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Permissive Change Application for FCC ID#GNW-21071

Industrie Canada RSS210 Reassessment Application

**EMI Test Report
and
Technical Documentation
on
Metricom, Inc.
Generation 1.2 Wired Access Point Radio
Model 21071**

Prepared by:
Metricom, Inc.
980 University Ave
Los Gatos, CA. 95030
408-399-8200

Test date(s): 13 October 1998

Schematics, block diagrams and algorithm descriptions subject to enclosed confidentiality statement

Table of Contents

Section	Title	Page
1.0	Verification of Compliance-----	3
2.0	General Information-----	4
3.0	Results Summary-----	5
4.0	Test Facilities-----	5
5.0	Test Equipment & General Test Methods-----	6
6.1	15.205 Radiated Emissions in Restricted bands-----	6
6.2	15.109 Class B Unintentional Radiated Emissions-----	8
Apdx A	Appendix A - Test data table of contents-----	10

1.0 Verification of Compliance

Description: Metricom Generation 1.2 Wired Access Point Radio
(GEN 1.2 WAP Radio)

Model Number: 21071

Serial Number(s): LG-840055ED


Applicant: Metricom Inc.

Type of Test: FCC part 15.247
Application for Permissive Change
Industrie Canada RSS-210 Reassessment

Date(s) of test: 13 October 1998

Tested By David Waitt (Metricom, Los Gatos)
Shawn McGuinness, Electronic Compliance Laboratories. (EC Labs)

The above equipment was tested by Metricom Inc. and EC Labs and found to be in compliance with the requirements set forth in Part 15 of the FCC Rules and Regulations and Industrie Canada RSS210 6.2.2.(O) governing licence-exempt low power radio communication devices.


David Waitt
Engineer
Metricom, Inc.

11-11-98
Date

2.0 General Information

Applicant: Metricom, Inc.
980 University Ave.
Los Gatos, CA. 95030

Contact Person David Waitt
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Equipment Under Test: Metricom Generation 1.2 Wired Access Point Radio (GEN 1.2 WAP Radio)

Model Number: 21071

Serial Number(s): LG-840055ED

Type of Test: Permissive Change Application for FCC ID GNW-21071
Industrie Canada RSS-210 Reassessment application

Reason for testing: Metricom has re-packaged an existing FCC Certified product, the Industrial Radio (GNW21071) into a cast aluminum enclosure used with other Metricom products (GNW 21000). The board set that is being used is the same as the circuit boards in the existing certified Industrial Radio product. The reason for this variation of the Industrial radio is that the enclosure of the current Industrial radio is not weatherproof. The cast aluminum enclosure used in the other Metricom is weatherproof. Metricom intends on installing these radios outdoors as part of the existing Mico-Cellular Data Network (MCDN)

The GEN 1.2 radio was tested with a 6 dBi "patch" antenna. This is the same antenna that is certified for use with GNW-21000, Metricom's "generic" MCDN Radio. This is the antenna that is currently use for rooftop installations

The GEN 1.2 radio is a frequency hopping spread spectrum radio-modem that operates within the 902-928 MHz band. The radio transmits and receives digital packet data at the rate of 100 kbps. The transmit power of the radio is 1 Watt. The radio is designed of communicate with MCDN microcell radios (GNW 21000) that make up the MCDN network or other industrial radios.

The GEN 1.2 radio is DC powered by 24 volts. There are two major circuit card assemblies in the unit. There are R.F. and a digital circuit cards. The digital card used in the new GEN 1.2 WAP radio is the same as the one used in the original GNW21071 radio. The RF card is the same as the one used in the GNW21000 and GNW21071 radios.

3.0 Results Summary

The following test were performed to demonstrate compliance with FCC Part 15.247 and RSS-210 6.2.2.(o). Compliance with the following Part 15 / RSS-210 regulations was verified:

Part 15 Paragraph	RSS-210 Paragraph	Test	Results (Worst Case)
15.205	6.3(c)	Radiated Emissions in Restricted bands	15.9 dB In Spec @ 3608.32 MHz
15.103	6.2.2.(o)(a)4	Class B Radiated Emissions	5.2 dB In Spec @ 112.06 MHz

4.0 Test Facilities

The following tests:

Part 15	RSS-210	
15.205	6.2.2(o)(a) 5	Radiated Emissions in Restricted bands
15.103	6.2.2.(o)(a)4	Class B Radiated Emissions

were conducted at:

Electronic Compliance Laboratories (**)
1249 Birchwood Drive
Sunnyvale, CA. 94089

(**)

A description of the sites located at EC Labs is on file at:

Federal Communications Commission
PO 429
Columbia, MD. 21045

All of the sites at EC Labs are constructed and calibrated to meet ANSI C63.4-1994 requirements.

5.0 Test Equipment & General Test Methods

Equipment:

The following test equipment was used to perform the testing

Item	Desc.	Manufacturer	Model	S/N
1.	EMI Receiver	HP	8546A	3325A00137
2.	Pre Amp	HP	8449B	3008A00527
3.	Pre-Amp	HP	8447F	3113A06829
4.	LISN	EM	ANS-25/2	2532
5.	Plotter	HP	7470A	2644V00365
6.	20 dB Pad	HP	NA	Not Req'd
7.	Spectrum Analyzer	HP	8563A	3137A01183
8.	2.0 - 4.0 GHz HPF	Laboratory	Grade	NA
9.	4.0 - 10 GHz HPF	Laboratory	Grade	NA
10.	Diagnostic Software	Metricom	MFG_CMDS	NA
11.	Spectrum Analyzer	HP	8594E	3441A01465
12.	Power Meter	HP	437B	3125U13400
13.	Power Sensor	HP	8481H	3318A16274

HP = Hewlett Packard EM = ElectroMetrics

Methods:

The Restricted Bands test was performed at the low, middle and the high portion of the 902 - 928 MHz band. These tests are typically performed on the following channels / frequencies:

Channel Frequency (MHz)

0	902.08
75	914.08
161	927.84

The Restricted Bands Emissions test required that the UUT be operated in modes that are not possible in the when the unit is in its normal mode. In this case, the UUT is put into the "Diagnostic Mode" which allows special commands to sent to the UUT.

6.0 Test Results

6.1 Radiated Emissions in Restricted bands Procedure

FCC Specification: **Paragraph 15.205**

Any emission falling within one of the restricted bands specified in 15.205 shall be below the limits specified in 15.209.

Industrie Canada Specification: **Paragraph RSS210, 6.2.3 (c)**

Except as provided in 6.2.2(o), unwanted emissions falling into restricted bands shall meet Tables 3 and 7 limits.

Procedure:

This test was conducted on a 3 meter open air test site at EC Labs. The unit was placed on a rotatable wooden table 1 meter above the ground plane. A 1 - 18 GHz Horn antenna was secured to a mast 3 meters away. The unit was tested at each of the standard test channels. The UUT was running in the diagnostic mode and set to transmit CW at maximum power on Channel 1. The test equipment was configured as shown in figure 3. The harmonics of the fundamental that fell in restricted bands (up to the tenth) were measured (See table 1 below). A high pass filter prior to the pre-amplifier was required to prevent the large signal level of the fundamental frequency from overloading the front end of the spectrum analyzer and creating harmonics within the analyzer.

The UUT was rotated 360 degrees and the height of the antenna adjusted from 1 to 4 meters above the ground plane to determine the maximum level of the emission. The level of the harmonic emission is measured in two modes, "Peak" and "Average". The spectrum analyzer reading was entered into a spread sheet where correction factors (antenna factor, cable loss, pre-amplifier gain, HPF loss...) were then applied by EC Lab's Software to obtain a final corrected measurement..

Once all the harmonics that fall in a restricted band (up to the 10th harmonic) have been examined for channel 0, the test is repeated for the remaining two standard test channels.

CHAN (MHz)	HARMONICS							
	3	4	5	6	7	8	9	10
902.24	2706.24	3608.32	4510.40	5412.48	X	X	8118.72	9020.80
914.08	2742.24	3656.32	4570.40	x	x	7312.64	8226.72	9140.80
927.84	2783.52	3711.36	4639.20	x	x	7422.72	8350.56	x

Table 1: 15.205 Harmonic test table

NOTE: X means that this harmonic does NOT fall within a restricted band, it is therefore subject to the limits of 15.209, NOT 15.205

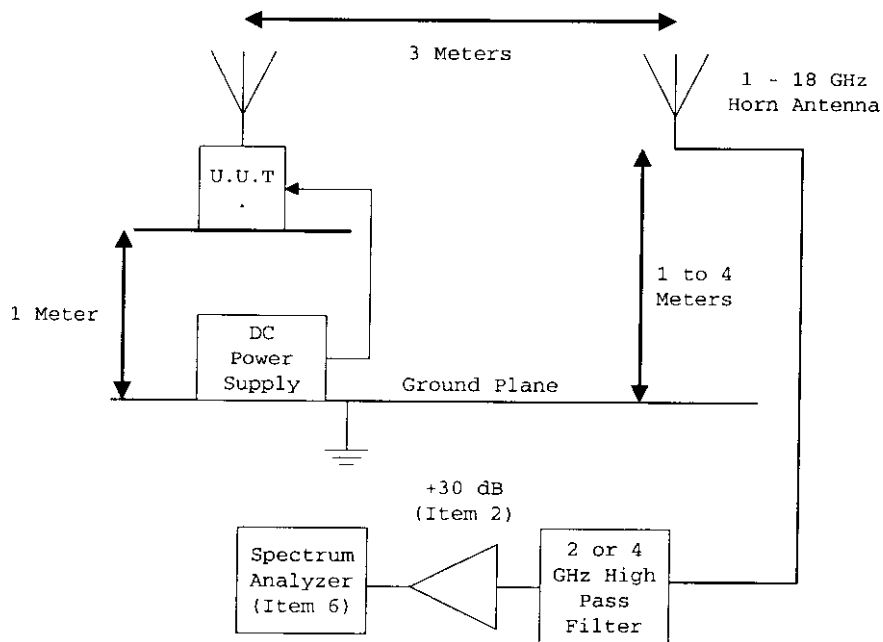


Figure 3: Radiated Emissions in Restricted Bands Test Setup

Results:

There were some harmonic emissions detected during the test. In the case of the "PEAK" measurement the RBW and VBW were always set to 1 MHz. The "AVG" test was conducted with the RBW and VBW set to 10 kHz maximum. There were some cases where an emission was not visible using these 10k/10k bandwidth settings. These cases are marked by an asterisk (*) in the N.F. (Noise Floor) column of the data sheet.

The data sheet showing the emission levels that were measured is contained in appendix A, sheet 1.

6.2 Class B Unintentional Radiated Emissions

FCC Specification: Paragraph 15.103

The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

FREQ (MHz)	Field Strength (uV/M)
30->88	100
88->216	150
216->960	200
Above 960	500

Industrie Canada Specification: Paragraph RSS210, 6.2.2.(o)(a)4

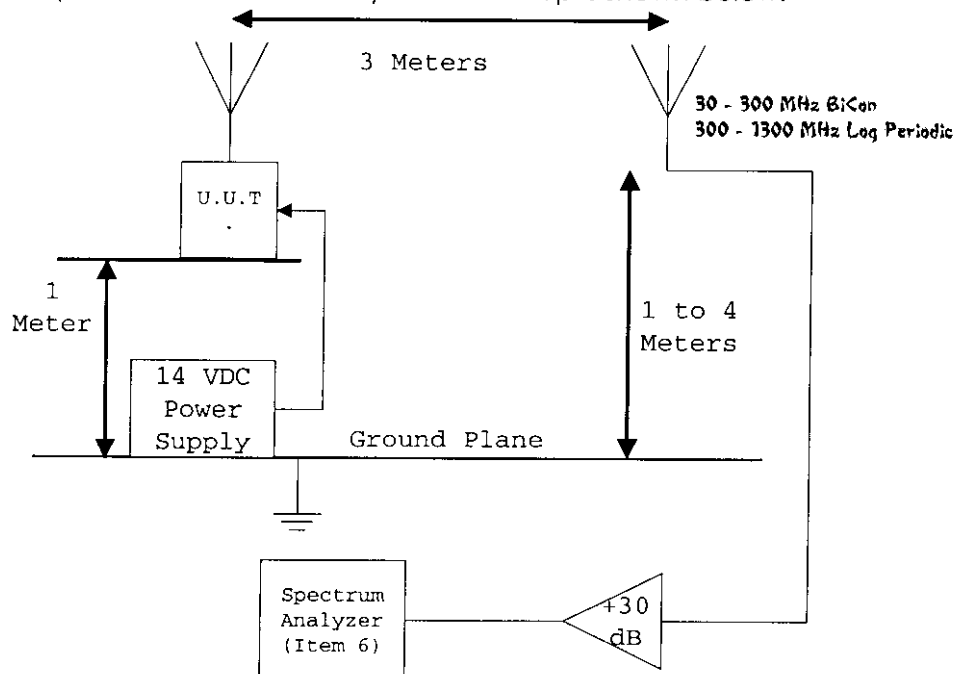
In any 100 kHz bandwidth outside the operating frequency bands, between 30 MHz and 5 times the carrier frequency, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in Table 3, whichever is less stringent.

FUNDAMENTAL FREQ (MHz)	FIELD STRENGTH microvolts/metre (watts) #	MEASUREMENT DISTANCE (metres) #
30-88	100 (3 nW), Note 1	3
88-216	150 (6.8 nW), Note 1	3
216-960	200 (12 nW), Note 1	3
Above 960 MHz	500 (75 nW)	3

(RSS-210 Table 3)

Procedure

This was performed on the 3-meter open-air test site located at EC Labs with the UUT running normal operating software. The band from 30 MHz to 1 GHz was examined using a BiConical and Log Periodic antenna. The UUT was put on the OATS turntable, and powered up in normal operating mode. The entire 30 MHz to 1 GHz band was examined in small segments for each of the 3 types of test antennas. There was, of course, a lot of background "noise" present (TV, broadcast radio,.....) so the turn-table was rotated and the spectrum analyzer closely watched for any signals that appear to coincide with the table movement. In some cases the unit under test was powered off to see if the emission disappeared (it was from the unit under test) or if it remains (it is from another source). The test setup is shown below.



Results:

The worst case radiated emission between 30 MHz and 1 GHz was at 112.006 MHz and was at a level of 38.3dBuV @ 3 Meters. This is 5.2 dB within the specification using a Quasi Peak Detector. The tables showing the levels of the emissions is contained in Appendix A on page 2

Appendix A

Data for Metricom, Inc.

FCC Part 15 Permissive Change Application for GNW-21071

Industrie Canada RSS-210 Reassessment Application

Appendix Table of Contents

<u>Description</u>	<u>Sheet</u>
Radiated Emissions in Restricted Bands.....	1
Class B Unintentional Radiated Emissions	2
Appendix B, Technical Documentation, Table of Contents.....	3

EUT: ICR900 w/ Gen1.1 Enclosure **CUSTOMER NAME:** METRICOM
RULE PART: FCC PART 25.247 **WORK ORDER:** 8101301
FILE: 8101301a
ANTENNA: HORN **ATTN dB:** 0
POLARIZATION: VERTICAL **DUTY dB:** 0
MODULATION TYPE: **HP IL dB:** 0
TESTED BY: SHAWN **DIST dB:** 0
COMMENT: S/N LG-840055ED

FREQ. MHz	READING dB(uV)	NF	Pk or Av	A.F. dB	Cbl dB	FLTR dB	AMP dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB	BW Settings
Ch 0 / 902.08 MHz											
2706.24	44.80		Pk	28.6	-5.3	-0.4	35.6	43.5	74.0	-30.5	R1M/V1M
2760.24	34.00		Avg	28.6	-5.3	-0.4	35.5	32.8	54.0	-21.2	R10K/V10K
3608.32	42.80		Pk	32.4	-6.2	-0.4	35.1	46.7	74.0	-27.3	R1M/V1M
3608.32	34.20		Avg	32.4	-6.2	-0.4	35.1	38.1	54.0	-15.9	R10K/V10K
4510.40	44.60	*	Pk	32.8	-7.0	-0.4	35.1	49.7	74.0	-24.3	R1M/V1M
4510.40	34.10		Avg	32.8	-7.0	-0.4	35.1	39.2	54.0	-14.8	R10K/V10K
5412.48	43.00	*	Pk	33.6	-8.1	-0.4	35.0	50.1	74.0	-23.9	R1M/V1M
5412.48	33.70	*	Avg	33.6	-8.1	-0.4	35.0	40.8	54.0	-13.2	R10K/V10K
8118.72	42.00	*	Pk	37.0	-11.4	-0.4	35.5	55.3	74.0	-18.7	R1M/V1M
8118.72	28.50	*	Avg	37.0	-11.4	-0.4	35.5	41.8	54.0	-12.2	R10K/V10K
9020.80	40.00	*	Pk	37.8	-12.1	-0.4	35.5	54.8	74.0	-19.2	R1M/V1M
9020.80	28.00	*	Avg	37.8	-12.1	-0.4	35.5	42.8	54.0	-11.2	R10K/V10K
CH 75 / 914.08 MHz											
2742.24	44.50		Pk	28.6	-5.3	-0.4	35.5	43.3	74.0	-30.7	R1M/V1M
2742.24	35.30		Avg	28.6	-5.3	-0.4	35.5	34.1	54.0	-19.9	R10K/V10K
3656.32	42.70		Pk	32.4	-6.2	-0.4	35.1	46.6	74.0	-27.4	R1M/V1M
3656.32	32.20		Avg	32.4	-6.2	-0.4	35.1	36.1	54.0	-17.9	R10K/V10K
4570.40	40.80	*	Pk	32.8	-7.0	-0.4	35.1	45.9	74.0	-28.1	R1M/V1M
4570.40	29.80	*	Avg	32.8	-7.0	-0.4	35.1	34.9	54.0	-19.1	R10K/V10K
7312.64	41.80	*	Pk	36.0	-10.6	-0.4	35.4	53.4	74.0	-20.6	R1M/V1M
7312.64	31.00	*	Avg	36.0	-10.6	-0.4	35.4	42.6	54.0	-11.4	R10K/V10K
8226.72	40.30	*	Pk	37.0	-11.4	-0.4	35.5	53.6	74.0	-20.4	R1M/V1M
8226.72	30.30	*	Avg	37.0	-11.4	-0.4	35.5	43.6	54.0	-10.4	R10K/V10K
9140.80	38.50	*	Pk	37.8	-12.1	-0.4	35.5	53.3	74.0	-20.7	R1M/V1M
9140.80	29.50		Avg	37.8	-12.1	-0.4	35.5	44.3	54.0	-9.7	R10K/V10K
CH 161 / 927.84 MHz											
2783.52	44.00		Pk	28.6	-5.3	-0.4	35.5	42.8	74.0	-31.2	R1M/V1M
2783.52	32.80		Avg	28.6	-5.3	-0.4	35.5	31.6	54.0	-22.4	R10K/V10K
3711.36	42.30		Pk	32.4	-6.2	-0.4	35.1	46.2	74.0	-27.8	R1M/V1M
3711.36	30.30		Avg	32.4	-6.2	-0.4	35.1	34.2	54.0	-19.8	R10K/V10K
4639.20	42.20	*	Pk	32.8	-7.0	-0.4	35.1	47.3	74.0	-26.7	R1M/V1M
4639.20	29.00	*	Avg	32.8	-7.0	-0.4	35.1	34.1	54.0	-19.9	R10K/V10K
7422.72	40.80	*	Pk	36.0	-10.6	-0.4	35.4	52.4	74.0	-21.6	R1M/V1M
7422.72	30.80	*	Avg	36.0	-10.6	-0.4	35.4	42.4	54.0	-11.6	R10K/V10K
8350.56	40.60	*	Pk	37.0	-11.4	-0.4	35.4	54.0	74.0	-20.0	R1M/V1M
8350.56	30.30	*	Avg	37.0	-11.4	-0.4	35.4	43.7	54.0	-10.3	R10K/V10K

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA

Radiated Emissions
Frequency range: 30MHz-1000MHz

3 Meter Open Site
Site Calibrated: June 1997

Government Agency and Limit: FCC Class B

QP = Quasi-Peak Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak

Customer: METRICOM Operator: SHAWN
Date: 10-13-1998 Time: 10:00:41
Temperature Range: 68 Deg F Percent Humidity: 62
E.U.T.: ICR900 W/ GEN1.1 ENCLOSURE
Serial Number: LG-840055ED
Support Devices:
Serial Number:
FCC ID:
Exercise Program:
Modifications: None
Report File Name: F:\TESTDATA\8101301.RF

Antenna Type: BICONICAL

TEST FREQ	TEST dBuV	ACTUAL dBuV/m	CLASS B LIMIT	VERSUS B LIMIT	TABLE DEGREES	ANTENNA HEIGHT	POLAR- IZATION	DETECTOR Type
112.006	52.0	40.1	43.5	-3.4	90	1.5	V	PK
112.006	50.2	38.3	43.5	-5.2	90	1.5	V	QP
144.040	45.9	36.3	43.5	-7.2	90	2.0	V	PK
272.006	43.0	36.8	46.0	-9.2	45	2.0	H	PK
256.000	39.0	31.7	46.0	-14.3	45	2.0	H	PK
240.000	41.2	33.7	46.0	-12.3	45	2.0	H	PK
224.000	39.6	31.9	46.0	-14.1	45	2.0	H	PK
160.056	44.2	35.2	43.5	-8.3	45	2.0	H	PK
144.000	48.6	39.0	43.5	-4.5	45	2.0	H	PK
144.000	46.5	36.9	43.5	-6.6	45	2.0	H	QP
112.000	46.8	34.9	43.5	-8.6	75	2.0	H	PK

CHANGED ANTENNA TO LOG PERIODIC

304.000	44.8	36.0	46.0	-10.0	90	2.0	V	PK
336.000	44.6	35.5	46.0	-10.5	150	2.5	V	PK
422.000	35.0	27.8	46.0	-18.2	150	2.5	V	PK
336.000	40.1	31.1	46.0	-14.9	200	2.0	H	PK
304.000	47.2	38.4	46.0	-7.6	220	2.0	H	PK

PAGE 1

Appendix B

Additional Data
for
Metricom, Inc.

FCC Part 15 Permissive Change Application
for GNW-21071

Industrie Canada RSS-210 Reassessment Application

Appendix Table of Contents

<u>Description</u>	<u>Sheet</u>
Test setup photographs, Product Photographs.....	Sec B1
ICR 900 Assembly Drawing.....	Sec B2
ICR 900 Assembly Drawing showing FCC label placement.....	Sec B3
ICR 900 FCC label drawing.....	Sec B4