



TESTING
CERT #803.01, 803.02, 803.05, 803.06

ADDENDUM TO SAFETRAN SYSTEMS, INC TEST REPORT FC09-104
FOR THE
RAILROAD LOCOMOTIVE RF COMMUNICATIONS SYSTEM (DATA), 53470
FCC PART 90I AND RSS-119 ISSUE 9 (2007)
TESTING

DATE OF ISSUE: SEPTEMBER 8, 2009

PREPARED FOR:

Safetran Systems, Inc
10655 7th Street
Rancho Cucamonga, CA 91730

P.O. No.: RSRV00636
W.O. No.: 87939

PREPARED BY:

Mary Ellen Clayton
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Date of test: June 3-23, 2009

Report No.: FC09-104A

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TABLE OF CONTENTS

Administrative Information	3
Approvals	3
Summary of Results	4
Conditions During Testing.....	4
Equipment Under Test (EUT) Description.....	5
Equipment Under Test	5
Peripheral Devices	5
Temperature and Humidity During Testing.....	6
FCC 2.1033(c)(3) User's Manual	6
FCC 2.1033(c)(4) Type of Emissions.....	6
FCC 2.1033(c)(5) Frequency Range.....	6
FCC 2.1033(c)(6) Operating Power.....	6
FCC 2.1033(c)(8) DC Voltages	6
FCC 2.1033(c)(9) Tune-Up Procedure	6
FCC 2.1033(c)(10) Schematics and Circuitry Description.....	6
FCC 2.1033(c)(11) Label and Placement	6
FCC 2.1033(c)(12) Submittal Photos	6
FCC 2.1033(c)(13) Modulation Information	6
Measurement Uncertainties	7
FCC 2.1033(c)(14)/2.1046/90.635(b) - RF Power Output	8
FCC 2.1033(c)(14)/2.1049(i)/90.210(i) – Emissions Mask.....	10
FCC 2.1033(c)(14)/2.1051/90.669(a) - Spurious Emissions at Antenna Terminal	14
FCC 2.1033(c)(14)/2.1053/90.669(a) - Field Strength of Spurious Radiation	18
FCC 2.1033(c)(14)/2.1055/90.213 - Frequency Stability	22
Bandedge.....	24
RSS-119 99% Bandwidth	26



ADMINISTRATIVE INFORMATION

DATE OF TEST: June 3-23, 2009

DATE OF RECEIPT: June 3, 2009

REPRESENTATIVE: Bill Wright

MANUFACTURER:

Safetran Systems, Inc
10655 7th Street
Rancho Cucamonga, CA 91730

TEST LOCATION:

CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

FREQUENCY RANGE TESTED: 9 kHz-10 GHz

TEST METHOD: FCC Part 90I, RSS-119 Issue 9 (2007) and RSS-GEN Issue 2 (2007)

PURPOSE OF TEST:

Original Report: To perform the testing of the Railroad Locomotive RF Communications System (data), 53470 with the requirements for FCC Part 90I and RSS-119 devices.

Addendum A: To remove a comment on page 8 with no new testing.

APPROVALS

Steve Behm, Director of Engineering Services

QUALITY ASSURANCE:

Joyce Walker, Quality Assurance Administrative Manager

TEST PERSONNEL:

Eddie Wong, Senior EMC Engineer

SUMMARY OF RESULTS

Test	Specification/Method	Results
RF Power Output	FCC 2.1033(c)(14)/2.1046/90.635(b)	Pass
Emissions Mask	FCC 2.1033(c)(14)/2.1049(i)/90.210(i)	Pass
Spurious Emissions at Antenna Terminal	FCC 2.1033(c)(14)/2.1051/90.669(a)	Pass
Field Strength of Spurious Radiation	FCC 2.1033(c)(14)/2.1053/90.669(a)	Pass
Frequency Stability	FCC 2.1033(c)(14)/2.1055/90.213	Pass
Bandedge		Pass
99% Bandwidth	RSS-119 Issue 9 (2007) RSS-GEN Issue 2 (2007)	Pass
Site File No.	FCC 90473 IC 3082D-1	

CONDITIONS DURING TESTING

Modification: Fairrite 0431164181 installed on Client Port 1 cable, two loops. Powder coat of inner chassis is removed to improve bonding. The chassis is mounted with reduced surface pressure to maintain optimal contact area. A specific torque was applied to select individual enclosure fastening screws in accordance with customer documentation.



EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The customer declares the EUT tested by CKC Laboratories was representative of a production unit.

EQUIPMENT UNDER TEST

Railroad Locomotive RF Communications

System (data)

Manuf: Safetran Systems, Inc.

Model: 53470

Serial: NA

PERIPHERAL DEVICES

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

Power Supply

Manuf: Astron

Model: RM-20M-BB

Serial: 202020001

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

FCC 2.1033(c)(3) USER'S MANUAL

The necessary information is contained in a separate document.

FCC 2.1033 (c)(4) TYPE OF EMISSIONS

FXW

FCC 2.1033 (c)(5) FREQUENCY RANGE

896-901MHz

FCC 2.1033 (c)(6) OPERATING POWER

30 Watts

FCC 2.1033 (c)(8) DC VOLTAGES

The necessary information is contained in a separate document.

FCC 2.1033 (c)(9) TUNE-UP PROCEDURE

The necessary information is contained in a separate document.

FCC 2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION

The necessary information is contained in a separate document.

FCC 2.1033(c)(11) LABEL AND PLACEMENT

The necessary information is contained in a separate document.

FCC 2.1033(c)(12) SUBMITTAL PHOTOS

The necessary information is contained in a separate document.

FCC 2.1033 (c)(13) MODULATION INFORMATION

GMSK

MEASUREMENT UNCERTAINTIES

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.

FCC 2.1033(c)(14)/2.1046/90.635(b) - RF POWER OUTPUT

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
RF Power meter	02778	HP	EPM-441A	GB37170458	021508	021510
Power Sensor	02777	HP	E4412A	MY41499662	021508	021510

Test Setup Photos



Test Data

The EUT is a locomotive RF transmitter, a transmit antenna is not offered for sale with the device.

The EUT is placed on the test bench. RS232 port is connected to a support laptop. The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with Audio Low Pass Filter.

896-901MHz

RF Output power = 30W

Tx = 896.8875MHz, 897.9875MHz MHz

Rx = 935.5-937 MHz

Transmit gain = **-17**

Modification: Fairrite 0431164181 installed on Client Port 1 cable, two loops. Powder coat of inner chassis is removed to improve bonding. The chassis is mounted with reduced surface pressure to maintain optimal contact area. A specific torque was applied to select individual enclosure fastening screws in accordance with customer documentation.

Freq	Power (dBm)	Power (Watt)
896.8875 MHz	44.7	30W
897.9875 MHz	44.7	30W

Sec. 90.635 Limitations on power and antenna height.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).



FCC 2.1033(c)(14)/2.1049(i)/90.210(i) – EMISSIONS MASK

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	091807	091809

Test Conditions

The EUT is placed on the test bench. RS232 port is connected to a support laptop. The emission profile is evaluated at the RF antenna port. The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with Audio Low Pass Filter.

896-901MHz

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Tx = 896.8875MHz, 897.9875MHz MHz

Rx = 935.5-937 MHz

Transmit gain = -17

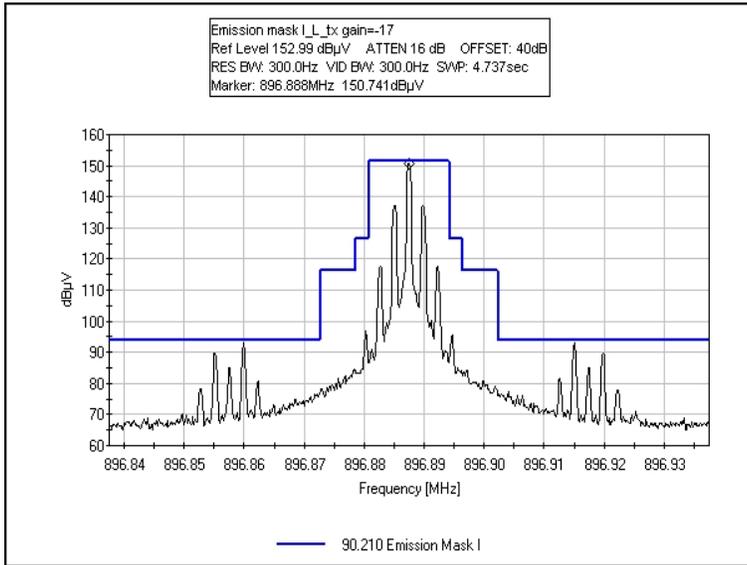
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Test Setup Photos

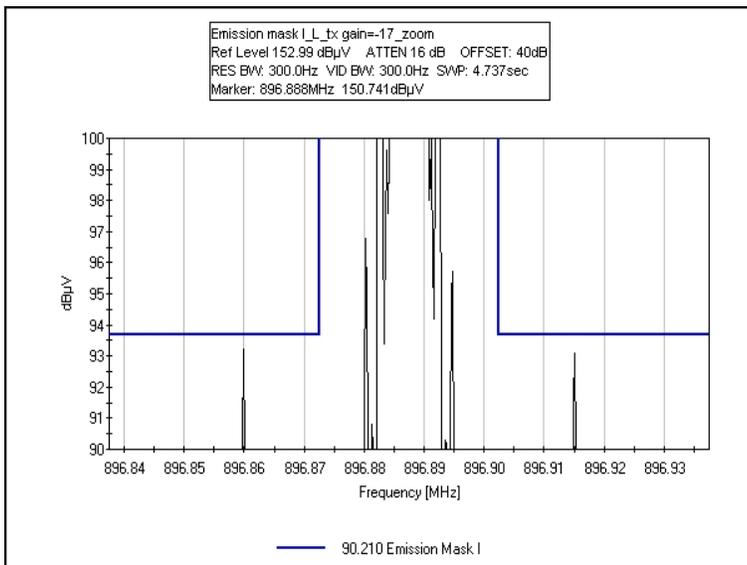


Test Plots

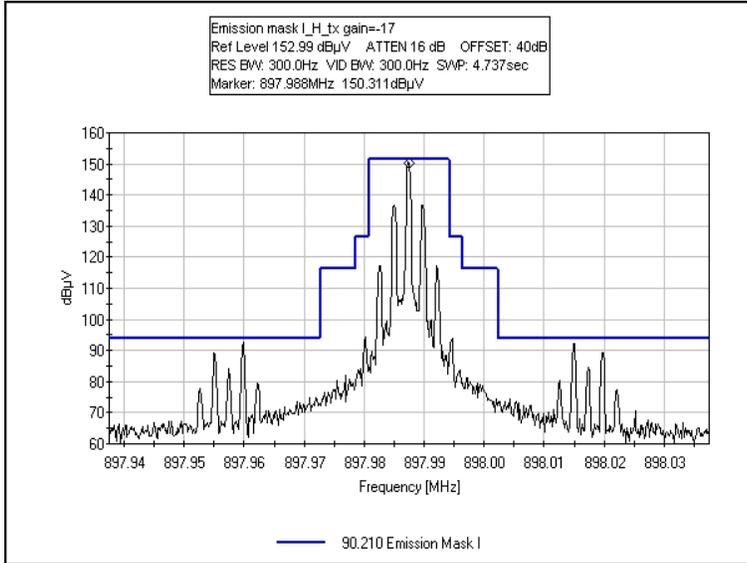
**FCC 90.210(i) EMISSIONS MASK LOW CHANNEL
TX GAIN = -17**



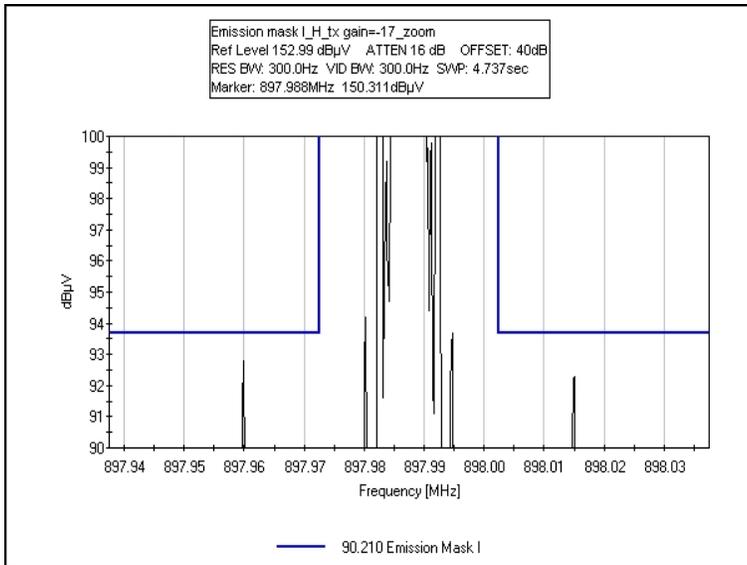
**FCC 90.210(i) EMISSIONS MASK LOW CHANNEL
TX GAIN = -17 ZOOM**



**FCC 90.210(i) EMISSIONS MASK HIGH CHANNEL
TX GAIN = -17**



**FCC 90.210(i) EMISSIONS MASK HIGH CHANNEL
TX GAIN = -17 ZOOM**



FCC 2.1033(c)(14)/2.1051/90.669(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Setup Photos



Test Data

Limit line for Spurious Conducted Emission

$$\underline{\text{Required Attenuation}} = \underline{43+10 \text{ Log P dB}}$$

$$\text{Limit line (dBuV)} = V_{\text{dBuV}} - \text{Attenuation}$$

$$\begin{aligned} V_{\text{dBuV}} &= 20 \text{ Log } \frac{V}{1 \times 10^{-6}} \\ &= 20 (\text{Log } V - \text{Log } 1 \times 10^{-6}) \\ &= 20 \text{ Log } V - 20 \text{ Log } 1 \times 10^{-6} \\ &= 20 \text{ Log } V - 20 (-6) \\ &= 20 \text{ Log } V + 120 \end{aligned}$$

$$\begin{aligned} \text{Attenuation} &= 43 + 10 \text{ Log } P \\ &= 43 + 10 \text{ Log } \frac{V^2}{R} \\ &= 43 + 10 (\text{Log } V^2 - \text{Log } R) \\ &= 43 + 10 (2 \text{ Log } V - \text{Log } R) \\ &= 43 + 20 \text{ Log } V - 10 \text{ Log } R \end{aligned}$$

$$\begin{aligned} \text{Limit line} &= V_{\text{dBuV}} - \text{Attenuation} \\ &= 20 \text{ Log } V + 120 - (43 + 20 \text{ Log } V - 10 \text{ Log } R) \\ &= 20 \text{ Log } V + 120 - 43 - 20 \text{ Log } V + 10 \text{ Log } R \\ = & 20 \text{ Log } V + 120 - 43 - 20 \text{ Log } V + 10 \text{ Log } R \\ &= 120 - 43 + 10 \text{ Log } 50 \quad \text{Note : } R = 50 \Omega \\ &= 120 - 43 + 16.897 \\ &= 94 \text{ dBuV} \quad \text{at any power level} \end{aligned}$$



Test Location: CKC Laboratories, Inc. •110. N. Olinda Place. • Brea, CA 92821 • (714) 993-6112

Customer: **Safetran Systems, Inc**
 Specification: **FCC90.669 (a) Conducted Spurious emission**
 Work Order #: **87939** Date: 6/19/2009
 Test Type: **Conducted Emissions** Time: 14:33:34
 Equipment: **Railroad Locomotive RF Communications System (data)** Sequence#: 2
 Manufacturer: Safetran Systems, Inc. Tested By: E. Wong
 Model: 53470 13.8 Vdc
 S/N: NA

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Spectrum Analyzer	US44300438	07/23/2008	07/23/2010	02672
1.0 GHz HPF	1	01/11/2008	01/11/2010	02749
3'-40GHz cable	NA	09/18/2007	09/18/2009	P02945

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Railroad Locomotive RF Communications System (data)*	Safetran Systems, Inc.	53470	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	Astron	RM-20M-BB	202020001

Test Conditions / Notes:

The EUT is placed on the test bench. RS232 port is connected to a support laptop. The emission profile is evaluated at the RF antenna port. The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with built in Audio Low Pass Filter.

896-901MHz
 RF Output power = 30W

Tx = 896.8875MHz, 897.9875MHz
 Rx = 935.5-937 MHz
 Transmit gain = -17

Frequency range of measurement = 9 kHz - 10 GHz.
 Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz - 30 MHz RBW=9 kHz, VBW=9 kHz; 30 MHz- 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 10,000 MHz RBW=1 MHz, VBW=1 MHz.

Modification: Fairrite 0431164181 installed on Client Port 1 cable, two loops. Powder coat of inner chassis is removed to improve bonding. The chassis is mounted with reduced surface pressure to maintain optimal contact area. A specific torque was applied to select individual enclosure fastening screws in accordance with customer documentation.

Transducer Legend:

T1=Hi Freq 40GHz 3ft CAB-ANP02945-091809

Measurement Data:			Reading listed by margin.				Test Lead: Antenna Terminal				
#	Freq MHz	Rdng dB μ V	T1 dB				Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	896.860M	93.2	+0.3				+0.0	93.5	94.0	-0.5	Anten
2	896.915M	93.1	+0.3				+0.0	93.4	94.0	-0.6	Anten
3	897.960M	92.8	+0.3				+0.0	93.1	94.0	-0.9	Anten
4	898.015M	92.6	+0.3				+0.0	92.9	94.0	-1.1	Anten
5	941.207M	83.0	+0.3				+0.0	83.3	94.0	-10.7	Anten
6	940.000M	80.9	+0.3				+0.0	81.2	94.0	-12.8	Anten
7	854.800M	79.4	+0.3				+0.0	79.7	94.0	-14.3	Anten
8	853.640M	78.9	+0.3				+0.0	79.2	94.0	-14.8	Anten
9	1795.800M	74.6	+0.4				+0.0	75.0	94.0	-19.0	Anten
10	1793.920M	71.0	+0.4				+0.0	71.4	94.0	-22.6	Anten

FCC 2.1033(c)(14)/2.1053/90.669(a) - FIELD STRENGTH OF SPURIOUS RADIATION

Test Setup Photos





Test Data Sheets

Test Location: CKC Laboratories, Inc. • 110. N. Olinda Place. • Brea, CA 92821 • (714) 993-6112

Customer: **Safetran Systems, Inc**
 Specification: **FCC 90.210 Radiated Spurious Emission**
 Work Order #: **87939** Date: 6/22/2009
 Test Type: **Radiated Scan** Time: 13:32:37
 Equipment: **Railroad Locomotive RF Communications System (data)** Sequence#: 6
 Manufacturer: Safetran Systems, Inc. Tested By: E. Wong
 Model: 53470
 S/N: NA

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Spectrum Analyzer	US44300438	07/23/2008	07/23/2010	02672
Bilog Antenna	2451	01/21/2008	01/21/2010	01995
Pre amp to SA Cable	Cable #10	04/16/2009	04/16/2011	P05050
Cable	Cable15	01/05/2009	01/05/2011	P05198
Pre Amp	1937A02548	05/02/2008	05/02/2010	00309
Horn Antenna	6246	06/06/2008	06/06/2010	00849
Microwave Pre-amp	3123A00281	07/28/2008	07/28/2010	00786
2'-40GHz cable	NA	09/18/2007	09/18/2009	P2948
HeliAx Antenna Cable	P5565	09/04/2008	09/04/2010	P05565
Loop Antenna	2014	06/16/2008	06/16/2010	00314

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Railroad Locomotive RF Communications System (data)*	Safetran Systems, Inc.	53470	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	Astron	RM-20M-BB	202020001

Test Conditions / Notes:

The EUT is placed on the test bench. RS232 port is connected to a remote support laptop. DC port is connected to remote power supply. Client Port 1 is connected to sections of unterminated cable, 1 meter in length. All other ports are service ports; hence unpopulated.

The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with built in Audio Low Pass Filter.

896-901MHz

RF Output power = 30W

Tx = 896.8875MHz, 897.9875MHz

Rx = 935.5-937 MHz

Transmit gain = -17

Frequency range of measurement = 9 kHz - 10 GHz.

Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz - 30 MHz RBW=9 kHz, VBW=9 kHz; 30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 10,000 MHz RBW=1 MHz, VBW=1 MHz.

Modification: Fairrite 0431164181 installed on Client Port 1 cable, two loops. Powder coat of inner chassis is removed to improve bonding. The chassis is mounted with reduced surface pressure to maintain optimal contact area. A specific torque was applied to select individual enclosure fastening screws in accordance with customer documentation.

21°C, 48% relative humidity.

Operating Frequency: 896-901MHz
 Channels: Low, Mid and High
 Highest Measured
 Output Power: 44.77 ERP(dBm)= 30 ERP(Watts)
 Distance: 3 meters
 Limit: $43+10\text{Log}(P)=$ 57.77 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,591.89	-42	Horiz	86.77
3,587.66	-42.5	Horiz	87.27
3,587.66	-44.7	Vert	89.47
3,591.85	-45.8	Vert	90.57
5,381.44	-47.6	Vert	92.37
4,489.88	-47.6	Horiz	92.37
7,183.71	-48	Horiz	92.77
5,387.65	-48.3	Vert	93.07
4,484.49	-48.3	Horiz	93.07
7,175.15	-48.5	Horiz	93.27
7,175.21	-48.9	Vert	93.67
1,795.91	-49.4	Vert	94.17
4,484.55	-49.6	Vert	94.37
5,381.38	-50	Horiz	94.77
4,489.75	-51	Vert	95.77
1,795.91	-51.4	Horiz	96.17
1,793.78	-52.6	Vert	97.37
1,793.89	-52.9	Horiz	97.67
2,693.81	-54.4	Horiz	99.17
2,690.78	-55.9	Vert	100.67
898.57	-61.5	Vert	106.27

FCC 2.1033(c)(14)/2.1055/90.213- FREQUENCY STABILITY

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Volt meter	1830	Fluke	45	6949042	2/22/2008	2/22/2010
Spectrum Analyzer	2672	Agilent	E4446A	US44300438	7/23/2008	7/23/2010
Temperature Data logger	1620	HP	34970A	US70131892	7/17/2008	7/17/2010
20 Ch Thermalcouple module	1849	HP	34901A	US37603966	7/17/2008	7/17/2010
Temperature Chamber	1878	Thermaltron	S1.2	NA	8/6/2008	8/6/2010

Test Conditions

The Locomotive battery powered EUT is placed in the temperature chamber. RF signal is monitored at the RF output port. A spectrum analyzer is employed to measure the frequency stability.

Test Setup Photos



Test Data

Customer: Safetran Systems, Inc
 WO#: 87939
 Date: 13-Aug-09
 Test Engineer: E. Wong

Operating Voltage: 13.8 Vdc

Frequency Limit: 1.50E+00 ppm

Temperature Variations

		Channel 1		Channel 2	
Channel Frequency:		(MHz)	Dev (ppm)	(MHz)	Dev (ppm)
		896.887446000		897.987616000	
Temp (C)	Voltage				
-30	13.8	896.887840000	-0.439297	897.987980000	-0.405351
-20	13.8	896.888248000	-0.894204	897.988218000	-0.670388
-10	13.8	896.888332000	-0.987861	897.988359000	-0.827406
0	13.8	896.888366000	-1.025770	897.988362000	-0.830746
10	13.8	896.888221000	-0.864100	897.988176000	-0.623617
20	13.8	896.887446000	0.000000	897.987616000	0.000000
30	13.8	896.887630000	-0.205154	897.987681000	-0.072384
40	13.8	896.887405000	0.045714	897.987392000	0.249447
50	13.8	896.887393000	0.059093	897.987406000	0.233856

Voltage Variations (battery end point)

Temp (C)	Voltage	Channel 1 (MHz)	Dev. (MHz)	Channel 2 (MHz)	Dev. (MHz)
20	11.0	896.887470000	-0.026759	897.987477000	0.154791
20	13.8	896.887446000	0.000000	897.987616000	0.000000

Max Deviation (ppm)	+	0.05909
Max Deviation (ppm)	-	1.02577
		PASS

	+	0.24945
	-	0.83075
		PASS

BANEDGE

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	091807	091809

Test Conditions

The EUT is placed on the test bench. RS232 port is connected to a support laptop. The emission profile is evaluated at the RF antenna port. The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with Audio Low Pass Filter.

896-901MHz

RF Output power = 30W

Tx = 896.8875MHz, 897.9875MHz

Rx = 935.5-937 MHz

Transmit gain = -17

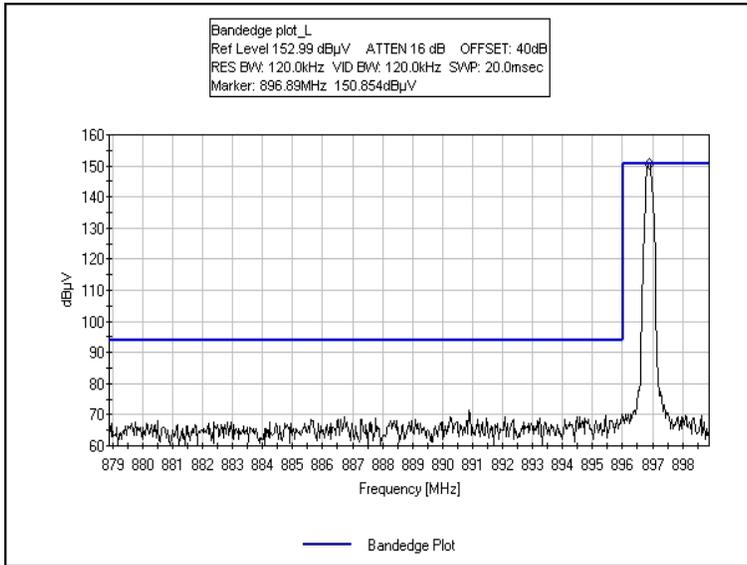
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Test Setup Photos

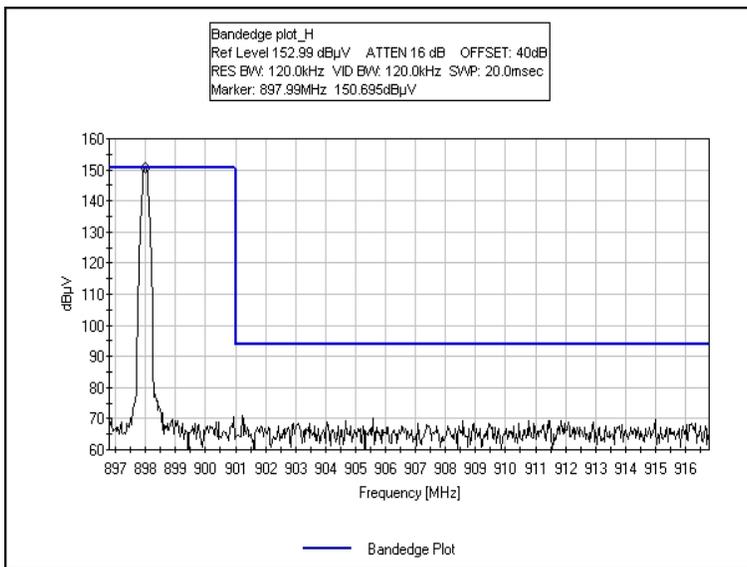


Test Plots

BANDEDGE LOW CHANNEL



BANDEDGE HIGH CHANNEL



RSS-119 99% BANDWIDTH

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02672	Agilent	E4446A	US44300438	072308	072310
36" 40GHz cable	02945	Strolab	NA	NA	091807	091809

Test Conditions

The EUT is placed on the test bench. RS232 port is connected to a support laptop. The emission profile is evaluated at the RF antenna port. The support Laptop sets the EUT in transmit mode. Data is routed into the transmitter circuit via the internal Audio input with Audio Low Pass Filter.

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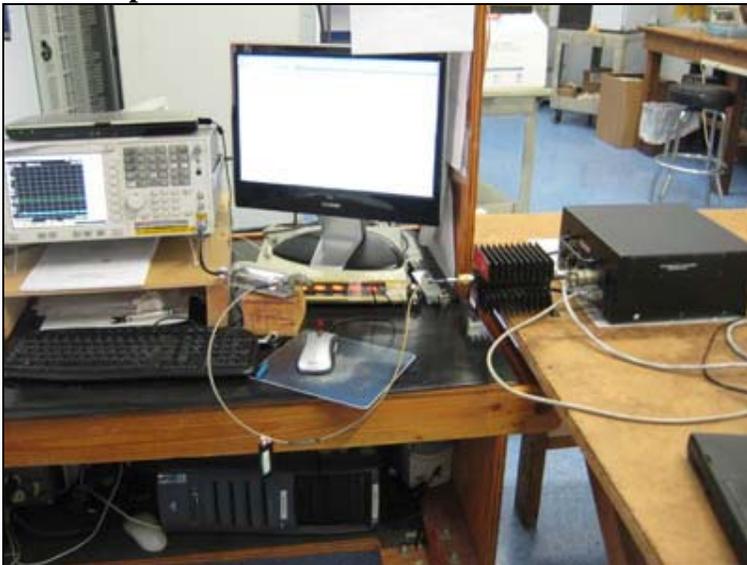
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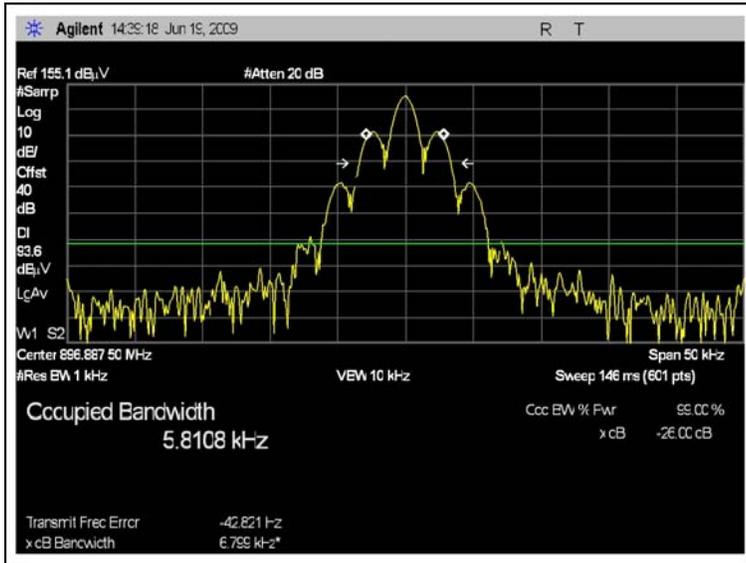
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Test Setup Photos



Test Plots

99% BANDWIDTH 5.8Hz LOW CHANNEL



99% BANDWIDTH 5.8Hz HIGH CHANNEL

