

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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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 \times 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. \pm 1MHz) | 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 \pm 68.7kHz |
| V-SYNC FREQUENCY RANGE | 56 Hz \pm 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

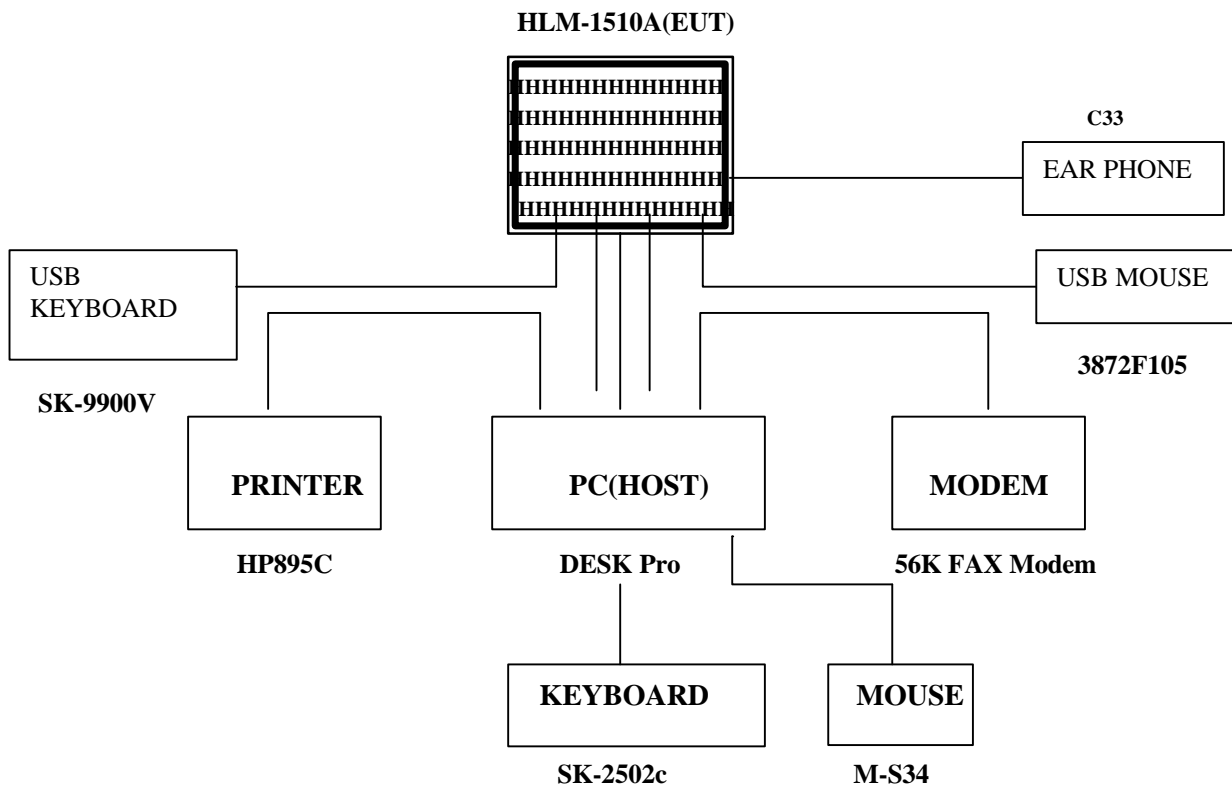
N/A

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

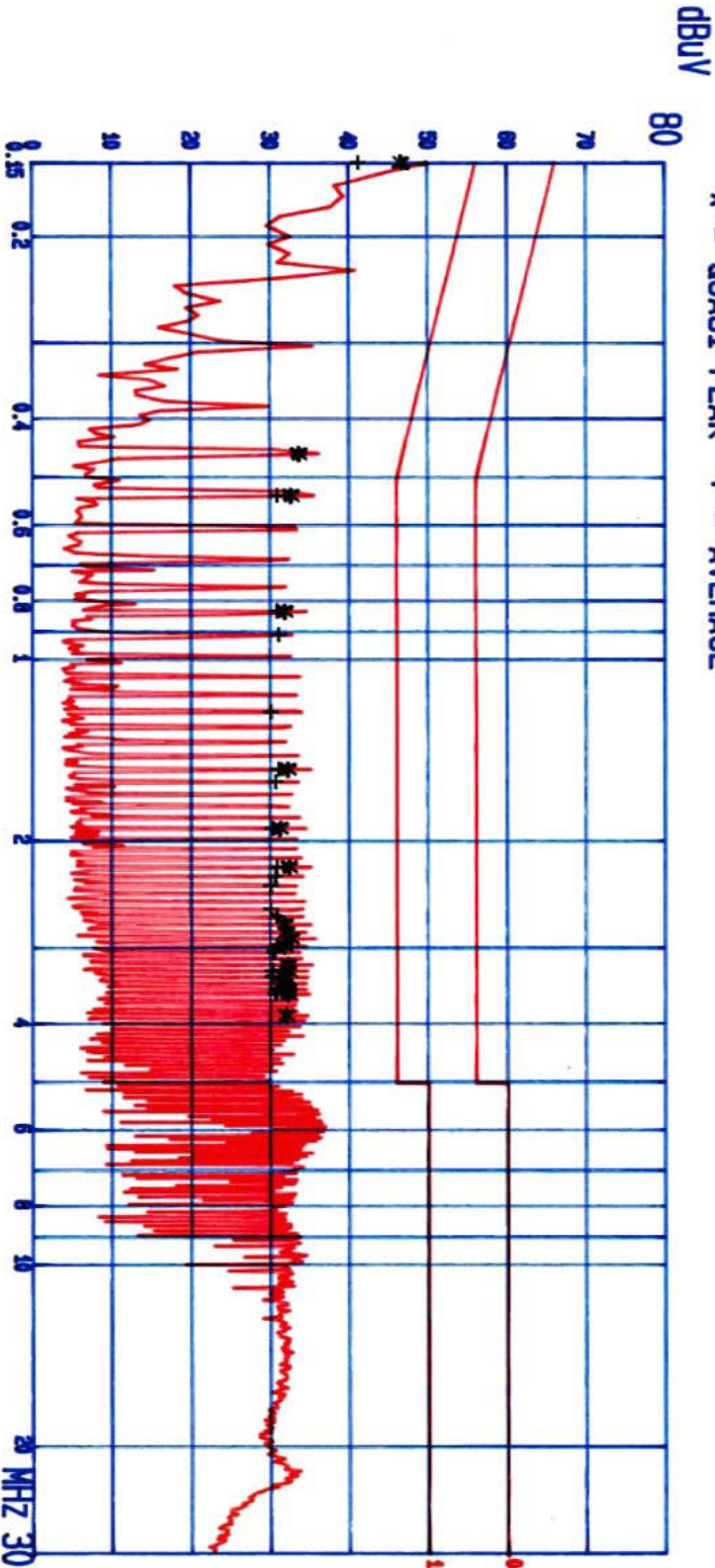
Date : MAR. 2. 2000

HYUNDAI
RFI Voltage Test

E.U.T.:
Operator: HLM-1510A
Test Spec: 4024 W 768 (41-68.7KHz V1-80Hz)
EN 55022 CLASS B

| Start Fr. MHz | Stop Fr. MHz | IF-BW KHz | Detec tor | Att. 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



POWER LINR POLARITY : HOT

HYUNDAI
RFI Voltage Test

E.U.T.: HLM-1510A
Oper. Condition: 1024 W 768 (HF-SS, 7KHz VF-SSHz)
Operator:
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 | -13.2 | |
| 0.5350 | 35.7 | 32.7 | -13.3 | |
| 0.8360 | 34.6 | 31.8 | -14.2 | |
| 1.5220 | 35.3 | 32.2 | -13.6 | |
| 1.8000 | 34.6 | 31.2 | -14.6 | |
| 2.2080 | 35.2 | 32.4 | -13.6 | |
| 2.7400 | 35.2 | 31.9 | -14.1 | |
| 2.8170 | 34.7 | 32.0 | -14.0 | |
| 2.8940 | 35.6 | 32.7 | -13.3 | |
| 2.8710 | 34.6 | 31.8 | -14.2 | |
| 3.1950 | 35.4 | 32.2 | -13.6 | |
| 3.2718 | 34.9 | 32.3 | -13.7 | |
| 3.3490 | 34.8 | 31.9 | -14.1 | |
| 3.4260 | 34.6 | 31.7 | -14.3 | |
| 3.5030 | 34.7 | 32.3 | -13.7 | |
| 3.5800 | 35.0 | 32.2 | -13.6 | |
| 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 | |
| 2.5850 | 34.3 | 30.1 | -25.9 | |
| 2.6529 | 34.2 | 30.8 | -25.2 | |
| 2.8710 | 34.6 | 30.8 | -25.2 | |
| 3.0480 | 33.6 | 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 | |

* Limit exceeded

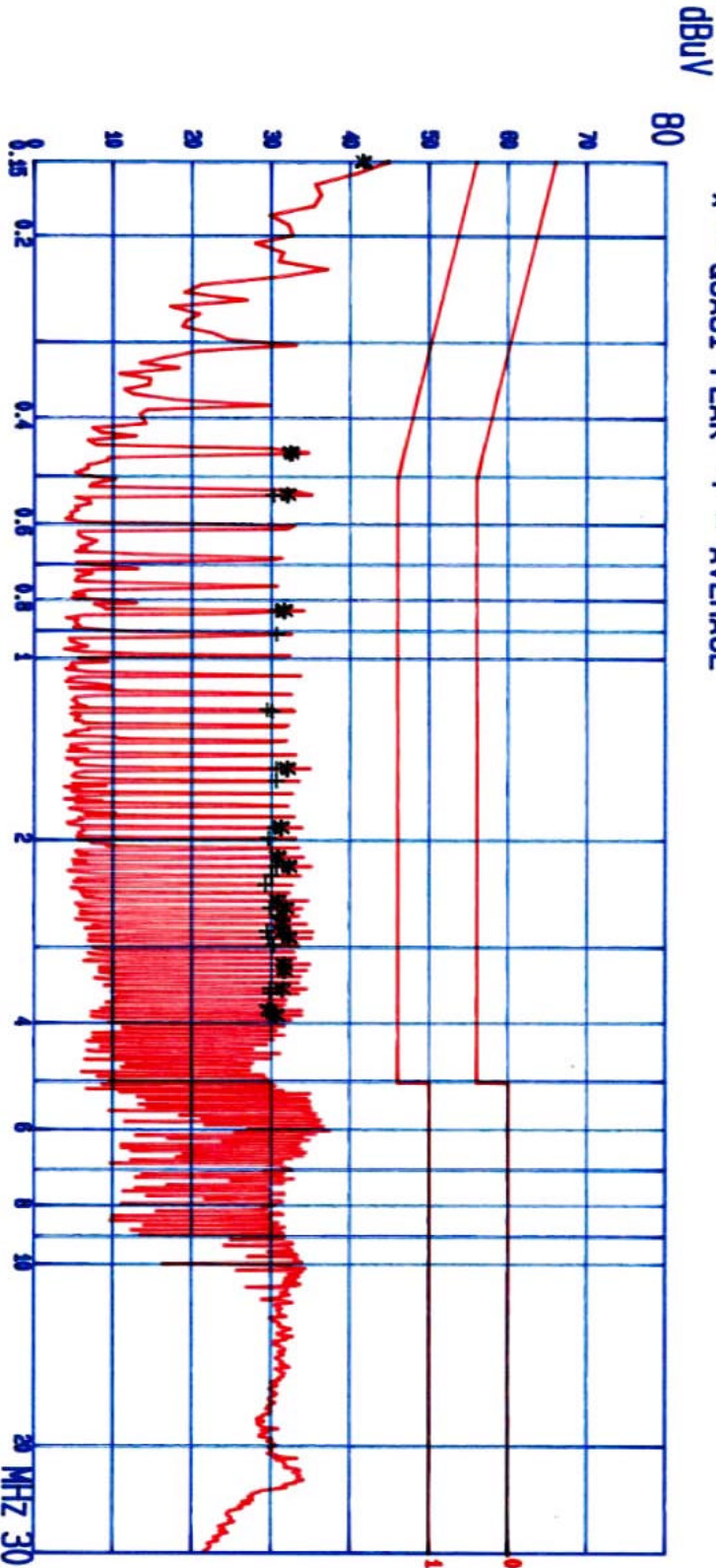
POWER LINR POLARITY : HOT

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 | 10 | Peak | LD | 0.010 | |
| 5.0000 | 30.0000 | 10 | Peak | LN | 0.010 | |

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



POWER LINE POLARITY : NEUTRAL

HYUNDAI

RFI Voltage Test

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

Start Fr. Stop Fr. IF-BW Detec Att. Meas.T. Trand.
 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

| Query 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 |
| 1.5000 | 35.3 | 32.3 | -13.7 |
| 1.6000 | 34.8 | 30.8 | -15.2 |
| 1.8000 | 34.1 | 31.8 | -14.2 |
| 2.0000 | 34.7 | 31.4 | -14.6 |
| 2.1700 | 35.5 | 31.5 | -14.5 |
| 2.3240 | 35.2 | 32.2 | -13.8 |
| 2.4000 | 35.0 | 31.7 | -14.3 |
| 2.6718 | 34.5 | 31.7 | -14.3 |
| 2.8030 | 34.7 | 31.4 | -14.6 |
| 2.8040 | 34.0 | 29.7 | -16.3 |
| 2.8810 | 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 |
| 1.2140 | 32.6 | 29.4 | -26.6 |
| 1.2210 | 33.1 | 30.0 | -26.0 |
| 1.5250 | 35.1 | 30.5 | -25.4 |
| 1.5580 | 33.7 | 30.5 | -25.4 |
| 1.9000 | 34.1 | 30.5 | -25.5 |
| 1.9770 | 33.2 | 29.5 | -25.4 |
| 2.0080 | 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 | 30.5 | -25.2 |
| 2.8170 | 35.5 | 29.5 | -26.5 |
| 2.8540 | 35.2 | 29.7 | -26.3 |
| 2.8710 | 33.7 | 30.3 | -25.7 |
| 2.8030 | 34.7 | 29.9 | -25.1 |
| 2.8800 | 33.6 | 29.8 | -25.2 |

M 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.

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

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