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Report On

Radio Testing of
LDL Technology S.A.S. 14127
WUS HOOK Tire Pressure Monitoring Transmitter

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

Report No. JT72126055-0217A_Rev2

March 2017



REPORT ON	Radio Testing of the LDL Technology S.A.S. Tire Pressure Monitoring Transmitter
TEST REPORT NUMBER	JT72126055-0217A_Rev2
REPORT DATE	March 2017
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APPROVED BY	 Juan Manuel Gonzalez Name Authorized Signatory Title: EMC Service Line Manager Western region
DATED	<u>March 16, 2017</u>



Revision History

JT72126055-0217A_Rev2 LDL Technology S.A.S. 14127 Tire Pressure Monitoring Transmitter					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/07/2017	Initial Release				Juan Manuel Gonzalez
03/15/2017	Initial Release	Rev1	Amend FCC/IC ID's and model Number. Include references to IC RSS	All Doc	Juan Manuel Gonzalez
03/16/2017	Rev1	Rev2	Ammend model from WUSU to WUS	All Doc	Juan M Gonzalez

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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.

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 Name	14127
FCC ID Number	T4514127
IC ID Number	6450A-14127
Serial Number(s)	00038
Number of Samples Tested	1
Test Specification/Issue/Date	FCC Part 15 Subpart C §15.231 (October 1, 2016). RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 9, August 2016). RSS-GEN _General Requirements for Compliance of Radio Apparatus (Issue 4, 2014)
Start of Test	March 02, 2017
Finish of Test	March 02, 2017
Name of Engineer(s)	Ivan Retana
Related Document(s)	Testing SetUp.pdf



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. 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 434 MHz frequency.



Equipment Under Test



1.3.2 EUT General Description

EUT Description	Tire Pressure Monitoring Transmitter
Model Number(s)	14127
Power Source	3.0VDC Internal coin cell battery
EUT Field Strength	84.56 dB μ V/m @ 3meters
Frequency Range	434.000 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
Default	EUT in test mode transmitting continually modulated signal. Configuration used for radiated emissions measurements.

1.4.2 EUT Exercise Software

EUT is loaded with a test firmware allowing continuous modulated transmission using PTU tool to load the following test file:

416132011111-FXTH87_1500KPA_WUSU_HOOK_appli_homologation.wusu3.

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

Not required. EUT is on a standalone configuration.

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 C63.10-2014: 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 C63.10-2014. 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)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 678 1400 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 §2.948 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 (ISED) 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 (ISED) 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: 00038/ Test Configuration A

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

March 03, 2017/IR

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.6°C
Relative Humidity	24.1%
ATM Pressure	98.3 kPa

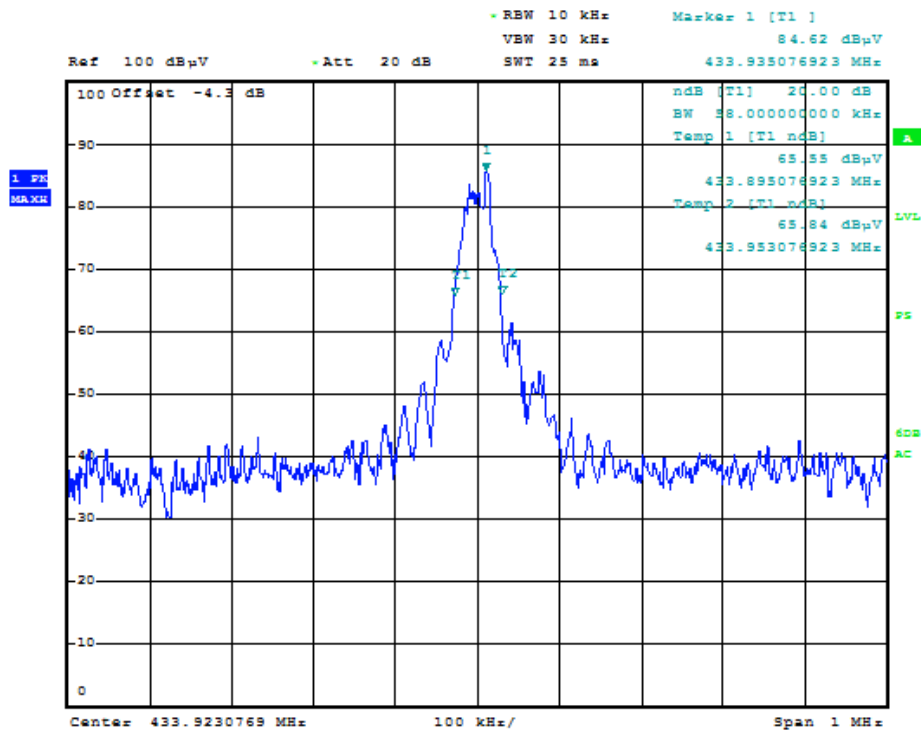
2.1.7 Additional Observations

- 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 analyser was used for FCC Part 15.231 requirement.
- Occupied bandwidth %power set to 99% for ISSED RSS-210 requirement.

2.1.8 Test Results

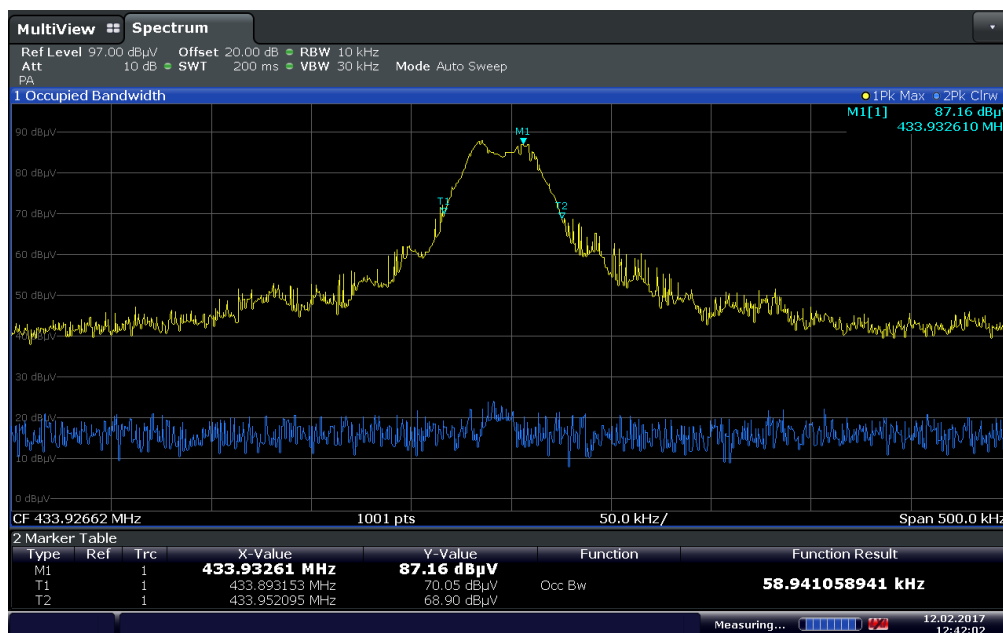
Transmitter Frequency (MHz)	Modulation	0.25% of the center frequency requirement	Measured 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
434.00	FSK	<1.085 MHz	0.058 MHz	0.059 MHz

2.1.9 Test Results Plots



Date: 12.FEB.2017 15:38:40

20 dB Occupied Bandwidth



Date: 12.FEB.2017 12:42:02

99% Occupied Bandwidth

2.2 FIELD STRENGTH OF EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.231(b)

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: 00038 / Test Configuration A

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

March 02, 2017 / IR

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. Rancho Bernardo facility

Ambient Temperature	26.6°C
Relative Humidity	24.1%
ATM Pressure	98.3 kPa

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2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (4.4 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 for spurious emissions. 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.

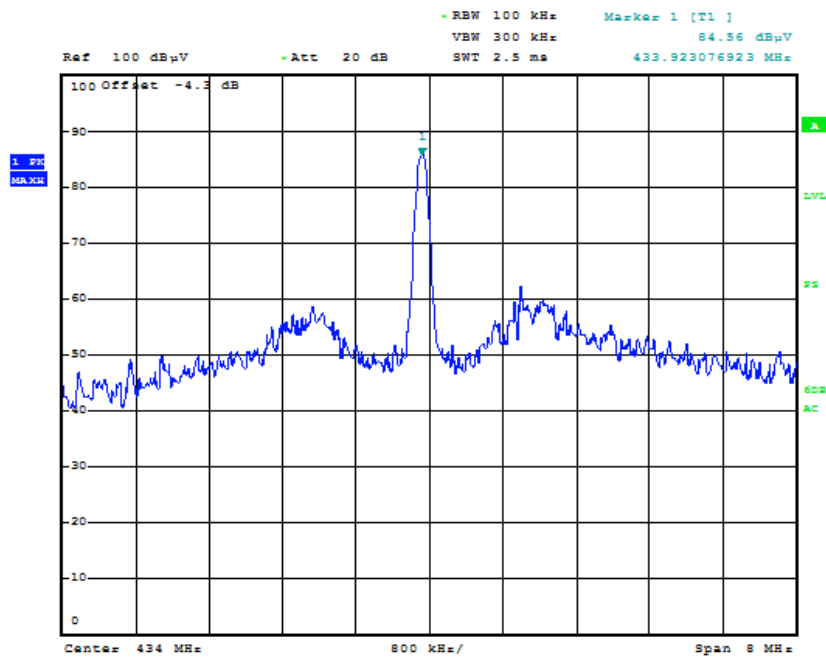
2.2.8 Sample Computation (Radiated Emission)

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 (434 MHz)



Date: 12.FEB.2017 15:28:41

Quasi Peak Data

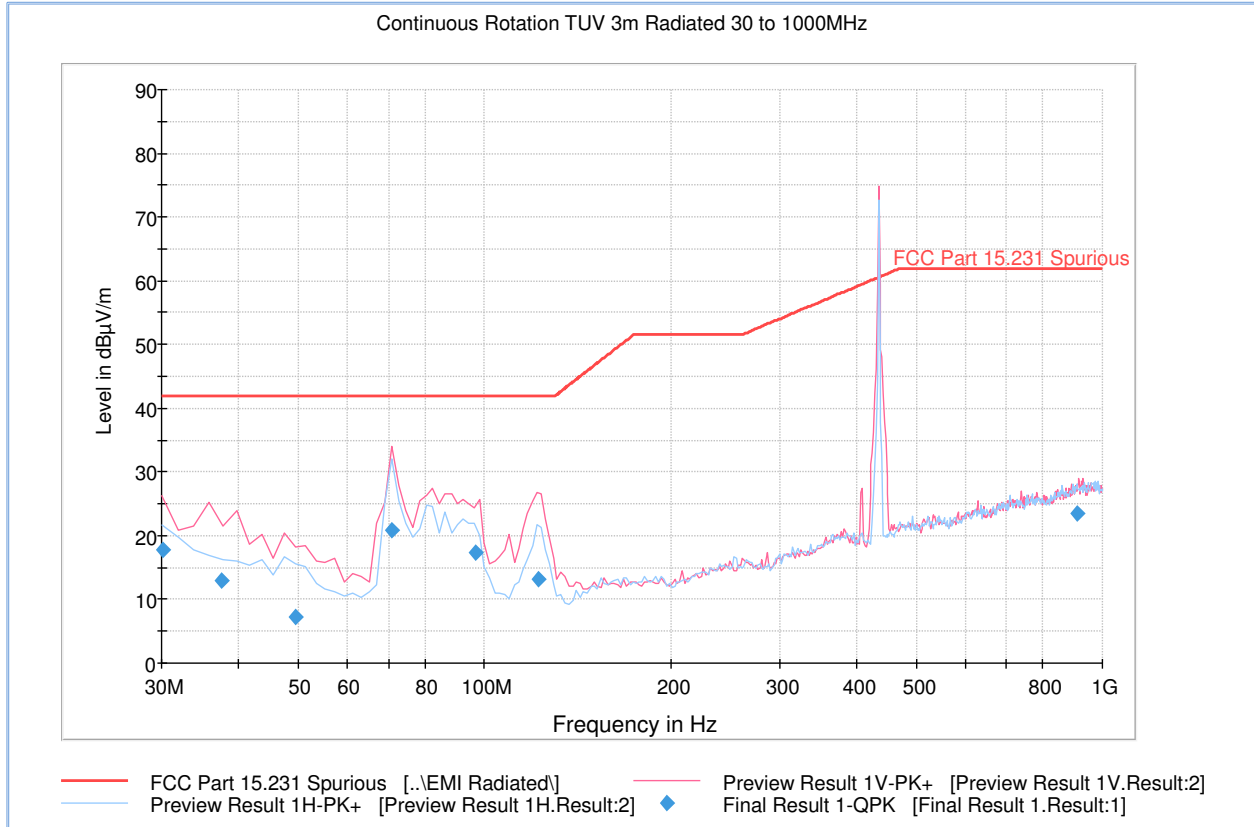
Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
433.92	84.56	2.5	120.000	129.4	V	60.2	4.3	10.24	94.8

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)
433.92	84.56	2.5	120.000	129.4	V	60.2	72.88	1.92	74.8

Test Notes: Duty Cycle Factor of 11.68 dB was used for average emissions calculation. See Section 2.2.13 of this test report for the details on the Duty Cycle Factor calculation.

2.2.11 Spurious Emissions (30 MHz to 1 GHz)

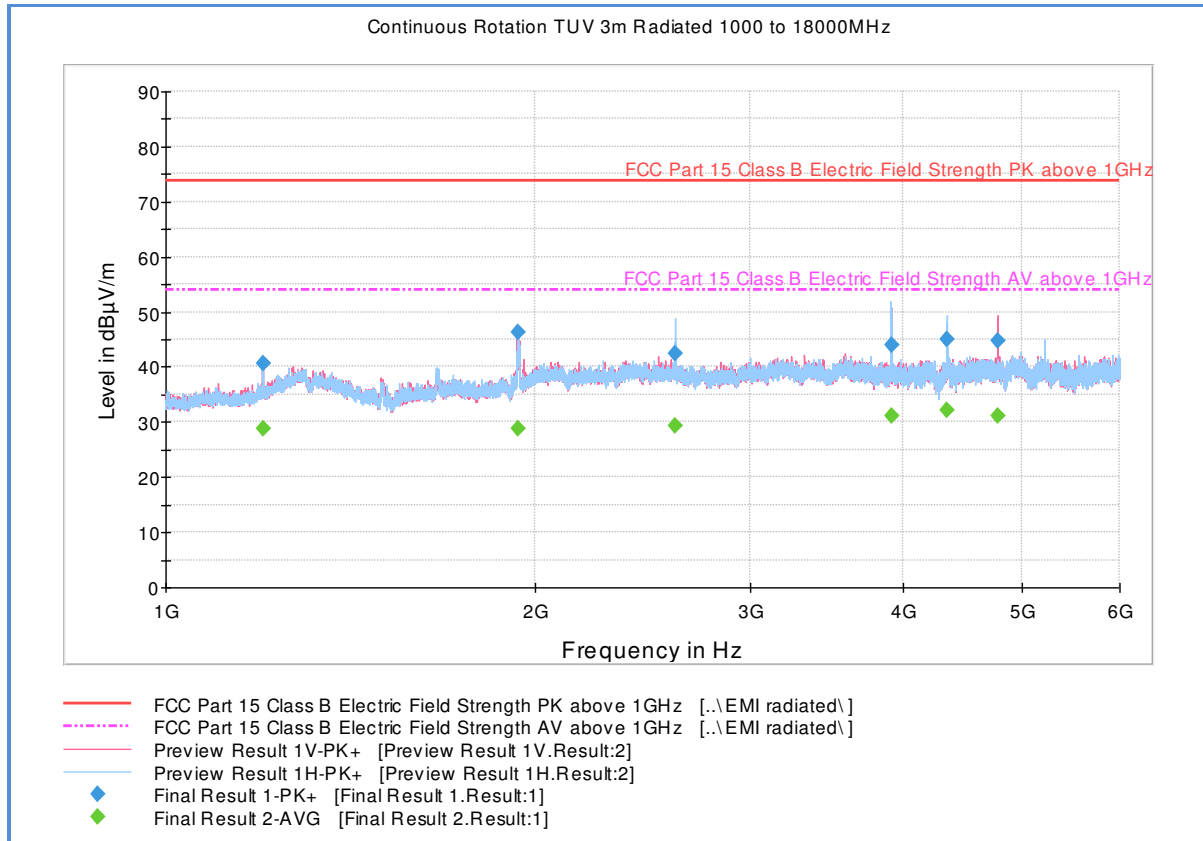


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.160000	17.9	1000.0	120.000	117.0	V	328.0	-7.0	24.1	41.9
37.431663	12.8	1000.0	120.000	155.0	V	135.0	-11.9	29.1	41.9
49.334990	7.2	1000.0	120.000	120.0	V	155.0	-15.1	34.7	41.9
70.701643	20.8	1000.0	120.000	400.0	V	11.0	-17.7	21.1	41.9
96.676072	17.4	1000.0	120.000	284.0	V	-8.0	-15.7	24.6	41.9
122.202725	13.2	1000.0	120.000	100.0	V	119.0	-16.7	28.7	41.9
433.488657	Fundamental Frequency								
911.748938	23.5	1000.0	120.000	366.0	V	206.0	5.6	38.4	61.9

Test Notes:

2.2.12 Test Results Above 1 GHz



Peak Data

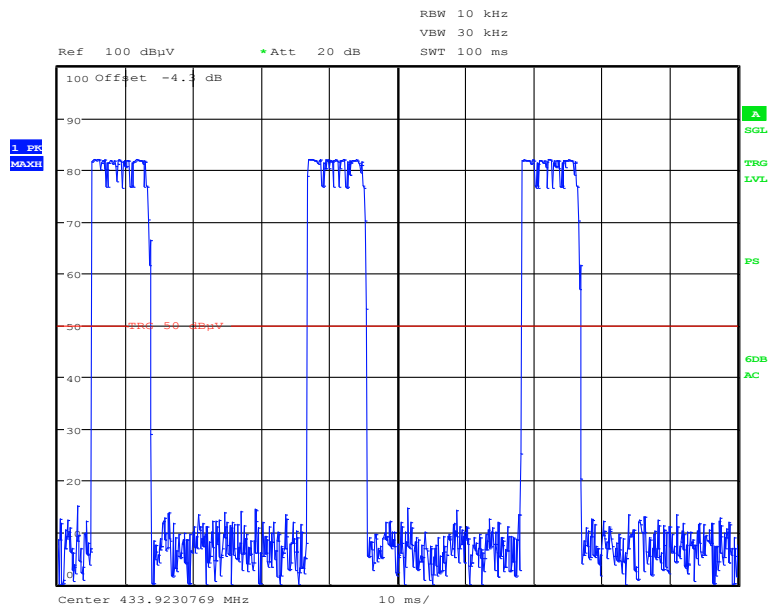
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1199.800000	40.7	1000.0	1000.000	274.3	V	10.0	-6.7	33.2	73.9
1938.700000	46.3	1000.0	1000.000	195.5	H	80.0	-2.2	27.6	73.9
2603.333333	42.4	1000.0	1000.000	134.7	H	154.0	-0.7	31.5	73.9
3906.300000	43.9	1000.0	1000.000	174.6	H	214.0	2.2	30.0	73.9
4339.900000	45.0	1000.0	1000.000	280.2	H	269.0	2.6	28.9	73.9
4772.166667	44.9	1000.0	1000.000	115.7	V	16.0	3.2	29.0	73.9

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)
1199.800000	28.8	1000.	1000.000	274.3	V	10.0	-6.7	25.1	53.9
1938.700000	28.7	1000.	1000.000	195.5	H	80.0	-2.2	25.2	53.9
2603.333333	29.4	1000.	1000.000	134.7	H	154.0	-0.7	24.5	53.9
3906.300000	31.1	1000.	1000.000	174.6	H	214.0	2.2	22.8	53.9
4339.900000	32.1	1000.	1000.000	280.2	H	269.0	2.6	21.8	53.9
4772.166667	31.2	1000.	1000.000	115.7	V	16.0	3.2	22.7	53.9

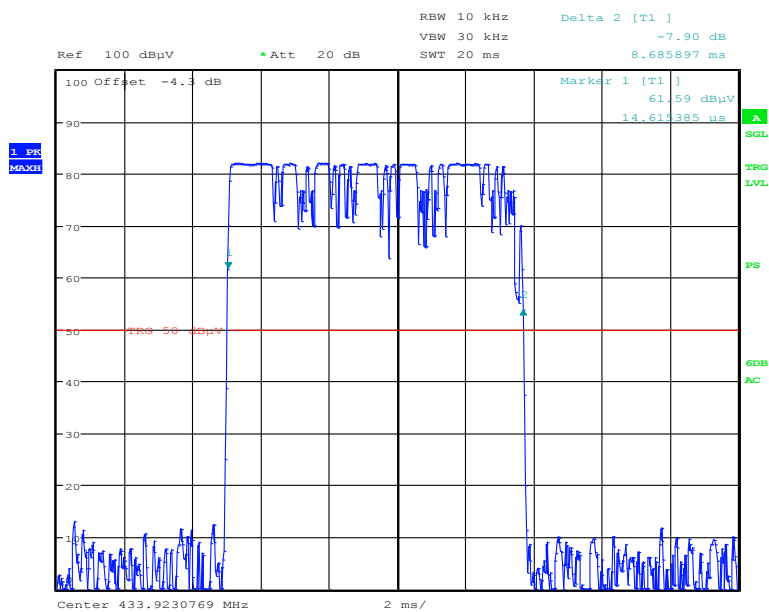
Test Notes:

2.2.13 Test Results Duty Cycle Factor



Date: 12.FEB.2017 15:46:05

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



Date: 12.FEB.2017 15:47:16

Pulse width: T1=8.68 ms



Calculated Duty Cycle (X)= $(T1+T2+T3)/T$
 $(8.68\text{ms} \times 3) / 100\text{ms}$
 $26.04 \text{ ms}/100\text{ms}$
 $0.2604 \text{ or } 26.04\%$

Duty Cycle Correction Factor= $20 \log (1/X)$
 $20 \log (1/0.2604)$
 11.68 dB

FCC ID T4514127
IC ID 6450A-14127

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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						
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	05/12/16	05/12/17
8849	High-frequency cable	SAC-26G-6.1	363	A.H.Systems	03/17/16	03/17/17
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/16	10/26/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/09/17	02/09/18
1016	Pre-amplifier	PAM-0202	187	PAM	02/09/17	02/09/18
Miscellaneous						
	Test Software	EMC32	V9.26.0	Rhode & Schwarz	N/A	
7554	Barometer/Temperature/Hu midity Transmitter	iBTHX-W	0400706	Omega	01/17/17	01/17/18

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)

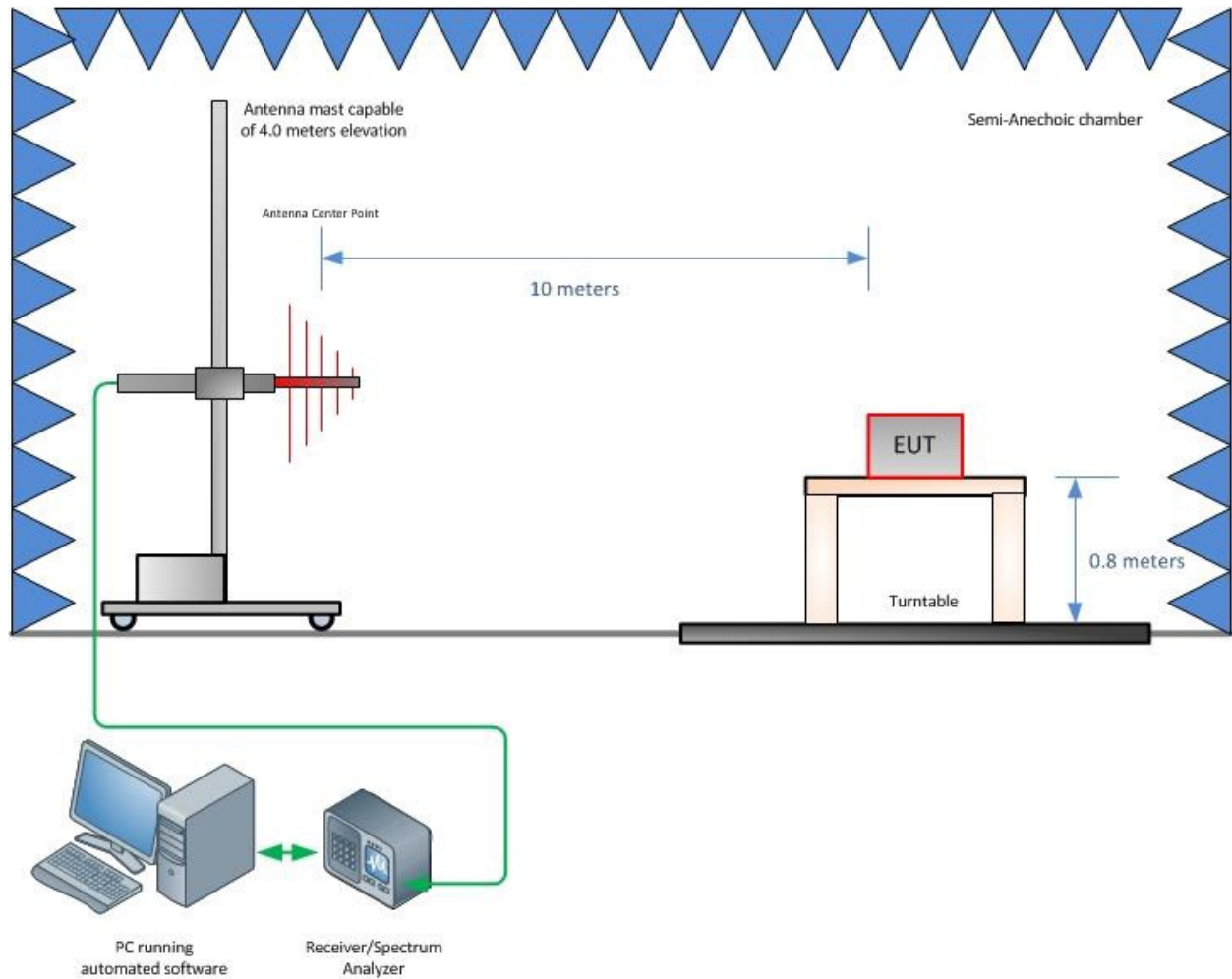
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	2.70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

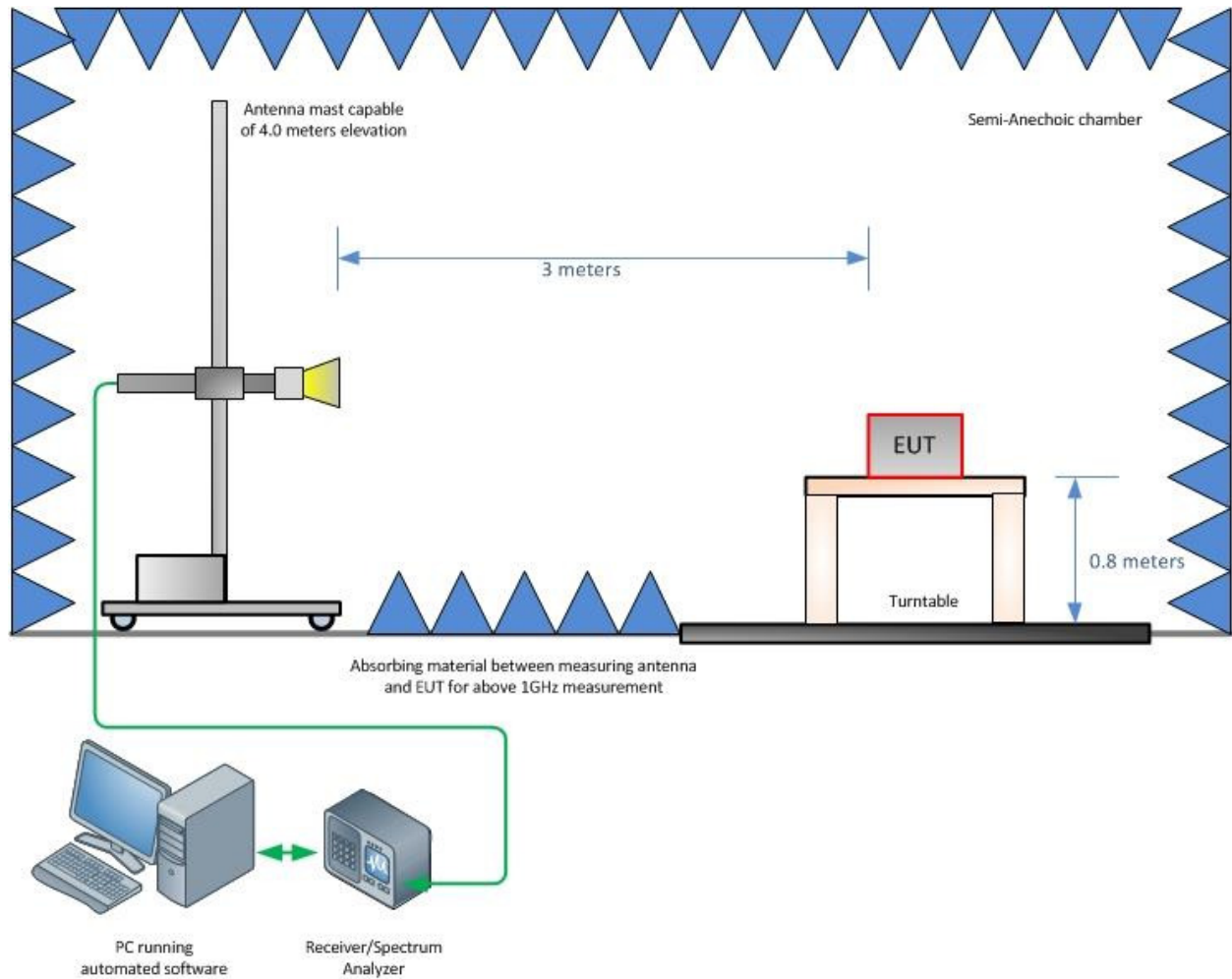
DIAGRAM OF TEST SETUP

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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