

EMC TEST REPORT




Project No.	LBE091158	Revision No.	None
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742 Korea	
	Date of application	2009.04.14	
EUT Equipment Under Test	Kind of product	CCTV controller	
	Model No.	SCX-RD100	
		Variant Model	none
	Manufacturer	Tianjin Samsung Electronics Company 300457, TSEC12, 4th Avenue, TEDA, Tianjin, China	
New / Alternative / Permissive change information	*) New		
Applied Standards	EN61000-6-4:2001		
	EN50130-4:1996+A1998+A2:2003		
	EN61000-3-2:2006		
	EN61000-3-3:1995+A1:2001+A2:2005		
Issued date	2009.04.24		
Test result : Complied The equipment under test has found to be compliant with the applied standards. (Refer to the attached test result for more detail.)			
Tested by : Seung Beom Choi 		Reviewed by : No Cheon Park 	
This report is the test result about the sphere accredited by KOLAS which signed the Mutual Recognition Arrangement of International Laboratory Accreditation Cooperation. The test results in this report only apply to the tested sample. This report must not be reproduced, except in full, without written permission from SEC EMC Laboratory.			
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1. Summary of test results

1.1 Emission

The EUT has been tested according to the following specifications:

Test type	Applied standard	Result	Remarks
Conducted Disturbance	EN61000-6-4:2001	Complied	Minimum margin is 17.7 dB at 2.21 MHz
Radiated Disturbance		Complied	Minimum margin is 5.0 dB at 186.1 MHz
Harmonics current	EN61000-3-2:2006	N/A	Below 75 W
Voltage fluctuation & Flicker	EN61000-3-3:1995 +A1:2001+A2:2005	Complied	

1.2 Immunity

Immunity test applied the normative documents of EN50130-4.

The EUT has been tested according to the following specifications:

Test type	Applied standard	Performance Criterion	
		Result	Specification
Electrostatic discharge	EN61000-4-2:1995	A	B : Air discharge
		A	B : Contact discharge
Radiated, radio-frequency, electromagnetic field	EN61000-4-3:1995	B / B / A	C / B / A
Electrical fast transient/burst	EN61000-4-4:1995	B	B
Surge	EN61000-4-5:1995	A	B
Conducted disturbances, induced by radio-frequency fields	EN61000-4-6:1996	B / A / A	C / B / A
Voltage dips, short interruptions and voltage variations	EN61000-4-11:1994	A	B : >30 %, 0.5 / 1 / 5 / 10 p
		A	B : >60 %, 0.5 / 1 / 5 / 10 p
		A	B : >100 %, 0.5 / 1 / 5 p



2. General Information












2.1 Test facility

The SEC EMC Laboratory is located on Samsung Electronics Co., Ltd. At 416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, South Korea.

All testing are performed in Semi-anechoic chambers conforming to the site attenuation Characteristics defined by ANSI C63.4, CISPR 22, 16-1 and 16-2. and Shielded rooms.

The SEC EMC Laboratory is operated as testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.

2.2 Accreditation and listing

Laboratory Qualifications		Remarks
	KOLAS(Korea Laboratory Accreditation Scheme)	Accredited : 124
	Korea Communications Commission Radio Research Agency	Accredited : KR0004
	FCC(Federal Communications Commission)	Accredited : KR0004
	National Voluntary Laboratory Accreditation Program	Lab Code: 200623-0
	Norges Elektriske Materiellkontroll	Accredited : ELA 195
	VCCI (Voluntary Control Council for Interference by Information Technology Equipment)	C-2421,R-2224
	China Quality Certification Center	5-053, 5-054
	TUV Rhineland	H9354285
	GOST(GOSTSTANDART)	ROSTEST
	Elektrotechnicky Zkusebni Ustav	Reg. No.: 001
	IC(Industry Canada)	Assigned Code: 5871

3. Test Setup configuration

3.1 Test peripherals

The peripherals which were interconnected to the EUT during the test are as follows:

Item	Model No.	Serial No.	Manufacturer	Note
CCTV controller	SCX-RD100	-	Samsung	EUT
AC adapter	DAD-12050KA	-	Dream Elec.	-
CCTV camera	SCC-B2333	-	Samsung	-
AC adapter	DAD-12050KA	-	Dream Elec.	-

3.2 EUT operating mode(s)

To achieve compliance applied standard specification, the following mode(s) were made during compliance testing:

Operating Mode 1	CCTV camera in + RS-485 communication
Operating Mode 2	-
Operating Mode 3	-

3.3 Details of Sampling

Customer selected, single unit.

3.4 Cable description

The type(s) of cables which were connected to the ports (of the EUT) are as follows:

No.	From the port of EUT	To	Length[m]	Shielded[Y/N]
1	DC in	AC adapter	2.0	Yes
2	Video in	CCTV camera	0.5	Yes
3	Video out	75 ohm termination	1.0	Yes
4	RS-485	CCTV camera	0.3	Yes
5	RS-232	Cable termination	1.5	Yes
6	USB	Cable termination	1.0	Yes

3.5 EUT Description

The following features describe EUT represented by this report:

Item		Description
COAXIAL	Communication Method	COAXIAL INTERFACE
	Range	Max. 500m (with 5C-2V cable)
RS-232	Connector Type	D-SUB 9P
	Port	1 PORT
	BAUD RATE	4800/9600/19200/38400bps
RS-485	Connector Type	4P Terminal Type
	PORT	1 PORT
	BAUD RATE	600/1200/2400/4800/9600/ 19200/38400bps
USB PORT(USB2.0)		S/W PROGRAM UPLOAD
VIDEO IN/OUT		Composite Video 1.0Vp-p, 75ohm, Cable Compensation out (Select:S/L)
MULTI PROTOCOL		3 programs A) SAMSUNG, PANASONIC, PELCO-P, PELCO-D B) SAMSUNG, AD, ERNA, VICON, VCLTP C) SAMSUNG, DIAMOND, KALATEL
Environmental Conditions	Operating Temp.	-10°C ~ +50°C
	Humidity	Less than 90%
POWER		DC12V ± 10%
DIMENSIONS (WxHxD)		150(W) X 36(H) X 102(D)

3.6 Description of the EUT exercising method

The EUT exercise program used during EMI and Immunity (EMS) testing was the SEC EMC Laboratory standardized test program for MS Windows. The program repetitively sends a screen of H – Character to the display. Connect video output of computer on EUT's PC IN(D-sub)port and scrolled H – character continuously on EUT's screen.

Also, when EUT has loudspeaker, it was regenerative through EUT's audio input reproducing "digital white noise" by MS Windows Media Player in the computer.

Examples of functions defined by the manufacturer to be evaluated during testing include the following:

3.7 Performance Criteria

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.

If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.

Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

3.8 Measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus: (According to CISPR 16-4 and UKAS Lab 34.)

3.8.1 Emission

Test type		Measurement uncertainty (C.L. 95%, k = 2)
Conducted Disturbance	Main terminal	± 3.50 dB
	10/100 Base LAN	± 2.80 dB
	1000 Base LAN	± 2.80 dB
	TEL line	± 2.80 dB
Radiated Disturbance	Horizontal	± 5.00 dB
	Vertical	± 5.03 dB
Harmonics current		7.5 %
Voltage fluctuation & Flicker		5.8 %

4. Results of individual test

4.1 Conducted disturbance

Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.

The EUT measured in accordance with the methods described in standards.

Limits for conducted disturbance at mains ports of class A ITE

Frequency range Limits MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60

Note 1: 1 μV is regarded as 0 dB.
 Note 2: If the average limit is met in the measurement with quasi-peak detector, the measurement with average detector at the same frequency is unnecessary.
 Note 3: The lower limit shall apply at the transition frequency.

Limits for conducted disturbance at the mains ports of class B ITE

Frequency range Limits MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Note 1: 1 μV is regarded as 0 dB.
 Note 2: The limits shall decrease linearly with the logarithm of the frequency in the range 150 – 500 kHz.
 Note 3: If the average limit is met in the measurement with quasi-peak detector, the measurement with average detector is unnecessary.
 Note 4: The lower limit shall apply at the transition frequency.

Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports for class A equipment

Frequency range Limits MHz	Voltage limits dB(μV)		Current limits dB(μA)	
	Quasi-peak	Quasi-peak	Quasi-peak	Average
0,15 to 0,50	97 to 87	84 to 74	53 to 43	40 to 30
0,50 to 30	87	74	43	30

Note 1: 1 μV is regarded as 0 dB. 1 μA is regarded as 0dB.
 Note 2: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Note 3: If the average limit is met in a measurement with quasi-peak detector receiver, the measurement with average detector receiver at the same frequency is unnecessary.

Note 4: The conversion factor between voltage limits and current limits is $20 \log_{10} 150/I = 44 \text{ dB}$.

Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports for class B equipment

Frequency range Limits MHz	Voltage limits dB(μV)		Current limits dB(μA)	
	Quasi-peak	Quasi-peak	Quasi-peak	Average
0,15 to 0,50	84 to 74	74 to 64	40 to 30	30 to 20
0,50 to 30	74	64	30	20

Note 1: 1 μV is regarded as 0 dB. 1 μA is regarded as 0dB.

Note 2: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Note 3: If the average limit is met in a measurement with quasi-peak detector receiver, the measurement with average detector receiver at the same frequency is unnecessary.

Note 4: The conversion factor between voltage limits and current limits is $20 \log_{10} 150 /I= 44 \text{ dB}$.

If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 seconds at each measurement frequency, the highest reading shall be recorded, with the exception of any brief isolated high reading (which shall be ignored).

4.1.1 Test instrumentation

Test instrumentations which were used in the Conducted disturbance test are as follows;

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Field strength meter	ESCS30	R&S	100104	2008-06-25	12
L.I.S.N	ENV216	R&S	100454	2008-11-28	12

4.1.2 Photograph of the test Configuration



4.1.3 Test result

Test date	2009.04.15		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	24.5 °C	Relative humidity	23 %	Atmospheric pressure	100.4 kPa
	Test place					
DM Shielded Room #1						

4.1.4 Test data

■ Operating Mode: CCTV camera in + RS-485 communication

Test Information

Test Description: SCX-RD100
Operating Conditions: CCTV camera controlling
Operator Name: SB Choi
Comment:

Hardware Setup: Voltage_ITE - [EMI conducted]

Subrange 1

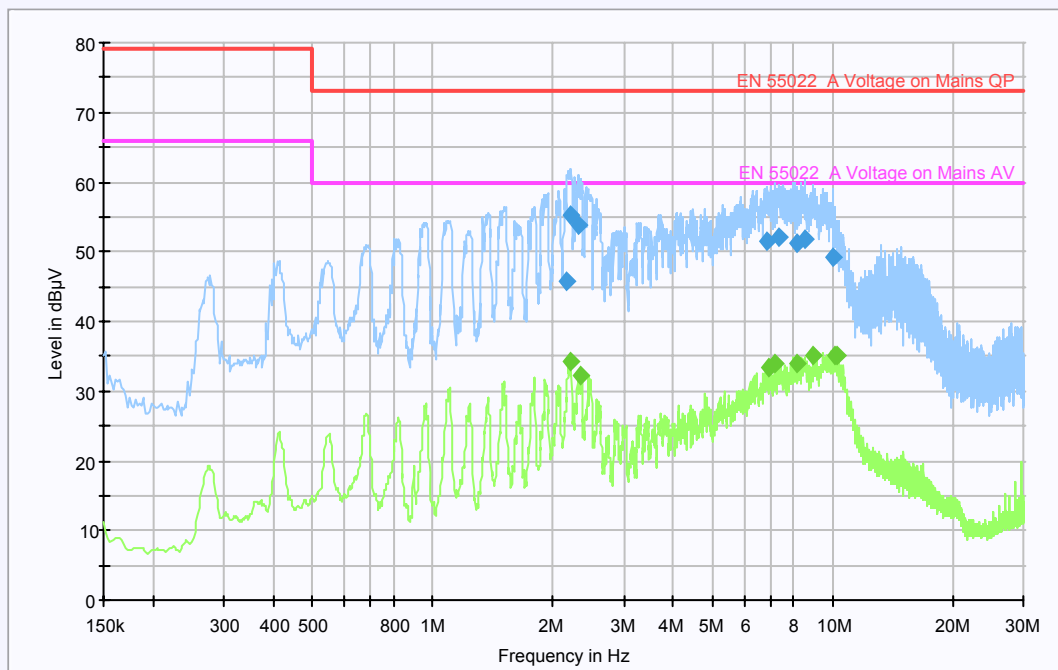
Frequency Range: 150kHz - 30MHz

Receiver: ESCS 30 [ESCS 30]
@ GPIB0 (ADR 18), SN 0, FW 2.30 02.01 02.36

Signal Path: ESCS 30-LISN
Correction Table: Cable loss_Receiver-2-LISN

LISN: LISN_ITE
Correction Table (Line 0): Factor_ENV216_100454_N
Correction Table (Line 1): Factor_ENV216_100454_L1

Conducted Emission_EN55022 class A



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
2.148600	45.8	L1	9.8	27.2	73.0
2.213400	55.3	N	9.8	17.7	73.0
2.316400	53.9	N	9.8	19.1	73.0
6.860600	51.6	N	9.9	21.4	73.0
7.310600	52.2	N	9.8	20.8	73.0
8.100400	51.3	N	10.0	21.7	73.0
8.514600	51.8	N	10.0	21.2	73.0
10.014000	49.1	N	10.0	23.9	73.0

Final Measurement Detector 2

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
2.207800	34.2	N	9.8	25.8	60.0
2.328800	32.3	N	9.8	27.7	60.0
6.892000	33.3	N	9.9	26.7	60.0
7.173800	34.0	N	9.8	26.0	60.0
8.113800	34.1	N	10.0	25.9	60.0
8.968600	35.2	N	10.0	24.8	60.0
10.088500	35.2	N	10.0	24.8	60.0
10.222800	35.1	N	10.0	24.9	60.0

4.2 Radiated disturbance

Of those disturbances above ($L - 20\text{dB}$), where L is the limit level in logarithmic units, record at least the disturbance levels and the frequencies of the six highest disturbances.

The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin. All measurements were taken utilizing quasi-peak detection unless stated otherwise. Measurements were performed at an antenna to EUT distance of 10 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Limits for radiated disturbance of ITE at a measuring distance of 10 m

Frequency range Limits MHz	Quasi-peak Limits dB dB($\mu\text{V}/\text{m}$)	
	Class A	Class B
30 to 230	40	30
230 to 1000	47	37

Note 1: The lower limit shall apply at the transition frequency.
 Note 2: Additional provisions may be required for cases where interference occurs.
 Note 3: 1 $\mu\text{V}/\text{m}$ is regarded as 0 dB.

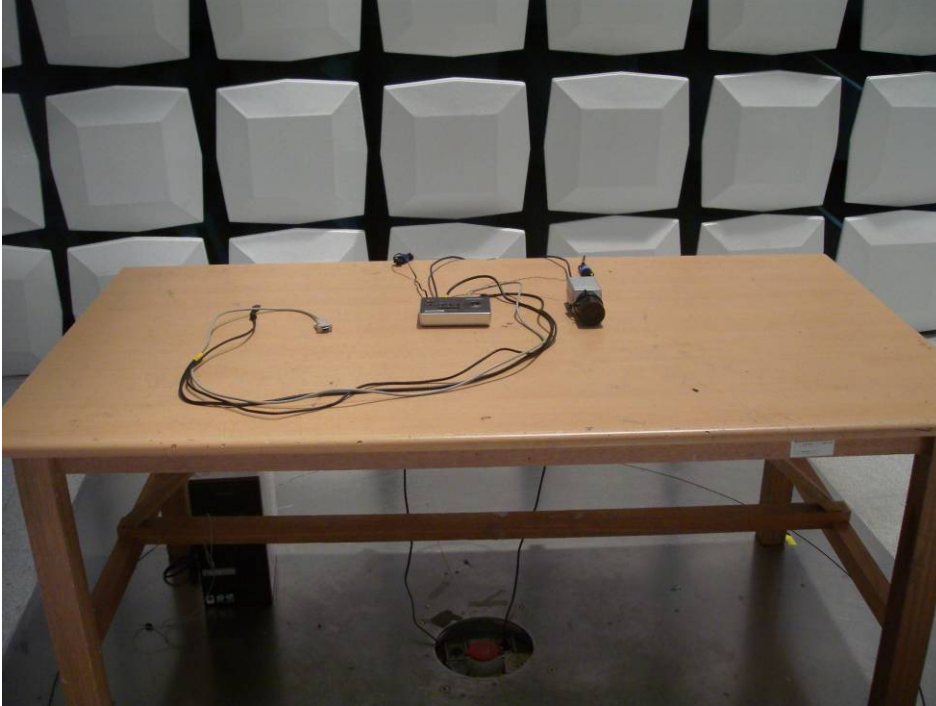
4.2.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

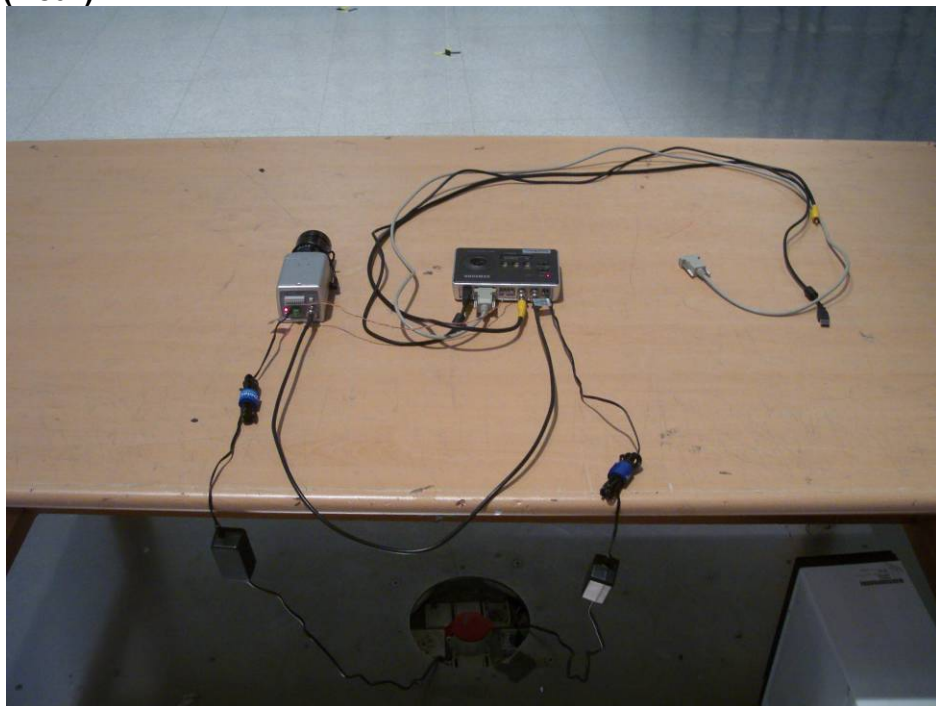
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
EMI Test Receiver	ESCS30	R&S	839809/002	2008-06-16	12
Spectrum Analyzer	E7405A	Agilent	MY42000052	2009-01-09	12
Ant. Mast	MA4000	inn-co	-	N/A	N/A
Mast Controller	CO2000	inn-co	-	N/A	N/A
Turntable Controller	HD100	inn-co	-	N/A	N/A
Amplifier	310N	SONOMA	251677	2009-03-26	12
RF selector	NS4900	TOYO	-	N/A	N/A
Bi-log Antenna	CBL6112B	SCHAFFNER	2953	2008-04-15	24

4.2.2 Photograph of the test Configuration

(Front)



(Rear)

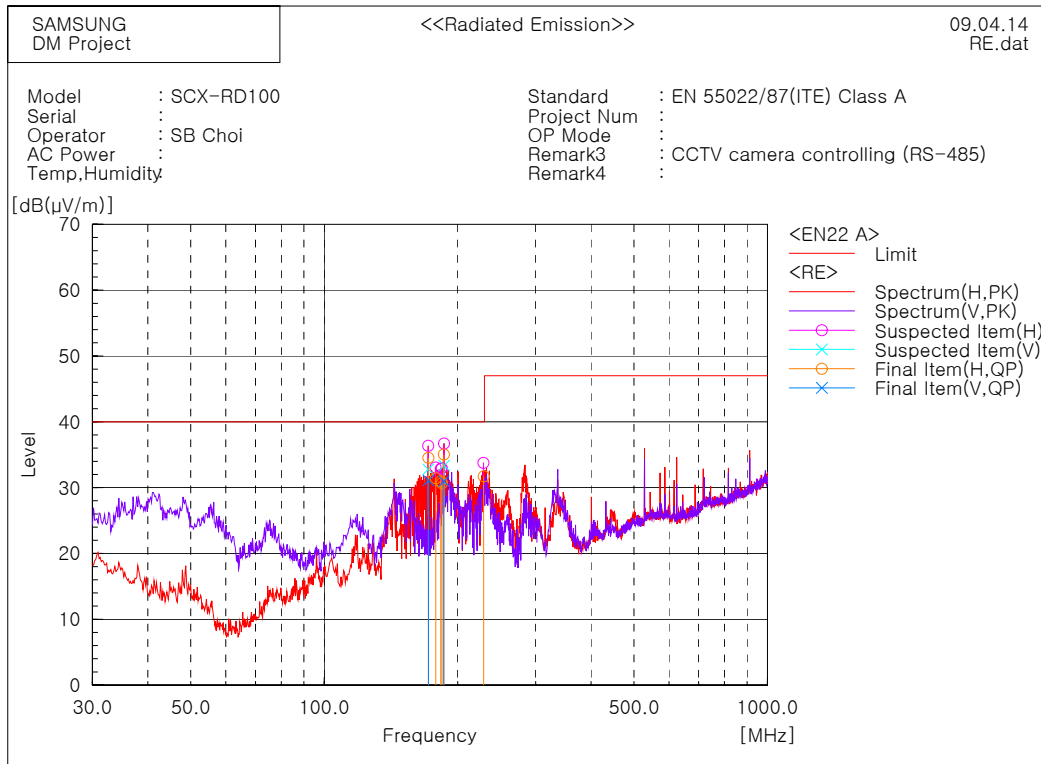


4.2.3 Test results

Test date	2009.04.14		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	26.9 °C	Relative humidity	12 %	Atmospheric pressure	100.4 kPa
	Test place DM 10m Semi-Anechoic Chamber					

4.2.4 Test data

■ **Operating Mode: CCTV camera in + RS-485 communication**



4.3 Harmonics current

The EUT operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

The power consumption, steady state harmonic currents were measured in the tested operating mode(s). The EUT measured in accordance with the test conditions described in Annex C (C.10).

Limits for Class A equipment

Harmonic order n	Maximum permissible harmonic current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 ≤ n ≤ 39 (odd harmonics only)	0.15 15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8 ≤ n ≤ 40	0.23 8/n

Limits for Class D equipment

Harmonic order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13 ≤ n ≤ 39 (odd harmonics only)	3.85/n	See Table 1

4.3.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Power Analyzer	PM6000A	Voltech	100006700167	2008-11-11	12
IEC Network	555	ZIMMER	IB10/9466	N/A	N/A

4.3.2 Photograph of the test Configuration





4.3.3 Test results

Test date	2009.04.16		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	23.5 °C	Relative humidity	31 %	Atmospheric pressure	100.9 kPa
Test place	Shield room #3					

4.3.4 Test data

■ Operating Mode: CCTV camera in + RS-485 communication

Product:	CCTV CONTROLLER	2009 Apr 17 4:33pm
Serial no:		Page 1 of 1
Description:		
Test Date:	2009 Apr 17 4:28pm	
Result Name:	SCX-RD100	
Type of Test:	EN61000:2006 Harmonics inc. interharmonics to EN61000-4-7:2002	
Limits:	Class A	
Power Analyzer:	Voltech PM6000 SN: 100006700167 Firmware version: v1.20.06RC3	
Channel(s):	1. SN: 090015500508, 25 Adjusted Date: 22 JUL 2007. 2. SN: 090015500521, 25 Adjusted Date: 23 JUL 2007.	
	3. SN: 090015500543, 25 Adjusted Date: 5 AUG 2007. 4. SN:None Adjusted Date:None	
	5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
Shunt(s):	1. SN: 091024300502, 4 Adjusted Date: 14 JUL 2007. 2. SN: 091024300503, 4 Adjusted Date: 14 JUL 2007.	
	3. SN: 091024300504, 4 Adjusted Date: 14 JUL 2007. 4. SN:None Adjusted Date:None	
	5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
AC Source:	Mains / Manual Source	
Harmonic Results Against Chosen Limits:	Notes:	
N/A	Minimum power is greater than maximum	
Test Parameter Details	User Entered	Measured
Operating Frequency:	50	49.9840
Operating Voltage:	230	230.1283
Specified Power:	0.0000	1.5477
Fundamental Current:	0.0000	0.0051
Power Factor:	0.0000	0.4857
Average Input Current:		0.0137
Maximum POHC:		0.0059
POHC Limit:		0.2514
Maximum THC:		0.0129
Minimum Power:	75	
Class Multiplier:	1.0000	
Test Duration:	00:02:30	

4.4 Voltage fluctuation & Flicker

The EUT operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

During the flicker measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes.

Limits of voltage fluctuations and flicker at the supply terminals

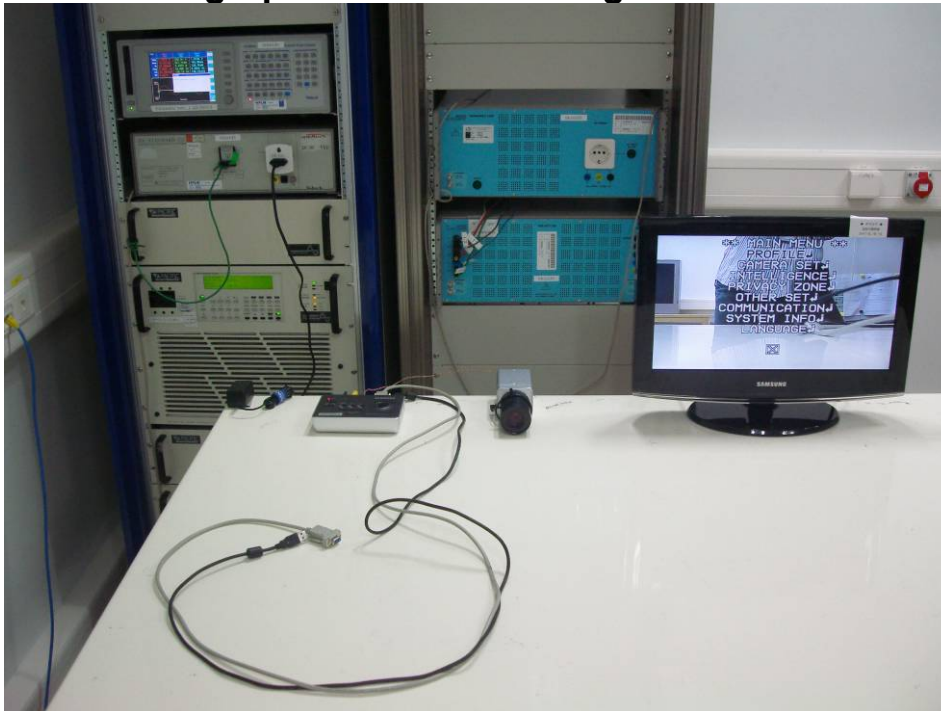
short-term flicker indicator, Pst	the relative steady-state voltage change, dc	the value of $d(t)$ during a voltage change, $d(t) > 3.3\%$	the maximum relative voltage change, d_{max}
1.0	3.3 %	500 ms	4 %

4.4.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Power Analyzer	PM6000A	Voltech	100006700167	2008-11-11	12
IEC Network	555	ZIMMER	IB10/9466	N/A	N/A

4.4.2 Photograph of the test Configuration





4.4.3 Test results

Test date	2009.04.16		Test engineer	Seung Beom Choi		
Climate condition	Ambient temperature	23.5 °C	Relative humidity	31 %	Atmospheric pressure	100.9 kPa
Test place	Shield room #3					

4.4.4 Test data

■ Operating Mode: CCTV camera in + RS-485 communication

Product:	CCTV CONTROLLER	2009 Apr 17 4:53pm
Serial no:		Page 1 of 1
Description:		
Result Name:	SCX-RD100	
Voltech IEC61000-3 Windows Software 1.10.04RC5		Test Date: 2009 Apr 17 4:36pm
Type of Test:	Flickermeter Test - Table	
Power Analyzer:	Voltech PM6000 SN: 100006700167 Firmware Version: v1.20.06RC3	
Channel(s):	1. SN: 090015500508, 25 Adjusted Date: 22 JUL 2007. 2. SN: 090015500521, 25 Adjusted Date: 23 JUL 2007. 3. SN: 090015500543, 25 Adjusted Date: 5 AUG 2007. 4. SN:None Adjusted Date:None 5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
Shunt(s):	1. SN: 091024300502, 4 Adjusted Date: 14 JUL 2007. 2. SN: 091024300503, 4 Adjusted Date: 14 JUL 2007. 3. SN: 091024300504, 4 Adjusted Date: 14 JUL 2007. 4. SN:None Adjusted Date:None 5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
AC Source:	Mains / Manual Source	
Overall Result:	Notes: Measurement method - Voltage	
PASS		

	Pst	dc (%)	dmax (%)	d(t) > 3.3%(ms)
Limit	1.000	3.300	4.000	500
Reading 1	0.089	0.002	0.310	0

4.5 Electrostatic discharge

Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points are subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane.

The remaining three test points are each receive at least 50 direct contact discharges.

If no direct contact test points are available, then at least 200 indirect discharges be applied in the indirect mode. Test is performed at a maximum repetition rate of one discharge per second.

Air discharges at slots and apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur.

Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user.

A minimum of 10 single air discharges shall be applied to the selected test point for each such area. The EUT was tested with all I/O ports exercised. Test results are listed below.

The basic test procedure was in accordance with IEC 61000-4-2.

Performance criteria

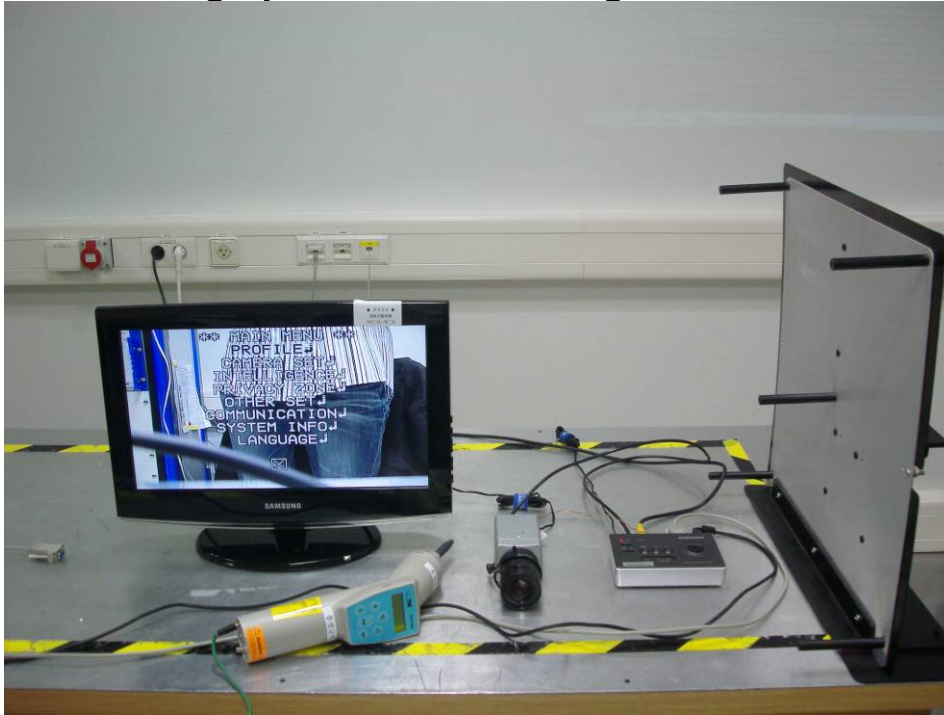
Application of discharge	Test specification (kV)	Performance criteria
Contact discharge	6	B
Air Discharge	8	B

4.5.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
ESD Gun	ESD3000	EMC PARTNER	365	2008-07-23	12

4.5.2 Photograph of the test Configuration



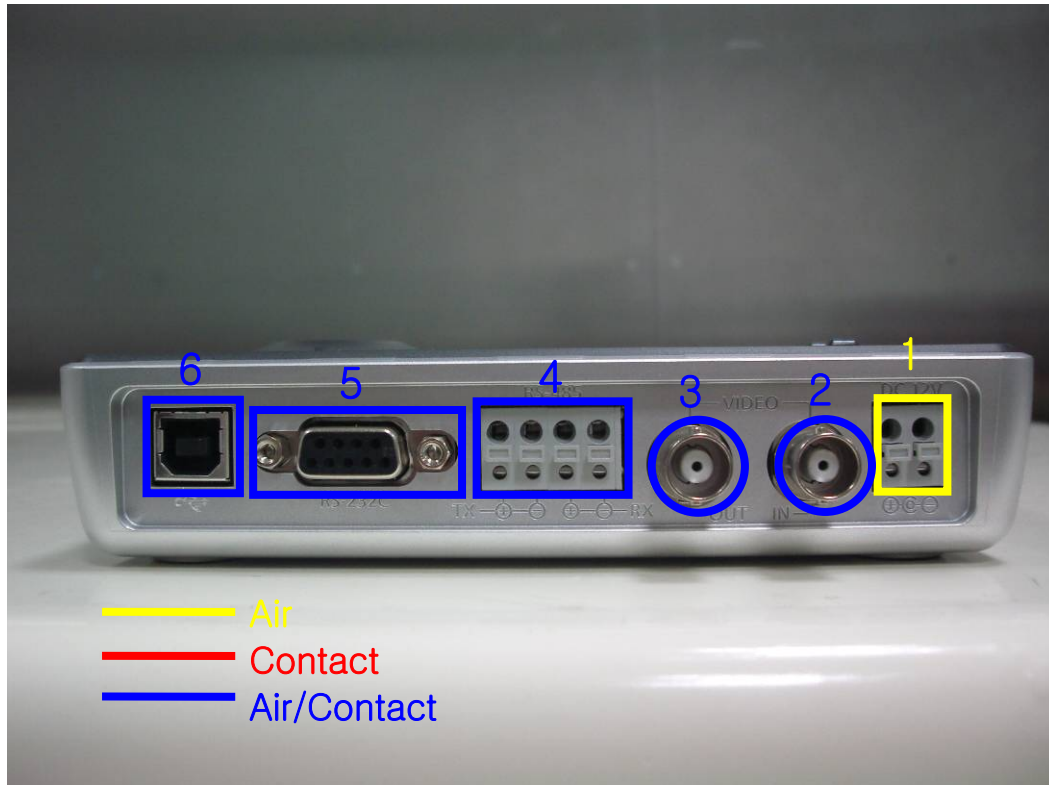
4.5.3 Test results

Test date	2009.04.16		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	23.4 °C	Relative humidity	31 %	Atmospheric pressure	101.0 kPa
	Test place	Shield room #3				

	No.	Applied Point	Method	Test Level	Tested No	Criteria	Result
Indirect		Horizontal Plane	Contact	±2 kV / ±4 kV	150	B	A
Indirect		Vertical Plane	Contact	±2 kV / ±4 kV	300	B	A
Direct	1	DC in	Air	±2 kV / ±4 kV / ±8 kV	60	B	A
Direct	2	Video in	Air	±2 kV / ±4 kV / ±8 kV	60	B	A
			Contact	±2 kV / ±4 kV / ±6 kV	150	B	A
Direct	3	Video out	Air	±2 kV / ±4 kV / ±8 kV	60	B	A
			Contact	±2 kV / ±4 kV / ±6 kV	150	B	A
Direct	4	RS-485	Air	±2 kV / ±4 kV / ±8 kV	60	B	A
			Contact	±2 kV / ±4 kV / ±6 kV	150	B	A
Direct	5	RS-232	Air	±2 kV / ±4 kV / ±8 kV	60	B	A
			Contact	±2 kV / ±4 kV / ±6 kV	150	B	A

Direct	6	USB	Air Contact	± 2 kV / ± 4 kV / ± 8 kV ± 2 kV / ± 4 kV / ± 6 kV	60 150	B B	A A
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4.5.4 Test points



4.6 Radiated, radio-frequency, electromagnetic field

The test was performed with the EUT exposed to both vertically and horizontally polarized fields. on each of the four sides.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond. The basic test procedure was in accordance with IEC 61000-4-3.

Performance criteria

Test range [MHz]	Test specification	Performance criteria	Remarks
80 ~ 2000	10, 3, 1 V/m(unmodulated, r.m.s) 80 % AM(1 kHz)	C / B / A	The test level specified is prior to modulation See *)
80 ~ 2000	10, 3, 1 V/m(unmodulated, r.m.s) PM 1 Hz	C / B / A	The test level specified is prior to modulation See *)

*) The frequency range is scanned as specified. However, when specified in Annex A, EN55024, an additional comprehensive functional test shall be carried out at a limited number of frequencies.
The selected frequencies are: 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (± 1 %).

4.6.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
10V Insertion Unit	URV5-Z2	R&S	100240	2008-05-19	12
10V Insertion Unit	URV5-Z2	R&S	100241	2008-05-19	12
Signal Generator	SML03	R&S	102190	2008-06-30	12
Mill volt Meter	NRVD	R&S	841501/010	N/A	N/A
Antenna	AT1080	AR	310700	N/A	N/A
Antenna Master	TP1000A	AR	311200	N/A	N/A
Amplifier	250W1000A	AR	312241	N/A	N/A
Amplifier	60SIG3	AR	311853	N/A	N/A
Relay Switching Unit	TS-RSP	R&S	N/A	N/A	N/A

4.6.2 Photograph of the test Configuration



4.6.3 Test results

Test date	2009.04.20		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	18.6 °C	Relative humidity	39 %	Atmospheric pressure	98.9 kPa
	Test place					
3m Fully Anechoic Chamber						

Frequency [MHz]	Test Specification	Table Azimuth [degree]	Polarity	Test Result	Performance Criterion
80 ~ 2 000	10 V/m AM 80 % 1 kHz	0	Horizontal	B	C
			Vertical	B	C
		90	Horizontal	B	C
			Vertical	B	C
		180	Horizontal	B	C
			Vertical	B	C
270	Horizontal	B	C		
	Vertical	B	C		
80 ~ 2 000	3 V/m AM 80 % 1 kHz	0	Horizontal	B	B
			Vertical	B	B

		90	Horizontal	B	B		
			Vertical	B	B		
		180	Horizontal	B	B		
			Vertical	B	B		
		270	Horizontal	B	B		
			Vertical	B	B		
80 ~ 2 000	1 V/m AM 80 % 1 kHz	0	Horizontal	A	A		
			Vertical	A	A		
		90	Horizontal	A	A		
			Vertical	A	A		
		180	Horizontal	A	A		
			Vertical	A	A		
		270	Horizontal	A	A		
			Vertical	A	A		
		80 ~ 2 000	10 V/m PM 1 Hz	0	Horizontal	B	C
					Vertical	B	C
				90	Horizontal	B	C
					Vertical	B	C
180	Horizontal			B	C		
	Vertical			B	C		
270	Horizontal			B	C		
	Vertical			B	C		
80 ~ 2 000	3 V/m PM 1 Hz			0	Horizontal	B	B
					Vertical	B	B
				90	Horizontal	B	B
					Vertical	B	B
		180	Horizontal	B	B		
			Vertical	B	B		
		270	Horizontal	B	B		
			Vertical	B	B		
		80 ~ 2 000	3 V/m PM 1 Hz	0	Horizontal	A	A
					Vertical	A	A
				90	Horizontal	A	A
					Vertical	A	A
180	Horizontal			A	A		
	Vertical			A	A		
270	Horizontal			A	A		
	Vertical			A	A		

4.7 Electrical fast transient/burst

■ Test on power supply ports and on protective earth terminals

Stationary, floor-mounted equipment

The test voltage applied between a reference ground plane and each of the power supply terminals, a.c. or d.c., and on the terminal for the protective or function earth on the cabinet of the EUT.

The EFT/B-generator shall be located on the reference plane.

The length of the "hot wire" from the coaxial output of the EFT/B-generator to the terminals on the EUT is not exceeding 1 m. This connection was unshielded but well insulated.

All other connections of the EUT are in accordance with its functional requirements.

Non-stationary mounted EUT, connected to the mains supply by flexible cord and plugs

The test voltage is applied between each of the power supply conductors and the protective earth at the power supply outlet to which the EUT is to be connected.

■ Test on I/O and communication ports

As far as possible, the capacitive coupling clamp is used for coupling the test voltage into the lines.

However, if the clamp cannot be used due to mechanical problems (size, cable routing) in the cabling, it may be replaced by a tape or a conductive foil enveloping the lines under test. The capacitance of this coupling arrangement with foil or tape is equivalent to that of the standard coupling clamp.

In other cases, it is useful to couple the EFT/B-generator to the terminals of the lines via discrete 100 pF capacitors instead of the distributed capacitance of the clamp or of the foil or tape arrangement.

All tests carried out in shielded room.

The EUT was tested with all I/O ports exercised. Test results are listed below.

Performance criteria

Applied conditions	Test specification	Performance criteria
Open-circuit output test voltage a.c. power ports signal and telecommunication ports d.c. power ports	1 kV(Peak) 0.5 kV(Peak) 0.5 kV(Peak)	B
Wave shape of the pulse	5/50 Tr/Th ns	
Repetition Frequency	5 kHz	

4.7.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
EFT/Burst Generator	PEFT 4010	HAEFELY	19872	2008-09-26	12
3 Phases CDN 690V/100A	FP-EFT 100M	HAEFELY	152635	2008-09-26	12

4.7.2 Photograph of the test Configuration





4.7.3 Test results

Test date	2009.04.16		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	21.0 °C	Relative humidity	32 %	Atmospheric pressure	101.0 kPa
Test place	Shield room #2					

Test Point		Polarity	Test Level (kV)	Phase wave Shapes & Repetitions	Performance Criterion
a.c. power ports	Live	+/-	2	5/50ns, 5kHz	B
	Neutral	+/-	2	5/50ns, 5kHz	B

4.8 Surge

The basic test procedure was in accordance with IEC 61000-4-5.

Performance criteria

Applied conditions	Test specification	Performance criteria
Combination wave a.c. power ports signal and telecommunication ports d.c. power ports	Line to Line 1 kV(Peak) ① Line to earth 2 kV(Peak) ① Line to ground 1 kV(Peak) ② 0.5 kV(Peak) ③	B
Waveform parameter Open-circuit voltage Short-circuit current	 1.2/50 Tr/Th μs 8/20 Tr/Th μs	

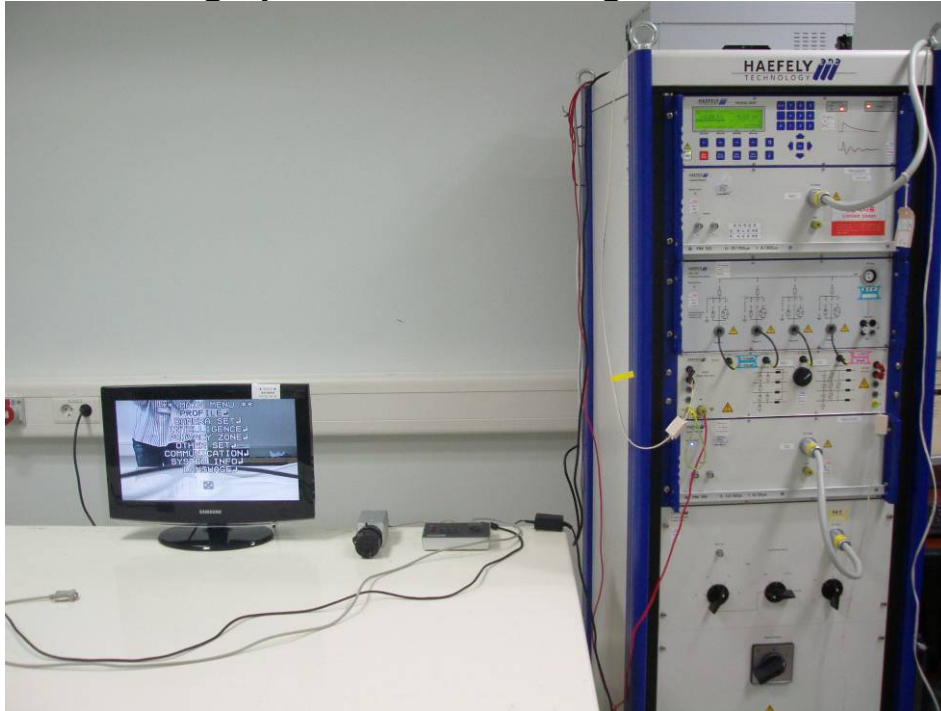
- ① Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables. Where normal functioning cannot be achieved because of the impact of the CDN on the EUT, no test shall be required.
- ② When the manufacturer specifies protection measures and it is impractical to simulate these measures during the tests, then the applied test levels shall be reduced to 0,5 kV and 1 kV.
- ③ Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables.

4.8.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Surge Tester	PSURGE 8000	HAEFELY	152602	N/A	N/A
Surge Impulse Module	PIM 100	HAEFELY	152288	2008-09-30	12
Impulse Module	PIM 120	HAEFELY	150663	2008-08-06	12
Coupling Decoupling Network	PCD 120	HAEFELY	148918	N/A	N/A
Coupling Decoupling Network	FP-SURGE 100M	HAEFELY	152636	N/A	N/A

4.8.2 Photograph of the test Configuration



4.8.3 Test results

Test date	2009.04.17		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	21.9 °C	Relative humidity	39 %	Atmospheric pressure	100.2 kPa
	Test place					
Shield room #3						

Test Point		Polarity	Test Level (kV)	Phase wave Shape [μs]	Performance Criterion
a.c. power ports	Live + Neutral	+/-	1	1.2/50 (8/20)	A

4.9 Conducted disturbances, induced by radio-frequency fields

The test was performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility. Test results are listed below.

The basic test procedure was in accordance with IEC 61000-4-6.

Performance criteria

Test range [MHz]	Test specification	Performance criteria	Remarks
0.15 ~ 100	10, 3, 1 V (unmodulated, r.m.s) 80 % AM (1 kHz)	C / B / A	See 1), 2)
0.15 ~ 100	10, 3, 1 V (unmodulated, r.m.s) PM 1 Hz	C / B / A	See 1), 2)

1) The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz (± 1 %).

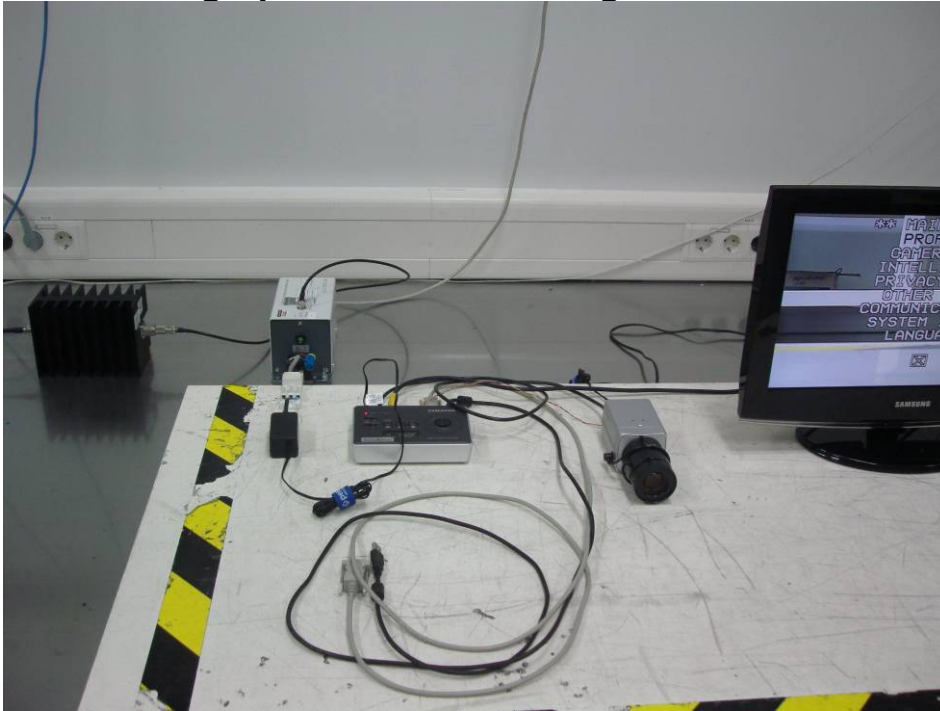
2) Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3m.

4.9.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Coupling Decoupling Network	CDN M016	SCHAFFNER	20571	2009-02-26	12
Coupling Decoupling Network	CDN M016	SCHAFFNER	20573	2008-05-21	12
Coupling Decoupling Network	CDN M016	SCHAFFNER	20574	2008-05-21	12
Coupling Decoupling Network	CDN T400	SCHAFFNER	21225	2008-06-17	12
Coupling Decoupling Network	CDN T200	SCHAFFNER	16899	2008-06-17	12
Attenuator	150-SA-MFN-06	SCHAFFNER	0613	2008-10-24	12
RF - Generator	NSG2070	SCHAFFNER	1118	2008-06-16	12

4.9.2 Photograph of the test Configuration



4.9.3 Test results

Test date	2009.04.21		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	21.7 °C	Relative humidity	36 %	Atmospheric pressure	98.8 kPa
	Test place					
Shield room #2						

Frequency (MHz)	Test Specification	Injection Method	Inject Points (Cable length)	Test Result	Performance Criterion
0.15 ~ 100	10 V, AM 80 % 1 kHz	CDN-M3	AC power line	B	C
0.15 ~ 100	3 V, AM 80 % 1 kHz	CDN-M3	AC power line	A	B
0.15 ~ 100	1 V, AM 80 % 1 kHz	CDN-M3	AC power line	A	A
0.15 ~ 100	10 V, PM 1 Hz	CDN-M3	AC power line	B	C
0.15 ~ 100	3 V, PM 1 Hz	CDN-M3	AC power line	A	B
0.15 ~ 100	1 V, PM 1 Hz	CDN-M3	AC power line	A	A

4.10 Voltage dips, short interruptions and voltage variations

The EUT is tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform. The basic test procedure was in accordance with IEC 61000-4-11.

Performance criteria

Environmental phenomenon	Test specification	Units	Performance criteria	Remarks
Voltage dips	30 0.5 / 1 / 5 / 10 p	% reduction periods	B	See NOTE
	60 0.5 / 1 / 5 / 10 p		B	
Voltage interruptions	100 0.5 / 1 / 5 p		A	
Voltage variations	10 % up	A		
	15 % down	A		

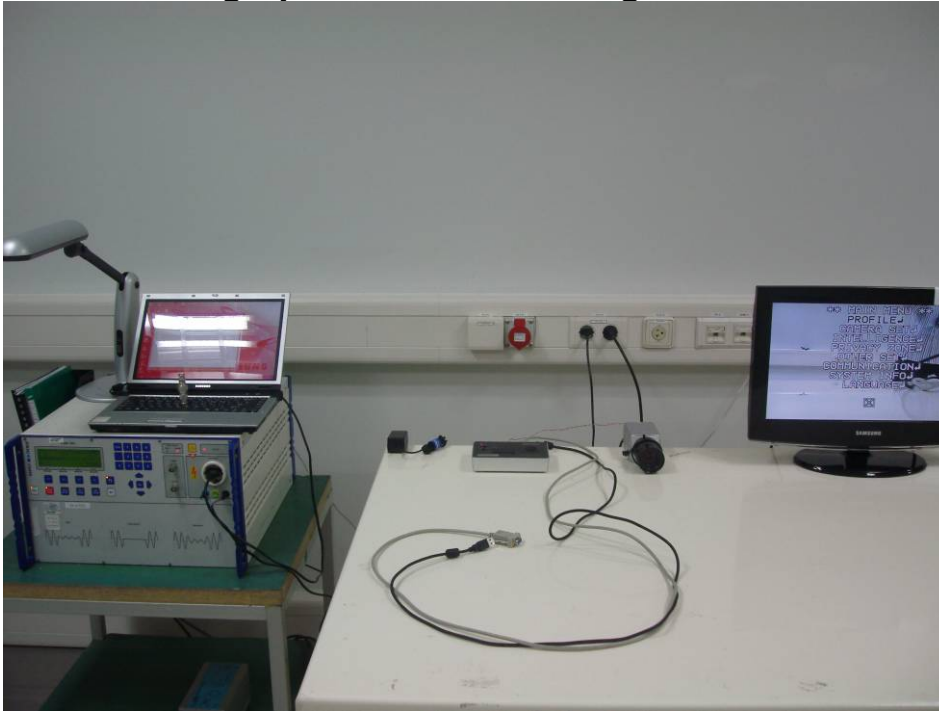
[NOTE] Changes to occur at 0 degree crossover point of the voltage waveform.

4.10.1 Test instrumentation

Test instrumentations which were used in the Radiated disturbance are as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Voltage Dip & Interruption	PLINE1610	HAEFELY	083690-21	2009-03-12	12

4.10.2 Photograph of the test Configuration



4.10.3 Test results

Test date	2009.04.21		Test engineer		Seung Beom Choi	
Climate condition	Ambient temperature	21.7 °C	Relative humidity	36 %	Atmospheric pressure	98.8 kPa
Test place	Shield room #2					

Test Voltage	Period [p]	Number of Applications	Angle [Degrees]	Performance Criterion
30 % UT	0.5 / 1 / 5 / 10	3	0, 180	A
60 % UT	0.5 / 1 / 5 / 10	3	0	A
100 % UT	0.5 / 1 / 5	3	0	A
10 % voltage up				A
15 % voltage down				A

Appendix A – EUT photography (Front)



(Rear)

