TESTING

CERT #803.01, 803.02, 803.05, 803.06

SAFETRAN SYSTEMS, INC. TEST REPORT

FOR THE

RAILROAD LOCOMOTIVE RF COMMUNICATIONS SYSTEM (DATA), 53470

FCC PART 15 SUBPART B SECTIONS 15.109 CLASS B AND 15.111

TESTING

DATE OF ISSUE: JULY 7, 2009

PREPARED FOR:

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

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

PREPARED BY:

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Mariposa, CA 95338

Date of test: June 4-22, 2009

Report No.: FC09-105

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ADMINISTRATIVE INFORMATION

DATE OF TEST: June 4-22, 2009

DATE OF RECEIPT: June 4, 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

TEST METHOD: ANSI C63.4 (2003)

PURPOSE OF TEST: To perform testing of the Railroad Locomotive RF Communications System (data), 53470 with the requirements for FCC Part 15 Subpart B Sections 15.109 Class B and 15.111 devices.

APPROVALS

QUALITY ASSURANCE:

Steve Behm, Director of Engineering Services

TEST PERSONNEL:

Eddie Wong, Senior EMC Engineer

SITE FILE REGISTRATION NUMBERS

Location	Japan	Canada	FCC
Brea A	R-301, C-314 & T-1572	3082D-1	90473

SUMMARY OF RESULTS

Test	Specification	Results
Radiated Emissions	FCC Part 15 Subpart B Section 15.109 Class B	Pass
Radiated Emissions	FCC Part 15 Subpart B Section 15.111	Pass

CONDITIONS DURING TESTING

Conducted emissions not required for this device. Modification: Fairrite 0431164181installed 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

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.

REPORT OF EMISSIONS MEASUREMENTS

TESTING PARAMETERS

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. 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
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 "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the highest readings, this is indicated as a "QP" or an "Ave" on the appropriate rows of the data sheets. 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/receiver readings recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the measuring device called "peak hold," the measuring device had the ability to measure transients 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

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the quasi-peak detector.

Average

For certain frequencies, average measurements may be made using the spectrum analyzer/receiver. 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.

RADIATED EMISSIONS

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 15.109 Class B**		
Work Order #:	**87939**	Date:	6/22/2009
Test Type:	**Radiated Scan**	Time:	09:24:36
Equipment:	**Railroad Locomotive RF Communications System (data)**	Sequence#:	7
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

***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 receive mode. RF port is terminated to a 50 ohm load. Chassis is grounded.
Rx Range = 935.5 - 937 MHz
RF Output power = Idle,
Rx = 935.5 MHz, 937 MHz
Frequency range of measurement = 30MHz - 10 GHz.
Frequency30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 10000 MHz RBW=1 MHz, VBW=1 MHz.
Modification: Fairrite 0431164181installed 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.

Transducer Legend:

T1=Bilog-AN01995 BILOG_012110	T2=Cable #10 ANP05050 041611
T3=Cable #15_05198_ Site A, 010511	T4=Pre_amp_HP8447D-AN00309-050210
T5=Heliax Cable 54' ANP05565 090410	T6=HF_pre AMP-1-26GHz_AN00786-072810.TRN
T7=Hi Freq_40GHz_2ft-ANP02948-091809	T8=Horn Ant AN00849 060610

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

#	Freq MHz	Rdng dBµV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 T8 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	345.601M	52.6	+14.6 +0.0	+0.3 +0.0	+3.3 +0.0	-27.8 +0.0	+0.0	43.0	46.0	-3.0	Vert
2	230.397M	56.1	+11.3 +0.0	+0.3 +0.0	+2.6 +0.0	-27.9 +0.0	+0.0	42.4	46.0	-3.6	Horiz
3	215.029M QP	54.5	+10.2 +0.0	+0.3 +0.0	+2.5 +0.0	-27.9 +0.0	+0.0	39.6	43.5	-3.9	Horiz
^	215.029M	55.6	+10.2 +0.0	+0.3 +0.0	+2.5 +0.0	-27.9 +0.0	+0.0	40.7	43.5	-2.8	Horiz
^	215.044M	53.9	+10.2 +0.0	+0.3 +0.0	+2.5 +0.0	-27.9 +0.0	+0.0	39.0	43.5	-4.5	Horiz
6	184.299M QP	55.5	+9.0 +0.0	+0.3 +0.0	+2.3 +0.0	-27.9 +0.0	+0.0	39.2	43.5	-4.3	Horiz
^	184.300M	56.3	+9.0 +0.0	+0.3 +0.0	+2.3 +0.0	-27.9 +0.0	+0.0	40.0	43.5	-3.5	Horiz
^	184.342M	52.1	+9.0 +0.0	+0.3 +0.0	+2.3 +0.0	-27.9 +0.0	+0.0	35.8	43.5	-7.7	Horiz
9	199.674M	55.2	+9.1 +0.0	+0.3 +0.0	+2.4 +0.0	-28.0 +0.0	+0.0	39.0	43.5	-4.5	Horiz
10	245.750M	53.3	+12.3 +0.0	+0.3 +0.0	+2.8 +0.0	-27.7 +0.0	+0.0	41.0	46.0	-5.0	Horiz
11	245.768M	53.1	+12.3 +0.0	+0.3 +0.0	+2.8 +0.0	-27.7 +0.0	+0.0	40.8	46.0	-5.2	Horiz
12	215.027M	52.4	+10.2 +0.0	+0.3 +0.0	+2.5 +0.0	-27.9 +0.0	+0.0	37.5	43.5	-6.0	Vert
13	853.743M	36.9	+22.9 +0.0	+0.7 +0.0	+5.5 +0.0	-27.0 +0.0	+0.0	39.0	46.0	-7.0	Vert
14	1244.350M	58.4	+0.0 +2.5	+0.0 -39.1	+0.0 +0.2	+0.0 +24.5	+0.0	46.5	54.0	-7.5	Vert
15	195.043M	51.9	+9.1 +0.0	+0.3 +0.0	+2.4 +0.0	-28.0 +0.0	+0.0	35.7	43.5	-7.8	Horiz
16	1244.200M	57.9	+0.0 +2.5	+0.0 -39.1	+0.0 +0.2	+0.0 +24.5	+0.0	46.0	54.0	-8.0	Horiz
17	189.997M	51.8	+9.1 +0.0	+0.3 +0.0	+2.3 +0.0	-28.0 +0.0	+0.0	35.5	43.5	-8.0	Horiz

18	184.330M	51.5	+9.0 +0.0	+0.3 +0.0	+2.3 +0.0	-27.9 +0.0	+0.0	35.2	43.5	-8.3	Vert
19	199.678M	50.8	+9.1 +0.0	+0.3 +0.0	+2.4 +0.0	-28.0 +0.0	+0.0	34.6	43.5	-8.9	Horiz
20	192.002M	49.8	+9.1 +0.0	+0.3 +0.0	+2.3 +0.0	-28.0 +0.0	+0.0	33.5	43.5	-10.0	Horiz
21	159.994M	47.4	+10.6 +0.0	+0.3 +0.0	+2.1 +0.0	-27.9 +0.0	+0.0	32.5	43.5	-11.0	Vert
22	853.724M	32.8	+22.9 +0.0	+0.7 +0.0	+5.5 +0.0	-27.0 +0.0	+0.0	34.9	46.0	-11.1	Horiz
23	189.998M	48.7	+9.1 +0.0	+0.3 +0.0	+2.3 +0.0	-28.0 +0.0	+0.0	32.4	43.5	-11.1	Horiz
24	215.055M	47.1	+10.2 +0.0	+0.3 +0.0	+2.5 +0.0	-27.9 +0.0	+0.0	32.2	43.5	-11.3	Vert
25	1174.800M	54.8	+0.0 +2.5	+0.0 -39.4	+0.0 +0.2	+0.0 +24.4	+0.0	42.5	54.0	-11.5	Vert
26	1520.500M	52.5	+0.0 +2.9	+0.0 -38.4	+0.0 +0.3	+0.0 +25.1	+0.0	42.4	54.0	-11.6	Vert
27	345.587M	44.0	+14.6 +0.0	+0.3 +0.0	+3.3 +0.0	-27.8 +0.0	+0.0	34.4	46.0	-11.6	Horiz
28	1175.000M	54.2	+0.0 +2.5	+0.0 -39.4	+0.0 +0.2	+0.0 +24.4	+0.0	41.9	54.0	-12.1	Horiz
29	414.719M	41.1	+16.4 +0.0	+0.4 +0.0	+3.7 +0.0	-27.8 +0.0	+0.0	33.8	46.0	-12.2	Vert
30	1521.000M	51.4	+0.0 +2.9	+0.0 -38.4	+0.0 +0.3	+0.0 +25.1	+0.0	41.3	54.0	-12.7	Horiz
31	1106.400M	53.9	+0.0 +2.5	+0.0 -39.7	+0.0 +0.3	+0.0 +24.2	+0.0	41.2	54.0	-12.8	Vert
32	2151.800M	46.6	+0.0 +3.6	+0.0 -37.9	+0.0 +0.3	+0.0 +27.7	+0.0	40.3	54.0	-13.7	Horiz
33	2073.150M	46.8	+0.0 +3.4	+0.0 -37.9	+0.0 +0.3	+0.0 +27.5	+0.0	40.1	54.0	-13.9	Vert
34	184.314M	45.9	+9.0 +0.0	+0.3 +0.0	+2.3 +0.0	-27.9 +0.0	+0.0	29.6	43.5	-13.9	Vert
35	168.964M	45.1	+9.8 +0.0	+0.3 +0.0	+2.2 +0.0	-27.9 +0.0	+0.0	29.5	43.5	-14.0	Horiz
36	1659.400M	49.0	+0.0 +3.0	+0.0 -38.2	+0.0 +0.3	+0.0 +25.8	+0.0	39.9	54.0	-14.1	Horiz
37	1382.750M	50.7	+0.0 +2.6	+0.0 -38.6	+0.0 +0.3	+0.0 +24.8	+0.0	39.8	54.0	-14.2	Vert
38	1797.200M	47.6	+0.0 +3.2	+0.0 -38.0	+0.0 +0.3	+0.0 +26.5	+0.0	39.6	54.0	-14.4	Vert
39	1732.650M	47.8	+0.0 +3.1	+0.0 -38.1	+0.0 +0.3	+0.0 +26.2	+0.0	39.3	54.0	-14.7	Vert
40	1382.600M	50.0	+0.0 +2.6	+0.0 -38.6	+0.0 +0.3	+0.0 +24.8	+0.0	39.1	54.0	-14.9	Horiz
41	1520.600M	48.6	+0.0 +2.9	+0.0 -38.4	+0.0 +0.3	+0.0 +25.1	+0.0	38.5	54.0	-15.5	Horiz

42	1659.500M	47.6	+0.0 +3.0	+0.0 -38.2	+0.0 +0.3	+0.0 +25.8	+0.0	38.5	54.0	-15.5	Vert
43	1354.400M	49.4	+0.0 +2.6	+0.0 -38.7	+0.0 +0.3	+0.0 +24.7	+0.0	38.3	54.0	-15.7	Horiz
44	1037.600M	51.2	+0.0 +2.4	+0.0 -40.0	+0.0 +0.2	+0.0 +24.1	+0.0	37.9	54.0	-16.1	Horiz
45	170.003M	42.1	+9.7 +0.0	+0.3 +0.0	+2.2 +0.0	-27.9 +0.0	+0.0	26.4	43.5	-17.1	Horiz
46	168.959M	41.3	+9.8 +0.0	+0.3 +0.0	+2.2 +0.0	-27.9 +0.0	+0.0	25.7	43.5	-17.8	Vert

ANTENNA POWER CONDUCTION LIMITS FOR RECEIVER

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:	**FCC15.111 Antenna Power Conduction limits for Receiver**		
Work Order #:	**87939**	Date:	6/4/2009
Test Type:	**Conducted Emissions**	Time:	13:49:23
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
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 is in receive mode.
Rx range = 935.5-937 MHz
RF Output power = Idle,
Rx = 935.5, 937 MHz
Frequency range of measurement = 30 kHz - 10 GHz.
Frequency 30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 10,000 MHz RBW=1 MHz, VBW=1 MHz.

Transducer Legend:

T1=Hi Freq_40GHz_3ft_CAB-ANP02945-091809

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

#	Freq MHz	Rdng dBµV	T1 dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	896.830M	24.3	+0.3				+0.0	24.6	50.0	-25.4	Anten
2	897.971M	24.0	+0.3				+0.0	24.3	50.0	-25.7	Anten
3	853.670M	20.0	+0.3				+0.0	20.3	50.0	-29.7	Anten
4	854.800M	19.2	+0.3				+0.0	19.5	50.0	-30.5	Anten