

Maiden Rock Communications

ADDENDUM TO TEST REPORT 95510-15

Packet Data Radio
Model: MRC565-47-50

Tested To The Following Standards:

FCC Part 90I

Report No.: 95510-15A

Date of issue: July 18, 2014



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Maiden Rock Communications
586 Double Arrow Road
Seeley Lake, MT 59868

REPORT PREPARED BY:

Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

REPRESENTATIVE: Fred Cleveland
Customer Reference Number: CKC 04152014

Project Number: 95510

DATE OF EQUIPMENT RECEIPT:

April 14, 2014

DATE(S) OF TESTING:

April 14 -16, 2014

Revision History

Original: Testing of Packet Data Radio Model: MRC565-47-50 to FCC Part 90I.

Addendum A: To correct the test conditions for section 2.1046 / 90.205 RF Power Output and to correct the test equipment and test conditions for section 2.1053 / 90.210(c) Field Strength of Spurious Radiation.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink that reads "Steve Behm".

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Bothell, WA 98021-4413

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.00.14

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Bothell	US0081	SL2-IN-E-1145R	3082C-1	318736	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part(s) 2 / 90I

Test Procedure/Method	Description	Results
2.1046 / 90.205	RF Power Output	Pass
2.1047	Modulation Characteristics	NA ¹
2.1049 / 90.209	Occupied Bandwidth	Pass
2.1051 / 90.210(c)	Spurious Emissions at Antenna Terminals	Pass
2.1053 / 90.210(c)	Field Strength of Spurious Radiation	Pass
2.1055 / 90.213	Frequency Stability	Pass

NA¹ = Not applicable. See the section in the report for the reason.

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Packet Data Radio

Manuf: Maiden Rock Communications

Model: MRC565-47-50

Serial: 1007

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Laptop

Manuf: Dell

Model: Inspiration N5110

Serial: 56ZMQR1

EUT power Supply

Manuf: Precision

Model: 1901

Serial: None

30dB Attenuator

Manuf: BIRD

Model: 50-A-FFN-30

Serial: None

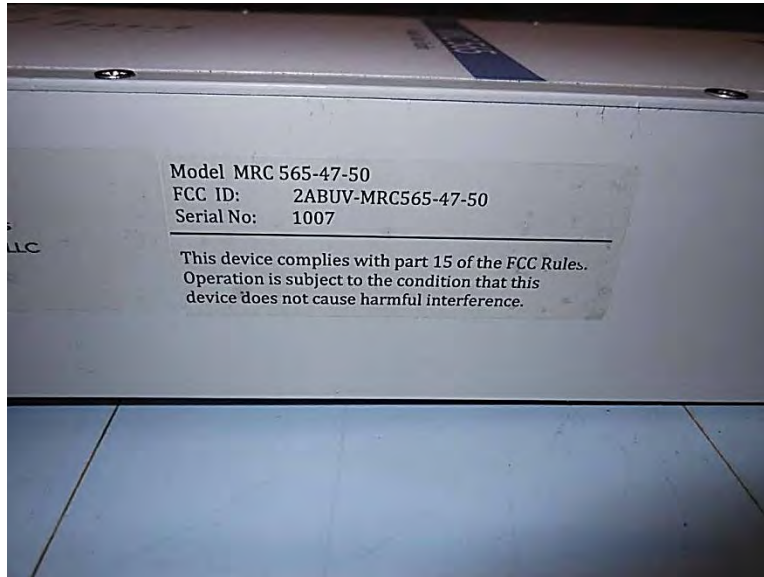
10 dB Attenuator 50 Ohm

Manuf: None

Model: None

Serial: None

General Setup Photo



FCC PART(S) 2 / 90I

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) requirements for 47 CFR Part 2: Frequency Allocations and Radio Treaty Matters, General Rules and Regulations and Licensed Device falling under Part 90: Private Land Mobile Radio Services.

2.1046 / 90.205 RF Power Output

Test Equipment					
Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
P05749	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05759	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05979	Attenuator	40-6-34	Weinschel	2/13/2014	2/13/2016
P06505	Cable	32026-29080-29080-84	Astrolab	10/18/2013	10/18/2015
2871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015

Test Conditions / Setup

TX OUTPUT POWER

Customer:	Maiden Rock Communications		
WO#:	95510		
Date:	14-Apr-14		
Test Engineer:	S. Pittsford		
Test Specification	2.1046/90.205		
Device Model #:	MRC565-47-50		
Operating Voltage:	12	VDC	
Power Limit	300	Watts	
	54.7	dBm	

Channel	Frequency	Power (dBm)	Result
Low BPSK	47MHz	50.5	PASS
Mid BPSK	48.5MHz	50.4	PASS
High BPSK	50MHz	50.2	PASS
Low GMSK	47MHz	50.5	PASS
Mid GMSK	48.5MHz	50.4	PASS
High GMSK	50MHz	50.2	PASS

Temp: 21°C

Humidity: 32%

Pressure: 102.6kPa

EUT is located on a table.

EUT is connected to a support laptop through a CAT 5 cable.

Antenna port is connected to the Spectrum analyzer through 45.6dB of attenuation.

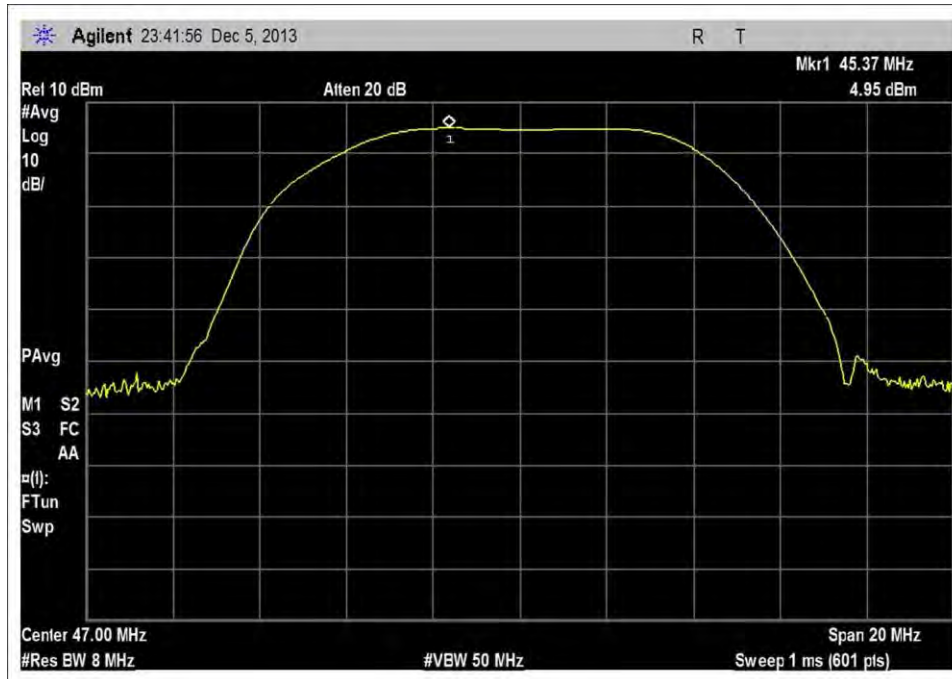
The measured power in the table has this 45.6dB of measurement system loss added to the plot readings.

EUT is connected to a DC power supply.

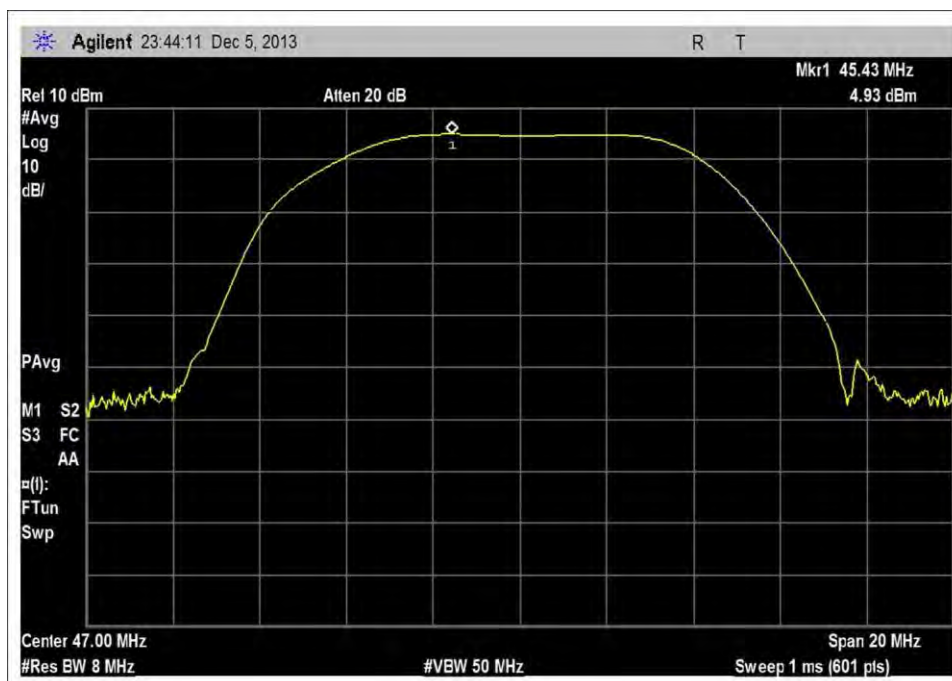
EUT will be in transmit mode.

Testing performed per TIA-603C

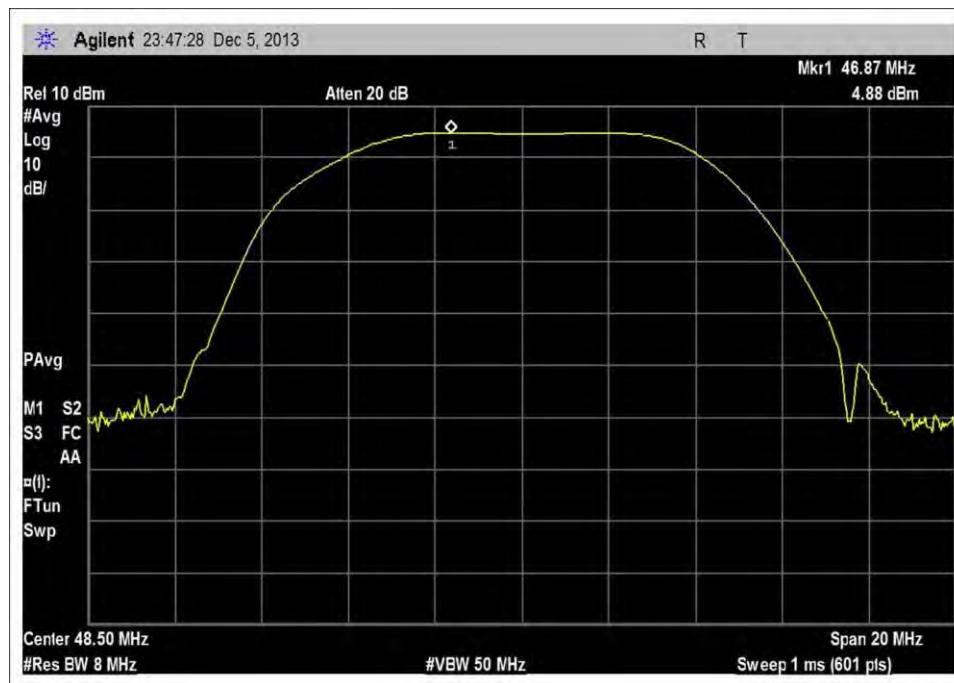
Test Data



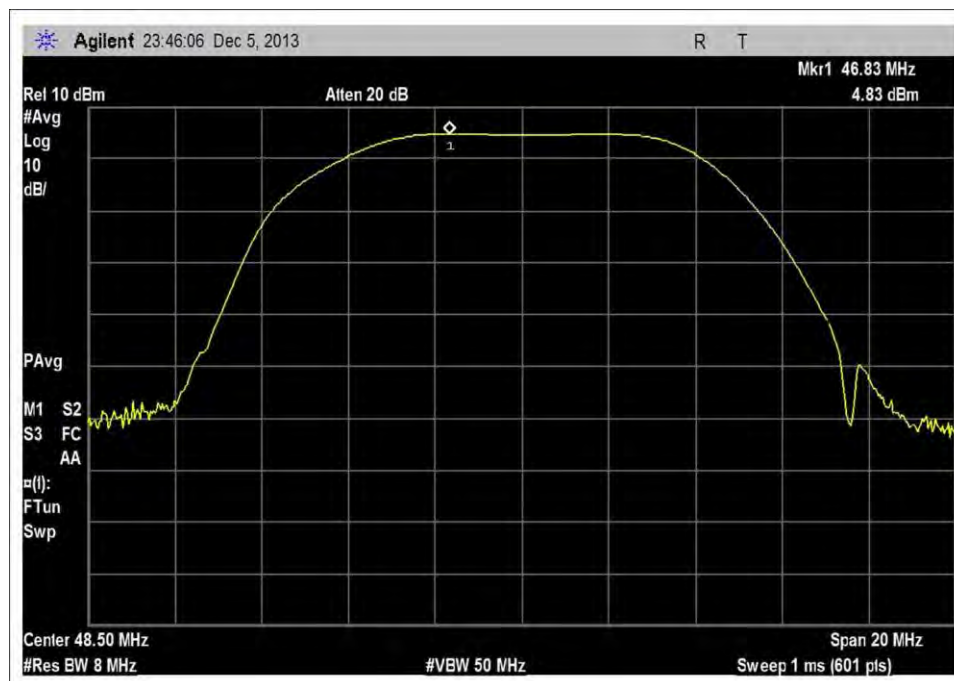
47MHz, BPSK



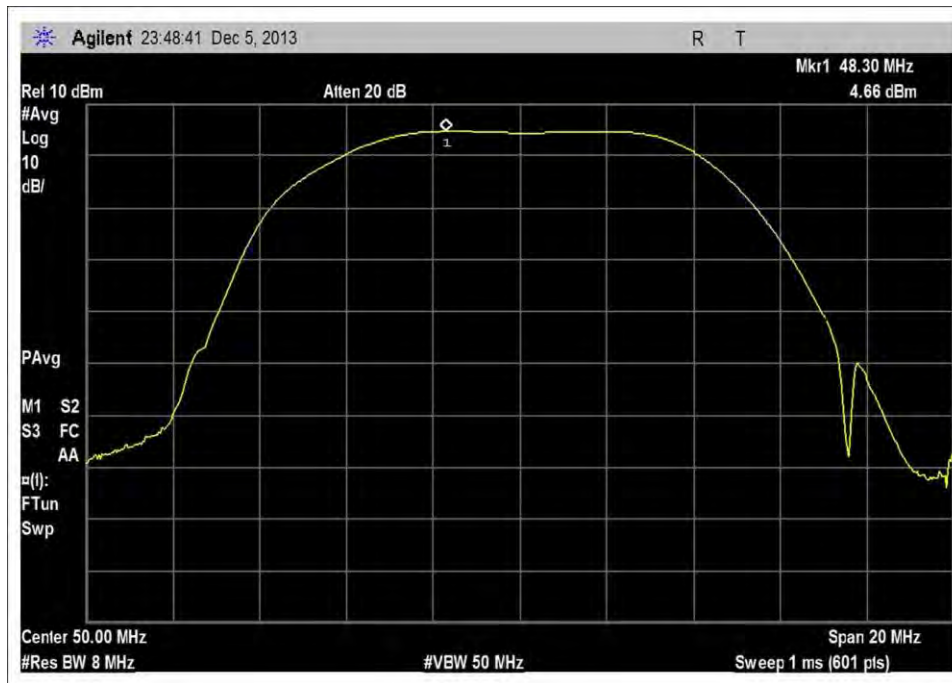
47MHz, GMSK



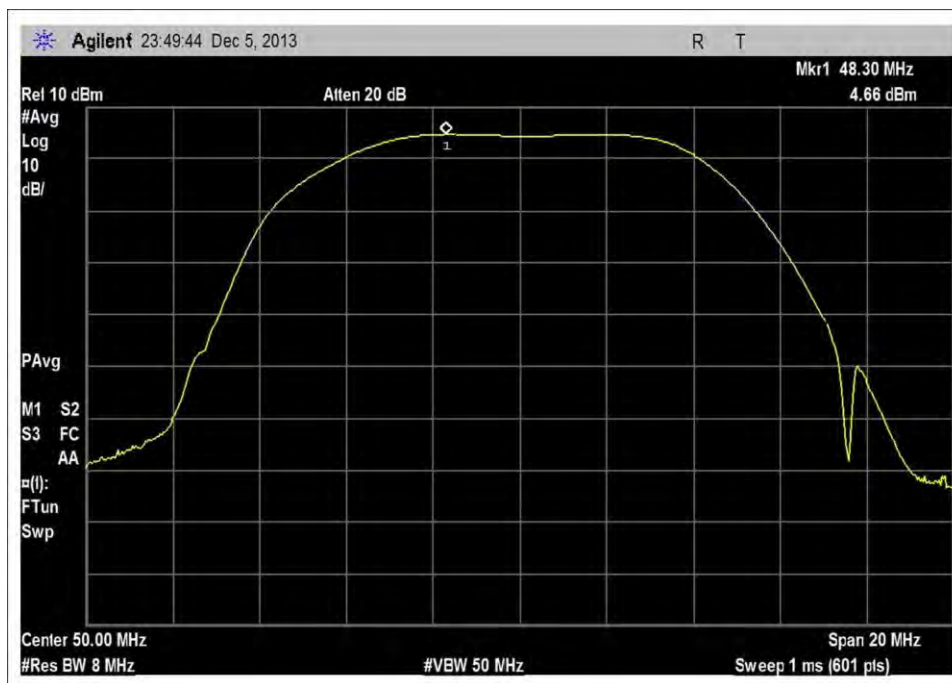
48.5MHz, BPSK



48.5MHz, GMSK



50MHz, BPSK



50MHz, GMSK

Test Setup Photo



2.1047 Modulation Characteristics

Not applicable because the software that generates the digital modulation types emitted by the EUT implements modulation limiting.

2.1049 / 90.209 Occupied Bandwidth

Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
P05749	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05759	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05979	Attenuator	40-6-34	Weinschel	2/13/2014	2/13/2016
P06505	Cable	32026-29080-29080-84	Astrolab	10/18/2013	10/18/2015
2871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015

Test Conditions / Setup

BW Limitations

Customer:	Maiden Rock Communications
WO#:	95510
Date:	14-Apr-14
Test Engineer:	S. Pittsford
Test Specification	2.1049/90.209
Device Model #:	MRC565-47-50
Operating Voltage:	12 VDC
BW Limit	20 kHz

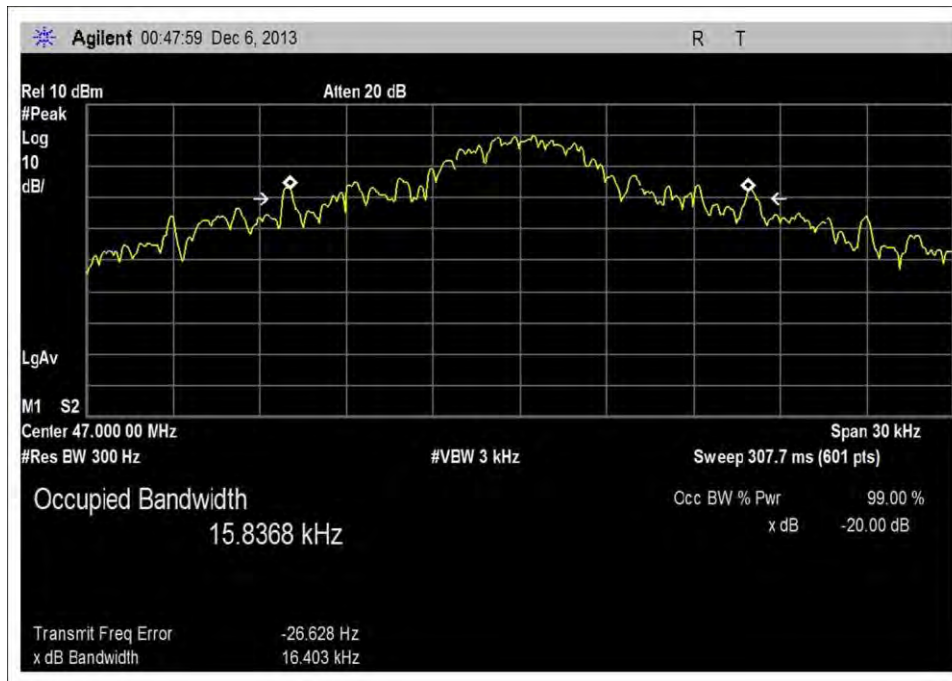
Channel	Frequency	BW (kHz)	Result
Low BPSK	47MHz	16.4	PASS
Mid BPSK	48.5MHz	16.28	PASS
High BPSK	50MHz	16.38	PASS
Low GMSK	47MHz	11.21	PASS
Mid GMSK	48.5MHz	11.99	PASS
High GMSK	50MHz	11.59	PASS

Temp: 24°C
Humidity: 31%
Pressure: 102.3kPa

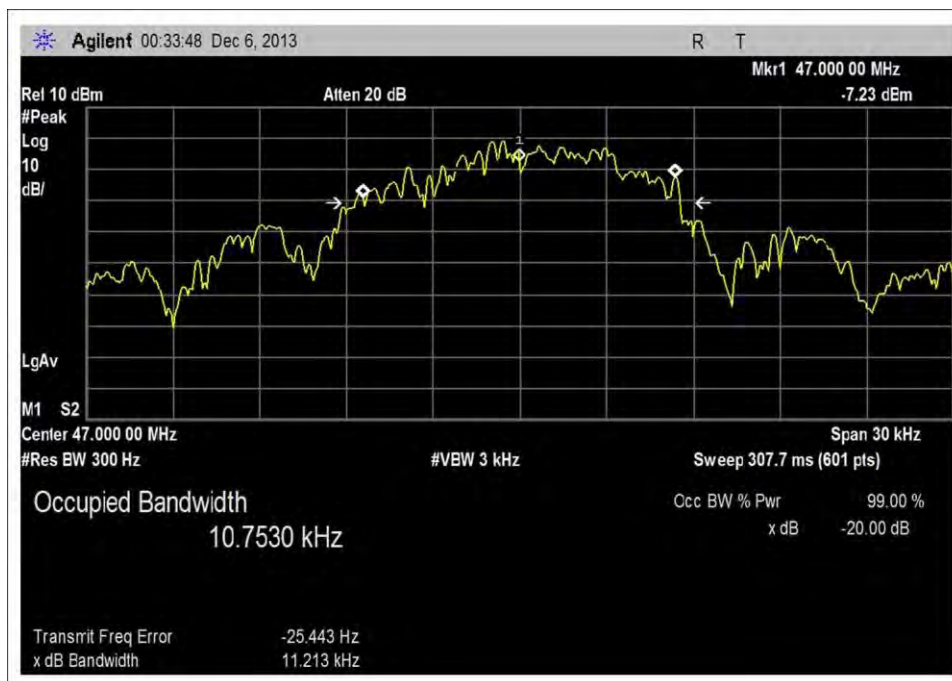
EUT is located on a table.
EUT is connected to a support laptop through a CAT 5 cable.
Antenna port is connected to the Spectrum analyser through 45.6dB of attenuation.
EUT is connected to a DC power supply.
EUT will be in transmit mode.

Testing performed per TIA-603C

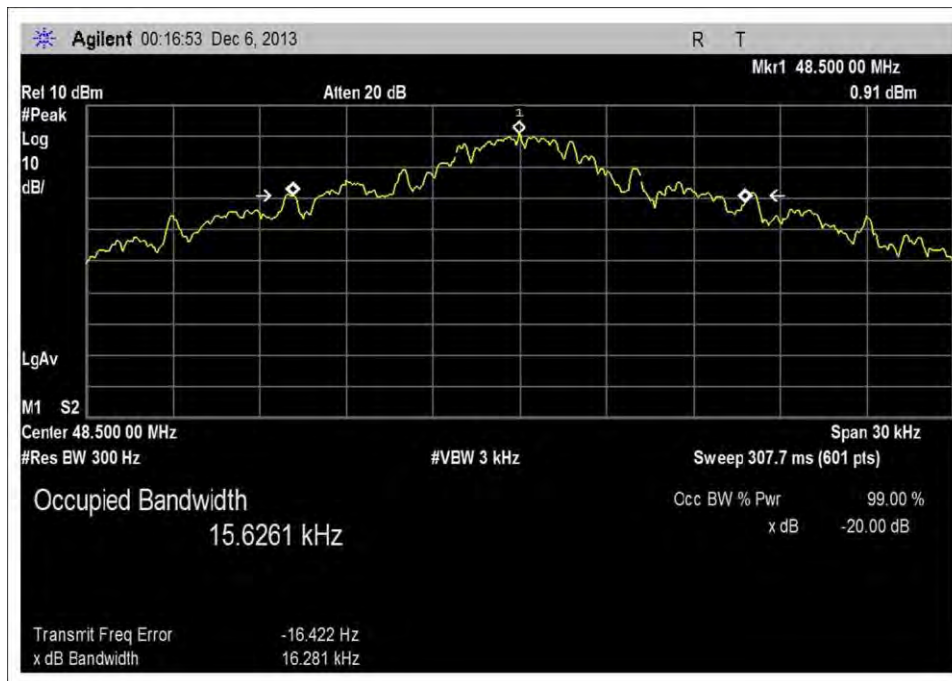
Test Data



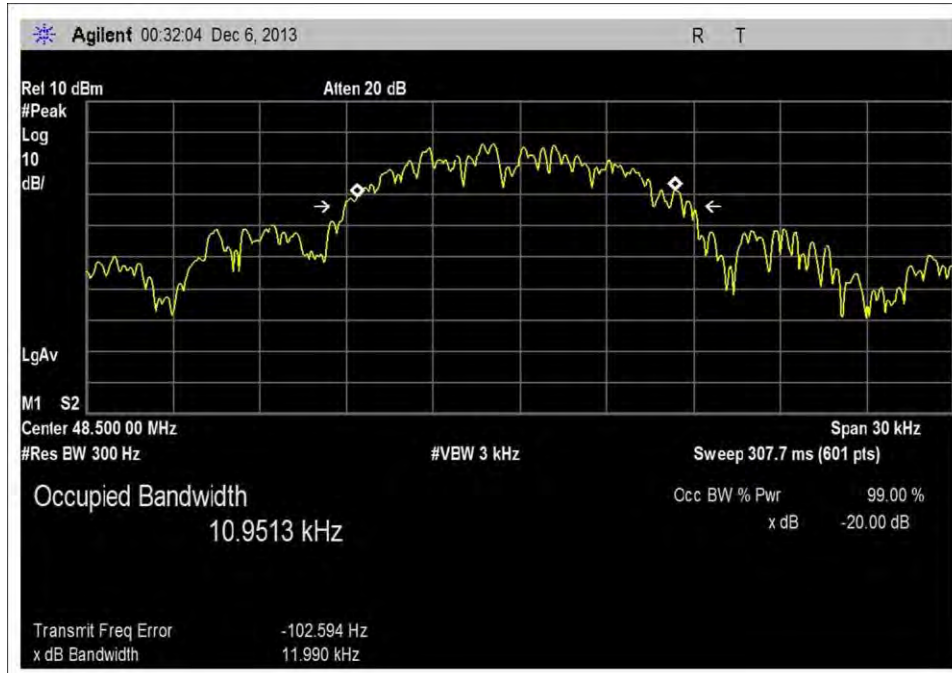
47MHz, BPSK



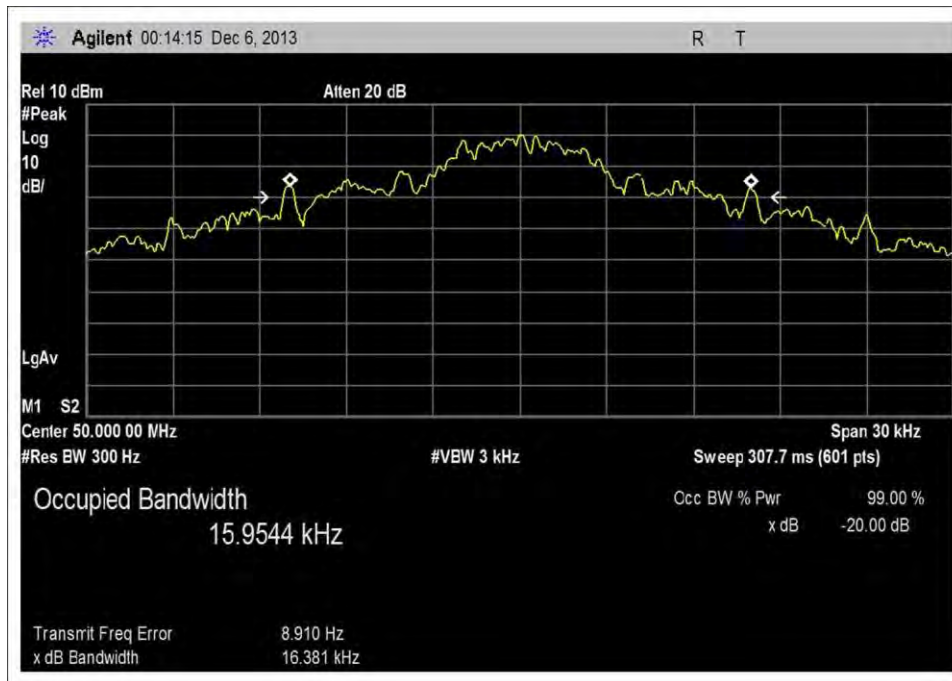
47MHz, GMSK



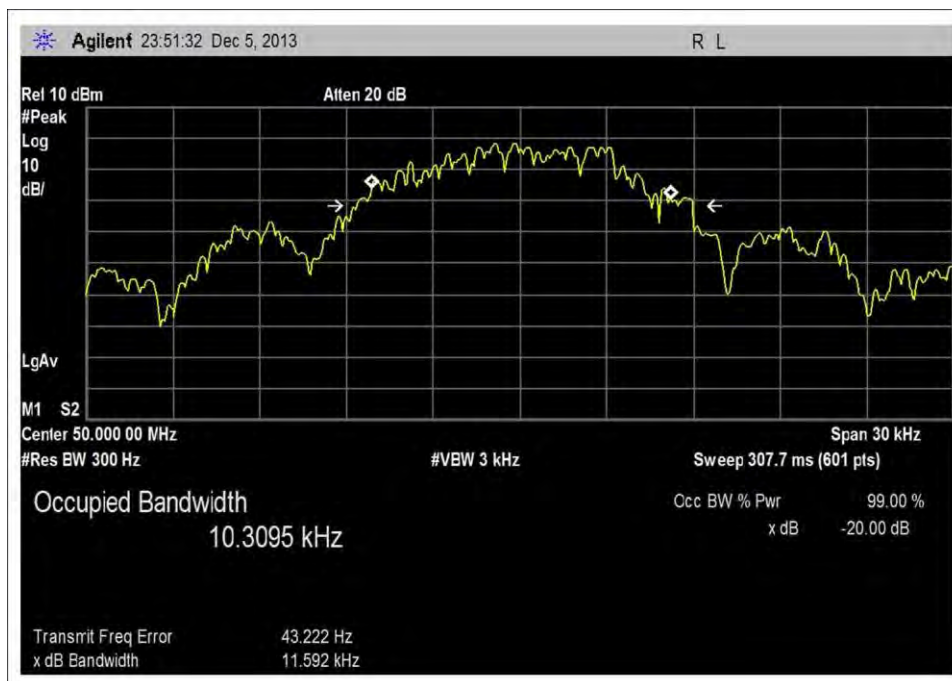
48.5, BPSK



48.5MHz, GMSK



50MHz, BPSK



50MHz, GMSK

Test Setup Photo



2.1051 / 90.210(c) Spurious Emissions at Antenna Terminals

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Maiden Rock Communications**

Specification: **47 CFR 2.1051/§90.210(c) Spurious Emissions**

Work Order #: **95510**

Date: 4/15/2014

Test Type: **Conducted Emissions**

Time: 10:48:35

Equipment: **Packet Data Radio**

Sequence#: 27

Manufacturer: Maiden Rock Communications

Tested By: Steven Pittsford

Model: MRC565-47-50

120V 60Hz

S/N: 1007

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05749	Attenuator	PE7010-20	1/27/2014	1/27/2016
T2	ANP05759	Attenuator	PE7010-20	1/27/2014	1/27/2016
T3	ANP05979	Attenuator	40-6-34	2/13/2014	2/13/2016
T4	ANP06505	Cable	32026-29080-29080-84	10/18/2013	10/18/2015
	AN02871	Spectrum Analyzer	E4440A	4/11/2013	4/11/2015

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Packet Data Radio*	Maiden Rock Communications	MRC565-47-50	1007

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Dell	Inspiration N5110	56ZMQR1
EUT power Supply	Precision	1901	

Test Conditions / Notes:

Temperature: 21°C

Pressure: 101.9kPa

Humidity: 32%

Freq: 9k-1GHz

Transmit mode only at 47, 48.5 & 50MHz. GMSK & BPSK

Support laptop is connected through a shielded cat5 and wrapped 3 times through a ferrite bead

Antenna port is terminated through a characteristic load.

100W 10% duty cycle

Ext Attn: 0 dB

Measurement Data:

Reading listed by margin.

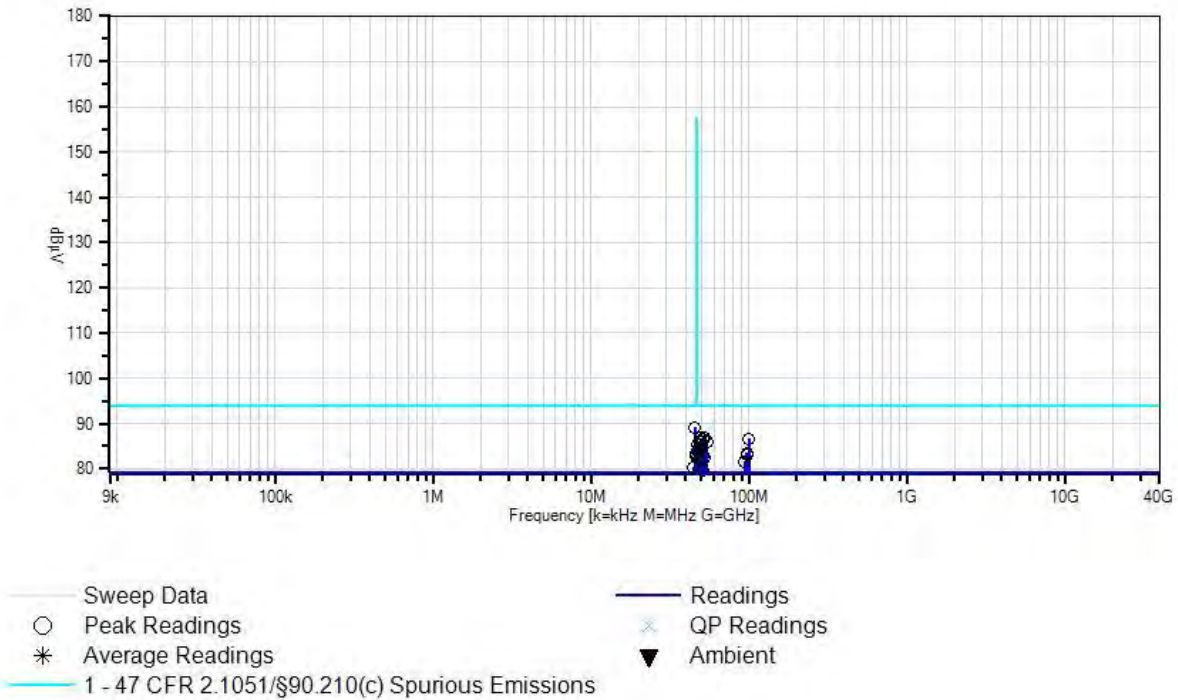
Test Lead: Antenna

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	45.767M	43.5	+19.5	+20.3	+5.6	+0.2	+0.0	89.1	94.1	-5.0	Anten
									50MHz BPSK		
2	52.950M	41.3	+19.5	+20.3	+5.6	+0.3	+0.0	87.0	94.1	-7.1	Anten
									50MHz BPSK		
3	49.492M	41.2	+19.5	+20.3	+5.6	+0.2	+0.0	86.8	94.1	-7.3	Anten
									50MHz GMSK		
4	100.000M	40.9	+19.5	+20.3	+5.6	+0.3	+0.0	86.6	94.1	-7.5	Anten
									50MHz BPSK		
5	50.900M	40.9	+19.5	+20.3	+5.6	+0.2	+0.0	86.5	94.1	-7.6	Anten
									48.5MHZ BPSK		
6	99.995M	40.7	+19.5	+20.3	+5.6	+0.3	+0.0	86.4	94.1	-7.7	Anten
									50MHz GMSK		
7	48.992M	40.6	+19.5	+20.3	+5.6	+0.2	+0.0	86.2	94.1	-7.9	Anten
									48.5MHZ BPSK		
8	50.508M	40.4	+19.5	+20.3	+5.6	+0.2	+0.0	86.0	94.1	-8.1	Anten
									50MHz GMSK		
9	54.283M	40.2	+19.5	+20.3	+5.6	+0.3	+0.0	85.9	94.1	-8.2	Anten
									50MHz BPSK		
10	49.500M	39.8	+19.5	+20.3	+5.6	+0.2	+0.0	85.4	94.1	-8.7	Anten
									50MHz BPSK		
11	47.483M	39.7	+19.5	+20.3	+5.6	+0.2	+0.0	85.3	94.1	-8.8	Anten
									47MHz BPSK		
12	50.517M	39.5	+19.5	+20.3	+5.6	+0.2	+0.0	85.1	94.1	-9.0	Anten
									50MHz BPSK		
13	47.500M	38.5	+19.5	+20.3	+5.6	+0.2	+0.0	84.1	94.1	-10.0	Anten
									47MHz GMSK		
14	49.000M	38.5	+19.5	+20.3	+5.6	+0.2	+0.0	84.1	94.1	-10.0	Anten
									48.5MHZ GMSK		
15	47.975M	38.3	+19.5	+20.3	+5.6	+0.2	+0.0	83.9	94.1	-10.2	Anten
									48.5MHZ GMSK		
16	97.001M	37.8	+19.5	+20.3	+5.6	+0.3	+0.0	83.5	94.1	-10.6	Anten
									48.5MHZ BPSK		
17	46.100M	37.8	+19.5	+20.3	+5.6	+0.2	+0.0	83.4	94.1	-10.7	Anten
									48.5MHZ BPSK		
18	97.005M	37.4	+19.5	+20.3	+5.6	+0.3	+0.0	83.1	94.1	-11.0	Anten
									48.5MHZ GMSK		
19	46.500M	37.4	+19.5	+20.3	+5.6	+0.2	+0.0	83.0	94.1	-11.1	Anten
									47MHz GMSK		
20	46.483M	37.3	+19.5	+20.3	+5.6	+0.2	+0.0	82.9	94.1	-11.2	Anten
									47MHz BPSK		
21	51.308M	37.2	+19.5	+20.3	+5.6	+0.2	+0.0	82.8	94.1	-11.3	Anten
									50MHz GMSK		
22	52.400M	37.0	+19.5	+20.3	+5.6	+0.2	+0.0	82.6	94.1	-11.5	Anten
									50MHz GMSK		
23	48.683M	36.5	+19.5	+20.3	+5.6	+0.2	+0.0	82.1	94.1	-12.0	Anten
									50MHz GMSK		
24	94.002M	35.9	+19.5	+20.3	+5.6	+0.3	+0.0	81.6	94.1	-12.5	Anten
									47MHz BPSK		

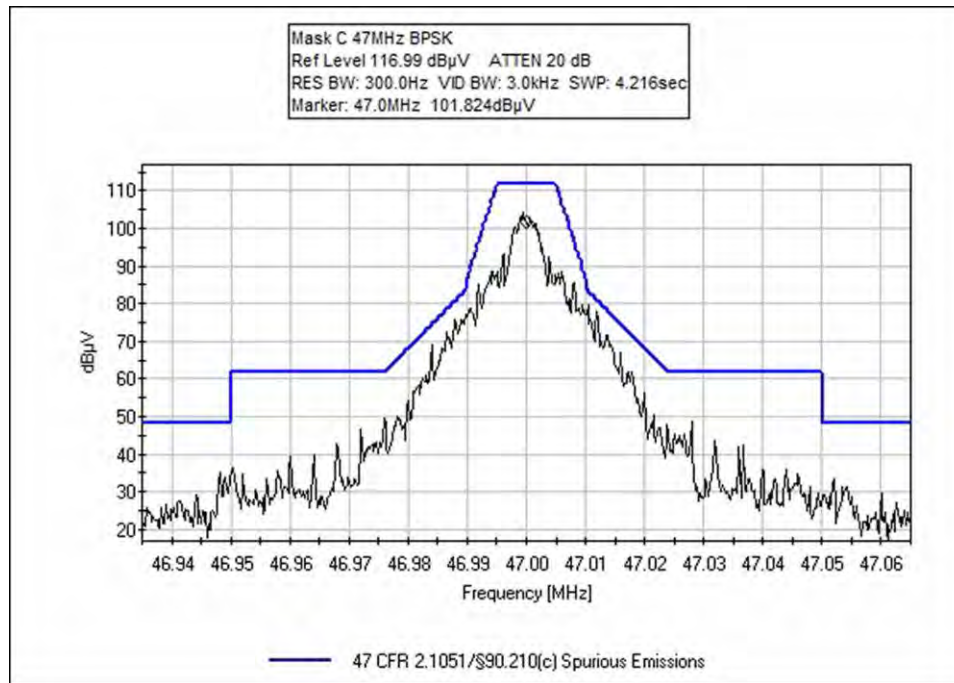
25	93.997M	35.7	+19.5	+20.3	+5.6	+0.3	+0.0	81.4	94.1	-12.7	Anten
									47MHz GMSK		
26	49.400M	35.1	+19.5	+20.3	+5.6	+0.2	+0.0	80.7	94.1	-13.4	Anten
									47MHz BPSK		
27	44.600M	34.8	+19.5	+20.3	+5.6	+0.2	+0.0	80.4	94.1	-13.7	Anten
									47MHz BPSK		
28	50.900M	34.1	+19.5	+20.3	+5.6	+0.2	+0.0	79.7	94.1	-14.4	Anten
									48.5MHz GMSK		
29	47.600M	31.5	+19.5	+20.3	+5.6	+0.2	+0.0	77.1	94.1	-17.0	Anten
									50MHz GMSK		
30	46.100M	31.4	+19.5	+20.3	+5.6	+0.2	+0.0	77.0	94.1	-17.1	Anten
									48.5MHz GMSK		
31	150.001M	31.2	+19.4	+20.3	+5.6	+0.4	+0.0	76.9	94.1	-17.2	Anten
									50MHz BPSK		
32	51.500M	30.6	+19.5	+20.3	+5.6	+0.2	+0.0	76.2	94.1	-17.9	Anten
	Ave								50MHz BPSK		
^	51.500M	54.1	+19.5	+20.3	+5.6	+0.2	+0.0	99.7	94.1	+5.6	Anten
									50MHz BPSK		
34	150.006M	30.3	+19.4	+20.3	+5.6	+0.4	+0.0	76.0	94.1	-18.1	Anten
									50MHz GMSK		
35	48.558M	29.1	+19.5	+20.3	+5.6	+0.2	+0.0	74.7	94.1	-19.4	Anten
	Ave								50MHz BPSK		
^	48.517M	53.3	+19.5	+20.3	+5.6	+0.2	+0.0	98.9	94.1	+4.8	Anten
									50MHz BPSK		
37	47.550M	28.9	+19.5	+20.3	+5.6	+0.2	+0.0	74.5	94.1	-19.6	Anten
									48.5MHz BPSK		
38	11.590M	28.4	+19.4	+20.3	+5.6	+0.1	+0.0	73.8	94.1	-20.3	Anten
									50MHz BPSK		
39	47.200M	27.8	+19.5	+20.3	+5.6	+0.2	+0.0	73.4	94.1	-20.7	Anten
	Ave								50MHz BPSK		
^	47.200M	48.9	+19.5	+20.3	+5.6	+0.2	+0.0	94.5	94.1	+0.4	Anten
									50MHz BPSK		
41	145.492M	27.1	+19.4	+20.3	+5.6	+0.4	+0.0	72.8	94.1	-21.3	Anten
									48.5MHz GMSK		
42	145.500M	27.1	+19.4	+20.3	+5.6	+0.4	+0.0	72.8	94.1	-21.3	Anten
									48.5MHz BPSK		
43	187.988M	25.1	+19.5	+20.3	+5.6	+0.4	+0.0	70.9	94.1	-23.2	Anten
									47MHz GMSK		
44	188.001M	25.1	+19.5	+20.3	+5.6	+0.4	+0.0	70.9	94.1	-23.2	Anten
									47MHz BPSK		
45	549.999M	24.1	+19.5	+20.4	+5.7	+0.7	+0.0	70.4	94.1	-23.7	Anten
									50MHz BPSK		
46	650.021M	23.6	+19.5	+20.4	+5.7	+0.8	+0.0	70.0	94.1	-24.1	Anten
									50MHz GMSK		
47	449.990M	23.8	+19.5	+20.3	+5.7	+0.6	+0.0	69.9	94.1	-24.2	Anten
									50MHz GMSK		
48	600.001M	23.6	+19.5	+20.3	+5.7	+0.7	+0.0	69.8	94.1	-24.3	Anten
									50MHz GMSK		
49	235.023M	23.4	+19.5	+20.3	+5.6	+0.5	+0.0	69.3	94.1	-24.8	Anten
									47MHz BPSK		
50	193.993M	23.4	+19.5	+20.3	+5.6	+0.4	+0.0	69.2	94.1	-24.9	Anten
									48.5MHz GMSK		

51	849.979M	22.5	+19.6	+20.4	+5.7	+0.9	+0.0	69.1	94.1	-25.0	Anten
									50MHz GMSK		
52	749.997M	22.7	+19.5	+20.4	+5.7	+0.8	+0.0	69.1	94.1	-25.0	Anten
									50MHz GMSK		
53	200.035M	23.0	+19.5	+20.3	+5.6	+0.4	+0.0	68.8	94.1	-25.3	Anten
									50MHz BPSK		
54	141.043M	23.1	+19.4	+20.3	+5.6	+0.4	+0.0	68.8	94.1	-25.3	Anten
									47MHz GMSK		
55	400.026M	22.6	+19.5	+20.3	+5.6	+0.6	+0.0	68.6	94.1	-25.5	Anten
									50MHz GMSK		
56	193.992M	22.7	+19.5	+20.3	+5.6	+0.4	+0.0	68.5	94.1	-25.6	Anten
									48.5MHz BPSK		
57	350.041M	22.5	+19.5	+20.3	+5.6	+0.6	+0.0	68.5	94.1	-25.6	Anten
									50MHz GMSK		
58	329.001M	22.4	+19.5	+20.3	+5.6	+0.6	+0.0	68.4	94.1	-25.7	Anten
									47MHz BPSK		
59	250.018M	22.4	+19.5	+20.3	+5.6	+0.5	+0.0	68.3	94.1	-25.8	Anten
									50MHz GMSK		
60	200.040M	22.4	+19.5	+20.3	+5.6	+0.4	+0.0	68.2	94.1	-25.9	Anten
									50MHz GMSK		
61	38.420M	22.3	+19.5	+20.3	+5.6	+0.2	+0.0	67.9	94.1	-26.2	Anten
									50MHz BPSK		
62	300.027M	21.7	+19.5	+20.3	+5.6	+0.5	+0.0	67.6	94.1	-26.5	Anten
									50MHz GMSK		
63	141.002M	20.9	+19.4	+20.3	+5.6	+0.4	+0.0	66.6	94.1	-27.5	Anten
									47MHz BPSK		
64	999.979M	19.1	+19.6	+20.3	+5.7	+0.9	+0.0	65.6	94.1	-28.5	Anten
									50MHz GMSK		
65	590.000k	17.8	+19.5	+20.4	+5.6	+0.0	+0.0	63.3	94.1	-30.8	Anten
									50MHz BPSK		

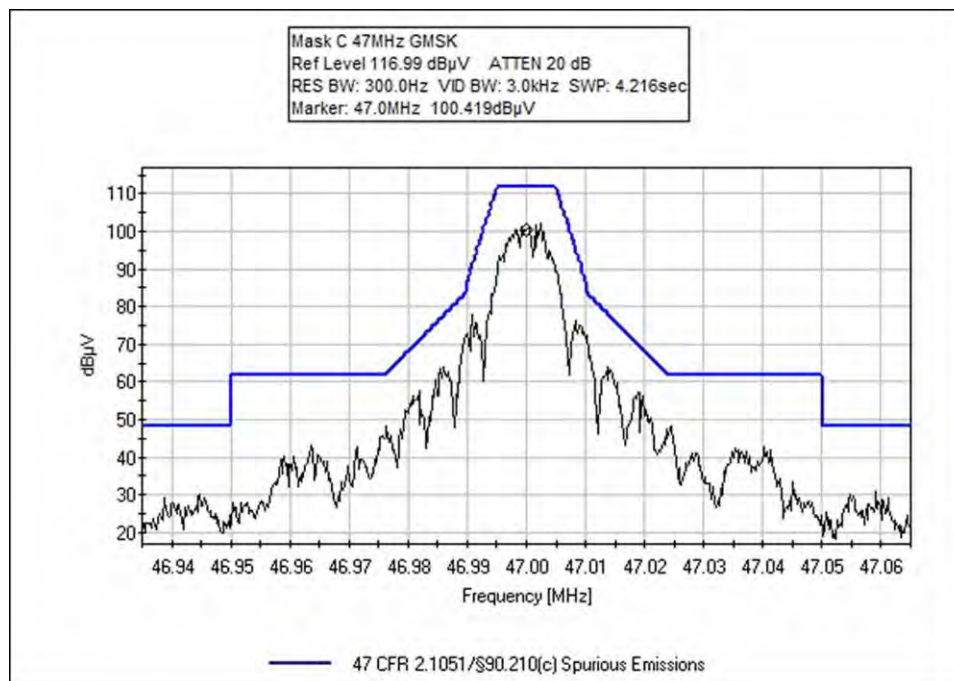
CKC Laboratories, Inc. Date: 4/15/2014 Time: 10:48:35 Maiden Rock Communications WO#: 95510
 Test Lead: Antenna 120V 60Hz Sequence#: 27 Antenna
 Maiden Rock Communications Packet Data Radio P/N: MRC565-47-50



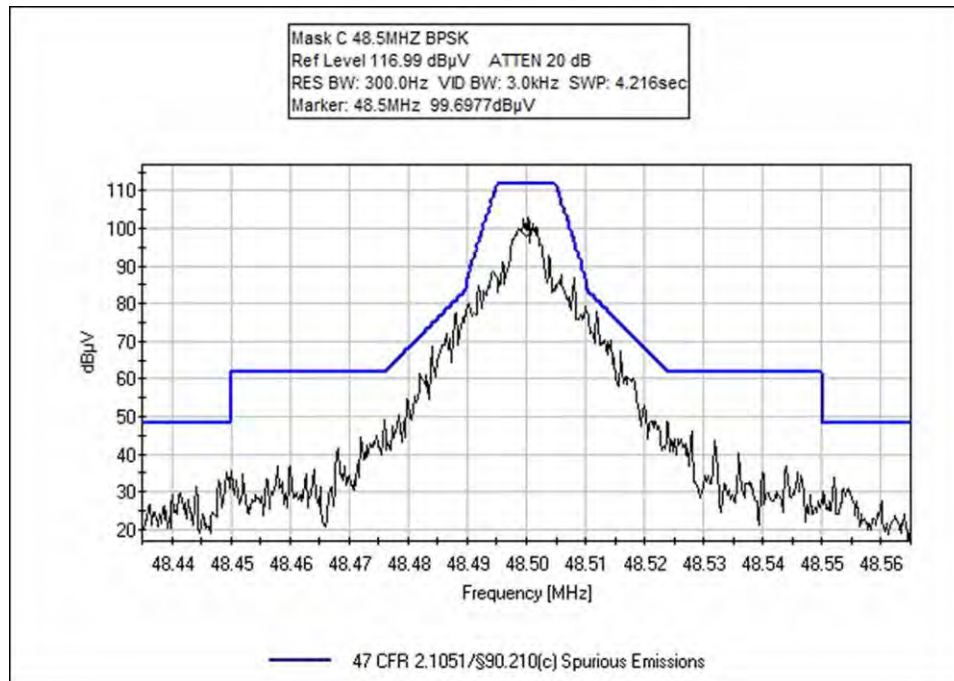
Test Data



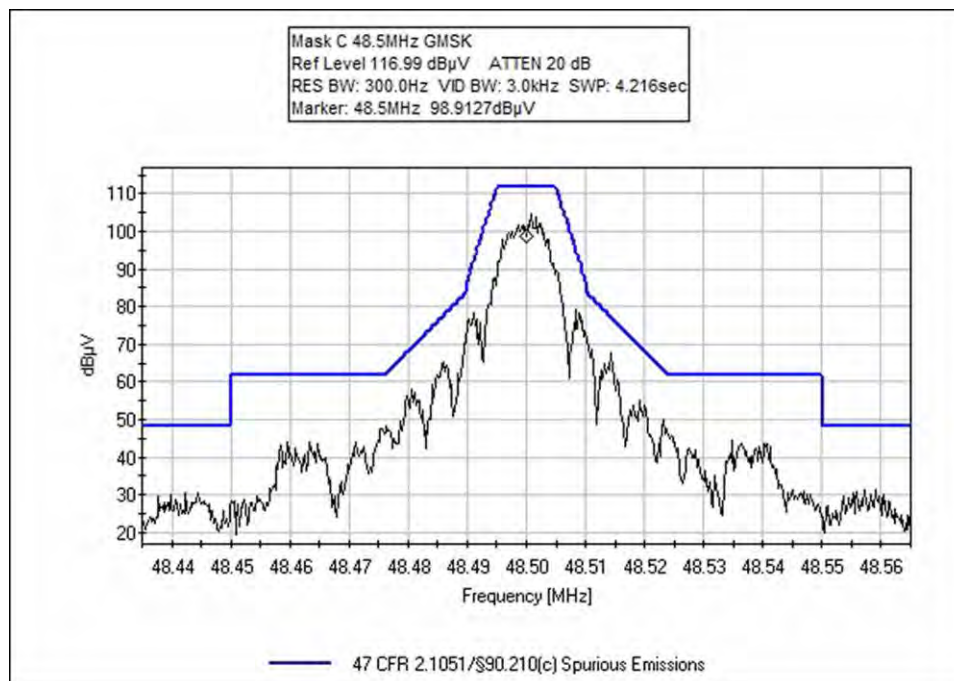
47MHz, BPSK



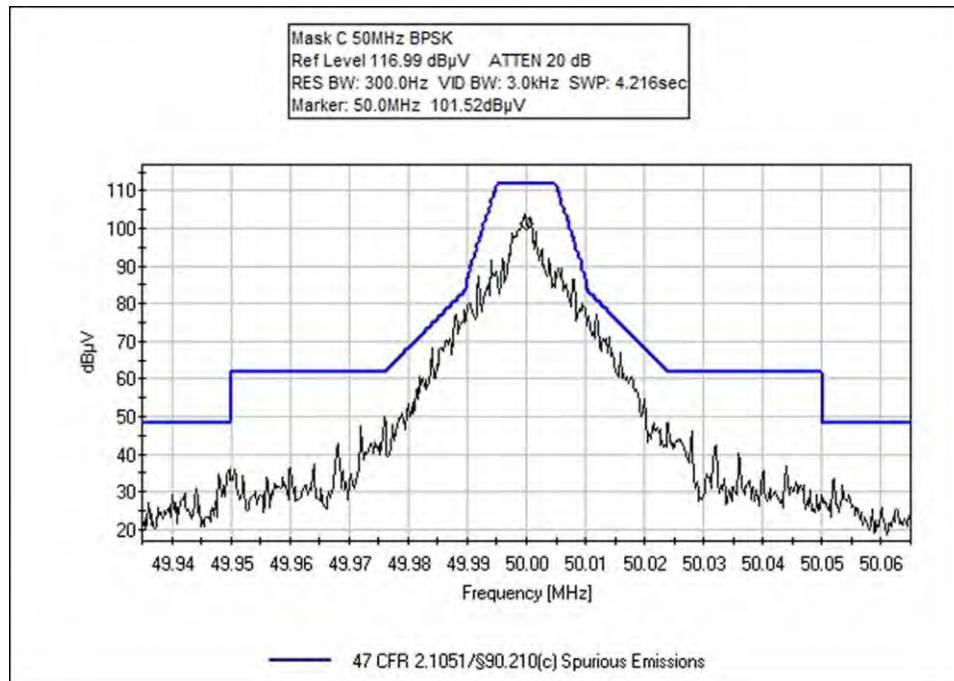
47MHz, GMSK



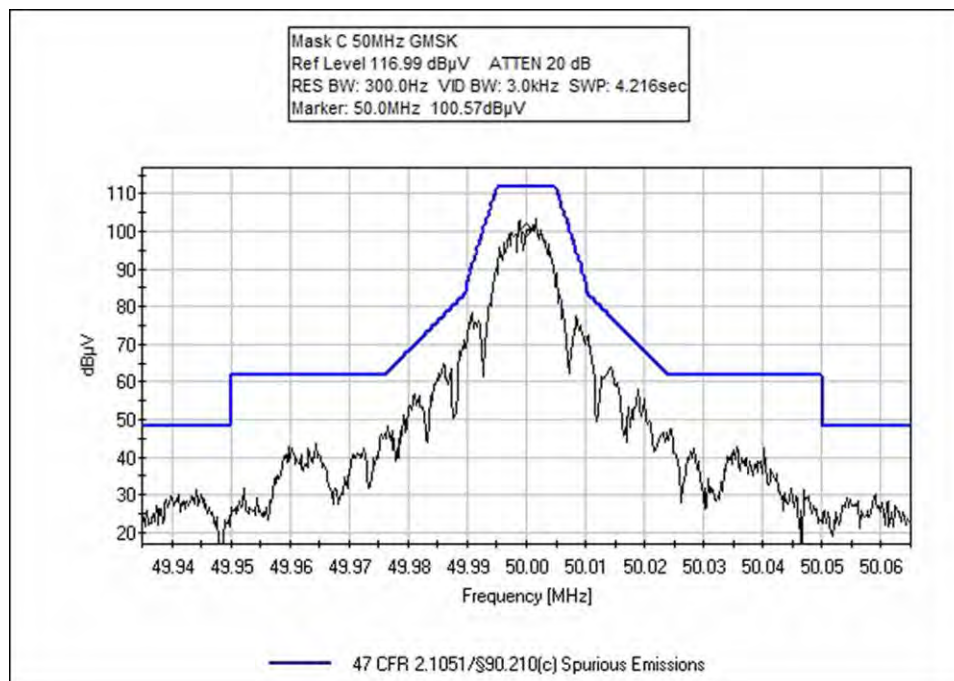
48.5MHz, BPSK



48.5MHz, GMSK



50MHz, BPSK



50MHz, GMSK

Test Setup Photo



2.1053 / 90.210(c) Field Strength of Spurious Radiation

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Maiden Rock Communications**
 Specification: **47 CFR §90.210(c) Spurious Emissions**
 Work Order #: **95510** Date: 4/15/2014
 Test Type: **Maximized Emissions** Time: 11:11:36
 Equipment: **Packet Data Radio** Sequence#: 4
 Manufacturer: Maiden Rock Communications Tested By: Steven Pittsford
 Model: MRC565-47-50
 S/N: 1007

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02307	Preamplifier	8447D	3/14/2014	3/14/2016
T2	AN01993	Biconilog Antenna	CBL6111C	3/7/2014	3/7/2016
T3	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T4	ANP05963	Cable	RG-214	2/21/2014	2/21/2016
T5	ANP06505	Cable	32026-29080-29080-84	10/18/2013	10/18/2015
T6	AN02872	Spectrum Analyzer	E4440A	7/19/2013	7/19/2015
	AN00052	Loop Antenna	6502	5/20/2014	5/20/2016

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Packet Data Radio*	Maiden Rock Communications	MRC565-47-50	1007

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Dell	Inspiration N5110	56ZMQR1
30dB Attenuator	BIRD	50-A-FFN-30	
EUT power Supply	Precision	1901	
10 dB Attenuator 50 Ohm			

Test Conditions / Notes:

Temperature: 21°C
 Pressure: 101.9kPa
 Humidity: 32%

Freq: 9k-1000MHz
 No Emissions were observed within 20dB of the limit from 9k-30MHz.

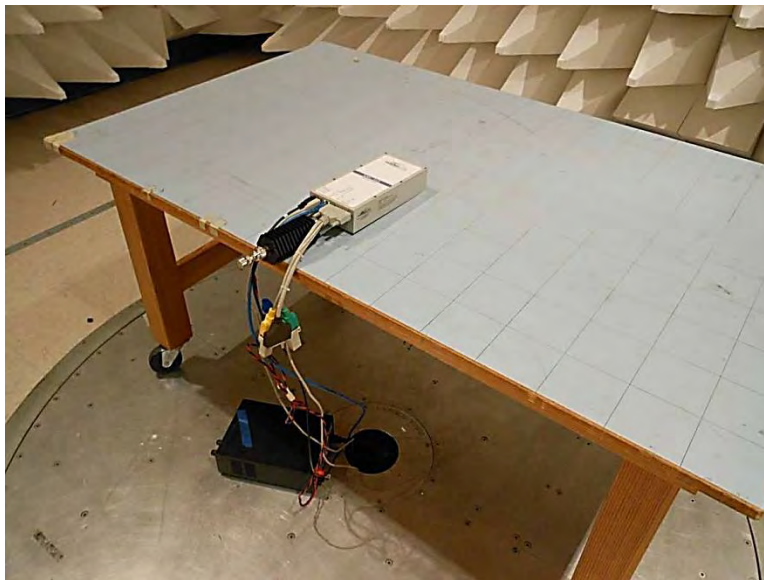
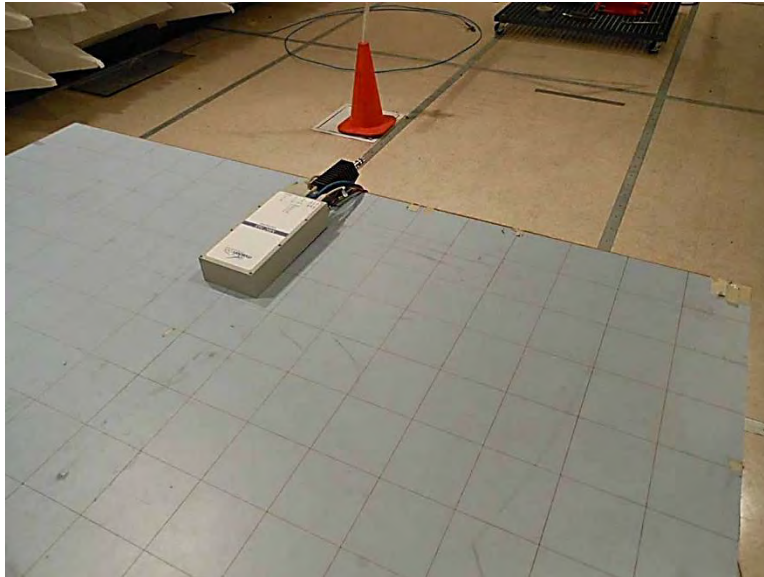
Notes:

Transmit mode only at 47, 48.5 & 50MHz. GMSK & BPSK Investigated. (BPSK is worst case)
 Support laptop is connected through a shielded cat5 and wrapped 3 times through a ferrite bead
 Antenna port is terminated through a characteristic load.
 100W 10% duty cycle

Operating Frequency(ies): 47, 48.5 & 50MHz

Operational Mode(s):		GMSK & BPSK(BPSK is worst case)		
Highest Measured Power:		50.5	dBm	
Measurement Distance:		3	meters	
Limit Definition:				
Frequency Range		Limit (dBc)	Limit Calculation	
9kHz - 1GHz		63.5	43+10*LOG(P)	
Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin	Antenna Polarity
47.002	-18.3	68.8	-5.3	Horizontal
49.990	-26.1	76.6	-13.1	Vertical
94.028	-31.6	82.1	-18.6	Horizontal
48.517	-33.2	83.7	-20.2	Horizontal
99.994	-33.6	84.1	-20.6	Horizontal
100.004	-33.8	84.3	-20.8	Horizontal
150.048	-35.2	85.7	-22.2	Horizontal
93.995	-36.7	87.2	-23.7	Horizontal
96.960	-37.6	88.1	-24.6	Horizontal
141.049	-37.9	88.4	-24.9	Vertical
96.995	-38.6	89.1	-25.6	Vertical
141.008	-41.5	92.0	-28.5	Horizontal
150.009	-42.0	92.5	-29.0	Horizontal
500.249	-42.2	92.7	-29.2	Horizontal
145.498	-44.3	94.8	-31.3	Horizontal
611.175	-47.0	97.5	-34.0	Vertical
145.493	-47.3	97.8	-34.3	Vertical
900.167	-50.4	100.9	-37.4	Horizontal
475.145	-52.6	103.1	-39.6	Horizontal
600.083	-54.3	104.8	-41.3	Vertical
339.399	-55.3	105.8	-42.3	Horizontal
549.874	-55.3	105.8	-42.3	Horizontal
194.101	-56.1	106.6	-43.1	Vertical
949.791	-56.3	106.8	-43.3	Vertical
574.978	-56.9	107.4	-43.9	Vertical
423.185	-57.0	107.5	-44.0	Vertical
625.187	-57.7	108.2	-44.7	Horizontal
987.156	-58.8	109.3	-45.8	Horizontal

Test Setup Photos



2.1055 / 90.213 Frequency Stability

Frequency stability does not apply to this type of equipment.

Test Equipment					
Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
2757	Temperature Chamber	F100/350-8	Bemco	1/22/2013	1/22/2015
2871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015
3029	Thermometer, Digital Infrared	566	Fluke	2/1/2013	2/1/2015
P05749	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05759	Attenuator	PE7010-20	Pasternack	1/27/2014	1/27/2016
P05979	Attenuator	40-6-34	Weinschel	2/13/2014	2/13/2016

Test Conditions / Setup

Frequency Stability							
Customer:		Maiden Rock Communications					
WO#:		95510					
Date:		15-Apr-14					
Test Engineer:		S. Pittsford					
Test Specification		90.213					
Device Model #:		MRC565-47-50					
Operating Voltage:		12 VDC/VAC					
Frequency Limit:		20 PPM					
Temperature Variations							
Channel Frequency:		Channel 1 (MHz)	Dev. (PPM)	Channel 2 (MHz)	Dev. (PPM)	Channel 3 (MHz)	Dev. (PPM)
Temp (C) Voltage		47		48.5		50	
-30	12	47.00002	0.46809	48.50002	0.35052	50.00002	0.46000
-20	12	47.00003	0.68085	48.50003	0.68041	50.00003	0.66000
-10	12	47.00004	0.89362	48.50004	0.88660	50.00004	0.86000
0	12	47.00004	0.76596	48.50004	0.76289	50.00004	0.74000
10	12	47.00003	0.61702	48.50003	0.61856	50.00003	0.60000
20	12	47.00001	0.27660	48.50002	0.35052	50.00001	0.26000
30	12	47.00001	0.27660	48.50001	0.26804	50.00001	0.26000
40	12	47.00001	0.19149	48.50001	0.18557	50.00001	0.18000
50	12	47.00001	0.10638	48.50001	0.12371	50.00001	0.10000
Voltage Variations (±15%)							
20	10.2	47.00002	0.36170	48.50001	0.26804	50.00001	0.26000
20	12	47.00001	0.27660	48.50002	0.35052	50.00001	0.26000
20	13.8	47.00002	0.36170	48.50002	0.35052	50.00001	0.26000
Max Deviation (PPM)		0.89362		0.88660		0.86000	
		PASS		PASS		PASS	
Test Conditions:							
Three EUTs are located inside the temperature chamber. Each has its own power cord to the power supply. The EUTs are connected to the support laptop via cat 5 cables that are routed through a CISCO ethernet hub. Each EUT's antenna port will be connected to the spectrum analyser via 46dB of attenuation.							

Test Setup Photos



Inside Temperature



Outside Temperature

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBμV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBμV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.