

Radio Testing of the
Rimage Corporation
Automated Disc Recording and Printing System
Professional 2450 RAS36

In accordance with
FCC Part 15 Subpart C §15.225
RSS-210 Issue 10 December 2019
AS/NZS 4268: 2017

Rimage Corporation
201 General Mills Blvd
Golden Valley, MN 55426



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Date: August 2020
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Authorized Signatory	Ferdinand S. Custodio	August 17, 2020	

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EXECUTIVE SUMMARY

A sample of this product was tested and found to be in compliance with FCC Part 15 Subpart C §15.225, RSS-210 Issue 10 December 2019 and AS/NZS 4268: 2017.



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REPORT ON	Radio Testing of the Rimage Corporation Automated Disc Recording and Printing System Professional 2450 RAS36
TEST REPORT NUMBER	72161531A
TEST REPORT DATE	August 2020
PREPARED FOR	Rimage Corporation 201 General Mills Blvd Golden Valley, MN 55426
CONTACT PERSON	Zahid Taufiq Compliance Engineer zahid.taufiq@rimage.com 952-683-7881
PREPARED BY	 Xiaoying Zhang Name Title: EMC/Wireless Test Engineer



Revision History

72161531A Rimage Corporation Automated Disc Recording and Printing System Professional 2450 RAS36					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/17/2020	—	Initial Release			Ferdinand S. Custodio



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SECTION 1

1 REPORT SUMMARY

Radio Testing of the
Rimage Corporation
Automated Disc Recording and Printing System
Professional 2450 RAS36



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Rimage Corporation Automated Disc Recording and Printing System Professional 2450 RAS36 to the requirements of FCC Part 15 Subpart C §15.225, RSS-210 Issue 10 December 2019 and AS/NZS 4268: 2017.

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	Rimage Corporation
EUT	Automated Disc Recording and Printing System
Model Name	Professional 2450
Model Number	RAS36
FCC ID	QT5-RAS36
IC Number	4496A-RAS36
Serial Number(s)	5369871 Rev. A
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC Part 15 Subpart C §15.225 (October 1, 2019).• RSS-210 - Licence-exempt Radio Apparatus: Category I Equipment (Issue 10, December 2019).• RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 5, March 2019, Amendment 1).• AS/NZS 4268: 2017 Radio Equipment and Systems – Short Range Devices – Limits and Method of Measurement.
Start of Test	July 27, 2020
Finish of Test	August 04, 2020
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.225 with cross-reference to the corresponding ISED RSS standard and AS/NZS 4268 is shown below:

Section	FCC Part 15	AS/NZS 4268	RSS	Test Description	Result	Comments
-	15.31(e)	-	-	Voltage Requirement	Compliant	§15.225(e)
-	15.203 and 204	-	RSS-Gen 6.8	Antenna Requirements	Compliant	See Test Note ¹
2.1	15.225(e)	-	RSS-210 B.6(b)	Frequency Tolerance	Compliant	-
2.2	15.215(c)	6.6	-	20dB Bandwidth	Compliant	-
2.3	-	6.5	RSS-Gen 6.7	Occupied Bandwidth	Compliant	-
2.4	15.225(a)(b)(c)	6.3.1	RSS-210 B.6(i)(ii)(iii)	Emission Mask	Compliant	-
2.5	15.209, 15.225(d)	6.4	RSS-210 B.6(a)(iv)	Spurious Radiated Emissions	Compliant	-
-	-	-	RSS-Gen 7.3	Receiver Spurious Emissions	N/A	See Test Note ²
2.6	15.207(a)	-	RSS-Gen 8.8	Conducted Emissions	Compliant	-

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 fall into the category of a Receiver as per RSS-Gen 5.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Rimage Corporation Automated Disc Recording and Printing System Professional 2450 RAS36. Only 13.56MHz RFID function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	Automated Disc Recording and Printing System
Model Name	Professional 2450
Model Number	RAS36
Rated Voltage	100 – 240 VAC 50-60 Hz
Mode Verified	13.56 MHz RFID
Capability	13.56 MHz RFID
Primary Unit (EUT)	<input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
RFID Module Output Power	0.0000008 mW
EUT RFID Field Strength	34.7 dB μ V/m @ 3 meters
Frequency Range	13.56 MHz in the 13.110 to 14.010 MHz band
Manufacturer Declared Temperature Range	5°C to 35°C
Number of Operating Frequencies	1
Antenna Type	Integral
RFID Antenna Connector	UMCC Connector
Modulation Used	ISO18000-3 Compliant
Antenna Part Number	Rimage P/N: 2003650

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT was AC Powered and was transmitting continuous RFID 13.56 MHz CW signal using firmware 0505A0p50_esr08_emc.hex.
Modulated	The EUT was AC Powered and was transmitting RFID 13.56 MHz modulated signal about 330ms of modulated data transfer; Carrier OFF for 670ms using firmware 0505A0p50_esr09_emc.hex.

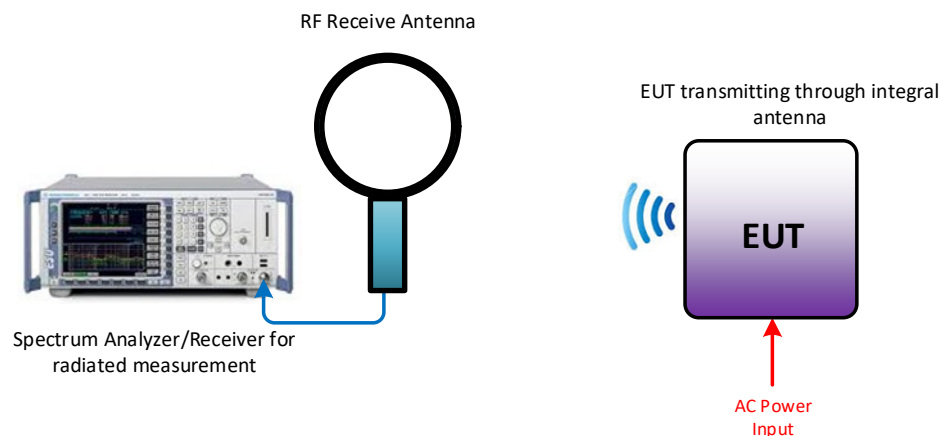
1.4.2 EUT Exercise Software

None.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
-		
-		

1.4.4 Simplified Test Configuration Diagram



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



1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: 5369871 Rev. A		
None	—	—

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 – 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 (ISED) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TÜV SÜD 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 TÜV SÜD 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)

TÜV 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)

TÜV SÜD 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

TÜV SÜD 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

TÜV SÜD 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

TÜV SÜD 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

2 TEST DETAILS

Radio Testing of the
Rimage Corporation
Automated Disc Recording and Printing System
Professional 2450 RAS36



2.1 Frequency Stability

2.1.1 Specification Reference

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

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: 5369871 Rev. A / Default Test Configuration

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

August 03, 2020 /XYZ

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	23.5 °C
Relative Humidity	51.0 %
ATM Pressure	99.1 kPa

2.1.7 Additional Observations

- This is a radiated test with the loop antenna next to the environmental chamber.
- EUT was transmitting continuous CW signal during the test.
- 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 for better resolution.
- The temperature was varied from 0°C to $+50^{\circ}\text{C}$ in 10 degree increments with voltage variation of 85% and 115% nominal input voltage @ 20°C .
- The EUT was powered off, then powered on once the temperature stabilized and the frequency was then measured.

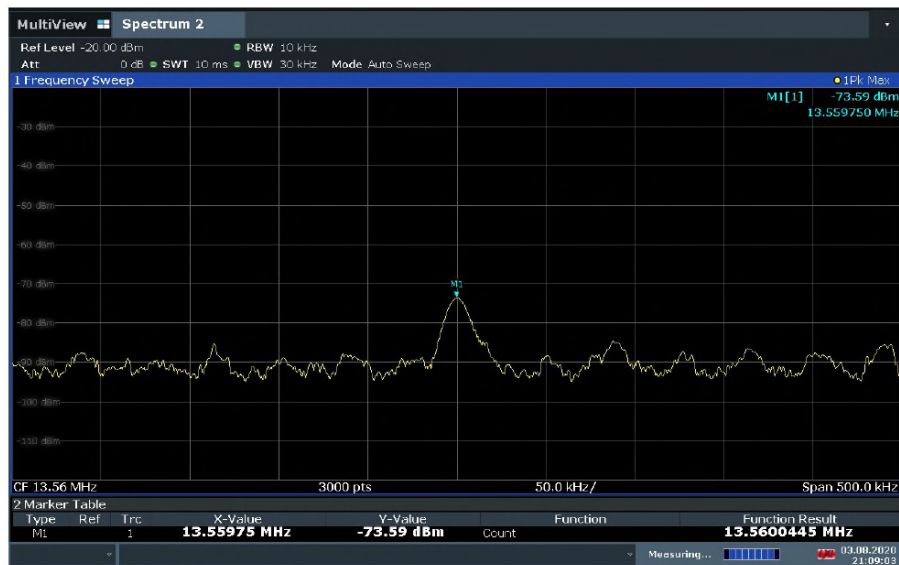
2.1.8 Test Results

RFID @ 13.56MHz					
Voltage (%)	Power (WAC)	Temp (°C)	Frequency (Hz)	Frequency Deviation	Deviation (%)
100	120	-20	-	-	Note
100		-10	-	-	Note
100		0	13.5600532	0.0000532	0.000392
100		+10	13.5600560	0.0000560	0.000413
100		+20	13.5600576	0.0000576	0.000425
100		+30	13.5600557	0.0000557	0.000411
100		+35	13.5600459	0.0000459	0.000338
100		+40	13.5600459	0.0000459	0.000338
100		+50	13.5600445	0.0000445	0.000328
Voltage Variation (85% and 115%)	102	+20	13.5600566	0.0000566	0.000417
	138	+20	13.5600568	0.0000568	0.000419

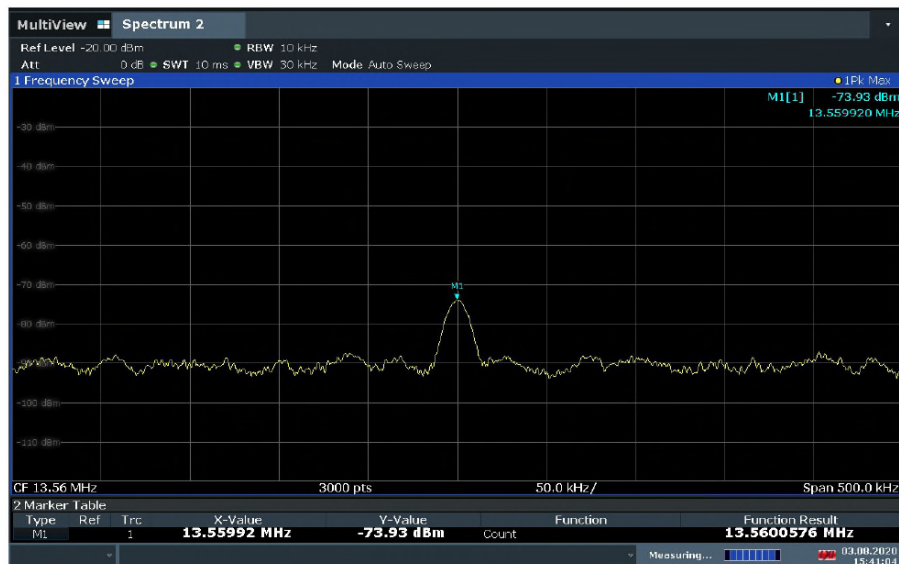
Note: The working temperature of the EUT is from +5°C to 35°C, so the lowest temperature tested is 0°C.

Maximum Deviation = 0.000425%
 = 0.000425% < 0.01% Limit (**Complies**)

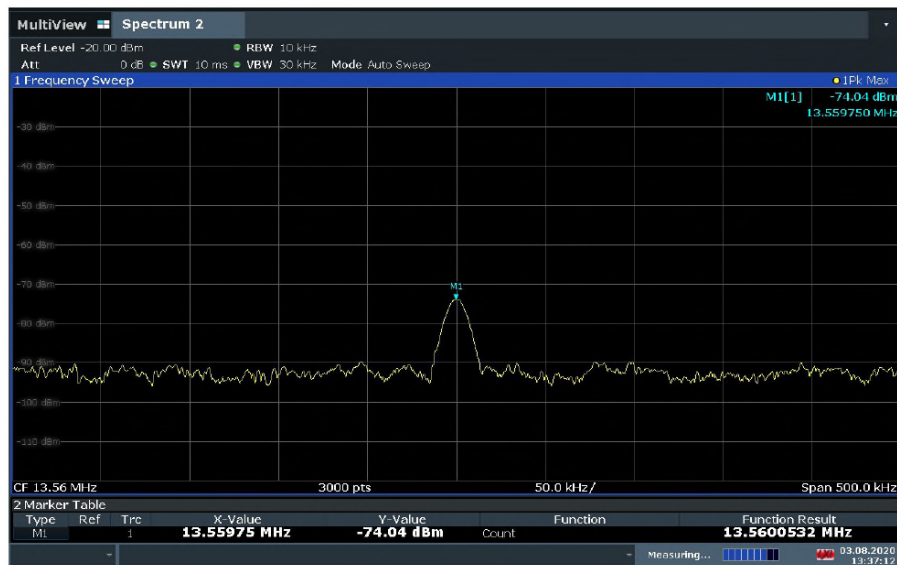
2.1.9 Sample Test Plots



Nominal Voltage @ 50°C



Nominal Voltage @ 20°C



Nominal Voltage @ 0°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: 5369871 Rev. A / Modulated Test Configuration

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

August 04, 2020 /XYZ

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

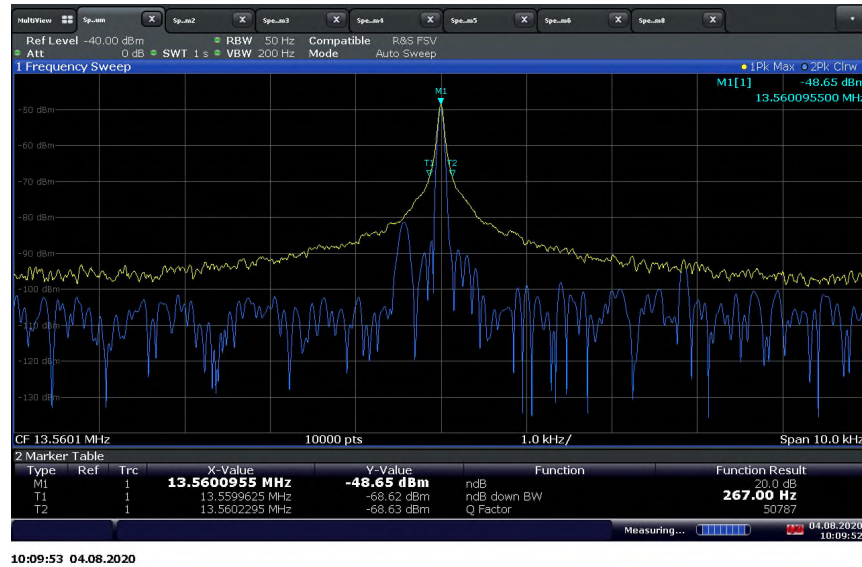
Ambient Temperature	23.4 °C
Relative Humidity	50.4 %
ATM Pressure	98.9 kPa

2.2.7 Additional Observations

- This is a radiated test and EUT was transmitting modulated signal during the test.
- Span is wide enough to capture the channel transmission.
- RBW is set from 1% to 5% of the anticipated occupied bandwidth.
- VBW is 3 X 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	267.0 Hz



Measured 20dB Bandwidth: 267.0 Hz
 Frequency Band: 13.110 to 14.010 MHz

13.56 MHz – (20dB BW/2) = 13.5598665 MHz (within the frequency band - **Compliant**)
 13.56 MHz + (20dB BW/2) = 13.5601335 MHz (within the frequency band - **Compliant**)



2.3 99% EMISSION bandwidth

2.3.1 Specification Reference

RSS-Gen Clause 6.7

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: 5369871 Rev. A / Modulated Test Configuration

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

August 04, 2020 / XYZ

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

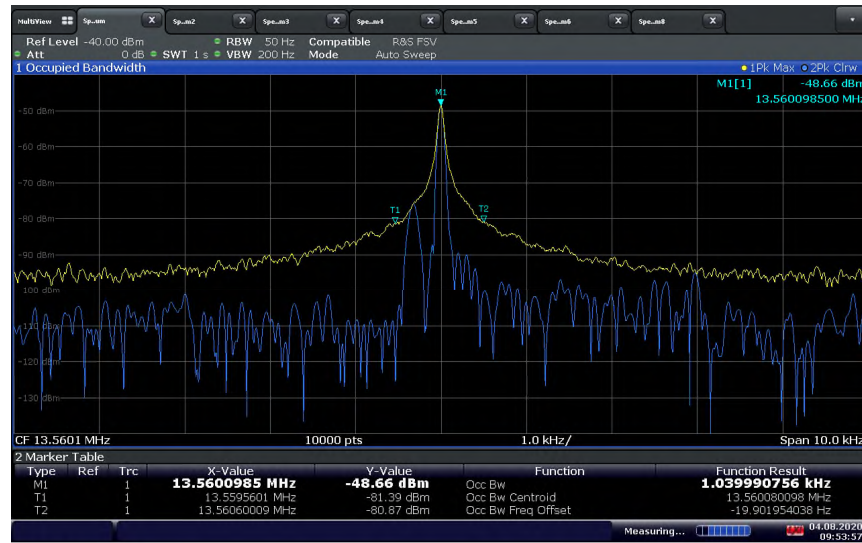
Ambient Temperature	23.4 °C
Relative Humidity	50.4 %
ATM Pressure	98.9 kPa

2.3.7 Additional Observations

- This is a radiated test and the EUT was transmitting modulated signal during the test.
- Span is wide enough to capture the channel transmission.
- RBW is set from 1% to 5% of the anticipated 99% OBW.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Occupied 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	1.040 kHz



09:53:57 04.08.2020



2.4 Emission mask

2.4.1 Specification Reference

Part 15 Subpart C §15.225(a)(b)(c) and RSS-210 B.6(i)(ii)(iii)

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: 5369871 Rev. A / Default Test Configuration

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

July 27, 2020 /XYZ

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	22.7 °C
Relative Humidity	57.0 %
ATM Pressure	98.8 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 13.110 MHz to 14.010 MHz. 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.
- 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 2.4.8 for sample computation.



2.4.8 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

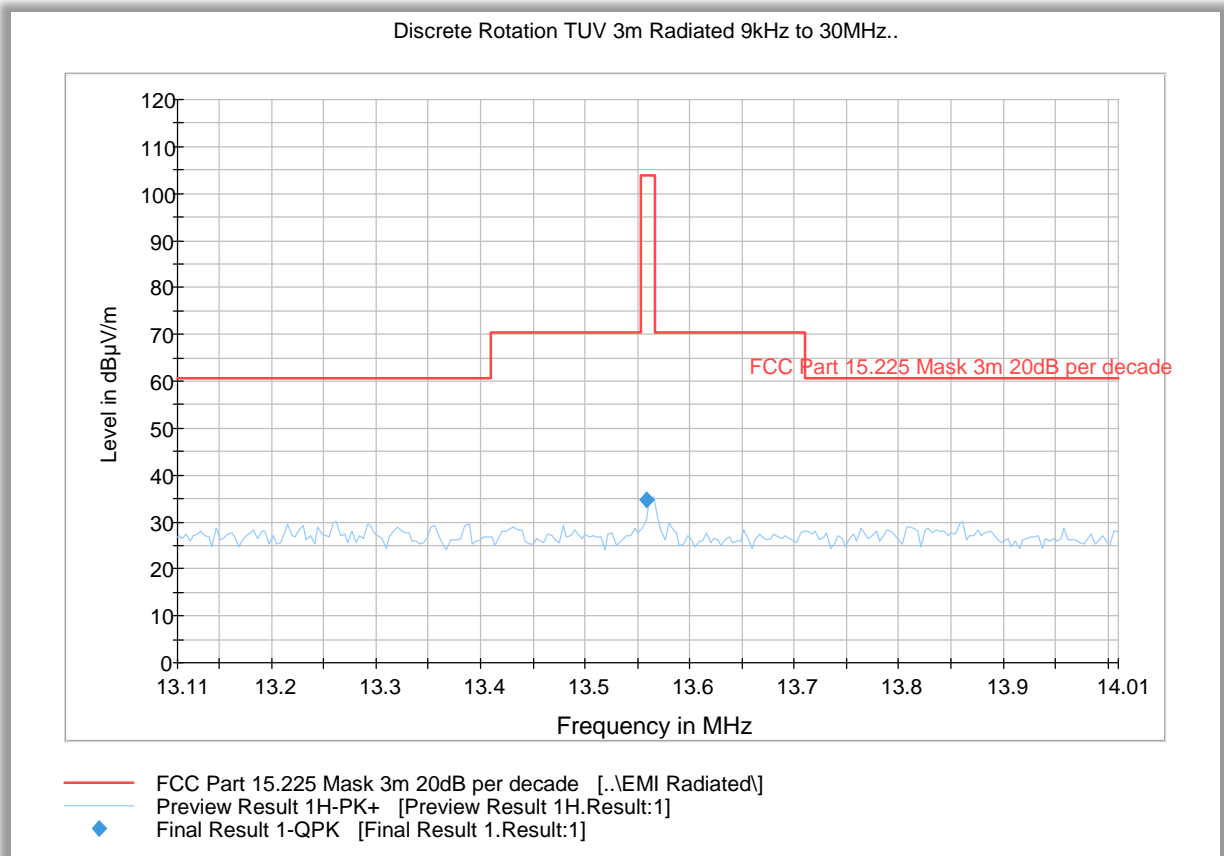
2.4.9 Sample Computation (Limits)

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

2.4.10 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)
13.558411	34.7	1500.0	9.000	100.0	H	6.0	21.8	69.3	104.0

Note: No spurious emissions associated with the RFID module other than the fundamental carrier were detected in this range.



2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.225(d) and RSS-210 B.6(a)(iv)

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.

2.5.1 Equipment Under Test and Modification State

Serial No: 5369871 Rev. A / Default Test Configuration

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

July 27, 2020 / XYZ

2.5.3 Test Equipment Used

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

2.5.4 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.7 °C
Relative Humidity	57.0 %
ATM Pressure	98.8 kPa

2.5.5 Additional Observations

- This is a radiated test. The spectrum was searched from 9kHz to 1GHz.
- There are no emissions found that do not comply with FCC Part 15 Subpart C, 15.209.
- 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 2.5.6 for sample computation.



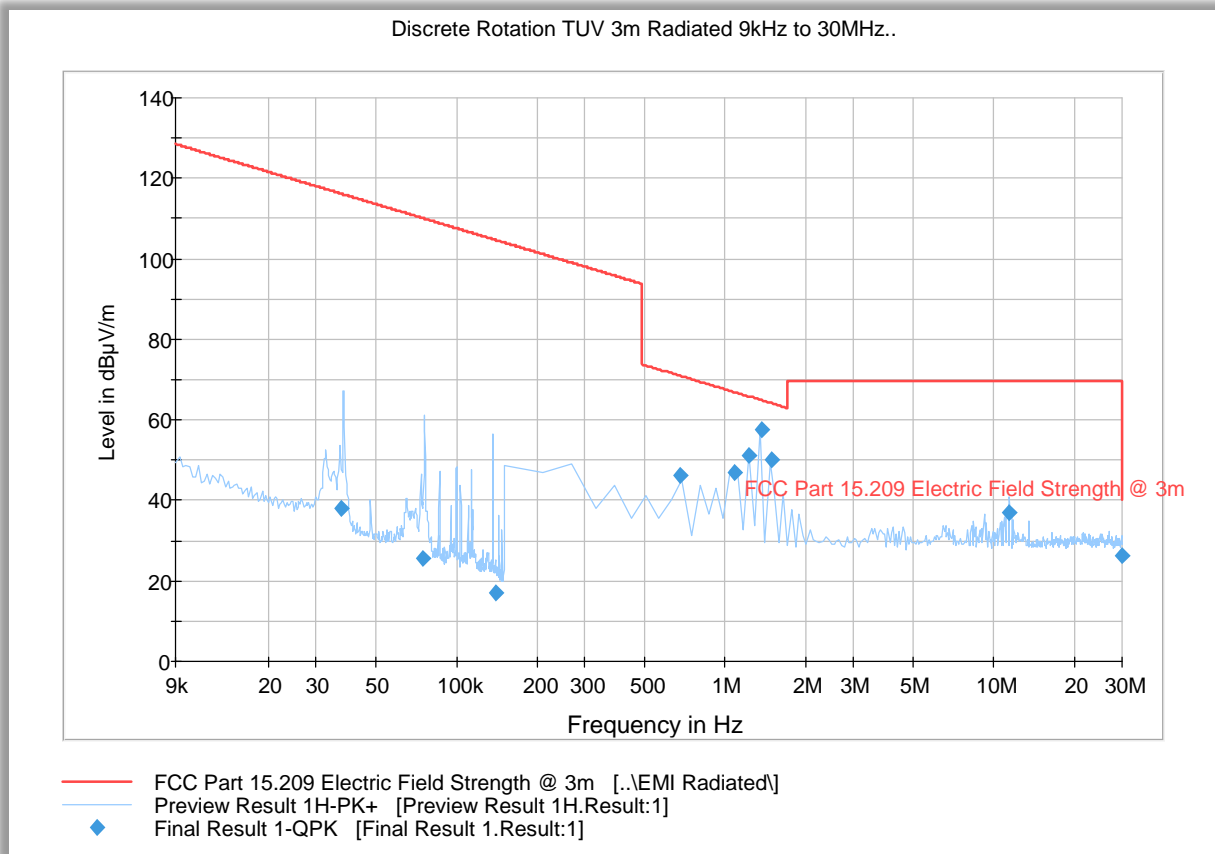
2.5.6 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbμV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz			11.8

2.5.7 Test Results

See attached plots.

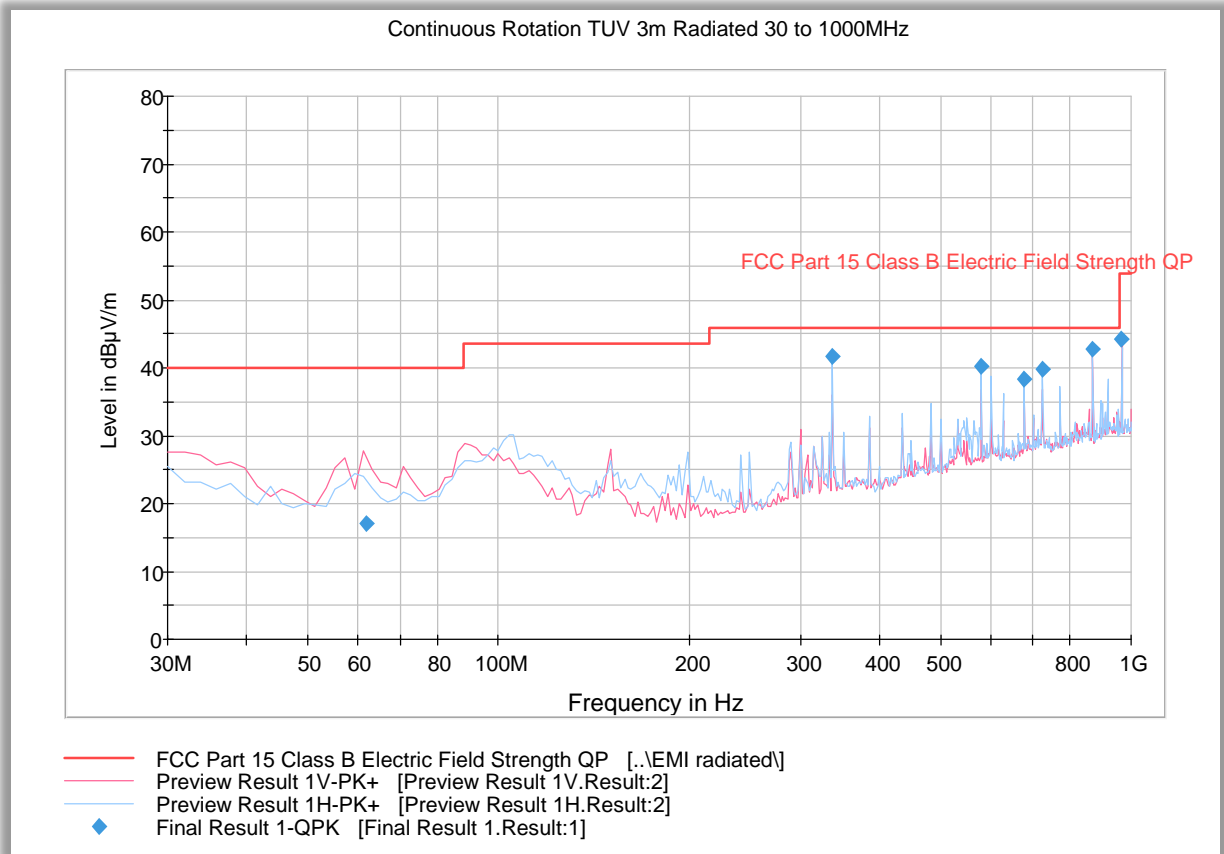
2.5.8 Test Results Below 30MHz



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)
0.037104	38.1	1000.0	0.200	100.0	H	95.0	21.1	78.2	116.2
0.074968	25.7	1000.0	0.200	100.0	H	106.0	19.9	84.4	110.1
0.139437	17.2	1000.0	0.200	100.0	H	13.0	19.7	87.5	104.7
0.681377	46.1	1500.0	9.000	100.0	H	13.0	19.7	24.9	70.9
1.088114	47.1	1500.0	9.000	100.0	H	13.0	20.0	19.8	66.9
1.227754	51.3	1500.0	9.000	100.0	H	21.0	20.0	14.5	65.8
1.363393	57.7	1500.0	9.000	100.0	H	37.0	20.0	7.2	64.9
1.499032	50.3	1500.0	9.000	100.0	H	13.0	20.0	13.8	64.1
11.440912	36.9	1500.0	9.000	100.0	H	81.0	21.5	32.7	69.5
29.973000	26.3	1500.0	9.000	100.0	H	351.0	25.3	43.2	69.5

2.5.9 Test Results from 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)
61.822204	17.0	1000.0	120.000	100.0	V	-12.0	-16.9	23.0	40.0
337.974269	41.6	1000.0	120.000	184.0	H	70.0	-5.7	4.4	46.0
579.360240	40.3	1000.0	120.000	100.0	H	9.0	0.0	5.7	46.0
675.954629	38.3	1000.0	120.000	100.0	H	131.0	2.7	7.7	46.0
724.207936	39.8	1000.0	120.000	105.0	H	26.0	3.3	6.2	46.0
869.039519	42.7	1000.0	120.000	150.0	V	95.0	4.8	3.3	46.0
965.633908	44.1	1000.0	120.000	100.0	V	38.0	6.2	9.8	53.9



2.6 CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.207(a) and RSS-Gen 8.8

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: 5369871 Rev. A / Default Test Configuration

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

July 29, 2020 / XYZ

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	23.0 °C
Relative Humidity	54.5 %
ATM Pressure	98.8 kPa

2.6.7 Additional Observations

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 2.6.8 for sample computation.



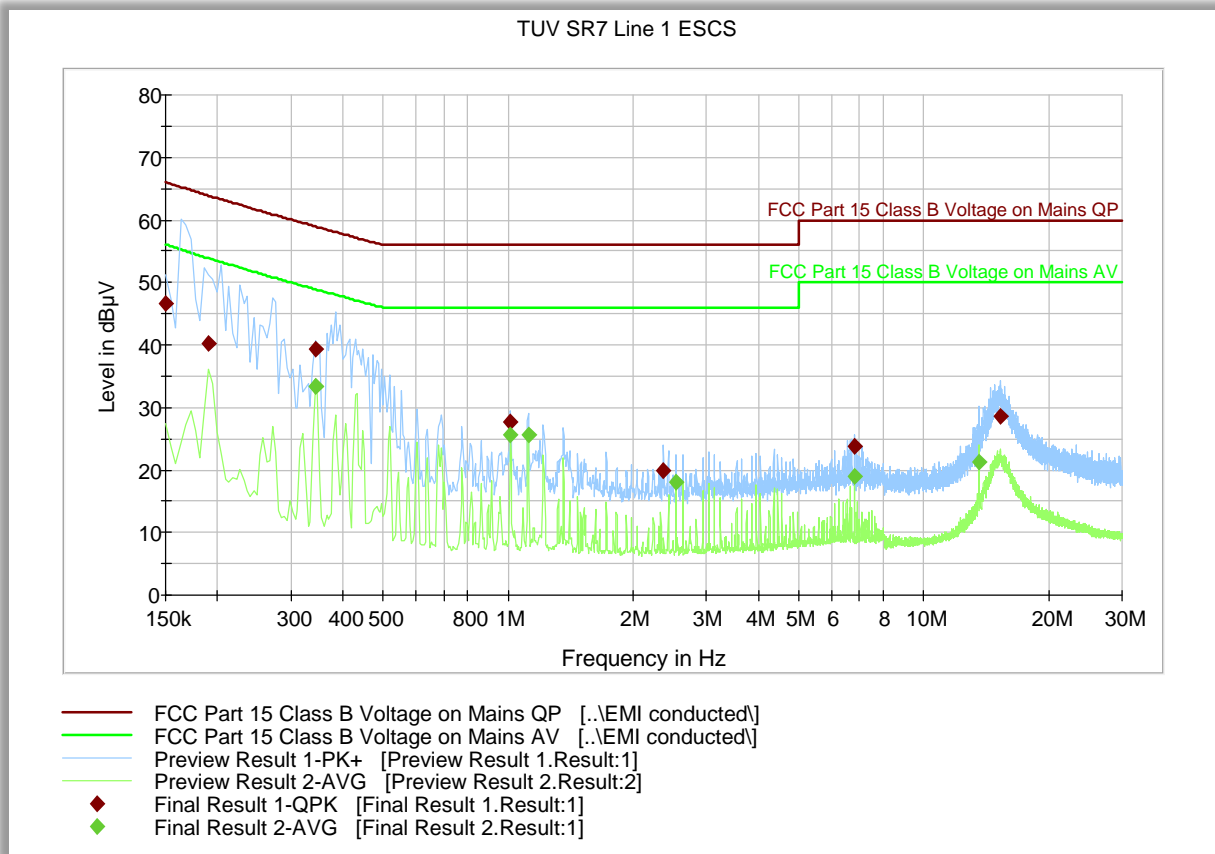
2.6.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbμV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (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 FCC Part 15B Class B Line 1



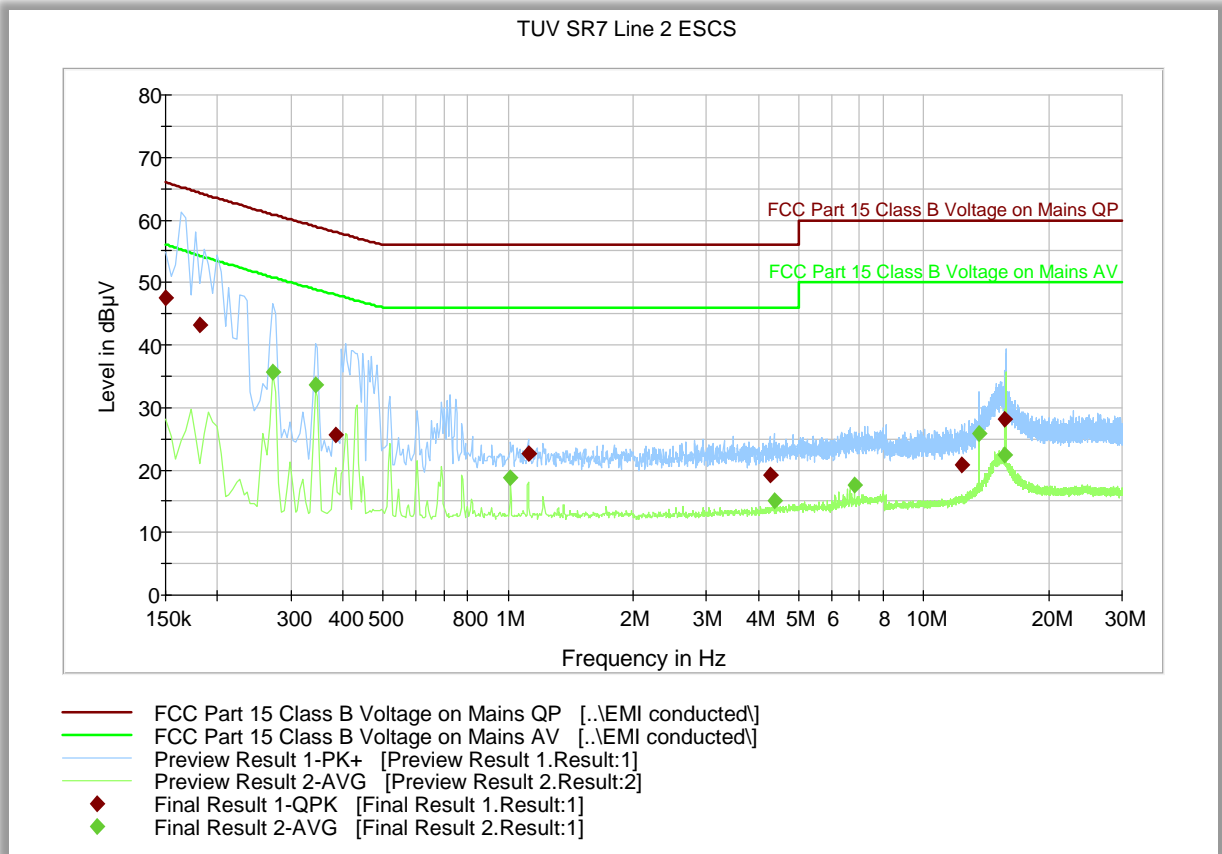
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	46.5	1000.0	9.000	Off	L1	20.4	19.5	66.0
0.190500	40.2	1000.0	9.000	Off	L1	20.2	23.6	63.9
0.343500	39.4	1000.0	9.000	Off	L1	20.4	19.5	58.9
1.014000	27.6	1000.0	9.000	Off	L1	20.3	28.4	56.0
2.368500	19.8	1000.0	9.000	Off	L1	20.3	36.2	56.0
6.805500	23.7	1000.0	9.000	Off	L1	20.2	36.3	60.0
15.351000	28.7	1000.0	9.000	Off	L1	20.5	31.3	60.0

Average Data

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.343500	33.3	1000.0	9.000	Off	L1	20.4	15.6	48.9
0.343500	33.3	1000.0	9.000	Off	L1	20.4	15.6	48.9
1.014000	25.5	1000.0	9.000	Off	L1	20.3	20.5	46.0
1.117500	25.6	1000.0	9.000	Off	L1	20.4	20.4	46.0
2.535000	18.0	1000.0	9.000	Off	L1	20.3	28.0	46.0
6.805500	18.9	1000.0	9.000	Off	L1	20.2	31.1	50.0
13.560000	21.3	1000.0	9.000	Off	L1	20.4	28.7	50.0

2.6.11 FCC Part 15B Class B Line 2



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)
0.150000	47.6	1000.0	9.000	Off	N	20.4	18.4	66.0
0.181500	43.2	1000.0	9.000	Off	N	20.1	21.1	64.3
0.384000	25.5	1000.0	9.000	Off	N	20.4	32.5	58.1
1.117500	22.6	1000.0	9.000	Off	N	20.4	33.4	56.0
4.281000	19.1	1000.0	9.000	Off	N	20.4	36.9	56.0
12.376500	20.8	1000.0	9.000	Off	N	20.4	39.2	60.0
15.697500	28.1	1000.0	9.000	Off	N	20.5	31.9	60.0

Average Data

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.271500	35.7	1000.0	9.000	Off	N	20.4	15.1	50.8
0.343500	33.6	1000.0	9.000	Off	N	20.4	15.3	48.9
1.014000	18.7	1000.0	9.000	Off	N	20.3	27.3	46.0
4.362000	15.0	1000.0	9.000	Off	N	20.5	31.0	46.0
6.805500	17.7	1000.0	9.000	Off	N	20.2	32.3	50.0
13.560000	25.8	1000.0	9.000	Off	N	20.4	24.2	50.0
15.697500	22.4	1000.0	9.000	Off	N	20.5	27.6	50.0



SECTION 3

3 TEST EQUIPMENT USED



3.1 Test Equipment Used

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Emissions						
7620	EMI Test Receiver	ESU40	100399	Rhode & Schwarz	10/18/19	10/18/20
7567	LISN	FCC-LISN-50-25-2-10	120304	Fisher Custom Comm	01/27/20	01/27/21
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/26/20	02/26/21
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/26/20	02/26/21
Radiated Emission						
1033	Bilog Antenna	3142C	00044556	EMCO	11/06/18	11/06/20
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/26/20	02/26/21
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/11/19	10/11/20
6628	Loop Antenna	HFH2-Z2335.4711.52	FNr.800.458/25	Schwarzbeck	05/22/20	05/22/22
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/22/20	01/22/21
Miscellaneous						
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	05/22/20	05/22/21
6610	Environmental Chamber	SH27	09963481-S10746	Envirotronics	01/17/20	01/17/21
9065	AC Power Source	5001iX	53318	California Instrument	02/13/20	02/13/21
43003	True RMS Multimeter	85 III	69880143	Fluke	10/07/19	10/07/20
-	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 Measurement Uncertainty

Calculation of Measurement Uncertainty per CISPR 16-4-2:2011 with Corr. 1

3.2.1 Antenna Conducted Port Measurements

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Cable attenuation	1.00 dB	Normal, k=2	2.000	0.50	0.25
3	Receiver sinewave accuracy	0.08 dB	Normal, k=2	2.000	0.04	0.00
4	Receiver pulse amplitude	0.00 dB	Rectangular	1.732	0.00	0.00
5	Receiver pulse repetition rate	0.00 dB	Rectangular	1.732	0.00	0.00
6	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
7	Frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
8	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
Combined standard uncertainty				Normal	0.52 dB	
Expanded uncertainty				Normal, k=2	1.03 dB	

3.2.2 Radiated Measurements (Below 30 MHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.44 dB	Normal, k=2	2.000	0.22	0.05
4	Receiver sinewave accuracy	0.96 dB	Normal, k=2	2.000	0.48	0.23
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 10 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 10 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	0.00 dB	Triangular	2.449	0.00	0.00
16	Separation distance at 10 m	1.00 dB	Rectangular	1.732	0.58	0.33
17	Effect of setup table material	0.00 dB	Rectangular	1.732	0.00	0.00
18	Table height at 10 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
Combined standard uncertainty				Normal	2.56 dB	
Expanded uncertainty				Normal, k=2	5.12 dB	

3.2.3 Radiated Measurements (30MHz - 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarization	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.76 dB	Triangular	2.449	1.54	2.36
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
Combined standard uncertainty				Normal	2.95 dB	
Expanded uncertainty				Normal, k=2	5.90 dB	

3.2.4 AC Conducted Emissions t Measurements

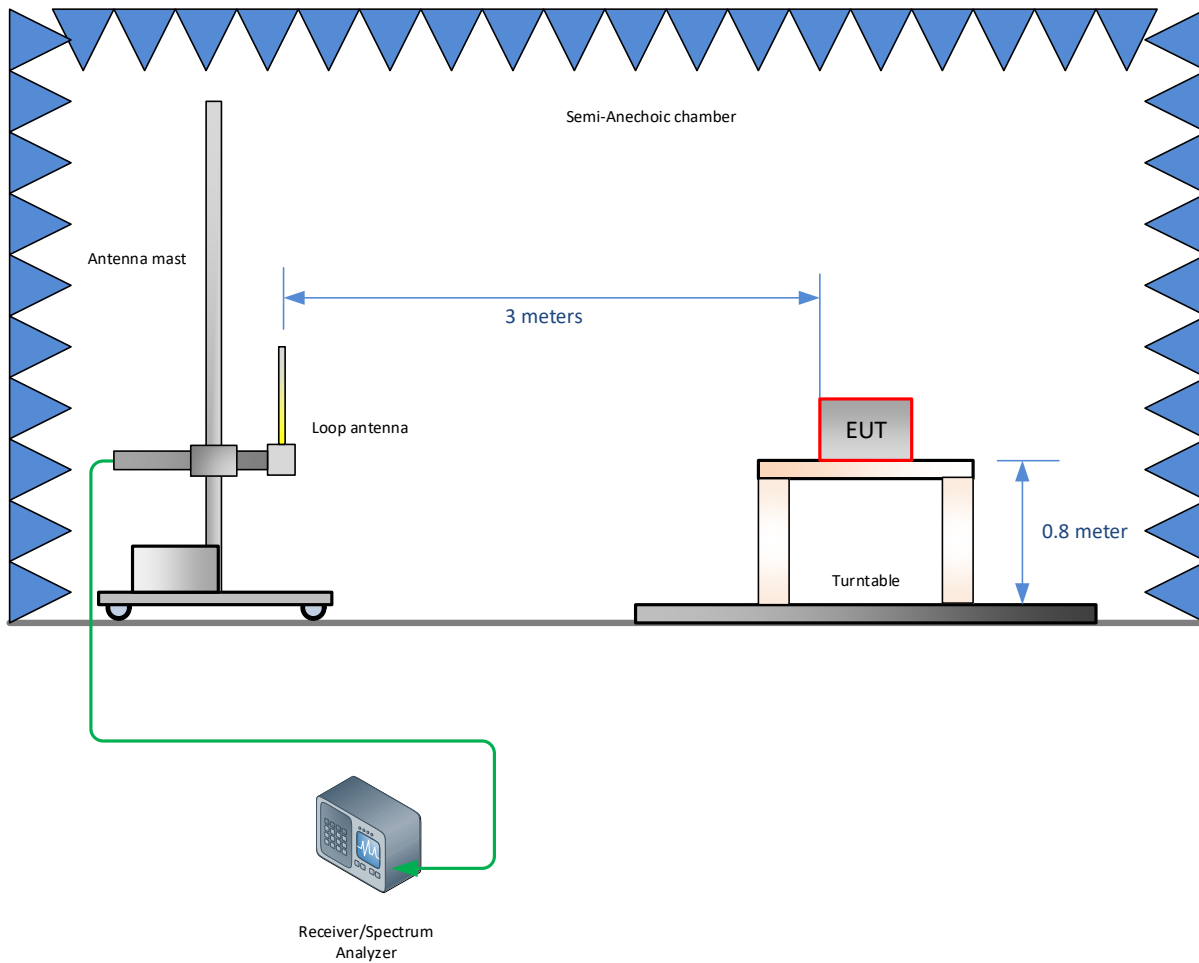
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	LISN-receiver attenuation	0.10 dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30 dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36 dB	Normal, k=2	2.000	0.18	0.03
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65 dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00 dB			0.00	0.00
12	Effect of the environment					
Combined standard uncertainty				Normal	1.66 dB	
Expanded uncertainty				Normal, k=2	3.31 dB	



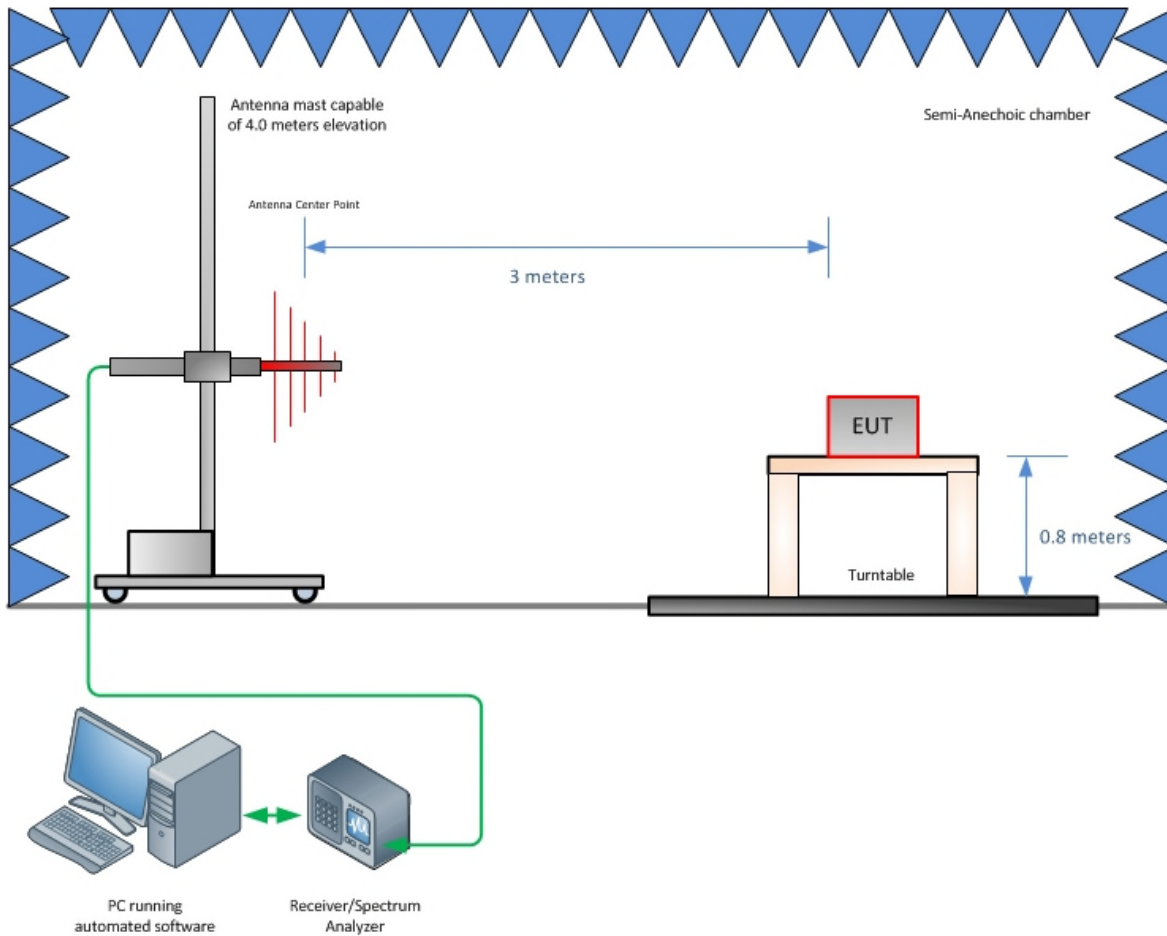
SECTION 4

4 Diagram of Test Setup

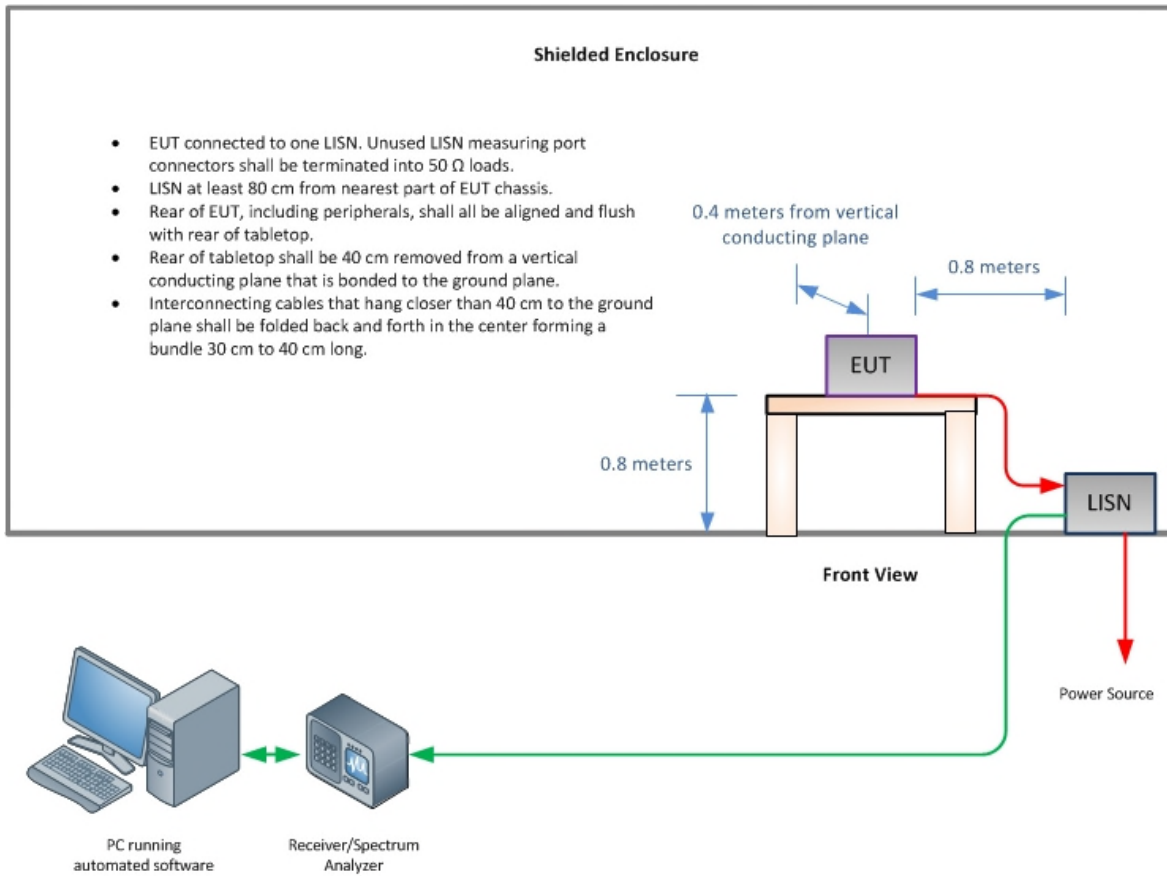
4.1 Test Setup Diagram



Radiated Emission Test Setup (Below 30 MHz)



Radiated Emission Test Setup (Below 1GHz)



Conducted Emission Test Setup



SECTION 5

5 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 Accreditation, Disclaimers and Copyright

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