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FCC

VHF PART 90

TEST REPORT

APPLICANT	KP ELECTRONIC SYSTEMS LTD.
	P.O. BOX 42 TEFEN INDUSTRIAL PARK 24959 ISRAEL
FCC ID	H78KPRFM200A
MODEL NUMBER	RFM200
PRODUCT DESCRIPTION	MOBILE TRANSCEIVER
STANDARD APPLIED	CFR 47 Part 90
DATE SAMPLE RECEIVED	6/19/2015
FINAL TEST DATE	9/1/2015
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders

Report Number	Version Number	Description	Issue Date
1250AUT15TestReport	Rev1	Initial Issue	7/1/2015
1250AUT15TestReport	Rev2	Updated Report	9/1/2015

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

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GENERAL REMARKS

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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:



Cory Leverett
Engineering Project Manager

Date: 9/1/2015

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GENERAL INFORMATION

EUT Specification

EUT Description	MOBILE TRANSCEIVER
FCC ID	H78KPRFM200A
Model Number	RFM200
Operating Frequency	150.8 - 174
Test Frequencies	151, 163, 173.3 MHz
Type of Emission	2K89F1D
Modulation	FM
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 26°C with a relative humidity of 50%.
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-D:2010, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. 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	RF Power Output	Pass
Part 2.1033(c) (4) Part 2.1047(a)(6)	Modulation Characteristics	NA
2.1049(c), 90.210(e)	Emission Mask	Pass
2.1051(a)	Antenna Conducted Emissions	Pass
2.1053, Part 90	Field Strength Spurious Emissions	Pass
Part 2.1055, Part 90.213	Frequency Stability	Pass
Part 90.214	Transient Frequency Behavior	Pass

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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 EUT 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 Rohde & Schwarz – EMI test receiver. 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.

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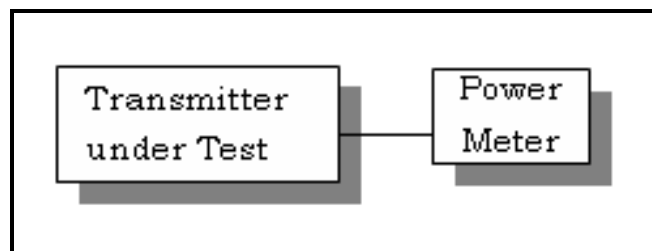
RF POWER OUTPUT

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

Test Requirements: Manufacturer's Specification

Method of Measurement: RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector.

Test Setup Diagram:



Test Data:

Tuned Frequency (MHz)	RF POWER	
	dBm	Watts
151	36.8	4.8
163	37	5
173.3	36.6	4.6

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

FOR HIGH POWER SETTING INPUT POWER: (12.5V) (.9A) = 11.25 Watts

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OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:

(d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

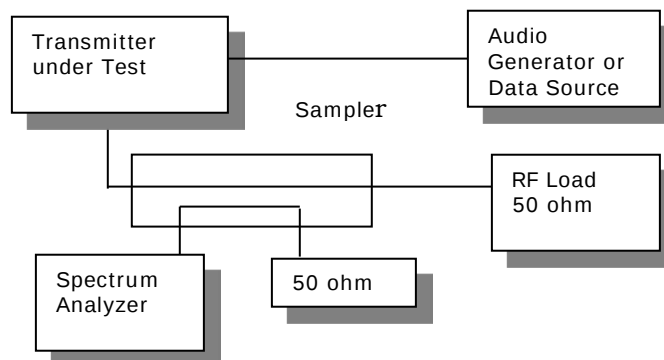
(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

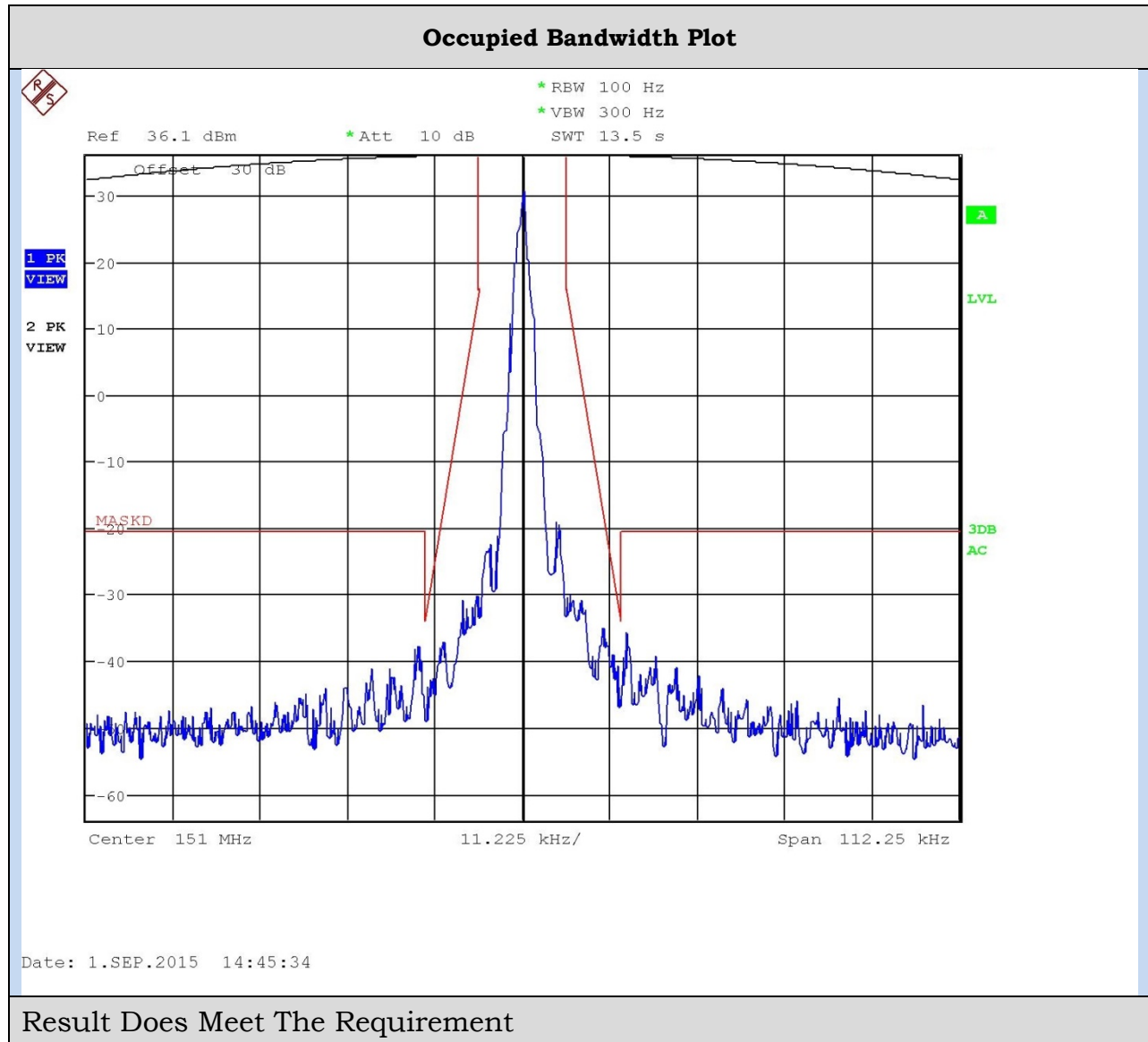
Method of Measurement: ANSI/TIA 603-D: 2010

Test Setup Diagram:



Test Data: See the plots below

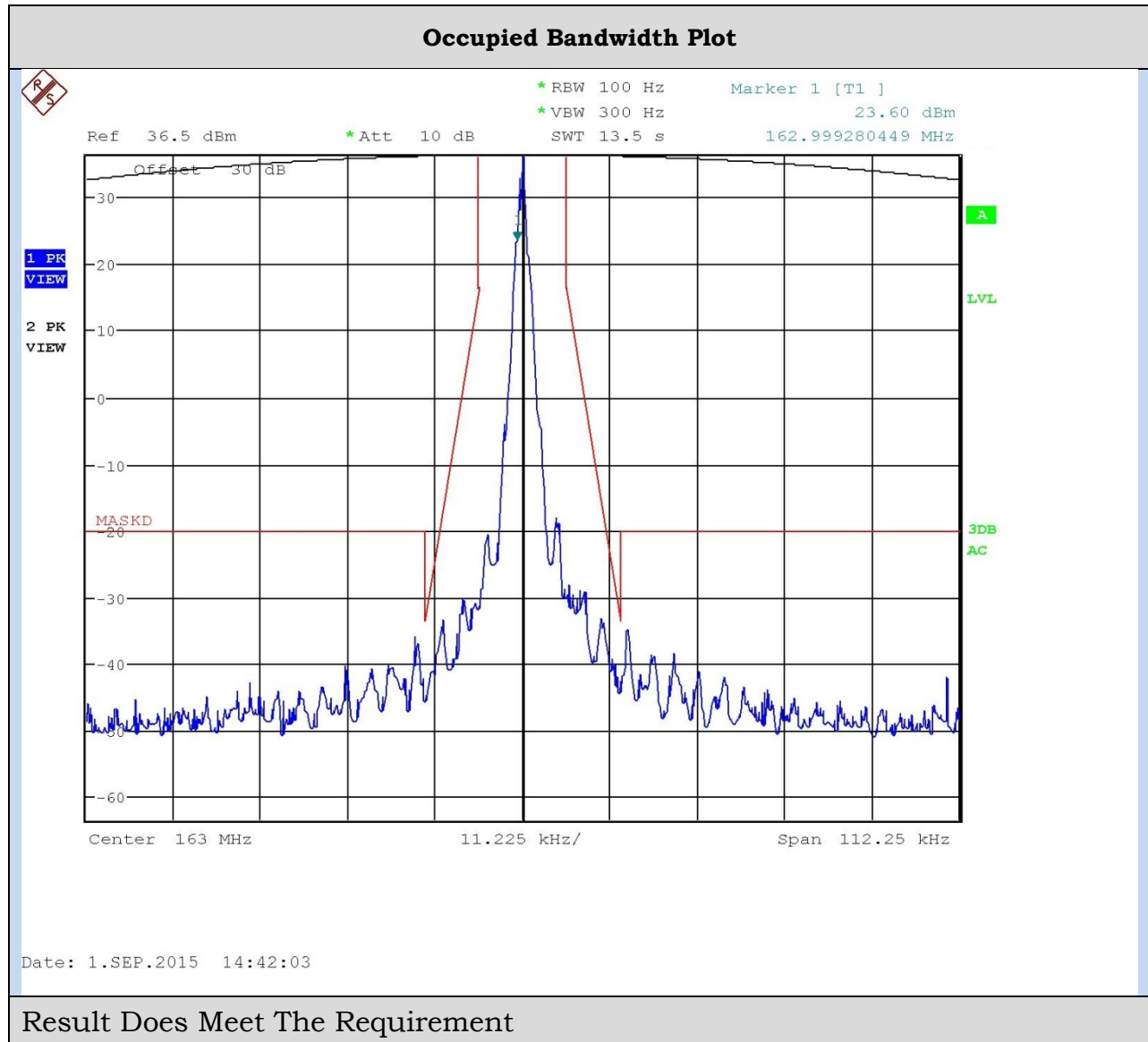
OCCUPIED BANDWIDTH PLOTS: Low End of Band Digital
Part 90.210(d) Emission Mask D – 12.5 KHz Channel Bandwidth -



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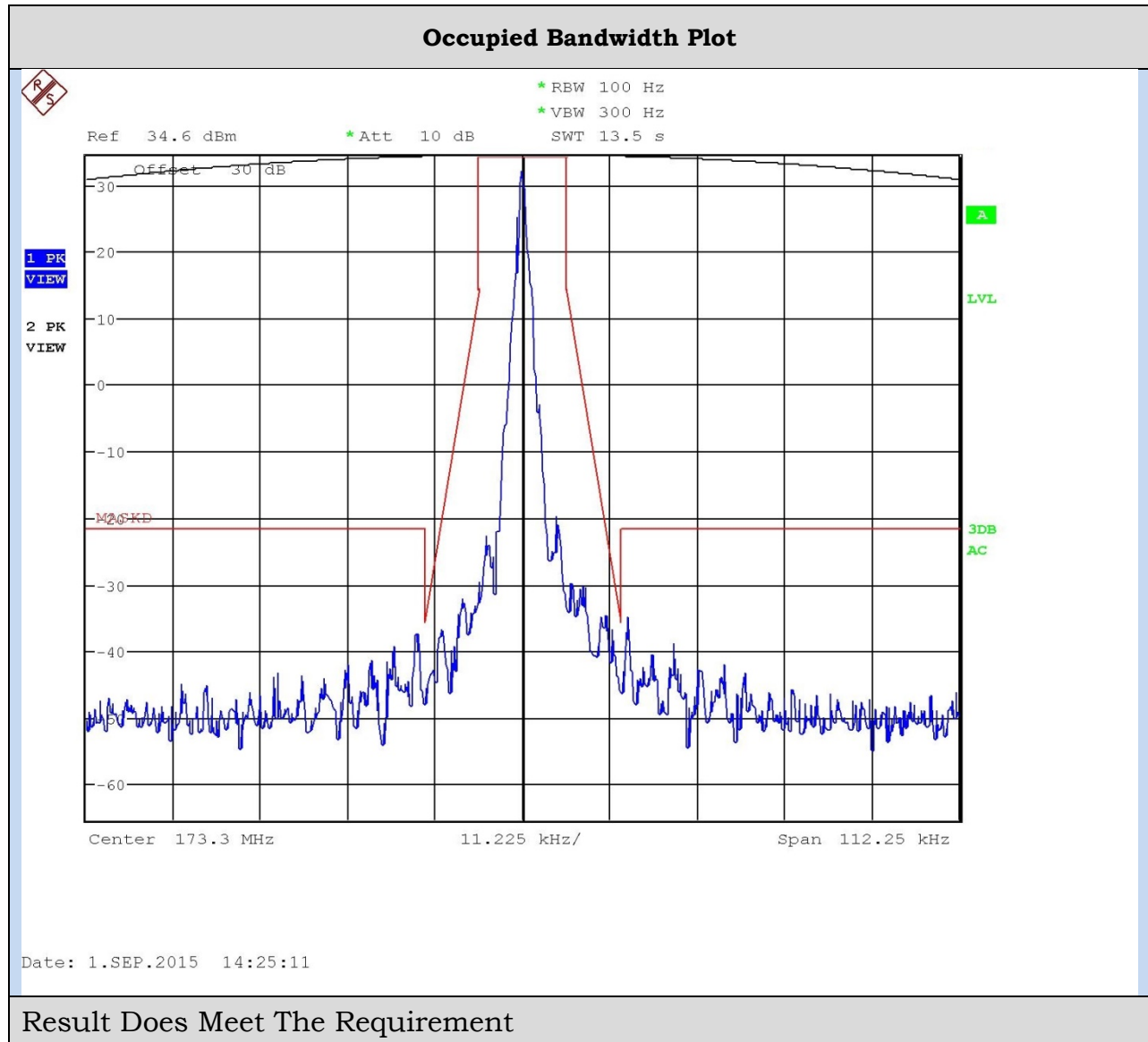
OCCUPIED BANDWIDTH PLOTS: Middle of Band Digital
Part 90.210(d) Emission Mask D – 12.5 KHz Channel Bandwidth -



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OCCUPIED BANDWIDTH PLOTS: High End of Band Digital **Part 90.210(d) Emission Mask D – 12.5 KHz Channel Bandwidth -**



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

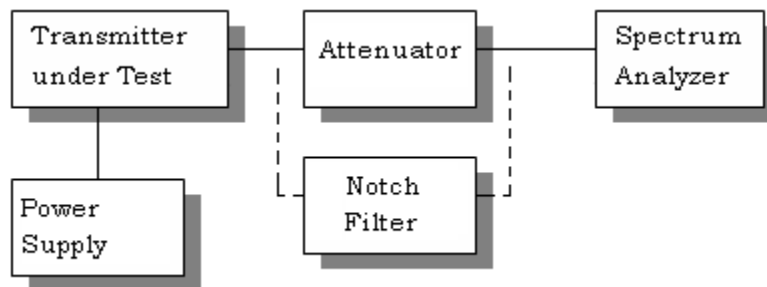
Rule Part No.: Part 2.1051(a), 90.210 (d)

Requirements:

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

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: Low end of Band 151 MHz

	dBm	Watts	Limit (dBc)
Power Output	36.8	4.78	56.79
	Frequency (MHz)	Level (dBc)	Margin (dB)
	45.99	79	22.21
	132.98	78.1	21.31
	302	74	17.21
	453	95.8	39.01
	604	82.8	26.01
	755	109.3	52.51
	906	105.8	49.01
	1057	98.9	42.11
	1208	102.3	45.51
	1359	104.6	47.81
	1510	104.6	47.81

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Test Data: Middle of Band 163 MHz

	dBm	Watts	Limit (dBc)
Power Output	37	5	56.99
	Frequency (MHz)	Level (dBc)	Margin (dB)
	47.24	85.4	28.41
	149.01	78.6	21.61
	326	80	23.01
	489	94.6	37.61
	652	72.7	15.71
	815	104.4	47.41
	978	101.1	44.11
	1141	102.2	45.21
	1304	102.2	45.21
	1467	98	41.01
	1630	100.9	43.91

Test Data: High End of Band 173.3 MHz

	dBm	Watts	Limit (dBc)
Power Output	36.6	4.57	56.60
	Frequency (MHz)	Level (dBc)	Margin (dB)
	82.69	81.6	25.00
	122.6	75.1	18.50
	346.6	90.9	34.30
	519.9	87.3	30.70
	693.2	88.9	32.30
	866.5	108.1	51.50
	1039.8	96.5	39.90
	1213.1	99	42.40
	1386.4	103	46.40
	1559.7	103	46.40
	1733	103	46.40

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FIELD STRENGTH OF SPURIOUS EMISSIONS

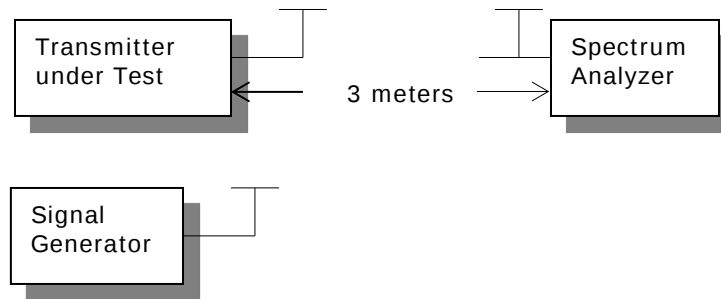
Rule Parts. No.: Part 2.1053

Requirements:

$$6.25 \text{ kHz Channel Spacing} = 55 + 10\log(\text{OP}) = \text{dBc}$$

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:

Low End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
151.00	Hi	36.80	4.79	56.80	12.50
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
302.00	V	100.48		38.68	
453.00	H	78.35		16.55	
604.00	V	78.31		16.51	
755.00	V	91.69		29.89	
906.00	H	80.79		18.99	
1,057.00	H	82.97		21.17	
1,208.00	H	91.25		29.45	
1,359.00	H	93.31		31.51	
1,510.00	H	92.20		30.40	

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FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data:

Middle of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
163.00	Hi	37.00	5.01	57.00	12.50
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
326.00	H	88.00		26.00	
489.00	H	77.94		15.94	
652.00	V	87.76		25.76	
815.00	H	103.09		41.09	
978.00	V	97.06		35.06	
1,141.00	H	87.89		25.89	
1,304.00	V	93.10		31.10	
1,467.00	H	86.77		24.77	
1,630.00	V	75.57		13.57	

High End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
173.33	Hi	36.60	4.57	56.60	12.50
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
346.66	H	89.15		27.55	
519.99	H	84.60		23.00	
693.32	V	94.21		32.61	
866.65	H	94.05		32.45	
1,039.98	H	82.57		20.97	
1,213.31	V	90.90		29.30	
1,386.64	V	90.31		28.71	
1,559.97	H	85.51		23.91	
1,733.30	H	76.44		14.84	

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FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%
±2.5 PPM

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

Test Data:

Temperature	Frequency MHz	PPM
25°C (reference)	173.299829	
-30°C	173.299911	0.473
-20°C	173.299901	0.415
-10°C	173.299869	0.231
0°C	173.299835	0.035
10°C	173.299853	0.138
20°C	173.299841	0.069
30°C	173.299838	0.052
40°C	173.299851	0.127
50°C	173.299846	0.098
Battery Voltage	Frequency	PPM
-15%	173.299836	0.040
15%	173.299838	0.052

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TRANSIENT FREQUENCY BEHAVIOR

Part 90.214 Transient Frequency Behavior

REQUIREMENTS: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

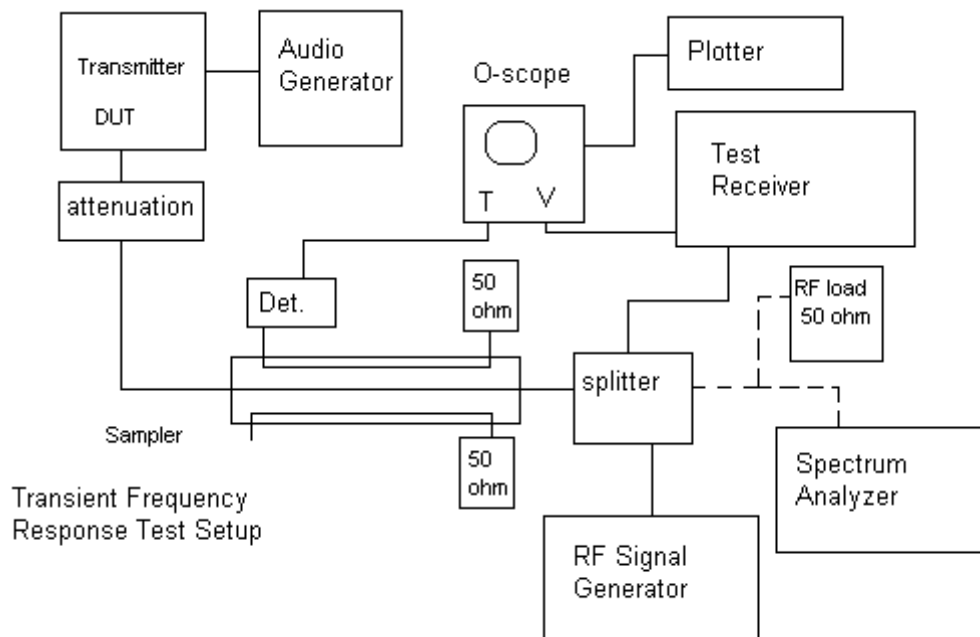
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
t_1^4	± 12.5 kHz	5.0 ms	10.0 ms
t_2	± 6.25 kHz	20.0 ms	25.0 ms
t_3^4	± 12.5 kHz	5.0 ms	10.0 ms

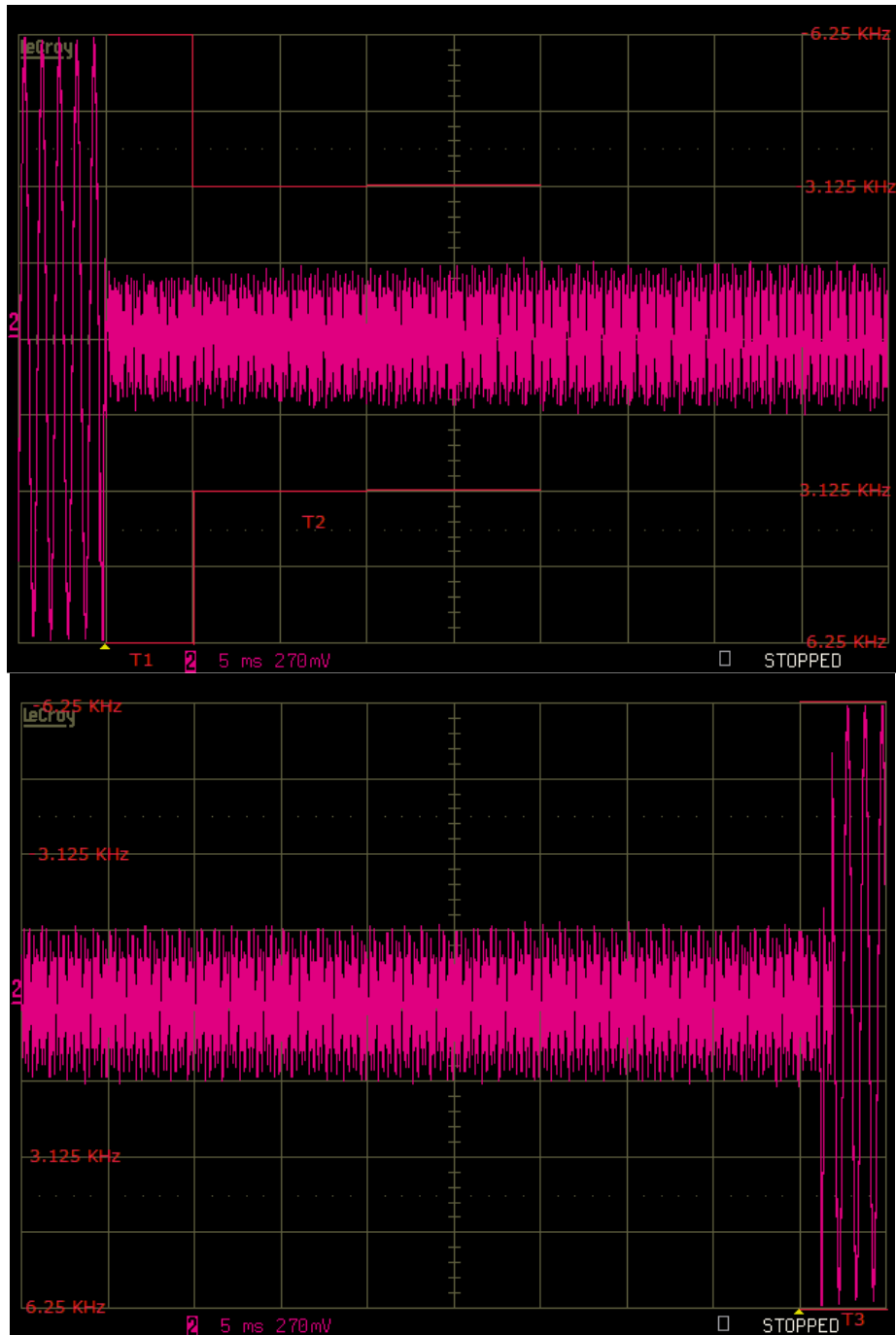
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TEST PROCEEDURE: ANSI/TIA 603-D: 2010, the levels were set as follows:

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, and then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB.
4. With the levels set as above, the transient frequency behavior was observed and recorded.



Test Data:



EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	12/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	11/30/15
DC Power Supply	HP	6264B	2032A04119	05/06/13	11/06/15
Digital Multimeter	Fluke	77	35053830	08/22/13	12/22/15
DC Power Supply	HP	6286A	2411A09414	NA	NA
Frequency Counter Small Chamber	HP	5385A	3242A07460	06/16/13	12/16/15
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
Temperature Chamber Small	Thermotron Corp.	S1.2 Mini Max	25-1420-09	08/20/14	08/20/16
EMI Test Receiver R & S ESIB 40	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	12/20/15
Attenuator N 30dB 150W DC-6G	Narda	769-30	10267	6/29/15	6/29/17
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	08/29/15

NA = No calibration required

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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