CANADA:

16 - 211 Schoolhouse Street

Coquitlam, British Columbia

Canada V3K 4X9

Electromagnetic Compatibility

INTENTIONAL RADIATOR

TEST REPORT

IC RSS-119, FCC 47 CFR Part 90

Report Reference No. .....: E10596-1304-A Rev 3.0
Date of issue.....: January 16,2014
Total number of pages.....: 25

Testing Laboratory.....: Quality Auditing Institute
Address.....: 16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada

Accreditations (ISO 17025):

Standard Council of Canada: Accredited Laboratory No. 743

International Accreditation Service Inc: Accredited Laboratory: No. TL-239

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Applicant's name .....: Rothenbuhler Engineering
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Email .....: richt@tooter.com
Phone.....: (360) 856-0836 Fax.....:(360) 856-2183

Test Standard.....: RSS-119 Issue 11, FCC 47 CFR Part90 Subpart I

Test item description.....: Remote Firing Device
Model.....: 1673-1 Controller
Manufacturer.....: Rothenbuhler Engineering
Registrations: : FCC ID: CW21673-1
IC: 2758A-1673-1

CANADA:

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1673-1 Controller

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Revision History

Date	Report Number	Rev #	Details	Authors Initials
Jan 10, 2014	E10596-1304-A	0.0	Draft Test Report	DJ
Jan 13, 2014	E10596-1304-A	1.0	- separated into Controller and Remote test reports - included client requested changes per email 13Jan2014 Release Test Report	DJ
Jan 14, 2014	E10596-1304-A	2.0	- Revised model numbers per email 13Jan2014 Release Test Report	DJ
Jan 16, 2014	E10596-1304-A	3.0	- Added FCC and IC numbers for the product to page 1 - Modified Page 5 RF Power to 5.55W to match measured result on page 11. Release Test Report	DJ

Note:All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.

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Section I: Statement of Compliance

The following tests demonstrate testimony for the FCC & IC Marks for Transceivers / electromagnetic compatibility testing for this EUT as required by FCC Part 90 and IC RSS-119.

Test / Requirement Description	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts	Results		Pass / Fail
			Limit	Measured	
RF power output at antenna terminals	90.205(d); 2.1046(a);	RSS-119(5.4)	28 Watt	5.55 Watt	Pass
Occupied Bandwidth	90.209(b)(5); 2.1049	RSS-119(5.5.3)	11.5kHz	5.44 kHz	Pass
Occupied Bandwidth Emissions mask	90.210(d) 2.1049	RSS-119(5.5.9)	12.5kHz Mask D	12.5 kHz Mask D	Pass
Spurious Emissions at antenna terminals	90.210(d)(3); 2.1051	RSS-119(5.8)	57dBc	81.5 dBc	Pass
Spurious Emissions Radiated Field Strength	90.210(d)(3); 2.1053	RSS-119(5.8)	57dBc	72.9 dBc	Pass
Frequency Stability	90.213 2.1055	RSS-119(5.3)	+/- 5.0ppm	+/- 0.7ppm	Pass
Transient Frequency Behaviour	90.214 TIA-603 2.2.19	RSS-119(5.9)	12.5kHz Mask	12.5 kHz Mask	Pass

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with CFR 47 FCC Part 90 and Industry Canada RSS-119. The manufacturer is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products as required.

X

Tested By & Report Written By David Johanson,
RF/EMC Test Engineer

X

Reviewed By Amandeep Jathaul
RF/EMC Test Engineer

Section II: Testing Location and Procedures

Testing Laboratory:	Quality Auditing Institute
Testing location/ address.....:	16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada
Associated Laboratory:	Quality Auditing Institute (Remote location)
Testing location/ address.....:	19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada
FCC Test Site Registration Number (OATS 10m and SAC-3m): 226383	
Industry Canada Site Registration Number (SAC-3m)……: 9543B-1	
Industry Canada Test Site Registration Number (OATS-10m)..: 9543C-1	
Tested by ……..:	David Johanson
Reviewed by…….:	Aman Jathaul
Sample Information:	
Product Name…….....:	1673-1 Controller
Part Number…….:	
Company:……:	Rothenbuhler Engineering
Received Date:……:	20Nov2013
Received By……..:	Parm Singh
Sample Log……..:	QAI Product Control Log (QM 1301 - Sample Inventory)
Environmental Conditions:	
Indoor:	Temperature: 22ºC R.H.: 40.0%

Measurement Uncertainty

Radio Frequency .....: ±1,5 x 10^{-5} MHz

Total RF power, conducted.....: ±1 dB

RF power density, conducted.....: ±2.75 dB

Spurious emissions, conducted.....: ±3 dB

All emissions, radiated.....: ±3.5 dB

Temperature.....: ±1ºC

Humidity.....: ±5 %

DC and low frequency voltages.....: ±3 %

Test Bench Equipment List

Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
Tektronix	TDS754C	Oscilloscope	B012403	10-Oct-2013	10-Oct-2016
HP	8648C	Signal Generator	3623A03622	30-Oct-2012	30-Oct-2015
Boonton	4200-S/17	RF MicroWattmeter	430519 BG	13-Mar-2013	13-Mar-2016
Boonton	51033-6E	Power Sensor 100kHz-18GHz +33dBm	15779	18-Mar-2013	18-Mar-2016
Rohde & Schwarz	ESCI	EMI Receiver	1000123	29-Mar-2011	29-Mar-2014

Semi-Anechoic Chamber Equipment List

Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
ETS Lindgren	2165	Turntable	00043677	N/A	N/A
ETS Lindgren	2125	Mast	00077487	N/A	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	26-June-2012	26-Jun-2015
FCC	FCC-LISN-50-25-2	LISN	9927	30-Nov-2012	30-Nov-2015
COM-POWER	AHA-118	Dual Ridge Horn Antenna	711040	11-Mar-2011	11-Mar-2014
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	31-Oct-2012	31-Oct-2015
AILTECH/Eaton	94455-1	Biconical Antenna 20-200MHz	0931	10-Mar-2011	10-Mar-2014
EMCO	93146	Log Periodical Antenna 200-1000MHz	9811-5136	10-Mar-2011	10-Mar-2014
ETS Lindgren	S201	5 meter Semi-Anechoic Chamber	1030	N/A	N/A

Section III: Product Description

Introduction:

The 1673 REMOTE FIRING DEVICE (RFD) is an intelligent and discrete 2-way radio controlled remote blast initiation system. The radio system's signal is digitally encoded (addressed) for each system consisting of the Controller and with up to 8 Remotes. The 1673 RFD has the capability to initiate nonelectric shock tube as well as electric detonators. The system can be used repeatedly throughout an operation and will give an "answer back" or confirmed status of the Remote(s) at a distance of 3 to 5 miles, typical line-of-sight. The Remote can be held in the standby (not armed) mode for up to 16 hours and still maintain the energy to initiate shock tube. The 1673 Remote Firing Device includes redundant internal safety circuitry and a timed automatic disarming feature. If the Remote does not receive a properly addressed firing signal within 20 minutes of being armed, the system will automatically return to the disarmed state.

EUT Test Configuration:

The 1673-1 Controller and the 1673-2 Remote have the same radio module and CPU board. The only difference between these units are the firmware and the peripheral options. Although the various options were verified individually, for the purpose of this test report, the RF section of the Controller and the Remote are considered to be the same device and only the worst case is reported as appropriate. For all high power measurements, the results from the Remote were used.

The 1673-1 Controller has 2 options for input power. In option 1, AC mode, the Controller is designed to operate 100% of the time using the AC Power Adapter and has a maximum transmitter power of 1 Watt. When the ac Power Adapter is unplugged, the Controller turns Off.

In Option 2, Battery Mode, the Controller is designed to operate 100% of the time from an internal rechargeable battery and has a maximum transmitter power of 5 Watts. The AC-DC power adapter is used to charge the Battery when the Controller is turned Off.

The Controller is also designed to have a PC connected to it using an AC-DC power adapter with a USB cable.

The Controller was verified in both power options of operation, but the report is only showing the AC power option with the Output transmitter limited to 1Watt. The Un-Armed, Armed and USB modes of operation were verified with the Laptop Connected. However, there was no measurement taken with data transfer from the unit to the laptop since the USB communications is only a maximum of 30 seconds.

The 1673-2 Remote has 1 option for input power. In Battery Mode, the Remote is designed to operate 100% of the time from an internal rechargeable battery and has a maximum transmitter power of 5 Watts. The AC-DC power adapter is only used to charge the Battery when the Remote is turned Off. The Remote was verified when with the EUT turned On and Off in charge mode of operation.

The battery of the units are self-contained and could not be measured directly. The units do have a built-in Volt Meter and uses this information to display the Voltage of the battery to the end user. It is this measurement that is used in this test report when referring to the battery voltage.

Equipment Under Test Information (1673-1 Controller)

Manufacturer	Rothenbuhler Engineering
Product Name	1673-1-A Controller (Variant options: -A , -V, -AV)
Model Name	1673 RFD
Serial No.	PROTO-001

AC-DC Power Adapter with USB Cable and Clamp-on Ferrite

Manufacturer	Phihong
Product Name	Switching power supply 12Vdc
Model	PSAA30R-120
Input	AC100-240V, 50/60Hz, 0.8A
Output	DC12V 2.5A

Equipment Under Test Information (1673-2 Remote)

Manufacturer	Rothenbuhler Engineering
Product Name	1673-2 Remote (Variant Options: -V)
Model Name	1673 RFD
Serial No.	PROTO-001

AC-DC Power Adapter

Manufacturer	Phihong
Product Name	Switching power supply 12Vdc
Model	PSAA30R-120
Input	AC100-240V, 50/60Hz, 0.8A
Output	DC12V 2.5A

PC Laptop

Manufacturer	Dell
Product Name	Latitude D810
Part No.	PP15L
Serial number	1117373677
Operating System	Windows XP sp3
Program	Rothenbuhler; 1673 RFD Configuration

120VAC POWER EXTENSION BAR with 450Joule Surge Protection –
(Required for each unit when using 120Vac 60Hz Power)

Manufacturer	Master Electrician
Product Name	3Foot-SJT 14/3 Power Cord
Part No.	YC-102F-1
Rating	450Joule 125Vac 60Hz 15Amp 1875Watt Type 3 SPD

230VAC POWER EXTENSION BAR with 2000 Joule Surge Protection –
(Required for each unit when using 230Vac 50Hz power)

Manufacturer	APC (American Power Conversion)
Product Name	SurgeArrest Home/Office
Part No.	PH6T3-GR
Rating	2000Joule 250Vac 50Hz 10Amp Class III

Controller Cabling Configuration

Description	Number of Lines	Connection Type	Load or Termination	Shielded	Ferrites
DC Power Cord from USB-AC Power	2	Mil-Spec 8Pin Polarized Cylindrical Twist Lock	No	No	Yes
USB Cord from USB-AC Power	5	USB Type B	No	Yes	Yes (same ferrite as above)

Remote Cabling Configuration

Description	Number of Lines	Connection Type	Load or Termination	Shielded	Ferrites
DC Power Cord from AC Power Adapter	2	Mil-Spec 8Pin Polarized Cylindrical Twist Lock	No	No	No

Section IV: Test Results

Section Ia: RF Output Power

DATE(s): November 25, 2013

TEST STANDARD: FCC Part 90.205

TEST PROCEDURE: TIA-603-D 2.2.1 ; Part 2.1046(a)

TEST VOLTAGE: Fully Charged Battery – 8.3Vdc

MINIMUM STANDARD: N/A

TEST SETUP: The Remote was programmed for maximum 5Watt Transmitter and was used in battery mode of operation. The antenna port of EUT was directly connected to an RF Power Meter through a 30dB Attenuator.

MEASUREMENT METHOD: As called by the standards above.

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

Frequency (MHz)	Measured (Watt)
150.000	4.80
161.000	4.81
174.000	5.55

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Section Ib: Occupied Bandwidth

DATE(s): November 27, 2013

TEST STANDARD: FCC Part 90.210(d)

TEST VOLTAGE: 120Vac 60Hz

MINIMUM STANDARD: For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88kHz)$ dB

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10log (P) dB or 70 dB, whichever is the lesser attenuation.

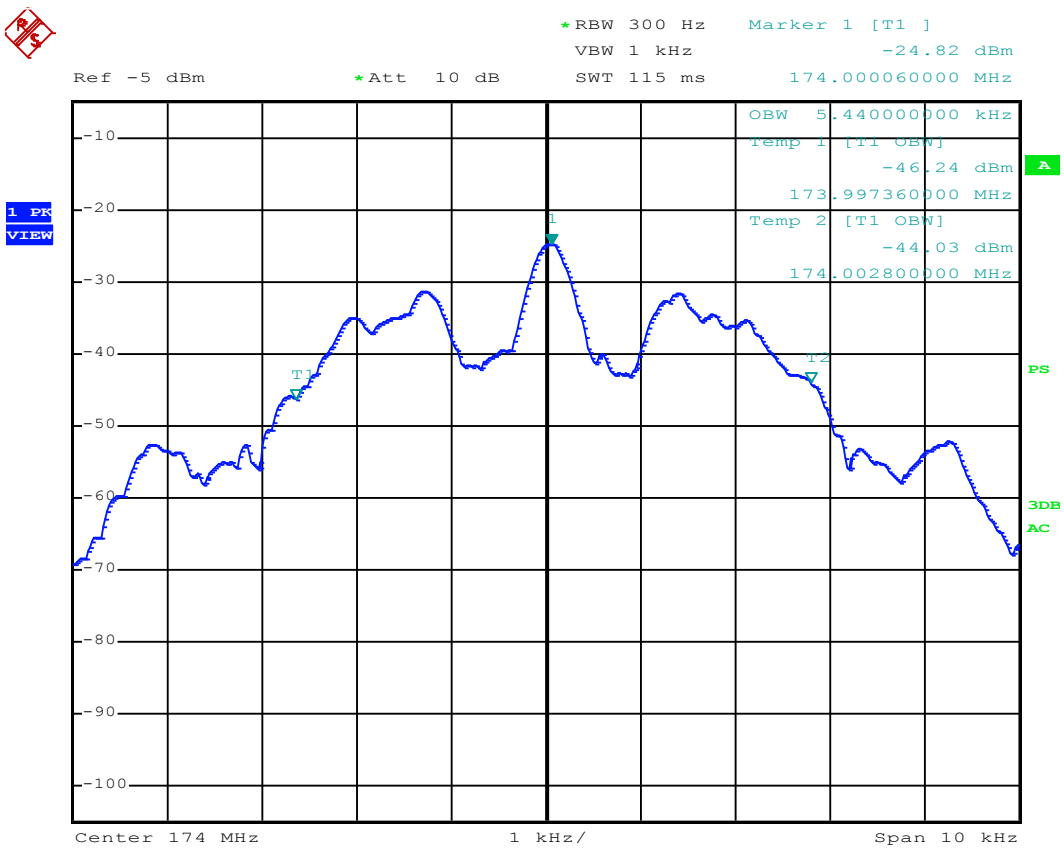
TEST SETUP: The Remote was programmed for maximum 5Watt Transmitter and was used in battery mode of operation. The antenna port of EUT was directly connected to a Spectrum Analyzer through a 30dB Attenuator.

The EUT has a factory setting option for the Deviation and the Balance of the transmission. The EUT was set for:
Deviation = 70
Balance = 50

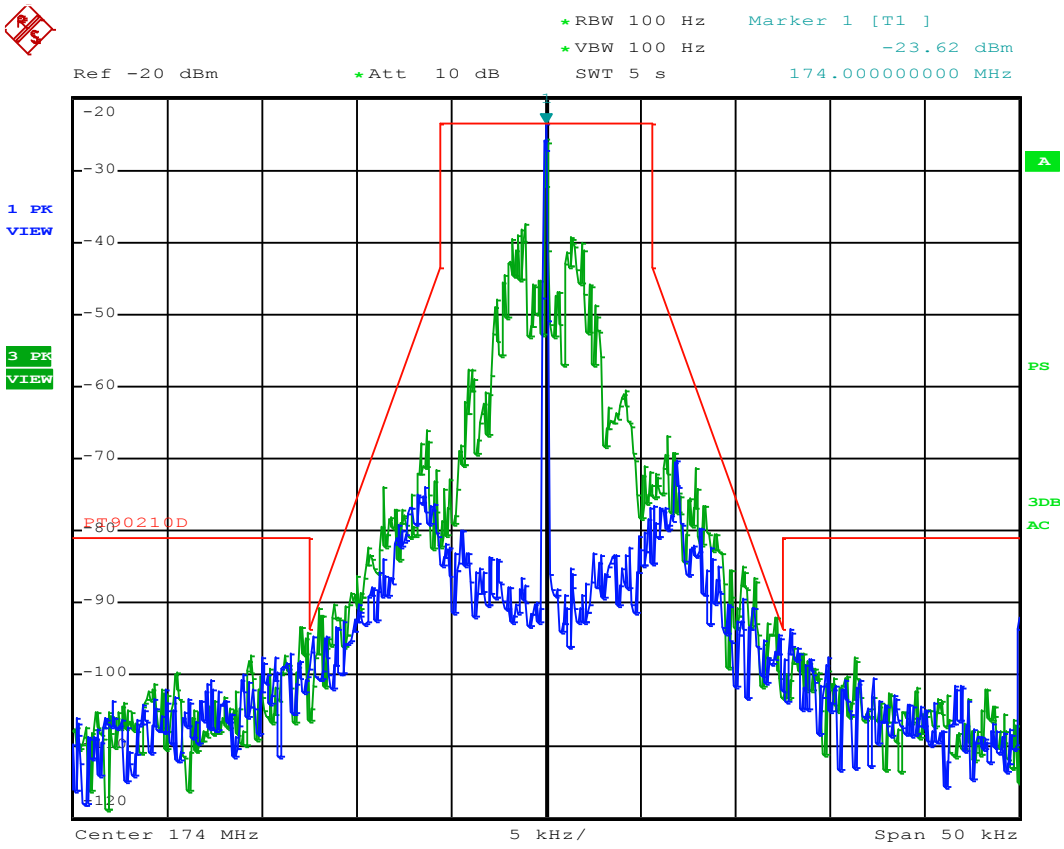
MEASUREMENT METHOD: As called by the standards above.

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:



Date: 27.NOV.2013 10:02:41



Date: 27.NOV.2013 09:37:00

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Section Ic: Out Of Band Spurious Emissions Conducted

DATE: January 03, 2014

TEST STANDARD: FCC Part 2.1051(a)

TEST VOLTAGE: Remote: Battery Mode set for 5Watt Transmission

TEST CONDITIONS: Indoor

MINIMUM STANDARD: 12.5kHz Channel Spacing = 50+10Log(Po) = 50+10Log(5W)
= 57dB below Carrier (dBc)

TEST SETUP: The Remote was programmed for maximum 5Watt Transmitter and was used in battery mode of operation. The antenna port of EUT was directly connected to a Spectrum Analyzer through a 30dB Attenuator and a highpass RF FIlter.

The EUT has a factory setting option for the Deviation and the Balance of the transmission. The EUT was set for:
Deviation = 70
Balance = 50

The transmitter was set for continuous transmission. The lowest, middle and highest channels were measured for all emissions 10kHz to 2 GHz.

Conversion Formulas used: For the frequency measurement:
E(dBm) = Meas(dBm) + Cable Loss(dB) + Attenuator/Filter Loss(dB)

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver using the appropriate attenuators and filters to optimize the reading. The settings used were:

200Hz RBW average detector for the frequency range 9kHz-150kHz
9kHz RBW average detector for the Frequency range 150kHz to 30MHz
120kHz RBW quasi-peak detector for the frequency range 30MHz to 1GHz
1MHz RBW Average detector for the frequency range 1GHz to 20GHz

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA: No transmitter Conducted Spurious Emissions were detected 9kHz to 150MHz..

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
150.0	36.2	n/a
300.0	-45.3	81.5
450.0	-64.1	100.3
600.0	-69.2	105.4
750.0	-60.4	96.6
900.0	-68.3	104.5
1050.0	-67.4	103.6
1200.0	-67.1	103.3
1350.0	-67.4	103.6
1500.0	-68.0	104.2

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
161.0	36.7	n/a
322.0	-60.6	97.3
483.0	-66.2	102.9
644.0	-68.1	104.8
805.0	-62.8	99.5
966.0	-66.9	103.6
1127.0	-67.1	103.8
1288.0	-66.4	103.1
1449.0	-66.8	103.5
1610.0	-66.3	103.0

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
174.0	36.3	n/a
348.0	-62.3	98.6
522.0	-63.4	99.7
696.0	-64.5	100.8
870.0	-67.6	103.9
1044.0	-66.8	103.1
1218.0	-66.6	102.9
1392.0	-66.7	103.0
1566.0	-66.2	102.5
1740.0	-64.6	100.9

Section Id: Out Of Band Spurious Emissions Radiated

DATE: November 21, 2013

TEST STANDARD: FCC Part 2.1053

TEST VOLTAGE: Remote: Battery Mode set for 5Watt Transmission

TEST CONDITIONS: Indoor

MINIMUM STANDARD: 12.5kHz Channel Spacing = 50+10Log(Po) = 50+10Log(5W)
= 57dB below Carrier (dBc)

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and powered up. The Transmitter Output was connected to a 50Ohm Load. The transmitter was set for continuous transmission. The lowest, middle and highest channels were measured for all radiated emissions 10kHz to 2 GHz. The EUT was placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver using the appropriate antennas, amplifiers, attenuators and filters. The settings used were:

200Hz RBW Peak detector for the frequency range 9kHz-150kHz
9kHz RBW Peak detector for the Frequency range 150kHz to 30MHz
10kHz RBW Peak detector for the frequency range 30MHz to 1GHz
1MHz RBW Peak detector for the frequency range 1GHz to 2GHz

The emissions were then re-measured using the Substitution method Procedure as described in ANSI TIA/EIA-603 Section 2.2.12

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA: No transmitter Radiated Spurious Emissions were detected 9kHz to 150MHz..

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
150.0	36.2	n/a
300.0	-41.1	77.3
450.0	-40.6	76.8
600.0	-41.9	78.1
750.0	-43.1	79.3
900.0	-52.9	89.1
1050.0	-47.3	83.5
1200.0	-48.4	84.6
1350.0	-44.8	81.0
1500.0	-43.7	79.9

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
161.0	36.7	n/a
322.0	-40.6	77.3
483.0	-40.8	77.5
644.0	-45.7	82.4
805.0	-44.8	81.5
966.0	-51.1	86.8
1127.0	-46.1	82.8
1288.0	-45.0	81.7
1449.0	-41.4	78.1
1610.0	-36.2	72.9

Frequency (MHz)	Final (dBm)	dB Below Carrier (dBc)
174.0	36.3	n/a
348.0	-37.1	73.4
522.0	-34.2	70.5
696.0	-42.7	79.0
870.0	-48.7	85.0
1044.0	-44.1	80.4
1218.0	-41.7	78.0
1392.0	-40.3	76.6
1566.0	-37.8	74.1
1740.0	-36.7	73.0

Section Ie: Frequency Stability

DATE: December 04, 2013

TEST STANDARD: FCC Part 90.213

TEST VOLTAGE: Controller: 120Vac 60Hz set for 2Watt Transmission
Remote: Battery Mode set for 5Watt Transmission

TEST CONDITIONS: Temperature Controlled Chamber -30 to +60ºCelsius

MINIMUM STANDARD: +/- 5ppm

TEST SETUP: The EUT was tested in our Temperature Chamber and was positioned on the center of the chamber and powered up. The Transmitter Output was connected to a Spectrum Analyzer using appropriate attenuators.

MEASUREMENT METHOD: The transmitter was set for CW Signals for the measurement using 1kHz RBW.. All three channels were measured for both the Controller and the Remote.

The Controller was powered on and "soaked" at each temperature for a minimum of 30 minutes prior to making the measurements.

The Remote was powered Off and "soaked" for 25 minutes and then powered On for another "soak" period of 5 minutes so that the battery was fully charged before each measurement. All measurements were taken when the EUT internal battery meter indicated 8.5Vdc or higher.

For the Battery Low Voltage test, the Remote's battery was allowed to discharge until the internal meter indicated 6.9Vdc. The Remote EUT would normally automatically shut down during a transmission when the battery was at 6.8Vdc or lower.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

DATA: Controller – 150MHz

Temp (C)	Frequency Measured at 115Vac 60Hz (MHz)	Drift (Hz)	Drift (ppm)
-30	149.9999015	-98.5	0.7
-20	149.9999303	-69.7	0.5
-10	149.9999565	-43.5	0.3
0	149.9999960	-4.0	0.0
10	149.9999760	-24.0	0.2
20	149.9999520	-48.0	0.3
30	149.9999820	-18.0	0.1
40	149.9999620	-38.0	0.3
50	150.0000080	8.0	0.0
60	150.0000080	8.0	0.0

Voltage (AC)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
97.8	149.9999968	-3.2	0.0
132.3	149.9999880	-22.0	0.1

Controller – 161MHz

Temp (C)	Frequency Measured at 115Vac 60Hz (MHz)	Drift (Hz)	Drift (ppm)
-30	160.9999457	54.3	0.3
-20	160.9999687	31.3	0.2
-10	160.9999630	37.0	0.2
0	161.0000140	14.0	0.1
10	161.0000068	6.8	0.0
20	161.0000070	7.0	0.0
30	161.0000037	3.7	0.0
40	161.0000066	6.6	0.0
50	161.0000036	3.6	0.0
60	161.0000110	11.0	0.1

Voltage (AC)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
97.8	160.9999968	-3.2	0.0
132.3	160.9999996	-0.4	0.0

Controller – 174MHz

Temp (C)	Frequency Measured at 115Vac 60Hz (MHz)	Drift (Hz)	Drift (ppm)
-30	173.9999615	-38.5	0.2
-20	173.9999423	-57.7	0.3
-10	174.0000025	2.5	0.0
0	173.9999760	-24.0	0.1
10	174.0000069	6.9	0.0
20	174.0000046	4.6	0.0
30	173.9999992	-0.8	0.0
40	174.0000052	5.2	0.0
50	174.0000080	8.0	0.0
60	174.0000682	68.2	0.4

Voltage (AC)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
97.8	174.0000008	0.8	0.0
132.3	174.0000000	0.0	0.0

Remote – 150MHz

Temp (C)	Frequency Measured at 8.5Vdc (MHz)	Drift (Hz)	Drift (ppm)
-30	149.9999444	-55.6	0.4
-20	149.9999952	-4.8	0.0
-10	149.9999988	-1.2	0.0
0	150.0000416	41.6	0.3
10	150.0000420	42.0	0.3
20	150.0000396	39.6	0.3
30	150.0000420	42.0	0.3
40	150.0000680	68.0	0.5
50	150.0000736	73.6	0.5
60	150.0000495	49.5	0.3

Voltage (Vdc)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
6.9	150.0000436	43.6	0.3
8.8	150.0000324	32.4	0.2

Remote – 161MHz

Temp (C)	Frequency Measured at 8.5Vdc (MHz)	Drift (Hz)	Drift (ppm)
-30	160.9999796	-20.4	0.1
-20	160.9999816	-18.4	0.1
-10	161.0000148	14.8	0.1
0	161.0000456	45.6	0.3
10	161.0000436	43.6	0.3
20	161.0000420	42.0	0.3
30	161.0000456	45.6	0.3
40	161.0000730	73.0	0.5
50	161.0000641	64.1	0.4
60	161.0000595	59.5	0.4

Voltage (Vdc)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
6.9	160.9999968	-3.2	0.0
8.8	160.9999996	-0.4	0.0

Remote – 174MHz

Temp (C)	Frequency Measured at 8.5Vdc (MHz)	Drift (Hz)	Drift (ppm)
-30	173.9999836	-16.4	0.1
-20	173.9999620	-38.0	0.2
-10	174.0000320	32.0	0.2
0	174.0000456	45.6	0.3
10	174.0000456	45.6	0.3
20	174.0000456	45.6	0.3
30	174.0000456	45.6	0.3
40	174.0000360	36.0	0.2
50	174.0000950	95.0	0.5
60	174.0000865	86.5	0.5

Voltage (Vdc)	Frequency Measured at 20 Deg. Celsius (MHz)	Drift (Hz)	Drift (ppm)
6.9	174.0000359	35.9	0.2
8.8	174.0000496	49.6	0.3

Section If: Transient Frequency Behaviour

DATE: December 30, 2013

TEST STANDARD: FCC Part 90.214

TEST VOLTAGE: Remote: Battery Mode set for 5Watt Transmission

TEST CONDITIONS: Indoor

MINIMUM STANDARD:

Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

Time intervals [1,2]	frequency difference Maximum	[3]150 to 174 MHz
t_1 [4]	12.5 kHz	5.0 ms
t_2	6.25 kHz	20.0 ms
t_3 [4]	12.5 kHz	5.0 ms

Notes:

1 t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t_1 is the time period immediately following ton.
t_2 is the time period immediately following t1.
t_3 is the time period from the instant when the transmitter is turned off until toff.
t_{off} is the instant when the 1 kHz test signal starts to rise.

2 During the time from the end of t2 to the beginning of t3, the frequency difference must not exceed the limits specified in § 90.213.
+/- 5ppm

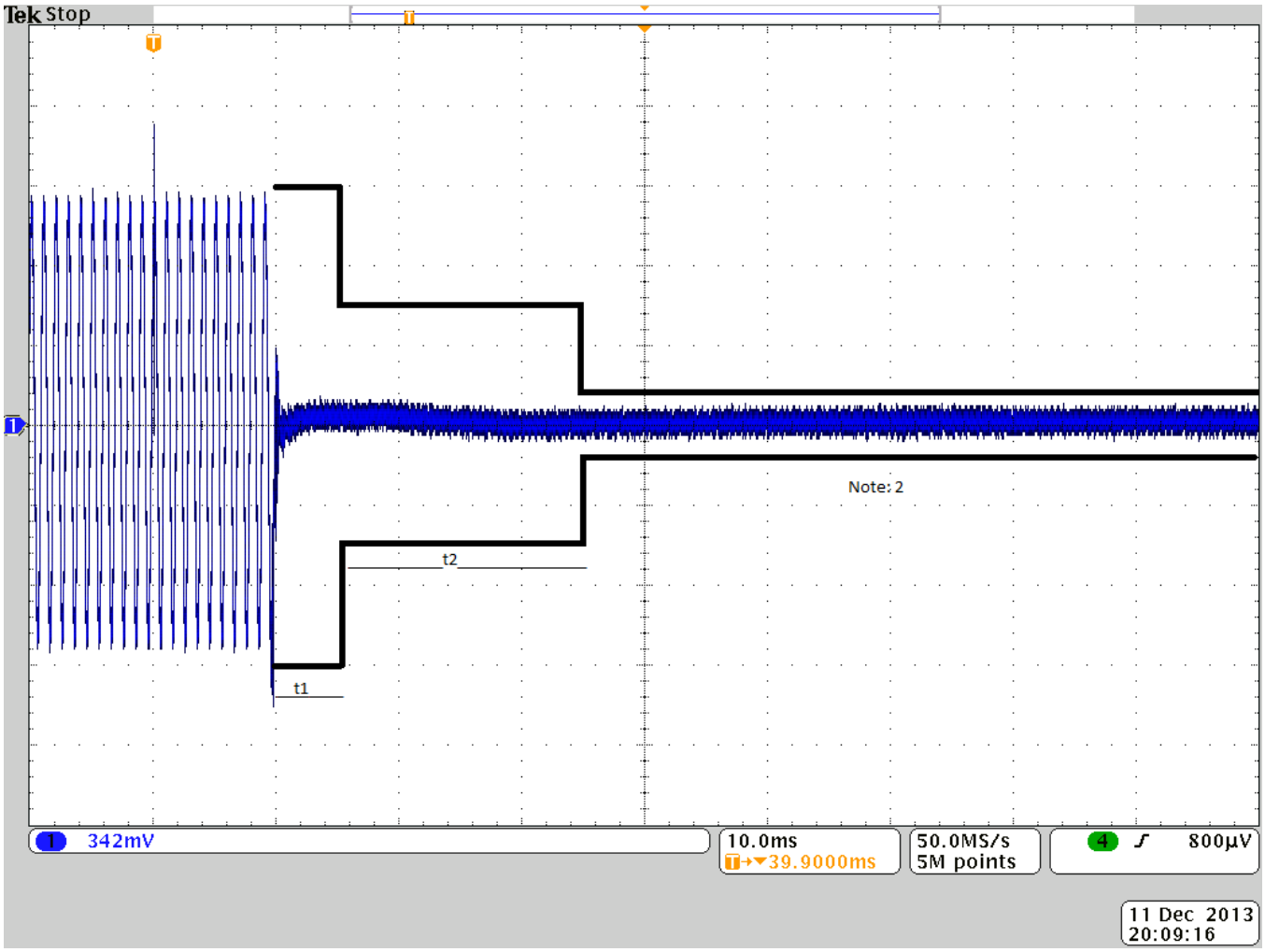
3 Difference between the actual transmitter frequency and the assigned transmitter frequency.

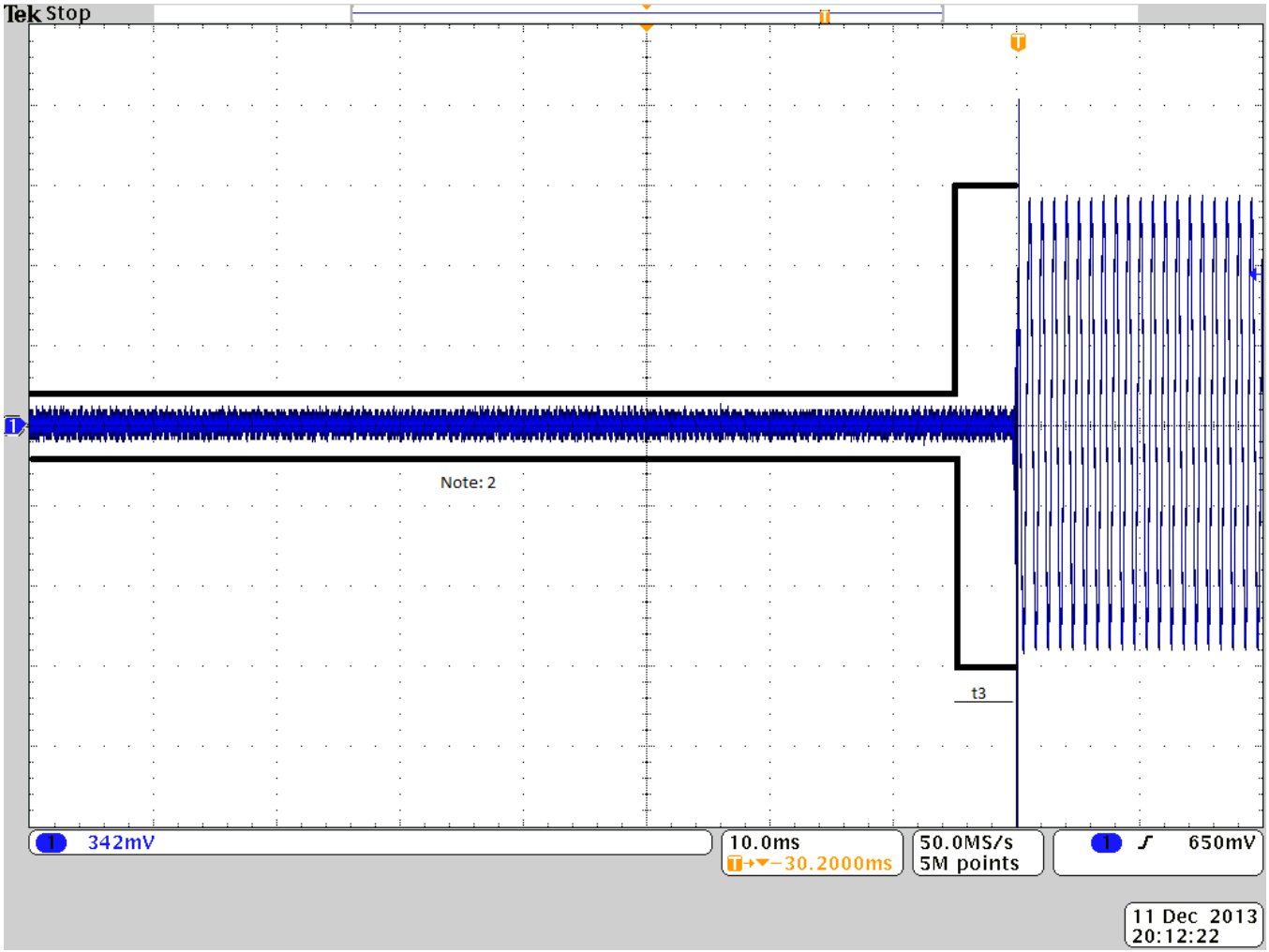
4 If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

TEST SETUP: The EUT was bench tested in our lab. The Transmitter Output was connected to a Spectrum Analyzer and Oscilloscope as per procedures and setup as outlined in TIA-603-D Section 2.2.19.3 Alternate Method of Measurement (Using a Test Receiver).

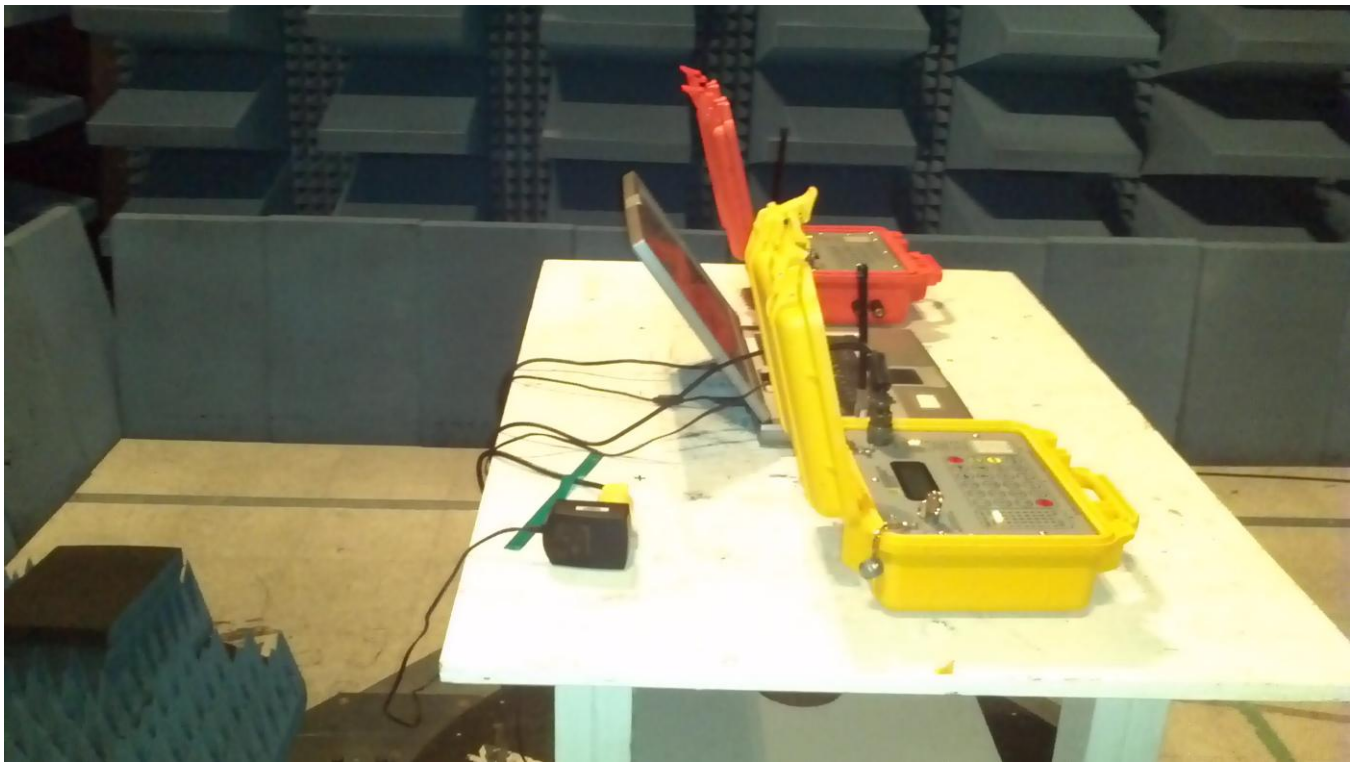
MEASUREMENT METHOD: As outlined in TIA-603-D Section 2.2.19.3

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.


Tek Stop
Note: 2
t2
t1
1 342mV
10.0ms
39.9000ms
50.0MS/s
5M points
4 800µV
11 Dec 2013
20:09:16


Tek Stop
Note: 2
t3
1 342mV
10.0ms
−30.2000ms
50.0MS/s
5M points
1 650mV
11 Dec 2013
20:12:22

Appendix A: EUT photos during the testing



- **End of report**

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last page of this test report