849 NW State Road 45
Newberry, FL 32669 USA
Ph.: 888.472.2424 or
352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

FCC PART 15.249 & IC RSS-210

UNLICENSED INTENTIONAL RADIATOR

TEST REPORT

Applicant	LAIRD CONTROLS NORTH AMERICA INC
Address	655 N. RIVER ROAD NW SUITE A WARREN OH 44483-2254 USA
FCC ID	CN279545
IC Certification Number	1007A-79545
Model Number	79545TRX
Product Description	LRM 900 MHz MODULE
Date Sample Received	11/16/2015
Final Test Date	2/2/2016
Tested By	Tim Royer
Approved By	Cory Leverett

Report Number	Version Number	Description	Issue Date
2400AUT15TestReport_	Rev1	Initial Issue	2/19/2016

TABLE OF CONTENTS

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report
☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:
Tim Royer
Project Manager
Date: 2/19/2016

GENERAL INFORMATION

EUT Specification

FCC Regulatory Standard	Title 47 CFR Part 2 & 15		
IC Regulatory Standard	RSS-210 (i8) & RSS-GEN (i4)		
FCC ID	**CN279545**		
IC	**1007A-79545**		
Model	**79545TRX**		
EUT Description	LRM 900 MHz MODULE		
Operating Frequency	TX:903 – 927.3 MHz		
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☒ DC Power		
	☐ Battery Operated Exclusively		
Test Item	☒ Prototype	☐ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	See Host Integration Manual		
Antenna	External		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standards	ANSI C63.10-2013 (test methods) ANSI C63.4-2014 (Site Validation)		
Test Exercise	EUT was powered with 3.3vDC and was transmitting packet data, 10% duty cycle with the power level set to 10.		

Test Supporting Equipment

Device	Manufacturer	Model	S/N	Supplied By	Use
Magnetic Antenna	Laird	5/8 wave collinear 3 dBi 896-970 MHz	PRT-0000196	Applicant	Testing

Note: The antenna used for testing has a gain of 3 dBi, this is the highest gain approved for use with this module.

TEST RESULTS SUMMARY

Requirement	FCC Rule Part	IC RSS	Result
Fundamental & Harmonic Emissions	15.249 (a)(c)(e)	210 § A2.9	Pass
Occupied Bandwidth	15.215 (c)	GEN § 6.6	Pass
Bandedge Compliance	15.249 (c)(d)(e) 15.209	210 § A2.9(b) GEN § 8.9	Pass
Spurious Emissions	15.249 (c)(d)(e) 15.209	210 § A2.9(b) GEN § 8.9	Pass
AC Power Line Conducted Emissions	15.207	GEN § 8.8	Pass
Restricted Band Emissions	15.205	210 § 2.2 GEN § 8.10	Pass
Antenna Requirements	15.203	GEN § 8.3	Pass

Notes:

Table of Contents

OCCUPIED BANDWIDTH

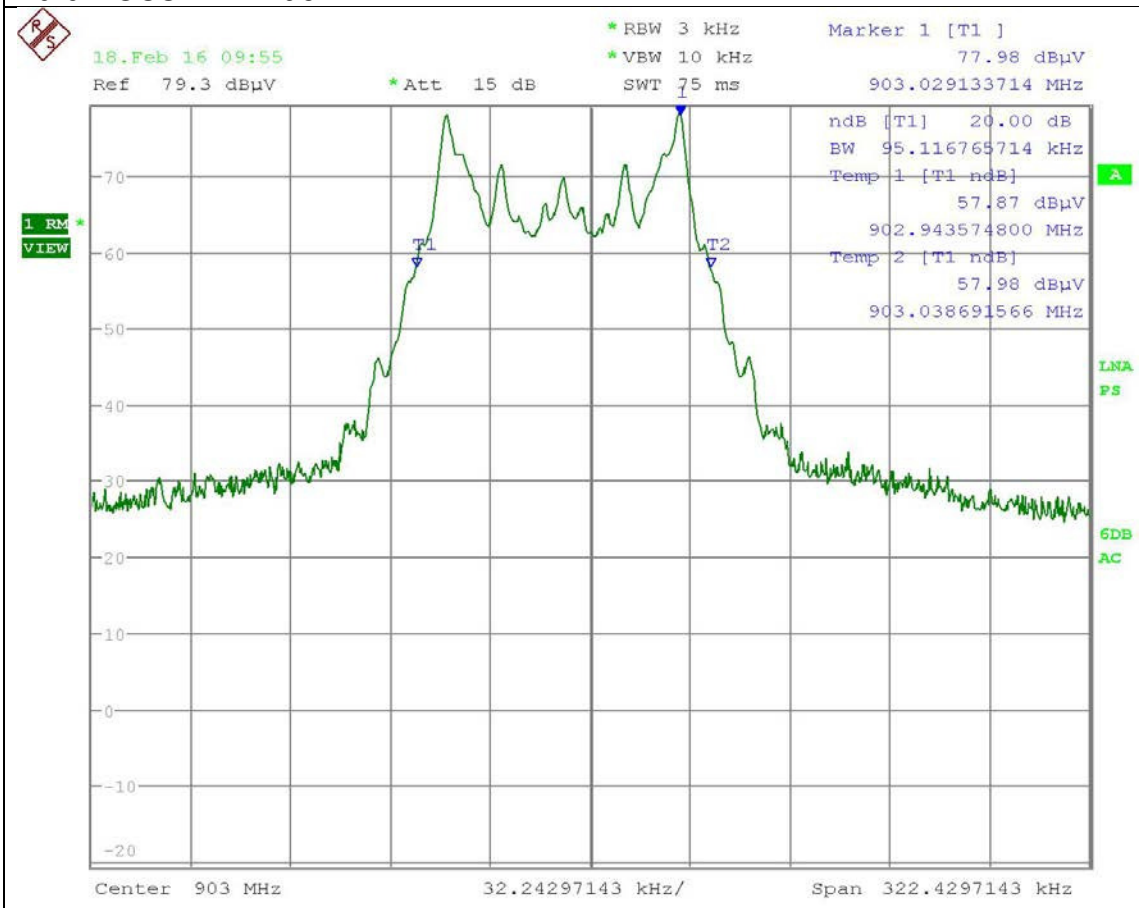
Rules Part No.: FCC 15.215(c) & IC RSS-GEN § 6.6

Requirements: FCC requires that the 20 dB bandwidth of the emission shall be contained within the frequency band designated under which the equipment is operated. Industry Canada 99% Bandwidth reporting only

Method of Measurement: ANSI C63.10 § 6.9 Occupied bandwidth tests

Test Data: Low End of Band

20 dB OCC BW = 95.1kHz



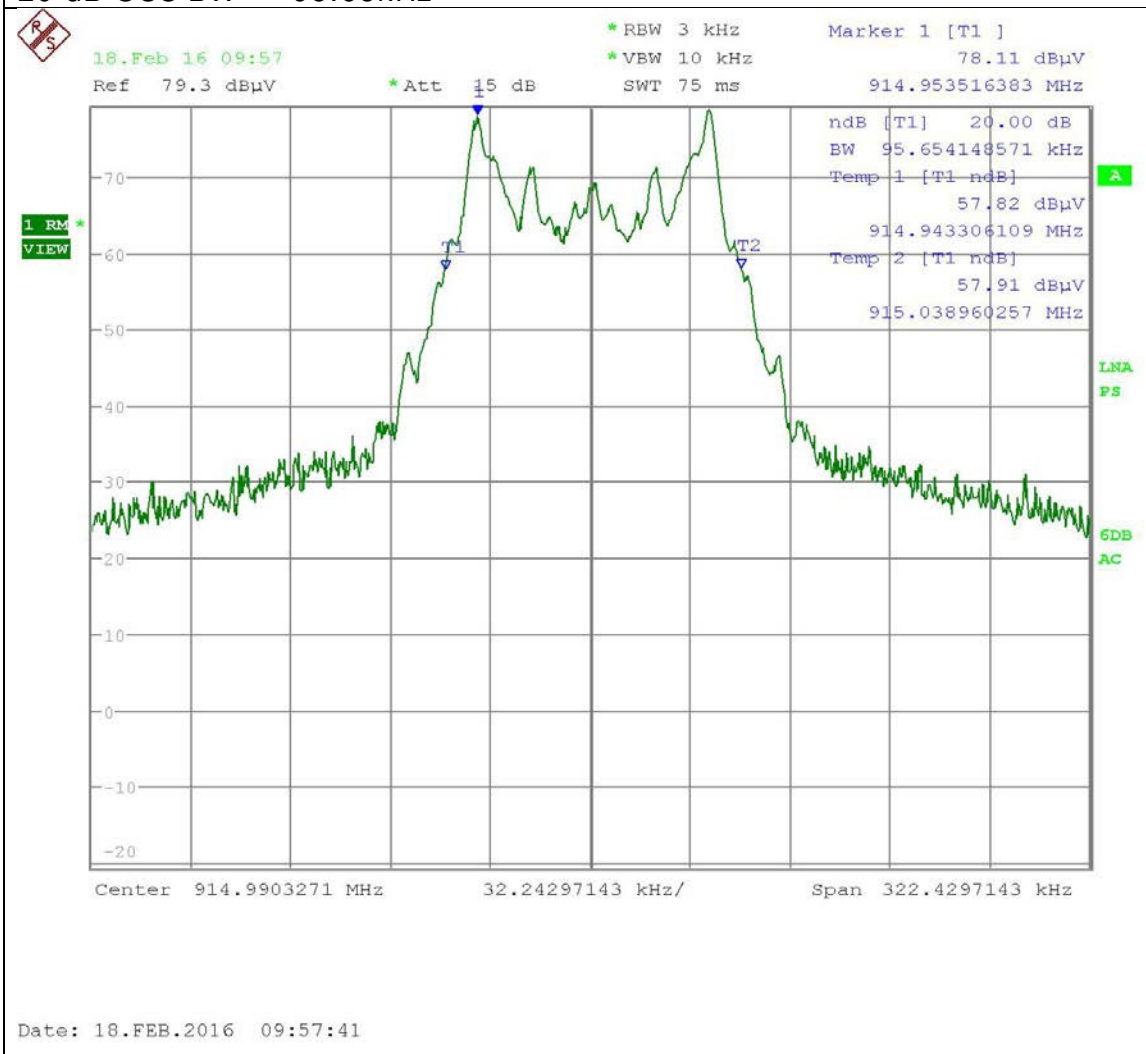
Date: 18.FEB.2016 09:55:29

RESULTS MEET REQUIREMENTS

OCCUPIED BANDWIDTH

Test Data: Middle of Band

20 dB OCC BW = 95.65kHz

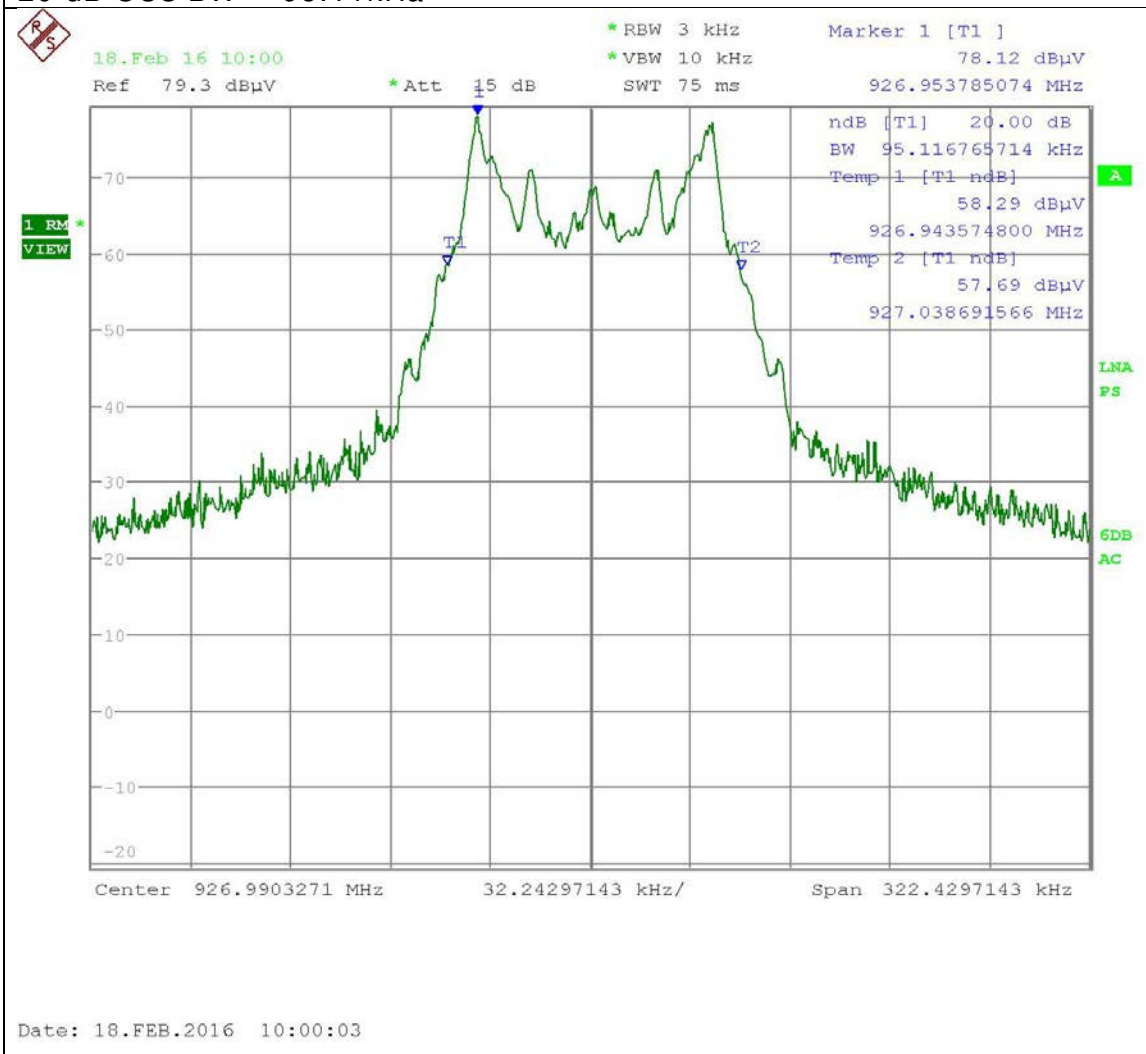


RESULTS MEET REQUIREMENTS

OCCUPIED BANDWIDTH

Test Data: High End of Band

20 dB OCC BW = 95.11kHa



RESULTS MEET REQUIREMENTS

BAND-EDGE

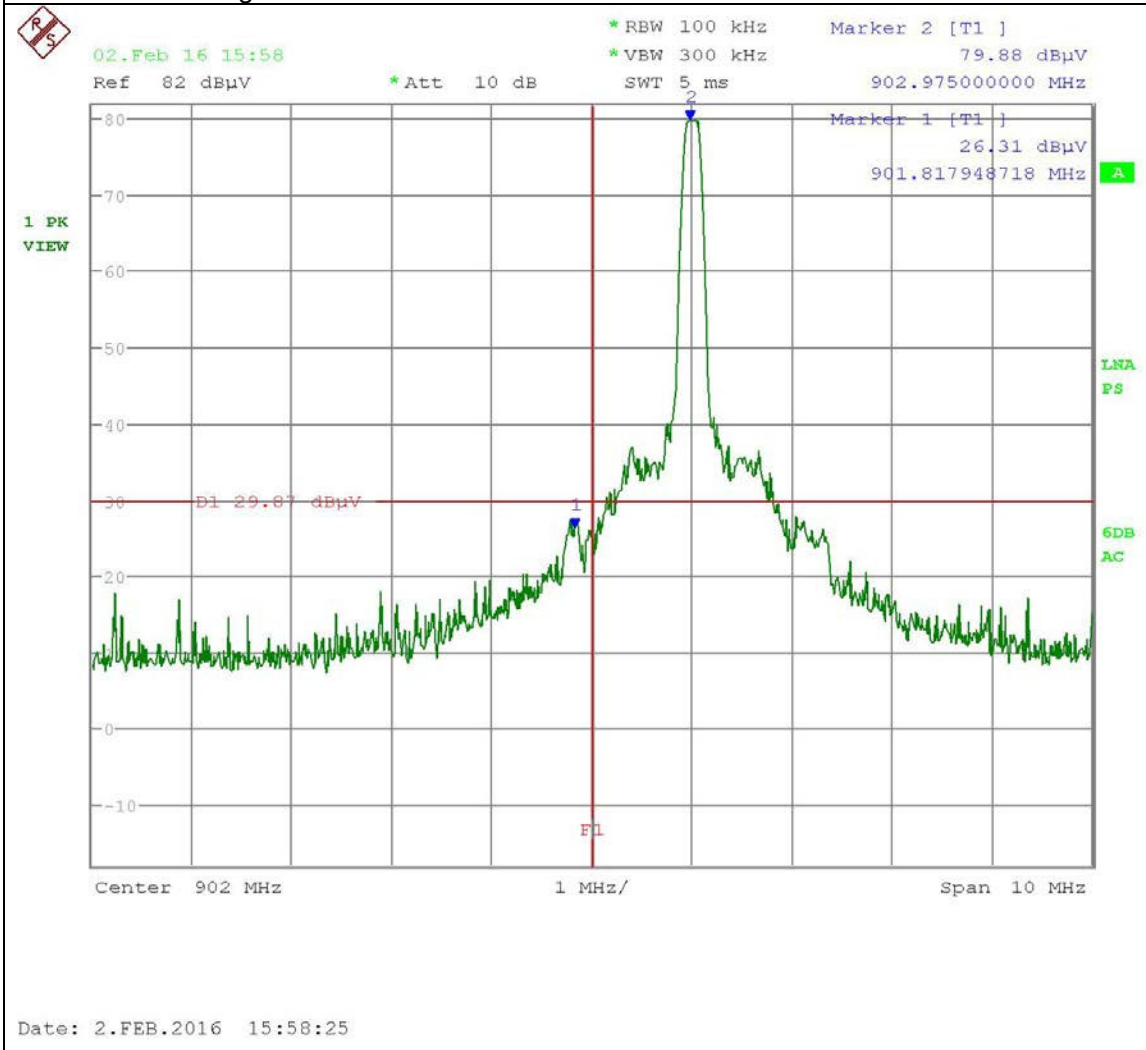
Rules Part No.: FCC 15.249(d) & IC RSS-210 § A2.9(b)

Requirements: The field strength of any emissions appearing outside the bandedges and up to 10 kHz above and below the band edges shall be attenuated at least 50 dB below the level of the carrier or to the general limits of 15.249.

Method of Measurement: ANSI C63.10 § 6.10 Band-edge testing

Test Data: Lower Bandedge

Lower Band Edge = 53.57 dBc



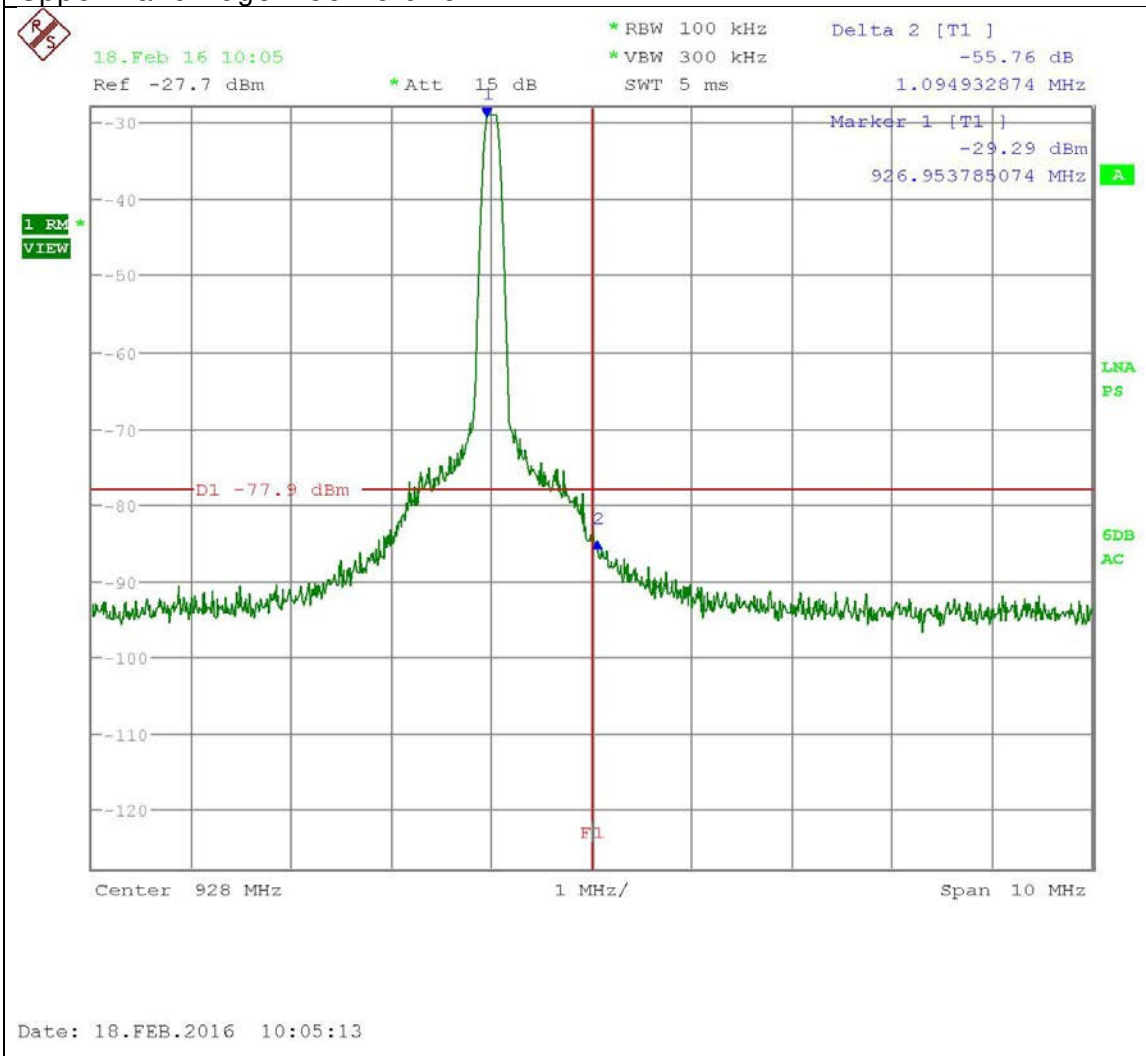
RESULTS MEET REQUIREMENTS

Table of Contents

BAND-EDGE

Test Data: Upper Bandedge

Upper Band Edge = 55.76 dBc



RESULTS MEET REQUIREMENTS

Table of Contents

PULSE DESENSITIZATION

Requirements: For EUT's employing pulse modulation and a rep rate of less than 20 Hz Calculation of the PDCF will be used to correct peak emission levels below 1 GHz to compare with the quasi peak limit as specified.

Procedure: ANSI C63.10 Annex C Calculation of Pulse Desensitization Correction Factor

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time long enough to capture the pulse rep rate. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the plot, the number of a given type of pulse is then multiplied by the duration of that type pulse.

$$\alpha_L\ (dB) = 20\log(t/T)$$

where

α_L is the Pulse desensitization correction factor (dB)
t is the pulse width
T is the Rep Rate

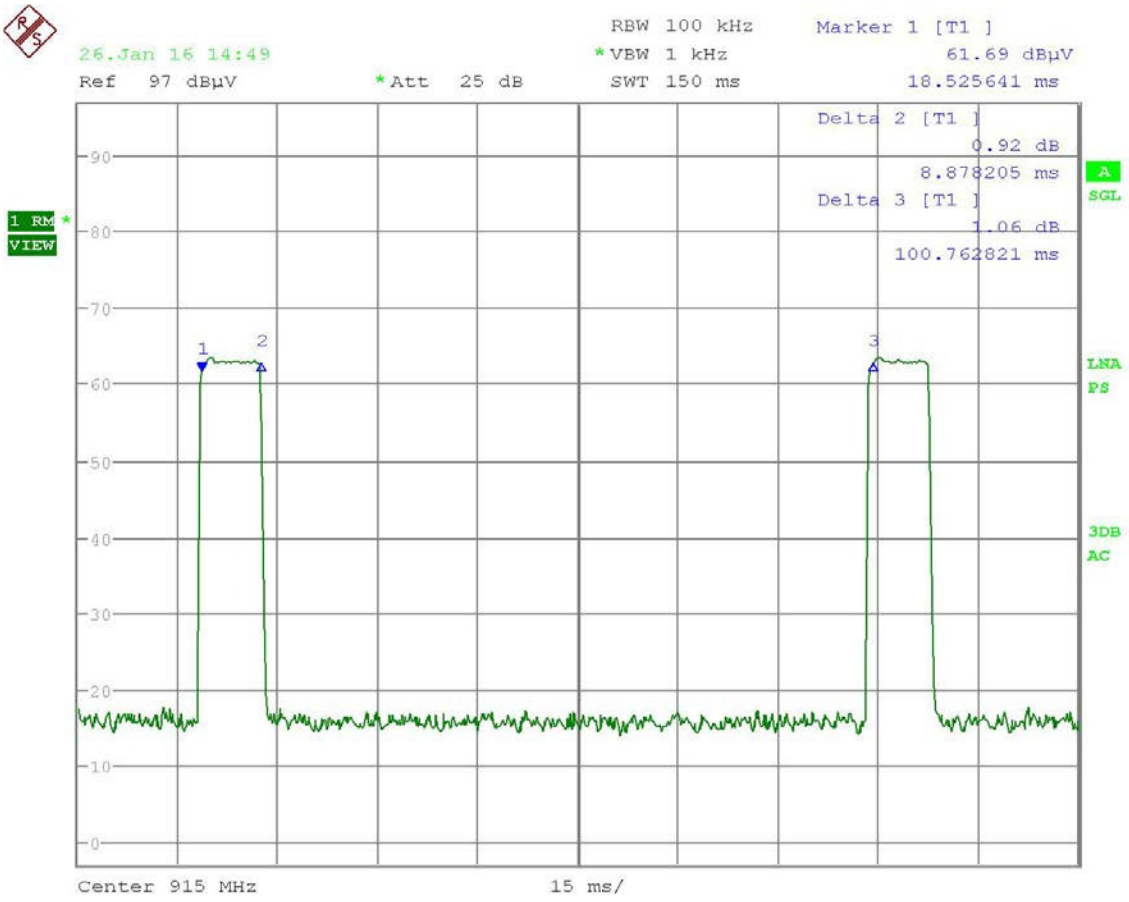
Test Data: **PDCF Calculation**

Pulse width	8.87ms
Rep Rate	100.7ms
α_L	-21 dB

See the following plots.

PULSE DESENSITIZATION

Test Data: **Plot of Pulse Train**



Date: 26.JAN.2016 14:49:50

DUTY CYCLE

Requirements: Calculation of duty cycle will be used to correct peak emission levels above 1 GHz to compare with the average limit.

Procedure: ANSI C63.10 Sec. 7.5 CALCULATION OF DUTY CYCLE CORRECTION

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the EUT is on within 100 ms.

$$\delta(dB) = 20 \log(\Delta)$$

where

δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

Test Data: **Duty Cycle Calculation**

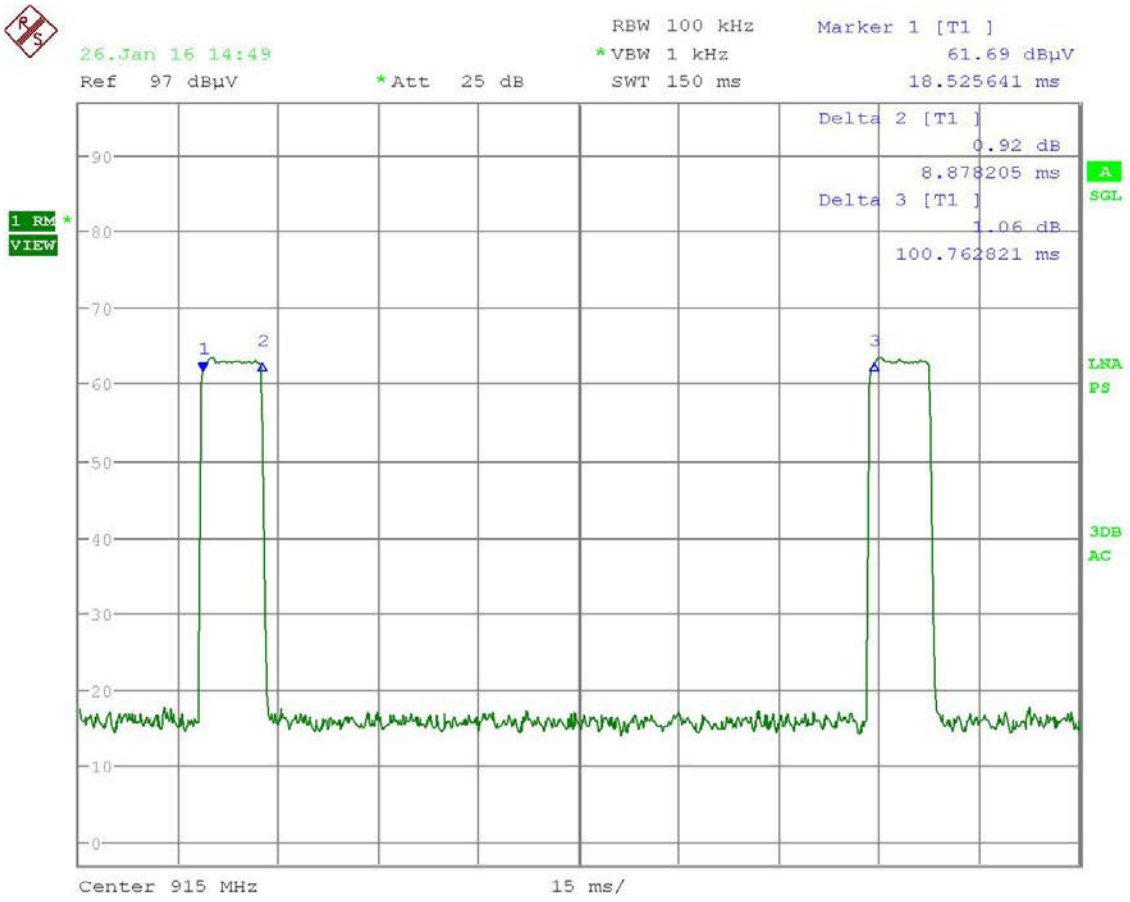
Pulse width	8.87ms
Rep Rate	100.7ms

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(8.87/100)
dB = 20*log(0.0887)
dB = -21

See the following plots.

DUTY CYCLE

Test Data: Plot of Pulse Train



Date: 26.JAN.2016 14:49:50

Table of Contents

RADIATION INTERFERENCE

Rules Part No.: FCC 15.249, 15.209 & IC RSS-210 ANNEX A2.9 (b), GEN § 8.9

Requirements: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

Frequency	Limits
Part 15.209 & RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters
Part 15.249 & RSS-210 (i8) ANNEX A.2.9	
Fundamental 902 – 928 MHz	94.0 dBµV/m @ 3 meters
Fundamental 2.4 – 2.4835 GHz	94.0 dBµV/m @ 3 meters
Harmonics	54.0 dBµV/m @ 3 meters

Method of Measurement: ANSI C63.10 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worst case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental. Emissions were scanned from 30MHz to the tenth harmonic of the fundamental frequency at three places in the band. All emissions greater than 20 dB from the limit are not reported.

Formula of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBuV	+ 10.36 dB	+ 0.5 = 30.86 dBuV/m @ 3m

RADIATION INTERFERENCE

Test Data: Low End of Band 9 KHz to 10th harmonic of Fundamental

Quasi Peak and Average Emissions							
Emission Frequency MHz	Meter Reading dBu V	PDCF / DCF dB	Antenna Polarity	Coax Loss Db	ACF dB	Field Strength dBu V/M	Margin
903	84.49	21	V	3.44	21.24	88.17	5.83
903	77.51	21	H	3.44	21.24	81.19	12.81
1806	26.93	20	V	4.94	30.55	42.42	11.58
1806	19.73	20	H	4.94	30.55	35.22	18.78
2709	25.21	20	V	6.04	32.67	43.92	10.08
2709	22.11	20	H	6.04	32.67	40.82	13.18
3612	13.61	20	V	6.96	33.52	34.09	19.91
6321	9.09	20	V	9.31	35.61	34.01	19.99
7224	8.40	20	V	10.53	35.72	34.65	19.35
8127	8.78	20	H	10.53	35.72	35.03	18.97
8127	8.86	20	V	11.03	35.92	35.81	18.19
9030	9.86	20	H	11.03	35.92	36.81	17.19

Peak Emissions							
Emission Frequency MHz	Meter Reading dBu V	Detector	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
1806	26.93	Peak	V	4.94	30.55	62.42	11.58
1806	19.73	Peak	H	4.94	30.55	55.22	18.78
2709	25.21	Peak	V	6.04	32.67	63.92	10.08
2709	22.11	Peak	H	6.04	32.67	60.82	13.18
3612	13.61	Peak	V	6.96	33.52	54.09	19.91
6321	9.09	Peak	V	9.31	35.61	54.01	19.99
7224	8.40	Peak	V	10.53	35.72	54.65	19.35
8127	8.78	Peak	H	10.53	35.72	55.03	18.97
8127	8.86	Peak	V	11.03	35.92	55.81	18.19
9030	9.86	Peak	H	11.03	35.92	56.81	17.19
9030	8.86	Peak	V	11.03	35.92	55.81	18.19

Note:

1. Quasi- Peak & Average Emissions, calculated by correcting the peak value of the emission
2. Emissions greater than 20 dB of the specified limit are not reported.

RESULTS MEET REQUIREMENTS

RADIATION INTERFERENCE

Test Data: Middle of Band 9 KHz to 10th harmonic of Fundamental

Quasi Peak and Average Emissions							
Emission Frequency MHz	Meter Reading dBu V	PDCF / DCF dB	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
915.00	83.60	21.00	V	3.47	22.00	88.07	5.93
915.00	74.42	21.00	H	3.47	22.00	78.89	15.11
2745.00	25.49	20.00	V	5.98	32.78	44.25	9.75
2745.00	20.57	20.00	H	6.08	32.47	39.12	14.88
7320.00	9.31	20.00	H	9.94	35.46	34.71	19.29
7320.00	9.62	20.00	V	9.94	35.46	35.02	18.98
8235.00	8.99	20.00	V	10.54	35.74	35.27	18.73
8235.00	8.90	20.00	H	10.54	35.74	35.18	18.82
9150.00	9.81	20.00	H	11.06	35.96	36.83	17.17
9150.00	8.68	20.00	V	11.06	35.96	35.70	18.30

Peak Emissions							
Emission Frequency MHz	Meter Reading dBu V	Detector	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
2745.00	25.49	PEAK	V	5.98	32.78	64.25	9.75
2745.00	20.57	PEAK	H	6.08	32.47	59.12	14.88
7320.00	9.31	PEAK	H	9.94	35.46	54.71	19.29
7320.00	9.62	PEAK	V	9.94	35.46	55.02	18.98
8235.00	8.99	PEAK	V	10.54	35.74	55.27	18.73
8235.00	8.90	PEAK	H	10.54	35.74	55.18	18.82
9150.00	9.81	PEAK	H	11.06	35.96	56.83	17.17
9150.00	8.68	PEAK	V	11.06	35.96	55.70	18.30

Note:

1. Quasi- Peak & Average Emissions, calculated by correcting the peak value of the emission
2. Emissions greater than 20 dB of the specified limit are not reported.

RESULTS MEET REQUIREMENTS

RADIATION INTERFERENCE

Test Data: High end of Band 9 KHz to 10th harmonic of Fundamental

Quasi Peak and Average Emissions							
Emission Frequency MHz	Meter Reading dBu V	PDCF / DCF dB	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
928.00	83.27	21.00	V	3.49	22.70	88.46	5.54
928.00	73.38	21.00	H	3.49	22.70	78.57	15.43
1830.00	27.37	20.00	V	4.93	31.28	43.58	10.42
1856.00	24.91	20.00	H	4.93	31.29	41.13	12.87
2784.00	21.23	20.00	H	6.11	32.28	39.62	14.38
2784.00	24.83	20.00	V	6.11	32.28	43.22	10.78
3712.00	18.54	20.00	H	7.06	33.70	39.30	14.70
4640.00	19.71	20.00	H	7.92	33.94	41.57	12.43
6496.00	8.96	20.00	H	9.44	35.70	34.10	19.90
6496.00	13.92	20.00	V	9.44	35.70	39.06	14.94
7424.00	9.28	20.00	V	10.07	35.60	34.95	19.05
7424.00	10.41	20.00	H	10.07	35.60	36.08	17.92
8352.00	9.62	20.00	H	10.66	35.70	35.98	18.02
8352.00	8.46	20.00	V	10.66	35.70	34.82	19.18
9280.00	9.11	20.00	H	11.20	36.26	36.57	17.43

Peak Emissions							
Emission Frequency MHz	Meter Reading dBu V	Detector	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
1830.00	27.37	PEAK	V	4.93	31.28	63.58	10.42
1856.00	24.91	PEAK	H	4.93	31.29	61.13	12.87
2784.00	21.23	PEAK	H	6.11	32.28	59.62	14.38
2784.00	24.83	PEAK	V	6.11	32.28	63.22	10.78
3712.00	18.54	PEAK	H	7.06	33.70	59.30	14.70
4640.00	19.71	PEAK	H	7.92	33.94	61.57	12.43
6496.00	8.96	PEAK	H	9.44	35.70	54.10	19.90
6496.00	13.92	PEAK	V	9.44	35.70	59.06	14.94
7424.00	9.28	PEAK	V	10.07	35.60	54.95	19.05
7424.00	10.41	PEAK	H	10.07	35.60	56.08	17.92
8352.00	9.62	PEAK	H	10.66	35.70	55.98	18.02
8352.00	8.46	PEAK	V	10.66	35.70	54.82	19.18
9280.00	9.11	PEAK	H	11.20	36.26	56.57	17.43

Note:

1. Quasi- Peak & Average Emissions, calculated by correcting the peak value of the emission
2. Emissions greater than 20 dB of the specified limit are not reported.

RESULTS MEET REQUIREMENTS

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/ Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic	Eaton	96005	1243	07/14/15	07/14/17
Digital Multimeter	Fluke	77	35053830	10/21/15	10/21/17
CHAMBER	Panashield	N/A	N/A	01/05/16	03/01/16
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17

*** EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

Table of Contents