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FCC PART 80, 90 AND IC RSS-138 TEST REPORT

APPLICANT	NAVICO AUCKLAND LTD
	3-5 OMEGA STREET ALBANY 0632 AUCKLAND NEW ZEALAND
FCC ID	RAY3G4G
IC CERTIFICATION	4697A-3G4G
MODEL NUMBER	3G, 4G
PRODUCT DESCRIPTION	FMCW RADAR WITH LINEAR FREQUENCY SWEEP
DATE SAMPLE RECEIVED	12/20/2010
DATE TESTED	1/3/2011
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	2877AT10TestReport.doc
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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ATTESTATIONS

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

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.

The test results apply only to the unit tested.

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



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

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



Authorized Signatory Name:

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: February/9/2011

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REPORT SUMMARY

Applicable Standards and Procedures	ANSI/TIA 603-C: 2004, FCC CFR 47 Part 90, Part 80, IC RSS-138, IC RSS-GEN
Related Report/Approval	N/A

TEST SETUP

Test facility	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
Test Condition	Temperature was 26°C Relative humidity of 50%.
Modifications	None
Test Exercise	The DUT was placed in continuous transmit mode of operation

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DUT SPECIFICATION

DUT Description	FMCW RADAR WITH LINEAR FREQUENCY SWEEP
FCC ID	RAY3G4G
IC Certification	4697A-3G4G
Model Number	3G, 4G
Serial Number	N/A
Operating Frequency	9300 to 9385 MHz
DUT Power Source	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power (13.8 Vdc)
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna	Narrow beamwidth patch antenna array with 22 dBi of gain
Antenna Connector	Permanently attached antenna

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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 3/10/10	3/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 6/10/09	6/10/11
Frequency Counter	HP	5385A	3242A07460	CAL 5/26/09	5/26/11
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/26/09	5/26/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/18/09	5/18/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12

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TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C:2 004 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI C63.4-2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a micro volt at the output of the antenna.

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RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 80, RSS-138 Section 4.5

Test Requirements: RSS-138 Section 6.3 – The output power shall not be below the minimum or exceed the maximum limits given in Table 1 (Section 6.5)

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

Test Data:

OUTPUT POWER: 31.7 Watts EIRP (calculated)
OUTPUT POWER (Peak): 200 milliwatts Conducted

Part 2.1033 (C)(8) DC Input into the final amplifier

FOR POWER SETTING INPUT POWER: $(13.8V)(1.5A) = 20.7$ Watts

Average Power Output (worst case)	141mW
Peak Power Output	200 mW (at antenna port)
Total Tx time	1.3ms
Warm up time	0.3ms
Sweep time	1ms
Pulse repetition rate (slot period)	5ms

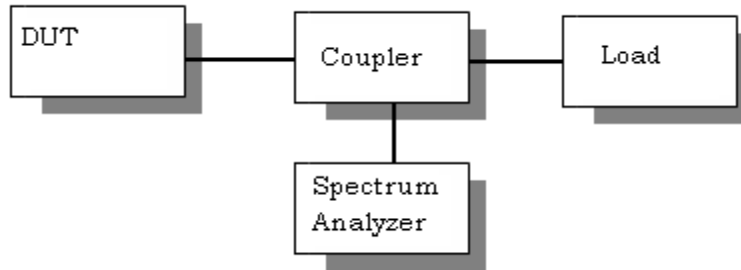
Antenna Gain	22 dBi
Rotation	24/36/48 rpm +/- 10%
Warm-up time	Instant ON
Sweep Repetition Frequency	200 Hz to 540 Hz
Sweep bandwidth	70 MHz max

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MODULATION CHARACTERISTICS

Method of Measurement: ANSI/TIA 603-C: 2004

Test Setup Diagram:



Range	Sweep width (MHz)	Used spectrum (MHz)	Possible number of channels
0	65	9315 - 9380	1
1	32.5	9315 - 9380	2
2	16	9315 - 9380	4
3	8	9315 - 9380	8
4	4	9315 - 9380	16
5	2	9315 - 9380	32
6	1	9315 - 9380	64
7	0.5	9315 - 9380	128

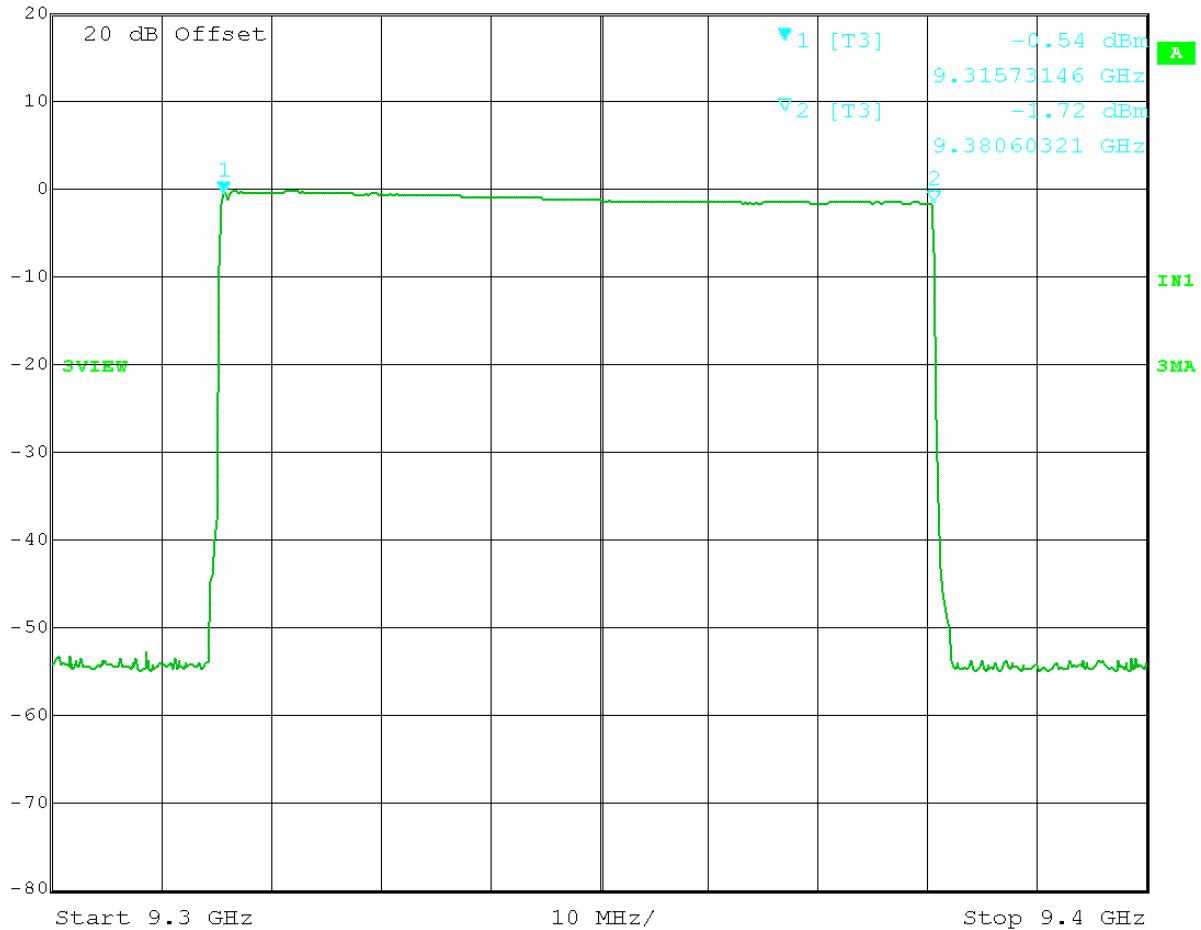
Possible sweep modes (parameters)

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OCCUPIED BANDWIDTH PLOT



Marker 1 [T3] RBW 200 kHz RF Att 10 dB
 Ref Lvl -0.54 dBm VBW 200 kHz Mixer -20 dBm
 20 dBm 9.31573146 GHz SWT 6.5 ms Unit dBm



Date: 4.JAN.2011 12:25:47

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a),

Requirements: $43+10\log(\text{mean power})$

Method of Measurement: The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004.

Test Data:

Permanently attached antenna.

The microwave generating portion of the radar unit is wholly contained in the panel antenna assembly and the antenna is part of the spurious emission limiting structure.

Method of Measuring Conducted Spurious Emissions

METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C: 2004

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FIELD STRENGTH OF SPURIOUS EMISSIONS

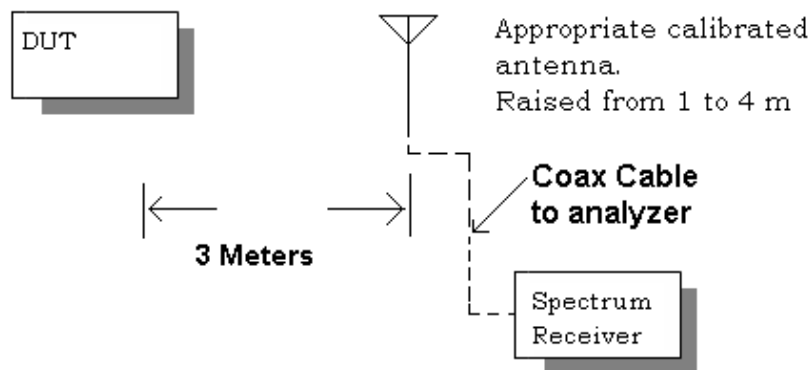
Rule Parts. No.: FCC Part 2.1053, RSS-138 SECTION 4.6

Requirements: Emissions must be $43+10\log(P)$ dB below the mean power output of the transmitter.

RSS-138 – The boundary between the out-of-band and spurious domains in the case of primary radars in the radio determination service and other relevant services can be defined as separated from the assigned frequency by 5 times the -40 dB bandwidth.

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the 5th harmonic of the fundamental or 40 GHz. This test was conducted per ANSI C63.4: 2003. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Test Setup Diagram:



Test Data:

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m
9,318.20	18,636.40	25.1	H	3.9	45.3	74.3
9,318.20	27,954.60	NF	H			
9,318.20	37,272.80	NF	H			

NF= Noise floor

Harmonics above 18 GHz were measured using a low noise preamp at the receiving antenna and the measurement distance was reduced to 1 meter and corrected to 3 m.

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80, RSS-138, section 4.4

Requirements Emission need only remain in the band.
RSS-138 – Section 6.2 – The carrier frequency shall not depart from the reference frequency in excess of the value given in Table 1 (Section 6.5).

Method of Measurements: ANSI/TIA 603-C: 2004

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		9315.380764
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	9315.906813	56.47
-20	9315.806613	45.71
-10	9315.726418	37.11
0	9315.656316	29.58
+10	9315.702863	34.58
+20	9315.654325	29.37
+30	9315.455917	8.07
+40	9315.105617	-29.54
+50	9314.864716	-55.40

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	Frequency (MHz)	Frequency Stability (PPM)
-15%	9315.105218	-29.58
0	9315.380764	0.00
+15%	9315.205417	-18.82

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