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

APPLICANT	KELVIN HUGHES LIMITED
	NEW NORTH PORT ROAD, HAINAULT
	ILFORD, ESSEX 1G6 2UR United Kingdom
FCC ID	CICDTX-A3
IC	1493A-DTXA3
MODEL NUMBER	DTX-A3
PRODUCT DESCRIPTION	RADAR
DATE SAMPLE RECEIVED	11/11/2010
DATE TESTED	12/2/2010
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	2579AT10TestReport.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.



Certificate # 0955-01

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GENERAL REMARKS

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

The test results relate only to the items tested.

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.



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: December 15th, 2010

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DUT SPECIFICATION

DUT Description	NAVIGATION RADAR 9.2 TO 9.5 GHz
FCC ID	CICDTX-A3
IC Certification	1493A-DTX-A3
Model Number	DTX-A3
Serial Number	N/A
Operating Frequency	9.2 to 9.5 GHz
Channels	14
Type of Emission	Pulse
Modulation	PON
DUT Power Source	<input checked="" type="checkbox"/> 110–120Vac/50– 60Hz
	<input type="checkbox"/> DC Power ()
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input type="checkbox"/> Pre-Production
	<input checked="" type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna Gain	30 dBi

TEST SETUP INFORMATION

Test facility	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
Test Condition	Temperature: 26°C Relative humidity: 50%.
Modifications	None
Test Exercise	The DUT was placed in continuous transmit mode of operation
Applicable Standards	ANSI/TIA 603-C: 2004, FCC CFR 47 Part 90, Part 80, IC RSS-138, IC RSS-GEN

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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 PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C: 2004 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 10.0 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/TIA 603-C: 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 microvolt at the output of the antenna.

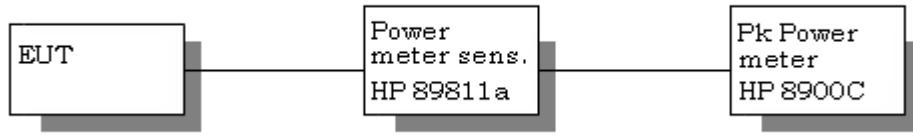
RF POWER OUTPUT

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, Peak Power Watt meter to the RF output connector. With a nominal voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: High = 188 Watts Peak
Low = 33 Watts Peak

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

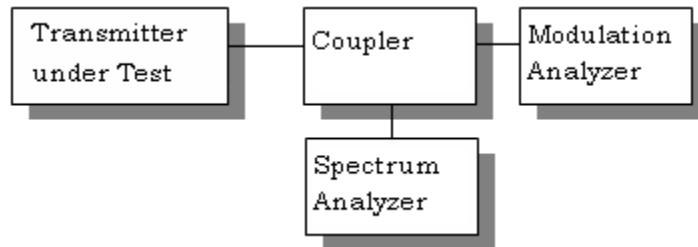
FOR POWER SETTING (HIGH) INPUT POWER: Volts DC = 36 V
Current Amperes = 3.8 A
= 136.8 Watts

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MODULATION CHARACTERISTICS

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

Test Setup Diagram:



The device under test is capable of pulse durations of many styles and durations.

1 single duration to multiples of up to 15.

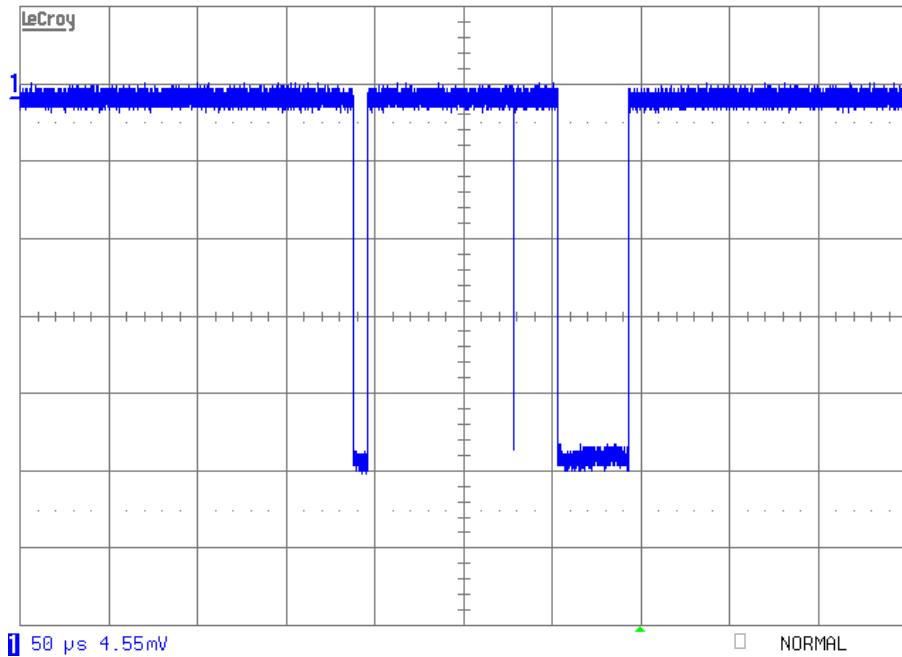
It is also capable of multiple pulse group chirps of up to 3 pulses.

Further detailed specifications are contained in “product specifications” manual.

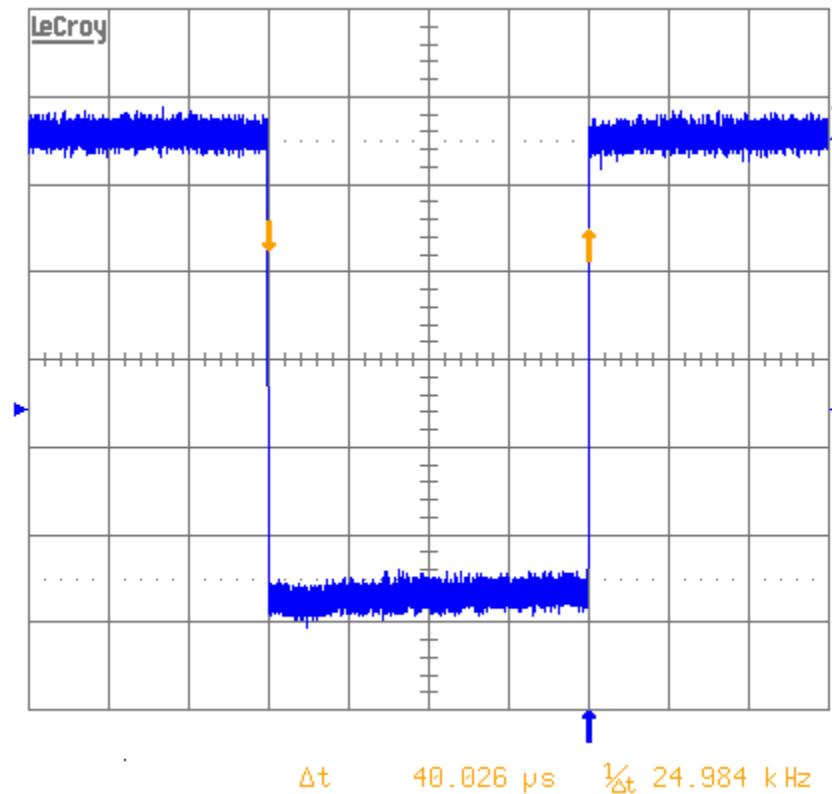
Below are plots of these pulse groups

Pulse widths	1 to 40 μ s
Pulse rep. rate	2000 pps

3 pulse chirp



Widest pulse from triple chirp



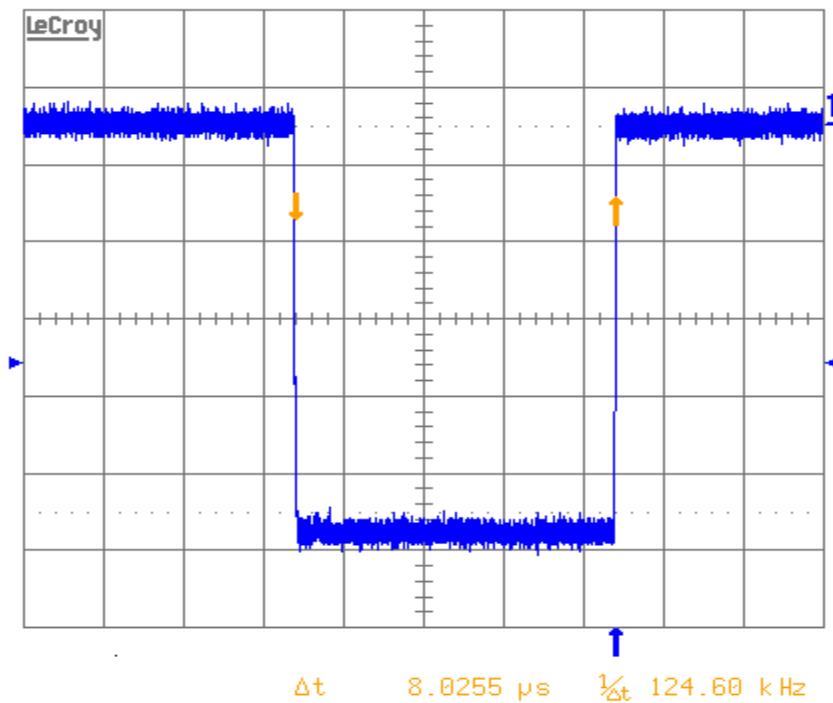
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FCC ID: CICDTX-A3

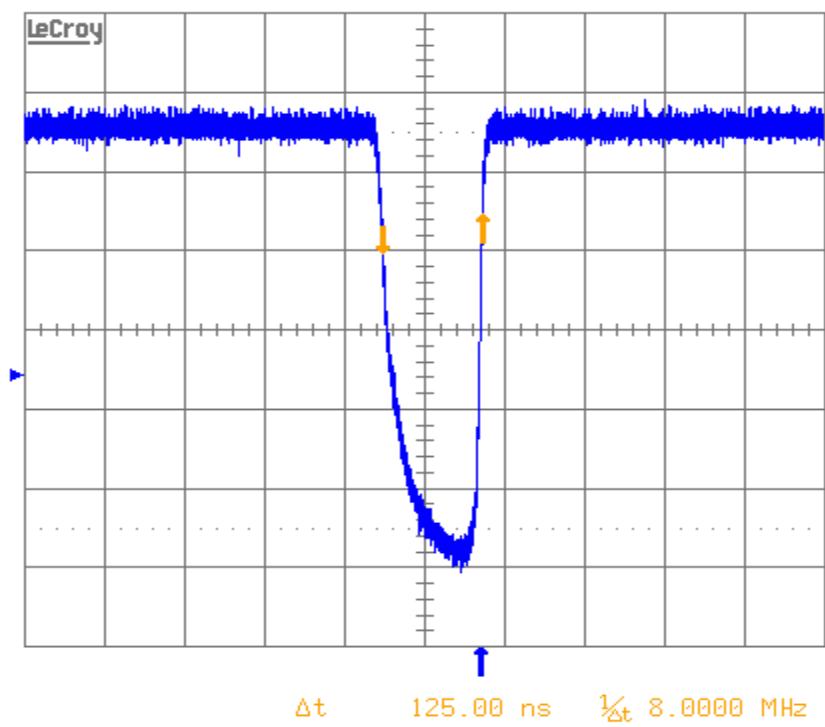
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Medium duration pulse from triple chirp



Shortest duration pulse from triple chirp



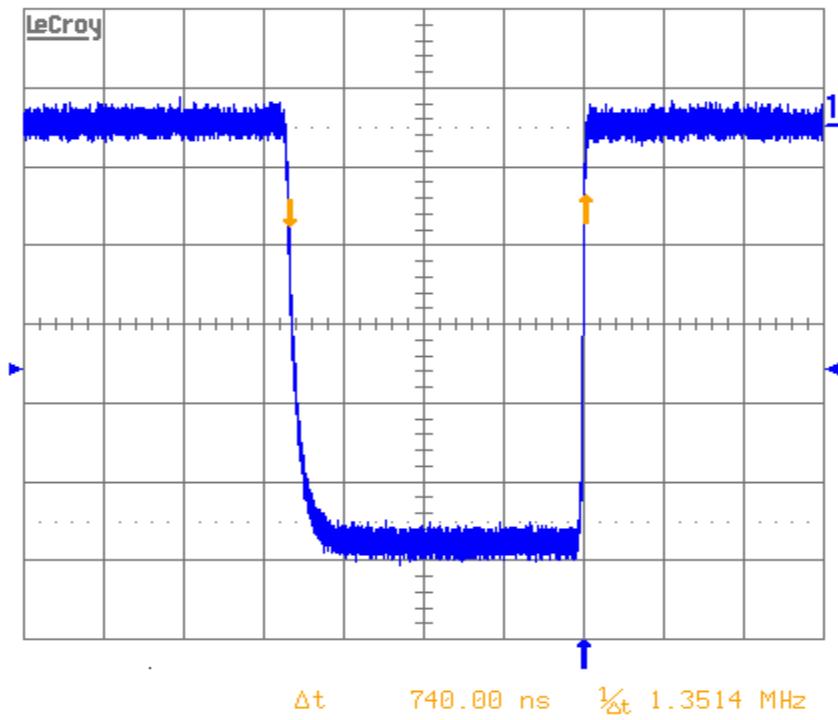
Applicant: KELVIN HUGHES LIMITED

FCC ID: CICDTX-A3

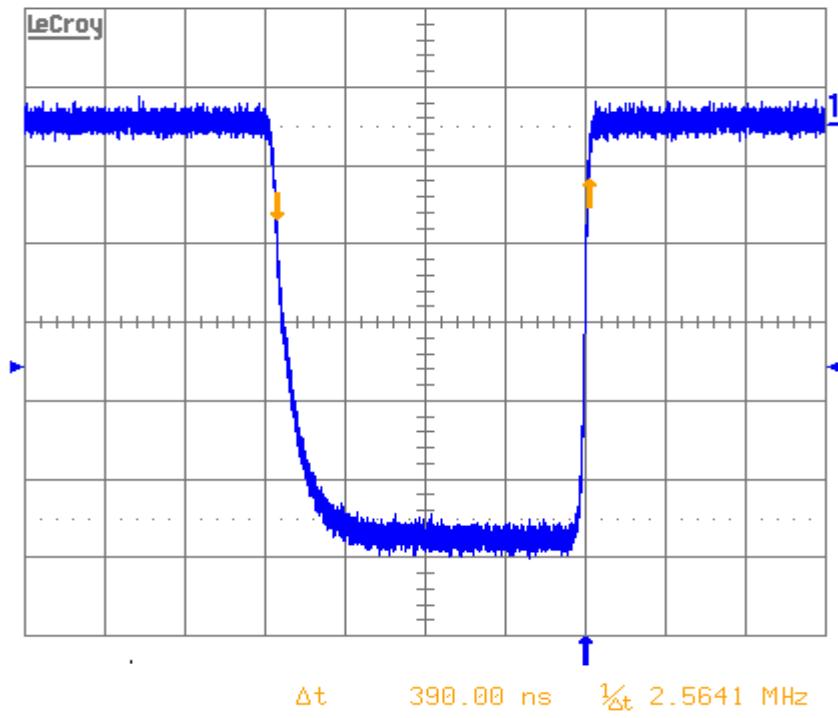
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Long duration pulse from single pulse set (position 15)



Medium duration pulse from single pulse set (position 8)



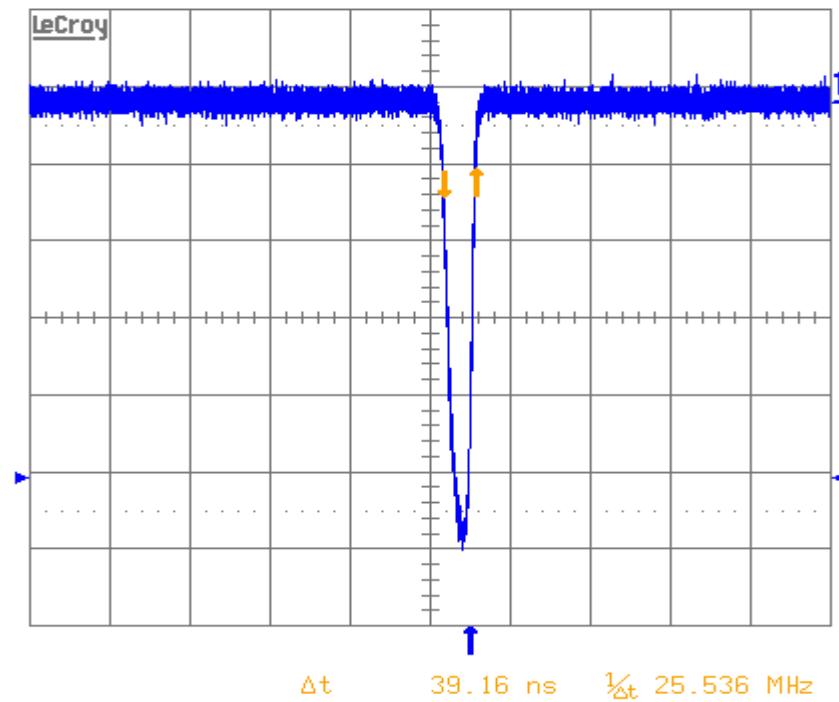
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Short duration pulse from single pulse set (position1)

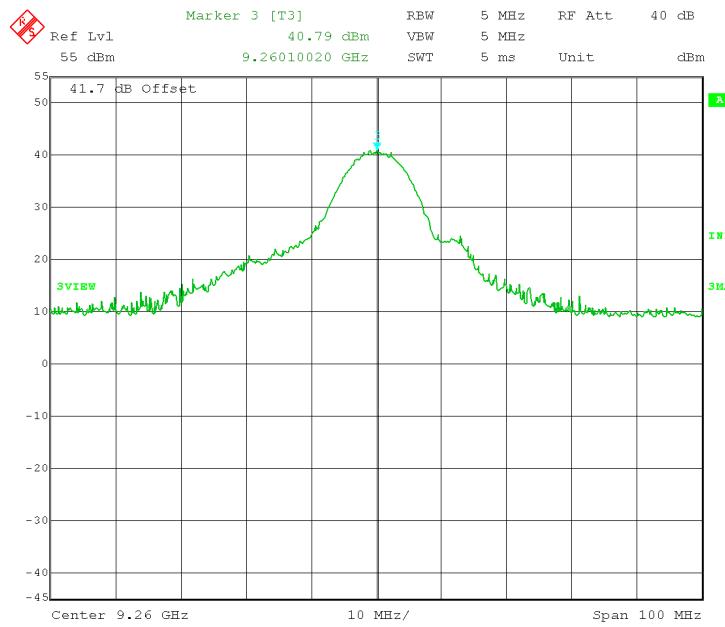


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OCCUPIED BANDWIDTH PLOT(S)

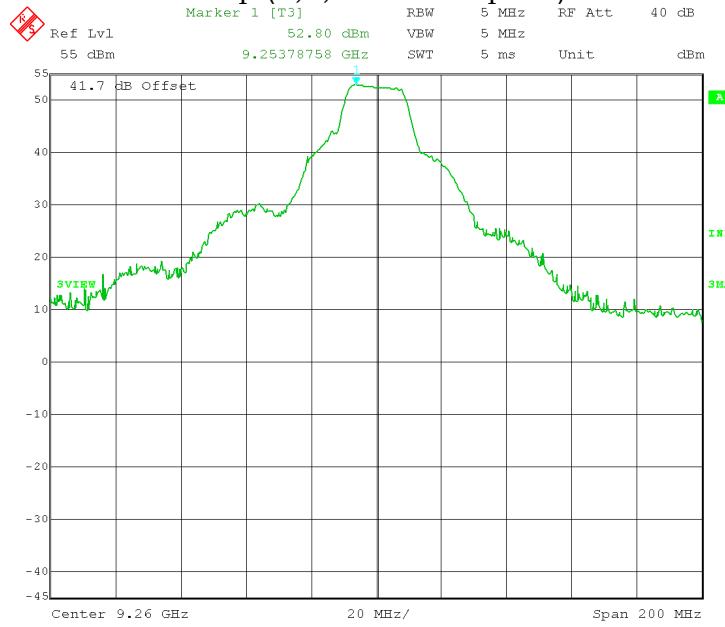
The emission mask for this device requires that the emission only need stay in the band.

OBW for a short duration pulse (chirp 1)



Date: 2.DEC.2010 15:46:16

OBW for the longest duration chirp (1,2, and 3 chirp set)



Date: 3.DEC.2010 12:32:22

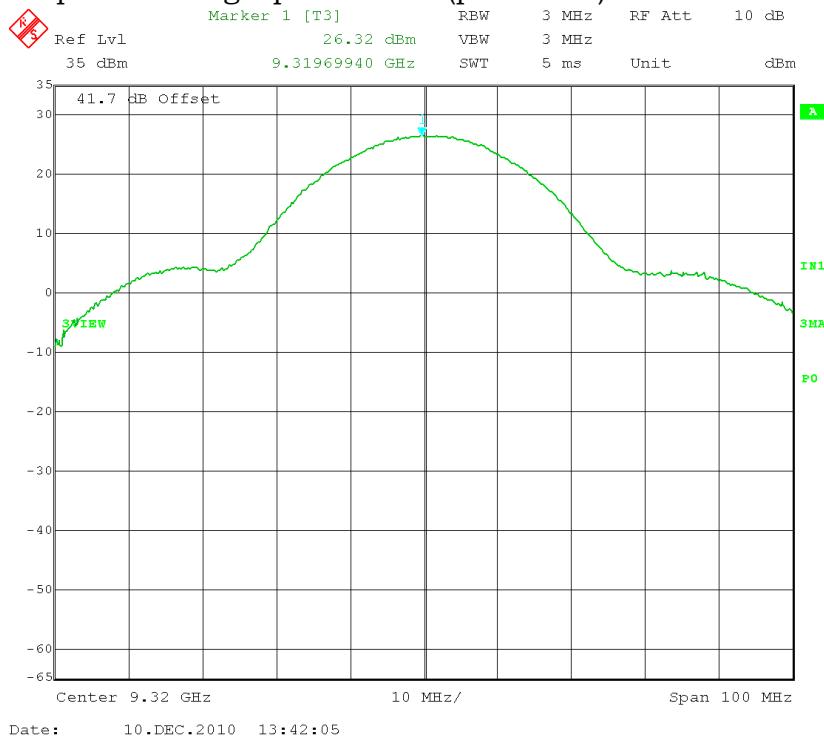
Applicant: KELVIN HUGHES LIMITED

FCC ID: CICDTX-A3

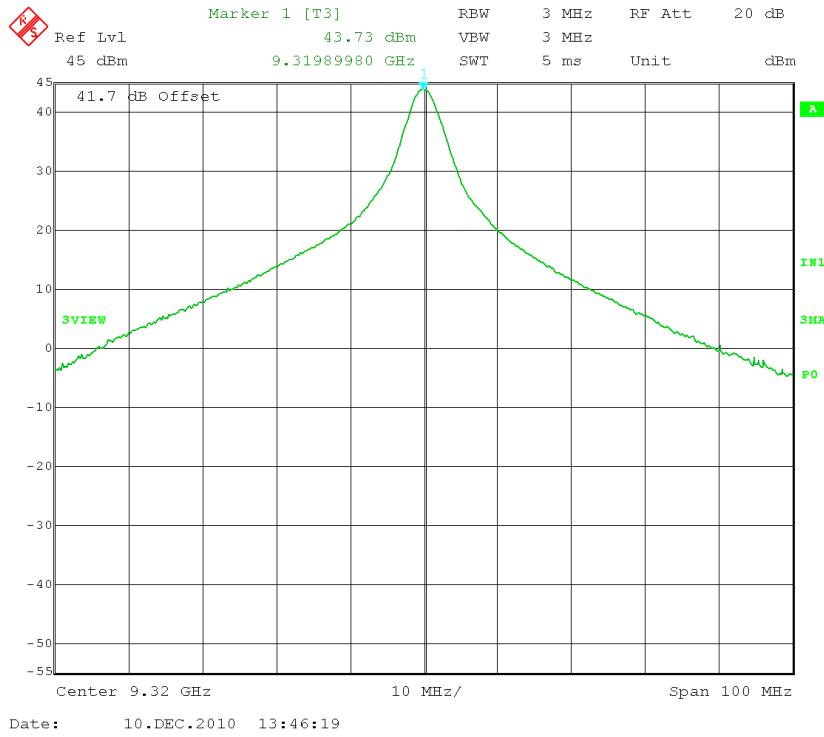
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OBW for shortest pulse in single pulse mode (position 1)



OBW for longest pulse in single pulse mode (position 15)



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a) & 80.217

Requirements: $43 + 10\log(\text{mean power})$
 $43 + 10\log (15) = 55 \text{ dB}$

Method of Measurement: The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental or 40 GHz. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004 or ANSI 63.4:2003.

The mean power was calculated based on the standard formula for radar systems:
 $P_a = P_m * T_d * f_r$. Where T_d is pulse duration, P_m is peak power, and f_r is pulse rep rate.

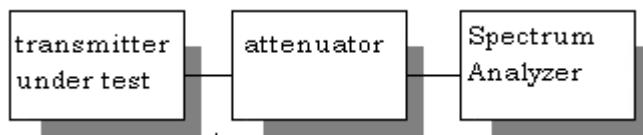
Test Data:

Worst case: chirp pulse mode setting (chirp 3)

Tuned Freq. (MHz)	Emission Freq. MHz	dB below carrier
9220	18440	61.1
	27660	61.8
	36880	64.4
9480	18960	60.6
	28440	64
	37920	66.2

Various modes and center frequencies were tested and the worst case presented above. Harmonics were checked to the 40 GHz.

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA-603-C: 2004 or ANSI 63.4: 2003

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FIELD STRENGTH OF SPURIOUS EMISSIONS

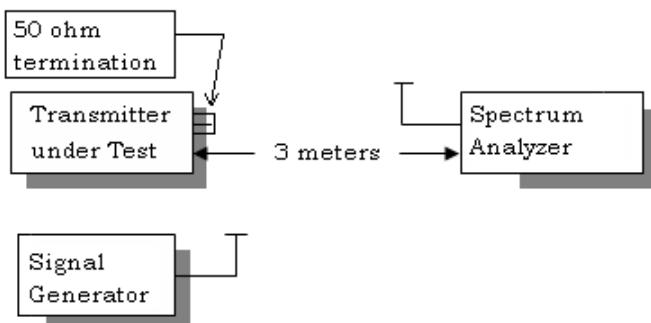
Rule Parts. No.: FCC Part 2.1053, RSS-138 SECTION 4.6

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 tenth harmonic of the fundamental or 40 GHz. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method.

Test Setup Diagram:



Test Data:

Tuned Frequency: 9220 MHz and 9480 MHz
Worst case: 3 pulse chirp

Emission Frequency MHz	Ant. Polarity	dB below Carrier (dBc)
18440	V	76.8
27660	H/V	NF
36880	H/V	NF

Emission Frequency MHz	Ant. Polarity	dB below Carrier (dBc)
18960	V	78.4
28440	H/V	NF
37920	H/V	NF

Harmonics were measured to the tenth harmonic.

Three places in the band were measured, various modes of operation were checked and the worst case reported.

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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:

	Ref. Freq. MHz	
	9221.242083	
TEMPERATURE °C	FREQUENCY MHz	PPM
-30°C	9222.242485	108.49
-20°C	9222.061458	88.86
-10°C	9221.953489	77.15
-0°C	9221.756015	55.73
10°C	9221.368514	13.71
20°C	9221.320167	8.47
30°C	9221.035482	-22.40
40°C	9220.685494	-60.36
50°C	9220.236473	-109.05
Battery Volts		PPM
-15%	9221.295483	5.79
+15%	9221.156948	-9.23