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FCC PART 15.249 & IC RSS-210

UNLICENSED INTENTIONAL RADIATOR

TEST REPORT

Applicant	JL MARINE SYSTEMS INC.
Address	9010 PALM RIVER RD
	TAMPA FL 33619 USA
FCC ID	A7FEA103
IC	11454A-EA103
Model Number	CM2-GTW-N2K
Product Description	NMEA2000 GATEWAY
Date Sample Received	06/23/2019
Final Test Date	06/26/2019
Tested By	Tim Royer
Approved By	Franklin Rose

Report Number	Version Number	Description	Issue Date
1589UT19TestReport	Rev1	Initial Issue	06/26/2019

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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: 06/26/2019

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

Date: 06/26/2019

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	A7FEA103		
IC	11454A-EA103		
Model	CM2-GTW-N2K		
EUT Description	NMEA2000 GATEWAY		
Operating Frequency	TX: 921 MHz		
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☒ DC Power		
	☐ Battery Operated		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☒ Mobile	☐ Portable
Antenna Connector	None		
Antenna	Integral		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070 ISED Test Site: 2056-A		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 ANSI C63.4-2014 (Radiated Site Validation)		
Test Exercise	EUT was operated in a normal operational mode		

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

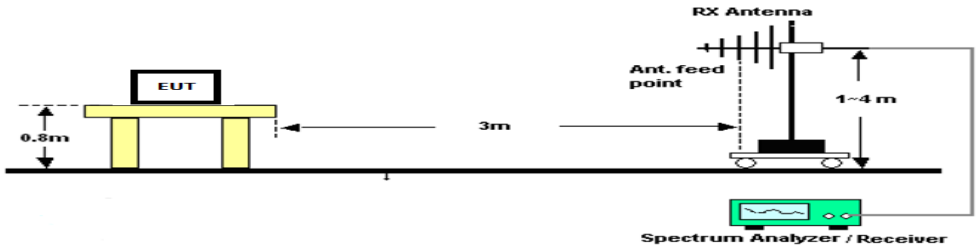
Rules Part No.: FCC 2.1049, FCC 15.215(c), IC RSS GEN § 6.6

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**

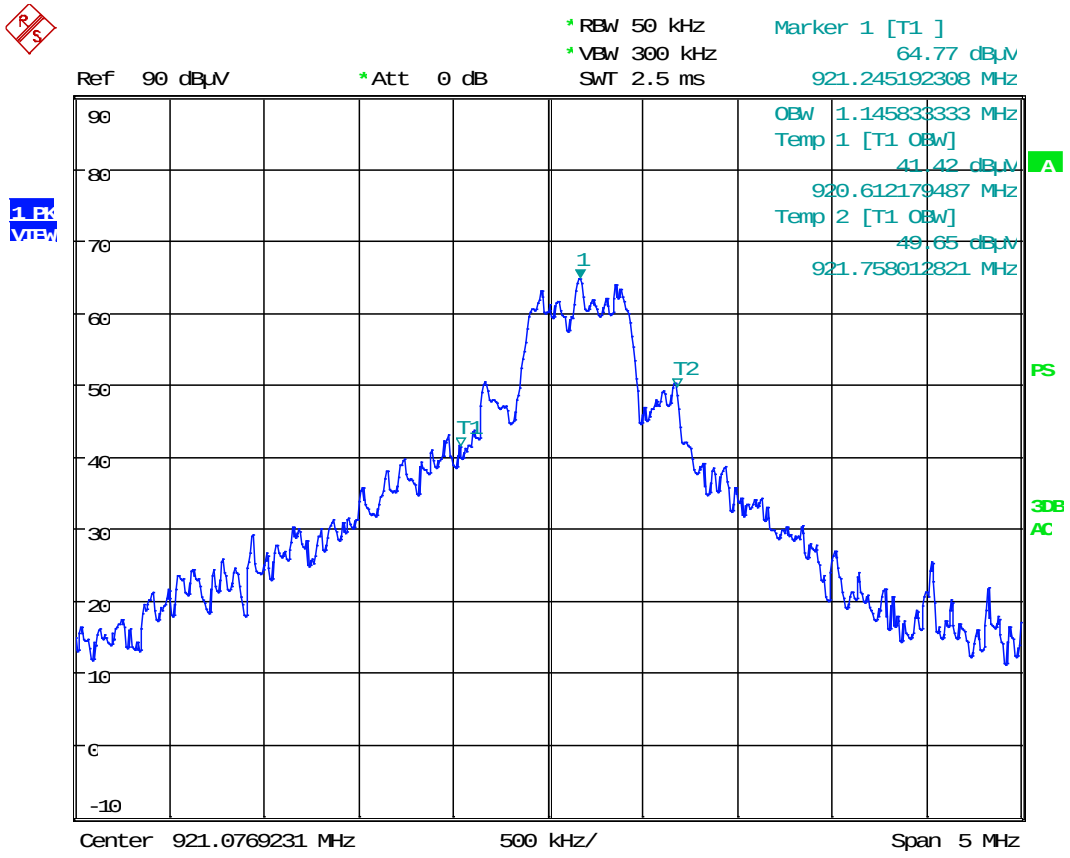
Tuned Frequency (MHz)	99% BW (MHz)	20dB BW (MHz)
921	1.14	1.53

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: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% OBW (921MHz)**

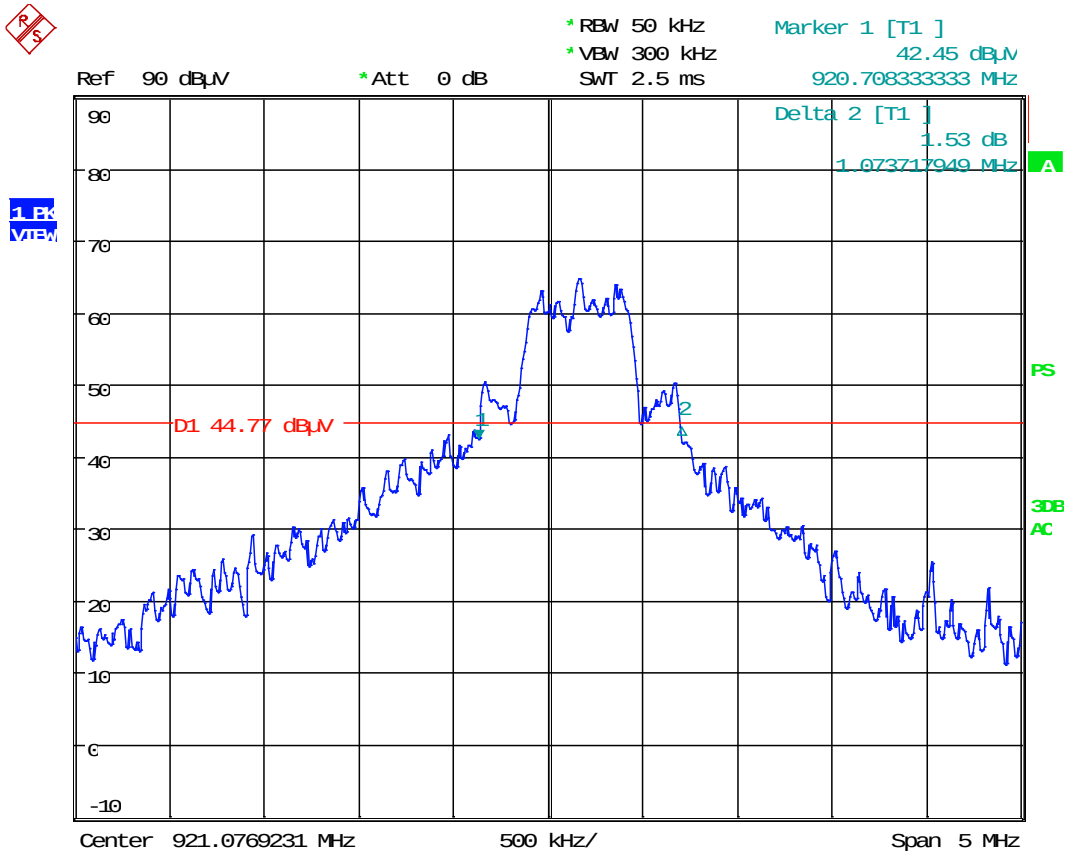


Date: 25.JUN.2019 17:18:00

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20dB OBW (921MHz)**



Date: 25.JUN.2019 17:19:32

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

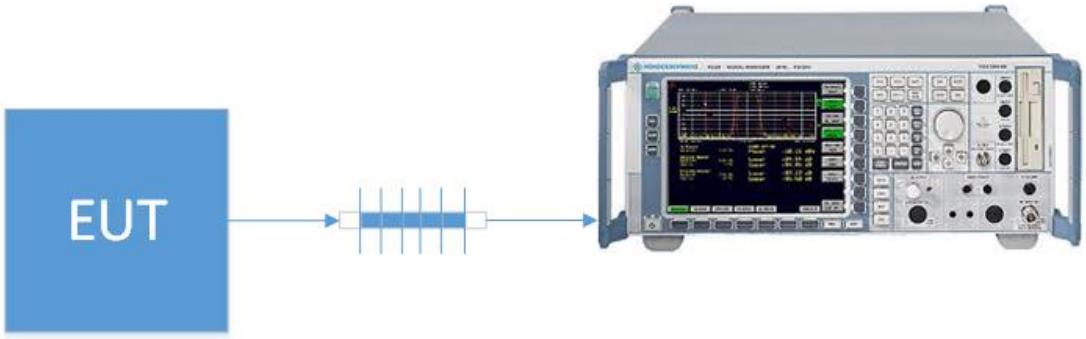
BANDEDGE

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

Test Method: ANSI C63.10 § 6.10.4 Authorized band-edge relative method

Setup:



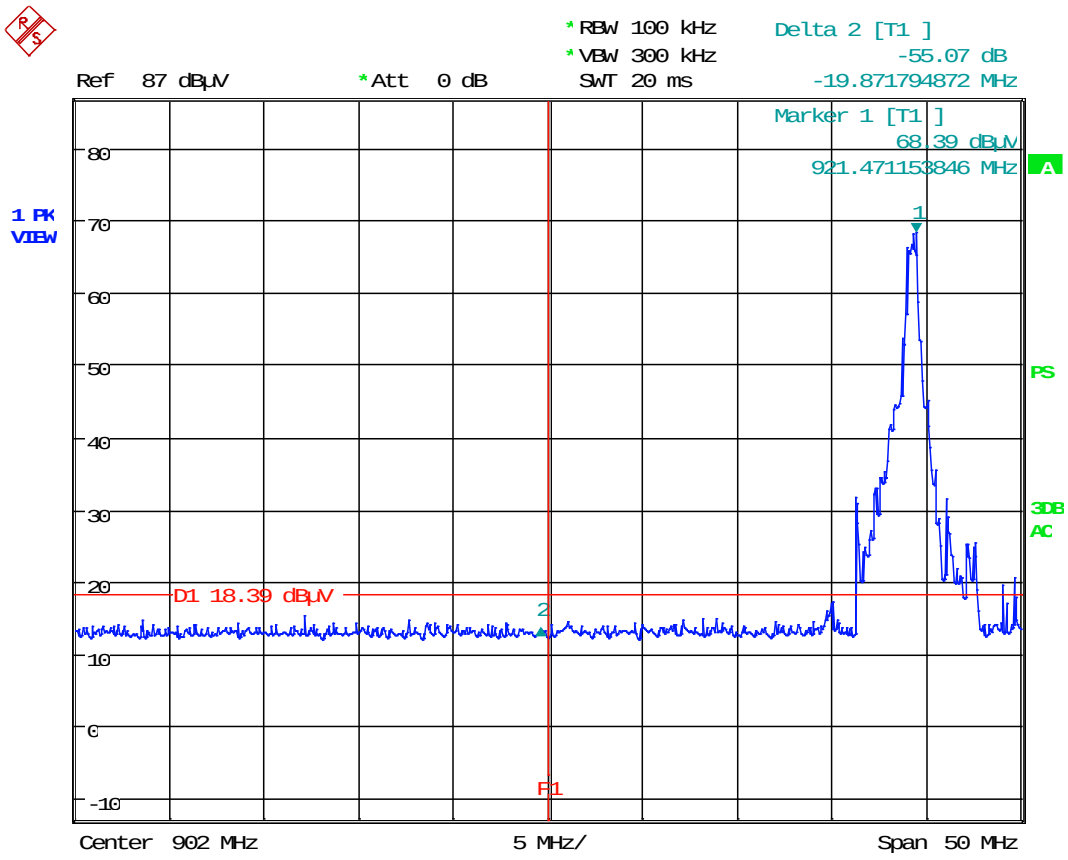
Test Data: **Bandedge Measurement Table**

Bandedge	Tuned Frequency (MHz)	Measured Level (dBc)	Limit (dBc)	Margin (dB)
Lower	901.6	55.07	50	5.07
Upper	929.56	63.12	50	13.12

Results Meet Requirements

BANDEDGE

Test Data: **Low End of Band Lower Band Edge Plot**



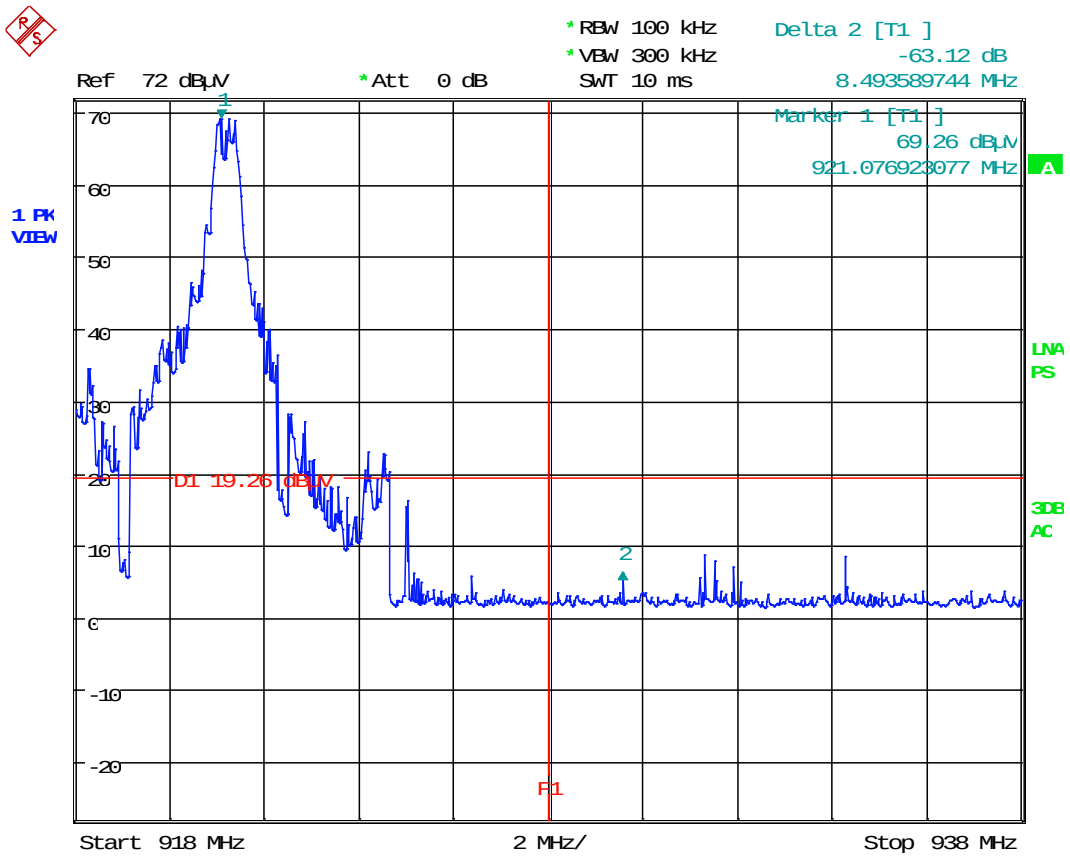
Date: 25.JUN.2019 16:51:20

RESULTS:

Meets Requirements

BANDEDGE

Test Data: **Upper Band Edge Plot**



Date: 25.JUN.2019 17:11:19

RESULTS: Meets Requirements

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.

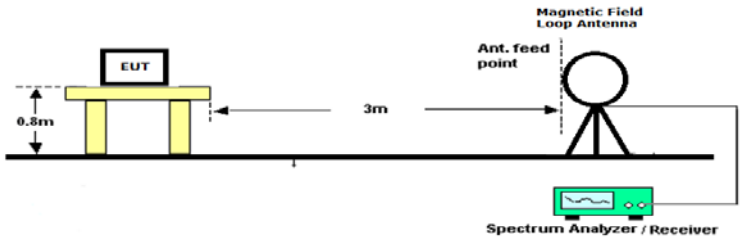
Example:

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

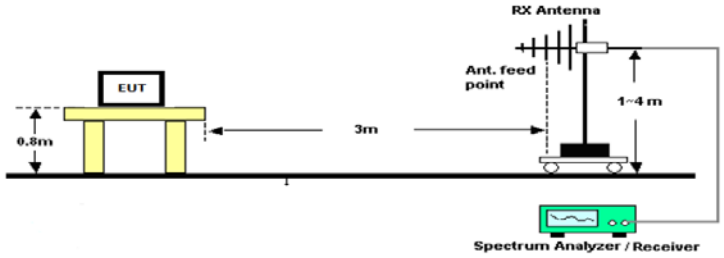
RADIATED SPURIOUS EMISSIONS

Setup:

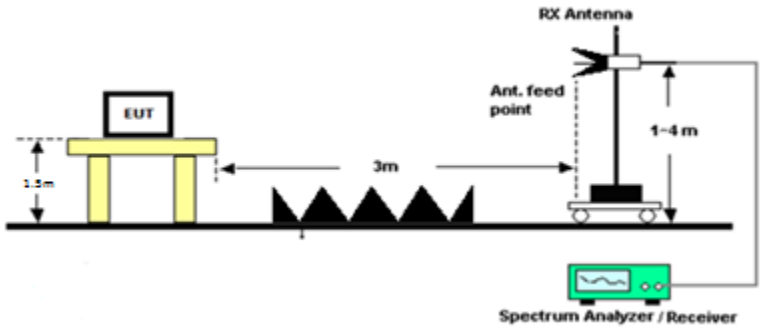
Emissions below 30 MHz



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 18 GHz

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

Tuned Freq MHz	Emission Frequency MHz	Detector	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
0.00	43.89	PK	20.98	V	0.75	12.72	34.45	19.55
0.00	144.15	PK	18.50	H	1.36	15.83	35.69	18.31
0.00	396.15	PK	18.73	V	2.28	15.30	36.31	17.69
0.00	633.33	PK	17.12	H	2.93	19.60	39.65	14.35
921.00	921.00	PK	73.82	V	3.58	23.90	101.30	2.70
921.00	921.00	PK	72.94	H	3.58	23.90	100.42	3.58
921.00	921.00	AVG	64.40	V	3.58	23.90	91.88	2.12
921.00	921.00	AVG	61.30	H	3.58	23.90	88.78	5.22
921.00	1842.00	PK	26.89	V	4.97	30.79	62.65	11.35
921.00	1842.00	AVG	-1.70	V	4.97	30.79	34.06	19.94
921.00	1842.00	AVG	-2.20	H	4.97	30.79	33.56	20.44
921.00	1842.00	PK	27.91	H	4.97	30.79	63.67	10.33
921.00	2763.00	PK	20.06	H	6.10	32.42	58.58	15.42
921.00	2763.00	AVG	-8.50	H	6.10	32.42	30.02	23.98
921.00	2763.00	AVG	-8.50	V	6.10	32.42	30.02	23.98
921.00	2763.00	PK	15.89	V	6.10	32.42	54.41	19.59
921.00	3684.00	PK	9.54	V	6.54	33.19	49.27	4.73
921.00	3684.00	PK	9.54	H	6.54	33.19	49.27	4.73
921.00	4605.00	PK	8.88	H	7.52	34.04	50.44	3.56
921.00	4605.00	PK	7.10	H	7.52	34.04	48.66	5.34
921.00	5526.00	PK	5.03	H	8.10	34.43	47.56	6.44
921.00	5526.00	PK	5.07	V	8.10	34.43	47.60	6.40
921.00	6447.00	PK	0.74	V	8.97	35.52	45.23	8.77
921.00	6447.00	PK	-0.63	H	8.97	35.52	43.86	10.14
921.00	7368.00	PK	-0.63	H	9.44	36.13	44.94	9.06
921.00	7368.00	PK	-0.63	V	9.44	36.13	44.94	9.06
921.00	8289.00	PK	-0.63	V	10.09	35.83	45.29	8.71
921.00	8289.00	PK	-0.63	H	10.09	35.83	45.29	8.71
921.00	9210.00	PK	-0.63	H	10.81	36.27	46.45	7.55
921.00	9210.00	PK	-0.63	V	10.81	36.27	46.45	7.55

Results Meet Requirements

AC POWER LINE CONDUCTED EMISSIONS

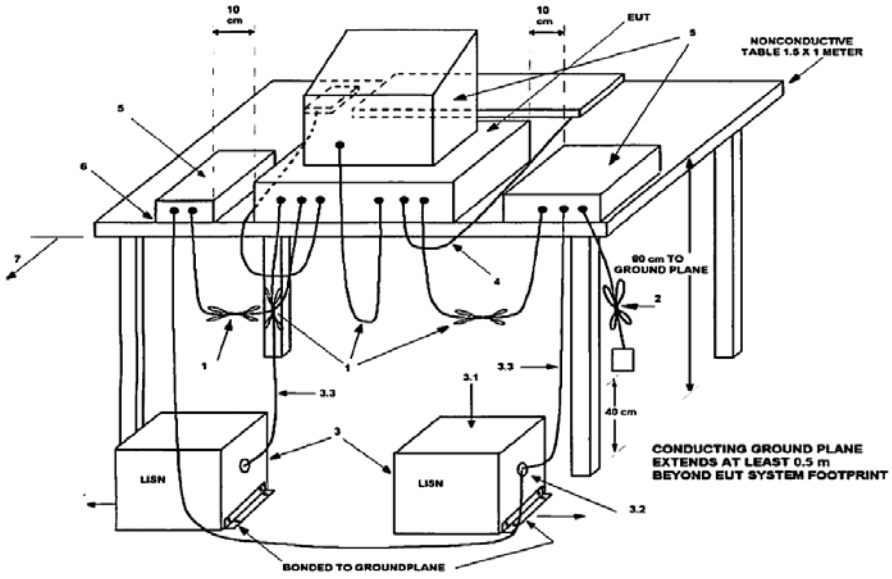
Rules Part No.: FCC 15.207(a), IC RSS Gen § 8.8

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBµV)	Average Limits (dBµV)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decrease with logarithm of frequency		

Test Method: ANSI C63.10 § 6.2 Test Method for AC power-line conducted emissions

Setup:



AC POWER LINE CONDUCTED EMISSIONS

N/A

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
CHAMBER	Panashield	3M	N/A	03/12/19	03/12/21
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	07/26/17	07/26/19
Antenna: Biconical 1057	Eaton	94455-1	1057	12/13/17	12/13/19
Antenna: Log-Periodic 1243	Eaton	96005	1243	04/20/18	04/20/21
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/20
Antenna: Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	12/08/17	12/08/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	02/27/19	02/27/21
Chamber Pre-amplifier	RF-LAMBDA	RLNA00M45GA	NA	02/27/19	02/27/21
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	08/28/18	08/28/20
Comb Generator	Com-Power Corp	CGO-515	291728	NA	NA

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF REPORT