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Report On

Radio Testing of the
Privoro LLC
Model M0002 SafeCase

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

Report No. 72138836 F

July 2018




REPORT ON EMC Evaluation of the
Privoro LLC
SafeCase Model No. M0002

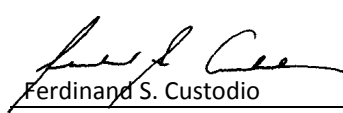
TEST REPORT NUMBER 72138836 F

REPORT DATE July 2018

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DATED August 17, 2018



Revision History

72138836 F Privoro LLC M0002 SafeCase					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
8/17/2018	Initial Release				Ferdie Custodio



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Privoro LLC
M0002 SafeCase



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Privoro LLC SafeCase 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	Privoro LLC
Model Number(s)	SafeCase
FCC ID Number	2APWV PM02SC
IC Number	23953-PW02SC
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	<ul style="list-style-type: none">• 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	June 11, 2018
Finish of Test	July 11, 2018
Name of Engineer(s)	Joel Rivera
Related Document(s)	<ul style="list-style-type: none">• Privoro SafeCase EMC Test Criteria.docx• Privoro SafeCase Compliance Block Diagram R2.pptx• 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	See Test Note ¹
2.1		§15.225(e)	RSS-210 B.6	Frequency Tolerance/Stability	Compliant	
2.2	§15.215(c)			20dB Bandwidth	Compliant	
2.3			RSS-Gen 6.6	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 4.10	Receiver Spurious Emissions	N/A	See Test Note ²
2.6		§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	N/A	See test Note ³

Compliant*: The EUT is a battery-operated equipment, the test was performed using a freshly charged battery.

Test Note¹: 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 Note²: The EUT does not have stand-alone receive mode and does not fall into any of the receiver category defined under RSS-Gen.

Test Note³: Not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Privoro LLC M0002 SafeCase as shown in the photograph below. The EUT is an iPhone case that serves several functions, all targeted toward user security and privacy: (1) video protection: a hood on the SafeCase covers the iPhone camera; (2) audio protection: small speakers drive noise into the iPhone microphones to prevent eavesdropping; (3) secure wireless communications (Bluetooth, Bluetooth Low Energy, WiFi, NFC); (4) accelerometer and magnetometer; (5) GPS; (6) RF power detector. Technologies include Bluetooth LE, WIFI 802.11a,b,g,n and NFC at 13.56MHz. NFC was verified in this test report.



Equipment Under Test (Front View)



Equipment Under Test (Back View)

1.3.2 EUT General Description

EUT Description	SafeCase
Model Number(s)	M0002
Rated Voltage	Battery Operated 3.7V 900 mAh Lithium Ion Model :GSP423255 LiCoO ₂ /C(Li-polymer cell)
Capability	Bluetooth LE, WIFI a,b,g,n, NFC
Mode Verified	NFC (13.56 MHz)
Measured Field Strength	48.3 dBμV/m @ 3 meters
Operating Temperature	-20°C to +50°C
Humidity	<93%RH non-condensing
Size	Height: (hood down): 185.50 mm (7.30 inches) Height: (hood up): 202.50 mm (7.97 inches) Width: 73.60 mm (2.9 inches) Depth: 23.60 mm (.93 inches)
Weight	5.7 ounces (162 grams)
Antenna	Integral
Antenna Manufacturer	Privoro
Antenna Dimension	20 mm x 20 mm x 0.2 mm
Antenna Gain	N/A (near field inductive coupling)

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	<p>Test Mode: Front Push To Talk Button cycles NFC mode. List of available test modes are as follows:</p> <p><u>Mode : Battery Led reflects current mode in binary</u> Corner Led : Green = NFC in CW mode Corner Led : Red = WL18xx in TX mode Corner Led : Yellow = NFC & WL18xx in TX mode</p> <p><u>"PTT Button" controls NFC Mode for PN7120</u> On - NFC in CW mode Off - NFC dormant</p> <p><u>"Power Button" controls main FCC Mode for WL18xx</u> 0) Power up - normal. BLE is advertising. All leds off 1) All transmitters off 2) BLE at 2.402 MHz. Corner led Red/Green 3) BLE at 2.442 MHz. Corner led Red/Green 4) BLE at 2.480 MHz. Corner led Red/Green 5) Wifi at 2.412 MHz. Corner led Red/Green 6) Wifi at 2.442 MHz. Corner led Red/Green 7) Wifi at 2.484 MHz. Corner led Red/Green</p> <p>NFC can be toggled ON/OFF in any of the above FCC modes.</p> <p>BLE and WLAN were also active during the test. The radiated emission test results presented in this test report satisfies the Intermodulation requirement of the NFC, BLE and WLAN.</p>

1.4.2 EUT Exercise Software

The EUTs were exercised using Privoro Test App PRIVORO PLATFORM Version 1.0.0 Build 10

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Apple	iPhone	Model A1660; Privoro.Test6
Apple	iPhone	Model Privoro.Test5
Generic	AC/DC Adaptor	Model: L1265
Apple	AC/DC Adaptor	Model: A1385
USB Meter	USB Male/USB Female	Model AVHzY-UM24C
Privoro	USB to Micro USB/Lightning Cable	3 foot from AC adaptor to EUT

1.4.4 Simplified Test Configuration Diagrams

Not Applicable. EUT has been tested in stand-alone configuration. See test section 1.4.1 for details.

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.

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: 858 678-1436/65/67 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TÜV SÜD 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
Privoro LLC
M0002 SafeCase

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 $\pm 0.01\%$ 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: N/A / Default Test Configuration

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

June 24, 2018 /JR

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	26.1 °C
Relative Humidity	43.6 %
ATM Pressure	99.3 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 NFC system.
- The RBW was set to 10 kHz for better resolution.
- The temperature was varied from -20°C to $+50^{\circ}\text{C}$ in 10 degree increments.
- The EUT was powered off, then powered on once the temperature stabilized and the frequency was then measured.
- Voltage variation not applicable as per ANSI C63.10 Clause 6.8.2 (d) for battery operated device.

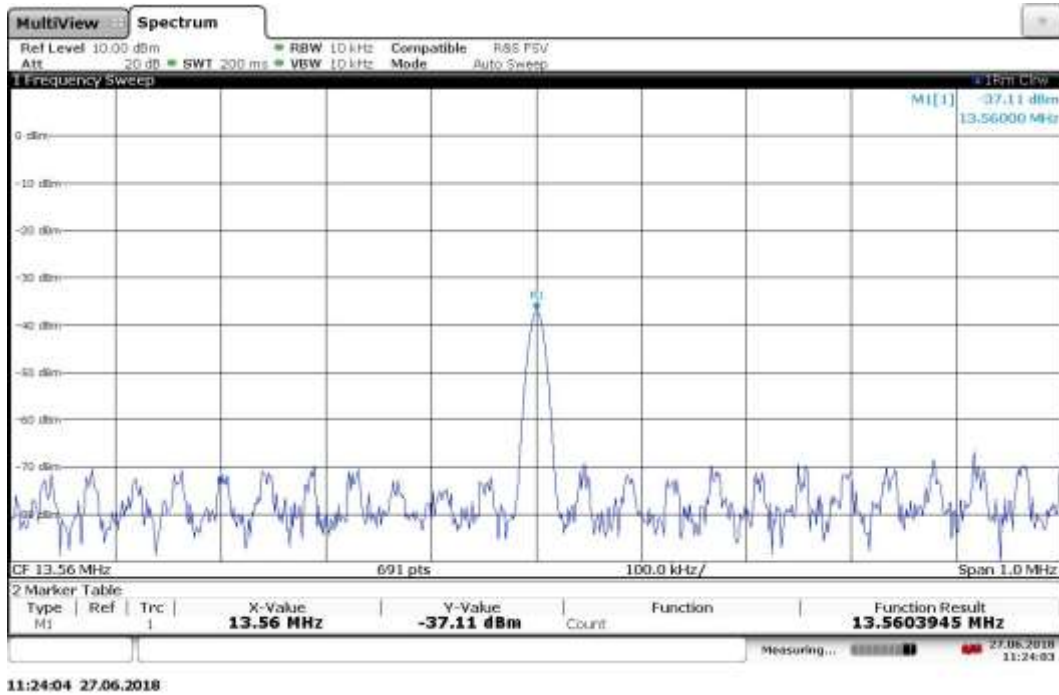
2.1.8 Test Results

NFC @ 13.56MHz					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Frequency Deviation	Deviation (%)
100	Battery Operated @ 3.7VDC	-20	13.5604958	0.00009150	0.0007
100		-10	13.5605177	0.00011340	0.0008
100		0	13.5605168	0.00011250	0.0008
100		+10	13.5604949	0.00009060	0.0007
100		+20	13.5604043	0.00000000	0.0000
100		+30	13.5604311	0.00002680	0.0002
100		+40	13.5604037	-0.00000060	0.0000
100		+50	13.5603945	-0.00000980	-0.0001
Voltage Variation (N/A)	-	+20	-	-	-
	-	-20	-	-	-

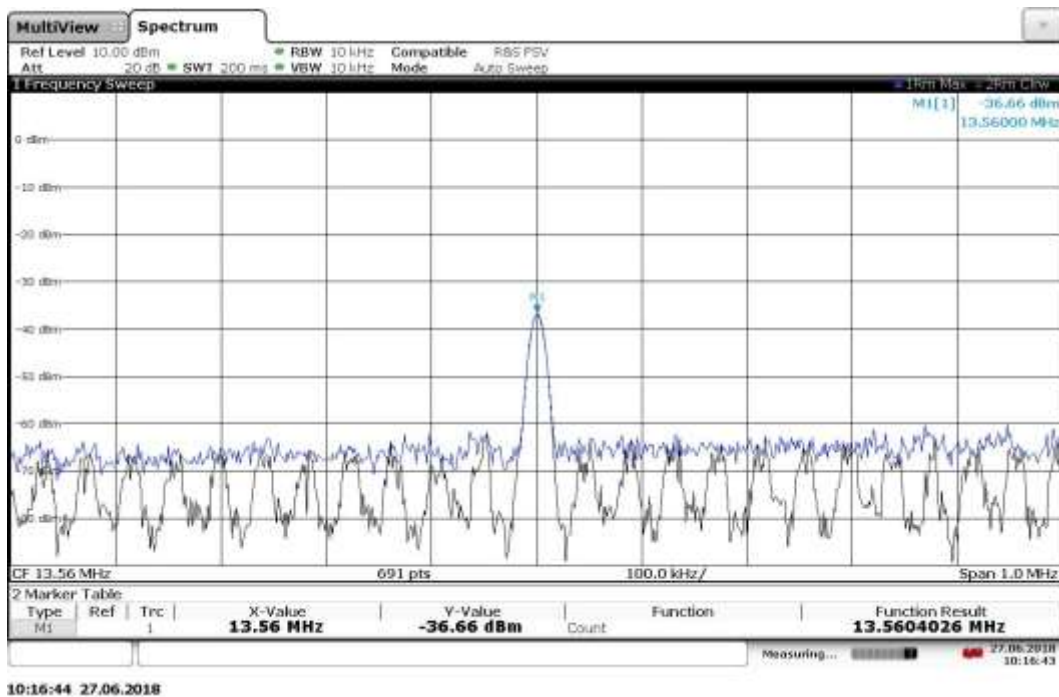
N/A : Not Applicable see additional observations section 2.1.7

Maximum Deviation = 0.0008%
 = 0.0008% < 0.01% Limit **(Complies)**

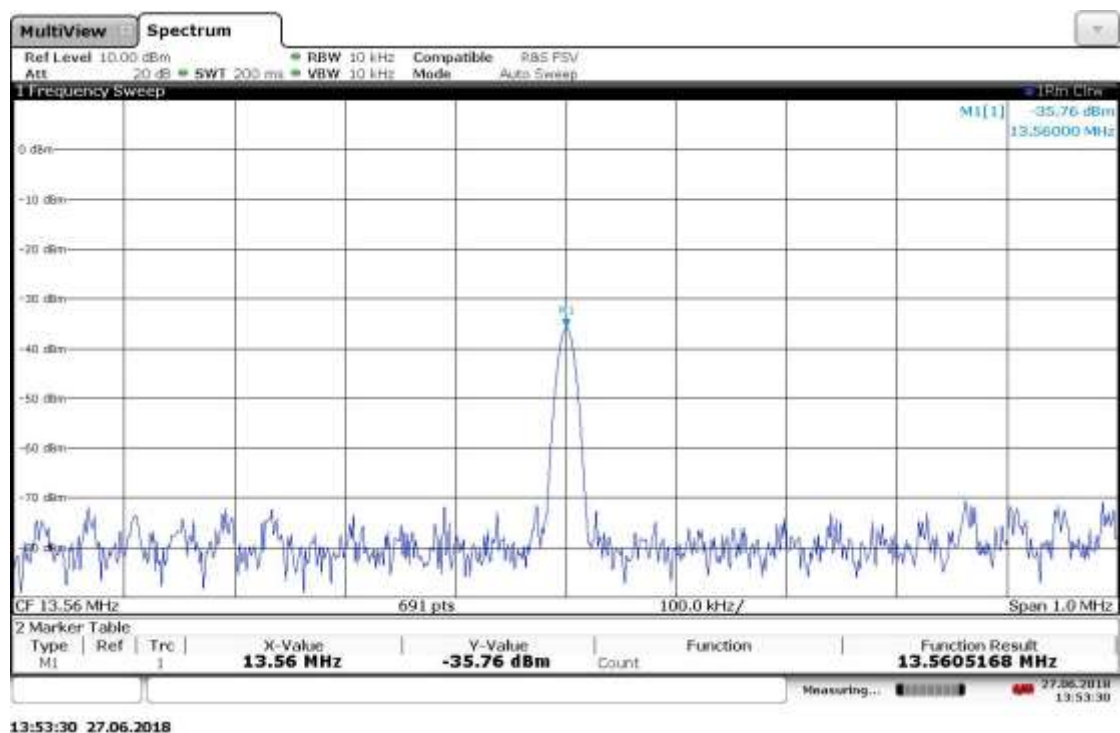
2.1.9 Sample Test Plots



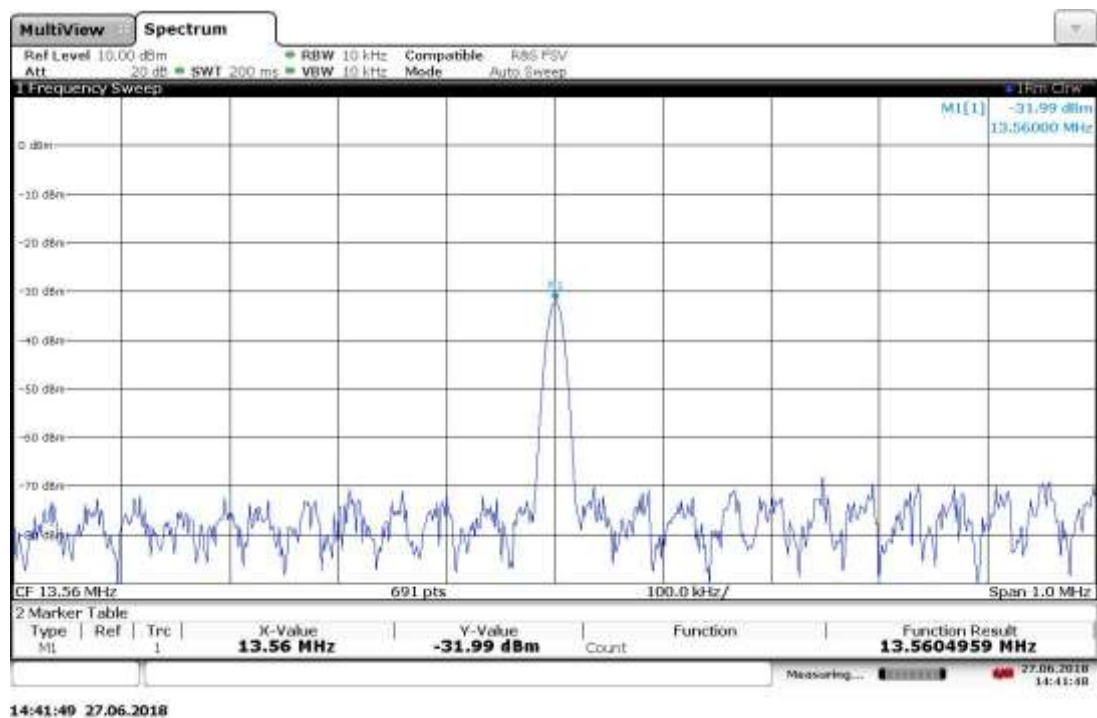
Nominal Voltage @ 50°C



Nominal Voltage @ 20°C



Nominal Voltage @ 0°C



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: N/A/ Default Test Configuration

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

July 11, 2018 / JR

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

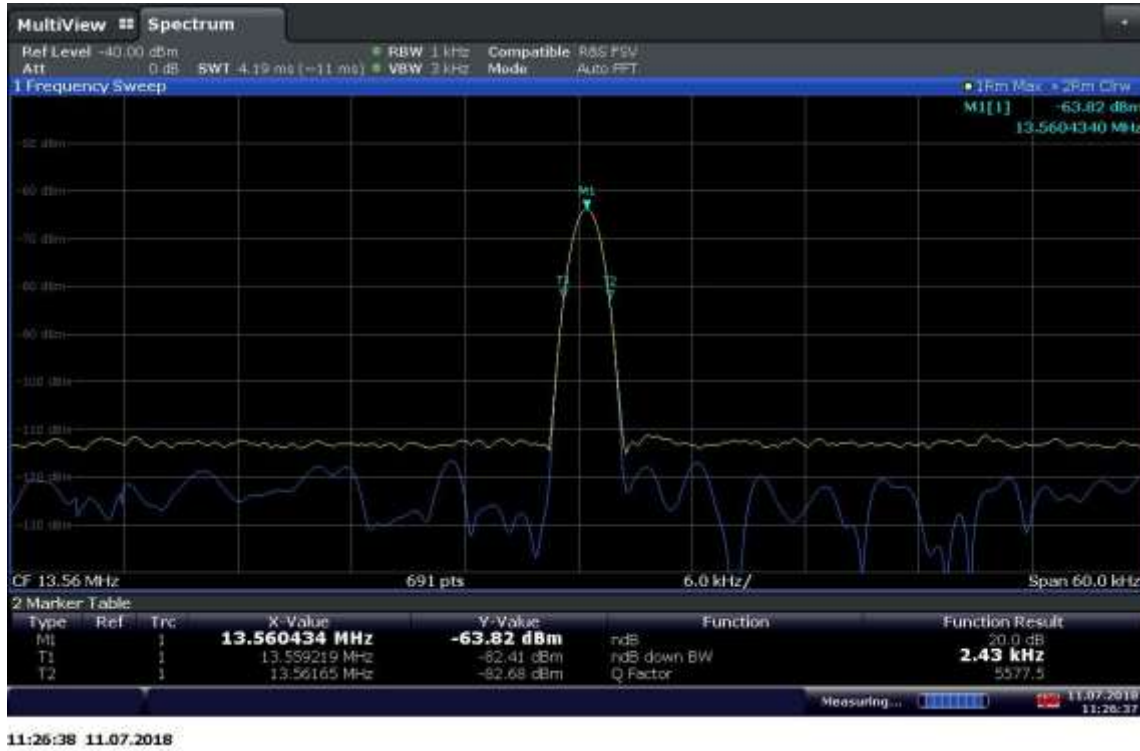
Ambient Temperature	25.7 °C
Relative Humidity	44.6 %
ATM Pressure	99.8 kPa

2.2.7 Additional Observations

- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW was set to 1 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	2.43 kHz



Measured 20dB Bandwidth: 2.43 kHz
Frequency Band: 13.110 to 14.010 MHz

$13.56 \text{ MHz} - (20\text{dB BW}/2) = 13.559219 \text{ MHz}$ (within the frequency band - **Compliant**)
 $13.56 \text{ MHz} + (20\text{dB BW}/2) = 13.561650 \text{ MHz}$ (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: N/A/ Default Test Configuration

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

July 11, 2018 /JR

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	25.7 °C
Relative Humidity	44.6 %
ATM Pressure	99.8 kPa

2.3.7 Additional Observations

- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW was set to 1 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

Frequency	99% Emission bandwidth
13.56 MHz	2.14 kHz



11:25:45 11.07.2018

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:N/A / Default Test Configuration

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

July 11, 2018 /JR

2.4.5 Test Equipment Used

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

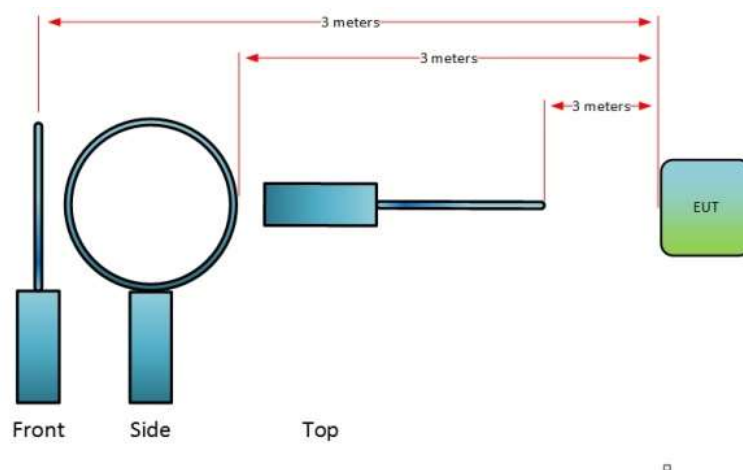
2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.6 °C
Relative Humidity	44.4 %
ATM Pressure	99.9 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.

2.4.1 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 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 (db μ V/m) @ 30MHz			36.5

2.4.2 Sample Computation (Limits)

Limit @ 13.553–13.567 MHz:

= 15,848 μ V/m @30 meters

= 20 log(15,848 μ V/m)

= 84 dB μ V/m @30 meters

Using 20dB/decade extrapolation rule:

= 20 log (30m/3m)

Measuring distance correction factor:

= 20 dB

Calculated limit @ 3 meters:

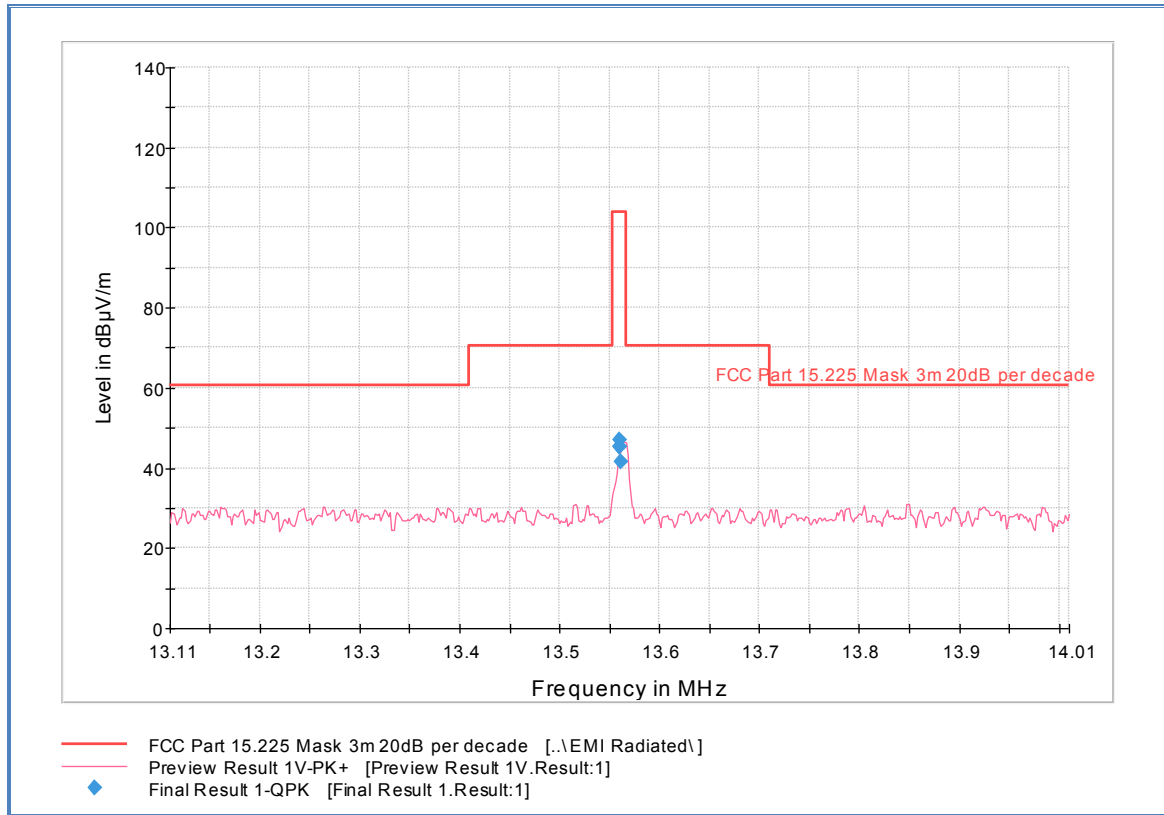
= 84 dB μ V/m + 20 dB

= 104 dB μ V/m

2.4.3 Test Results

See attached plots.

2.4.4 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)
13.559385	45.2	1500.0	9.000	100.0	V	0.0	22.5	58.8	104.0
13.559633	45.3	1500.0	9.000	100.0	V	359.0	22.5	58.7	104.0
13.559705	47.1	1500.0	9.000	100.0	V	191.0	22.5	56.9	104.0
13.560812	41.6	1500.0	9.000	100.0	V	125.0	22.5	62.4	104.0

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: N/A / Default Test Configuration

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

June 26, 2017 /JR

2.5.5 Test Equipment Used

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

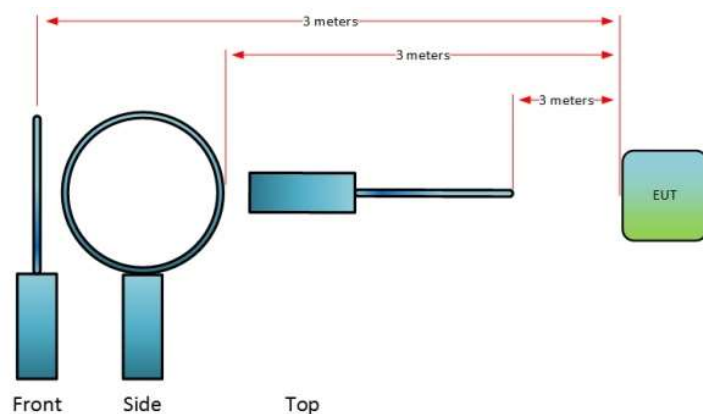
2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo and Mira Mesa facility

Ambient Temperature	23.6 °C
Relative Humidity	44.4 %
ATM Pressure	99.9 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9 kHz to the 10th harmonic
- 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 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 (db μ V) @ 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 (db μ V/m) @ 9kHz			50.9

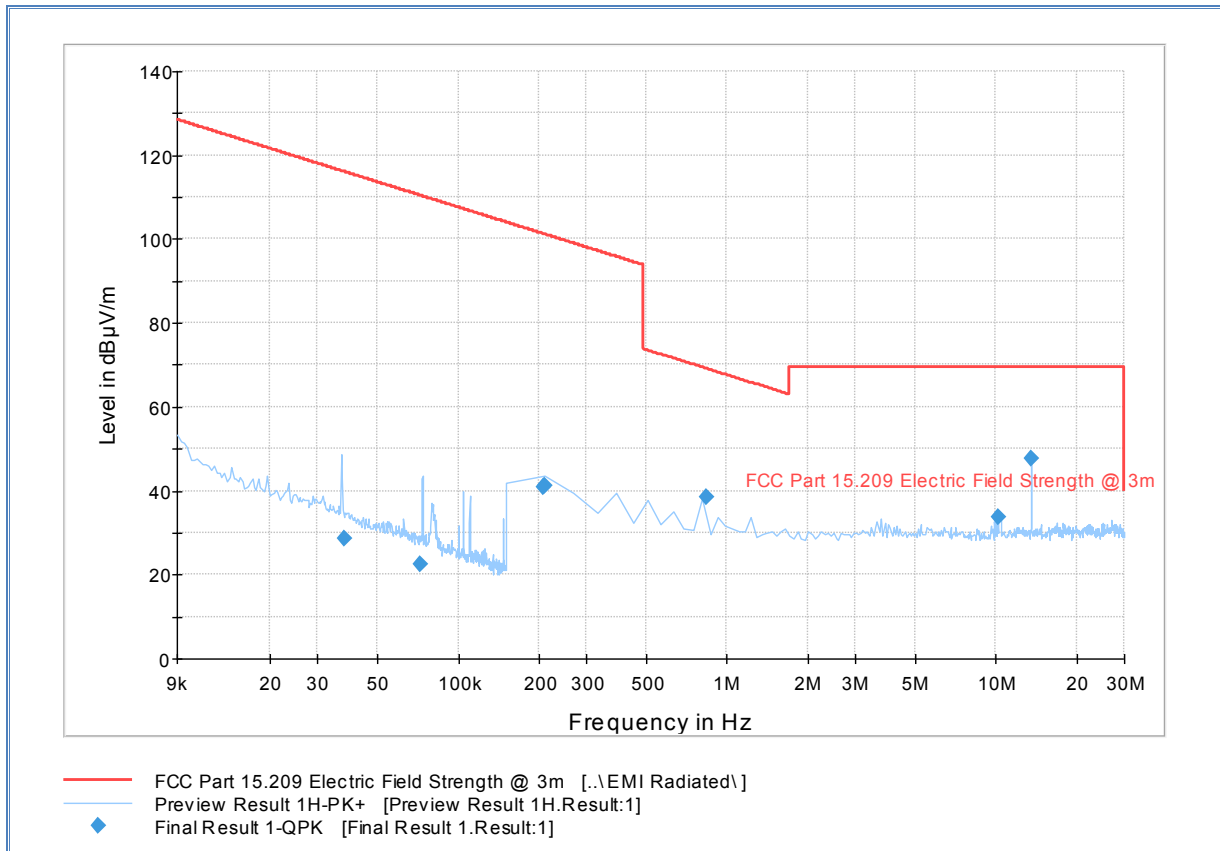
2.5.9 Sample Computation (Radiated Emission 30 MHz to 1 GHz)

Measuring equipment raw measurement (db μ V) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1026 (cable)	0.8	-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 (db μ V/m) @ 30MHz			17.4

2.5.10 Test Results

See attached plots.

2.5.11 Test Results Below 30MHz

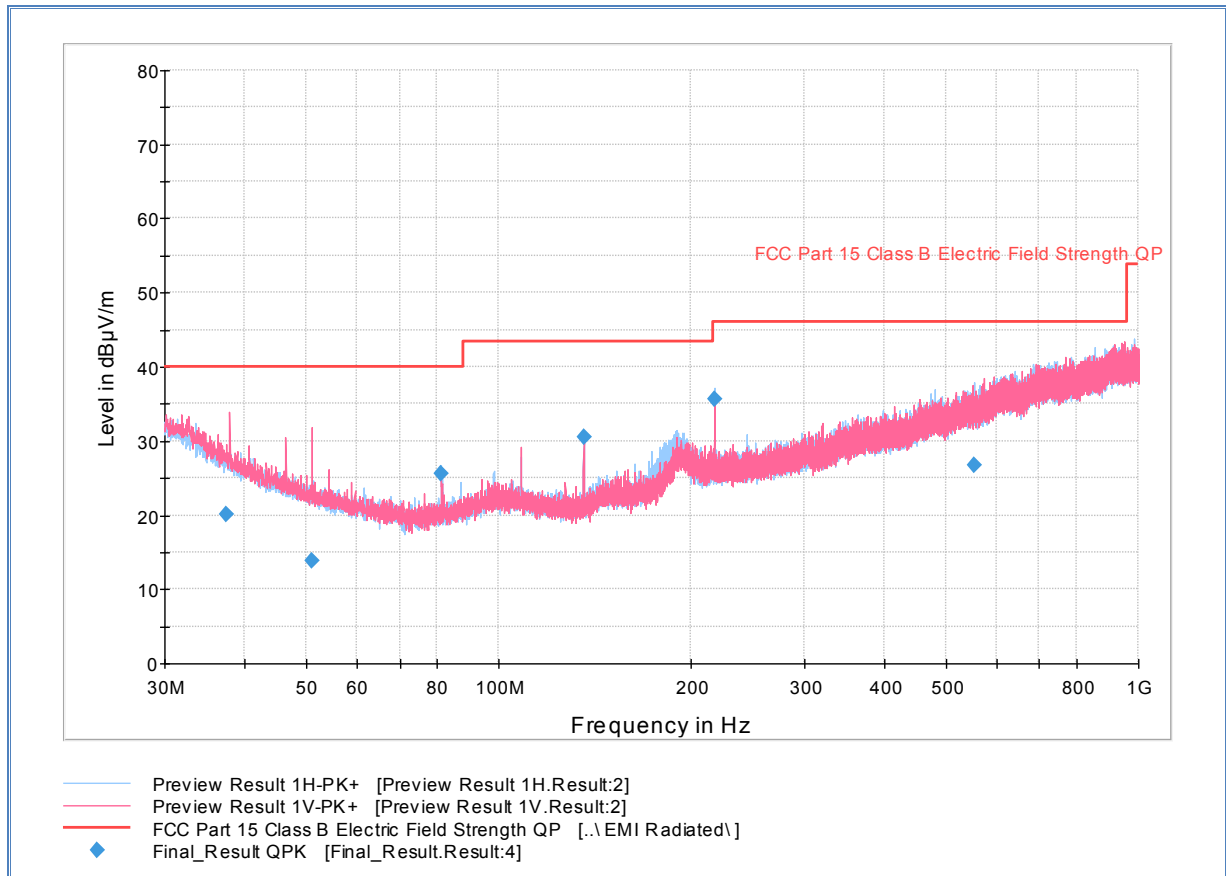


Quasi Peak Data (§15.209 Limits)

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
0.037691	28.6	1000.0	0.200	100.0	H	11.0	21.1	87.4	116.1
0.072425	22.4	1000.0	0.200	100.0	H	147.0	20.0	88.0	110.4
0.207000	40.9	1500.0	9.000	100.0	H	117.0	19.6	60.4	101.3
0.209000	41.3	1500.0	9.000	100.0	H	343.0	19.6	59.9	101.2
0.833016	38.4	1500.0	9.000	100.0	H	7.0	19.8	30.8	69.2
10.248519	33.9	1500.0	9.000	100.0	H	81.0	21.2	35.7	69.5

Test Notes: This test also satisfies Intermodulation Testing See section 1.4.1 for details

2.5.12 Test Results 30MHz to 1GHz

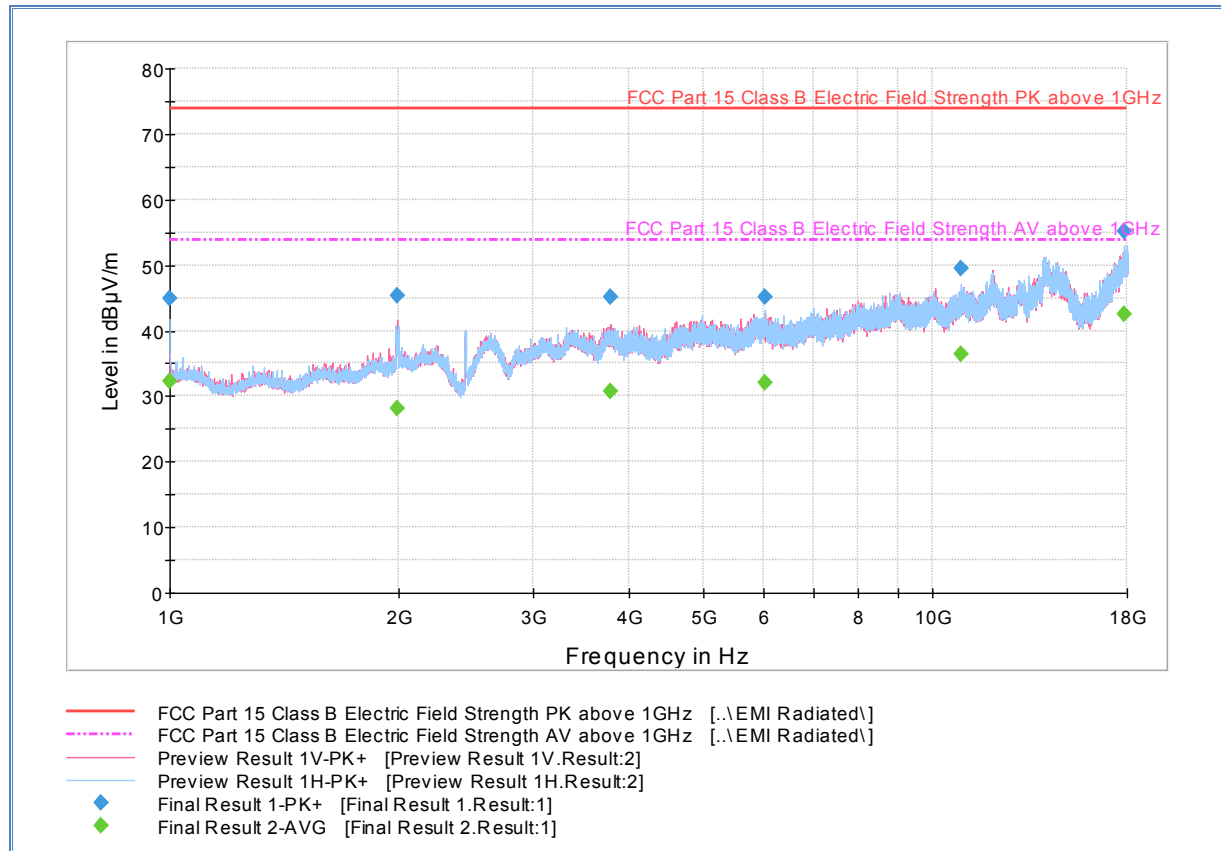


Quasi Peak Data (§15.209 Limits)

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
37.481667	20.10	40.00	19.90	1000.0	120.000	125.3	V	108.0	20.9
50.984333	13.84	40.00	26.16	1000.0	120.000	125.1	V	158.0	16.3
81.345333	25.57	40.00	14.43	1000.0	120.000	204.6	H	26.0	14.1
135.600667	30.54	43.50	12.96	1000.0	120.000	125.2	H	-10.0	15.1
216.951333	35.66	46.00	10.34	1000.0	120.000	104.0	H	133.0	19.7
553.018667	26.79	46.00	19.21	1000.0	120.000	325.1	H	-13.0	28.5

Test Notes: This test also satisfies Intermodulation Testing See section 1.4.1 for details

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	45.0	1000.0	1000.000	103.7	H	235.0	-10.7	28.9	73.9
1990.500000	45.3	1000.0	1000.000	116.7	V	184.0	-6.1	28.6	73.9
3788.933333	45.0	1000.0	1000.000	152.6	V	155.0	1.0	28.9	73.9
6041.433333	45.1	1000.0	1000.000	378.1	H	210.0	4.5	28.8	73.9
10921.733333	49.6	1000.0	1000.000	332.1	H	72.0	11.9	24.3	73.9
17874.066667	55.2	1000.0	1000.000	152.6	H	14.0	21.1	18.7	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	32.3	1000.0	1000.000	103.7	H	235.0	-10.7	21.6	53.9
1990.500000	28.1	1000.0	1000.000	116.7	V	184.0	-6.1	25.8	53.9
3788.933333	30.8	1000.0	1000.000	152.6	V	155.0	1.0	23.1	53.9
6041.433333	32.0	1000.0	1000.000	378.1	H	210.0	4.5	21.9	53.9
10921.733333	36.4	1000.0	1000.000	332.1	H	72.0	11.9	17.5	53.9
17874.066667	42.5	1000.0	1000.000	152.6	H	14.0	21.1	11.4	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures. This test also satisfies Intermodulation Testing See section 1.4.1 for details

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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: N/A

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

Not Performed/ Not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Emission						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/20/18	11/06/19
1051	Horn Antenna	3115	9408-4329	EMCO	07/17/17	0717/18
6628	Loop Antenna	HFH2-Z2335.4711.52	121086	TUV	05/02/18	05/02/19
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
8628	Pre-amplifier	QLJ-01182835-JO	187	Quinstar	03/06/18	02/06/19
1193	Pre-amplifier	PAM-0202	185	A.H.Systems.	04/11/18	04/11/19
7582	Signal/Spectrum Analyzer	FSW26	102853	Rhode & Schwarz	12/14/17	12/14/18
7620	Signal/Spectrum Analyzer	FSW26	103026	Rhode & Schwarz	10/17/17	10/17/18
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	08/25/16	08/25/17
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/29/16	08/29/17
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	08/22/16	08/22/17
	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 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	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.76
Coverage Factor (k):					2
Expanded Uncertainty:					3.53

3.2.2 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	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

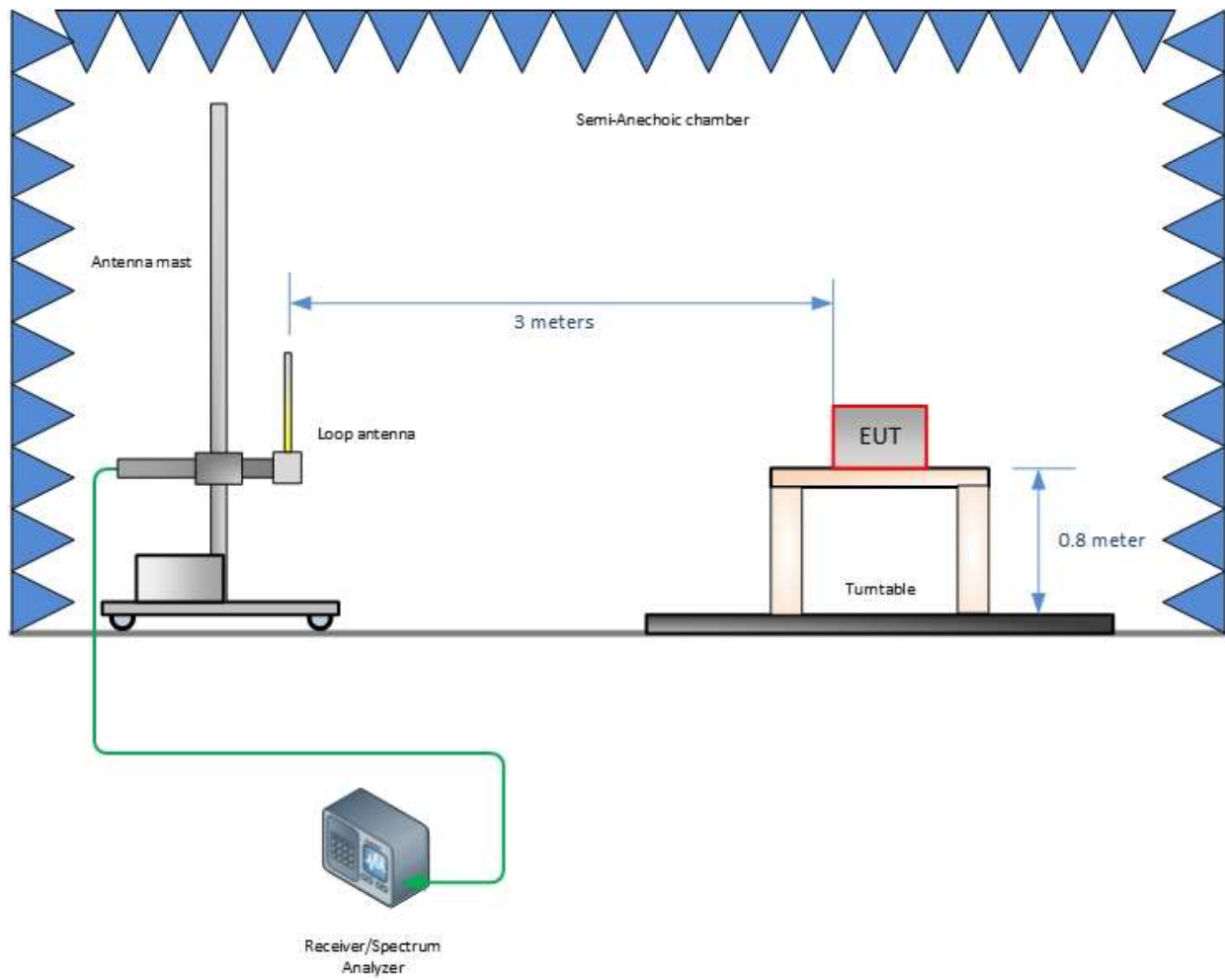
3.2.3 Radiated Emission Measurements (Above 1GHz)

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

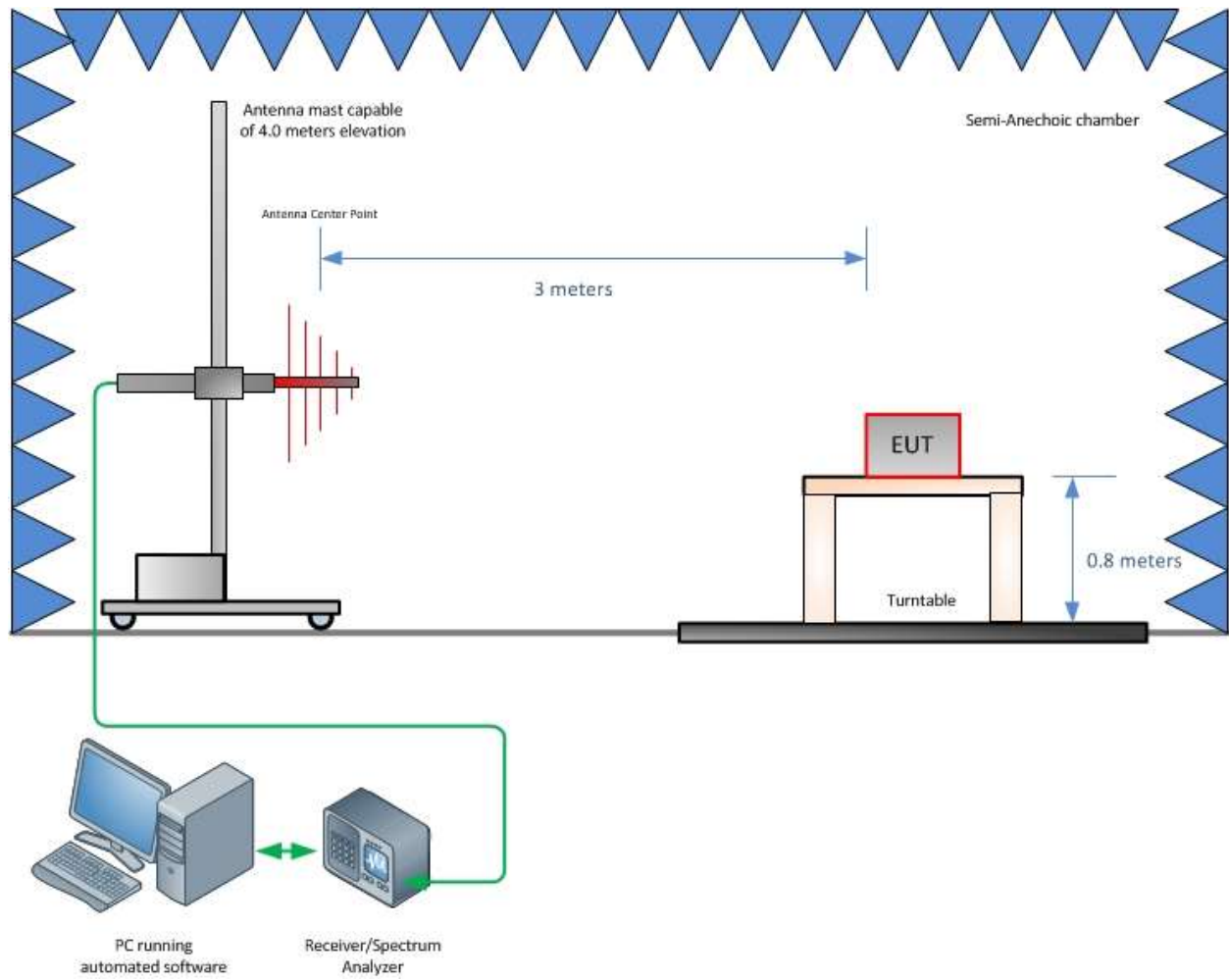
SECTION 4

DIAGRAM OF TEST SETUP

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

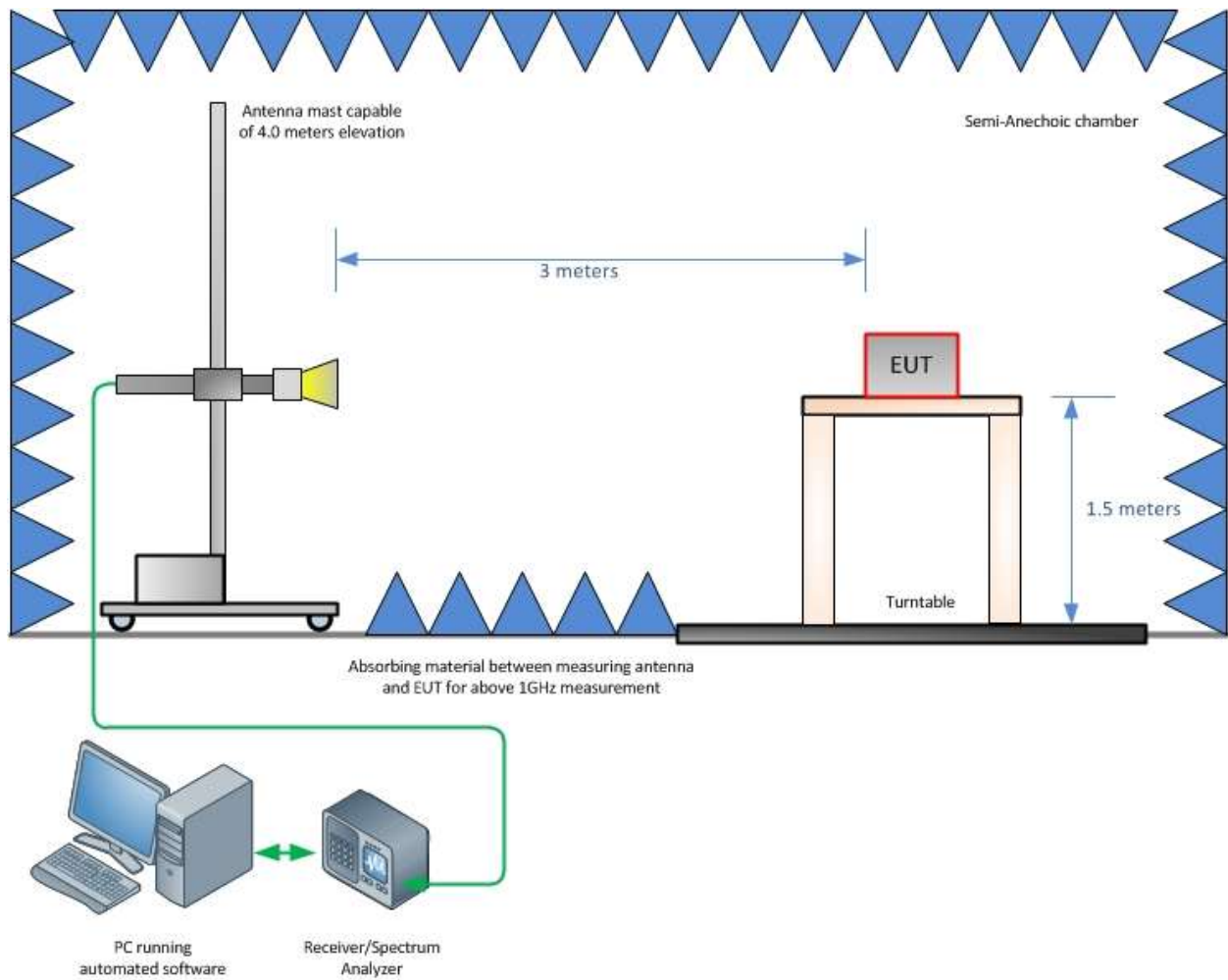


4.2 TEST SETUP DIAGRAM (30MHZ TO 1GHZ)



Radiated Emission Test Setup (Below 1GHz)

4.3 TEST SETUP DIAGRAM (> 1GHZ)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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