Testing Tomorrow's Technology

October 10, 2013

Ms. Cindy Allen
Radio Systems Corporation
10427 Petsafe Way
Knoxville, TN 37932

Dear Ms. Allen:

Enclosed herewith, please find Radio Systems Corporation's file copy of the FCC Part 95 Certification Report for the Radio Systems Corporation model: GPSC Sniffer USB.

Please keep the report in your files as proof that the product has been successfully tested.

If you have any questions, please don't hesitate to call. Thank you very much for your business.

Sincerely,

Alan Ghasiani
Consulting Engineer - President

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

Testing Tomorrow's Technology

Report of

Title 47 CFR Part 95 Subpart J, Multi User Radio Services (MURS) and TIA-603-C (2004) Land Mobile FM or PM- Communications Equipment Measurement and Performance Standard

For the
Radio Systems Corporation

Family Name: GPSC Sniffer USB
Model: 300-2789
FCC ID: KE3-3002789

Issue Date: October 19, 2013
Test Dates: September 26 thru October 2, 2013

UST Project No.: 13-0261

Total Number of Pages Contained in this Report: 23

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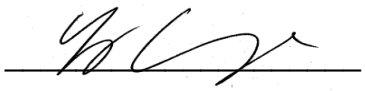
I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: 

Name: George Yang

Title: Laboratory Manager

Date: October 19, 2013

NVLAP LAB CODE 200162-0

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1 General Information

1.1 Product Description

The Equipment Under Test (EUT) is the Radio Systems Corporation GPSC Sniffer USB, Model 300-2789. Invisible Fence Dealers will use this device connected to a laptop or notebook PC for on-site GPSC monitoring/troubleshooting/parameter setting.

1.2 Related Submittal(s)/Grant(s)

The EUT is subject to the following authorizations:

a) Certification as a 151.82 MHz, MURS transmitter per FCC Part 2, Subpart J and Part 95, Subpart J, MURS and Subpart E, Technical Requirements.

1.3 Test Methodology

These measurements were conducted in accordance with the requirements of Title 47 CFR Part 95, Subpart E and TIA-603-C (2004). All measurements are in terms of peak values unless stated otherwise. The measurement system video bandwidth was set to at least three times that of the resolution bandwidth to prevent the introduction of amplitude smoothing throughout the evaluation process. If interconnecting cables are part of the measurement setup then they were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1.

1.4 Test Facility

The open area test site (OATS) used to collect the radiated data is located at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC under Site Registration number 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

1.5 Test Equipment

Table 1 describes test equipment used to evaluate this product.

1.6 Modifications to EUT

No modifications were necessary to bring the EUT into compliance with FCC Part 95.

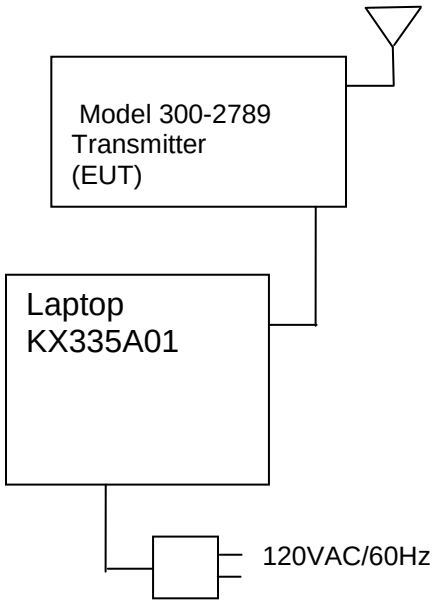


Figure 1- Block Diagram

Table 1- EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/ IC ID:	CABLES P/D
GPSC Sniffer USB (EUT) Radio Systems	300-2789	Engineering Sample	FCC: KE3-3002789 IC: N/A	NONE
Laptop Dell	Various	Various	Various	1.5m U P

P = Power; D = Data U = Unshielded

Table 2- Test Instruments

Instrument Type	Manufacturer	Model	Serial Number	Last Calibration Date
Spectrum Analyzer	Hewlett-Packard	8566B	2410A00109	11/21/2012
Spectrum Analyzer	Agilent	E4407B	US41442935	10/29/2012
RF Preamp	Hewlett-Packard	8449B	3008A00480	3/4/2013
Loop Antenna	AH Systems	SAS-200/562	142	9/12/2013
Biconical Antenna	EMCO	3110B	9306-1708	07/02/12 2 yr cal
Log Periodic Antenna	EMCO	3146	9110-3236	11/22/11 2 yr cal
Environmental Chamber	Thermotron	SM16	17095	04/24/2013 2 yr cal
Regulated Power Supply	TekPower	HY1803D	N/A	Not Required
LISN	Solar Electronics	8028-50-TS24-BNC	955824 & 955825	3/02/2013
UST calculation software	UST	N/A	N/A	N/A

2 Measurement Procedure

2.1 Maximum Transmitter Power (FCC 2.1046 & 95.639(h)

Maximum Transmitter Power was measured per the substitution method because the EUT incorporates a trace antenna. There are no RF ports to tap into to provide conducted output power measurements.

2.1.1 Maximum Power Allowed

The maximum power allowed is 2 Watts per FCC 95.639(h).

2.1.2 Measured Signal

The Fundamental signal is measured on the Spectrum Analyzer as 80.30 dBuV using the Biconical antenna and no preamplifier or attenuators. Cable loss at this frequency is minimal.

2.1.3 Sample Calculation

Per the signal substitution method: P_{dBm} = Corrected RF power in Tx Antenna+ Tx Antenna Gain relative to dipole + Difference Column A - B = (-3.04) + (-0.54) + (-0.6) = -4.18 dBm

$$P_{mW} = 10^{((-4.18) / 10)} = 0.38 \text{ mW}$$

Note: No pre-amplification used here.

Table 3- Output Power Calculation

Freq.	Maximum RX Reading	Recreated Reading	Difference Column A - B	TX Gain (dBi)	TX Gain Relative to Dipole (dB)	Corrected RF Power into TX antenna	Corrected Output Power (dBm)	Corrected Output Power (mW)
151.828	80.3	80.9	-0.6	1.6	-0.54	-3.04	-4.18	0.38

2 Measurement Procedure (Cont'd)

2.2 Bandwidth of Fundamental Emissions (Part 95.633(f)(1))

The EUT was modulated by its own internal sources. The Bandwidth of the Fundamental was measured using a spectrum analyzer, as shown in the screen shot below. A RBW that was > 1% of the authorized bandwidth was used to measure the EUT's bandwidth.

Using the Emission Bandwidth measurement technique of subparagraph 95.633(e)(3) as a guide, the measurement of the Emission Bandwidth is found to be 6.44 kHz.

2.2.1 Maximum Authorized Bandwidth, FCC requirement.

The maximum authorized Bandwidth per 95.633 (f)(1) = 11.25 kHz.

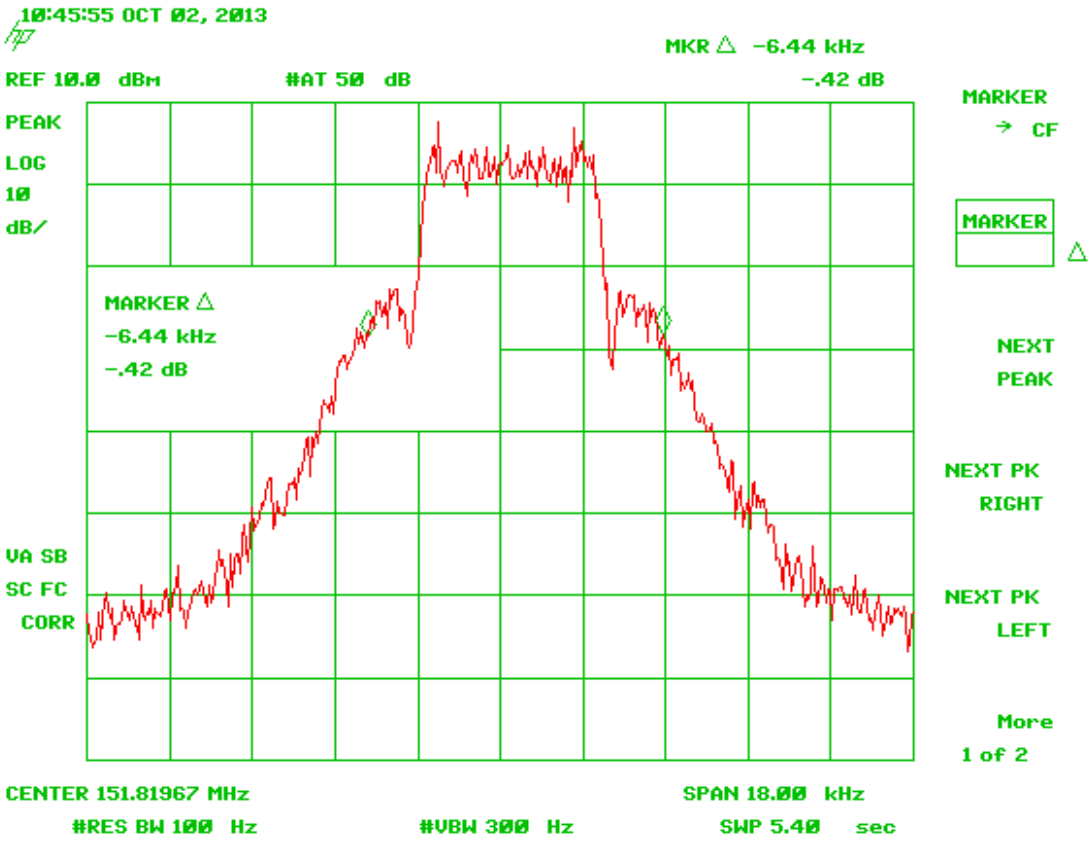


Figure 2- Bandwidth Measurement

2 Measurement Procedure (Cont'd)

2.3 Unwanted Radiation (CFR 95.635(b))

This requirement is from 47 CFR Part 2, Subpart J, Section 1053 and 95.635(e). The power of each unwanted emission shall be less than TP (Transmitter Power) as specified in paragraph 2.3.1 below.

2.3.1 FCC Limits

Per CFR Part 95.635(e) transmitters designed to operate in the MURS, transmitters shall comply with the following:

Frequency	Mask with audio low pass filter	Mask without audio low pass filter
151.820 MHz, 151.880 MHz and 151.940 MHz	(1)	(1)
154.570 MHz and 154.600 MHz	(2)	(3)

(1) *Emission Mask 1* —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:

(i) On any frequency from the center of the authorized bandwidth f_o to 5.625 kHz removed from fo: Zero dB.
(ii) 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 kHz) dB.
(iii) 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.

(2) *Emission Mask 2* —For transmitters designed to operate with a 25 kHz channel bandwidth that are equipped with an audio low-pass filter, the power of any emission must be below the unmodulated carrier power (P) as follows:

(i) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: at least 25 dB.
(ii) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: at least 35 dB.
(iii) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: at least 43 + 10 log (P) dB.

(3) *Emission Mask 3* —For transmitters designed to operate with a 25 kHz channel bandwidth that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: at least 83 log (f_d /5) dB.
(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: at least 29 log (f_d^2 /11) dB or 50 dB, whichever is the lesser attenuation.
(iii) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: at least 43 + 10 log (P) dB.

The EUT is designed to operate in the 151.8200 MHz frequency and assumed not be using any audio low pass filter circuits therefore only Emissions Mask 1 was applied.

2 Measurement Procedure (Cont'd)

2.4 Emissions Mask (CFR 95.635(e)(1))

2.4.1 Emissions Mask, Part 1

On any frequency from the center of the authorized bandwidth, f_o to 5.625 kHz removed from f_o: Zero dB.

2.4.2 Emissions Mask, Part 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 kHz) dB.

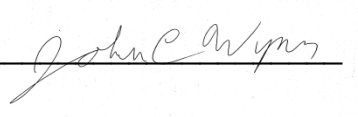
2.4.3 Emissions Mask, Part 3

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.

Table 4- Spurious Signals dB down from Fundamental

Fundamental Frequency	Bandwidth at Center Frequency, f_c (Authorized bandwidth)	Removed from Authorized Bandwidth	Center Frequency Minus Removed bandwidths	Center Frequency plus removed bandwidths	dB Down Down from Fundamental
151.82	11.25 kHz	5.625 kHz kHz	151.80	151.83	>0
151.82	11.25 kHz	5.625 to 12.5 kHz	151.80	151.83	>70
151.82	11.25 kHz	> 12.5 kHz	151.80	151.83	>70

Test Date: October 2, 2013

Tested By:  Name: John Wynn

2 Measurement Procedure (Cont'd)

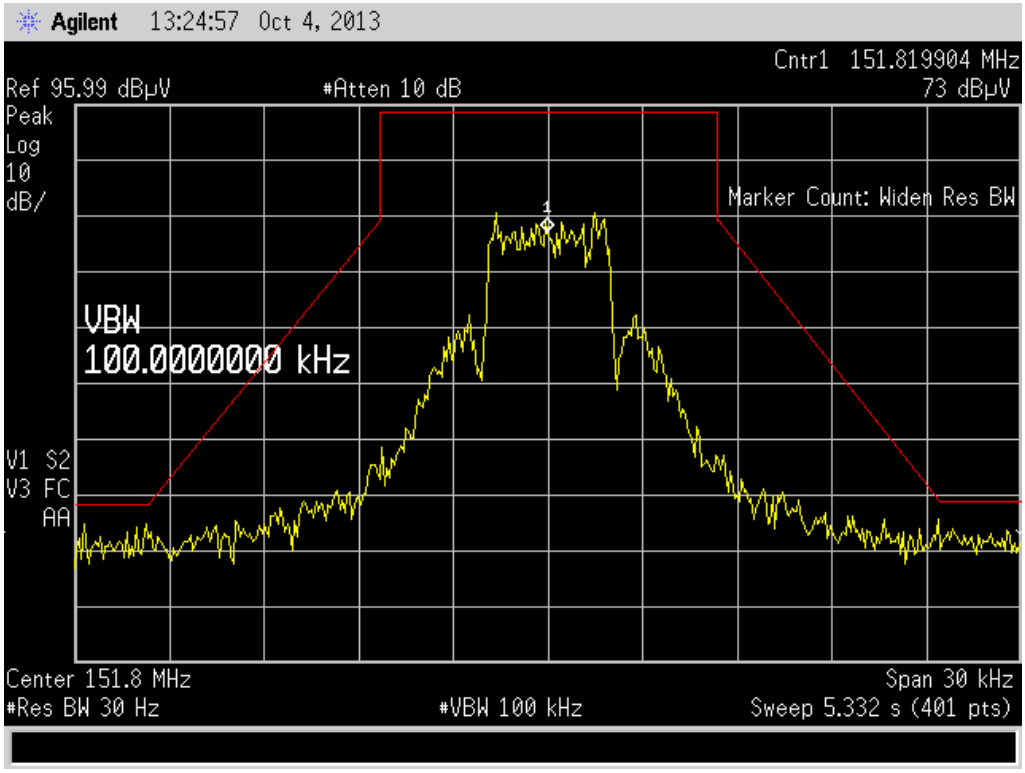


Figure 3- Transmitter Spurious Emissions at Antenna Terminals

2 Measurement Procedure (Cont'd)

2.5 Field Strength of Spurious Radiation, (FCC 2.1051 & 95.635(b))

Spurious emissions were evaluated from 30 MHz to 1.0 GHz at a EUT to antenna distance of 3 meters. The EUT was tested in the far field. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth set to 120 kHz. Measurements above 1000 MHz were made with analyzer's bandwidth set to 1 MHz and 3 MHz. Since the EUT is part of a portable handheld configuration, the EUT was rotated through the three orthogonal planes to produce the highest emission relative to the limit. Results are shown in Table 5.

2.5.1 FCC Limits

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.

In this case 70 dB was used since it was the lesser attenuation. The limit is calculated to be -37 dBm.

Table 5- Field Strength of Spurious Radiation

Frequency MHz	Maximum RX Reading (Units A)	Recreated Reading During Substitution (Using Same Units A) - Ideally 0	Difference Column A - B	TX Gain (dBi)	TX Gain Relative to Dipole (dB)	RF Power into TX antenna (dBm) (SG Value-CL)	RF Power into substitution TX antenna (dBm)	Limit (dBm)	Margin Below Limit (dB)
303.65	50.40	54.60	-4.20	4.00	1.86	-51.20	-53.54	-37.00	16.54
455.46	44.00	47.40	-3.40	6.00	3.86	-56.87	-56.41	-37.00	19.41
607.29	38.00	42.70	-4.70	6.20	4.06	-64.60	-65.24	-37.00	28.24
759.11	39.10	42.30	-3.20	6.20	4.06	-51.55	-50.69	-37.00	13.69
910.92	34.60	39.00	-4.40	5.80	3.66	-58.11	-58.85	-37.00	21.85
1214.39	51.32	52.37	-1.05	7.50	5.36	-64.45	-60.14	-37.00	23.14
1366.21	44.42	47.66	-3.24	8.00	5.86	-64.57	-61.95	-37.00	24.95
1518.26	48.30	51.35	-3.05	8.67	6.53	-64.65	-61.17	-37.00	24.17

Test Date: September 30, 2013

Tested By: John C Wynn Name: John Wynn

2.6 Unintentional/Intentional Radiator, Power Conducted Emissions (CFR 15.107)

The EUT was connected to the laptop computer using and powered over the USB port of the Laptop.

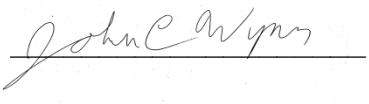
Measurements were made over the 150 kHz to 30 MHz frequency range for the unit. The measurement receiver was connected to the RF (receiver) Port on the LISN and each power lead was individually measured. Test results are shown in the table below.

Table 6- Power Line Conducted Emissions Data, Class B

Conducted Emissions - 120 VAC 60 Hz						
Test By: JW	Test: Part 15 and Part 95J			Client: Radio Systems Corporation		
	Project: 13-0261		Class: B	EUT: 300-2789		
Frequency (MHz)	**Test Data (dBuV)**	**AF+CA-AMP (dB)**	**Results (dBuV)**	**Average Limits (dBuV)**	**Margin (dB)**	**Detector Used**
Phase Lead						
0.1506	50.40	1.40	51.80	66.0	*14.2	QP
0.1506	36.80	1.40	38.20	56.0	17.8	AVG
0.5599	34.60	0.41	35.01	46.0	11.0	PK
4.0960	44.40	0.42	44.82	56.0	*11.2	PK
4.0960	30.90	0.42	31.32	46.0	14.7	AVG
9.9200	38.30	0.58	38.88	50.0	11.1	PK
10.3100	39.10	0.59	39.69	50.0	10.3	PK
21.4200	36.40	0.64	37.04	50.0	13.0	PK
Neutral Lead						
0.1699	54.20	1.20	55.40	65.0	*9.6	PK
0.1699	37.90	1.20	39.10	55.0	15.9	AVG
0.8430	30.50	0.36	30.86	46.0	15.1	PK
3.8680	43.00	0.41	43.41	56.0	*12.6	PK
3.8680	28.40	0.41	28.81	46.0	17.2	AVG
9.9100	37.40	0.57	37.97	50.0	12.0	PK
10.1800	38.00	0.58	38.58	50.0	11.4	PK
23.2600	34.60	0.66	35.26	50.0	14.7	PK

* denotes Quasi-Peak limits

Sample Calculations: at 0.1506 MHz: 50.40 dBuV + 1.40 dB = 51.80 dBuV

Test Date: September 26, 2013
Tested by
Signature:  **Name: John Wynn**

2.7 Unintentional/Intentional Radiator, Radiated Emissions (CFR 15.109/15.209)

The test data provided herein is to support the verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmitting state per 15.109 were evaluated from 30 MHz to 1000 MHz and radiated emissions coming from the EUT in a transmitting state per 15.209 were investigated from 9 kHz or the lowest operating clock frequency to 1000 MHz and tested as detailed in ANSI C63.4:2003, Paragraph 8. The worst case data is presented herein.

For equipment with clock frequencies operating below 30 MHz, radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.4:2003.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth: 1 MHz RBW and 3 MHz VBW. The test data was maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure. All measured signals were at least 4.3 dB below the specification limit. The results are shown in Table 7 and 8 below.

Table 7- Unintentional Radiated Emissions Below 1000MHz (CFR 15.109)

Radiated Emissions							
Test By: JW	Test: Part 15B Verification	Client: Radio Systems Corporation					
	Project: 13-0261	Class: B		Model: 300-2789			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Quasi-Peak Limits (dBuV/m)**	**Application Test Distance/ Polarization**	**Margin (dB)**	**Detector Used**
Measurements were made over the frequency range of 150 kHz – 1 GHz							
39.4510	50.70	-14.97	35.73	40.0	3m/H	4.3	QP
48.0210	49.00	-16.44	32.56	40.0	3m/H	7.4	PK
87.3730	44.60	-17.63	26.97	40.0	3m/H	13.0	PK
115.3600	42.10	-15.91	26.19	43.5	3m/H	17.3	PK
39.5300	51.30	-16.27	35.03	40.0	3m/V	5.0	QP
163.6810	47.90	-12.76	35.14	43.5	3m/V	8.4	PK
386.0680	39.30	-11.40	27.90	46.0	3m/H	18.1	PK
455.4810	41.40	-10.29	31.11	46.0	3m/H	14.9	PK
240.0210	38.20	-13.78	24.42	46.0	3m/V	21.6	PK
607.2900	35.90	-8.98	26.92	46.0	3m/V	19.1	PK
All other emissions are more than 20 dB below the limit.							

Sample Calculations: at 39.4510 MHz (50.70 dBuV – 14.97 dB/m) = 35.73 dBuV/m

Test Date: September 30, 2013

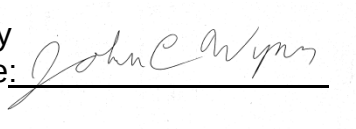
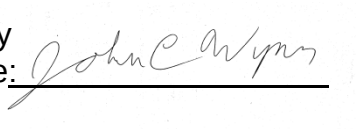
Tested by
Signature:  Name: John Wynn

Table 8 - Unintentional Radiated Emissions Above 1000MHz (CFR 15.109)

Radiated Emissions							
Test By: JW and RN	Test: Part 15B Verification	Client: Radio Systems Corporation					
	Project: 13-0261	Class: B		Model: 300-2789			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Average Limits (dBuV/m)**	**Application Test Distance/ Polarization**	**Margin (dB)**	**Detector Used**
Measurements were made over the frequency range of 150 kHz – 1 GHz							
1001.0000	57.09	-15.68	41.41	54.0	3m/H	12.6	PK
3188.0000	55.07	-5.56	49.51	54.0	3m/H	4.5	PK
3188.3800	49.87	-5.56	44.31	54.0	3m/H	9.7	AVG
3188.9900	53.76	-5.52	48.24	54.0	3m/V	5.8	PK
3188.9900	45.60	-5.52	40.08	54.0	3m/V	13.9	AVG
1821.8140	52.68	-11.91	40.77	54.0	3m/H	13.2	PK
1001.0000	57.09	-15.68	41.41	54.0	3m/H	12.6	PK
3188.0000	55.07	-5.56	49.51	54.0	3m/V	4.5	PK
1973.6210	47.40	-11.21	36.19	54.0	3m/H	17.8	PK
2429.1150	50.07	-8.45	41.62	54.0	3m/H	12.4	PK
All other emissions are more than 20 dB below the limit.							

Sample Calculations: at 1001.0 MHz (57.09 dBuV – 15.68 dB/m) = 41.41 dBuV/m

Test Date: September 30, 2013

Tested by
Signature:  Name: John Wynn

2 Measurement Procedure (Cont'd)

2.8 Frequency Stability (CFR 2.1055, 95.623(b))

The EUT was placed in a temperature controlled environment and connected to a spectrum analyzer. The temperature was varied from -30 to 50º C in 10º increments; allowing at least one half hour of temperature stabilization before a frequency measurement was taken. The PPM calculations were made as compared to a baseline frequency at 20ºC. A RBW of 1Hz, VBW of 30Hz and a 1s sweep settings were utilized.

The EUT was also connected to a variable voltage source and varied from 85% to 115% of rated voltage. The fundamental frequency for each voltage setting was compared to the 100% voltage ambient temperature measurement and reported as compared to the limit.

2.8.1 FCC Limits

MURS transmitters must maintain a frequency stability of 5.0 ppm, or 2.0 ppm if designed to operate with a 6.25 kHz bandwidth.

< 0.0005% = 5 PPM = 0.000005

Table 9- Frequency Deviation/Stability

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	151.8199	-1.0
-20	151.8198	-1.3
-10	151.8198	-1.1
0	151.8199	-0.7
10	151.8199	-0.6
20	151.8200	-0.3
30	151.8199	-0.6
40	151.8199	-0.7
50	151.8199	-0.9

Actual TX Frequency was: 151.8200MHz

Maximum Deviation Calculation:

$$\text{Deviation} = \frac{|(151.820 - 151.819800)|}{151.819800} = 0.0000013 = 0.00013\% = 1.3\text{ppm} < 5\text{ppm}$$

Test date: October 1-2, 2013

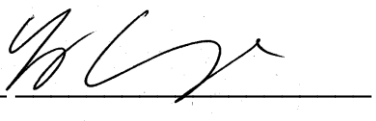
Tested By
Signature:  Name: George Yang

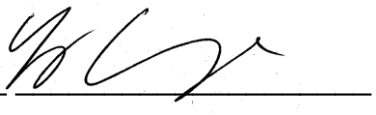
Table 10- Voltage Deviation/Stability

Voltage Measurements		
Voltage Variation	**Measured Frequency**	**Deviation (ppm)**
85%	151.8199	-0.6
100%	151.8199	-0.8
115%	151.8199	-0.7

Maximum Deviation Calculation:

$$\text{Deviation} = \frac{|(151.820 - 151.819900)|}{151.819900} = 0.0000006 = 0.00006\% = 0.6 \text{ ppm} < 5 \text{ ppm}$$

Test date: October 1-2, 2013

Tested By
Signature:  Name: George Yang