



Report Number: 12511671-E3V6
Issue Date: NOVEMBER 12, 2020
Product Name: MILLIMETER WAVE RADAR SENSOR DEVELOPMENT BOARD
Model Numbers: IWR6843ISK, MMWAVEICBOOST

Electromagnetic Compatibility Test Report

For

**TEXAS INSTRUMENTS
12500 TI BLVD.
DALLAS
TEXAS, 75243, USA**



NVLAP Lab code: 200065-0

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Test Report Details

Tests Performed By: UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.

Tests Performed For: TEXAS INSTRUMENTS
12500 TI BLVD.
DALLAS, TX 75243, USA

Issue Date: NOVEMBER 12, 2020

Product Name: MILLIMETER WAVE RADAR SENSOR DEVELOPMENT BOARD

Model Numbers: IWR6843ISK, MMWAVEICBOOST

Sample Serial Numbers: 5498300573 (IWR6843)
5604000467 (MMWAVEICBOOST)

Applicable Standards: DRAFT EN 301 489-1 v2.2.0* as referenced by test plan 12511671-TP1V2
DRAFT EN 301 489-1 v2.2.1* as referenced by test plan 12511671-TP1V2
EN 301 489-3 v2.1.1 as referenced by test plan 12511671-TP1V2

Date Test Item Received: 2019/6/13

Testing Start Date: 2019/6/18

Date Testing Complete: 2019/6/18

Overall Results: Compliant

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

* DRAFT EN 301 489-1 v2.2.0 and DRAFT EN 301 489-1 v2.2.1 are not covered by the laboratory's NVLAP scope of accreditation under certificate 200065-0."

Report Directory

1.0	SUMMARY.....	5
1.1	Deviations from standard test methods.....	5
1.2	Device Modifications Necessary for Compliance.....	5
1.3	Applicable Standards	5
1.4	Summary of Tests	6
2.0	CALIBRATION AND UNCERTAINTY	7
2.1	Measuring Instrument Calibration	7
2.2	Sample Calculation	7
2.3	Measurement Uncertainty	7
3.0	GENERAL - Product Description	8
3.1	Equipment Description	8
3.2	Device Configuration During Test	8
3.2.1	Equipment Used During Test:	8
3.2.2	Input/Output Ports:.....	8
3.2.3	EUT Internal Operating Frequencies:	9
3.2.4	Power Interface:.....	9
3.2.5	Software and Firmware	9
3.3	Block Diagram:.....	10
3.4	EUT Configurations.....	11
3.5	EUT Operation Modes.....	11
3.6	Rational for EUT Configurations	11
4.0	IMMUNITY TEST RESULTS	12
4.1	Performance Criteria	12
4.1.1	EN 301 489-3 IMMUNITY PERFORMANCE CRITERIA	12
4.2	Test Conditions and Results - ELECTROSTATIC DISCHARGES (ESD).....	13
4.3	Test Conditions and Results - RADIATED IMMUNITY	18
	Appendix A	23
	Facilities, Accreditations and Authorizations.....	23

Report Revision History

Revision Date	Revision Version	Description	Revised By	Revision Reviewed By
2019/6/25	V1	Initial Issue	Michael Heckrotte	--
2019/07/08	V2	Removed EN 301 489-1 V2.2.0 and identified standard not on NVLAP scope	Edgard Rincand	--
2019/07/09	V3	Added DRAFT EN 301 489-1 V2.2.0 and updated statement for standard not on NVLAP scope	Edgard Rincand	
2019/07/22	V4	Added model MMWAVEICBOOST	Michael Heckrotte	
2020/08/25	V5	Revised Test Plan reference to 12511671-TP1V2	Michael Heckrotte	
2020/11/12	V6	Revised descriptions of EUT and antennas	Michael Heckrotte	

1.0 SUMMARY

The tests documented in this report were performed in accordance with DRAFT EN 301 489-1 v2.2.0 and DRAFT EN 301 489-1 v2.2.1 as referenced by EN 301 489-3 v2.1.1 as referenced by test plan 12511671-TP1V2.

1.1 Deviations from standard test methods

See Summary above.

1.2 Device Modifications Necessary for Compliance

None

1.3 Applicable Standards

Standards
DRAFT EN 301 489-1 v2.2.0 as referenced by test plan 12511671-TP1V2
DRAFT EN 301 489-1 v2.2.1 as referenced by test plan 12511671-TP1V2
EN 301 489-3 v2.1.1 as referenced by test plan 12511671-TP1V2

1.4 Summary of Tests

Requirement – Test	Result (Compliant / Non-Compliant)
ELECTROSTATIC DISCHARGES (ESD)	Compliant
RADIATED IMMUNITY	Compliant

Approved & Released For

UL Verification Services Inc. By:



Michael Heckrotte
Principal Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



29427 THANH NGUYEN
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2.0 CALIBRATION AND UNCERTAINTY

2.1 Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

2.2 Sample Calculation

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

2.3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

Uncertainty figures are valid to a confidence level of 95%.

3.0 GENERAL - Product Description

3.1 Equipment Description

The EUT consists of a radar chipset, compatible development board and an interface board.

User software with a GUI is installed in a third-party control computer that is connected to the interface board via a USB interface.

Power is furnished by a third-party laboratory bench-top power supply with a 5 VDC output.

The IWR6843ISK is a 60 to 64 GHz mmWave radar sensor development board with integral high-gain (~7 dBi) antennas on the printed circuit board.

The MMWAVEICBOOST is an interface board.

3.2 Device Configuration During Test

3.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Millimeter wave radar sensor development board	Texas Instruments	IWR6843ISK	None
EUT	Interface Board	Texas Instruments	MMWAVEICBOOST	None
AE	EUT Power Adapter	CUI INC.	EMSA050300	None
AE	Laptop	Dell	Latitude E6520	None
AE	Laptop Adapter	Dell	LA130PM121	None
AE	Radar Cross Section (RCS) Target	UL	Not Available	Reflective target, cone shaped with 5.5" on 3 sides and 2.5" deep.

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

3.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	DC Power Port	DC	N	N	Power adapter directly connected to AC Mains

2	USB	I/O	N	N	
*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

3.2.3 EUT Internal Operating Frequencies:

Frequency (GHz)	Description
60-64 GHz	Radar Frequency

3.2.4 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	5 Vdc	--	--	60Hz	Single	Interface Board
Rated	120 Vac	--	--	50/60Hz	Single	AC Adapter
1	120 Vac	--	--	60Hz	Single	

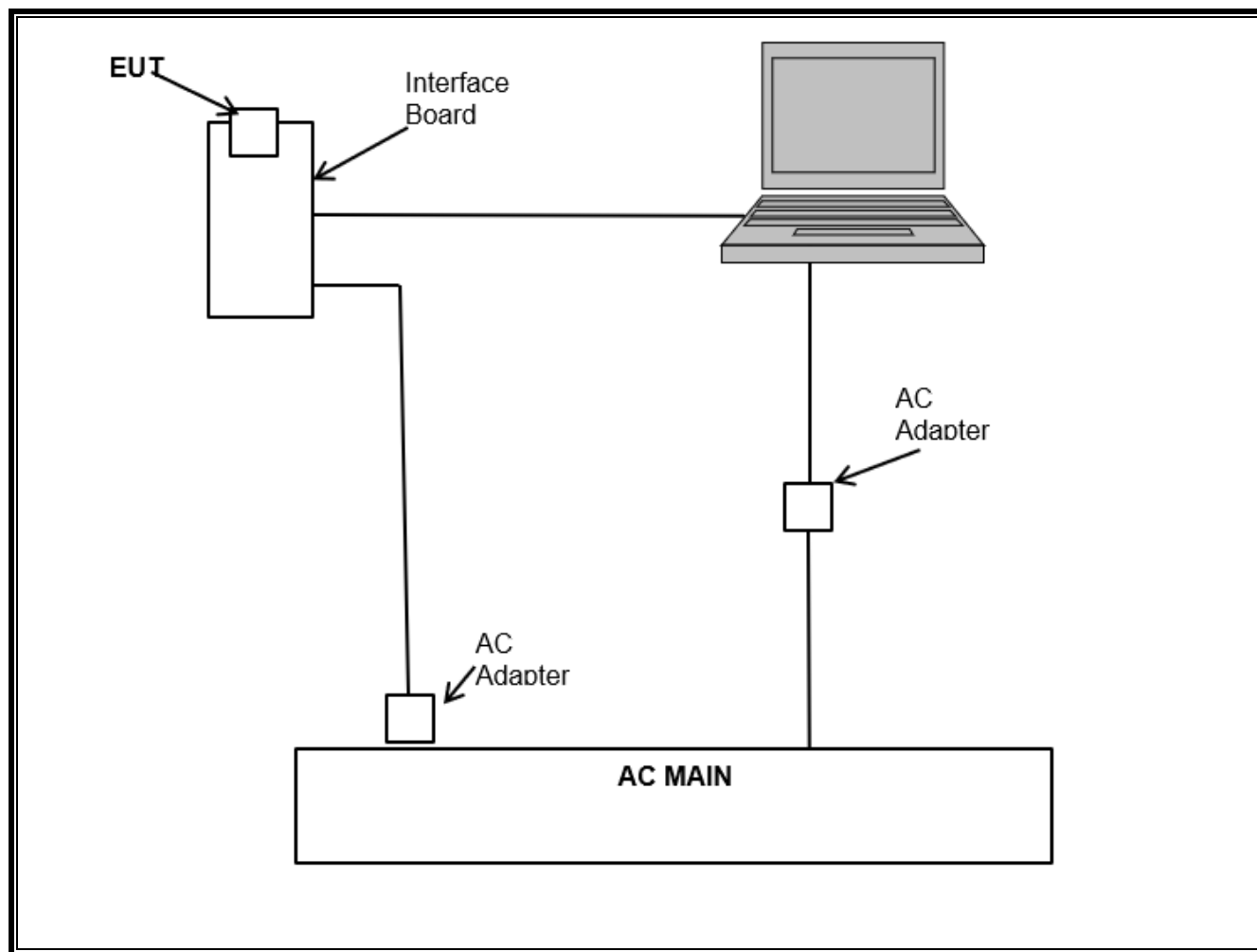
3.2.5 Software and Firmware

The software used on the support laptop is mmWave Demo Visualizer 3.2.0, Platform 0xa6843,

SDK Version 3.2.0.4.

3.3 Block Diagram:

The diagram below illustrates the configuration of the equipment above.



3.4 EUT Configurations

Configuration #	Description
1	EUT connected to interface board via terminal block. USB port of interface board connected to support laptop.

3.5 EUT Operation Modes

Mode #	Description
1	4 GHz BW mode using TX1-2-3 - Running test script provided by client.

3.6 Rational for EUT Configurations

Configuration #	Description
1	The selected EUT configuration was specified by test plan 12511671-TP1V2

4.0 IMMUNITY TEST RESULTS

In accordance with:

BASIC STANDARD	VERSION	SUBJECT
EN 61000-4-2 IEC 61000-4-2	2009 2008	ESD
EN 61000-4-3 A1 A2 IEC 61000-4-3 A1 A2	2006 2008 2010 2006 2007 2010	Radiated Immunity

Note: IEC versions are the latest versions unless otherwise stated in the product standard or noted above.

4.1 Performance Criteria

4.1.1 EN 301 489-3 IMMUNITY PERFORMANCE CRITERIA

Table 2: Performance Requirements

Criterion	During test	After test
A	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
B	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions

Product Specific Performance Criteria

After the application of ESD discharges, the EUT shall indicate the distance to the target within 20 cm of the distance indicated prior to the application of ESD discharges.

During and after the application of the immunity field, the EUT shall indicate the distance to the target within 20 cm of the distance indicated prior to the application of the immunity field.

4.2 Test Conditions and Results - ELECTROSTATIC DISCHARGES (ESD)

Method	Measurements were made on a ground plane that extends 0.5-meter minimum beyond all sides of the system under test and the minimum distance between the equipment under test and any laboratory walls or any other metallic surfaces shall be at least 1-meter. Discharges were also applied to the Horizontal and Vertical Coupling Planes, where applicable. Each discharge was applied at a rate of one (1) discharge per second.		
Test Standards	DRAFT EN 301 489-1 v2.2.0 DRAFT EN 301 489-1 v2.2.1 EN 301 489-3 v2.1.1 IEC/EN 61000-4-2:2008		
Test Engineer	29427 TN		
Test Date	2019 June 18		
Laboratory Parameters	Required prior to the test		During the test
Ambient Temperature	15 to 35 °C		22.5 °C
Relative Humidity	30 to 60 %		54 %
Atmospheric Pressure	86 kPa (860 mbar) to 106 kPa (1060 mbar)		1015 mbar
	Measurement Point		
Sample subjected to the levels shown below.	Indirect Discharge		
Test Levels			Minimum Performance Criteria Required
Discharge type	Discharge Level (kV)		
	Positive	Negative	
Contact – Indirect	2, 4	2, 4	10
Supplementary information:			

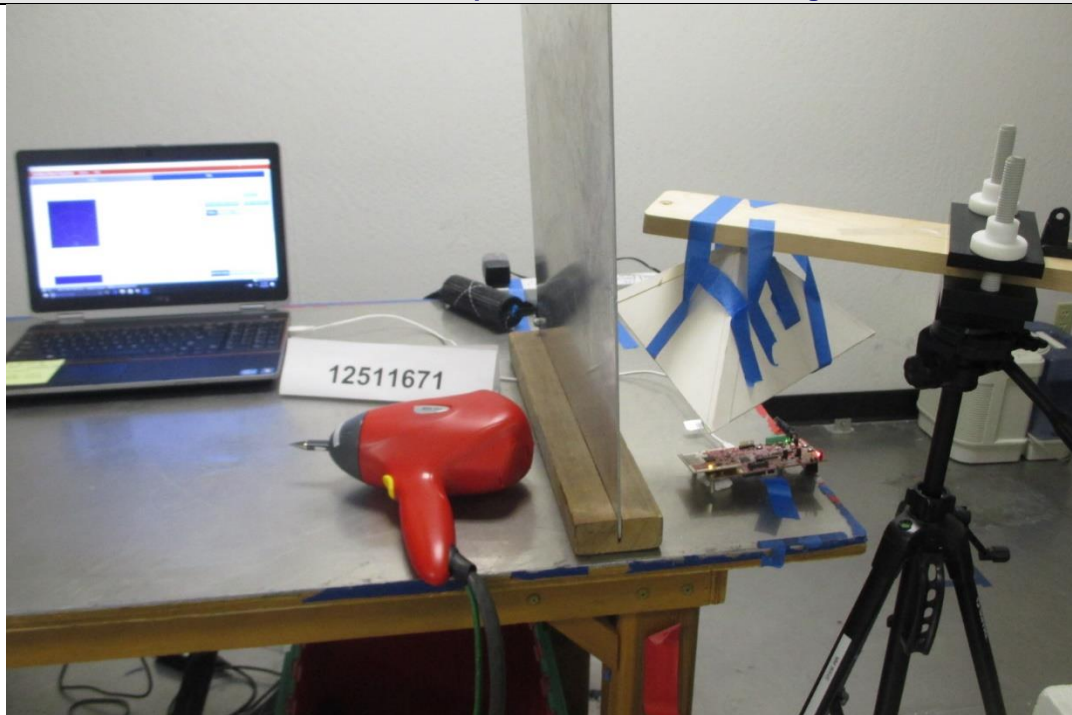
ESD EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

ESD Test Equipment

Test Equipment List					
Description	Manufacturer	Model	Local ID (T No.)	Cal Date	Cal Due
ESD Simulator	Teseq Inc.	NSG 437	995	2019/01/23	2020/01/23
Static Charge Monitor	Wescorp	W210A	690	C.N.R	C.N.R
Temp/Humidity/Pressure Meter	Control Company	14-650-118	PRE0186421	2019/02/28	2020/02/28

Photo of test setup for Electrostatic Discharge



TEST LOCATIONS

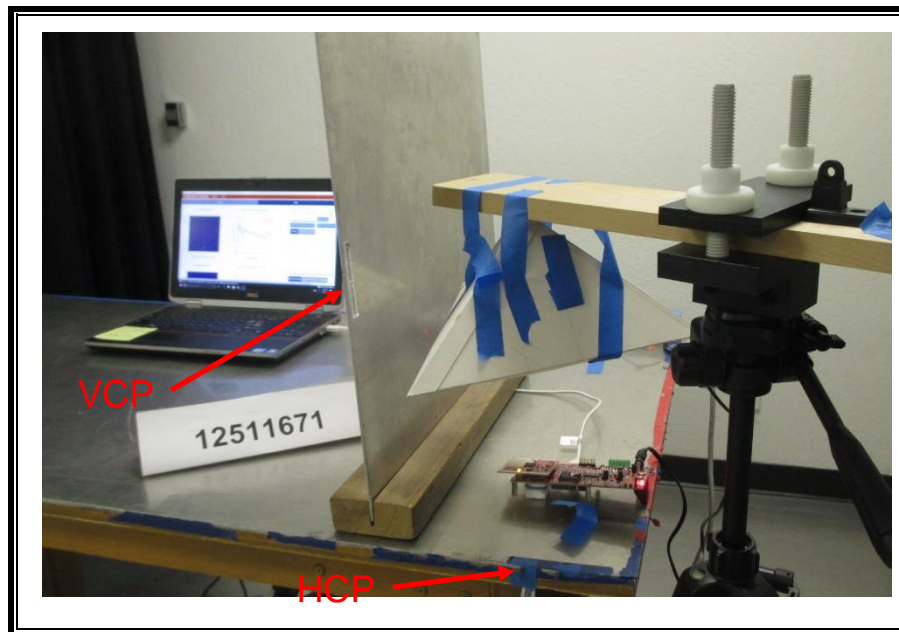
DIRECT CONTACT DISCHARGE POINTS

NOT APPLICABLE FOR THIS DEVICE

DIRECT AIR DISCHARGE POINTS

NOT APPLICABLE FOR THIS DEVICE

HCP AND VCP FOR INDIRECT CONTACT DISCHARGE TESTS



Results for Electrostatic Discharges - Contact Discharges

TEST POINT	Positive Polarity		Negative Polarity	
	2kV	4kV	2kV	4kV
VCP - Four Sides	2	2	2	2
HCP - Four Sides	2	2	2	2

Result Descriptions

Actual Performance (A, B or C)
A
X - Not Performed nor required.
1 – Compliant - No perceived discharge, no anomalies observed. The EUT functioned as expected according to manufacturer's instructions.
2 – Compliant - Discharge observed, no anomalies observed. The EUT functioned as expected according to manufacturer's instructions.

4.3 Test Conditions and Results - RADIATED IMMUNITY

Test Description	Measurements were made in a chamber and the indicated field strength was pre-calibrated prior to placement of the system under test. Tests were performed in both the horizontal and vertical polarizations, where applicable.			
Test Standards	DRAFT EN 301 489-1 v2.2.0 DRAFT EN 301 489-1 v2.2.1 EN 301 489-3 v2.1.1 IEC/EN 61000-4-3:2006			
Test Engineer	29427 TN			
Test Date	2019 JUNE 18			
Laboratory Parameters	Required prior to the test		During the test	
Humidity	< 95 %		45%	
Measurement Point - Enclosure				
Applied Field				Minimum Performance Criteria Required
Frequency (MHz)	Strength (V/m)	Modulation	Dwell Time	
80 – 6000	3	80% 1kHz AM	3 sec	A
Supplementary information: None				

Radiated Immunity EUT Configuration Settings

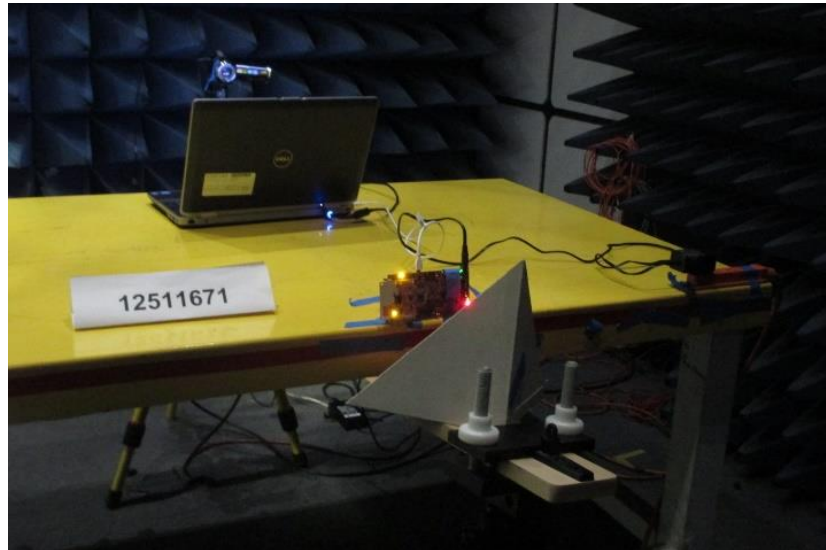
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Radiated Immunity Test Equipment

Test Equipment List					
Description	Manufacturer	Model	Local ID (T No.)	Cal Date	Cal Due
Signal Generator	Agilent	MXG, N5183A	454	2019/06/11	2020/06/11
RF Amplifier	Amplifier Research	500W1000B	N/A	C.N.R	C.N.R
RF Amplifier	Amplifier Research	60S1G4M3	525	C.N.R	C.N.R
RF Amplifier	Amplifier Research	40S4G11M3	527	C.N.R	C.N.R
Directional Coupler	Werlatone	C6021	67	C.N.R	C.N.R
Directional Coupler	Amplifier Research	DC7144A	524	C.N.R	C.N.R
Power Meter	HP/Agilent	N1914A	254	2018/08/09	2019/08/09
Power Sensor	HP/Agilent	E9304A	255	2018/08/09	2019/08/09
Power Sensor	HP/Agilent	E9304A	256	2018/08/09	2019/08/09
Log Periodic Antenna	Rohde & Schwarz	HL 046	620	C.N.R	C.N.R
Horn Antenna	EMCO	3115	59	C.N.R	C.N.R
Temp/Humidity Meter	Control Company	14-650-118, 15557603	PRE0186411	2019/02/25	2020/02/25
Radiated immunity s/w	UL	UL EMS	ver. 9.5, dated October 18, 2018		

EUT TEST ORIENTATIONS

FRONT



RIGHT

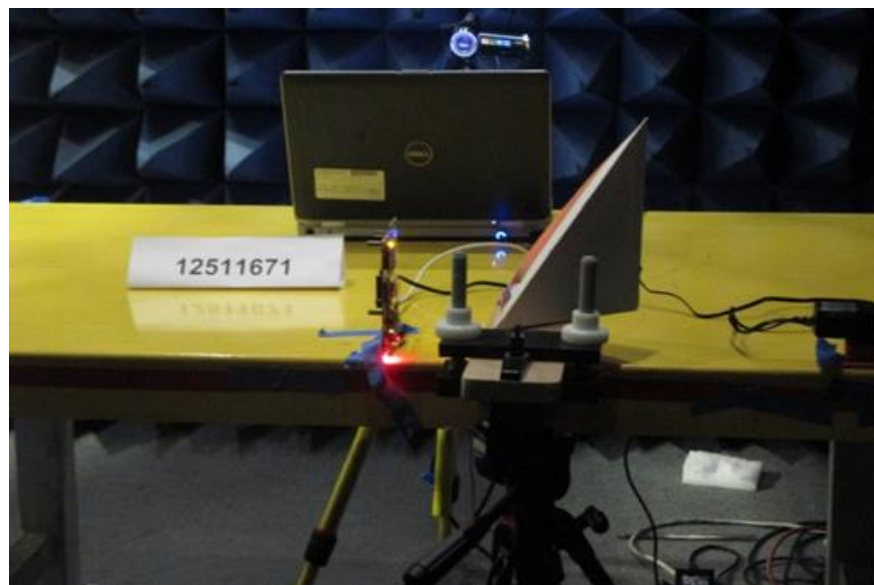


Photo of test setup for Radiated Immunity



Results

EUT Side	Polarity	Results
		80MHz – 6000MHz
Front	Horizontal	1
	Vertical	1
Left	Horizontal	X
	Vertical	X
Right	Horizontal	1
	Vertical	1
Back	Horizontal	X
	Vertical	X
Top	Horizontal	X
	Vertical	X
Bottom	Horizontal	X
	Vertical	X

Result Description

Actual Performance (A, B or C)
A
X - Not Performed nor required.
1 – Compliant – No anomalies observed. The EUT functioned as expected according to manufacturer's instructions.

Appendix A

Facilities, Accreditations and Authorizations

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

END OF TEST REPORT