BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:
FCC Part 15 Subpart C Intentional Radiator

ARRIS Model XG1-RM
Rack Mount Set Top Box

REPORT BEC-1584-01

TEST DATES: 01/29/2015 – 02/16/2015

CUSTOMER:
ARRIS Group Incorporated
101 Tournament Drive
Horsham, PA 19044

PREPARED BY: _____
Steve Fanella**,** Test Engineer

REVIEWED and APPROVED BY: _____
Al Fanella**,** Test Director

ACCREDITED
Testing Cert #2957.01

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Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	02/18/2015
1	Added Details for Duty Cycle Correction Factor into section 4.2.2	03/30/2015	03/30/2015

1.0 Administrative Information

1.1 Project Details

Project Number	BEC-1584
Set Top Box Manufacturer	ARRIS Group Incorporated
Set Top Box Model Number	XG1-RM
Set Top Box Serial Number	M11446TD0198
Set Top Box Sample Number	1584-01 (Unmodified Antennas)
Set Top Box Serial Number	M11446TD0197
Set Top Box Sample Number	1584-02 (Modified With SMA Ports to the Antennas)
FCC ID	ACQ-XG1RM
Frequency of Operation	2400 - 2483.5 MHz
Test Laboratory Location	BEC Incorporated 970 East High Street Pottstown, PA 19464
Test Performed For	ARRIS Group Incorporated 101 Tournament Drive Horsham, PA 19044
Test Personnel	Paul Banker / Steve Fanella
Technical Contact	Mike Welty
Date Received	01/29/2014
Condition Received	Suitable for test
Sample Type	Production unit
EUT Classification	Unlicensed Unintentional Radiator
FCC Classification	DTS- Part 15 Digital Transmission System
Applicable FCC Rule Part	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System

1.2 Preface

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures, and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

1.3 Test Result Summary Table

The ARRIS Model XG1-RM Rack Mount Set Top Box was tested and found to be compliant to the sections of the FCC Part 15 Subpart C standard listed below:

FCC Part 15, Subpart C Intentional Radiators	Test Description	Result
15.207(b)	Conducted Emissions, Power Leads, 150 kHz to 30 MHz	**PASS**
15.209(a)	Spurious Radiated Emissions, 30 MHz to 1 GHz	**PASS**
15.209, 15.205	Spurious Radiated Emissions, 1 GHz to 25 GHz	**PASS**
15.247(a)(2)	6 dB Occupied Bandwidth	**PASS**
15.247(b)(3)	Maximum Peak Power Output	**PASS**
15.247(d)	Antenna Port, Conducted Spurious Emissions	**PASS**
15.247(e)	Antenna Port, Power Spectral Density	**PASS**
15.247(d)	Band Edge Measurement	**PASS**
15.247(i), 1.1310	Radiofrequency radiation exposure limits	**PASS**

1.4 Measurement Uncertainty

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Conducted Disturbance	N/A	150 kHz – 30 MHz	FCC Section 15.207	3.58
Radiated Disturbance	3 m	30 MHz – 1 GHz	FCC Section 15.209	4.02

No adjustments to measured data presented in this report are required because all values of uncertainty are less that the CISPR 16-4-2:2003 recommendations. These uncertainties have a coverage factor of $k = 2$, which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.

1.5 Condition of Received Sample

An evaluation of the EUT was conducted in order to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damage was noted. The test item condition was deemed acceptable for the performance of the requested test services.

1.6 Test Equipment

All test equipment is checked to manufacturer's specifications and, when applicable, have current N.I.S.T. traceable, ISO 9002 conforming certificates of calibration. Test equipment used for the tests described herein is listed in Appendix A.

2.0 Equipment Under Test

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

2.1 EUT Description

The ARRIS Model XG1-RM Rack Mount Set Top Box is an IP Video Gateway (next-gen, set-top technology). It is a high-definition set-top with multiple 1 GHz tuners that support both MPEG-2 and MPEG-4 AVC services. The all-digital XG1-RM includes the latest audio and video output interfaces, including HDMI™, Award-winning Dolby® Digital Plus audio and Dolby Volume Leveling. With the included MoCA® home networking, the XG1-RM provides the flexibility to serve as a multimedia client for accessing content from other compatible devices in the home. An embedded DOCSIS 2.0+ cable modem provides support for DSG and downstream channel bonding.

2.2 Receiver Classification

N/A

2.3 Product Category

FCC Part 15, Subpart C (Section 15.247)

2.4 Product Classification

RF4CE Intentional Radiator Testing Requirements for RF Signal Operation within the bands of 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz-Direct Sequence System.

2.5 Test Configuration

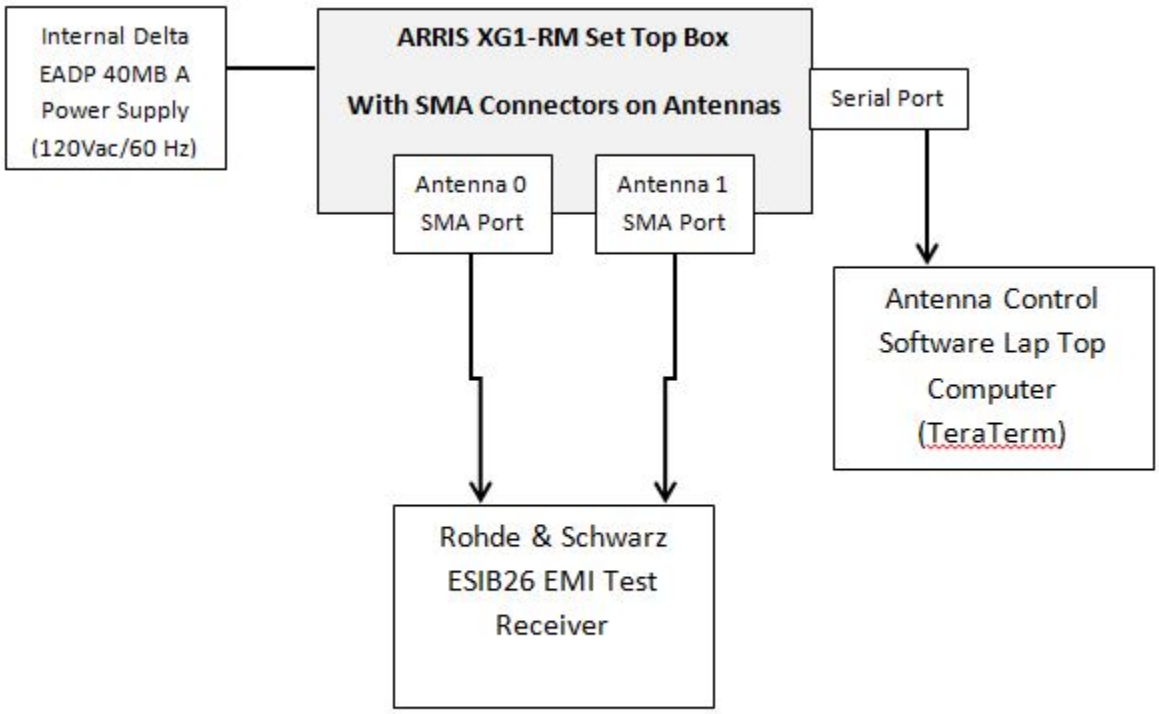
The antennas within the ARRIS XG1-RM set top box were controlled by software which allowed the test technician to select the specific antenna within the EUT, designate the specific Channel Frequency, control the antenna power and control the antenna modulation (on/off).

2.6 Test Configuration Rationale

The tested configuration of the EUT was required so that the test technician could view the characteristics of the antenna at specific frequencies and allow the technician to record the required measurements.

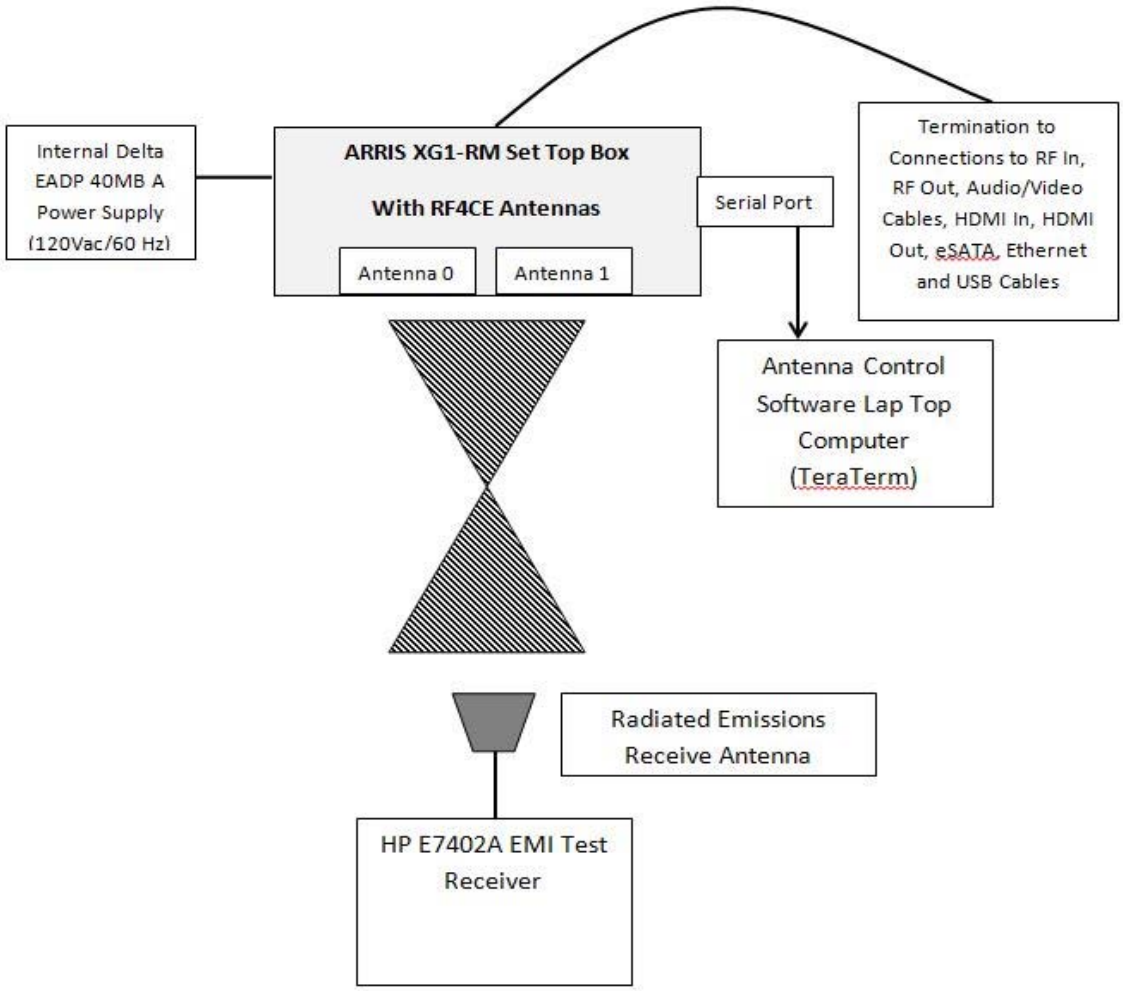
2.7 Test Configuration Diagram (Conducted Measurements)

A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.



2.8 Test Configuration Diagram (Radiated Measurements)

A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.



2.9 EUT Information, Interconnection Cabling and Support Equipment

EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Rack Mount Set Top Box (Modified Antennas with SMA Connectors)	ARRIS	XG1-RM	M11446TD0198	1584-01
Rack Mount Set Top Box (Unmodified Antennas)	ARRIS	XG1-RM	M11446TD0197	1584-02

Interconnection Cable List (Conducted Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Workhorse	WHU18-3636-036	High Frequency RF Cable 1 to 40 GHz	Double Braid	1 Meter	Measurement Cable from the Antenna SMA Connector to the Rohde and Schwarz ESIB26 Receiver. Asset # BEC-814

Interconnection Cable List (Radiated Test Setup)

Type	Mfr/Part#	Shielding	Length	Description
Audio Video	Acoustic Research/PR161	95% braid w/100% aluminum Mylar foil	6 Ft	Audio & Video Out Ports
HDMI	Rocketfish	Braid over foil	1.3 m	HDMI Port
75-Ohm Coax	Belden-T 9114 Duobond	Double Braid	1 m	RF In and RF Out
Ethernet CAT5	Siemon Co. / MC5-8-T-07-20	Mylar foil	7 Ft	Ethernet Port
USB	Hannstar/E52534-D	Braid over foil	2 m	USB Port
eSATA	Keen Top Serial ATA	Braid over foil	1 m	eSATA Port I/F cable

Support Equipment

Description	Manufacturer	Model	Serial Number
AC/DC Power Convertor for XG1-RM Rack Mount Set Top Box	Delta	EADP 40MB A	N/A
Antenna Control Software Lap Top Computer	Dell	Latitude D830	CH-0HN338-48643-84F-0307

2.10 Test Signals and Test Modulation

By design this product does not have an external Modulation input connector, therefore, normal operating modulation was used for all testing reported herein. The only test where modulation was not active was during testing of the Maximum Peak Power Output FCC Section 15.247(b)(3) (Section 4.4 of this report) because the signal amplitude was higher without modulation applied when measuring.

For some of the required testing, the EUT was configured to transmit individually at low Channel 15 (2.425 GHz), middle Channel 20 (2.450 GHz) or high Channel 25 (2.475 GHz) during the measurement of the signal.

2.11 Grounding

During all testing presented in this report, earth grounding of the test sample was accomplished through the AC mains input power cord to the EUT and through the return of the DC line to the Controller.

2.12 EUT Modifications

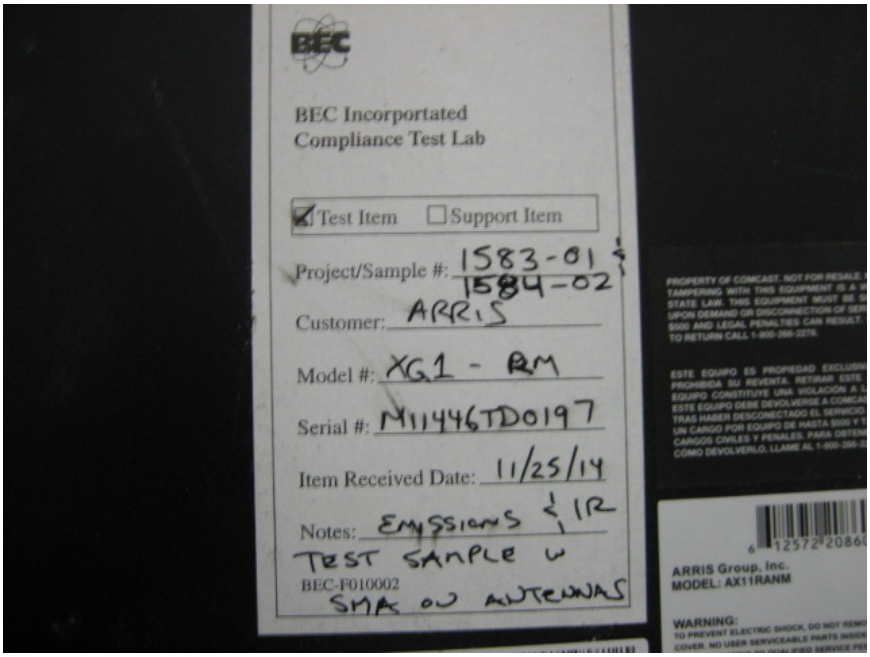
No modifications were made to the ARRIS Model XG1-RM Rack Mount Set Top Box.

2.13 EUT Pictures

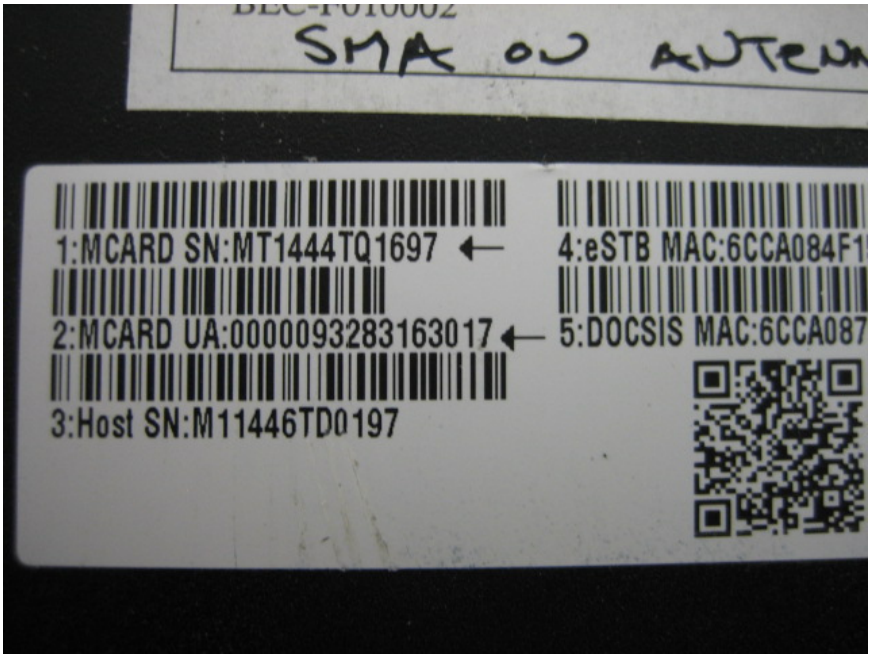
ARRIS XG1-RM RACK MOUNT SET TOP BOX (FRONT)

ARRIS XG1-RM RACK MOUNT SET TOP BOX PRODUCTION RUN NUMBER

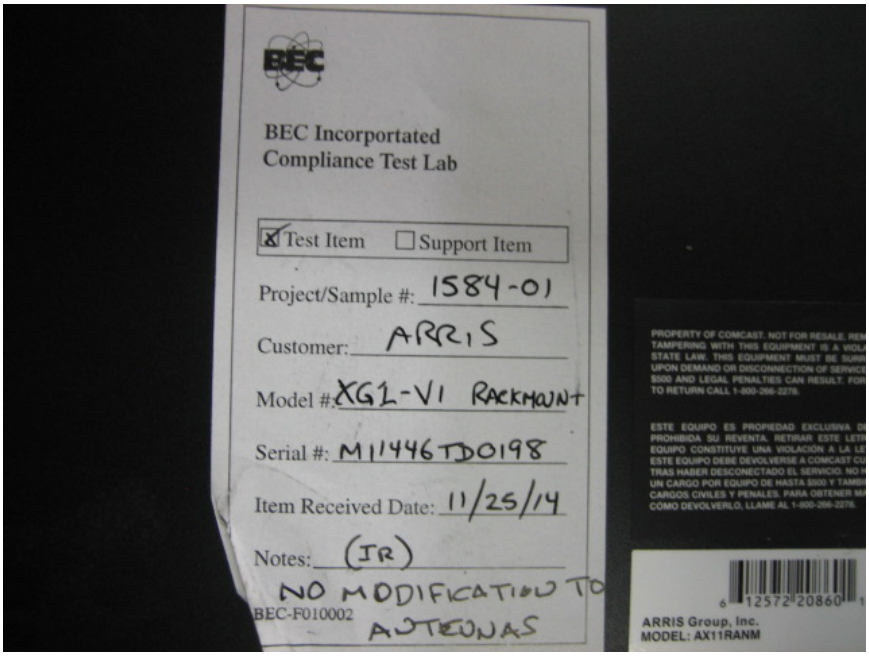
ARRIS XG1-RM SAMPLE TAG 1584-02 MODIFIED ANTENNA EUT



ARRIS XG1-RM SERIAL NUMBER MODIFIED ANTENNA EUT

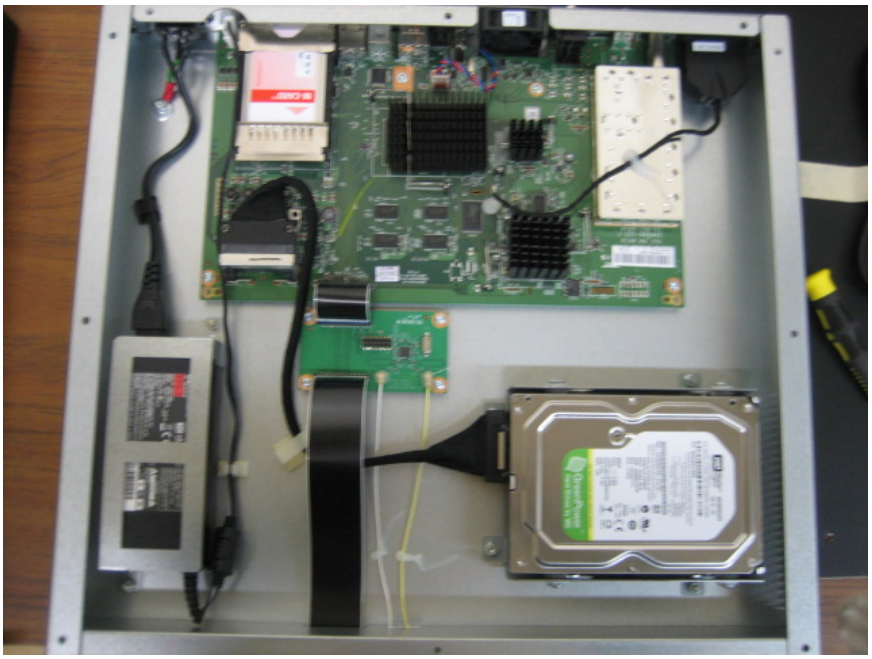


ARRIS XG1-RM SAMPLE TAG 1584-01 UNMODIFIED ANTENNA EUT



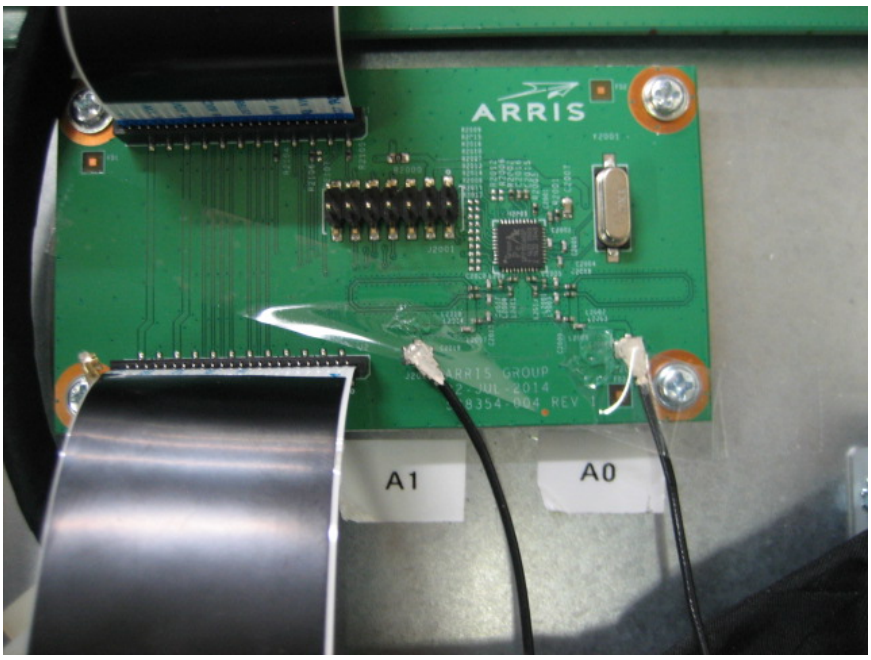
ARRIS XG1-RM SERIAL NUMBER UNMODIFIED ANTENNA EUT

ARRIS XG1-RM (UNMODIFIED ANTENNAS)



ARRIS XG1-RM (MODIFIED ANTENNAS SHOWING SMA CONNECTORS)

ARRIS XG1-RM (MODIFIED ANTENNAS SHOWING CONNECTION TO THE BOARD)



3.0 Applicable Requirements, Methods, and Procedures

3.1 Applicable Requirements

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirements at the discretion of the customer, regulatory agencies, or other entities.

3.1.1 FCC Requirements

USA

Code of Federal Regulations:

Title 47 – Telecommunication

Chapter I - Federal Communications Commission

Sub-chapter A – General

Part 15 – Radio Frequency Devices

Subpart C - Intentional Radiators

Subpart D - Unlicensed Personal Communications Service Devices

Subpart E - Unlicensed National Information Infrastructure Devices

3.1.2 Basic Test Methods and Test Procedures

ANSI C63.4, 2009, 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

3.2 Deviations or Exclusions from the Requirements

No deviations or exclusions were made.

4.0 Test Results

4.1 Conducted Emissions Power Leads, 150 kHz to 30 MHz. FCC Section 15.207(b)

4.1.1 Conducted Emissions Test Procedure

AC Power Line

Conducted emissions at the power line input of the EUT were measured with an EMI receiver set to the appropriate detector and CISPR bandwidth, which was connected to the RF output of a 50 Ω, 50 μH Line Impedance Stabilization Network (LISN) installed in each power line. Measurements were made over the frequency range of 150 kHz to 30 MHz while the EUT was operating as described in the EUT section of this report. The significant amplitudes of emissions measured on the AC power lines of the EUT were recorded as follows:

Emission (dBμV) = Meter Reading (dBμv) + Cable Loss (dB) + LISN Factor (dB) + Limiter Loss (dB)

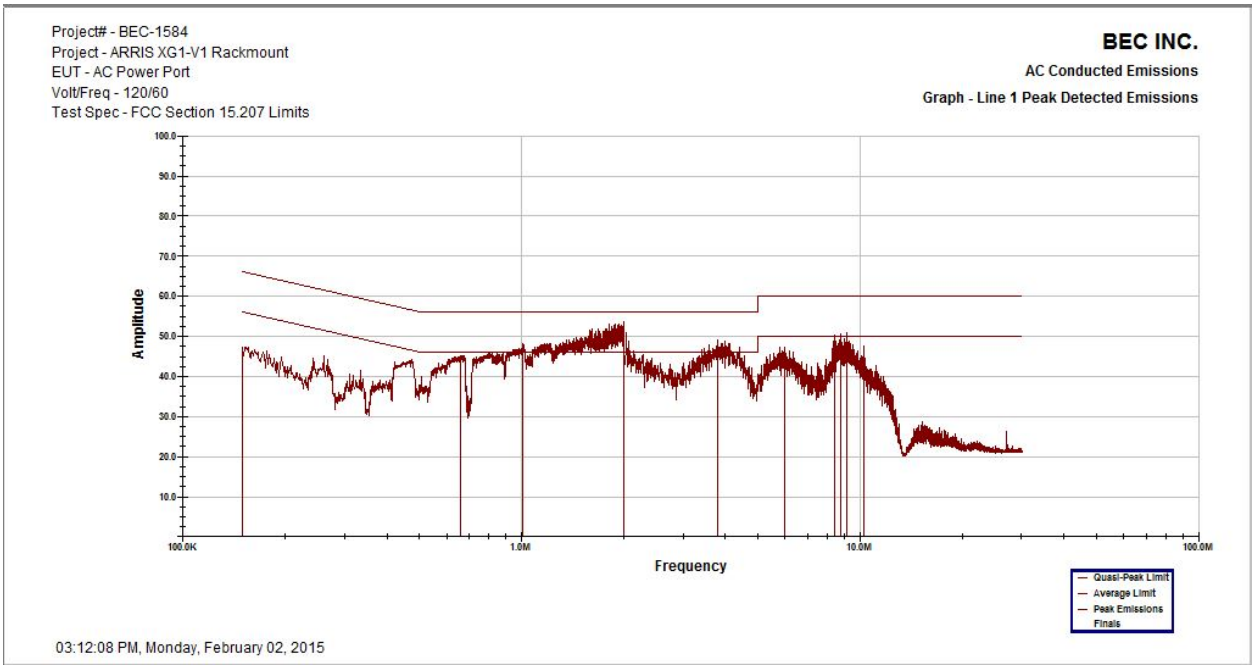
4.1.2 Conducted Emissions Test Results Delta Model EADP 40MB A Power Supply (02/02/2015)

The following graphs and tables show the conducted emissions recorded on the AC power line of the EUT displayed against the FCC limits as outlined in Section 15.207(b). The internal Delta Model EADP 40MB A supply was powered at 120Vac/60 Hz.

BEC INC.
Line 1 Conducted Emissions
03:12:05 PM, Monday, February 02, 2015

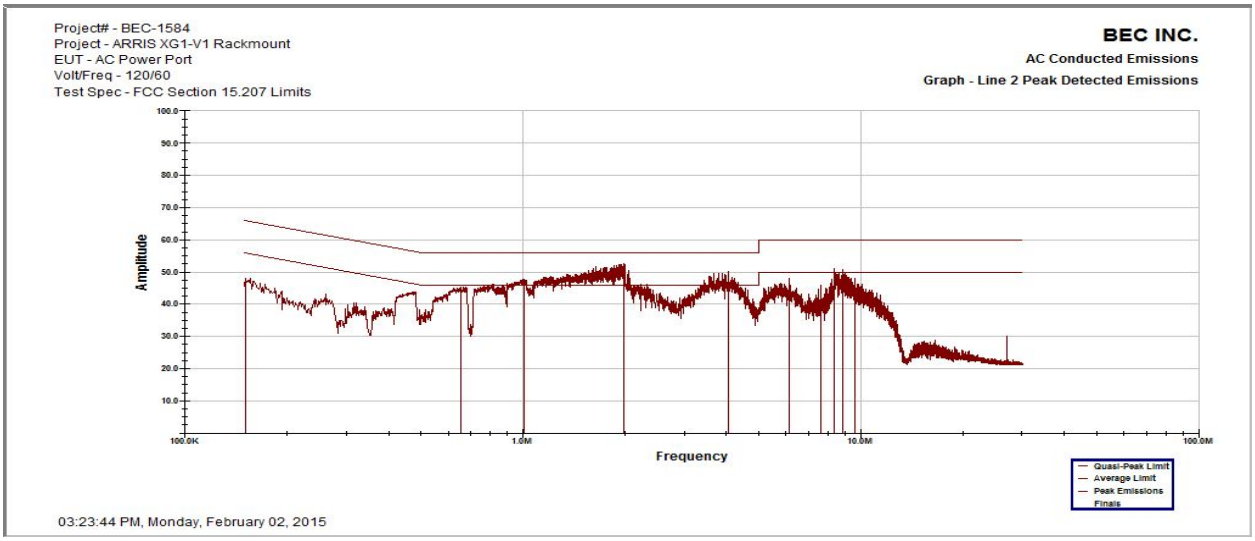
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
150.410 KHz	17.13	55.99	-38.86	41.68	65.99	-24.31	0.130
657.615 KHz	27.17	46.00	-18.83	42.30	56.00	-13.70	0.166
1.006 MHz	33.77	46.00	-12.23	44.43	56.00	-11.57	0.180
1.991 MHz	32.81	46.00	-13.19	46.53	56.00	-9.47	0.230
3.823 MHz	35.43	46.00	-10.57	44.10	56.00	-11.90	0.299
5.943 MHz	35.28	50.00	-14.72	41.66	60.00	-18.34	0.388
8.462 MHz	37.81	50.00	-12.19	44.52	60.00	-15.48	0.532
8.731 MHz	38.10	50.00	-11.90	45.16	60.00	-14.84	0.551
9.083 MHz	37.54	50.00	-12.46	44.66	60.00	-15.34	0.576
10.146 MHz	34.04	50.00	-15.96	40.60	60.00	-19.40	0.643

Project# - BEC-1584
Project - ARRIS XG1-V1 Rackmount
EUT - AC Power Port
Volt/Freq - 120/60
Test Spec - FCC Section 15.207 Limits



BEC INC.
Line 2 Conducted Emissions
03:23:41 PM, Monday, February 02, 2015

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
151.627 KHz	17.810	55.954	-38.143	41.310	65.954	-24.643	0.130
656.109 KHz	27.388	46.000	-18.612	42.596	56.000	-13.404	0.166
1.001 MHz	31.673	46.000	-14.327	44.310	56.000	-11.690	0.180
1.968 MHz	33.117	46.000	-12.883	45.949	56.000	-10.051	0.219
4.016 MHz	36.648	46.000	-9.352	44.876	56.000	-11.124	0.306
6.068 MHz	35.438	50.000	-14.562	42.283	60.000	-17.717	0.393
7.578 MHz	29.860	50.000	-20.140	37.492	60.000	-22.508	0.472
8.352 MHz	37.412	50.000	-12.588	44.139	60.000	-15.861	0.529
8.785 MHz	38.851	50.000	-11.149	45.771	60.000	-14.229	0.561
9.545 MHz	37.027	50.000	-12.973	43.657	60.000	-16.343	0.617
Project# - BEC-1584							
Project - ARRIS XG1-V1 Rackmount							
EUT - AC Power Port							
Volt/Freq - 120/60							
Test Spec - FCC Section 15.207 Limits							



Results: All conducted emissions measured on the telecommunications port(s) of the Delta Model EADP 40MB A supply are below the limits specified in FCC Section 15.207 by a margin of at least 9.35 dB.

4.2 Spurious Radiated Emissions, 1 GHz to 25 GHz. FCC Section 15.209

4.2.1 Test Facility

OATS

The Open Area Test Site (OATS) is an all-weather facility with a wooden enclosure that contains a ground level 4-foot diameter turntable capable of rotating equipment 360 degrees. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This non-metallic enclosure and the 3 and 10 meter test range existing outside the enclosure rest upon a protective insulating material, which in turn covers a flat, metal, continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel indoors. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

The test site complies with the attenuation measurements specified in ANSI C63.4 and CISPR 22.

SR#1

The Semi-Anechoic Shielded Room (SR#1) is an ferrite and absorber lined chamber which houses a 5-foot diameter turntable capable of rotating equipment 360 degrees and antenna mast for Horizontal and Vertical polarity measurements. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This 3 meter shielded enclosure has a raised computer floor with metal tile bottoms providing a continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel outside the chamber. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

The test site complies with the attenuation measurements specified in ANSI C63.4 and CISPR 22.

4.2.2 Spurious Radiated Emissions Test Procedure

Radiated Emissions 30 MHz – 40 GHz
The EMI receiver was set to quasi-peak mode for frequencies from 30MHz to 1GHz and the appropriate CISPR bandwidths were employed. The receiver was set to average mode for frequencies above 1GHz with the appropriate CISPR bandwidths were employed. Significant emissions found during the preliminary scans were maximized by rotating the turntable and varying the antenna height. Both horizontal and vertical antenna polarities were also investigated for suspect emissions. The signals are maximized and measured using the in house generated RADE or off the shelf TILE software. The support equipment and test item(s) were powered off in turn to determine the source of the emissions where appropriate.

Field strengths were calculated as follows:

Field Strength (dBµV/m) = Meter Reading (dBµV) + Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB)

Because the intentional radiator has a pulse modulated amplitude signal, a "duty cycle correction factor" must be taken against the Peak Measurement of the harmonic spurious emissions when calculating the final field strengths against the required limits. The duty cycle correction factor for the GreenPeak GP711 is 20 dB (maximum allowed by the FCC).

Section 15.35 (c) mentions: "Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds."

The maximum duty cycle of the RF4CE set top box is gated by the remote control. The maximum repeat rate of a RF4CE remote control, while continuously pressing a key, is 1 packet per 100 ms, so the set top box can confirm every 100 ms a packet with an ACK. The duration of an ACK is ~0.5 ms.

The duration of a ACK is 0.5 ms, the interval time is 100 ms. This means that the correction factor for the average spurious emission field strength is:
$20 * \log_{10}(0.5 / 100) = -46$ dB. FCC limits the max duty cycle correction factor to 20 dB.

4.2.3 Spurious Radiated Emissions 1 GHz to 25 GHz Test Results (02/16/2015)

The following table shows the highest amplitude average detected field strengths as recorded from the EUT. These measurements were performed over the frequency range of 1.0 GHz to 25 GHz at a distance of 3 meters to satisfy FCC Section 15.209 requirements. Spurious emissions from the Antenna 0 and Antenna 1 were measured when individually set to low (Channel 15), middle (Channel 20) and high (Channel 25). The signal output was maximized with modulation.

Settings: Antenna 0, Channel 15 (2.425 GHz Fundamental) Maximum Output with Modulation

Freq [GHz}	Peak [dBuV/m]	Calculated Average w Duty Cycle Correction Factor [dBuV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBuV/m]	Margin [dB]	Comment
4.850	62.10	42.10	H	360	100	1.10	53.98	-10.78	PASS
4.850	47.40	27.40	V	360	100	1.10	53.98	-25.48	PASS

Settings: Antenna 0, Channel 20 (2.450 GHz Fundamental) Maximum Output with Modulation

Freq [GHz]	Peak [dBµV/m]	Calculated Average w Duty Cycle Correction Factor [dBµV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBµV/m]	Margin [dB]	Comment
4.90	62.90	42.90	H	0	100	1.10	53.98	-9.98	PASS
7.350	48.30	28.30	H	0	100	4.30	53.98	-21.38	PASS
9.80	49.70	29.70	H	63.4	100	7.00	53.98	-17.28	PASS
4.90	49.30	29.30	V	360	100	1.10	53.98	-23.58	PASS
9.80	53.60	33.60	V	24.2	100	7.00	53.98	-13.38	PASS

Settings: Antenna 0, Channel 25 (2.475 GHz Fundamental) Maximum Output with Modulation

Freq [GHz]	Peak [dBµV/m]	Calculated Average w Duty Cycle Correction Factor [dBµV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBµV/m]	Margin [dB]	Comment
4.95	61.20	41.20	H	0	100	1.1	53.98	-11.68	PASS
7.425	47.50	27.50	H	0	100	4.3	53.98	-22.18	PASS
4.95	52.20	32.20	V	315	100	1.1	53.98	-20.68	PASS

Settings: Antenna 1, Channel 15 (2.425 GHz Fundamental) Maximum Output with Modulation

Freq [GHz]	Peak [dBµV/m]	Calculated Average w Duty Cycle Correction Factor [dBµV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBµV/m]	Margin [dB]	Comment
4.85	55.50	35.50	H	0	100	1.1	53.98	-17.38	PASS
4.85	51.40	31.40	V	340	100	1.1	53.98	-21.48	PASS

Settings: Antenna 1, Channel 20 (2.450 GHz Fundamental) Maximum Output with Modulation

Freq [GHz]	Peak [dBµV/m]	Calculated Average w Duty Cycle Correction Factor [dBµV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBµV/m]	Margin [dB]	Comment
4.90	52.90	32.90	H	0	100	1.1	53.98	-19.98	PASS
4.90	52.90	32.90	V	325	100	1.1	53.98	-19.98	PASS

Settings: Antenna 1, Channel 25 (2.475 GHz Fundamental) Maximum Output with Modulation

Freq [GHz]	Peak [dBµV/m]	Calculated Average w Duty Cycle Correction Factor [dBµV/m]	Pol	Angle [deg]	Height [cm]	CF [dB]	Limit [dBµV/m]	Margin [dB]	Comment
4.95	51.00	31.00	H	0	100	1.1	53.98	-21.88	PASS
4.95	50.70	30.70	V	317	100	1.1	53.98	-22.18	PASS

Results: All harmonic spurious radiated emissions as recorded at a distance of 3 meters from the ARRIS Model XG1-RM Rack Mount Set Top Box are below the 3 meter limit specified by FCC Section 15.209 requirements by a margin of at least 9.98 dB.

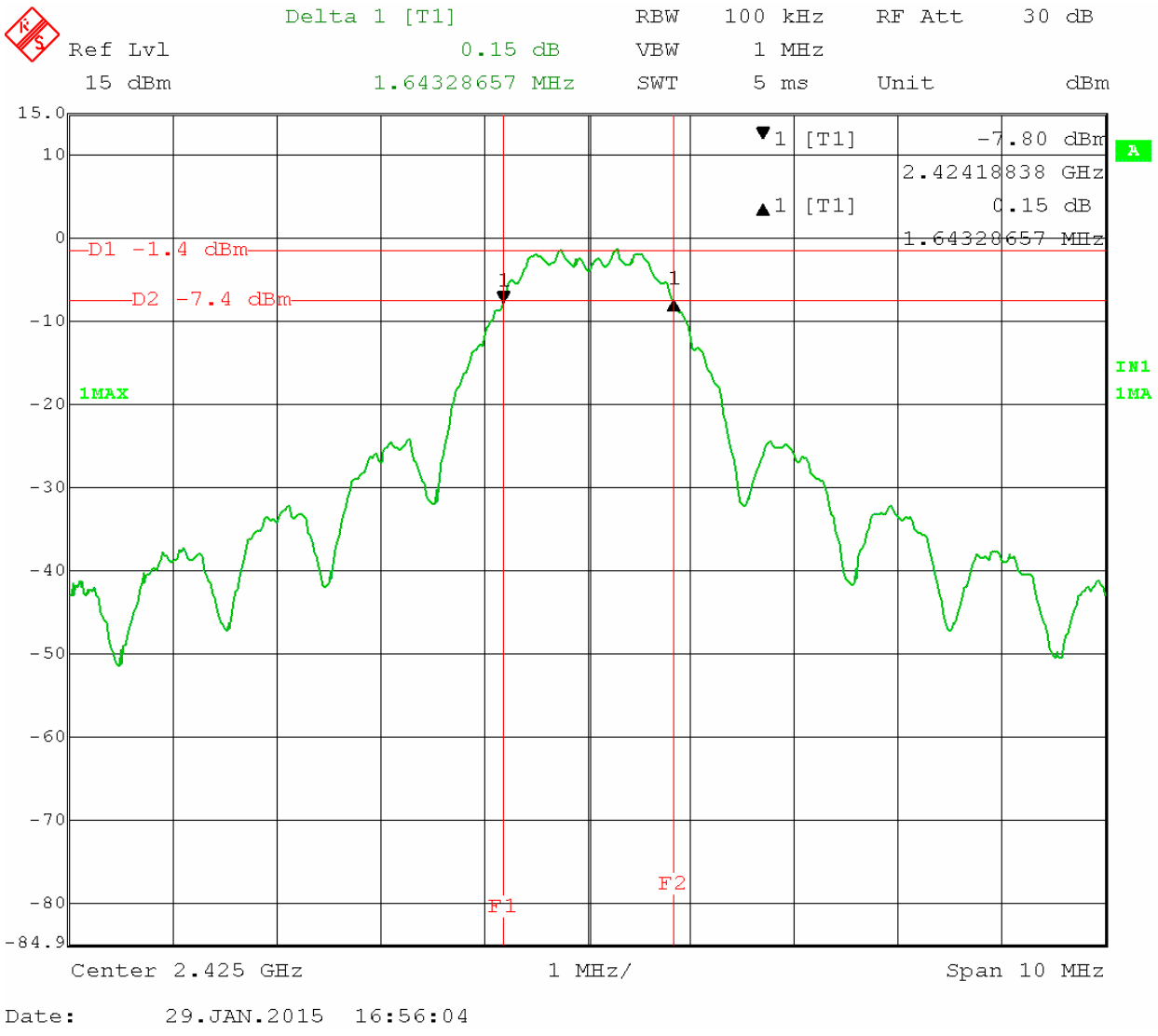
4.3 6 dB Occupied Bandwidth. FCC Section 15.247(a)(2)

4.3.1 6 dB Occupied Bandwidth – Test Procedure

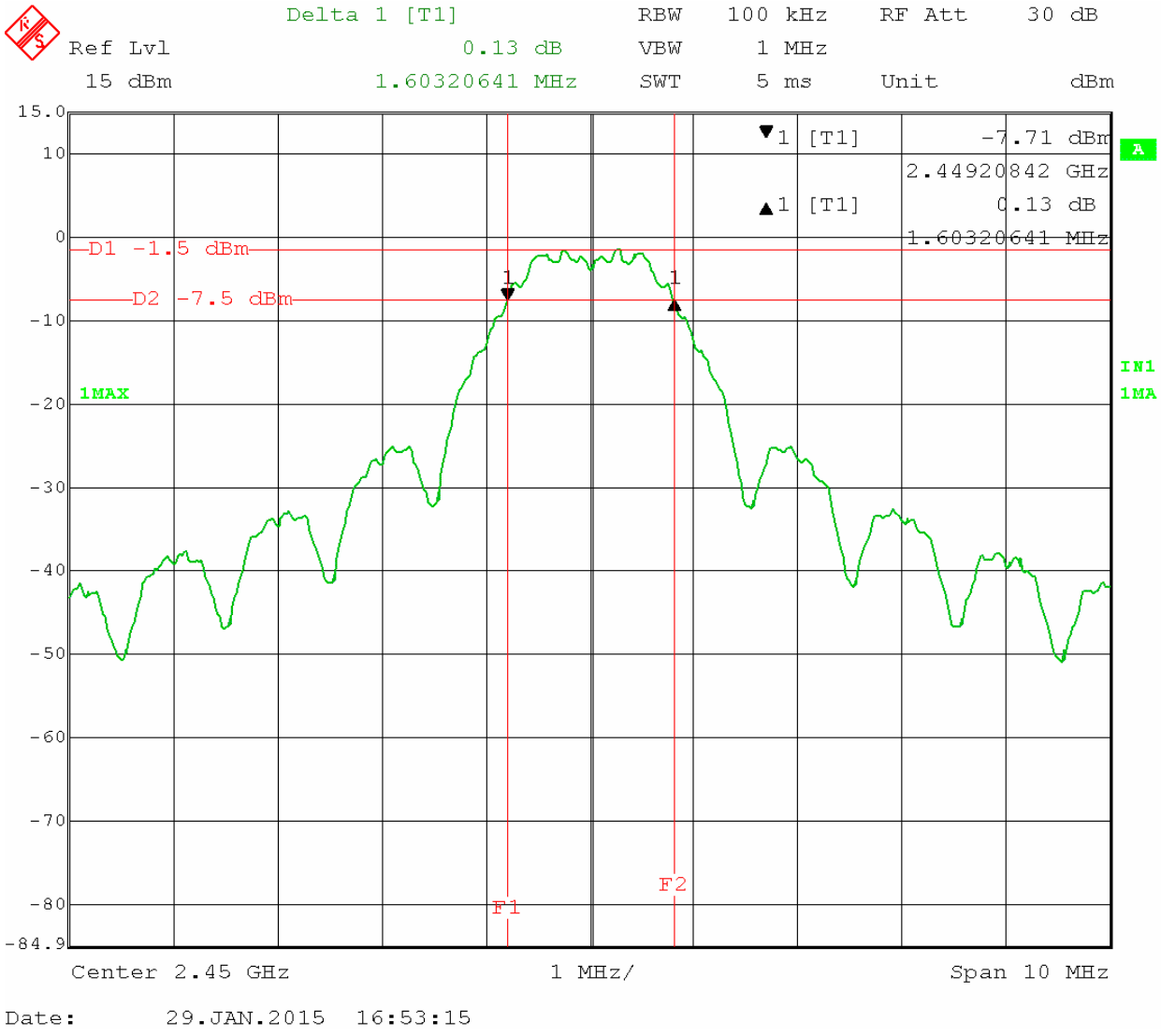
The minimum 6 dB bandwidths per FCC Section 15.247(a)(2) were measured using a 50 Ohm EMI Test Receiver with settings of 100 kHz resolution bandwidth and 300 kHz video bandwidth. The Antenna 0 and Antenna 1 were set individually to low (Channel 11), middle (Channel 19) and high (Channel 26). The signal output was maximized with modulation.

4.3.2 6 dB Occupied Bandwidth Analyzer Display Captures Antenna 0

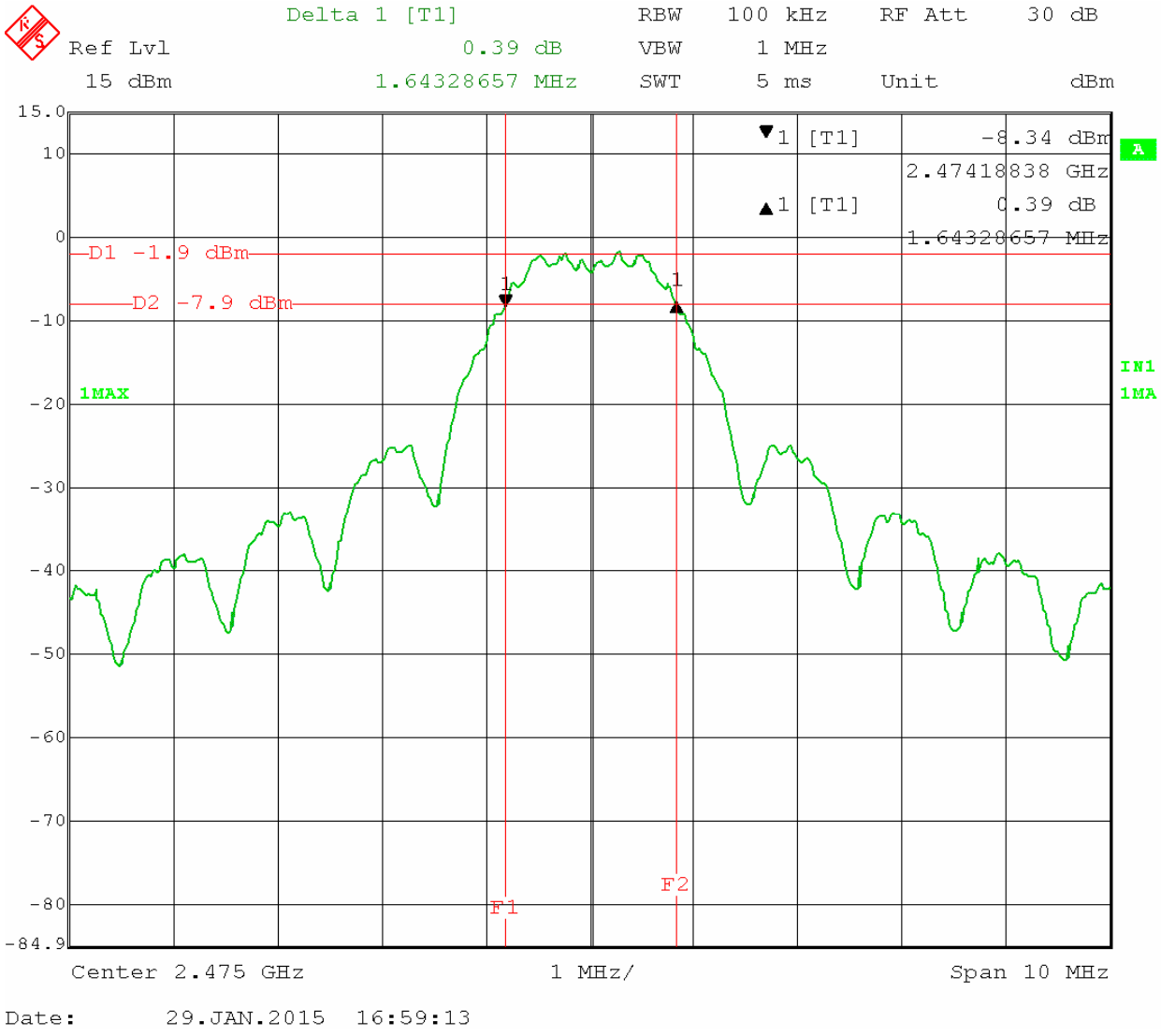
Antenna 0, Channel 15 (2.425 GHz)



Antenna 0, Channel 20 (2.50 GHz)

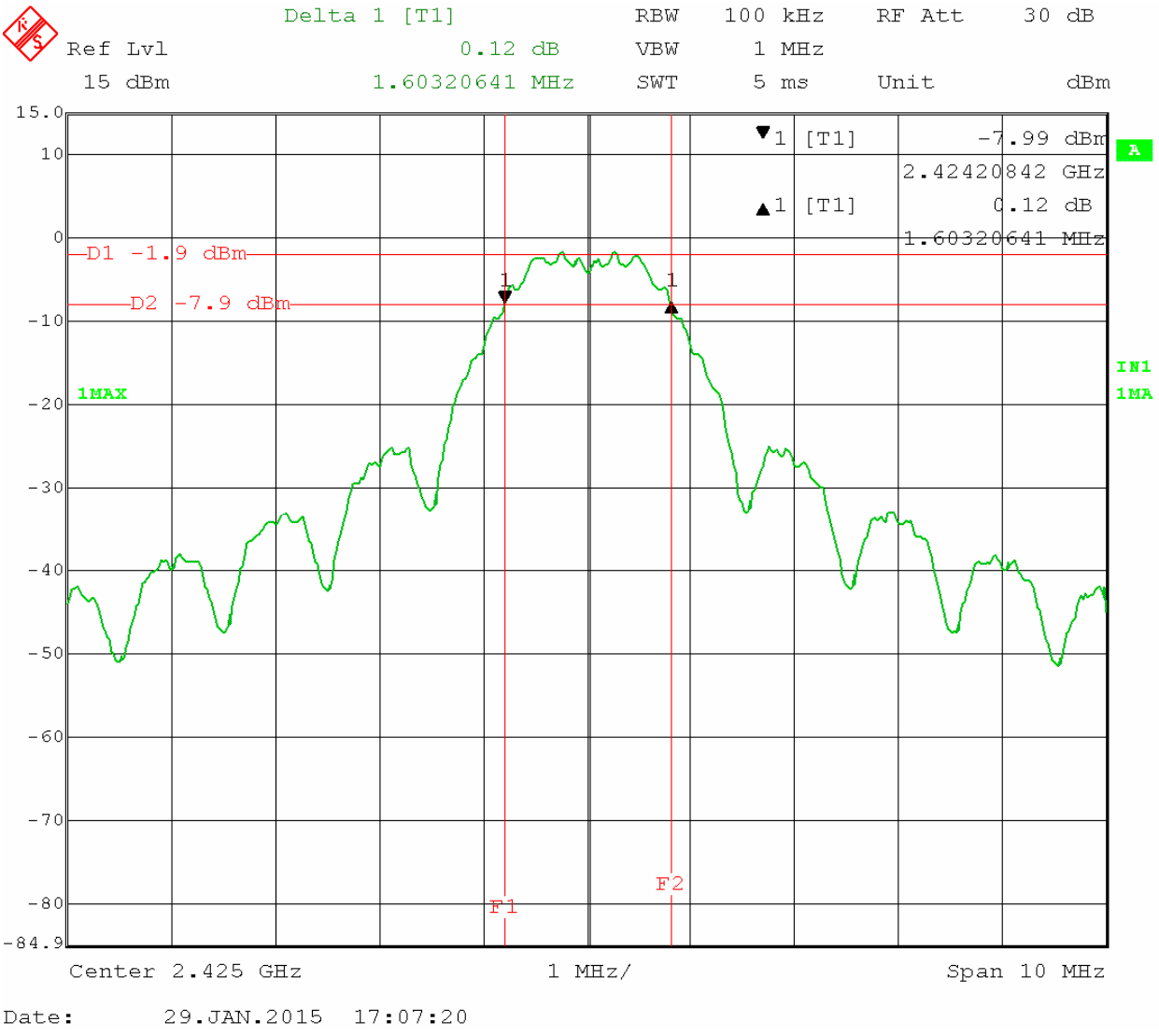


Antenna 0, Channel 25 (2.475GHz)

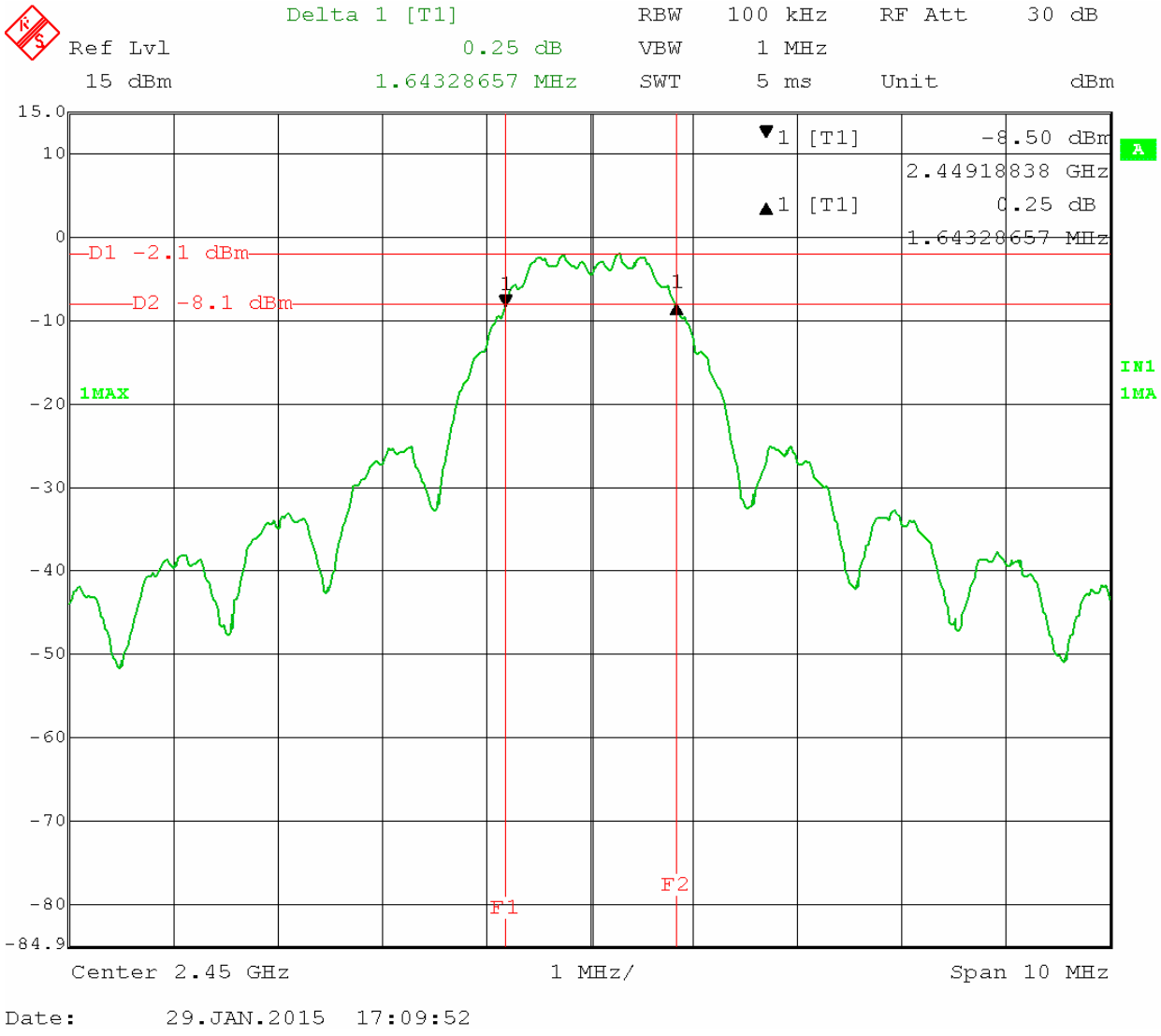


4.3.3 6 dB Occupied Bandwidth Analyzer Display Captures Antenna 1

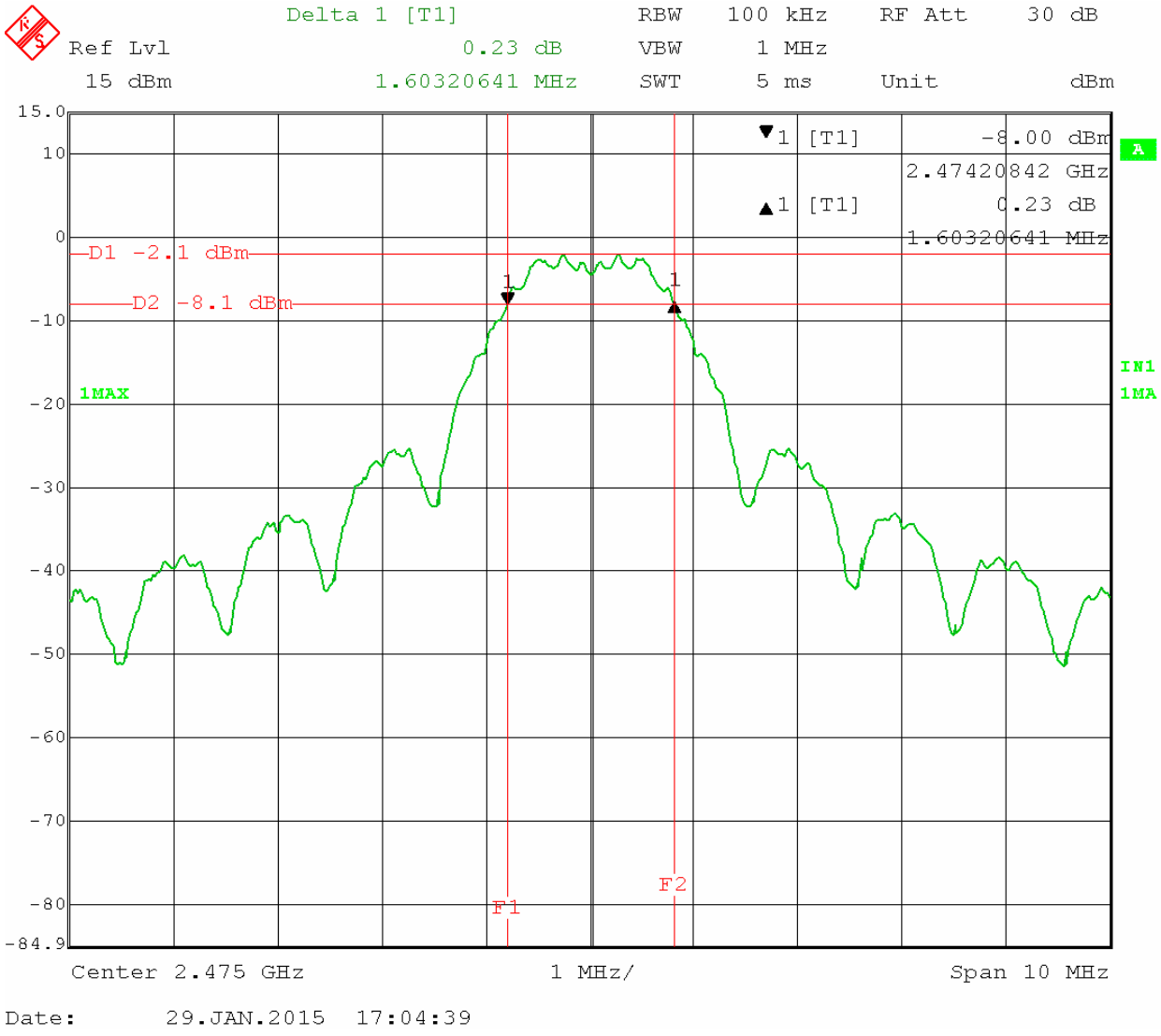
Antenna 1, Channel 11 (2.425 GHz)



Antenna 1, Channel 20 (2.450 GHz)



Antenna 1, Channel 25 (2.475 GHz)



4.3.4 6 dB Occupied Bandwidth Test Results (01/29/2015)

Antenna 0

Antenna Number	Freq (GHz)	6 - dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
0	2.425	1.6432	0.5	PASS
0	2.450	1.6032	0.5	PASS
0	2.475	1.6432	0.5	PASS

Antenna 1

Antenna Number	Freq (GHz)	6 - dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
1	2.425	1.6032	0.5	PASS
1	2.450	1.6432	0.5	PASS
1	2.475	1.6032	0.5	PASS

Results: The 6 dB Occupied Bandwidth measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box are compliant with the limits specified in FCC Section 15.247(a)(2).

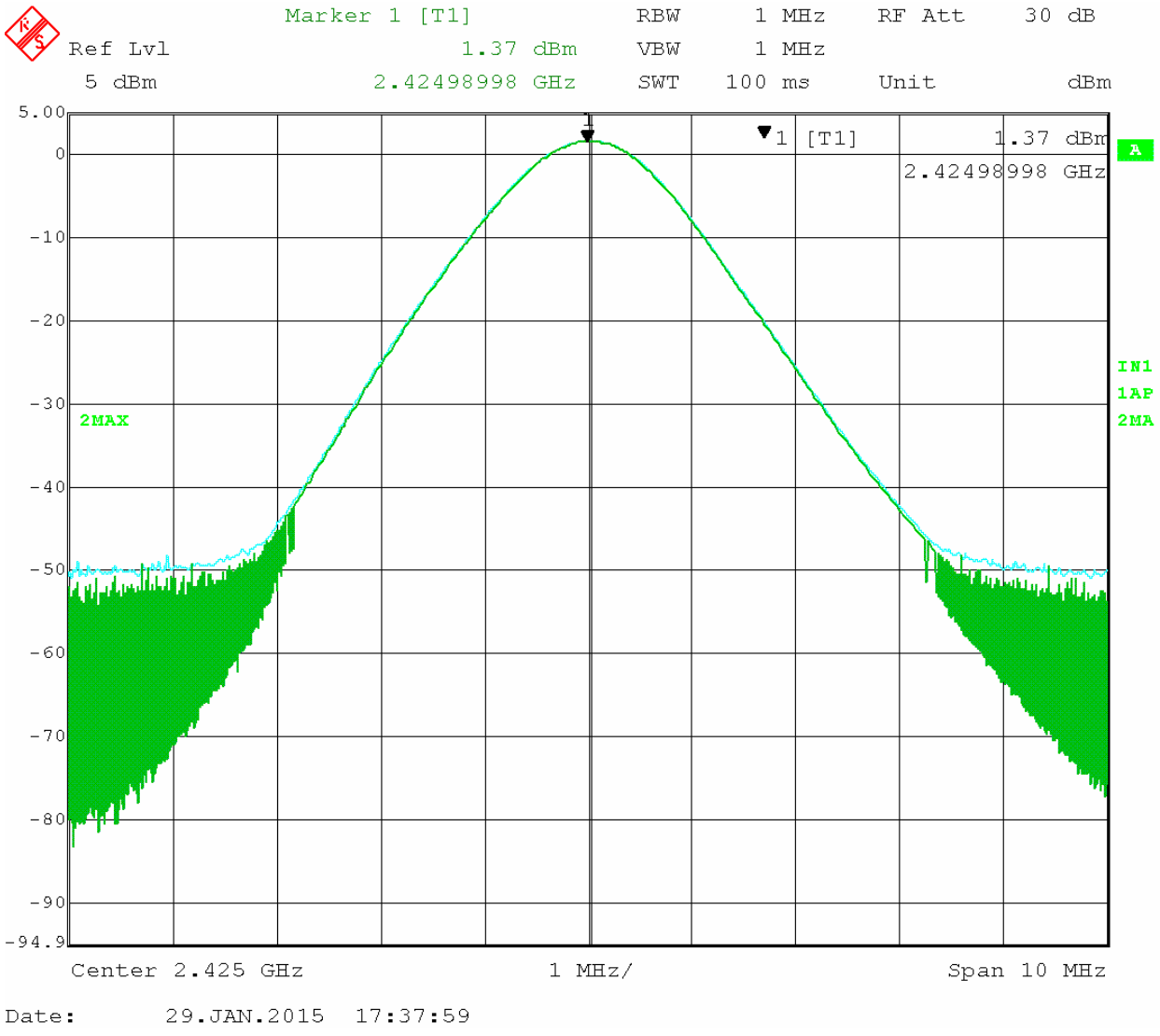
4.4 Maximum Peak Power Output FCC Section 15.247(b)(3)

4.4.1 Maximum Peak Power Output Test Procedure

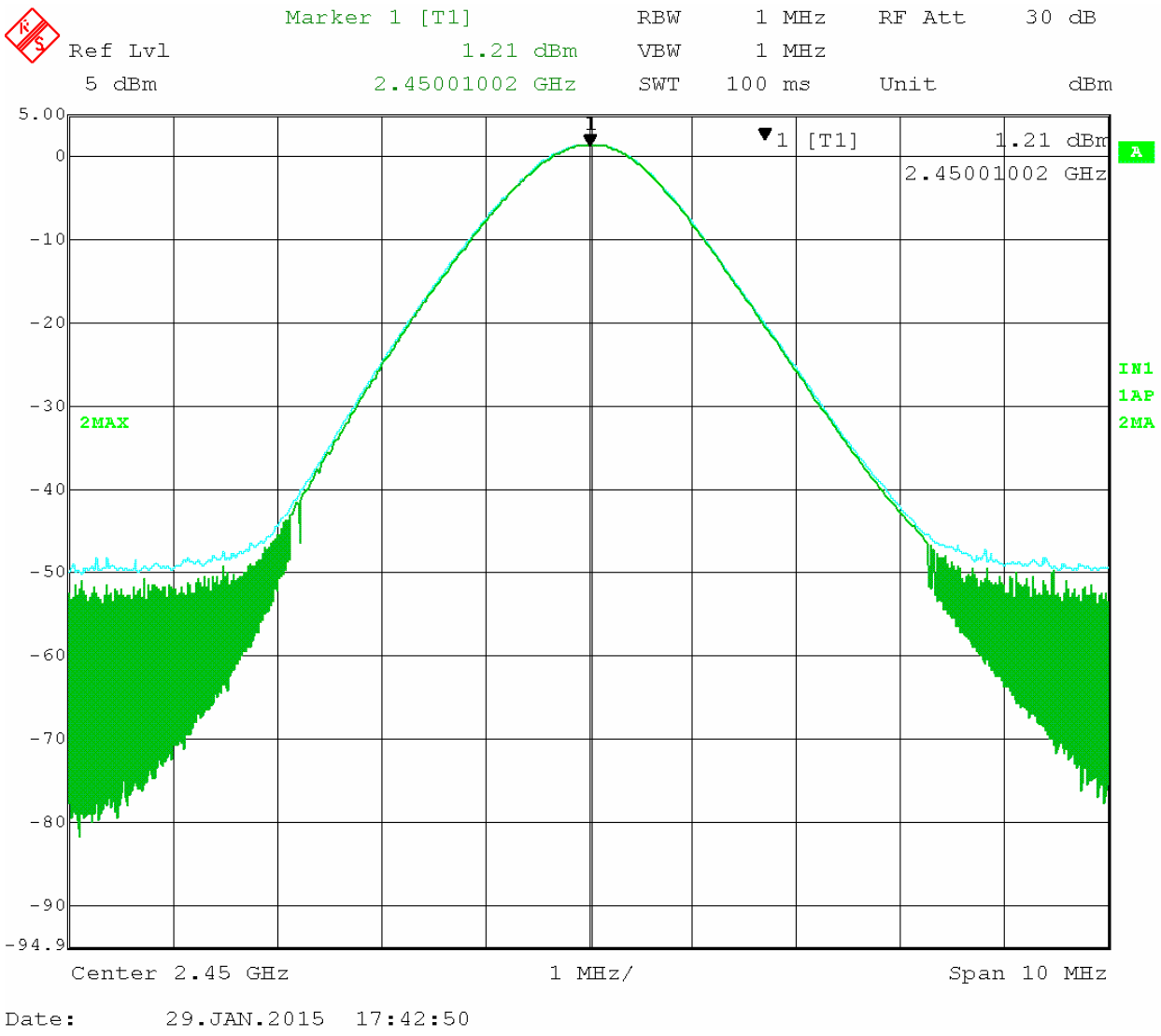
A conducted power measurement of the output frequency was measured for both Antenna 0 and Antenna 1. The Antenna 0 and Antenna 1 were set individually to low (Channel 15), middle (Channel 20) and high (Channel 25). The signal output was maximized without modulation. Signal was measured with no modulation since the peak of the signal was higher when modulation was turned off.

4.4.2 Maximum Peak Power Output Analyzer Display Captures Antenna 0

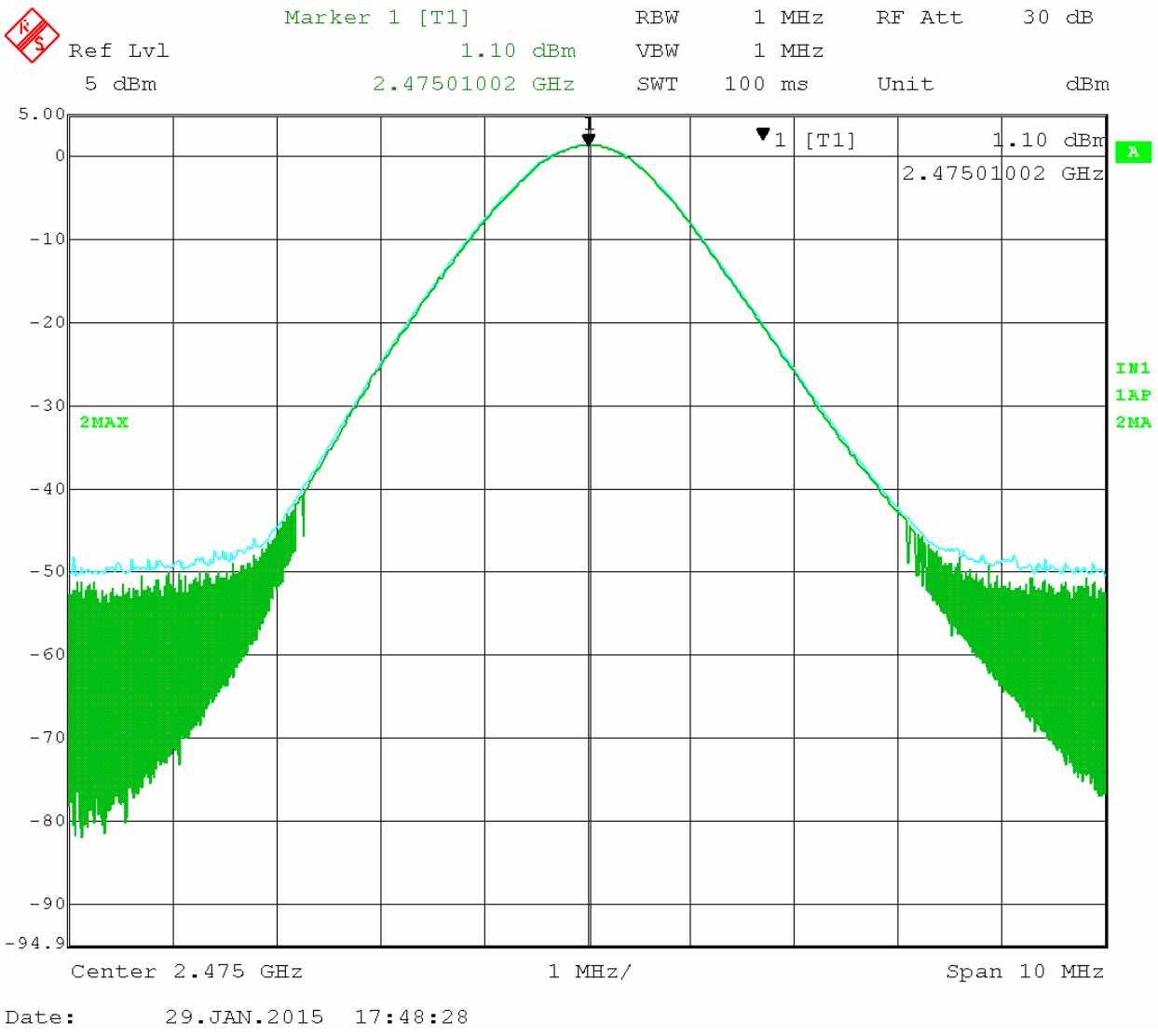
Antenna 0, Channel 15 (2.425 GHz)



Antenna 0, Channel 20 (2.450 GHz)

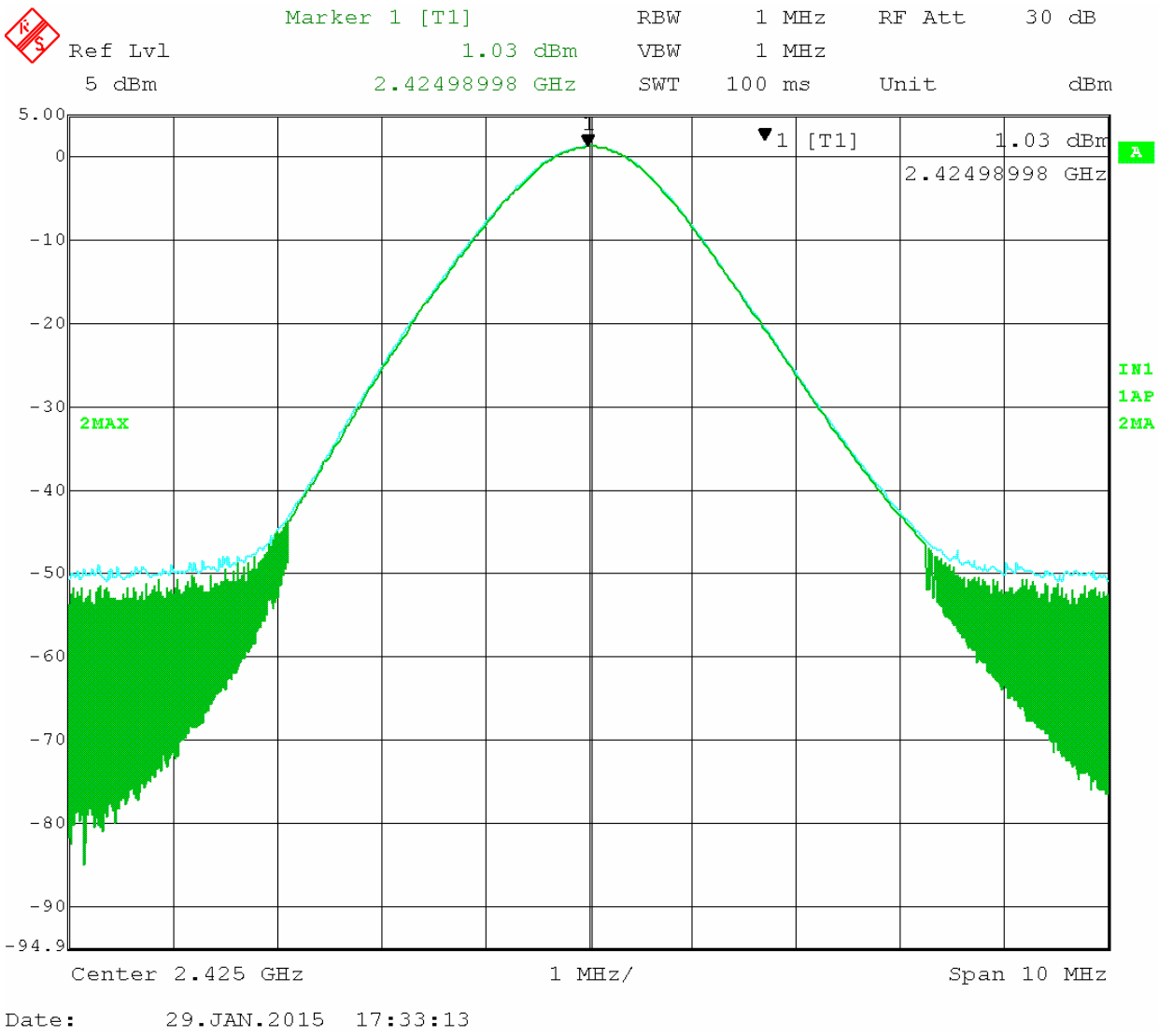


Antenna 0, Channel 25 (2.475 GHz)

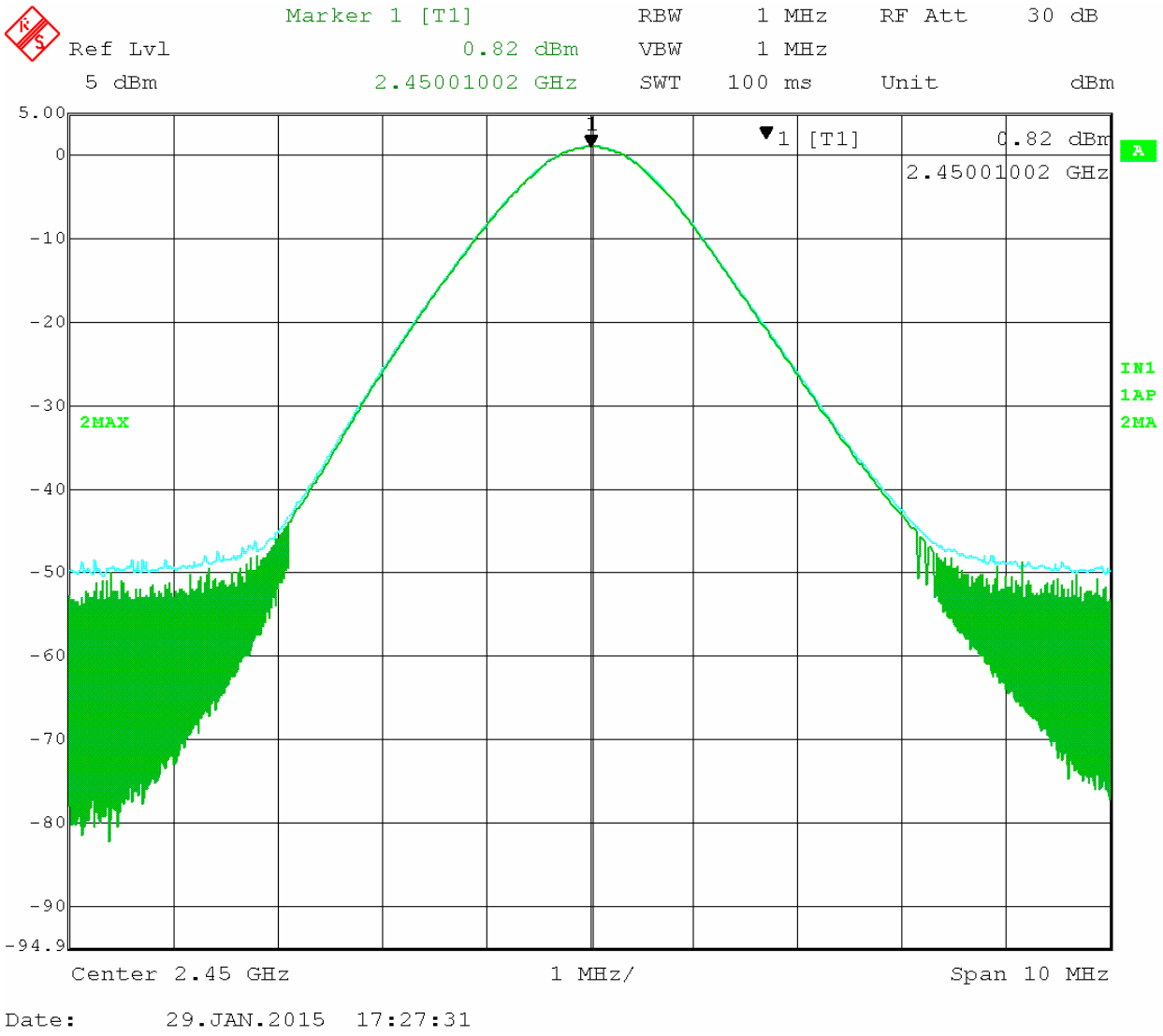


4.4.3 Maximum Peak Power Output Analyzer Display Captures Antenna 1

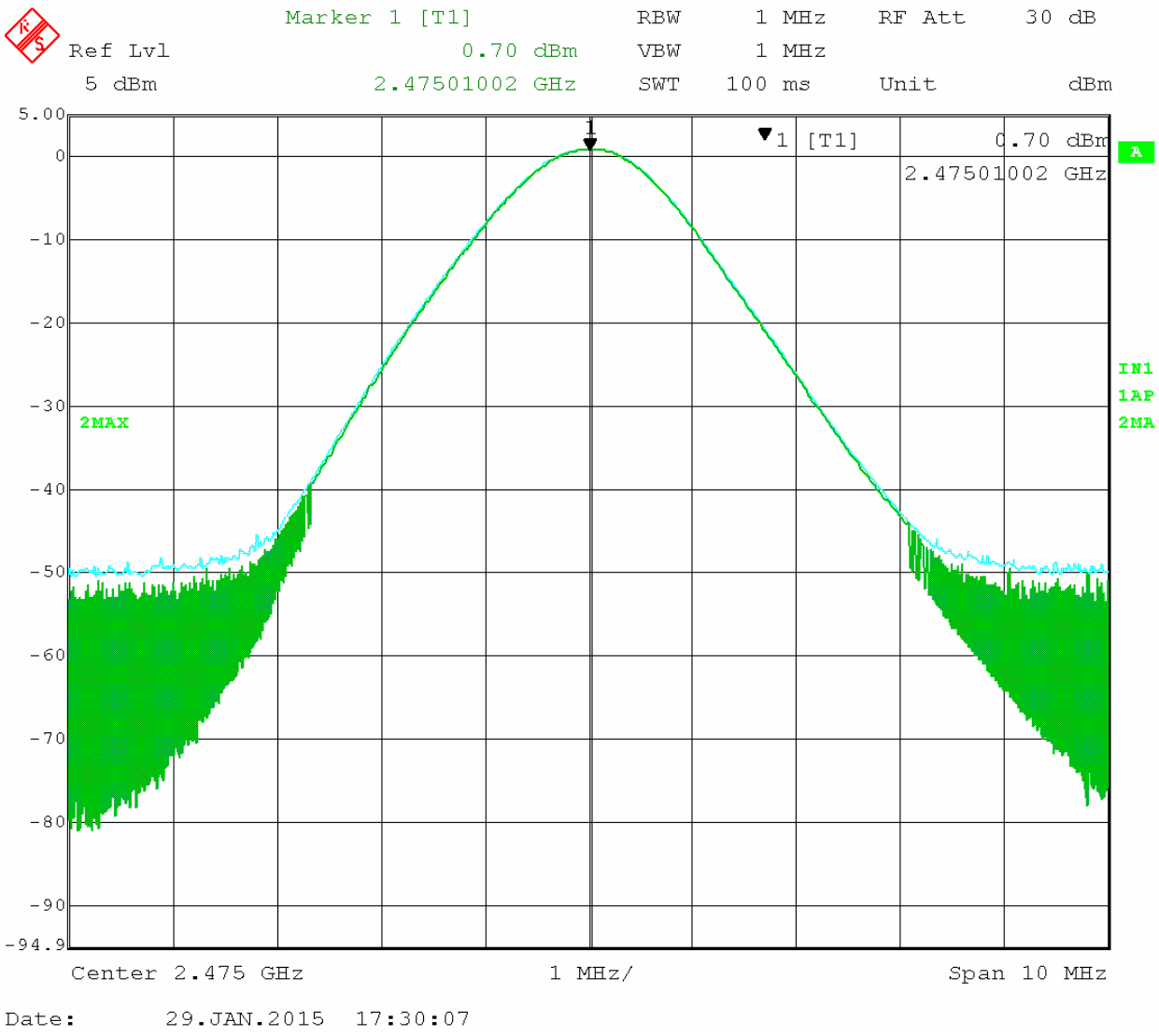
Antenna 1, Channel 15 (2.425 GHz)



Antenna 1, Channel 20 (2.450 GHz)



Antenna 1, Channel 25 (2.475 GHz)



4.4.4 Maximum Peak Power Output Test Results (01/29/2015)

Antenna 0

Frequency GHz	Measured Level dBm	Cable Loss dB	Total		Limit		Margin	
			dBm	Watts	dBm	Watts	dBm	Watts
2.425	1.38	0.6	1.98	0.001577611	30	1	-28.02	-0.99842
2.450	1.21	0.6	1.81	0.001517050	30	1	-28.19	-0.99848
2.475	1.1	0.6	1.7	0.001479108	30	1	-28.3	-0.99852

Antenna 1

Frequency GHz	Measured Level dBm	Cable Loss dB	Total		Limit		Margin	
			dBm	Watts	dBm	Watts	dBm	Watts
2.425	1.01	0.6	1.61	0.001448772	30	1	-28.39	-0.99855
2.450	0.82	0.6	1.42	0.001386756	30	1	-28.58	-0.99861
2.475	0.72	0.6	1.32	0.001355189	30	1	-28.68	-0.99864

Results: The Peak Power Output measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box are compliant with the limits specified in FCC Section 15.247(b)(3).

4.5 Antenna Conducted Spurious Emissions FCC Section 15.247(d)

4.5.1 Antenna Conducted Spurious Emissions Test Procedure

A conducted power measurement of the output frequency was measured for both Antenna 0 and Antenna 1. The Antenna 0 and Antenna 1 were set individually to low (Channel 15), middle (Channel 20) and high (Channel 25). The signal output was maximized with modulation.

4.5.2 Antenna Conducted Spurious Emissions Test Results (01/30/2015)

Antenna 0

Channel	Fundamental Channel Freq (GHz)	Freq (GHz)	Measured Level (dBm)	Cable Loss (dB)	Total Corrected Level (dBm)	Output Spurious Limit (dBm)	Pass/Fail
15	2.400	4.8476	-47.23	0.92	-46.31	-21.7	PASS
15	2.400	7.2525	-55.61	1.08	-54.53	-21.7	PASS
15	2.400	9.7054	-45.73	1.3	-44.43	-21.7	PASS
		No other Frequencies up to 25 GHz					
20	2.450	4.8957	-49.89	0.92	-48.97	-22.07	PASS
20	2.450	7.3486	-59.6	1.08	-58.52	-22.07	PASS
20	2.450	9.8016	-47.09	2.1	-44.99	-22.07	PASS
20	2.450	12.2545	-62.38	2.2	-60.18	-22.07	PASS
		No other Frequencies up to 25 GHz					
25	2.475	4.9438	-49.99	0.92	-49.07	-22.07	PASS
25	2.475	7.3967	-56.7	1.08	-55.62	-22.07	PASS
25	2.475	9.8977	-51.42	2.1	-49.32	-22.07	PASS
25	2.475	12.3500	-63.54	2.2	-61.34	-22.07	PASS
		No other Frequencies up to 25 GHz					

Antenna 1

Channel	Fundamental Channel Freq (GHz)	Freq (GHz)	Measured Level (dBm)	Cable Loss (dB)	Total Corrected Level (dBm)	Output Spurious Limit (dBm)	Pass/Fail
15	2.400	4.8476	-46.76	0.92	-45.84	-21.7	PASS
15	2.400	7.2525	-58.97	1.08	-57.89	-21.7	PASS
15	2.400	9.7054	-52.42	1.3	-51.12	-21.7	PASS
		No other Frequencies up to 25 GHz					
20	2.450	4.8957	-49.9	0.92	-48.98	-22.07	PASS
20	2.450	7.3486	-55	1.08	-53.92	-22.07	PASS
20	2.450	9.8016	-56.63	2.1	-54.53	-22.07	PASS
		No other Frequencies up to 25 GHz					
25	2.475	4.9438	-50.38	0.92	-49.46	-22.07	PASS
25	2.475	7.3967	-54.99	1.08	-53.91	-22.07	PASS
25	2.475	9.8977	-59.28	2.1	-57.18	-22.07	PASS
		No other Frequencies up to 25 GHz					

Results: The Antenna Conducted Spurious Emissions measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box are compliant with the limits specified in FCC Section 15.247(d).

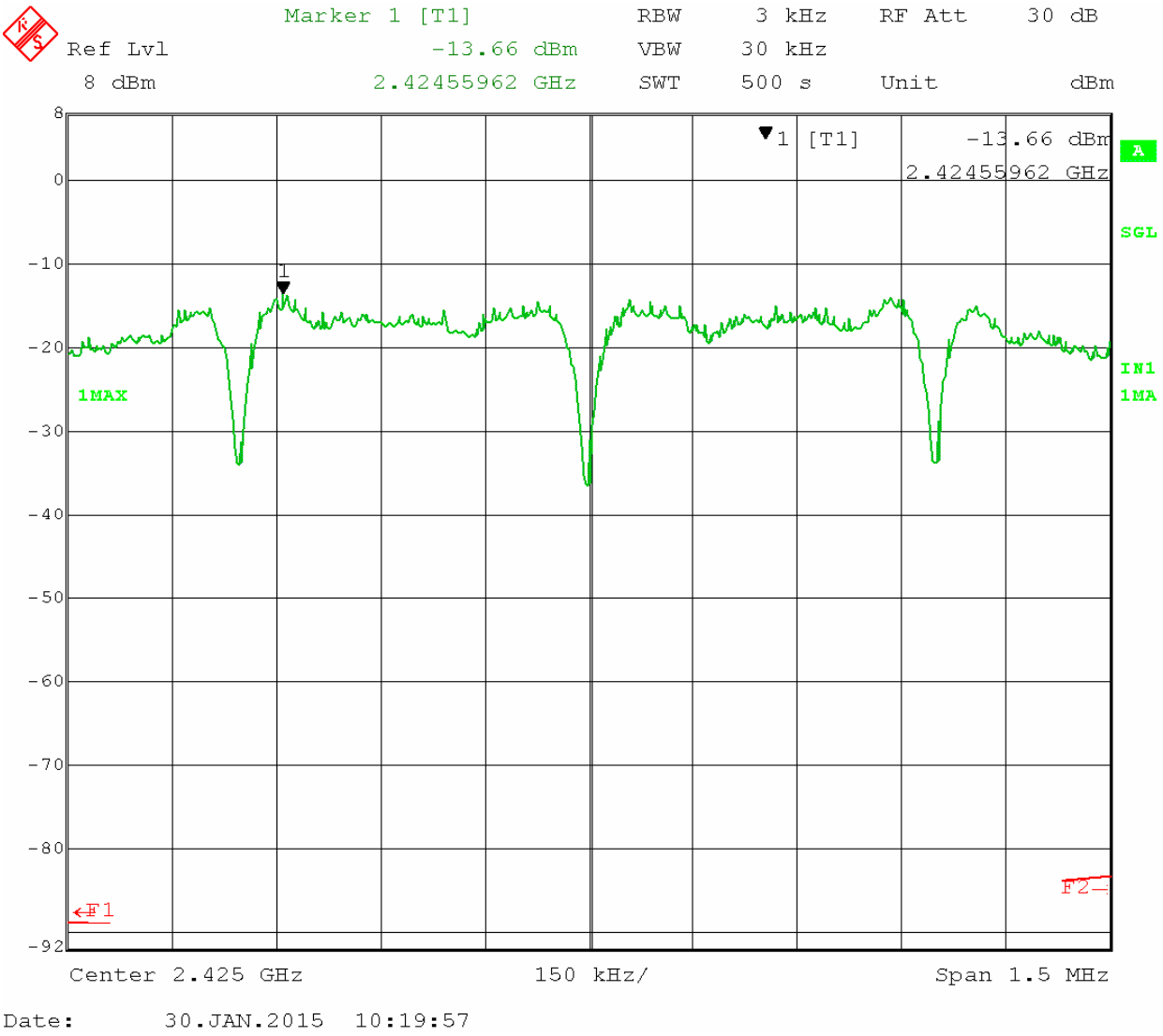
4.6 Power Spectral Density FCC Section 15.247(e)

4.6.1 Power Spectral Density Test Procedure

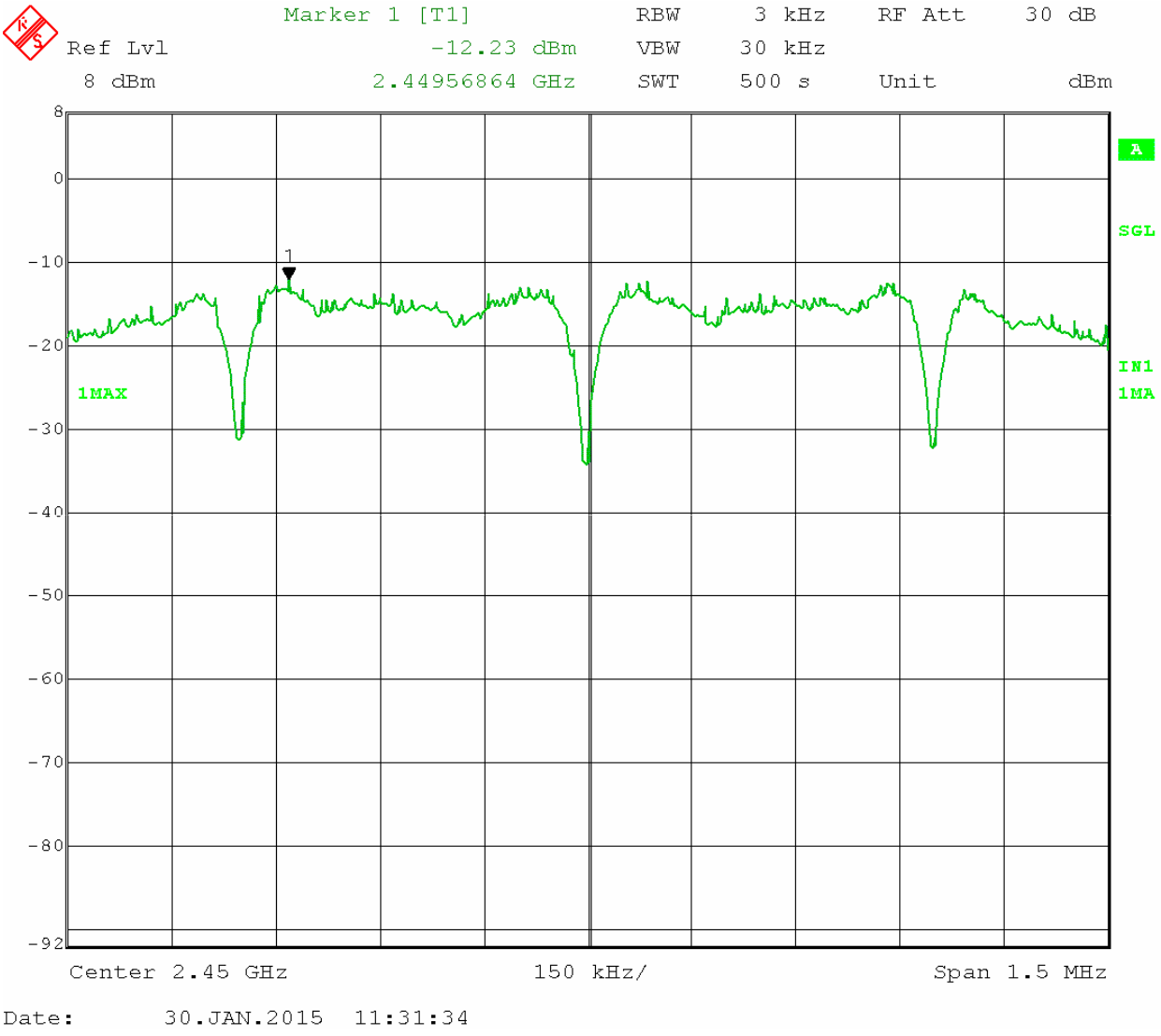
A conducted power measurement of the output frequency was measured for both Antenna 0 and Antenna 1. The Antenna 0 and Antenna 1 were set individually to low (Channel 15), middle (Channel 20) and high (Channel 25). The signal output was maximized with modulation.

4.6.2 Power Spectral Density Analyzer Display Captures Antenna 0

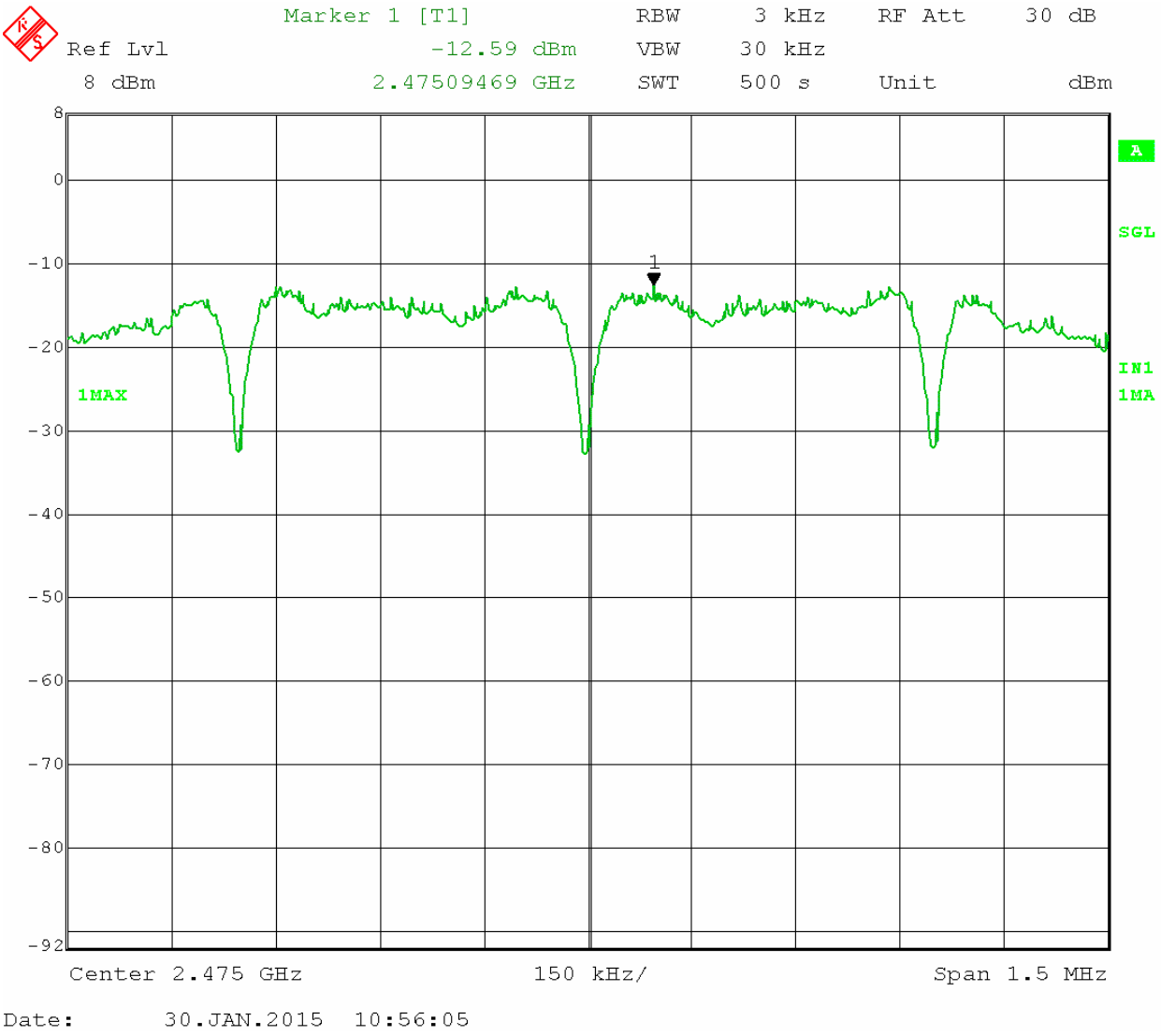
Antenna 0, Channel 11 (2.425 GHz)



Antenna 0, Channel 20 (2.450 GHz)

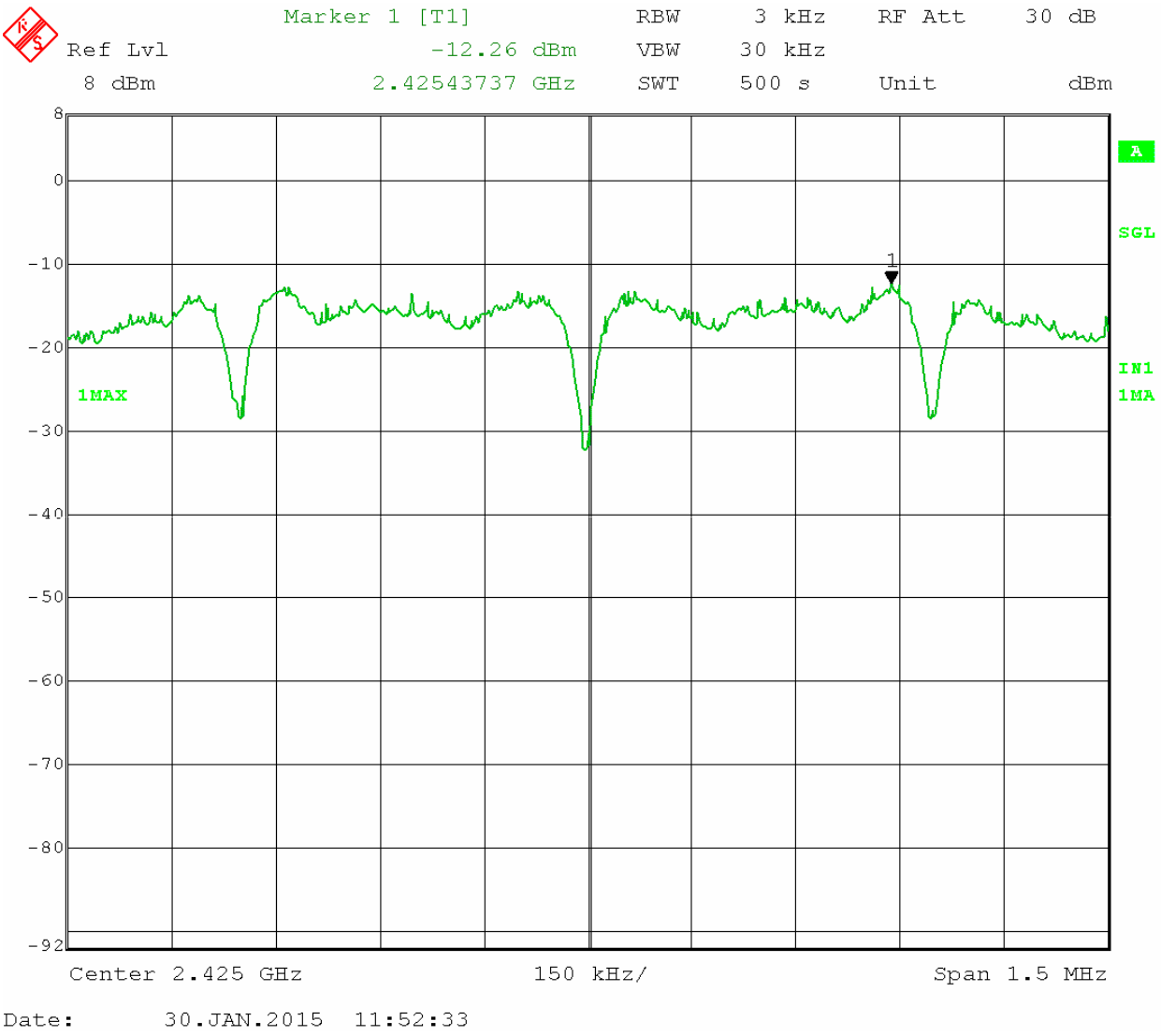


Antenna 0, Channel 25 (2.475GHz)

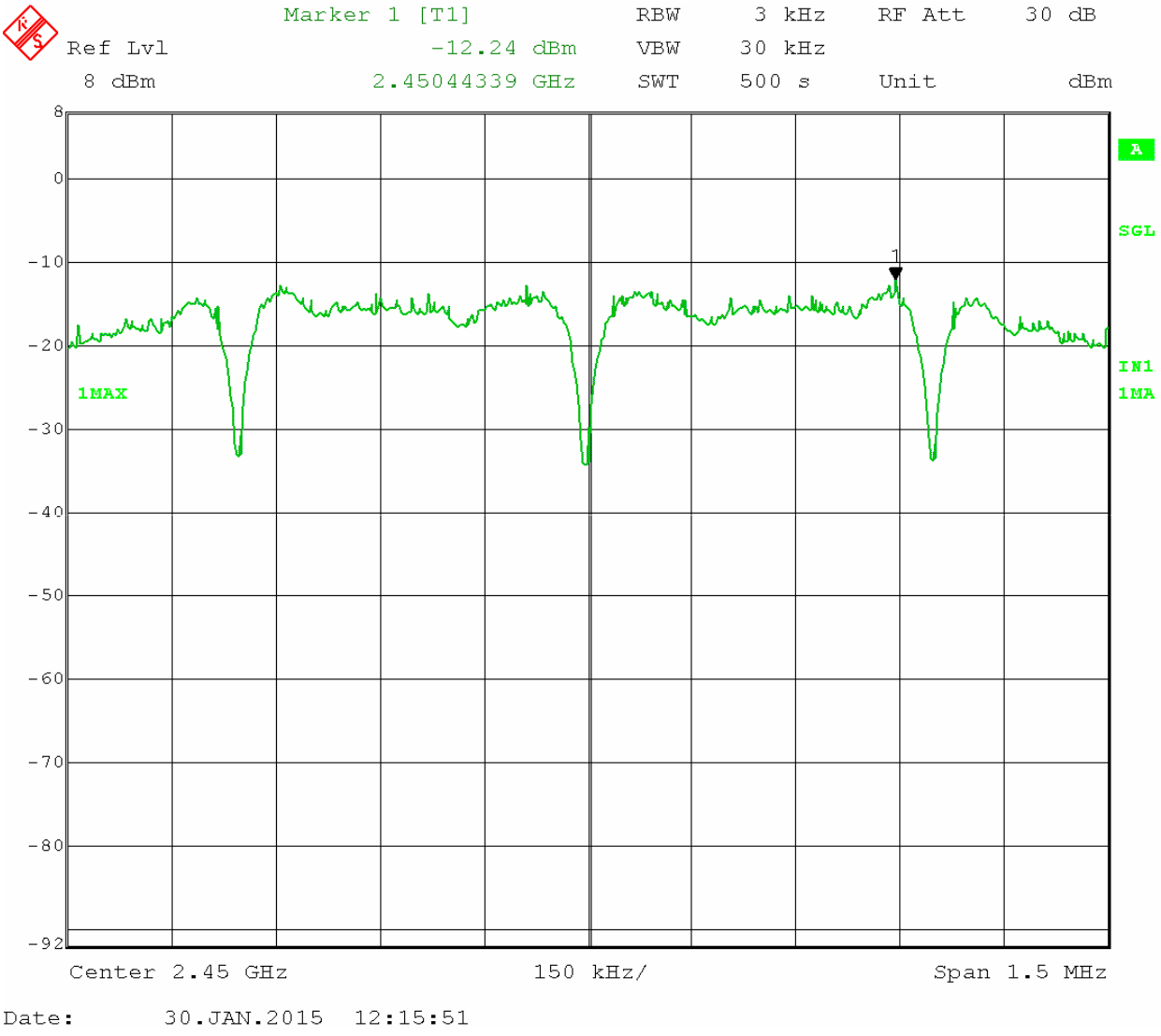


4.6.3 Power Spectral Density Analyzer Display Captures Antenna 1

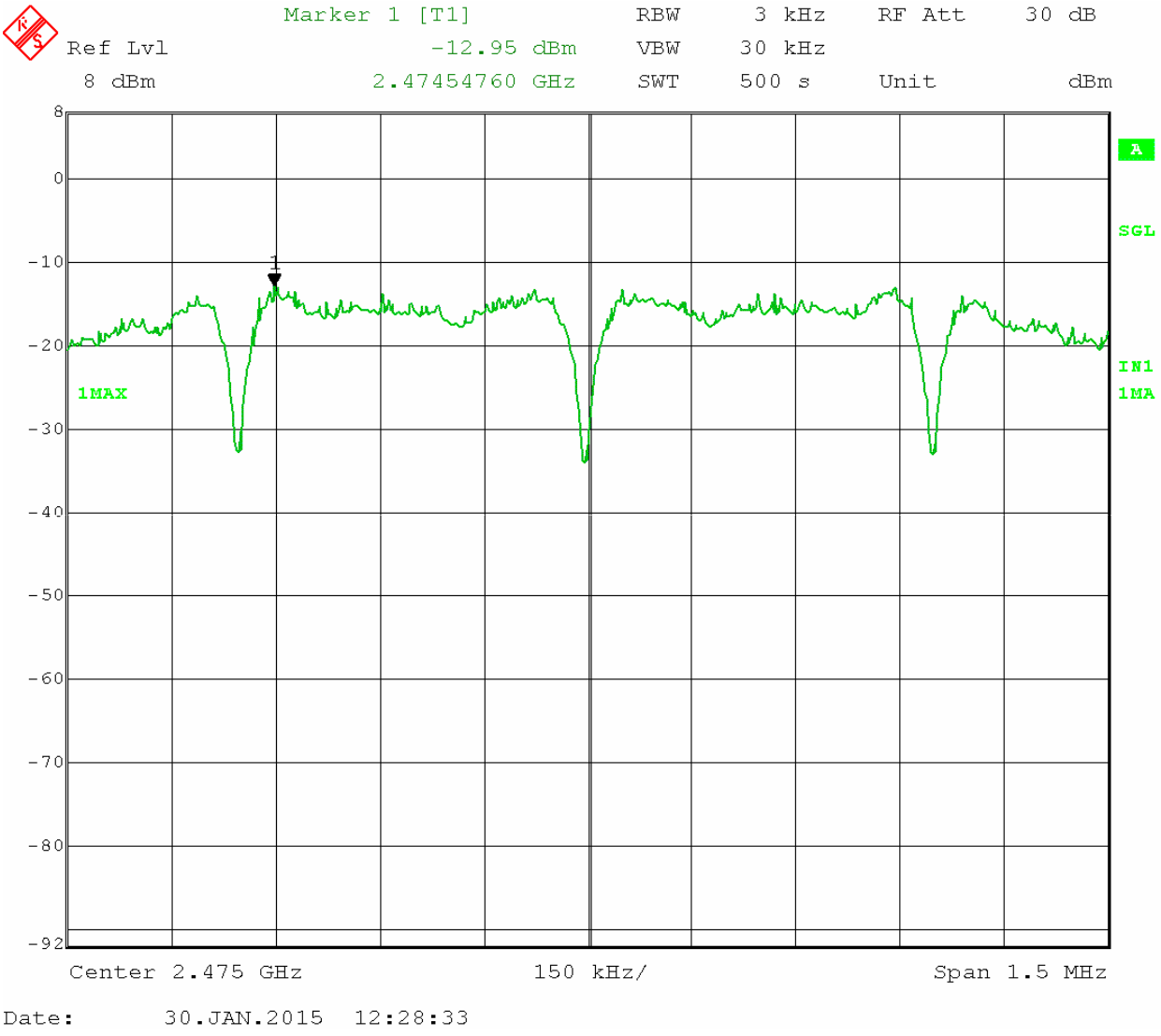
Antenna 1, Channel 15 (2.425 GHz)



Antenna 1, Channel 20 (2.450 GHz)



Antenna 1, Channel 25 (2.475 GHz)



4.6.4 Power Spectral Density Test Results (01/30/2015)

Antenna 0

Antenna	Channel	Freq (GHz)	Measured Power Spectral Density (dBm)	Cable Loss (dB)	Total Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Pass/Fail
0	CH.15	2.4245	-13.66	0.6	-13.06	8	PASS
0	CH.20	2.4495	-12.23	0.6	-11.63	8	PASS
0	CH.25	2.4750	-12.59	0.6	-11.99	8	PASS

Antenna 1

Antenna	Channel	Freq (GHz)	Measured Power Spectral Density (dBm)	Cable Loss (dB)	Total Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Pass/Fail
1	CH.15	2.4254	-12.26	0.6	-11.66	8	PASS
1	CH.20	2.4504	-12.24	0.6	-11.64	8	PASS
1	CH.25	2.4745	-12.95	0.6	-12.35	8	PASS

Results: The Power Spectral Density measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box are compliant with the limits specified in FCC Section 15.247(e).

4.7 Band Edge Measurement FCC Section 15.247(d)

4.7.1 Band Edge Measurement Test Procedure

Band edge measurements were recorded on the EUT while operating with a modulated carrier at three frequencies (low middle and high) in the operating band of 2.4 GHz to 2.48 GHz. The measurement procedure used was the conducted output power method, where the antenna output port of the EUT was connected to the receiver input port for direct measurement.

The frequencies and associated channel numbers chosen for measurement were as follows:

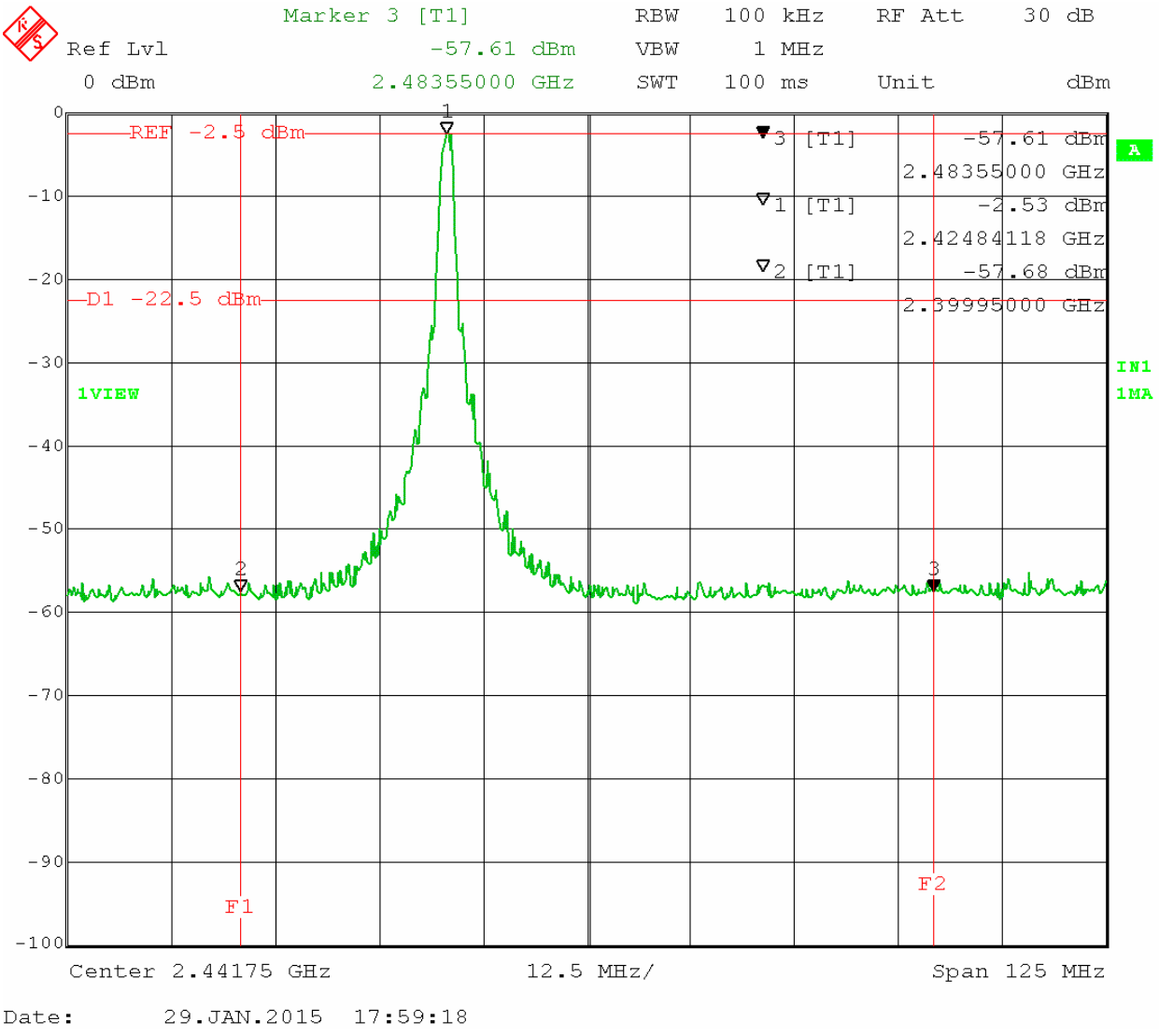
Channel	Frequency (GHz)
15	2.425
20	2.450
25	2.475

The data was recorded in three screen captures from the Spectrum Analyzer. Parameters particular to each measurement are as follows:

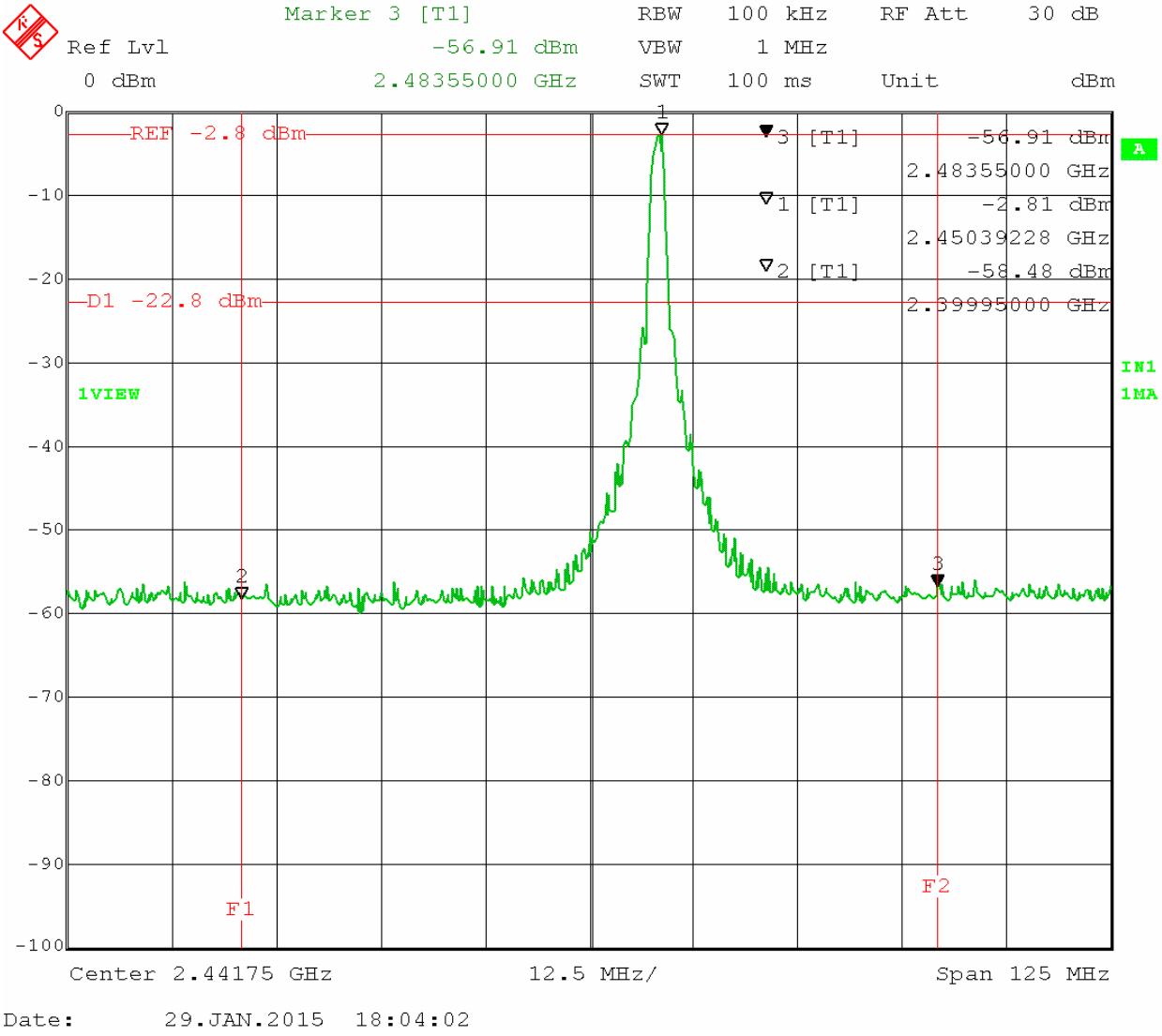
Center Frequency	
Resolution Bandwidth	100 kHz
Video Bandwidth	1 MHz
Span	125 MHz
Scale:	dBm
Reference Level:	0 dBm

4.7.2 Band Edge Measurement Analyzer Display Captures Antenna 0

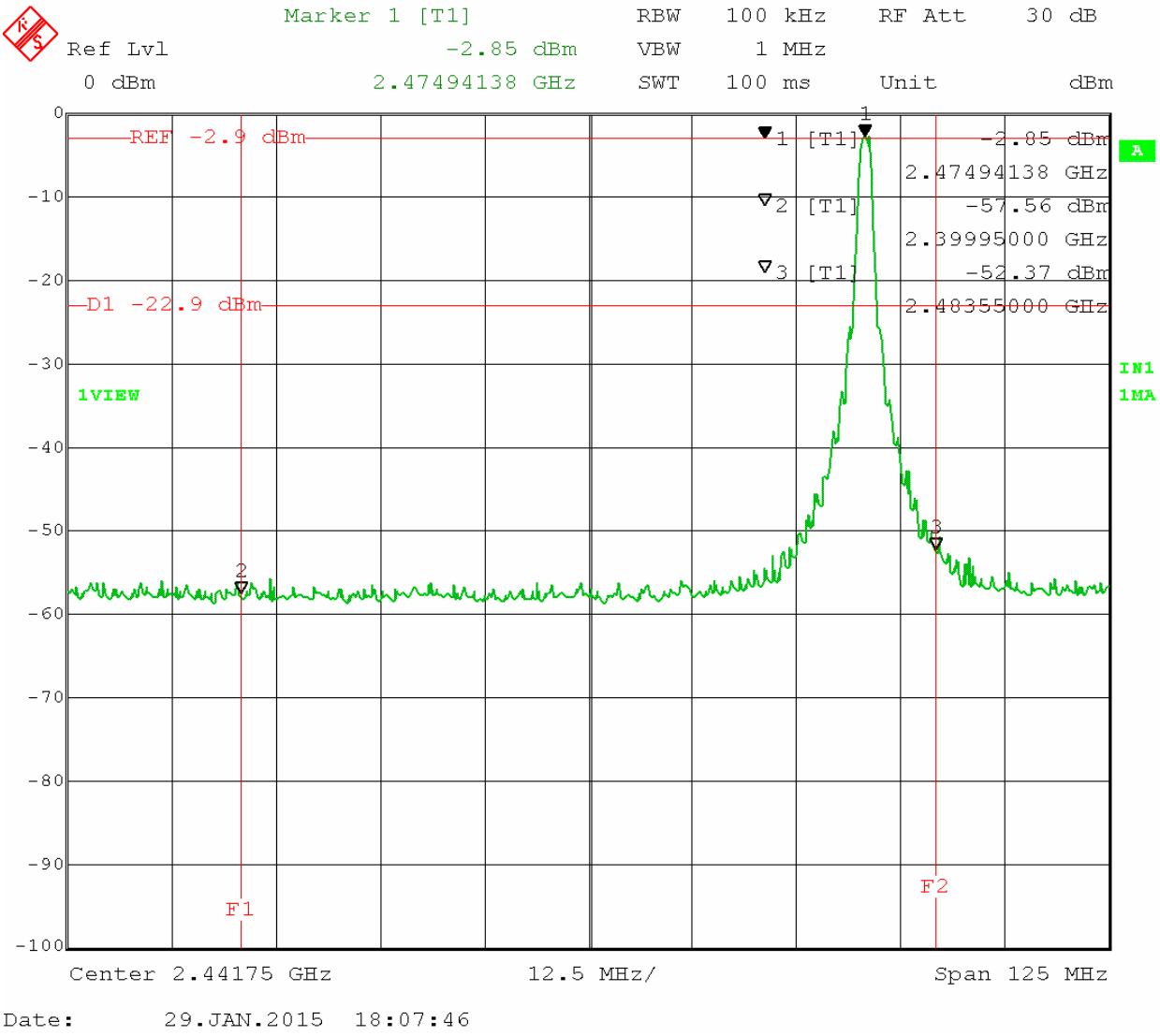
Antenna 0, Channel 15 (2.425 GHz)



Antenna 0, Channel 20 (2.450 GHz)

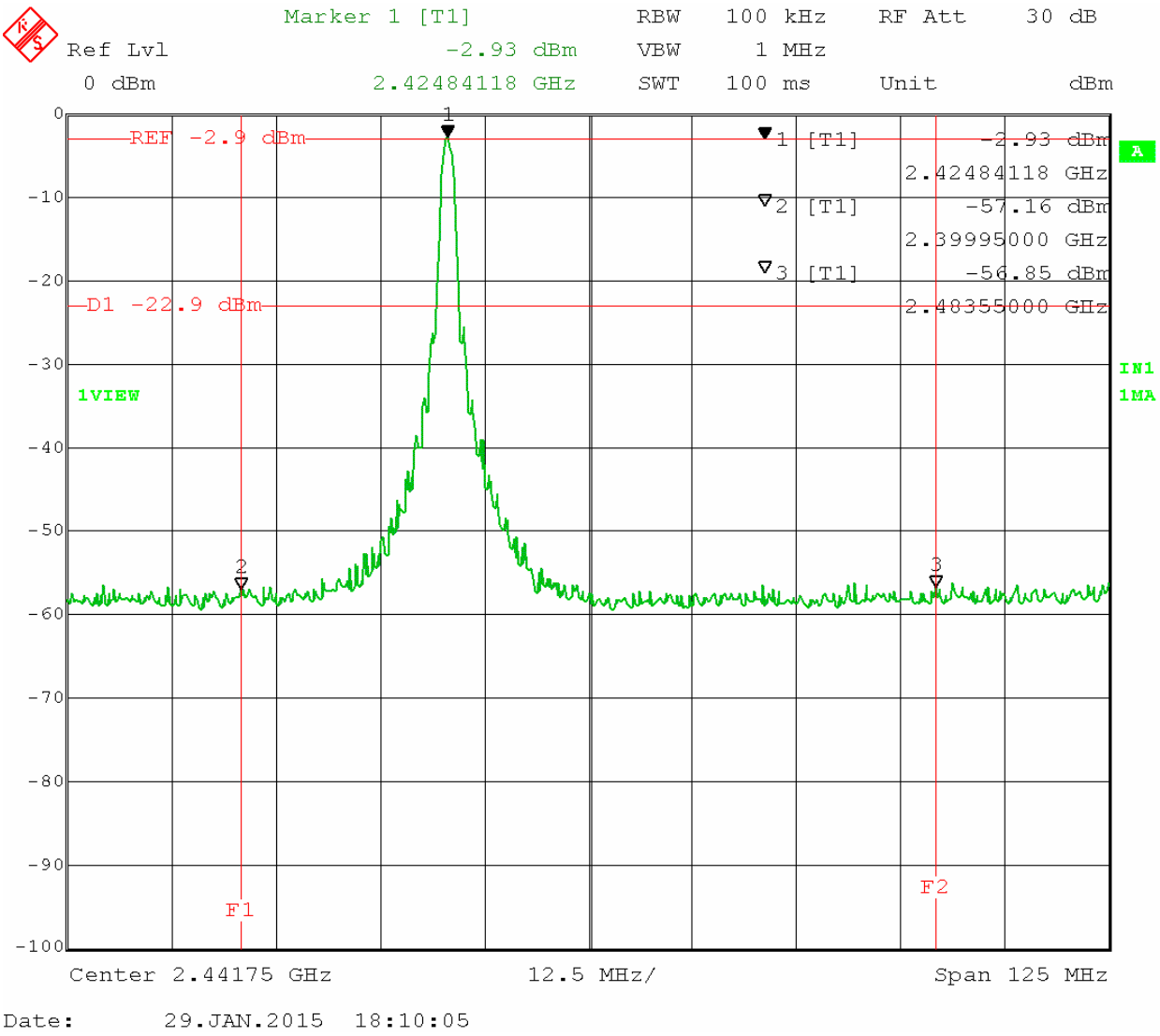


Antenna 0, Channel 25 (2.475 GHz)

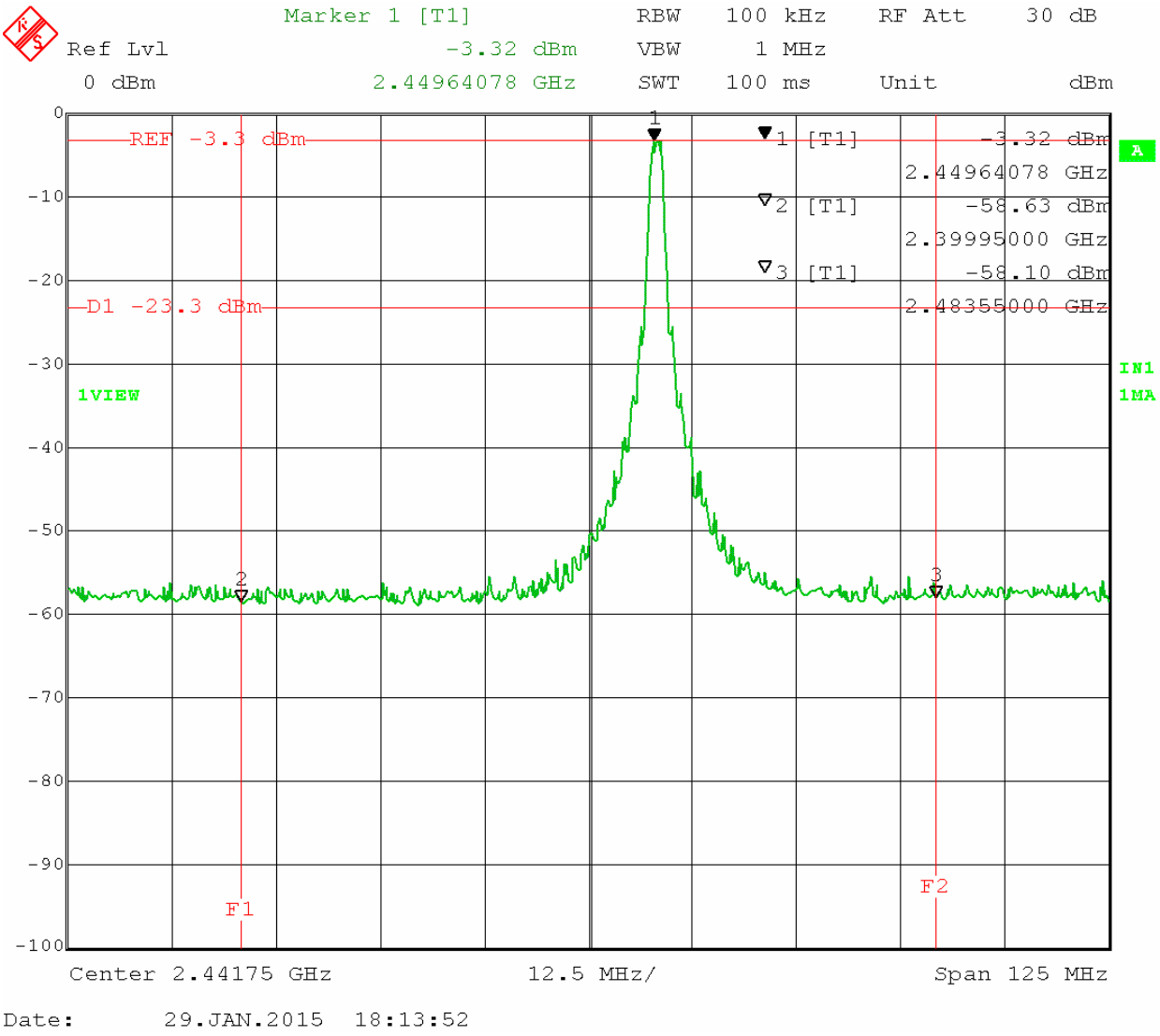


4.7.3 Band Edge Measurement Analyzer Display Captures Antenna 1

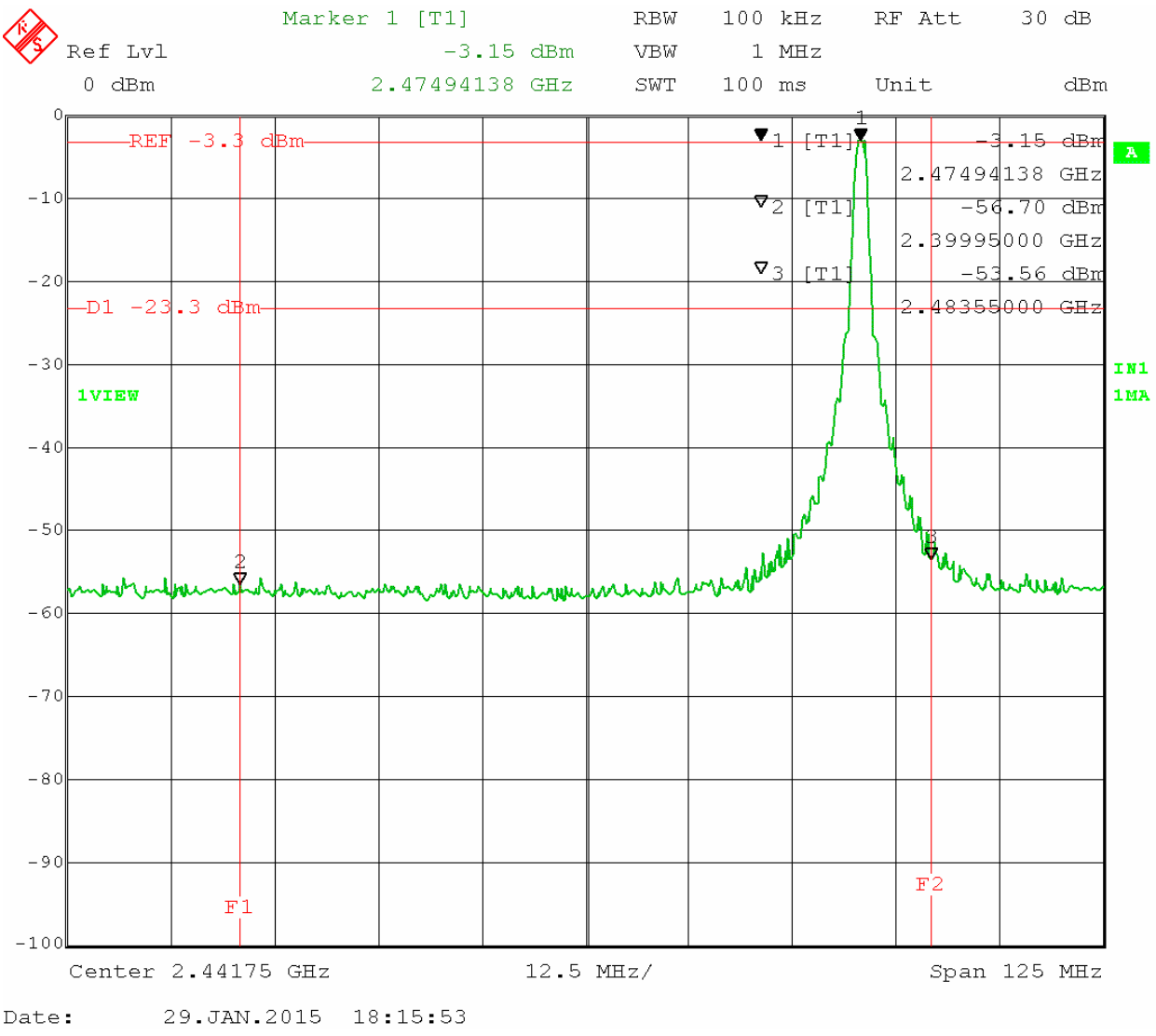
Antenna 1, Channel 15 (2.425 GHz)



Antenna 1, Channel 20 (2.450 GHz)



Antenna 0, Channel 25 (2.475 GHz)



4.7.4 Band Edge Measurement Test Data Results (01/29/2015)

Antenna 0

Channel	Measurement Frequency (GHz)	Peak Amplitude (dBm)	20 dB Limit	Lower Edge of Freq Band (GHz)	Upper Edge of Freq Band (GHz)	Lower Measured Freq (GHz)	Lower Measured Amplitude (dBm)	Upper Measured Frequency (GHz)	Upper Measured Amplitude (dBm)
CH. 15	2.425	-2.5	-22.5	2.4	2.4835	2.39995	-57.68	2.48355	-57.61
CH. 20	2.450	-2.81	-22.81	2.4	2.4835	2.39995	-58.48	2.48355	-56.91
CH. 25	2.475	-2.85	-22.85	2.4	2.4835	2.39995	-57.56	2.48355	-52.37

Antenna 1

Channel	Measurement Frequency (GHz)	Peak Amplitude (dBm)	20 dB Limit	Lower Edge of Freq Band (GHz)	Upper Edge of Freq Band (GHz)	Lower Measured Freq (GHz)	Lower Measured Amplitude (dBm)	Upper Measured Frequency (GHz)	Upper Measured Amplitude (dBm)
CH. 15	2.425	-2.93	-22.93	2.4	2.4835	2.39995	-57.16	2.48355	-56.85
CH. 20	2.450	-3.32	-23.32	2.4	2.4835	2.39995	-58.63	2.48355	-58.1
CH. 25	2.475	-3.15	-23.15	2.4	2.4835	2.39995	-56.7	2.48355	-53.56

Results: The Band Edge measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box are compliant with the limits specified in FCC Section 15.247(d).

4.8 Maximum Permissible Exposure Calculation

§15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. *See* §1.1307(b)(1) of this chapter.

§1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

(b)(1) The appropriate exposure limits in §§1.1310 and 2.1093 of this chapter are generally applicable to all facilities, operations and transmitters regulated by the Commission.

§1.1310 Radiofrequency radiation exposure limits.

(2) At operating frequencies less than or equal to 6 GHz, the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 of paragraph (e) of this section, may be used instead of whole-body SAR limits as set forth in paragraph (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b), except for portable devices as defined in §2.1093 as these evaluations shall be performed according to the SAR provisions in §2.1093 of this chapter.

(4) Both the MPE limits listed in Table 1 of paragraph (e) of this section and the SAR limits as set forth in paragraph (a) through (c) of this section and in §2.1093 of this chapter are for continuous exposure, that is, for indefinite time periods. Exposure levels higher than the limits are permitted for shorter exposure times, as long as the average exposure over the specified averaging time in Table 1 is less than the limits. Detailed information on our policies regarding procedures for evaluating compliance with all of these exposure limits can be found in the FCC's *OET Bulletin 65,* "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," and in supplements to *Bulletin 65,* all available at the FCC's Internet Web site: *http://www.fcc.gov/oet/rfsafety*

§2.1093 Radiofrequency radiation exposure evaluation: portable devices.

(b) For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

From: OET Bulletin 65 Edition 97-02, page 19.

$$S = \frac{PG}{4\pi R^2} \quad (3)$$

where: S = Power Density (in appropriate units, e.g., mW/cm^2)
P = Power input to the antenna (in appropriate units, e.g., mW)
G = Power Gain of the antenna in the direction of interest to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

or: $$S = \frac{EIRP}{4\pi R^2} \quad (4)$$

where: EIRP = equivalent (or effective) isotropically radiated power

4.8.1 Maximum Permissible Exposure Calculation Results

Effective Isotropic Radiated Power (EIRP) =

Antenna Power Output (dBW) + antenna gain (dBi) or
Antenna Power Output (Watts) X numeric gain

Antenna Power	Antenna Gain	EIRP
dBW	dBi	dBW
-27.6498	3	-24.6498

Antenna Power	Antenna Gain	EIRP
Watts	numeric	Watts
.001718	1.9952	.003428

The value R, distance to the center of radiation of the antenna, is 20 cm.

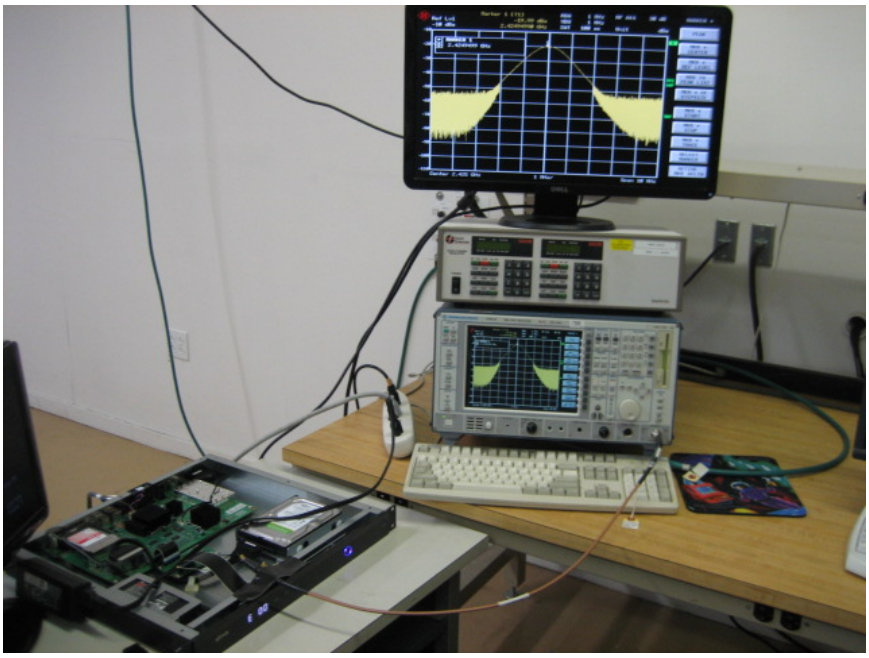
$$S = \frac{EIRP}{4\pi R^2} = \frac{3.428\ mW}{4\pi(20)^2} = .000682\ mW/cm^2$$

Results: The calculated Power Density of the measurements for antenna 0 and antenna 1 of the ARRIS Model XG1-RM Rack Mount Set Top Box is 0.000682 mW/cm^2. This complies with the limit of 1.0 mW/cm^2 from Table 1(B) of 47 CFR Part 1.1310. Therefore, no exposure evaluation is required.

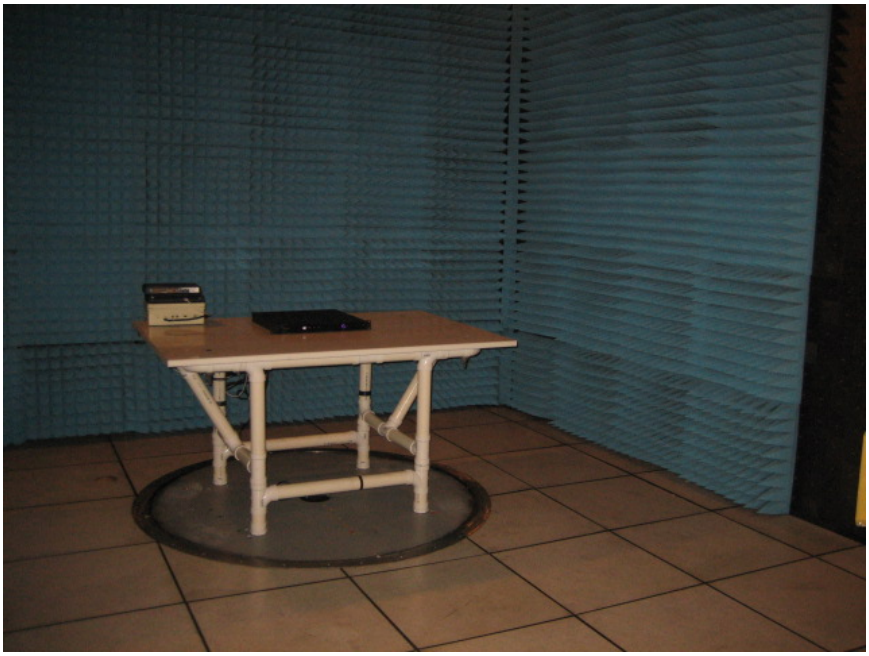
5.0 Test Setup Pictures

5.1 Conducted Emissions Power Line Test Setup Picture

5.2 Conducted Emissions Antenna Test Setup Picture



5.3 Harmonic Radiated Emissions Test Setup Picture



Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	04/25/14	2 Years	04/25/16
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	06/18/14	1 Year	06/18/15
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	12/22/14	1 Year	12/22/15
Amplifier (.1 – 1300 MHz)	Hewlett Packard	8447F	2805A02896	1003	No Cal. Required	No Cal. Required	No Cal. Required
EMC Analyzer (9 kHz - 1.8 GHz)	Hewlett Packard	8591EM	3536A00746	821	10/14/14	2 Years	10/14/16
GTEM (30 MHz – 1 GHz)	ETS Lindgren	5317	1014	1001	No Cal. Required	No Cal. Required	No Cal. Required
Spectrum Analyzer (9 kHz - 40 GHz)	Hewlett Packard	8564E	3410A00129	769	08/07/12	3 Years	08/07/15
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	09/09/14	2 Year	09/09/16
Double Ridged Horn Antenna (1 - 18 GHz)	EMCO	3115	9705-5225	1028	10/08/14	2 Years	10/06/16
Antenna (18 - 26.5 GHz)	Hewlett Packard	84125-80008	N/A	1056	10/08/14	2 Years	10/08/16

EMI Receiver (9 kHz - 6.5 GHz)	Hewlett Packard	8546A	3325A00158	761	05/11/13	2 Years	05/11/15
Amplifier (.1 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	No Cal. Required	No Cal. Required	No Cal. Required
Limiter	Hewlett Packard	11867A	01423	802	04/23/13	2 Years	04/23/15
LISN (9 kHz – 30 MHz)	EMCO	4825/2	9803-1047	750	04/12/13	2 Years	04/12/15
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	05/14/13	1 Year	05/14/15
Intentional Radiator Testing High Frequency RF Test Cable	Workhorse	WHU18-3636-036	N/A	814	12/04/14	2 Years	12/04/16
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	05/07/14	1 Year	05/07/15
Temp/Humidity Meter	Control Company	4096	140055652	780	01/21/14	2 Years	01/21/16
Software (Tile Instrument Control System)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required
Radiated Emissions Test Software	BEC	RADE	2.2	N/A	No Cal. Required	No Cal. Required	No Cal. Required