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## **TEST REPORT PER FCC PT 15.247 FHSS**

<b>APPLICANT</b>	ELK PRODUCTS, INC.
<b>ADDRESS</b>	3266 HIGHWAY 70 WEST
	HILDEBRAN NC 28637 USA
<b>FCC ID</b>	TMAELK-M1XRFTW
<b>PRODUCT DESCRIPTION</b>	ELK M1 INTERFACE TRANSCEIVER
<b>DATE SAMPLE RECEIVED</b>	5/18/2011
<b>DATE TESTED</b>	5/18/2011
<b>TESTED BY</b>	Nam Nguyen
<b>APPROVED BY</b>	Mario de Aranzeta
<b>TIMCO REPORT NO.</b>	1021AT11TestReport.doc
<b>TEST RESULTS</b>	<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.**



Certificate # 0955-01

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## ATTESTATION

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards.

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 by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.



Testing Certificate #0955-01

**AUTHORIZED BY:** Mario de Aranzeta



**SIGNATURE:**

**FUNCTION:** Lab Supervisor/ Test Engineer

**DATE:** 5/29/11

APPLICANT: ELK PRODUCTS INC.

FCC ID: TMAELK-M1XRFTW

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## REPORT SUMMARY

Disclaimer:	The test results relate only to the items tested.
Purpose of Test:	To demonstrate that the DUT is compliant with FCC Pt 15.247 requirements for a FHSS radio.
Applicable Standards:	FCC Pt 15.247, ANSI C63.4: 2003, ANSI TIA-603: 2004, FCC Pt 15.109
Related Reports:	N/A

## TEST ENVIRONMENT AND TEST SETUP

Test Facilities:	All measurements were made at one or more of the test sites of TIMCO ENGINEERING INC. located at 849 N.W. State Road 45, Newberry, FL 32669.
Laboratory Test Conditions:	Temperature: 26°C, Humidity: 55%
Test Exercise:	The DUT was set in continuous transmit mode of operation.
Deviation to the Standards:	There was no deviation from the standard.
Modification to the DUT:	No modification was made.
Supporting Accessories:	None

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## DUT DESCRIPTION

<b>DUT Description</b>	ELK M1 INTERFACE TRANSCEIVER
<b>FCC ID</b>	TMAELK-M1XRFTW
<b>Operating Frequency</b>	(903.00 – 926.50) MHz
<b>Type of Modulation</b>	GFSK
<b>DUT Power Source</b>	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Antenna</b>	Integral antenna
<b>Antenna Connector</b>	None

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## EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 3/10/10	3/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/12
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 6/10/09	6/10/11
Frequency Counter	HP	5385A	3242A07460	CAL 5/26/09	5/26/12
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/12
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/26/09	5/26/12
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/18/09	5/18/12
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12

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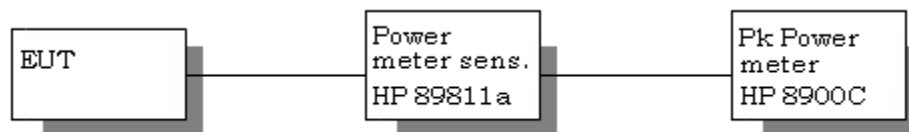
## TEST PROCEDURES

**POWER LINE CONDUCTED INTERFERENCE:** The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed with the DUT transmitting. The resolution bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

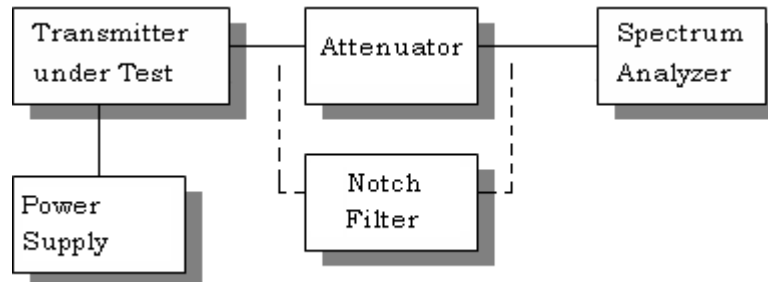
**BANDWIDTH 20 dB:** The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

**RF Power Output:** The RF power output was measured at the antenna feed point using a peak power meter.

Output Power Test Setup Diagram



**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 10<sup>th</sup> Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz. Power was measured by disconnecting the antennas and measuring across a 50 ohm load as recommended by the manufacturer using a peak power meter. The antenna is non-directional and doesn't exceed 6 dBi gain. The power output was measured at three places in the band highest is reported below.



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**RADIATION INTERFERENCE:** The test procedure used was ANSI C63.4-2003 using an Agilent spectrum receiver with preselector. 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.

**RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND:** An in band field strength measurement of the fundamental emission using the RBW and detector function required by ANSI C63.4-2003 and the FCC rules.

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**POWER LINE CONDUCTED INTERFERENCE****RULES PART NO.:** 15.207**REQUIREMENTS:**

Emission Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-peak (QP)	Average (AV)
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50
* Decreases with the logarithm of the frequency.		

**TEST DATA:** Not applicable – 12Vdc operated device.

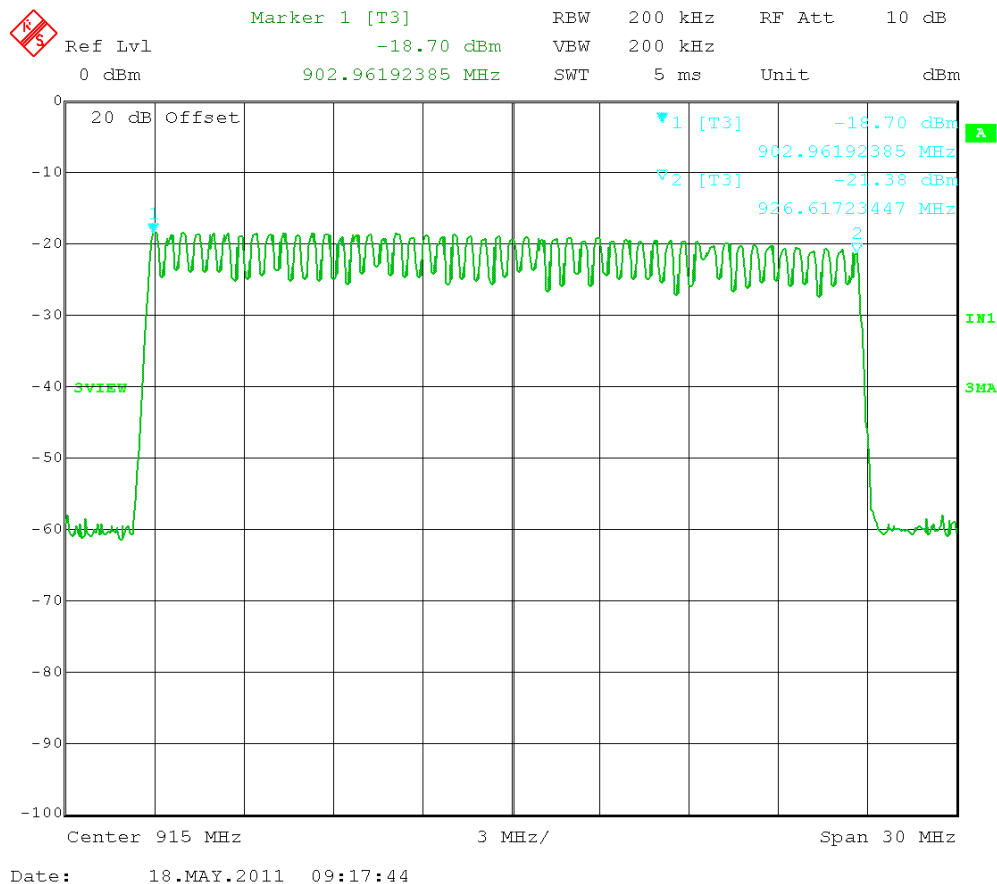
## NUMBER OF HOPPING CHANNELS

**Rules Part No.:** 15.247(a)(1), RSS-210

### Requirements:

902-928 MHz	If the 20 dB bandwidth is < 250 kHz, the system shall use at least 50 hopping frequencies.
	If the 20 dB bandwidth is 250 kHz or greater, the system shall use at least 25 hopping frequencies.
2400-2483.5 MHz	At least 15 channels
5725-5850 MHz	At least 75 channels

**Test Data:** There are 50 hopping channels



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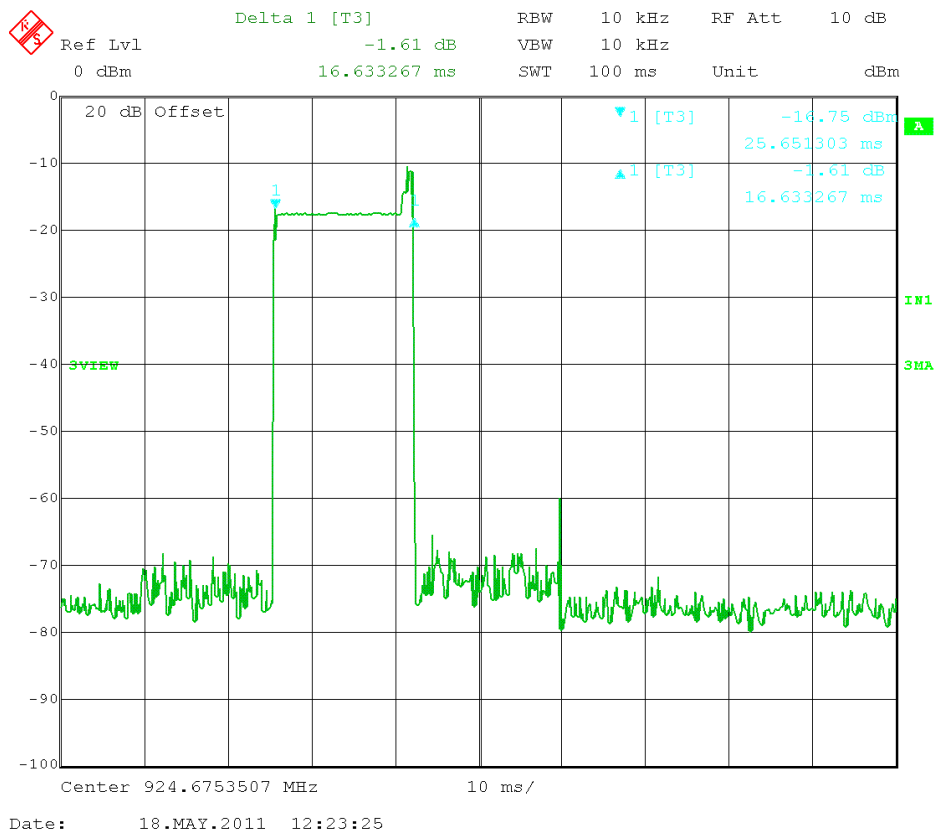
## DWELL TIME OF A HOPPING CHANNEL

**RULES PART NO.:** 15.247(a)(1)(i)

### REQUIREMENTS:

902-928 MHz	If 20 dB bandwidth is < 250 kHz, average time of occupancy of any frequency shall not exceed 0.4 sec in 20 seconds.
	If 20 dB bandwidth is 250 kHz or greater, dwell time < = 0.4 seconds in a 10 second period.
2400-2483.5 MHz	< = 0.4 seconds in a 0.4 seconds multiplied the number of hopping channels employed.
5725-5850 MHz	< = 0.4 seconds in a 30 second period.

**TEST DATA:** The dwell time is 16.63 ms per hop.  
Three places in the band were measured and the worst case presented.



APPLICANT: ELK PRODUCTS INC.

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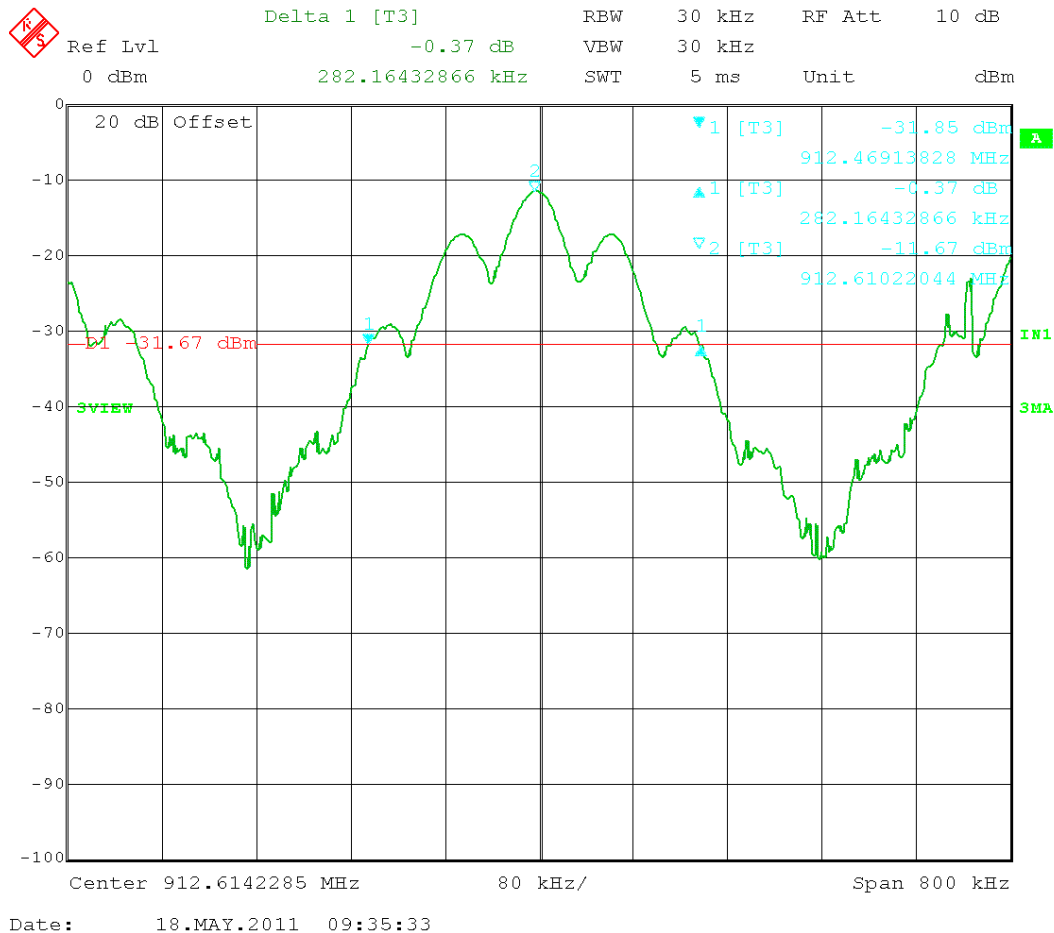
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## 20 dB BANDWIDTH

**RULES PART NO.:** 15.247(a)(2), RSS-210

**REQUIREMENTS:** The 20 dB bandwidth must be less than 500 kHz.

**TEST DATA:** See the following plot(s). 282 kHz



Three places in the band were measured and the worst case presented above.

APPLICANT: ELK PRODUCTS INC.

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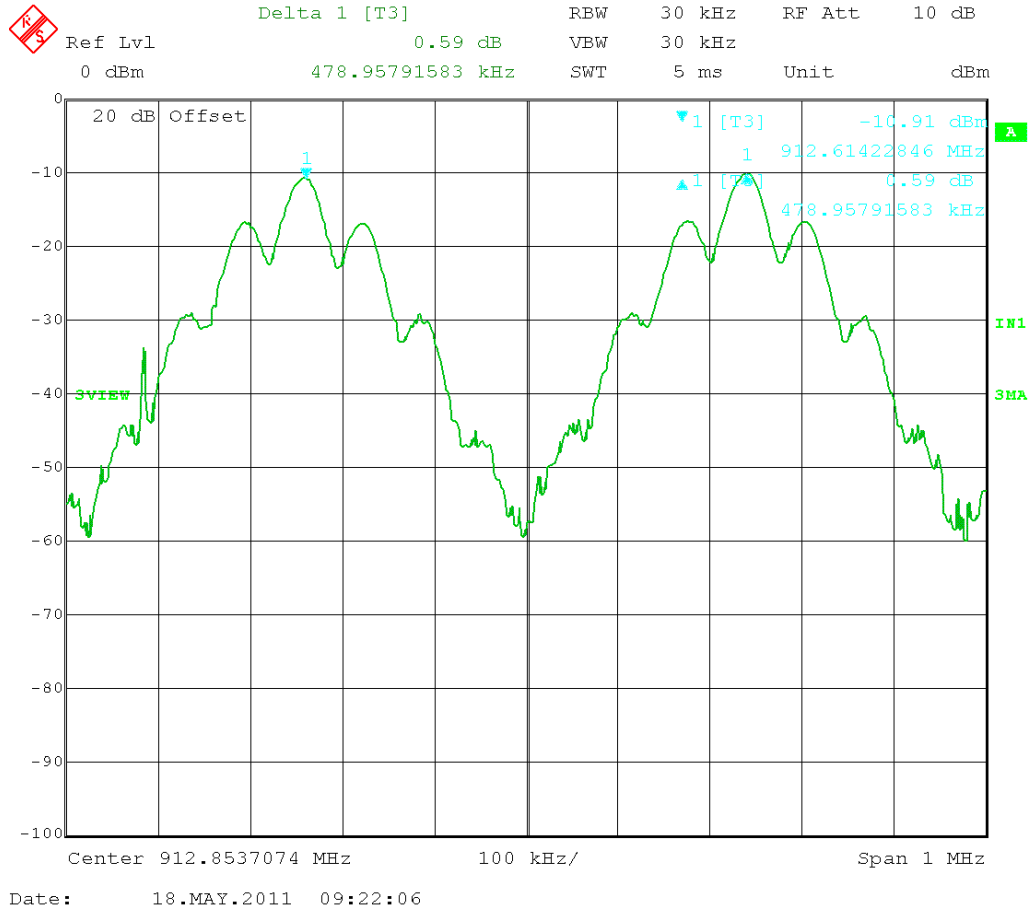
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## CARRIER FREQUENCY SEPARATION

**RULES PART NO.:** 15.247(a)(2)

**REQUIREMENTS:** The hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

**TEST DATA:** See the following plot. 478.95 kHz



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## POWER OUTPUT

**Rules Part No.:** 15.247(b)

**Requirements:** The maximum peak output power shall not exceed 1 watt (30 dBm). If directional transmitting antennas with a gain of more than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Test Data:** The device under test has an integral antenna and the power was measured on a radiated basis.

Frequency MHz	Power (EIRP) mW
903.00	7.24
915.00	4.47
926.50	3.98

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## **SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

**RULES PART NO.:** 15.247(c)

**REQUIREMENTS:** Emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

Note: The spectrum was scanned to the tenth harmonic.

**TEST DATA:** Not applicable – none antenna connected device.

APPLICANT: ELK PRODUCTS INC.

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## FIELD STRENGTH OF SPURIOUS EMISSIONS

**RULES PART NO.:** 15.247(c), 15.205 & 15.209(b)

### REQUIREMENTS:

§15.247(c) & §15.205	
(Fundamental) Frequency	(Field Strength) Limits
902 – 928 MHz 2.4 – 2.4835 GHz	127.37 dB $\mu$ V/m
§15.209	
30 - 88 MHz	40 dB $\mu$ V/m @3M
88 - 216 MHz	43.5 dB $\mu$ V/m @3M
216 - 960 MHz	46 dB $\mu$ V/m @3M
ABOVE 960 MHz	54 dB $\mu$ V/m

Emissions that fall in the restricted bands (15.205) must be less than or equal to 500  $\mu$ V/m (54 dB $\mu$ V/m). Spurious not in a restricted band must be 20 dBc.

Harmonics were measured to the 10<sup>th</sup> harmonic.

### Test Data:

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle	Field Strength dB $\mu$ V/m	Margin dB
903	903	73.3	H	1.95	23.8	15.6	83.45	43.92
903	903	78.1	V	1.95	23.8	15.6	88.25	39.12
903	1,806.00	28.1	H	2.74	29.96	15.6	45.2	23.05
903	1,806.00	26.3	V	2.74	29.96	15.6	43.4	24.85
903	2,709.00	20.1	V	3.4	32.54	15.6	40.44	13.56
903	2,709.00	20.5	H	3.4	32.54	15.6	40.84	13.16
903	3,612.00	25.8	V	4.15	32.98	15.6	47.33	6.67
903	3,612.00	27.5	H	4.15	32.98	15.6	49.03	4.97
903	4,515.00	21.2	V	4.76	34.1	15.6	44.46	9.54
903	4,515.00	20	H	4.76	34.1	15.6	43.26	10.74
903	5,418.00	12.7	H	5.13	34.6	15.6	36.83	17.17
903	5,418.00	11	V	5.13	34.6	15.6	35.13	18.87

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**Test Data Continue:**

<b>Tuned Frequency MHz</b>	<b>Emission Frequency MHz</b>	<b>Meter Reading dBuV</b>	<b>Ant. Polarity</b>	<b>Coax Loss dB</b>	<b>Correction Factor dB/m</b>	<b>Duty Cycle</b>	<b>Field Strength dBuV/m</b>	<b>Margin dB</b>
903	6,321.00	23	H	5.4	35.66	15.6	48.46	19.79
903	6,321.00	23.7	V	5.4	35.66	15.6	49.16	19.09
903	7,224.00	8.8	V	5.73	36.04	15.6	34.97	33.28
903	7,224.00	10.4	H	5.73	36.04	15.6	36.57	31.68
903	8,127.00	21.4	V	6.25	36	15.6	48.05	5.95
903	8,127.00	20.8	H	6.25	36	15.6	47.45	6.55
903	9,030.00	10.5	V	6.61	36.32	15.6	37.83	16.17
903	9,030.00	9.9	H	6.61	36.32	15.6	37.23	16.77
915	915	72.6	H	1.97	23.8	15.6	82.77	44.6
915	915	76	V	1.97	23.8	15.6	86.17	41.2
915	1,830.00	29.8	V	2.76	30.11	15.6	47.07	19.1
915	1,830.00	32.4	H	2.76	30.11	15.6	49.67	16.5
915	2,745.00	19.9	V	3.42	32.55	15.6	40.27	13.73
915	2,745.00	19.4	H	3.42	32.55	15.6	39.77	14.23
915	3,660.00	29.4	V	4.19	33.06	15.6	51.05	2.95
915	3,660.00	26.5	H	4.19	33.06	15.6	48.15	5.85
915	4,575.00	19.1	V	4.79	34.1	15.6	42.39	11.61
915	4,575.00	18.7	H	4.79	34.1	15.6	41.99	12.01
915	5,490.00	16.2	V	5.15	34.69	15.6	40.44	25.73
915	5,490.00	15.6	H	5.15	34.69	15.6	39.84	26.33
915	6,405.00	22.8	H	5.42	35.72	15.6	48.34	17.83
915	6,405.00	23.9	V	5.42	35.72	15.6	49.44	16.73
915	7,320.00	8.5	V	5.79	36.06	15.6	34.75	19.25
915	7,320.00	7.8	H	5.79	36.06	15.6	34.05	19.95
915	8,235.00	19.1	H	6.29	36	15.6	45.79	8.21
915	8,235.00	20.2	V	6.29	36	15.6	46.89	7.11
915	9,150.00	10.8	H	6.65	36.39	15.6	38.24	15.76
926.5	926.5	72	H	1.99	23.93	15.6	82.32	45.05
926.5	926.5	75.3	V	1.99	23.93	15.6	85.62	41.75
926.5	1,853.00	32	H	2.78	30.26	15.6	49.44	16.18
926.5	1,853.00	29.7	V	2.78	30.26	15.6	47.14	18.48
926.5	2,779.50	24	H	3.45	32.56	15.6	44.41	9.59

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<b>Tuned Frequency MHz</b>	<b>Emission Frequency MHz</b>	<b>Meter Reading dB<math>\mu</math>V</b>	<b>Ant. Polarity</b>	<b>Coax Loss dB</b>	<b>Correction Factor dB/m</b>	<b>Duty Cycle</b>	<b>Field Strength dB<math>\mu</math>V/m</b>	<b>Margin dB</b>
926.5	2,779.50	24.1	V	3.45	32.56	15.6	44.51	9.49
926.5	3,706.00	29	V	4.24	33.13	15.6	50.77	3.23
926.5	3,706.00	30.8	H	4.24	33.13	15.6	52.57	1.43

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**Test Data Continue:**

<b>Tuned Frequency MHz</b>	<b>Emission Frequency MHz</b>	<b>Meter Reading dB<math>\mu</math>V</b>	<b>Ant. Polarity</b>	<b>Coax Loss dB</b>	<b>Correction Factor dB/m</b>	<b>Duty Cycle</b>	<b>Field Strength dB<math>\mu</math>V/m</b>	<b>Margin dB</b>
926.5	4,632.50	16.4	V	4.82	34.1	15.6	39.72	14.28
926.5	4,632.50	20	H	4.82	34.1	15.6	43.32	10.68
926.5	5,559.00	17.4	V	5.17	34.78	15.6	41.75	23.87
926.5	5,559.00	18.5	H	5.17	34.78	15.6	42.85	22.77
926.5	6,485.50	21.4	H	5.45	35.79	15.6	47.04	18.58
926.5	6,485.50	17.8	V	5.45	35.79	15.6	43.44	22.18
926.5	7,412.00	8	H	5.85	36.08	15.6	34.33	19.67
926.5	7,412.00	8.2	V	5.85	36.08	15.6	34.53	19.47
926.5	8,338.50	19.1	H	6.34	36	15.6	45.84	8.16
926.5	8,338.50	17.1	V	6.34	36	15.6	43.84	10.16
926.5	9,265.00	12.4	V	6.68	36.46	15.6	39.94	25.68
926.5	9,265.00	10.8	H	6.68	36.46	15.6	38.34	27.28

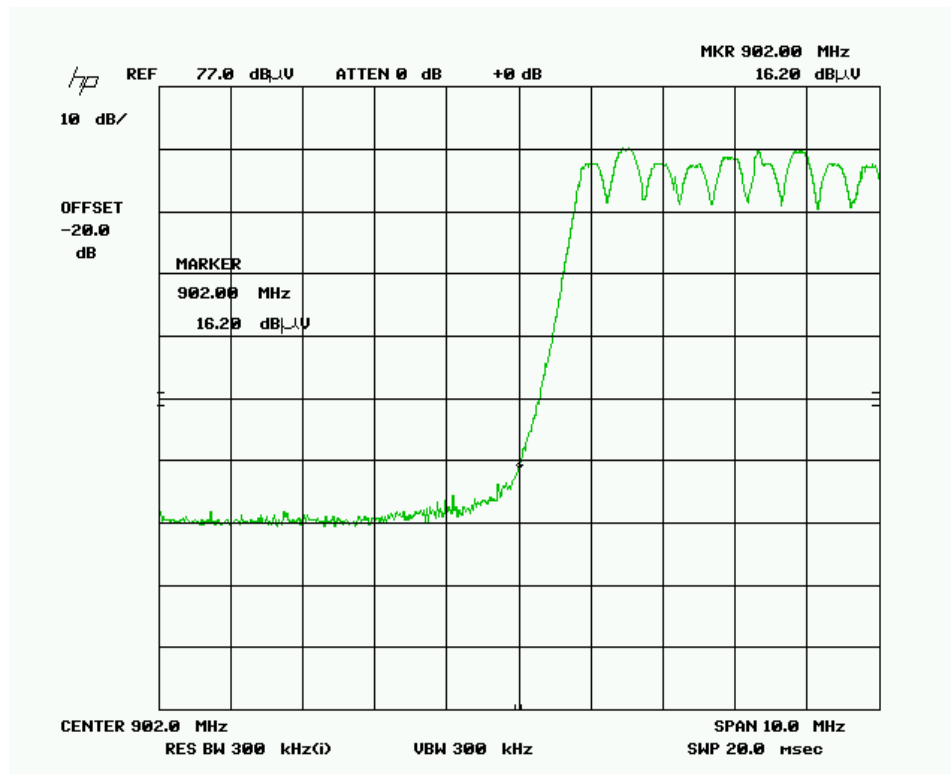
All readings are peak unless marked otherwise.  
P= Peak, A= Average, R= Restricted band frequency  
Harmonics were checked through the 10<sup>th</sup> harmonic.

## RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

**REQUIREMENTS:** Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 uV/m (54dBuV/m). Emissions not in the restricted band must be 20 dBc.

**TEST DATA:** The plots are presented below.

Lower bandedge



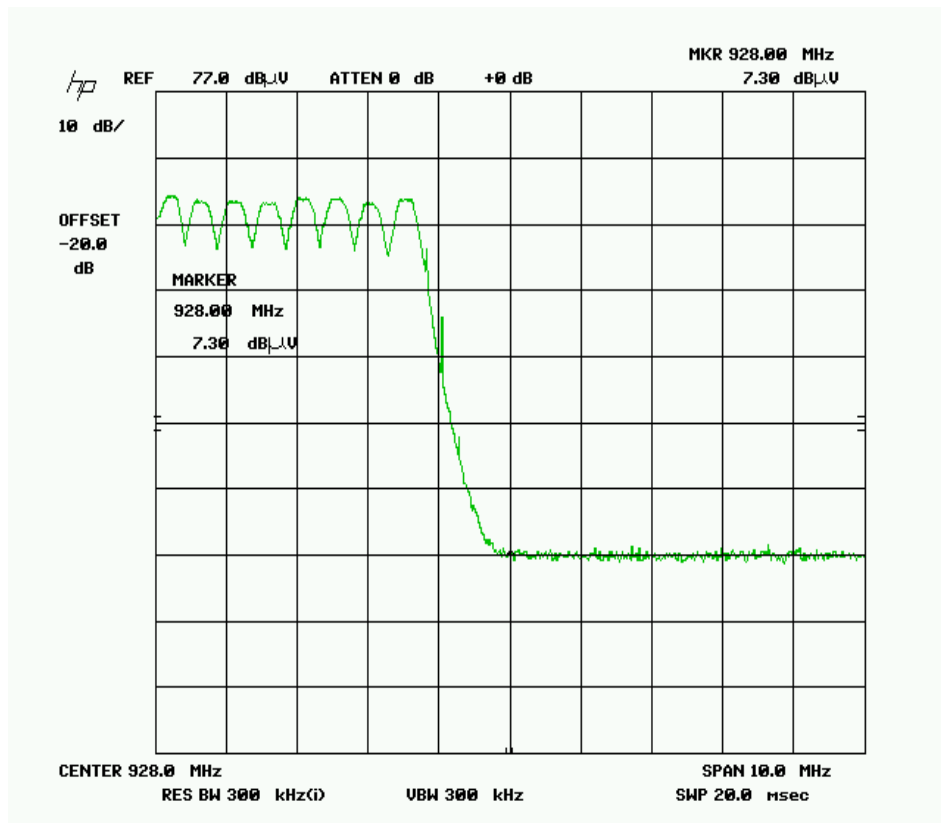
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
903	902	16.2	V	1.95	23.8	41.95	12.05

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Upper bandedge (peak value)



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
926.5	928	7.3	V	1.99	23.96	33.25	20.75

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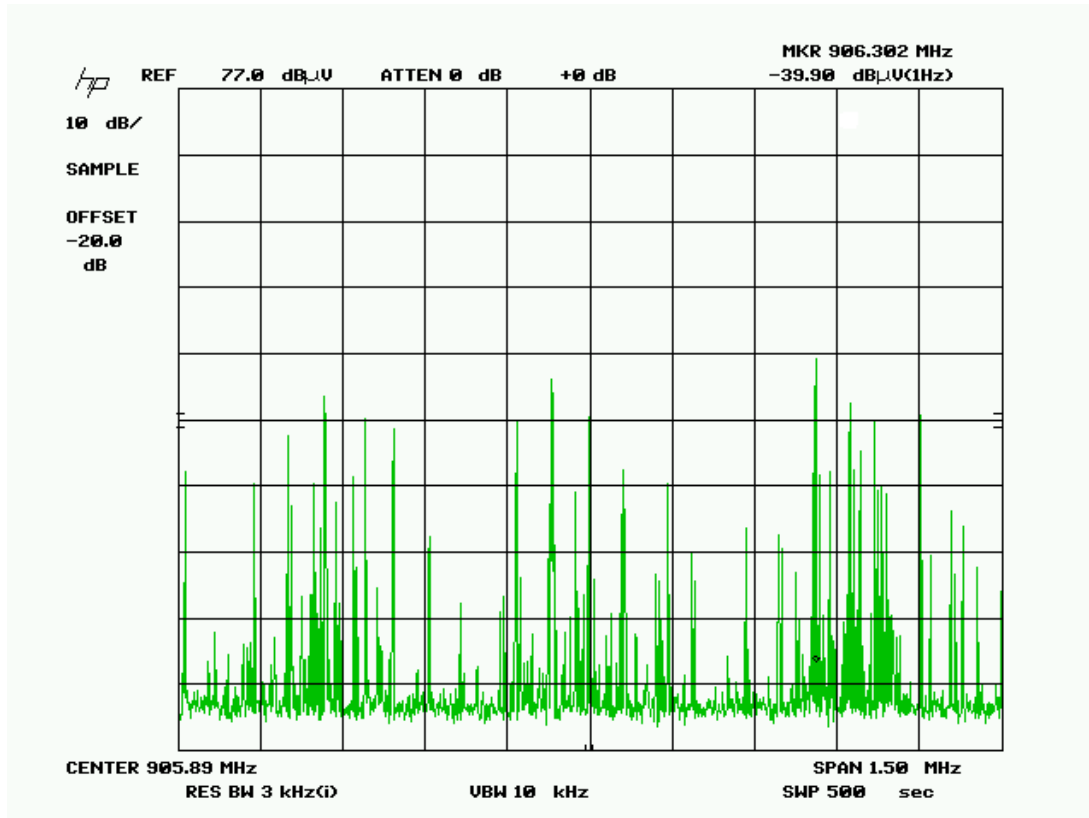
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## POWER SPECTRAL DENSITY

**Rules Part No.:** 15.247(d)

**Requirements:** The peak level measured must be less than +8.0 dBm.

**Test Data:** SEE THE FOLLOWING PLOT(S)



-39.9 dBμV From plot  
+35.0 dB correction factor to 3 kHz  
+30.0 dB attenuator used  
25.1 dBμV  
+25.87 dB/m  
50.97 dBμV/m Field strength  
-44.3 dBm EIRP is less than +8 dBm

Three places in the band were tested and the worst case presented.

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