EMC Test Group

FCC Part 15, Subpart C and Industry Canada RSS-210 Compliance Report for
Xerox Corporation Short Range Radio Frequency Identification (RFID) Device
Model: IGEN

Judgement: The Equipment Under Test (EUT) met the requirements specified in FCC Part 15, Subpart C, Sections 15.207, 15.209 and 15.225, and Industry Canada RSS-GEN, Sections 6 and 7.2.2.

ACCREDITED

Accreditation Certificate Number: 1248-01
Electrical (EMC) Testing

This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with the laboratory's terms of accreditation unless stated otherwise in the report. The client is hereby notified that products, materials or other items in this report are in no way approved or endorsed by A2LA unless A2LA explicitly permits such endorsement or approval.

XEROX
Test Plan / Report
For

EUT NAME	TEST PLAN NUMBER	DATE
IGEN	EMC2007025	November 28, 2007

Abstract:

This report documents the testing completed on an RFID Model IGEN as supplied by the client. The EUT was found to conform with the Federal Communications Commission, and Industry Canada regulatory limits for an intentional radiator and low power licence-exempt radiocommunication device, respectively. FCC is an acronym for "Federal Communications Commission. The FCC acronym is used throughout the document in lieu of the CFR 47 Part 15 Subpart C terminology. The IC acronym is used throughout the document in lieu of the Industry Canada RSS-GEN and RSS-210 terminology.

Summary of Results		
Test	**Result**	**Modifications required to pass**
Conducted Emissions	Pass	AC Line filter
Radiated Emissions	Pass	None

	NAME	TITLE	SIGNATURE	DATE
Prepared By	David Spencer	EMC Engineer	David Spencer	11/29/07
Approved By	Gary E. Myers	EMC Group Manager	Gary E Myers	11/29/07

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TEST PLAN SECTIONS 1-8

1 CLIENT INFORMATION

	CLIENT
Company	Xerox Corporation
Address	800 Phillips Road, Building 207, 2nd Floor, cube 460, Webster, NY 14580
Telephone	(585) 422-5724
E-Mail	Marty Oksenhorn@xerox.com
Contact	Marty Oksenhorn

2 EMC TEST LABORATORY

	EMC LABORATORY
Company	Xerox Corporation
Address	800 Phillips Road, Building 205-99P, Webster, NY 14580 USA
Telephone	(585) 422-4120
E-Mail	gary.myers@xerox.com
Contact	Gary E. Myers

3 EQUIPMENT UNDER TEST

3.1 Identification of EUT

DESCRIPTION	MANUFACTURER	MODEL NAME	SERIAL NUMBER
RFID	Xerox Corp	IGEN	79153-6

3.2 Identification of Tested Optional Devices / Accessories

DESCRIPTION	MANUFACTURER	MODEL NAME	PRODUCT CODE	SERIAL NUMBER
None	-	-	-	-

3.3 Physical Information

DEVICE	HEIGHT (Meters)	WIDTH (Meters)	LENGTH (Meters)
RFID	0.01	0.1	0.1

3.4 Interface Ports

Port Type	Port Description	Connected		Connector Type	Cable Type	Cable Length
		From	To			
10 pin	DC input/ signal	Control PWBA & Power Supply	RFID	Molex	Unshielded	1M
6 pin	DC input/ signal	Control PWBA & Power Supply	RFID	Molex	Unshielded	1M

3.5 Description of the EUT

The EUT is a 13.56Mhz Short Range Radio Frequency Identification (RFID) Reader/Writer Device that uses inductive loop coupling and an integral transmitter/receiver for information exchange between the host Xerox printing system and a passive tag placed on an internal Customer Replaceable Unit (CRU) such as a toner cartridge. The EUT is intended for use within a copier or printer placed in a Class A (EME) business environment. The EUT is intended to communicate within the host equipment only.

Operating frequency:	13.56MHz +/-7KHz.
Number of Channels:	One
Modulation:	10% ASK (Amplitude Shift Keying)
	BPSK (Binary Phase Shift Keying)
Antenna:	Two Loop Inductive Coil
Field Strength:	2.7uA/m (at 3m) Maximum
Power Supply:	7.5 and 5Vdc, 100mA
Duty Cycle:	System-Defined by the host control algorithm
	ASK_ Based on 106Kbits data rate

3.6 Potential Emission Sources

The highest oscillator present during this testing was: 13.56MHz from the RFID.

3.7 New Parts or Modifications Incorporated in the EUT

*Fill this section out for re-compliance testing only.

PART NUMBER	DESCRIPTION
None	N/A

3.8 Support Equipment

DESCRIPTION	MANUFACTURER	MODEL NAME	SERIAL NUMBER
Host Laptop	Compaq	Armada 1573DM	J824BZW6M787
Power Supply	Mean Well	ES25B07-00754	None

4 TEST SPECIFICATIONS & PROCEDURES

4.1 General

FCC Part 15	CFR 47 Part 15, Subpart C.
Industry Canada, RSS-210 Issue 7, June 2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands).
Industry Canada, RSS-Gen Issue 2: June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment.

4.2 Methods and Procedures

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

4.3 Test Equipment

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

4.4 Test Facility

The EMC Group main offices are located at Xerox Corporation's Building 843, 800 Salt Road, Webster, NY 14580. The Semi-Anechoic chamber test site, building 199, located in Webster, NY was used to collect the data. This facility has been fully described in a report submitted to the FCC and accepted in a letter dated January 09, 2007 (Registration # 91070); additionally, submitted to Industry Canada and accepted in a letter dated February 17, 2005 (File # IC 482).

4.5 Test Methodology

4.5.1 Conducted Emissions

The EUT is configured as detailed in ANSI C63.4:2003 figures 10a & 10b. The EUT power cord is connected to a grounded Line Impedance Stabilization Network (LISN) for measurement. The measurement LISN(s) are powered through grounded AC mains line filters. If the EUT has multiple power cords, each will be powered through a LISN and measured separately. Any separately powered host equipment will be powered through a LISN for isolation purposes. The emissions are measured with a compliant EMI receiver using 9KHz measurement bandwidth. The initial scan data is collected using the peak and average detectors of the receiver from the range of 150KHz-30MHz. The peak scan is compared to the Quasi-peak or broad-band limit, while the average scan is compared to the average or narrow-band limit. The conducted emissions from the EUT were maximized for operating mode as well as cable and peripheral placement. In cases where the peak scan data is within 6dBuV of the Quasi-peak limit, the Quasi-peak detector is used to record the final test results.

4.5.2 Radiated Emissions

The EUT is configured as detailed in ANSI C63.4: 2003 figures 11a & 11b on the center of the 3/10 meter turn-table within the Xerox Corporation's 10 meter Semi-anechoic chamber. A compliant EMI reviever was used to make all measurements. The EME receiver is used in the peak detect mode with the "Max Hold" feature activated. In this mode, the receiver records the highest measured reading over the bands of 30MHz-200MHz and 200MHz-1GHz while the turntable is rotated. At any emission within 10dBuV/m of the limit, the Max Hold peak reading is measured using the Quasi-peak detector at the worse case azimuth. At this point the antenna is raised and lowed. The quasi-peak detector was used for all final readings up to 1 GHz recorded in this report. The effective measurement bandwidth used for the radiated emissions test was 120 kHz. Broadband biconical and log periodic antennas were used as transducers during the measurement. The biconical antenna was used from 30 MHz to 200 MHz, and the log periodic antenna was used from 200 MHz to 1 GHz. For testing with the magnetic loop antenna; the loop antenna remains at 1 meter height from the center of the loop to the floor and is rotated about its vertical center axis while the signal level is maximized. The angle, height, and polarity are then recorded. The procedure is then repeated with the antenna placed in the horizontal polarity. The emissions are maximized as described for the vertical polarity. The Semi-Anechoic test chamber site of the XEROX CORPORATION was used for radiated emission testing. This test site is set up according to CISPR 16-1: 1999. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The EUT was tested at a 10 meter test distance to obtain final test data. EUTs with clock frequencies equal to or greater than 108 MHz are evaluated against the applicable FCC limits above 1 GHz using a 1 MHz resolution bandwidth. Both peak and average detectors are used to determine compliance.

The field strength is calculated by adding the Antenna Factor, Attenuator Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows.

FS = RA + AF + CF + ATF- AG

where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
ATF = Attenuator Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5 dBµV/m is obtained. The Antenna Factor of 6.4 dB, a Cable Factor of 1.1 dB and an Attenuator Factor of 1 dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBµV/m.

FS = 52.5 + 6.4 + 1.1 + 1 - 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

5 CONFIGURATION & OPERATION OF EUT DURING TEST

5.1 Configuration

CONFIGURATION	RATIONALE
RFID with coupler tag. 1 meter unshielded, terminated signal cable.	This configuration allows the RFID to operate in a stand-alone mode.

OPTIONAL DEVICE	RATIONALE FOR NOT TESTING
None	N/A

5.2 Operating Environment

DEVICE	SUPPLY VOLTAGE	SUPPLY FREQUENCY	PHASE	CURRENT RATING
RFID	7.5/5 V	DC	N/A	150mA

TEMPERATURE	RELATIVE HUMIDITY
22 °C ± 5%	45% ± 5%

5.3 Special Operating Requirements

REQUIREMENT	RATIONALE FOR SPECIAL REQUIREMENT
None	N/A

5.4 Operating Modes

OPERATING MODE	RATIONALE FOR OPERATION MODE
RF on: Read-Write operation from RFID tag, standard ASK modulation	Normal usage of EUT

5.5 Monitoring of the EUT

The performance of the EUT shall be monitored using a closed circuit TV system in the following areas.

MONITOR	OBSERVATION
PC Interface	To monitor any malfunctions when exercising RFID

6 DETAILED TEST PLAN

6.1 Test Plan

6.1.1 Conducted Emissions

PORT	METHOD	CLASS
AC Mains Inlet	ANSI C63.4: 2003	B

6.1.2 Radiated Emissions

PORT	METHOD	CLASS
Enclosure	ANSI C63.4: 2003	B

6.1.3 Frequency Stability

PORT	METHOD
Enclosure	ANSI C63.4: 2003

7 EMC MODIFICATION DETAILS

Required in order to meet all applicable test requirements

PART NUMBER	DESCRIPTION
6EH1	Corcom AC Line Filter (min. insertion loss required 10Mhz-20MHz: 20dB)

8 EMISSIONS COMPLIANCE CERTIFICATION

8.1 Judgment

The EUT was found to comply with the regulatory requirements as specified in FCC Part 15, Subpart C, Sections 15.207, 15.209 and 15.225, and Industry Canada RSS-GEN, Sections 6 and 7.2.2.

8.2 Filing

The Data has been filed under EMC Group Compliance Data Log Number: EMC07025

8.3 Test Facility

The test site located at Xerox building 199, Webster, NY was used to collect the data. The test site met the site attenuation measurements in accordance with the methods / requirements as specified in ANSI C63.4: 2003.

Conducted Emissions: *David Spencer* Date of Testing: 11/13 /07
David Spencer, EMC Engineer
EH&S / EMC Test Group

Radiated Emissions: *David Spencer* Date of Testing: 11/13/07
David Spencer, EMC Engineer
EH&S / EMC Test Group

Frequency Stability: *David Spencer* Date of Testing: 11/14/07
David Spencer, EMC Engineer
EH&S / EMC Test Group

These signatures serve as a check for the accuracy of the data transferred from the data sheet to this report.

9 CONDUCTED EMISSIONS

9.1 Worse Case Run Mode

OPERATING MODE	RATIONALE FOR OPERATION MODE
RF on: Read-Write operation from RFID tag, standard ASK modulation	Normal usage of EUT

9.2 Measured Data

Conductor	Frequency [MHz]	Measured Value* [db(µV)]	Margin dB	FCC Part 15 15.207 Average Limit [db(µV)]	FCC Part 15 15.207 Quasi-Peak Limit [db(µV)]
Neutral	0.181	52.2/34.6**	11.3	53.5	63.5
Neutral	0.366	42.8/33.6**	15.4	49.0	59.0
Neutral	0.690	35.6/26.7**	19.3	46.0	56.0
Neutral	0.825	34.8/25.8**	20.2	46.0	56.0
Neutral	13.564	37.2/35.4**	14.6	50.0	60.0
Neutral	27.132	29.7/26.9**	23.1	50.0	60.0
Line 1	0.159	53.4/16.8**	12.4	55.8	65.8
Line 1	0.370	45.2/38.6**	10.3	48.9	58.9
Line 1	0.6495	38.4/30.9**	15.1	46.0	56.0
Line 1	0.7845	37.5/29.1**	16.9	46.0	56.0
Line 1	13.564	39.3/37.2**	12.8	50.0	60.0
Line 1	27.132	32.5/29.9**	20.1	50.0	60.0

120Vac 60Hz 150KHz-30MHz Measurements

* All readings are peak unless stated otherwise.
** Identifies an average reading.
*** Identifies a quasi-peak reading.

10 RADIATED EMISSIONS

10.1 Worse Case Run Mode

OPERATING MODE	RATIONALE FOR OPERATION MODE
RF on: Read-Write operation from RFID tag, standard ASK modulation	Normal usage of EUT

10.2 Measured Data

Frequency [MHz]	EUT Orientation	EUT Angle [Degrees]	Corrected Reading* [db(µV/m)]	Margin dB	10 Meter Limit* [db(µV/m)]
13.5663	X	0	47.1	46.4	93.5
27.132	X	0	28.4	10.6	39.0
13.5663	Y	0	46.9	46.6	93.5
27.132	Y	24	28.7	10.3	39.0
13.5663	Z	0	32.2	61.3	93.5
27.132	Z	35	28.0	11	39.0

Measurements 9KHz-30MHz

Frequency [MHz]	EUT Orientation	Antenna Height [Meters]	Antenna Polarity	EUT Angle [Degrees]	Corrected Reading* [db(µV/m)]	Margin	3 Meter Limit [db(µV/m)]
40.675	X	1	V	37	25.7	14.3	40.0
54.241	X	1	V	45	25.0	15	40.0
67.804	X	1	V	41	24.1	15.9	40.0
108.505	X	4	H	100	23.7	19.8	43.5
122.070	X	4	H	107	23.0	20.5	43.5
135.635	X	4	H	102	25.9	17.6	43.5
40.675	Y	1	V	35	29.4	10.6	40.0
54.240	Y	1	V	31	21.6	18.4	40.0
67.804	Y	1	V	43	23.0	17	40.0
108.505	Y	4	H	110	22.6	20.9	43.5
122.070	Y	1	V	100	24.4	19.1	43.5
135.635	Y	4	H	120	28.5	15	43.5
40.675	Z	1	V	30	26.1	13.9	40.0
54.240	Z	1	V	35	23.7	16.3	40.0
67.804	Z	1	V	42	23.6	16.4	40.0
108.505	Z	4	H	100	24.3	19.2	43.5
122.070	Z	4	H	105	24.6	18.9	43.5
135.635	Z	4	H	110	25.9	17.6	43.5

Measurements for 30-1000 MHz

* All readings are quasi-peak unless stated otherwise.
** Identifies an average reading.
*** Identifies a peak reading.

11 Frequency Stability

11.1 Run Mode

OPERATING MODE	RATIONALE FOR OPERATION MODE
RF on: Read/Write operation from RFID tag: Standard ASK modulation	Typical operation of Igen Coupler

11.2 Measured Data

Frequency versus Temperature				
Reference Frequency: measured 13.565883 MHz at 20°C				
Temperature (Celsius)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Drift (%)	Limit (%)
50	13.565741	-142.00	-0.00105	0.01
40	13.565756	-127.00	-0.00094	0.01
30	13.565782	-101.00	-0.00074	0.01
20	Reference			N/A
10	13.565792	-91.00	-0.00067	0.01
0	13.565792	-91.00	-0.00067	0.01
-10	13.565842	-41.00	-0.00030	0.01
-20	13.56585	-33.00	-0.00024	0.01
-30	13.565858	-25.00	-0.00018	0.01

Frequency versus Voltage				
Reference Frequency: measured 13.559883 MHz at 20°C with 5Vdc				
Measured Voltage ±15% of nominal (5Vdc)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Drift (%)	Limit (%)
5.75	13.565875	-8.00	-0.00006	0.01
4.25	13.565883	0.00	0.00000	0.01
Reference Frequency: measured 13.559883 MHz at 20°C with 7.5Vdc				
Measured Voltage ±15% of nominal (7.5Vdc)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Drift (%)	Limit (%)
8.625	13.565871	-12.00	-0.00009	0.01
6.375	13.565881	-2.00	-0.00001	0.01

12 TEST EQUIPMENT

Type	EMC Group Barcode	Manufacturer / Model Number	Serial Number	Last Calibration Date	Calibration Interval
LISN	036823	Fischer Custom Communications / FCC-LISN-50/250-100-4	9704	10/16/07	1 Year
LISN	036823	Fischer Custom Communications / FCC-LISN-50/250-100-4	9703	10/15/07	1 Year
Temperature & Relative Humidity Sensor	101206	Omega / CT-485B	412000741W	6/9/07	1 Year
EME Receiver	024086	Rohde & Schwarz / ESIB 40	100090	12/7/06	1 Year
RF Preamplifier	031570	Hewlett Packard / 8447D	2944409226	3/5/07	1 Year
RF 6 dB Attenuator	031417	Hewlett Packard / 8491A	34402	3/5/07	1 Year
Biconical Antenna	030862	EMCO / 3109	9303-2891	6/7/07	1 Year
Log Periodic Antenna	030850	EMCO / 3146	9305-3621	6/7/07	1 Year
Magnetic Loop Antenna	034466	Rohde & Schwarz/ HFH2-Z2	880665/005	4/5/07	1 Year
Source DC Supply	19329	Sorensen/ DCR 60-18B	1883	1/25/07	1 Year
Network Analyzer	035504	Hewlett Packard/ 4396B	JP1KE00618	4/24/07	1 Year
High Frequency Probe	0647463	Hewlett Packard/ 85024A	2801A07858	11/27/06	1 Year

13 PHOTOGRAPHS and ATTACHMENTS

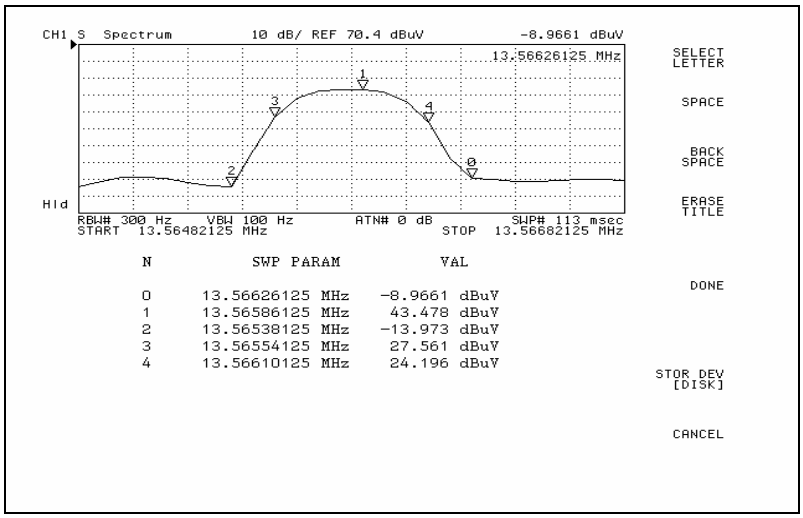

Fig.1
Normal Conditions

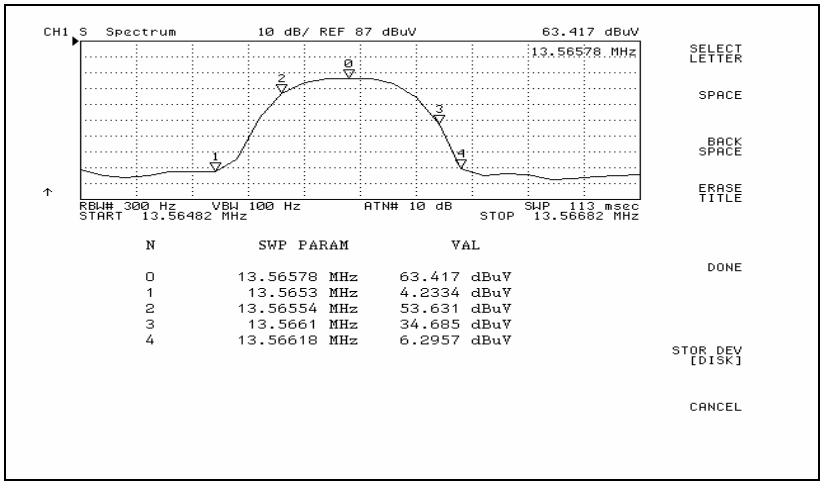

Fig. 2
Elevated Voltage & Elevated Temperature

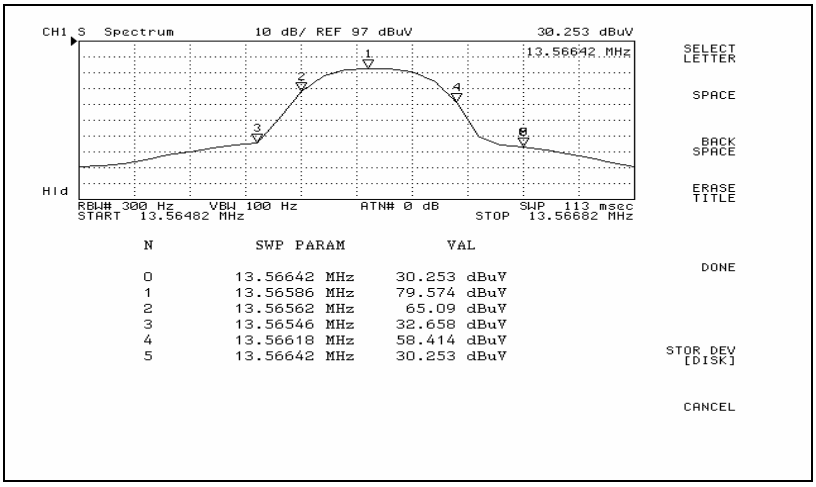

Fig.3
Elevated Voltage & Reduced Temperature

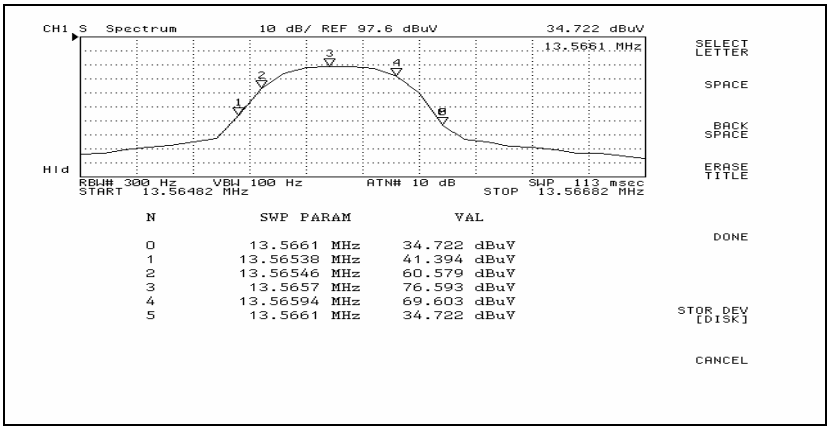

Fig.4
Reduced Voltage & Elevated Temperature

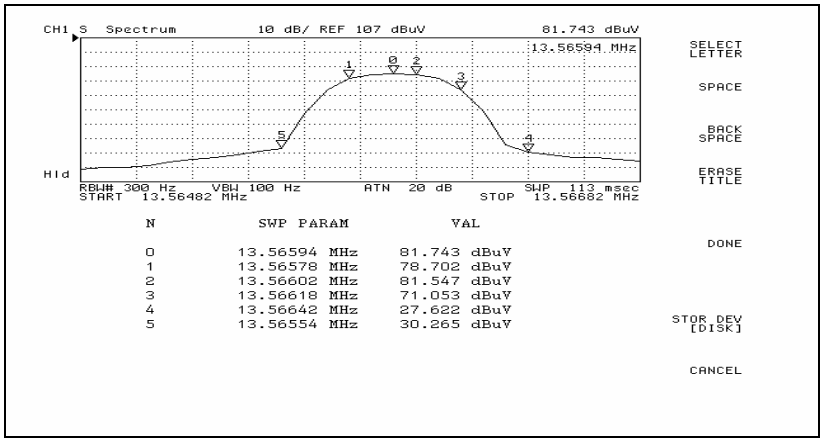

Fig. 5
Reduced Voltage & Reduced Temperature

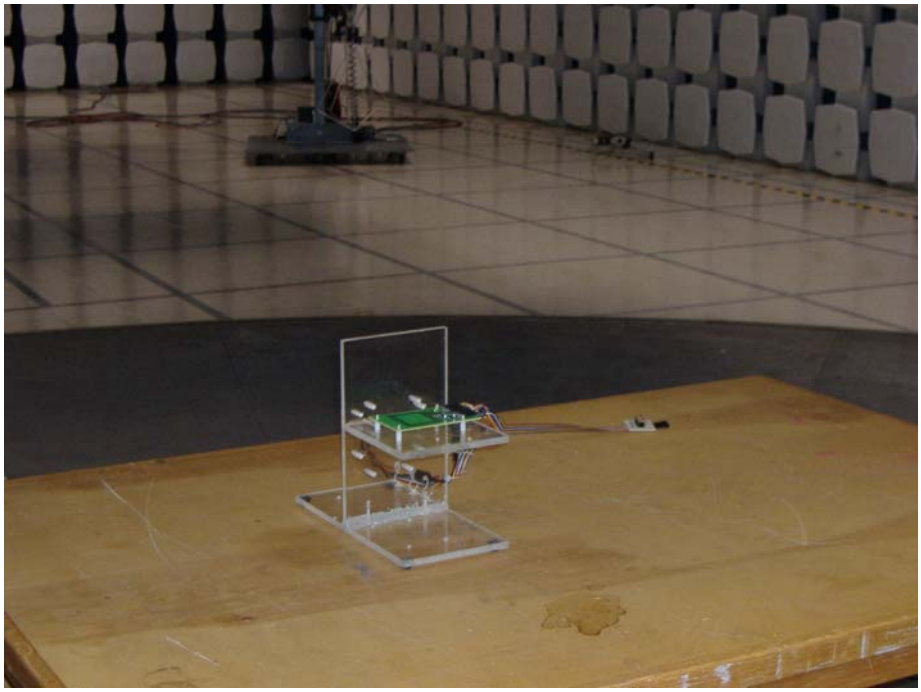

Fig. 5 Photo of Test setup

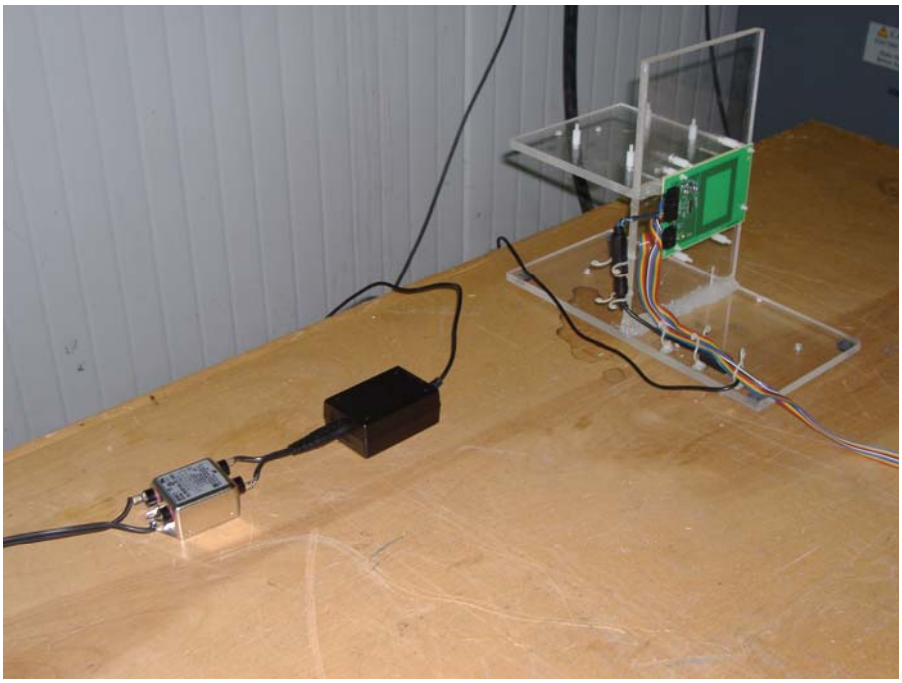

Fig.2
Conducted Emissions Setup

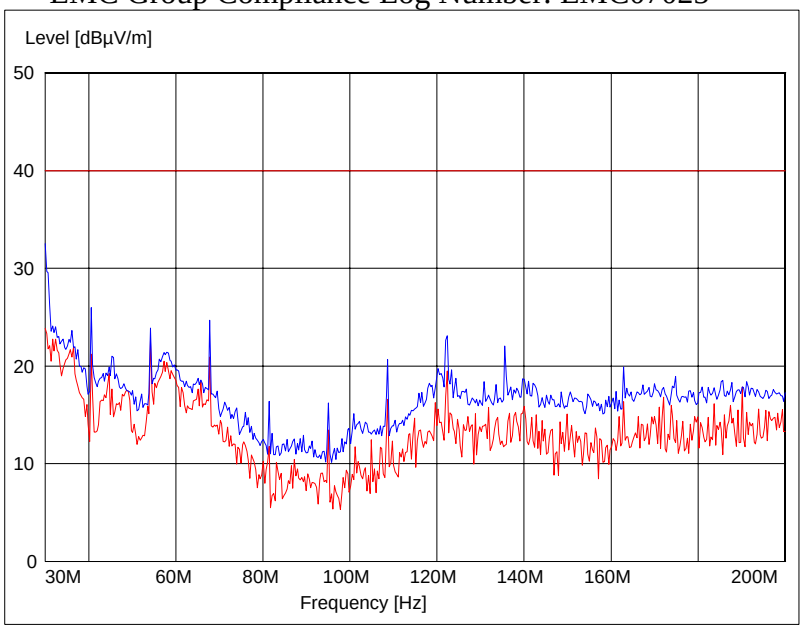

Fig. 3
Radiated Emissions 30-200MHz Vertical Antenna
EUT X Axis

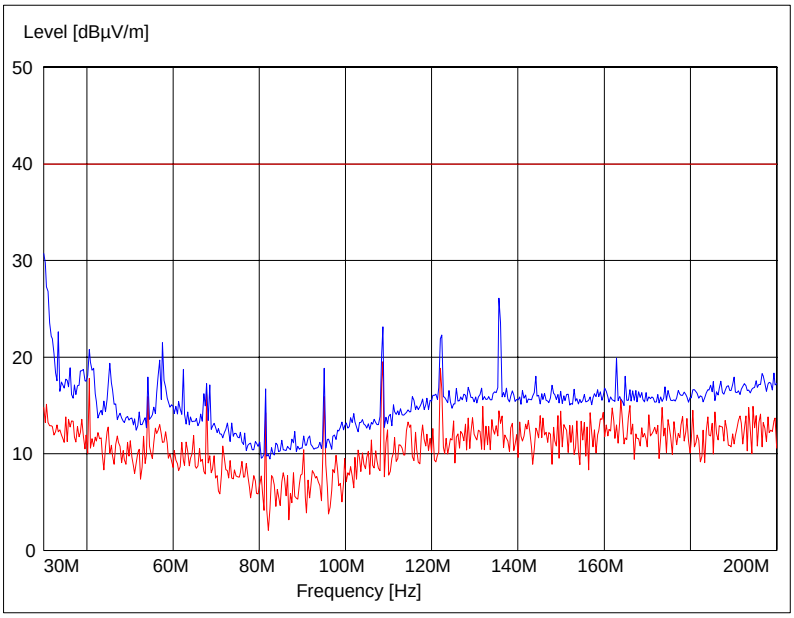

Fig. 4
Radiated Emissions 30-200MHz Horizontal Antenna
EUT X Axis

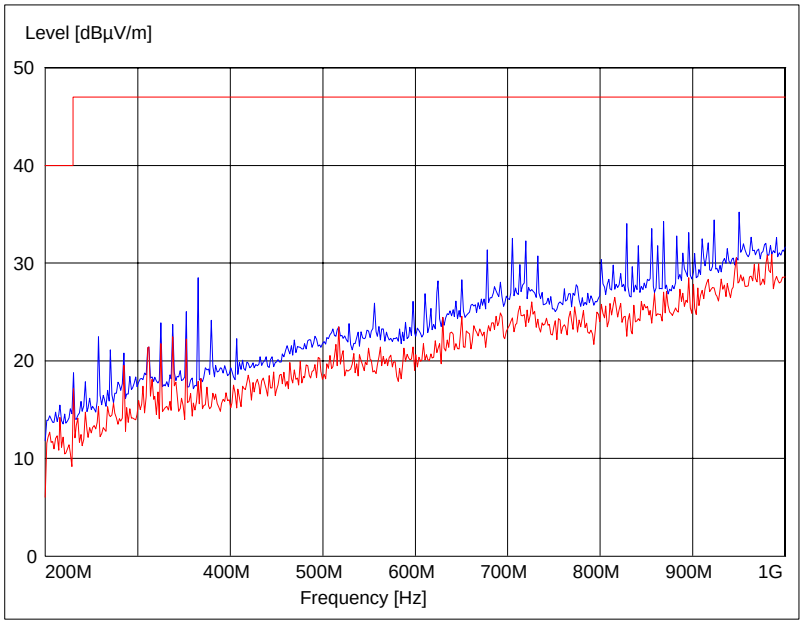

Fig. 5
Radiated Emissions 200-1000MHz Vertical Antenna
EUT X Axis

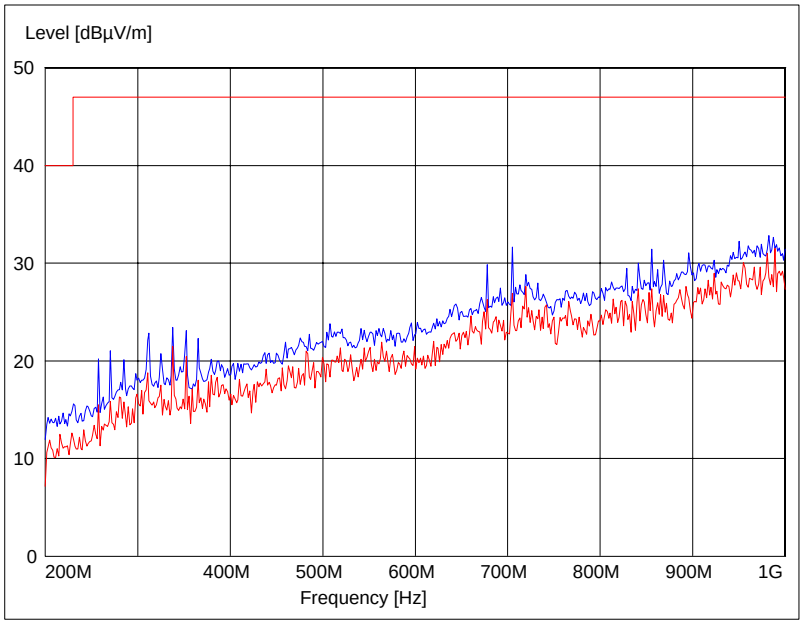

Fig. 6
Radiated Emissions 200-1000MHz Horizontal Antenna
EUT X Axis

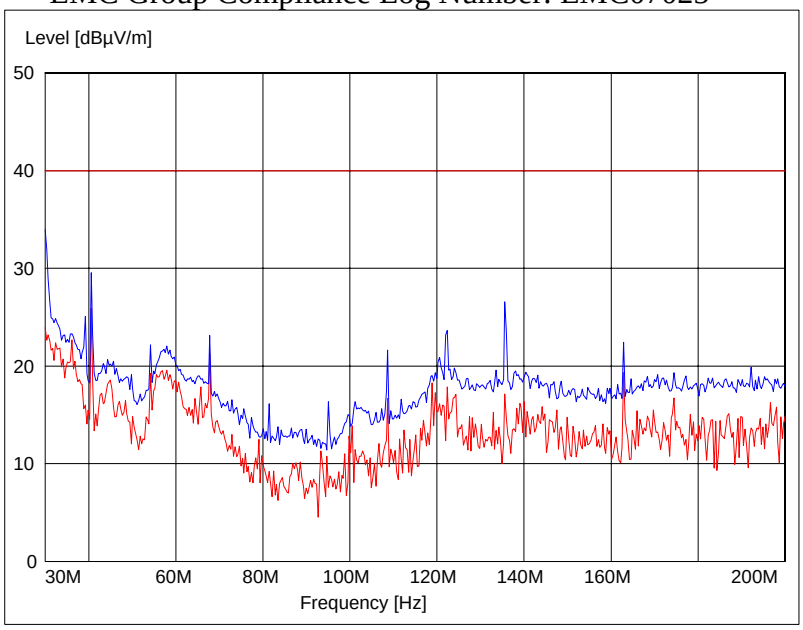

Fig. 7
Radiated Emissions 30-200MHz Vertical Antenna
EUT Y Axis

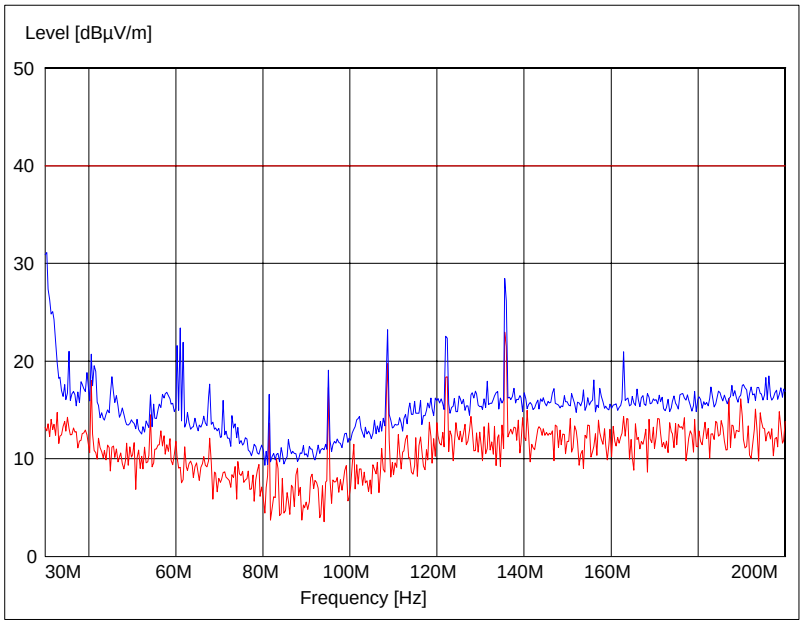

Fig. 8
Radiated Emissions 30-200MHz Horizontal Antenna
EUT Y Axis

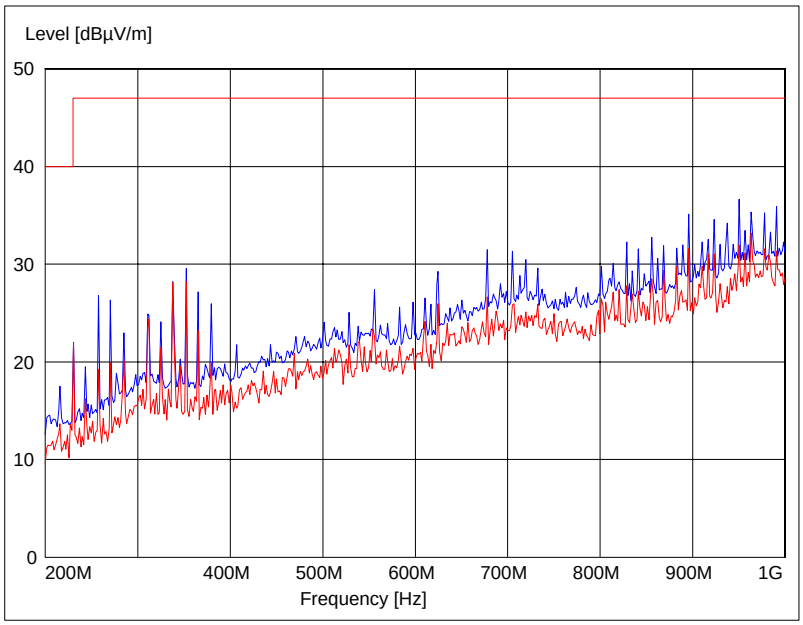

Fig. 9
Radiated Emissions 200-1000MHz Vertical Antenna
EUT Y Axis

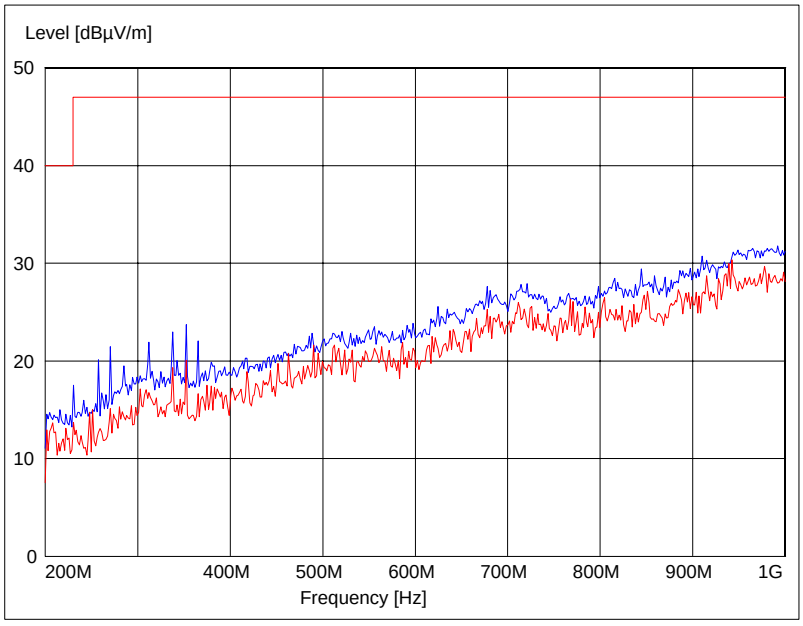

Fig. 10
Radiated Emissions 200-1000MHz Horizontal Antenna
EUT Y Axis

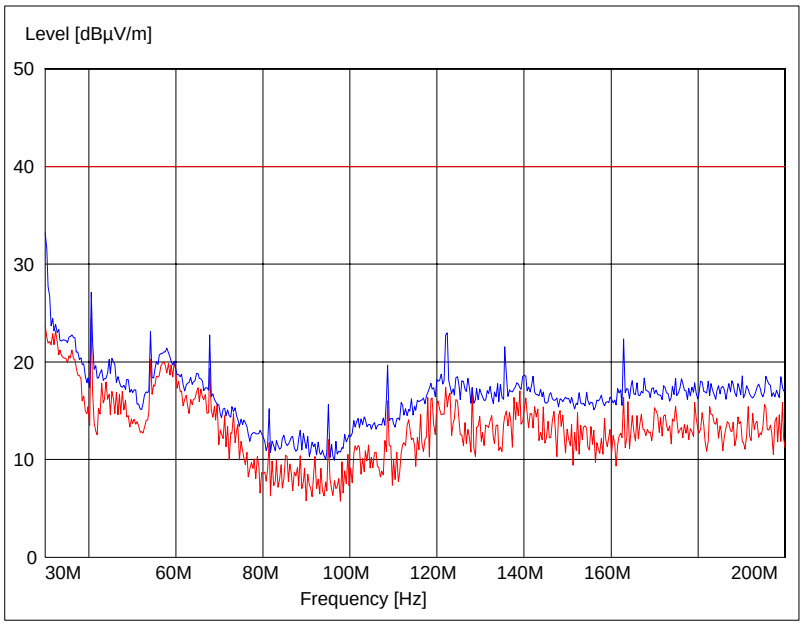

Fig. 11
Radiated Emissions 30-200MHz Vertical Antenna
EUT Z Axis

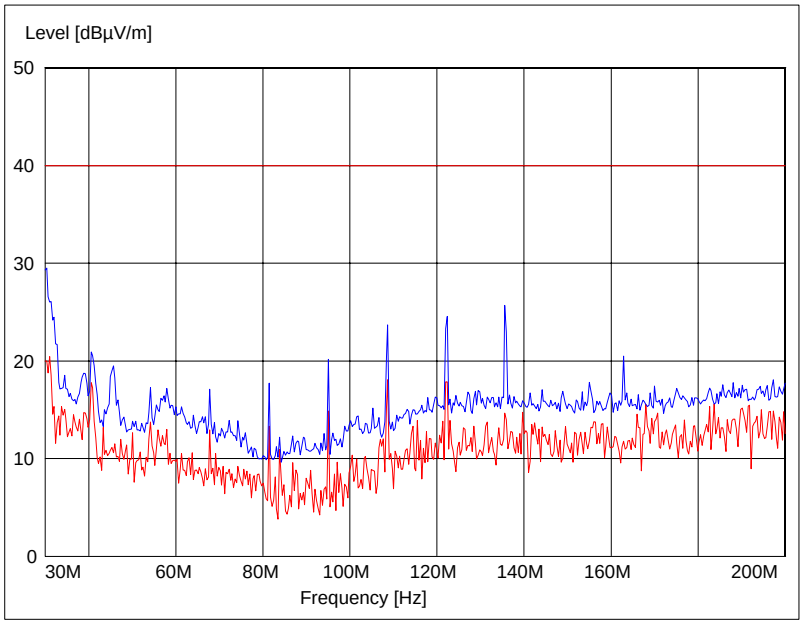

Fig. 12
Radiated Emissions 30-200MHz Horizontal Antenna
EUT Z Axis

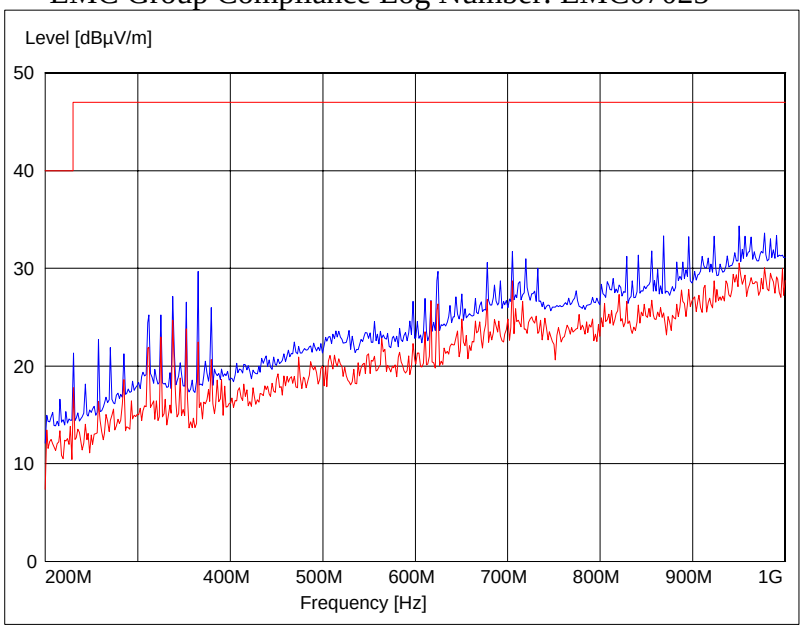

Fig. 13
Radiated Emissions 200-1000MHz Vertical Antenna
EUT Z Axis

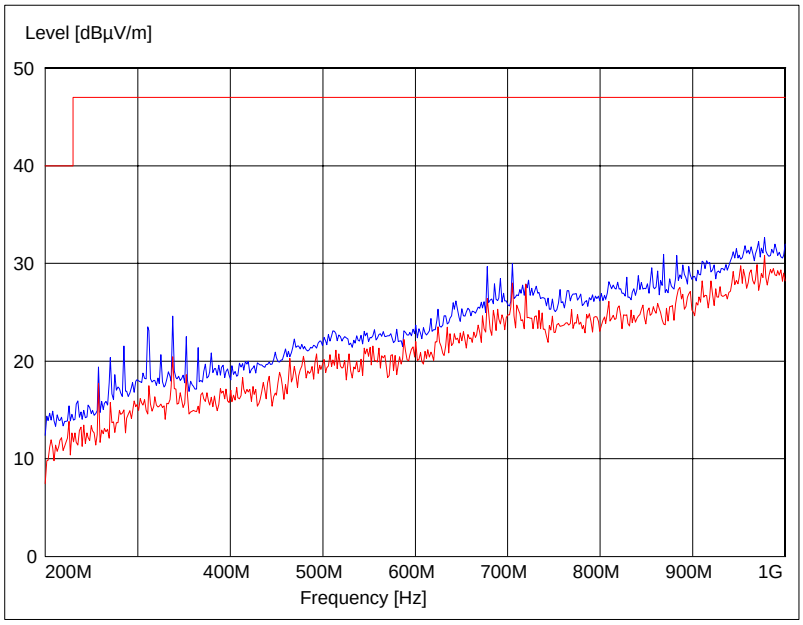

Fig. 14
Radiated Emissions 200-1000MHz Horizontal Antenna
EUT Z Axis

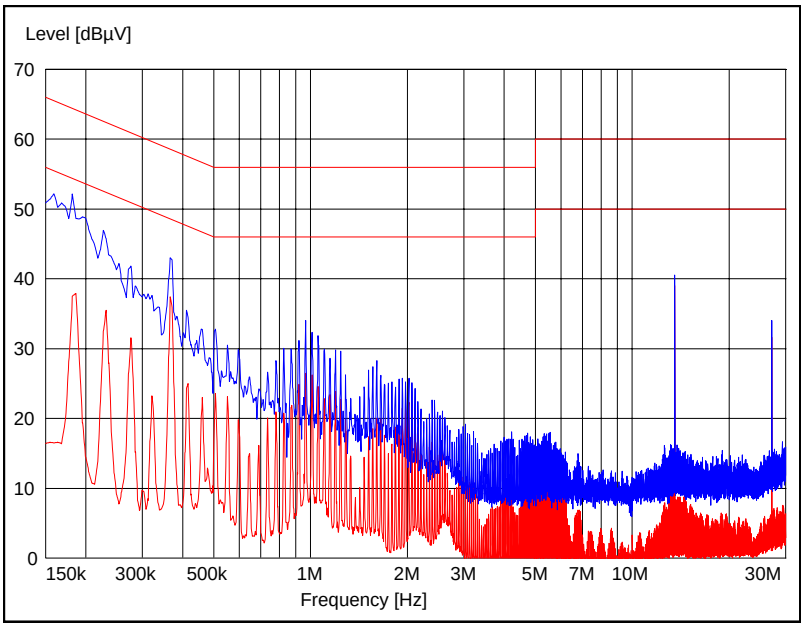

Fig. 15
150KHz-30MHz Conducted Emissions Neutral

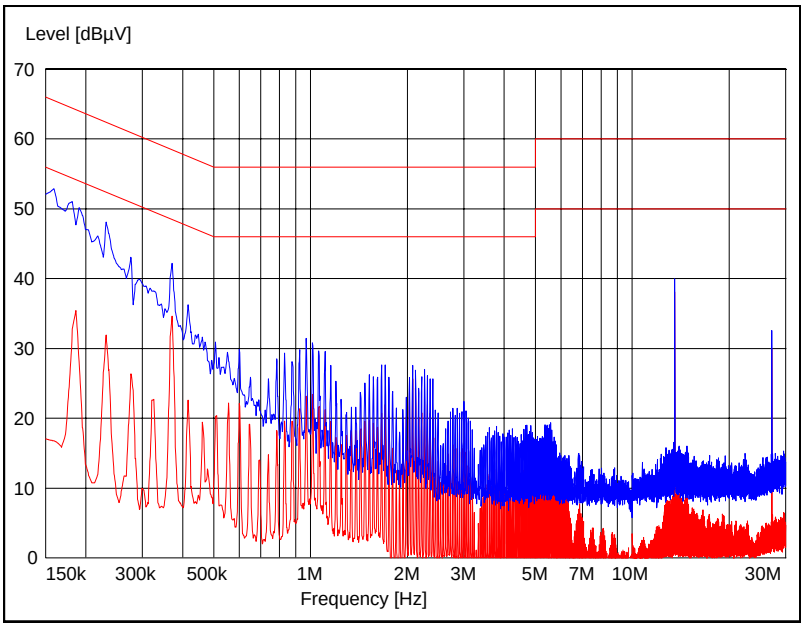

Fig. 15
150KHz-30MHz Conducted Emissions Hot

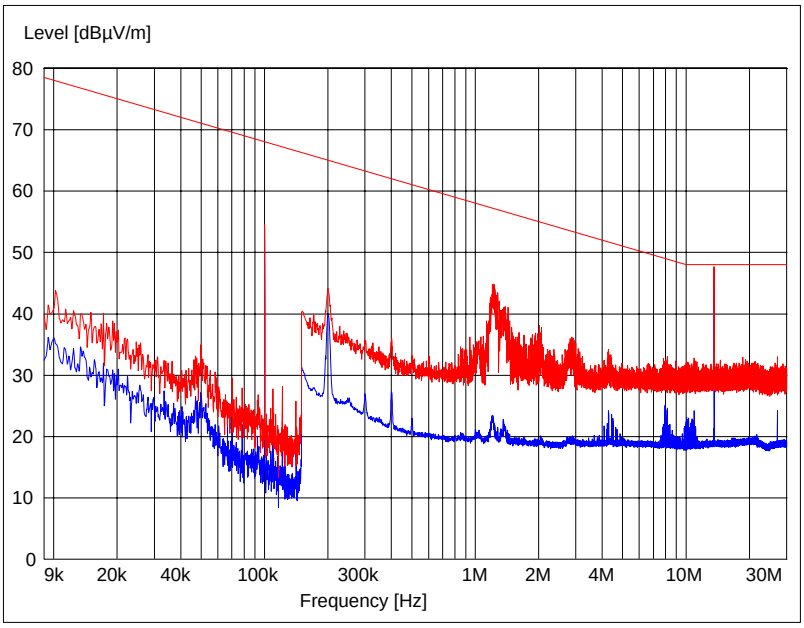

Fig. 17
EUT in X Orientation 9KHz-30MHz Magnetic Loop Scan

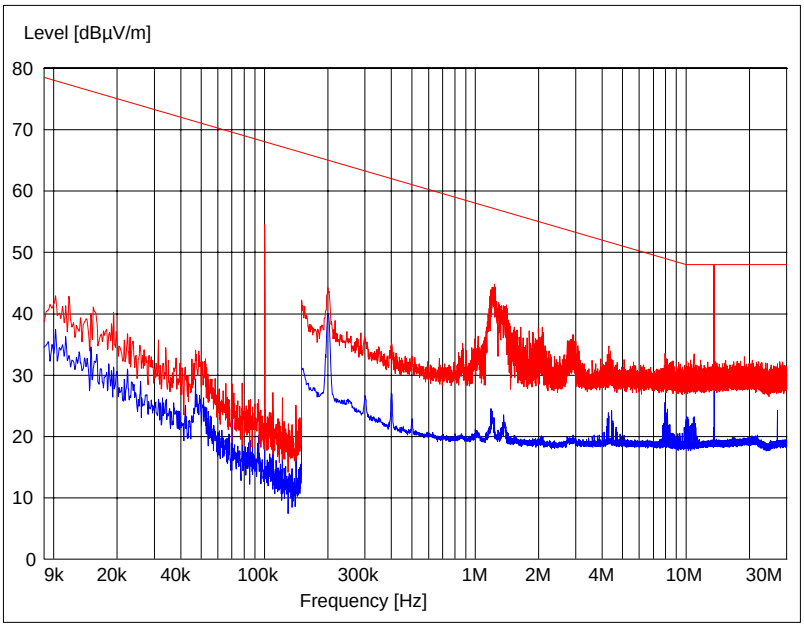

Fig. 18
EUT in Y Orientation 9KHz-30MHz Magnetic Loop Scan

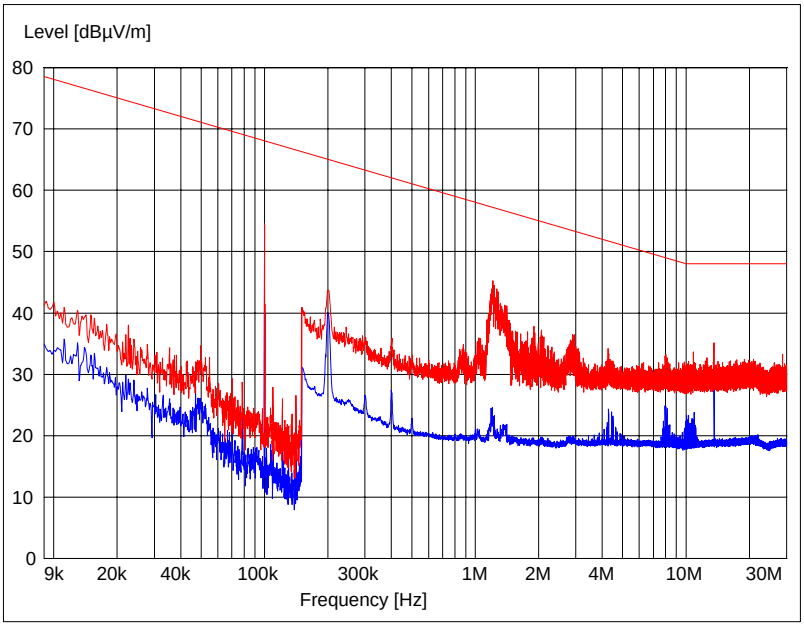

Fig. 19
EUT in Z Orientation 9KHz-30MHz Magnetic Loop Scan

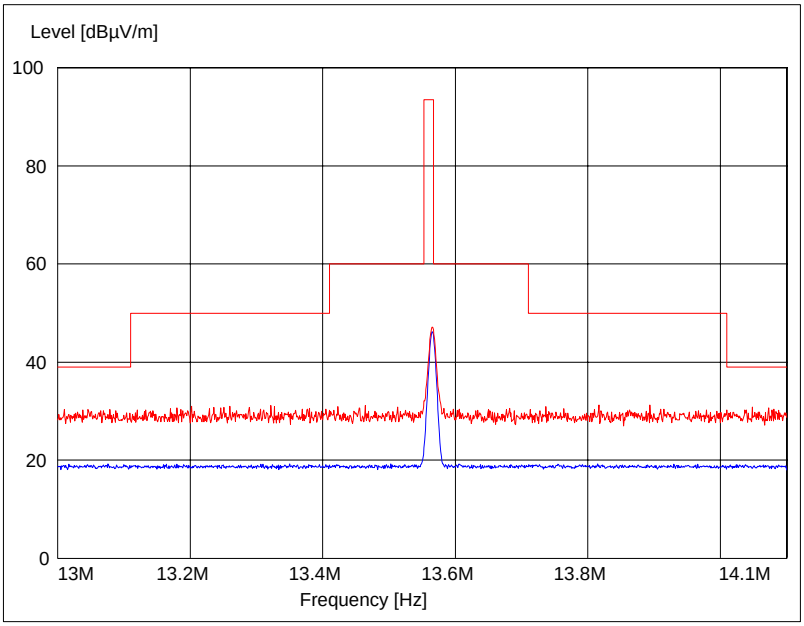

Fig. 20
EUT in X Orientation 13.56Mhz BW Scan

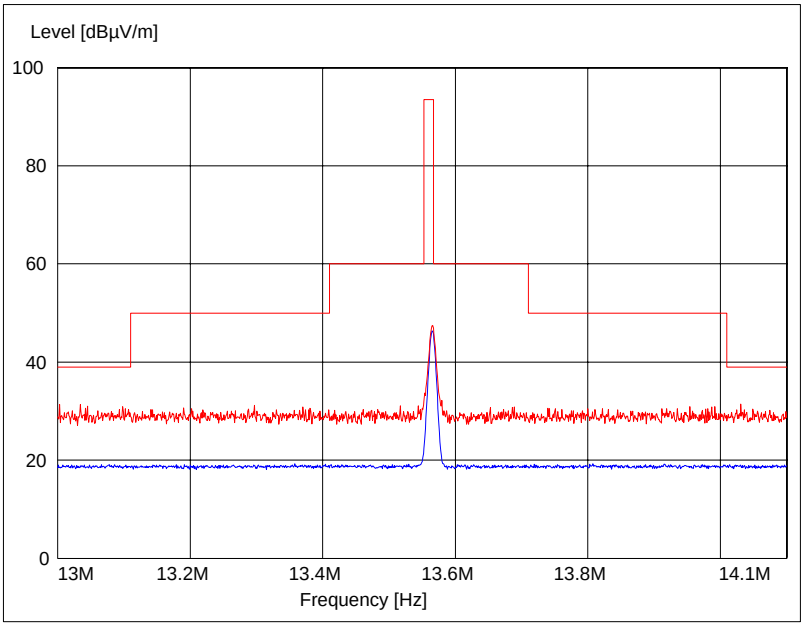

Fig. 21
EUT in Y Orientation 13.56Mhz BW Scan

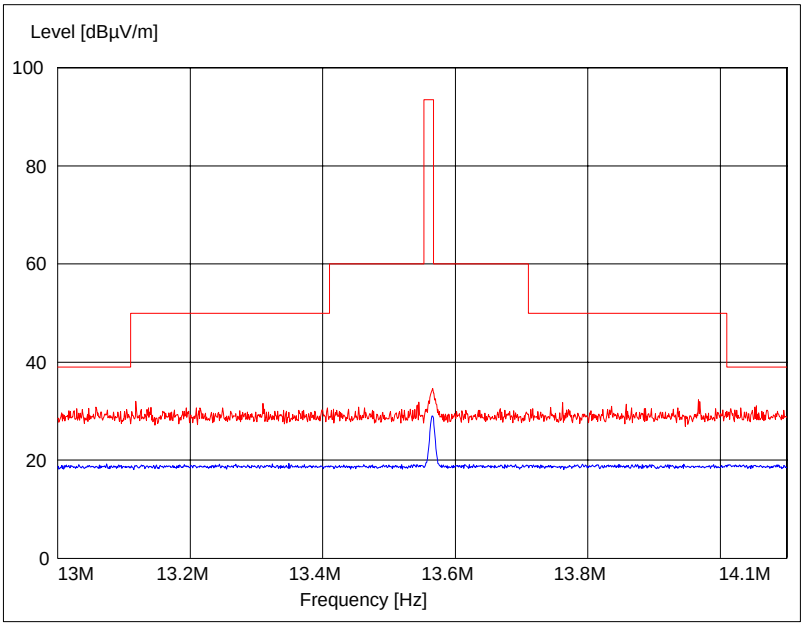

Fig. 22
EUT in Z Orientation 13.56Mhz BW Scan

14 AMENDMENTS TO THIS REPORT

No Amendments were made to this test report.