

**HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.**

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**CERTIFICATION (Permissive change class II)**

**Manufacture;**

**IMAGEQUEST CO., LTD.**

**SAN 136-1, AMI-RI, BUBAL-EUP, ICHEON-SI,  
KYOUNKI-DO, 467-701, KOREA**

**IMAGEQUEST FRN : 0005-8664-39**

**Date of Issue : FEBRUARY 7, 2003**

**Test Report No.: HCT-F03-0201**

**Test Site: HYUNDAI CALIBRATION & CERTIFICATION  
TECHNOLOGIES CO., LTD.**

**HCT FRN : 0005-8664-21**

**FCC ID :**

**PJIL17C0D081**

**MODEL / TYPE :**

**Q17/L17C0D081**

<b>Rule Part(s):</b>	<b>Part 15 &amp; 2; ET Docket 95-19</b>
<b>Equipment Class:</b>	<b>FCC Class B Peripheral Device (JBP)</b>
<b>Standard(s):</b>	<b>FCC Class B: 1998 (CISPR 22)</b>
<b>EUT Type:</b>	<b>17" LCD Monitor</b>
<b>Max. Resolution(s):</b>	<b>1280 X 1024 Non-interlaced (@80.0KHz/ 75Hz)</b>
<b>Model(s):</b>	<b>Q17</b>
<b>Port/Connector(s)</b>	<b>15-pin D-sub VGA connector, 20-pin DVI-D (Digital RGB), USB 1 upstream port and 2 downstream ports, AUDIO IN/OUT.</b>

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992 (Grant Notes: #19, #28).

I attest to the accuracy of data. All measurements reported 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.



Report prepared by : Ki-Soo Kim

Manager of EMC Tech. Part

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# MEASUREMENT REPORT

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

<b>Applicant Name:</b>	IMAGEQUEST
<b>Address:</b>	SAN 136-1, AMI-RI , BUBAL-EUP, ICHEON-SI, KYOUNGKI-DO, 467-701,KOREA

- **FCC ID : PJIL17C0D081**
- Equipment Class: FCC Class B Peripheral Device (JBP)
- EUT Type: 17" LCD MONITOR
- Model(s): Q17
- Max. Resolution: 1280 X 1024, 80KHz 75Hz
- Frequency Range: V-Sync: 56Hz – 75Hz , H-Sync: 31kHz – 80kHz
- Cable(s): Shielded D-Sub (with ferrite on both ends)
- Power Cord: Unshielded
- Rule Part(s): FCC Part 15 Subpart B
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Tests: December 30, 2002 ~ January 9, 2003
- Place of Tests: 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO,467-701,KOREA

## **2.1 INTRODUCTION**

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **IMAGEQUEST CO., LTD. 17-inch LCD Monitor FCC ID: PJIL17C0D081**

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 and accepted dated July 24, 2000 (Confirmation Number: EA90661)

## 3.1 PRODUCT INFORMATION

### 3.2 Equipment Description

Equipment Under Test (EUT) is the **IMAGEQUEST CO.,Ltd. ( Model : Q17 ) 17-inch LCD Monitor**

FCC ID: **PJIL17C0D081**

Maximum Resolution(s): 1280 x 1024 Non-interlaced @80kHz/75Hz

Frequency Range(s): H-Sync: 31kHz – 80kHz

V-Sync: 56Hz – 75 Hz

Pixel Pitch: 0.26mm

Power Supply: AC 100-240V 50/ 60Hz 1.0A

Power Cord: *Unshielded* AC power cord

Port(s)/Input Connector(s): 15-pin D-sub VGA connector, 20-pin DVI-D (Digital RGB),  
USB 1 upstream port and 2 downstream ports, AUDIO IN/OUT.

Cable(s): Shielded D-Sub (with ferrite on both ends)

Dimensions (WxHxD): 396x414x200mm(WxHxDmm)

Weight (Net): 4.8Kg unpacked

### EMI Suppression Devices:

~ No modifications were made to the device.

## 4.1 Description of Tests (Conducted)

### 4.2 Powerline Conducted RFI (150kHz- 30MHz)

The power line conducted RFI measurements were performed according to CISPR 22.

The EUT was placed on a non-conducting 1.0 by 1.5 meter table, which is 0.8 meters in height and 0.40 meters away from the vertical wall of the shielded enclosure. Power to the EUT is provided through a Rohde & Schwarz 50  $\Omega$  / 50 uH Line Impedance Stabilization Network (LISN) and the support equipment through a separate Solar 50  $\Omega$  / 50 uH Line- Conducted Test Facility LISN. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME. The spectrum was scanned from 150kHz to 30 MHz. Each maximum EME was remeasured using an EMI receiver. The detector function of the receiver was set to CISPR quasi- peak and average mode with the bandwidth set to 9 kHz. Each emission was maximized consistent with the typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum Diagram emission. Excess cable lengths were bundled at the centre with 30- 40cm. in length. The worst-case configuration is noted in the test report and the photographs are attached. Each EME reported was calibrated using the Rohde & Schwarz SMX signal generator and are listed on Table 1. RFI Conducted FCC Class B

RFI CONDUCTED	FCC CLASS B Limits dB(uV/m)	CISPR 22 CLASS B Limits dB(uV/m)	
Freq. Range	FCC Class B Quasi-Peak	CISPR 22 Quasi-Peak	CISPR 22 Average
150kHz - 0.5MHz	48*	66-56**	56-46**
0.5MHz - 5MHz	48	56	46
5MHz - 30MHz	48	60	50
*FCC Class B limits starts from 450kHz			
**Limits decreases linearly with the logarithm of frequency			

Table 1. RFI Conducted Limits

## 4.3 Description of Tests (Radiated)

### Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The spectrum was scanned from 30 to 300 MHz using biconical antenna, 300 to 1000 MHz using log-periodic antenna, and above 1 GHz using linearly polarized horn antennas. Final measurements were made outdoors at 10-meter test range using Dipole antennas and EMI receiver. For frequencies above 1 GHz, horn antennas were used. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The EMI receiver detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz. The EUT, support equipment, and interconnecting cables were arranged to the configuration that produces the maximum EME emission found during preliminary scan. 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 maximum emission. Horizontal and vertical antenna polarizations were checked. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/ or support equipment, and powering the monitor the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.

ITE Radiated Limits			
Frequency (MHz)	FCC Limit @ 3m. Quasi-Peak dB[μV/m]	FCC Limit @ 10m.* Quasi – Peak dB [μV/m]	CISPR Limit @ 10m. Quasi-Peak dB [μV/m]
30-88	40.0	29.5	30.0
88-216	43.5	33.0	30.0
216-230	46.0	35.6	30.0
230-960	46.0	35.6	37.0
960-1000	54.0	43.5	37.0
> 1000	54.0	43.5	No Specified Limit
* Limit extrapolated 20 dB/decade			

Table 2. Radiated Class B limits @ 10-meters

## 5.1 Support Equipment Used

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
MONITOR (EUT)	IMAGEQUEST CO., LTD.	Q17	PJIL17C0D081	P.C
P.C	H/P	HP Pavilion 700	DoC	N/A
KEY BOARD	H/P	5181	DoC	P.C
MOUSE	MICROSOFT	Intellimouse optical USB and PS/2 compatible	DoC	P.C
PRINTER	H/P	C6410A	DoC	P.C
MODEM	3COM	56K FAX MODEM	DoC	P.C
USB MOUSE	LOGITECH	M-BE55	DoC	EUT
USB DRIVER	JUNG MYUNG TELECOM	USB XDRIVER	DoC	EUT
HEADSET	SAMBO COMPUTER	DW-400M	DoC	EUT



## 5.2 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
MONITOR(EUT)	N	Y	1.8(P), 1.5(D)
PC(HOST)	N	N/A	1.8(P)
KEY BOARD	N/A	Y	1.8(D)
MOUSE	N/A	Y	1.8(D)
PRINTER	N	Y	1.8(P), 1.8(D)
MODEM	N	Y	1.5(P), 1.2(D)
USB MOUSE	N/A	Y	0.8(D)
USB DRIVER	N/A	N/A	N/A
AUDIO IN	N/A	N	1.5(D)
HEADSET	N/A	N	1.8(D)

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

## 5.3 Noise Suppression Parts on Cable. (I/O CABLE)

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
MONITOR(EUT)	Y	BOTH END	Y	BOTH END
KEY BOARD	N	N/A	Y	P.C END
MOUSE	Y	P.C END	Y	P.C END
PRINTER	N	N/A	Y	BOTH END
MODEM	N	N/A	Y	BOTH END
USB MOUSE	Y	P.C END	Y	EUT END
USB DRIVER	N	N/A	Y	EUT END
AUDIO IN	Y	BOTH END	N	BOTH END
HEADSET	Y	P.C END	N	EUT END

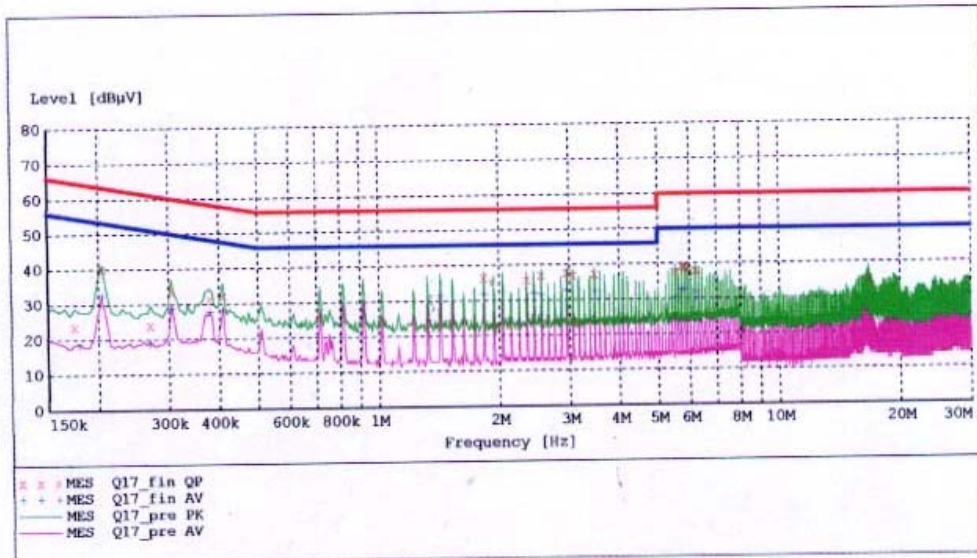
## 6.1 LINE-CONDUCTED TEST DATA

### HYUNDAI C-TECH. EMC Testing Laboratory

EUT: Q17  
Manufacturer: IMAGEQUEST  
Operating Condition: 1280 X 1204 75Hz  
Test Site: SHIELD ROOM  
Operator: KH-SEO  
Test Specification: CISPR 22 CLASS B  
Comment: N  
Start of Test: 12/30/02 / 11:00:41PM

#### SCAN TABLE: "EN 55022 Voltage #1"

Short Description:		EN 55022 Voltage		Detector	Meas. Time	IF Bandw.	Transducer
Start Frequency	Stop Frequency	Step Width					
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	ESH2-Z2 (50 Ohms)	
			Average				
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	ESH2-Z2 (50 Ohms)	
			Average				



#### MEASUREMENT RESULT: "Q17\_fin QP"

12/30/02 11:05PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.175000	23.70	10.0	65	41.0	1	---
0.205000	40.20	10.0	63	23.2	1	---
0.270000	24.00	10.0	61	37.1	1	---
0.305000	33.90	10.0	60	26.2	1	---
0.380000	31.30	10.0	58	27.0	1	---
0.410000	32.30	10.1	58	25.3	1	---
1.840000	36.60	10.2	56	19.4	1	---
2.350000	35.90	10.3	56	20.1	1	---
2.555000	37.10	10.3	56	18.9	1	---
2.965000	37.70	10.3	56	18.3	1	---
3.065000	37.00	10.3	56	19.0	1	---
3.475000	37.30	10.4	56	18.7	1	---
5.520000	37.60	10.5	60	22.4	1	---
5.725000	39.40	10.5	60	20.6	1	---

**MEASUREMENT RESULT: "Q17\_fin QP"**  
 (continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
5.825000	39.10	10.5	60	20.9	1	---
5.930000	39.00	10.5	60	21.0	1	---
6.235000	38.10	10.5	60	21.9	1	---
16.765000	35.30	11.2	60	24.7	1	---

**MEASUREMENT RESULT: "Q17\_fin AV"**  
 12/30/02 11:05PM

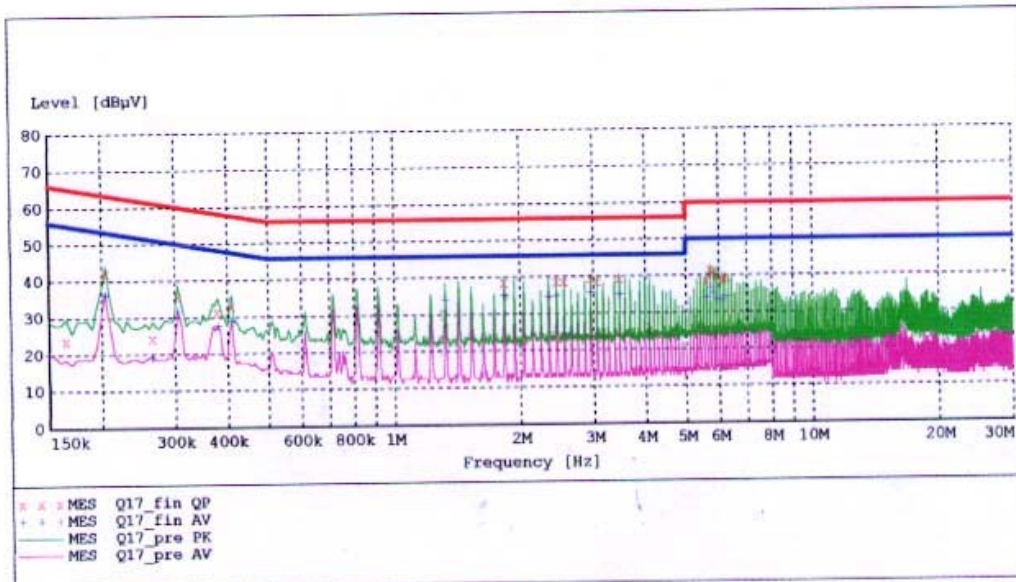
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.180000	18.30	10.0	55	36.2	1	---
0.205000	32.50	10.0	53	20.9	1	---
0.270000	18.90	10.0	51	32.2	1	---
0.305000	28.90	10.0	50	21.2	1	---
0.380000	27.80	10.0	48	20.5	1	---
0.410000	28.40	10.1	48	19.3	1	---
1.430000	31.80	10.2	46	14.2	1	---
1.840000	32.00	10.2	46	14.0	1	---
2.455000	32.10	10.3	46	13.9	1	---
2.555000	31.70	10.3	46	14.3	1	---
2.965000	32.90	10.3	46	13.1	1	---
3.475000	32.50	10.4	46	13.5	1	---
5.520000	30.40	10.5	50	19.6	1	---
5.725000	32.70	10.5	50	17.3	1	---
5.825000	32.90	10.5	50	17.1	1	---
6.235000	32.00	10.5	50	18.0	1	---
6.340000	30.30	10.5	50	19.7	1	---
29.850000	30.60	11.7	50	19.4	1	---

**HYUNDAI C-TECH.**  
**EMC Testing Laboratory**

EUT: Q17  
Manufacturer: IMAGEQUEST  
Operating Condition: 1280 X 1204 75Hz  
Test Site: SHIELD ROOM  
Operator: KH-SEO  
Test Specification: CISPR 22 CLASS B  
Comment: H  
Start of Test: 12/30/02 / 11:05:56PM

**SCAN TABLE: "EN 55022 Voltage #1"**

Short Description:		EN 55022 Voltage		Detector	Meas. Time	IF Bandw.	Transducer
Start Frequency	Stop Frequency	Step Width					
150.0 kHz	500.0 kHz	5.0 kHz		MaxPeak	10.0 ms	9 kHz	ESH2-Z2 (50 Ohms)
				Average			
500.0 kHz	5.0 MHz	5.0 kHz		MaxPeak	10.0 ms	9 kHz	ESH2-Z2 (50 Ohms)
				Average			



**MEASUREMENT RESULT: "Q17\_fin QP"**

12/30/02 11:10PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Line	PE
0.165000	23.70	10.1	65	41.5	1	---
0.205000	42.20	10.0	63	21.2	1	---
0.265000	24.30	10.0	61	37.0	1	---
0.305000	35.80	10.0	60	24.3	1	---
0.380000	31.40	10.0	58	26.9	1	---
0.410000	33.00	10.1	58	24.7	1	---
1.840000	38.60	10.2	56	17.4	1	---
2.455000	38.70	10.3	56	17.3	1	---
2.555000	38.70	10.3	56	17.3	1	---
2.965000	39.60	10.3	56	16.4	1	---
3.065000	38.70	10.3	56	17.3	1	---
3.475000	39.30	10.4	56	16.7	1	---
5.620000	38.50	10.5	60	21.5	1	---
5.725000	41.40	10.5	60	18.6	1	---



**MEASUREMENT RESULT: "Q17\_fin QP"**

(continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
5.825000	40.70	10.5	60	19.3	1	---
5.930000	39.90	10.5	60	20.1	1	---
6.135000	38.90	10.5	60	21.1	1	---
6.235000	39.40	10.5	60	20.6	1	---

**MEASUREMENT RESULT: "Q17\_fin AV"**

12/30/02 11:10PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.150000	20.10	10.1	56	35.9	1	---
0.205000	36.30	10.0	53	17.1	1	---
0.265000	19.20	10.0	51	32.1	1	---
0.305000	31.90	10.0	50	18.2	1	---
0.380000	27.80	10.0	48	20.4	1	---
0.410000	28.90	10.1	48	18.7	1	---
1.330000	34.10	10.2	46	11.9	1	---
1.840000	35.20	10.2	46	10.8	1	---
2.350000	34.70	10.3	46	11.3	1	---
2.455000	35.00	10.3	46	11.0	1	---
2.965000	35.80	10.3	46	10.2	1	---
3.475000	35.30	10.4	46	10.7	1	---
5.620000	34.00	10.5	50	16.0	1	---
5.725000	36.80	10.5	50	13.2	1	---
5.825000	35.20	10.5	50	14.8	1	---
5.930000	33.50	10.5	50	16.5	1	---
6.135000	33.30	10.5	50	16.7	1	---
6.235000	34.50	10.5	50	15.5	1	---

**NOTES:**

- 1. All modes of operation were investigated and the worst-case emissions are reported.**
- 2. The CISPR RFI conducted limits are listed on Table 1 (Page 6).**
- 3. Line A = Phase Line B = Neutral**

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**\*\* Measurements using CISPR quasi-peak mode.**

## 7.1 RADIATED TEST DATA

MHz	dBuV	dB	dB	(H/V)	dBuV/m	dBuV/m	dB
48.2	10.72	11.88	1.5	V	24.1	30	-5.9
71.9	17.88	6.20	1.8	V	25.9	30	-4.1
96.0	15.03	9.55	2.2	H	26.8	30	-3.2
108.1	13.28	11.38	2.3	V	27.0	30	-3.0
133.3	9.19	13.91	2.6	V	25.7	30	-4.3
217.0	5.31	16.76	3.3	V	25.4	30	-4.6
324.5	10.31	16.34	4.1	V	30.8	37	-6.2
352.5	11.83	16.46	4.3	V	32.6	37	-4.4
434.8	8.68	17.95	4.8	H	31.4	37	-5.6
459.6	7.36	18.54	4.9	V	30.8	37	-6.2
489.0	9.20	18.96	5.0	V	33.2	37	-3.8
569.5	7.49	20.56	5.4	V	33.5	37	-3.5

Radiated Measurements at 10-meters.

**1280 x 1024 Non-interlaced @ 75Hz**

### NOTES:

1. All modes of operation were investigated, and the worst-case emissions are reported.
2. The radiated limits are listed on Table 2 (Page 7).

\*\* AFCL = Antenna Factor (Roberts dipole) and Cable Loss .

\*\*\* Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

## 8.1 Sample Calculations

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

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

### 8.2 Example 1:

**@ 20.3 MHz**

Class B limit	= 250 $\mu\text{V}$ = 47.96 dB $\mu\text{V}$
Reading	= - 67.8 dBm (calibrated level)
Convert to dB $\mu\text{V}$	= - 67.8 + 107 = 39.2 dB $\mu\text{V}$
$10^{(39.2/20)}$	= 91.2 $\mu\text{V}$
<b>Margin</b>	= 39.2 - 47.96 = - 8.76
	= <b>8.8 dB below limit</b>

### 8.3 Example 2:

**@ 66.7 MHz**

Class B limit	= 100 $\mu\text{V/m}$ = 47.96 dB $\mu\text{V/m}$
Reading	= - 76.0 dBm (calibrated level)
Convert to dB $\mu\text{V/m}$	= - 76.0 + 107 = 31.0 dB $\mu\text{V/m}$
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V/m}$
<b>Margin</b>	= 36.8 - 40.0 = - 3.2
	= <b>3.2 dB below limit</b>



## 9.1 Test Equipment

<u>Type</u>	<u>Manufacture</u>	<u>Model Number</u>	<u>CAL Date</u>
EMI Test Receiver	Rohde & Schwarz	ESH3	2002.07.16
EMI Test Receiver	Rohde & Schwarz	ESVP	2002.10.01
EMI Test Receiver	Rohde & Schwarz	ESI40	2002.11.16
EMI Test Receiver	Rohde & Schwarz	ESVS30	2002.07.16
LISN	EMCO	3816/2	2002.11.29
LISN	EMCO	3816/2	2002.08.22
Amplifier	Hewlett-Packard	8447E	2002.08.23
Absorbing Clamp	Rohde & Schwarz	MDS-21	2002.04.24
Dipole Antennas	Rohde & Schwarz	VHAP	2002.07.16
Dipole Antennas	Rohde & Schwarz	UHAP	2002.07.16
Biconical Antenna	Rohde & Schwarz	VHA9103	2002.07.12
Log-Periodic Antenna	Rohde & Schwarz	UHALP9107	2002.07.12
Antenna Position Tower	EMCO	1051-12	N/A
Turn Table	EMCO	1060-06	N/A
Power Analyzer	Voltech	PM 3300	2002.2.16
Reference Network	ImpedanceVoltech	IEC 555	N/A
AC Power Source	PACIFIC	Magnetic Module	N/A
AC Power Source	PACIFIC	360AMX	2002.11.25
Controller	HD GmbH	HD 100	N/A
EMI in Motion	HD GmbH	KMS 560	N/A

## 10.1 Test Software Used

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.

NOTE: This is a sample of the basic program used during the test. However, during testing, a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

Actual program used is the "H" pattern in Notepad under Windows environment. All resolution modes (1280x1024, 1024x768, 800x600, 640x480, 720x400, Non-interlaced) were investigated and tested

## 11.1 Conclusion

The data collected shows that the IMAGEQUEST CO., LTD. 17-inch LCD Monitor **FCC ID: PJIL17C0D081.**

complies with §15.107 and §15.109 of the FCC Rules.