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TEST REPORT

Part 15 Subpart C 15.225

Equipment under test	Computed Radiography Scanner
Model name	FireCR Flash
FCC ID	X68CRSCANNER5
Applicant	3D Imaging & Simulations Corp.
Manufacturer	3D Imaging & Simulations Corp.
Date of test(s)	2013.09.23 ~ 2013.09.25
Date of issue	2013.09.27

Issued to

3D Imaging & Simulations Corp.
#201~202, 815, Tamnip-dong, Yuseong-Gu, Daejeon, KOREA

Issued by

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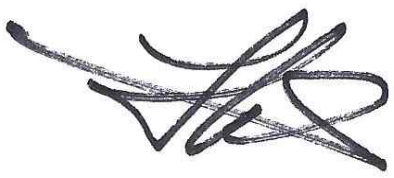
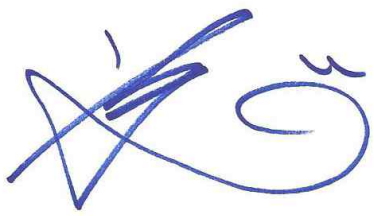
Test and report completed by :	**Report approval by :**
	
Hyeon-Su, Jang Test engineer	Jeff Do Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2013.09.27	KES-RF-13T0021	Initial

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1. General information

1.1. EUT description

Equipment under test	Computed Radiography Scanner
Model name	FireCR Flash
Serial number	N/A
Frequency range	13.562 ㎒
Modulation technique	ASK
Channel separation	1
Antenna type	Fixed type(PCB antenna)
Power source	AC 110 V

1.2. Test frequency

	Low channel	**Middle channel**	**High channel**
Frequency (㎒)	13.562	N/A	N/A

1.3. Information about variant model

N/A

1.4. Device modifications

N/A

1.5. Test facility

C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea

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

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	C
15.225(b)(c)	The field strength of spurious emission(In-band)	C
15.225(d) 15.209	The field strength of spurious emission(Out-band)	C
15.225(e)	The frequency tolerance	C
15.215(c)	20 dB bandwidth	C
15.207	AC conducted emission	C
Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable		

3. Test results

3.1. Fundamental and spurious emission

Test procedures

[9 ㎑ to 30 ㎒]

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

[30 ㎒ to 1 ㎓]

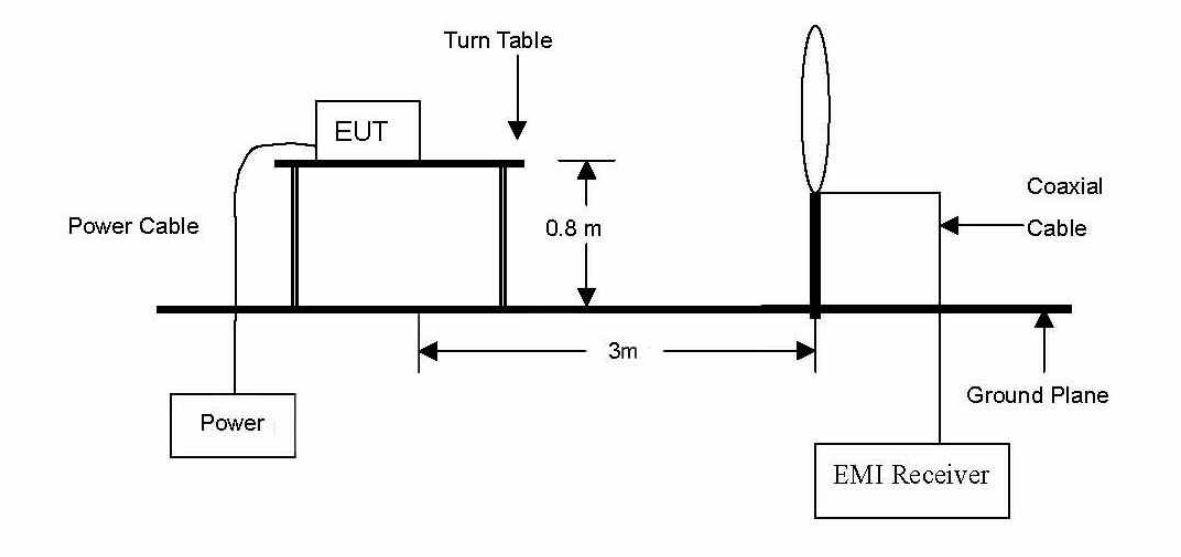
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

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

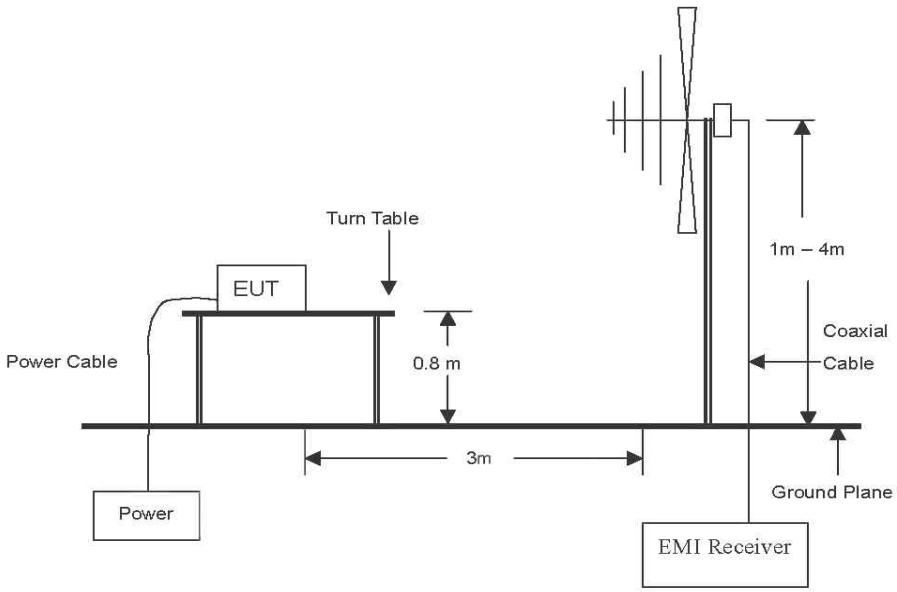
The spectrum analyzer is set to:

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

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



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



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 (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400 / F(㎑)
0.490 ~ 1.705	30	24000 / F(㎑)
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 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. 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 ㎒ shall not exceed 15,848 microvolts/meter (= 84 ㏈㎶/m) at 30 meters.

(b) Within the bands 13.410 ~ 13.553 ㎒ and 13.567 ~ 13.710 ㎒, the field strength of any emissions shall not exceed 334 microvolts/meter (=50.5 ㏈㎶/m) at 30 meters.

(c) Within the bands 13.110 ~ 13.410 ㎒ and 13.710 ~ 14.010 ㎒ the field strength of any emissions shall not exceed 106 microvolts/meter (=40.5 ㏈㎶/m) at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110 ~ 14.010 ㎒ band shall not exceed the general radiated emission limits in § 15.209.

Test results for fundamental

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/3m)	Margin (dB)
13.562	40.58	H	18.30	0.75	59.63	124.00	64.37
13.562	41.25	V	18.30	0.75	60.30	124.00	63.70

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

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/3m)	Margin (dB)
13.592	27.44	H	18.30	0.75	46.49	69.54	23.05
13.568	27.28	V	18.30	0.75	46.33	69.54	23.21

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

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/3m)	Margin (dB)
19.047	16.61	H	18.70	0.90	36.21	69.54	33.33
15.194	15.56	V	18.38	0.81	34.75	69.54	34.79

※ 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 ㎒)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/3m)	Margin (dB)
41.577	17.90	V	13.19	1.18	32.27	40.00	7.73
67.565	19.80	V	10.54	1.53	31.87	40.00	8.13
124.298	16.40	H	11.76	2.16	30.32	43.50	13.18
161.924	16.50	H	13.15	2.52	32.17	43.50	11.33
168.787	16.40	V	12.30	2.57	31.27	46.00	14.73
226.532	22.70	H	10.32	3.05	36.07	46.00	9.93
311.182	18.60	H	12.92	3.64	35.16	46.00	10.84
375.736	16.90	H	14.37	4.06	35.33	46.00	10.67
392.713	16.80	H	14.71	4.18	35.69	46.00	10.31
424.355	16.80	V	15.50	4.38	36.68	46.00	9.32
474.376	16.90	V	16.48	4.67	38.05	46.00	7.95
525.443	17.00	V	17.27	4.98	39.25	46.00	6.75

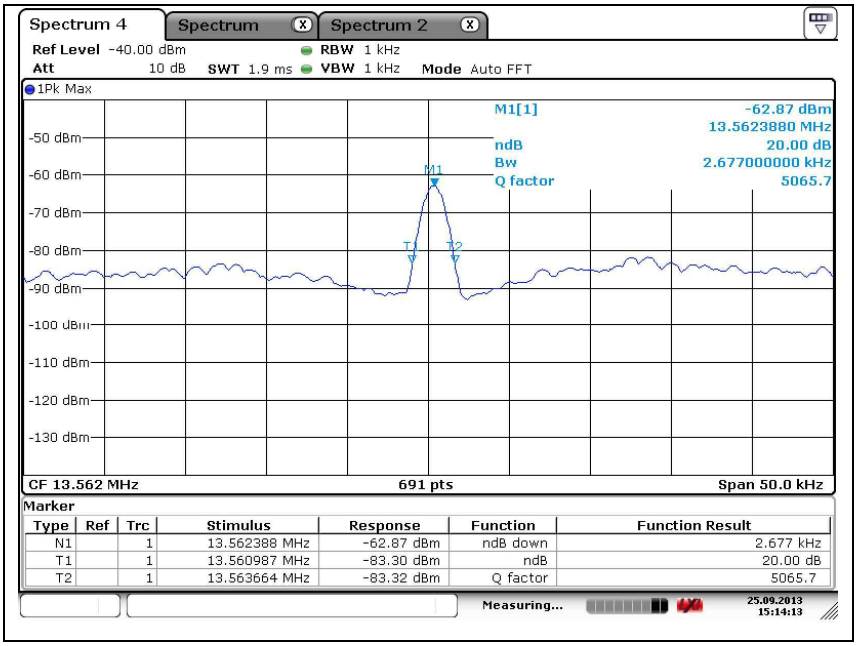
※ Remark

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

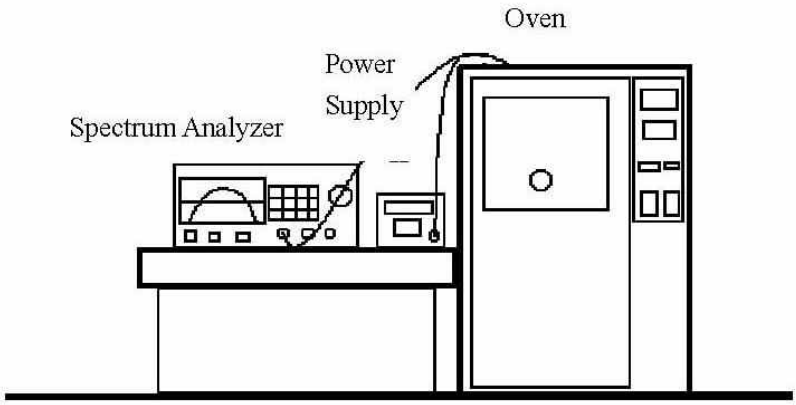
Test setup: The EUT was connected to a spectrum analyzer.

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 ㎑, VBW=1 ㎑.
3. Set the temperature of chamber to -20℃. 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℃ decreased per stage until the highest temperature 50℃ 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 +/-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 (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 110	-20	13.562 446	58	0.000 427
100 %		-10	13.562 460	72	0.000 530
100 %		0	13.562 417	29	0.000 214
100 %		10	13.562 402	14	0.000 103
100 %		20	13.562 388	0	0.000 000
100 %		30	13.562 373	-15	-0.000 111
100 %		40	13.562 370	-18	-0.000 133
100 %		50	13.562 373	-15	-0.000 111
85 %	AC 93.5	20	13.562 387	-1	-0.000 007
115 %	AC 126.5	20	13.562 388	0	0.000 000

3.4. AC conducted emissions

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 ㎑ to 30 ㎒, 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 (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

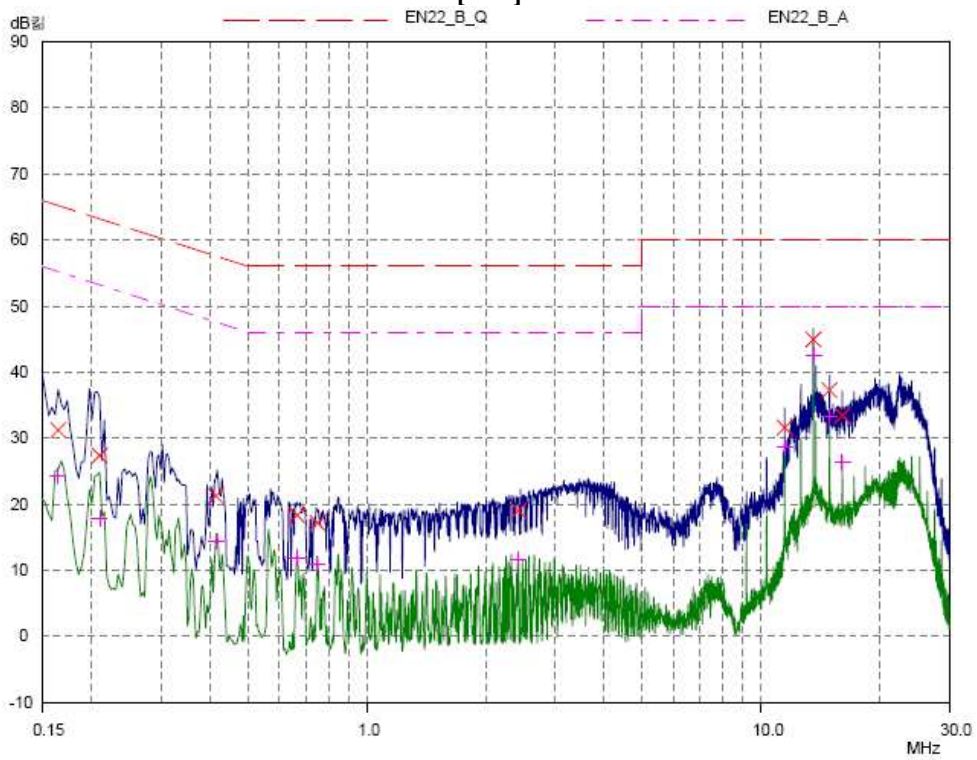
※ Remark

Decreases with the logarithm of the frequency.

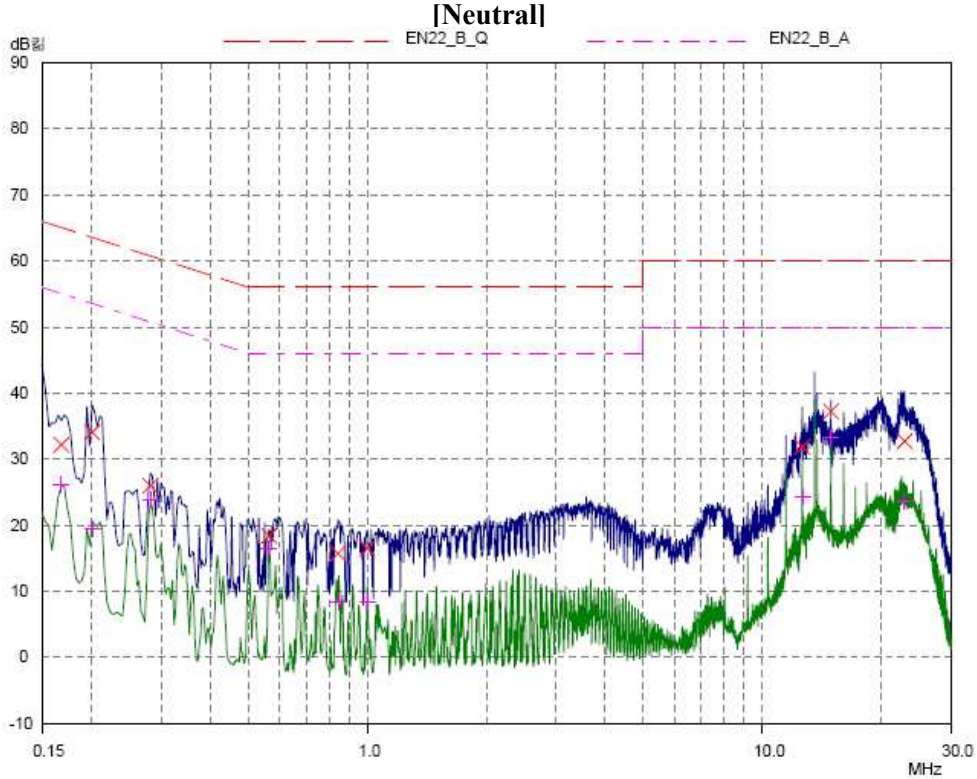
Test results

Frequency (㎒)	Correction		Phase Hot/ Neutral	Quasi peak			Average		
	LISN	Cable Loss		Reading	Result	Limit	Reading	Result	Limit
0.165	9.580	0.080	H	31.210	31.210	65.208	24.180	24.180	55.208
0.168	9.580	0.080	N	32.170	32.170	65.059	26.050	26.050	55.059
0.201	9.570	0.070	N	34.030	34.030	63.569	19.530	19.530	53.569
0.210	9.580	0.070	H	27.350	27.350	63.205	17.730	17.730	53.205
0.282	9.570	0.070	N	25.960	25.960	60.757	23.770	23.770	50.757
0.414	9.570	0.080	H	21.250	21.250	57.568	14.360	14.360	47.568
0.564	9.570	0.070	N	18.410	18.410	56.000	16.370	16.370	46.000
0.666	9.570	0.180	H	18.320	18.320	56.000	11.740	11.740	46.000
0.750	9.570	0.180	H	17.140	17.140	56.000	10.880	10.880	46.000
0.843	9.580	0.180	N	15.720	15.720	56.000	8.470	8.470	46.000
0.999	9.580	0.170	N	16.470	16.470	56.000	8.310	8.310	46.000
2.424	9.580	0.190	H	19.000	19.000	56.000	11.580	11.580	46.000
11.471	9.654	0.250	H	31.610	31.610	60.000	28.560	28.560	50.000
12.632	9.690	0.260	N	31.870	31.870	60.000	24.200	24.200	50.000
14.909	9.666	0.280	H	37.260	37.260	60.000	33.330	33.330	50.000
14.918	9.710	0.280	N	37.240	37.240	60.000	33.380	33.380	50.000
16.052	9.756	0.290	H	33.420	33.420	60.000	26.440	26.440	50.000
22.928	9.842	0.310	N	32.720	32.720	60.000	23.660	23.660	50.000

[Hot]



[Neutral]



Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2014.01.09
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2015.04.25
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.10.25
Temp. & Humid. Chamber	ALL THREE Eng	ATH-50M	2014.09.16
EMI Test Receiver	Agilent	E7410A	2014.04.09
EMI Test Receiver	R&S	ESHS10	2014.05.10
LISN	R&S	ENV216	2014.02.27
AC Power Source/Analyzer	HP	6813A	2014.05.06

Peripheral device

Device	Manufacturer	Model No.	Serial No.
Notebook	Samsung	NT-R519	ZLT393BSBOOZO4H

Appendix B. Test setup photo