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Report On

Radio Testing of the
SKIDATA AG
sd905 RFID Reader Module

FCC Part 15 Subpart C §15.225
ISED RSS-210 Issue 9

Report No. SD72122051-1116

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Report No. SD72122051-1116

REPORT ON	Radio Testing of the SKIDATA AG RFID Reader Module
TEST REPORT NUMBER	SD72122051-1116
REPORT DATE	December 2016
PREPARED FOR	SKIDATA AG Untersbergstrasse 40 A-5083 Grödig / Salzburg Austria
CONTACT PERSON	Mr. Christoph Sonderegger Hardware Research & Development Senior Engineer – Product Certification +43 6246 888-4070 christoph.sonderegger@skidata.com
PREPARED BY	Nikolay Shtin **Name** Title: EMC/Wireless Test Engineer
APPROVED BY	Juan Manuel Gonzalez **Name** Authorized Signatory Title: EMC Service Line Manager Western region
DATED	December 16, 2016

Revision History

SD72122051-1116 SKIDATA AG sd905 RFID Reader Module					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
12/16/2016	Initial Release				Juan Manuel Gonzalez

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
SKIDATA AG
sd905 RFID Reader Module

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SKIDATA AG RFID Reader Module to the requirements of FCC Part 15 Subpart C §15.225 and ISED RSS-210 Issue 9.

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	SKIDATA AG
Model Number(s)	sd905
FCC ID Number	QSS-SD905
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.225 (October 1, 2016). • ISED RSS-210 Issue 9 (August, 2016)
Start of Test	December 02, 2016
Finish of Test	December 06, 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 ISED RSS standard is shown below.

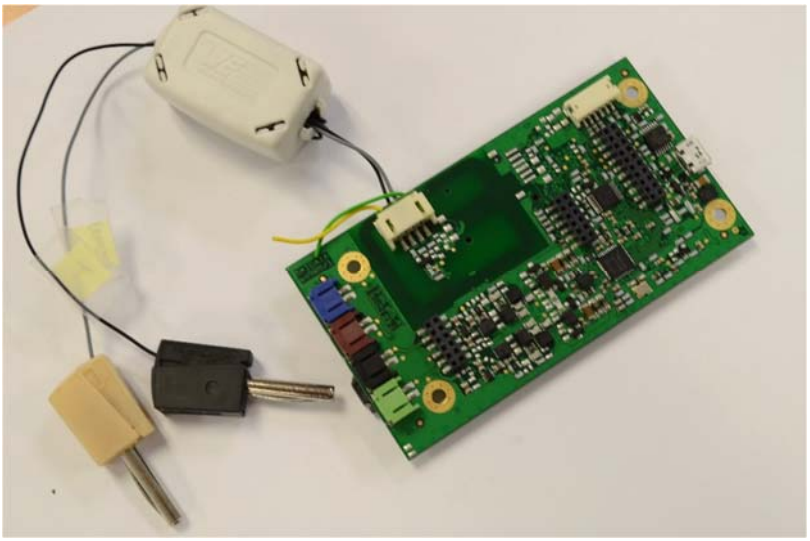
Section	FCC Part 15	§15.225 Spec Clause	ISED RSS	Test Description	Result	Comments/Base Standard
	§15.31(e)			Voltage Requirement	Compliant	§15.225(e)
	§15.203 and 204		RSS-Gen 8.3	Antenna Requirements	Compliant	N/A *
2.1		§15.225(e)	RSS-210 B.6 RSS-Gen 6.11 RSS-Gen 8.11	Frequency Tolerance	Compliant	
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	
2.5.13			RSS-Gen 7.1	Receiver Spurious Emissions	Compliant	
		§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A **	

N/A* This requirement does not apply to intentional radiators that are professionally installed.
N/A** EUT is a USB powered device, test is not required.

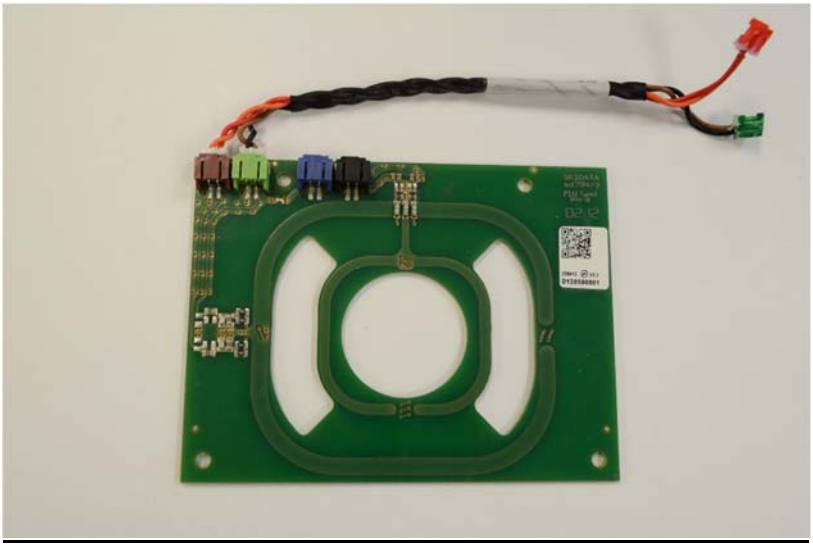
1.3 PRODUCT INFORMATION

1.3.1 Technical Description

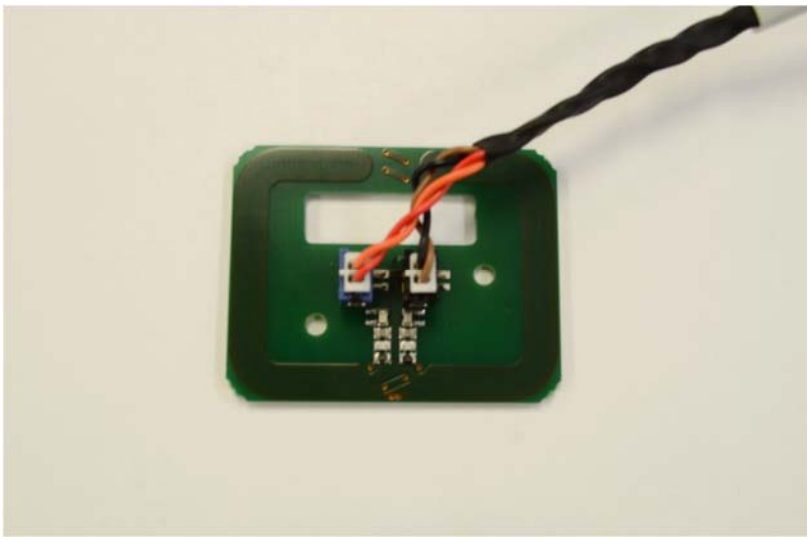
The Equipment Under Test (EUT) was a SKIDATA AG sd905 RFID Reader Module as shown in the photographs below. The sd905 functions as a built-in interface between a SKIDATA device and contactless data carriers (RFID). Data communication between the sd905 and the SKIDATA device is provided by means of a 0 V/5 V RS232 data link or a USB connection. The EUT can be used with several external antennas. At the time of the test three different antennas were evaluated: sd794, sd888 and sd901.



Equipment Under Test



Antenna Model: sd794



Antenna Model: sd901

Ski Antenna unit incorporating sd905 and sd888 Antenna

1.3.2 EUT General Description

EUT Description	RFID Reader Module
Model Number(s)	sd905
Rated Voltage	5.0 VDC
EUT RFID Field Strength	**99.36 dBµV/m** @ 3 meters
Frequency Range	RFID: 13.56 MHz in the 13.110 to 14.0101 MHz band
Number of Operating Frequencies	1
Modulation Used	ASK
Antenna(s) Dimensions	
Antenna sd749:	100,0 mm x 75,0 mm
Antenna sd901:	55,0 mm x 40,0 mm
Antenna sd888:	720,0 mm x 490,0 mm

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	EUT with attached sd901 antenna continuously transmitting unmodulated carrier.
B	EUT configured in continuous modulated transmission mode transmitting from the attached antennas (sd888 “worst case” or sd794, or sd901.

1.4.2 EUT Exercise Software

None. No special software was used during evaluation.

1.4.3 Support Equipment and I/O cables

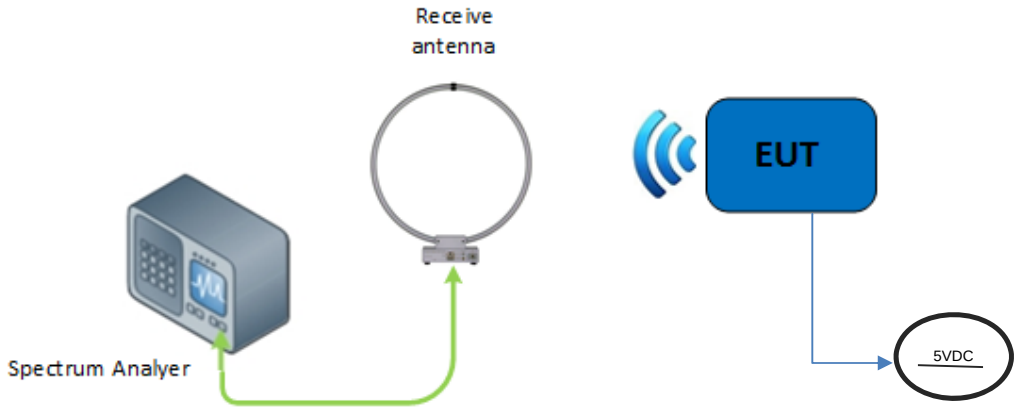
Manufacturer	Equipment/Cable	Description
LIN SHIUNG	Hi-speed USB 2.0 Cable 0.9m	Model: E166307
SKIDATA	RFID test card	EMV-SD905 cont. carrier

1.4.4 Worst Case Configuration

For radiated measurements EUT was verified using three different antennas: sd794, sd888 and sd901. Official measurements were performed on the Ski Antenna unit incorporating sd905 module and sd888 antenna (worst case configuration).

1.4.5 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)

16936 Via Esprillo, 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 §2.498 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
SKIDATA AG
sd905 RFID Reader Module

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 ±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: N/A / Test configuration A

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

December 05 and December 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/ Test Location

Test performed at TÜV SÜD America Inc. MM Laboratory

Ambient Temperature	23.7-24.1°C
Relative Humidity	40.8-41.1%
ATM Pressure	99.1-99.5 kPa

2.1.7 Additional Observations

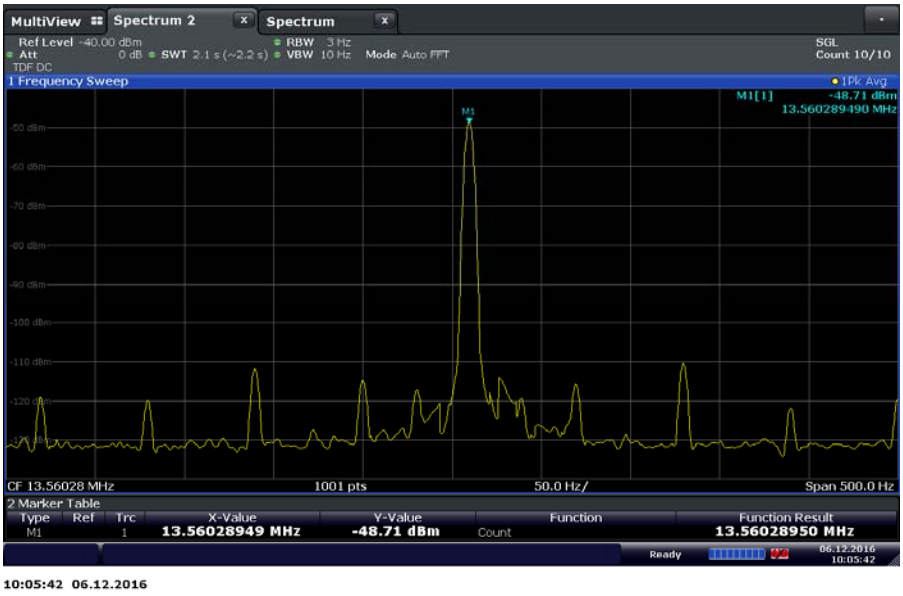
- The temperature was varied from −20°C to +50°C in 10 degree increments with a nominal voltage of 5.0 VDC, then the voltage was changed from 4.25 VDC to 5.75 VDC (75% and 115%.of nominal voltage) mantaining a temperature of 20 °C.
- Test performed with antenna sd794 “Representative for the 3 antennas”.

2.1.8 Test Results

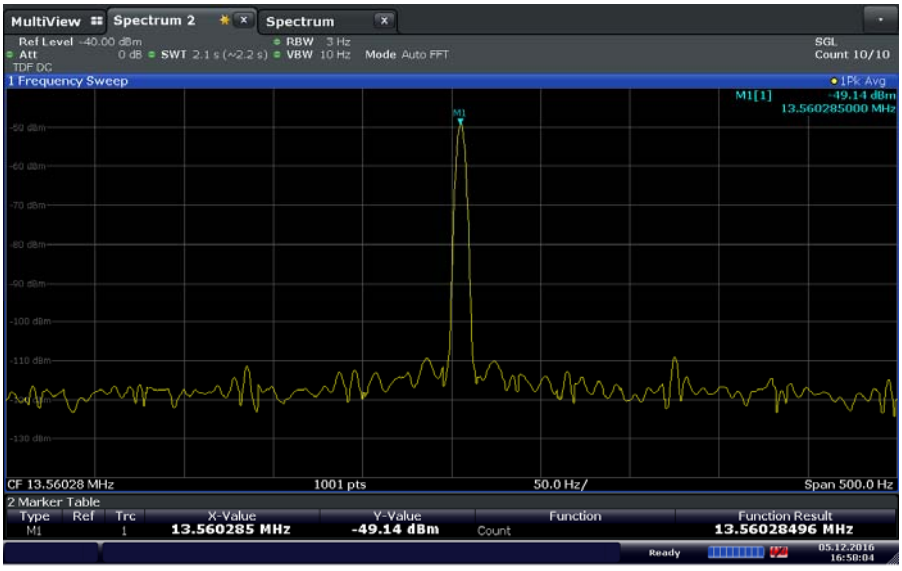
RFID @ 13.56MHz					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (MHz)	Frequency Deviation (MHz)	Deviation (%)
100		-20	13.56028496	0.00028496	0.00210143
100		-10	13.56031088	0.00031088	0.00229257
100		0	13.56031319	**0.00031319**	**0.00230961**
100		+10	13.56030213	0.00030213	0.00222805
100		+20	13.5602895	0.00028950	0.00213491
100		+30	13.56027126	0.00027126	0.00200040
100		+40	13.56025922	0.00025922	0.00191162
100		+50	13.56026283	0.00026283	0.00193824
85	4.25	+20	13.56029222	0.0002922200	0.00215497
115	5.75	+20	13.56028712	0.0002871200	0.00211736

Maximum Deviation Allowed = 0.00031319MHz< 0.01% (13.558644MHz to 13.561356MHz)
Maximum Deviation Recorded = 0.00230961 (Complies)

2.1.9 Sample Test Plots

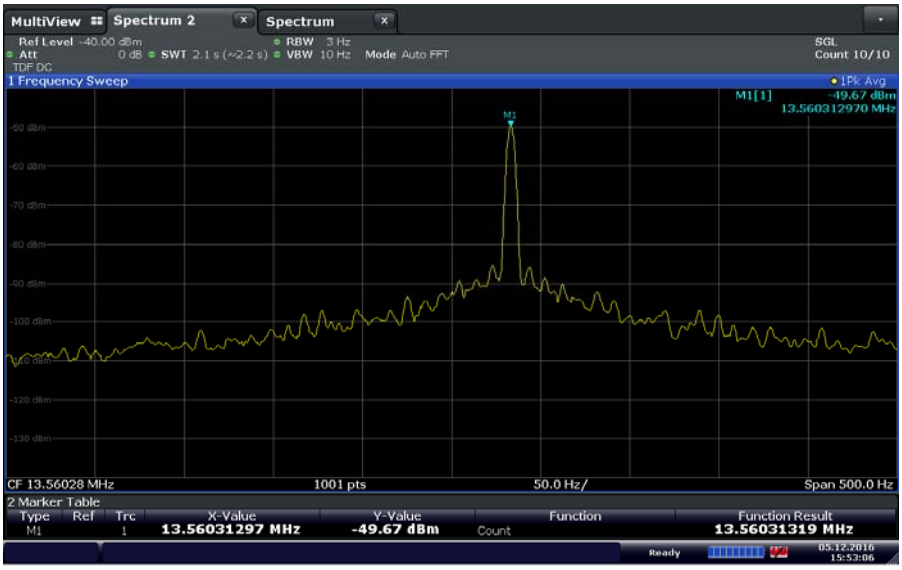


Unmodulated carrier @ 20°C (Nominal Voltage)



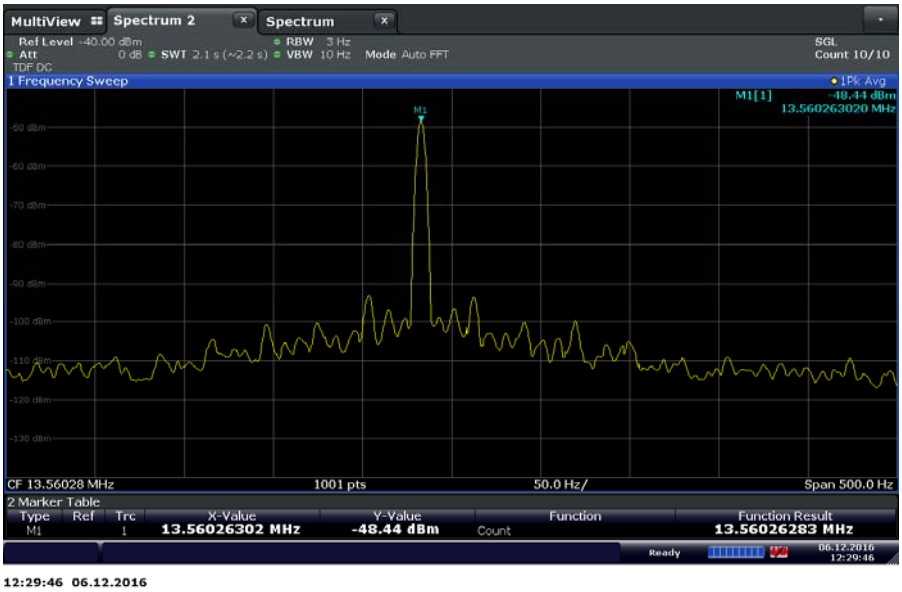
16:58:04 05.12.2016

Unmodulated carrier @ -20°C (Nominal Voltage)



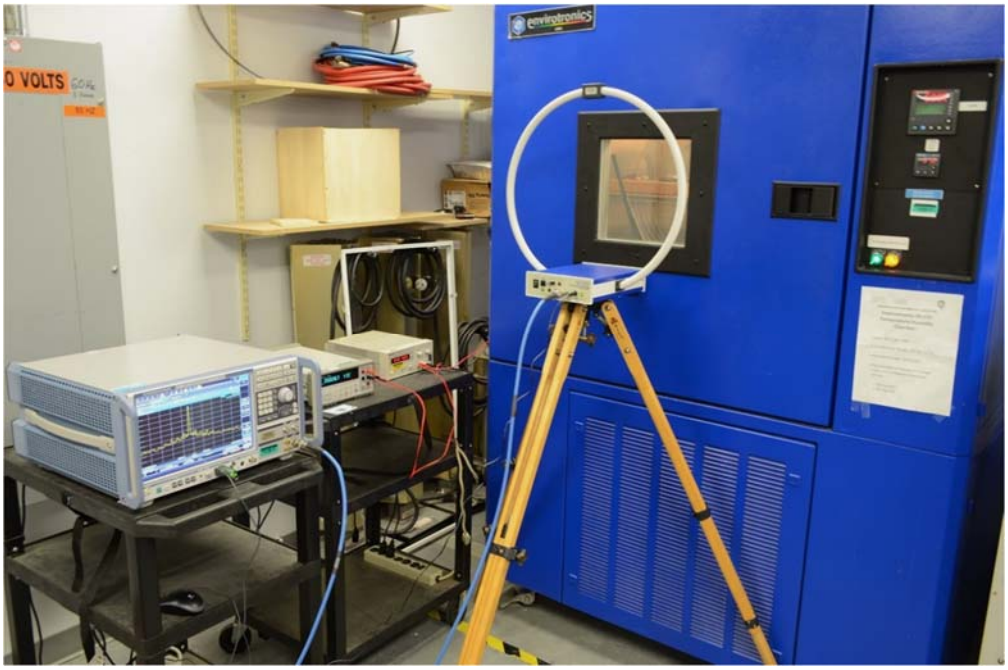
15:53:07 05.12.2016

Unmodulated carrier @ 0°C (Nominal Voltage)



Unmodulated carrier @ 50°C (Nominal Voltage)

2.1.10 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: N/A / Test Configuration B

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

December 05, 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. MM laboratory

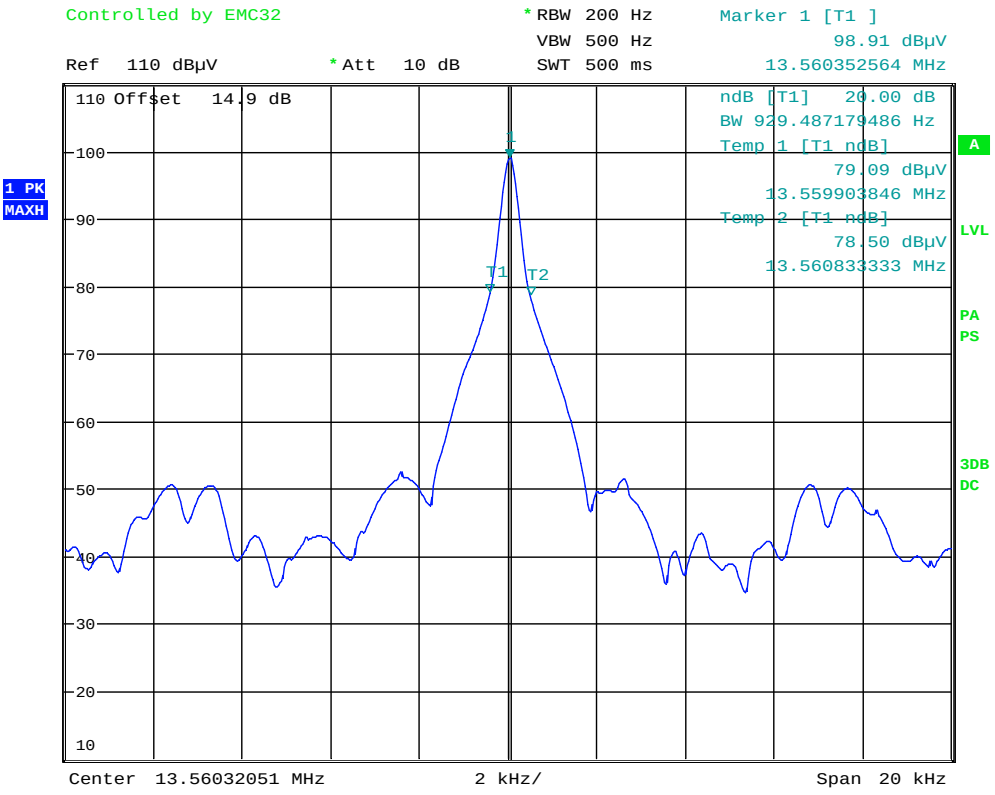
Ambient Temperature	23.7°C
Relative Humidity	40.8%
ATM Pressure	99.5 kPa

2.2.7 Additional Observations

- This is a Radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is set to 500 Hz.
- VBW is 2 kHz.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.
- Test performed with antenna sd888 “worst case Configuration”.

2.2.8 Test Results

Frequency	20dB bandwidth
13.56035 MHz	0.929 kHz

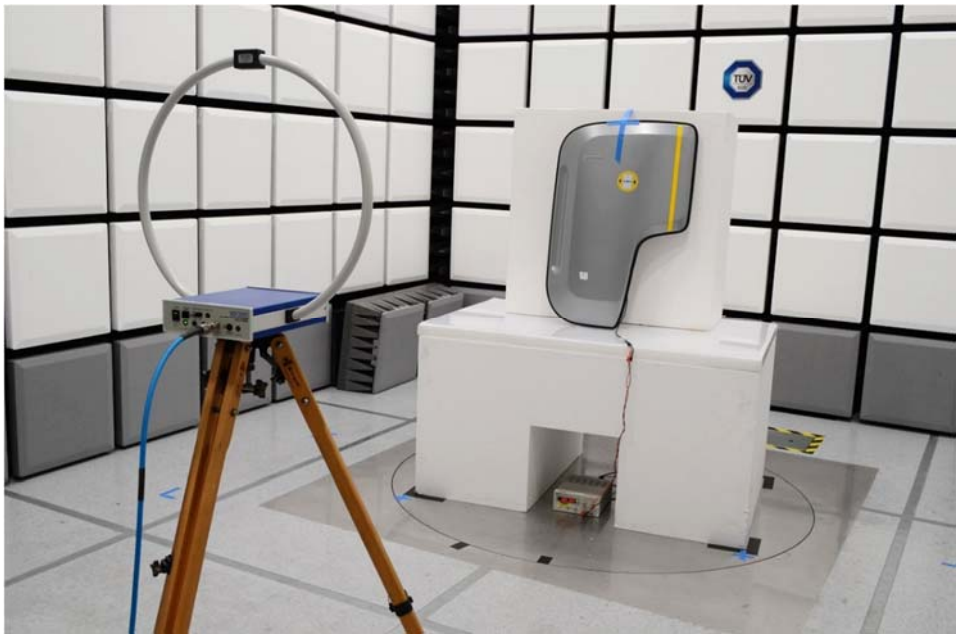


Measured 20dB Bandwidth: 0.929 kHz
Frequency Band: 13.110 to 14.010 MHz

13.56035 MHz – (20dB BW/2) = 13.559886MHz (within the frequency band - **Compliant**)
13.56035 MHz + (20dB BW/2) = 13.560815MHz (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 (×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 × 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× 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×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: N/A / Test Configuration B

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

December 05, 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

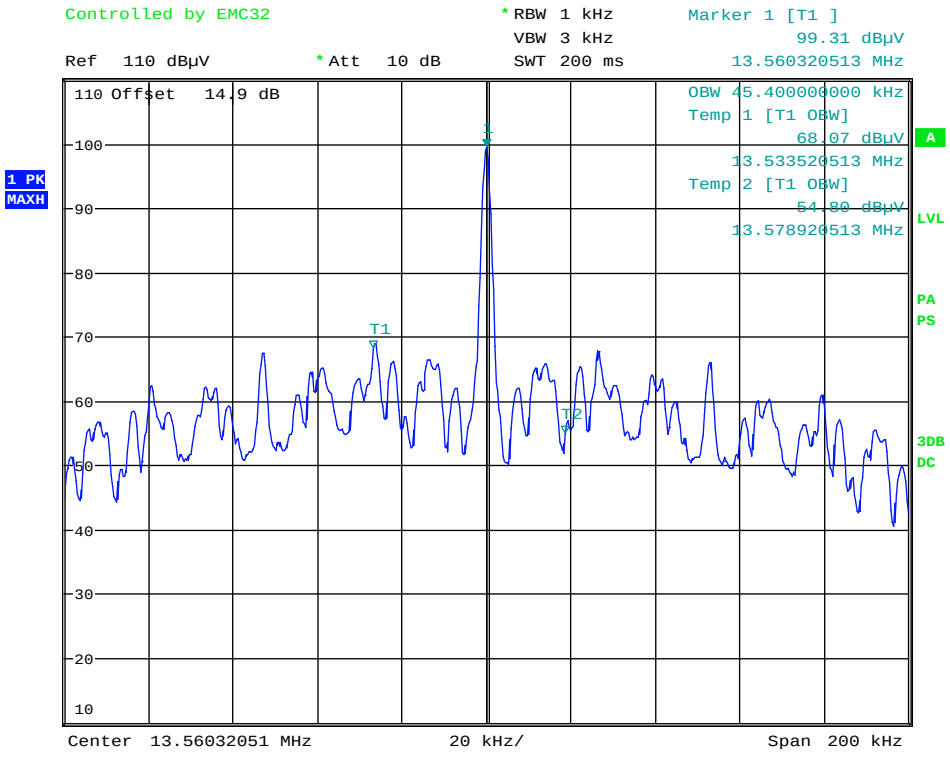
Ambient Temperature	23.7°C
Relative Humidity	40.8%
ATM Pressure	99.5 kPa

2.3.7 Additional Observations

- This is a radiated 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).
- Test performed with antenna sd888 “worst case Configuration”.

2.3.8 Test Results

Frequency	99% Emission bandwidth
13.56032 MHz	45.4 kHz


Controlled by EMC32
*RBW 1 kHz
VBW 3 kHz
SWT 200 ms
Marker 1 [T1]
99.31 dBµV
13.560320513 MHz
Ref 110 dBµV
*Att 10 dB
110 Offset 14.9 dB
OBW 45.400000000 kHz
Temp 1 [T1 OBW]
68.07 dBµV
13.533520513 MHz
Temp 2 [T1 OBW]
54.80 dBµV
13.578920513 MHz
1 PK
MAXH
A
LVL
PA
PS
3DB
DC
T1
T2
100
90
80
70
60
50
40
30
20
10
Center 13.56032051 MHz
20 kHz/
Span 200 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: N/A / Test Configuration B

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

December 02, 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.

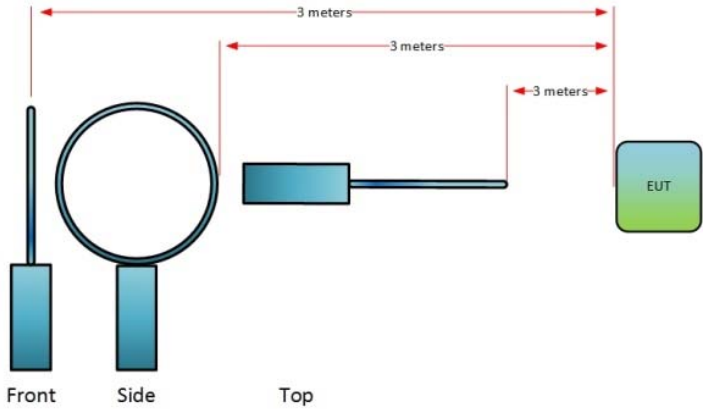
2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. MM Laboratory

Ambient Temperature	24.2°C
Relative Humidity	40.6%
ATM Pressure	99.5 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 40 dB/decade extrapolation rules.
- Final Test performed with antenna sd888 “worst case Configuration”.
- Prescans were performed in the 3 antennas 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 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 2.4.8 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**

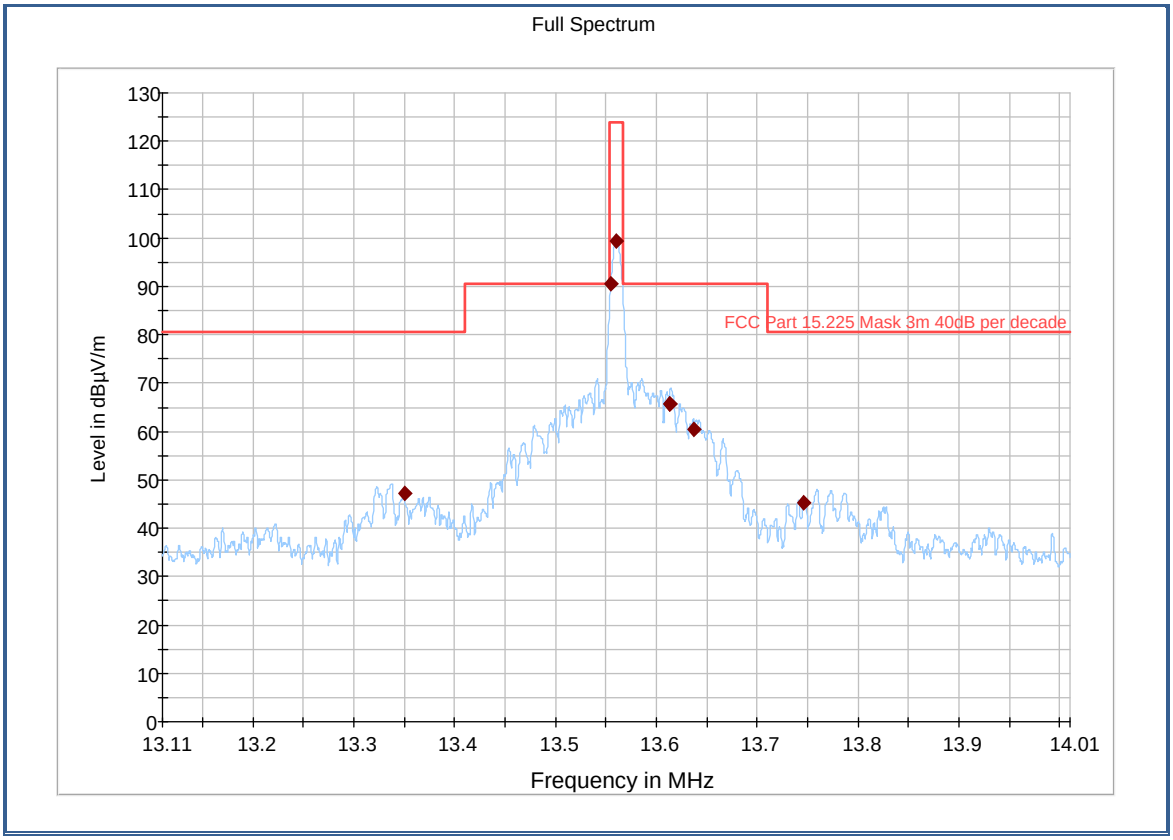
2.4.9 Sample Computation (Limits)

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:	= 40 dB
Calculated limit @ 3 meters:	= 84 dB µV/m + 40 dB
	= 124 dB µV/m

2.4.10 Test Results

See attached plots.

2.4.11 Test Results



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
13.349900	47.10	80.50	33.40	1000.0	9.000	120.0	H	27.0	15.0
13.554900	90.50	124.00	33.50	1000.0	9.000	120.0	H	15.0	14.9
13.560150	99.36	124.00	24.64	1000.0	9.000	120.0	H	15.0	14.9
13.587700	67.69	90.48	22.79	1000.0	9.000	120.0	H	26.0	14.9
13.612800	65.66	90.48	24.82	1000.0	9.000	120.0	H	24.0	14.9
13.637600	60.39	90.48	30.08	1000.0	9.000	120.0	H	30.0	14.9
13.745700	45.24	80.50	35.26	1000.0	9.000	120.0	H	7.0	14.9

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: N/A / Default Test Configuration

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

December 05, 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.

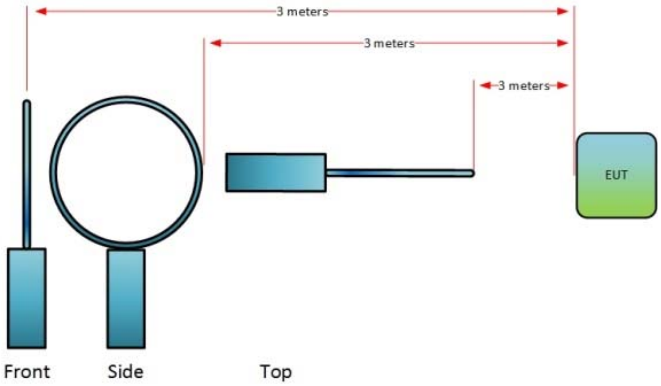
2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. MM Laboratory

Ambient Temperature	24.2°C
Relative Humidity	40.6%
ATM Pressure	99.5 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to 1 GHz.
- Test performed with antenna sd888 “worst case Configuration”.
- 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 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 Sections 2.5.8 and 2.5.9 for sample computations.

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

Measuring equipment raw measurement (dbµV) @ 9 kHz			25.0
Correction Factor (dB)	Asset# 1057 (cable)	0.1	25.9
	Asset# 8850 (cable)	0.0	
	Asset# 6628 (antenna)	25.8	
	Asset# 1026 (cable)	0.0	
Reported QuasiPeak Final Measurement (dbµV/m) @ 9kHz			**50.9**

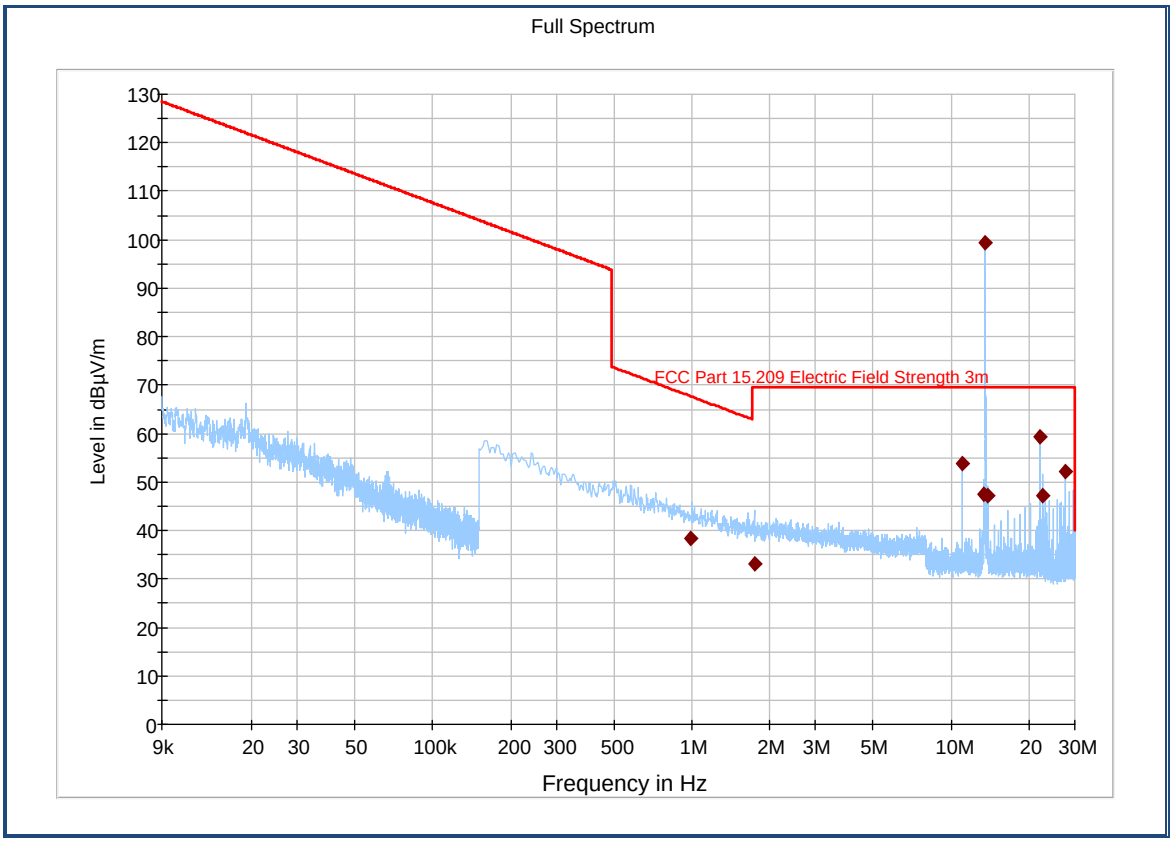
2.5.9 Sample Computation (Radiated Emission 30 MHz to 1 GHz)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1026 (cable)	0.8	-7.0
	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

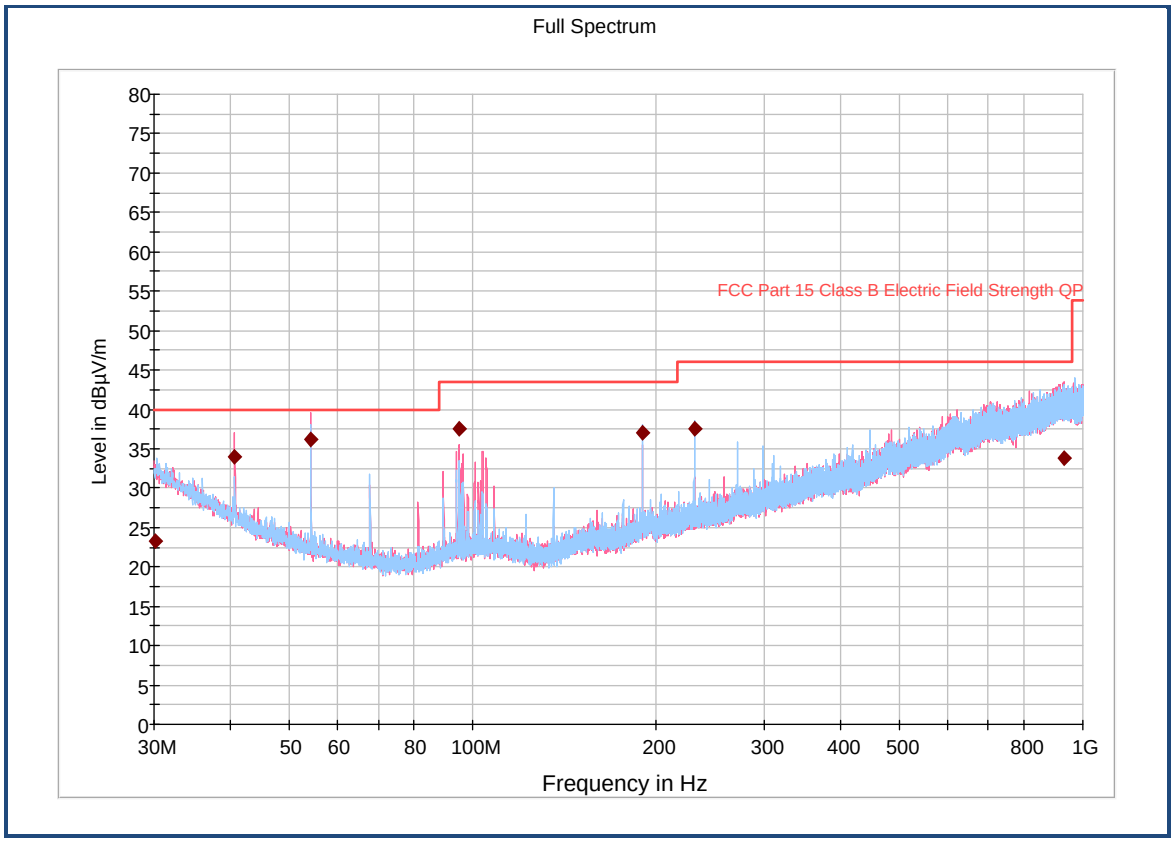


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.992225	38.37	67.67	29.30	1000.0	9.000	120.0	H	57.0	14.6
1.750505	33.24	69.50	36.26	1000.0	9.000	120.0	H	214.0	14.6
11.060675	53.93	69.50	15.57	1000.0	9.000	120.0	H	183.0	15.0
13.190980	35.68	69.50	33.82	1000.0	9.000	120.0	H	351.0	15.0
13.349185	47.48	69.50	22.02	1000.0	9.000	120.0	H	21.0	15.0
13.560105	99.36	Fundamental		1000.0	9.000	120.0	H	22.0	14.9
13.772040	47.26	69.50	22.24	1000.0	9.000	120.0	H	14.0	14.9
13.994885	19.97	69.50	49.53	1000.0	9.000	120.0	H	66.0	14.9
22.120085	59.30	69.50	10.20	1000.0	9.000	120.0	H	45.0	14.6
22.580775	47.11	69.50	22.39	1000.0	9.000	120.0	H	124.0	14.4
27.650305	52.20	69.50	17.30	1000.0	9.000	120.0	H	24.0	13.7

Test Notes:

2.5.12 Test Results 30 MHz to 1 GHz



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.215667	23.19	40.00	16.81	1000.0	120.000	325.8	H	55.0	25.0
40.690000	34.01	40.00	5.99	1000.0	120.000	106.4	V	316.0	19.2
54.237667	36.26	40.00	3.74	1000.0	120.000	127.7	V	227.0	15.4
94.913000	37.58	43.50	5.92	1000.0	120.000	154.5	V	271.0	15.6
189.843667	36.97	43.50	6.53	1000.0	120.000	99.8	H	190.0	18.7
230.511333	37.55	46.00	8.45	1000.0	120.000	99.9	H	15.0	19.7
930.197000	33.80	46.00	12.20	1000.0	120.000	125.8	V	-7.0	33.8

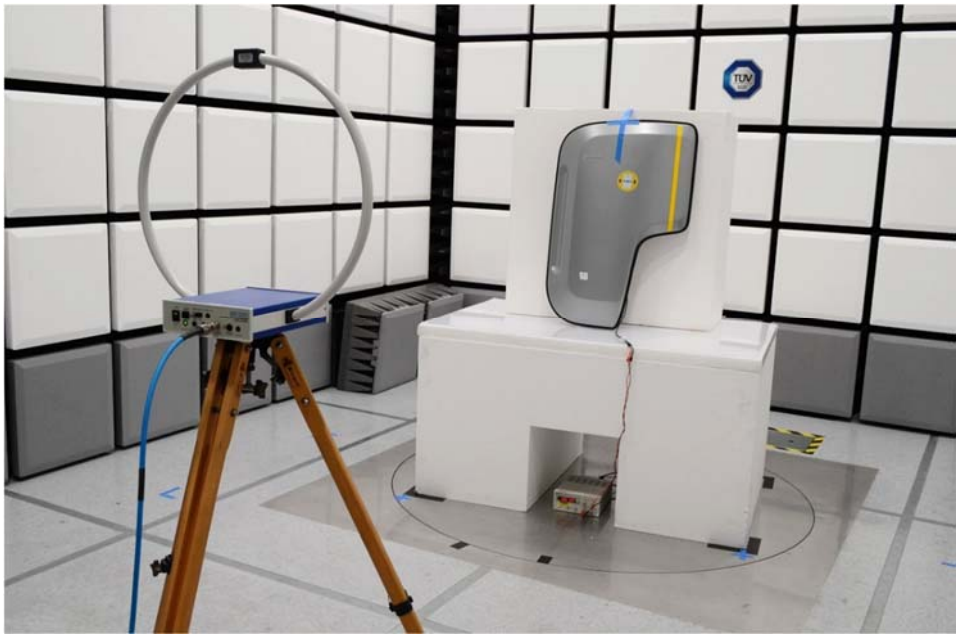
Test Notes:

2.5.13 Receive Mode

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

2.5.14 Test Set Up Pictures

Below 30 MHz (front)



Below 30 MHz (back)

30 MHz to 1 GHz (front)

30 MHz to 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						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
7640	Loop Antenna	AL-130R	121086	Com-Power Corporation	11/21/16	11/21/17
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	02/01/16	02/01/17
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
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
Miscellaneous						
6708	Multimeter	34401A		Hewlett Packard	06/09/16	06/09/17
6672	DC Power Supply	E3611A	KR73012637	HP	Verified by 6708	
6610	Temperature chamber	SH-27C	9963481-S1074	Envirotronics	01/20/16	01/20/17
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	08/22/16	08/22/17
	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:

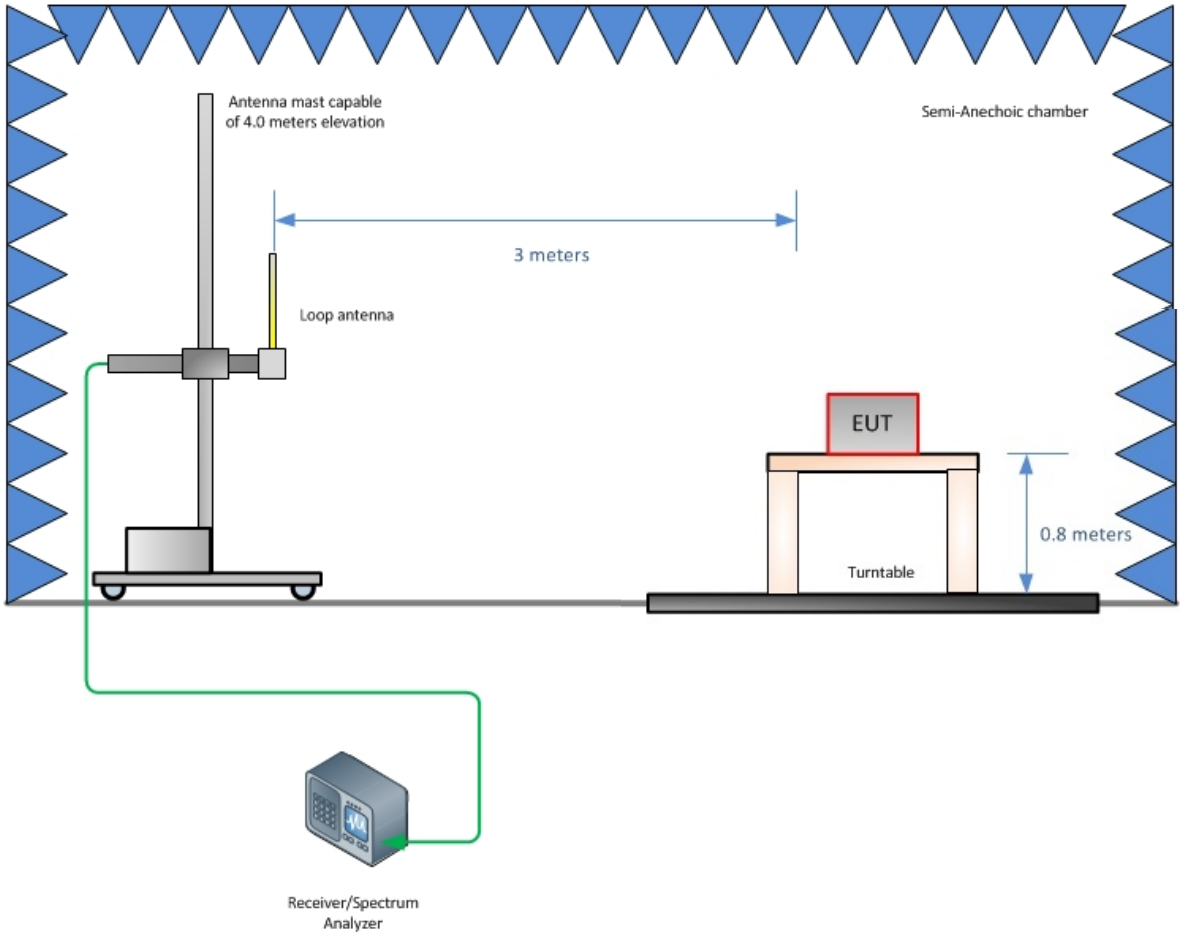
3.2.1 Radiated Emission Measurements

	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

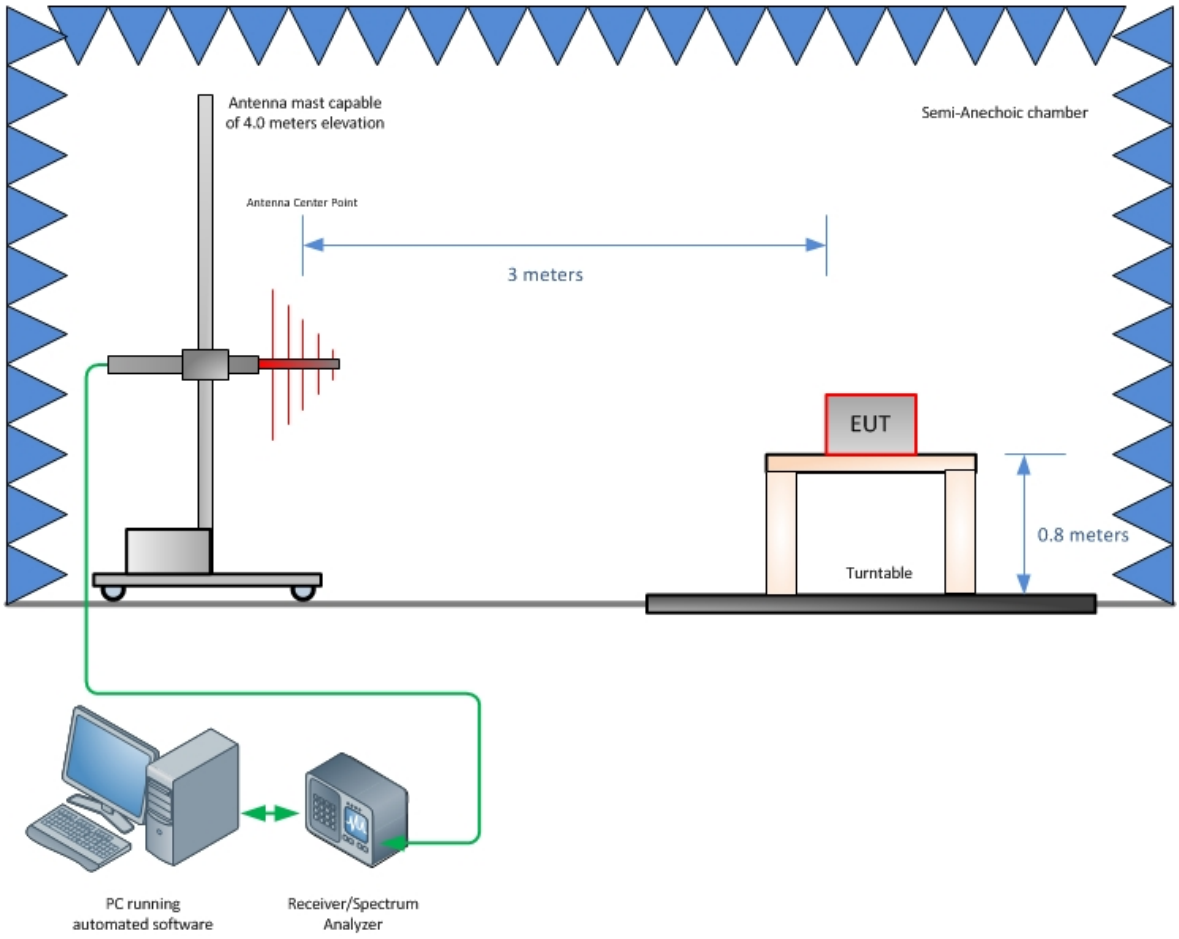
SECTION 4

DIAGRAM OF TEST SETUP

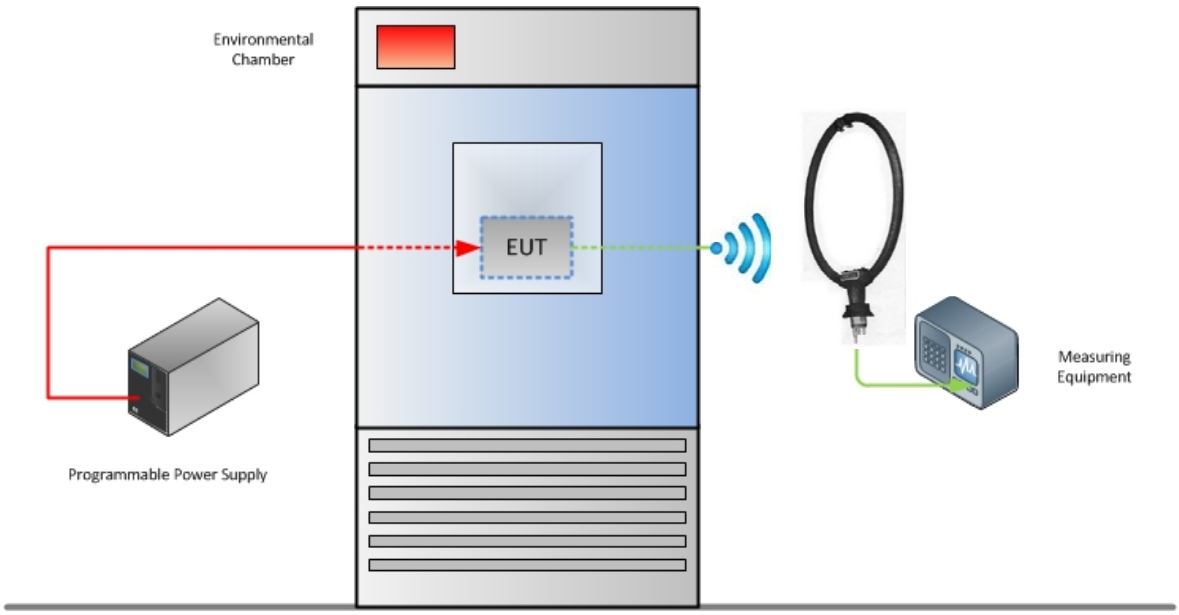
4.1 TEST SETUP DIAGRAM (EMISSION MASK)



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



4.3 TEST SETUP DIAGRAM (FREQUENCY STABILITY)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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