Washington Laboratories, Ltd.

FCC Certification Test Report
For the
Eastman Kodak Company
L153 Harpo Remote

FCC ID: PA408001

WLL JOB# **10511-02**
August 8, 2008

Revision 1 August 15, 2008

Prepared for:

Eastman Kodak Company
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Rochester, NY 14653-4107

Prepared By:

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ACCREDITED
Testing Certificate 2675.01

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Prepared by:

Steven Dovell
Compliance Engineer

Reviewed by:

Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of Eastman Kodak Company, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a 2.4 GHz Transmitter under Part 15.249 (9/2007) of the FCC Rules. This Certification Test Report documents the test configuration and test results for a Eastman Kodak Company, Inc. Remote.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

The Eastman Kodak Company, Inc. Remote complies with the limits for a Transmitter device under FCC Part 15.249.

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1 Introduction

1.1 Compliance Statement

The Eastman Kodak Company, Inc. Remote complies with the limits for a 2.4GHz Transmitter device under FCC Part 15.249 (9/2007).

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Eastman Kodak Company, Inc. 343 State St Rochester, NY 14650
Purchase Order Number:	2008-07-090
Quotation Number:	64374A

1.4 Test Dates

Testing was performed on the following date(s): July 16 – July 22, 2008

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steve Dovell
Client Representative	Roy Illingworth

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**w**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The Eastman Kodak Company Remote is a device which allows a user to control the Eastman Kodak L153 Media Player via a 2.4GHz radio link. The remote is powered via by two AA Alkyl in batteries.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Eastman Kodak Company, Inc.
FCC ID:	PA408001
Model:	Remote
FCC Rule Parts:	§15.249
Frequency Range:	2401MHz-2482MHz
Maximum Output Power:	Channel 42 – 88.6dBuV/m
Modulation:	Minimum-shift keying (MSK)
Occupied Bandwidth:	953kHz
Keying:	Automatic, Manual
Type of Information:	Data
Number of Channels:	82
Power Output Level	Fixed
Antenna Connector	none
Antenna Type	PCB trace
Interface Cables:	none
Power Source & Voltage:	2 x AA Alkaline batteries

2.2 Test Configuration

The Remote was configured with internal antennas and operated from two AA Alkaline Batteries. All measurements were made are radiated measurements because no antenna port was available for conducted measurements.

2.3 Testing Algorithm

The Remote was programmed for continuous operation via control software resident on the L153 Media player.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 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

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation1 and Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{{div_a}^2} + \frac{b^2}{{div_b}^2} + \frac{c^2}{{div_c}^2} + \ldots\ldots}$$

where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$div_{a,\,b,\,c}$ = the individual uncertainty element divisor based on the probability distribution

divisor = 1.732 for rectangular distribution

divisor = 2 for normal distribution

divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

2.7 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

TEST NAME **Radiated Emissions**		Test Date:	**7/16/08**
ASSET #	**Manufacturer/Model**	**Description**	**Cal. Due**
00644	Sunol Science JB1	BiConalog Antenna	11/27/2009
00069	HP, 85650A	Adapter, QP	07/09/2009
00071	HP, 85685A	Preselector, RF	07/09/2009
00073	HP, 8568B	Analyzer, Spectrum	07/08/2009
00667	MegaPhase, LLC EM18-S1NK5-600	Test cable for OATS testing	03/17/2009
00004	ARA, DRG-118/A	Antenna, DRG, 1-18GHz	02/02/2009
00066	HP, 8449B	Pre-Amplifier, RF. 1-26.5GHz	07/15/2009

3 Results Summary Part 15.249

TX Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	**Description**	**Limit**	**Result**
15.249 (a)(e)	Transmit Output Pov	50mV/m	Pass
15.249 (a)	Harmonics	500uV/m	Pass
15.249 (d)	Radiated Spurious emissions	500uV/m	Pass
15.205 15.209	General Field Streng Limits (Restricted Bands & RE Limits		Pass

3.1 Output Power Part 15.249 (a)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
2400 - 2483.5 MHz	50	500

3.1.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site for testing above 1GHz. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The unit was tested in 3 orthogonal planes and the worst case data is reported here. Both the horizontal and vertical field components were measured.

The Duty Cycle of the transmitter was measured and applied to the peak measurement to obtain the Average measurement.

3.1.2 Test Results

In accordance with FCC 15.35, the spurious radiated emissions measurements may be adjusted if using a duty cycle correction factor if the dwell time per channel of the hopping signal is less than 100 ms.

The duty cycle correction factor is calculated by:

20 x LOG (dwell time/100 ms)

The following dwell times was calculated from data shown in Figure 1 and Figure 2.

Each pulse is 1ms wide, reference Figure 1

There are 8 Pulses / 100ms, reference Figure 2

This results in a total a dwell time of (8 * 1ms) = 8ms

The Correction factor = 20 * LOG (8ms/100ms) => 21.9dB

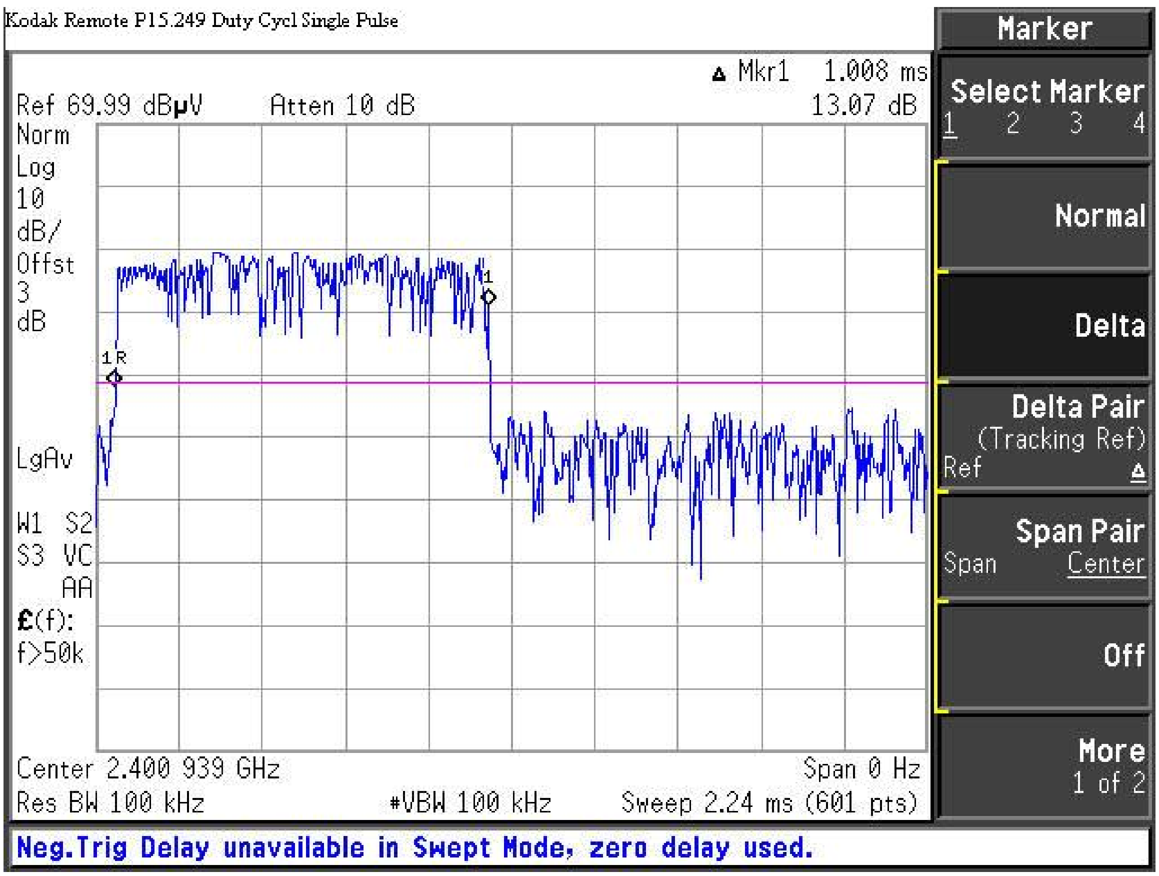

Figure 1: Duty Cycle Individual Pulse

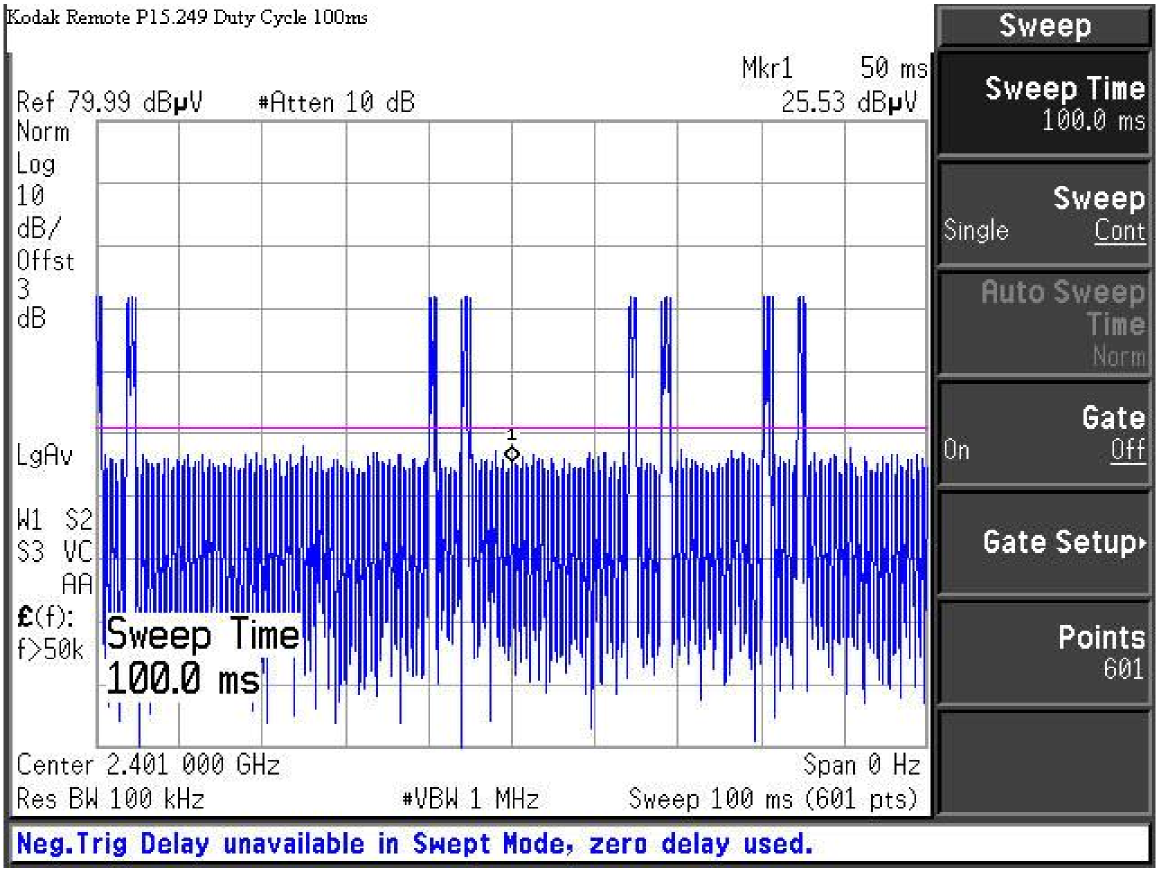

Figure 2: Duty Cycle (100ms)

Average correction factors given in the operational description state they are a probabilistic approach.
The FCC expects worse case information provided in the theory and then the test data would be less then or equal to this information. However theory is based on long term probability and not actual worse case as the FCC desires. It would appear that with using weighting factors only and not a table that has to utilize all frequencies – that in theory the same channel can possible be used 100% or 50% (if a different channel has to be chosen next). Therefore the measured duty cycle is not the worst possible case as described in the theory of operation. To account for the worst possible case, the calculated values are used as the duty cycl;e correction factor and not the measured values.

Table 4: Radiated Power of Fundamental Frequencies

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Power											
2401.000	V	270.0	3.0	53.8	30.1	1.4	17.8	67.5	2377.7	50000.0	-26.5
2401.000	H	200.0	3.0	56.8	30.1	1.4	17.8	70.5	3358.6	50000.0	-23.5
2442.000	V	270.0	3.0	57.2	30.2	1.2	17.8	70.8	3467.3	50000.0	-23.2
2442.000	H	180.0	3.0	49.2	30.2	1.2	17.8	62.8	1380.4	50000.0	-31.2
2482.000	V	270.0	3.0	53.0	30.2	1.1	17.8	66.5	2116.0	50000.0	-27.5
2482.000	H	180.0	2.8	51.5	30.2	1.1	17.8	65.0	1780.4	50000.0	-29.0

3.1.3 Results

Table 5: Harmonic Emissions – Channel 1

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Comments
2401.000													
4802.000	V	180.0	3.0	48.0	33.1	5.0	35.7	0.0	50.4	332.4	5000.0	-23.5	Peak
7203.000	V	0.0	3.0	44.9	37.3	6.5	35.6	0.0	53.1	454.4	5000.0	-20.8	Peak
9604.000	V	0.0	3.0	43.7	39.3	8.0	36.0	0.0	55.1	568.3	5000.0	-18.9	Peak
12005.000	V	0.0	3.0	43.6	42.4	8.7	35.8	0.0	58.9	880.7	5000.0	-15.1	Peak
14406.000	V	0.0	3.0	46.0	41.9	10.6	34.5	0.0	64.1	1601.8	5000.0	-9.9	Peak
16807.000	V	0.0	3.0	46.3	40.1	8.9	34.9	0.0	60.4	1052.6	5000.0	-13.5	Peak
4802.000	V	180.0	3.0	48.0	33.1	5.0	35.7	17.8	32.6	42.8	500.0	-21.3	Avg
7203.000	V	0.0	3.0	44.9	37.3	6.5	35.6	17.8	35.3	58.5	500.0	-18.6	Avg
9604.000	V	0.0	3.0	43.7	39.3	8.0	36.0	17.8	37.3	73.2	500.0	-16.7	Avg
12005.000	V	0.0	3.0	43.6	42.4	8.7	35.8	17.8	41.1	113.5	500.0	-12.9	Avg
14406.000	V	0.0	3.0	46.0	41.9	10.6	34.5	17.8	46.3	206.4	500.0	-7.7	Avg
16807.000	V	0.0	3.0	46.3	40.1	8.9	34.9	17.8	42.6	135.6	500.0	-11.3	Avg
4802.000	H	270.0	3.0	58.6	33.1	5.0	35.7	0.0	61.1	1129.0	5000.0	-12.9	Peak
7203.000	H	180.0	3.0	42.5	37.3	6.5	35.6	0.0	50.7	344.7	5000.0	-23.2	Peak
9604.000	H	180.0	3.0	40.7	39.3	8.0	36.0	0.0	52.1	401.8	5000.0	-21.9	Peak
12005.000	H	180.0	3.0	41.7	42.4	8.7	35.8	0.0	57.0	706.9	5000.0	-17.0	Peak
14406.000	H	180.0	3.0	41.7	41.9	10.6	34.5	0.0	59.8	974.1	5000.0	-14.2	Peak
16807.000	H	180.0	3.0	39.7	40.1	8.9	34.9	0.0	53.9	493.5	5000.0	-20.1	Peak
4802.000	H	270.0	3.0	58.6	33.1	5.0	35.7	17.8	43.3	145.4	500.0	-10.7	Avg
7203.000	H	180.0	3.0	42.5	37.3	6.5	35.6	17.8	32.9	44.4	500.0	-21.0	Avg
9604.000	H	180.0	3.0	40.7	39.3	8.0	36.0	17.8	34.3	51.8	500.0	-19.7	Avg
12005.000	H	180.0	3.0	41.7	42.4	8.7	35.8	17.8	39.2	91.1	500.0	-14.8	Avg
14406.000	H	180.0	3.0	41.7	41.9	10.6	34.5	17.8	42.0	125.5	500.0	-12.0	Avg
16807.000	H	180.0	3.0	39.7	40.1	8.9	34.9	17.8	36.1	63.6	500.0	-17.9	Avg

Table 6: Harmonic Emissions – Channel 42

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Comments
2442.000													
4884.000	V	270.0	3.0	51.2	33.3	5.1	35.7	0.0	53.7	486.2	5000.0	-20.2	Peak
7326.000	V	180.0	3.0	41.7	37.4	6.4	35.6	0.0	50.0	315.4	5000.0	-24.0	Peak
9768.000	V	180.0	3.0	43.5	39.4	8.1	36.0	0.0	55.0	563.7	5000.0	-19.0	Peak
12210.000	V	180.0	3.0	41.5	42.2	8.5	35.6	0.0	56.7	681.8	5000.0	-17.3	Peak
14652.000	V	180.0	3.0	40.8	42.5	10.5	34.6	0.0	59.3	924.3	5000.0	-14.7	Peak
17094.000	V	180.0	3.0	39.1	40.9	9.2	34.6	0.0	54.6	535.6	5000.0	-19.4	Peak
4884.000	V	270.0	3.0	51.2	33.3	5.1	35.7	17.8	35.9	62.6	500.0	-18.0	Avg
7326.000	V	180.0	3.0	41.7	37.4	6.4	35.6	17.8	32.2	40.6	500.0	-21.8	Avg
9768.000	V	180.0	3.0	43.5	39.4	8.1	36.0	17.8	37.2	72.6	500.0	-16.8	Avg
12210.000	V	180.0	3.0	41.5	42.2	8.5	35.6	17.8	38.9	87.8	500.0	-15.1	Avg
14652.000	V	180.0	3.0	40.8	42.5	10.5	34.6	17.8	41.5	119.1	500.0	-12.5	Avg
17094.000	V	180.0	3.0	39.1	40.9	9.2	34.6	17.8	36.8	69.0	500.0	-17.2	Avg
4884.000	H	45.0	3.0	59.7	33.3	5.1	35.7	0.0	62.3	1301.2	5000.0	-11.7	Peak
7326.000	H	90.0	3.0	41.1	37.4	6.4	35.6	0.0	49.4	294.3	5000.0	-24.6	Peak
9768.000	H	90.0	3.0	41.0	39.4	8.1	36.0	0.0	52.5	422.7	5000.0	-21.5	Peak
12210.000	H	90.0	3.0	43.4	42.2	8.5	35.6	0.0	58.6	848.5	5000.0	-15.4	Peak
14652.000	H	90.0	3.0	39.4	42.5	10.5	34.6	0.0	57.9	784.0	5000.0	-16.1	Peak
17094.000	H	90.0	3.0	39.0	40.9	9.2	34.6	0.0	54.4	526.4	5000.0	-19.6	Peak
4884.000	H	45.0	3.0	59.7	33.3	5.1	35.7	17.8	44.5	167.6	500.0	-9.5	Avg
7326.000	H	90.0	3.0	41.1	37.4	6.4	35.6	17.8	31.6	37.9	500.0	-22.4	Avg
9768.000	H	90.0	3.0	41.0	39.4	8.1	36.0	17.8	34.7	54.5	500.0	-19.3	Avg
12210.000	H	90.0	3.0	43.4	42.2	8.5	35.6	17.8	40.8	109.3	500.0	-13.2	Avg
14652.000	H	90.0	3.0	39.4	42.5	10.5	34.6	17.8	40.1	101.0	500.0	-13.9	Avg
17094.000	H	90.0	3.0	39.0	40.9	9.2	34.6	17.8	36.6	67.8	500.0	-17.4	Avg

Table 7: Harmonic Emissions – Channel 82

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Comments
2482.000													
4964.000	V	200.0	2.7	54.7	33.4	5.1	35.8	0.0	57.4	744.3	5000.0	-16.5	Peak
7446.000	V	180.0	2.7	40.2	37.6	6.3	35.6	0.0	48.5	266.2	5000.0	-25.5	Peak
9928.000	V	180.0	2.7	40.8	39.6	8.1	36.0	0.0	52.4	419.0	5000.0	-21.5	Peak
12410.000	V	180.0	2.7	43.4	42.1	8.4	35.4	0.0	58.5	837.0	5000.0	-15.5	Peak
14892.000	V	180.0	2.7	44.1	43.1	10.0	34.7	0.0	62.5	1339.0	5000.0	-11.4	Peak
17374.000	V	180.0	2.7	44.2	41.8	9.7	34.3	0.0	61.4	1171.5	5000.0	-12.6	Peak
4964.000	V	200.0	2.7	54.7	33.4	5.1	35.8	17.8	39.6	95.9	500.0	-14.3	Avg
7446.000	V	180.0	2.7	40.2	37.6	6.3	35.6	17.8	30.7	34.3	500.0	-23.3	Avg
9928.000	V	180.0	2.7	40.8	39.6	8.1	36.0	17.8	34.6	54.0	500.0	-19.3	Avg
12410.000	V	180.0	2.7	43.4	42.1	8.4	35.4	17.8	40.7	107.8	500.0	-13.3	Avg
14892.000	V	180.0	2.7	44.1	43.1	10.0	34.7	17.8	44.7	172.5	500.0	-9.2	Avg
17374.000	V	180.0	2.7	44.2	41.8	9.7	34.3	17.8	43.6	150.9	500.0	-10.4	Avg
4964.000	H	0.0	2.7	55.8	33.4	5.1	35.8	0.0	58.5	844.7	5000.0	-15.4	Peak
7446.000	H	0.0	2.7	42.2	37.6	6.3	35.6	0.0	50.5	335.1	5000.0	-23.5	Peak
9928.000	H	0.0	2.7	44.2	39.6	8.1	36.0	0.0	55.8	619.8	5000.0	-18.1	Peak
12410.000	H	0.0	2.7	46.5	42.1	8.4	35.4	0.0	61.6	1196.0	5000.0	-12.4	Peak
14892.000	H	0.0	2.7	46.5	43.1	10.0	34.7	0.0	64.9	1765.2	5000.0	-9.0	Peak
17374.000	H	0.0	2.7	45.0	41.8	9.7	34.3	0.0	62.2	1284.5	5000.0	-11.8	Peak
4964.000	H	0.0	2.7	55.8	33.4	5.1	35.8	17.8	40.7	108.8	500.0	-13.2	Avg
7446.000	H	0.0	2.7	42.2	37.6	6.3	35.6	17.8	32.7	43.2	500.0	-21.3	Avg
9928.000	H	0.0	2.7	44.2	39.6	8.1	36.0	17.8	38.0	79.8	500.0	-15.9	Avg
12410.000	H	0.0	2.7	46.5	42.1	8.4	35.4	17.8	43.8	154.1	500.0	-10.2	Avg

14892.00 0	H	0.0	2.7	46.5	43.1	10.0	34.7	17.8	47.1	227.4	500.0	-6.8	Avg
17374.00 0	H	0.0	2.7	45.0	41.8	9.7	34.3	17.8	44.4	165.5	500.0	-9.6	Avg

3.1.4 Bandwidth

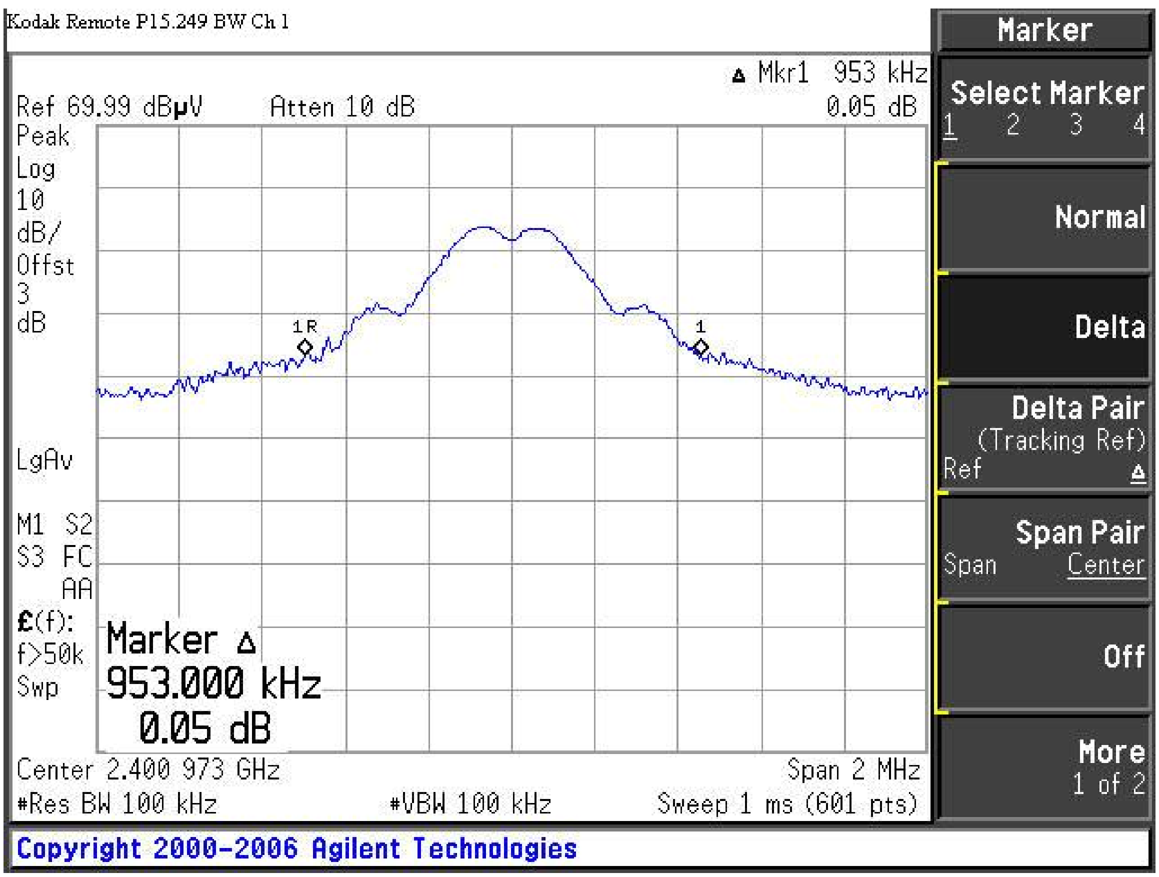

Figure 3: 20dB Bandwidth Channel 1

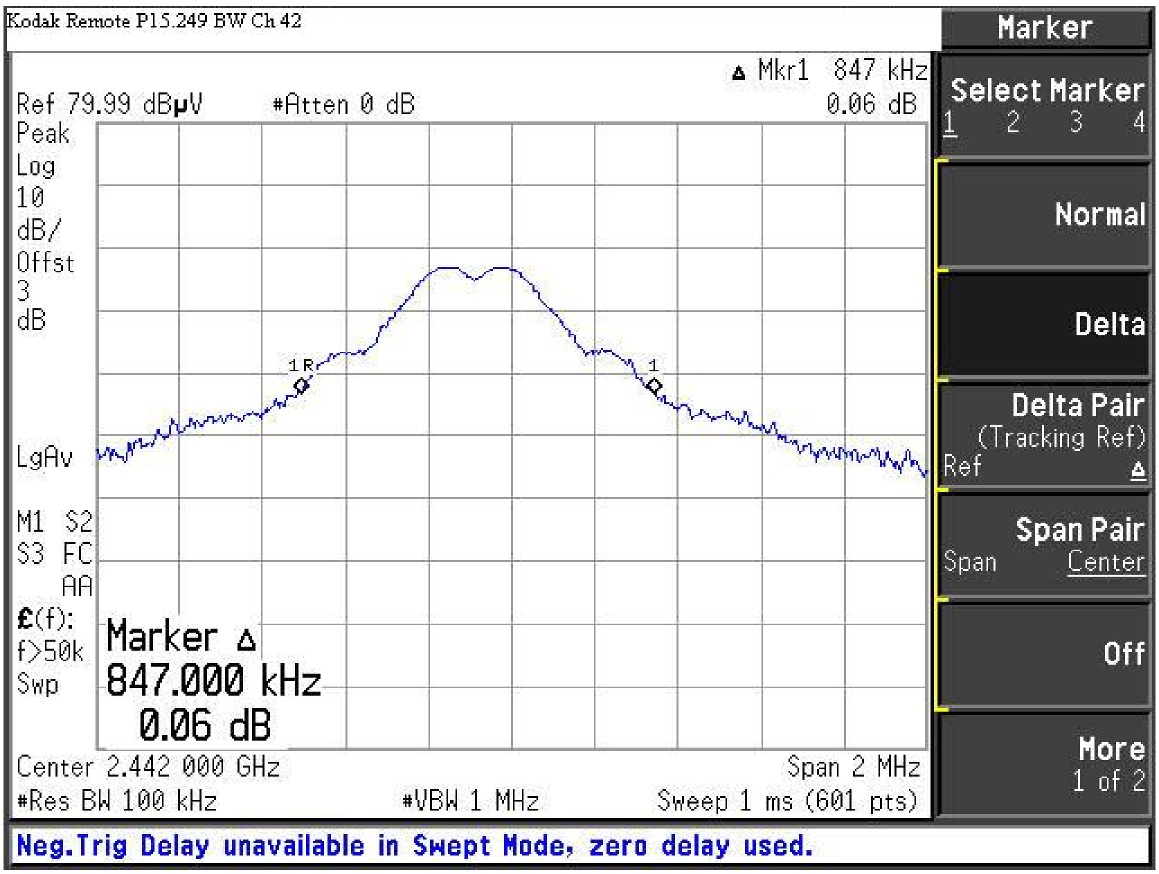

Figure 4: 20dB Bandwidth Channel 42

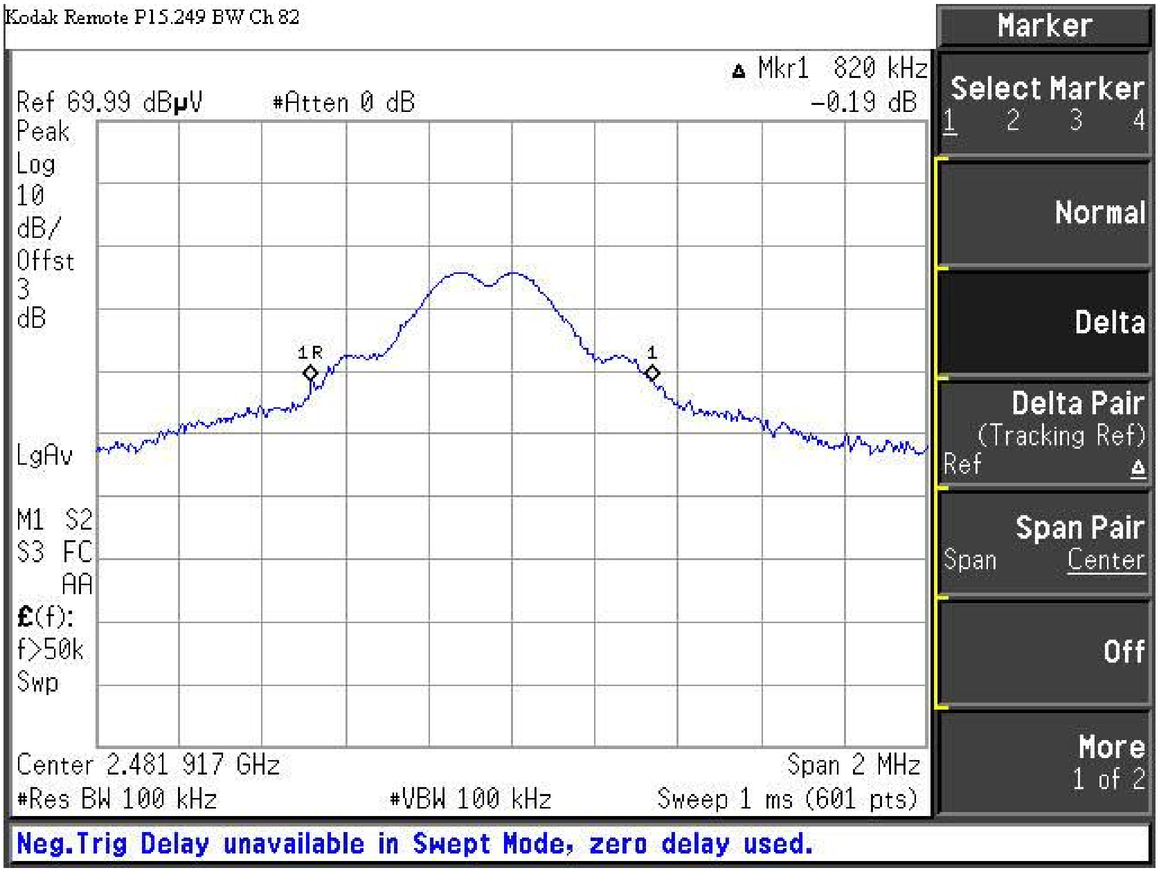

Figure 5: 20dB Bandwidth Channel 82

3.1.5 Band edge

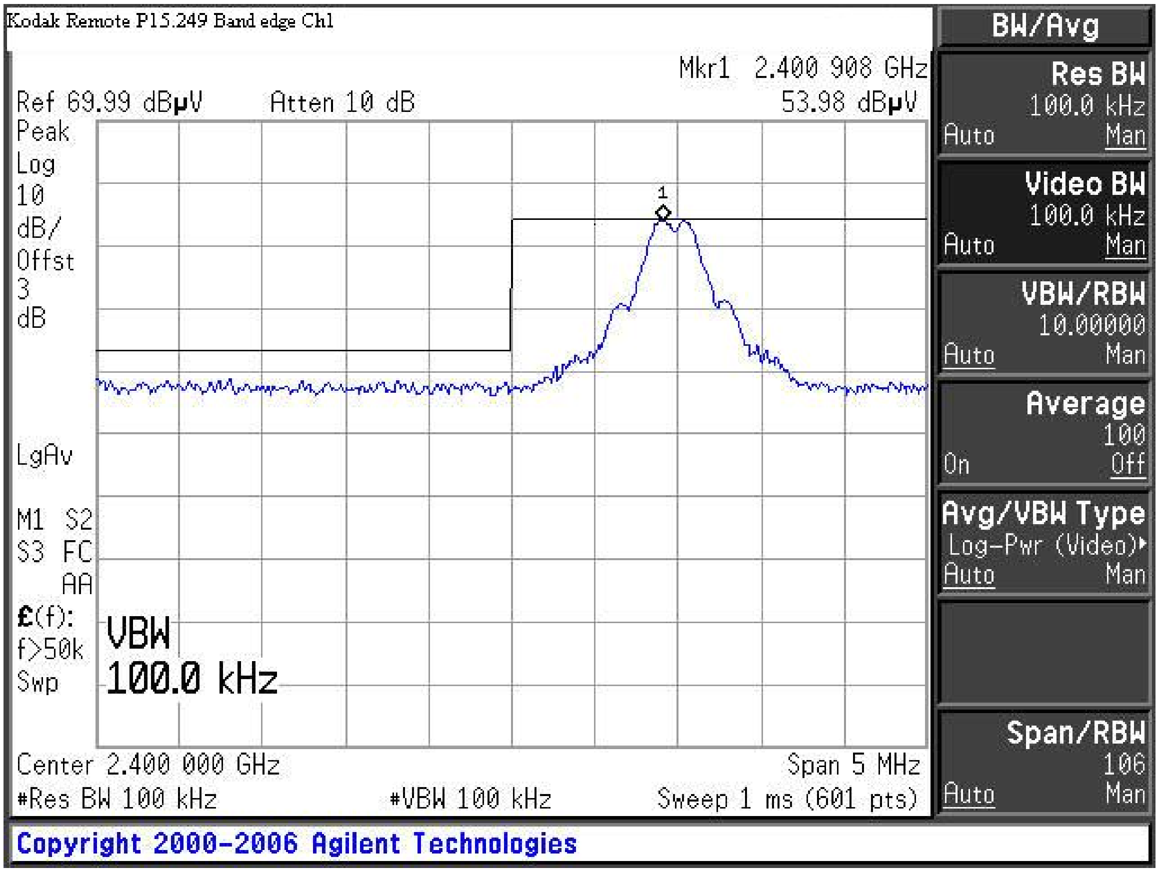

Figure 6: 20dB Band Edge Channel 1

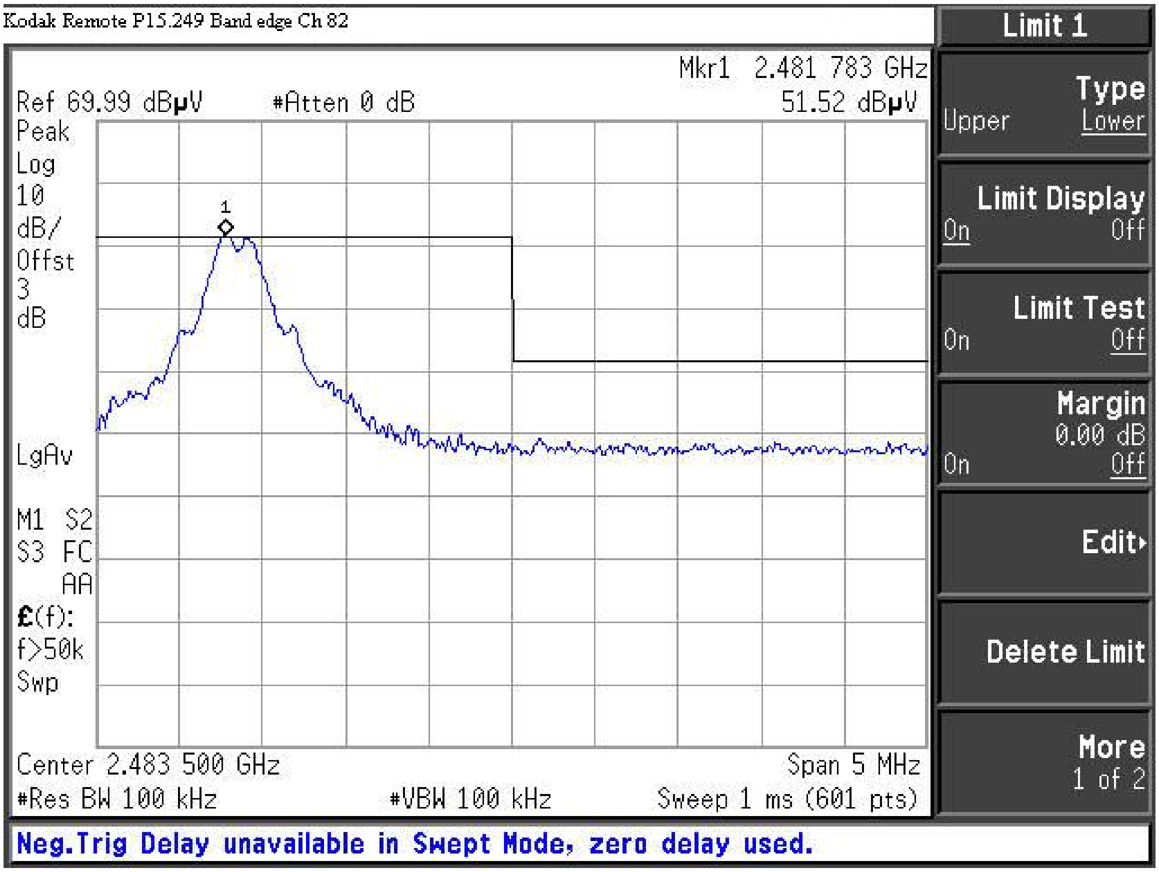

Figure 7: 20dB Band Edge Channel 82

