DATE: 22 March 2010

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Mobile Access Networks

Equipment under test:

VE WIMAX 2.5 GHZ Distributed Antenna System

1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Measurement/Technical Report for

FCC ID: OJFVE-WIMAX-25E

This report concerns: Original Grant: X
Class II change:
Class I change:

Equipment type: WiMAX Licensed Transmitter

Limits used:
47CFR Part 27 Subpart C

Measurement procedure used is ANSI C63.4-2003.
Substitution Method used as in ANSI/TIA-603-B: 2002

Application for Certification prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Steve Blum
Mobile Access Networks
8391 Old Courthouse Rd., Suite #300
Vienna, VA. 22182
U.S.A.
Tel: +1-541-758-2880
Fax: +1-703-848-0260
e-mail: sblum@mobileaccess.com

TABLE OF CONTENTS

1. General Information

1.1 Administrative Information

Manufacturer:	Mobile Access Networks
Manufacturer's Address:	8391 Old Courthouse Rd. Suite #300 Vienna, VA 22182 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Steve Blum
Equipment Under Test (E.U.T):	VE WIMAX 2.5 GHZ Distributed Antenna System
Equipment Model No.:	1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E) 2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)
Equipment Serial No.:	1. 0010050014 2. 0010030000F
Date of Receipt of E.U.T:	22.02.10
Start of Test:	22.02.10
End of Test:	03.03.10
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 27 Subpart C

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

MobileAccess**VE** WiMAX solution provides enhanced, cost effective in-building WiMAX coverage for enterprise environment. This solution is quickly and simply deployed using the existing cable infrastructure to provide instant MIMO or SISO WiMAX coverage without requiring the installation of new cables and without affecting existing LAN services. MobileAccess**VE** minimizes disruption while providing a scalable and flexible solution at a significantly lower total installation cost.

The VE solution distributes WiMAX wireless service from the service provider's equipment and Ethernet services from the corporate LAN, to Access Pods installed throughout the enterprise. The Access Pods distribute the WiMAX services via integrated internal antennas (or external antennas for additional coverage optimization), and also provide Ethernet connectivity to the LAN terminals. The MobileAccess**VE** solution seamlessly coexists with the Enterprise LAN and does not consume LAN capacity.

The VAPs are distributed on each floor and plug into standard Ethernet jacks already installed at the enterprise site. They are powered via PoE technology and managed via a VE Control Unit (VCU) located in the floor's communication shaft for site coverage that requires more than one VCU (each VCU supports up to 12 VAPs), several VCUs (up to 12) can be aggregated under a single VCU serving as Master. The Master VCU provides the interface to the capacity sources (the service provider's equipment) and for management of all units.

This enhanced WiMAX coverage solution can be easily and quickly installed with minimal disturbance to the enterprise. In less than a few hours, with no additional cables required, a scalable and flexible solution is provided at a significantly lower total installation cost.

VE Control Unit (VCU) – Control Unit that can serve either as a Master or a Slave and interfaces the other VCUs (in case of Master) or the VAPs (when serving as Slave). The Master or Slave mode is automatically detected according to the VCU's physical connection. If a connection to another VCU is detected the VCU will be identified as a Slave; otherwise it will assume the role of a Master.

VAP (VE Access Pod) – These are pluggable antennas distributed at strategic locations on the floor to provide maximum WiMAX coverage. VAPs provide RF coverage via integrated, internal antennas. VAPs are also equipped with interfaces for external antennas that can be used for special coverage requirements. VAPs are remotely powered from the VCU using Power over Ethernet (PoE) – no local power required.

Up to twelve VAPs can be connected to a single VCU using LAN cables (CAT-5e or higher).

The antenna type recommended is a dipole with N-type connector with a gain of 7 dBi.

In this system, “Uplink” and “Downlink” are alternative names for Rx and Tx. Transmission from the Base station towards mobile users called “Downlink” or Tx. Reception from mobiles called “Uplink” or Rx.

The system supports spatial multiplexing / Cyclic delay (two types of MIMO), the E.U.T. supports whatever MIMO mode the BS operates in.

The system is professionally installed.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.’s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing 03 September 2009).
I.T.L.’s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. System Test Configuration

2.1 Justification

The test setup was configured to closely resemble the standard installation.

The EUT consists of the VCU and VAP. The WiMax source signal is represented in the setup by appropriate signal generator loaded with WiMax Studio SW.

An “Exercise” SW on the computer was used to enable / disable transmission of the VAP, while the EUT output was connected to the spectrum analyzer.

Both MIMO channels transmit during the testing.

2.2 EUT Exercise Software

The Element Management System EngGUI ver. 0.8 B02 used for commands delivery. These commands are used to enable / disable of VAP transmission. VCU version 0.8 B01 , VAP version 0.8 B01.

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

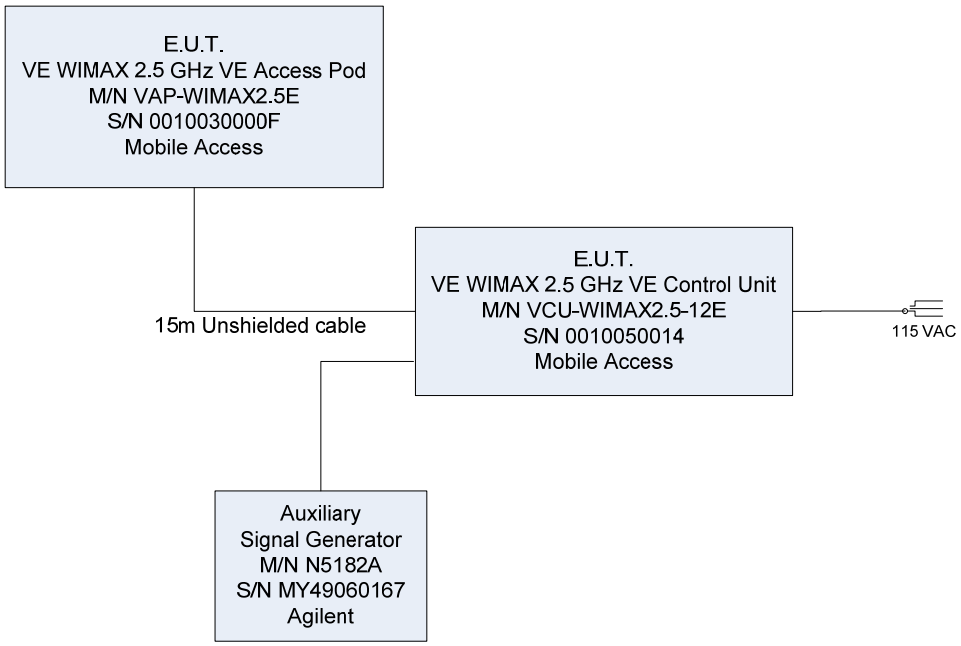


Figure 1. Test Set-up

Note: For the spurious radiated emission tests, the VE Access Pod was configured to transmit from its internal integral antennas and the VE Control Unit was connected to the signal generator via the Control Unit's MIMO 2 port on the same channel and amplitude as on MIMO 1 Port.

3. Maximum Peak Output Power

3.1 Test Specification

FCC Part 27, Subpart C (27.50(h)(2))

3.2 Test procedure

Peak Power Output must not exceed 2W. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (1.5 dB). The E.U.T. RF output was OFDMA modulated with 64QAM at 10MHz at 2501.0, 2600.0, and 2685.0 MHz and for the 5MHz bandwidth at the frequencies 2498.5, 2600, and 2687.5 MHz.

Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 100 kHz RBW.

ANTENNA TYPE Dipole antenna with N type connector (Antenna Gain : 7dBi)

5 MHz Bandwidth:

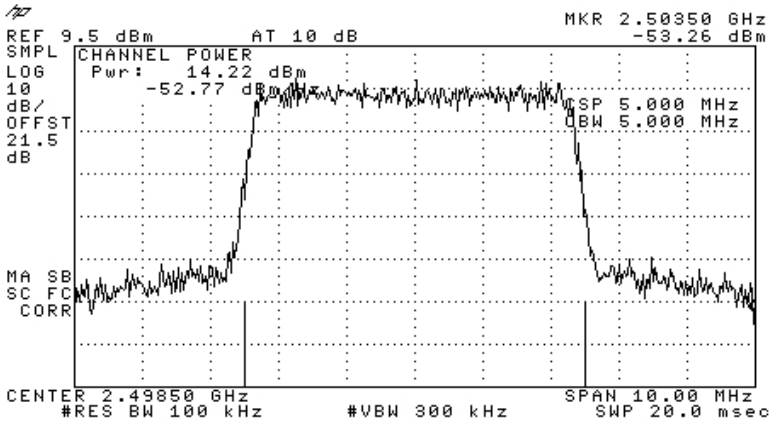


Figure 2.— 2498.5 MHz

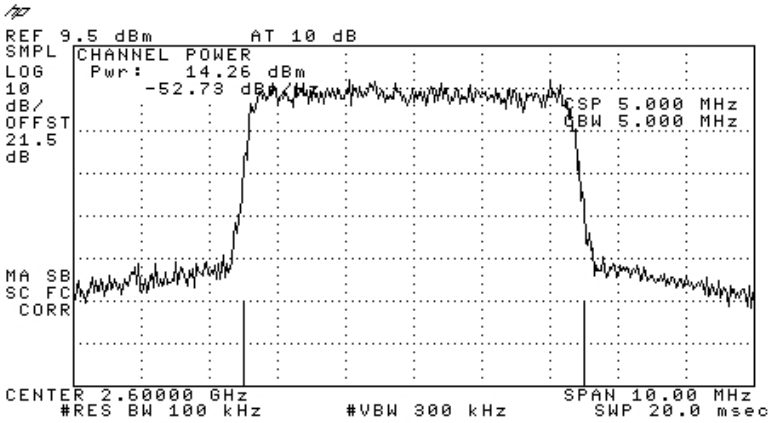


Figure 3.— 2600.00 MHz

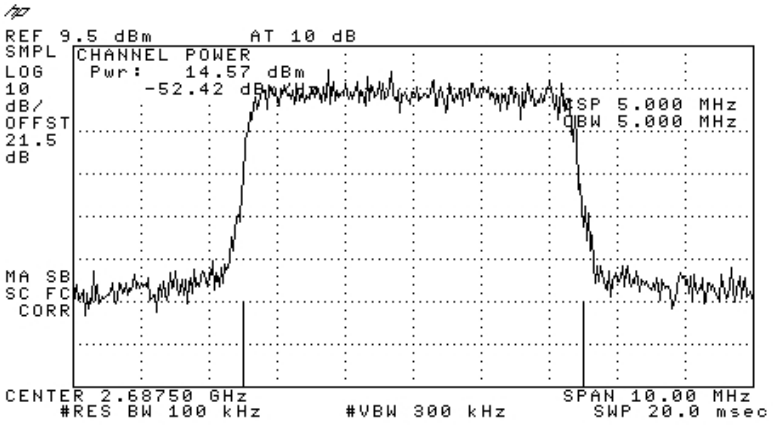


Figure 4.— 2687.50 MHz

10 MHz Bandwidth:

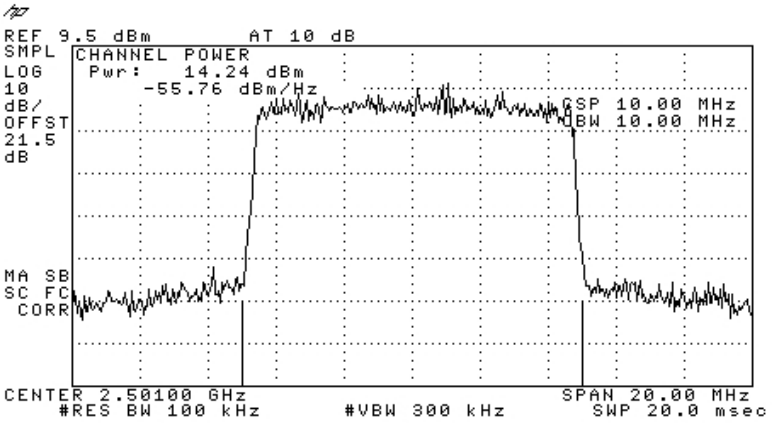


Figure 5.— 2501.0 MHz

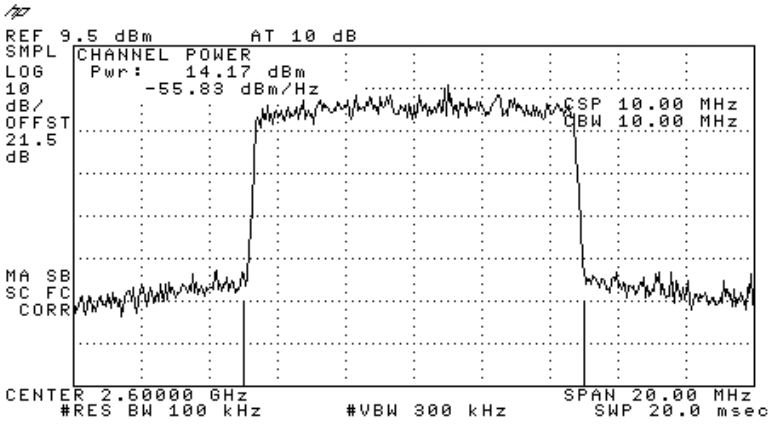


Figure 6.— 2600.00 MHz

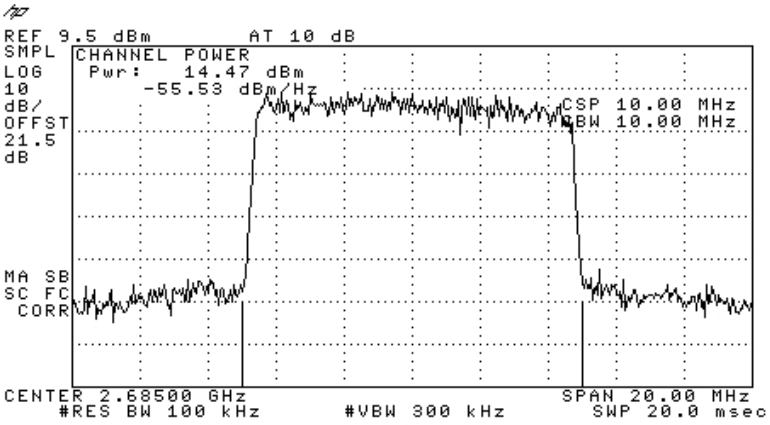


Figure 7.— 2685.0 MHz

3.3 Results table

E.U.T. Description: VE WIMAX 2.5 GHZ Distributed Antenna System
Model No.: 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)
Serial Number: 1. 0010050014 2. 0010030000F
Specification: FCC Part 27, Subpart C, Section 27.50 (h) (2)

Bandwidth	Operation Frequency (MHz)	Reading (dBm)	Antenna Gain (dB)	Reading (EIRP) (mW)	MIMO Total **(EIRP)** (mW)	Specification (mW)	Margin (mW)
5 MHz	2498.50	14.22	7	132.4	264.8	2000	-1735.2
5 MHz	2600.00	14.26	7	133.7	267.4	2000	-1732.6
5 MHz	2687.50	14.57	7	143.5	287.0	2000	-1713.0
10 MHz	2501.00	14.24	7	133.0	266.0	2000	-1734.0
10 MHz	2600.00	14.17	7	130.9	261.8	2000	-1738.2
10 MHz	2685.00	14.47	7	140.3	280.6	2000	-1719.4

Note: The peak output power is the combined maximum conducted output power.

Figure 8 Maximum Peak Power Output

JUDGEMENT: Passed by 1713.0 mW

TEST PERSONNEL:

Tester Signature: _____ Date: 22.03.10

Typed/Printed Name: A. Sharabi

3.4 Test Equipment Used.

Maximum Peak Output Power

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Signal Generator	Agilent	N5182A	MY49060167	May 20, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G 2W20	October 19, 2009	1 year
Cable	TestLINE	18	11556	January 4, 2010	1 year

Figure 9 Test Equipment Used

4. Emission Bandwidth

4.1 Test Specification

FCC Part 2, Section 1049; FCC Part 27 Section 27.53(m)(6)

4.2 Test Procedure

The E.U.T. was set to the applicable test frequency with OFDMA and 64QAM 10 MHz and 5 MHz modulation in the 2496.0-2690.0 MHz frequency range. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable. The spectrum analyzer was set to proper resolution B.W.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

5MHz:

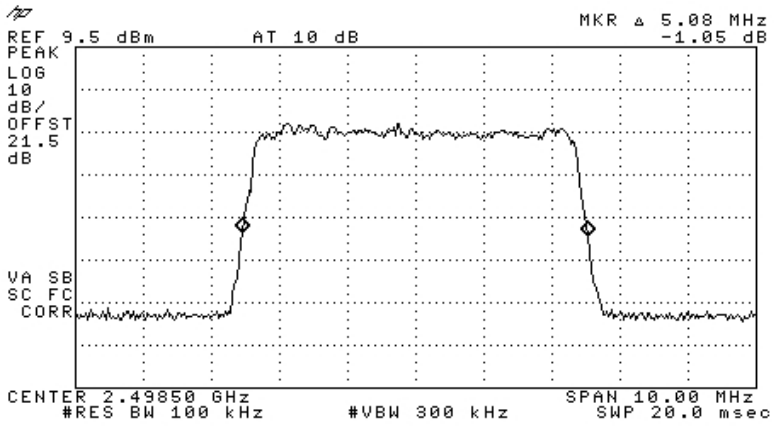


Figure 10.— 2498.50 MHz IN

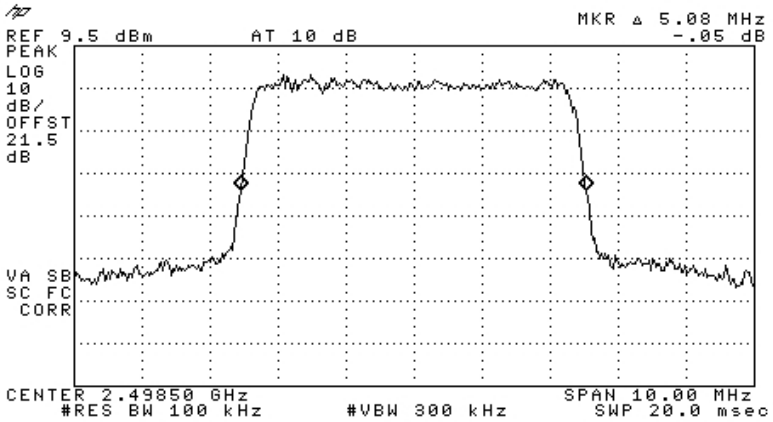


Figure 11.— 2498.50 MHz OUT

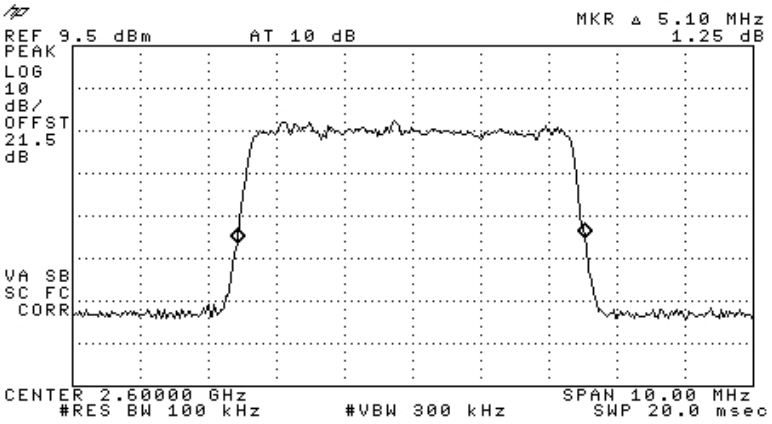


Figure 12.— 2600.00 MHz IN

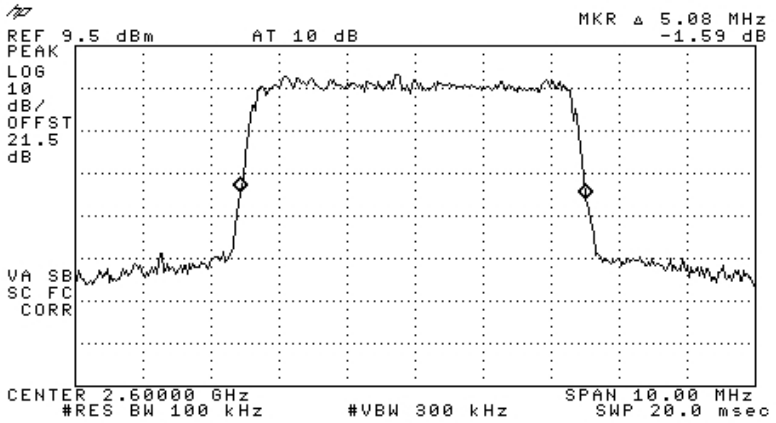


Figure 13.— 2600.00 MHz OUT

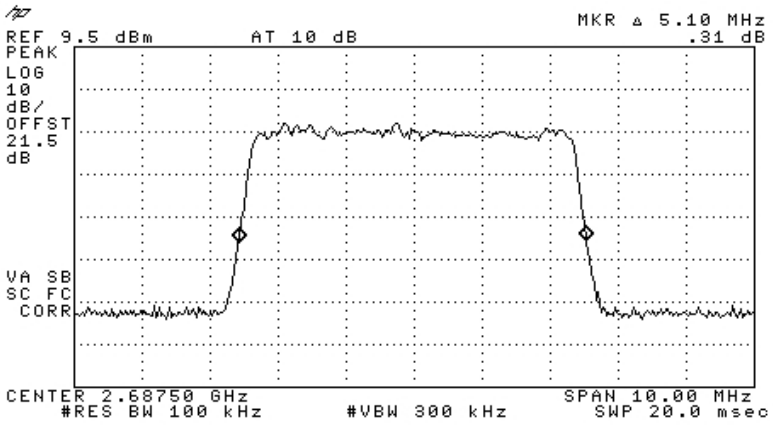


Figure 14.— 2687.50 MHz IN

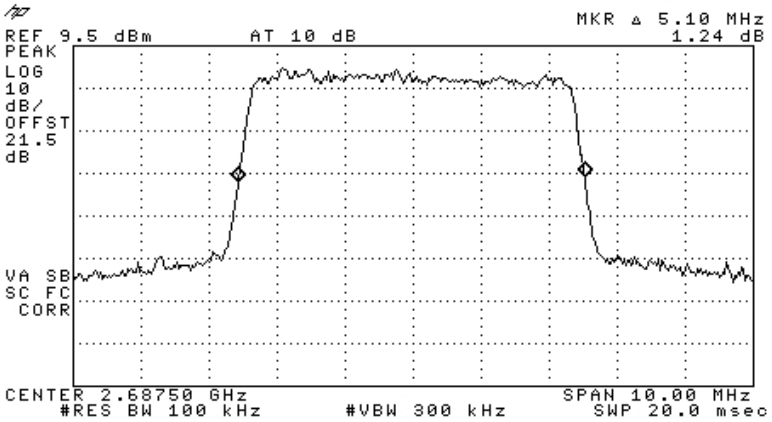


Figure 15.— 2687.50 MHz OUT

10 MHz:

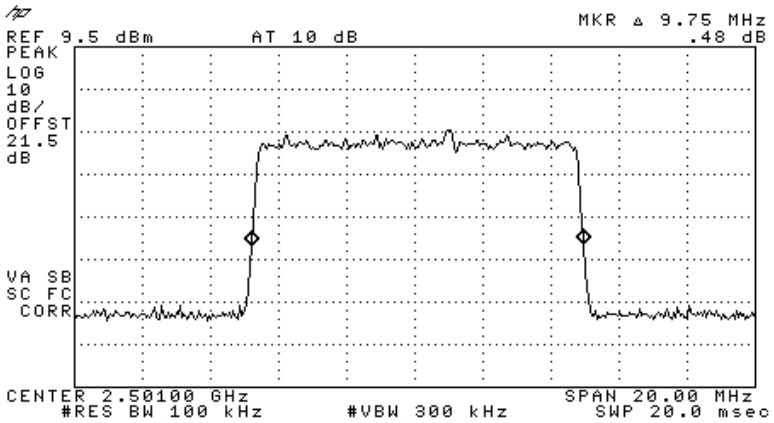


Figure 16.— 2501.0MHz IN

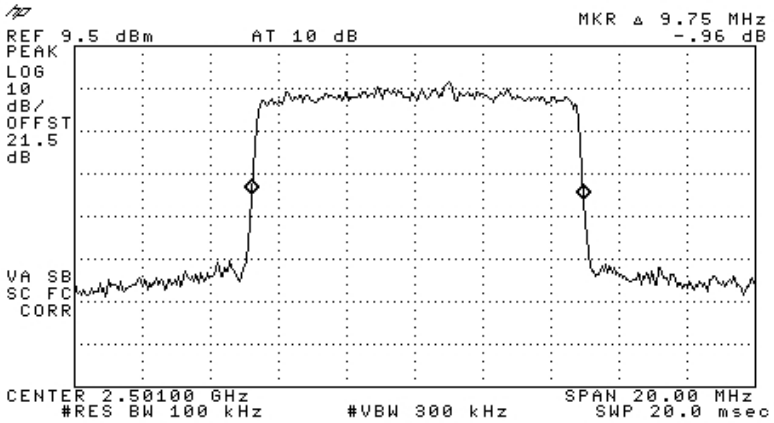


Figure 17.— 2501.0 MHz OUT

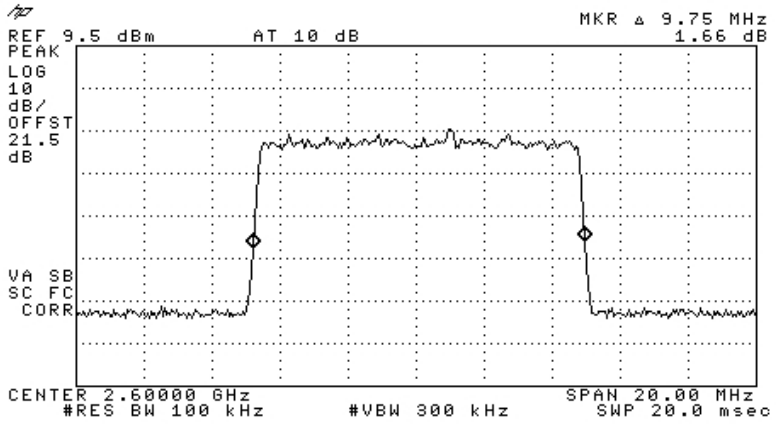


Figure 18.— 2600.00 MHz IN

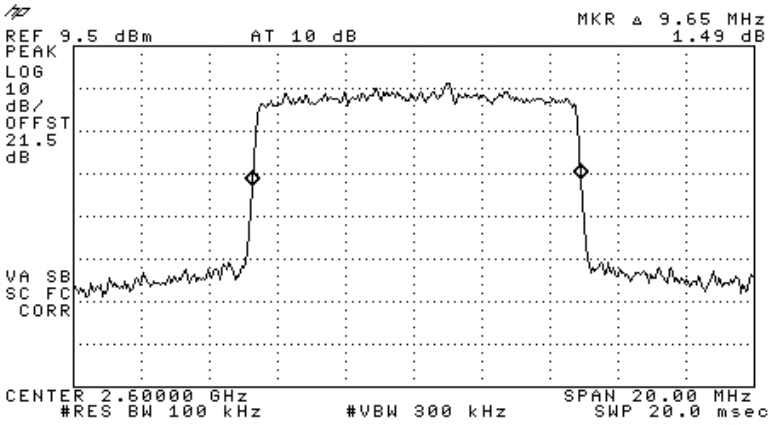


Figure 19.— 2600.00 MHz OUT

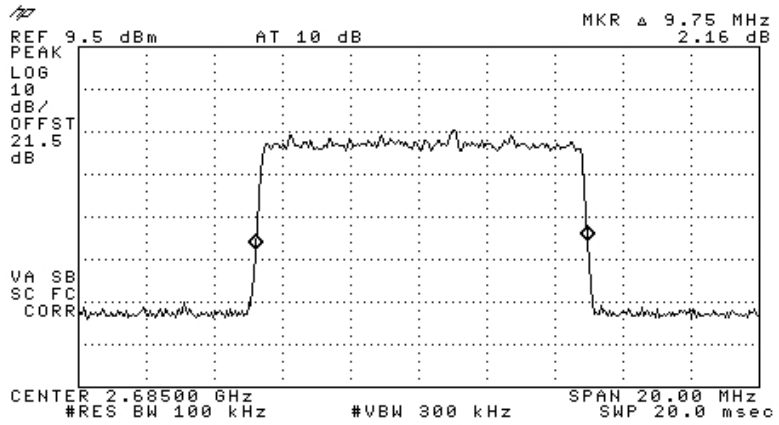


Figure 20.— 2685.0 MHz IN

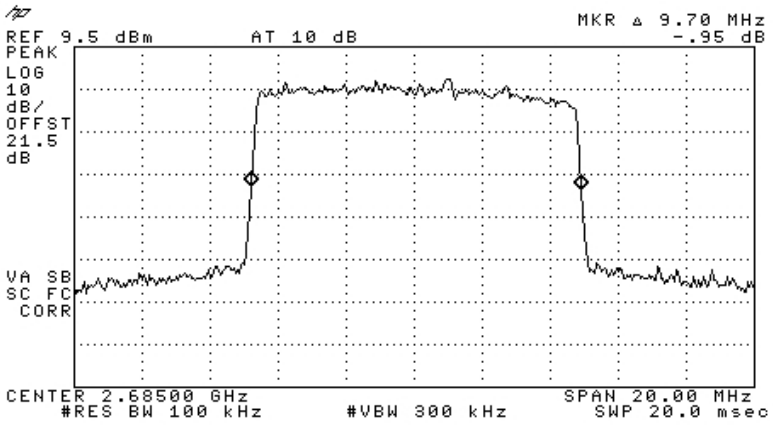


Figure 21.— 2685.0 MHz OUT

4.3 Results Table

E.U.T. Description: VE WIMAX 2.5 GHZ Distributed Antenna System
Model No.: 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)
Serial Number: 1. 0010050014 2. 0010030000F
Specification: FCC Part 2, Section 1049; FCC Part 27 Section 27.53(m)(6)

Modulation		Operating Frequency (MHz)	Reading (26dBc) (MHz)
5 MHz	Input	2498.50	5.08
5 MHz	Output	2498.50	5.08
5 MHz	Input	2600.00	5.10
5 MHz	Output	2600.00	5.08
5 MHz	Input	2687.50	5.10
5 MHz	Output	2687.50	5.10
10 MHz	Input	2501.00	9.75
10 MHz	Output	2501.00	9.75
10 MHz	Input	2600.00	9.75
10 MHz	Output	2600.00	9.65
10 MHz	Input	2685.00	9.75
10 MHz	Output	2685.00	9.70

Figure 22 Emission Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 22.03.10

Typed/Printed Name: A. Sharabi

1.1 Test Equipment Used.

Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Signal Generator	Agilent	N5182A	MY49060167	May 20, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G 2W20	October 19, 2009	1 year
Cable	TestLINE	18	11556	January 4, 2010	1 year

Figure 23 Test Equipment Used

5. Conducted Spurious Emissions

5.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (m)

5.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of 55 + 10 log (P) dB at 5.5 MHz from the channel edges.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (21.5 dB).

5MHz:

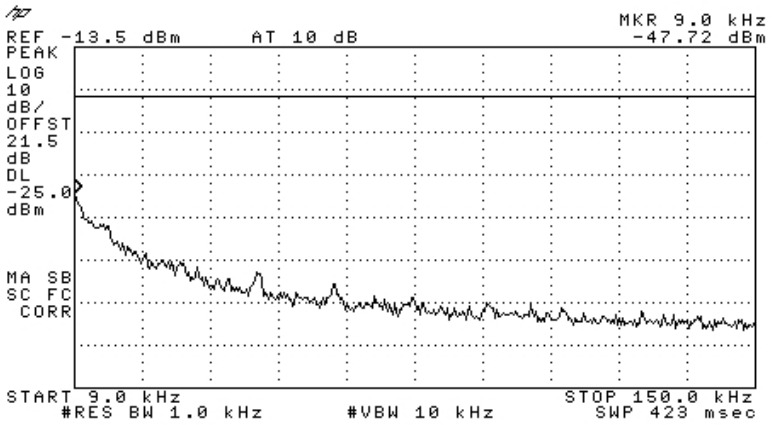


Figure 24.— 2498.5 MHz

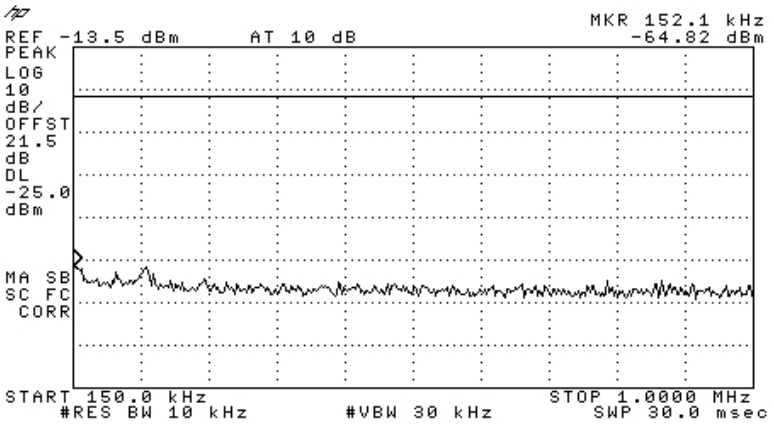


Figure 25.— 2498.5 MHz

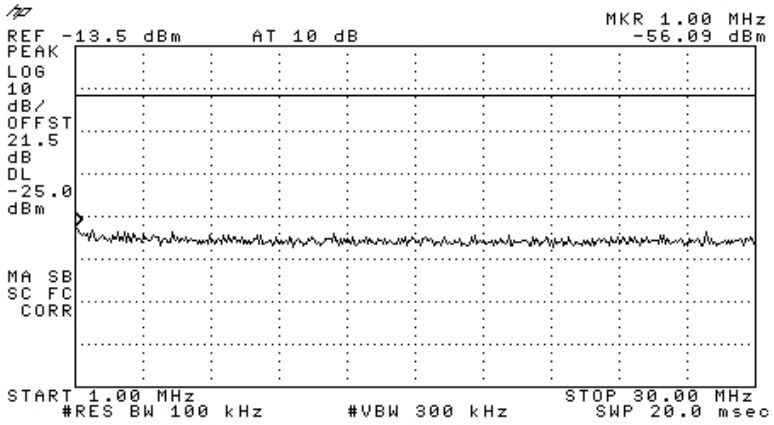


Figure 26.— 2498.5 MHz

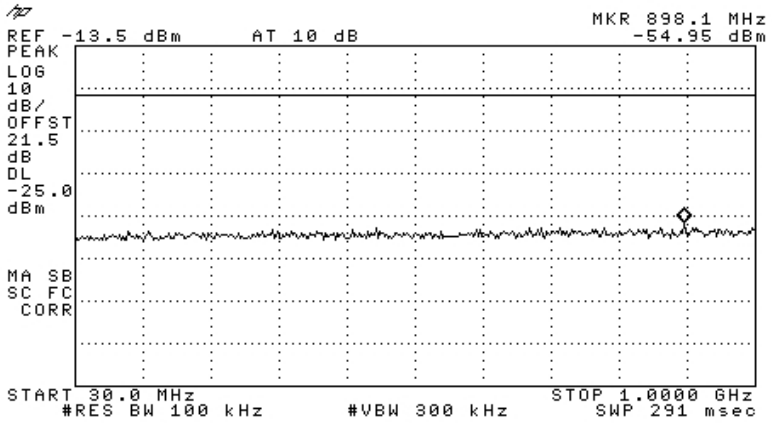


Figure 27.— 2498.5 MHz

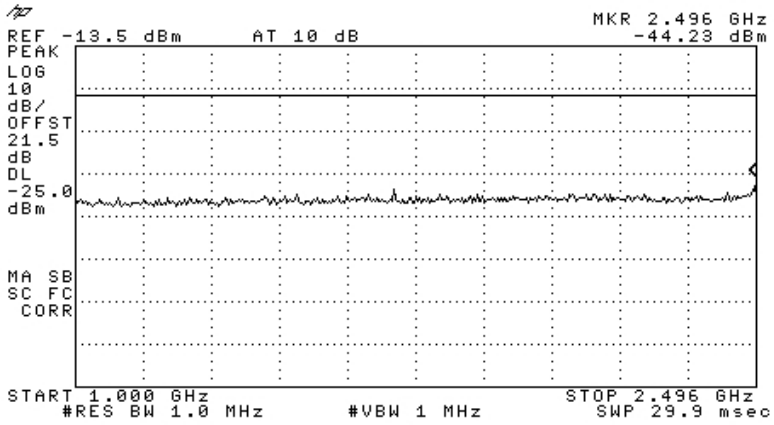


Figure 28.— 2498.5 MHz

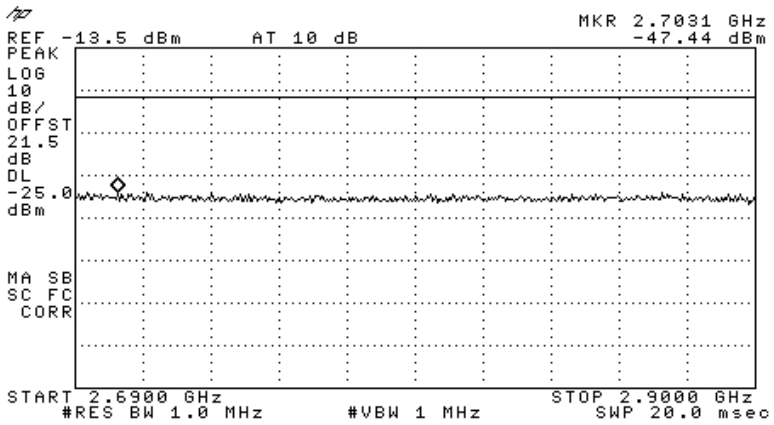


Figure 29.— 2498.5 MHz

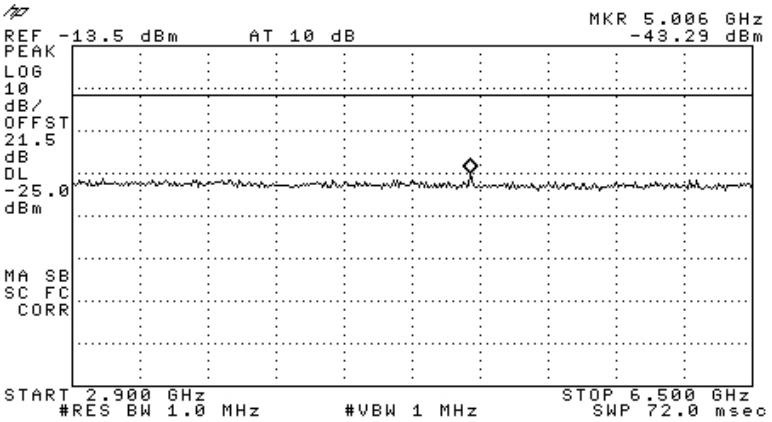


Figure 30.— 2498.5 MHz

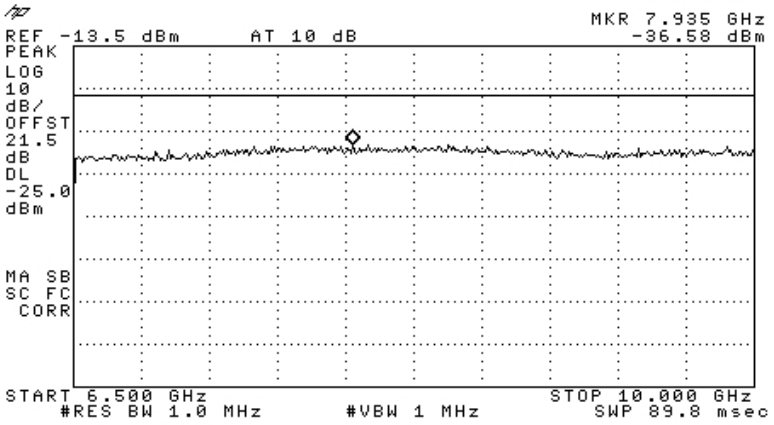


Figure 31.— 2498.5 MHz

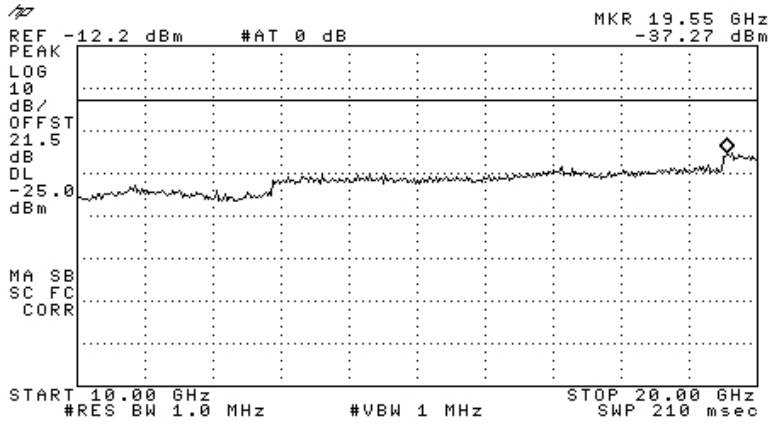


Figure 32.— 2498.5 MHz

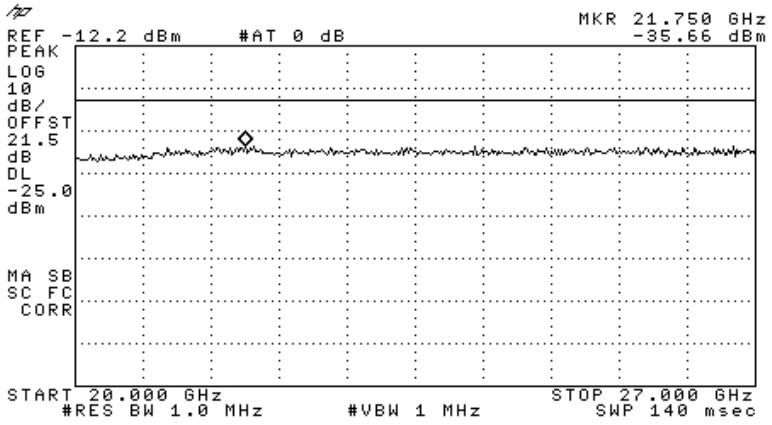


Figure 33.— 2498.5 MHz

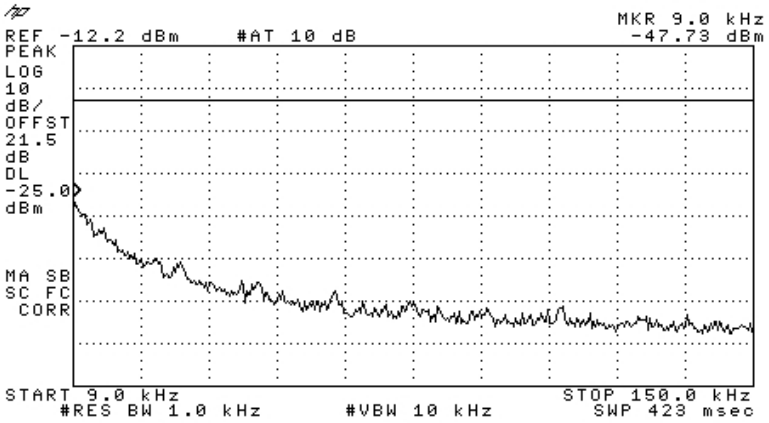


Figure 34.— 2600.00 MHz

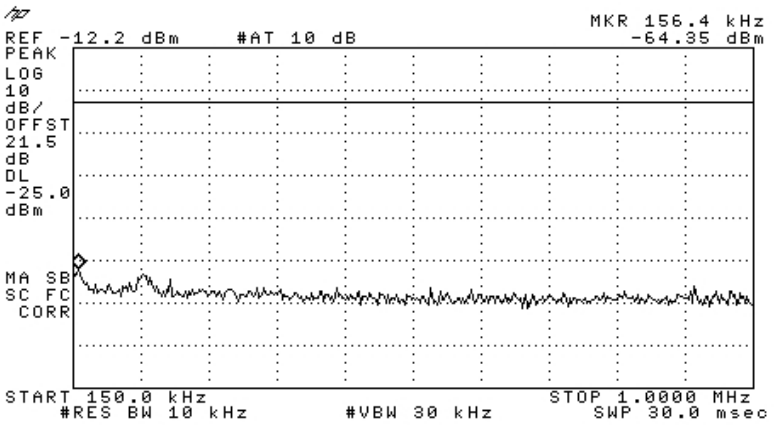


Figure 35.— 2600.00 MHz

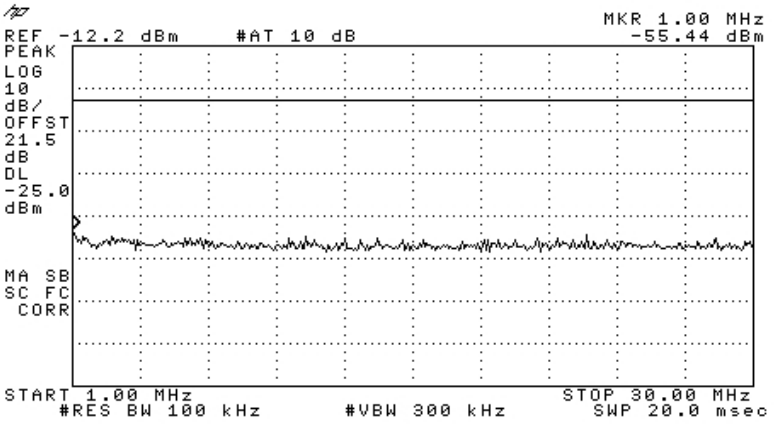


Figure 36.— 2600.00 MHz

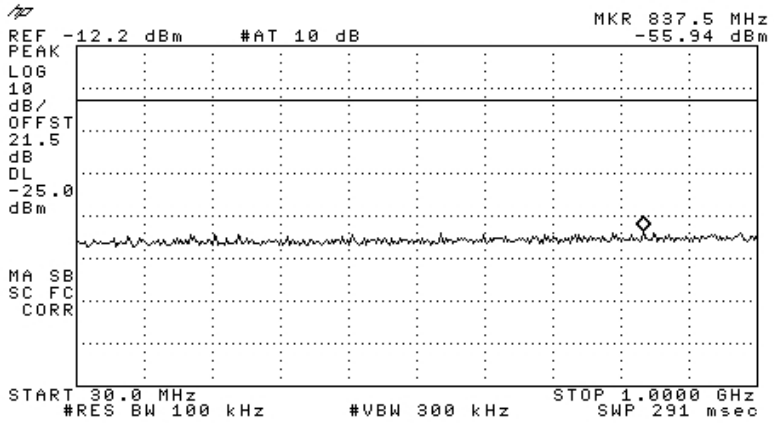


Figure 37.— 2600.00 MHz

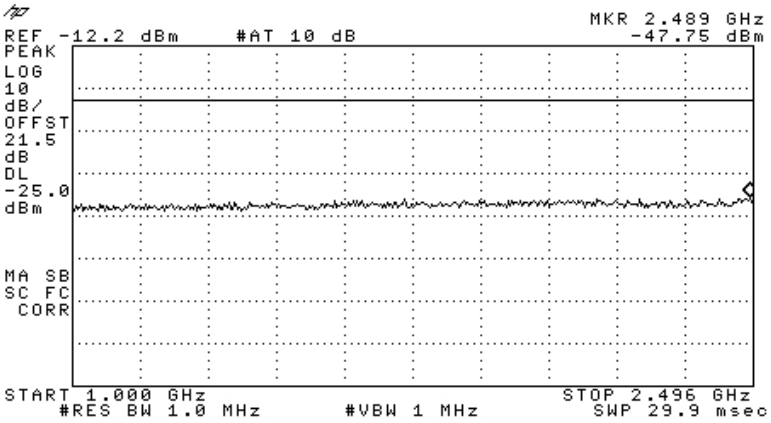


Figure 38.— 2600.00 MHz

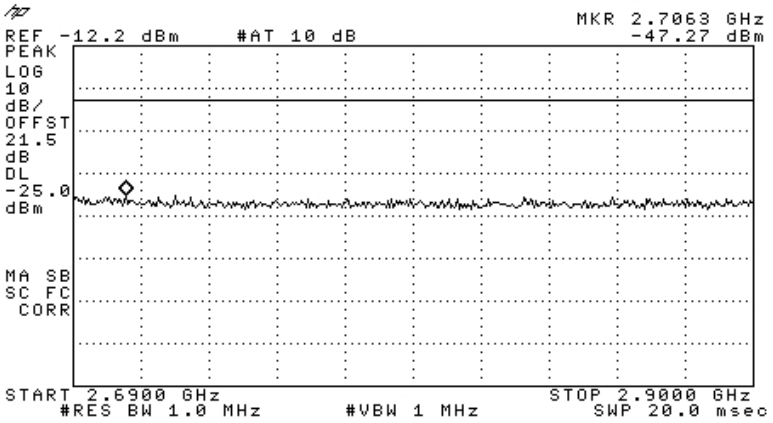


Figure 39.— 2600.00 MHz

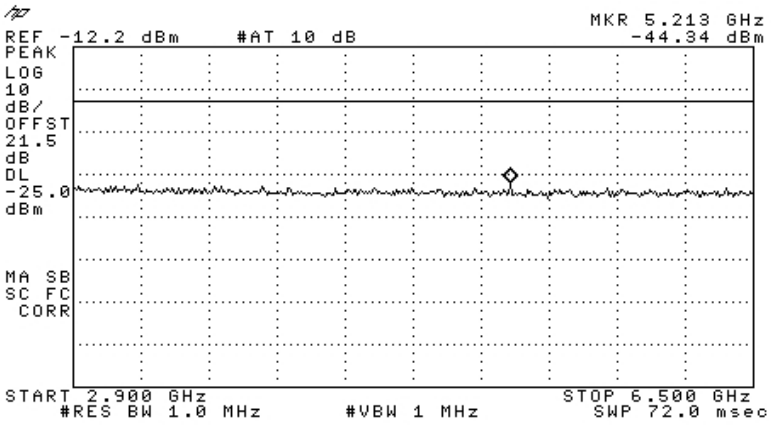


Figure 40.— 2600.00 MHz

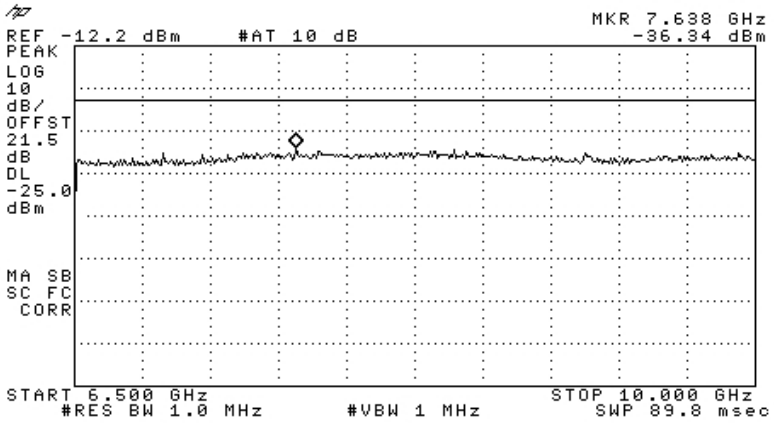


Figure 41.— 2600.00 MHz

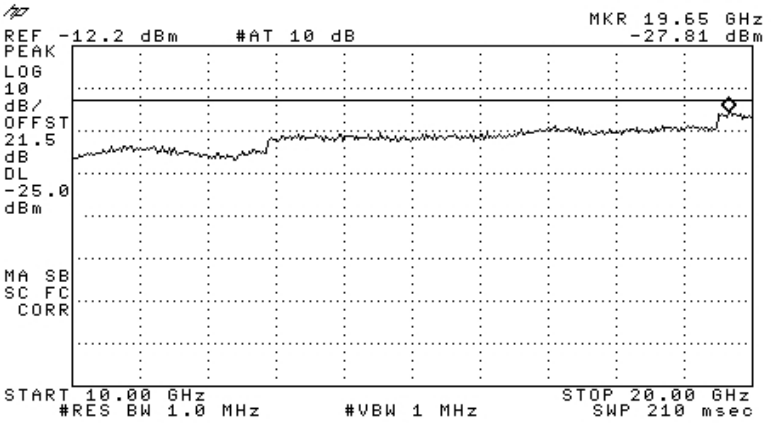


Figure 42.— 2600.00 MHz

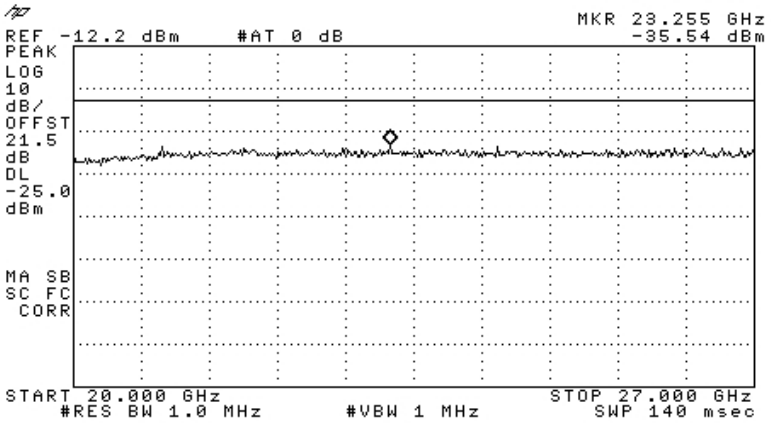


Figure 43.— 2600.00 MHz

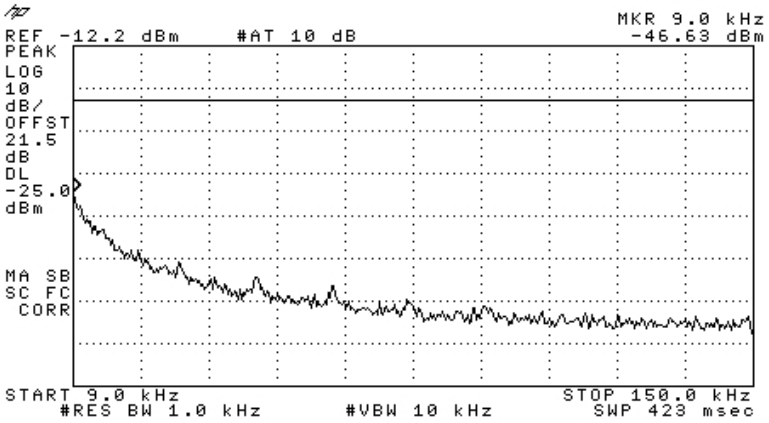


Figure 44.— 2687.50 MHz

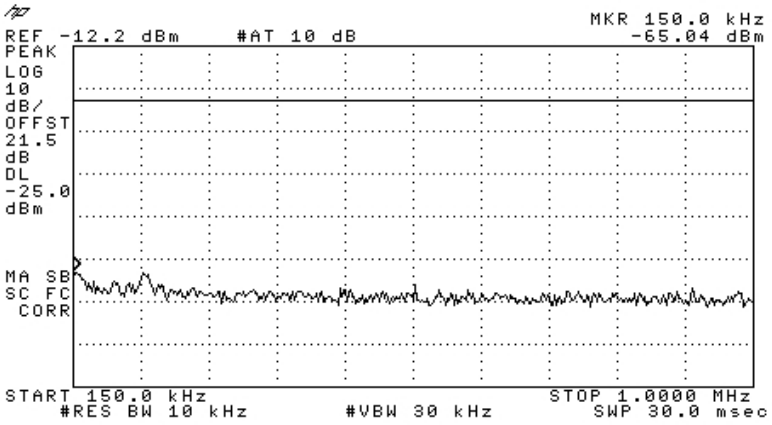


Figure 45.— 2687.50MHz

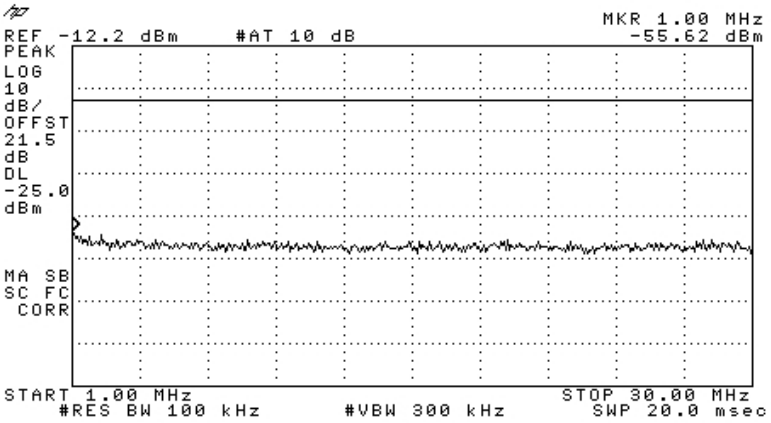


Figure 46.— 2687.50 MHz

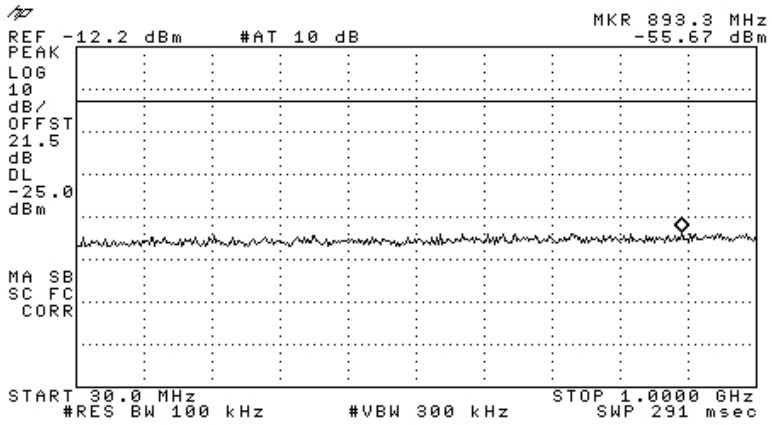


Figure 47.— 2687.50MHz

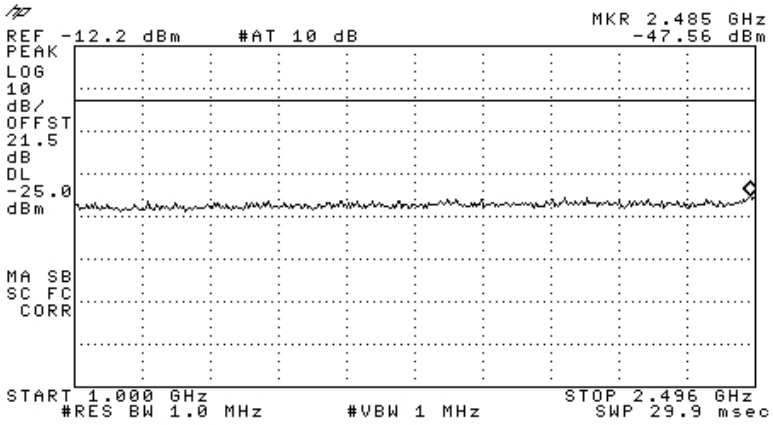


Figure 48.— 2687.50 MHz

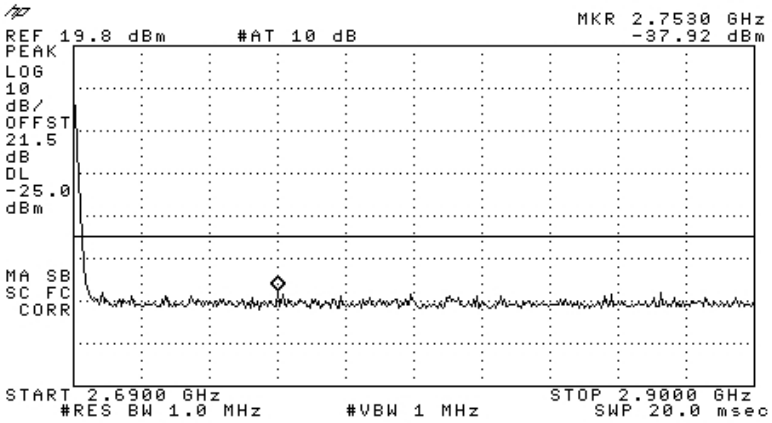


Figure 49.— 2687.50 MHz

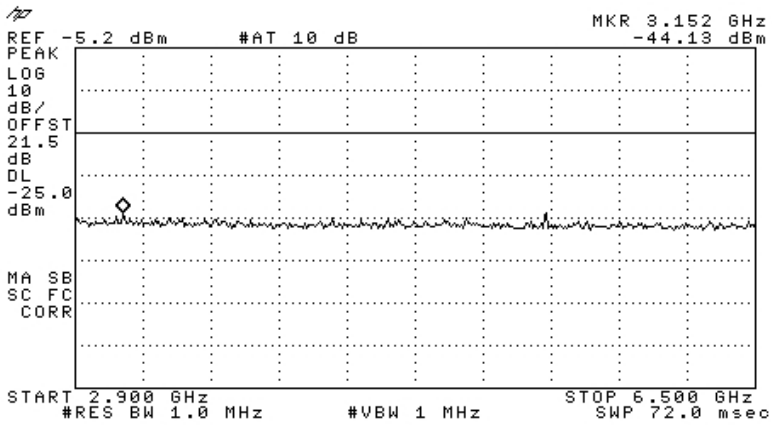


Figure 50.— 2687.50 MHz

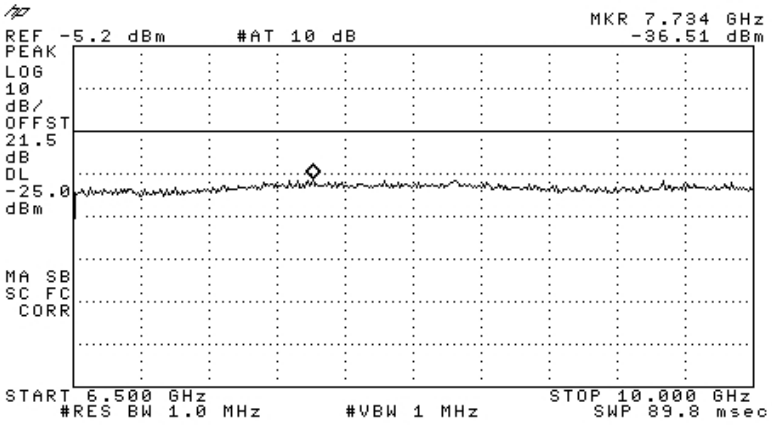


Figure 51.— 2687.50 MHz

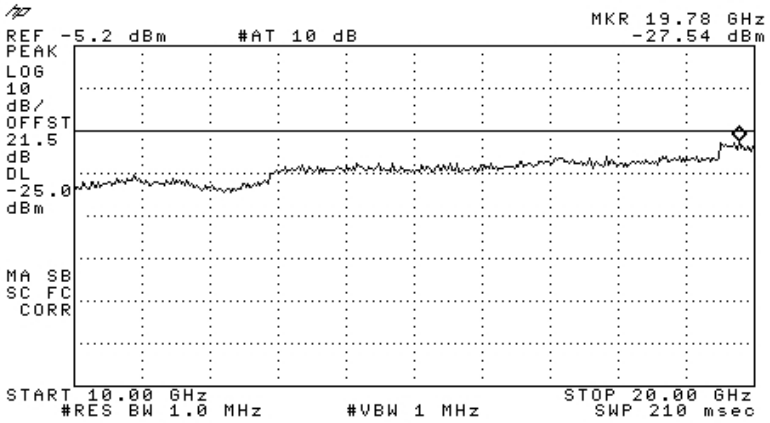


Figure 52.— 2687.50 MHz

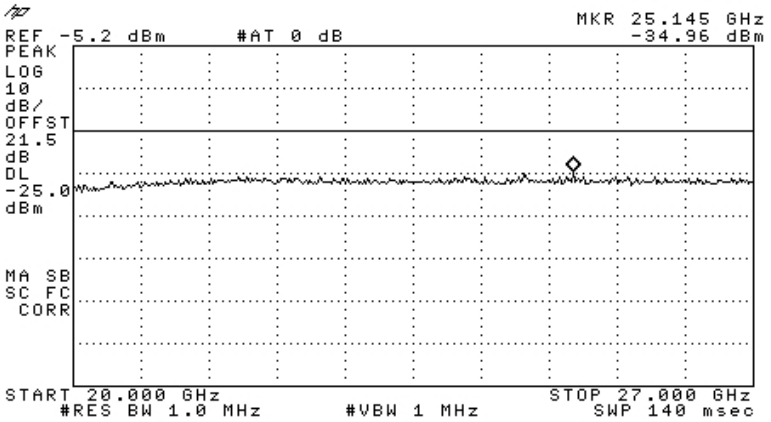


Figure 53.— 2687.50 MHz

10MHz:

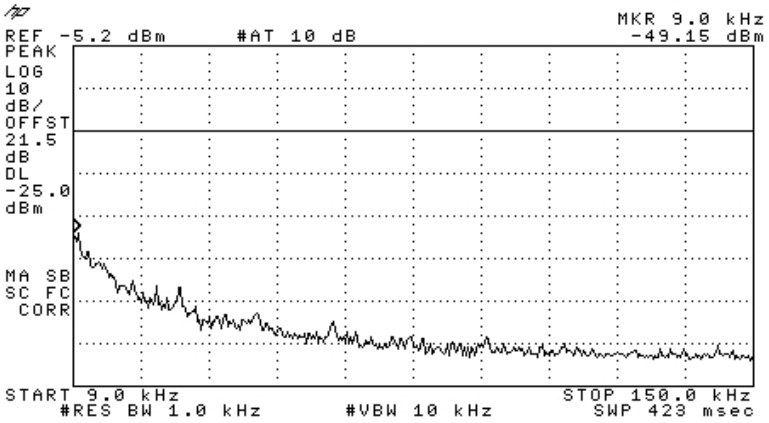


Figure 54.— 2501.0 MHz

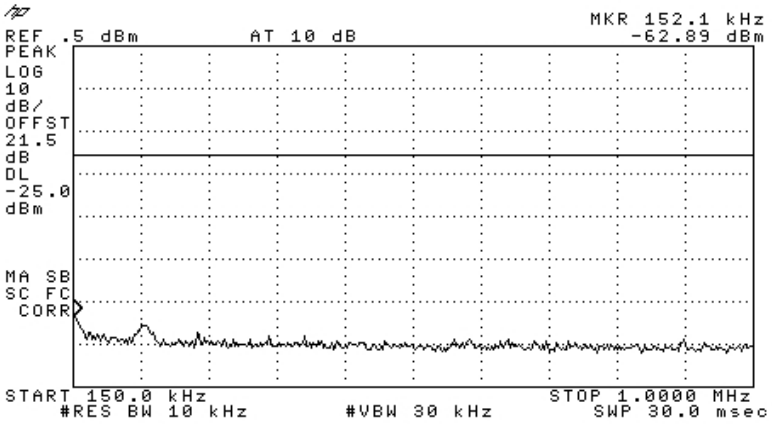


Figure 55.— 2501.0 MHz

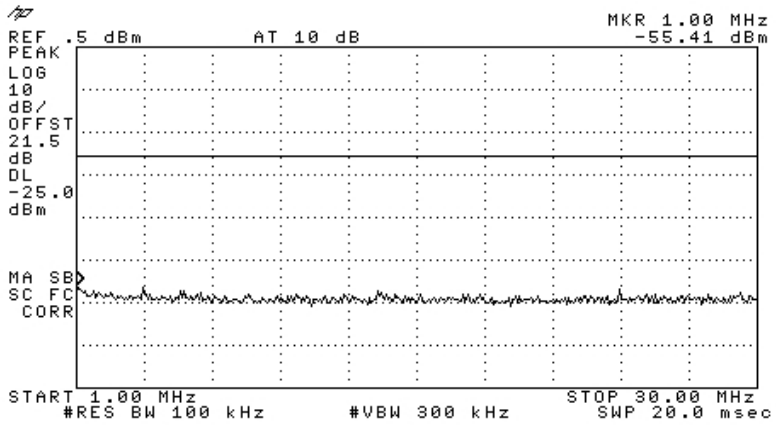


Figure 56.— 2501.0 MHz

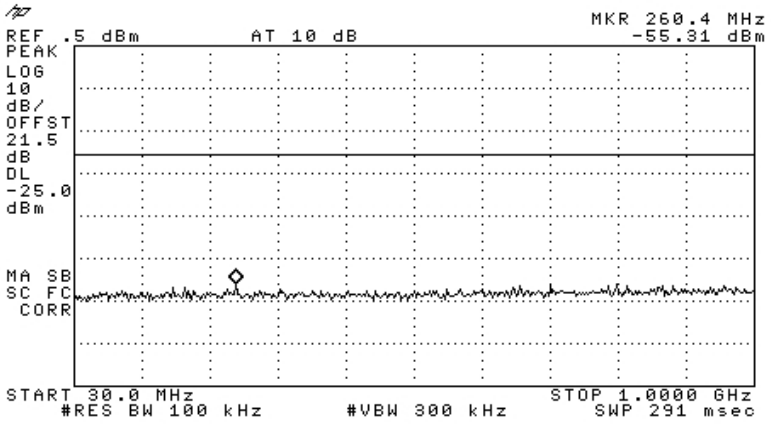


Figure 57.— 2501.0 MHz

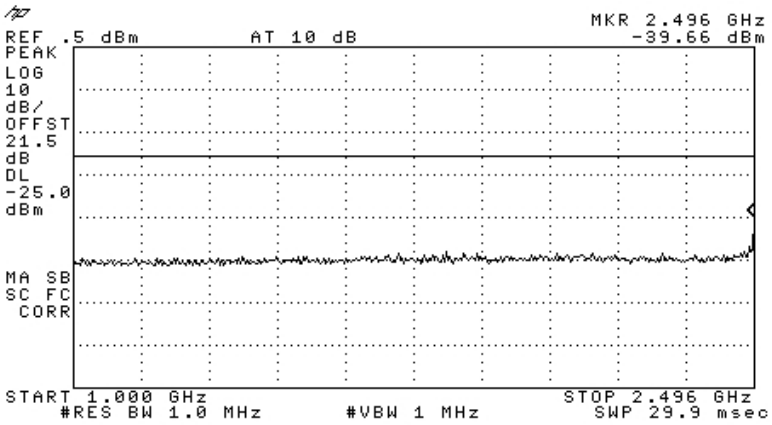


Figure 58.— 2501.0 MHz

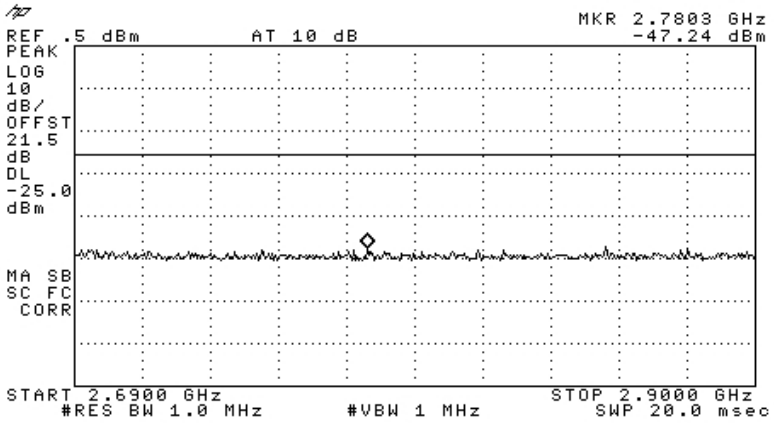


Figure 59.— 2501.0 MHz

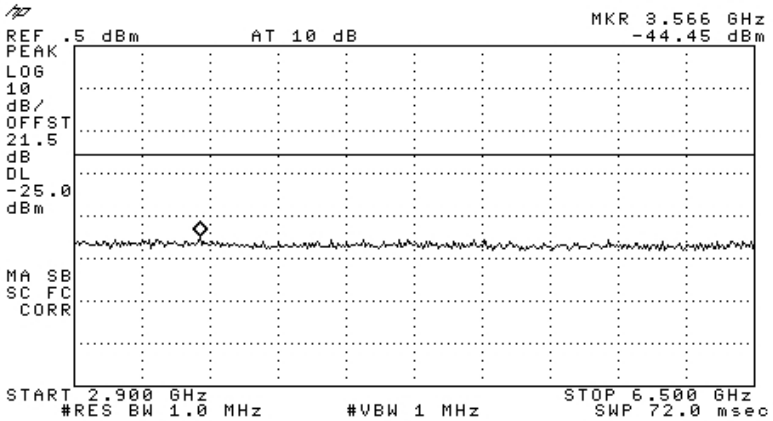


Figure 60.— 2501.0 MHz

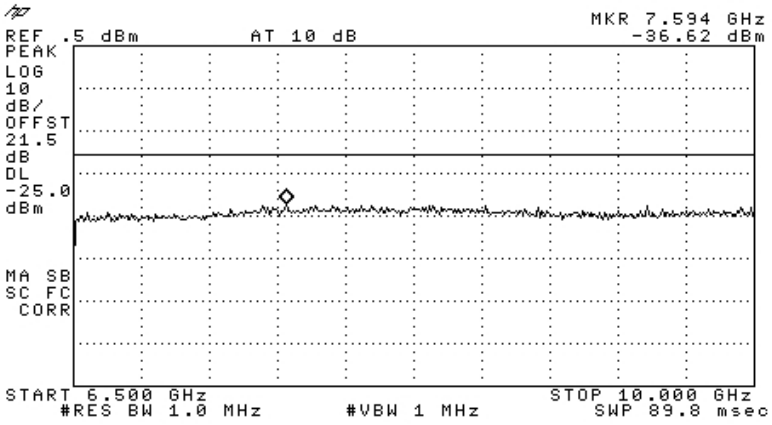


Figure 61.— 2501.0 MHz

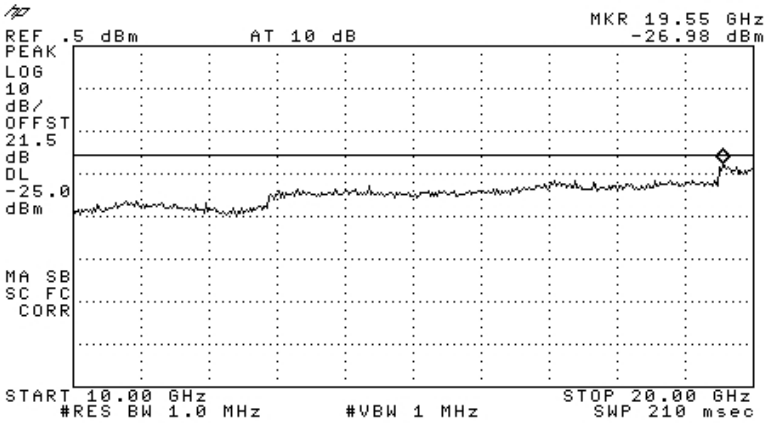


Figure 62.— 2501.0 MHz

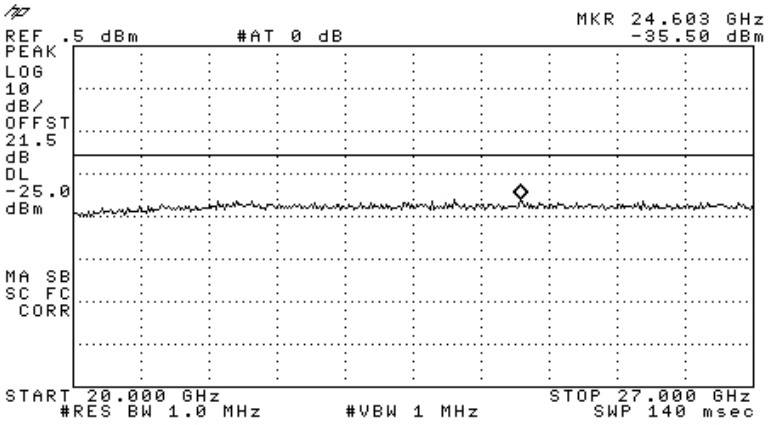


Figure 63.— 2501.0 MHz

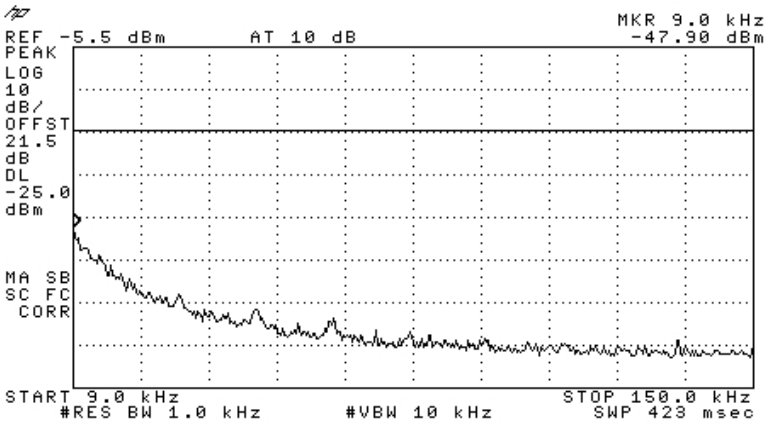


Figure 64.— 2600.00 MHz

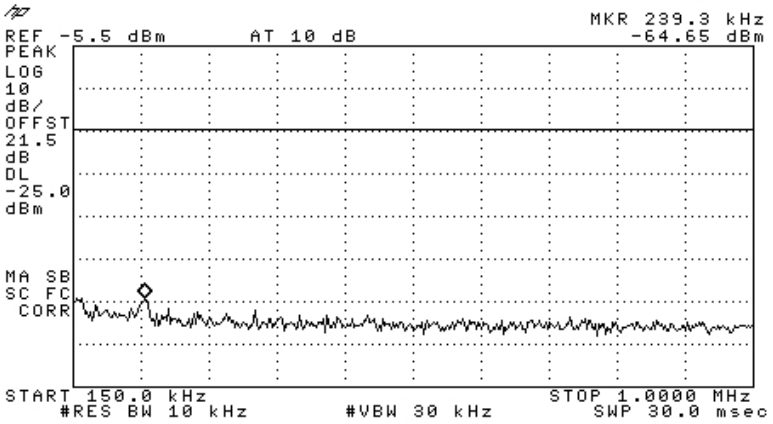


Figure 65.— 2600.00 MHz

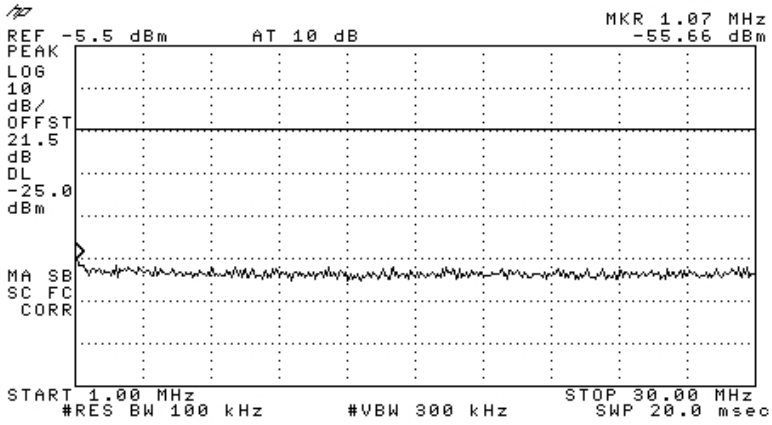


Figure 66.— 2600.00 MHz

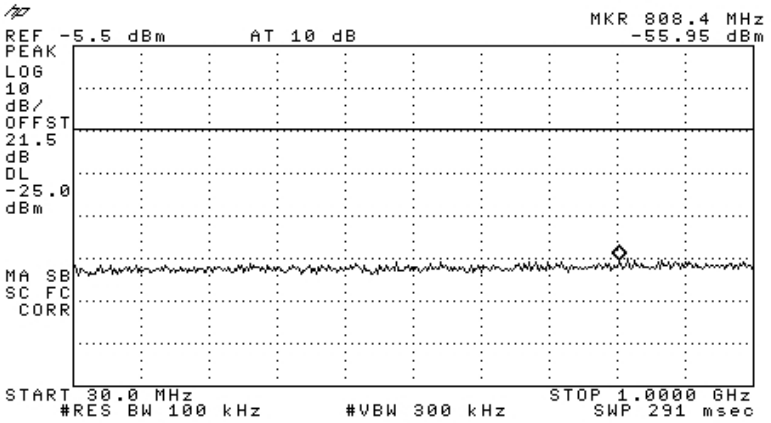


Figure 67.— 2600.00 MHz

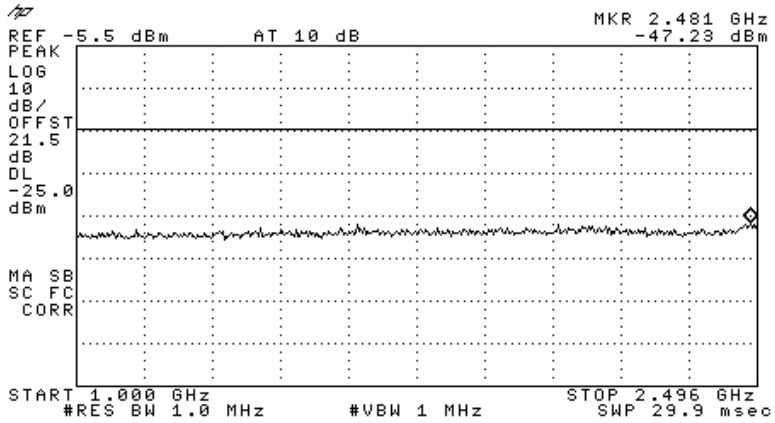


Figure 68.— 2600.00 MHz

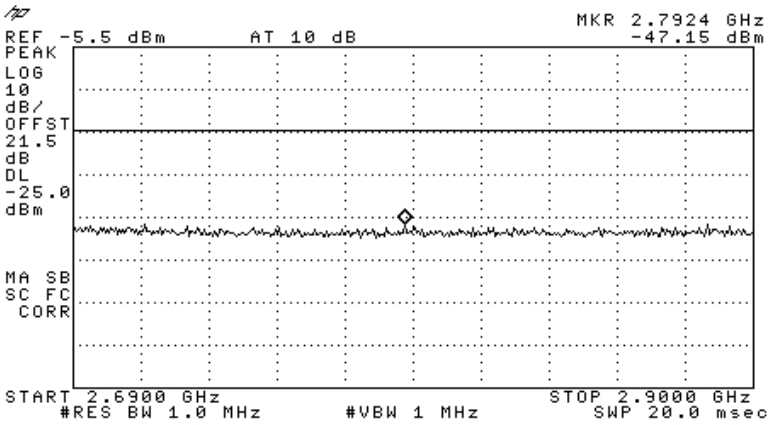


Figure 69.— 2600.00 MHz

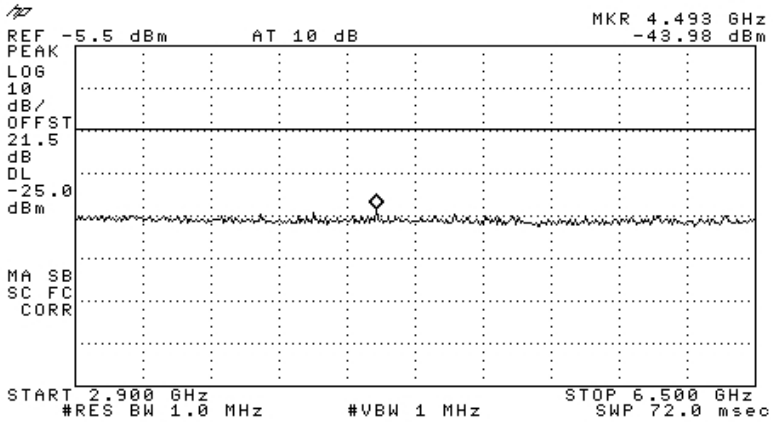


Figure 70.— 2600.00 MHz

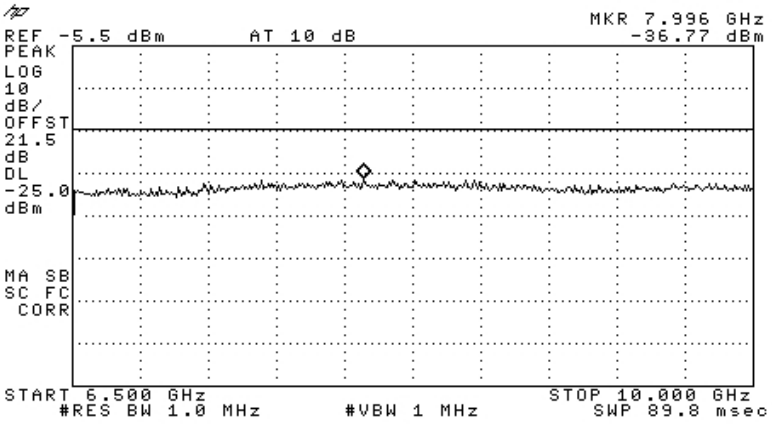


Figure 71.— 2600.00 MHz

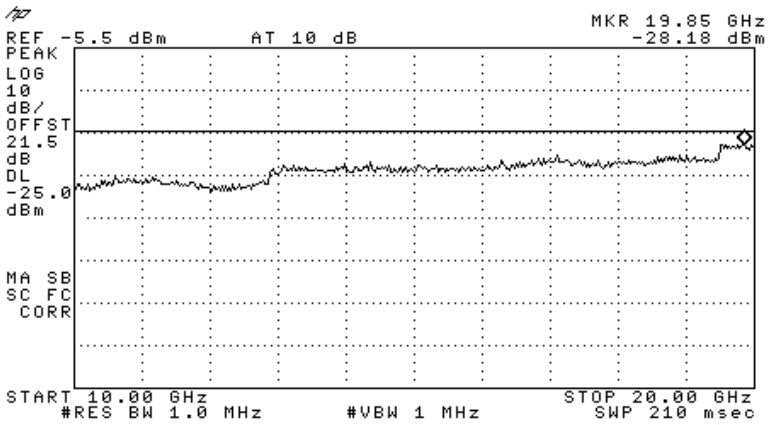


Figure 72.— 2600.00 MHz

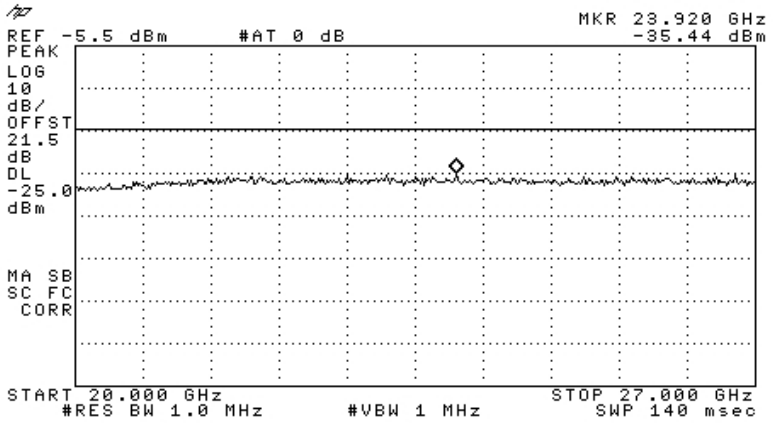


Figure 73.— 2600.00 MHz

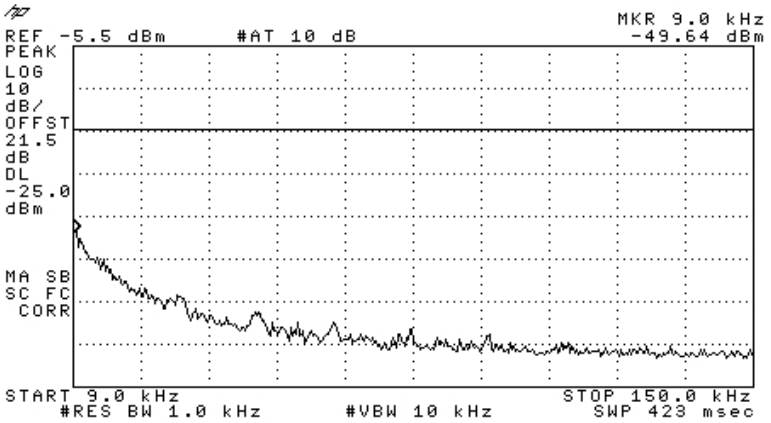


Figure 74.— 2685.0 MHz

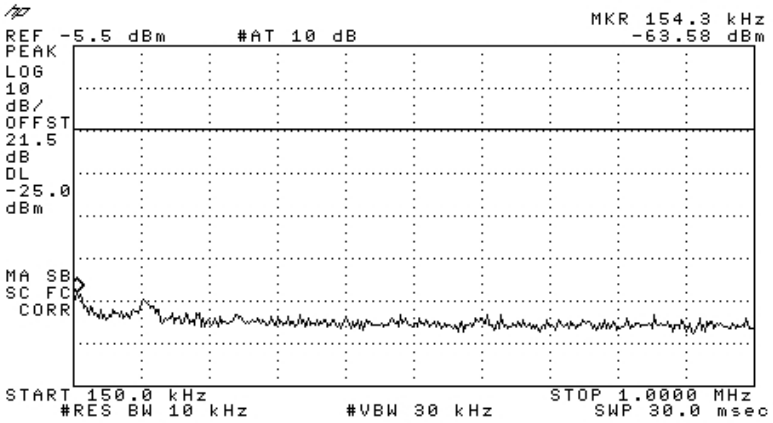


Figure 75.— 2685.0 MHz

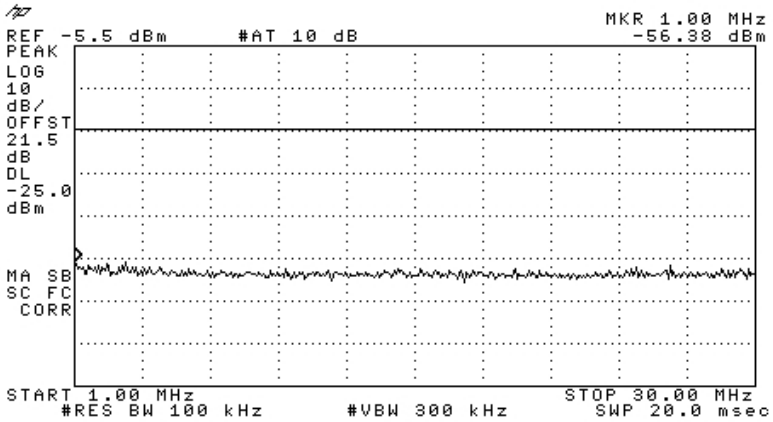


Figure 76.— 2685.0MHz

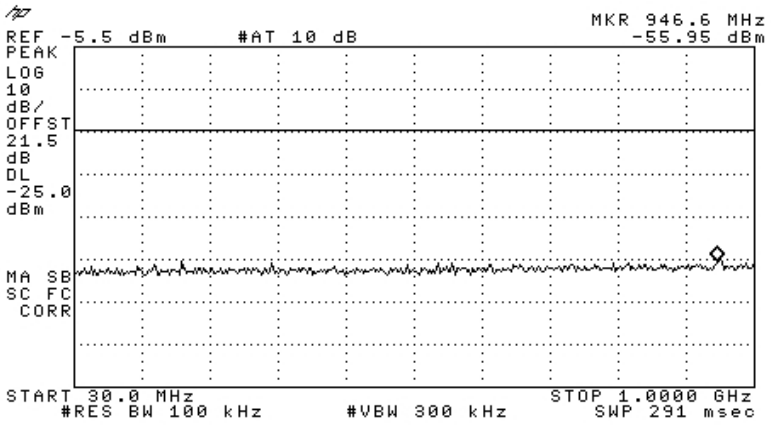


Figure 77.— 2685.0 MHz

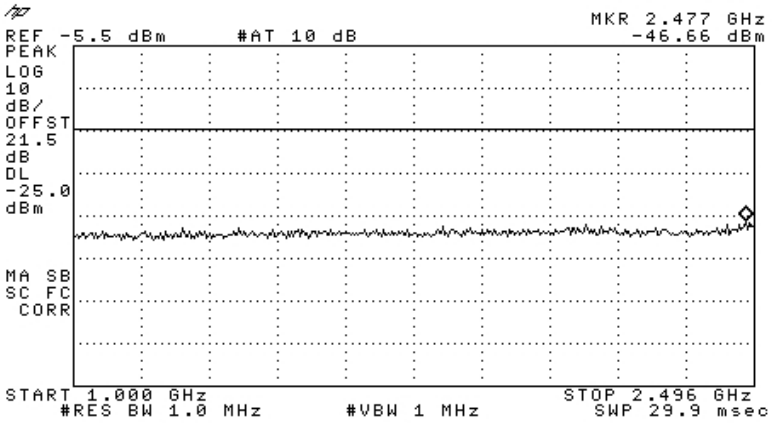


Figure 78.— 2685.0MHz

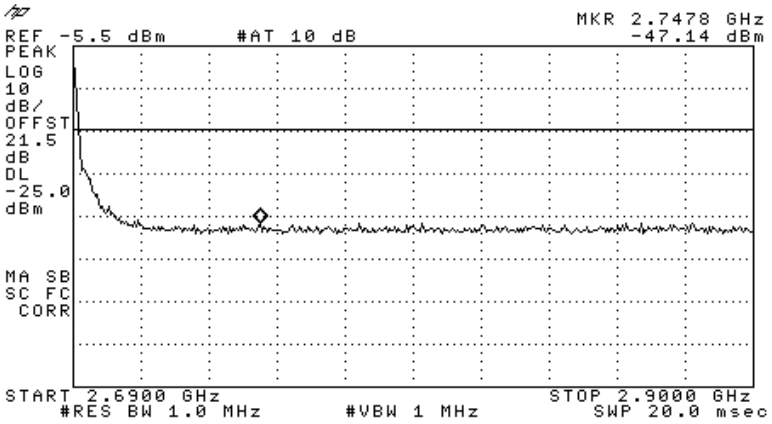


Figure 79.— 2685.0 MHz

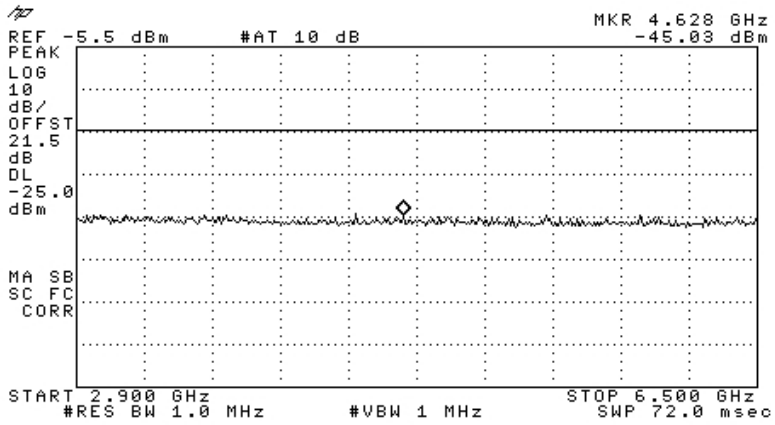


Figure 80.— 2685.0 MHz

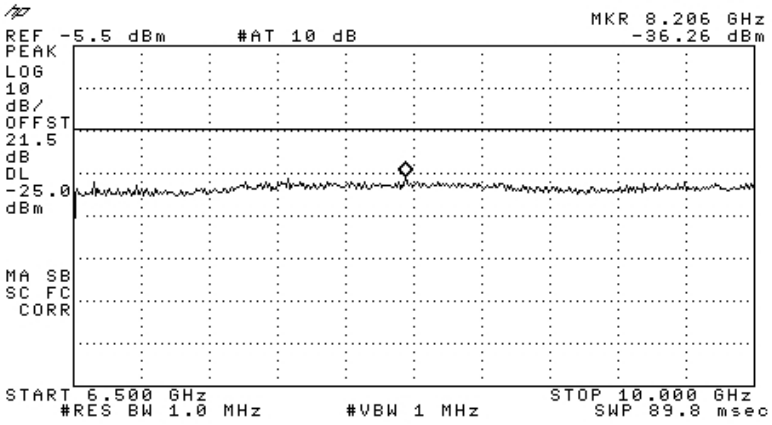


Figure 81.— 2685.0 MHz

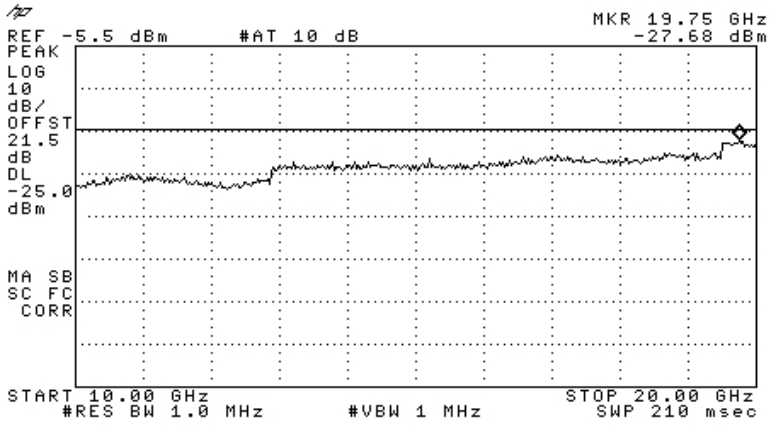


Figure 82.— 2685.0MHz

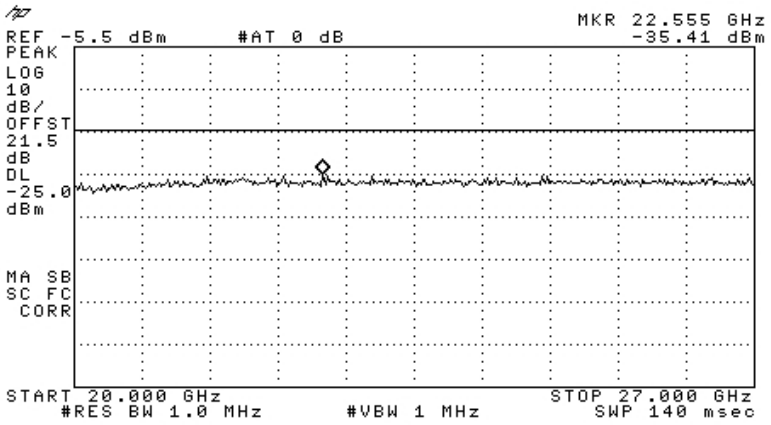


Figure 83.— 2685.0MHz

5.3 Results table

E.U.T. Description: VE WIMAX 2.5 GHZ Distributed Antenna System
Model No.: 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)
Serial Number: 1. 0010050014 2. 0010030000F
Specification: FCC Part 27, Sub-part C, Section 27.53 (m)

Bandwidth	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
5 MHz	2498.50	-35.66	-25.0	-10.66
5 MHz	2600.00	-27.81	-25.0	-2.81
5 MHz	2687.50	-27.54	-25.0	-2.54
10 MHz	2501.00	-26.98	-25.0	-1.98
10 MHz	2600.00	-28.18	-25.0	-3.18
10 MHz	2685.00	-27.68	-25.0	-2.68

Figure 84 Conducted Spurious Emission Results

JUDGEMENT: Passed by 1.98 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 22.03.10

Typed/Printed Name: A. Sharabi

5.4 Test Equipment Used.

Spurious Emissions at Antenna Terminals

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Signal Generator	Agilent	N5182A	MY49060167	May 20, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	October 19, 2009	1 year
Cable	TestLINE	18	11556	January 4, 2010	1 year

Figure 85 Test Equipment Used

6. Band Edge Measurements

6.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (m)

6.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency and the highest operation frequency in which the E.U.T. is planned to be used.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (21.5 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

5MHz:

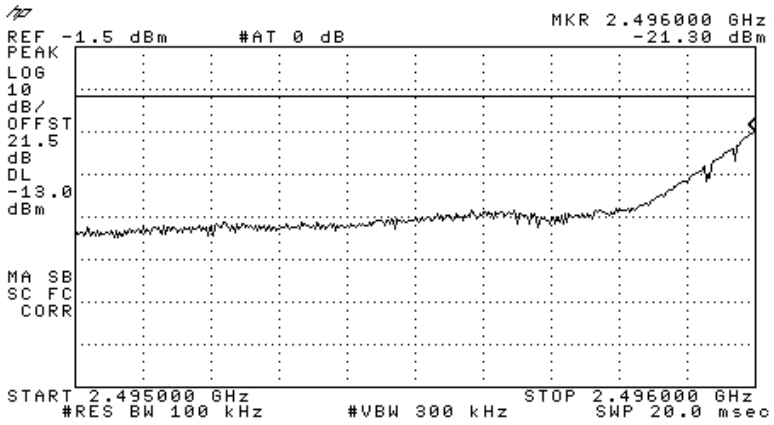


Figure 86.— 2498.5MHz

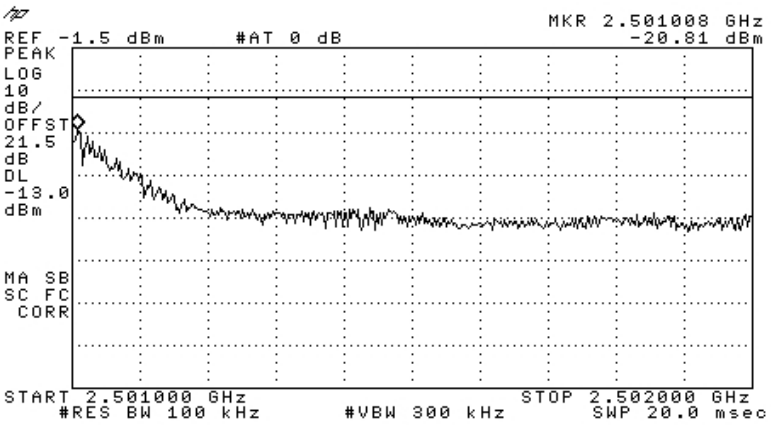


Figure 87.— 2498.5 MHz

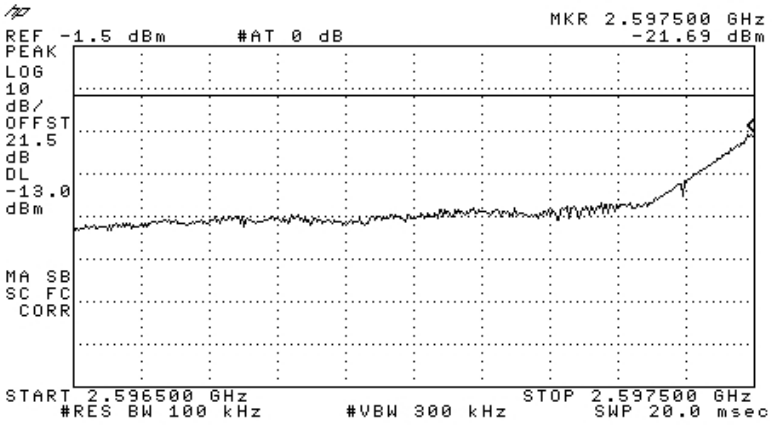


Figure 88.— 2600.0 MHz

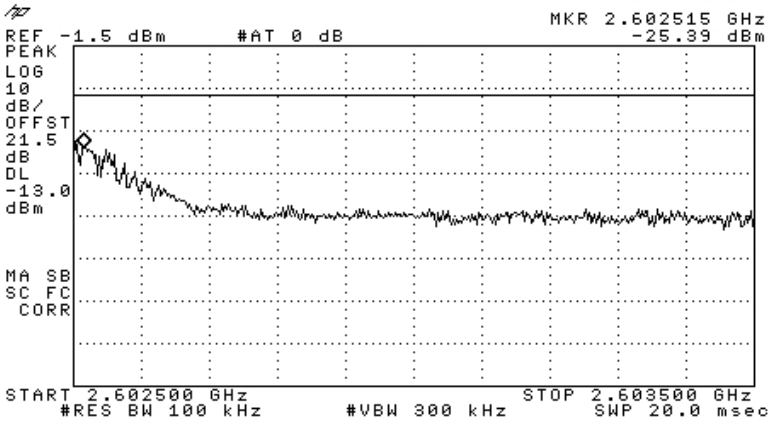


Figure 89.— 2600.0 MHz

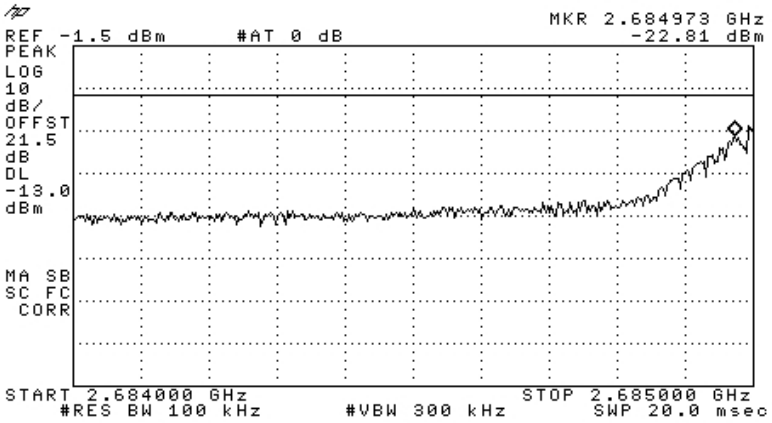


Figure 90.— 2687.50 MHz

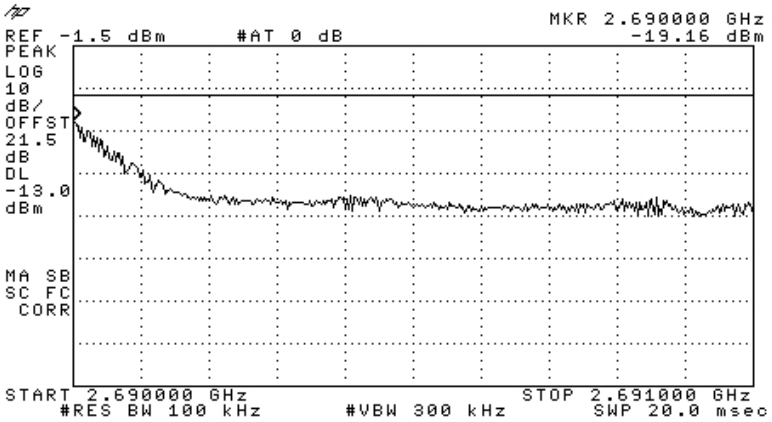


Figure 91.— 2687.50 MHz

10MHz:

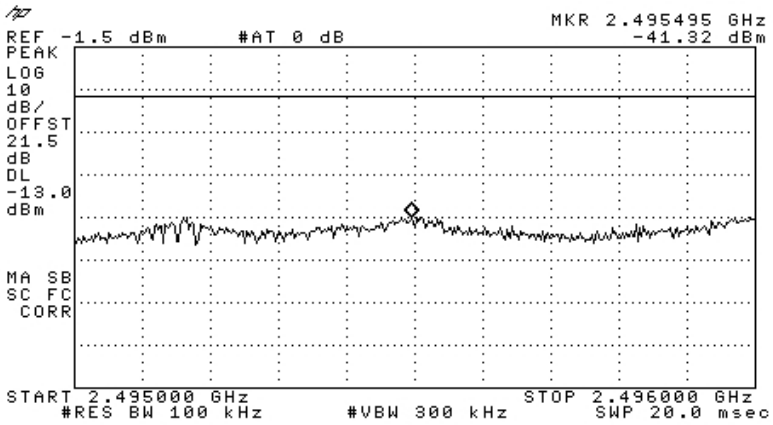


Figure 92.— 2501.0MHz

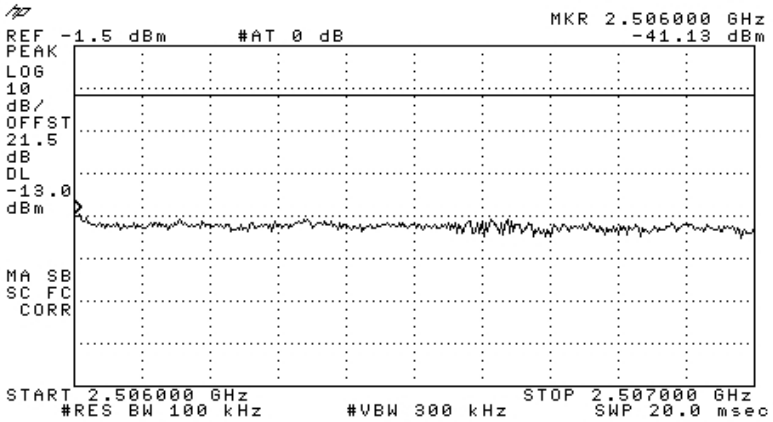


Figure 93.— 2501.0 MHz

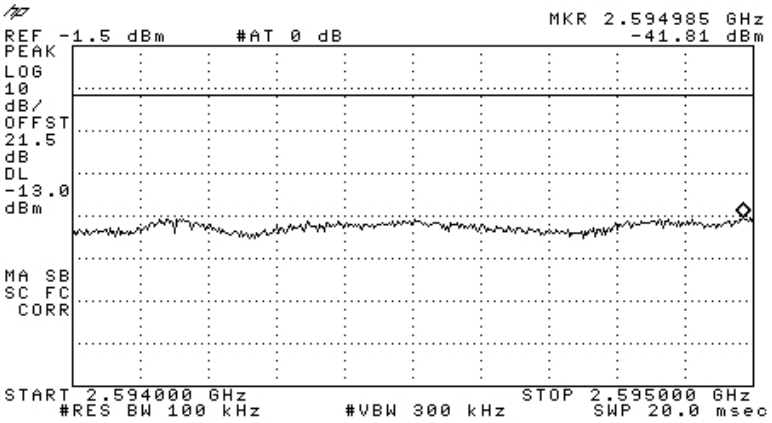


Figure 94.— 2600.0 MHz

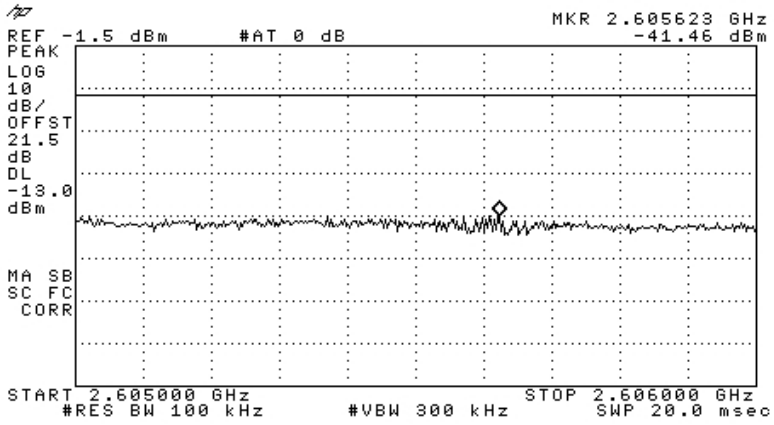


Figure 95.— 2600.0 MHz

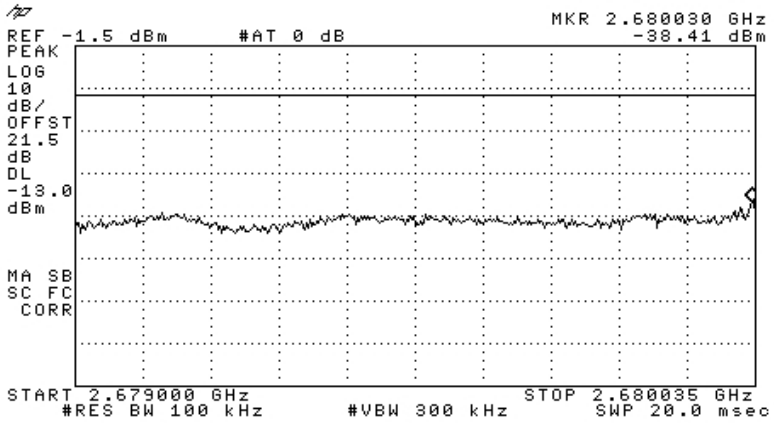


Figure 96.— 2685.00 MHz

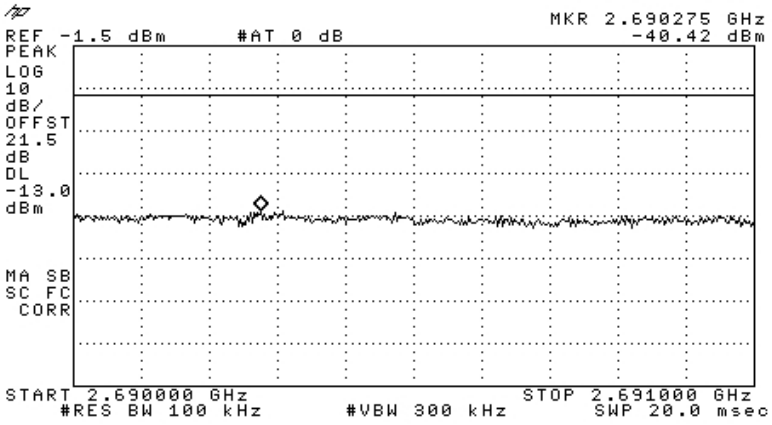


Figure 97.— 2685.00 MHz

6.3 Results table

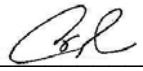
E.U.T. Description: VE WIMAX 2.5 GHZ Distributed Antenna System
Model No.: 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)
Serial Number: 1. 0010050014 2. 0010030000F
Specification: FCC Part 27, Sub-part C, Section 27.53 (m)

Bandwidth	Operation Frequency (MHz)	Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
5 MHz	2498.50	2495.00	-21.30	-13.0	-8.30
5 MHz	2498.50	2501.00	-20.81	-13.0	-7.81
5 MHz	2600.00	2596.50	-21.69	-13.0	-8.69
5 MHz	2600.00	2602.50	-25.39	-13.0	-12.39
5 MHz	2687.50	2684.00	-22.81	-13.0	-9.81
5 MHz	2687.50	2690.00	-19.16	-13.0	-6.16
10 MHz	2501.00	2495.00	-41.32	-13.0	-28.32
10 MHz	2501.00	2506.00	-41.13	-13.0	-28.13
10 MHz	2600.00	2594.00	-41.81	-13.0	-28.81
10 MHz	2600.00	2605.00	-41.46	-13.0	-28.46
10 MHz	2685.00	2679.00	-38.41	-13.0	-25.41
10 MHz	2685.00	2690.00	-40.42	-13.0	-27.42

Figure 98 Band Edge Measurements Results

JUDGEMENT: Passed by

TEST PERSONNEL:

Tester Signature:  Date: 22.03.10

Typed/Printed Name: A. Sharabi

6.4 Test Equipment Used.

Band Edge Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Signal Generator	Agilent	N5182A	MY49060167	May 20, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	October 19, 2009	1 year
Cable	TestLINE	18	11556	January 4, 2010	1 year

Figure 99 Test Equipment Used

7. Spurious Radiated Emission

7.1 Test Specification

FCC, Part 27, Subpart C Section 27.53 (m)

7.2 Test Procedure

The test method was based on ANSI/TIA-603-B: 2002, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 3. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
P_d(dBm) = P_g(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dB)
P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

The controller was connected to 2 signal generators on the same RF channel (one OFDMA modulated and the other CW).
Both Signal generators were 0dBm output power.
The VAP unit was configured to work with the internal integrated antenna.

10MHz:

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
2501	196.35	V	50.56	-49.5	1.5	1.57	-49.43	-13.0	-36.43
2501	196.35	H	54.85	-45.3	1.5	1.57	-45.23	-13.0	-29.23
2600	189.63	V	56.07	-43.4	1.5	1.57	-43.33	-13.0	-30.33
2600	189.63	H	58.66	-41.8	1.5	1.57	-41.73	-13.0	-28.73
2685	198.25	V	56.90	-43.5	1.5	1.57	-43.43	-13.0	-30.43
2685	198.25	H	58.46	-41.8	1.5	1.57	-41.73	-13.0	-28.73

2nd Harmonic:

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
2501	5002	V	58.51	-36.2	10.0	10.0	-36.2	-13.0	-23.2
2501	5002	H	57.95	-37.0	10.0	10.0	-37.0	-13.0	-24.0
2600	5200	V	55.11	-39.4	10.0	10.0	-39.4	-13.0	-26.4
2600	5200	H	56.32	-38.2	10.0	10.0	-38.2	-13.0	-25.2
2685	5370	V	56.89	-37.6	10.0	10.0	-37.6	-13.0	-24.6
2685	5370	H	56.82	-37.6	10.0	10.0	-37.6	-13.0	-24.6

5MHz:

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
2498.5	188.75	V	58.10	-41.9	1.5	1.57	-41.83	-13.0	-28.83
2498.5	188.75	H	59.83	-40.4	1.5	1.57	-40.33	-13.0	-27.33
2600	189.25	V	60.32	-39.5	1.5	1.57	-39.43	-13.0	-26.43
2600	189.25	H	62.53	-37.3	1.5	1.57	-37.23	-13.0	-24.23
2687.5	188.75	V	61.87	-38.5	1.5	1.57	-38.43	-13.0	-25.43
2687.5	188.75	H	62.34	-37.3	1.5	1.57	-37.23	-13.0	-24.23

2nd Harmonic:

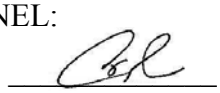
Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
2598.5	4997.0	V	59.22	-35.7	10.0	10.0	-35.7	-13.0	-22.7
2598.5	4997.0	H	56.90	-38.5	10.0	10.0	-38.5	-13.0	-25.5
2600	5200	V	58.35	-36.4	10.0	10.0	-36.4	-13.0	-23.4
2600	5200	H	55.26	-39.4	10.0	10.0	-39.4	-13.0	-26.4
2687.5	5375.0	V	55.38	-39.3	10.0	10.0	-39.3	-13.0	-26.3
2687.5	5375.0	H	53.76	-41.4	10.0	10.0	-41.4	-13.0	-28.4

7.3 Test Results

JUDGEMENT: Passed by 22.7 dB

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 specifications.

TEST PERSONNEL:

Tester Signature:  Date: 22.03.10

Typed/Printed Name: A. Sharabi

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 08, 2009	1 year
RF Section	HP	85420E	3427A00103	November 08, 2009	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	January 7, 2009	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2009	1 year
Signal Generator	HP	8648C	3623A04126	January 11, 2010	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 year

8. Frequency Stability

8.1 Test Specification

Part 27 Section 27.54

8.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 2. The E.U.T. was operated with a CW signal in the downlink path.

The E.U.T. was placed inside a temperature chamber. The E.U.T. was operated from 115 VAC at normal temperature and the chamber temperature was set to +20°C.

The spectrum analyzer was set to 50.0 kHz span and 1.0 kHz resolution B.W.

The carrier frequency was measured and recorded (reference frequency reading).

The carrier frequency measurement was repeated for:

(a). +20°C and 97.5 VAC

(b). +20°C and 132.5 VAC

(c). -30°C and 115 VAC

(f). +50°C and 115 VAC

The carrier frequency was measured and recorded after at least 20 minutes of exposing the E.U.T. to the temperature.

The E.U.T. was operated at 2498.5, 2600, and 2687.5 MHz.

Frequency Stability

E.U.T Description VE WIMAX 2.5 GHZ Distributed Antenna System

Type 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)

Serial Number: 1. 0010050014 2. 0010030000F

Specification: Part 27 Section 27.54

Operation Frequency (MHz)				Δ f(max) (kHz)	Spec. (kHz)
	Temp	Volt	Readings		
2498.5	+50	115	2498.49815	0.02	±1.9
2498.5	+40	115	2498.49815	0.02	±1.9
2498.5	+30	115	2498.49813	0	±1.9
2498.5	+20	115	2498.49813	0	±1.9
2498.5	+20	133	2498.49813	0	±1.9
2498.5	+20	97	2498.49813	0	±1.9
2498.5	+10	115	2498.49813	0	±1.9
2498.5	0	115	2498.49813	0	±1.9
2498.5	-10	115	2498.49813	0	±1.9
2498.5	-20	115	2498.49813	0	±1.9
2498.5	-30	115	2498.49813	0	±1.9
2600	+50	115	2599.99810	0.05	±1.9
2600	+40	115	2599.99810	0.05	±1.9
2600	+30	115	2599.99805	0	±1.9
2600	+20	115	2599.99805	0	±1.9
2600	+20	133	2599.99805	0	±1.9
2600	+20	97	2599.99805	0	±1.9
2600	+10	115	2599.99805	0	±1.9
2600	0	115	2599.99804	0.01	±1.9
2600	-10	115	2599.99805	0	±1.9
2600	-20	115	2599.99803	0.02	±1.9
2600	-30	115	2599.99803	0.02	±1.9

Figure 100. Frequency Stability

Notes:

1. Δ f = Reference frequency – frequency reading.
2. Reference reading measured at 115 VAC, + 20°C.
3. Specification: spec: ± 1 ppm = ± 1.9 kHz

Frequency Stability

E.U.T Description VE WIMAX 2.5 GHZ Distributed Antenna System

Type 1. VE WIMAX 2.5 GHz VE Control Unit (VCU-WIMAX2.5-12E)
2. VE WIMAX 2.5 GHz VE Access Pod (VAP-WIMAX2.5E)

Serial Number: 1. 0010050014 2. 0010030000F

Specification: Part 27 Section 27.54

Operation Frequency (MHz)				Δ f(max) (kHz)	Spec. (kHz)
	Temp	Volt	Readings		
2687.5	+50	115	2687.49803	0.08	±1.9
2687.5	+40	115	2687.49803	0.08	±1.9
2687.5	+30	115	2687.49803	0.08	±1.9
2687.5	+20	115	2687.49795	0	±1.9
2687.5	+20	133	2687.49795	0	±1.9
2687.5	+20	97	2687.49795	0	±1.9
2687.5	+10	115	2687.49795	0	±1.9
2687.5	0	115	2687.49795	0	±1.9
2687.5	-10	115	2687.49796	0.01	±1.9
2687.5	-20	115	2687.49798	0.03	±1.9
2687.5	-30	115	2687.49793	0.02	±1.9

Figure 101. Frequency Stability

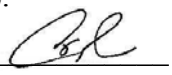
Notes:

4. Δ f = Reference frequency – frequency reading.
5. Reference reading measured at 115 VAC, + 20°C.
6. Specification: spec: ± 1 ppm = ± 1.9 kHz

JUDGEMENT: Passed

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.54 specifications.

TEST PERSONNEL:

Tester Signature:  Date: 22.03.10

Typed/Printed Name: A. Sharabi

8.3 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Environmental Chamber	THERMOTRON CORP	SM 32C Mini Max	25-1030	March 04, 2009	1 Year
Digital Voltage Meter	Escort	EDM1111A	10313121	November 3, 2008	2 Years
Variable Voltage Transformer	Variac Voltage Co.	-	-	N/A	N/A
Spectrum Analyzer	HP	8594E	3809U03785	February 26, 2009	1 Year

9. APPENDIX A - CORRECTION FACTORS

9.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 27 meters.*
3. *The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".*

9.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

9.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

9.4 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.

2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.

3. The files mentioned above are located on the disk marked "Antenna Factors".

9.5 Correction factors forDouble-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			