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TEST REPORT

Part 15 Subpart C 15.225

Equipment under test RFID Reader

Model name Fire ID

Variant model Pro ID

FCC ID X68CRSCANNER4

Applicant 3D Imaging & Simulations Corp.

Manufacturer 3D Imaging & Simulations Corp.

Date of test(s) 2013.08.20 ~ 2013.08.26

Date of issue 2013.09.06

Issued to

3D Imaging & Simulations Corp.

#201~202, 815, Tamnip-dong, Yuseong-Gu, Daejeon, KOREA

Issued by

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Revision history

Revision	Date of issue	Test report No.	Description
-	2013.09.06	KES-RF-13T0019	Initial



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1. General information

1.1. EUT description

Equipment under test	RFID Reader
Model name	Fire ID (Variant model : Pro ID)
Serial number	N/A
Frequency range	13.562 MHz
Modulation technique	ASK
Channel separation	1
Antenna type	Fixed type (PCB antenna)
Power source	DC 5 V (USB port)

1.2. Test frequency

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

1.3. Information about variant model

Variant model (Pro ID) is same as basic model (Fire ID) for model name of overseas supplier.

1.4. Device modifications

N/A



1.5. Test facility

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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



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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

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 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]

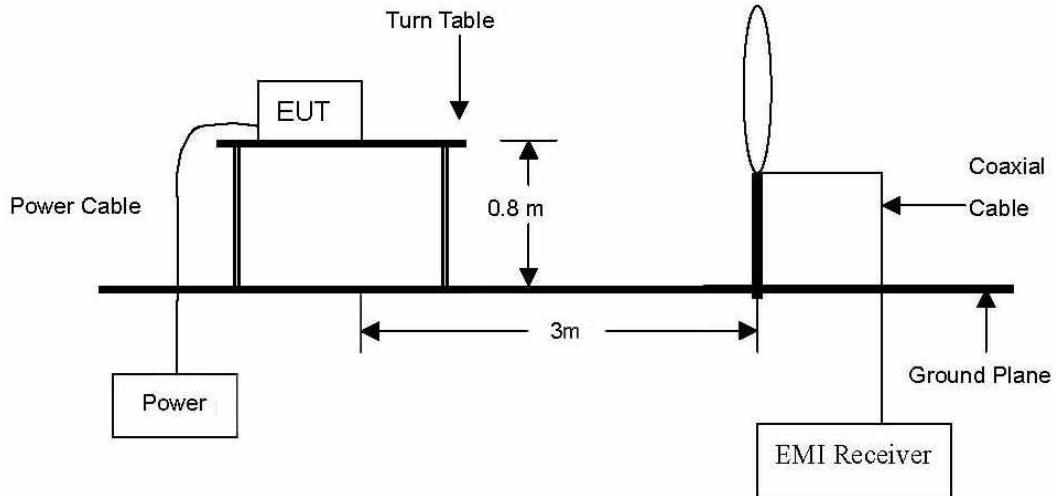
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

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

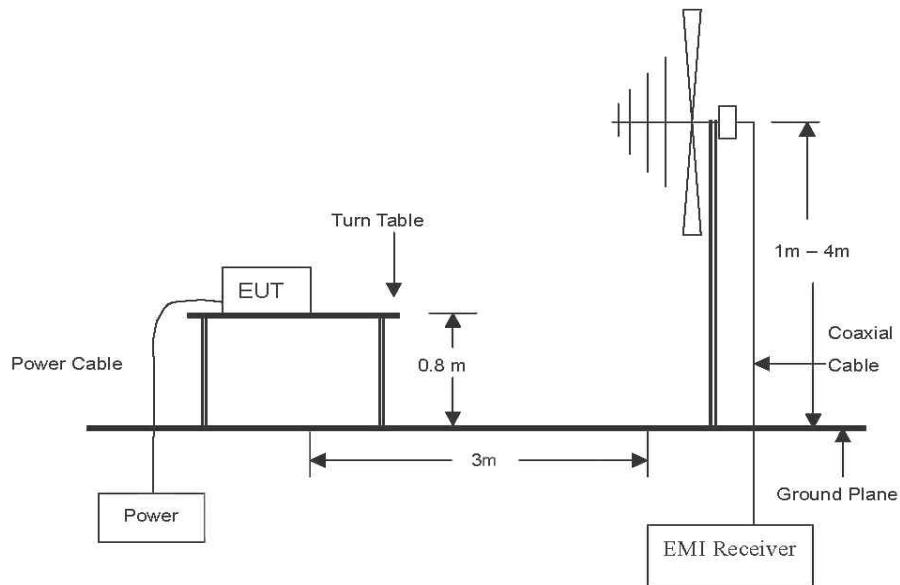
The spectrum analyzer is set to:

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.

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.



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 (μ N/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 μ V/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 μ V/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 μ V/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.



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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)
13.563	45.26	H	18.30	0.75	64.31	124.00	59.63
13.563	47.06	V	18.30	0.75	66.11	124.00	57.89

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)
13.401	23.38	H	18.29	0.74	42.41	69.54	27.13
13.390	19.73	V	18.29	0.74	38.76	69.54	30.78

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)
19.236	18.49	H	18.72	0.90	38.11	69.54	31.43
14.534	18.45	V	18.34	0.79	37.58	69.54	31.96

※ 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.



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Test results (Below 1 000 MHz)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ N)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ N/m)	Limit (dB μ N/3m)	Margin (dB)
40.448	17.50	H	13.28	1.16	31.94	40.00	8.06
122.263	17.50	V	11.63	2.14	31.27	43.50	12.23
135.473	16.30	V	12.47	2.26	31.03	43.50	12.47
167.674	17.10	H	12.44	2.56	32.10	43.50	11.40
176.336	10.40	V	11.37	2.63	24.40	43.50	19.10
211.379	10.70	H	9.73	2.93	23.36	43.50	20.14
272.425	10.70	H	11.88	3.38	25.96	46.00	20.04
282.211	16.30	V	12.15	3.45	31.90	46.00	14.10
318.591	21.30	H	13.10	3.69	38.09	46.00	7.91
353.148	16.40	V	13.90	3.91	34.21	46.00	11.79
597.841	16.80	V	18.67	5.42	40.89	46.00	5.11
624.526	16.90	H	19.08	5.54	41.52	46.00	4.48

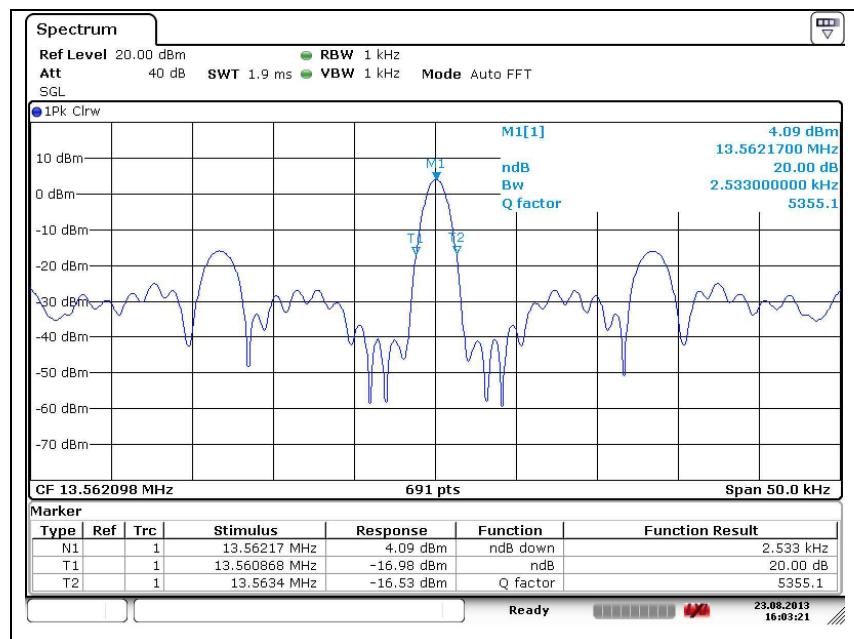
※ Remark

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

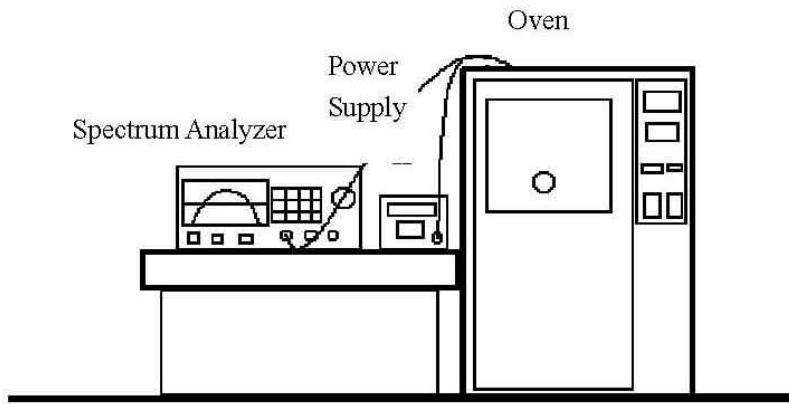
Test setup: The EUT was connected to a spectrum analyzer.

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 $RBW=1$ 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.



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Test results

Test voltage (%)	Test voltage (V)	Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	DC 5.00	-20	13.561 662	-338	-0.002 492
100 %		-10	13.561 977	-33	-0.000 243
100 %		0	13.562 051	51	0.000 376
100 %		10	13.562 084	84	0.000 619
100 %		20	13.562 098	98	0.000 722
100 %		30	13.562 170	170	0.001 253
100 %		40	13.562 199	199	0.001 467
100 %		50	13.562 218	218	0.001 607
85 %	DC 4.25	20	13.562 086	86	0.000 634
115 %	DC 5.75	20	13.562 103	103	0.000 759



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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	2013.09.13
EMI Test Receiver	Agilent	E7410A	2014.04.09
DC Power Supply	Agilent	6632B	2014.05.06

Peripheral device

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

Appendix B. Test setup photo

