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Report On

EMC Evaluation of
Pinnacle Technology
9087 RFID Reader

FCC Part 15 Subpart B
ICES-003 Issue 6

Report No. SD72125578-0317C Rev 1.0

January 2018



America

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
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REPORT ON EMC Evaluation of the
Pinnacle Technology
9087 RFID Reader

TEST REPORT NUMBER SD72125578-0317C Rev 1.0

TEST REPORT DATE January 2018

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DATED January 17, 2018



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Revision History

SD72125578-0317C Rev 1.0 Pinnacle Technology RFID Reader					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
11/21/2017	—	Initial Release			Alex Chang
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SECTION 1

REPORT SUMMARY

EMC Evaluation of the
Pinnacle Technology
RFID Reader



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Pinnacle Technology 9087 RFID Reader to the requirements of FCC Part 15 Subpart B and Innovation, Science and Economic Development Canada ICES-003.

Objective	To perform EMC Evaluation to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Pinnacle Technology
Model Name	9087 RFID Reader
Model Number(s)	9087
Serial Number(s)	N/A
Number of Samples Tested	1
Date sample(s) received	September 24, 2017
Highest Frequency Generated or Used	< 108 MHz
Test Specification/Issue/Date	<ul style="list-style-type: none"> FCC Part 15 Subpart B (October 1, 2016) Spectrum Management and Telecommunications Interference-Causing Equipment Standard ICES-003 Information Technology Equipment (ITE) — Limits and methods of measurement (Issue 6 January 2016 updated June 30, 2016).
Start of Test	September 25, 2017
Finish of Test	September 25, 2017
Name of Engineer(s)	Ferdie Custodio
Related Document(s)	None



1.2 BRIEF SUMMARY OF RESULTS

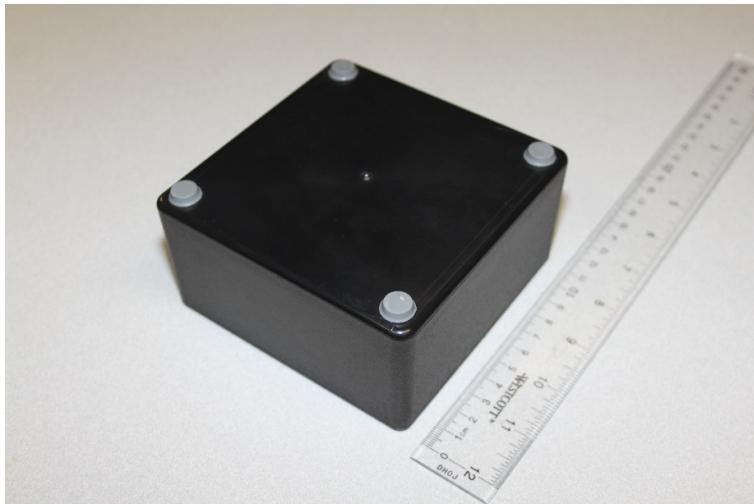
A brief summary of the tests carried out in accordance with FCC Part 15 Subpart B is shown below. Test results from these tests are deemed satisfactory evidence of compliance with Innovation, Science and Economic Development Canada Interference-Causing Equipment Standard ICES-003.

Part 15	ICES-003	Test Description	Result	Comments/Base Standard
§15.107	6.1	Conducted Limits	Compliant	Class B requirement
§15.109	6.2	Radiated Emission Limits	Compliant	Class B requirement

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Pinnacle Technology Model 9087 RFID Reader as shown in the photograph below. The EUT is an RFID reader for rodent identification in research facilities.



Equipment Under Test

1.3.2 Labelling Requirement for Innovation, Science and Economic Development Canada

The manufacturer, importer or supplier shall meet the labelling requirements set out in this section and in Notice 2014-DRS1003 for electronic labelling for every unit:

- (i) Prior to marketing in Canada, for ITE manufactured in Canada, and;
- (ii) Prior to importation into Canada, for imported ITE.

Each unit of an ITE model shall bear a label (see below) that represents the manufacturer's or the importer's SDoC with Innovation, Science and Economic Development Canada's ICES-003. This label shall be permanently affixed to the ITE or displayed electronically and its text must be clearly legible. If the dimensions of the device are too small or if it is not practical to place the label on the ITE and electronic labelling has not been implemented, the label shall be, upon agreement with Innovation, Science and Economic Development Canada, placed in a prominent location in the user manual supplied with the ITE. The user manual may be in an electronic format and must be readily available.

Innovation, Science and Economic Development Canada ICES-003 Compliance Label

CAN ICES-3 (B)/NMB-3(B)

* Insert either "A" or "B" but not both to identify the applicable Class of ITE.

1.3.3 Labelling Requirement for Part 15 (Verification) Device

See FCC Publication Number: 784748 for details:

<https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=27980&switch=P>

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Running an Experiment via USB (9087 RFID Module) using Sirenia Acquisition – 2017-09-12_12_37_13

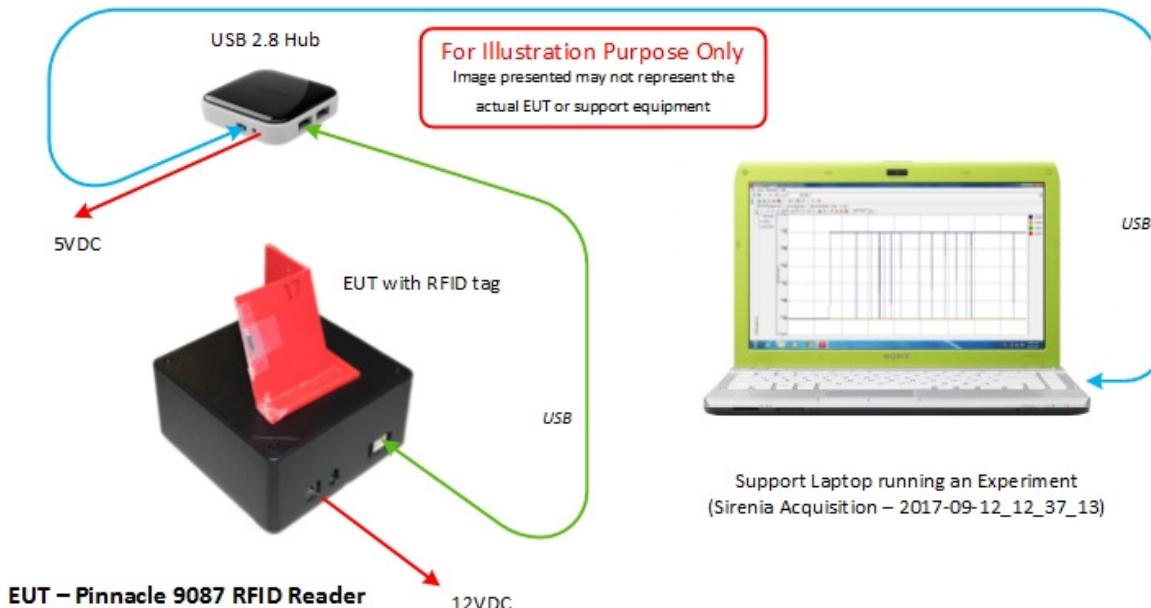
1.4.2 EUT Exercise Software

Sirenia Acquisition – 2017-09-12_12_37_13.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Model PP39L S/N 20L9RJ1
Dell	Support AC Adapter for Laptop	Model LA65NS1-00 S/N CN-0YD637-71615-VKT-2208
SL Power	EUT I.T.E Power Supply	Model PW173KB1203B01 12VDC 2.5A
Belkin	USB 2.0 4 Port Hub	Model F4U020
Belkin	Switching Adapter for USB Hub	Model ADS-6MA-06 05050EPCU

1.4.4 Simplified Test Configuration Diagram





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: N/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 C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 C63.4-2014. 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 (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-0230

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.



SECTION 2

TEST DETAILS

EMC Evaluation of the
Pinnacle Technology
RFID Reader

2.1 CONDUCTED LIMITS (AC CONDUCTED EMISSIONS VERIFICATIONS)

2.1.1 Specification Reference

Part 15 Subpart B §15.107(a)

2.1.2 Standard Applicable

Except for Class A digital devices, for equipment 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). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges

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.*

2.1.3 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

September 25, 2017 / FSC

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	25.2 °C
Relative Humidity	33.0 %
ATM Pressure	98.6 kPa

2.1.7 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 2.1.8 for sample computation.



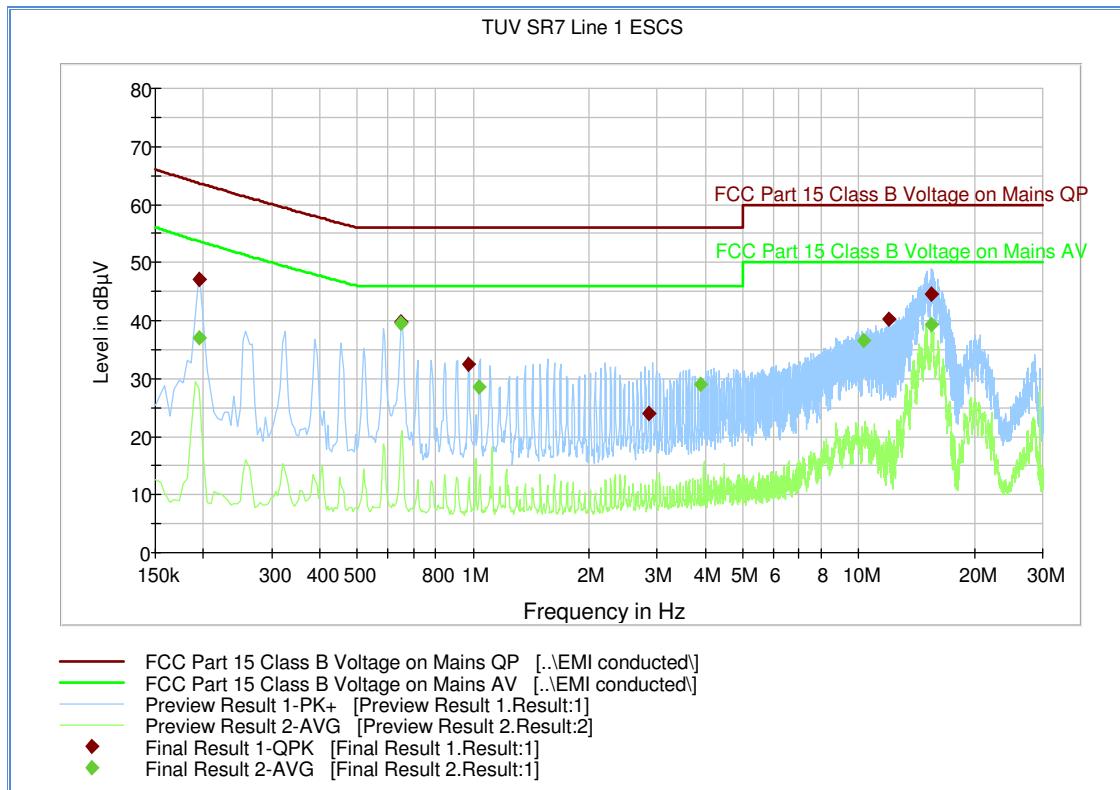
2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dB μ V) @ 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 Quasi Peak Final Measurement (dB μ V) @ 150kHz			26.2

2.1.9 Test Results

Compliant. See attached plots and tables.

2.1.10 120VAC 60Hz (Line 1)



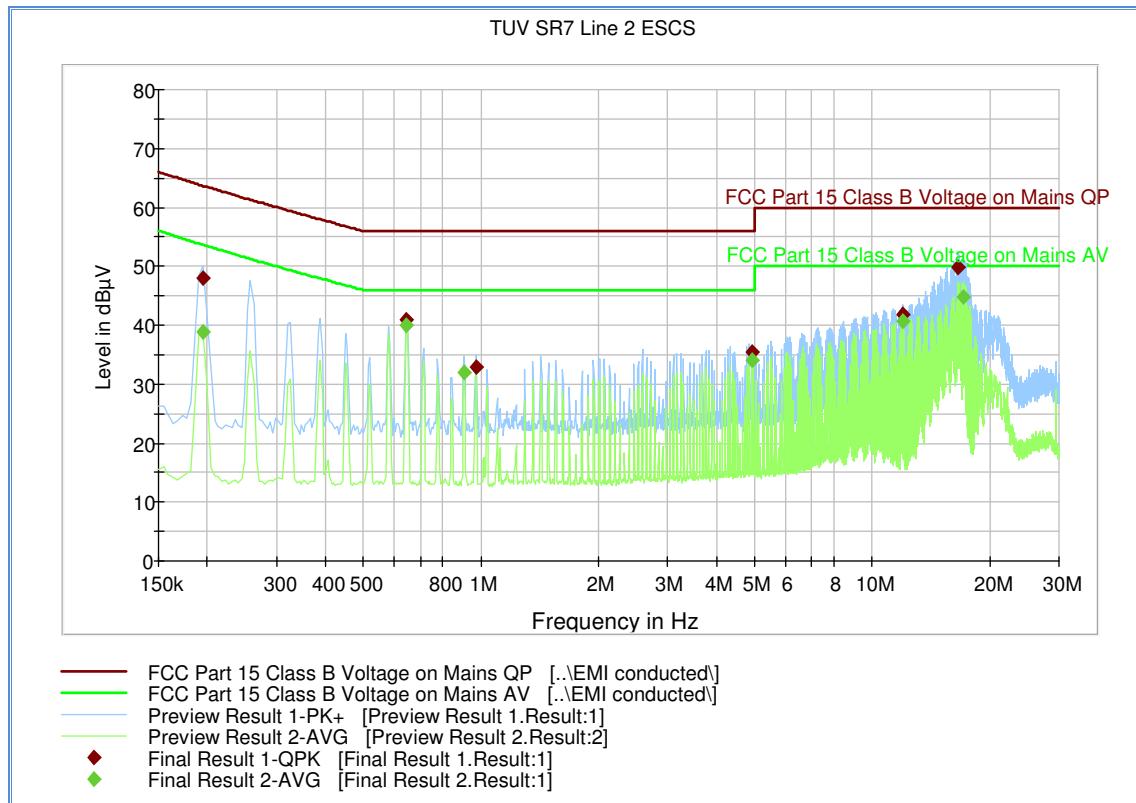
Quasi Peak

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)
0.195000	47.2	1000.0	9.000	Off	L1	19.9	16.5	63.7
0.649500	39.9	1000.0	9.000	Off	L1	20.0	16.1	56.0
0.969000	32.5	1000.0	9.000	Off	L1	20.0	23.5	56.0
2.845500	24.0	1000.0	9.000	Off	L1	20.3	32.0	56.0
11.976000	40.2	1000.0	9.000	Off	L1	20.5	19.8	60.0
15.472500	44.7	1000.0	9.000	Off	L1	20.6	15.3	60.0

Average

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.195000	37.0	1000.0	9.000	Off	L1	19.9	16.6	53.7
0.649500	39.5	1000.0	9.000	Off	L1	20.0	6.5	46.0
1.036500	28.5	1000.0	9.000	Off	L1	19.9	17.5	46.0
3.885000	29.1	1000.0	9.000	Off	L1	20.3	16.9	46.0
10.293000	36.5	1000.0	9.000	Off	L1	20.4	13.5	50.0
15.477000	39.3	1000.0	9.000	Off	L1	20.6	10.7	50.0

2.1.11 120VAC 60Hz (Line 2)



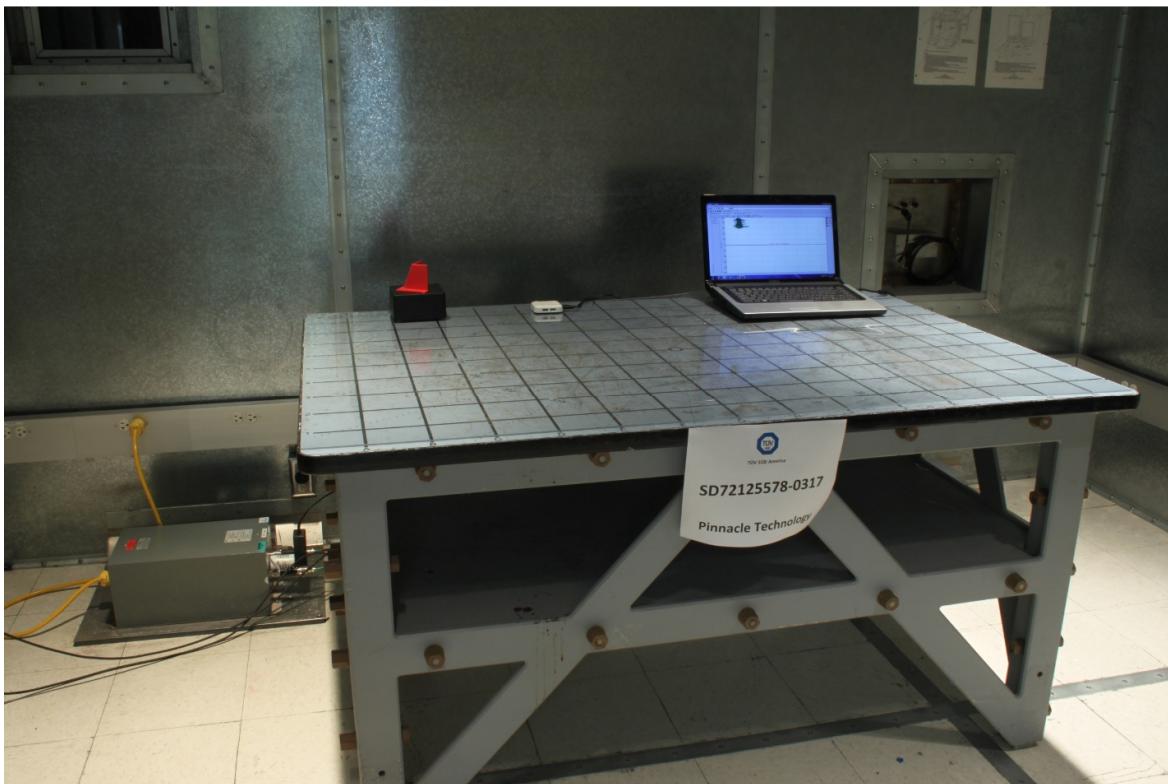
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.195000	48.0	1000.0	9.000	Off	N	19.9	15.7	63.7
0.645000	41.0	1000.0	9.000	Off	N	20.0	15.0	56.0
0.969000	33.0	1000.0	9.000	Off	N	20.0	23.0	56.0
4.920000	35.4	1000.0	9.000	Off	N	20.4	20.6	56.0
11.976000	41.8	1000.0	9.000	Off	N	20.6	18.2	60.0
16.575000	49.8	1000.0	9.000	Off	N	20.6	10.2	60.0

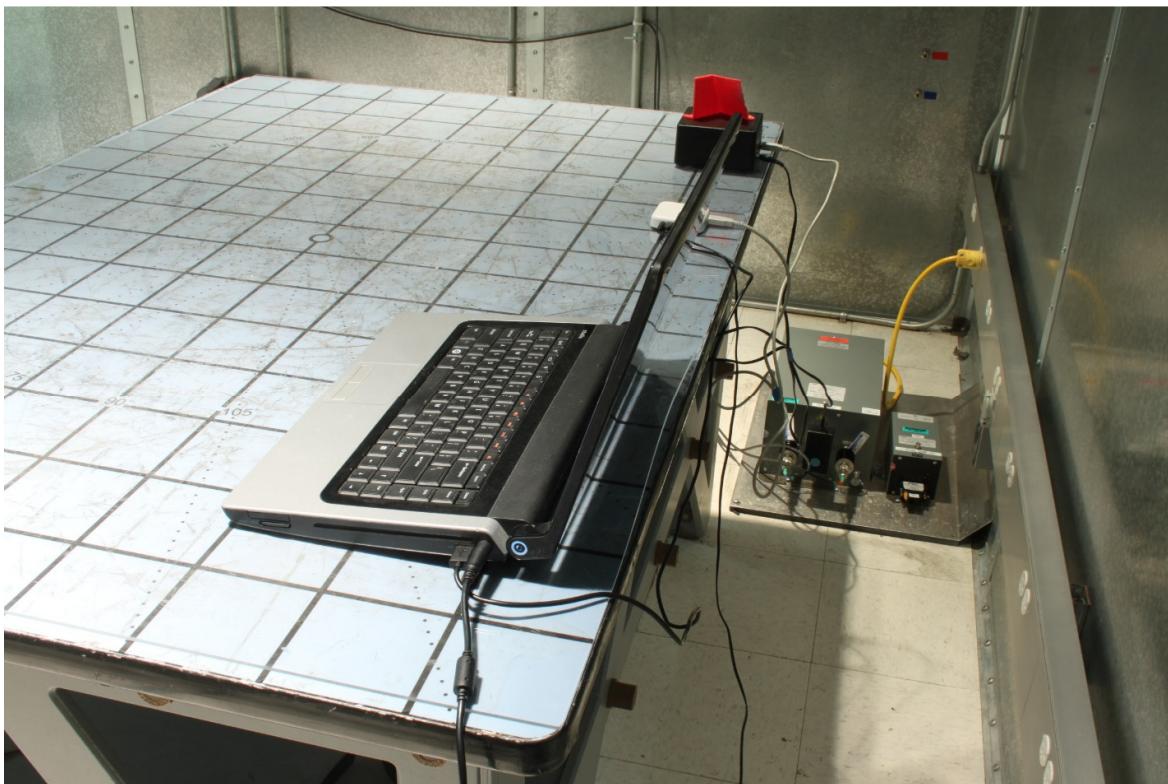
Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.195000	38.8	1000.0	9.000	Off	N	19.9	14.8	53.7
0.645000	40.0	1000.0	9.000	Off	N	20.0	6.0	46.0
0.906000	31.9	1000.0	9.000	Off	N	20.1	14.1	46.0
4.920000	34.1	1000.0	9.000	Off	N	20.4	11.9	46.0
11.976000	40.7	1000.0	9.000	Off	N	20.6	9.3	50.0
17.155500	44.8	1000.0	9.000	Off	N	20.7	5.2	50.0

2.1.12 Test Setup Photo (Front)



2.1.13 Test Setup Photo (Back)





2.2 RADIATED EMISSION LIMITS (RADIATED EMISSIONS VERIFICATION)

2.2.1 Specification Reference

Part 15 Subpart B §15.109(a)

2.2.2 Standard Applicable

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field Strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

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

September 25, 2017 / FSC

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	25.2 °C
Relative Humidity	33.0 %
ATM Pressure	98.6 kPa

2.2.7 Additional Observations

- The spectrum was searched from 30MHz to 1GHz.
- Verification was performed at 3 meters.
- The sample received transmits by default. Data from §15.209 testing is presented. Limits between §15.209 and §15.109 are identical.
- 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 2.2.8 for sample computation.



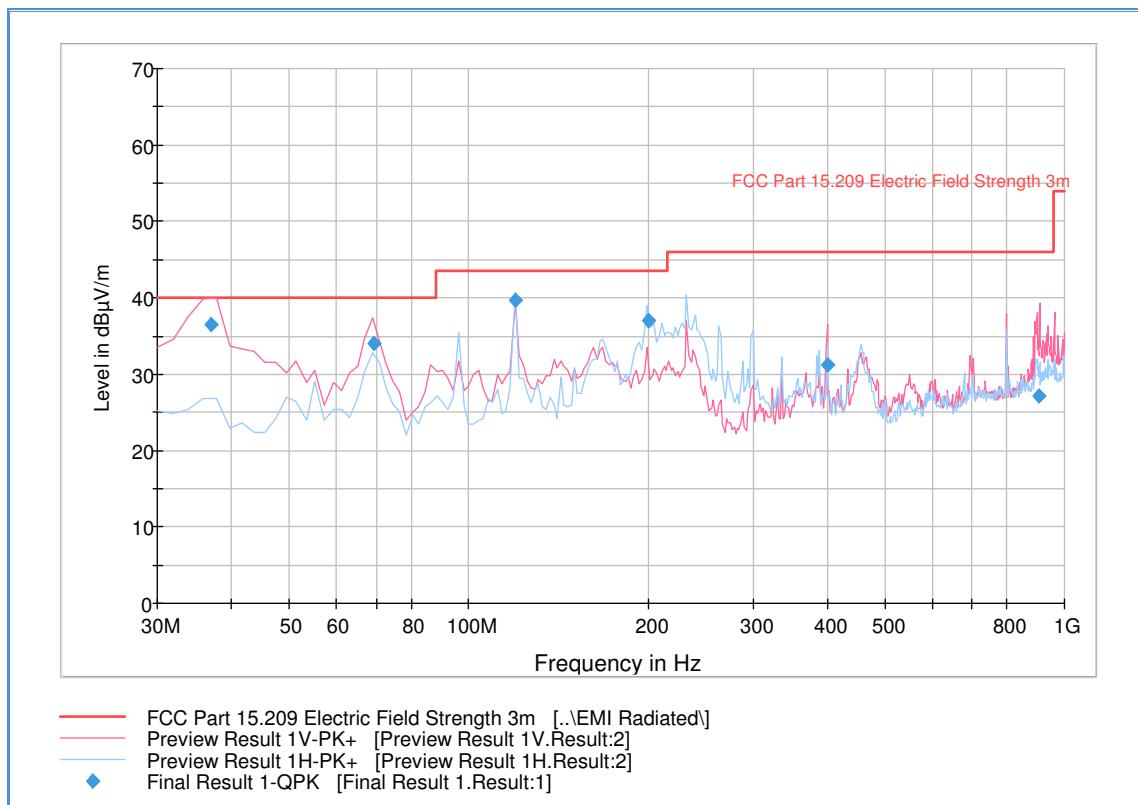
2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dB μ V) @ 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# 1033 (antenna)	17.2	
	Reported Quasi Peak Final Measurement (dB μ V/m) @ 30MHz		11.8

2.2.9 Test Results

Compliant. See attached plots and tables.

2.2.10 Test Results 30MHz to 1GHz



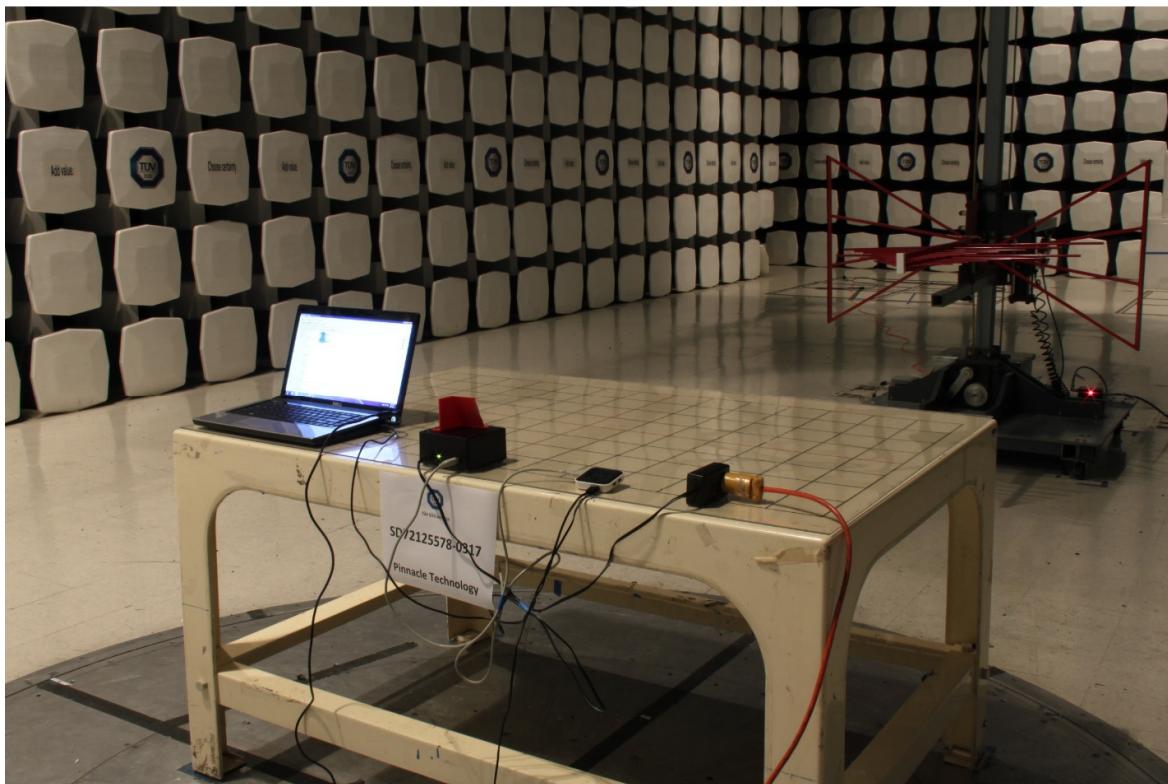
Quasi Peak Data (§15.209 Limits)

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
36.895551	36.5	1000.0	120.000	100.0	V	25.0	-10.8	3.5	40.0
69.157756	34.0	1000.0	120.000	100.0	V	235.0	-17.0	6.0	40.0
120.018838	39.6	1000.0	120.000	200.0	H	3.0	-15.8	3.9	43.5
199.998236	37.0	1000.0	120.000	100.0	H	76.0	-12.0	6.5	43.5
399.618677	31.2	1000.0	120.000	100.0	V	162.0	-4.3	14.8	46.0
908.157275	27.2	1000.0	120.000	139.0	V	47.0	5.8	18.8	46.0

2.2.11 Test Setup Photo (Below 1GHz Front)



2.2.12 Test Setup Photo (Below 1GHz Back)





SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
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.	11/05/16	11/05/17
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	11/05/16	11/05/17
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	
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/16	10/26/17
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
Radiated Emission						
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
1016	Pre-amplifier	PAM-0202	187	PAM	02/09/17	02/09/18
Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/05/17	07/05/18
7554	Barometer/Temperature/Humidity Transmitter	iBTHX-W	0400706	Omega	01/17/17	01/17/18
-	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 1GHz)

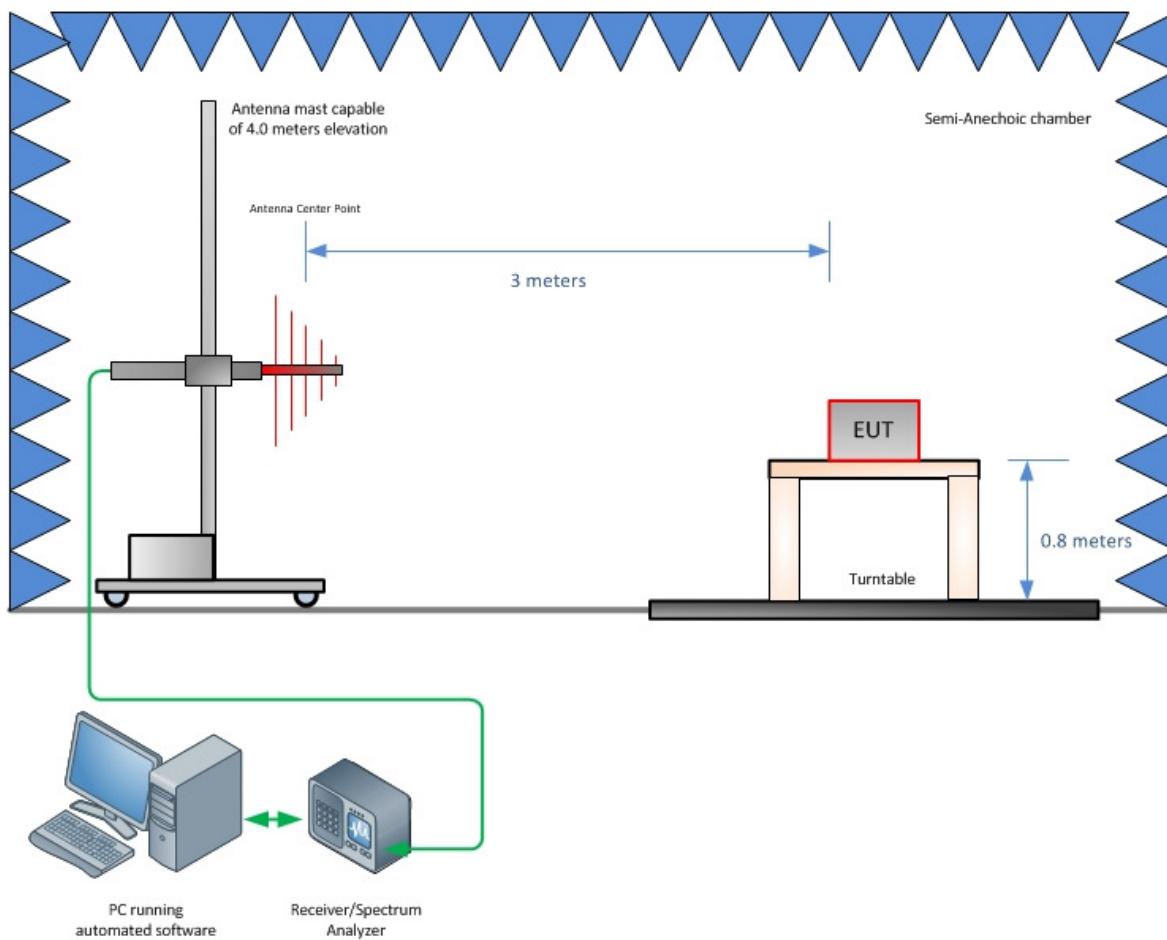
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	2.70	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



SECTION 4

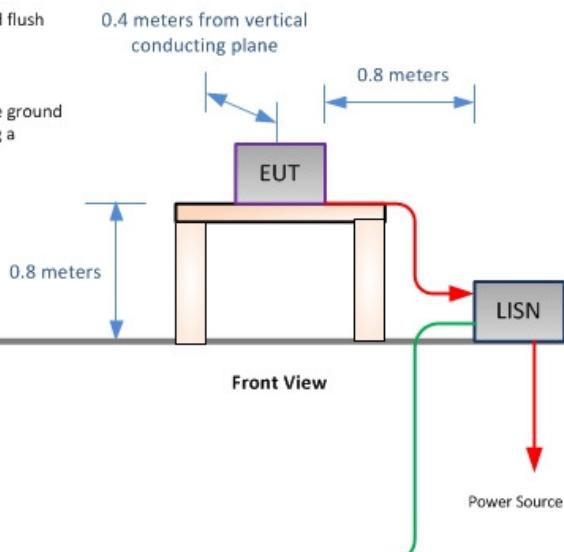
DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Shielded Enclosure

- EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated into $50\ \Omega$ loads.
- LISN at least 80 cm from nearest part of EUT chassis.
- Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.



Conducted Emission Test Setup



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

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