

MEASUREMENT/TECHNICAL REPORT

HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.

MODEL : HLM-1510A

This report concerns(check one) : Original grant ☒ Class ☐ ±change ☐

Equipment type : LCD MONITOR

Deferred grant requested per 47 CFR 0.457(d)(1)(☐ ☒? yes ☐ no ☒

If yes, defer until: _____

_____ agrees to notify the Commission by _____

of the intended date of announcement of the product so that the grant can be issued on that date.

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TABLE OF CONTENTS

	PAGE
1. GENERAL INFORMATION.....	3
1.1 Product Description.....	3
1.2 Related submittal(s)/Grant(s).....	3
1.3 Tested System Details.....	4
1.4 Test Methodology.....	4
1.5 Test Facility.....	4
2. SYSTEM TEST CONFIGURATION.....	5
2.1 Justification.....	5
2.2 EUT Exercise Software.....	5
2.3 Cable Description.....	6
2.4 Noise Suppression Parts on Cable.....	6
2.5 Equipment Modifications.....	7
2.6 Configuration of Tested System.....	8
3. PRELIMINARY TESTS.....	9
3.1 Power line Conducted Emissions Tests.....	9
3.2 Radiated Emissions Tests.....	9
4. FINAL CONDUCTED AND RADIATED EMISSION TESTS SUMMARY.....	10
4.1 Conducted Emission Tests.....	10
4.2 Radiated Emission Tests.....	11
5. FIELD STRENGTH CALCULATION.....	12
ATTACHMENT A	ID Label / Location Info.
ATTACHMENT B.....	External Photos.
ATTACHMENT C	Block Diagram..
ATTACHMENT D	Test Setup Photos.
ATTACHMENT E	User's Manual.
ATTACHMENT F	Internal Photos.

1. GENERAL INFORMATION

1.1 Product Description

The Hyundai Electronics Industries Co., Ltd. Model (referred to as the EUT in this report) is a 15" COLOR LCD Monitor HOR. Freq. 68.7 kHz w/max. Resolution of 1024_i 768 Non-Interlaced.

Product specification information described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	PLASTIC
LIST OF EACH OSC. OR XTAL. FREQ.(FREQ. _i Å1MHz)	12 MHz 20 MHz
CHIPSET BRAND AND PART NO.	Pixelworks : PW164-10R SGS-TOMSON : TDA7496L AMERIX : ICS502M AMERIX : ICS501M TEXAS:SN74LVC126A TEXAS:SN74LVC541A
SPEAKER NO	T401S01G0050
POWER REQUIREMENT	100 - 240 VAC 50/60Hz 1.5A
NUMBER OF LAYERS	MAIN BOARD 4 LAYER OSD BOARD 2 LAYER POWER BOARD 2 LAYER INVERTER BOARD 2 LAYER LCD MODULE BOARD 6 LAYER
MAX. RESOLUTION	1024 X 768 NON-INTERLACED (@ 68.7 kHz/85 Hz)
H-SYNC FREQUENCY RANGE	31.3 kHz _i -68.7kHz
V-SYNC FREQUENCY RANGE	56 Hz _i -85 Hz
LCD SIZE	15" (HYUNDAI / Type : HT15X11-100)
USB CONNECTOR	DUAL TYPE
PHONE JACK PART NO.	TC38-009-01
VIDEO CONNECTOR TYPE	D-SUB 15-PIN

1.2 Related Submittal(s) / Grant(s)

ORIGINAL SUBMITTAL ONLY

1.3 Tested System Details

The Model names for all equipment, plus descriptions used in the tested system (including inserted cards) are:

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
LCD COLOR MONITOR(EUT)	HYUNDAI	HLM-1510A	CKLHLM1510A	HOST
PC(HOST)	COMPAQ	DESK Pro	DoC	N/A
USB Keyboard	Gateway	SK-9900V	DoC	EUT
USB Mouse	Gateway	3872F105	DoC	EUT
KEYBOARD	H/P	SK-2502C	DoC	HOST
EAR PHONE	LAB Tec	C33	N/A	EUT
PRINTER	H/P	HP895C	DoC	HOST
MODEM	3 COM	56K FAX Modem	DoC	HOST
VIDEO CARD	ATI	ATI RAGE PRO	DoC	HOST
MOUSE	H/P	M-S34	DZL211029	HOST

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4/1992. Radiated testing was performed at an antenna to EUT distance of 10 meters.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO, 467-701,KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission on May 22, 1997 and accepted dated July 25,1997(1300F2)

2.SYSTEM TEST CONFIGURATION

2.1 Justification

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following components and I/O cards inside the E.U.T were used.

DEVICE TYPE	MANUFACTURE	MODEL/PART NUMBER
MAIN BOARD	HYUNDAI	3041000979
ODS BOARD	HYUNDAI	3010700719
POWER BOARD	HYUNDAI	CHL-060-01HD2F
INVERTER	HYUNDAI	KLS742
LCD MODULE BOARD	HYUNDAI	46-602007

2.2 EUT exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software, contained on a 3-1/2 inch disc, was inserted into drive A and is auto starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is :(1) Display test, (2) RS 232 test (3) Key board test,(4) Printer test,(5) FDD test,(6) HDD test. The complete cycle takes about 20 seconds and is repeated continuously. As the keyboard and mouse are strictly input devices, no data is transmitted to them during test. They are however, continuously scanned for data input activity. The video resolution modes setup and change program was used during the radiated and conducted emission testing.

2.3 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
PC(HOST)	N	N/A	1.8(P)
LCD COLOR MONITOR(EUT)	N	Y	1.8(P), 1.5(D)
PRINT	N	Y	2.0(P),1.5(D)
USB KEYBOARD	N/A	Y	1.8(D)
USB MOUSE	N/A	Y	0.8(D)
USB CABLE	N/A	Y	1.8(D)
KEYBOARD	N/A	Y	2.0(D)
AUDIO CABLE	N/A	Y	1.5(D)
EAR PHONE	N/A	N	2.4(D)
MODEM	N	Y	2.0(P),1.5(D)
MOUSE(PS/2)	N/A	Y	1.8(D)

The marked "(D)" means the Data Cable and "(P)" means the Power Cable.

2.4 Noise Suppression Parts on Cable.

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
PC(HOST)	N	N/A	N	N/A
COLOR MONITOR(EUT)	Y	PC END	Y	PC END
PRINT	N	N/A	Y	BOTH END
USB KEYBOARD	Y	EUT END	N	N/A
USB MOUSE	N	N/A	N	N/A
USB CABLE	N	N/A	N	N/A
KEYBOARD	N	N/A	N	N/A
AUDIO CABLE	Y	PC END	N	N/A
EAR PHONE	N	N/A	N	N/A
MODEM	N	N/A	Y	BOTH END
MOUSE(PS/2)	N	N/A	N	N/A

2.5 Equipment Modifications

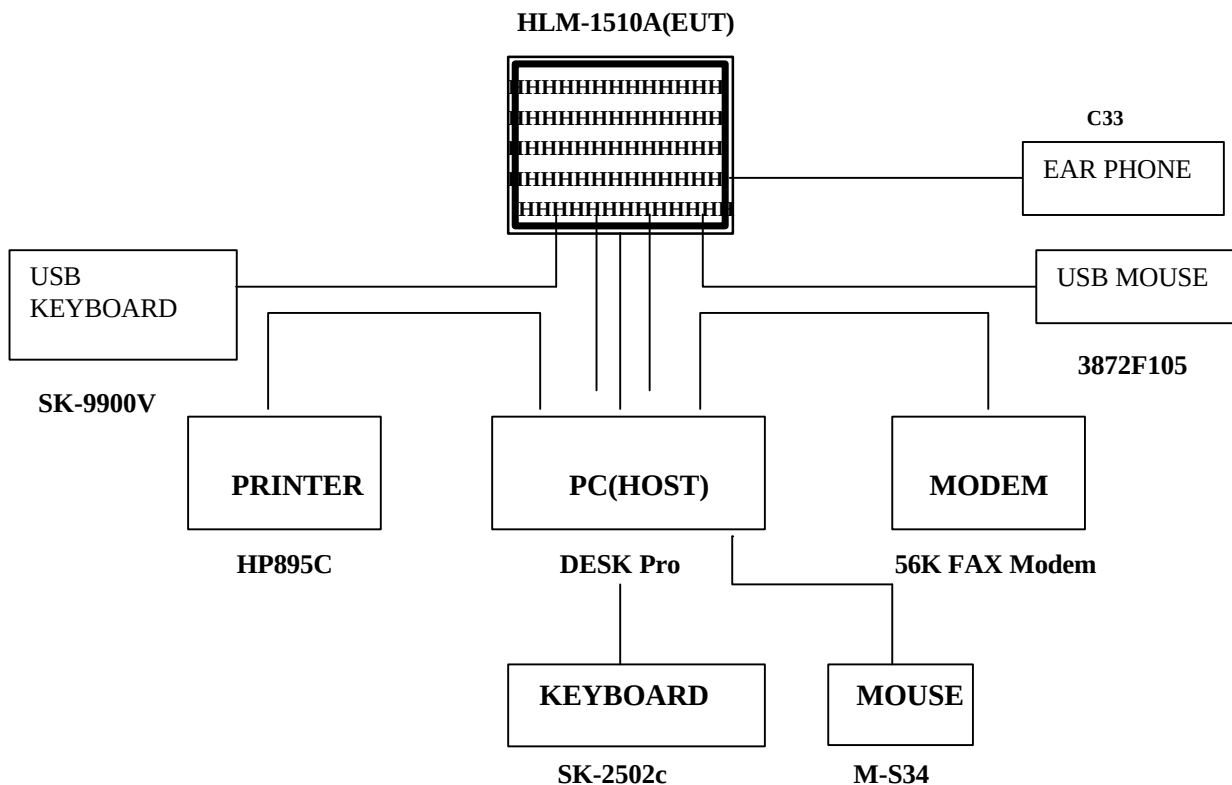
N/A

2.6 Configuration of Test system

Line Conducted Test : EUT was connected to LISN, all other supporting equipment were connected to another LISN.
Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.4/1992 7.2.3 to determine the worse operating conditions.

Radiated Emission Test : Preliminary Radiated Emissions tests were conducted using the procedure in ANSI C63.4/1992 8.3.1.1 to determine the worse operating condition. Final Radiated Emission tests were conducted at 3 meter open area test site.

[Configuration of Tested System]



3. PRELIMINARY TESTS

3.1 AC Power line Conducted Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)		The worst operating condition
Pentium 350 MHz	1024 x 768	Non-Interlaced (68.7kHz/85Hz)	X
Pentium 350 MHz	800 x 600	Non-Interlaced (53.6 kHz/85Hz)	
Pentium 350 MHz	640 x 480	Non-Interlaced (43.3 KHz/85Hz)	
Pentium 350 MHz	640 x 350	Non-Interlaced (31.5 KHz/70Hz)	

4.2 Radiated Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)		The worst operating condition
Pentium 350 MHz	1024 x 768	Non-Interlaced (68.7kHz/85Hz)	X
Pentium 350 MHz	800 x 600	Non-Interlaced (53.6 kHz/85Hz)	
Pentium 350 MHz	640 x 480	Non-Interlaced (43.3 KHz/85Hz)	
Pentium 350 MHz	640 x 350	Non-Interlaced (31.5 KHz/70Hz)	

Tested by Ja Beom, Koo

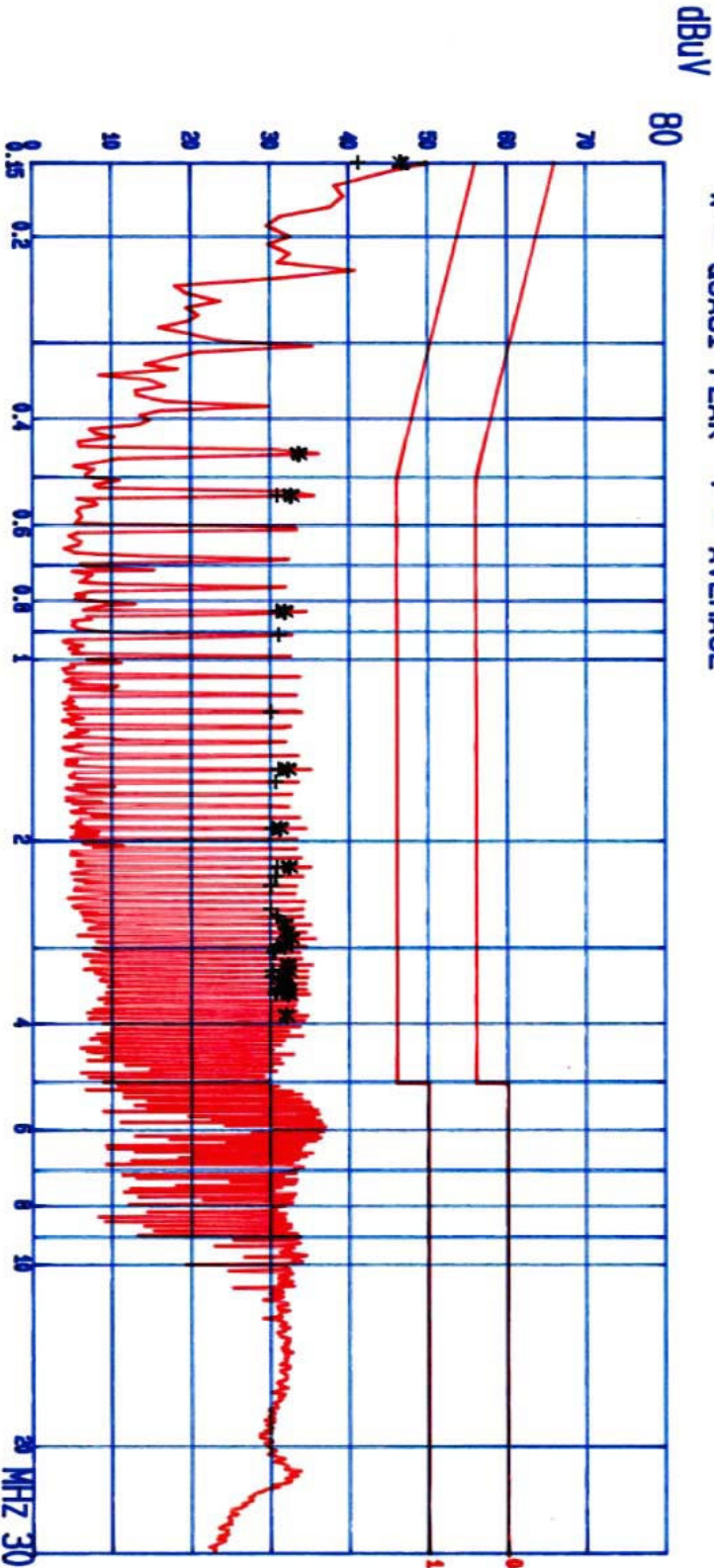
Date : MAR. 2. 2000

HYUNDAI
RFI Voltage Test

E.U.T.:
Operator: HLM-1510A
Test Spec: 4024 W 768 (41-68.7KHz V1-8MHz)
EN 55022 CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW KHz	Detect type	Atten dB	Meas. T. s	Traced. type
0.1500	5.0000	10	Peak	LD	0.010	
5.0000	30.0000	10	Peak	LN	0.010	

Final evaluation: Quasi Peak/average
* = QUASI PEAK + = AVERAGE



HYUNDAI
RFI Voltage Test

E.U.T.:
Oper. Condition: HLM-1510A
Operator: 1024 W 768 (HF-SS, 7KHz VF-SSHz)
Test Spec: EN 55022 CLASS B

Start Fr. Stop Fr. IF-SW Detec Att. Meas.T. Transd.
MHz MHz kHz for dB s type
0.1500 5.0000 10 Peak LD 0.010
5.0000 50.0000 10 Peak LN 0.010

Quasi Peak values		G-Peak		G-Margin dB
Frequency MHz	Peak dBuV	dBuV	dBuV	
0.1500	49.8	46.6	-9.4	
0.4280	36.2	33.6	-15.2	
0.5350	35.7	32.7	-15.3	
0.8360	34.6	31.8	-14.2	
1.5220	35.3	32.2	-15.6	
1.8000	34.6	31.2	-14.6	
2.2080	35.2	32.4	-15.6	
2.7400	35.2	31.9	-14.1	
2.8170	34.7	32.0	-14.0	
2.8940	35.6	32.7	-15.3	
2.8710	34.6	31.8	-14.2	
3.1960	35.4	32.2	-15.8	
3.2718	34.9	32.3	-15.7	
3.3490	34.8	31.9	-14.1	
3.4260	34.6	31.7	-14.3	
3.5030	34.7	32.3	-15.7	
3.5800	35.0	32.2	-15.6	
3.6610	34.9	32.0	-14.0	
Average values				
Frequency MHz	Peak dBuV	Average dBuV	Average-Margin dB	
0.1500	49.8	41.3	-84.7	
0.4280	36.2	33.7	-23.1	
0.5350	35.7	30.8	-25.2	
0.8360	34.6	30.9	-25.1	
0.9130	32.6	31.0	-25.0	
1.2210	34.0	30.1	-25.9	
1.5220	35.3	31.1	-24.9	
1.5990	33.6	30.6	-25.4	
1.8000	34.6	30.3	-25.7	
2.2080	35.2	30.9	-25.1	
2.2850	34.2	30.6	-25.4	
2.3620	33.5	30.1	-25.9	
2.5860	34.3	30.1	-25.9	
2.6629	34.2	30.8	-25.2	
2.8710	34.6	30.8	-25.2	
3.0480	33.8	30.5	-25.5	
3.2718	34.8	30.2	-25.8	
3.3490	34.9	30.2	-25.6	
3.5030	34.7	30.9	-25.1	
3.5800	35.0	30.6	-25.4	

W Limit exceeded

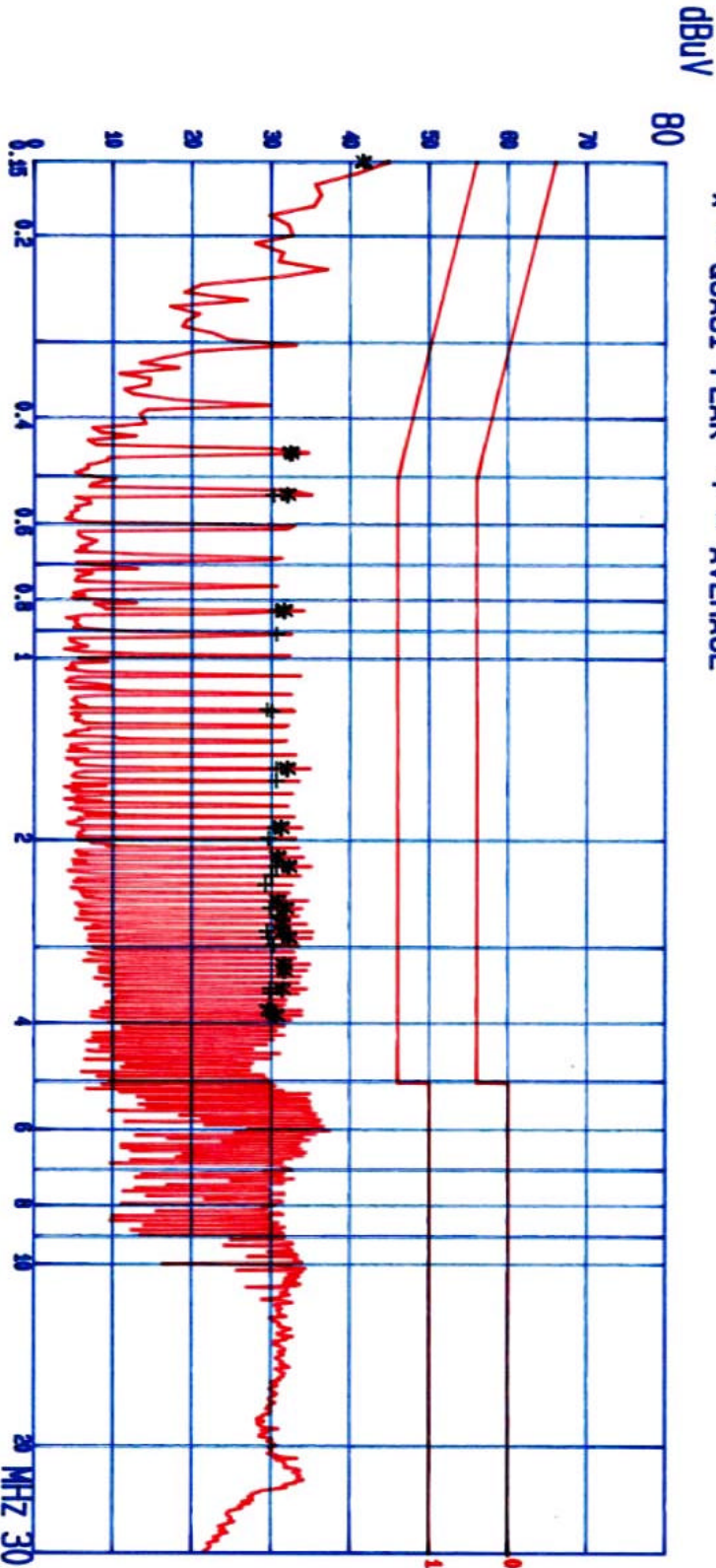
POWER LINR POLARITY : HOT

HYUNDAI
RFI Voltage Test

E.U.T.:
Operator: HLM-1510A
Test Spec: 1024 * 768 (44-68.7KHz V7-8GHz)
EN 55022 CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW KHz	Detec tor	Att. dB	Meas.T. s	Transd. type
0.1500	5.0000	30.0000	10	Peak	LD	0.010
5.0000	30.0000	10	Peak	LN	0.010	

Final evaluation: Quasi Peak/average
* = QUASI PEAK + = AVERAGE



POWER LINR POLARITY : NEUTRAL

HYUNDAI
RFI Voltage Test

E.U.T.: HLM-1510A
Oper. Condition: 1024 W 768 (Mf-GS.7KHz Vf-80Hz)
Operator:
Test Spec: EN 55022 CLASS B

Start Fr. Stop Fr. If-SM Detec Att. Meas.T. Trained.
MHz MHz KHz tor dB u type
0.1500 5.0000 10 Peak LD 0.010
5.0000 30.0000 10 Peak LN 0.010

Guest Peak values			0-Peak GP-Margin	
Frequency MHz	Peak dBuV		dBuV	dB
0.1500	44.9		41.7	-14.3
0.4350	34.8		32.5	-14.3
0.6350	36.2		32.0	-14.0
0.8350	34.3		31.5	-14.4
1.0350	35.1		32.1	-13.9
1.2000	34.1		31.2	-14.8
1.3000	34.2		30.8	-15.2
1.4000	35.3		32.3	-13.7
1.5000	34.8		30.8	-15.2
1.6000	34.1		31.8	-14.2
1.7400	34.7		31.4	-14.6
1.8170	35.5		31.5	-14.5
1.8840	35.2		32.2	-13.8
1.9550	35.0		31.7	-14.3
1.9719	34.5		31.7	-14.3
1.9930	34.7		31.4	-14.6
1.9940	34.0		29.7	-16.3
1.9910	34.0		30.7	-15.3
Average values				
Frequency MHz	Peak dBuV	Average dBuV	Average-Margin	
			dB	
0.4350	34.9	32.7	-24.1	
0.6350	35.2	30.2	-25.8	
0.8350	34.3	30.7	-25.3	
0.9130	32.6	30.7	-25.3	
1.1440	32.6	29.4	-26.6	
1.2210	33.1	30.0	-26.0	
1.3250	33.1	30.6	-25.4	
1.5580	33.7	30.5	-25.4	
1.9000	34.1	30.5	-25.5	
1.9770	33.2	29.6	-26.4	
1.9980	35.3	30.5	-25.4	
2.2850	33.9	30.1	-25.9	
2.3650	32.8	29.2	-26.8	
2.5560	34.1	29.8	-25.2	
2.6539	33.7	30.8	-25.2	
2.8170	35.5	29.5	-26.5	
2.8940	35.2	29.7	-26.3	
2.9710	33.7	30.3	-26.7	
2.9930	34.7	29.9	-26.1	
2.9900	33.6	29.8	-26.2	

W Limit exceeded

POWER LINR POLARITY : NEUTRAL

5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The 30 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 21.5 + 7.4 + 1.1 = 30 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(30 \text{ dBuV/m})/20] = 31.6 \text{ uV/m}$$