

TEST REPORT

of

FCC Part 15 Subpart C §15.225

FCC ID: X68CRSCANNER2

Equipment Under Test : Computed Radiography Scanner
Model Name : FireCR Dental
(Add models : Dental CR, Planmeca Proscanner)
Serial No. : N/A
Applicant : 3D Imaging & Simulations Corp.
Manufacturer : 3D Imaging & Simulations Corp.
Date of Test(s) : 2013.03.18 ~ 2013.05.06
Date of Issue : 2013.05.06

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date: 2013.05.06

Harim Lee

Approved By:



Date: 2013.05.06

Logan Lee

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1. General Information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

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1.2. Details of Applicant

Applicant : 3D Imaging & Simulations Corp.

Address : 815, Tamnip-dong, Yuseong-gu, Daejeon, Korea

Contact Person : Kim, Young-Sul

Phone No. : +82 10 9087 0703

1.3. Description of EUT

Kind of Product	Computed Radiography Scanner
Model Name	FireCR Dental (Add models : Dental CR, Planmeca Proscanner)
Serial Number	N/A
Power Supply	AC 120 V
Frequency Range	13.562 MHz
Modulation Technique	ASK
Number of Channels	1
Antenna Type	Internal Type

1.4. Declaration by the manufacturer

Model name	Information
FireCR Dental	- Basic model
Dental CR, Planmeca Proscanner	- H/W and S/W are same to basic model. - It has only different model name.

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100540	Jan. 05, 2013	Annual	Jan. 05, 2014
Spectrum Analyzer	R&S	FSV30	101004	Jul. 05, 2012	Annual	Jul. 05, 2013
Temperature Chamber	JEIO TECH	TH-ME-100(1ph)	S040281	Jul. 25, 2012	Annual	Jul. 25, 2013
Horn Antenna	R&S	HF 907	100208	Aug. 13, 2012	Biennial	Aug. 13, 2014
Loop Antenna	R&S	HFH2-Z2	100118	Aug. 24, 2011	Biennial	Aug. 24, 2013
Trilog Antenna	SCHWARZBECK	VULB9163	9163-390	Apr. 19, 2011	Biennial	Apr. 19, 2014
Preamplifier	H.P.	8447D	2727A05143	Jul. 18, 2012	Annual	Jul. 18, 2013
Attenuator	Aeroflex / Weinschel	89-20-12	407	Aug. 07, 2012	Annual	Aug. 07, 2013
Two-Line V-Network	R & S	ENV216	101180	May. 14, 2012	Annual	May. 14, 2013
Test Receiver	R&S	ESU40	100075	Feb. 15, 2013	Annual	Feb. 15, 2014
AC power Supply	KIKUSUI	PCR500M	QJ001755	Jul. 07, 2012	Annual	Jul. 07, 2013
Preamplifier	R&S	SCU 18	10070	Aug. 06, 2012	Annual	Aug. 06, 2013
Anechoic Chamber	SY Corporation	L × W × H (21.5 m × 13.0 m × 9.0 m)	N/A	N.C.R.	N/A	N.C.R.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

Applied standard : FCC Part15 subpart C		
Standard section	Test item	Result
15.207	Transmitter AC Power Line Conducted Emission	Complied
15.225(a)(b)(c)(d) 15.209	Radiated emission	Complied
15.225(e)	Frequency Stability	Complied
15.215(c)	20 dB Bandwidth	-

1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL006383	Initial
1	F690501/RF-RTL006383-1	Added AC power line & 2nd Harmonic Spurious emission data

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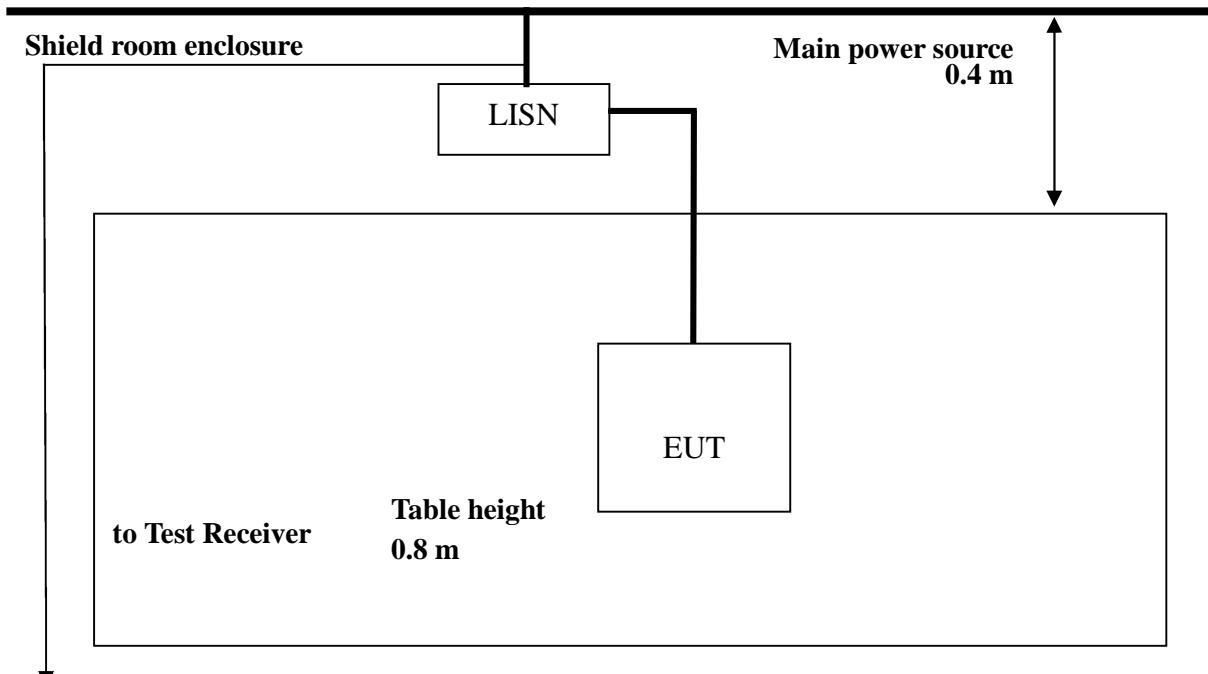
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2. Transmitter AC power line conducted emission

2.1. Test Setup



2.2. 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 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall be 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 frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

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2.4. Test Results

Ambient temperature : (23 ± 2) °C

Relative humidity : 47 % R.H.

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Frequency range : 0.15 MHz – 30 MHz

Measured Bandwidth : 9 kHz

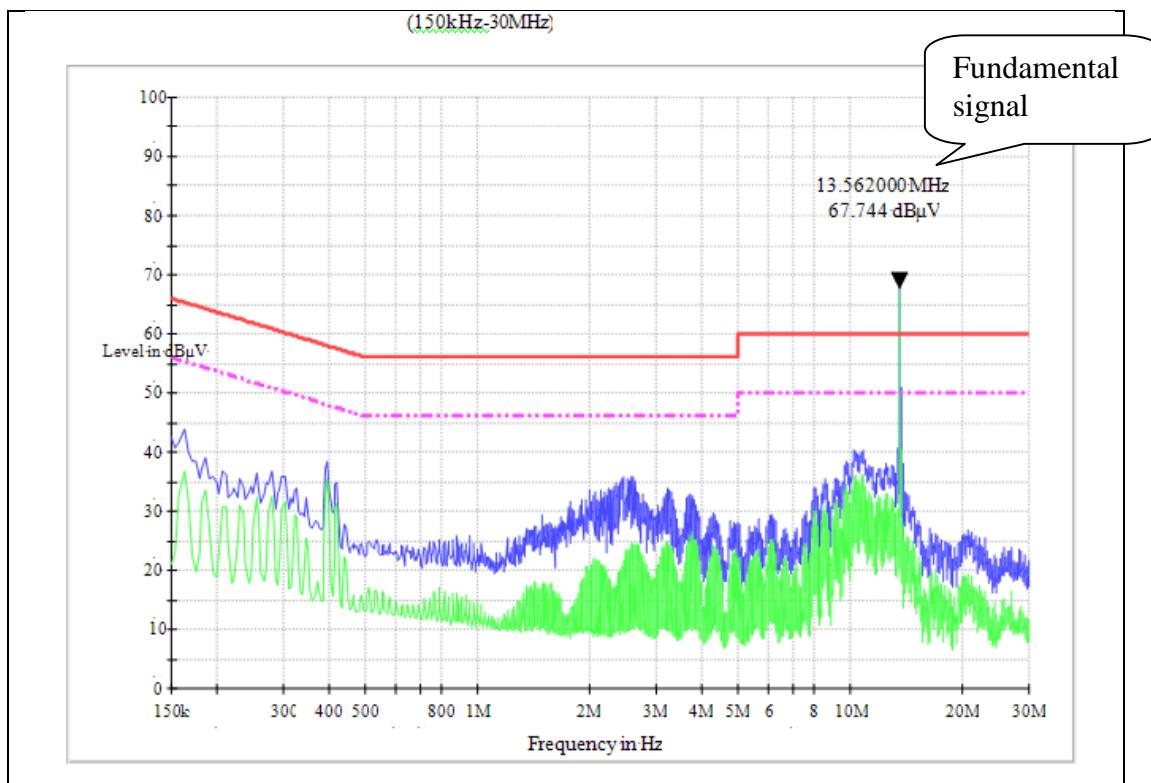
FREQ. (MHz)	LEVEL(dB uV)		LINE	LIMIT(dB uV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	42.61	36.93	H	65.36	55.36	22.75	18.43
0.39	36.98	35.25	H	57.98	47.98	21.00	12.73
0.42	32.78	30.88	H	57.49	47.49	24.71	16.61
1.77	19.40	11.47	H	56.00	46.00	36.60	34.53
2.45	24.20	16.75	H	56.00	46.00	31.80	29.25
10.22	36.89	24.14	H	60.00	50.00	23.11	25.86
0.16	43.05	38.46	N	65.36	55.36	22.31	16.90
0.39	39.08	37.63	N	57.98	47.98	18.90	10.35
0.42	34.81	33.08	N	57.49	47.49	22.68	14.41
1.41	23.90	17.91	N	56.00	46.00	32.10	28.09
2.54	25.89	16.92	N	56.00	46.00	30.11	29.08
10.23	38.62	32.48	N	60.00	50.00	21.38	17.52

Note :

1. Line (H): Hot, Line (N): Neutral
2. Traces shown in plot made using a peak detector and average detector

Plot of Conducted Power line

Test mode : (Hot)



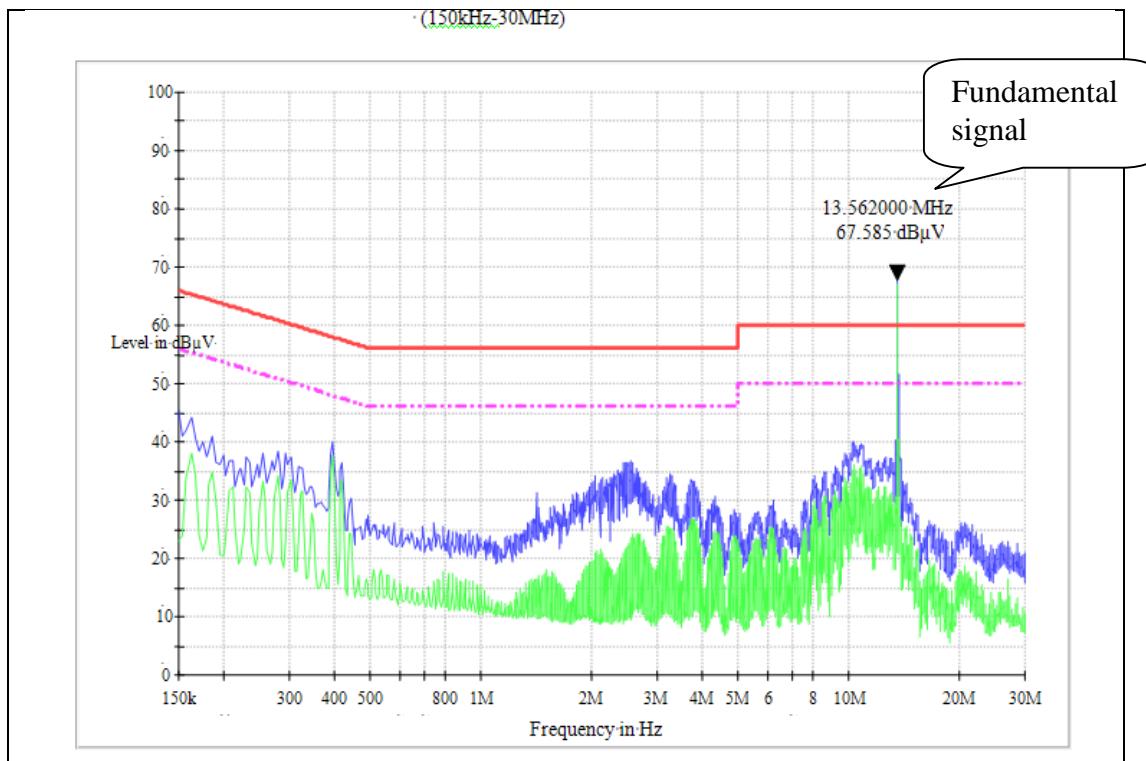
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Test mode : (Neutral)



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Additional test

- The AC power line emissions were investigated by terminate the antenna.
- The PCB Antenna was replaced with two resistor(0.01 kΩ)across the two sides of antenna by manufacturer

Frequency range : 0.15 MHz – 30 MHz

Measured Bandwidth : 9 kHz

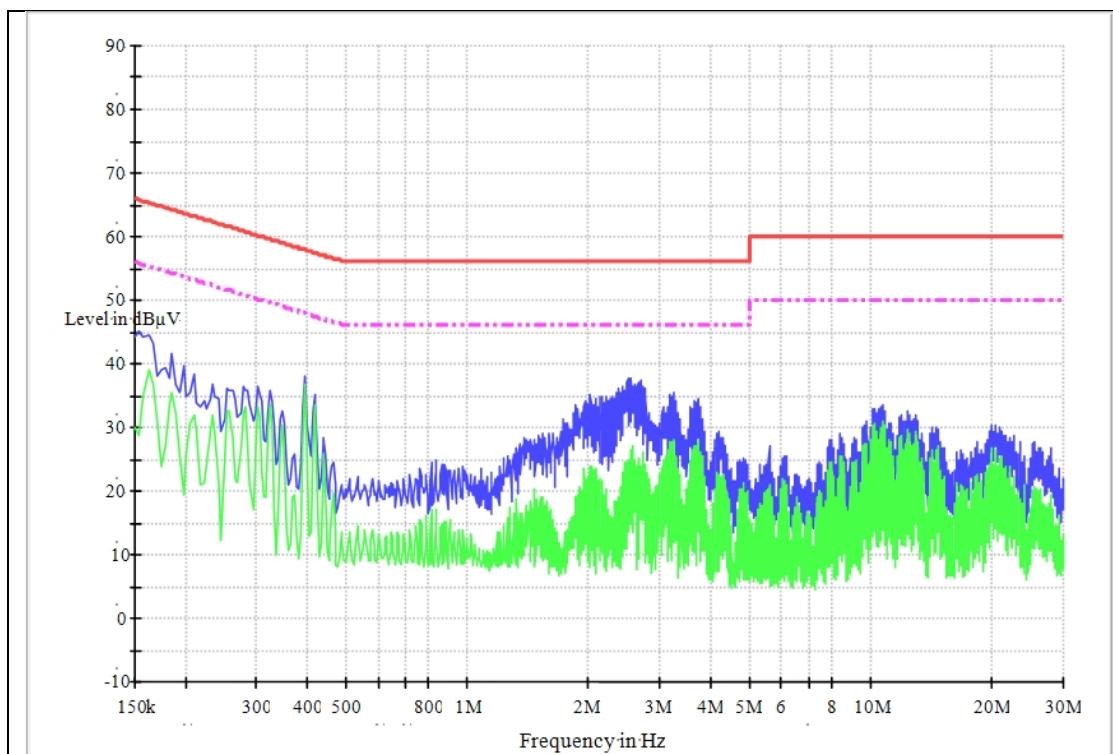
FREQ. (MHz)	LEVEL(dB uV)		LINE	LIMIT(dB uV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	37.56	26.22	H	65.78	55.78	28.22	29.56
0.30	35.42	35.02	H	60.19	50.19	24.77	15.17
0.40	35.11	34.98	H	57.90	47.90	22.79	12.92
0.42	33.84	33.59	H	57.49	47.49	23.65	13.90
2.53	27.59	19.13	H	56.00	46.00	28.41	26.87
10.72	26.54	15.62	H	60.00	50.00	33.46	34.38
0.16	43.29	39.98	N	65.36	55.36	22.07	15.38
0.39	35.52	35.16	N	57.98	47.98	22.46	12.82
0.42	31.53	31.12	N	57.49	47.49	25.96	16.37
2.37	25.50	18.76	N	56.00	46.00	30.50	27.24
2.55	26.62	19.90	N	56.00	46.00	29.38	26.10
10.63	27.60	21.19	N	60.00	50.00	32.40	28.81

Note :

1. Line (H): Hot, Line (N): Neutral
2. Traces shown in plot made using a peak detector and average detector

Plot of Conducted Power line

Test mode : (Hot)



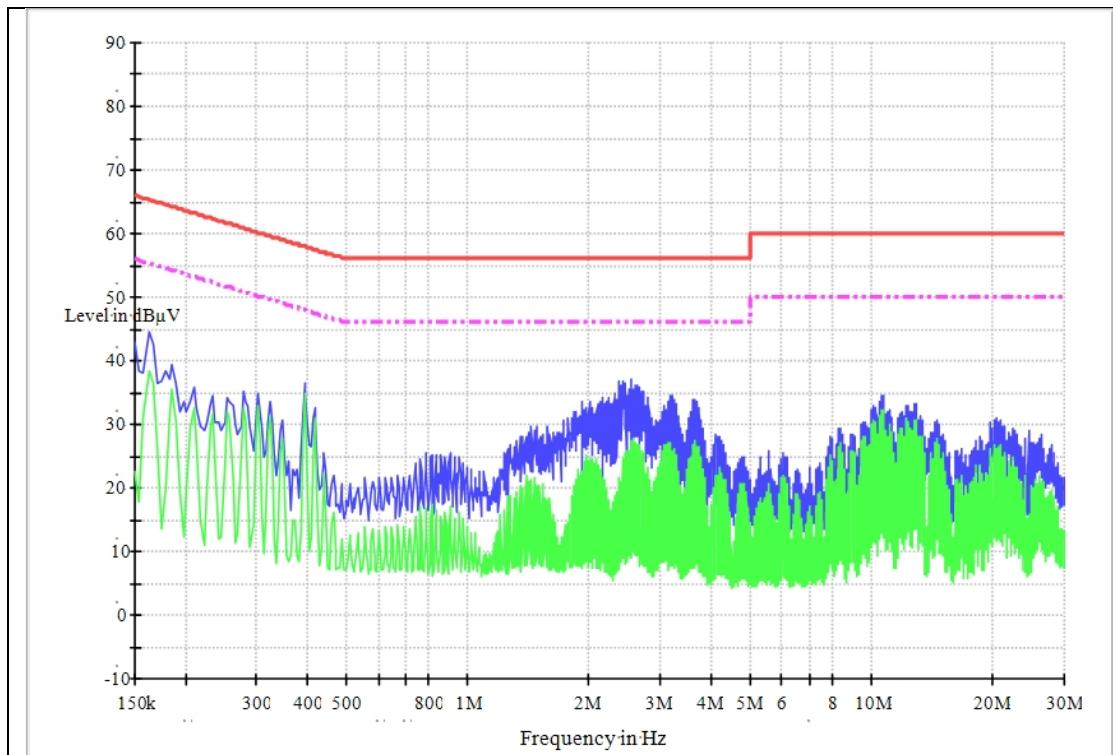
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Test mode : (Neutral)



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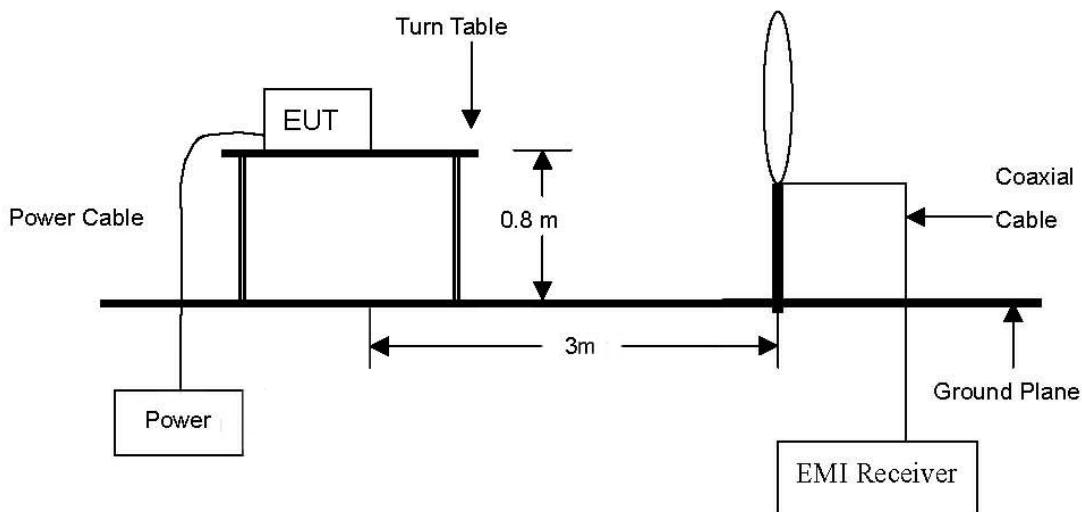
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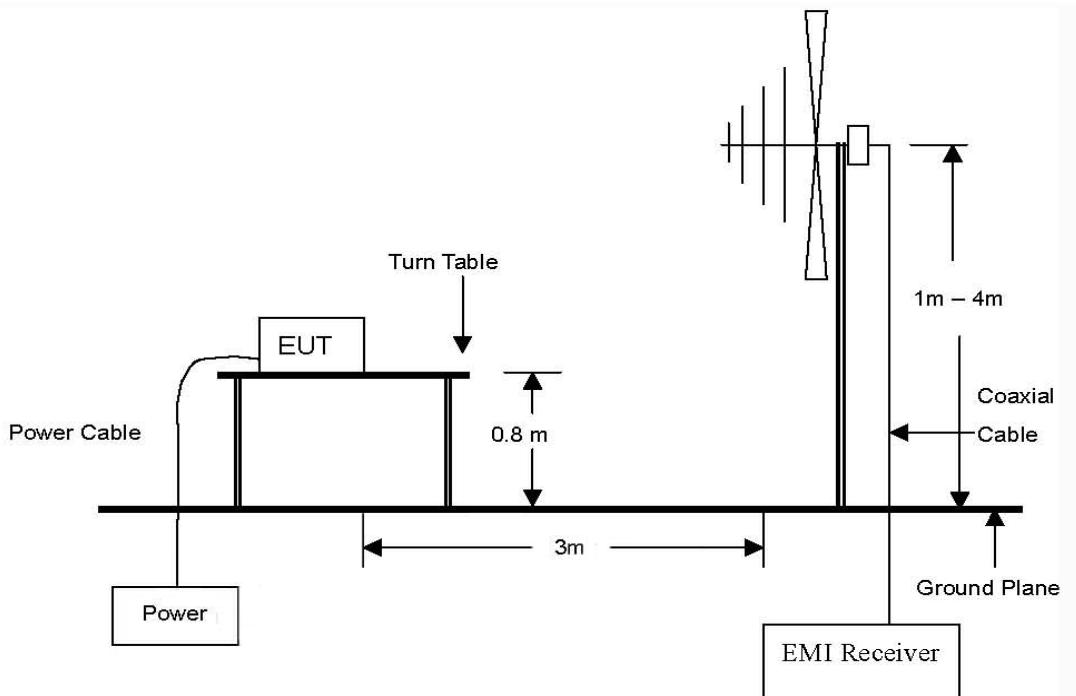
3. Radiated Emissions

3.1. 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 .The spurious emissions were investigated form 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



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3.2. Limit

According to §15.225,

- (a) The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15.848 microvolts / meter 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 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 at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.

3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4-2003

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. 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.
- c. 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.
- d. The test-receiver system was set to Average Detect Function and Specified Bandwidth with Maximum Hold Mode.
- e. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

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3.4. Test Result

Ambient temperature : (23 ± 2) °C

Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions.

-Fundamental within the band 13.553 – 13.567 MHz

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
13.562	28.40	Q.Peak	V	17.32	0.76	46.48	6.48	84.00	77.52

-Spurious emission within the bands 13.410 – 13.553 MHz and 13.567 -13.710 MHz

Radiated Emissions			Ant.	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
13.553	10.90	Q.Peak	V	17.32	0.76	28.98	-11.02	50.47	61.49
13.567	21.40	Q.Peak	V	17.31	0.76	39.47	-0.53	50.47	51.00

- Spurious emission within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz

Radiated Emissions			Ant.	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
13.394	6.60	Q.Peak	V	17.33	0.82	24.75	-15.25	40.51	55.76
13.811	6.60	Q.Peak	V	17.30	0.70	24.60	-15.40	40.51	55.91

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- Spurious emission below 30 MHz except for 13.110 – 14.010 MHz

Radiated Emissions			Ant.	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
6.834	6.60	Q.Peak	V	17.85	0.31	24.76	-15.24	29.54	44.78
27.124	6.20	Q.Peak	V	17.20	0.86	24.26	-15.74	29.54	45.28

- Spurious emission above 30 MHz

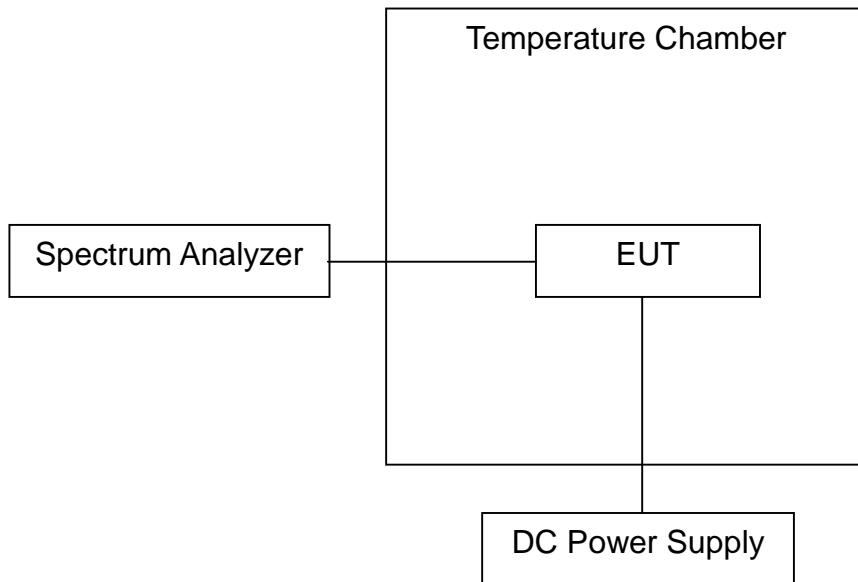
Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Freq. (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable loss & Amp (dB)	Actual (dB μ V/m) at 3 m	Limit (dB μ V/m) at 3 m	Margin (dB)
190.27	35.01	Q.Peak	V	10.14	-22.88	22.27	43.50	21.23
295.66	30.20	Q.Peak	V	12.95	-22.14	21.01	46.00	24.99
826.97	29.75	Q.Peak	V	20.34	-21.34	28.75	46.00	17.25
Above 900.00	Not detected	-	-	-	-	-	-	-

Note:

1. 30 m Limit (uV/m) = $20\log(15848) = 84.00$ dB μ V/m
2. 30 m distance compensation = $40\log(3/30) = -40$ dB μ V/m

4. Frequency Stability

4.1. Test Setup



4.2. Limit

According to §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.

4.3. Test Procedures

- a. Place the EUT on the table and set it in the transmitting mode.
- b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- c. Set the environment into appropriate environment.
- d. Set the spectrum analyzer as RBW=100 Hz, VBW = RBW, Span = 10 kHz, Sweep = auto.
- e. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
- f. Repeat until all the results are investigated.

4.4. Test Result

Ambient temperature : (23 ± 2) °C

Relative humidity : 47 % R.H.

Operating Frequency: 13.562 MHz

Reference Voltage: 120 V_{AC}

Temperature Variations

Voltage (%)	Power (V _{AC})	Temperature (°C)	Frequency (MHz)	Deviation (%)
100	120	-20	13.562 446	0.000 43
		-10	13.562 460	0.000 53
		0	13.562 417	0.000 21
		10	13.562 402	0.000 10
		20(Ref)	13.562 388	0.000 00
		30	13.562 373	-0.000 11
		40	13.562 370	-0.000 13
		50	13.562 373	-0.000 11

Voltage Variations

Voltage (%)	Power (V _{AC})	Temperature (°C)	Frequency (MHz)	Deviation (%)
85	102	20	13.562 387	-0.000 01
100	120	20	13.562 388	-
115	138	20	13.562 388	0

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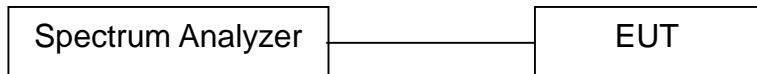
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5. 20 dB Bandwidth

5.1. Test Setup



5.2. Limit

None; for reporting purposes only.

5.3. Test Procedures

- a. Place the EUT on the table and set it in the transmitting mode.
- b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- c. Set the spectrum analyzer as RBW=1 kHz, VBW = RBW, Span = 200 kHz, Sweep = sweep.
- d. Mark the peak frequency and 20 dB (upper and lower) frequency.
- e. Repeat until all the rest channels are investigated.

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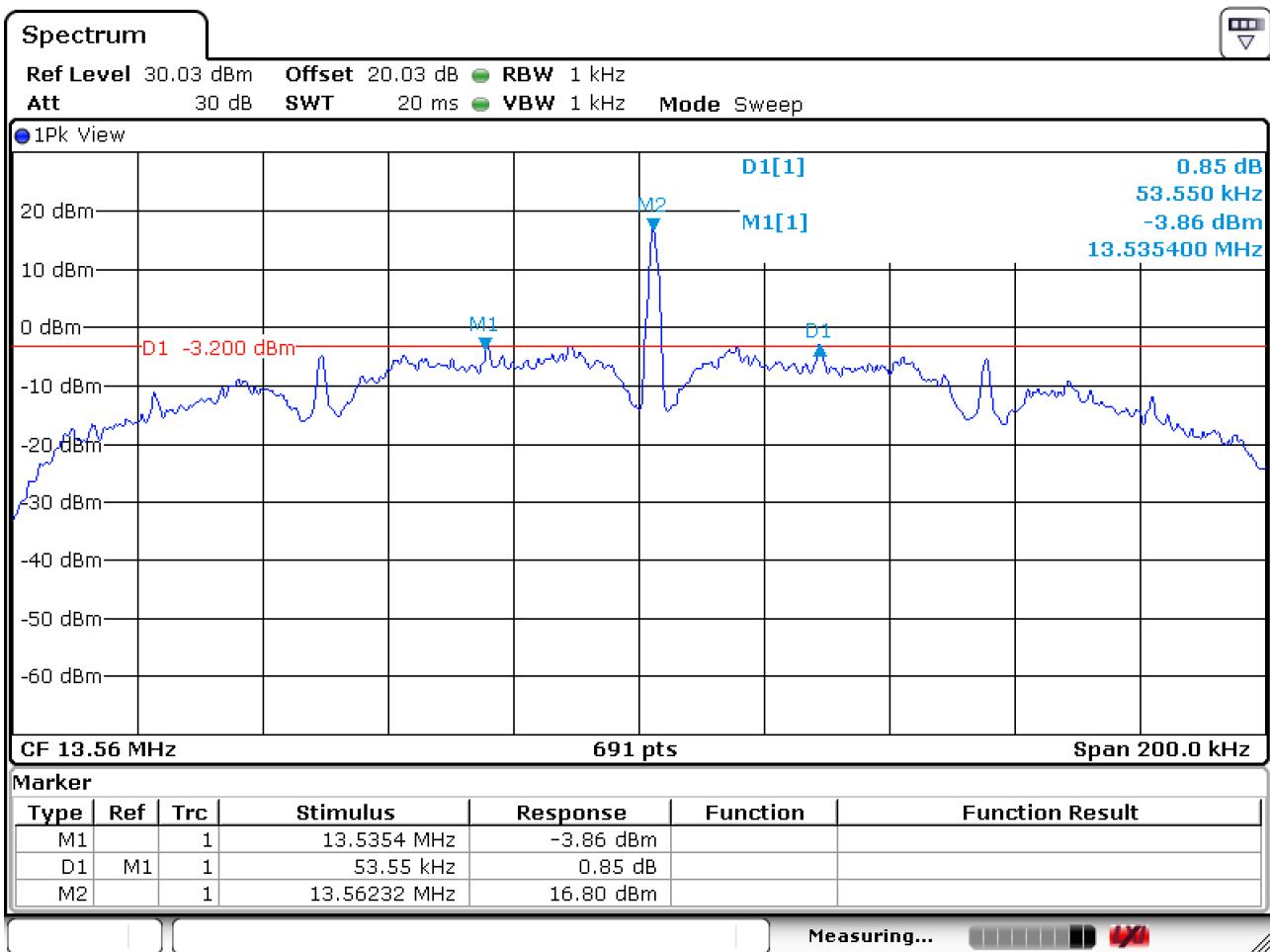
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5.4. Test Result

Ambient temperature : (23 ± 2) °C

Relative humidity : 47 % R.H.

Frequency (MHz)	20 dB Bandwidth (kHz)
13.562	53.55



Date: 21.MAR.2013 07:24:59

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