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FCC PART 80, 90 AND IC RSS-238
TEST REPORT
For
KODEN ELECTRONICS CO., LTD.

APPLICANT	KODEN ELECTRONICS CO., LTD.
	5278 UENOHARA UENOHARA-SHI
	YAMANASHI JAPAN 409-0112
FCC ID	O5VRB806
IC	8477A-RB806
MODEL NUMBER	RB806
PRODUCT DESCRIPTION	X BAND MARINE RADAR
DATE SAMPLE RECEIVED	6/30/2016
DATE TESTED	07/25/2016 – 09/28/2016
TESTED BY	Christian Pawlak
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1247AZUT16TestReport.docx	Rev.1	Initial Issue	10/14/2016
1247AZUT16TestReport.docx	Rev.2	Added antenna information	01/27/2017

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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 and was selected by the customer.

☐ 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 at:

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

Tested by: _____
Christian Pawlak, Project Manager/Testing Technician

Date: 09/28/2016

Reviewed and approved by: _____
Name and Title: Sid Sanders, Engineer

Date: 09/28/2016

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EUT SPECIFICATION

EUT Description	X BAND MARINE RADAR
FCC ID	O5VRB806
IC Certification	8477A-RB806
Model Number	RB806
Serial Number	N/A
Operating Frequency	9380-9440 MHz
Type of Emission	Pulse
Modulation	PON
EUT Power Source	☒ 110–120Vac/50– 60Hz Shipboard Only
	☐ DC Power ()
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☐ Pre-Production
	☒ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Antenna Gain	28 dBi

TEST SETUP INFORMATION

Test facility	**Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669**
Test Condition	Temperature: 26ºC Relative humidity: 50%. Barometer: 1012.5mb
Modifications	None
Test Exercise	The EUT was placed in continuous transmit mode of operation
Applicable Standards	ANSI/TIA 603-D: 2010, FCC CFR 47, Part 80, IC RSS-238, IC RSS-GEN

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TEST RESULTS SUMMARY

Test	Regulatory Body	Rule	Result
RF Power Output	FCC	Part 80.215(a)(3)	Pass
		Part 90.205(r)	Pass
	IC	RSS-238 Section 4.2	Pass
Modulation Characteristics	FCC	Part 90.207	Report Only
	IC	RSS 238 3.2(a)	Report Only
Occupied Bandwidth	FCC	Part 80.205(a)	Pass
		Part 90.209, Part 90.210(b)	Pass
	IC	RSS 238 3.2(c)	Report Only
Spurious Emissions at Antenna Terminals	FCC	Part 80.211(f)	Pass
		Part 90.210, Part 90.215	Pass
	IC	RSS 238 4.3	Pass
Field Strength of Spurious Emissions	FCC	Part 80.211(f)	Pass
		Part 90.210, Part 90.215	Pass
	IC	RSS 238 4.3	Pass
Frequency Stability	FCC	Part 80.209(b)	Pass
		Part 90.213	Pass
	IC	RSS-238 4.1	Pass

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ANTENNA INFORMATION

Rule Part No.: RSS-238 Section 3.2

TYPE: RW701A-03	
Antenna length Size	3.06 feet
Antenna Gain	25.3 dBi
Beamwidith_horizontal	2.5deg.
Beamwidth_vertical	22 deg.
Side-lobe suppression	Within +/- 10 degree not to exceed -23dB Without +/- 10 degree not to exceed -28dB
Back-lobe suppression	Within +/- 10 degree not to exceed -23dB Without +/- 10 degree not to exceed -28dB
Polarization	Horizontal polarization

TYPE: RW701A-04	
Antenna length Size	4.09 feet
Antenna Gain	27 dBi
Beamwidith_horizontal	1.8 deg.
Beamwidth_vertical	22 deg.
Side-lobe suppression	Within +/- 10 degree not to exceed -25dB Without +/- 10 degree not to exceed -30dB
Back-lobe suppression	Within +/- 10 degree not to exceed -25dB Without +/- 10 degree not to exceed -30dB
Polarization	Horizontal polarization

TYPE: RW701A-06	
Antenna length Size	6.14 feet
Antenna Gain	28.5 dBi
Beamwidith_horizontal	1.2 deg.
Beamwidth_vertical	22 deg.
Side-lobe suppression	Within +/- 10 degree not to exceed -25dB Without +/- 10 degree not to exceed -30dB
Back-lobe suppression	Within +/- 10 degree not to exceed -25dB Without +/- 10 degree not to exceed -30dB
Polarization	Horizontal polarization

RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 80.215(a)(3), Part 90.205(r), RSS-238 Section 4.2

Requirements:

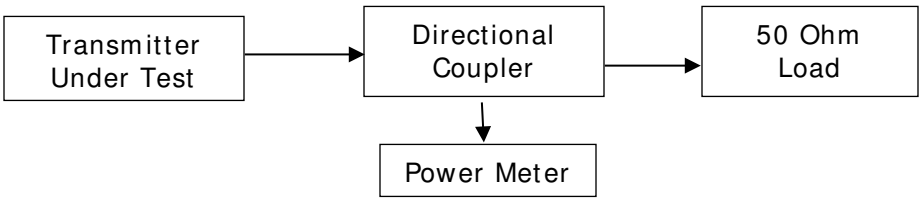
Part 90.205(r) – Power will be authorized on a case-by-case basis.

RSS-238 Section 4.2 – The output power shall not exceed 60 kW and the antenna gain shall not exceed 35 dBi.

Method of Measurement: RF power is measured by connecting a 50-ohm, Peak Power meter to the RF output connector.

Test Setup Diagram:

b) Method of Measurement



Test Data:

OUTPUT POWER:

Pulse Type	Peak Power (dBm)	Peak Power (Watts)	Duty Cycle (%)	Average Power (Watts)
S1	64.94	3118.89	0.017%	0.54
S2	64.944	3121.76	0.017%	0.54
M1	65.433	3493.82	0.026%	0.91
M2	65.911	3900.32	0.037%	1.44
L1	65.943	3929.16	0.037%	1.47
L2	65.951	3936.41	0.049%	1.92

Results Meet Requirements

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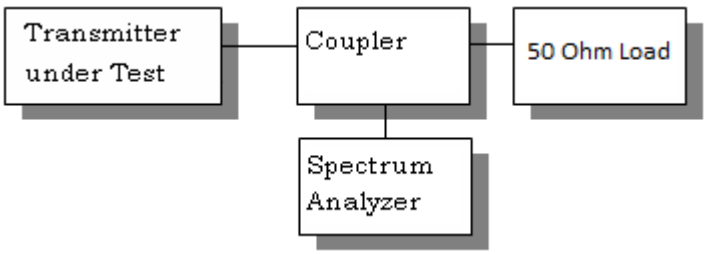
MODULATION CHARACTERISTICS

Rule Part No.: Part 90.207, RSS-238 Section 3.2(a)

Requirements: None

Method of Measurement: Modulation Characteristics are reported using a 50-ohm peak power sensor or spectrum analyzer in zero span mode. A directional coupler is used to sample output power.

Test Setup Diagram:



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

Detailed specifications are contained in “product specifications” manual.

Plots of these pulse groups are shown below.

Pulse Type	Pulse Width (us)	Rise Time (us)	Period Min (us)	Period Max (us)	Period Avg (us)	Duty Cycle (%)
S1	0.088	0.010	463	556	509.5	0.017%
S2	0.088	0.010	463	556	509.5	0.017%
M1	0.150	0.013	531	622	576.5	0.026%
M2	0.255	0.019	623	756	689.5	0.037%
L1	0.459	0.060	1154	1298	1226	0.037%
L2	1.011	0.061	1928	2207	2067.5	0.049%

Results Meet Requirements

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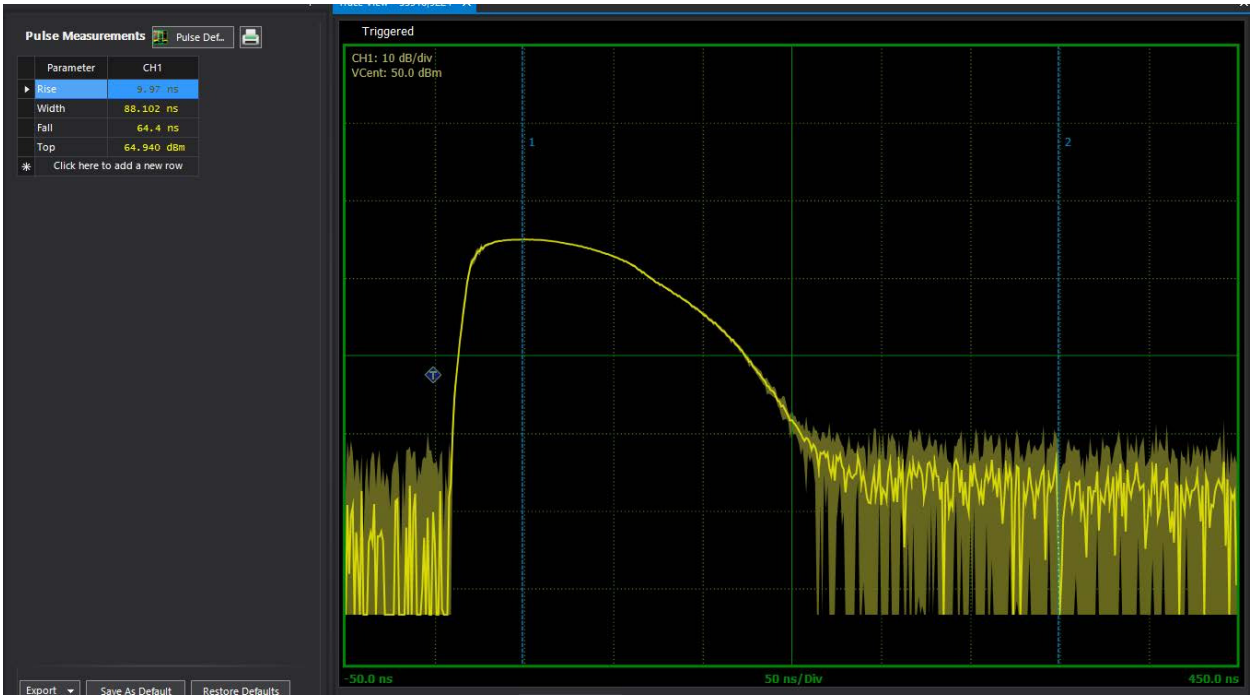
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – S1

Results Meet Requirements

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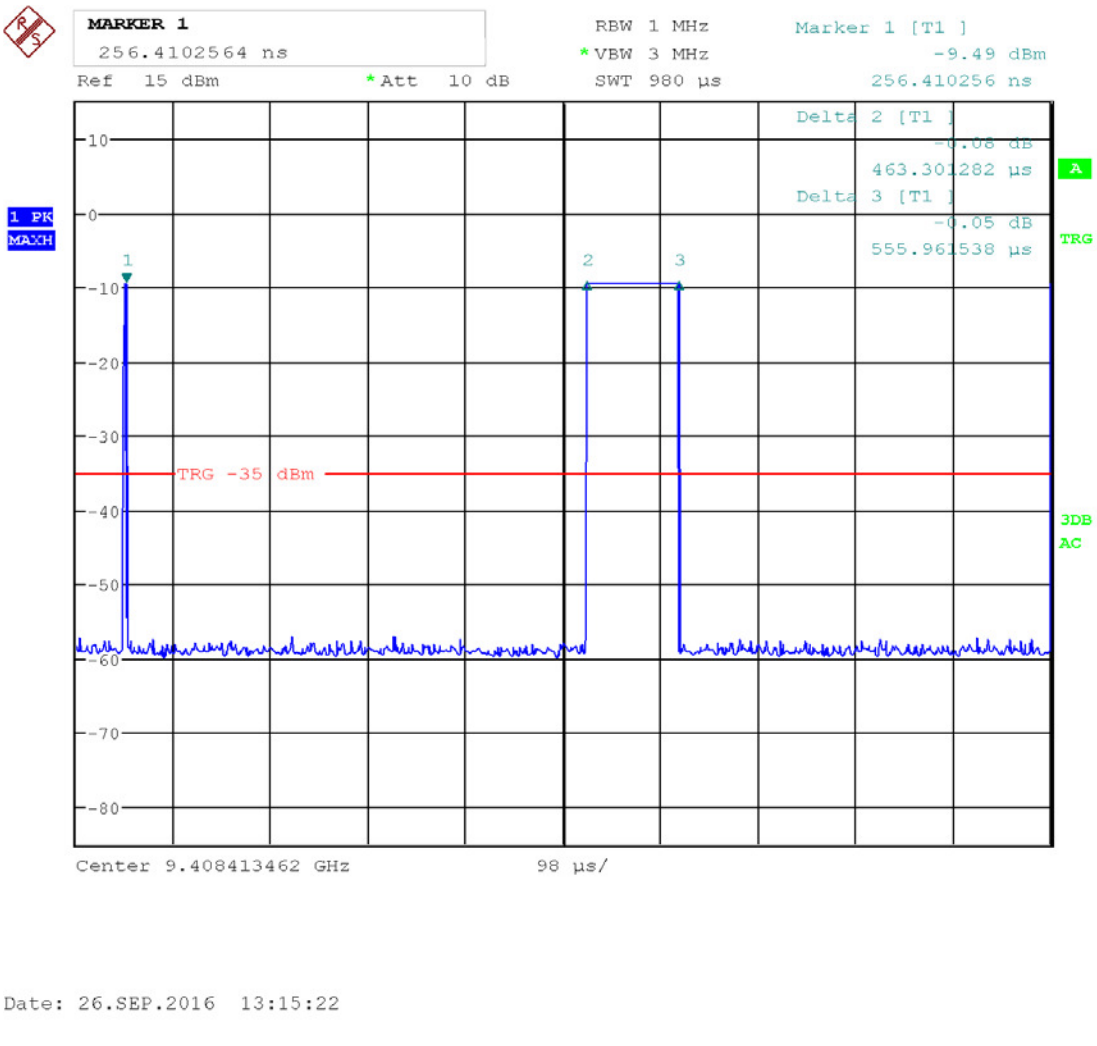
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – S1



Results Meet Requirements

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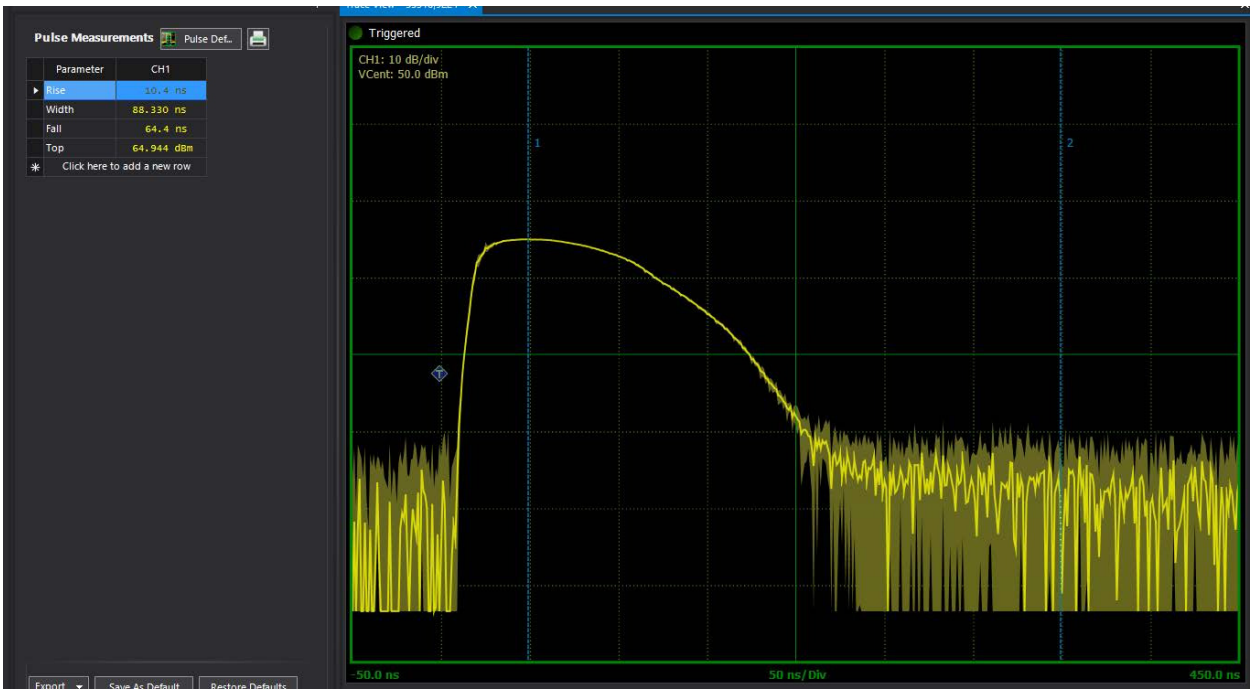
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – S2

Results Meet Requirements

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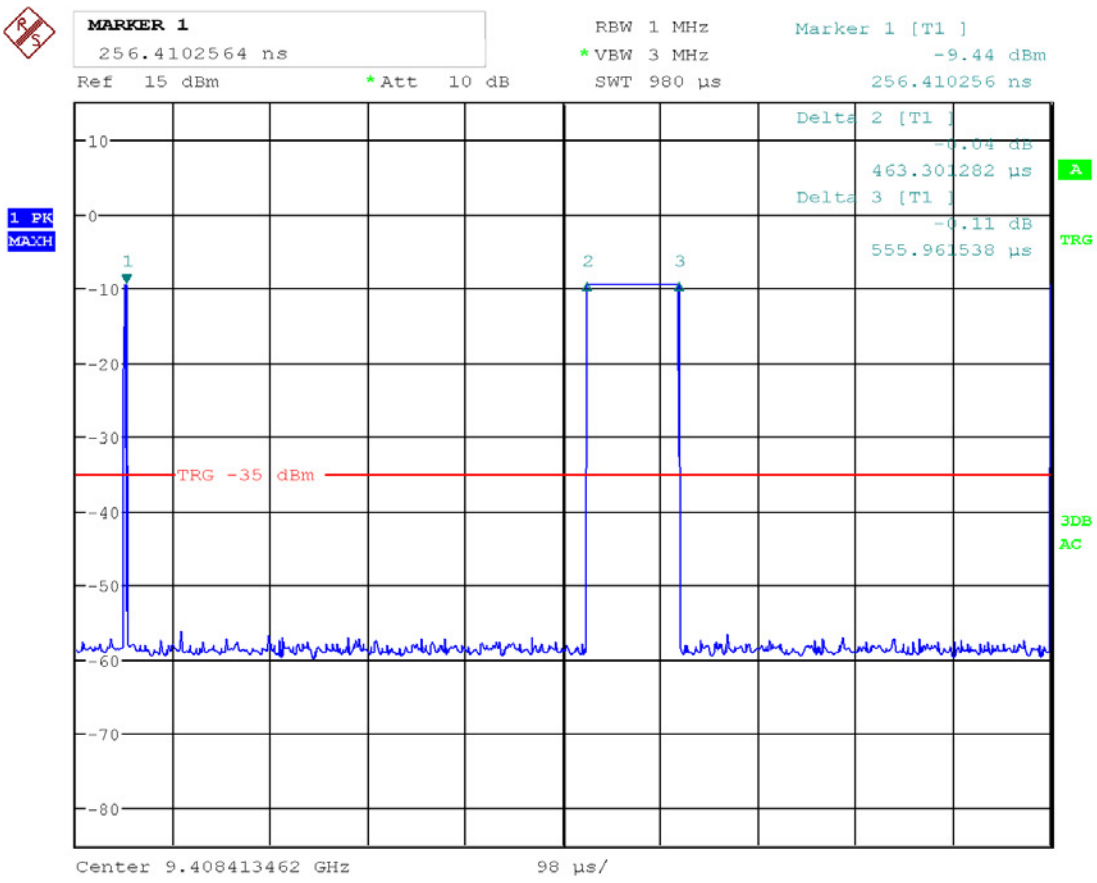
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – S2



Results Meet Requirements

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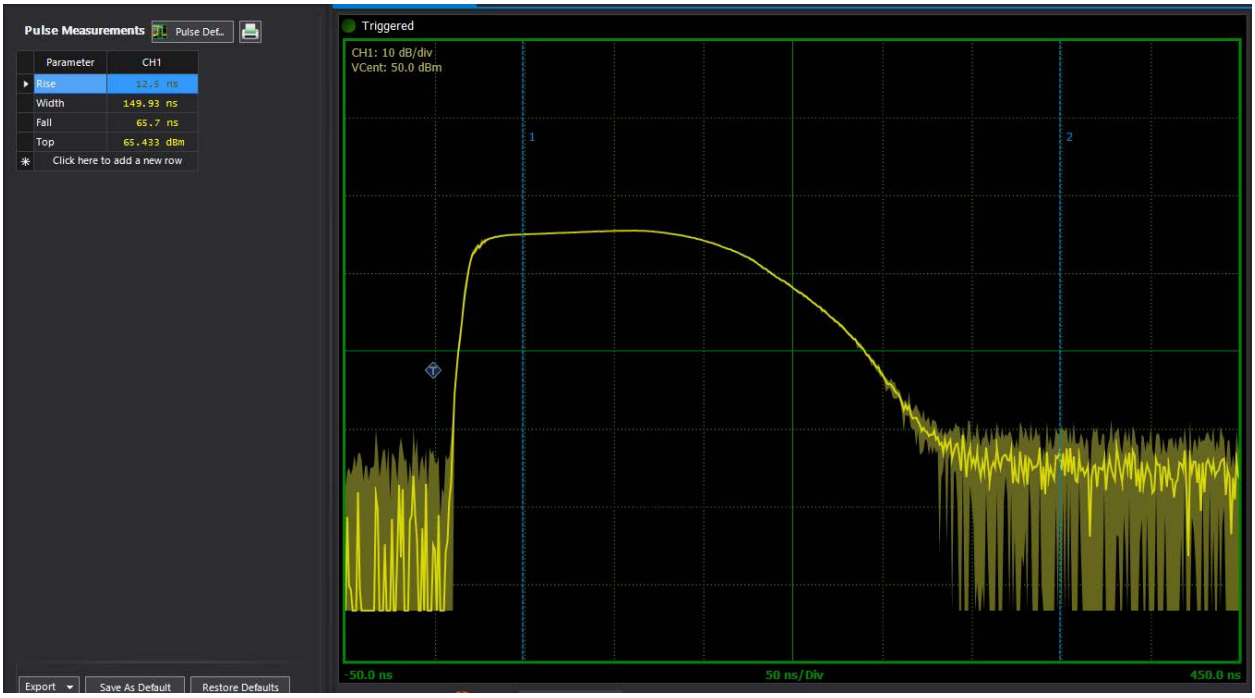
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – M1



Results Meet Requirements

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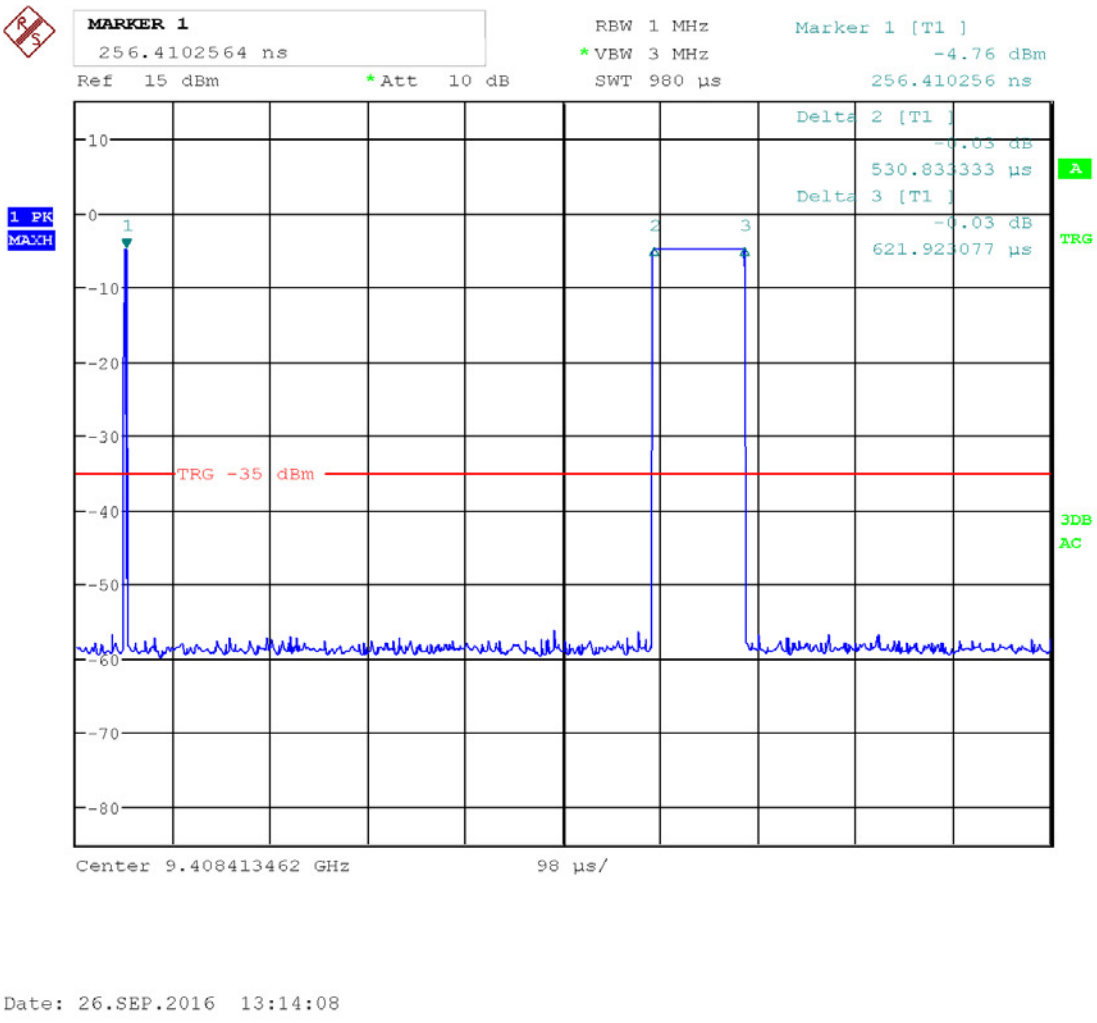
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – M1



Results Meet Requirements

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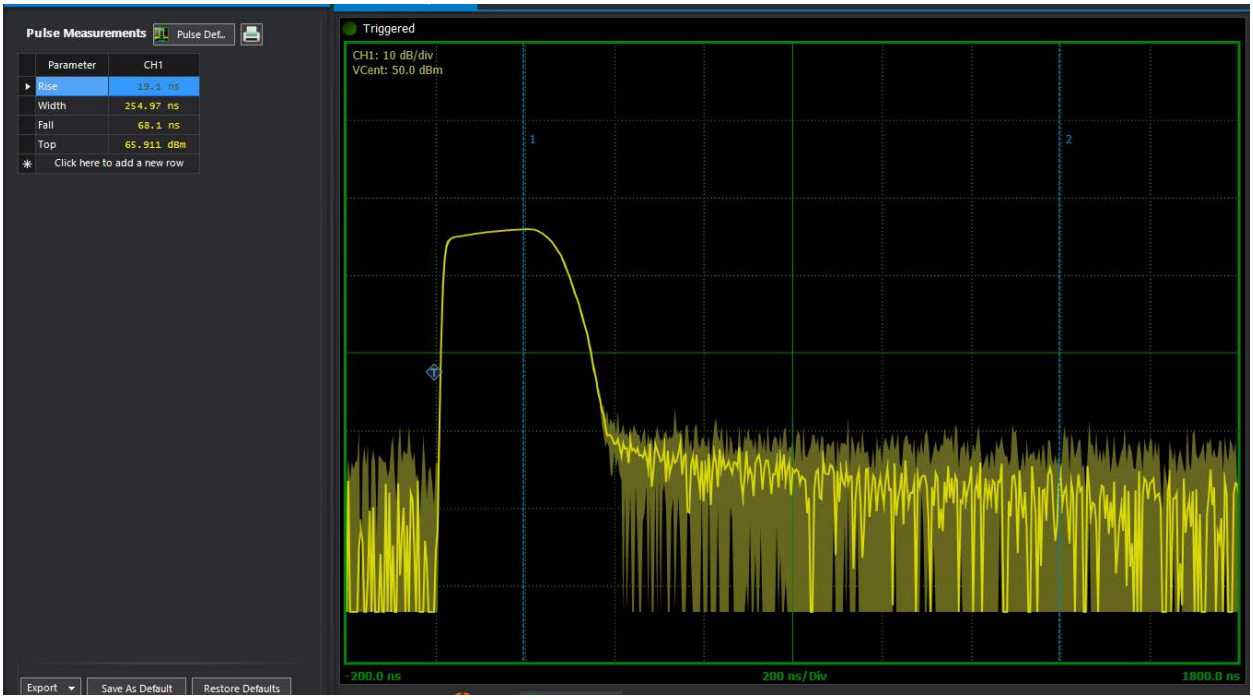
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – M2

Results Meet Requirements

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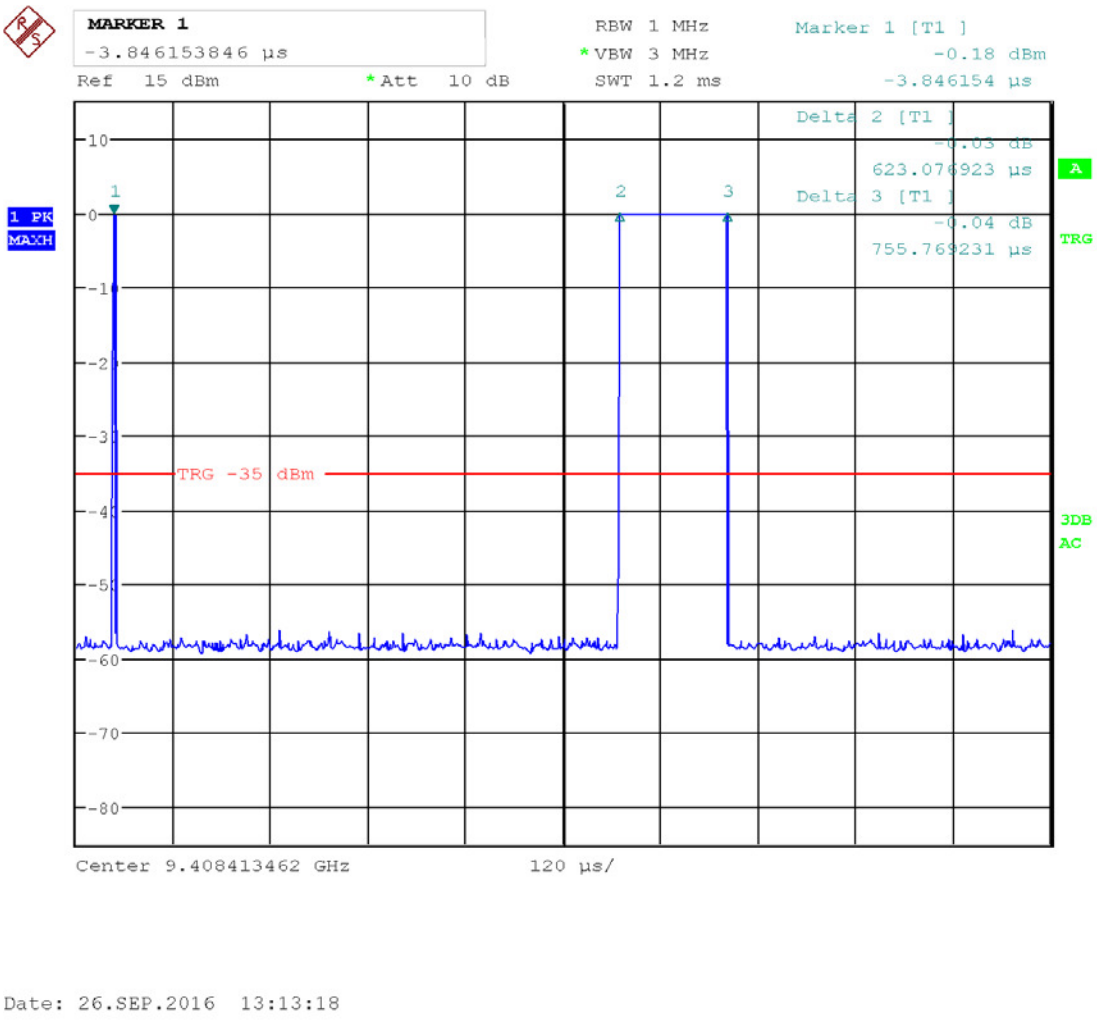
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – M2



Results Meet Requirements

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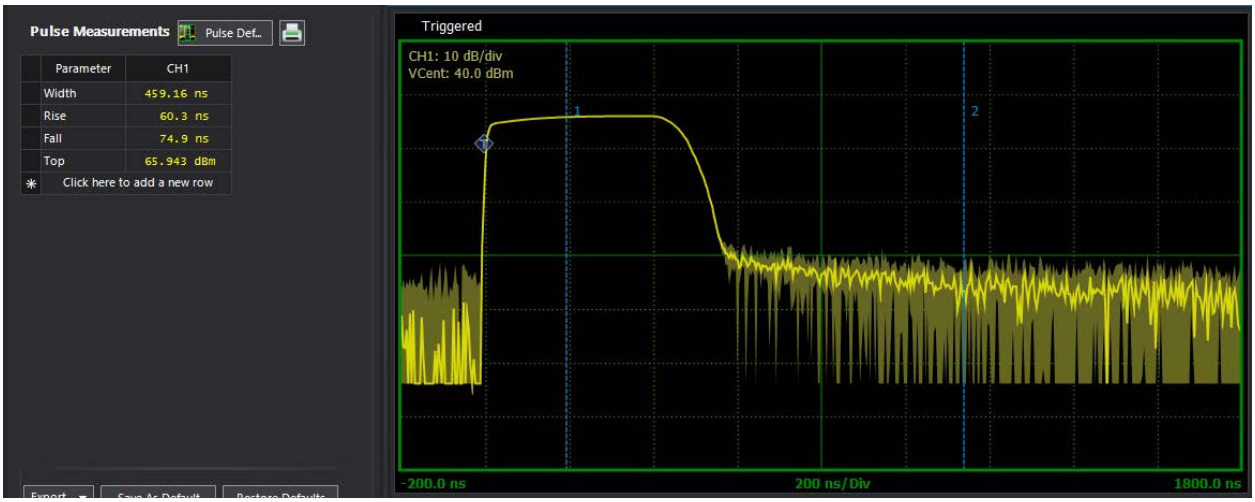
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – L1

Results Meet Requirements

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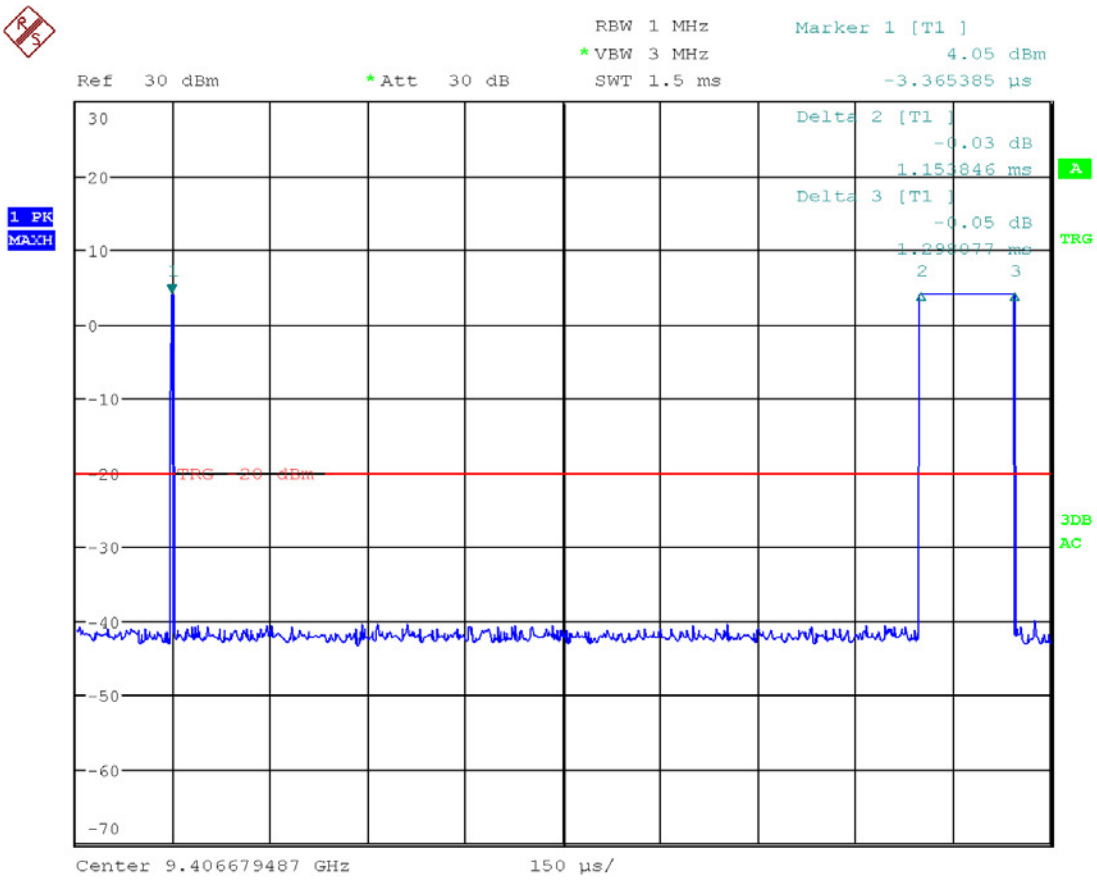
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – L1



Date: 24.JUL.2016 20:32:47

Results Meet Requirements

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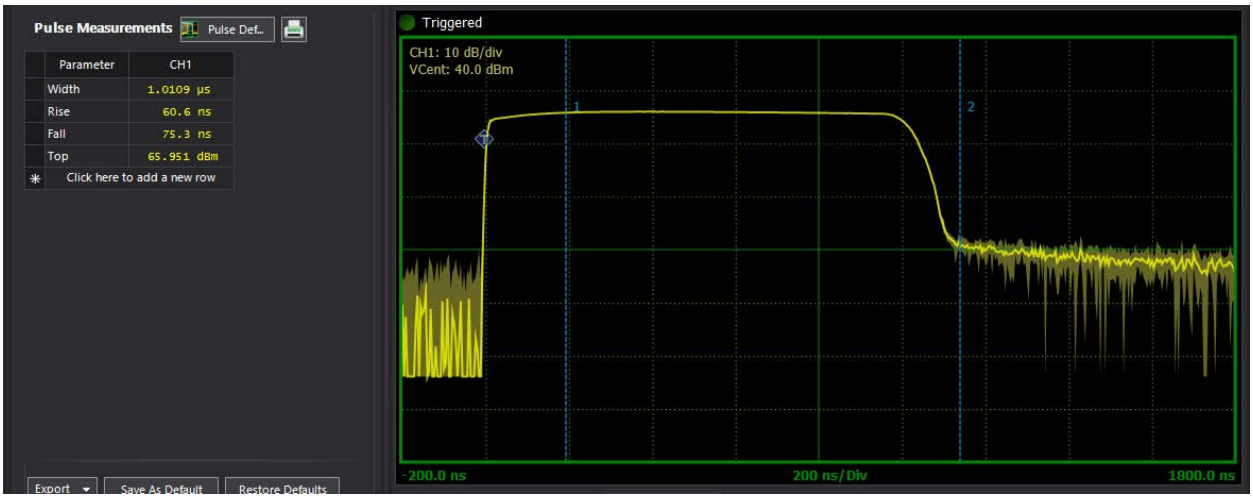
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE PROFILE – L2



Results Meet Requirements

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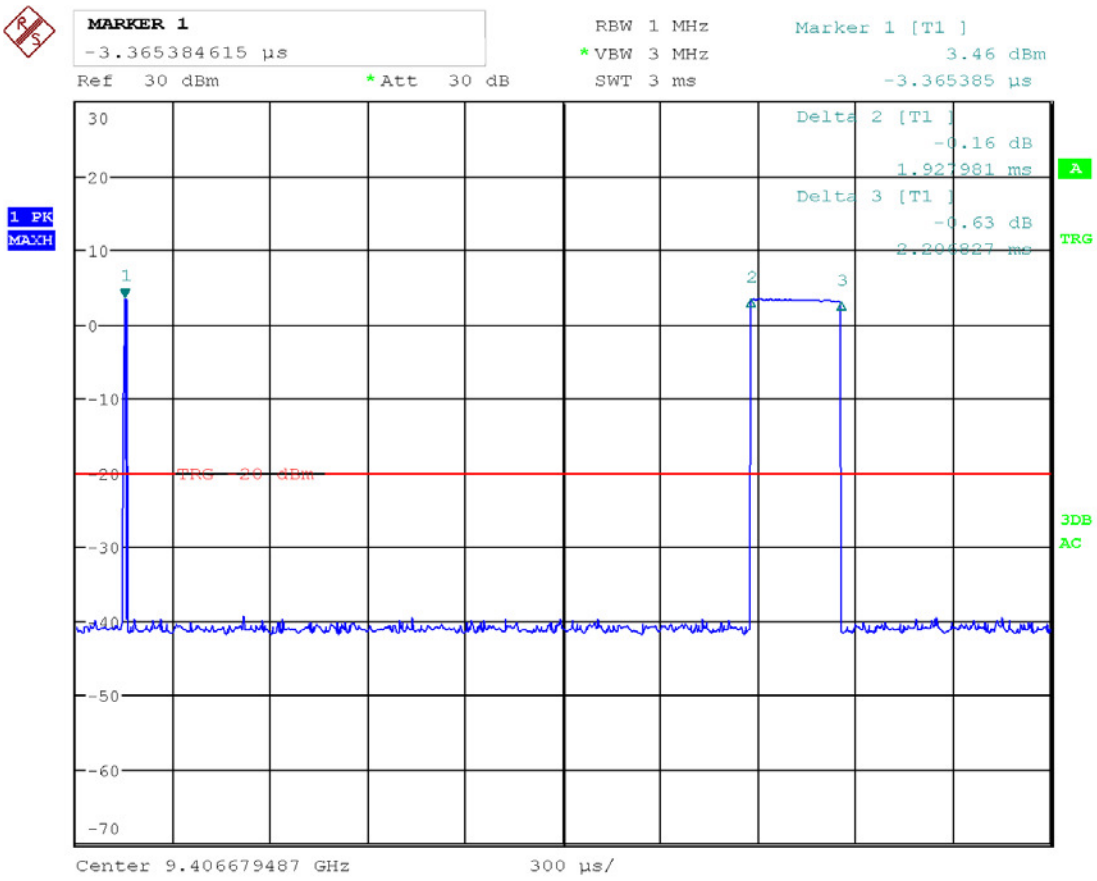
MODULATION CHARACTERISTICS PLOTS

MODULATION CHARACTERSISTICS – PULSE INTERVAL – L2

Results Meet Requirements

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OCCUPIED BANDWIDTH

Rule Part No.: Part 90.209, Part 90.210(b), Part 80.205(a), RSS 238 3.2(c)

Requirements:

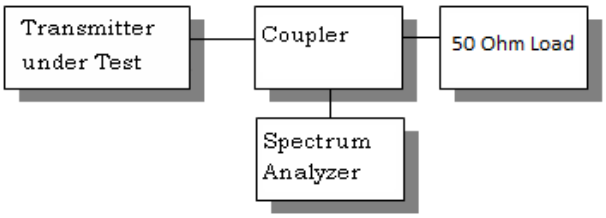
Part 80.205(a): Emissions must remain within the band

Part 90.209: Subject to case-by-case review

RSS 238 3.2(c): 40dB bandwidth measurements must be reported

Method of Measurement: Measurements were made in accordance with standard listed above.

Block Diagram:



Test Data:

Pulse Type	Measurement Type	Occupied Bandwidth (MHz)
S1	99%	48.478
	40dB	124.199
S2	99%	47.676
	40dB	114.984
M1	99%	35.256
	40dB	88.942
M2	99%	22.436
	40dB	71.314
L1	99%	14.423
	40dB	52.885
L2	99%	9.135
	40dB	40.865

Results Meet Requirements

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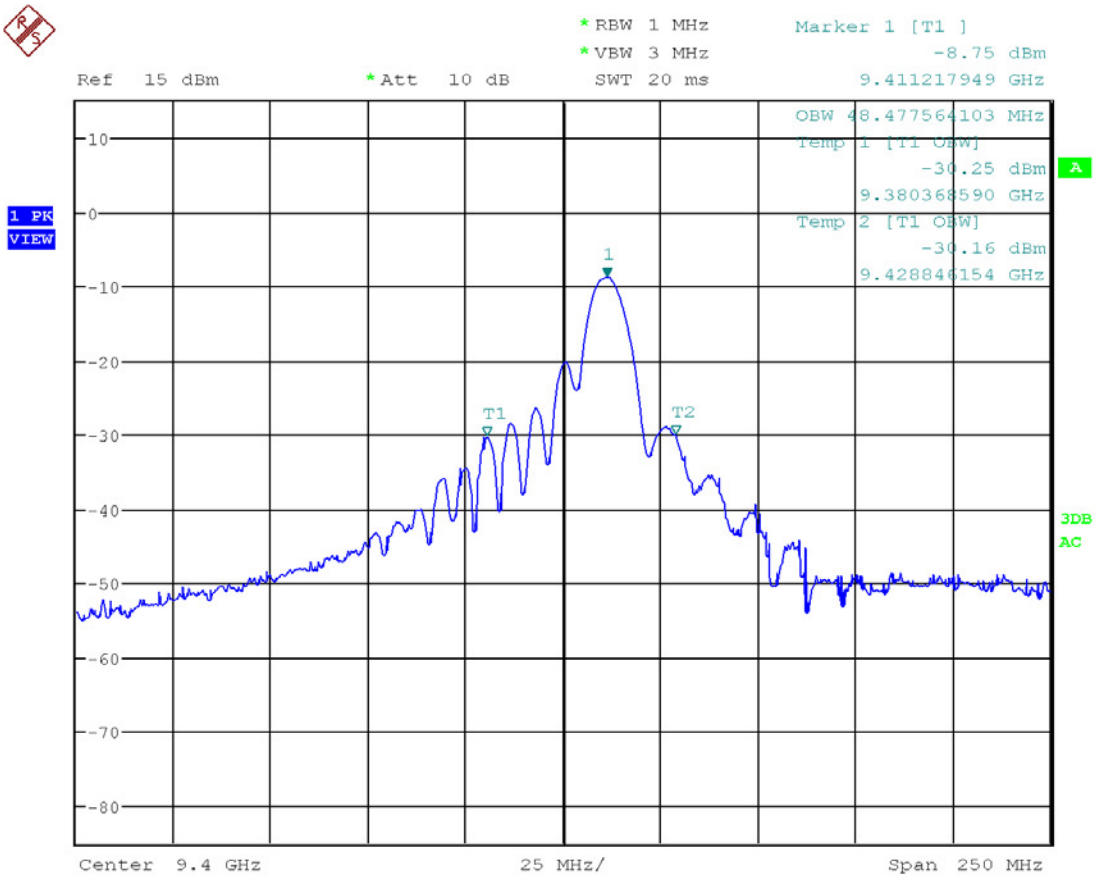
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – S1



Date: 26.SEP.2016 13:05:23

Results Meet Requirements

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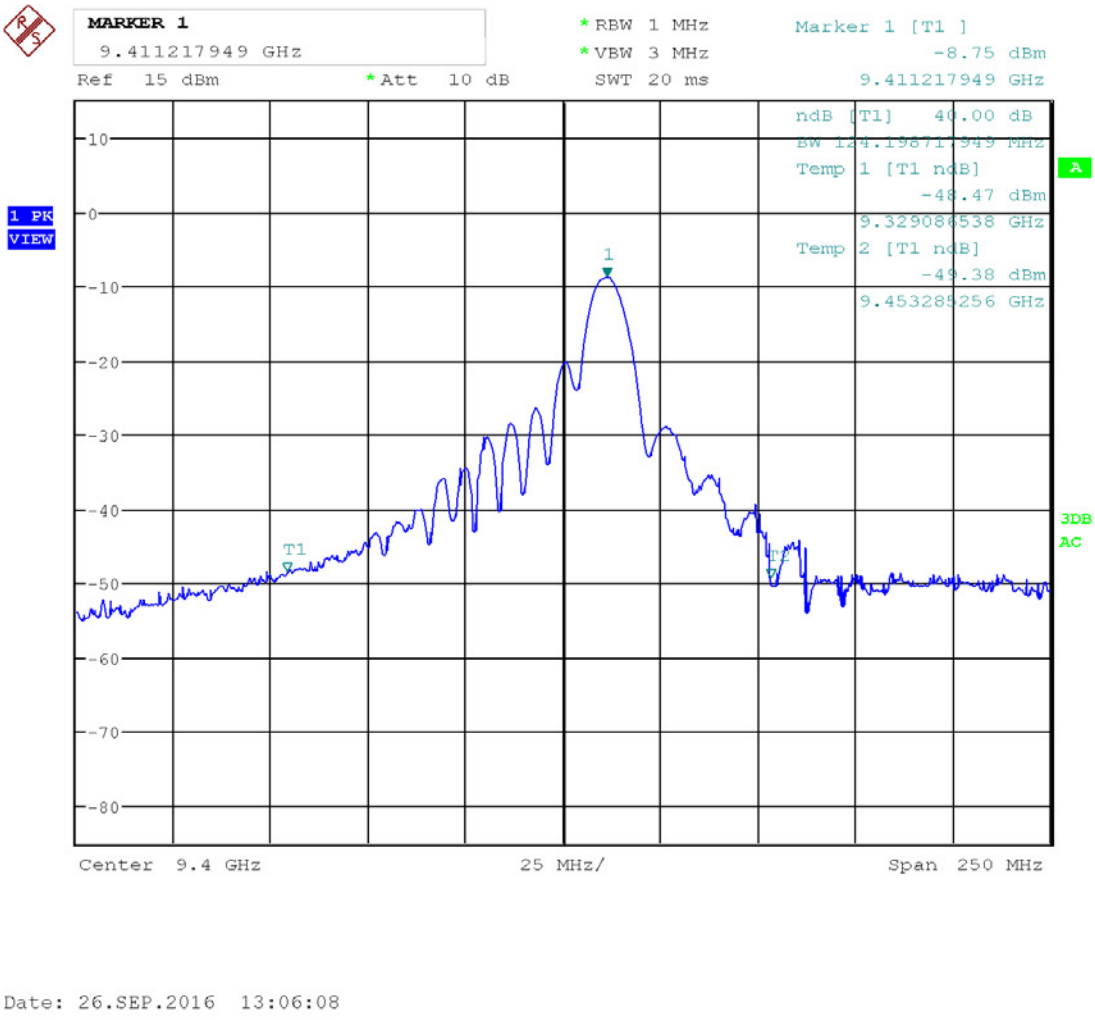
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH – 40 dB – S1



Results Meet Requirements

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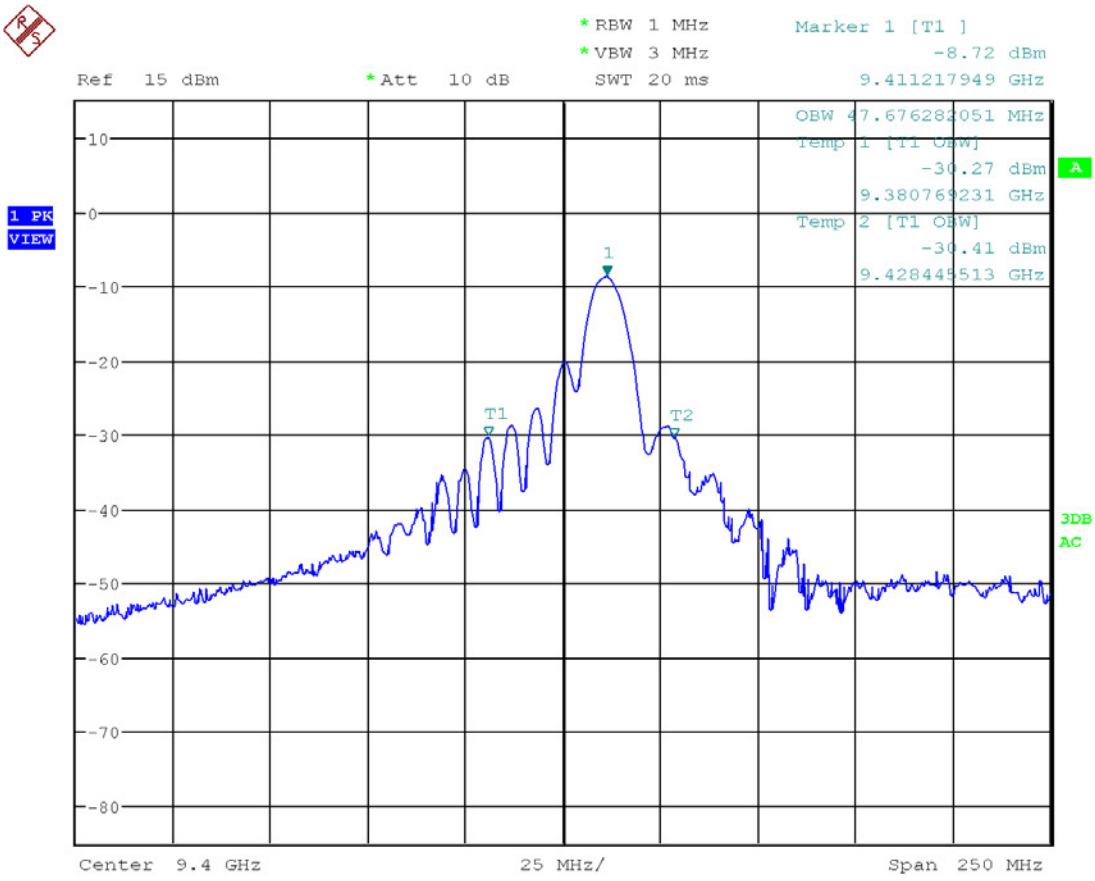
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – S2



Date: 26.SEP.2016 13:07:45

Results Meet Requirements

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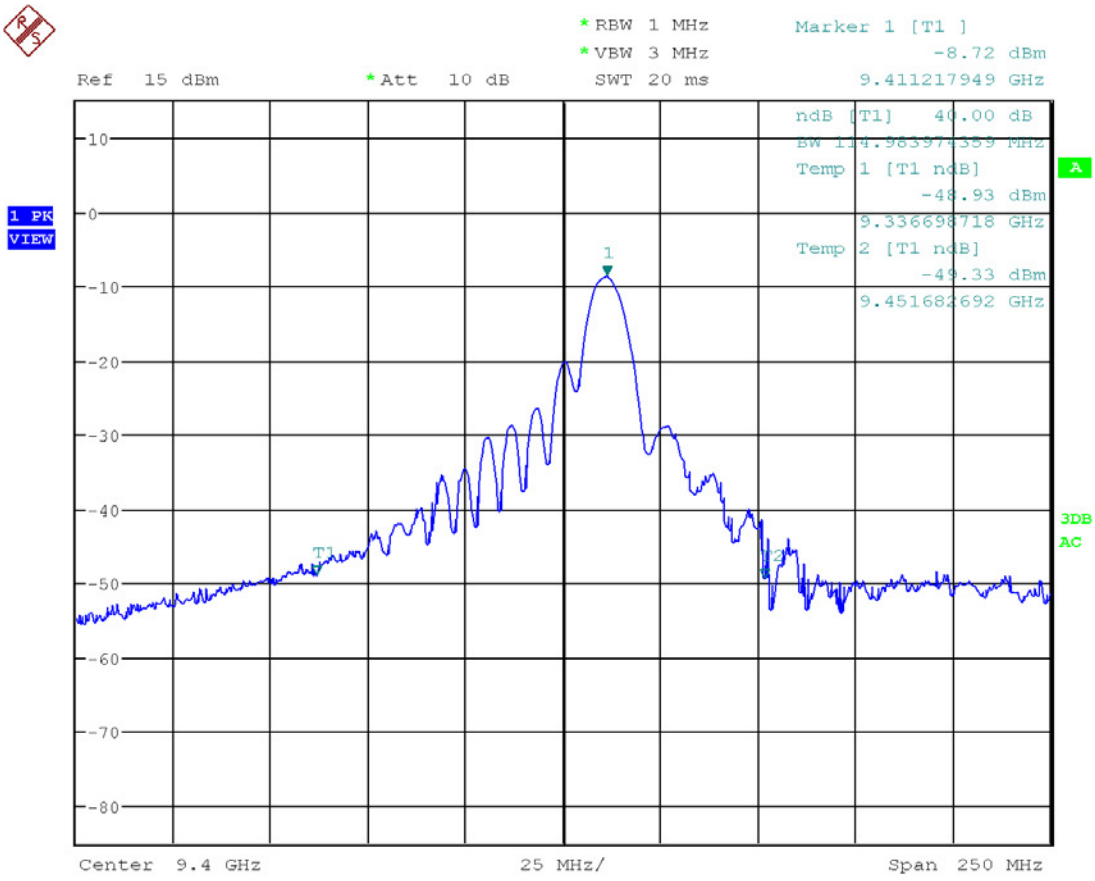
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH – 40 dB – S2



Date: 26.SEP.2016 13:07:16

Results Meet Requirements

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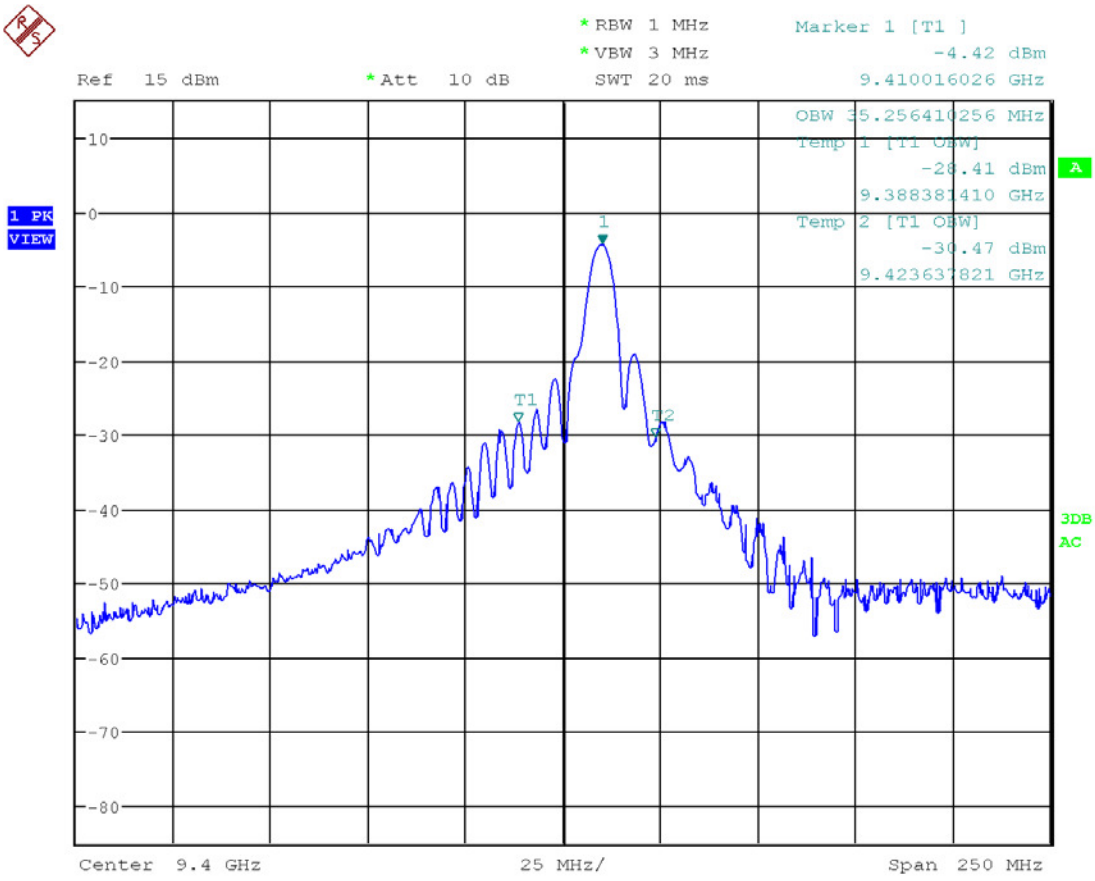
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – M1



Date: 26.SEP.2016 13:09:29

Results Meet Requirements

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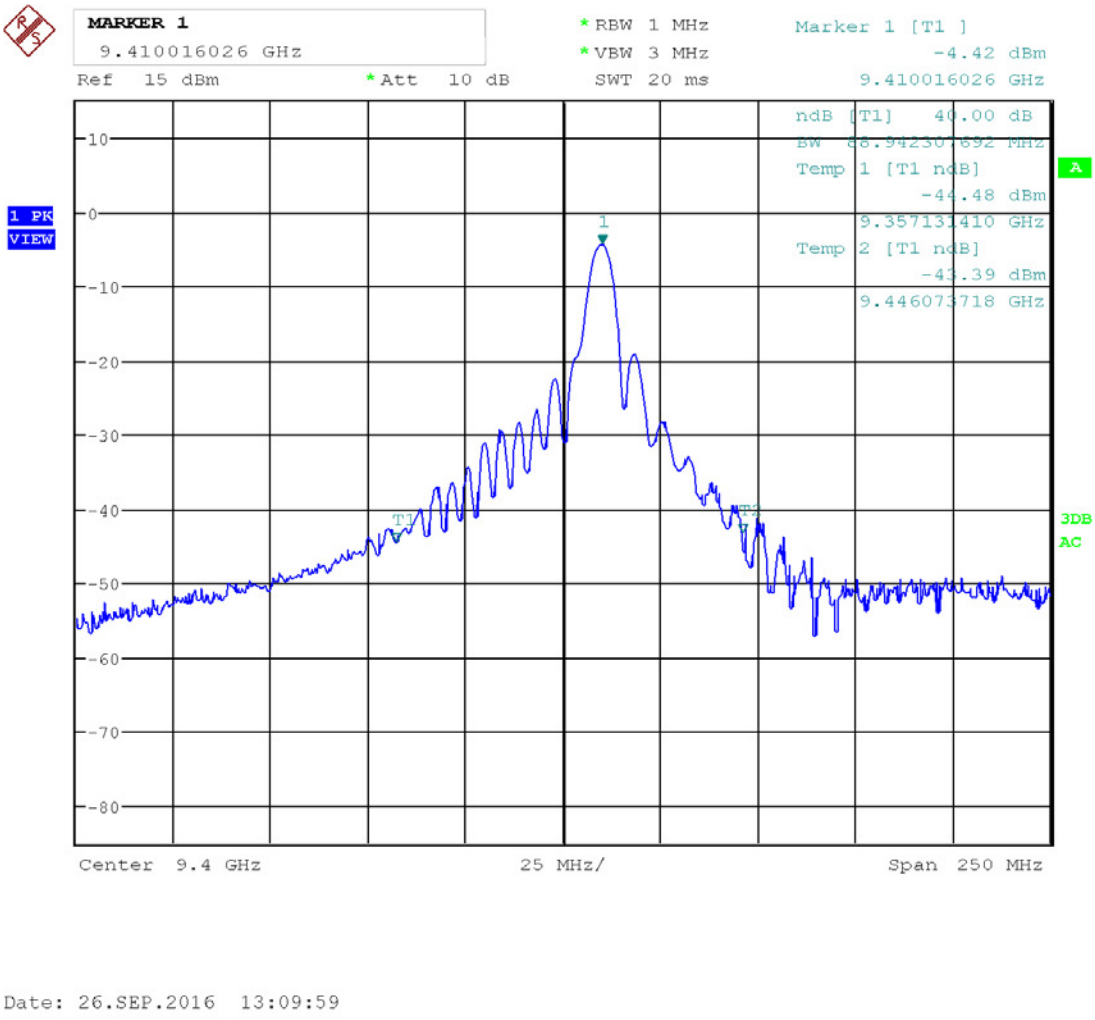
OCCUPIED BANDWIDTH – 40 dB – M1



Results Meet Requirements

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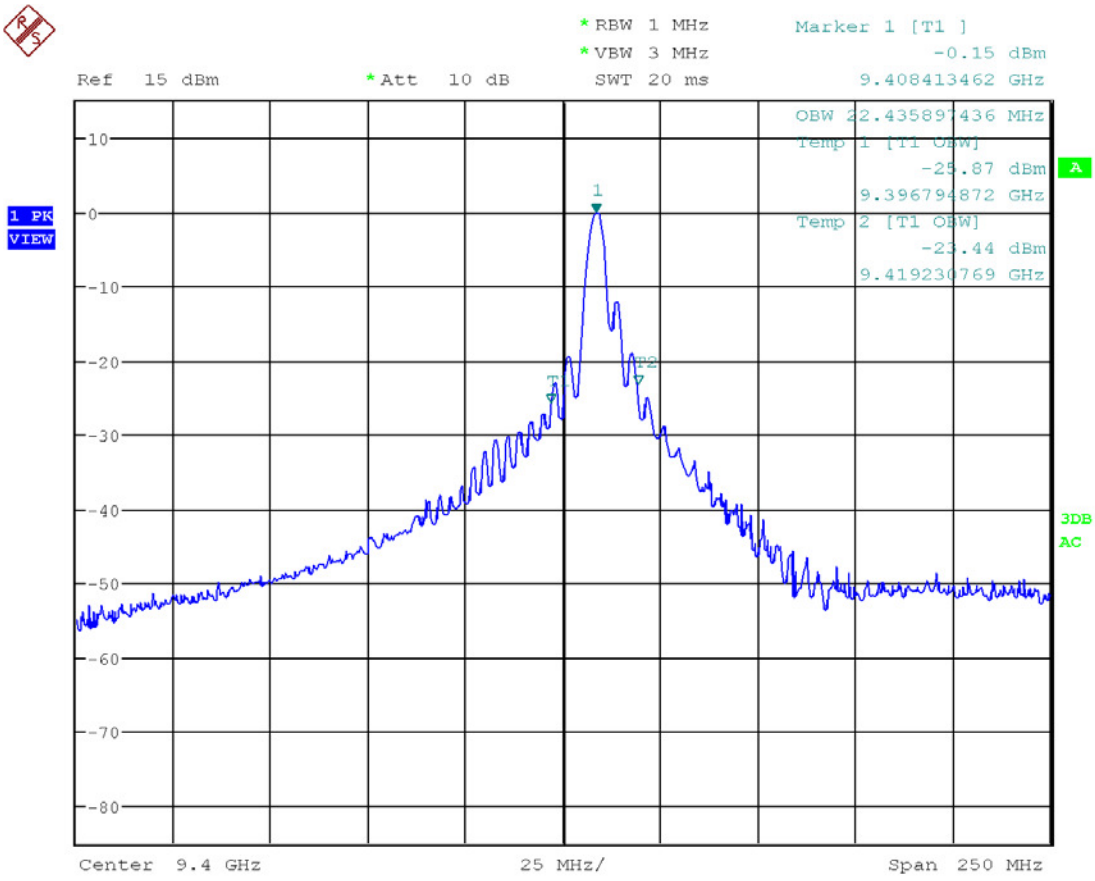
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – M2



Date: 26.SEP.2016 13:11:53

Results Meet Requirements

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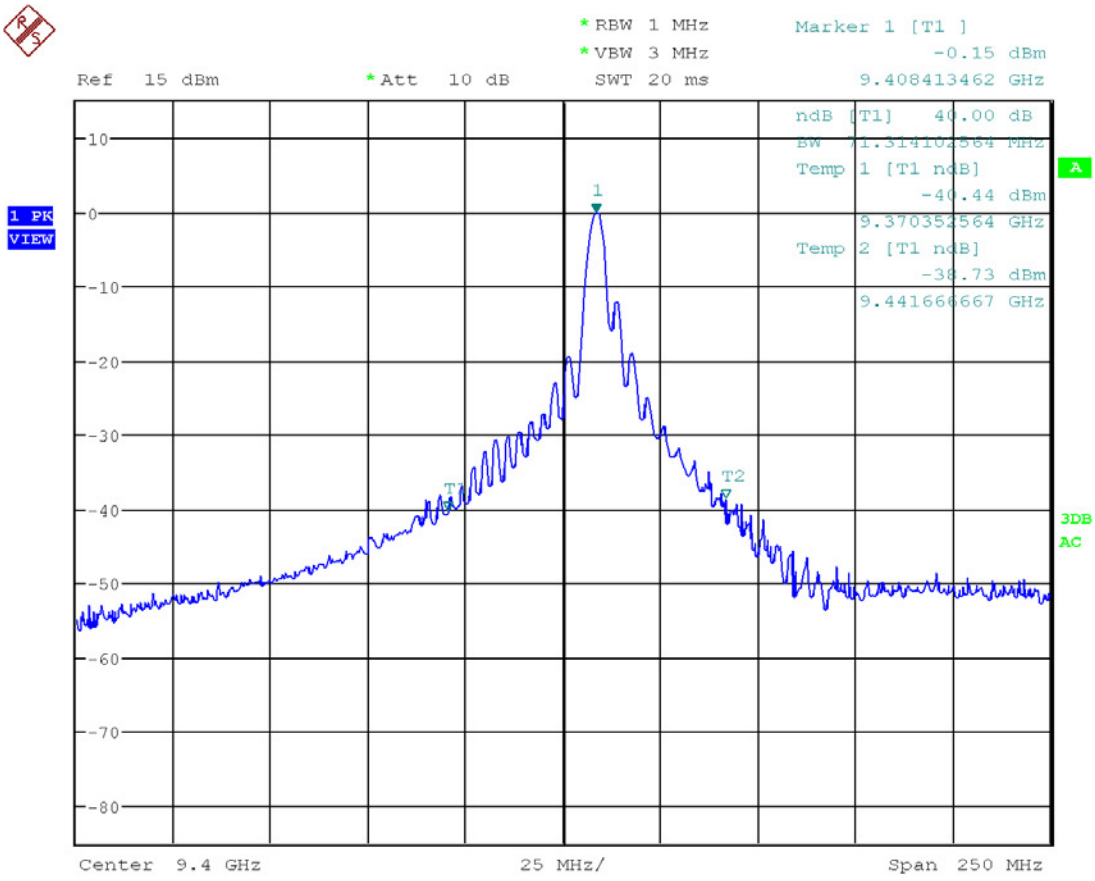
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH – 40 dB – M2



Results Meet Requirements

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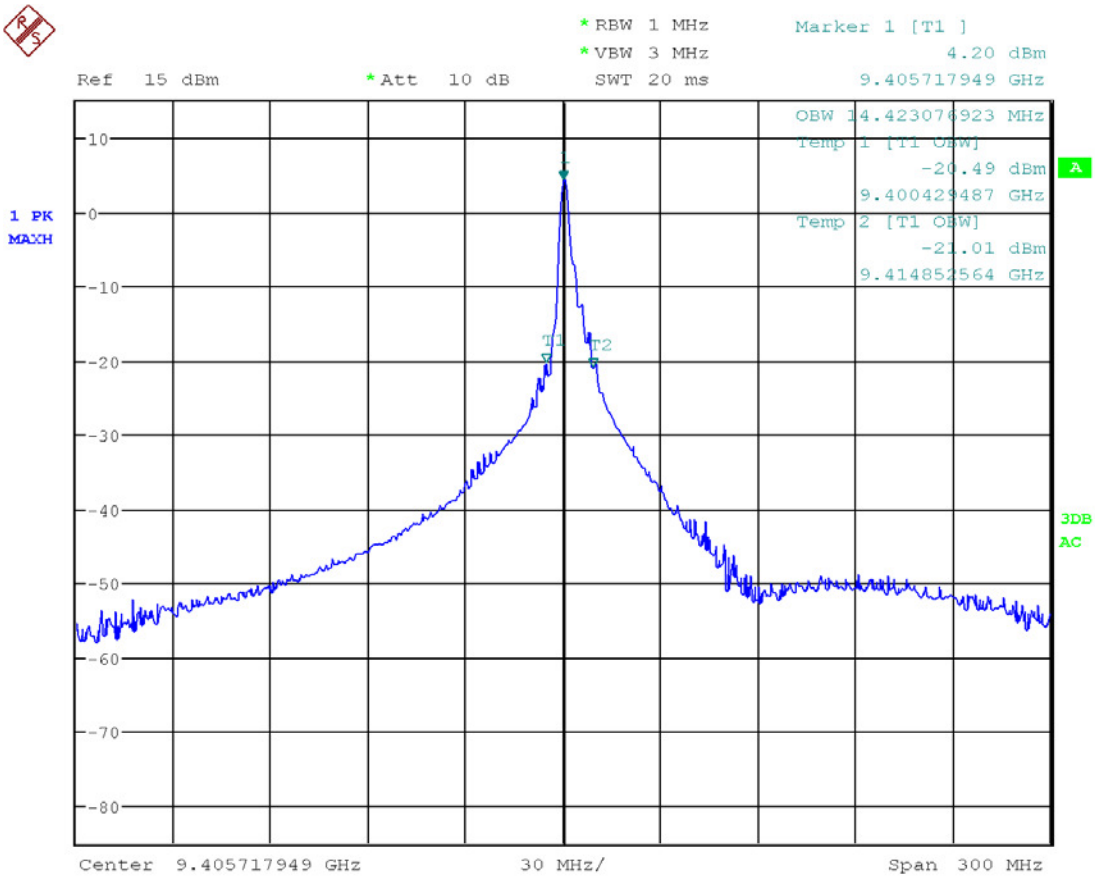
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – L1



Date: 24.JUL.2016 20:50:16

Results Meet Requirements

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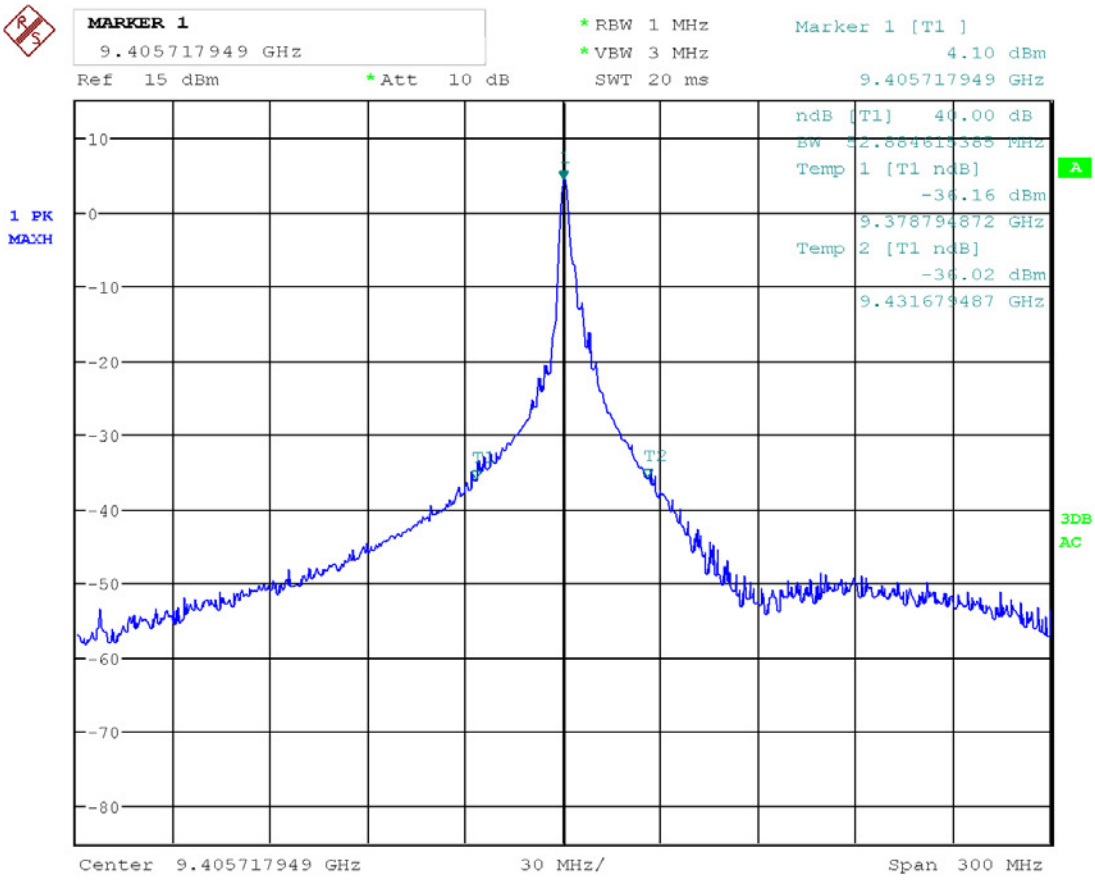
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH – 40 dB – L1



Date: 24.JUL.2016 20:51:56

Results Meet Requirements

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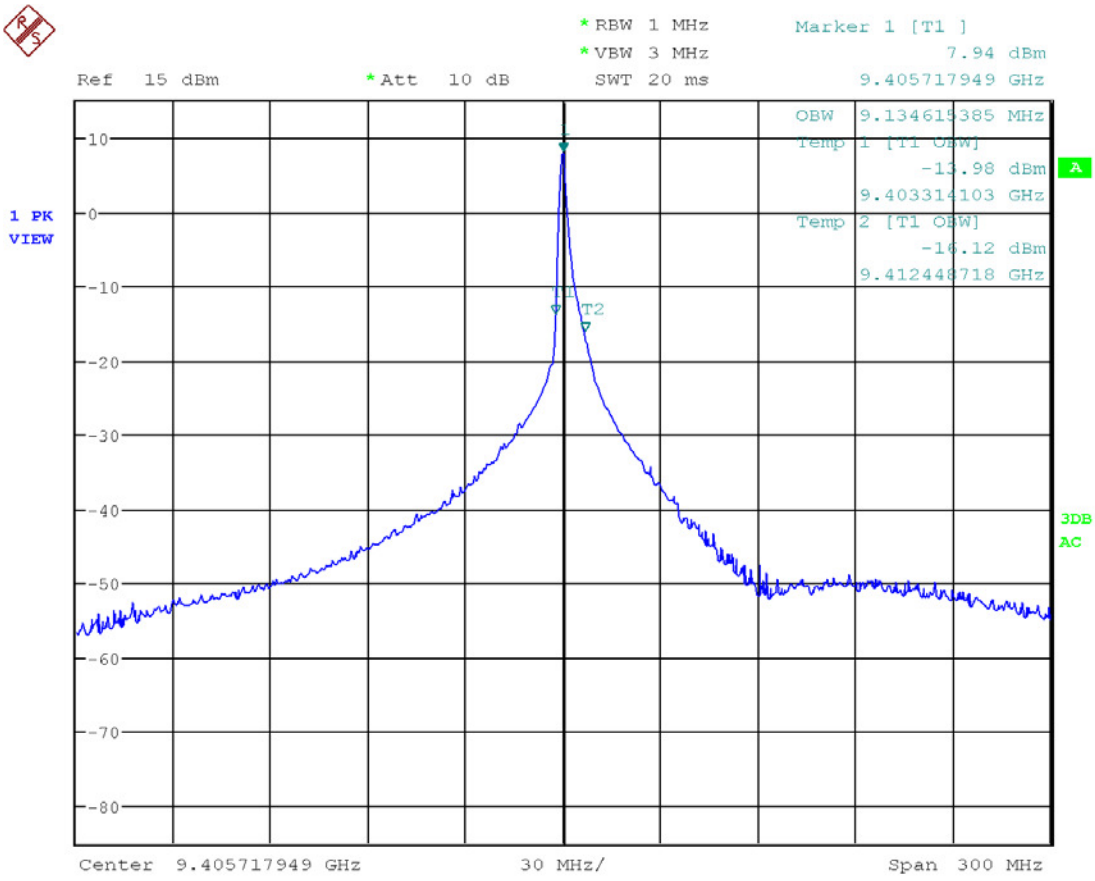
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH - 99 PERCENT – L2



Date: 24.JUL.2016 20:44:38

Results Meet Requirements

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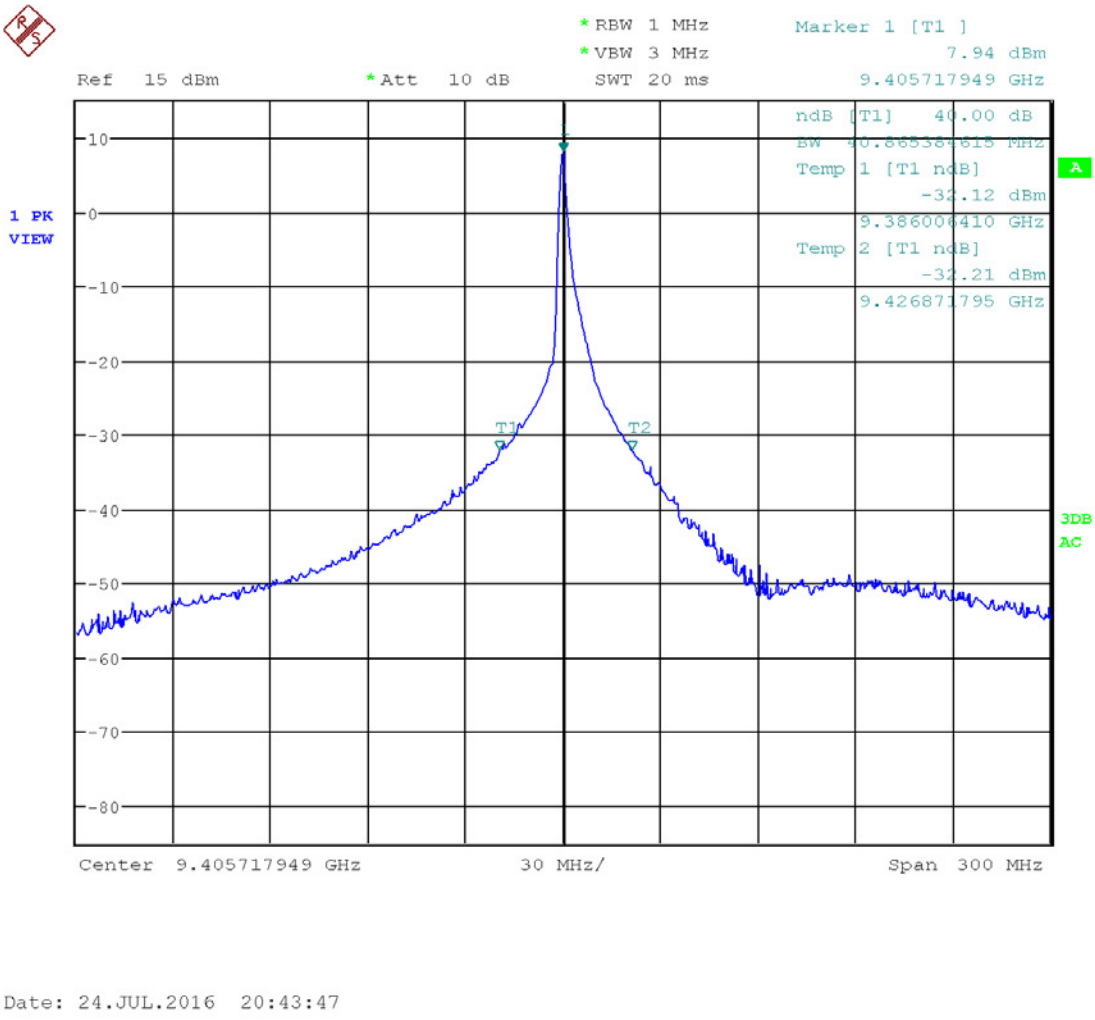
OCCUPIED BANDWIDTH PLOT(S)

OCCUPIED BANDWIDTH – 40 dB – L2



Results Meet Requirements

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a), Part 90.210, Part 90.215, Part 80.211(f), RSS 238 4.3

Requirements:

Part 80.211(f): 43+10log(mean power in watts)

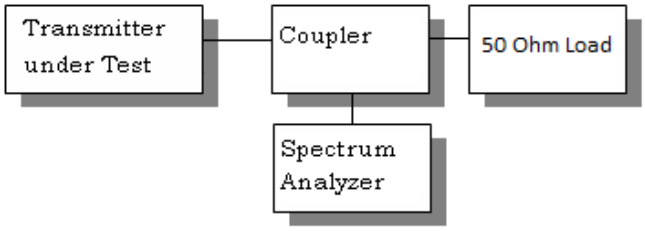
Part 90.210(c): 43+10log(mean power in watts)

RSS 238 4.3: 20dB per decade from 40 dB bandwidth, not more than 60 dB

Method of Measurement: Measurements were made in accordance with standard listed above.

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.

Block Diagram:



Test Data:

Pulse Type	Mean Power (Watts)	Emission Frequency (MHz)	Emission Power (dBc)	FCC Limit (dBc)	FCC Margin (dB)	IC Limit (dBc)	IC Margin (dB)
S1	0.54	18814.44	-55.88	-40.32	15.56	-46.04	9.84
S2	0.54	18814.53	-56.04	-40.32	15.72	-46.04	10.00
M1	0.91	18813.94	-55.73	-42.59	13.14	-46.04	9.69
M2	1.44	18814.70	-55.84	-44.58	11.26	-46.04	9.80
L1	1.47	18814.76	-54.67	-44.67	10.00	-46.04	8.63
L2	1.92	18813.72	-55.26	-45.83	9.43	-46.04	9.22

Results Meet Requirements

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FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, Part 90.210, Part 90.215, Part 80.211(f), RSS-238 4.3

Requirements:

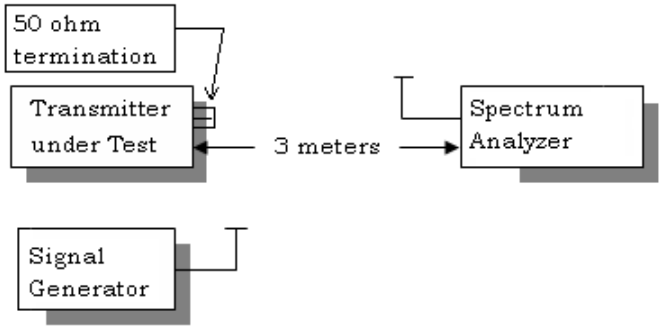
Part 80.211(f): 43+10log(mean power in watts)

Part 90.210(c): 43+10log(mean power in watts)

RSS 238 4.3: 20dB per decade from 40 dB bandwidth, not more than 60 dB

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 the standard listed above using the substitution method.

Test Setup Diagram:



Test Data:

No emissions present within 20 dB of the limit

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 90.213, Part 80.209(b), RSS-238 4.1

Requirements

Part 80.209(b): Emissions must not be closer than 1.5/T MHz from the band edges, where T is the pulse duration in microseconds

Part 90.213(a) Specified in station authorization

RSS 238 4.1: The carrier frequency shall not depart from the reference frequency in excess of 800 ppm for equipment which operates in the band 2900-3100 MHz nor in excess of 1250 ppm for equipment which operates in the band 9225-9500 MHz.

Method of Measurements: The test procedures used are detailed in the standard listed above

Test Data:

Temperature (°C)	Frequency (MHz)	Error (ppm)	Margin (ppm)
25 (ref)	9405.0		
-20	9401.0	-425	-1675
-10	9412.0	744	-506
0	9410.0	532	-718
10	9408.0	319	-931
20	9405.0	0	-1250
30	9410.0	532	-718
40	9403.0	-213	-1463
50	9400.0	-532	-1782

Results Meet Requirements

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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	02/25/15	02/25/17
Antenna: Double-Ridged Horn	Emco	3116	9011-2145	11/18/2015	11/18/2017
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-00; KMKM-0670-00; KFKF-0198-00	12/05/15	12/05/17
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	NA	NA
Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	01/04/16	01/04/18
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
USB Peak Power Sensor 50 MHz to 18 GHz	Boonton	55318	9224	09/13/16	09/13/18
Directional Coupler	HP	X752D	1829A24209	02/12/2016	02/12/2017
Adapter Waveguide WR-62 to Waveguide WR-90	ATM	62/90-6-6-6	S539608-01	N/A	N/A
Adapter Waveguide WR-62 to Coax SMA	ATM	62-251A-6	S539808-01	N/A	N/A

Adapter Waveguide WR-42 to Waveguide WR-90	ATM	42/90-8-6-6	S539408-01	N/A	N/A
Adapter Waveguide WR-42 to Coax K	ATM	42-25KA-6	S539508-01	N/A	N/A
Adapter Waveguide WR-28 to Waveguide WR-90	ATM	28/90-8-6-6	S539708-01	N/A	N/A
Adapter Waveguide WR-28 to Coax K	ATM	28-25KZA-6	S539908-01	N/A	N/A
WR90-Load	Pasternack	PE6824	N/A	N/A	N/A
Coaxial Cable	Micro-Coax	UFB142A-0-0720-200200	225363-002	08/05/2015	08/05/2017

*** EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

END OF REPORT

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