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FCC PART 80 & 90 TEST REPORT

APPLICANT	KELVIN HUGHES LIMITED
	VOLTAGE, MOLLISON AVENUE
	ENFIELD EN3 7XQ UNITED KINGDOM
FCC ID	CICDTX-A3-FDLR
MODEL NUMBER	DTX-A3-AFFB
PRODUCT DESCRIPTION	X-BAND RADAR
DATE SAMPLE RECEIVED	June/23/ 2014
DATE TESTED	June 23 rd to June 26 th 2014
TESTED BY	Mario de Aranzeta
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	1055AUT14TestReport.docx
TOTAL PAGES	17
REPORT ISSUE DATE:	June 27 th 2014
TEST RESULTS	☒ PASS ☐ FAIL

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WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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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.

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.
Project Manager

Date: June 27, 2014

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DUT SPECIFICATION

DUT Description	NAVIGATION RADAR 9.2 TO 9.5 GHz
FCC ID	CICDTX-A3-FDLR
Model Number	DTX-A3-AFFB
Serial Number	N/A
Operating Frequency	9.22 to 9.48 GHz
Type of Emission	Pulse
Modulation	48M2P0N
DUT Power Source	☒ 110–220Vac/50– 60Hz
	☐ DC Power ()
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☐ Pre-Production
	☒ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Antenna Gain	Various from 28 to 39 dB
Antenna Connector	WR-90 (waveguide)

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 mode that transmitted the same burst over and over, continuously
Applicable Standards	ANSI/TIA 603-D: 2010, FCC CFR 47 Part 80 & 90

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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
EMI Test Receiver	Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	06/05/13	06/05/15
Analyzer Silver Tower Quasi-Peak Adapter	HP	85650A	2811A01175	06/05/13	06/05/15
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	06/05/13	06/05/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	03/31/15
Coaxial Cable - Chamber 3 cable set	Semiflex	Unknown	Chamber 3 cable set	01/13/14	01/13/16
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
LISN	Electro-Metrics	ANS-25/2	2604	01/07/14	01/07/16
LISN	Electro-Metrics	EM-7820	2682	02/26/13	02/26/15
LISN	Electro-Metrics	FCC-25/2	2512	06/05/13	06/05/15
Measuring Tape- 7.5M	Kraftixx	7.5M PROFI		05/20/13	05/20/15
Oscilloscope	LeCroy	LT364	00414	08/22/13	08/22/15
RF Power Amplifier	Ophir RF	5150F	1041	02/22/13	02/22/15
RF Power Meter	Boonton	4531	11793	01/19/13	01/19/15
Sensor	Boonton	51072A	34647	01/19/13	01/19/15
Signal Generator	HP	8648C	3623A02898	08/29/13	08/29/15
Signal Generator	Anritsu	68369A	985112	8/29/13	8/29/15

Manufacturer	Model	Receiver Firmware	BIOS Ver
Rohde & Schwarz	ESU40	4.43 SP3	V5.1-24-3
Rohde & Schwarz	ESIB40	4.34.3	3.3

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TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-D: 2010 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-D: 2010 using a 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.

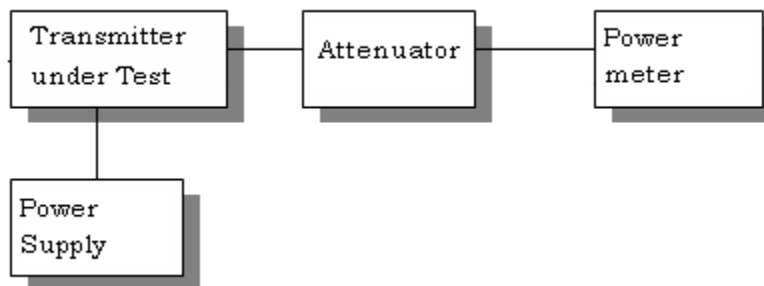
RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 80, 90

Test Requirements:

Method of Measurement: RF power is measured by connecting a 50-ohm, Spectrum analyzer 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 = 200 Watts Peak conducted
Low = 40 Watts Peak conducted

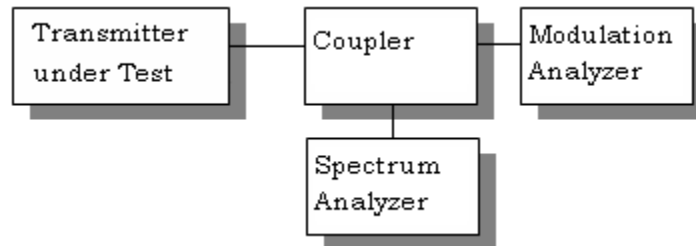
Part 2.1033 (C)(8) DC Input into the final amplifier

FOR POWER SETTING (HIGH) INPUT POWER: 15 Volts DC
Current Amperes = 19.5 A
= 293 Watts

MODULATION CHARACTERISTICS

Method of Measurement: ANSI/TIA 603-D: 2010

Test Setup Diagram:



The radar transmits 2 carriers simultaneously. The carriers are always 80 MHz apart.

The carriers start at 9220 and end at 9480 MHz and are selectable in 20 MHz steps.

The device under test is capable of 4 different pulse durations which are grouped.

The groups consist of 1 short pulse, one medium pulse, and one long pulse with a variation of length of the long pulse for long range applications.

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

Below are plots of these pulse groups

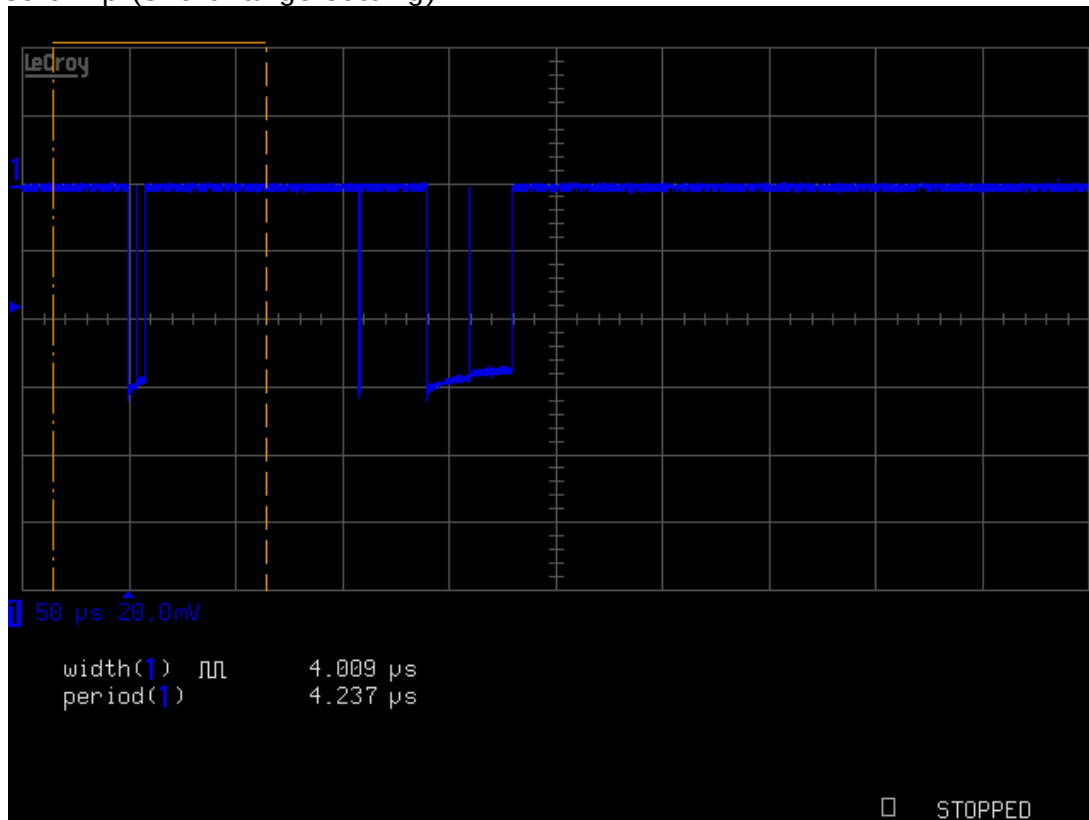
Pulse widths (short range)	20 + 4 + 0.1 μ s
Pulse widths (long range)	50 + 4 + 0.1 μ s
Pulse rep. rate	2500 pps

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3 pulse chirp (short range setting)



Overall chirp composition.

2 medium length pulses followed by 2 short duration pulses and followed again by 2 long duration pulses.

The groups of 2 represent the 2 carriers (1 then 2,1 then 2,1 then 2)

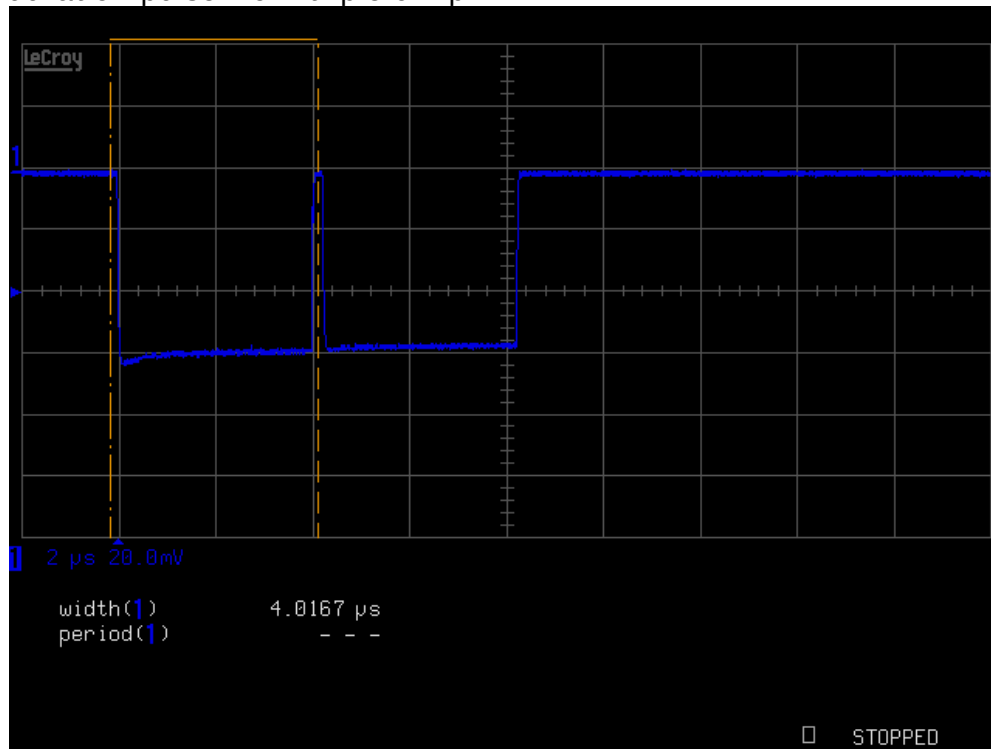
In the Long range setting the long duration pulses change to 50 μ s from 20 μ s.

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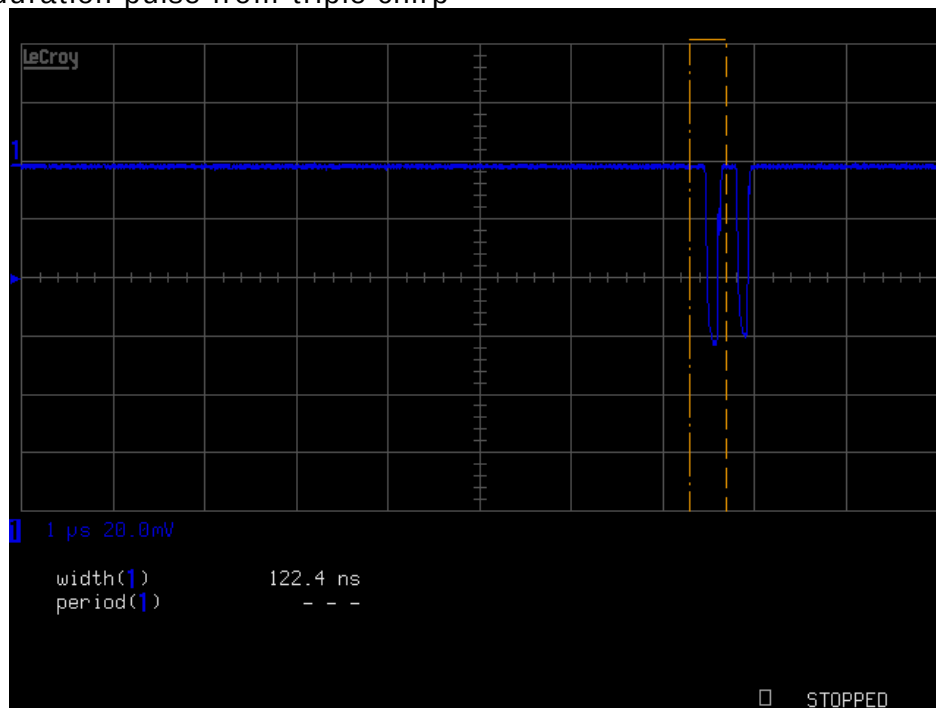
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Medium duration pulse from triple chirp



4 μs duration

Shortest duration pulse from triple chirp



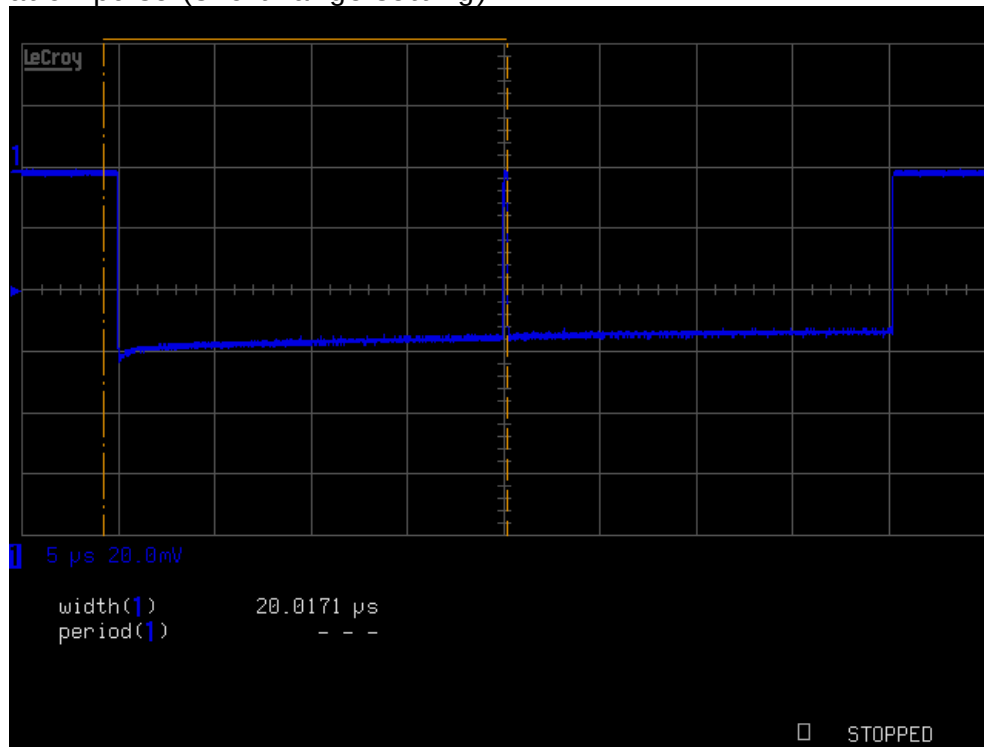
100 ns duration

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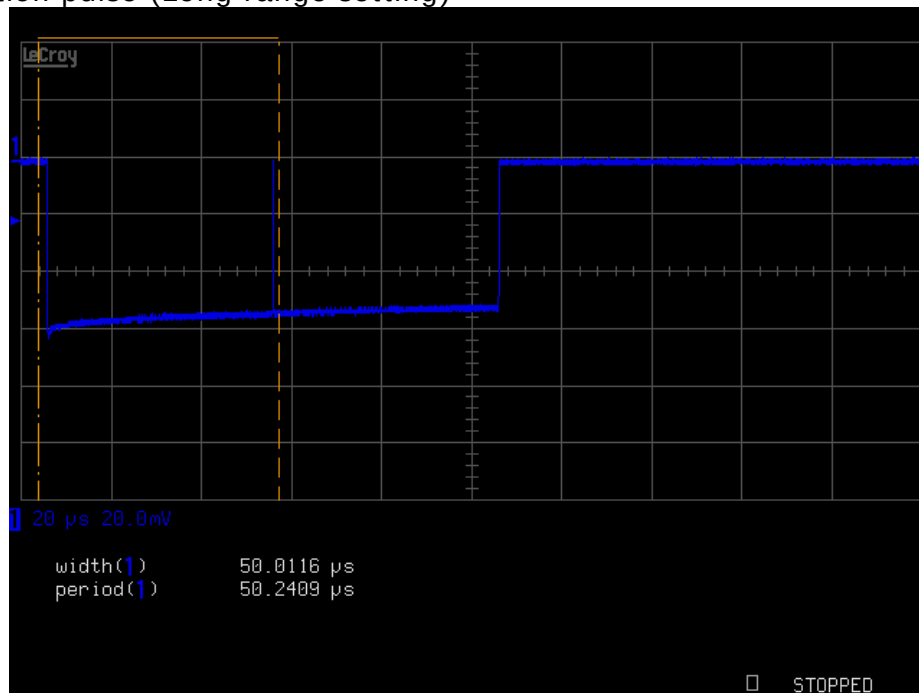
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Long duration pulse (short range setting)



20 μ s duration

Long duration pulse (Long range setting)



50 μ s duration

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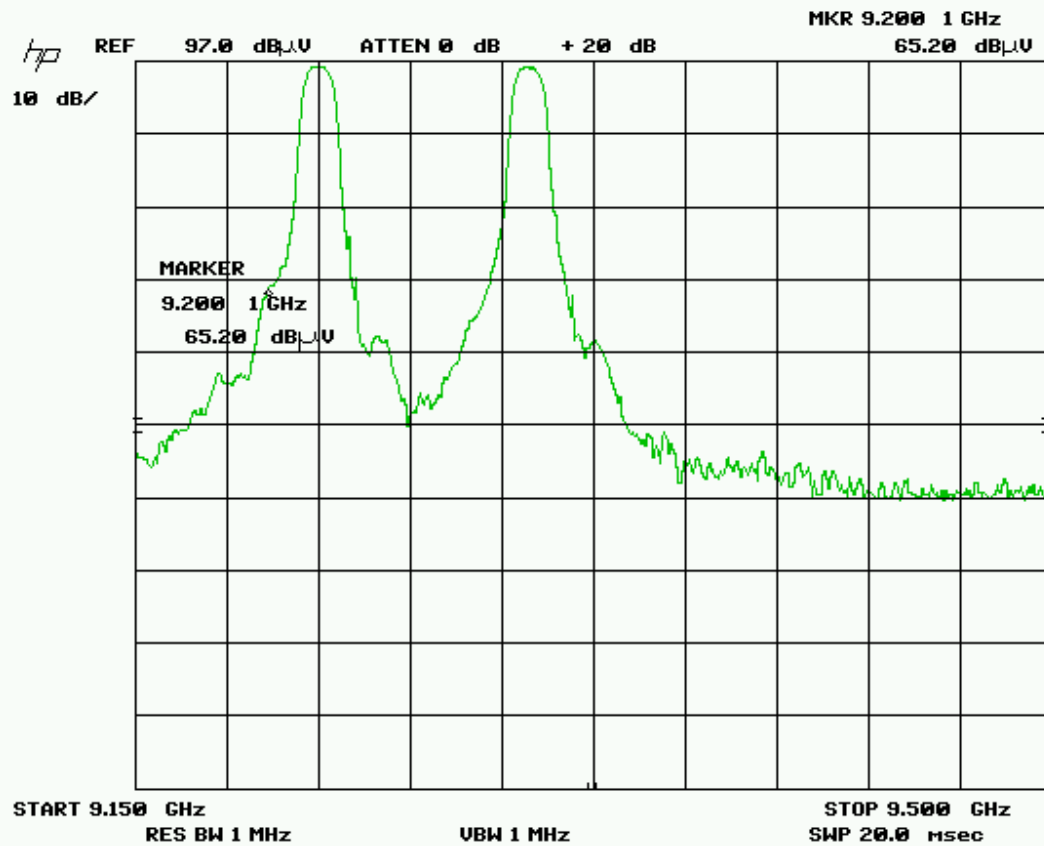
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OCCUPIED BANDWIDTH PLOT(S)

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

OBW at lowest frequency setting (3 pulse group)

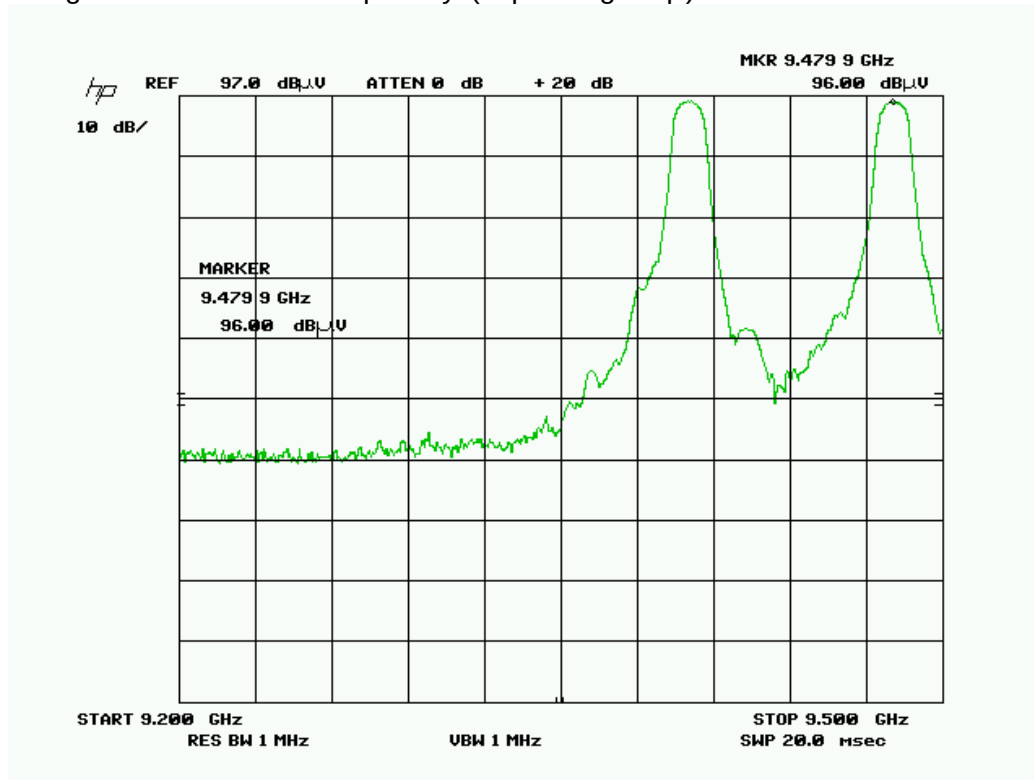


Applicant: KELVIN HUGHES LIMITED

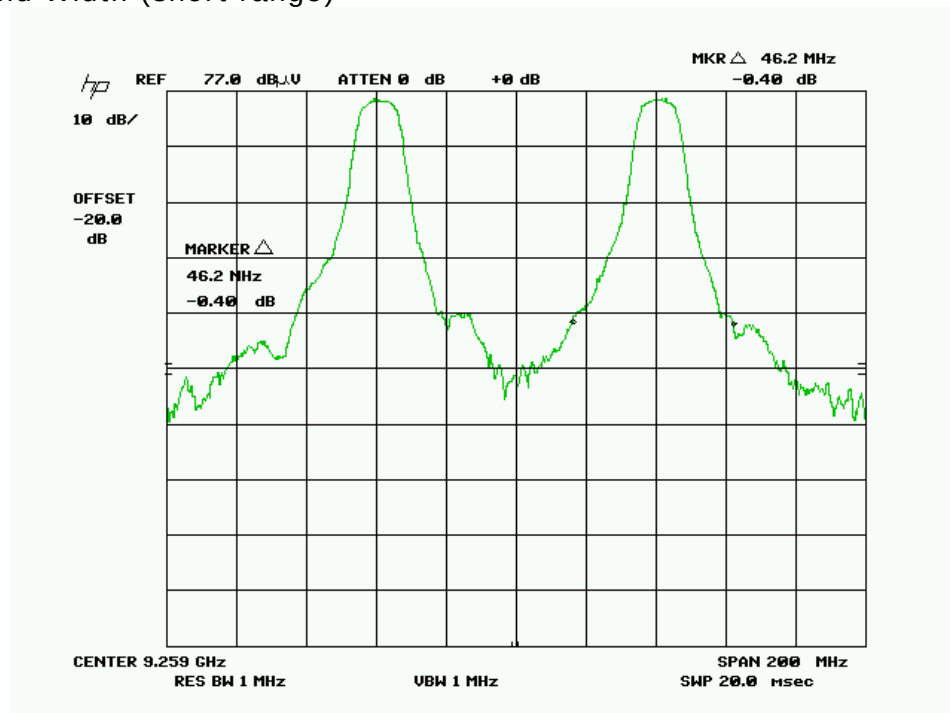
FCC ID: CICDTX-A3-FDLR

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OBW for highest selectable frequency (3 pulse group)



40 dB Band Width (short range)

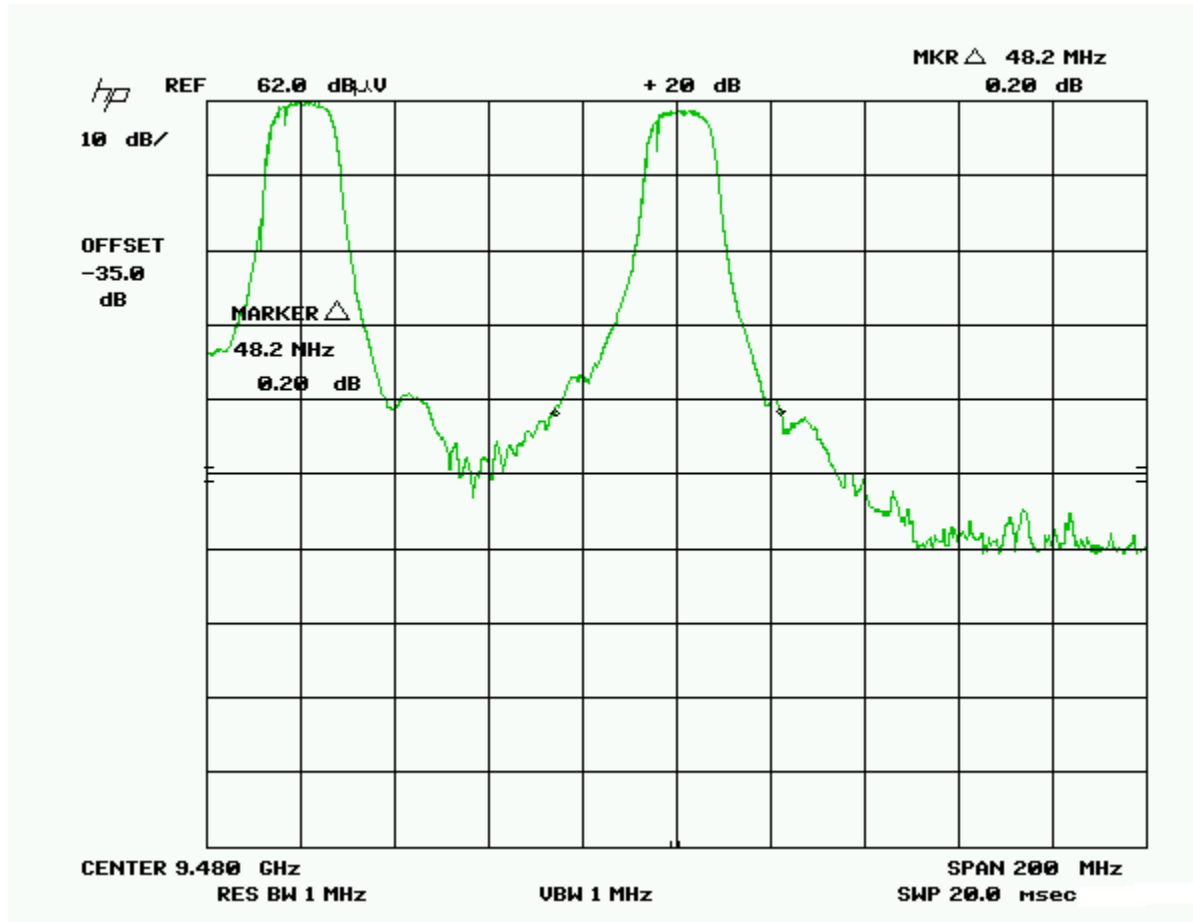


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40 dB Band Width (long range)



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

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

Requirements: $43 + 10\log(\text{mean power})$
 $43 + 10\log(27) = 57.3 \text{ dB}$

Method of Measurement: The spectrum was scanned from 9 kHz or the lowest frequency generated to at least the 10th harmonic of the fundamental or 40 GHz. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010 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. In the case of this device:

Pm Watts	Fr Hz	Td μs	Pa Watts
200 W	2500 Hz	20+4+0.1	12 W
200 W	2500 Hz	50+4+-.1	27 W

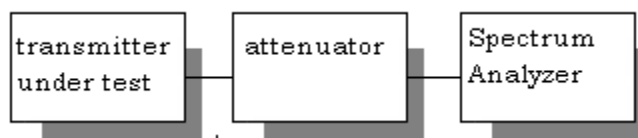
Test Data:

Worst case: chirp pulse mode setting (chirp 3)

Tuned Freq. (MHz)	Emission Freq. MHz	dB below carrier
9220	18440	64
	27660	62
	36880	62
9480	18960	65
	28440	63
	37920	62

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-D: 2010 or ANSI 63.4: 2003

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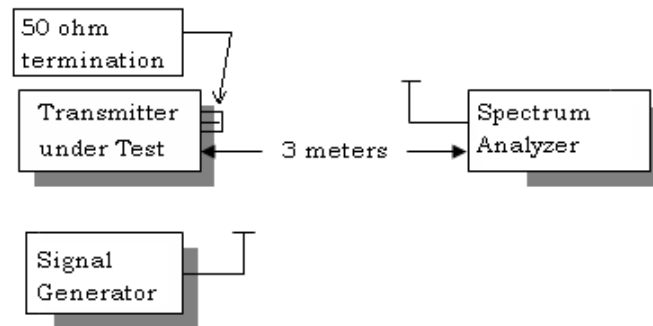
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053

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

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from the lowest frequency generated to at least the tenth harmonic of the fundamental or 40 GHz. This test was conducted per ANSI/TIA 603-D: 2010 using the substitution method.

Test Setup Diagram:



Test Data:

Tuned Frequency: 9220 MHz and 9480 MHz

Emission Frequency MHz	Ant. Polarity	dB below Carrier (dBc)
18440	V	71
27660	H/V	NF
36880	H/V	NF

Emission Frequency MHz	Ant. Polarity	dB below Carrier (dBc)
18960	V	72
28440	H/V	NF
37920	H/V	NF

NF is no significant emission found

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80 & 90

Requirements: The carrier frequency shall not depart from the reference frequency in excess of the value given in Part 80.209(b).

Method of Measurements: ANSI/TIA 603-D: 2010

Test Data:

	Ref. Freq. MHz		Ref. Freq. MHz	
	9219.799		9480.00	
TEMPERATURE °C	FREQUENCY MHz	PPM	FREQUENCY MHz	PPM
-30C	9219.79	-1.08	9479.98	-2.11
-20C	9219.79	-1.08	9479.99	-1.05
-10C	9219.81	1.08	9479.99	-1.05
0C	9219.81	1.08	9479.99	-1.05
10C	9219.81	1.08	9479.99	-1.05
20C	9219.79	-1.08	9480.00	0.00
30C	9219.8	0.00	9480.00	0.00
40C	9219.8	0.00	9480.01	1.05
50C	9219.8	0.00	9480.01	1.05
AC Volts		PPM		
-15 %	9219.80	0.0	9480.00	0.0
+15 %	9219.80	0.0	9480.00	0.0

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