6. Radiated Emission

6.1 Operating environment

Temperature : 25℃
Relative humidity : 70 %

6.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for open area test site.
The formal radiated emission was measured at 3m-distance open area test site.
The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.
The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels.
This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

6.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement".
The measurement uncertainty was given with a confidence of 95%.

Contribution	Probability Distribution	Uncertainty (dB)			
		Biconical Ant.		Log-periodic Ant.	
		3m	10m	3m	10m
Ambient signal					
Antenna factor calibration	Normal (k=2)	1.00	1.00	1.00	1.00
Receiver specification	Rectangular	1.00	1.00	1.00	1.00
Antenna directivity	Rectangular	0.50	0.00	3.00	0.50
Antenna phase center variation	Rectangular	0.00	0.00	1.00	0.20
Antenna factor frequency interpolation	Rectangular	0.25	0.25	0.25	0.25
Measure distance variation	Rectangular	0.60	0.40	0.60	0.40
Site imperfections	Rectangular	2.83	-2.94	-1.96	-2.96
Mismatch Receiver VRC : Γl= 0.09 Antenna VRC : Γg= 0.43 (Bi) 0.23 (Lp) Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.33 -0.35	0.33 -0.35	0.33 -0.18	0.33 -0.18
System repeatability	Std Deviation	0.07	0.05	0.06	0.10
Cable loss calibration	Normal (k=2)	0.20	0.20	0.20	0.20
Combined standard uncertainty Uc(y)	Normal	1.88 -1.88	1.90 -1.90	2.33 -2.32	1.94 -1.93
Extended uncertainty U	Normal (k=2)	3.77 -3.77	3.80 -3.80	4.65 -4.63	3.87 -3.85

6.4 Limit

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 20dB / decade			

6.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 12. 2002
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 12. 2002
■ -	HK116	Rohde & Schwarz	Biconical antenna	836239/007	12. 18. 2002
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	835998/004	12. 20. 2002
■ -	BBHA9120D	Schwarzbeck	horn antenna	207	02. 27. 2002
■ -	8449B	Agilent	Pre-Amplifier	3008A01828	Verification
■ -	54200	FLUKE	TV Signal generator	831011	02. 07. 2003
■ -	HD100	HD GmbH	Position Controller	100/692/01	NCR
■ -	DS415S	HD GmbH	Turntable	415/657/01	NCR
■ -	MA240	HD GmbH	Antenna Mast	240/565/01	NCR

6.6 Test data for radiated emission

-. Test Date : July 08, 2003
-. Resolution bandwidth : 120kHz / 1MHz
-. Frequency range : 30MHz ~ 2000MHz
-. Detector mode : 30MHZ ~1000MHz : Quasi-peak detector mode
1000MHz ~ 2000MHz : Average detector mode

6.6.1 PC Mode

♦ Test resolution: 1024*768/85Hz (Analog)

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
64.66	25.1	H	7.85	2.27	35.2	40.0	4.8
65.88	24.8	V	7.81	2.29	34.9	40.0	5.1
139.74	12.7	H	11.72	3.20	27.6	43.5	15.9
141.6	11.7	V	11.80	3.22	26.7	43.5	16.8
157.49	19.5	V	12.35	3.37	35.2	43.5	8.3
195.67	16.7	H	13.82	3.76	34.3	43.5	9.2
417	12.2	H	15.93	5.54	33.7	46.0	12.3
468.02	19.1	H	16.78	5.94	41.8	46.0	4.2
625.04	4.8	H	19.46	6.85	31.1	46.0	14.9
693	13.7	H	20.35	7.26	41.3	46.0	4.7
782.68	11.7	H	20.53	7.80	40.0	46.0	6.0
944.98	6.7	H	21.83	8.77	37.3	46.0	8.7
Above 1GHz							
1106.97	16.3	V	24.47	4.83	45.6	54.0	8.4
1344.46	7.7	V	25.09	5.34	38.1	54.0	15.9
1660.42	7	V	24.86	6.45	38.3	54.0	15.7

Note: “H”: Horizontal, “V”: Vertical

♦ Test resolution: 1024*768/85Hz (Digital)

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
65.23	25.7	V	7.83	2.28	35.8	40.0	4.2
128.88	13.3	V	11.34	3.15	27.8	43.5	15.7
130.45	18.3	H	11.39	3.16	32.8	43.5	10.7
131.26	18	H	11.42	3.16	32.6	43.5	10.9
139.98	13.3	H	11.73	3.20	28.2	43.5	15.3
195.67	12.2	H	13.82	3.76	29.8	43.5	13.7
468.02	16.3	H	16.78	5.94	39.0	46.0	7.0
682.5	11.5	H	20.16	7.20	38.9	46.0	7.1
700.02	10.5	H	20.48	7.30	38.3	46.0	7.7
782.68	10.9	H	20.53	7.80	38.2	46.0	6.8
787.48	12.7	H	20.64	7.82	41.2	46.0	4.8
984.34	11.2	H	22.76	9.01	43.0	54.0	11.0
Above 1GHz							
1106.98	16.4	V	24.47	4.83	45.7	54.0	8.3
1181.38	13.6	V	24.73	5.13	43.5	54.0	10.5
1344.28	9.9	V	25.09	5.34	40.3	54.0	13.7
1575	8.6	V	24.85	6.19	39.6	54.0	14.4
1660.47	7.9	V	24.86	6.45	39.2	54.0	14.8
1968.64	6.2	H	25.93	7.56	39.7	54.0	14.3

Note: “H”: Horizontal, “V”: Vertical

6.6.2 TV Mode

♦ Radiated Emission due to the local oscillator
Fundamental frequency

Band	Ch. NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
VHF	2	55.25	1	101.0	-	43.5	<<
	3	61.25	1	107.0	-	43.5	<<
	4	67.25	1	113.0	-	43.5	<<
	5	77.25	1	123.0	-	43.5	<<
	6	83.25	1	129.0	-	43.5	<<
	7	175.25	1	221.0	-	46.0	<<
	8	181.25	1	227.0	30.15	46.0	15.85
	9	187.25	1	233.0	-	46.0	<<
	10	193.25	1	239.0	-	46.0	<<
	11	199.25	1	245.0	-	46.0	<<
	12	205.25	1	251.0	25.52	46.0	20.48
	13	211.25	1	257.0	23.86	46.0	22.14
UHF	14	471.25	1	517.0	-	46.0	<<
	19	501.25	1	547.0	-	46.0	<<
	24	531.25	1	577.0	-	46.0	<<
	29	561.25	1	607.0	-	46.0	<<
	34	591.25	1	637.0	-	46.0	<<
	39	621.25	1	667.0	-	46.0	<<
	44	651.25	1	697.0	-	46.0	<<
	49	681.25	1	727.0	-	46.0	<<
	54	711.25	1	757.0	35.73	46.0	10.27
	59	741.25	1	787.0	-	46.0	<<
	64	771.25	1	817.0	-	46.0	<<
	69	801.25	1	847.0	-	46.0	<<

"<<" : The margin is more than 30dB

♦ Radiated Emission due to the local oscillator
Harmonic frequency

Channel NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
3	61.25	3	321.0	27.34	46.0	18.66
		4	428.0	28.59	46.0	17.41
		8	856.0	30.48	46.0	15.52
4	67.25	2	226.0	30.31	43.5	13.19
9	187.25	2	466.0	36.25	46.0	9.75
11	199.25	3	735.0	30.76	46.0	15.24

"<<" : The margin is more than 30dB

♦ Radiated Emission due to the other source than local oscillator

Channel NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
2	55.25	--	49.02	33.42	40.0	6.58
			65.70	35.08	40.0	4.92
			82.38	28.92	40.0	11.08
			113.16	28.17	43.5	15.33
			130.44	30.83	43.5	12.67
			410.52	41.53	46.0	4.47
			615.66	37.01	46.0	8.99
			821.16	33.71	46.0	12.29
			847.98	31.19	46.0	14.81
			913.20	35.3	46.0	10.7
			1239.28	35.52	54.0	18.48
			1369.00	36.01	54.0	17.99

6.6.3 DVD Mode

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
49.49	19.8	V	7.55	1.98	29.3	40.0	10.7
65.22	25.8	V	7.83	2.28	35.9	40.0	4.1
113.7	11.5	V	10.48	3.01	25.0	43.5	18.5
130.44	17.1	H	11.39	3.16	31.6	43.5	11.9
212.76	5.3	V	14.48	3.90	23.7	43.5	19.8
409.37	15.8	H	15.73	5.47	37.0	46.0	9.0
614.16	5.4	V	19.00	6.78	31.2	46.0	14.8
818.76	8.5	H	21.12	8.01	37.6	46.0	8.4
848.04	2	H	21.75	8.19	31.9	46.0	14.1
913.2	2.2	H	22.08	8.58	32.9	46.0	13.1
921.84	0.9	H	22.08	8.63	31.6	46.0	14.4
Above 1GHz							
1239.28	5	H	24.88	5.24	35.1	54.0	18.9
1369.58	7	H	25.14	5.37	37.5	54.0	16.5
1500	2.5	V	25.00	5.85	33.4	54.0	20.7

Note: “H”: Horizontal, “V”: Vertical

7. Antenna power conduction

7.1 Operating environment

Temperature : 25℃
Relative humidity : 81 %

7.2 Test set-up

The Antenna power conduction measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 12. 2002
■ -	11852B	Hewlettpackard	MIN LOSS PAD	03313	NCR

7.4 Test data for Antenna power conduction

-. Test Date : July 09, 2003
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 2000MHz

♦ Antenna power conduction due to the local oscillator
Fundamental frequency

Band	Ch. NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
VHF	2	55.25	1	101.0	24.17	50.0	25.83
	3	61.25	1	107.0	24.22	50.0	25.78
	4	67.25	1	113.0	24.20	50.0	25.80
	5	77.25	1	123.0	23.00	50.0	27.00
	6	83.25	1	129.0	22.52	50.0	27.48
	7	175.25	1	221.0	32.10	50.0	17.90
	8	181.25	1	227.0	-	50.0	<<
	9	187.25	1	233.0	30.00	50.0	20.00
	10	193.25	1	239.0	29.30	50.0	20.70
	11	199.25	1	245.0	28.40	50.0	21.70
	12	205.25	1	251.0	27.90	50.0	22.10
	13	211.25	1	257.0	27.60	50.0	22.40
UHF	14	471.25	1	517.0	28.30	50.0	21.70
	19	501.25	1	547.0	30.60	50.0	19.40
	29	561.25	1	607.0	33.70	50.0	16.30
	44	651.25	1	697.0	33.30	50.0	16.70
	46	663.25	1	709.0	30.80	50.0	19.20
	47	669.25	1	715.0	27.30	50.0	22.80
	49	681.25	1	727.0	27.80	50.0	22.20
	51	693.25	1	739.0	33.30	50.0	16.80
	54	711.25	1	757.0	33.60	50.0	16.40
	59	741.25	1	787.0	29.40	50.0	20.60
	64	771.25	1	817.0	-	50.0	<<
	69	801.25	1	847.0	32.70	50.0	17.30

"<<" : The margin is more than 30dB

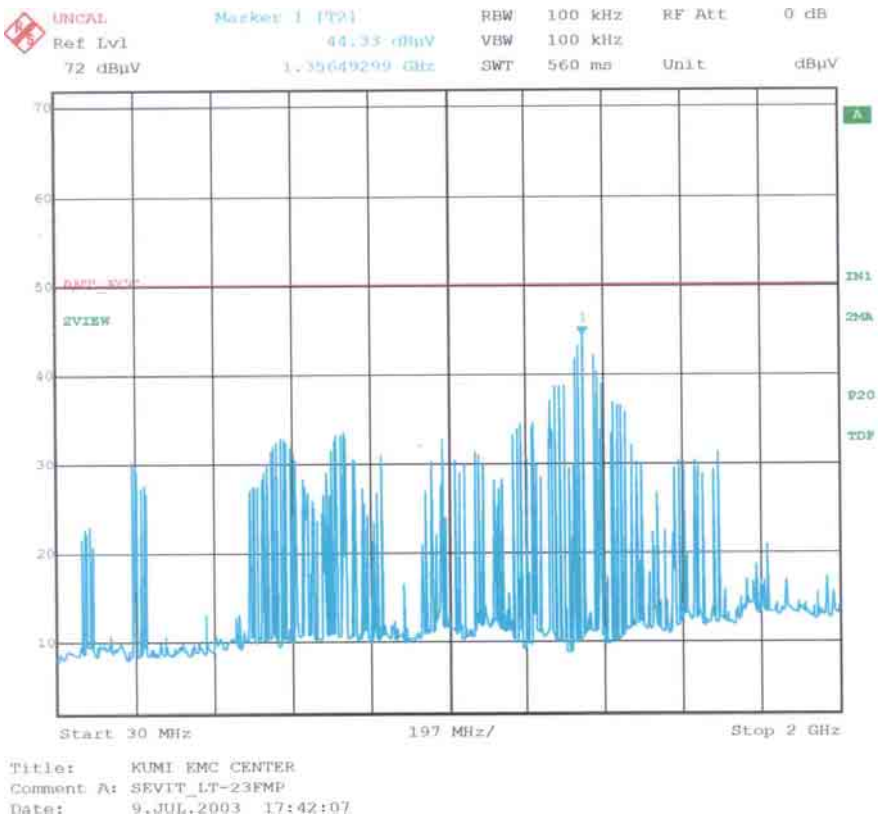
♦ Antenna power conduction due to the local oscillator
Harmonic frequency

Band	Ch. NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
VHF	2	55.25	10	1010.0	25.3	50.0	24.7
			12	1212.0	32.2	50.0	17.8
	3	61.25	12	1284.0	32.4	50.0	17.6
	4	67.25	10	1130.0	30.0	50.0	20.0
			12	1356.0	28.7	50.0	21.3
	5	77.25	10	1230.0	36.7	50.0	13.4
	6	83.25	10	1290.0	35.6	50.0	14.4
	7	175.25	6	1326.0	32.9	50.0	17.1
	8	181.25	6	1362.0	37.6	50.0	12.4
	9	187.25	6	1398.0	35.4	50.0	14.6
	10	193.25	6	1434.0	35.5	50.0	14.5
	11	199.25	6	1470.0	37.3	50.0	12.7
	12	205.25	6	1506.0	34.3	50.0	15.7
	13	211.25	6	1542.0	33.3	50.0	16.7
UHF	14	471.25	2	1034.0	30.0	50.0	20.0
	19	501.25	2	1094.0	33.4	50.0	16.6
	24	531.25	2	1154.0	30.5	50.0	19.5
	29	561.25	2	1214.0	35.9	50.0	14.1
	34	591.25	2	1274.0	39.2	50.0	10.8
	39	621.25	2	1334.0	42.1	50.0	7.9
	40	627.25	2	1346.0	44.0	50.0	6.0
	41	633.25	2	1358.0	44.9	50.0	5.2
	42	639.25	2	1370.0	44.2	50.0	5.8
	43	645.25	2	1382.0	42.2	50.0	7.8
	44	651.25	2	1394.0	40.0	50.0	10.0
	49	681.25	2	1454.0	37.5	50	12.5
	54	711.25	2	1514.0	30.0	50.0	20.0
	59	741.25	2	1574.0	29.7	50.0	20.3
	64	771.25	2	1634.0	27.4	50.0	22.7
	69	801.25	2	1694.0	33.0	50.0	17.0

♦ Antenna power conduction due to other source than the local oscillator

Channel NO.	Ch. Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
--	All frequency	--	--	--	50.0	<<

"<<" : The margin is more than 30dB



< Fig 4. Antenna power conduction result >

8. Noise Figure

8.1 Operating environment

Temperature : 25℃
Relative humidity : 81 %

8.2 Test set-up

The Noise Figure measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall.
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ -	N8973A	Hewlettpackard	Noise Figure Analyzer	GB42151318	02.26.2003
■ -	N4000A	Hewlettpackard	Noise Source	US41120227	10.18.2002
■ -	11852B	Hewlettpackard	MIN LOSS PAD	03313	NCR
■ -	11852B	Hewlettpackard	MIN LOSS PAD	03309	NCR

8.4 Test data for Noise Figure

-. Test Date : July 09, 2003
-. Test Channel : 2 ~ 69CH

VHF				UHF			
Ch.No.	Ch. Freq. (MHz)	Noise Figure (dB)	Limit (dB)	Ch.No.	Ch. Freq. (MHz)	Noise Figure (dB)	Limit (dB)
2	55.25	6.3	14.0	14	471.25	8.1	14.0
3	61.25	7.2		19	501.25	8.1	
4	67.25	5.8		24	531.25	8.0	
5	73.25	4.6		29	561.25	7.9	
6	79.25	4.3		34	591.25	7.6	
7	85.25	6.1		39	621.25	7.5	
8	91.25	6.5		44	651.25	9.1	
9	97.25	6.8		49	681.25	8.3	
10	103.25	6.1		54	711.25	7.4	
11	109.25	6.4		59	741.25	7.2	
12	115.25	6.2		64	771.25	7.1	
13	211.25	6.0		69	801.25	7.8	

9. Sample Calculations

$$dB\mu V = 20 \text{ Log }_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

9.1 Example 1 :

■ 20.3 MHz

Class B Limit	=	250 μV	= 48 dBμV
Reading	= - 67.8 dBm(Calibrated level)		
Convert to dBμV	= - 67.8 dBm + 107	=	39.2 dBμV
$10^{(39.2dB\mu V/20)}$	=	91.2 μV	
Margin	=	39.2 – 48 = -8.8	
	=	8.8 dB below Limit	

9.2 Example 2 :

■ 66.7 MHz

Class B Limit	=	100 μV/m	= 40.0 dBμV/m
Reading	= - 76.0 dBm(Calibrated level)		
Convert to dBμV/m	= - 67.8 dBm + 107	=	31.0 dBμV/m
Antenna Factor + Cable Loss	=	5.8 dB	
Total	=	36.8 dBμV/m	
Margin	=	36.8 – 40.0 = -3.2	
	=	3.2 dB below Limit	

10. Recommendation & conclusion

The data collected shows that the **SEVIT Co., Ltd. 23" LCD TV/Monitor (Model No.: LT-23FMP)** was complies with §15.107, §15.109, §15.111, and §15.117 of the FCC Rules.

PC Mode: The highest emission observed was at 1.3MHz for conducted emission with a margin of 3.21dB(640*480/85Hz,Analog), at 468.02MHz for radiated emission with a margin of 4.2dB(1024*768/85Hz, Analog)

TV Mode: The highest emission observed was at 0.195MHz for conducted emission with a margin of 4.23dB, at 410.52MHz for radiated emission with a margin of 4.47dB(2CH), at 1.358GHz for Antenna power conduction with a margin of 5.2dB(41CH), at 44CH(651.25MHz) for Noise Figure with a margin of 4.9dB.

DVD Mode: The highest emission observed was at 0.195MHz for conducted emission with a margin of 4.13dB, at 65.22MHz for radiated emission with a margin of 4.1dB.