TIMCO ENGINEERING, Inc.

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TEST REPORT

CLASS II PERMISSIVE CHANGE

PER FCC PT 15.247 FHSS

APPLICANT	ELK PRODUCTS, INC.
ADDRESS	3266 HIGHWAY 70 WEST
	HILDEBRAN NC 28637 USA
FCC ID	TMAELK-M1XRFTW
PRODUCT DESCRIPTION	ELK M1 INTERFACE TRANSCEIVER
DATE SAMPLE RECEIVED	12/12/2011
DATE TESTED	12/14/2011
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	2911UT11TestReport.doc
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
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.

ACCREDITED

Testing Certificate #0955-01

AUTHORIZED BY: Mario de Aranzeta

SIGNATURE:

FUNCTION: Lab Supervisor/ Test Engineer

DATE: 12/14/2011

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

DUT DESCRIPTION

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

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/10/10	5/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 6/12/11	6/12/13
Antenna: Active Loop	ETS-Lindgren	6502	00062529	CAL 9/23/10	9/23/12
Frequency Counter	HP	5385A	2730A03025	CAL 8/17/11	8/17/13
Hygro-Thermometer	Extech	445703	0602	CAL 6/15/11	6/15/13
Modulation Analyzer	HP	8901A	3435A06868	CAL 7/18/11	7/18/13
Digital Multimeter	Fluke	FLUKE-77	35053830	CAL 9/9/11	9/9/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 10/28/11	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12
Antenna	ETS	3117	41534	9/22/2010	9/22/2012
Antenna	Electro metrics	LPA-25	1122	5/04/2011	5/04/2013
Antenna	Electro metrics	BIA-25	1096	5/04/2011	5/04/2013

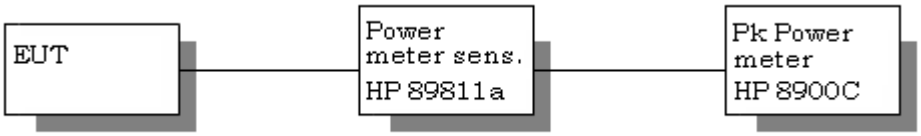
TEST PROCEDURES

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.

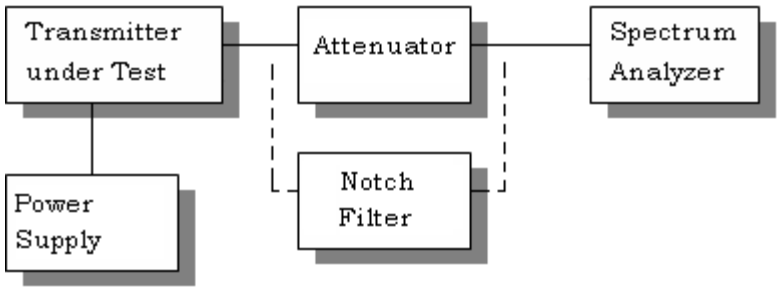
BANDWIDTH 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

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 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. 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.



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.

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.

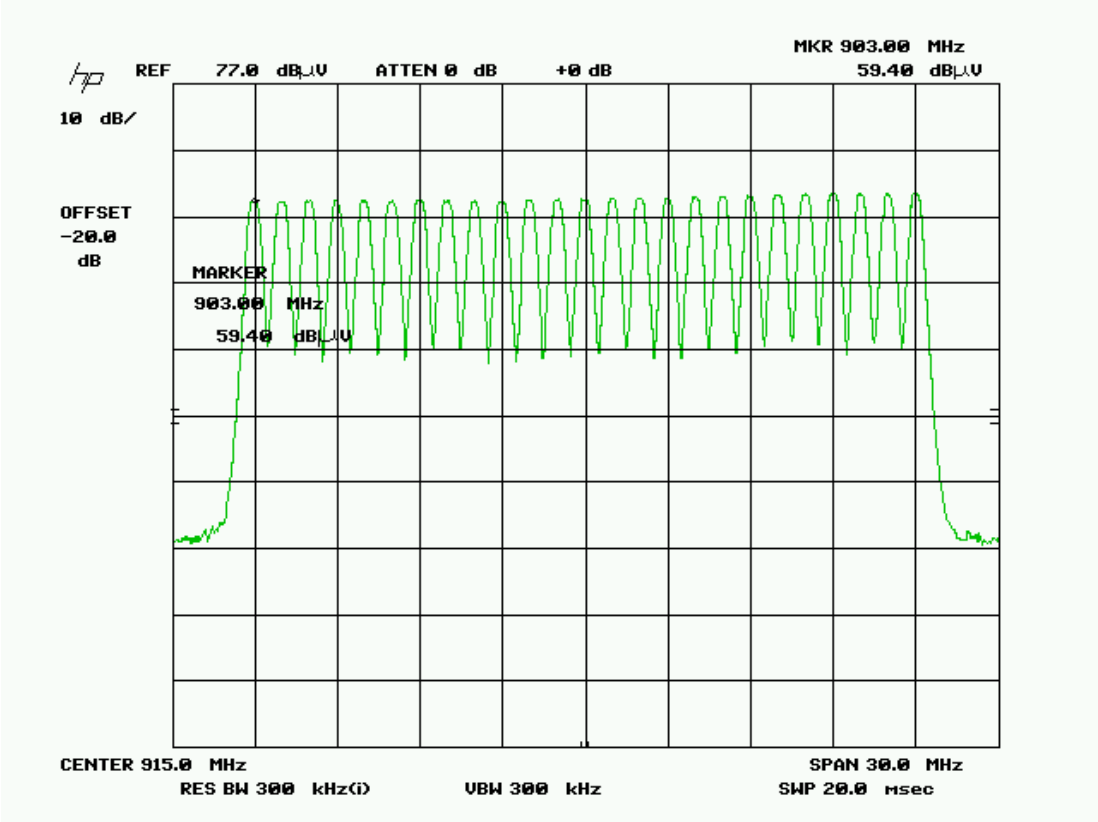
NUMBER OF HOPPING CHANNELS

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 25 hopping channels



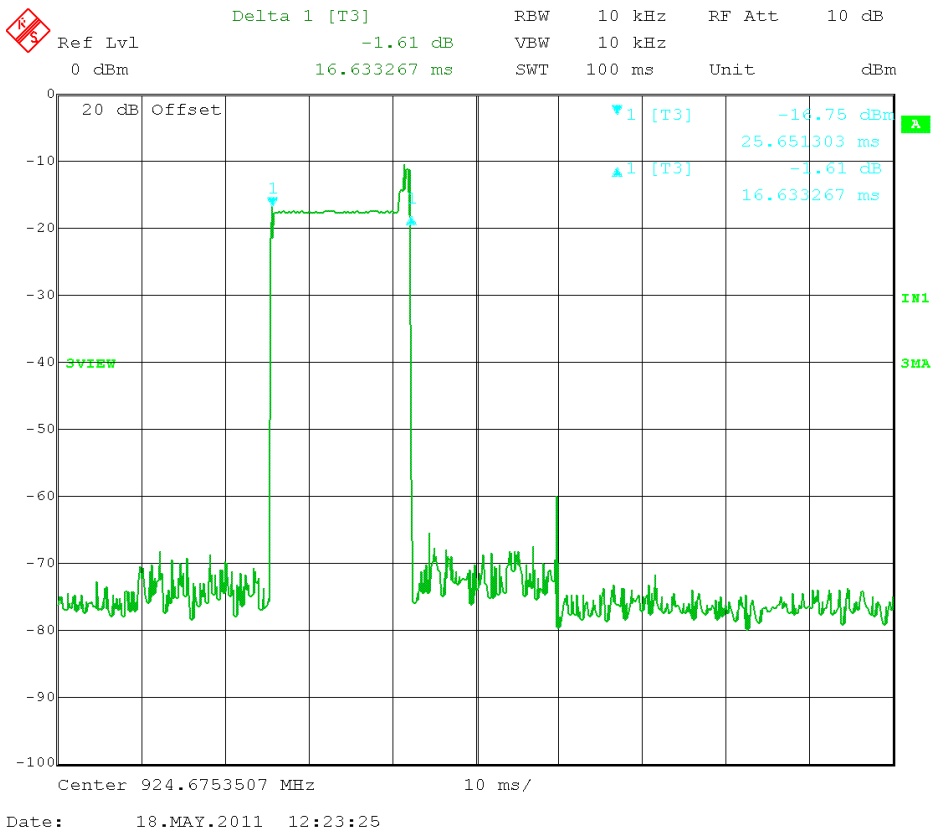
DWELL TIME OF A HOPPING CHANNEL

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 n 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.

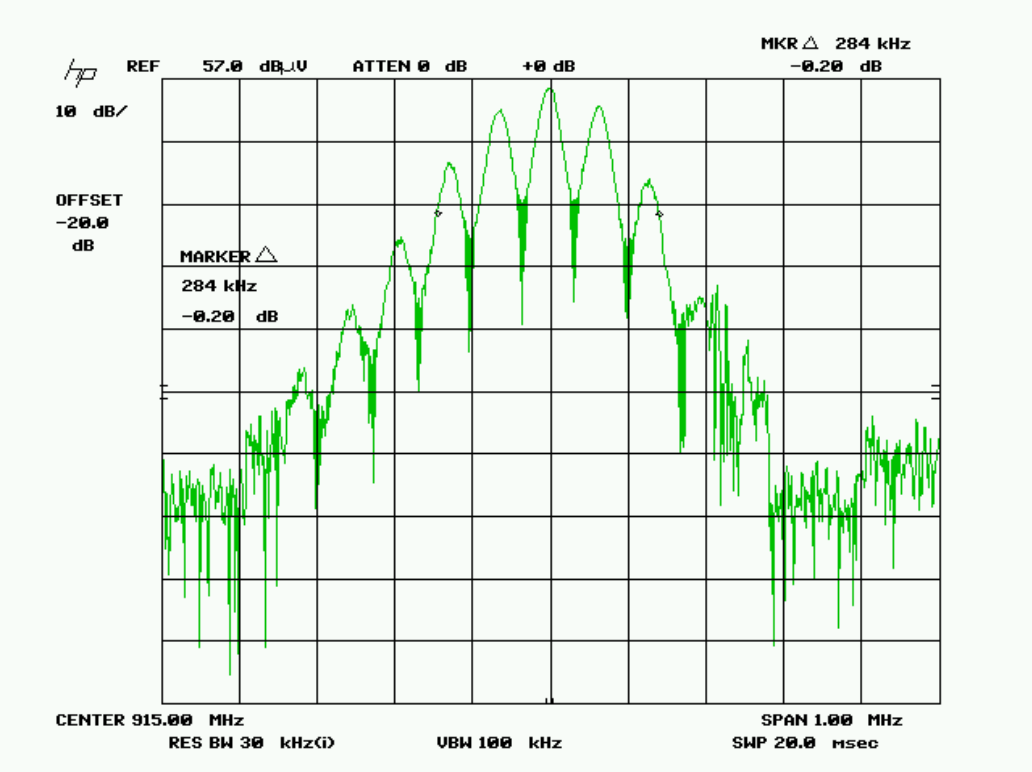


20 dB BANDWIDTH

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). 284 kHz



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

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 – 928MHz 2.4 – 2.4835GHz	127.37dBuV/m
§15.209	
30 - 88 MHz	40 dBµV/m @3M
88 -216 MHz	43.5 dBµV/m @3M
216 -960 MHz	46 dBµV/m @3M
ABOVE 960 MHz	54dBuV/m

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

Harmonics were measured to the 10th harmonic.

Test Data – 15.209:

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBµV/m	Margin dB
915.0	30.10	15.5	H	0.40	13.60	29.50	10.50
915.0	30.20	16.7	V	0.40	13.60	30.70	9.30
915.0	60.00	11.2	V	0.53	7.50	19.23	20.77
915.0	60.20	6.8	H	0.53	7.43	14.76	25.24
915.0	77.96	19.9	V	0.59	7.55	28.04	11.96
915.0	123.98	8.1	H	0.67	11.30	20.07	23.43
915.0	160.04	7.7	V	0.74	16.70	25.14	18.36
915.0	366.50	11.5	V	1.17	15.23	27.90	66.10
915.0	448.00	8.6	V	1.25	17.52	27.37	66.63
915.0	448.00	9.6	V	1.25	17.52	28.37	65.63

Test Data: 15.247

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle (dB)	Field Strength dBµV/m	Margin dB
903	903	53	V	1.95	21.81	17.3	59.46	67.91
903	903	60	V	1.95	21.81	17.3	66.46	60.91
903	1,806.00	14.1	H	2.74	30.49	17.3	30.03	16.53
903	1,806.00	20.4	V	2.74	30.49	17.3	36.33	10.23
903	2,709.00	12.2	H	3.4	32.89	17.3	31.19	22.81
903	2,709.00	18.1	V	3.4	32.89	17.3	37.09	16.91
903	3,612.00	17.8	H	4.15	33.28	17.3	37.93	8.63
903	3,612.00	23.2	V	4.15	33.28	17.3	43.33	3.23
903	4,515.00	11.2	H	4.76	33.9	17.3	32.56	21.44
903	4,515.00	12	V	4.76	33.9	17.3	33.36	20.64
903	6,321.00	11.4	V	5.4	35.59	17.3	35.09	11.47
903	8,127.00	9.9	H	6.25	35.75	17.3	34.6	19.4
915	915	53.8	H	1.97	23.8	17.3	62.27	65.10
915	915	59.7	V	1.97	23.8	17.3	68.17	59.20
915	1,830.00	13.3	H	2.76	30.67	17.3	29.43	18.74
915	1,830.00	17.7	V	2.76	30.67	17.3	33.83	14.24
915	2,745.00	13.1	H	3.42	32.94	17.3	32.16	21.84
915	2,745.00	18.3	V	3.42	32.94	17.3	37.36	16.64
915	3,660.00	15.9	H	4.19	33.36	17.3	36.15	12.02
915	3,660.00	22.4	V	4.19	33.36	17.3	42.65	5.52
915	4,575.00	10.2	V	4.79	33.92	17.3	31.61	22.39
915	6,405.00	9	H	5.42	35.69	17.3	32.81	15.36
915	6,405.00	10.4	V	5.42	35.69	17.3	34.21	13.96
927	927	55	H	1.99	23.94	17.3	63.63	63.74
927	927	61.5	V	1.99	23.94	17.3	70.13	57.24
927	1,854.00	12.8	H	2.78	30.86	17.3	29.14	20.99
927	1,854.00	19	V	2.78	30.86	17.3	35.34	14.79
927	2,781.00	14	H	3.45	32.99	17.3	33.14	20.86
927	2,781.00	18	V	3.45	32.99	17.3	37.14	16.86
927	3,708.00	16.6	H	4.24	33.43	17.3	36.97	13.16
927	3,708.00	21.7	V	4.24	33.43	17.3	42.07	8.06
927	4,635.00	12.5	V	4.82	33.93	17.3	33.95	20.05
927	4,635.00	13.1	H	4.82	33.93	17.3	34.55	19.45

Test Data Continued: 15.247

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle (dB)	Field Strength dBµV/m	Margin dB
927	6,489.00	9.2	H	5.45	35.79	17.3	33.14	16.99
927	8,343.00	11.9	H	6.34	35.84	17.3	36.78	17.22

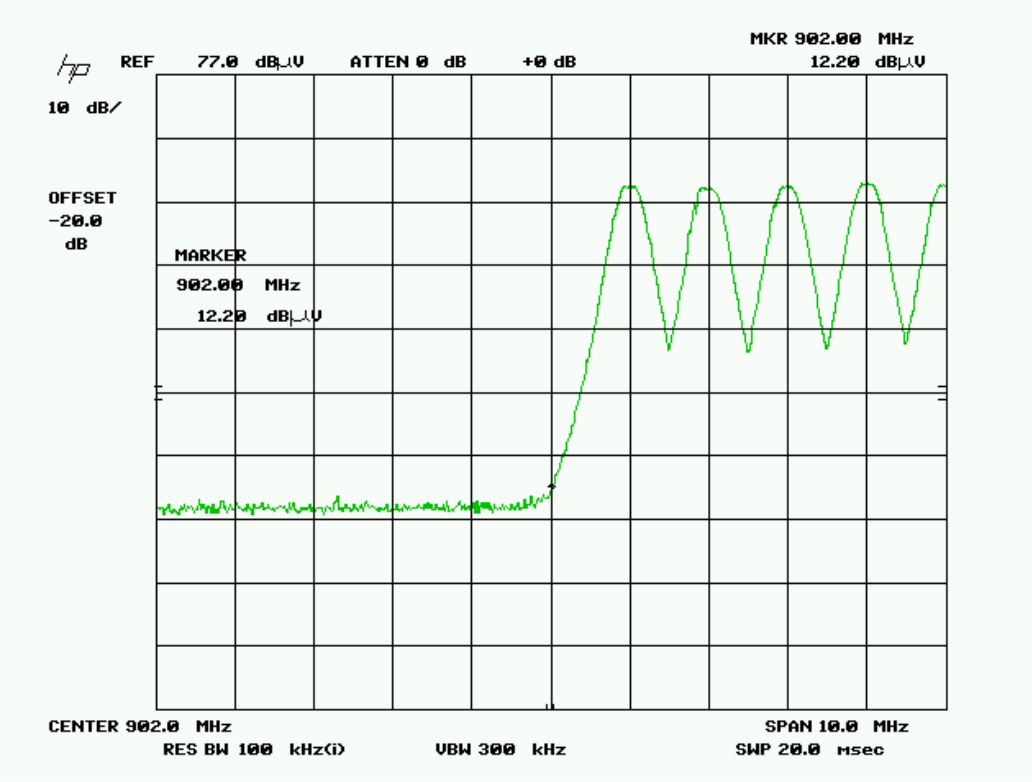
All readings are peak unless marked otherwise.
P= Peak, A= Average, R= Restricted band frequency
Harmonics were checked through the 10th harmonic.

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.

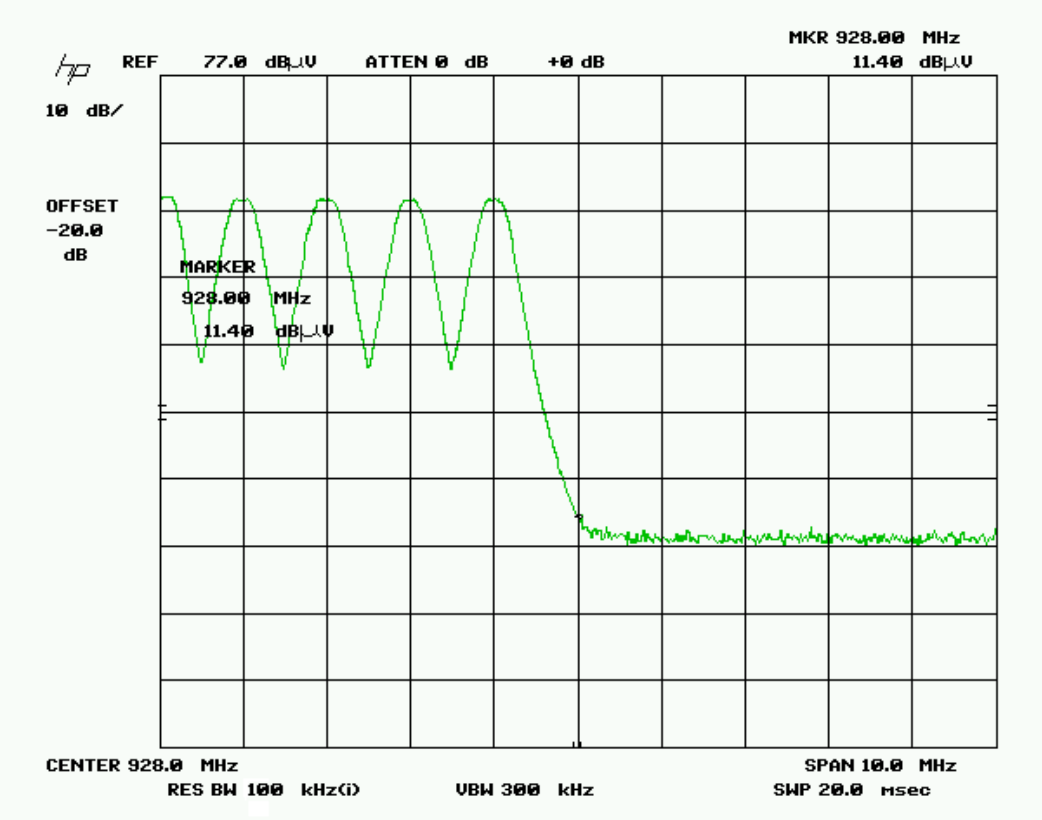
TEST DATA: The plots are presented below.

Lower bandedge



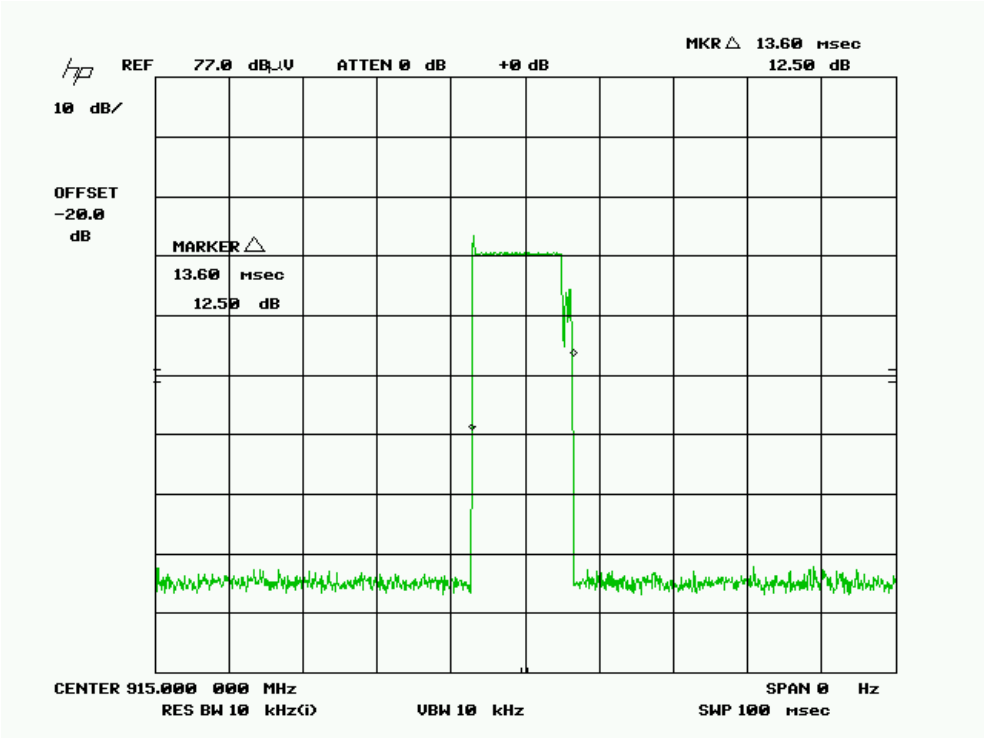
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle (dB)	Field Strength dBµV/m	Margin dB
903	902	12.2	V	1.95	21.74	17.3	18.59	35.41

Upper bandedge (peak value)



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle (dB)	Field Strength dBµV/m	Margin dB
927	928	11.4	V	1.99	22.64	17.3	18.73	35.27

DUTY CYCLE



Total # of pulses: 1 in 100 ms
Duration of pulse: 13.6 ms maximum duration of pulse according to manufacturer.
20*log (13.6/100)=20*log (0.136)=17.3 dB