T E S T R E P O R T

REPORT NUMBER	:	ANKK-104060
APPLICANT	:	Sony Corporation
MODEL NUMBER	:	RC-S310
FCC ID	:	AK8RCS310
REGULATION	:	FCC Part15C Section 15.207
		Section 15.209

1, Oaza Sunayama, Hasaki-machi, Kashima-gun
Ibaraki-ken, 314-0255 Japan
Tel.: +81 479 40 1097 Fax.: +81 479 46 1788

TABLE OF CONTENTS

ABBREVIATIONS

LISN = Line Impedance Stabilization Network

AMN = Artificial Mains Network

ANT = Antenna

BBA = Broadband Antenna

DIP = Dipole Antenna

AMP = Amplifier

ATT = Attenuator

EUT = Equipment Under Test

AE = Associated Equipment

QP = Quasi peak

AVG = Average

SECTION 1. TEST CERTIFICATION

APPLICANT INFORMATION

Company	:	Sony Corporation
Address		Gotenyama Hills 4-7-35 Kitashinagawa Shinagawa-ku, Tokyo 140-0001 Japan
Telephone number	:	+81 3 5448 4847
Fax number	:	+81 3 5448 2160

DESCRIPTION OF TEST ITEM

Kind of equipment	:	Contactless IC Card Reader/Writer
Condition of equipment	:	Production
Type	:	Tabletop
Trademark	:	SONY
FCC ID		AK8RCS310
Model number	:	RC-S310
Serial number	:	00090545

TEST PERFORMED

Location	:	Kashima No. 7 Test Site (FCC Reg. No.:90433)
EUT received	:	November 6, 2003
Test started	:	November 7, 2003
Test completed	:	November 17, 2003
Regulation	:	FCC Part15 Subpart C Section 15.207 / 15.209 Intentional Radiators
Test setup	:	ANSI C63.4-2001

Report issue date : March 17, 2004

Test engineer : Naoki Ikeda

Report approved by : Takeshi Yamanaka
[Site Manager]

On the basis of the measurements made, the equipment tested is capable of operation in compliance with the requirements of Part 15 of the FCC Rules under normal use and maintenance.

Note

a. The test result of this report is effective for equipment under test itself and under the test configuration described on the report.

b. This test report does not assure that whether the test result taken in other testing laboratory is compatible or reproducible to the test result on this report or not.

c. This test report shall not be reproduced except in full, without issuer's permission.

SECTION 2. CONCLUSION

This test report clearly shows that the EUT is in compliance with the FCC Part15C Section15.207 & Section15.209 specification.

The minimum margins to the limits are as follows:

AC Conducted Emission (AV)	13.9 dB	at	0.1765 MHz
Spurious Emissions - Radiated Emission Test	3.5 dB	at	324.51 MHz

Note : See Section 9 for details.

SECTION 3. EQUIPMENT UNDER TEST

The equipment under test (EUT) consisted of the following equipment.
Indication in the following left side column corresponds to Section 6.

Symbol	Item	Model No.	Serial No.	FCC ID / DoC	Manufacturer	Remarks
A)	Contactless IC Card Reader/Writer	RC-S310	00090545	AK8RCS310	SONY	

Power ratings of EUT : DC INPUT 5V, Max 100[mA]

3.1 Overview of EUT :

Carrier Frequency	:	13.56 MHz +/– 5%
Modulation Method	:	Transmitting – Amplitude Shift Keying (10%)
RF Output Power	:	49.6dBuV/m (at 3.0 m.13.52MHz)

3.2 Port(s)/Connector(s) :

Port name	Connector type	Connector pin	Remarks
USB	A type	4 pin	USB 1.1

3.3 RF Operation Frequency :

Oscillator	Operating	Board name	Remarks
13.56 MHz	13.56 MHz	Main Board	± 0.5 %
12 MHz	12 MHz	Main Board	

SECTION 4. SUPPORT EQUIPMENT USED

The EUT was supported by the following equipment during the test.
Indication in the following left side column corresponds to Section 6.

Symbol Item	Model No.	Serial No.	FCC ID / DoC	Manufacturer	Remarks
B) Computer	PCG-9312	283124303201388	DoC	SONY	
C) Printer	P12PB	0E11397879	BKM9A8P12PB	EPSON	
D) AC Adapter	PCGA-AC19V1	0044D0192264	N.A.	SONY	

Power ratings of Computer's AC Adapter : AC 100 240V, 50/60 Hz, 1.6 A

SECTION 5. CABLE (S) USED

The following cable(s) was used for the test.
Indication number in the following left side column corresponds to Section 6.

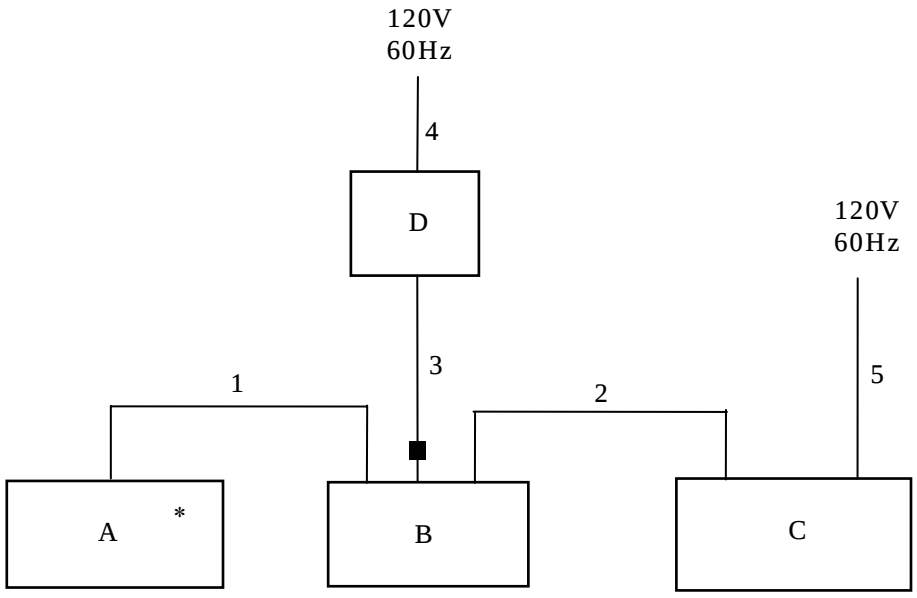
Number	Name	Length	Shield	Connector	Core
1)	USB cable	0.80 m	Yes	Metal	
2)	Centronics cable	2.30 m	Yes	Metal	
3)	Power cable for Computer (DC)	1.70 m	None		Fixed × 1
4)	Power cable for Computer (AC)	0.70 m	None		
5)	Power cable for Printer	1.90 m	None		

SECTION 6.CONSTRUCTION OF EQUIPMENT

The construction of EUT during the test was as follows.

System configuration

* EUT
■ Ferrite core



Symbols or numbers assigned to equipment or cables on this diagram are corresponded to the symbols or numbers assigned to equipment or cables on tables in Sections 3 to 5.

SECTION 7. OPERATING CONDITIONS

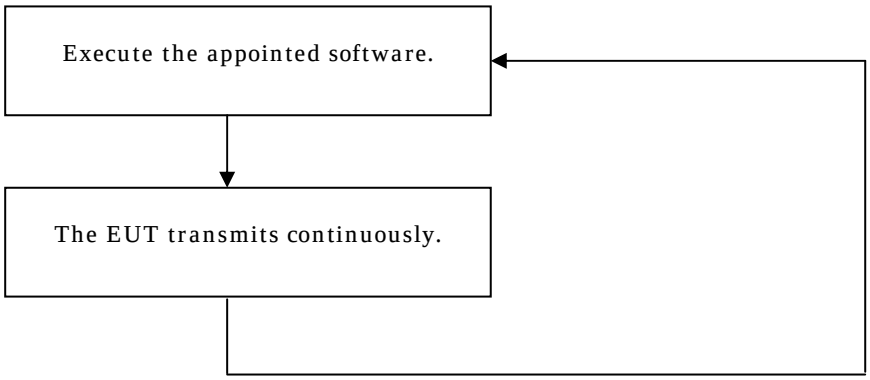
The EUT was operated under the following conditions during the test.

7.1 Operating condition

The test was carried out under TX mode
EUT was examined in the operating conditions that had maximum emissions.

7.2 Operating flow

Following operations were performed continuously.

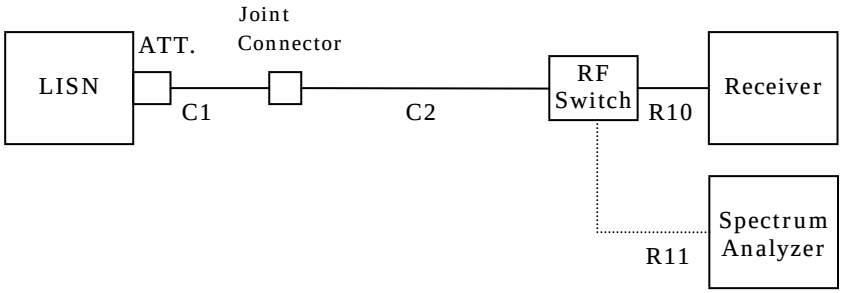


SECTION 8. TEST PROCEDURE(S)

Test was carried out under the following conditions.
Test was carried out with no deviations from standards and test methods.

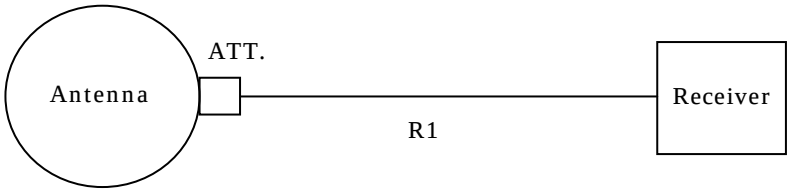
Subject	Test procedure	Scanned frequency
AC Conducted Emission	Akzo Nobel Document number : 03-10-004	0.150-30 MHz
Spurious Emissions - Radiated Emission Test	Akzo Nobel Document number : 03-10-003	0.009-1000 MHz

Schema for the AC conducted emission measurement

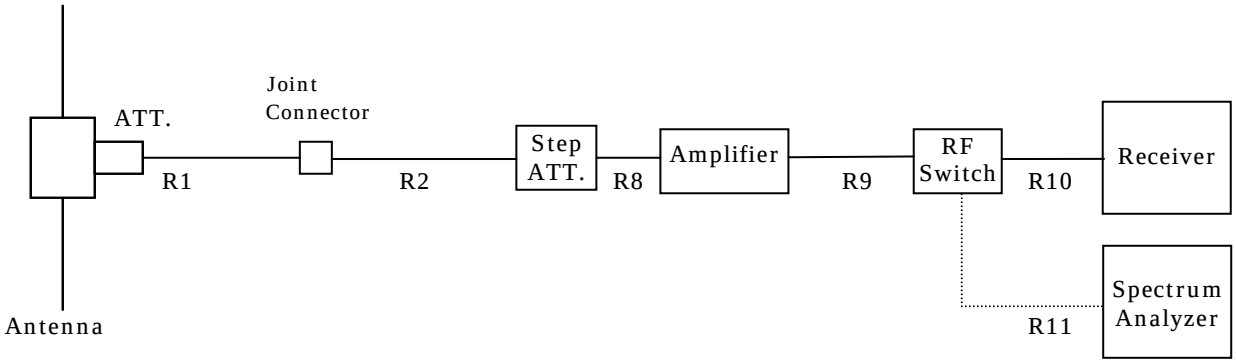


Schema for the radiated emission measurement

Below 30MHz



Above 30MHz



Summary ;

8.1 AC Conducted Emission

8.1.1 Equipment Setup

System configuration and Equipment setup are shown on Section 6 and Annex A.

8.1.1.1 Tabletop Equipment

EUT is placed on the wooden table, the top of which is 0.8meter above the metal ground plane.

8.1.1.2 Interconnecting Cables

Excess part of the interconnecting cables longer than 1 meter are bundled in the center. Cables that hang closer than 40 cm to the ground plane is folded back and forth forming bundle 30 to 40 cm long, hanging approx, in the middle between ground plane and table.

8.1.1.3 AC Power Cable

AC power cable for EUT is connected to one LISN which is placed on the ground plane. The LISN is placed in 80 cm from the nearest part of EUT chassis.
The excess power cable is bundled in the center, or shortened to appropriate length.

8.1.2 Measuring Instruments

Measuring instruments list and their calibration schedule are shown on Section 11.
The brief description are as follows;

8.1.2.1 Spectrum Analyzer

The Spectrum analyzer is used for preliminary measurement.

8.1.2.2 EMI Test Receiver

The Quasi peak detector (IF bandwidth : 10 kHz) and average detector (IF bandwidth : 10 kHz) built in test receiver is used for final measurement.
The test receiver is complied with the specification of the CISPR publication 16.

8.1.2.3 LISN

The 50microH//50ohm LISN are used. The chassis of the LISN is bonded to the ground plane by the copper blade.
The LISN is connected to the EUT.

8.1.3 Test Procedure

8.1.3.1 Preliminary Measurement

EUT is tested on all operating conditions.
The spectrum analyzer is controlled by the computer program to sweep the frequency range to be measured, then spectrum chart are plotted out to find the worst emission conditions in operating mode and/or configuration decision for the final test.
All leads other than safety ground are tested.

8.1.3.2 Final Measurement

The EUT is operated in the worst emission condition found by the preliminary test.
The equipment and cables are arranged or manipulated within the range of the test standard in the above condition.
At least six highest spectrum are measured in quasi peak and average (if necessary) using the test receiver.

8.2 Radiated Emission Test

8.2.1 Equipment Setup

System configuration and Equipment setup are shown on Section 6 and Annex A.

8.2.1.1 Tabletop Equipment

EUT is placed on the wooden table, the top of which is 0.8meter above the metal ground plane (turntable).

8.2.1.2 Interconnecting Cables

Excess part of the interconnecting cables longer than 1 meter are bundled in the center. Cables that hang closer than 40 cm to the ground plane is folded back and forth forming bundle 30 to 40 cm long, hanging approx, in the middle between ground plane and table.

8.2.2 Measuring Instruments

Measuring instruments list and calibration schedule are shown on Section 11.
The brief description are as follows;

8.2.2.1 Antennas

The Loop antenna is used for Magnetic field measurements on the frequency range 0.009 – 30 MHz.
The broadband Tri Log antenna is used forElectric field measurement on the frequency range 30 – 1000 MHz.
If uncertain result was obtained, the broadband antenna is replaced by the half wave length dipole, then measurement is carried out over again.

8.2.2.2 Pre amplifier

The broadband preamplifier is used for Radiated Electric Field measurement.
The signal to noise ratio is improved by using pre amplifier.

8.2.2.3 Spectrum Analyzer

The spectrum analyzer is used for preliminary measurement of frequency range 0.009 – 1000 MHz.

8.2.2.4 EMI Test Receiver

The Quasi peak detector (IF bandwidth : 10 kHz) built in test receiver is used for final measurement of the frequency 0.009 – 30 MHz.
The Quasi peak detector (IF bandwidth : 120 kHz) built in test receiver is used for final measurement of the frequency 30 – 1000 MHz.
The test receiver is complied with the specification of the CISPR publication 16.

8.2.2.5 Turntable

The turntable is capable for EUT weight and rotatable 0 to 360 degree horizontally by remote control in the test room.

8.2.2.6 Antenna Mast

<Magnetic field>
The antenna mast is attachable to Loop antenna and antenna's center height is adjustable 1 meter above the ground. Antenna position is changed horizontally and vertically.
<Electric field>
The antenna mast is attachable to The broadband Tri Log antenna height is adjustable 1 to 4 meters continuously by remotecontrol at the test room, and antenna polarization is also changed by the remote control.

8.2.3 Test Procedure

8.2.3.1 Preliminary Measurement

EUT is tested on all operating conditions.
The spectrum analyzer is set max hold mode and swept during turntable was rotated 0 to 360 degree. Then spectrum chart are plotted out to find the worst emission conditions in configuration, operating mode, or ambient noise notation.

8.2.3.2 Final Measurement

The EUT operated in the worst emission condition found by the preliminary test. The turntable azimuth (EUT direction) and antenna height are adjusted the position so that maximum field strength is obtained for each frequency spectrum to be measured. The equipment and cables are arranged or manipulated within the range of the test standard in the above condition.
When the uncertain result was obtained, the measurement is retried by using the half wave dipole antenna instead of the broadband antenna.

SECTION 9. EVALUATION OF TEST RESULTS

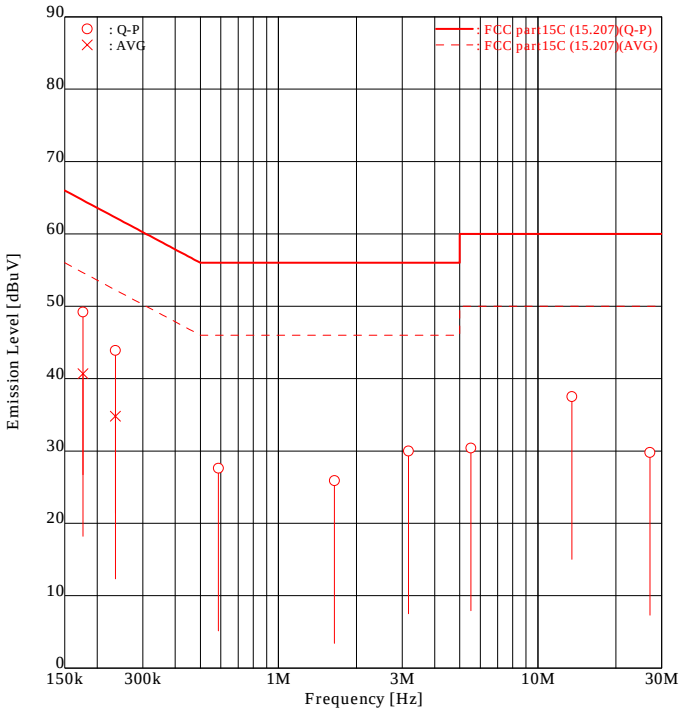
9.1 AC Conducted Emission (Section15.207)

Akzo Nobel K. K.

Kashima No.7 Test Site

AC Conducted Emission Test

APPLICANT	: Sony Corporation
EUT NAME	: Contactless IC Card Reader/Writer
MODEL NO.	: RC-S310
SERIAL NO.	: 00090545
TEST MODE	: TX : 13.56MHz (ASK10%)
POWER SOURCE	: DC 5V (AC120V/60Hz)
DATE TESTED	: Nov 07 2003
FILE NO.	: ANKK-104060
REGULATION	: FCC part15C (15.207)
TEST METHOD	: ANSI C63.4-2001
TEMPERATURE	: 21.0 [degC]
HUMIDITY	: 59.0 [%]
NOTE	:



ENGINEER : Naoki Ikeda

[No]	FREQUENCY [MHz]	MODE	READING [dBuV] Line1	READING [dBuV] Line2	FACTOR [dB] Line1	FACTOR [dB] Line2	EMISSION [dBuV] Line1	EMISSION [dBuV] Line2	LIMIT [dBuV]	MARGIN [dB] Line1	MARGIN [dB] Line2
1	0.1765	Q-P	41.7	42.6	6.6	6.6	48.3	49.2	64.6	16.3	15.4
2	0.1765	AVG	33.0	34.1	6.6	6.6	39.6	40.7	54.6	15.0	**13.9**
3	0.2351	Q-P	35.2	37.3	6.6	6.6	41.8	43.9	62.3	20.5	18.4
4	0.2351	AVG	26.6	28.2	6.6	6.6	33.2	34.8	52.3	19.1	17.5
5	0.5872	Q-P	17.8	20.9	6.6	6.7	24.4	27.6	56.0	31.6	28.4
6	1.6448	Q-P	18.5	19.1	6.7	6.8	25.2	25.9	56.0	30.8	30.1
7	3.1688	Q-P	21.3	23.0	7.0	7.0	28.3	30.0	56.0	27.7	26.0
8	5.5187	Q-P	23.4	22.5	7.0	7.0	30.4	29.5	60.0	29.6	30.5
9	13.5203	Q-P	30.3	29.4	7.2	7.3	37.5	36.7	60.0	22.5	23.3
10	27.0223	Q-P	21.9	22.0	7.1	7.8	29.0	29.8	60.0	31.0	30.2

Higher six points are underlined.

Other frequencies : Below the FCC part15C (15.207) limit

Emisson Level = Read + Factor(LISN,Pad,Cable)

9.2 Spurious Emissions - Radiated (Section15.209)

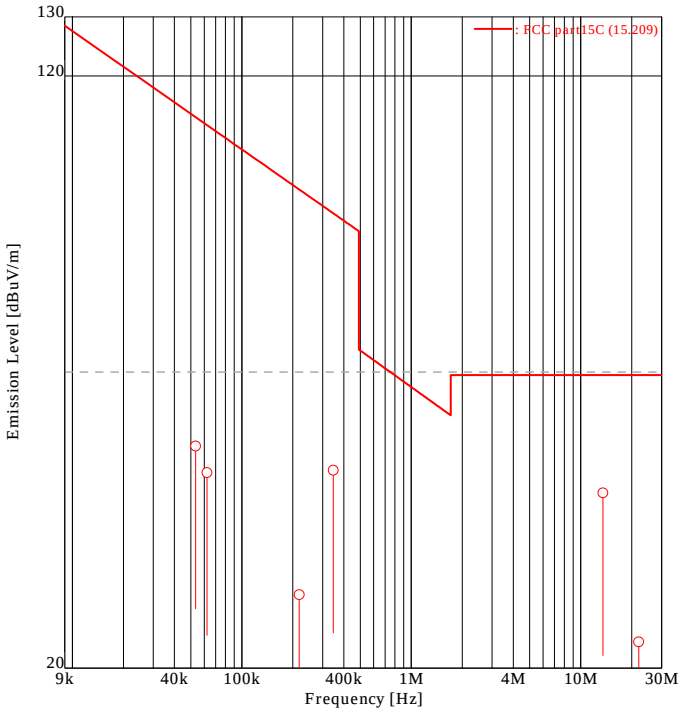
9.2.1 9 kHz - 30 MHz

Akzo Nobel K. K.

Kashima No.7 Test Site

Spurious Emissions - Radiated Test

APPLICANT : Sony Corporation
EUT NAME : Contactless IC Card Reader/Writer
MODEL NO. : RC-S310
SERIAL NO. : 00090545
TEST MODE : TX : 13.56MHz (ASK10%)
POWER SOURCE : DC 5V (AC120V/60Hz)
DATE TESTED : Nov 12 2003
FILE NO. : ANKK-104060
REGULATION : FCC part15C (15.209)
TEST METHOD : ANSI C63.4:2001
DISTANCE : 3.0 [m]
TEMPERATURE : 21.0 [degC]
HUMIDITY : 58.0 [%]
NOTE :



ENGINEER : Naoki Ikeda

[No]	FREQUENCY [MHz]	READING [dBuV] Hori	READING [dBuV] Vert	FACTOR [dB] Hori	FACTOR [dB] Vert	EMISSION [dBuV/m] Hori	EMISSION [dBuV/m] Vert	LIMIT [dBuV/m]	MARGIN [dB] Hori	MARGIN [dB] Vert
1	0.0533	-	50.5	7.0	7.0	-	57.5	113.1	-	55.6
2	0.0623	-	46.0	7.0	7.0	-	53.0	111.7	-	58.7
3	0.2180	-	26.0	6.4	6.4	-	32.4	100.8	-	68.4
4	0.3465	-	47.0	6.4	6.4	-	53.4	96.8	-	43.4
5	13.5200	32.1	42.7	6.9	6.9	39.0	49.6	69.5	30.5	**19.9**
6	22.0000	-	16.0	8.4	8.4	-	24.4	69.5	-	45.1

Higher six points are underlined.
Other frequencies : Below the FCC part15C (15.209) limit
Emisson Level = Read + Factor(Antenna,Pad,Cable)

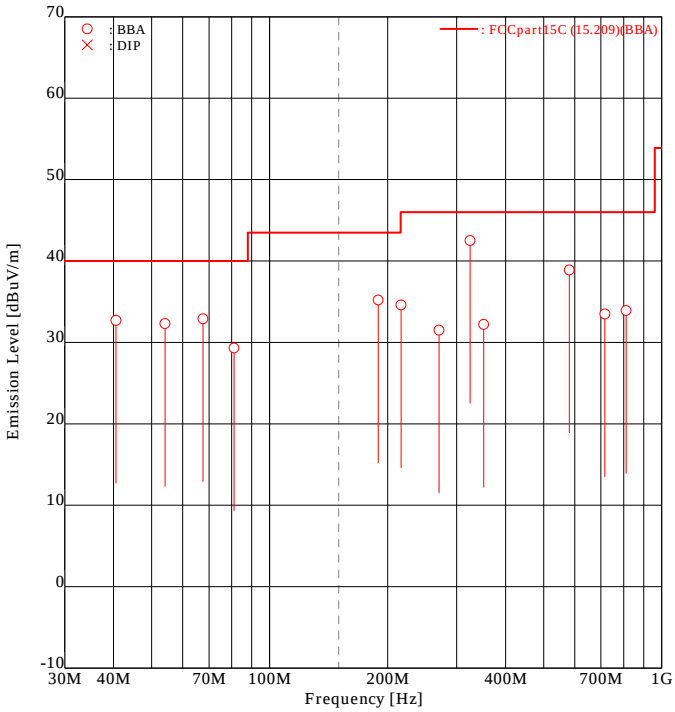
9.2.2 30 MHz - 1000 MHz

Akzo Nobel K. K.

Kashima No.7 Test Site

Spurious Emissions - Radiated Test

APPLICANT : Sony Corporation
EUT NAME : Contactless IC Card Reader/Writer
MODEL NO. : RC-S310
SERIAL NO. : 00090545
TEST MODE : TX : 13.56MHz (ASK10%)
POWER SOURCE : DC 5V (AC120V/60Hz)
DATE TESTED : Nov 07 2003
FILE NO. : ANKK-104060
REGULATION : FCCpart15C (15.209)
TEST METHOD : ANSI C63.4:2001
DISTANCE : 3.0 [m]
TEMPERATURE : 21.0 [degC]
HUMIDITY : 59.0 [%]
NOTE :



ENGINEER : Naoki Ikeda

[No]	FREQUENCY [MHz]	ANT.	READING [dBuV] Hori	READING [dBuV] Vert	FACTOR [dB] Hori	FACTOR [dB] Vert	EMISSION [dBuV/m] Hori	EMISSION [dBuV/m] Vert	LIMIT [dBuV/m]	MARGIN [dB] Hori	MARGIN [dB] Vert
1	40.56	BBA	39.9	37.9	-7.2	-7.2	32.7	30.7	40.0	7.3	9.3
2	54.08	BBA	31.1	38.4	-6.1	-6.1	25.0	32.3	40.0	15.0	7.7
3	67.61	BBA	40.7	39.9	-7.8	-7.8	32.9	32.1	40.0	7.1	7.9
4	81.12	BBA	40.2	-	-10.9	-10.9	29.3	-	40.0	10.7	-
5	189.30	BBA	42.0	-	-6.8	-6.8	35.2	-	43.5	8.3	-
6	216.32	BBA	41.5	-	-6.9	-6.9	34.6	-	46.0	11.4	-
7	270.43	BBA	35.8	-	-4.3	-4.3	31.5	-	46.0	14.5	-
8	324.51	BBA	45.2	40.1	-2.7	-2.7	42.5	37.4	46.0	**3.5**	8.6
9	351.54	BBA	34.3	-	-2.1	-2.1	32.2	-	46.0	13.8	-
10	581.39	BBA	35.8	30.8	3.1	3.1	38.9	33.9	46.0	7.1	12.1
11	716.61	BBA	28.4	-	5.1	5.1	33.5	-	46.0	12.5	-
12	811.26	BBA	26.8	25.6	7.1	7.1	33.9	32.7	46.0	12.1	13.3

Higher six points are underlined.
Other frequencies : Below the FCCpart15C (15.209) limit
Emisson Level = Read + Factor(Antenna,Antenna Pad,Cable,Preamp)
ANT. : Used antenna(BBA = Broadband antenna, DIP = Dipole antenna)

9.3 Sample Calculations

9.3.1 AC Conducted Emission (Section15.207)

Example @ 0.1765 MHz (AV)

Emission Level	=	Meter Reading		34.1	dBuV
	+	Factor	+	6.6	dB
			=	40.7	dBuV
Margin	=	Limit		54.6	dBuV
		Emission Level		40.7	dBuV
			=	13.9	dB

Factor = LISN Factor + Cable Loss + Pad Loss

9.3.2 Spurious Emission – Radiated (Section15.209)

Example @ 324.51 MHz

Emission Level	=	Meter Reading		45.2	dBuV
	+	Factor	+	-2.7	dB
			=	42.5	dBuV
Margin	=	Limit		46.0	dBuV
		Emission Level		42.5	dBuV
			=	3.5	dB

Factor = Antenna Factor + Cable Loss + Pad Loss

SECTION 10. INSTRUMENTS USED FOR FINAL TEST

Instrument	Model No.	Serial No.	Manufacturer	Last cal. date	Period
LISN (EUT)	ESH2-Z5	879675/014	ROHDE & SCHWARZ	Jun. 19, 03	1 Year
6dB Attenuator	CFA-01	None	TME	Jan. 15, 03	1 Year
Coaxial cable	RG-5A/U(7.2 m)	C1	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(4.0 m)	C2	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(1.1 m)	R11	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(1.0 m)	R12	AKZO	Jan. 15, 03	1 Year
Broad Band antenna	VULB9168	107	Schwarzbeck	Jul. 15, 03	1 Year
Loop antenna	HFH2-Z2	882964/29	ROHDE & SCHWARZ	Jul. 22, 03	1 Year
6dB Attenuator	MP721B	M56993	ANRITSU	Jan. 15, 03	1 Year
Step Attenuator	8494B	2406A09036	HEWLETT PACKARD	Jan. 15, 03	1 Year
Amplifier	8447D	2443A03849	HEWLETT PACKARD	Jan. 15, 03	1 Year
Coaxial cable	RG-5A/U(12.3 m)	R1	AKZO	Jan. 15, 03	1 Year
	23D-4AF(10.0 m)	R2	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(1.8 m)	R3	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(0.2 m)	R9	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(0.4 m)	R10	AKZO	Jan. 15, 03	1 Year
	RG-5A/U(1.1 m)	R11	AKZO	Jan. 15, 03	1 Year
Test receiver	ESH2	891678/010	ROHDE & SCHWARZ	Jul. 11, 03	1 Year
	ESS (Firmware Version 1.08)	842886/011	ROHDE & SCHWARZ	Mar. 19, 03	1 Year
RF Switch	ACX-150	None	AKZO	Jan. 15, 03	1 Year
Site Attenuation				Jun. 03, 03	1 Year

Note : Test instruments are calibrated according to Quality Manual and Calibration Rules of EMC division.

SECTION 11. MEASUREMENT UNCERTAINTY

The uncertainty of the measurements performed for this report lies:

AC Conducted Emission
0.1500MHz – 30 MHz ..... 2.45 dB

Spurious Emission - Radiated at 3m
0.009 MHz – 30 MHz ..... 2.50 dB
30 MHz – 1000 MHz ..... 4.07 dB

Note on Radiated Electric Field measurement uncertainty

The following items are not included in the calculations in spite of their own uncertainty components because it is impracticable to find the value.
It is our problem awaiting solution in future.

(1)Repeatability of measurement
It is not possible to calculate repeatability since the measurement was carried out only one time.

(2)Antenna factor variation
The definition of measured (radiated electric field strength) is not completed on the referred standard(s).

(3)Loss of EUT radiation propagation
It is certainly one of the uncertainty components, however is not able to calculate.

Please note that these uncertainties are not reflected to the compliance judgement of the test results in this report.

SECTION 12. DESCRIPTION OF TEST LABORATORY

12.1 Outline of Akzo Nobel K. K. (formerly Akzo Kashima Limited), EMC Division

Akzo Nobel K. K., the country organization in Japan for Akzo Nobel NV, was established in 1968. The shares are owned by Akzo Nobel NV (100%). Akzo Nobel NV, headquartered in the Netherlands, is one of the world's leading companies in selected areas of chemicals, coatings, healthcare products and fibers with work force of approximately 70,000 people in over 50 countries.

In 1984, in order to respond to the growing testing demand, in particular, for FCC filing, Akzo Nobel K. K. started EMI testing business, installing the first open air test site in Kashima, Ibaraki prefecture. Further the business has been expanded by installing additional testing facilities not only in Ibaraki but also in other areas such as Shizuoka, Nagano, Kanagawa and Tochigi. As results, Akzo Nobel K. K. has now 16 open air test sites and 4 anechoic chambers for EMI/EMC testing. As the largest EMC testing laboratory in number of testing facilities and staffs, EMC Division has been organized separately in the company and independently operated in conformity with the requirements of ISO/IEC17025 for its competency as a testing laboratory.

Akzo Nobel K. K. EMC Division is the first foreign private laboratory accredited by NVLAP, National Voluntary Laboratory Accreditation Program-NIST, USA. The division has been certified, authorized and/or filed as a competent testing laboratory by various testing organizations/authorities as described below.

12.2 Filing, certification, authorization and accreditation list

EMI/EMC testing		Telecommunications terminal testing	
FCC	(USA)	FCC	(USA)
NVLAP	(USA)	NVLAP	(USA)
NEMKO	(Norway)	NATA	(Australia)
VCCI	(Japan)	IC	(Canada)
VLAC	(Japan)		
ETL SEMKO	(Sweden)		
TÜV PRODUCT SERVICE	(Germany)		
BSMI	(Taiwan)		

Note 1 : NVLAP accreditation does not constitute any product endorsement by NVLAP or any agent of the U.S. Government.