FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

Transmitter for RFID Electronic Store Labeling

MODEL NUMBER: X4-36120

REPORT NUMBER: 09U12822-2, Revision A

FCC ID: XV9-SES36120
IC: 8714A-SES36120

ISSUE DATE: DECEMBER 18, 2009

Prepared for
Store Electronic Systems (SES)
39, rue de Montigny
95100 ARGENTEUIL
FRANCE

Prepared by
COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	12/10/09	Initial Issue	M. Heckrotte
A	12/18/09	Clarified distance factor below 30 MHz	M. Heckrotte

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: STORE ELECTRONIC SYSTEMS (SES)
39, rue de Montigny
95100 ARGENTEUIL
FRANCE

EUT DESCRIPTION: Transmitter for RFID Electronic Store Labeling

MODEL: X4-36120

SERIAL NUMBER: Prototype

DATE TESTED: October 26 – December 8, 2009

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 7	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:

DOUGLAS ANDERSON
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, RSS-210 Issue 7 and RSS-102 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a VLF transmitter used in stores to program electronic price tags located on shelves. Operating frequency range is 37.8 kHz, +/- 1.8 kHz. The modulation is QPSK. The emission designator is 8K23G1D.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The transmitter antenna is a simple wire loop antenna, in rectangles strung around the periphery of the area containing the shelves with the price tags.

The antenna wire is a UL approved type AWM Style 1015 single-conductor multi-strand wire.

The product was tested in situ at 3 different locations with 3 different antenna loop routings:

47280 Kato Street (Site 1):	13m x 20m
47280 Kato Street (Site 2):	20m x 20m
47173 Benicia Street (Site 3):	12m x 19m

For the AC line conducted test and laboratory radiated emissions test, a multi-turn loop approx. 45cm x 25 cm was used as a TX dummy load.

5.3. OUTPUT CURRENT

The maximum rated output current of the transmitter is 3.5 A.

5.4. SOFTWARE AND FIRMWARE

Firmware	EmtManu 4.03
Driver	Gest 9.03

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT consists of a transmitter and loop antenna. The EUT, once powered, will start transmitting; there is only one operating mode.

6. DESCRIPTION OF TEST SETUP

6.1. CABLING

I/O CABLES

Cable	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
Power	AC	1	IEC connector	unshielded	1.5m	N/A
PROG	On TX PCB	1	molded dual	unshielded	1.5m	Internal Connector, Service Only
Ant	ANT1&2	1	Screwdown	Single conductor	Varies	N/A

6.2. TEST MODE

TEST SETUP

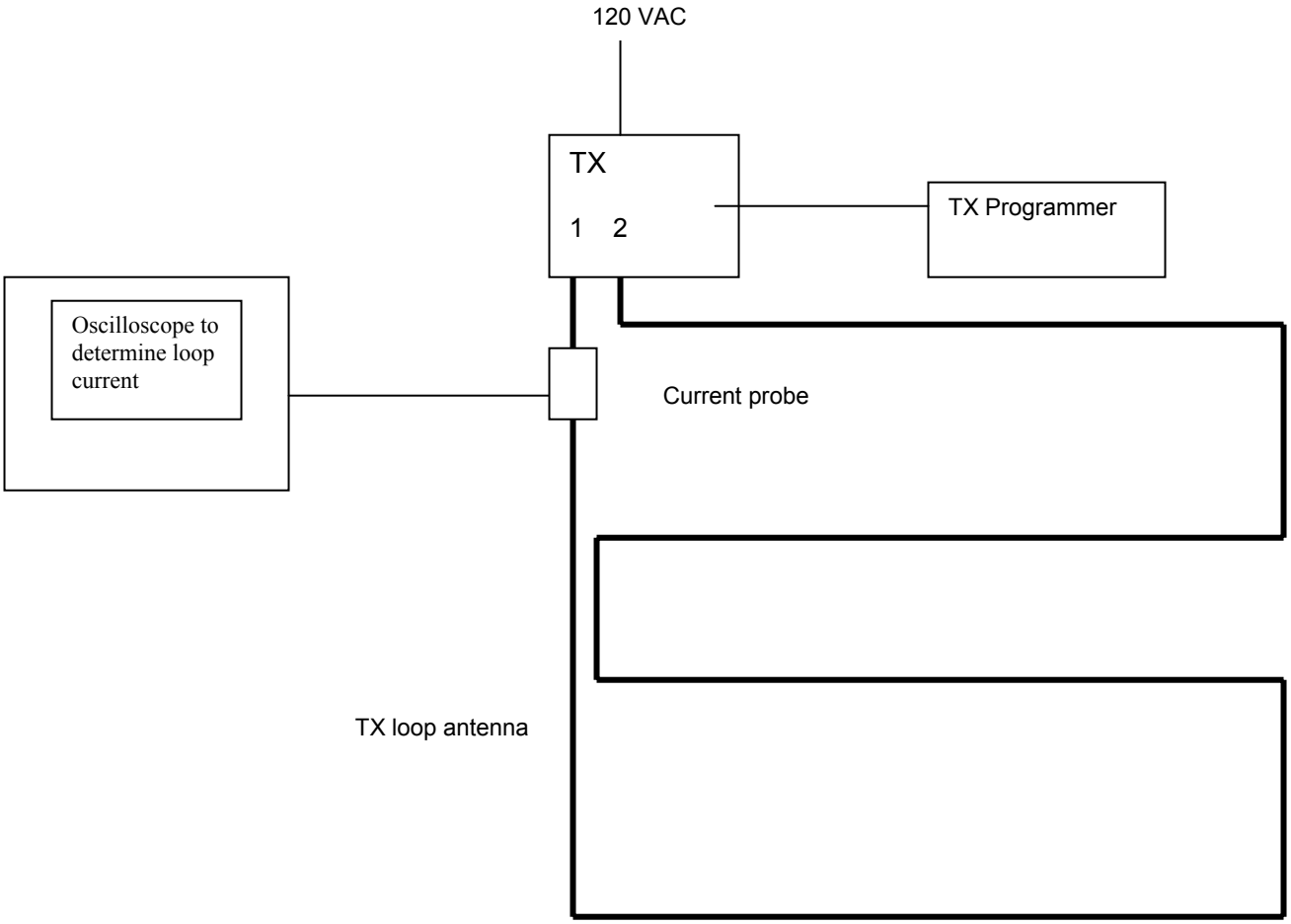
The EUT consists of a transmitter and loop antenna. The TX controller is used to tune the matching network for the loop antenna.

For test mode operation, the chassis cover is removed, the controller is connected to the internal connector on the transmitter PCB board and used to set the TX match parameters.

For all tests, the TX output was set to produce an antenna loop current of 3.5 A.

6.3. TEST SETUP

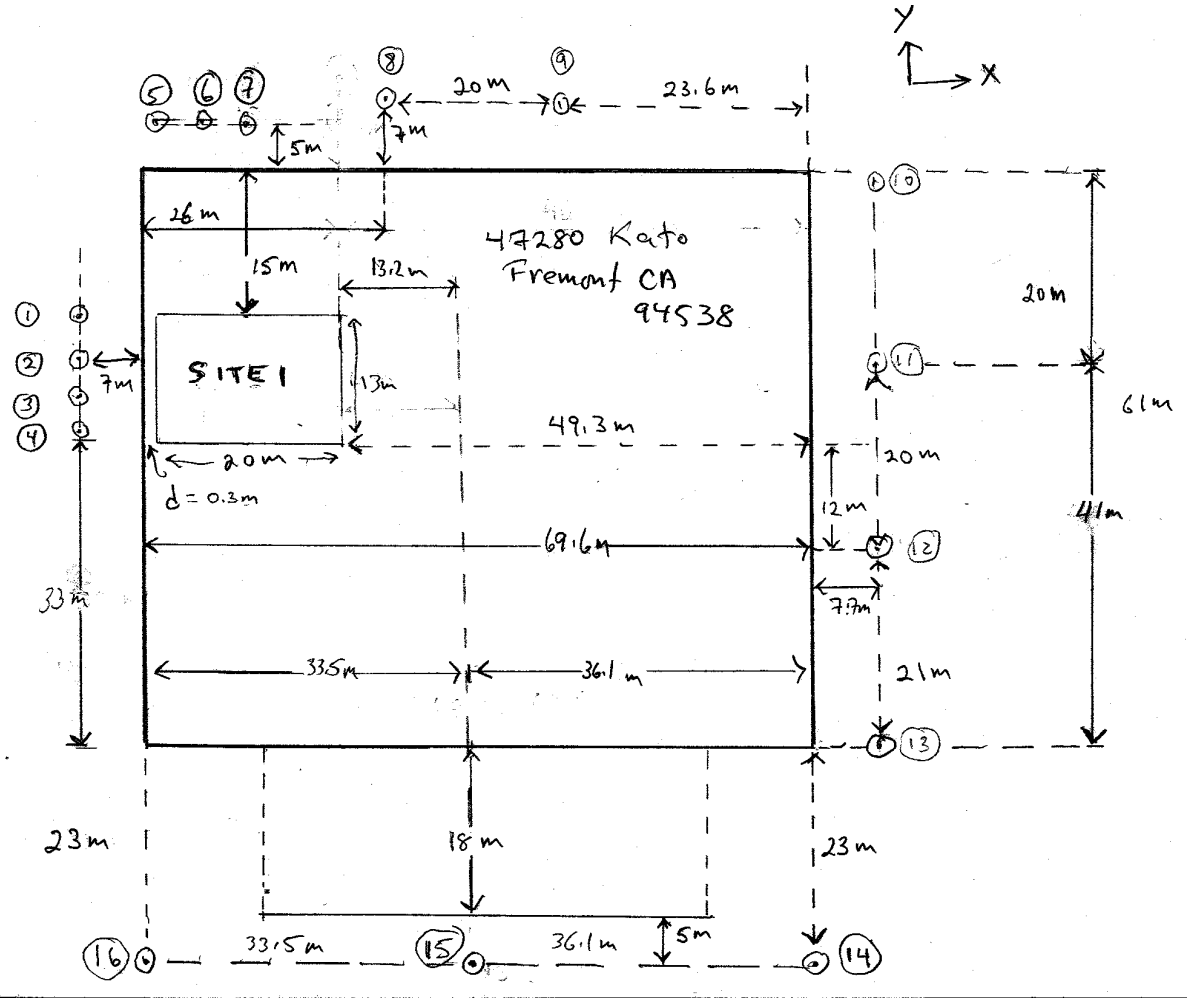
6.3.1. TEST DIAGRAM



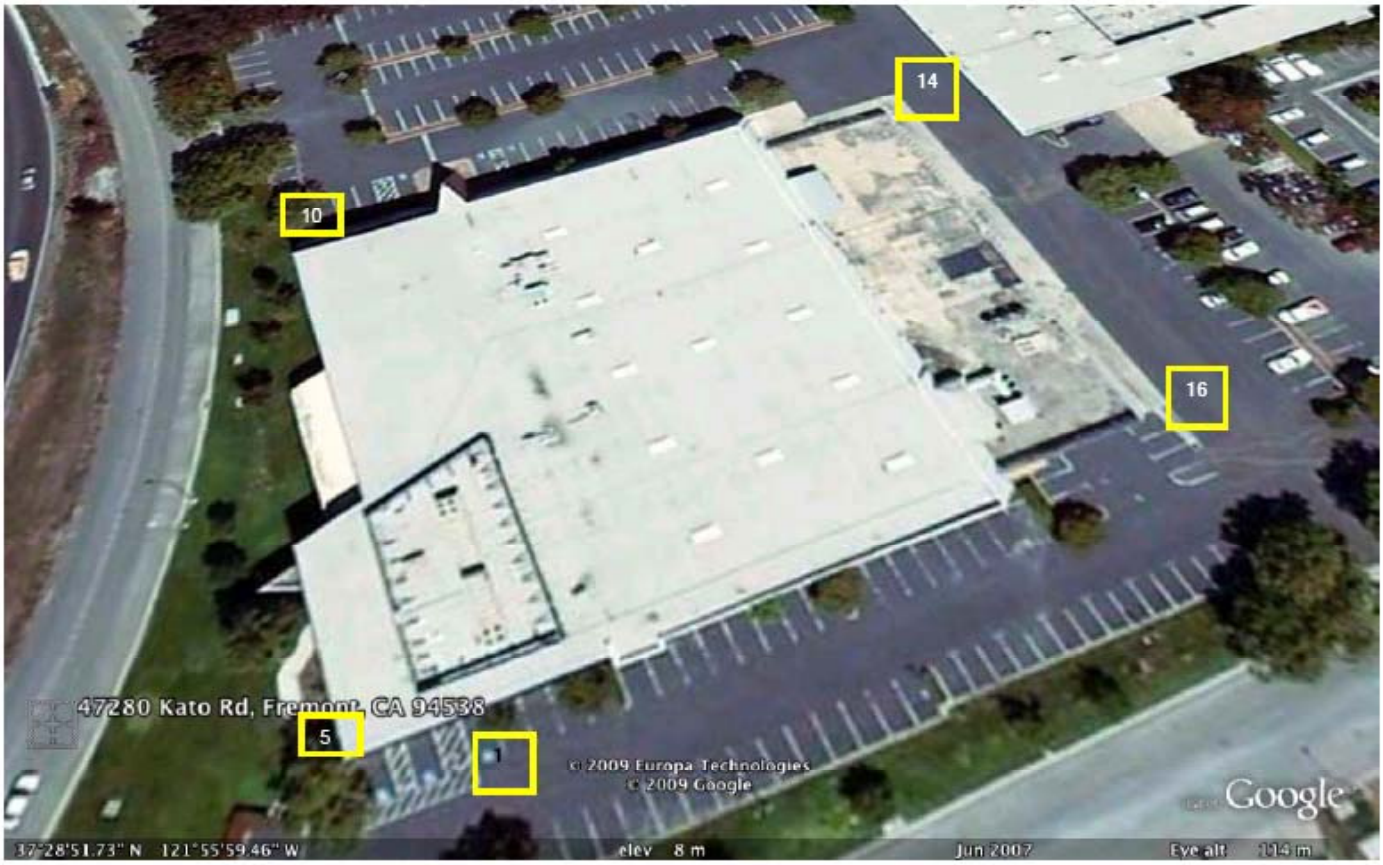
7. IN-SITU TEST LOCATIONS

7.1. SITE 1: 47280 KATO

7.1.1. SITE 1 DIAGRAM



7.1.2. SITE 1 PHOTO

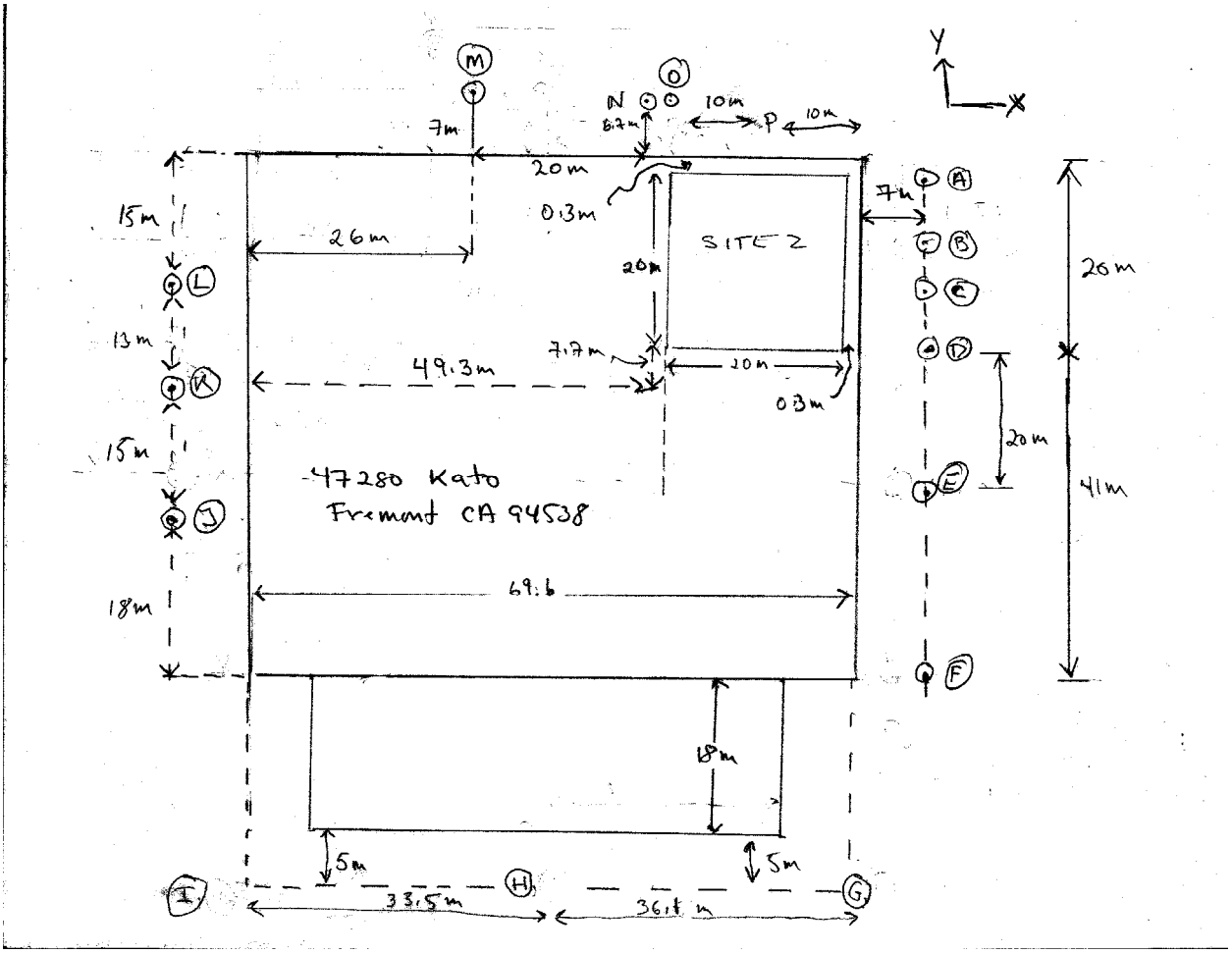


7.1.3. SITE 1 WORST-CASE RADIATED EMISSION BELOW 30 MHz

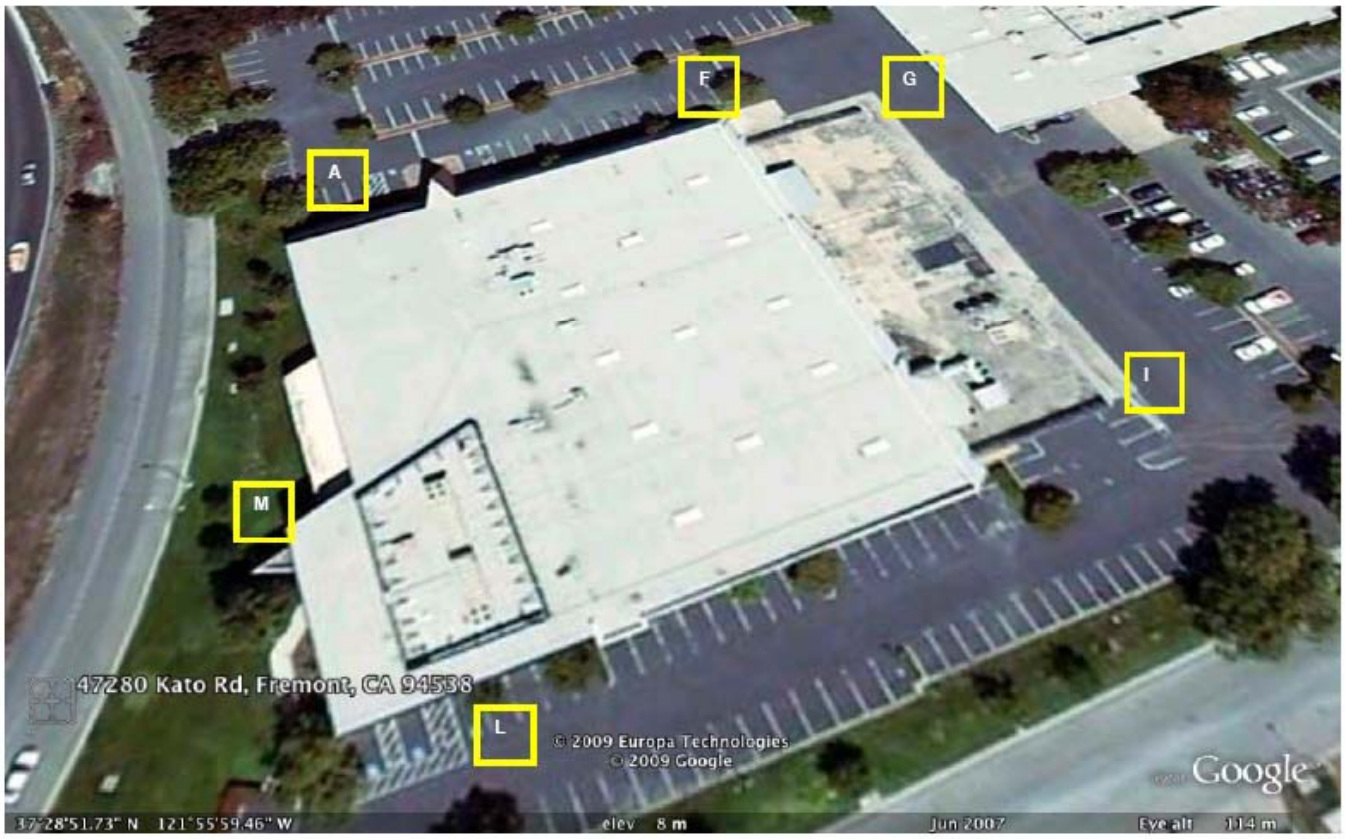
Site 1 Radial 3

7.2. SITE 2: 47280 KATO

7.2.1. SITE 2 DIAGRAM



7.2.2. SITE 2 PHOTO

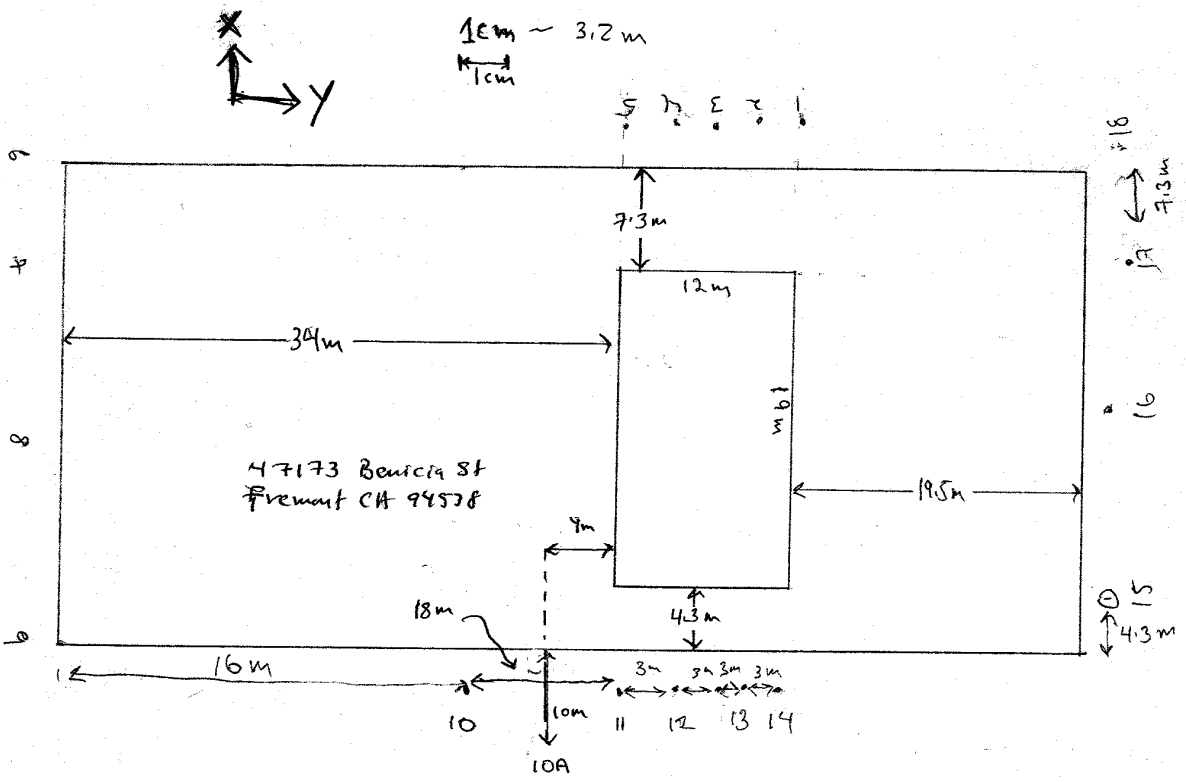


7.2.3. SITE 2 WORST-CASE RADIATED EMISSION BELOW 30 MHz

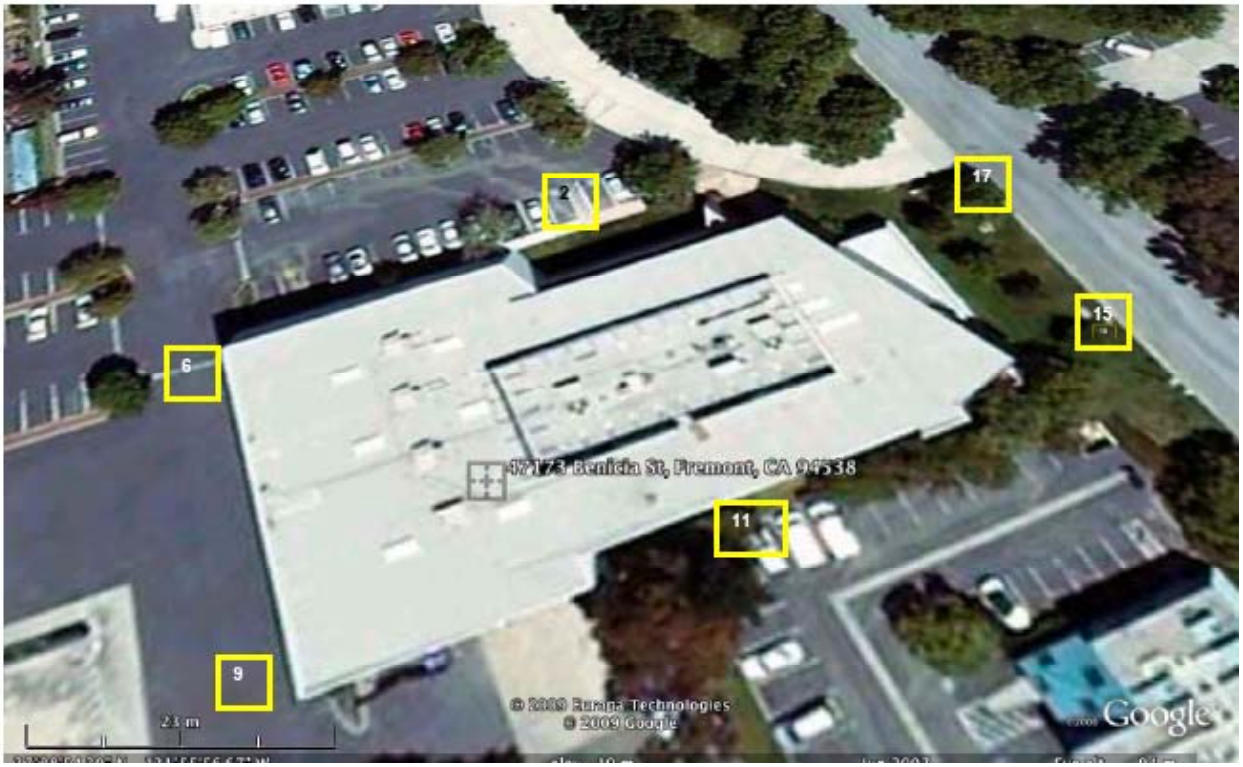
Site 2 Radial D

7.3. SITE 3: 47173 BENICIA STREET

7.3.1. SITE 3 DIAGRAM



7.3.2. SITE 3 PHOTO



7.3.3. SITE 3 WORST-CASE RADIATED EMISSION BELOW 30 MHz

Site 3 Radial 13

8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Current Probe	FCC Inc.	F-33-1	s/n 681	4/23/2010
Oscilloscope	HP	HP54601A	T36	2/21/2010
Preamplifier	Sonoma	310	T173	12/16/2009
Antenna, Bilog.	ARA	LPB-25201A	T102	1/29/2010
Spectrum Analyzer, 22 GHz	HP	HP8564E	T106	6/12/2010
Preamplifier	Agilent / HP	8447D	C00778	12/16/2009
Antenna, Bilog.	Sunol	JB1	C01016	1/14/2020
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	04/20/10
LISN, 30 MHz	FCC	LISN-50/250-25-	N02625	10/29/2009
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	5/6/2011
Antenna, Loop, 30 MHz	EMCO	6502	C00593	9/16/2010
Magnetic Field Probe	Holaday	HI-3637	C01010	10/12/2010

9. APPLICABLE LIMITS AND TEST RESULTS

9.1. 99% OCCUPIED BANDWIDTH

TEST PROCEDURE

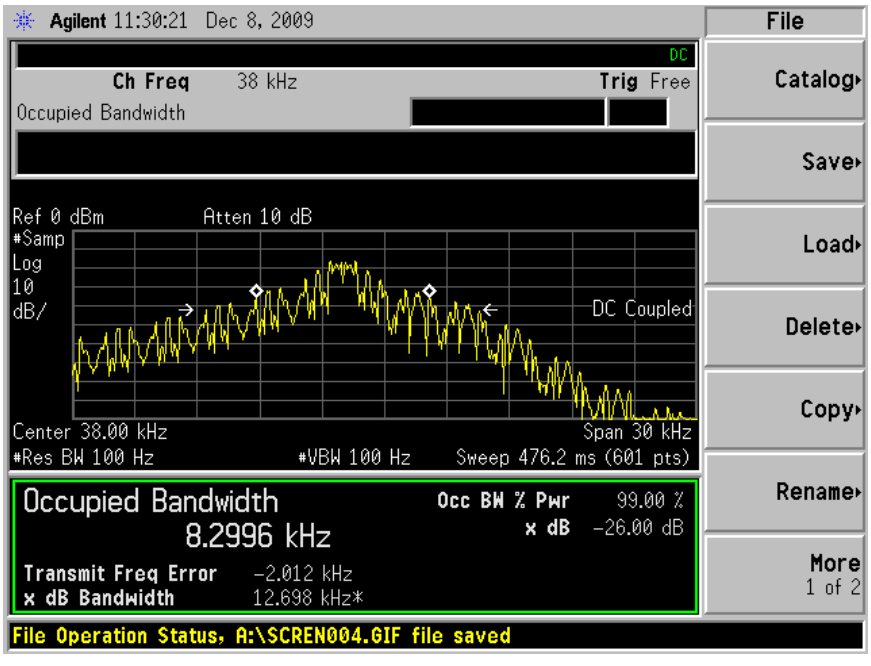
A small pickup loop was placed near the TX loop and was connected to the spectrum analyzer. The 99% BW function of the analyzer was activated.

LIMIT

None; for reporting purposes only.

RESULTS

99% BW



9.2. RADIATED EMISSIONS

9.2.1. PROCEDURE AND LIMITS

TEST PROCEDURE

ANSI C63.4

The frequency range was investigated from 9 kHz to 1000 MHz.

Testing of the transmitter was performed in a laboratory with a spool of wire configured as a dummy load for AC Mains line conducted emisions from 150 kHz to 30 MHz and radiated emissions from 30 to 1000 MHz.

Testing of the transmitter was performed at 3 different in-situ locations with three different antennna setups for radiated emissions from 9 kHz to 30 MHz, and for additional radiated emisions from 30 to 1000 MHz.

In-situ testing was performed at 3 different installations, located in two different buildings. Final measurements of field strength below 30 MHz was performed at 16 different radials around each installation. At the location where the strongest fundamental emission was measured, readings were taken at two different distances along that radial. These data points were used to determine field strength decay with respect to distance.

LIMIT

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

9.2.2. IN-SITU RADIATED EMISSIONS BELOW 30 MHz WITH ANTENNA

0.009 TO 30 MHz (IN-SITU, WORST-CASE RADIAL)

FCC Part 15.209
Loop Antenna Measurement At Open Field below 30 MHz

Company: SES
Project : 09U12822
Model # X4
Tester: T. Cokenias
Date: 27 October - 6 November 2009

Frequency	Reading	Measurement	Field Strength	Reading	Measurement	Field Strength	Antenna	Distance	Limit	Field Strength	Limit	Delta	Notes
	A	Distance A	A	B	Distance B	B	Factor	Factor	Distance	at Limit Distance			(Pk/QP/AV, etc.)
(MHz)	(dBuV)	(m)	(dBuV/m)	(dBuV)	(m)	(dBuV/m)	(dB/m)	(dB/decade)	(m)	(dBuV/m)	(dBuV/m)	(dB)	
Loop Antenna Maximized over all 3 planes: XY, YZ, and ZX:													
0.0378	57.7	28.5	70.80	53.2	34.5	66.30	13.10	54.23	300	15.36	36.05	-20.7	Site1 Radial @3
0.0378	63	28.5	76.10	55	38.5	68.10	13.10	61.25	300	13.49	36.05	-22.6	Site2 Radial @D
0.0378	65.2	17.2	78.30	49.7	35.6	62.80	13.10	49.06	300	17.38	36.05	-18.7	Site3 Radial@10A
0.0378	84.8	8.3	97.90				13.10	49.06	300	21.46	36.05	-14.6	Site3 Radial @13
No other emissions detected													

Notes: In accordance with 15.31 (f) (2):
The applied extrapolation factor is calculated from the measurements at two different distances.
Distance Factor [dB/decade] = (Field Strength A - Field Strength B) [dB] / Log [Base 10] (Distance B / Distance A)

Inclement weather prevented taking second measurment at site 3 radial 13.
The distance factor for site 3 radial 10A taken earlier was applied to site 3 radial 13 measurement.

9.2.3. LABORATORY RADIATED EMISSIONS ABOVE 30 MHz WITH DUMMY LOAD

RADIATED EMISSIONS, 30 – 1000 MHz, (SPOOL OF WIRE AS DUMMY LOAD)

30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date:
Project #: 09U12822
Company:
EUT Description: X4
EUT M/N:
Test Target:
Mode Oper: Dummy Load

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
92.163	3.0	63.0	8.1	0.9	29.6	0.0	0.0	42.3	43.5	-1.2	H	QP			
147.365	3.0	58.7	12.8	1.1	29.3	0.0	0.0	43.2	43.5	-0.3	H	P			
184.326	3.0	56.9	11.0	1.2	29.0	0.0	0.0	40.2	43.5	-3.3	H	P			
221.168	3.0	61.2	11.9	1.3	28.9	0.0	0.0	45.6	46.0	-0.4	H	QP			
294.851	3.0	54.3	13.1	1.6	28.8	0.0	0.0	40.2	46.0	-5.8	H	P			
350.173	3.0	50.8	14.2	1.8	29.0	0.0	0.0	37.6	46.0	-8.4	H	P			
605.184	3.0	50.8	18.3	2.4	29.6	0.0	0.0	41.9	46.0	-4.1	H	P			
59.858	3.0	54.0	7.9	0.7	29.6	0.0	0.0	32.9	40.0	-7.1	V	P			
64.898	3.0	54.3	8.1	0.7	29.6	0.0	0.0	33.5	40.0	-6.5	V	P			
89.016	3.0	53.4	7.5	0.8	29.6	0.0	0.0	32.2	43.5	-11.3	V	P			
92.136	3.0	57.9	8.1	0.9	29.6	0.0	0.0	37.3	43.5	-6.2	V	P			
147.453	3.0	55.8	12.8	1.1	29.3	0.0	0.0	40.3	43.5	-3.2	V	P			
221.128	3.0	52.0	11.9	1.3	28.9	0.0	0.0	36.4	46.0	-9.6	V	P			
571.387	3.0	46.6	17.8	2.3	29.7	0.0	0.0	37.1	46.0	-8.9	V	P			
641.942	3.0	45.5	18.7	2.5	29.6	0.0	0.0	37.0	46.0	-9.0	V	P			
780.174	3.0	40.6	20.7	2.8	29.2	0.0	0.0	34.8	46.0	-11.2	V	P			
789.413	3.0	39.8	20.8	2.8	29.2	0.0	0.0	34.2	46.0	-11.8	V	P			

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

9.2.4. IN-SITU ADDITIONAL RADIATED EMISSIONS ABOVE 30 MHz WITH ANTENNA

RADIATED EMISSIONS, 30 – 1000 MHz, (ADDITIONAL EMISSIONS WITH ANTENNA)

High Frequency Measurement

In Situ Test Data

Company: SES
Model: X4
Project #: 06U10672
Date: 10/28-10/30/2009
Test Engineer: T. Cokenias
Configuration: 3m from TX and TX Loop antenna indoors
Mode: Tx

f MHz	Dist (m)	Read Pk dBuV	AF dB/m	CL dB	Amp dB	Peak dBuV/m	Limit dBuV/m	Delta dB	Notes (V/H)
341.850	3.0	51.9	14.0	0.7	-32.6	34.0	46.0	-12.0	Site 1 (H worst case)
341.850	3.0	59.0	14.0	0.7	-32.6	41.1	46.0	-4.9	Site 2 (H worst case)
341.850	3.0	52.2	14.0	0.7	-32.6	34.3	46.0	-11.7	Site 3 (H worst case)

No other emissions detected
Rev. 5.1.6

f Measurement Frequency
Dist Distance to Antenna
Reac Analyzer Reading
AF Antenna Factor
CL Cable Loss
Amp Amplifier

9.3. AC MAINS LINE CONDUCTED EMISSIONS WITH DUMMY LOAD

TEST PROCEDURE

ANSI C63.4

LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50
* Decreases with the logarithm of the frequency.		

RESULTS

6 WORST EMISSIONS

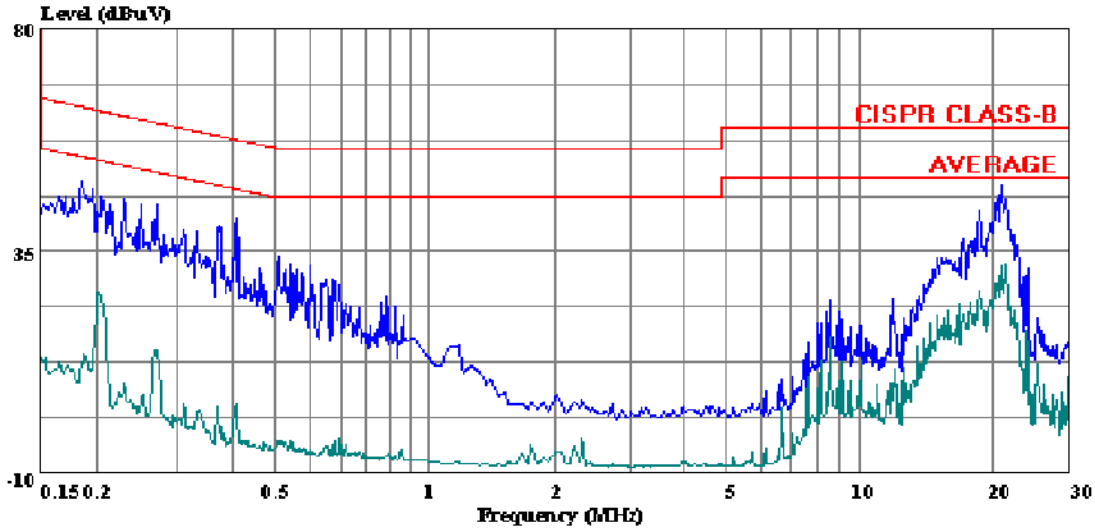
CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq.	Reading			Closs	Limit		Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	49.30	--	12.52	0.00	64.35	54.35	-15.05	-41.83	L1
0.41	41.86	--	3.84	0.00	57.69	47.69	-15.83	-43.85	L1
20.92	48.46	--	31.95	0.00	60.00	50.00	-11.54	-18.05	L1
0.17	57.49	--	8.40	0.00	64.77	54.77	-7.28	-46.37	L2
0.18	53.33	--	4.40	0.00	64.35	54.35	-11.02	-49.95	L2
20.92	48.86	--	31.60	0.00	60.00	50.00	-11.14	-18.40	L2
6 Worst Data									

LINE 1 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 7 File#: 09U12822LC.EMI Date: 10-26-2009 Time: 13:44:05



(Line Conduction)

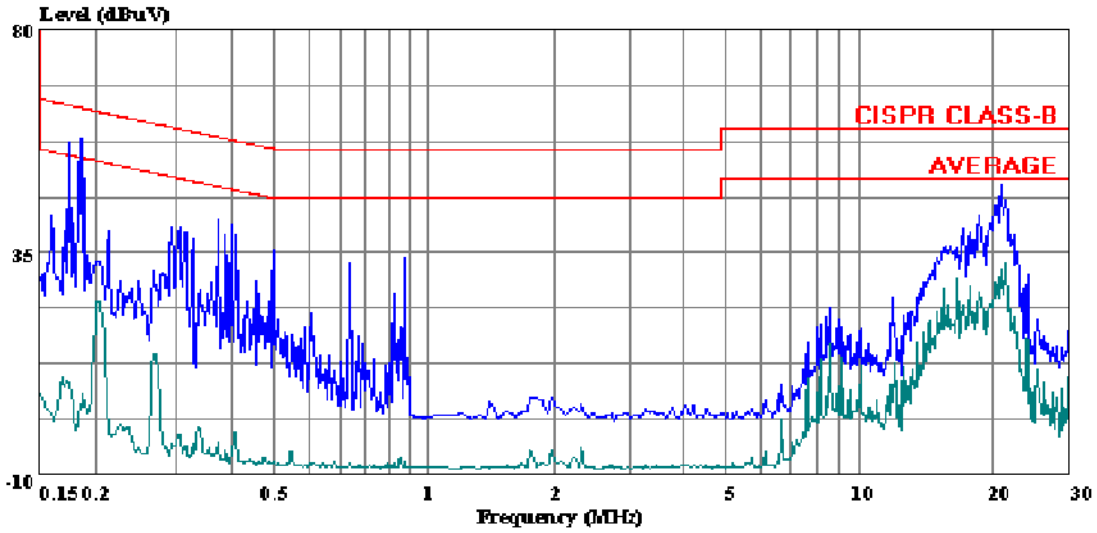
Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Doug Anderson
Project #: : 09U12822
Company: : SES
EUT Description:: X4 VLF Transmitter
Configuration: : EUT with Support Equipment
Mode: : Continuous XMIT
Target: : FCC Class B
Voltage: : 115VAC / 60Hz
: L1: Peak (Blue), Average (Green)

LINE 2 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 14 File#: 09U12822LC.EMI Date: 10-26-2009 Time: 13:55:03



(Line Conduction)

Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Doug Anderson
Project #: : 09U12822
Company: : SES
EUT Description:: X4 VLF Transmitter
Configuration: : EUT with Support Equipment
Mode: : Continuous XMIT
Target: : FCC Class B
Voltage: : 115VAC / 60Hz
: L2: Peak (Blue), Average (Green)

10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

RSS-102 Clause 4. For the purpose of this Standard, Industry Canada has adopted the SAR and RF exposure limits established in Health Canada's RF exposure guideline, Safety Code 6.

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

LIMITS

From FCC §1.1310 Table 1 (B), no limits are specified for an operating frequency of 38 kHz.

From IC Safety Code 6, Section 2.2 Table 5 Column 3, the Magnetic Field limit at 38 kHz is 2.19 A/m.

A magnetic field of 2.19 A/m corresponds to a magnetic flux density of 2.76 uT.

SEPARATION DISTANCE

As a fixed device, the separation distance is specified as 20 cm.

PROCEDURE

The Magnetic Flux Density is measured at a distance of 20 cm from the antenna using an isotropic VLF magnetic field probe.

RESULTS

Frequency (kHz)	Distance (cm)	Magnetic Flux Density (uT)	Magnetic Field (A/m)	Limit (A/m)
38	20	0.60	0.48	2.19