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Newberry, FL 32669 USA
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FCC PART 15.247

900 MHz DTS

TEST REPORT

Applicant	**ELK PRODUCTS, INC.**
Address	**3266 US Highway 70 West**
	Hildebran, NC 28637 USA
FCC ID	**TMAELK-ALRT**
Model Number	ELK-6032
Product Description	900 MHz MODULE
Date Sample Received	11/30/2015
Final Test Date	12/8/2015
Tested By	Tim Royer
Approved By	Cory Leverett

Report Number	Version Number	Description	Issue Date
1581AXUT15TestReport	Rev1	Initial Issue	12/8/2015

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.

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:

Tim Royer
Engineering Project Manager

Date: 12/9/2015

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GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.247		
FCC ID	**TMAELK-ALRT**		
Model	ELK-6032		
EUT Description	900 MHz MODULE		
Modulation Type	Gaussian FSK at 128K bits per second		
Operating Frequency	TX: 902 - 928MHz		
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☒ Prototype	☐ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	Internal		
Antenna	Integrated		
Test Facility	**Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.**		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 (Measurement Procedures) ANSI C63.4-2009 (Radiated Site Validation)		
Test Exercise	EUT was powered with (2) two 3V Batteries.		

Test Supporting Equipment

Device	Manufacturer	Model	S/N	Supplied By	Used For
N/A	N/A	N/A	N/A	N/A	N/A

RESULTS SUMMARY

FCC Rule Part No.	Requirement	Test Item	Result
FCC 15.247(b) (3) (4)	Frequency hopping systems	Power Output	Pass
15.247 (i)	Frequency hopping systems	Number of Hopping Channels/ Occupancy Time	Pass
15.215(c)	Occupied Bandwidth	20 dB Bandwidth	Pass
15.247(b)	Transmitter Output Power and Equivalent Isotropically Radiated Power	Peak Power Output (ERP)	Pass
		Antenna Gain (EIRP)	Pass
15.247(d)	Unwanted Emissions	Bandedge	Pass
		Radiated Spurious	Pass

Notes:

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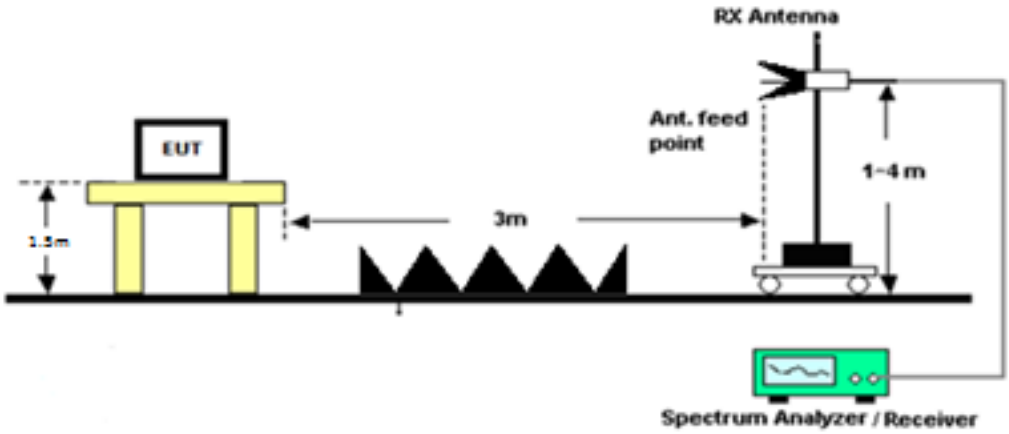
PEAK POWER OUTPUT

Rules Part No.: FCC 15.247(b) (3) (4)

Requirements: Maximum Conducted Peak Power Output shall not exceed 1 Watt
Also the Peak Power Output shall not exceed 4 Watts EIRP

Test Method: ANSI C63.10 § 11.2 Power Limits, definitions, and device configuration
ANSI C63.10 § 11.9.1.1 Fundamental Output Power RBW ≥ DTS Bandwidth
ANSI C63.10 § 6.3 Radiated Emissions testing- Common
ANSI C63.10 § Annex G Relationship among Field Strength and ERP/EIRP

Setup:



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PEAK POWER OUTPUT

Field Strength Conversion Formula: eirp = $(E \times d)^2/30$

E = electric field strength in V/m,
d = measurement distance in meters (m).

EIRP to ERP Conversion Formula: erp = eirp/1.64

Test Data: **Peak Power Output Measurement Table**

Peak Power Output EIRP			
Tuned Frequency (MHz)	3M Field Strength (dBuV/M)	EIRP (W)	Margin (W)
902.9	95.37	0.00103	3.998967
915	94.59	0.00086	3.999137
926.9	93.26	0.00064	3.999364

Peak Power Output ERP		
Tuned Frequency (MHz)	ERP (W)	Margin (W)
902.9	0.00063	0.99937
915	0.00053	0.99947
926.9	0.00039	0.99961

RESULTS: Meets Requirements

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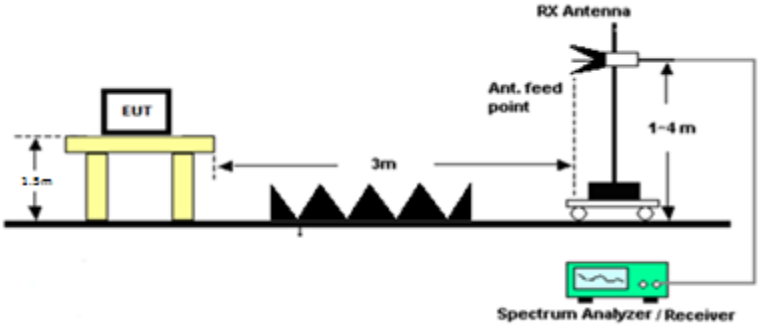
OCCUPIED BANDWIDTH

Rules Part No.: FCC 15.215 (c)

Requirements: The 20 dB Bandwidth shall remain inside the band of operation.
The 99% Bandwidth is for reporting only.

Test Method: ANSI C63.10 § 6.9.2 Occupied Bandwidth- Relative procedure
ANSI C63.10 § 6.9.3 Occupied Bandwidth- 99% Power Bandwidth procedure
ANSI C63.10 § 6.3 Radiated Emissions testing- Common

Setup:



Test Data: **Occupied Bandwidth Measurement Table**

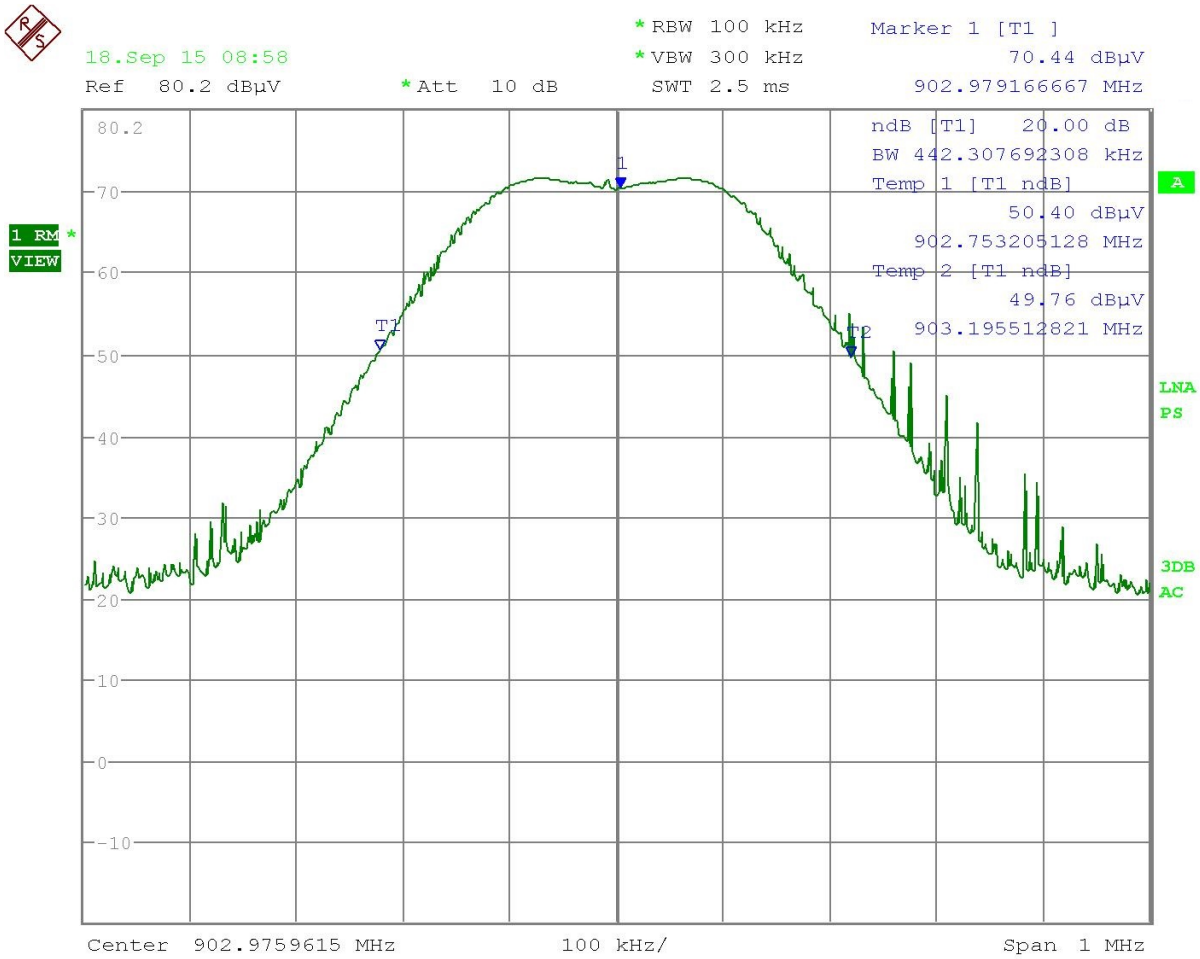
Tuned Frequency (MHz)	20 dB BW (MHz)	99% BW (MHz)
902	442.3	358.97
915	455.12	341.34
928	419.9	346.15

RESULTS: Meets Requirements

Table of Contents

OCCUPIED BANDWIDTH

Test Data: 20 dB Bandwidth Plot Low End of Band



Date: 18.SEP.2015 08:58:40

RESULTS: Meets Requirements

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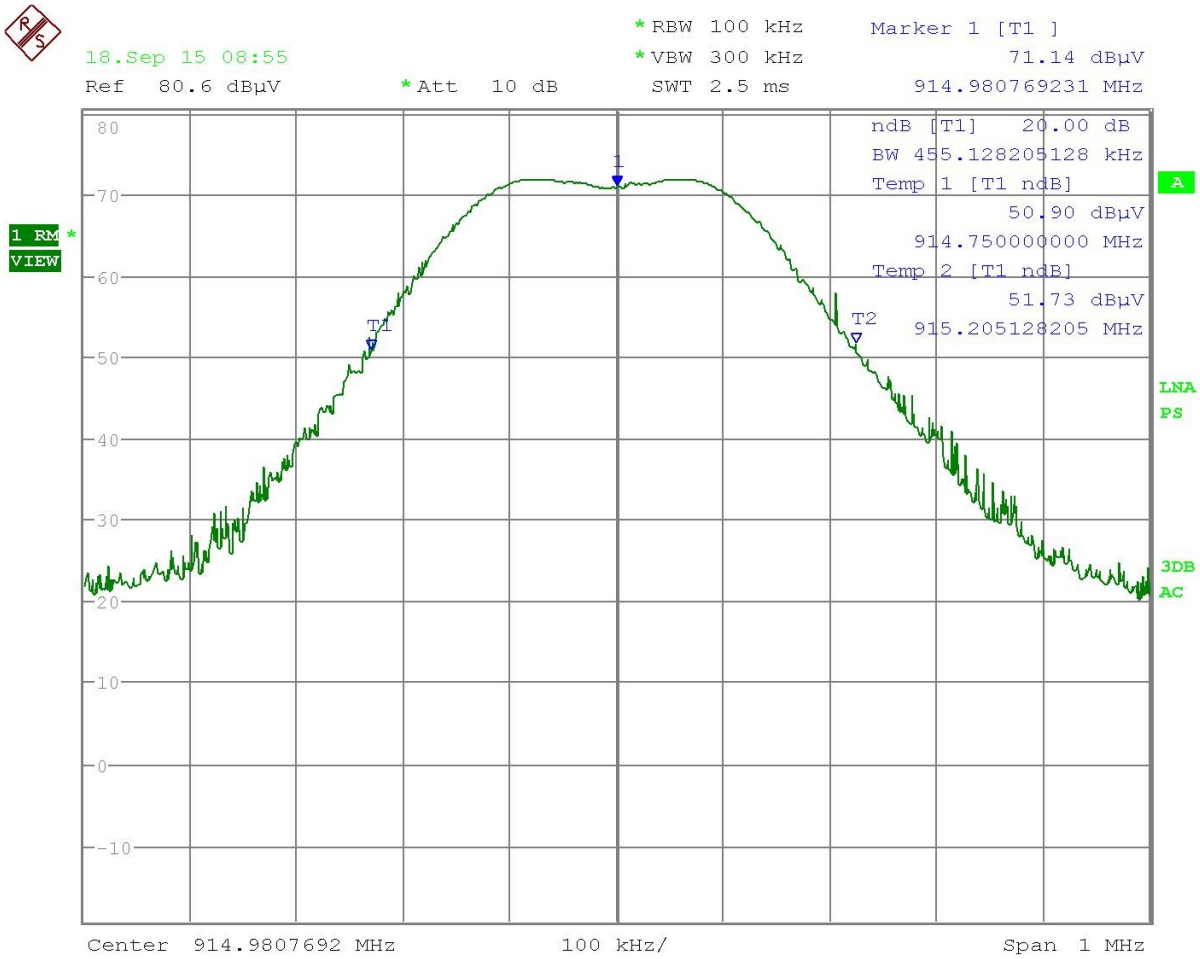
Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

OCCUPIED BANDWIDTH

Test Data: 20 dB Bandwidth Plot Middle of Band



Date: 18.SEP.2015 08:55:35

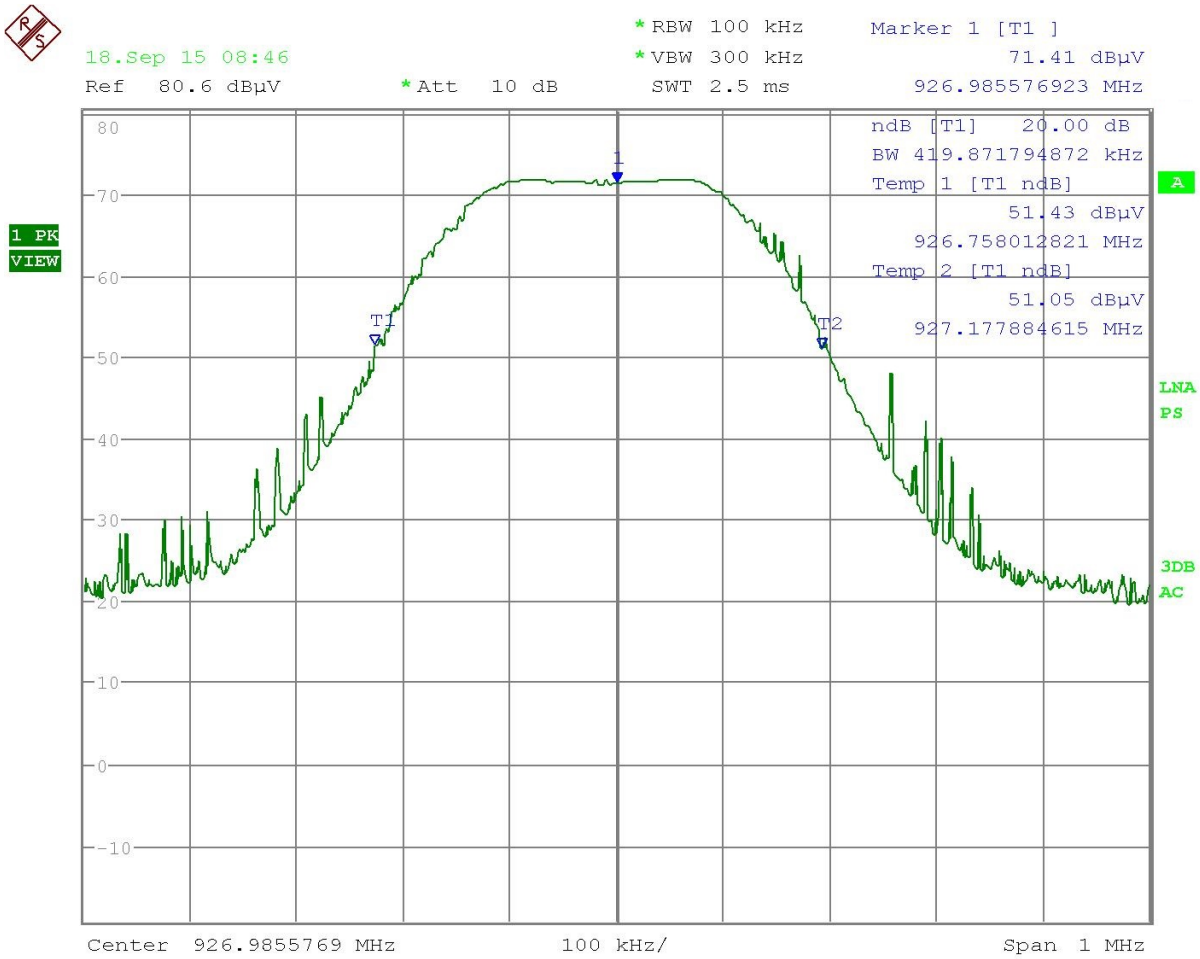
RESULTS: Meets Requirements

Table of Contents

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

OCCUPIED BANDWIDTH

Test Data: 20 dB Bandwidth Plot High end of Band



Date: 18.SEP.2015 08:46:33

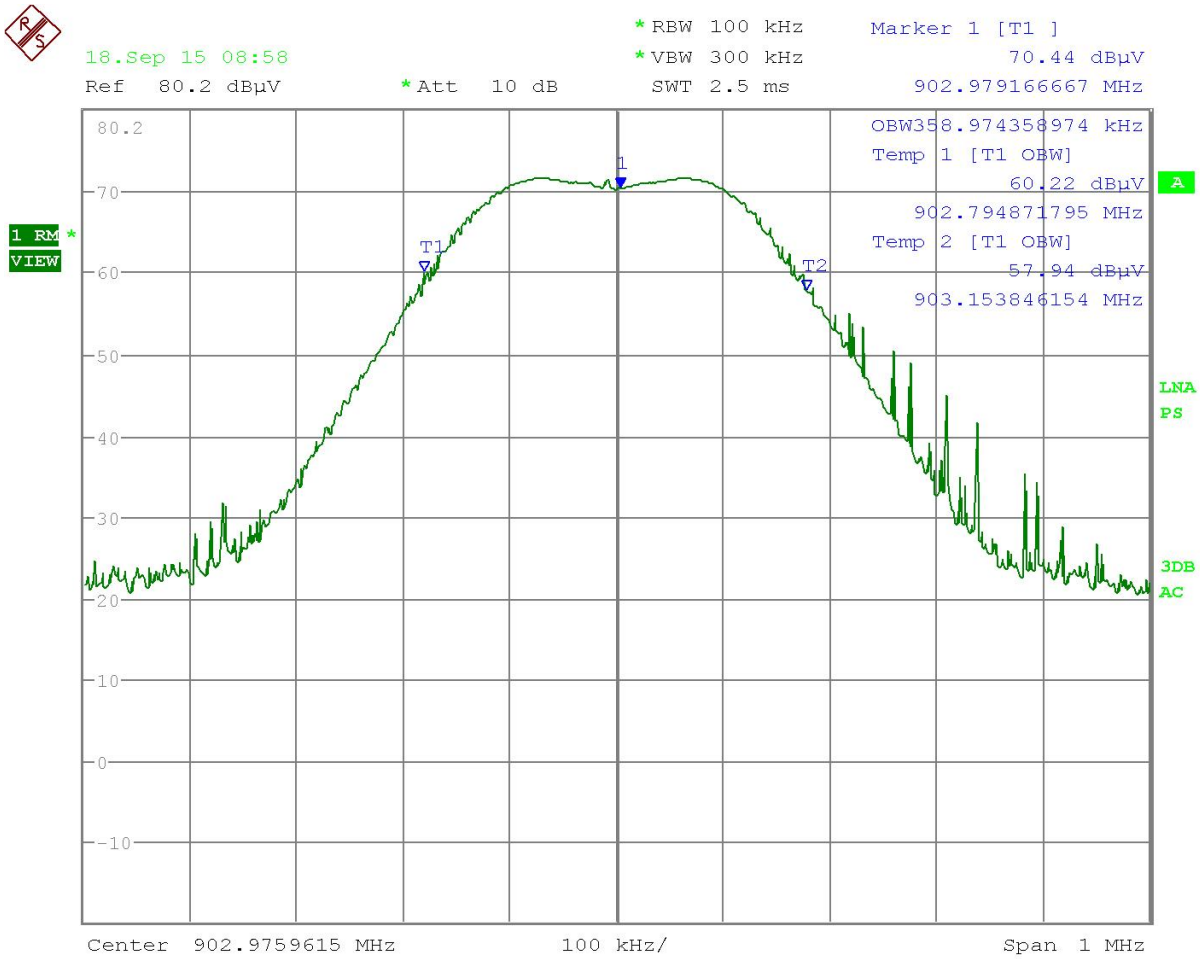
RESULTS: Meets Requirements

Table of Contents

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

OCCUPIED BANDWIDTH

Test Data: 99% Bandwidth Low End of Band



Date: 18.SEP.2015 08:58:00

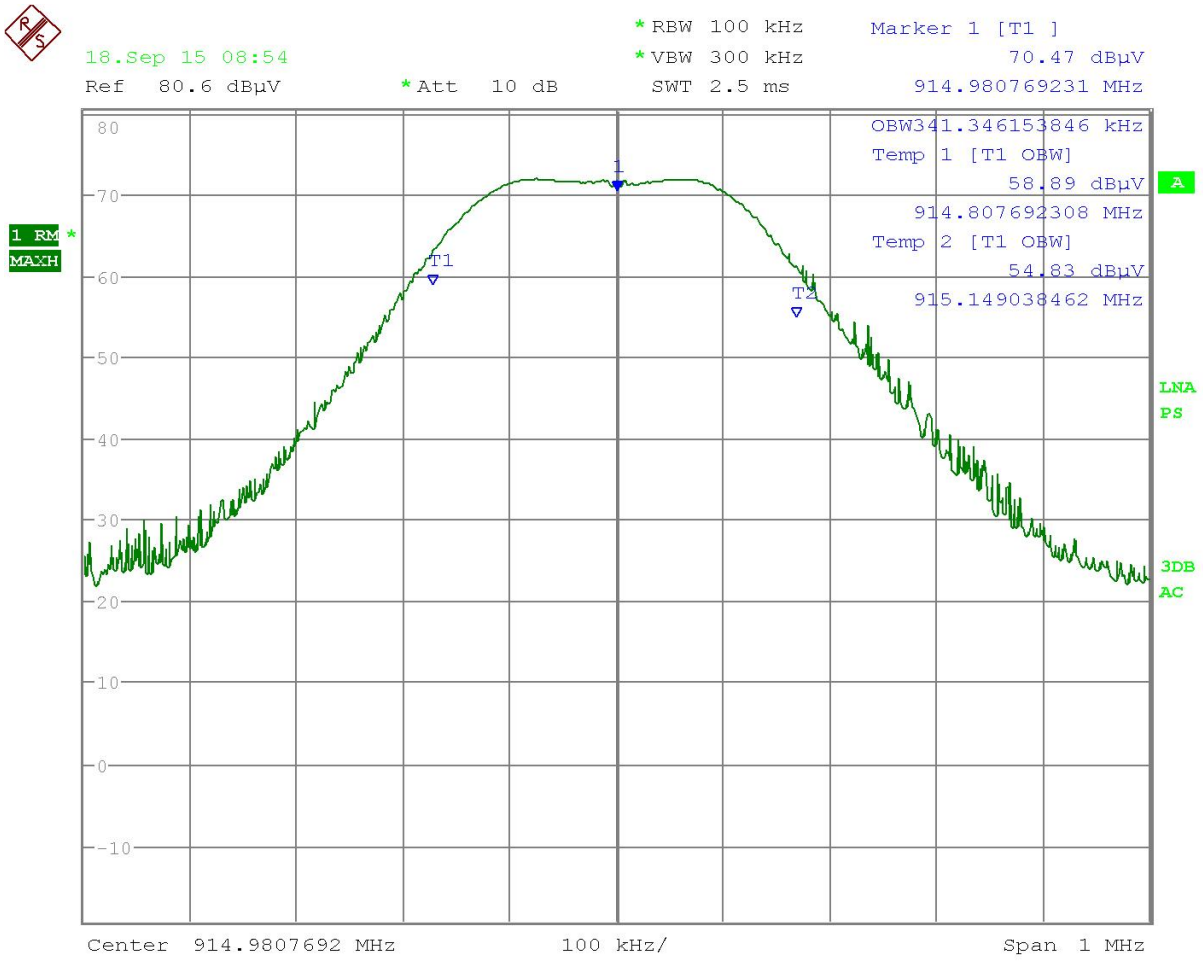
RESULTS: Meets Requirements

Table of Contents

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

OCCUPIED BANDWIDTH

Test Data: 99% Bandwidth



Date: 18.SEP.2015 08:54:28

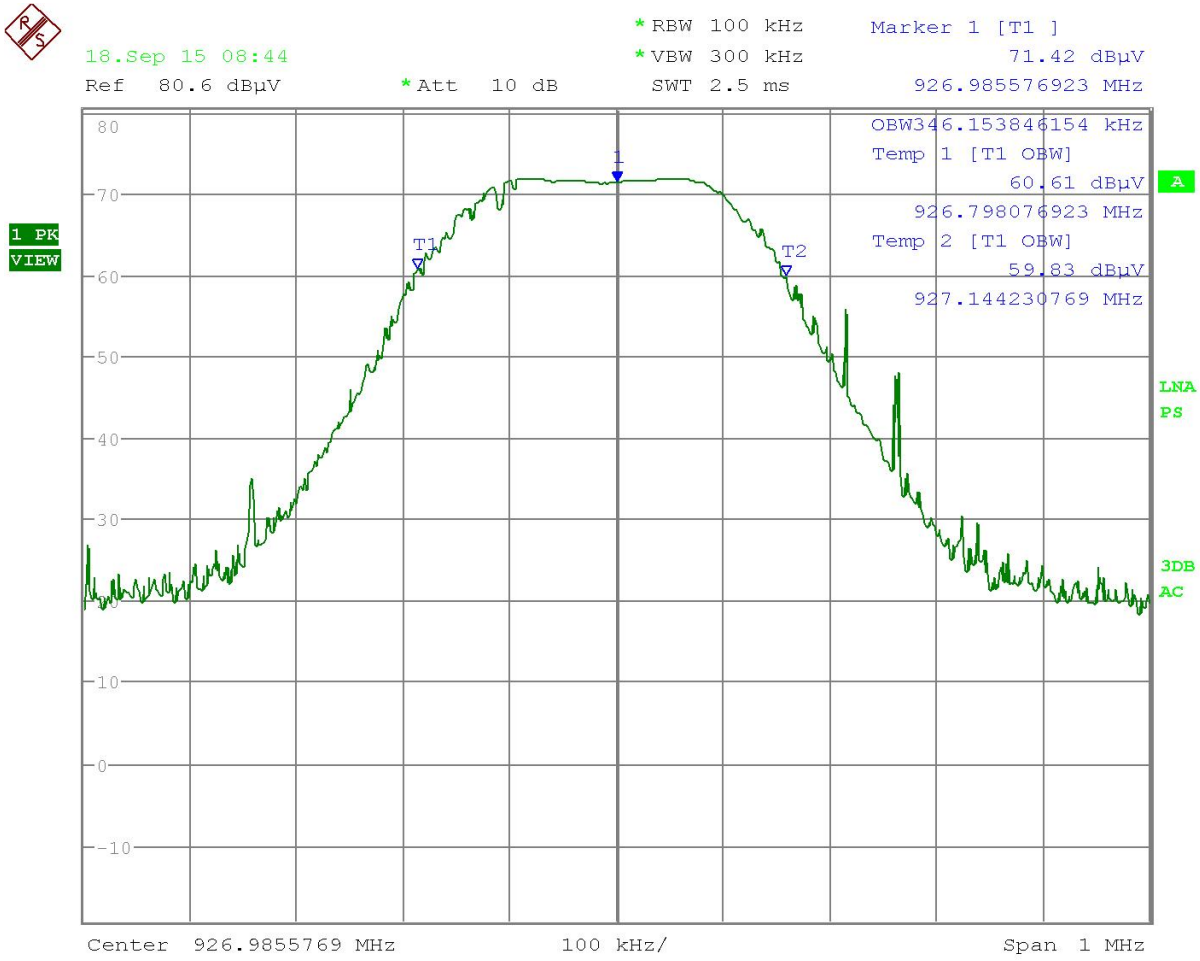
RESULTS: Meets Requirements

Table of Contents

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

OCCUPIED BANDWIDTH

Test Data: 99% Bandwidth High end of Band



Date: 18.SEP.2015 08:44:12

RESULTS: Meets Requirements

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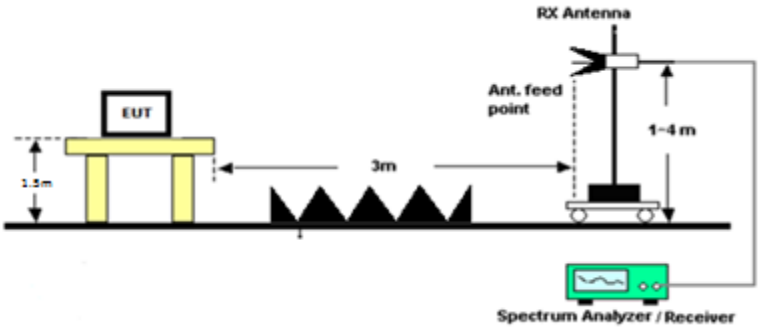
Number of Hopping Channels / Occupancy Time

Rules Part No.: FCC 15.247 (i)

Requirements: If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period

Test Method: ANSI C63.10 § 6.3 Radiated Emissions testing- Common

Setup:



Test Data: **Occupied Bandwidth Measurement Table**

Number Of Channels	Occupancy Time
25	0.345s

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

RESULTS: Meets Requirements

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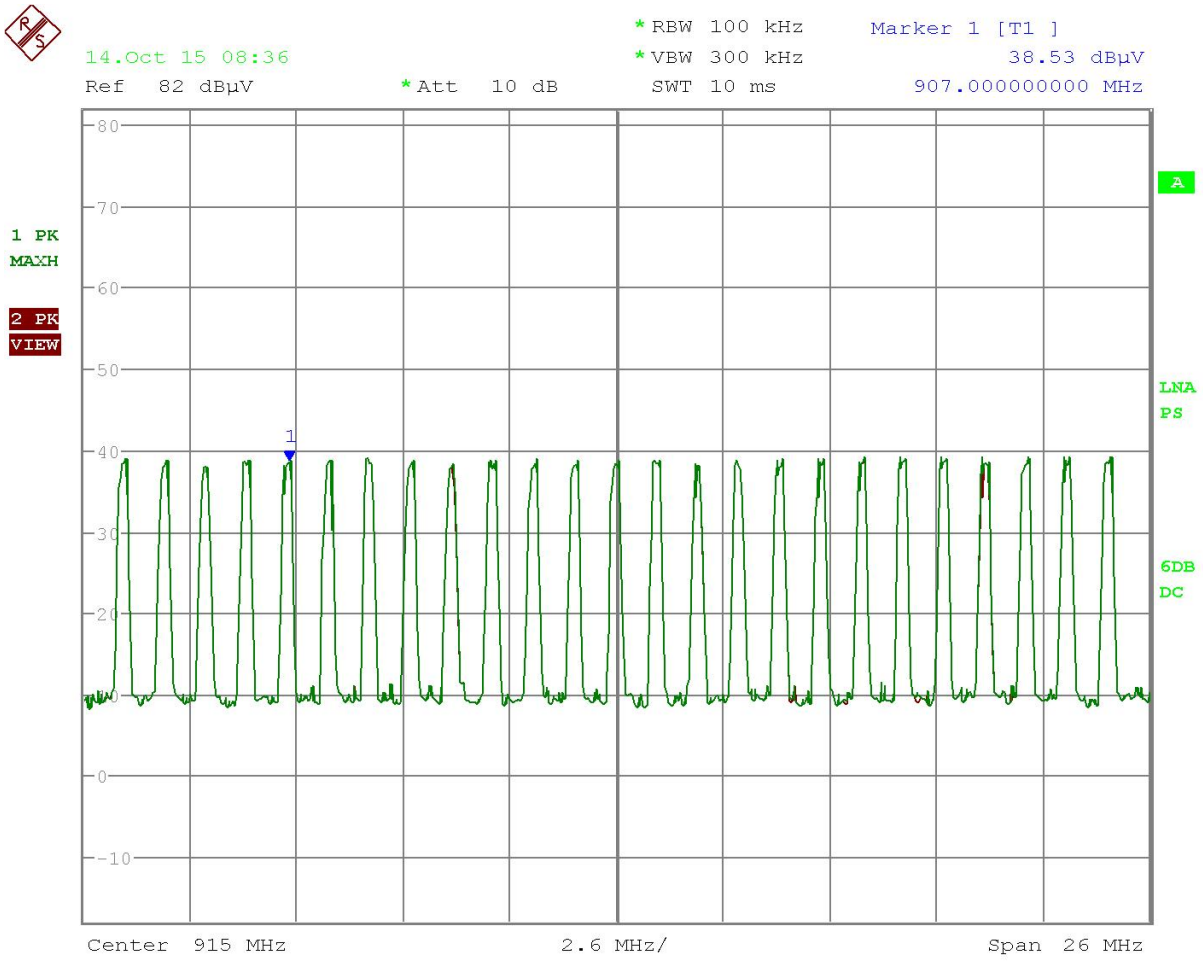
Number of hopping channels

Test Data:



Date: 14.OCT.2015 08:36:37

RESULTS: Meets Requirements

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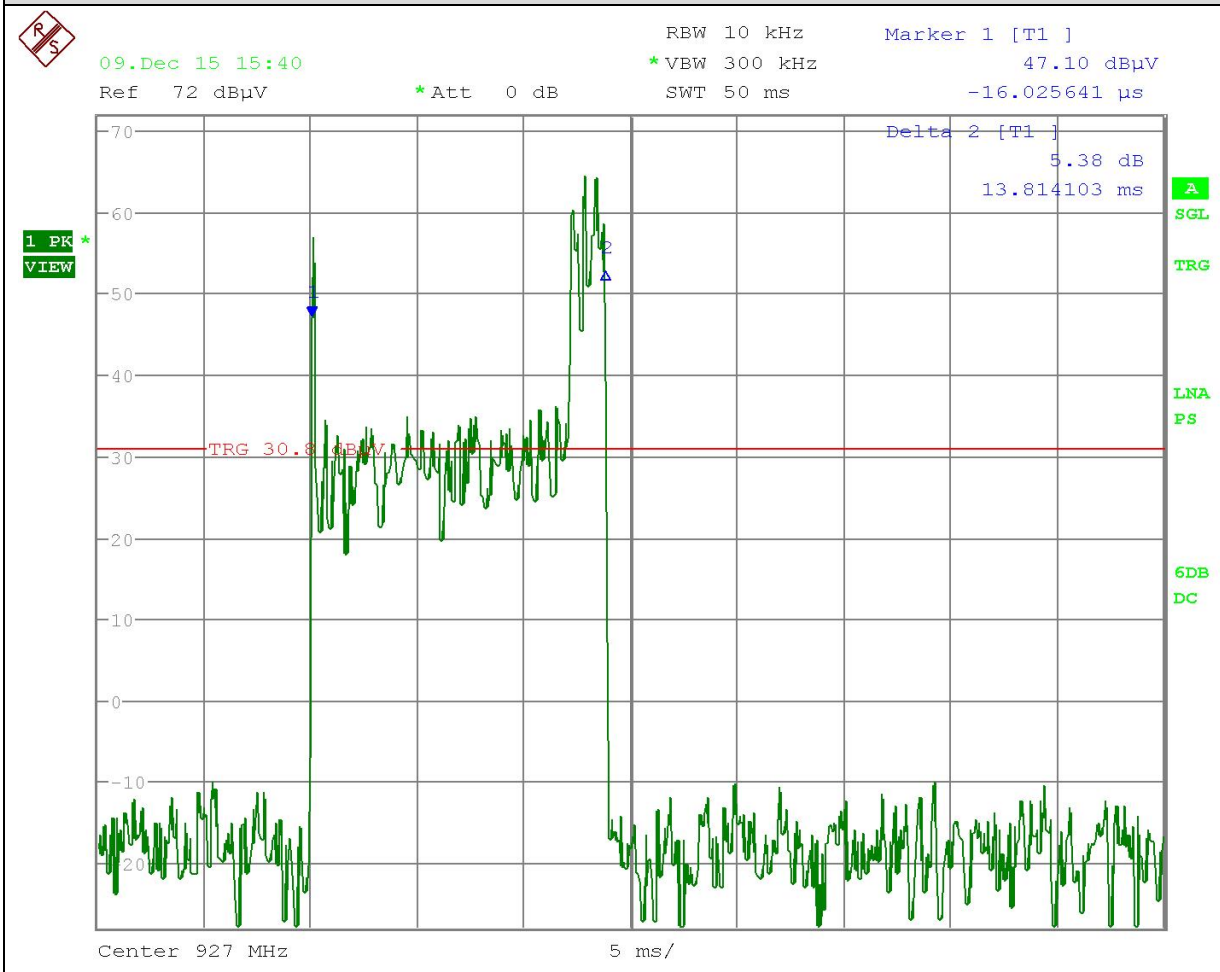
Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

Occupancy Time

Dwell time per hopping channel: 13.8ms



Date: 9.DEC.2015 15:40:10

RESULTS: Meets Requirements

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Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

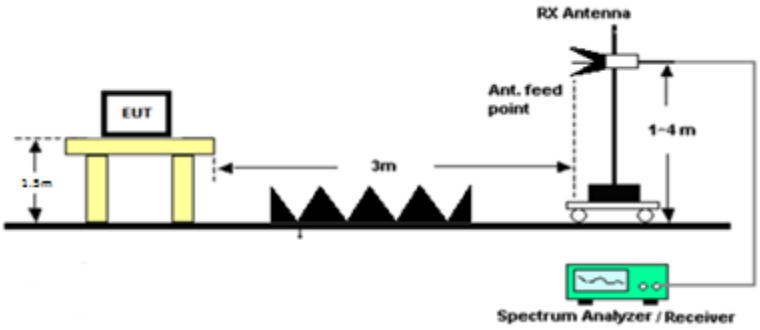
BANDEDGE

Rule Part No.: FCC 15.247(d)

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

Test Method: ANSI C63.10 § 6.10.4 Authorized band-edge relative method
ANSI C63.10 § 6.3 Radiated Emissions testing- Common

Setup:



Test Data: **Authorized Bandedge measurement table**

Tuned Frequency (MHz)	Lower Bandedge (dBc)	Upper Bandedge (dBc)	Margin (dB)
903.04	57.89	-	37.89
927.03	-	56.03	36.03

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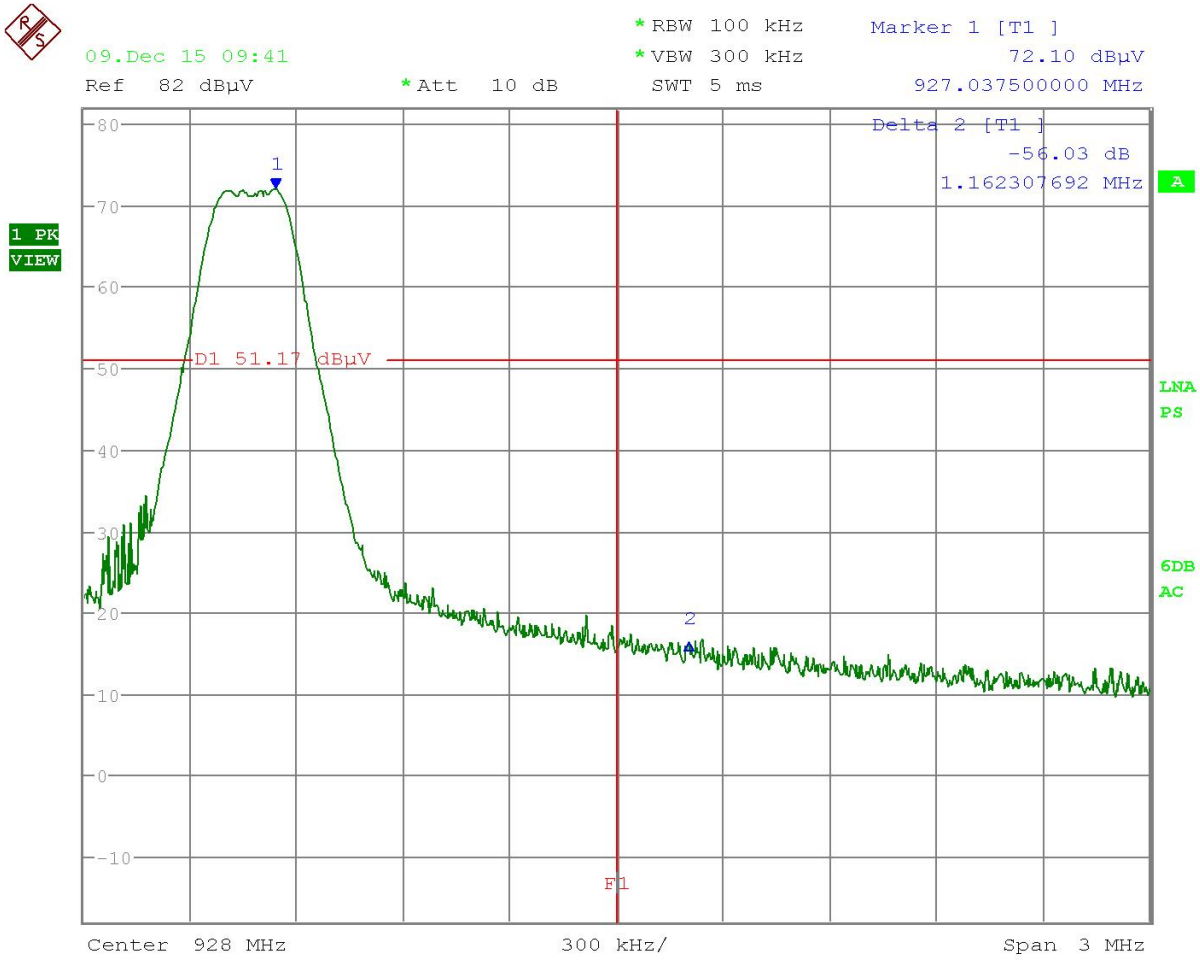
BANDEDGE

Test Data: Upper Band Edge Plot



Date: 9.DEC.2015 09:41:34

RESULTS: Meets Requirements

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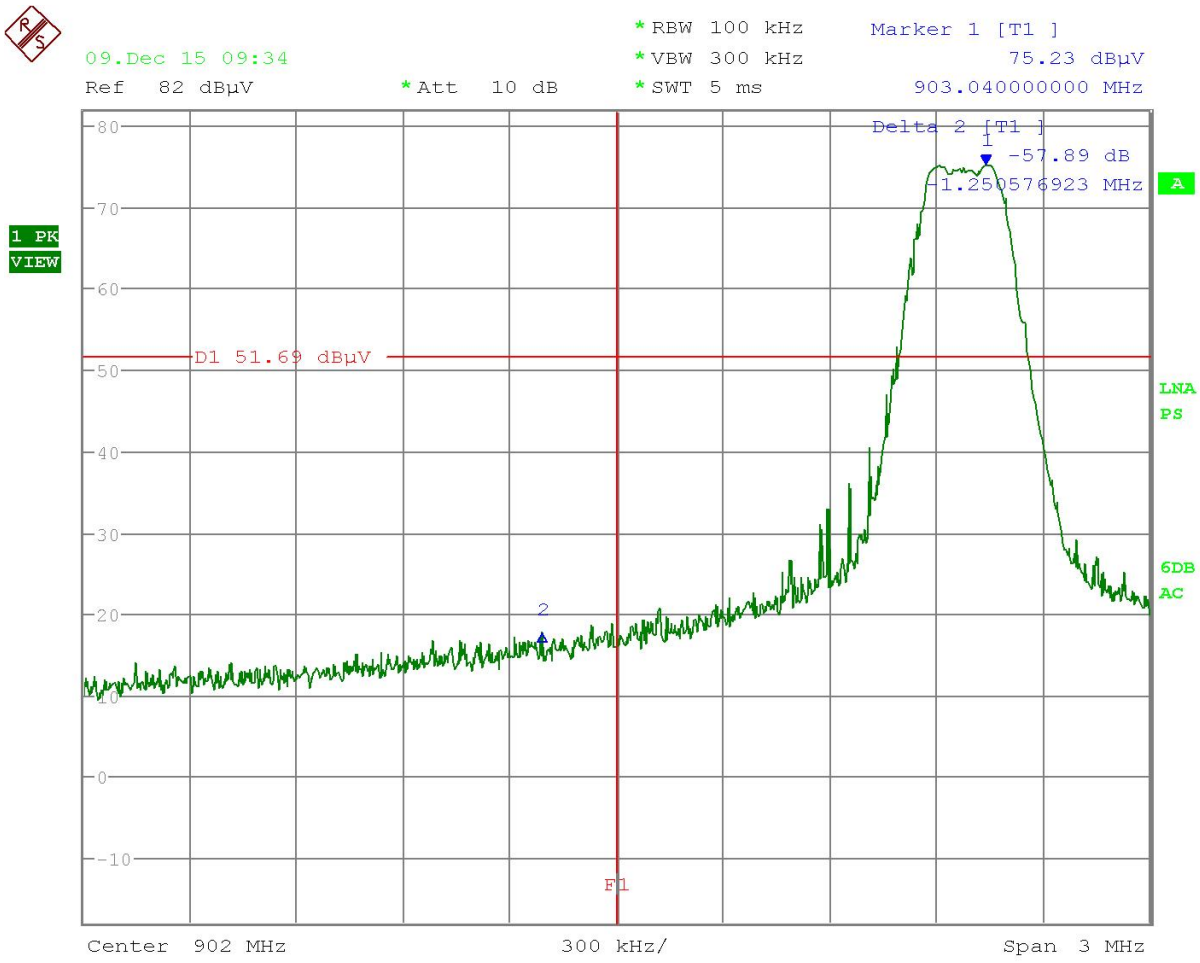
Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

BANDEDGE

Test Data: Lower Band Edge

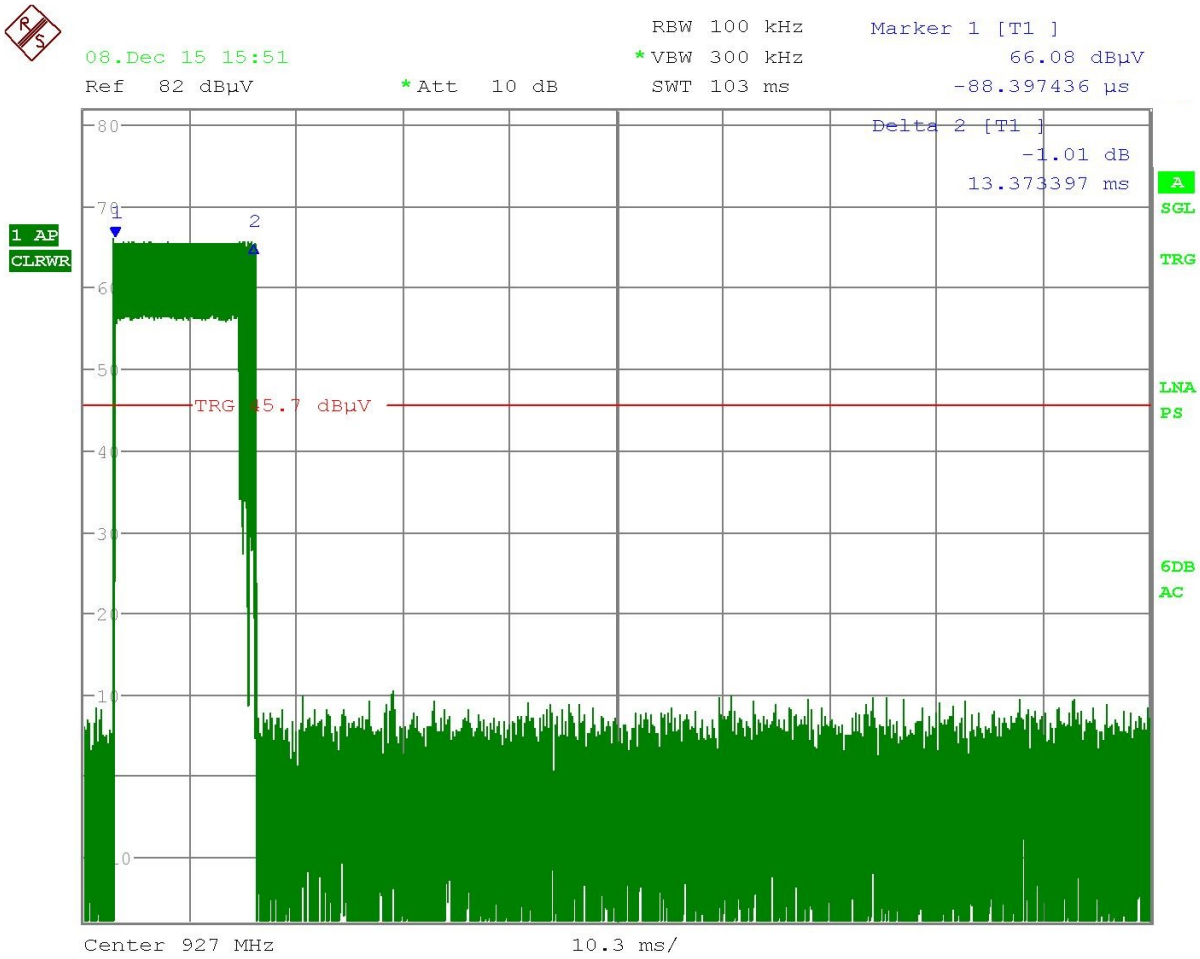


Date: 9.DEC.2015 09:34:08

RESULTS: Meets Requirements

Table of Contents

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport



Date: 8.DEC.2015 15:51:34

Requirements: There are no requirements for the duty cycle; it is measured to determine compliance with average emission limits above 1 GHz by reducing the peak emission by the duty cycle correction factor

Procedure: ANSI C63.10 § 7.5 Average value of pulsed emissions

Formula: δ (dB) = 20log (Δ)

Where:

δ is the duty cycle correction factor (dB)

Δ is the duty cycle (dimensionless)

Test Data: **Duty Cycle Calculation**

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the EUT is on within 100 ms.

Long Pulse	13.63 ms
Short Pulse	0 ms
Period	100 ms
Length of Pulse Train	13.63 ms
Total	13.93 ms

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(13.63/100)
dB = 20*log(0.1363)
dB = -17.31

See the following plots.

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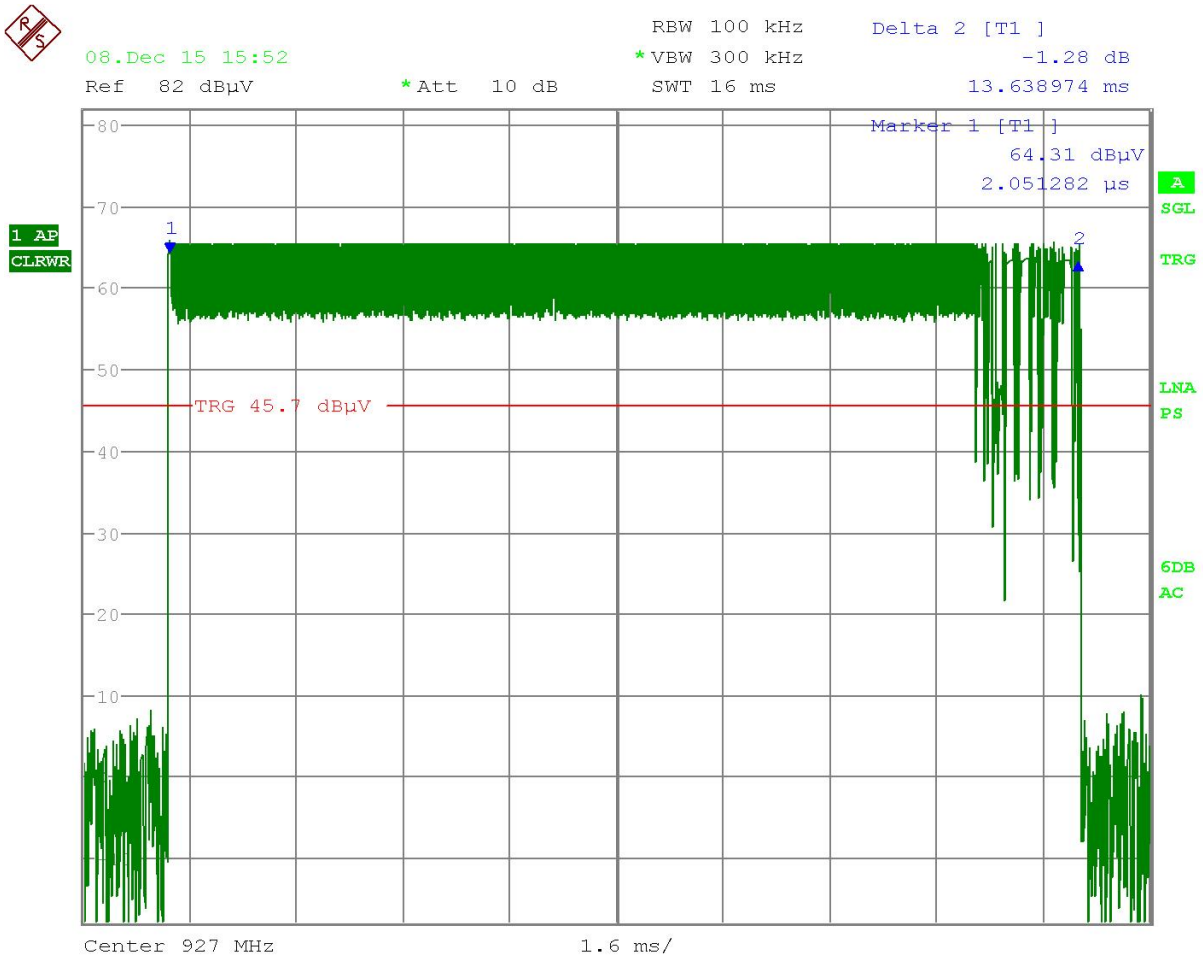
DUTY CYCLE

Test Data: 16 ms sweep Plot

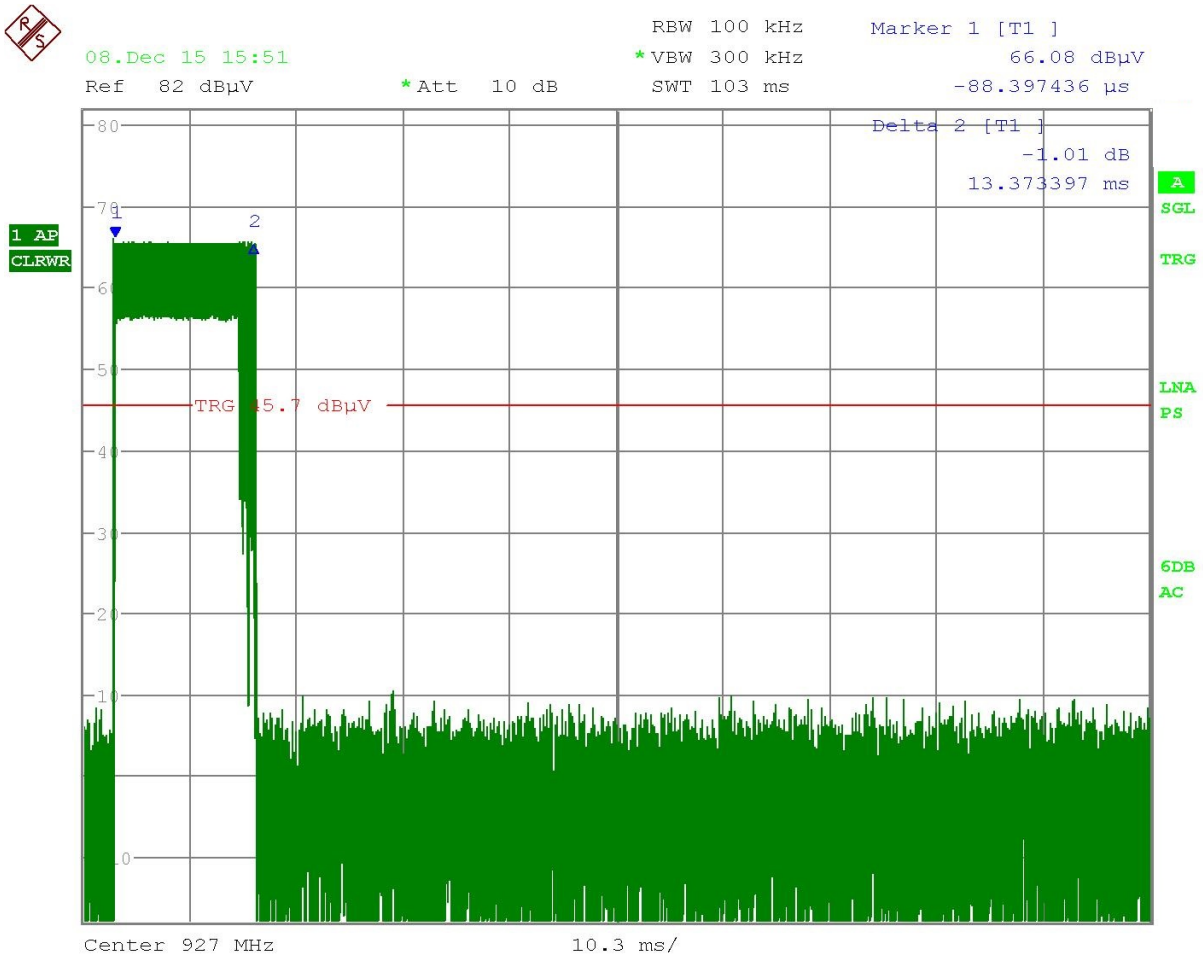


Date: 8.DEC.2015 15:52:47

Applicant: ELK PRODUCTS, INC.
FCC ID: TMAELK-ALRT
MODEL #: ELK-6032
Report: 1581AXUT15TestReport

DUTY CYCLE

Test Data:	100 ms Sweep Plot



Date: 8.DEC.2015 15:51:34

RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.247 (d) & 15.209

Requirements: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below

In addition, Emissions found in restricted bands the levels must comply with the general limits found in FCC part 15.209

Frequency	Limits
FCC Part 15.209, IC RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters

Test Method: ANSI C63.4 § Annex D Validation of radiated emissions standard test sites
ANSI C63.10 § 6.3 Common requirements radiated emissions
ANSI C63.10 § 6.4 Emissions below 30 MHz
ANSI C63.10 § 6.5 Emissions between 30 & 1000 MHz
ANSI C63.10 § 6.6 Emissions above 1 GHz

Field Strength Calculation:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBµV	+ 10.36 dB	+ 0.5 = 30.86 dBµV/m @ 3m

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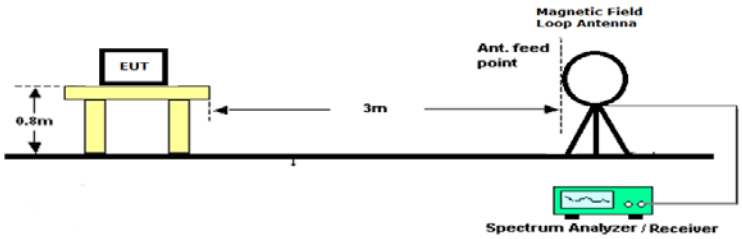
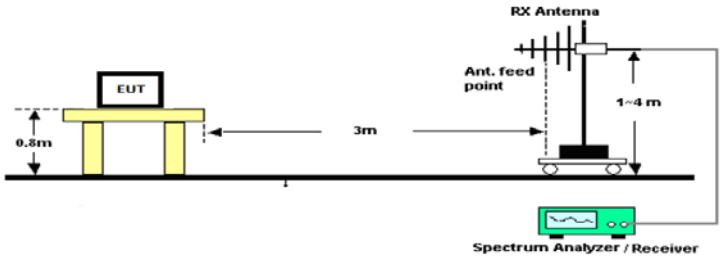
RADIATED SPURIOUS EMISSIONS

Setup:

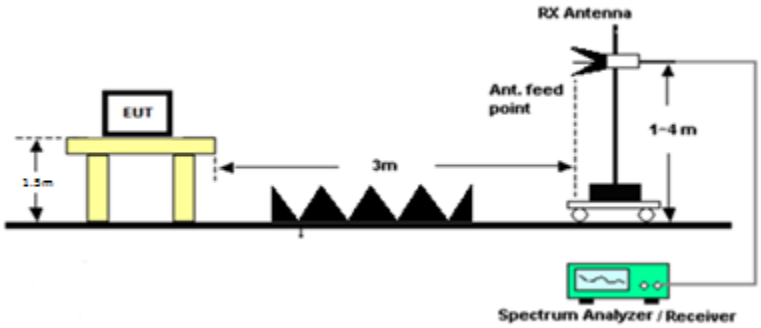
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



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RADIATED SPURIOUS EMISSIONS

Notes: Only emissions within 20dB of the limit are reported from 9 KHz to 25 GHz

Test Data: Field Strength table (Hopping Mode)

Emission Frequency MHz	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
0.04	2.36	V	0.00	75.20	77.56	-37.56
0.13	0.76	V	0.00	63.67	64.43	-24.43
0.58	2.59	V	0.01	50.90	53.50	-13.50
0.69	1.65	V	0.01	49.52	51.18	-11.18
57.24	5.12	V	0.37	8.40	13.89	26.11
66.77	6.87	V	0.42	6.02	13.31	26.69
95.38	7.01	V	0.56	10.74	18.31	25.19
133.52	10.54	H	0.67	13.76	24.97	18.53
208.97	2.98	H	0.87	10.72	14.57	28.93
247.11	6.94	V	0.92	11.31	19.17	108.21
447.91	3.71	V	1.44	16.00	21.15	106.23

Results Meet Requirements

Test Data: Field Strength table (Peak Measurements/Limit)

Tuned Freq MHz	Emission Frequency MHz	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
902.90	902.90	71.73	V	2.38	21.26	95.37	32.01
902.90	1805.90	24.97	V	2.93	30.26	58.16	20.00
902.90	2706.05	32.16	V	3.39	32.69	68.24	20.00
902.90	3611.60	23.67	V	4.15	33.21	61.03	20.00
902.90	4514.80	21.47	V	4.76	34.01	60.24	20.00
902.90	5417.80	19.00	V	5.13	34.58	58.71	20.00
902.90	6320.70	19.00	V	5.40	35.60	60.00	20.00
902.90	7223.74	18.68	V	5.73	36.35	60.76	20.00
902.90	8126.69	16.59	V	6.25	35.90	58.74	20.00
902.90	9029.60	18.77	V	6.61	36.20	61.58	20.00
915.00	915.00	70.19	V	2.40	22.00	94.59	32.79
915.00	1830.00	25.11	V	2.99	30.50	58.60	20.00
915.00	2744.89	29.90	V	3.42	32.61	65.93	20.00
915.00	3659.53	22.98	V	4.19	33.26	60.43	20.00
915.00	4574.60	19.42	V	4.79	34.07	58.28	20.00
915.00	5489.50	20.19	V	5.15	34.51	59.85	20.00
915.00	6404.50	18.10	V	5.42	35.60	59.12	20.00
915.00	7319.40	19.44	V	5.79	36.16	61.39	20.00
915.00	8234.30	18.33	V	6.29	35.93	60.55	20.00
915.00	9149.25	19.10	V	6.64	36.25	61.99	20.00
926.90	926.90	68.25	V	2.42	22.59	93.26	34.12
926.90	1854.00	26.21	V	3.04	30.74	59.99	20.00
926.90	2780.90	30.56	V	3.45	32.54	66.55	20.00
926.90	3708.20	23.41	V	4.24	33.29	60.94	20.00
926.90	4634.50	19.47	V	4.82	34.10	58.39	20.00
926.90	5561.45	20.63	V	5.17	34.50	60.30	20.00
926.90	6488.30	18.07	V	5.45	35.69	59.21	20.00
926.90	7415.26	19.79	V	5.85	35.98	61.62	20.00
926.90	8342.10	18.91	V	6.34	36.00	61.25	20.00
926.90	9269.08	19.14	V	6.68	36.37	62.19	20.00

Results Meet Requirements

Test Data: Field Strength table (Average Measurements/Limit)

Tuned Freq MHz	Emission Frequency MHz	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
902.90	902.90	71.73	V	2.38	21.26	95.37	32.01
902.90	1805.90	24.97	V	2.93	30.26	-17.00	71.00
902.90	2706.05	32.16	V	3.39	32.69	-17.00	71.00
902.90	3611.60	23.67	V	4.15	33.21	-17.00	71.00
902.90	4514.80	21.47	V	4.76	34.01	-17.00	71.00
902.90	5417.80	19.00	V	5.13	34.58	-17.00	71.00
902.90	6320.70	19.00	V	5.40	35.60	-17.00	71.00
902.90	7223.74	18.68	V	5.73	36.35	-17.00	71.00
902.90	8126.69	16.59	V	6.25	35.90	-17.00	71.00
902.90	9029.60	18.77	V	6.61	36.20	-17.00	71.00
915.00	915.00	70.19	V	2.40	22.00	94.59	32.79
915.00	1830.00	25.11	V	2.99	30.50	-17.00	71.00
915.00	2744.89	29.90	V	3.42	32.61	-17.00	71.00
915.00	3659.53	22.98	V	4.19	33.26	-17.00	71.00
915.00	4574.60	19.42	V	4.79	34.07	-17.00	71.00
915.00	5489.50	20.19	V	5.15	34.51	-17.00	71.00
915.00	6404.50	18.10	V	5.42	35.60	-17.00	71.00
915.00	7319.40	19.44	V	5.79	36.16	-17.00	71.00
915.00	8234.30	18.33	V	6.29	35.93	-17.00	71.00
915.00	9149.25	19.10	V	6.64	36.25	-17.00	71.00
926.90	926.90	68.25	V	2.42	22.59	93.26	34.12
926.90	1854.00	26.21	V	3.04	30.74	-17.00	71.00
926.90	2780.90	30.56	V	3.45	32.54	-17.00	71.00
926.90	3708.20	23.41	V	4.24	33.29	-17.00	71.00
926.90	4634.50	19.47	V	4.82	34.10	-17.00	71.00
926.90	5561.45	20.63	V	5.17	34.50	-17.00	71.00
926.90	6488.30	18.07	V	5.45	35.69	-17.00	71.00
926.90	7415.26	19.79	V	5.85	35.98	-17.00	71.00
926.90	8342.10	18.91	V	6.34	36.00	-17.00	71.00
926.90	9269.08	19.14	V	6.68	36.37	-17.00	71.00

Results Meet Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	07/14/2015	07/14/17
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	07/09/15	07/09/17
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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