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FCC PART 80

RADAR TEST REPORT

APPLICANT	ALPHATRON MARINE USA, INC.
	1205 BUTLER ROAD
	LEAGUE CITY TX 77573 USA
FCC ID	2ADJKJMA-610
MODEL NUMBER	JMA-610
PRODUCT DESCRIPTION	MARINE RADAR
DATE SAMPLE RECEIVED	1/7/2015
DATE TESTED	02/09/2015 – 02/13/2015, 03/20/2015
TESTED BY	Christian Pawlak
APPROVED BY	Sid Sanders
TIMCO REPORT NO.	45AUT15TestReport.docx
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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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:



Christian Pawlak
Engineering Project Manager

Date:

03/25/2025

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EUT SPECIFICATION

EUT Description	MARINE RADAR MARINE RADAR
FCC ID	2ADJKJMA-610
Model Number	JMA-610
Serial Number	N/A
Frequency Range	9300-9500 MHz
Test Frequency	9410 MHz
Type of Emission	PON
Modulation	Pulsed, no modulation
EUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz <input checked="" type="checkbox"/> DC Power (24v) <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 type="checkbox"/> Fixed <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable
Antenna	None

TEST SETUP INFORMATION

Test facility	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
Test Condition	The EUT was tested under normal temperature and humidity. The temperature was 24-26°C with a relative humidity of 50-70%.
Modifications	Using magnetron EEV MG4006
Test Exercise	The EUT was placed in continuous transmit mode of operation
Applicable Standards	ANSI/TIA 603-D:2010, FCC CFR 47 Part 80

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SYSTEM DESCRIPTION:

Function of this System

The JMA-610 series is a color radar system. The main functions include:

- * Sensitivity adjustment
- * Sea clutter & rain/snow clutter suppression.
- * Interference reflector
- * Bearing & range measurement using a cursor, fixed/variable range & electronic bearing line
- * Targets expansion
- * trails display
- * receiving inland AIS sentence
- * Display of AIS label (vessel name) while pushing the button when the AIS sentence is being received
- * Delivery of echo's screen by LAN
- * Display of user map
- * Controlling almost function of the radar by PS2 mouse which user connected
- * Saving the radar screen to the inside or the external memory (Screen capture function)

GENERAL SPECIFICATION FOR SCANNER UNIT

1. Dimensions: Height: 458mm, Swing Circle: 2270mm
2. Mass: 36.0 kg
3. Polarization: Horizontal
4. Beam width
 - Horizontal (-3dB): 1.0 degree
 - Vertical (-3dB): 25 degree
 - Side lobe level: Less than -26dB within 10 degree of main beam
 - Less than -30dB outside 10 degree of main beam
5. Rotation speed: 24, 36, 48rpm
6. Frequency: 9410±30MHz
7. Peak Power: 4.9 kW
8. Pulse length / Repetition frequency: SP .05 uS/4000 Hz, MP1 .1 uS/2000 Hz, MP2 .3 uS/2000 Hz, SP .6 uS/1000 Hz,
9. Modulator: Solid-state modulator

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TEST REPORT SUMMARY

Rule Part No.	Scope of Work	Status Pass/Fail/NA
<u>Part 2.1033(c)(8),</u> <u>Part 2.1046(a), Part</u> <u>80.215 & Part 90</u>	RF Power Output	Pass
<u>Part 2.1033(c) (4)</u> <u>Part 2.1047(a)(6)</u> <u>Part 80.213</u>	Modulation Characteristics	Pass
<u>2.1049(c), 80.209(b),</u> <u>80.211(f)</u>	Emission Mask and Occupied Bandwidths	Pass
<u>2.1051(a), 80.211(f)</u>	Antenna Conducted Emissions	Pass
<u>2.1053, 80.211(f)</u>	Field Strength Spurious Emissions	Pass
<u>Part 2.1055, Part</u> <u>80.209</u>	Frequency Stability	Pass

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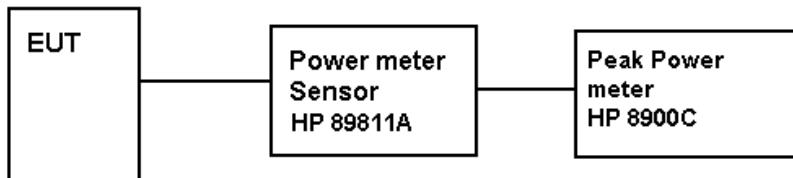
RF POWER OUTPUT

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

Test Requirements:

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: 4900 Watts Peak

Average Power: 2.94Watts

Results Meet Requirements

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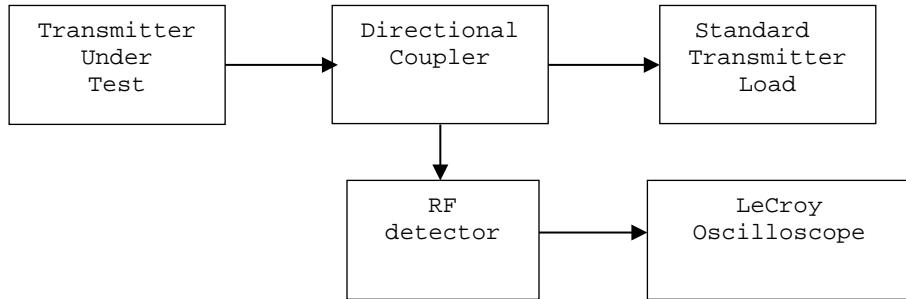
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MODULATION CHARACTERISTICS

Rule Part No.: 2.1047

Method of Measurement: ANSI/TIA 603-D

Test Setup Diagram:



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

Further detailed specifications are contained in "product specifications" manual.

Below are plots of these pulse groups

No.	RANGE IN km	Pulse Name	Pulse widths μ s	Pulse rep. rate Hz
1.	0.15	SP	0.05	4000
2.	0.30	SP	0.05	4000
3.	0.50	SP	0.05	4000
4.	0.80	SP	0.05	4000
5.	1.20	SP	0.05	4000
6.	1.60	SP	0.05	4000
7.	2.0	SP	0.05	4000
8.	4.0	MP1	0.10	2000
9.	8.0	MP2	0.30	2000
10.	16.0	LP	0.60	1000
11.	32.0	LP	0.60	1000

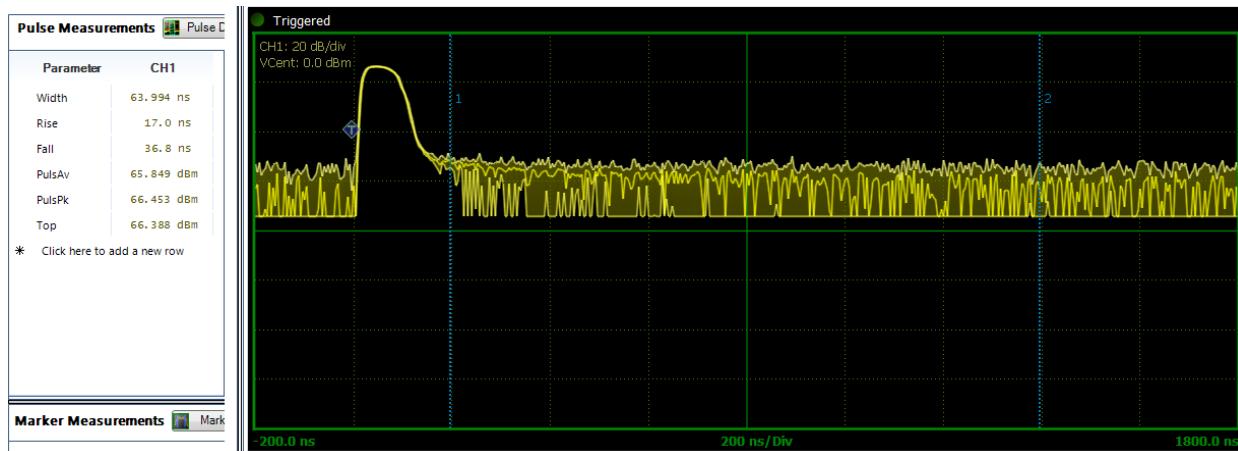
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MODULATION CHARACTERISTICS - SP

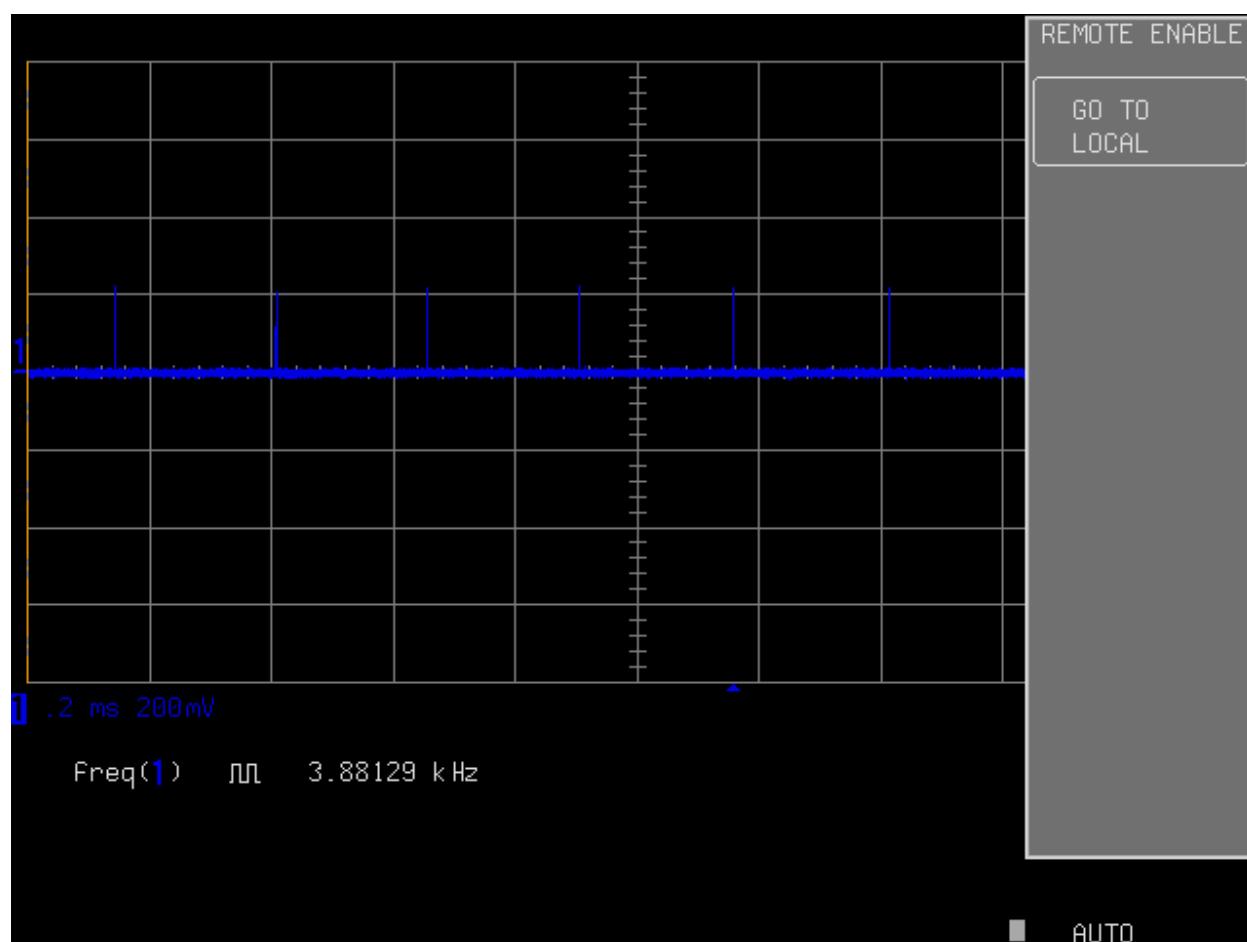


Rise: 17.0 ns

Fall: 36.8 ns

Width: 63.99 ns

Top: 66.38 dBm



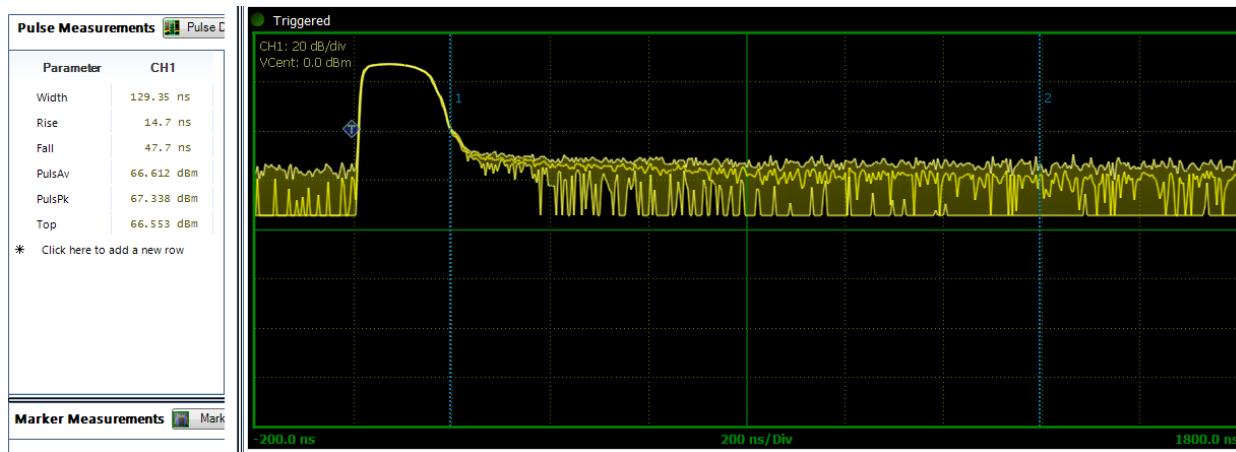
Results Meet Requirements

Applicant: ALPHATRON MARINE USA, INC.

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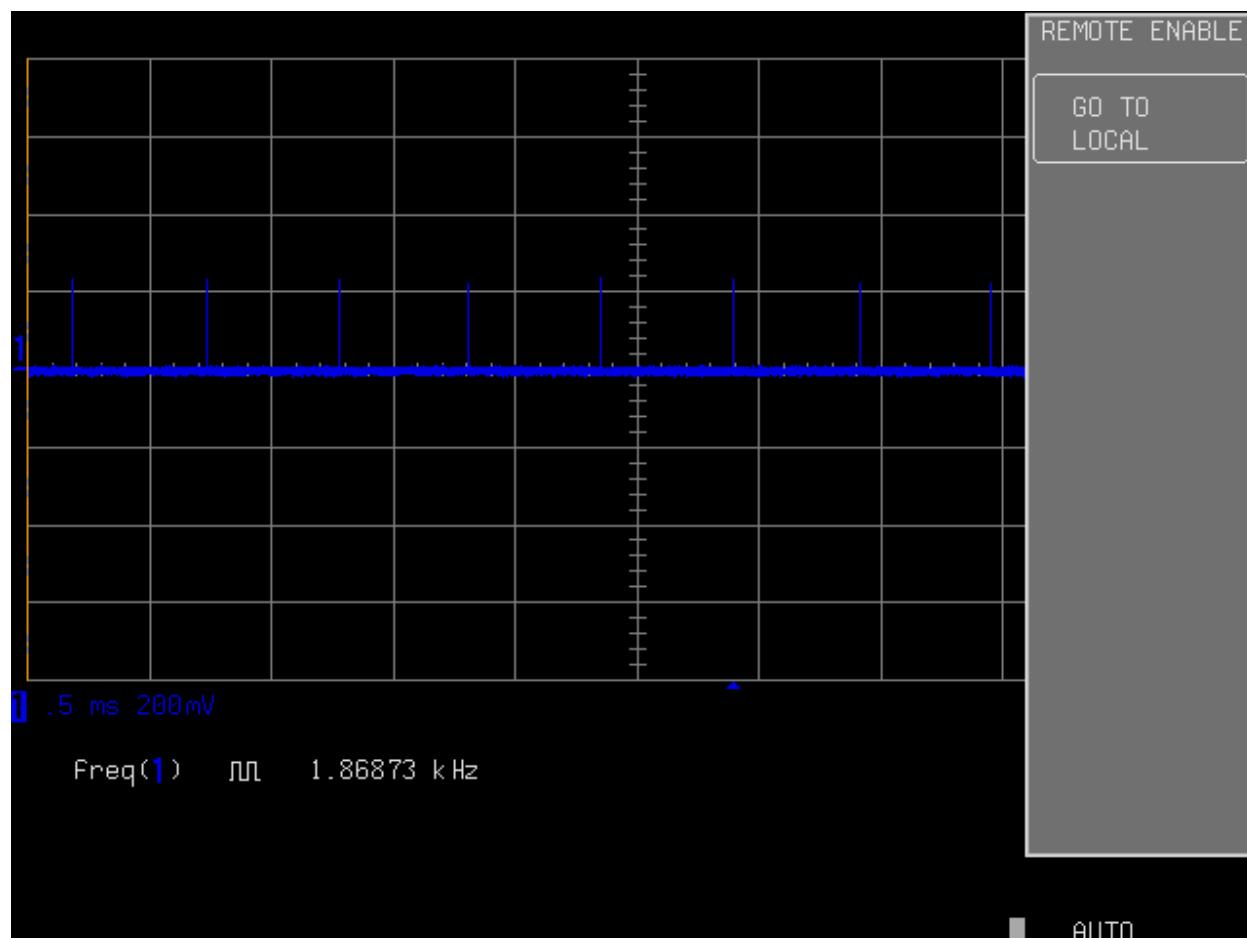
Report: a\Alphatron\45AUT15\45AUT15TestReport.docx

MODULATION CHARACTERISTICS - MP1



Rise: 14.7 ns
Fall: 47.7 ns

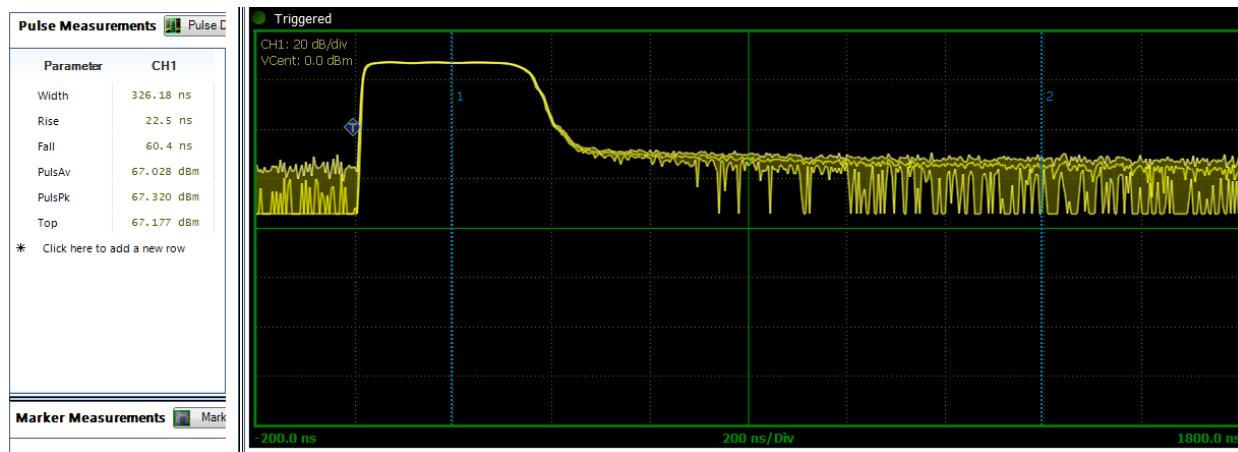
Width: 129.35 ns
Top: 66.55 dBm



Results Meet Requirements

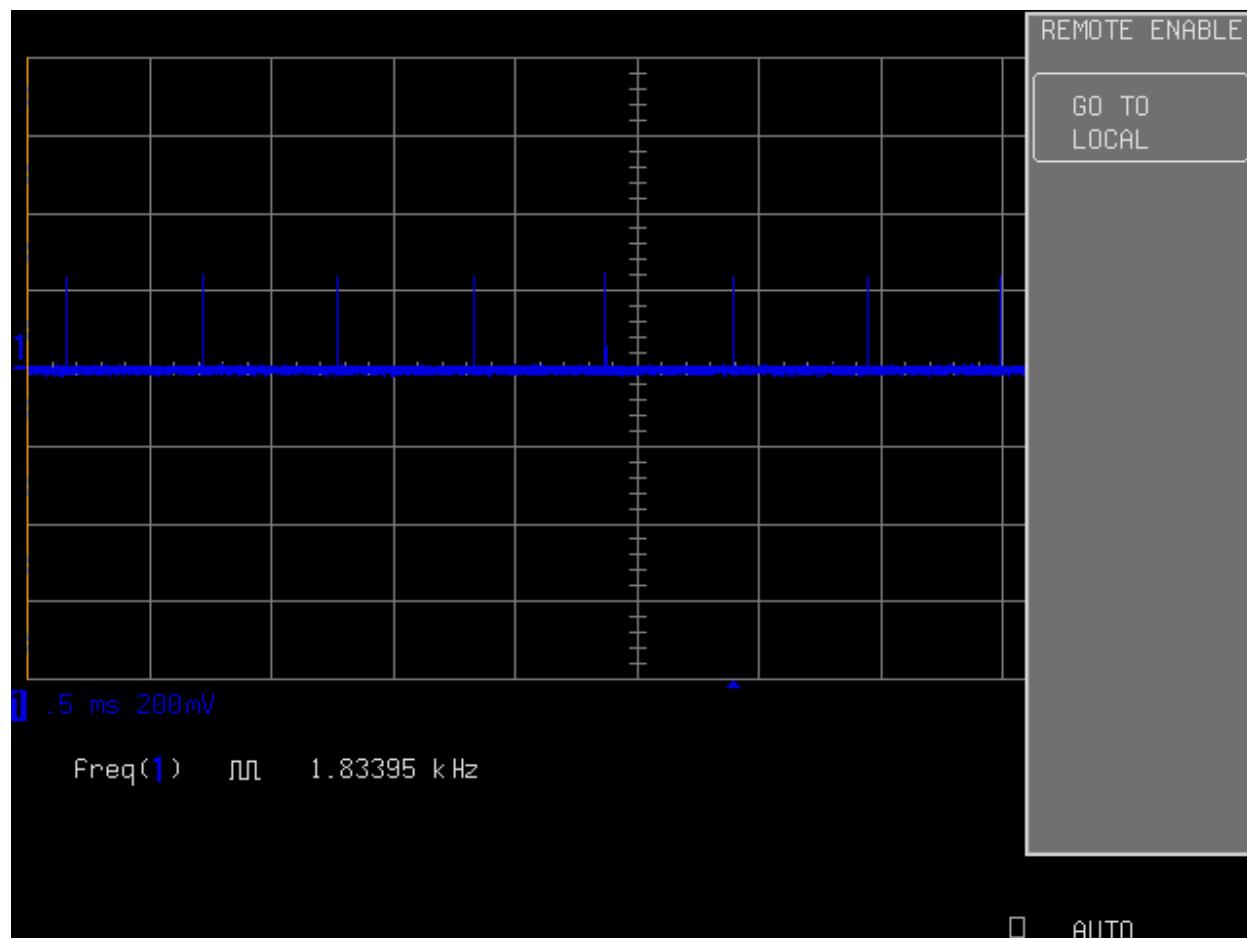
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MODULATION CHARACTERISTICS - MP2



Rise: 22.5 ns
Fall: 60.4 ns

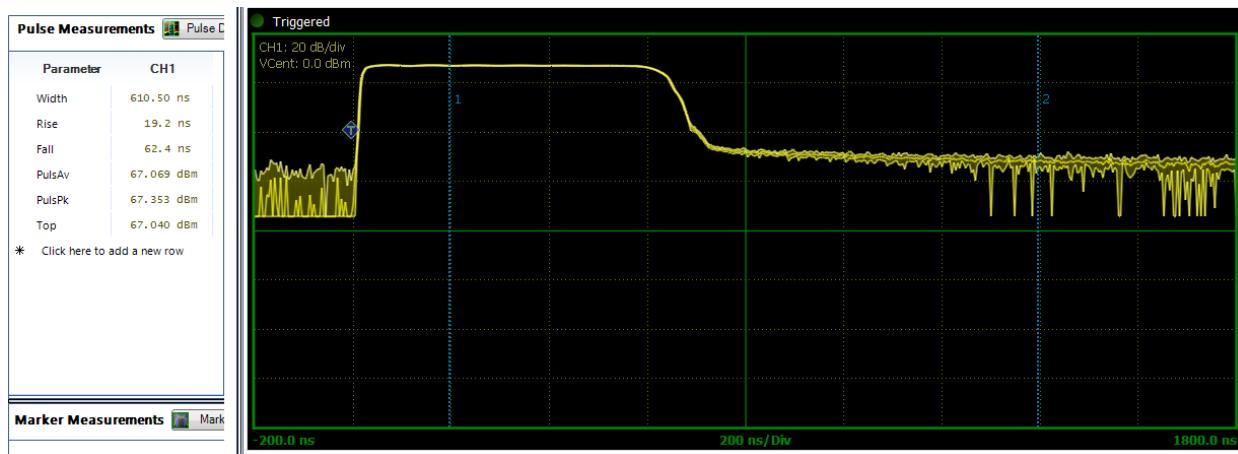
Width: 326.18 ns
Top: 67.177 dBm



Results Meet Requirements

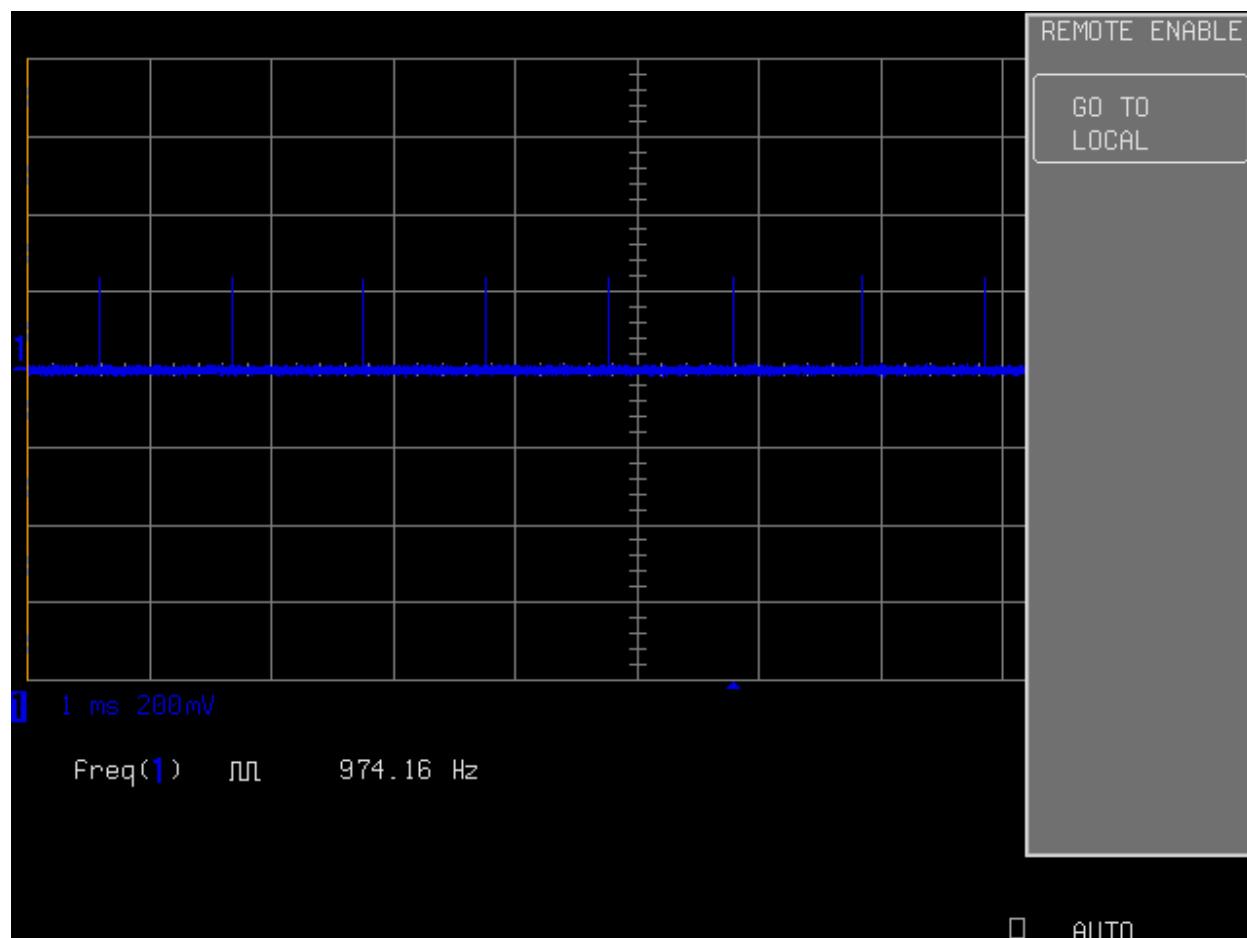
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MODULATION CHARACTERISTICS - LP



Rise: 19.2 ns
Fall: 62.4 ns

Width: 610.50 ns
Top: 67.04 dBm



Results Meet Requirements

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OCCUPIED BANDWIDTH

Rule Part No.: 2.1049, 80.209(b)

Requirement: The emission mask for this device requires that the emission only need stay in the band and be no closer than $1.5/T$, where T = narrowest pulse, of the band edge.

Test Data:

Worst case SP, $T = .05 \mu\text{s}$

Limit Below = $9300 \text{ MHz} + 1.5/.05 = 9330 \text{ MHz}$

Limit Above = $9500 \text{ MHz} - 1.5/.05 = 9470 \text{ MHz}$

OBW must stay within [9330 MHz, 9470 MHz]

Pulse	Occupied Bandwidth	Endpoint Below MHz	Endpoint Above MHz	Margin Below MHz	Margin Above MHz	Result
SP	65.21 MHz	9371.91	9437.12	41.91	32.88	Pass
MP1	59.43 MHz	9371.04	9430.48	41.04	39.52	Pass
MP2	28.56 MHz	9394.41	9422.98	64.41	47.02	Pass
LP	16.73 MHz	9403.36	9420.09	73.36	49.91	Pass

Results Meet Requirements

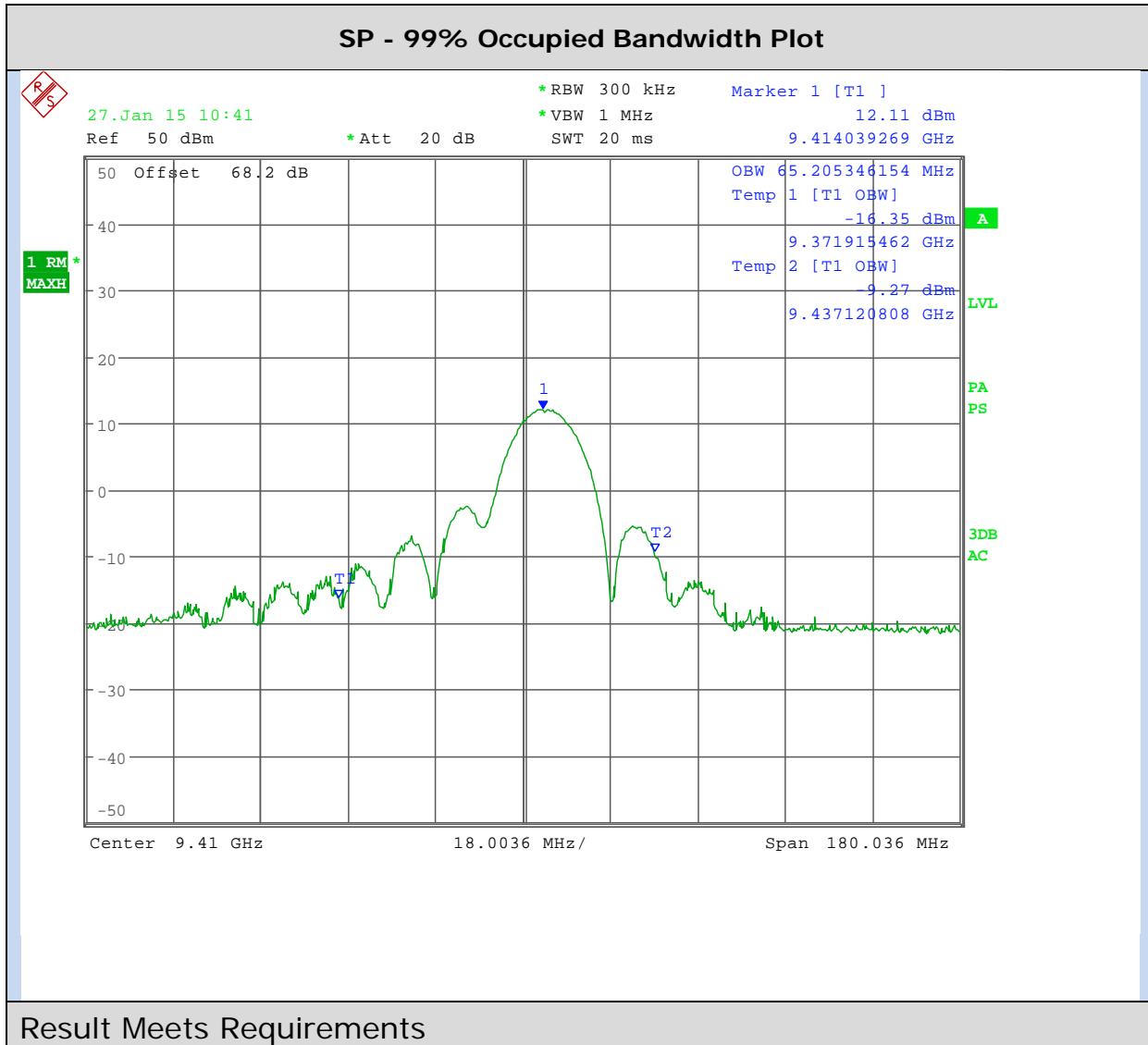
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OCCUPIED BANDWIDTH - SP

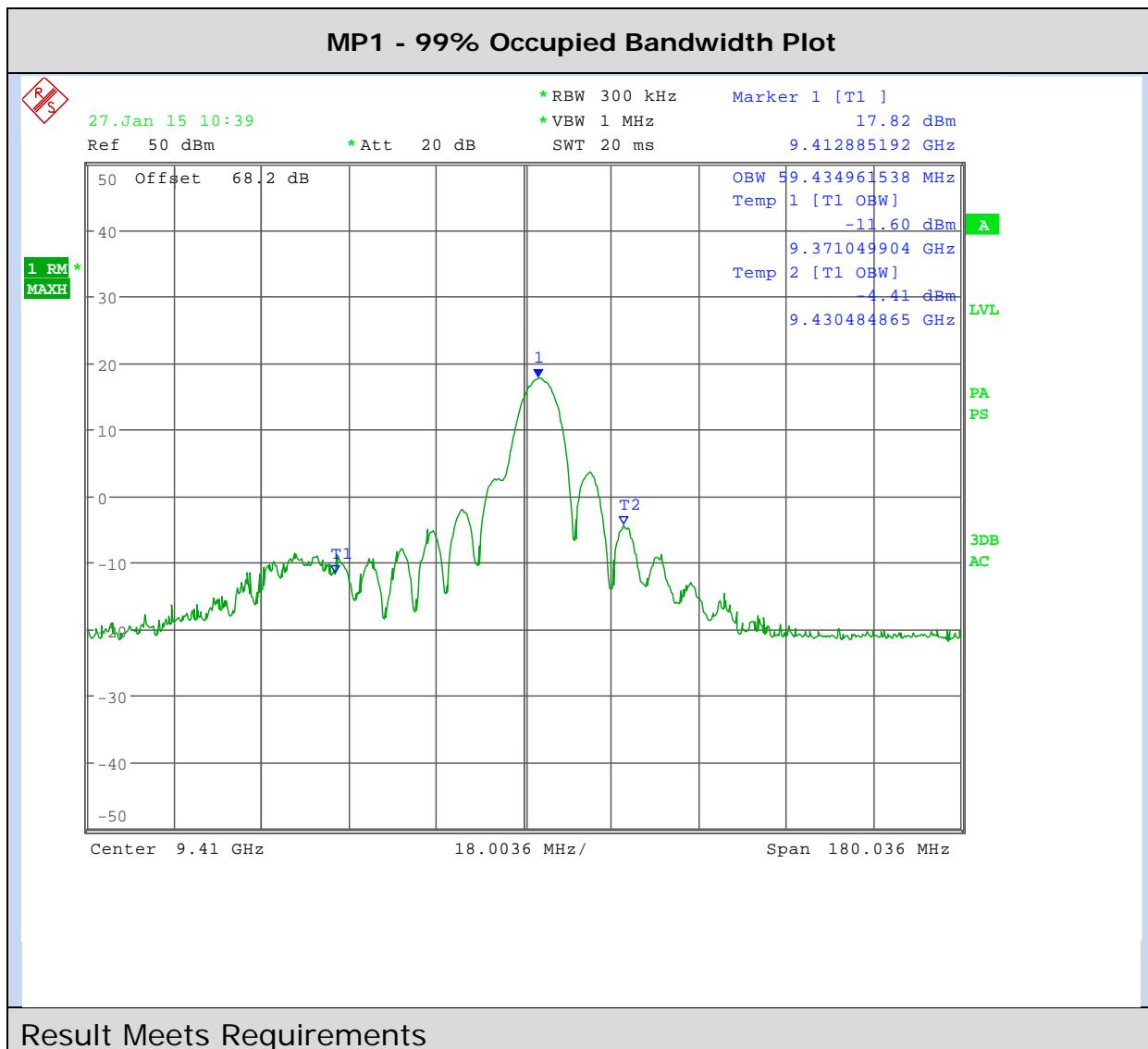


Results Meet Requirements

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OCCUPIED BANDWIDTH – MP1

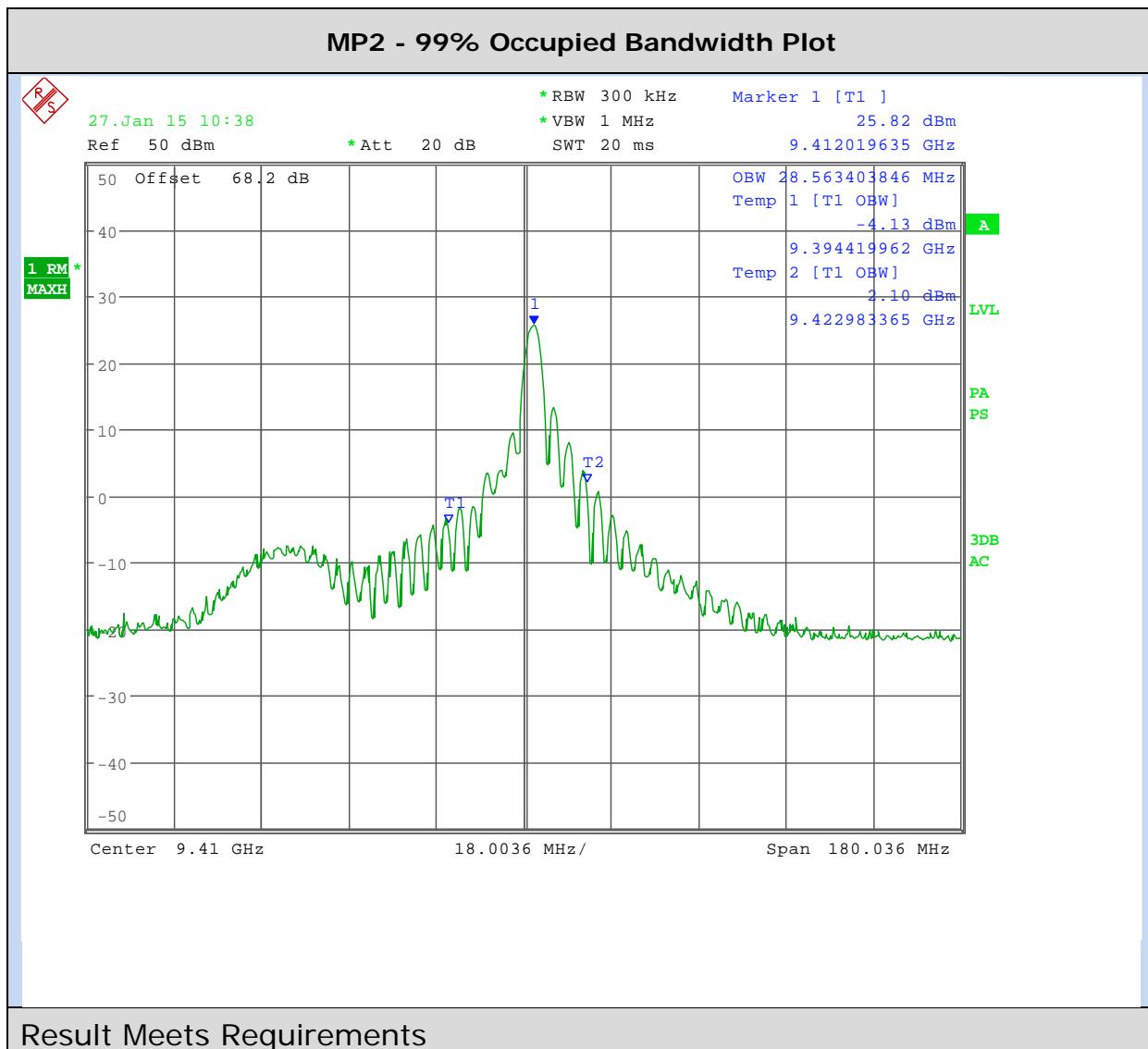


Results Meet Requirements

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OCCUPIED BANDWIDTH - MP2

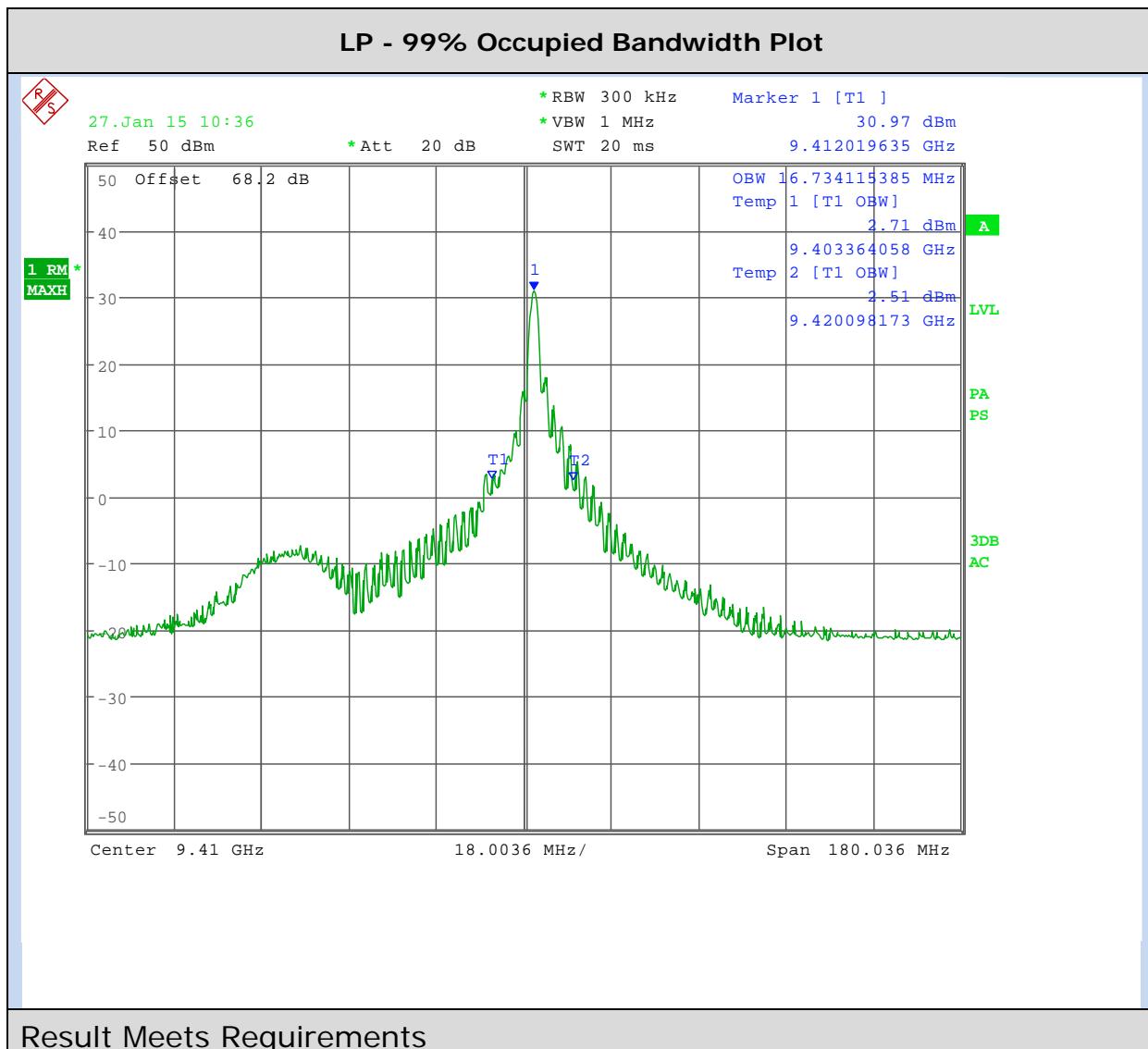


Results Meet Requirements

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OCCUPIED BANDWIDTH - LP



Results Meet Requirements

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

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

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

$$SP = 43 + 10\log (1) = 43.00 \text{ dBc}$$

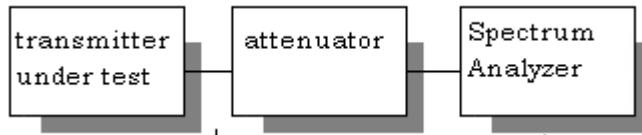
$$MP1 = 43 + 10\log (1) = 43.00 \text{ dBc}$$

$$MP2 = 43 + 10\log (3) = 47.77 \text{ dBc}$$

$$LP = 43 + 10\log (3) = 47.77 \text{ dBc}$$

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 or ANSI 63.4:2003.

The mean power was calculated based on the standard formula for radar systems: $Pa = Pm * Td * fr$. Where Td is pulse duration, Pm is peak power, and fr is pulse rep rate.



Various modes were tested and the worst case presented below. Harmonics were checked to 40 GHz.

Test Data:

Worst case: Pulse LP

	dBm	Watts	Margin
Power Output	34.7	2.94	
	Frequency	dBc	
	9410	0	
	18820	59.7	11.9
	28230	57.1	9.3
	37640	70.7	22.9

All other emissions were more than 20 dB below the limit.

Results Meet Requirements

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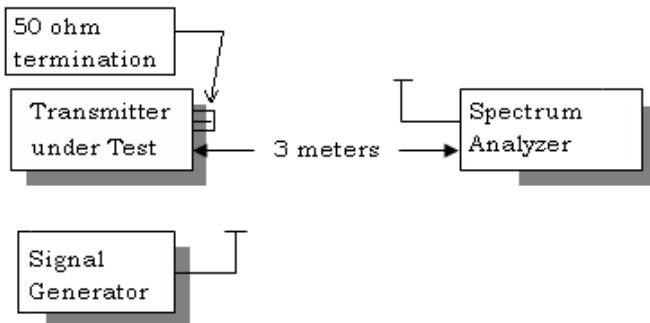
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053, Part 15.205, Part 80.211(f)

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions, except for restricted bands found in 15.205 which must meet the general limits found in 15.209

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 using the substitution method.

Test Setup Diagram:



Test Data:

Worst case: Pulse LP

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
9,410.00	Hi	34.70	2.95	47.70	25.00

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
18,820.00	V	90.19	42.49
28,230.00	H	81.18	33.48
37,640.00	H	70.44	57.44

All other emissions were more than 20 dB below the limit.

Results Meet Requirements

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FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055

Requirements: The emission mask for this device requires that the emission only need stay in the band and be no closer than $1.5/T$, where T = narrowest pulse, of the band edge.

Method of Measurements: ANSI/TIA 603-D

Notes: Manufacturer states temperature range of -15 °C to 55 °C.

Test Data:

Temperature	Emission Frequency	Difference in MHz	PPM	Result
-15 °C	9410.52 GHz	-0.11	-11.689	Pass
-10 °C	9410.58 GHz	-0.05	-5.313	Pass
0 °C	9410.60 GHz	-0.03	-3.188	Pass
10 °C	9410.60 GHz	-0.03	-3.188	Pass
20 °C	9410.63 GHz	0.00	0.000	Pass
25 °C (reference)	9410.63 GHz			
30 °C	9410.61 GHz	-0.02	-2.125	Pass
40 °C	9410.65 GHz	0.02	2.125	Pass
50 °C	9410.64 GHz	0.01	1.063	Pass
55 °C	9410.66 GHz	0.03	3.188	Pass

Results Meet Requirements

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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
24 Volt Power Supply	Astron	VLS-25M	9510040	N/A	N/A
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
Sweep/Signal Generator	Anritsu	68369B	985112	08/29/13	08/29/15
Oscilloscope	LeCroy	LT364	00414	08/22/13	08/22/15
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	Version 4.0	N/A	N/A	N/A
USB Peak Power Sensor 50 MHz to 18 GHz	Boonton	55318	9224	11/06/14	11/06/16
RF Power Meter	Boonton	4531	11793	02/17/15	02/17/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Bi-Directional Coupler	HP	778D	1144A08107	05/06/13	05/06/15
Directional Coupler	HP	X752D	1829A24209	N/A	N/A
WR90 to SMA Adapter	Pasternack	PE9804	N/A	N/A	N/A
WR90 End Load	Lectronic Research Lab	WL-108	N/A	N/A	N/A

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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