



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

CERTIFICATION TEST REPORT

FOR

VLF RADIO TRANSMITTER

FCC ID: XV9-SES37120

IC ID: 8714A-SES37120

MODEL NUMBER: 37120 and 37000*

REPORT NUMBER: 10U13278-3, Revision D

ISSUE DATE: JANUARY 6, 2011

**Prepared for
STORE ELECTRONIC SYSTEMS (SES)
39 RUE DE MONTIGNY
ARGENTEUIL
ARGENTEUIL 95100, FRANCE**

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***Model Difference shown in report**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	10/14/10	Initial Issue	F. Ibrahim
A	12/22/10	Added model difference to report and FCC/IC ID	A. Zaffar
B	12/28/10	Revised the formulas in radiated emissions data sheets for below 30 MHz.	F. Ibrahim
C	1/06/11	Show 10m to 300m extrapolation calculation p.21/44	T. Cokenias
D	1/06/11	Edit extrapolation calculations p21 and p22	T. Cokenias

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: STORE ELECTRONIC SYSTEMS (SES)
39 RUE DE MONTIGNY ARGENTEUIL
ARGENTEUIL 95100, FRANCE

EUT DESCRIPTION: VLF RADIO TRANSMITTER AND BUFFER MODULATOR

MODEL: 37120 and 37000

SERIAL NUMBER: Transmitter 0012 10/25, Buffer S0009 10/22

DATE TESTED: September 21-28, 2010

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 (UL 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 UL 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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 UL CCS By:



FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:



TOM COKENIAS
Principal Consultant
UL CCS

1. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

2. FACILITIES AND ACCREDITATION

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

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

3. CALIBRATION AND UNCERTAINTY

3.1. 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.

3.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

3.3. 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%.

4. EQUIPMENT UNDER TEST

4.1. DESCRIPTION OF EUT

The EUT is a VLF transmitter used in stores to program electronic price tags located on shelves. The transmitter can operate in either one of two modes: QPSK, CF = 36 kHz, and FSK (NRZ), CF=38.4 kHz, +/- 1.8 kHz excursion.

4.2. MODEL DIFFERENCES

37120 is the VLF Radio Transmitter which is the EUT;
37000 is support equipment, ITE equipment. Both 37120 and 37000 work together.

4.3. 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 pattern is a double rectangle, the standard configuration used in actual installations.

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 (South Side):	13.2m x 16.5m
47280 Kato Street (North Side):	10.5m x 15m
47173 Benicia Street:	13.2m x 20m

For the AC line conducted test, a small loop dummy load was attached to the TX antenna port.

4.4. SOFTWARE AND FIRMWARE

Firmware EmtManu 4.03
Driver Gest 9.03

Firmware Version:

Buffer 37000: v111 0139F800
Transmitter 37120: v111 0139F800

4.5. WORST-CASE CONFIGURATION AND MODE

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

During tests the antenna current was set to the maximum value of 2 A p-p, (0.707 RMS).

5. DESCRIPTION OF TEST SETUP

5.1. SUPPORT EQUIPMENT AND CABLING

SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial Number	FCC ID
PC	Gateway	DT100	P80670Z0332393-15891800	DoC
Monitor	Hyundai	X71S	10A701L04915	N/A
Keyboard	Gateway	KU-0355	KBUSB0G0179180-04780B00	DoC
Mouse	Acer	M-UVACRI	HC901A0051E	DoC

CABLES

Cable	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
RS232	Serial	2	D9	shielded	4m	N/A
Power	AC	1	IEC connector	unshielded	1.5m	N/A
Ant	ANT1&2	1	Screwdown	Single conductor	Varies	N/A

CLIENT EQUIPMENT

Description	Mfr	Model Number	Serial	Cal Date	Cal Due
Current probe	Tektronix	P6201	X005097	03/02/10	03/02/11
Tuning Controller	SES	na	na	NCR	NCR

5.2. TEST MODE

TEST SETUP

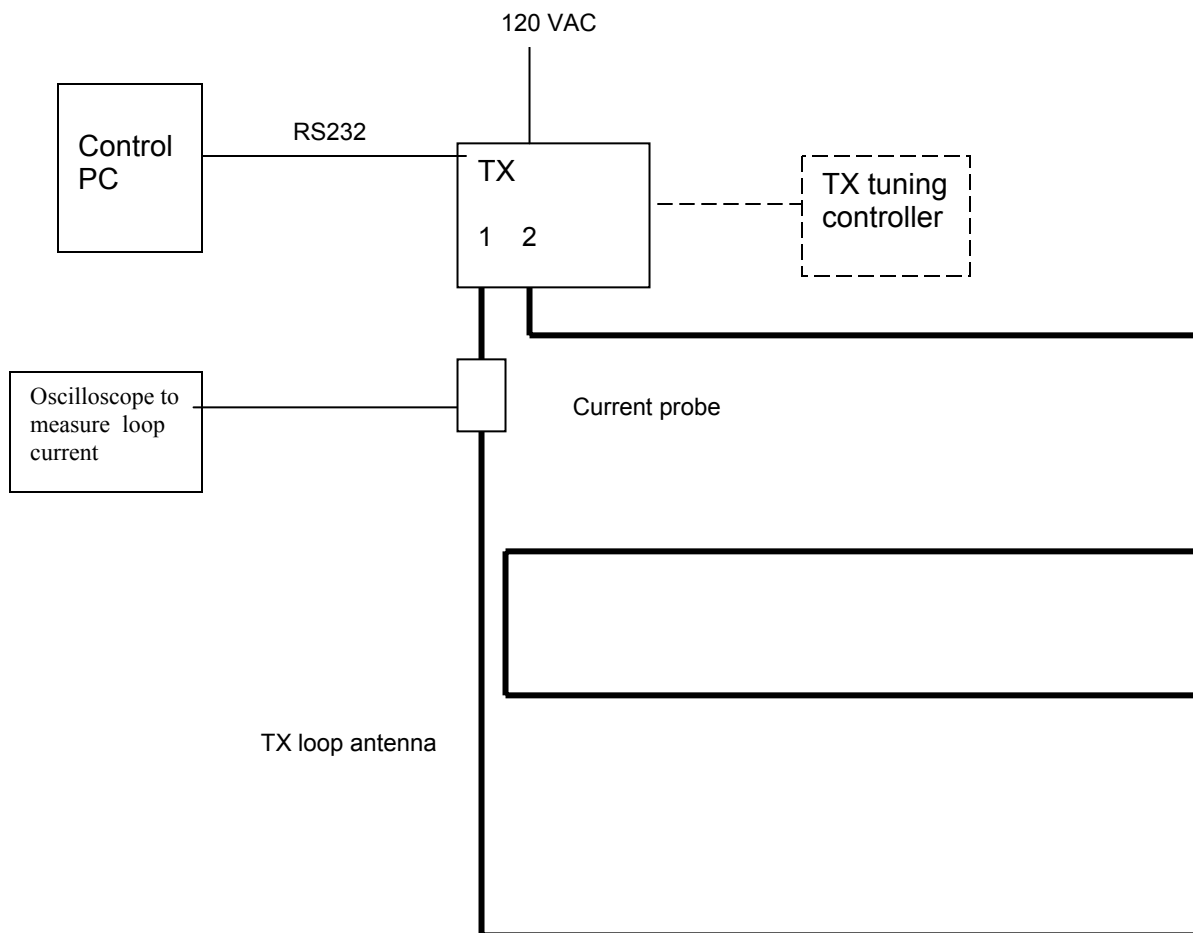
The EUT consists of a transmitter and loop antenna. The TX tuning controller is used to tune the TX match network for each loop antenna.

After the TX has been tuned for the specific loop antenna to which it is connected, the TX tuning controller is disconnected, the TX lid is replaced, and the pc then controls operation of the TX.

For all tests, the TX output was set to produce an antenna loop current of 2 A p-p (0.707A RMS), which per the manufacturer is the maximum level for operation in actual installations.

5.3. TEST SETUP

5.3.1. TEST DIAGRAM



5.3.2. KATO STREET SOUTH TX LOOP ANTENNA



5.3.3. KATO STREET NORTH TX LOOP ANTENNA

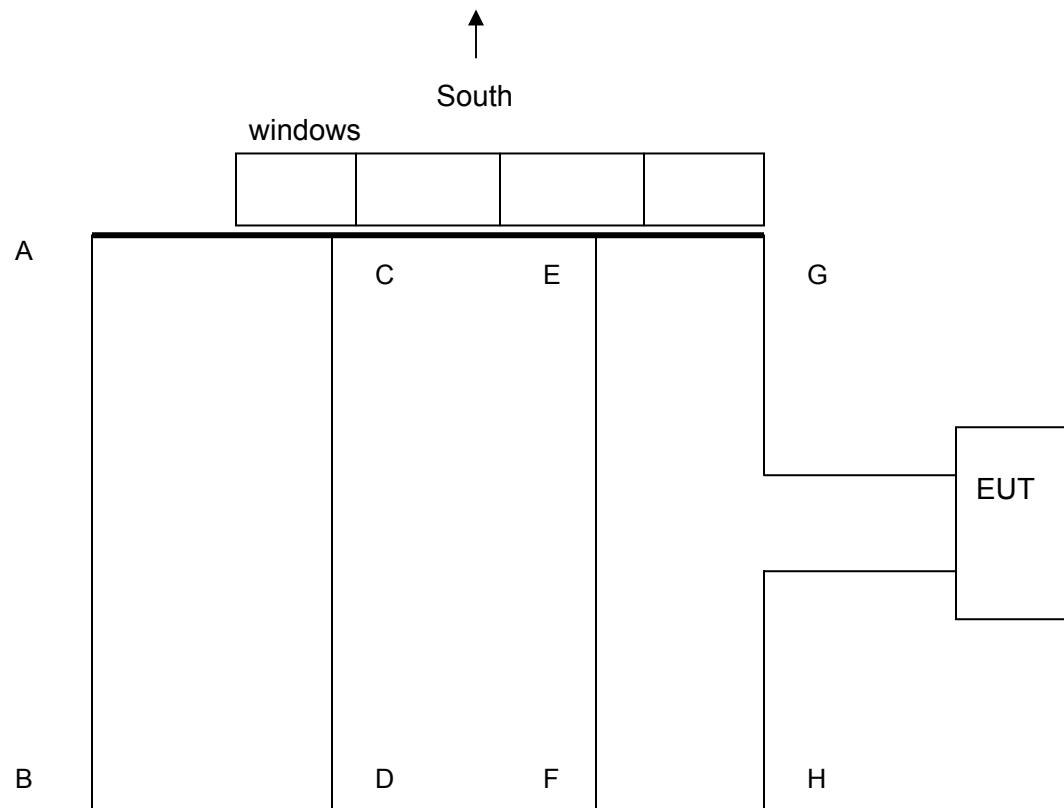


5.3.4. 47173 Benicia Street Loop ANTENNA



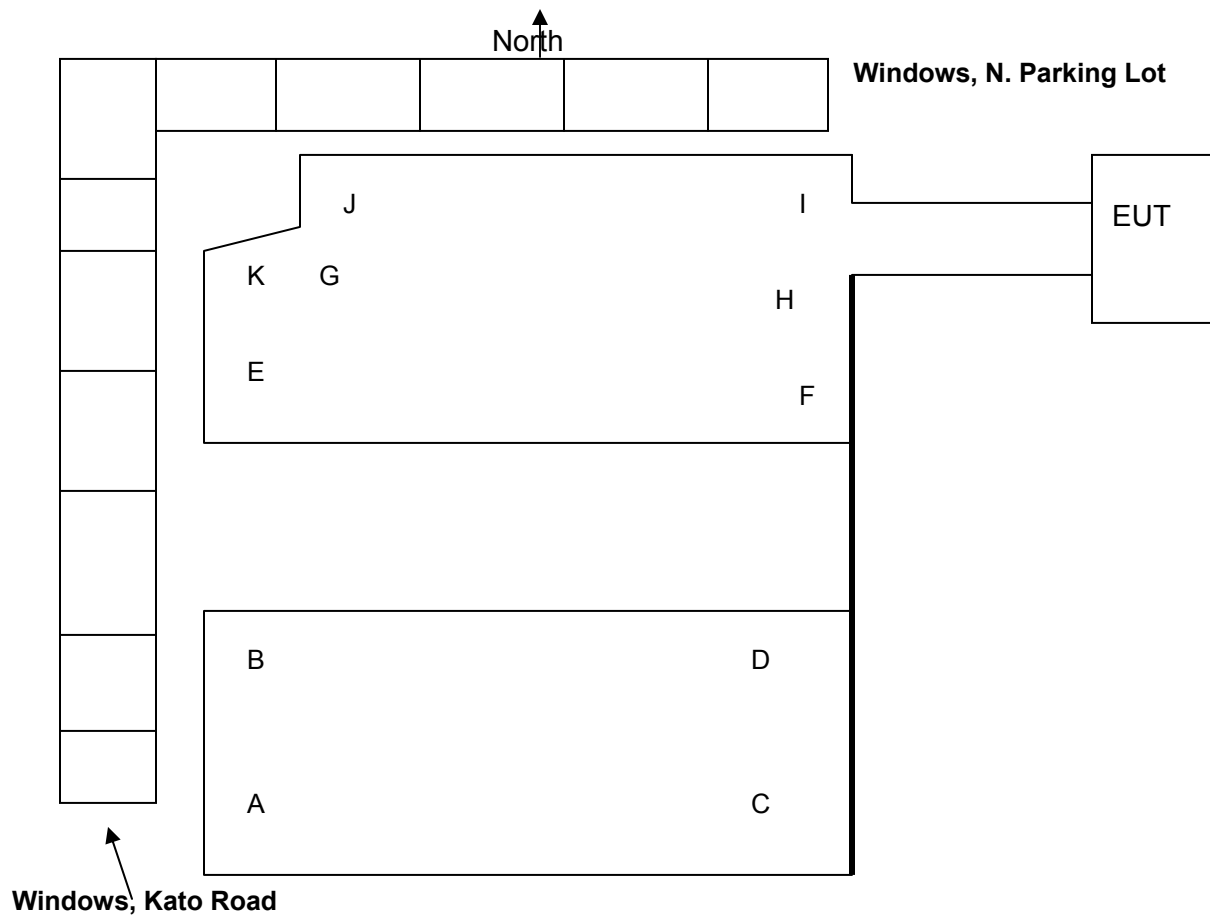
5.4. TEST LOCATIONS

5.4.1. SOUTH KATO LOOP DIAGRAM



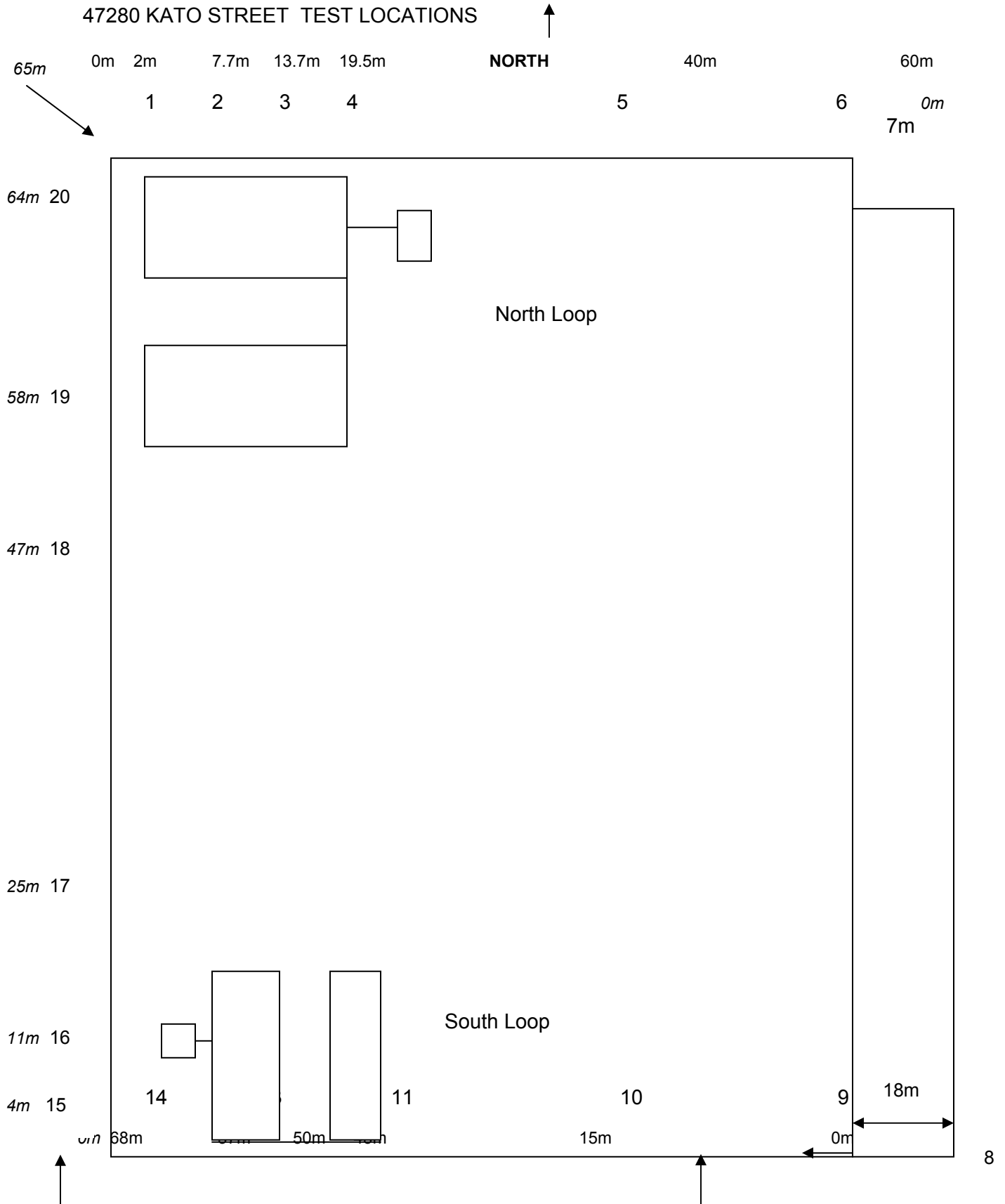
A-B, C-D, E-F, G-H:	16.5m (55 ft.)
A-C, B-D:	4.8m (16ft)
C-E, D-F:	5m (16.67 ft)
E-G, F-H:	3.45m (11.5 ft)

5.4.2. NORTH KATO LOOP DIAGRAM

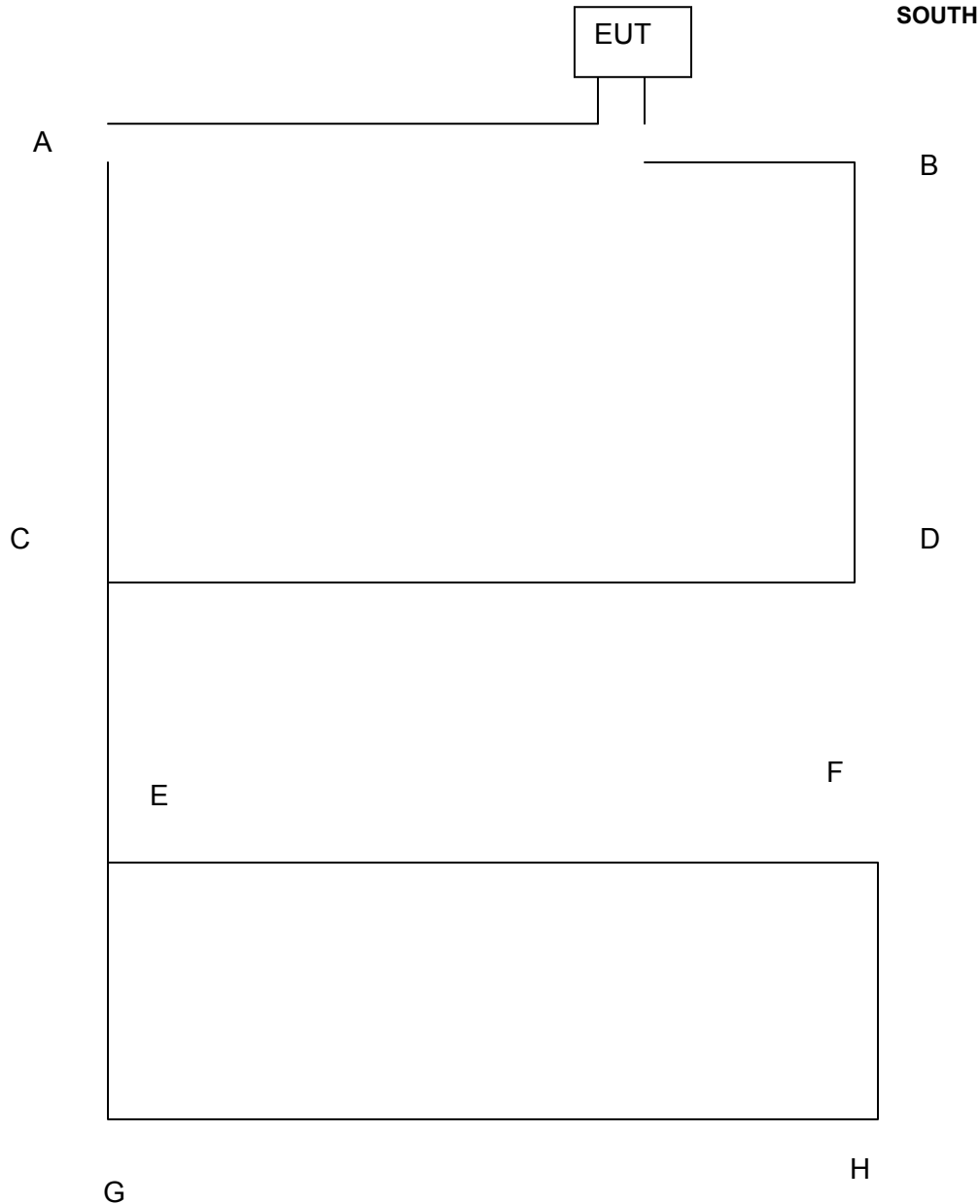


A-B, C-D:	4.65m (15.5 ft)
I-F, E-J:	4.75m (15.83 ft)
A-C, B-D:	15 m (50 ft)
B-E, D-F:	3.6m (12 ft.)
J-I:	13.5m (45 ft)
K-G:	1.5m (5 ft)
K-E:	1.8m (6 ft)
H-F:	3.9m (13 ft)

47280 KATO STREET TEST LOCATIONS

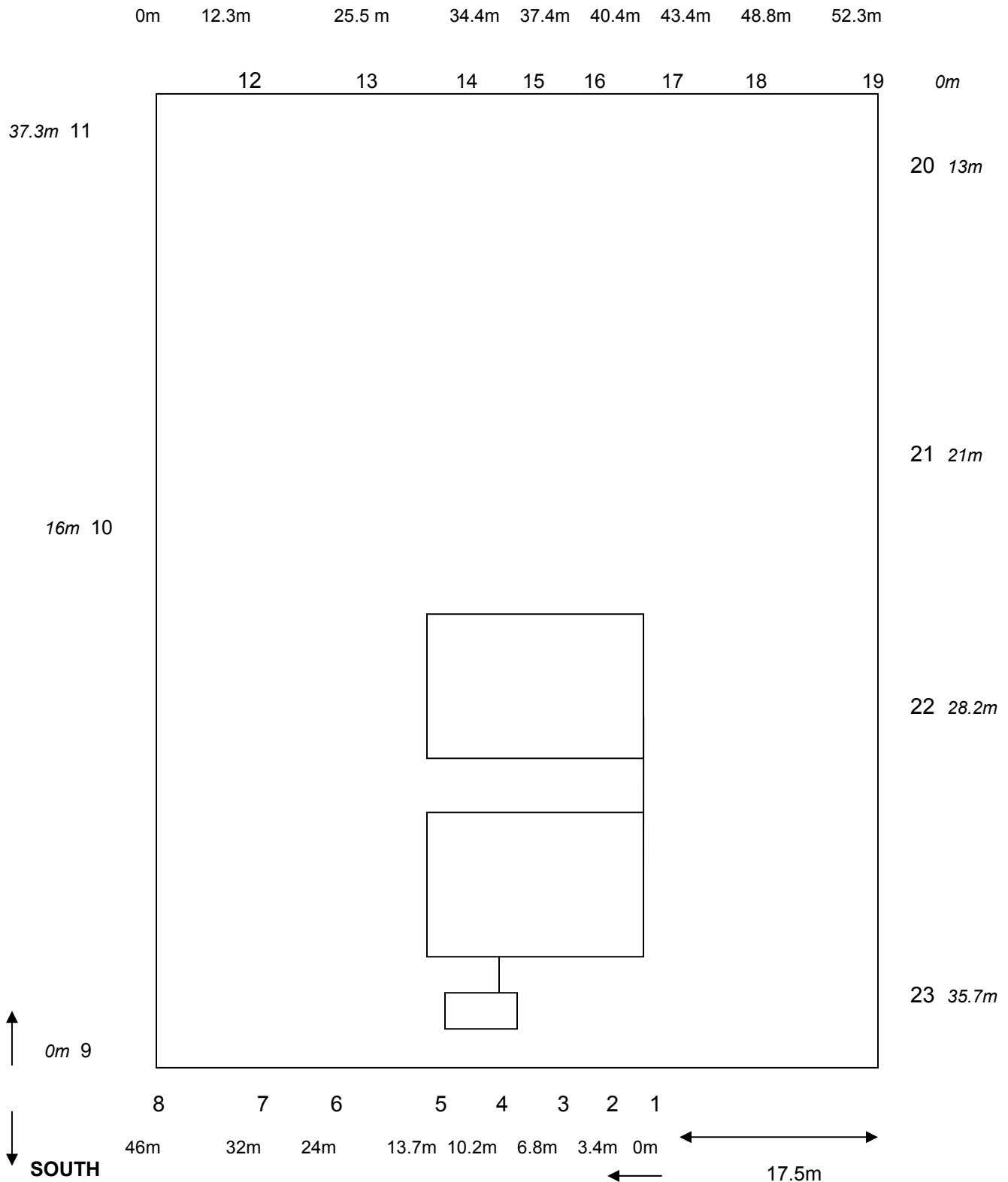


5.4.3. 47173 BENICIA STREET LOOP DIAGRAM



A-B, C-D, E-F, G-H: 13.2m (44 ft)
B-D: 9.2m (30.67 ft)
B-H: 20m (60.67 ft)
D-F: 5.2m (17.33 ft)
F-H: 5.6m (18.67 ft)

47173 BENICIA STREET TEST LOCATIONS



6. 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 Date	Cal Due
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	1/14/2009	12/18/2010
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	3/31/2009	12/19/2010
Spectrum Analyzer	Agilent / HP	E4446A	C01069	1/5/2010	4/5/2011
Oscilloscope	HP	54601A	T36	2/21/2010	2/21/2011
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	8/5/2009	12/17/2010
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/2009	10/29/2010
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/2009	10/29/2010
EMI Receiver	R & S	ESHS 20	N02396	6/8/2009	5/6/2011
Loop Antenna	EMCO	6502	C00593	9/16/2010	1/12/2012

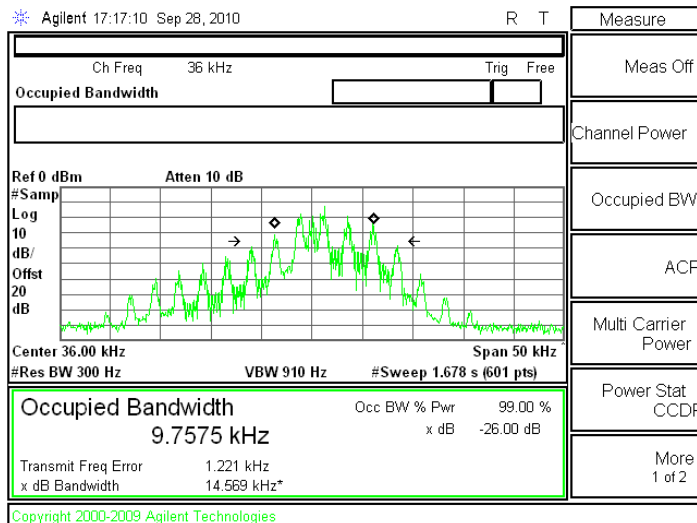
7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 99% OCCUPIED BANDWIDTH

TEST PROCEDURE

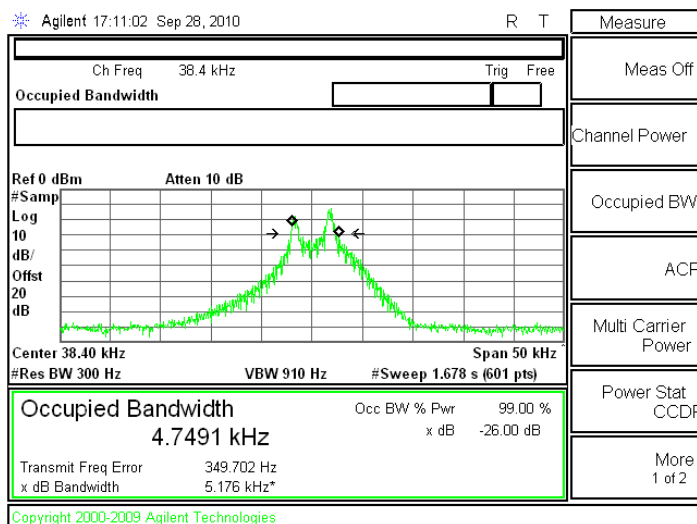
A small pickup loop was placed near the TX loop and was connected to the spectrum analyzer by a 3m length of coax cable. The transmitter was set to transmit continuously. The spectrum analyzer 99% OCC BW internal function was activated.

LIMIT NONE. For reporting purposes only



QPSK modulation

Emission designator: 9K75G1D



FSK modulation

Emission designator: 4K75F1D

7.2. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

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

Testing was performed at 3 different installations, located in two different buildings. Field strength was measured at 21-23 different radials around each installation.

Preliminary testing was performed at 3 m separation distance from the loop, inside the building, to search for spurious and harmonic emissions between 9 kHz – 30 MHz. For 30-1000 MHz, testing was performed in an anechoic chamber using a dummy load antenna.

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.		

RESULTS

0.15 TO 30 MHz (WORST-CASE CONFIGURATION)

FSK Modulation

FCC Part 15.209

FSK Modulation: Loop Antenna Measurement At Open Field below 30 MHz

Company: SES
Project #: 10U13278
Model #: 37120
Tester: T. Cokenias
Date: 21-23 September 2010

Frequency	Reading	Measurement	Field Strength	Reading	Measurement	Field Strength	Antenna	Distance	Limit	Field Strength	Limit	Delta	Notes
(MHz)	A	Distance A	A	B	Distance B	B	Factor	Factor	Distance	at Limit Distance			(PK/QP/AV, etc.)
	(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:													
0.0366	75.17	10	87.67				12.50	40.00	300	28.59	36.33	-7.7	KatoSouth Loc11
0.042	73.83	10	85.93				12.10	40.00	300	26.85	35.14	-8.3	
0.0366	77.2	10	89.70				12.50	40.00	300	30.62	36.33	-5.7	KatoNorth Loc4
0.042	76	10	88.10				12.10	40.00	300	29.02	35.14	-6.1	
0.0366	57.33	10	69.83				12.50	40.00	300	10.75	36.05	-25.3	47173Benicia Loc4
0.042	61	10	72.10				12.10	40.00	300	13.02	36.05	-23.0	
No other emissions detected													

Notes: In accordance with 15.31 (f) (2):
For each frequency at which a measurement is made at only one distance, the square of an inverse linear distance extrapolation factor (40 dB/decade) is applied.
Extrapolation factor from 10m to 300m: $40\log(10/300) = -59.08 \text{ dB}$

QPSK Modulation

FCC Part 15.209

QPSK Modulation: Loop Antenna Measurement At Open Field below 30 MHz

Company: SES

Project #10U13278

Model #: 37120

Tester: T. Cokenias

Date: 21-23 September 2010

Frequency	Reading	Measurement	Field Strength	Reading	Measurement	Field Strength	Antenna	Distance	Limit	Field Strength	Limit	Delta	Notes
(MHz)	A	Distance A	A	B	Distance B	B	Factor	Factor	Distance	at Limit Distance	(dBuV/m)	(dB)	(Pk/QP/AV, etc.)
(MHz)	(dBuV)	(m)	(dBuV/m)	(dBuV)	(m)	(dBuV/m)	(dB/m)	(dB/decade)	(m)				
Loop Antenna Maximized over all 3 planes: XY, YZ, and ZX:													
0.036	74.17	10	86.67				12.50	40.00	300	27.59	36.48	-8.9	KatoSouth Loc11
0.036	73.7	10	86.20				12.50	40.00	300	27.12	36.48	-9.4	KatoNorth Loc3
0.036	61	10	78.30				12.50	40.00	300	19.22	36.05	-16.8	47173Benicia Loc4
No other emissions detected													

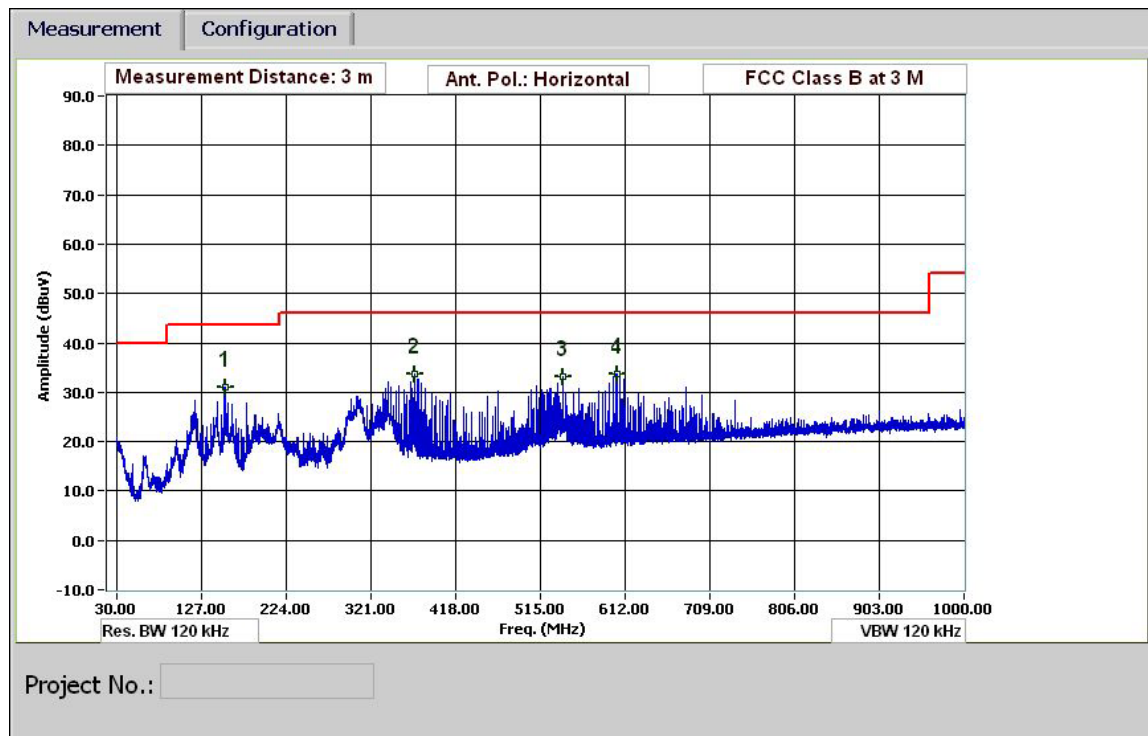
Notes: In accordance with 15.31 (f) (2):

For each frequency at which a measurement is made at only one distance, the square of an inverse linear distance extrapolation factor (40 dB/decade) is applied.
Extrapolation factor from 10m to 300m: $40\log(10/300) = -59.08 \text{ dB}$

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

Tx FSK

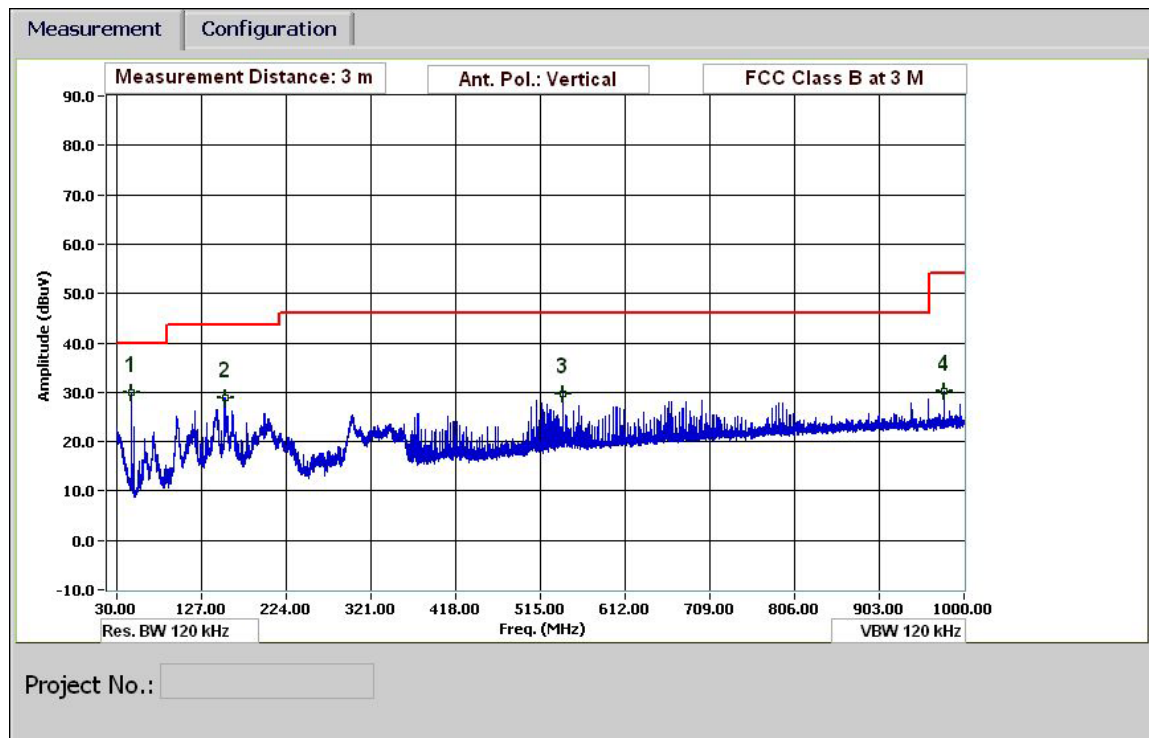
HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

Tx FSK

VERTICAL PLOT



EMISSIONS DATA

Tx FSK

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

Test Engr: Thanh Nguyen
Date: 09/22/10
Project #: 10U13278
Company: SES
Test Target: FCC Class B
Mode Oper: FSK Modulation

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	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
FSK															
46.681	3.0	47.7	10.0	0.6	28.4	0.0	0.0	29.9	40.0	-10.1	V	P	100.0	0 - 360	
153.605	3.0	43.8	12.3	1.1	28.3	0.0	0.0	29.0	43.5	-14.5	V	P	100.0	0 - 360	
540.741	3.0	38.0	17.4	2.1	27.7	0.0	0.0	29.8	46.0	-16.2	V	P	100.0	0 - 360	
976.959	3.0	32.8	22.3	2.9	27.9	0.0	0.0	30.2	54.0	-23.8	V	P	100.0	0 - 360	
153.605	3.0	46.0	12.3	1.1	28.3	0.0	0.0	31.1	43.5	-12.4	H	P	100.0	0 - 360	
370.694	3.0	45.6	14.5	1.7	28.1	0.0	0.0	33.7	46.0	-12.3	H	P	100.0	0 - 360	
540.741	3.0	41.5	17.4	2.1	27.7	0.0	0.0	33.3	46.0	-12.7	H	P	100.0	0 - 360	
602.184	3.0	40.4	18.4	2.2	27.5	0.0	0.0	33.6	46.0	-12.4	H	P	100.0	0 - 360	

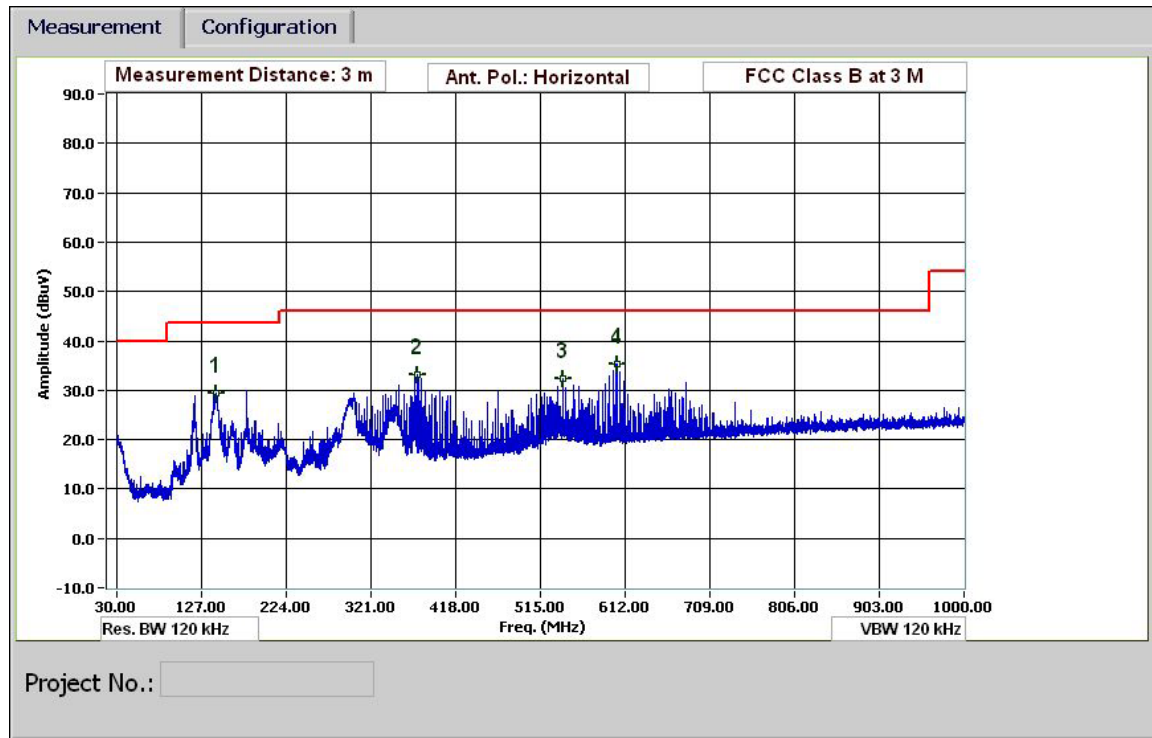
Rev. 1.27.09

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

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

Tx QPSK

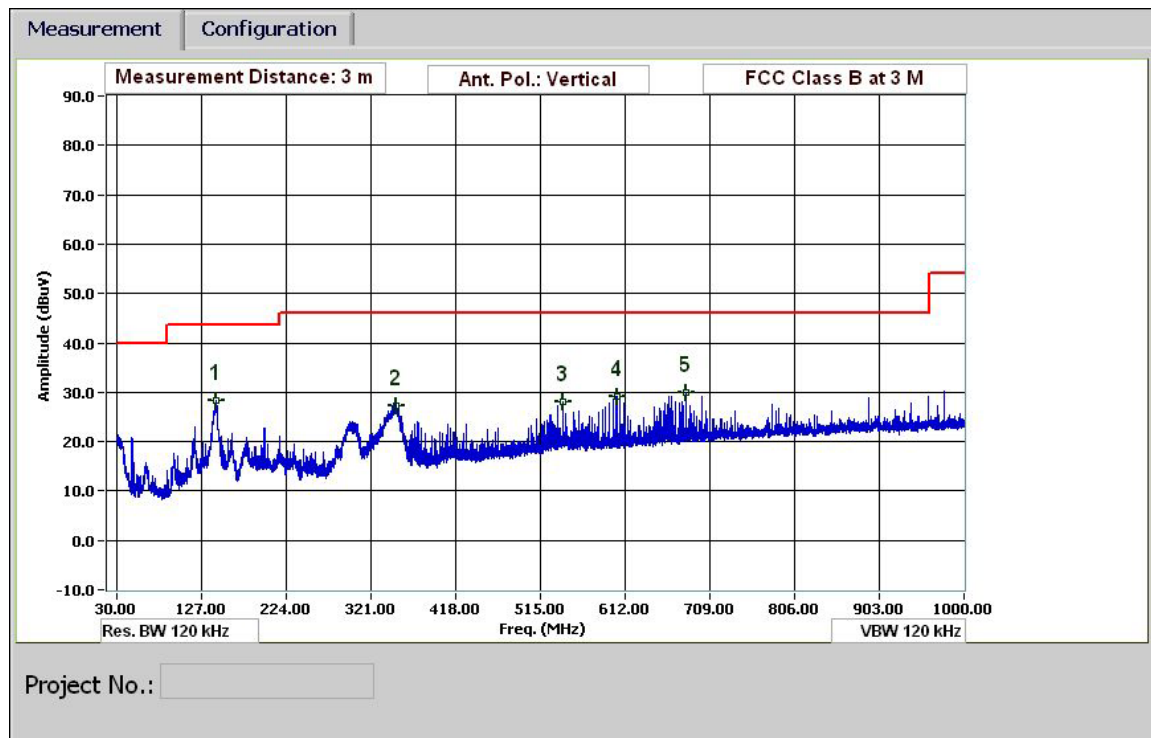
HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

Tx QPSK

VERTICAL PLOT



EMISSIONS DATA

Tx QPSK

30-1000MHz Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Test Engr:		Thanh Nguyen													
Date:		09/22/10													
Project #:		10U13278													
Company:		SES													
Test Target:		FCC Class B													
Mode Oper:		QPSK Modulation													

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	Dist	Read	AF	CL	Amp	D Corr	Pad	Corr.	Limit	Margin	Ant. Pol	Det.	Ant. High	Table Angle	Notes
MHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	cm	Degree	
QPSK															
143.165	3.0	42.4	13.1	1.1	28.3	0.0	0.0	28.2	43.5	-15.3	V	P	100.0	0 - 360	
349.813	3.0	39.5	14.2	1.7	28.1	0.0	0.0	27.2	46.0	-18.8	V	P	100.0	0 - 360	
540.741	3.0	36.2	17.4	2.1	27.7	0.0	0.0	28.1	46.0	-17.9	V	P	100.0	0 - 360	
602.184	3.0	36.1	18.4	2.2	27.5	0.0	0.0	29.3	46.0	-16.7	V	P	100.0	0 - 360	
682.107	3.0	35.5	19.4	2.4	27.3	0.0	0.0	30.1	46.0	-15.9	V	P	100.0	0 - 360	
143.405	3.0	43.4	13.0	1.1	28.3	0.0	0.0	29.3	43.5	-14.2	H	P	100.0	0 - 360	
374.774	3.0	45.0	14.5	1.7	28.1	0.0	0.0	33.1	46.0	-12.9	H	P	100.0	0 - 360	
540.741	3.0	40.6	17.4	2.1	27.7	0.0	0.0	32.4	46.0	-13.6	H	P	100.0	0 - 360	
602.184	3.0	42.0	18.4	2.2	27.5	0.0	0.0	35.2	46.0	-10.8	H	P	100.0	0 - 360	

Rev. 1.27.09

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

7.3 AC MAINS LINE CONDUCTED EMISSIONS

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 μ H/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 (dB μ V)	
	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

Tx FSK

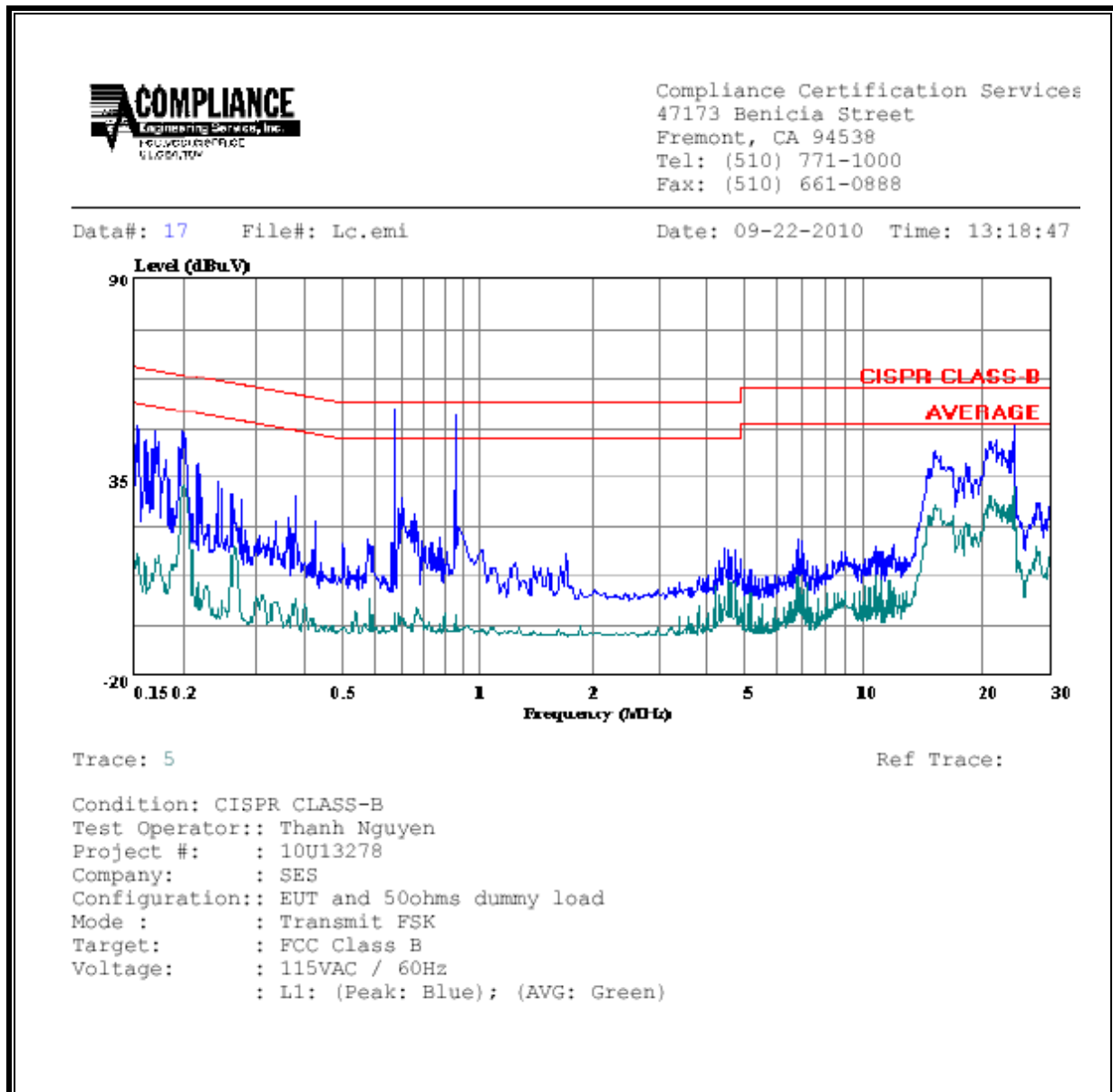
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_A	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.67	54.42	--	--	0.00	73.00	60.00	-18.58	-5.58	L1
0.95	52.30	--	--	0.00	73.00	60.00	-20.70	-7.70	L1
24.01	49.34	--	--	0.00	73.00	60.00	-23.66	-10.66	L1
0.39	54.08	--	--	0.00	79.00	66.00	-24.92	-11.92	L2
0.83	55.74	--	--	0.00	73.00	60.00	-17.26	-4.26	L2
24.01	48.93	--	--	0.00	73.00	60.00	-24.07	-11.07	L2
6 Worst Data									

Tx QPSK

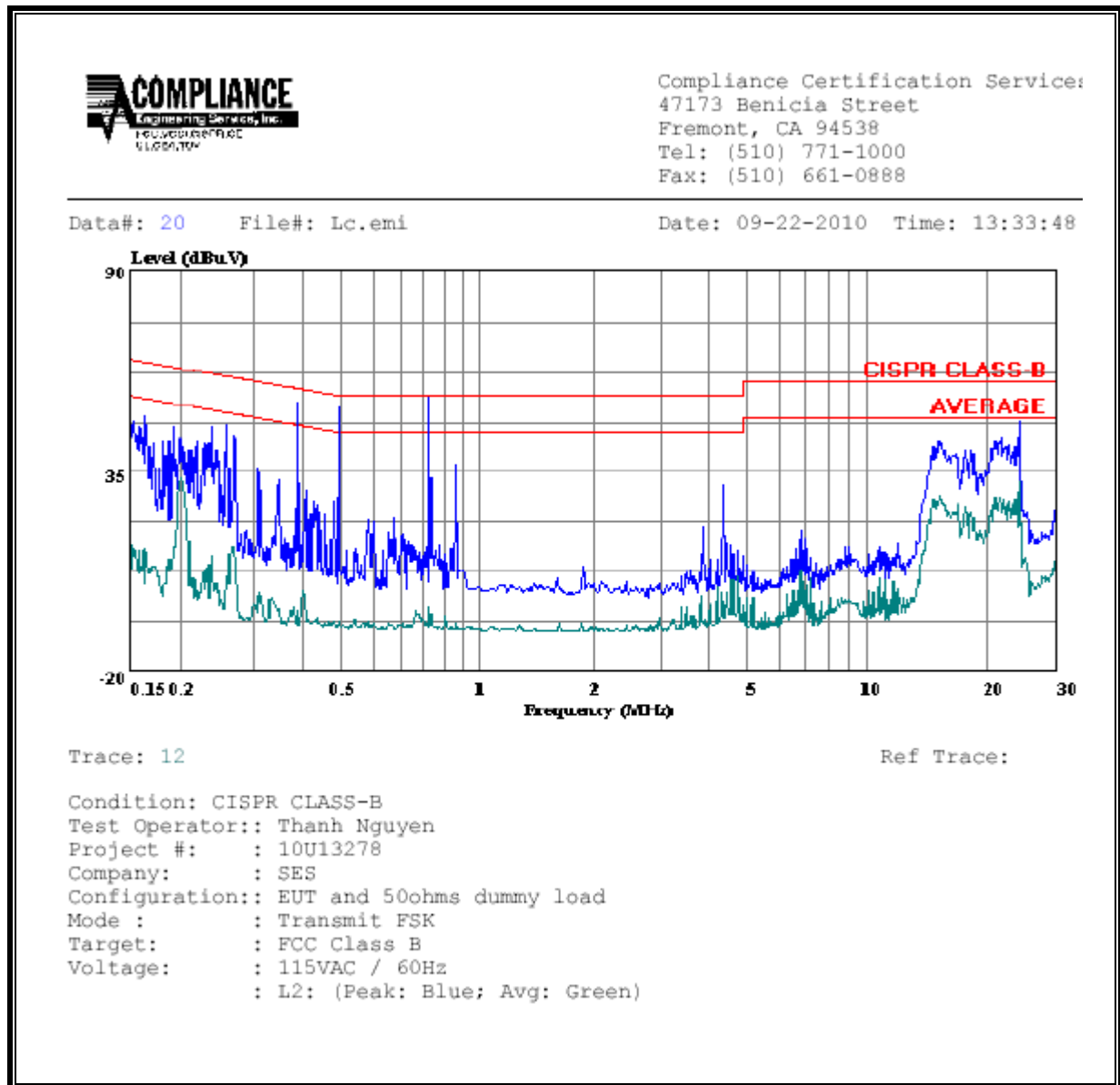
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.15	61.99	--	23.52	0.00	66.00	56.00	-4.01	-32.48	L1
0.50	47.31	--	3.21	0.00	56.00	46.00	-8.69	-42.79	L1
24.01	50.38	--	41.35	0.00	60.00	50.00	-9.62	-8.65	L1
0.19	51.88	--	33.02	0.00	64.26	54.26	-12.38	-21.24	L2
0.26	47.74	--	17.67	0.00	61.43	51.43	-13.69	-33.76	L2
24.01	49.23	--	40.23	0.00	60.00	50.00	-10.77	-9.77	L2
6 Worst Data									

FSK Modulation

LINE 1 RESULTS

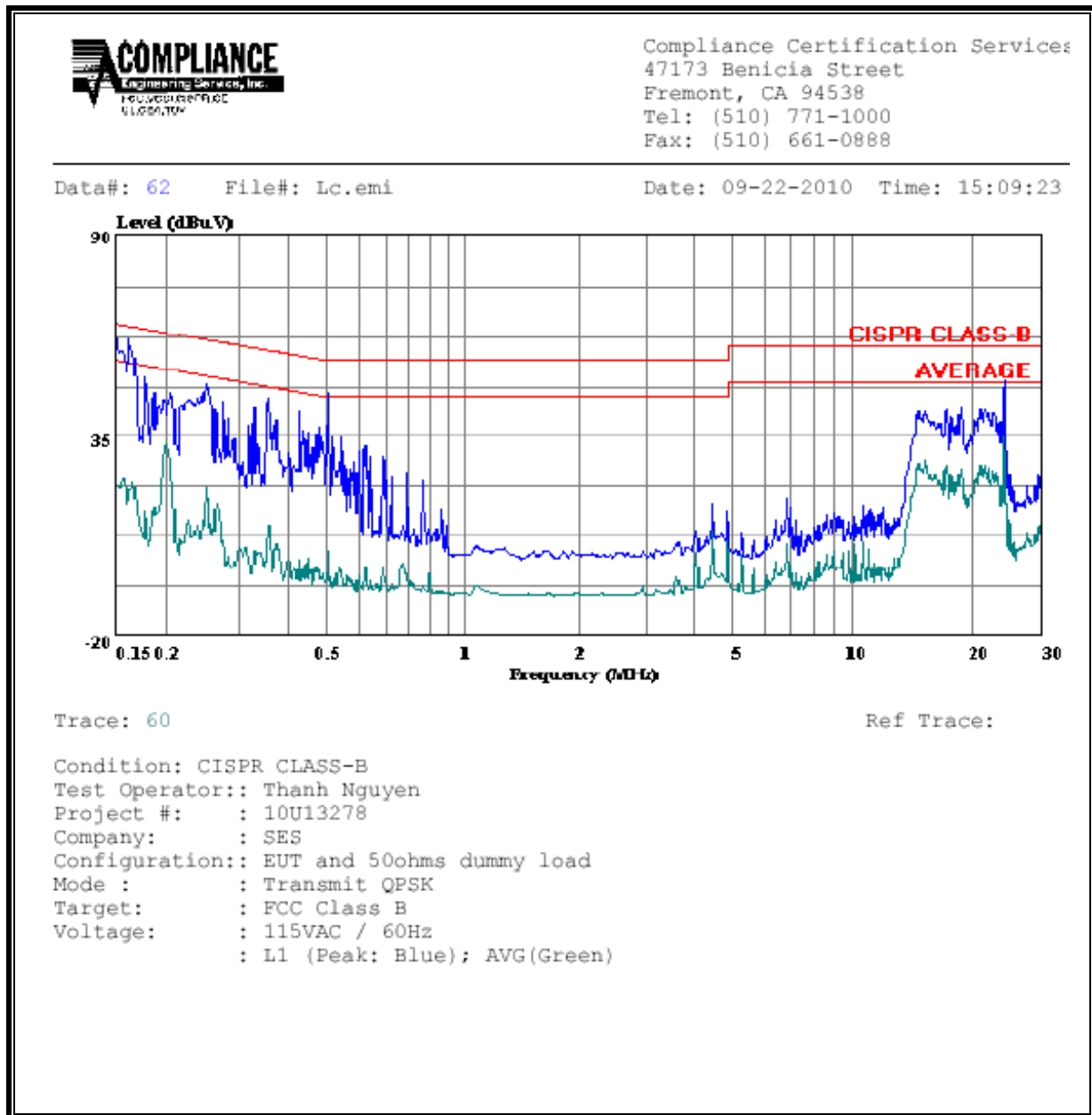


LINE 2 RESULTS



QPSK Modulation

LINE 1 RESULTS



LINE 2 RESULTS

