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Report On

Radio Testing of the
FLIR Detection Inc.
Fido X3 Explosives Trace Detector

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

Report No. 72138632 **May 2018**

REPORT ON	EMC Evaluation of the FLIR Detection Inc. Fido X3
TEST REPORT NUMBER	72138632
REPORT DATE	May 2018
PREPARED FOR	FLIR Detection Inc. 1024 S. Innovation way Stillwater, OK 74074
CONTACT PERSON	Sam Parnell Manufacturing Engineer, Explosives / Chem-Bio Detection (504) 372-9535 ext. 1221 sam.parnell@flir.com
PREPARED BY	Omar Castillo **Name** Authorized Signatory Title: EMC Test Engineer
APPROVED BY	Ferdinand S. Custodio Name Authorized Signatory Title:
DATED	June 05, 2018

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

72138632 FLIR Detection Inc. Fido X3					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/05/2018		Initial Release			

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
FLIR Detection Inc.
Fido X3

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FLIR Detection Inc. Fido X3 Explosives Trace Detector to the requirements of FCC Part 15 Subpart C §15.225 and IC RSS-210 Issue 9 August 2016.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	FLIR Detection Inc.
Model Number(s)	Fido X3
FCC ID Number	2AJVE-FIDOX3FEY
IC Number	21981-FIDOX3FEY
Serial Number(s)	08703542
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.225 (October 1, 2016). • RSS-210 - Licence-exempt Radio Apparatus: Category I Equipment (Issue 9, August 2016). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 5, April 2018).
Start of Test	May 14, 2017
Finish of Test	May 18,2017
Name of Engineer(s)	Omar Castillo
Related Document(s)	

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	See Test Note[1]
2.1		§15.225(e)	RSS-210 B.6	Frequency Stability	Compliant	
2.2	§15.215(c)			20dB Bandwidth	Compliant	
2.3			RSS-Gen 6.7	Occupied 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	
			RSS-Gen 7.3	Receiver Spurious Emissions	N/A	See Test Note[2]
2.6		§15.207(a)	RSS-Gen 7.4	Conducted Emissions	Compliant	

Test Note[1]: The EUT uses a permanently attached antenna to the intentional radiator and is considered sufficient evidence to comply with the provisions of this requirement.

Test Note[2]: The EUT does not fall into the category of a Receiver as per RSS-Gen 5.0.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a FLIR Detection Inc. Fido X3 Explosives Trace Detector as shown in the photograph below. The EUT is a handheld explosives trace detector for critical security applications. It identifies military, commercial, homemade, and liquid explosive threats by class collected from surfaces (particulate) and from in bottles (vapor). The Sensing Elements that the product uses come bagged with a RFID label that the RFID reader uses to ID what type of Sensing Element being used. The EUT has a rechargeable battery that is charged via a supplied AC Power adaptor

Equipment Under Test

1.3.2 EUT General Description

EUT Description	Explosives Trace Detector
Model Number(s)	Fido X3
Rated Voltage	12 VDC Via external AC Adapter (M/N PSAC60M-120) or 14.4VDC Rechargeable Li-Ion Battery (Model 4INR19/66-2) AC/DC Power Adapter rated 100-240VAC; 50/60Hz
HW	FidoX3
FW	16492136 Version 9.99
Configuration	RFID Continuously Transmitting
Frequency (Capability)	13.56 MHz
Mode Verified	13.56 MHz
Configuration	Auto Read

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	*Description*
Default	RFID was set in continuous transmission mode with a special command provided by client. EUT was plugged in and charging via supplied AC Power adaptor.

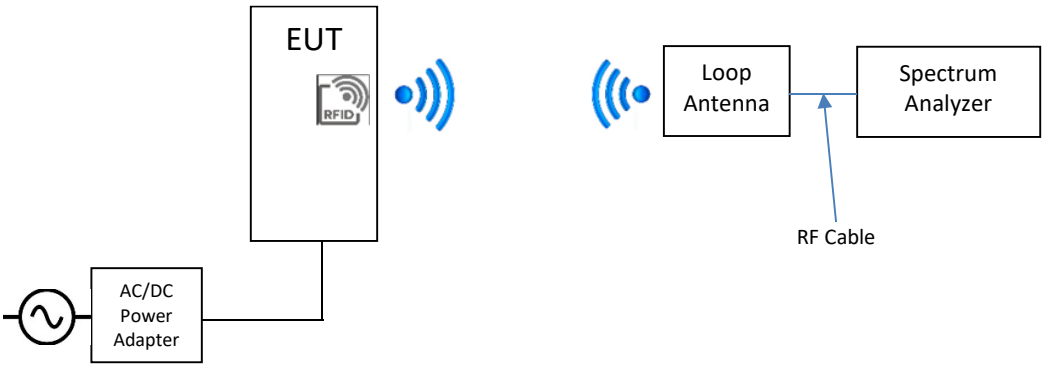
1.4.2 EUT Exercise Software

Firmware used for testing is version 9.99 of the firmware named 16492136

1.4.3 Support Equipment and I/O cables

Manufacturer	*Equipment/Cable*	*Description*
PHIHONG	AC/DC Power Adapter	M/N PSAC60M-120 S/N P62900101A1

1.4.4 Simplified Test Configuration Diagrams



1.5 DEVIATIONS FROM THE STANDARD

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

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number 08703542		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013. American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 Fax: 858 546 0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

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 Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

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 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0280 and A-0281

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.

1.9.6 RRA – Identification No. US0102

TUV SUD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TUV SUD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

SECTION 2

TEST DETAILS

Radio Testing of the
FLIR Detection Inc.
Fido X3

2.1 FREQUENCY STABILITY

2.1.1 Specification Reference

Part 15 Subpart C §15.225(e) and RSS-210 B.6

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: 08703542 / Default Test Configuration

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

May 18, 2018 /OC

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. Rancho Bernardo facility

Ambient Temperature	25.4 °C
Relative Humidity	43.6 %
ATM Pressure	98.4 kPa

2.1.7 Additional Observations

- This is a radiated test with the loop antenna next to the environmental chamber.
- Measurement was done using the spectrum analyzer's frequency counter function to measure the frequency variation of the EUT's RFID system.
- The RBW was set to 10 kHz Hz for better resolution.
- The temperature was varied from 50°C to -20°C in 10 degree increments with voltage variation of 85% and 115% (10.2VDC to 13.8VDC on the DC connector) at 20°C.
- The EUT was powered off, then powered on once the temperature stabilized and the frequency was then measured.

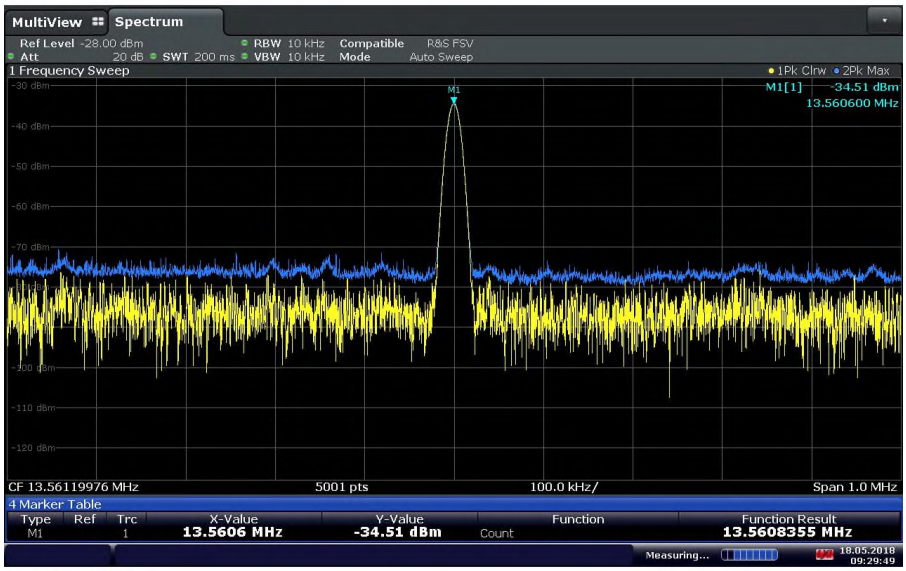
2.1.8 Test Results

RFID @ 13.56MHz					
Voltage (%)	***Power (VDC)***	***Temp (°C)***	***Frequency (Hz)***	***Frequency Deviation***	***Deviation (%)***
100	12	+50	13.5608355	0.0008355	0.0061615
100		+40	13.5608197	0.0008197	0.0060450
100		+30	13.5608148	0.0008148	0.0060088
100		+20	13.5608218	0.0008218	0.0060605
100		+10	13.5608359	0.0008359	0.0061645
100		0	13.5608360	0.0008360	0.0061652
100		-10	13.5608698	0.0008698	0.0064145
100		-20	13.5608804	0.0008804	0.0064926
Voltage Variation (85% and 115%)	10.2	+20	13.5608219	0.0008219	0.0060612
	13.8	+20	13.5608219	0.0008219	0.0060612

Maximum Deviation = 0.0064926%
= 0.0064926% < 0.01% Limit **(Complies)**

2.1.9 Sample Test Plots

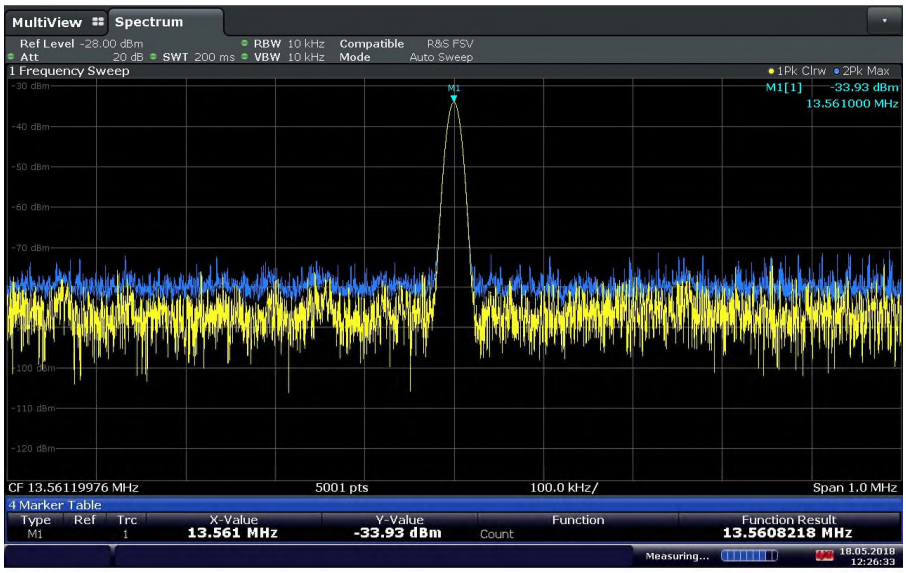
50C



09:29:50 18.05.2018

Nominal Voltage @ 50°C

50C



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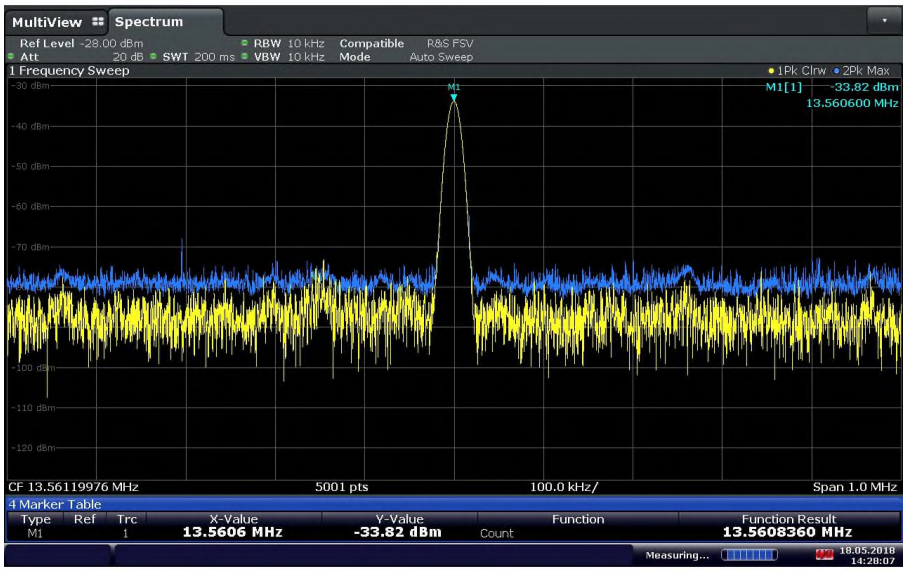
Nominal Voltage @ 20°C

50C



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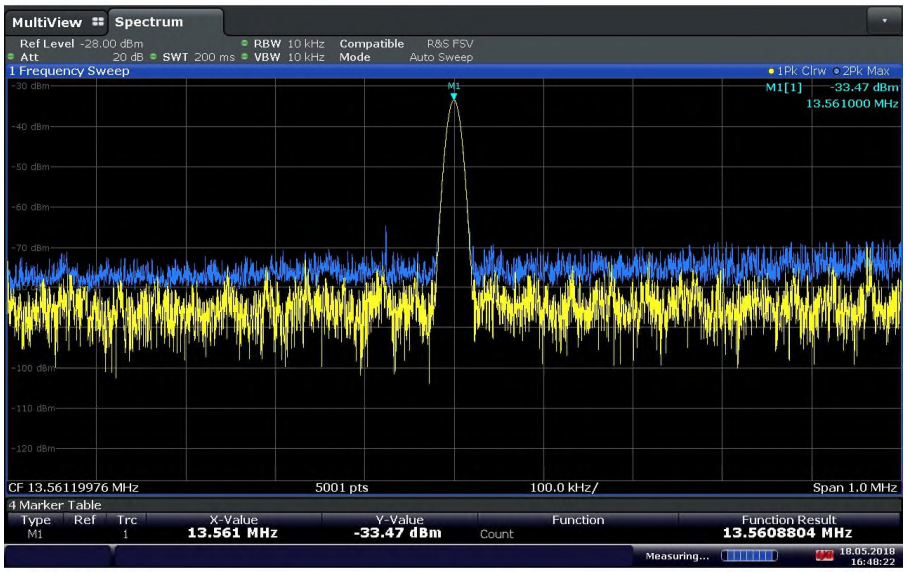
Nominal Voltage @ 0°C

50C



16:48:22 18.05.2018

Nominal Voltage @ -20°C

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: 08703542 / Default Test Configuration

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

May 15, 2018 /OC

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

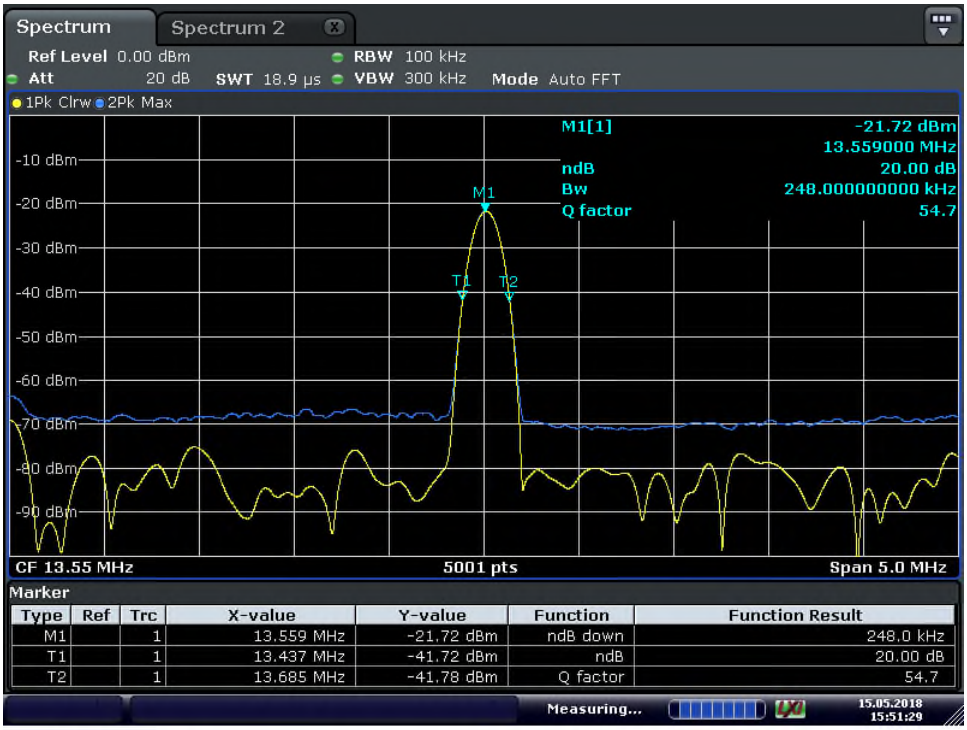
Ambient Temperature	24.8 °C
Relative Humidity	47.6 %
ATM Pressure	98.8 kPa

2.2.7 Additional Observations

- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW was set to 100 kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyser was used for this test.

2.2.8 Test Results

Frequency	20dB bandwidth
13.56 MHz	248.0 kHz



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Measured 20dB Bandwidth: 248.0 kHz
Frequency Band: 13.110 to 14.010 MHz

13.56 MHz – (20dB BW/2) = 13.436 MHz (within the frequency band - **Compliant**)
13.56 MHz + (20dB BW/2) = 13.684 MHz (within the frequency band - **Compliant**)

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.6

2.3.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 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 shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear 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. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Serial No: 08703542 / Default Test Configuration

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

May 15, 2018 /OC

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	24.8 °C
Relative Humidity	47.6 %
ATM Pressure	98.8 kPa

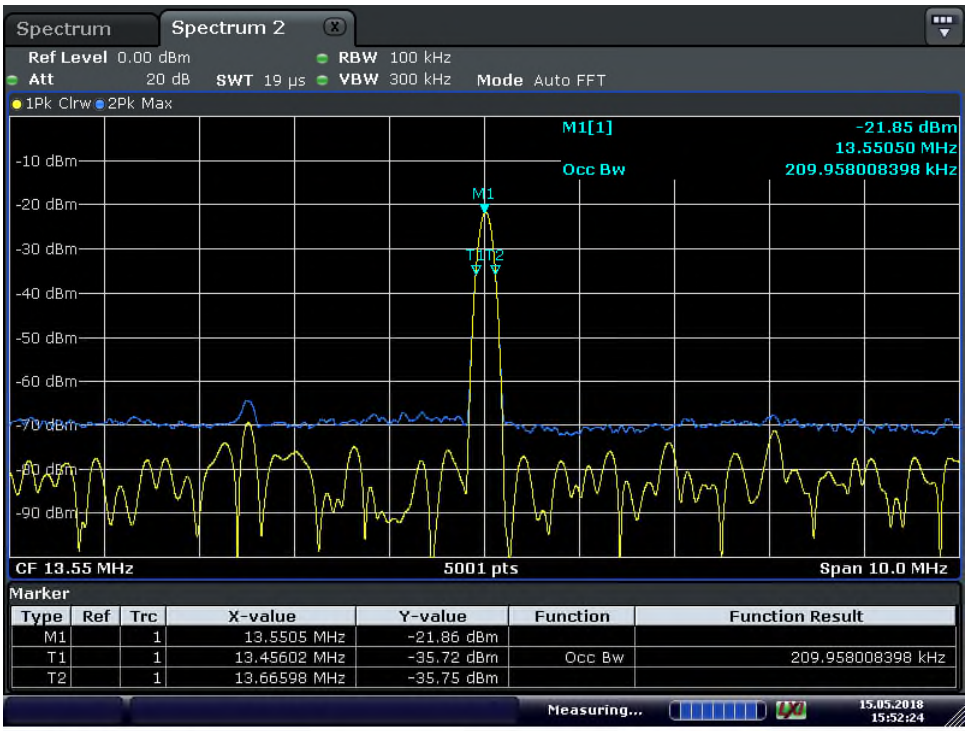
2.3.7 Additional Observations

- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW was set to 100 kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.

- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

2.3.8 Test Results (Reporting Purposes Only)

Frequency	99% Emission bandwidth
13.56 MHz	209.958008398 kHz



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2.4 EMISSION MASK

2.4.1 Specification Reference

Part 15 Subpart C §15.225(a)(b)(c) and RSS-210 B.6(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: 08703542 / Default Test Configuration

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

May 17, 2018/OC

2.4.5 Test Equipment Used

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

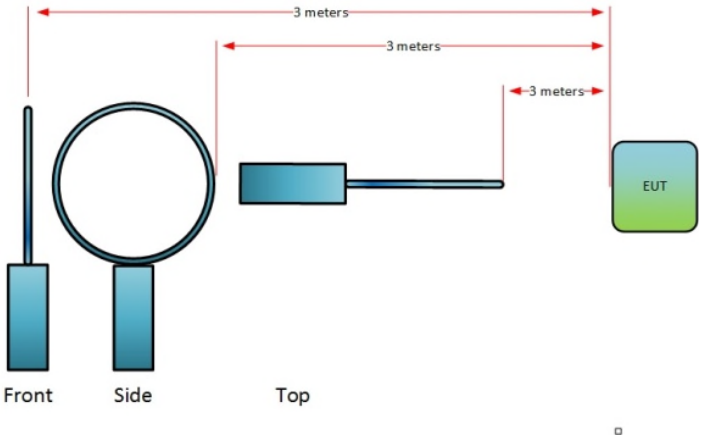
2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4 °C
Relative Humidity	36.4 %
ATM Pressure	98.9 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9kHz to 30MHz. Only 13.110 MHz to 14.010 MHz 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 on the following page) 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 Section 2.4.1 for sample computation.

2.4.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 13.56MHz			15.0
Correction Factor (dB)	Asset# 1026 (cable)	0.6	21.5
	Asset# 1057 3m (cable)	0.7	
	Asset# 6628 (antenna)	19.9	
	Asset# 1187(cable)	0.3	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**36.5**

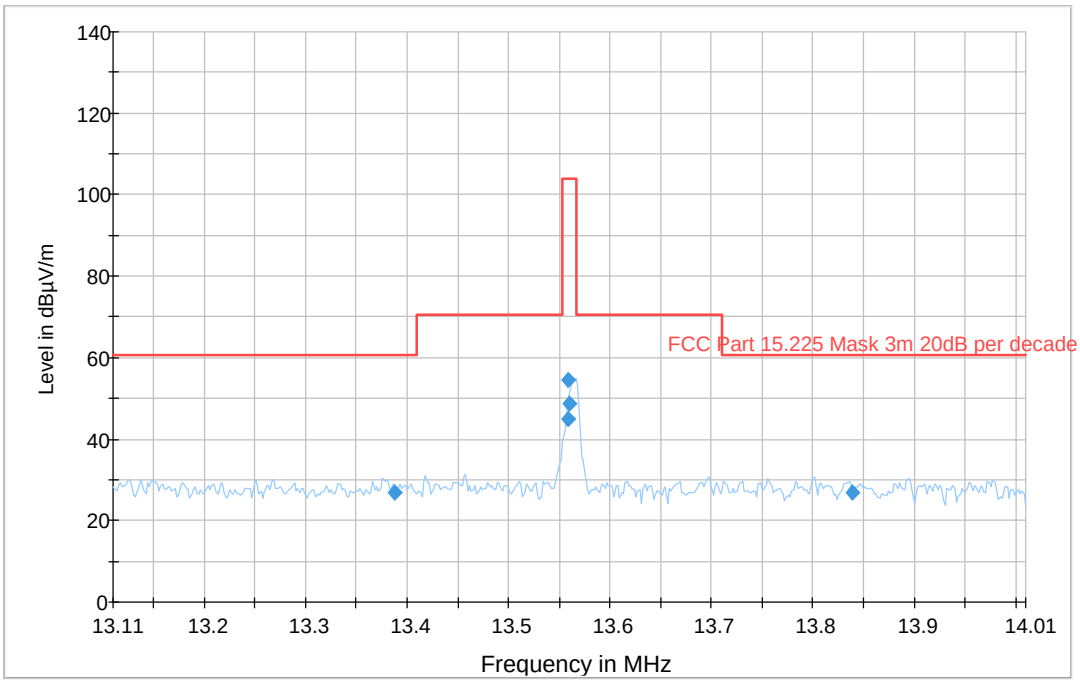
2.4.9 Sample Computation (Limits)

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 (§15.225 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
13.387485	27.0	1500.0	9.000	100.0	H	241.0	22.4	33.5	60.5
13.559136	45.1	1500.0	9.000	100.0	H	145.0	22.5	58.9	104.0
13.559313	54.5	1500.0	9.000	100.0	H	271.0	22.5	49.5	104.0
13.559489	48.8	1500.0	9.000	100.0	H	15.0	22.5	55.2	104.0
13.838784	27.1	1500.0	9.000	100.0	H	15.0	22.5	33.4	60.5

2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.225(d) and RSS-210 B.6(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: 08703542 / Default Test Configuration

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

May 17, 2018/OC

2.5.5 Test Equipment Used

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

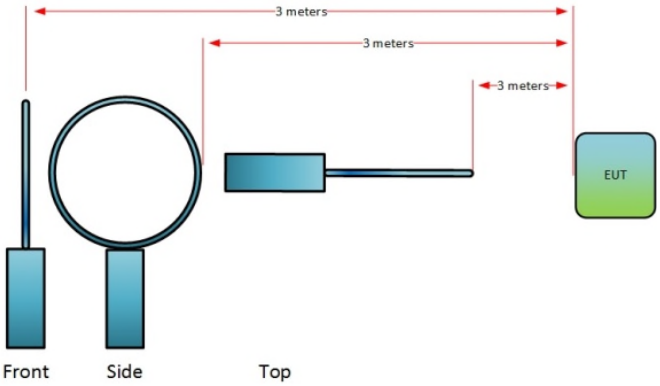
2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4 °C
Relative Humidity	36.4 %
ATM Pressure	98.9 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to 18GHz.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Prescans were performed to determine the best test antenna orientation with the highest recorded emissions. Verification was performed using “Front” configuration (see the figure on the following page) 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 Section 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**

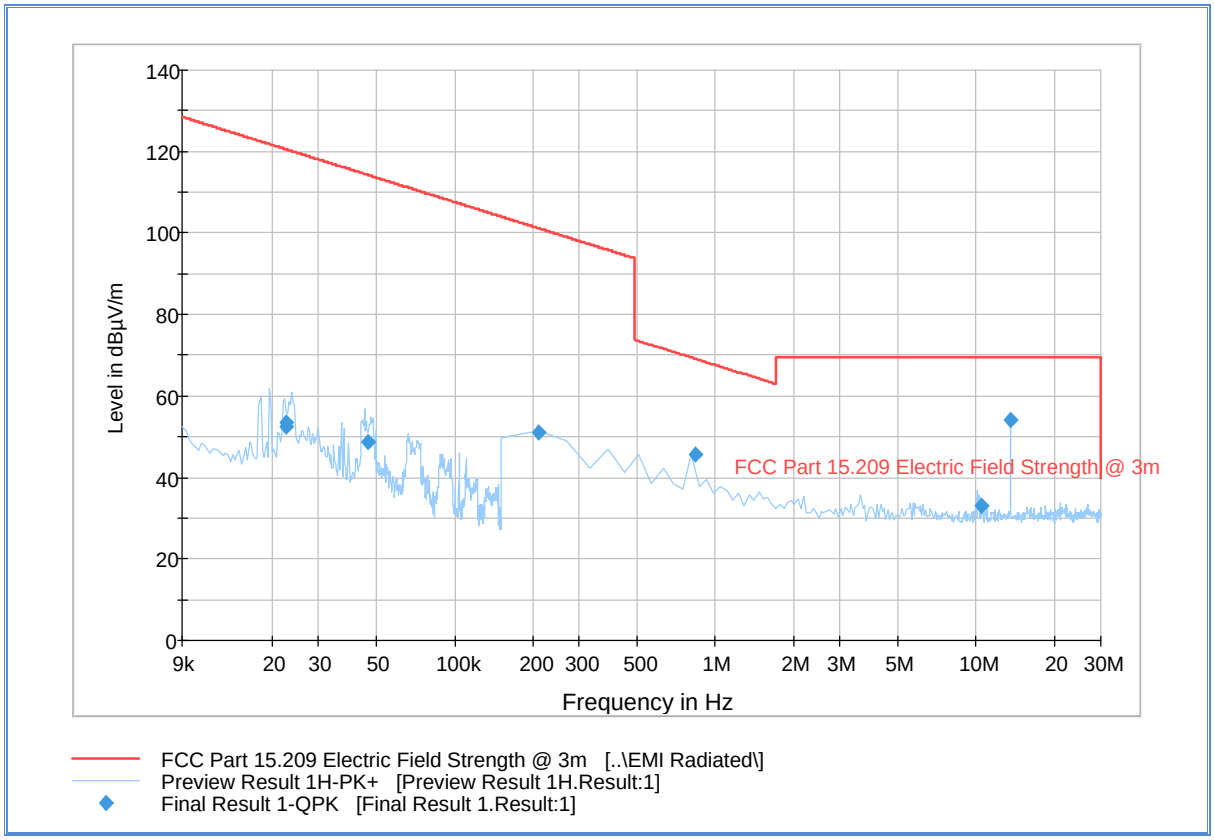
2.5.9 Sample Computation (Radiated Emission 30 MHz to 1 GHz)

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# 1193 (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.

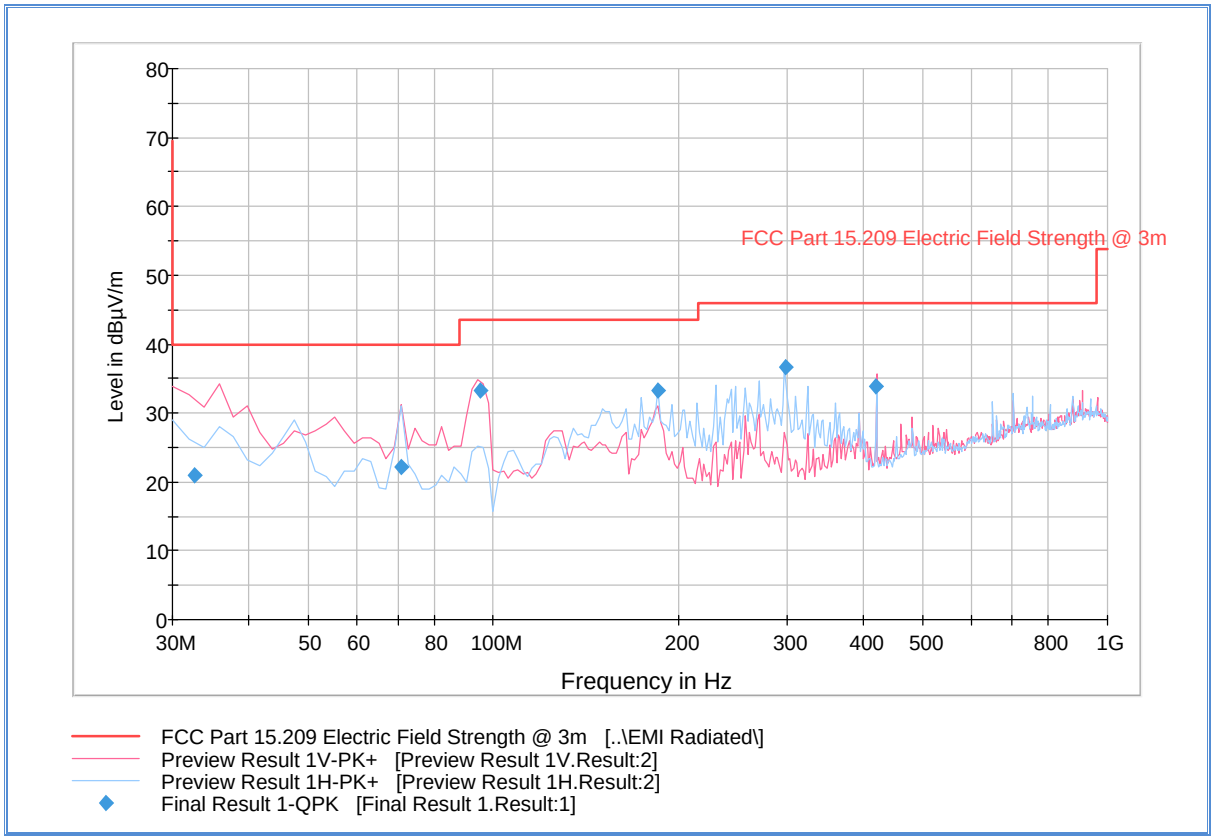
2.5.11 Test Results Below 30MHz



Quasi Peak Data (§15.209 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.022455	52.5	1000.0	0.200	100.0	H	7.0	21.6	68.0	120.6
0.022693	53.6	1000.0	0.200	100.0	H	161.0	21.6	66.9	120.5
0.046733	48.7	1000.0	0.200	100.0	H	164.0	20.6	65.6	114.2
0.209000	51.0	1500.0	9.000	100.0	H	169.0	19.9	50.2	101.2
0.833016	45.8	1500.0	9.000	100.0	H	345.0	20.2	23.4	69.2
10.435978	32.9	1500.0	9.000	100.0	H	66.0	21.6	36.7	69.5
13.562599	54.0	1500.0	9.000	100.0	H	270.0	22.5	15.5	69.5

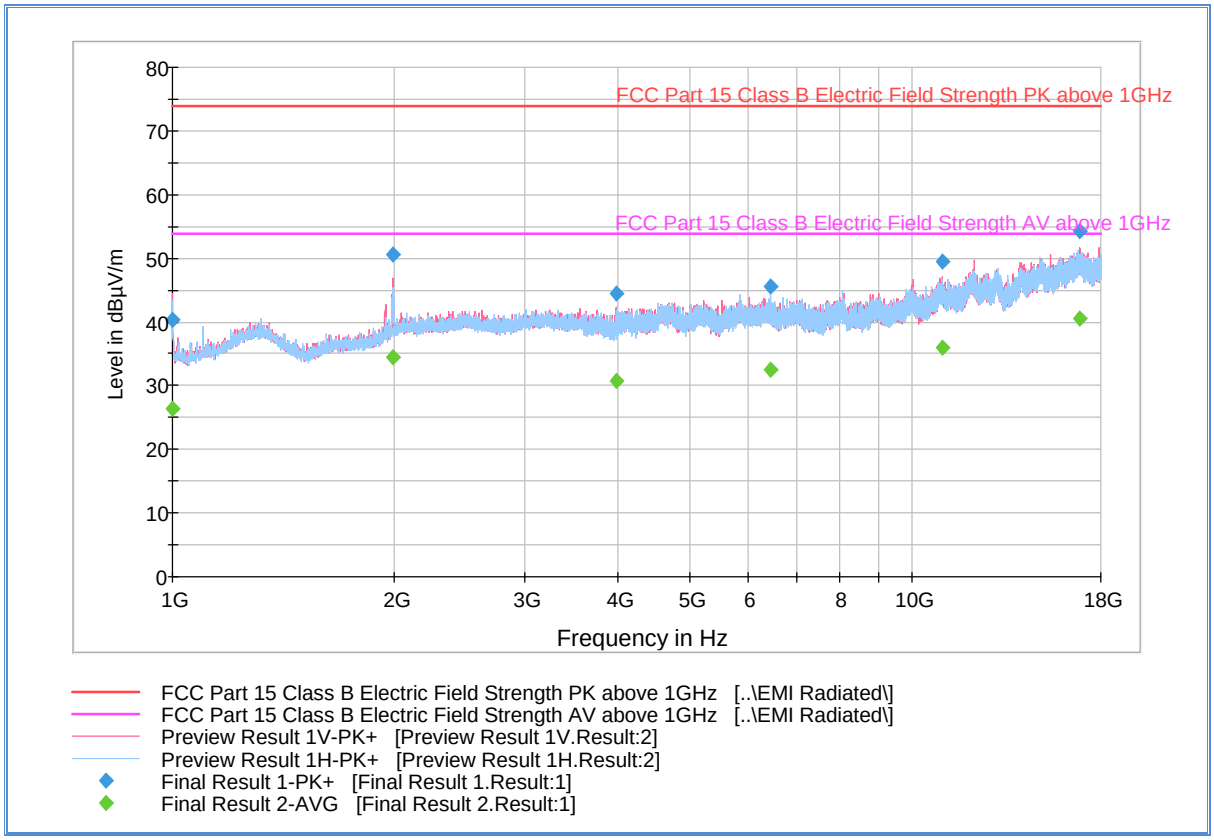
2.5.12 Test Results 30MHz to 1GHz



Quasi Peak Data (§15.209 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
32.671663	21.0	1000.0	120.000	110.0	V	276.0	-7.6	19.0	40.0
70.941643	22.1	1000.0	120.000	400.0	V	24.0	-16.5	17.9	40.0
94.988297	33.2	1000.0	120.000	100.0	V	161.0	-14.7	10.3	43.5
184.991022	33.2	1000.0	120.000	150.0	H	99.0	-11.6	10.3	43.5
298.336513	36.8	1000.0	120.000	100.0	H	267.0	-7.8	9.2	46.0
420.001443	33.9	1000.0	120.000	105.0	V	338.0	-3.7	12.1	46.0

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)
1000.400000	40.3	1000.0	1000.000	132.7	V	249.0	-7.3	33.6	73.9
1987.666667	50.7	1000.0	1000.000	221.5	V	112.0	-2.3	23.2	73.9
3989.700000	44.4	1000.0	1000.000	296.3	V	172.0	2.3	29.5	73.9
6438.533333	45.5	1000.0	1000.000	240.4	H	296.0	5.9	28.4	73.9
11019.366667	49.4	1000.0	1000.000	116.7	V	49.0	11.5	24.5	73.9
16868.933333	54.3	1000.0	1000.000	275.3	V	20.0	17.9	19.6	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)
1000.400000	26.4	1000.0	1000.000	132.7	V	249.0	-7.3	27.5	53.9
1987.666667	34.5	1000.0	1000.000	221.5	V	112.0	-2.3	19.4	53.9
3989.700000	30.7	1000.0	1000.000	296.3	V	172.0	2.3	23.2	53.9
6438.533333	32.4	1000.0	1000.000	240.4	H	296.0	5.9	21.5	53.9
11019.366667	36.0	1000.0	1000.000	116.7	V	49.0	11.5	17.9	53.9
16868.933333	40.6	1000.0	1000.000	275.3	V	20.0	17.9	13.3	53.9

2.6 CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.6.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.6.3 Equipment Under Test and Modification State

Serial No: 08703542 / Default Test Configuration

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

May 16, 2018

2.6.5 Test Equipment Used

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

2.6.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.1 °C
Relative Humidity	48.7%
ATM Pressure	99.1 kPa

2.6.7 Additional Observations

- Measurement was performed on the support AC/DC power adapter of the EUT.
- Termination of the EUT RFID antenna is not possible, the position of the EUT on the test table was adjusted to lessen the influence of the RFID frequencies on the measurements.
- 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 Section 2.6.8 for sample computation.

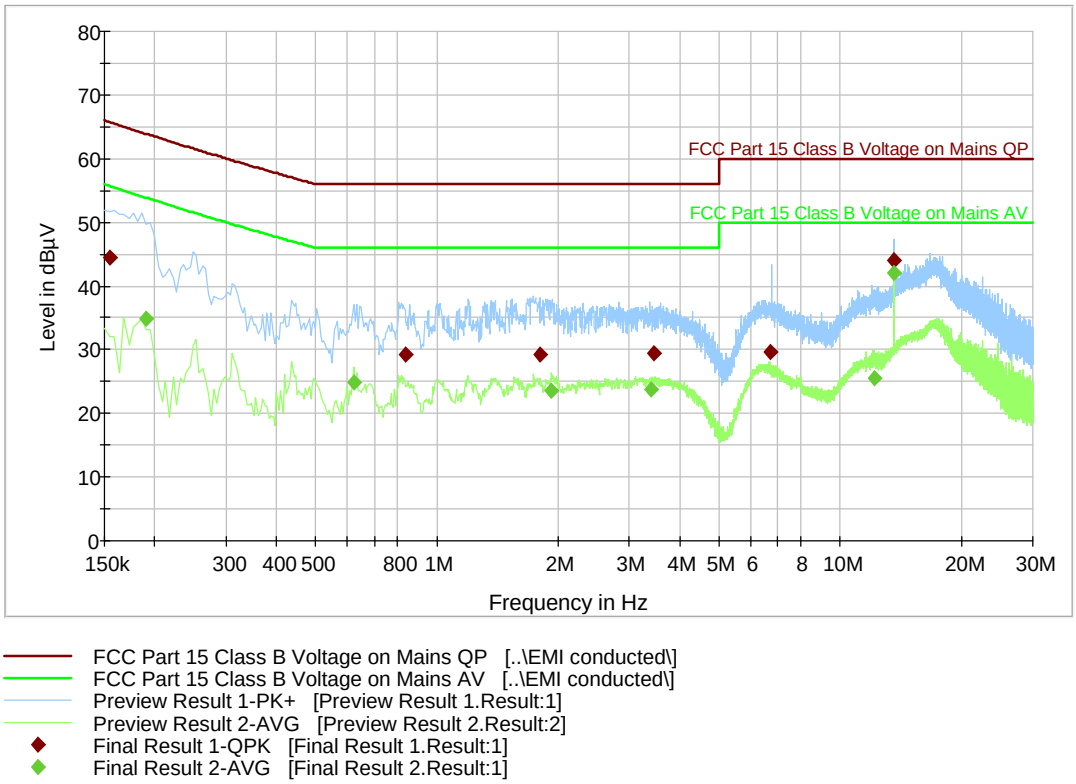
2.6.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8822 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7567 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.6.9 Test Results

Compliant. See attached plots and tables.

2.6.10 120VAC 60Hz (Line 1)



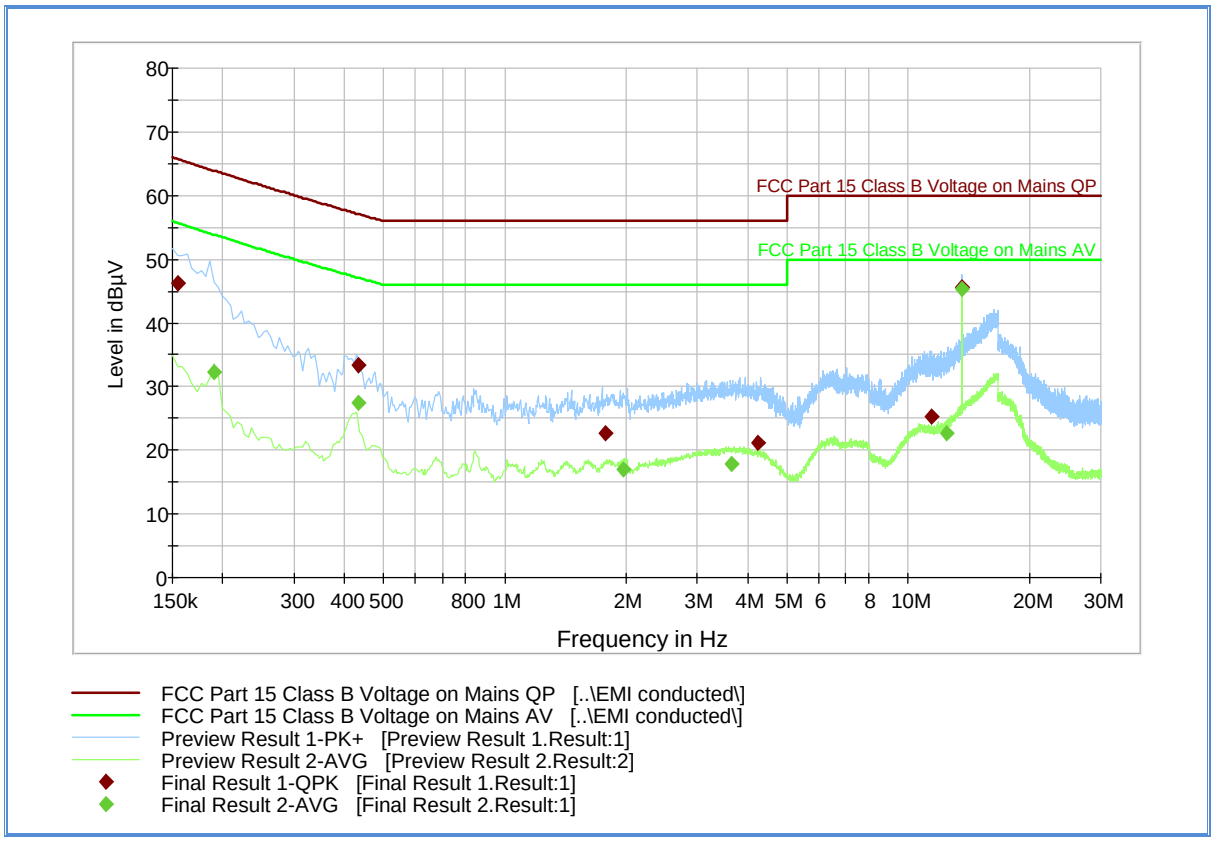
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.154500	44.6	1000.0	9.000	Off	L1	20.4	21.2	65.7
0.834000	29.2	1000.0	9.000	Off	L1	20.3	26.8	56.0
1.797000	29.1	1000.0	9.000	Off	L1	20.3	26.9	56.0
3.457500	29.4	1000.0	9.000	Off	L1	20.4	26.6	56.0
6.702000	29.6	1000.0	9.000	Off	L1	20.4	30.4	60.0
13.560000	44.1	1000.0	9.000	Off	L1	20.6	15.9	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	34.9	1000.0	9.000	Off	L1	20.2	19.0	53.9
0.622500	24.9	1000.0	9.000	Off	L1	20.2	21.1	46.0
1.923000	23.6	1000.0	9.000	Off	L1	20.4	22.4	46.0
3.408000	23.8	1000.0	9.000	Off	L1	20.4	22.2	46.0
12.174000	25.5	1000.0	9.000	Off	L1	20.6	24.5	50.0
13.560000	42.0	1000.0	9.000	Off	L1	20.6	8.0	50.0

2.6.11 120VAC 60Hz (Line 2)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.154500	46.1	1000.0	9.000	Off	L2	20.3	19.6	65.7
0.433500	33.3	1000.0	9.000	Off	L2	20.2	23.8	57.1
1.779000	22.6	1000.0	9.000	Off	L2	20.2	33.4	56.0
4.254000	21.2	1000.0	9.000	Off	L2	20.3	34.8	56.0
11.454000	25.3	1000.0	9.000	Off	L2	20.5	34.7	60.0
13.560000	45.6	1000.0	9.000	Off	L2N	20.6	14.4	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	32.2	1000.0	9.000	Off	L2	20.2	21.7	53.9
0.433500	27.5	1000.0	9.000	Off	L2	20.2	19.6	47.1
1.963500	17.0	1000.0	9.000	Off	L2	20.2	29.0	46.0
3.642000	17.9	1000.0	9.000	Off	L2	20.4	28.1	46.0
12.453000	22.6	1000.0	9.000	Off	L2	20.7	27.4	50.0
13.560000	45.3	1000.0	9.000	Off	L2	20.6	4.7	50.0

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
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/15/17	09/15/18
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	12/14/17	12/14/18
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7582 and 7608	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7582 and 7608	
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/15/17	09/15/18
Radiated Emission						
7640	Loop Antenna	AL-130R	121086	Com-Power	02/06/18	02/06/19
7579	Temperature Chamber	TE115F	151617	Test Equity	08/22/17	08/22/18
7582	Signal & Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
7643	Signal Analyzer	FSV30	1321-3008K30-103166-BB	Rhode & Schwarz	04/11/18	04/11/19
6628	Loop Antenna	HFH 2 –Z2	880 458/25	Rhode & Schwarz	05/02/18	05/02/20
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/25/17	10/25/18
1193	Pre-amplifier	PAM-0202	185	PAM	04/11/18	04/11/19
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/01/17	06/01/18
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/13/17	07/13/18
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/06/18	03/06/19
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 1003 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 1003 and 7582	
Miscellaneous						
7579	Temperature Chamber	115	151617	TestQuity	08/22/17	08/22/18
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/05/17	07/05/18
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	02/26/18	02/26/19
	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 AC Conducted Emissions

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.80
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.59

3.2.2 Radiated Measurements (Below 30MHz)

	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
4	Loop Antenna	Rectangular	0.75	0.44	0.19
5	Site	Rectangular	3.52	1.44	2.07
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.66
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.31

3.2.3 Radiated Measurements (30 MHz to 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	3.52	1.44	2.07
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.68
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.36

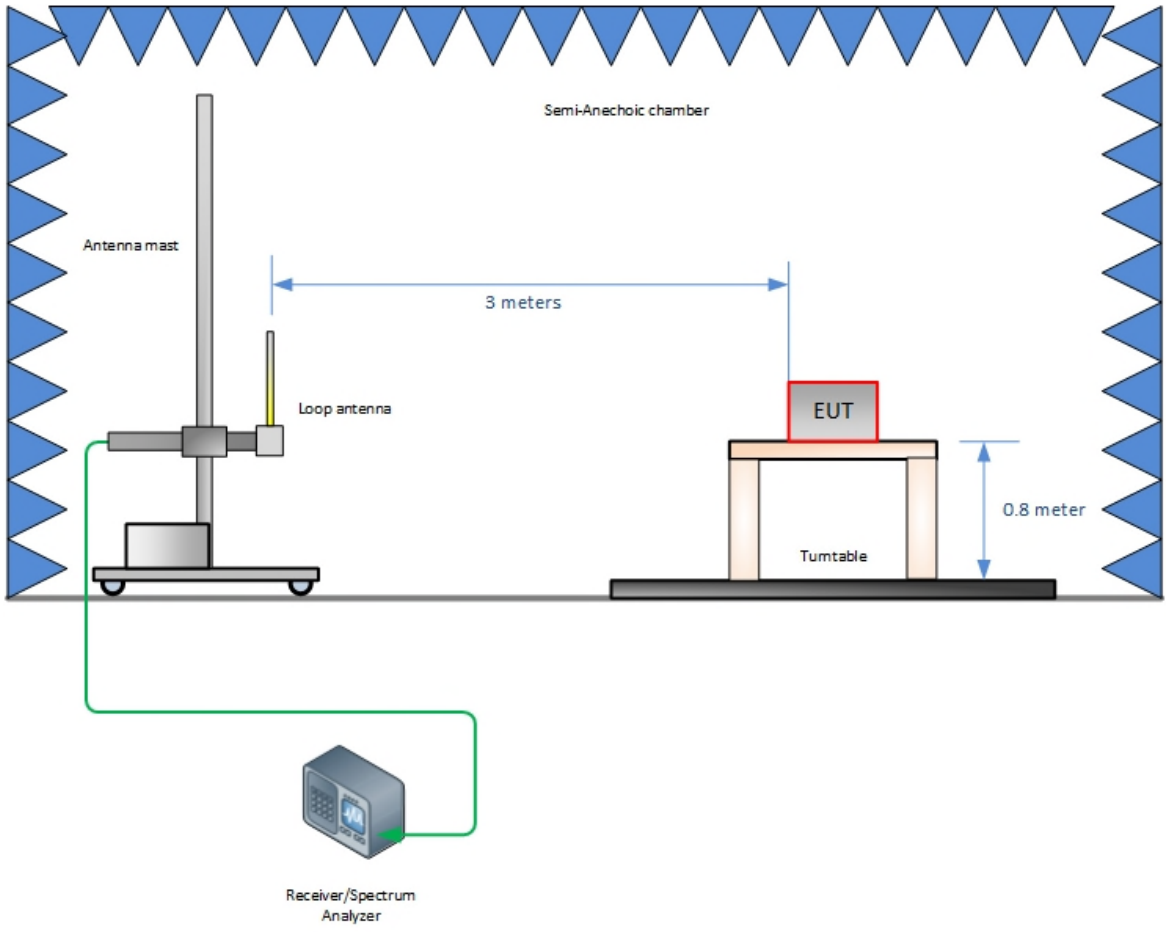
3.2.4 Radiated Emission Measurements (Above 1GHz)

	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	3.00	1.22	1.5
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.49
				Coverage Factor (k):	2
				Expanded Uncertainty:	2.99

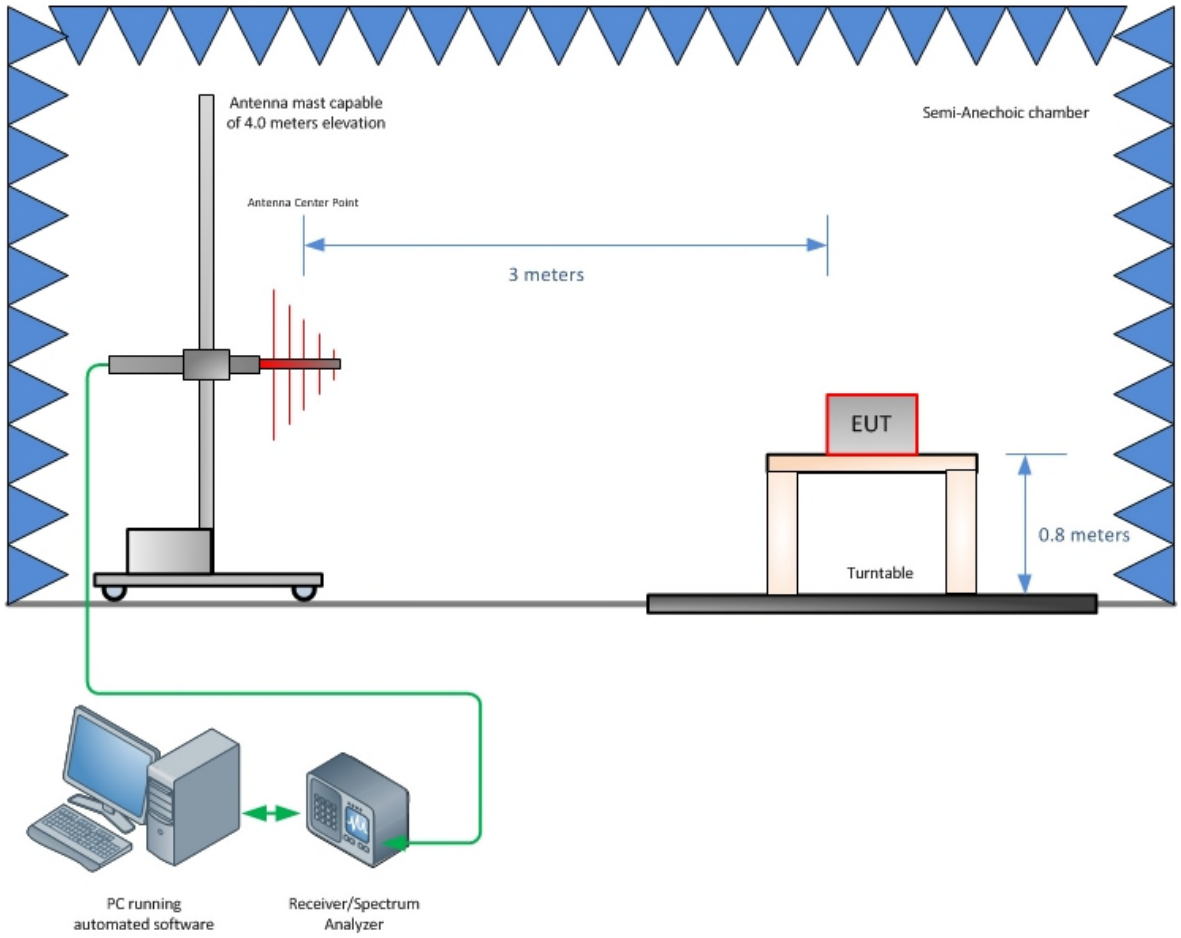
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM (EMISSION MASK AND BELOW 30MHZ)

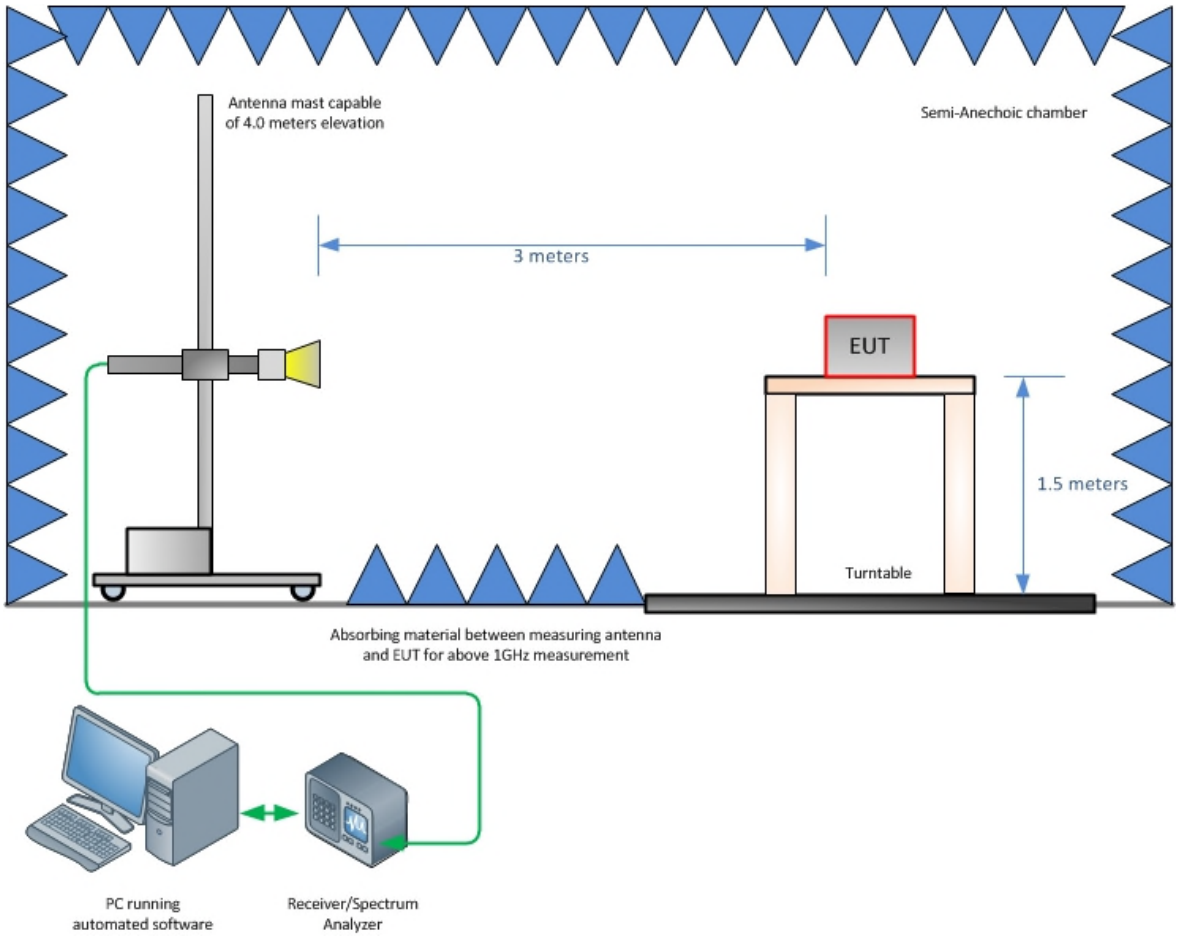


4.2 TEST SETUP DIAGRAM (30MHZ TO 1GHZ)

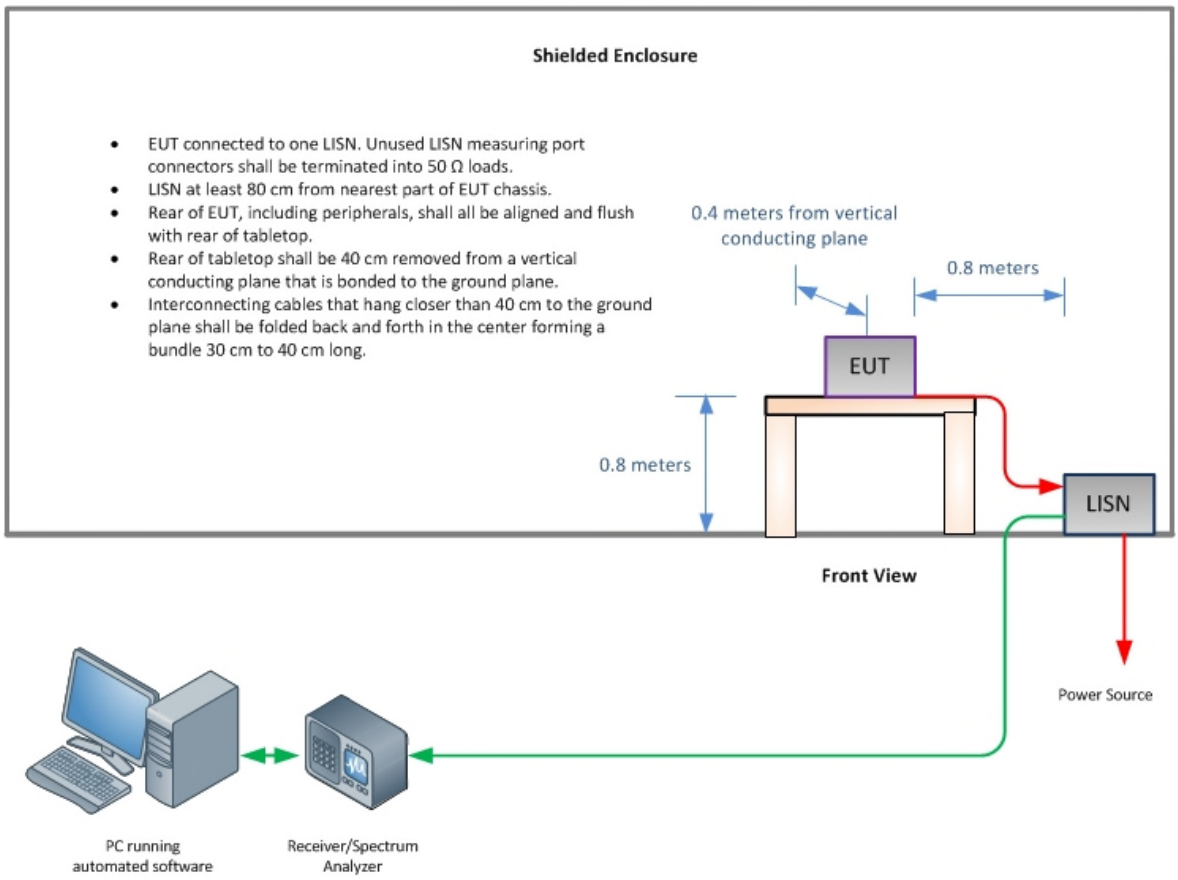


Radiated Emission Test Setup (Below 1GHz)

4.3 TEST SETUP DIAGRAM (ABOVE 1GHZ)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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