



America

**Choose certainty.
Add value.**

Report On

Radio Testing of the
Sphinx Electronics GmbH &Co. KG
WT210-BLE RFID Access control system

FCC Part 15 Subpart C §15.225
IC RSS-210 Issue 9 August 2016

Report No. SD72119117-0816F_Rev1.0

September 2016




REPORT ON Radio Testing of the
Sphinx Electronics GmbH &Co. KG
RFID Access control system

TEST REPORT NUMBER SD72119117-0816F_Rev1.0

REPORT DATE September 2016

PREPARED FOR Mr. Marco Bürgel
Tullastr. 3
79341, Kenzingen, Germany

+49 76 44 92 28 51
marco.buergel@sphinx-electronics.de

PREPARED BY 

Name Nikolay Shtin
Title: EMC/Wireless Test Engineer

APPROVED BY 

Name Juan Manuel Gonzalez
Title: Authorized Signatory
EMC Service Line Manager Western region

DATED September 21, 2016



Revision History

SD72119117-0816F_Rev1.0 Sphinx Electronics GmbH &Co. KG WT210-BLE RFID Access control system					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/31/2016	Initial Release				Juan Manuel Gonzalez
09/21/2016	Initial Release	Rev 1.0	Include references to RSS-210 standard	All Doc.	Juan Manuel 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 11
1.6	Modification Record 11
1.7	Test Methodology 11
1.8	Test Facility Location 11
1.9	Test Facility Registration 11
2	TEST DETAILS 13
2.1	Frequency Stability 14
2.2	20 Db Bandwidth 17
2.3	99% Emission Bandwidth 20
2.4	Emission Mask 22
2.5	Spurious Radiated Emissions 26
3	TEST EQUIPMENT USED 34
3.1	Test Equipment Used 35
3.2	Measurement Uncertainty 36
4	DIAGRAM OF TEST SETUP 37
4.1	Test Setup Diagram (Emission Mask) 38
4.2	Test Setup Diagram (Radiated Emissions 30 To 1000 Mhz) 39
4.3	Test Setup Diagram (Radiated Emissions Above 1 Ghz) 40
4.4	Test Setup Diagram (Frequency Stability) 41
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 42
5.1	Accreditation, Disclaimers And Copyright 43



SECTION 1

REPORT SUMMARY

Radio Testing of the
WT210-BLE
Sphinx Electronics GmbH &Co. KG
RFID Access control system



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Sphinx Electronics GmbH & Co. KG RFID Access control system to the requirements of FCC Part 15 Subpart C §15.225.

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	Sphinx Electronics GmbH & Co. KG
Model Number(s)	WT210-BLE
FCC ID Number	TCN017
IC Number	5103A-017
Serial Number(s)	Engineering Sample
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC Part 15 Subpart C §15.225 (October 1, 2015).• RSS-210 (Issue 9, August 2016) - Licence-exempt Radio Apparatus: Category I Equipment.• RSS-Gen (Issue 4, November 2014) - General Requirements for Compliance of Radio Apparatus.
Start of Test	August 12, 2016
Finish of Test	August 17, 2016
Name of Engineer(s)	Nikolay Shtin
Related Document(s)	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 §15.225 with cross-reference to the corresponding IC RSS standard is shown below.

Section	FCC Part 15	§15.225 Spec Clause	RSS	Test Description	Result	Comments/Base Standard
	§15.31(e)			Voltage Requirement	Compliant	§15.225(e)
	§15.203 and 204		RSS-Gen 8.3	Antenna Requirements	Compliant	*)
2.1		§15.225(e)	RSS-210 B.6 RSS-Gen 6.11 RSS-Gen 8.11	Frequency Tolerance	Compliant	
2.2	§15.215(c)			20dB Bandwidth	Compliant	
2.3			RSS-Gen 6.6	99% Emission Bandwidth	Compliant	
2.4		§15.225(a)(b)(c)	RSS-210 B.6(a)(b)(c)	Emission Mask	Compliant	
2.5	§15.209	§15.225(d)	RSS-210 B.6(d)	Spurious Radiated Emissions	Compliant	
2.5.14			RSS-Gen 7.1	Receiver Spurious Emissions	Compliant	
		§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A **)	

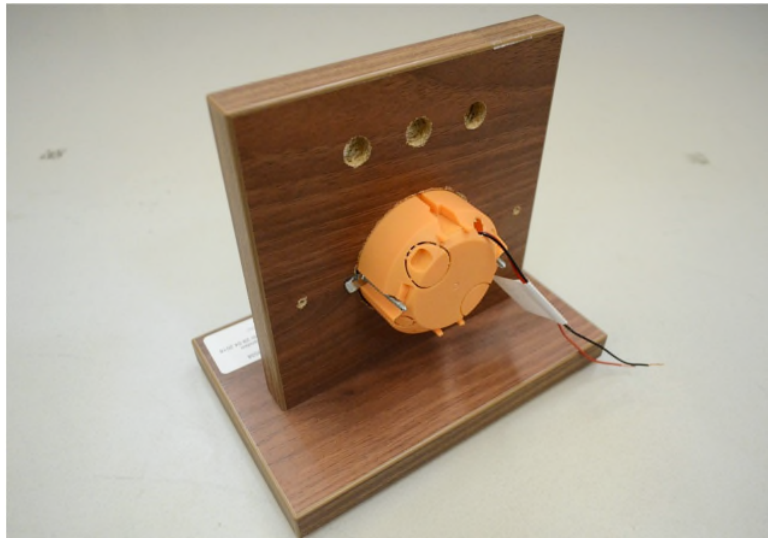
*) This requirement does not apply to intentional radiators that are professionally installed.

***) EUT is a battery powered device, test is not required.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Sphinx Electronics GmbH &Co. KG RFID Access control system WT210-BLE as shown in the photograph below.



Equipment Under Test



1.3.2 EUT General Description

EUT Description	RFID Access control system
Model Number(s)	WT210-BLE
Rated Voltage	9.0-28.0 VDC (Nominal Voltage 12.0 VDC)
EUT RFID Field Strength	59.5 dBμV/m @ 3 meters
Frequency Range	RFID: 13.56 MHz in the 13.110 to 14.0101 MHz band BT LE: 2402 to 2480 MHz in the 2400 to 2483.5 MHz band
Number of Operating Frequencies	1 (RFID) 40 (BT LE)
Modulation Used	ASK (RFID) GFSK (BT LE)
Antenna(s) Dimension	5,0 cm x 5,0 cm

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT configured in RFID and BT LE test modes. During testing EUT was in transponder card reading mode.

1.4.2 EUT Exercise Software

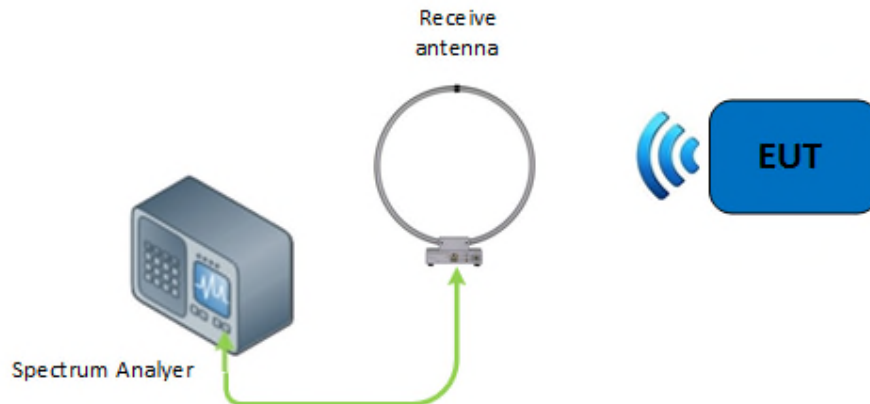
None. No special software was used during evaluation. The EUT was configured in RFID and BT LE test modes using MDU 110 Mobile Data Unit.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Häfele	Mobile Data Unit	Model: MDU 110, S/N: 0601000014
Häfele	Transponder Keycard	n/a

1.4.4 Simplified Test Configuration Diagrams

Radiated Test Setup



Not To Scale – Illustration Purpose Only
 Objects may not represent actual image of original equipment or set-up.



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.

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 the
WT210-BLE
Sphinx Electronics GmbH &Co. KG
RFID Access control system



2.1 FREQUENCY STABILITY

2.1.1 Specification Reference

Part 15 Subpart C §15.225(e)

2.1.2 Standard Applicable

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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 12, 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/ Test Location

Test performed at TÜV SÜD America Inc. RB Laboratory

Ambient Temperature	24.2°C
Relative Humidity	45.9%
ATM Pressure	98.9 kPa

2.1.7 Additional Observations

- The temperature was varied from -20°C to $+50^{\circ}\text{C}$ in 10 degree increments with a nominal voltage of 12.0 VDC, then the voltage was changed from 9 VDC to 28.0 VDC (75% and 233%.of nominal voltage) maintaining a temperature of 20°C .



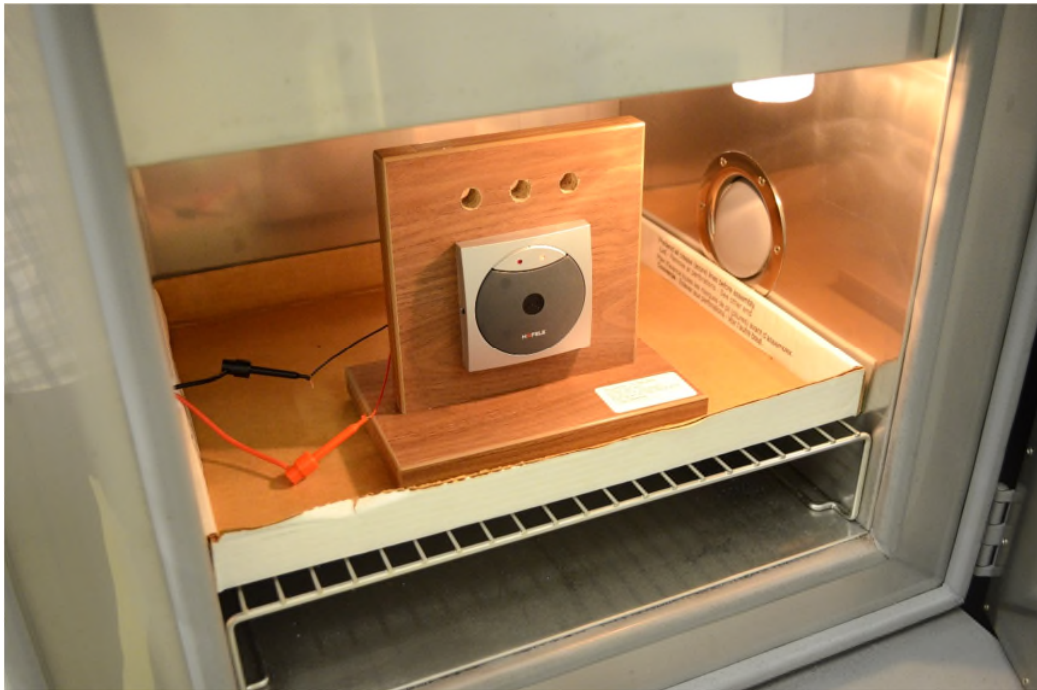
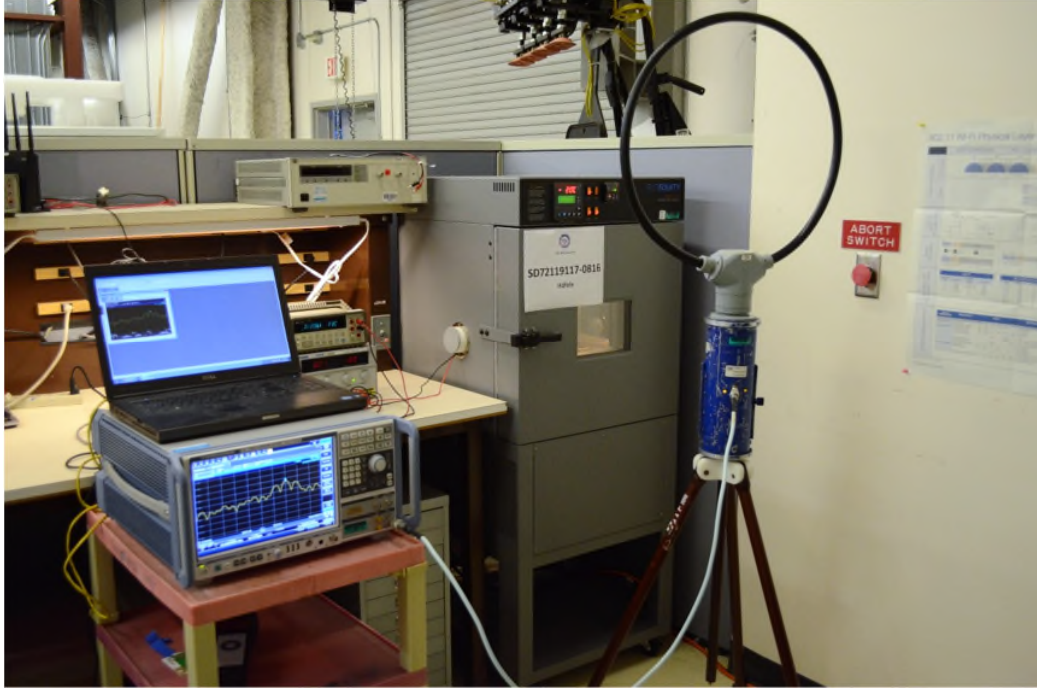
2.1.8 Test Results

RFID @ 13.56MHz					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Frequency Deviation (MHz)	Deviation (%)
100	6.0	-20	13.56008944	0.00008944	0.00065958
100		-10	13.56010153	0.00010153	0.00074874
100		0	13.56008254	0.00008254	0.00060870
100		+10	13.56004659	0.00004659	0.00034358
100		+20	13.56002098	0.00002098	0.00015472
100		+30	13.55998766	-0.00001234	-0.00009100
100		+40	13.55994971	-0.00005029	-0.00037087
100		+50	13.55992602	-0.00007398	-0.00054558
75		9.0	+20	13.56002240	0.0000224000
85	5.1	+20	13.56002350	0.0000235000	0.00017330
115	6.9	+20	13.56002122	0.0000212200	0.00015649
233	28.0	+20	13.56002103	0.0000210300	0.00015509

Maximum Deviation Allowed = 0.001356MHz < 0.01% (13.558644MHz to 13.561356MHz)

Maximum Deviation Recorded = 0.00074874 (Complies)

2.1.9 Test Set Up Pictures





2.2 20 dB BANDWIDTH

2.2.1 Specification Reference

Part 15 Subpart C §15.215(c)

2.2.2 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.

2.2.3 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 17, 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. RB laboratory

Ambient Temperature	22.5°C
Relative Humidity	54.7%
ATM Pressure	98.8 kPa

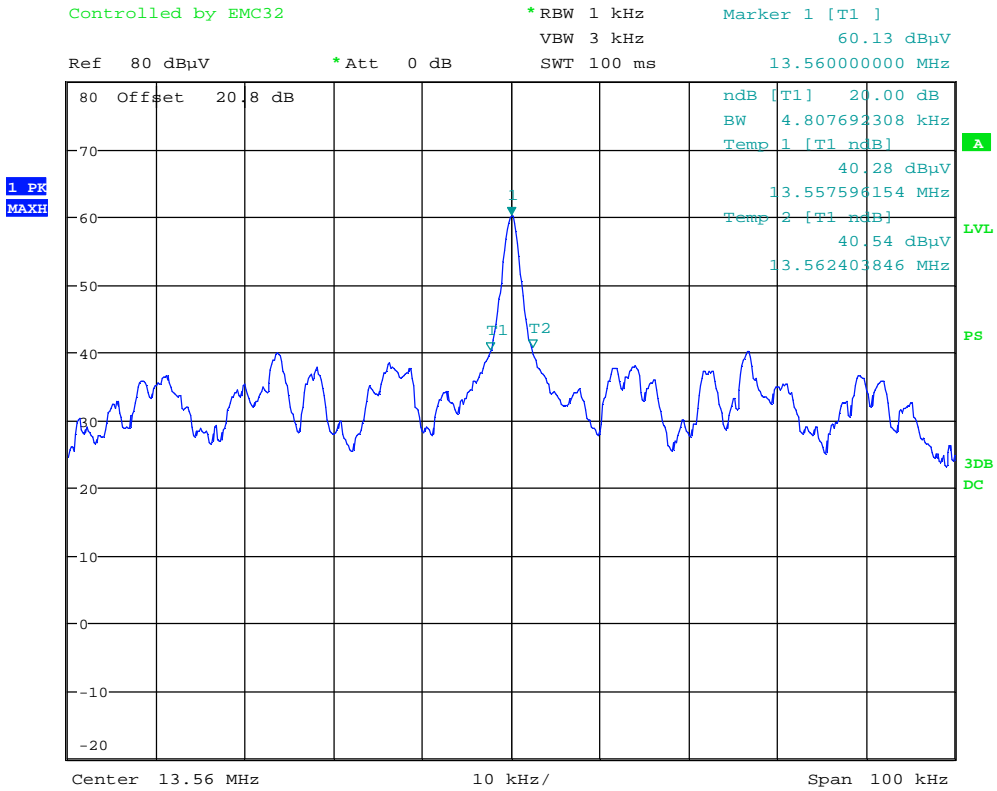
2.2.7 Additional Observations

- This is a Radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is set to 1 kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.



2.2.8 Test Results

Frequency	20dB bandwidth
13.56 MHz	4.81 kHz

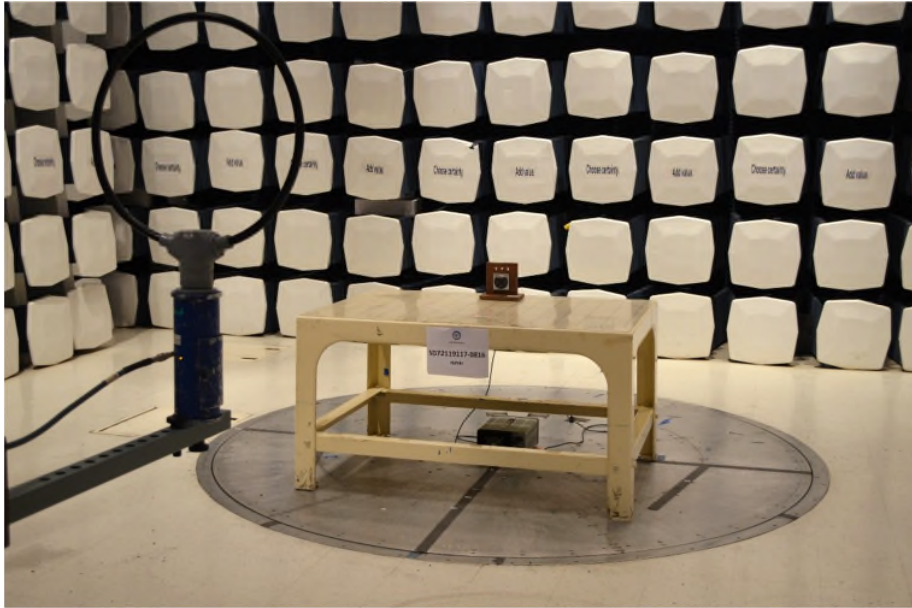


Measured 20dB Bandwidth: 4.81 kHz
 Frequency Band: 13.110 to 14.010 MHz

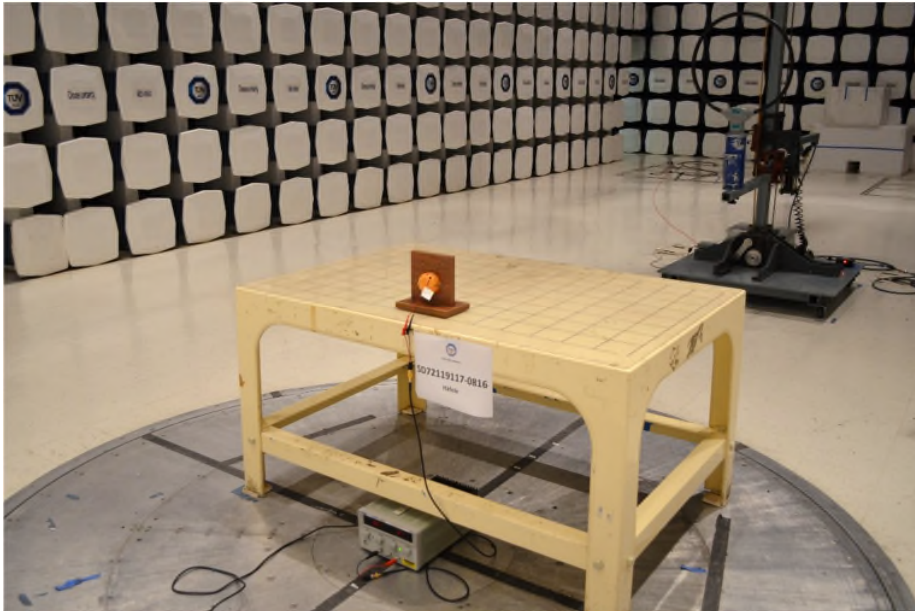
13.56 MHz – (20dB BW/2) = 13.557595MHz (within the frequency band - **Compliant**)
 13.56 MHz + (20dB BW/2) = 13.562405MHz (within the frequency band - **Compliant**)

2.2.9 Test Set Up Pictures

Front



Back





2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.6

2.3.2 Standard Applicable

The emission bandwidth (\times dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated \times dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least $3\times$ the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately $3\times$ RBW.

Note: Video averaging is not permitted.

- A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.
- The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.
- The difference between the two recorded frequencies is the 99% occupied bandwidth

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 17, 2016 /NS

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. Rancho Bernardo facility

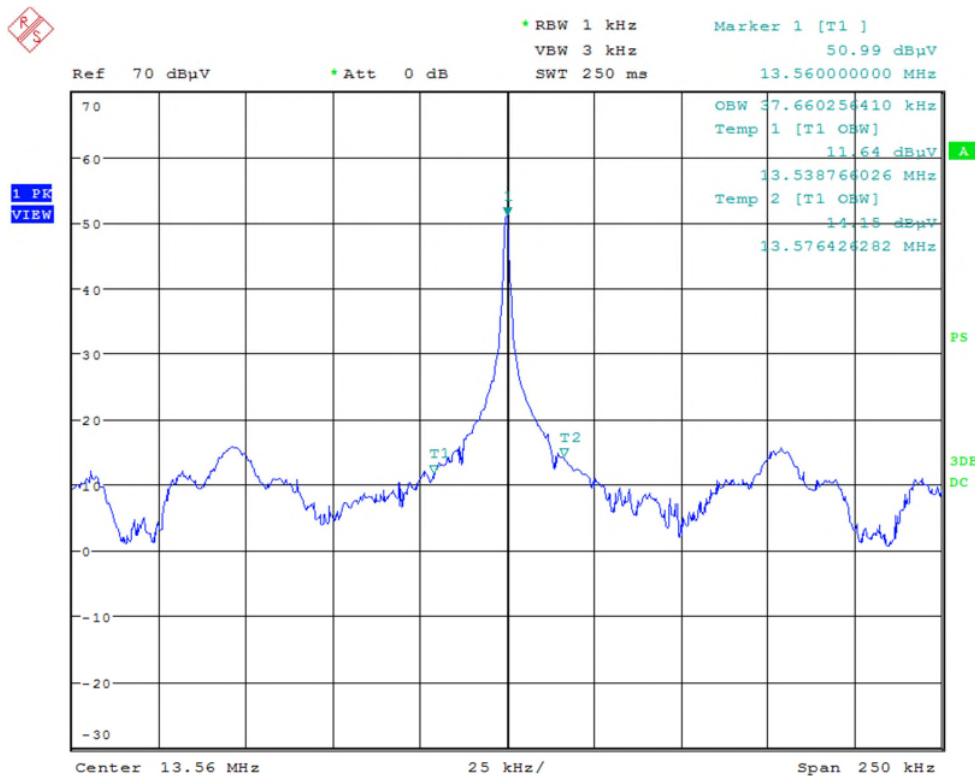
Ambient Temperature 22.5°C
 Relative Humidity 54.7%
 ATM Pressure 98.8 kPa

2.3.7 Additional Observations

- This is a conducted test.
- Span is wide enough to capture the channel transmission.
- RBW is 1 to 5% of the OBW
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).

2.3.8 Test Results

Frequency	99% Emission bandwidth
13.56 MHz	37.66 kHz





2.4 EMISSION MASK

2.4.1 Specification Reference

Part 15 Subpart C §15.225(a)(b)(c)

2.4.2 Standard Applicable

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

2.4.3 Equipment Under Test and Modification State

Serial No: Engineering Sample / Default Test Configuration

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

August 17, 2016 /NS

2.4.5 Test Equipment Used

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

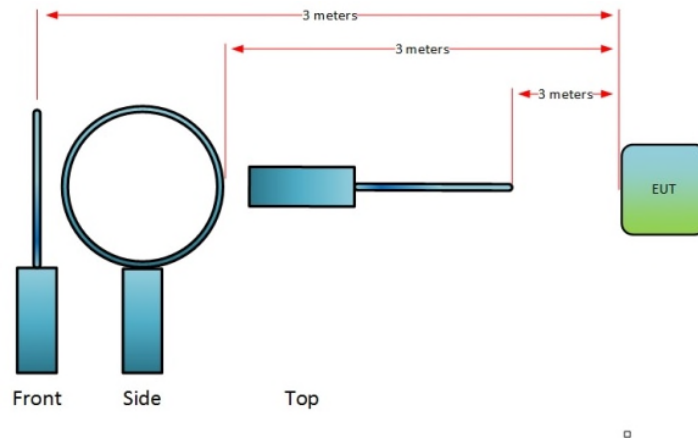
2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. RB Laboratory

Ambient Temperature	22.5°C
Relative Humidity	54.7%
ATM Pressure	98.8 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to 30 MHz. Only 13.110 MHz to 14.010 MHz data is presented. There are no significant emissions observed other than the fundamental frequency (13.56 MHz) measured at 3 meters.
- Limits were converted from 30 meters to 3 meters using worst case 20 dB/decade extrapolation rules.
- Prescans were performed to determine the best test antenna orientation with the highest recorded emissions. Verification was performed using “Front” configuration (see the figure below) corresponding to the best antenna orientation as found during the prescans.



- 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 2.3.8 for sample computations.

2.4.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 13.56MHz			15.0
Correction Factor (dB)	Asset# 1026 (cable)	0.5	20.9
	Asset# 1057 3m (cable)	0.1	
	Asset# 6628 (antenna)	20.2	
	Asset# 8850 (cable)	0.1	
Reported QuasiPeak Final Measurement (dbµV/m) @ 13.56MHz			35.9

2.4.9 Sample Computation (Limits)

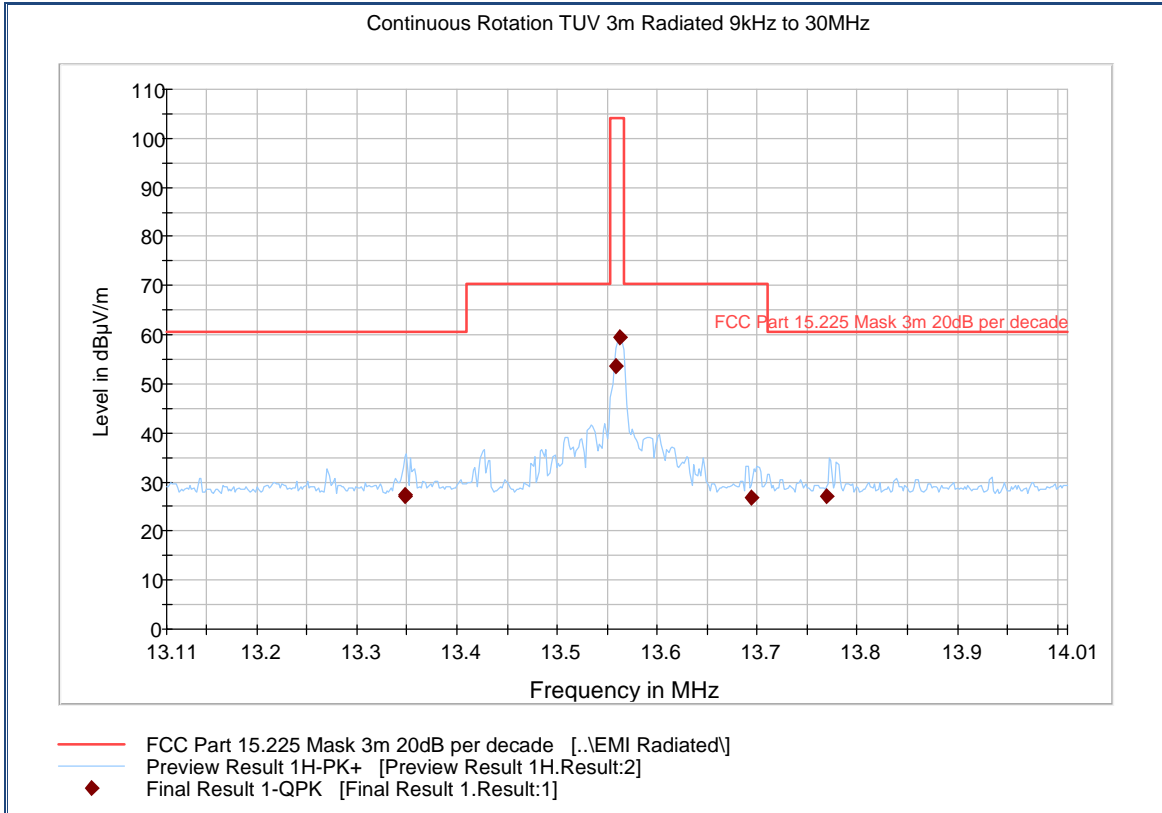
Limit @ 13.553–13.567 MHz: = 15,848 µV/m @30 meters
 = 20 log(15,848 µV/m)
 = 84 dB µV/m @30 meters

Using 20dB/decade extrapolation rule: = 20 log (30m/3m)
 Measuring distance correction factor: = 20 dB
 Calculated limit @ 3 meters: = 84 dB µV/m + 20 dB
 = 104 dB µV/m

2.4.10 Test Results

See attached plots.

2.4.11 Test Results



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)
13.347521	27.3	1500.0	9.000	100.0	H	357.0	20.9	33.2	60.5
13.347880	27.0	1500.0	9.000	100.0	H	23.0	20.9	33.5	60.5
13.558116	53.7	1500.0	9.000	100.0	H	7.0	20.9	50.3	104.0
13.562705	59.5	1500.0	9.000	100.0	H	12.0	20.9	44.5	104.0
13.694405	26.9	1500.0	9.000	100.0	H	27.0	21.0	43.6	70.5
13.769924	27.0	1500.0	9.000	100.0	H	358.0	21.0	33.5	60.5

Test Notes:



2.4.12 Test Set Up Pictures

Identical to section 2.2.9 of this test report.

2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.225(d)

2.5.2 Standard Applicable

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

2.5.3 Equipment Under Test and Modification State

Serial No: Engineering Sample / Default Test Configuration

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

August 17, 2016 /NS

2.5.5 Test Equipment Used

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

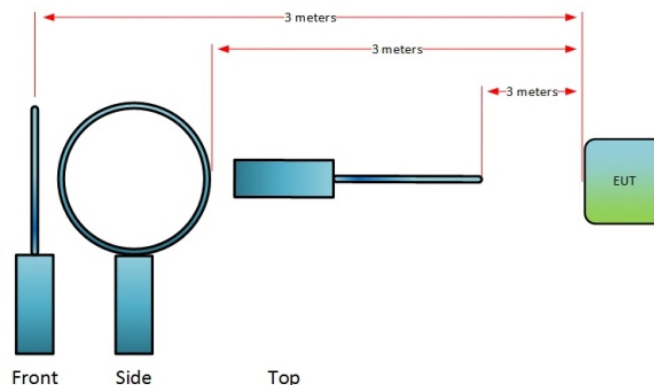
2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. RB Laboratory

Ambient Temperature	22.5°C
Relative Humidity	54.7%
ATM Pressure	98.8 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to the 10th harmonic (25 GHz).
- Below 30 MHz emissions prescans were performed to determine the best test antenna orientation with the highest recorded emissions. Verification was performed using “Front” configuration (see the figure below) corresponding to the best antenna orientation as found during the prescans.





- 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 2.4.8 and 2.4.9 for sample computations.

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

Measuring equipment raw measurement (db μ V) @ 9 kHz		25.0
Correction Factor (dB)	Asset# 1057 (cable)	0.1
	Asset# 8850 (cable)	0.0
	Asset# 6628 (antenna)	25.8
	Asset# 1026 (cable)	0.0
Reported QuasiPeak Final Measurement (dbμV/m) @ 9kHz		50.9

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

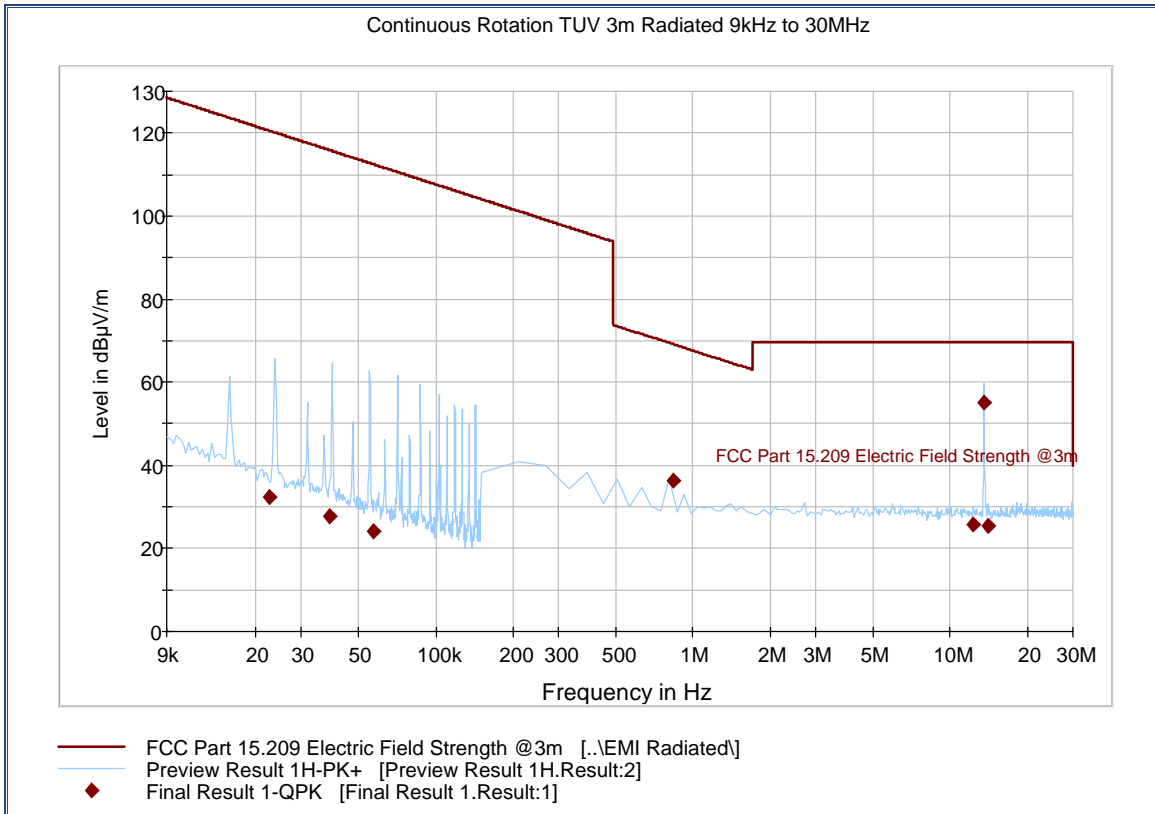
Measuring equipment raw measurement (db μ V) @ 30 MHz		24.4
Correction Factor (dB)	Asset# 1026 (cable)	0.8
	Asset# 1057 (cable)	0.2
	Asset# 1016 (preamplifier)	-30.8
	Asset# 8850 (cable)	0.2
	Asset# 1033 (antenna)	17.2
	Asset# 8771 (6-dB attenuator)	5.4
Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz		17.4

2.5.10 Test Results

See attached plots.



2.5.11 Test Results 9 kHz to 30 MHz

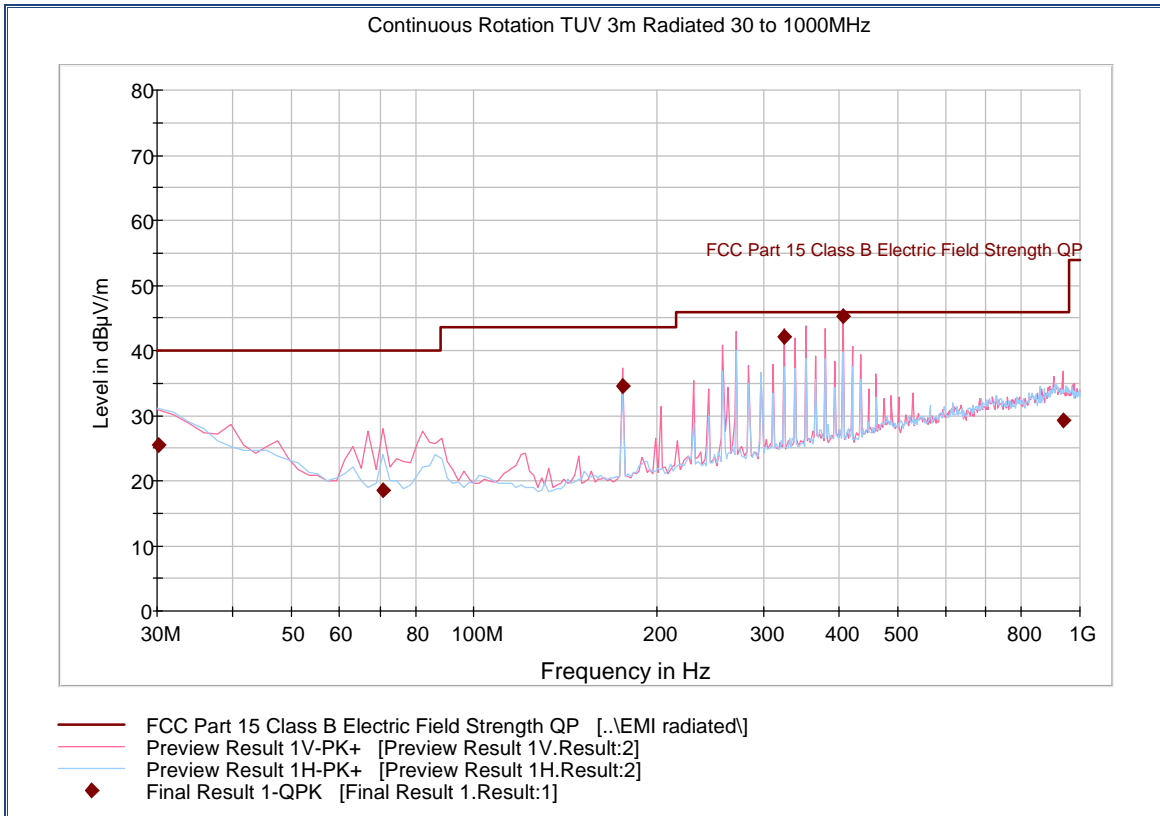


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.022693	32.4	1000.0	0.200	100.0	H	79.0	21.3	88.1	120.5
0.038517	27.8	1000.0	0.200	100.0	H	222.0	20.8	88.1	115.9
0.057341	24.2	1000.0	0.200	100.0	H	125.0	20.1	88.3	112.4
0.834016	36.4	1500.0	9.000	100.0	H	-1.0	19.7	32.8	69.2
12.303387	25.7	1500.0	9.000	100.0	H	-9.0	20.9	43.8	69.5
13.559599	55.0	1500.0	9.000	100.0	H	0.0	20.9	14.6	69.5
14.085976	25.4	1500.0	9.000	100.0	H	-9.0	21.0	44.2	69.5

Test Notes:

2.5.12 Test Results 30 MHz to 1 GHz



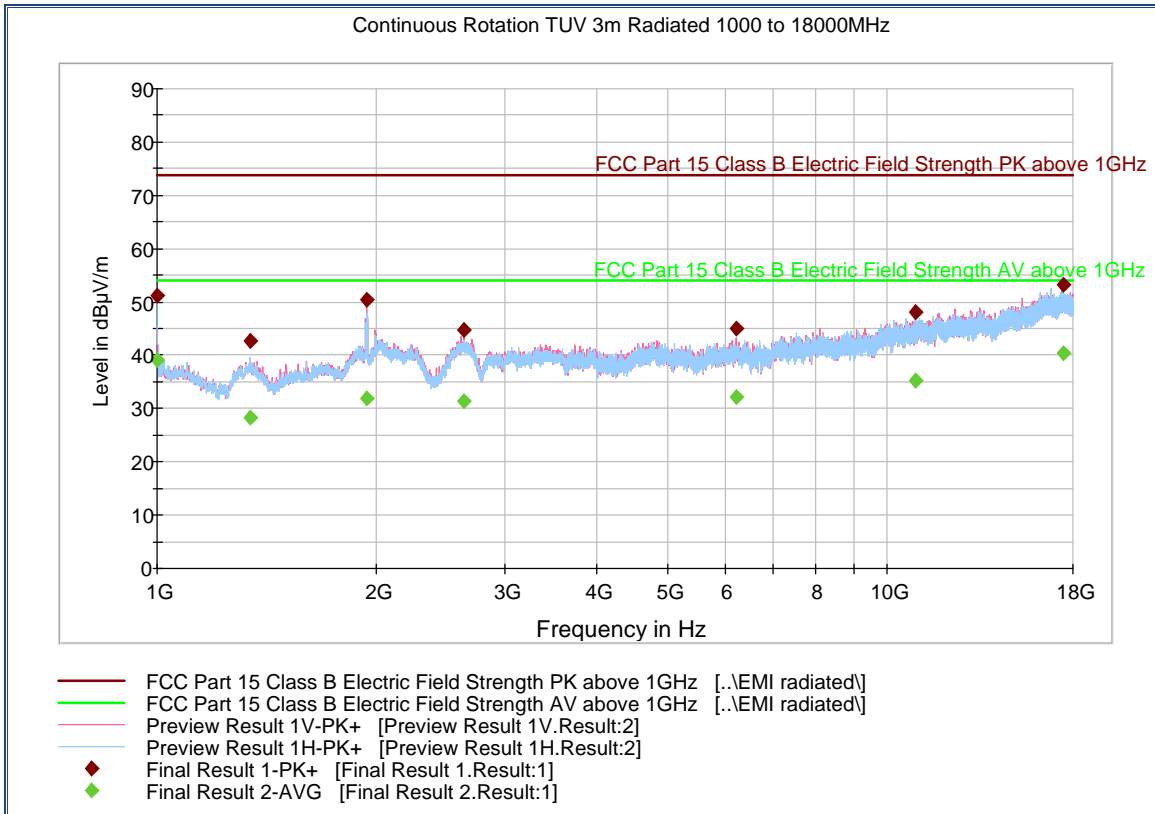
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.080000	25.6	1000.0	120.000	233.0	H	269.0	-5.8	14.4	40.0
70.941643	18.5	1000.0	120.000	100.0	V	18.0	-16.8	21.5	40.0
176.271583	34.6	1000.0	120.000	100.0	V	354.0	-12.7	8.9	43.5
325.470942	42.0	1000.0	120.000	134.0	V	31.0	-6.3	4.0	46.0
406.794228	45.3	1000.0	120.000	109.0	V	94.0	-4.0	0.7	46.0
939.635591	29.4	1000.0	120.000	230.0	V	87.0	6.2	16.6	46.0

Test Notes:



2.5.13 Test Results Above 1GHz



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	51.2	1000.0	1000.000	103.7	H	86.0	-7.7	22.7	73.9
1342.466667	42.8	1000.0	1000.000	102.7	H	320.0	-5.3	31.1	73.9
1936.666667	50.4	1000.0	1000.000	202.3	V	61.0	-0.7	23.5	73.9
2635.933333	44.6	1000.0	1000.000	394.0	V	328.0	-0.9	29.3	73.9
6228.600000	44.9	1000.0	1000.000	124.7	V	279.0	5.7	29.0	73.9
10944.966667	48.0	1000.0	1000.000	400.2	V	221.0	12.7	25.9	73.9
17454.666667	53.3	1000.0	1000.000	400.2	H	-2.0	20.1	20.6	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)
1000.000000	39.1	1000.0	1000.000	103.7	H	86.0	-7.7	14.8	53.9
1342.466667	28.2	1000.0	1000.000	102.7	H	320.0	-5.3	25.7	53.9
1936.666667	31.9	1000.0	1000.000	202.3	V	61.0	-0.7	22.0	53.9
2635.933333	31.3	1000.0	1000.000	394.0	V	328.0	-0.9	22.6	53.9
6228.600000	32.1	1000.0	1000.000	124.7	V	279.0	5.7	21.8	53.9
10944.966667	35.1	1000.0	1000.000	400.2	V	221.0	12.7	18.8	53.9
17454.666667	40.3	1000.0	1000.000	400.2	H	-2.0	20.1	13.6	53.9

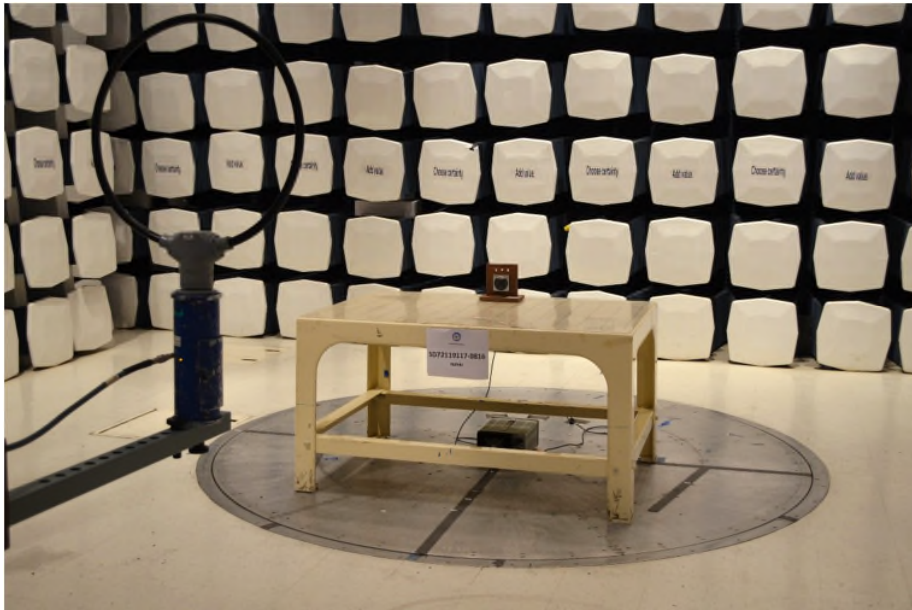
Test Notes: No significant emissions were observed.

2.5.14 Receive Mode

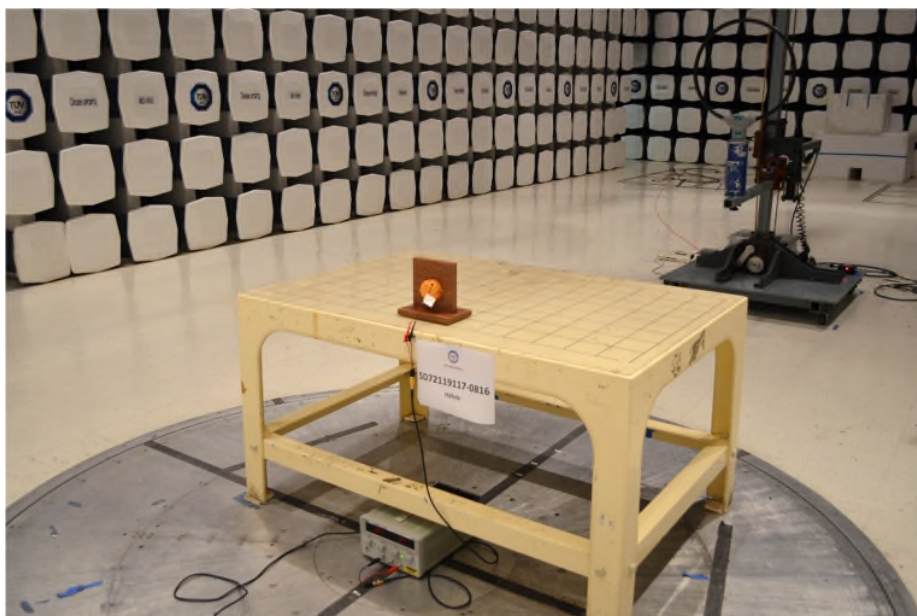
Compliant: Emissions at Receive mode can be compared to test results obtained in sections 2.5.11, 2.5.12 & 2.5.13 of this report (Worst case scenario).

2.5.15 Test Set Up Pictures

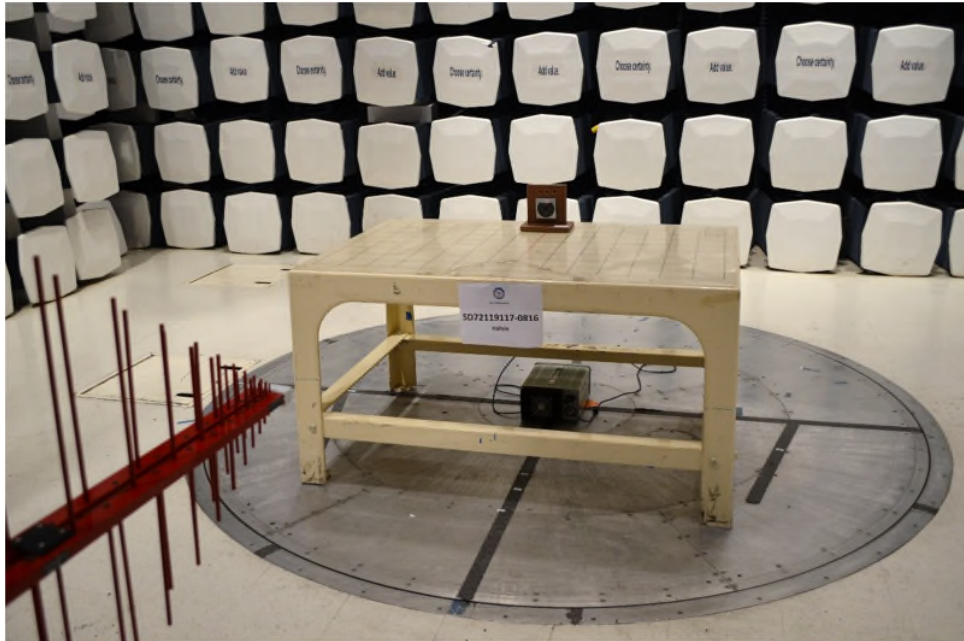
Below 30 MHz (front)



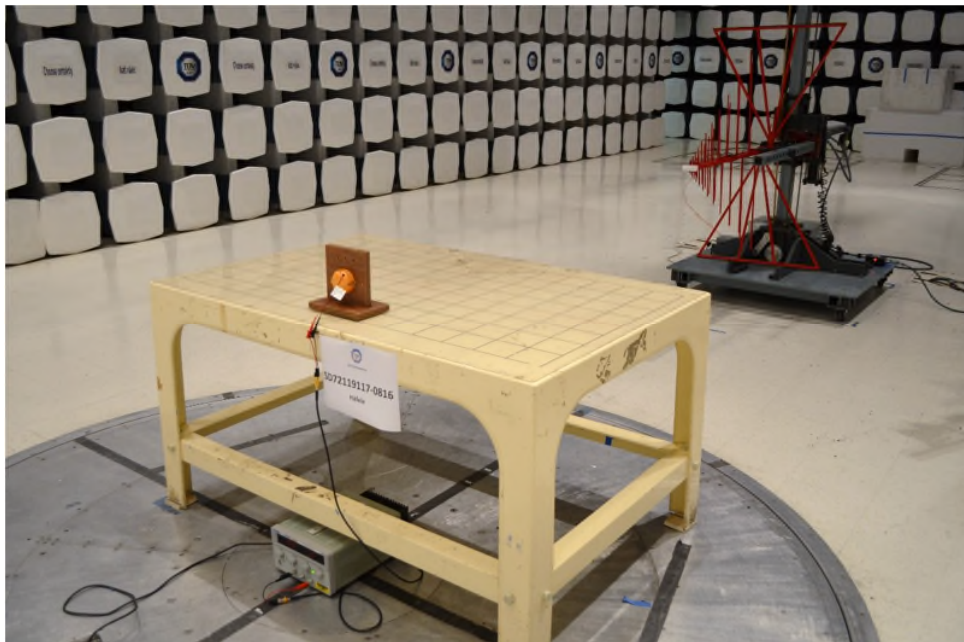
Below 30 MHz (back)



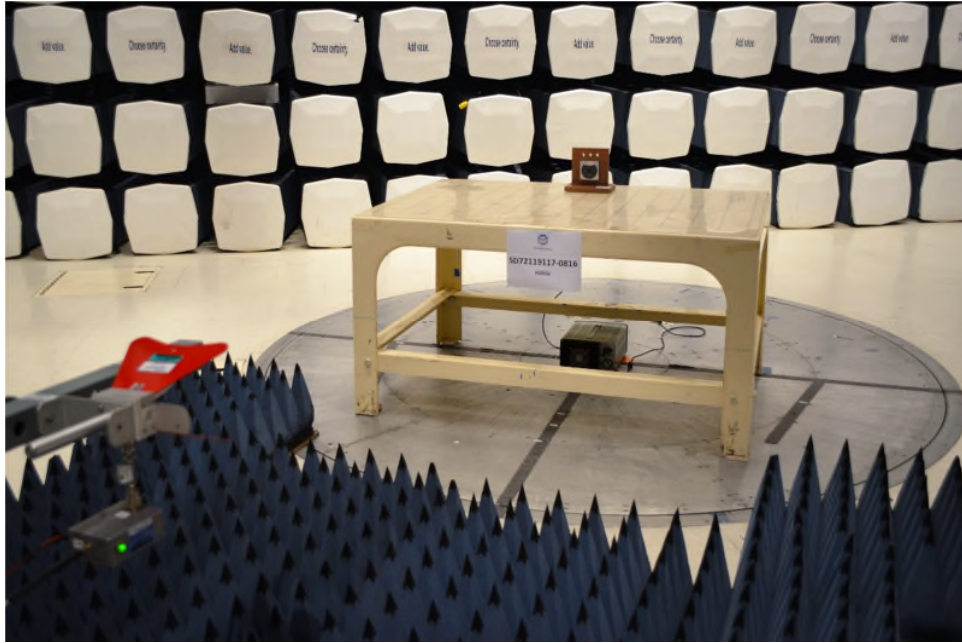
30 MHz to 1 GHz (front)



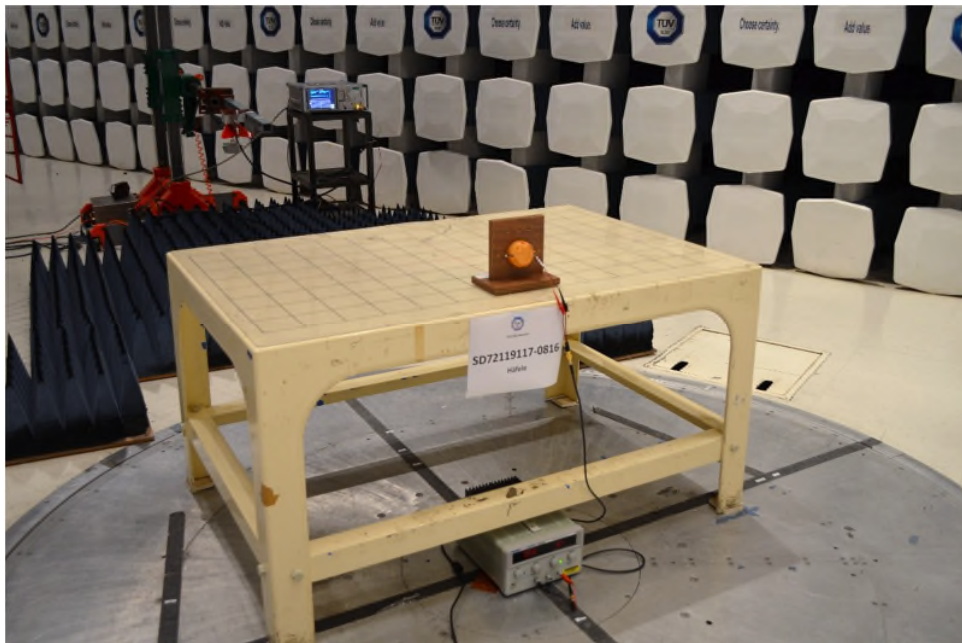
30 MHz to 1 GHz (back)



Above 1 GHz (front)



Above 1 GHz (back)





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						
7575	Double-ridged waveguide horn antenna	3117	0015511	ETS-Lindgren	5/12/2016	5/12/2017
1033	Bilog Antenna	3142C	00044556	ETS-Lindgren	09/25/14	09/25/16
6628	Loop Antenna	HFH 2 –Z2	880 458/25	Rhode & Schwarz	10/28/15	10/28/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	01/11/16	01/11/17
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
9075	Laboratory DC Power Supply	35010M	N/A	Protek	Verified by 6792	
7579	Temperature Chamber	115	151617	TestQuity	08/14/15	08/14/16
7619	Barometer/Temperature/Humidity Transmitter	iBTHX-W	15250268	Omega	10/19/15	10/19/16
	Test Software	EMC32	V8.53	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	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)

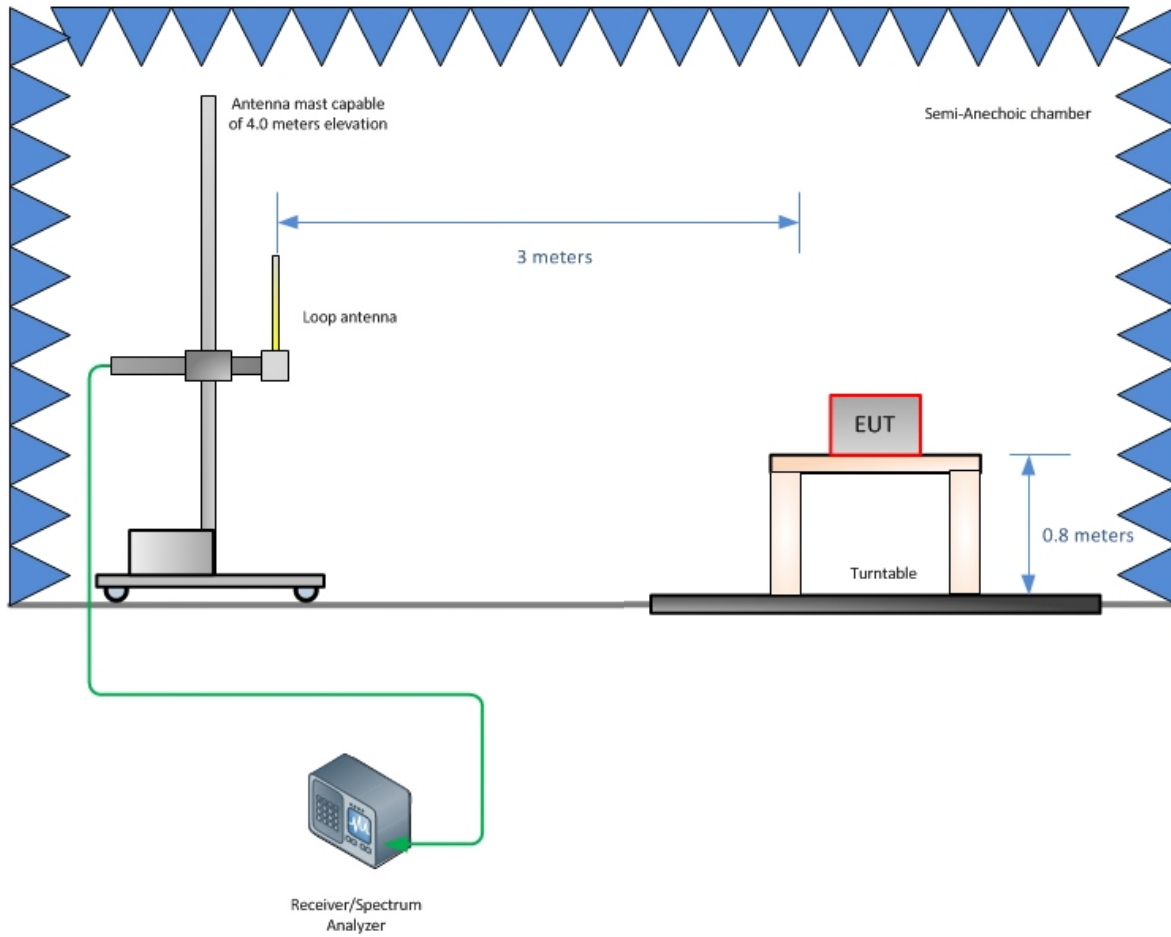
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	2.70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



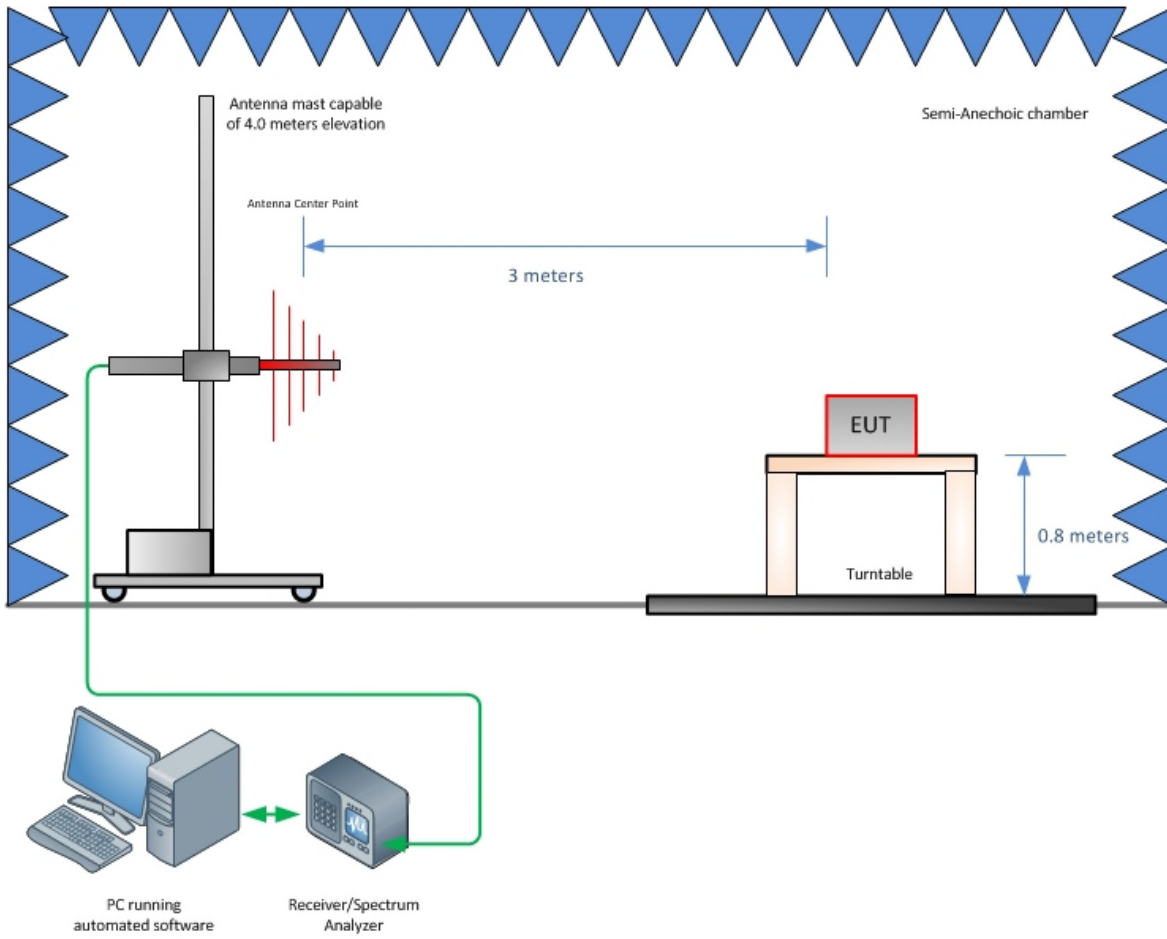
SECTION 4

DIAGRAM OF TEST SETUP

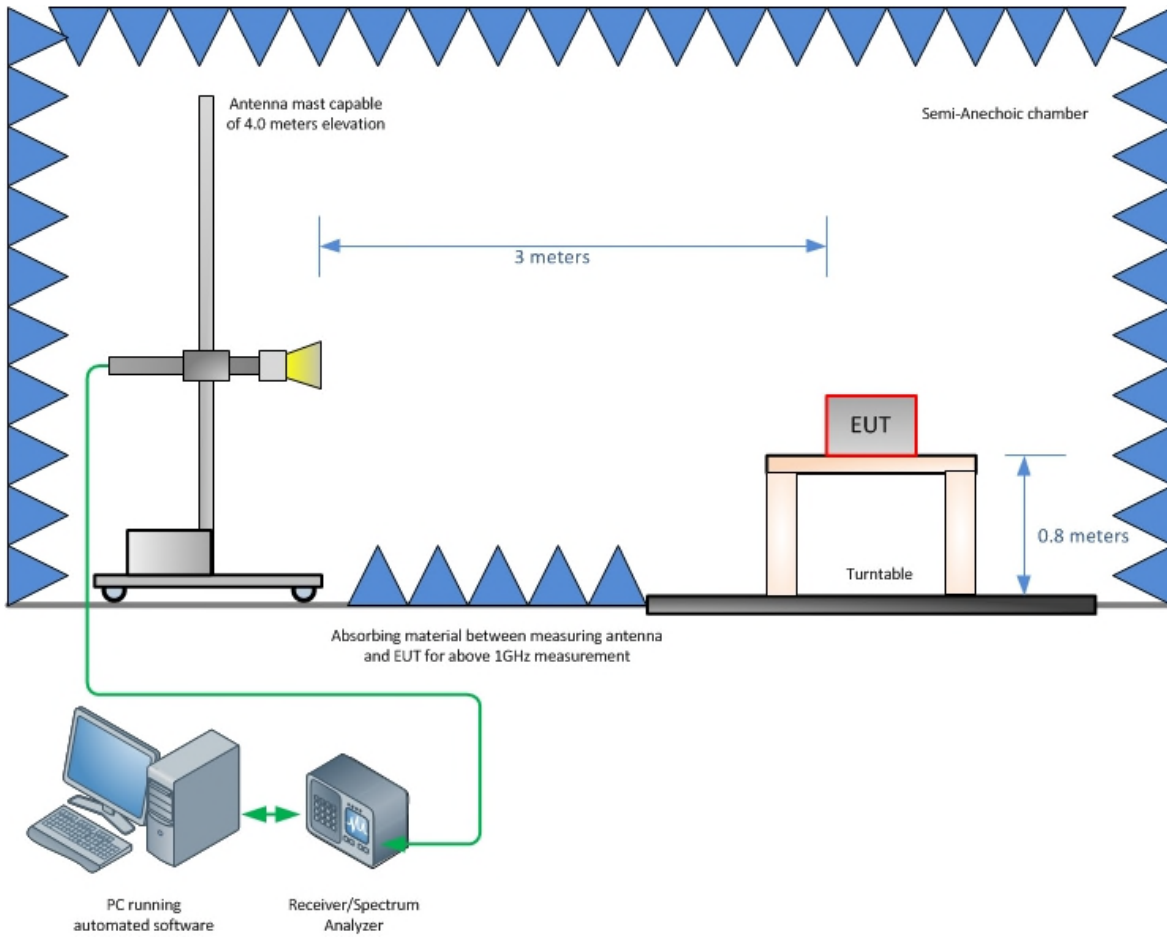
4.1 TEST SETUP DIAGRAM (EMISSION MASK)



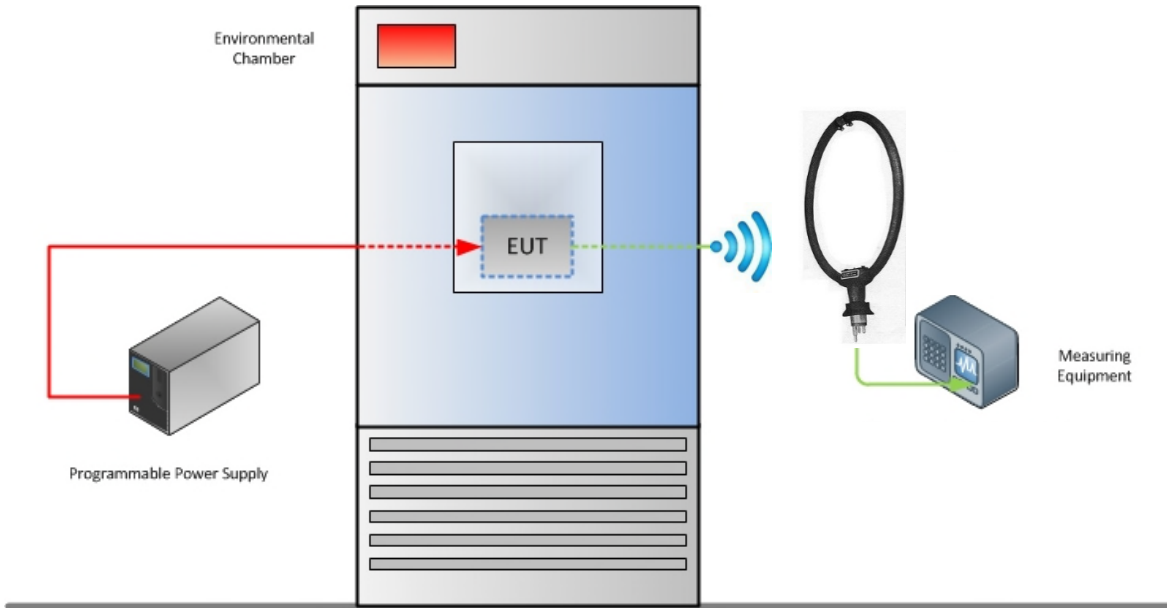
4.2 TEST SETUP DIAGRAM (RADIATED EMISSIONS 30 TO 1000 MHZ)



4.3 TEST SETUP DIAGRAM (RADIATED EMISSIONS ABOVE 1 GHZ)



4.4 TEST SETUP DIAGRAM (FREQUENCY STABILITY)





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.

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