Rothenbuhler Engineering

TEST REPORT FOR

Controller, 1678-1-V2
Electric Remote, 1678-2-V2
RSTI, 1678-3-V2
Test Box, 1678-4-V2
Mini Controller, 1678-6-V2

Tested To The Following Standards:

FCC Part 90I

Report No.: 94091-7

Date of issue: April 11, 2013

A2LA ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

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:

Rothenbuhler Engineering
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Sedro Woolley, WA 98284-0708

Representative: Tom Jacobson
Customer Reference Number: 22980

REPORT PREPARED BY:

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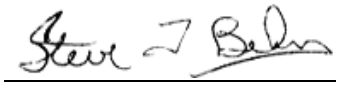
Mariposa, CA 95338

Project Number: 93918

DATE OF EQUIPMENT RECEIPT: March 19, 2013
DATE(S) OF TESTING: March 19-22, 2013

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
Immunity	5.00.07

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 90I

Description	Test Procedure/Method	Results
RF Output Power	FCC Part 90I / 90.205(d) / TIA-603-C 2.2.1	Pass
Occupied Bandwidth	FCC Part 90I / 2.90.209(b)(5) / 2.1049 / ANSI C63.4	Pass
Emissions Mask	FCC Part 90I / 90.210(d) / TIA 603-C 2.2.11	Pass
Conducted Spurious Emissions	FCC Part 90I / 90.210(d) / TIA 603-C 2.2.11	Pass
Radiated Spurious Emissions	FCC Part 90I / 90.210(d) / TIA 603-C 2.2.11	Pass
Frequency Stability	FCC Part 90I / 90.213 / 2.1055 / TIA-603-C 2.2.2 / 2.3.2	Pass
Transient Frequency Behavior	FCC Part 90I / 90.214 / TIA-603-C 2.2.19	Pass

Conditions During Testing

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

Summary of Conditions
Model 1678-1-V2 is representative of Models: 1678-2-V2, 1678-3-V2 & 1678-6-V2.

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Controller
Manuf: Rothenbuhler Engineering
Model: 1678-1-V2
Serial: 00001

RSTI
Manuf: Rothenbuhler Engineering
Model: 1678-3-V2
Serial: 00001

Electric Remote
Manuf: Rothenbuhler Engineering
Model: 1678-2-V2
Serial: 00001

Test box
Manuf: Rothenbuhler Engineering
Model: 1678-4-V2
Serial: 00002

Mini Controller
Manuf: Rothenbuhler Engineering
Model: 1678-6-V2
Serial: 00002

PERIPHERAL DEVICES

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

Laptop
Manuf: DELL
Model: Latitude D810
Serial:

Power Supply
Manuf: HQ
Model: PS50050
Serial: 0-50VDC/5A

USB 2.0 Kit
Manuf: S.I. Tech
Model: 2172
Serial: AN03081

Switching Power Adaptor
Manuf: PHIHONG
Model: PSC30R-120
Serial: NA

Test box
Manuf: Rothenbuhler Engineering
Model: 1678-4-V2
Serial: 00002

Controller
Manuf: Rothenbuhler Engineering
Model: 1678-1-V2
Serial: 00001

Mini Controller
Manuf: Rothenbuhler Engineering
Model: 1678-6-V2
Serial: 00002

FCC PART 90I

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR Part 90I requirements for radio communications systems licensed and used in the Public Safety, Industrial/Business Radio Pool, and Radiolocation Radio Services.

RF Power Output

Test Conditions / Setup

Temp: 21°
Humidity: 32%
Pressure: 102.6kPa
Frequency Range: 150-174MHz

EUT's RF output is connected to the Spectrum Analyzer.
EUT is connected to a laptop and to a controller.
EUT is powered by a power supply as a battery replacement.
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.

Engineer Name: S. Pittsford

Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
02871	Spectrum Analyzer	Agilent	E4440A	4/22/2011	4/22/2013
03227	Cable	Astrolab	32026-29080-29080-84	5/2/2011	5/2/2013
P06219	Attenuator	Narda	768-10	3/22/2012	3/22/2014
01706	Attenuator	HP	8495B	1/11/2012	1/11/2014

Test Data

Frequency (MHz)	RF Output Power (dBm)	90.205 Limit	Result
150.00	29	30dBm	Pass
162.00	28.8	30dBm	Pass
174.00	29	30dBm	Pass

Note: The above table applies to Model: Test Box, 1678-4-V2.

Frequency (MHz)	RF Output Power (dBm)	90.205 Limit	Result
150.00	36.9	44.5dBm	Pass
162.00	36.9	44.5dBm	Pass
174.00	36.9	44.5dBm	Pass

Note: The above table applies to Model: Controller, 1678-1-V2.

Frequency (MHz)	RF Output Power (dBm)	90.205 Limit	Result
150.00	32.9	44.5dBm	Pass
162.00	32.9	44.5dBm	Pass
174.00	33.0	44.5dBm	Pass

Note: The above table applies to Model: Electric Remote, 1678-2-V2.

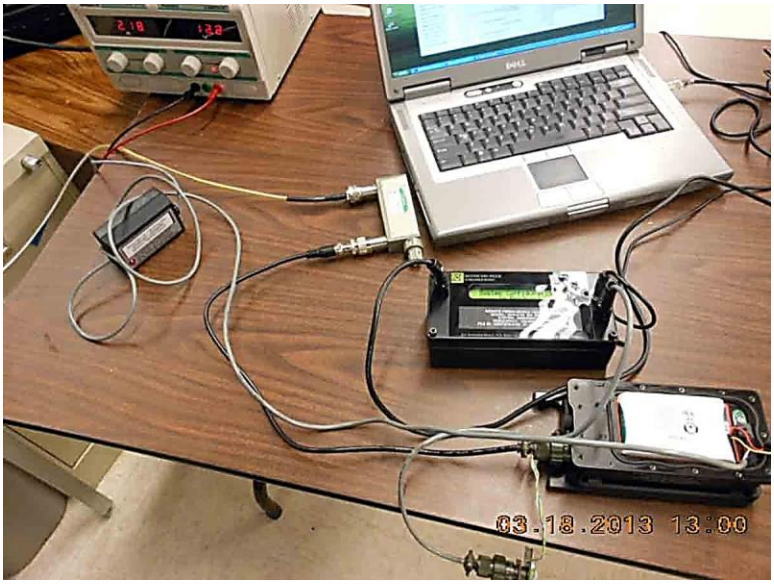
Frequency (MHz)	RF Output Power (dBm)	90.205 Limit	Result
150.00	36.9	44.5dBm	Pass
162.00	36.8	44.5dBm	Pass
174.00	36.0	44.5dBm	Pass

Note: The above table applies to Model: RSTI, 1678-3-V2.

Frequency (MHz)	RF Output Power (dBm)	90.205 Limit	Result
150.00	37.0	44.5dBm	Pass
162.00	36.8	44.5dBm	Pass
174.00	36.9	44.5dBm	Pass

Note: The above table applies to Model: Mini Controller, 1678-6-V2.

Test Setup Photos



1678-1-V2

1678-2-V2

1678-3-V2

1678-4-V2

1678-6-V2

Occupied Bandwidth

Test Conditions / Setup

Temp: 21°
Humidity: 32%
Pressure: 102.7kPa
Frequency Range: 150-174MHz

EUT's RF output is connected to the Spectrum Analyzer.
For 1678-4-V2: EUT is connected to a laptop and to a controller.
For 1678-1-V2: EUT is connected to a laptop and to a Test box
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.
Channel spacing is 12.5kHz: Allowed OBW is 11.25kHz

1678-1-V2 has identical transceiver circuitry as the 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The 1678-1-V2 is worst case of the units and is representative of 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The1678-1-V2, 1678-2-V2, 1678-3-V2 & 1678-6-V2 have the ability to transmit at 5W or 2W. 5W will be tested.

RBW=300Hz
VBW=3kHz

Engineer Name: S. Pittsford

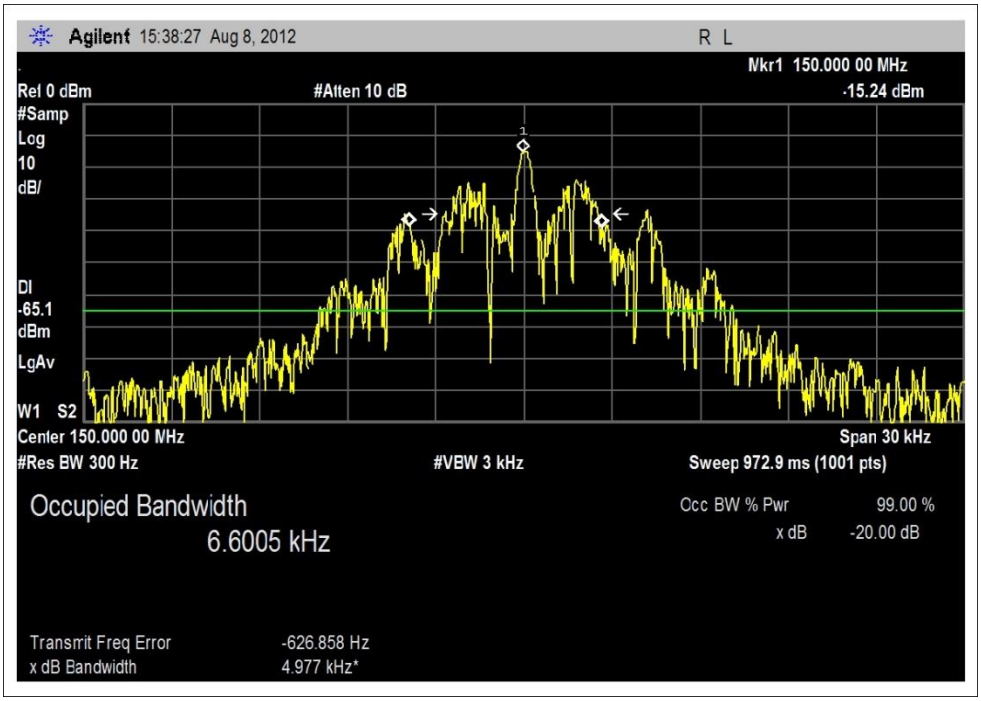
Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
02871	Spectrum Analyzer	Agilent	E4440A	4/22/2011	4/22/2013
03227	Cable	Astrolab	32026-29080-29080-84	5/2/2011	5/2/2013
01706	Attenuator	HP	8495B	1/11/2012	1/11/2014

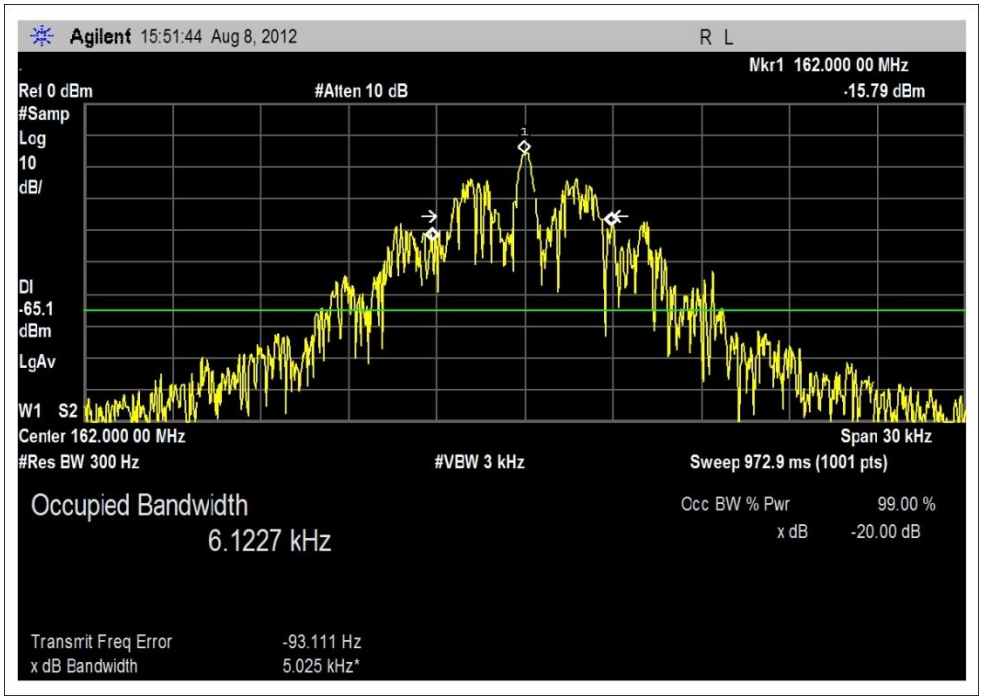
Test Data

Frequency (MHz)	Occupied Bandwidth	99% Bandwidth
150.00	4.98kHz	6.60kHz
162.00	5.03kHz	6.12kHz
174.00	5.38kHz	5.96kHz

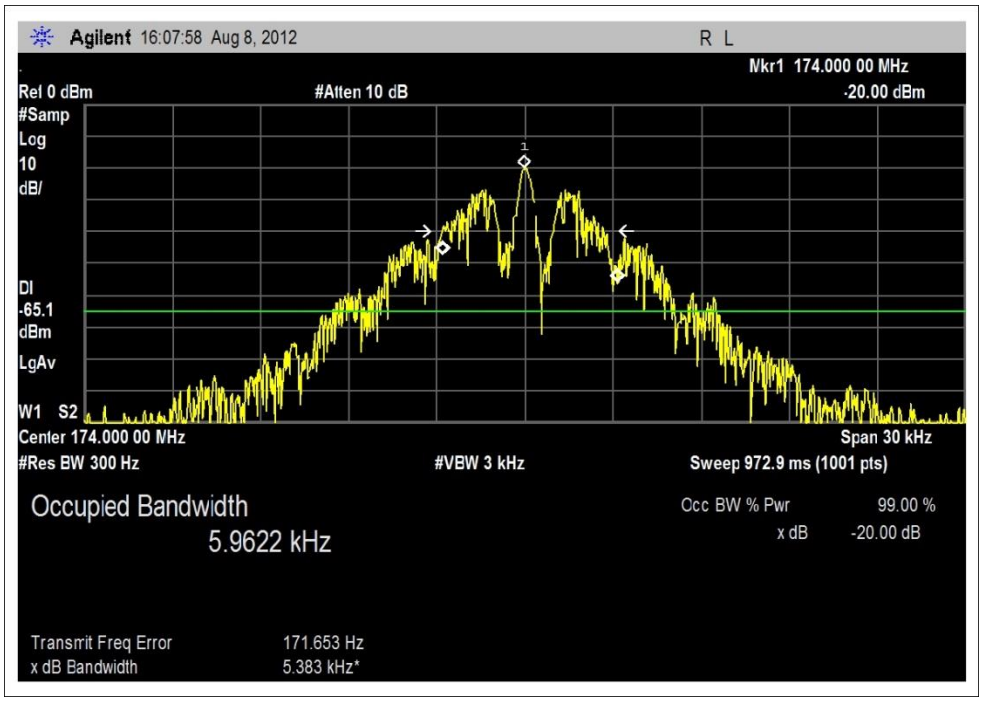
Note: The above table applies to Model: Controller, 1678-1-V2.



Low , 1678-1-V2



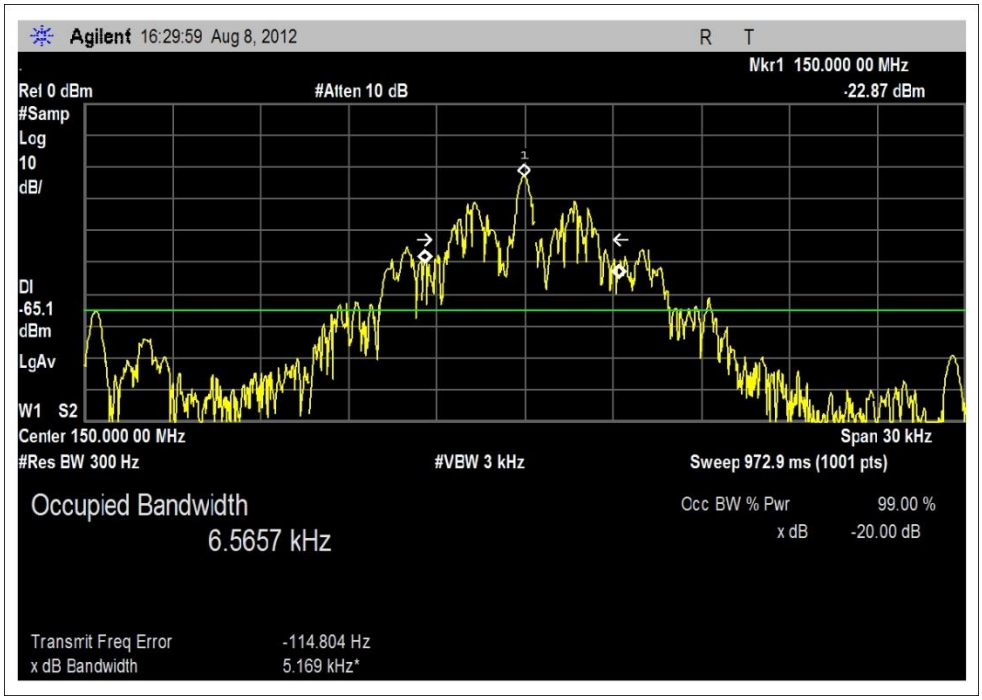
Mid, 1678-1-V2



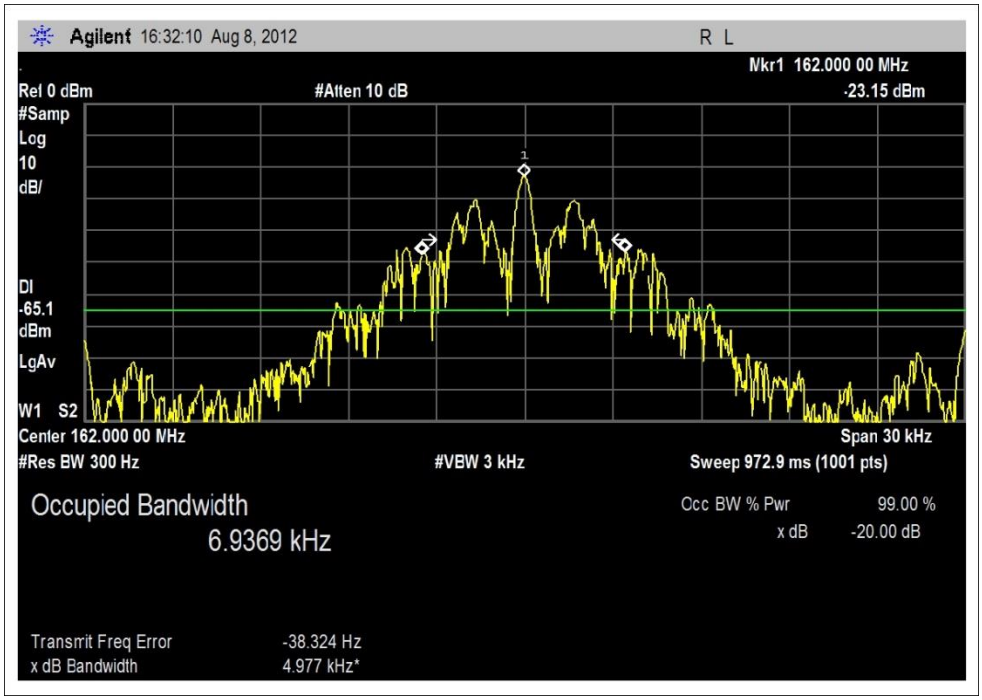
High, 1678-1-V2

Frequency (MHz)	Occupied Bandwidth	99% Bandwidth
150.00	5.17kHz	6.57kHz
162.00	4.98kHz	6.94kHz
174.00	5.37kHz	7.21kHz

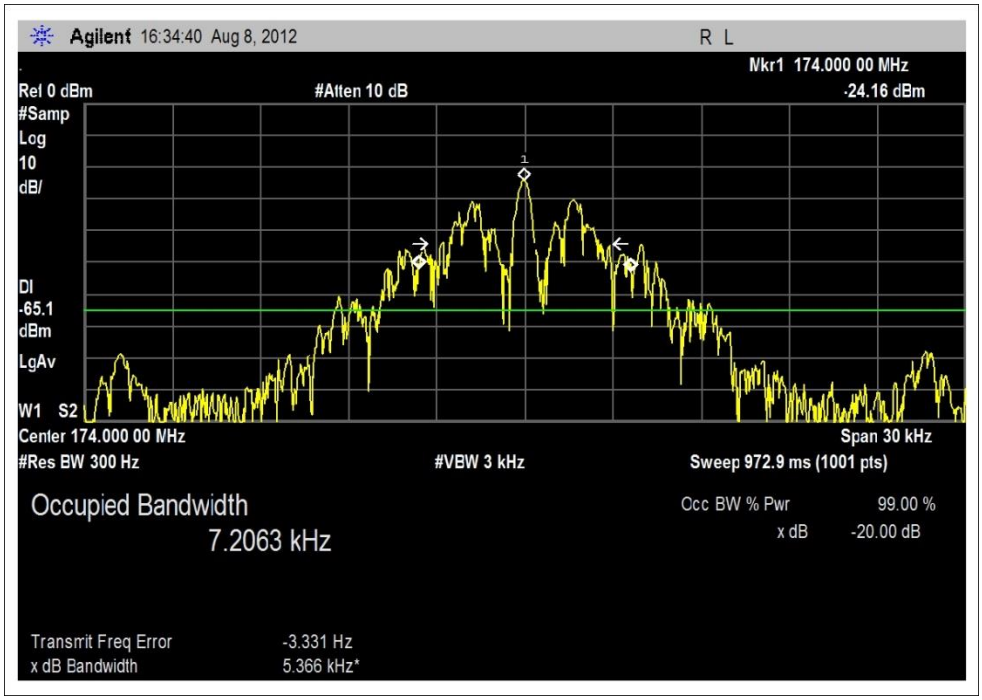
Note: The above table applies to Model: Test Box, 1678-4-V2.



Low 1678-4-V2

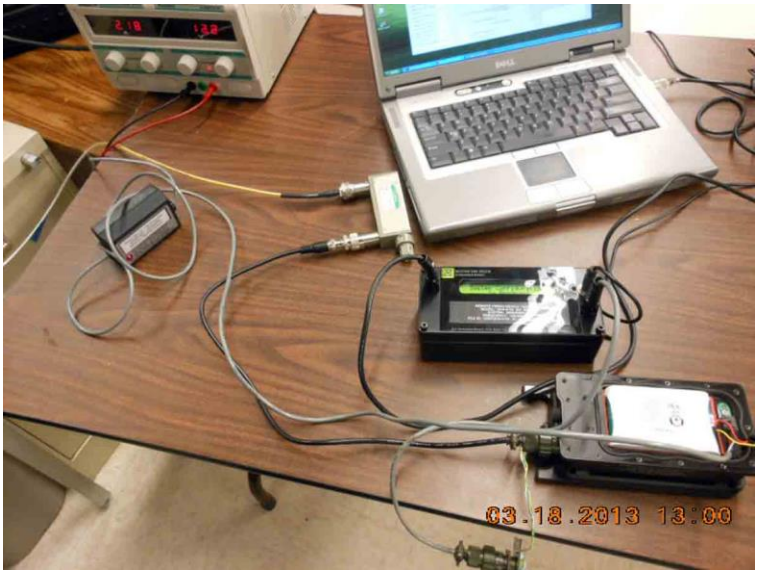


Mid, 1678-4-V2

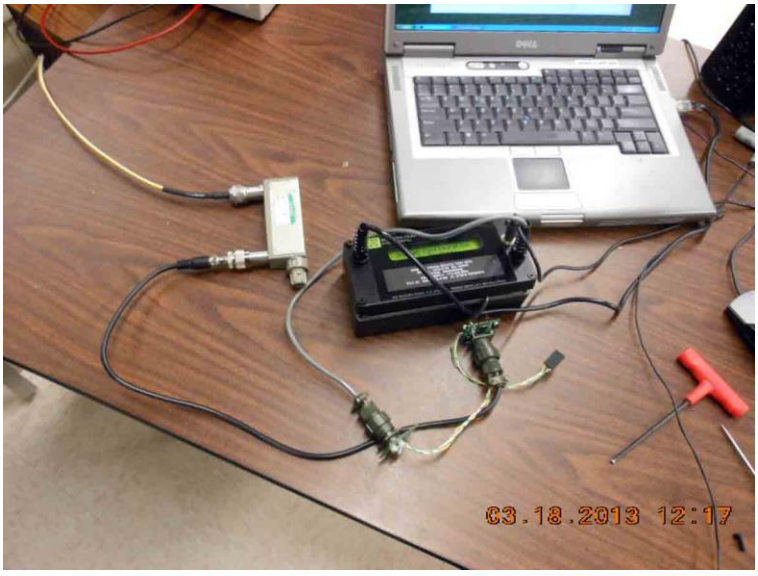


High, 1678-4-V2

Test Setup Photos



1678-1-V2



1678-4-V2

Emissions Mask

Test Conditions / Setup

Test Conditions

Temp: 23°
Humidity: 28%
Pressure: 101.7kPa

EUT's RF output is connected to the Spectrum Analyzer.
For 1678-4-V2: EUT is connected to a laptop and to a controller.
For 1678-1-V2: EUT is connected to a laptop and to a test box.
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.

Mask D

1678-1-V2 has identical transceiver circuitry as the 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The 1678-1-V2 is worst case of the units and is representative of 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The1678-1-V2, 1678-2-V2, 1678-3-V2 & 1678-6-V2 have the ability to transmit at 5W or 2W. 5W will be tested.

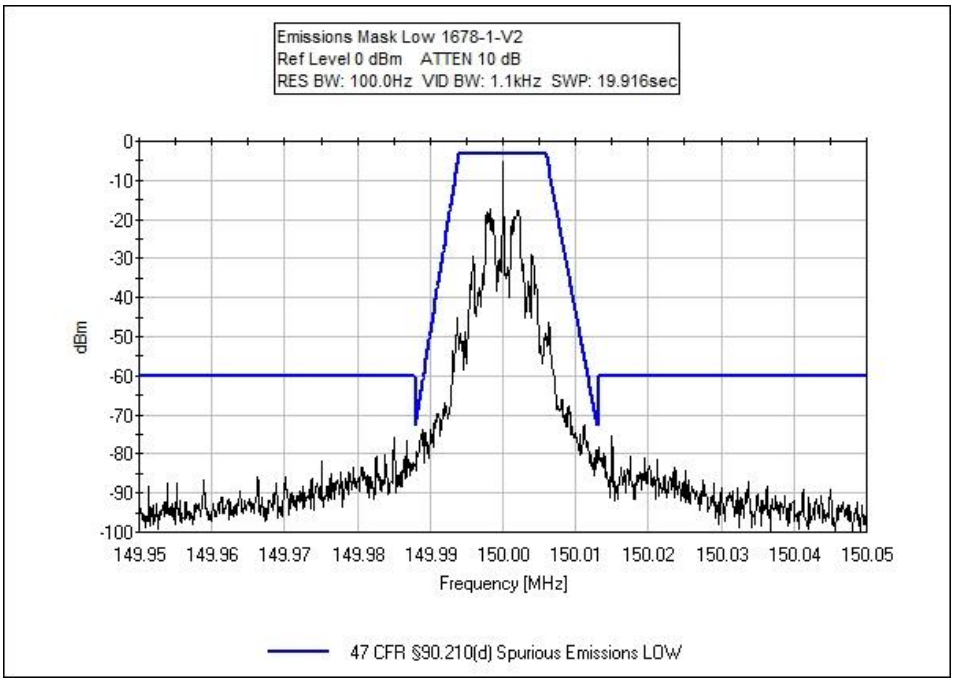
Limit line adjusted to the data.
RBW=100Hz
VBW=1.1kHz

Engineer Name: S. Pittsford

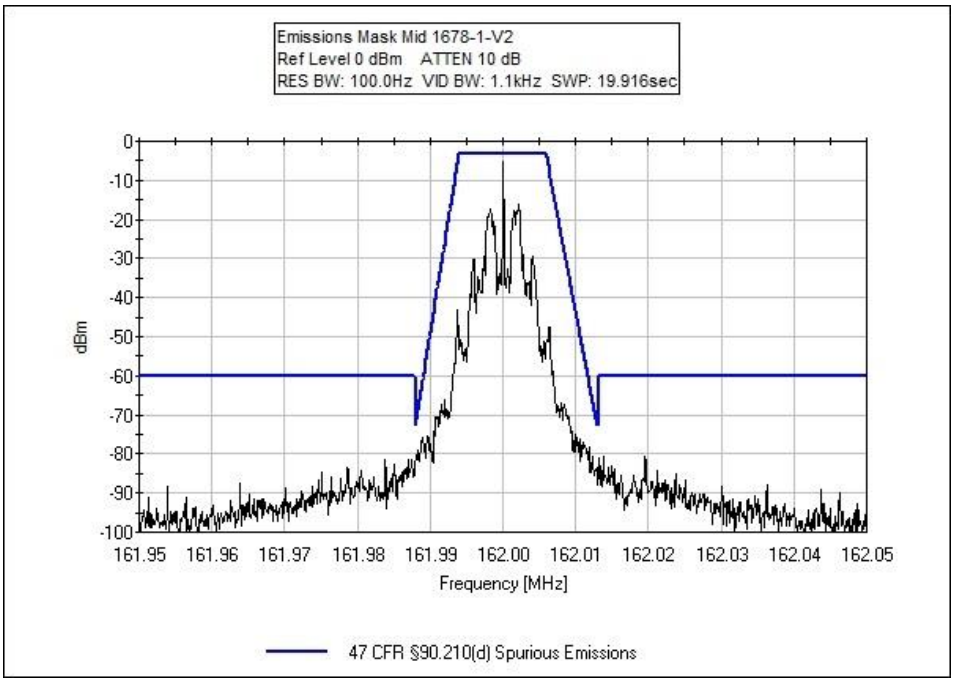
Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
02871	Spectrum Analyzer	Agilent	E4440A	4/22/2011	4/22/2013
03227	Cable	Astrolab	32026-29080-29080-84	5/2/2011	5/2/2013
01706	Attenuator	HP	8495B	1/11/2012	1/11/2014

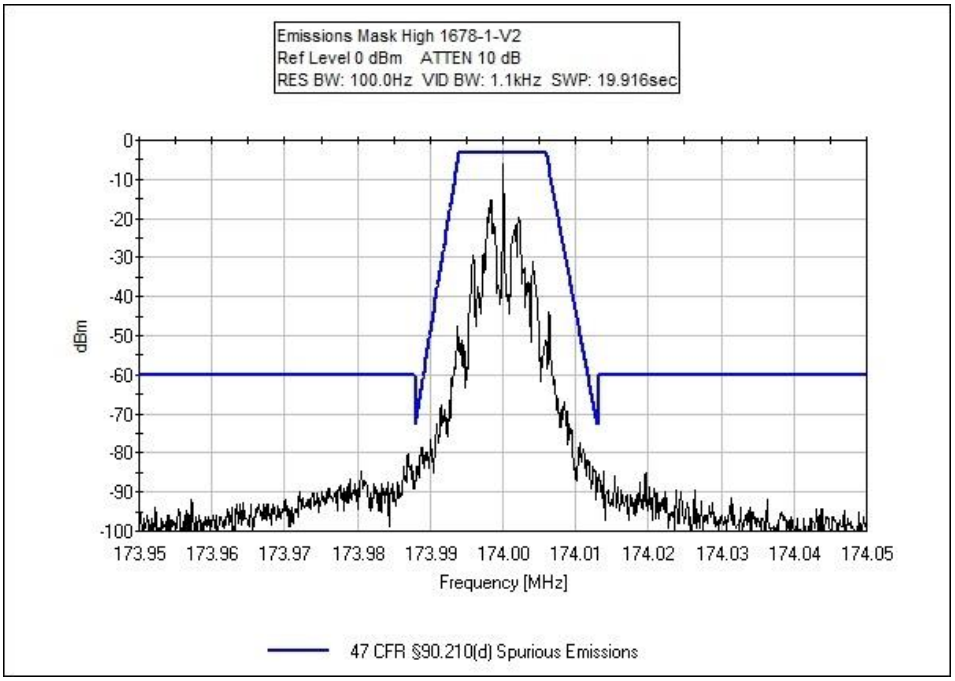
Test Data



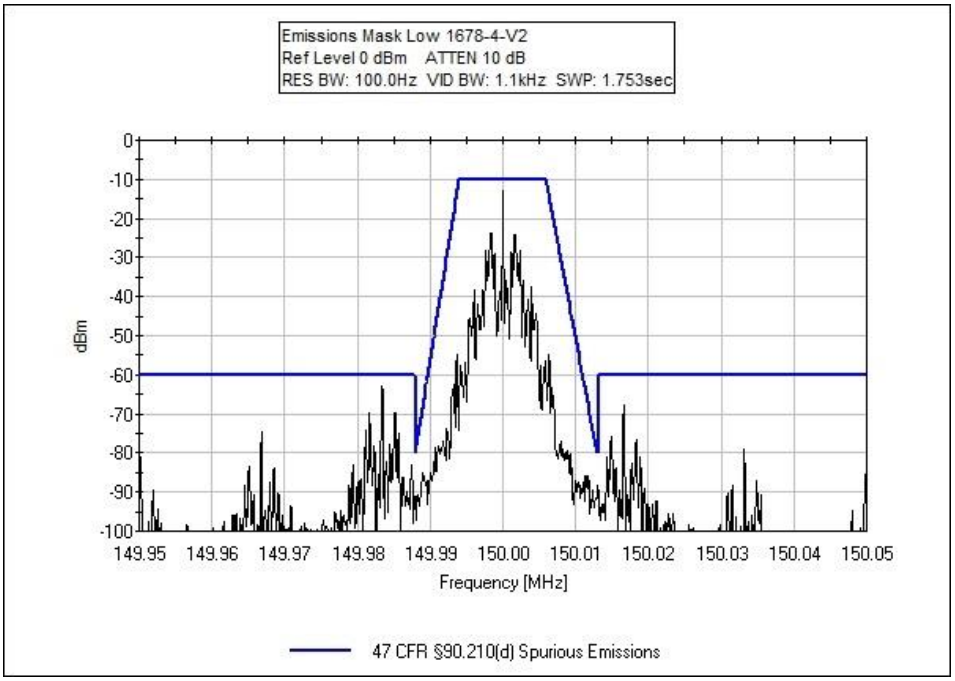
1678-1-V2 Low Mask



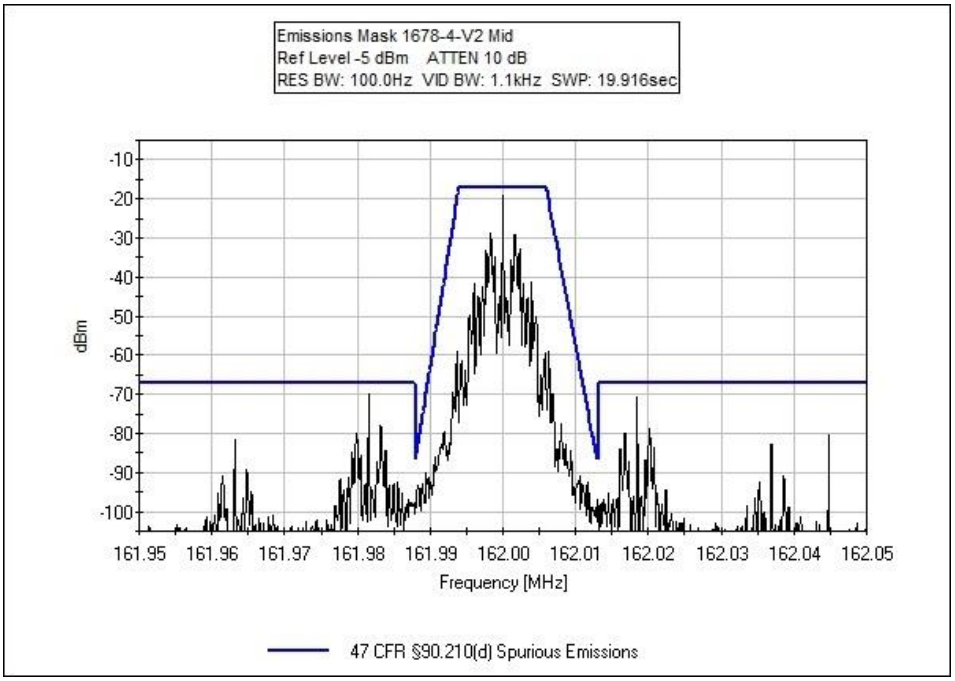
1678-1-V2 Mid Mask



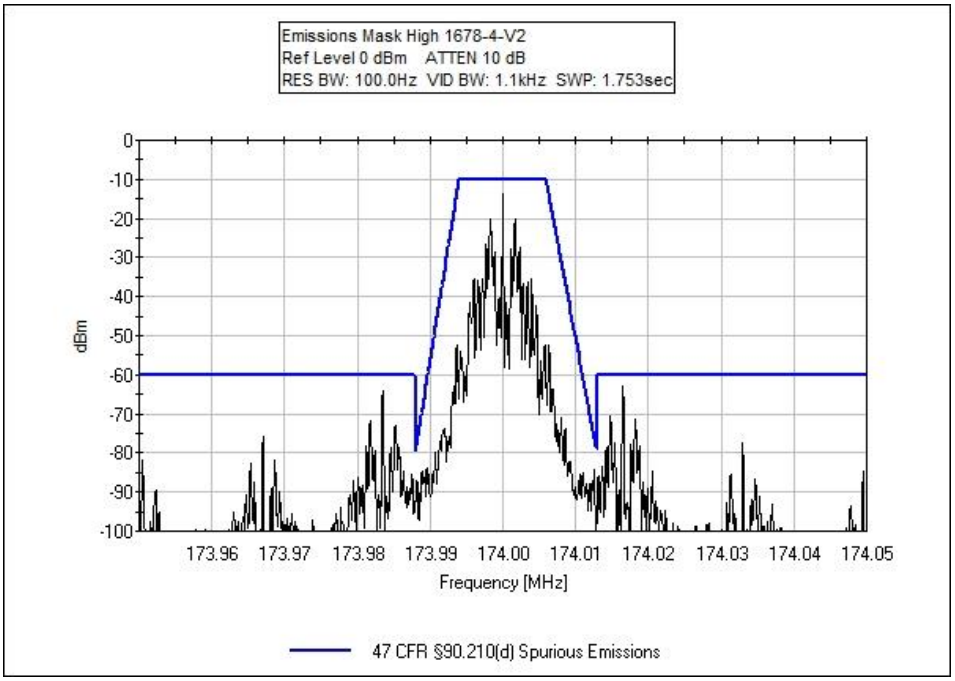
1678-1-V2 High Mask



1678-4-V2 Low Mask



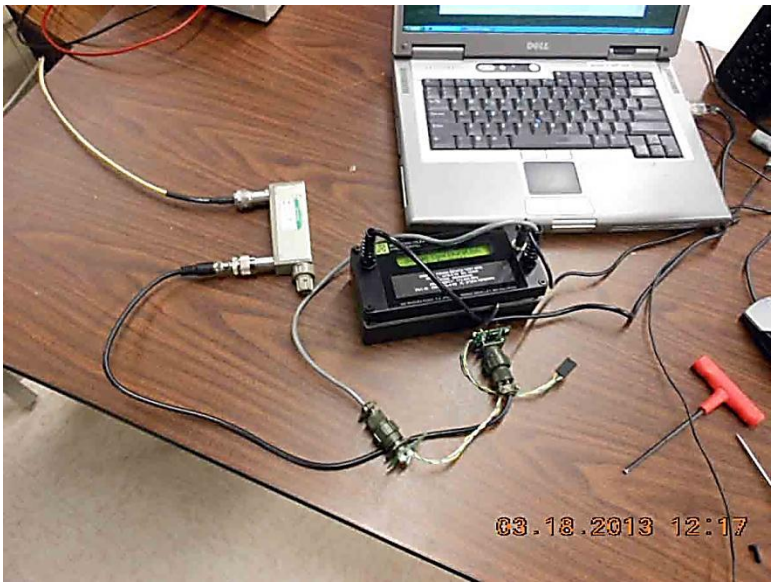
1678-4-V2 Mid Mask



1678-4-V2 High Mask

Test Setup Photos

1678-1-V2



1678-4-V2

Conducted Spurious Emissions

Test Data Sheets

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

Customer: **Rothenbuhler Engineering**
Specification: **47 CFR §90.210(d) Spurious Emissions**
Work Order #: **93918** Date: 3/19/2013
Test Type: **Conducted Emissions** Time: 08:23:15
Equipment: **Controller** Sequence#: 10
Manufacturer: Rothenbuhler Engineering Tested By: Steven Pittsford
Model: 1678-1-V2 None
S/N: 00001

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03227	Cable	32026-29080-29080-84	5/2/2011	5/2/2013
	AN02871	Spectrum Analyzer	E4440A	4/22/2011	4/22/2013
T2	AN01706	Attenuator-Factor @ 40dB (dB)	8495B	1/11/2012	1/11/2014

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Controller*	Rothenbuhler Engineering	1678-1-V2	00001

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	DELL	Latitude D810	NA
Test box	Rothenbuhler Engineering	1678-4-V2	00002
Power Supply	HQ	PS50050	0-50VDC/5A

Test Conditions / Notes:

Temp: 21°C, Humidity: 34%, Pressure: 102.6kPa
Frequency Range: 9k-2GHz
Mask D
EUT's RF output is connected to the Spectrum Analyzer
EUT is connected to a laptop and to a test box
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.
Only highest emissions will be recorded.

1678-1-V2 has identical transceiver circuitry as the 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The 1678-1-V2 is worst case of the units and is representative of 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The1678-1-V2, 1678-2-V2, 1678-3-V2 & 1678-6-V2 have the ability to transmit at 5W or 2W. 5W will be tested.
RBW: 200Hz 9kHz - 150kHz; 10kHz 150kHz - 30MHz; 100kHz 30MHz - 1GHz; 1MHz; 1-2GHz
VBW: 10x RBW
Sweep: Auto

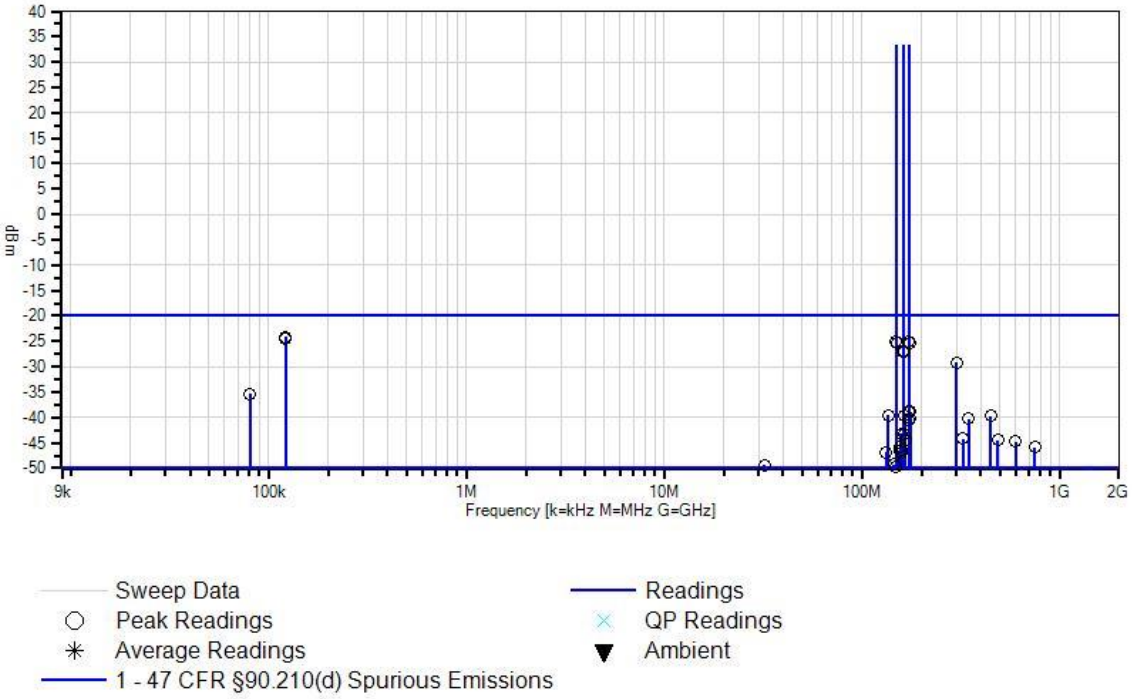
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: Antenna

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	122.230k	-64.0	+0.0	+39.8			+0.0	-24.2	-20.0 Low	-4.2	Anten
2	122.035k	-64.4	+0.0	+39.8			+0.0	-24.6	-20.0 Mid	-4.6	Anten
3	173.215M	-65.2	+0.4	+39.8			+0.0	-25.0	-20.0 High	-5.0	Anten
4	149.283M	-65.3	+0.4	+39.8			+0.0	-25.1	-20.0 Low	-5.1	Anten
5	150.708M	-65.5	+0.4	+39.8			+0.0	-25.3	-20.0 Low	-5.3	Anten
6	174.785M	-65.5	+0.4	+39.8			+0.0	-25.3	-20.0 High	-5.3	Anten
7	162.750M	-67.1	+0.4	+39.8			+0.0	-26.9	-20.0 Mid	-6.9	Anten
8	161.250M	-67.3	+0.4	+39.8			+0.0	-27.1	-20.0 Mid	-7.1	Anten
9	300.000M	-69.4	+0.5	+39.7			+0.0	-29.2	-20.0 Low	-9.2	Anten
10	80.675k	-75.2	+0.0	+39.8			+0.0	-35.4	-20.0 Mid	-15.4	Anten
11	80.205k	-75.3	+0.0	+39.8			+0.0	-35.5	-20.0 Low	-15.5	Anten
12	172.811M	-78.9	+0.4	+39.8			+0.0	-38.7	-20.0 High	-18.7	Anten
13	175.213M	-79.0	+0.4	+39.8			+0.0	-38.8	-20.0 High	-18.8	Anten
14	135.670M	-79.7	+0.3	+39.8			+0.0	-39.6	-20.0 Low	-19.6	Anten
15	450.000M	-79.9	+0.6	+39.6			+0.0	-39.7	-20.0 Low	-19.7	Anten
16	164.500M	-79.9	+0.4	+39.8			+0.0	-39.7	-20.0 Low	-19.7	Anten
17	348.000M	-80.5	+0.6	+39.7			+0.0	-40.2	-20.0 High	-20.2	Anten
18	174.404M	-80.4	+0.4	+39.8			+0.0	-40.2	-20.0 High	-20.2	Anten
19	173.596M	-80.8	+0.4	+39.8			+0.0	-40.6	-20.0 High	-20.6	Anten
20	158.420M	-83.4	+0.4	+39.8			+0.0	-43.2	-20.0 Mid	-23.2	Anten
21	163.590M	-83.5	+0.4	+39.8			+0.0	-43.3	-20.0 Mid	-23.3	Anten
22	324.000M	-84.4	+0.5	+39.7			+0.0	-44.2	-20.0 Mid	-24.2	Anten
23	486.000M	-84.7	+0.7	+39.6			+0.0	-44.4	-20.0 Mid	-24.4	Anten

24	165.580M	-84.7	+0.4	+39.8		+0.0	-44.5	-20.0	-24.5	Anten
								Mid		
25	600.000M	-84.9	+0.7	+39.4		+0.0	-44.8	-20.0	-24.8	Anten
								Low		
26	156.420M	-85.9	+0.4	+39.8		+0.0	-45.7	-20.0	-25.7	Anten
								High		
27	750.000M	-85.8	+0.8	+39.1		+0.0	-45.9	-20.0	-25.9	Anten
								Low		
28	157.220M	-86.6	+0.4	+39.8		+0.0	-46.4	-20.0	-26.4	Anten
								Mid		
29	154.800M	-86.8	+0.4	+39.8		+0.0	-46.6	-20.0	-26.6	Anten
								High		
30	159.570M	-87.0	+0.4	+39.8		+0.0	-46.8	-20.0	-26.8	Anten
								High		
31	133.170M	-86.9	+0.3	+39.8		+0.0	-46.8	-20.0	-26.8	Anten
								Mid		
32	145.250M	-89.4	+0.4	+39.8		+0.0	-49.2	-20.0	-29.2	Anten
								High		
33	32.170M	-89.4	+0.2	+39.8		+0.0	-49.4	-20.0	-29.4	Anten
								High		
34	147.570M	-90.0	+0.4	+39.8		+0.0	-49.8	-20.0	-29.8	Anten
								Mid		
35	1458.000M	-90.7	+1.1	+39.2		+0.0	-50.4	-20.0	-30.4	Anten
								Mid		
36	176.380M	-90.7	+0.4	+39.8		+0.0	-50.5	-20.0	-30.5	Anten
								Mid		
37	1392.000M	-90.8	+1.1	+39.1		+0.0	-50.6	-20.0	-30.6	Anten
								High		
38	522.000M	-91.7	+0.7	+39.6		+0.0	-51.4	-20.0	-31.4	Anten
								High		
39	648.000M	-93.9	+0.7	+39.4		+0.0	-53.8	-20.0	-33.8	Anten
								Mid		
40	972.000M	-93.6	+0.9	+38.4		+0.0	-54.3	-20.0	-34.3	Anten
								Mid		
41	810.000M	-98.3	+0.8	+38.9		+0.0	-58.6	-20.0	-38.6	Anten
								Mid		

CKC Laboratories, Inc. Date: 3/19/2013 Time: 08:23:15 Rothenbuhler Engineering WO#: 93918
Test Lead: Antenna None Sequence#: 10 Antenna
Rothenbuhler Engineering Controller P/N: 1678-1-V2



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

Customer: **Rothenbuhler Engineering**
Specification: **47 CFR §90.210(d) Spurious Emissions**
Work Order #: **93918** Date: 3/19/2013
Test Type: **Conducted Emissions** Time: 08:56:03
Equipment: **Test box** Sequence#: 11
Manufacturer: Rothenbuhler Engineering Tested By: Steven Pittsford
Model: 1678-4-V2 None
S/N: 00002

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03227	Cable	32026-29080-29080-84	5/2/2011	5/2/2013
	AN02871	Spectrum Analyzer	E4440A	4/22/2011	4/22/2013
T2	AN01706	Attenuator-Factor @ 40dB (dB)	8495B	1/11/2012	1/11/2014

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Test box*	Rothenbuhler Engineering	1678-4-V2	00002

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	DELL	Latitude D810	NA
Power Supply	HQ	PS50050	0-50VDC/5A
Controller	Rothenbuhler Engineering	1678-1-V2	00001

Test Conditions / Notes:

Temp: 21°C
Humidity: 34%
Pressure: 102.6kPa
Frequency Range: 9k-2GHz

Mask D

EUT's RF output is connected to the Spectrum Analyzer
EUT is connected to a laptop and to a controller.
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.
Only highest emissions will be recorded.

RBW: 200Hz 9kHz - 150kHz
10kHz 150kHz - 30MHz
100kHz 30MHz - 1GHz
1MHz 1-2GHz
VBW: 10x RBW
Sweep: Auto

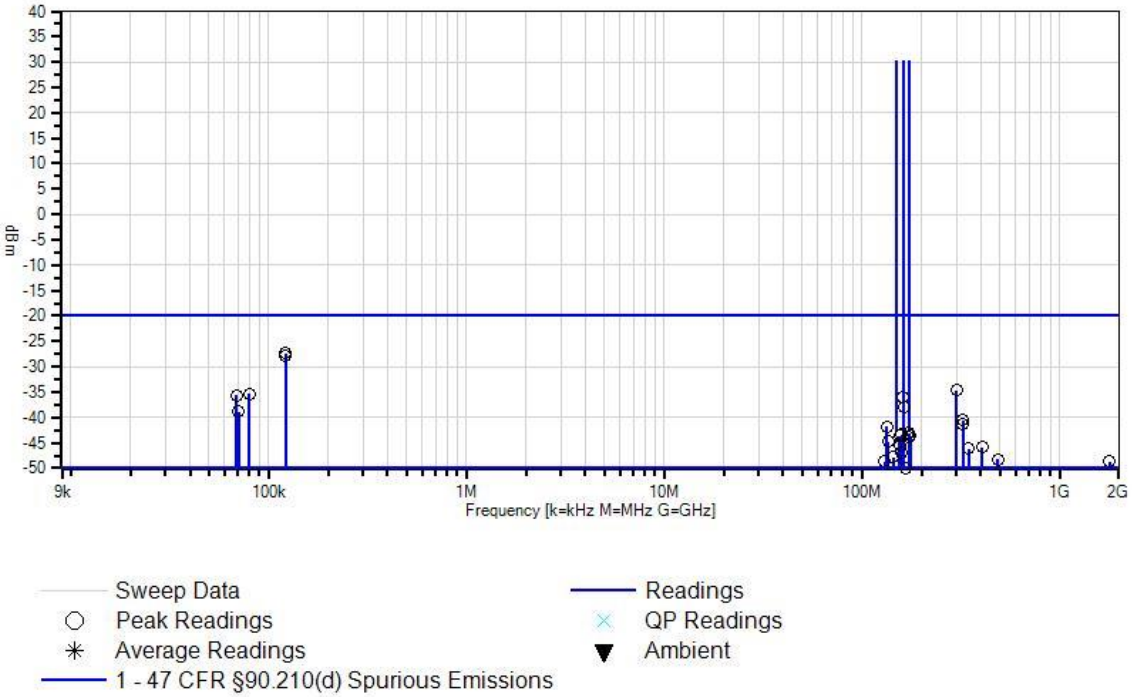
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: Antenna

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	122.223k	-67.1	+0.0	+39.8			+0.0	-27.3	-20.0 Mid	-7.3	Anten
2	122.082k	-67.2	+0.0	+39.8			+0.0	-27.4	-20.0 Low	-7.4	Anten
3	122.082k	-67.6	+0.0	+39.8			+0.0	-27.8	-20.0 High	-7.8	Anten
4	300.000M	-74.9	+0.5	+39.7			+0.0	-34.7	-20.0 Low	-14.7	Anten
5	80.064k	-75.1	+0.0	+39.8			+0.0	-35.3	-20.0 High	-15.3	Anten
6	69.066k	-75.4	+0.0	+39.8			+0.0	-35.6	-20.0 Low	-15.6	Anten
7	161.400M	-76.3	+0.4	+39.8			+0.0	-36.1	-20.0 Mid	-16.1	Anten
8	162.660M	-78.1	+0.4	+39.8			+0.0	-37.9	-20.0 Mid	-17.9	Anten
9	70.617k	-78.7	+0.0	+39.8			+0.0	-38.9	-20.0 Mid	-18.9	Anten
10	323.700M	-80.7	+0.5	+39.7			+0.0	-40.5	-20.0 Mid	-20.5	Anten
11	324.030M	-81.4	+0.5	+39.7			+0.0	-41.2	-20.0 Mid	-21.2	Anten
12	134.090M	-81.9	+0.3	+39.8			+0.0	-41.8	-20.0 Low	-21.8	Anten
13	173.609M	-83.3	+0.4	+39.8			+0.0	-43.1	-20.0 High	-23.1	Anten
14	159.600M	-83.5	+0.4	+39.8			+0.0	-43.3	-20.0 High	-23.3	Anten
15	174.406M	-83.8	+0.4	+39.8			+0.0	-43.6	-20.0 High	-23.6	Anten
16	175.220M	-83.8	+0.4	+39.8			+0.0	-43.6	-20.0 High	-23.6	Anten
17	154.800M	-83.8	+0.4	+39.8			+0.0	-43.6	-20.0 High	-23.6	Anten
18	172.800M	-84.0	+0.4	+39.8			+0.0	-43.8	-20.0 High	-23.8	Anten
19	135.710M	-84.8	+0.3	+39.8			+0.0	-44.7	-20.0 Low	-24.7	Anten
20	156.400M	-85.7	+0.4	+39.8			+0.0	-45.5	-20.0 High	-25.5	Anten
21	407.500M	-86.2	+0.6	+39.7			+0.0	-45.9	-20.0 High	-25.9	Anten
22	348.010M	-86.5	+0.6	+39.7			+0.0	-46.2	-20.0 High	-26.2	Anten
23	158.430M	-87.0	+0.4	+39.8			+0.0	-46.8	-20.0 Mid	-26.8	Anten
24	143.980M	-88.0	+0.4	+39.8			+0.0	-47.8	-20.0 Low	-27.8	Anten

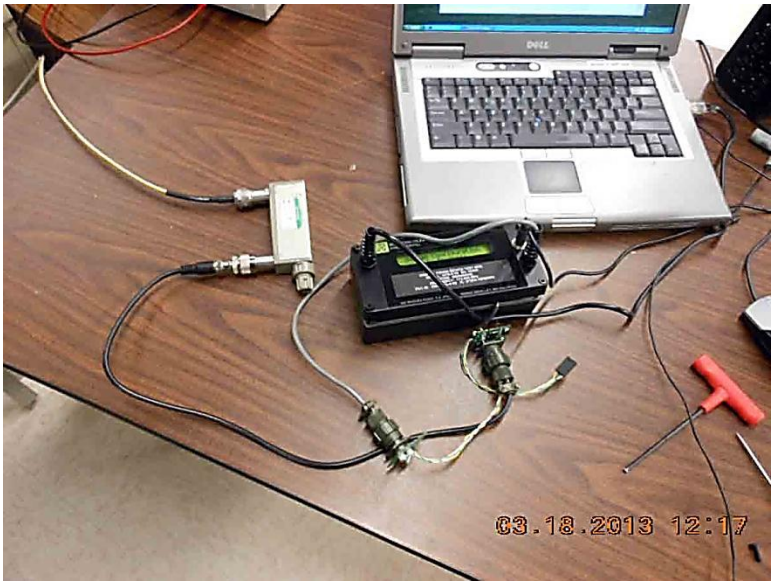
25	486.000M	-88.6	+0.7	+39.6		+0.0	-48.3	-20.0	-28.3	Anten
								Mid		
26	1782.030M	-89.4	+1.3	+39.5		+0.0	-48.6	-20.0	-28.6	Anten
								Mid		
27	130.810M	-88.7	+0.3	+39.8		+0.0	-48.6	-20.0	-28.6	Anten
								Low		
28	166.000M	-90.1	+0.4	+39.8		+0.0	-49.9	-20.0	-29.9	Anten
								Low		
29	164.390M	-90.3	+0.4	+39.8		+0.0	-50.1	-20.0	-30.1	Anten
								Low		
30	156.020M	-90.6	+0.4	+39.8		+0.0	-50.4	-20.0	-30.4	Anten
								Low		
31	648.000M	-90.6	+0.7	+39.4		+0.0	-50.5	-20.0	-30.5	Anten
								Mid		
32	149.600M	-90.8	+0.4	+39.8		+0.0	-50.6	-20.0	-30.6	Anten
								Low		
33	150.400M	-90.8	+0.4	+39.8		+0.0	-50.6	-20.0	-30.6	Anten
								Low		
34	696.010M	-90.6	+0.8	+39.2		+0.0	-50.6	-20.0	-30.6	Anten
								High		
35	810.060M	-90.9	+0.8	+38.9		+0.0	-51.2	-20.0	-31.2	Anten
								Mid		
36	129.300M	-91.4	+0.3	+39.8		+0.0	-51.3	-20.0	-31.3	Anten
								Low		
37	870.010M	-91.5	+0.9	+38.6		+0.0	-52.0	-20.0	-32.0	Anten
								High		
38	522.010M	-92.4	+0.7	+39.6		+0.0	-52.1	-20.0	-32.1	Anten
								High		
39	450.000M	-92.7	+0.6	+39.6		+0.0	-52.5	-20.0	-32.5	Anten
								Low		
40	1495.400M	-93.3	+1.1	+39.3		+0.0	-52.9	-20.0	-32.9	Anten
								Low		
41	1044.010M	-92.6	+0.9	+38.5		+0.0	-53.2	-20.0	-33.2	Anten
								High		
42	600.000M	-94.6	+0.7	+39.4		+0.0	-54.5	-20.0	-34.5	Anten
								Low		

CKC Laboratories, Inc. Date: 3/19/2013 Time: 08:56:03 Rothenbuhler Engineering WO#: 93918
Test Lead: Antenna None Sequence#: 11 Antenna
Rothenbuhler Engineering Testbox P/N: 1678-4-V2



Test Setup Photos

1678-1-V2



1678-4-V2

Radiated Spurious Emissions

Test Data Sheets

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

Customer: **Rothenbuhler Engineering**
Specification: **47 CFR §90.210(d) Spurious Emissions**
Work Order #: **93918** Date: 3/20/2013
Test Type: **Radiated Scan** Time: 10:05:27
Equipment: **Controller** Sequence#: 13
Manufacturer: Rothenbuhler Engineering Tested By: Steven Pittsford
Model: 1678-1-V2
S/N: 00001

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02308	Preamp	8447D	4/3/2012	4/3/2014
T2	AN01993	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014
T3	AN03227	Cable	32026-29080-29080-84	5/2/2011	5/2/2013
T4	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T5	ANP05366	Cable	RG-214	10/14/2011	10/14/2013
T6	AN02871	Spectrum Analyzer	E4440A	4/22/2011	4/22/2013
T7	AN00052	Loop Antenna	6502	5/16/2012	5/16/2014
T8	ANP05965	Cable	Various	8/26/2011	8/26/2013
T9	AN01271	Preamp	83017A	8/18/2011	8/18/2013
T10	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	10/19/2011	10/19/2013
T11	AN03123	Cable	32026-2-29801-12	10/14/2011	10/14/2013
T12	ANP05435	Attenuator	PE7015-10	10/5/2012	10/5/2014
T13	ANP06219	Attenuator	768-10	3/22/2012	3/22/2014
T14	ANP06217	Attenuator	768-10	3/22/2012	3/22/2014

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Controller*	Rothenbuhler Engineering	1678-1-V2	00001

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	DELL	Latitude D810	NA
USB 2.0 Kit	S.I. Tech	2172	AN03081
Test box	Rothenbuhler Engineering	1678-4-V2	00002
Power Supply	HQ	PS50050	0-50VDC/5A

Test Conditions / Notes:

Temp: 23°C
Humidity: 28%
Pressure: 101.7kPa
Frequency Range: 9k-2GHz
Test Method: ANSI 63.4 (2003)

Mask D

EUT is in the center of the turntable 80cm above the ground plane
EUT is connected to a laptop and to a test box
EUT is communicating with laptop through USB to fiber adaptor
EUT is powered by power supply (on the ground plane) as a battery replacement for 1-2GHz and freshly charged battery powered for 9k-1000MHz
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.
Only highest emissions will be recorded.

1678-1-V2 has identical transceiver circuitry as the 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The 1678-1-V2 is worst case of the units and is representative of 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The1678-1-V2, 1678-2-V2, 1678-3-V2 & 1678-6-V2 have the ability to transmit at 5W or 2W. 5W will be tested.

RBW: 200Hz 9kHz - 150kHz
10kHz 150kHz - 30MHz
100kHz 30MHz - 1GHz
1MHz 1-2GHz
VBW: 10x RBW
Sweep: Auto

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10 T14	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBm	dBm	dB	Ant
1	13.089k	-60.9	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +14.9 +0.0	+0.0 +0.0 +0.0	+0.0 360	-46.0	-31.8 High	-14.2	Perpe 129
2	12.243k	-61.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +15.3 +0.0	+0.0 +0.0 +0.0	+0.0	-46.1	-31.8 Low	-14.3	Perpe 101
3	12.243k	-61.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +15.3 +0.0	+0.0 +0.0 +0.0	+0.0 184	-46.1	-31.8 Low	-14.3	Paral 101
4	347.988M	-66.5	-27.4 +1.2 +0.0 +10.0	+14.9 +0.0 +0.0 +10.2	+0.6 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0	-46.2	-31.8 High	-14.4	Horiz 99

5	150.000k	-55.7	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0 360	-46.2	-31.8 Mid	-14.4	Paral 129
6	150.000k	-55.7	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0	-46.2	-31.8 Mid	-14.4	Perpe 129
7	299.998M	-65.4	-27.1 +1.1 +0.0 +10.0	+13.5 +0.0 +0.0 +10.2	+0.5 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0 359	-46.4	-31.8 Low	-14.6	Horiz 99
8	15.063k	-60.8	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +14.1 +0.0	+0.0 +0.0 +0.0	+0.0 360	-46.7	-31.8 Mid	-14.9	Perpe 129
9	150.000k	-56.3	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0	-46.8	-31.8 High	-15.0	Perpe 129
10	150.000k	-56.5	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0 360	-47.0	-31.8 Low	-15.2	Perpe 129
11	150.000k	-56.6	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0 360	-47.1	-31.8 High	-15.3	Paral 129
12	150.000k	-56.7	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0 35	-47.2	-31.8 Low	-15.4	Paral 101
13	972.204M	-80.1	-27.2 +2.4 +0.0 +10.1	+24.0 +0.0 +0.0 +10.2	+0.9 +0.0 +0.0	+2.1 +0.0 +9.6	+0.0	-48.0	-31.8 Mid	-16.2	Horiz 105
14	971.984M	-80.9	-27.2 +2.4 +0.0 +10.1	+24.0 +0.0 +0.0 +10.2	+0.9 +0.0 +0.0	+2.1 +0.0 +9.6	+0.0 360	-48.8	-31.8 Mid	-17.0	Vert 115
15	869.602M	-79.6	-27.5 +2.2 +0.0 +10.1	+22.8 +0.0 +0.0 +10.1	+0.9 +0.0 +0.0	+2.0 +0.0 +9.7	+0.0 360	-49.3	-31.8 High	-17.5	Horiz 101
16	900.060M	-80.7	-27.4 +2.3 +0.0 +10.1	+23.0 +0.0 +0.0 +10.2	+0.9 +0.0 +0.0	+2.0 +0.0 +9.6	+0.0 360	-50.0	-31.8 Low	-18.2	Vert 100
17	900.060M	-80.7	-27.4 +2.3 +0.0 +10.1	+23.0 +0.0 +0.0 +10.2	+0.9 +0.0 +0.0	+2.0 +0.0 +9.6	+0.0	-50.0	-31.8 Low	-18.2	Horiz 100

18	870.036M	-81.1	-27.5 +2.2 +0.0 +10.1	+22.8 +0.0 +0.0 +10.1	+0.9 +0.0 +0.0	+2.0 +0.0 +9.7	+0.0	-50.8	-31.8 High	-19.0	Vert 101
19	810.080M	-80.5	-27.8 +2.1 +0.0 +10.1	+22.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.9 +0.0 +9.7	+0.0 360	-51.0	-31.8 Mid	-19.2	Horiz 105
20	810.080M	-80.5	-27.8 +2.1 +0.0 +10.1	+22.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.9 +0.0 +9.7	+0.0	-51.0	-31.8 Mid	-19.2	Vert 117
21	750.105M	-79.4	-28.0 +2.0 +0.0 +10.1	+21.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.9 +0.0 +9.7	+0.0 360	-51.2	-31.8 Low	-19.4	Horiz 100
22	749.805M	-79.5	-28.0 +2.0 +0.0 +10.1	+21.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.9 +0.0 +9.7	+0.0	-51.3	-31.8 Low	-19.5	Vert 100
23	300.004M	-70.4	-27.1 +1.1 +0.0 +10.0	+13.5 +0.0 +0.0 +10.2	+0.5 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0 -10	-51.4	-31.8 Low	-19.6	Vert 187
24	323.986M	-71.2	-27.2 +1.2 +0.0 +10.0	+14.2 +0.0 +0.0 +10.2	+0.5 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0	-51.5	-31.8 Mid	-19.7	Horiz 99
25	348.004M	-73.0	-27.4 +1.2 +0.0 +10.0	+14.9 +0.0 +0.0 +10.2	+0.6 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0 360	-52.7	-31.8 High	-20.9	Vert 190
26	648.042M	-78.8	-28.3 +1.8 +0.0 +10.1	+20.2 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.7 +0.0 +9.7	+0.0	-52.7	-31.8 Mid	-20.9	Horiz 99
27	600.115M	-79.4	-28.3 +1.7 +0.0 +10.1	+20.0 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.6 +0.0 +9.7	+0.0 -16	-53.7	-31.8 Low	-21.9	Horiz 105
28	600.220M	-79.6	-28.3 +1.7 +0.0 +10.1	+20.0 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.6 +0.0 +9.7	+0.0 376	-53.9	-31.8 Low	-22.1	Vert 105
29	696.036M	-80.5	-28.2 +1.9 +0.0 +10.0	+20.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.7 +0.0 +9.7	+0.0 360	-53.9	-31.8 High	-22.1	Vert 101
30	696.024M	-80.7	-28.2 +1.9 +0.0 +10.0	+20.5 +0.0 +0.0 +10.2	+0.8 +0.0 +0.0	+1.7 +0.0 +9.7	+0.0	-54.1	-31.8 High	-22.3	Horiz 99

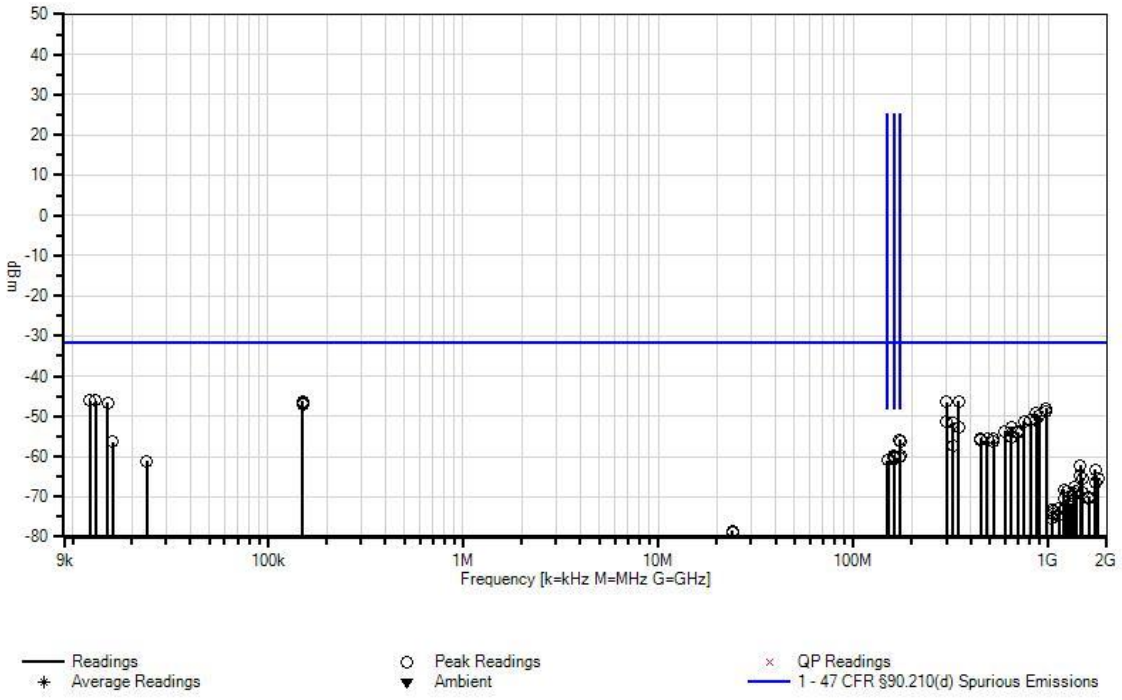
31	648.016M	-81.3	-28.3 +1.8 +0.0 +10.1	+20.2 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.7 +0.0 +9.7	+0.0 360	-55.2	-31.8 Mid	-23.4	Vert 120
32	449.968M	-78.2	-28.1 +1.5 +0.0 +10.1	+17.3 +0.0 +0.0 +10.2	+0.6 +0.0 +0.0	+1.4 +0.0 +9.7	+0.0 360	-55.5	-31.8 Low	-23.7	Vert 99
33	485.992M	-79.2	-28.2 +1.6 +0.0 +10.1	+18.0 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.4 +0.0 +9.7	+0.0 360	-55.7	-31.8 Mid	-23.9	Horiz 101
34	485.992M	-79.2	-28.2 +1.6 +0.0 +10.1	+18.0 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.4 +0.0 +9.7	+0.0	-55.7	-31.8 Mid	-23.9	Vert 99
35	522.004M	-79.9	-28.2 +1.7 +0.0 +10.0	+18.6 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.5 +0.0 +9.7	+0.0 360	-55.7	-31.8 High	-23.9	Horiz 103
36	450.030M	-78.5	-28.1 +1.5 +0.0 +10.1	+17.3 +0.0 +0.0 +10.2	+0.6 +0.0 +0.0	+1.4 +0.0 +9.7	+0.0 360	-55.8	-31.8 Low	-24.0	Horiz 108
37	173.250M	-69.9	-27.4 +0.8 +0.0 +10.0	+9.7 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.5	+0.0 376	-55.9	-31.8 High	-24.1	Horiz 132
38	522.004M	-80.4	-28.2 +1.7 +0.0 +10.0	+18.6 +0.0 +0.0 +10.2	+0.7 +0.0 +0.0	+1.5 +0.0 +9.7	+0.0	-56.2	-31.8 High	-24.4	Vert 140
39	16.050k	-70.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +13.7 +0.0	+0.0 +0.0 +0.0	+0.0	-56.3	-31.8 High	-24.5	Paral 129
40	174.740M	-70.2	-27.4 +0.8 +0.0 +10.0	+9.5 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.5	+0.0 376	-56.4	-31.8 High	-24.6	Horiz 132
41	323.968M	-77.1	-27.2 +1.2 +0.0 +10.0	+14.2 +0.0 +0.0 +10.2	+0.5 +0.0 +0.0	+1.1 +0.0 +9.7	+0.0 360	-57.4	-31.8 Mid	-25.6	Vert 99
42	161.225M	-74.7	-27.5 +0.8 +0.0 +10.0	+10.8 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0 344	-59.8	-31.8 Mid	-28.0	Horiz 99
43	174.768M	-73.7	-27.4 +0.8 +0.0 +10.0	+9.5 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.5	+0.0	-59.9	-31.8 High	-28.1	Vert 192

44	173.264M	-74.0	-27.4 +0.8 +0.0 +10.0	+9.7 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.5	+0.0	-60.0	-31.8 High	-28.2	Vert 192
45	161.285M	-75.1	-27.5 +0.8 +0.0 +10.0	+10.8 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0 157	-60.2	-31.8 Mid	-28.4	Vert 99
46	162.765M	-74.9	-27.5 +0.8 +0.0 +10.0	+10.6 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0 344	-60.2	-31.8 Mid	-28.4	Horiz 99
47	162.775M	-75.1	-27.5 +0.8 +0.0 +10.0	+10.6 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0 157	-60.4	-31.8 Mid	-28.6	Vert 99
48	150.755M	-76.4	-27.6 +0.7 +0.0 +10.0	+11.5 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0	-61.0	-31.8 Low	-29.2	Vert 99
49	149.295M	-76.4	-27.6 +0.7 +0.0 +10.0	+11.5 +0.0 +0.0 +10.2	+0.4 +0.0 +0.0	+0.8 +0.0 +9.4	+0.0	-61.0	-31.8 Low	-29.2	Vert 99
50	23.946k	-72.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +11.3 +0.0	+0.0 +0.0 +0.0	+0.0 360	-61.1	-31.8 Mid	-29.3	Paral 129
51	1457.920M	-51.2	+0.0 +0.0 -35.2 +0.0	+0.0 +0.0 +21.3 +0.0	+1.1 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0	-62.2	-31.8 Mid	-30.4	Vert 99
52	1740.050M	-55.7	+0.0 +0.0 -34.7 +0.0	+0.0 +0.0 +24.0 +0.0	+1.3 +0.0 +0.3	+0.0 +1.6 +0.0	+0.0 139	-63.2	-31.8 High	-31.4	Vert 99
53	1457.920M	-53.8	+0.0 +0.0 -35.2 +0.0	+0.0 +0.0 +21.3 +0.0	+1.1 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0 360	-64.8	-31.8 Mid	-33.0	Horiz 99
54	1500.000M	-54.5	+0.0 +0.0 -35.1 +0.0	+0.0 +0.0 +21.4 +0.0	+1.1 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0	-65.3	-31.8 Low	-33.5	Vert 99
55	1800.050M	-58.6	+0.0 +0.0 -34.6 +0.0	+0.0 +0.0 +24.6 +0.0	+1.3 +0.0 +0.3	+0.0 +1.6 +0.0	+0.0 360	-65.4	-31.8 Mid	-33.6	Vert 128
56	1739.925M	-59.1	+0.0 +0.0 -34.7 +0.0	+0.0 +0.0 +24.0 +0.0	+1.3 +0.0 +0.3	+0.0 +1.6 +0.0	+0.0	-66.6	-31.8 High	-34.8	Horiz 124

57	1349.945M	-55.9	+0.0 +0.0 -35.4 +0.0	+0.0 +0.0 +20.9 +0.0	+1.1 +0.0 +0.3	+0.0 +1.4 +0.0	+0.0 360	-67.6	-31.8 Low	-35.8	Vert 99
58	1200.125M	-55.1	+0.0 +0.0 -35.9 +0.0	+0.0 +0.0 +20.2 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0	-68.2	-31.8 Low	-36.4	Vert 99
59	1391.960M	-57.1	+0.0 +0.0 -35.3 +0.0	+0.0 +0.0 +21.0 +0.0	+1.1 +0.0 +0.3	+0.0 +1.4 +0.0	+0.0	-68.6	-31.8 High	-36.8	Horiz 113
60	1259.985M	-56.0	+0.0 +0.0 -35.7 +0.0	+0.0 +0.0 +20.5 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0 360	-68.6	-31.8 Low	-36.8	Vert 99
61	1500.000M	-58.2	+0.0 +0.0 -35.1 +0.0	+0.0 +0.0 +21.4 +0.0	+1.1 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0 302	-69.0	-31.8 Low	-37.2	Horiz 124
62	1350.000M	-57.8	+0.0 +0.0 -35.4 +0.0	+0.0 +0.0 +20.9 +0.0	+1.1 +0.0 +0.3	+0.0 +1.4 +0.0	+0.0	-69.5	-31.8 Low	-37.7	Horiz 132
63	1619.840M	-60.9	+0.0 +0.0 -34.9 +0.0	+0.0 +0.0 +22.8 +0.0	+1.2 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0 360	-70.0	-31.8 Mid	-38.2	Vert 100
64	1619.805M	-61.2	+0.0 +0.0 -34.9 +0.0	+0.0 +0.0 +22.8 +0.0	+1.2 +0.0 +0.3	+0.0 +1.5 +0.0	+0.0	-70.3	-31.8 Mid	-38.5	Horiz 101
65	1217.755M	-57.7	+0.0 +0.0 -35.8 +0.0	+0.0 +0.0 +20.3 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0	-70.6	-31.8 High	-38.8	Vert 104
66	1296.030M	-59.4	+0.0 +0.0 -35.5 +0.0	+0.0 +0.0 +20.6 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0 360	-71.7	-31.8 Mid	-39.9	Vert 103
67	1295.975M	-60.1	+0.0 +0.0 -35.5 +0.0	+0.0 +0.0 +20.6 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0	-72.4	-31.8 Mid	-40.6	Horiz 100
68	1134.040M	-59.3	+0.0 +0.0 -36.2 +0.0	+0.0 +0.0 +20.0 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0	-72.9	-31.8 Mid	-41.1	Vert 109
69	1217.960M	-60.1	+0.0 +0.0 -35.8 +0.0	+0.0 +0.0 +20.3 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0 360	-73.0	-31.8 High	-41.2	Horiz 108

70	1199.760M	-60.2	+0.0 +0.0 -35.9 +0.0	+0.0 +0.0 +20.2 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0 360	-73.3	-31.8 Low	-41.5	Horiz 99
71	1044.170M	-58.5	+0.0 +0.0 -36.6 +0.0	+0.0 +0.0 +19.5 +0.0	+0.9 +0.0 +0.2	+0.0 +1.2 +0.0	+0.0	-73.3	-31.8 High	-41.5	Horiz 99
72	1050.075M	-59.0	+0.0 +0.0 -36.5 +0.0	+0.0 +0.0 +19.6 +0.0	+0.9 +0.0 +0.2	+0.0 +1.2 +0.0	+0.0 193	-73.6	-31.8 Low	-41.8	Vert 99
73	1049.950M	-59.7	+0.0 +0.0 -36.5 +0.0	+0.0 +0.0 +19.6 +0.0	+0.9 +0.0 +0.2	+0.0 +1.2 +0.0	+0.0	-74.3	-31.8 Low	-42.5	Horiz 99
74	1133.950M	-61.2	+0.0 +0.0 -36.2 +0.0	+0.0 +0.0 +20.0 +0.0	+1.0 +0.0 +0.3	+0.0 +1.3 +0.0	+0.0 360	-74.8	-31.8 Mid	-43.0	Horiz 125
75	1044.170M	-60.7	+0.0 +0.0 -36.6 +0.0	+0.0 +0.0 +19.5 +0.0	+0.9 +0.0 +0.2	+0.0 +1.2 +0.0	+0.0 360	-75.5	-31.8 High	-43.7	Vert 99
76	24.000M	-85.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0	-78.5	-31.8 Low	-46.7	Paral 101
77	24.000M	-85.1	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0 360	-78.6	-31.8 Mid	-46.8	Paral 129
78	24.000M	-85.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0 360	-78.9	-31.8 High	-47.1	Paral 129
79	24.000M	-87.1	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0	-80.6	-31.8 Mid	-48.8	Perpe 129
80	24.000M	-87.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0 360	-80.9	-31.8 Low	-49.1	Perpe 129
81	24.000M	-88.7	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.1 +6.2 +0.0	+0.0 +0.2 +0.0	+0.0	-82.2	-31.8 High	-50.4	Perpe 129

CKC Laboratories, Inc. Date: 3/20/2013 Time: 10:05:27 Rothenbuhler Engineering WO#: 93918
Test Distance: 3 Meters Sequence#: 13 Perpendicular
Rothenbuhler Engineering Controller P/N: 1678-1-V2



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

Customer: **Rothenbuhler Engineering**
Specification: **47 CFR 90.210(d) Spurious Emissions**
Work Order #: **93918** Date: 3/19/2013
Test Type: **Radiated Scan** Time: 14:21:38
Equipment: **Test box** Sequence#: 12
Manufacturer: Rothenbuhler Engineering Tested By: Steven Pittsford
Model: 1678-4-V2
S/N: 00002

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02308	Preamp	8447D	4/3/2012	4/3/2014
T2	AN01993	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014
T3	AN03227	Cable	32026-29080-29080-84	5/2/2011	5/2/2013
T4	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T5	ANP05366	Cable	RG-214	10/14/2011	10/14/2013
	AN02871	Spectrum Analyzer	E4440A	4/22/2011	4/22/2013
T6	AN00052	Loop Antenna	6502	5/16/2012	5/16/2014
T7	ANP05965	Cable	Various	8/26/2011	8/26/2013
T8	AN01271	Preamp	83017A	8/18/2011	8/18/2013
T9	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	10/19/2011	10/19/2013
T10	AN03123	Cable	32026-2-29801-12	10/14/2011	10/14/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Test box*	Rothenbuhler Engineering	1678-4-V2	00002

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	DELL	Latitude D810	NA
Mini Controller	Rothenbuhler Engineering	1678-6-V2	00002
USB 2.0 Kit	S.I. Tech	2172	AN03081
Power Supply	HQ	PS50050	0-50VDC/5A

Test Conditions / Notes:

Temp: 21°C, Humidity: 34%, Pressure: 102.6kPa
Frequency Range: 9k-2GHz
Test Method: ANSI 63.4 (2003)
Mask D
EUT is in the center of the turntable 80cm above the ground plane
EUT is communicating with laptop through USB to fiber adaptor
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.
Only highest emissions will be recorded.
RBW: 200Hz 9kHz - 150kHz; 10kHz 150kHz - 30MHz; 100kHz 30MHz - 1GHz, 1MHz; 1-2GHz
VBW: 10x RBW
Sweep: Auto

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBm	dBm	dB	Ant
1	299.995M	-27.2	-27.1 +1.1 +0.0	+13.5 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0 243	-38.1	-31.8 Low	-6.3	Vert 99
2	299.995M	-30.5	-27.1 +1.1 +0.0	+13.5 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0	-41.4	-31.8 Low	-9.6	Horiz 99
3	150.000k	-56.3	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-46.8	-31.8 Mid	-15.0	Perpe 117
4	150.000k	-56.7	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-47.2	-31.8 Mid	-15.4	Paral 117
5	15.486k	-61.2	+0.0 +0.0 +0.0	+0.0 +13.9 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-47.3	-31.8 Mid	-15.5	Paral 117
6	324.010M	-37.1	-27.2 +1.2 +0.0	+14.2 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0 89	-47.3	-31.8 Mid	-15.5	Vert 159
7	12.948k	-62.3	+0.0 +0.0 +0.0	+0.0 +15.0 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-47.3	-31.8 High	-15.5	Perpe 117
8	14.358k	-61.8	+0.0 +0.0 +0.0	+0.0 +14.4 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-47.4	-31.8 Low	-15.6	Perpe 117
9	150.000k	-57.1	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-47.6	-31.8 Low	-15.8	Paral 117
10	150.000k	-57.4	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-47.9	-31.8 High	-16.1	Perpe 117
11	14.781k	-62.1	+0.0 +0.0 +0.0	+0.0 +14.2 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-47.9	-31.8 Mid	-16.1	Perpe 117
12	150.000k	-57.6	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0	-48.1	-31.8 High	-16.3	Paral 117
13	150.000k	-58.1	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-48.6	-31.8 Low	-16.8	Perpe 117
14	324.002M	-39.2	-27.2 +1.2 +0.0	+14.2 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0 342	-49.4	-31.8 Mid	-17.6	Horiz 100
15	22.818k	-61.5	+0.0 +0.0 +0.0	+0.0 +11.6 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-49.9	-31.8 Low	-18.1	Paral 117

16	20.139k	-62.5	+0.0 +0.0 +0.0	+0.0 +12.4 +0.0	+0.0 +0.0	+0.0 +0.0	+0.0 360	-50.1	-31.8 High	-18.3	Paral 117
17	810.002M	-52.4	-27.8 +2.1 +0.0	+22.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0 360	-52.9	-31.8 Mid	-21.1	Horiz 99
18	347.990M	-47.5	-27.4 +1.2 +0.0	+14.9 +0.0 +0.0	+0.6 +0.0	+1.1 +0.0	+0.0	-57.1	-31.8 High	-25.3	Vert 149
19	486.005M	-52.6	-28.2 +1.6 +0.0	+18.0 +0.0 +0.0	+0.7 +0.0	+1.4 +0.0	+0.0 330	-59.1	-31.8 Mid	-27.3	Vert 129
20	521.990M	-54.0	-28.2 +1.7 +0.0	+18.6 +0.0 +0.0	+0.7 +0.0	+1.5 +0.0	+0.0 360	-59.7	-31.8 High	-27.9	Vert 99
21	347.990M	-50.3	-27.4 +1.2 +0.0	+14.9 +0.0 +0.0	+0.6 +0.0	+1.1 +0.0	+0.0 360	-59.9	-31.8 High	-28.1	Horiz 108
22	810.005M	-59.6	-27.8 +2.1 +0.0	+22.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0 360	-60.1	-31.8 Mid	-28.3	Vert 136
23	599.995M	-56.5	-28.3 +1.7 +0.0	+20.0 +0.0 +0.0	+0.7 +0.0	+1.6 +0.0	+0.0 360	-60.8	-31.8 Low	-29.0	Vert 104
24	810.048M	-60.4	-27.8 +2.1 +0.0	+22.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0 360	-60.9	-31.8 High	-29.1	Horiz 99
25	810.010M	-61.5	-27.8 +2.1 +0.0	+22.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0	-62.0	-31.8 High	-30.2	Vert 124
26	486.002M	-55.6	-28.2 +1.6 +0.0	+18.0 +0.0 +0.0	+0.7 +0.0	+1.4 +0.0	+0.0 84	-62.1	-31.8 Mid	-30.3	Horiz 99
27	521.990M	-56.9	-28.2 +1.7 +0.0	+18.6 +0.0 +0.0	+0.7 +0.0	+1.5 +0.0	+0.0	-62.6	-31.8 High	-30.8	Horiz 109
28	900.018M	-63.9	-27.4 +2.3 +0.0	+23.0 +0.0 +0.0	+0.9 +0.0	+2.0 +0.0	+0.0 360	-63.1	-31.8 Low	-31.3	Vert 125
29	1739.895M	-55.8	+0.0 +0.0 +24.0	+0.0 +0.0 +0.3	+1.3 +1.6	+0.0 -34.7	+0.0	-63.3	-31.8 High	-31.5	Vert 99
30	870.000M	-64.1	-27.5 +2.2 +0.0	+22.8 +0.0 +0.0	+0.9 +0.0	+2.0 +0.0	+0.0 351	-63.7	-31.8 High	-31.9	Horiz 99
31	1799.928M	-57.3	+0.0 +0.0 +24.6	+0.0 +0.0 +0.3	+1.3 +1.6	+0.0 -34.6	+0.0	-64.1	-31.8 Low	-32.3	Vert 108
32	810.030M	-63.6	-27.8 +2.1 +0.0	+22.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0 360	-64.1	-31.8 Mid	-32.3	Vert 116

33	600.040M	-60.6	-28.3 +1.7 +0.0	+20.0 +0.0 +0.0	+0.7 +0.0	+1.6 +0.0	+0.0 360	-64.9	-31.8 Mid	-33.1	Vert 116
34	449.995M	-57.8	-28.1 +1.5 +0.0	+17.3 +0.0 +0.0	+0.6 +0.0	+1.4 +0.0	+0.0	-65.1	-31.8 Low	-33.3	Vert 141
35	972.005M	-67.4	-27.2 +2.4 +0.0	+24.0 +0.0 +0.0	+0.9 +0.0	+2.1 +0.0	+0.0 169	-65.2	-31.8 Mid	-33.4	Vert 116
36	696.000M	-62.3	-28.2 +1.9 +0.0	+20.5 +0.0 +0.0	+0.8 +0.0	+1.7 +0.0	+0.0 360	-65.6	-31.8 High	-33.8	Vert 99
37	599.995M	-61.4	-28.3 +1.7 +0.0	+20.0 +0.0 +0.0	+0.7 +0.0	+1.6 +0.0	+0.0	-65.7	-31.8 Low	-33.9	Horiz 147
38	648.005M	-62.2	-28.3 +1.8 +0.0	+20.2 +0.0 +0.0	+0.7 +0.0	+1.7 +0.0	+0.0 80	-66.1	-31.8 Mid	-34.3	Vert 99
39	648.002M	-62.3	-28.3 +1.8 +0.0	+20.2 +0.0 +0.0	+0.7 +0.0	+1.7 +0.0	+0.0 339	-66.2	-31.8 Mid	-34.4	Horiz 125
40	899.968M	-67.0	-27.4 +2.3 +0.0	+23.0 +0.0 +0.0	+0.9 +0.0	+2.0 +0.0	+0.0	-66.2	-31.8 Low	-34.4	Horiz 176
41	110.250M	-50.8	-27.9 +0.6 +0.0	+10.7 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-66.4	-31.8 Mid	-34.6	Vert 139
42	49.250M	-48.6	-28.0 +0.3 +0.0	+9.0 +0.0 +0.0	+0.2 +0.0	+0.4 +0.0	+0.0	-66.7	-31.8 Mid	-34.9	Vert 139
43	870.000M	-67.1	-27.5 +2.2 +0.0	+22.8 +0.0 +0.0	+0.9 +0.0	+2.0 +0.0	+0.0	-66.7	-31.8 High	-34.9	Vert 99
44	1649.984M	-58.3	+0.0 +0.0 +23.1	+0.0 +0.0 +0.3	+1.2 +1.6	+0.0 -34.8	+0.0 360	-66.9	-31.8 Low	-35.1	Vert 108
45	1619.945M	-57.9	+0.0 +0.0 +22.8	+0.0 +0.0 +0.3	+1.2 +1.5	+0.0 -34.9	+0.0 360	-67.0	-31.8 Mid	-35.2	Vert 113
46	1200.000M	-54.0	+0.0 +0.0 +20.2	+0.0 +0.0 +0.3	+1.0 +1.3	+0.0 -35.9	+0.0	-67.1	-31.8 Low	-35.3	Vert 99
47	123.980M	-53.2	-27.8 +0.6 +0.0	+11.6 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-67.8	-31.8 Mid	-36.0	Vert 139
48	1499.768M	-57.0	+0.0 +0.0 +21.4	+0.0 +0.0 +0.3	+1.1 +1.5	+0.0 -35.1	+0.0 4	-67.8	-31.8 Low	-36.0	Vert 125
49	972.002M	-70.0	-27.2 +2.4 +0.0	+24.0 +0.0 +0.0	+0.9 +0.0	+2.1 +0.0	+0.0	-67.8	-31.8 Mid	-36.0	Horiz 99

50	1740.010M	-60.7	+0.0 +0.0 +24.0	+0.0 +0.0 +0.3	+1.3 +1.6	+0.0 -34.7	+0.0 360	-68.2	-31.8 High	-36.4	Horiz 99
51	750.030M	-66.8	-28.0 +2.0 +0.0	+21.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0	-68.6	-31.8 Low	-36.8	Vert 178
52	1740.105M	-61.4	+0.0 +0.0 +24.0	+0.0 +0.0 +0.3	+1.3 +1.6	+0.0 -34.7	+0.0 5	-68.9	-31.8 Low	-37.1	Vert 108
53	1650.096M	-60.3	+0.0 +0.0 +23.1	+0.0 +0.0 +0.3	+1.2 +1.6	+0.0 -34.8	+0.0	-68.9	-31.8 Low	-37.1	Horiz 99
54	696.000M	-65.7	-28.2 +1.9 +0.0	+20.5 +0.0 +0.0	+0.8 +0.0	+1.7 +0.0	+0.0 154	-69.0	-31.8 High	-37.2	Horiz 128
55	56.390M	-49.5	-28.0 +0.4 +0.0	+7.3 +0.0 +0.0	+0.2 +0.0	+0.4 +0.0	+0.0	-69.2	-31.8 Mid	-37.4	Vert 139
56	449.995M	-62.1	-28.1 +1.5 +0.0	+17.3 +0.0 +0.0	+0.6 +0.0	+1.4 +0.0	+0.0 360	-69.4	-31.8 Low	-37.6	Horiz 99
57	1457.770M	-58.8	+0.0 +0.0 +21.3	+0.0 +0.0 +0.3	+1.1 +1.5	+0.0 -35.2	+0.0 52	-69.8	-31.8 Mid	-38.0	Vert 116
58	48.000M	-52.6	-28.0 +0.3 +0.0	+9.8 +0.0 +0.0	+0.2 +0.0	+0.4 +0.0	+0.0 360	-69.9	-31.8 Low	-38.1	Vert 99
59	1350.232M	-58.2	+0.0 +0.0 +20.9	+0.0 +0.0 +0.3	+1.1 +1.4	+0.0 -35.4	+0.0 360	-69.9	-31.8 Low	-38.1	Vert 99
60	1566.050M	-60.3	+0.0 +0.0 +22.2	+0.0 +0.0 +0.3	+1.2 +1.5	+0.0 -35.0	+0.0 205	-70.1	-31.8 High	-38.3	Vert 112
61	660.010M	-66.7	-28.3 +1.9 +0.0	+20.3 +0.0 +0.0	+0.8 +0.0	+1.7 +0.0	+0.0	-70.3	-31.8 Mid	-38.5	Vert 116
62	749.995M	-68.5	-28.0 +2.0 +0.0	+21.5 +0.0 +0.0	+0.8 +0.0	+1.9 +0.0	+0.0 360	-70.3	-31.8 Low	-38.5	Horiz 163
63	1620.075M	-61.3	+0.0 +0.0 +22.8	+0.0 +0.0 +0.3	+1.2 +1.5	+0.0 -34.9	+0.0	-70.4	-31.8 Mid	-38.6	Horiz 112
64	270.048M	-59.1	-27.1 +1.1 +0.0	+12.9 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0	-70.6	-31.8 High	-38.8	Horiz 99
65	1500.144M	-59.8	+0.0 +0.0 +21.4	+0.0 +0.0 +0.3	+1.1 +1.5	+0.0 -35.1	+0.0 339	-70.6	-31.8 Low	-38.8	Horiz 99
66	1457.875M	-59.9	+0.0 +0.0 +21.3	+0.0 +0.0 +0.3	+1.1 +1.5	+0.0 -35.2	+0.0 360	-70.9	-31.8 Mid	-39.1	Horiz 99

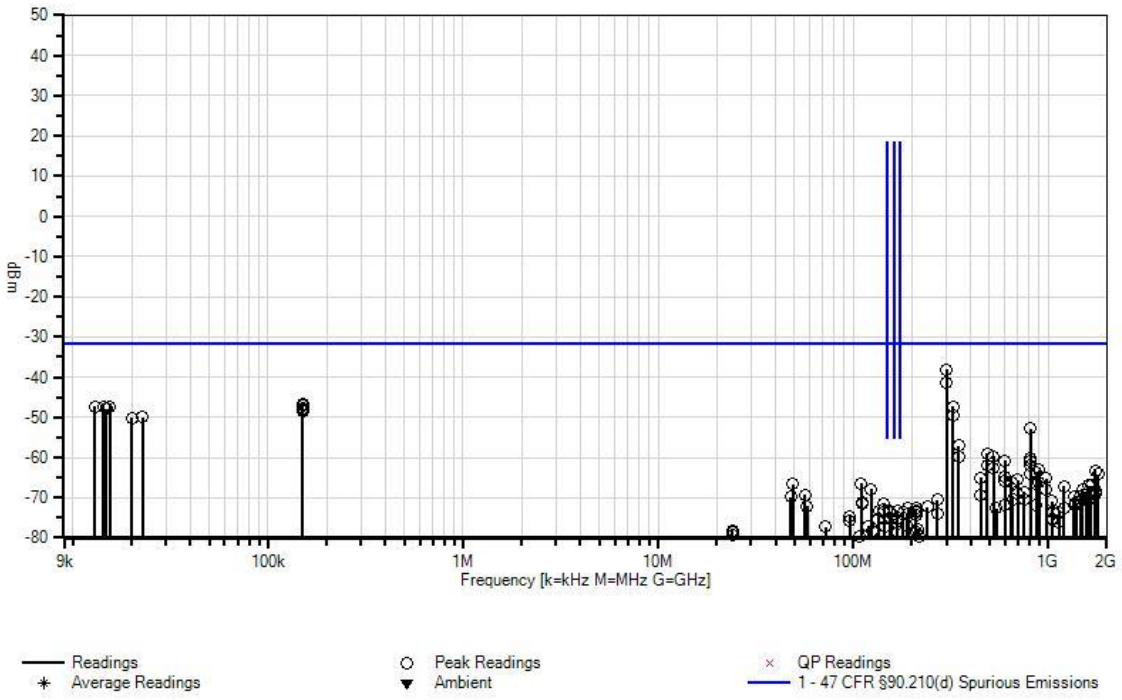
67	1043.925M	-56.1	+0.0 +0.0 +19.5	+0.0 +0.0 +0.2	+0.9 +1.2	+0.0 -36.6	+0.0 -15	-70.9	-31.8 High	-39.1	Vert 99
68	110.880M	-55.5	-27.9 +0.6 +0.0	+10.8 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0 360	-71.0	-31.8 Low	-39.2	Vert 99
69	1392.050M	-59.9	+0.0 +0.0 +21.0	+0.0 +0.0 +0.3	+1.1 +1.4	+0.0 -35.3	+0.0 19	-71.4	-31.8 High	-39.6	Vert 99
70	143.904M	-57.4	-27.6 +0.7 +0.0	+11.6 +0.0 +0.0	+0.4 +0.0	+0.7 +0.0	+0.0	-71.6	-31.8 High	-39.8	Vert 99
71	110.928M	-56.1	-27.9 +0.6 +0.0	+10.8 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-71.6	-31.8 High	-39.8	Vert 99
72	870.000M	-72.1	-27.5 +2.2 +0.0	+22.8 +0.0 +0.0	+0.9 +0.0	+2.0 +0.0	+0.0 360	-71.7	-31.8 Mid	-39.9	Vert 116
73	600.040M	-67.4	-28.3 +1.7 +0.0	+20.0 +0.0 +0.0	+0.7 +0.0	+1.6 +0.0	+0.0 137	-71.7	-31.8 Mid	-39.9	Horiz 177
74	1349.912M	-60.0	+0.0 +0.0 +20.9	+0.0 +0.0 +0.3	+1.1 +1.4	+0.0 -35.4	+0.0	-71.7	-31.8 Low	-39.9	Horiz 125
75	58.224M	-52.2	-28.0 +0.4 +0.0	+7.0 +0.0 +0.0	+0.2 +0.0	+0.5 +0.0	+0.0	-72.1	-31.8 High	-40.3	Vert 99
76	239.952M	-59.5	-27.1 +1.0 +0.0	+11.8 +0.0 +0.0	+0.5 +0.0	+1.0 +0.0	+0.0	-72.3	-31.8 High	-40.5	Horiz 99
77	1200.032M	-59.4	+0.0 +0.0 +20.2	+0.0 +0.0 +0.3	+1.0 +1.3	+0.0 -35.9	+0.0 359	-72.5	-31.8 Low	-40.7	Horiz 103
78	191.980M	-56.5	-27.3 +0.8 +0.0	+9.0 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0	-72.7	-31.8 Mid	-40.9	Horiz 149
79	210.000M	-57.3	-27.3 +0.9 +0.0	+9.7 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0	-72.7	-31.8 Low	-40.9	Horiz 151
80	539.970M	-67.3	-28.3 +1.7 +0.0	+19.0 +0.0 +0.0	+0.7 +0.0	+1.5 +0.0	+0.0 360	-72.7	-31.8 Mid	-40.9	Vert 116
81	144.000M	-58.7	-27.6 +0.7 +0.0	+11.6 +0.0 +0.0	+0.4 +0.0	+0.7 +0.0	+0.0 360	-72.9	-31.8 Low	-41.1	Vert 99
82	168.580M	-57.8	-27.4 +0.8 +0.0	+10.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0	-73.1	-31.8 Mid	-41.3	Horiz 149
83	210.000M	-57.9	-27.3 +0.9 +0.0	+9.7 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0	-73.3	-31.8 High	-41.5	Horiz 99

84	153.120M	-59.1	-27.6 +0.8 +0.0	+11.3 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0	-73.4	-31.8 High	-41.6	Vert 99
85	135.830M	-59.1	-27.7 +0.7 +0.0	+11.7 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-73.4	-31.8 Mid	-41.6	Vert 139
86	209.920M	-58.1	-27.3 +0.9 +0.0	+9.7 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0	-73.5	-31.8 Mid	-41.7	Horiz 149
87	1134.040M	-60.0	+0.0 +0.0 +20.0	+0.0 +0.0 +0.3	+1.0 +1.3	+0.0 -36.2	+0.0 360	-73.6	-31.8 Mid	-41.8	Vert 108
88	179.960M	-57.3	-27.4 +0.8 +0.0	+9.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 333	-73.6	-31.8 Mid	-41.8	Horiz 163
89	153.960M	-59.5	-27.6 +0.8 +0.0	+11.3 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 360	-73.8	-31.8 Low	-42.0	Vert 151
90	1050.152M	-59.2	+0.0 +0.0 +19.6	+0.0 +0.0 +0.2	+0.9 +1.2	+0.0 -36.5	+0.0 360	-73.8	-31.8 Low	-42.0	Vert 106
91	144.010M	-59.6	-27.6 +0.7 +0.0	+11.6 +0.0 +0.0	+0.4 +0.0	+0.7 +0.0	+0.0	-73.8	-31.8 Mid	-42.0	Horiz 203
92	269.970M	-62.5	-27.1 +1.1 +0.0	+12.9 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0	-74.0	-31.8 Mid	-42.2	Vert 99
93	189.000M	-57.9	-27.3 +0.8 +0.0	+9.0 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0 360	-74.1	-31.8 Low	-42.3	Vert 151
94	210.050M	-59.1	-27.3 +0.9 +0.0	+9.7 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0 7	-74.5	-31.8 Mid	-42.7	Horiz 222
95	96.000M	-57.7	-27.9 +0.5 +0.0	+9.6 +0.0 +0.0	+0.3 +0.0	+0.6 +0.0	+0.0	-74.6	-31.8 Low	-42.8	Horiz 125
96	167.950M	-59.5	-27.5 +0.8 +0.0	+10.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0	-74.9	-31.8 Mid	-43.1	Vert 99
97	155.970M	-60.9	-27.5 +0.8 +0.0	+11.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0	-75.3	-31.8 Mid	-43.5	Horiz 203
98	134.160M	-61.1	-27.7 +0.7 +0.0	+11.7 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-75.4	-31.8 Low	-43.6	Horiz 125
99	1049.760M	-60.8	+0.0 +0.0 +19.6	+0.0 +0.0 +0.2	+0.9 +1.2	+0.0 -36.5	+0.0	-75.4	-31.8 Low	-43.6	Horiz 99
100	1043.925M	-60.7	+0.0 +0.0 +19.5	+0.0 +0.0 +0.2	+0.9 +1.2	+0.0 -36.6	+0.0 369	-75.5	-31.8 High	-43.7	Horiz 99

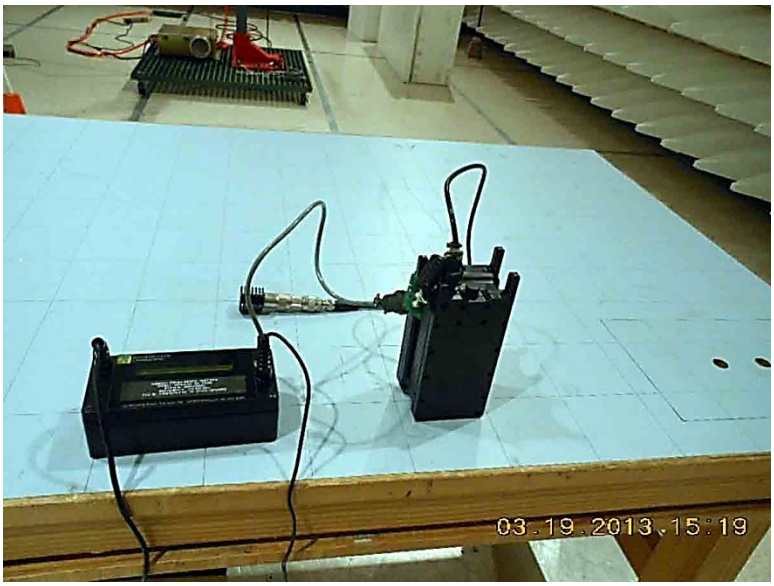
101	96.096M	-58.7	-27.9 +0.5 +0.0	+9.6 +0.0 +0.0	+0.3 +0.0	+0.6 +0.0	+0.0 360	-75.6	-31.8 High	-43.8	Horiz 162
102	1134.040M	-62.5	+0.0 +0.0 +20.0	+0.0 +0.0 +0.3	+1.0 +1.3	+0.0 -36.2	+0.0 39	-76.1	-31.8 Mid	-44.3	Horiz 99
103	168.096M	-61.1	-27.5 +0.8 +0.0	+10.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 349	-76.5	-31.8 High	-44.7	Horiz 162
104	188.256M	-60.5	-27.3 +0.8 +0.0	+9.0 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 360	-76.8	-31.8 High	-45.0	Vert 99
105	144.580M	-63.0	-27.6 +0.7 +0.0	+11.6 +0.0 +0.0	+0.4 +0.0	+0.7 +0.0	+0.0	-77.2	-31.8 Mid	-45.4	Vert 139
106	120.000M	-62.4	-27.8 +0.6 +0.0	+11.4 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-77.2	-31.8 Low	-45.4	Horiz 125
107	71.990M	-57.4	-28.0 +0.4 +0.0	+6.9 +0.0 +0.0	+0.3 +0.0	+0.5 +0.0	+0.0	-77.3	-31.8 Mid	-45.5	Horiz 203
108	214.320M	-62.7	-27.2 +0.9 +0.0	+10.0 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0 360	-77.7	-31.8 High	-45.9	Vert 99
109	124.250M	-63.7	-27.8 +0.6 +0.0	+11.7 +0.0 +0.0	+0.3 +0.0	+0.7 +0.0	+0.0	-78.2	-31.8 Mid	-46.4	Horiz 203
110	24.000M	-84.7	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0 360	-78.2	-31.8 Mid	-46.4	Paral 117
111	24.000M	-84.8	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0	-78.3	-31.8 High	-46.5	Paral 117
112	167.952M	-63.1	-27.5 +0.8 +0.0	+10.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 21	-78.5	-31.8 High	-46.7	Vert 99
113	24.000M	-85.0	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0	-78.5	-31.8 Mid	-46.7	Perpe 117
114	168.000M	-63.2	-27.5 +0.8 +0.0	+10.1 +0.0 +0.0	+0.4 +0.0	+0.8 +0.0	+0.0 360	-78.6	-31.8 Low	-46.8	Vert 151
115	210.030M	-63.2	-27.3 +0.9 +0.0	+9.7 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0	-78.6	-31.8 Mid	-46.8	Vert 99
116	24.000M	-85.2	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0	-78.7	-31.8 Low	-46.9	Paral 117
117	24.000M	-85.8	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0 360	-79.3	-31.8 High	-47.5	Perpe 117

118	217.440M	-64.8	-27.2 +0.9 +0.0	+10.2 +0.0 +0.0	+0.4 +0.0	+0.9 +0.0	+0.0 360	-79.6	-31.8 Low	-47.8	Vert 151
119	106.830M	-63.7	-27.9 +0.6 +0.0	+10.5 +0.0 +0.0	+0.3 +0.0	+0.6 +0.0	+0.0	-79.6	-31.8 Mid	-47.8	Horiz 203
120	270.048M	-69.1	-27.1 +1.1 +0.0	+12.9 +0.0 +0.0	+0.5 +0.0	+1.1 +0.0	+0.0 360	-80.6	-31.8 High	-48.8	Vert 99
121	24.000M	-87.6	+0.0 +0.0 +0.0	+0.0 +6.2 +0.0	+0.1 +0.2	+0.0 +0.0	+0.0 360	-81.1	-31.8 Low	-49.3	Perpe 117
122	72.000M	-62.5	-28.0 +0.4 +0.0	+6.9 +0.0 +0.0	+0.3 +0.0	+0.5 +0.0	+0.0	-82.4	-31.8 Low	-50.6	Horiz 125

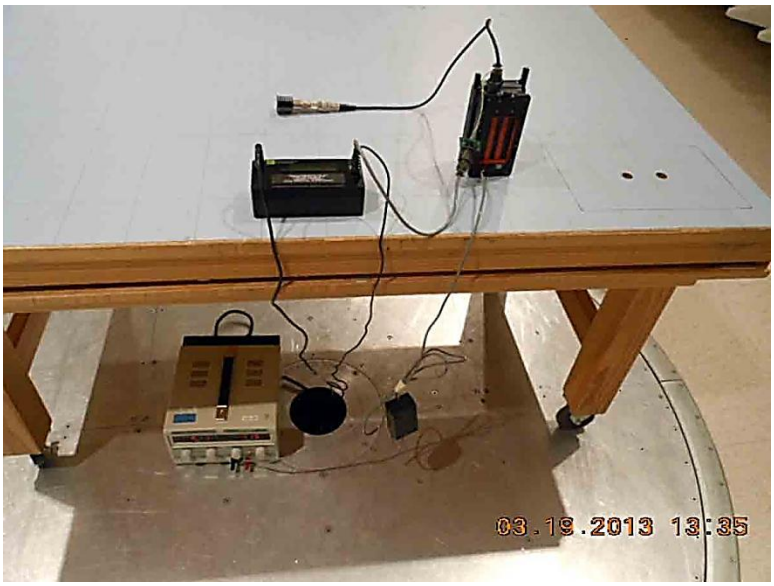
CKC Laboratories, Inc. Date: 3/19/2013 Time: 14:21:38 Rothenbuhler Engineering WO#: 93918
Test Distance: 3 Meters Sequence#: 12 Vert
Rothenbuhler Engineering Testbox P/N: 1678-4-V2



Test Setup Photos



1678-1-V2 Battery Setup



1678-1-V2, PS1

1678-1-V2, PS1

1678-4-V2, PS1

1678-4-V2, PS2

Frequency Stability

Test Conditions / Setup

Temp: 21°
Humidity: 34%
Pressure: 102.3kPa
Frequency Range: 150-174MHz

EUT's RF output is connected to the Spectrum Analyzer.
For 1678-4-V2: EUT is connected to a laptop and to a controller.
For 1678-1-V2: EUT is connected to a laptop and to a test box.
EUT is in operational mode.
2 EUTs are located inside the Temperature chamber.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.

1678-1-V2 has identical transceiver circuitry as the 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The 1678-1-V2 is worst case of the units and is representative of 1678-2-V2, 1678-3-V2 & 1678-6-V2.
The1678-1-V2, 1678-2-V2, 1678-3-V2 & 1678-6-V2 have the ability to transmit at 5W or 2W. 5W will be tested.

EUTs are Mobile stations with 12.5kHz channels.

Engineer Name: S. Pittsford

Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
03029	Thermometer, Digital Infrared	Fluke	566	2/1/2013	2/1/2015
02757	Temperature Chamber	Bemco	F100/350-8	1/22/2013	1/22/2015
02872	Spectrum Analyzer	Agilent	E4440A	7/23/2011	7/23/2013
P06219	Attenuator	Narda	768-10	3/22/2012	3/22/2014
P06217	Attenuator	Narda	768-10	3/22/2012	3/22/2014
P05759	Attenuator	Pasternack	PE7010-20	2/6/2012	2/6/2014

Test Data

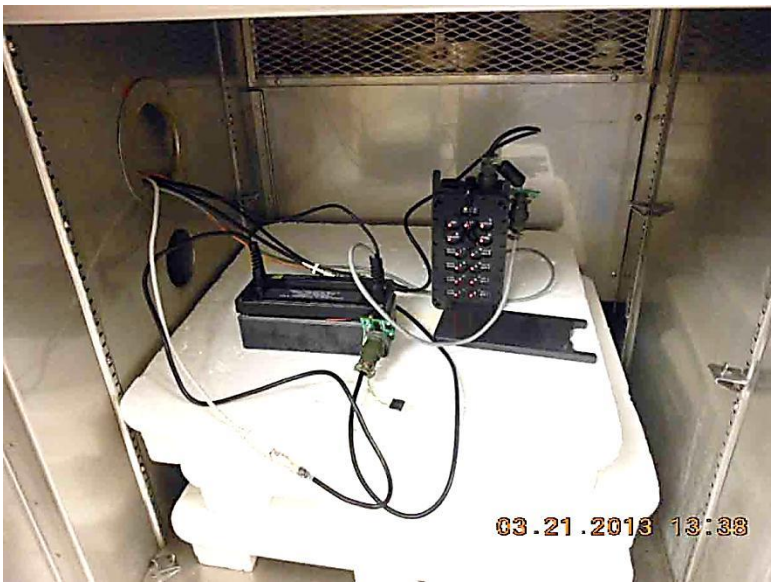
Customer:		Rothenbuhler Engineering						
WO#:		94091						
Date:		21-Mar-13						
Test Engineer:		S. Pittsford						
Test Specification		FCC Part 90.213 & RSS 119 Issue 11 para 5.3						
Device Model #:		Model 1678-1-V2 is a representative of Models: 1678-2-V2, 1678-3-V2 & 1678-6-V2						
Operating Voltage:		8.5	**VDC/VAC**					
Frequency Limit:		5	**PPM**					
Temperature Variations								

		Channel 1 (MHz)	**Dev. (PPM)**	**Channel 2 (MHz)**	**Dev. (PPM)**	**Channel 3 (MHz)**	**Dev. (PPM)**
Channel Frequency:		**150**		**162**		**174**	
Temp (C)	**Voltage**						
-30	8.5	150.00007	0.44667	162.00000	0.00000	174.00000	0.00000
-20	8.5	150.00007	0.46667	162.00008	0.48148	174.00006	0.32759
-10	8.5	150.00008	0.50000	162.00000	0.00000	174.00000	0.00000
0	8.5	150.00000	0.00000	162.00007	0.41975	174.00006	0.35632
10	8.5	150.00007	0.45333	162.00008	0.47531	174.00007	0.38506
20	8.5	150.00006	0.40000	162.00007	0.41975	174.00006	0.32759
30	8.5	150.00005	0.32000	162.00005	0.32716	174.00003	0.18966
40	8.5	150.00006	0.38667	162.00006	0.38272	174.00004	0.20115
50	8.5	150.00009	0.56667	162.00010	0.58642	174.00008	0.47701
60	8.5	150.00012	0.81333	162.00013	0.81481	174.00012	0.67816
Voltage Variations (±15%)							
20	7.2	150.00006	0.40000	162.00007	0.40123	174.00005	0.30460
20	8.5	150.00006	0.40000	162.00007	0.41975	174.00057	3.27586
20	9.8	150.00006	0.40000	162.00007	0.45062	174.00006	0.35632
Max Deviation (PPM)			**0.81333**		**0.81481**		**3.27586**
			PASS		**PASS**		**PASS**

Customer:	Rothenbuhler Engineering						
WO#:	94091						
Date:	21-Mar-13						
Test Engineer:	S. Pittsford						
Test Specification	FCC Part 90.213 & RSS 119 Issue 11 para 5.3						
Device Model #:	1678-4-V2						
Operating Voltage:	115	**VDC/VAC**					
Frequency Limit:	5	**PPM**					
Temperature Variations							

		Channel 1 (MHz)	**Dev. (PPM)**	**Channel 2 (MHz)**	**Dev. (PPM)**	**Channel 3 (MHz)**	**Dev. (PPM)**
Channel Frequency:		**150**		**162**		**174**	
Temp (C)	**Voltage**						
-30	115	149.99990	0.68667	162.00000	0.00000	173.99989	0.64943
-20	115	149.99990	0.65333	161.99990	0.64815	173.99988	0.68966
-10	115	149.99992	0.54667	161.99991	0.57407	173.99990	0.57471
0	115	150.00000	0.00000	161.99989	0.67901	173.99988	0.68966
10	115	150.00000	0.00000	162.00000	0.00000	173.99987	0.72989
20	115	149.99997	0.18000	161.99997	0.18519	173.99997	0.18391
30	115	149.99997	0.22000	161.99997	0.21605	173.99996	0.21839
40	115	149.99995	0.33333	161.99995	0.30864	173.99995	0.31609
50	115	149.99999	0.10000	161.99998	0.11111	173.99998	0.11494
60	115	149.99998	0.14667	161.99998	0.13580	173.99998	0.14368
Voltage Variations (±15%)							
20	97.8	149.99997	0.18667	161.99997	0.17284	173.99997	0.17241
20	115	149.99997	0.18000	161.99997	0.18519	173.99997	0.18391
20	132.3	149.99997	0.18000	161.99997	0.18519	173.99997	0.17241
Max Deviation (PPM)			**0.68667**		**0.67901**		**0.72989**
			PASS		**PASS**		**PASS**

Test Setup Photos



Transient Frequency Behavior

Test Conditions / Setup

Temp: 21°
Humidity: 34%
Pressure: 102.3kPa
Frequency Range: 150-174MHz

EUT's RF output and Signal Generator output are connected to the 4 port splitter.
The Output of the splitter is connected to the demodulator input and the spectrum analyzer through a step attenuator.
The spectrum analyzer is only being used to be sure that the sig-gen output is 20dB lower that the EUT's output.
The Output of the demodulator is connected to an oscilloscope.
For 1678-4-V2: EUT is connected to a laptop and to a controller.
For 1678-1-V2: EUT is connected to a laptop and to a test box.
EUT is in operational mode.
EUT will be transmitting at LOW (150MHz), MID (162MHz), and HIGH (174MHz) Channels.

Engineer Name: S. Pittsford

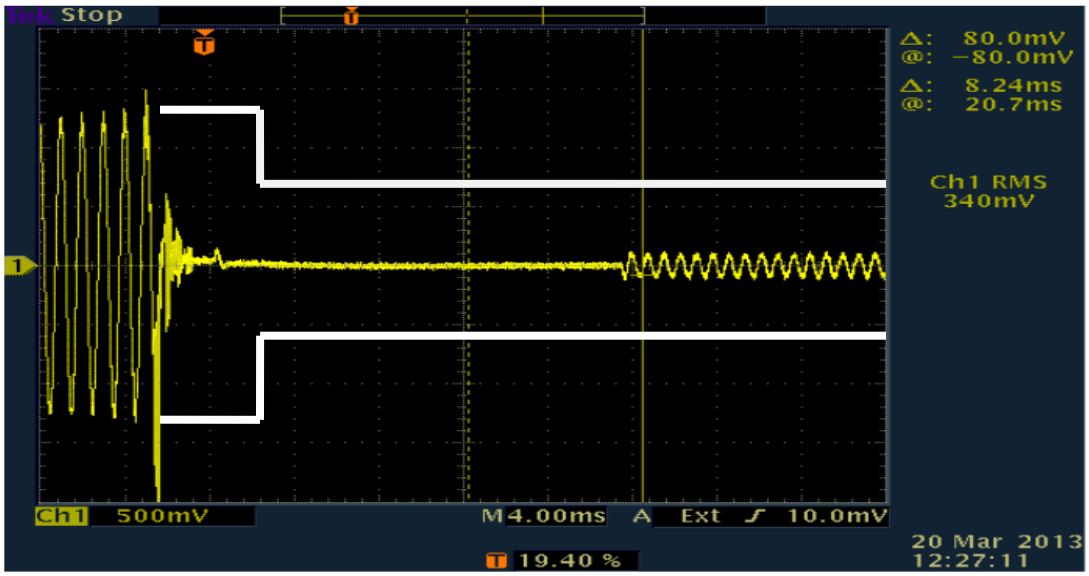
Test Equipment

Asset #	Description	Manufacturer	Model	Cal Date	Cal Due
P06219	Attenuator	Narda	768-10	3/22/2012	3/22/2014
P06217	Attenuator	Narda	768-10	3/22/2012	3/22/2014
P06124	Attenuator	Aeroflex	18N-6	7/8/2011	7/8/2013
01977	Directional Coupler	Werlatone Inc.	C5571	3/5/2013	3/5/2015
01496	RF Generator	Marconi	2022-0003X	11/30/2011	11/30/2013
01706	Attenuator	HP	8495B	1/11/2012	1/11/2014
02072	RF Characteristics Analyzer	HP	8901A	4/14/2011	4/14/2013
03331	Oscilloscope	Tektronix	TDS3052A	8/1/2012	8/1/2014
00784	Spectrum Analyzer	HP	8596E	11/12/2012	11/12/2014

Test Data

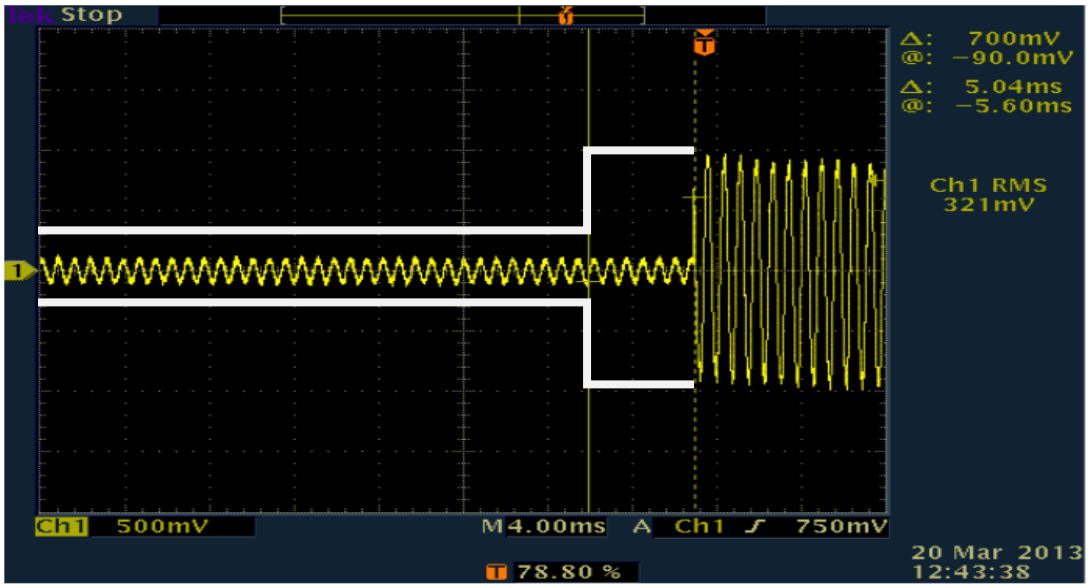
Model: 1678-4-V2, SN: 00002

150MHz
ON time



TDS 3052 - 1:29:22 PM 3/20/2013

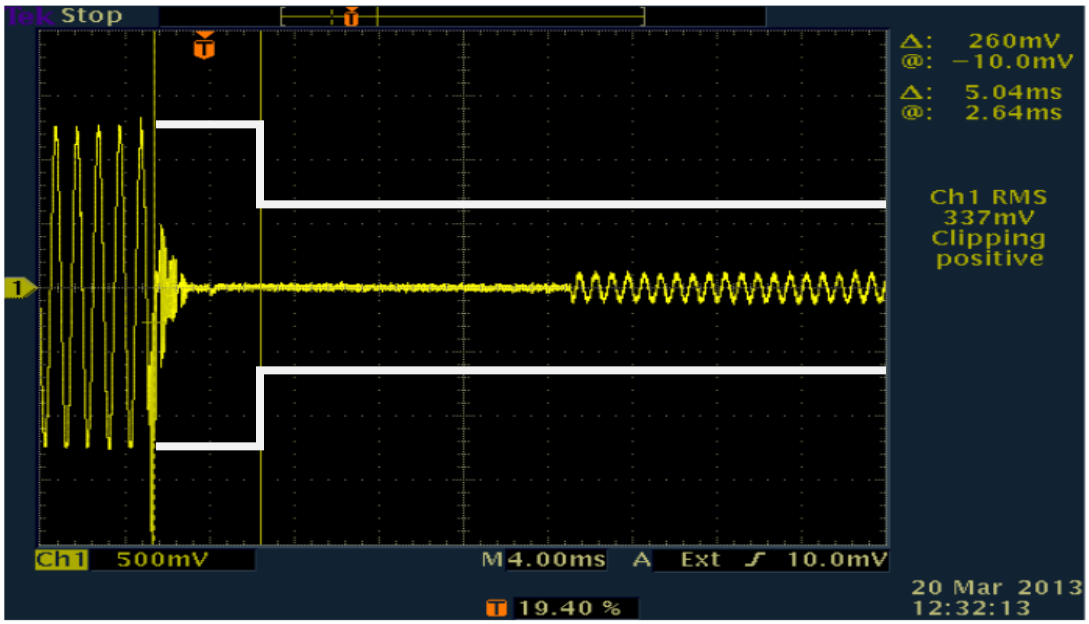
OFF time



TDS 3052 - 1:45:49 PM 3/20/2013

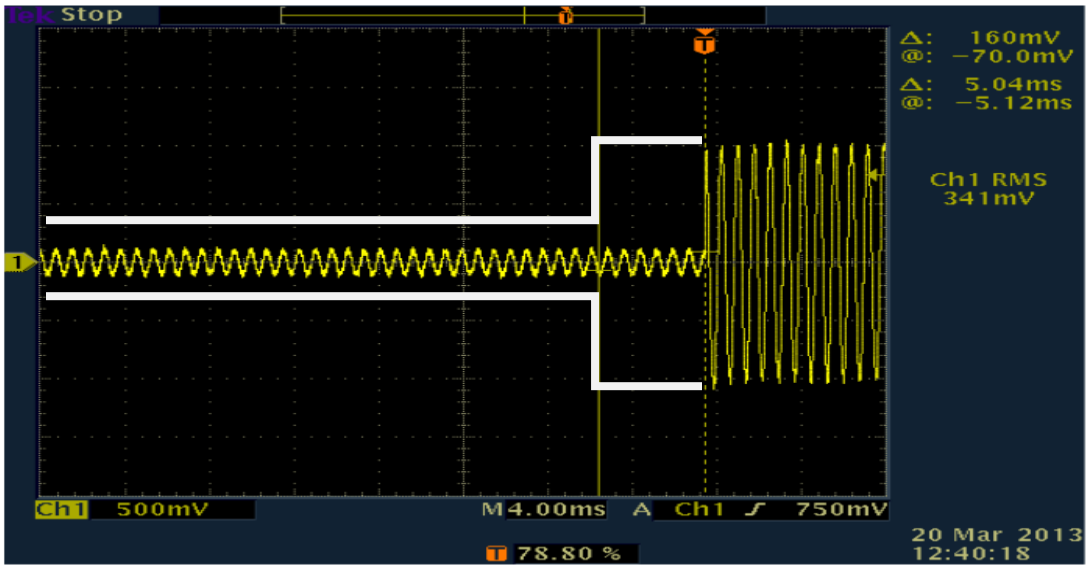
162MHz

ON time



TDS 3052 - 1:34:24 PM 3/20/2013

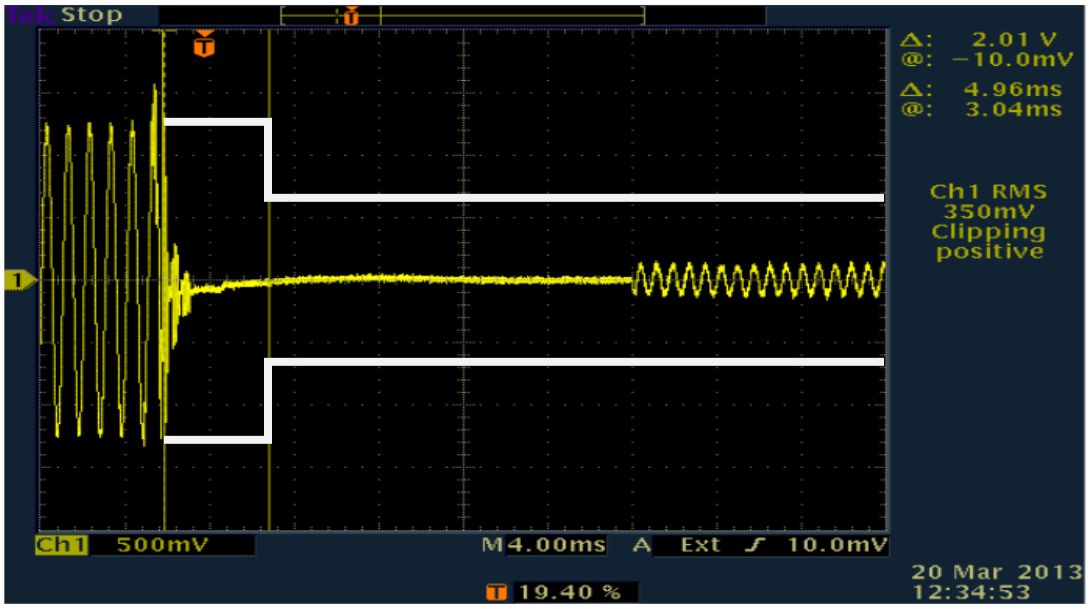
OFF time



TDS 3052 - 1:42:29 PM 3/20/2013

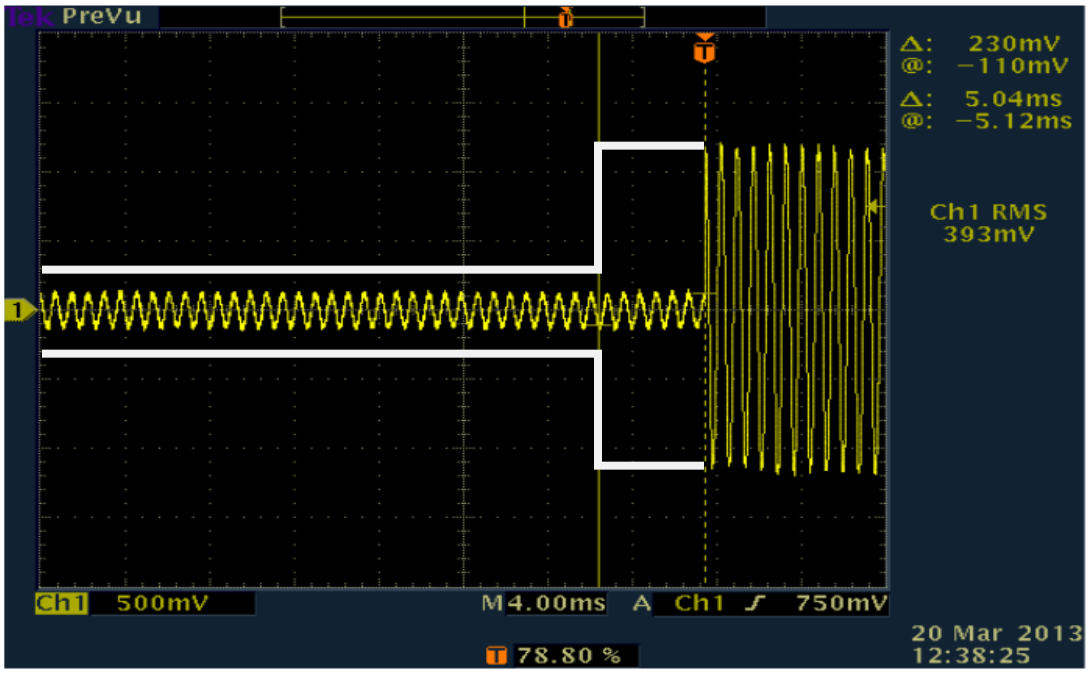
174MHz

ON time



TDS 3052 - 1:37:04 PM 3/20/2013

OFF time

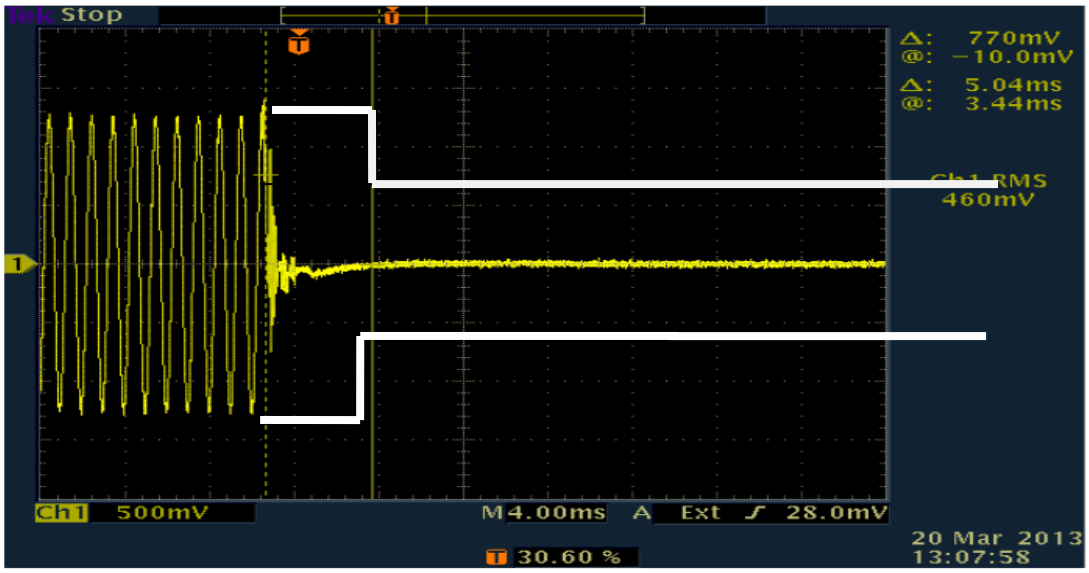


TDS 3052 - 1:40:36 PM 3/20/2013

Model: 1678-1-V2, SN: 00001

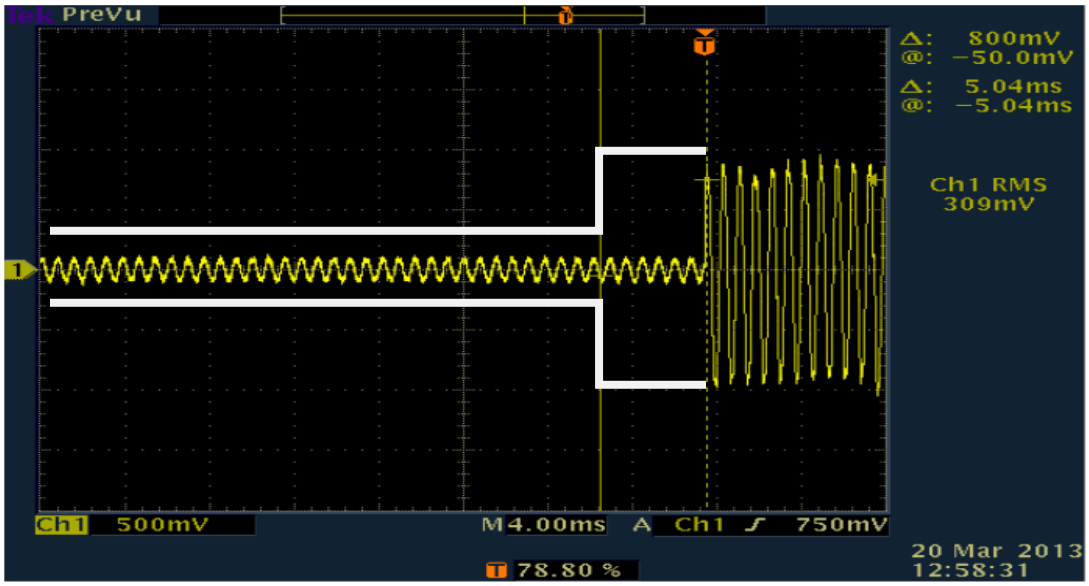
150MHz

ON time



TDS 3052 - 2:10:09 PM 3/20/2013

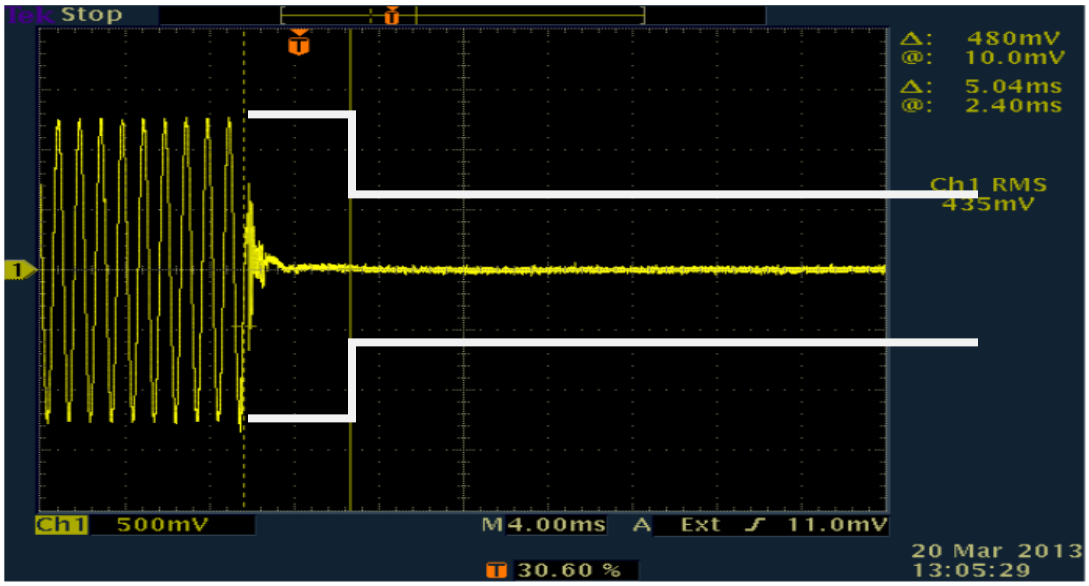
OFF time



TDS 3052 - 2:00:42 PM 3/20/2013

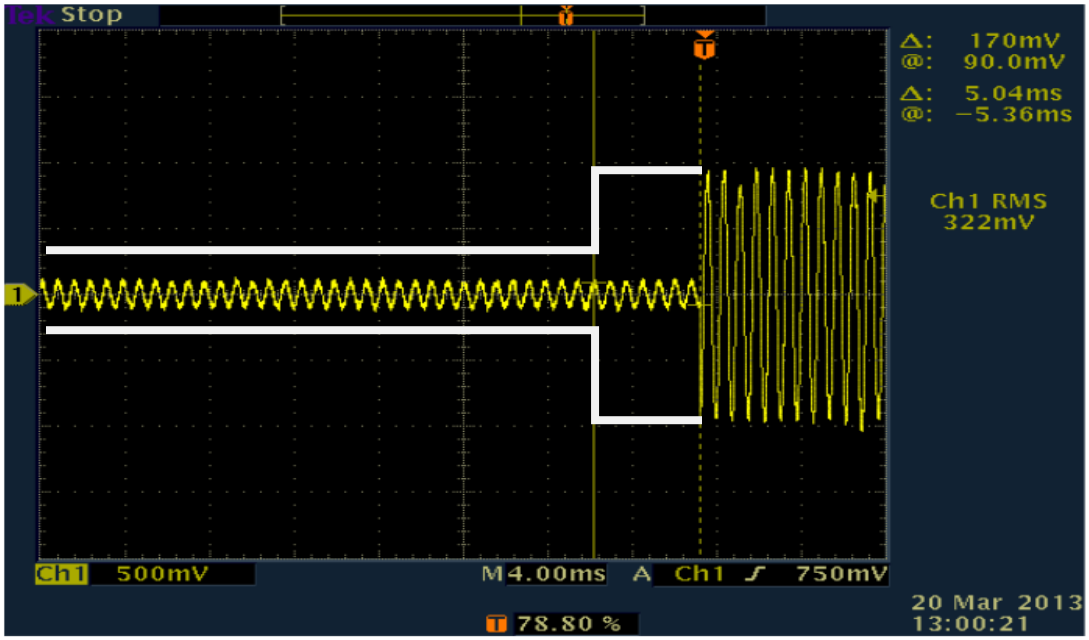
162MHz

ON time



TDS 3052 - 2:07:40 PM 3/20/2013

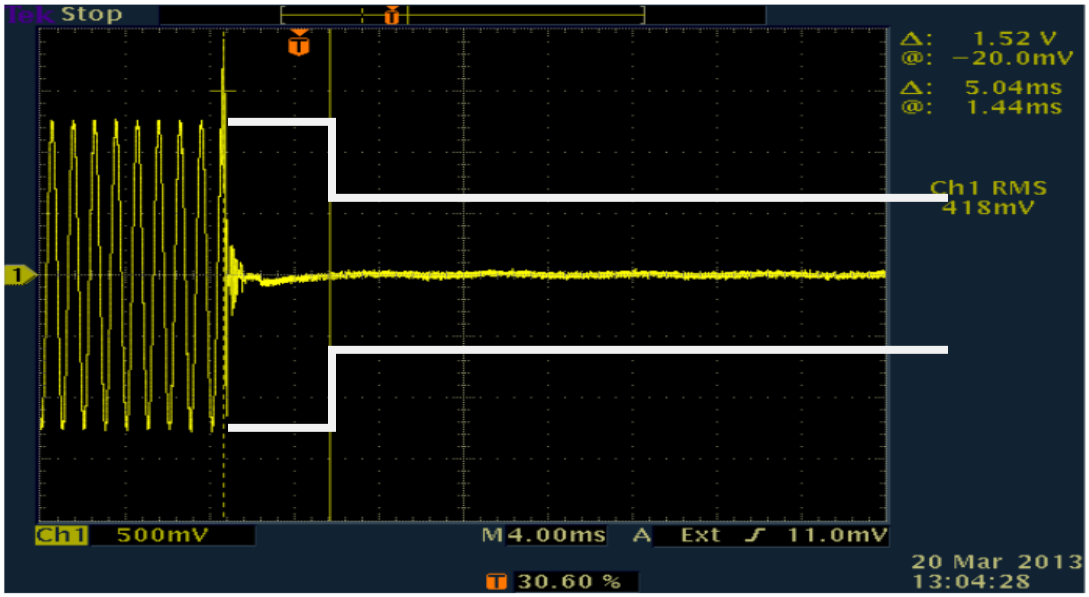
OFF time



TDS 3052 - 2:02:32 PM 3/20/2013

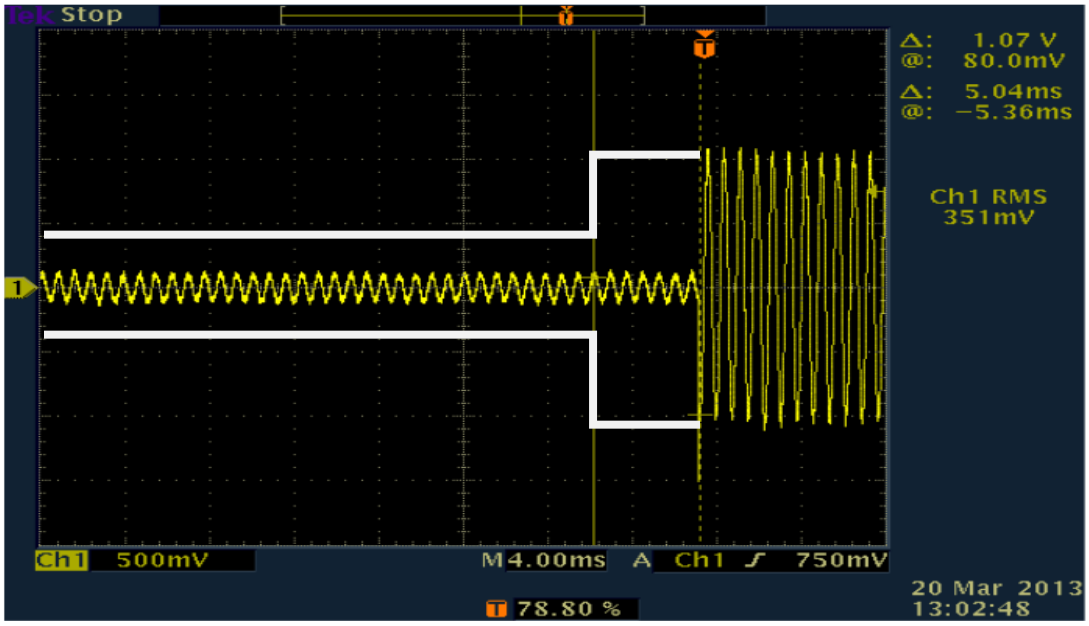
174MHz

ON time



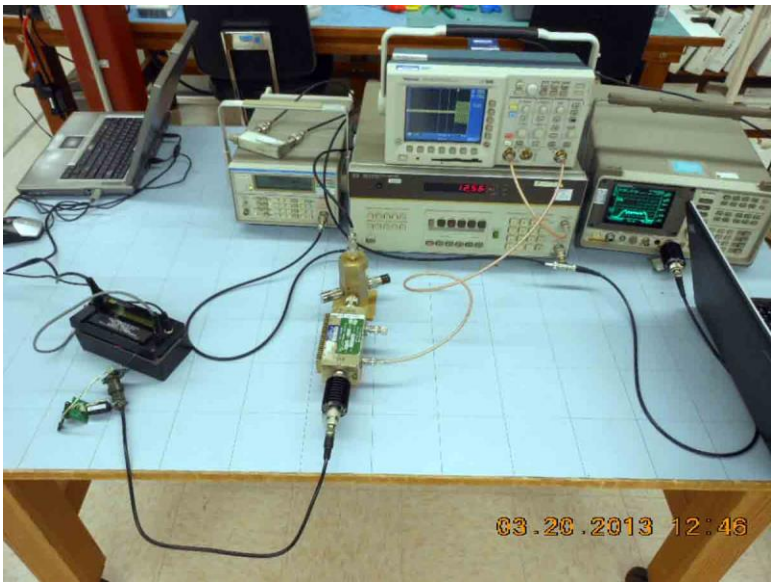
TDS 3052 - 2:06:39 PM 3/20/2013

OFF time



TDS 3052 - 2:04:59 PM 3/20/2013

Test Setup Photos



1678-4-V2

1678-1-V2

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 dBµV/m, the spectrum analyzer reading in dBµV 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.