

TEST REPORT

Part 15 Subpart C 15.225

Equipment under test RFID & Biometrics System

Model name Gateway FVS

FCC ID X8JGATEWAREFVS

Applicant DOALLTECH CO.,LTD

Manufacturer DOALLTECH CO.,LTD

Date of test(s) 2014.06.04 ~ 2013.07.18

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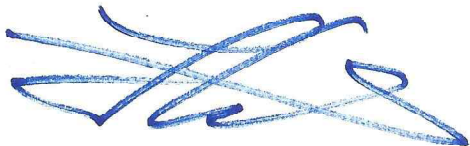
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Revision history

Revision	Date of issue	Test report No.	Description
-	2014.07.22	KES-RF-13T0039	Initial

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1. General information

1.1. EUT description

Equipment under test	RFID & Biometrics System
Model name	Gateway FVS
Serial number	N/A
Frequency range	13.560 MHz
Modulation technique	ASK
Channel separation	1
Antenna type	Fixed type (PCB antenna)
Power source	AC 120V Adaptor (Output : DC 19V)

1.2. Test frequency

	Low channel	Middle channel	High channel
Frequency (MHz)	13.560	N/A	N/A

1.3. Information about derivative model

N/A

1.4. Device modifications

N/A



1.5. Test facility

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

The open area test site is constructed in conformance with the requirements ANSI C63.4-2003/2009.

1.6. Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Certificate No.
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	KR0100
CANADA	IC	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1



2. Summary of tests

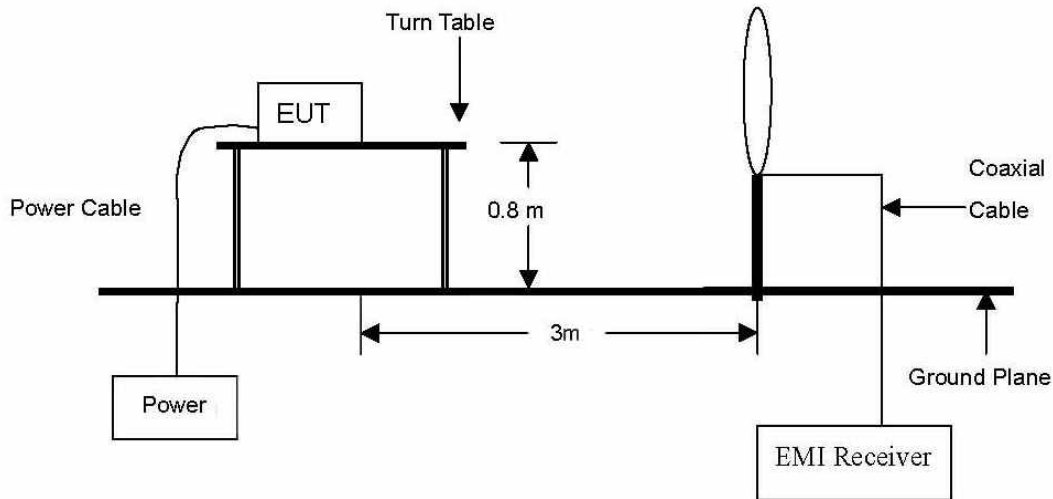
Reference	Parameter	Status
15.225(a)	The field strength of fundamental	Pass
15.225(b)(c)	The field strength of spurious emission(In-band)	Pass
15.225(d) 15.209	The field strength of spurious emission(Out-band)	Pass
15.225(e)	The frequency tolerance	Pass
15.215(c)	20 dB bandwidth	Pass
15.207	AC conducted emission	Pass

3. Test results

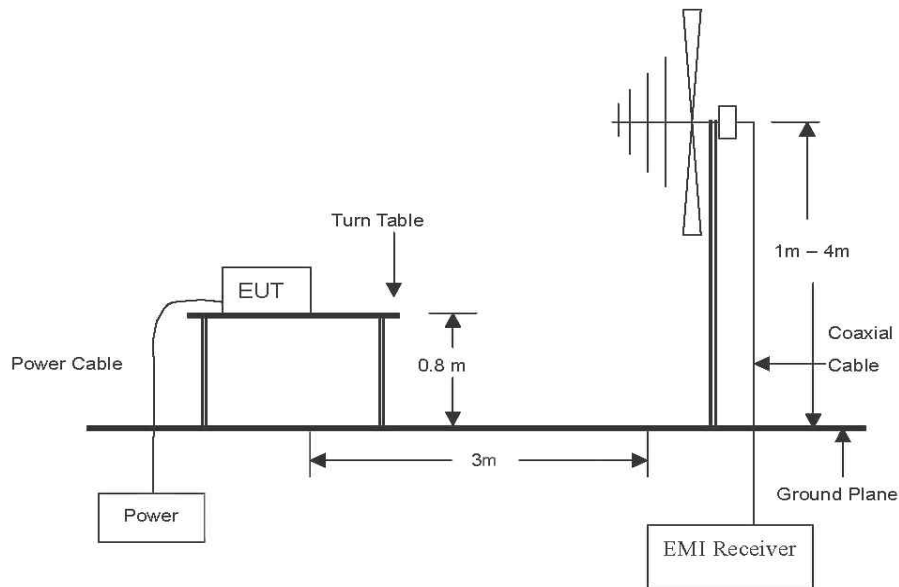
3.1. Radiated spurious emissions

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



Test procedure

[9 kHz to 30 MHz]

The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter Open Area Test Site. The table was rotated 360 degrees to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 Hz for Quasi-peak detection (QP) at frequency below 9 kHz~ 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz for Quasi-peak detection (QP) at frequency below 150 kHz~ 30 MHz.

[30 MHz to 1 GHz]

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.

Limit

In the section 15.209:

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Distance (Meters)	Radiated ($\mu\text{V}/\text{m}$)
0.009 ~ 0.490	300	2400 / F(kHz)
0.490 ~ 1.705	30	24000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

In the section 15.225:

- (a) The field strength of any emissions within the band 13.553 ~ 13.567 MHz shall not exceed 15,848 microvolts/meter (= 84 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (b) Within the bands 13.410 ~ 13.553 MHz and 13.567 ~ 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (=50.5 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (c) Within the bands 13.110 ~ 13.410 MHz and 13.710 ~ 14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (=40.5 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 ~ 14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.



Test results for fundamental

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/3m)	Margin (dB)
13.560	25.72	H	21.18	0.78	47.68	124.00	76.32
13.560	28.89	V	21.18	0.78	50.85	124.00	73.15

Test results for in-band & out-band(9 kHz to 14.010 MHz)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/3m)	Margin (dB)
13.554	18.87	H	20.98	0.70	40.55	69.54	28.99
13.554	21.44	V	20.93	0.74	43.11	69.54	26.43

Test results for in-band & out-band(14.010 MHz to 30 MHz)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/3m)	Margin (dB)
26.008	19.46	H	22.72	1.02	43.20	69.54	26.34
26.008	20.34	V	22.72	1.02	44.08	69.54	25.46

※ Remark

1. Actual = Reading + Ant. factor + Cable loss
2. Measurement distance: 3 m
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



Test results (Below 1 000 MHz)

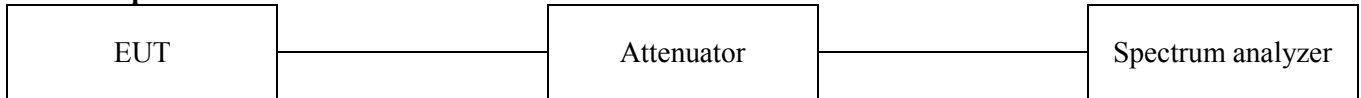
Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
47.931	23.10	V	13.60	0.88	37.58	40.00	2.42
65.174	22.40	H	12.35	1.18	35.93	40.00	4.07
135.108	20.40	V	12.40	1.88	34.68	43.50	8.82
135.597	26.90	H	12.43	1.89	41.22	43.50	2.28
202.379	28.60	V	9.97	2.43	41.00	43.50	2.50
203.268	28.20	H	10.00	2.44	40.64	43.50	2.86
242.593	27.60	H	11.47	2.76	41.83	46.00	4.17
325.236	18.80	V	13.95	3.33	36.08	46.00	9.92
363.846	18.30	V	14.79	3.57	36.66	46.00	9.34
389.774	18.00	H	15.36	3.76	37.12	46.00	8.88
519.869	17.50	V	18.12	4.47	40.09	46.00	5.91
524.927	12.00	H	18.21	4.49	34.70	46.00	11.30

※ Remark

1. Actual = Reading + Ant. factor + Cable loss
2. Detector mode: Quasi peak
3. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

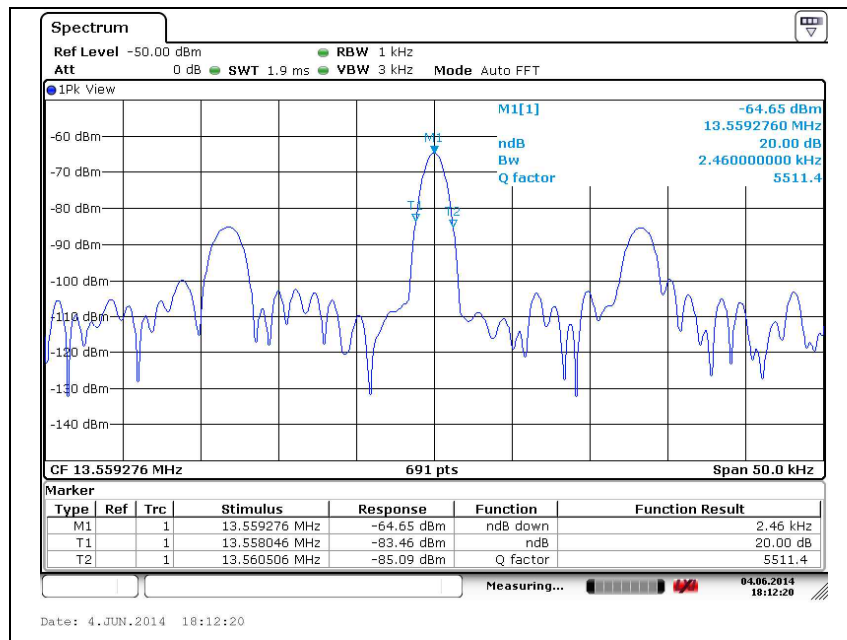
3.2 20 dB bandwidth

Test setup



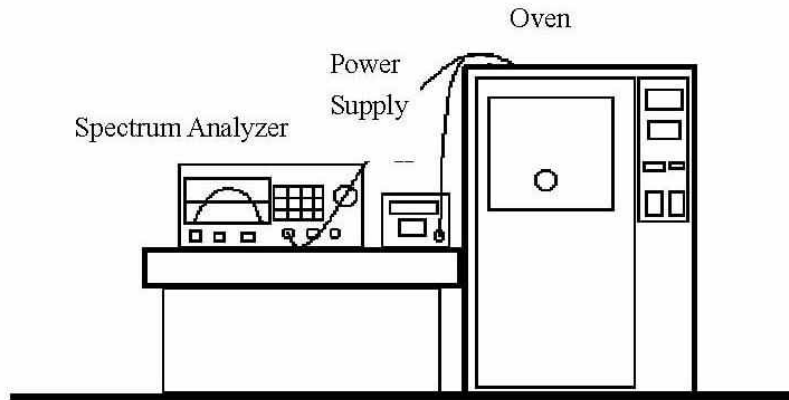
Test procedure

The 20 dB bandwidth was measured by using a spectrum analyzer.



3.3. Frequency tolerance

Test setup



Test procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The transmission time was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz.
3. Set the temperature of chamber to -20°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the highest temperature 50°C is measured, record all measured frequencies on each temperature step.

Limit

According to FCC Part 15 Section 15.225 (e),

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 results

Test voltage (%)	Test voltage (V)	Temperature (℃)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	AC 110	-20	13.559 420	-580	-0.004 277
100 %		-10	13.559 445	-555	-0.004 093
100 %		0	13.559 440	-560	-0.004 123
100 %		10	13.559 385	-615	-0.004 454
100 %		20	13.559 355	-645	-0.004 476
100 %		30	13.599 305	-695	-0.004 513
100 %		40	13.599 245	-755	-0.004 557
100 %		50	13.599 240	-760	-0.004 560
85 %	AC 93.5	20	13.559 325	-675	-0.004 498
115 %	AC 126.5	20	13.559 345	-655	-0.004 483

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3.4. AC conducted emissions

Frequency range of measurement

150 kHz to 30 MHz

Instrument settings

IF Band Width: 9 kHz

Test procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

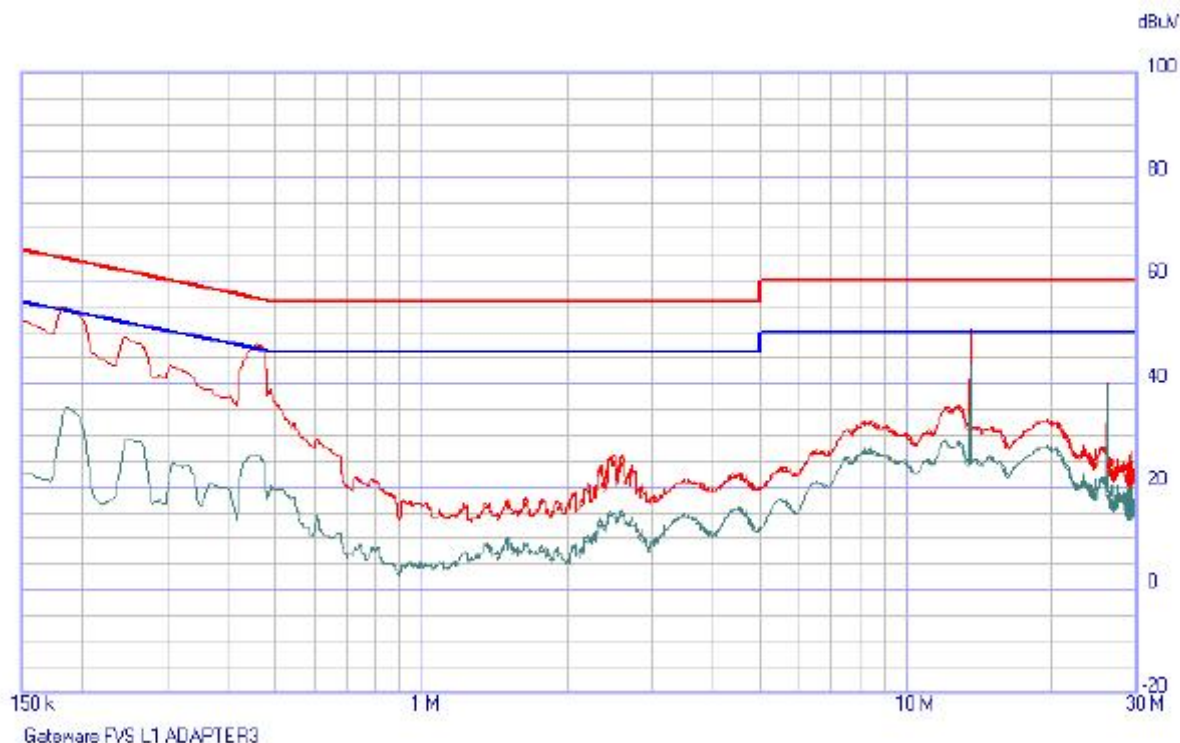
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Note.

- a) Decreases with the logarithm of the frequency.

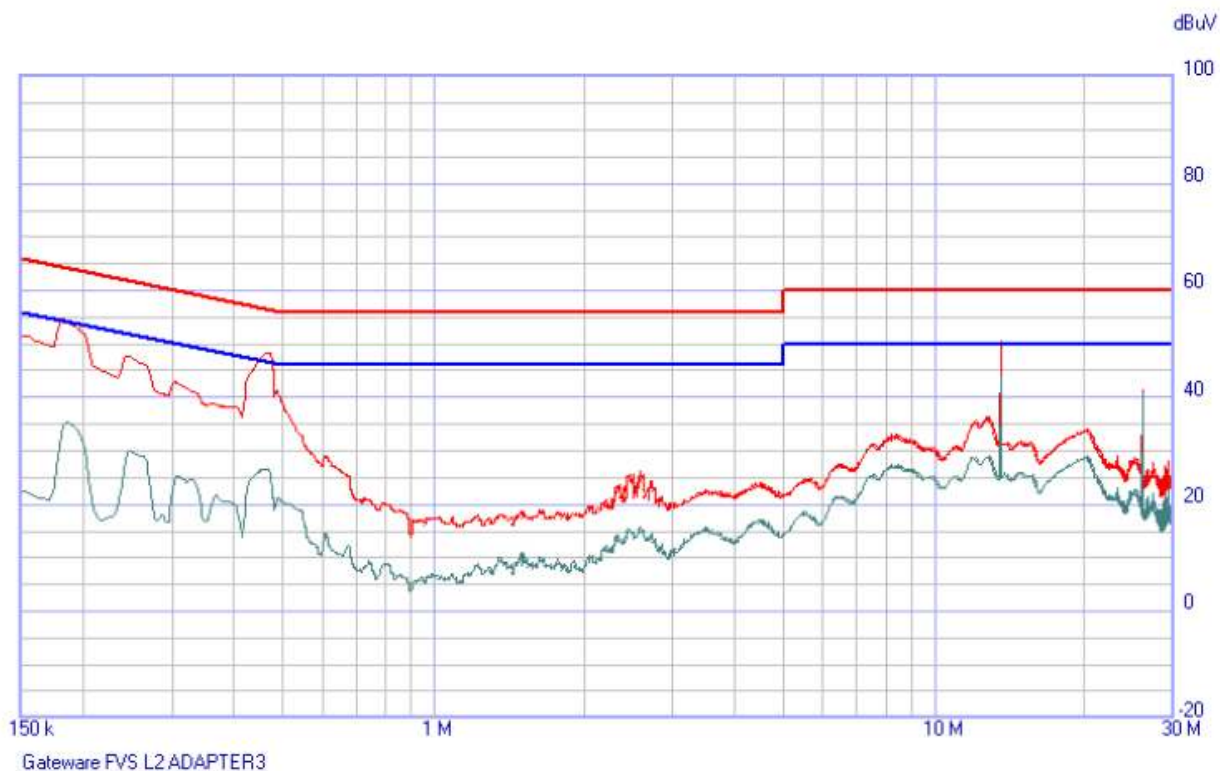
Test results



Frequency (MHz)	Result	
	QP (dB μ V)	C-AVG (dB μ V)
0.186	54.46	35.28
0.452	47.40	26.24
0.518	33.98	19.48
2.575	26.14	15.60
12.025	35.29	28.90
26.000	40.24	39.54

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.184	54.38	35.44
0.246	47.71	29.87
0.610	28.74	14.26
2.571	26.21	15.70
12.784	36.21	29.00
20.019	34.18	29.08

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



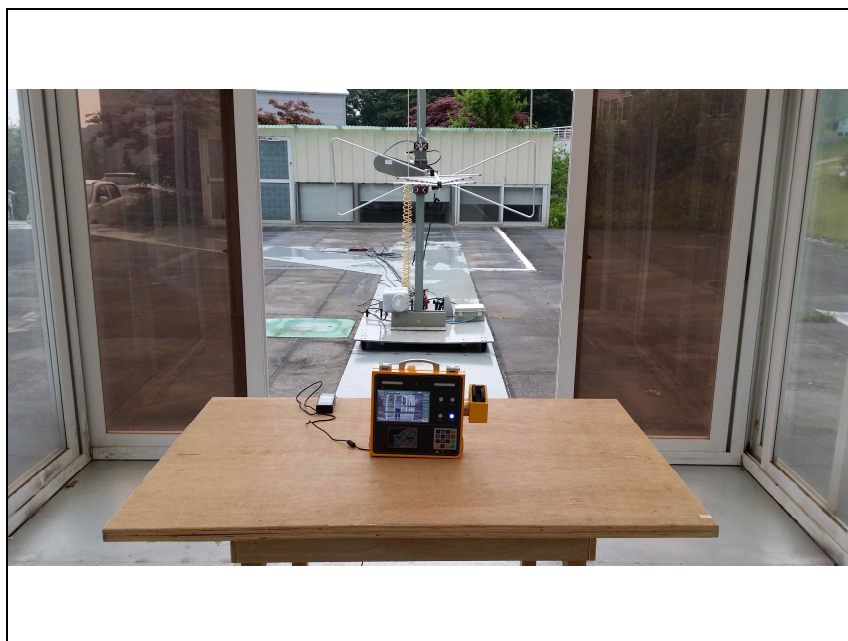
Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Cal Interval	Calibration due.
Spectrum analyzer	R&S	FSV30	101389	1 year	2015.04.30
Vector signal generator	R&S	SMBV2100A	1407.6004K02	1 year	2015.01.06
Radio Communication Tester	R&S	CMU200	107627	1 year	2014.12.27
Loop antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2015.04.25
Trilog-broadband antenna	Schwarzbeck	VULB 9168	9168-385	2 years	2015.05.09
Preamplifier	HP	8447F	2805A02570	1 year	2015.04.30
AC power supply	HP	6813A	전-3-5-1292	1 year	2014.08.05
EMI Test Receiver	LIG NEX1	ISA-80	L0912K014	1 year	2014.11.15
EMI Receiver/Signal Analyzer	Narda S.T.S / PMM	PMM 9010F	020WW31006	1 year	2015.04.04
LISN	R&S	ENV216	101137	1 year	2015.02.21

Peripheral device

Device	Manufacturer	Model No.	Serial No.
N/A	-	-	-

Appendix B. Test setup photo



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