

# Electromagnetic Emission

## FCC MEASUREMENT REPORT

### CERTIFICATION OF COMPLIANCE

### FCC Part 15 Certification Measurement

**PRODUCT** : TFT-LCD Monitor  
**MODEL/TYPE NO** : NACO 170D  
**FCC ID** : RF6NACO170D  
**APPLICANT** : ALL IN ONE DISPLAY.INC.  
3F, C-dong., Micro office B/D 554-2, Gasan-Dong,  
Gumchun-Ku, Seoul, Korea  
Attn. : Ji-Hong, Jung / Deputy General Manager  
**FCC CLASSIFICATION** : Class B personal computers and peripherals  
**FCC RULE PART(S)** : FCC Part 15 Subpart B  
**FCC PROCEDURE** : Certification  
**TRADE NAME** : AOD  
**TEST REPORT No.** : E04.0803.FCC.436N  
**DATES OF TEST** : July 21 ~ 25, 2004  
**DATES OF ISSUE** : July 27, 2004  
**TEST LABORATORY** : ETL Inc. ( FCC Registration Number : 95422)  
#584 Sangwhal-ri, Kanam-myon, Yoju-kun, Kyonggi-do,  
469-880, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074

This TFT-LCD Monitor, Model NACO 170D has been tested in accordance with the measurement procedures specified in ANSI C63.4-1992 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B :

I attest to the accuracy of data. All measurement herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

*Yo Han, Park*

Yo Han, Park / Chief Engineer

**ETL Inc.**

**#584 Sangwhal-ri, Kanam-myon, Yoju-kun,  
Kyonggi-do, 469-880, Korea**



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**Scope** – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

## General Information

**Applicant Name** : ALL IN ONE DISPLAY,INC.

**Address** : 3F, C-dong., Micro office B/D 554-2, Gasan-Dong,  
Gumchun-Ku, Seoul, Korea

**Attention** : Ji-Hong, Jung / Deputy General Manager

- **EUT Type** : TFT-LCD Monitor
- **Model Number** : NACO 170D
- **FCC ID** : RF6NACO170D
- **S/N** : N/A
- **FCC Rule Part(s)** : FCC Part 15 Subpart B
- **Test Procedure** : ANSI C63.4-1992
- **FCC Classification** : Class B personal computers and peripherals
- **Dates of Tests** : July 27, 2004  
ETL Inc.  
EMC Testing Lab (FCC Registration Number : 95422)
- **Place of Tests** : 584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,  
Kyounggi-Do, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074
- **Test Report No.** : E04.0803.FCC.436N

## 1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyonggi-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-1992 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission(Registration Number : 95422 ).

The measurement procedure described in American national standard for method of measurement of radio-noise emission from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the ALL IN ONE DISPLAY.INC. Model: NACO 170D

## 2. PRODUCT INFORMATION

### 2.1 General Remark

The Equipment Under Test (EUT) is the ALL IN ONE DISPLAY.INC., TFT-LCD Monitor, NACO 170D & NACO 170A has a minor changes to the basic model.

**Model Difference:** Basic model name: NACO 170D  
Multi listing model name: NACO 170A

#### Technical Deviation:

| Model Classification |           | Function |     |
|----------------------|-----------|----------|-----|
|                      |           | DVI      | RGB |
| Basic model          | NACO 170D | O        | O   |
| Multi listing model  | NACO 170A | X        | O   |

### 2.2 Equipment Description

The Equipment Under Test (EUT) is the ALL IN ONE DISPLAY.INC., TFT-LCD Monitor, NACO 170D

### 2.3 General Specification

|                              |                                                                                                                                                                                                                                            |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Display</b>               | Type - 17" Color Active Matrix TFT LCD<br>Color - 16.2M Color<br>Pixel - 0.264 x 0.264 mm<br>Screen Size - 337.92 (H) x 270.336 (V) mm<br>Resolution (Max) - 1280 x 1024 at 60 to 75Hz<br>Contrast Ratio - 500:1<br>Brightness - 300 cd/m2 |
| <b>Video Frequency</b>       | Horizontal: 56 ~ 75Hz<br>Vertical: 31.5 ~ 80KHz                                                                                                                                                                                            |
| <b>Power Consumption</b>     | Operation Mode: 35 watt max.<br>Stand-by: 4 watt max.                                                                                                                                                                                      |
| <b>Temperature</b>           | Operation Mode : 0 °C ~ 40 °C<br>Stand-by: -20 °C ~ 60 °C                                                                                                                                                                                  |
| <b>Humidity</b>              | Operation Mode: 10% ~ 85% R.H.<br>Stand-by: 90% R.H. Max.                                                                                                                                                                                  |
| <b>User's Mode (OSD Key)</b> | Menu / Enter / Down / Up / Power                                                                                                                                                                                                           |
| <b>Dimension</b>             | Retail Box: 435 (W) x 510 (D) x 154 (H) mm                                                                                                                                                                                                 |
| <b>Weight</b>                | 5.0kg                                                                                                                                                                                                                                      |

## 3. DESCRIPTION OF TESTS

### 3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with § 12.2 in ANSI C63.4-1992 "measurement of information technology equipment ". The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a 50Ω/50uH LISN as the input transducer to a spectrum analyzer or a field intensity meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

#### - Procedure of Test

The line-conducted facility is located inside a shielded room 1 m X 1.5 m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5 m away from the side wall of the shielded room. Ground of two EMCO 3825/2 LISN are bonded to the reference horizontal ground. The EUT is powered from the EMCO LISN and the support equipment is powered from the other EMCO LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. Non-inductive bundling to a 1m length shortened all interconnecting cables more than 1m. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the ESHS30 EMI Test Receiver to determine the frequency producing the max. emission from the EUT. The frequency producing the max. level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

## 3. DESCRIPTION OF TESTS

### 3.2 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-1992 "measurement of information technology equipment ". The measurements were performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a spectrum analyzer or a field intensity meter. The measurements were made with the detector set for "Quasi-peak" within a bandwidth of 120 kHz.

#### - Procedure of Test

Preliminary measurements were made at 3 meter using broadband antennas, and spectrum analyzer to determined the frequency producing the max. emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000 MHz using SchwarzBeck Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10-meters. The test equipment was placed on a wooden turn-table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the max. emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

## 4. TEST CONDITION

### 4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

### 4.2 EUT operation

| Operating Mode                                      | The worst operating condition |
|-----------------------------------------------------|-------------------------------|
| Stand-by mode                                       | ×                             |
| Test program executed<br>("H" pattern display mode) |                               |

: Worst case investigated during the test.

### 4.3 Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

#### EUT – TFT-LCD Monitor

FCC ID : RF6NACO170D  
Model Name : NACO 170D  
Serial No. : N/A  
Manufacturer : ALL IN ONE DISPLAY.INC.  
Power Supply Type : Adapter  
Input - AC100-240V 50/60Hz 1.2A, Output – DC+12V 3.5A  
Power Cord : Non-Shielded, Detachable: 1.5 m  
Data Cable : 1.8 m Shielded RGB Cable, 1.8 m Shielded DVI Cable,  
1.5 m Shielded Adapter Cable

#### Support unit 1 – Personal computer (DELL)

FCC ID : N/A (DoC)  
Model Name : DHM  
Serial No. : H9MB71S  
Manufacturer : DELL  
Power Supply Type : Switching  
Power Cord : Non-Shielded, Detachable: 1.2 m  
Data Port : RGB IN:1, Parallel:1, RS-232:1, PS/2: 2, USB: 4, RJ-45:1  
Audio in:1, Audio out:1, MIC IN:1

#### Support unit 2 –Keyboard (COMPAQ)

FCC ID : N/A (DoC)  
Model Name : KB-9963  
Serial No. : B26960GBUKO13F  
Manufacturer : COMPAQ  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.5m

**Support unit 3 – Mouse (LOGITECH)**

FCC ID : DZL211029  
Model Name : M-S34  
Serial No. : LZC01002314  
Manufacturer : LOGITECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : None-Shielded, 1.2m

**Support unit 4 – USB Mouse (N/A)**

FCC ID : N/A  
Model Name : HL898W  
Serial No. : HL80811837  
Manufacturer : N/A  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.2m

**Support unit 5 – Serial Mouse (PETRA)**

FCC ID : JKGMUS5S01  
Model Name : MUS5S  
Serial No. : E183027  
Manufacturer : PETRA  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.2m

**Support unit 6 – Printer (SINDO RICOH)**

FCC ID : N/A  
Model Name : Color cap 330  
Serial No. : 11-03098  
Manufacturer : LEXMARK INTERNATIONAL INC.  
Power Supply Type : AC 110V~220V  
Power Cord : Non-Shield, 1.5m  
Data Cable : Shielded, 1.5m

**Support unit 7 – EAR-MIC (JETECH)**

FCC ID : N/A  
Model Name : JE101  
Serial No. : N/A  
Manufacturer : JETECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.5m

## 5. TEST RESULTS

### 5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

| Test Rule Parts | Measurement Required            | Result             |
|-----------------|---------------------------------|--------------------|
| 15.107          | Conducted emissions measurement | Passed by 15.75 dB |
| 15.109          | Radiated emissions measurement  | Passed by 4.83 dB  |

The data collected shows that the **ALL IN ONE DISPLAY.INC. / TFT-LCD Monitor / NACO 170D** complies with technical requirements of above rules part 15.107 and 15.109 Class B Limits and CISPR Publication 22.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

## 5. TEST RESULTS

### 5.2 Conducted Emissions Measurement

|                       |                                           |
|-----------------------|-------------------------------------------|
| EUT                   | TFT-LCD Monitor / NACO 170D (SN: N/A)     |
| Limit apply to        | FCC Part 15. 107(CISPR Pub.22 Class B)    |
| Test Date             | July 21, 2004                             |
| Operating Condition   | Full "H" pattern display(1280*1024, 75Hz) |
| Environment Condition | Humidity Level: 44 %RH, Temperature: 23   |
| Result                | Passed by 15.75 dB                        |

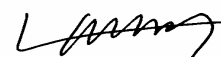
### Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarizations of hot and neutral line.  
Detector mode: CISPR Quasi-Peak mode ( 6dB Bandwidth : 9 KHz )

| Frequency<br>[MHz] | Reading<br>[dB $\mu$ V] |         | Phase<br>[ *H/ **V<br>] | Limit<br>[dB $\mu$ V] |         | Margin<br>[dB] |         |
|--------------------|-------------------------|---------|-------------------------|-----------------------|---------|----------------|---------|
|                    | Quasi-peak              | Average |                         | Quasi-peak            | Average | Quasi-peak     | Average |
| 0.156              | 46.45                   |         | H                       | 65.67                 |         | 19.22          |         |
| 0.185              | 42.72                   |         | H                       | 64.26                 |         | 21.54          |         |
| 0.415              | 37.57                   |         | N                       | 57.55                 |         | 19.98          |         |
| 0.538              | 40.25                   |         | N                       | 56.00                 |         | 15.75          |         |
| 0.600              | 35.85                   |         | N                       | 56.00                 |         | 20.15          |         |
| 2.200              | 35.12                   |         | N                       | 56.00                 |         | 20.88          |         |

#### NOTES:

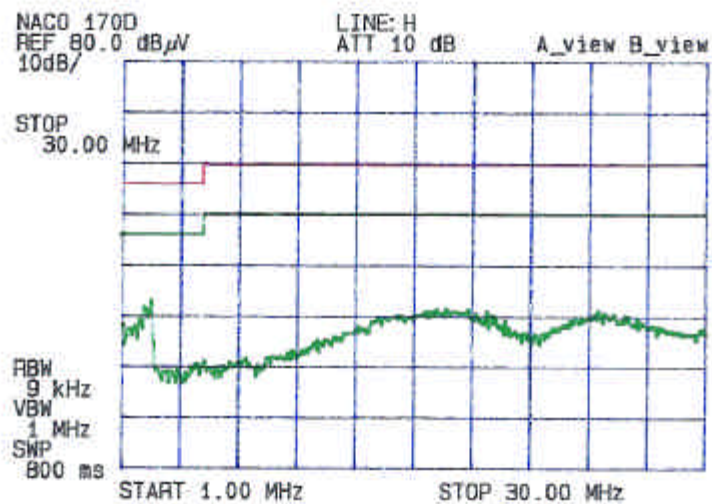
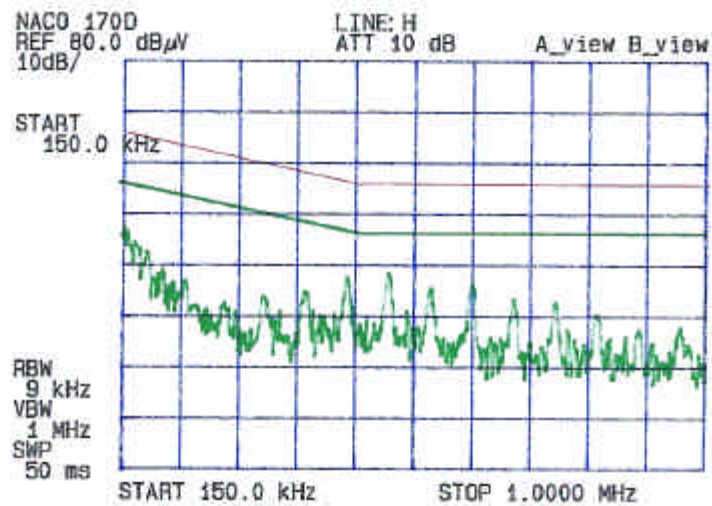
- \* H : HOT Line , \*\*N : Neutral Line
- Margin value = Limit – Reading
- Measurement were performed at the AC/DC adapter in the frequency band of 150 kHz ~ 30 MHz according to the CISPR 22 Class B
- If the reading Quasi-Peak value is bellowed the average limit, do not test average mode.



Test Engineer: H. S. Lee

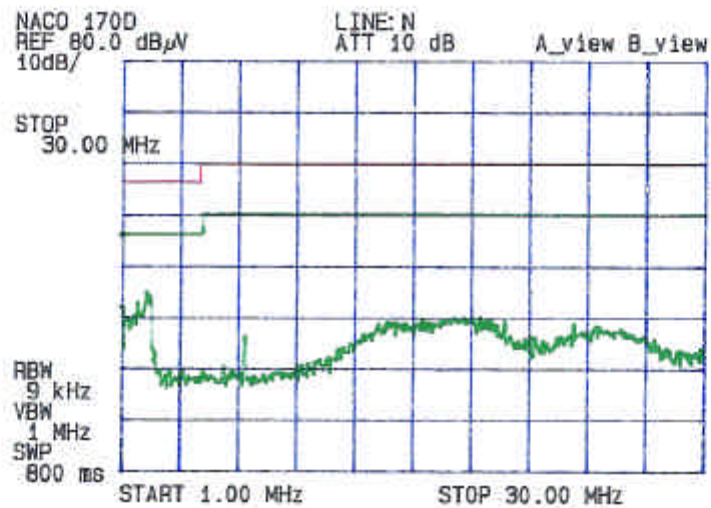
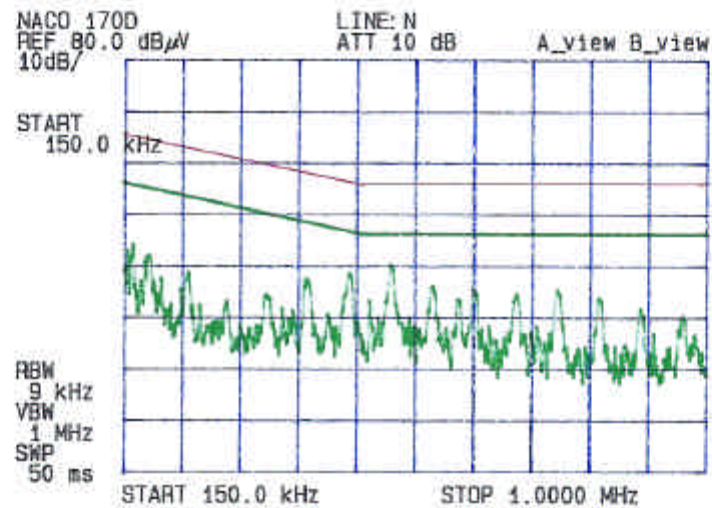
## 5. TEST RESULTS

Line: HOT Line



## 5. TEST RESULTS

Line: Neutral Line



## 5. TEST RESULTS

### 5.3 Radiated Emissions Measurement

|                       |                                           |
|-----------------------|-------------------------------------------|
| EUT                   | TFT-LCD Monitor / NACO 170D (SN: N/A)     |
| Limit apply to        | FCC Part 15. 109(CISPR Pub.22 Class B)    |
| Test Date             | July 23, 2004                             |
| Operating Condition   | Full "H" pattern display(1280*1024, 75Hz) |
| Environment Condition | Humidity Level: 41 %RH, Temperature: 28   |
| Result                | Passed by 4.83 dB                         |

#### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.  
Detector mode: CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )

| Frequency [MHz] | Reading [dB $\mu$ V] | Polarization [*H/**V] | Ant.Factor [dB/m] | Cable Loss [dB] | Result [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | Margin [dB] |
|-----------------|----------------------|-----------------------|-------------------|-----------------|-----------------------|----------------------|-------------|
| 135.01          | 9.32                 | V                     | 11.90             | 3.95            | 25.17                 | 30.00                | 4.83        |
| 216.01          | 7.91                 | V                     | 10.28             | 4.68            | 22.87                 | 30.00                | 7.13        |
| 243.00          | 9.90                 | V                     | 10.93             | 5.05            | 25.87                 | 37.00                | 11.13       |
| 270.00          | 9.63                 | V                     | 12.29             | 5.45            | 27.37                 | 37.00                | 9.63        |
| 310.48          | 6.66                 | V                     | 13.14             | 6.30            | 26.10                 | 37.00                | 10.90       |
| 405.00          | 7.81                 | H                     | 14.76             | 7.17            | 29.74                 | 37.00                | 7.26        |

NOTES : \* H : Horizontal polarization , \*\* V : Vertical polarization

1. Emission Level = Reading + Antenna factor + Cable loss
2. Margin value = Limit - Emission level
3. The measurement was performed for the frequency range 30 MHz ~ 1000 MHz according to the CISPR 22 Class B



Test Engineer: H. S. Lee

## 6. SAMPLE CALCULATION

### Sample 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

$$dB(\mu V/m) = 20 \log_{10} (\mu V / m) : \text{Equation 1}$$

$$dB\mu V = dBm + 107 : \text{Equation 2}$$

Example 1 : @ 0.538 MHz

|                    |   |                                |
|--------------------|---|--------------------------------|
| Class B Limit      | = | 630.96 $\mu V$ = 56 dB $\mu V$ |
| Reading            | = | 40.25 dB $\mu V$               |
| Convert to $\mu V$ | = | 102.92 $\mu V$                 |
| Margin             | = | 56 – 40.25 = 15.75 dB $\mu V$  |
|                    | = | 15.75 dB $\mu V$ below Limit   |

Example 2 : @ 135.01 MHz

|                             |   |                                 |
|-----------------------------|---|---------------------------------|
| Class B Limit               | = | 31.63 $\mu V$ = 30 dB $\mu V$   |
| Reading                     | = | 9.32 dB $\mu V$                 |
| Antenna Factor + Cable Loss | = | 11.90 + 3.95 = 15.85 dB $\mu V$ |
| Total                       | = | 25.17 dB $\mu V$                |
| Margin                      | = | 30 – 25.17 = 4.83 dB $\mu V$    |
|                             | = | 4.83 dB $\mu V$ below Limit     |

## 7. TEST EQUIPMENT LIST

### List of Test Equipments Used for Measurements

|                                     | Test Equipment     | Model    | Mfg.            | Serial No.  | Cal. Due Date |
|-------------------------------------|--------------------|----------|-----------------|-------------|---------------|
| <input checked="" type="checkbox"/> | Spectrum Analyzer  | E7402A   | H.P             | US39110107  | 05-06-07      |
| <input checked="" type="checkbox"/> | Spectrum Analyzer  | R3261A   | Advantest       | 21720033    | 04-10-24      |
| <input checked="" type="checkbox"/> | Receiver           | ESVS 10  | R & S           | 835165/001  | 05-04-12      |
| <input checked="" type="checkbox"/> | EMI TEST Receiver  | ESHS30   | Rohde & Schwarz | 0401901/002 | 05-03-29      |
| <input type="checkbox"/>            | Preamplifier       | HP 8347A | HP              | 2834A00544  | 05-04-12      |
| <input checked="" type="checkbox"/> | LISN               | 3825/2   | EMCO            | 9006-1669   | 05-04-13      |
| <input checked="" type="checkbox"/> | LISN               | 3825/2   | EMCO            | 9208-1995   | 05-01-29      |
| <input checked="" type="checkbox"/> | TriLog Antenna     | VULB9160 | Schwarz Beck    | 3082        | 05-07-27      |
| <input type="checkbox"/>            | LogBicon           | VULB9165 | Schwarz Beck    | 2023        | 05-07-06      |
| <input type="checkbox"/>            | Dipole Antenna     | VHAP     | Schwarz Beck    | 964         | 05-06-10      |
| <input type="checkbox"/>            | Dipole Antenna     | VHAP     | Schwarz Beck    | 965         | 05-07-09      |
| <input type="checkbox"/>            | Dipole Antenna     | UHAP     | Schwarz Beck    | 949         | 05-07-09      |
| <input type="checkbox"/>            | Dipole Antenna     | UHAP     | Schwarz Beck    | 950         | 05-06-10      |
| <input type="checkbox"/>            | Double Ridged Horn | 3115     | EMCO            | 9809-2334   | 05-09-20      |
| <input checked="" type="checkbox"/> | Turn-Table         | DETT-03  | Daeil EMC       | -           | N/A           |
| <input checked="" type="checkbox"/> | Antenna Master     | DEAM-03  | Daeil EMC       | -           | N/A           |
| <input type="checkbox"/>            | Plotter            | 7440A    | H.P             | 2725A 75722 | N/A           |
| <input checked="" type="checkbox"/> | Chamber            | DTEC01   | DAETONG         | -           | N/A           |
| <input type="checkbox"/>            | Thermo Hygrograph  | 3-3122   | ISUZU           | 3312201     | 05-04-16      |
| <input type="checkbox"/>            | BaroMeter          | -        | Regulus         | -           | -             |
|                                     |                    |          |                 |             |               |