

FCCID:VU2-Smart

# Certification of Compliance

CFR 47 Part 15 Subpart B, Subpart C

Test Report File No. : 07-IST-0506

Date of Issue : November 29, 2007

Model(s) : Smart  
Kind of Product : Card Printer  
FCC ID : VU2-Smart  
Applicant : I&ASYSTEM LTD  
Address : 401 Ace Twin Tower 1st, 212-1, Guro-dong, Guro-gu, Seoul,  
Korea  
Manufacturer : I&ASYSTEM LTD  
Address : 401 Ace Twin Tower 1st, 212-1, Guro-dong, Guro-gu, Seoul,  
Korea  
Registration Number 400603

**Test Result** **Positive** **Negative**

Reviewed By

Approved By



S.J.CHO / EMC Group Manager



B.S.Kim / Chief

**Comment (s)**

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
  - The test report with appendix consists of 22 pages.
  - The test result only responds to the tested sample.
  - This equipment as for has been shown to be capable of continued 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
- I assume full responsibility for accuracy and completeness of these data.



FCCID:VU2-Smart

**TABLE OF CONTENTS**

Table of contents	2
Information of test laboratory, Environmental conditions, Power used, Product information	3
Descriptions of Test	4
- Radiated Emission(30MHz to 1000MHz)	4
- Radiated Emission, 9KHz to 30MHz(Magnetic Field Test)	5
- Conducted Emission	5
Measurement Uncertainty Calculations	5
Equipment Under Test	5
Test Set-Up (Figure)	6
Summary	7
■ Test and Data - Emissions	
◆ Conducted Emissions	10
Power Line Conducted Emission-15.107, 15.207	10-12
◆ Radiated Field Emissions	15-18
Radiated Emission-15.225(a)	13-14
Radiated Field Emission-15.225(b) (c)	15
Radiated Field Emission-15.109, 15.209&15.225(d)	16
Frequency Stability -15.225(e)	17
◆ ANTENNA REQUIREMENT	18
Appendix	
A. The Photos of Test Setup	19 -21
B. The Photos of Equipment Under Test	22

Note:

FCCID:VU2-Smart

**INFORMATIONS OF TEST LABORATORY**EMC LABORATORY of IST Co., Ltd. (**FCC Filing Lab.**)

400-19 Singal-dong, Giheung-gu Yongin-City

Gyeonggi-Do, 449-860, Korea

TEL : +82 31 326 6797

FAX : +82 31 326 9767

**ENVIRONMENTAL CONDITIONS**

Temperature 18 °C

Humidity 57 %

Atmospheric pressure 1012 mbar

**POWER SUPPLY SYSTEM USED**

Power supply system AC120V60Hz to DC 24V 3.75A

(Refer to the product information)

**PRODUCT INFORMATION****The Equipment Under Test(EUT) is portable smart card printer.****(FCC ID : VU2-Smart)**

Card Type	PVC, Polyester Cards with polished PVC finish
Printing Method	Dye-Sublimation / Resin Thermal Transfers / Edge - to - Edge
Card Format	ISO CR-80 (54mm X86mm)
Card Thickness	0.38 mm (15 mil) ~ 1.0 mm(40 mil)
Resolution	300 dpi
Memory	32 MB
Printing Speed	Color(YMCKO) : max 144 cards / hour
	Black Overlay (KO) : Max 360 Cards / hour
	Mono (black) : max 720 cards / hour
Ribbon Capacity	Color(YMCKO) : max 250 cards / roll
	Black Overlay (KO) : Max 600 Cards / roll
	Mono : 1,200 cards / roll (Black, Gold, Silver)
Hopper & Stacker	Hopper : 80 cards, Stacker : 30 cards
Interface	USB
Display	2 Lines LCD & LED
Power	Free Voltage( 110 / 240 Vac), 50 ~ 60 Hz,
Dimension	166mm(W)*190mm(H)*360mm(D), 4.5 kg
Operating Environment	Temperature : -20 ~ 55 °C, Humidity : 20 ~ 95 %
Printer Driver	Windows 2000 / 2003 / XP

- Please refer to user's manual.

FCCID:VU2-Smart

## DESCRIPTION OF TEST

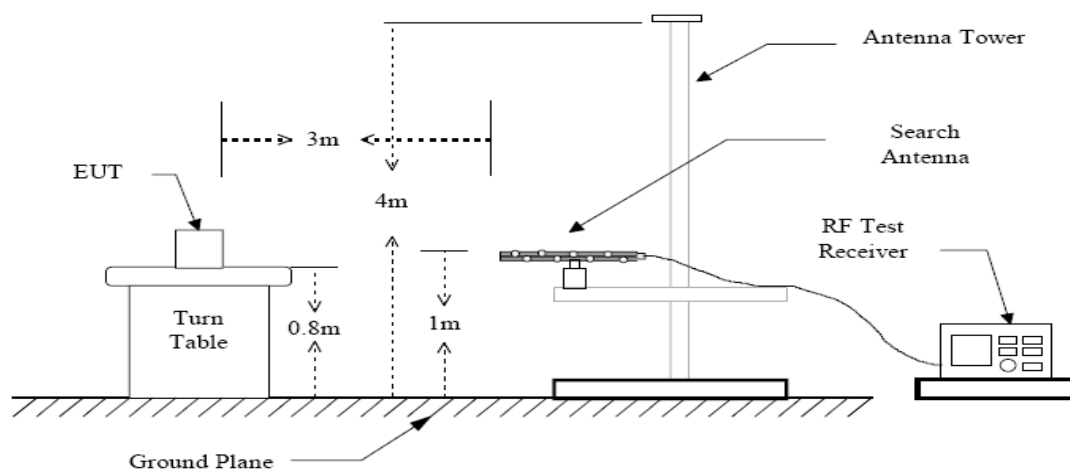
### Radiated Emissions(30MHz~1000MHz):

The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120KHz.

#### -Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. 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. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.

Figure 1 : Frequencies measured below 1 GHz configuration



FCCID:VU2-Smart

**Radiated Emissions Test,9kHz to 30MHz(Magnetic Field Test)**

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f) (2).
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.

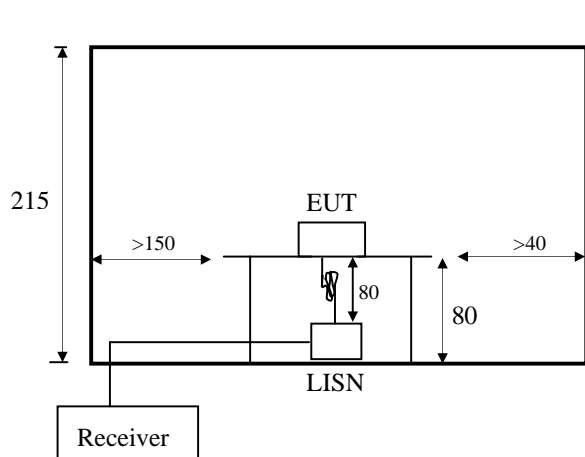
FCCID:VU2-Smart

## Conducted Emissions:

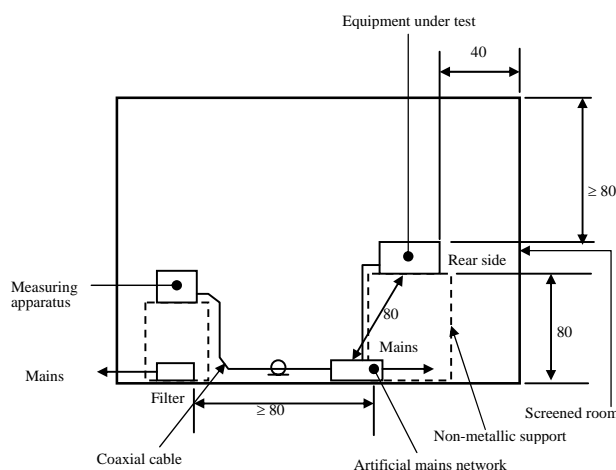
The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

### -Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESCI and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the EMCO LISN .The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.



< Side View >



< Concept Drawing >

**FCCID:VU2-Smart**

## Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Conducted Emissions)	Probability Distribution	Uncertainty (±dB)
		0.15-30 MHz
LISN		
Impedance Test	Normal (k=2)	± 0.60
Insertion Loss	Normal (k=2)	± 0.09
Voltage Division Factor	Rectangular	± 0.30
Cable Loss	Rectangular	± 0.20
Receiver		
QP Sine-wave Voltage Accuracy	Normal (k=2)	± 0.20
QP Pulse Amplitude Sensibility		± 0.40
QP Pulse Frequency Response		± 0.57
Random Noise		± 0.35
Mismatch AMNto Reciver	U-Shaped	-0.80/+0.70
System Repeatability	Normal (k=1)	± 0.20
Combined Standard Uncertainty	Normal	± 0.86
Expanded Uncertainty U	Normal (k=2)	± 1.72

**U = ± 1.72(k=2, 95.45 % confidence level)**

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties (±dB)
		10 m
Antenna		
Factor Frequency Interpolation	Normal (k=2)	± 0.5
Height Variation	Rectangular	-2.60/+1.50
Directivity Difference	Rectangular	-1.00/+0.00
Phase Center Location	Rectangular	± 1.00
Cable Loss	Rectangular	± 0.50
Receiver		
QP Sine-wave Voltage Accuracy	Normal (k=2)	± 0.20
QP Pulse Amplitude Sensibility		± 0.40
QP Pulse Frequency Response		± 0.57
Random Noise		± 0.35
Mismatch to Receiver	U-Shaped	-1.00/+0.90
$\Gamma_{\text{antenna}}$   = 0.33		
$\Gamma_{\text{receiver}}$   = 0.33		
System Repeatability	Std Deviation	± 0.20
Combined Standard Uncertainty	Normal	± 1.35
Expanded Uncertainty U	Normal (k=2)	± 2.70

**U = ± 2.70(k=2, 95.45 % confidence level)**

FCCID:VU2-Smart

## Equipment Under Test

**EUT Type :**

- Table-Top.                       Floor-Standing.
- Table-Top and Floor-Standing(Combination).
- Built-in

**EUT Operating Mode(s):**

The equipment under test was operated during the measurement under following conditions :

- Standby Mode
- Operational Condition : Continue TX Mode and Card Printing mode

**Configuration of the equipment under test :**

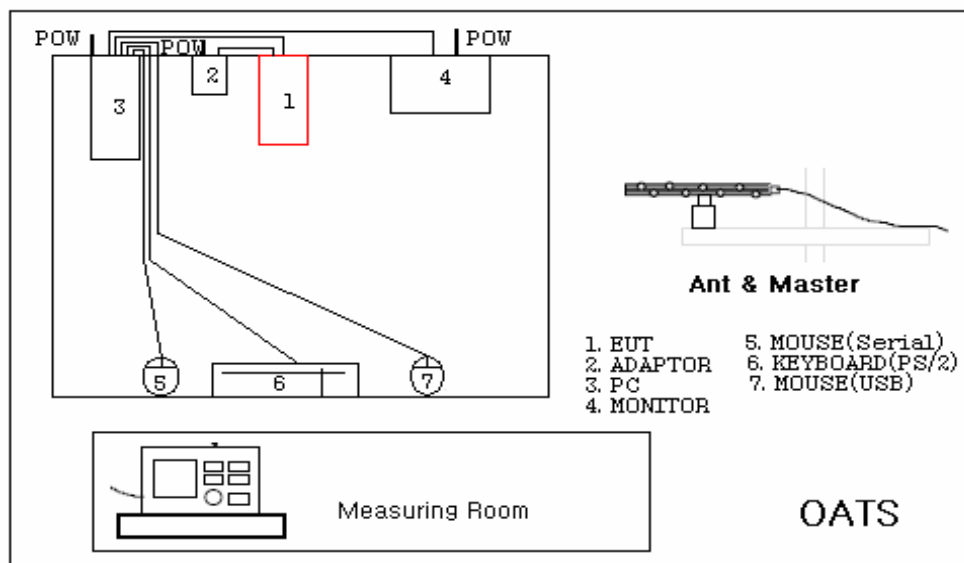
Following peripheral devices and interface cables were connected during the measurement :

Equipment	Type	Brand	Serial No.
Desktop Pc	dx6120MT	HP	CNG550092Q
PS/2 KEYBORAD	SK-2880	HP	N/A
LCD Monitor	1707 FPt	Dell Inc.	N/A
Serial Mouse	M-M28	Logitech	N/A
USB Mouse	M-UV69a	HP	N/A

Unshielded Adaptor's DC in cable(with one ferrite core) : 1.8 m  
 Shielded USB Cable (without ferrite core) : 1.9 m

Note :

### Test Set-Up Configuration



**Radiated/Conducted Emissions**



FCCID:VU2-Smart

### SUMMARY

#### Emissions

■ Conducted Emission 15.107, 15.207

The requirements are  MET  Not MET  
 Minimum limit margin 10.93 dB at 19.92 MHz

■ Radiated Emission-15.225(a)

Test result  MET  Not MET

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.553 - 13.567	15,848	83.9	123.9

■ Radiated Electric Field Emission-15.225(b) (c)

Test result  MET  Not MET

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.110 - 13.410	106	40.5	80.5
13.410 - 13.553	334	50.4	90.4
13.567 - 13.710	334	50.4	90.4
13.710 - 14.010	106	40.5	80.5

■ Radiated Electric Field Emission-15.109, 15.225(d)

Test result  MET  Not MET

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(3m)
1.705 - 30.0	30	49.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	600	54

■ Frequency Stability -15.225(e)

Test result  MET  Not MET

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

#### Test Date

Begin of Testing : Nov. 8, 2007

End of Testing : Nov. 21, 2007

Note :

Prepared By



- means the test is applicable,
- is not applicable.

J.Y. CHOI / Research Engineer

FCCID:VU2-Smart

## TEST CONDITIONS AND DATA

### Conducted Emissions

[Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacturer	Calibration Date	Serial No.
ESCI	Test Receiver	Rohde & Schwarz	May 18, 2007	100373
KNW-407	LISN	Hyup-Rip	Oct. 11, 2007	8-883-10
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May 21, 2007	357.8810.52

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Test Program            Continue TX Mode and Card printing mode

◆ Test Date                Nov. 08, 2007

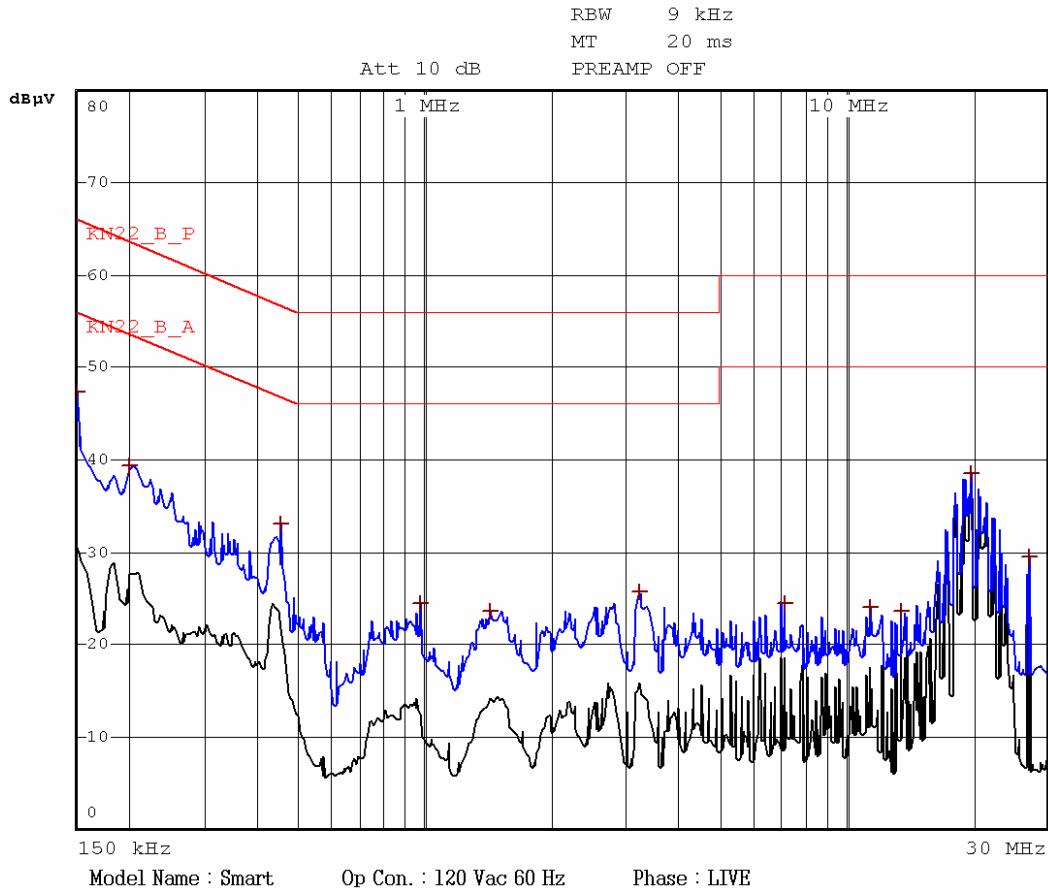
◆ Test Area                Conducted room No.1

*Note : The equipment used is calibrated in regular for every year.*

FCCID:VU2-Smart

**Conducted Emissions**

Test Mode : RFID Signal ON(Live Phase)



Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss [dB]	Cable Loss [dB µV]	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.15	42.63	30.23	66.00	56.00	0.14	0.25	43.02	30.62	22.98	25.38
0.20	33.47	27.59	63.48	53.48	0.13	0.30	33.90	28.02	29.58	25.46
0.45	26.59	21.48	56.80	46.80	0.15	0.27	27.01	21.90	29.79	24.90
3.23	20.33	15.97	56.00	46.00	0.29	0.39	21.01	16.65	34.99	29.35
19.92	37.52	35.82	60.00	50.00	0.67	0.56	38.75	37.05	21.25	12.95
27.13	28.35	28.34	60.00	50.00	0.66	0.75	29.76	29.75	30.24	20.25

Note : It operates the signal of the EUT.

RFID signal of the EUT is turned on automatically when the main power is supplied, Therefore, Conducted Emission test was only performed in the State of RFID signal on.

FCCID:VU2-Smart

**Conducted Emissions**

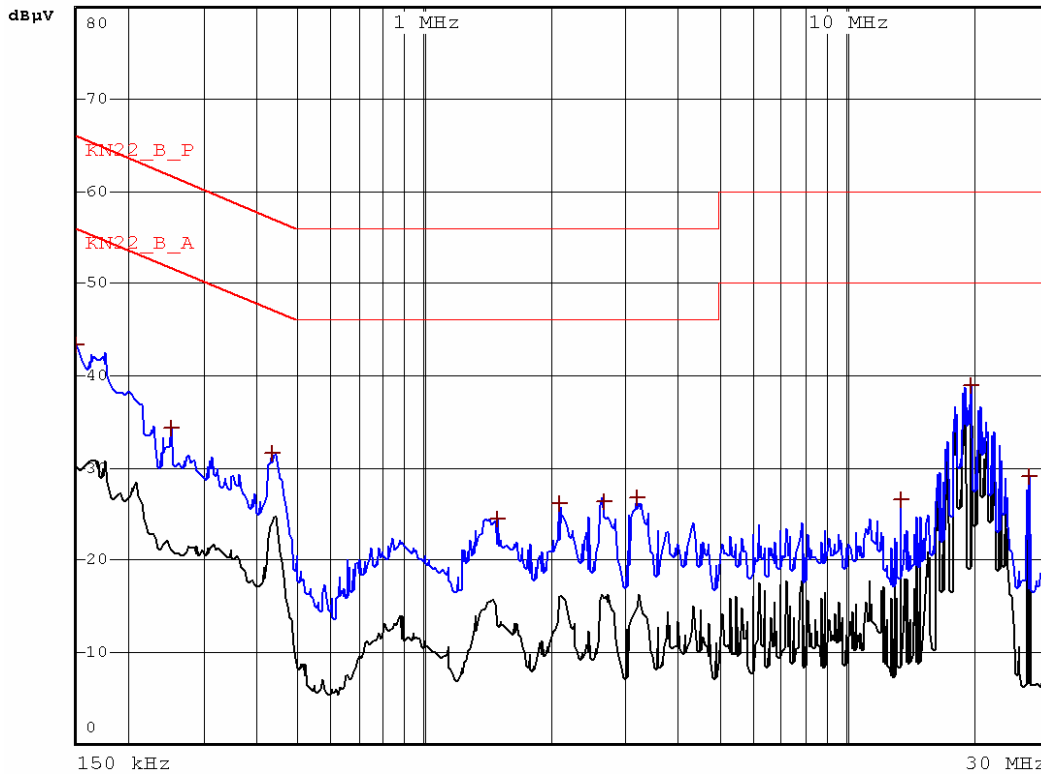
Test Mode : RFID Signal ON(Neutral Phase)

RBW 9 kHz

MT 20 ms

Att 10 dB

PREAMP OFF



150 kHz

Model Name : Smart

Op Con. : 120 Vac, 60 Hz

Phase : NEUTRAL

30 MHz

Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss [dB]	Cable Loss [dB µV]	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.15	38.59	29.52	66.00	56.00	0.10	0.25	38.94	29.87	27.06	26.13
0.20	25.71	20.72	63.48	53.48	0.14	0.30	26.15	21.16	37.33	32.32
0.45	27.97	23.08	56.80	46.80	0.20	0.27	28.44	23.55	28.36	23.25
3.23	19.82	15.54	56.00	46.00	0.27	0.39	20.48	16.20	35.52	29.80
19.92	37.86	37.81	60.00	50.00	0.70	0.56	39.12	39.07	20.88	10.93
27.13	27.80	27.78	60.00	50.00	0.67	0.75	29.22	29.20	30.78	20.80

Note : It operates the signal of the EUT.

RFID signal of the EUT is turned on automatically when the main power is supplied, Therefore, Conducted Emission test was only performed in the State of RFID signal on.

FCCID:VU2-Smart

**Radiated Field Emission-15.225(a)****[Applicable]**

## ◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	Test Receiver	Rohde & Schwarz	Aug. 14, 2007	100171
VULB 9160	Antenna	Schwarzbeck	Aug. 14, 2007	3047
R3132	Spectrum analyzer	advantest	Sep. 08, 2007	110101565
HFH2-Z2	Loop Antenna	Rohde & Schwarz	Oct. 18, 2007	862077/017

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

Where

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain (if any)}$$

## ◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Test Program                      Continue TX Mode and Card printing mode

◆ Test Date                              Nov. 09, 2007 ~ Nov. 21, 2007

◆ Test Area                              Open site or Compact Chamber, Shield Room(4.2 X 7.5 X 4.5)  
Testing was performed at a test distance of 3 m.

Note : The equipment used is calibrated in regular for every year.

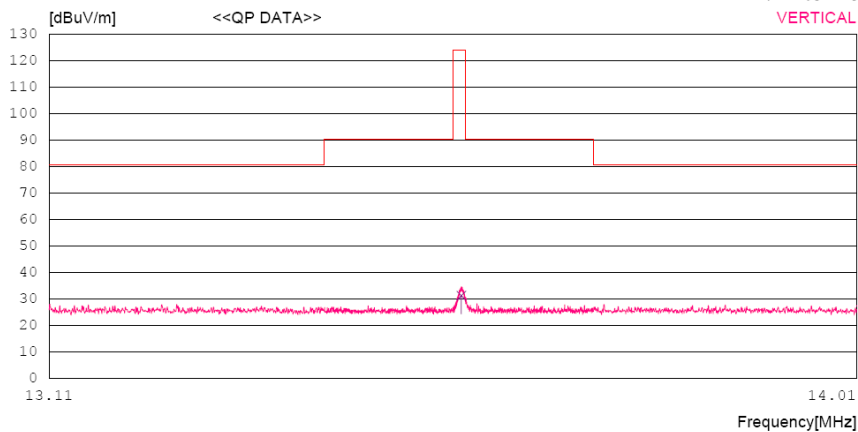
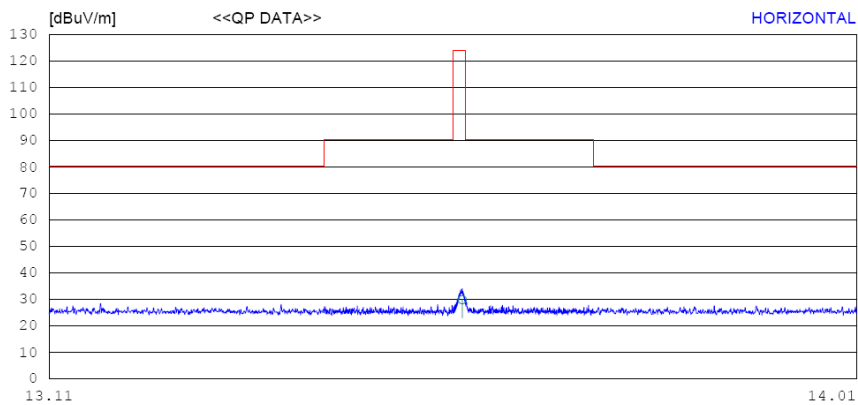
FCCID:VU2-Smart

**Radiated Field Emission-15.225(a)**

Frequency(MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.553 - 13.567	15,848	83.9	123.9

**[Applicable]**

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.5625	11.5	1	18.3	0.6	H	30.4	123.9	93.5
13.5625	12.8	1	18.3	0.6	V	31.7	123.9	92.2



Note :

FCCID:VU2-Smart

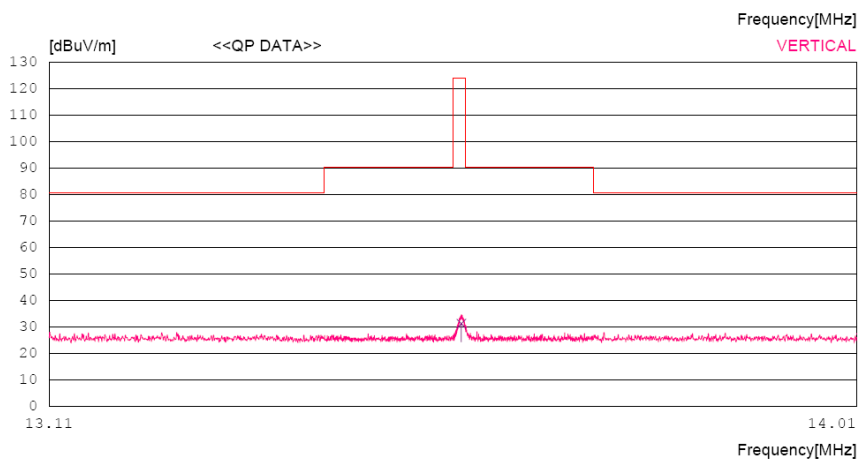
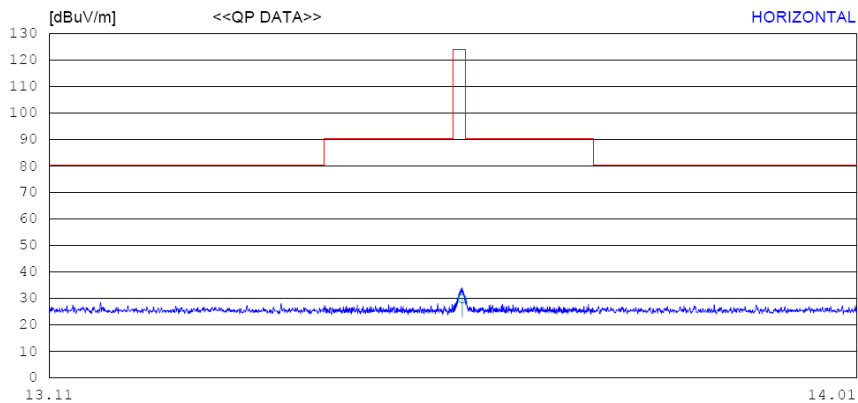
**Radiated Electric Emission-15.225(b)(c)**

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.110 - 13.410	106	40.5	80.5
13.410 - 13.553	334	50.4	90.4
13.567 - 13.710	334	50.4	90.4
13.710 - 14.010	106	40.5	80.5

[Applicable]

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
-	-	-	-	-	-	-	-	-

Note : Other emission don't exceed the level 20dB below the applicable limit.



FCCID:VU2-Smart

**Radiated Field Emission-15.109, 15.225(d)**

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(3m)
1.705 - 30.0	30	49.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

[Applicable]

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
18.220	13.89	100	18.35	0.66	V	32.90	49.50	16.60
19.995	5.84	100	18.40	0.69	H	24.93	49.50	24.57
23.335	3.96	100	18.41	0.70	V	23.07	49.50	26.43
24.395	5.18	100	18.41	0.70	H	24.29	49.50	25.21
108.499	17.90	107	10.80	2.30	V	31.0	43.50	12.50
135.624	15.90	120	13.60	2.50	V	32.0	43.50	11.50
352.623	13.60	105	13.80	3.90	H	31.3	46.00	14.70
448.253	18.60	105	16.70	4.50	V	39.8	46.00	6.20
515.382	18.50	104	17.00	4.60	V	40.1	46.00	5.90
596.753	15.10	116	18.70	5.00	H	38.8	46.00	7.20
786.634	14.30	162	21.30	5.50	H	41.1	46.00	4.90
800.194	12.10	101	21.50	5.60	H	39.2	46.00	6.80



FCCID:VU2-Smart

**Frequency Stability -15.225(e)**

## ◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
R3273	SPECTRUM ANALYZER	ADVANTEST	Dec. 11, 2006	95090431
PL-4SP	Temp&Humi Chamber	TABAI	Aug. 19, 2007	44VH0266

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery

[Applicable]

Table 1 : Frequency Tolerance

Reference Frequency : 13.5625 MHz, Limit : within  $\pm 1356$  Hz

Environment Temperature [°C]	Power Supplied [Vac]	Carrier Frequency Measured with Time Elapsed							
		STARTUP		2 minutes		5 minutes		10 minutes	
		[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]
+50	120	13562474	-26	13562463	-37	13562458	-42	13562454	-46
+40	120	13562537	37	13562521	21	13562510	10	13562501	1
+30	120	13562571	71	13562553	53	13562543	43	13562537	37
+20	120	13562604	104	13562583	83	13562579	79	13562628	128
+10	120	13562624	124	13562614	114	13562607	107	13562601	101
0	120	13562631	131	13562632	132	13562631	131	13562630	130
-10	120	13562626	126	13562631	131	13562632	132	13562632	132
-20	120	13562629	129	13562625	125	13562627	127	13562630	130

Table 2 : Frequency Tolerance

Reference Frequency : 13.5625 MHz, Limit : within  $\pm 1356$  Hz

Power Supplied [Vdc]	Carrier Frequency Measured with Time Elapsed							
	STARTUP		2 minutes		5 minutes		10 minutes	
	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]
85%	13562571	71	13562555	55	13562550	50	13562548	48
100%	13562570	70	13562555	55	13562550	50	13562548	48
115%	13562569	69	13562554	54	13562550	50	13562548	48

**Err[Hz] = Measured carrier frequency (MHz) – Reference Frequency (13.5625 MHz)**

FCCID:VU2-Smart

## **ANTENNA REQUIREMENT**

### **1 Standard Applicable**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### **2 Antenna Construction**

The antenna is permanently mounted on PCB, no consideration of replacement.

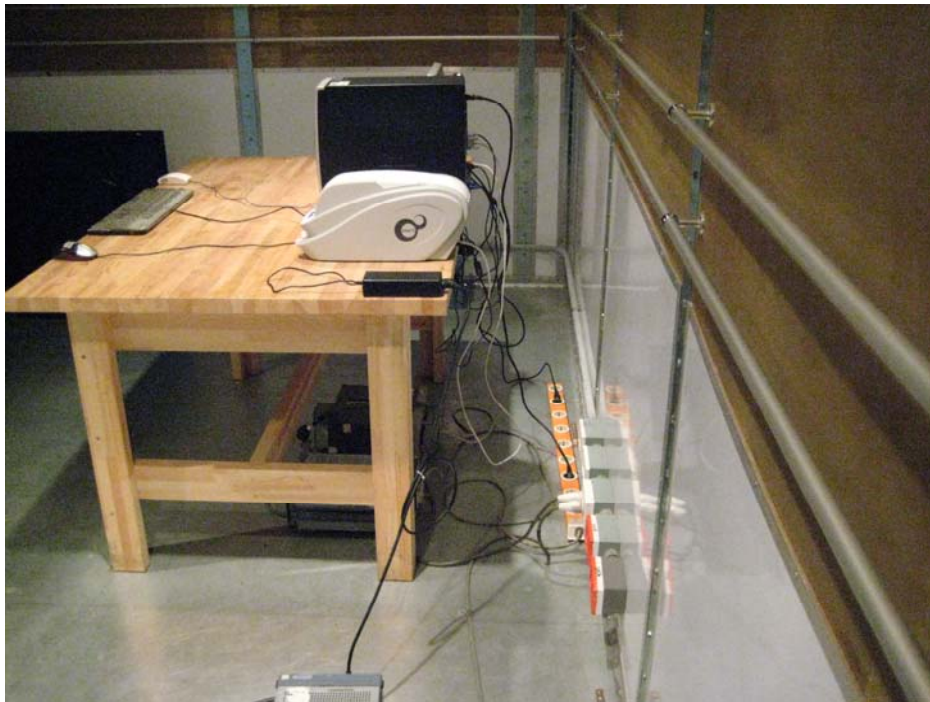
FCCID:VU2-Smart

Appendix A. The Photos of Test Setup

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Conducted Emissions - (Front View)



FCCID:VU2-Smart

Conducted Emissions - (Rear View)

Appendix A. The Photos of Test Setup



Radiated Emissions- (30 MHz to 1GHz Front View)



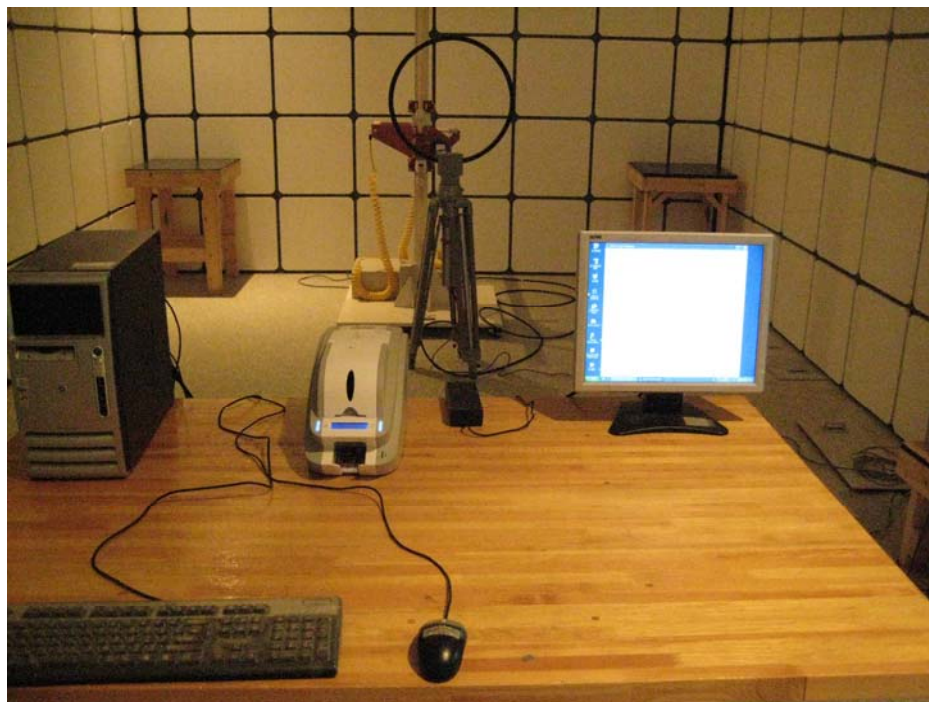
Radiated Emissions- (30 MHz to 1GHz Rear View)



FCCID:VU2-Smart

Appendix A. The Photos of Test Setup(Shield Room)

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Radiated Emissions- (9kHz to 30 MHz)

FCCID:VU2-Smart

Appendix B. The Photos of Equipment Under Test

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Front View



Rear View