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Report On

EMC Evaluation of
Harman Becker Automotive Systems, Inc.
Fiat VP4 520 Automotive Infotainment Unit

FCC Part 15 Subpart B
ICES-003 Issue 5

Report No. SC1311870I **March 2014**

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

REPORT ON	EMC Evaluation of the Harman Becker Automotive Systems, Inc. Fiat VP4 520 Automotive Infotainment Unit
TEST REPORT NUMBER	SC1311870I
TEST REPORT DATE	March 2014
PREPARED FOR	Harman Becker Automotive Systems, Inc. 39001 West Twelve Mile Road Farmington Hills, MI 48331 USA
CONTACT PERSON	Shain E. Chmura Regulatory Compliance Engineer schmura@harman.com (248) 592-3157
PREPARED BY	Alex Chang **Name** Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory Title: West Coast EMC Manager
DATED	March 13, 2014

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

Revision History

SC1311870I Harman Becker Automotive Systems, Inc. Fiat VP4 520 Automotive Infotainment Unit					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/13/2014	Initial Release				Chip R. Fleury

CONTENTS

Section **Page No**

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SECTION 1

REPORT SUMMARY

EMC Evaluation of the
Harman Becker Automotive Systems, Inc.
Automotive Infotainment Unit

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Harman Becker Automotive Systems, Inc. Fiat VP4 520 Automotive Infotainment Unit to the requirements of FCC Part 15 Subpart B and Industry Canada ICES-003.

Objective	To perform EMC Evaluation to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Harman Becker Automotive Systems, Inc.
Model Name	Fiat VP4 520
Model Number(s)	VP4
Serial Number(s)	T00BE263340002
Number of Samples Tested	1
Highest Frequency Generated or Used	2.4 GHz
Test Specification/Issue/Date	• FCC Part 15 Subpart B (October 1, 2013) • Spectrum Management and Telecommunications Interference-Causing Equipment Standard ICES-003 Information Technology Equipment (ITE) — Limits and methods of measurement (Issue 5 August 2012).
Start of Test	December 13, 2013
Finish of Test	December 24, 2013
Name of Engineer(s)	Alex Chang
Related Document(s)	None

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart B is shown below. Test results from these tests are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

Part 15	Test Description	Result	Comments/Base Standard
§15.107	Conducted Limits	N/A	***)**
§15.109	Radiated Emission Limits	Compliant	Class B requirement

***)** Not applicable. EUT is intended to be installed and powered by vehicle battery. Therefore, measurement is not required.

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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Harman Becker Automotive Systems, Inc. Fiat VP4 520 Automotive Infotainment Unit as shown in the photograph below. The EUT is a radio entertainment and navigation system intended to install in vehicle use. It also has the feature of GPS, Bluetooth, CDMA, and Wi-Fi installed for user to navigate and make connection via Bluetooth/Wi-Fi/CDMA to other devices.

Equipment Under Test

1.3.2 Labelling Requirement for Industry Canada

The manufacturer, importer or supplier shall meet the labelling requirements set out in this section for every ITE unit:

(i) Prior to marketing in Canada, for ITE manufactured in Canada, and;
(ii) Prior to importation into Canada, for imported ITE.

The presence of the label on the ITE represents the manufacturer's or importer's Self-Declaration of Compliance (SDoC) to Industry Canada ICES-003. Each unit of an ITE model shall bear a label indicating the model's compliance with ICES-003.

The label shall be permanently affixed to the ITE or displayed electronically and its text must be clearly legible. When the dimension of the device is too small or it is otherwise not practical to place the label on the ITE, the label shall be placed in a prominent location in the user manual supplied with the ITE. The user manual may be in an electronic format and must be readily available.

Industry Canada ICES-003 Compliance Label

CAN ICES-3 (A)/NMB-3(A)

1.3.3 Labelling Requirement for Part 15 (Verification) Device

See FCC Publication Number: 784748 for details:

https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=27980&switch=P

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Radiated emission test configuration. Measurements were performed while EUT in standby mode.

1.4.2 EUT Exercise Software

None. No special software was used to exercise the EUT except the fireware 13.46.0 used during the investigation.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Harman	DC power cable	Custom DC power cable harness provided by client

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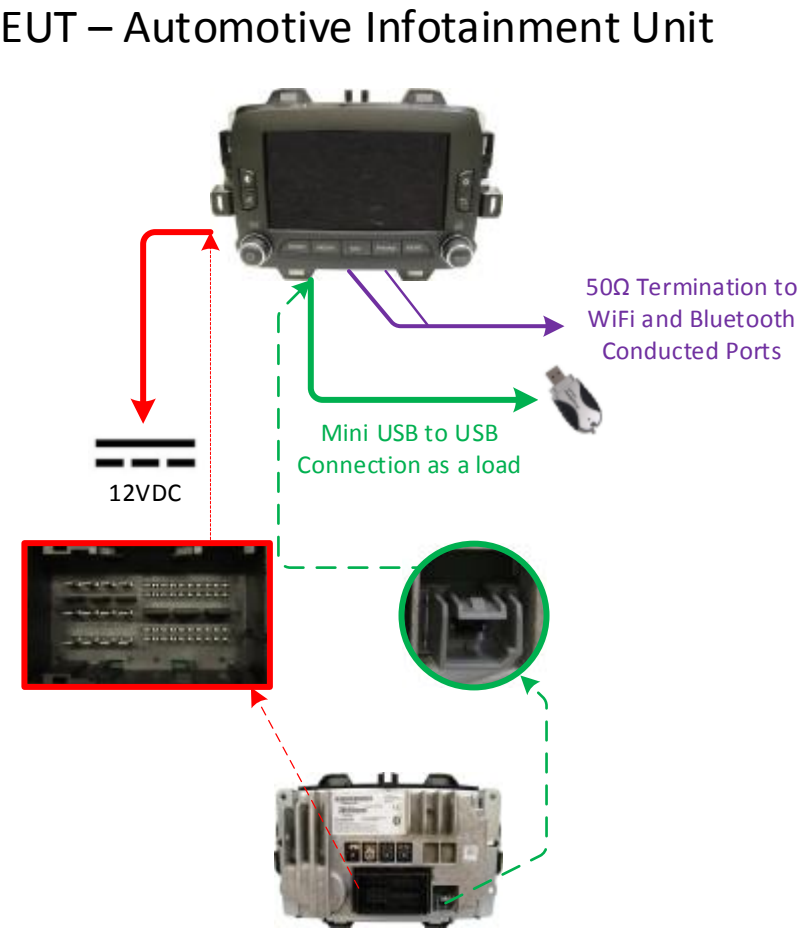
1.4.4 Simplified Test Configuration Diagram



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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: T00BE263340002		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
For radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 Fax: 858 546 0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8, 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US1146

TÜV SÜD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.9.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

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SECTION 2

TEST DETAILS

EMC Evaluation of the
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Automotive Infotainment Unit

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2.1 RADIATED EMISSION LIMITS

2.1.1 Specification Reference

Part 15 Subpart B §15.109(a)

2.1.2 Standard Applicable

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field Strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

2.1.3 Equipment Under Test and Modification State

Serial No: T00BE263340002 / Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

February 04, 2014/AC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	19.5°C
Relative Humidity	72.1%
ATM Pressure	101.6 kPa

2.1.7 Additional Observations

- The spectrum was searched from 30MHz to 18GHz and verified to Class B limits. There are no spurious emissions observed above 4GHz when in “Receive” mode.
- Verifications are performed at 3 meters.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

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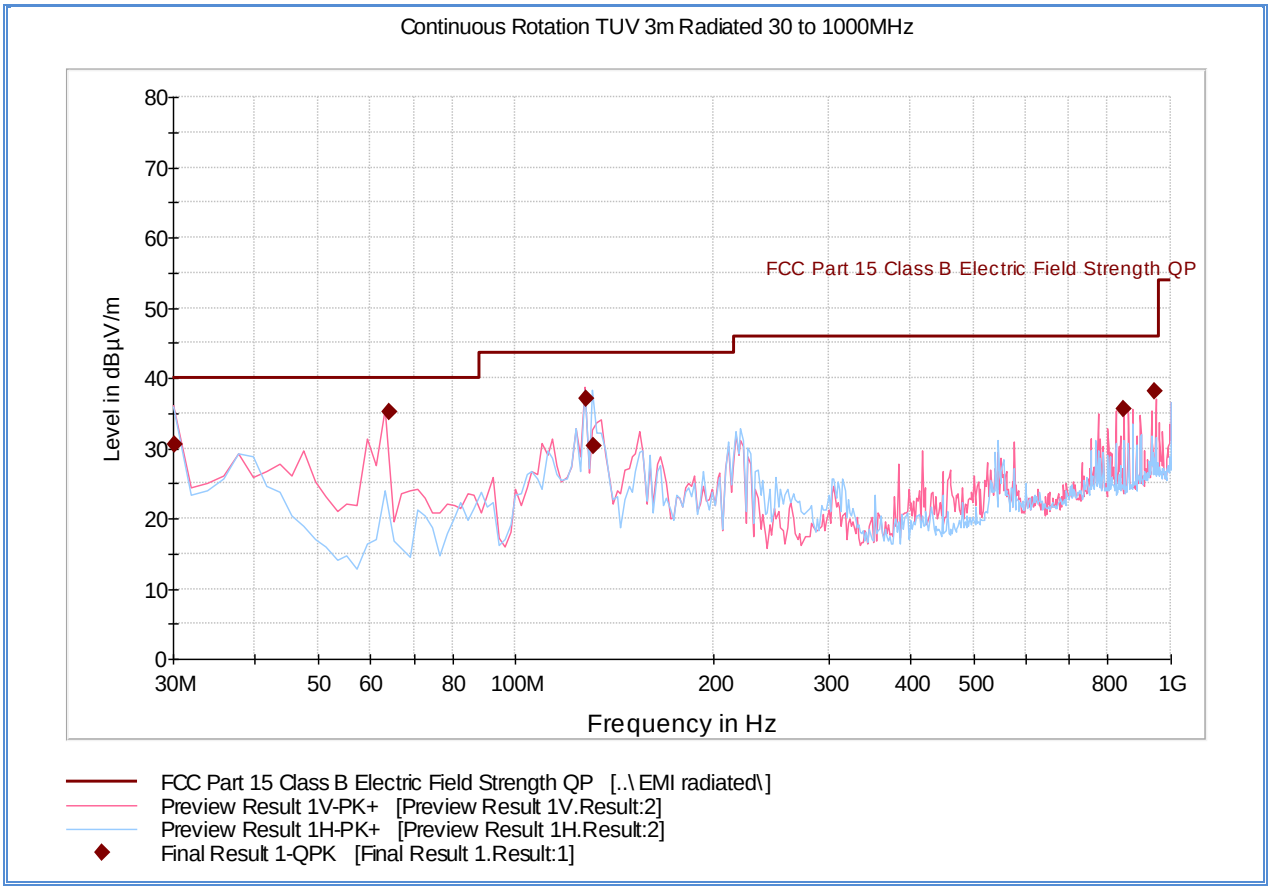
2.1.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

2.1.9 Test Results

See attached plots.

2.1.9.1 Below 1GHz Radiated Emission Test



Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.120000	30.4	1000.0	120.000	143.0	V	120.0	-10.4	9.6	40.0
64.006092	35.2	1000.0	120.000	122.0	V	321.0	-21.1	4.8	40.0
127.994389	37.1	1000.0	120.000	100.0	V	128.0	-20.0	6.4	43.5
131.682164	30.3	1000.0	120.000	150.0	H	304.0	-19.9	13.2	43.5
847.776754	35.7	1000.0	120.000	100.0	V	188.0	1.4	10.3	46.0
946.115030	38.1	1000.0	120.000	100.0	V	186.0	3.0	7.9	46.0

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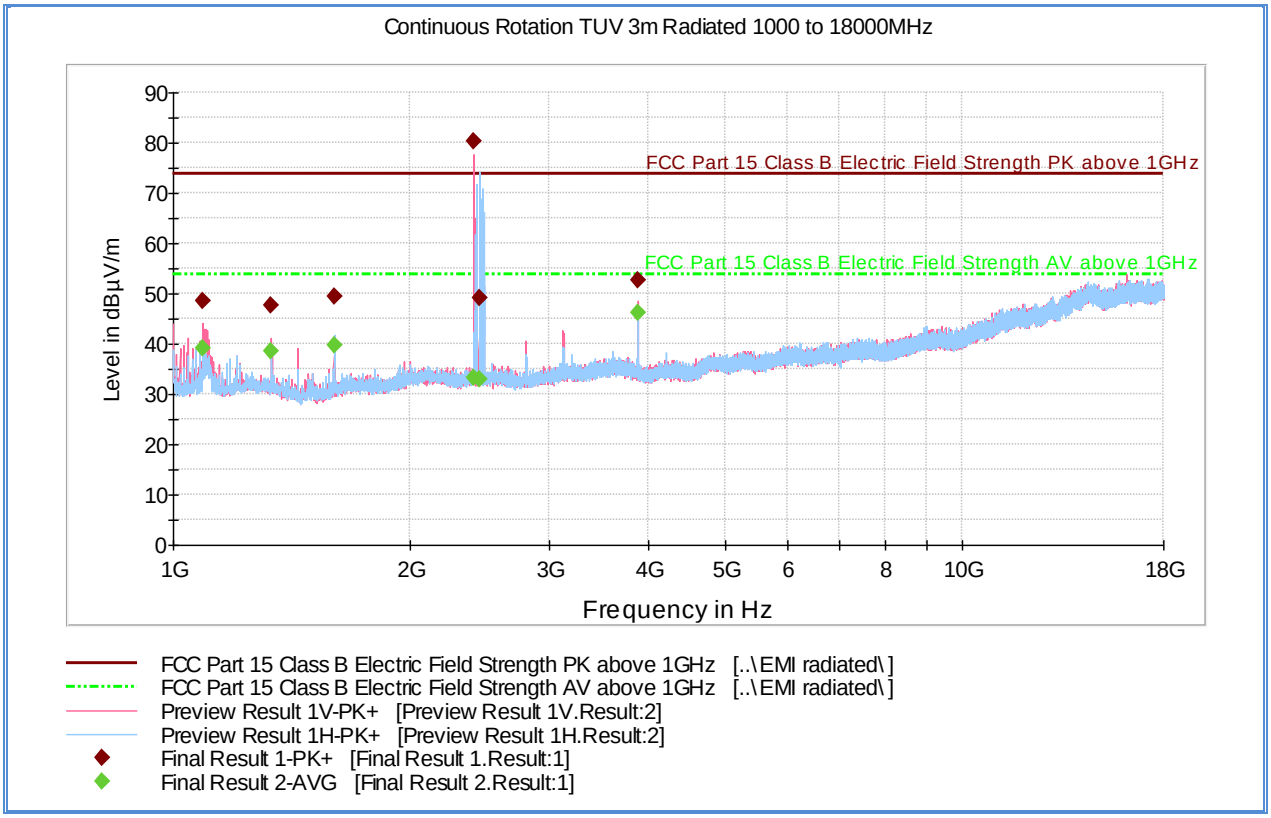
2.1.9.2 Above 1GHz Radiated Emission Test



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1091.066667	48.6	1000.0	1000.000	100.0	V	44.0	-1.5	25.3	73.9
1332.833333	47.6	1000.0	1000.000	202.0	V	323.0	-2.0	26.3	73.9
1599.533333	49.4	1000.0	1000.000	378.0	H	286.0	-0.9	24.5	73.9
*)2403.63333	80.3	1000.0	1000.000	406.9	V	263.0	Fundamental		
*)2447.40000	49.1	1000.0	1000.000	373.0	H	230.0	Fundamental		
3877.733333	52.7	1000.0	1000.000	305.0	V	68.0	5.6	21.2	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1091.066667	39.1	1000.0	1000.000	100.0	V	44.0	-1.5	14.8	53.9
1332.833333	38.5	1000.0	1000.000	202.0	V	323.0	-2.0	15.4	53.9
1599.533333	39.6	1000.0	1000.000	378.0	H	286.0	-0.9	14.3	53.9
*)2403.63333	33.2	1000.0	1000.000	406.9	V	263.0	Fundamental		
*)2447.40000	33.0	1000.0	1000.000	373.0	H	230.0	Fundamental		
3877.733333	46.1	1000.0	1000.000	305.0	V	68.0	5.6	7.8	53.9

Test Notes: *)* This is the fundamental frequency is not part of spurious emission consideration. Data for information only. No significant emissions observed above 4GHz.

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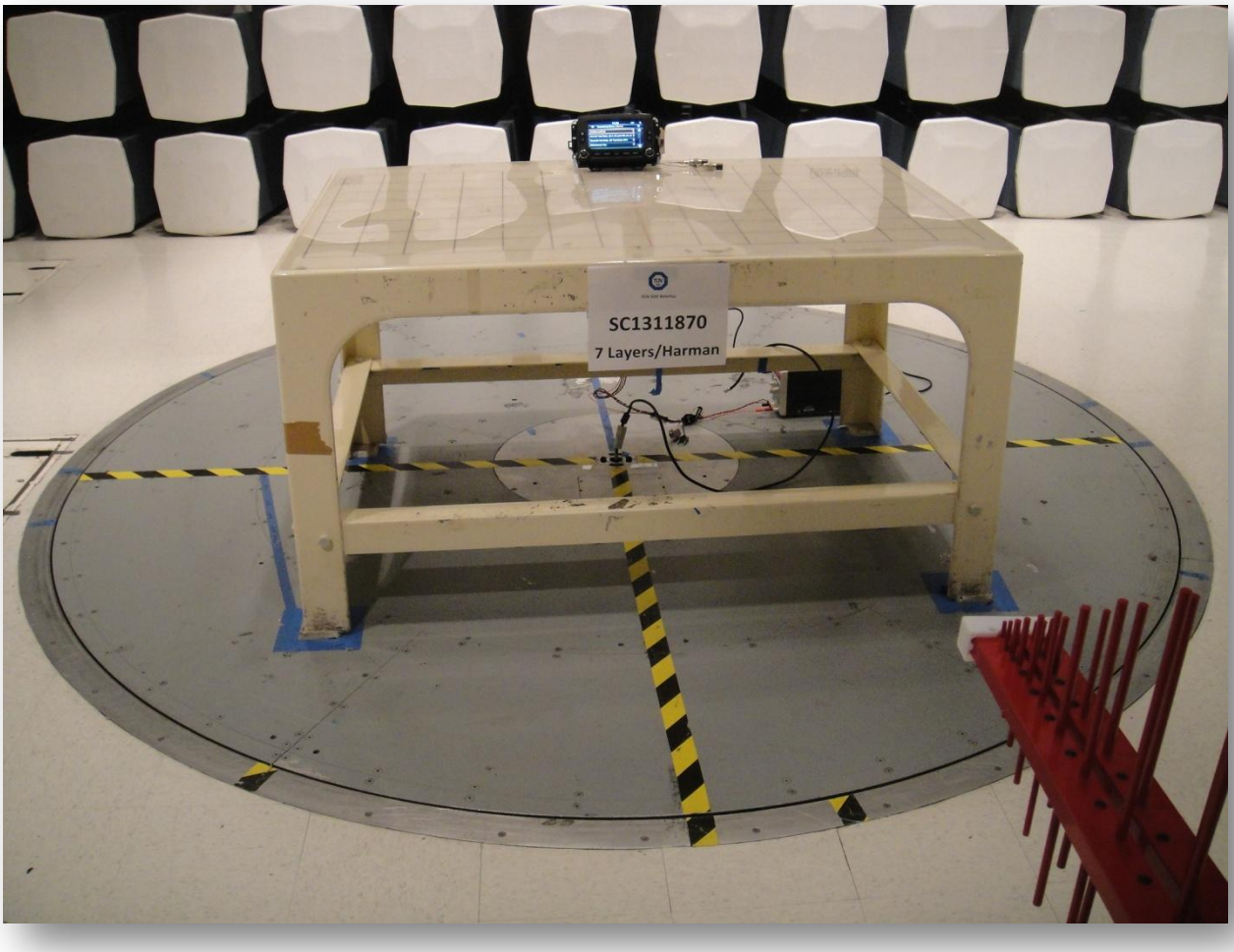
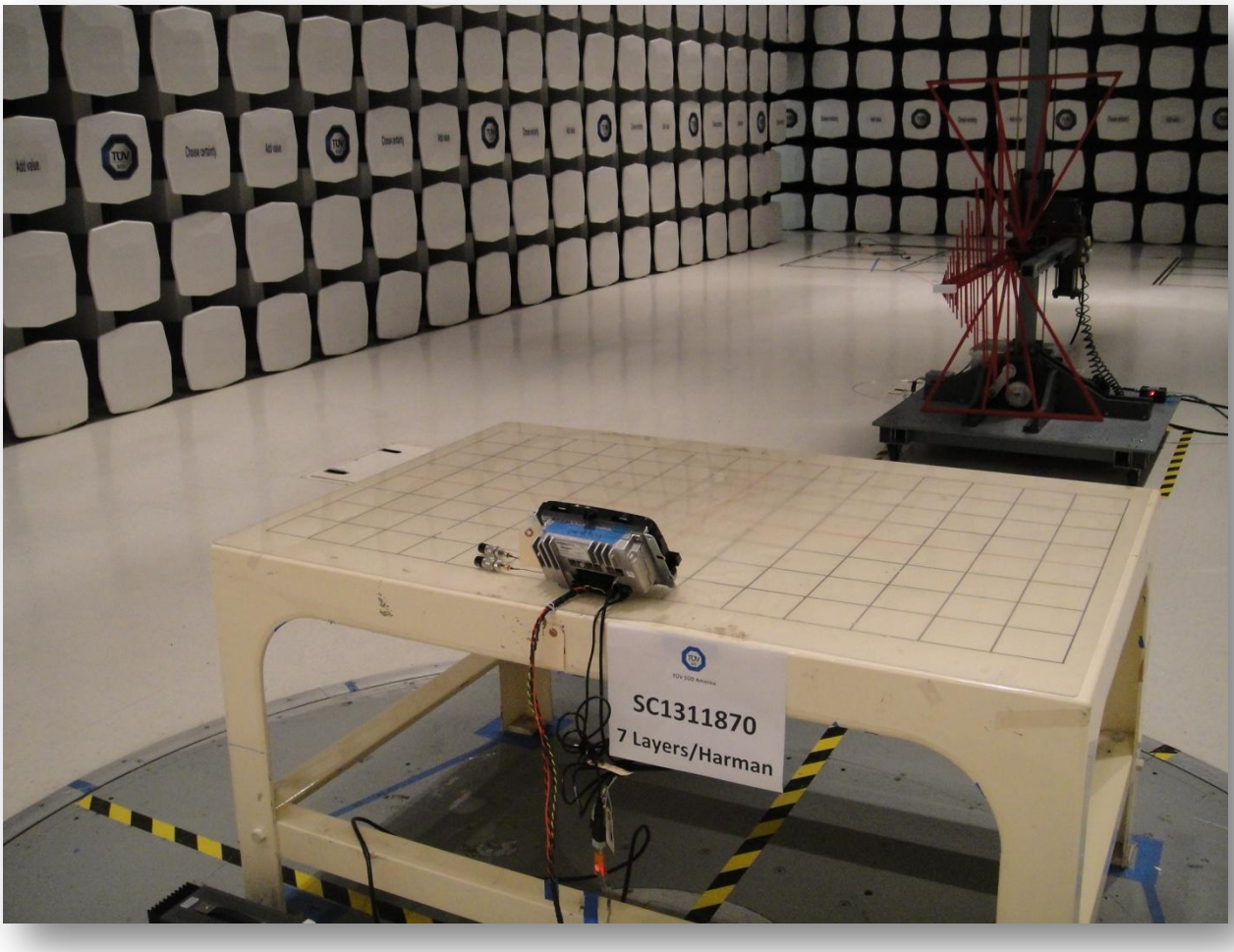
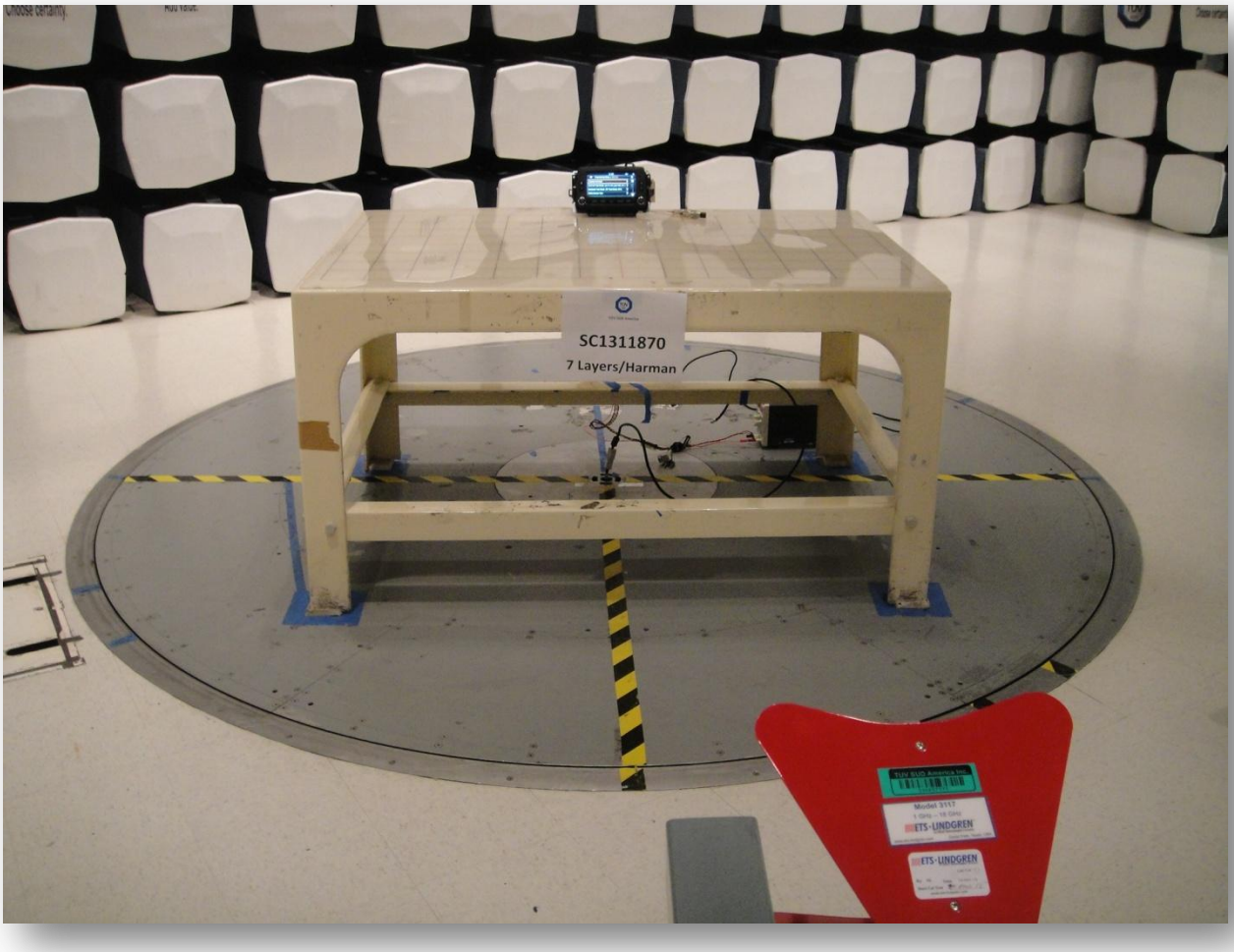
2.1.10 Test Setup Photo (Below 1GHz Front)



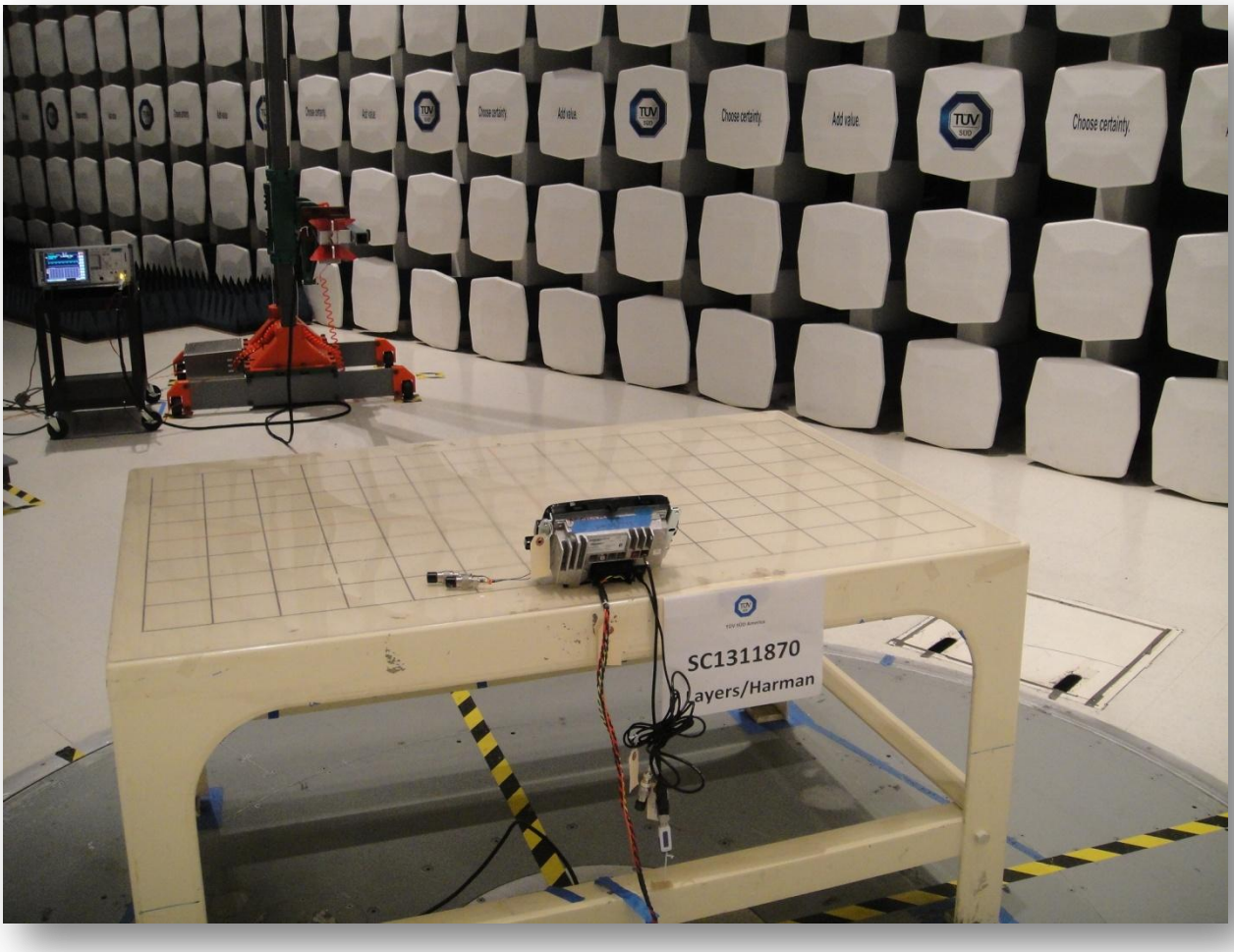
2.1.11 Test Setup Photo (Below 1GHz Back)



2.1.12 Test Setup Photo (Above 1GHz Front)



2.1.13 Test Setup Photo (Above 1GHz Back)



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SECTION 3

TEST EQUIPMENT USED

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3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	06/25/13	06/25/14
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/03/13	09/03/14
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/24/13	07/24/14
1016	Pre-amplifier	PAM-0202	187	PAM	10/08/13	10/08/14
Miscellaneous						
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
7539	DC Power Supply	6434B	1140A01866	Hewlett Packard	Verified by 6452	
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

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3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.41
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.82

3.2.1 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

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SECTION 4

DIAGRAM OF TEST SETUP

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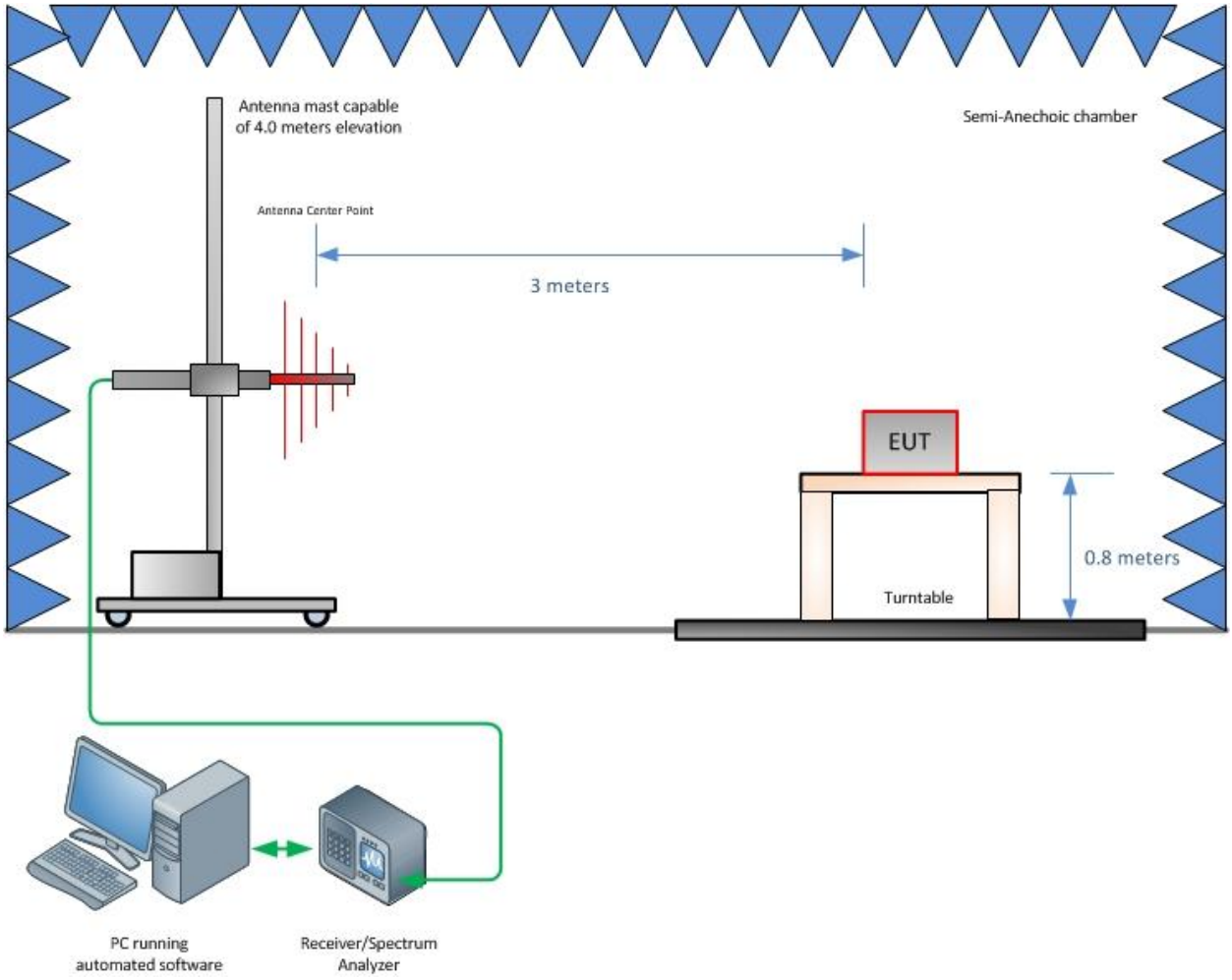
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)

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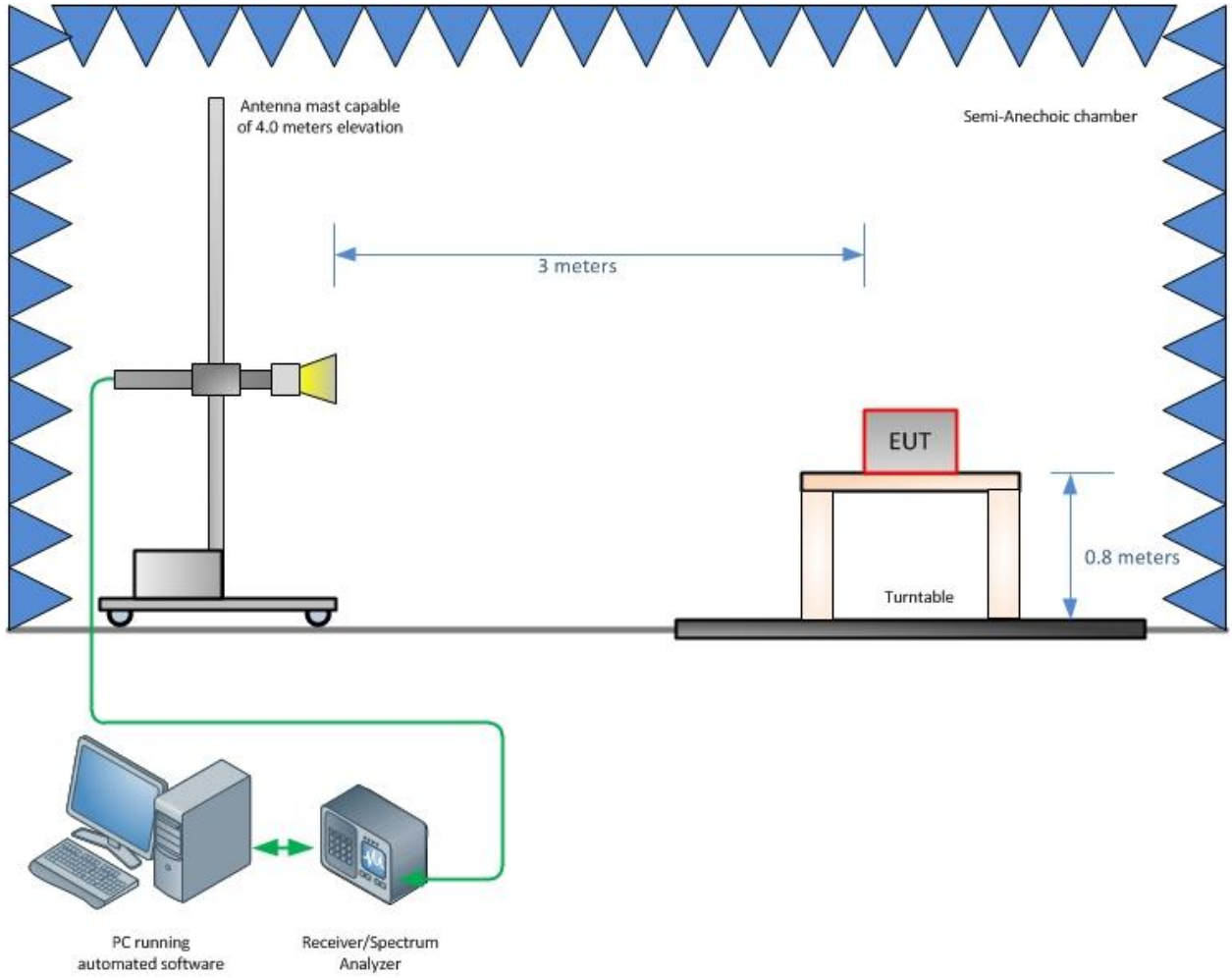

Radiated Emission Test Setup (Above 1GHz)

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SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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