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AMPLIFIER
FCC Part 90 & IC RSS-131
TEST REPORT

Applicant	CRESCEND TECHNOLOGIES, LLC
Address	140 E. State Parkway SCHAUMBURG IL 60173 USA
FCC ID	CWWP2RTK450
IC LABEL	7291A-P2RTK450
Model Number	P2-RTK-450
Product Description	25W ONE-WAY AMPLIFIER
Standards Applied	CFR 47 Part 90 IC Standard RSS-131, Issue 2, July 2003 IC Standard RSS-GEN, Issue 4, November 14
Date Sample Received	4/30/2015
Date Report Issued	5/6/2015
Date Tested	5/1/2015
Tested By	Sid Sanders
Approved By	Cory Leverett
Test Results	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
820AUT15TestReport.docx	Rev.1	Initial Issue	5/6/2015

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
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.

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 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:



Sid Sanders
Engineering Project Manager

Date: 5/6/2015

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EUT DESCRIPTION

EUT Description	25W ONE-WAY AMPLIFIER
FCC ID	CWWP2RTK450
IC	7291A-P2RTK450
Model Number	P2-RTK-450
Operating Frequency	450 to 470MHz
Test Frequencies	450.025, 460, & 469.075 MHz
Type of Emission	F1D
Modulation	C4FM
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 24- 26°C with a relative humidity of 50 - 65%.
Revision History to the EUT	None
Test Exercise	The EUT was operated in a normal mode.
Requirements	FCC CFR 47 PART 90, IC STANDARD RSS-131 ISS.2
Test Standards	ANSI/TIA 603-D:2010, ANSI C63.4: 2003 , RSS-131 I.2 Iss. 2
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

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TEST REPORT SUMMARY

Rule Part No.	Scope of Work	Status Pass/Fail/NA
Part 2.1033(c)(8) , Part 2.1046(a) , Part 90 RSS-131 Para. 6.2	RF Power Output	PASS
RSS-131 Para. 4.2	20dB PASSBAND	PASS
RSS-131 Para. 6.3.3	99% BANDWIDTH	PASS
RSS-131 Para. 6.3.	BANDWIDTH NON-LINEARITY:	PASS
Part 2.1033(c) (4) Part 2.1047(a)(6)	Modulation Characteristics	PASS
2.1051(a) RSS-131Para 6.4	Antenna Conducted Emissions	PASS
2.1053 , Part 90	Field Strength Spurious Emissions	PASS

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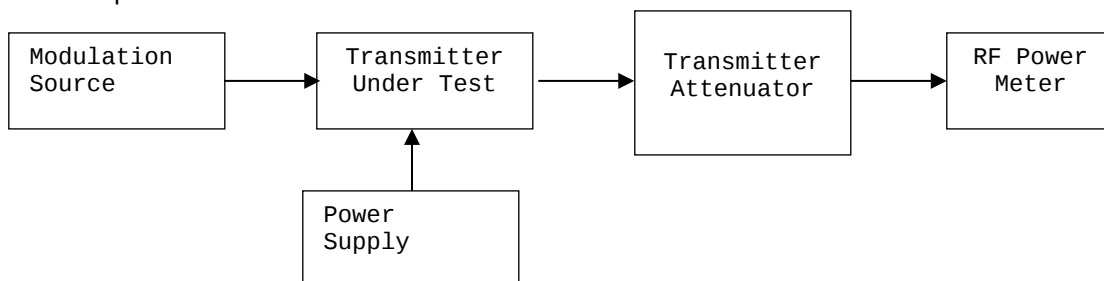
TEST RESULTS

RF POWER OUTPUT

Rule Part No.: Pt 2.1046(a), Pt 90.205, Pt 90.210, RSS-131

Requirements: Pt 2.1046(a), Pt 90, Pt 90.210, RSS-131 Para. 6.2 & 4.3.2

Method of Measurement: The RF power output was measured at the antenna feed point using a Average power meter. A 50-ohm, resistive wattmeter was connected to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:



Test Data: Power = 42.16 Watts

DC Power Consumption

Vdc = 13.6

Ic = 3.1

Frequency MHz	Input dBm	Output dBm	Output W	Gain dB
450	34.08	43.90	24.5	9.8
460	34.36	44.4	27.5	9.84
470	34.71	44.76	29.91	10.05

Gain Variation in Passband

Rule Part No.; RSS – 131 Para. 6.1

Requirement: The passband Gain shall not exceed the Nominal gain by more than 1.0dB.

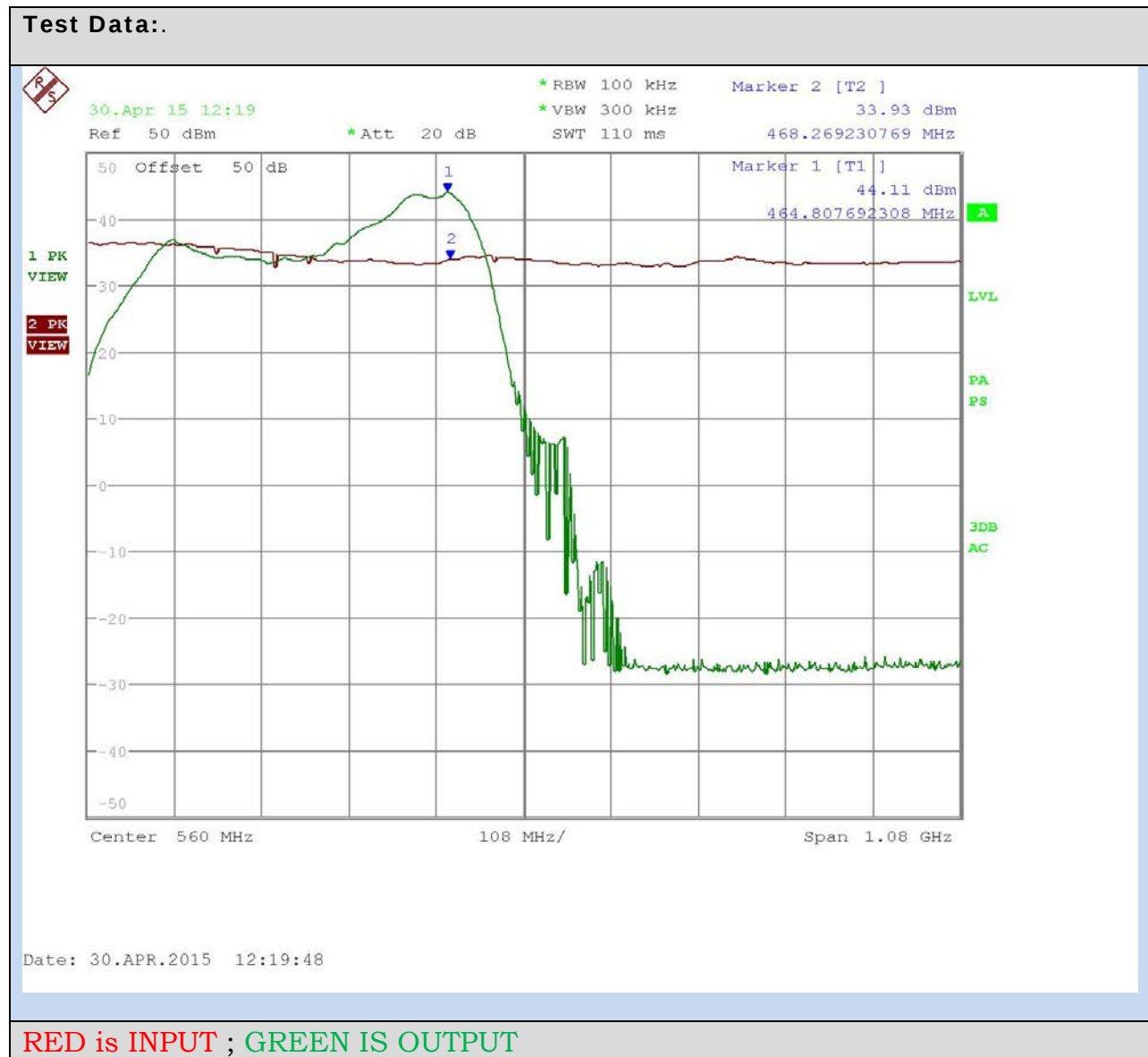
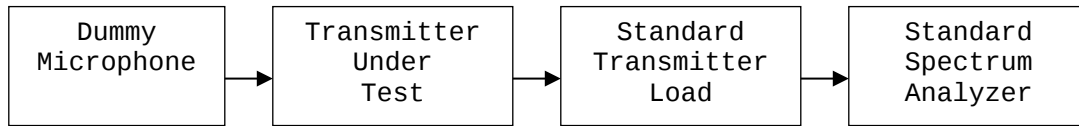
Results: Less than 0.76dB.

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PASS BAND 20dB BANDWIDTH:

Requirements: RSS-131 Para. 4.2,



Result Meets The Requirement

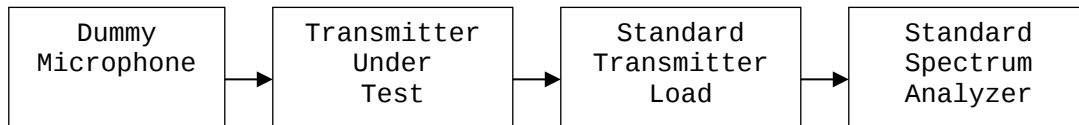
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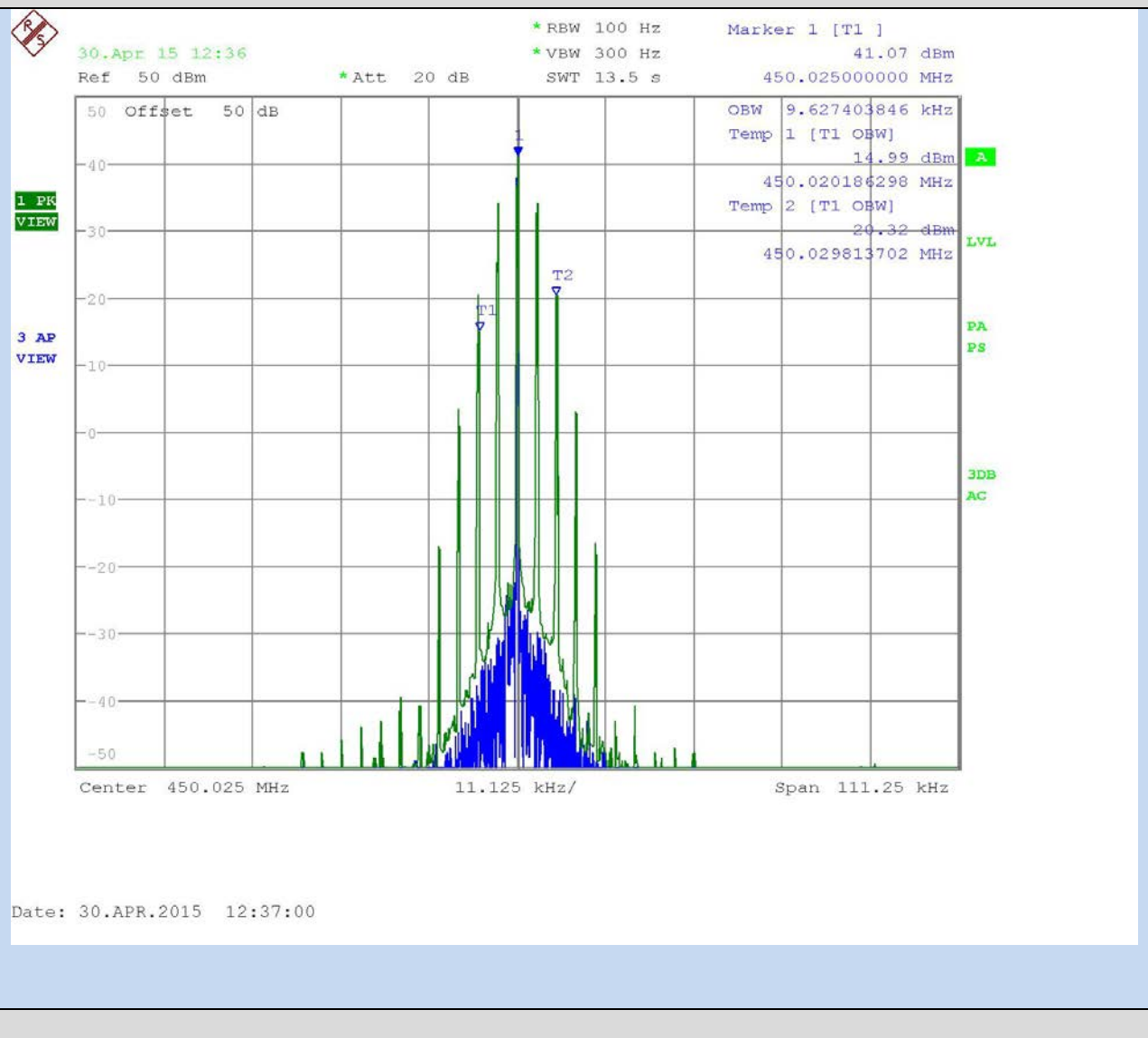
OCCUPIED BANDWIDTH 99 % at OUTPUT:

Requirements: RSS-131 Para. 6.3.3

Measurement Method: ANSI/TIA-603-C:2004 para 2.2.11.

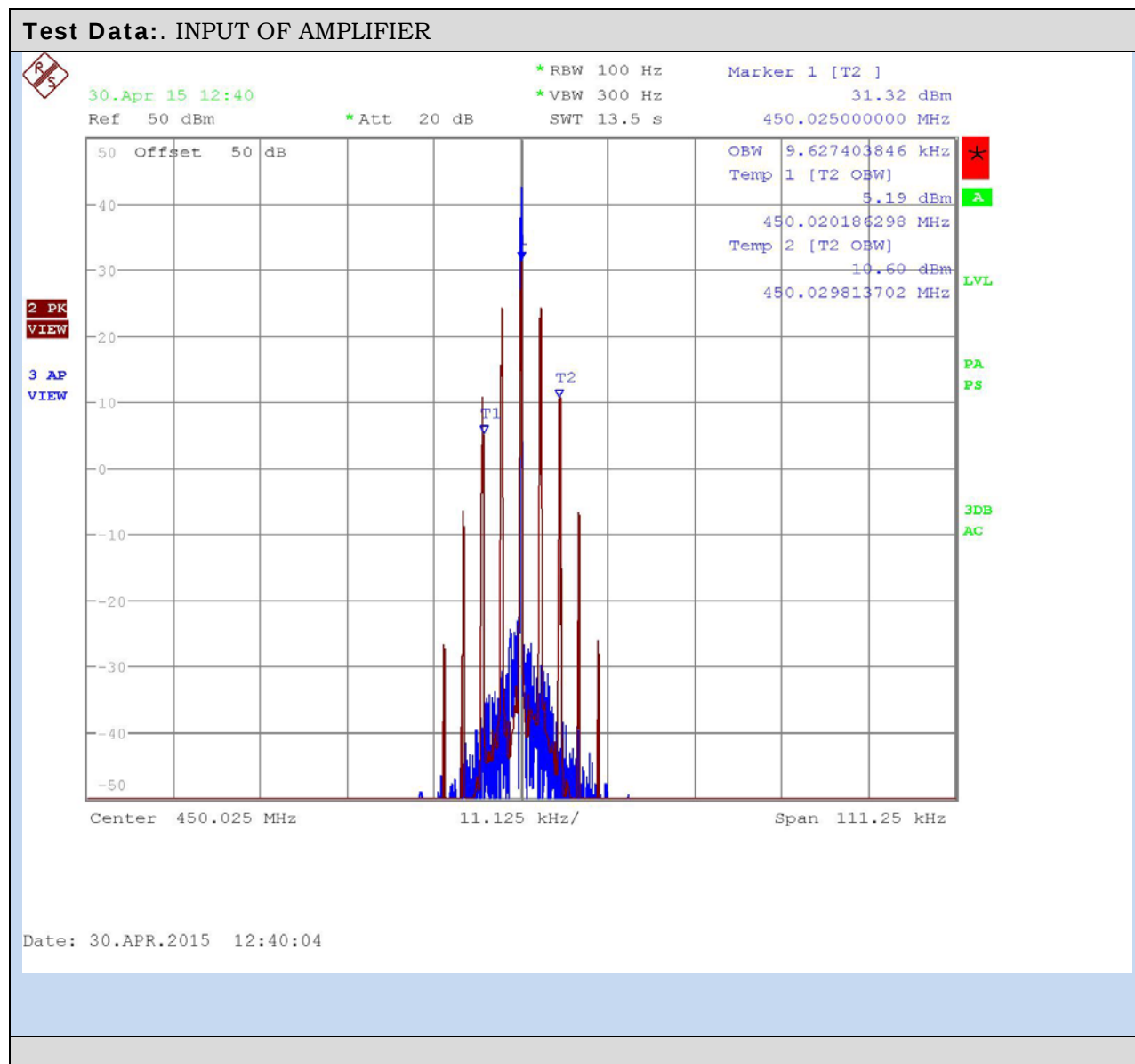


Test Data Output of Amplifier:



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OCCUPIED BANDWIDTH 99 at INPUT%:



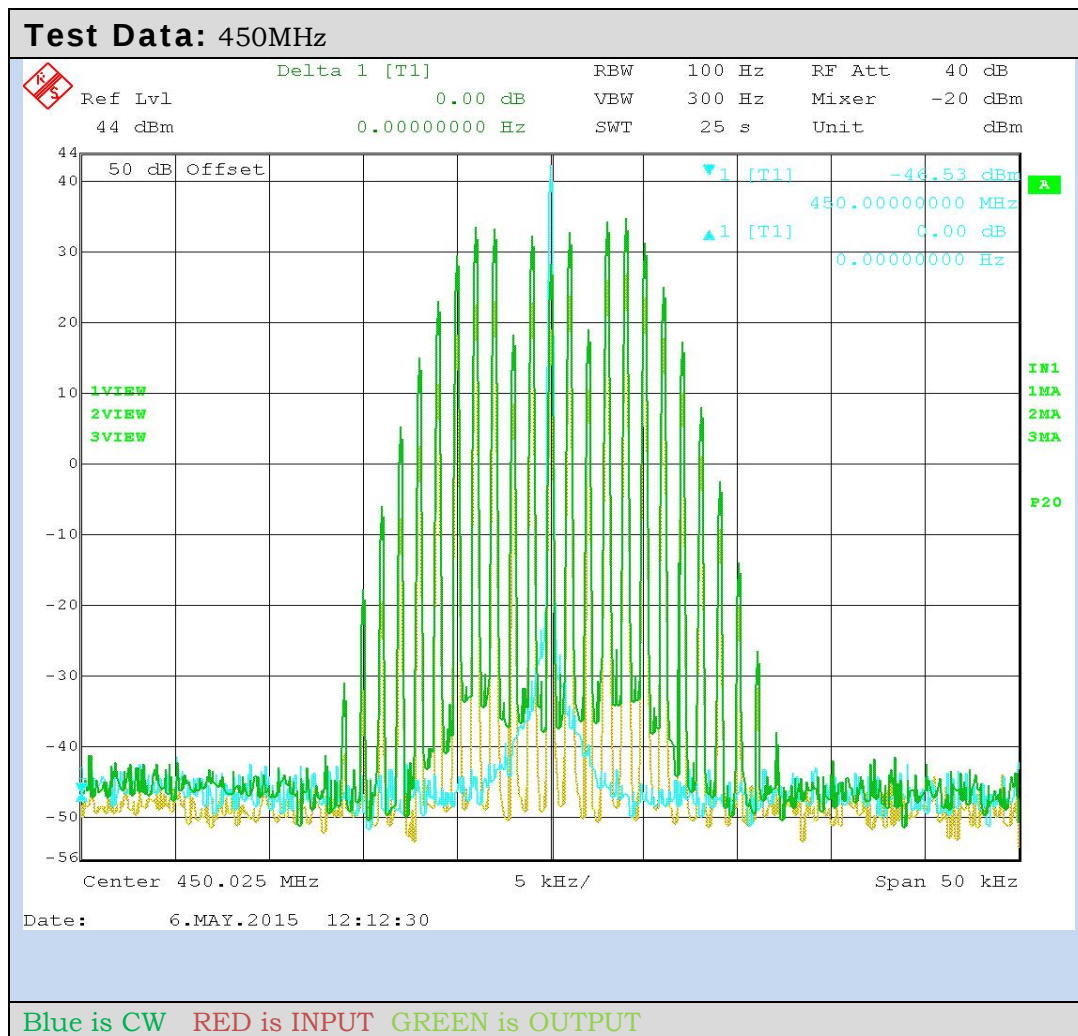
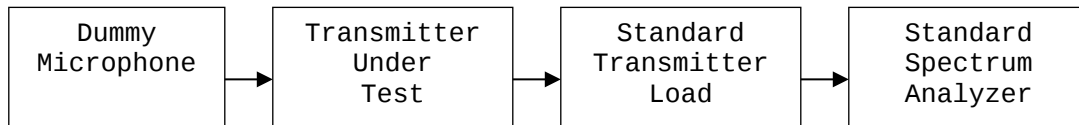
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BANDWIDTH NON-LINEARITY at 450MHz:

Requirements: RSS-131 Para. 6.3.3

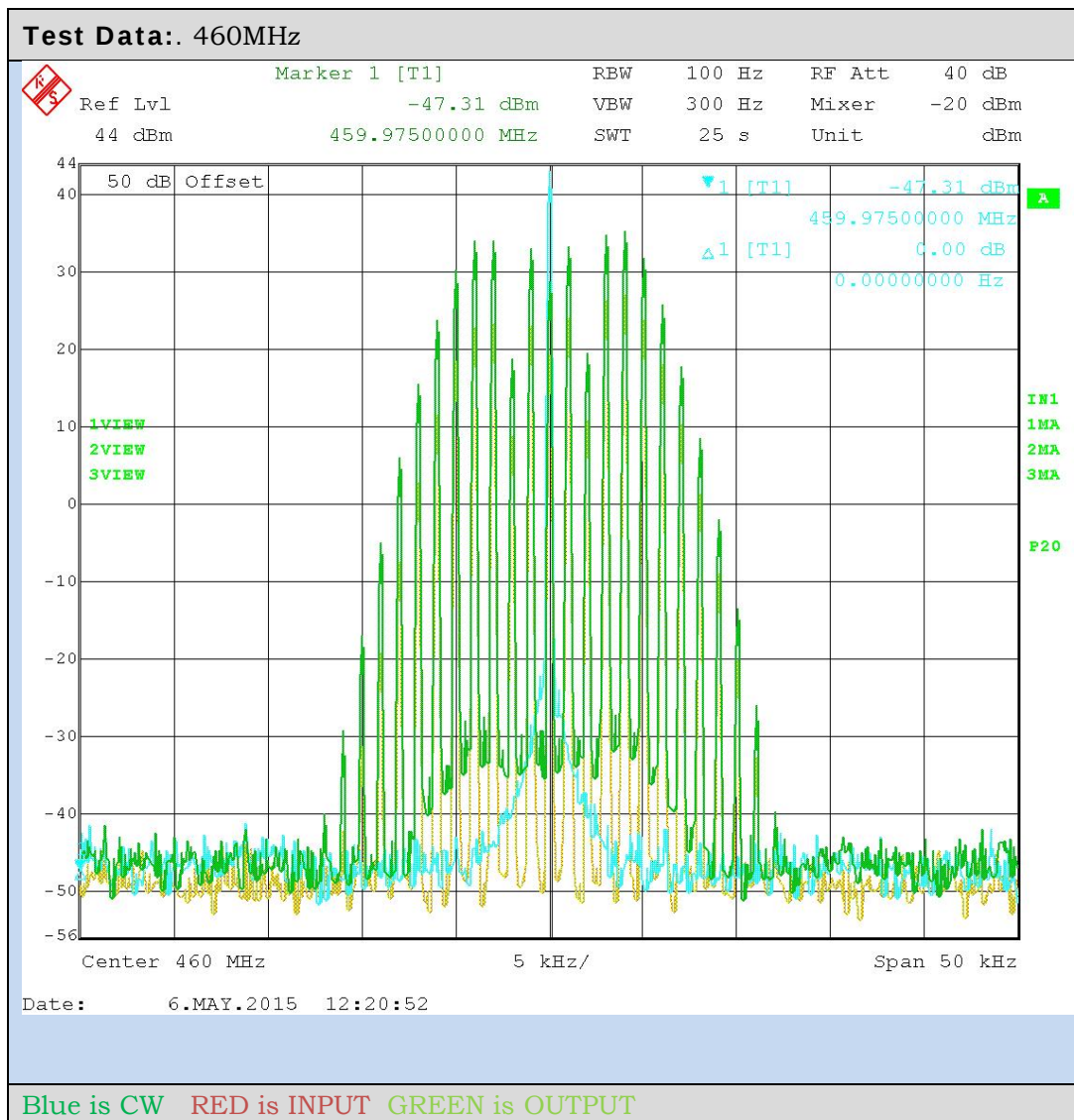
Measurement Method: ANSI/TIA-603-C:2004 para 2.2.11.



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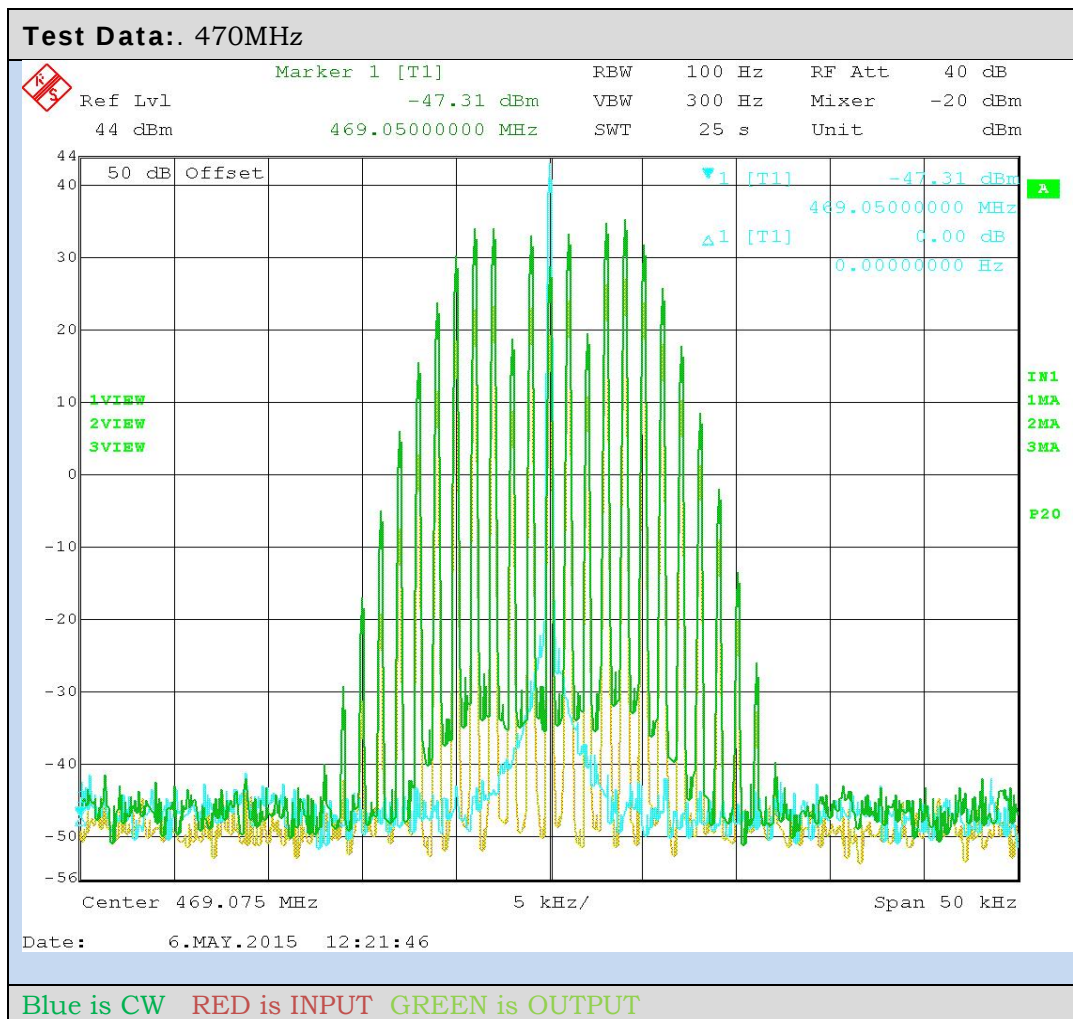
BANDWIDTH NON-LINEARITY at 460MHz:



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BANDWIDTH NON-LINEARITY at 470MHz:



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

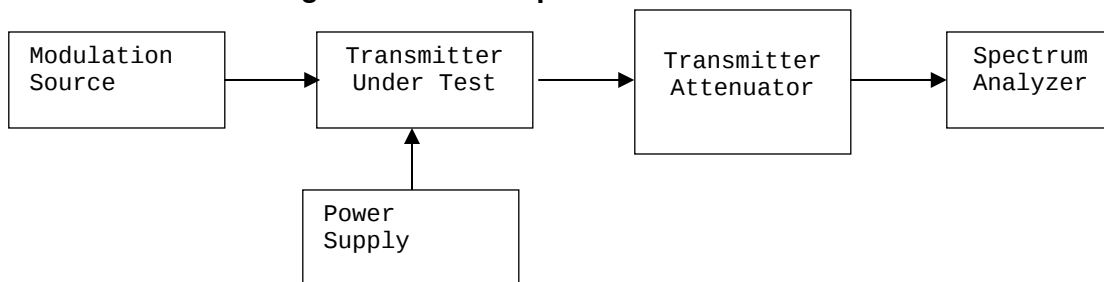
Requirements:

12.5 kHz Channel Spacing = $50 + 10 \log(25.0) = 64.0$ dBc (high power)

12.5 kHz Channel Spacing = $50 + 10 \log(5.0) = 57.0$ dBc (low power)

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010.

Method of Measuring Conducted Spurious Emissions:



Test Data: High Power Low end of Band

	dBm	Watts
Power Output		25
	Frequency	dBc
	450.025	0
	900.05	69.03
	1350.075	71.46
	1800.1	71.42
	2250.125	70.2
	2700.15	70.21
	3150.175	70.31
	3600.2	80.36
	4050.225	77.5
	4500.25	77.21

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Pt 2.1051(a), IC RSS-131

Requirements: $43 + 10\log(P_o) = 50 + 10\log(25) = 64.0 \text{ dB}$

Test Data: High Power Middle of Band

	dBm	Watts
Power Output	44	25
	Frequency	dBc
	460	0
	920	70.27
	1380	71.3
	1840	73.32
	2300	68.97
	2760	70.44
	3220	72.18
	3680	80
	4140	81.7
	4600	79.9

Test Data: High Power High End of Band

	dBm	Watts
Power Output	44	25
	frequency	dBc
	469.075	0
	938.15	71.1
	1407.225	74.56
	1876.3	69.52
	2345.375	68.75
	2814.45	68.9
	3283.525	69.89
	3752.6	77.77
	4221.675	77.8
	4690.75	79.2

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: Low Power Low end of Band

	dBm	Watts
Power Output	37	5
	Frequency	dBc
	450.025	0
	900.05	67.8
	1350.075	67.4
	1800.1	64.2
	2250.125	62
	2700.15	61.6
	3150.175	62.7
	3600.2	70.9
	4050.225	71.4
	4500.25	71.6

Test Data: Low Power Middle of Band

	dBm	Watts
Power Output	37	5
	Frequency	dBc
	460	0
	920	67.8
	1380	63.6
	1840	64.4
	2300	64.2
	2760	63
	3220	62.7
	3680	73.7
	4140	71.9
	4600	71.7

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: low Power High End of Band

	dBm	Watts
Power Output	37	5
	Frequency	dBc
	469.075	0
	938.15	65.8
	1407.225	65.5
	1876.3	66.3
	2345.375	64.3
	2814.45	61.5
	3283.525	64.1
	3752.6	73.1
	4221.675	73.9
	4690.75	82

RESULTS: PASS

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FIELD STRENGTH OF SPURIOUS EMISSIONS - RADIATED

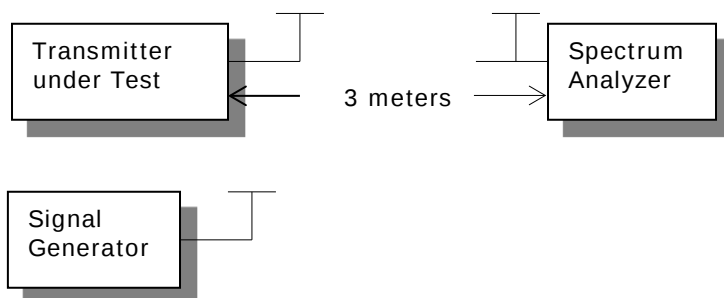
Rule Parts. No.: Part 2.1053, IC RSS-119

Requirements:

$$12.5\text{kHz Channel Spacing} = 50 + 10\log(OP) = \text{dBc}$$

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. This test was conducted per ANSI/TIA 603-D: 2010 using the substitution method. 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:

HIGH POWER: Low End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
450.00	Hi	44.00	25.12	64.00	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
900.00	H	68.98	4.98
1,350.00	V	85.49	21.49
1,800.00	V	81.18	17.18
2,250.00	H	68.62	48.62
2,700.00	H	66.25	46.25
3,150.00	H	63.63	43.63
3,600.00	H	62.12	42.12
4,050.00	H	57.31	37.31
4,500.00	H	60.78	40.78

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HIGH POWER: Middle of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
460.00	Hi	44.00	25.12	64.00	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
920.00	H	71.64	7.64
1,380.00	H	84.26	20.26
1,840.00	V	80.60	16.60
2,300.00	V	78.92	14.92
2,760.00	H	66.08	53.08
3,220.00	H	63.24	50.24
3,680.00	H	61.49	48.49
4,140.00	H	58.78	45.78
4,600.00	H	68.06	55.06

HIGH POWER: High End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
470.00	Hi	44.00	25.12	64.00	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
940.00	H	27.78	7.78
1,410.00	H	41.94	21.94
1,880.00	H	67.26	47.26
2,350.00	H	67.99	47.99
2,820.00	H	65.88	45.88
3,290.00	H	63.07	43.07
3,760.00	H	60.76	40.76
4,230.00	H	60.26	40.26
4,700.00	H	63.42	43.42

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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
DC Power Supply	HP	6286A	1744A03842	12/12/99	12/12/99
Antenna: Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	05/31/15
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	08/19/14	08/19/16
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Ant: Double-Ridged Horn/ETS Horn 1 Ch	ETS-Lindgren Chamber	3117	00035923	06/13/14	06/13/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Attenuator N 30dB 150W DC-6G	Narda	769-30	10267	03/15/13	09/15/15
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	08/29/15
Attenuator 30dB 500W	Bird	8325	1761	02/25/13	08/25/15

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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