SAMSUNG ELECTRONICS

EMC TEST REPORT

Project No. :LBE031621

Product : DIRECTV DVR

Model No. : SIR-S4120R

Date of test : July 23 ~ August 08, 2003

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Tested by:
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1. Introduction & Summary

1.1 Description of the EUT

Applicant	SAMSUNG ELECTRONICS Co., Ltd.	
Project Number	LBE031621	
Equipment Under Test	DIRECTV DVR	
Trade Name	SAMSUNG	
Model Number	SIR-S4120R	
Variant Model	None	
Type of RF Output Connector	Type "F" Connector 75ohm(Unbalanced)	
FCC ID Number	A3LDIRECTV	
Operating(RF Modulator) Frequency	CH.3	Visual Carrier 61.25MHz Aural Carrier 65.75MHz
	CH.4	Visual Carrier 67.25MHz Aural Carrier 71.75MHz
Mains input	AC 100 ~ 120V, 50/60Hz	
LNB Input	LNB Input 950 ~ 2150MHz (75 Ohm Unbalanced)	

1.2 Test facility

The EMI/EMS measurement facilities used to collect the tested data are located at 416 Maetan 3 Dong, Paldal-Ku, Suwon City, Kyungki Do, Korea.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1 & 16-2.
SAMSUNG Electronics Co.,Ltd is accredited by Korea Laboratory Accreditation Scheme(KOLAS) which signed the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for the above test item(s) and test method(s).

Measured in Semi-anechoic chamber #1 that is FCC Registration Number 98856.

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1.3 Test mode

The EUT was tested in the following operating modes(at both channel 3 and 4) for the tests mention in this report:

HDD Play + Time Shift Recording

According to the requirements in Subpart B of Part 15, the measurement is made at each function of the EUT being connected with appropriate cables and peripherals. This model has video/audio output terminals in RCA-type plugs, LNB antenna input, TV antenna input and RF output terminal.
The LNB input of the EUT was connected to a digital stream system directly.

1.4 Measuring instrument setup

The explanation of measuring instrument setup when respective function is used in any frequency band is as following:

Frequency Band [MHz]	Instrument	Detector function	Resolution Bandwidth	Video Bandwidth
30 to 1000	Spectrum analyzer	Peak	100kHz (1MHz)	1MHz
	EMI Test receiver	Quasi-Peak	120kHz	-
Above 1000	EMI Test receiver	Average	1MHz	-

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1.5 Test rule and Procedure

FCC Rule Part 15, Subpart B : Unintentional Radiators
TV Interface Devices.
Test Procedure : ANSI C63.4-1992

1.6 Test Summary

Test item	Applied Standards	Result
AC POWERLINE CONDUCTED EMISSION	ANSI C63.4-1992	Pass
RADIATED EMISSION	ANSI C63.4-1992	Pass
OUTPUT SIGNAL LEVEL	ANSI C63.4-1992	Pass
OUTPUT TERMINAL CONDUCTED SPURIOUS EMISSION	ANSI C63.4-1992	Pass
ANTENNA TRANSFER SWITCH ISOLATION	ANSI C63.4-1992	Pass

* N/A : Test not applicable

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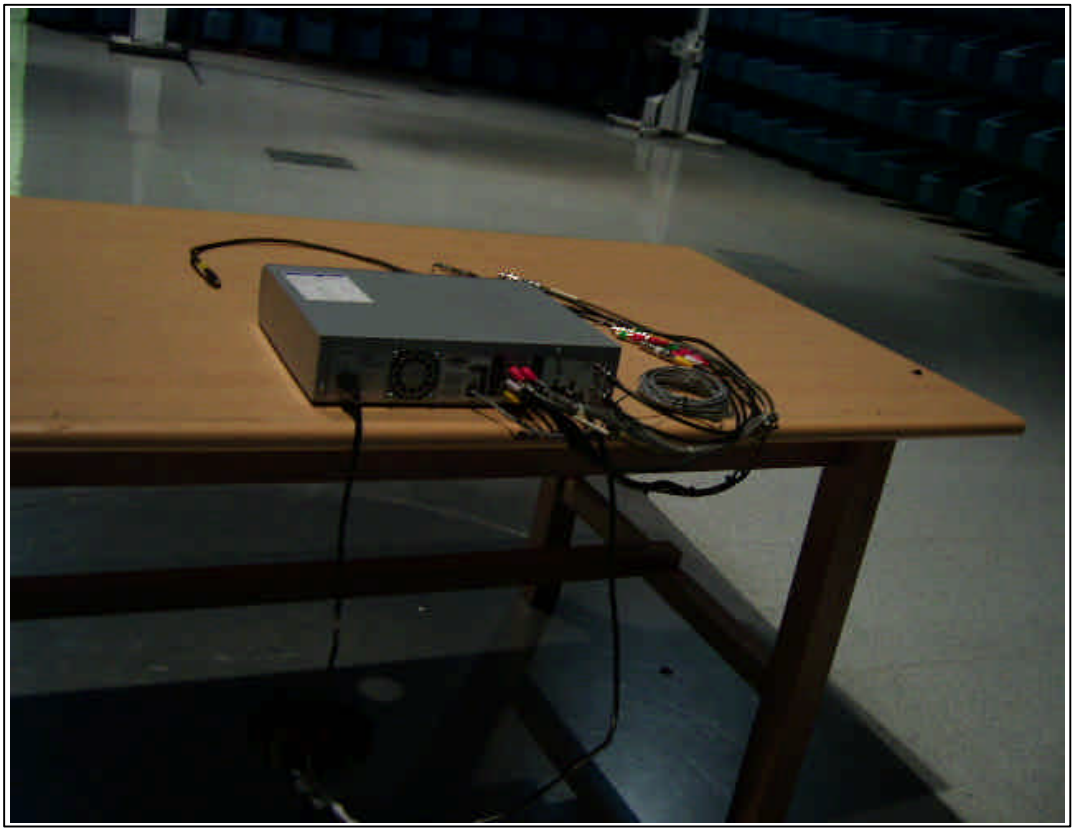
2. Test Results

2.1 RADIATED EMISSION MEASUREMENT

2.1.1 Test Procedure

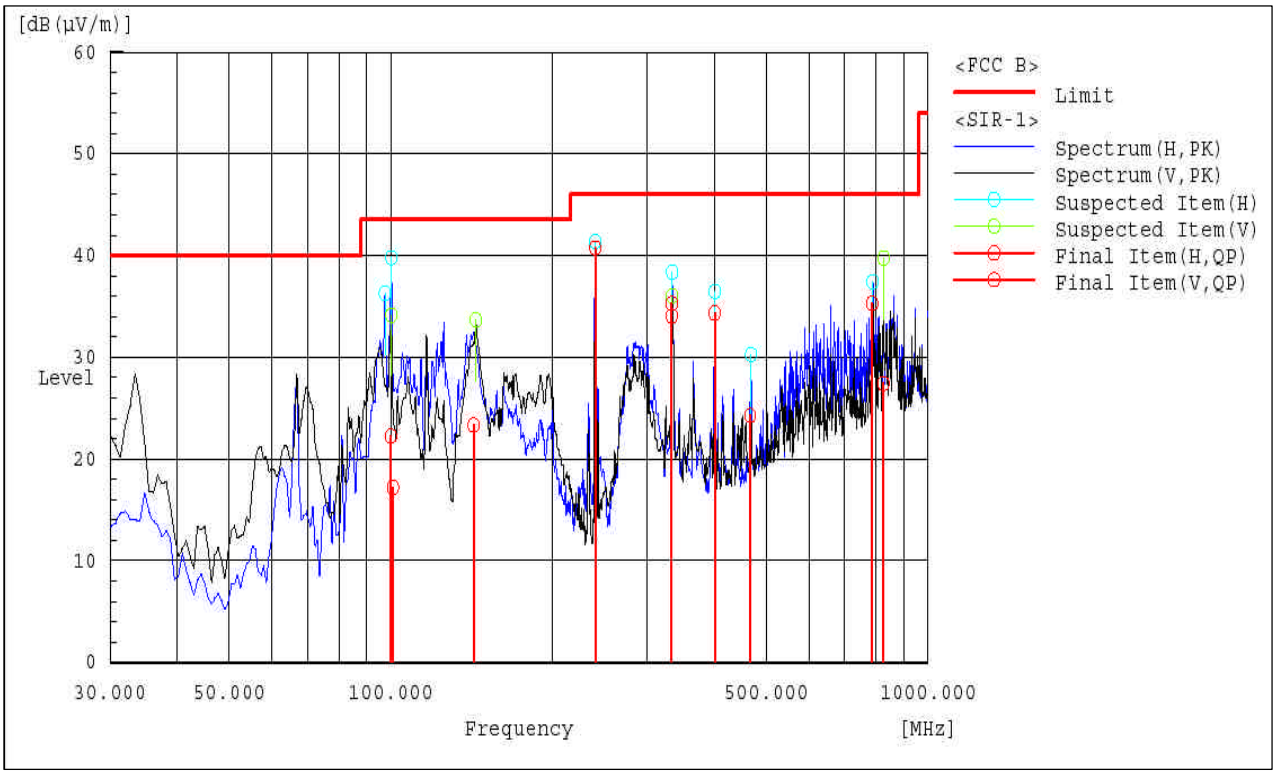
Configurate the EUT System in accordance with ANSI C63.4-1992section 8 and 12.2.
Power cords for the EUT System are connected the receptacle on the ground plane.
The output ports are connected to the cable provided with the device and the ending port of the cable are terminated in the proper impedance.
To find out the maximum emission, change the position of the cable, and the EUT operation mode under normal usage of the EUT.
The spectrum analyzer are scanned from 30MHz to 2000MHz in channel 3 and 4.

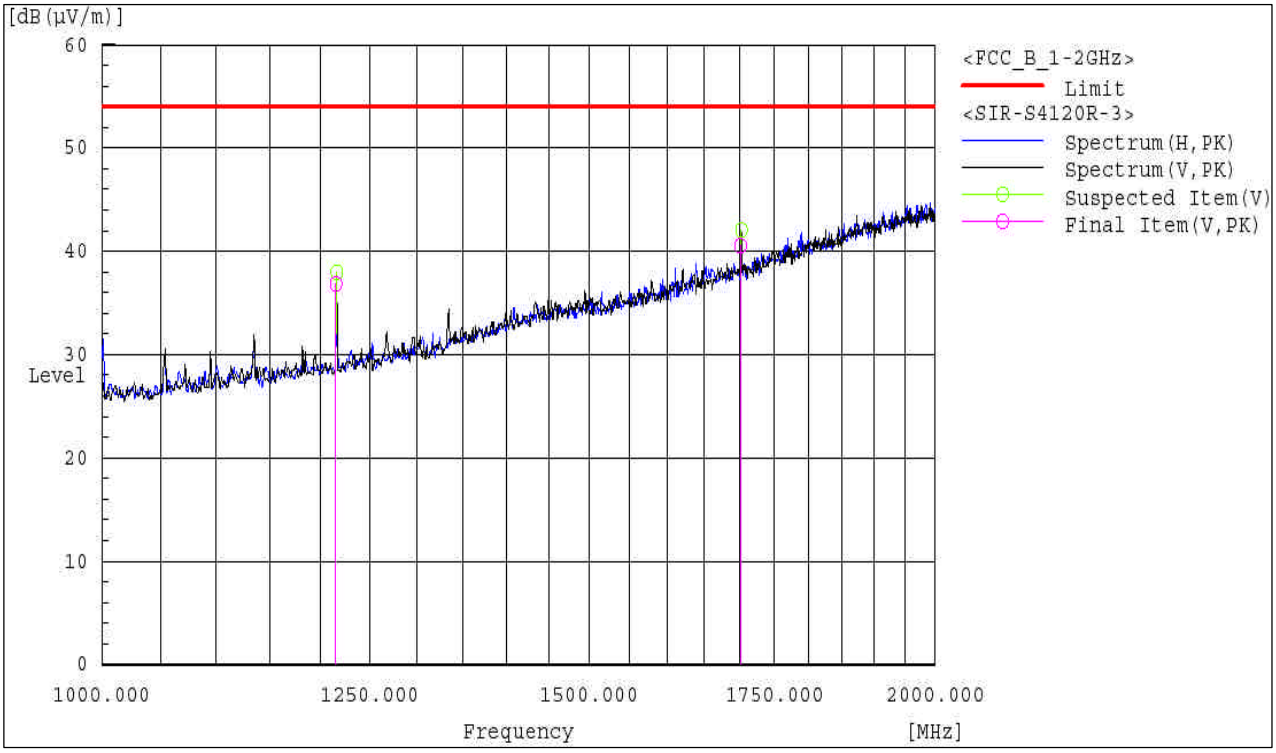
2.1.2 Setup Photograph



2.1.3 Test Results

EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH3**





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EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH3**

Frequency Range : 30 ~ 1000MHz

Final Result

--- Horizontal Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	100.875	37.0	-19.8	17.2	43.5	26.3	399.0	143.0
2	239.999	58.9	-18.2	40.7	46.0	5.3	128.0	134.0
3	333.340	49.7	-14.4	35.3	46.0	10.7	102.0	101.0
4	786.410	40.8	-5.5	35.3	46.0	10.7	102.0	151.0
5	400.680	46.5	-12.1	34.4	46.0	11.6	102.0	84.0
6	466.710	34.6	-10.3	24.3	46.0	21.7	173.0	122.0

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	99.964	42.1	-19.9	22.2	43.5	21.3	331.0	353.0
2	142.523	43.2	-19.9	23.3	43.5	20.2	105.0	58.0
3	333.360	48.5	-14.4	34.1	46.0	11.9	102.0	265.0
4	825.750	32.7	-5.3	27.4	46.0	18.6	210.0	358.0

Frequency Range : 1000 ~ 2000MHz

Final Result

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1215.050	32.6	4.2	36.8	54.0	17.2	101.0	284.0
2	1701.070	23.7	16.8	40.5	54.0	13.5	102.0	1.0

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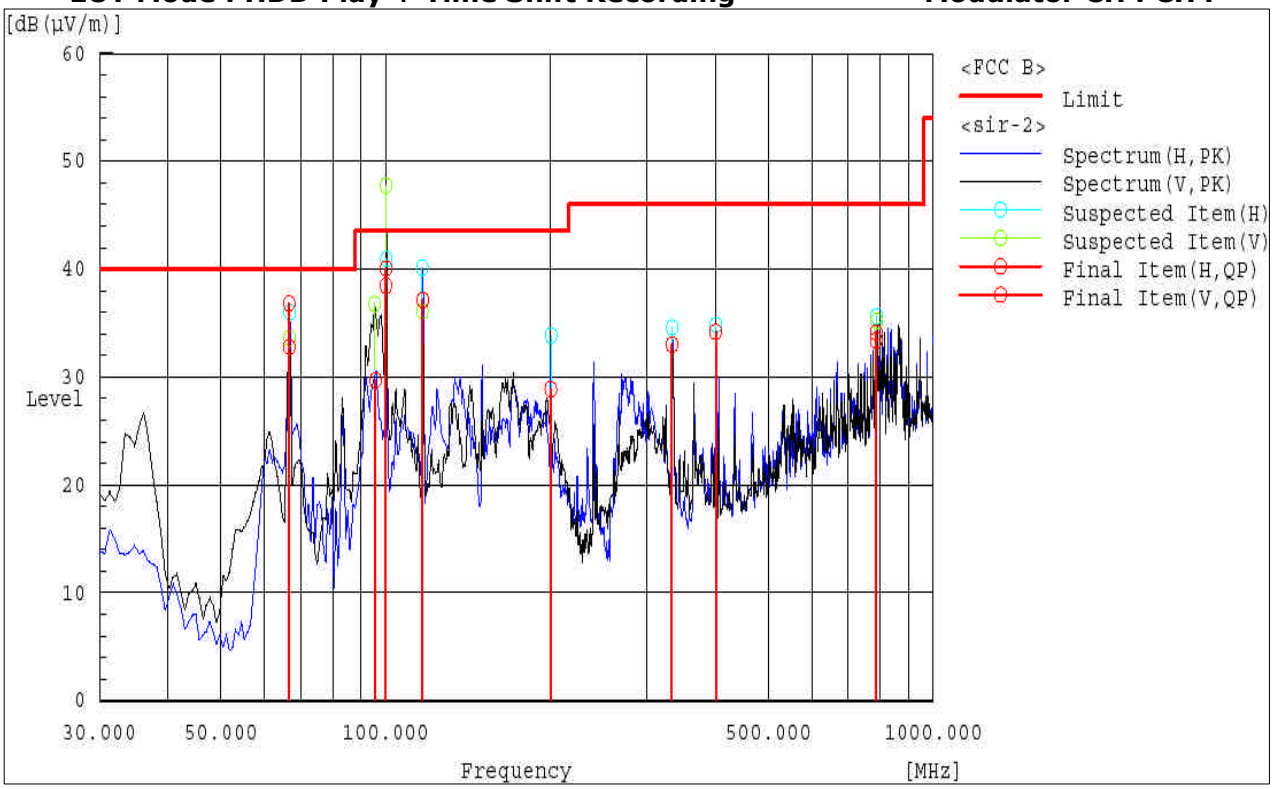
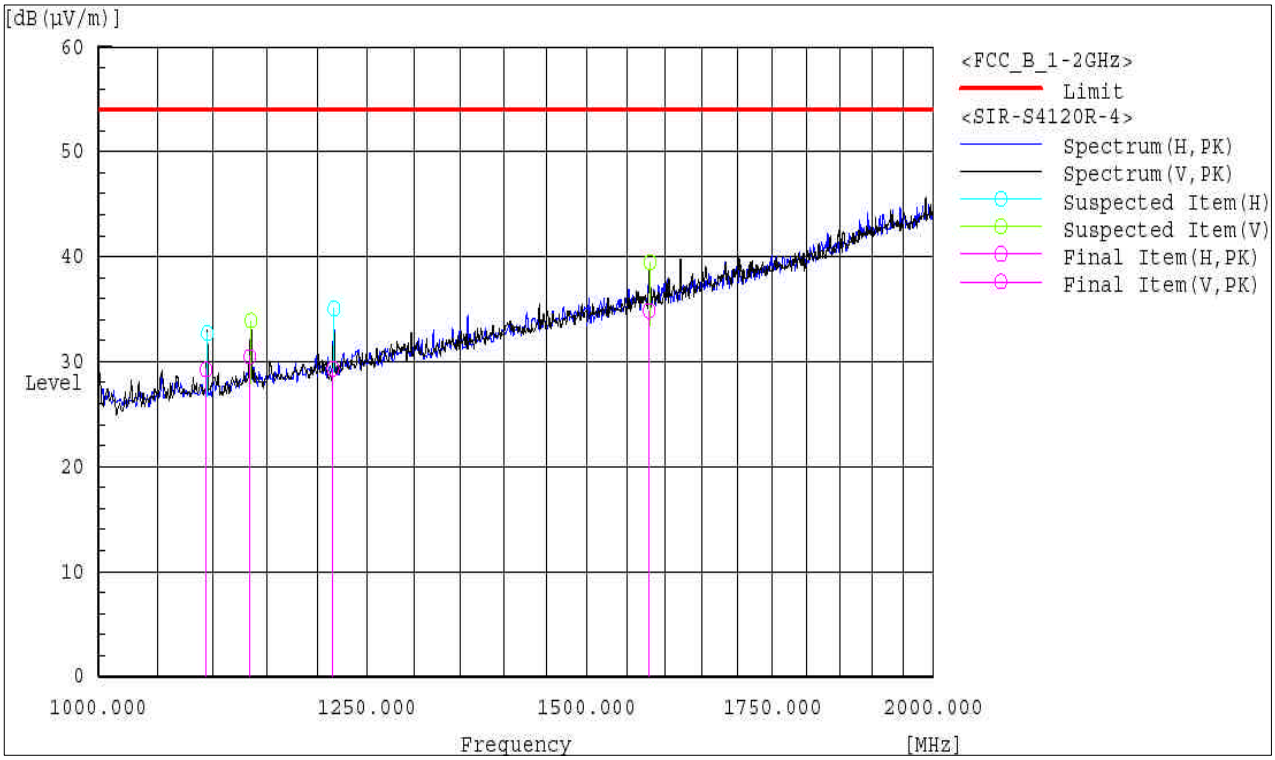
EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH4**





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EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH4**

Frequency Range : 30 ~ 1000MHz

Final Result

--- Horizontal Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(µV)]	c.f [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	66.666	62.8	-26.0	36.8	40.0	3.2	253.0	148.0
2	100.166	60.0	-19.9	40.1	43.5	3.5	290.0	140.0
3	116.852	56.0	-18.9	37.1	43.5	6.4	231.0	150.0
4	200.343	49.8	-20.9	28.9	43.5	14.6	129.0	288.0
5	333.370	47.4	-14.4	33.0	46.0	13.0	113.0	249.0
6	400.671	46.3	-12.1	34.2	46.0	11.8	107.0	249.0
7	786.430	38.9	-5.5	33.4	46.0	12.6	202.0	227.0

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(µV)]	c.f [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	66.666	58.8	-26.0	32.8	40.0	7.2	334.0	51.0
2	95.840	50.3	-20.6	29.7	43.5	13.8	108.0	310.0
3	100.166	58.4	-19.9	38.5	43.5	5.0	232.0	16.0
4	786.430	39.6	-5.5	34.1	46.0	11.9	102.0	33.0

Frequency Range : 1000 ~ 2000MHz

Final Result

--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(µV)]	c.f [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1093.550	28.0	1.3	29.3	54.0	24.7	101.0	302.0
2	1215.050	25.0	4.4	29.4	54.0	24.6	102.0	288.0

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(µV)]	c.f [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1134.050	28.1	2.4	30.5	54.0	23.5	102.0	341.0
2	1579.560	21.0	13.9	34.9	54.0	19.1	102.0	355.0

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*** Local Oscillator Frequency** IF Freq. = 0 MHz

Tuned to Frequency [MHz]	Local Oscillator Frequency [MHz]	Freq. [MHz]	Meter reading(a) [dBuV/m] H	Meter reading(a) [dBuV/m] V	Correction Factor(b) [dB]	Results (a) + (b) [dBuV/m]	Limits [dBuV/m]
988.58	Fundamental	988.58	-	-	-	-	54
	2nd Harmonic	1977.16	-	-	-	-	54
1192.7	Fundamental	1192.7	-	-	-	-	54
	2nd Harmonic	2385.4	-	-	-	-	54
1425.98	Fundamental	1425.98	-	-	-	-	54
	2nd Harmonic	2851.96	-	-	-	-	54

* There was no found any emission during the above test
* This EUT use zero-IF

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2.2 AC POWERLINE CONDUCTED EMISSION MEASUREMENT

2.2.1 Reference Rule and Specification

FCC Rule Part 15, Section 15.107(a)

2.2.2 Test Procedure

1) Configurate the EUT System in accordance with ANSI C63.4-1992 section 7 and 12.2. Connect the EUT's AC line cord to the EUT port of LISN.
2) All input terminals are terminated in the proper impedance.
   The output ports are connected to the cable provided with the device and the ending port are terminated in the proper impedance.
3) Using a calibrated coaxial cable, the TEST RECEIVER is connected to the measuring port of the LISN for EUT. To the find out an EUT condition procedures the maximum emission, the position of cables, EUT operations mode are the position of cables, EUT operations mode are checked under normal usage of EUT.
   Then, the emission are scanned from 0.45MHz to 30MHz relative to the limit are recorded.

3.2.3 Setup Photograph

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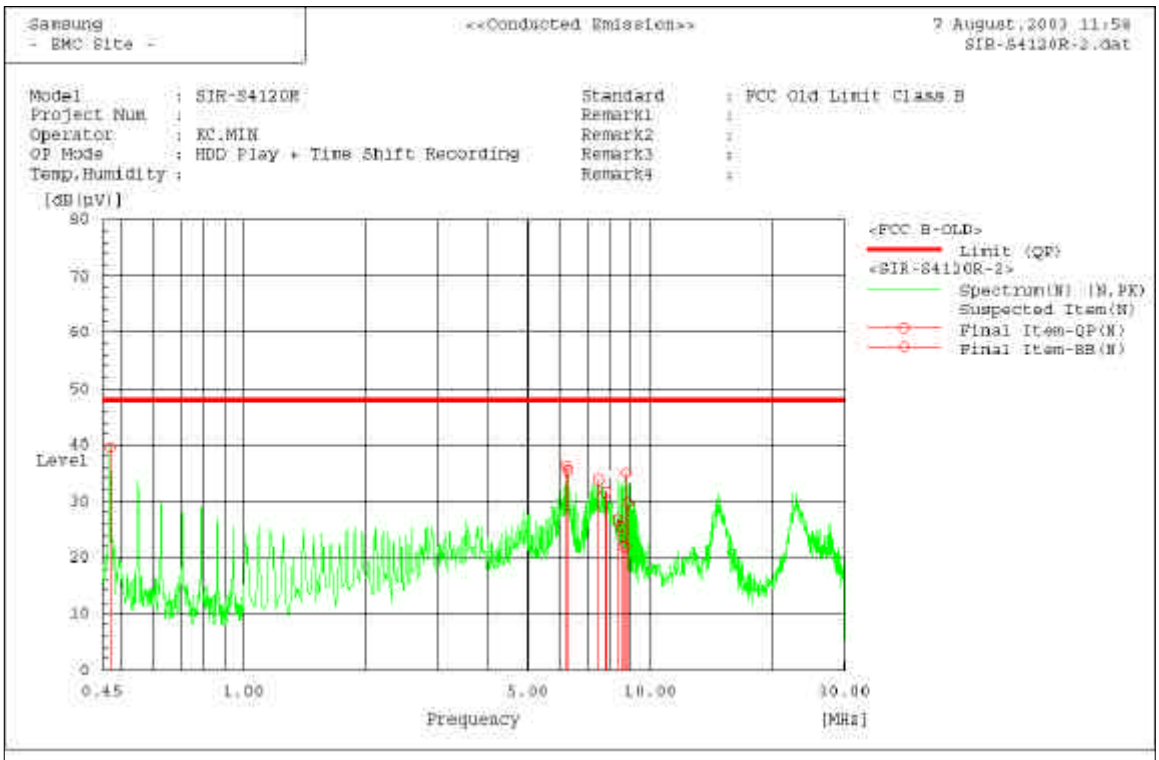
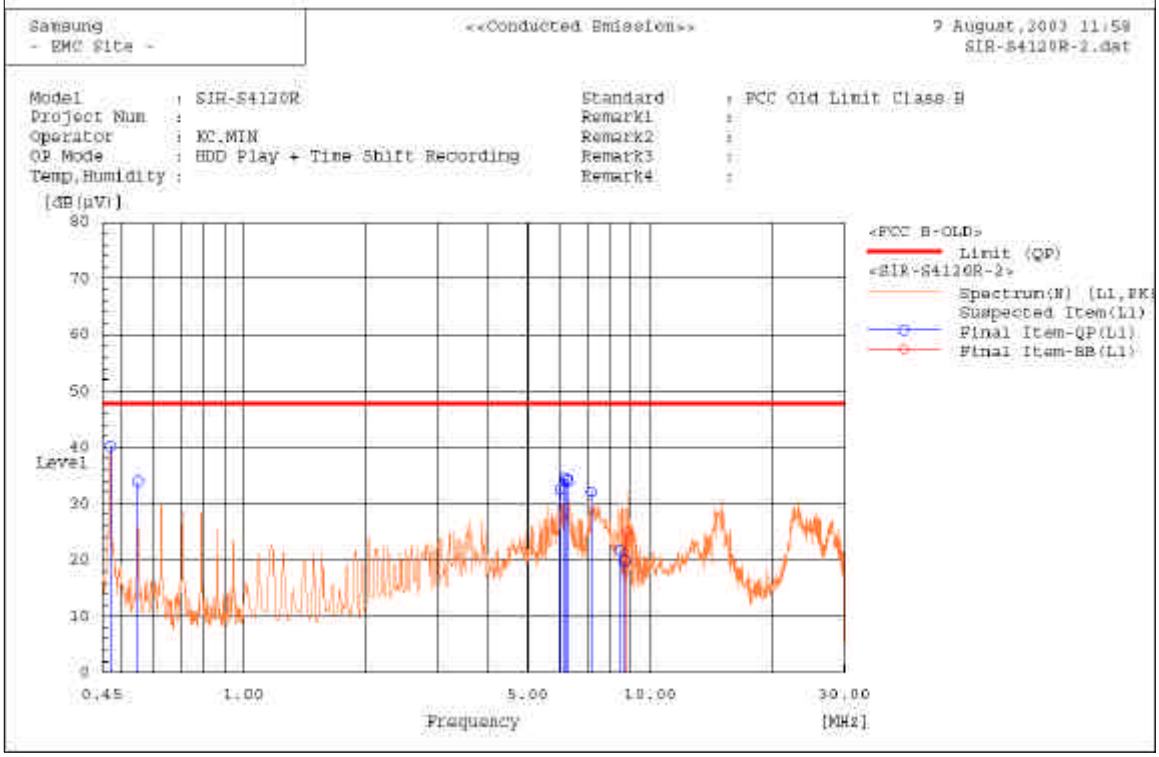
2.2.4 Test Results

EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH3**





EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH3**

Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	ID Value [dB]	ID	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Remark
1	0.47149	29.2	29.0	10.3	0.2		39.5	47.9	8.4	
2	6.21089	26.0	23.1	10.4	2.9		36.4	47.9	11.5	
3	6.29007	25.1	22.6	10.4	2.4		35.5	47.9	12.4	
4	7.47306	23.3	18.8	10.5	4.5		33.8	47.9	14.1	
5	7.78706	21.0	16.1	10.5	4.9		31.5	47.9	16.4	
6	8.34113	16.1	11.6	10.5	4.5		26.6	47.9	21.3	
7	8.49263	15.0	12.3	10.5	2.7		25.5	47.9	22.4	
8	8.66181	11.4	6.8	10.5	4.5		21.9	47.9	26.0	
9	8.73378	24.4	13.2	10.5	11.2	BB	34.9	47.9	13.0	
10	8.81368	19.1	10.8	10.5	8.3	BB	29.6	47.9	18.3	

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	ID Value [dB]	ID	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Remark
1	0.47253	30.0	29.7	10.3	0.2		40.3	47.9	7.6	
2	0.55164	23.6	22.7	10.3	0.9		33.9	47.9	14.0	
3	5.98183	22.1	19.1	10.4	2.9		32.5	47.9	15.4	
4	6.14145	23.9	21.7	10.4	2.2		34.3	47.9	13.6	
5	6.22316	23.9	20.3	10.4	3.5		34.3	47.9	13.6	
6	6.30161	23.6	20.8	10.4	2.9		34.0	47.9	13.9	
7	7.16807	21.6	18.1	10.5	3.5		32.1	47.9	15.8	
8	8.42302	11.2	6.5	10.5	4.7		21.7	47.9	26.2	
9	8.68201	9.2	3.4	10.5	5.7		19.7	47.9	28.2	
10	8.7969	14.4	4.2	10.5	10.2	BB	24.9	47.9	23.0	

* BB means broadband noise

* QP : Quasi-peak, AV: Average

* Results = Meter Reading + Correcting Factor(LISN Insertion loss + Cable loss)

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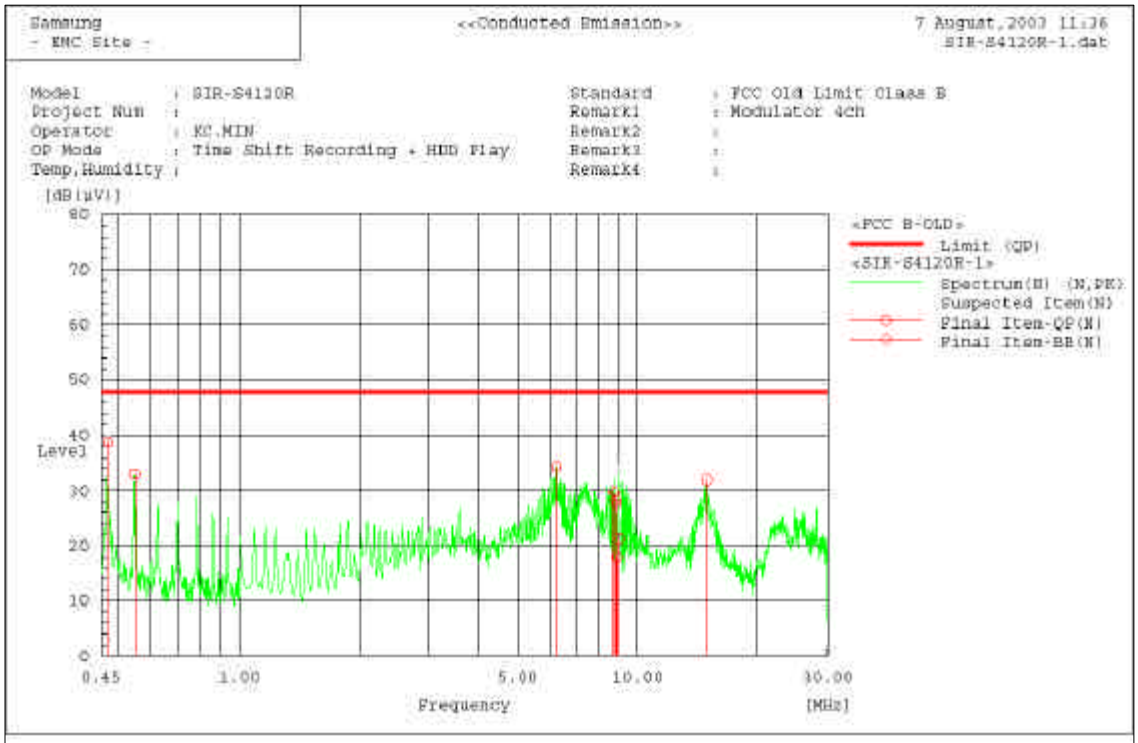
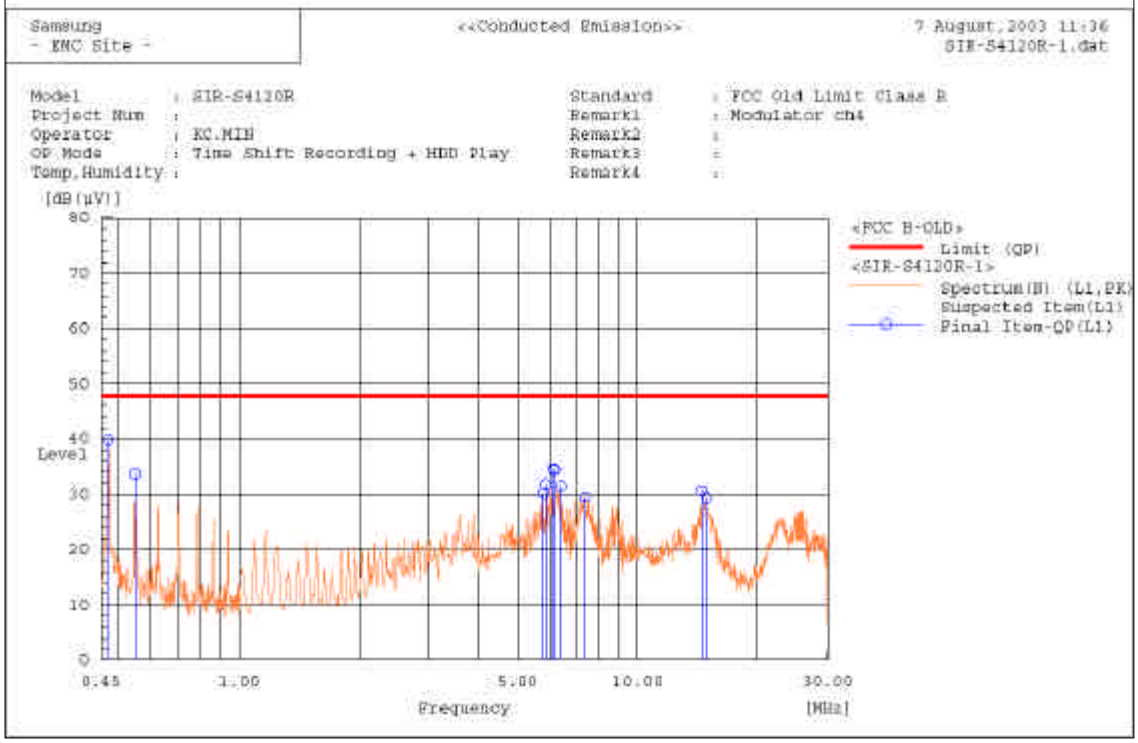
EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH4**





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EUT Mode : HDD Play + Time Shift Recording **Modulator CH : CH4**

Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	ID Value [dB]	ID	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Remark
1	0.46852	28.5	28.4	10.3	0.1		38.8	47.9	9.1	
2	0.54622	22.7	22.1	10.3	0.6		33.0	47.9	14.9	
3	6.24678	23.9	21.8	10.4	2.1		34.3	47.9	13.6	
4	8.68923	19.4	5.1	10.5	14.2	BB	29.9	47.9	18.1	
5	8.75362	19.1	10.9	10.5	8.2	BB	29.6	47.9	18.3	
6	8.80123	16.9	5.1	10.5	11.8	BB	27.4	47.9	20.5	
7	8.82288	17.8	4.5	10.5	13.3	BB	28.3	47.9	19.6	
8	8.87482	7.4	1.8	10.5	5.5		17.9	47.9	30.0	
9	8.99584	10.8	9.0	10.5	1.7		21.3	47.9	26.6	
10	14.9004	21.2	17.7	10.7	3.5		31.9	47.9	16.0	

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	ID Value [dB]	ID	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Remark
1	0.46994	29.5	29.4	10.3	0.0		39.8	47.9	8.1	
2	0.54877	23.4	22.5	10.3	1.0		33.7	47.9	14.2	
3	5.80201	19.8	16.1	10.4	3.7		30.2	47.9	17.7	
4	5.87903	21.3	18.9	10.4	2.4		31.7	47.9	16.2	
5	6.11566	24.1	21.4	10.4	2.8		34.5	47.9	13.4	
6	6.19358	24.0	21.7	10.4	2.3		34.4	47.9	13.5	
7	6.43039	21.1	19.0	10.4	2.2		31.5	47.9	16.4	
8	7.39803	19.0	13.1	10.5	5.9		29.5	47.9	18.4	
9	14.51844	19.8	15.8	10.8	4.0		30.6	47.9	17.3	
10	14.84068	18.5	13.3	10.8	5.2		29.3	47.9	18.6	

* BB means broadband noise

* QP : Quasi-peak, AV: Average

* Results = Meter Reading + Correcting Factor(LISN Insertion loss + Cable loss)

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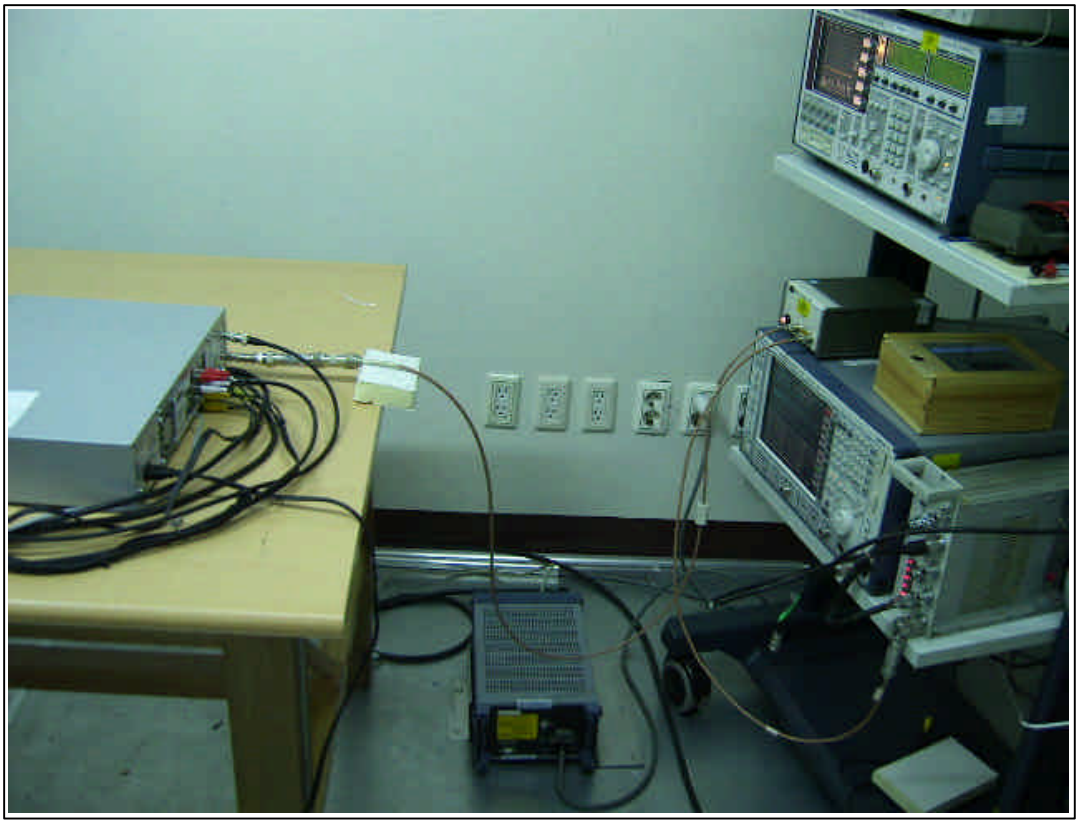
2.3 OUTPUT SIGNAL LEVEL MEASUREMENT

2.3.1 Test Procedure

Configurate the EUT System in accordance with ANSI C63.4-1992 section 12.2.
The RF output terminal is connected is to the spectrum analyzer through the matching transformer with a calibrated 75 ohms coaxial cable.
Then, the RF output signal level is measured under the EUT condition produces the maximum signal level.

2.3.2 Setup Photograph



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2.3.3 Test Results

EUT Mode : HDD Play + Time Shift Recording

Video Signal

CH No.	Frequency [MHz]	Reading [dB(μV)]	CF Factor [dB]	Level [dB(μV)]	Limit [dB(μV)]	Margin [dB]
CH3	61.26734	76.3	-10.1	66.2	69.5	3.3
CH4	67.25702	75.8	-10	65.8	69.5	3.7

*CF Factor = Preamp Gain + Matching Pad Loss + Cable Loss

Audio Signal

CH No.	Frequency [MHz]	Reading [dB(μV)]	CF Factor [dB]	Level [dB(μV)]	Limit [dB(μV)]	Margin [dB]
CH3	56.76673	62.1	-10.1	52	56.5	4.5
	65.75912	61.6	-10.1	51.5	56.5	5
CH4	62.75601	61.7	-10.1	51.6	56.5	4.9
	71.752	60.9	-10	50.9	56.5	5.6

*CF Factor = Preamp Gain + Matching Pad Loss + Cable Loss

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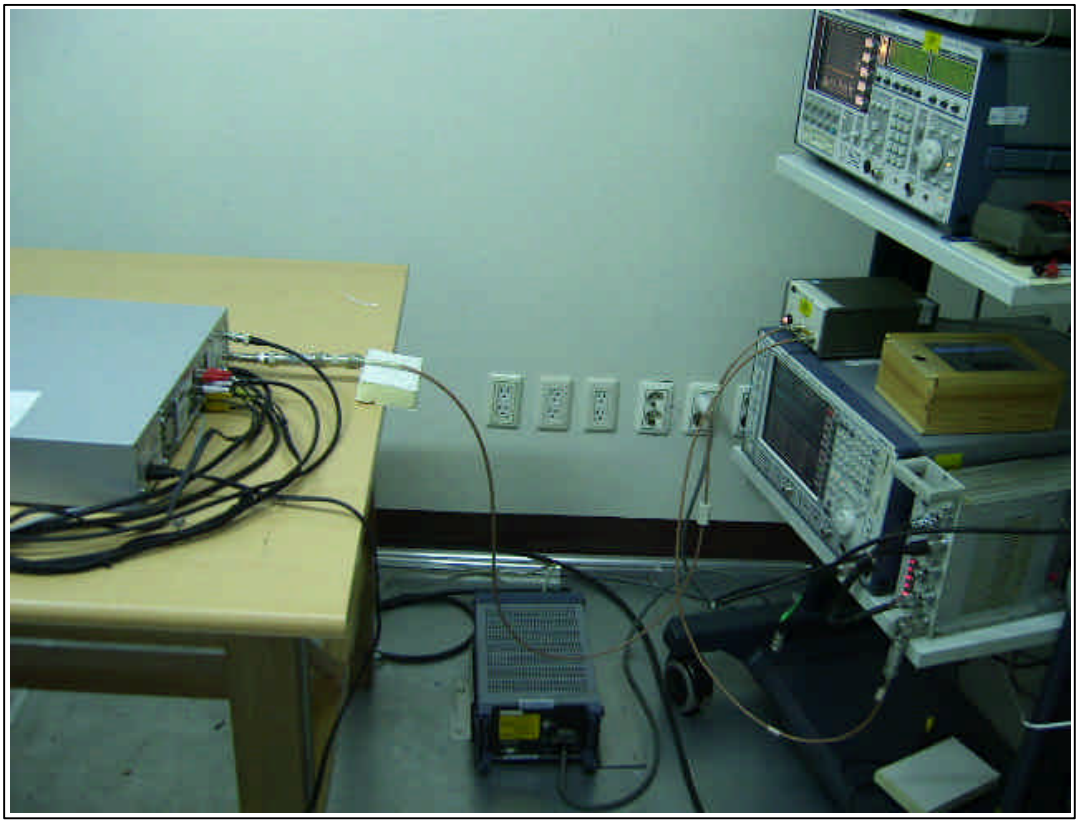
2.4 OUTPUT TERMINAL CONDUCTED SPURIOUS EMISSION MEASUREMENT

2.4.1 Test Procedure

The EUT system and measuring instrument are set up in the same manner of the output signal measurement.
The spectrum was scanned from 30MHz to more than 4.6MHz below the visual carrier frequency, and from more than 7.4MHz above the visual carrier frequency to 1000MHz.
Then, the significant spurious emissions are measured at the output terminal.

2.4.2 Setup Photograph



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2.4.3 Test Results

EUT Mode : HDD Play + Time Shift Recording **Modulator CH: 3ch**

Frequency [MHz]	Reading [dB(μV)]	CF Factor [dB]	Level [dB(μV)]	Limit [dB(μV)]	Margin [dB]
38.76166	25.8	-10.3	15.5	39.5	24
47.72225	33.1	-10.2	22.9	39.5	16.6
55.36743	20.8	-10.1	10.7	39.5	28.8
74.81125	31.8	-10	21.8	39.5	17.7
83.79752	22.1	-10	12.1	39.5	27.4
122.5389	31.4	-9.8	21.6	39.5	17.9

*CF Factor = Preamp Gain + Matching Pad Loss + Cable Loss

EUT Mode : HDD Play + Time Shift Recording **Modulator CH: 4ch**

Frequency [MHz]	Reading [dB(μV)]	CF Factor [dB]	Level [dB(μV)]	Limit [dB(μV)]	Margin [dB]
44.68825	25	-10.2	14.8	39.5	24.7
53.75435	33.1	-10.1	23	39.5	16.5
61.75065	21.2	-10.1	11.1	39.5	28.4
80.81004	30	-10	20	39.5	19.5
89.76423	20.8	-9.9	10.9	39.5	28.6
134.5134	28.6	-9.7	18.9	39.5	20.6

*CF Factor = Preamp Gain + Matching Pad Loss + Cable Loss

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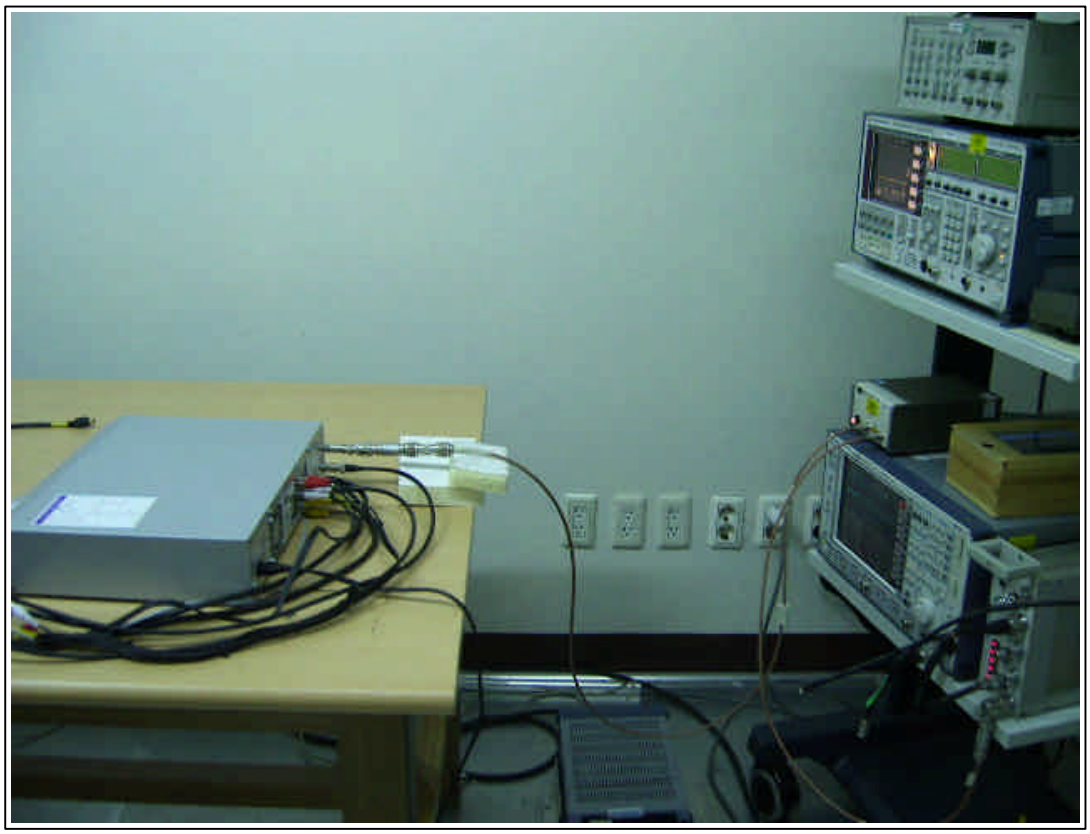
2.5 ANTENNA TRANSFER SWITCH ISOLATION MEASUREMENT

2.5.1 Test Procedure

Configurate the EUT System in accordance with ANSI C63.4-1992 section 12.2.
The RF output terminal is terminated in the proper impedance.
The ANT input terminal is connected is to the spectrum analyzer through the matching transformer with a calibrated 75 ohms coaxial cable.
Then, the RF output leakage level is measured under the EUT condition produces the maximum signal level.

2.5.2 Setup Photograph



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2.5.3 Test Results

EUT Mode : HDD Play + Time Shift Recording

CH No.	Frequency [MHz]	Reading [dB(μV)]	CF Factor [dB]	Level [dB(μV)]	Limit [dB(μV)]	Margin [dB]
3	61.26694	14.7	-10.1	4.6	9.5	4.9
4	67.25488	14.7	-10	4.7	9.5	4.8

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3.1 Test Equipment List

Description	Model	Manufacturer	Serial No.	Applied
TEST RECEIVER	ESI26	R & S	100067	o
RF RELAIS MATRIX	PSU	R & S	861206/024	o
10dB ATTENUATOR	8491B	Agilent	58226	o
LISN	ESH3-Z5	R & S	847265/028	o
TEST SOFTWARE	EP5CE	TOYO	-	o
TEST RECEIVER	ESCS30	R & S	100104	o
PATTERN GEN.	PM5418-TDSI	PHILIPS	LO612437	o
SPECTRUM ANALYZER	E7405A	Agilent	US41110272	o
BI-LOG ANTENNA	CBL6112B	SCHAFFNER	2766	o
RF SELECTOR	NS4900	TOYO	0303-015	o
MAST CONTROLLER	HD2000	HD	HD20000902027	o
TEST SOFTWARE	EP5RE	TOYO	-	o
MATCHING PAD	RAM	R & S	829712/026	o
Turn Table	DS412	HD	-	N/A
Antenna Mast	MA240	HD	240/620	N/A
Preamplifier	8447D	Agilent	2944A10430	o
Preamplifier	310	SONOMA Instrument	185821	o
Horn Antenna	3115	EMCO	00027026	o

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