RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC Certification Report

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Model: Aprisa SR SRN400-000 5W Mobile Radio

FCC ID: UIPSRN0400012A

January 23, 2012

Standards Referenced for this Report	
Part 2: 2011	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2011	Private Land Mobile Radio Services
TIA-EIA-603-C August 2004	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA-2002	Digital C4FM/CQPSK Transceiver Measurement Methods
ANSI/TIA/EIA– 102.BAAA–1998	Project 25 FDMA Common Air Interface—New Technology Standards Project—Digital Radio Technical Standards

Frequency Range (MHz)	Measured Conducted Output Power (W)*	Frequency Tolerance (ppm)	Emission Designator
406.1-454	5	0.67	9K00F1D
456-470	5	0.67	9K00F1D

** reported power is manufacturer's rated power*

Report Prepared By: Daniel Baltzell

Document Number: 2011198

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

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1 Test Result Summary

Test	FCC Reference	Result
RF Power Output	2.1046(a), 90.205	Complies
Spurious Emissions at Antenna Terminals	2.1046(a), 90.210	Complies
Field Strength of Spurious Radiation	2.1053(a), 90.210	Complies
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 90.210	Complies
Frequency Stability vs. Temperature and Voltage	2.1055, 90.213	Complies
Modulation Characteristics	2.1047(a)(b)	Complies
Transient Frequency Response	90.214	Complies

2 General Information

The following Type Certification Report is prepared on behalf of **4RF Communications, Ltd.**in accordance with the Federal Communications Commission Rules and Regulations. The Equipment Under Test (EUT) was the **SR N400-000; FCC ID: UIPSRN0400012A.**

The radio is subject to FCC DoC. DoC testing was performed, and the data is contained in a separate DoC report.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 Parts 2 and 90. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

2.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report submitted to, and approved by, the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

2.2 Related Submittal(s)/Grant(s)

N/A

2.3 Grant Notes

N/A

2.4 Tested System Details

The test sample was received on October 23, 2011. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable. The device was programmed for multiple modes of operation and modulation types.

Models Tested	SR N400-000
Frequency Band	406.1 – 454 MHz and 456 – 470 MHz
Modulation Type	4-CPFSK
Channel Step Size	6.25 kHz
Authorized Channel Bandwidth	12.5 kHz
Primary Power	10 to 30 VDC
Rated Transmitter Output Power	37.0 dBm
Duty Cycle	Continuous 100%

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model Number	Part Number	FCC ID	RTL Bar Code
SR Radio	4RFCommunications Limited	SR N400-000	APSR-N400-012-SO-12-ETAA	UIPSRN0400012A	20455
SR Radio	4RFCommunications Limited	SR N400-000	APSR-N400-012-SO-12-ETAA	UIPSRN0400012A	20456

Table 2-2: Ports and Cabling (EUT)

Port	Cable Type	Quantity	Length (meter)	Shield
DC Power	10 AWG	1	1.8	No
RF Output	TNC	1	N/A	N/A
2 – Ethernet	RJ-45	4	1.8	No
Mgmt	Micro USB	1	N/A	No
Mgmt	USB	1	N/A	No
Serial	RJ-45	1	N/A	No

Table 2-3: Support Equipment

Part	Manufacturer	Model	PN/SN	RTL Bar Code
Laptop Computer	Sony	Vaio	27524632-3042604	N/A
Ethernet Router	Netgear	FS608 v2	FS 69144 CB140109	N/A
USB Mouse	Dell	M056U0	407027597	N/A
Power Supply	Samlex America	SEC 1223	03061-3J04-00763	N/A
Power Supply	Hewlett Packard	6024A	N/A	N/A
Laptop Computer	Dell	Vostro	0G2R51	N/A

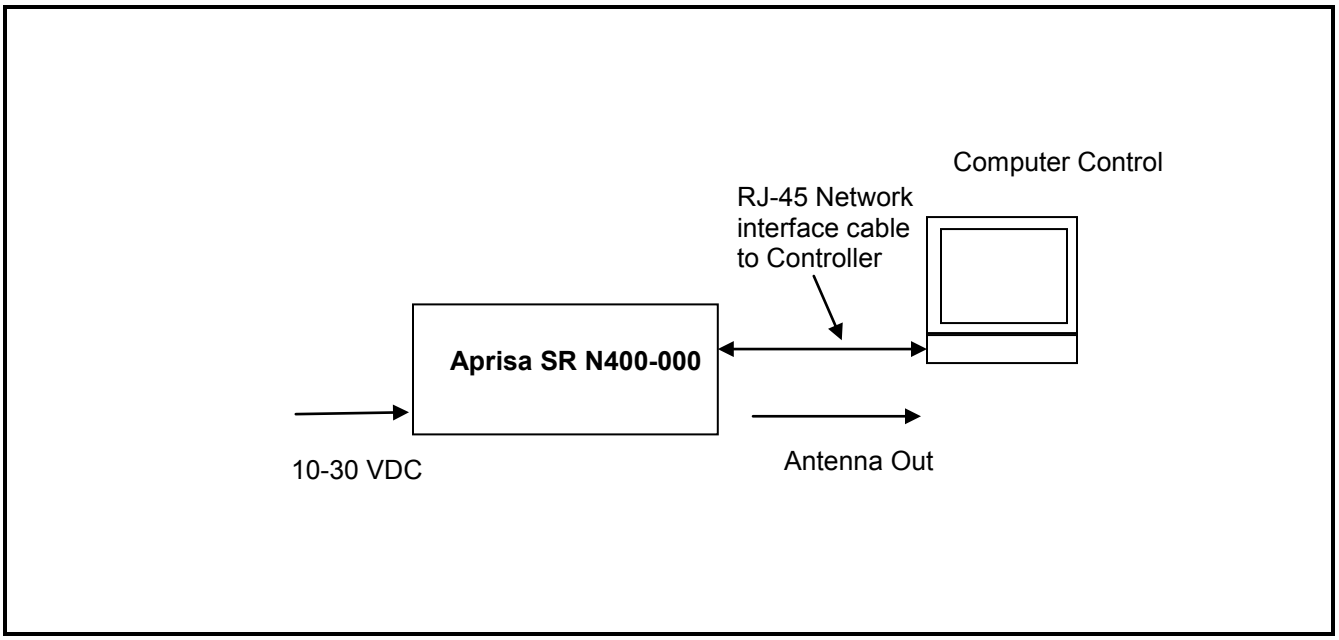


Figure 2-1: Configuration of Tested System

3 FCC Rules and Regulations Part 2.1033(C)(8) Voltages and Currents Through The Final Amplifying Stage

10 VDC / 1.71 A
13.8 VDC / 1.38 A
30 VDC / 0.55 A

4 FCC Rules and Regulations Part 2.1046(a): RF Power Output: Conducted, Part 90.205 Transmitting Power Limits

4.1 Test Procedure

ANSI/TIA/EIA-603-2002, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

Manufacturer's rated power: 5 W

4.2 Test Data

Table 4-1: RF Conducted Output Power - Measured

Frequency (MHz)	Power (dBm)	Power (W)
406.10	37.3	5.4
454.00	37.1	5.1
456.00	37.1	5.1
470.00	37.0	5.0

Table 4-2: Test Equipment Used For Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	1/20/12
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	1/20/12
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	7/15/12
901537	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	CB6628	10/14/12

Test Personnel:

Daniel Baltzell	Daniel W. Baltzell	January 12, 2012
EMC Test Engineer	Signature	Date Of Test

5 FCC Rules and Regulations Part 2.1051: Spurious Emissions at Antenna Terminals; Part 90.210: Emission Limitations

5.1 Test Procedure

ANSI/TIA/EIA-603-2002, Section 2.2.13

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 modes.

5.2 Test Data

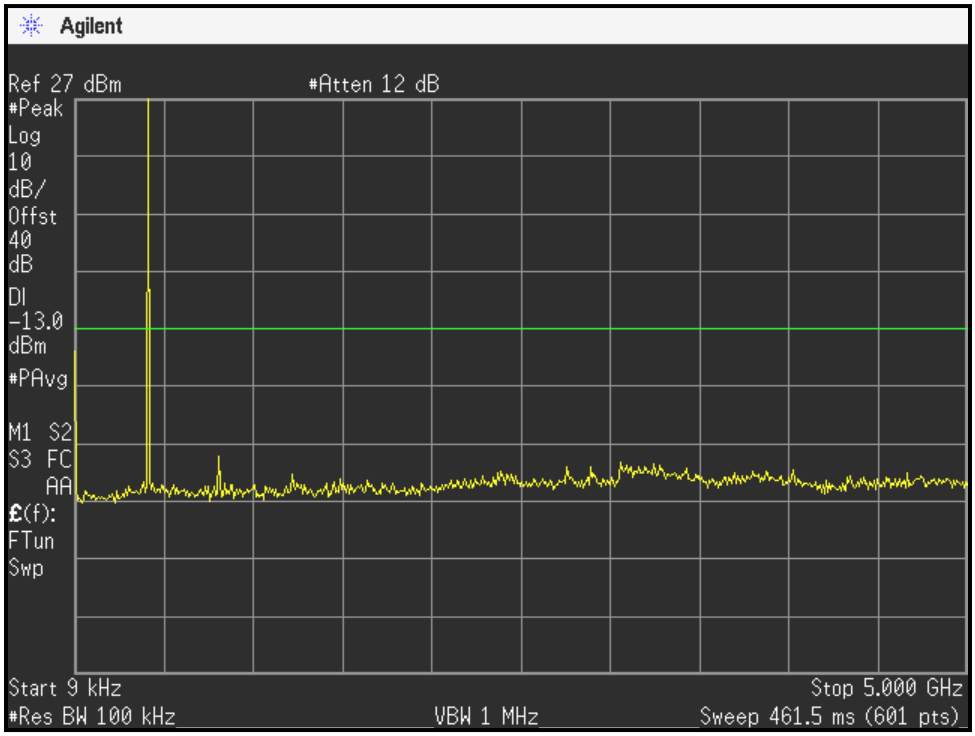
Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: (43 + 10 LOG P(W))

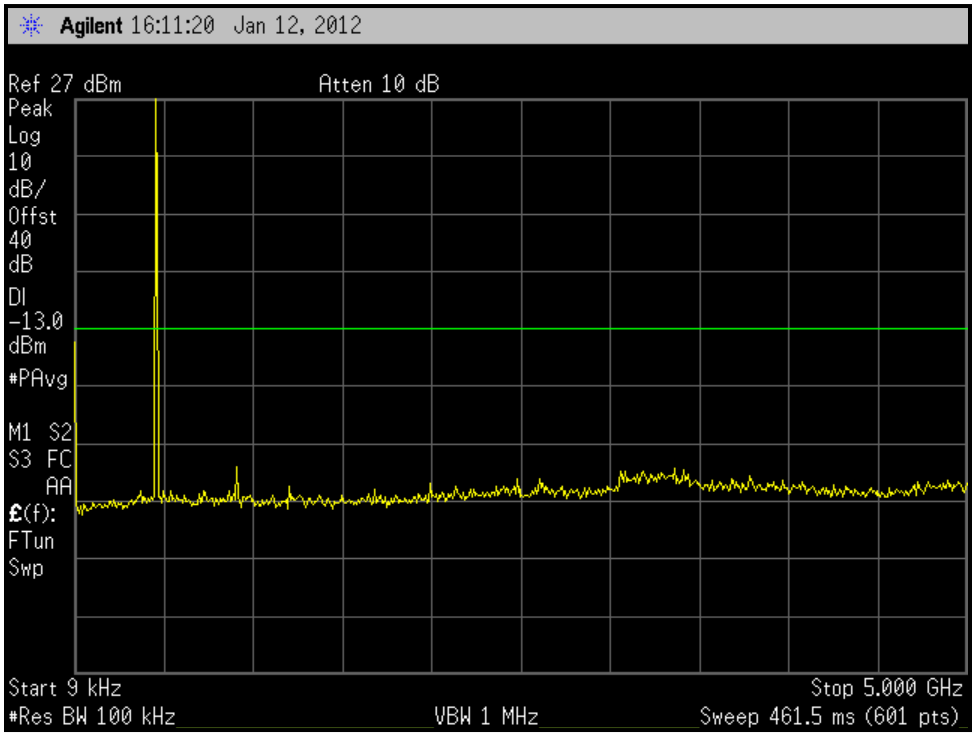
The following channels (MHz) were investigated:

406.1, 454, 456, and 470 MHz.

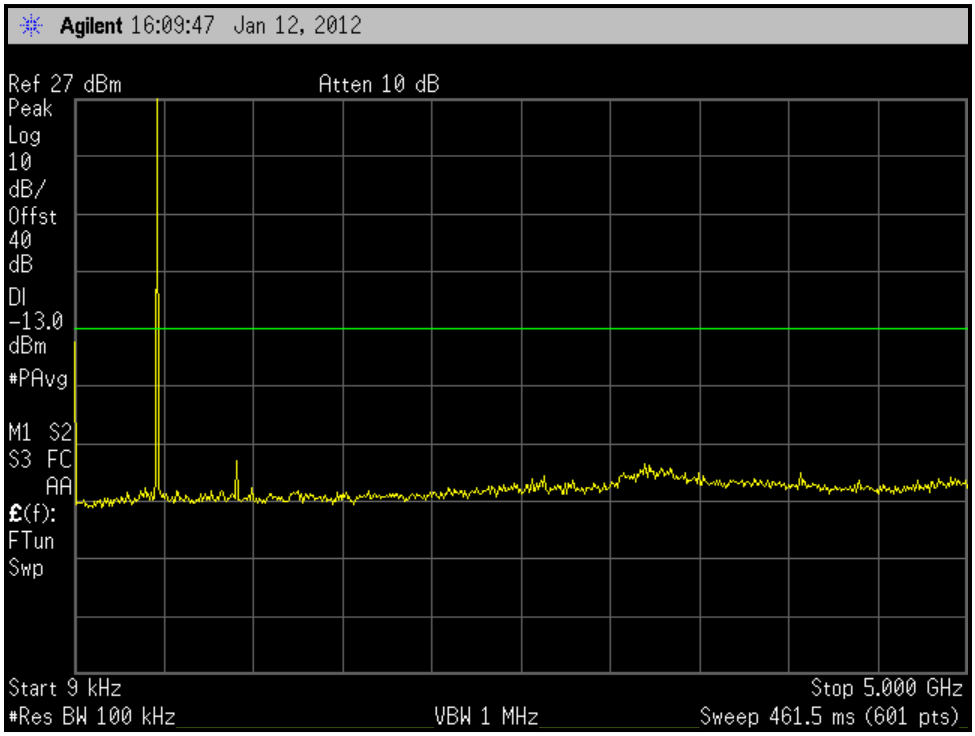
Plot 5-1: Conducted Spurious - 406.1 MHz - Analog High Power



Plot 5-2: Conducted Spurious – 454 MHz – Analog High Power



Plot 5-3: Conducted Spurious – 456 MHz – Analog High Power



Plot 5-4: Conducted Spurious – 470 MHz – Analog High Power

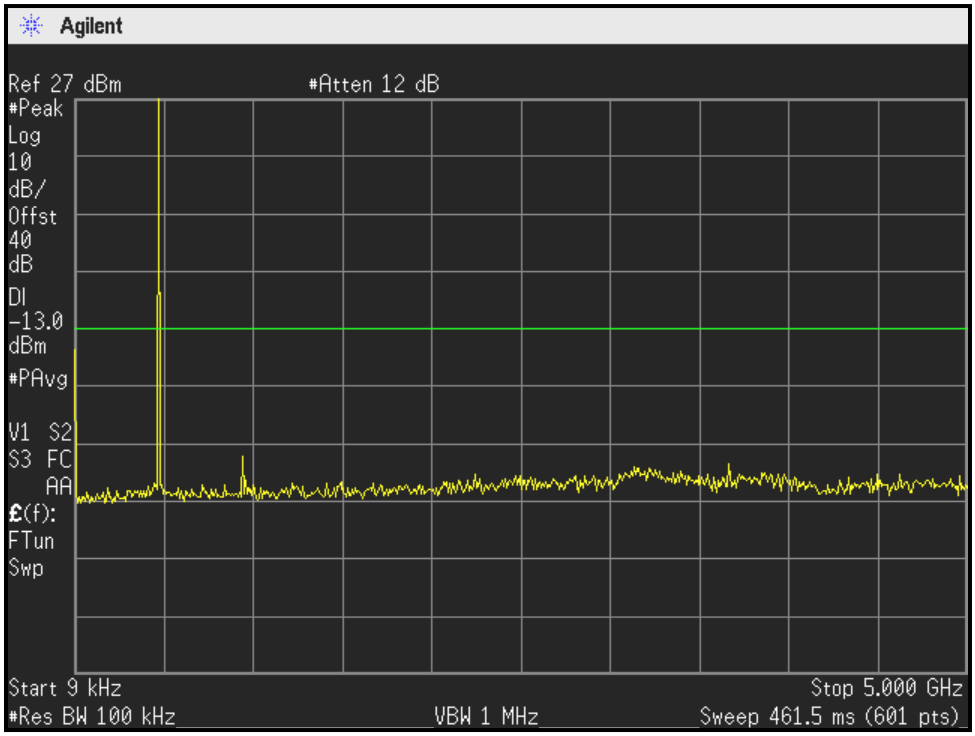


Table 5-1: Test Equipment Used For Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	4/8/12
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/14/12
901133	Par Electronics	400-460 (25W)	UHF Notch Filter	N/A	3/10/12
901537	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	CB6628	10/14/12

Test Personnel:

Daniel Baltzell		January 12, 2012
EMC Test Engineer	Signature	Date Of Test

6 FCC Rules and Regulations Part 2.1053(a): Field Strength of Spurious Radiation; Part 90 90.210 Out of Band Emissions Limit

6.1 Test Procedure

ANSI/TIA/EIA-603-2002, section 2.2.12

Analog Modulation: The transmitter is terminated with a 50 Ω load and is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz. Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 and EDACS modes.

The spurious emissions levels were measured, and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna was further corrected to a half wave dipole.

6.2 Test Data

6.2.1 CFR 47 Part 90.210 Requirements

The worst-case emissions test data are shown.

Table 6-1: Field Strength of Spurious Radiation – 406.1 MHz – Analog High Power

Frequency (MHz)	Spectrum Analyzer Level (dBuV/M)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
812.2	41.5	-71.5	0.8	1.0	108.6	-58.3
1218.3	29.1	-82.7	1.0	4.8	116.1	-65.8
1624.4	29.0	-80.8	1.2	6.7	112.6	-62.3
2030.5	21.7	-76.1	1.4	6.7	108.1	-57.8
2436.6	21.6	-70.1	1.6	7.2	101.8	-51.5
2842.7	19.7	-71.3	1.8	7.9	102.5	-52.2
3248.8	18.9	-71.1	2.0	7.0	103.4	-53.1
3654.9	12.7	-76.8	2.1	7.1	109.1	-58.8
4061.0	16.5	-70.5	2.3	7.8	102.2	-51.9

Table 6-2: Field Strength of Spurious Radiation – 454 MHz – Analog High Power

Frequency (MHz)	Spectrum Analyzer Level (dBuV/M)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
908.0	42.1	-70.6	0.9	1.3	107.3	-57.2
1362.0	25.9	-85.2	1.1	5.6	117.8	-67.7
1816.0	35.8	-68.3	1.3	6.4	100.3	-50.2
2270.0	25.7	-68.5	1.6	7.3	99.8	-49.7
2724.0	20.9	-70.3	1.8	7.8	101.4	-51.3
3178.0	18.7	-71.5	2.0	7.0	103.5	-53.4
3632.0	16.1	-73.4	2.1	7.2	105.5	-55.4
4086.0	17.2	-69.7	2.3	8.0	101.1	-51.0
4540.0	14.8	-69.9	2.4	9.0	100.4	-50.3

Table 6-3: Field Strength of Spurious Radiation – 456 MHz – Analog High Power

Frequency (MHz)	Spectrum Analyzer Level (dBuV/M)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
912.0	35.8	-76.9	0.9	1.3	113.5	-63.4
1368.0	23.0	-88.1	1.1	5.6	120.6	-70.5
1824.0	26.2	-77.7	1.3	6.4	109.7	-59.6
2280.0	22.4	-71.7	1.6	7.3	103.0	-52.9
2736.0	17.6	-73.6	1.8	7.8	104.7	-54.6
3192.0	18.0	-72.1	2.0	7.0	104.2	-54.1
3648.0	13.0	-76.5	2.1	7.1	108.6	-58.5
4104.0	15.6	-71.2	2.3	8.1	102.5	-52.4
4560.0	13.1	-71.5	2.4	9.0	102.0	-51.9

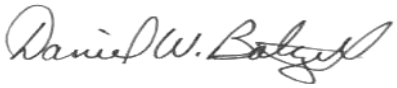
Table 6-4: Field Strength of Spurious Radiation – 470 MHz – Analog High Power

Frequency (MHz)	Spectrum Analyzer Level (dBuV/M)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
940.0	48.6	-64.0	0.8	1.5	100.3	-50.3
1410.0	22.1	-88.8	1.1	5.9	121.0	-71.0
1880.0	29.2	-73.0	1.3	6.2	105.1	-55.1
2350.0	23.1	-69.9	1.6	7.3	101.2	-51.2
2820.0	20.7	-70.3	1.8	8.0	101.1	-51.1
3290.0	16.3	-73.6	2.0	7.1	105.5	-55.5
3760.0	15.9	-73.2	2.2	7.0	105.4	-55.4
4230.0	16.2	-70.0	2.3	8.6	100.7	-50.7
4700.0	14.8	-69.1	2.4	9.0	99.6	-49.6

Table 6-5: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	1/31/13
900932	Hewlett Packard	8449B OPT H02	Preamplifier 1-26.5 GHz	3008A00505	2/22/12
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	1/13/12
900928	Hewlett Packard	83752A	Synthesized Sweeper, (0.01 - 20 GHz)	3610A00866	2/18/13
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	10/14/12
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS-09302008	RF cable, 20'	NA	10/14/12
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/14/12
901262	ETS	3160-9	Double ridged Guide Antenna (1 - 18 GHz)	6748	5/11/14
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	6/14/13
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/13

Test Personnel:



Daniel Baltzell		January 13, 2012
Test Engineer	Signature	Date Of Test

7 FCC Rules and Regulations Part 2.1049(c)(1): Occupied Bandwidth; Part 90.210 Authorized Bandwidth

Occupied Bandwidth - Compliance with the Emission Masks

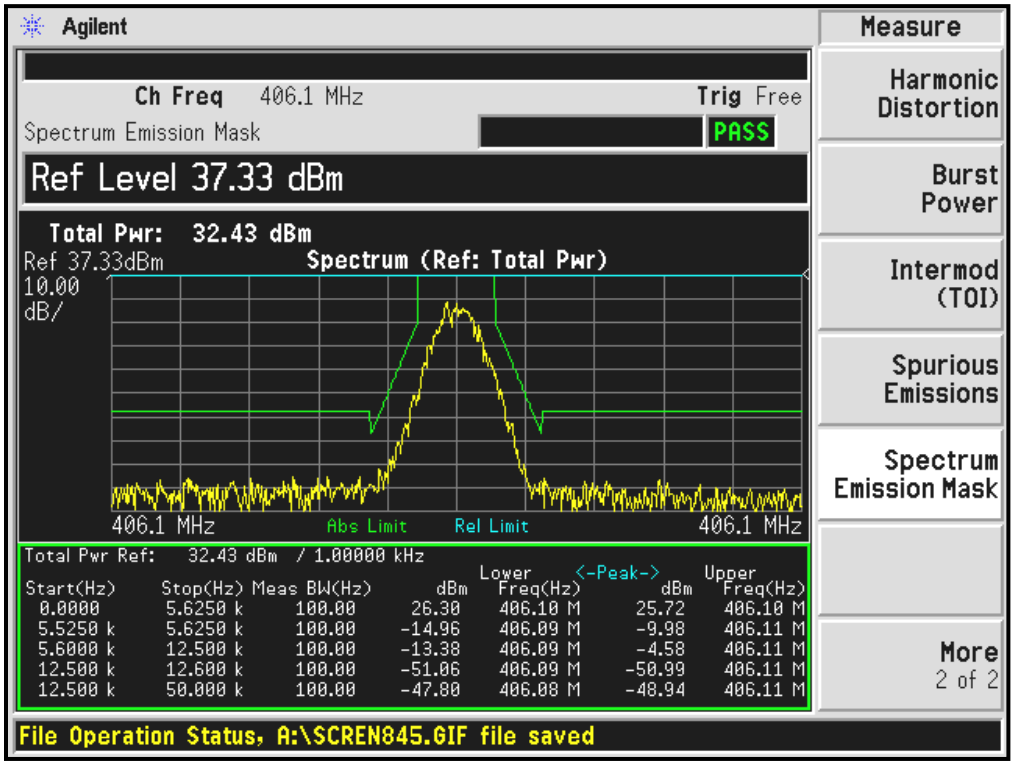
7.1 Test Procedure

ANSI/TIA/EIA-603-2002, section 2.2.11 and TIA/EIA-102.CAAA-2002 section 2.2.5

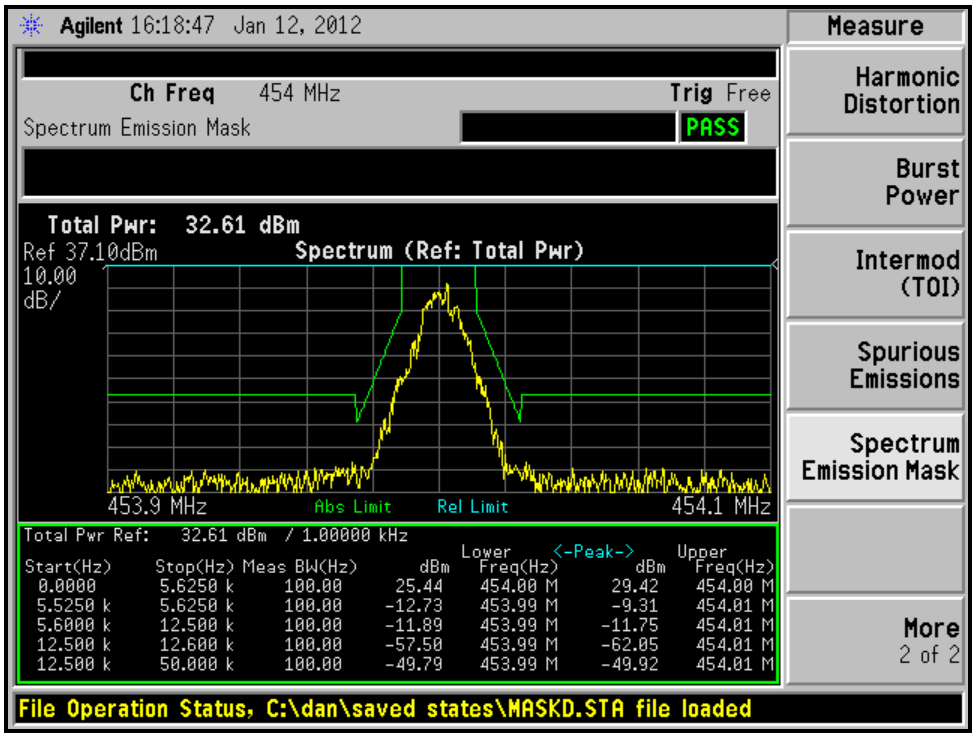
Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

7.2 Test Data

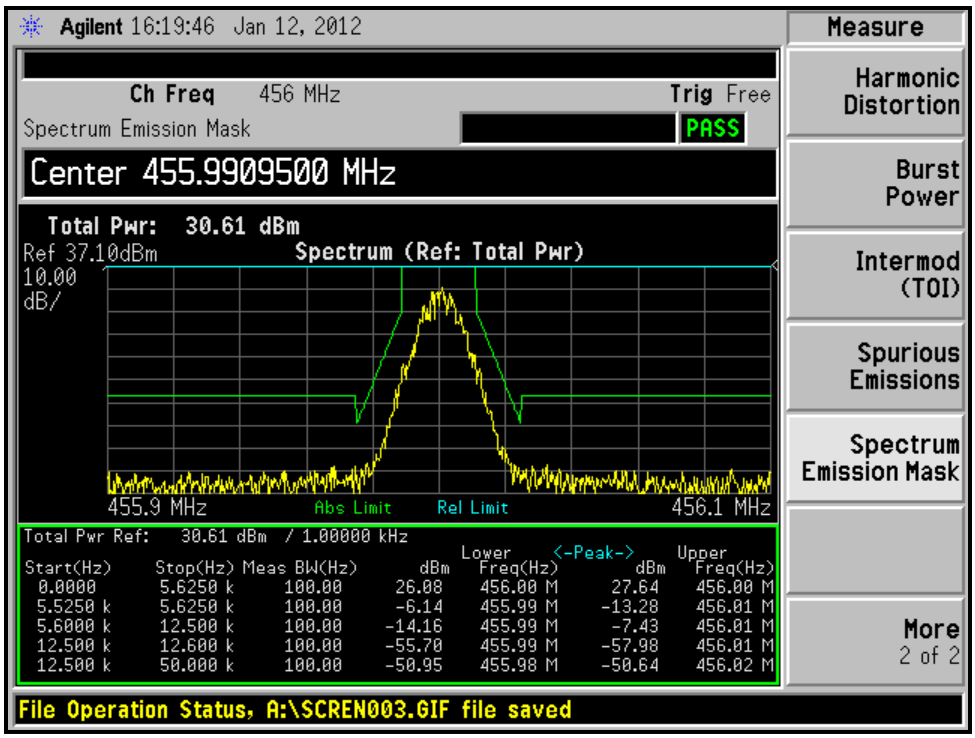
Plot 7-1: Occupied Bandwidth – 406.1 MHz (Mask D)



Plot 7-2: Occupied Bandwidth – 454 MHz (Mask D)



Plot 7-3: Occupied Bandwidth – 456 MHz (Mask D)



Plot 7-4: Occupied Bandwidth – 470 MHz (Mask D)

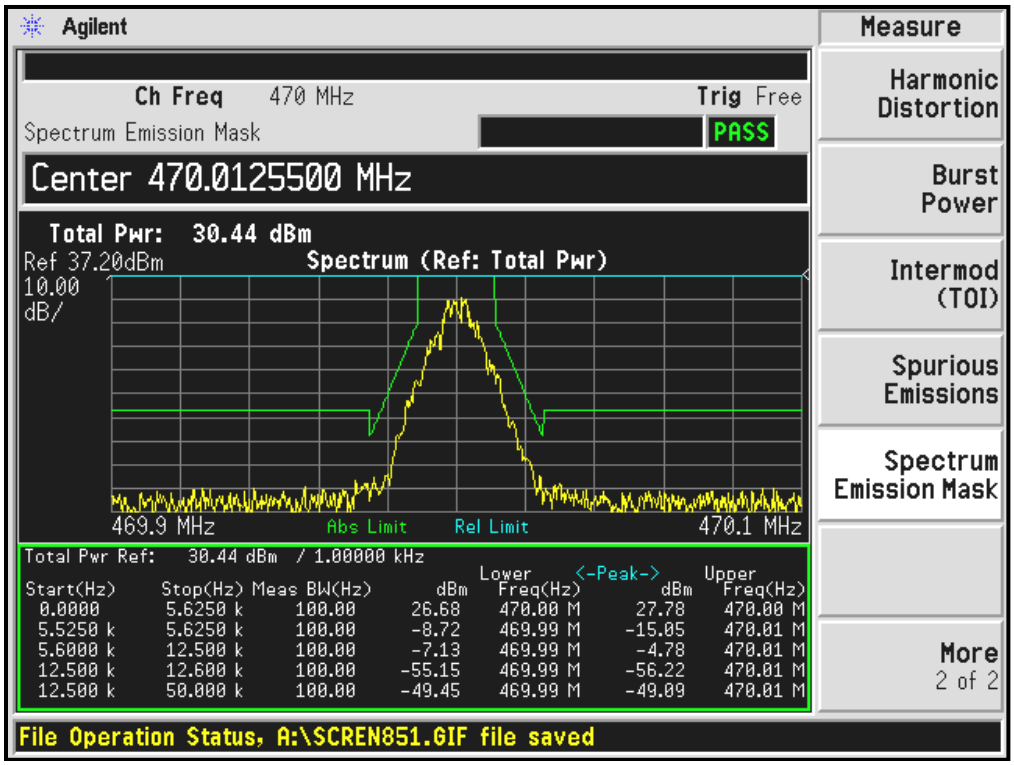


Table 7-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	4/8/12
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/14/12
901537	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	CB6628	10/14/12

Test Personnel:

Daniel Baltzell		January 12, 2012
Test Engineer	Signature	Date Of Test

8 FCC Rules and Regulation Part 2.1055: Frequency Stability; Part 90.213: Frequency Stability

8.1 Test Procedure

ANSI/TIA/EIA-603-2002, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter.

Limit: 20 kHz Authorized Bandwidth (ABW) or 25 kHz Channel Bandwidth (CBW) = 5ppm; 11.25 kHz ABW or 12.5 kHz CBW = 2.5 ppm; and 6.25 kHz ABW or CBW = 1 ppm for mobile > 2W

8.2 Test Data

Table 8-1: Temperature Frequency Stability – 406.1 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	406.099826	0.42
-20	406.099840	0.38
-10	406.099864	0.32
0	406.099797	0.49
10	406.099802	0.48
20	406.099995	0.00
30	406.099829	0.41
40	406.099816	0.44
50	406.099783	0.52

Table 8-2: Temperature Frequency Stability – 470 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	469.999676	0.67
-20	469.999748	0.52
-10	469.999752	0.51
0	469.999752	0.51
10	469.999826	0.35
20	469.999992	0.00
30	469.999894	0.21
40	469.999857	0.29
50	469.999823	0.36

Table 8-3: Voltage Frequency Stability

Voltage (DC)	406.1 MHz	406.1 MHz	470 MHz	470 MHz
10.00	406.100072	0.03	470.000146	0.07
11.73	406.100088	-0.01	470.000191	-0.02
13.80	406.100085	0.00	470.000180	0.00
15.87	406.100072	0.03	470.000176	0.01
30.00	406.100062	0.06	470.000138	0.09

The worst-case deviation was found to be 0.67 ppm.

Result: The EUT is compliant.

Table 8-4: Test Equipment Used For Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	1/13/12
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/14/12
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/14/12
901354	Meterman	37XR	Digital Multimeter	N/A	10/19/12
901300	Agilent Technologies	53131A (225 MHz)	Universal Frequency Counter	MY40001345	7/18/12

Test Personnel:

Daniel Baltzell		October 26, 2011
EMC Test Engineer	Signature	Date Of Test

9 FCC Rules and Regulations Part 90.214: Transient Frequency Response

9.1 Test Procedure

ANSI/TIA-603-C-2004 Section 2.2.3

Test Exceptions: The transmitter was unable to operate in an unmodulated mode and the plots show between t2 and t3 this unmodulated condition; this is why the plots deviate greater than when a normal unmodulated carrier is used.

When a transmitter is turned on, the radio frequency may take some time to stabilize. During this initial period, the frequency error or frequency difference (i.e. between the instantaneous and the steady state frequencies) shall not exceed the limits as follows.

Transient Frequency Behavior Channel Spacing (kHz)	Time Intervals	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	421-512 MHz
25	t1	±25	5	10
	t2	±12.5	20	25
	t3	±25	5	10
12.5	t1	±12.5	5	10
	t2	±6.25	20	25
	t3	±12.5	5	10
6.25	t1	±6.25	5	10
	t2	±3.125	20	25
	t3	±6.25	5	10

Plot 9-1: Transient Frequency Behavior – On/Off Time; 470 MHz

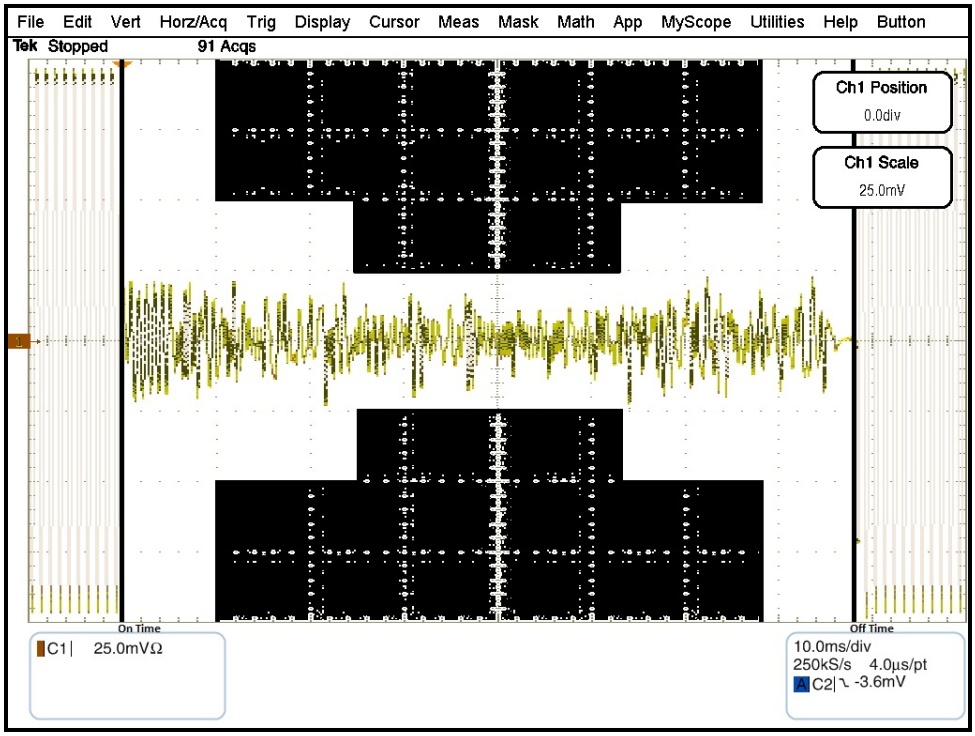


Table 9-1: Test Equipment Used For Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	10/7/12
901514	Tektronix	TDS7404B	Oscilloscope	B010161	6/28/12
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	10/20/12
900948	Weinschel	47-10-43	Attenuator DC-18 GHz 10 dB 50W	BH148.01257	2/17/12
901511	Pasternack	PE 2003	Power Divider (10 MHz - 1 GHz)	NA	N/A
901463	Werlatone Inc.	C1795	Directional Coupler, 100W, 40 dB, 1 - 1000 MHz	4067	2/18/12
901263	Agilent Technologies	.01-12 GHz	SMA Detector	2936A05505	N/A

Test Personnel:

Daniel Baltzell		November 2, 2011
Test Engineer	Signature	Date of Test

10 FCC Rules and Regulations Part 2.202: Necessary Bandwidth and Emission Bandwidth

Type of Emission: F1D

Calculation:

Date rate R = 9.6 kilobits per second
Number of state in each symbol S = 4; $Log_2S=2$
Peak deviation D = 2.5 kHz
K = 0.84
$B(n) = (R/Log_2S + 2DK) = 9$ kHz

Emission Designator: 9K00F1D

11 Conclusion

The data in this measurement report shows that the **4RF Communications Ltd, Model SR N400-000, FCC ID: UIPSRN0400012A,** complies with all the applicable requirements of Parts 2 and 90 of the FCC Rules.