



LSRESEARCH, LLC

Wireless Product Development

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ENGINEERING TEST REPORT # TR 315103 C

LSR Job #: C-2210

Compliance Testing of:

OneExpert CATV

Test Date(s):

April-June 2015

Prepared For:

JDSU

5808 Churchman Bypass

Indianapolis, IN 46203

This Test Report is issued under the Authority of: Tom Smith, VP EMC Test Services

Signature:

Date: 9-1-15

Test Report Reviewed by:

Tom Smith, VP EMC Test Services

Signature:

Date: 8-7-15

Report by:

Adam Alger, EMC Engineer

Signature:

Date: 8-3-15

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Prepared For: JDSU

Report: TR 315103 C

LSR: C-2210

Name: OneExpert CATV

Model: OneExpert CATV

Serial: Eng. Sample

Table of Contents

i.	Title Page	1
ii.	Table of Contents	2
iii.	LS Research, LLC in Review	3
1.0	Summary of Test Report.....	4
2.0	Test Facilities	6
3.0	Client Information.....	7
3.1	Equipment Under Test (EUT) Information.....	7
3.2	Product Description	7
3.3	Modifications Incorporated In the EUT for Compliance Purposes	7
3.4	Deviations & Exclusions from Test Specifications	7
3.5	Additional Information	7
4.0	Conditions of Test.....	8
5.0	Test Equipment	8
6.0	Conformance Summary	8
	Appendix A – Test Equipment	9
	Appendix B – Test Data.....	10
	B.1 – RF Conducted Emissions	10
	B.2 – Transmitter Radiated Emissions.....	26
	B.3 – AC Mains Conducted Emissions	40
	Appendix C - Uncertainty Summary	43
	Appendix D - References.....	44

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:



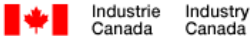
A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01



Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756



Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088



U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

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Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

1.0 Summary of Test Report

In April-June 2015 the EUT, OneExpert CATV, as supplied by JDSU was tested and MEETS the following requirements:

Operation in the 5.15 – 5.25 GHz band

FCC Rule Part	IC Standard	Test Description	Measurement Procedure	Test Result
15.407 (a)(1)(iv)	RSS-247 Section 6.2.1	Power Limits	ANSI C63.10-2013 Section 12.3	Pass
15.407 (a)(1) (iv)	RSS-247 Section 6.2.1	Power Spectral Density	ANSI C63.10-2013 Section 12.5	Pass
15.407 (a)(5)	RSS-247 Section 6.2.1	26dB / 99% Bandwidth	ANSI C63.10-2013 Section 12.4	Pass
15.407 (b)(1)	RSS-247 Section 6.2.1	Undesirable emissions Limit	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(6)	RSS-GEN	Spurious Emissions below 1GHz & AC Mains	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(7)	RSS-GEN	Restricted Bands	ANSI C63.10-2013 Section 12.7	Pass
15.407 (g)	RSS-GEN	Frequency Stability	ANSI C63.10-2013 Section 6.8	Pass
15.109	RSS-GEN	Receive Mode (Digital Device) Radiated Emissions	ANSI C63.4-2014 Section 8	Pass

Prepared For: JDSU

Name: OneExpert CATV

Report: TR 315103 C

Model: OneExpert CATV

LSR: C-2210

Serial: Eng. Sample

Operation in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands

FCC Rule Part	IC Standard	Test Description	Measurement Procedure	Test Result
15.407 (a)(2)	RSS-247 Section 6.2.2	Power Limits	ANSI C63.10-2013 Section 12.3	Pass
15.407 (a)(2)	RSS-247 Section 6.2.2	Power Spectral Density	ANSI C63.10-2013 Section 12.5	Pass
15.407 (a)(5)	RSS-247 Section 6.2.2	26dB / 99% Bandwidth	ANSI C63.10-2013 Section 12.4	Pass
15.407 (b)(2) & (3)	RSS-247 Section 6.2.2	Undesirable emissions Limit	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(6)	RSS-GEN	Spurious Emissions below 1GHz & AC Mains	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(7)	RSS-GEN	Restricted Bands	ANSI C63.10-2013 Section 12.7	Pass
15.407 (g)	RSS-GEN	Frequency Stability	ANSI C63.10-2013 Section 6.8	Pass
15.407 (h)(1)	RSS-247 Section 6.2.2	Transmit Power Control (TPC)	N/A**	N/A**
15.407 (h)(2)	RSS-247 Section 6.3	Dynamic Frequency Selection	Note 2	Pass ¹
15.407 (h)(2)(ii)	RSS-247 Section 6.3	Channel Availability Check Time	N/A*	N/A*
15.407 (h)(2)(iii)	RSS-247 Section 6.3	Channel Move Time	Note 2	Pass ¹
15.407 (h)(2)(iv)	RSS-247 Section 6.3	Non-Occupancy period	Note 2	Pass ¹
15.109	RSS-GEN	Receive Mode (Digital Device) Radiated Emissions	ANSI C63.4-2014 Section 8	Pass

* : The EUT is a client device

** : The EUT has an EIRP of less than 500mW.

Note 1: Not covered in this test report. See DFS report.

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

Operation in the 5.725 – 5.85 GHz band

FCC Rule Part	IC Standard	Test Description	Measurement Procedure	Test Result
15.407 (a)(3)	RSS-247 Section 6.2.4	Power Limits	ANSI C63.10-2013 Section 12.3	Pass
15.407 (a)(3)	RSS-247 Section 6.2.4	Power Spectral Density	ANSI C63.10-2013 Section 12.5	Pass
15.407 (a)(5)	RSS-247 Section 6.2.4	26dB / 99% Bandwidth	ANSI C63.10-2013 Section 12.4	Pass
15.407 (b)(4)	RSS-247 Section 6.2.4	Undesirable emissions Limit	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(6)	RSS-GEN	Spurious Emissions below 1GHz & AC Mains	ANSI C63.10-2013 Section 12.7	Pass
15.407 (b)(7)	RSS-GEN	Restricted Bands	ANSI C63.10-2013 Section 12.7	Pass
15.407 (g)	RSS-GEN	Frequency Stability	ANSI C63.10-2013 Section 6.8	Pass
15.407(e)	RSS-247 Section 6.2.4	Minimum 6dB bandwidth	ANSI C63.10-2013 Section 11.8	Pass

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

3.0 Client Information

Manufacturer Name:	JDSU
Address:	5808 Churchman Bypass Indianapolis, IN 46203
Contact Person:	Adam Nowotarski

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	OneExpert CATV
Model Number:	OneExpert CATV
Serial Number:	Eng. Sample
FCC ID:	WUW-22100382
IC:	9613A-22100382

3.2 Product Description

802.11 a/n device using HT20 channels
Device does not transmit BT and WLAN simultaneously

3.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test

3.5 Additional Information

EUT programmed for continuous transmit or receive on selectable channel and data rate (modulation) using hyper terminal program connection via programming port on EUT.
Device does not utilize channel 48 and 52.

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Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

4.0 Conditions of Test

Environmental:

Temperature: 20-25° C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage: 120 VAC 60 Hz

5.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

6.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Subpart E Part as well as RSS-247 Issue 1 and RSS-GEN Issue 4.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

Appendix A – Test Equipment



Date : 22-Apr-2015 Type Test : Emissions Job # : C-2210
 Prepared By: Shane Rismeyer Customer : JDSU Quote #: 315103

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	10/19/2014	10/19/2015	Active Calibration
2	EE 960088	8GHz MIXE Spectrum Analyzer	Agilent	N9038A	MY51210138	1/9/2015	1/9/2016	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	33146	9701-4855	1/19/2015	1/19/2016	Active Calibration
4	AA 960150	Biconical Antenna	ETS	3110B	0003-3346	1/22/2015	1/22/2016	Active Calibration
5	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	8/20/2014	8/20/2015	Active Calibration
6	AA 960137	Standard Gain Horn Ant.	EMCO	3160-10	69259	8/20/2014	8/20/2015	Active Calibration
7	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	6/20/2014	6/20/2015	Active Calibration
8	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213K-S+	740411007	6/20/2014	6/20/2015	Active Calibration
9	AA 960161	Highpass Filter	K&L Microwave	11SH10-8000	2	2/6/2015	2/6/2016	Active Calibration
10	EE 960089	LISN - 15A	COM-POWER	LI-215A	191943	3/2/2015	3/2/2016	Active Calibration

Project Engineer: *Shane Rismeyer*

Quality Assurance: *Peter Finken*

Prepared For: JDSU
 Report: TR 315103 C
 LSR: C-2210

Name: OneExpert CATV
 Model: OneExpert CATV
 Serial: Eng. Sample

Appendix B – Test Data
B.1 – RF Conducted Emissions

Manufacturer	JDSU
Test Location	LS Research, LLC
Rule Part	FCC Subpart E IC RSS-247
General Measurement Procedure	ANSI C63.10 Section 6.7
General Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

B.1.1 – RF Conducted – Fundamental Bandwidth

Manufacturer	JDSU
Date	5-28, 29, 6-24 2015
Operator	Shane R. / Peter F.
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407 (a)(5) & (e) RSS-247 Section 6
Specific Measurement Procedure	ANSI C63.10-2013 Section 12.4 & 11.8
Additional Description of Measurement	Peak detector used
Additional Notes	Continuous transmit modulated used for this test.

**Table
UNII-1**

Mode (802.11)	Mode (Mbps)	Channel	Frequency (MHz)	99 % BW (MHz)	EBW (MHz)
a	6	36	5180	16.410	20.760
		40	5200	16.423	21.470
		44	5220	16.780	24.560
n	6.5	36	5180	17.618	21.650
		40	5200	17.633	21.990
		44	5220	17.820	26.020

UNII-2A

Mode (802.11)	Mode (Mbps)	Channel	Frequency (MHz)	99 % BW (MHz)	EBW (MHz)
a	6	56	5280	16.476	23.290
		60	5300	16.479	24.490
		64	5320	16.478	24.650
n	6.5	56	5280	17.640	24.220
		60	5300	17.670	24.770
		64	5320	17.662	24.800

Prepared For: JDSU

Name: OneExpert CATV

Report: TR 315103 C

Model: OneExpert CATV

LSR: C-2210

Serial: Eng. Sample

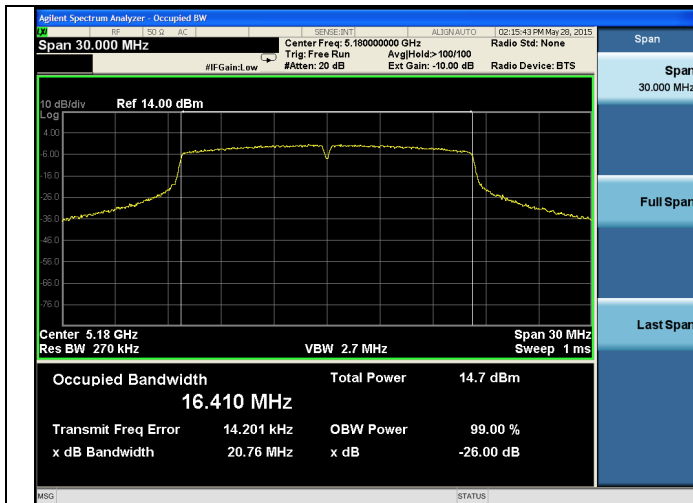
UNII-2C

Mode (802.11)	Mode (Mbps)	Channel	Frequency (MHz)	99 % BW (MHz)	EBW (MHz)
a	6	100	5500	16.47	22.59
		116	5580	16.42	21.04
		140	5700	16.41	19.95
n	6.5	100	5500	17.63	22.88
		116	5580	17.63	22.33
		140	5700	17.60	21.09

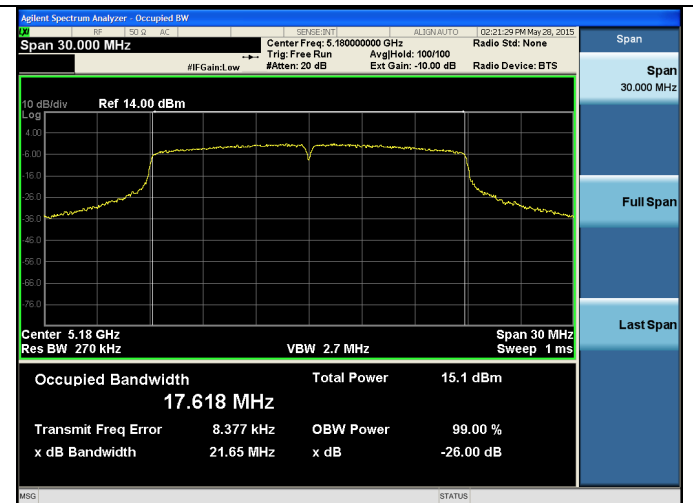
UNII-3

Mode (802.11)	Mode (Mbps)	Channel	Frequency (MHz)	DTS BW (MHz)	99 % BW (MHz)	EBW (MHz)
a	6	149	5745	15.48	16.49	24.14
		157	5785	15.94	16.45	22.26
		165	5825	15.16	16.44	21.90
n	6.5	149	5745	15.83	17.65	23.44
		157	5785	15.08	17.64	23.63
		165	5825	14.63	17.63	22.89

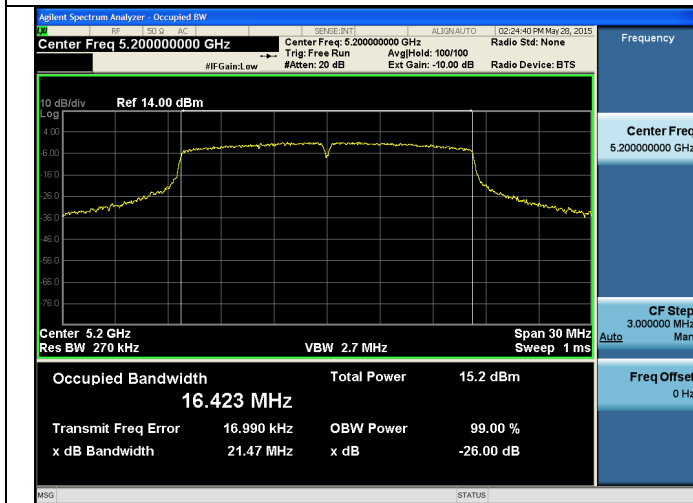
Plots – UNII-1



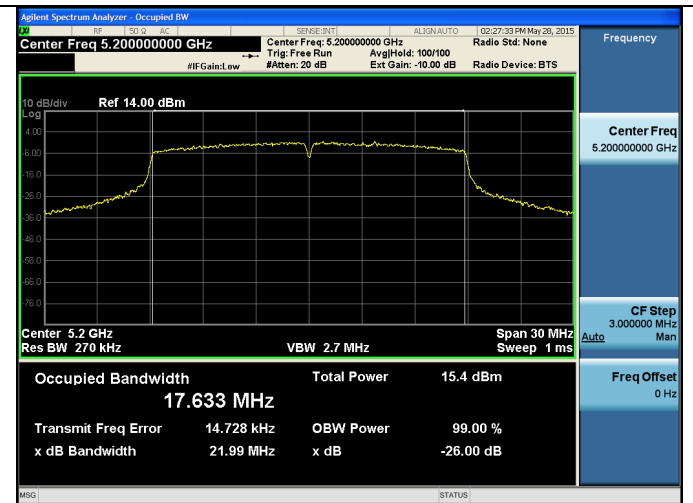
Channel 36 – 802.11a



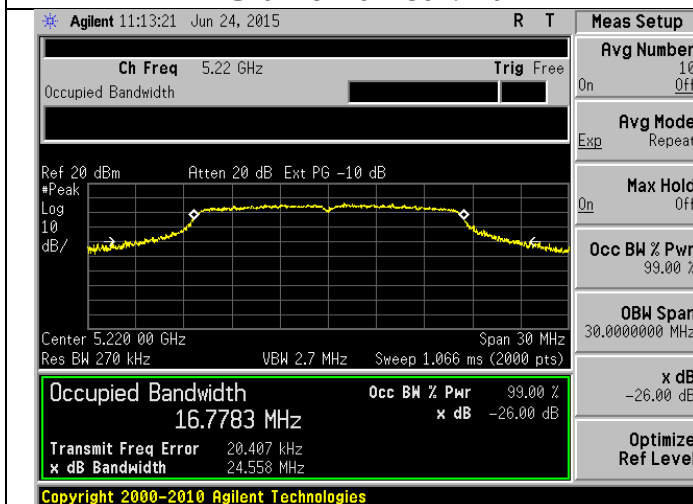
Channel 36 – 802.11n



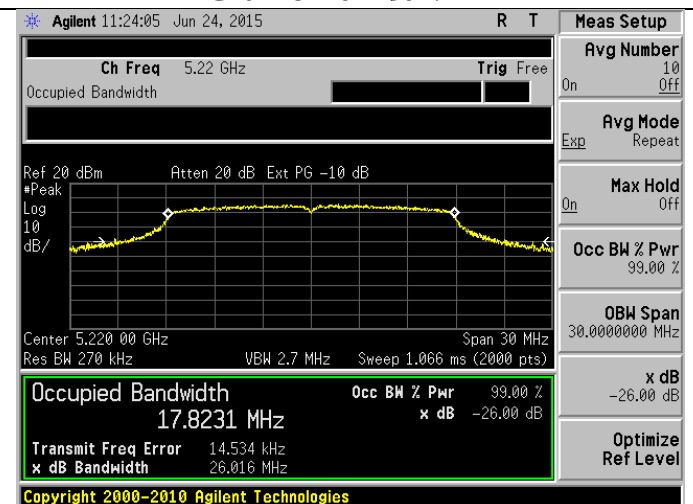
Channel 40 – 802.11a



Channel 40 – 802.11n



Channel 44 – 802.11a

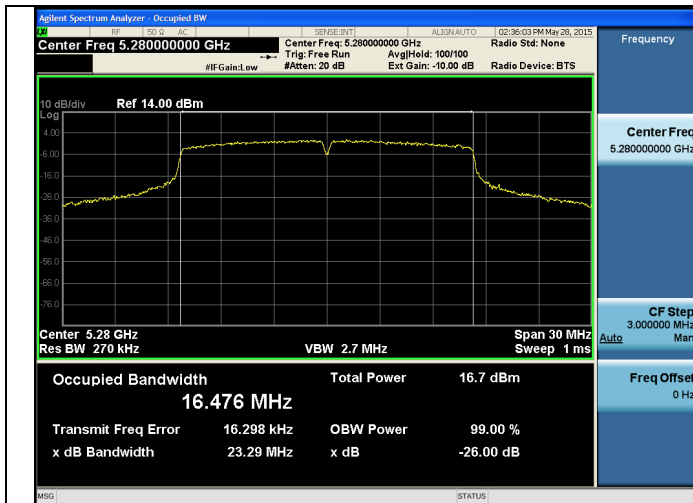


Channel 44 – 802.11n

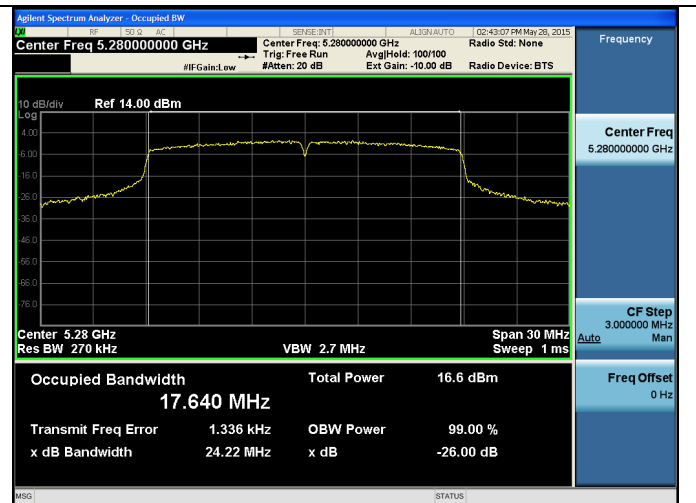
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

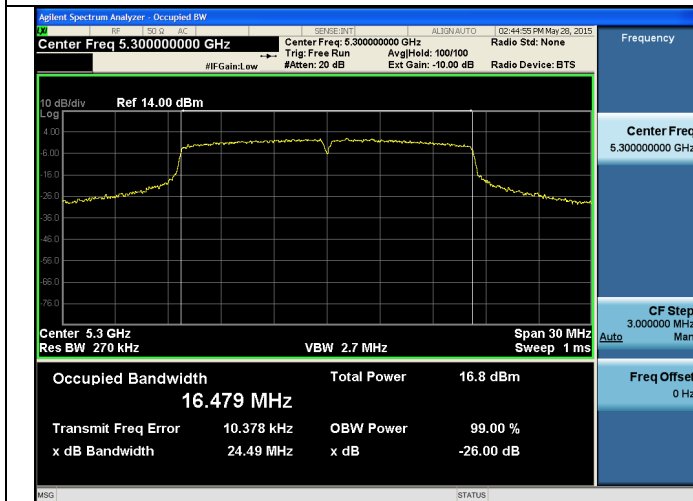
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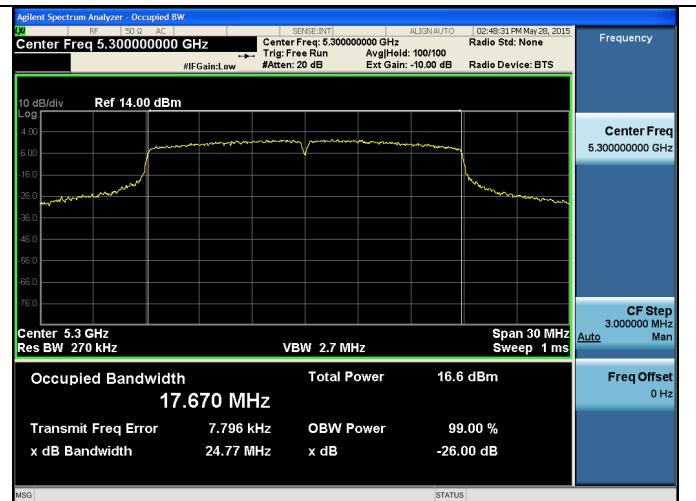
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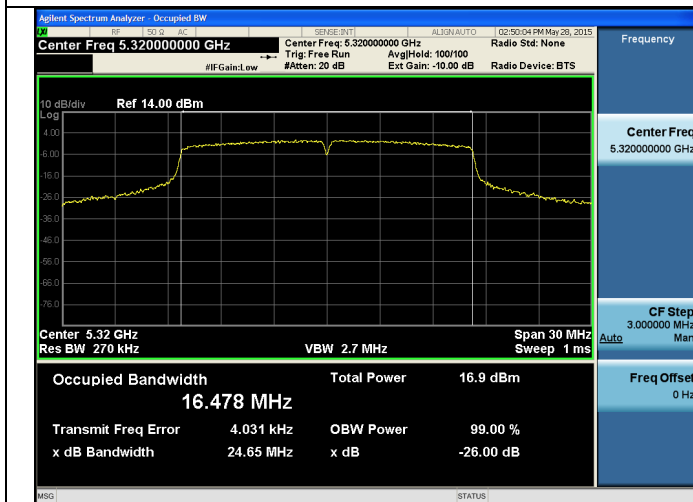
Channel 56 – 802.11n



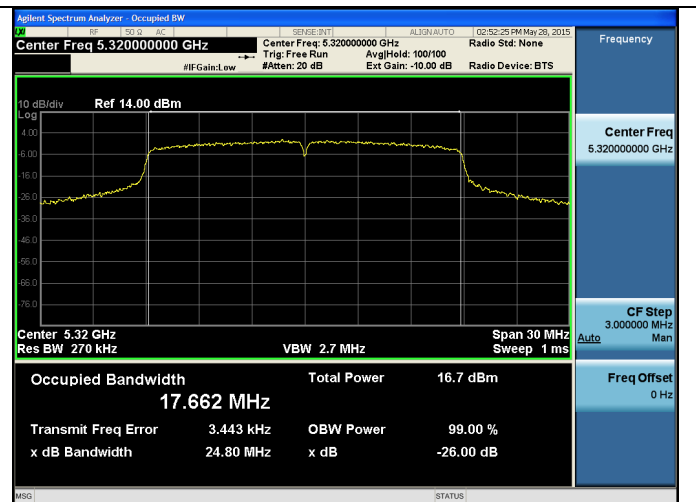
Channel 60 – 802.11a



Channel 60 – 802.11n



Channel 64 – 802.11a

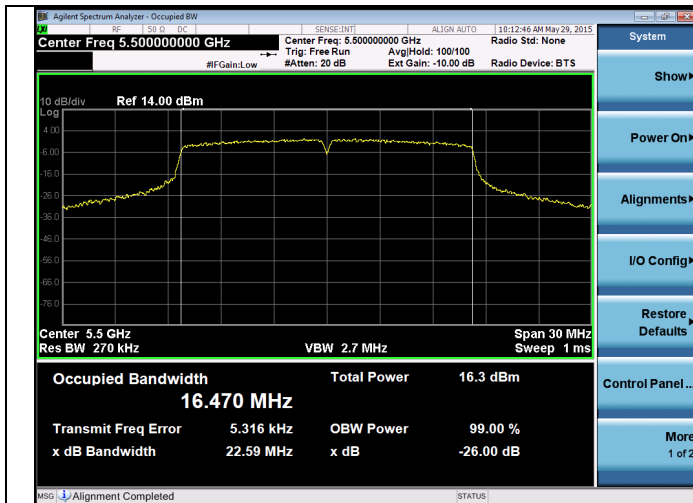


Channel 64 – 802.11n

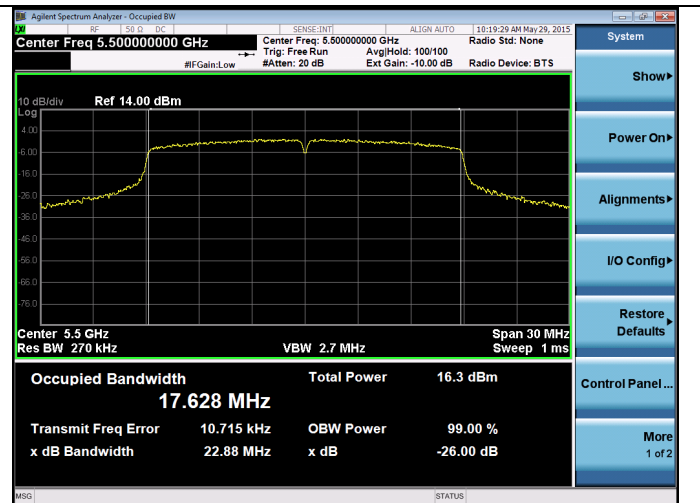
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

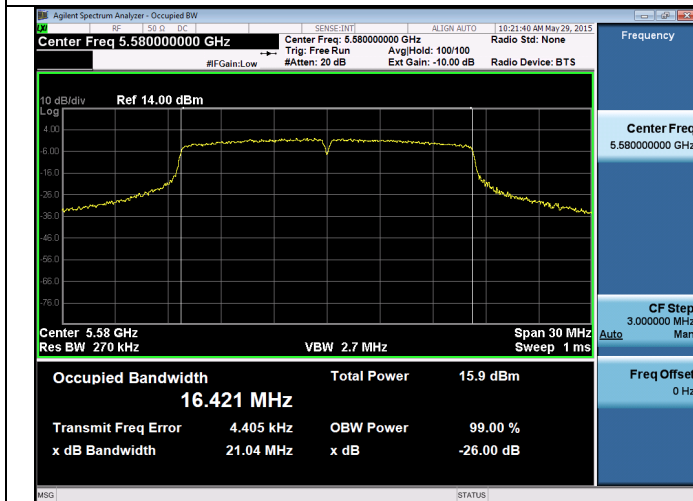
Plots – UNII-2C



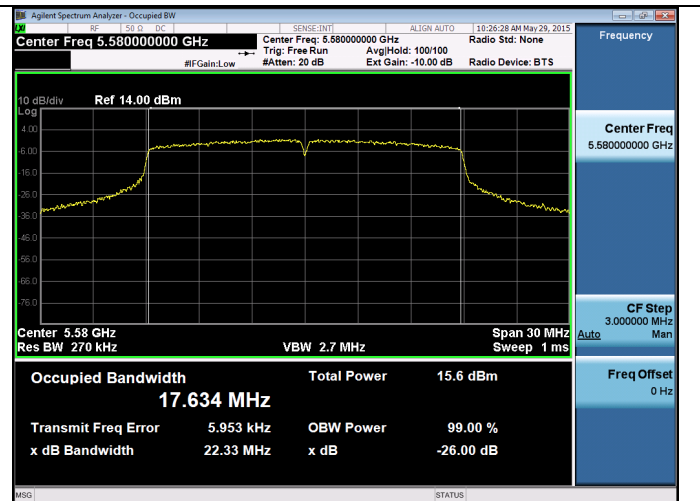
Channel 100 – 802.11a



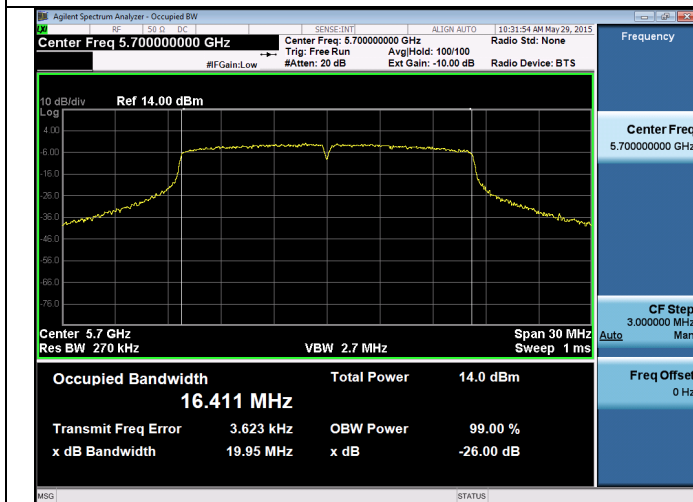
Channel 100 – 802.11n



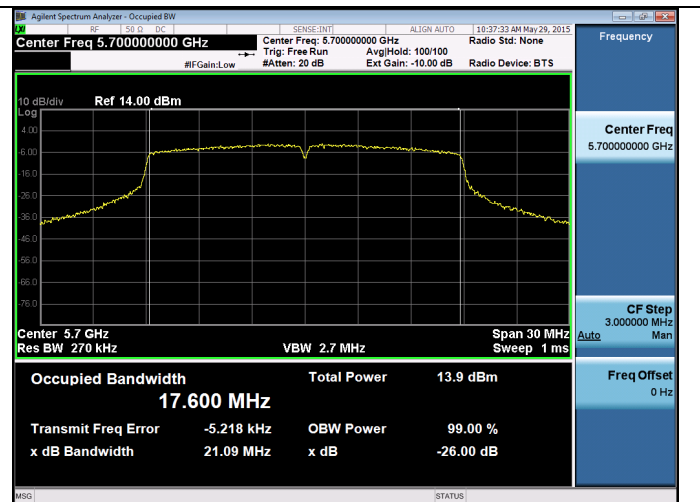
Channel 116 – 802.11a



Channel 116 – 802.11n



Channel 140 – 802.11a

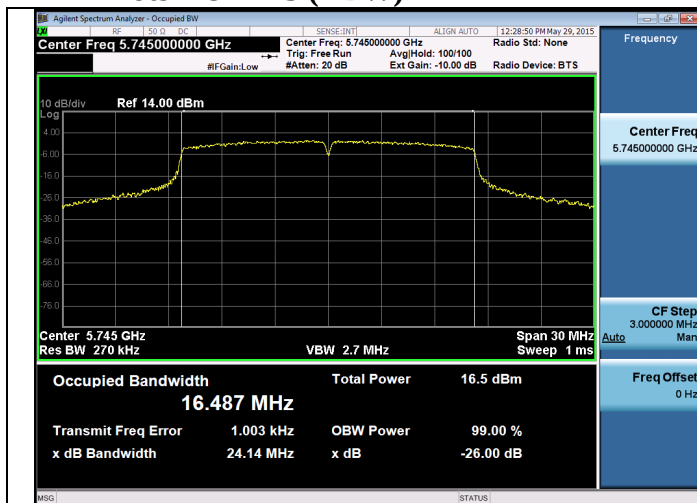


Channel 140 – 802.11n

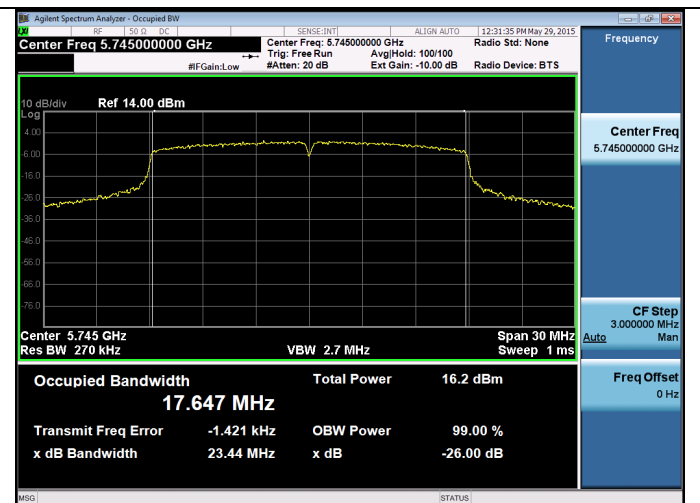
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

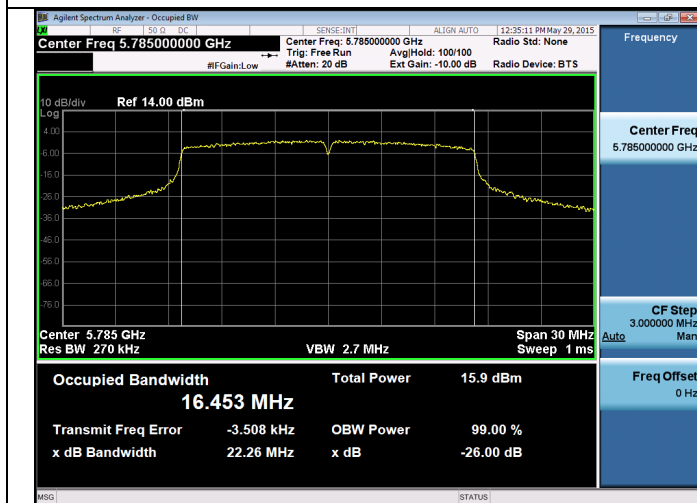
Plots – UNII-3 (EBW)



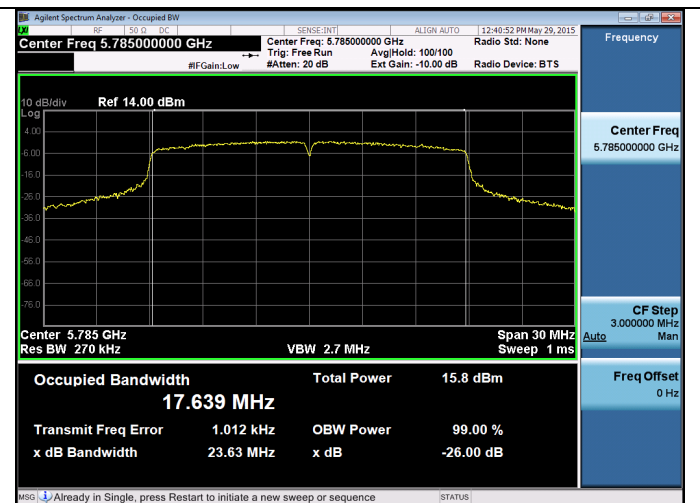
Channel 149 – 802.11a



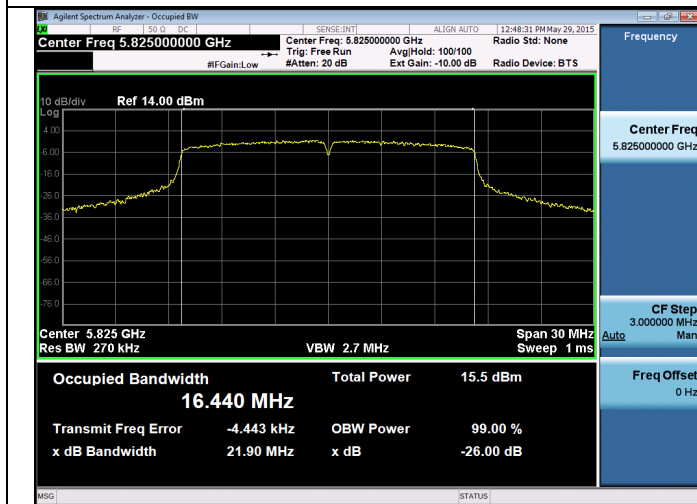
Channel 149 – 802.11n



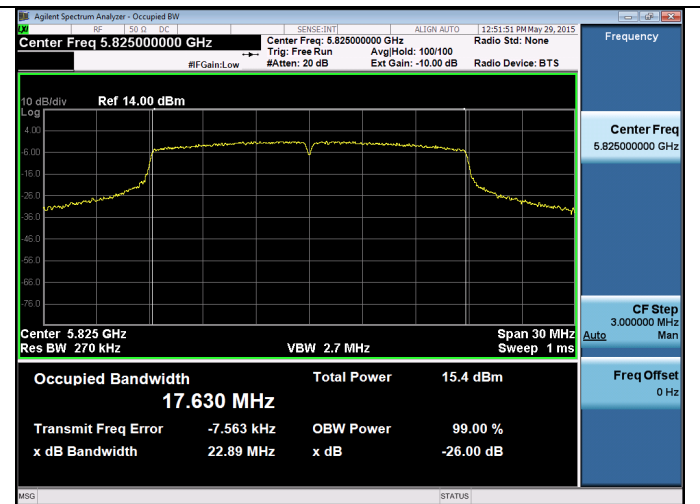
Channel 157 – 802.11a



Channel 157 – 802.11n



Channel 165 – 802.11a

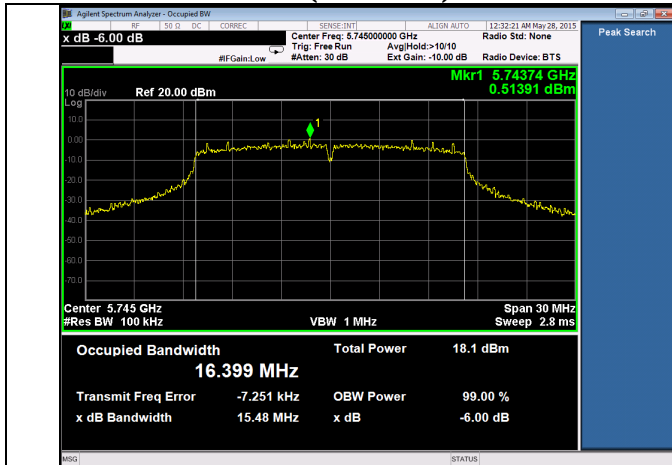


Channel 165 – 802.11n

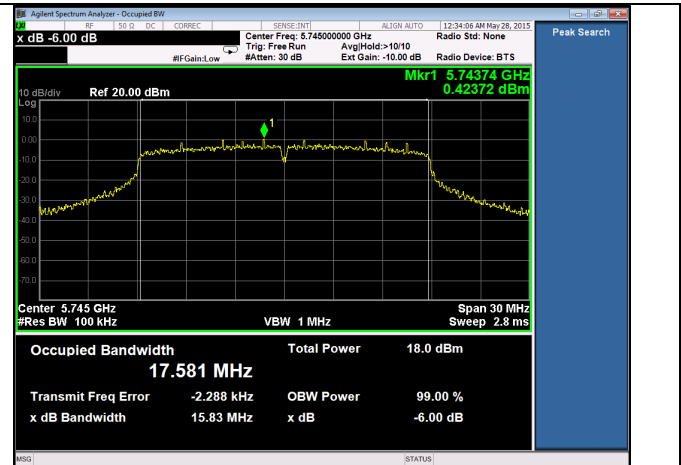
Prepared For: JDSU
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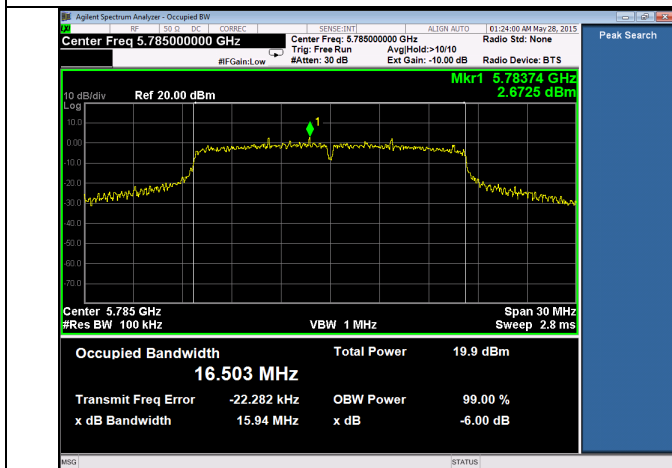
Plots – UNII-3 (DTS BW)



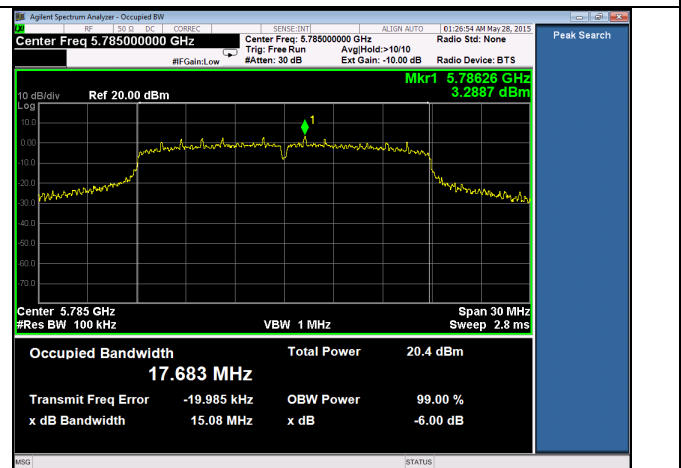
Channel 149 – 802.11a



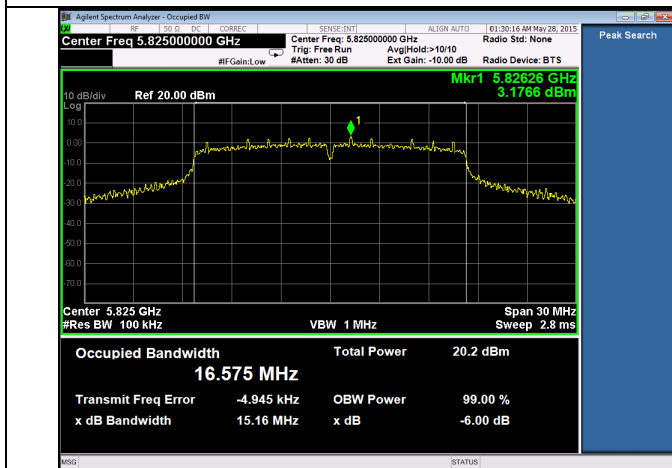
Channel 149 – 802.11n



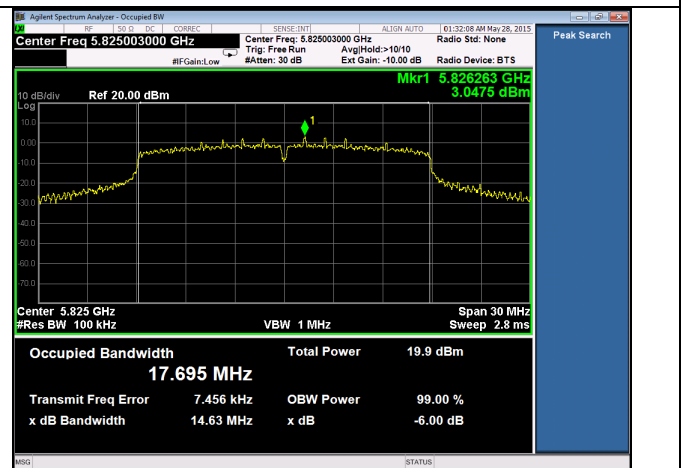
Channel 157 – 802.11a



Channel 157 – 802.11n



Channel 165 – 802.11a



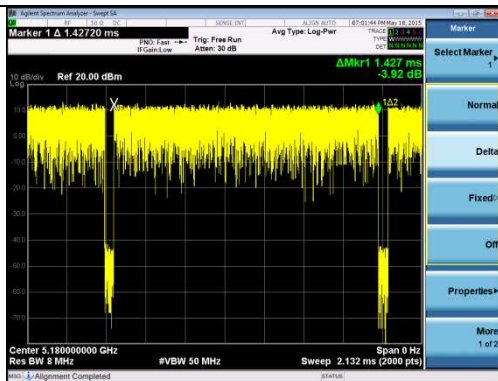
Channel 165 – 802.11n

B.1.2 – RF Conducted – Duty Cycle

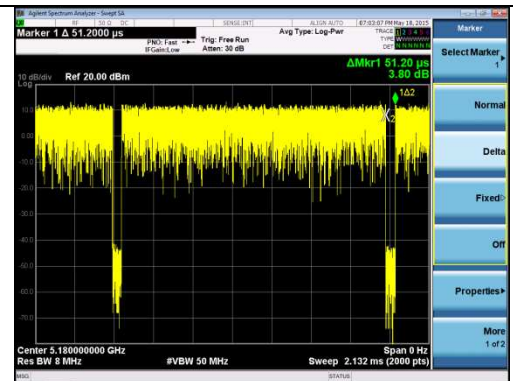
Manufacturer	JDSU
Date	5-18, 20 2015
Operator	Shane R.
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	N/A
Specific Measurement Procedure	ANSI C63.10-2013 Section 12.2
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	1. Duty cycle consistent between all channels.

Table

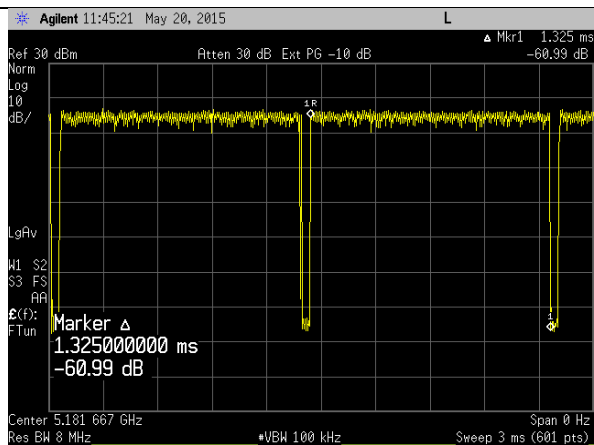
Mode (802.11)	Mode (Mbps)	On-time (ms)	Total Time (ms)	Duty Cycle	Duty Cycle Correction
a	6	1.427	0.051	0.97	0.2
n	6.5	1.325	0.045	0.97	0.1



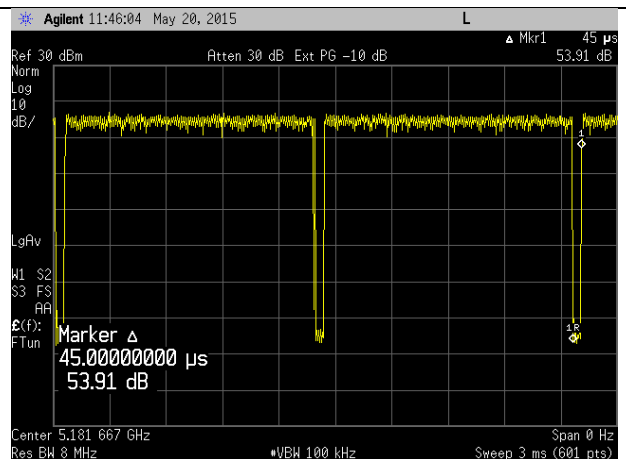
802.11a – On-time



802.11a – Off time



802.11n – On-time



802.11n – Off time

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

B.1.3 – RF Conducted – Fundamental Power and Spectral Density

Manufacturer	JDSU
Date	6-24, 7-22 2015
Operator	Peter F / Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407 (a)(1)(iv) & (a)(2) & (a)(3) IC RSS-247
Specific Measurement Procedure	ANSI C63.10-2013 Section 12.3.2.4 (Power Method SA-2) & 12.5
Additional Description of Measurement	Average methods used
Additional Notes	Continuous transmit modulated used for this test.

Sample Calculations:

Adj Power (dBm) = Measured Power (dBm) + Duty Cycle (dB)

Adj PSD (dBm/MHz) = Measured PSD (dBm/MHz) + Duty Cycle (dB)

Limits:

UNII-1

FCC: Power Limit = 250 mW = 23.98 dBm

FCC: PSD Limit = 11 dBm/MHz

IC: Power Limit = $10 + 10 \cdot \log(99\% \text{ BW}) = 22.17 \text{ dBm}$

IC: PSD Limit = 10 dBm/MHz EIRP

UNII-2A

FCC: Power Limit = lesser of 250 mW or $11 \text{ dBm} + 10 \cdot \log(\text{EBW}) = 250 \text{ mw} = 23.98 \text{ dBm}$

FCC: PSD Limit = 11 dBm/MHz

IC: Power Limit = $11 + 10 \cdot \log(99\% \text{ BW}) = 23.17 \text{ dBm}$

IC: PSD Limit = 11 dBm/MHz

IC: PSD EIRP Limit = $17 + 10 \cdot \log(99\% \text{ BW}) = 23.17 \text{ dBm}$

UNII-2C

FCC: Power Limit = lesser of 250 mW or $11 \text{ dBm} + 10 \cdot \log(\text{EBW}) = 250 \text{ mw} = 23.98 \text{ dBm}$

FCC: PSD Limit = 11 dBm/MHz

IC: Power Limit = $11 + 10 \cdot \log(99\% \text{ BW}) = 23.17 \text{ dBm}$

IC: PSD Limit = 11 dBm/MHz

IC: PSD EIRP Limit = $17 + 10 \cdot \log(99\% \text{ BW}) = 23.17 \text{ dBm}$

UNII-3

FCC / IC: Power Limit = 1 W = 30 dBm

FCC / IC: PSD Limit = 30 dBm/500 kHz

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

**Table
UNII-1**

Channel	Frequency (MHz)	Mode (Mbps)	99 % OBW (MHz)	EBW (MHz)	Power (dBm)	Adj Power (dBm)	PSD (dBm/MHz)	Adj PSD (dBm/MHz)
36	5180	6	16.410	20.760	12.86	13.06	1.61	1.81
		6.5	17.618	21.650	13.01	13.11	2.26	2.36
40	5200	6	16.423	21.470	13.59	13.79	3.10	3.30
		6.5	17.633	21.990	12.85	12.95	2.80	2.90
44	5220	6	16.780	24.560	13.89	14.09	2.66	2.86
		6.5	17.820	26.020	13.73	13.83	2.68	2.78

UNII-2A

Channel	Frequency (MHz)	Mode (Mbps)	99 % OBW (MHz)	EBW (MHz)	Power (dBm)	Adj Power (dBm)	PSD (dBm/MHz)	Adj PSD (dBm/MHz)
56	5280	6	16.476	23.290	13.16	13.36	1.91	2.11
		6.5	17.640	24.220	12.93	13.03	2.40	2.50
60	5300	6	16.479	24.490	13.27	13.47	2.83	3.03
		6.5	17.670	24.770	12.76	12.86	1.86	1.96
64	5320	6	16.478	24.650	13.10	13.30	2.78	2.98
		6.5	17.662	24.800	12.90	13.00	2.44	2.54

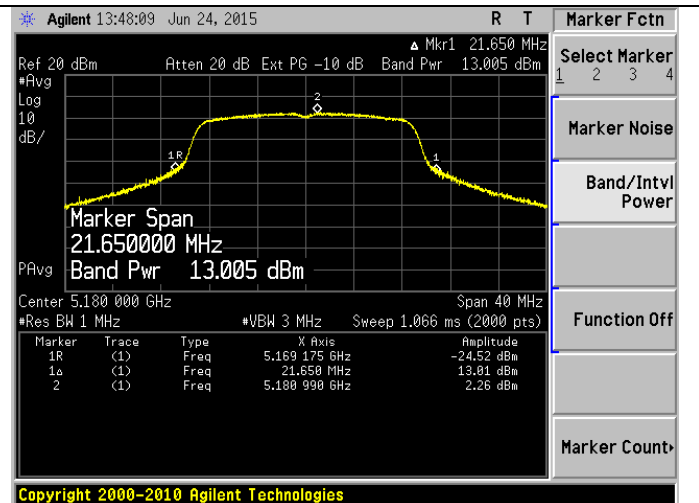
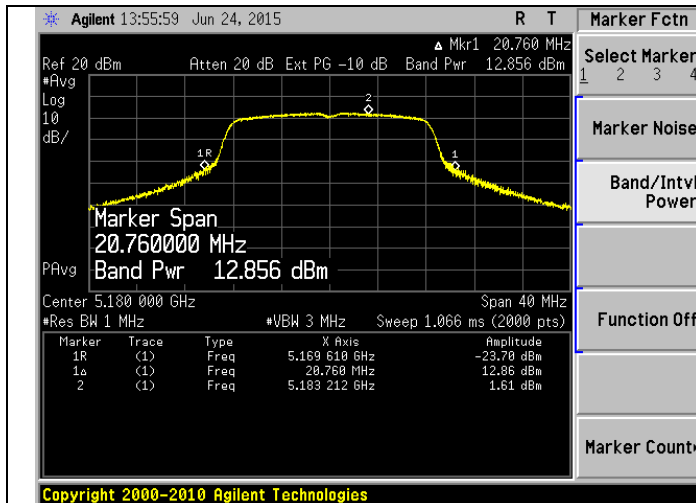
UNII-2C

Channel	Frequency (MHz)	Mode (Mbps)	99 % OBW (MHz)	EBW (MHz)	Power (dBm)	Adj Power (dBm)	PSD (dBm/MHz)	Adj PSD (dBm/MHz)
100	5500	6	16.47	22.59	13.94	14.14	3.72	3.92
		6.5	17.63	22.88	13.90	14.00	3.49	3.59
116	5580	6	16.42	21.04	13.16	13.36	2.87	3.07
		6.5	17.63	22.33	13.01	13.11	2.69	2.79
140	5700	6	16.41	19.95	10.96	11.16	0.58	0.78
		6.5	17.60	21.09	10.81	10.91	0.65	0.75

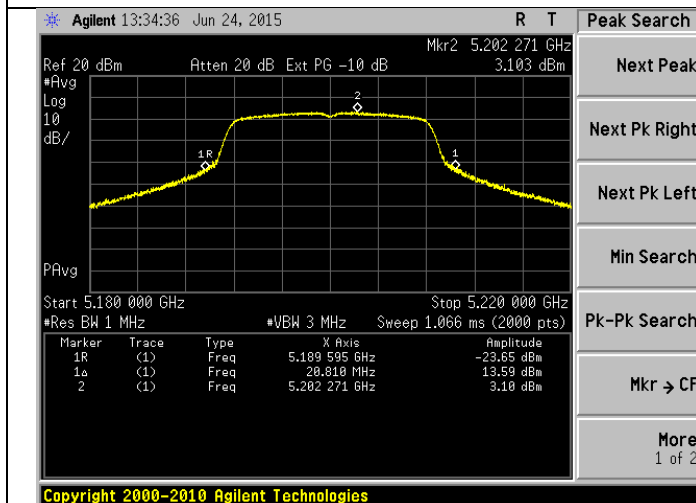
UNII-3

Channel	Frequency (MHz)	Mode (Mbps)	99 % OBW (MHz)	EBW (MHz)	Power (dBm)	Adj Power (dBm)	PSD (dBm/MHz)	Adj PSD (dBm/MHz)
149	5745	6	16.49	24.14	11.15	11.35	0.67	0.87
		6.5	17.65	23.44	10.97	11.07	0.77	0.87
157	5785	6	16.45	22.26	10.04	10.24	0.16	0.36
		6.5	17.64	23.63	9.92	10.02	-0.34	-0.24
165	5825	6	16.44	21.90	9.79	9.99	-0.83	-0.63
		6.5	17.63	22.89	9.69	9.79	-0.92	-0.82

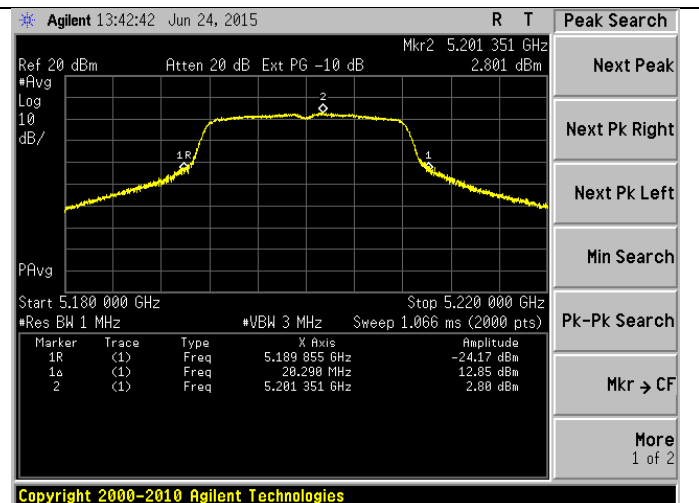
Plots – UNII-1



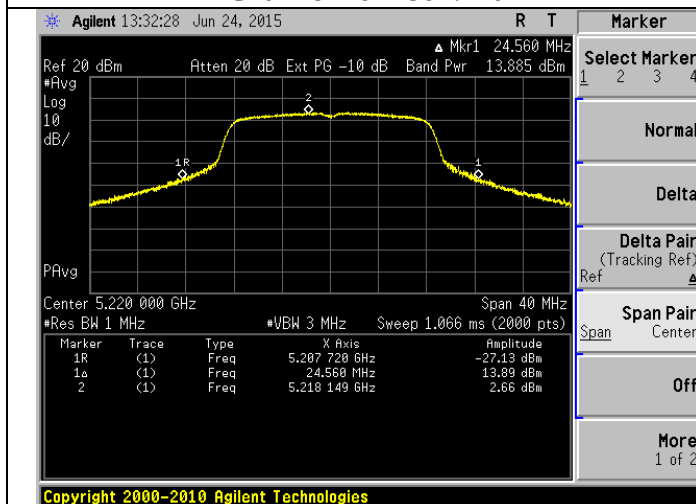
Channel 36 – 802.11a



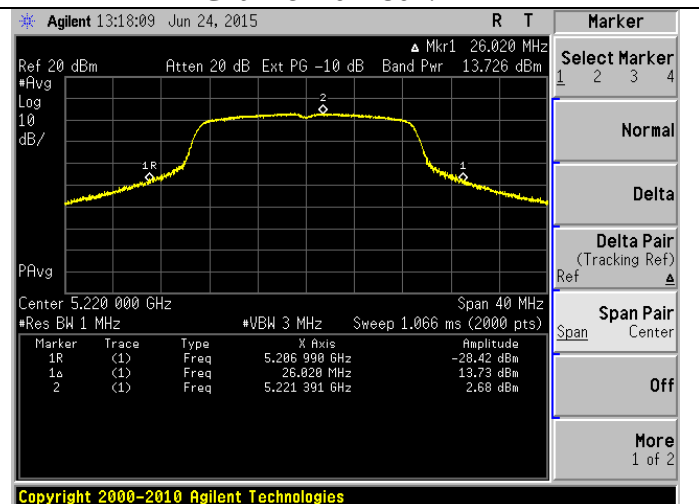
Channel 36 – 802.11n



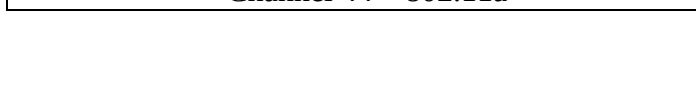
Channel 40 – 802.11a



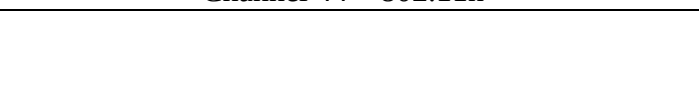
Channel 40 – 802.11n



Channel 44 – 802.11a



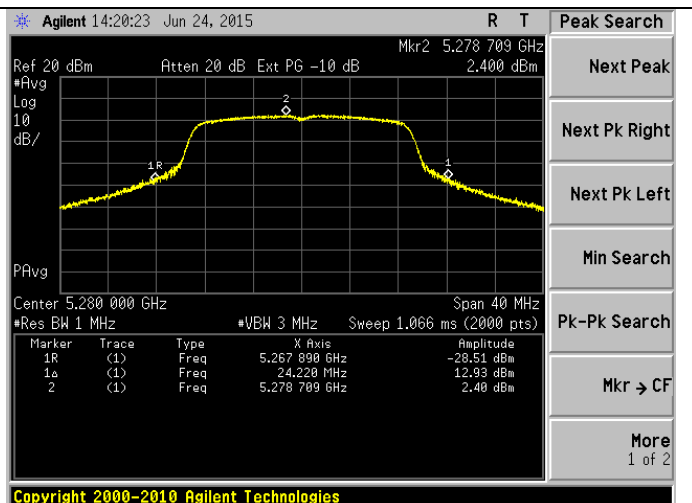
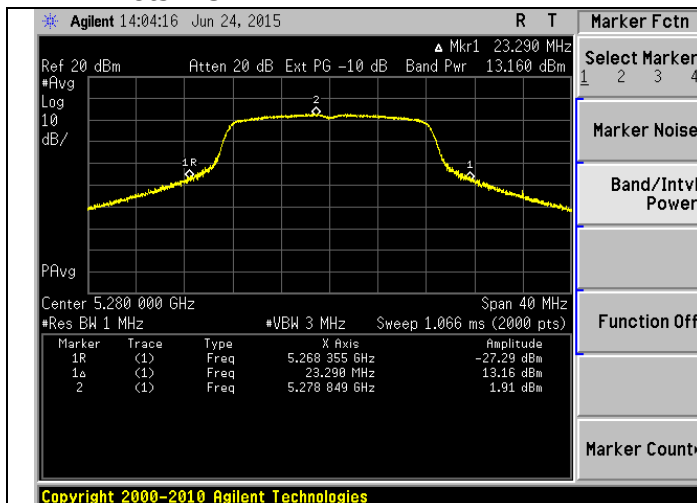
Channel 44 – 802.11n



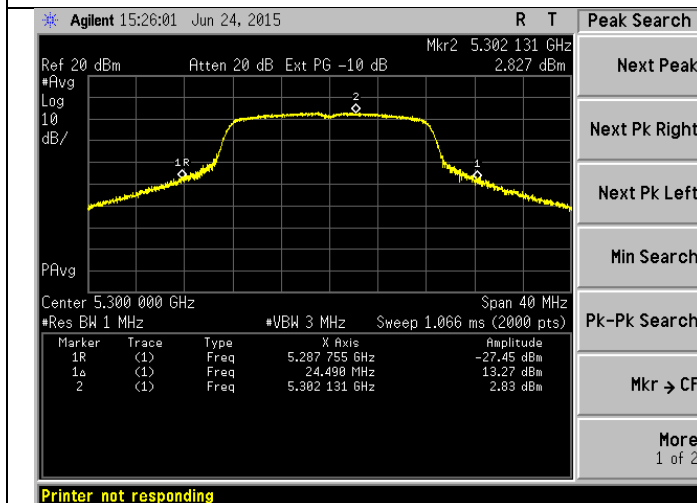
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

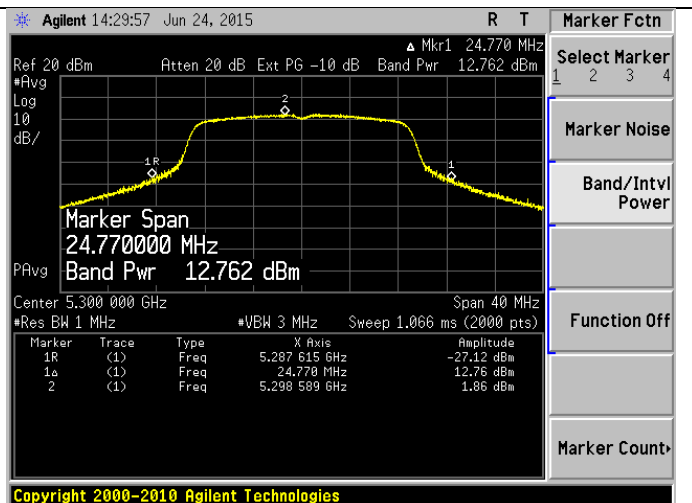
Plots – UNII-2A



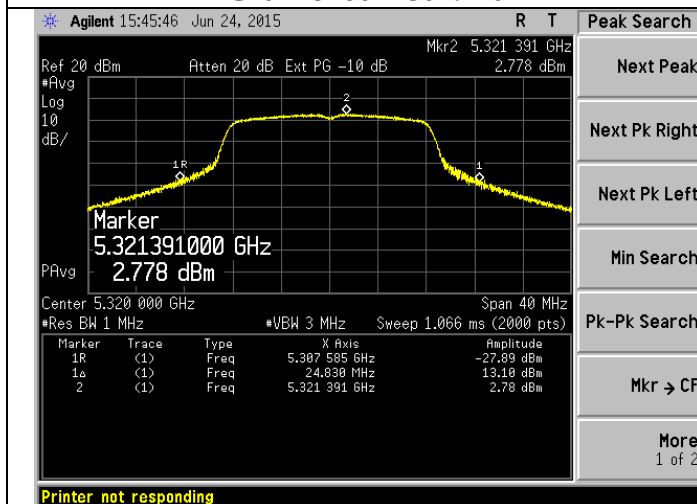
Channel 56 – 802.11a



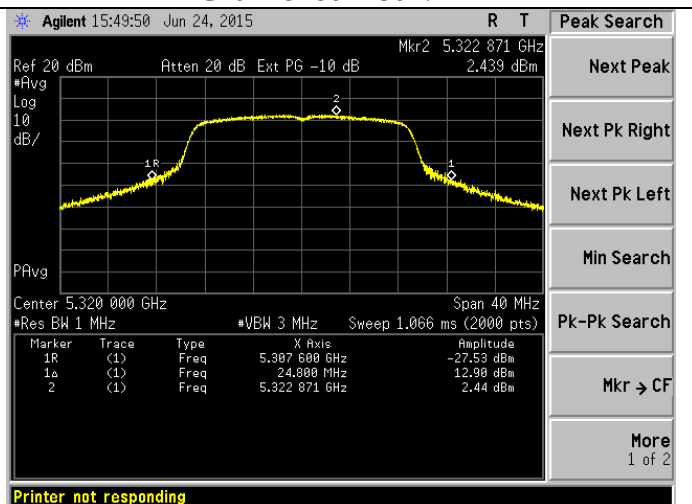
Channel 56 – 802.11n



Channel 60 – 802.11a



Channel 60 – 802.11n



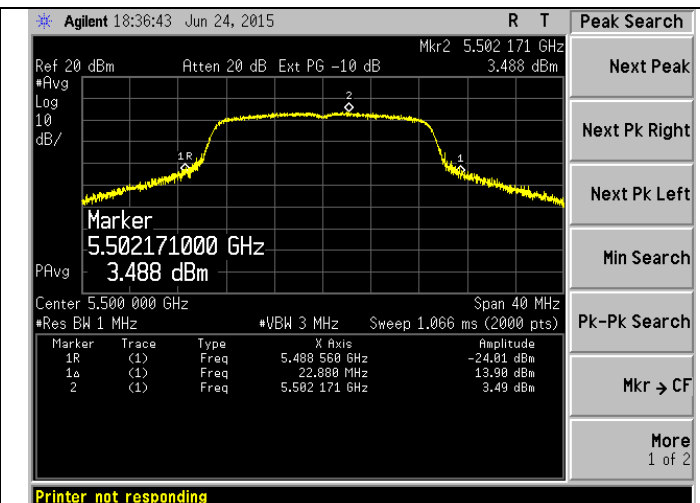
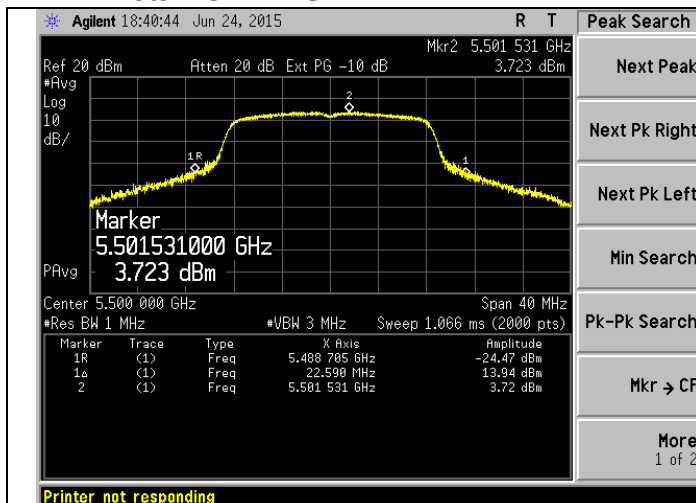
Channel 64 – 802.11a

Channel 64 – 802.11n

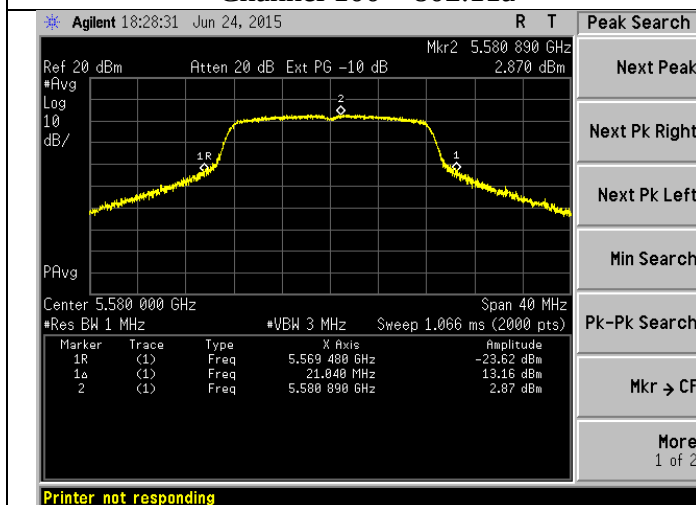
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

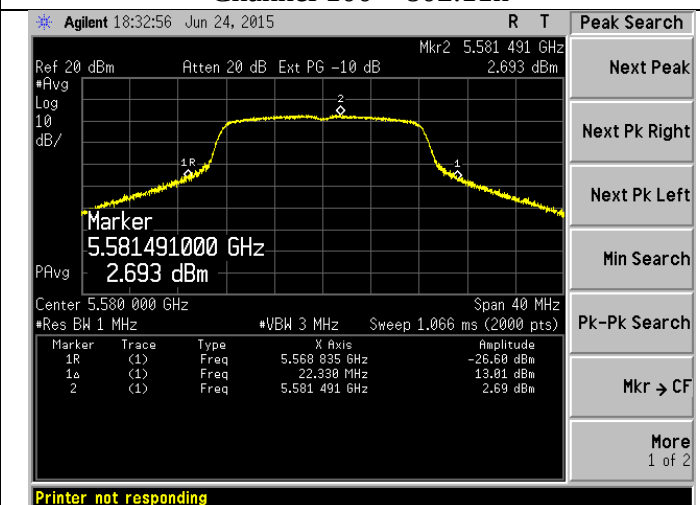
Plots – UNII-2C



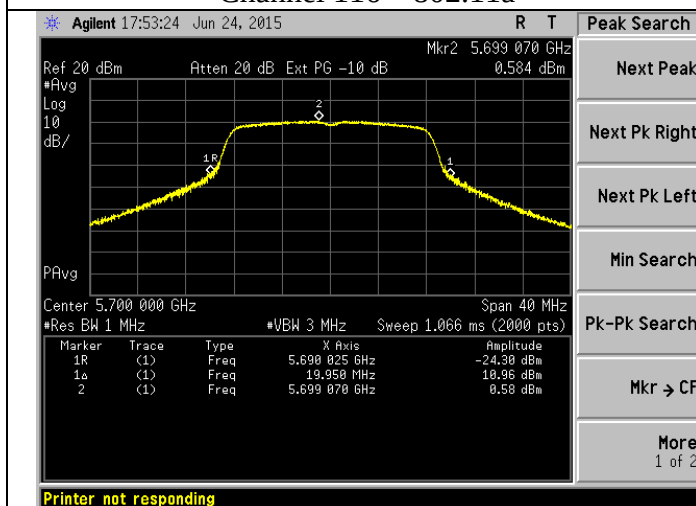
Channel 100 – 802.11a



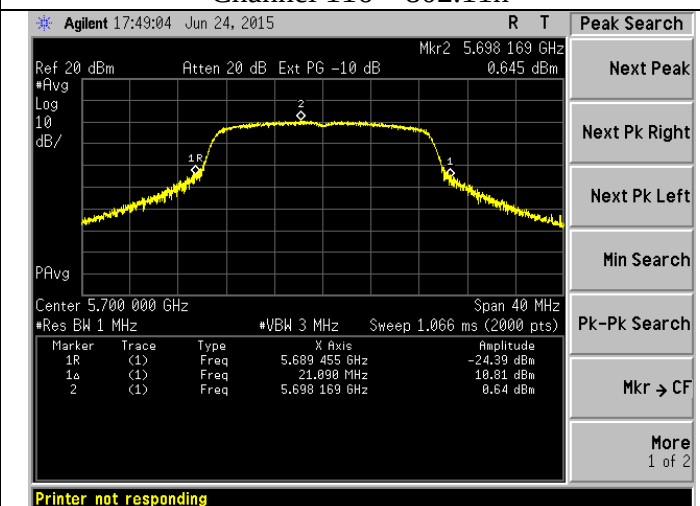
Channel 100 – 802.11n



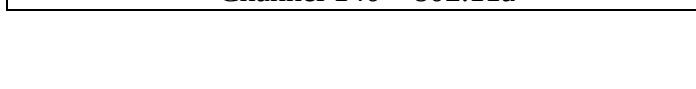
Channel 116 – 802.11a



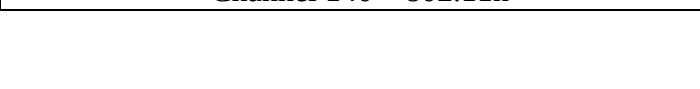
Channel 116 – 802.11n



Channel 140 – 802.11a



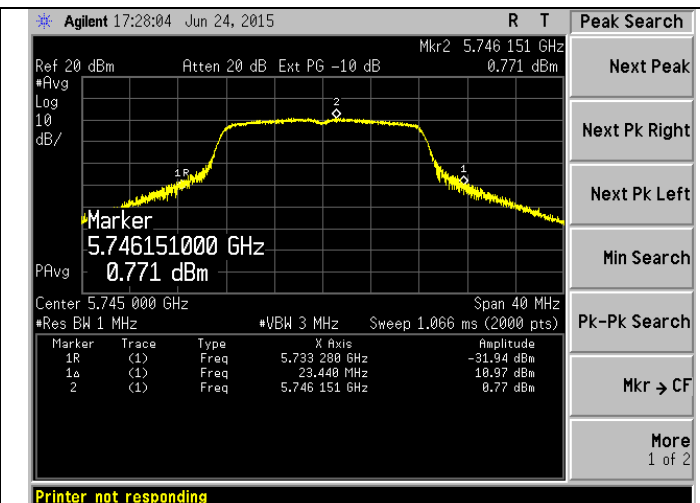
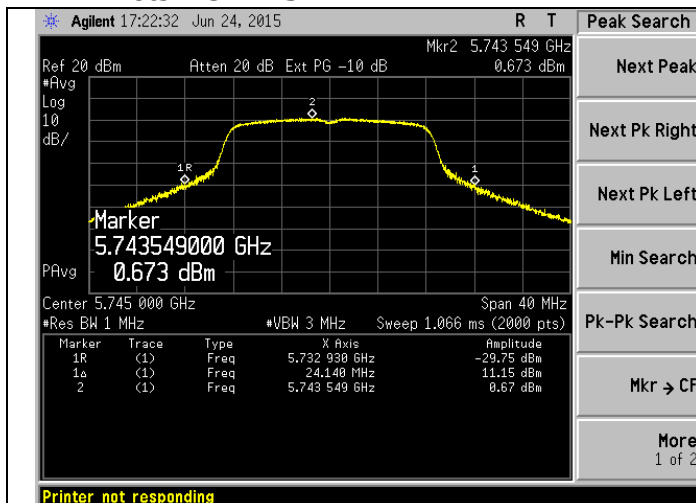
Channel 140 – 802.11n



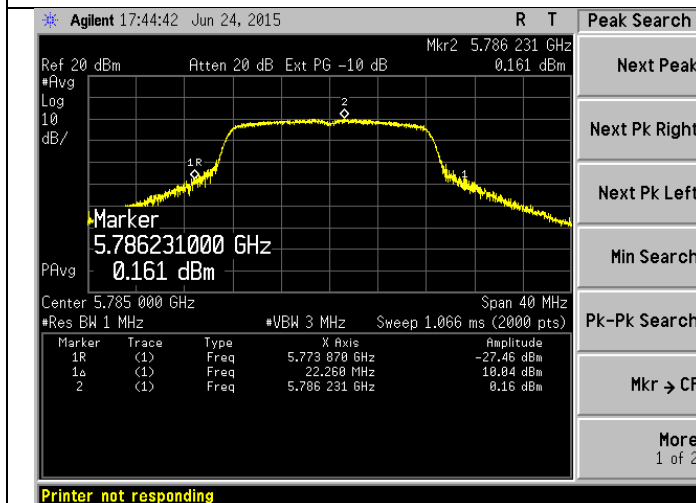
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

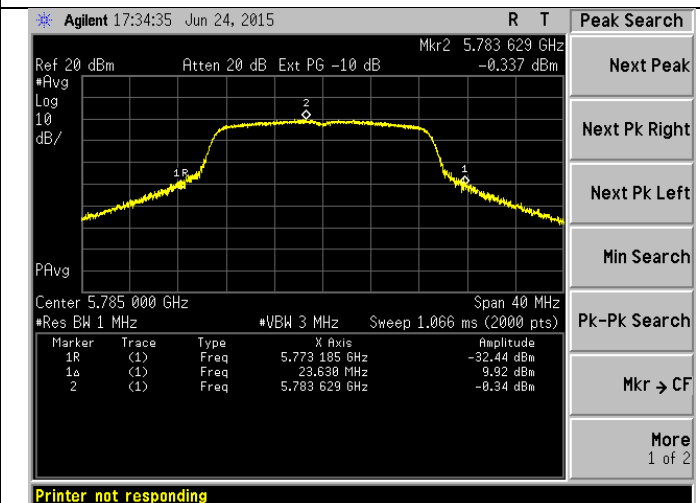
Plots – UNII-3



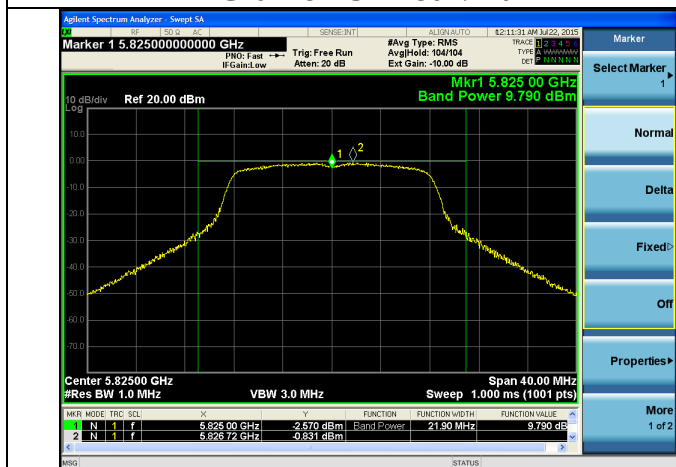
Channel 149 – 802.11a



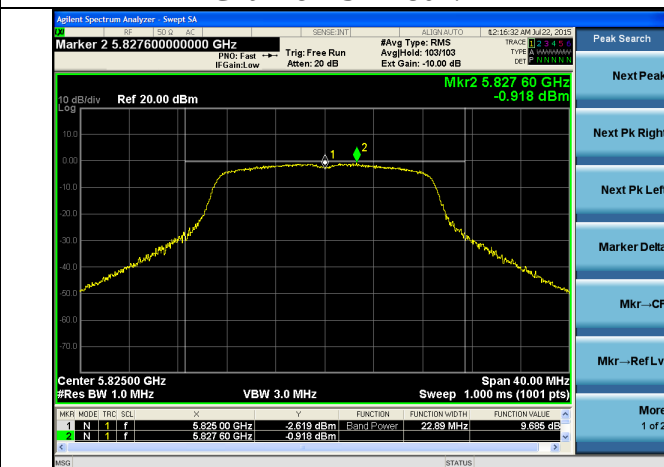
Channel 149 – 802.11n



Channel 157 – 802.11a



Channel 157 – 802.11n



Channel 165 – 802.11a

Channel 165 – 802.11n

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

B.1.4 – RF Conducted – Frequency Stability

Manufacturer	JDSU
Date	6-24-15
Operator	Peter F.
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407 (g) IC: RSS-GEN
Specific Measurement Procedure	ANSI C63.10-2013 Section 6.8
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the RF output power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied from the nominal. The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle. Below is data showing stability of the fundamental frequency. Continuous transmit un-modulated used for this test. The internal battery was replaced with a DC bench supply. EUT does not operate above 7.4 VDC EUT operates over temperature range -10°C to +50°C Channel 100 worst case data

Voltage (VDC)	+22° C		-10° C		+50° C	
	Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)
7.4	8.7	5499993666	8.8	5499993645	8.6	5499993675
6.7	8.6	5499993622	8.7	5499993629	8.7	5499993664

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

B.2 – Transmitter Radiated Emissions

Rule Part(s)	FCC: 15.407 / 15.205 / 15.209 IC: RSS-GEN			
Measurement Procedure	ANSI C63.10 – 2013 Section 12.7			
Test Location	LS Research, LLC – FCC/IC Listed 3 meter Chamber			
Test Distance	See data section			
EUT Placement	Above 1 GHz: 150 cm height non-conductive table above reference ground plane covered with absorbers Below 1 GHz: 80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-26GHz
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: At least 300 kHz		1 - 40 GHz: RBW : 1MHz VBW: At least 3 MHz Peak VBW: 30 Hz Average	
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

Limits:

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

B.2.1 – Radiated Band-Edge

Manufacturer	JDSU
Date	6-16-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407 / 15.205 / 15.209 IC RSS-247 Section 6 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 12.7
Test Distance	3 meter
EUT Placement	150 cm height non-conductive table centered on turn-table , absorbers covering ground plane
Detectors	Final Measurements: RBW 1 MHz, 3 MHz (Detector = Peak or RMS w/ trace average)
Additional Notes	1) EUT maximized in orientation, azimuth, and antenna height with maximum results reported.

Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin (dB)

-27 dBm/MHz + 95.2 (Conversion to dBμV/m) = 68.2 dBμV/m

-17 dBm/MHz + 95.2 (Conversion to dBμV/m) = 78.2 dBμV/m

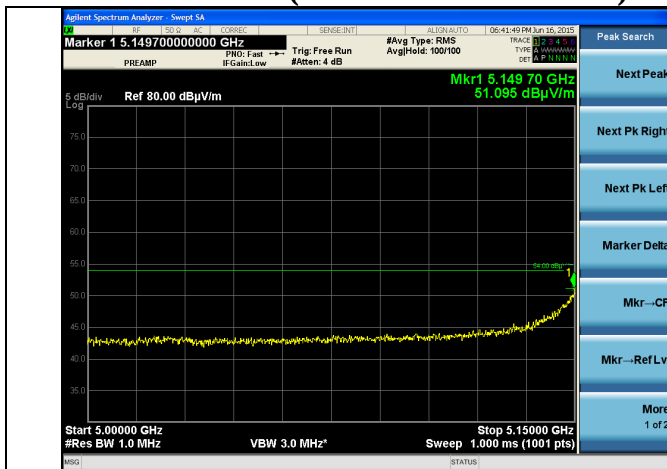
Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

Table

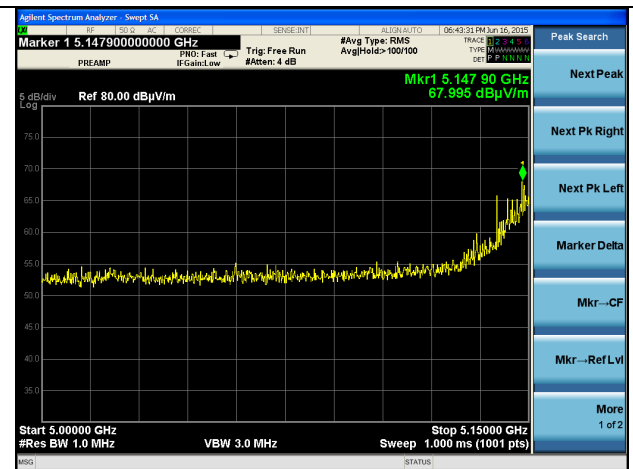
Mode (802.11)	Channel	Measurement Type	Frequency (GHz)	Reading (dBμV/m)	Duty Cycle Correction (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)
a	36	RB Average	5.1497	51.10	0.2	51.30	54	2.7
n		RB Average	5.1500	51.78	0.1	51.88	54	2.1
a		RB Peak	5.1479	68.00	0.0	68.00	74	6.0
n		RB Peak	5.1484	65.64	0.0	65.64	74	8.4
a	64	RB Average	5.3504	51.68	0.2	51.88	54	2.1
n		RB Average	5.3502	52.41	0.1	52.51	54	1.5
a		RB Peak	5.3502	70.35	0.0	70.35	74	3.7
n		RB Peak	5.3506	70.26	0.0	70.26	74	3.7
a	100	RB Average	5.4696	51.03	0.2	51.23	54	2.8
n		RB Average	5.4698	51.53	0.1	51.63	54	2.4
a		RB Peak	5.4692	65.12	0.0	65.12	74	8.9
n		RB Peak	5.4684	66.77	0.0	66.77	74	7.2
a	140	-27 dBm/MHz	5.7267	65.65	0.0	65.65	68.2	2.6
n		-27 dBm/MHz	5.7254	65.30	0.0	65.30	68.2	2.9
a	149	-17 dBm/MHz	5.72476	74.494	0.0	74.49	78.2	3.7
n		-17 dBm/MHz	5.72465	75.521	0.0	75.52	78.2	2.7
a		-27 dBm/MHz	5.714925	64.395	0.0	64.40	68.2	3.8
n		-27 dBm/MHz	5.7138	63.14	0.0	63.14	68.2	5.1
a	165	-17 dBm/MHz	5.85239	70.917	0.0	70.92	78.2	7.3
n		-17 dBm/MHz	5.85032	68.848	0.0	68.85	78.2	9.4
a		-27 dBm/MHz	5.86148	59.899	0.0	59.90	68.2	8.3
n		-27 dBm/MHz	5.86024	61.736	0.0	61.74	68.2	6.5

Plots

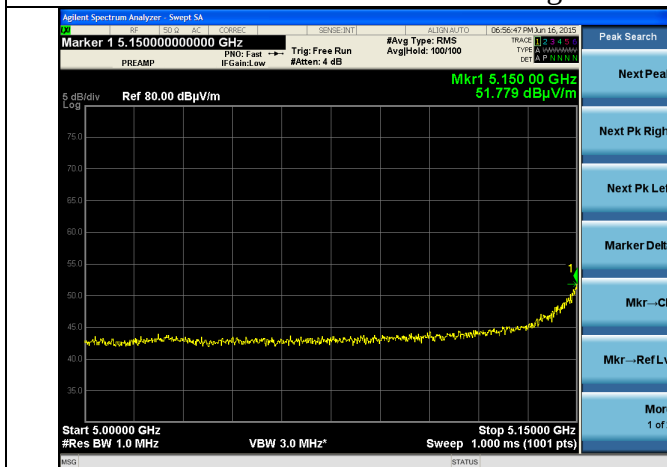
5.1-5.15 GHz (Restricted Band Limits)



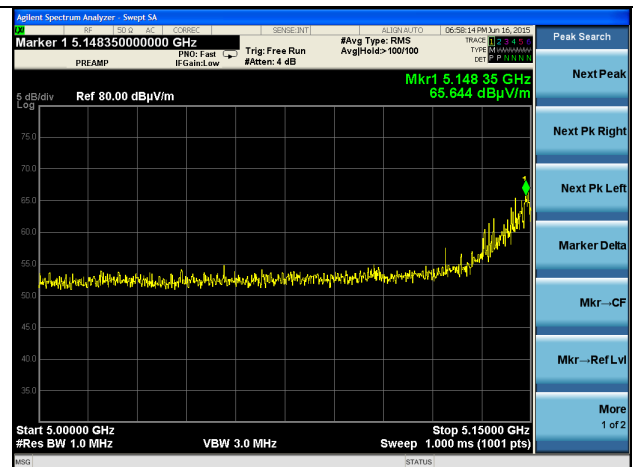
Channel 36 – 802.11a – Average



Channel 36 – 802.11a – Peak



Channel 36 – 802.11n – Average



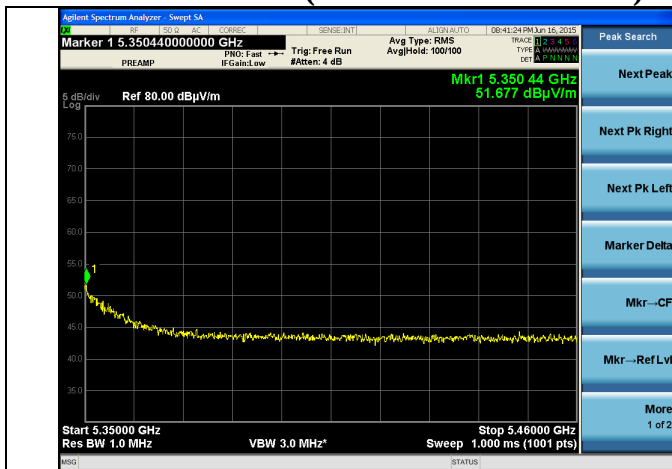
Channel 36 – 802.11n – Peak

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

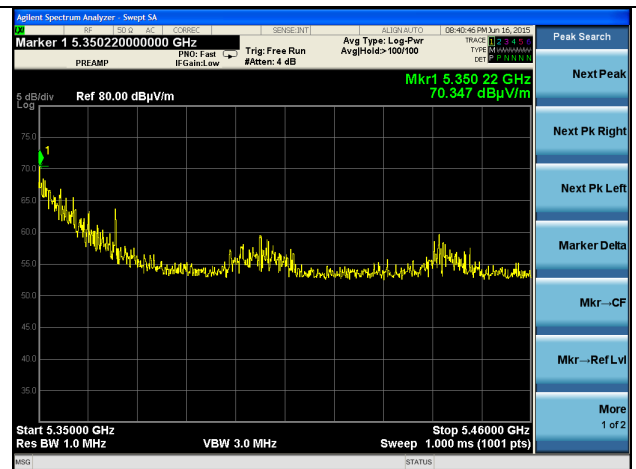
Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

Plots

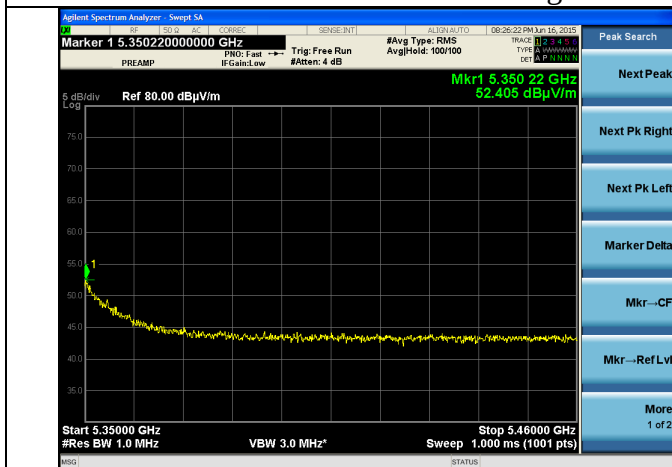
5.35-5.47 GHz (Restricted Band Limits)



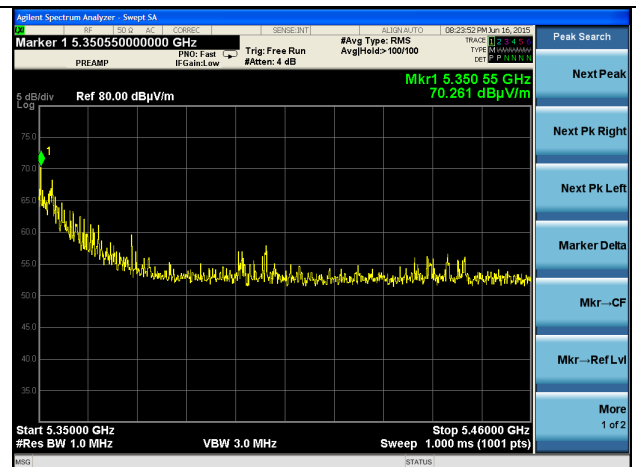
Channel 64 – 802.11a – Average



Channel 64 – 802.11a – Peak



Channel 64 – 802.11n – Average



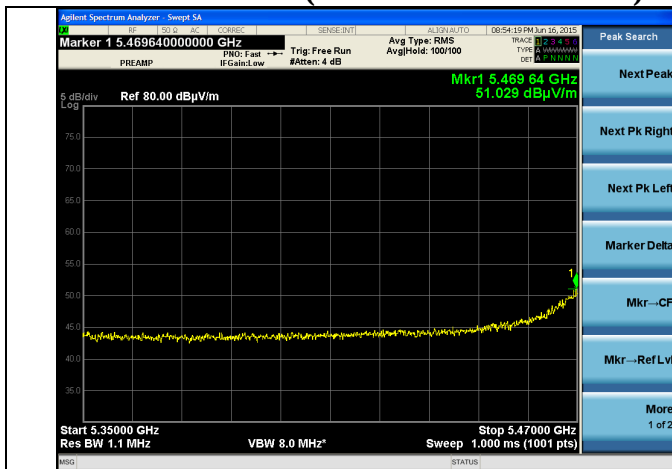
Channel 64 – 802.11n – Peak

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

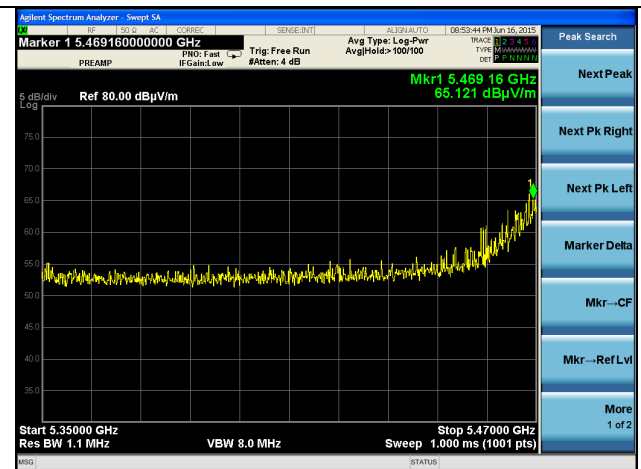
Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

Plots

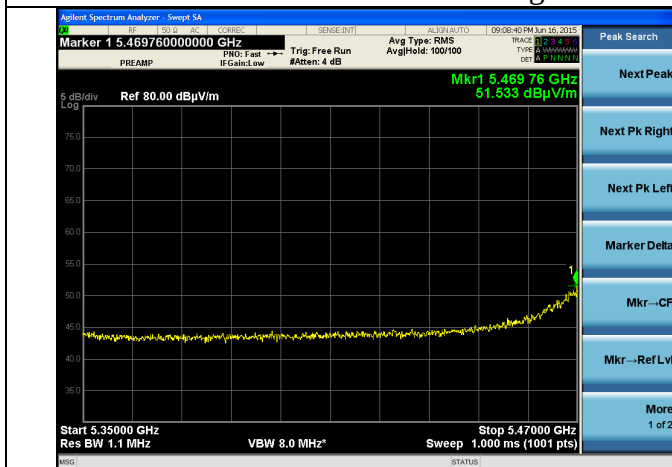
5.35-5.47 GHz (Restricted Band Limits)



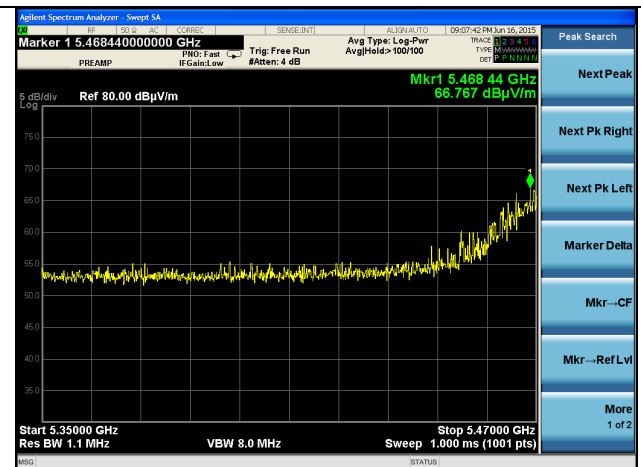
Channel 100 – 802.11a – Average RB



Channel 100 – 802.11a – Peak RB



Channel 100 – 802.11n – Average RB



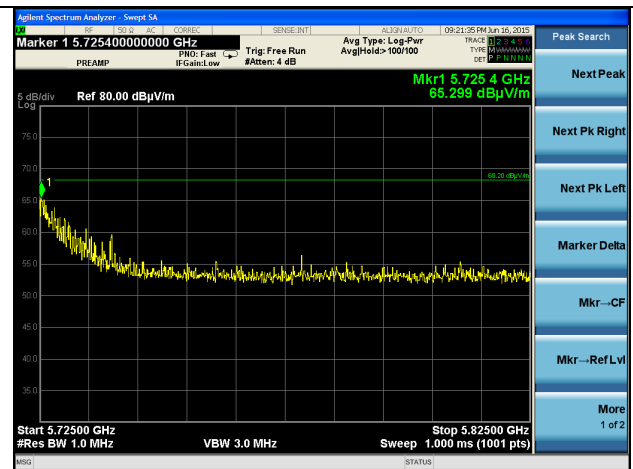
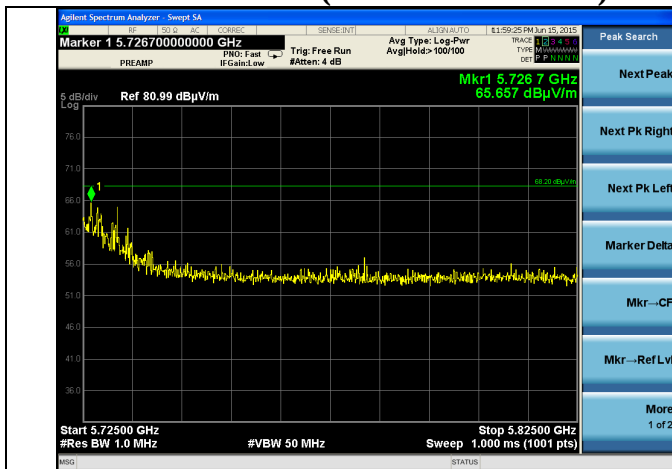
Channel 100 – 802.11n – Peak RB

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

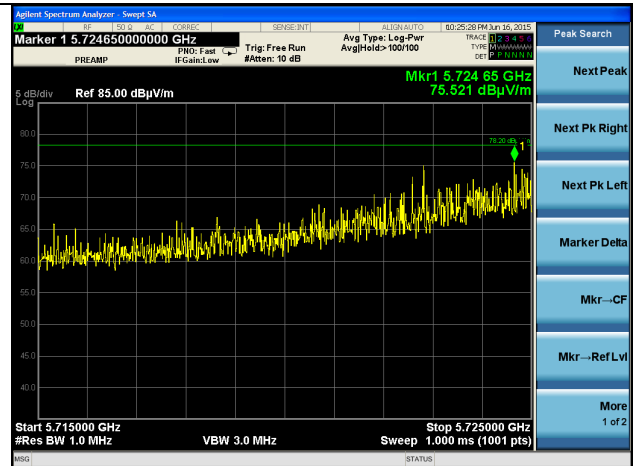
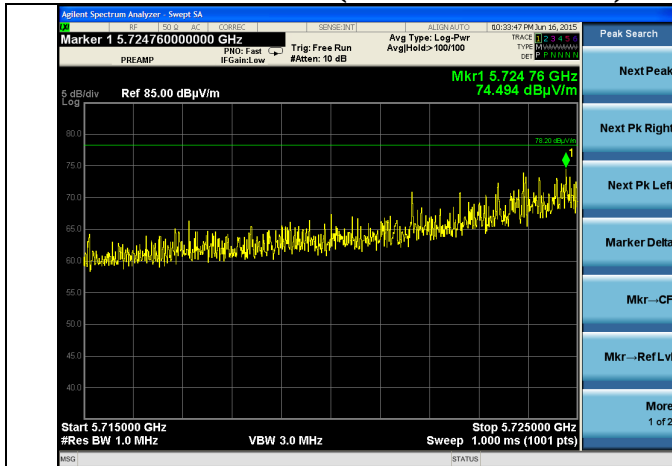
Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

Plots

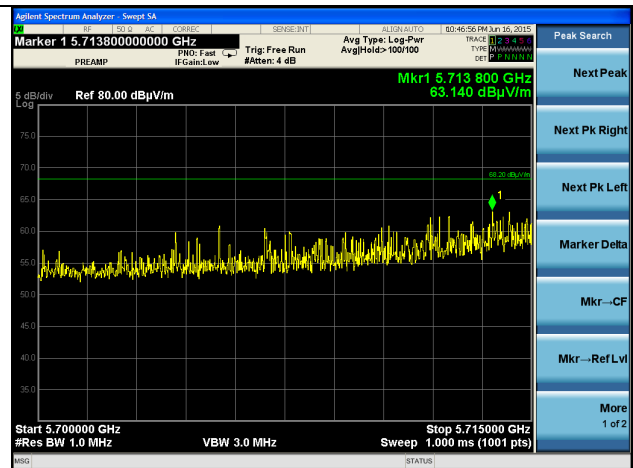
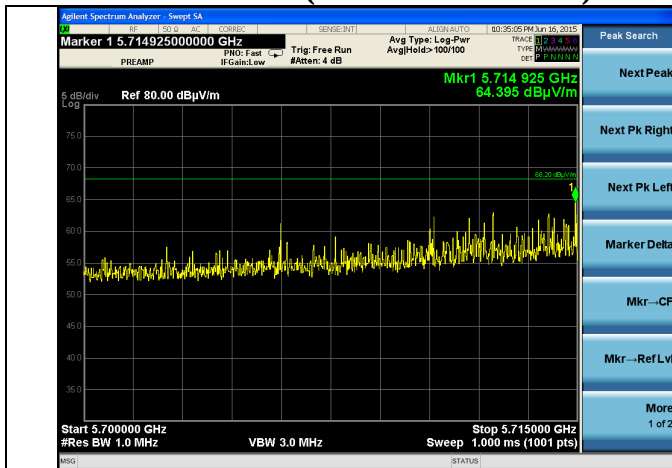
5.725-5.85 GHz (-27 dBm/MHz limit)



5.715-5.725 GHz (-17 dBm/MHz limit)



5.7-5.715 GHz (-27 dBm/MHz limit)



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Report: TR 315103 C

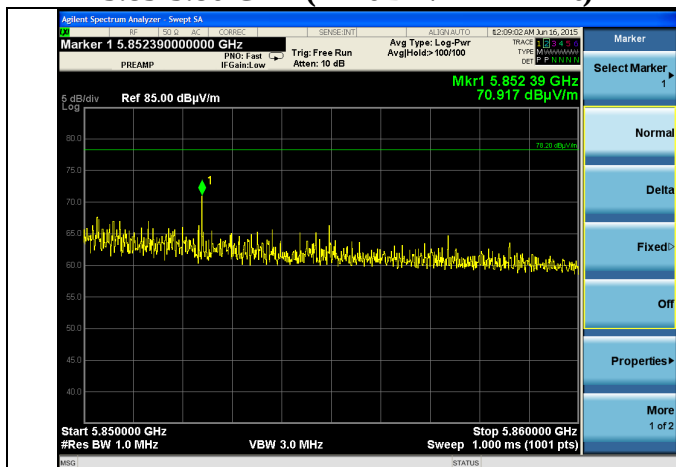
LSR: C-2210

Name: OneExpert CATV

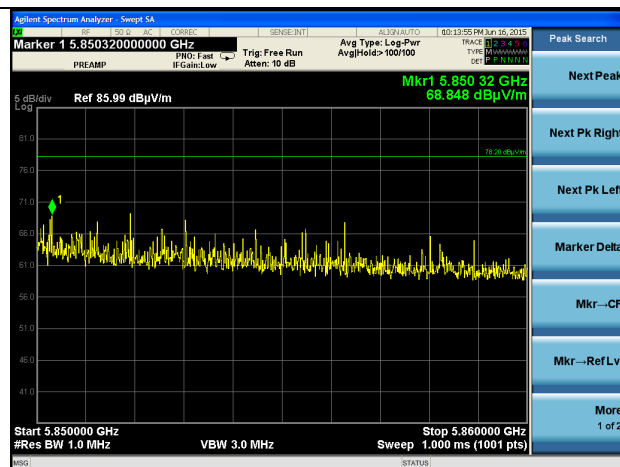
Model: OneExpert CATV

Serial: Eng. Sample

5.85-5.86 GHz (-17 dBm/MHz limit)

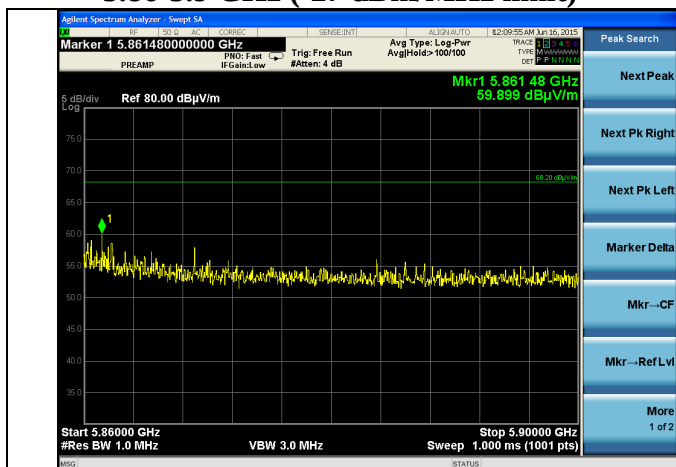


Channel 165 – 802.11a – Peak

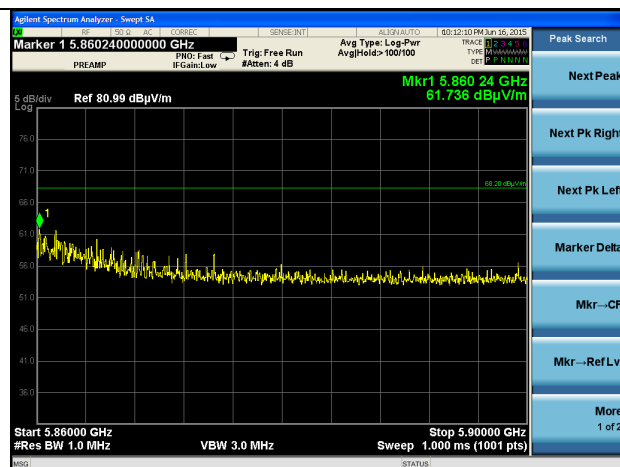


Channel 165 – 802.11n – Peak

5.86-5.9 GHz (-27 dBm/MHz limit)



Channel 165 – 802.11a – Peak



Channel 165 – 802.11n – Peak

B.2.2 – Radiated Emissions (1-40 GHz)

Manufacturer	JDSU
Date	6-16, 17, 19, 22 2015
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407 / 15.205 / 15.209 IC RSS-247 Section 6 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 12.7
Test Distance	3 meter 1-18 GHz; 1 meter 18-40 GHz
EUT Placement	150 cm height non-conductive table centered on turn-table , absorbers covering ground plane
Detectors	Final Measurements: Peak
Additional Notes	1) EUT maximized in orientation, azimuth, and antenna height with maximum results reported. 2) No emissions found associated with transmit channel or modulation.

Example Calculation:

Limit (dBμV/m) – Reading (dBμV/m) = Margin (dB)

Table

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Peak Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Limit (dBμV/m)	Peak Margin (dB)
1501	Horizontal	135	157	47.13	50.66	54	6.9	74	23.3
1750	Horizontal	122	13	42.01	44.43	54	12.0	74	29.6
1624	Horizontal	178	219	39.57	42.39	54	14.4	74	31.6
1126	Vertical	141	27	43.22	46.57	54	10.8	74	27.4
1501	Vertical	100	183	46.55	52.45	54	7.5	74	21.6
1750	Vertical	130	0	40.37	42.98	54	13.6	74	31.0

Note: Emissions seen determined not associated with channel or modulation

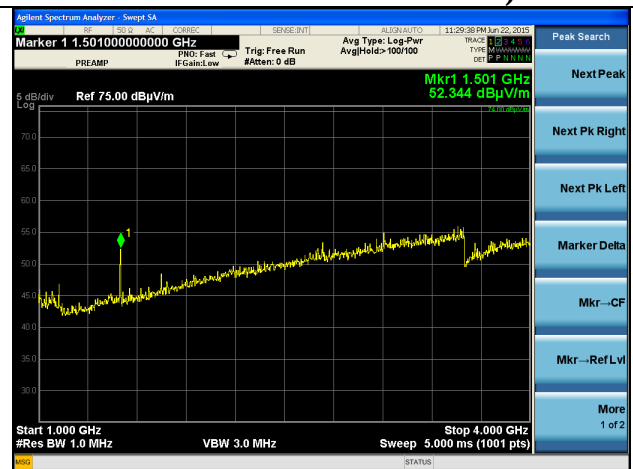
Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

Plots

1-4 GHz (Note: Emissions seen determined not associated with channel or modulation)

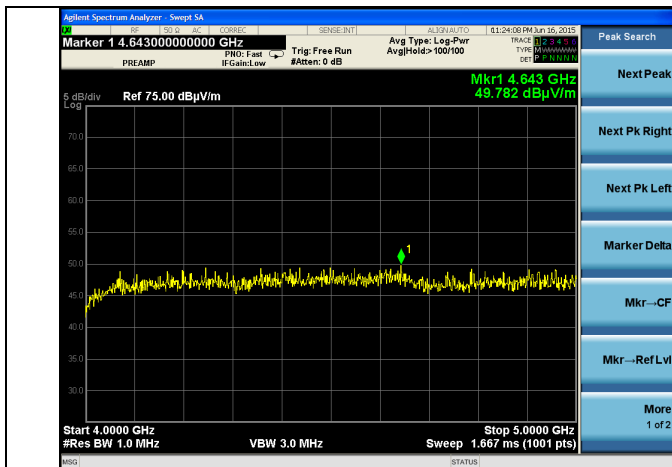


Reduced VBW

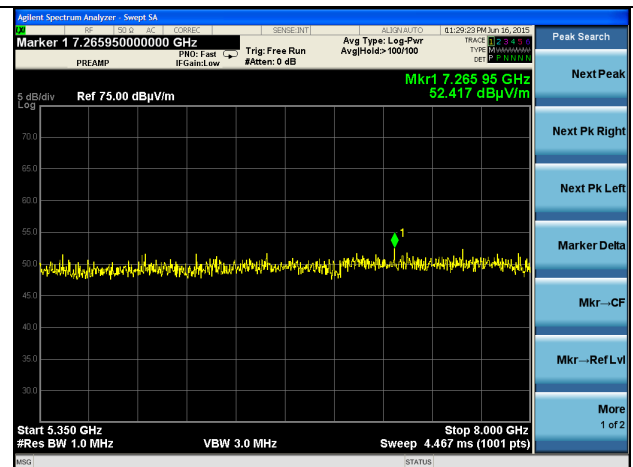


Peak

UNII-1

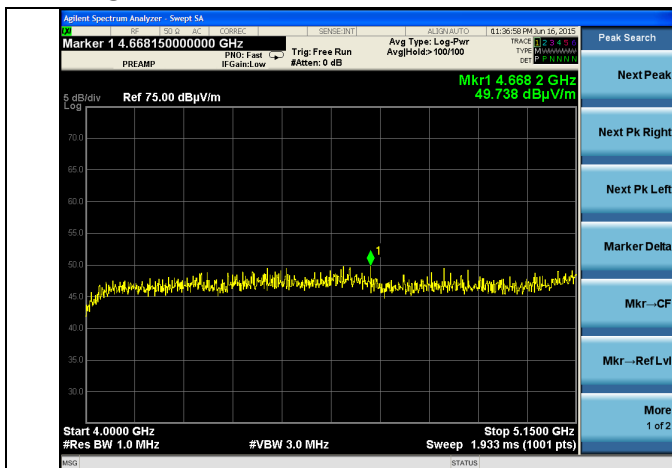


4-5 GHz - Channel 36

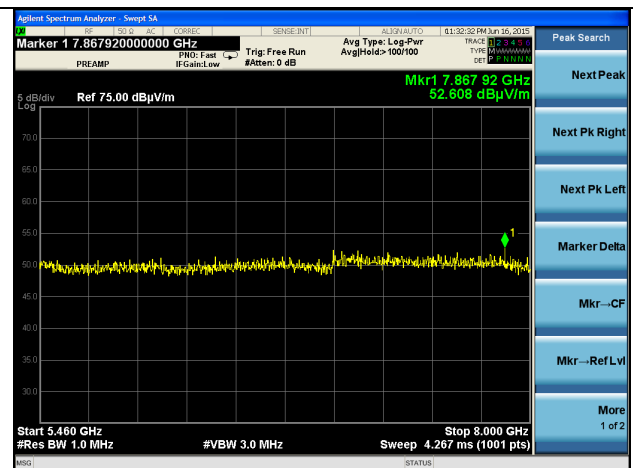


5.35-8 GHz - Channel 44

UNII-2A



4-5.15 GHz - Channel 56

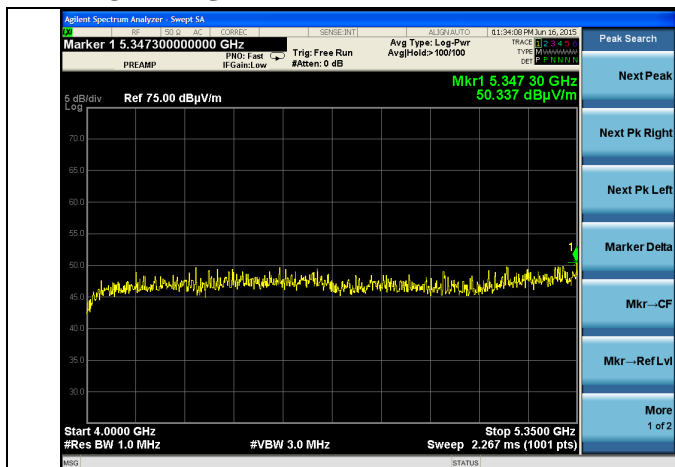


5.46-8 GHz - Channel 64

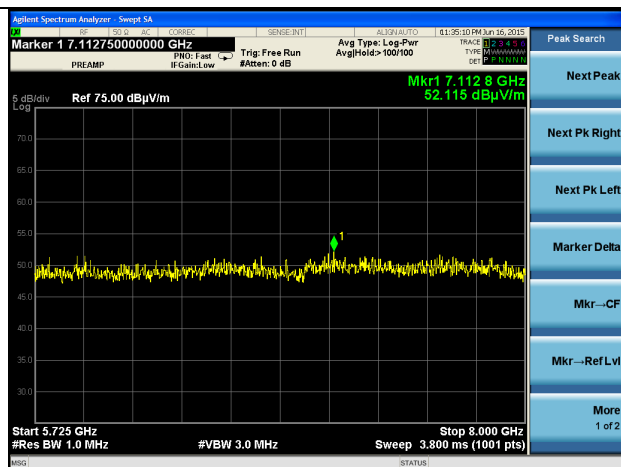
Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

UNII-2C

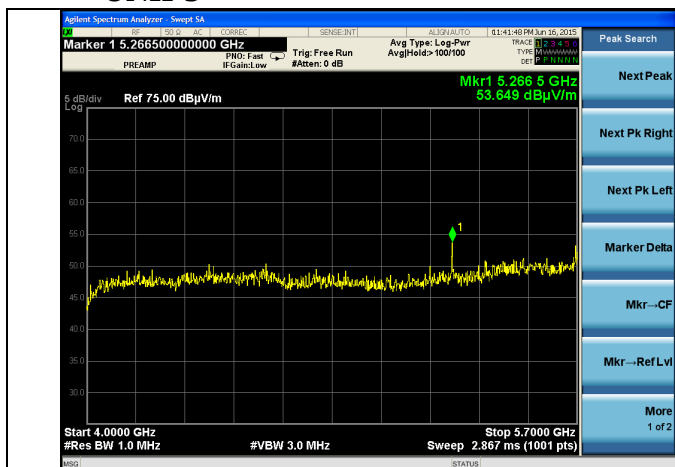


4-5.35 GHz – Channel 100

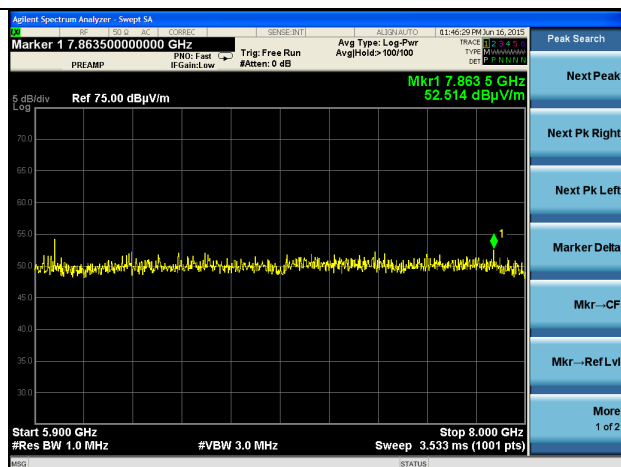


5.725-8 GHz – Channel 140

UNII-3



4-5.7 GHz – Channel 149



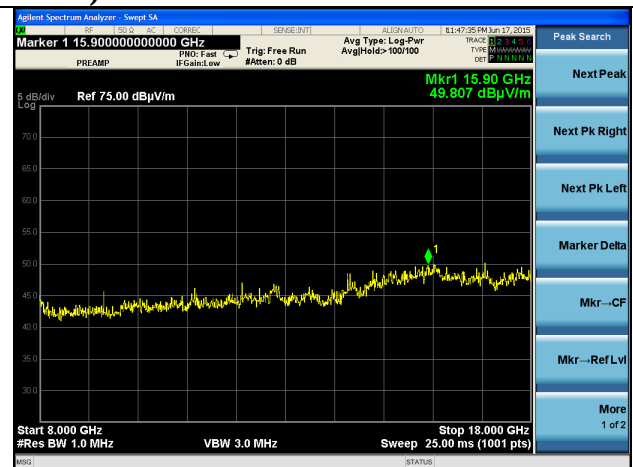
5.9-8 GHz – Channel 165

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

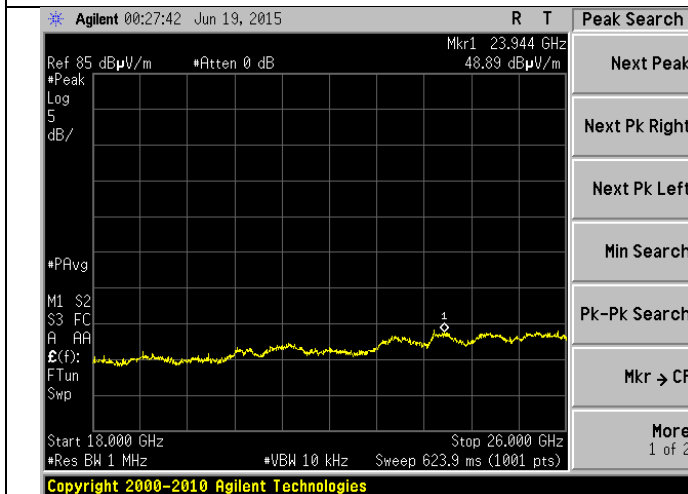
Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

Plots

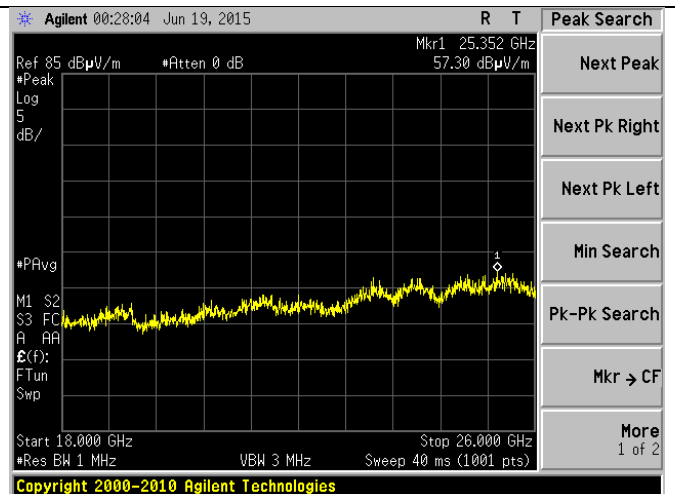
8-40 GHz (No emissions found above system noise floor)



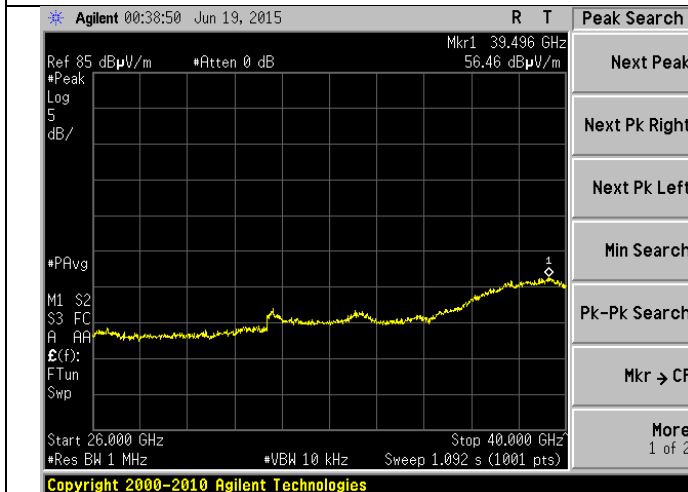
8-18 GHz Reduced VBW



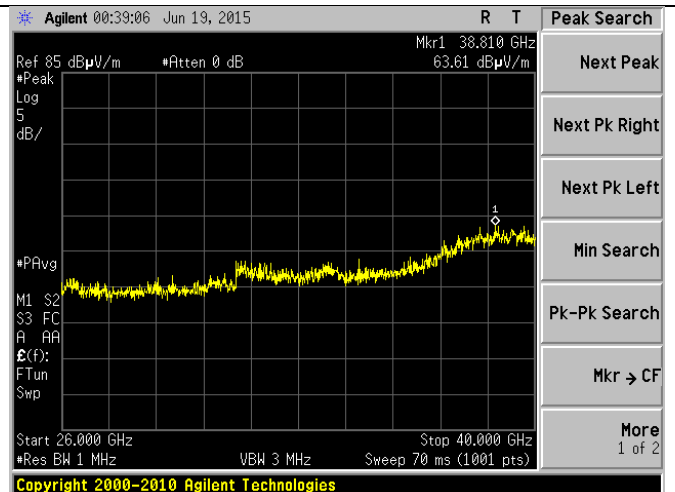
8-18 GHz Peak



18-26 GHz Reduced VBW



18-26 GHz Peak



26-40 GHz Reduced VBW

26-40 GHz Peak

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

B.2.3 – Radiated Spurious Emissions Transmit Mode (30-1000 MHz)

Manufacturer	JDSU
Date	6-19-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.407/ 15.205 / 15.209 IC RSS-247 Section 6 / RSS-GEN
Measurement Procedure	ANSI C63.10-2013 Section 12.7
Test Distance	3 meter 30-1000 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table (no absorbers on ground plane)
Detectors	Peak; RBW 120 kHz
Additional Notes	1) Tested in continuous transmit modulated mode with EUT in three orientations at maximum power. 2) Emissions not effected by channel or modulation.

Example Calculation:

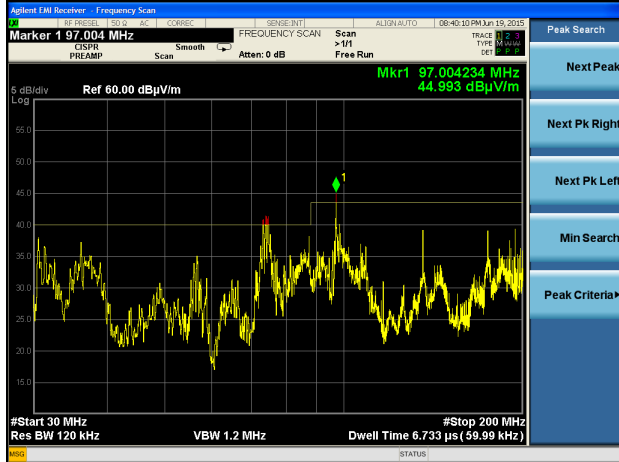
Limit (dBµV/m) – Reading (dBµV/m) = Margin

Table

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
97.0	Vertical	100	0	40.7	43.5	2.8
73.9	Vertical	100	257	38.4	40.0	1.6
31.4	Vertical	100	187	33.5	40.0	6.5
135.8	Horizontal	314	252	39.2	43.5	4.3
97.0	Horizontal	218	90	38.5	43.5	5.0
174.5	Horizontal	179	126	38.1	43.5	5.4
875.0	Vertical	126	16	44.4	46.0	1.6
213.4	Vertical	100	159	34.5	43.5	9.0
625.0	Vertical	100	0	39.0	46.0	7.0
698.2	Horizontal	121	0	39.9	46.0	6.1
504.2	Horizontal	201	300	40.9	46.0	5.1
426.6	Horizontal	195	0	39.3	46.0	6.7

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

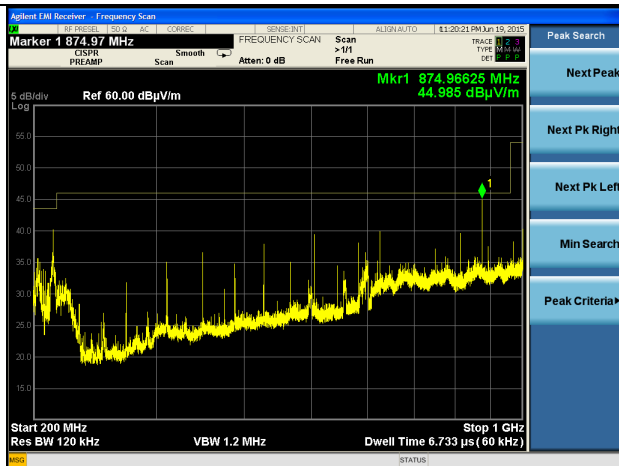
Plots



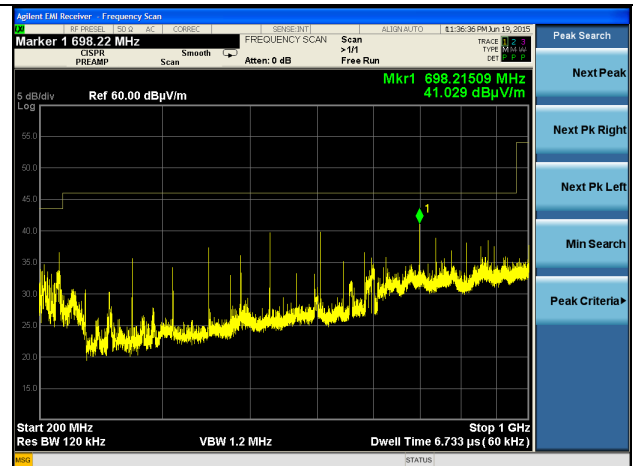
30-200 MHz Vertical



30-200 MHz Horizontal



200-1000 MHz Vertical



200-1000 MHz Horizontal

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample

B.3 – AC Mains Conducted Emissions

Rule Part(s)	FCC: 15.207 / 15.107 IC: RSS-247 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2014 ANSI C63.10 – 2013
Test Location	LS Research, LLC – Conducted Emissions Area
Test Voltage	120 VAC 60 Hz
EUT Placement	80 cm height non-conductive table above reference ground plane
Frequency Range of Measurement	150 kHz – 30 MHz
Measurement Detectors	Peak, Quasi-Peak, Average RBW: 9 kHz VBW: At least 27 kHz
Description of Measurement	1) The LISN, cable, limiter, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal at appropriate distance from ground planes and plugged into LISN. The LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral). 3) Maximum emissions are determined with peak detector and measurements at select points are made with quasi-peak and average detectors. Results are recorded and compared to limit.
Example Calculations	Reported Measurement data = Raw receiver measurement + LISN Factor + Cable factor (dB) + Additional factor (when applicable)

Limits of Conducted Emissions at the AC Mains Ports:

Frequency Range (MHz)	Class B Limits (dBμV)	
	Quasi-Peak	Average
0.150 -0.50 *	66-56	56-46
0.5 – 5.0	56	46
5.0 – 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

B.3.1 – AC Mains Conducted Emissions

Manufacturer	JDSU
Date	6-22-15
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.207 / 15.107 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2014 ANSI C63.10 - 2013 Section 6.2
Test Voltage	120 VAC 60 Hz supplied to AC adapter supplied by applicant for use with EUT
EUT Placement	80 cm height non-conductive table, 40 cm from vertical ground plane
Detectors	Peak; RBW 9 kHz Quasi-Peak and Average
Additional Notes	1) Tested in continuous transmit and receive with no significant difference between operating channels or mode. WLAN Channel 6, 1 MBPS for final data.

Example Calculation:

Margin (dB) = Limit (dBμV) – Reading (dBμV)

Table

Frequency (MHz)	Line	Peak Reading (dBμV)	Quasi-Peak Reading (dBμV)	Average Reading (dBμV)	Q-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Limit (dBμV)	Average Margin (dB)
0.150	1	52.6	47.4	34.7	66.00	18.6	56.00	21.3
0.222	1	47.7	41.0	30.6	62.74	21.7	52.74	22.1
0.469	1	43.3	39.3	30.0	56.53	17.2	46.53	16.5
6.193	1	38.4	34.9	28.6	60.00	25.1	50.00	21.4
6.445	1	38.1	34.4	27.9	60.00	25.6	50.00	22.1
0.177	1	49.3	43.0	32.7	64.63	21.6	54.63	21.9
0.163	2	50.0	45.8	32.2	65.31	19.5	55.31	23.1
0.190	2	46.2	42.4	29.0	64.04	21.6	54.04	25.0
0.469	2	43.2	40.0	29.9	56.53	16.5	46.53	16.6
0.437	2	41.5	37.9	29.2	57.12	19.2	47.12	17.9
6.179	2	38.6	35.9	29.7	60.00	24.1	50.00	20.3
6.449	2	38.5	35.8	29.5	60.00	24.2	50.00	20.5

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Name: OneExpert CATV

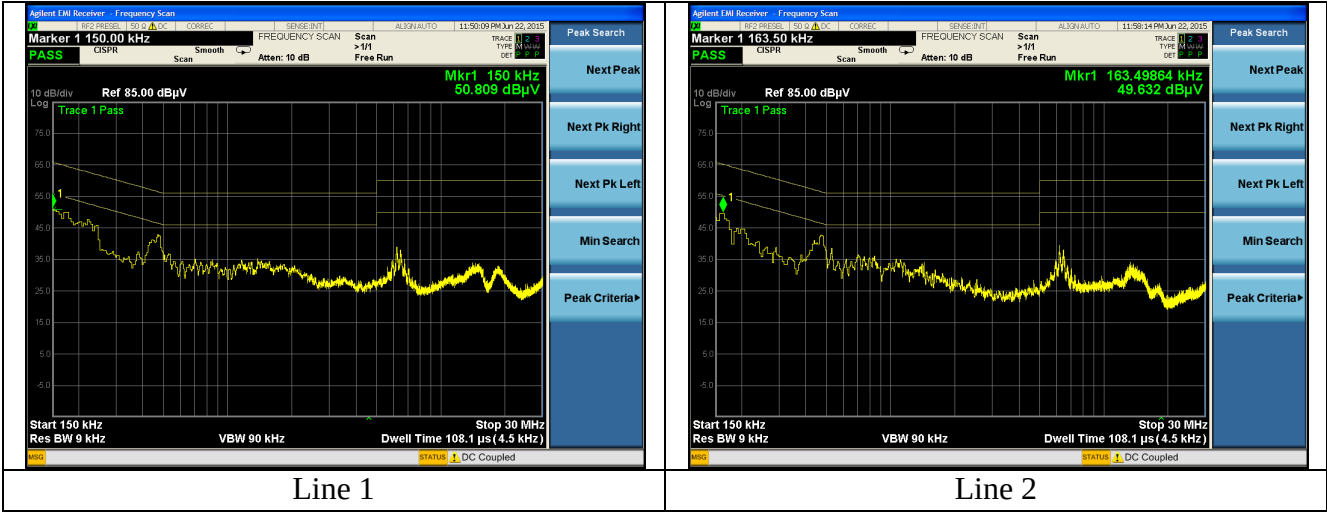
Report: TR 315103 C

Model: OneExpert CATV

LSR: C-2210

Serial: Eng. Sample

Plots



Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

Appendix C - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k=2$.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64° / 2.88 %RH

Appendix D - References

Publication	Year	Title
FCC CFR Parts 0-15	2015	Code of Federal Regulations – Telecommunications
RSS-247 Issue 1	2015	Digital Transmissions Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing Unlicensed Wireless Devices

Prepared For: JDSU	Name: OneExpert CATV
Report: TR 315103 C	Model: OneExpert CATV
LSR: C-2210	Serial: Eng. Sample

END OF REPORT

Date	Version	Comments	Person
8-03-15	V0	Initial Draft Release	Adam Alger
8-11-15	V1	Final Release	Tom Smith
9-1-15	V1a	TCB Comments Addressed	Adam Alger

Prepared For: JDSU
Report: TR 315103 C
LSR: C-2210

Name: OneExpert CATV
Model: OneExpert CATV
Serial: Eng. Sample