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Report On

Radio Testing of
LDL Technology S.A.S.
12134 Tire Pressure Monitoring Transmitter

FCC Part 15 Subpart C §15.231
IC RSS-210 Issue 9 August 2016

Report No. SD72119616-0816

September 2016



REPORT ON Radio Testing of the
LDL Technology S.A.S.
Tire Pressure Monitoring Transmitter

TEST REPORT NUMBER SD72119616-0816

REPORT DATE September 2016

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DATED

September 6, 2016



Revision History

SD72119616-0816 LDL Technology S.A.S. 12134 Tire Pressure Monitoring Transmitter					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
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SECTION 1

REPORT SUMMARY

Radio Testing of
LDL Technology S.A.S.
Tire Pressure Monitoring Transmitter



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the LDL Technology S.A.S. Tire Pressure Monitoring Transmitter to the requirements of FCC Part 15 Subpart C §15.231 and IC RSS-210 Issue 9 August 2016.

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	LDL Technology S.A.S.
Model Number(s)	12134
FCC ID Number	T4512134
IC Number	6450A-12134
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.231 (October 1, 2015). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 9, August 2016).
Start of Test	August 29, 2016
Finish of Test	September 01, 2016
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 FCC Part 15 Subpart C §15.231 with cross-reference to the corresponding ISSED RSS standard is shown below.

Section	FCC Part 15	§15.231 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
-	§15.207 (a)		RSS-Gen 8.8	Conducted Emissions	N/A ¹	
-		§15.231(a)(2)	RSS-210 A1.1 (b)	Transmission Verification For Transmitter Activated Automatically	N/A ²	
-		§15.231(a)(3)	RSS-210 A1.1 (c)	Polling Or Supervision Transmissions, Including Data, To Determine System Integrity Of Transmitters Used In Security Or Safety Applications	N/A ²	
-		§15.231(b)	RSS-210 A1.2	Field Strength Of Emissions	N/A ²	
2.1		§15.231(c)	RSS-210 A1.3	Bandwidth Requirement	Compliant	
-		§15.231(d)	-	Frequency tolerance	N/A ³	
2.2		§15.231(e)	RSS-210 A1.4	Field Strength Of Emissions	Compliant	

N/A¹ Not applicable. EUT is battery powered designed for vehicular use only.

N/A² Not applicable. Requirements of 15.231(e) were used.

N/A³ Not applicable. EUT does not transmit in the 40.60 – 40.70 MHz band.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was an LDL Technology S.A.S. 12134 Tire Pressure Monitoring Transmitter as shown in the photograph below. The EUT has a self-powered sensors measuring the tire pressure/temperature and transfers coded information to the Receiver Control Unit using wireless communication at 315 MHz frequency.



Equipment Under Test

1.3.2 EUT General Description

EUT Description	Tire Pressure Monitoring Transmitter
Model Number(s)	12134
Power Source	3.0VDC Internal coin cell battery
EUT Field Strength	76.84 dBμV/m @ 3meters
Frequency Range	315.000 MHz
Modulation	FSK
Antenna Type	Integral Antenna
RFID Antenna Connector	N/A

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	EUT in test mode transmitting continually modulated signal. Configuration used for radiated emissions measurements.
B	EUT in Alarm mode. Configuration used for Duty Cycle Factor verification.

1.4.2 EUT Exercise Software

EUT is loaded with a test firmware allowing continuous modulated transmission (test mode used for radiated emissions measurement). For duty cycle evaluation EUT was set into alarm mode using PTU tool and 410204120000-IHM_QUALIF_SP37.exe programming software.

1.4.3 Support Equipment and I/O cables

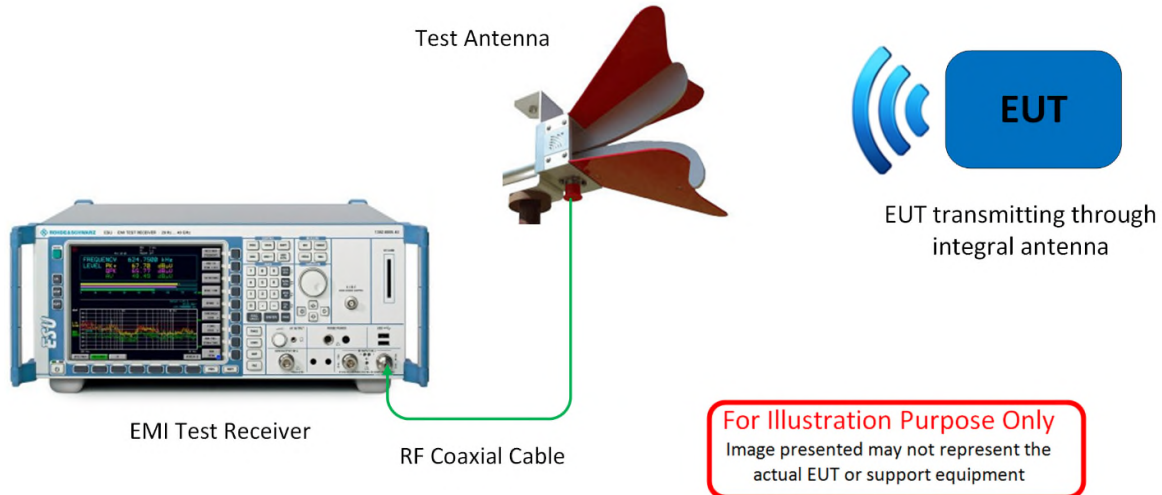
Manufacturer	Equipment/Cable	Description
Alligator Ventilfabrik GmbH	Programming tool	P/N: 030180
Sony	Laptop (PCG-31311L)	S/N 27545534 3006488
Sony	Laptop AC Adapter (ACDP-120E03)	S/N 592C60AYMSO26N

1.4.4 Worst Case Configuration

For radiated measurements X, Y and Z orientations were verified. Official measurements were performed using X orientation (worst case).



1.4.5 Simplified Test Configuration Diagrams



1.5 DEVIATIONS FROM THE STANDARD

All deviations made during testing from the applicable test standards or test plan are detailed under Section 1.2 of this test report.

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 ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. For conducted and 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 C63.10-2013. 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)

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

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 §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.9.2 Innovation, Science and Economic Development Canada Registration No.: 3067A

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

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 VCCI – Registration No. A-0230

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.



SECTION 2

TEST DETAILS

Radio Testing of
LDL Technology S.A.S.
Tire Pressure Monitoring Transmitter



2.1 BANDWIDTH REQUIREMENT

2.1.1 Specification Reference

Part 15 Subpart C §15.231(c), RSS-210 Issue A1.3

2.1.2 Standard Applicable

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

2.1.3 Equipment Under Test and Modification State

Serial No: N/A/ Test Configuration A

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

August 29, 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	24.2°C
Relative Humidity	44.1%
ATM Pressure	99.4 kPa

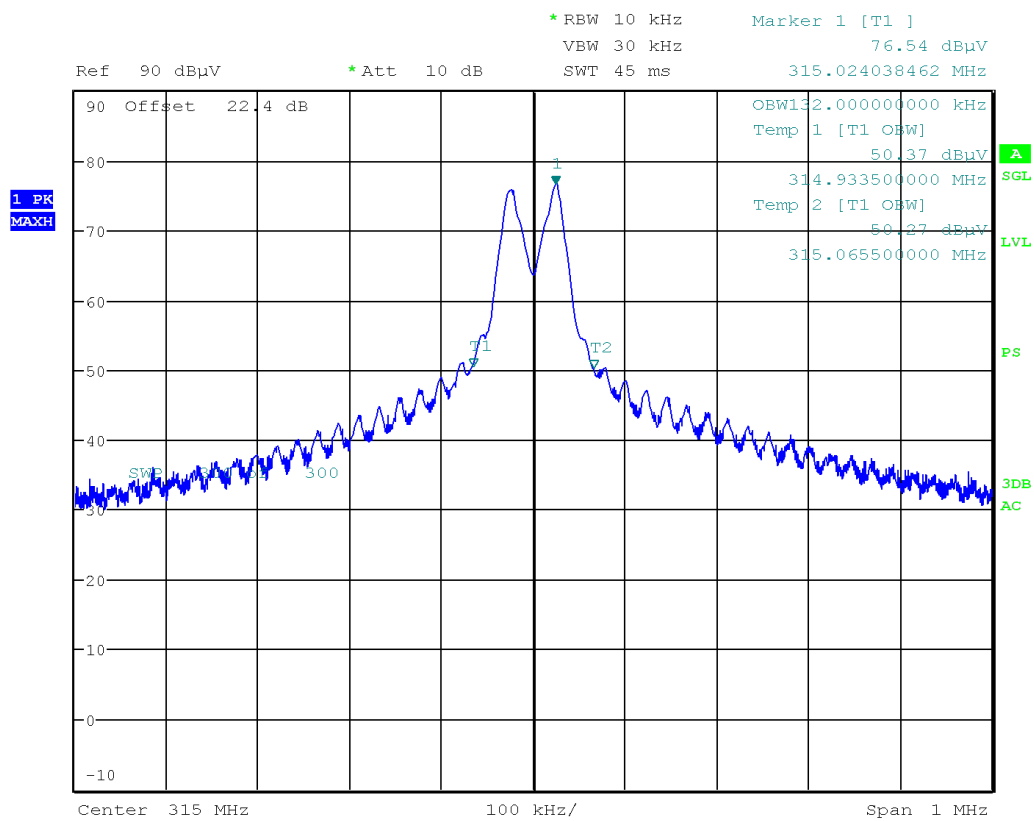
2.1.7 Additional Observations

- This is a radiated test.
- Span is set to encompass the whole emission
- RBW is 1% of the span while VBW is greater than 3X RBW.
- Sweep is auto.
- Detector is peak.
- Max hold function activated.
- "x dB" function (20dB) under Occupied Bandwidth measurement of the spectrum analyzer was used for FCC Part 15.231 requirement.
- Occupied bandwidth % power set to 99% for ISSED RSS-210 requirement.

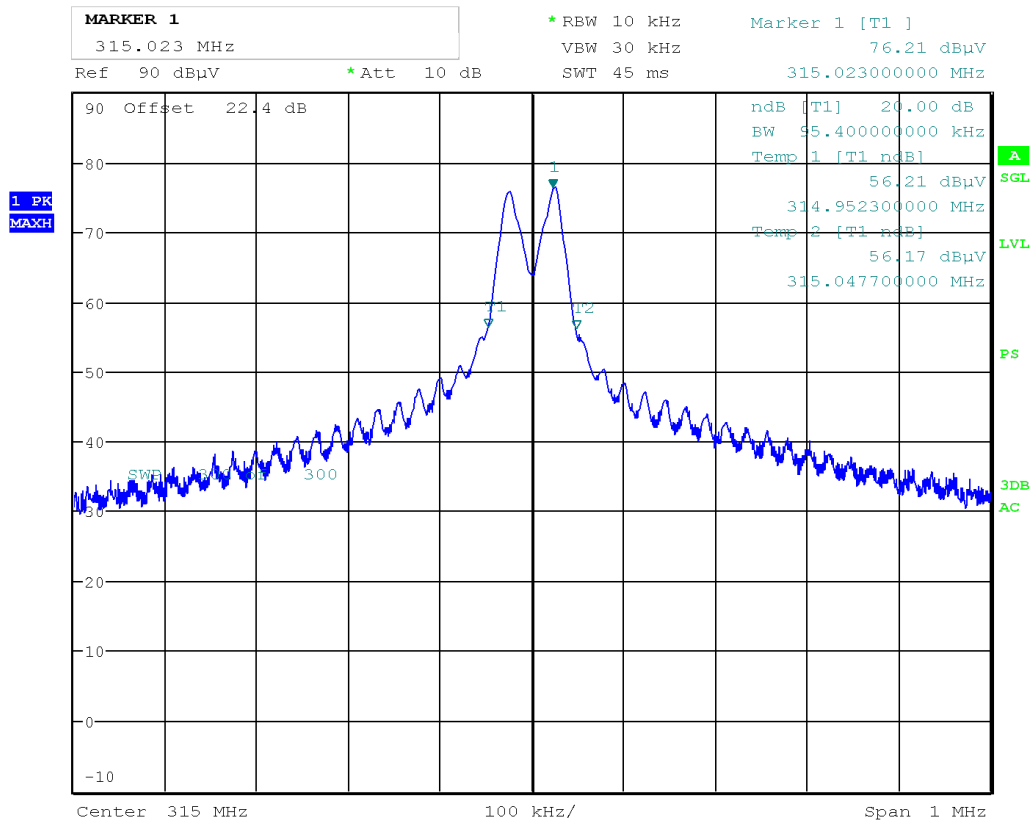
2.1.8 Test Results

Transmitter Frequency (MHz)	Modulation	0.25% of the center frequency requirement	Measured 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
315.00	FSK	<787.5 kHz	95.40 kHz	132.00 kHz

2.1.9 Test Results Plots



99% Occupied Bandwidth



20 dB Occupied Bandwidth

2.2 FIELD STRENGTH OF EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.231(b), RSS-210 Issue 9 A1.4

2.2.2 Standard Applicable

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	¹ 500 to 1500	¹ 50 to 150
174-260	1,500	150
260-470	¹ 1,500 to 5,000	¹ 150 to 500
Above 470	5,000	500

¹Linear Interpolations

2.2.3 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A and B

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

August 30 and September 1, 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/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	23.9-24.3°C
Relative Humidity	44.1-48.6%
ATM Pressure	99.1-99.3 kPa



2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (3.15 GHz), up to 6GHz presented.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Measurement was done using EMC32 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 2.5.8 for sample computation.

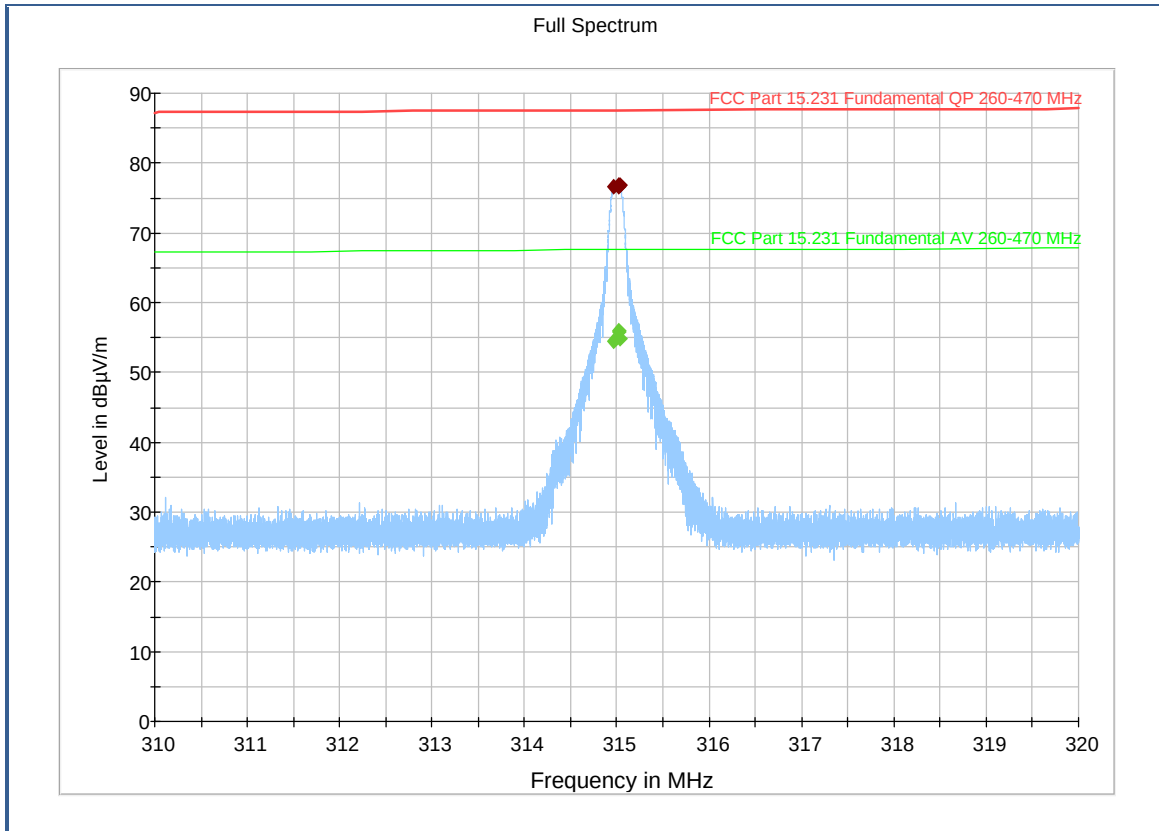
2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 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 (db μ V/m) @ 30MHz			11.8

2.2.9 Test Results

See attached plots.

2.2.10 Fundamental Emissions (315 MHz)



Quasi Peak Data

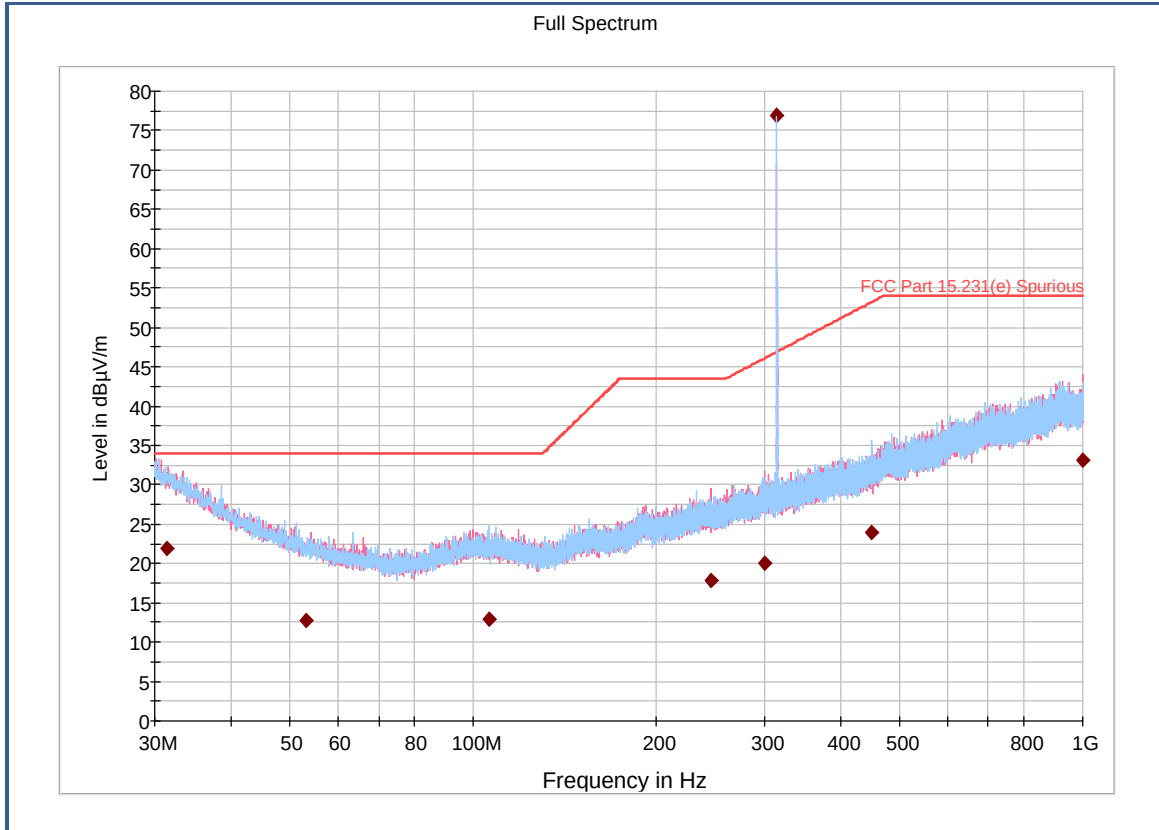
Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
314.963000	76.54	1000.0	120.000	105.2	H	182.0	22.4	11.06	87.60
315.020000	76.61	1000.0	120.000	104.1	H	185.0	22.4	10.99	87.60
315.020667	76.84	1000.0	120.000	99.9	H	2.0	22.4	10.76	87.60
315.036333	76.81	1000.0	120.000	99.8	H	183.0	22.4	10.79	87.60

Average Data

Frequency (MHz)	Average without DCF (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Average with DCF (dBμV/m)	Margin (dB)	Limit (dBμV/m)
314.963000	73.49	1000.0	120.000	105.2	H	182.0	54.43	13.17	67.60
315.020000	74.84	1000.0	120.000	104.1	H	185.0	55.78	11.82	67.60
315.020667	75.03	1000.0	120.000	99.9	H	2.0	55.97	11.63	67.60
315.036333	73.84	1000.0	120.000	99.8	H	183.0	54.78	12.82	67.60

Test Notes: Duty Cycle Factor of 19.06 dB was used for average emissions calculation. See Section 2.5.13 of this test report for the details on the Duty Cycle Factor measurement.

2.2.11 Spurious Emissions (30 MHz to 1 GHz)

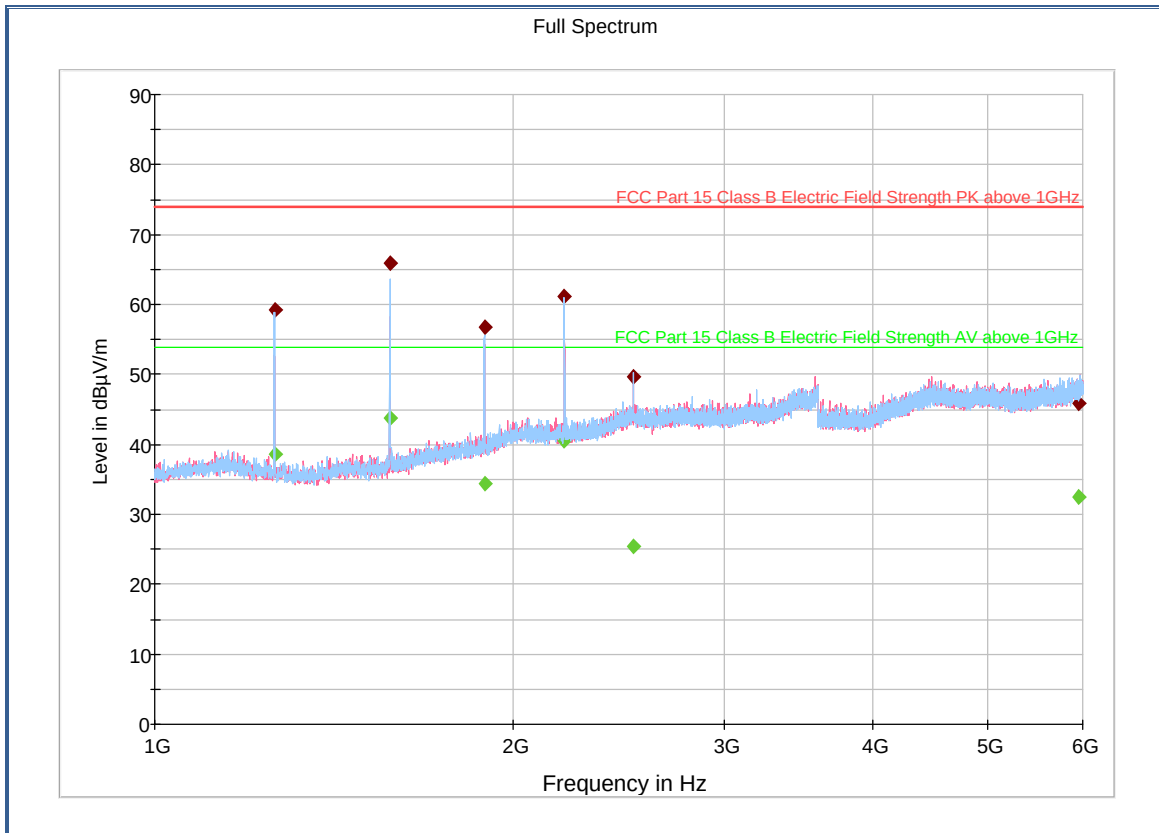


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
31.320000	21.99	1000.0	120.000	157.6	V	18.0	24.2	11.99	33.98
53.177667	12.75	1000.0	120.000	169.5	V	99.0	15.5	21.23	33.98
106.303333	12.92	1000.0	120.000	410.3	H	22.0	15.8	21.06	33.98
245.038667	17.77	1000.0	120.000	126.6	V	232.0	20.1	25.75	43.52
300.684667	20.03	1000.0	120.000	212.9	V	11.0	22.2	26.06	46.09
314.978333	76.97	1000.0	120.000	99.8	H	2.0	22.4	Fundamental	
450.006333	23.98	1000.0	120.000	245.5	H	105.0	25.9	29.23	53.21
998.935333	33.07	1000.0	120.000	99.8	V	73.0	33.6	20.91	53.98

Test Notes:

2.2.12 Test Results Above 1 GHz



Peak Data

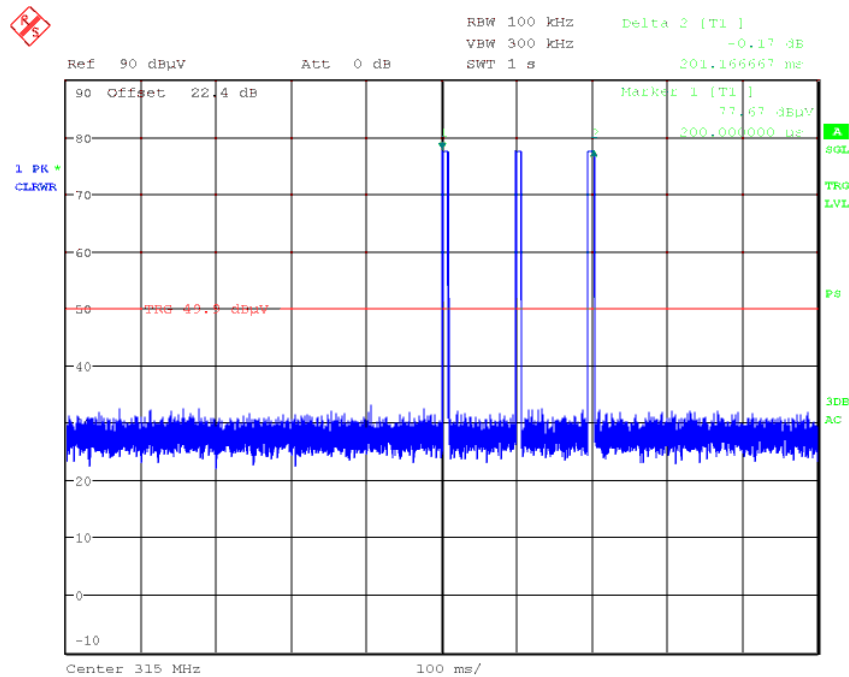
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1260.200000	59.18	1000.0	1000.000	105.3	H	184.0	-0.6	14.72	73.90
1574.700000	65.88	1000.0	1000.000	228.1	H	169.0	-0.4	8.02	73.90
1890.200000	56.71	1000.0	1000.000	322.2	H	162.0	2.7	17.19	73.90
2205.100000	61.17	1000.0	1000.000	402.6	H	140.0	3.9	12.73	73.90
2519.700000	49.64	1000.0	1000.000	184.7	H	129.0	5.0	24.26	73.90
5960.800000	45.90	1000.0	1000.000	410.2	H	114.0	13.1	28.00	73.90

Average Data

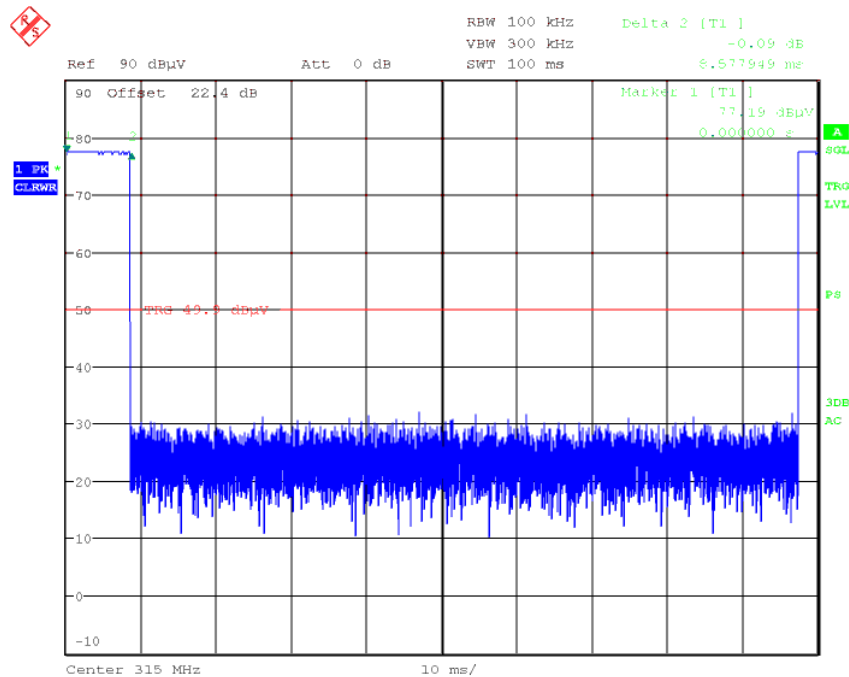
Frequency (MHz)	Average without DCF (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Average with DCF (dBµV/	Margin (dB)	Limit (dBµV/m)
1260.200000	57.62	1000.	1000.000	105.3	H	184.0	38.56	15.34	53.90
1574.700000	62.81	1000.	1000.000	228.1	H	169.0	43.75	10.15	53.90
1890.200000	53.44	1000.	1000.000	322.2	H	162.0	34.38	19.52	53.90
2205.100000	59.58	1000.	1000.000	402.6	H	140.0	40.52	13.38	53.90
2519.700000	44.55	1000.	1000.000	184.7	H	129.0	25.49	28.41	53.90
5960.800000	32.47	1000.	1000.000	410.2	H	114.0	32.47	21.43	53.90

Test Notes: Duty Cycle Factor of 19.06 dB was used for average emissions calculation. See Section 2.5.13 of this test report for the details on the Duty Cycle Factor measurement.

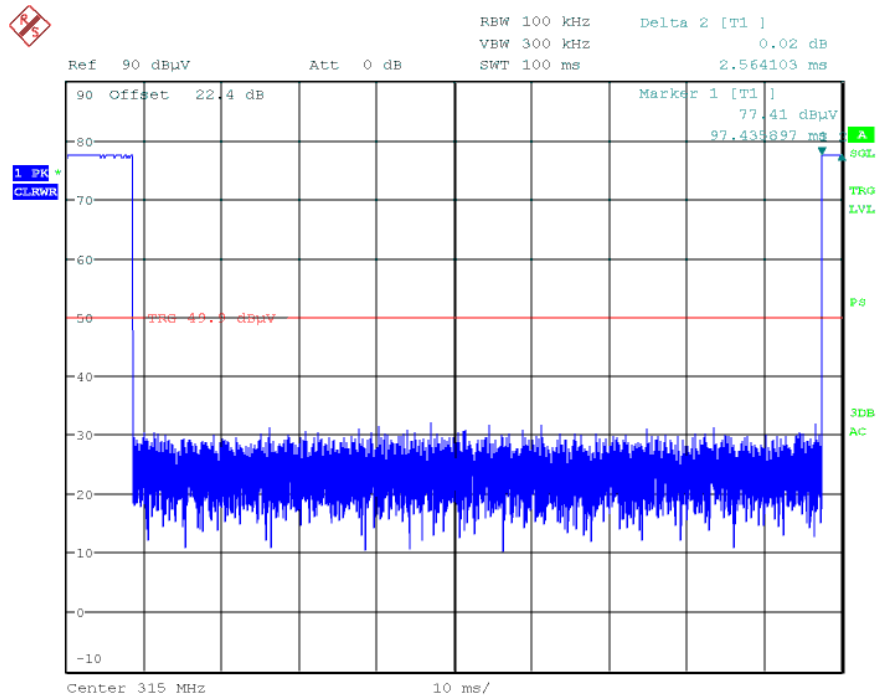
2.2.13 Test Results Duty Cycle Factor



Pulse train length 201.167 ms (100 ms time frame will be used for DCF calculation)



First pulse width: T1=8.578 ms



Second pulse width: T2=2.564 ms

Calculated Duty Cycle (X)= $(T1+T2)/T$
 $(8.578\text{ms}+2.564\text{ms})/100\text{ms}$
 $11.142\text{ ms}/100\text{ms}$
 0.11142 or 11.14%

Duty Cycle Correction Factor= $20 \log (1/X)$
 $20 \log (1/0.11142)$
 19.06 dB



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 Emission						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
7631	Double-ridged waveguide horn antenna	3117	00205418	EMCO	07/05/16	07/05/17
8878	High-frequency cable	R90-088-240	N/A	Teledyne/Storm Microwave	03/16/16	03/16/17
8879	High-frequency cable	084-0505-100	N/A	Teledyne/Storm Microwave	03/16/16	03/16/17
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
8891	Pre-amplifier	PE15A3262	1012	Pasternack	04/29/16	04/29/17
Miscellaneous						
	Test Software	EMC32	V9.26.0	Rhode & Schwarz	N/A	
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	Preamp	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

3.2.2 Radiated Emission Measurements (Above 1GHz)

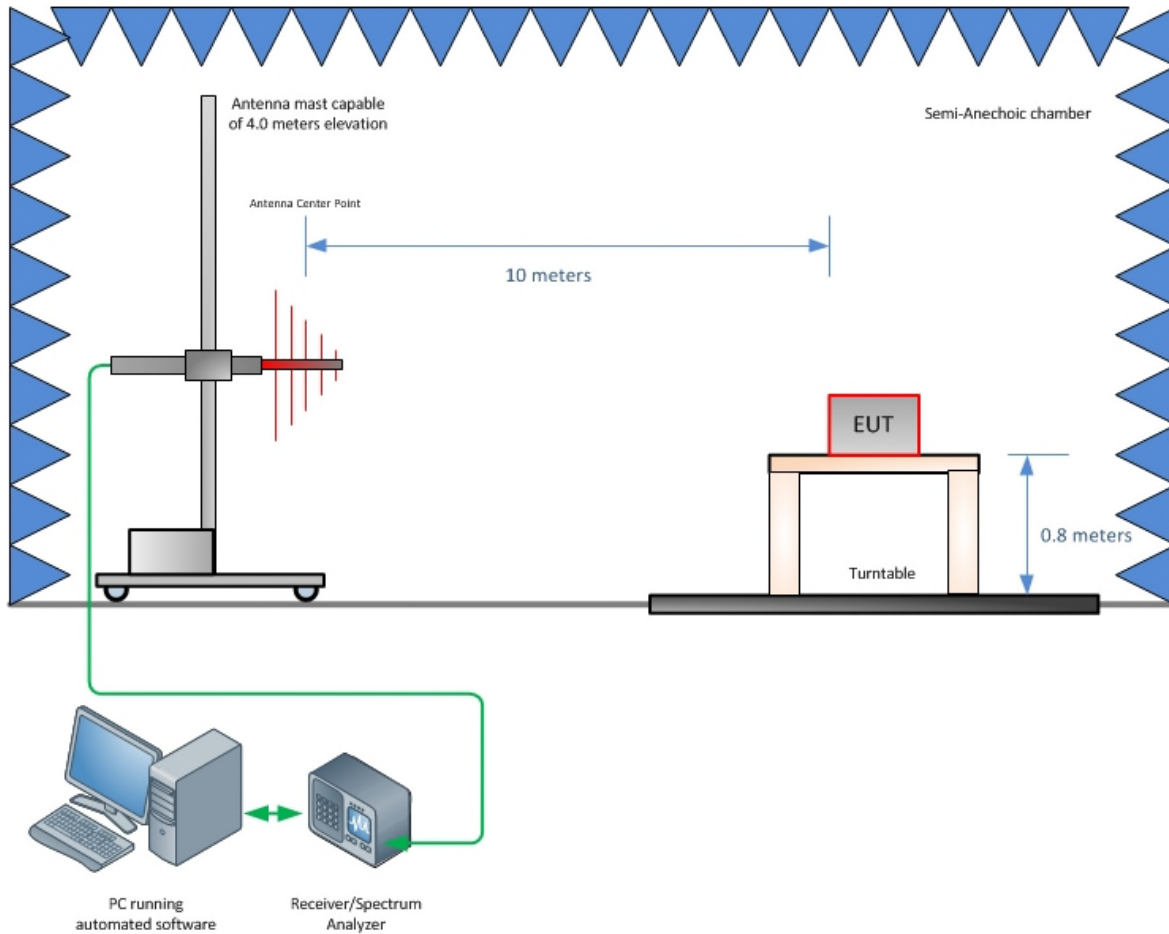
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	2.70	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:					3.56



SECTION 4

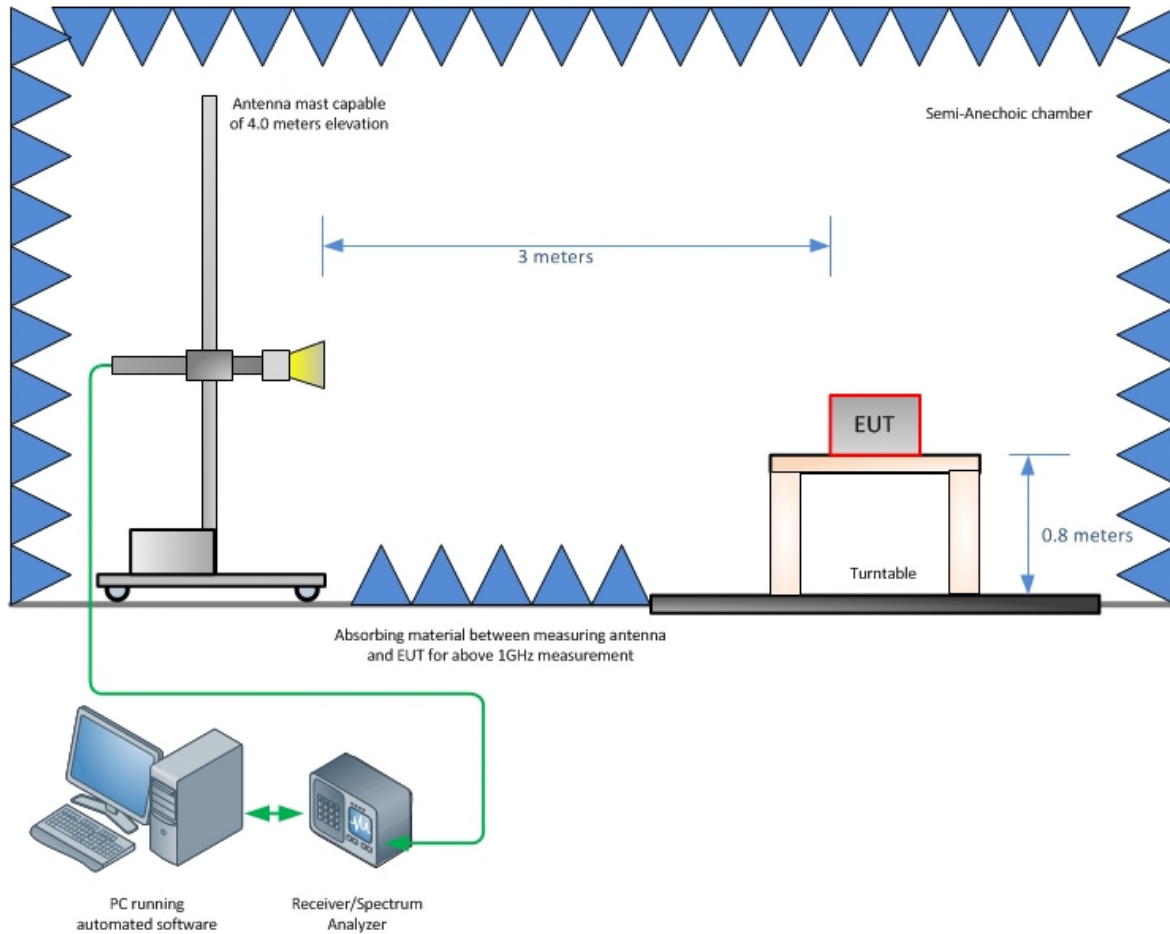
DIAGRAM OF TEST SETUP

4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)



Radiated Emission Test Setup (Below 1GHz)

4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)



Radiated Emission Test Setup (Above 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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