



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: ALD Systems, Inc.

Model: RF506B-900

Description: Modular Wireless Signal Link and Data Transceiver

To

FCC Part(s) 15.247 DTS

Date of Issue: June 27, 2013

On the behalf of the applicant:

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Attention of:

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Greg Corbin
Project Test Engineer

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All results contained herein relate only to the sample tested



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	June 27, 2013	Greg Corbin	Original Document
2.0	February 17, 2014	Greg Corbin	Added AC Conducted Emissions test data to page 34



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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



**FCC OATS Reg. # 933597
IC Reg. # 2044A-1**

and

**FCC Site Reg. # 349717
IC Site Reg. # 2044A-2**

Non-accredited tests contained in this report:

N/A



The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



Standard Test Conditions Engineering Practices

The tests referenced in this report were performed in accordance with the FCC CFR Part 15.247 rule sections along with the KDB 558074_DTS Measurement Guide v03r01.

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
27.0 – 30.2	27.1 – 33.4	964.1 – 971.1

EUT Description

Model: RF506B-900

Description: Modular Wireless Signal Link and Data Transceiver

S/N: 01

Additional Information:

The EUT is a DTS transmitter module operating in the 902 – 928 frequency bands.

The device can operate on any one of 10 channels from 906 – 924 MHz.

The tests results in this test report confirm that the EUT meets the specifications required for a FCC CFR 15.247 modular certification.

EUT Operation during Tests

The manufacturer provided test software that allowed the EUT to be tuned to the low, middle and high channel with the power set to the maximum level.

The test software was controlled using a Hyper terminal and communicated with the module via a USB to serial adapter. The module was connected to the USB adapter with a 20 cm ribbon cable as part of the modular certification requirements.

For AC Conducted Emissions testing, the manufacturer provided a module with the transmitter continuously transmitting during the test.



Accessories:

Qty	Description	Mfg	Model	S/N
1	Laptop PC with Hyper Terminal Program	HP	Compac nc6400	N/A
1	AC Power Adapter	HP	PPP012D-S	N/A
1	AC / DC Adapter for Conducted Emissions Test	Palm	157-10108-00	N/A

Cables:

Qty	Description	Length	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	USB to Serial Interface	2 m	N	N	N
1	Ribbon Cable	20 cm	N	N	N

Modifications: None

15.203: Antenna Requirement:

- ☒ The antenna is permanently attached to the EUT
- ☐ The antenna uses a unique coupling
- ☐ The EUT must be professionally installed
- ☐ The antenna requirement does not apply



Test Reports Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(b)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	Pass	



Peak Output Power

Name of Test:

Peak Output Power

Engineer: Greg Corbin

Test Equipment Utilized:

i00331

Test Date: 6/26/2013

Test Procedure

The EUT was connected as shown in the test set-up.

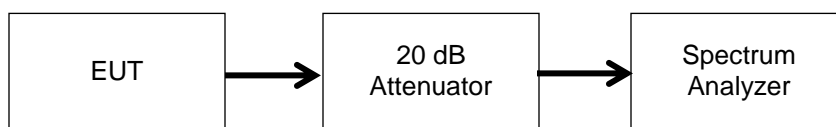
The test was performed per section 9.1.1 of KDB 558074 D01_DTS Measurement Guidance v03r01.

The cable and attenuator correction factors were input to the spectrum analyzer as a reference level offset before recording the final data.

RBW = 1 MHz

VBW = 3 MHz

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
906	10.4	1 W (30 dBm)	Pass
914	10.4	1 W (30 dBm)	Pass
924	10.1	1 W (30 dBm)	Pass



Conducted Spurious Emission

Name of Test:

Conducted Spurious Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

i00331

Test Date: 6/26/2013

Test Procedure

The EUT was connected as shown in the test setup.

The test was performed per section 11.0 of KDB 558074 D01_DTS Measurement Guidance v03r01".

The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The peak output power is added to the recorded measurement to provide the corrected spurious level dBc.

The spectrum analyzer span was set in accordance with KDB 558074, which states that the "number of measurement points \geq span/RBW".

RBW = 100 KHz

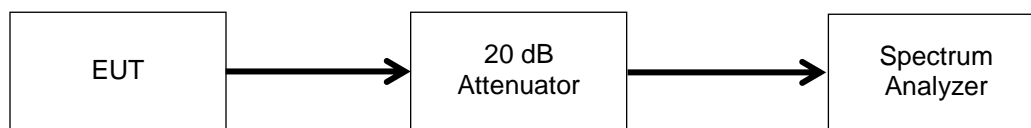
VBW = 300 KHz

of measurement points = 8192

Based on the information above, the conducted spurious emission plots were recorded with the span set to 800 MHz.

Only the worst case is recorded in the Conducted Spurious Emissions Summary Test Table.

Test Setup



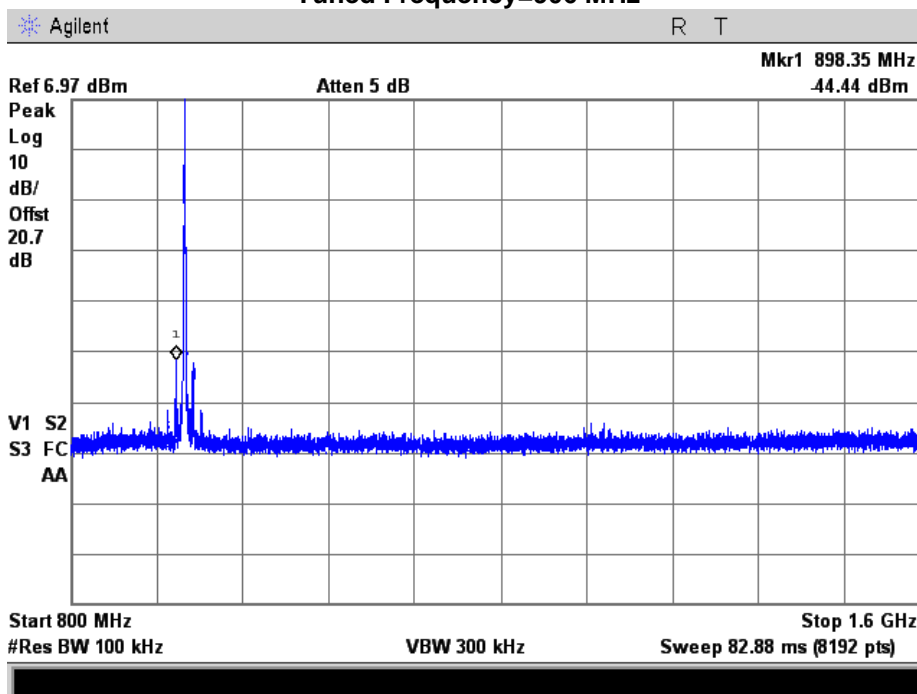
Conducted Spurious Emissions Summary Test Table

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBm)	Reference Level (dBm)	Corrected Measurement (dBc)	Specification Limit (dBc)	Result
906	898.35	-44.4	10.4	-54.8	-20	Pass
914	905.77	-43.8	10.4	-54.2	-20	Pass
924	931.75	-44.1	10.1	-54.2	-20	Pass

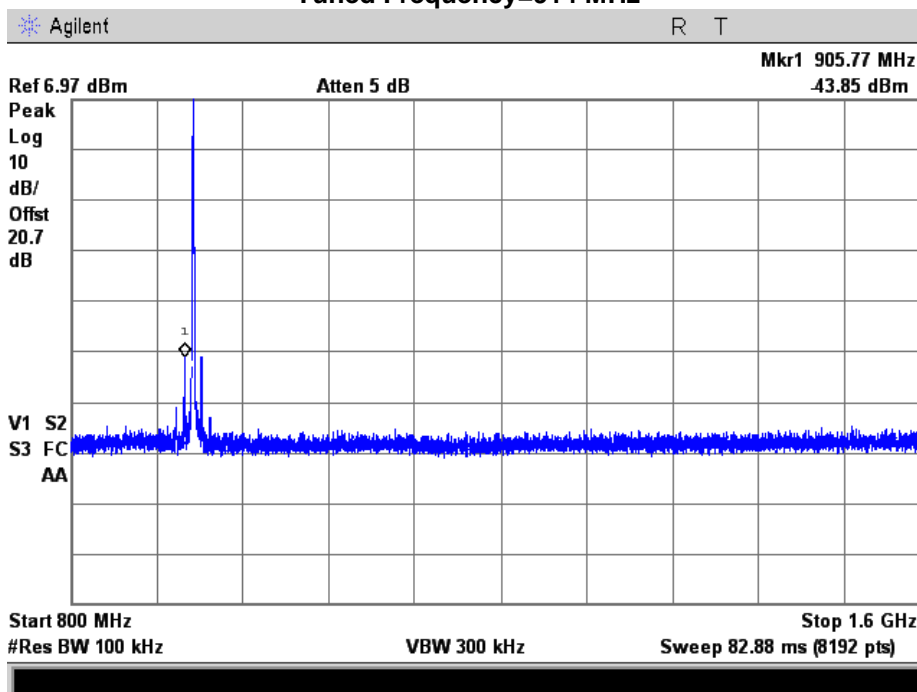
No other emissions were observed except for the 5th harmonic which falls in a restricted band and is measured as part of the radiated spurious emissions test later in this test report.



Conducted Spurious Emissions Tuned Frequency=906 MHz

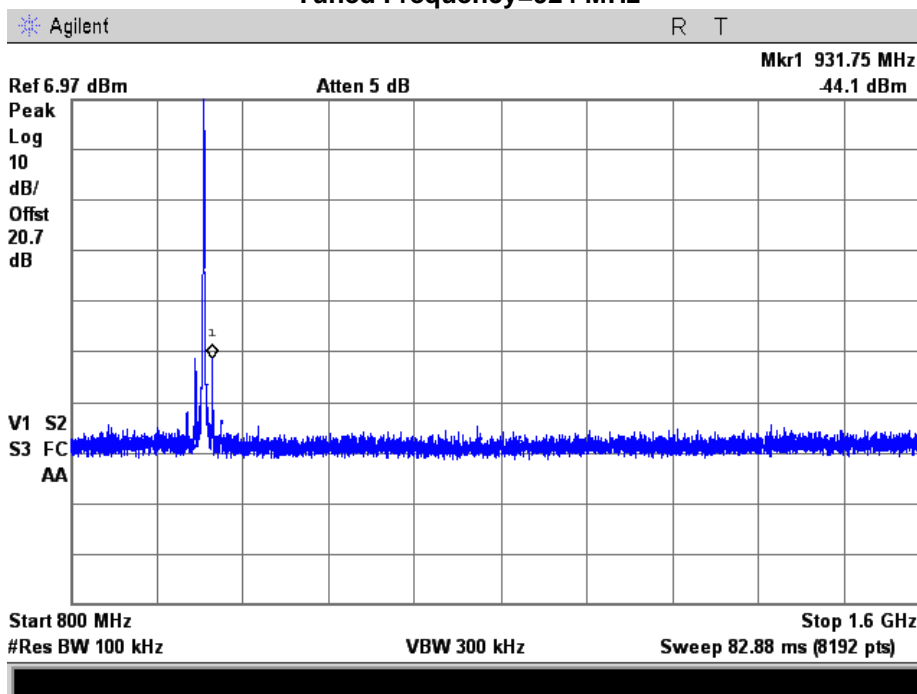


Conducted Spurious Emissions Tuned Frequency=914 MHz





Conducted Spurious Emissions Tuned Frequency=924 MHz





Radiated Spurious Emissions

Name of Test:

Radiated Spurious Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

i00033, i00175, i00267, i00271, i00331

Test Date: 6/26/2013

Test Procedure

Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized. All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

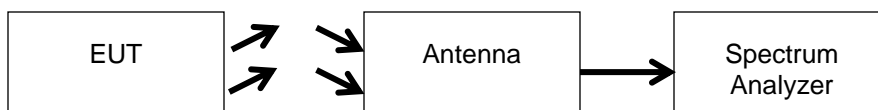
Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



Radiated Spurious Emissions Test Data: 30 MHz – 1000 MHz

Frequency (MHz)	Peak (dBuV/m)	C.F. (dB)	Calc (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity (V/H)	Height (cm)	Position (degrees)
51.32	14.37	8.75	23.12	40	-16.89	V	119	361
175.30	11.98	10.85	22.83	43.5	-20.67	V	119	361
319.35	7.31	15.86	23.17	46	-22.83	V	119	361
569.09	6.55	21.37	27.92	46	-18.08	V	119	361
725.09	7.15	23.55	30.70	46	-15.30	V	119	361
934.18	5.89	27.07	32.96	46	-13.04	V	119	361

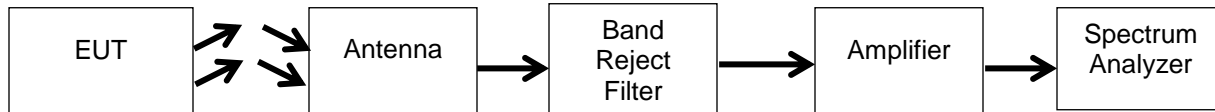
No other emissions were detectable. All emissions were greater than -20 dBc.



Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



Detector Settings	RBW (MHz)	VBW (MHz)	Span
Peak	1	3	As Necessary
Average	1	3	As Necessary

The only detectable spurious emissions were the 5th Harmonic which falls in a restricted band and that test data is recorded in the restricted band section of this test report.



Restricted Bands

Name of Test:

Restricted Bands

Engineer: Greg Corbin

Test Equipment Utilized:

i00175, i00271, i00331

Test Date: 6/26/2013

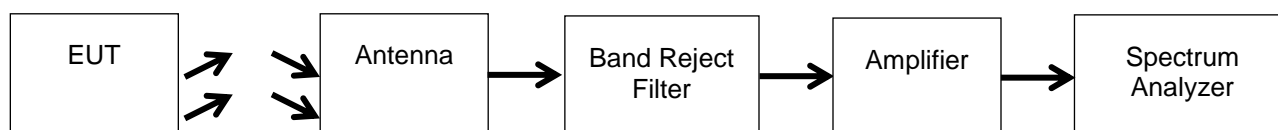
Test Procedure

For Restricted Band testing, the EUT was tested on an OATS (Open Area Test Site) with the EUT set 3m from the receiving antenna.

The test was performed per section 12.0 of KDB 558074 D01_DTS Measurement Guidance v03r01"

A spectrum analyzer was used to verify that the EUT met the requirements for restricted band for both peak and average measurements. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained. For the restricted band the amplifier and band reject filter correction factors were also input to the spectrum analyzer.

Restricted Band Test Setup



Restricted Band Emissions Summary

Restricted Band	Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Measured Value (dBuV/m)	Peak Limit (dBuV/m)	Average Measured Value (dBuV/m)	Average Limit (dBuV/m)	Result
2690 - 2900	906	2718	46.6	74.0	39.3	54.0	Pass
3600 - 4400	906	3624	44.0	74.0	38.6	54.0	Pass
4500 - 5150	906	4530	52.2	74.0	47.0	54.0	Pass
5350 - 5460	906	5436	44.3	74.0	38.9	54.0	Pass
2690 - 2900	914	2742	44.8	74.0	39.3	54.0	Pass
3600 - 4400	914	3656	44.6	74.0	39.3	54.0	Pass
4500 - 5150	914	4570	50.7	74.0	45.4	54.0	Pass
5350 - 5460	914	5484	44.3	74.0	38.6	54.0	Pass
2690 - 2900	924	2772	45.7	74.0	39.3	54.0	Pass
3600 - 4400	924	3696	46.12	74.0	39.2	54.0	Pass
4500 - 5150	924	4620	49.6	74.0	43.2	54.0	Pass
5350 - 5460	924	5544	44.4	74.0	38.5	54.0	Pass

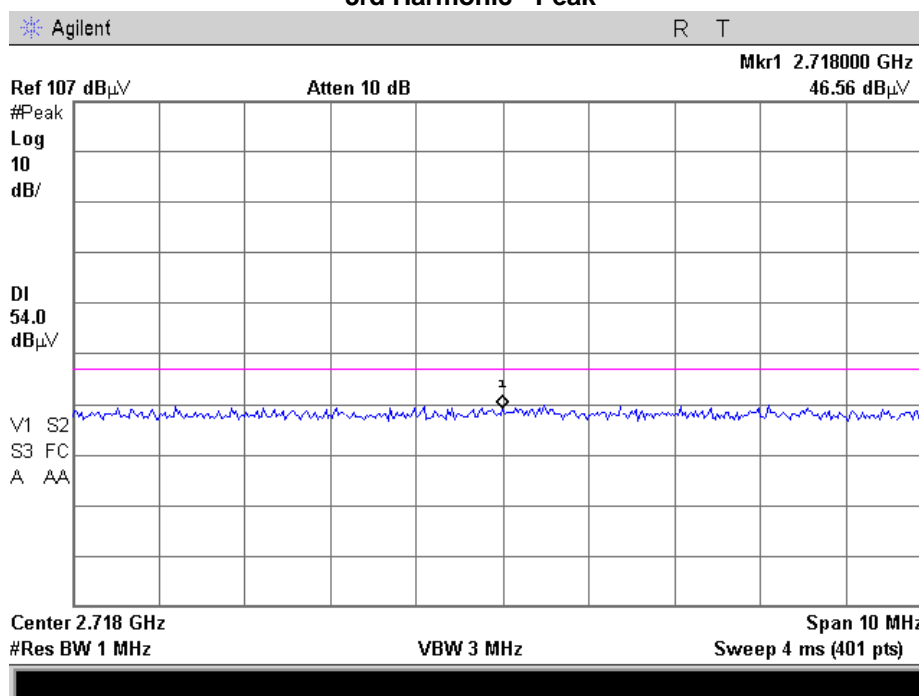
Several harmonics fall within the restricted bands.

The only detectable spurious emissions were the 5th harmonic.

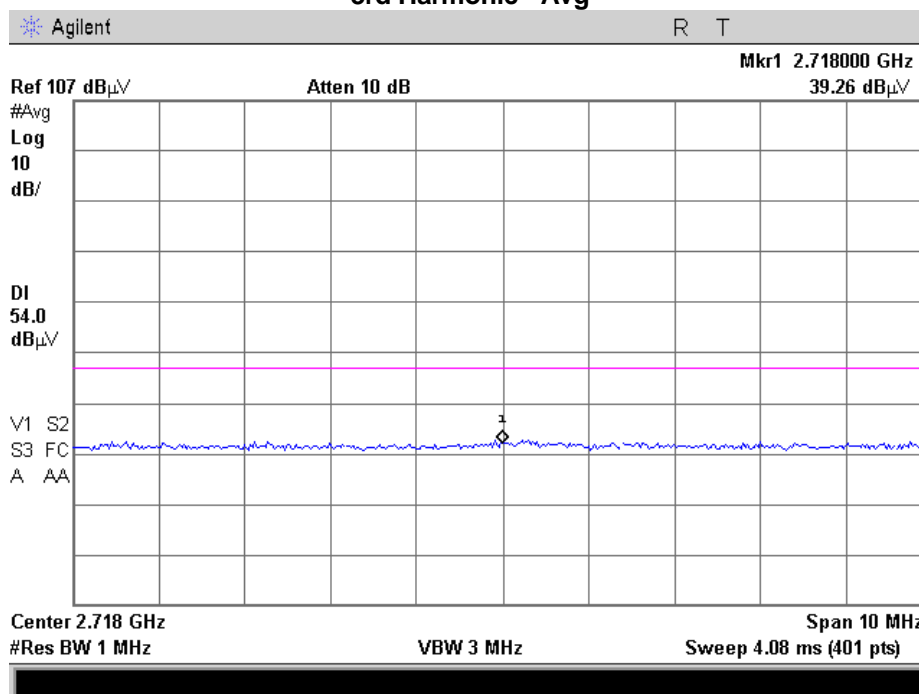
The rest of the measurements are noise floor measurements and are >6 dB below the limit



Tuned Frequency = 906 MHz
3rd Harmonic - Peak

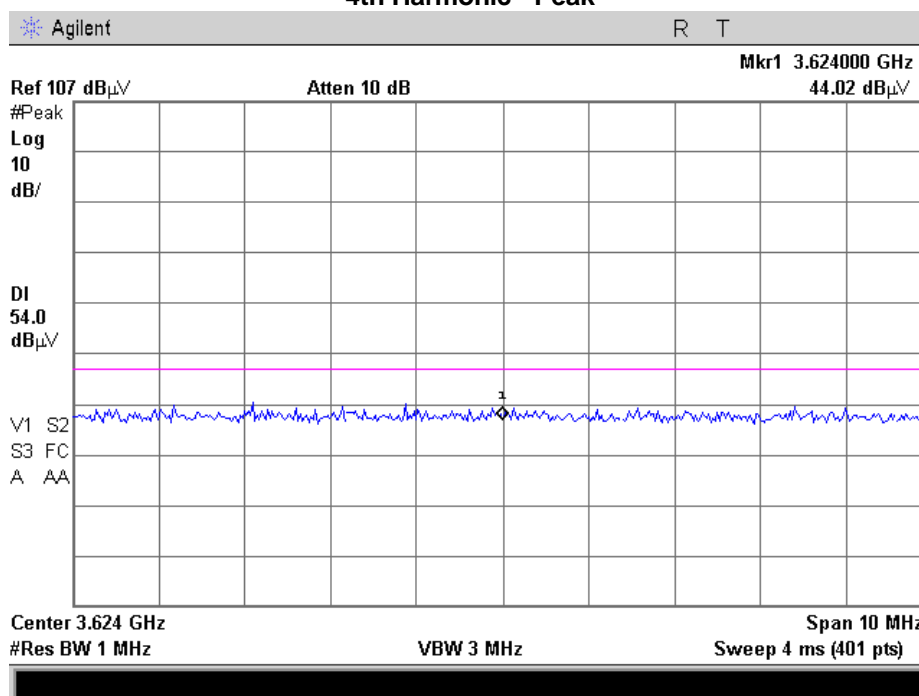


Tuned Frequency = 906 MHz
3rd Harmonic - Avg

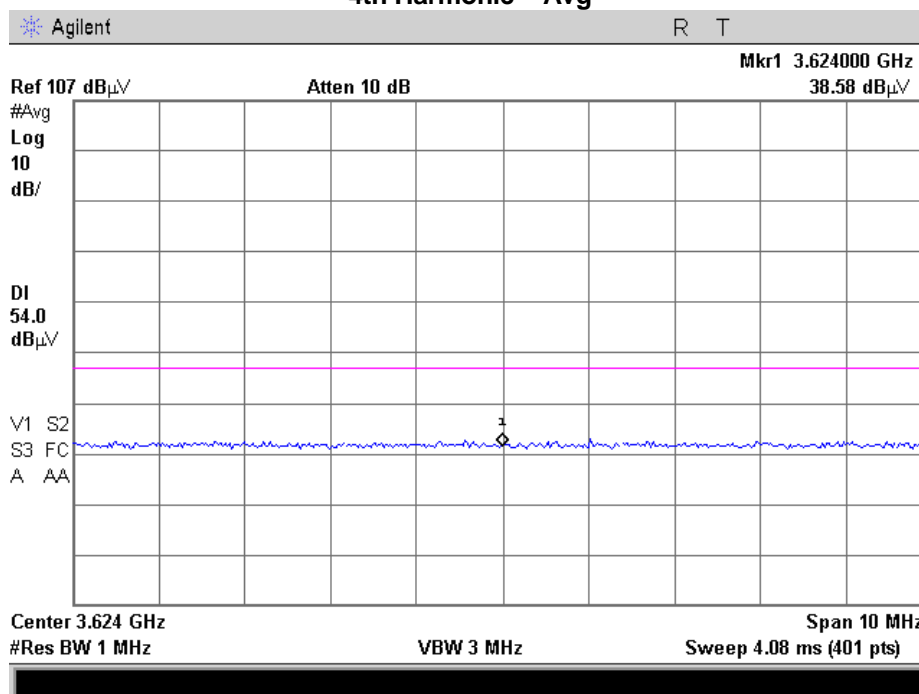




Tuned Frequency = 906 MHz
4th Harmonic - Peak

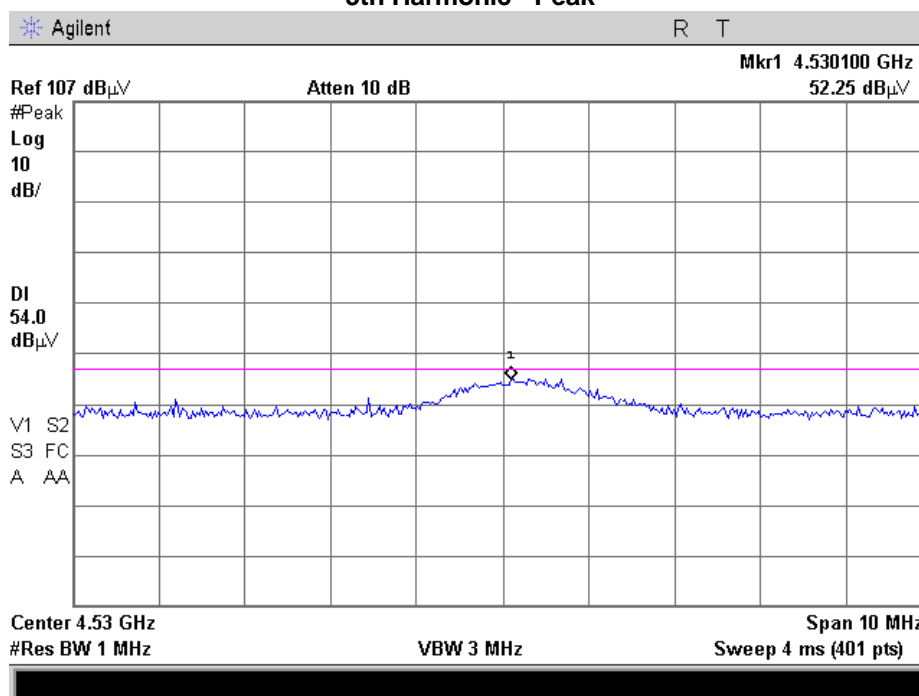


Tuned Frequency = 906 MHz
4th Harmonic - Avg

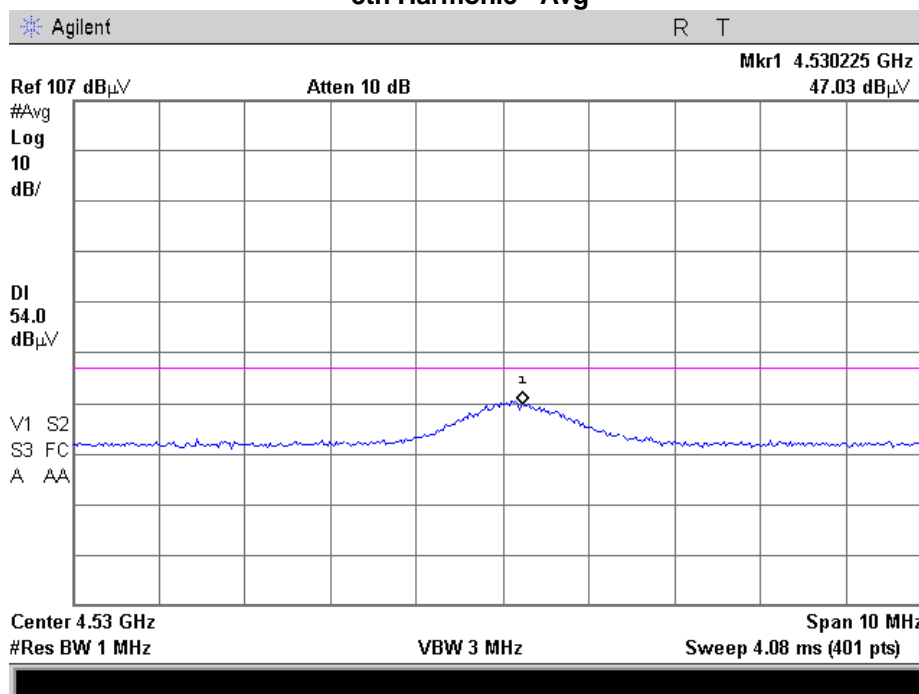




Tuned Frequency = 906 MHz
5th Harmonic - Peak

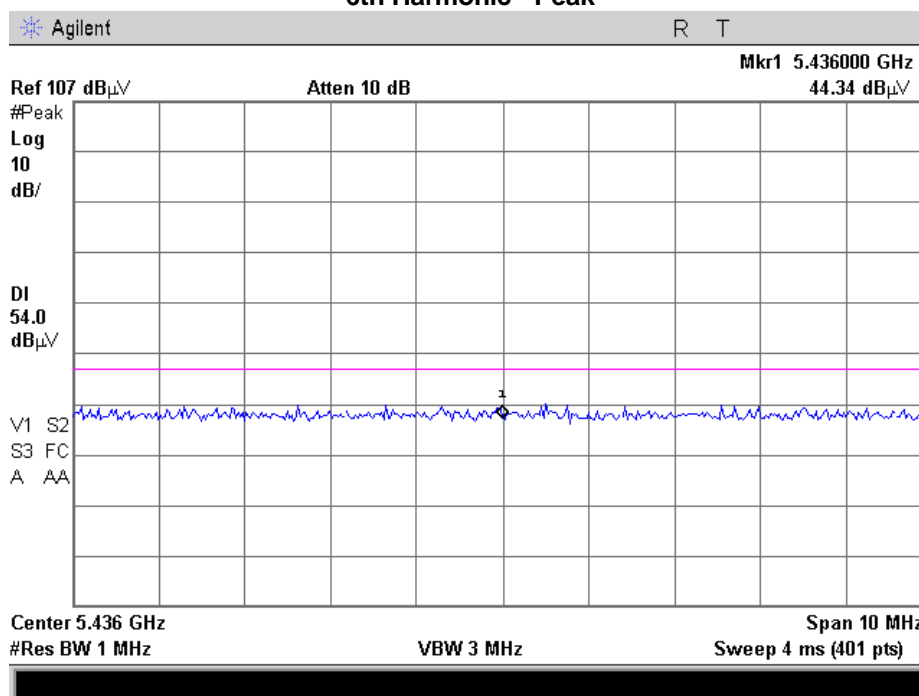


Tuned Frequency = 906 MHz
5th Harmonic - Avg

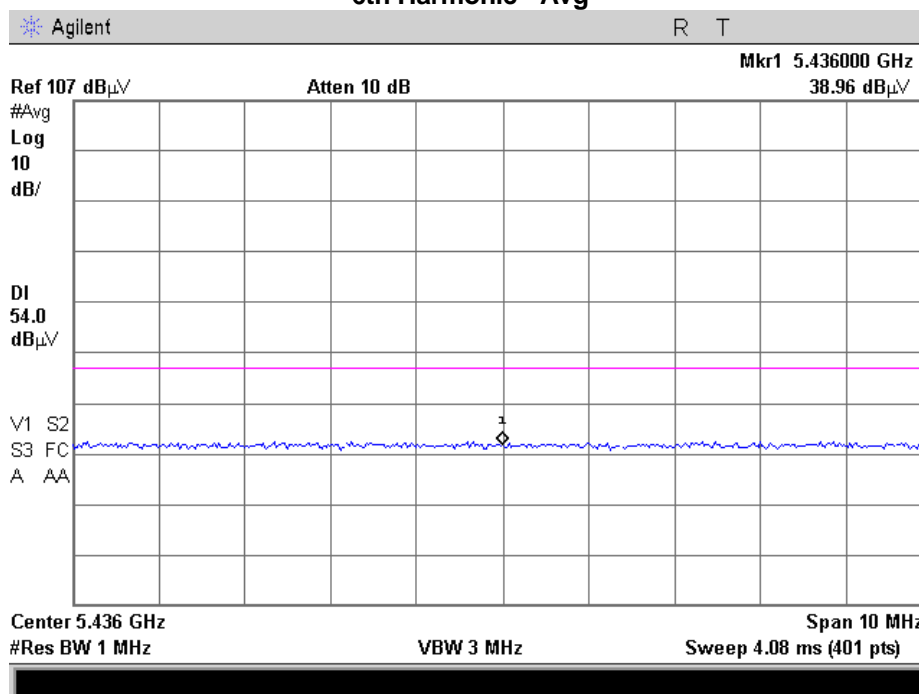




Tuned Frequency = 906 MHz
6th Harmonic - Peak

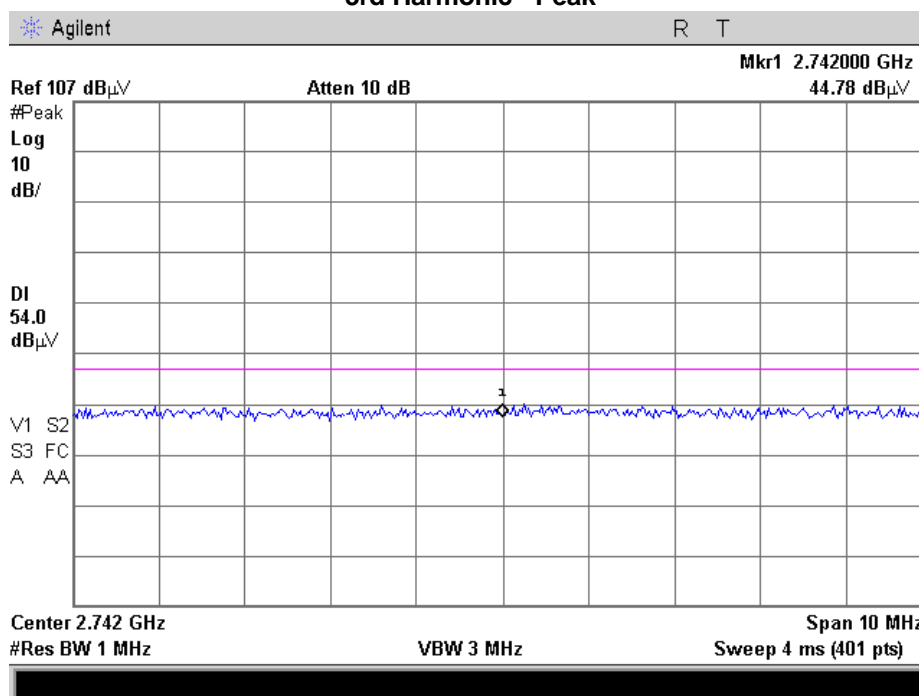


Tuned Frequency = 906 MHz
6th Harmonic - Avg

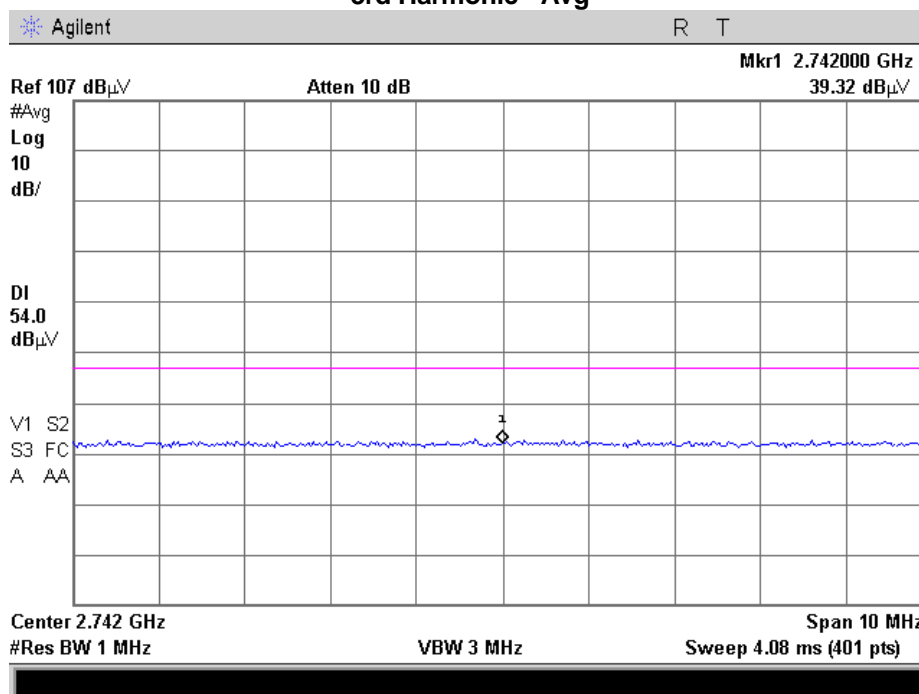




Tuned Frequency = 914 MHz
3rd Harmonic - Peak

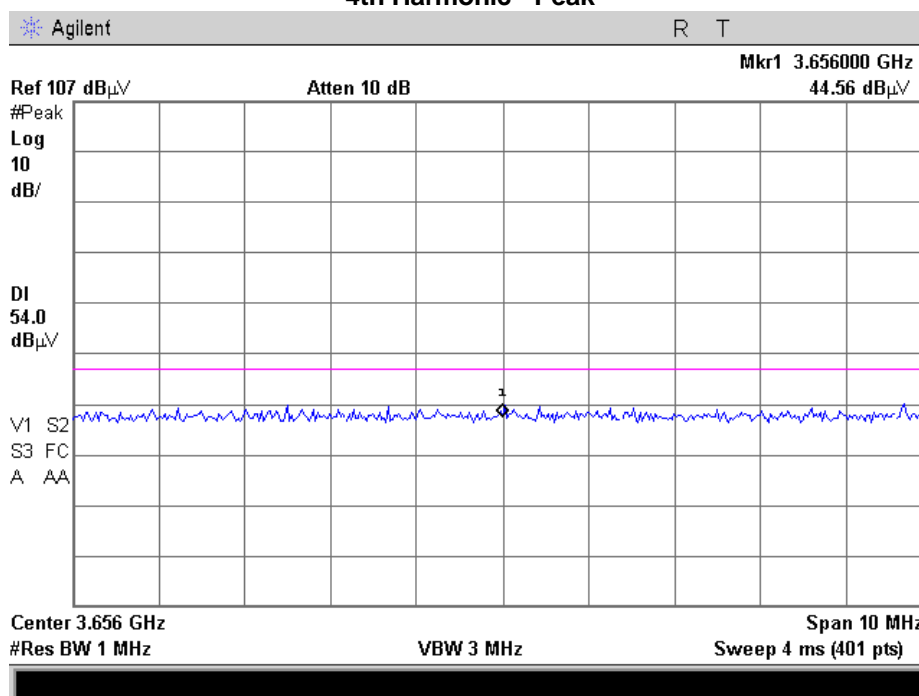


Tuned Frequency = 914 MHz
3rd Harmonic - Avg

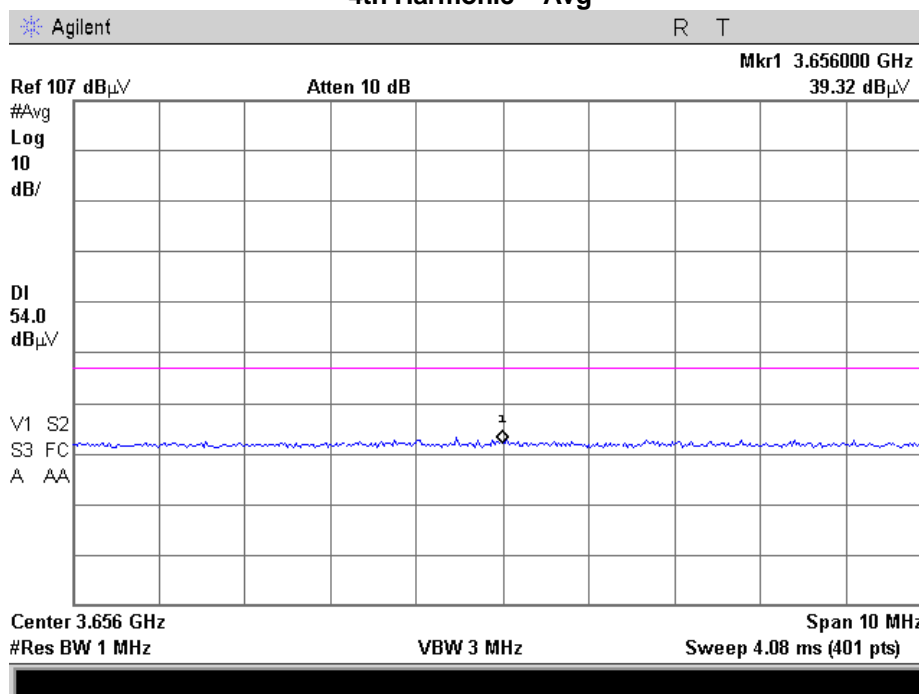




Tuned Frequency = 914 MHz
4th Harmonic - Peak

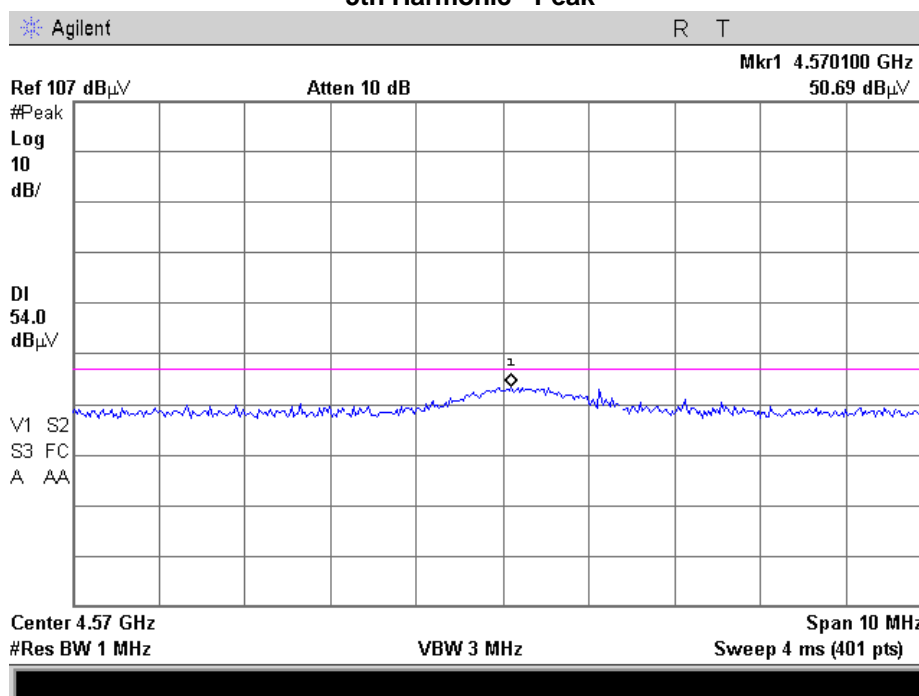


Tuned Frequency = 914 MHz
4th Harmonic - Avg

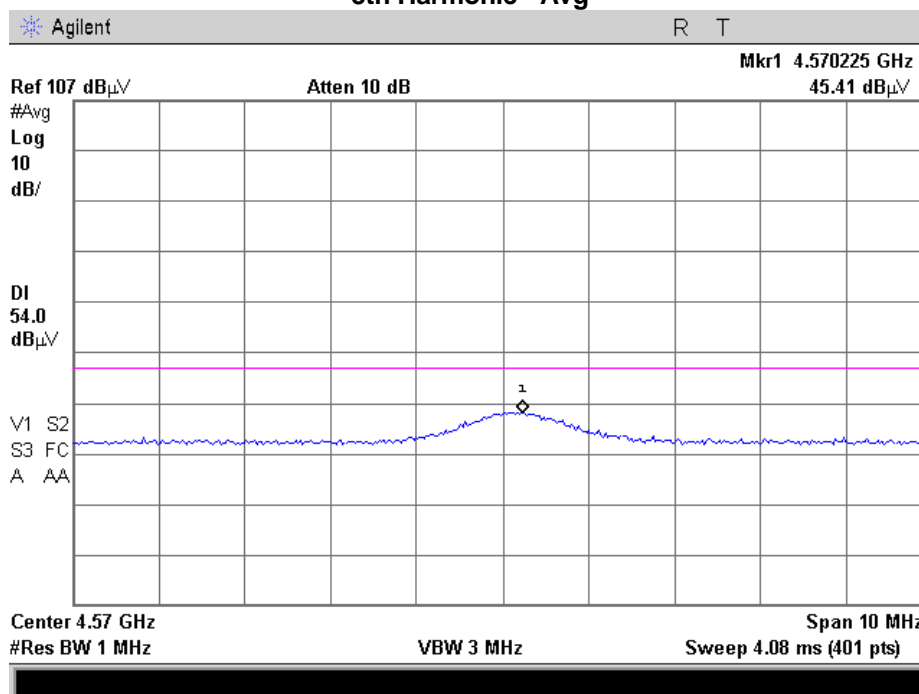




Tuned Frequency = 914 MHz
5th Harmonic - Peak

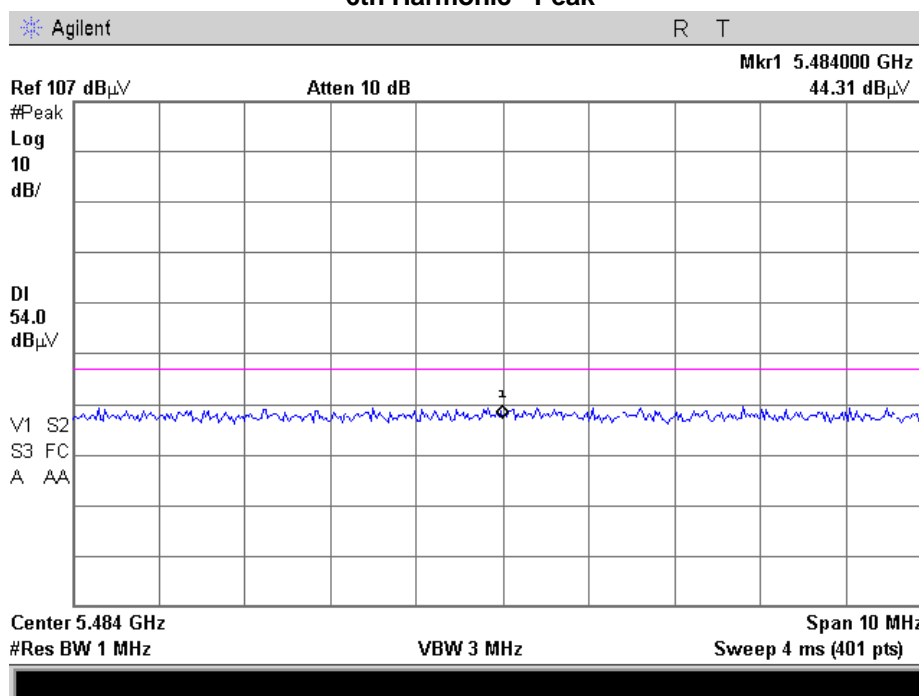


Tuned Frequency = 914 MHz
5th Harmonic - Avg

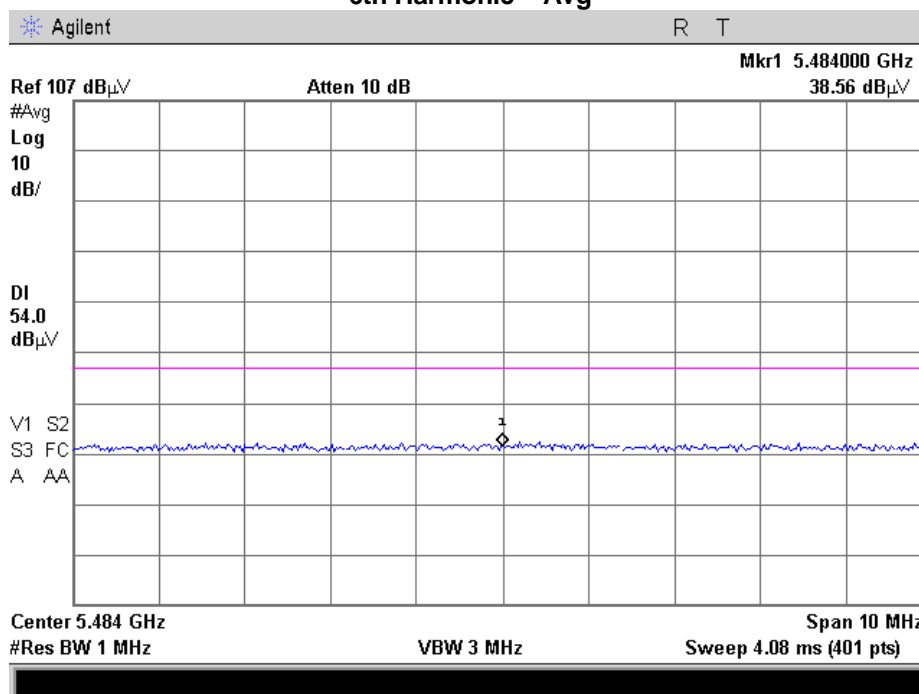




Tuned Frequency = 914 MHz
6th Harmonic - Peak

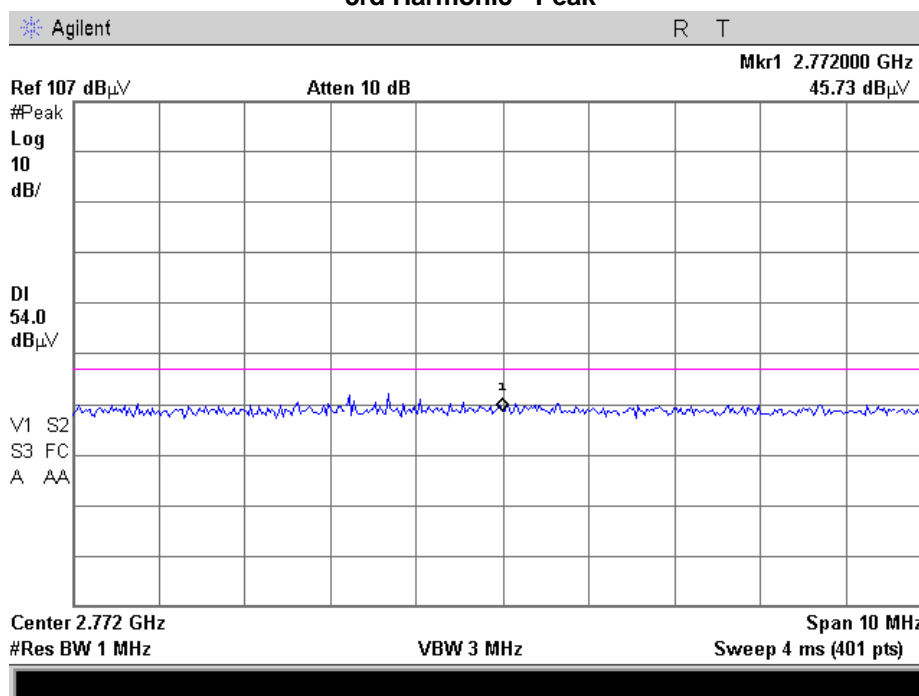


Tuned Frequency = 914 MHz
6th Harmonic - Avg

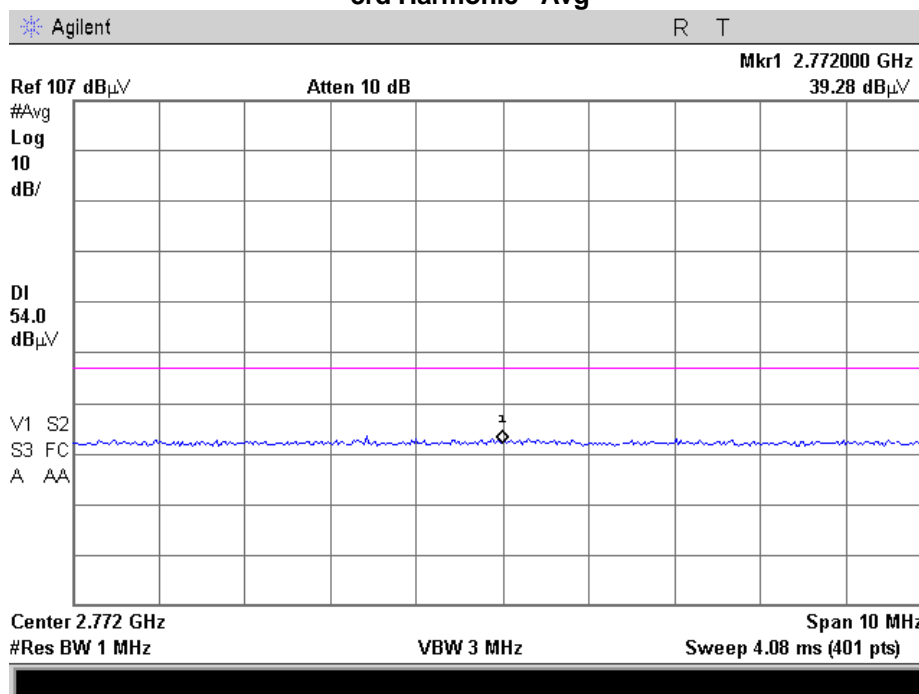




Tuned Frequency = 924 MHz
3rd Harmonic - Peak

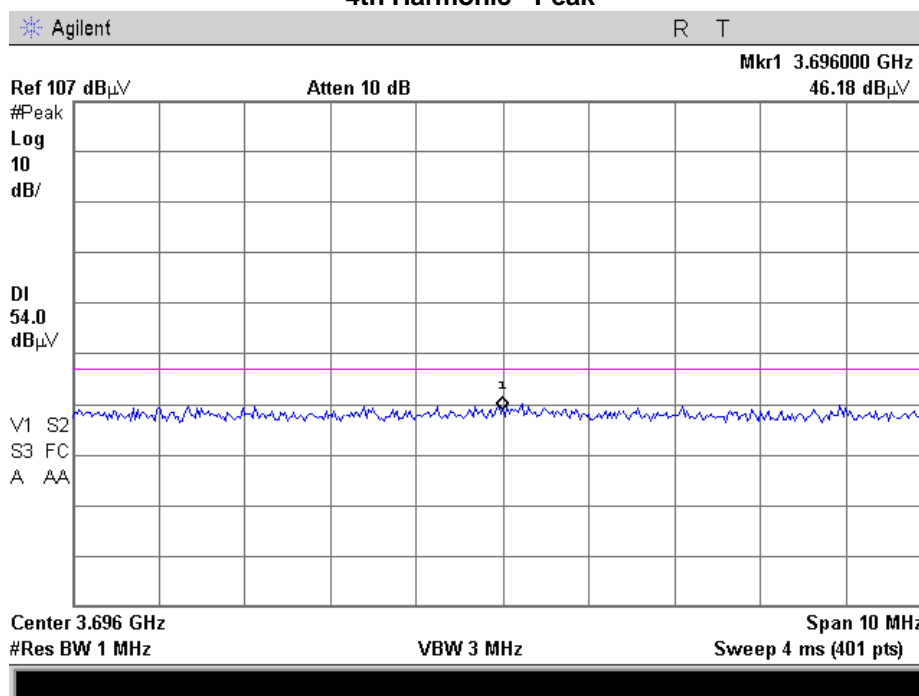


Tuned Frequency = 924 MHz
3rd Harmonic - Avg

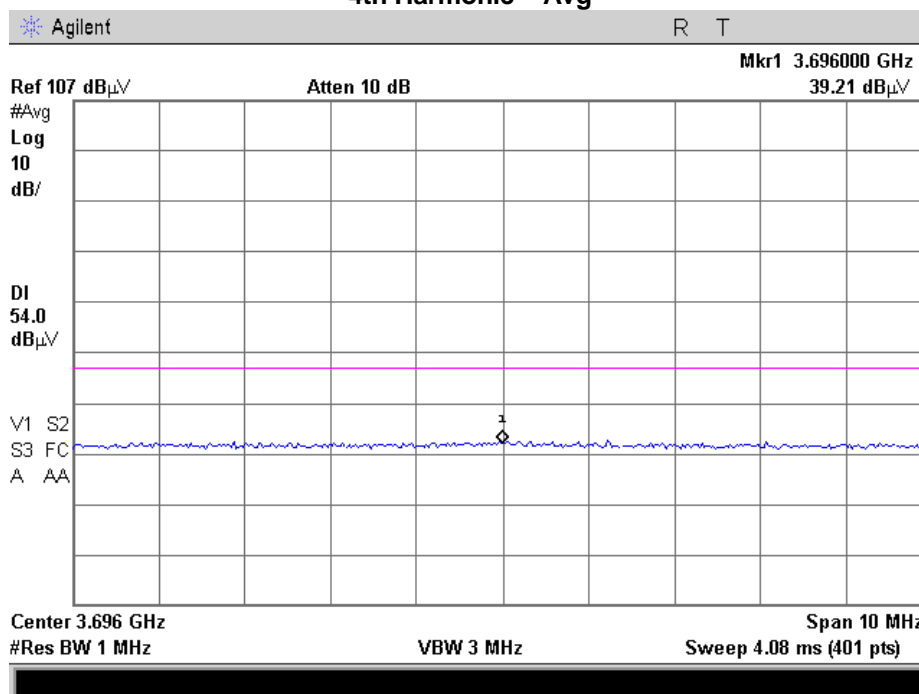




Tuned Frequency = 924 MHz
4th Harmonic - Peak

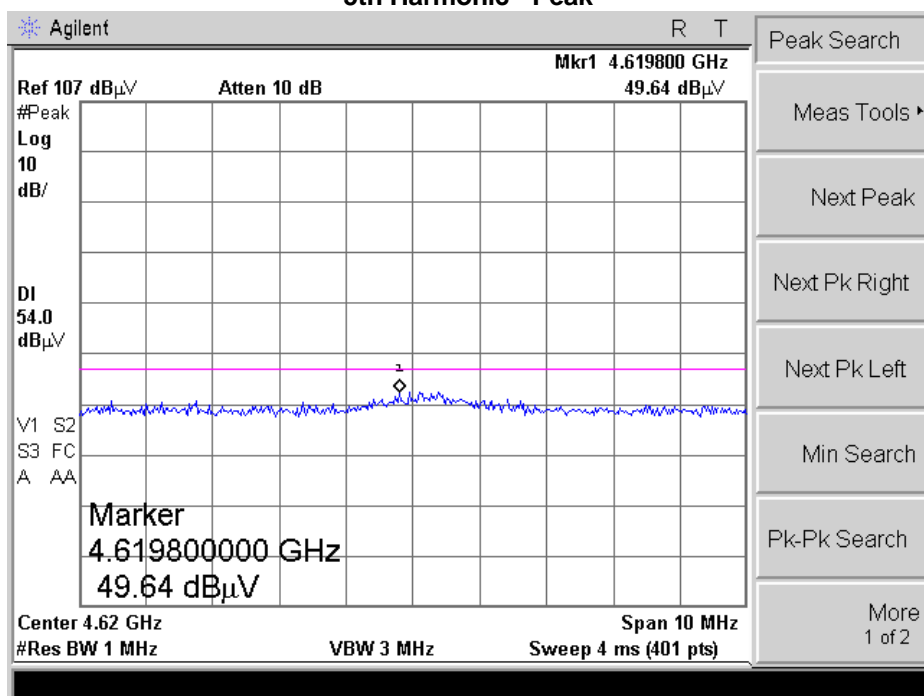


Tuned Frequency = 924 MHz
4th Harmonic - Avg

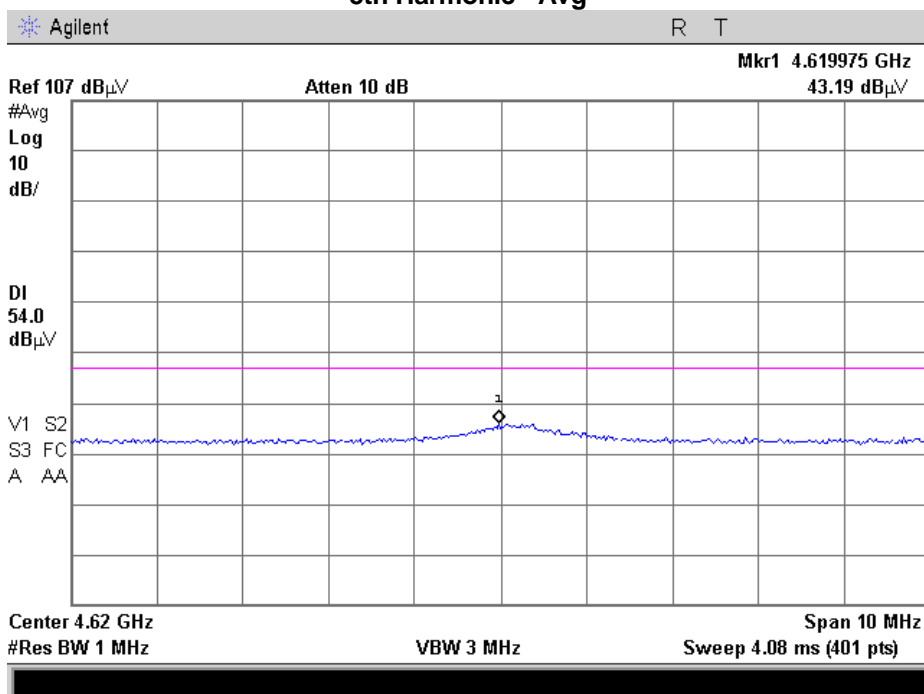




Tuned Frequency = 924 MHz
5th Harmonic - Peak

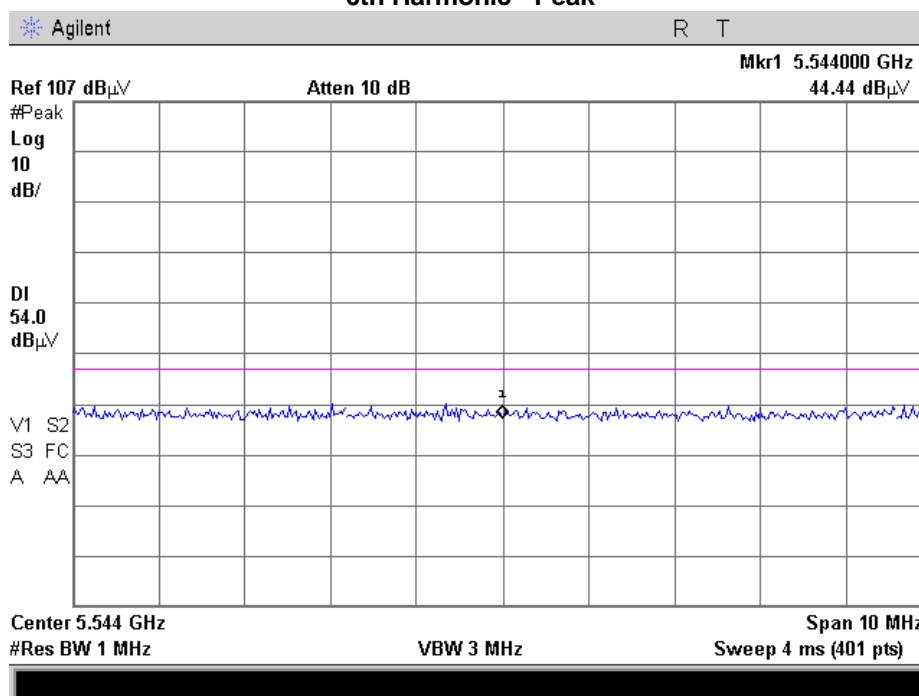


Tuned Frequency = 924 MHz
5th Harmonic - Avg

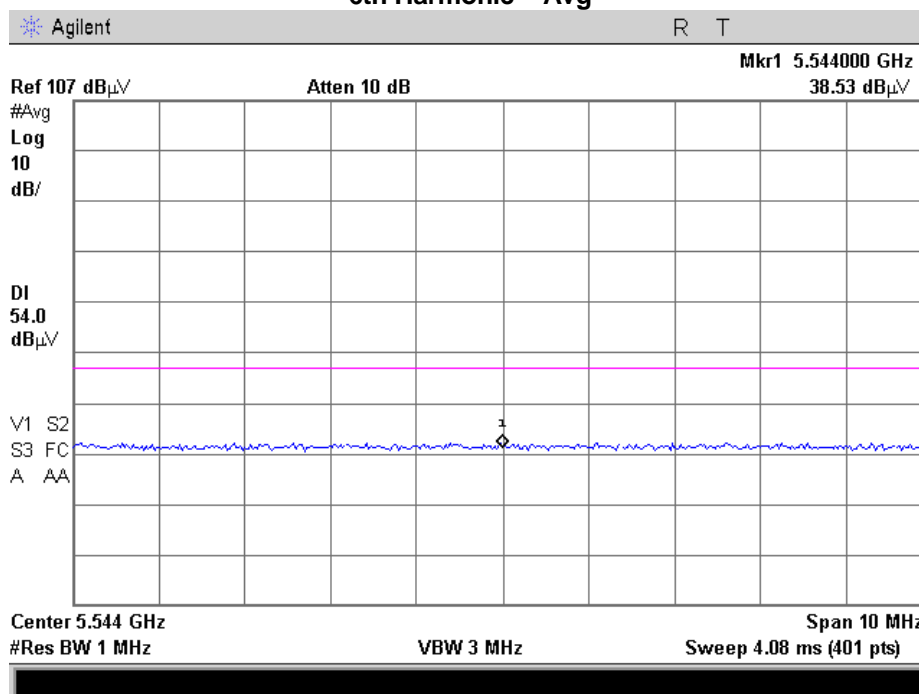




Tuned Frequency = 924 MHz
6th Harmonic - Peak



Tuned Frequency = 924 MHz
6th Harmonic - Avg





Emissions at Band Edges

Name of Test:

Emissions at Band Edges

Engineer: Greg Corbin

Test Equipment Utilized:

i00331

Test Date: 6/26/2013

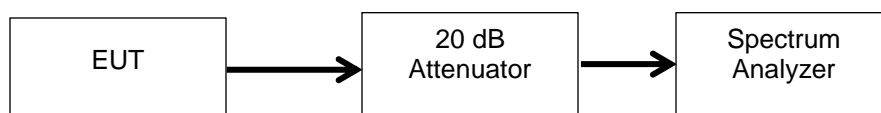
Test Procedure

For Band Edge testing the EUT was configured for conducted measurements as shown.

The test was performed per section 13.0 of KDB 558074 D01_DTS Measurement Guidance v03r01".

The cable and attenuator correction factors were entered into the spectrum analyzer as reference level offsets before recoding the final data.

Band Edge Test Setup

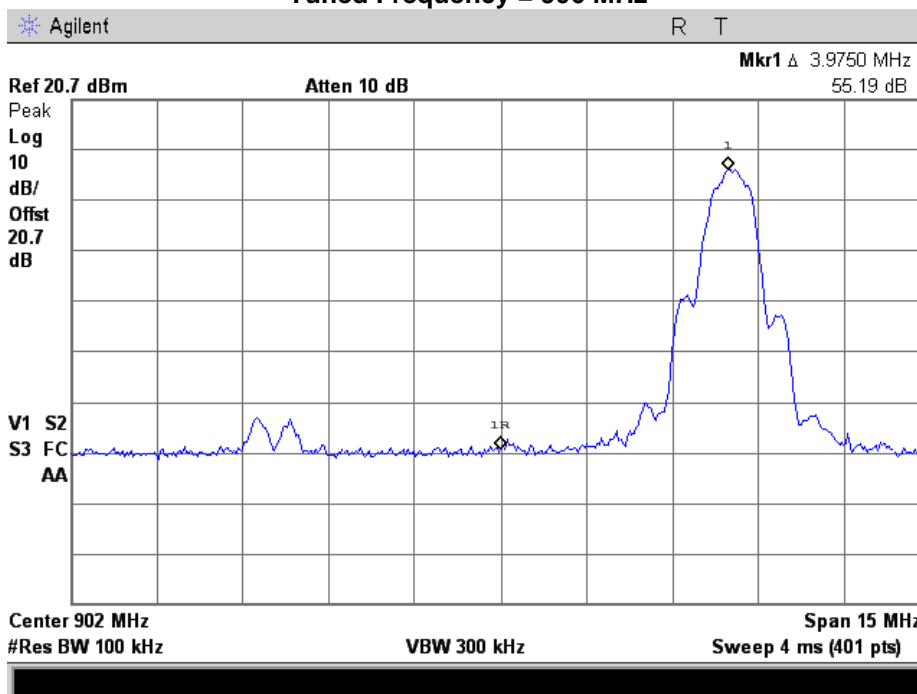


Band Edge Emissions Summary

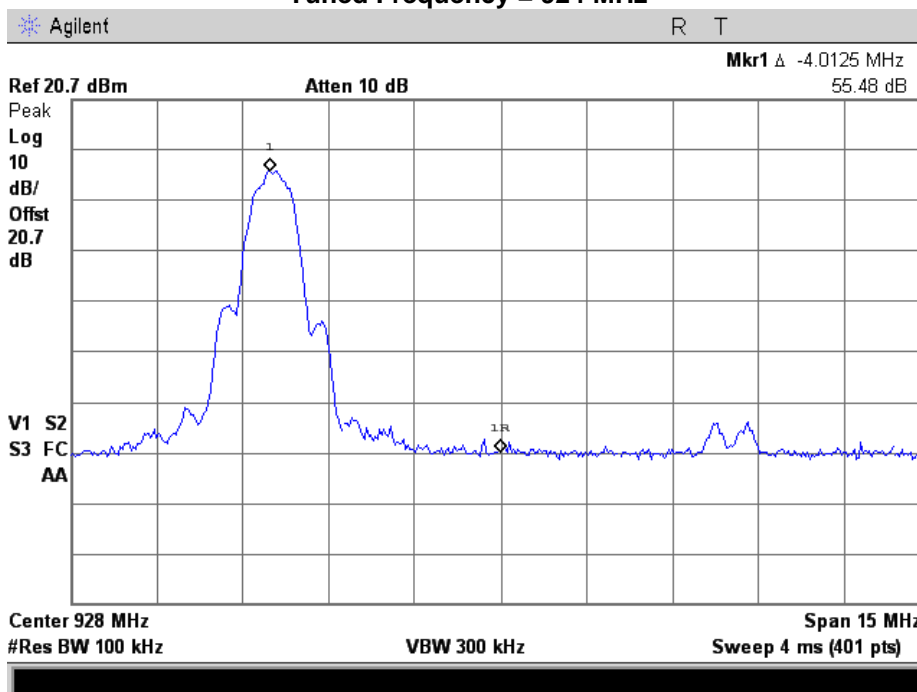
Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
906	902	-55.2	Peak	-20 dBc	Pass
924	926	-55.5	Peak	-20dBc	Pass



Band Edge 902 MHz Tuned Frequency = 906 MHz



Band Edge 928 MHz Tuned Frequency = 924 MHz





Occupied Bandwidth

Name of Test: DTS Bandwidth
Test Equipment Utilized: i00331

Engineer: Greg Corbin
Test Date: 6/26/2013

Test Procedure

The EUT was connected as shown.

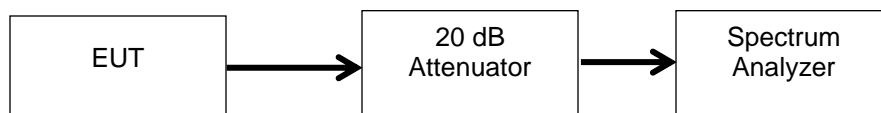
The test was performed per section 8.0 of KDB 558074 D01_DTS Measurement Guidance v03r01".

The Span was set wide enough to capture the entire transmit spectrum. The analyzer was set to max hold and when the entire spectrum was captured the 6dB bandwidths were measured to verify the bandwidth met the specification.

RBW = 100 kHz

VBW = 300 kHz

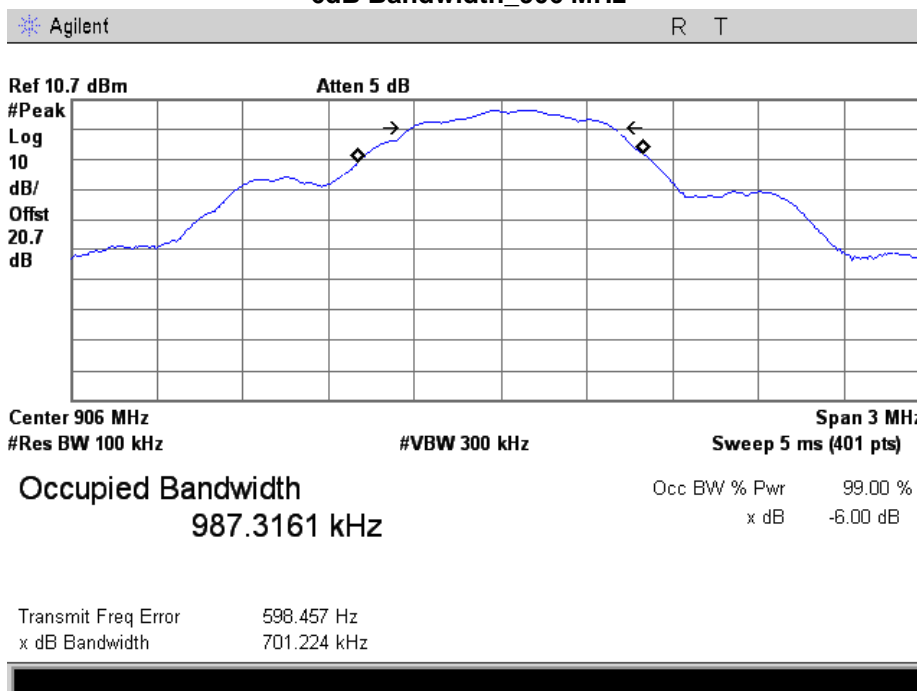
Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Specification Limit (kHz)	Result
906	701.224	≥ 500	Pass
914	696.546	≥ 500	Pass
924	694.994	≥ 500	Pass

6dB Bandwidth_906 MHz

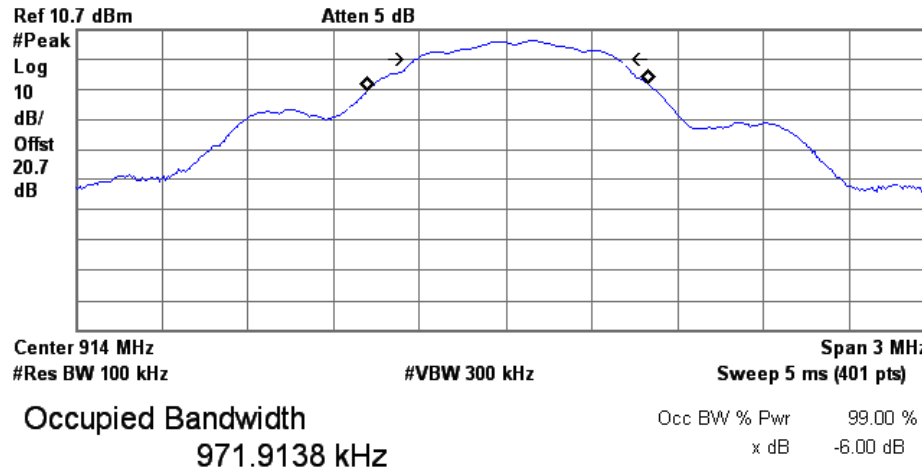




6dB Bandwidth_914 MHz

Agilent

R T

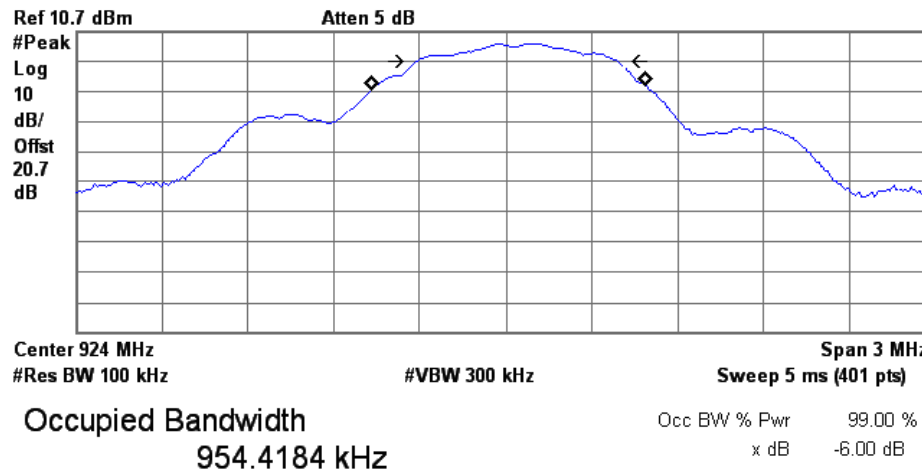


Transmit Freq Error 8.615 kHz
x dB Bandwidth 696.546 kHz

6dB Bandwidth_924 MHz

Agilent

R T



Transmit Freq Error 8.838 kHz
x dB Bandwidth 694.994 kHz



Transmitter Power Spectral Density (PSD)

Name of Test: Transmitter Power Spectral Density (PSD)
Test Equipment Utilized: i00331

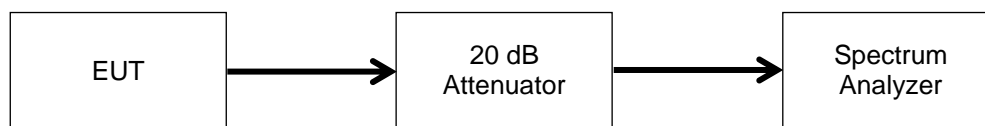
Engineer: Greg Corbin
Test Date: 6/26/2013

Test Procedure

The EUT was connected as shown in the test set-up.

The test was performed per section 10.2 of KDB 558074 D01_DTS Measurement Guidance v03r01”.

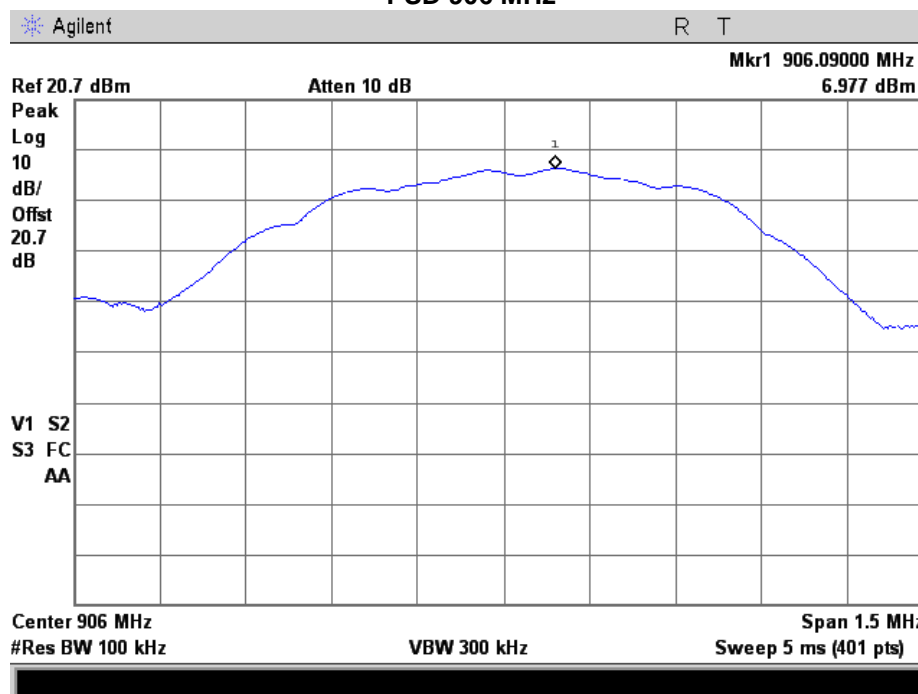
Test Setup



PSD Summary

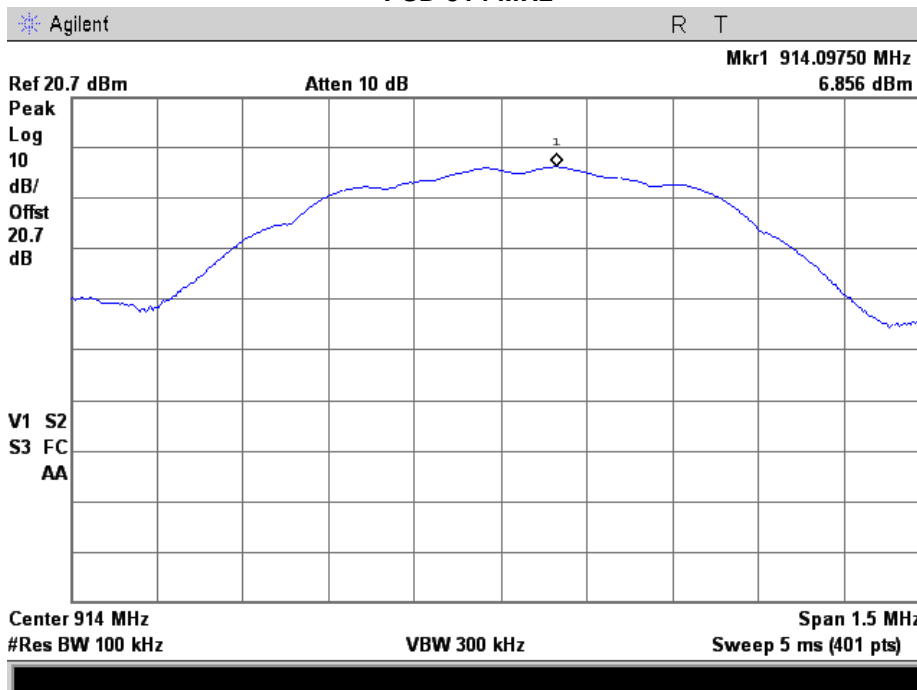
Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
906	6.97	8	Pass
914	6.85	8	Pass
924	6.61	8	Pass

PSD 906 MHz

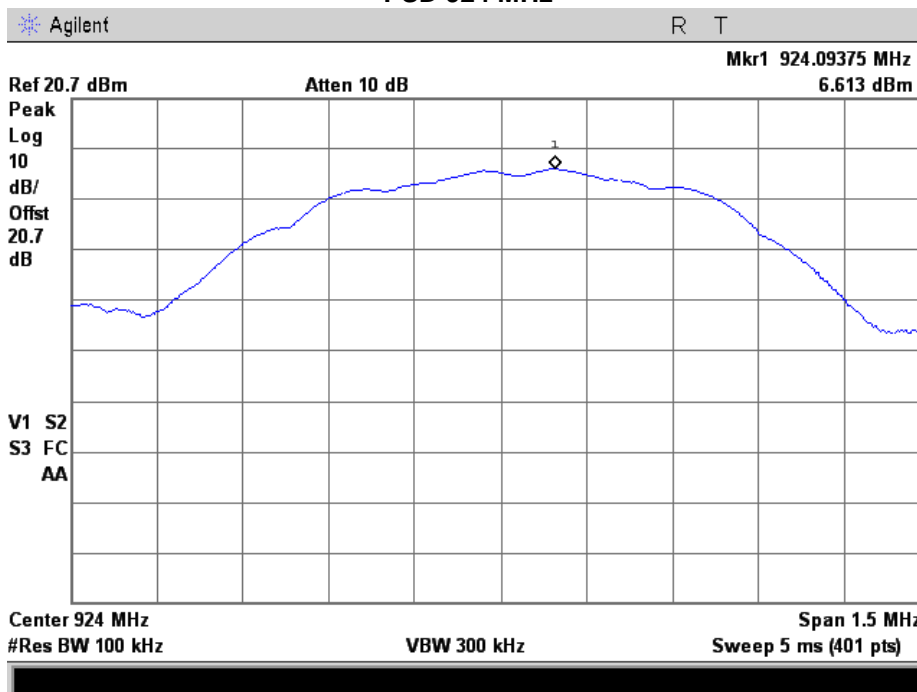




PSD 914 MHz



PSD 924 MHz





A/C Powerline Conducted Emission

Name of Test:

A/C Powerline Conducted Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

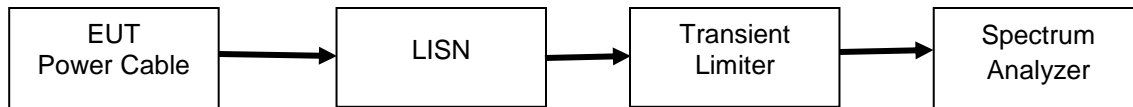
i00123, i00270, i00362, i00379

Test Date: 2/17/2014

Test Procedure

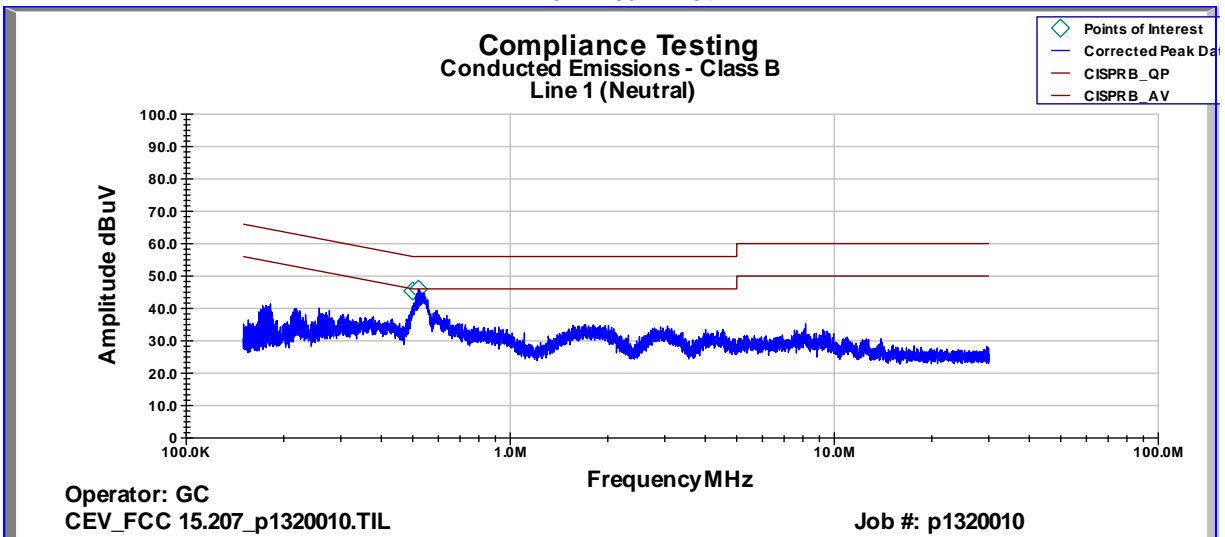
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup

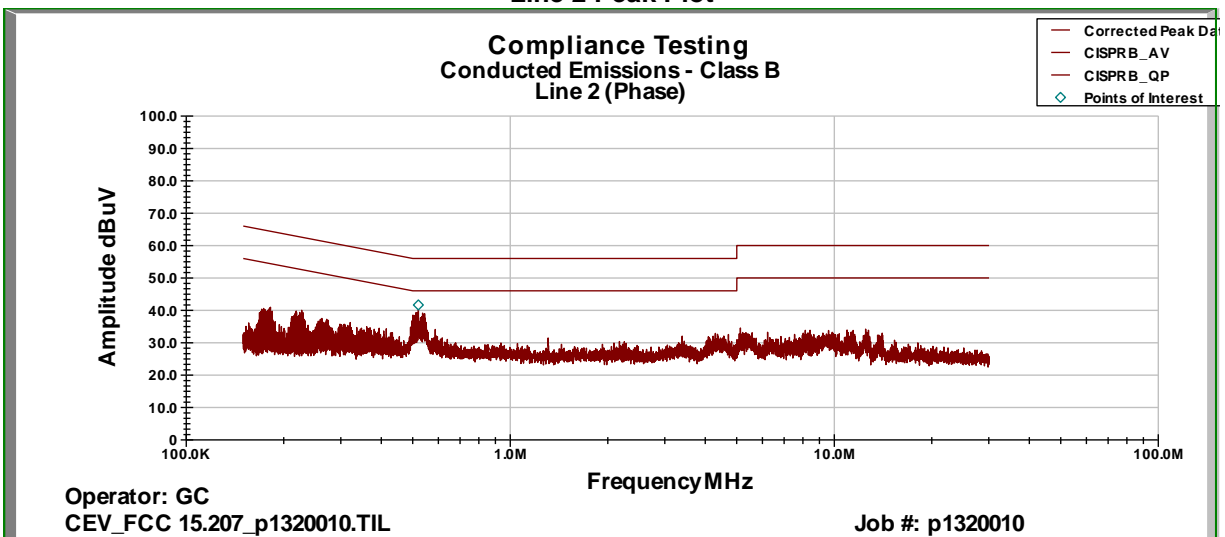


Conducted Emission Test Results

Line 1 Peak Plot



Line 2 Peak Plot





Line 1 Neutral Avg Detector

Frequency (KHz)	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
517.9	14.5	0.1	0.03	10.1	24.732	46	-21.268
520.97	14.5	0.1	0.03	10.1	24.732	46	-21.268

Line 2 Phase Avg Detector

Frequency (KHz)	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
524.52	14.5	0.1	0.03	10.1	24.732	46	-21.268

Line 1 Neutral QP Detector

Frequency (KHz)	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
517.9	31.496	0.1	0.03	10.1	41.726	56	-14.274
520.97	32.699	0.1	0.03	10.1	42.929	56	-13.071

Line 2 Phase QP Detector

Frequency (KHz)	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
524.52	24.81	0.1	0.03	10.1	35.044	56	-20.956



Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Power Supply	Kenwood	PR18-3A	i00008	Verified on: 6/26/13	
EMI Receiver	HP	8546A	i00033	12/27/12	12/27/13
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 2/17/14	
High Pass Filter	Trilithic	X2H11R00	i00175	Verified on: 6/26/13	
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/11	12/19/13
LISN	FCC	FCC LISN 50-32-2-01	i00270	10/5/12	10/5/14
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13
Voltmeter	Fluke	87III	i00319	7/3/12	7/3/13
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14
AC Power Source	Behlman	BL 6000	i00362	Verified on: 2/17/14	
EMI Analyzer	Agilent	E7405A	i00379	1/14/14	1/14/15

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT