Test Report

Curtis-Straus LLC, *a wholly owned subsidiary of BV CPS*

Report No	EN2817-1
Client	Airvana
Address	19 Alpha Road Chelmsford, MA 01824
Phone	978-250-2622
Item tested	Femto Cell 750722 and Femto Cell 750723
FCC ID	QHYHUBBUBC4502-RT
FRN	0021466594
Equipment Type	PCS Licensed Transmitter
Equipment Code	PCB
Emission Designator	1M27D7D
FCC Rule Parts	47 CFR 22 Subpart H 47 CFR 24 Subpart E 47 CFR 90 Subpart S
Test Dates	November 4-8 & 11-13, 2013, and January 17, 2014
Results	As detailed within this report
Prepared by	Arik Zwirner
Authorized by	Mairaj Hussain – EMC Supervisor
Issue Date	January 17, 2014

Contents

Summary

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 22 Subpart H, 47 CFR 24 Subpart E, and 47 CFR 90 Subpart S.

There are two models of this transmitter, the Femto Cell 750722 and Femto Cell 750723, which are variants of a single product. They are transceivers that operate in the ranges 862-869MHz, 869-894MHz, and 1930-1990MHz.

Both models are intended to be labeled under a single FCC ID. The design differences are noted in the next section of this report.

Note that there are five antennas on each product. Three are transmitting antennas and were tested. The other two are receiving antennas.

We found that the products met the above requirements without modification. The test samples were received in good condition. Tests were performed on November 4-8 and 11-13, 2013 and on January 17, 2014.

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	March 4, 2013

Description of Model Variations

Two model variations are required to support end of life component issues and substitutions. The two model variations are described as follows:

750723: This model supports current production BC1 saw devices, FL2-FL6, which are due to be discontinued at some later date.

750722: This model supports current production BC1 saw devices which are replacement devices for FL2-FL6 in the 750723 assembly, and this design is expected to supersede the 750722 assembly, but may be manufactured in conjunction with the 750723 assembly.

Specifically, the design differences between the 750722 and 750723 are as follows**:**

> For the BC1 saw devices (FL2-FL6), the 750723 assembly contains the Airvana Part Number 130232: Epcos B39202B9007E610, while the750722 assembly contains the Airvana Part Number 130333: Epcos B39202B9477P810

More details on the design variations can be found with the associated application documents in the PDF file *Circuit Description of Design Differences*.

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	March 4, 2013

Test Methodology

The Femto Cell 750722 and Femto Cell 750723 each have three transmitters, identified as follows:

- Band Class 0 (BC0) and Band Class 10 (BC10), which operate on one radio
- Band Class 1 (One-X)
- Band Class 1 (EVDO)

Two of the three transmitters, Band Class 1 (One-X) and Band Class 1 (EVDO), operate in the 1930-1990MHz band and were tested for FCC Part 24. The third transmitter operates in either Band Class 0 mode or Band Class 10 mode. Band Class 0 operates in the 869-894MHz band and was tested for FCC Part 22. Band Class 10 operates in the 862-869MHz band and was tested for FCC Part 90.

For Part 22, the lowest and highest operating frequencies are 870.03MHz and 889.2MHz, respectively. For Part 24, the lowest and highest operating frequencies are 1931.25MHz and 1988.75MHz, respectively. For Part 90, the lowest and highest operating frequencies are 862.9MHz and 867.9MHz, respectively

Per Airvana, the device under test prevents the operation of multiple transmit channels operating on the same frequency at the same time. Thus it is not allowed for the One-X and EVDO to simultaneously operate at the same frequency

Modulation is QAM -16 for each of the different types of channels.

The substitution method is used for ERP and EIRP measurements. The method is performed as follows. When performing ERP or EIRP measurements, the fundamental emission of the EUT is measured in terms of field strength. The EUT is then substituted with a calibrated antenna, cable, and signal generator. The initially measured field strength is reproduced and matched by the substituting equipment. The power of the substitution source (the signal generator) is recorded, and this value is then corrected for the cable loss and the antenna gain (dBi) to determine the ERP or EIRP of the EUT.

Radiated emission testing was performed according to the procedures specified in ANSI C63.4 (2003) and TIA-603-C. Radiated Emissions were maximized by rotating the device around its upright axes as well as varying the test antenna's height and polarity. Radiated spurious emissions tests were done in the frequency range of 30MHz-20GHz.

Conducted measurements at the antenna port were performed. For antenna port conducted spurious emissions testing 30MHz-20GHz range was checked.

AC mains conducted emissions tests were performed using 50Ω/5μH LISN's.

During AC mains conducted emissions and radiated spurious measurements, the product was removed from the plastic enclosure which should have no effects on EMI results. Transmit chain which produced the highest EIRP was used for spurious emission scans. The EUT operating voltage is 120Vac 60Hz.

Product Tested - Configuration Documentation

Model 750722

EUT Configuration

Work Order: N2817
Company: Airvana
Company Address: 19 Alpha Road
Chelmsford, Ma 01824
Contact: Kevin Craig
Person Present: Stuart MacEacchern

	MN	SN
EUT:	750722	13277003390
power supply:	MPBS-12020000	Test Sample 1

EUT Description: Femto Cell, Train 8
EUT Max Frequency: 1990MHz

Support Equipment:	**MN**	**SN**
Litepoint iQnav GPS simulator	iQnav	IQN00962
Dell laptop computer	D610	not listed

EUT Ports:

Port Label	Port Type	No. of ports	No. Populated	Cable Type	Shielded	Ferrites	Length	Max Length	In/Out NEBS Type	Unpopulated Reason
AC Mains	two-pin	1	1	AC	no	none	n/a	n/a	Out	
DC power	two-wire	1	1	two-wire	no	none	1.5m	1.5m	In	
Ethernet	RJ45	3	3	Cat. 5	no	none	3m	100m	In	
GPS	coax.	1	1	coax.	yes	none	10m	10m	Out	

Software / Operating Mode Description:

All three transceivers (One-X, EVDO, BC0/BC10) are active. The EUT receives a simulated GPS signal from the iQnav.

Performance Criteria:

N/A. Emissions and transmitter testing only.

Model 750723

EUT Configuration

Work Order: N2817
Company: Airvana
Company Address: 19 Alpha Road
Chelmsford, Ma 01824
Contact: Kevin Craig
Person Present: Stuart MacEacchern

	MN	SN
EUT:	750723	13277003369
power supply:	MPBS-12020000	Test Sample 1

EUT Description: Femto Cell, Train 8
EUT Max Frequency: 1990MHz

Support Equipment:	**MN**	**SN**
Litepoint iQnav GPS simulator	iQnav	IQN00962
Dell laptop computer	D610	not listed

EUT Ports:

Port Label	Port Type	No. of ports	No. Populated	Cable Type	Shielded	Ferrites	Length	Max Length	In/Out NEBS Type	Unpopulated Reason
AC Mains	two-pin	1	1	AC	no	none	n/a	n/a	Out	
DC power	two-wire	1	1	two-wire	no	none	1.5m	1.5m	In	
Ethernet	RJ45	3	3	Cat. 5	no	none	3m	100m	In	
GPS	coax.	1	1	coax.	yes	none	10m	10m	Out	

Software / Operating Mode Description:

All three transceivers (One-X, EVDO, BC0/BC10) are active. The EUT receives a simulated GPS signal from the iQnav.

Performance Criteria:

N/A. Emissions and transmitter testing only.

Statement of Conformity

The Femto Cell 750722 and Femto Cell 750723 have been found to conform to the following parts of 47 CFR 22, 47 CFR 24, & 47 CFR 90 as detailed below:

Part 2	**Part 22, 24, 90**	**Comments**
2.1033(c)(4)		CDMA is the type of RF modulation.
2.1033(c)(6)		RF output power is not adjustable to end users.
2.1049(l)		Occupied bandwidth measured
2.1033(c)(9)		The Femto Cell 705722, Femto Cell 705723, and Femto Cell 705724 do not require a tune-up procedure.
2.1055(a)(d)		Frequency stability within 1.5ppm
	Part 22	
	22.913(a)(2)	Meets ERP limit: 7W
	22.359	Band edge
	22.917(a)	Spurious emissions within limit of -13dBm
	Part 24	
2.1033(c)(7)	24.232(c)	Meets power limit: 2W EIRP.
	24.235	Fundamental is within authorized frequency block
	24.238(a)	Meets out of band emissions limits
	Part 90	
2.1051	90.691(a)	Spurious emissions within limit of -13dBm
2.1053	90.691(a)	Spurious emissions within limit of -13dBm
	90.213(a)	Frequency stability within 1.5ppm
	90.635	Meets power limit: 100W ERP

Model 750722 Test Data and Results

Tests Specific to Part 22

Bandwidth

Bandwidth Measurements

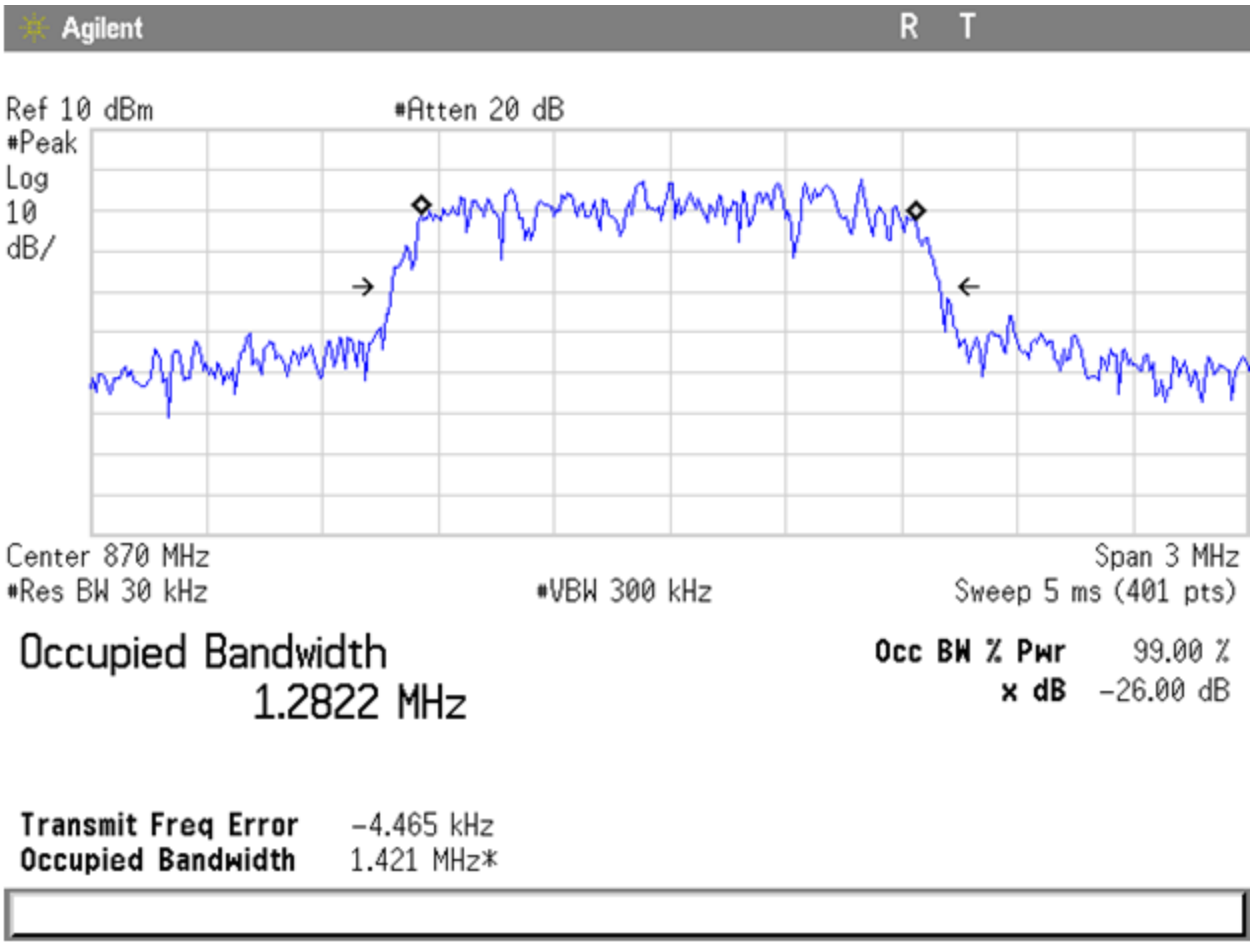
Date: 05-Nov-13	**Company:** Airvana	**Work Order:** N2817
Engineer: Arik Zwirner	**EUT Desc:** 750722	**EUT Power:** 120Vac/60Hz
Temp: 21°C	**Humidity:** 21%	**Pressure:** 1025mbar

Frequency Range: 869-894MHz, FCC Part 22

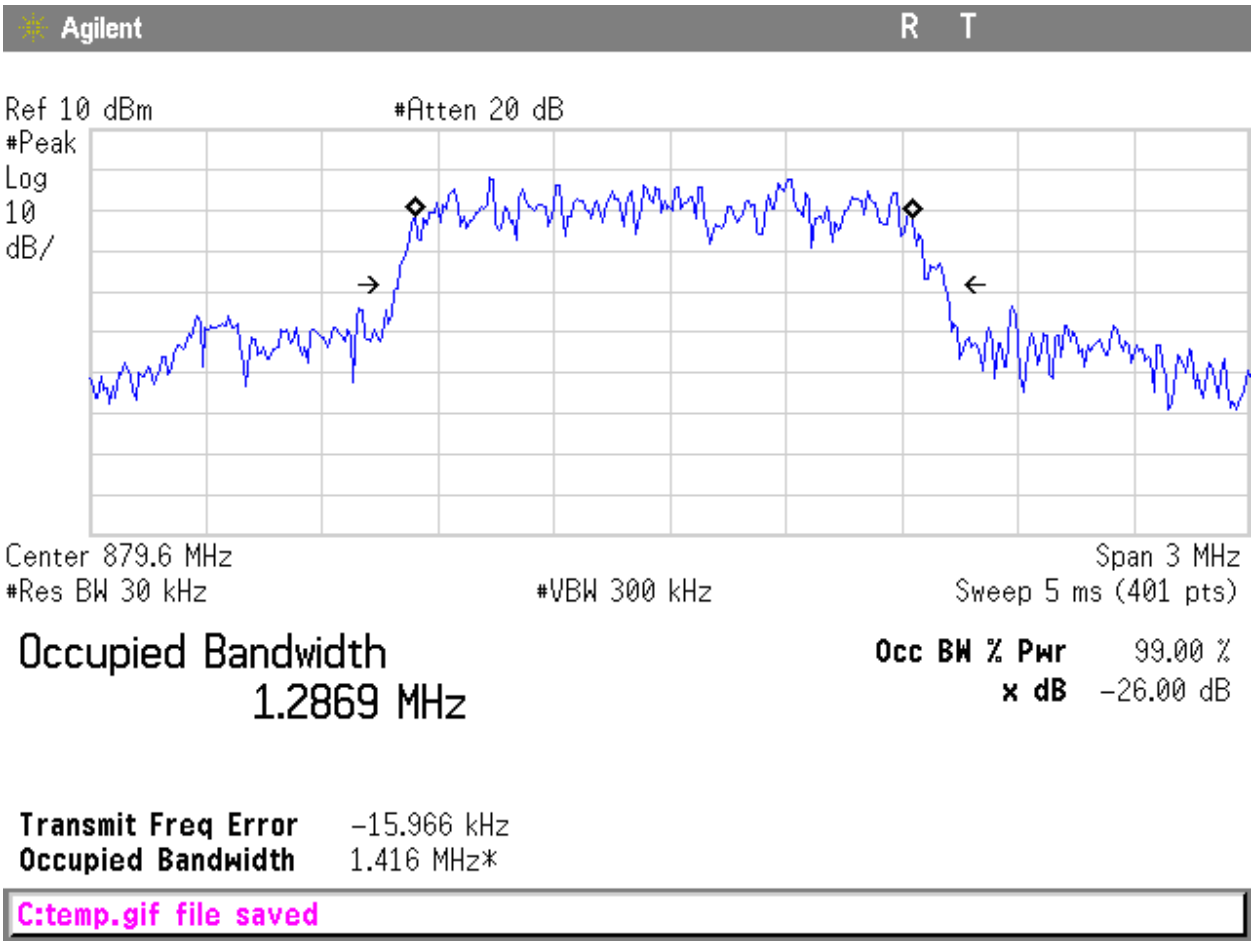
Notes: Band Class 0 (BC0)

OUTPUT	CHANNEL POSITION	CHANNEL NUMBER	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)
BC0				
	Low	1	870.03	1.421
	Mid	320	879.6	1.416
	High	640	889.2	1.427

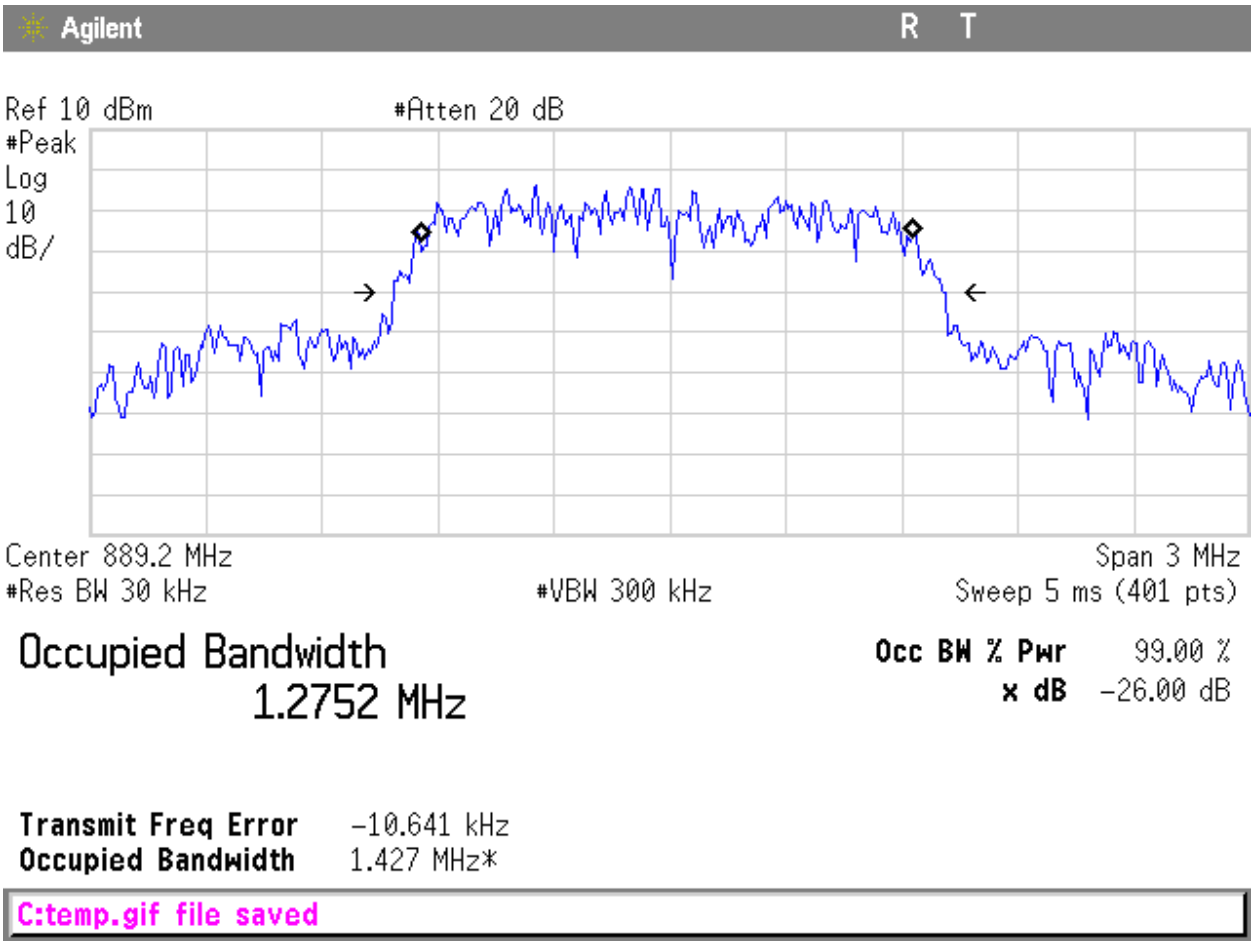
Test Site: 1DCC-OATS-3M-I **Spectrum Analyzer:** Rental #1



BC0 Low Channel (Ch. 1)



BC0 Mid Channel (Ch. 320)



BC0 High Channel (Ch. 640)

ERP

ERP Using Substitution Method

Date: 05-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 21°C **Humidity:** 21% **Pressure:** 1025mbar

Frequency Range: Part 22 ERP measurements **Measurement Distance:** 3 m

Notes: Transmitter mode: Band Class 0 (BC0)
7W =38.45 dBm

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted ERP (dBm)	FCC 22.913 (a) Limit (dBm)	Margin (dB)	Result (Pass/Fail)
Channel 1			---	---	---	---	---	---
V	870.03	4.0	0.5	0.0	3.5	38.45	-35.0	Pass
H	870.03	3.5	0.5	0.0	3.0	38.45	-35.5	Pass
			---	---	---	---	---	---
Channel 320			---	---	---	---	---	---
V	879.6	5.8	0.5	0.0	5.3	38.45	-33.2	Pass
H	879.6	4.0	0.5	0.0	3.5	38.45	-35.0	Pass
			---	---	---	---	---	---
Channel 640			---	---	---	---	---	---
V	889.2	0.1	0.6	0.0	-0.5	38.45	-39.0	Pass
H	889.2	-3.2	0.6	0.0	-3.8	38.45	-42.3	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1786
Analyzer: Rental #1 **Receive Antenna:** Green **Transmit Cable:** Asset 1722
Transmit Antenna: Dipole, Asset 756

Band Edge Measurements

LIMITS

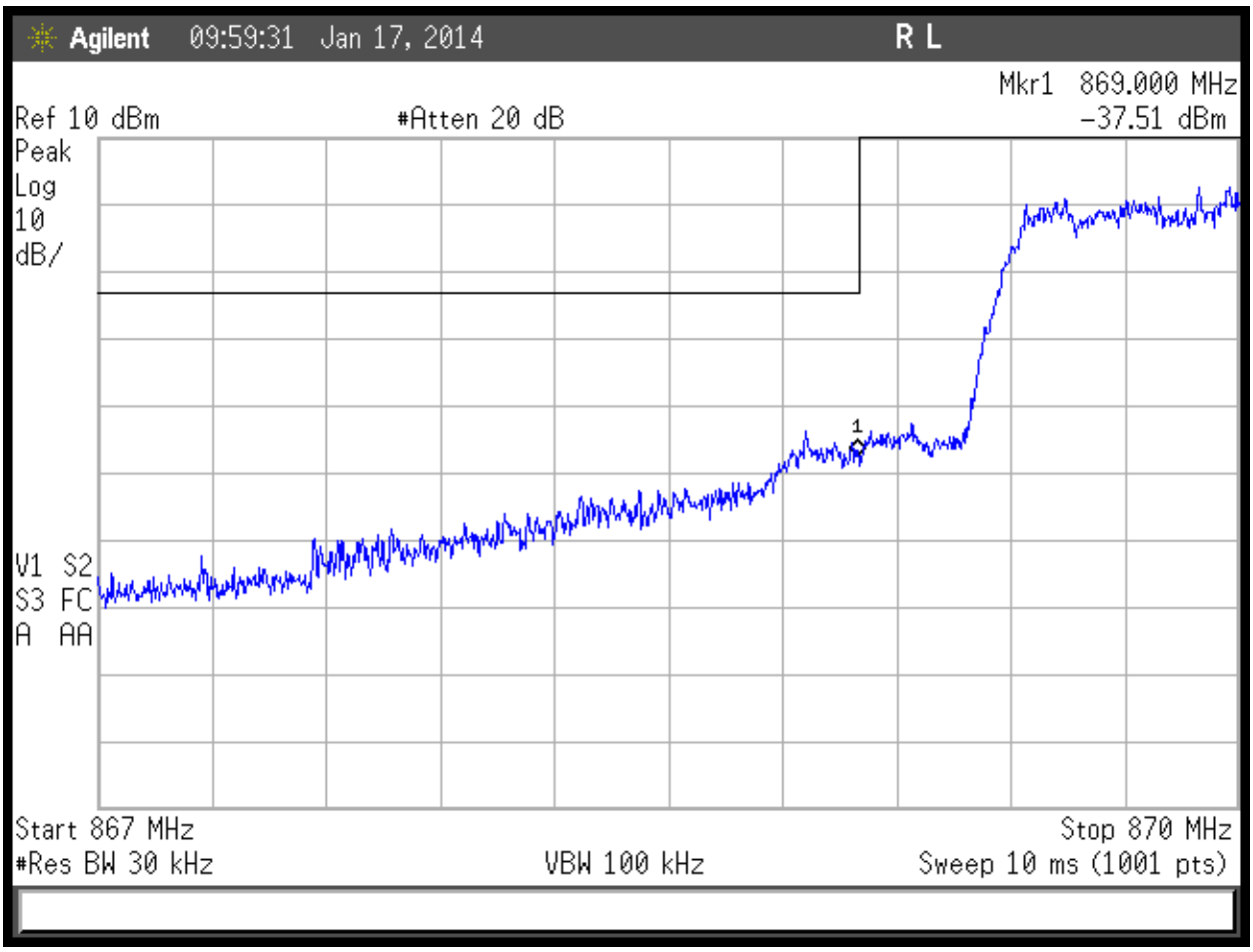
§ 22.359 Emission limitations.

(a) *Out of band emissions.* 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.

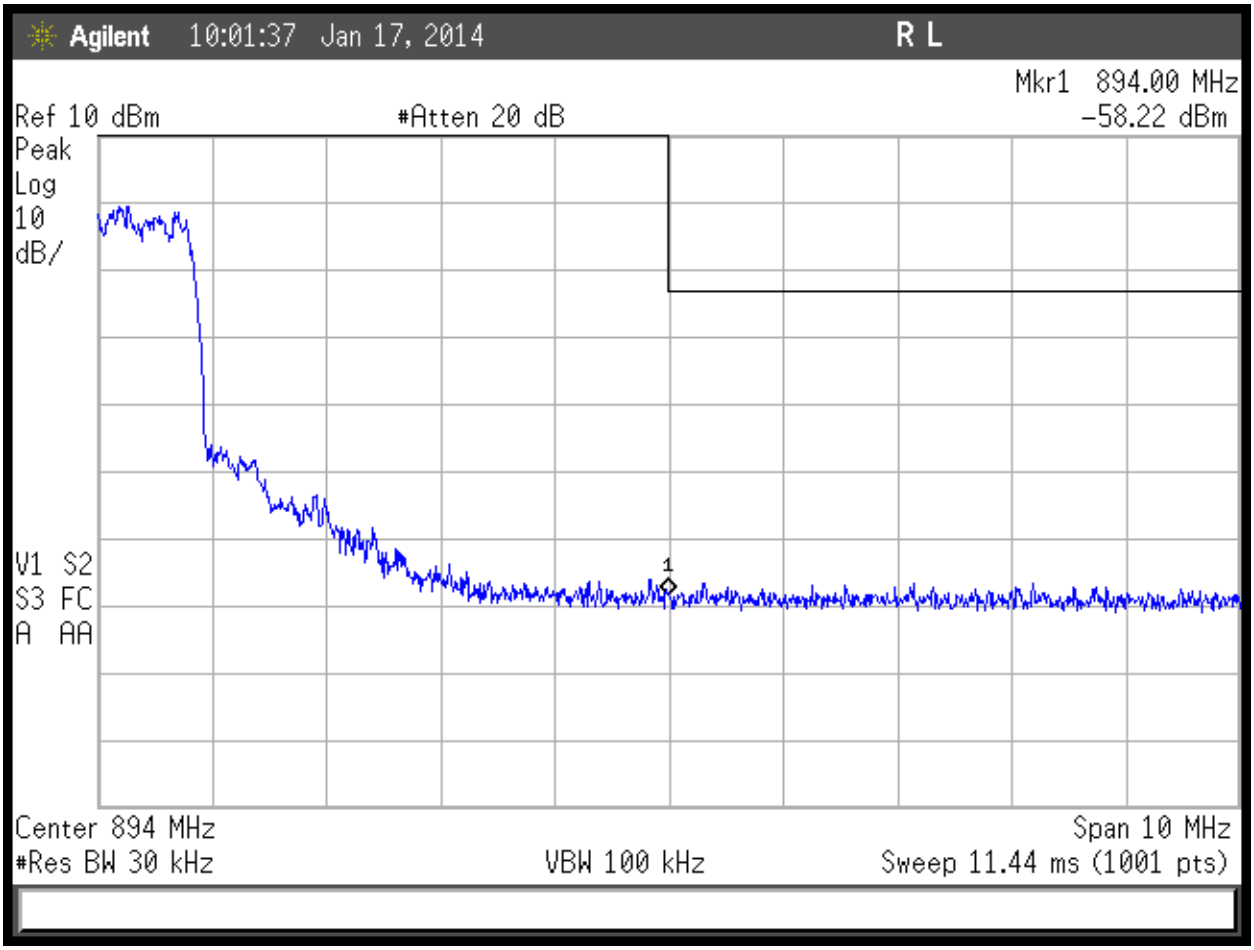
MEASUREMENTS / RESULTS

Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Note: Mask lines are set to -13dBm at 869MHz and 894MHz.



BC0 Low Channel



BC0 High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

§ 22.359 Emission limitations.

(a) *Out of band emissions.* 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.

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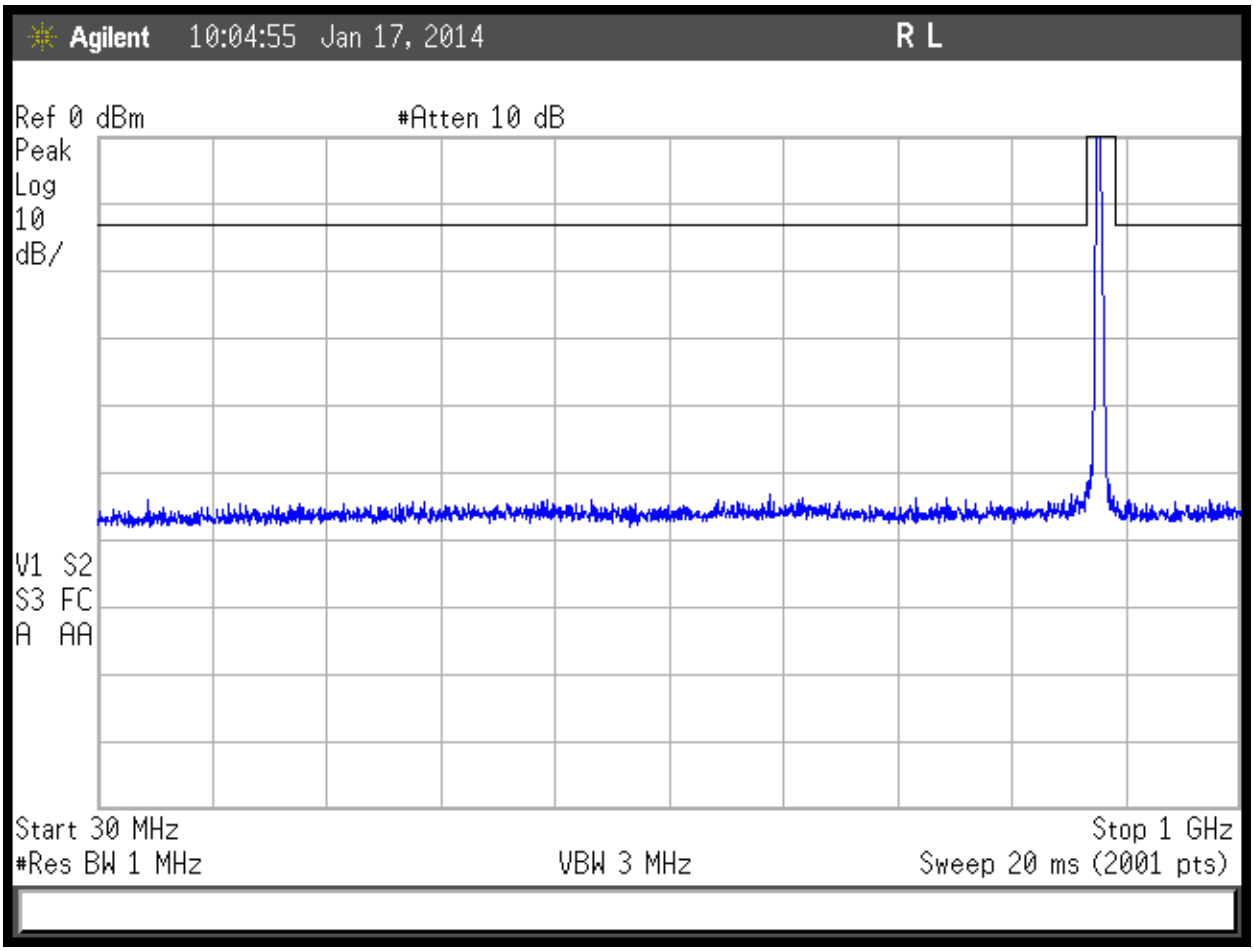
MEASUREMENTS / RESULTS

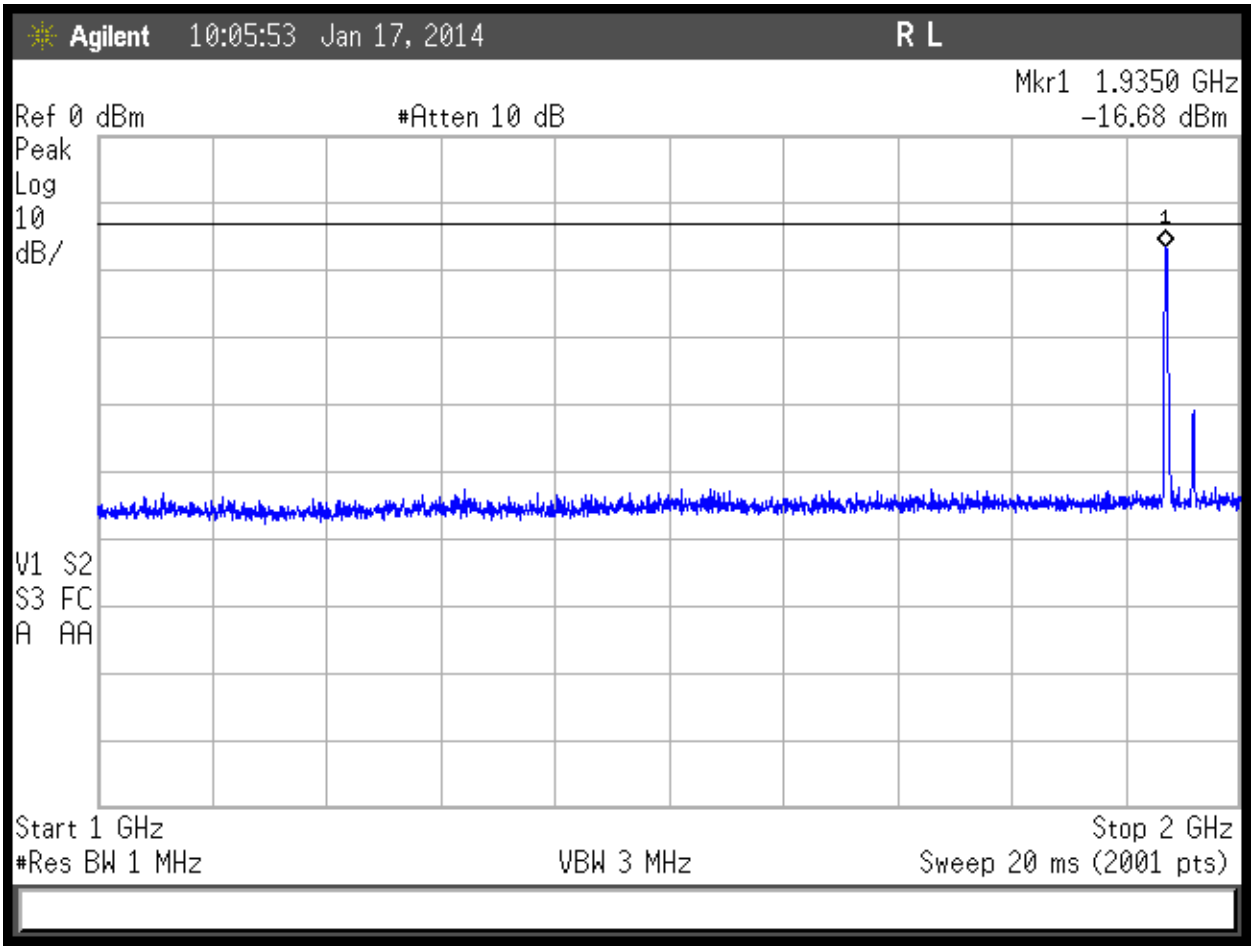
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Notes: Limit lines are set to -13dBm at 30-869MHz and 894-20000MHz. The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

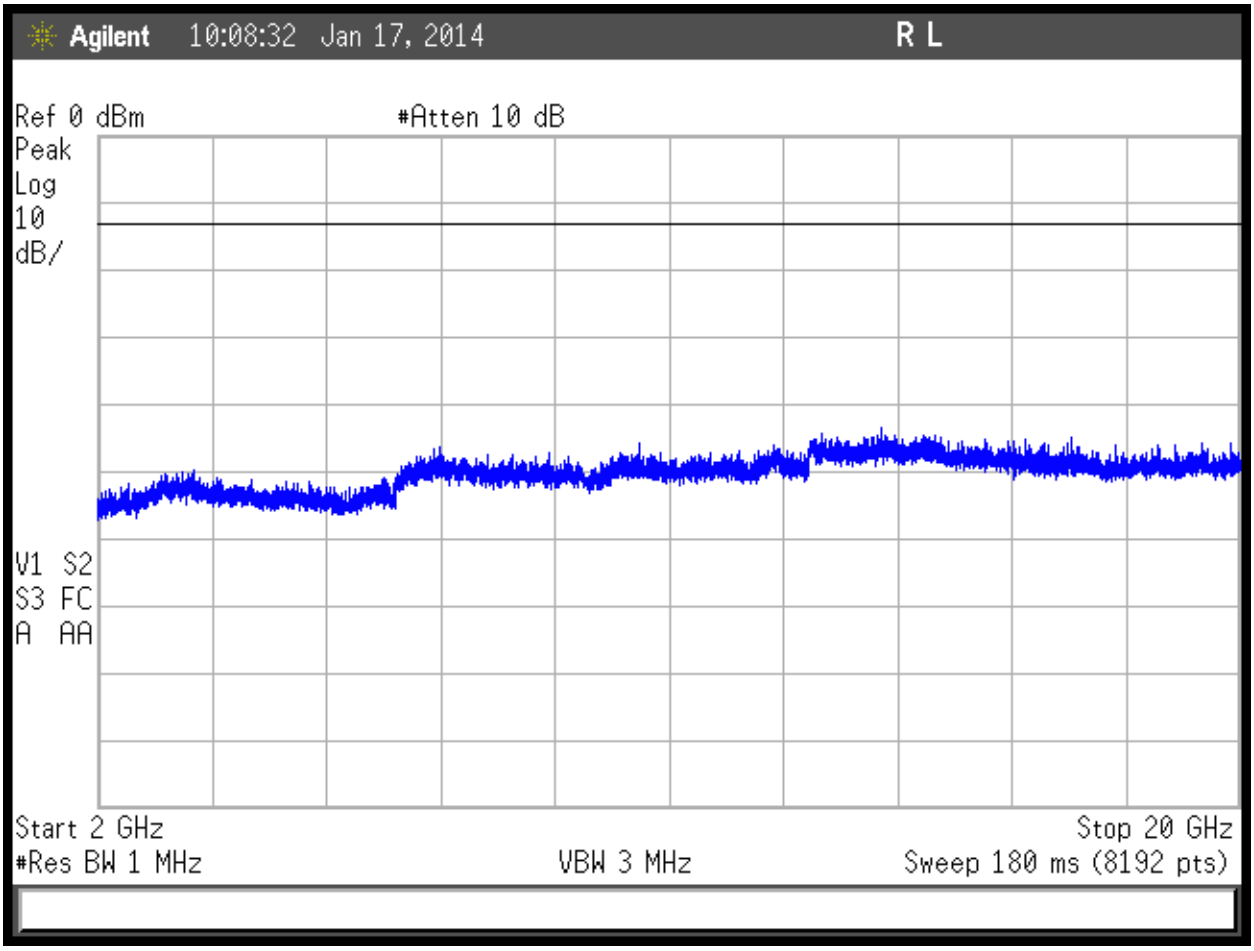
PLOTS



BC0, 30-1000MHz


Agilent 10:05:53 Jan 17, 2014
R L
Mkr1 1.9350 GHz
Ref 0 dBm
#Atten 10 dB
-16.68 dBm
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
Stop 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 20 ms (2001 pts)

BC0, 1-2GHz


Agilent 10:08:32 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 20 GHz
Sweep 180 ms (8192 pts)

BC0, 2-20GHz

Tests Specific to Part 24

Bandwidth

LIMIT

"The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power." [24.238(b)]

MEASUREMENTS / RESULTS

Bandwidth Measurements

Date: 05-Nov-13	**Company:** Airvana	**Work Order:** N2817
Engineer: Arik Zwirner	**EUT Desc:** 750722	**EUT Power:** 120Vac/60Hz
Temp: 21°C	**Humidity:** 21%	**Pressure:** 1025mbar

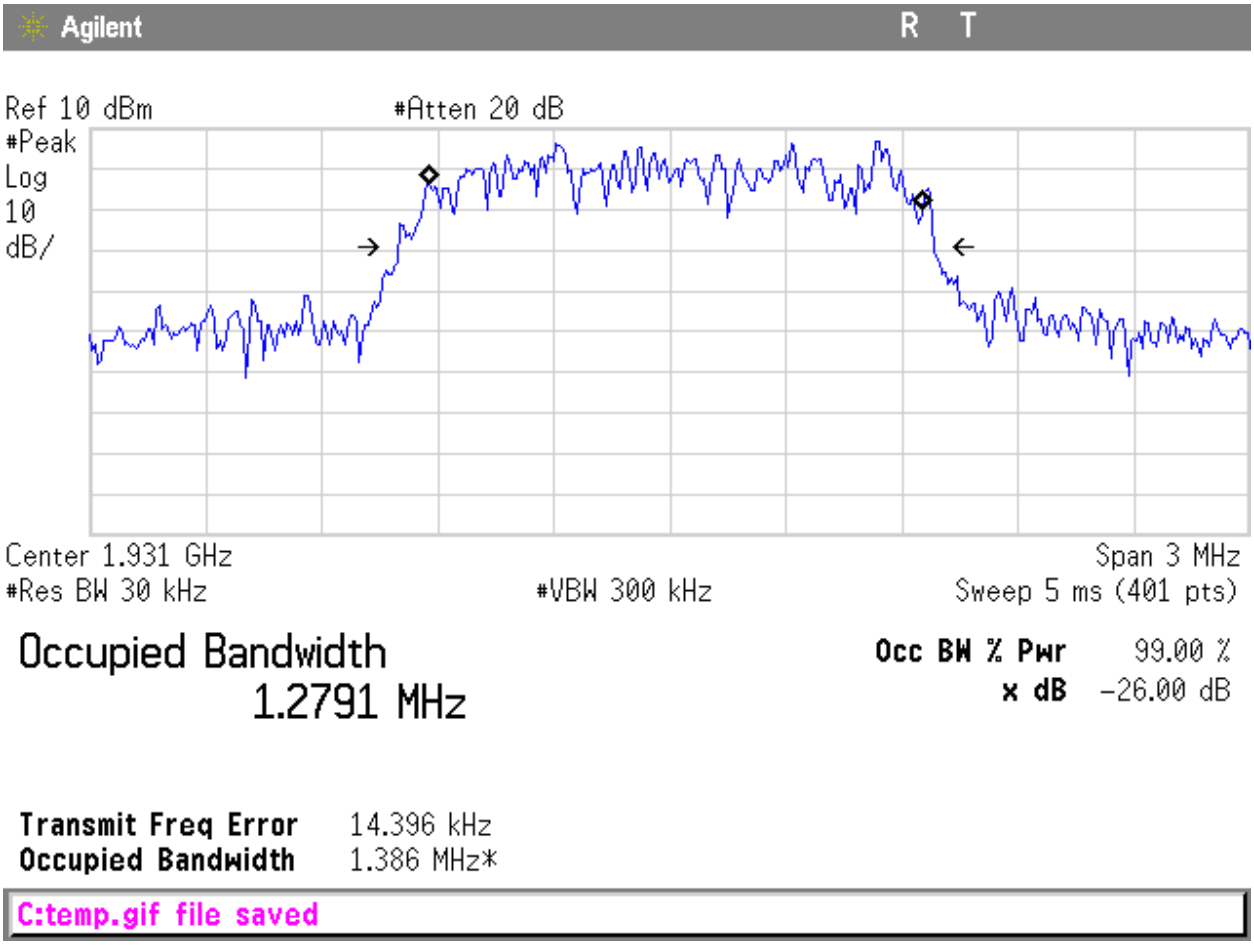
Frequency Range: 1930-1990MHz, FCC Part 24 E

Notes:

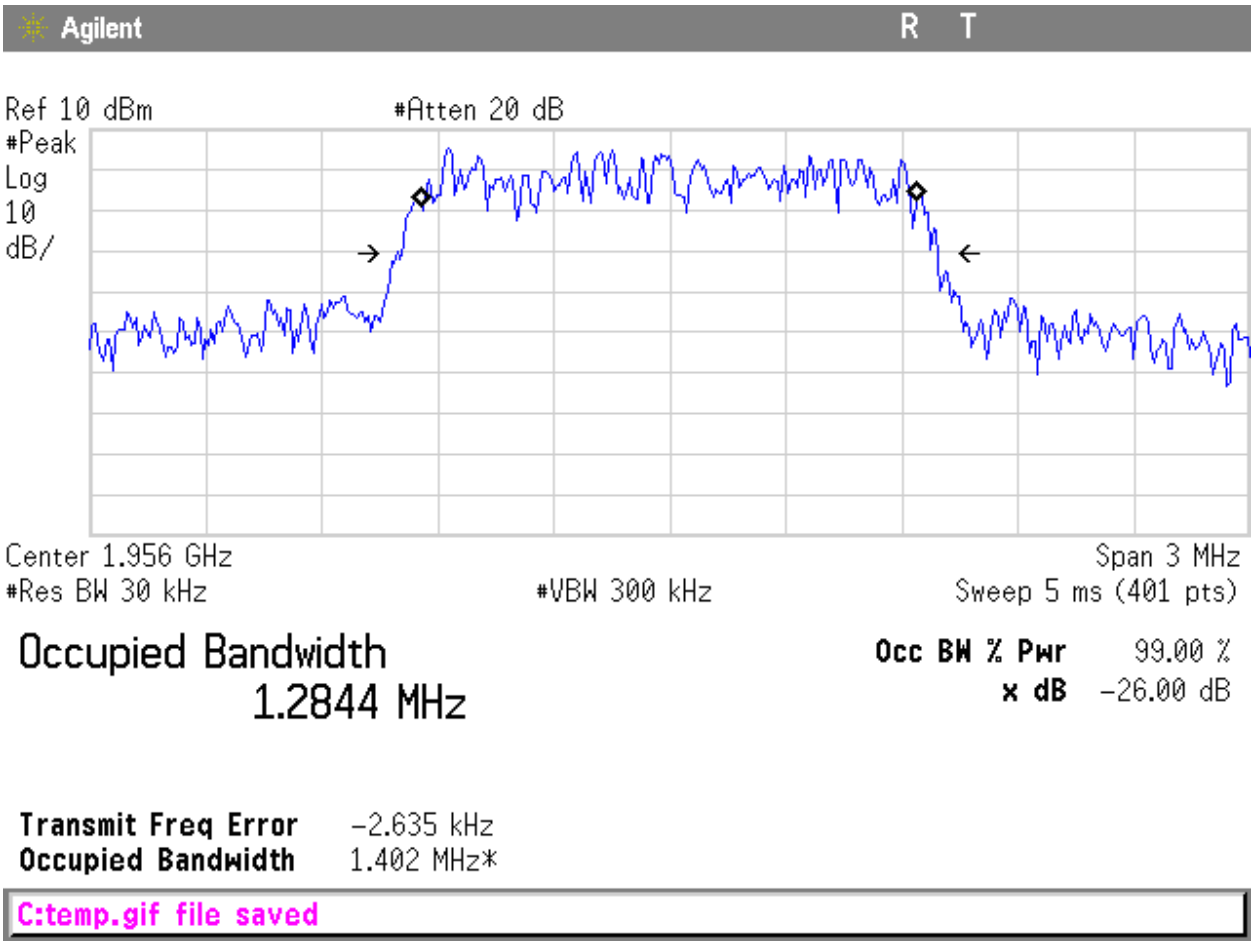
OUTPUT	CHANNEL POSITION	CHANNEL NUMBER	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)
EVDO				
	Low	25	1931.25	1.386
	Mid	525	1956.25	1.402
	High	1075	1983.75	1.410
One-X				
	Low	25	1931.25	1.410
	Mid	525	1956.25	1.403
	High	1075	1983.75	1.407

Test Site: 1DCC-OATS-3M-I **Spectrum Analyzer:** Rental #1

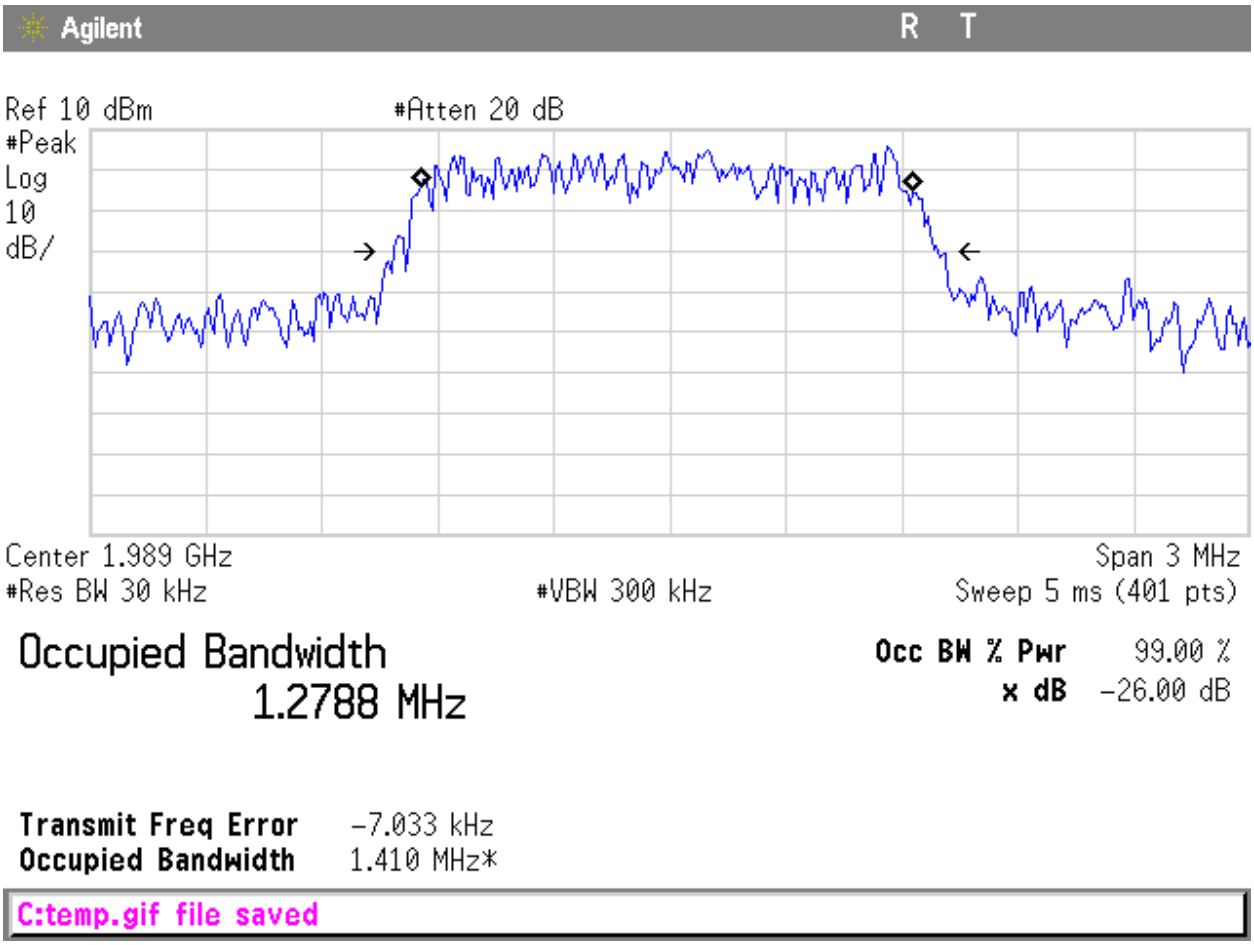
EVDO:



EVDO Low Channel

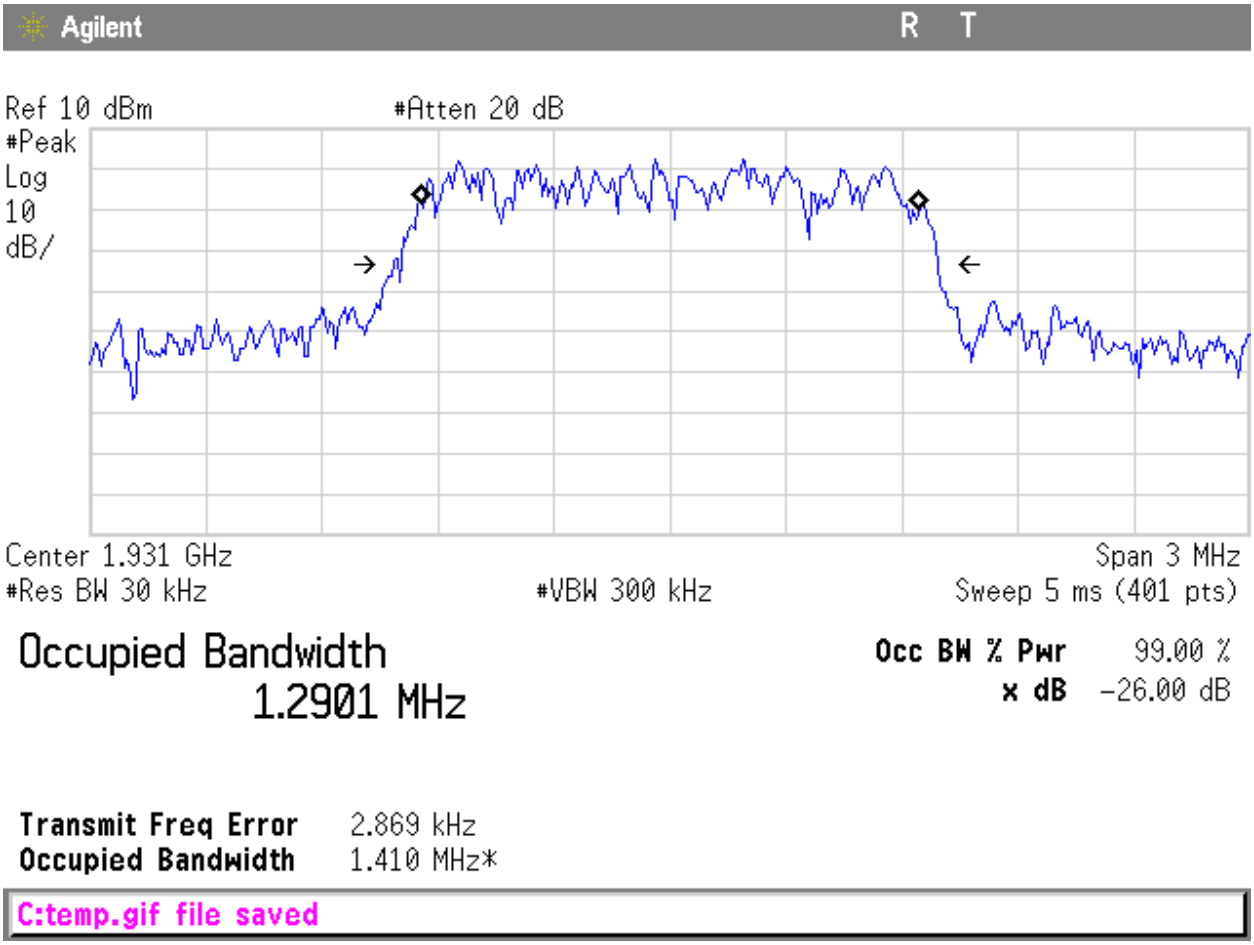


EVDO Mid Channel

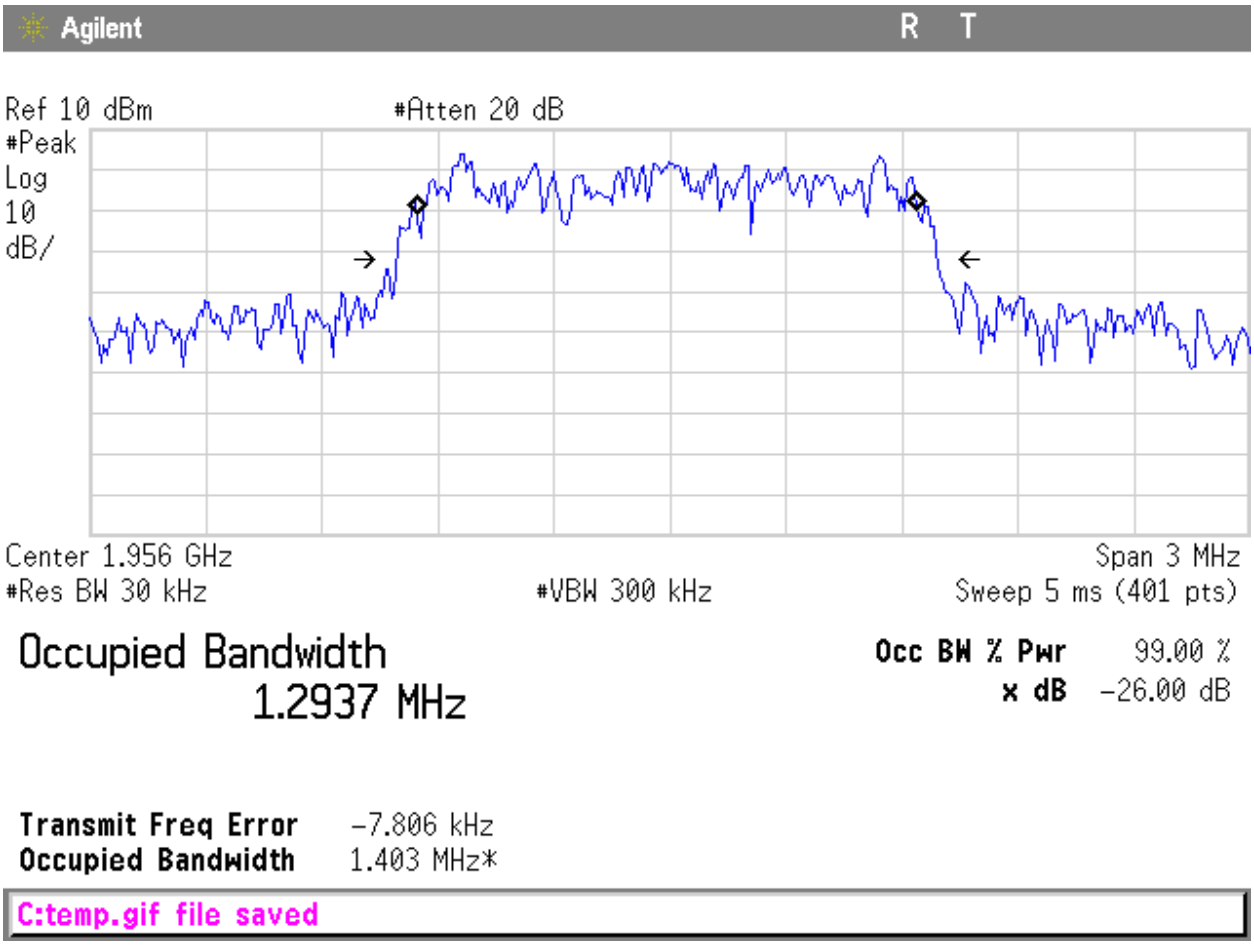


EVDO High Channel

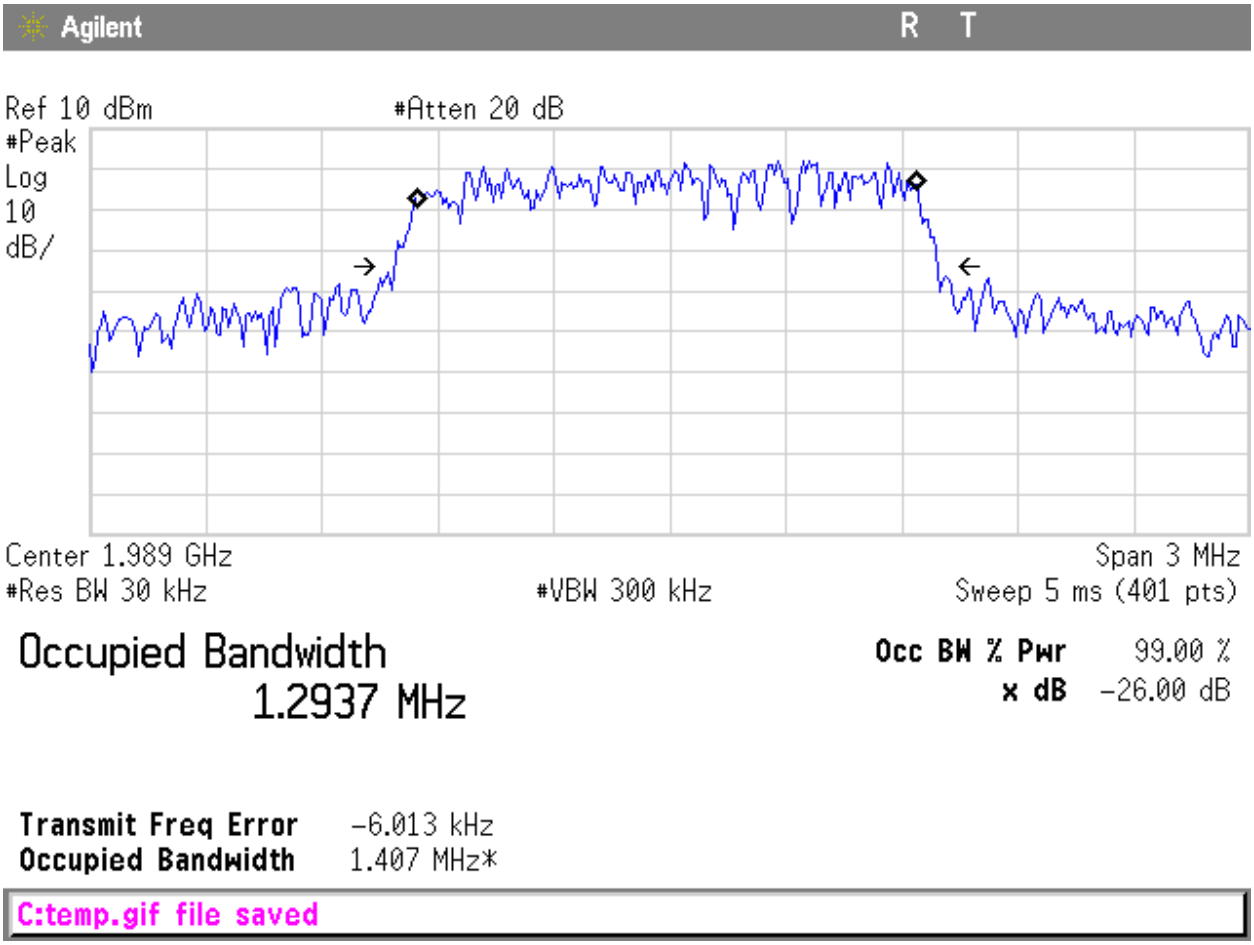
One-X:



One-X Low Channel



One-X Mid Channel



One-X High Channel

EIRP

"Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications."
[24.232 (c)]

BC1 (One-X):

EIRP Using Substitution Method

Date: 05-Nov-13 **Company:** Airvana **Work Order:** M2419
Engineer: Arik Zwirner **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 21°C **Humidity:** 21% **Pressure:** 1025mbar
Frequency Range: Part 24 E, EIRP measurements **Measurement Distance:** 3 m
Notes: Band Class 1 (BC1) One-X transmitter

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted EIRP (dBm)	FCC 24.232 section c Limit (dBm)	Margin (dB)	Result (Pass/Fail)
One-X Ch. 25			---	---	---	---	---	---
H	***1931.25***	***8.4***	***0.8***	***7.6***	***15.2***	33.0	-17.8	Pass
V	***1931.25***	***8.6***	***0.8***	***7.6***	***15.4***	33.0	-17.6	Pass
One-X Ch. 525			---	---	---	---	---	---
H	***1956.25***	***6.5***	***0.7***	***7.6***	***13.4***	33.0	-19.6	Pass
V	***1956.25***	***14.0***	***0.7***	***7.6***	***20.9***	33.0	-12.1	Pass
One-X Ch. 1175			---	---	---	---	---	---
H	***1988.75***	***8.8***	***0.8***	***7.7***	***15.7***	33.0	-17.3	Pass
V	***1988.75***	***11.2***	***0.8***	***7.7***	***18.1***	33.0	-14.9	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1722
Analyzer: Brown (Rental #1) **Receive Antenna:** Yellow Horn **Transmit Cable:** Asset 1786
Transmit Antenna: Black Horn

BC1 (EVDO):

EIRP Using Substitution Method

Date: 05-Nov-13 **Company:** Airvana **Work Order:** M2419
Engineer: Arik Zwirner **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 21°C **Humidity:** 21% **Pressure:** 1025mbar
Frequency Range: Part 24 E, EIRP measurements **Measurement Distance:** 3 m
Notes: Band Class 1 (BC1) EVDO transmitter

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted EIRP (dBm)	FCC 24.232 section c Limit (dBm)	Margin (dB)	Result (Pass/Fail)
EVDO Ch. 25			---	---	---	---	---	---
H	***1931.25***	***15.5***	***0.8***	***7.6***	***22.3***	33.0	-10.7	Pass
V	***1931.25***	***16.2***	***0.8***	***7.6***	***23.0***	33.0	-10.0	Pass
EVDO Ch. 525			---	---	---	---	---	---
H	***1956.25***	***18.2***	***0.7***	***7.6***	***25.1***	33.0	-7.9	Pass
V	***1956.25***	***21.3***	***0.7***	***7.6***	***28.2***	33.0	-4.8	Pass
EVDO Ch. 1175			---	---	---	---	---	---
H	***1988.75***	***16.5***	***0.8***	***7.7***	***23.4***	33.0	-9.6	Pass
V	***1988.75***	***18.6***	***0.8***	***7.7***	***25.5***	33.0	-7.5	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1722
Analyzer: Brown (Rental #1) **Receive Antenna:** Yellow Horn **Transmit Cable:** Asset 1786
Transmit Antenna: Black Horn

Band Edge Measurements

LIMITS

"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." [24.238(a)]

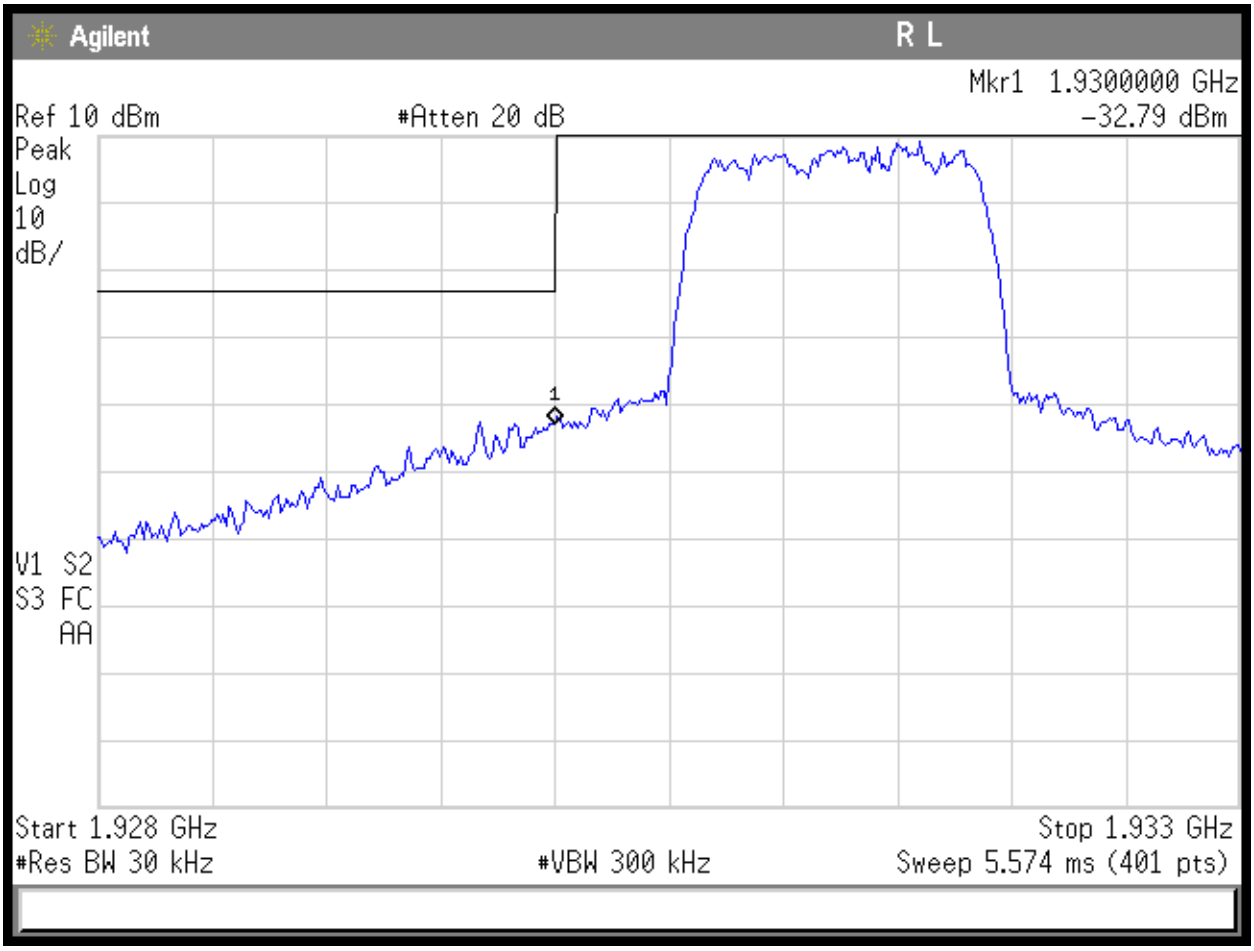
"A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1MHz or 1 percent of emission bandwidth, as specified)." [24.238(b)]

MEASUREMENTS / RESULTS

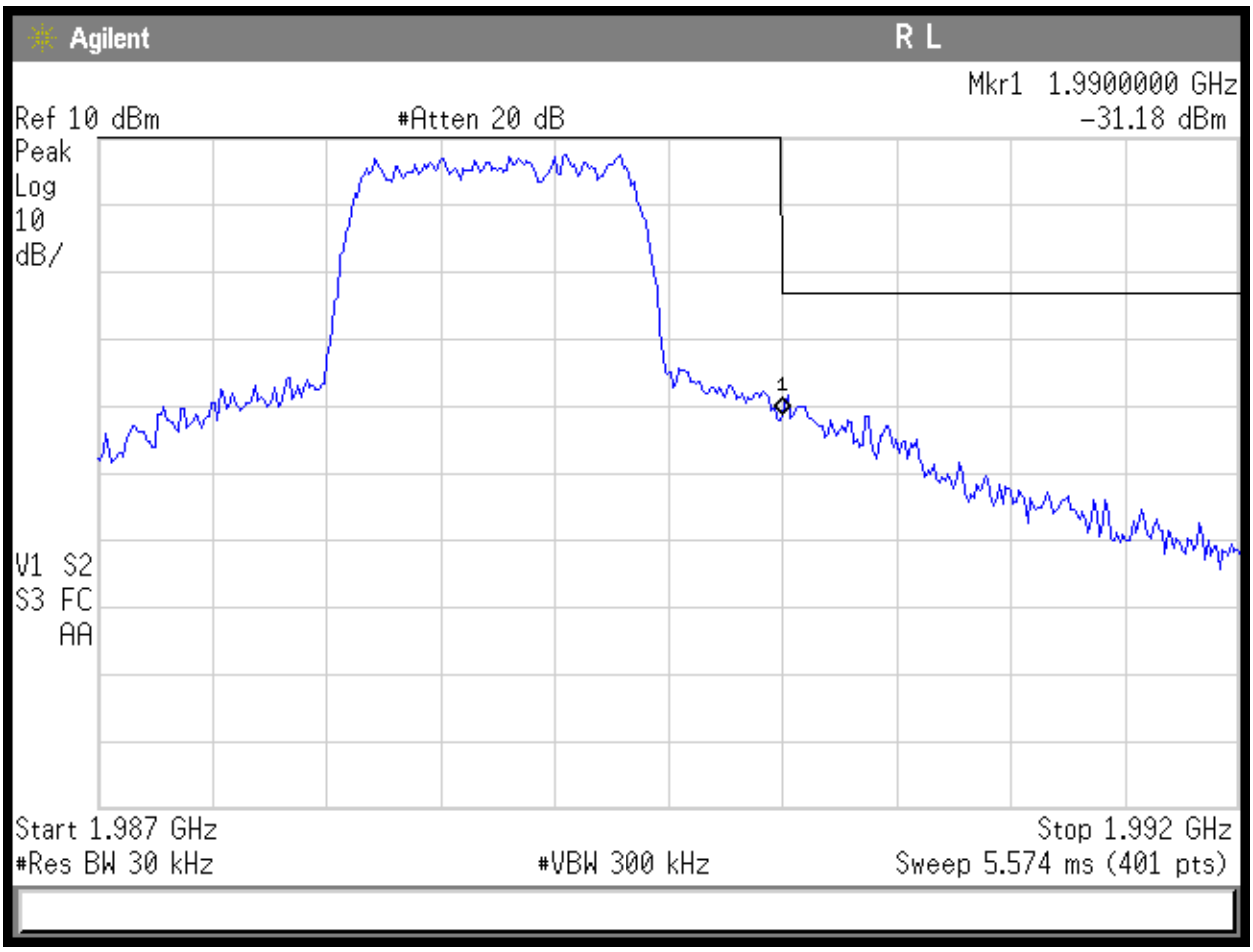
Note: Mask lines are set to -13dBm at 1930MHz and 1990MHz.

Spectrum analyzer screen plots for EVDO and One-X are shown on the following pages.

EVDO:

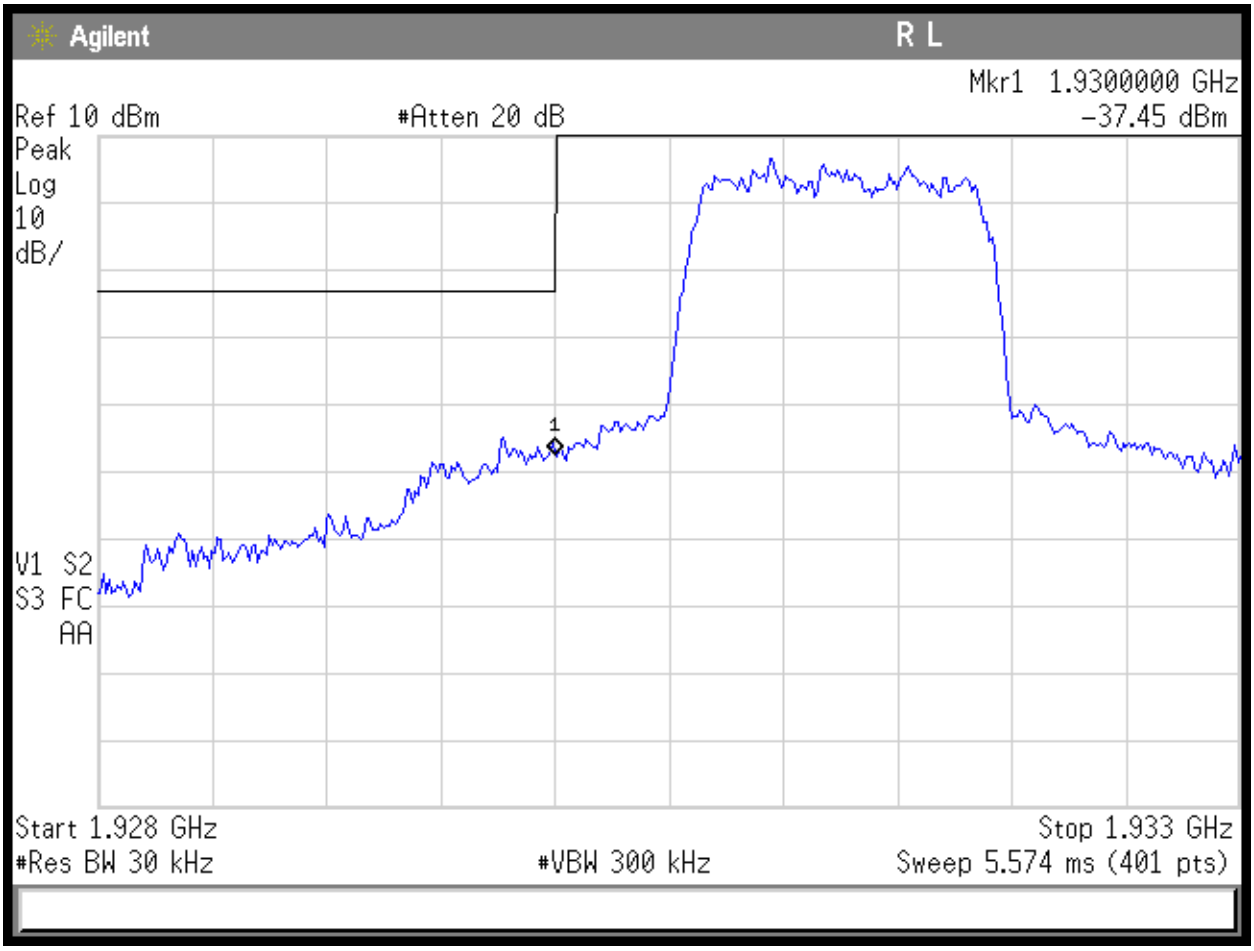


EVDO Low Channel

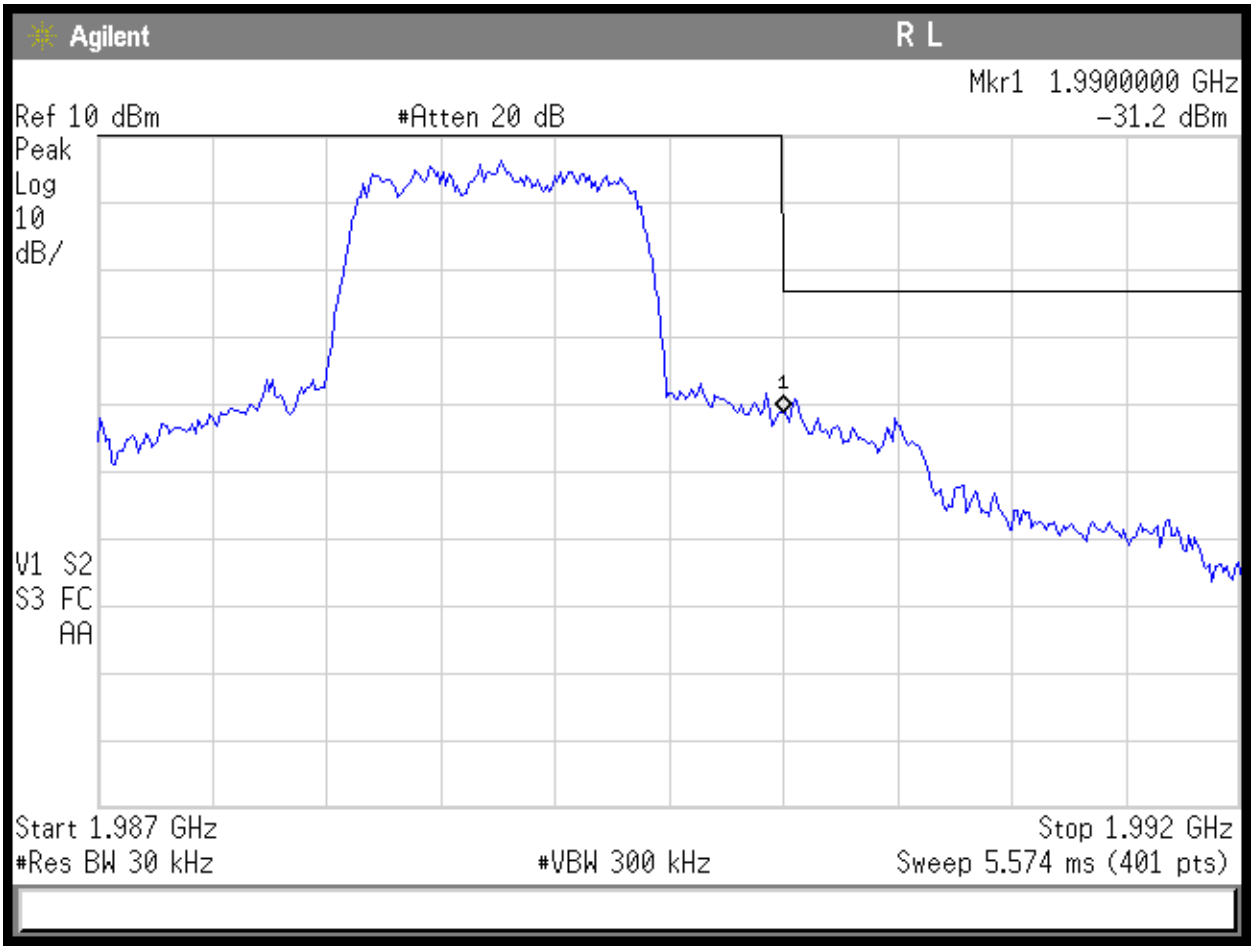


EVDO High Channel

One-X:



One-X Low Channel



One-x High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

"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." [24.238(a)]

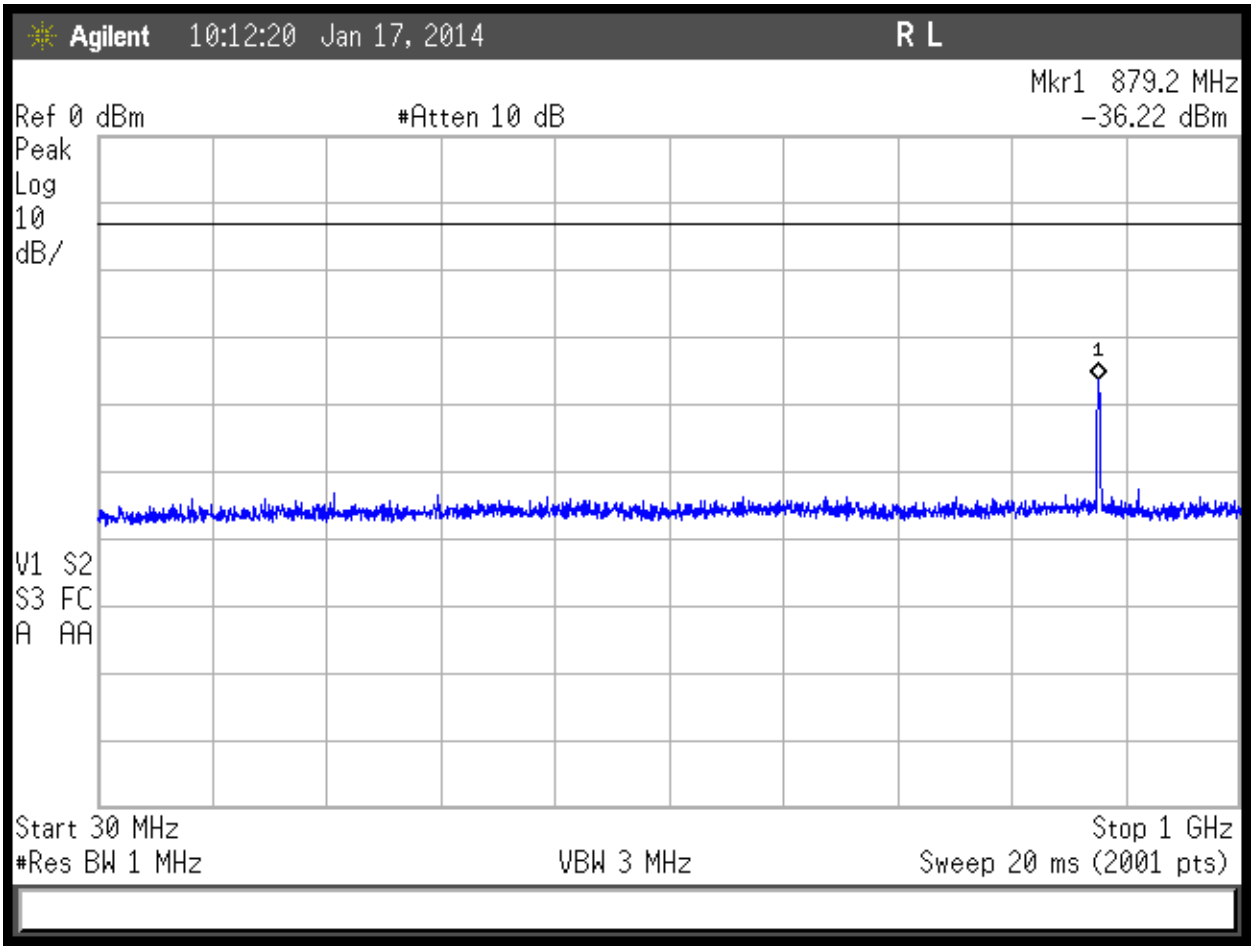
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Spectrum analyzer screen plots for EVDO and One-X are shown on the following pages.

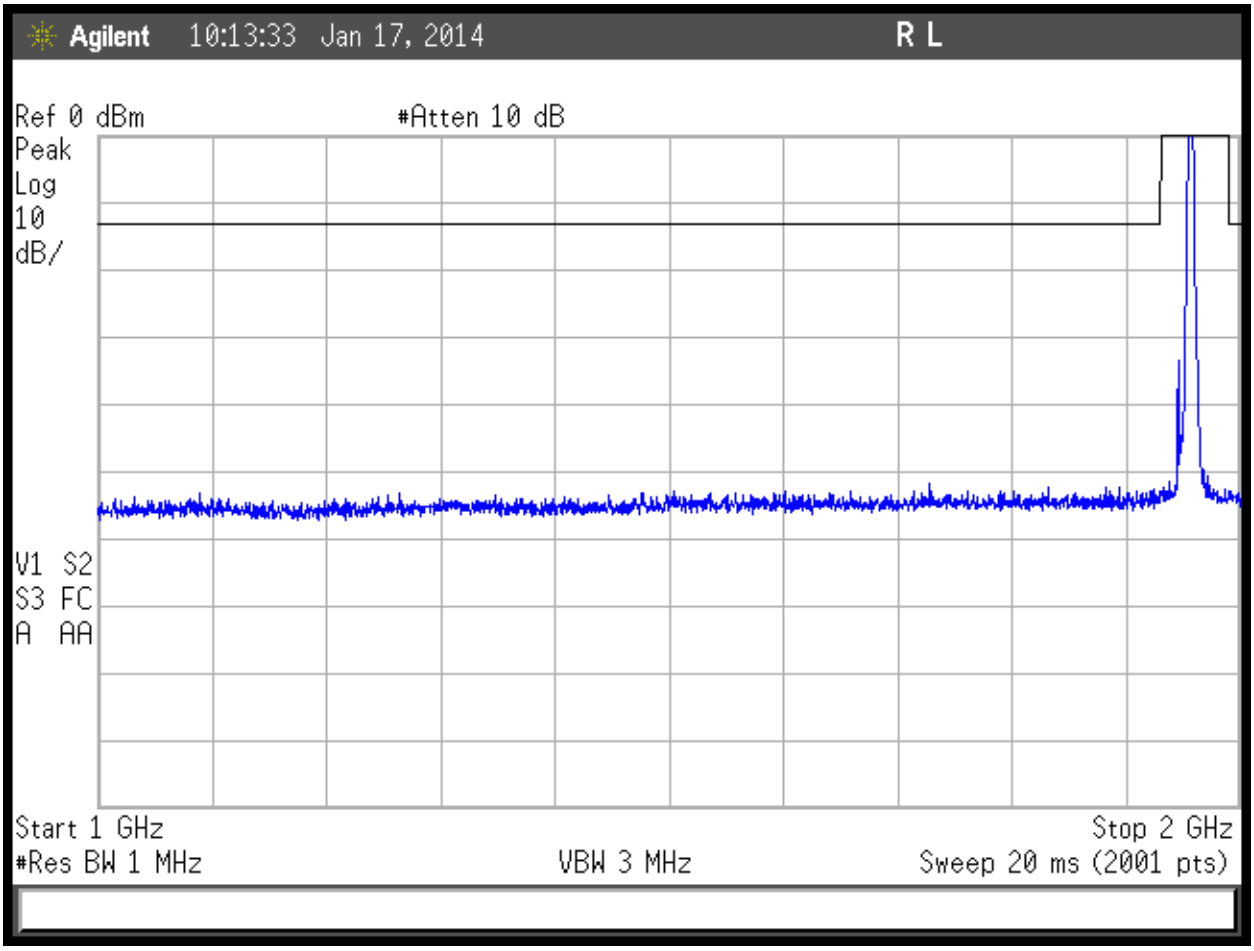
The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

PLOTS

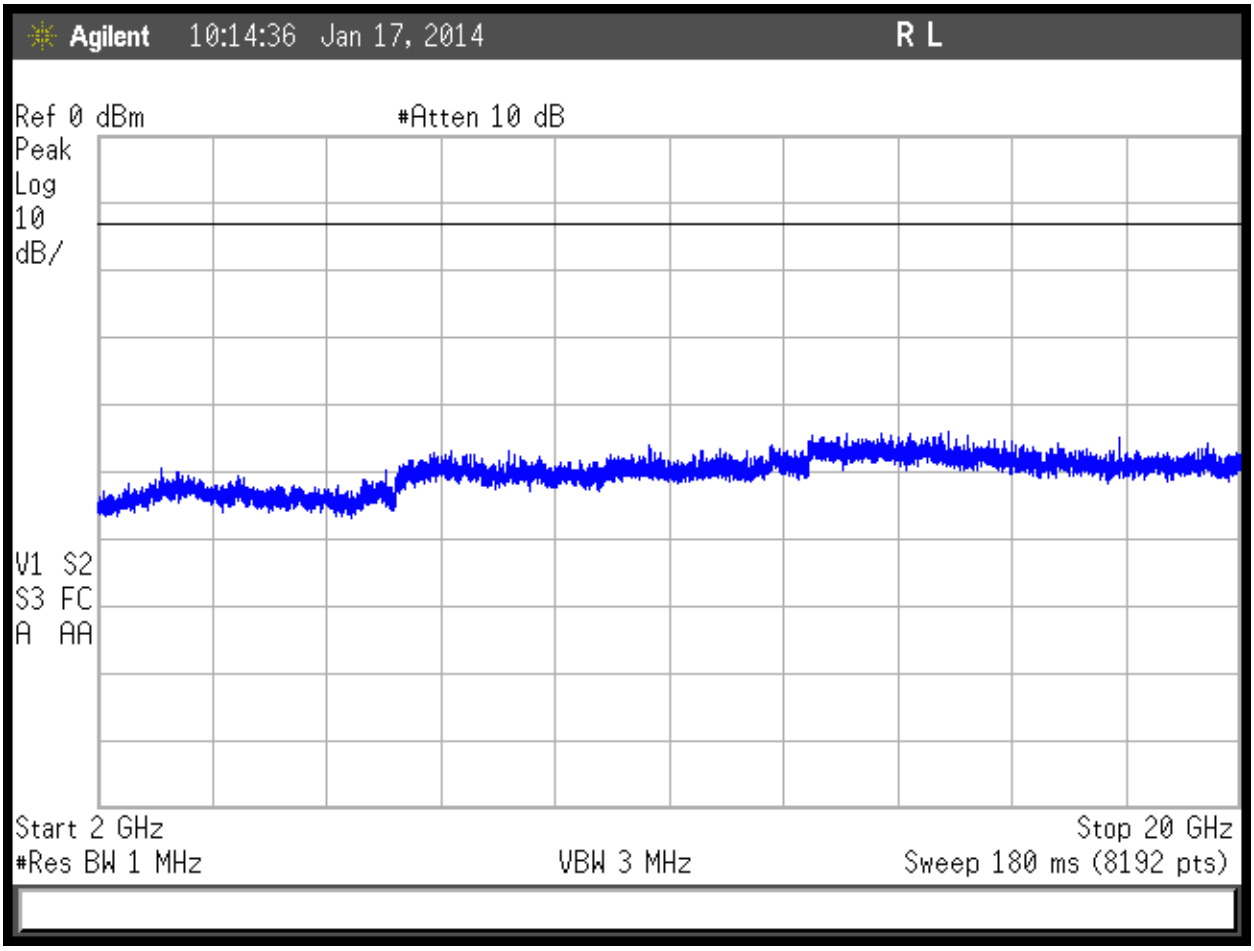
EVDO:



EVDO 30MHz to 1GHz

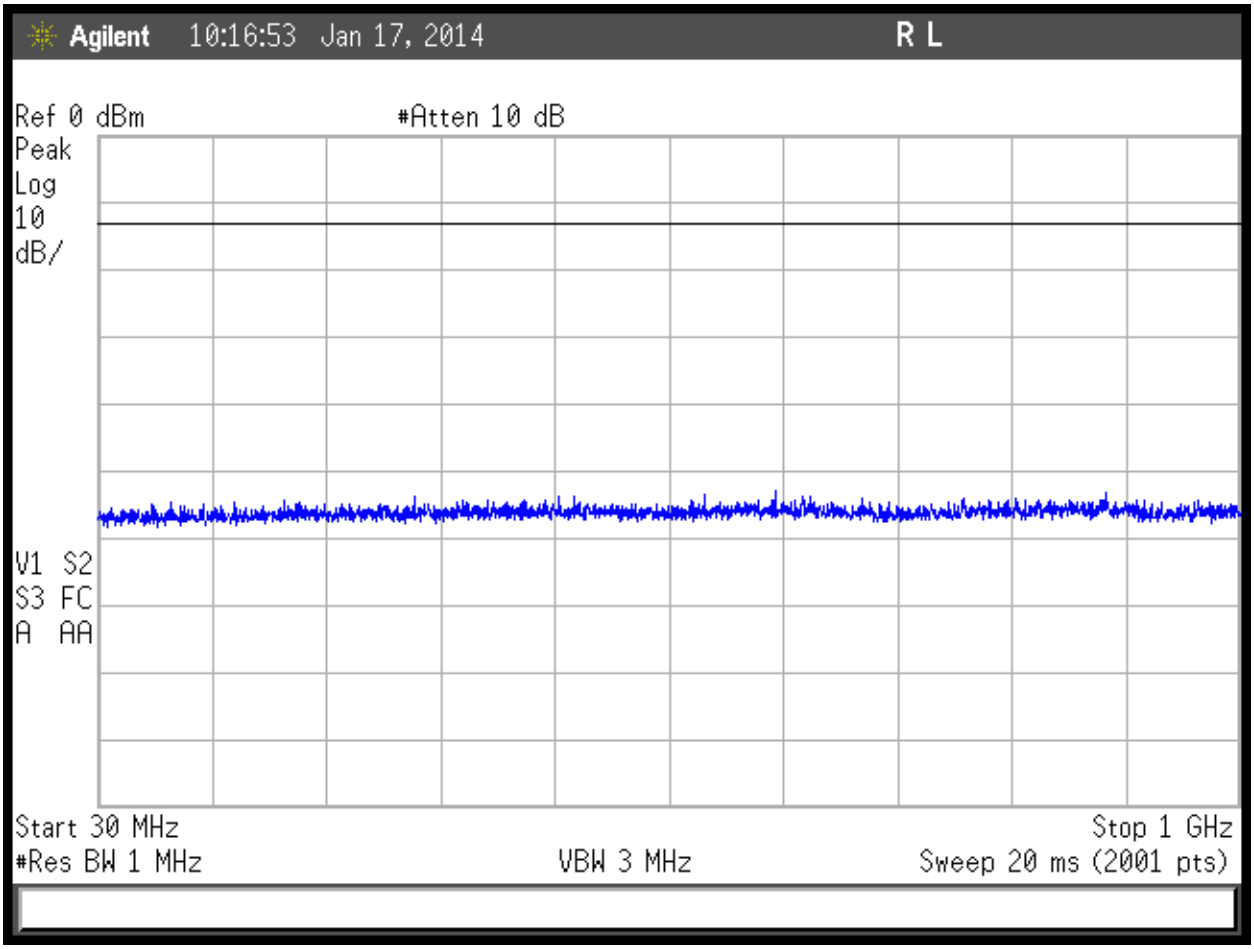

Agilent 10:13:33 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 2 GHz
Sweep 20 ms (2001 pts)

EVDO 1-2GHz

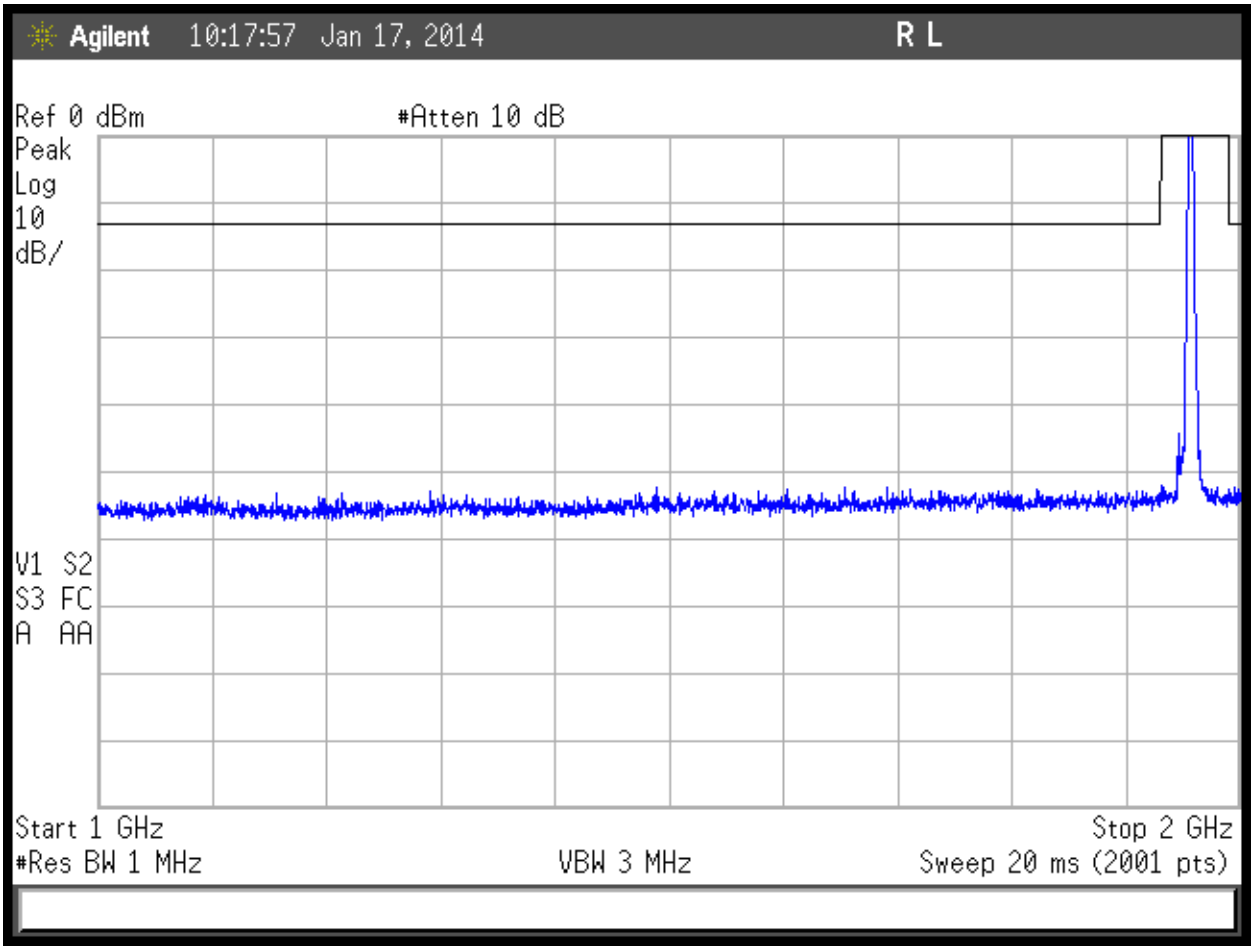


EVDO 2GHz to 20GHz

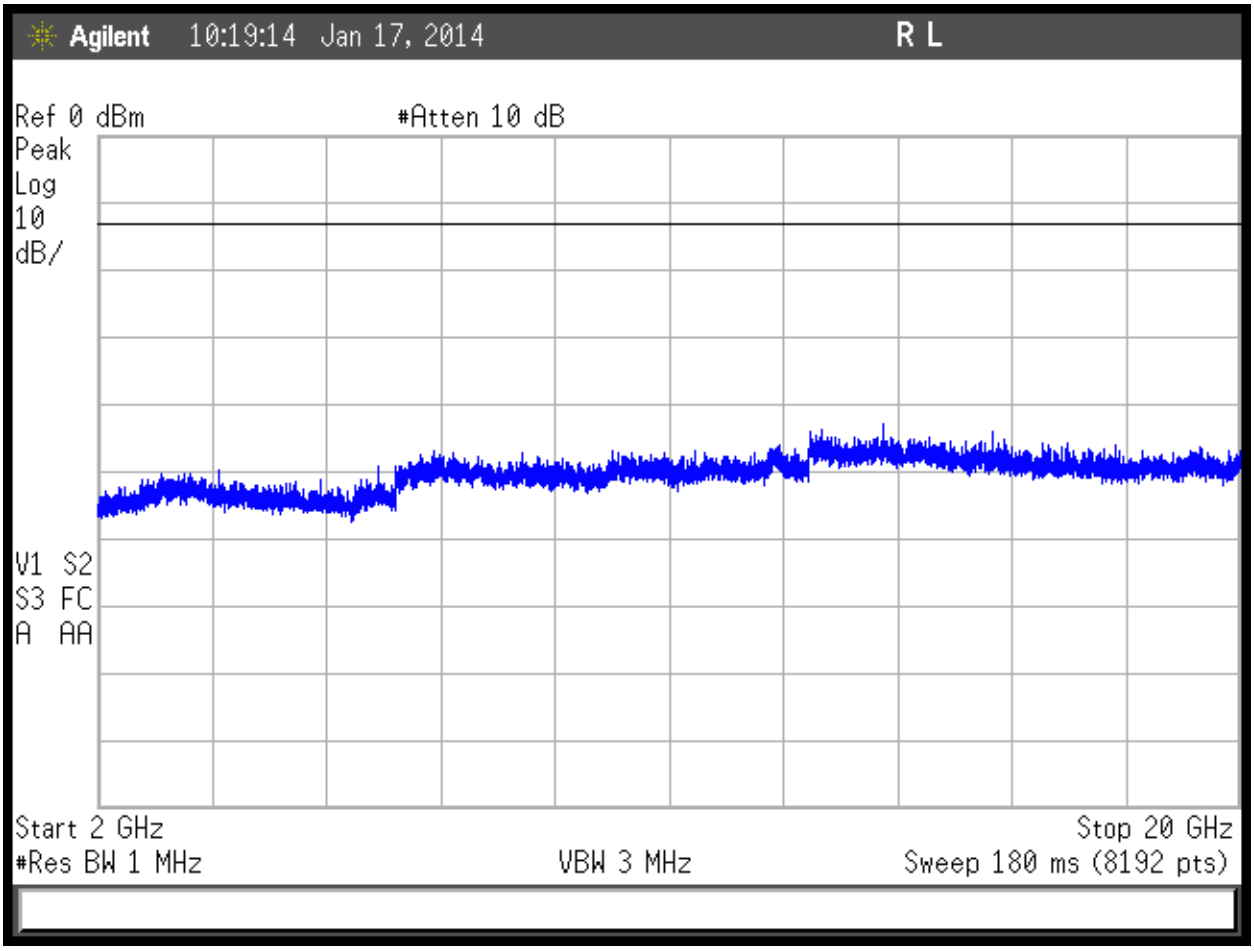
One-X:



One-X 30MHz to 1GHz


Agilent 10:17:57 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 2 GHz
Sweep 20 ms (2001 pts)

One-X 1-2GHz



One-X 2GHz to 20GHz

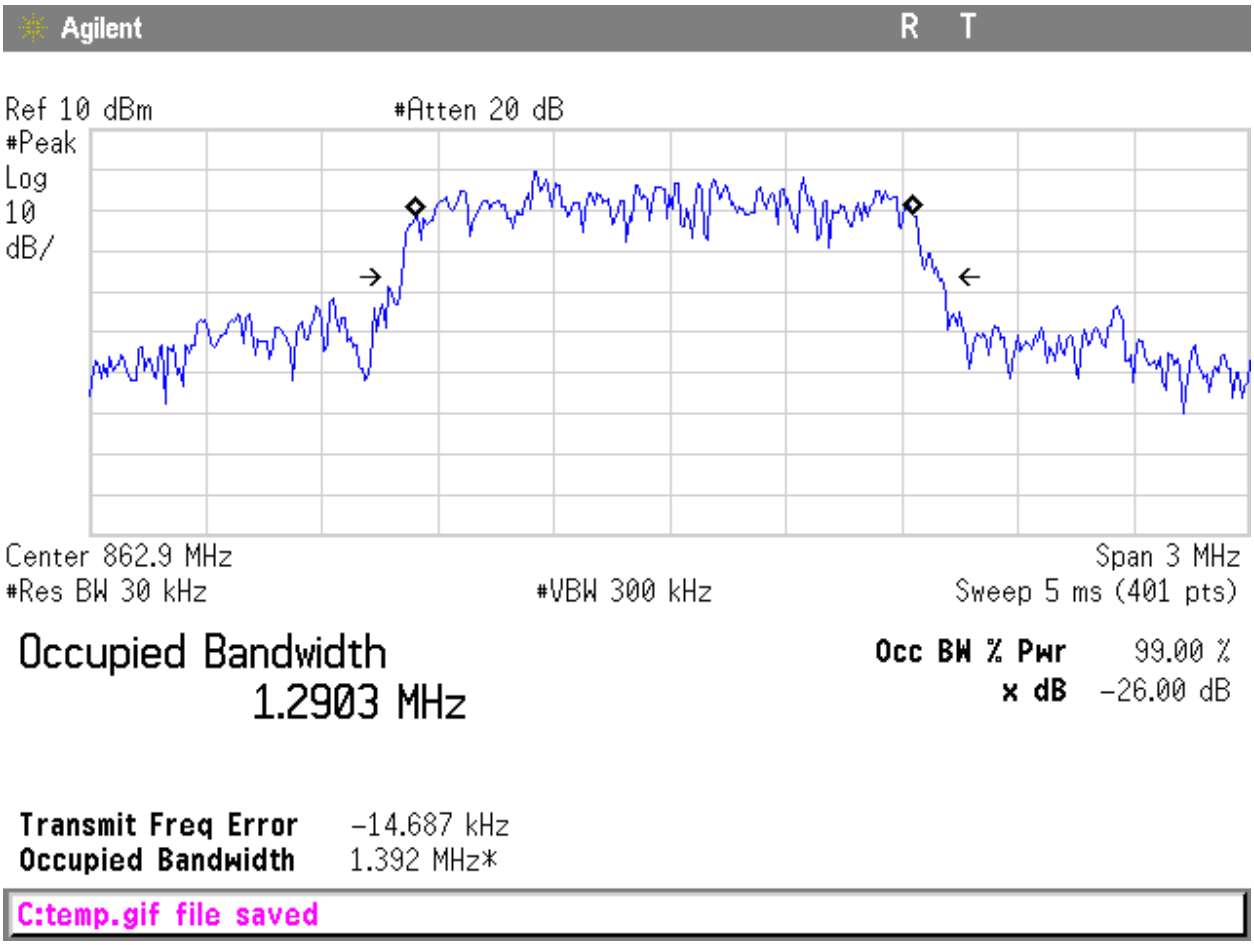
Tests Specific to Part 90

Occupied Bandwidth

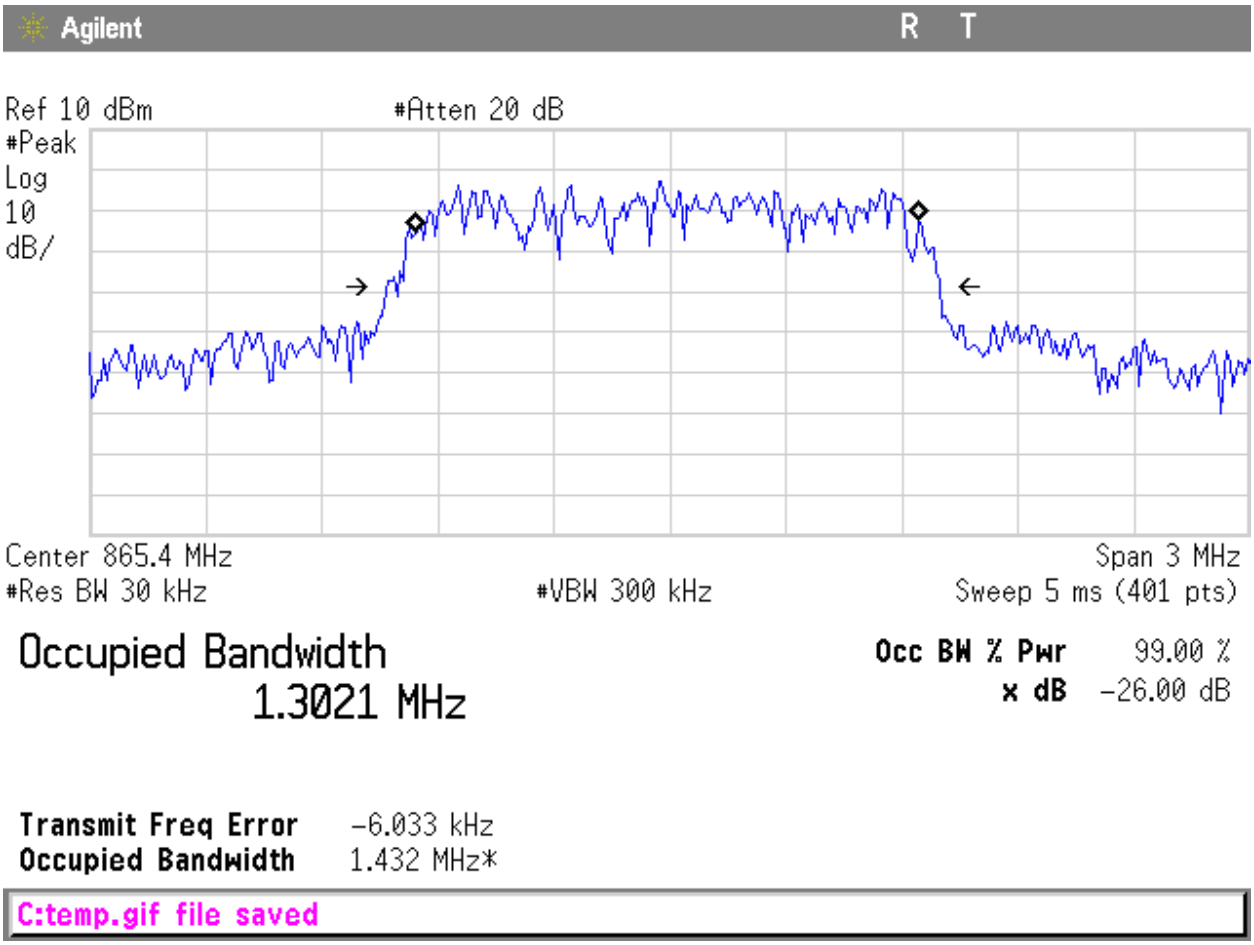
Bandwidth Measurements		
Date: 05-Nov-13	**Company:** Airvana	**Work Order:** N2817
Engineer: Arik Zwirner	**EUT Desc:** 750722	**EUT Power:** 120Vac/60Hz
Temp: 21°C	**Humidity:** 21%	**Pressure:** 1025mbar
Frequency Range: 862-869MHz, FCC Part 90		
Notes: Band Class 10 (BC10)		

OUTPUT	CHANNEL POSITION	CHANNEL NUMBER	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)
BC10				
	Low	476	862.90	1.392
	Mid	576	865.4	1.432
	High	676	867.9	1.402

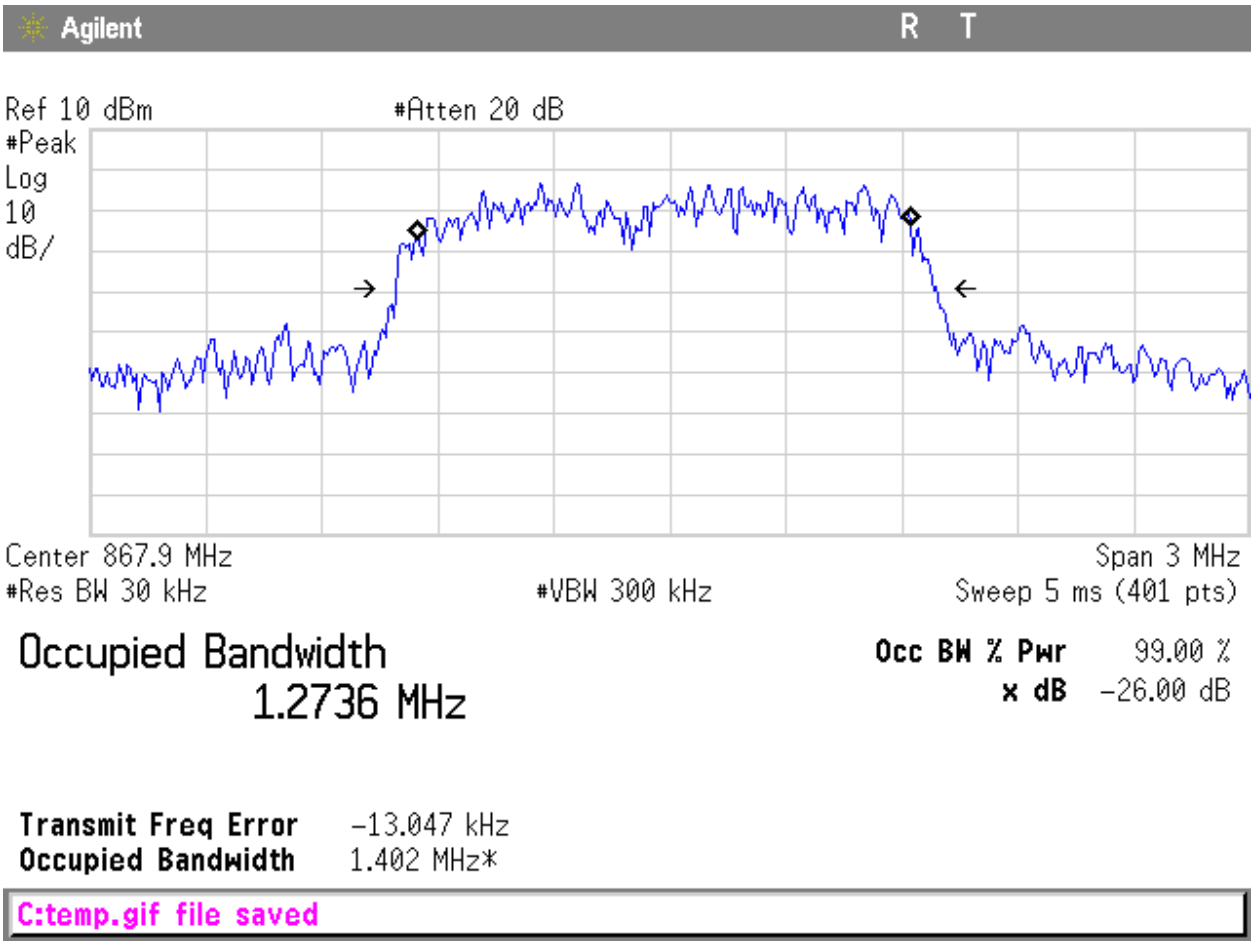
Test Site: 1DCC-OATS-3M-I **Spectrum Analyzer:** Rental #1



BC10 Low Channel (Ch. 476)



BC10 Mid Channel (Ch. 576)



BC10 High Channel (Ch. 676)

ERP

ERP Using Substitution Method

Date: 05-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** Femto Cell Train 8, 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 21°C **Humidity:** 21% **Pressure:** 1025mbar

Frequency Range: 862-869MHz, FCC Part 90 **Measurement Distance:** 3 m

Notes: Band Class 10 (BC10) is under test.
20dBW = 100W = 50dBm

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted ERP (dBm)	FCC 90.635 (b) Limit (dBm)	Margin (dB)	Result (Pass/Fail)
Channel 476			---	---	---	---	---	---
V	862.9	2.8	0.9	0.0	1.9	50.0	-48.1	Pass
H	862.9	4.3	0.9	0.0	3.4	50.0	-46.6	Pass
			---	---	---	---	---	---
Channel 576			---	---	---	---	---	---
V	865.4	3.2	0.9	0.0	2.3	50.0	-47.7	Pass
H	865.4	0.9	0.9	0.0	0.0	50.0	-50.0	Pass
			---	---	---	---	---	---
Channel 676			---	---	---	---	---	---
V	867.9	-3.9	0.9	0.0	-4.8	50.0	-54.8	Pass
H	867.9	3.5	0.9	0.0	2.6	50.0	-47.4	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1786
Analyzer: Rental #1 **Receive Antenna:** Green **Transmit Cable:** Asset 1722
Transmit Antenna: Dipole, Asset 756

Emission Mask

LIMITS

47 CFR 90.961:

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116\ \text{Log}_{10}\ (f/6.1)$ decibels or $50 + 10\ \text{Log}_{10}\ (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\text{Log}_{10}\ (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

MEASUREMENTS / RESULTS

Spectrum Analyzer settings:

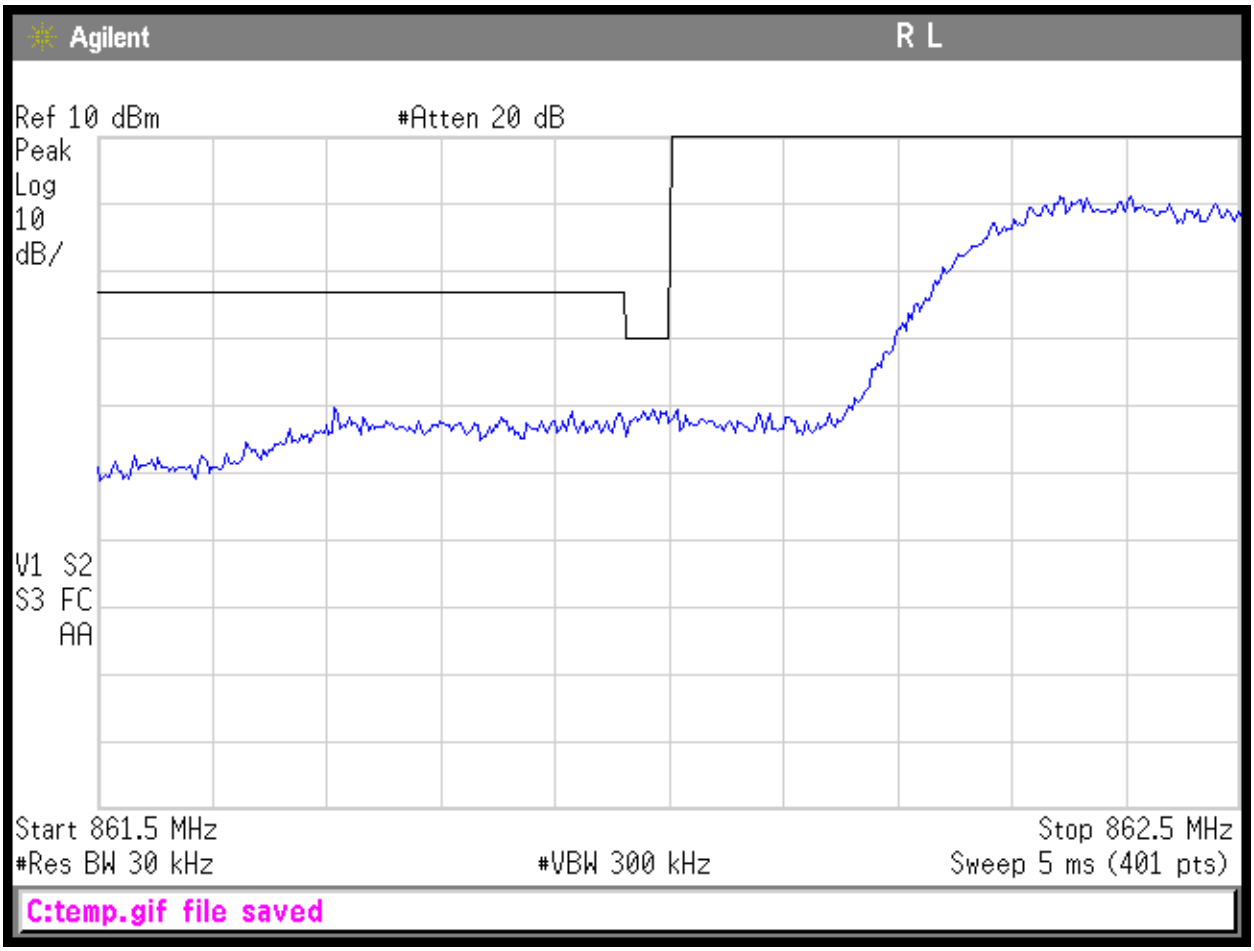
Resolution Bandwidth: 30kHz
Video Bandwidth: 300kHz
Peak detector

Emission Mask:

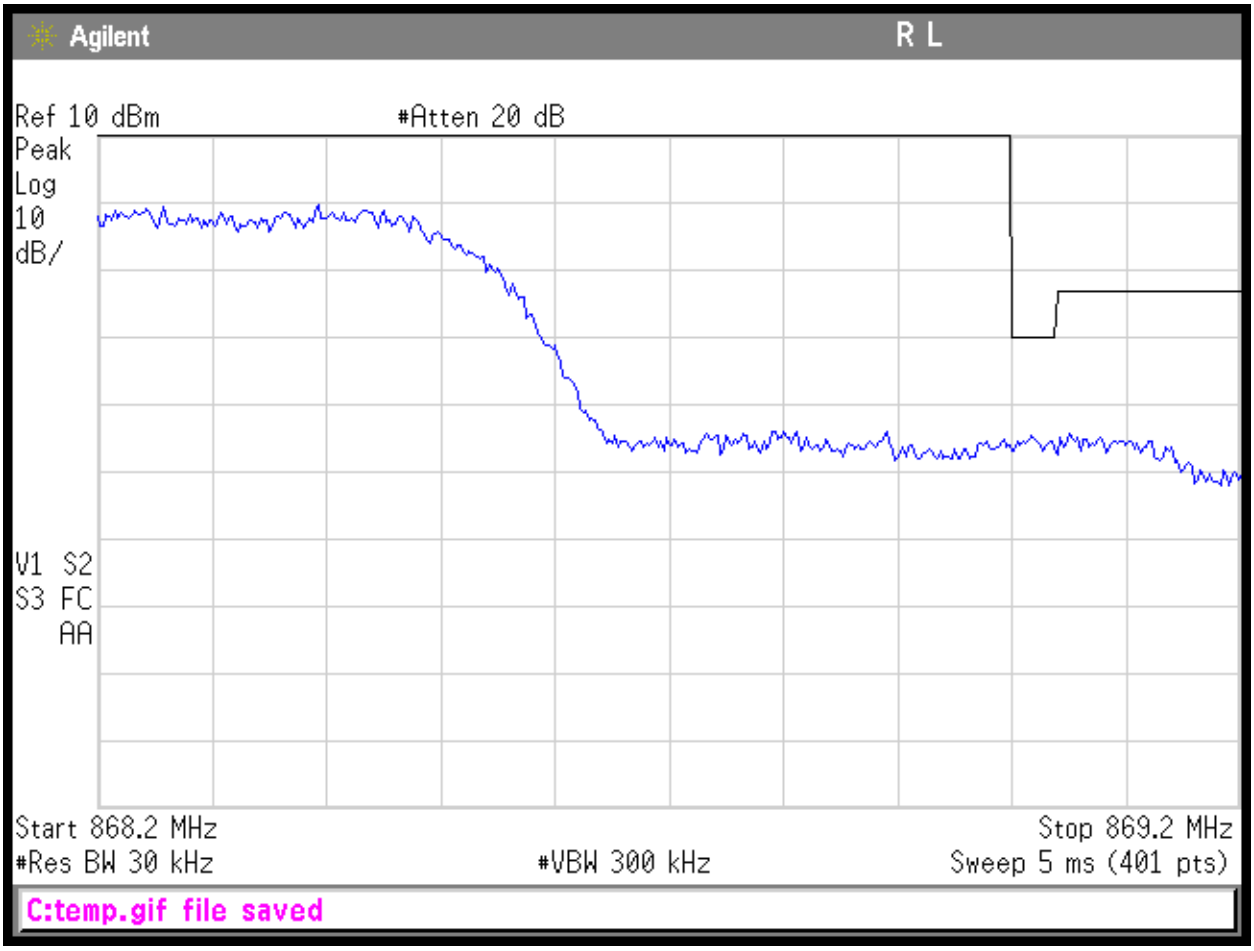
The following limits are applied in the spectral plots:

Attenuation within 37.5kHz of band: 50 + 10*Log*(P), resulting in -20dBm
Attenuation beyond 37.5kHz from band: 43 + 10*Log*(P), resulting in -13dBm

PLOTS



BC10 Low Channel



BC10 High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

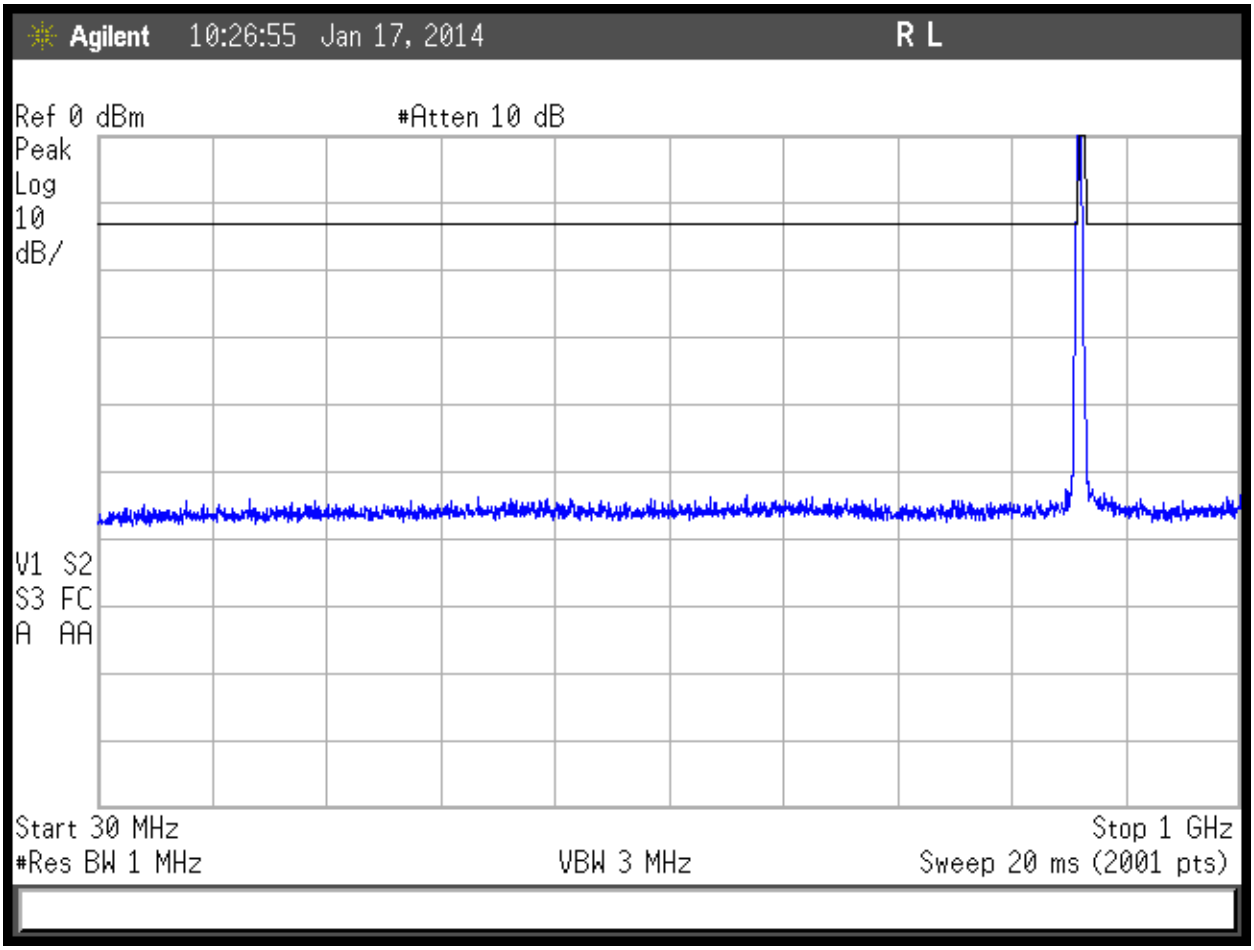
90.669 Emission limits.

(a) On any frequency in an MTA licensee's spectrum block that is adjacent to a non-MTA frequency, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus 10 $\log_{10}$ (P) decibels or 80 decibels, whichever is the lesser attenuation.

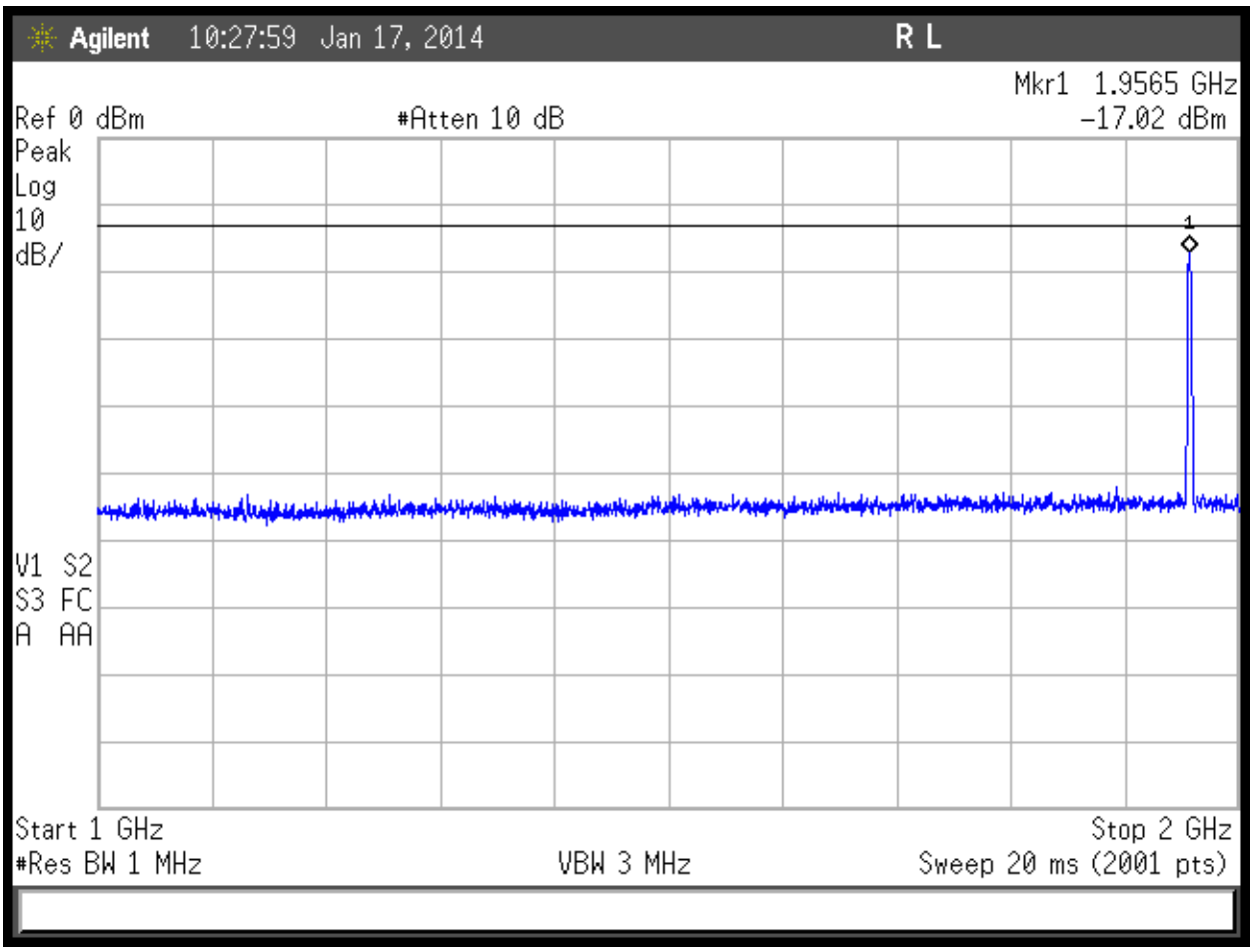
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

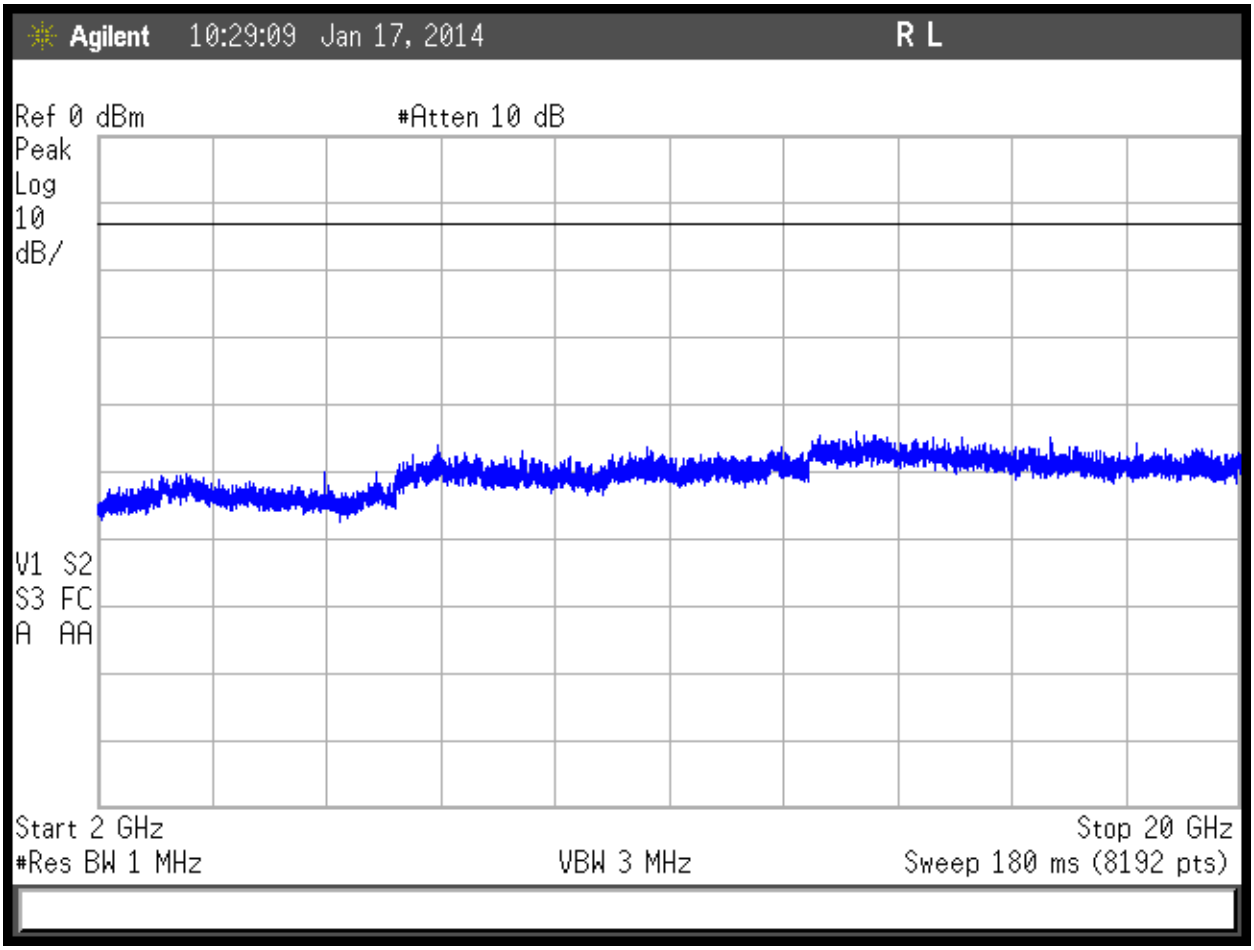
PLOTS



BC10, 30MHz to 1GHz


Agilent 10:27:59 Jan 17, 2014
R L
Mkr1 1.9565 GHz
Ref 0 dBm
#Atten 10 dB
-17.02 dBm
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
Stop 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 20 ms (2001 pts)

BC10, 1-2GHz


Agilent 10:29:09 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 20 GHz
Sweep 180 ms (8192 pts)

BC10, 2-20GHz

Radiated Spurious Emissions Measurements

MEASUREMENTS / RESULTS

Note that the EUT passes the FCC Class B limit, which is much lower than the -13dBm limit (82.158dBuV/m at 3 meters) for licensed transmitter spurious emissions. Only worst-case radiated spurious data is presented.

Radiated Emissions Table

Date: 18-Oct-13 **Company:** Airvana **Work Order:** N2817
Engineer: Doug Cormier **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 24.2°C **Humidity:** 40% **Pressure:** 997mBar
Frequency Range: 30-1000MHz **Measurement Distance:** 3 m
Notes:

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
H	49.8	43.9	25.6	7.8	0.6	26.7	---	---	---	40.0	-13.3	Pass
V	75.4	44.6	25.6	8.1	0.6	27.7	---	---	---	40.0	-12.3	Pass
V	250.0	44.1	25.7	11.6	1.1	31.1	---	---	---	46.0	-14.9	Pass
H	250.0	52.8	25.7	11.6	1.1	39.8	---	---	---	46.0	-6.2	Pass
V	375.0	39.4	25.7	15.1	1.4	30.2	---	---	---	46.0	-15.8	Pass
H	375.0	43.8	25.7	15.1	1.4	34.6	---	---	---	46.0	-11.4	Pass
V	500.0	43.0	25.9	18.0	1.4	36.5	---	---	---	46.0	-9.5	Pass
H	500.0	46.3	25.9	18.0	1.4	39.8	---	---	---	46.0	-6.2	Pass
V	625.0	39.8	25.9	19.4	1.8	35.1	---	---	---	46.0	-10.9	Pass
H	625.0	41.0	25.9	19.4	1.8	36.3	---	---	---	46.0	-9.7	Pass
V	750.0	39.2	25.8	20.8	1.9	36.1	---	---	---	46.0	-9.9	Pass
H	750.0	37.8	25.8	20.8	1.9	34.7	---	---	---	46.0	-11.3	Pass
V	1000.0	31.1	25.5	23.3	2.2	31.1	---	---	---	54.0	-22.9	Pass

Table Result: Pass by -6.2 dB ***Worst Freq:*** 250.0 & 500.0 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #1781 **Cable 2:** Asset #1785
Analyzer: Asset #1327 **Preamp:** Green **Antenna:** Red-Brown

Radiated Emissions Table

Date: 04-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Tuyen Truong **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 20°C **Humidity:** 25% **Pressure:** 1030mBar
Frequency Range: 1-18GHz **Measurement Distance:** 3 m

Notes: Spurious Emissions. EUT is running BC0, BC1 (One-X), and BC1 (EVDO) on its three transmitters for tests 1-3.
EUT is running BC10, BC1 (One-X), and BC1 (EVDO) on the three transmitters for tests 4-6. Note that the first transmitter operates in either BC0 or BC10 mode.

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Test 1: BC0 at mid; BC1 One-X at mid, BC1 EVDO at low				---	---	---	---	---	---	---	---	---	---	---
V	5820.0	38.88	20.1	20.5	34.2	6.2	58.8	40.0	74.0	-15.2	Pass	54.0	-14.0	Pass
V	4770.0	36.72	20.9	20.7	33.0	5.2	54.2	38.4	74.0	-19.8	Pass	54.0	-15.6	Pass
V	10370.0	31.29	18.0	19.7	38.7	7.4	57.7	44.4	74.0	-16.3	Pass	54.0	-9.6	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 2: BC0 at low; BC1 One-X at low; BC1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
V	4787.5	37.01	19.9	20.7	33.0	5.2	54.5	37.4	74.0	-19.5	Pass	54.0	-16.6	Pass
V	5837.5	38.95	21.9	20.6	34.2	6.2	58.8	41.7	74.0	-15.2	Pass	54.0	-12.3	Pass
H	5872.5	41.72	23.9	20.7	34.3	6.2	61.5	43.7	74.0	-12.5	Pass	54.0	-10.3	Pass
V	10580.0	31.54	18.8	19.5	38.6	7.4	58.0	45.3	74.0	-16.0	Pass	54.0	-8.7	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 3: BC0 at high; BC1 One-X at high; BD1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
V	4805.0	32.01	18.5	20.7	33.1	5.2	49.6	36.1	74.0	-24.4	Pass	54.0	-17.9	Pass
H	5872.5	39.98	22.1	20.7	34.3	6.2	59.8	41.9	74.0	-14.2	Pass	54.0	-12.1	Pass
V	5907.5	39.57	21.0	20.7	34.4	6.2	59.5	40.9	74.0	-14.5	Pass	54.0	-13.1	Pass
V	10090.0	31.48	18.1	19.4	38.9	7.5	58.5	45.1	74.0	-15.5	Pass	54.0	-8.9	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 4: BC10 at low; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
V	4787.5	31.56	18.6	20.7	33.0	5.2	49.1	36.1	74.0	-24.9	Pass	54.0	-17.9	Pass
V	5960.0	33.52	16.7	20.7	34.5	6.3	53.6	36.8	74.0	-20.4	Pass	54.0	-17.2	Pass
H	5960.0	42.08	19.5	20.7	34.5	6.3	62.2	39.6	74.0	-11.8	Pass	54.0	-14.4	Pass
V	10772.5	32.31	18.3	19.3	38.4	7.5	58.9	44.9	74.0	-15.1	Pass	54.0	-9.1	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 5: BC10 at mid; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
H	5960.0	45.35	20.9	20.7	34.5	6.3	65.5	41.0	74.0	-8.5	Pass	54.0	-13.0	Pass
V	5970.5	30.98	17.5	20.6	34.6	6.3	51.3	37.8	74.0	-22.7	Pass	54.0	-16.2	Pass
V	10527.5	31.54	18.4	19.7	38.6	7.5	57.9	44.8	74.0	-16.1	Pass	54.0	-9.2	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 6: BC10 at high; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
H	5960.0	41.89	17.9	20.7	34.5	6.3	62.0	38.0	74.0	-12.0	Pass	54.0	-16.0	Pass
C	10352.5	31.31	18.1	19.6	38.7	7.4	57.8	44.6	74.0	-16.2	Pass	54.0	-9.4	Pass

Table Result: Pass by -8.7 dB ***Worst Freq:*** 10580.0 MHz

Test Site: EMI Chamber 2 **Cable 1:** Asset #1782 **Cable 2:** Asset #1784
Analyzer: Rental SA#2 **Preamp:** Asset #1517 **Antenna:** Black Horn

Radiated Emissions Table

Date: 04-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Tuyen Truong **EUT Desc:** 750722 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 20°C **Humidity:** 25% **Pressure:** 1030mBar
Frequency Range: 18-20GHz **Measurement Distance:** 0.1 m

Notes: Spurious Emissions. EUT is running BC10, BC1 (One-X), and BC1 (EVDO) on the three transmitters for tests 7-9.
BC10 and BC0 modes are not applicable in this range, as the max channel is under 900MHz for these two.

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Test 7: BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
Test 8: BC1 One-X at mid; BC1 EVDO at low				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
Test 9: BC1 One-X at high; BC1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---

Table Result: Pass by N/A dB ***Worst Freq:*** N/A MHz

Test Site: EMI Chamber 2 **Cable 1:** EMIR-HIGH-21
Analyzer: Rental SA#2 **Preamp:** 18-26.5GHz **Antenna:** 18-26.5GHz Horn

Frequency Stability

REQUIREMENTS

Part 22:
Per 22.355, Table C-1, the frequency stability shall remain within 1.5ppm for this device.

Part 24:
"The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." [24.235]

Part 90:
Per 90.213(a), the frequency stability shall remain within 1.5ppm for this device.

MEASUREMENTS / RESULTS

Frequency Stability — ***Curtis-Straus LLC***

Engineer: Arik Zwirner **Company:** Airvana
Date: 6-Nov-13 **EUT:** 750722
Spectrum Analyzer: Rental #1 **Work Order:** N2817
Set Frequency: 1,956,250,000 Hz
Notes: Reference Conditions: 110Vac/60Hz, 20°C

Temperature (°C)	Supply Voltage (60Hz)	Center Frequency (Hz)	Frequency Deviation (ppm)
-30	110Vac	1956250000	0.0
-20	110Vac	1956250000	0.0
-10	110Vac	1956250000	0.0
0	110Vac	1956250000	0.0
10	110Vac	1956250000	0.0
20	93.5Vac	1956250000	0.0
20	110Vac	1956250000	0.0
20	126.5Vac	1956250000	0.0
30	110Vac	1956250000	0.0
40	110Vac	1956250000	0.0
50	110Vac	1956250000	0.0

The EUT has an intentional transmitter that operates at both 800 and 1900MHz bands. The hardware utilized for both bands is the same while the software controls the different bands. Testing was performed at only the 1900MHz band to satisfy the 800MHz band requirements because a single oscillator is used as the source for both.

Conducted Spurious Emissions on AC Mains

AC Conducted Emissions Data Table

Date: 11-Nov-13 **Company:** Airvana **Work Order:** N2818
Engineer: Arik Zwirner **EUT Desc:** 750722
Temp: 20.0 ºC **Humidity:** 33% **Pressure:** 1011 mBar
Notes:

Frequency Range: 0.15-30MHz **EUT Input Voltage/Frequency:** 120Vac/60Hz

	Quasi-Peak Readings		Average Readings		LISN Factors		Cable	ATTN	FCC/CISPR Class B			FCC/CISPR Class B		
Frequency (MHz)	QP1 (dBµV)	QP2 (dBµV)	AVG1 (dBµV)	AVG2 (dBµV)	L1 (dB)	L2 (dB)	Factor (dB)	Factor (dB)	QP Limit (dBµV)	Margin (dB)	Result (Pass/Fail)	AVG Limit (dBµV)	Margin (dB)	Result (Pass/Fail)
0.150	31.7	32.1	13.7	16.4	-0.1	-0.1	-0.1	-19.8	66.0	-13.9	Pass	56.0	-19.6	Pass
0.180	32.5	34.2	18.3	20.4	-0.1	-0.1	-0.1	-19.8	64.5	-10.3	Pass	54.5	-14.1	Pass
0.220	26.7	26.3	8.8	11.2	-0.1	-0.1	0.0	-19.8	62.8	-16.2	Pass	52.8	-21.7	Pass
1.75	19.5	18.8	8.8	5.7	0.0	-0.1	-0.1	-19.8	56.0	-16.6	Pass	46.0	-17.3	Pass
4.34	18.8	18.1	6.9	5.4	0.0	-0.1	-0.1	-19.8	56.0	-17.3	Pass	46.0	-19.2	Pass
10.83	17.3	16.2	6.6	4.5	-0.1	-0.1	-0.3	-19.8	60.0	-22.6	Pass	50.0	-23.3	Pass

Result: Pass ***Worst Margin:*** -10.3 dB ***Frequency:*** 0.180 MHz

Measurement Device: LISN ASSET 1728(Line 1) LISN ASSET 1731(Line 2) **Cable:** CEMI-05 **Spectrum Analyzer:** SA EMI Chamber (1328)
Attenuator: 20dB Attenuator-73 **Site:** CEMI 1

Model 750723 Test Data and Results

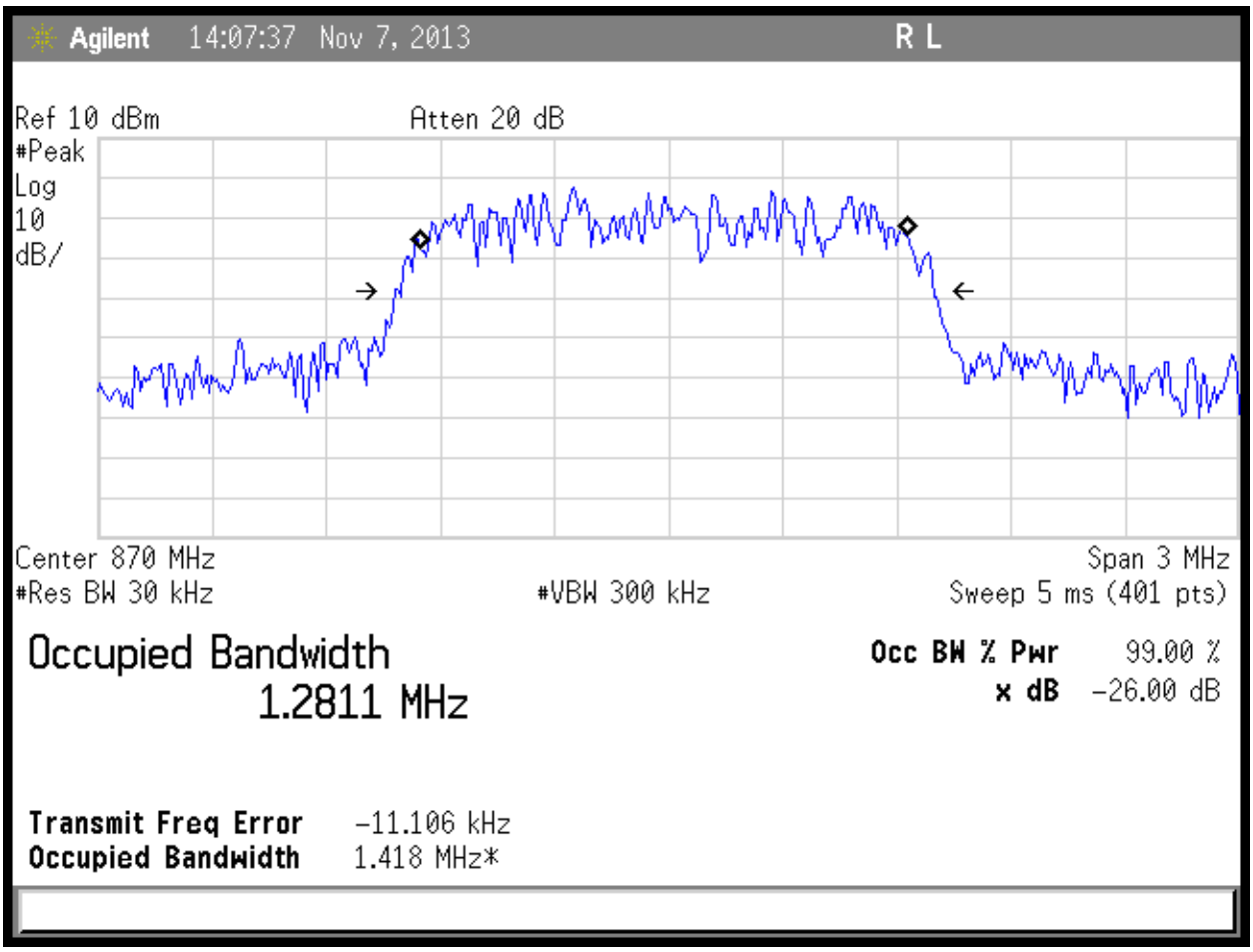
Tests Specific to Part 22

Bandwidth

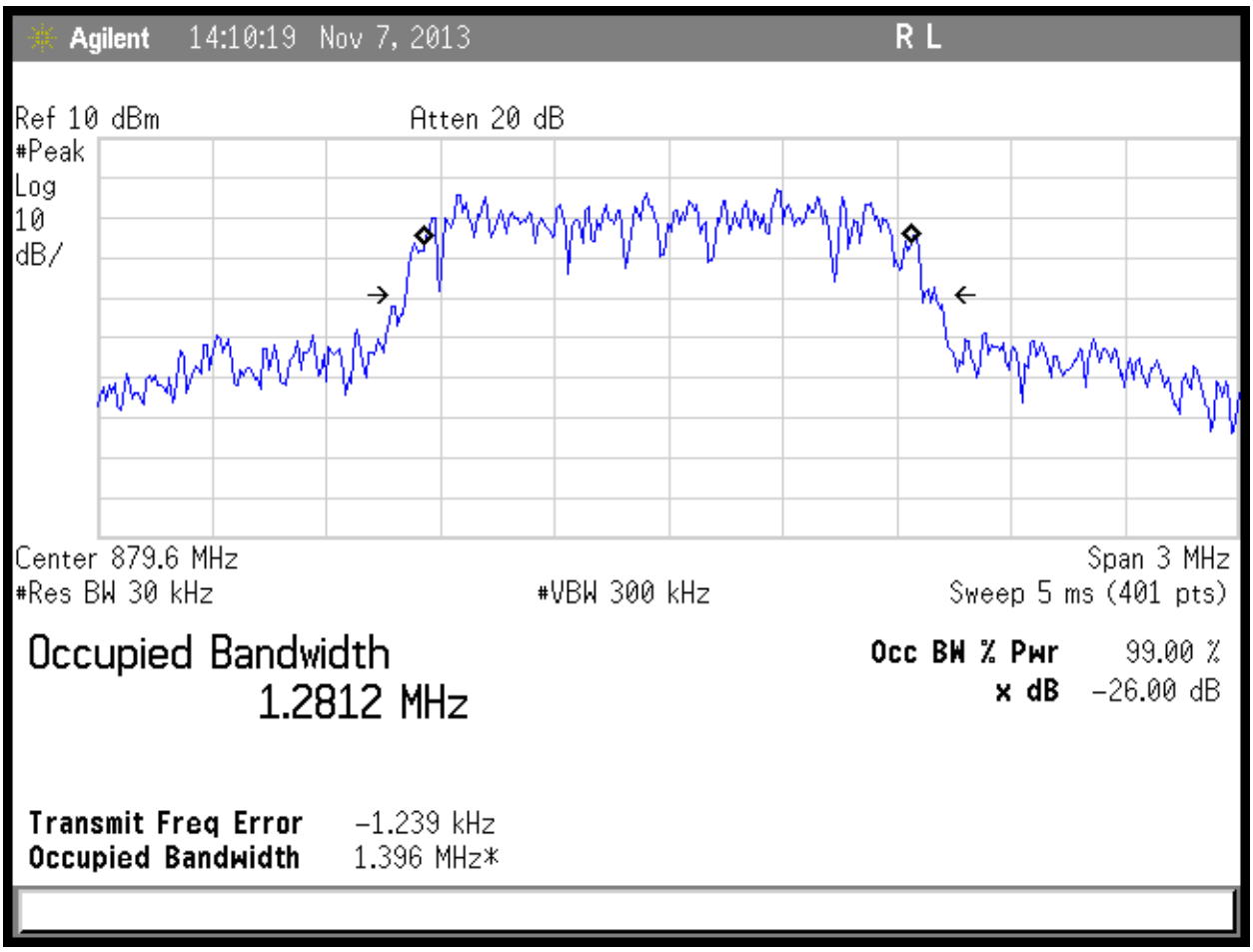
Bandwidth Measurements		
Date: 07-Nov-13	**Company:** Airvana	**Work Order:** N2817
Engineer: Arik Zwirner	**EUT Desc:** 750723	**EUT Power:** 120Vac/60Hz
Temp: 23°C	**Humidity:** 27%	**Pressure:** 1008mbar
Frequency Range: 869-894MHz, FCC Part 22		
Notes: Band Class 0 (BC0)		

OUTPUT	CHANNEL POSITION	CHANNEL NUMBER	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)
BC0				
	Low	1	870.03	1.418
	Mid	320	879.6	1.396
	High	640	889.2	1.429

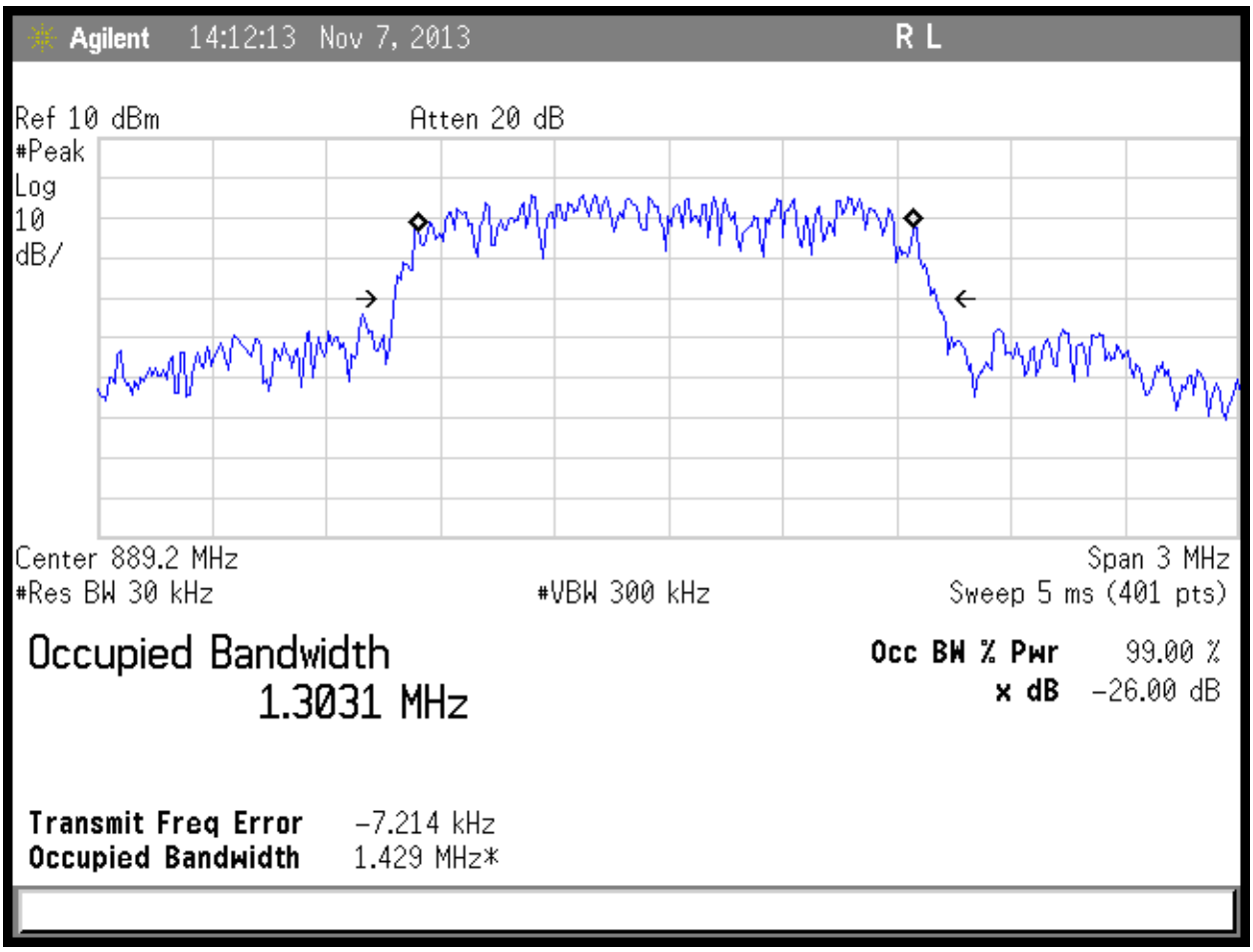
Test Site: 1DCC-OATS-3M-I **Spectrum Analyzer:** Rental #1



BC0 Low Channel (Ch. 1)



BC0 Mid Channel (Ch. 320)



BC0 High Channel (Ch. 640)

ERP

ERP Using Substitution Method

Date: 07-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 23°C **Humidity:** 27% **Pressure:** 1008mbar

Frequency Range: Part 22 ERP measurements **Measurement Distance:** 3 m

Notes: Transmitter mode: Band Class 0 (BC0)
7W =38.45 dBm

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted ERP (dBm)	FCC 22.913 (a) Limit (dBm)	Margin (dB)	Result (Pass/Fail)
Channel 1			---	---	---	---	---	---
H	870.03	-2.5	0.5	0.0	-3.0	38.45	-41.5	Pass
V	870.03	1.2	0.5	0.0	0.7	38.45	-37.8	Pass
			---	---	---	---	---	---
Channel 320			---	---	---	---	---	---
H	879.6	-0.4	0.5	0.0	-0.9	38.45	-39.4	Pass
V	879.6	2.8	0.5	0.0	2.3	38.45	-36.2	Pass
			---	---	---	---	---	---
Channel 640			---	---	---	---	---	---
H	889.2	-2.9	0.6	0.0	-3.5	38.45	-42.0	Pass
V	889.2	-0.7	0.6	0.0	-1.3	38.45	-39.8	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1786
Analyzer: Rental #1 **Receive Antenna:** Green **Transmit Cable:** Asset 1722
Transmit Antenna: Dipole, Asset 756

Band Edge Measurements

LIMITS

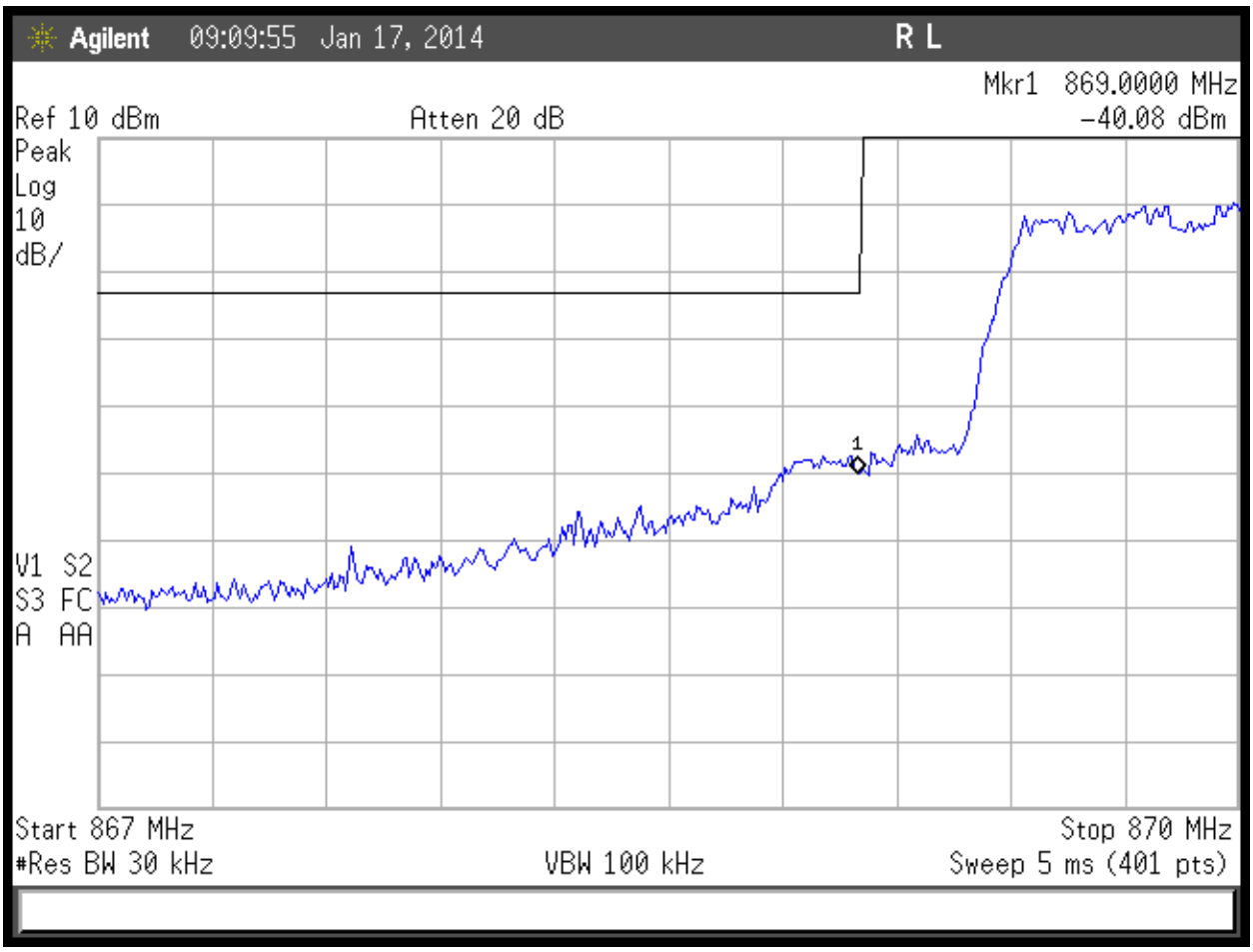
§ 22.359 Emission limitations.

(a) *Out of band emissions.* 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.

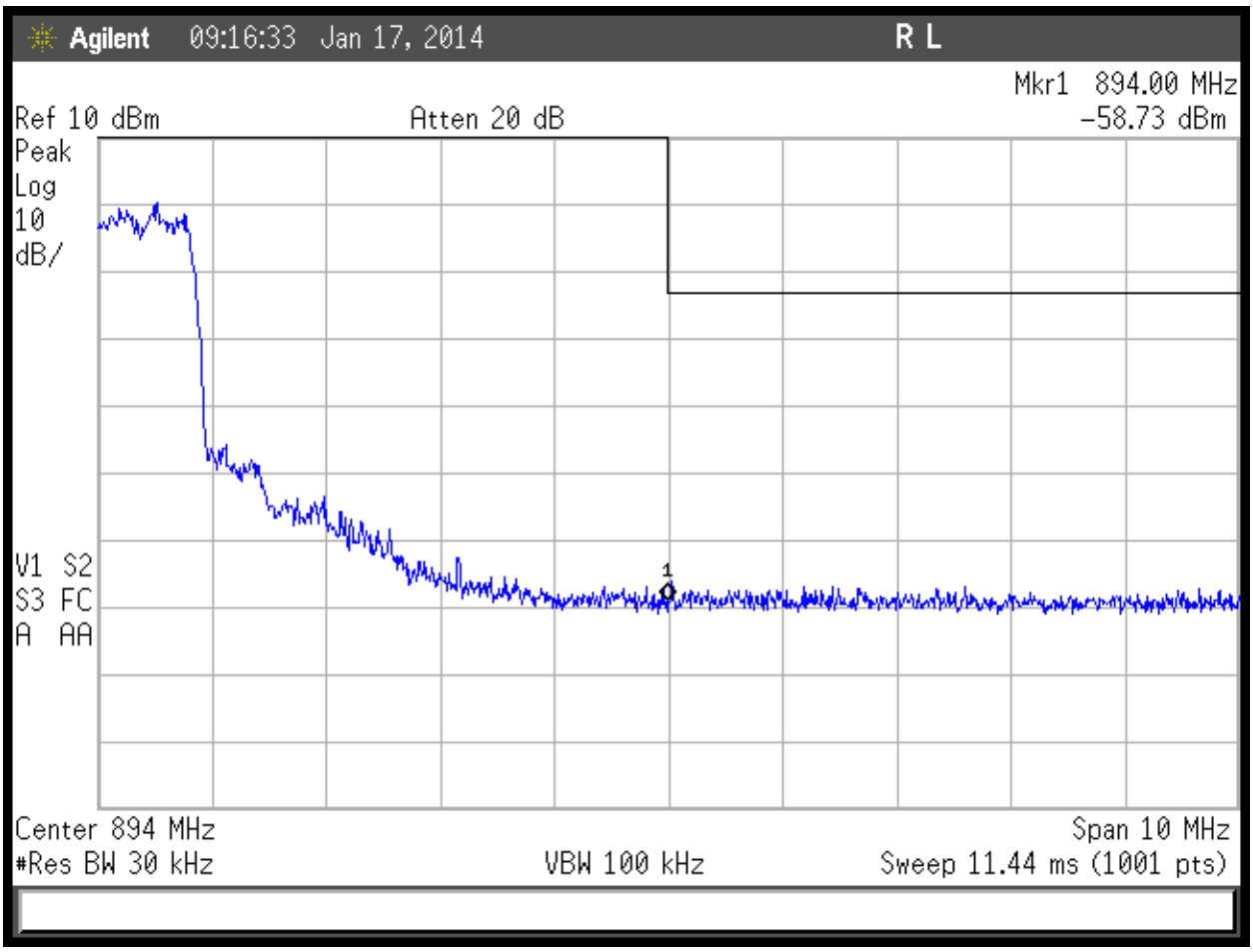
MEASUREMENTS / RESULTS

Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Note: Mask lines are set to -13dBm at 869MHz and 894MHz.



BC0 Low Channel



BC0 High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

§ 22.359 Emission limitations.

(a) *Out of band emissions.* 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.

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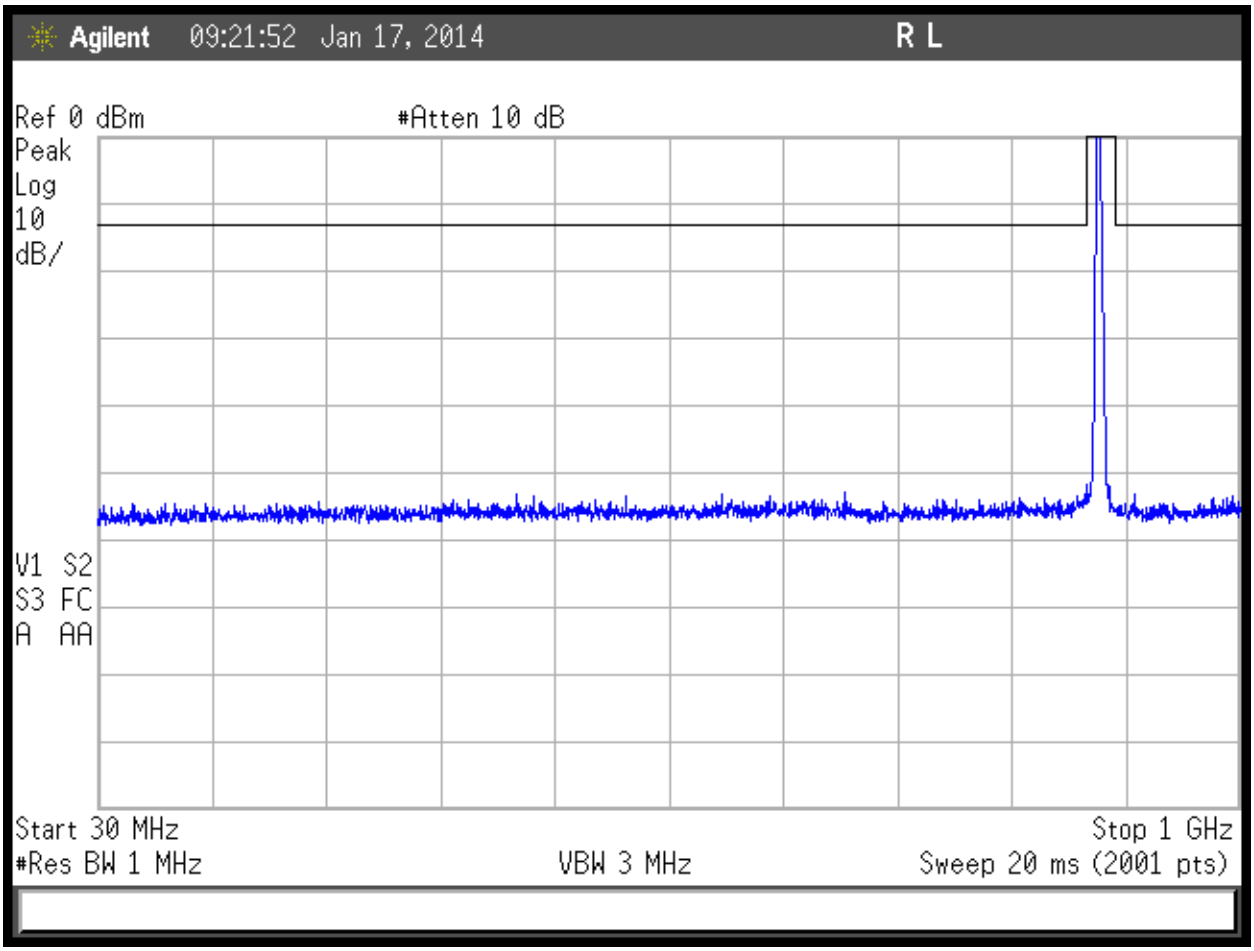
MEASUREMENTS / RESULTS

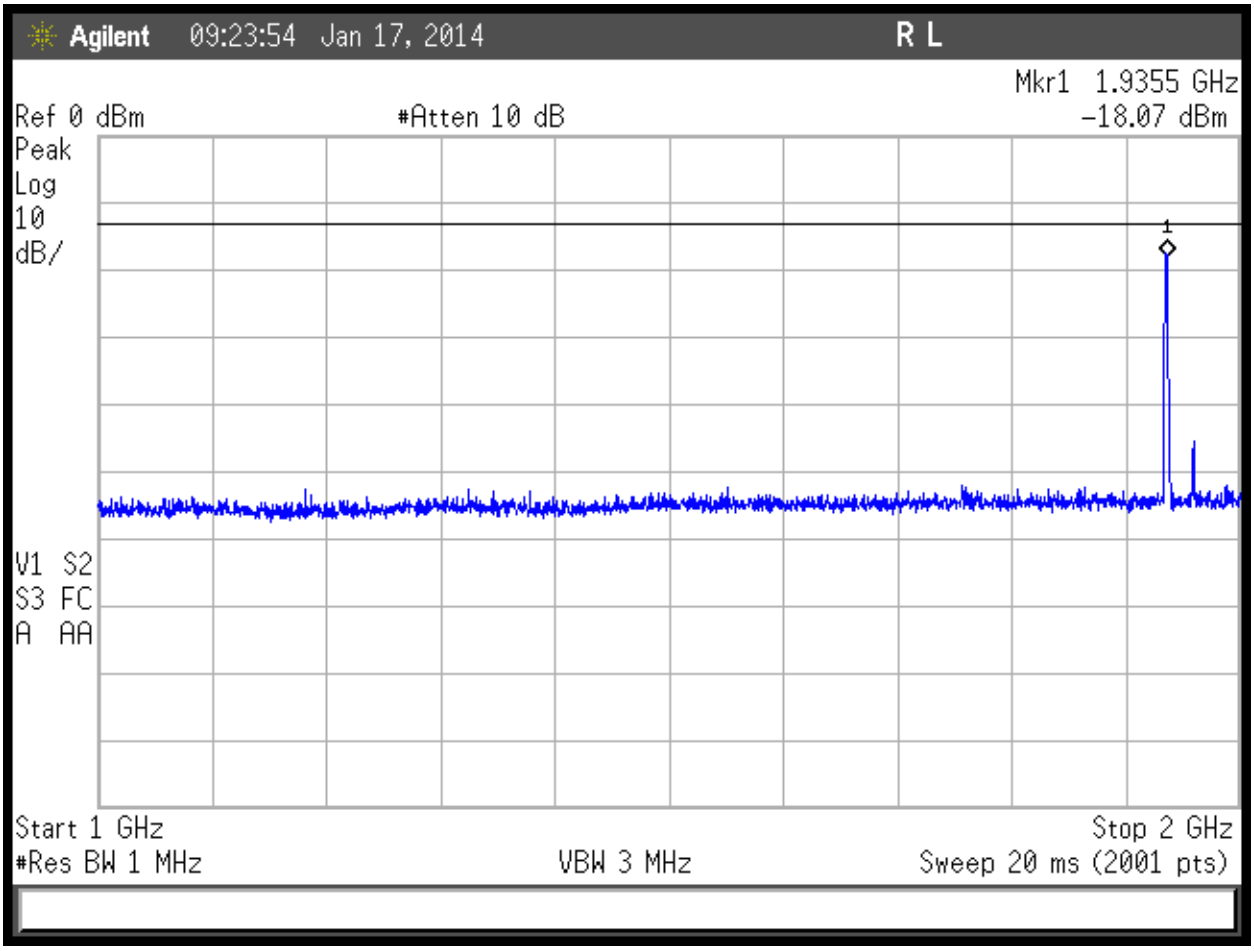
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Notes: Limit lines are set to -13dBm at 30-869MHz and 894-20000MHz. The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

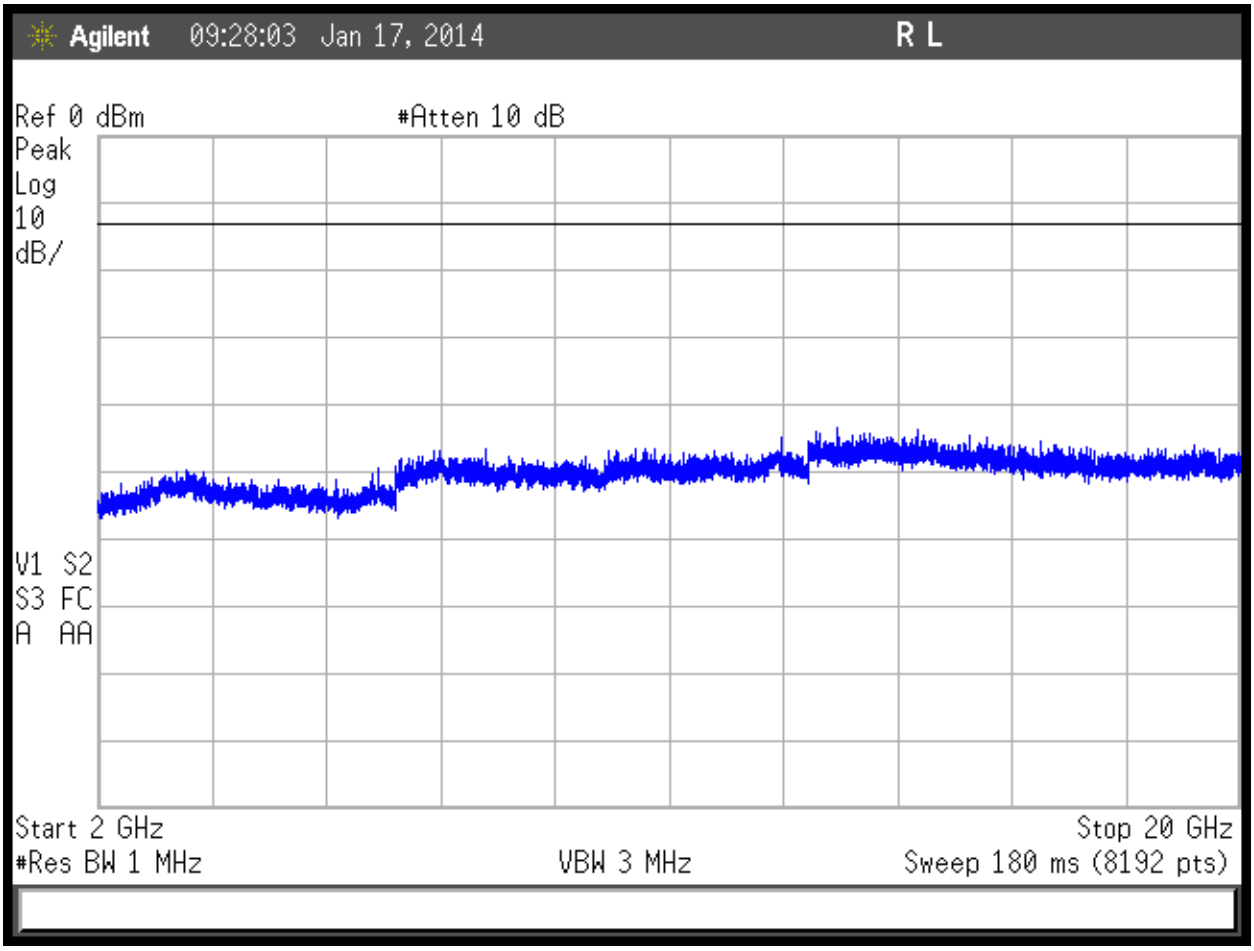
PLOTS



BC0, 30-1000MHz


Agilent 09:23:54 Jan 17, 2014
R L
Mkr1 1.9355 GHz
-18.07 dBm
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 2 GHz
Sweep 20 ms (2001 pts)

BC0, 1-2GHz


Agilent 09:28:03 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 20 GHz
Sweep 180 ms (8192 pts)

BC0, 2-20GHz

Tests Specific to Part 24

Bandwidth

LIMIT

"The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power." [24.238(b)]

MEASUREMENTS / RESULTS

Bandwidth Measurements

Date: 07-Nov-13	**Company:** Airvana	**Work Order:** N2817
Engineer: Arik Zwirner	**EUT Desc:** 750723	**EUT Power:** 120Vac/60Hz
Temp: 23°C	**Humidity:** 27%	**Pressure:** 1008mbar

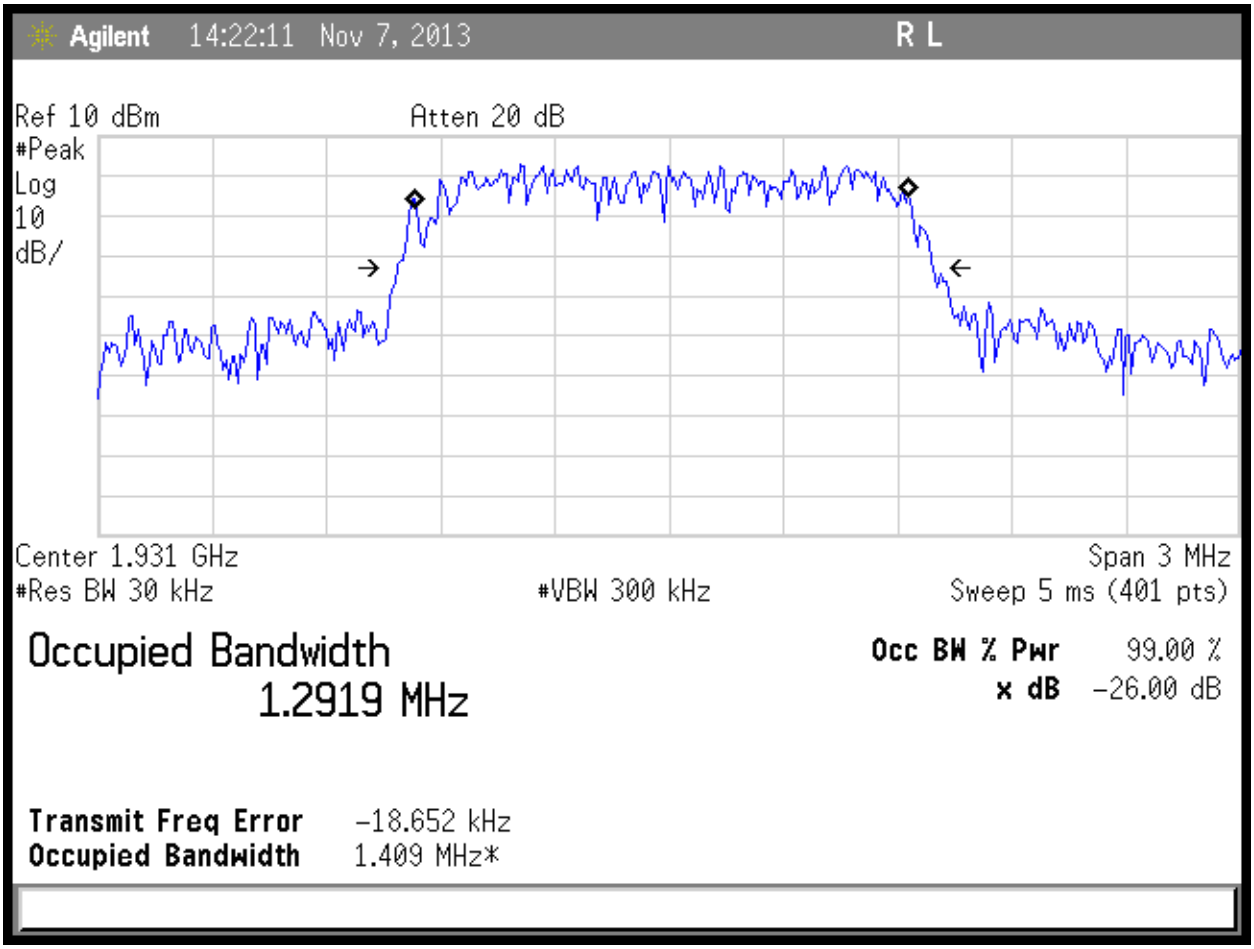
Frequency Range: 1930-1990MHz, FCC Part 24 E

Notes:

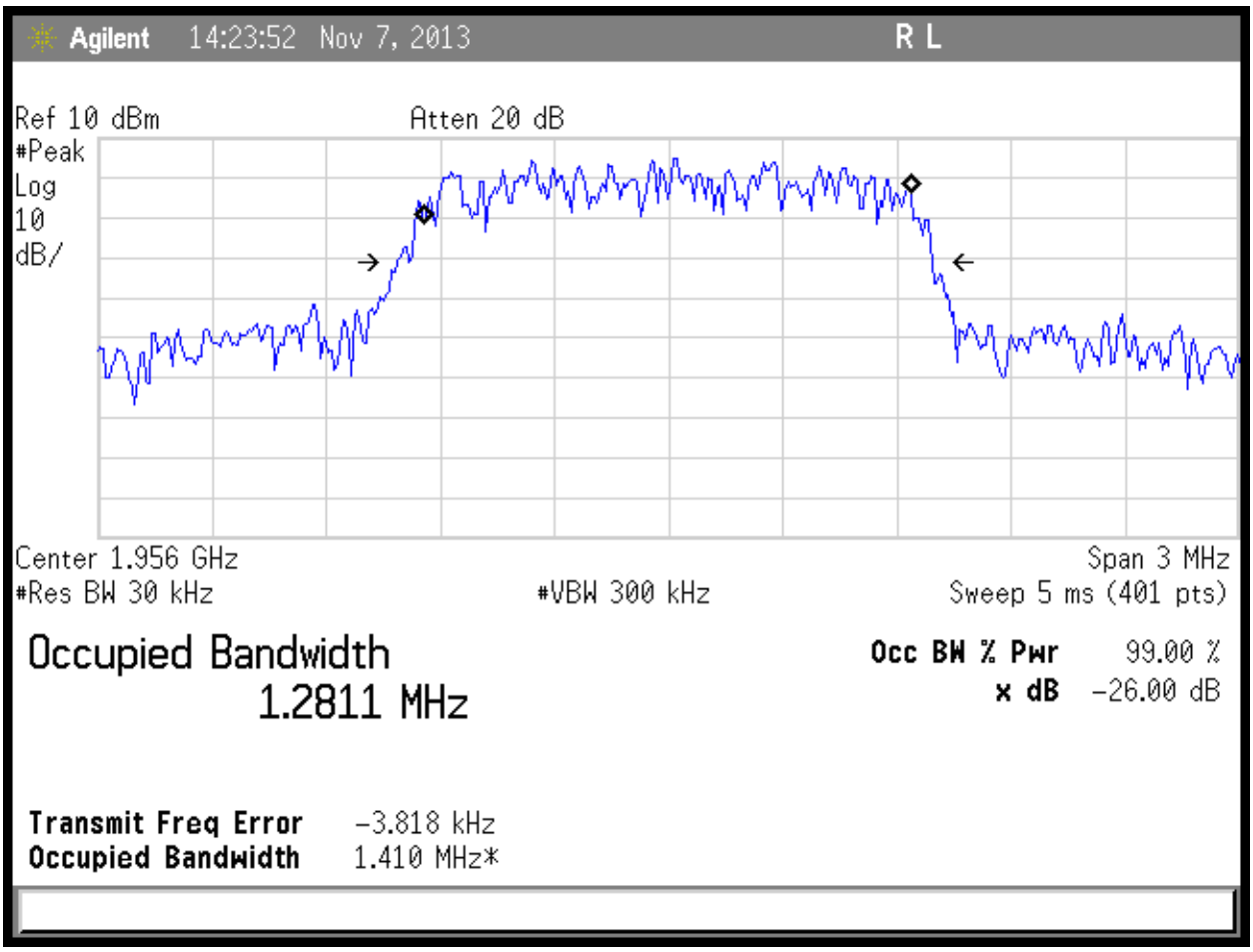
OUTPUT	CHANNEL POSITION	CHANNEL NUMBER	FREQUENCY (MHz)	26dB BANDWIDTH (MHz)
EVDO				
	Low	25	1931.25	1.409
	Mid	525	1956.25	1.410
	High	1075	1983.75	1.427
One-X				
	Low	25	1931.25	1.412
	Mid	525	1956.25	1.415
	High	1075	1983.75	1.403

Test Site: 1DCC-OATS-3M-I **Spectrum Analyzer:** Rental #1

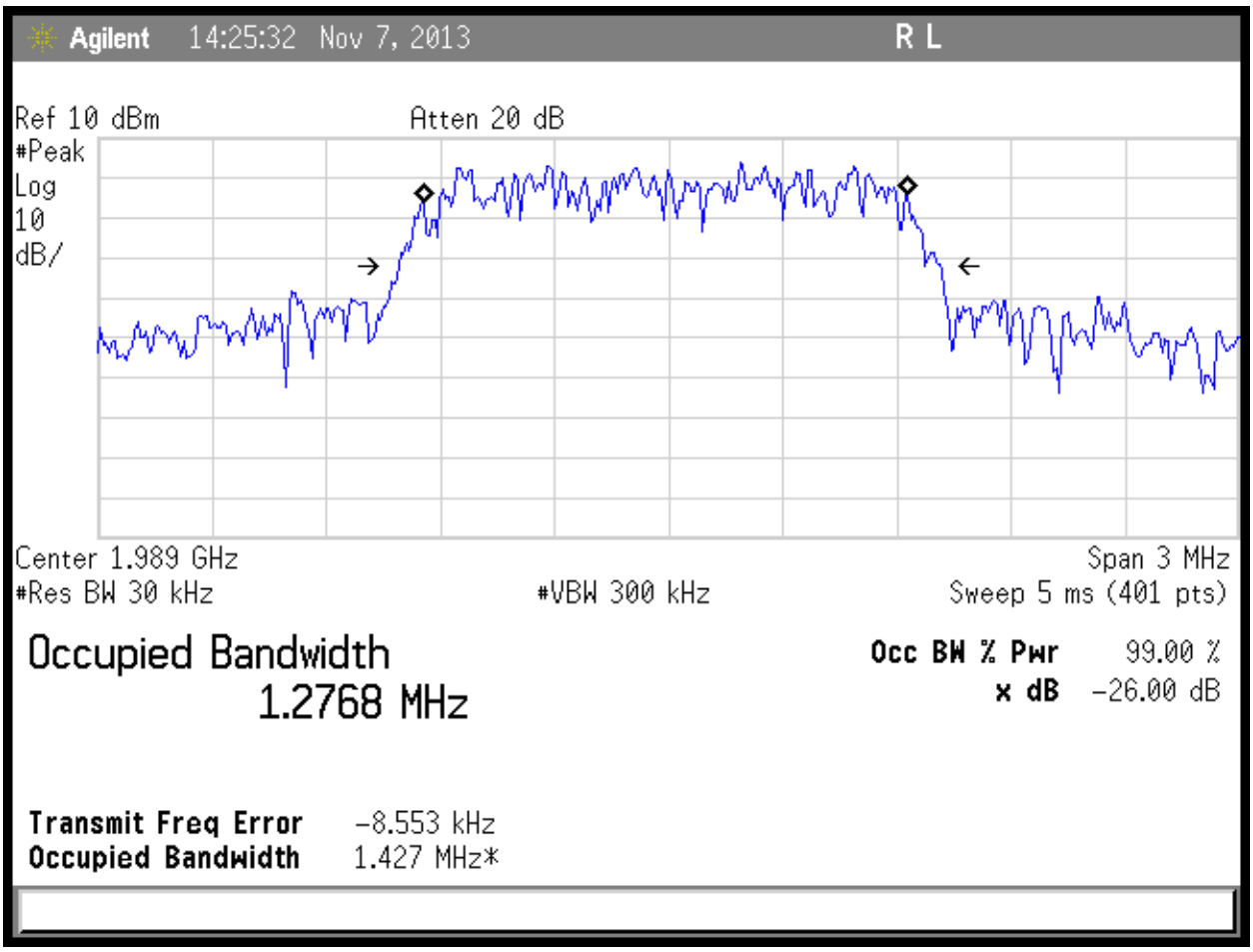
EVDO:



EVDO Low Channel

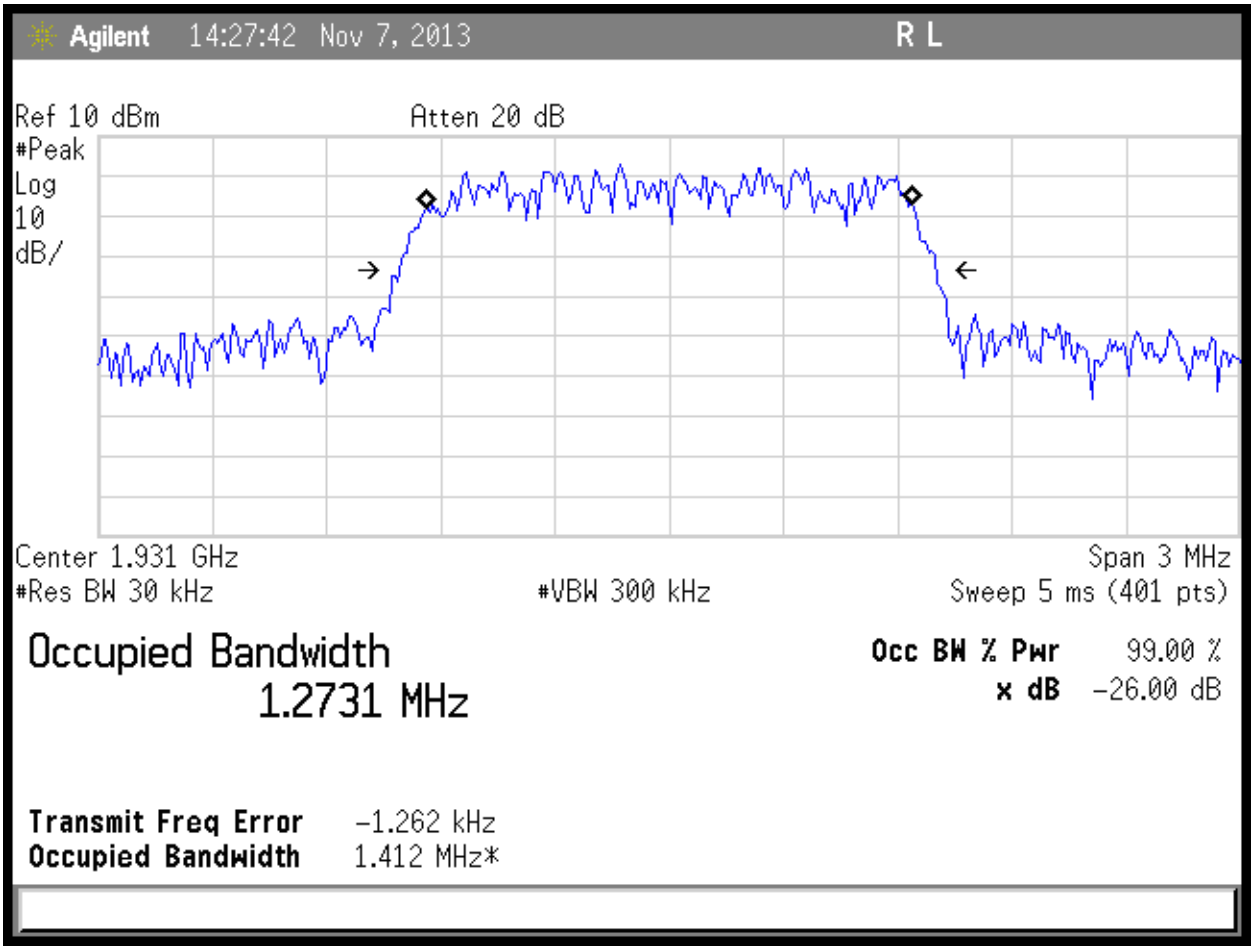


EVDO Mid Channel

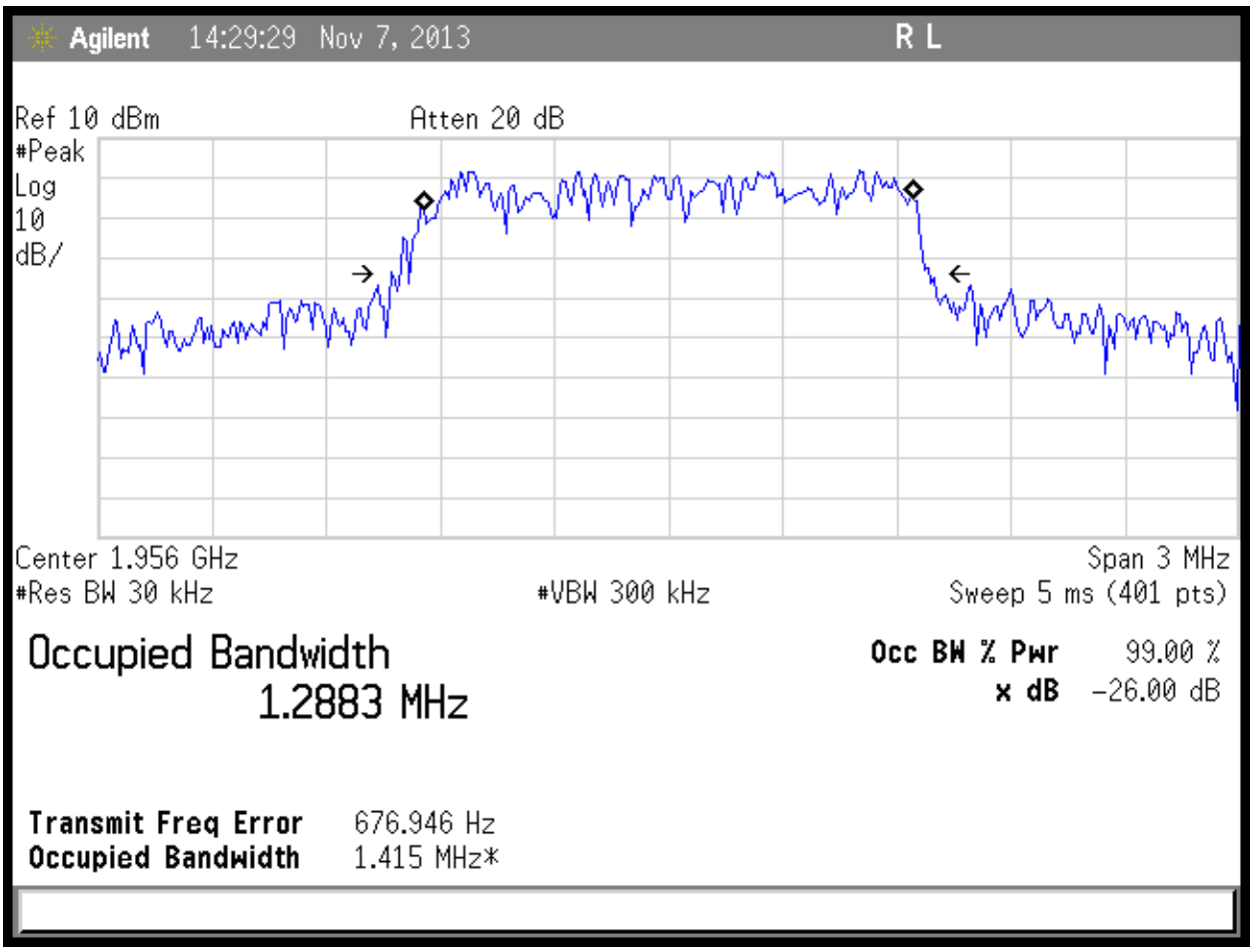


EVDO High Channel

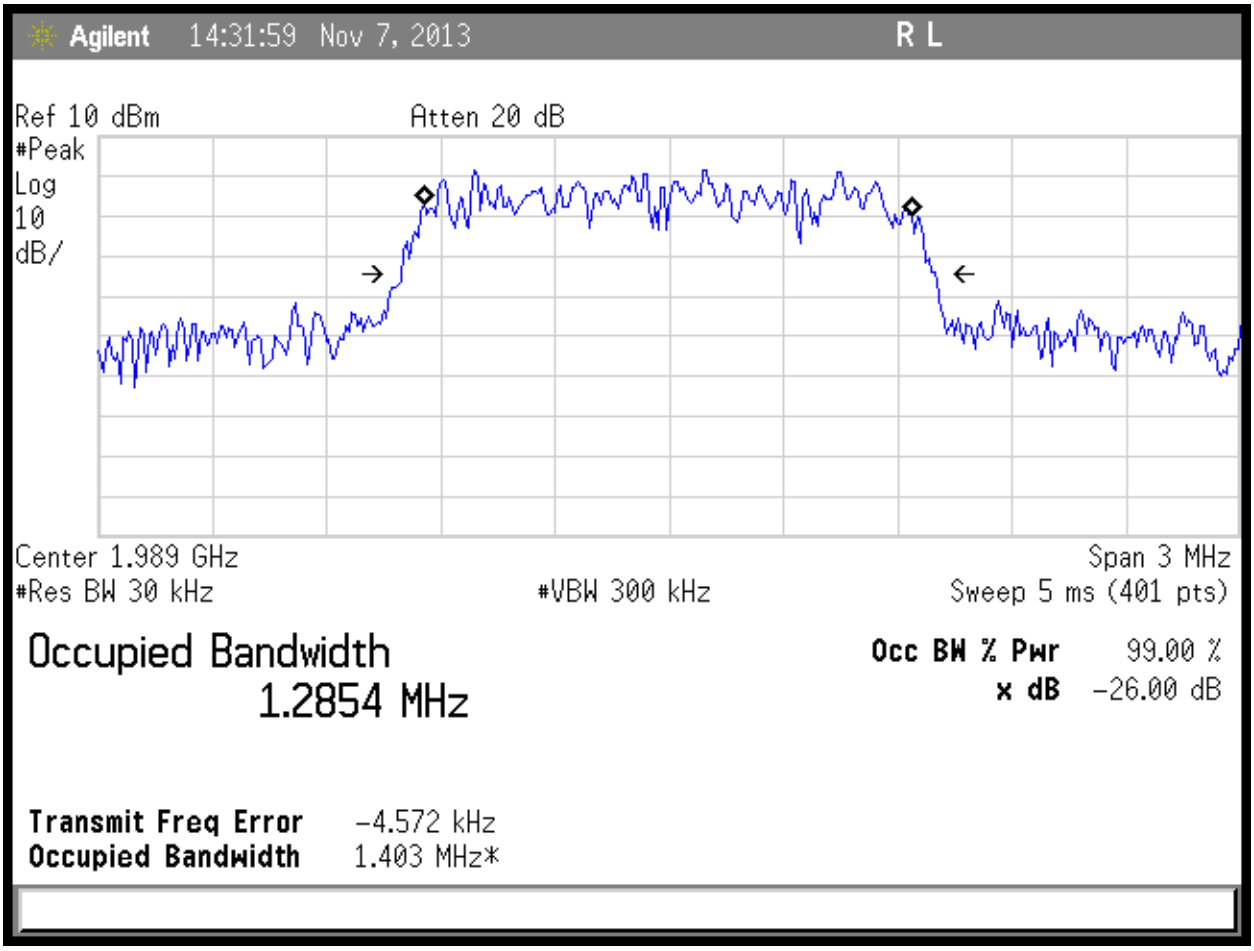
One-X:



One-X Low Channel



One-X Mid Channel



One-X High Channel

EIRP

"Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications."
[24.232 (c)]

BC1 (One-X):

EIRP Using Substitution Method

Date: 07-Nov-13 **Company:** Airvana **Work Order:** M2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 23°C **Humidity:** 27% **Pressure:** 1008mbar
Frequency Range: Part 24 E, EIRP measurements **Measurement Distance:** 3 m
Notes: Band Class 1 (BC1) One-X transmitter

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted EIRP (dBm)	FCC 24.232 section c Limit (dBm)	Margin (dB)	Result (Pass/Fail)
EVDO Ch. 25			---	---	---	---	---	---
H	***1931.25***	***9.8***	***0.8***	***7.6***	***16.6***	33.0	-16.4	Pass
V	***1931.25***	***9.0***	***0.8***	***7.6***	***15.8***	33.0	-17.2	Pass
EVDO Ch. 525			---	---	---	---	---	---
H	***1956.25***	***14.3***	***0.7***	***7.6***	***21.2***	33.0	-11.8	Pass
V	***1956.25***	***16.2***	***0.7***	***7.6***	***23.1***	33.0	-9.9	Pass
EVDO Ch. 1175			---	---	---	---	---	---
H	***1988.75***	***16.5***	***0.8***	***7.7***	***23.4***	33.0	-9.6	Pass
V	***1988.75***	***16.8***	***0.8***	***7.7***	***23.7***	33.0	-9.3	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1722
Analyzer: Brown (Rental #1) **Receive Antenna:** Yellow Horn **Transmit Cable:** Asset 1786
Transmit Antenna: Black Horn

BC1 (EVDO):

EIRP Using Substitution Method

Date: 07-Nov-13 **Company:** Airvana **Work Order:** M2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 23°C **Humidity:** 27% **Pressure:** 1008mbar
Frequency Range: Part 24 E, EIRP measurements **Measurement Distance:** 3 m
Notes: Band Class 1 (BC1) EVDO transmitter

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted EIRP (dBm)	FCC 24.232 section c Limit (dBm)	Margin (dB)	Result (Pass/Fail)
EVDO Ch. 25			---	---	---	---	---	---
H	***1931.25***	***15.5***	***0.8***	***7.6***	***22.3***	33.0	-10.7	Pass
V	***1931.25***	***18.6***	***0.8***	***7.6***	***25.4***	33.0	-7.6	Pass
EVDO Ch. 525			---	---	---	---	---	---
H	***1956.25***	***15.6***	***0.7***	***7.6***	***22.5***	33.0	-10.5	Pass
V	***1956.25***	***17.0***	***0.7***	***7.6***	***23.9***	33.0	-9.1	Pass
EVDO Ch. 1175			---	---	---	---	---	---
H	***1988.75***	***16.4***	***0.8***	***7.7***	***23.3***	33.0	-9.7	Pass
V	***1988.75***	***18.1***	***0.8***	***7.7***	***25.0***	33.0	-8.0	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1722
Analyzer: Brown (Rental #1) **Receive Antenna:** Yellow Horn **Transmit Cable:** Asset 1786
Transmit Antenna: Black Horn

Band Edge Measurements

LIMITS

"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." [24.238(a)]

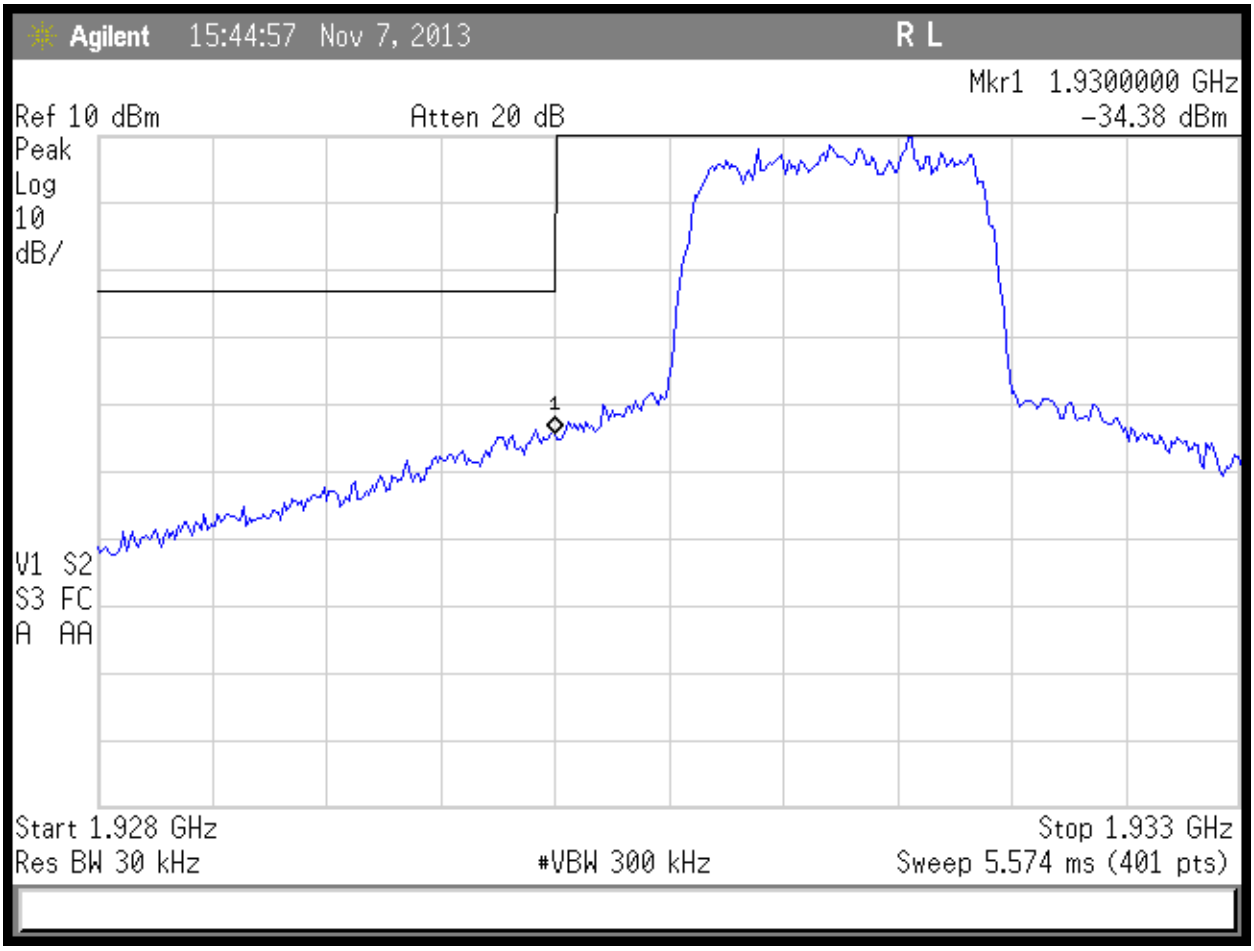
"A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1MHz or 1 percent of emission bandwidth, as specified)." [24.238(b)]

MEASUREMENTS / RESULTS

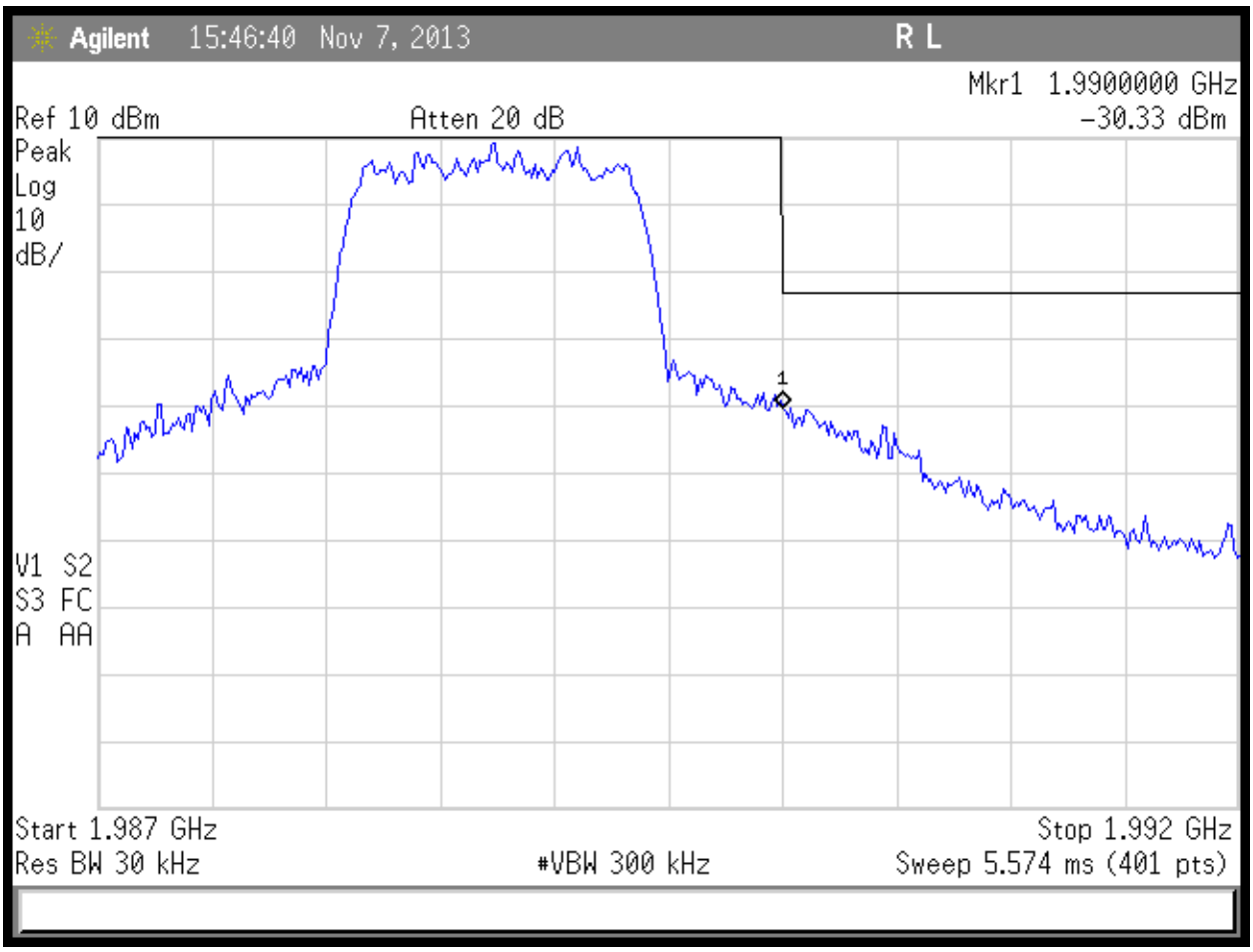
Note: Mask lines are set to -13dBm at 1930MHz and 1990MHz.

Spectrum analyzer screen plots for EVDO and One-X are shown on the following pages.

EVDO:

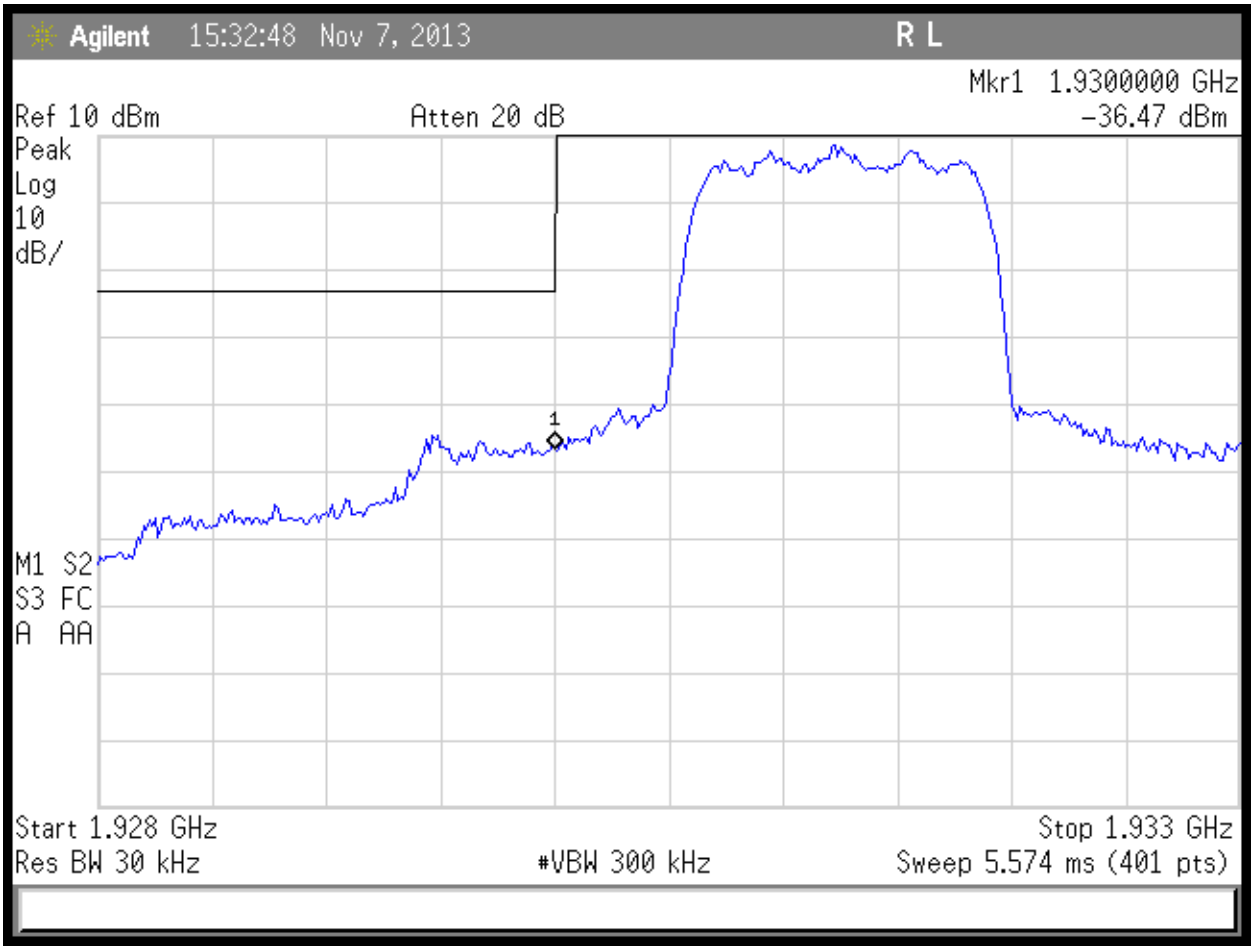


EVDO Low Channel

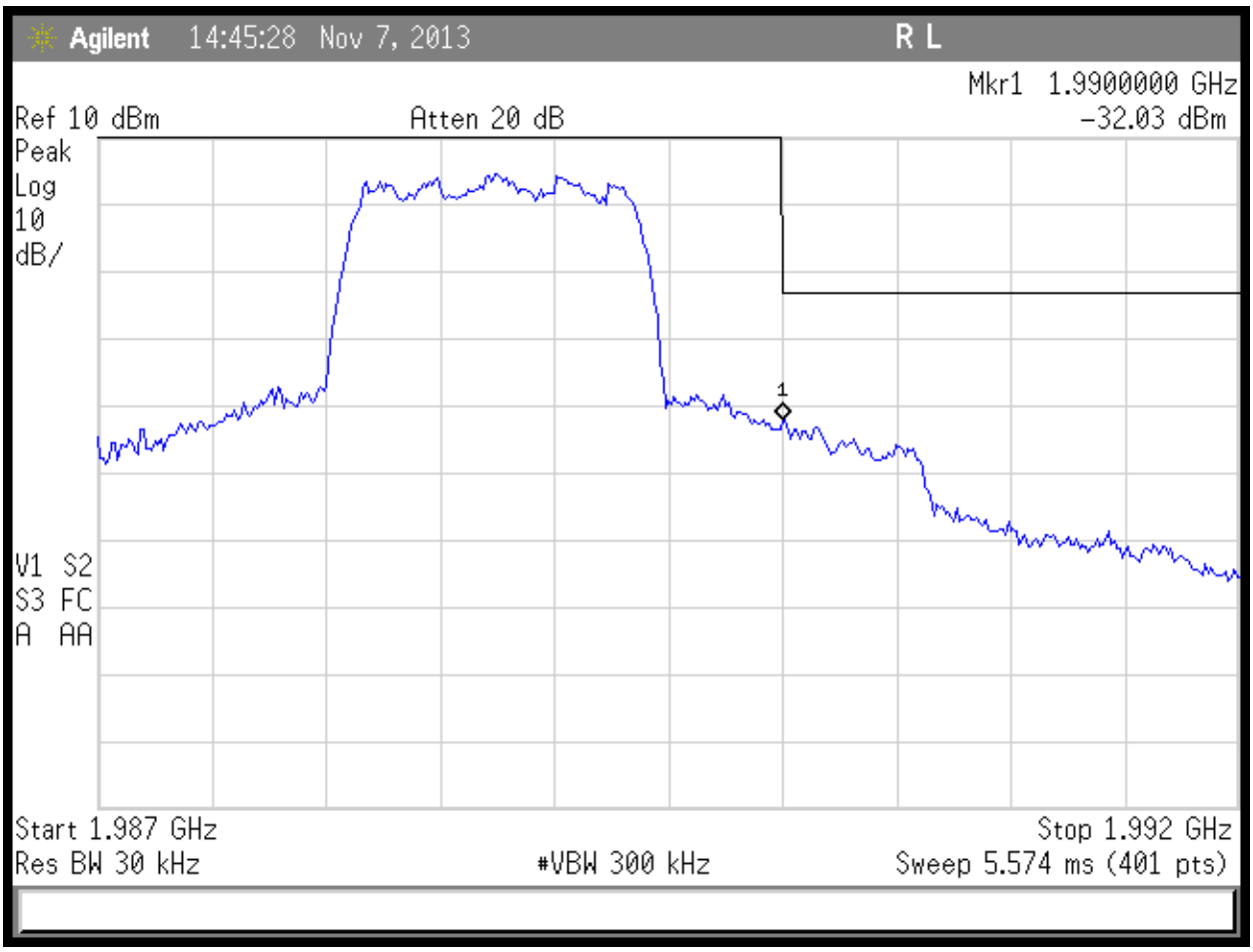


EVDO High Channel

One-X:



One-X Low Channel



One-x High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

"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." [24.238(a)]

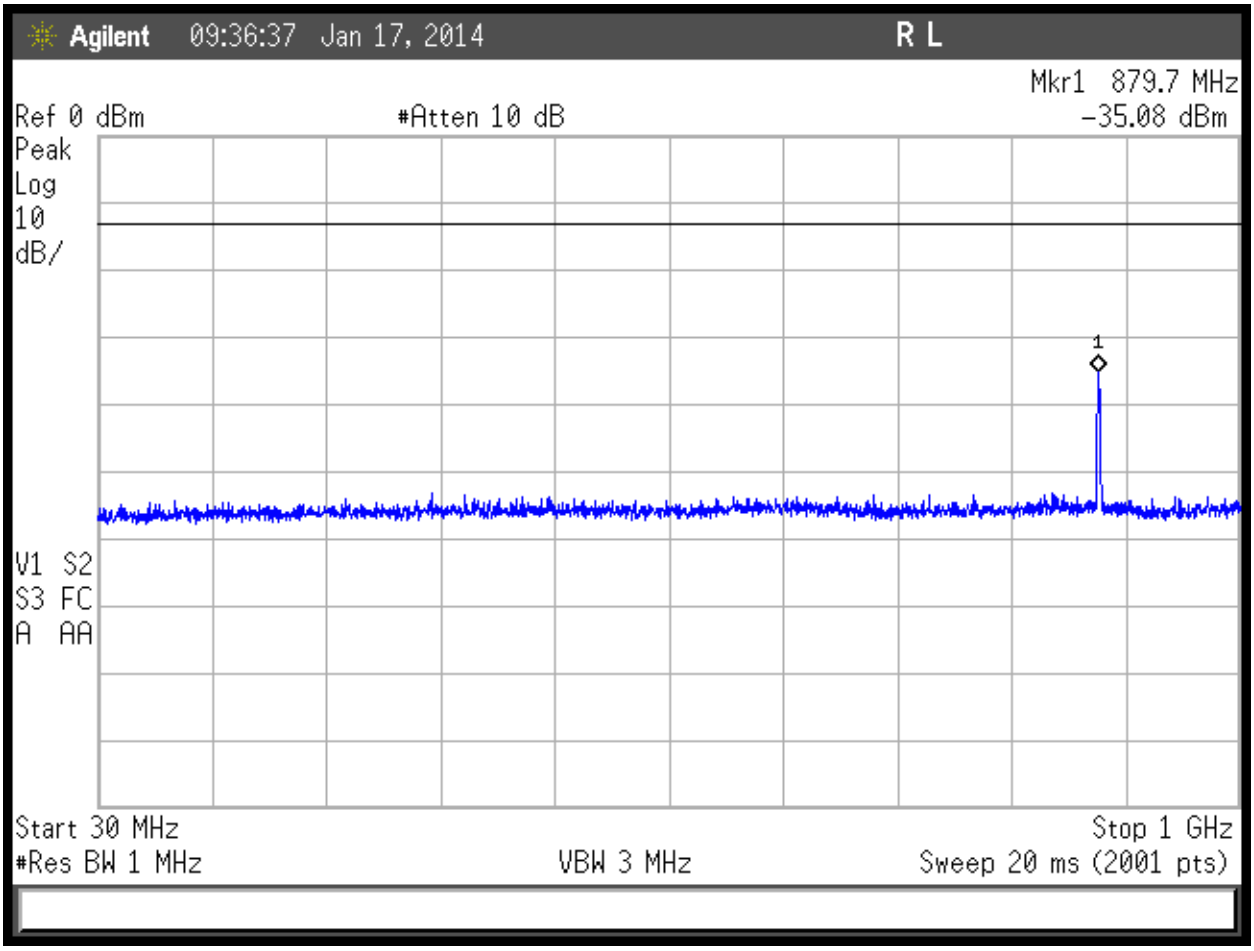
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

Spectrum analyzer screen plots for EVDO and One-X are shown on the following pages.

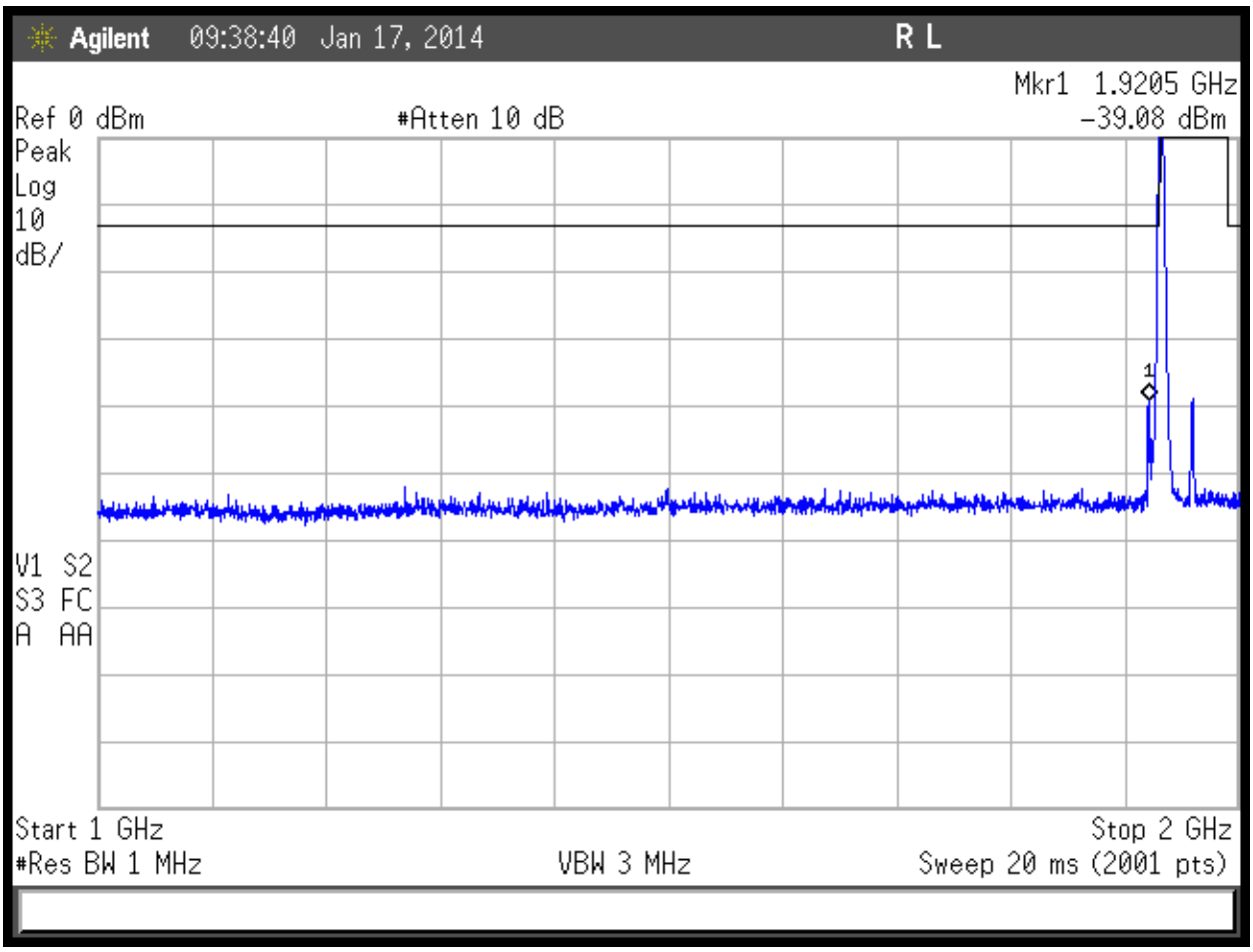
The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

PLOTS

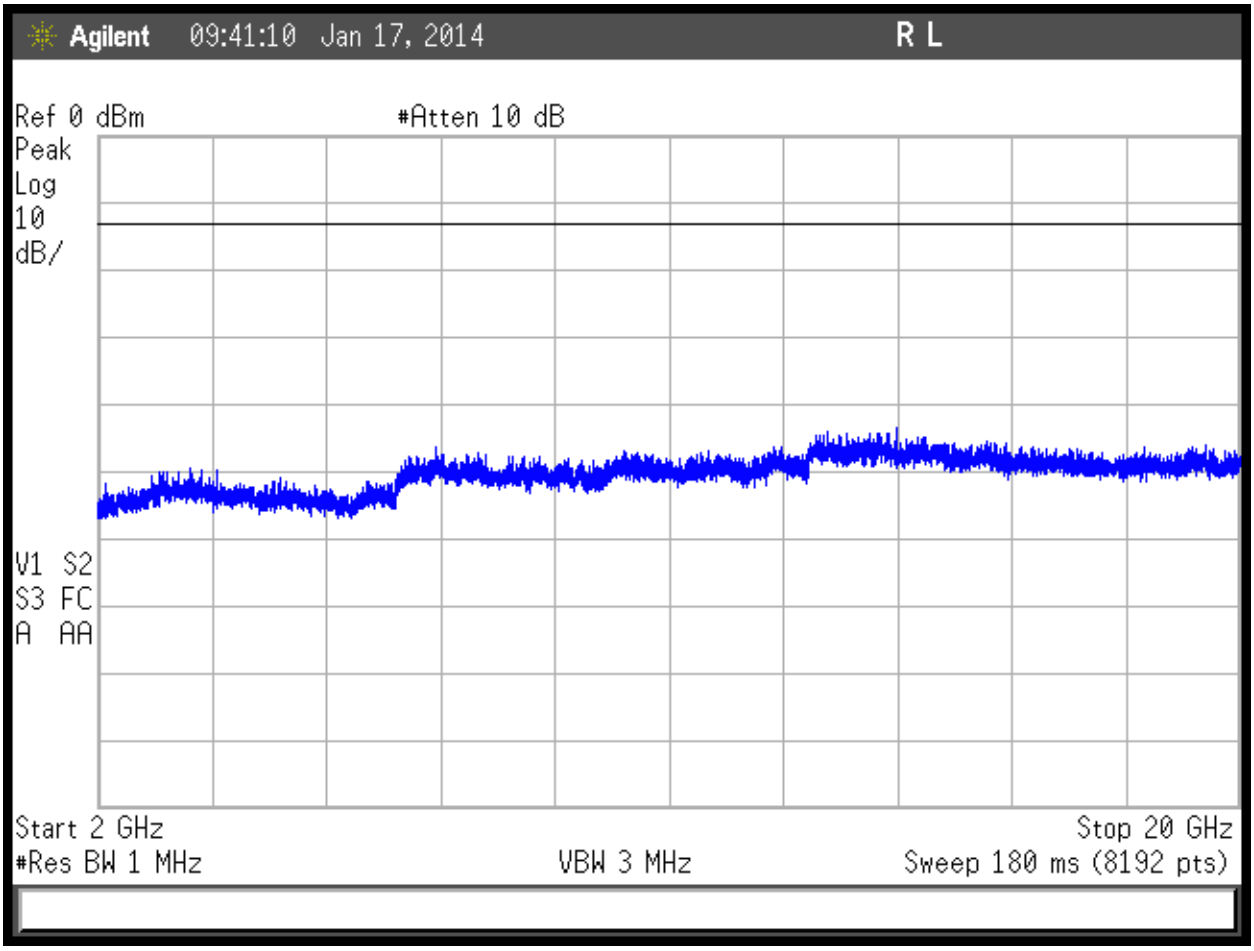
EVDO:



EVDO, 30MHz to 1GHz

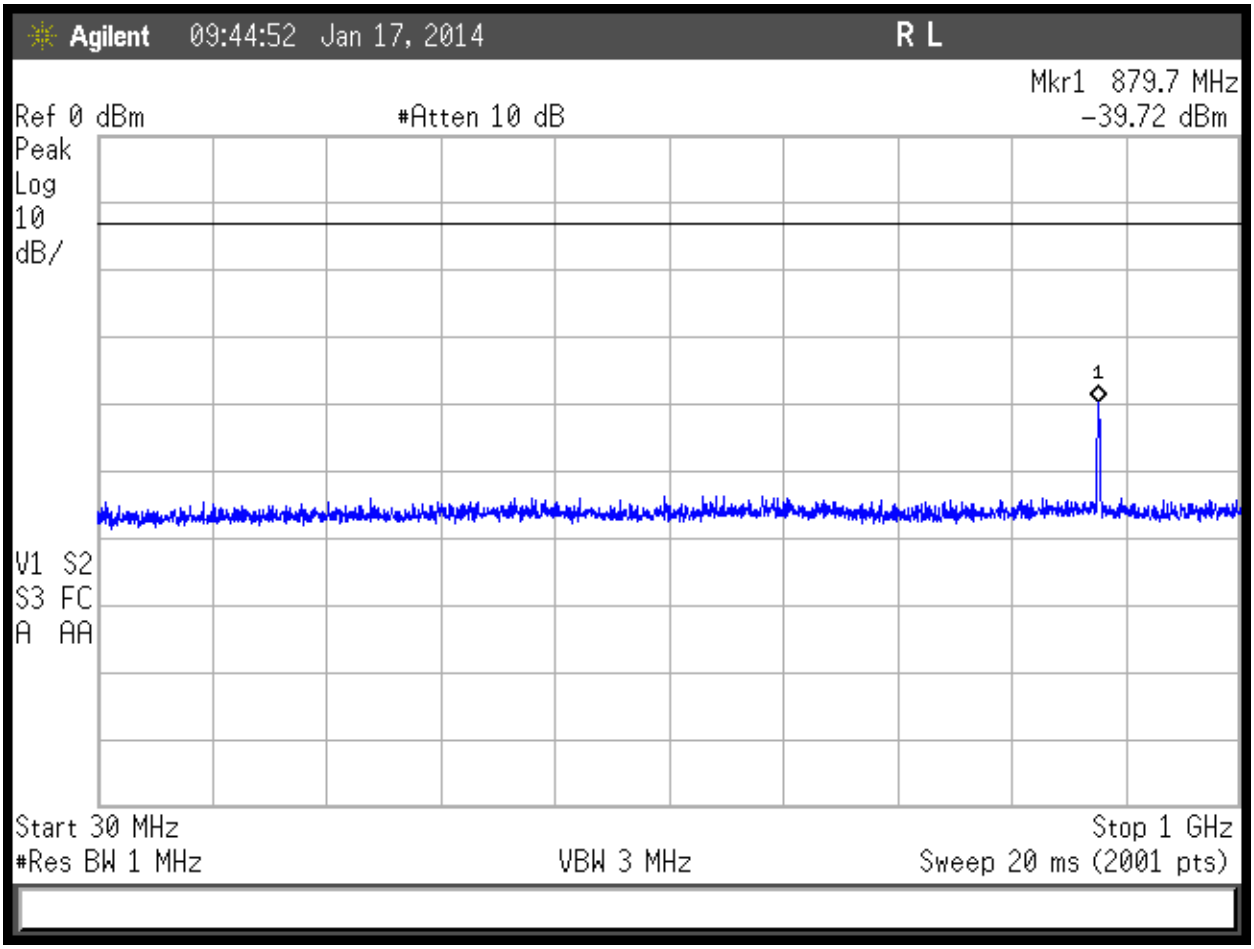

Agilent 09:38:40 Jan 17, 2014
R L
Mkr1 1.9205 GHz
Ref 0 dBm
#Atten 10 dB
-39.08 dBm
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
Stop 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 20 ms (2001 pts)

EVDO, 1-2GHz

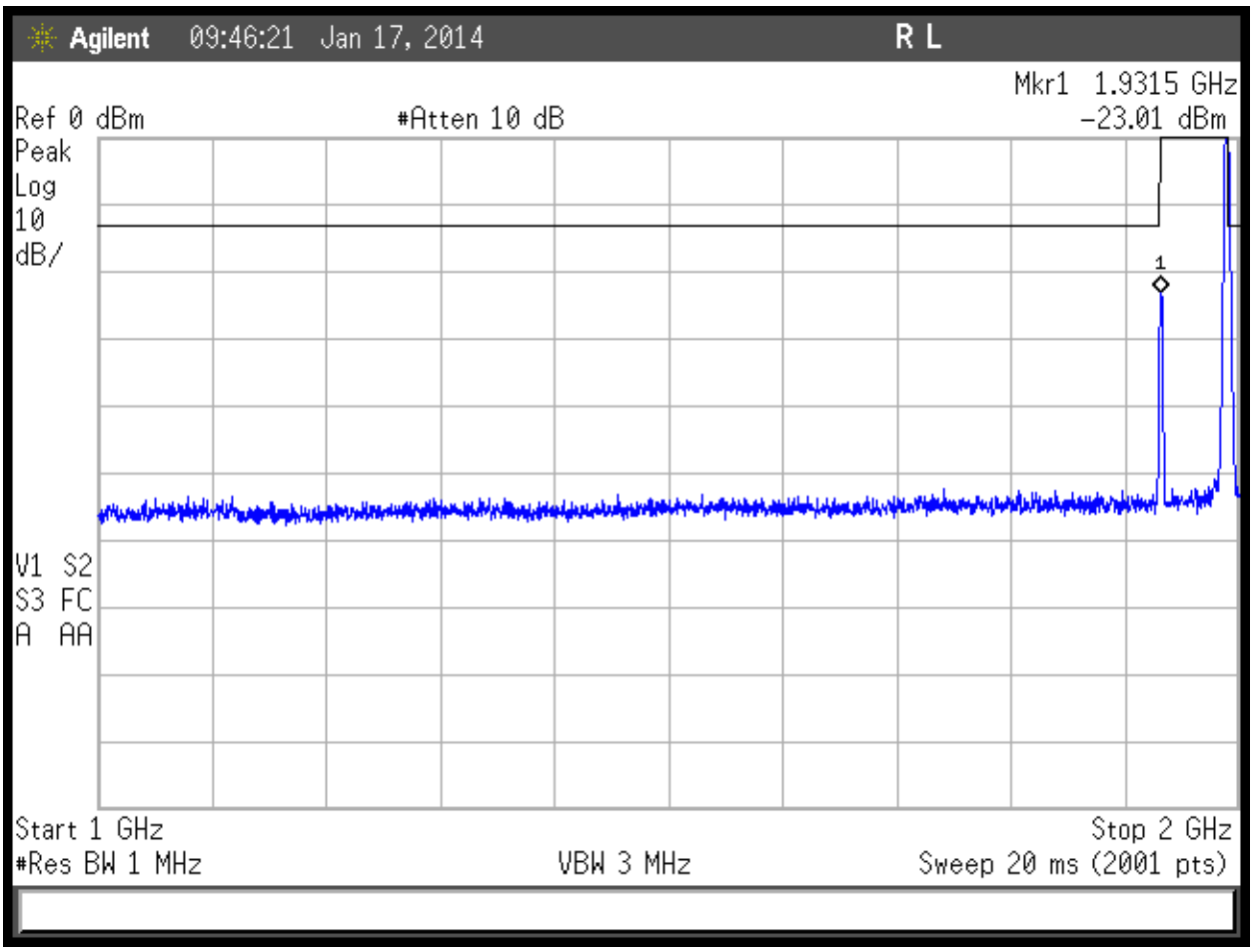


EVDO, 2GHz to 20GHz

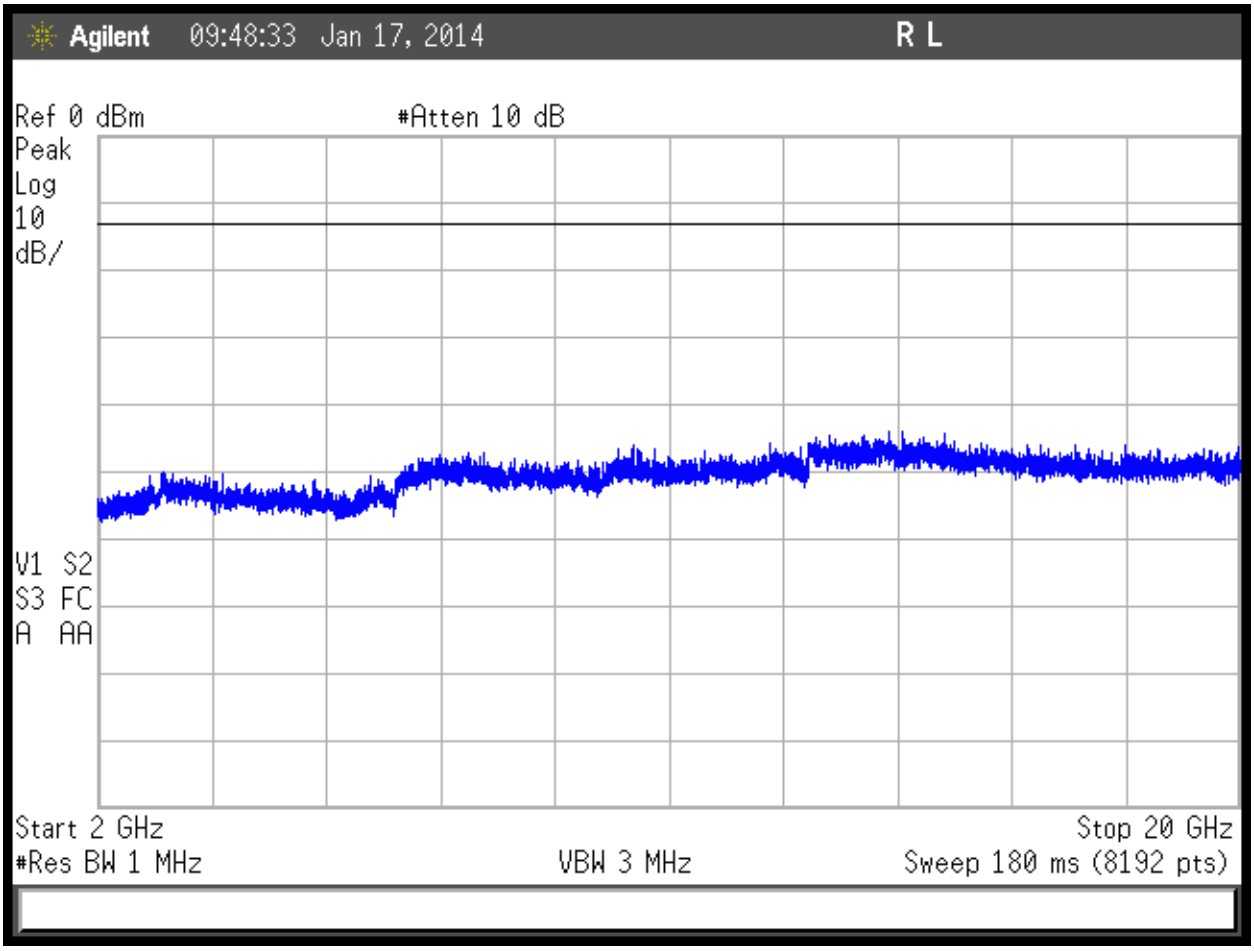
One-X:



One-X, 30MHz to 1GHz


Agilent 09:46:21 Jan 17, 2014
R L
Mkr1 1.9315 GHz
Ref 0 dBm
#Atten 10 dB
-23.01 dBm
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
Stop 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 20 ms (2001 pts)

One-X, 1-2GHz

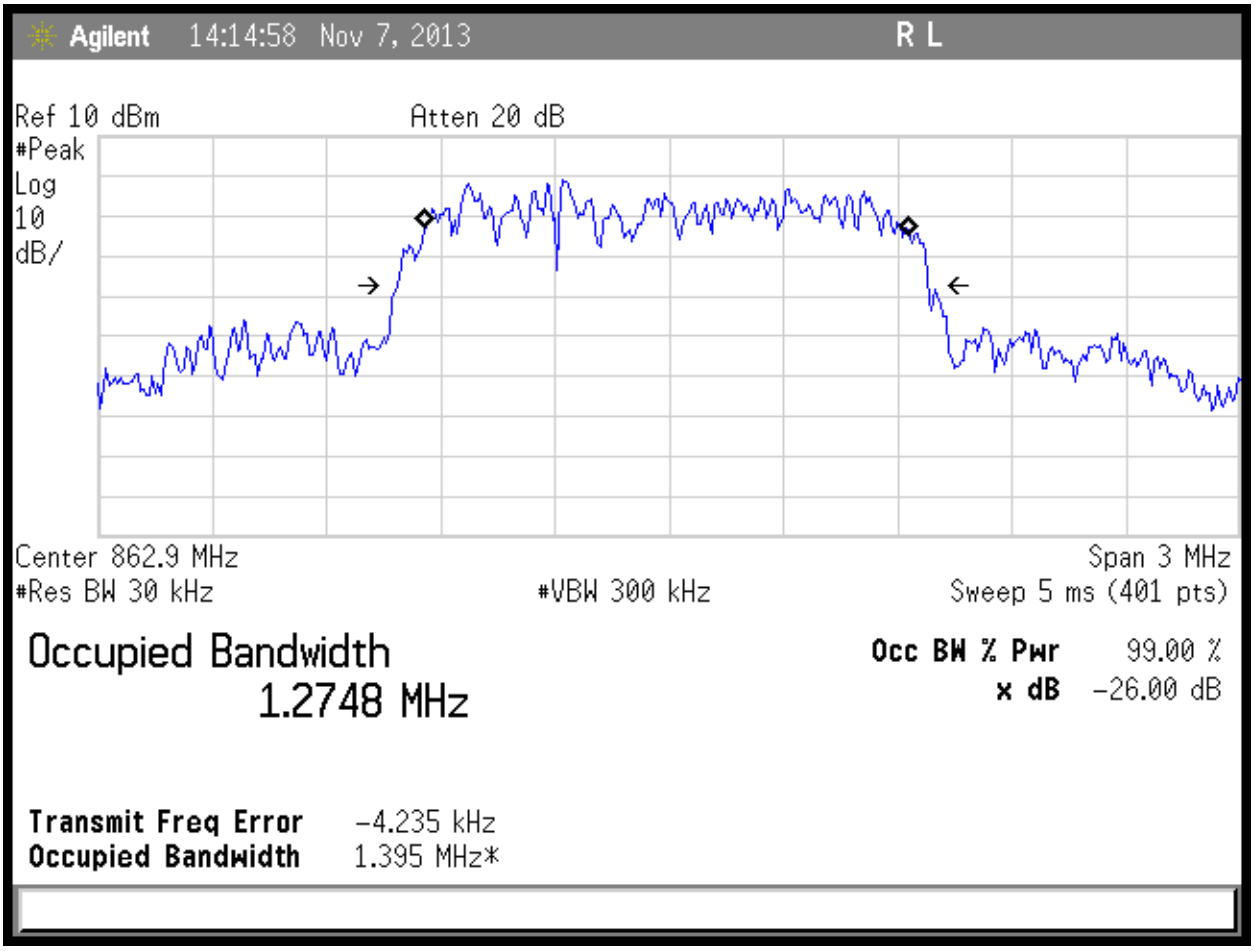


One-X, 2GHz to 20GHz

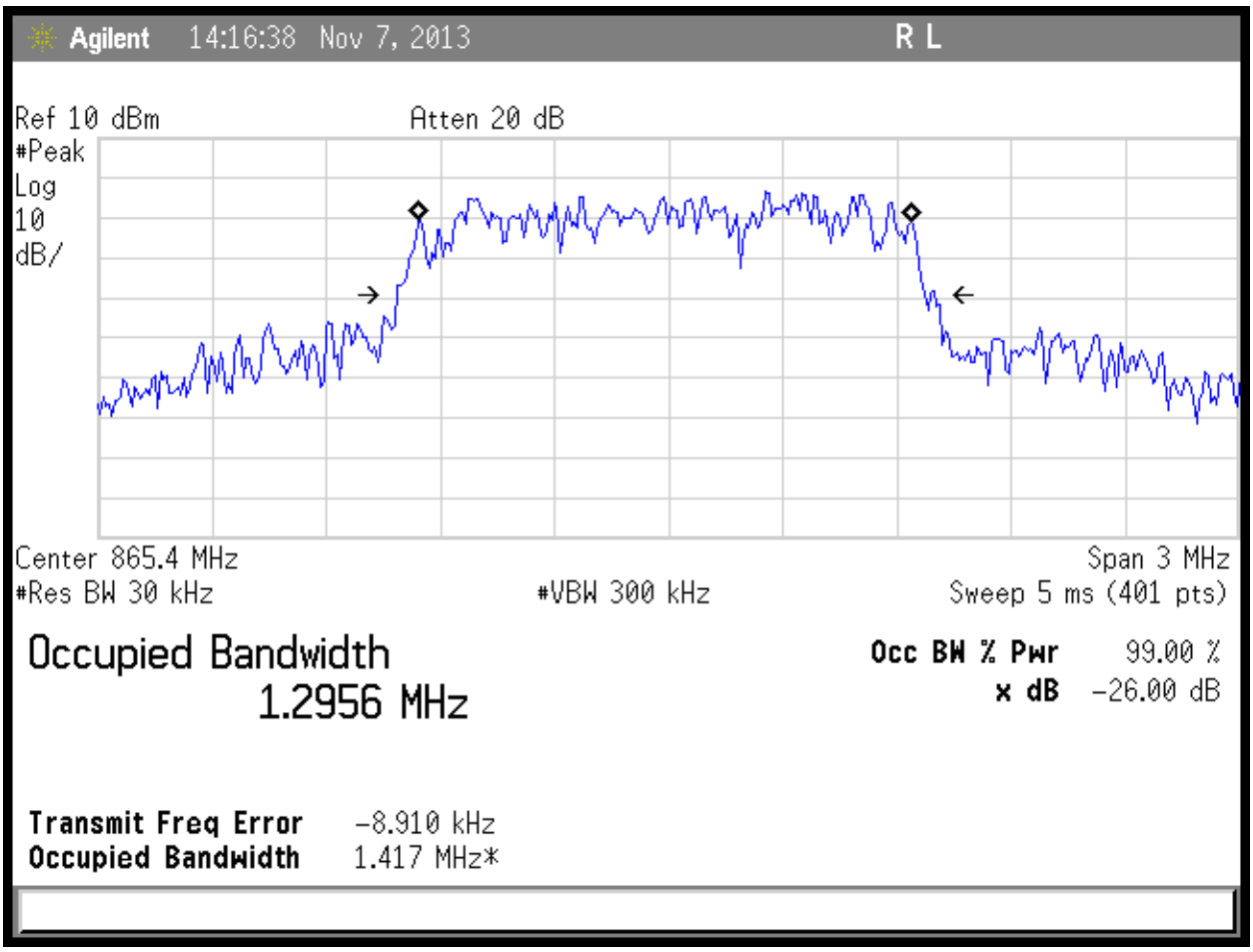
Tests Specific to Part 90

Occupied Bandwidth

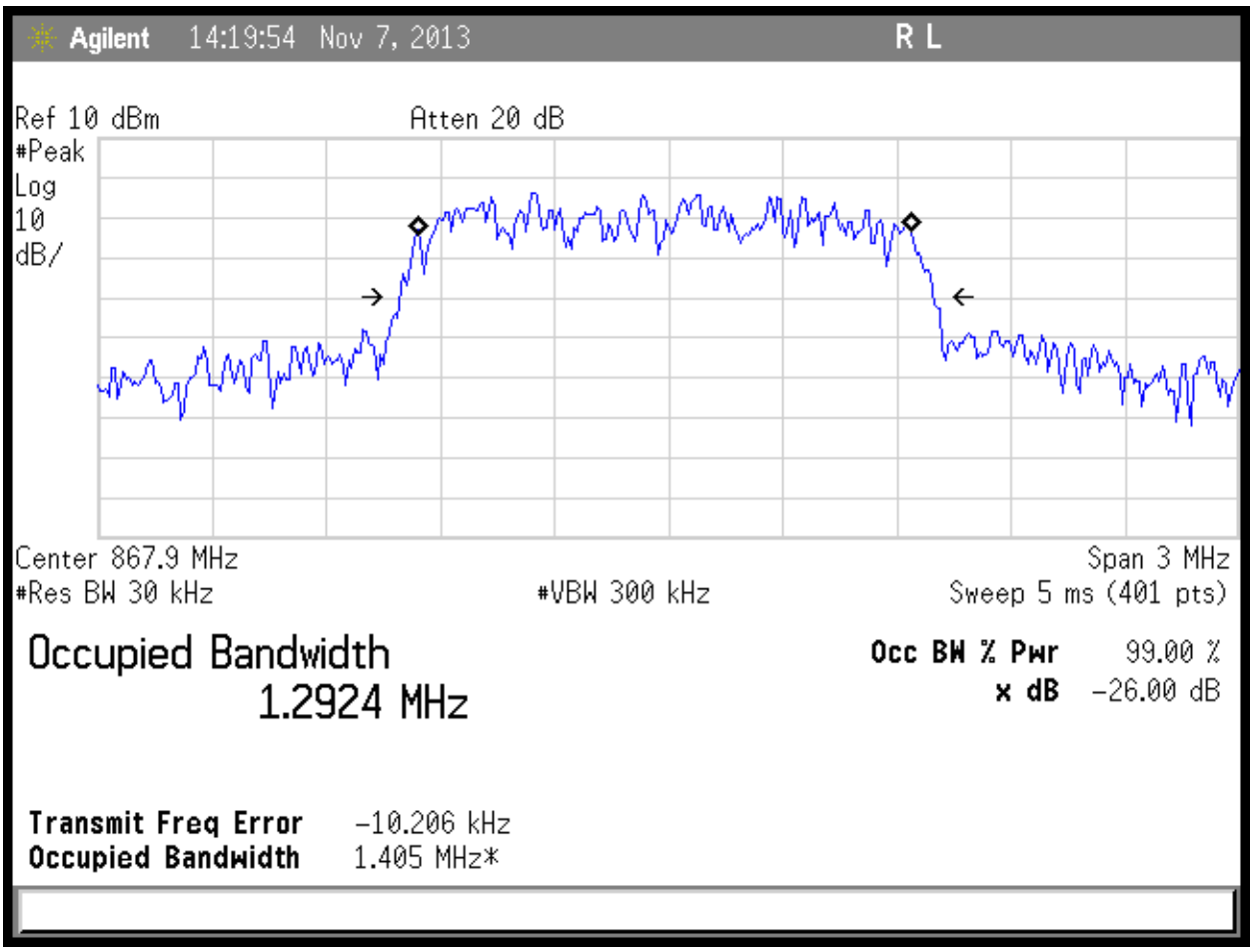
Bandwidth Measurements				
Date: 07-Nov-13		**Company:** Airvana		**Work Order:** N2817
Engineer: Arik Zwirner		**EUT Desc:** 750723		**EUT Power:** 120Vac/60Hz
Temp: 23°C		**Humidity:** 27%		**Pressure:** 1008mbar
Frequency Range: 862-869MHz, FCC Part 90				
Notes: Band Class 10 (BC10)				
OUTPUT	**CHANNEL POSITION**	**CHANNEL NUMBER**	**FREQUENCY** (MHz)	**26dB BANDWIDTH** (MHz)
BC10				
	Low	476	862.90	1.395
	Mid	576	865.4	1.417
	High	676	867.9	1.405
Test Site: 1DCC-OATS-3M-I			**Spectrum Analyzer:** Rental #1	



BC10 Low Channel (Ch. 476)



BC10 Mid Channel (Ch. 576)



BC10 High Channel (Ch. 676)

ERP

ERP Using Substitution Method

Date: 07-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 23°C **Humidity:** 27% **Pressure:** 1008mbar

Frequency Range: 862-869MHz, FCC Part 90 **Measurement Distance:** 3 m

Notes: Band Class 10 (BC10) is under test.
20dBW = 100W = 50dBm

Antenna Polarization (H / V)	Frequency (MHz)	Signal Generator Power Output (dBm)	Tx Cable (dB)	Tx Ant Gain (dBi)	Adjusted ERP (dBm)	FCC 90.635 (b) Limit (dBm)	Margin (dB)	Result (Pass/Fail)
Channel 476			---	---	---	---	---	---
H	862.9	-0.5	0.9	0.0	-1.4	50.0	-51.4	Pass
V	862.9	3.1	0.9	0.0	2.2	50.0	-47.8	Pass
			---	---	---	---	---	---
Channel 576			---	---	---	---	---	---
H	865.4	0.7	0.9	0.0	-0.2	50.0	-50.2	Pass
V	865.4	3.9	0.9	0.0	3.0	50.0	-47.0	Pass
			---	---	---	---	---	---
Channel 676			---	---	---	---	---	---
H	867.9	-2.6	0.9	0.0	-3.5	50.0	-53.5	Pass
V	867.9	1.1	0.9	0.0	0.2	50.0	-49.8	Pass

Test Site: 1DCC-OATS-3M-I **Signal Generato:** Red **Receive Cable:** Asset 1786
Analyzer: Rental #1 **Receive Antenna:** Green **Transmit Cable:** Asset 1722
Transmit Antenna: Dipole, Asset 756

Emission Mask

LIMITS

47 CFR 90.961:

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116\ \text{Log}_{10}\ (f/6.1)$ decibels or $50 + 10\ \text{Log}_{10}\ (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\text{Log}_{10}\ (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

MEASUREMENTS / RESULTS

Spectrum Analyzer settings:

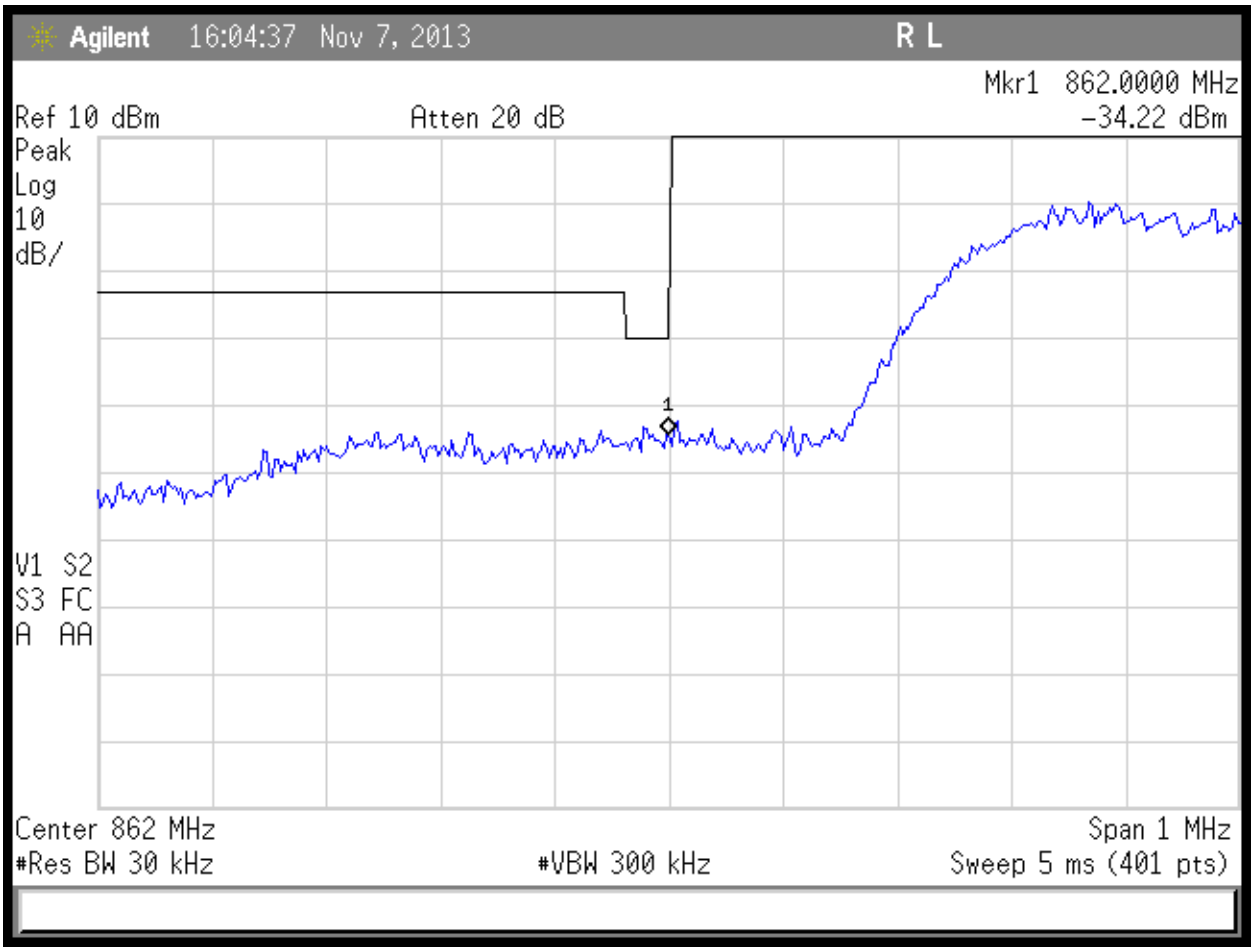
Resolution Bandwidth: 30kHz
Video Bandwidth: 300kHz
Peak detector

Emission Mask:

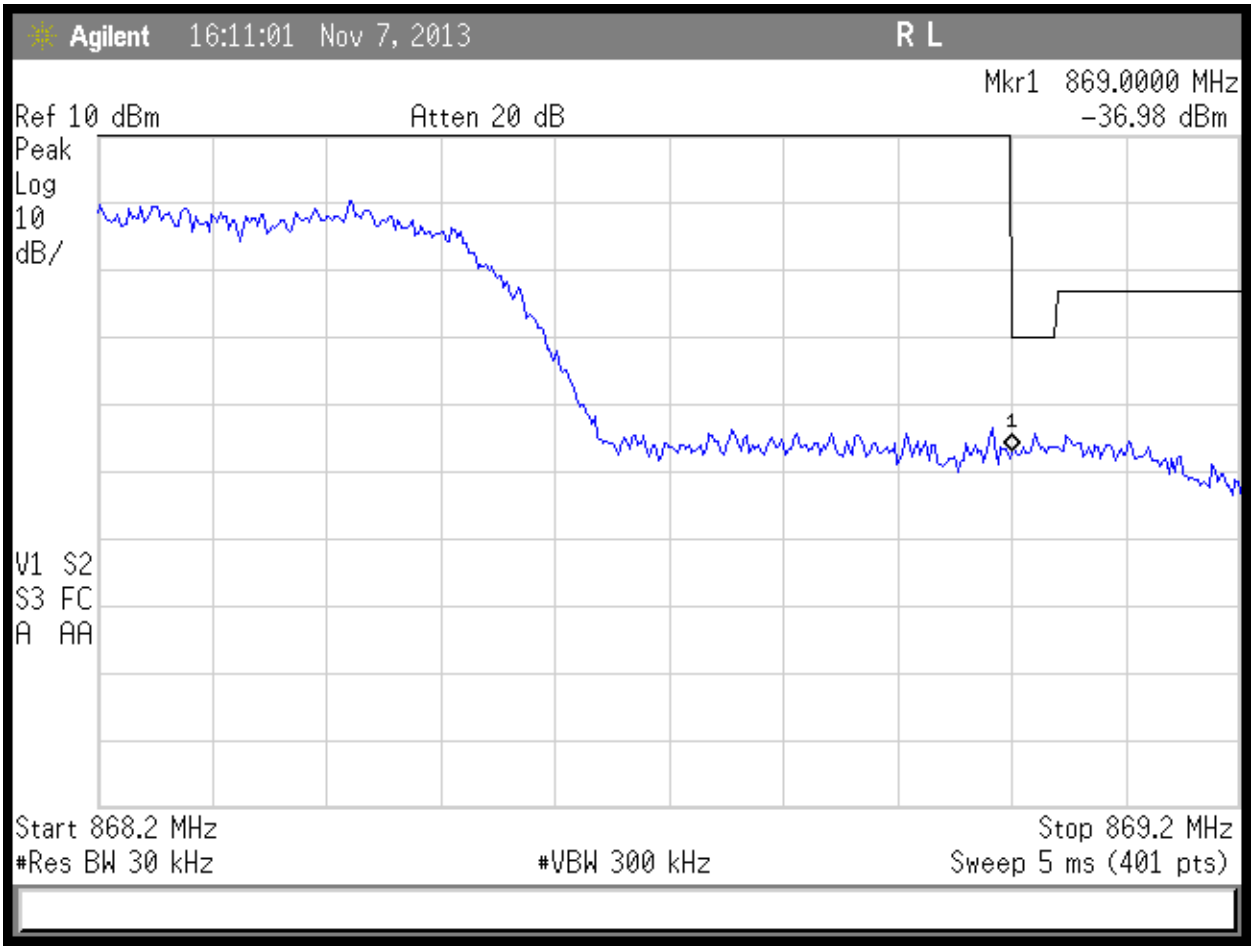
The following limits are applied in the spectral plots:

Attenuation within 37.5kHz of band: 50 + 10*Log*(P), resulting in -20dBm
Attenuation beyond 37.5kHz from band: 43 + 10*Log*(P), resulting in -13dBm

PLOTS



BC10 Low Channel



BC10 High Channel

Conducted Spurious Emissions at Antenna Port

LIMITS

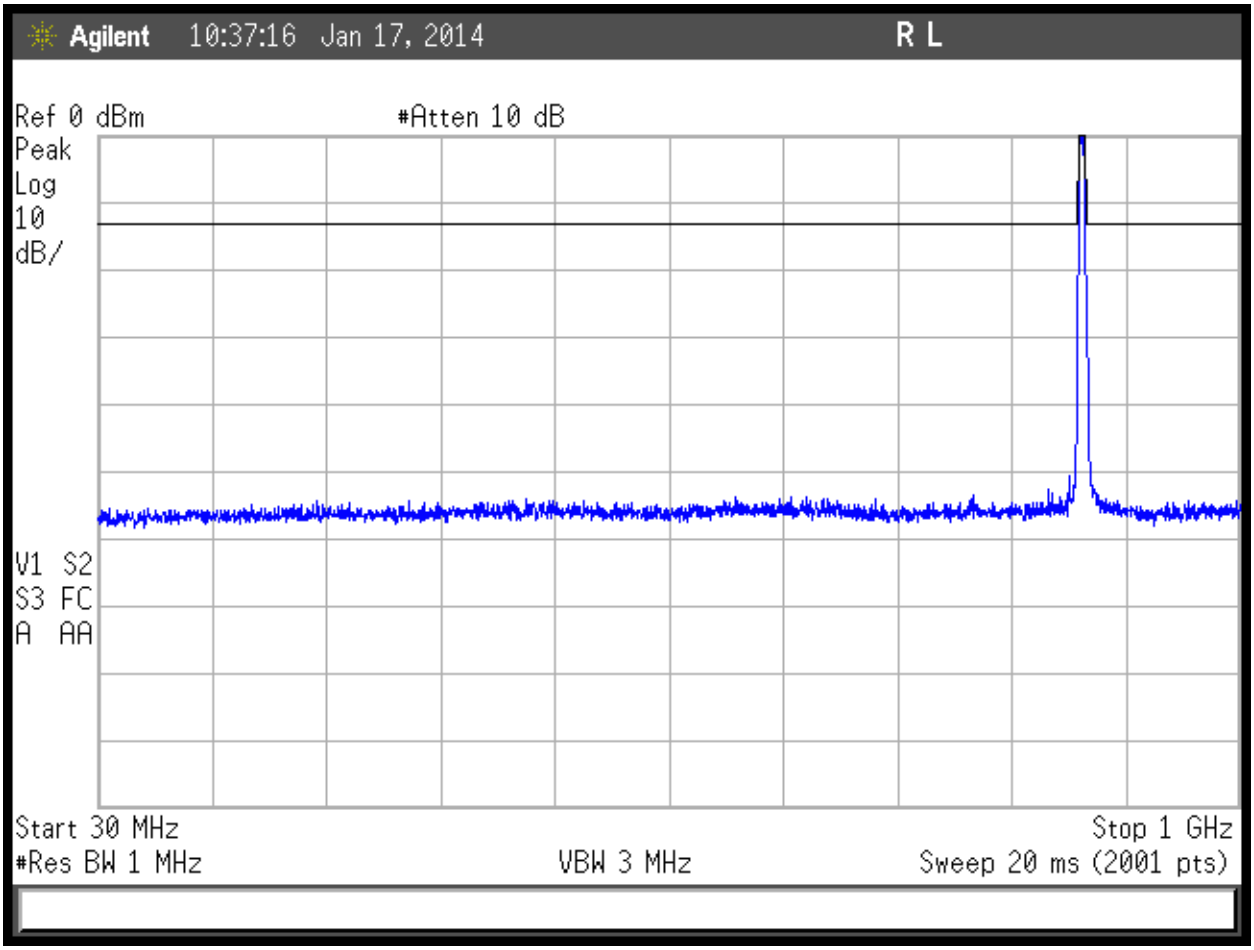
90.669 Emission limits.

(a) On any frequency in an MTA licensee's spectrum block that is adjacent to a non-MTA frequency, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus 10 $\log_{10}$ (P) decibels or 80 decibels, whichever is the lesser attenuation.

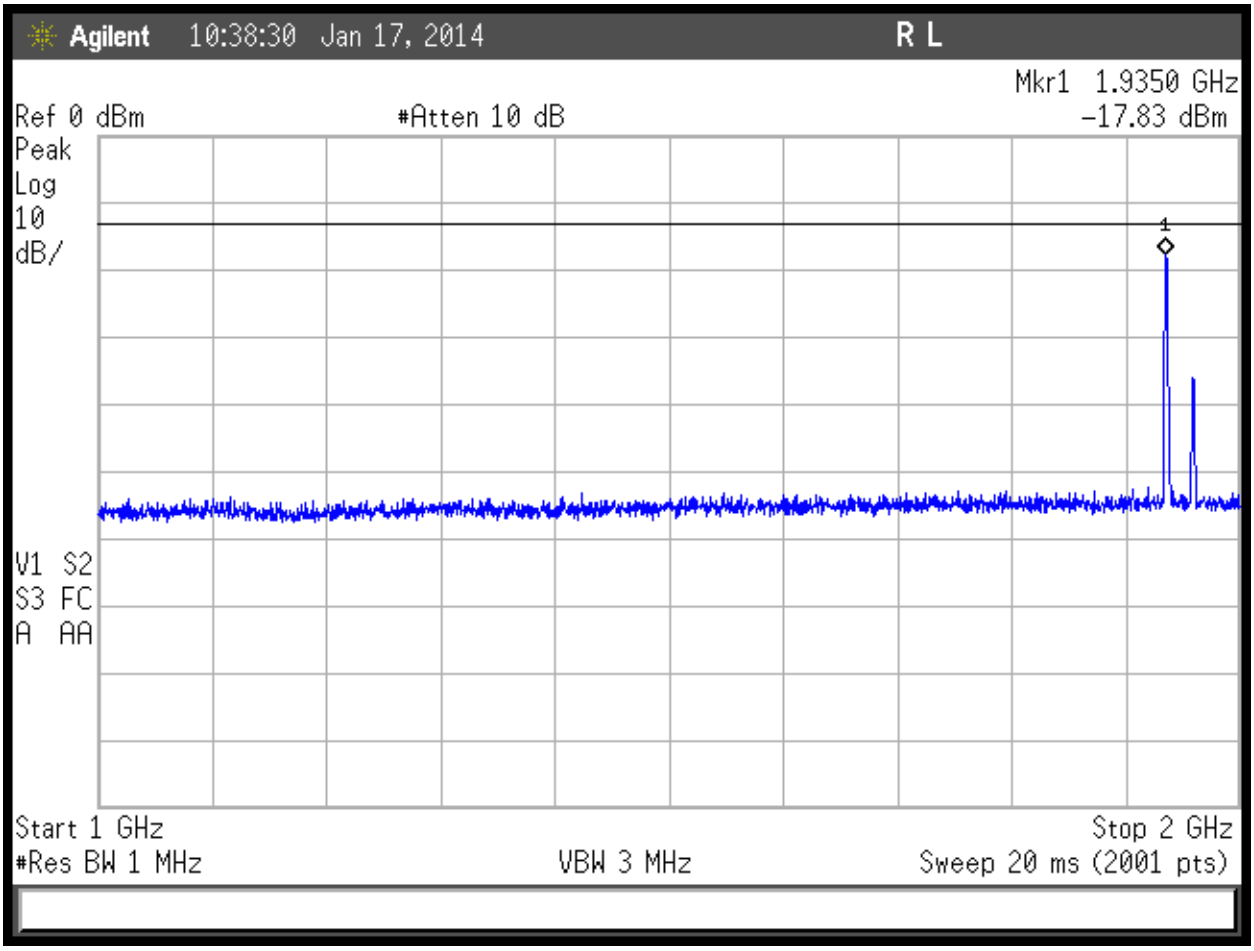
Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

The spurious emissions scans were performed across the entire frequency range (30MHz-20GHz) with the spectrum analyzer set to a 1GHz span with 2001 measurement points at 1MHz RBW and 3MHz VBW. The 2-20GHz spectrum analyzer plot provided in this report used 8192 points and is included for information only.

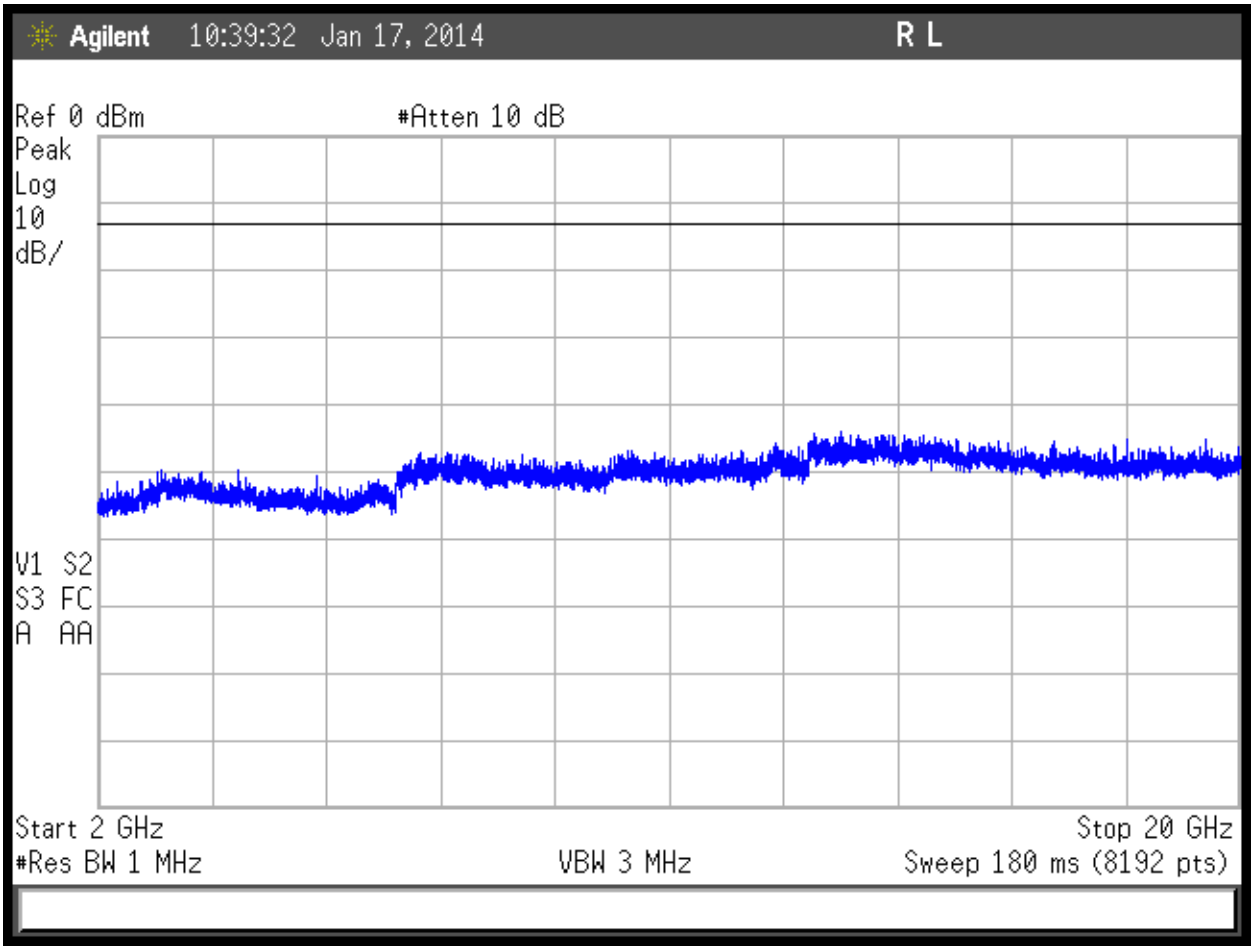
PLOTS



BC10, 30MHz to 1GHz


Agilent 10:38:30 Jan 17, 2014
R L
Mkr1 1.9350 GHz
-17.83 dBm
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
1
V1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 2 GHz
Sweep 20 ms (2001 pts)

BC10, 1-2GHz


Agilent 10:39:32 Jan 17, 2014
R L
Ref 0 dBm
#Atten 10 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Start 2 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 20 GHz
Sweep 180 ms (8192 pts)

BC10, 2-20GHz

Radiated Spurious Emissions Measurements

MEASUREMENTS / RESULTS

Note that the EUT passes the FCC Class B limit, which is much lower than the -13dBm limit (82.158dBuV/m at 3 meters) for licensed transmitter spurious emissions. Only worst-case radiated spurious data is presented.

Radiated Emissions Table

Date: 18-Oct-13 **Company:** Airvana **Work Order:** N2817
Engineer: Doug Cormier **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 24.2°C **Humidity:** 40% **Pressure:** 997mBar
Frequency Range: 30-1000MHz **Measurement Distance:** 3 m
Notes:

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
V	48.4	47.7	25.6	8.3	0.5	30.9	---	---	---	40.0	-9.1	Pass
V	74.6	50.2	25.6	8.1	0.6	33.3	---	---	---	40.0	-6.7	Pass
V	81.2	42.5	25.6	7.6	0.7	25.2	---	---	---	40.0	-14.8	Pass
V	136.56	38.4	25.7	13.5	0.7	26.9	---	---	---	43.5	-16.6	Pass
V	167.6	46.5	25.7	11.7	0.9	33.4	---	---	---	43.5	-10.1	Pass
V	226.9	47.3	25.7	11.0	1.1	33.7	---	---	---	46.0	-12.3	Pass
V	250.0	49.7	25.7	11.6	1.1	36.7	---	---	---	46.0	-9.3	Pass
H	250.0	52.6	25.7	11.6	1.1	39.6	---	---	---	46.0	-6.4	Pass
V	375.0	43.4	25.7	15.1	1.4	34.2	---	---	---	46.0	-11.8	Pass
H	375.0	39.5	25.7	15.1	1.4	30.3	---	---	---	46.0	-15.7	Pass
V	430.0	42.0	25.9	16.6	1.6	34.3	---	---	---	46.0	-11.7	Pass
V	440.0	40.9	25.8	16.7	1.6	33.4	---	---	---	46.0	-12.6	Pass
V	500.0	44.5	25.9	18.0	1.4	38.0	---	---	---	46.0	-8.0	Pass
H	500.0	45.9	25.9	18.0	1.4	39.4	---	---	---	46.0	-6.6	Pass
V	625.0	44.0	25.9	19.4	1.8	39.3	---	---	---	46.0	-6.7	Pass
H	625.0	41.2	25.9	19.4	1.8	36.5	---	---	---	46.0	-9.5	Pass
V	703.0	41.0	25.8	20.3	1.8	37.3	---	---	---	46.0	-8.7	Pass
V	750.0	34.7	25.8	20.8	1.9	31.6	---	---	---	46.0	-14.4	Pass

Table Result: Pass by -6.4 dB ***Worst Freq:*** 250.0 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #1781 **Cable 2:** Asset #1785
Analyzer: Asset #1327 **Preamp:** Green **Antenna:** Red-Brown

Radiated Emissions Table

Date: 04-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 24°C **Humidity:** 39% **Pressure:** 1030mBar
Frequency Range: 1-18GHz **Measurement Distance:** 3 m

Notes: Spurious Emissions. EUT is running BC0, BC1 (One-X), and BC1 (EVDO) on its three transmitters for tests 1-3.
EUT is running BC10, BC1, and BC1 on the three transmitters for tests 4-6. Note that the first transmitter operates in either BC0 or BC10 mode.

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	FCC Class B High Frequency - Average Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Test 1: BC0 at mid; BC1 One-X at mid, BC1 EVDO at low				---	---	---	---	---	---	---	---	---	---	---
H	4770.0	36.1	22.2	17.3	33.0	5.2	57.0	43.1	74.0	-17.0	Pass	54.0	-10.9	Pass
V	5805.0	42.9	21.8	16.4	34.2	6.2	66.9	45.8	74.0	-7.1	Pass	54.0	-8.2	Pass
V	10532.0	37.3	17.9	14.8	38.6	7.5	68.6	49.2	74.0	-5.4	Pass	54.0	-4.8	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 2: BC0 at low; BC1 One-X at low; BC1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
V	5890.0	41.4	21.8	16.1	34.3	6.2	65.8	46.2	74.0	-8.2	Pass	54.0	-7.8	Pass
V	10532.0	38.8	18.7	14.8	38.6	7.5	70.1	50.0	74.0	-3.9	Pass	54.0	-4.0	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 3: BC0 at high; BC1 One-X at high; BD1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
V	5890.0	40.3	20.6	16.1	34.3	6.2	64.7	45.0	74.0	-9.3	Pass	54.0	-9.0	Pass
V	10532.0	36.5	17.9	14.8	38.6	7.5	67.8	49.2	74.0	-6.2	Pass	54.0	-4.8	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 4: BC10 at low; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
V	10532.0	36.8	17.6	14.8	38.6	7.5	68.1	48.9	74.0	-5.9	Pass	54.0	-5.1	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 5: BC10 at mid; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
V	10532.0	36.7	17.4	14.8	38.6	7.5	68.0	48.7	74.0	-6.0	Pass	54.0	-5.3	Pass
				---	---	---	---	---	---	---	---	---	---	---
Test 6: BC10 at high; BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
V	10532.0	38.8	17.7	14.8	38.6	7.5	70.1	49.0	74.0	-3.9	Pass	54.0	-5.0	Pass

Table Result: Pass by -3.9 dB ***Worst Freq:*** 10532.0 MHz

Test Site: EMI Chamber 2 **Cable 1:** Asset #1782 **Cable 2:** Asset #1784
Analyzer: Rental SA#2 **Preamp:** Brown **Antenna:** Black Horn

Radiated Emissions Table

Date: 04-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750723 **EUT Operating Voltage/Frequency:** 120Vac/60Hz
Temp: 24°C **Humidity:** 39% **Pressure:** 1030mBar
Frequency Range: 18-20GHz **Measurement Distance:** 0.1 m

Notes: Spurious Emissions. EUT is running BC10, BC1 (One-X), and BC1 (EVDO) on the three transmitters for tests 7-9.
BC10 and BC0 modes are not applicable in this range, as the max channel is under 900MHz for these two.

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	FCC Class B High Frequency - Average Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Test 7: BC1 One-X at low; BC1 EVDO at high				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
Test 8: BC1 One-X at mid; BC1 EVDO at low				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
Test 9: BC1 X One-at high; BC1 EVDO at mid				---	---	---	---	---	---	---	---	---	---	---
NO EMISSIONS WERE FOUND IN THIS RANGE.				---	---	---	---	---	---	---	---	---	---	---

Table Result: Pass by N/A dB ***Worst Freq:*** N/A MHz

Test Site: EMI Chamber 2 **Cable 1:** EMIR-HIGH-21
Analyzer: Rental SA#2 **Preamp:** White **Antenna:** 18-26.5GHz Horn

Frequency Stability

REQUIREMENTS

Part 22:
Per 22.355, Table C-1, the frequency stability shall remain within 1.5ppm for this device.

Part 24:
"The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." [24.235]

Part 90:
Per 90.213(a), the frequency stability shall remain within 1.5ppm for this device.

MEASUREMENTS / RESULTS

Frequency Stability — ***Curtis-Straus LLC***

Engineer: Arik Zwirner **Company:** Airvana
Date: 8-Nov-13 **EUT:** 750723
Spectrum Analyzer: Rental #1 **Work Order:** N2817
Set Frequency: 1,956,250,000 Hz
Notes: Reference Conditions: 110Vac/60Hz, 20°C

Temperature (°C)	Supply Voltage (60Hz)	Center Frequency (Hz)	Frequency Deviation (ppm)
-30	110Vac	1956250000	0.0
-20	110Vac	1956250000	0.0
-10	110Vac	1956250000	0.0
0	110Vac	1956250000	0.0
10	110Vac	1956250000	0.0
20	93.5Vac	1956250000	0.0
20	110Vac	1956250000	0.0
20	126.5Vac	1956250000	0.0
30	110Vac	1956250000	0.0
40	110Vac	1956250000	0.0
50	110Vac	1956250000	0.0

The EUT has an intentional transmitter that operates at both 800 and 1900MHz bands. The hardware utilized for both bands is the same while the software controls the different bands. Testing was performed at only the 1900MHz band to satisfy the 800MHz band requirements because a single oscillator is used as the source for both.

Conducted Spurious Emissions on AC Mains

AC Conducted Emissions Data Table

Date: 11-Nov-13 **Company:** Airvana **Work Order:** N2817
Engineer: Arik Zwirner **EUT Desc:** 750723
Temp: 20.0 ºC **Humidity:** 33% **Pressure:** 1011 mBar
Notes:
Frequency Range: 0.15-30MHz **EUT Input Voltage/Frequency:** 120Vac/60Hz

	Quasi-Peak Readings		Average Readings		LISN Factors		Cable	ATTN	FCC/CISPR Class B			FCC/CISPR Class B		
Frequency	QP1	QP2	AVG1	AVG2	L1	L2	Factor	Factor	QP Limit	Margin	Result	AVG Limit	Margin	Result
(MHz)	(dBµV)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dB)	(dB)	(dB)	(dBµV)	(dB)	(Pass/Fail)	(dBµV)	(dB)	(Pass/Fail)
0.150	32.3	31.0	12.6	13.3	-0.1	-0.1	-0.1	-19.8	66.0	-13.7	Pass	56.0	-22.7	Pass
0.180	33.8	34.4	17.0	10.4	-0.1	-0.1	-0.1	-19.8	64.5	-10.1	Pass	54.5	-17.5	Pass
0.220	27.4	28.3	9.5	8.3	-0.1	-0.1	0.0	-19.8	62.8	-14.6	Pass	52.8	-23.4	Pass
2.57	18.6	17.7	6.7	5.9	0.0	-0.1	-0.1	-19.8	56.0	-17.5	Pass	46.0	-19.4	Pass
7.06	16.2	16.0	6.8	6.1	0.0	-0.1	-0.2	-19.8	60.0	-23.8	Pass	50.0	-23.2	Pass
7.88	16.7	18.3	5.3	7.8	0.0	-0.1	-0.2	-19.8	60.0	-21.7	Pass	50.0	-22.2	Pass

Result: Pass ***Worst Margin:*** -10.1 dB ***Frequency:*** 0.180 MHz

Measurement Device: LISN ASSET 1728(Line 1) LISN ASSET 1731(Line 2) **Cable:** CEMI-05 **Spectrum Analyzer:** SA EMI Chamber (1328)
Attenuator: 20dB Attenuator-73 **Site:** CEMI 1

Test Equipment

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
SA EMI Chamber (1327)	9kHz-13.2 GHz	E4405B	Agilent	MY45103416	1327	I	5/30/2014	5/30/2013
SA EMI Chamber (1328)	9kHz-13.2 GHz	E4405B	Agilent	MY44210241	1328	I	12/19/2013	12/19/2012
Rental SA #1 (Brown)	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	4/15/2014	4/15/2013
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	12/8/2013	12/8/2012

LISNs/Measurement Probes	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
LISN Asset 1728	150kHz-30MHz	LI-150A	Com-Power	201084	1728	I	1/28/2014	1/28/2013
LISN Asset 1731	150kHz-30MHz	LI-150A	Com-Power	201091	1731	I	2/14/2014	2/14/2013

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range		Cat	Calibration Due	Calibrated on
1DCC-OATS-3M-I	719150	2762A-8	A-0015	30-1000MHz		II	5/17/2015	5/17/2013
1DCC-OATS-3M-II	719150	2762A-10	A-0015	30-1000MHz		II	5/11/2015	5/11/2013
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz		II	2/16/2014	2/16/2012
EMI Chamber 1	719150	2762A-6	A-0015	>1GHz		I	5/17/2015	5/17/2013

Conducted Test Sites (Mains / Telco)	FCC Code		VCCI Code			Cat	Calibration Due	Calibrated on
CEMI 5	719150		A-0015			III	NA	N/A

Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Orange	0.009-2000MHz	ZFL-1000-LN	CS	N/A	765	II	2/2/2014	2/2/2013
Brown	1-18GHz	CS	CS	N/A	1523	II	2/27/2014	2/27/2013
1517 HF Preamp	1-20GHz	CS	CS	N/A	1517	II	9/11/2014	9/11/2013
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	I	10/12/2014	10/12/2013

Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Green-Red Bilog	30-2000MHz	CBL6112B	Chase	2435	990	I	1/9/2015	1/9/2013
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	1/8/2015	1/8/2013
Yellow Horn	1-18GHz	3115	EMCO	9608-4898	37	I	7/19/2014	7/19/2013
Black Horn	1-18GHz	3115	EMCO	9703-5148	56	I	8/5/2015	8/5/2013
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	I	Verify before Use	date of test
Adjustable Dipole	30-1000MHz	3121C	EMCO	1371	756	I	12/28/2014	12/28/2013

Chambers and Stripline		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Environmental (Safety)		SGTH-31S	B-M-A Inc.	2245	321	I	11/19/2013	11/19/2012

Signal Generators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red	0.009-2000MHz	HP8648B	Agilent	3847U02192	366	I	8/29/2014	8/129/2013
Green	0.009-2000MHz	HP8648B	Agilent	3623A02072	125	I	1/31/2014	1/31/2013

RMS Voltmeters/Current Clamp		MN	Mnfr	SN	Asset	Cat	Calibration Due	Calibrated on
True-RMS Multimeter		177	Fluke	83390025	974	I	5/13/2014	5/13/2013

Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Temp./Humidity/Atm. Pressure Gauge		7400 Perception II	Davis	N/A	965	I	5/29/2014	5/29/2013
TH A#1828		35519-044	Control Company	130318292	1828	II	6/13/2015	6/13/2013
TH A#1830		35519-044	Control Company	130320003	1830	II	6/13/2015	6/13/2013
TH A#1832		35519-044	Control Company	130318277	1832	II	6/13/2015	6/13/2013
TH A#1834		35519-044	Control Company	130320004	1834	II	6/13/2015	6/13/2013

Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #1722	9kHz - 18GHz		Florida RF			II	3/2/2014	3/2/2013
Asset #1781	9kHz - 18GHz		Florida RF			II	3/6/2014	3/6/2013
Asset #1782	9kHz - 18GHz		Florida RF			II	3/6/2014	3/6/2013
Asset #1784	9kHz - 18GHz		Florida RF			II	3/14/2014	3/14/2013
Asset #1785	9kHz - 18GHz		Florida RF			II	3/14/2014	3/14/2013
Asset #1786	9kHz - 18GHz		Florida RF			II	3/14/2014	3/14/2013
CEMI-05	9kHz - 2GHz		C-S			II	5/3/2014	5/3/2013
REMI-High-21	9kHz - 26.5GHz		C-S			II	2/2/2014	2/2/2013

Attenuators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
20dB Attenuator-73	9kHz-2GHz			N/A		II	10/12/2014	10/12/2013

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Conditions Of Testing

[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("**Client**"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "**Conditions**"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("**Test Report**") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPS**", "**MTL**", "**ACTS**", "**MTL-ACTS**" and **CURTIS-STRAUS** (collectively, the "**Marks**") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.

13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.

14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B)NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

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