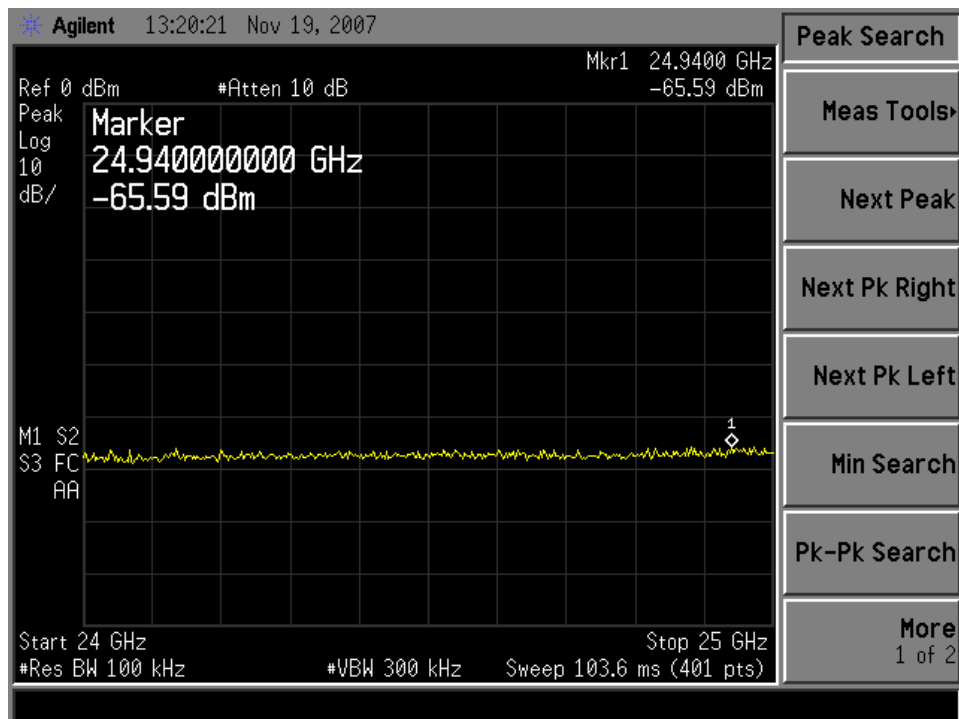
Channel 18: 21-22GHz, Net reading with cable loss at 21.4000GHz is -61.88dBm



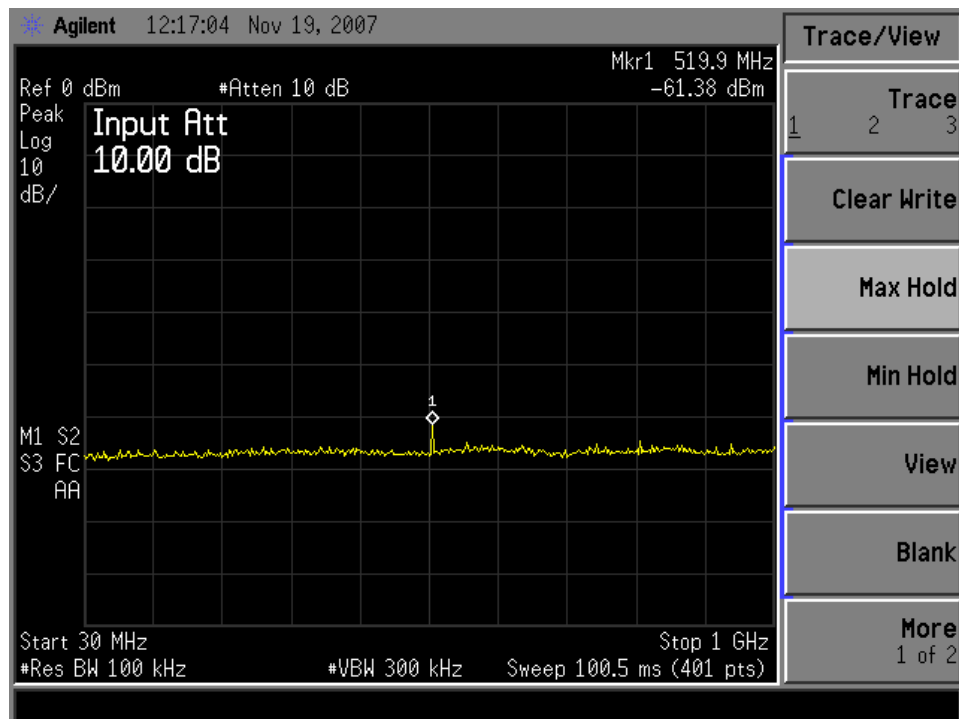
Channel 18: 22-23GHz, Net reading with cable loss at 22.6225GHz is -61.45dBm



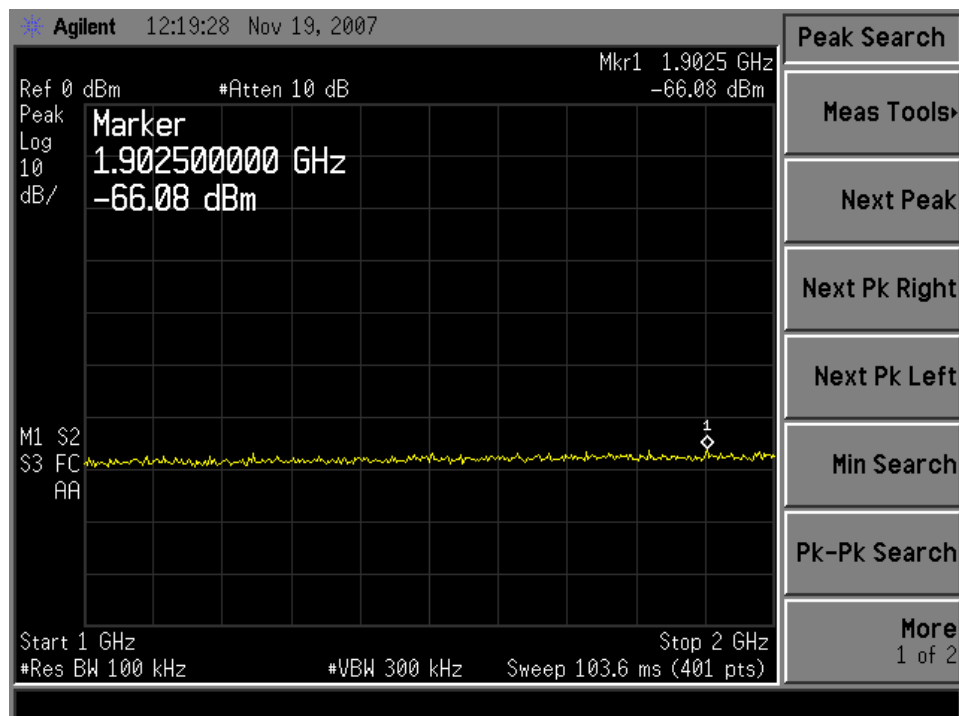
Channel 18: 23-24GHz, Net reading with cable loss at 23.5525GHz is -60.82dBm



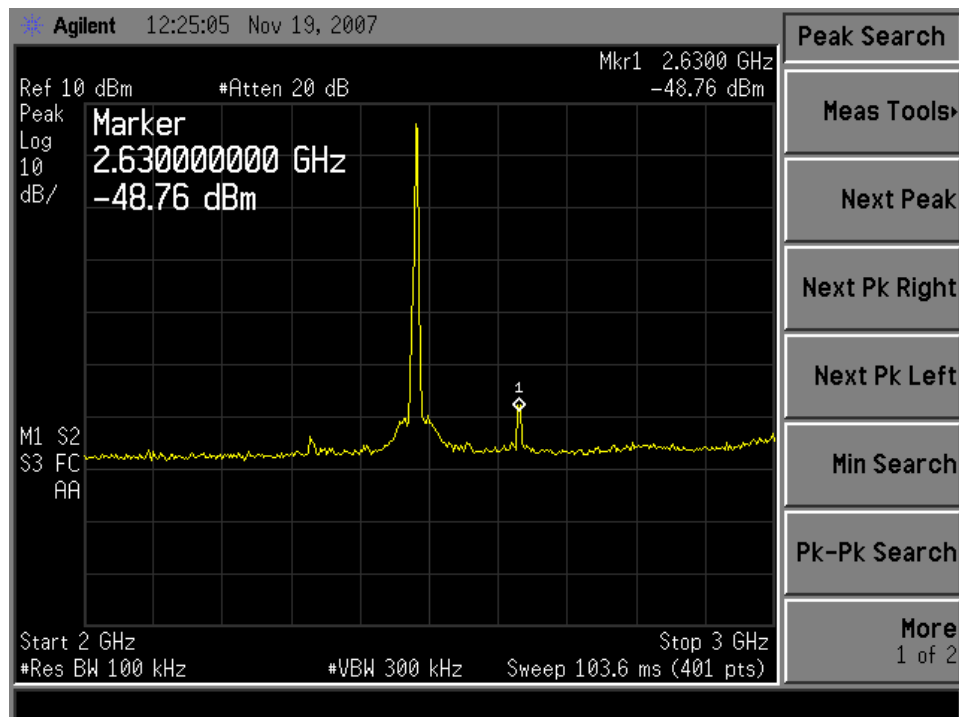
Channel 18: 24-25GHz, Net reading with cable loss at 24.9400GHz is -60.39dBm



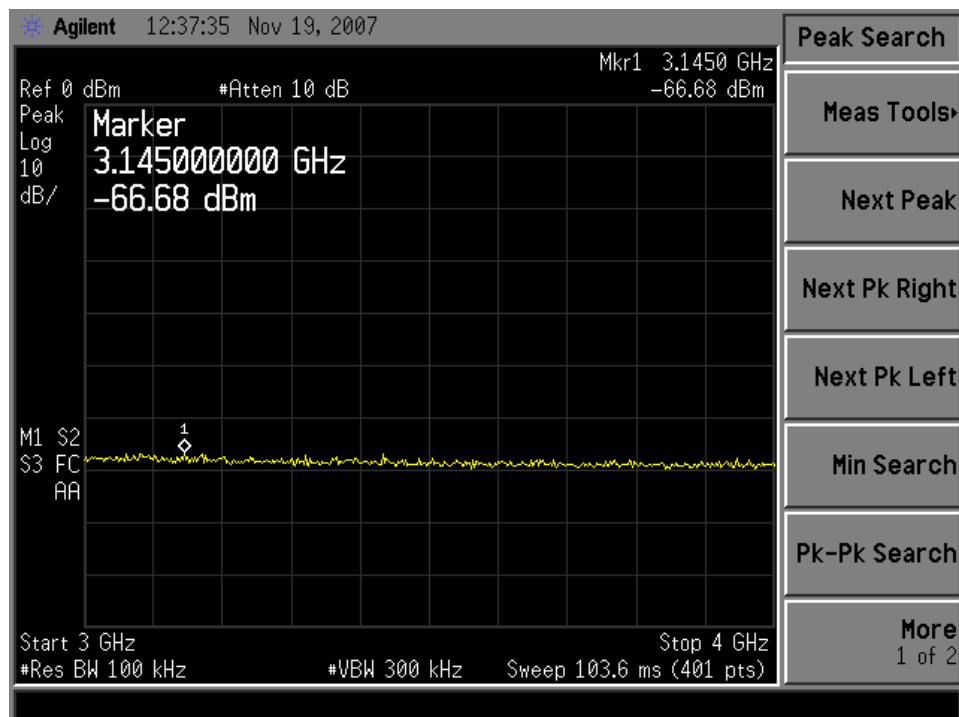
Channel 26: 30MHz -1GHz, Net reading with cable loss at 519.9MHz is -60.88dBm



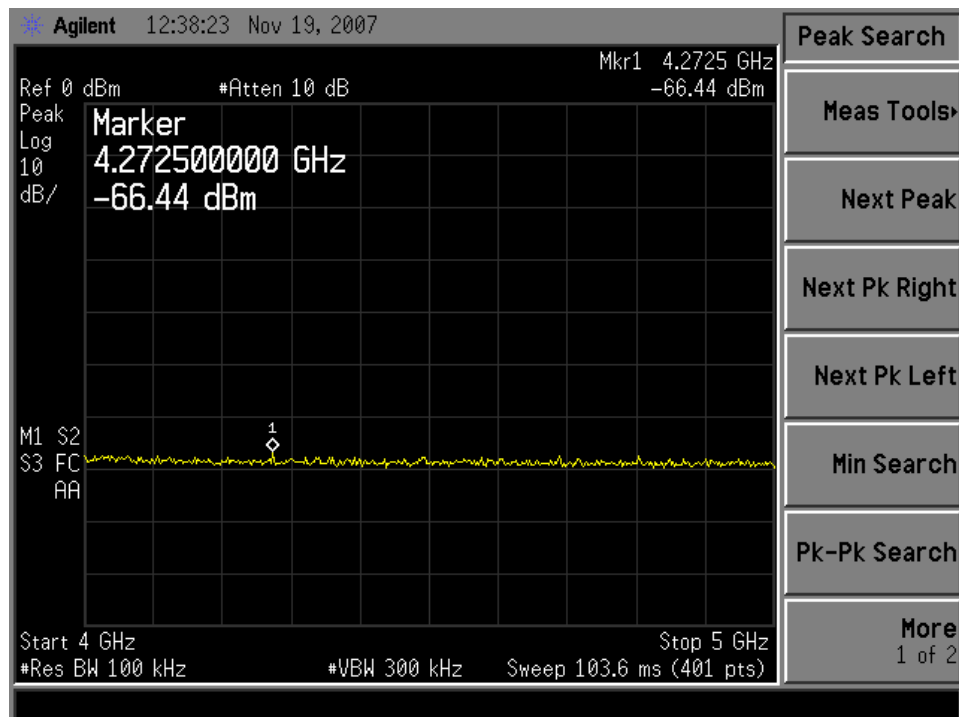
Channel 26: 1-2 GHz, Net reading with cable loss at 1.9025GHz is -64.98dBm



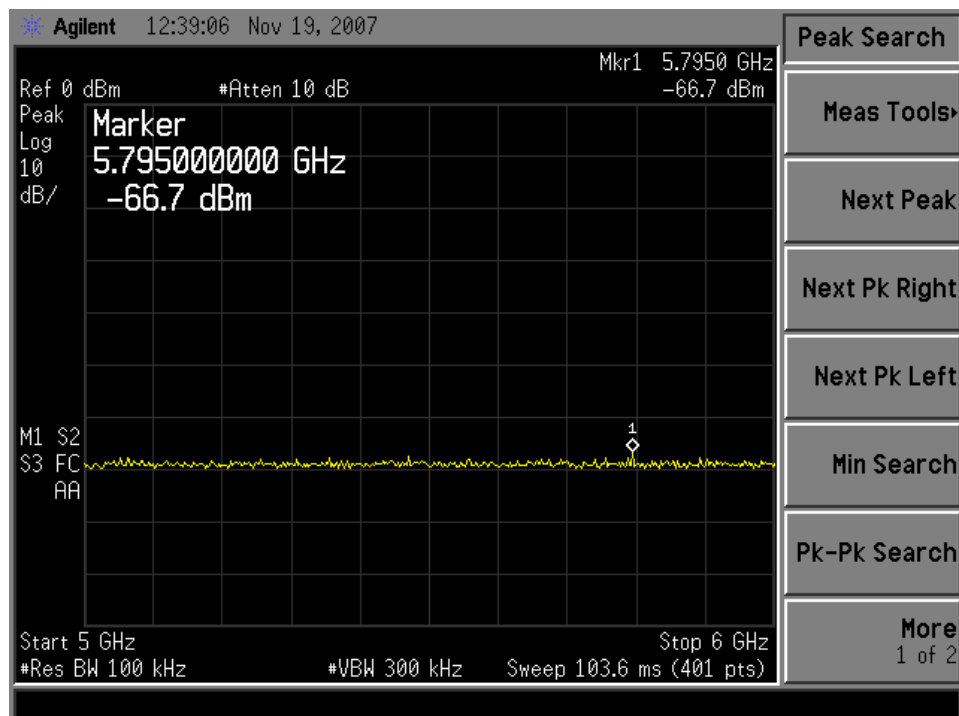
Channel 26: 2-3 GHz Net reading with cable loss at 2.6300GHz is -47.26dBm



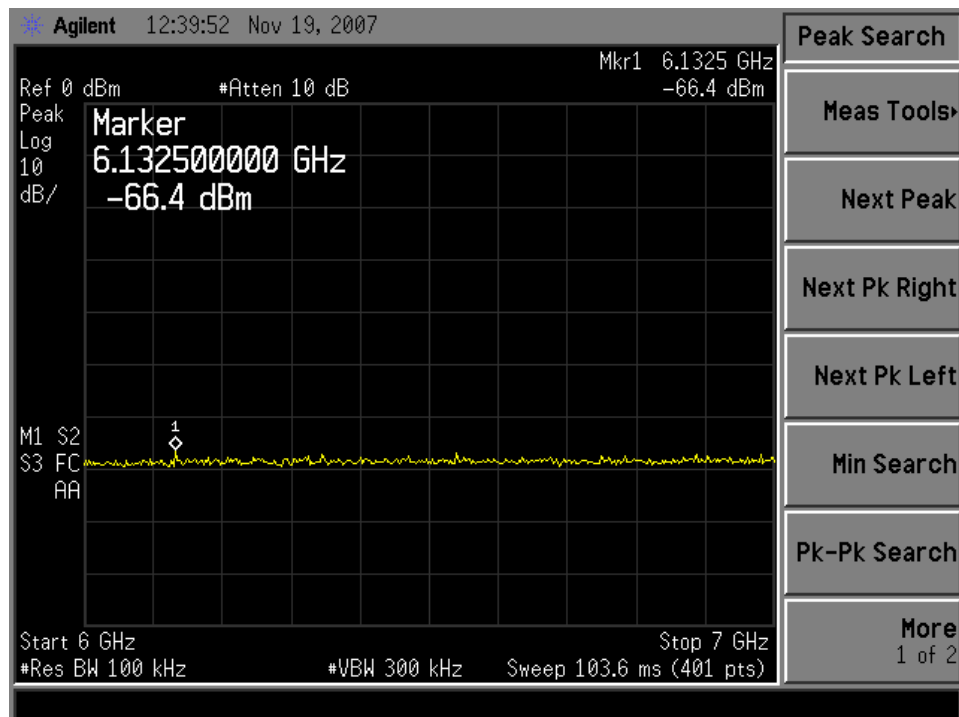
Channel 26: 3-4 GHz, Net reading with cable loss at 3.1450GHz is -65.18dBm



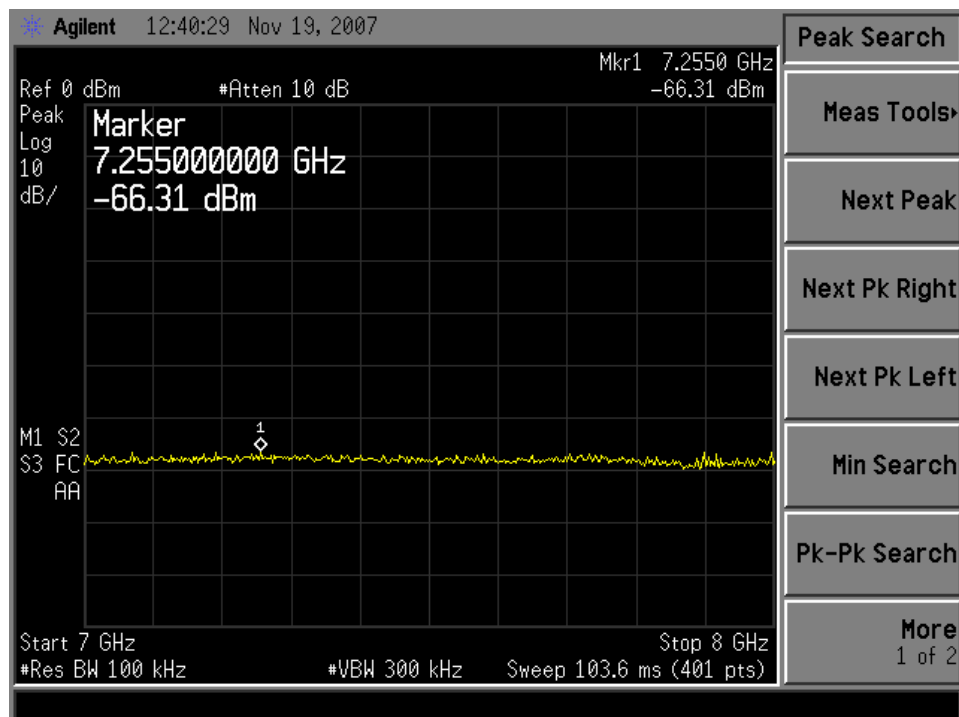
Channel 26: 4-5 GHz, Net reading with cable loss at 4.2725GHz is -64.64dBm



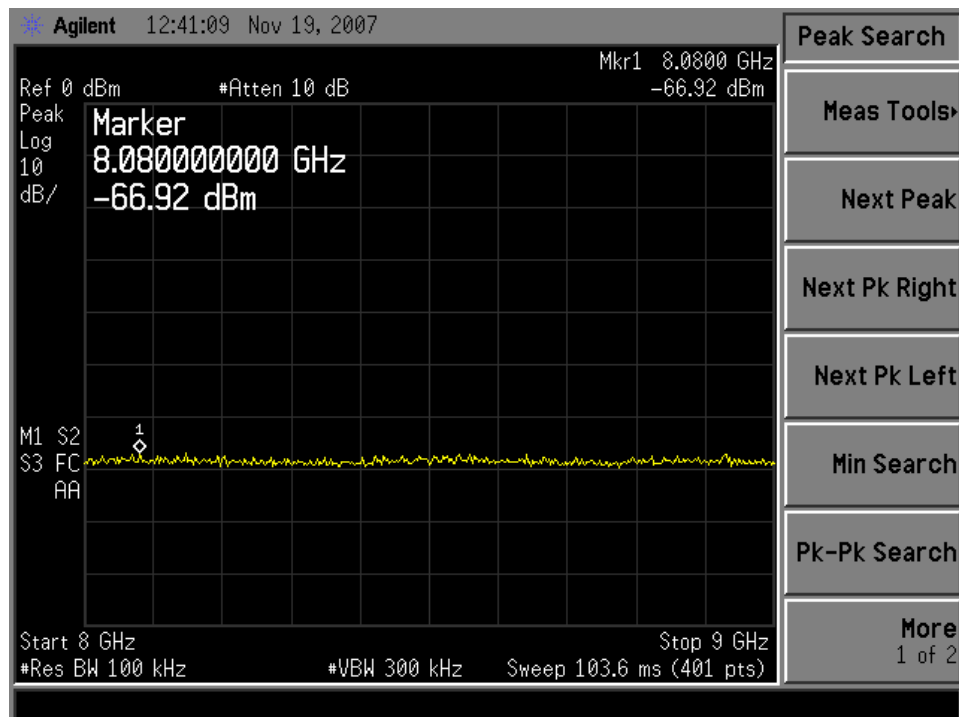
Channel 26: 5-6 GHz, Net reading with cable loss at 5.7950GHz is -64.6dBm



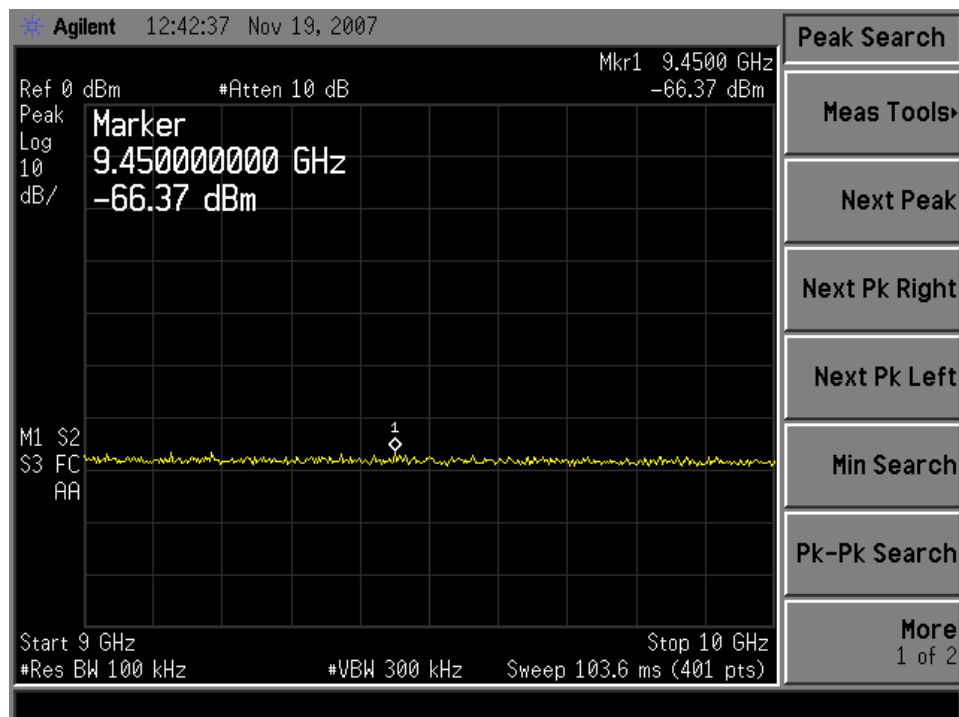
Channel 26: 6-7 GHz, Net reading with cable loss at 6.1325GHz is -64.2dBm



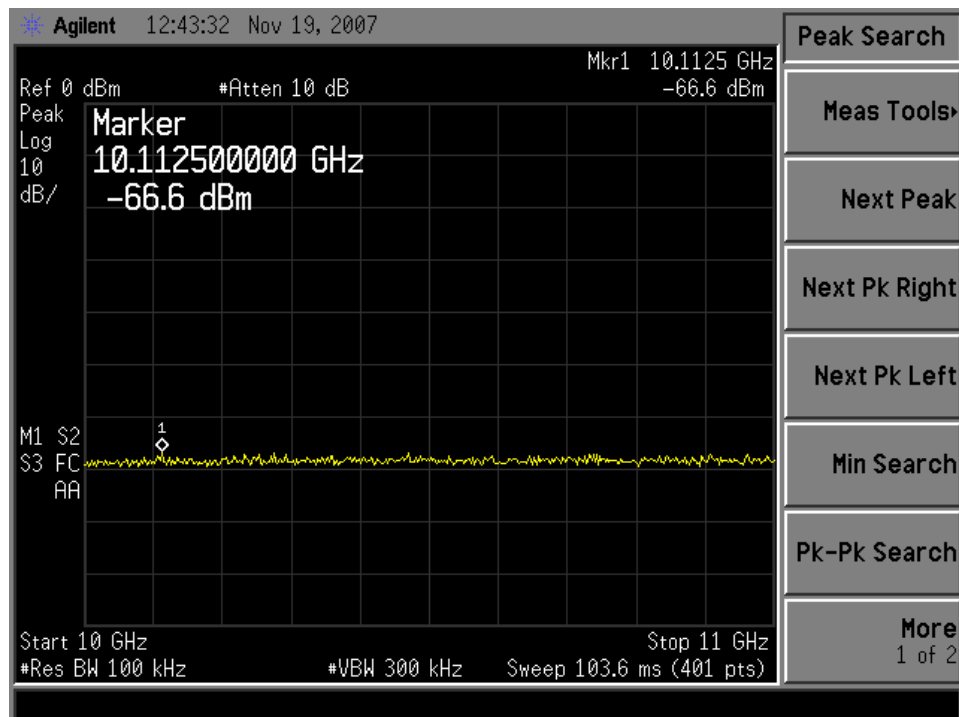
Channel 26: 7-8 GHz, Net reading with cable loss at 7.2550GHz is -63.91dBm



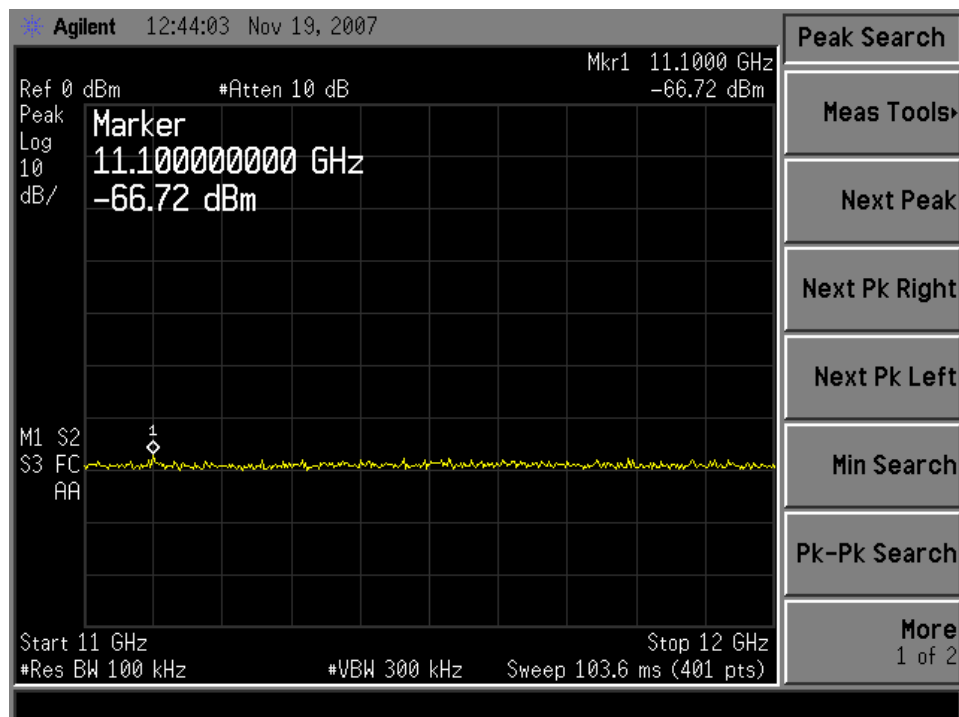
Channel 26: 8-9 GHz, Net reading with cable loss at 8.0800GHz is -64.32dBm



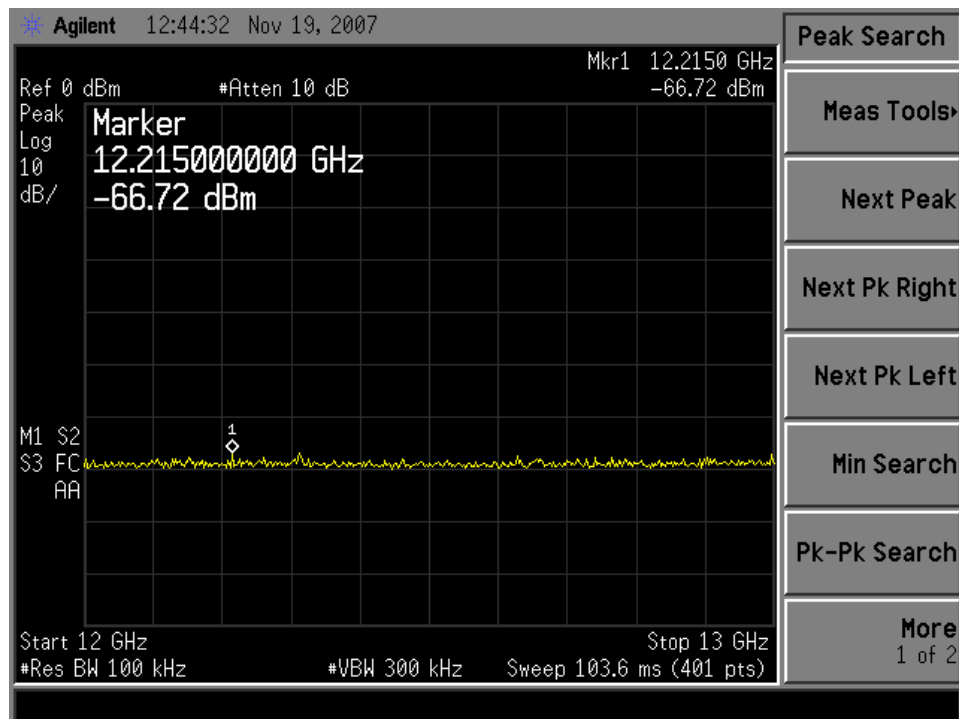
Channel 26: 9-10 GHz, Net reading with cable loss at 9.4500GHz is -63.57dBm



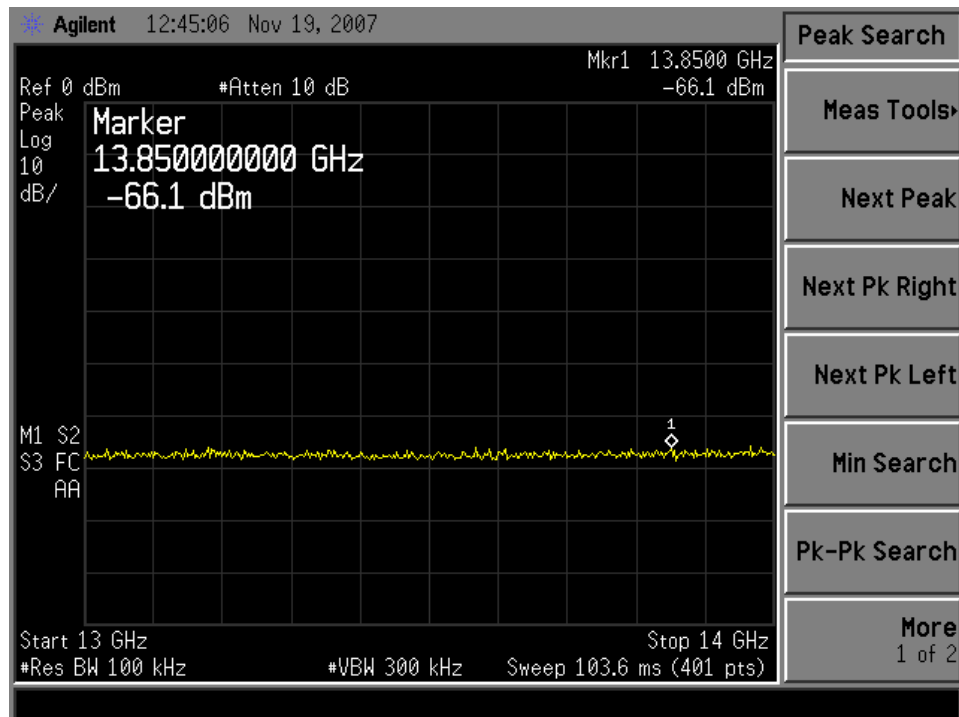
Channel 26 10-11 GHz, Net reading with cable loss at 10.1125GHz is -63.7dBm



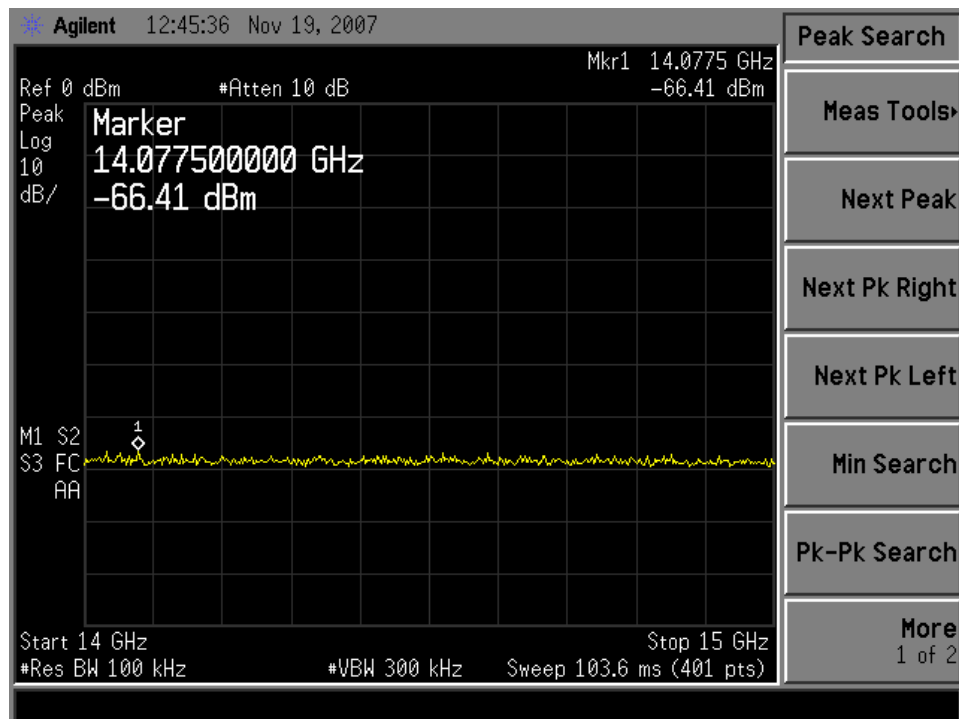
Channel 26: 11-12 GHz, Net reading with cable loss at 11.1000GHz is -63.62dBm



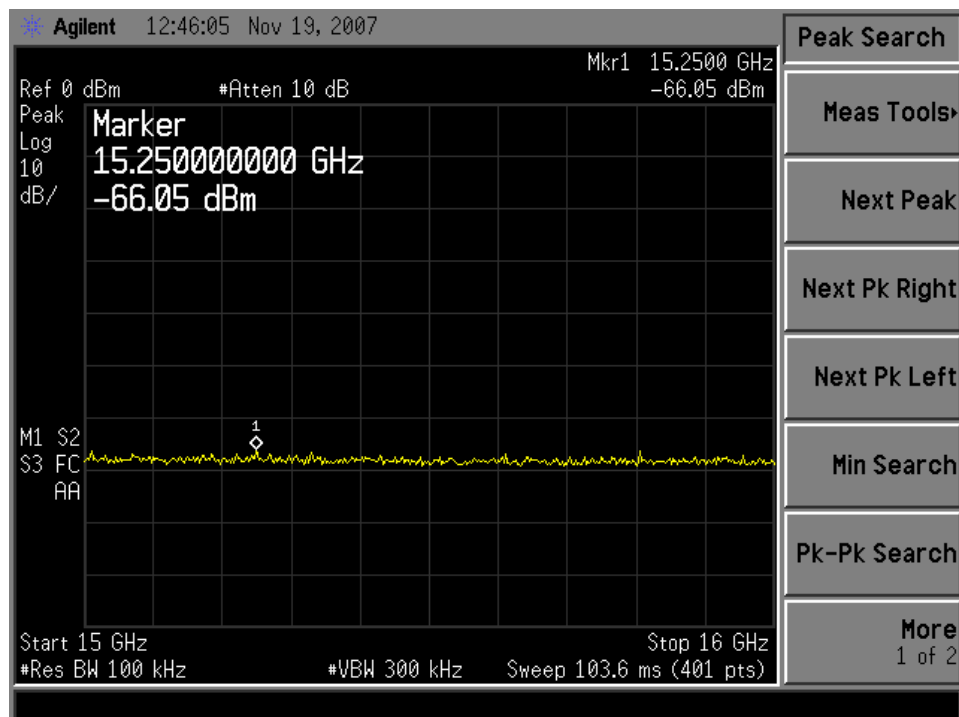
Channel 26: 12-13 GHz, Net reading with cable loss at 12.2150GHz is -63.42dBm



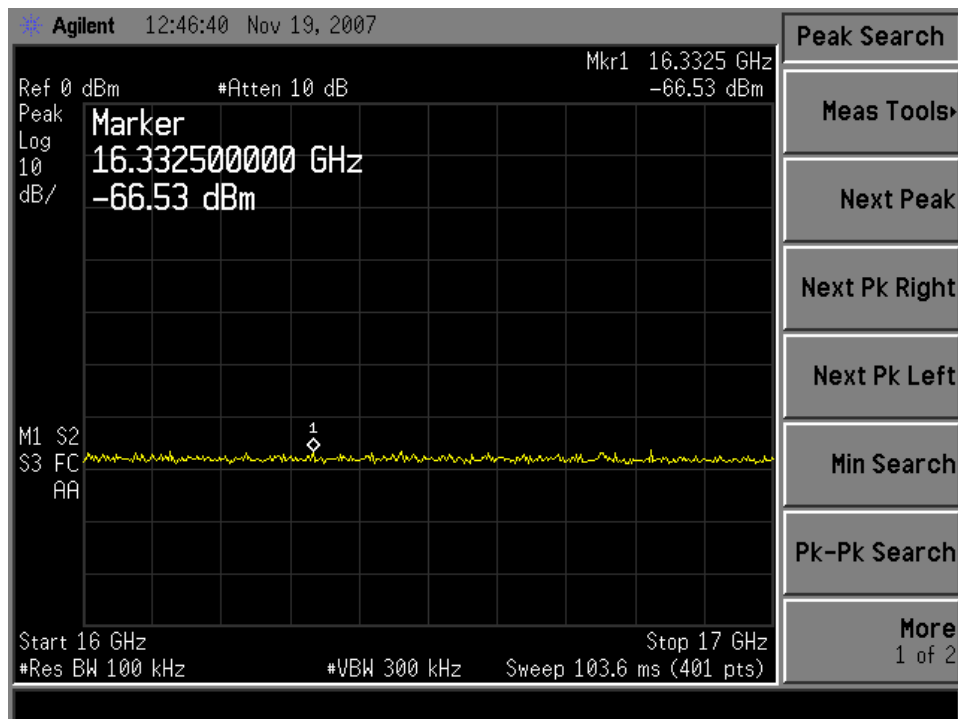
Channel 26: 13-14 GHz, Net reading with cable loss at 13.850GHz is -62.6dBm



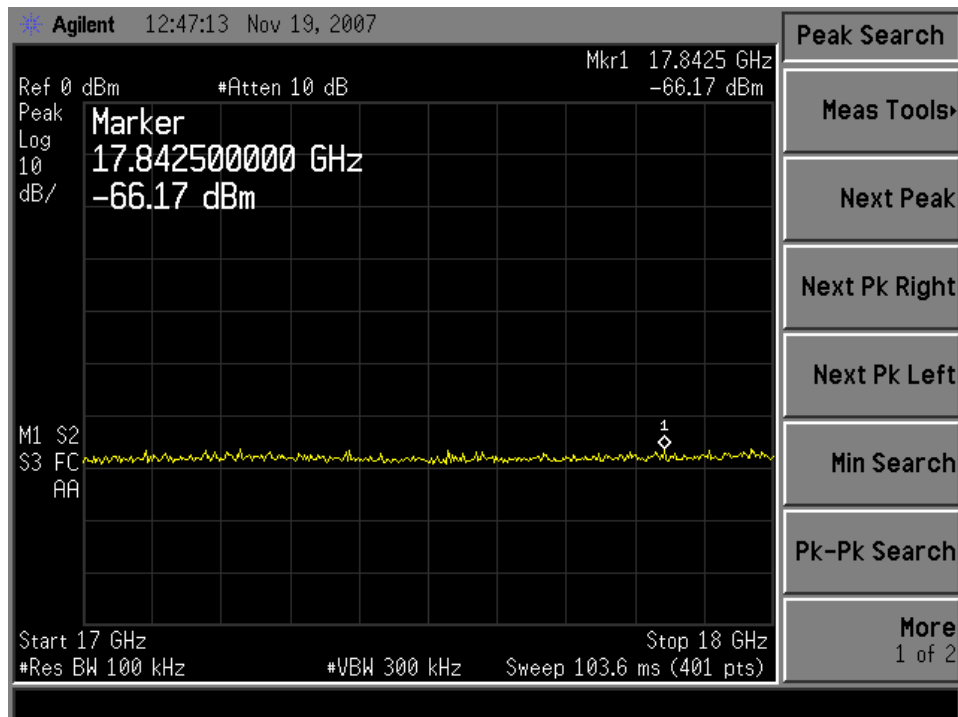
Channel 26: 14-15 GHz, Net reading with cable loss at 14.0775GHz is -62.91dBm



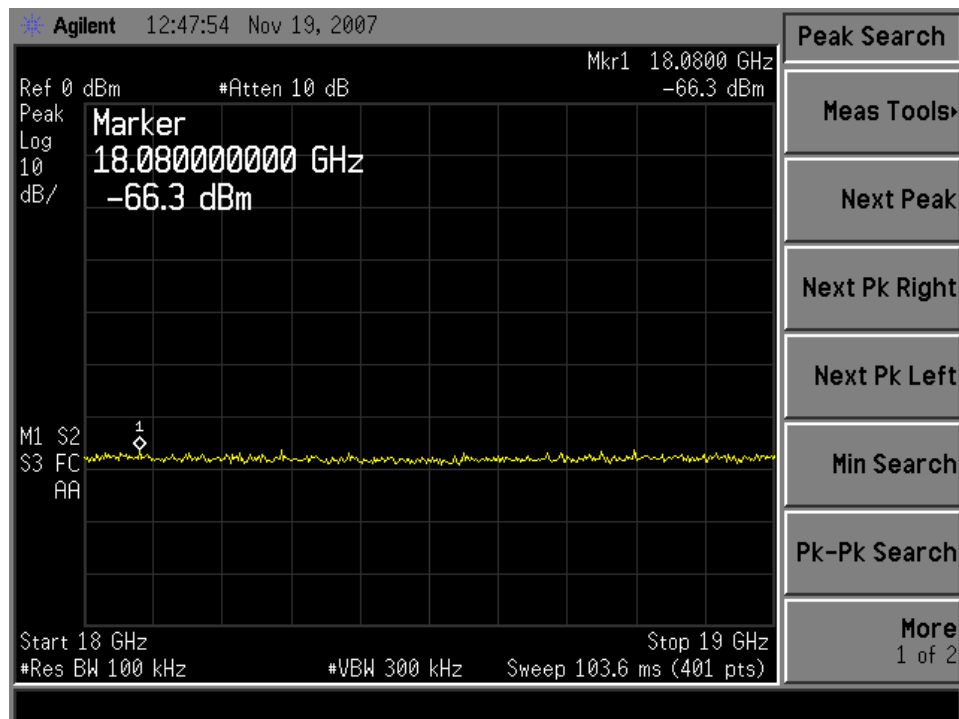
Channel 26: 15-16 GHz, Net reading with cable loss at 15.2500GHz is -62.35dBm



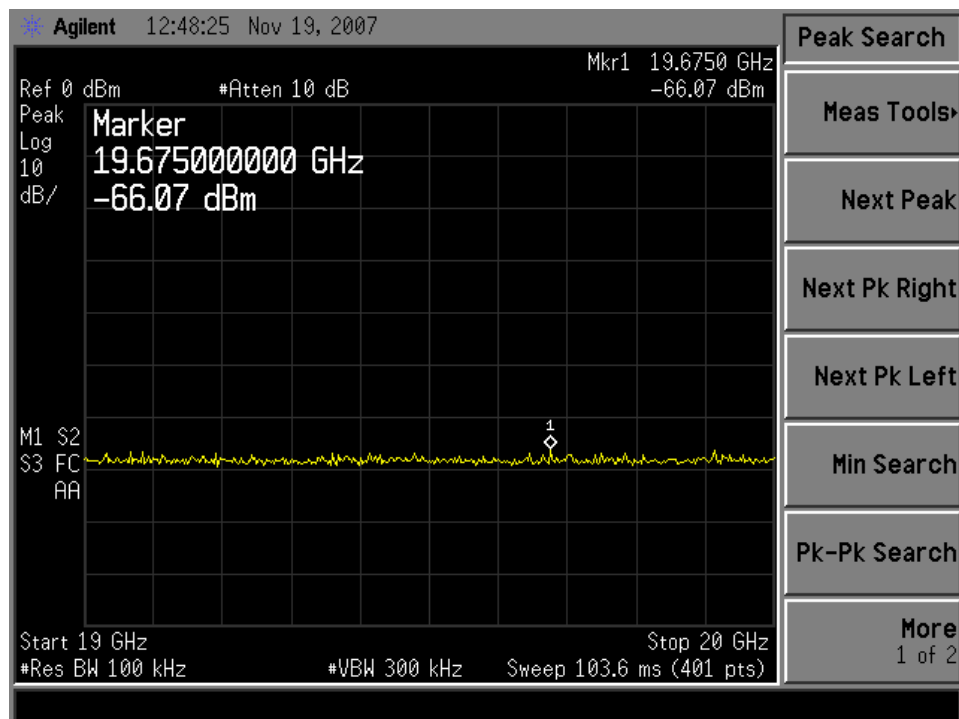
Channel 26: 16-17 GHz, Net reading with cable loss at 16.3325GHz is -62.63dBm



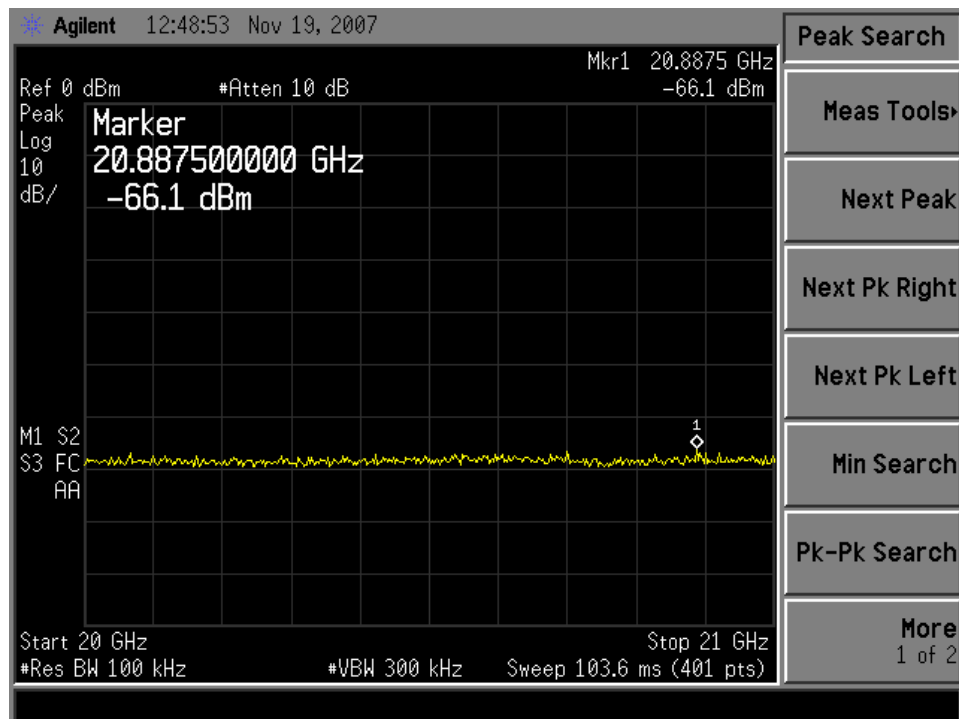
Channel 26: 17-18GHz, Net reading with cable loss at 17.8425GHz is -62.07dBm



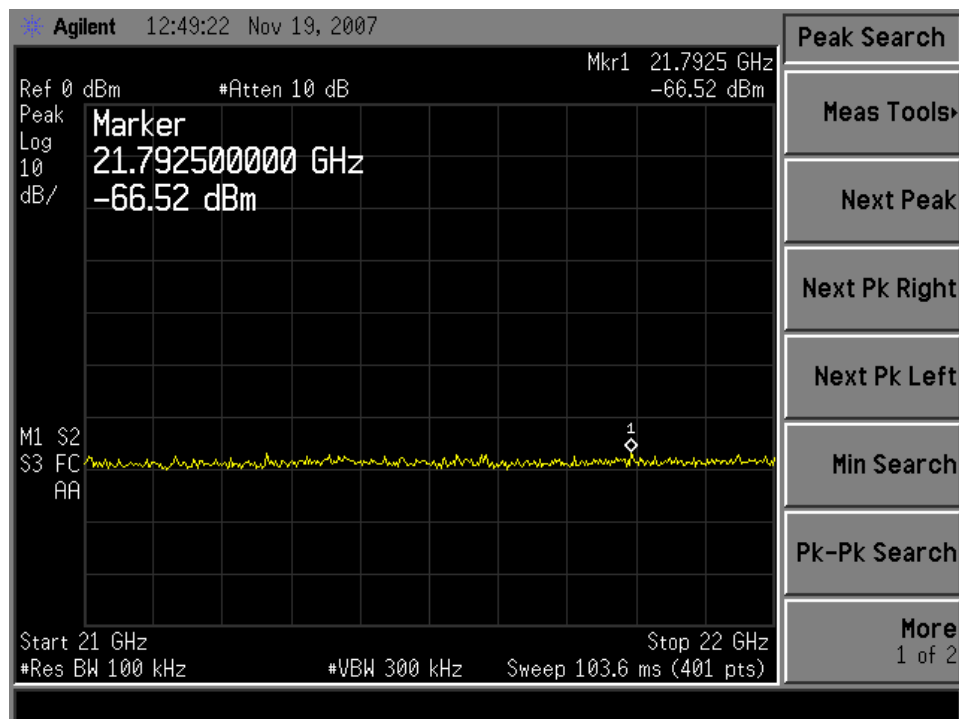
Channel 26: 18-19GHz, Net reading with cable loss at 18.0800GHz is -62.2dBm



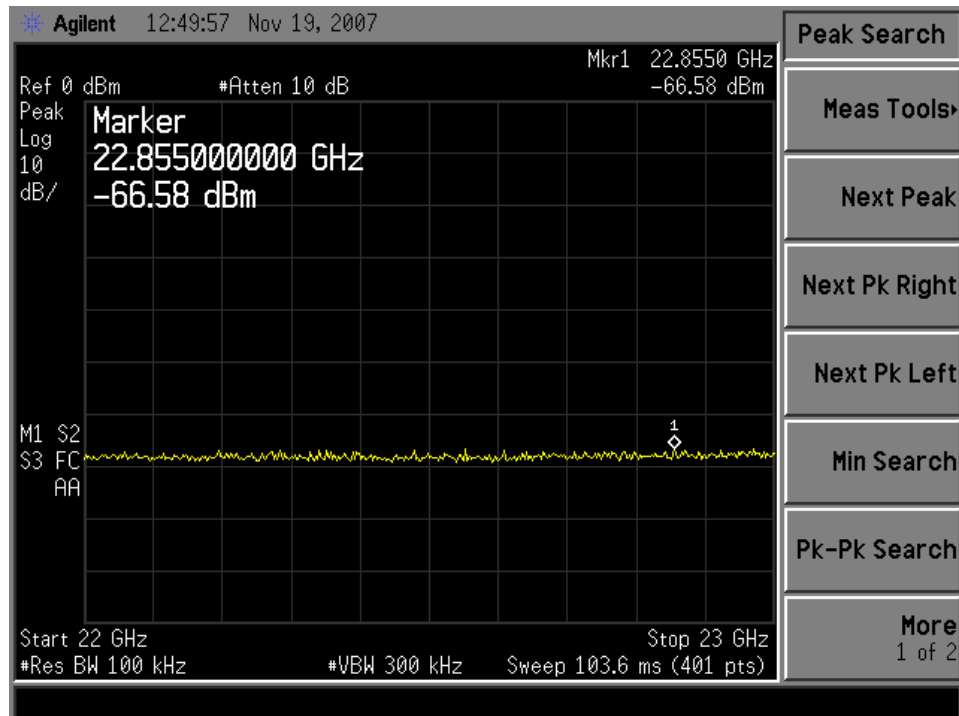
Channel 26: 19-20GHz, Net reading with cable loss at 19.6750GHz is -61.67dBm



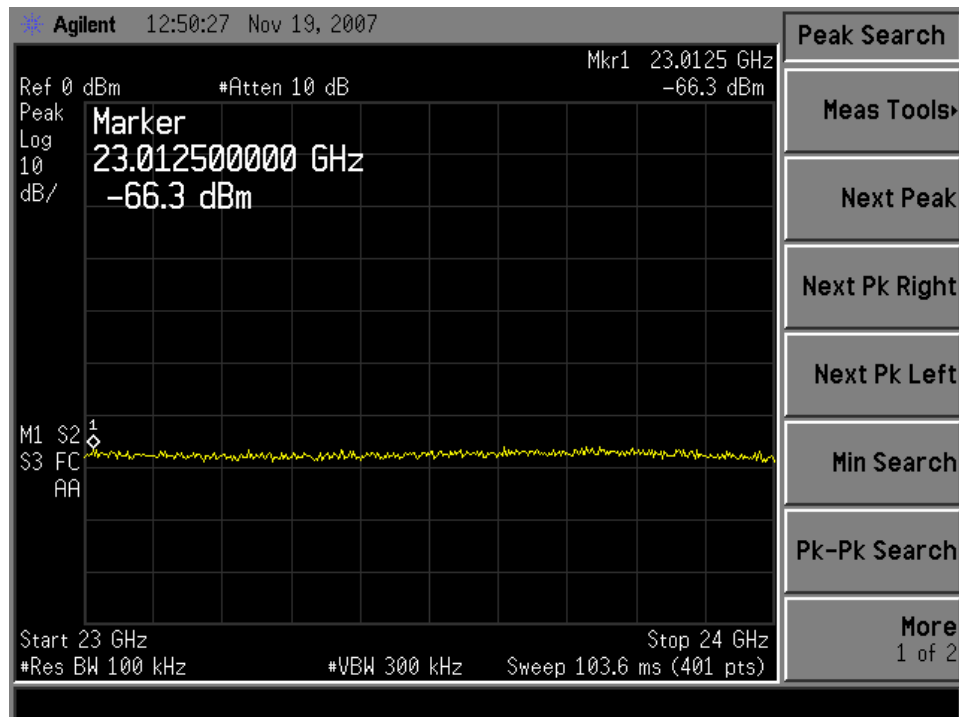
Channel 26: 20-21GHz, Net reading with cable loss at 20.8875GHz is -61.5dBm



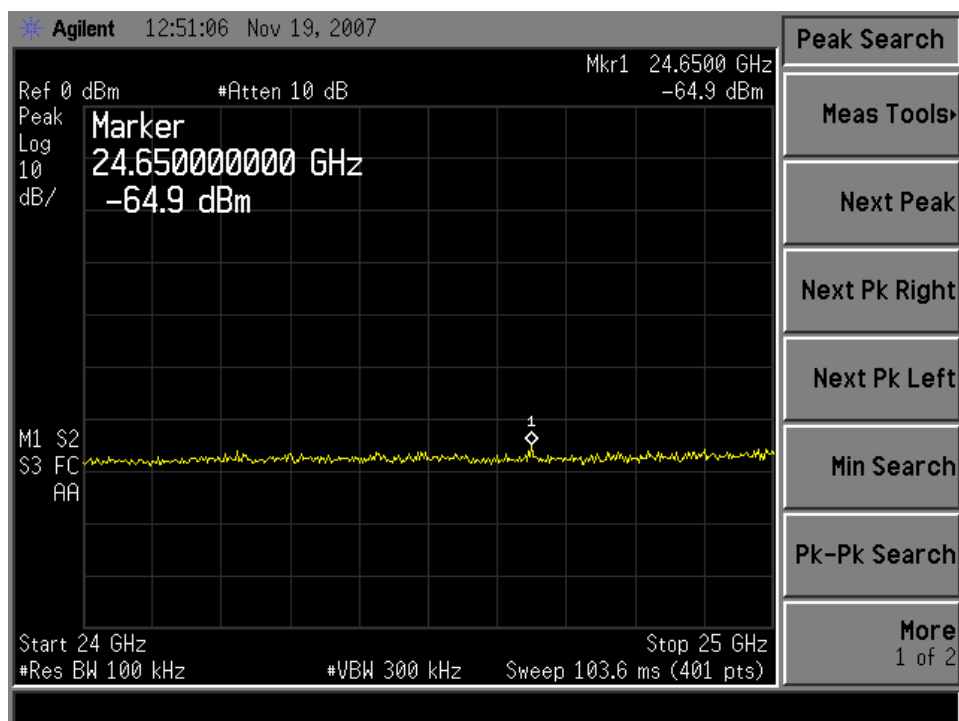
Channel 26: 21-22GHz, Net reading with cable loss at 21.7925GHz is -61.72dBm



Channel 26: 22-23GHz, Net reading with cable loss at 22.8550GHz is -61.68dBm



Channel 26: 23-24GHz, Net reading with cable loss at 23.0125GHz is -61.5dBm



Channel 26: 24-25GHz, Net reading with cable loss at 24.6500GHz is -59.8dBm

Test Results: Pass

Test Standard: FCC 15.205, 15.209, 15.247(d)

Test: Radiated Spurious Emissions

Performance Criterion: The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209.

EUT Operating Voltage: 115V/60Hz

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	65	Pressure (hPa):	1065	Ambient (°C):	20
Pretest Verification Performed:	Yes		Equipment under Test:	MG-5424L-200-R		

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	ANTENNA	EMCO	3142	9701-1116	12/04/2007
2	BROADBAND ANTENNA	Compliance Design	B100	1852	09/13/2008
3	BROADBAND ANTENNA	Compliance Design	B200	1850	09/13/2008
4	40 GHz Cable	Megaphase	TM40-K1K1-80	7030802 002	04/24/2008
5	CABLE	ITS	RG214B/U	S2, 3M FLR	09/17/2008
6	Synthesized Sweep Generator	Hewlett Packard	83620A	3213A01244	02/06/2009
7	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
8	EMI Receiver Set W/RF Filter	Hewlett Packard	8542E	Littleton Asset # 145-092	02/16/2008
9	RF FILTER	Hewlett Packard	85420E	Littleton Asset # 145-092	02/16/2008
10	HORN ANTENNA	EMCO	3115	9602-4675	09/24/2008
11	Pre-Amp	Miteq	NSP 4000-NFG	1260417	03/25/2008
12	HORN ANTENNA	EMCO	200116	J4107070326001	04/20/2008
13	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Details:

Radiated Emissions 30-1000MHz

Company: Millenneial Net, Inc.

Model #: MG-5424L-200-R

Serial #: 0307371385

Engineers: Kouma Sinn

Project #: 3134983

Date(s): 10/01/07

Standard: FCC Part Subpart C 15.247

Receiver: Little Receiver (Asset # 145-092)

PreAmp: Miteg2-3-25-08.txt

PreAmp Used? (Y or N): N

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency: 115V/60Hz

Antenna & Cables: N

Bands: N, LF, HF, SHF

Antenna: LOG1 12-04-2007 V3.txt LOG1 12-04-2007 H3.txt

Cable(s): S2 3M FLR 9-17-08.txt NONE.

Barometer: BAR2

Location: 2

Temp/Humidity/Pressure: 21C

45%

1050mbar

Frequency Range: 30-1000MHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
The channel is set to 11											
QP	V	31.000	9.0	16.4	0.6	0.0	0.0	26.1	40.0	-13.9	120/300 kHz
QP	V	46.940	19.8	9.3	0.8	0.0	0.0	29.9	40.0	-10.1	120/300 kHz
QP	V	50.000	25.1	8.4	0.8	0.0	0.0	34.2	40.0	-5.8	120/300 kHz
QP	V	64.000	10.0	8.1	0.9	0.0	0.0	19.0	40.0	-21.0	120/300 kHz
QP	V	74.570	12.8	7.4	1.0	0.0	0.0	21.2	40.0	-18.8	120/300 kHz
QP	V	82.540	20.4	7.5	1.1	0.0	0.0	29.0	40.0	-11.0	120/300 kHz
QP	V	85.660	21.5	7.6	1.1	0.0	0.0	30.3	40.0	-9.7	120/300 kHz
QP	V	91.280	21.8	7.9	1.2	0.0	0.0	30.8	43.5	-12.7	120/300 kHz
QP	V	102.000	30.4	8.1	1.2	0.0	0.0	39.7	43.5	-3.8	120/300 kHz
QP	V	103.000	30.0	8.1	1.2	0.0	0.0	39.3	43.5	-4.2	120/300 kHz
QP	V	106.000	28.7	8.0	1.2	0.0	0.0	38.0	43.5	-5.5	120/300 kHz
QP	V	110.000	29.7	8.0	1.3	0.0	0.0	39.0	43.5	-4.5	120/300 kHz
QP	V	112.000	29.8	7.8	1.3	0.0	0.0	38.8	43.5	-4.7	120/300 kHz
QP	V	114.000	29.8	7.5	1.3	0.0	0.0	38.6	43.5	-4.9	120/300 kHz
QP	V	120.000	21.7	6.8	1.4	0.0	0.0	29.9	43.5	-13.6	120/300 kHz
QP	V	137.000	21.6	6.9	1.4	0.0	0.0	29.9	43.5	-13.6	120/300 kHz
QP	V	168.000	20.7	9.2	1.6	0.0	0.0	31.6	43.5	-11.9	120/300 kHz
QP	V	196.000	15.2	9.9	1.8	0.0	0.0	26.9	43.5	-16.6	120/300 kHz
QP	V	202.000	18.7	10.3	1.8	0.0	0.0	30.9	43.5	-12.6	120/300 kHz
QP	V	229.300	16.5	11.9	1.9	0.0	0.0	30.3	46.0	-15.7	120/300 kHz
QP	V	242.000	21.0	12.3	2.0	0.0	0.0	35.3	46.0	-10.7	120/300 kHz

Special Radiated Emissions Channel 11 1-25GHz

Company: Millenneial Net, Inc.

Model #: MG-5424L-200-R

Serial #: 0307371385

Engineers: Kouma Sinn

Project #: 3134983

Standard: FCC Part 15 Subpart C 15.247

Receiver: ROS001

PreAmp: Miteg2-3-25-08.txt

PreAmp Used? (Y or N): y

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency: 115V/60Hz

Antenna & Cables: If Bands: N, LF, HF, SHF

Antenna: Horn2 V1m 9-24-2008.txt Horn2 H1m 9-24-2008.txt

Cable(s): CBL028 12-04-2007.txt CBL030 12-04-2007.txt

Barometer: BAR2

Location: 2

Date(s): 10/02/07

Temp/Humidity/Pressure: 22C 40% 1050mbar

Frequency Range: 1-25GHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
CH11(2405)											
PK	V	4810.000	40.7	33.5	7.1	28.4	0.0	52.9	74.0	-21.1	1M/3M
AVG	V	4810.000	31.3	33.5	7.1	28.4	0.0	43.5	54.0	-10.5	1M/3M
PK	V	7215.000	24.0	36.6	9.4	28.1	0.0	41.9	89.0	-47.1	100k/300k NF
PK	V	9620.000	20.8	38.2	10.8	27.8	0.0	42.0	89.0	-47.0	100k/300k NF
PK	V	12025.000	31.3	39.1	14.1	27.7	0.0	56.8	74.0	-17.2	1M/3M NF
AVG	V	12025.000	24.7	39.1	14.1	27.7	0.0	50.2	54.0	-3.8	1M/3M NF
PK	V	14430.000	22.7	40.8	14.4	27.6	0.0	50.3	89.0	-38.7	100k/300k NF
PK	V	16835.000	20.9	40.4	15.1	28.3	0.0	48.1	89.0	-40.9	100k/300k NF

No emissions detected from 18-25GHz. EMCO4 & CBL030 were used for this range

Special Radiated Emissions Channel 18 1-25GHz

Company: Millenneial Net, Inc.

Model #: MG-5424L-200-R

Serial #: 0307371385

Engineers: Kouma Sinn

Project #: 3134983

Date(s): 10/02/07

Location: 2

Standard: FCC Part 15 Subpart C 15.247

Receiver: ROS001

PreAmp: Miteg2-3-25-08.txt

Limit Distance (m): 3

Test Distance (m): 3

PreAmp Used? (Y or N): y

Voltage/Frequency:

115V/60Hz

Frequency Range:

1-25GHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
CH18(2440)											
PK	V	4880.000	43.2	33.7	8.3	28.4	0.0	56.8	74.0	-17.2	1M/3M
AVG	V	4880.000	34.4	33.7	8.3	28.4	0.0	48.0	54.0	-6.0	1M/3M
PK	V	4881.117	42.9	33.7	8.3	28.4	0.0	56.5	74.0	-17.5	1M/3M
AVG	V	4881.117	36.6	33.7	8.3	28.4	0.0	50.2	54.0	-3.8	1M/3M
PK	V	7320.000	34.1	36.9	9.3	28.1	0.0	52.1	74.0	-21.9	1M/3M NF
AVG	V	7320.000	25.8	36.9	9.3	28.1	0.0	43.8	54.0	-10.2	1M/3M NF
PK	V	9760.000	23.3	38.4	10.9	27.8	0.0	44.8	93.0	-48.2	100k/300k NF
PK	V	12200.000	33.0	39.1	12.6	27.7	0.0	57.0	74.0	-17.0	1M/3M NF
AVG	V	12200.000	24.3	39.1	12.6	27.7	0.0	48.3	54.0	-5.7	1M/3M NF
PK	V	14640.000	22.1	40.1	13.6	27.6	0.0	48.3	93.0	-44.7	100k/300k NF
PK	V	17080.000	22.7	41.6	14.9	28.4	0.0	50.7	93.0	-42.3	100k/300k NF
PK	V	9760.000	23.3	38.4	10.9	27.8	0.0	44.8	93.0	-48.2	100k/300k NF
PK	V	12200.000	33.0	39.1	14.5	27.7	0.0	58.9	74.0	-15.1	1M/3M NF
AVG	V	12200.000	24.3	39.1	14.5	27.7	0.0	50.2	54.0	-3.8	1M/3M NF
PK	V	14640.000	22.1	40.1	14.2	27.6	0.0	48.8	93.0	-44.2	100k/300k NF
PK	V	17080.000	22.7	41.6	15.4	28.4	0.0	51.2	93.0	-41.8	100k/300k NF
No emissions detected from 18-25GHz. EMCO4 & CBL030 were used for this range											

Special Radiated Emissions Channel 26 1-25GHz

Company: Millenneial Net, Inc.

Model #: MG-5424L-200-R

Serial #: 0307371385

Engineers: Kouma Sinn

Project #: 3134983

Date(s): 10/02/07

Standard: FCC Part 15 Subpart C 15.247

Receiver: ROS001

PreAmp: Miteg2-3-25-08.txt

PreAmp Used? (Y or N): y

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency: 115V/60Hz

Frequency Range: 1-25GHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
CH26(2480)											
PK	V	4960.000	42.6	33.9	8.3	28.4	0.0	56.4	74.0	-17.6	1M/3M
AVG	V	4960.000	34.5	33.9	8.3	28.4	0.0	48.3	54.0	-5.7	1M/3M
PK	V	4961.000	42.4	33.9	8.3	28.4	0.0	56.2	74.0	-17.8	1M/3M
AVG	V	4961.000	36.0	33.9	8.3	28.4	0.0	49.8	54.0	-4.2	1M/3M
PK	V	7440.000	33.4	37.2	9.4	28.1	0.0	51.8	74.0	-22.2	1M/3M
AVG	V	7440.000	26.1	37.2	9.4	28.1	0.0	44.5	54.0	-9.5	1M/3M
PK	V	9920.000	21.6	38.6	11.1	27.8	0.0	43.5	93.7	-50.2	100k/300k
AVG	V	9920.000	20.1	38.6	11.1	27.8	0.0	42.0	93.7	-51.7	100k/300k
PK	V	12400.000	33.9	39.2	14.2	27.7	0.0	59.5	74.0	-14.5	1M/3M
AVG	V	12400.000	24.9	39.2	14.2	27.7	0.0	50.6	54.0	-3.4	1M/3M
PK	V	14880.000	22.6	39.3	14.2	27.6	0.0	48.5	93.7	-45.2	100k/300k
PK	V	17360.000	21.6	43.3	15.5	28.5	0.0	51.8	93.7	-41.9	100k/300k

No emissions detected from 18-25GHz. EMCO4 & CBL030 were used for this range

Setup Photos:

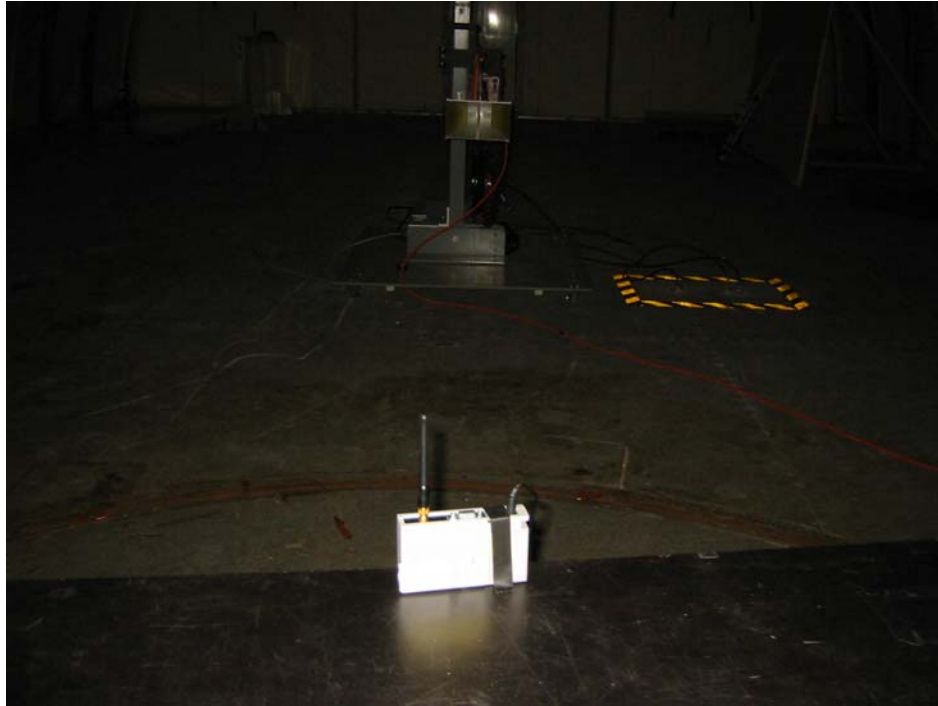


Setup Photo 1



Setup Photo 2

Setup Photos:



Setup Photo 3



Setup Photo 4

Test Results: Pass

Test Standard: FCC 15.247(e)

Test: Peak Power Spectral Density

Performance Criterion: The peak power spectral density must not exceed 8 dBm / 3 kHz.

EUT Operating Voltage: 115V/60Hz

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	60	Pressure (hPa):	1050	Ambient (°C):	17
Pretest Verification Performed:	Yes		Equipment under Test:	MG-5424L-200-R		

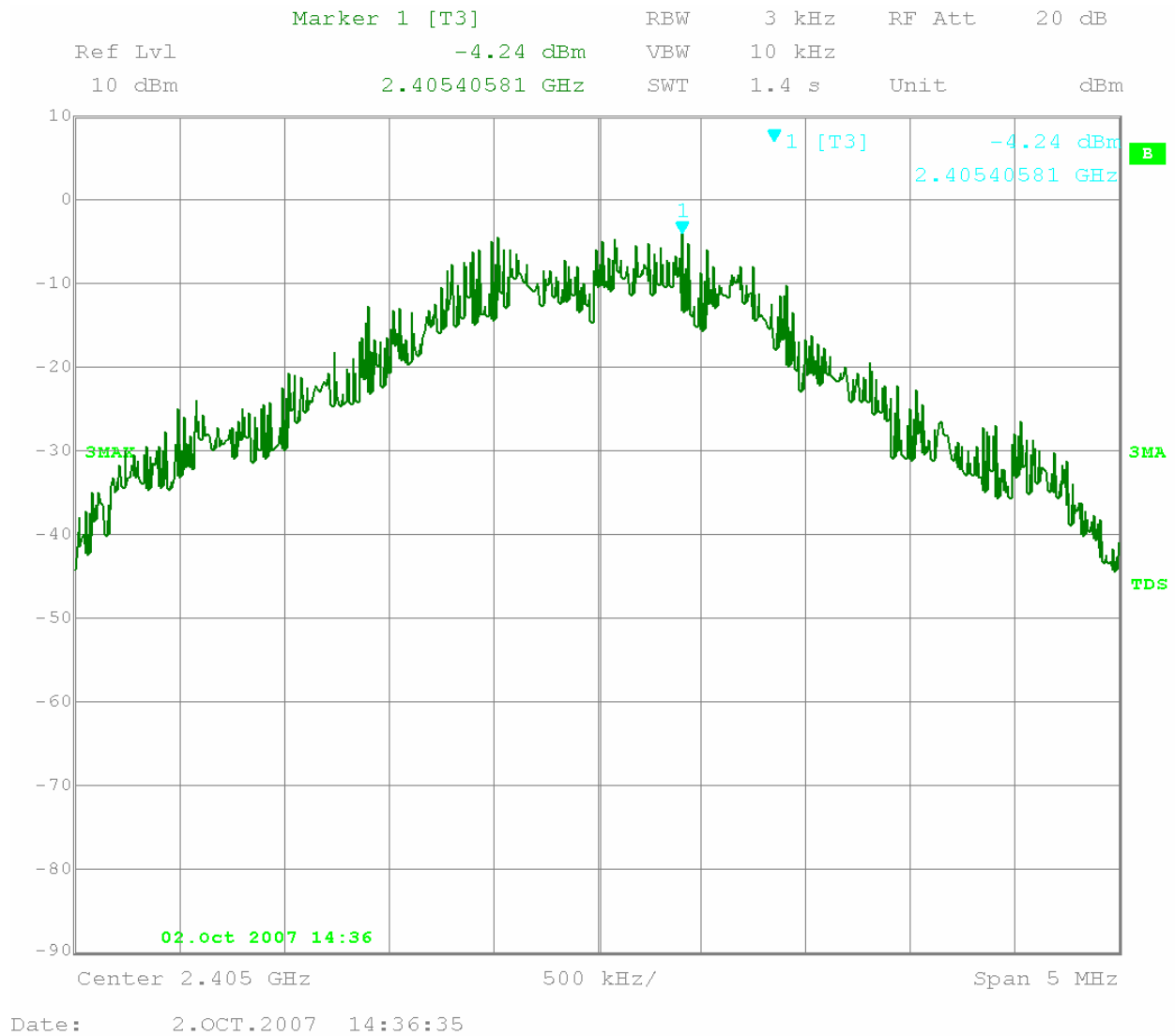
Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/04/2007
3	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007

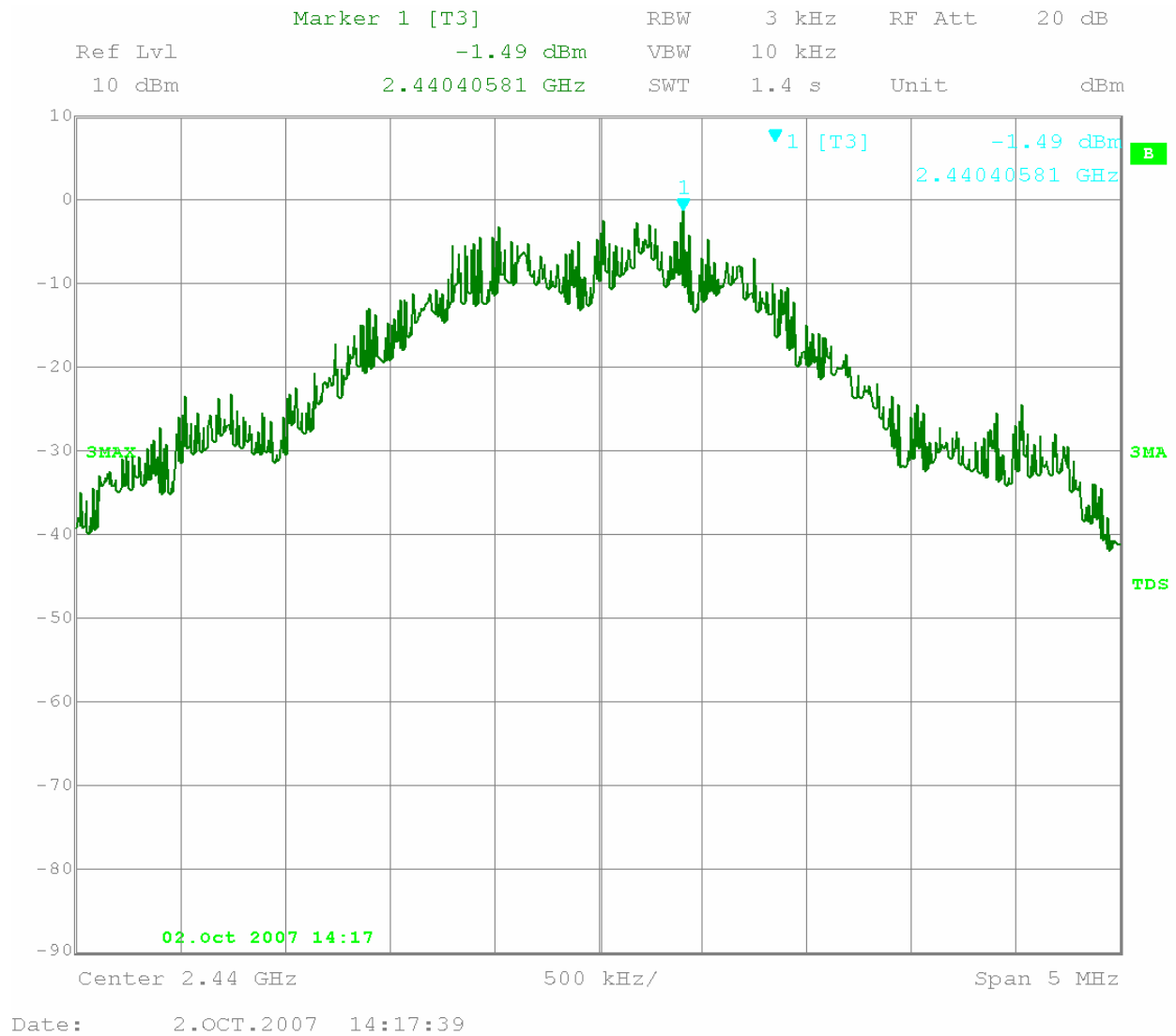
Test Details:

Channel	Frequency	Spectral Density	Spectral Density Limit
11	2405 MHz	-4.24 dBm	8 dBm
18	2440 MHz	-1.49 dBm	8 dBm
26	2480 MHz	-2.14 dBm	8 dBm

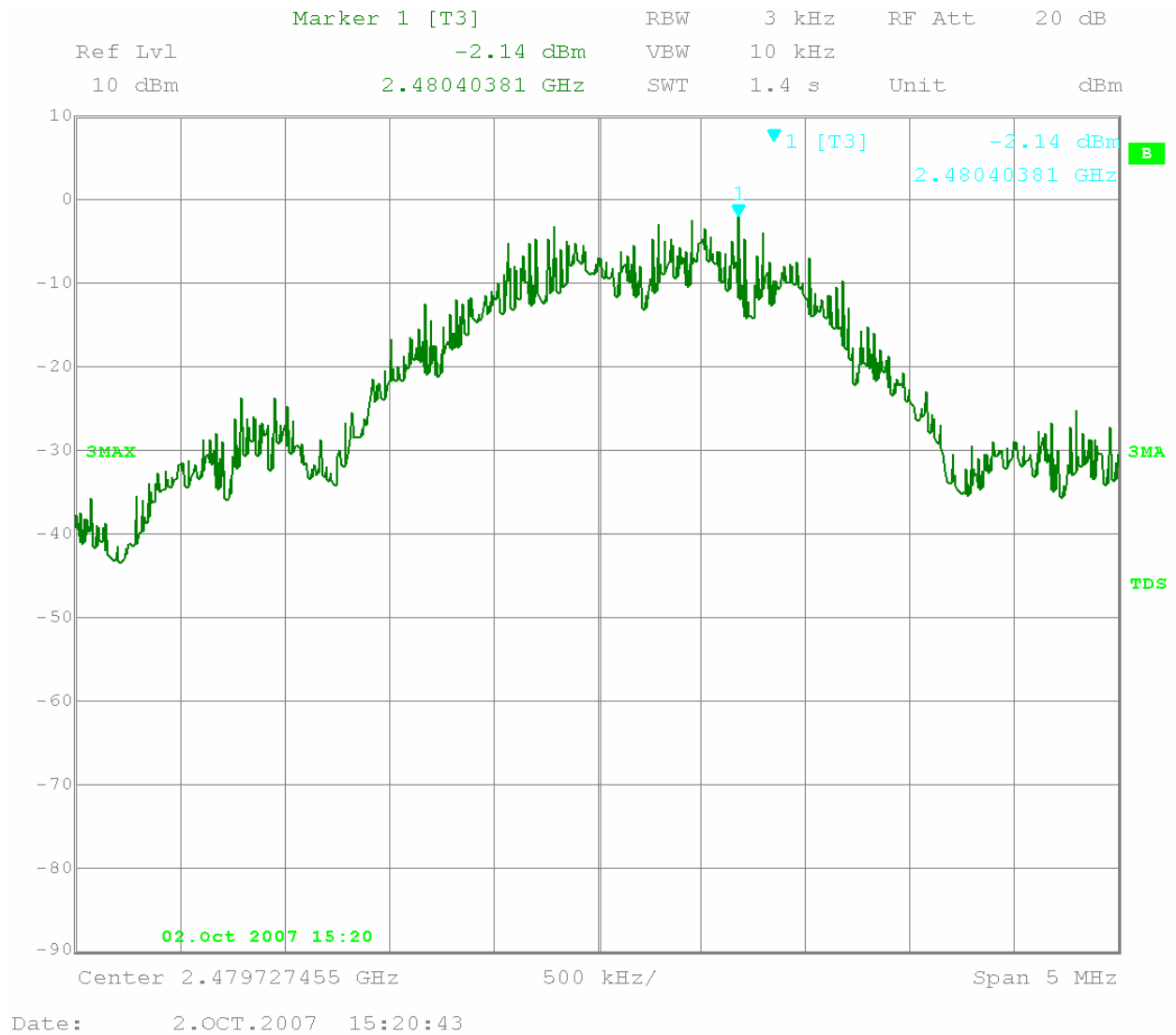
Notes: The cable loss was compensated for in the spectrum analyzer.



Channel 11: Peak Spectral Density



Channel 18: Peak Spectral Density



Channel 26: Peak Spectral Density

Test Results: Pass

Test Standard: FCC 15.215

Test: Band Edge Compliance

Performance Criterion: The fundamental frequency must stay within the assigned frequency band, 2.400-2.4835GHz.

EUT Operating Voltage: 115V/60Hz

Test Environment:

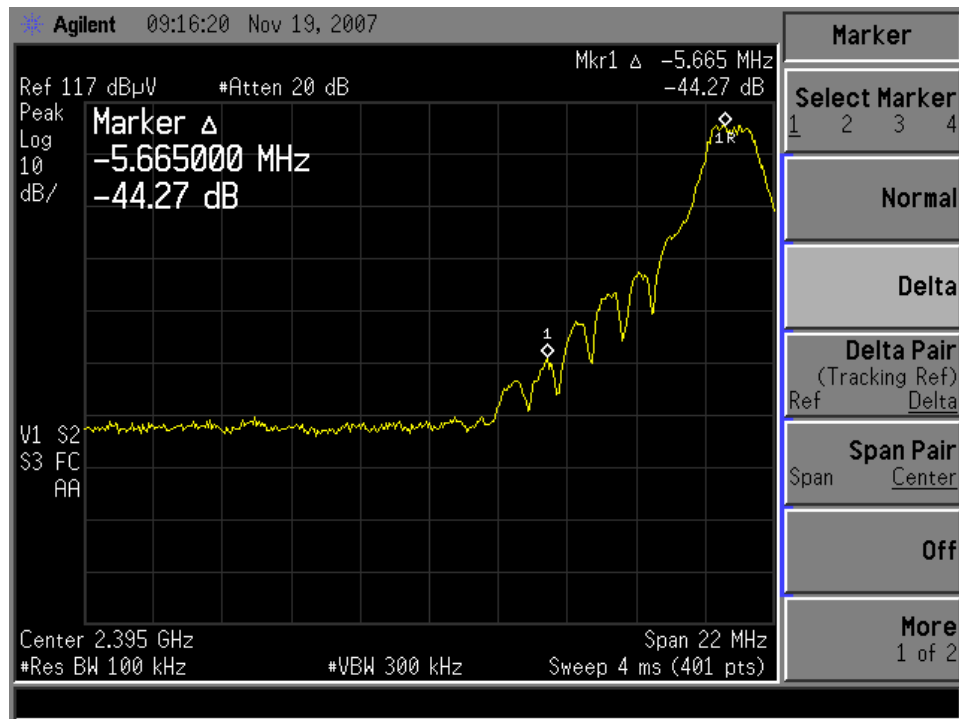
Environmental Conditions During Testing:	Humidity (%):	26	Pressure (hPa):	1050	Ambient (°C):	25
Pretest Verification Performed:	N/A		Equipment under Test:	MG-5424L-200-R		

Test Equipment Used:

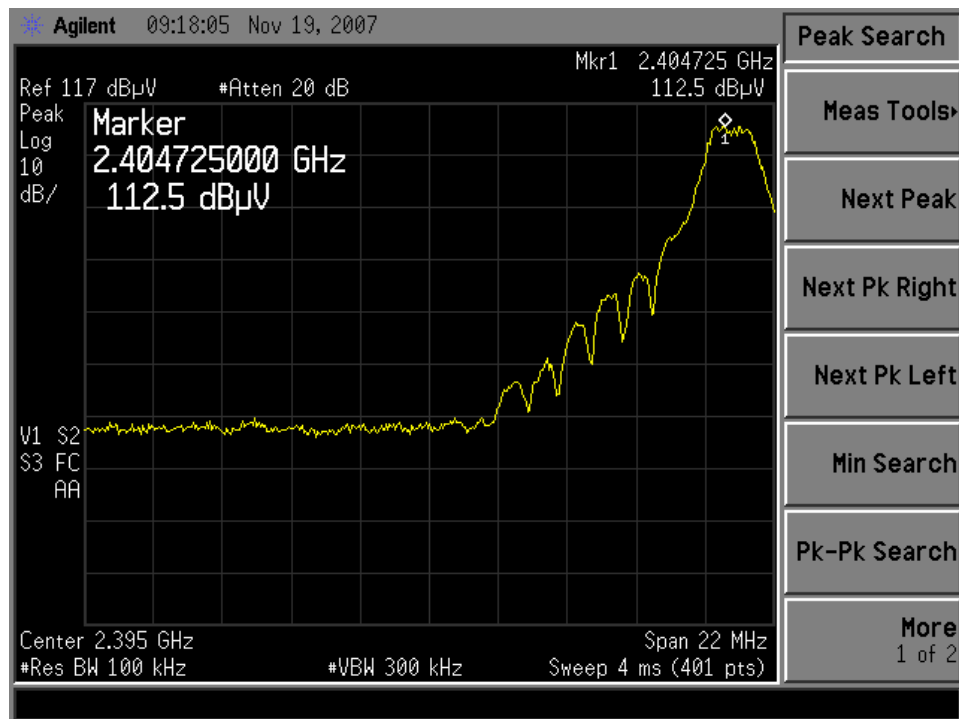
TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2008
3	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/04/2007

Test Details:

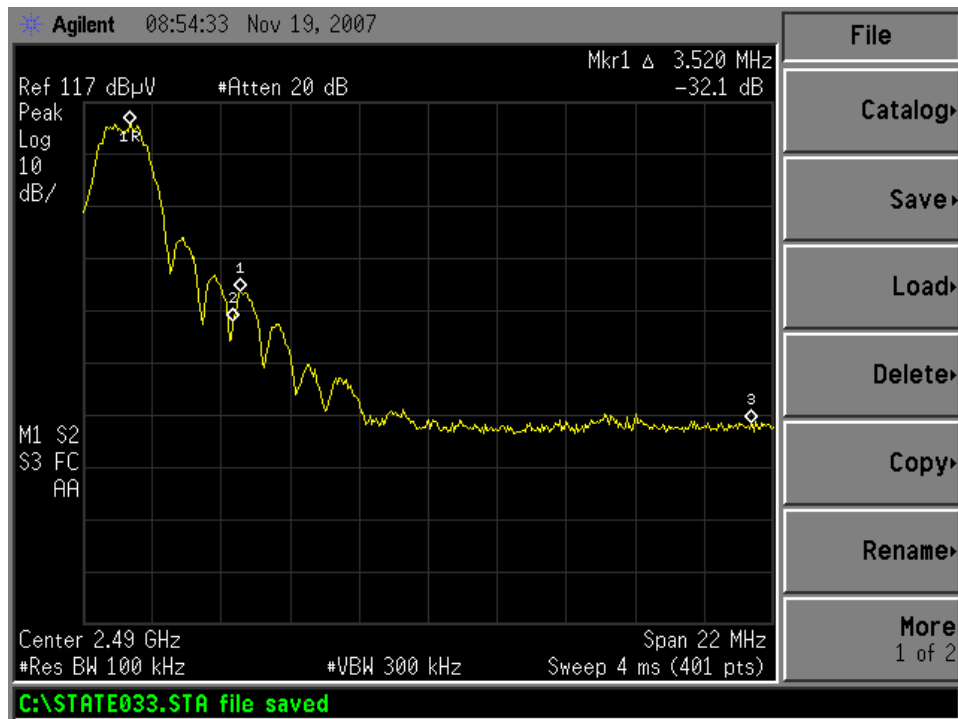
Notes: The upper and lower channels (channels 11 and 26) were observed using a 100 kHz bandwidth. A marker was placed at the peak of the fundamental. Another marker was placed at the band edges, 2400 MHz and 2483.5 MHz and at the highest signal level above and below the band edge. It can be seen that the highest signal level above the 2483.5 MHz band edge is 32.1 dB below the peak signal level of the 2480 MHz fundamental.



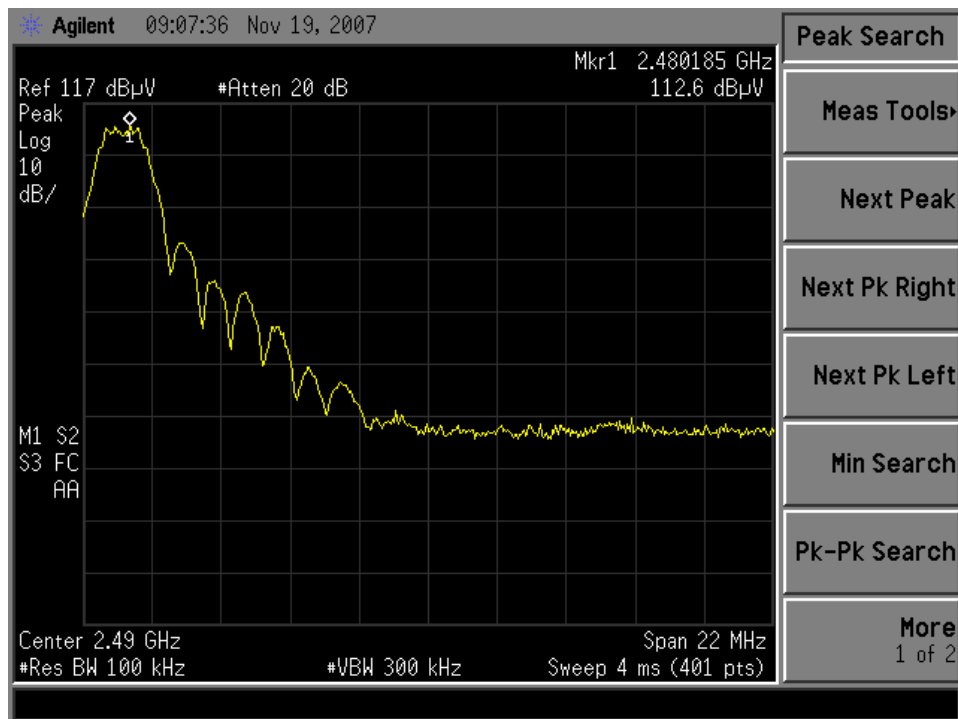
Lower Bandedge 1



Lower Bandedge 2



Upper Bandedge 1



Upper Bandedge 2

Test Results: Pass

Test Standard: FCC 15.207

Test: AC Line-Conducted Spurious Emissions

Performance Criterion: Emissions must meet the general limits of 15.207.

EUT Operating Voltage: 115V/60Hz

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	50	Pressure (hPa):	1050	Ambient (°C):	21
Pretest Verification Performed:	Yes		Equipment under Test:	MG-5424L-200-R		

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	Cable BNC/BNC, 30'	ITS	BNC-30	CBLBNC2	05/30/2008
3	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	9252-50-R-24-BNC	955107	04/11/2008
4	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS22A	09/18/2008

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Details:

Conducted Emissions

Company: Millenneial Net, Inc. Receiver: Little Receiver (Asset # 145-092)
 Model #: MG-5424L-200-R Cable: CBLBNC2 3-22-08.txt
 Serial #: 0307371385 LISN 1: LISN13(1) 04_11_08.TXT
 Engineer(s): Kouma Sinn Location: 2 LISN 2: LISN13(2) 04_11_08.TXT
 Project #: 3134983 Date: 10/01/07 LISN 3: NONE.
 Standard: FCC Part 15.207 LISN 4: NONE.
 Barometer: BAR2 Temp/Humidity/Pressure: 21C 50% 1050mbar Attenuator: DS22A 9-18-08.txt
 Voltage/Frequency: 115V/60Hz Frequency Range: 150kHz-30MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
QP	0.178	29.7	28.3			49.6	64.6	-14.9	9/30 kHz
QP	0.238	25.4	25.7			45.6	62.2	-16.6	9/30 kHz
QP	0.300	25.7	26.1			46.0	60.2	-14.2	9/30 kHz
QP	0.655	22.3	21.8			42.2	56.0	-13.8	9/30 kHz
QP	0.954	21.8	21.3			41.8	56.0	-14.2	9/30 kHz
QP	1.666	19.4	19.0			39.5	56.0	-16.5	9/30 kHz
QP	4.000	12.4	12.6			32.7	56.0	-23.3	9/30 kHz
QP	30.000	1.4	1.3			21.8	60.0	-38.2	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
AVG	0.178	17.4	13.6			37.3	54.6	-17.2	9/30 kHz
AVG	0.238	16.3	11.0			36.2	52.2	-16.0	9/30 kHz
AVG	0.300	19.7	19.0			39.6	50.2	-10.6	9/30 kHz
AVG	0.655	15.2	10.9			35.1	46.0	-10.9	9/30 kHz
AVG	0.954	13.9	13.9			33.9	46.0	-12.1	9/30 kHz
AVG	1.666	6.9	6.2			27.0	46.0	-19.0	9/30 kHz
AVG	4.000	6.4	6.4			26.5	46.0	-19.5	9/30 kHz
AVG	30.000	-6.6	-7.7			13.7	50.0	-36.3	9/30 kHz

Line-Conducted Emissions Photos:



AC Mains Line-Conducted Emissions Setup Photo 1



AC Mains Line-Conducted Emissions Setup Photo 2