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FCC Certification Test Report

FCCID: OYE-MGL 916

MILLER EDGE

MONITORED GATE LINK
MGL-TX20

WLL REPORT# **14219-01 Rev 0**
December 2, 2015

Prepared for:

Miller Edge
300 N Jennersville Road
West Grove, PA 19390

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

Testing Certificate AT-1448

FCC Certification Test Report

For the
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Prepared by:

John P. Repella
Compliance Engineer

Reviewed by:

Steven D. Koster
President

Abstract

This report has been prepared on behalf of Miller Edge to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.249 (10/2014) of the FCC Rules. This Certification Test Report documents the test configuration and test results for Miller Edge MGL-TX20.

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. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Miller Edge MGL-TX20 complies with the limits for an Intentional Radiator device under FCC Part 15.249.

Revision History	Reason	Date
Rev 0	Initial Release	December 2, 2015

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1 Introduction

1.1 Compliance Statement

The Miller Edge MGL-TX20 complies with the limits for an Intentional Radiator device under FCC Part 15.249 (10/2014).

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with FCC Part 15.249 and the 2014 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Miller Edge 300 N Jennersville Road West Grove, PA 19390
Purchase Order Number:	Signed quotation serves as the PO
Quotation Number:	69032

1.4 Test Dates

Testing was performed on the following date(s):	10/21/15, 11/04/2015, and 11/09/2015

1.5 Test and Support Personnel

Washington Laboratories, LTD	John P. Repella
Customer Representative	Dan Laskey

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	**d**eci**B**el
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

Miller Edge designs and manufactures safety “edges” for use on industrial doors, such as shipping doors, airplane hangars, and access gates. One type of edge uses air movement or pressure to activate a switch that indicates that the edge has encountered an obstruction. This switch is usually connected to the motor controller, which would then stop and/or reverse the movement of the door, preventing injury and damage. These new products replace the switch wiring with an RF interface, similar to a garage door opener keyfob. The transmitter is installed inside the existing air switch devices, and the receiver is mounted near the motor controller.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Miller Edge
FCC ID:	OYE-MGL916
Model(s):	MGL-TX20
FCC Rule Parts:	§15.249
Frequency Range:	915MHz
Maximum Output Power:	45972.7µV/m @ 3 meters (915MHz)
Modulation:	FSK
Occupied Bandwidth:	236.2kHz
Keying:	automatic
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Connector	None
Antenna Type	Internal
Interface Cables:	None
Power Source & Voltage:	Battery
TX Spurious	79.8uV/m @ 3meters (161.14MHz) 333.6µV/m @ 3 meters (1830.14MHz)

2.2 Test Configuration

The Miller Edge MGL-TX20 was configured with a 915MHz transmitter constantly on. A sample operating normally was used to determine the EUT duty cycle.

2.3 Testing Algorithm

The Miller Edge MGL-TX20 was programmed for continuous operation by the vendor. Under normal conditions there are no user accessible settings. The unit is simply plugged in to the battery pack to operate.

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. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB-ACLASS under Certificate AT-1448 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 (R2002) 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

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

2.7 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name:	**Project Test Equipment**	Test Date:	**11/09/2015**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	8/31/2017
559	HP - 8447D	AMPLIFIER	2/20/2016
522	HP - 8449B	PRE-AMPLIFIER 1-26.5GHZ	12/24/2015
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	8/5/2016
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	10/8/2016
849	AH SYSTEMS - SAC-18G-16	16 METER CABLE	8/22/2016
337	WLL - 1.2-5GHZ	FILTER BAND PASS	4/19/2016

3 Test Results

3.1 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity. This calculation is applied to limits for pulsed licensed and unlicensed devices.

- For Unlicensed Intentional Radiators under 47CFR Part 15, all duty cycle measurements compared to a 100 millisecond period
- i.e. duty cycle = on time/100, milliseconds
- The EUT under normal operating conditions has 8.76mS on time per 100mS. This result is a 21.14dB Duty Cycle Correction.
- DCC = 20*log(9.147e-3/100.3e-3) = 20.80dB

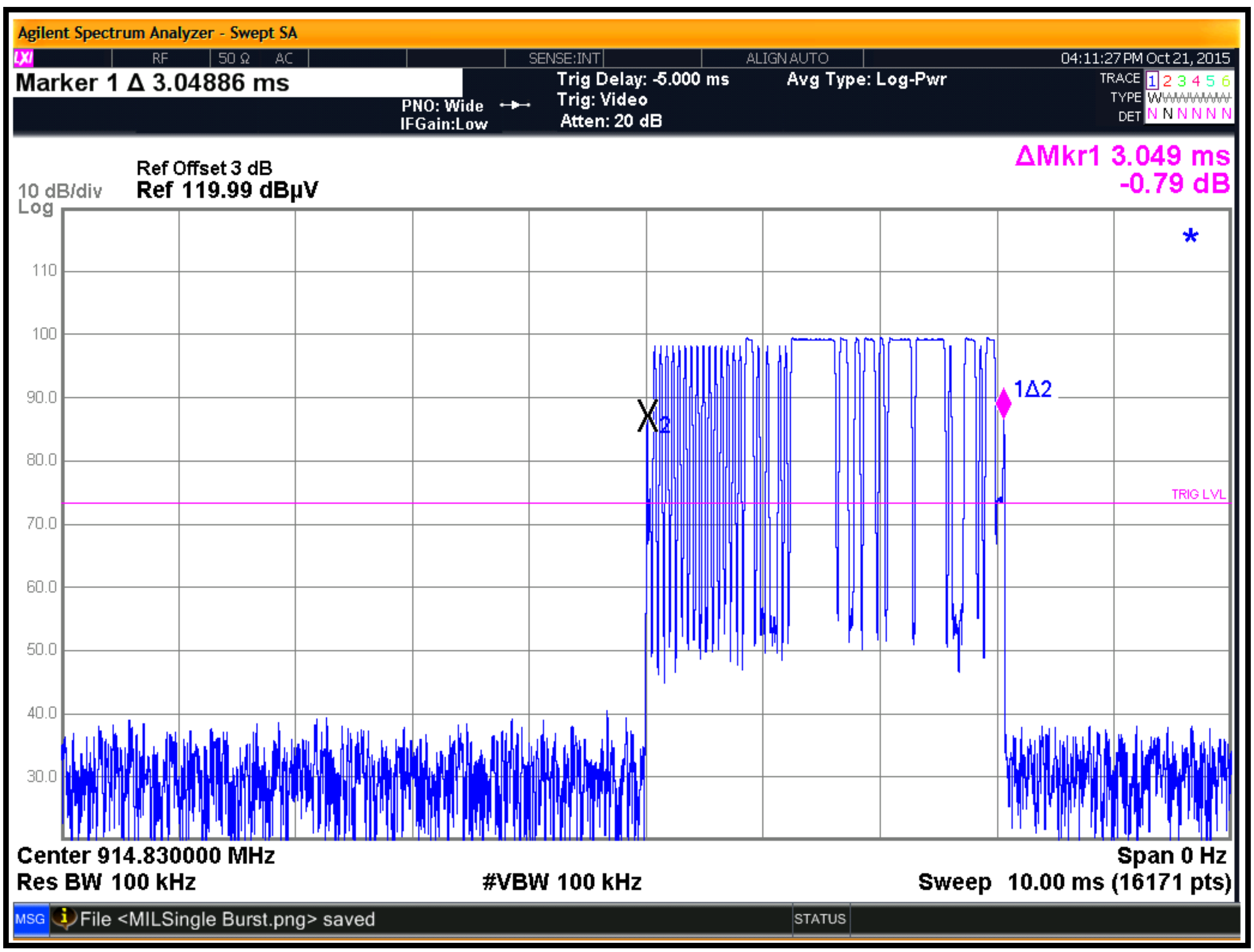

Figure 1: Duty Cycle (Single Burst)

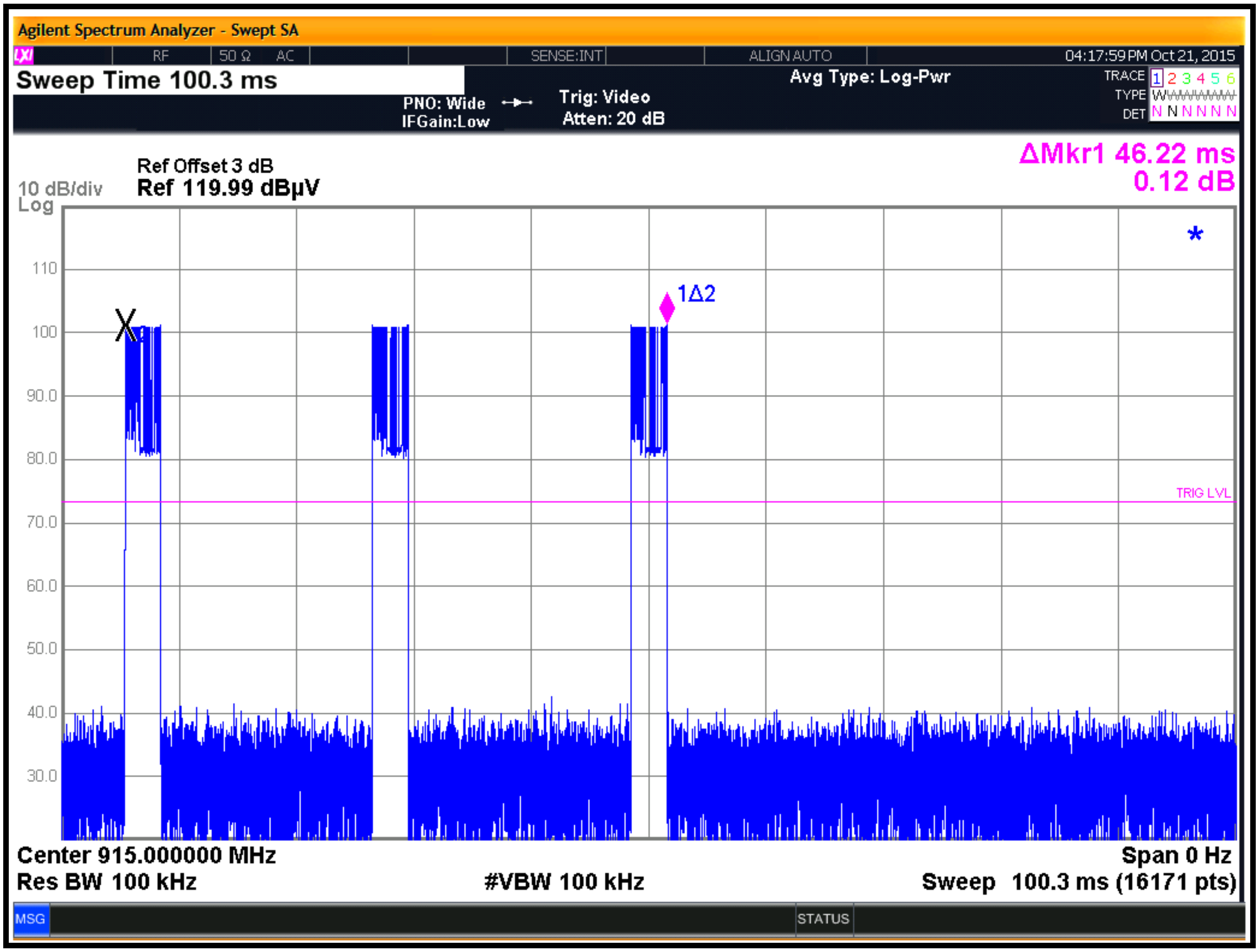

Figure 2: Duty Cycle (TX on time in 100ms)

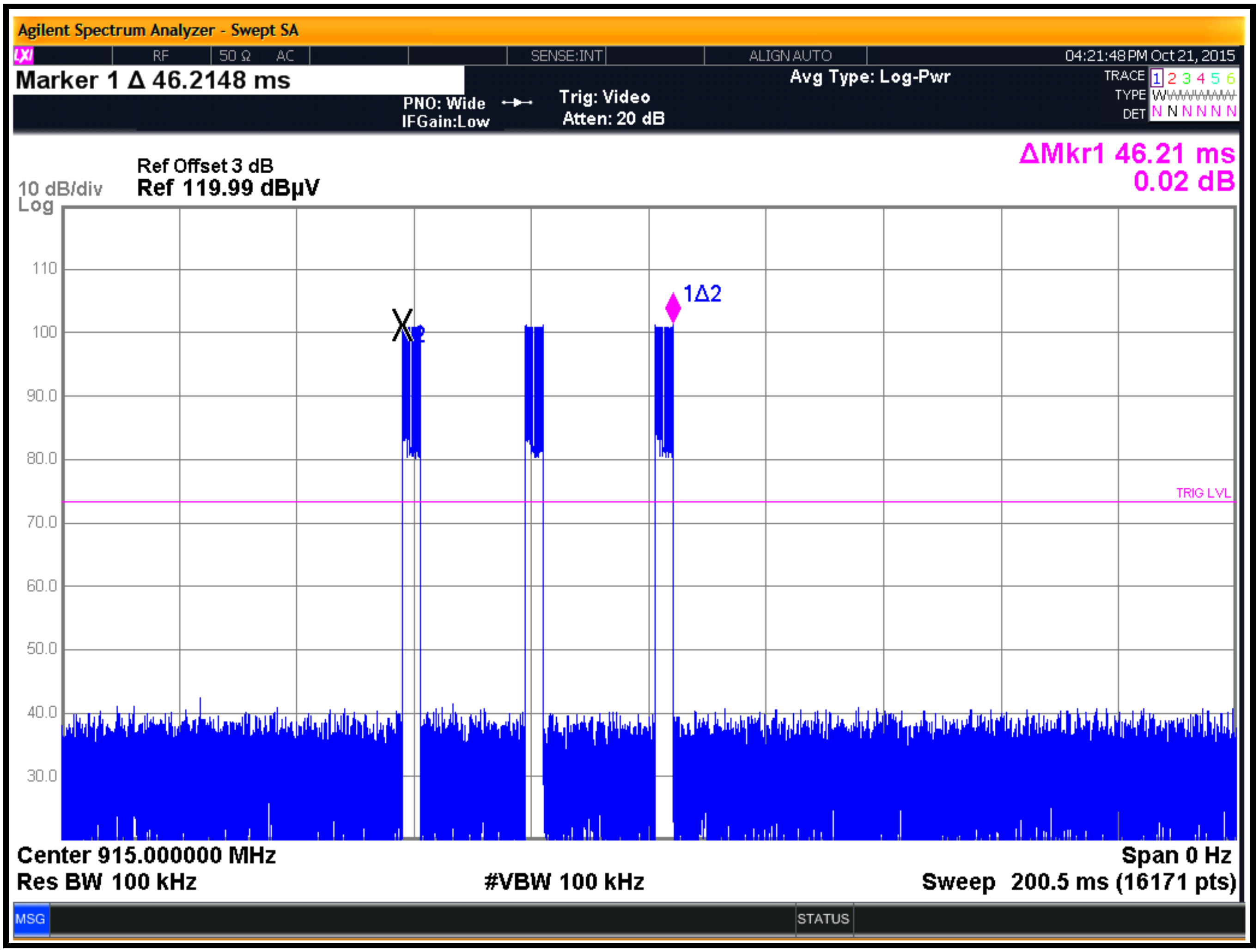

Figure 3: Duty Cycle (Worst Case)

3.2 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
915MHz	235.9kHz	N/A	Pass

At full modulation, the occupied bandwidth was measured as shown:

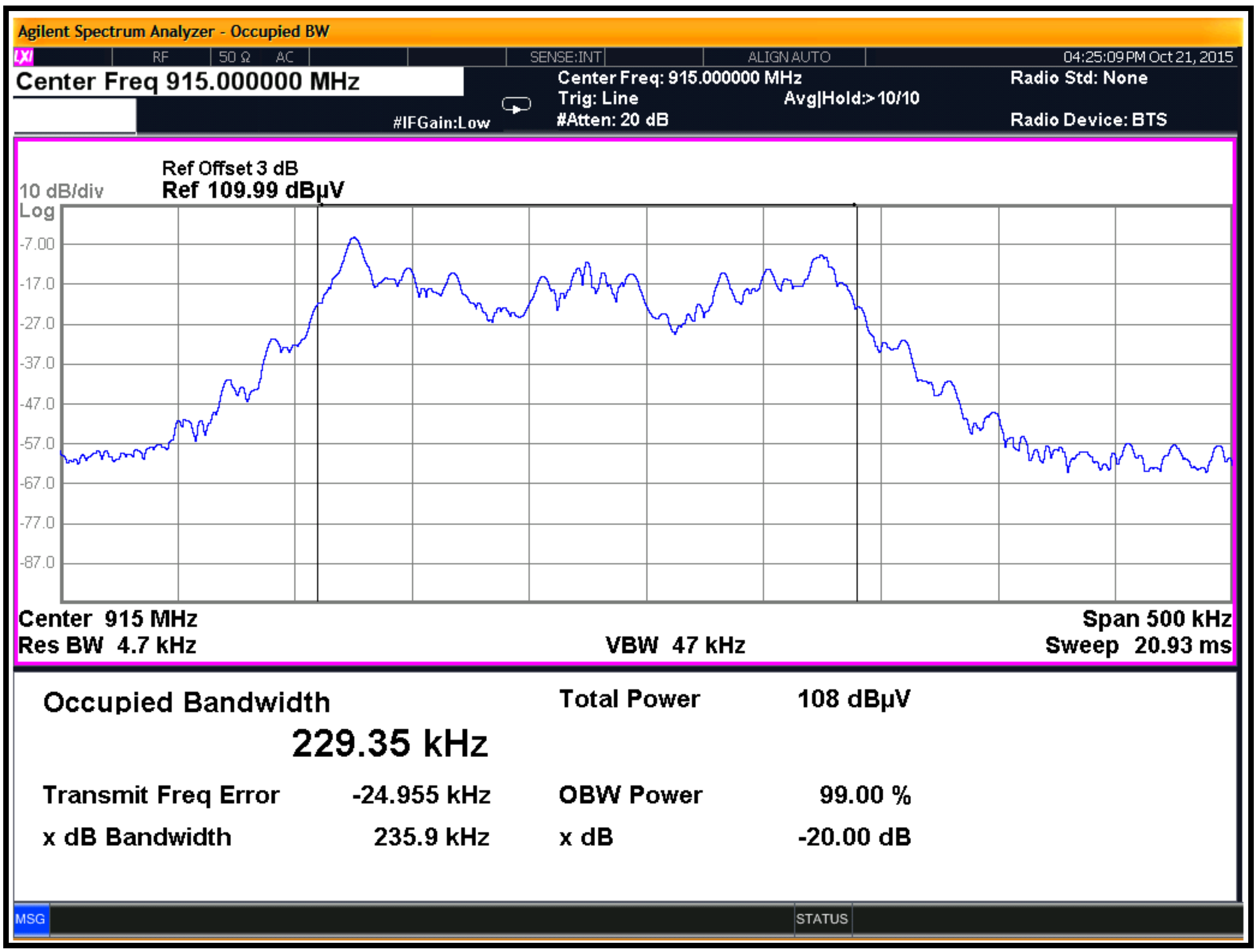

Figure 4: Occupied Bandwidth, TX @ 915MHz

3.3 Radiated Emissions: (FCC Part §2.1053, RSS210 A2.9)

The EUT must comply with the radiated emission limits of 15.249(a). The limits are as shown in the following table.

Table 5: Radiated Emissions Limits

Fundamental Frequency	Field Strength of Fundamental (μV/m)	Field Strength of Harmonics (μV/m)
902 – 928 MHz	50,000	500
2400 – 2483.5 MHz	50,000	500
5725 – 5875 MHz	50,000	500
24.00 – 24.25 GHz	250,000	2500

3.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. 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 peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Readings below 1000MHz were performed using a Peak Detector function.

The unit was examined in three orthogonals.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<30 Hz (Ave) 1MHz (Peak)

Emissions were measured to the 10th harmonic of the transmit frequency. Worst case emission levels are reported.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level): V dBμV
Antenna Factor (Ant Corr): AFdB/m
Cable Loss Correction (Cable Corr): CCdB
Duty Cycle Correction (Average) DCCdB
Amplifier Gain: GdB
Electric Field (Corr Level): EdBμV/m = VdBμV + AFdB/m + CCdB + DCCdB - GdB

Table 6: Radiated Emission Test Data (Fundamental)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Unit Upright									
915.00	V	180.00	1.30	59.55	26.0	18945.2	50000.0	-8.4	
915.00	H	225.00	1.50	62.04	26.0	25234.8	50000.0	-5.9	
Unit Flat									
915.00	V	270.00	1.60	60.76	26.0	21777.1	50000.0	-7.2	
915.00	H	225.00	1.20	67.25	26.0	45972.7	50000.0	-0.7	
Unit Side									
915.00	V	225.00	2.00	61.32	26.0	23227.4	50000.0	-6.7	
915.00	H	0.00	1.00	62.88	26.0	27797.1	50000.0	-5.1	

Table 7: Radiated Emission Test Data (Harmonics)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Average Measurements									
Unit Side									
1830.14	V	90.00	1.00	60.83	-14.9	197.1	500.0	-8.1	
1830.14	H	180.00	1.00	59.58	-14.9	170.7	500.0	-9.3	
3659.47	V	0.00	1.00	44.48	-5.3	90.5	500.0	-14.8	
3659.47	H	0.00	1.00	47.31	-5.3	125.4	500.0	-12.0	
Unit Upright									
1830.14	V	90.00	1.00	60.16	-14.9	182.5	500.0	-8.8	
1830.14	H	0.00	1.00	58.33	-14.9	147.8	500.0	-10.6	
3659.47	V	0.00	1.00	44.07	-5.3	86.4	500.0	-15.3	
3659.47	H	0.00	1.00	43.48	-5.3	80.7	500.0	-15.8	
Unit Flat									
1830.14	V	90.00	1.00	60.42	-14.9	188.1	500.0	-8.5	
1830.14	H	0.00	1.00	62.40	-14.9	236.2	500.0	-6.5	
3659.47	V	90.00	1.00	46.66	-5.3	116.3	500.0	-12.7	
3659.47	H	0.00	1.00	43.80	-5.3	83.7	500.0	-15.5	

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Peak Measurements									
Unit Side									
1830.14	V	90.00	1.00	64.20	-14.9	290.6	5000.0	-24.7	
1830.14	H	180.00	1.00	62.87	-14.9	249.3	5000.0	-26.0	
3659.47	V	0.00	1.00	47.25	-5.3	124.5	5000.0	-32.1	
3659.47	H	0.00	1.00	55.78	-5.3	332.5	5000.0	-23.5	
Unit Upright									
1830.14	V	90.00	1.00	63.25	-14.9	260.5	5000.0	-25.7	
1830.14	H	0.00	1.00	61.83	-14.9	221.2	5000.0	-27.1	
3659.47	V	0.00	1.00	46.92	-5.3	119.9	5000.0	-32.4	
3659.47	H	0.00	1.00	53.24	-5.3	248.2	5000.0	-26.1	
Unit Flat									
1830.14	V	90.00	1.00	63.49	-14.9	267.8	5000.0	-25.4	
1830.14	H	0.00	1.00	65.40	-14.9	333.6	5000.0	-23.5	
3659.47	V	90.00	1.00	55.23	-5.3	312.1	5000.0	-24.1	
3659.47	H	0.00	1.00	53.49	-5.3	255.4	5000.0	-25.8	

Table 8: Radiated Spurious Emission Test Data

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
30.29	V	180.00	1.00	34.70	-2.8	39.5	100.0	-8.1	
33.48	V	180.00	1.00	35.92	-5.0	35.2	100.0	-9.1	
41.22	V	180.00	1.00	34.40	-10.8	15.2	100.0	-16.4	
41.56	V	180.00	1.00	34.58	-11.0	15.1	100.0	-16.4	
41.95	V	180.00	1.00	35.96	-11.3	17.0	100.0	-15.4	
47.88	V	180.00	1.00	38.67	-15.0	15.2	100.0	-16.4	
48.93	V	180.00	1.00	40.16	-15.5	17.1	100.0	-15.3	
54.03	V	180.00	1.00	41.39	-16.8	17.0	100.0	-15.4	
59.97	V	180.00	1.00	41.31	-16.5	17.3	100.0	-15.2	
64.20	V	180.00	1.00	42.91	-16.0	22.2	100.0	-13.1	
114.43	V	180.00	1.00	32.30	-9.8	13.3	150.0	-21.1	
161.14	V	225.00	1.00	49.06	-11.0	79.8	150.0	-5.5	
312.57	V	225.00	1.00	40.31	-9.4	35.2	200.0	-15.1	
30.29	H	180.00	4.00	37.03	-2.8	51.7	100.0	-5.7	
33.48	H	180.00	4.00	36.28	-5.0	36.7	100.0	-8.7	
41.22	H	180.00	4.00	42.26	-10.8	37.6	100.0	-8.5	
41.56	H	180.00	4.00	40.78	-11.0	30.7	100.0	-10.2	
41.95	H	180.00	4.00	39.47	-11.3	25.5	100.0	-11.9	
47.88	H	180.00	4.00	41.08	-15.0	20.0	100.0	-14.0	
48.93	H	180.00	4.00	42.72	-15.5	23.0	100.0	-12.8	
54.03	H	180.00	4.00	42.17	-16.8	18.6	100.0	-14.6	
59.97	H	180.00	4.00	47.85	-16.5	36.7	100.0	-8.7	
64.20	H	180.00	4.00	42.16	-16.0	20.3	100.0	-13.8	
114.43	H	180.00	4.00	33.19	-9.8	14.7	150.0	-20.2	
161.14	H	225.00	4.00	33.94	-11.0	14.0	150.0	-20.6	
312.57	H	225.00	4.00	24.72	-9.4	5.8	200.0	-30.7	

