



FCC & Industry Canada Certification Test Report

For the

NBB Controls and Components AG

PLANAR-B

PLANAR-C

PLANAR-D

FCC ID: SJ7BCD433

IC ID: 2634B-BCD433

WLL JOB# 14167 Rev 2

June 30, 2016

Re-issued

August 2, 2016

Prepared for:

NBB Controls and Components AG

Otto-Hahn-Strasse 3-5

Oelbronn-Duerrn, N-A 75248

Prepared By:

Washington Laboratories, Ltd.

7560 Lindbergh Drive

Gaithersburg, Maryland 20879



Testing Certificate AT-1448

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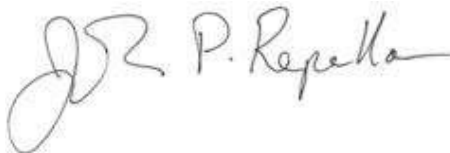
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August 2, 2016

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Abstract

This report has been prepared on behalf of NBB Controls and Components AG to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.231 (10/2014) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210, Issue 8, 12/2010 of Industry Canada. This Certification Test Report documents the test configuration and test results for the NBB Controls and Components AG PLANAR-B, PLANAR-C and PLANAR-D.

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 ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The NBB Controls and Components AG PLANAR-B, PLANAR-C and PLANAR-D comply with the limits for an Intentional Radiator device under FCC Part 15.231 and RSS-210 of Industry Canada.

Revision History	Description of Change	Date
Rev 0	Initial Release	June 30, 2016
Rev 1	Model name revised to include “-“	July 22, 2016
Rev 2	Added information to 4.3.1 to answer TCB questions	August 2, 2016

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1 Introduction

1.1 Compliance Statement

The NBB Controls and Components AG PLANAR-B, PLANAR-C and PLANAR-D comply with the limits for an Intentional Radiator device under FCC Part 15.231 (10/2014) and Industry Canada RSS-210 Issue 8 December 2010 & A1 2015.

TX Test Summary (Low Power Transmitter)			
FCC Rule Part	IC Rule Part	Description	Result
15.231 (a)	RSS-210	Transmission Length	Pass
15.231 (b)	RSS-210	Field Strength Limits	Pass
15.231 (c)	RSS-210	20dB Bandwidth	Pass
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
RX/Digital Test Summary (Low Power Transmitter)			
FCC Rule Part	IC Rule Part	Description	Result
15.107	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
15.109	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance Knowledge Data Base (KDB) publication number 558074 entitled "Measurement of Digital Transmission Systems operating under Section 15.231". The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	NBB Controls and Components AG Otto-Hahn-Strasse 3-5 Oelbronn-Duerrn, N-A 75248
Purchase Order Number:	Deposit Terms
Quotation Number:	69052

1.4 Test Dates

Testing was performed on the following date(s): 2/9/2016 to 2/29/2016

1.5 Test and Support Personnel

Washington Laboratories, LTD Customer Representative	Misael Flores Thomas Burchard
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1.6 Abbreviations

A	Ampere
ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	BandWidth
CE	Conducted Emission
cm	Centimeter
CW	Continuous Wave
dB	Decibel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga – prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo – prefix for 10^3 multiplier
LISN	Line Impedance Stabilization Network
M	Mega – prefix for 10^6 multiplier
m	Meter
μ	micro – prefix for 10^{-6} multiplier
NB	Narrowband
QP	Quasi-Peak
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The NBB Controls and Components AG PLANAR-B, PLANAR-C and PLANAR-D is a handheld remote control for various crane operations

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	NBB Controls and Components AG
FCC ID:	SJ7BCD433
IC:	2634B-BCD433
Model:	PLANAR-B, PLANAR-C, PLANAR-D
FCC Rule Parts:	§15.231
Industry Canada:	RSS210
Frequency Range:	433.1 – 434.75MHz
Maximum Output Power:	Measured: 6775.3uV/m @ 434.75MHz (Manufacturer Stated <10mW, 7.07e ⁵ uV/m)
Modulation:	GFSK
Occupied Bandwidth:	19.4 kHz
Keying:	Manual
Type of Information:	Data
Number of Channels:	67
Power Output Level	Fixed
Antenna Connector	Soldered Wire
Antenna Type	Internal
Interface Cables:	None
Power Source & Voltage:	2x “AA” NiMH– 2.4VDC
Serial Number of Unit Tested	9600112667

2.2 Test Configuration

The PLANAR-B, PLANAR-C and PLANAR-D were configured in stand-alone configurations.

2.3 Testing Algorithm

The PLANAR-B, PLANAR-C and PLANAR-D were tested while the units were in a continuous transmitting operation.

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 ANAB 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 Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

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

Where u_c = standard uncertainty

$a, b, c, \dots$ = 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

3 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: Conducted Emissions Voltage		Test Date: 02/23/2016	
Asset #	Manufacturer/Model	Description	Cal. Due
728	AGILENT - 8564EC	SPECTRUM ANALYZER 30HZ - 40GHZ	6/9/2016
65	HP - 8447D	PRE-AMPLIFIER RF 50KHZ-1GHZ	6/6/2016
125	SOLAR - 8028-50-TS-24-BNC	LISN	10/10/2016
126	SOLAR - 8028-50-TS-24-BNC	LISN	10/10/2016
Test Name: Radiated Emissions		Test Date: 02/22/2016	
Asset #	Manufacturer/Model	Description	Cal. Due
728	AGILENT - 8564EC	SPECTRUM ANALYZER 30HZ - 40GHZ	6/9/2016
65	HP - 8447D	PRE-AMPLIFIER RF 50KHZ-1GHZ	6/6/2016
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	8/14/2017
528	AGILENT - E4446A	3HZ - 44GHZ ANALYZER SPECTRUM	7/15/2016
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	6/6/2016
626	ARA - DRG-118/A	ANTENNA HORN	2/29/2016

4 Test Results

4.1 Transmission Cessation from Time-of-Release (FCC Part §15.231(a), RSS210 A2.9)

FCC Part 15.231 states that a periodic intentional radiator shall cease transmission within a five second period from release of automatic or manual keying of operation.

Testing was conducted to verify that the Planar-B Industrial Remote Control stopped transmitting within the required time period. A 6 second sweep was made, during which the control toggle was activated and released, and the time to transmission end was measured. Figure 1 through Figure 3 show the indicated time period from un-keying the device until cessation of transmission. The EUT complies with the requirements for this section.

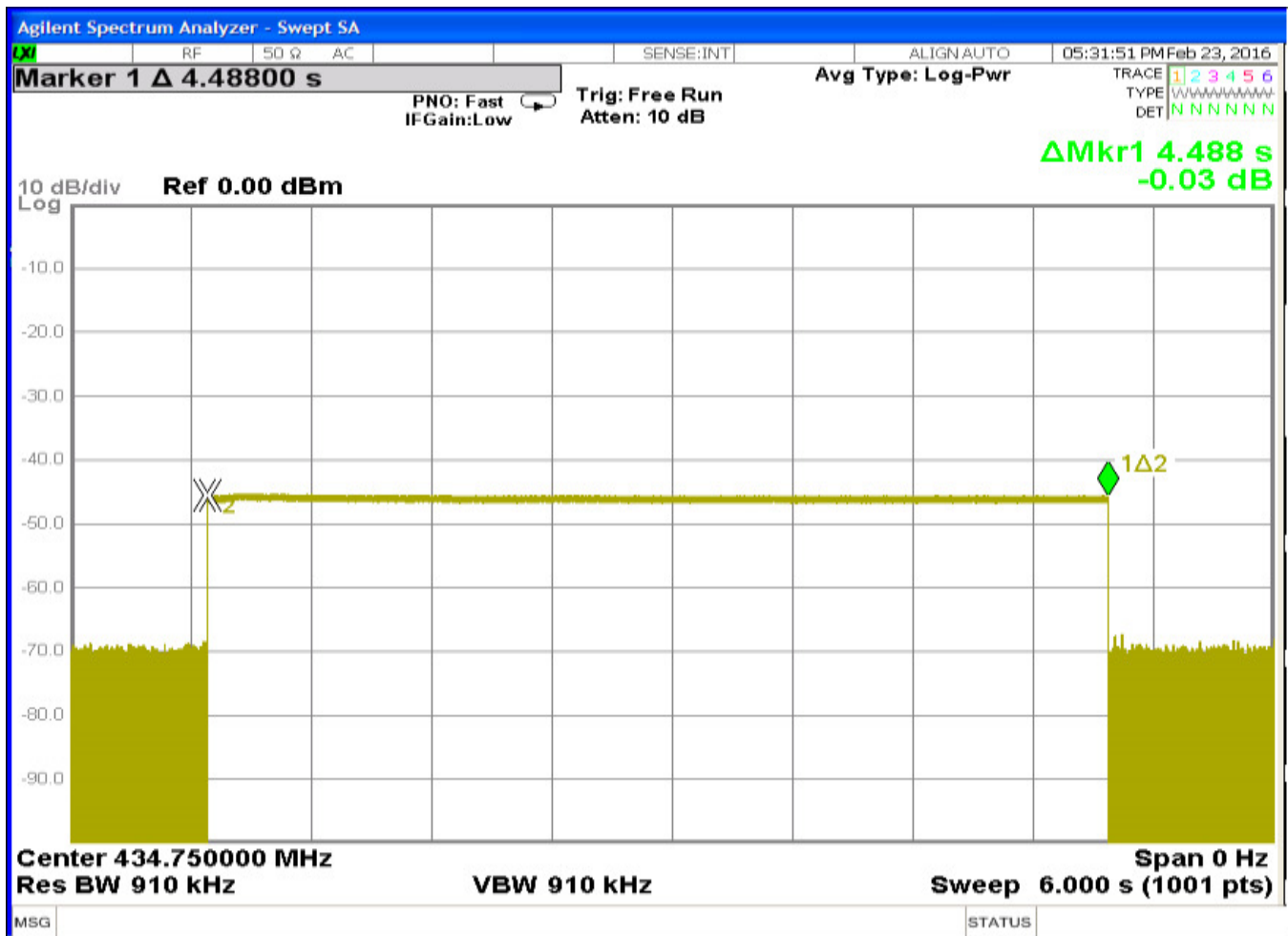


Figure 1: Time Period: Release to Termination of Transmission, PLANAR-B

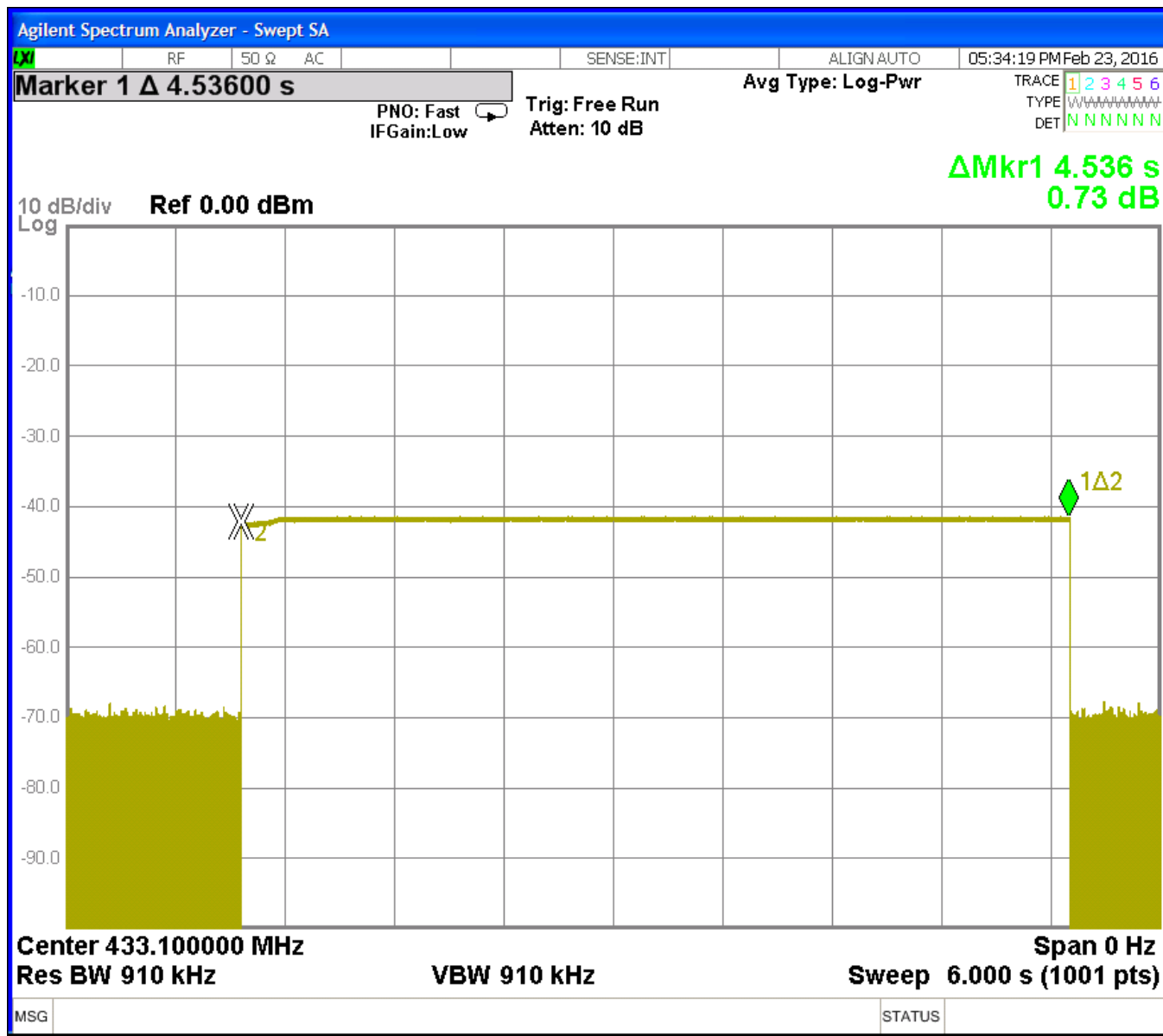


Figure 2: Time Period: Release to Termination of Transmission, PLANAR-C

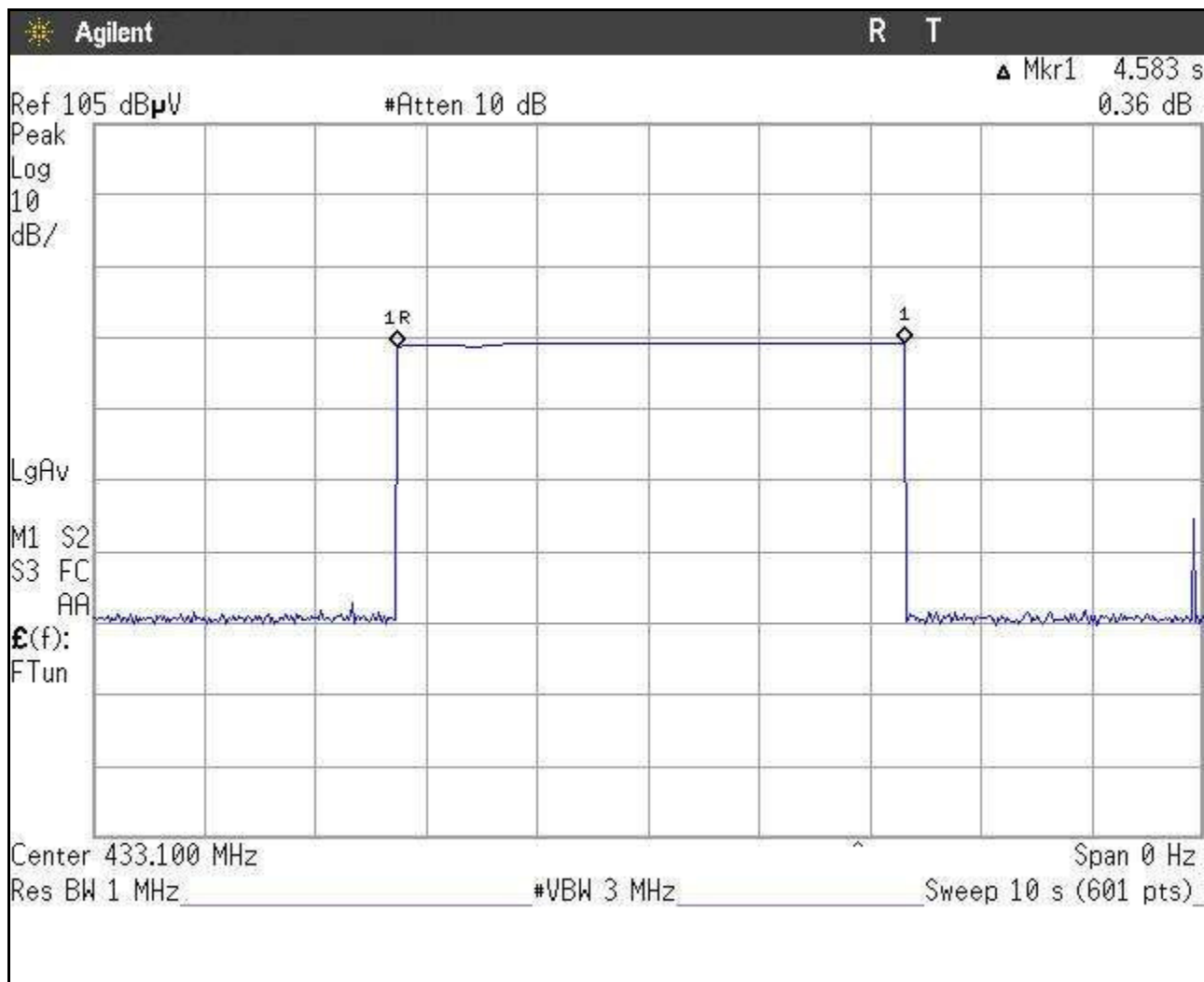


Figure 3: Time Period: Release to Termination of Transmission, PLANAR-D

4.2 Occupied Bandwidth (FCC Part §2.1049 and RSS-Gen [4.6.1]):

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

No Limits are provided for this measurement

Table 4: Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
300 Hz	3 kHz

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

Table 5 provides a summary of the Occupied Bandwidth Results.

Table 5: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 433.100 MHz, PLANAR-B	19.16 kHz	N/A	Pass
High Channel: 434.750 MHz, PLANAR-B	10.71 kHz	N/A	Pass
Low Channel: 433.100 MHz, PLANAR-C	19.01 kHz	N/A	Pass
High Channel: 434.750 MHz, PLANAR-C	19.21 kHz	N/A	Pass
Low Channel: 433.100 MHz, PLANAR-D	19.4 kHz	N/A	Pass
High Channel: 434.750 MHz, PLANAR-D	10.1 kHz	N/A	Pass



Figure 4: Occupied Bandwidth, Low Channel PLANAR-B

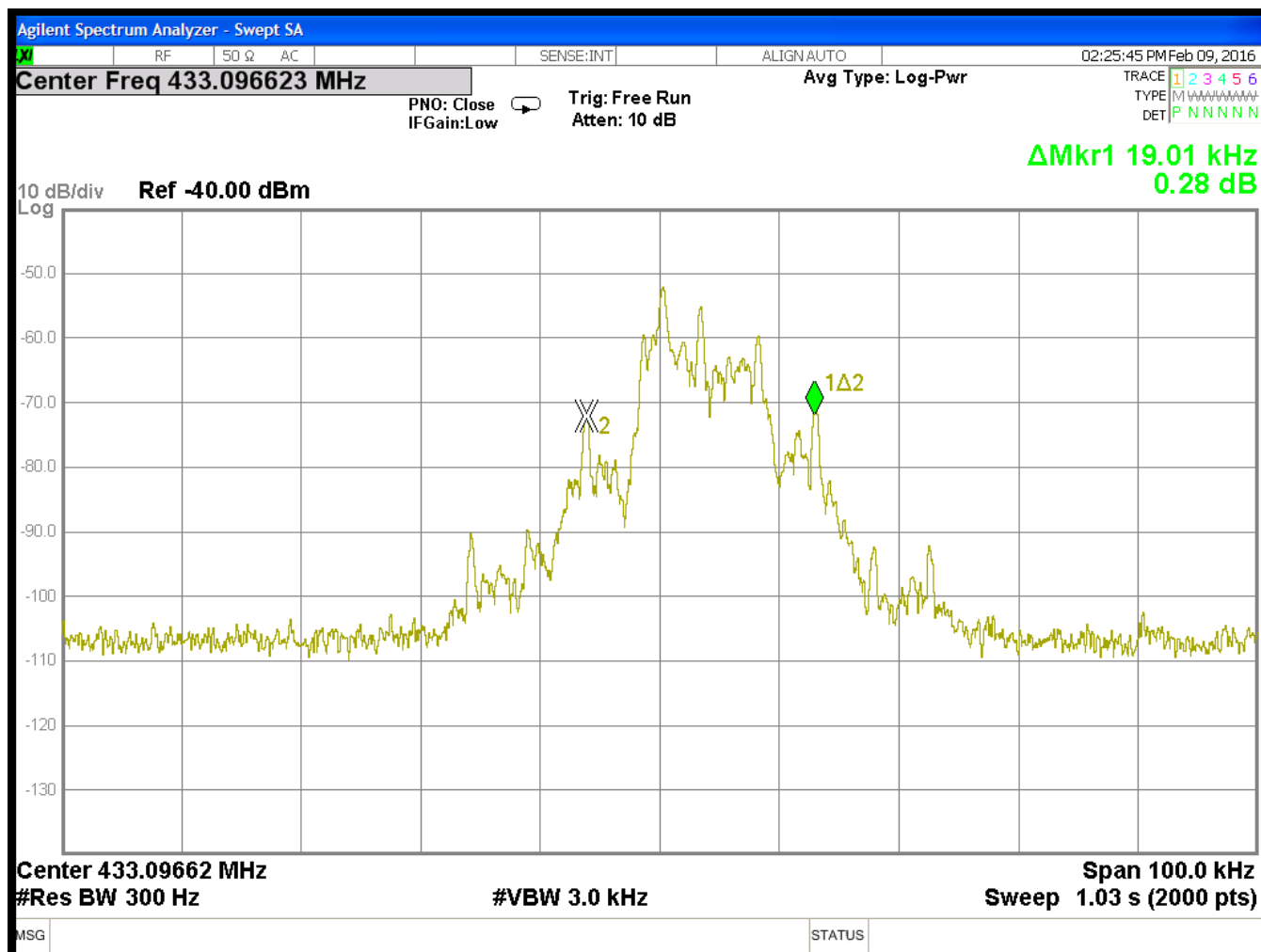


Figure 6: Occupied Bandwidth, Low Channel PLANAR-C

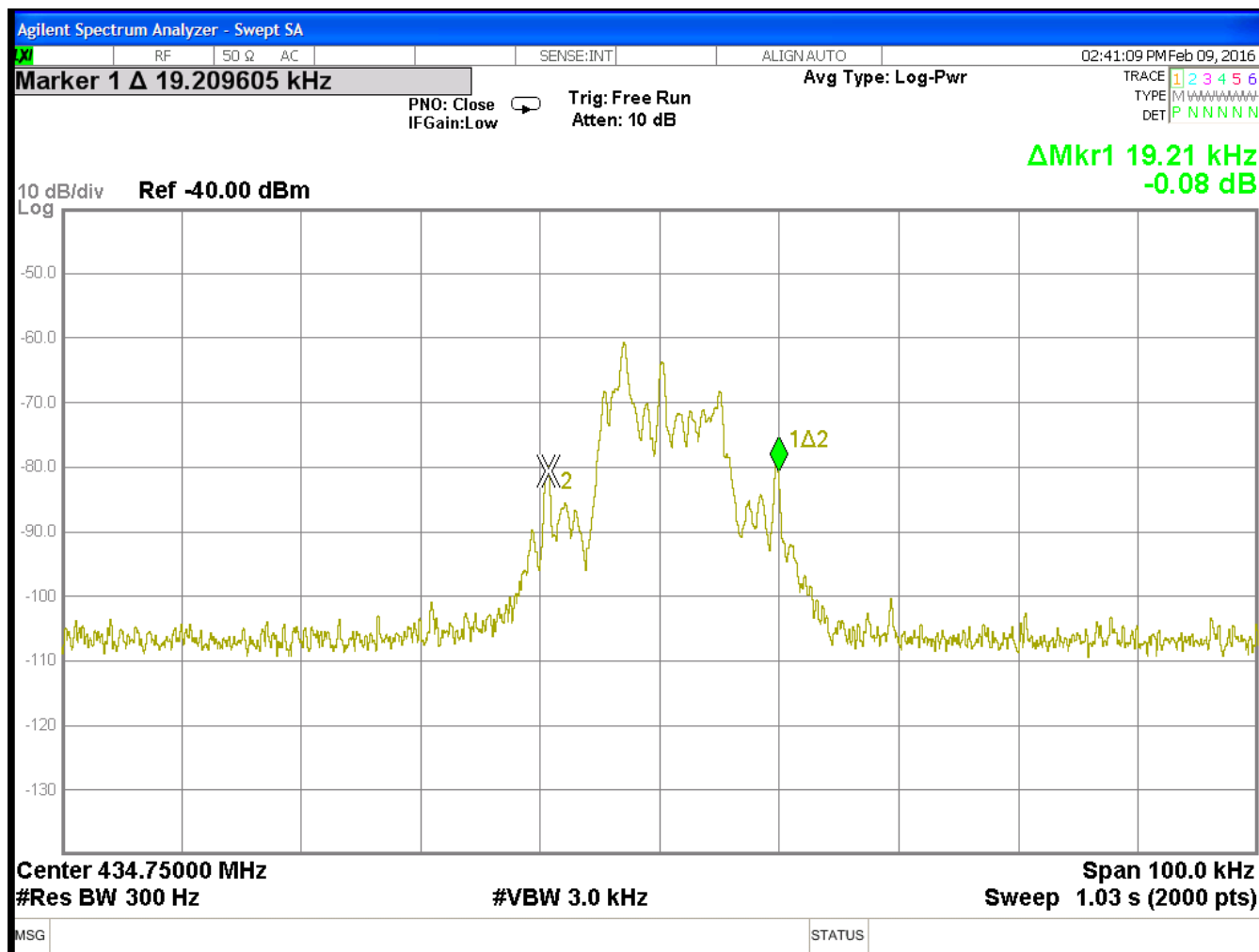


Figure 7: Occupied Bandwidth, High Channel PLANAR-C

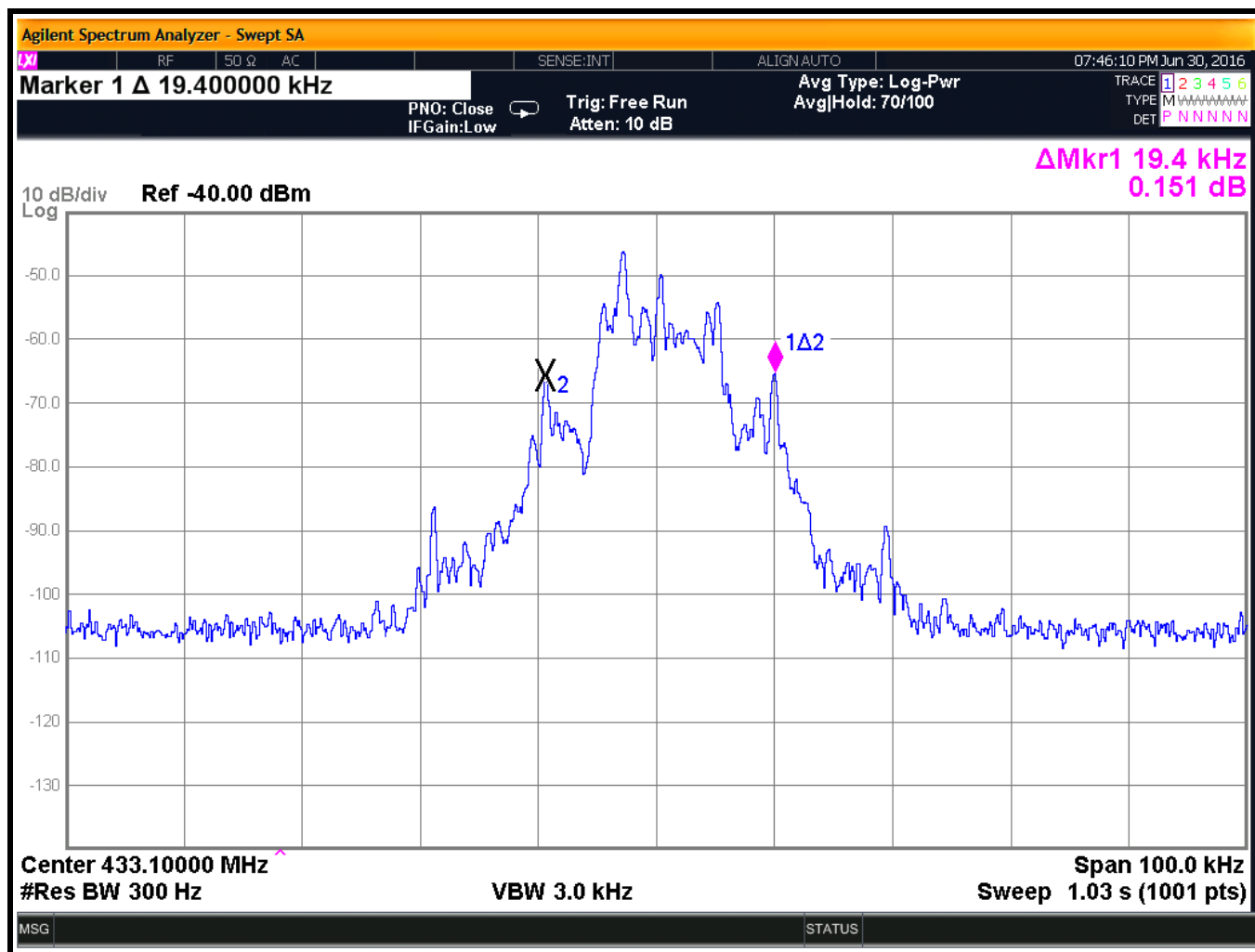


Figure 8: Occupied Bandwidth, Low Channel PLANAR-D



Figure 9: Occupied Bandwidth, High Channel PLANAR-D

4.3 Radiated Spurious Emissions: (FCC Part §15.249(a), RSS210 A2.9)

4.3.1 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.

The fundamental frequencies were all tested in peak mode as this is worst case and the units were low enough in power we did not have to test in average. The units were tested in all 3 orthogonal, with the worst case data presented here In the report.

The emissions were measured using the following resolution bandwidths:

Table 6: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Average measurements above 1GHz were made with the Spectrum analyzer set to the linear mode with a Video bandwidth of 10Hz, and the resultant reading mathematically converted to dBuV. Correction factors were then applied and the resulting value was compared to the limit.

Table 7: Radiated Emission Test Data, Transmitter, PLANAR-B, Low Channel

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
221.18	V	300.00	1.00	26.30	-13.4	4.4	200.0	-33.1	Amb Amb Amb peak peak avg
325.79	V	180.00	2.50	26.50	-9.5	7.1	200.0	-29.0	
332.00	V	280.00	2.50	33.17	-9.5	15.3	200.0	-22.3	
336.00	V	270.00	2.50	29.53	-9.4	10.1	200.0	-25.9	
344.60	V	285.00	3.00	31.33	-9.1	12.9	200.0	-23.8	
343.26	V	300.00	2.50	31.83	-9.2	13.5	200.0	-23.4	
2320.80	V	200.00	4.00	43.58	0.5	159.4	500.0	-9.9	
1555.00	V	315.00	4.00	46.82	-4.8	126.5	500.0	-11.9	
2344.00	V	0.00	4.00	44.17	0.5	172.1	500.0	-9.3	
433.10	V	185.00	2.50	74.66	-6.1	2671.5	11291.6	-12.5	
866.20	V	190.00	2.50	59.20	1.3	1065.3	1129.2	-0.5	
866.20	V	190.00	2.50	44.98	1.3	207.2	1129.2	-14.7	
221.20	H	265.00	1.00	34.33	-13.4	11.1	200.0	-25.1	Amb Amb Amb peak
228.57	H	270.00	1.00	36.00	-13.0	14.1	200.0	-23.0	
235.94	H	270.00	1.00	32.83	-12.6	10.3	200.0	-25.8	
325.80	H	135.00	3.00	37.33	-9.5	24.6	200.0	-18.2	
334.01	H	135.00	3.00	39.17	-9.5	30.6	200.0	-16.3	
335.96	H	135.00	3.00	35.83	-9.4	20.9	200.0	-19.6	
343.01	H	135.00	3.00	37.17	-9.2	25.0	200.0	-18.1	
427.63	H	135.00	3.00	35.07	-6.5	26.9	200.0	-17.4	
523.21	H	120.00	3.00	39.67	-5.0	53.9	200.0	-11.4	
540.39	H	135.00	3.00	37.63	-5.4	41.1	200.0	-13.8	
1555.80	H	0.00	4.00	48.72	-4.8	157.4	500.0	-10.0	
2322.33	H	0.00	4.00	47.25	0.5	243.4	500.0	-6.3	
1054.50	H	0.00	4.00	45.09	-7.6	75.1	500.0	-16.5	
433.10	H	180.00	2.00	75.42	-6.1	2915.8	11291.6	-11.8	
866.20	H	205.00	1.00	32.65	1.3	50.1	1129.2	-27.1	

Table 8: Radiated Emission Test Data, Transmitter, PLANAR-B, High Channel

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
434.75	V	0.00	3.00	69.50	-6.0	1492.5	11347.8	-17.6	Peak
346.28	V	45.00	3.00	33.57	-9.0	17.0	200.0	-21.4	
244.17	V	150.00	1.00	32.17	-12.2	9.9	200.0	-26.1	Amb
305.17	V	0.00	1.00	34.83	-10.2	17.1	200.0	-21.3	Amb
506.42	V	270.00	1.00	36.67	-5.2	37.4	200.0	-14.6	Amb
714.25	V	180.00	1.00	31.17	-2.6	26.9	200.0	-17.4	Amb
771.50	V	0.00	1.00	40.67	-1.3	93.2	200.0	-6.6	Amb
1377.20	V	180.00	4.00	46.20	-5.1	113.2	500.0	-12.9	Amb
1157.33	V	180.00	4.00	47.02	-6.5	106.6	500.0	-13.4	Amb
2325.60	V	180.00	4.00	44.56	0.5	178.8	500.0	-8.9	Amb
434.75	V	270.00	2.00	71.78	-6.0	1940.6	11347.8	-15.3	Peak
869.50	V	270.00	2.50	55.88	1.3	722.2	1134.8	-3.9	Peak
869.50	V	270.00	2.50	38.88	1.3	102.0	1134.8	-20.9	Avg
221.18	H	180.00	2.50	35.00	-13.4	12.0	200.0	-24.4	
327.50	H	315.00	2.50	40.00	-9.5	33.5	200.0	-15.5	
335.63	H	315.00	2.50	41.83	-9.4	41.6	200.0	-13.6	
333.62	H	315.00	2.50	36.50	-9.5	22.5	200.0	-19.0	
337.63	H	315.00	2.50	39.33	-9.4	31.3	200.0	-16.1	
344.63	H	315.00	3.00	38.83	-9.1	30.6	200.0	-16.3	
346.23	H	315.00	3.00	38.50	-9.0	29.9	200.0	-16.5	
542.05	H	315.00	3.00	40.67	-5.4	57.7	200.0	-10.8	
1556.70	H	0.00	4.00	47.63	-4.8	138.9	500.0	-11.1	Amb
2834.00	H	0.00	4.00	37.94	2.7	107.4	500.0	-13.4	Amb
2421.50	H	0.00	4.00	38.35	0.9	91.8	500.0	-14.7	Amb
434.75	H	170.00	3.00	82.64	-6.0	6775.3	11347.8	-4.5	Peak
869.50	H	190.00	2.50	49.04	1.3	328.6	1134.8	-10.8	

Table 9: Radiated Emission Test Data, Transmitter, PLANAR-C, Low Channel

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
433.10	V	90.00	3.00	69.18	-6.8	1313.9	12583.0	-19.6	Peak
344.50	V	30.00	2.00	34.83	-9.8	17.8	200.0	-21.0	
248.40	V	0.00	1.00	34.33	-13.1	11.6	200.0	-24.8	Amb
305.13	V	0.00	1.00	34.00	-10.8	14.5	200.0	-22.8	Amb
332.00	V	200.00	3.00	35.67	-10.0	19.2	200.0	-20.3	
344.57	V	280.00	2.50	35.17	-9.8	18.5	200.0	-20.7	
511.47	V	0.00	1.00	30.53	-5.1	18.8	200.0	-20.5	Amb
1760.00	V	0.00	4.00	46.17	-0.8	186.0	500.0	-8.6	Amb
1643.30	V	0.00	4.00	44.83	-1.8	141.3	500.0	-11.0	Amb
1565.20	V	0.00	4.00	46.67	-2.3	165.6	500.0	-9.6	Amb
433.10	V	180.00	1.00	70.25	-6.8	1486.8	11291.6	-17.6	Peak
1732.40	V	45.00	4.00	39.33	-1.1	81.8	1129.2	-22.8	
433.10	H	45.00	1.00	77.74	-6.8	3521.8	12583.0	-11.1	Peak
221.19	H	160.00	1.00	36.33	-14.0	13.0	200.0	-23.7	
235.95	H	170.00	1.00	35.17	-13.3	12.5	200.0	-24.1	
333.67	H	160.00	1.00	37.83	-10.0	24.7	200.0	-18.2	
435.01	H	350.00	2.50	36.17	-6.7	29.8	200.0	-16.5	
438.57	H	335.00	2.00	38.67	-6.5	40.5	200.0	-13.9	
540.42	H	315.00	3.00	38.67	-4.4	51.5	200.0	-11.8	
1056.70	H	0.00	4.00	47.67	-5.6	126.2	500.0	-12.0	Amb
1565.50	H	0.00	4.00	47.50	-2.3	182.2	500.0	-8.8	Amb
1185.20	H	0.00	4.00	46.63	-4.3	131.5	500.0	-11.6	Amb
433.10	H	180.00	2.50	78.15	-6.8	3692.0	11291.6	-9.7	
866.20	H	205.00	1.00	48.04	1.1	287.6	1129.2	-11.9	

Table 10: Radiated Emission Test Data, Transmitter, PLANAR-C, High Channel

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
434.75	V	200.00	3.00	71.83	-6.7	1806.1	11347.8	-16.0	Peak
333.69	V	270.00	3.00	37.53	-10.0	23.8	200.0	-18.5	
346.23	V	270.00	2.00	36.50	-9.7	21.8	200.0	-19.3	
345.46	V	270.00	2.00	34.67	-9.8	17.5	200.0	-21.1	
909.60	V	0.00	1.00	34.12	1.6	61.4	200.0	-10.3	Amb
981.30	V	0.00	1.00	34.94	2.2	71.6	500.0	-16.9	Amb
458.50	V	0.00	1.00	32.31	-6.6	19.4	200.0	-20.3	Amb
1742.70	V	100.00	4.00	45.83	-1.0	175.0	500.0	-9.1	Amb
1642.20	V	0.00	4.00	44.17	-1.8	130.9	500.0	-11.6	Amb
1753.00	V	0.00	4.00	45.17	-0.9	164.3	500.0	-9.7	Amb
434.75	V	270.00	3.00	71.83	-6.7	1806.1	11347.8	-16.0	Peak
869.50	V	205.00	3.00	34.20	1.3	59.9	1134.8	-25.5	
1739.00	V	270.00	4.00	35.00	-1.0	50.1	1134.8	-27.1	
221.20	H	170.00	1.00	34.83	-14.0	10.9	200.0	-25.2	Amb
228.57	H	180.00	1.00	31.80	-13.7	8.0	200.0	-27.9	
235.95	H	180.00	1.00	32.01	-13.3	8.7	200.0	-27.3	
327.48	H	180.00	3.00	37.18	-10.0	22.8	200.0	-18.9	
335.64	H	175.00	3.00	41.19	-10.0	36.4	200.0	-14.8	
344.63	H	180.00	3.00	38.42	-9.8	26.9	200.0	-17.4	
427.62	H	180.00	2.50	33.44	-7.1	20.7	200.0	-19.7	
441.89	H	180.00	2.50	35.28	-6.4	27.7	200.0	-17.2	
542.06	H	180.00	3.00	38.48	-4.5	50.0	200.0	-12.0	
621.07	H	180.00	2.50	33.67	-3.3	33.2	200.0	-15.6	
1130.20	H	0.00	4.00	44.67	-4.8	98.9	500.0	-14.1	
1565.30	H	100.00	4.00	47.33	-2.3	178.7	500.0	-8.9	
1236.50	H	0.00	4.00	43.50	-3.8	96.5	500.0	-14.3	
434.75	H	180.00	2.50	80.80	-6.7	5072.8	11347.8	-7.0	
869.50	H	90.00	3.00	31.24	1.3	42.6	1134.8	-28.5	
1739.00	H	0.00	4.00	35.17	-1.0	51.1	1134.8	-26.9	

Table 11: Radiated Emission Test Data, Transmitter, PLANAR-D, Low Channel

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
433.10	V	235.00	1.20	74.82	-5.8	2820.4	12583.0	-13.0	Amb
866.20	V	0.00	0.00	N/A	0.6	1.1	200.0	-45.4	
1299.30	V	180.00	1.90	43.76	-5.4	0.5	500.0	-59.4	
1732.40	V	0.00	2.25	47.02	-3.3	0.7	500.0	-57.3	
2165.50	V	235.00	2.00	38.05	1.3	1.2	500.0	-52.7	
2598.60	V	0.00	2.00	32.10	3.6	1.5	500.0	-50.4	
3031.70	V	0.00	2.00	32.15	5.2	1.8	500.0	-48.8	
3464.80	V	200.00	2.10	36.90	7.0	2.2	500.0	-47.0	
3897.90	V	0.00	2.25	32.68	8.5	2.7	500.0	-45.5	
4331.00	V	0.00	2.00	32.26	10.3	3.3	500.0	-43.7	
433.10	H	90.00	1.00	80.69	-5.8	5543.7	12583.0	-7.1	Amb
866.20	H	0.00	0.00	N/A	0.6	1.1	200.0	-45.4	
1299.30	H	350.00	2.10	40.80	-5.4	0.5	500.0	-59.4	
1732.40	H	45.00	2.00	51.15	-3.3	0.7	500.0	-57.3	
2165.50	H	180.00	1.70	36.36	1.3	1.2	500.0	-52.7	
2598.60	H	0.00	1.70	33.06	3.6	1.5	500.0	-50.4	
3031.70	H	0.00	1.70	31.49	5.2	1.8	500.0	-48.8	
3464.80	H	295.00	2.30	35.72	7.0	2.2	500.0	-47.0	
3897.90	H	0.00	2.00	30.97	8.5	2.7	500.0	-45.5	
4331.00	H	0.00	2.00	30.72	10.3	3.3	500.0	-43.7	

Table 12: Radiated Emission Test Data, Transmitter, PLANAR-D, High Channel

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
434.75	V	0.00	1.3	68.96	-5.7	1453.6	11347.8	-17.8	Peak
346.28	V	45.00	3.00	33.57	-9.0	17.0	200.0	-21.4	
244.17	V	150.00	1.00	32.17	-12.2	9.9	200.0	-26.1	Amb
305.17	V	0.00	1.00	34.83	-10.2	17.1	200.0	-21.3	Amb
506.42	V	270.00	1.00	36.67	-5.2	37.4	200.0	-14.6	Amb
714.25	V	180.00	1.00	31.17	-2.6	26.9	200.0	-17.4	Amb
771.50	V	0.00	1.00	40.67	-1.3	93.2	200.0	-6.6	Amb
1377.20	V	180.00	4.00	46.20	-5.1	113.2	500.0	-12.9	Amb
1157.33	V	180.00	4.00	47.02	-6.5	106.6	500.0	-13.4	Amb
2325.60	V	180.00	4.00	44.56	0.5	178.8	500.0	-8.9	Amb
869.50	V	270.00	2.50	38.88	1.3	102.0	1134.8	-20.9	Avg
434.75	H	45.00	1.00	74.19	-5.7	2654.3	11347.8	-12.6	Peak
221.18	H	180.00	2.50	35.00	-13.4	12.0	200.0	-24.4	Amb
327.50	H	315.00	2.50	40.00	-9.5	33.5	200.0	-15.5	Amb
335.63	H	315.00	2.50	41.83	-9.4	41.6	200.0	-13.6	Amb
333.62	H	315.00	2.50	36.50	-9.5	22.5	200.0	-19.0	Amb
337.63	H	315.00	2.50	39.33	-9.4	31.3	200.0	-16.1	Amb
344.63	H	315.00	3.00	38.83	-9.1	30.6	200.0	-16.3	Amb
346.23	H	315.00	3.00	38.50	-9.0	29.9	200.0	-16.5	Amb
542.05	H	315.00	3.00	40.67	-5.4	57.7	200.0	-10.8	Amb
1556.70	H	0.00	4.00	47.63	-4.8	138.9	500.0	-11.1	Amb
2834.00	H	0.00	4.00	37.94	2.7	107.4	500.0	-13.4	Amb
2421.50	H	0.00	4.00	38.35	0.9	91.8	500.0	-14.7	Amb

Table 13: Radiated Emission Test Data, Receiver

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
221.18	V	300.00	1.00	26.30	-13.4	4.4	200.0	-33.1	
228.57	H	270.00	1.00	36.00	-13.0	14.1	200.0	-23.0	
235.94	H	270.00	1.00	32.83	-12.6	10.3	200.0	-25.8	
325.79	V	180.00	2.50	26.50	-9.5	7.1	200.0	-29.0	
332.00	V	280.00	2.50	33.17	-9.5	15.3	200.0	-22.3	
336.00	V	270.00	2.50	29.53	-9.4	10.1	200.0	-25.9	
523.21	H	120.00	3.00	39.67	-5.0	53.9	200.0	-11.4	
540.39	H	135.00	3.00	37.63	-5.4	41.1	200.0	-13.8	
346.28	V	45.00	3.00	33.57	-9.0	17.0	200.0	-21.4	
542.05	H	315.00	3.00	40.67	-5.4	57.7	200.0	-10.8	

4.4 AC Conducted Emissions

The requirements of FCC Part 15 (10/2014) and ICES-003 call for the EUT to be placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω /50 mH Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Power and data cables were moved about to obtain maximum emissions. Test Procedure

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements the post-detector filter was set to 10 Hz.

These emissions must meet the limits specified in §15.207 for quasi-peak and average measurements.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

Table 11: Conducted Emissions

NEUTRAL

Frequency (MHz)	Level QP (dB μ V)	Level AVG (dB μ V)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dB μ V)	Level Corr Avg (dB μ V)	Limit QP (dB μ V)	Limit AVG (dB μ V)	Margin QP (dB)	Margin AVG (dB)
1.240	39.3	19.3	10.2	0.3	49.8	29.8	56.0	46.0	-6.2	-16.2
3.380	38.5	18.5	10.6	0.3	49.4	29.4	56.0	46.0	-6.6	-16.6
5.030	38.5	19.3	10.7	0.2	49.4	30.2	60.0	50.0	-10.6	-19.8
12.240	38.8	17.7	11.3	0.4	50.5	29.3	60.0	50.0	-9.5	-20.7
6.770	37.3	18.5	11.1	0.1	48.5	29.6	60.0	50.0	-11.5	-20.4
4.480	37.3	19.2	10.7	0.2	48.2	30.1	56.0	46.0	-7.8	-15.9
1.990	37.2	19.8	10.5	0.3	48.0	30.6	56.0	46.0	-8.0	-15.4

PHASE

Frequency (MHz)	Level QP (dB μ V)	Level AVG (dB μ V)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dB μ V)	Level Corr Avg (dB μ V)	Limit QP (dB μ V)	Limit AVG (dB μ V)	Margin QP (dB)	Margin AVG (dB)
5.080	41.8	34.5	10.7	0.2	52.7	45.4	60.0	50.0	-7.3	-4.6
4.280	40.5	32.2	10.7	0.2	51.4	43.1	56.0	46.0	-4.6	-2.9
3.530	40.0	29.7	10.6	0.3	50.9	40.6	56.0	46.0	-5.1	-5.4
6.170	38.0	29.2	11.0	0.1	49.0	40.2	60.0	50.0	-11.0	-9.8
10.000	36.0	27.0	11.1	0.2	47.3	38.3	60.0	50.0	-12.7	-11.7
1.940	39.8	30.7	10.5	0.3	50.6	41.4	56.0	46.0	-5.4	-4.6
1.440	41.2	34.0	10.3	0.3	51.7	44.6	56.0	46.0	-4.3	-1.4