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Report On

Radio Testing of the
Delphi Deutschland GmbH
GEELY CV1-134TRX Immobilizer

CFR 47 Part 15, Subpart C

Report No. 7130-83380-01

July 2016



REPORT ON Radio Testing of the
Delphi Deutschland GmbH
GEELY CV1-134TRX Immobilizer

TEST REPORT NUMBER 7130-83380-01

PREPARED FOR Delphi Deutschland GmbH
Delphiplatz 1
42119 Wuppertal, Germany

CONTACT PERSON Ljiljana Trivic
+49 2261 971415
Ljiljana_Trivic@Delphi.com

A black ink signature of Nikolay Shtin, consisting of stylized, overlapping loops and horizontal strokes.

PREPARED BY Nikolay Shtin
Name
Authorized Signatory
Title: EMC/Wireless Test Engineer

A blue ink signature of Juan Manuel Gonzalez, featuring a large, sweeping loop followed by several smaller, connected strokes.

APPROVED BY Juan Manuel Gonzalez
Name
Authorized Signatory
Title: EMC Service Line Manager Western Region

DATED July 18, 2016



Revision History

7130-83380-01 Delphi Deutschland GmbH GEELY CV1-134TRX Immobilizer					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
07/18/2015	Initial Release				Juan Manuel Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Delphi Deutschland GmbH
GEELY CV1-134TRX Immobilizer



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Delphi Deutschland GmbH Immobilizer to the requirements of the CFR 47 Part 15, Subpart C.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Delphi Deutschland GmbH
Model Number(s)	8888003016
Model Name(s)	CV1-134TRX
FCC ID Number	LTQCV1134
Serial Number(s)	161320039
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">CFR 47 Part 15, Subpart C (October 1, 2015)
Start of Test	July 06, 2016
Finish of Test	July 07, 2016
Test Facility location	All tests performed on this test report were performed at: TÜV SÜD America Inc. (Rancho Bernardo) 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,- 117.092409). Phone: 858 942 5542 FAX: 858-546 0364
Name of Engineer(s)	Nikolay Shtin
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with CFR 47 Part 15, Subpart C standard is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
-	§2.1046(a)	Conducted output power	N/A*	
-	§15.207	AC Conducted Emissions	N/A**	
2.1	§2.1049, §2.202(a)	Occupied Bandwidth	As Reported	
2.2	§15.205, §15.209	Radiated Emissions	Compliant	

N/A* Not applicable. No requirements on the EUT output power.

N/A** Not applicable. EUT is a DC powered device and has no connection to the AC mains.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Delphi Deutschland GmbH GEELY CV1-134TRX Immobilizer. EUT is a highly reliable theft deterrent system. Using a transponder and an encrypted key code, the system authenticates users to enable or disable vehicle start-up. Upon authentication, the ECM (engine control module) is released over a secure communication line to start the vehicle.



1.3.2 EUT General Description

EUT Description	Immobilizer
Model Name	GEELY CV1-134TRX
Model Number(s)	8888003016
Rated Voltage	11.25-16.25 VDC, 12.5 VDC (Nominal)
Mode Verified	RF Transponder
Device Capabilities	RF Transponder
Frequency Range	134.192 kHz
Primary Unit (EUT)	<input type="checkbox"/> Production <input type="checkbox"/> Pre-Production <input checked="" type="checkbox"/> Engineering
Output Power	73.48 dBμV/m @ 10 meters
Number of Operating Frequencies	1
Channel Verified	134.192 KHz
Antenna Type (used during evaluation)	Volvo, 31343397
Modulation Used	ASK

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT with attached antenna unit connected to laboratory DC power supply.

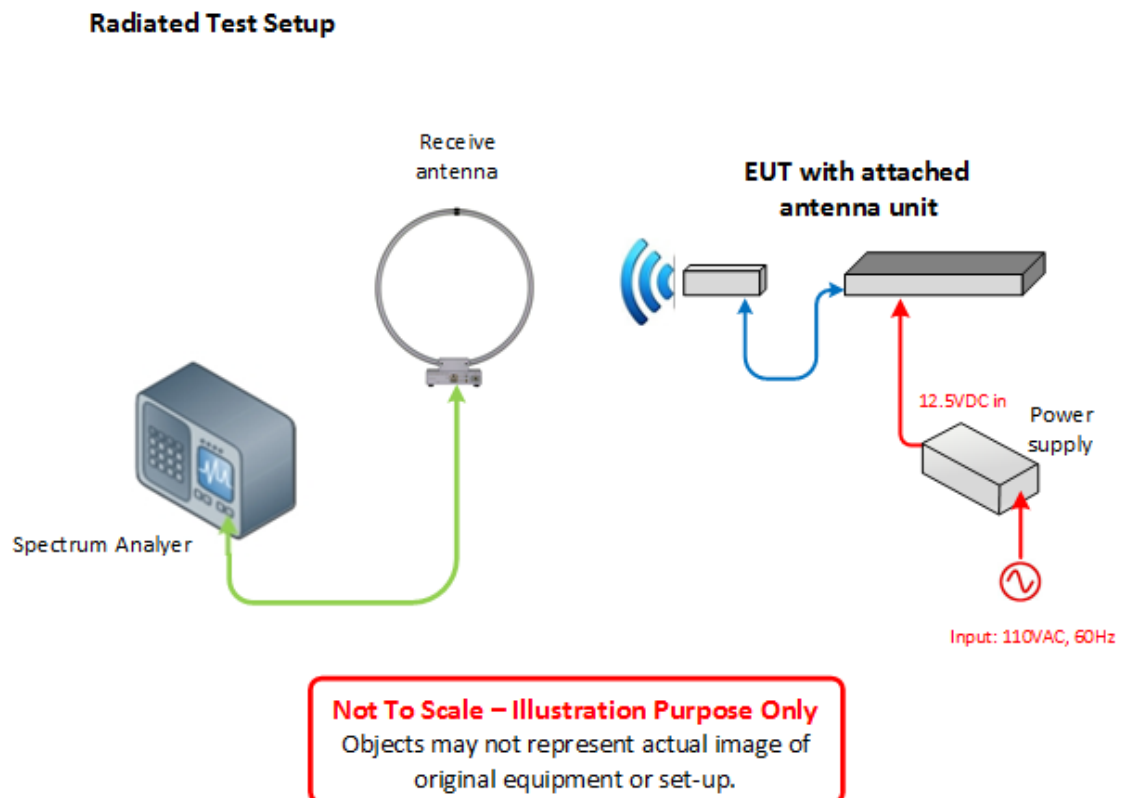
1.4.2 EUT Exercise Software

None.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
n/a	Unshielded cable (approx. 1.8 m long)	From EUT to DC power supply

1.4.4 Simplified Test Configuration Diagram





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: N/A		
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 C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.8 TEST FACILITY

1.8.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

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

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



SECTION 2

TEST DETAILS

Radio Testing of the
Delphi Deutschland GmbH
GEELY CV1-134TRX Immobilizer



2.1 OCCUPIED BANDWIDTH

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049 and 2.202(a)

2.1.2 Standard Applicable

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

2.1.3 Equipment Under Test and Modification State

Serial No: 161320039 / Default Test Configuration

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

July 06, 2016/NS

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

Ambient Temperature	26.5°C
Relative Humidity	43.3%
ATM Pressure	98.9kPa

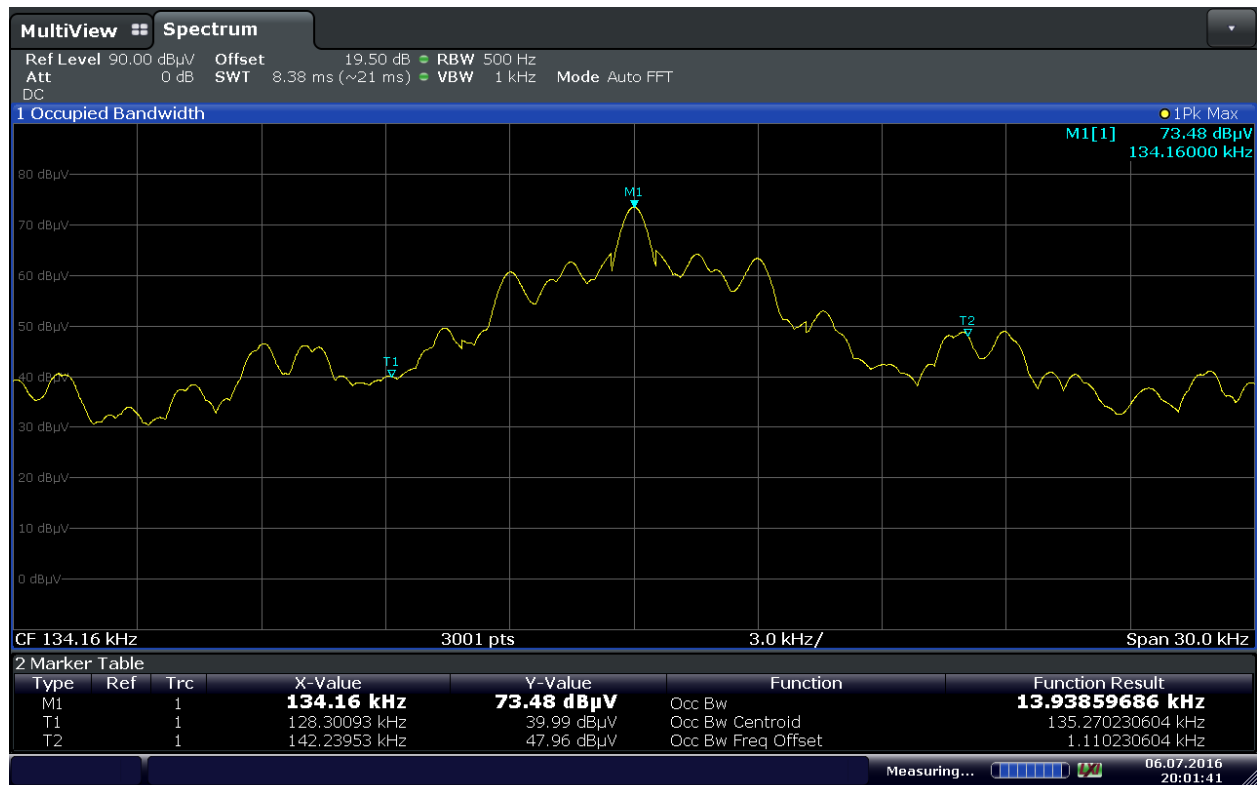
2.1.7 Additional Observations

- This is a radiated test using a loop antenna connected to the spectrum analyzer.
- A peak output reading was taken.
- For 99% bandwidth, the OBW measurement function of the spectrum analyzer was used.
- 20dB bandwidth verified using the “n” dB down marker function of the spectrum analyzer.
- Span is wide enough to capture the channel transmission.
- RBW is 500 Hz
- VBW is 1 kHz.
- Sweep is auto.
- Detector is peak.
- Trace is Max Hold.



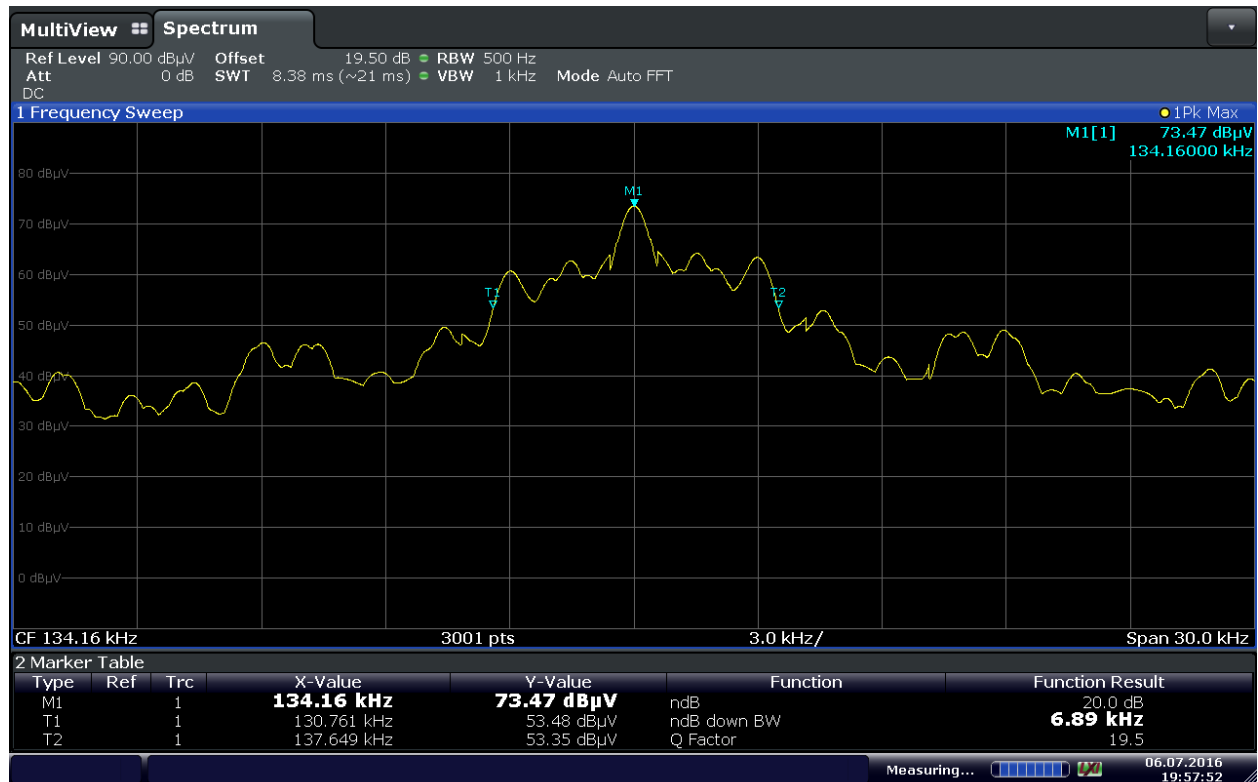
2.1.8 Test Results

Frequency	20 dB Bandwidth	99% Bandwidth
134.160 kHz	6.89 kHz	13.94 kHz



20:01:42 06.07.2016

99% OBW



19:57:53 06.07.2016

20 dB BW



2.2 RADIATED EMISSIONS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.205 and 15.209

2.2.2 Standard Applicable

§ 15.209 Radiated emission limits; general requirements.

(a) 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 of emission (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

** 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., §§ 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

§ 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz
² Above 38.6

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

2.2.3 Equipment Under Test and Modification State

Serial No: 161320039 / Default Test Configuration

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

July 06 and July 07, 2016/NS

2.2.5 Test Equipment Used

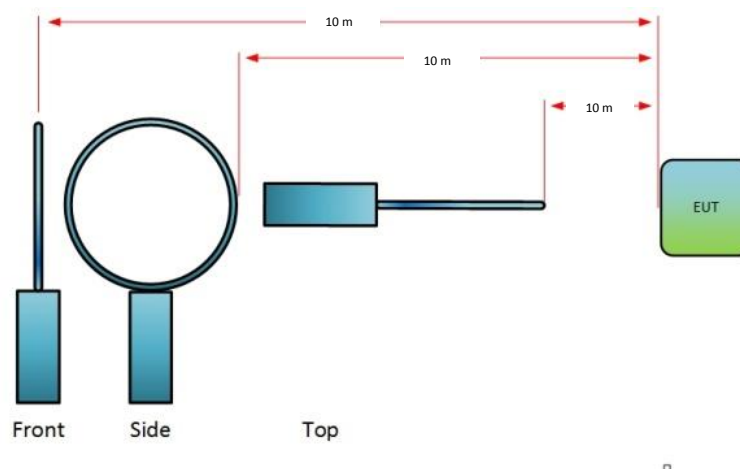
The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions

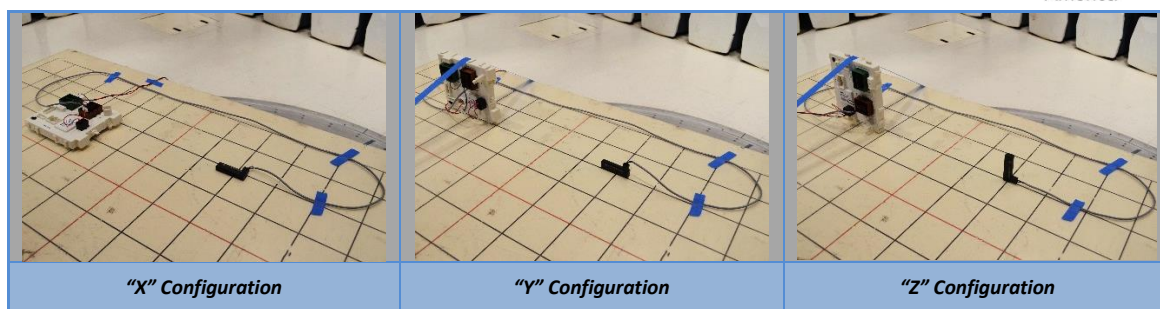
Ambient Temperature	25.5-26.5°C
Relative Humidity	40.9-43.3%
ATM Pressure	98.9-99.0kPa

2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to 1GHz.
- Below 30MHz, prescans were performed to determine best test antenna orientation with the highest recorded emissions. Verification was performed using "Side" configuration (see the figure below) corresponding to the best antenna orientation as found during the prescans.



- The EUT was verified in three (3) orthogonal axes. Only the worst case configuration presented ("X" Axis).



- Measurement was done at 10 meters below 30MHz and at 3 meters above 30MHz. Limits below 30MHz were corrected using extrapolation factor of 40 dB/decade. See sample computation below:

$$\begin{aligned}
 \text{Limit @ 9kHz} &= 2400/F(\text{kHz}) \mu\text{V/m} \\
 &= 20 \log (2400/9) \text{ dB}\mu\text{V/m} \\
 &= 48.52 \text{ dB}\mu\text{V/m @ 300 meters} \\
 &= 48.52 \text{ dB}\mu\text{V/m} + (40 \log 300/10) @ 10 \text{ meters} \\
 &= 107.60 \text{ dB}\mu\text{V/m @ 10 meters}
 \end{aligned}$$

- 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 Sections 2.2.8 and 2.2.9 for sample computations.

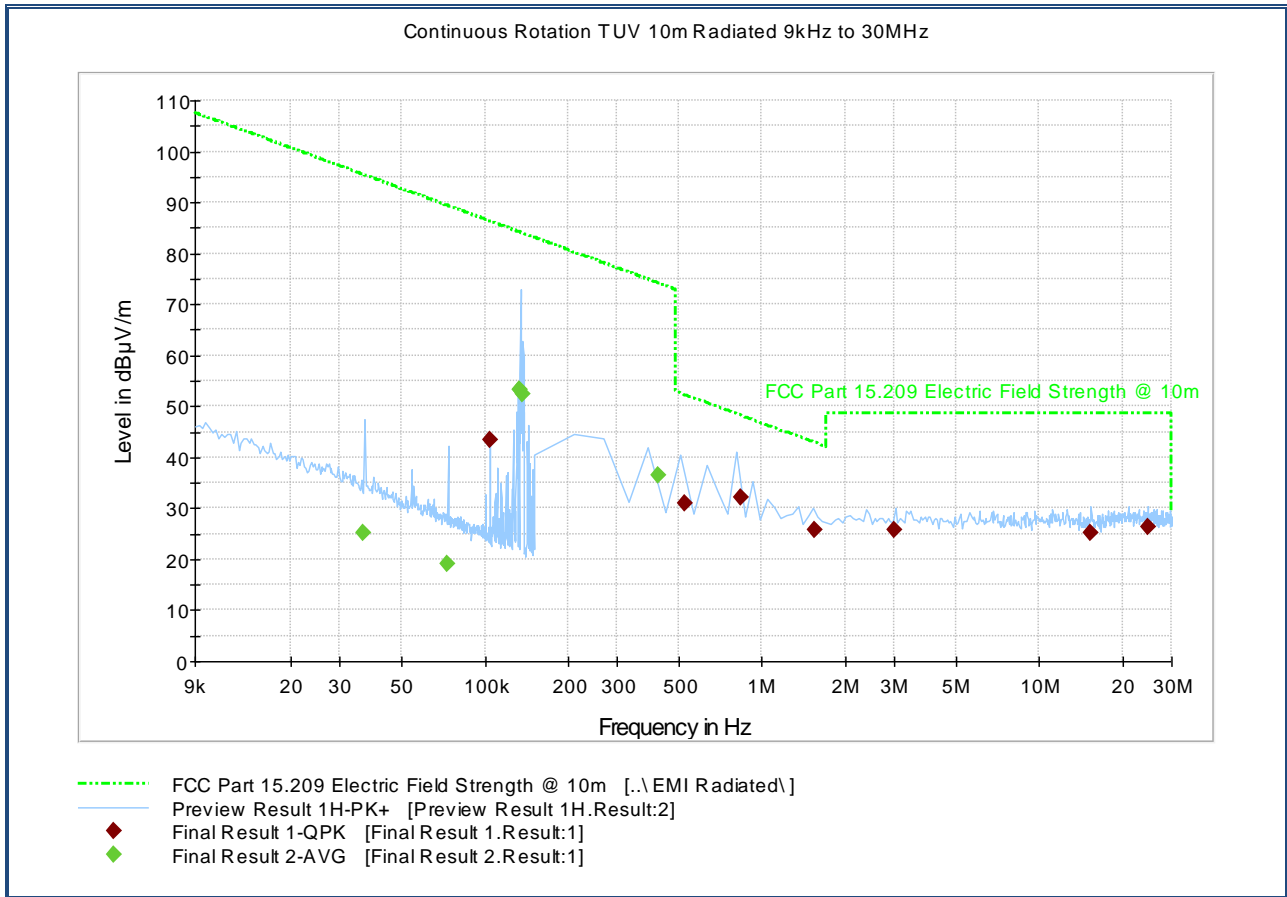
2.2.8 Sample Computation (Radiated Emission 9kHz to 30MHz)

Measuring equipment raw measurement (dbμV) @ 9 kHz			25.0
Correction Factor (dB)	Asset# 1057 (cable)	0.1	24.8
	Asset# 8850 (cable)	0.3	
	Asset# 6628 (antenna)	24.4	
Reported QuasiPeak Final Measurement (dbμV/m) @ 9kHz			49.8

2.2.9 Sample Computation (Radiated Emission 30MHz to 1GHz)

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# 8850 (cable)	0.3	
	Asset# 1033 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz			11.8

2.2.10 Test Results (Worst Case Orientation 9kHz to 30MHz)



Quasi Peak Data

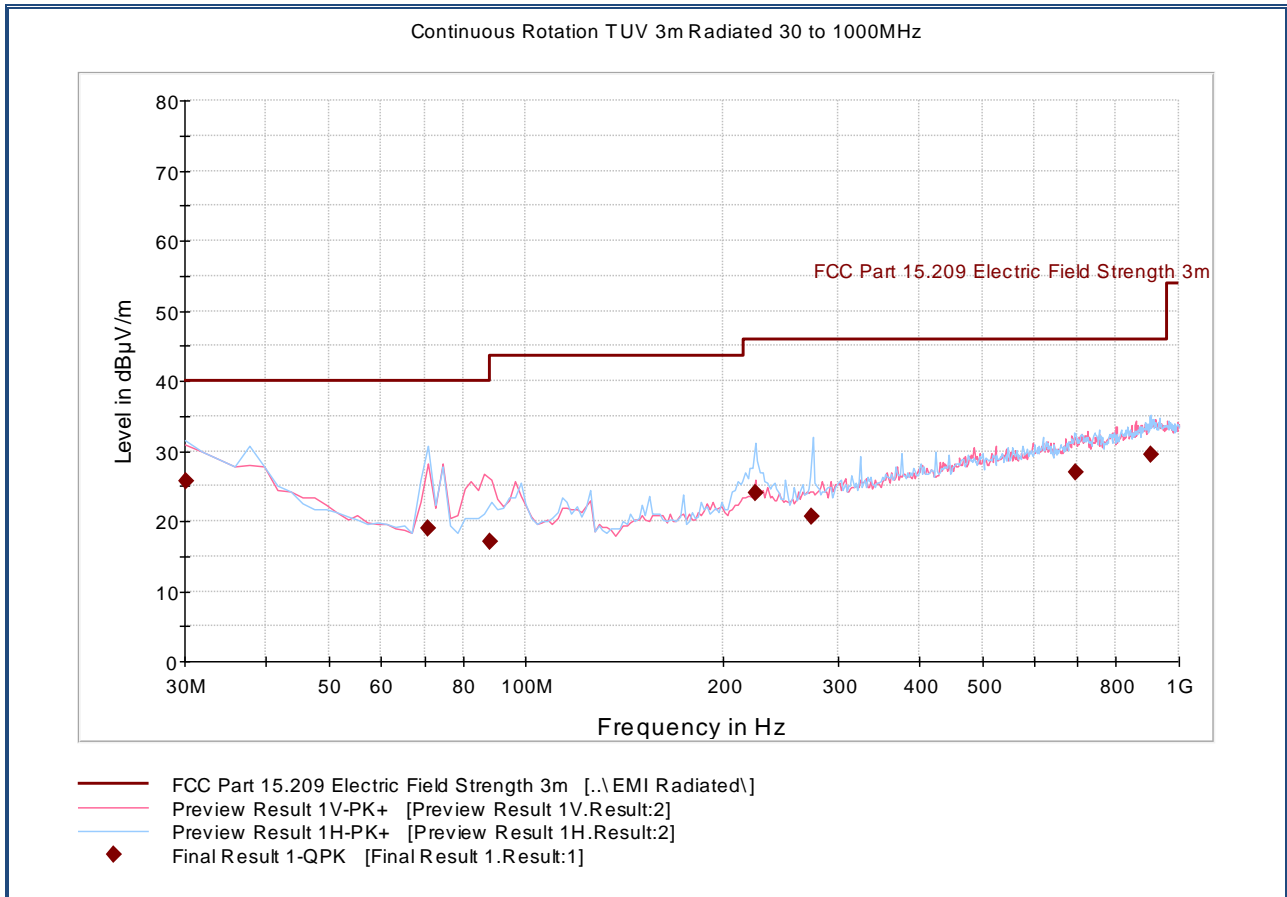
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.104207	43.3	1000.0	0.200	100.0	H	98.0	19.5	43.0	86.3
0.527418	31.0	1000.0	9.000	100.0	H	-8.0	19.7	21.2	52.2
0.839516	32.2	1000.0	9.000	100.0	H	-8.0	19.6	16.0	48.2
1.552352	25.8	1000.0	9.000	100.0	H	-8.0	20.1	17.1	42.9
3.007843	25.7	1000.0	9.000	126.0	H	-8.0	20.3	22.9	48.6
15.370688	25.3	1000.0	9.000	100.0	H	10.0	20.8	23.3	48.6
24.624732	26.3	1000.0	9.000	206.0	H	9.0	23.4	22.3	48.6

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.036274	25.3	1000.0	0.200	105.0	H	9.0	21.0	70.2	95.5
0.073407	19.0	1000.0	0.200	150.0	H	-9.0	19.9	70.4	89.4
0.133505	53.4	1000.0	9.000	122.0	H	10.0	19.5	30.8	84.2
0.134159	53.3	1000.0	9.000	100.0	H	11.0	19.5	30.8	84.1
0.136172	52.3	1000.0	9.000	100.0	H	3.0	19.5	31.7	84.0
0.420779	36.5	1000.0	9.000	100.0	H	15.0	19.5	37.7	74.2

Test Notes:

2.2.11 Test Results (Worst Case Orientation 30MHz to 1GHz)



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)
30.080000	25.6	1000.0	120.000	159.0	H	152.0	-5.8	14.4	40.0
70.821643	18.9	1000.0	120.000	200.0	H	18.0	-16.8	21.1	40.0
88.292745	17.0	1000.0	120.000	100.0	V	182.0	-15.7	26.5	43.5
224.908778	24.1	1000.0	120.000	150.0	H	78.0	-9.7	21.9	46.0
273.609860	20.6	1000.0	120.000	150.0	H	11.0	-7.9	25.4	46.0
695.345731	26.9	1000.0	120.000	100.0	H	18.0	2.8	19.1	46.0
904.749499	29.4	1000.0	120.000	250.0	H	57.0	6.0	16.6	46.0

Test Notes:



SECTION 3

TEST EQUIPMENT USED



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 Emissions						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	02/01/16	02/01/17
1033	Bilog Antenna	3142C	00044556	EMCO	09/25/14	09/25/16
6628	Loop Antenna	HFH 2 –Z2	880 458/25	Rhode & Schwarz	10/28/15	10/28/16
8850	High-frequency cable	N/A	N/A	N/A	12/17/15	12/17/16
1066	High-frequency cable	1066/C2	N/A	MicroCoax	03/16/16	03/16/17
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
9075	Laboratory DC Power Supply	35010M	N/A	Protek	Verified by 6792	
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
7619	Barometer/Temperature /Humidity Transmitter	iBTHX-W	15250268	Omega	10/19/15	10/19/16

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Radiated Emission Measurements (Below 1GHz)

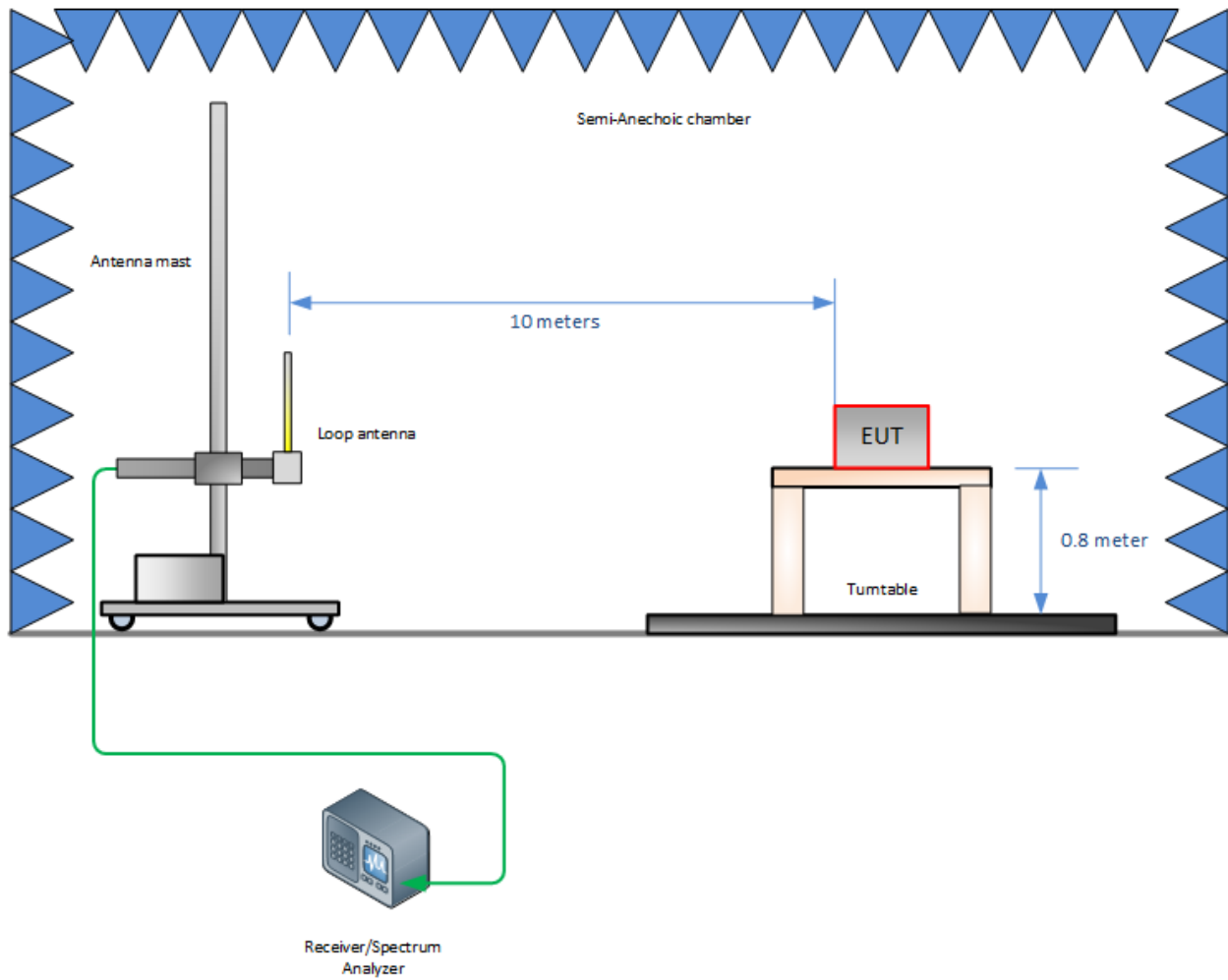
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamplifier	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.78
Coverage Factor (k):					2
Expanded Uncertainty:					3.57



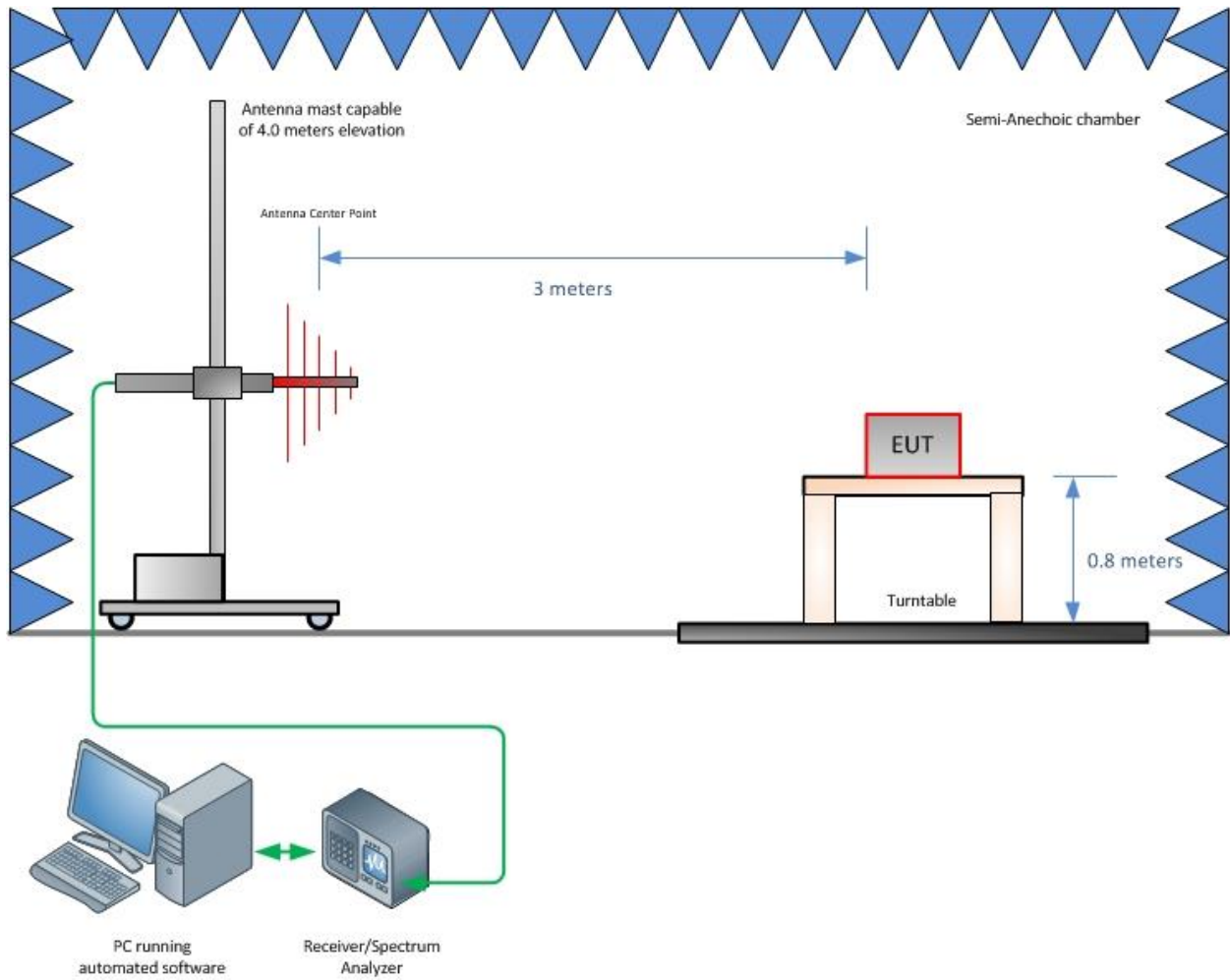
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 30 MHz)



Radiated Emission Test Setup (30MHz to 1GHz)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

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