



**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT**

TEST REPORT

FOR

916MHz SENSORLINK TRANCEIVER REPEATER

FCC ID: IR2DWW7614

MODEL NO: 7614

REPORT NO: 99U0131

APRIL 12,1999

Prepared for
DAVIS INSTRUMENTS
3465 Diablo Ave.
Hayward, CA 94545

Prepared by
COMPLIANCE CERTIFICATION SERVICES, INC.
1366 BORDEAUX DRIVE
SUNNYVALE, CA 94089, U.S.A.
TEL: (408) 752-8166
FAX: (408) 752-8168

NVLAQ[®]
LAB CODE:200065-0

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1. VERIFICATION OF COMPLIANCE

COMPANY NAME : DAVIS INSTRUMENTS
 3465 DIABLO AVE.
 HAYWARD, CA 94545

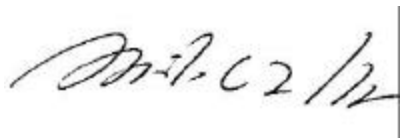
CONTACT PERSON : JEFF THAYER / ENGINEERING MANAGER

TELEPHONE NO : (510) 732-9229

EUT DESCRIPTION : 916 MHz SENSORLINK TRANCIEVER REPEATER

MODEL NAME : 7614

DATE TESTED : APRIL 12, 1999

LIMITS APPLY TO: FCC PART 15 SECTION 15.249	
TECHNICAL LIMITS	TEST RESULT
Radiated Emission of fundamental Frequency	PASSED
Radiated Emission of Harmonic Frequency	PASSED
Radiated Emission Outside the Band	PASSED
<p>The above equipment was tested by Compliance Certification Services Inc. for compliance with the requirements set forth in CFR 47 PART 15 SUBPART C. This said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.</p> <div></div> <p>MIKE C.I. KUO / VICE PRESIDENT COMPLIANCE CERTIFICATION SERVICES, INC.</p>	

2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

CHASSIS TYPE	PLASTIC
Frequency Range	916.5 MHz
Transmitter chip	RFM; HX2000
Receiver chip	RFM; RX2010
Antenna Requirement	Permanently Attached (Internal)
Power supply Manuf/ model	Davis Instrument; 7916
Power requirement	9Vdc
Emission Designator	F1D

3. TEST LOCATION

All emissions tests were performed at:

Compliance Consulting Services
561F Monterey Road
Morgan Hill, CA 95087

CCS has site descriptions on file with the FCC for 10 and 3 meter site configurations. CCS is a NVLAP accredited facility.

4. EQUIPMENT MODIFICATIONS

To achieve compliance Levels, the following change(s) were made during compliance testing:

Mod.#1 A 47 ohm resistor was place in series with antenna transmitter to reduce power output.

5. TEST RESULT SUMMARY

Radiated Emissions

Test Requirement: 15.249(A)(B)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)

HP Spectrum Display/85662A (Cal Due: 09/99)

HP Quasi-Peak Detector/85650A (Cal Due: 09/99)

HP Pre-Amp(P5)/8447D (Cal Due: 09/99)

Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

TEST SETUP FOR MEASUREMENT OF FUNDAMENTAL FREQUENCY

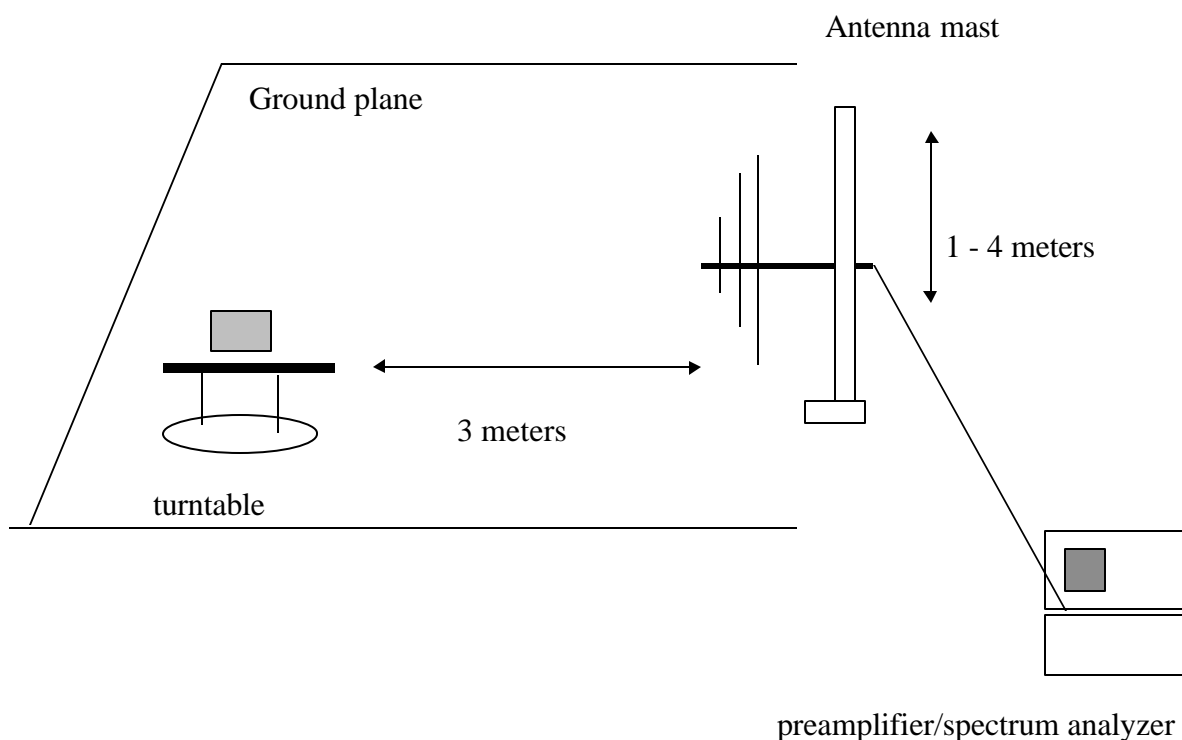


Fig.1(a)

Test Procedures

- 1) Place the EUT on the turntable as shown. The EUT was placed as close as possible to the center of the turntable with the axis of rotation going through the EUT antenna when in vertical or horizontal polarization. Activated Eut to transmit.

- 2) The log periodic search antenna was place at a distance of 3 meters. The antenna was raised and lowered and the EUT rotated on the turntable so to produce maximum emission levels on the spectrum analyzer.
- 3) The Eut was placed standing-up (y-axis) and laying down (z-axis). Step (1) and (2) were repeated for each orientation.

Test Results:

Please refer to attached data.

Compliance Engineering Services Inc.

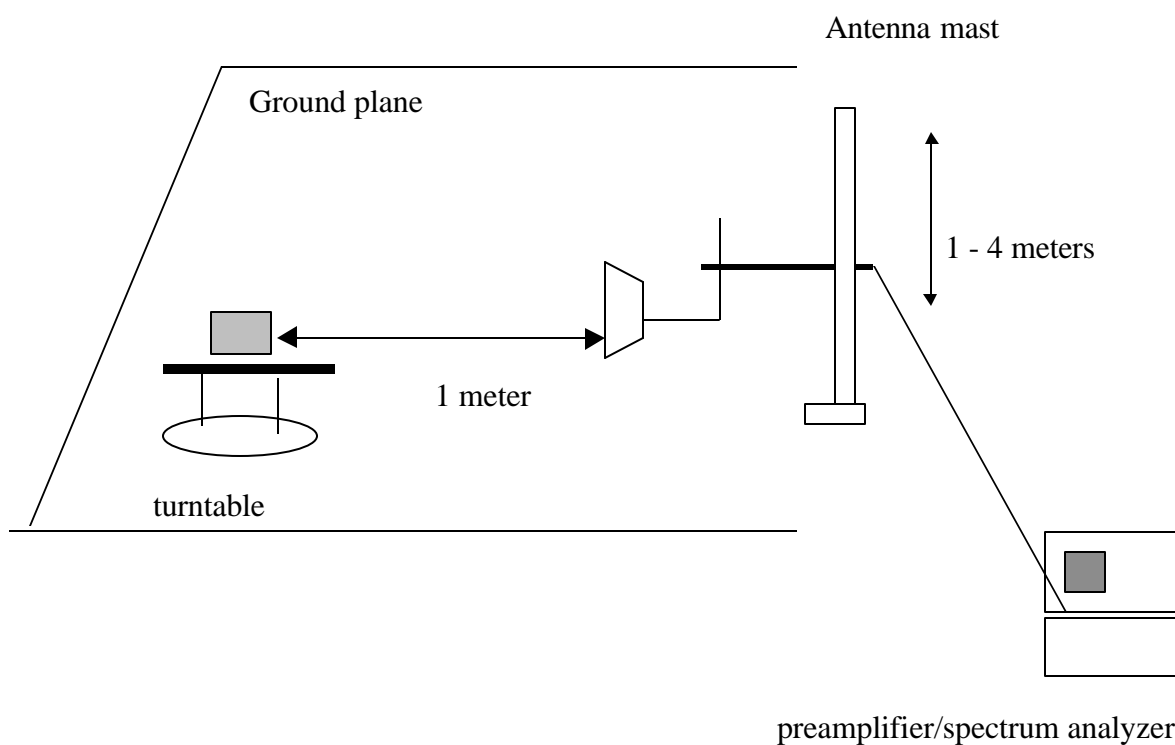
Project No. : 99U0131
Report No. : 990412C1
Date : 04/12/1999
Time : 09:28
Test Engr: JUAN MARTINEZ

>> 3 M RADIATED EMISSION DATA <<

Company : DAVIS INSTRUMENTS
Equipment Under Test : SENSORLINK REPEATER (M/N:7614)
Test Configuration : EUT ONLY
Type of Test : FCC CLASS B
Mode of Operation : TX

Freq.	dBuV	PreAmp	Ant	Cable	dBuV/m	Limit	Margin	Pol	Hgt(m)	Az
916.46	94.90	-27.71	22.39	4.30	93.89	94.00	-0.11	V	1.1	0
916.46	90.00	-27.71	23.24	4.30	89.84	94.00	-4.16	H	1.2	90
y-axis:										
916.46	91.30	-27.71	23.24	4.30	91.14	94.00	-2.86	H	1.5	0
916.46	86.40	-27.71	22.39	4.30	85.39	94.00	-8.61	V	1.6	180

Total # of data 4
V. c2.2

Radiated Emissions**Test Requirement: 15.249(A)(B)****Measurement Equipment Used:****Emco Horn Antenna/3146****HP Pre-Amp (1 – 26.5 GHz)/8449B****HP Spectrum Analyzer/8593EM****FSY High Pass Filter(1.802GHz)/001****FLEXCO cable/20761; 19ft. coaxial cable (loss: .9dB/ft @ 26GHz)****TEST SETUP FOR MEASUREMENT OF FUNDAMENTAL HARMONICS ABOVE 1GHz****Fig.1(b)****Test Procedures**

1. The EUT was placed on a wooden turntable. The search antenna was placed at 1 meter. from the EUT.
2. The turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.

3. The Eut was placed standing-up (y-axis) and laying down (z-axis). Step (1) and (2) were repeated for each orientation.axis.

Test result:

Please refer to attached spreadsheets. Also, a plot of the Eut's duty cycle is included. Duty cycle was included in the average harmonic readings, only.

Compliance Certification Services										4/20/1999				
Fcc Part 15.249(A)										Juan Martinez				
										(1Meter)				
DAVIS INSTRUMENTS														
SENSORLINK REPEATER														
$f_o=916.5\text{MHz}$														
F(MHz)	<u>PK</u>	<u>AV</u>	AF	CL	AMP	DC	DIST	OTHER	<u>TOTAL</u>	LIMIT		MARGIN		
	dBuV	dBuV	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)		
<u>Y-AXIS(Vertical polarization)</u>										<u>PK</u>	<u>AV</u>	<u>PK</u>	<u>AV</u>	<u>PK</u>
1832	77.85	77.5	27	2.59	-35	-14.6	-9.5	0	63	48	74	54	-11	-6.01
2749	57.9	52.89	30	4.07	-35		-9.5	0	47	42.5	74	54	-27	-11.54
3665	60.64	59.14	32	4.63	-35	-14.6	-9.5	0	53	36.7	74	54	-21	-17.33
4582	68.36	67.7	31.9	5.18	-35	-14.6	-9.5	0	61	45.7	74	54	-13	-8.32
5498	63.3	63	34.6	5.74	-35	-14.6	-9.5	0	59	44.2	74	54	-15	-9.76
6145	55.1	53.1	34.4	6.08	-35		-9.5	0	51	49.1	74	54	-23	-4.92
7321	50.4	40.61	36	6.65	-35		-9.5	0	49	38.8	74	54	-25	-15.24
8247	51.7	44.6	36.5	7.6	-35		-9.5	0	51	44.2	74	54	-23	-9.8
9164	50.96	40.4	38.2	7.98	-35		-9.5	0	53	42.1	74	54	-21	-11.92
<u>Z-AXIS</u>														
1832	79.9	79.5	27	2.59	-35	-14.6	-9.5	0	65	50	74	54	-9	-4.01
2749	58.9	57.87	30	4.07	-35		-9.5	0	48	47.4	74	54	-26	-6.56
3665	67.89	66.89	32	4.63	-35	-14.6	-9.5	0	60	44.4	74	54	-14	-9.58
4582	62.9	62.2	31.9	5.18	-35	-14.6	-9.5	0	55	40.2	74	54	-19	-13.82
5498	60.7	60.2	34.6	5.74	-35	-14.6	-9.5	0	57	41.4	74	54	-17	-12.56
6145	56.48	55.78	34.4	6.08	-35		-9.5	0	52	51.8	74	54	-22	-2.24
7321	50.4	44.55	36	6.65	-35		-9.5	0	49	42.7	74	54	-25	-11.3
8247	52.78	46.89	36.5	7.6	-35		-9.5	0	52	46.5	74	54	-22	-7.51
9164	50.79	44.23	38.2	7.98	-35		-9.5	0	52	45.9	74	54	-22	-8.09
<u>Z-AXIS(Horizontal polarization)</u>														
1832	72.1	71.4	27	2.59	-35	-14.6	-9.5	0	57	41.9	74	54	-17	-12.11
2749	50.5	45.5	30	4.07	-35		-9.5	0	40	35.1	74	54	-34	-18.93
3665	60.2	59.1	32	4.63	-35		-9.5	0	52	51.2	74	54	-22	-2.77
4582	63.7	62.3	31.9	5.18	-35	-14.6	-9.5	0	56	40.3	74	54	-18	-13.72
5498	53.2	49.89	34.6	5.74	-35		-9.5	0	49	45.7	74	54	-25	-8.27
6145	73.79	33.67	34.4	6.08	-35		-9.5	0	70	29.7	74	54	-4.2	-24.35
7321	47.28	35.08	36	6.65	-35		-9.5	0	45	33.2	74	54	-29	-20.77
8247	41.37	36.51	36.5	7.6	-35		-9.5	0	41	36.1	74	54	-33	-17.89
9164	45.85	36.11	38.2	7.98	-35		-9.5	0	48	37.8	74	54	-26	-16.21

Compliance Certification Services									4/20/1999					
Fcc Part 15.249(A)									Juan Martinez					
									(1Meter)					
DAVIS INSTRUMENTS														
SENSORLINK REPEATER														
f _o =916.5MHz														
F(MHz)	<u>PK</u>	<u>AV</u>	AF	CL	AMP	DC	DIST	OTHER	<u>TOTAL</u>	<u>LIMIT</u>		<u>MARGIN</u>		
	dBuV	dBuV	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)		
<u>Y-AXIS</u>														
1832	76.6	76.3	27	2.59	-35	-14.6	-9.5	0	62	46.8	74	54	-12	-7.21
2749	51.78	50.54	30	4.07	-35		-9.5	0	41	40.1	74	54	-33	-13.89
3665	64.8	64.1	32	4.63	-35	-14.6	-9.5	0	57	41.6	74	54	-17	-12.37
4582	69.3	68.9	31.9	5.18	-35	-14.6	-9.5	0	62	46.9	74	54	-12	-7.12
5498	55.78	54.23	34.6	5.74	-35		-9.5	0	52	50.1	74	54	-22	-3.93
6145	55	52.7	34.4	6.08	-35		-9.5	0	51	48.7	74	54	-23	-5.32
7321	46.89	35.12	36	6.65	-35		-9.5	0	45	33.3	74	54	-29	-20.73
8247	42.78	36.48	36.5	7.6	-35		-9.5	0	42	36.1	74	54	-32	-17.92
9164	44.78	36.08	38.2	7.98	-35		-9.5	0	46	37.8	74	54	-28	-16.24
										<u>RES</u>	<u>VBW</u>			
N: Noise Floor			DIST: Distance Correction(9.5dB, 1meter)						PK: 1MHz		1MHz		PK: Peak	
AF: Antenna Factor			OTHER: High pass filter insertion loss						AV: 1MHz		10Hz		AV: Average	
AMP: Pre-amp gain			FSY Microwave high pass filter (f _o =1.802GHz)											
CL: Cable loss			DC: Duty Cycle correction factor applied to average readings only											
20 * log (M%)														
20*log (18.5 / 100 msec) = -14.6 dB														

Out-of-Band Emissions

Test Requirement: 15.249(C)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)

HP Spectrum Display/85662A (Cal Due: 09/99)

HP Quasi-Peak Detector/85650A (Cal Due: 09/99)

HP Pre-Amp(P5)/8447D (Cal Due: 09/99)

Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

Test Set-Up

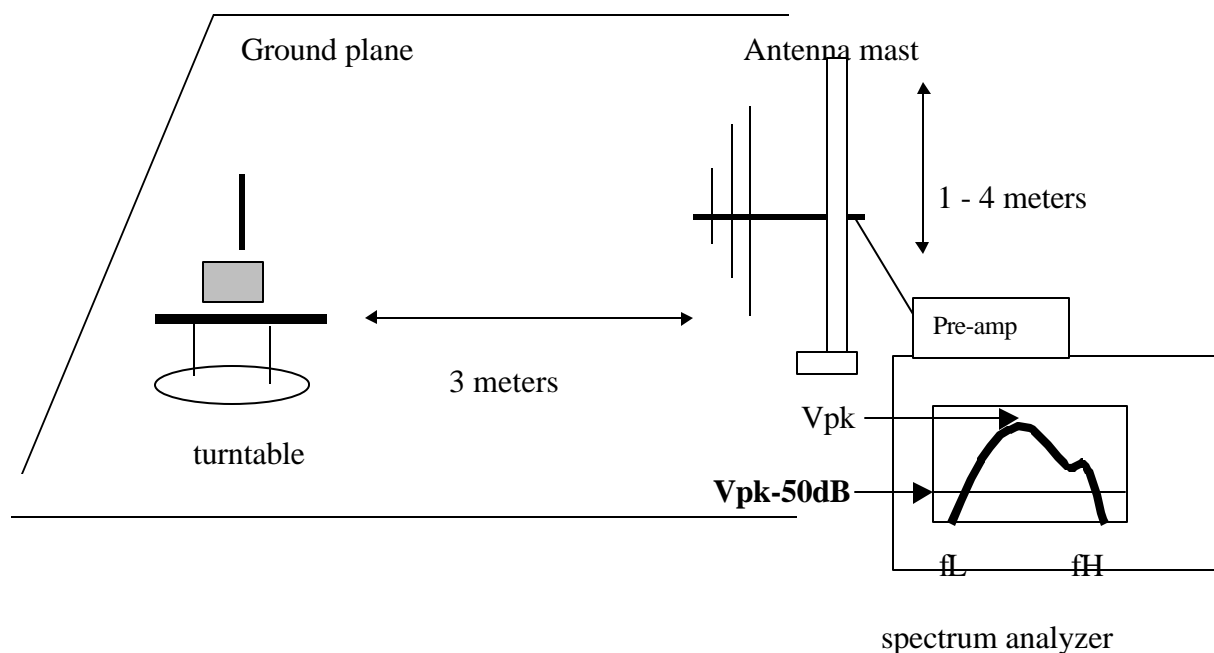


fig.2

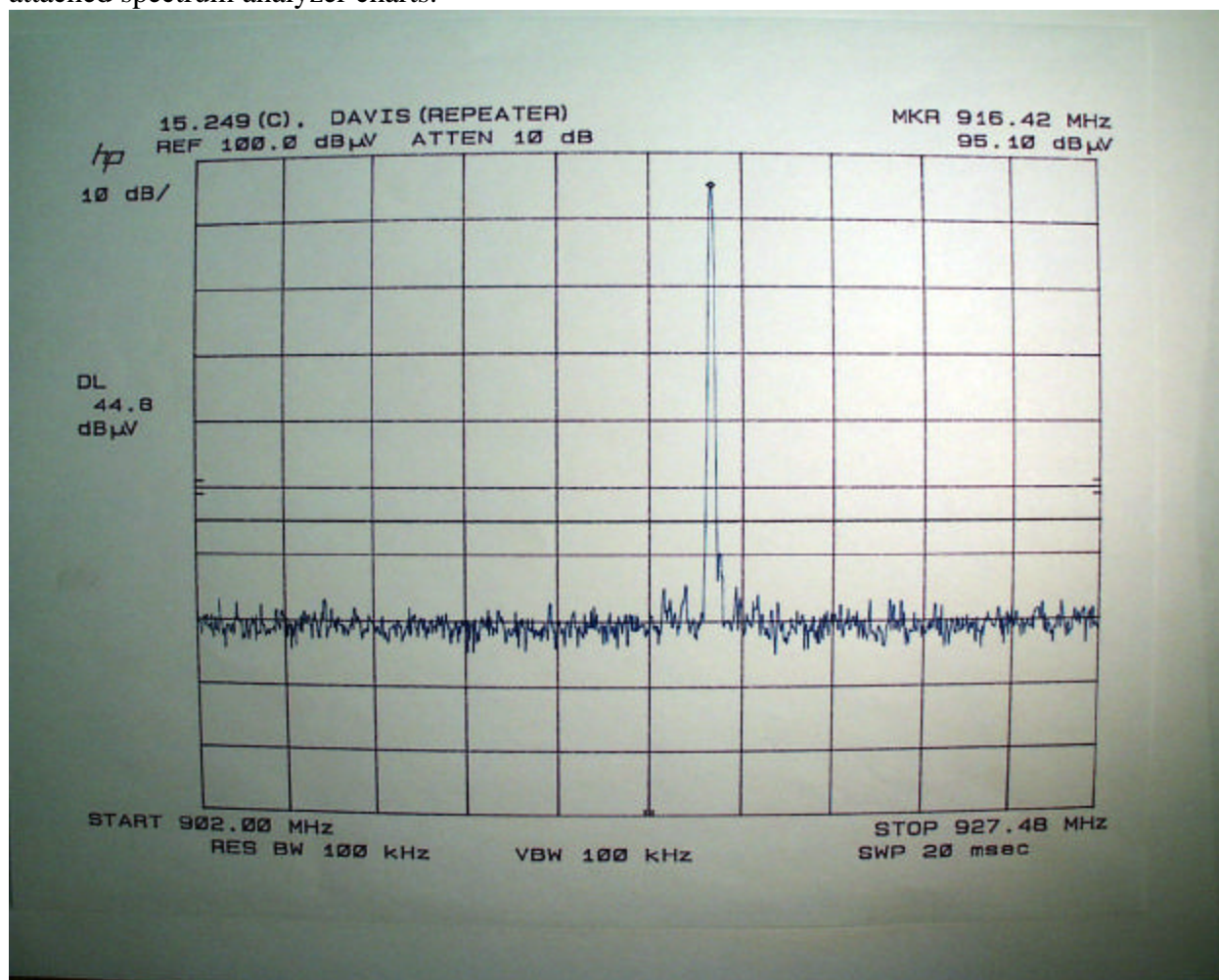
Test Procedures

1. The EUT was configured on wooden turntable as shown on figure 2. The log periodic search antenna was placed at a distance of 3 meters. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth, antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.
2. Spectrum analyzer START and STOP frequencies are set to the limits of the specified frequency band under which the EUT is operating, fL being the low end of the band, fH being the high end of the band. The DISPLAY LINE was set 50dB below the maximum peak of the signal. The EUT was set to operate on its lowest frequency.

3. While the transmitter is operating, the analyzer MAX HOLD function was used to capture the envelope of the transmitters occupied bandwidth.

Test Results:

All signals outside 902MHz and 928MHz were at least 50 dB below the fundamental. Refer to attached spectrum analyzer charts.

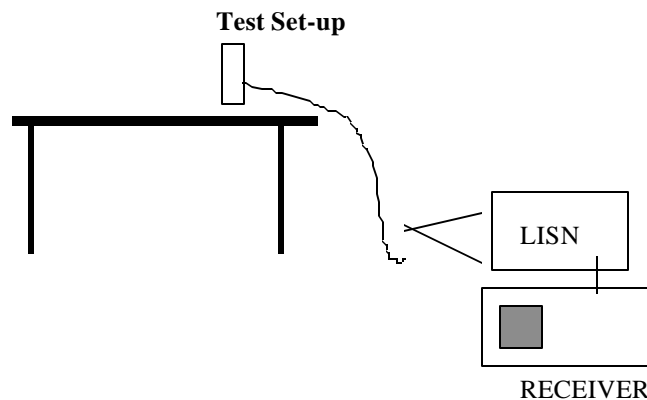


AC Line Conducted Emissions

Test Requirement: 15.207

Measurement Equipment Used:

Rhode & Schwarz EMI Receiver ESHS-20
Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

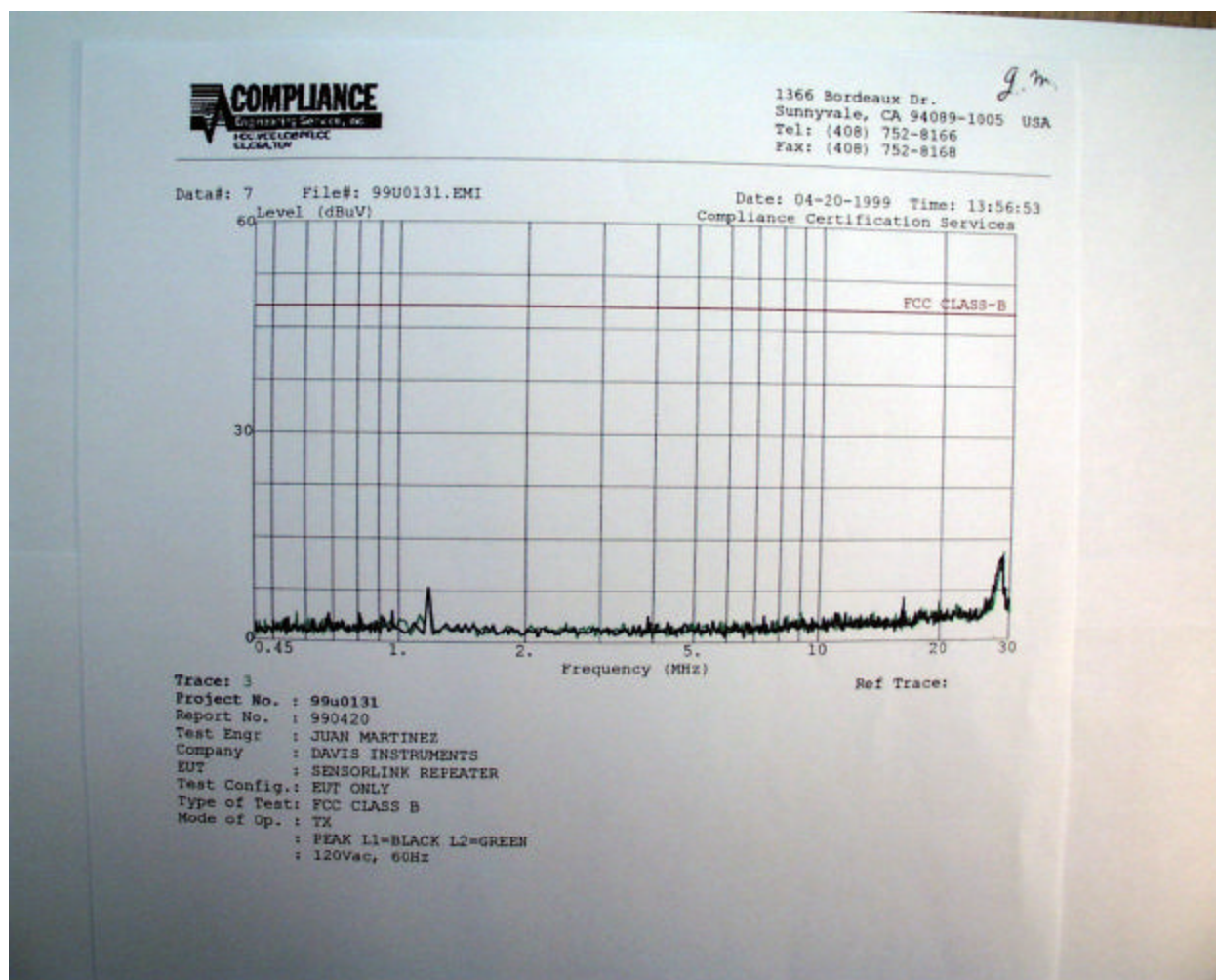


Test Procedure

1. The DC is supplied by a AC adapter. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in a normal hopping mode.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

Refer to attached graph.



EUT SETUP PHOTO



