

Maiden Rock Communications

ADDENDUM TO TEST REPORT 95510-11

Packet Data Radio
Model: MRC565-43-47

Tested To The Following Standards:

FCC Part 90I

Report No.: 95510-11A

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: MRC565-43-47 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.



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 ²
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

NA² = 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
During Testing: A support laptop is connected through a shielded cat5 and wrapped 3 times through a ferrite bead. Antenna port is terminated through a characteristic load.

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Packet Data Radio

Manuf: Maiden Rock Communications
Model: MRC565-43-47
Serial: 1006

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

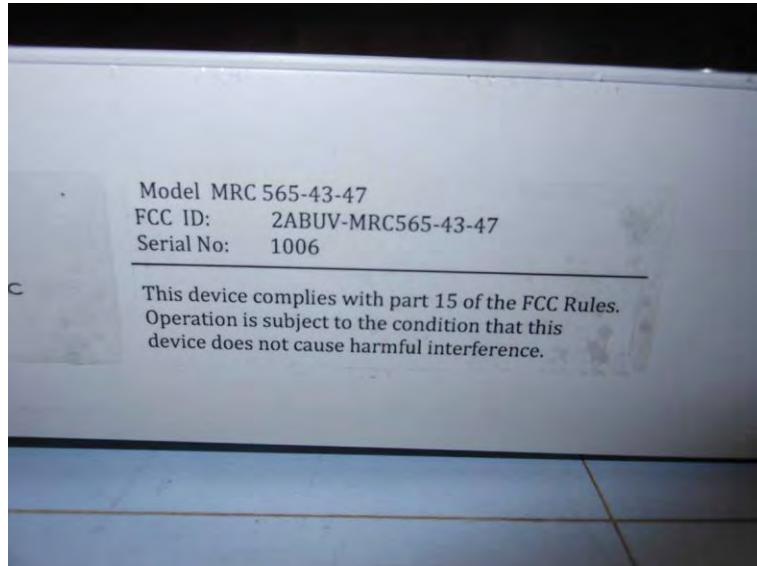
30dB Attenuator

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 #:	MRC565-43-47
Operating Voltage:	12 VDC
Power Limit	300 Watts
	54.7 dBm

Channel	Frequency	Power (dBm)	Result
Low BPSK	43MHz	50.1	PASS
Mid BPSK	45MHz	50.2	PASS
High BPSK	47MHz	50.2	PASS
Low GMSK	43MHz	50.1	PASS
Mid GMSK	45MHz	50.3	PASS
High GMSK	47MHz	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 analyser through 45.6dB of attenuation.

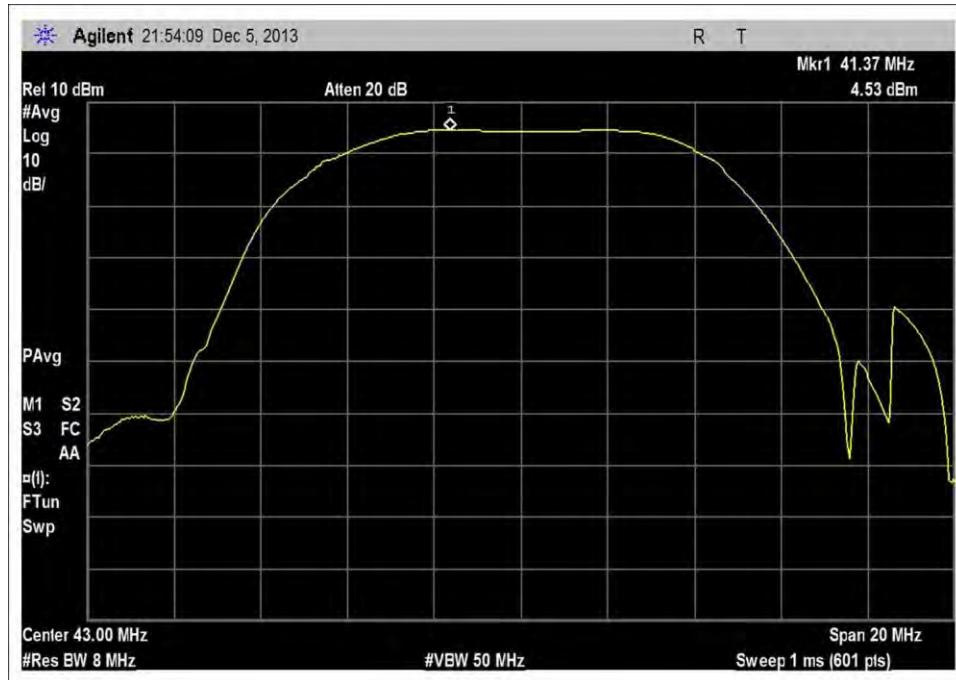
The measured power in the table has this 45.6dB of measurement system loss added to the plot readings

EUT is connected to a DC power supply.

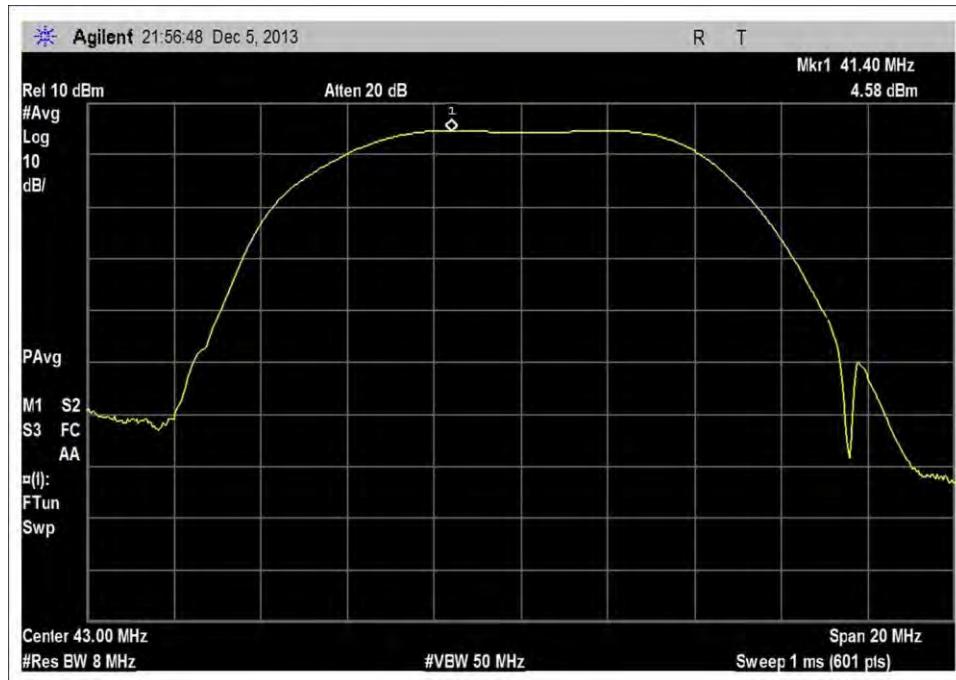
EUT will be in transmit mode.

Testing performed per TIA-603C

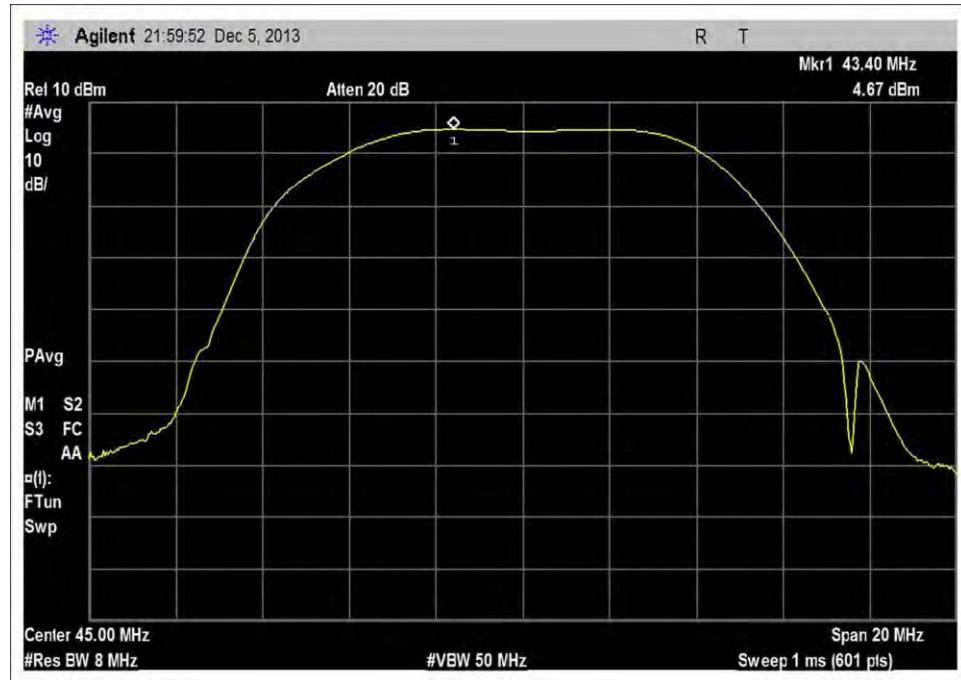
Test Data



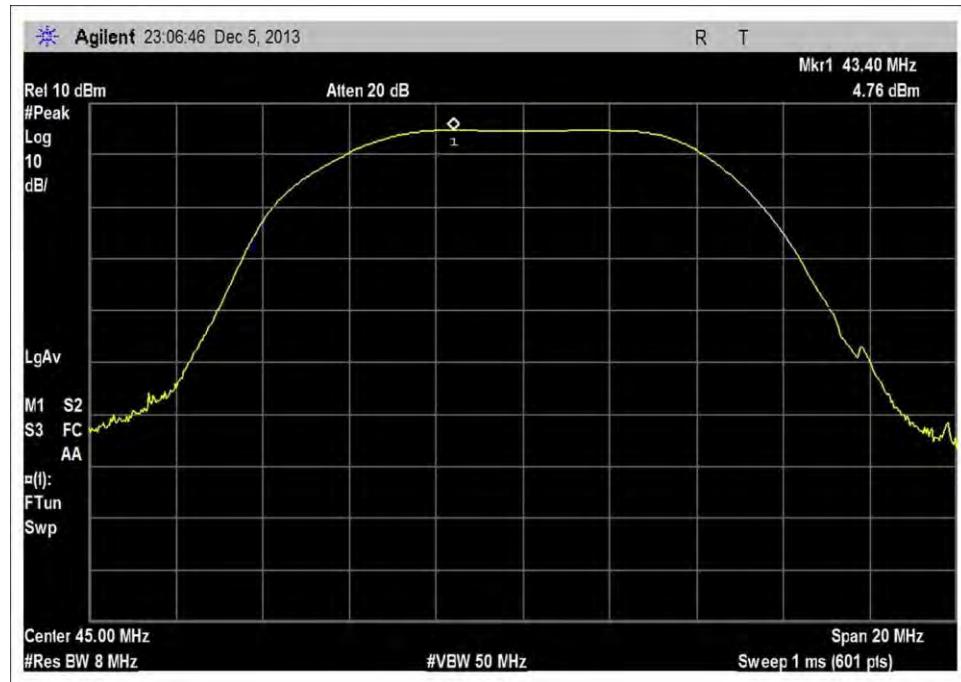
43MHz, BPSK



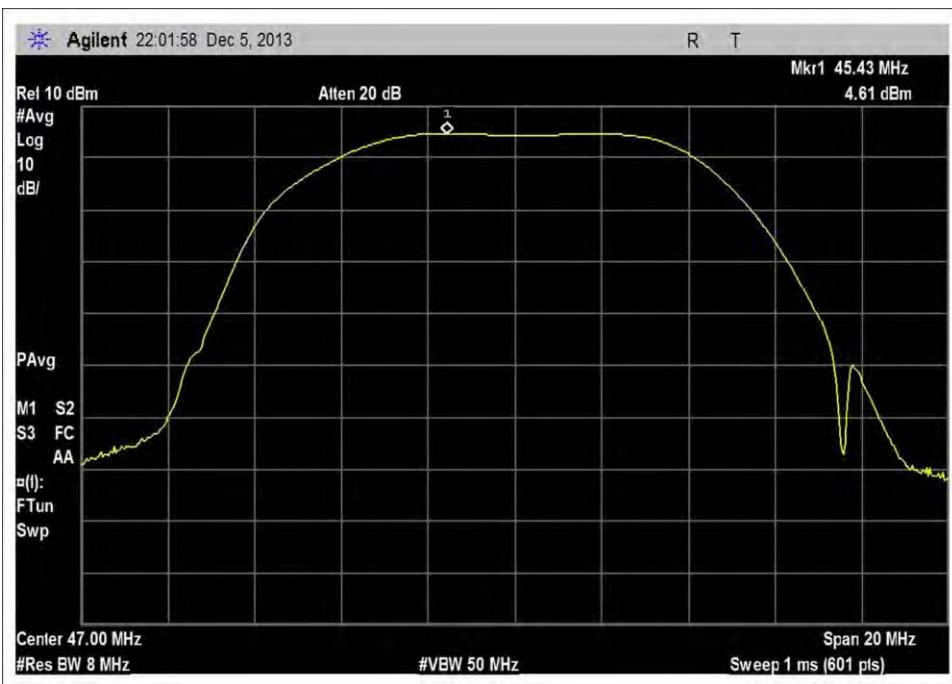
43MHz, GMSK



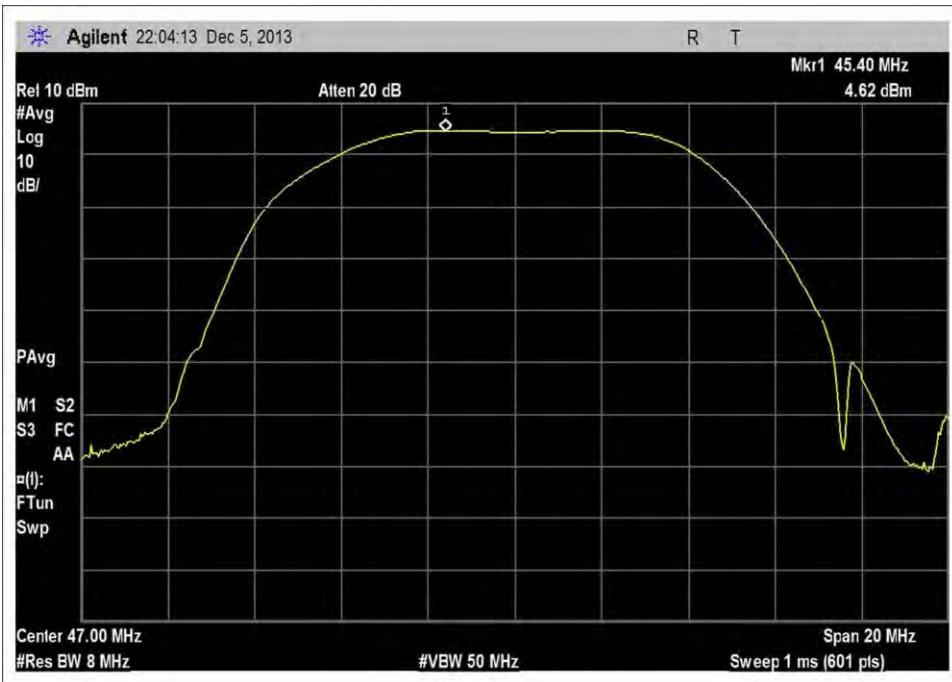
45MHz, BPSK



45MHz, GMSK



47MHz, BPSK



47MHz, 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 #:	MRC565-43-47
Operating Voltage:	12 VDC
BW Limit	20 kHz

Channel	Frequency	BW (kHz)	Result
Low BPSK	43MHz	16.3	PASS
Mid BPSK	45MHz	16.19	PASS
High BPSK	47MHz	16.35	PASS
Low GMSK	43MHz	11.58	PASS
Mid GMSK	45MHz	11.6	PASS
High GMSK	47MHz	11.7	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.

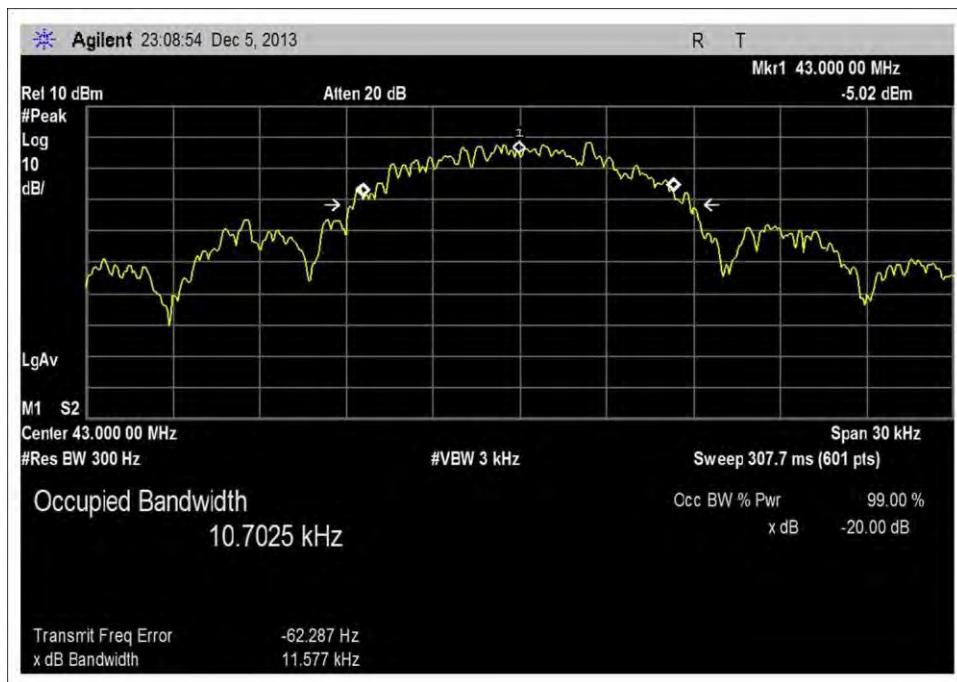
EUT will be in transmit mode.

Testing performed per TIA-603C

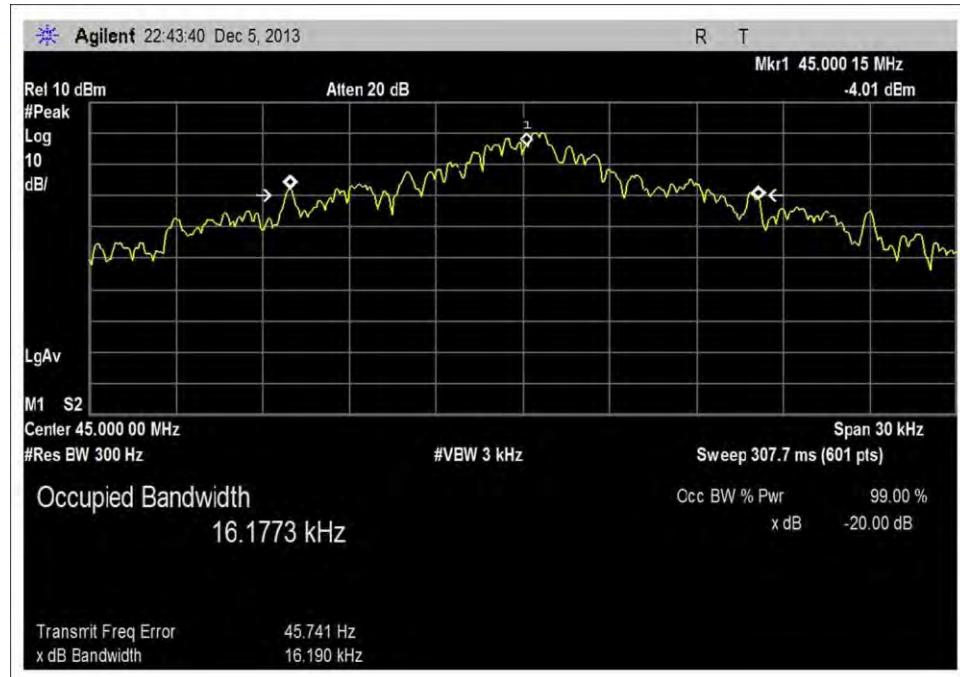
Test Data



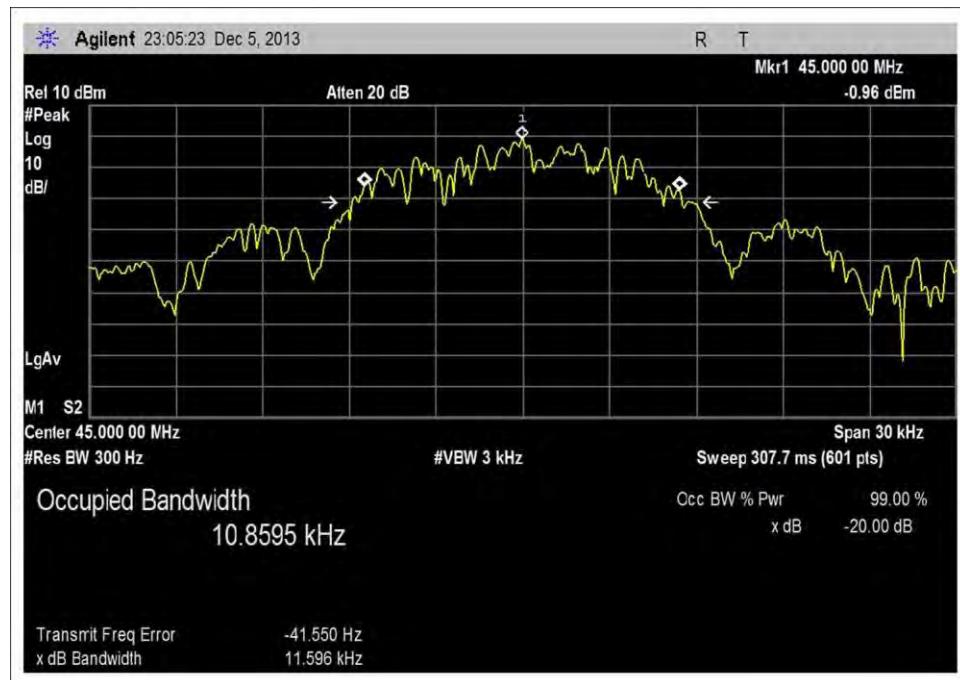
43MHz, BPSK



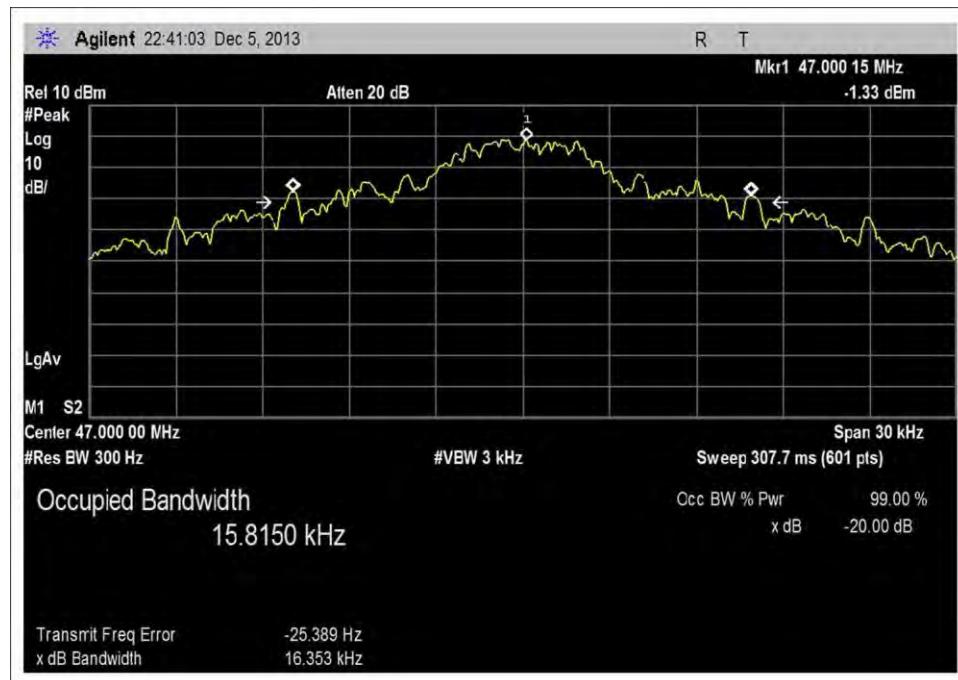
43MHz, GMSK



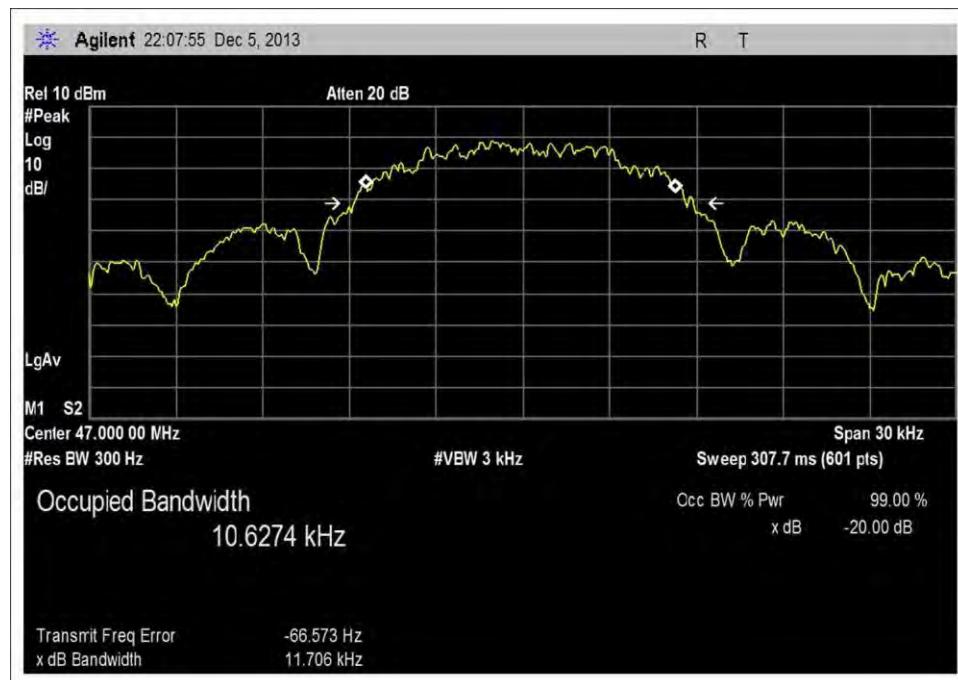
45MHz, BPSK



45MHz, GMSK

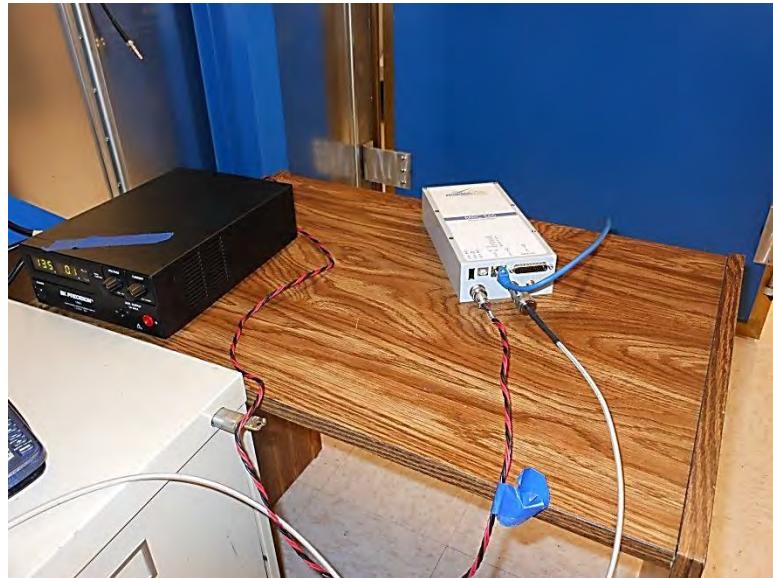


47MHz BPSK



47MHz, 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: **09:28:17**
 Equipment: **Packet Data Radio** Sequence#: **26**
 Manufacturer: Maiden Rock Communications Tested By: Steven Pittsford
 Model: MRC565-43-47 120V 60Hz
 S/N: 1006

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	MRC565-43-47	1006

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 43, 45 & 47MHz. 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

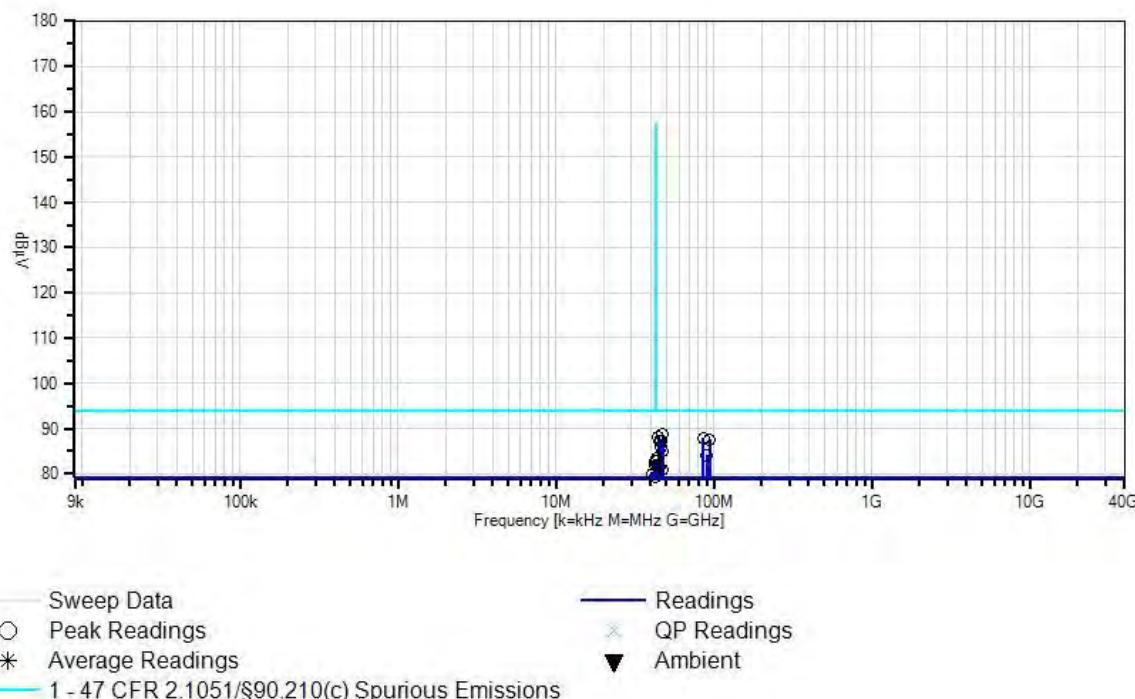
Ext Attn: 0 dB

Measurement Data:			Reading listed by margin.					Test Lead: Antenna			
#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	47.550M	43.0	+19.5	+20.3	+5.6	+0.2	+0.0	88.6	94.0	-5.4	Anten 47MHz BPSK
2	44.503M	42.6	+19.5	+20.3	+5.6	+0.2	+0.0	88.2	93.9	-5.7	Anten 45MHz BPSK
3	86.000M	42.2	+19.5	+20.3	+5.6	+0.3	+0.0	87.9	93.9	-6.0	Anten 43MHz BPSK
4	85.994M	42.1	+19.5	+20.3	+5.6	+0.3	+0.0	87.8	93.9	-6.1	Anten 43MHz GMSK
5	94.000M	41.8	+19.5	+20.3	+5.6	+0.3	+0.0	87.5	94.0	-6.5	Anten 47MHz BPSK
6	94.006M	41.7	+19.5	+20.3	+5.6	+0.3	+0.0	87.4	94.0	-6.6	Anten 47MHz GMSK
7	45.550M	41.6	+19.5	+20.3	+5.6	+0.2	+0.0	87.2	93.9	-6.7	Anten 45MHz BPSK
8	46.450M	41.7	+19.5	+20.3	+5.6	+0.2	+0.0	87.3	94.0	-6.7	Anten 47MHz BPSK
9	46.497M	40.3	+19.5	+20.3	+5.6	+0.2	+0.0	85.9	94.0	-8.1	Anten 47MHz GMSK
10	47.500M	39.5	+19.5	+20.3	+5.6	+0.2	+0.0	85.1	94.0	-8.9	Anten 47MHz GMSK
11	90.002M	38.4	+19.5	+20.3	+5.6	+0.3	+0.0	84.1	93.9	-9.8	Anten 45MHz BPSK
12	89.999M	38.2	+19.5	+20.3	+5.6	+0.3	+0.0	83.9	93.9	-10.0	Anten 45MHz GMSK
13	43.143M	37.7	+19.5	+20.3	+5.6	+0.2	+0.0	83.3	93.9	-10.6	Anten 43MHz GMSK
14	43.550M	37.3	+19.5	+20.3	+5.6	+0.2	+0.0	82.9	93.9	-11.0	Anten 43MHz BPSK
15	42.450M	37.1	+19.5	+20.3	+5.6	+0.2	+0.0	82.7	93.9	-11.2	Anten 43MHz BPSK
16	42.487M	36.1	+19.5	+20.3	+5.6	+0.2	+0.0	81.7	93.9	-12.2	Anten 43MHz GMSK
17	44.500M	36.1	+19.5	+20.3	+5.6	+0.2	+0.0	81.7	93.9	-12.2	Anten 45MHz GMSK
18	45.500M	36.0	+19.5	+20.3	+5.6	+0.2	+0.0	81.6	93.9	-12.3	Anten 45MHz GMSK
19	45.400M	35.9	+19.5	+20.3	+5.6	+0.2	+0.0	81.5	93.9	-12.4	Anten 43MHz BPSK
20	47.400M	35.2	+19.5	+20.3	+5.6	+0.2	+0.0	80.8	93.9	-13.1	Anten 45MHz BPSK
21	40.600M	34.5	+19.5	+20.3	+5.6	+0.2	+0.0	80.1	93.9	-13.8	Anten 43MHz BPSK
22	42.600M	33.7	+19.5	+20.3	+5.6	+0.2	+0.0	79.3	93.9	-14.6	Anten 45MHz BPSK
23	135.002M	31.8	+19.4	+20.3	+5.6	+0.4	+0.0	77.5	93.9	-16.4	Anten 45MHz BPSK
24	135.007M	31.6	+19.4	+20.3	+5.6	+0.4	+0.0	77.3	93.9	-16.6	Anten 45MHz GMSK

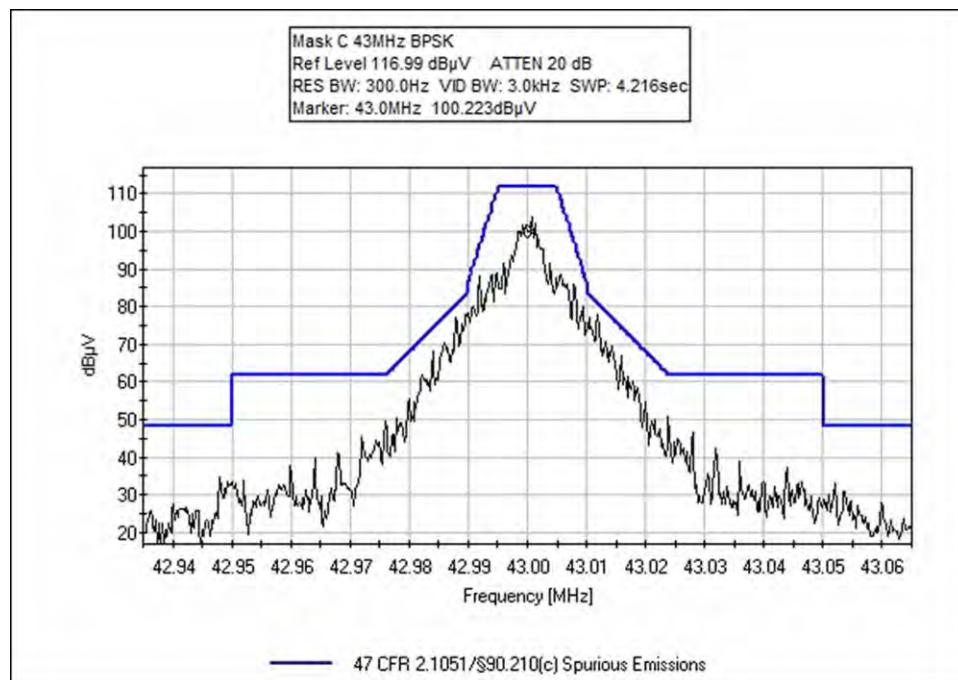
25	46.517M	31.0	+19.5	+20.3	+5.6	+0.2	+0.0	76.6	93.9	-17.3	Anten
									45MHz GMSK		
26	43.600M	30.3	+19.5	+20.3	+5.6	+0.2	+0.0	75.9	93.9	-18.0	Anten
									45MHz GMSK		
27	141.000M	29.5	+19.4	+20.3	+5.6	+0.4	+0.0	75.2	94.0	-18.8	Anten
									47MHz BPSK		
28	180.001M	29.1	+19.5	+20.3	+5.6	+0.4	+0.0	74.9	93.9	-19.0	Anten
									45MHz BPSK		
29	140.995M	29.0	+19.4	+20.3	+5.6	+0.4	+0.0	74.7	94.0	-19.3	Anten
									47MHz GMSK		
30	128.993M	28.1	+19.4	+20.3	+5.6	+0.4	+0.0	73.8	93.9	-20.1	Anten
									43MHz GMSK		
31	128.999M	28.0	+19.4	+20.3	+5.6	+0.4	+0.0	73.7	93.9	-20.2	Anten
									43MH BPSK		
32	179.989M	27.7	+19.5	+20.3	+5.6	+0.4	+0.0	73.5	93.9	-20.4	Anten
									45MHz GMSK		
33	49.800M	27.7	+19.5	+20.3	+5.6	+0.2	+0.0	73.3	93.9	-20.6	Anten
									45MHz GMSK		
34	49.800M	27.6	+19.5	+20.3	+5.6	+0.2	+0.0	73.2	93.9	-20.7	Anten
									45MHz BPSK		
35	171.998M	27.5	+19.4	+20.3	+5.6	+0.4	+0.0	73.2	93.9	-20.7	Anten
									43MH BPSK		
36	40.200M	26.5	+19.5	+20.3	+5.6	+0.2	+0.0	72.1	93.9	-21.8	Anten
									45MHz GMSK		
37	40.200M	26.3	+19.5	+20.3	+5.6	+0.2	+0.0	71.9	93.9	-22.0	Anten
									45MHz BPSK		
38	10.670M	26.2	+19.4	+20.3	+5.6	+0.1	+0.0	71.6	94.0	-22.4	Anten
39	172.004M	25.5	+19.4	+20.3	+5.6	+0.4	+0.0	71.2	93.9	-22.7	Anten
									43MHz GMSK		
40	187.999M	25.5	+19.5	+20.3	+5.6	+0.4	+0.0	71.3	94.0	-22.7	Anten
									47MHz BPSK		
41	215.016M	24.2	+19.5	+20.3	+5.6	+0.4	+0.0	70.0	93.9	-23.9	Anten
									43MHz GMSK		
42	495.011M	23.6	+19.5	+20.4	+5.7	+0.7	+0.0	69.9	93.9	-24.0	Anten
									45MHz BPSK		
43	657.913M	23.5	+19.5	+20.4	+5.7	+0.8	+0.0	69.9	94.0	-24.1	Anten
									47MHz GMSK		
44	215.017M	24.0	+19.5	+20.3	+5.6	+0.4	+0.0	69.8	93.9	-24.1	Anten
									43MH BPSK		
45	235.025M	23.7	+19.5	+20.3	+5.6	+0.5	+0.0	69.6	94.0	-24.4	Anten
									47MHz BPSK		
46	188.003M	23.8	+19.5	+20.3	+5.6	+0.4	+0.0	69.6	94.0	-24.4	Anten
									47MHz GMSK		
47	282.004M	23.5	+19.5	+20.3	+5.6	+0.5	+0.0	69.4	94.0	-24.6	Anten
									47MHz GMSK		
48	799.047M	23.0	+19.5	+20.3	+5.7	+0.8	+0.0	69.3	94.0	-24.7	Anten
									47MHz GMSK		
49	224.994M	23.2	+19.5	+20.3	+5.6	+0.5	+0.0	69.1	93.9	-24.8	Anten
									45MHz BPSK		
50	224.982M	23.1	+19.5	+20.3	+5.6	+0.5	+0.0	69.0	93.9	-24.9	Anten
									45MHz GMSK		

51	359.994M	22.8	+19.5	+20.3	+5.6	+0.6	+0.0	68.8	93.9	-25.1	Anten
52	986.919M	22.3	+19.6	+20.3	+5.7	+0.9	+0.0	68.8	94.0	-25.2	Anten
53	423.004M	22.6	+19.5	+20.3	+5.6	+0.6	+0.0	68.6	94.0	-25.4	Anten
54	235.037M	22.7	+19.5	+20.3	+5.6	+0.5	+0.0	68.6	94.0	-25.4	Anten
55	38.400M	21.7	+19.5	+20.3	+5.6	+0.2	+0.0	67.3	94.0	-26.7	Anten
56	329.004M	20.3	+19.5	+20.3	+5.6	+0.6	+0.0	66.3	94.0	-27.7	Anten
57	1.410M	17.0	+19.4	+20.3	+5.6	+0.0	+0.0	62.3	94.0	-31.7	Anten

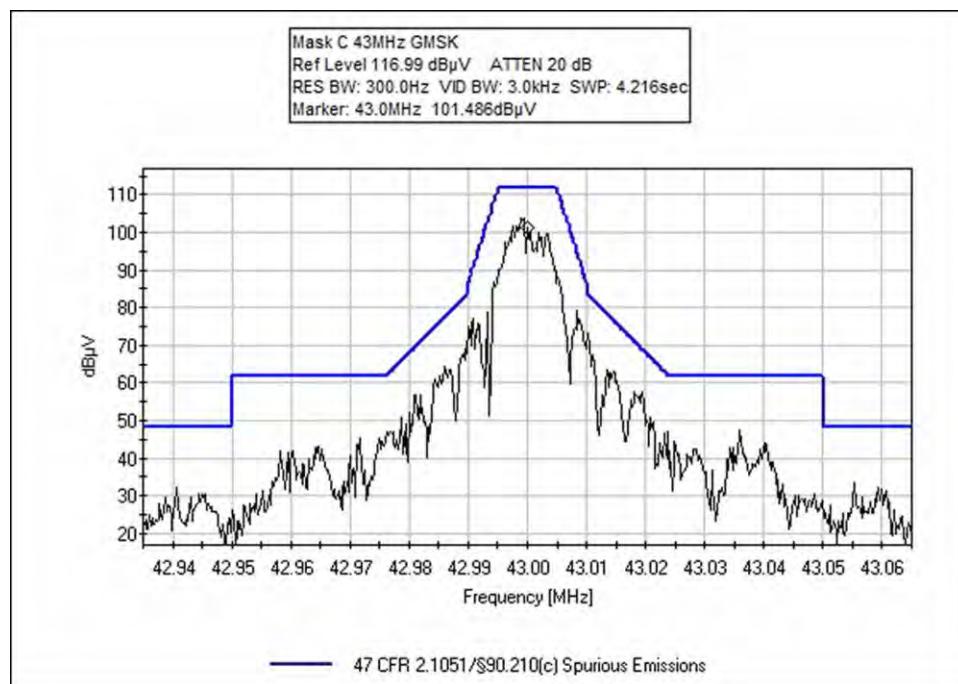
CKC Laboratories, Inc. Date: 4/15/2014 Time: 09:28:17 Maiden Rock Communications WO# 95510
 Test Lead: Antenna 120V 60Hz Sequence#: 26 Antenna
 Maiden Rock Communications Packet Data Radio P/N: MRC565-43-47



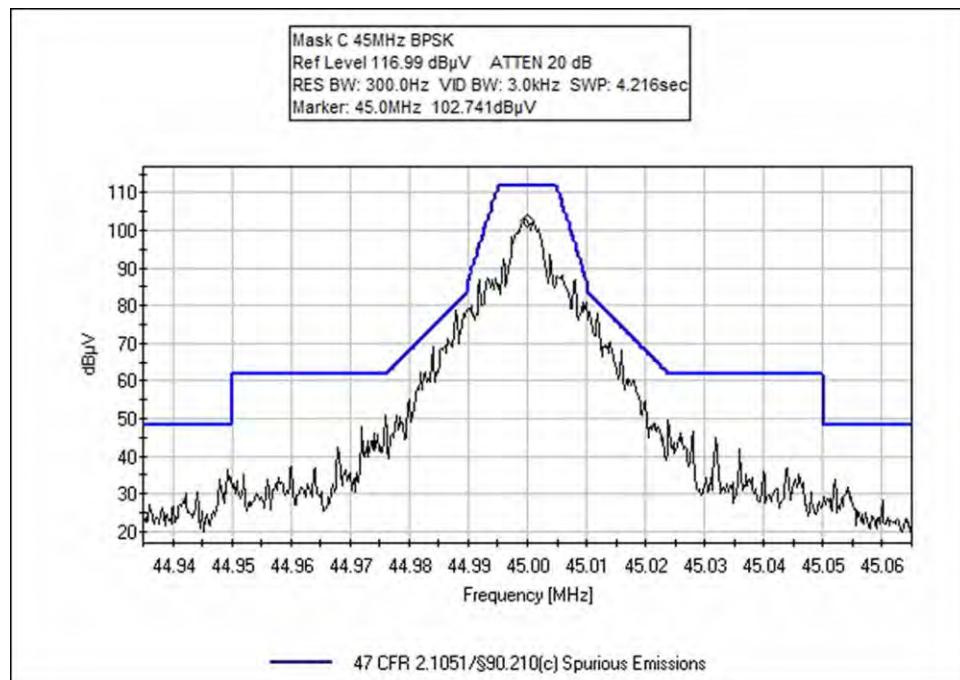
Test Data



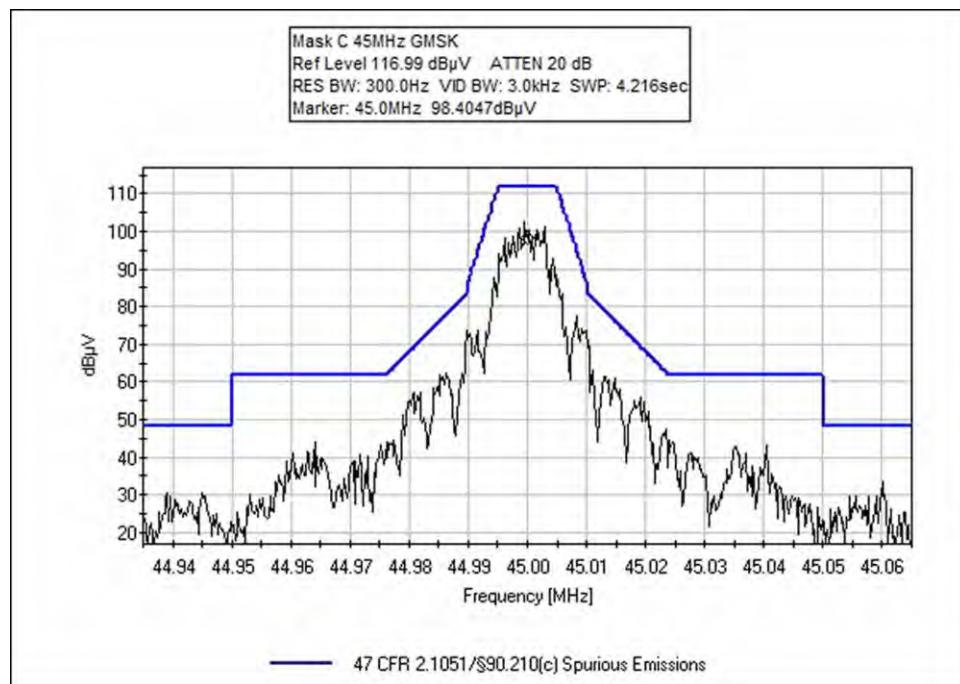
43MHz, BPSK



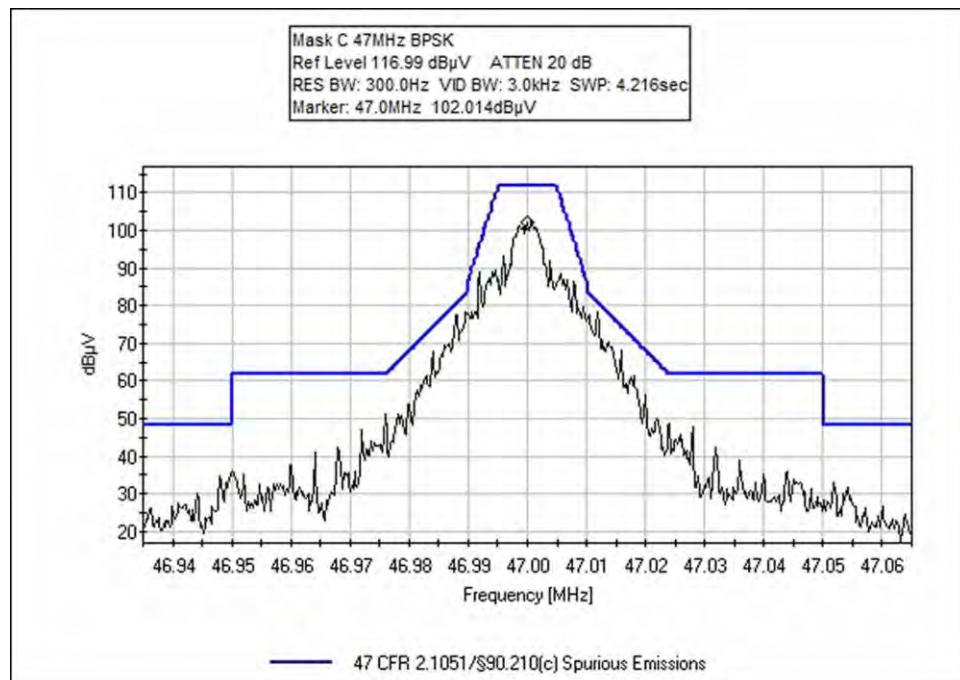
43MHz, GMSK



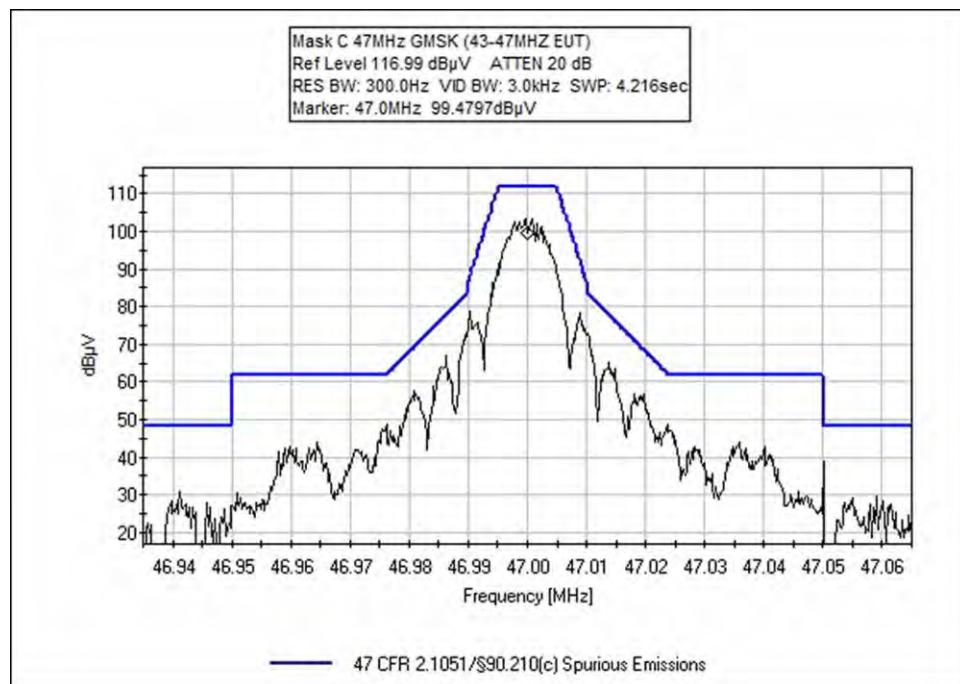
45MHz, BPSK



45MHz, GMSK



47MHz, BPSK



47MHz, 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: **11:26:41**
 Equipment: **Packet Data Radio** Sequence#: **3**
 Manufacturer: Maiden Rock Communications Tested By: Steven Pittsford
 Model: MRC565-43-47
 S/N: 1006

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02307	Preamp	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	MRC565-43-47	1006

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 43, 45 & 47MHz. 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):	43, 45 & 47MHz	
Operational Mode(s):	GMSK & BPSK(BPSK is worst case)	
Highest Measured Power:	50.3	dBm
Measurement Distance:	3	meters

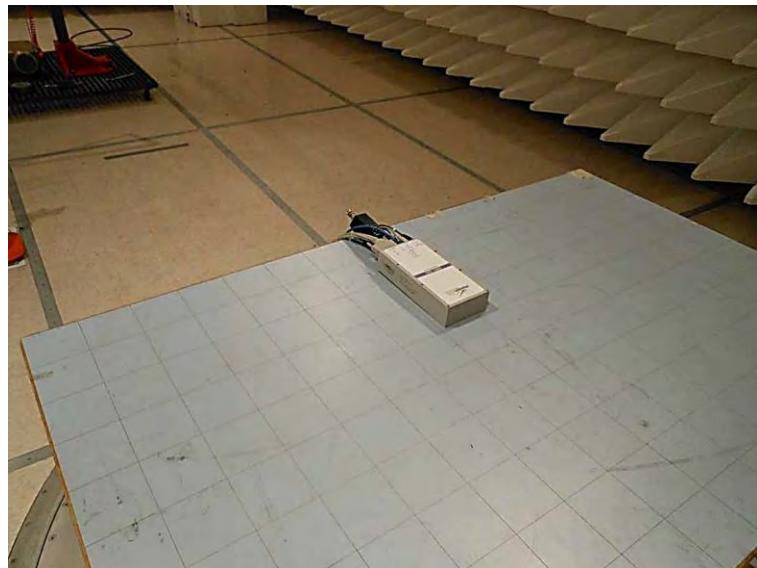
Limit Definition:

Frequency Range	Limit (dBc)	Limit Calculation
9kHz - 1GHz	63.3	43+10*LOG(P)

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin	Antenna Polarity
134.981	-34.1	84.4	-21.1	Horizontal
539.949	-36.1	86.4	-23.1	Vertical
472.810	-40.0	90.3	-27.0	Horizontal
89.983	-40.3	90.6	-27.3	Vertical
89.996	-40.8	91.1	-27.8	Vertical
141.049	-41.8	92.1	-28.8	Horizontal
516.013	-44.9	95.2	-31.9	Horizontal
214.997	-45.7	96.0	-32.7	Horizontal
94.008	-46.6	96.9	-33.6	Horizontal
469.891	-47.1	97.4	-34.1	Vertical
500.249	-47.4	97.7	-34.4	Vertical
94.028	-47.6	97.9	-34.6	Horizontal
86.006	-47.7	98.0	-34.7	Horizontal
134.993	-48.1	98.4	-35.1	Horizontal
563.886	-48.6	98.9	-35.6	Vertical
86.039	-49.0	99.3	-36.0	Horizontal
129.015	-50.2	100.5	-37.2	Horizontal
141.007	-50.4	100.7	-37.4	Horizontal
559.215	-52.0	102.3	-39.0	Horizontal
128.991	-52.3	102.6	-39.3	Vertical
900.167	-52.5	102.8	-39.5	Horizontal
533.527	-53.0	103.3	-40.0	Vertical
171.992	-53.0	103.3	-40.0	Horizontal
600.083	-53.6	103.9	-40.6	Vertical
180.008	-53.7	104.0	-40.7	Horizontal

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin	Antenna Polarity
450.041	-54.4	104.7	-41.4	Horizontal
174.906	-54.6	104.9	-41.6	Horizontal
719.766	-54.9	105.2	-41.9	Vertical
751.876	-54.9	105.2	-41.9	Vertical
524.770	-55.3	105.6	-42.3	Horizontal
549.874	-56.1	106.4	-43.1	Horizontal
538.198	-56.4	106.7	-43.4	Horizontal
430.191	-56.6	106.9	-43.6	Vertical
75.017	-56.7	107.0	-43.7	Horizontal
949.791	-56.9	107.2	-43.9	Horizontal
188.027	-57.2	107.5	-44.2	Horizontal
424.937	-60.4	110.7	-47.4	Vertical

Test Setup Photos



2.1055 / 90.213 Frequency Stability

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 #:	MRC565-43-47
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	43		45		47	
-30	12	42.99999	0.25581	44.99999	0.26667	46.99999	0.25532
-20	12	43.00000	0.09302	45.00001	0.11111	47.00001	0.12766
-10	12	43.00000	0.09302	45.00000	0.08889	47.00000	0.08511
0	12	43.00000	0.02326	45.00000	0.02222	47.00000	0.02128
10	12	43.00000	0.09302	45.00000	0.06667	47.00000	0.08511
20	12	42.99998	0.46512	44.99998	0.44444	46.99998	0.36170
30	12	42.99998	0.46512	44.99998	0.51111	46.99998	0.48936
40	12	42.99998	0.51163	44.99998	0.53333	46.99997	0.55319
50	12	42.99997	0.67442	44.99997	0.66667	46.99997	0.65957

Voltage Variations ($\pm 15\%$)

20	10.2	42.99998	0.39535	44.99998	0.44444	46.99998	0.36170
20	12	42.99998	0.46512	44.99998	0.44444	46.99998	0.36170
20	13.8	42.99998	0.39535	44.99998	0.44444	46.99998	0.42553

Max Deviation (PPM)	0.67442			0.66667			0.65957
		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



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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ was corrected by using the following formula. This reading was then compared to the applicable specification limit.

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