Test Report

FCC Part 95, LPRS

Model: TPC002
FCC ID.: NBI-TPC002

Report No.: 10236680_TRF_Part 95

Prepared for: Spectrum Management LLC– Electronic Tracking Systems
2545 Tarpley Rd.
Carrollton, TX 75006

Issue Date: 12 November, 2013

Report Summary
Nemko USA, Dallas Lab

Accreditation Numbers: FCC: 298477
IC: 2040C-3

NVLAP LAB CODE: 100426-0

Applicant: Spectrum Management LLC – Electronic Tracking Systems

Customer Representative: Richard C. Brown

EUT Description	Manufacturer	Model	Revision	Serial Number
The EUT is a transceiver used in a wireless data network.	Spectrum Management LLC– Electronic Tracking Systems	TPC002	-	3402181

Test Summary

Test/Requirement Description	Pass / Fail	Applicable Rule Parts
Maximimum RF Transmitting Power	P	2.1046, 95.135, 95.639(e)
Modulation Characteristics	P	2.1047, 95.631(g), 95.637
Occupied Bandwidth	P	2.1049, 95.633(d)(2)
Spurious Emissions at Antenna Terminals	P	2.1051, 95.635(c)(1)
Field Strength of Spurious Emissions	P	2.1053, 95.635(c)(1)
Frequency Stability	P	2.1055, 95.629(b)(2)
Control Accessibility	P	95.645(a)
Power Capability	P	95.649
Permissible Communications	P	95.1009(c)
Antennas and ERP	P	95.1013(a)

Notes:

Test Result: The product as presented for testing complied with test requirements as shown above.

This is to certify that this report is true and correct to the best of my knowledge.

Tom Tidwell

David Light

Table of Contents

Revision History

Revision No.	Reason for Revision	Revision Date
0	Initial release	7/13/2013
1	Add emission designator page 15	10/17/2013
2	Added frequency channel information page 6	11/12/2013

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe results of the tests applied by Nemko USA to demonstrate compliance of the device described to FCC Part 95 for a Low Power Radio System (LPRS) transmitter.

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	TracPacPlus-Currency-2	TPC002	-	3402181
RF Exposure Classification	☐ Portable (<20 cm. separation from user) ☒ Mobile (>20 cm. separation from user) ☐ Fixed (Antenna mounted on an outdoor, permanent fixed structure)			
Channels/Frequency Range	216.4625 MHz 216.4875 MHz 216.5125 MHz			
Antenna type	☒ Integral ☐ External ☐ Integral and External			
Antenna gain (dBi)	1.4 dBd + 2.15 = 3.55 dBi			
Power supply	☒ Battery ☐ External adapter ☐ Direct to AC mains			
Functional Description	The EUT is used for wireless data transmission.			

2.1.1 EUT POWER

Voltage Rating	3.3 ☒DC ☐AC
Current Rating	0.3 Amps

2.2 INTERCONNECT CABLES

☒ NONE

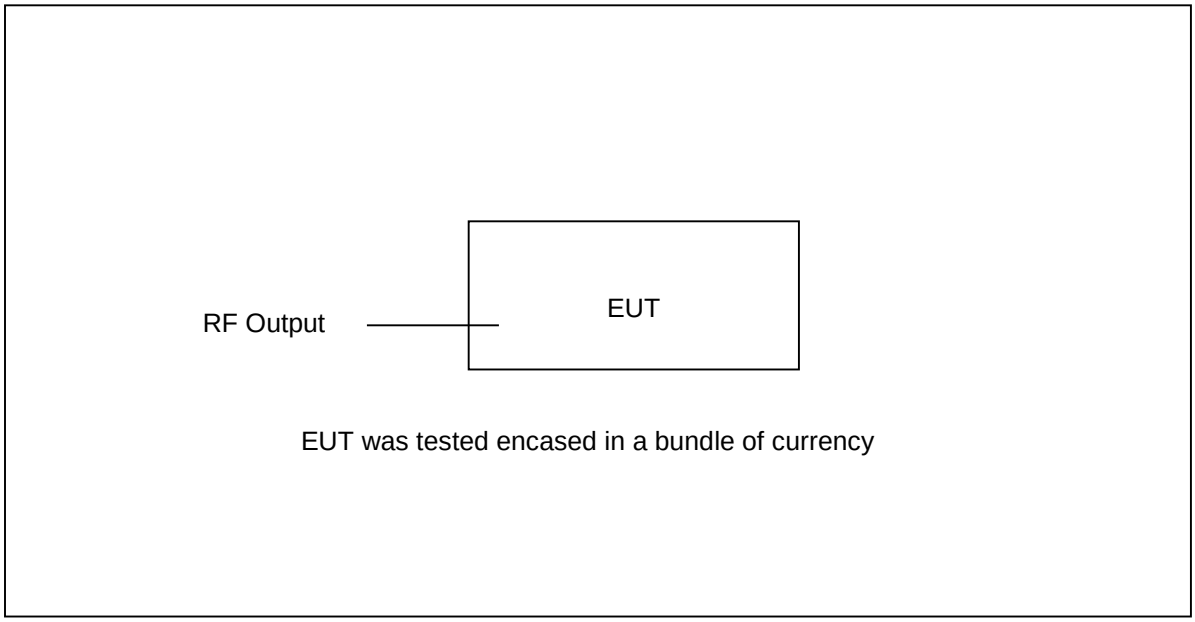
Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			

2.3 MODE OF OPERATION DURING TESTS

The EUT was tested while in a continuous transmit mode. The EUT continuously transmitted pseudo-random data. While transmitting the EUT was setup to operate at the intended maximum power output available to the end user. For all test cases pre-scans were completed in all modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION



APPENDICES

APPENDIX A: MAXIMUM RF TRANSMIT POWER

A.1. Base Standard & Test Basis

Base Standard	FCC PART 95.135, 95.639(e)
Test Basis	FCC PART 2.1046
Test Method	ANSI/TIA 603-C

A.2. Specifications

95.639(e) – The maximum transmitter output power authorized for LPRS stations is 100 mW.

A.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.2 dB / .01 ppm

A.4. Deviations

Deviation Number	**Date**	**Description and Justification of Deviation**	**Deviation Reference**	
			Base Standard	**Test Procedure**
none				

A.5. Test Procedure

ANSI/TIA 603-C

Temperature: 23.4
Humidity: 58.9

A.6. Test Results

The EUT is in compliance with the limits as specified above

A.7. Operating Mode During Test

The EUT was tested in a beacon transmit mode.

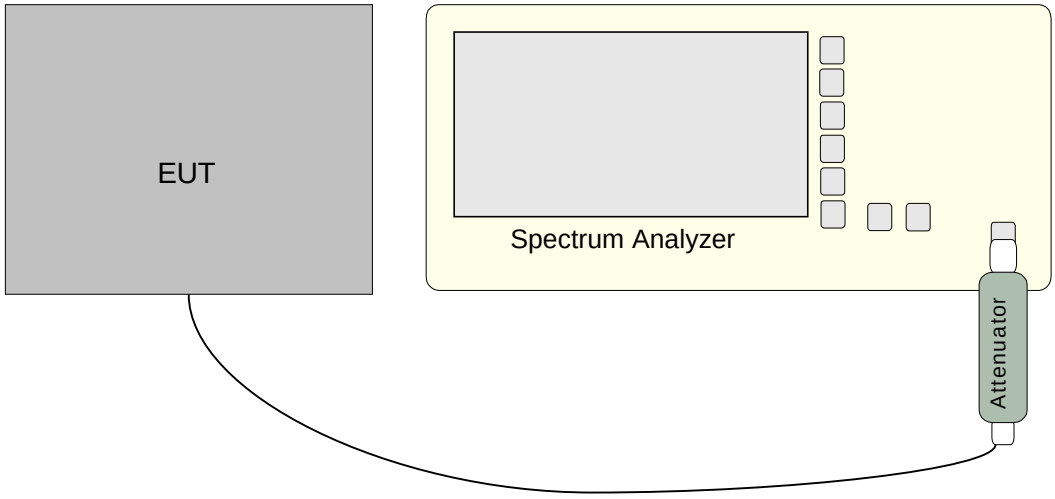
A.8. Sample Calculation

$P(mW) = 10^{(P(dBm)/10)}$

A.9. Test Data

Frequency (MHz)	Peak Conducted Power (dBm)	Limit (dBm)
216.4875	+17.94	+20

A.10. Test Configuration

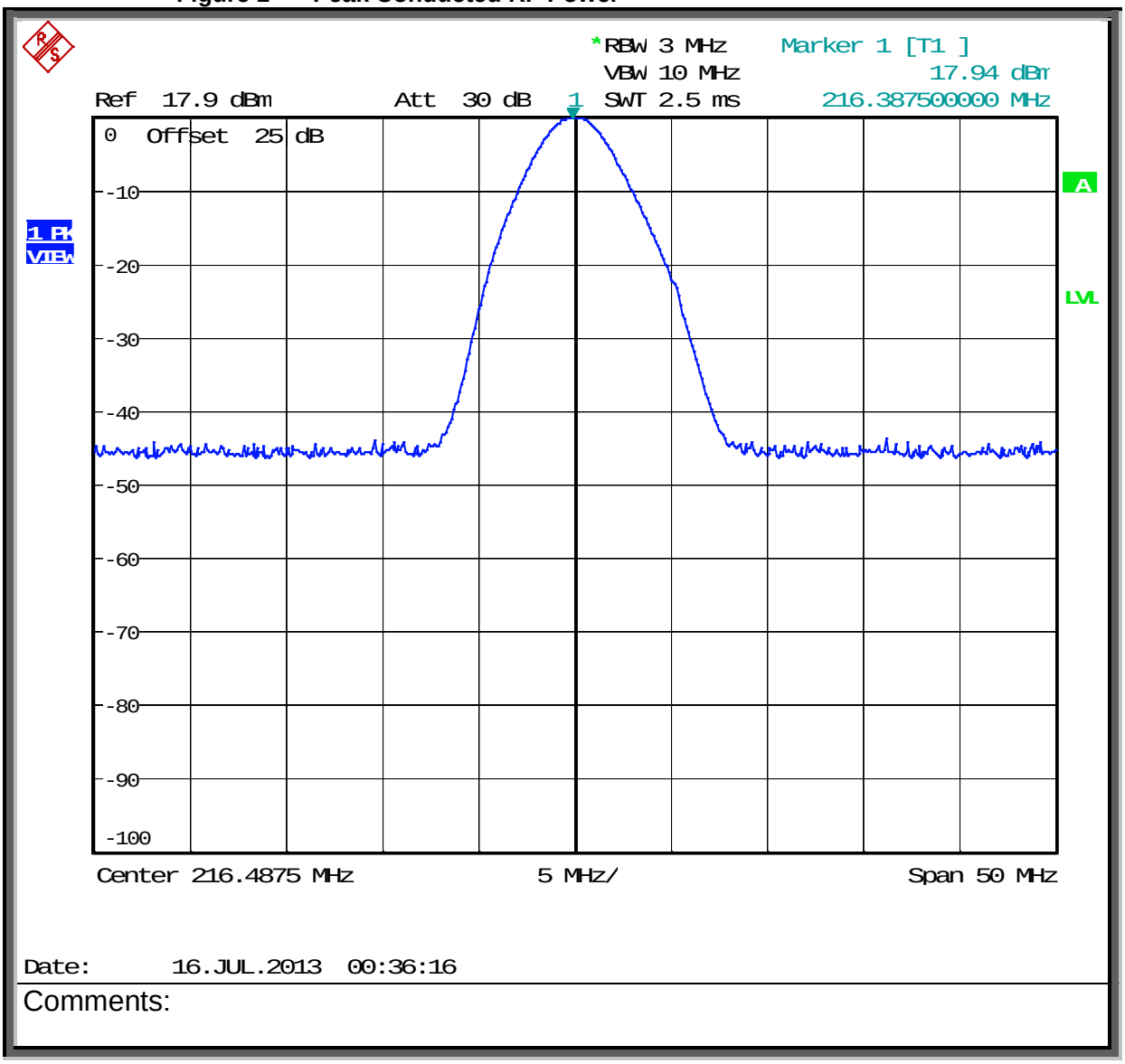


A.11. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

Figure 1 Peak Conducted RF Power



APPENDIX B: MODULATION CHARACTERISTICS

B.1. Base Standard & Test Basis

Base Standard	FCC CFR 47, 95.631(g), 95.637
Test Basis	FCC CFR 47, 2.1047
Test Method	ANSI/TIA 603-C

B.2. Specifications

95.631(g) – An LPRS station may transmit any emission type appropriate for communications in this service. Two-way voice communications, however, are prohibited.

95.637(a) – A GMRS transmitter that transmits emission types F1D, G1D, or G3E must not exceed a peak frequency deviation of plus or minus 5 kHz.

B.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
0.00125 kHz

B.4. Deviations

Deviation Number	**Date**	**Description and Justification of Deviation**	**Deviation Reference**	
			Base Standard	**Test Procedure**
none				

B.5. Test Method

ANSI/TIA 603-C

B.6. Test Results

Compliant.

B.7. Sample Calculation

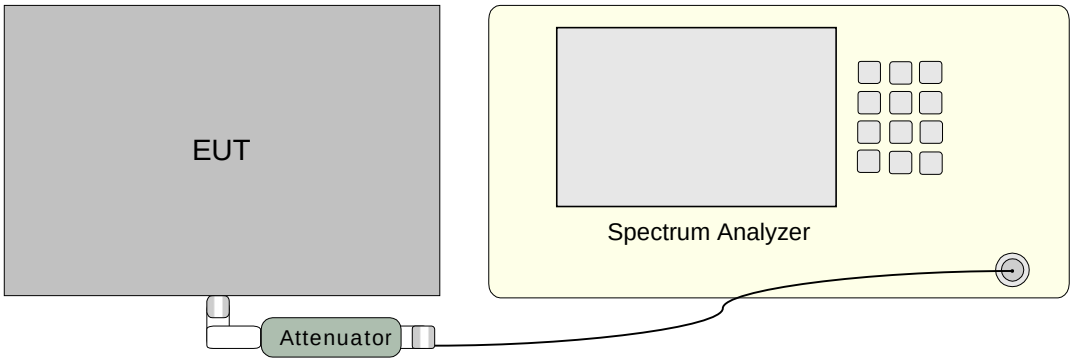
B.8. Test Data

Transmit Frequency (MHz)	Modulation Mode	Measured Mod. Depth
216.4875	AM	80%

Notes:
This device uses 50% Amplitude tone modulation.
Voice modulation is not used

These measurements were made using the following instrumentation:

B.9. Test Diagram



B.10. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX C: OCCUPIED BANDWIDTH

C.1. Base Standard & Test Basis

Base Standard	FCC CFR 47, 95.633(d)(2)
Test Basis	FCC CFR 47, 2.1049
Test Method	ANSI/TIA 603-C

C.2. Specifications

95-633(d)(2) – The channel bandwidth for standard channels is 25 kHz.

95.635(c)(1) – Emissions for LPRS transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:

(i) Emisssions 12.5 kHz to 22.5 kHz away from the carrier center frequency: at least 30 dB; and

(ii) Emissions more than 22.5 kHz away from the channel center frequency: at least 43 + 10log(carrier power in watts) dB.

C.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+/-1.2 dB

C.4. Deviations

Deviation Number	**Date**	**Description and Justification of Deviation**	**Deviation Reference**	
			Base Standard	**Test Procedure**
none				

C.5. Test Method

ANSI/TIA 603-C

C.6. Test Results

Compliant.

Emission designator: 856HA1D
20 dB bandwidth (99% power bandwidth): 856 Hz

C.7. Deviations from Normal Operating Mode During Test

None.

C.8. Sample Calculation

None

C.9. Test Data

Figure 2 Occupied bandwidth – 20 dB

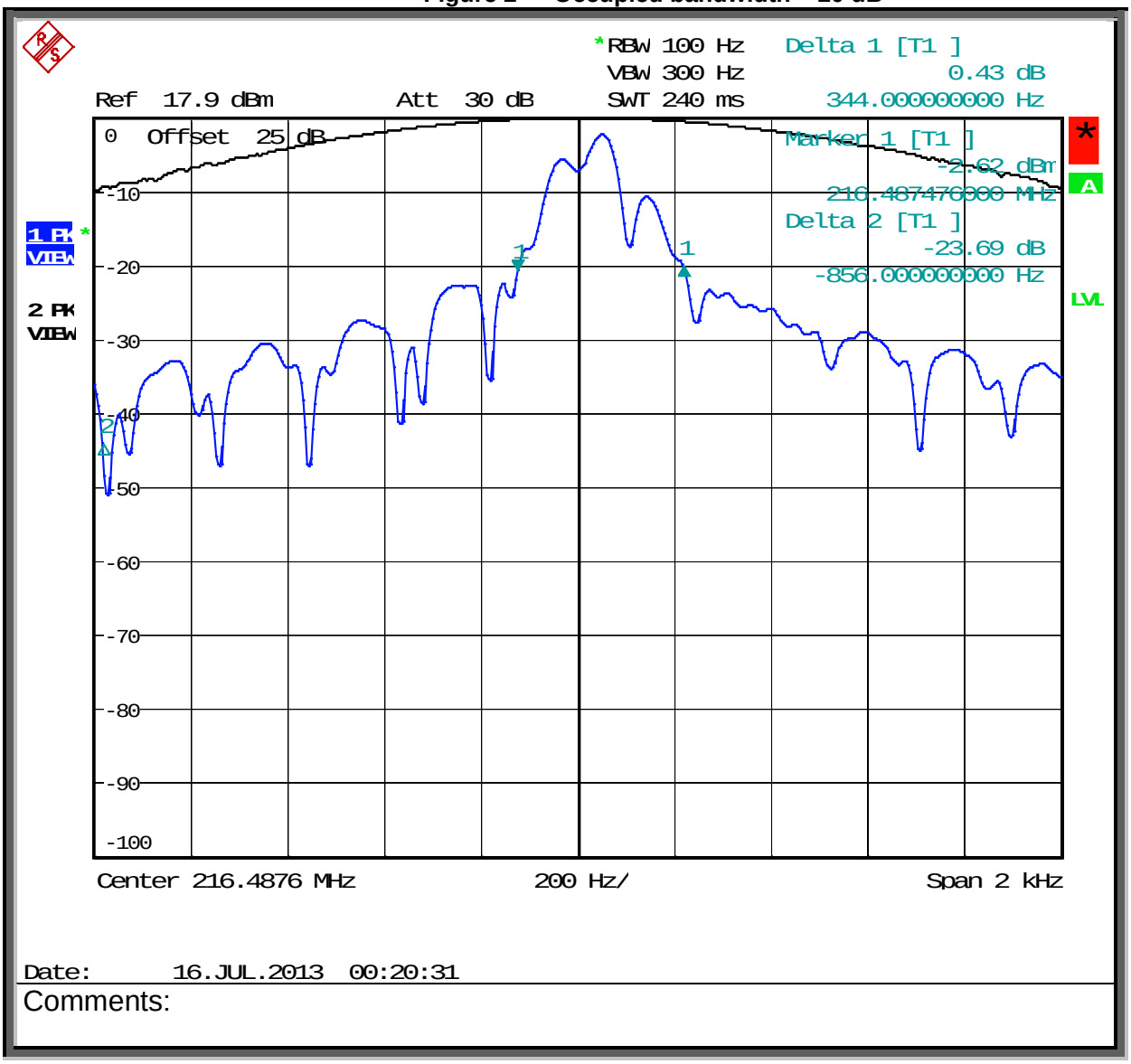


Figure 3 Occupied bandwidth – Mask

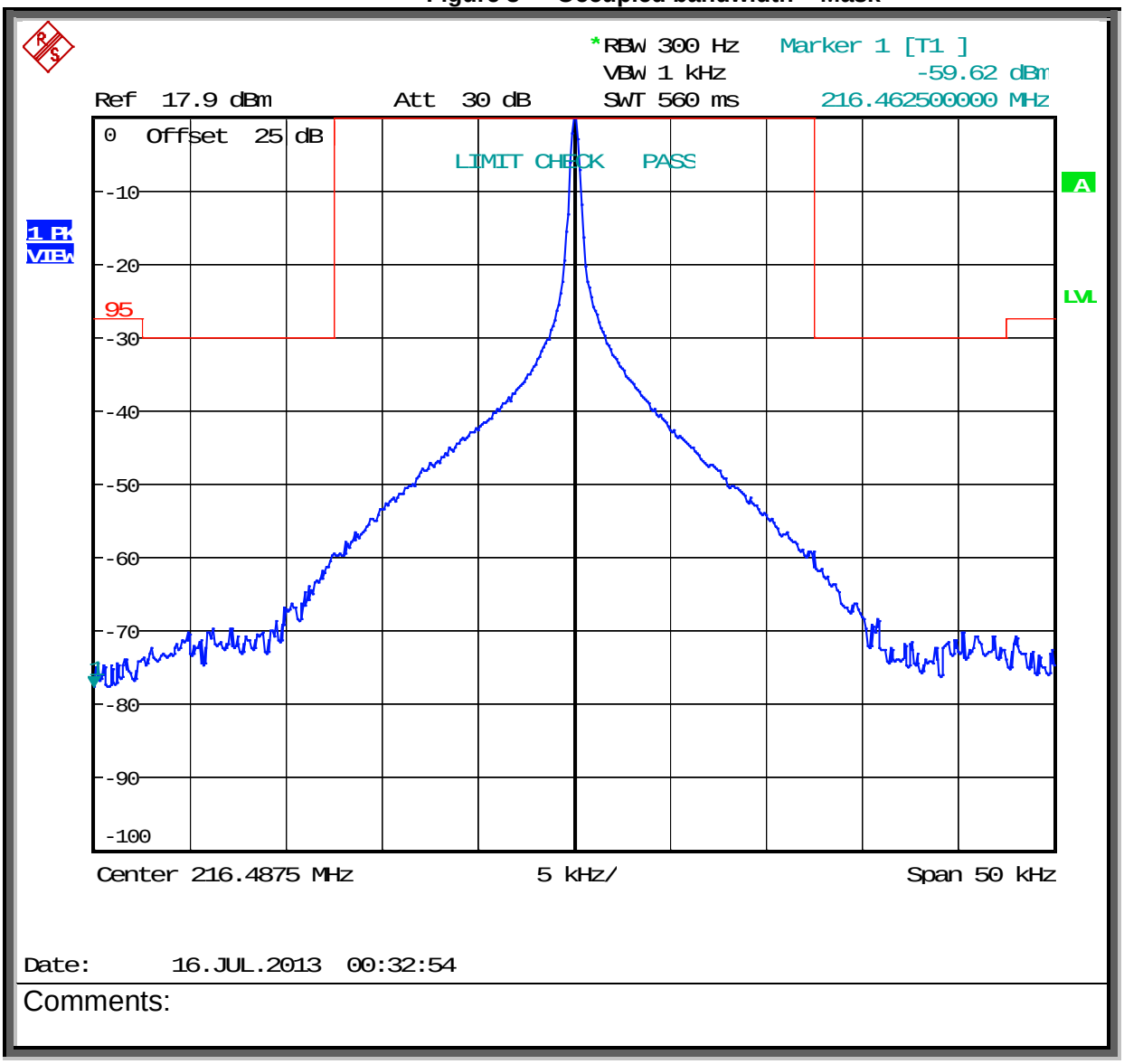
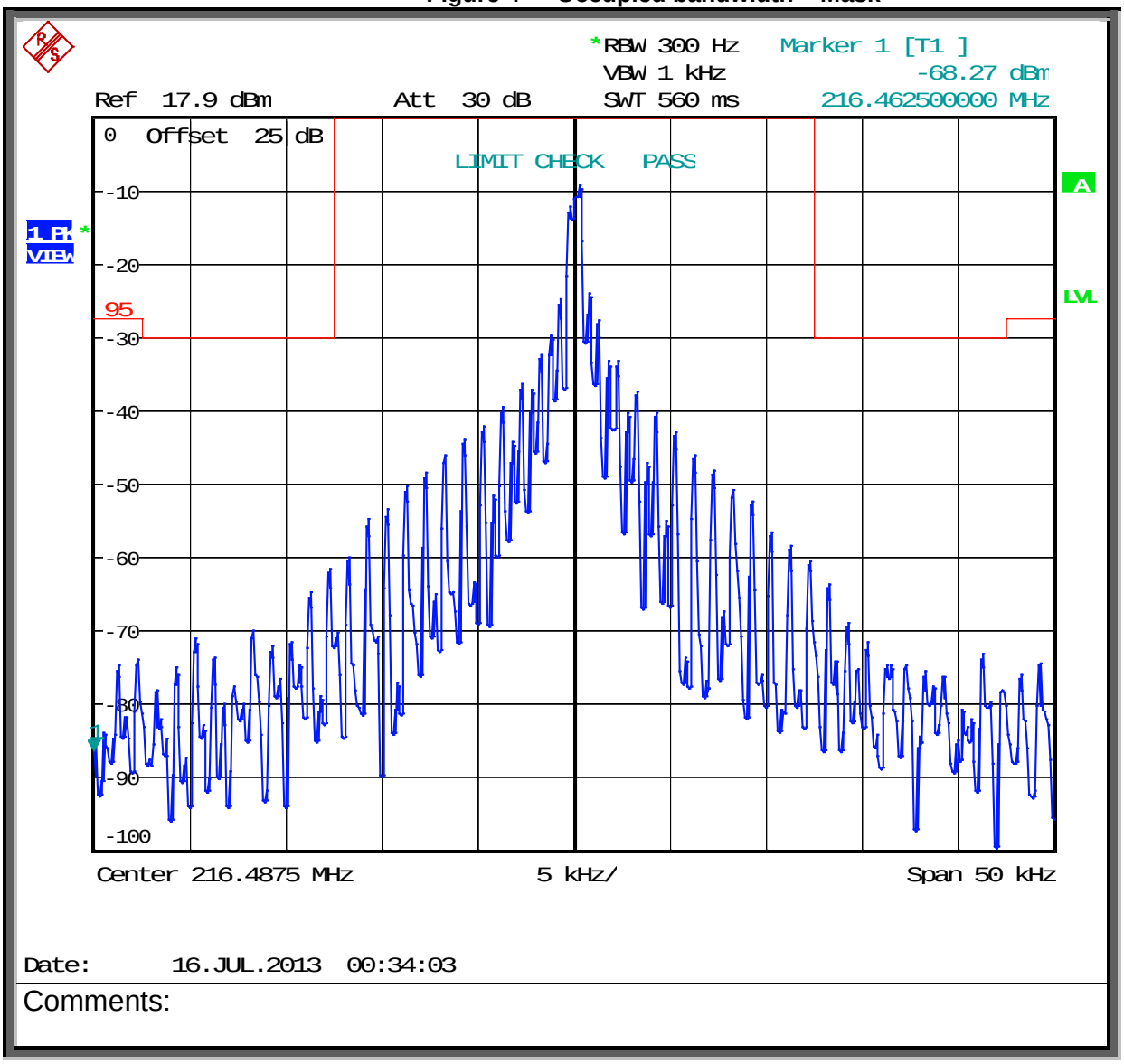
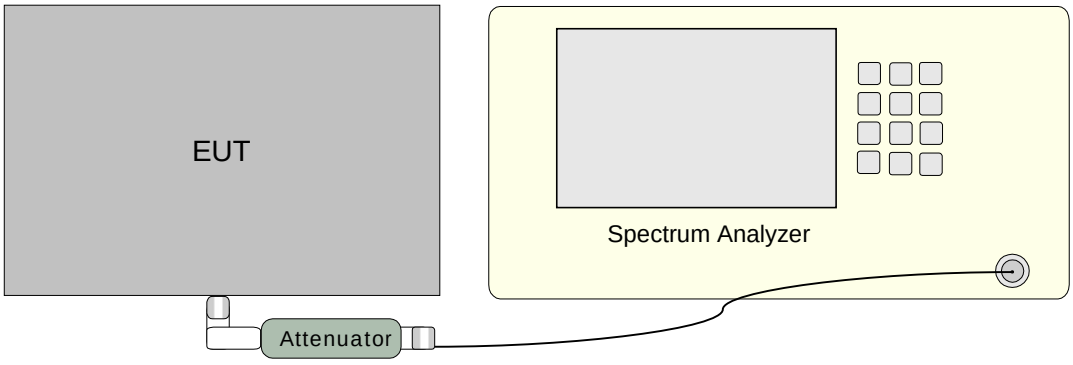


Figure 4 Occupied bandwidth – Mask



C.10. Test Diagram



C.11. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX D: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

D.1. Base Standard & Test Basis

Base Standard	FCC CFR 47, 95.635(c)(1)
Test Basis	FCC CFR 47, 2.1051
Test Method	ANSI/TIA 603-C

D.2. Specifications

95.635(c)(1) – Emissions for LPRS transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:

(i) Emisssions 12.5 kHz to 22.5 kHz away from the carrier center frequency: at least 30 dB; and

(ii) Emissions more than 22.5 kHz away from the channel center frequency: at least 43 + 10log(carrier power in watts) dB.

D.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+/- 1.2 dB

D.4. Deviations

Deviation Number	Date	Description and Justification of Deviation	Deviation Reference	
			Base Standard	Test Procedure
none				

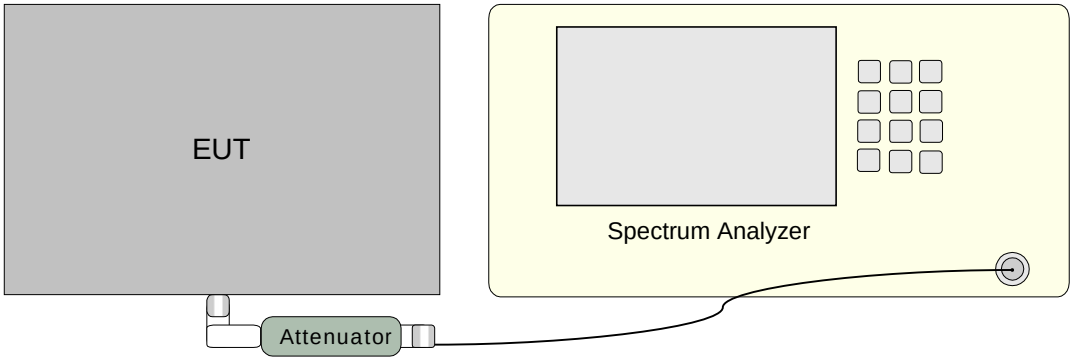
D.5. Test Results

Compliant.

D.6. Test Data

See following pages.

D.7. Test Configuration

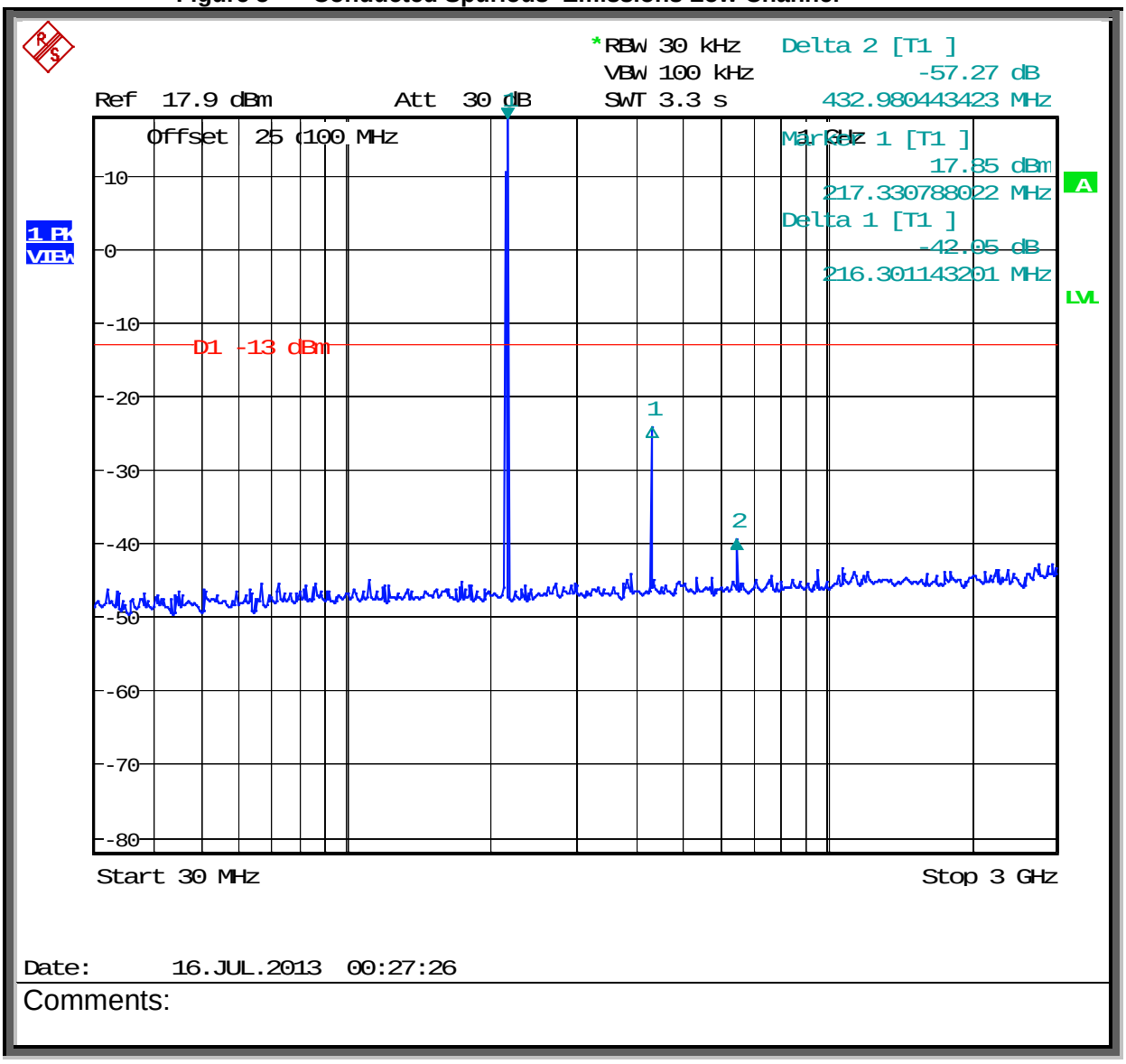


D.8. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

Figure 5 Conducted Spurious Emissions Low Channel



APPENDIX E: FIELD STRENGTH OF SPURIOUS EMISSIONS

E.1. Base Standard & Test Basis

Base Standard	CFR 47, 95.635(c)(1)
Test Basis	CFR 47, 2.1053
Test Method	ANSI/TIA 603-C

E.2. Limits

95.635(c)(1) – Emissions for LPRS transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:

(i) Emissions 12.5 kHz to 22.5 kHz away from the carrier center frequency: at least 30 dB; and

(ii) Emissions more than 22.5 kHz away from the channel center frequency: at least 43 + 10log(carrier power in watts) dB.

E.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+/- 1.2 dB

E.4. Test Results

Compliant.

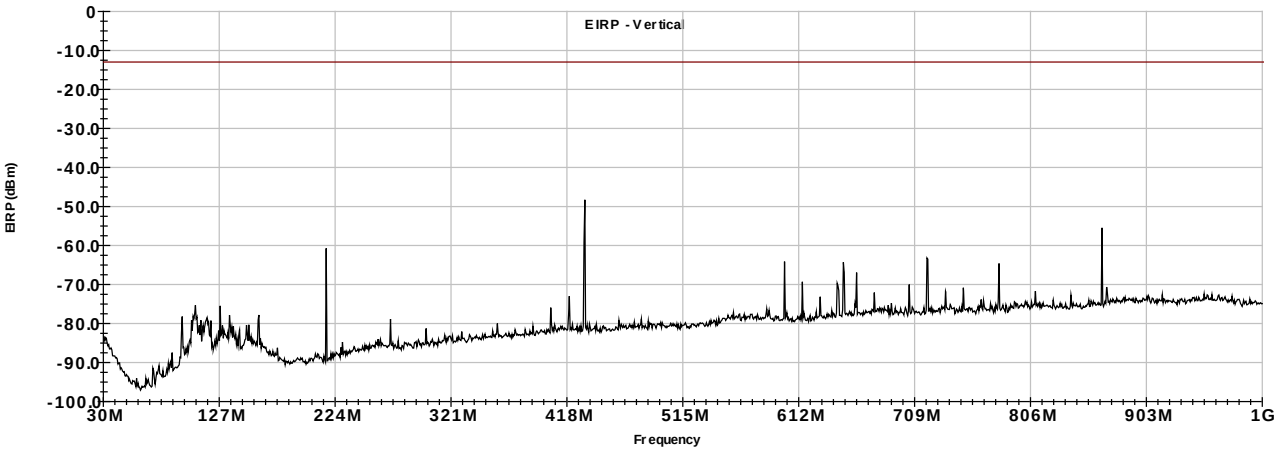
E.5. Deviations from Normal Operating Mode During Test

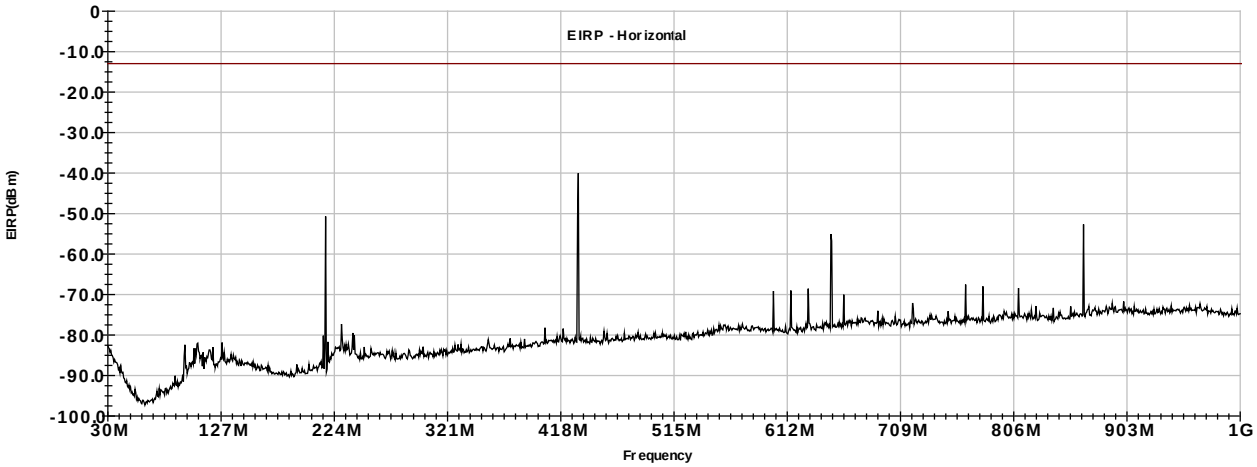
None.

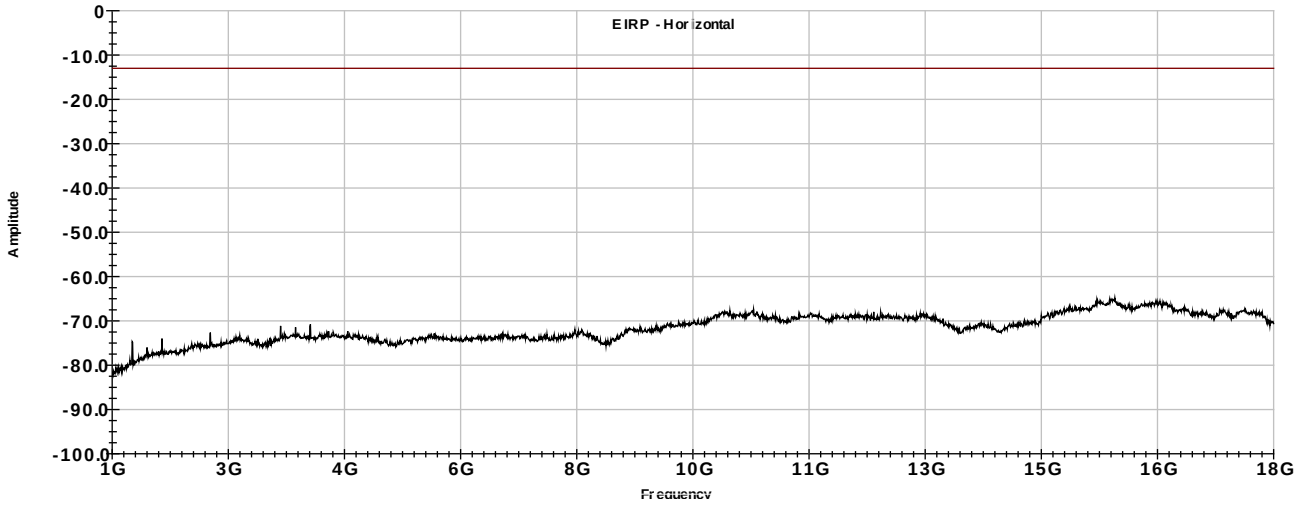
E.6. Sample Calculation

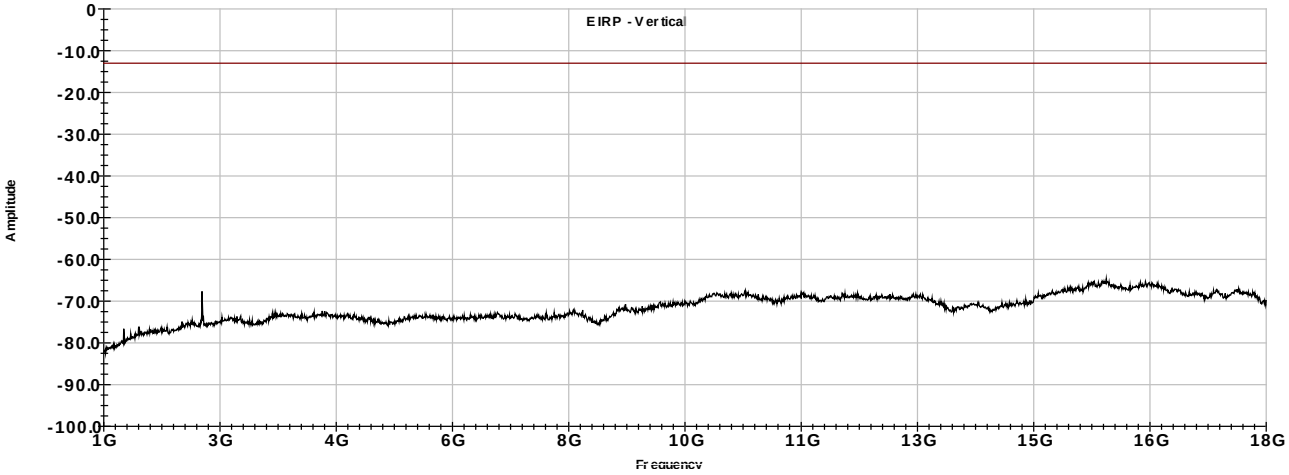
NA.

E.7. Test Data

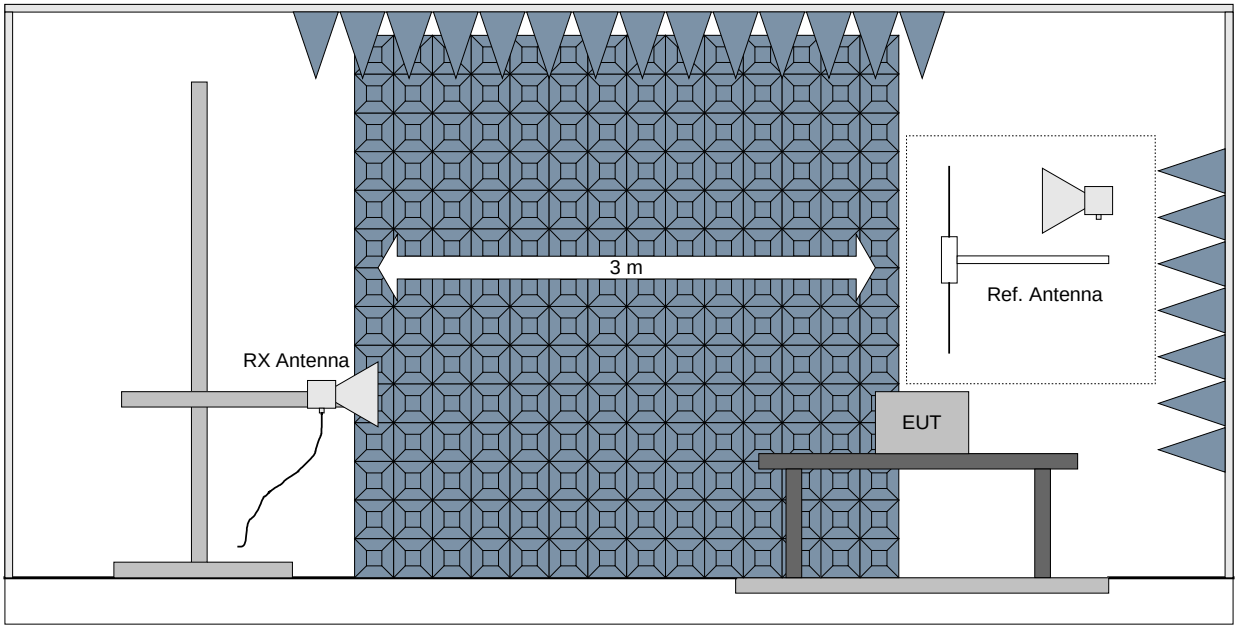








E.8. Test Diagram



Note: The EUT is set to transmit a signal at maximum rf output power into a coaxial load for this testing.

E.9. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX F: FREQUENCY STABILITY

F.1. Base Standard & Test Basis

Base Standard	FCC CFR 47 Part 95.629(b)(2)
Test Basis	FCC CFR 47 Part 2.1055
Test Method	ANSI/TIA 603-C

Specifications

95.629(b)(2) – LPRS transmitters operating on standard band channels must be maintained within a frequency stability of 50 parts per million.

F.2. Test Results

Compliant.

F.3. Observations

None

F.4. Deviations from Normal Operating Mode During Test

None.

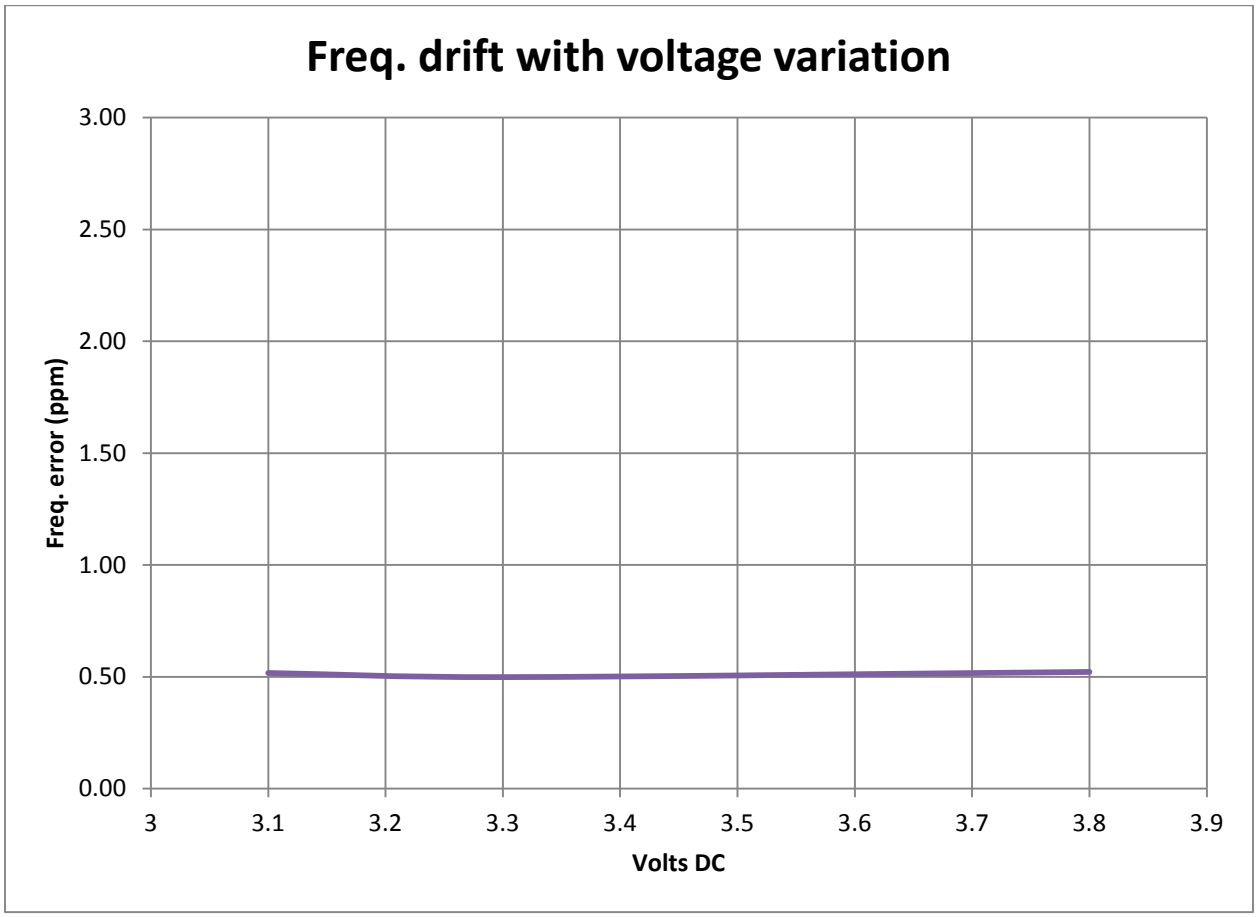
F.5. Sample Calculation

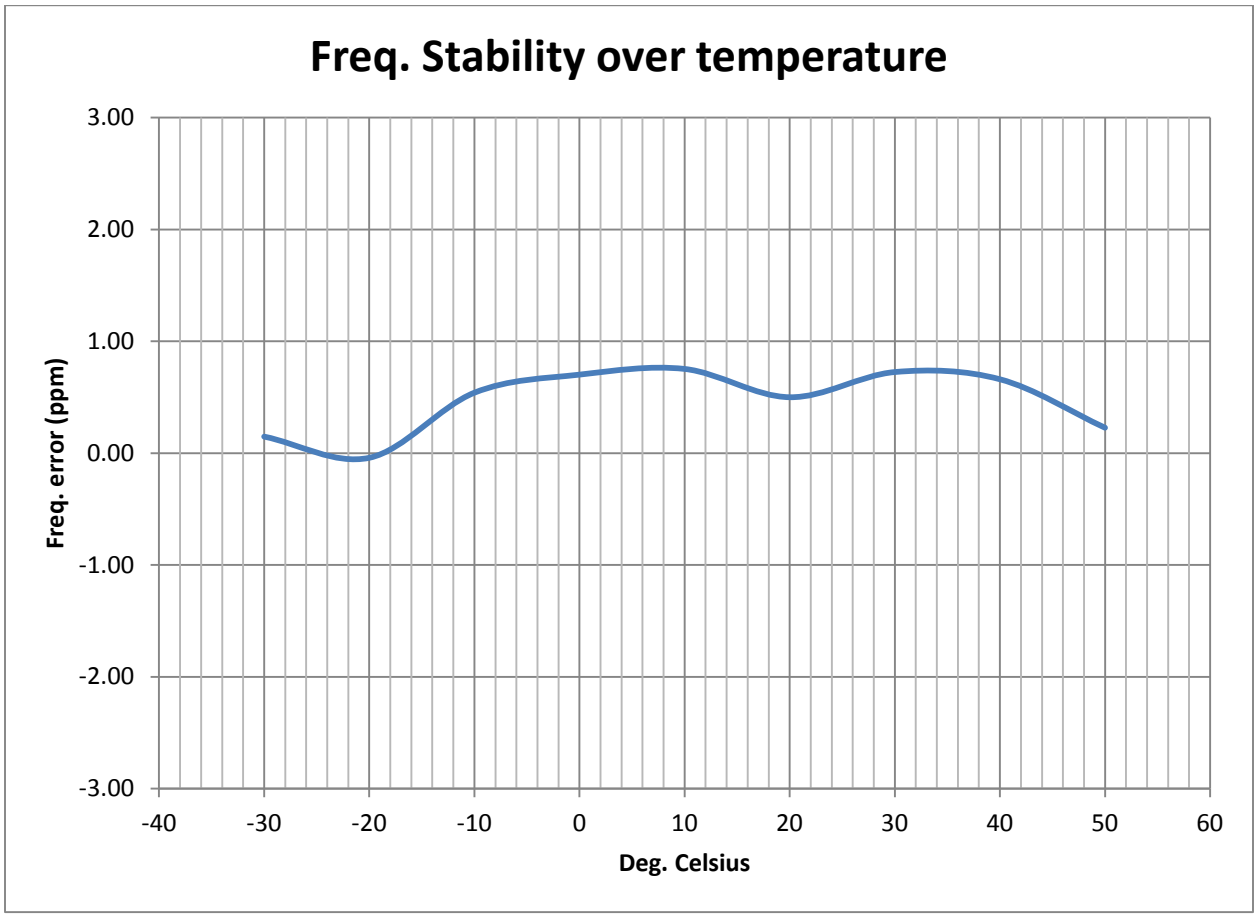
F_{drift} (ppm) = F_m / F_{ref}

where,
F_{drift} = The maximum carrier drift in parts-per-million
F_m = The measured carrier drift in Hertz
F_{ref} = The reference frequency in MHz

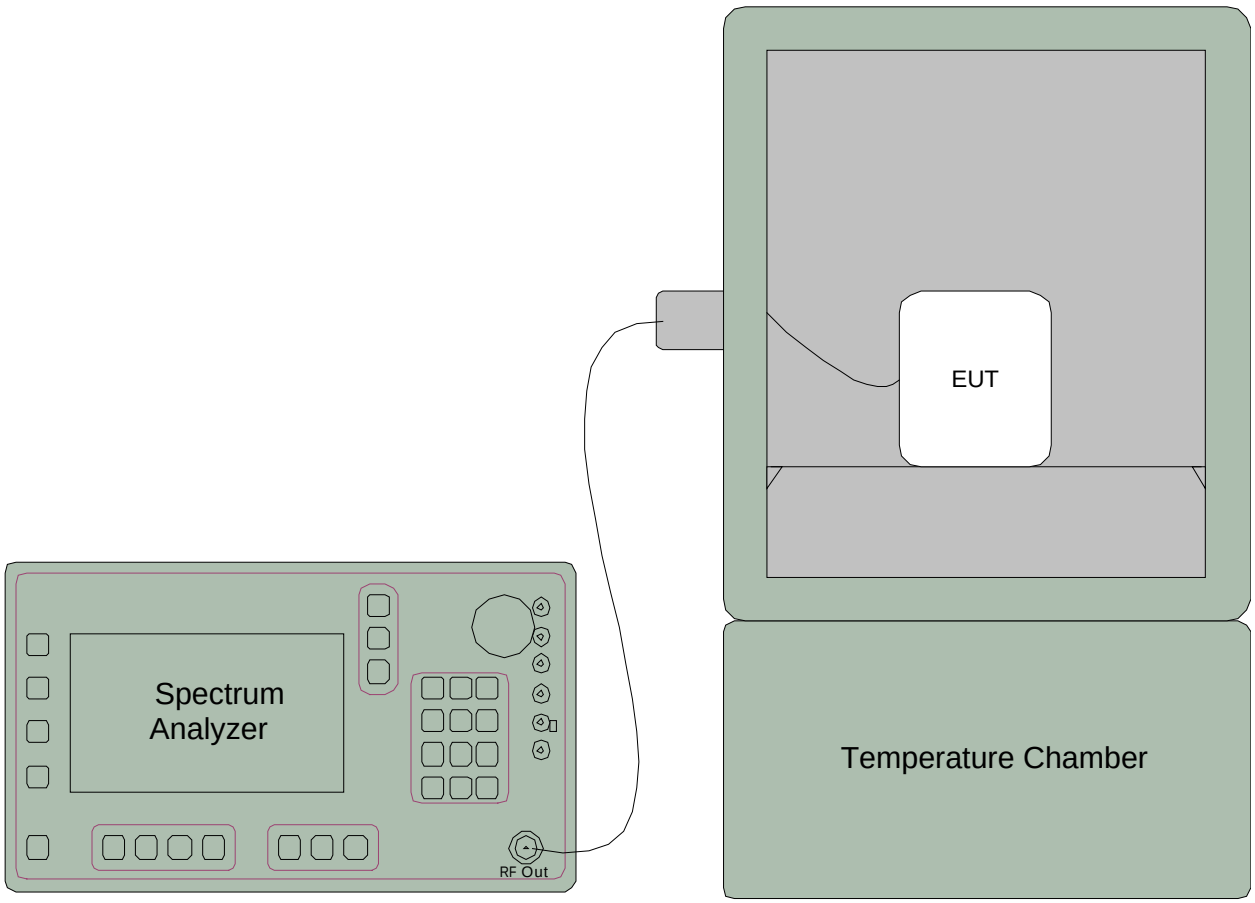
F.6. Test Data

Temp (°C)	Measured Frequency (MHz)		Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)
20	216.487612		3.1	112	216.5	0.52
20	216.487608		3.3	108	216.5	0.50
20	216.487613		3.8	113	216.5	0.52
50	216.487549		3.3	49	216.5	0.23
40	216.487643		3.3	143	216.5	0.66
30	216.487657		3.3	157	216.5	0.73
20	216.487608			108		0.50
10	216.487663		3.3	163	216.5	0.75
0	216.487652		3.3	152	216.5	0.70
-10	216.487617		3.3	117	216.5	0.54
-20	216.487491		3.3	-9	216.5	-0.04
-30	216.487532		3.3	32	216.5	0.15





F.7. Test Diagram



F.8. Tested By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX G: CONTROL ACCESSIBILITY

G.1. Base Standard & Test Basis

Base Standard	CFR 47, Part 95.645(a)
Basis	CFR 47, Part 95.645(a)
Test Method	Not Applicable

Specifications

95.645(a) – No control, switch or other type of adjustment which, when manipulated, can result in a violation of the rules shall be accessible

G.2. Test Results

Compliant

G.3. Observations

There are no controls or adjustment available on the device.

G.4. Deviations from Normal Operating Mode During Test

None.

G.5. Sample Calculation

N/A

G.6. Evaluated By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX H: POWER OUTPUT CAPABILITY

H.1. Base Standard & Test Basis

Base Standard	CFR 47, Part CFR 47, Part 95.649
Basis	CFR 47, Part 95.649
Test Method	Not Applicable

Specifications

95.649 – No CB, R/C, LPRS, FRS, MICS, MURS, or WMTS unit shall incorporate provisions for increasing its transmitter power to any level in excess of the limits specified in 95.639.

H.2. Test Results

Compliant

H.3. Observations

There is no provision for the device to increase rf power output in excess of the limits.

H.4. Deviations from Normal Operating Mode During Test

None.

H.5. Sample Calculation

N/A

H.6. Evaluated By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX I: PERMISSIBLE COMMUNICATIONS

I.1. Base Standard & Test Basis

Base Standard	CFR 47, Part CFR 47, Part 95.1009(c)
Basis	CFR 47, Part 95.1009(c)
Test Method	Not Applicable

Specifications

95.1009 – LPRS stations may transmit voice, data, or tracking signals as permitted in this section. Two-way voice communications are prohibited.

95.1009(c) Law enforcement tracking signals (for homing or interrogation), including the tracking of persons or stolen goods under the authority or agreement with a law enforcement agency (federal, state, or local) having jurisdiction in the area where the transmitters are placed.

I.2. Test Results

Compliant

I.3. Observations

This device transmits law enforcement tracking signals.

I.4. Deviations from Normal Operating Mode During Test

None.

I.5. Sample Calculation

N/A

I.6. Evaluated By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX J: ANTENNAS AND ERP

J.1. Base Standard & Test Basis

Base Standard	CFR 47, Part CFR 47, Part 95.1013(a)
Basis	CFR 47, Part 95.1013(a)
Test Method	Not Applicable

Specifications

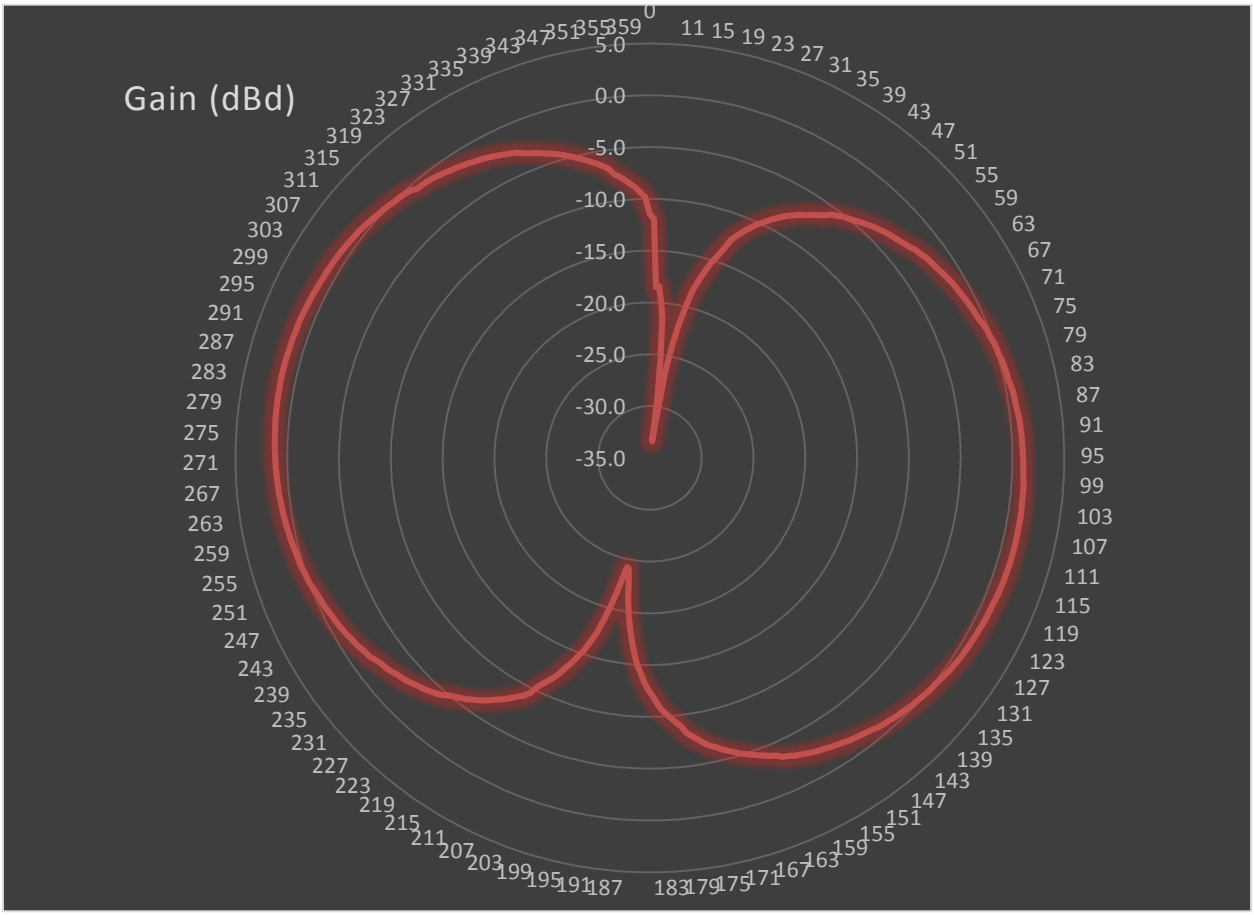
95.1013(a) – The maximum allowable ERP for a station in the LPRS other than an AMTS station is 100 mW.

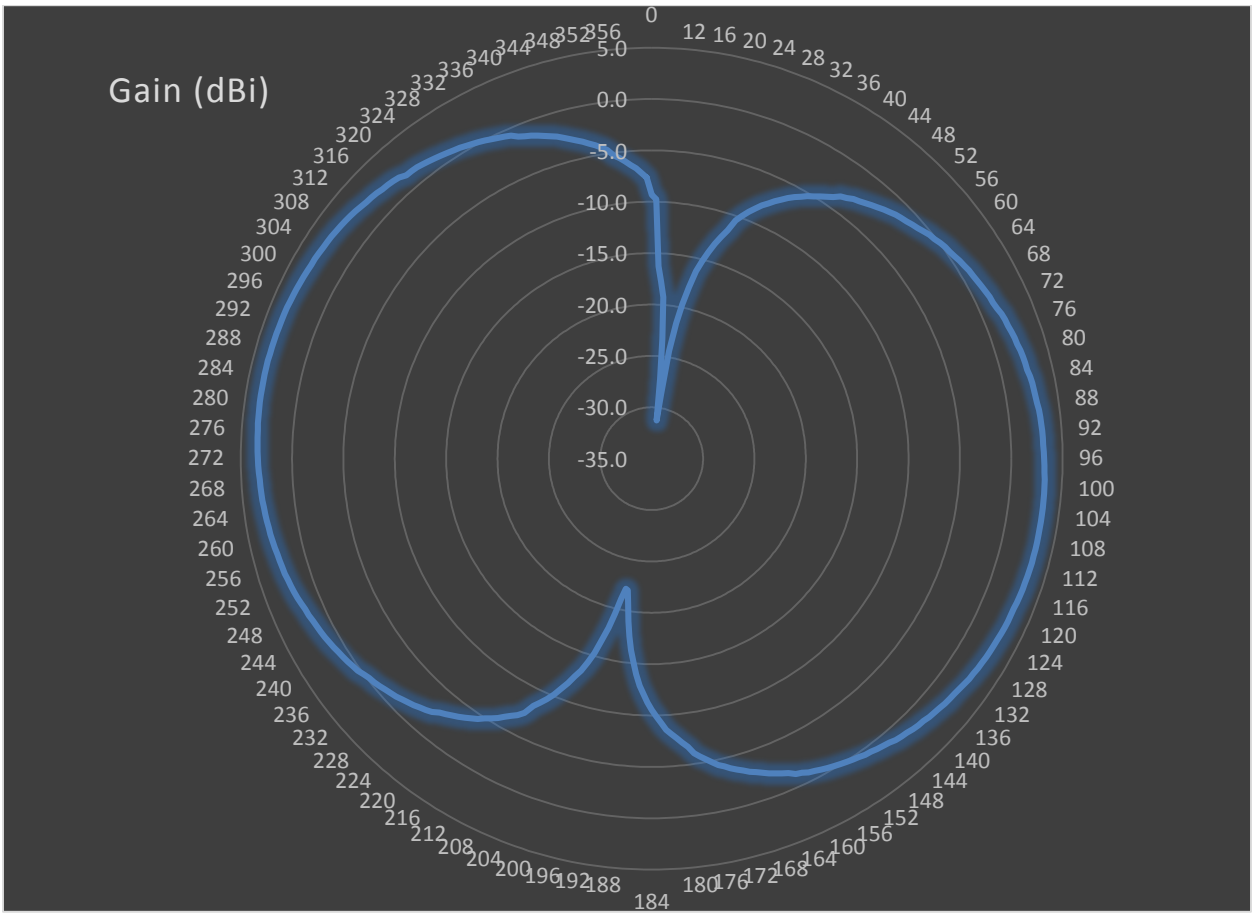
J.2. Test Results

Compliant

J.3. Observations

Antenna gain: 1.4 dBd
ERP = 17.9 dBm + 1.4 dBd = +19.3 dBm = 85.1 mW





J.4. Deviations from Normal Operating Mode During Test

None.

J.5. Sample Calculation

ERP = RF Power at antenna port (dBm) + antenna gain (dBd) = ERP (dBm)
ERP(mW) = $10^{(ERPdBm/10)}$

J.6. Evaluated By

Name: Tom Tidwell
Date: 16 July, 2013

Temperature: 23.4
Humidity: 58.9

APPENDIX K: TEST EQUIPMENT LIST

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
1016	Preamplifier	Hewlett Packard	8449A	2749A00159	23-Jul-2012	23-Jul-2013
1025	Preamplifier, 25dB	Nemko USA, Inc.	LNA25	399	05-Mar-2013	05-Mar-2014
1061	Filter, Tunable Notch	K&L	3TNF-200/400-N/N	81	N/R	
1304	Antenna, Horn	Electro Metrics	RGA-60	6151	11-Dec-2012	11-Dec-2014
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	07-Mar-2013	07-Mar-2014
1767	Receiver, EMI Test 20Hz - 26.5 GHz - 150 - +30 dBm LCD	Rohde & Schwartz	ESIB26	837491/0002	19-Dec-2012	19-Dec-2013
1783	Cable Assy, 3m Chamber	Nemko	Chamber		26-Sep-2012	26-Sep-2013
1950	Spectrum Analyzer (formerly tagged #1659)	Rohde & Schwartz	FSP	100037	17-Jan-2013	17-Jan-2014
1839	Environmental Chamber (Temperature only)	Tenney	T-14	14	N/R	
487	Digital Thermometer	Fluke	52	6100733	22-Oct-2012	22-Oct-2013

END OF DOCUMENT