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FCC PART 87
AERONAUTICAL TRANSMITTER
TEST REPORT

APPLICANT	MGL AVIONICS CC
	Postnet Somerset Mall Suite 325 Private Bag X15 Somerset West West 7129 SOUTH AFRICA
FCC ID	2ANEFV16
MODEL NUMBER	V16
PRODUCT DESCRIPTION	VHF AIRBAND TRANSCEIVER
DATE SAMPLE RECEIVED	11/27/2017
DATE TESTED	12/08/2017
TESTED BY	Franklin Rose
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1854AZUT17TestReport	Rev1	Initial Issue	12/08/2017
1854AZUT17TestReport	Rev2	Corrected Applicable Standards	03/16/2017

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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

Tested by:
Name and Title: Franklin Rose, Test Technician/Project Manager

Date: 12/08/2017

Reviewed and approved by: _____
Name and Title: Sid Sanders, Engineer

Date: 12/11/2017

GENERAL INFORMATION

EUT Specification

EUT Description	VHF AIRBAND TRANSCEIVER
FCC ID	2ANEFV16
Model Number	V16
Operating Frequency	118.000 to 136.975 MHz
Test Frequencies	118.000, 127.500, 136.975
Emission Designator	6K00A3E
Type of Emission	AM voice = A3E
Modulation	Amplitude Modulated
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power 12V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Test Conditions	The temperature was 26ºC with a relative humidity of 50%. Atmospheric Pressure: 1022 mb
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-E:2016, FCC CFR 47 Part 87
Test Facility	Timco Engineering Inc. 849 NW State Road 45 Newberry, FL 32669 USA.

RF POWER OUTPUT

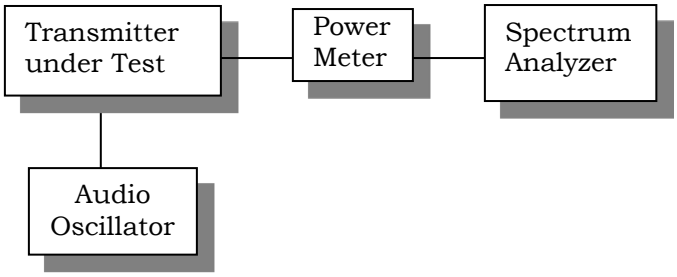
Rule Part No.: Part 2.1046(a), Part 87.131

Test Requirements: **Max Output Power ≤ 10 W**

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

For a Device that has a fixed antenna, RF power is measured as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage of 13.8 VDC and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data: Measurement Table

Frequency (MHz)	Power (dBm)	Power (W)
118.000	39.35	8.610
127.500	39.57	9.057
136.975	39.21	8.337

Part 2.1033(c)(8) DC Voltages & Current into Final Amplifier:

INPUT POWER – (13.8 VDC) x (3.5 A) = **48.3 W**

MODULATION CHARACTERISTICS

Part 2.1033(c) (4)

Type of Emission: 6K00A3E

Bn = 2M
M = 3000
Bn = 2(3000) = **6k**

The authorized bandwidth is **25 kHz**. (see FCC CFR 47 Pt. 87.137 Note 3)

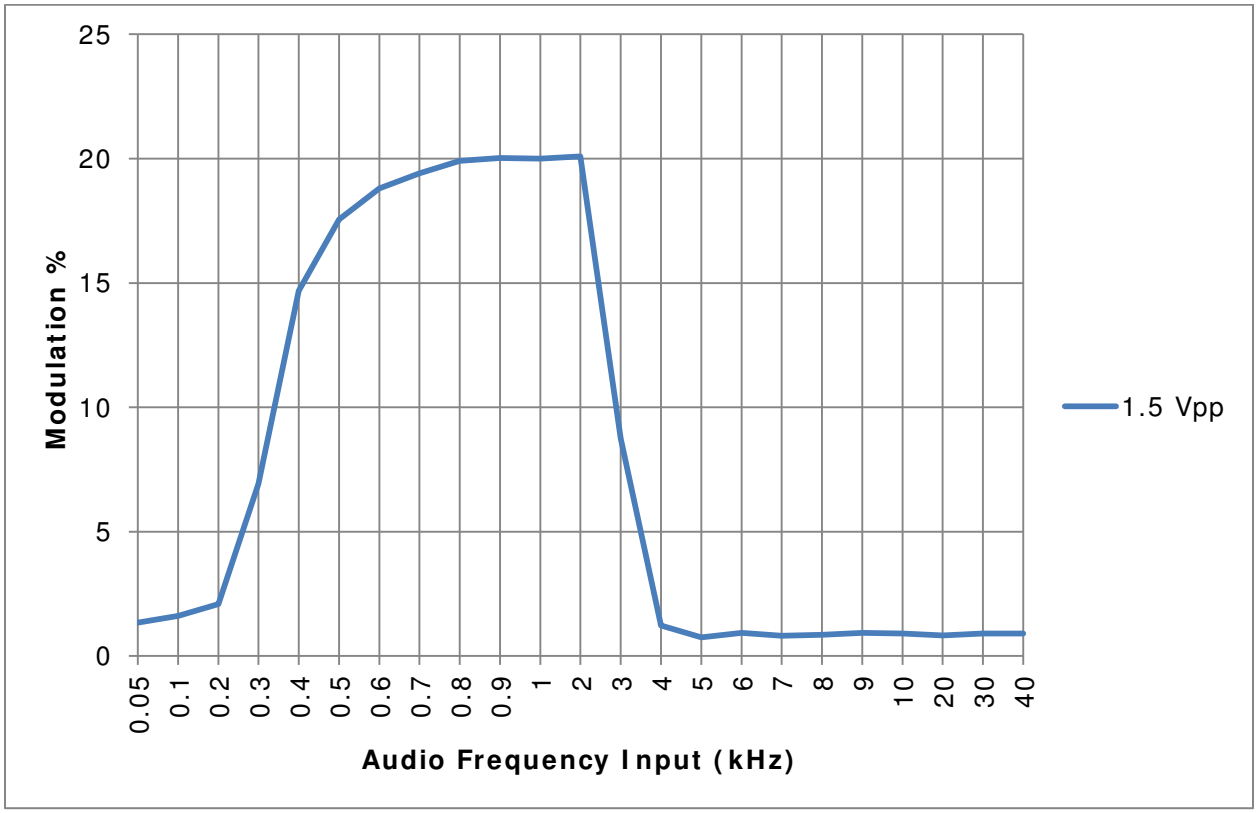
MODULATION CHARACTERISTICS

Rule Part No.: Part 2.1047(a) (b)

Test Requirements:

Method of Measurement: The audio frequency response was measured in accordance with TIA/EIA Specification 603 with the exception that for an AM modulated transmitter the input was varied for a constant modulation of 20%. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

Test Data: Audio Frequency Response



VOICE MODULATED COMMUNICATION EQUIPMENT

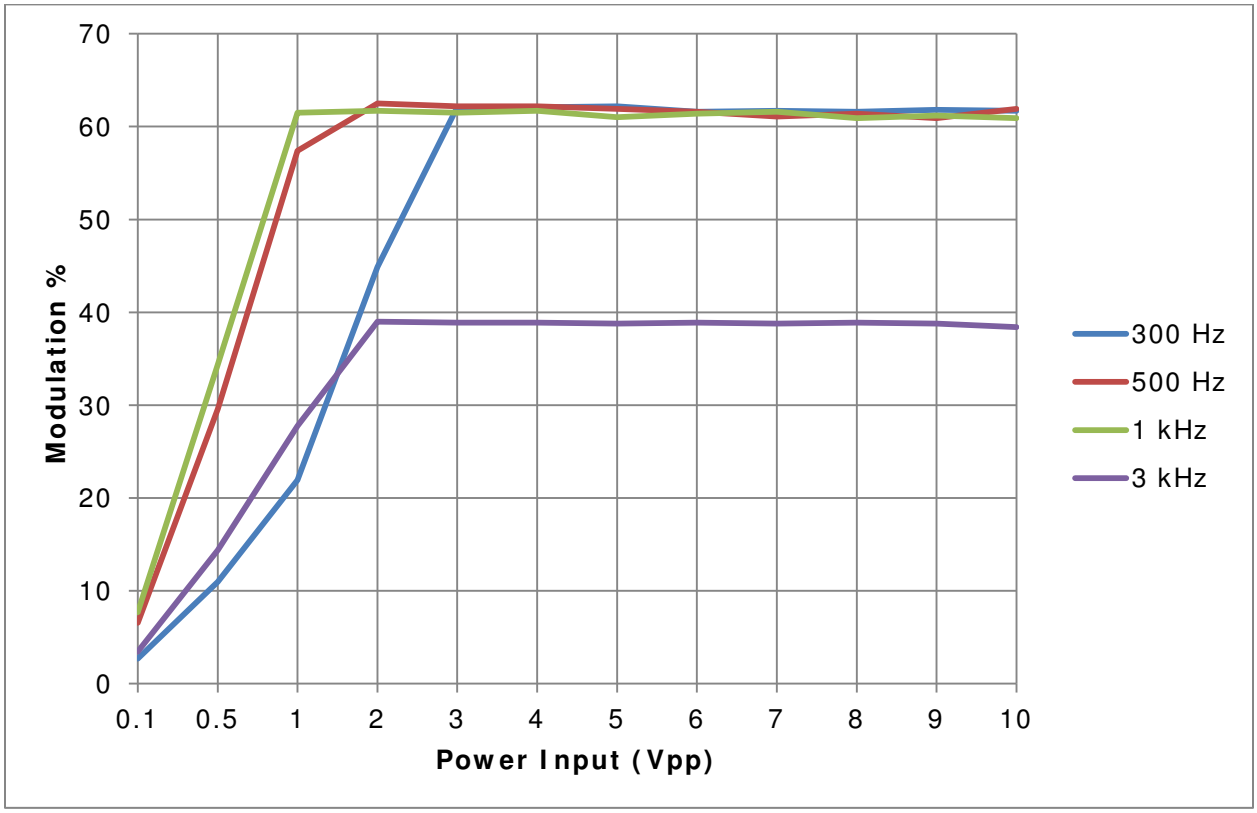
AUDIO INPUT VERSUS MODULATION

Rule Part No.: Part 2.1047(b) & 87.141

Test Requirements:

Method of Measurement: Modulation cannot exceed 100%, The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 500, 1000, and 3000 Hz.

Test data: Modulation Limiting



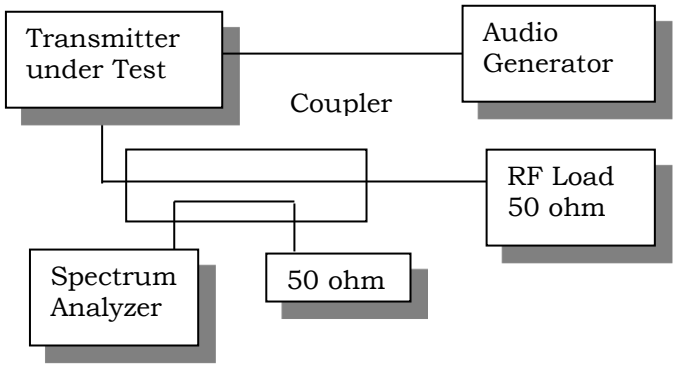
OCCUPIED BANDWIDTH

Rule Part No.: Part 2.1049, Part 87.139(a)

Test Requirements: Any frequency removed from the assigned frequency by 50 – 100 % of the authorized bandwidth shall be attenuated by 25 dB, from 100 – 250% by 35 dB, and more than 250% by **43 + 10*log(P)** for aeronautical stations.

Method of Measurement:

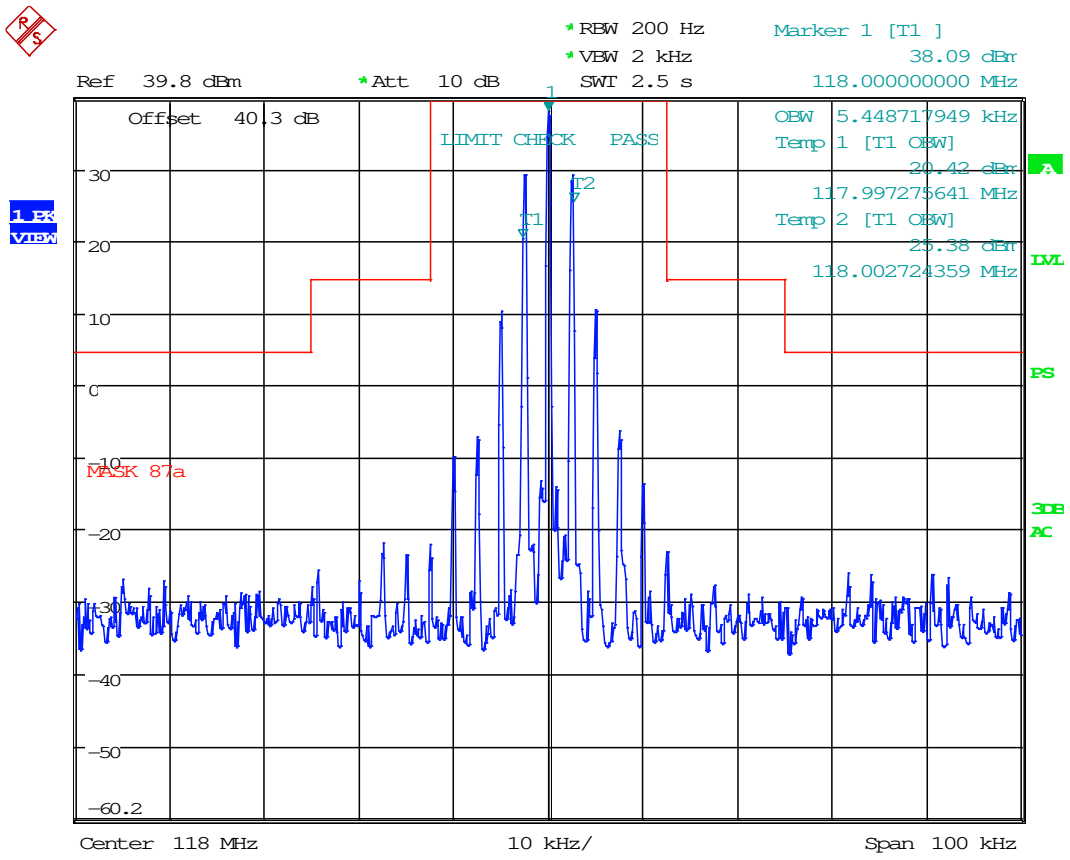
Test Setup Diagram: TIA 603 E para 2.2.11, the modulating frequency is 2500Hz. The audio input is adjusted for 50% modulation then the input level is increased by 16dB and the occupied bandwidth is measured a 3 different frequencies in the band.



Test Data: See the plots below

OCCUPIED BANDWIDTH

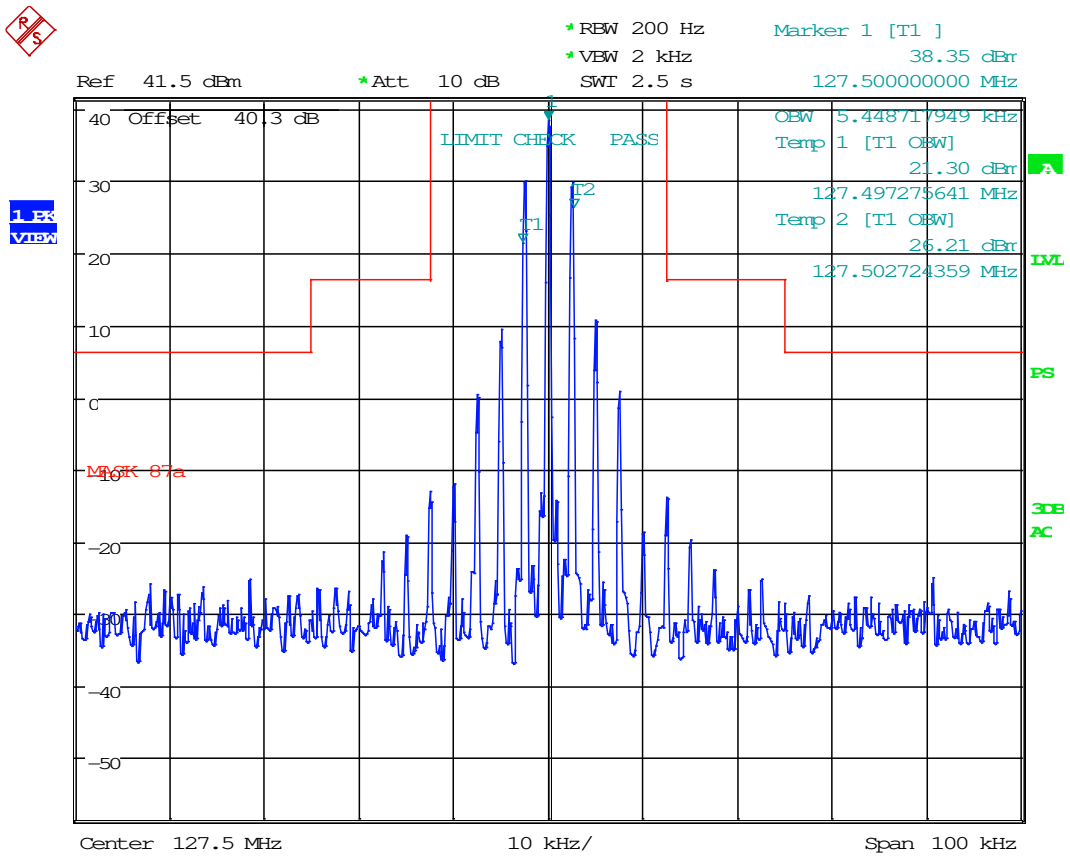
Test Data: **Low End of Band – 118.000 MHz**



Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **Middle of Band – 127.500 MHz**

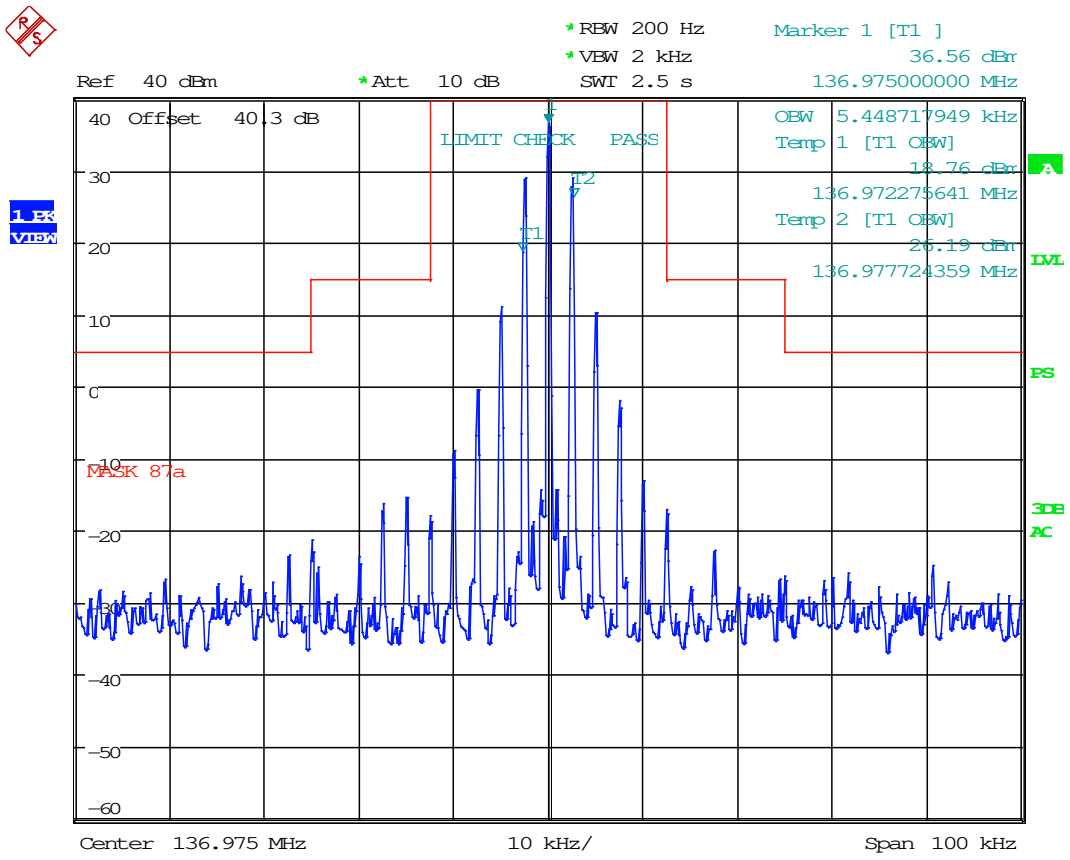


Date: 8.DEC.2017 14:44:05

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **High End of Band – 136.975 MHz**



Date: 8.DEC.2017 14:47:39

Result: Meets Requirements

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a), 87.139(d)

Requirements: **40 dB below the fundamental power**

Method of Measurement: The carrier was fully modulated using a 2500 Hz tone. The spectrum was scanned from 0.3 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

Test Data: **Low end of Band – 118.000 MHz**

Power Output	dBm	Watts	Limit (dBc)
	39.35	8.61	52.57

Frequency		Peak (dBm)	Margin
(fundamental)	118.000	0.00	0.00
	236.000	-28.55	15.33
	354.000	-30.97	17.75
	472.000	-40.99	27.77
	590.000	-50.02	36.80
	708.000	-45.46	32.24
	826.000	-39.75	26.53
	944.000	-38.89	25.67
	1062.000	-38.50	25.28
	1180.000	-30.82	17.60

* Indicates Noise Floor

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: **Middle of Band – 127.500 MHz**

Power Output	dBm	Watts	Limit (dBc)
	39.57	9.06	52.57

Frequency		Peak (dBm)	Margin
(fundamental)	127.500	0.00	0.00
	255.000	-40.38	27.38
	382.500	-40.54	27.54
	510.000	-34.65	21.65
	637.500	-43.37	30.37
	765.000	-43.82	30.82
	892.500	-44.33	31.33
	1020.000	-44.65	31.65
	1147.500	-37.21	24.21
	1275.000	-40.37	27.37

* Indicates Noise Floor

Test Data: **High end of Band – 136.975 MHz**

Power Output	dBm	Watts	Limit (dBc)
	39.21	8.34	52.57

Frequency		dBc	Margin
(fundamental)	136.975	0.00	0.00
	273.950	-23.97	10.61
	410.925	-25.64	12.28
	547.900	-35.88	22.52
	684.875	-40.50	27.14
	821.850	-43.18	29.82
	958.825	-34.45	21.09
	1095.800	-31.32	17.96
	1232.775	-30.93	17.57
	1369.750	-42.57	29.21

* Indicates Noise Floor

Result: Meets Requirements

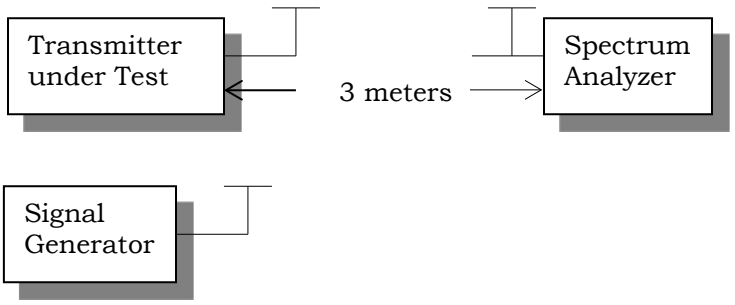
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Test Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

Method of Measurements: The spectrum was scanned from 9 KHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method.

Test Setup Diagram:



Test Data: **Low end of Band – 118.000 MHz**

Emission Frequency (MHz)	Antenna Polarity	Field Strength (dBuV/m)	ERP (dBm)	52.57 dBc Limit as dBm	Margin (dBm)
236.000	H	75.008	-22.369	-13.220	9.149
236.000	V	71.168	-26.209	-13.220	12.989
354.000	H	73.720	-23.657	-13.220	10.437
354.000	V	69.770	-27.607	-13.220	14.387
590.000	H	68.620	-28.757	-13.220	15.537
826.000	H	68.460	-28.917	-13.220	15.697
1180.000	H	68.208	-29.169	-13.220	15.949
590.000	V	67.270	-30.107	-13.220	16.887
944.000	H	66.418	-30.959	-13.220	17.739
708.000	H	66.394	-30.983	-13.220	17.763
1180.000	V	66.208	-31.169	-13.220	17.949

Note: The worst case orientation of the EUT was used. Emissions lower than 20 dB under the limit are not required to be reported.

Result: Meets Requirements

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: Middle of Band – 127.500 MHz

Emission Frequency (MHz)	Antenna Polarity	Field Strength (dBuV/m)	ERP (dBm)	52.57 dBc Limit as dBm	Margin (dBm)
255.000	H	70.860	-26.517	-13.000	13.517
382.500	H	72.165	-25.212	-13.000	12.212
382.500	V	68.995	-28.382	-13.000	15.382
637.500	H	72.540	-24.837	-13.000	11.837
637.500	V	70.230	-27.147	-13.000	14.147
892.500	H	70.535	-26.842	-13.000	13.842
765.000	H	68.340	-29.037	-13.000	16.037
255.000	V	66.600	-30.777	-13.000	17.777

Note: The worst case orientation of the EUT was used. Emissions lower than 20 dB under the limit are not required to be reported.

Result: Meets Requirements

Test Data: High end of Band – 136.975 MHz

Emission Frequency (MHz)	Antenna Polarity	Field Strength (dBuV/m)	ERP (dBm)	52.57 dBc Limit as dBm	Margin (dBm)
273.950	H	74.062	-23.315	-13.360	9.955
410.925	H	75.693	-21.684	-13.360	8.324
410.925	V	73.793	-23.584	-13.360	10.224
821.850	H	69.330	-28.047	-13.360	14.687
958.825	H	69.266	-28.111	-13.360	14.751
1232.780	V	70.022	-27.355	-13.360	13.995
547.900	H	67.727	-29.650	-13.360	16.290
273.950	V	67.322	-30.055	-13.360	16.695
1095.800	H	67.092	-30.285	-13.360	16.925
1095.800	V	66.972	-30.405	-13.360	17.045
1232.780	H	66.692	-30.685	-13.360	17.325
958.825	V	65.966	-31.411	-13.360	18.051
684.875	H	64.720	-32.657	-13.360	19.297
547.900	V	64.477	-32.900	-13.360	19.540

Note: The worst case orientation of the EUT was used. Emissions lower than 20 dB under the limit are not required to be reported.

Result: Meets Requirements

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 87.133

Requirements: Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15% ±20 PPM

Method of Measurements: TIA/EIA Specification 603

Test Data: **Measurement Table**

Reference Frequency (Hz)	127499980

Temperature (°C)	Frequency (Hz)	Deviation (Hz)	PPM
-30°C	127499950	30	0.235
-20°C	127499970	10	0.078
-10°C	127500000	-20	-0.157
0°C	127500000	-20	-0.157
10°C	127499980	0	0.000
20°C	127499980	0	0.000
30°C	127500000	-20	-0.157
40°C	127499970	10	0.078
50°C	127499950	30	0.235

Voltage	Frequency (Hz)	Deviation (Hz)	PPM
11.73	127499970	10	0.078
13.80	127499980	0	0.000
15.87	127499990	-10	-0.078

Result: Meets Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/ Char Date	Due Date
Coaxial Cable - BMBM-0065-01 Black DC-2G	Belden		BMBM-0065-01	07/18/16	07/18/18
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
Frequency Counter Small Chamber	HP	5385A	3242A07460	07/01/15	12/01/17
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00	N/A	N/A
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Rohde & Schwarz Signal Generator SMU200A	Rohde & Schwarz	SMU200A	103195	03/07/16	03/07/18
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	11/18/15	11/18/17
Type K J Thermometer	Martel	303	080504494	11/02/17	11/02/19
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/24/19
Attenuator BNC 10dB DC-2G	MiniCircuits	HAT-10+	#54	07/14/17	07/14/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Tuneable Notch Filter 100-350 MHz	Eagle	210BFBF	100-350 MHz	07/01/15	12/01/17

*** EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

STATE OF THE MEASUREMENT UC

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	 ±2.14dB	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT