



America

**Choose certainty.
Add value.**

Report On

Radio Testing of the
Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
E2016/5 Remote Control Transmitter / Transceiver

FCC Part 15 Subpart C §15.249

Report No. SD72119117-0816A

August 2016



America

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

REPORT ON Radio Testing of the
Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
E2016/5 Remote Control Transmitter / Transceiver

TEST REPORT NUMBER SD72119117-0816A

PREPARED FOR Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
Pfählerstr. 1
D-66125 Saarbrücken

CONTACT PERSON Mr. Michael Leffer

PREPARED BY 
Juan Manuel Gonzalez
Name
Title: EMC Service Line Manager Western region

APPROVED BY 
Fleury Chip
Name
Authorized Signatory
Title: Regional EMC manager

DATED August 08, 2016



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

Revision History

SD72119117-0816A					
Stahl- und Apparatebau Hans Leffer GmbH & Co. KG E2016/5 Remote Control Transmitter / Transceiver					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/05/2016	Initial Release				Juan M Gonzalez



CONTENTS

Section	Page No
1	REPORT SUMMARY 5
1.1	Introduction 6
1.2	Brief Summary Of Results 7
1.3	Product Information 8
1.4	Eut Test Configuration 10
1.5	Deviations From The Standard..... 12
1.6	Modification Record 12
1.7	Test Methodology 12
1.8	Test Facility Location 12
1.9	Test Facility Registration 12
2	TEST DETAILS 13
2.1	20 dB Bandwidth..... 14
2.2	Field Strength Limits For Fundamental And Harmonics..... 17
2.3	Radiated Spurious Emissions..... 23
3	TEST EQUIPMENT USED 24
3.1	Test Equipment Used 25
3.2	Measurement Uncertainty 26
4	DIAGRAM OF TEST SETUP 27
4.1	Radiated Emission Test Setup (Below 1ghz) 28
4.2	Radiated Emission Test Setup (Above 1ghz)..... 29
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT..... 30
5.1	Accreditation, Disclaimers And Copyright 31



SECTION 1

1REPORT SUMMARY

Radio Testing of the
Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
E2016/5 Remote Control Transmitter / Transceiver



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Stahl- und Apparatebau Hans Leffer GmbH & Co. KG E2016/5 Remote Control Transmitter / Transceiver to the requirements of FCC Part 15 Subpart C §15.249.

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	Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
Model Name	E2016/5
FCC ID Number	2AHMMSHT12LEFFER
IC Number	21190-SHT12LEFFER
Serial Number(s)	Engineering Sample
Number of Samples Tested	1
Test Specification/Issue/Date	FCC Part 15 Subpart C §15.249 (October 1, 2015).
Start of Test	August 1, 2016
Finish of Test	August 2, 2016
Name of Engineer(s)	Juan M. Gonzalez
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 §15.249 standard is shown below:

Section	Spec Clause	Test Description	Result	Comments/Base Standard
-	§15.107	Conducted Limits	N/A ¹	See Note
2.1	§15.215(c)	20 dB Bandwidth	Compliant	
2.2	§15.249(a)	Field Strength Limits for Fundamental and Harmonics	Compliant	
2.3	§15.249(d)	Radiated Spurious Emissions	Compliant	

Note: N/A¹: *Not applicable, EUT is battery powered.*

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Stahl- und Apparatebau Hans Leffer GmbH & Co. KG E2016/5 Remote Control Transmitter / Transceiver as shown in the photograph below.



Equipment Under Test



1.3.2 EUT General Description

EUT Description	Remote Control Transmitter / Transceiver
Model Name	E2016/5
Rated Voltage	4.5 VDC (3 x AAA batteries)
Output Power	93.90 dBμV/m @ 3 meters
Frequency Range	910.0MHz to 910.9MHz in the 902 MHz to 928 MHz Band
Number of Operating Frequencies	4
Modulation	FSK
Channels Verified	Mid Channel 910.3MHz * *Per FCC §15.31(m): When the frequency range over which device operates ≤ 1MHz the measurements can be limited to the middle channel.
Antenna Type	Integral

1.3.3 Antenna Details

Antenna Type	Integrated coil antenna
Antenna Size/length	0.5cm x 4.5 cm

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT was configured to transmit continuously at Mid Channel.

1.4.2 EUT Exercise Software

EUT is loaded with a test firmware allowing continuous transmission (test mode) at test frequencies.

1.4.3 Support Equipment and I/O cables

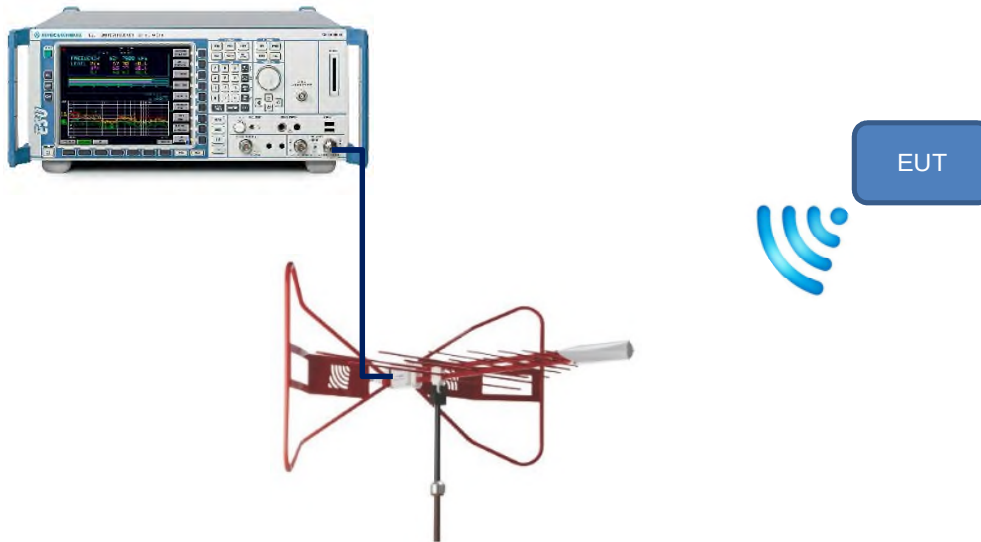
Manufacturer	Equipment/Cable	Model	Description

1.4.4 Worst Case Configuration

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



1.4.5 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 Engineering Sample		
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.

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

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 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

2TEST DETAILS

Radio Testing of the
Stahl- und Apparatebau Hans Leffer GmbH & Co. KG
E2016/5 Remote Control Transmitter / Transceiver



2.1 20 dB BANDWIDTH

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.215(c)

2.1.2 Standard Applicable

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

2.1.3 Equipment Under Test and Modification State

Serial No: Engineering Sample / Default Test Configuration

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

August 01, 2016/JMG

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. Mira Mesa facility

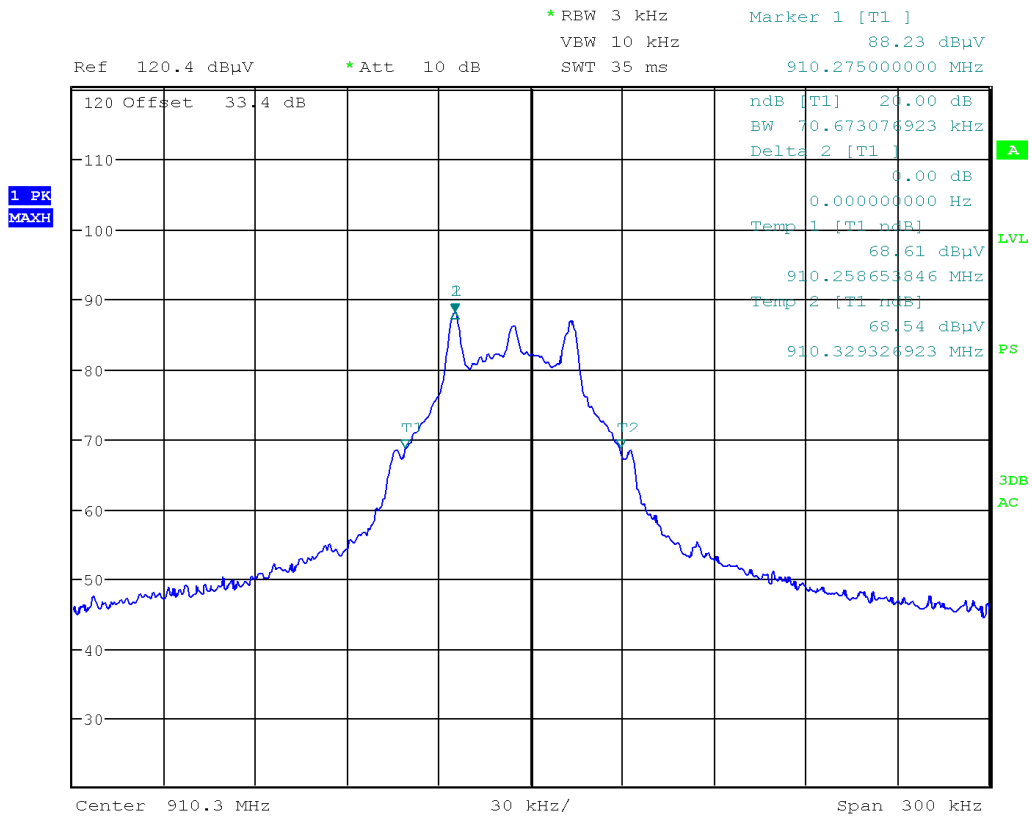
Ambient Temperature	24.1°C
Relative Humidity	51.2%
ATM Pressure	98.9 kPa

2.1.7 Additional Observations

- This is a radiated test.
- “n dB down” marker function of the Spectrum Analyzer used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the Span, VBW is 3XRBW.
- An offset of 33.4 dB was added to compensate antenna CF and cable losses.
- Sweep is auto.
- Detector is peak.
- Trace is max hold.

2.1.8 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
MID Channel	910.3	70.67



Mid Channel (910.3 MHz)

2.1.9 Test set up pictures





2.2 FIELD STRENGTH LIMITS FOR FUNDAMENTAL AND HARMONICS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.249(a)

2.2.2 Standard Applicable

(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of fundamental (dBμV/m)	Field strength of harmonics (microvolts/meter)	Field strength of harmonics (dBμV/m)
902–928 MHz	50	93.98	500	53.98
2400–2483.5 MHz	50	93.98	500	53.98
5725–5875 MHz	50	93.98	500	53.98
24.0–24.25 GHz	250	107.96	2500	67.96

The field strength limits in paragraphs (a) of this section are based on average limits.

2.2.3 Equipment Under Test and Modification State

Serial No: Engineering Sample / Default Test Configuration

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

August 01-02, 2016/JMG

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	24.1°C	23.5°C
Relative Humidity	51.2%	53.2%
ATM Pressure	98.9 kPa	99.1 kPa

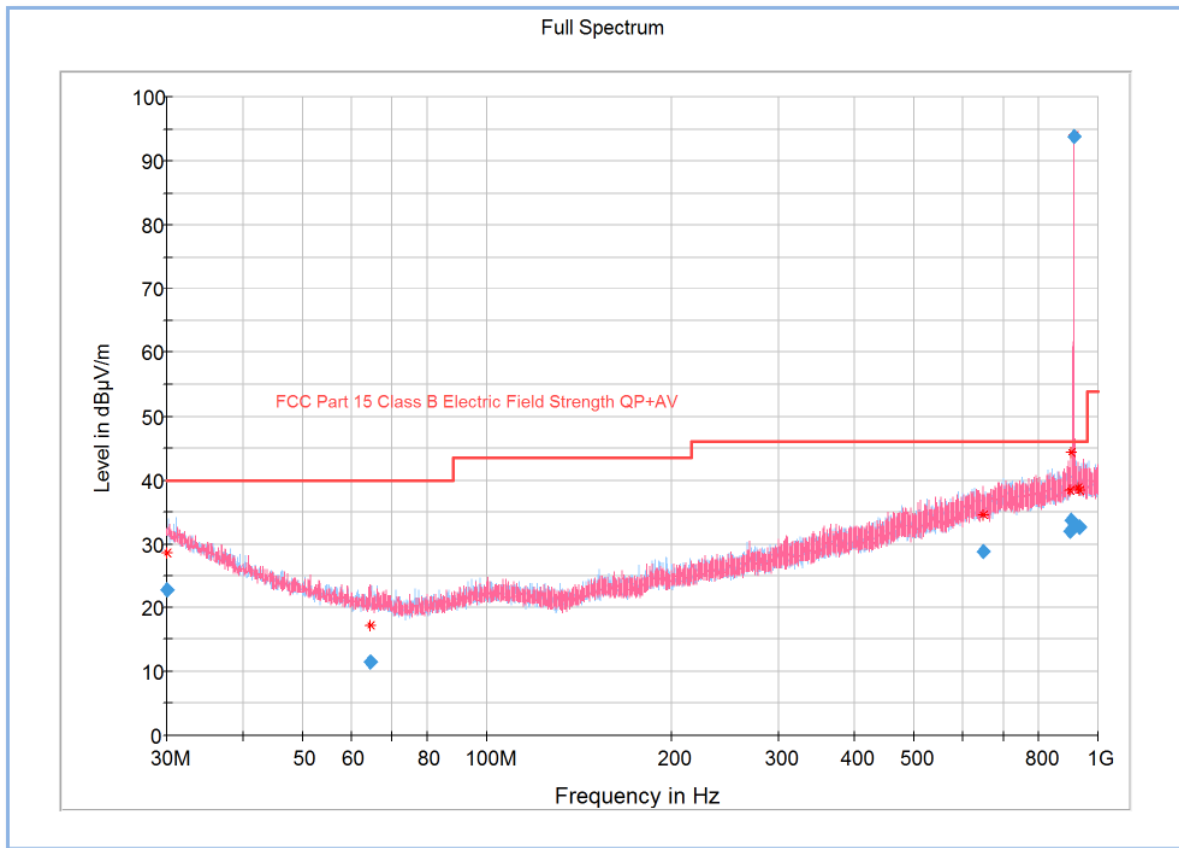
2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 1GHz to at least the 10th harmonic (10GHz).
- Measurement was done using EMC32 V9.26.0 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.

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# 1033 (antenna)	17.2	
Reported QuasiPeak Final Measurement (db μ V/m) @ 30MHz			11.8

2.2.9 Test Results for Mid Channel 910.3MHz below 1GHz (Fundamental, Band Edges and Immediate Restricted Bands)

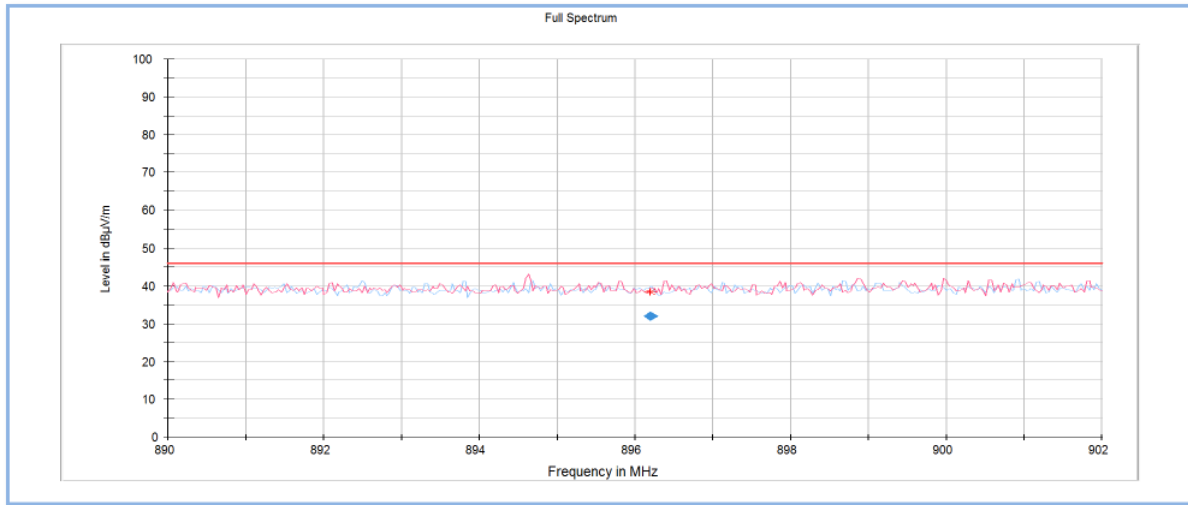


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
30.000000	22.80	40.00	17.20	1000.0	120.000	140.4	H	181.0	25.0	
64.470667	11.48	40.00	28.52	1000.0	120.000	150.0	H	187.0	14.0	
649.646333	28.89	46.00	17.11	1000.0	120.000	204.8	V	249.0	29.4	
896.185667	32.10	46.00	13.90	1000.0	120.000	324.4	V	128.0	32.9	
903.116000	33.72	46.00	12.28	1000.0	120.000	106.1	V	46.0	33.2	
910.299667	93.90	94.00	0.10	1000.0	120.000	106.6	V	237.0	33.4	Fundamental
929.793333	32.79	46.00	13.21	1000.0	120.000	167.1	H	303.0	33.5	
929.793333	32.79	46.00	13.21	1000.0	120.000	167.1	H	303.0	33.5	

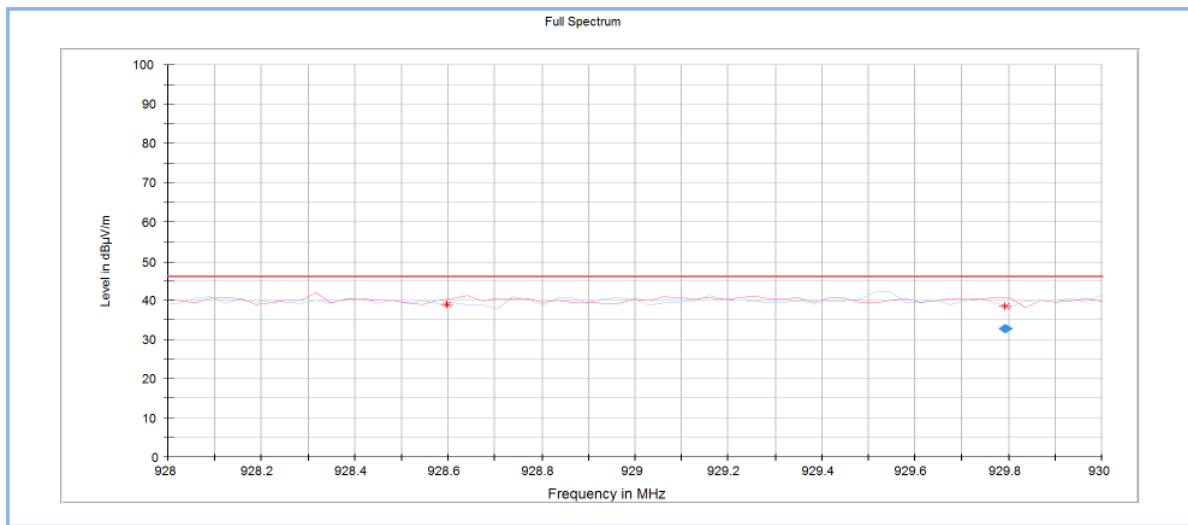
Test Notes: All spurious emissions complies with the general requirement of 15.209 and 15.249. The fundamental complies with 15.249.

Test Results Mid Channel 910.3 MHz (Band Edges)



Low Band Edge

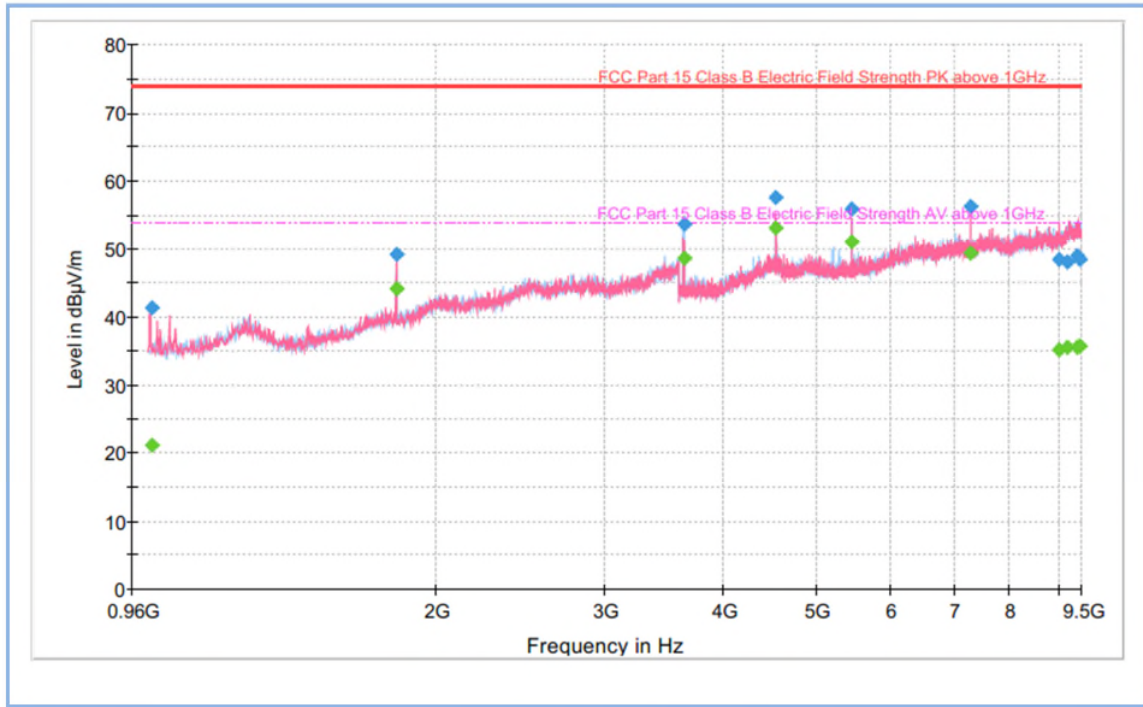
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
896.185667	32.10	46.00	13.90	1000.0	120.000	324.4	V	128.0	32.9	



High Band Edge

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
929.793333	32.79	46.00	13.21	1000.0	120.000	167.1	H	303.0	33.5	

Test Results for mid Channel 910.3 MHz above 1GHz (Harmonics)



Final Result PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1008.600000	41.25	73.90	32.65	1000.0	1000.000	215.4	V	90.0	-1.9	
1820.400000	49.10	73.90	24.80	1000.0	1000.000	301.9	V	233.0	2.2	
3641.100000	53.67	73.90	20.23	1000.0	1000.000	189.8	H	331.0	7.0	
4551.500000	57.66	73.90	16.24	1000.0	1000.000	150.3	V	263.0	10.9	
5461.800000	55.98	73.90	17.92	1000.0	1000.000	135.7	H	350.0	11.4	
7282.100000	56.31	73.90	17.59	1000.0	1000.000	122.4	V	3.0	14.6	
9016.500000	48.48	73.90	25.42	1000.0	1000.000	150.2	V	268.0	16.6	
9202.600000	48.08	73.90	25.82	1000.0	1000.000	405.9	V	12.0	17.1	
9390.500000	48.93	73.90	24.97	1000.0	1000.000	311.5	H	143.0	17.5	
9483.300000	48.46	73.90	25.44	1000.0	1000.000	154.3	H	72.0	17.6	
11105.900000	51.53	73.90	22.37	1000.0	1000.000	410.2	H	332.0	20.6	
16582.000000	57.90	73.90	16.00	1000.0	1000.000	250.0	H	266.0	26.8	

Final Result AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1008.600000	21.12	53.90	32.78	1000.0	1000.000	215.4	V	90.0	-1.9	
1820.400000	44.11	53.90	9.79	1000.0	1000.000	301.9	V	233.0	2.2	
3641.100000	48.68	53.90	5.22	1000.0	1000.000	189.8	H	331.0	7.0	
4551.500000	53.12	53.90	0.78	1000.0	1000.000	150.3	V	263.0	10.9	
5461.800000	51.00	53.90	2.90	1000.0	1000.000	135.7	H	350.0	11.4	
7282.100000	49.42	53.90	4.48	1000.0	1000.000	122.4	V	3.0	14.6	
9016.500000	35.23	53.90	18.67	1000.0	1000.000	150.2	V	268.0	16.6	
9202.600000	35.51	53.90	18.39	1000.0	1000.000	405.9	V	12.0	17.1	
9390.500000	35.59	53.90	18.31	1000.0	1000.000	311.5	H	143.0	17.5	
9483.300000	35.68	53.90	18.22	1000.0	1000.000	154.3	H	72.0	17.6	
11105.900000	38.59	53.90	15.31	1000.0	1000.000	410.2	H	332.0	20.6	
16582.000000	45.09	53.90	8.81	1000.0	1000.000	250.0	H	266.0	26.8	

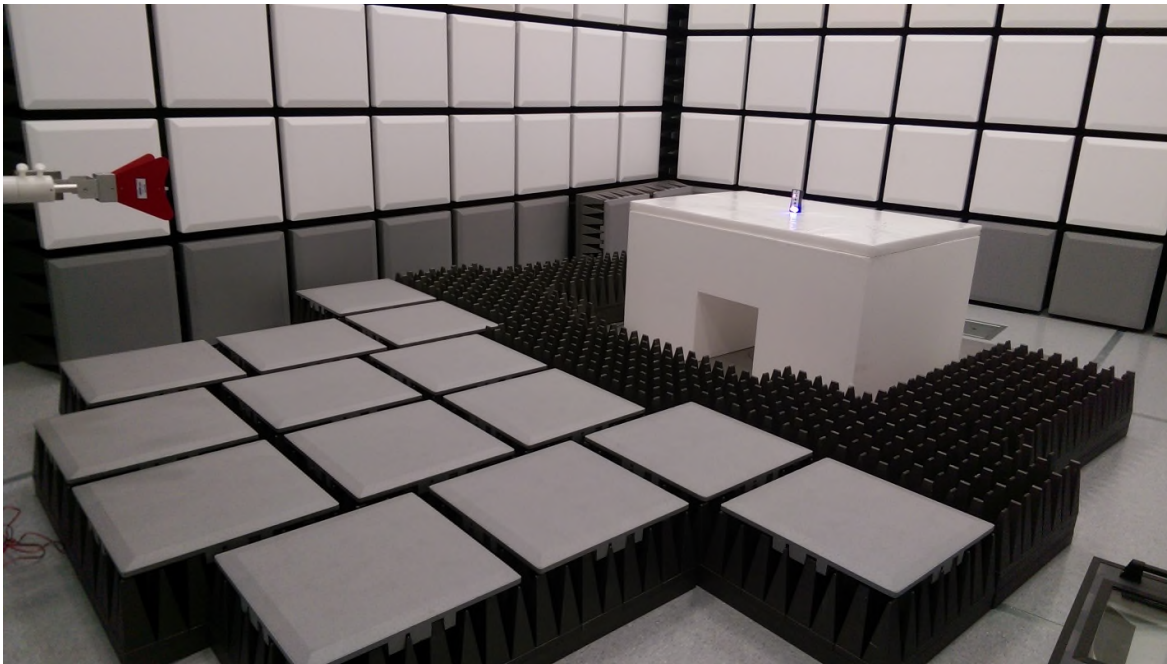
Test Notes: All harmonics complies with the general requirement of 15.209.

2.2.10 Test set up pictures

Below 1 GHz



Above 1 GHz





2.3 RADIATED SPURIOUS EMISSIONS

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.249(d)

2.3.2 Standard Applicable

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

2.3.3 Equipment Under Test and Modification State

Serial No: Engineering Sample / Default Test Configuration

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

August 01, 2016/JMG

2.3.5 Test Equipment Used

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

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	24.1°C
Relative Humidity	51.2%
ATM Pressure	98.9 kPa

2.3.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to at least the 10th harmonic (10GHz).
- The measurement results are identical to test results presented under Section 2.2.9 of this test report. No other significant spurious emissions observed other than harmonics of the fundamental frequency.



SECTION 3

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 Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
7631	Double-ridged waveguide horn antenna	3117	00205418	EMCO	02/04/16	07/05/16
08891	Pre-amplifier 1-18GHz	PE15A3262	1012	Pasternack	04/29/16	04/29/16
7620	EMI Test Receiver	ESU	100399	Rhode & Schwarz	08/24/15	08/24/15
Miscellaneous						
	Test Software	EMC32	V9.26.0	Rhode & Schwarz	N/A	

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	3.55	2.05	4.20
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.23
Coverage Factor (k):					2
Expanded Uncertainty:					4.45

3.2.2 Radiated Emission Measurements (Above 1GHz)

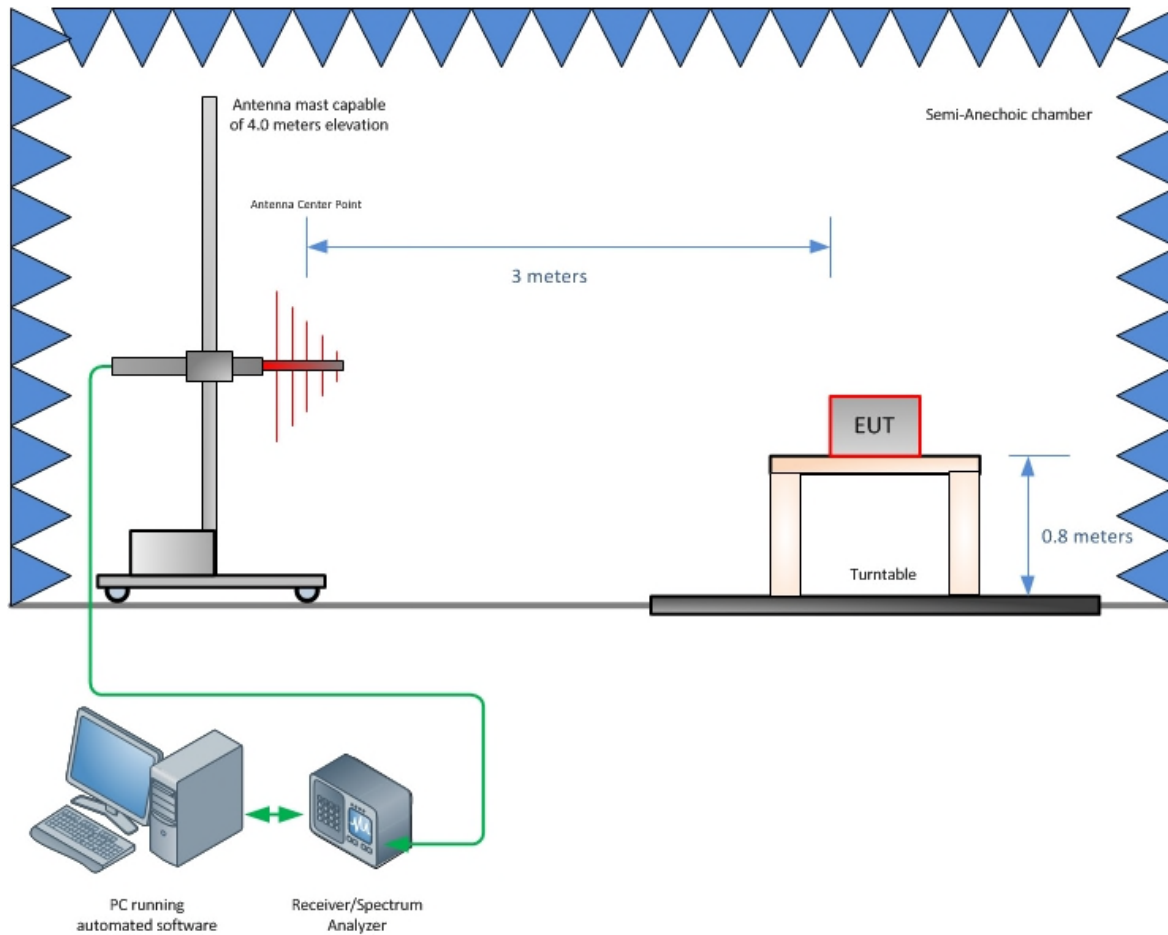
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.55	2.05	4.20
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.22
Coverage Factor (k):					2
Expanded Uncertainty:					4.44



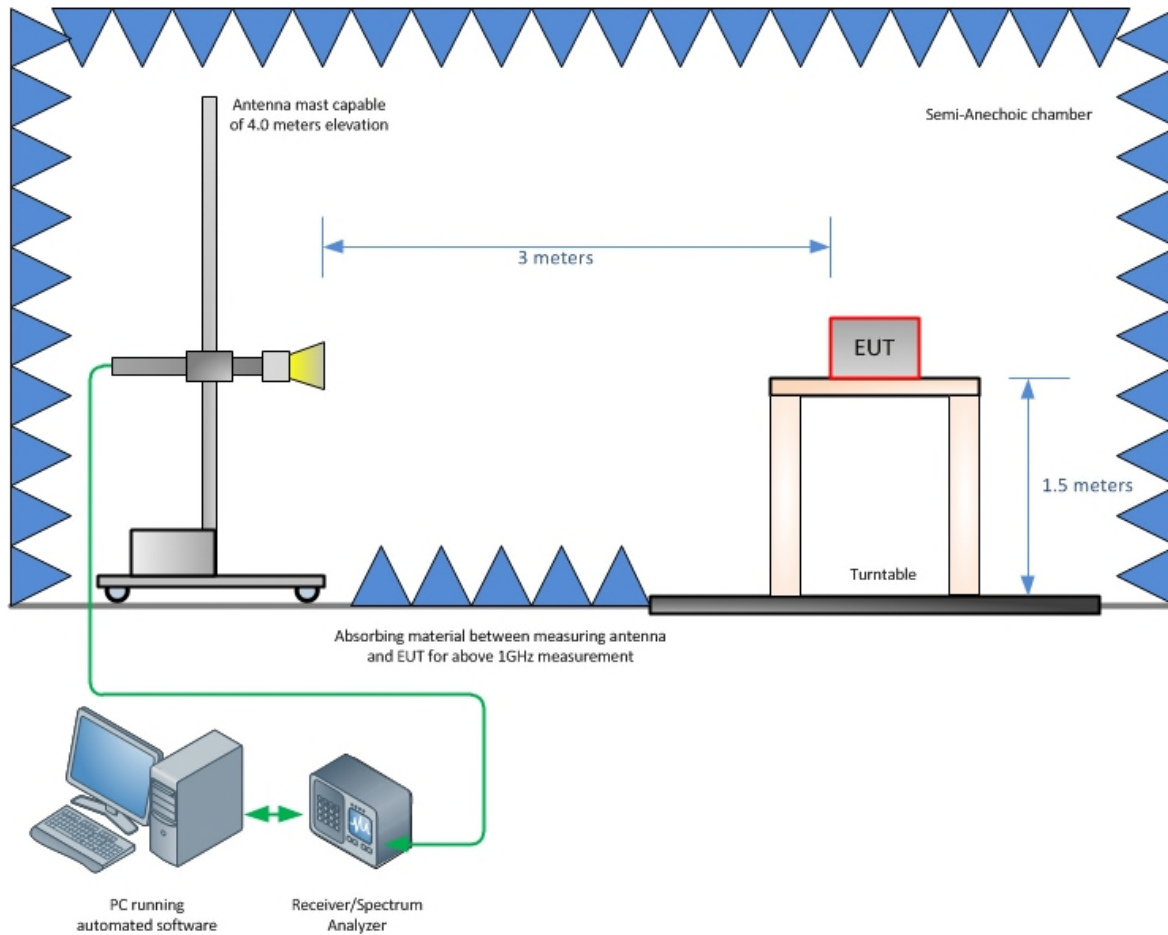
SECTION 4

4DIAGRAM OF TEST SETUP

4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)



4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)





SECTION 5

5ACCREDITATION, 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.

This report is the confidential property of the client. As a mutual protection to our clients, the public and TÜV SÜD America, Inc., extracts from the test report shall not be reproduced, except in full without TÜV SÜD America, Inc.'s written approval.

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal government.

TÜV SÜD America, Inc. and its professional staff hold government and professional organization certifications for AAMI, ACIL, AEA, ANSI, IEEE, A2LA, NIST and VCCI.



A2LA Cert. No. 2955.13