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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	CN2818A
IC	1007A-818A
Model Number	21T18A
Product Description	TRANSMITTER
Date Sample Received	06/1/2018
Final Test Date	06/11/2018
Tested By	Tim Royer
Approved By	Franklin Rose

Report Number	Version Number	Description	Issue Date
772UT18TestReport	Rev1	Initial Issue	06/18/2018
772UT18TestReport	Rev2	Updated Summary and frequency range Added IC test site number	07/18/2018

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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 and was selected by the customer.

☐ 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 requirements.

I attest that the necessary measurements were made at:

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

Sr. EMC Engineer
EMC-003838-NE

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Date: 6/12/2018

Reviewed and approved by:
Name and Title: Franklin Rose, Project Manager/ EMC Testing Technician

Date: 06/18/2018

GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.249 IC RSS-210 Issue 8 A2.9 & RSS-GEN Issue 4		
FCC ID	CN2818A		
IC	1007A-818A		
Model	21T18A		
EUT Description	TRANSMITTER		
Operating Frequency	TX: 903-927MHz		
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	None		
Antenna	Integral		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070 ISED Test Site #: 2056A		
Measurement Standard	ANSI C63.10-2013 ANSI C63.4-2014 (Radiated Site Validation)		

Test Supporting Equipment

Device	Manufacturer	Model	S/N	Supplied By	Used For
N/A					

RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Test Item	Result
2.1049	RSS-GEN 6.6	Occupied Bandwidth	99% Bandwidth	**Pass**
15.249(a)(c)	RSS-210 § A2.9(a)	Fundamental and Harmonics	Radiated Spurious Emissions	**Pass**
15.249(d)(e)	RSS-247 § 5.5	Spurious Emissions	Bandedge	**Pass**
			Radiated Spurious Emissions	**Pass**
15.207(a)	RSS-GEN § 8.8	AC Conducted Emissions	AC Powerline Conducted Emissions	**N/A**

OCCUPIED BANDWIDTH

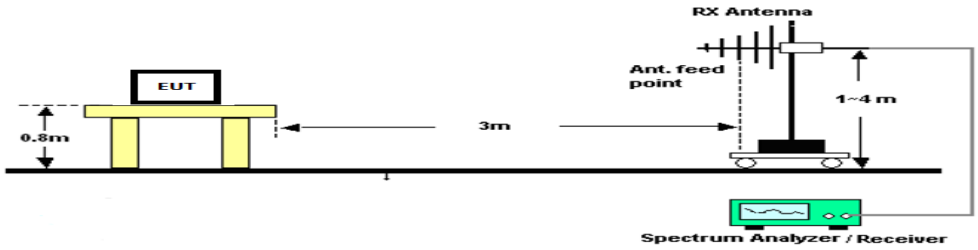
Rules Part No.: FCC 2.1049, FCC 15.215(c), IC RSS GEN § 6.6

FCC 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.

IC Requirements: Reporting Only

Test Method: THE TEST PROCEDURES USED ARE DETAILED IN THE STANDARD LISTED ABOVE.

Setup:



Test Data: **99% Occupied Bandwidth Measurement Table**

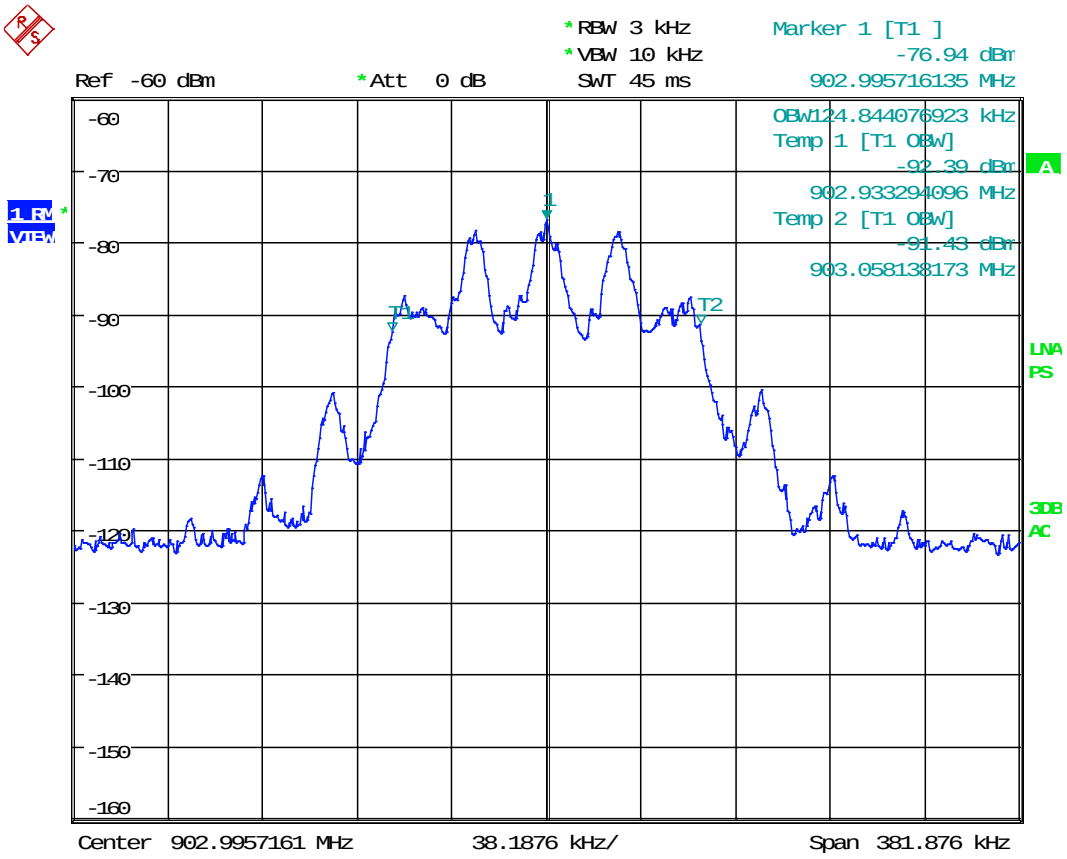
Tuned Frequency (MHz)	99% BW (KHz)	20dB BW (KHz)
903	124.84	135.41
915	123	130.6
927	121.78	130.6

Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to ANSI C63.26, 5.4.4, Step e).

RESULTS:

OCCUPIED BANDWIDTH

Test Data: **99% OBW (903MHz)**

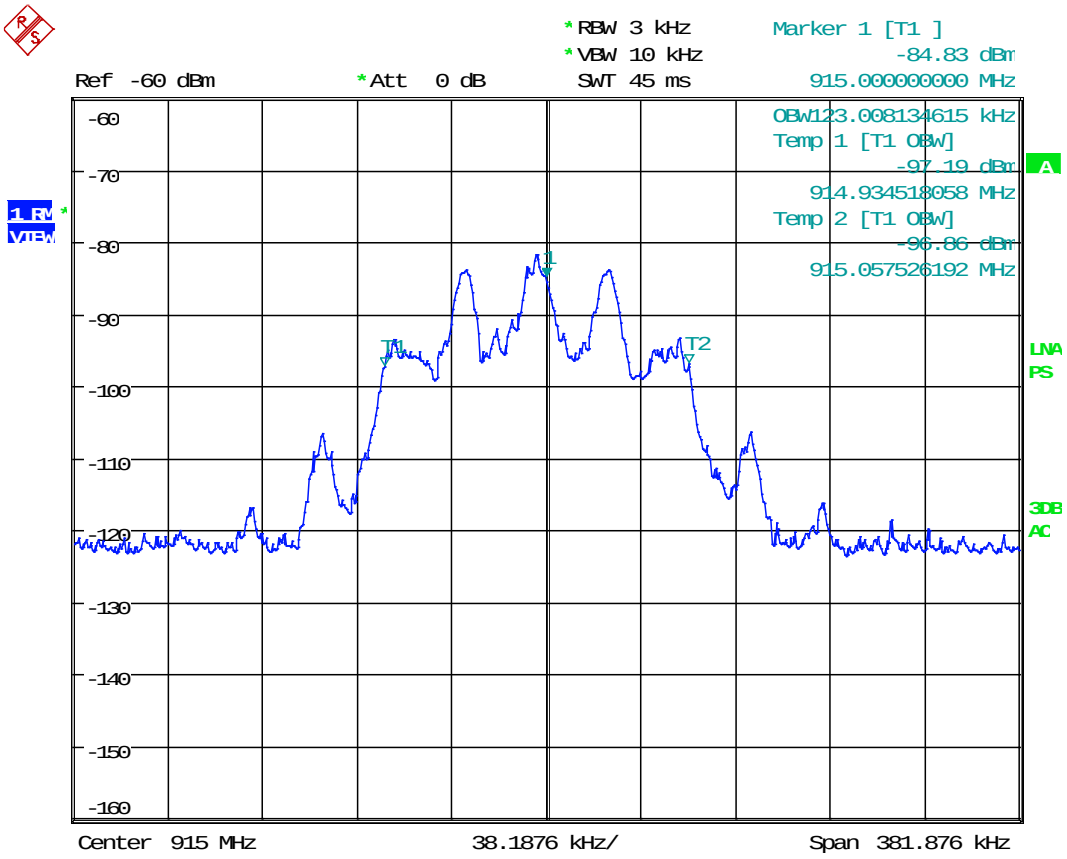


Date: 7.JUN.2018 15:55:45

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% OBW (915MHz)**

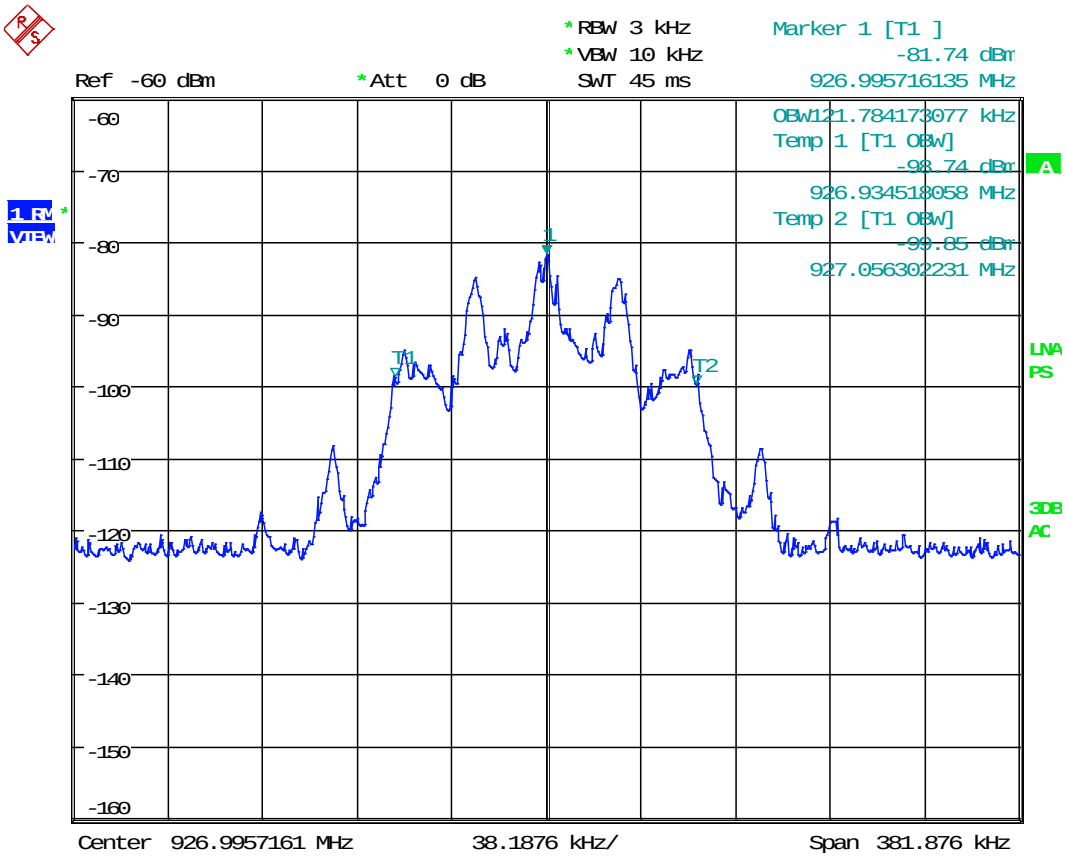


Date: 7.JUN.2018 15:41:43

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% OBW (927MHz)**

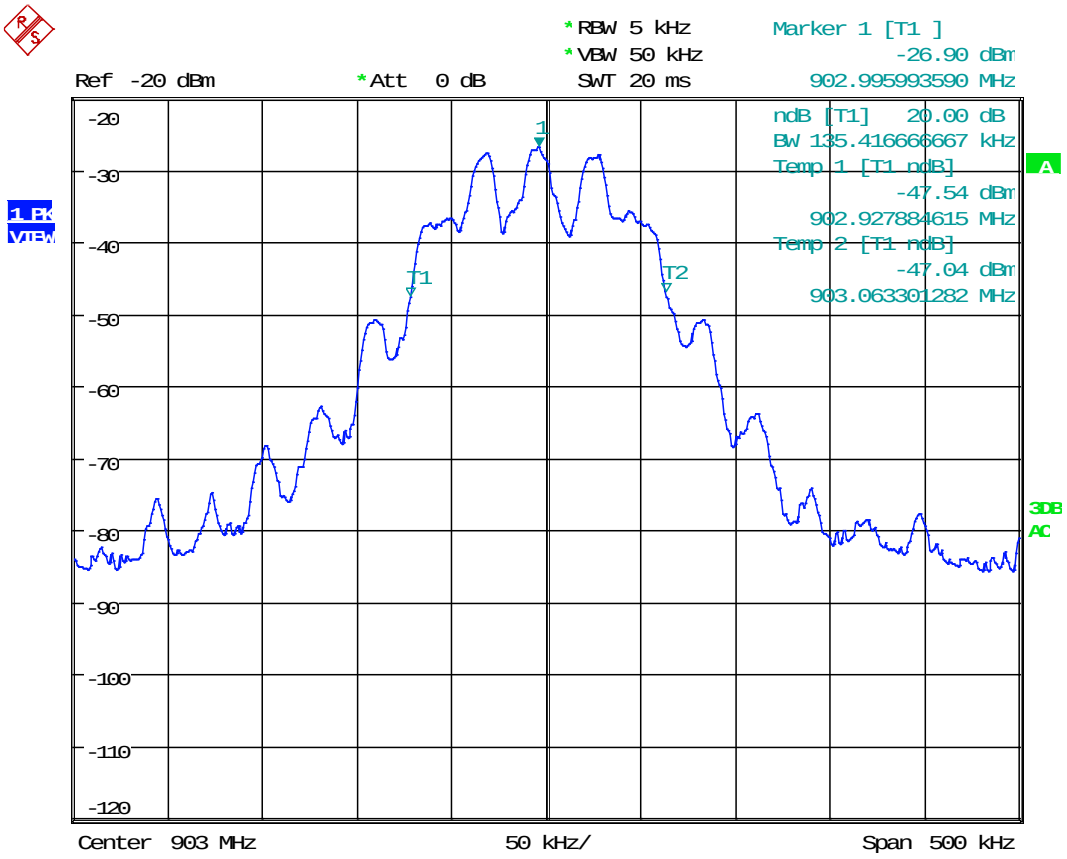


Date: 7.JUN.2018 15:43:26

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20dB OBW (903MHz)**

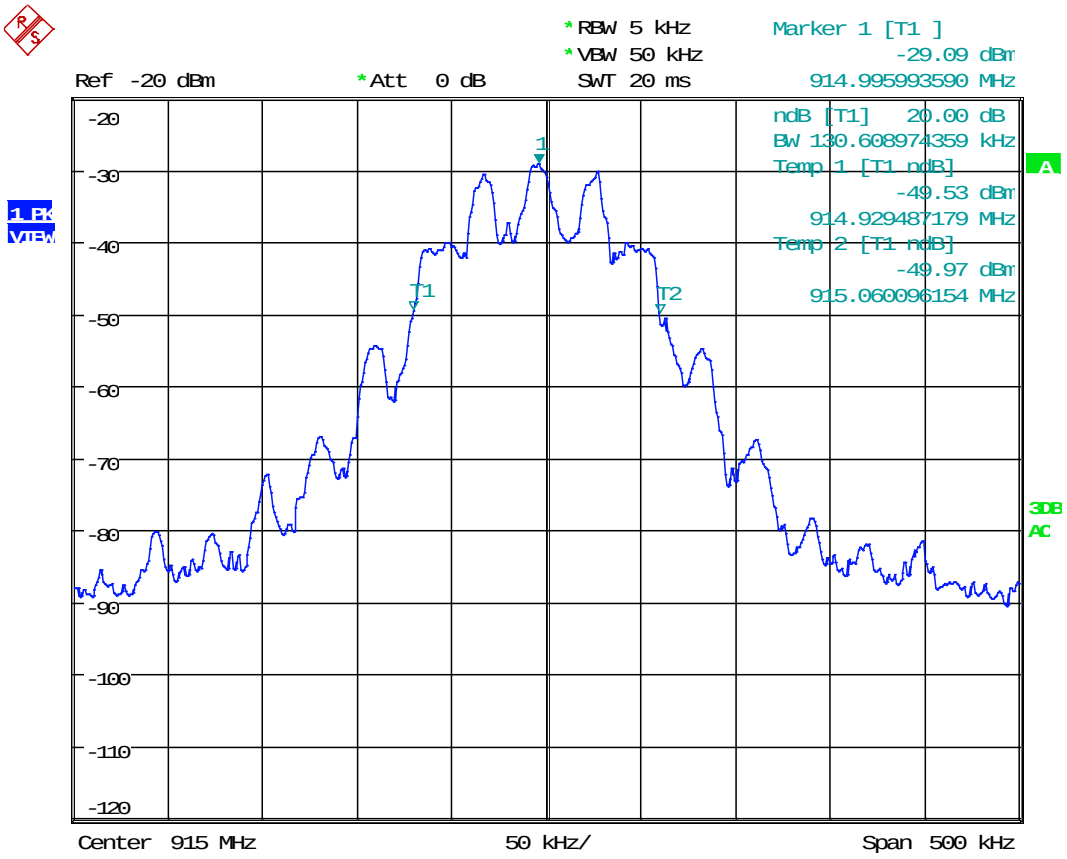


Date: 8.JUN.2018 14:27:14

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20dB OBW (915MHz)**

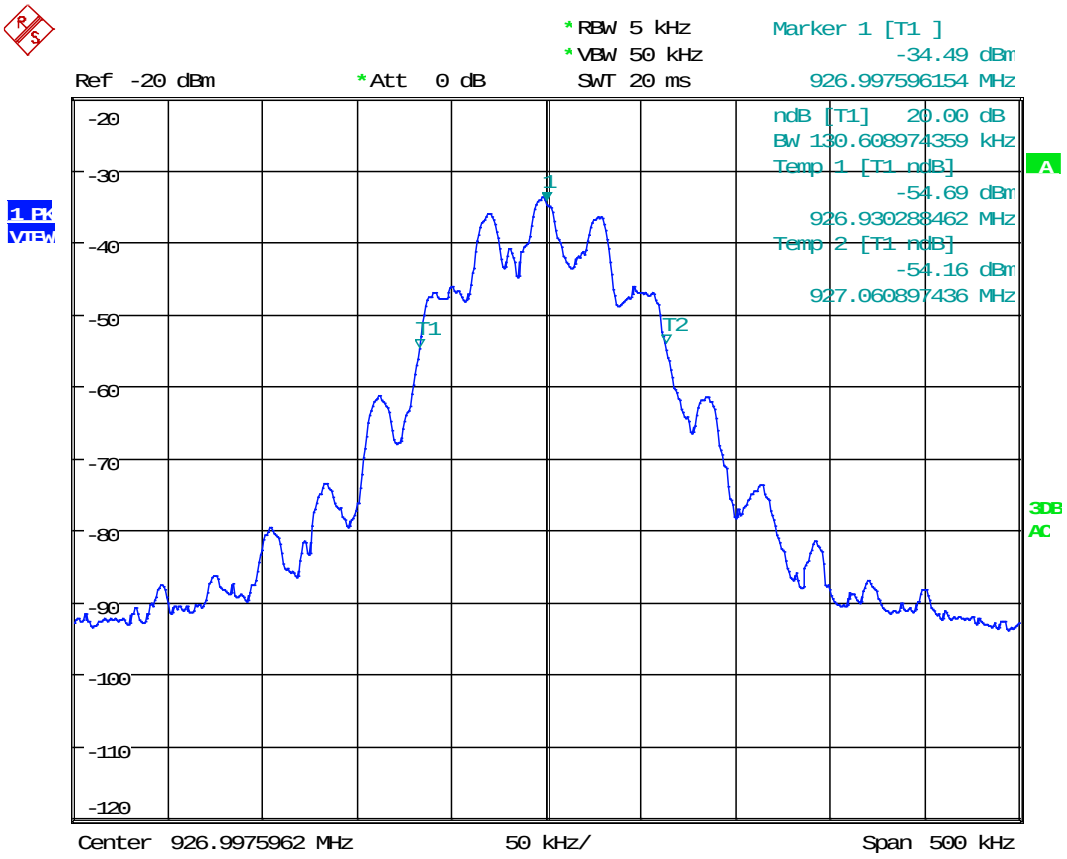


Date: 8.JUN.2018 14:25:42

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20dB OBW (927MHz)**



Date: 8.JUN.2018 14:21:56

RESULTS: Meets Requirements

BANDEDGE

Rule Part No.: FCC 15.249(d), IC RSS 210 § A2.9(b)

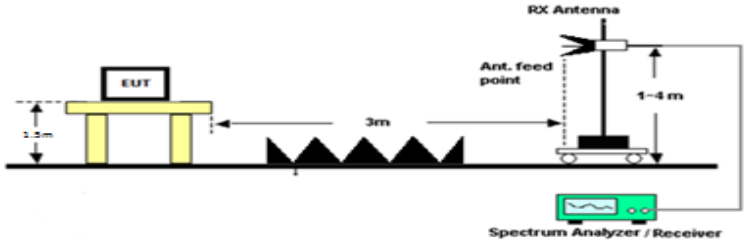
Requirements: Emissions must be at least 50 dB down from the highest emission level Within the authorized band as measured with a 100 kHz RBW, or to the limits of 15.209.

Test Method: THE TEST PROCEDURES USED ARE DETAILED IN THE STANDARD LISTED ABOVE.

Setup:

Emissions 30 – 1000 MHz

Emissions above 1 GHz

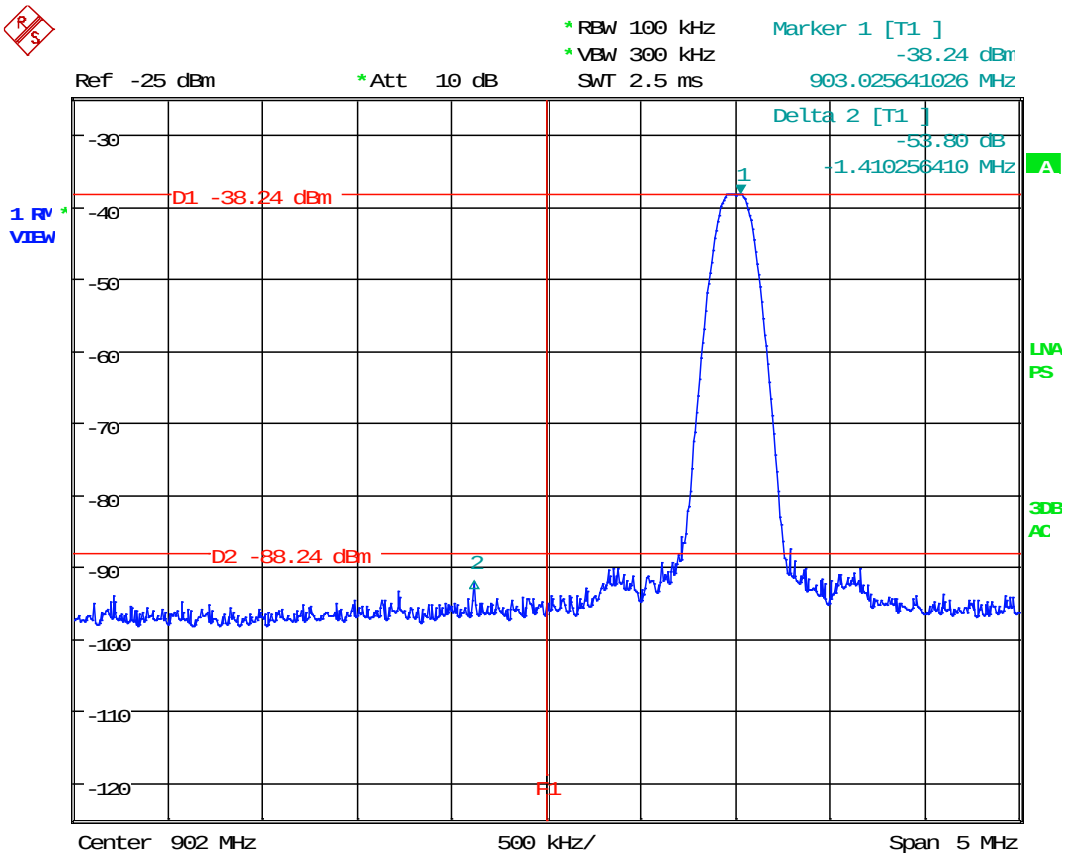


Test Data: **Bandedge Measurement Table**

Bandedge	Tuned Frequency (MHz)	Measured Level (dBc)	Limit (dBc)	Margin (dB)
Lower	903	53.8	50	3.8
Upper	927	55.63	50	5.63

Results Meet Requirements

Test Data: **Lower Band Edge Plot**

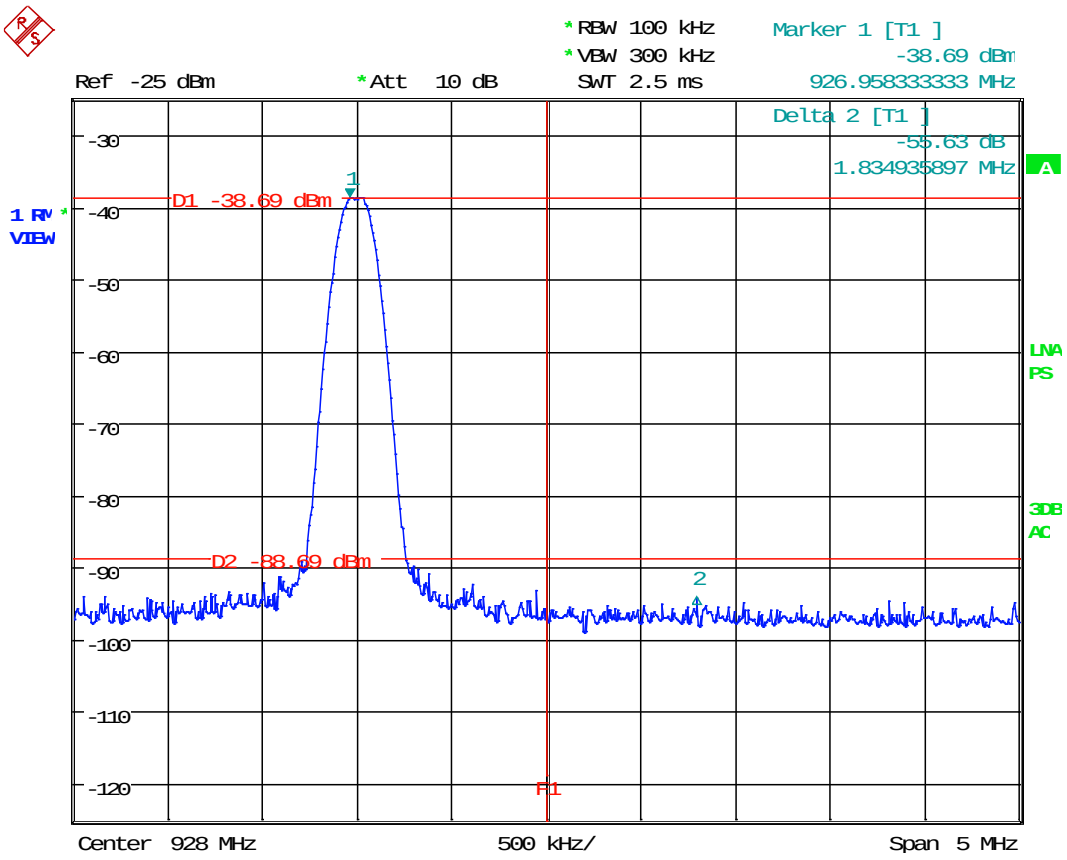


Date: 8.JUN.2018 09:39:13

RESULTS: Meets Requirements

BANDEDGE

Test Data: **Upper Band Edge Plot**



Date: 8.JUN.2018 09:41:54

RESULTS: Meets Requirements

PULSE DESENSITIZATION

Requirements: 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	8.5ms
Rep Rate	239ms
α_L	-28.97 dB

See the following plots.

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.

$$\delta(\mathrm{dB}) = 20\log(\Delta)$$

where

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

Test Data: Duty Cycle Calculation

Pulse width	8.5ms
Rep Rate	100ms

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(8.5/100)
dB = 20*log(0.085)
dB = -21.41

See the following plots.

RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.249 (a)(c)(d)(e)

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

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation

Field strength limits are specified at a distance of 3 meters

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	
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	
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

Test Method: ANSI C63.4 § Annex D Validation of radiated emissions standard test sites
ANSI C63.10 § 6.3 Common requirements radiated emissions
ANSI C63.10 § 6.4 Emissions below 30 MHz
ANSI C63.10 § 6.5 Emissions between 30 & 1000 MHz
ANSI C63.10 § 6.6 Emissions above 1 GHz

Field Strength Calculation:

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

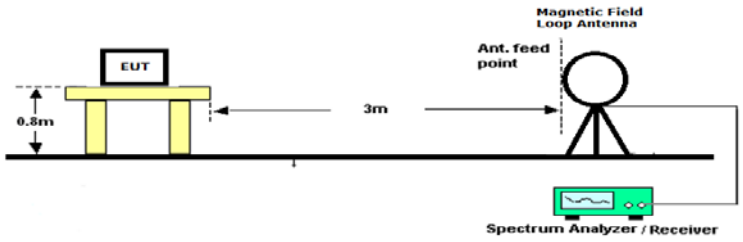
Example:

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

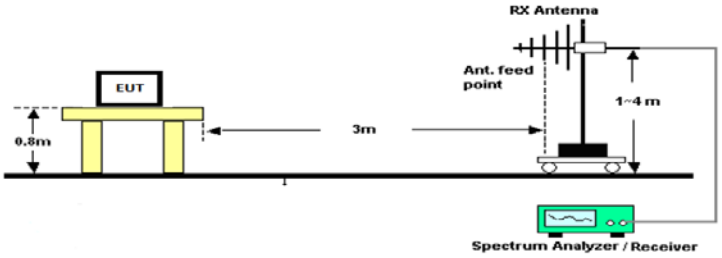
RADIATED SPURIOUS EMISSIONS

Setup:

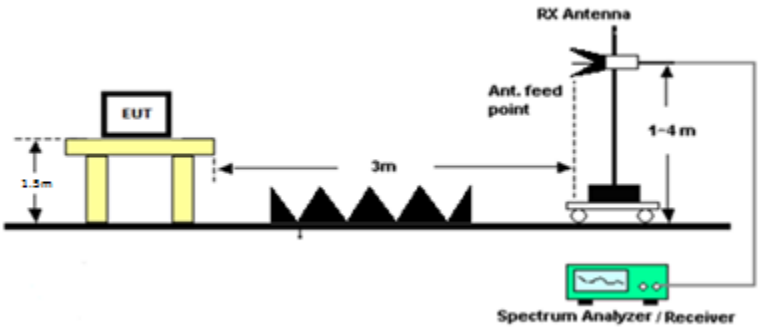
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



RADIATED SPURIOUS EMISSIONS

Notes: The EUT was checked in three orthogonal planes as required, a setup photo is provided to show the orientation of the worst case position.

Only emissions within 20dB of the limit are reported.

The spectrum was measured from 9 KHz to 10 GHz

Test Data: **Field Strength at 3 Meters Measurement Table**

Tuned Freq MHz	Emission Frequency MHz	Meter Reading dBu V	Correction Factor	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
903	896.50	13.13	28.97	H	3.55	21.80	9.51	36.49
903	903.00	76.61	28.97	H	3.54	21.90	73.08	20.92
903	903.00	66.78	28.97	V	3.54	21.90	63.25	30.75
903	923.17	16.42	28.97	H	3.58	23.88	14.91	31.09
903	942.40	15.67	28.97	H	3.59	23.70	13.99	32.01
903	1790.00	26.74	21.41	V	5.07	30.55	40.95	13.05
903	1790.00	12.74	21.41	H	5.07	30.55	26.95	27.05
903	2689.10	9.77	21.41	V	6.18	32.65	27.19	26.81
903	2689.10	8.38	21.41	H	6.18	32.65	25.80	28.20
903	3615.30	9.06	21.41	H	7.15	33.54	28.34	25.66
915	896.25	11.36	28.97	H	3.55	21.80	7.74	38.26
915	915.00	61.55	28.97	V	3.57	23.10	59.24	34.76
915	915.00	72.56	28.97	H	3.57	23.10	70.25	23.75
915	1817.30	21.24	21.41	H	5.11	31.03	35.97	18.03
915	1817.30	26.38	21.41	V	5.11	31.03	41.11	12.89
915	2743.50	12.69	21.41	H	6.24	32.51	30.03	23.97
915	2743.50	9.90	21.41	V	6.24	32.51	27.24	26.76
927	321.89	9.22	28.97	H	2.09	13.80	-3.86	49.86
927	927.00	69.84	28.97	H	3.58	23.50	67.95	26.05
927	927.00	57.89	28.97	V	3.58	23.50	56.00	38.00
927	1844.50	26.60	21.41	V	5.11	31.48	41.78	12.22
927	1844.50	25.96	21.41	H	5.11	31.48	41.14	12.86
927	2770.80	16.25	21.41	H	6.27	32.40	33.51	20.49

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1057	Eaton	94455-1	1057	N/A	N/A
Antenna: Log-Periodic 1243	Eaton	96005	1243	04/20/18	04/20/21
CHAMBER	Panashield	3M	N/A	12/31/17	12/31/19
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/11/19
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/19
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	08/09/16	08/09/18
Band Reject Filter 2.4 GHz	Micro-Tronics	BRM50702-02	-G042	09/27/16	09/27/18
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Pre-amp	RF-LAMBDA	RLNA00M45GA	N/A	01/04/16	01/04/19

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT