



Nemko Test Report: 2015_274721_FCC15247_CAM

Applicant: MicroPower Technologies
4350 Executive Dr.
Suite 325
San Diego CA 92121

Equipment Under Test: SLV-C30S SERIES
(E.U.T.)

FCC Identifier: ZHXSLVC30S

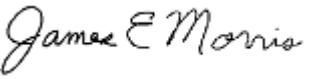
In Accordance With: **FCC Part 15, Subpart C, 15.247 and**
Industry Canada RSS-210, Issue 8
Digital Transmission Systems

Tested By: Nemko USA Inc.
2210 Faraday Ave.
Suite 150
Carlsbad, CA 92008

TESTED BY: 

David Light, Wireless Engineer

DATE: 16 January 2015

APPROVED BY: 

James Morris, EMC/Wireless
Manager

DATE: 9 February 2015

Number of Pages: 57

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Nemko USA, Inc.

EQUIPMENT: SLV-C30S
SERIES

FCC PART 15, SUBPART C and
Industry Canada RSS-210
Digital Transmission Systems

Test Report No.: 2015_274721_FCC15247_CAM

Section 1. Summary of Test Results

Manufacturer: MicroPower Technologies

Model No.: SLV-C30S SERIES

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 and Industry Canada RSS-210, Issue 8 for Digital Transmission Systems. Radiated tests were conducted in accordance with ANSI C63.10: 2013. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and Industry Canada.



New Submission



Production Unit



Class II Permissive Change

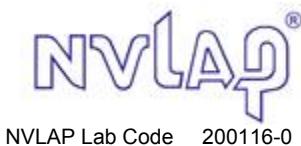


Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. Nemko USA, Inc. is a NVLAP accredited laboratory.

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EQUIPMENT: SLV-C30S
SERIES

FCC PART 15, SUBPART C and
Industry Canada RSS-210
Digital Transmission Systems

Test Report No.: 2015_274721_FCC15247_CAM

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	FCC 15.207(a) / RSS-GEN 7.2.4	NA
Minimum 6 dB Bandwidth	FCC 15.247(a)(2) / RSS-210 A8.2(a)	Complies
Maximum Peak Power Output	FCC 15.247(b)(3) / RSS-210 A8.4(4)	Complies
Spurious Emissions (Antenna Conducted)	FCC 15.247(d) / RSS-210 A8.5	Complies
Spurious Emissions (Restricted Bands)	FCC 15.209(a) RSS-Gen 7.2.2	Complies
Peak Power Spectral Density	FCC 15.247(e) / RSS-210 A8.2(b)	Complies

Footnotes:

The EUT is powered by a solar rechargeable battery.

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EQUIPMENT: SLV-C30S
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Digital Transmission Systems

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Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band (MHz): 902-928 2400-2483.5 5725-5850

Operating Frequency of Test Sample: 2405 to 2480 MHz (OQPSK)
2417 to 2462 MHz (OFDM)

User Frequency Adjustment: Software controlled

Description of EUT

The SLV-C30S SERIES camera sends video feed to remote hub. The EUT has a wideband OFDM radio and a narrow band OQPSK radio.

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EQUIPMENT: SLV-C30S
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Section 3. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth

PARA. NO.: FCC 15.247(a)(2)
RSS-210 A8.2(a)

TESTED BY: David Light

DATE: 17 December 2014
and 05 January 2015

Test Results: Complies.

Measurement Data: See 6 dB BW plot

Measured 6 dB bandwidth: 16.4 MHz (OFDM)
1.9 MHz (OQPSK)

Test Conditions: 35 %RH
22 °C

Measurement Uncertainty: 0.20 ms

Test Equipment Used: 1036

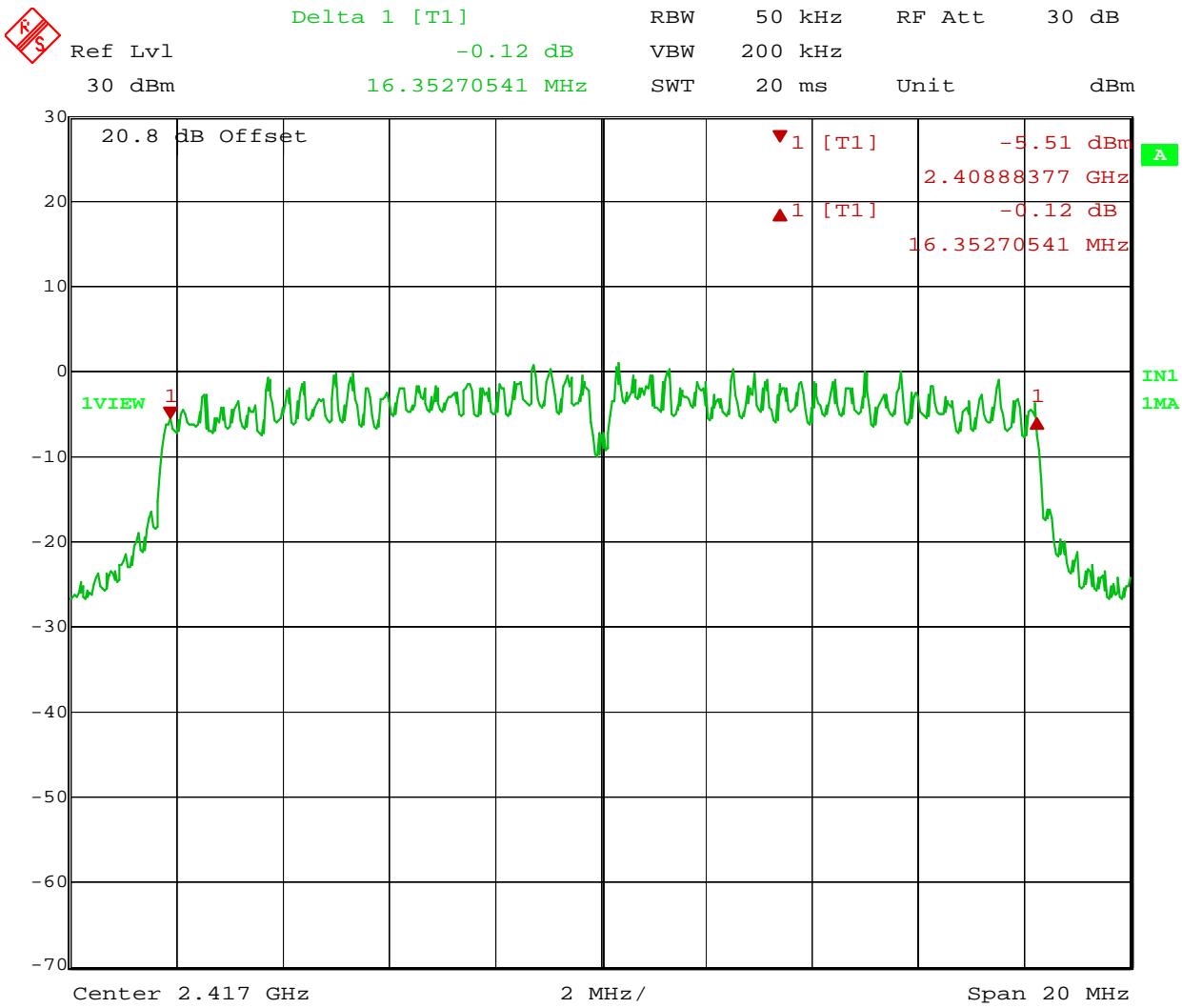
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Digital Transmission Systems

**EQUIPMENT: SLV-C30S
SERIES**

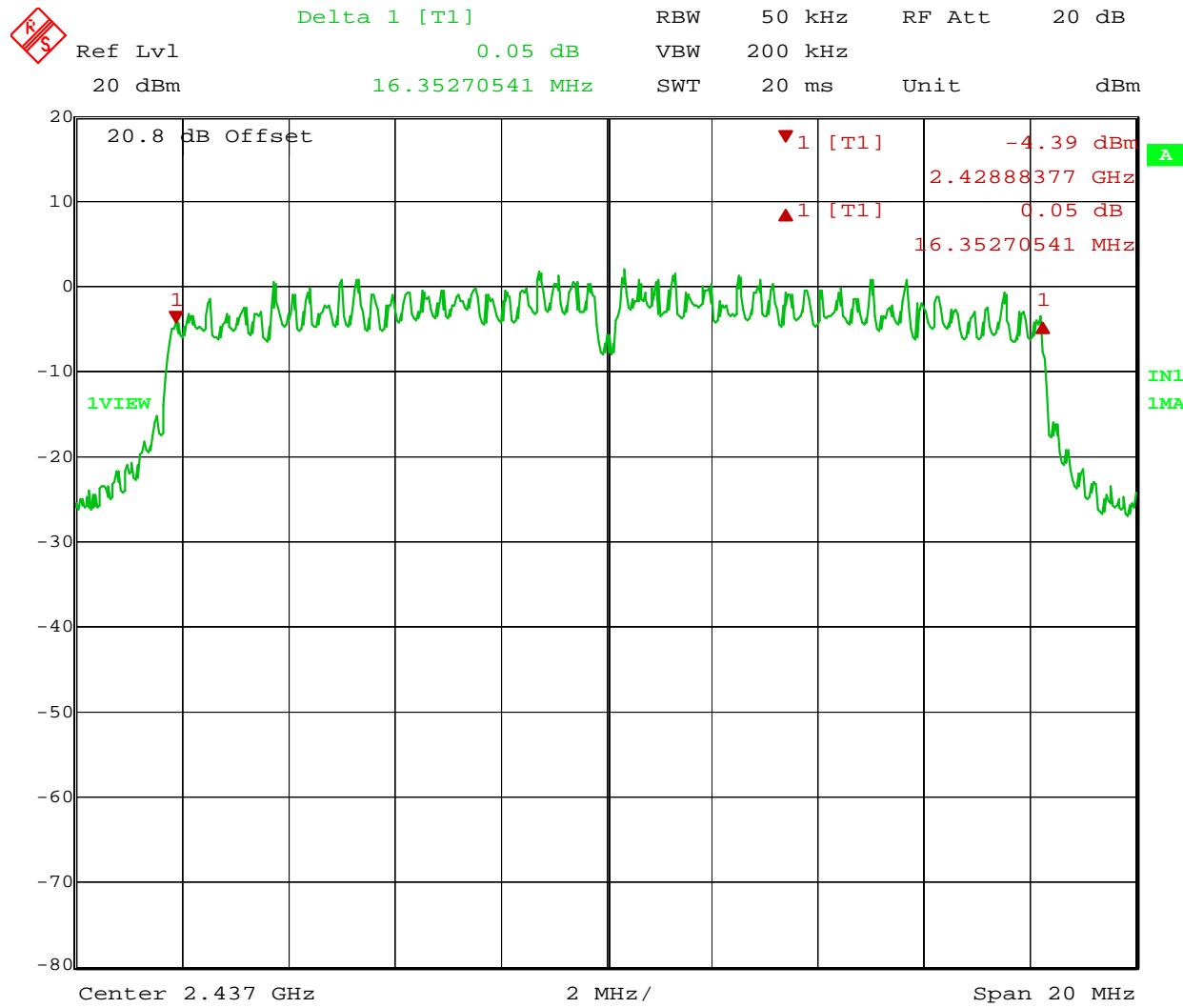
Test Report No.: 2015 274721 FCC15247 CAM

Test Data – Occupied Bandwidth - OFDM



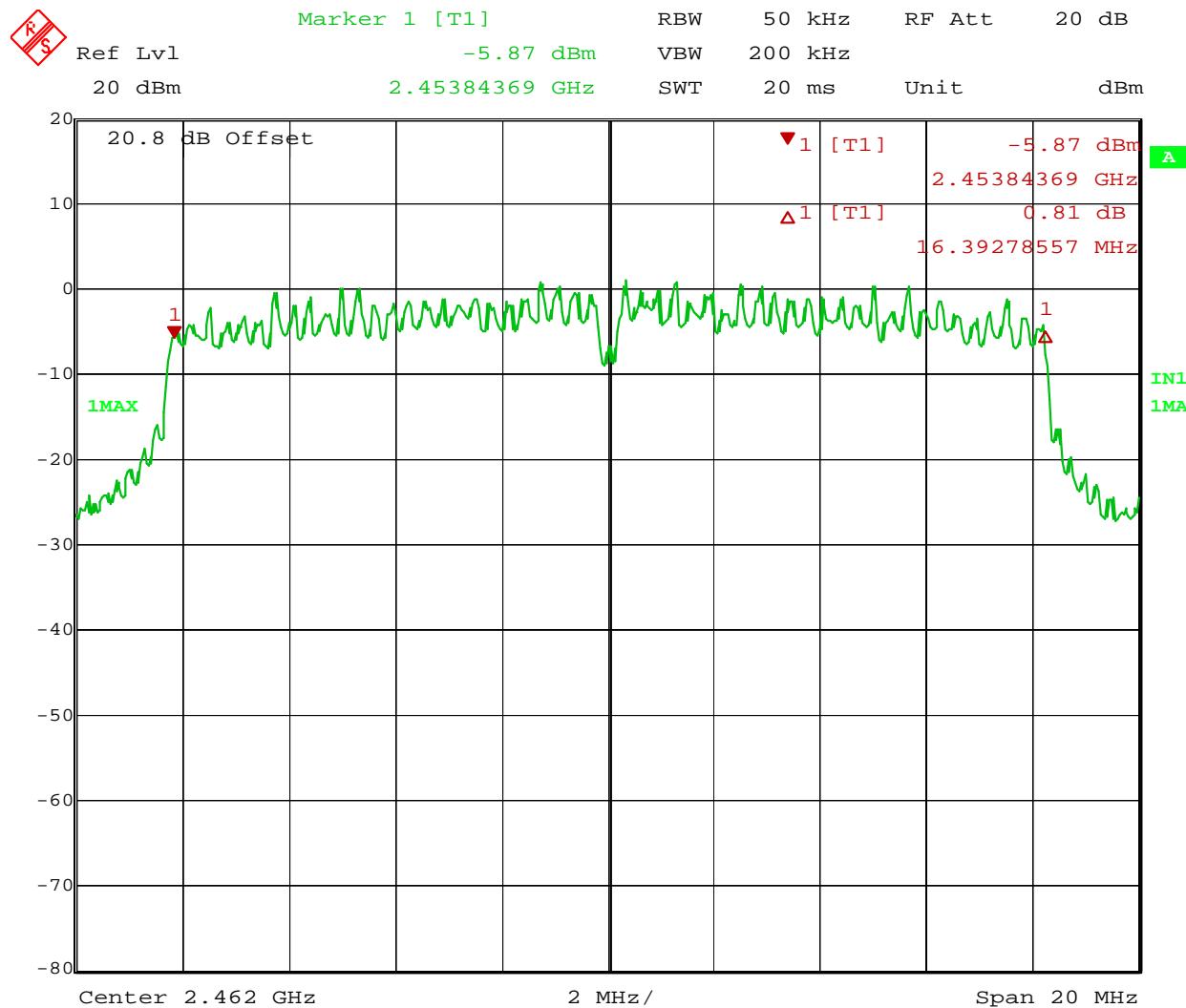
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Test Data – Occupied Bandwidth – OFDM



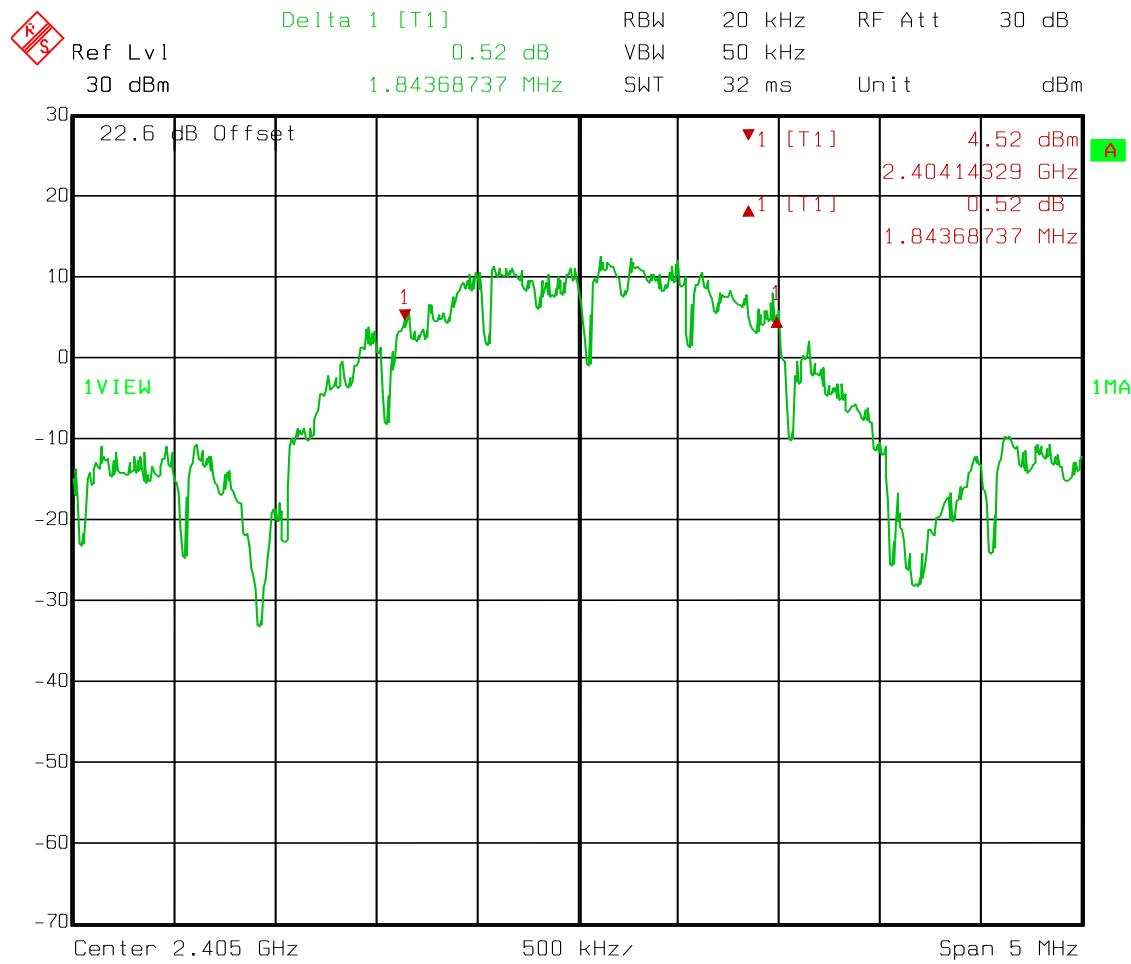
Date: 5.JAN.2015 08:45:50

Test Data – Occupied Bandwidth - OFDM



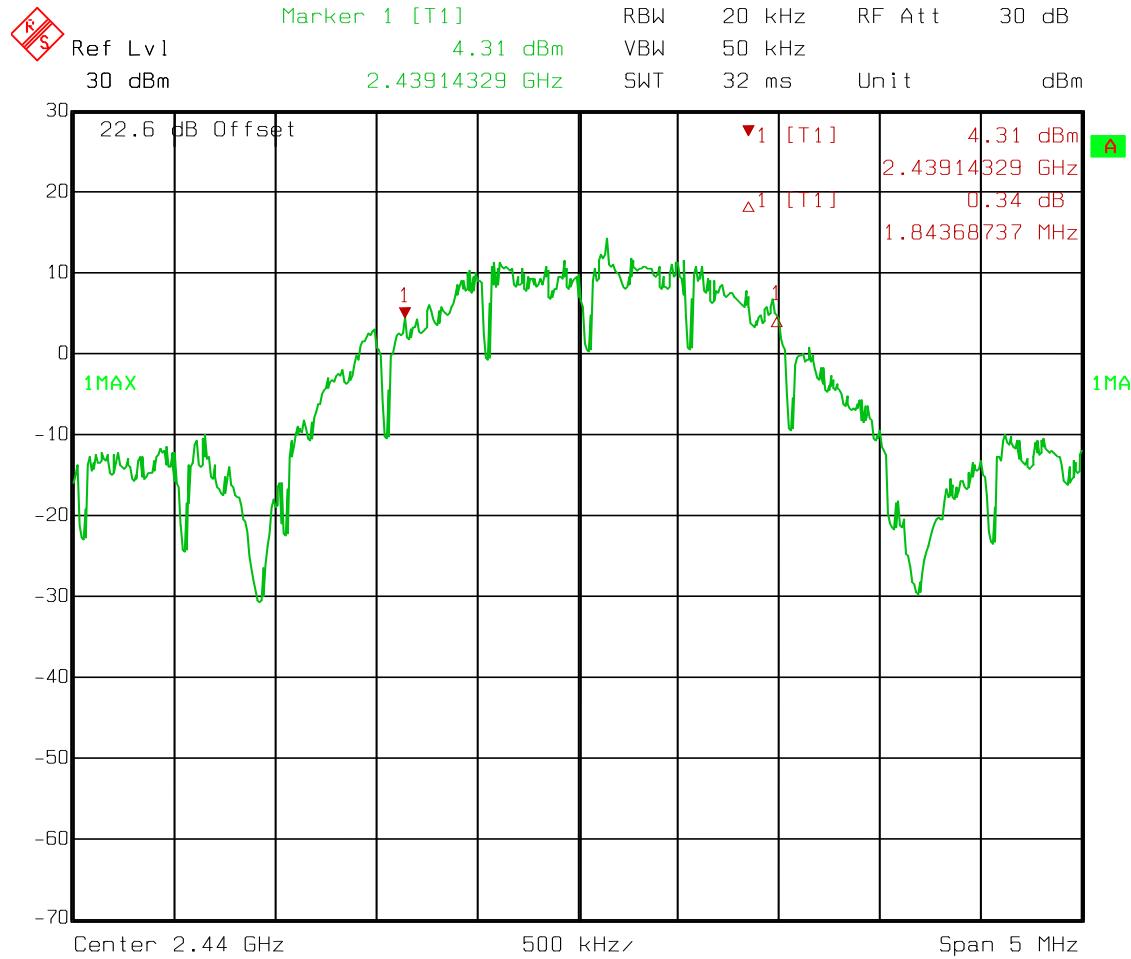
Date: 5.JAN.2015 08:52:55

Test Data – Occupied Bandwidth – OQPSK

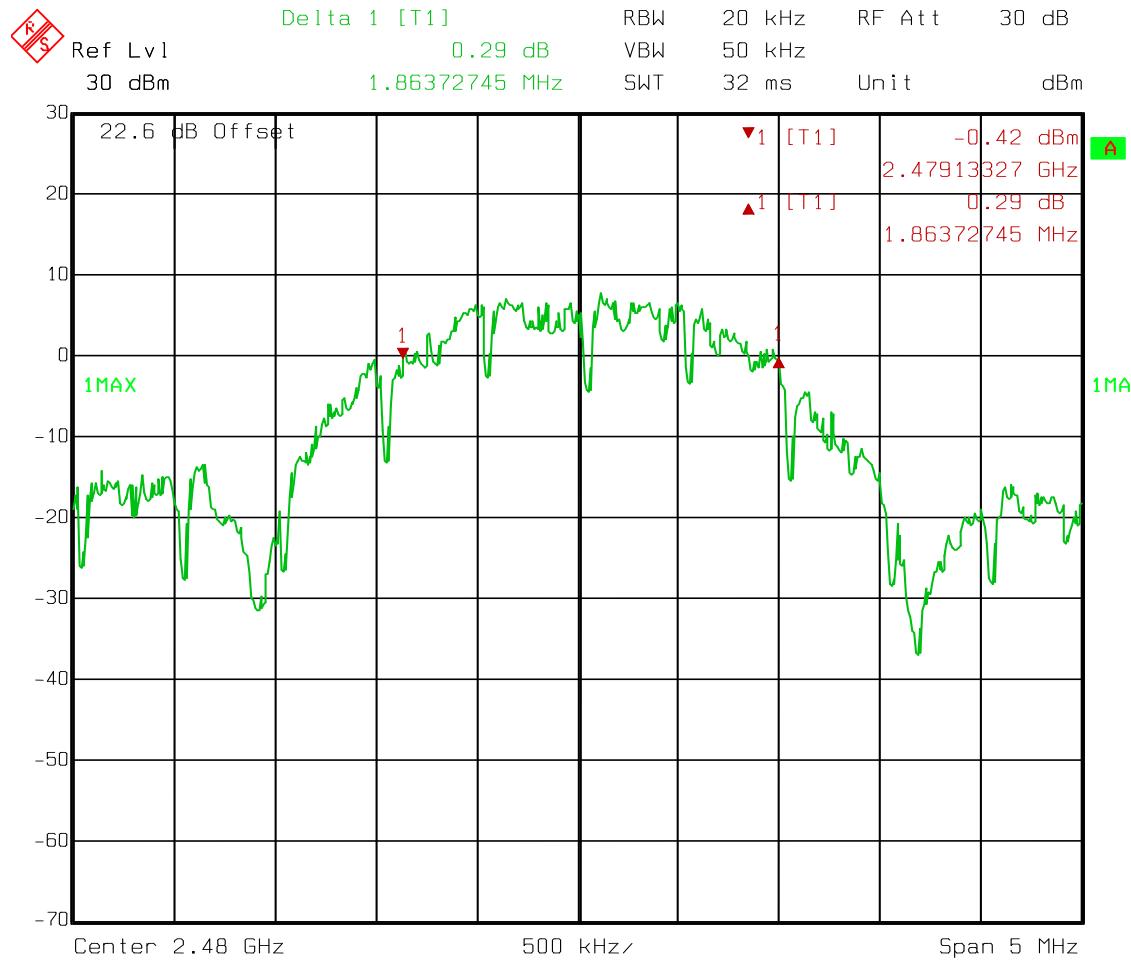


Date: 17.DEC.2014 09:07:13

Test Data – Occupied Bandwidth – OQPSK



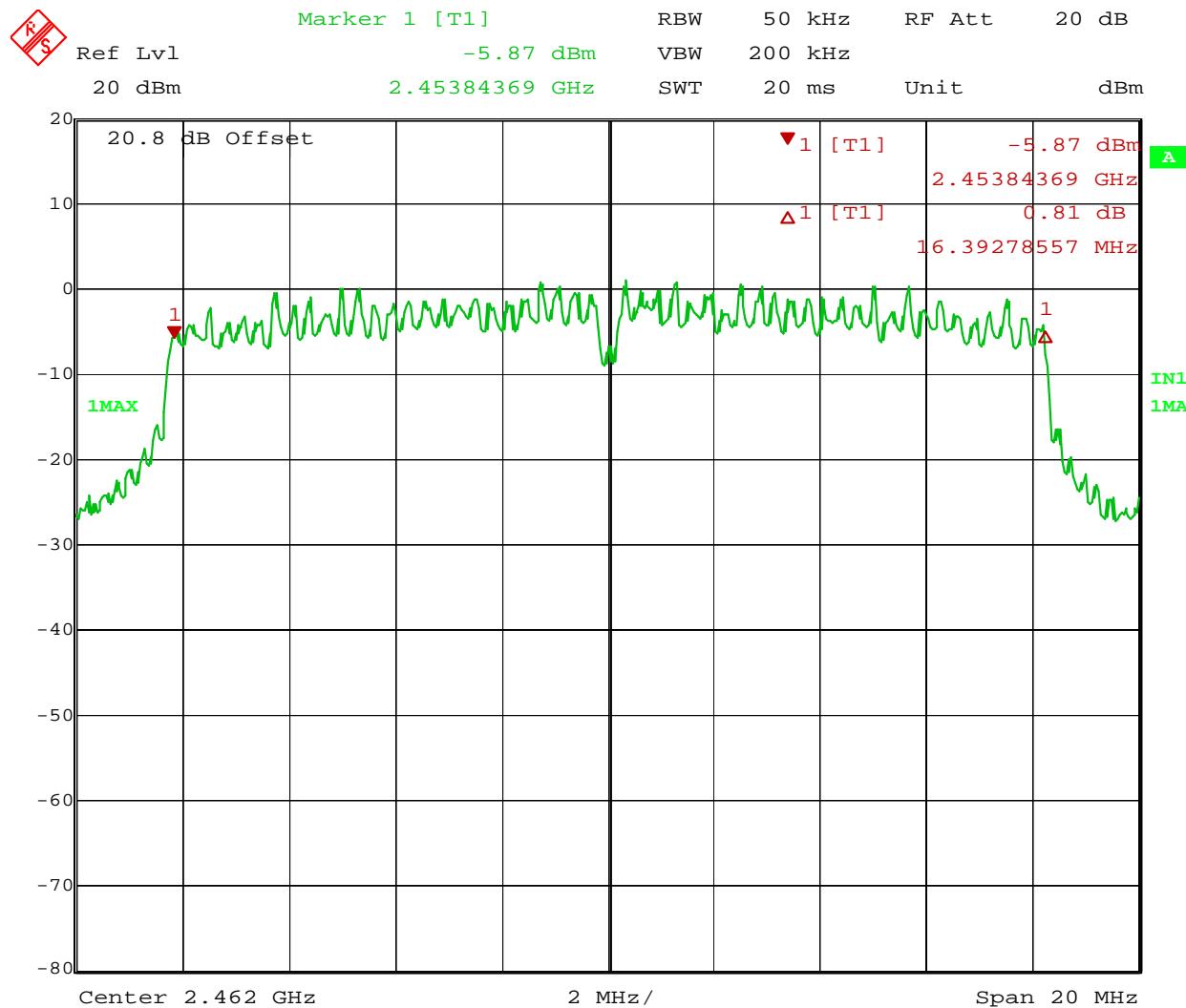
Date: 17.DEC.2014 09:22:18

Test Data – Occupied Bandwidth – OQPSK

Date: 17.DEC.2014 09:30:43

Test Data – Occupied Bandwidth - OFDM

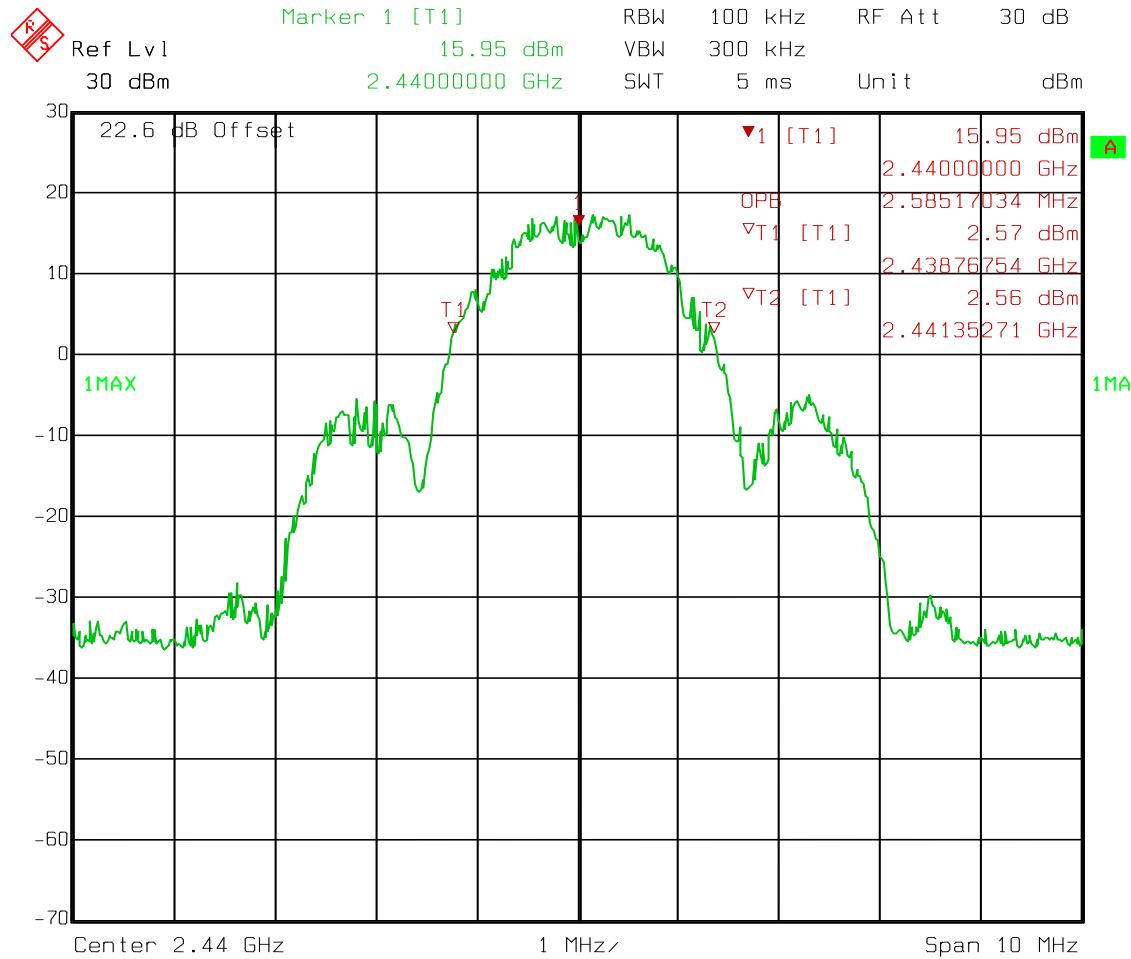
99% bandwidth



Date: 5.JAN.2015 08:52:55

Test Data – Occupied Bandwidth - OQPSK

99% bandwidth



Date: 17.DEC.2014 09:55:51

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EQUIPMENT: SLV-C30S
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Section 4. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: FCC 15.247(b)(3) RSS-210 A8.4(4)
TESTED BY: David Light	DATE: 17 December 2014 and 05 January 2015

Test Results: Complies.

Antenna Gain: 8 dBi

Maximum EIRP: 30.9 dBm / 1.23 W (OFDM)
30.3 dBm / 1.07 W (OQPSK)

Measurement Data: Refer to attached data

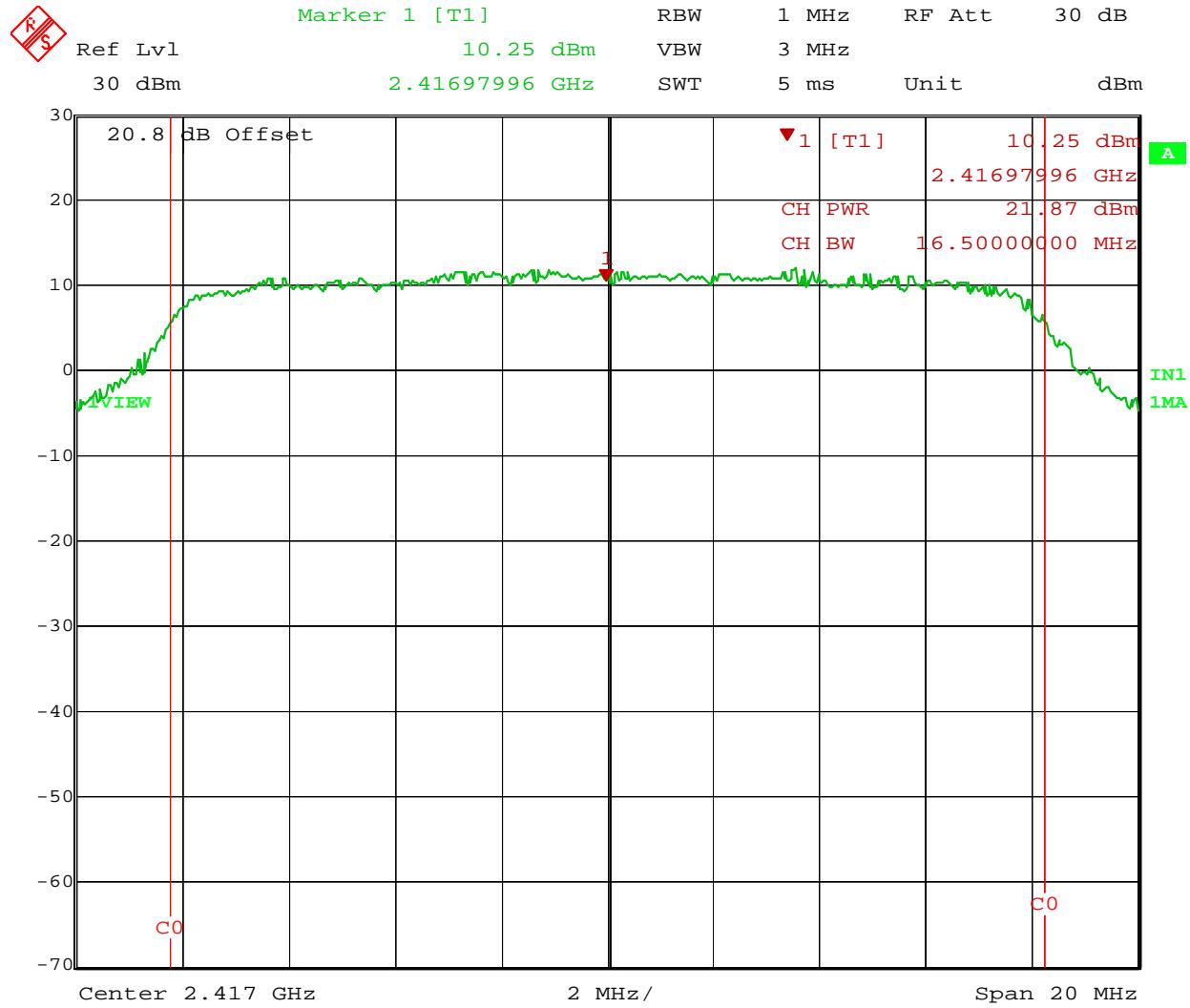
Test Conditions: 35 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1036

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).
- This test was performed radiated.

Test Data – Peak Power - OFDM



Date: 5.JAN.2015 11:33:01

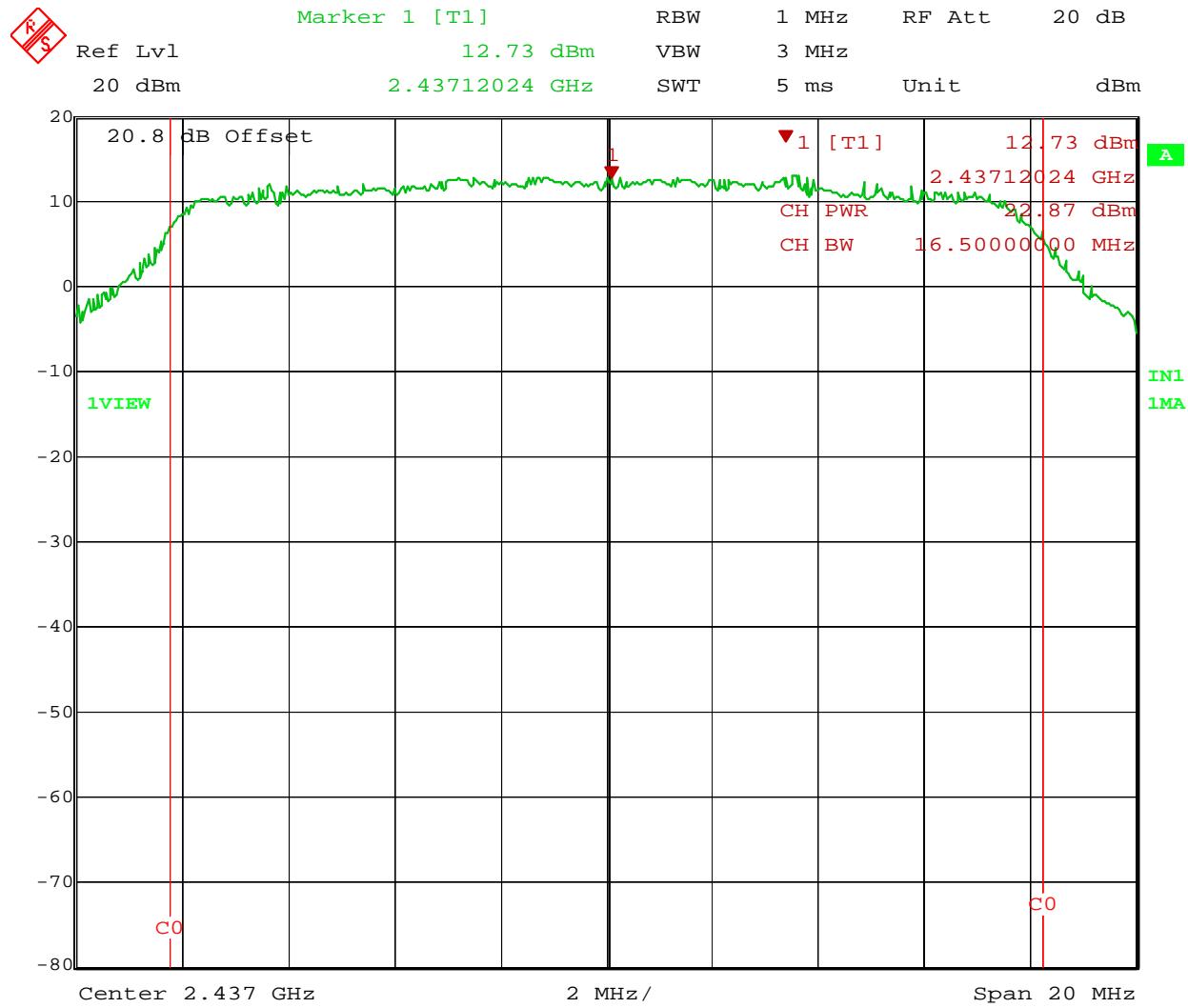
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Digital Transmission Systems

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SERIES**

Test Report No.: 2015 274721 FCC15247 CAM

Test Data – Peak Power - OFDM



Date: 5.JAN.2015 08:47:48

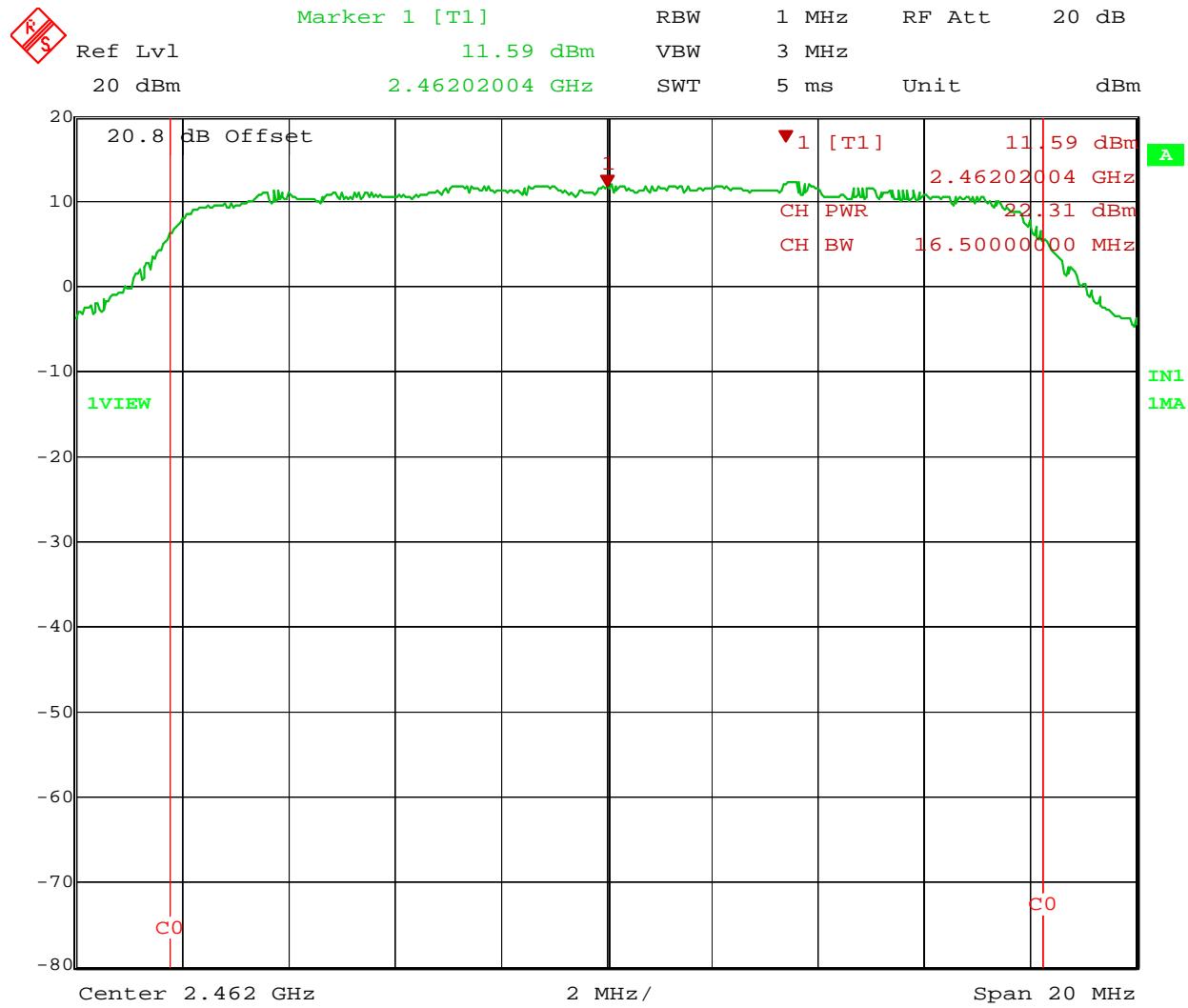
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Digital Transmission Systems

**EQUIPMENT: SLV-C30S
SERIES**

Test Report No.: 2015 274721 FCC15247 CAM

Test Data – Peak Power - OFDM



Date: 5.JAN.2015 08:53:31

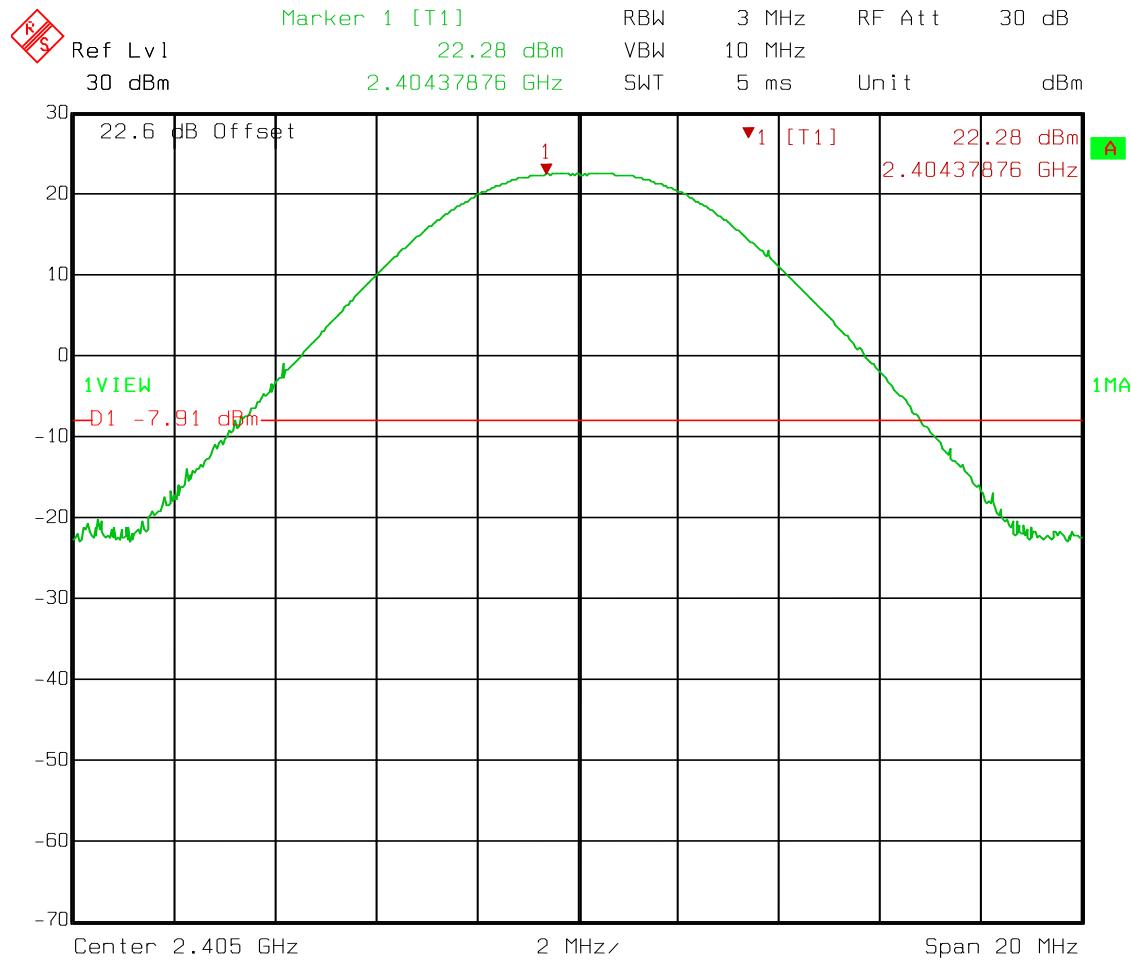
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Digital Transmission Systems

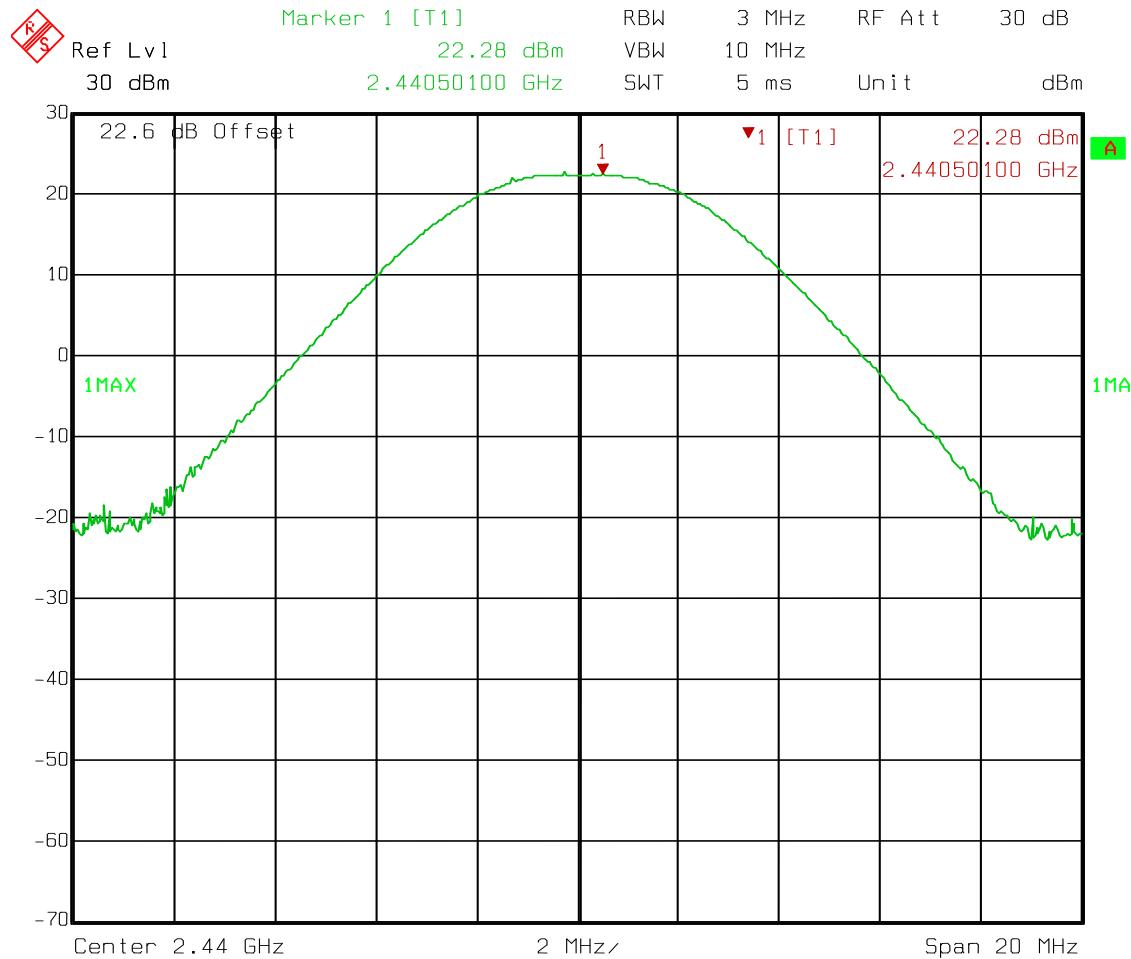
**EQUIPMENT: SLV-C30S
SERIES**

Test Report No.: 2015 274721 FCC15247 CAM

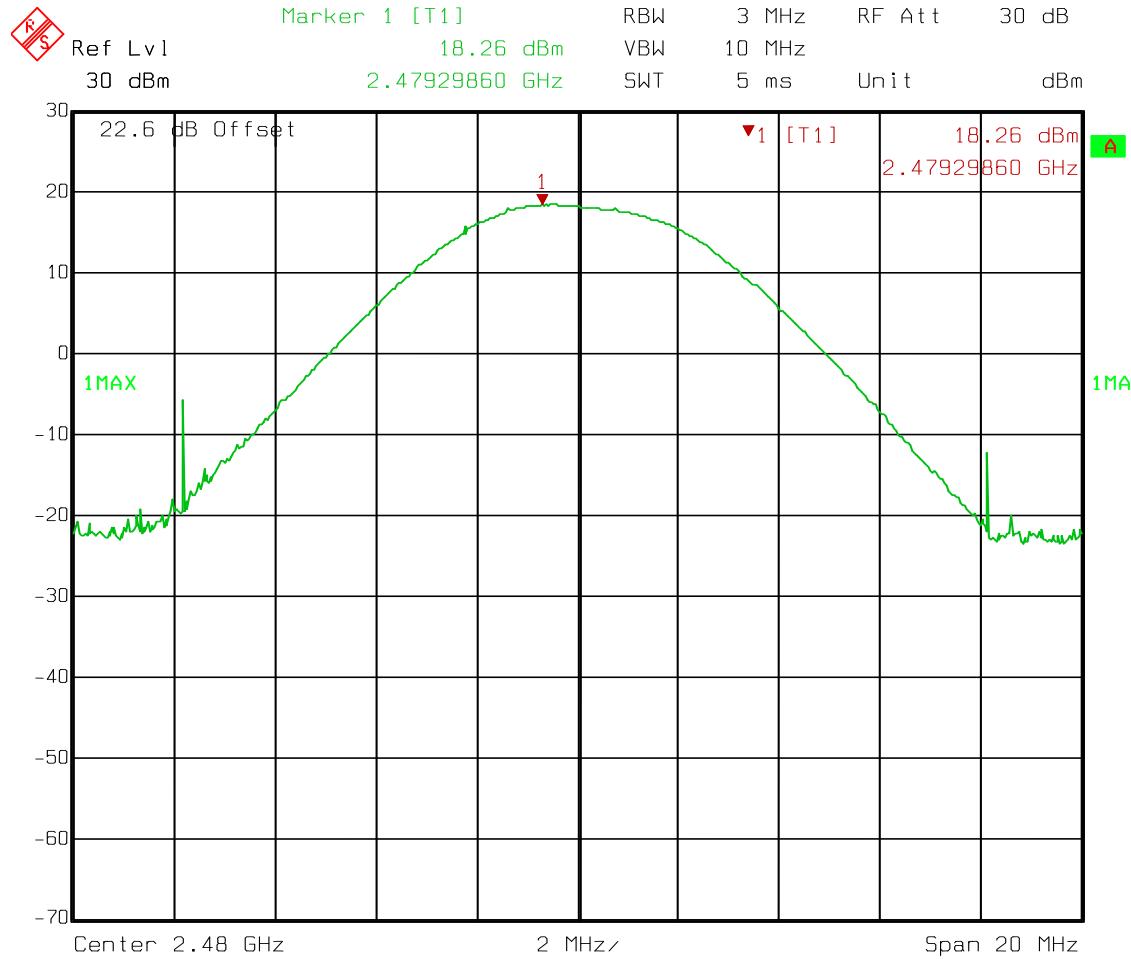
Test Data – Peak Power - OQPSK



Date: 17.DEC.2014 09:05:25

Test Data – Peak Power - OQPSK

Date: 17.DEC.2014 09:22:51

Test Data – Peak Power - OQPSK

Date: 17.DEC.2014 09:31:13

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EQUIPMENT: SLV-C30S
SERIES

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Digital Transmission Systems

Test Report No.: 2015_274721_FCC15247_CAM

Section 5 Spurious Emissions at Antenna

NAME OF TEST: Spurious Emissions at Antenna

PARA. NO.: FCC 15.247 (d)
RSS-210 A8.5

TESTED BY: David Light

DATE: 17 December 2014 and
05 January 2015

Test Results: Complies.

Measurement Data: See attached plots.

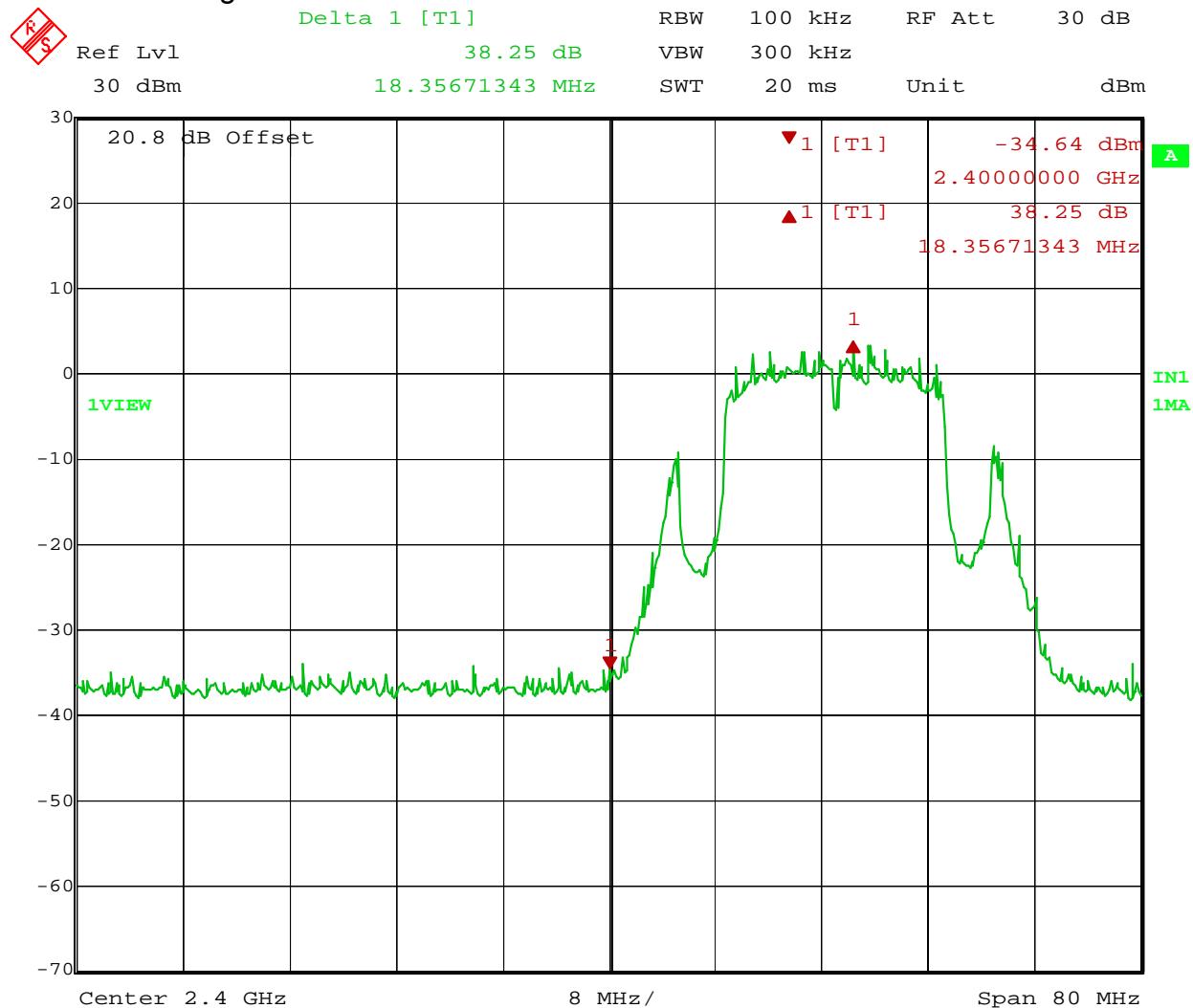
Test Conditions: 35 %RH
 22 °C

Measurement Uncertainty: +/-1.7 dB

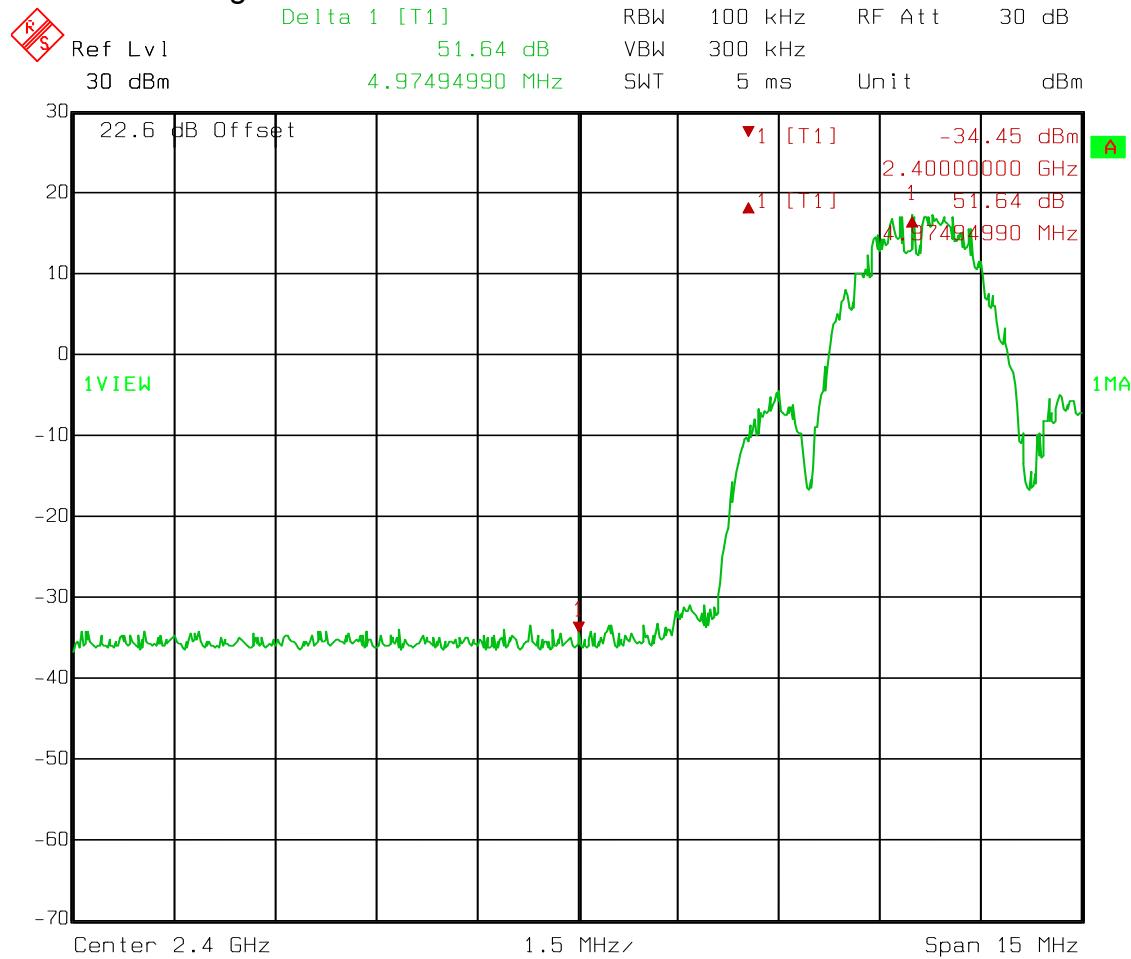
Test Equipment Used: 1036

Test Data – Spurious Emissions at Antenna Terminals – (OFDM)

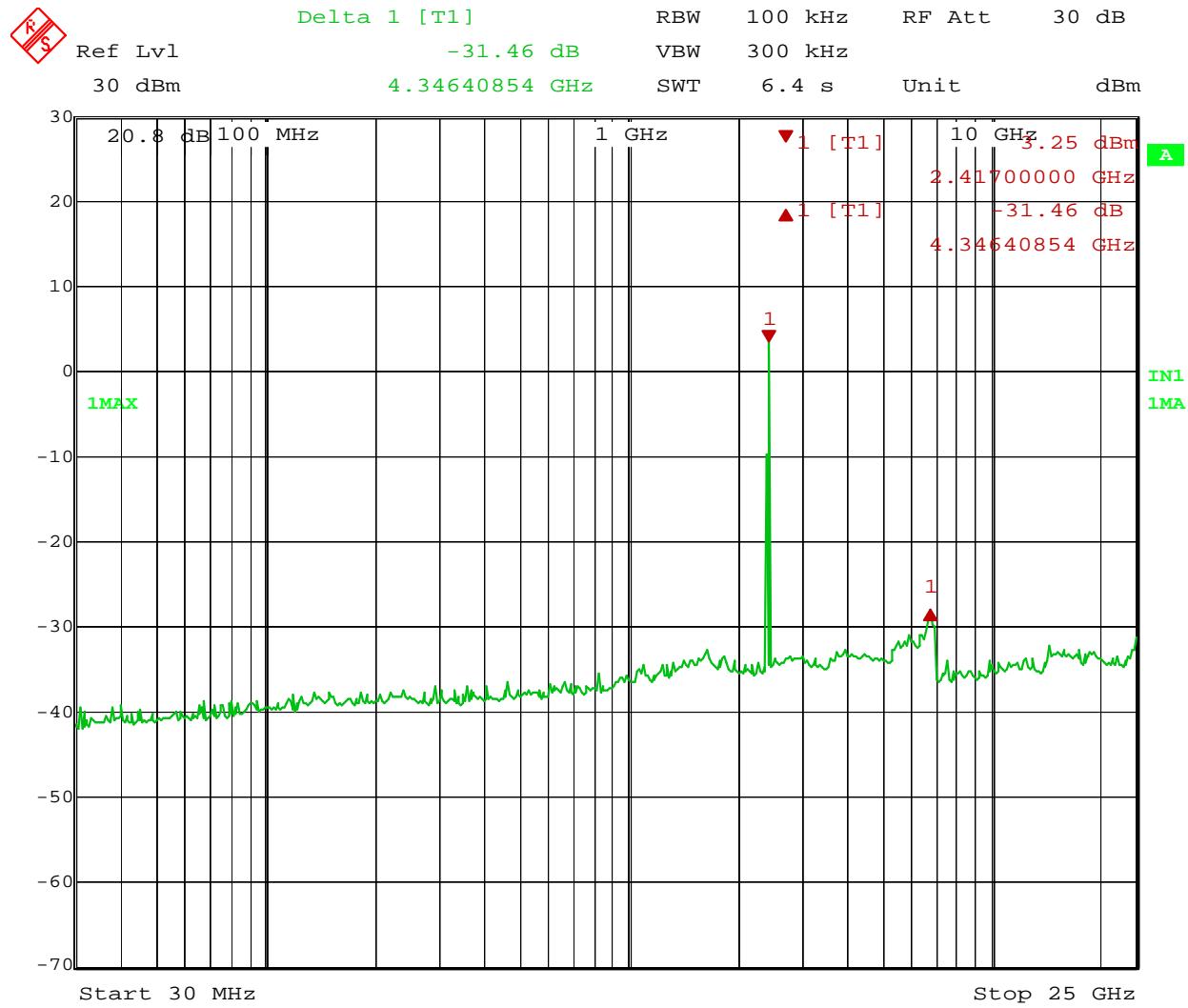
Lower Band Edge



Date: 5.JAN.2015 11:35:19

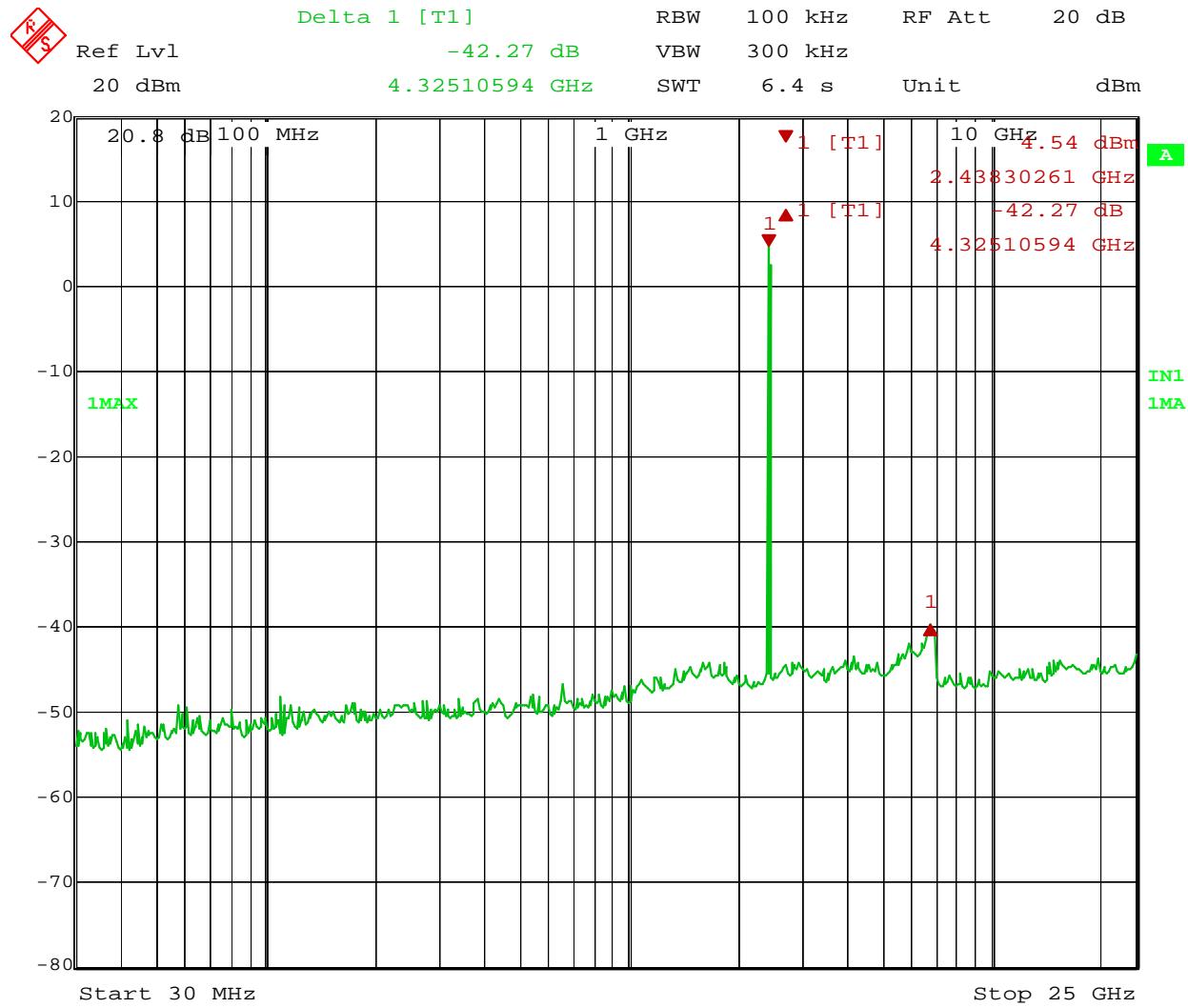
Test Data – Spurious Emissions at Antenna Terminals – OQPSK**Lower Band Edge**

Test Data – Spurious Emissions at Antenna Terminals - OFDM



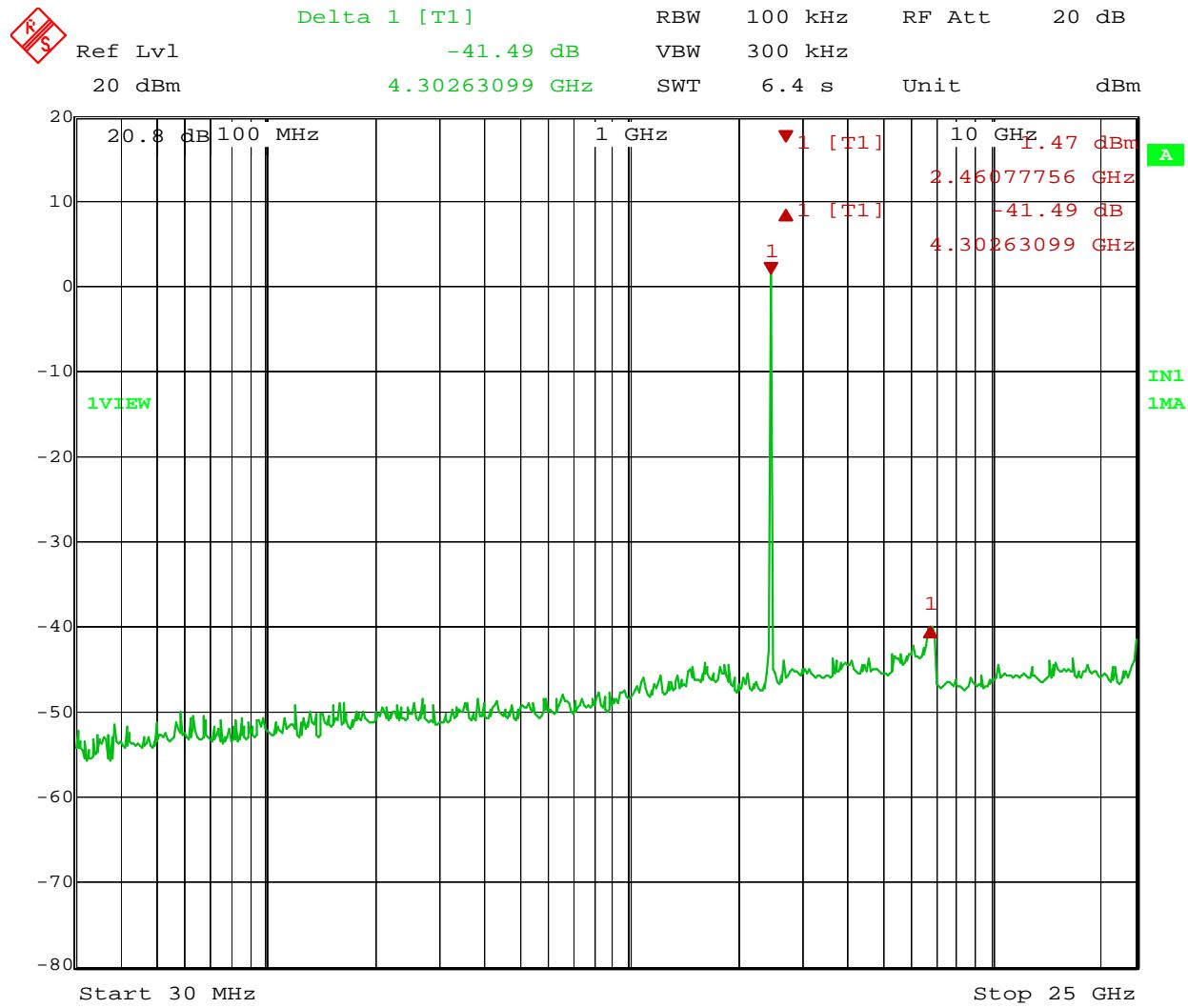
Date: 5.JAN.2015 11:44:57

Test Data – Spurious Emissions at Antenna Terminals - OFDM

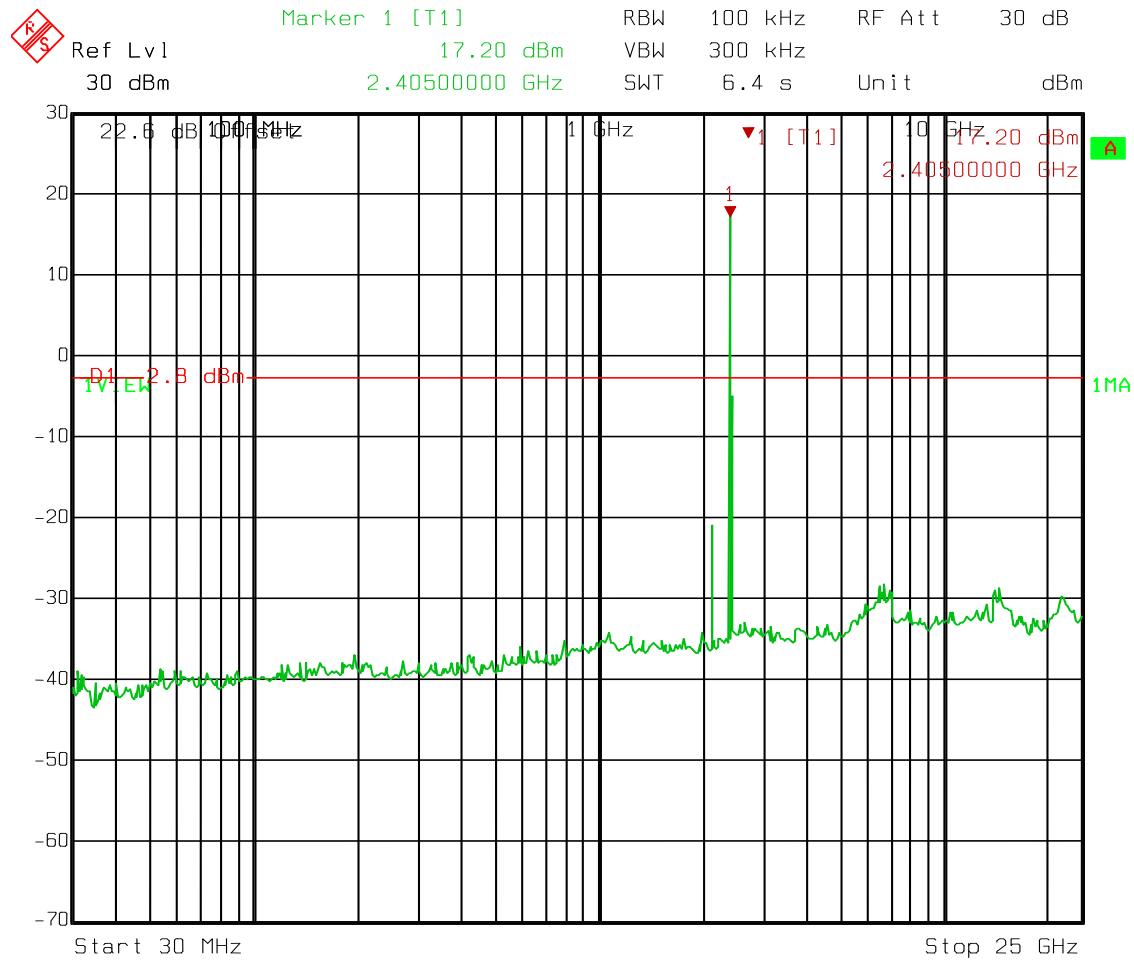


Date: 5.JAN.2015 08:49:06

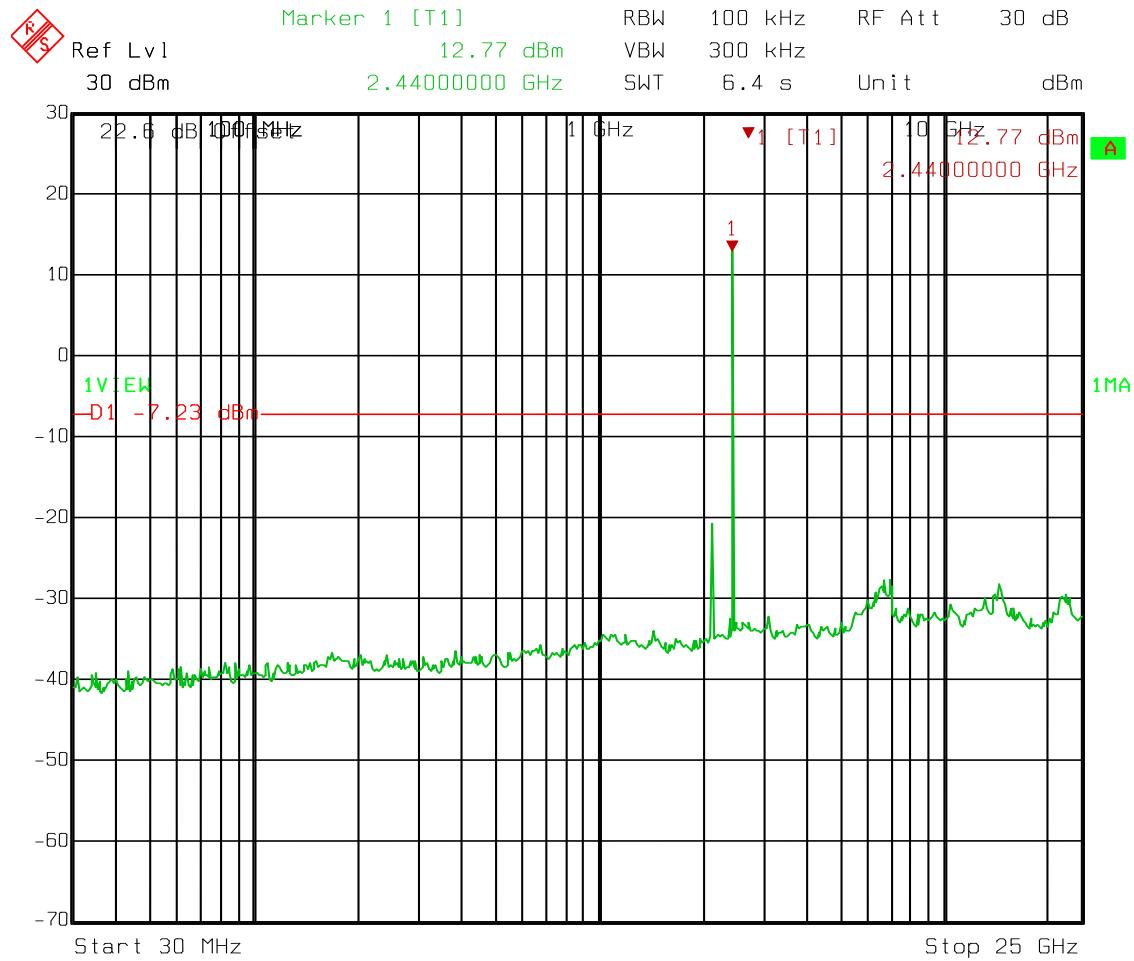
Test Data – Spurious Emissions at Antenna Terminals - OFDM



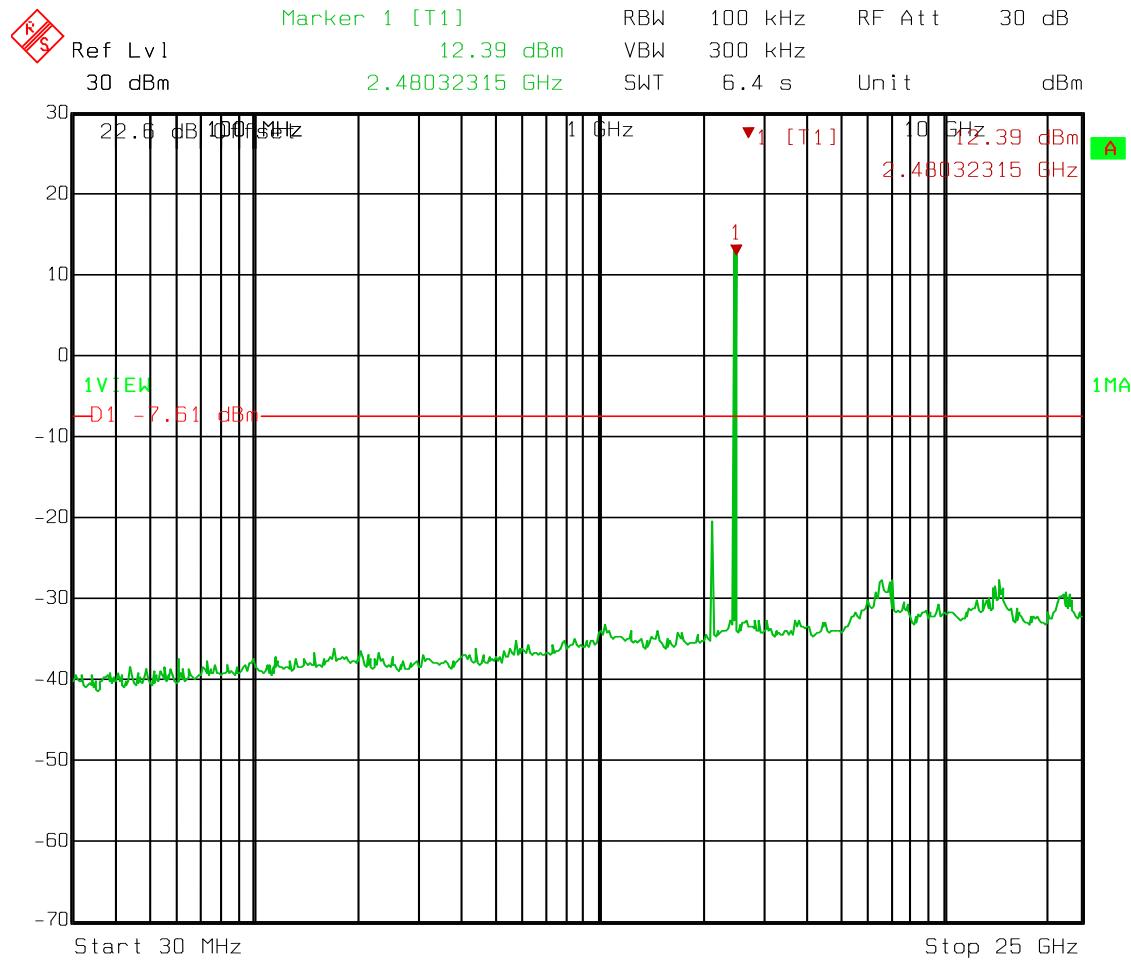
Date: 5.JAN.2015 08:54:36

Test Data – Spurious Emissions at Antenna Terminals - OQPSK

Date: 17.DEC.2014 09:12:57

Test Data – Spurious Emissions at Antenna Terminals - OQPSK

Date: 17.DEC.2014 09:27:19

Test Data – Spurious Emissions at Antenna Terminals - OQPSK

Date: 17.DEC.2014 09:39:37

Nemko USA, Inc.

EQUIPMENT: SLV-C30S
SERIES

FCC PART 15, SUBPART C and
Industry Canada RSS-210
Digital Transmission Systems

Test Report No.: 2015_274721_FCC15247_CAM

Section 6. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: FCC 15.247 (d) RSS-Gen 7.2.2
TESTED BY: David Light	DATE: 17 December 2014

Test Results: Complies.

Measurement Data: See attached table.

Test Conditions: 35 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 529-E1029-1480-911-902

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).
- All emissions within 20 dB of the specification limit are reported per 15.31(o).

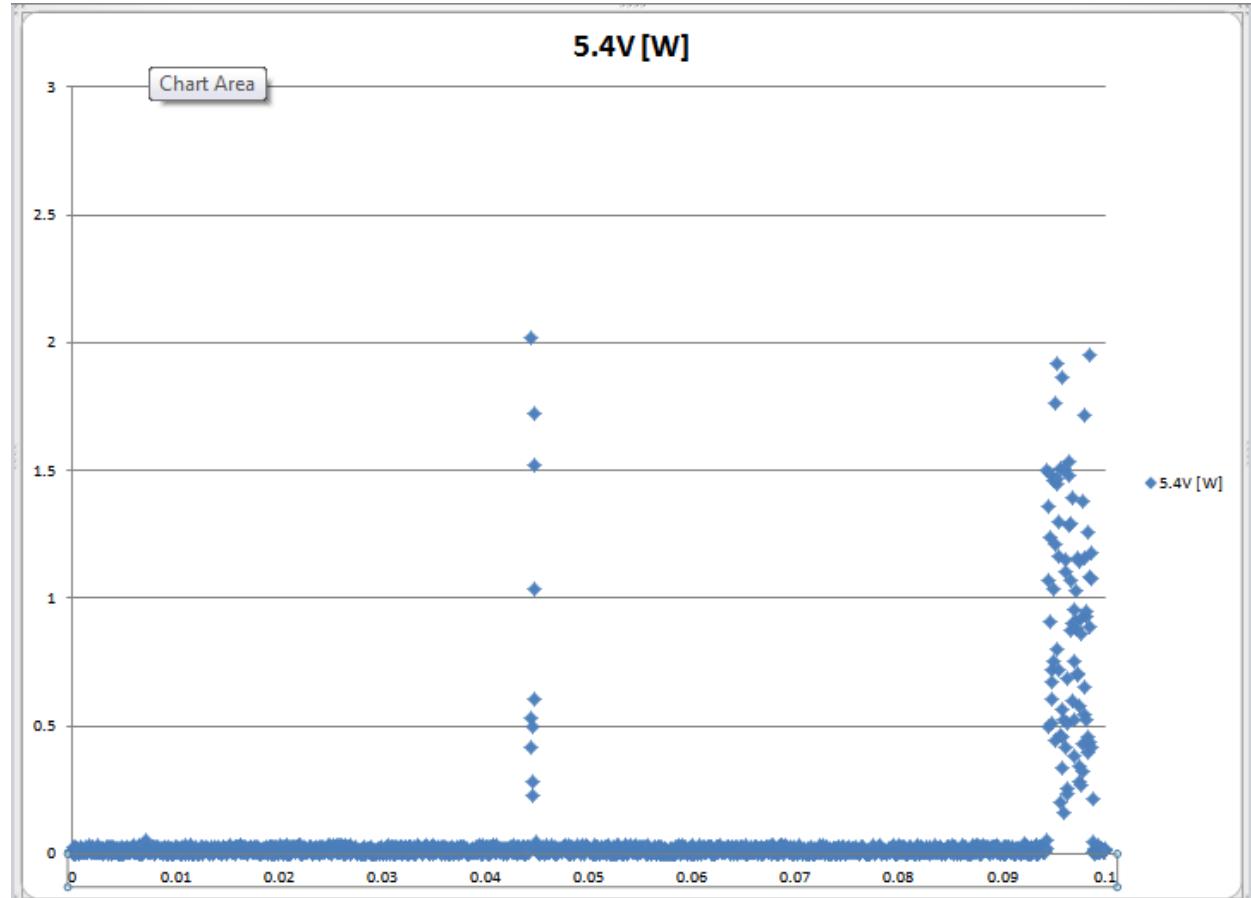
RBW=VBW=100 kHz below 1000 MHz (Peak detector)
RBW= 1 MHz / VBW = 3 MHz above 1000 MHz (Peak detector)
RBW= 1 MHz / VBW=10 MHz (Average detector)

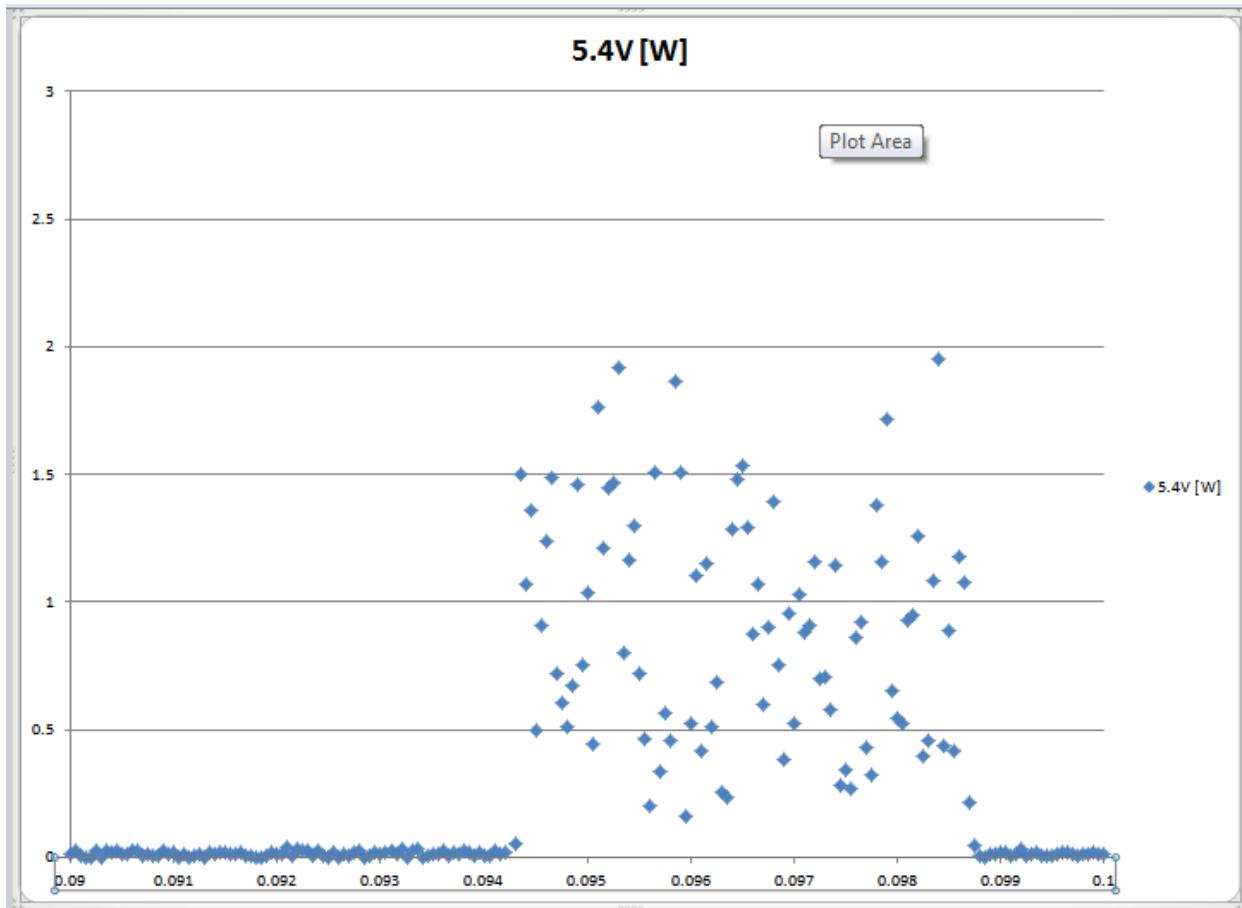
Radiated Emissions - OFDM

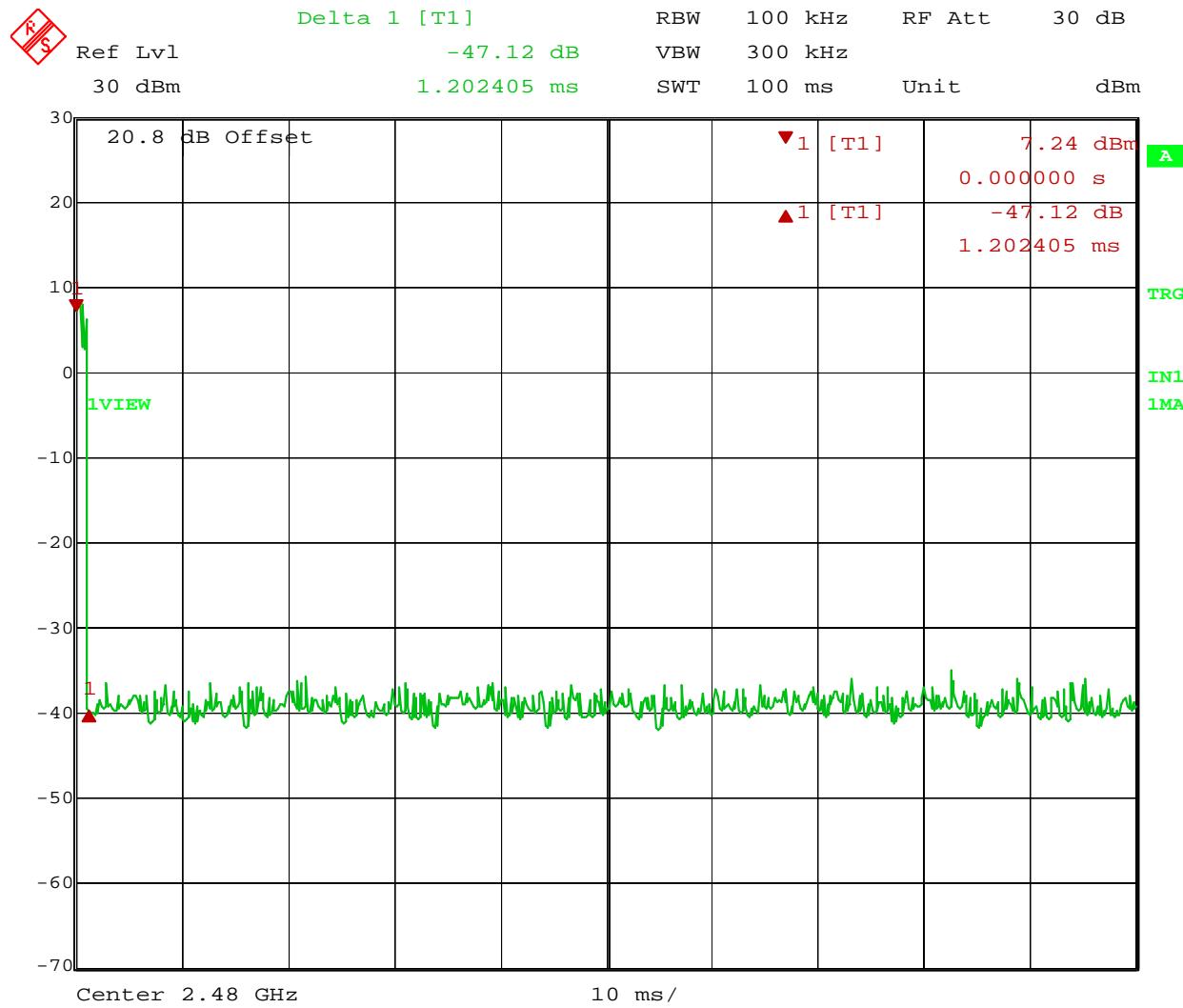
Meas. Freq. (MHz)	Ant. Pol. (H/V)	Duty Cycle (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
											Low Channel
4824	H	0	57.6	32.8	12.1	44.5	58.0	74.0	-16.0	Pass	2417 MHz
4824	H	-20	57.6	32.8	12.1	44.5	38.0	54.0	-16.0	Pass	
7236	H	0	44.3	35.9	13.3	46.6	46.9	74.0	-27.1	Pass	
7236	H	-20	44.3	35.9	13.3	46.6	26.9	54.0	-27.1	Pass	
4824	V	0	54.2	32.8	12.1	44.5	54.6	74.0	-19.4	Pass	
4824	V	-20	54.2	32.8	12.1	44.5	34.6	54.0	-19.4	Pass	
7236	V	0	44	35.9	13.3	46.6	46.6	74.0	-27.4	Pass	
7236	V	-20	44	35.9	13.3	46.6	26.6	54.0	-27.4	Pass	
											Mid Channel
4874	H	0	56.3	32.8	12.1	44.5	56.7	74.0	-17.3	Pass	
4874	H	-20	56.3	32.8	12.1	44.5	36.7	54.0	-17.3	Pass	
7311	H	0	41.9	35.9	13.3	46.6	44.5	74.0	-29.5	Pass	
7311	H	-20	41.9	35.9	13.3	46.6	24.5	54.0	-29.5	Pass	
9748	H	0	44.8	37.6	15.6	45.7	52.3	74.0	-21.7	Pass	
9748	H	-20	44.8	37.6	15.6	45.7	32.3	54.0	-21.7	Pass	
4874	V	0	54.8	32.8	12.1	44.5	55.2	74.0	-18.8	Pass	
4874	V	-20	54.8	32.8	12.1	44.5	35.2	54.0	-18.8	Pass	
7311	V	0	42.7	35.9	13.3	46.6	45.3	74.0	-28.7	Pass	
7311	V	-20	42.7	35.9	13.3	46.6	25.3	54.0	-28.7	Pass	
9748	V	0	43	37.6	15.6	45.7	50.5	74.0	-23.5	Pass	
9748	V	-20	43	37.6	15.6	45.7	30.5	54.0	-23.5	Pass	
											Highest channel
2483.5	H	0	29.77	28.7	9.4	0.0	67.9	74.0	-6.1	Pass	2462 MHz
2483.5	H	-20	29.8	28.7	9.4	0.0	47.9	54.0	-6.1	Pass	
4924	H	0	67.5	32.8	12.1	44.5	67.9	74.0	-6.1	Pass	
4924	H	-20	67.5	32.8	12.1	44.5	47.9	54.0	-6.1	Pass	
7386	H	0	45.3	35.9	13.3	46.6	47.9	74.0	-26.1	Pass	
7386	H	-20	45.3	35.9	13.3	46.6	27.9	54.0	-26.1	Pass	
9848	H	0	43	37.6	15.6	45.7	50.5	74.0	-23.5	Pass	
9848	H	-20	43	37.6	15.6	45.7	30.5	54.0	-23.5	Pass	
2483.5	V	0	25	28.7	9.4	0.0	63.1	74.0	-10.9	Pass	
2483.5	V	-20	25	28.7	9.4	0.0	43.1	54.0	-10.9	Pass	
4924	V	0	66.2	32.8	12.1	44.5	66.6	74.0	-7.4	Pass	
4924	V	-20	66.2	32.8	12.1	44.5	46.6	54.0	-7.4	Pass	
7386	V	0	49	35.9	13.3	46.6	51.6	74.0	-22.4	Pass	
7386	V	-20	49	35.9	13.3	46.6	31.6	54.0	-22.4	Pass	
9848	V	0	47.6	37.6	15.6	45.7	55.1	74.0	-18.9	Pass	
9848	V	-20	47.6	37.6	15.6	45.7	35.1	54.0	-18.9	Pass	

Radiated Emissions – OQPSK

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Duty Cycle (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
Highest channel											
2483.5	H	0	28.61	28.7	9.4	0.0	66.7	74.0	-7.3	Pass	
2483.5	H	-20	28.6	28.7	9.4	0.0	46.7	54.0	-7.3	Pass	
4950	H	0	62	32.8	12.1	44.5	62.4	74.0	-11.6	Pass	
4950	H	-20	62	32.8	12.1	44.5	42.4	54.0	-11.6	Pass	
7425	H	0	58.6	35.9	13.3	46.6	61.2	74.0	-12.8	Pass	
7425	H	-20	58.6	35.9	13.3	46.6	41.2	54.0	-12.8	Pass	
9900	H	0	49.6	37.6	15.6	45.7	57.1	74.0	-16.9	Pass	
9900	H	-20	49.6	37.6	15.6	45.7	37.1	54.0	-16.9	Pass	
2483.5	V	0	22.5	28.7	9.4	0.0	60.6	74.0	-13.4	Pass	
2483.5	V	-20	22.5	28.7	9.4	0.0	40.6	54.0	-13.4	Pass	
4950	V	0	60.8	32.8	12.1	44.5	61.2	74.0	-12.8	Pass	
4950	V	-20	60.8	32.8	12.1	44.5	41.2	54.0	-12.8	Pass	
7425	V	0	59.7	35.9	13.3	46.6	62.3	74.0	-11.7	Pass	
7425	V	-20	59.7	35.9	13.3	46.6	42.3	54.0	-11.7	Pass	
9900	V	0	46.1	37.6	15.6	45.7	53.6	74.0	-20.4	Pass	
9900	V	-20	46.1	37.6	15.6	45.7	33.6	54.0	-20.4	Pass	
Mid Channel											
4880	H	0	59.9	32.8	12.1	44.5	60.3	74.0	-13.7	Pass	
4880	H	-20	59.9	32.8	12.1	44.5	40.3	54.0	-13.7	Pass	
7320	H	0	56.2	35.9	13.3	46.6	58.8	74.0	-15.2	Pass	
7320	H	-20	56.2	35.9	13.3	46.6	38.8	54.0	-15.2	Pass	
9760	H	0	48	37.6	15.6	45.7	55.5	74.0	-18.5	Pass	
9760	H	-20	48	37.6	15.6	45.7	35.5	54.0	-18.5	Pass	
4880	V	0	60	32.8	12.1	44.5	60.4	74.0	-13.6	Pass	
4880	V	-20	60	32.8	12.1	44.5	40.4	54.0	-13.6	Pass	
7320	V	0	59.2	35.9	13.3	46.6	61.8	74.0	-12.2	Pass	
7320	V	-20	59.2	35.9	13.3	46.6	41.8	54.0	-12.2	Pass	
9760	V	0	46	37.6	15.6	45.7	53.5	74.0	-20.5	Pass	
9760	V	-20	46	37.6	15.6	45.7	33.5	54.0	-20.5	Pass	
Low Channel											
4810	H	0	64.3	32.8	12.1	44.5	64.7	74.0	-9.3	Pass	
4810	H	-20	64.3	32.8	12.1	44.5	44.7	54.0	-9.3	Pass	
7215	H	0	58	35.9	13.3	46.6	60.6	74.0	-13.4	Pass	
7215	H	-20	58	35.9	13.3	46.6	40.6	54.0	-13.4	Pass	
9620	H	0	50	37.6	15.6	45.7	57.5	74.0	-16.5	Pass	
9620	H	-20	50	37.6	15.6	45.7	37.5	54.0	-16.5	Pass	
4810	V	0	65.1	32.8	12.1	44.5	65.5	74.0	-8.5	Pass	
4810	V	-20	65.1	32.8	12.1	44.5	45.5	54.0	-8.5	Pass	
7215	V	0	65.3	35.9	13.3	46.6	67.9	74.0	-6.1	Pass	
7215	V	-20	65.3	35.9	13.3	46.6	47.9	54.0	-6.1	Pass	
9620	V	0	51.9	37.6	15.6	45.7	59.4	74.0	-14.6	Pass	
9620	V	-20	51.9	37.6	15.6	45.7	39.4	54.0	-14.6	Pass	

Test Data – Duty Cycle**OFDM**

Test Data – Duty Cycle**OFDM**

Test Data – Duty Cycle**OQPSK**

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Test Report No.: 2015_274721_FCC15247_CAM

Section 7. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density

PARA. NO.: FCC 15.247(e)
RSS-210 A8.2(b)

TESTED BY: David Light

DATE: 17 January 2014
05 January 2015

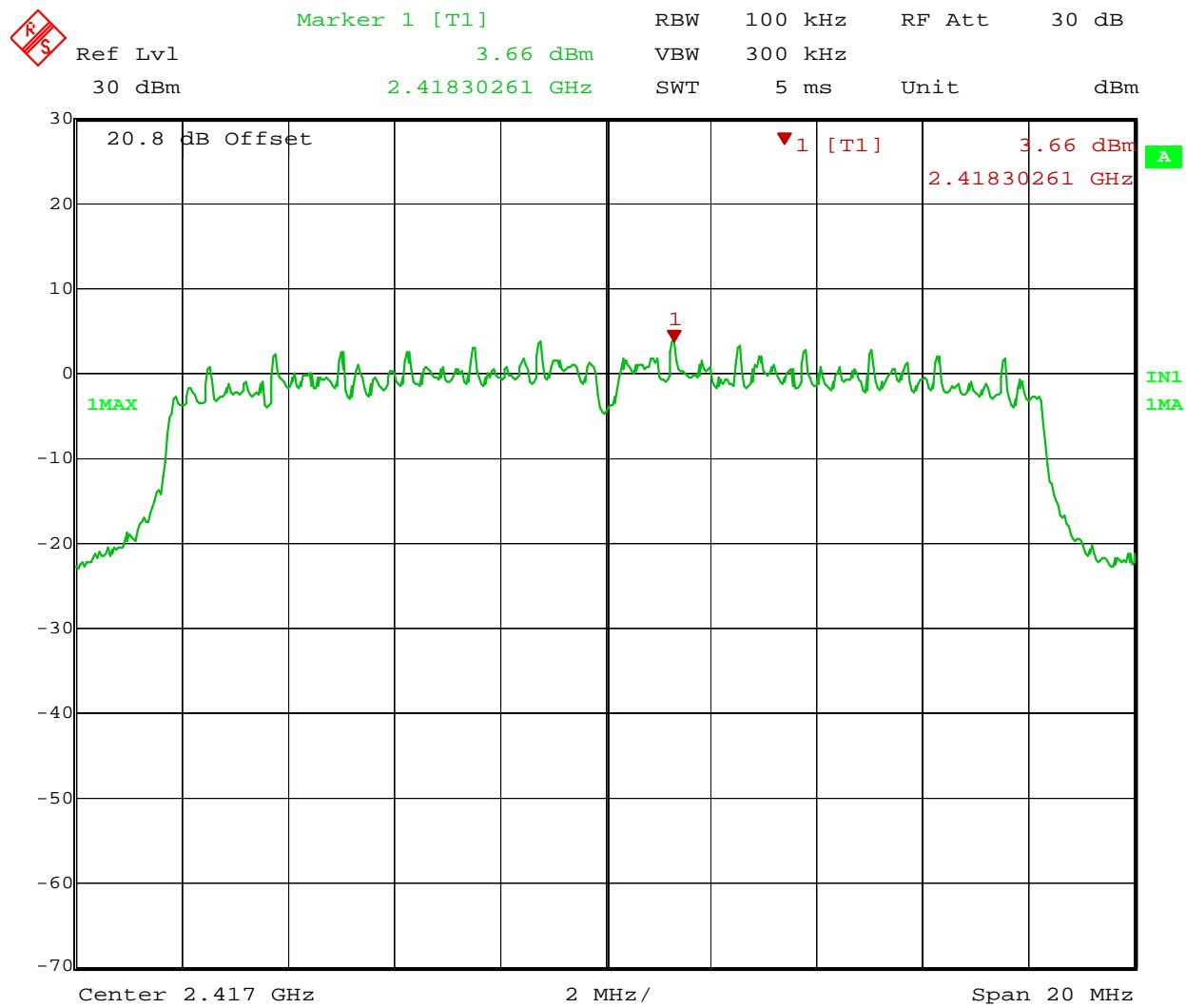
Test Results: Complies.

Measurement Data: See attached data..

Test Conditions: 35 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1036

Peak Power Spectral Density - OFDM

Date: 5.JAN.2015 11:34:09

Density = 3.66 dBm – 15.2 dB = -11.54 dBm

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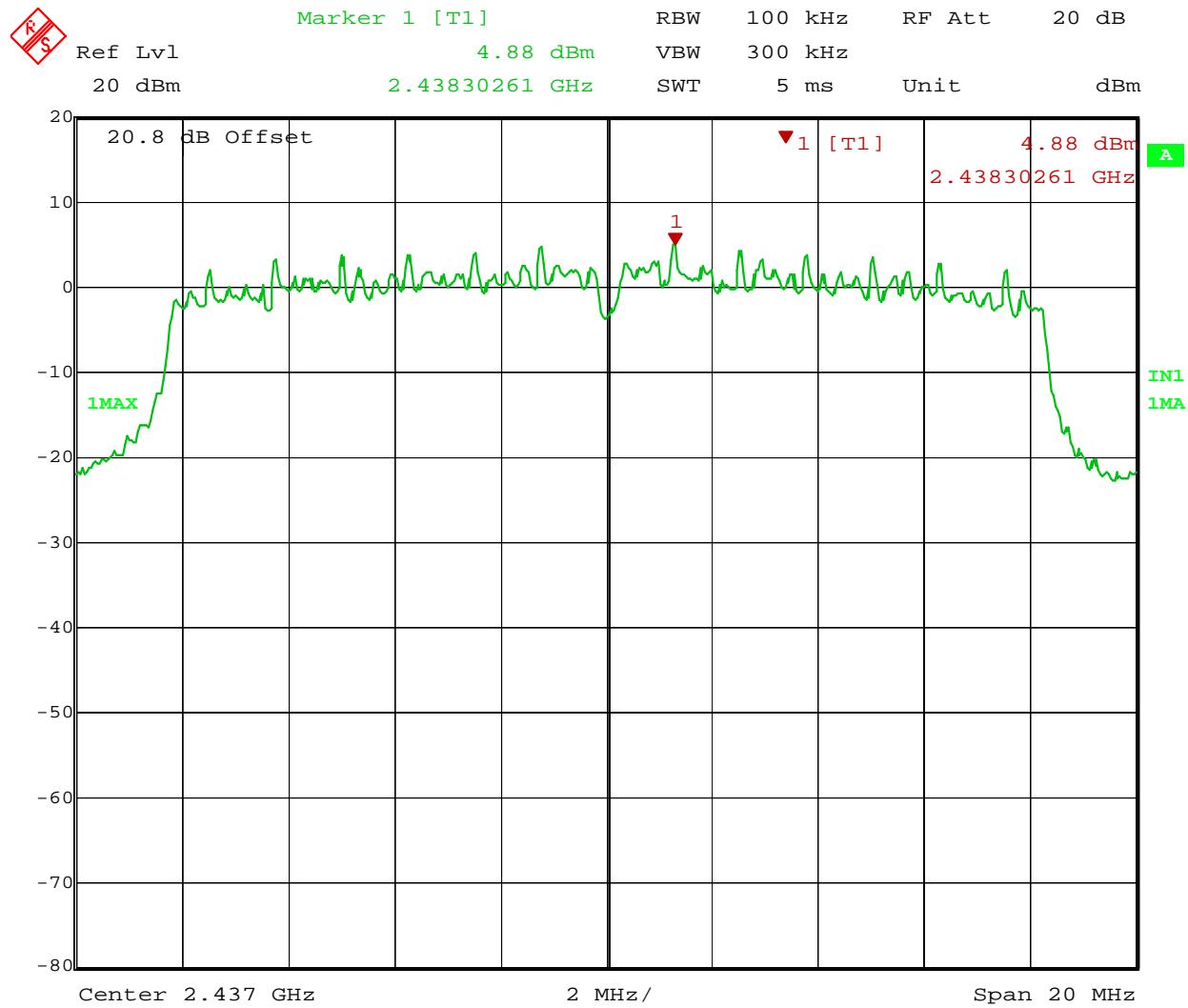
Industry Canada RSS-210

Digital Transmission Systems

**EQUIPMENT: SLV-C30S
SERIES**

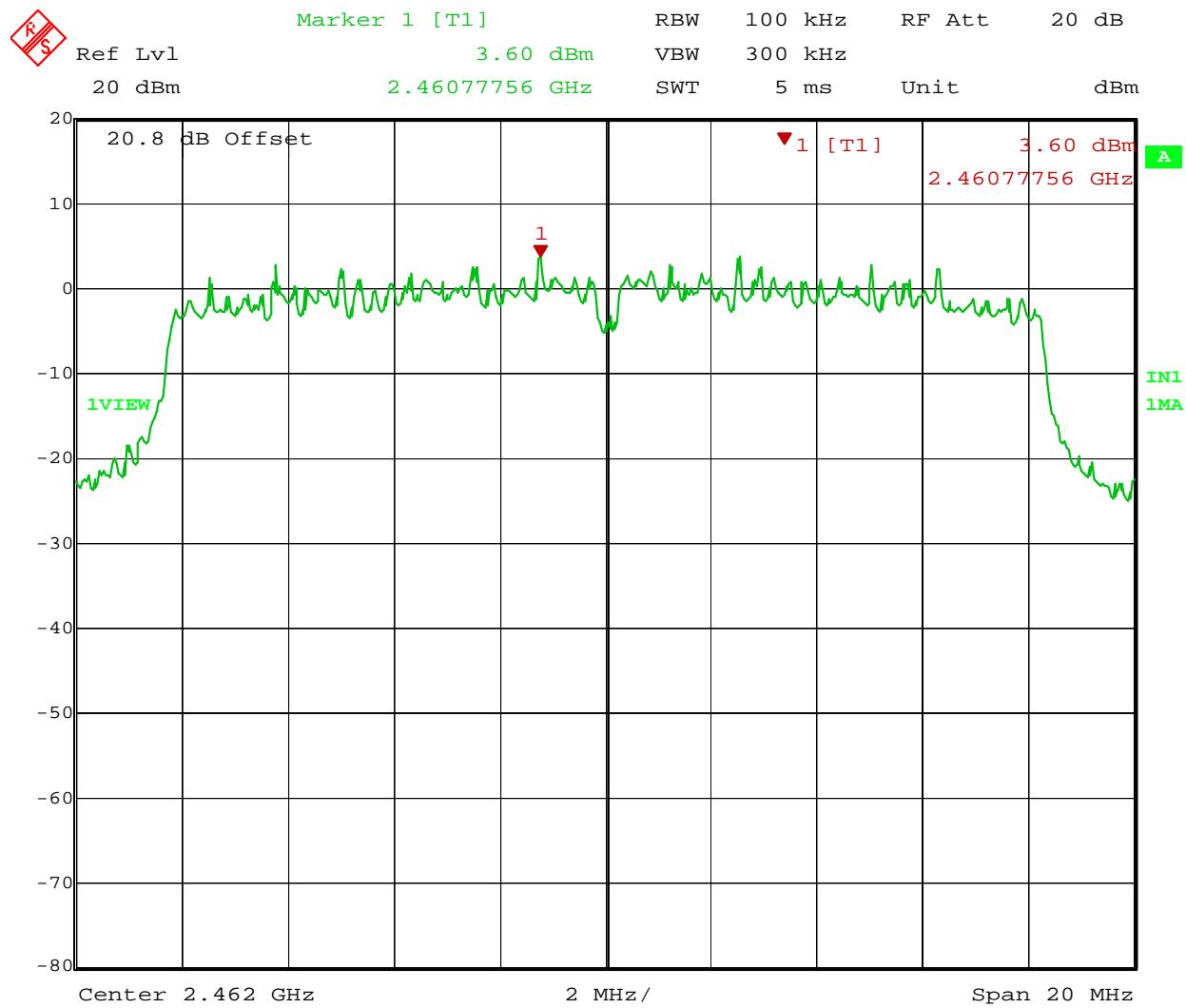
Test Report No.: 2015_274721_FCC15247_CAM

Peak Power Spectral Density - OFDM



Date: 5.JAN.2015 08:48:17

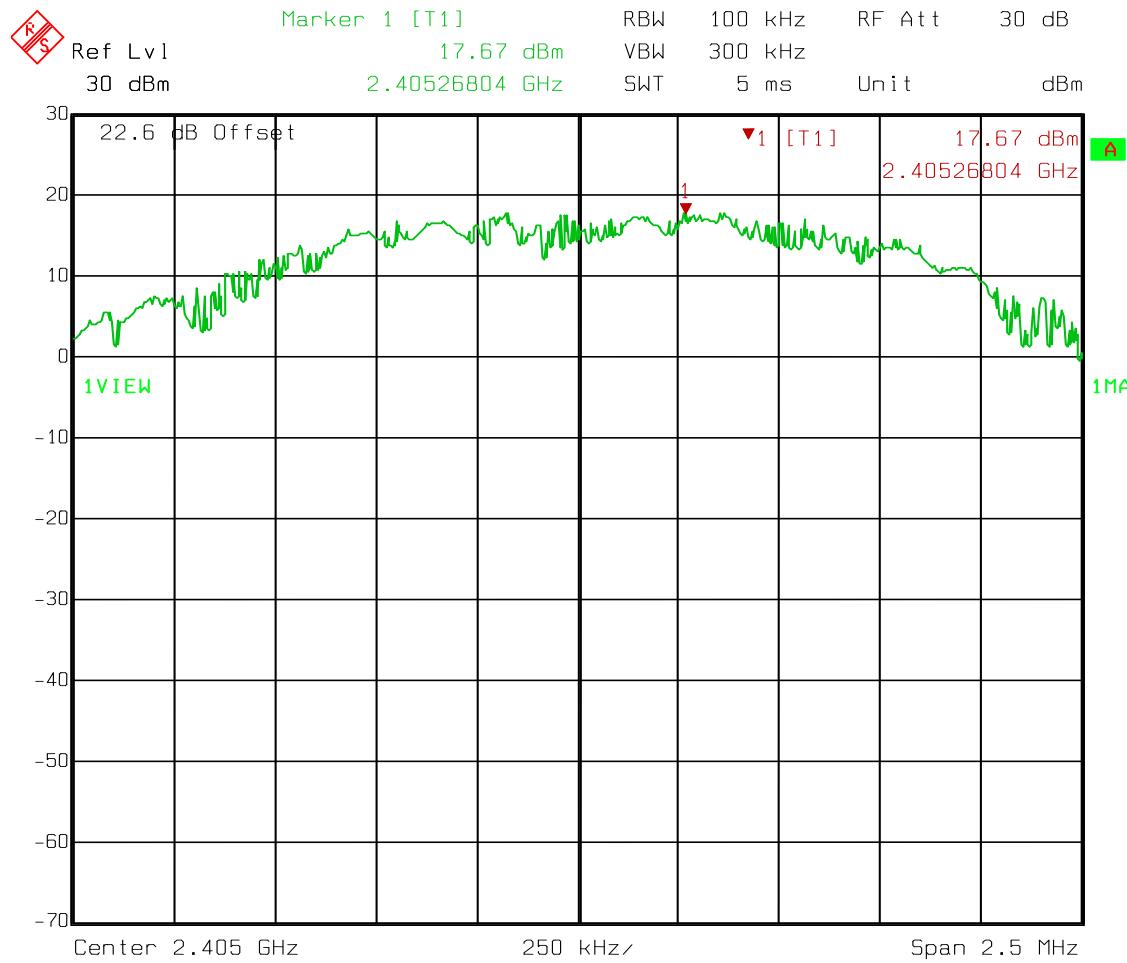
Density = 4.88 dBm – 15.2 dB = -10.32 dBm

Peak Power Spectral Density - OFDM

Date: 5.JAN.2015 08:53:52

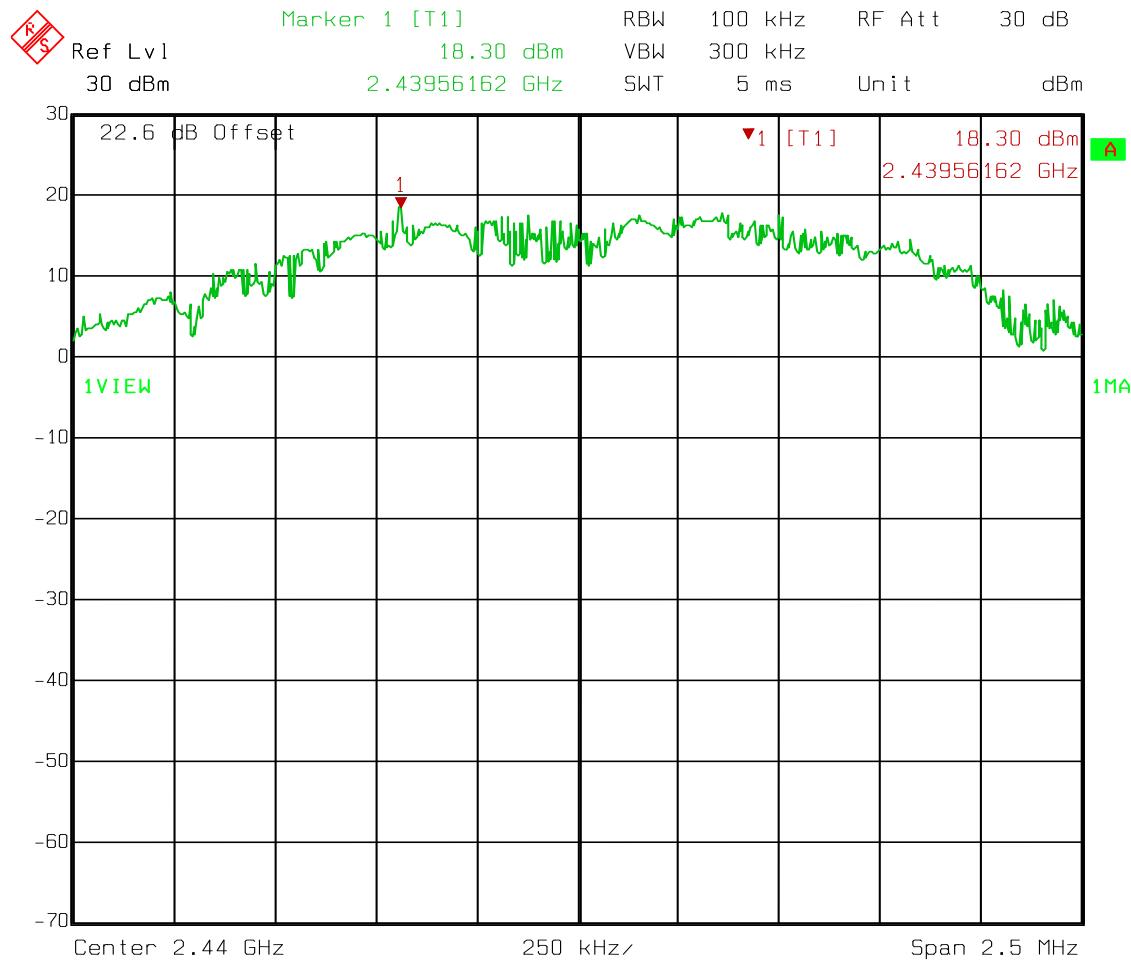
Density = 3.6 dBm – 15.2 dB = -11.6 dBm

Peak Power Spectral Density - OQPSK

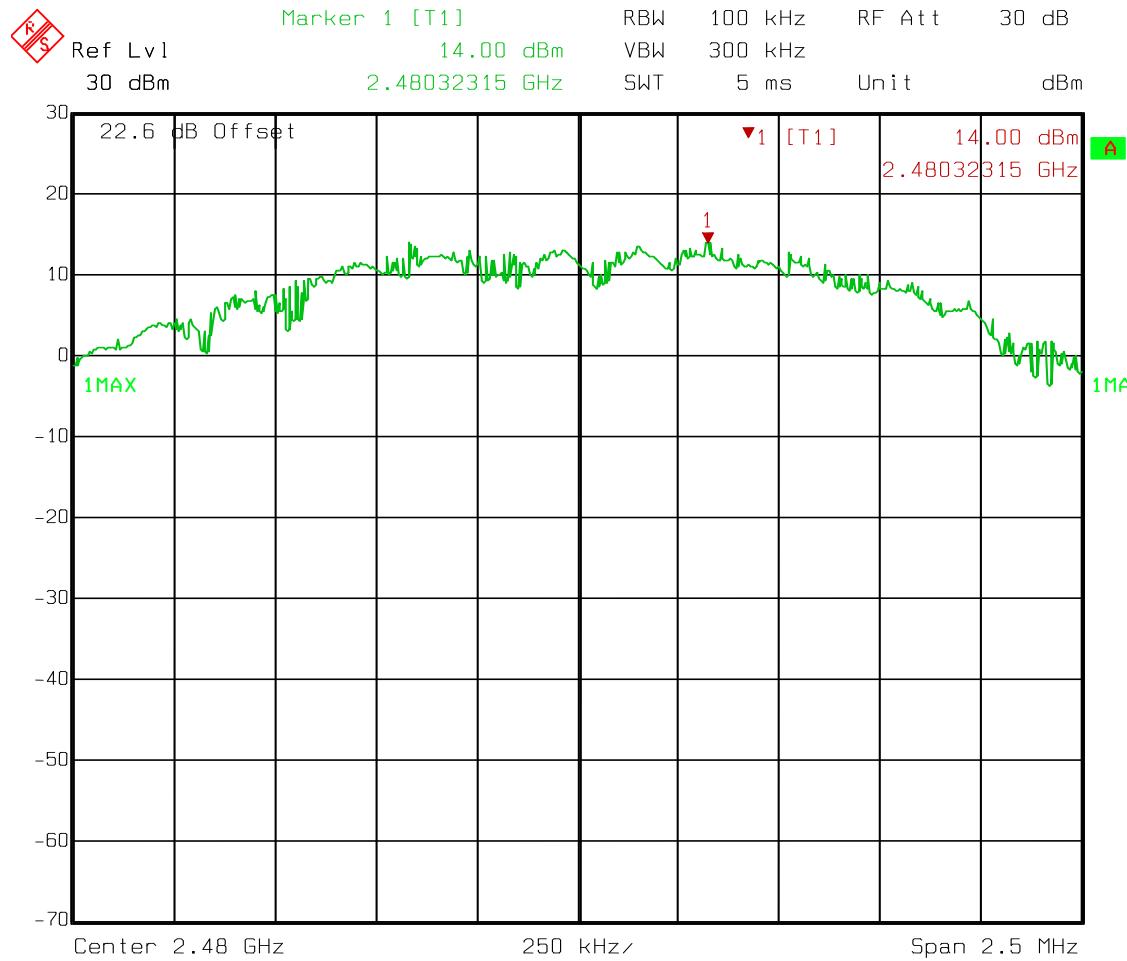


Date: 17.DEC.2014 09:09:17

$$\text{Density} = 17.67 \text{ dBm} - 15.2 \text{ dB} = 2.47 \text{ dBm}$$

Peak Power Spectral Density - OQPSK

$$\text{Density} = 18.3 \text{ dBm} - 15.2 = 3.1 \text{ dBm}$$

Peak Power Spectral Density - OQPSK

Date: 17.DEC.2014 09:31:52

$$\text{Density} = 14.0 \text{ dBm} - 15.2 \text{ dB} = -1.2 \text{ dBm}$$

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Section 8. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
529	Antenna, DRWG	EMCO	3115	2505	08-Dec-2014	08-Dec-2016
902	pre amp	Sonoma	310 N	185803	08-Aug-2014	08-Aug-2015
911	Spectrum Analyzer	Agilent	E4440A	US41421266	21-Jan-2014	21-Jan-2015
E1029	Preamplifier (20MHz to 18GHz)	A.H. Systems, Inc.	PAM-0118	343	12-Aug-2014	12-Aug-2015
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	15-Jul-2013	15-Jul-2015
1480	Antenna, Bilog	Schaffner- Chase	CBL6111C	2572	02-Apr-2014	02-Apr-2015

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ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a) / 7.2.4
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Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Conducted Emission (MHz)	Limit (dBmV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another

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device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

NAME OF TEST: Maximum Peak Output Power	PARA. NO.: 15.247(b)(3) / A8.4(4)
---	-----------------------------------

Minimum Standard: The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Measurement Method

5.2.1 Maximum Peak Conducted Output Power Level

§15.247(b)(3) specifies that the maximum peak conducted output power for DTS transmitters in any of the three authorized frequency bands is 1 watt (30 dBm). The following procedures can be used to determine the maximum peak conducted output power from a DTS EUT using a spectrum analyzer.

5.2.1.1 Measurement Procedure PK1:

1. This procedure requires availability of a spectrum analyzer resolution bandwidth that is \geq EBW.
2. Set the RBW \geq EBW.
3. Set VBW $\geq 3 \times$ RBW.
4. Set span = zero.
5. Sweep time = auto couple.
6. Detector = peak.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use peak marker function to determine the peak amplitude level within the fundamental emission.

5.2.1.2 Measurement Procedure PK2:

1. This procedure provides an integrated measurement alternative when the maximum available RBW < EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Set the span to a value that is 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at 1 MHz intervals extending across the EBW of the spectrum.

5.2.2 Maximum Conducted (Average) Output Power Level

§15.247(b)(3) permits the maximum conducted output power to be measured as an alternative to a peak power measurement to demonstrate compliance to the one watt (30 dBm) output power limit. The maximum conducted output power is the highest total transmit power occurring in any mode when averaged over the EUT EBW. This measurement requires that the EUT be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. Time intervals during which the transmitter is off or transmitting at reduced power levels shall not be included.

The spectrum analyzer must be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW in order to ensure bin-to-bin spacing of \leq RBW/2 so that narrowband signals are not lost between frequency bins (the use of a greater number of measurement points than the minimum requirement is recommended).

The following procedures are acceptable for determining the maximum conducted output power with a spectrum analyzer.

5.2.2.1 Measurement Procedure AVG1 (power averaging over the EBW with slow sweep speed):

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW \geq 3 MHz.
4. Detector = power average (RMS).
5. Ensure that the number of measurement points in the sweep \geq 2 x (span/RBW).
6. Manually set the sweep time to: \geq 10 x (number of measurement points in sweep) x (transmission symbol period).
7. Perform the measurement over a single sweep.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW.

Note: If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

5.2.2.2 Measurement Procedure AVG2 (trace averaging over the EBW):

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW \geq 3 MHz.
4. Ensure that the number of measurement points in the sweep $\geq 2 \times (\text{span}/\text{RBW})$.
5. Sweep time = auto couple.
6. Detector = power averaging (RMS) or sample.
7. Employ trace averaging in power averaging (RMS) mode over a minimum of 100 traces.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW. If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(2) / A8.2(a)

Minimum Standard: Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Method Of Measurement:**5.1.1 EBW Measurement Procedure:**

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

5.1.2 Alternate EBW Measurement Procedure:

The automatic bandwidth measurement capability of a spectrum analyzer may be employed if it implements the functionality described above (e.g., RBW = 1-5% of EBW, VBW $\geq 3 \times$ RBW, peak detector with maximum hold). When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any nulls in the fundamental emission.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Spurious Emissions(conducted)	PARA. NO.: 15.247(d) / A8.5
---	-----------------------------

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

5.4.1.1 Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW \geq 300 kHz.
3. Set the span to 5-30 % greater than the EBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW. Next, determine the power in 100 kHz band segments outside of the authorized frequency band using the following measurement:

5.4.1.2 Measurement Procedure - Unwanted Emissions

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified above.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c) / 7.2.2
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Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (μ V/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

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15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d) A8.2(b)
---	------------------------------

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement:**5.3.1 Measurement Procedure PKPSD:**

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW \geq 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3\text{ kHz}/100\text{ kHz}) = -15.2\text{ dB}$.
11. The resulting peak PSD level must be $\leq 8\text{ dBm}$.

5.3.2 Measurement Procedure AVGPSD:

1. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
2. Set the analyzer span to 5-30% greater than the EBW.
3. Set the RBW = 100 kHz.
4. Set the VBW \geq 300 kHz.
5. Detector = power average (RMS).
6. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$ (use of a greater number of measurement points than this minimum requirement is recommended).
7. Manually set the sweep time to: $\geq 10 \times (\text{number of measurement points in sweep}) \times (\text{transmission symbol period})$.
8. Perform the measurement over a single sweep.
9. Use the peak marker function to determine the maximum level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent level in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3\text{ kHz}/100\text{ kHz}) = -15.2\text{ dB}$.
11. The resulting PSD level must be $\leq 8\text{ dBm}$

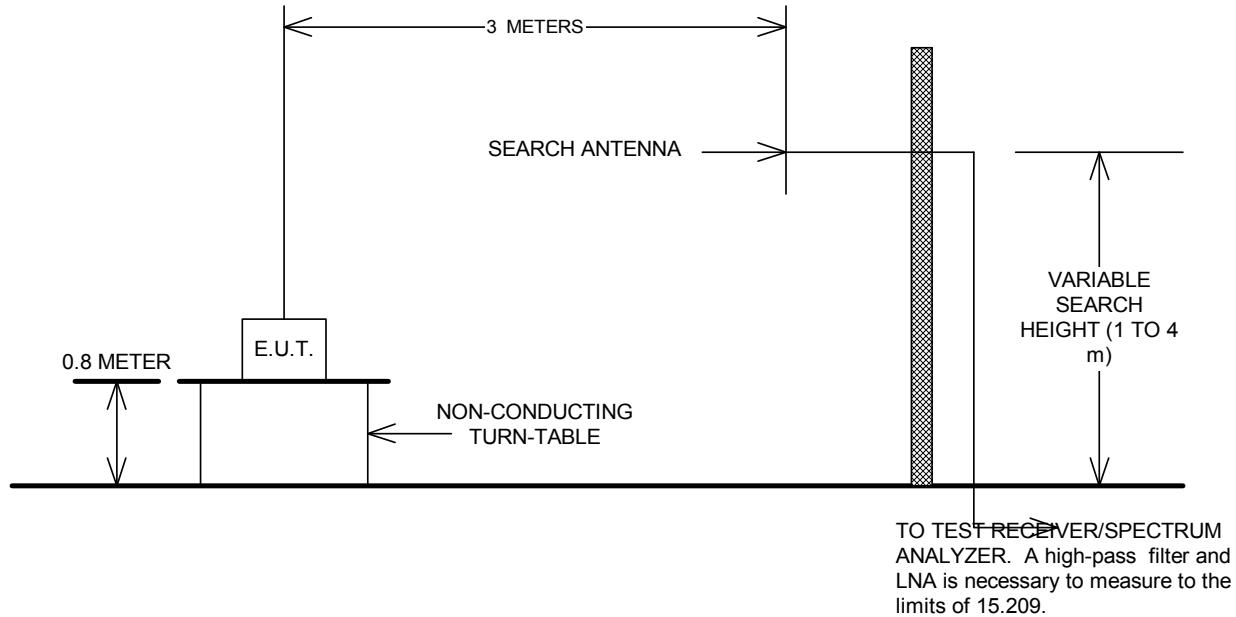
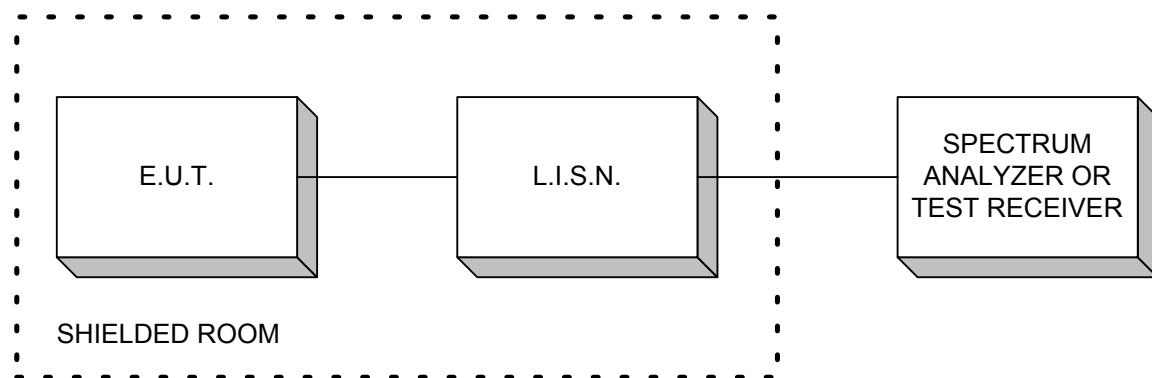
Nemko USA, Inc.

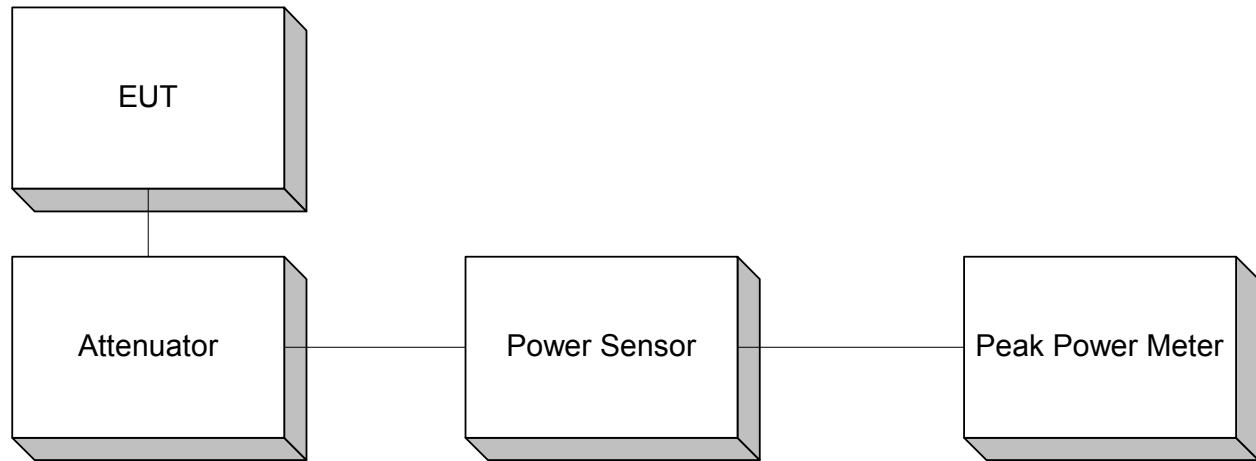
EQUIPMENT: SLV-C30S
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ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**

Peak Power At Antenna Terminals

Note: A spectrum analyzer may be substituted for Peak Power Meter given that the measurement bandwidth is sufficient to capture the 60 dB bandwidth of the transmitter.

**Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)**