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Test report

393152TRFEMC

Date of issue: February 20, 2020

Applicant:

Texas Instruments Incorporated

Product:

Evaluation Board

Model:

IWR6843AOPEVM

Specifications:

EN 301 489-1 V2.2.3 (2019-11)

Electromagnetic Compatibility (EMC) standard for radio equipment and services;
Part 1: Common technical requirements;
Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

EN 301 489-3 V2.1.1 (2019-03)

Electromagnetic compatibility and Radio spectrum Matters (ERM)
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz

Lab and test locations

Company name	Nemko USA, Inc.
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Province	California
Postal code	92008
Country	USA
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Tested by	Lan Sayasane, Sr. EMC Test Engineer
Tested by	Enrique Hernández, EMC Test Engineer
Reviewed by	Mark Phillips, Sr. EMC Test Engineer
Review date	February 20, 2020
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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Section 1 Report summary

1.1 Test specifications

EN 301 489-1 V2.2.3 (2019-11)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
EN 301 489-3 V2.1.1 (2019-03)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz

Note: Accreditation pending for latest versions of ETSI EN 301 489 standards listed.

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Details of changes made to test report
393152TRFEMC	Original report issued

Notes: None

Section 2 Summary of test results

2.1 Equipment classification

Table 2.1-1: *Equipment classification (EN 301 489-1 V2.1.1 – Clause 5.5)*

Equipment classification	
☒	Radio and ancillary equipment for fixed use (e.g. base stations equipment)
☐	Radio and ancillary equipment for vehicular use (e.g. mobile equipment)
☐	Radio and ancillary equipment for portable use (portable equipment)

Notes: For the purpose of the EMC performance assessment, the radio equipment and/or associated ancillary equipment under test shall be classified into one of the following three classes

This classification determines the extent of applicable EMC tests. However, the following instructions shall also apply to multiple use radio and/or ancillary equipment:

- Radio and/or ancillary equipment for portable use or combinations thereof declared as capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as equipment for vehicular use;
- Radio and/or ancillary equipment for portable or vehicular use or combinations thereof declared as capable of being powered for intended use by an AC mains or DC network shall additionally be considered as equipment for fixed use.

Table 2.1-2: *Technical nature of the primary function (EN 301 489-3 V2.1.1 – Clause 4.1)*

Primary function type	**Technical nature of the primary function**	**Applicable**
I	Transfer of messages (digital or analogue signals)	☒
II	Transfer of audio (speech or music)	☐
III	Others	☐

Notes: For the purpose of the present document Short Range Devices are divided into three types of primary function, based on the technical nature of the primary function.

Table 2.1-3: *Classification of SRD equipment (EN 301 489-3 V2.1.1 – Clause 6.1)*

Device type	**Risk assessment of communication link performance**	**Applicable**
1	Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person)	☐
2	Medium reliable SRD communication media; e.g. causing inconvenience to persons, which cannot simply be overcome by other means	☐
3	Standard reliable SRD communication media; e.g. inconvenience to persons, which can simply be overcome by other means (e.g. manual)	☒

Notes: The product family of Short Range Devices is divided by device type, each having its own set of performance criteria. This classification is based upon the impact on persons and/or goods in case the equipment does not operate above the specified performance level under EMC stress.

2.2 Results

Table 2.2-1: *Clause 8 of EN 301 489-1 – Methods of measurement and limits for EMC emissions results*

Environmental phenomenon		Verdict
Enclosure of ancillary equipment measured on a stand alone basis – *Clause 8.2*	***Ancillary equipment*** Class B limits given in EN 55032	Pass
	Ancillary equipment Radiated disturbance above 1 GHz at a measurement distance of 3 m	Pass
	Ancillary equipment intended to be used in telecommunication centers only Class A limits given in EN 55032	Not applicable
	Ancillary equipment intended to be used in telecommunication centers only Radiated disturbance above 1 GHz at a measurement distance of 3 m	Not applicable
DC power input/output ports[1] – *Clause 8.3*	Class B limits according to EN 55032	Not applicable
	Equipment intended to be used in telecommunication centers only	Not applicable
AC mains power input/output ports[2] – *Clause 8.4*	Class B limits given in EN 55032	Pass
	Equipment intended to be used in telecommunication centers only Class A limits given in EN 55032	Not applicable
Harmonic current emissions (AC mains input port)[2] – *Clause 8.5*	The appropriate requirements of EN 61000-3-2/A1 for harmonic current emission apply for equipment with an input current up to and including 16 A per phase. For equipment with an input current of greater than 16 A per phase EN 61000-3-12 applies.	Pass
Voltage fluctuations and flicker (AC mains input port)[2] – *Clause 8.6*	The appropriate requirements of EN 61000-3-3 for voltage fluctuations and flicker apply for equipment with an input current up to and including 16 A per phase. For equipment with an input current of greater than 16 A per phase EN 61000-3-11 [13] applies.	Pass
Telecommunication ports – *Clause 8.7*	Class B limits given in EN 55032	Not applicable
	Equipment intended to be used in telecommunication centers only Class A limits given in EN 55032	Not applicable

Notes: [1] Not applicable for radio and ancillary equipment for portable use (portable equipment)
[2] Applicable only for radio and ancillary equipment for fixed use (e.g. base station equipment)

2.2 Test results, continued

Table 2.2-2: *Clause 9 of EN 301 489-1 Test methods and levels for immunity tests results*

Environmental phenomenon	Test port	Basic standard	Verdict
Radio frequency electromagnetic field (80 MHz to 6000 MHz) – *Clause 9.2*	Enclosure	EN 61000-4-3	Pass
Electrostatic discharge[1] – *Clause 9.3*	Enclosure	EN 61000-4-2	Pass
Fast transients, common mode[2] – *Clause 9.4*	AC mains power port	EN 61000-4-4	Pass
	Signal ports, telecommunication ports, control ports		Not applicable
	DC power ports		Not applicable
Radio frequency, common mode[3] (0.15 MHz to 80 MHz) – *Clause 9.5*	AC mains power port	EN 61000-4-6	Pass
	Signal ports, telecommunication ports, control ports		Not applicable
	DC power ports		Not applicable
Transients and surges[4] – *Clause 9.6*	12 V and 24 V DC supply voltage input ports of mobile radio and ancillary equipment, which are also intended for mobile use in vehicles.	ISO 7637-2	Not applicable
Voltage dips and interruptions[2] – *Clause 9.7*	AC mains power port	EN 61000-4-11	Pass
Surges line to line and line to ground[2] – *Clause 9.8*	AC mains power port	EN 61000-4-5	Pass
	Telecommunication ports		Not applicable

Notes:
[1] Not applicable for radio and ancillary equipment for vehicular use (e.g. mobile equipment)
[2] Applicable only for radio and ancillary equipment for fixed use (e.g. base station equipment)
[3] Not applicable for radio and ancillary equipment for portable use (portable equipment)
[4] Applicable only for radio and ancillary equipment for vehicular use (e.g. mobile equipment)

Section 3 Equipment under test (EUT) details

3.1 Applicant

Company name	Texas Instruments Incorporated
Address	12500 TI Boulevard
City	Dallas
Province/State	TX
Postal/Zip code	75243
Country	USA

3.2 Manufacturer

Company name	Texas Instruments Incorporated
Address	12500 TI Boulevard
City	Dallas
Province/State	TX
Postal/Zip code	75243
Country	USA

3.3 Sample information

Receipt date	February 14, 2020
Nemko sample ID number	393152

3.4 EUT information

Product name	Evaluation Board
Model	IWR6843AOPEVM
Serial Number	5119910017
Power requirements	AC/DC Adapter: 100-240Vac; 50/60Hz; Output 5 VDC
Description/theory of operation	IWR6843AOPEVM is an easy-to-use mmWave sensor evaluation module with integrated, short-range, wide field of view antenna-on-package technology enabling direct connectivity to mmWave Carrier Platform (MMWAVEICBOOST) and standalone use. The evaluation module enables access to point-cloud data through USB interface and raw ADC data through 60-pin high-speed connector.
Operational frequencies	Crystal – 40 MHz, VCO – 14.4 GHz
Software details	mmWave Demo Visualizer 1.0.0
Intended Use	Base Station equipment
Intended environment	Fixed location

3.5 EUT exercise and monitoring details

EUT was exercised with Software mmWave Demo Visualizer 1.0.0 with testing file “profile_iwr6843_aop_3d.cfg”. Stable active “Range Profile for Zero Doppler” was captured on supporting PC monitor screen. “3D Scatter Plot” displayed stable measured active points.

3.6 EUT setup details

Table 3.6-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number	Rev.
Evaluation Board	Texas Instruments Inc.	IWR6843AOPEVM	5119910017	--
Switch-Mode Power Supply Adapter	CUI, Inc.	EMSA050300	N/A	--

Table 3.6-2: EUT interface ports

Description	Qty.
USB port (XDS110_USB)	1

Table 3.6-3: Support equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Support Laptop	DELL	Latitude E6420	H1J8DS1	--
Support Laptop AC/DC Adapter	DELL	HA65NS0-00	CN-0DF261-47890-72N-A3AE	A02

Table 3.6-4: Inter-connection cables

Cable description	From	To	Length (m)
USB cable	EUT	Support Laptop	0.9
DC cable	EUT	Switch-Mode Power Supply Adapter	1.5

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Test name	Measurement uncertainty, dB
Radiated spurious emissions	3.78
AC power line conducted emissions	1.38

Section 7 Terms and definitions

7.1 Performance criterion

Performance criteria: Reference clause 6 of EN 301 489-3 V2.1.1 (2019-03)

7.2 General definitions

7.2.1 EN 61000-3-2 (Harmonic emissions)

For the purpose of harmonic current limitation, equipment is classified as follows:

Class A	– Balanced three-phase equipment; – Household appliances excluding equipment identified as Class D; – Tools excluding portable tools; – Dimmers for incandescent lamps; – Audio equipment. Equipment not specified in one of the three other classes shall be considered as Class A equipment.
Class B	– Portable tools; – Arc welding equipment, which is not professional equipment.
Class C	– Lighting equipment.
Class D	Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types: – Personal computers and personal computer monitors; – Television receivers.

7.2.2 EN 61000-3-3 (Flicker)

Voltage fluctuation	Series of changes of r.m.s voltage evaluated as a single value for each successive half-period between zero-crossings of the source voltage.
Flicker	Impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.
Short-term flicker indicator, *P*st	The flicker severity evaluated over a short period (in minutes); *P*st = 1 is the conventional threshold of irritability.
Long-term flicker indicator, *P*lt	The flicker severity evaluated over a long period (a few hours) using successive *P*st values.

7.2 General definitions, continued

7.2.3 EN 61000-4-2 (Electrostatic discharge)

Electrostatic discharge; ESD	A transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact.
Contact discharge method	A method of testing, in which the electrode of the test generator is held in contact with the EUT, and the discharge actuated by the discharge switch within the generator.
Air discharge method	A method of testing, in which the charged electrode of the test generator is brought close to the EUT, and the discharge actuated by a spark to the EUT.
Direct application	Application of the discharge directly to the EUT.
Indirect application	Application of the discharge to a coupling plane in the vicinity of the EUT, and simulation of personnel discharge to objects, which are adjacent to the EUT.
Coupling plane	A metal sheet or plate, to which discharges are applied to simulate electrostatic discharge to objects adjacent to the EUT. HCP: Horizontal Coupling Plane; VCP: Vertical Coupling Plane.

7.2.4 EN 61000-4-6 (Immunity to conducted disturbances, induced by radio-frequency fields)

Clamp injection	Clamp injection is obtained by means of a clamp-on “current” injecting device on the cable.
Coupling/decoupling network CDN	Electrical circuit incorporating the functions of both the coupling and decoupling networks.
Sweep	Continuous or incremental traverse over a range of frequencies.

7.2.5 EN 61000-4-3: (Radiated, radio-frequency, electromagnetic field)

Continuous waves (CW)	Electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.
Electromagnetic (EM) wave	Radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields.
Field strength	The term “field strength” is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m2; any one of these may be converted into the others.
Sweep	Continuous or incremental traverse over a range of frequencies.

7.2 General definitions, continued

7.2.6 EN 61000-4-5 (Surge)

Surge	Transient wave of electrical current, voltage, or power propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease.
Ground (reference)	Part of the Earth considered as conductive, the electrical potential of which is conventionally taken as zero, being outside the zone of influence of any earthing (grounding) arrangement.

7.2.7 EN 61000-4-4 (Electrical fast transient/burst)

Burst	Sequence of a limited number of distinct pulses or an oscillation of limited duration.
Common mode (coupling)	Simultaneous coupling to all lines versus the ground reference plane.
Ground reference plane	Flat conductive surface whose potential is used as a common reference.
Coupling clamp	Device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it.
Transient	Pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the time-scale of interest.

7.2.8 EN 61000-4-11 (Voltage dips, short interruptions and voltage variations)

Voltage dip	A sudden reduction of the voltage at a particular point of an electricity supply system below a specified dip threshold followed by its recovery after a brief interval.
Short interruption	A sudden reduction of the voltage on all phases at a particular point of an electric supply system below a specified interruption threshold followed by its restoration after a brief interval.

Section 8 Testing data

8.1 Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis

8.1.1 References

EN 55032: 2015 +AC: 2016

8.1.2 Test summary

Verdict	Pass		
Test date	February 19, 2020	Temperature	22 °C
Test engineer	Enrique Hernández, EMC Test Engineer	Air pressure	1005 mbar
Test location	10m semi anechoic chamber	Relative humidity	55 %

8.1.3 Observations/special notes

AC adapter powered at 230Vac/50Hz

8.1.4 Setup details

EUT setup configuration	Table top
Test facility	10 m Semi anechoic chamber
Measuring distance	10 m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurement); Quasi-peak (final measurement)
Trace mode	Max Hold
Measurement time	100 ms (preview measurement); 1000 ms (final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview); Peak and Average (final)
Trace mode	Max Hold
Measurement time	100 ms (preview); 1000 ms (final)

8.1.4 Setup details, continued

Table 8.1-1: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rohde & Schwarz	ESU 40	E1121	2 years	5/25/2020
System Controller	Sunol Sciences	SC104V	E1191	NCR	NCR
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	1 year	4/18/2020
Antenna, DRG Horn	ETS-Lindgren	3117-PA	E1139	1 year	3/21/2020
Pre Amp as part of DRG Horn	ETS-Lindgren	3117-PA	Part of E1139	1 year	3/21/2020

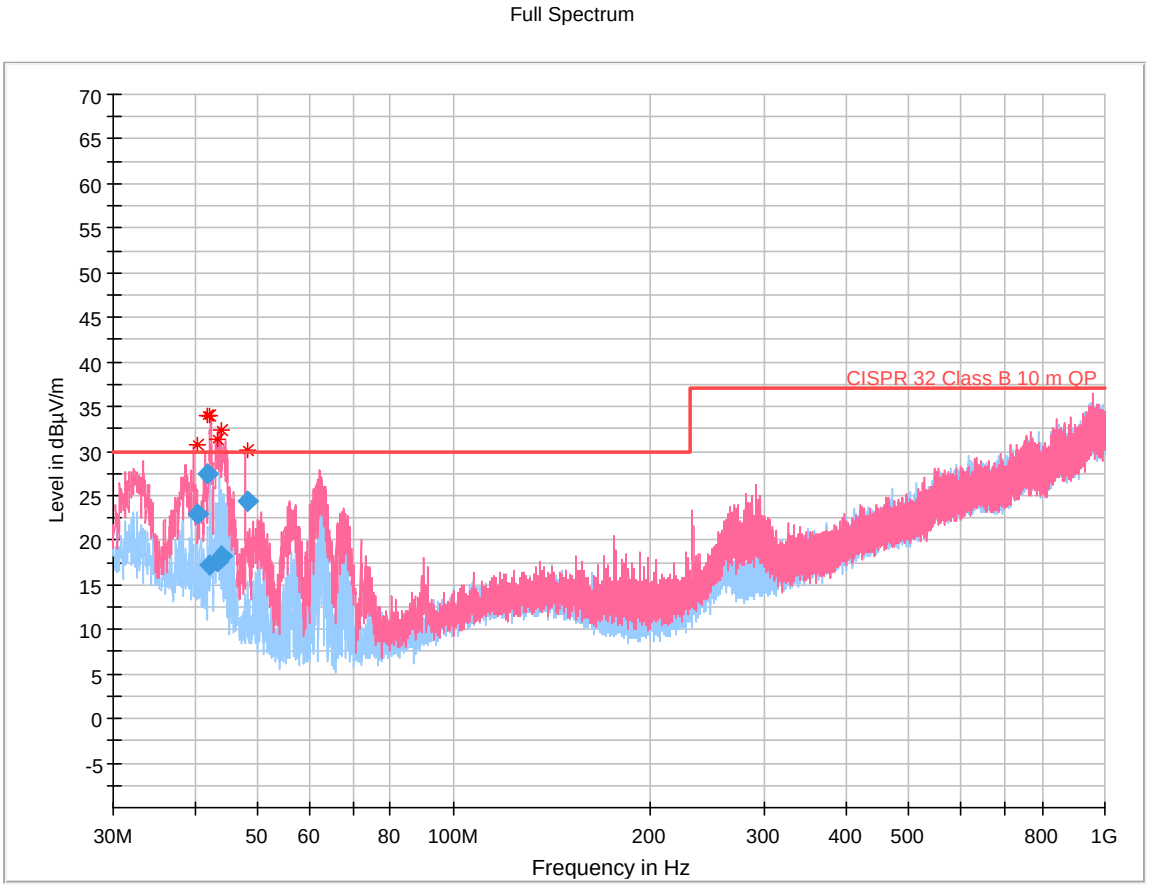
Notes: NCR - no calibration required

Table 8.1-2: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis test software details

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.0.00

Notes: None

8.1.5 Test data



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
An inverse proportionality factor of 20 dB per decade (20 log (10/3) = 10.5 dB) has been used to normalize the specification limit to a measurement distance of 3 meters

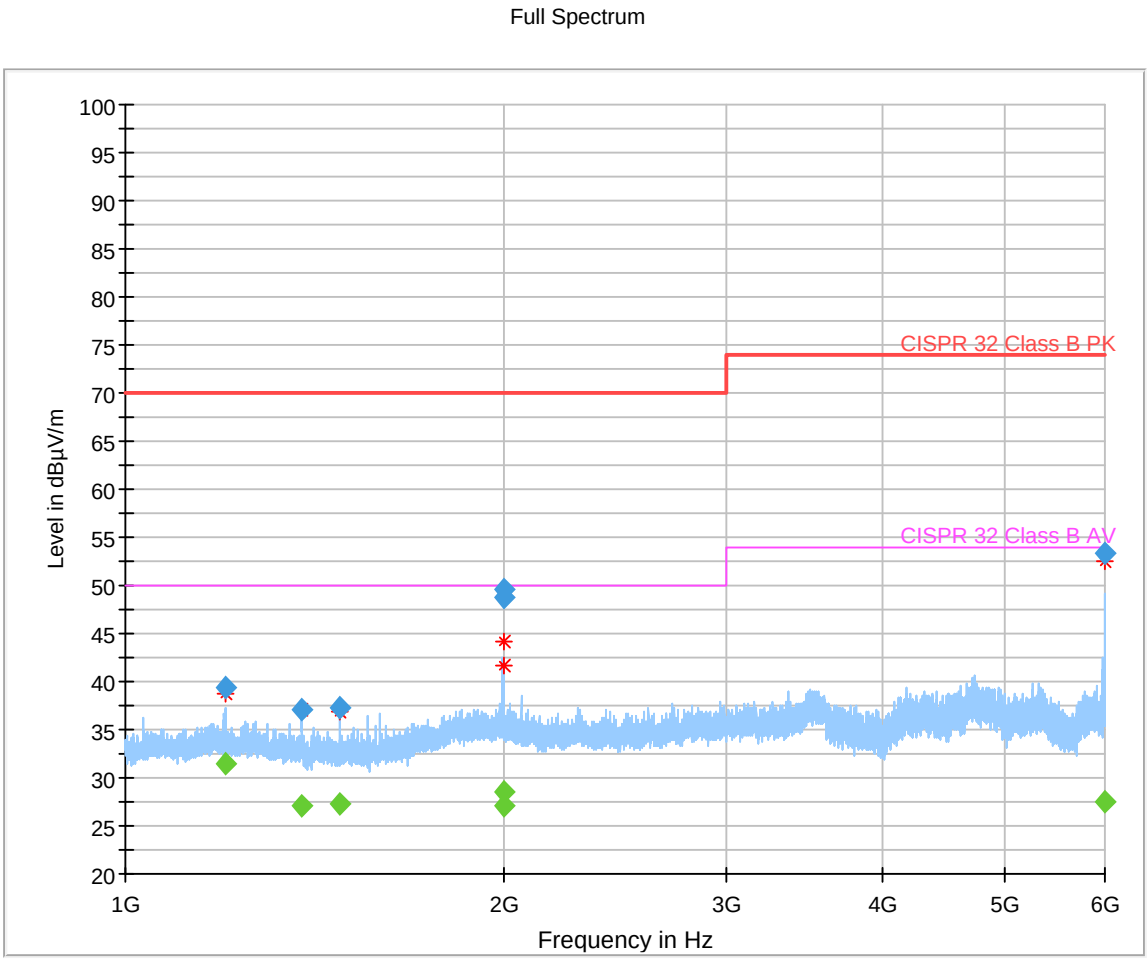
Figure 8.1-1: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis spectral plot (30 to 1000 MHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.317000	**22.97**	**30.00**	**7.03**	**5000.0**	**120.000**	**158.2**	**V**	**176.0**	**20.1**
41.839000	**27.35**	**30.00**	**2.65**	**5000.0**	**120.000**	**117.8**	**V**	**270.0**	**19.2**
42.199000	**17.27**	**30.00**	**12.73**	**5000.0**	**120.000**	**164.5**	**V**	**17.0**	**19.0**
43.222667	**17.54**	**30.00**	**12.46**	**5000.0**	**120.000**	**241.3**	**V**	**174.0**	**18.4**
43.852333	**18.19**	**30.00**	**11.81**	**5000.0**	**120.000**	**160.1**	**V**	**294.0**	**18.1**
48.057333	**24.42**	**30.00**	**5.58**	**5000.0**	**120.000**	**144.1**	**V**	**177.0**	**15.9**

Table 8.1-3: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis (Quasi-Peak) results

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] An inverse proportionality factor of 20 dB per decade (20 log (10/3) = 10.5 dB) has been used to normalize the specification limit to a measurement distance of 3 meters to determine compliance.

8.1.5 Test data



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-2: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis spectral plot (1 to 6 GHz).

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1199.800000	39.47	---	70.00	30.53	5000.0	1000.000	202.3	V	197.0	-13.8
1199.800000	---	31.38	50.00	18.62	5000.0	1000.000	202.3	V	197.0	-13.8
1379.966667	37.10	---	70.00	32.90	5000.0	1000.000	226.5	V	253.0	-14.3
1379.966667	---	27.17	50.00	22.83	5000.0	1000.000	226.5	V	253.0	-14.3
1480.200000	---	27.25	50.00	22.75	5000.0	1000.000	120.5	V	287.0	-14.4
1480.200000	37.20	---	70.00	32.81	5000.0	1000.000	120.5	V	287.0	-14.4
1995.433333	---	28.59	50.00	21.41	5000.0	1000.000	112.6	V	126.0	-10.5
1995.433333	49.48	---	70.00	20.52	5000.0	1000.000	112.6	V	126.0	-10.5
1999.733333	---	27.05	50.00	22.95	5000.0	1000.000	246.9	H	118.0	-10.5
1999.733333	48.69	---	70.00	21.31	5000.0	1000.000	246.9	H	118.0	-10.5
5990.866667	---	27.43	54.00	26.57	5000.0	1000.000	166.3	V	0.0	-1.2
5990.866667	53.31	---	74.00	20.69	5000.0	1000.000	166.3	V	0.0	-1.2

Table 8.1-4: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis (Peak and CAverage) results

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)

8.1.6 Setup photo

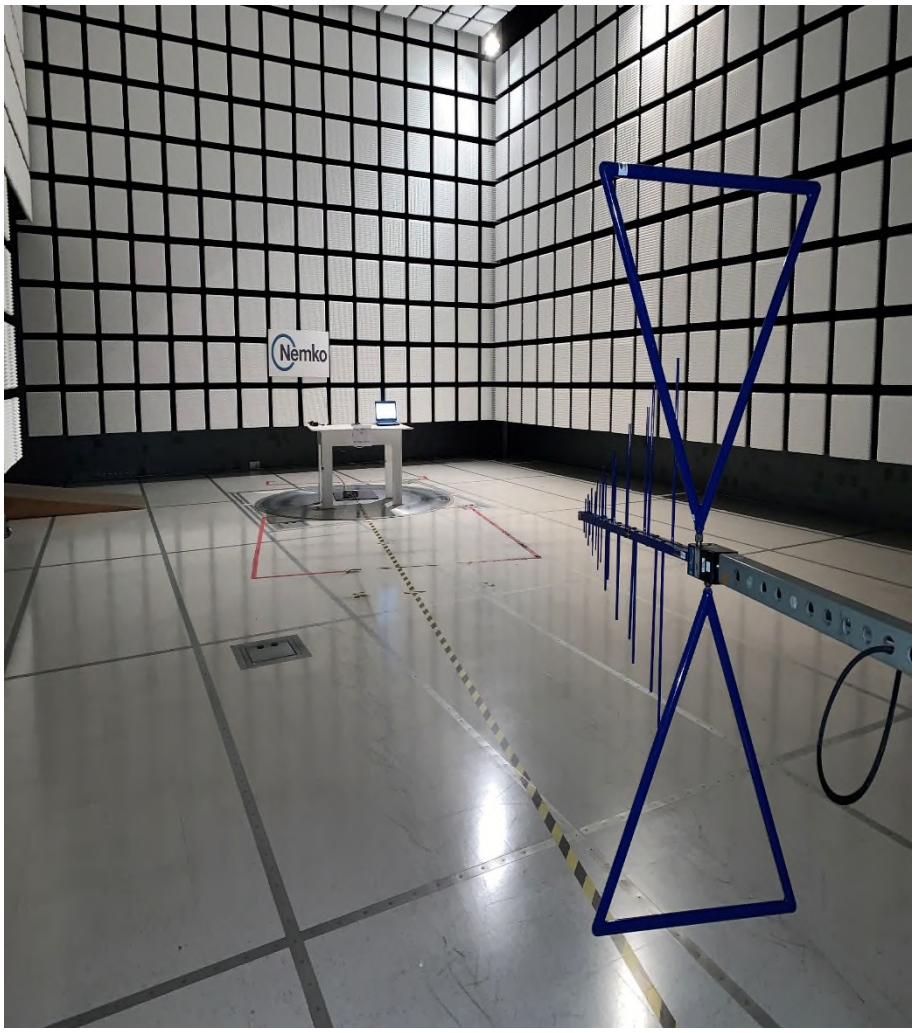


Figure 8.1-3: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis setup photo (30 to 1000 MHz)

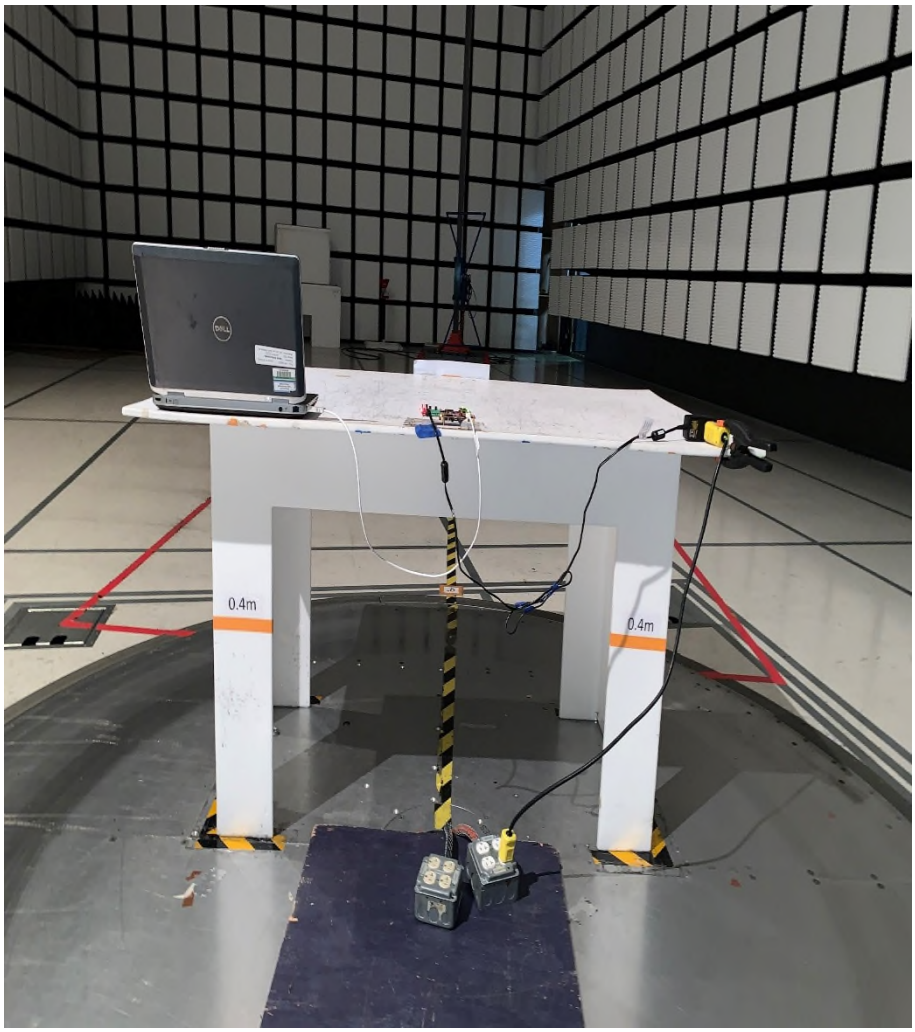


Figure 8.1-4: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis setup photo (30 to 1000 MHz)

8.1.6 Setup photo, continued

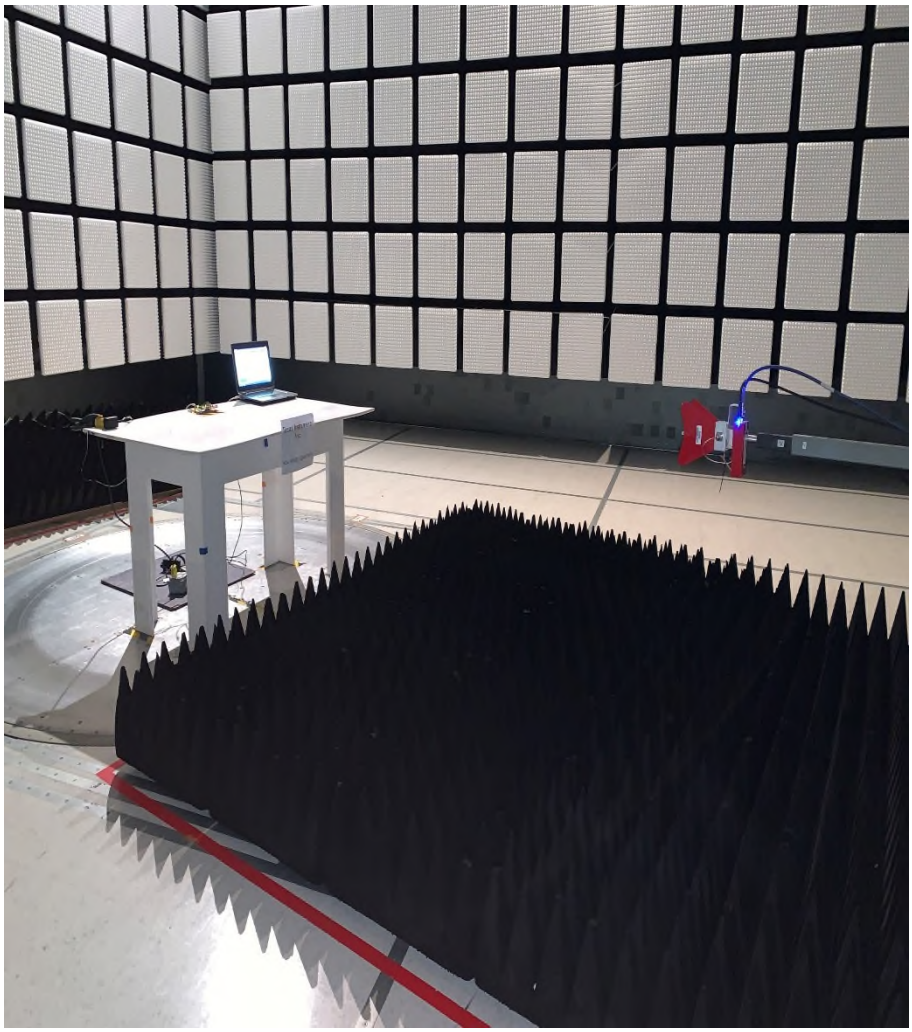


Figure 8.1-5: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis setup photo (1 to 6 GHz)

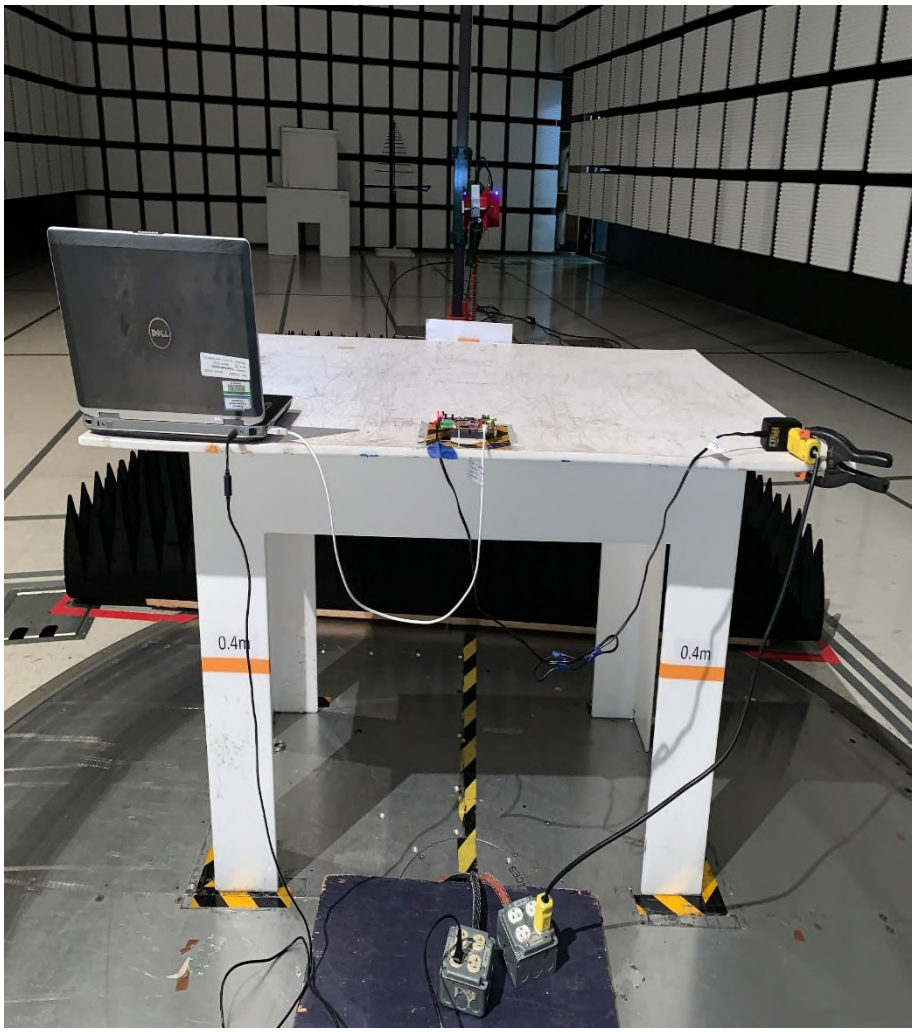


Figure 8.1-6: Clause 8.2 – Enclosure of ancillary equipment measured on a stand alone basis setup photo (1 to 6 GHz)

8.2 Clause 8.4 – AC mains power input/output ports

8.2.1 References

EN 55032: 2015

8.2.2 Test summary

Verdict	Pass		
Test date	February 18, 2020	Temperature	20 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1004 mbar
Test location	Ground Plane	Relative humidity	54 %

8.2.3 Notes

AC adapter powered at 230Vac/50Hz

8.2.4 Setup details

Port under test	AC Mains
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (preview measurement); Quasi-peak and Average (final measurement)
Trace mode	Max Hold
Measurement time	100 ms (preview measurement); 1000 ms (final measurement)

Table 8.2-1: Clause 8.4 – AC mains power input/output ports equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rohde & Schwarz	ESCI 7	E1026	2 years	5/29/2021
Transient Limiter	Hewlett Packard	11947A	684	1 year	1/20/2021
Two Line V-Network	Rohde & Schwarz	ENV216	E1019	1 year	7/12/2020
LISN	Solar Electronics	9348-50-R-24-BNC	384	1 year	8/8/2020

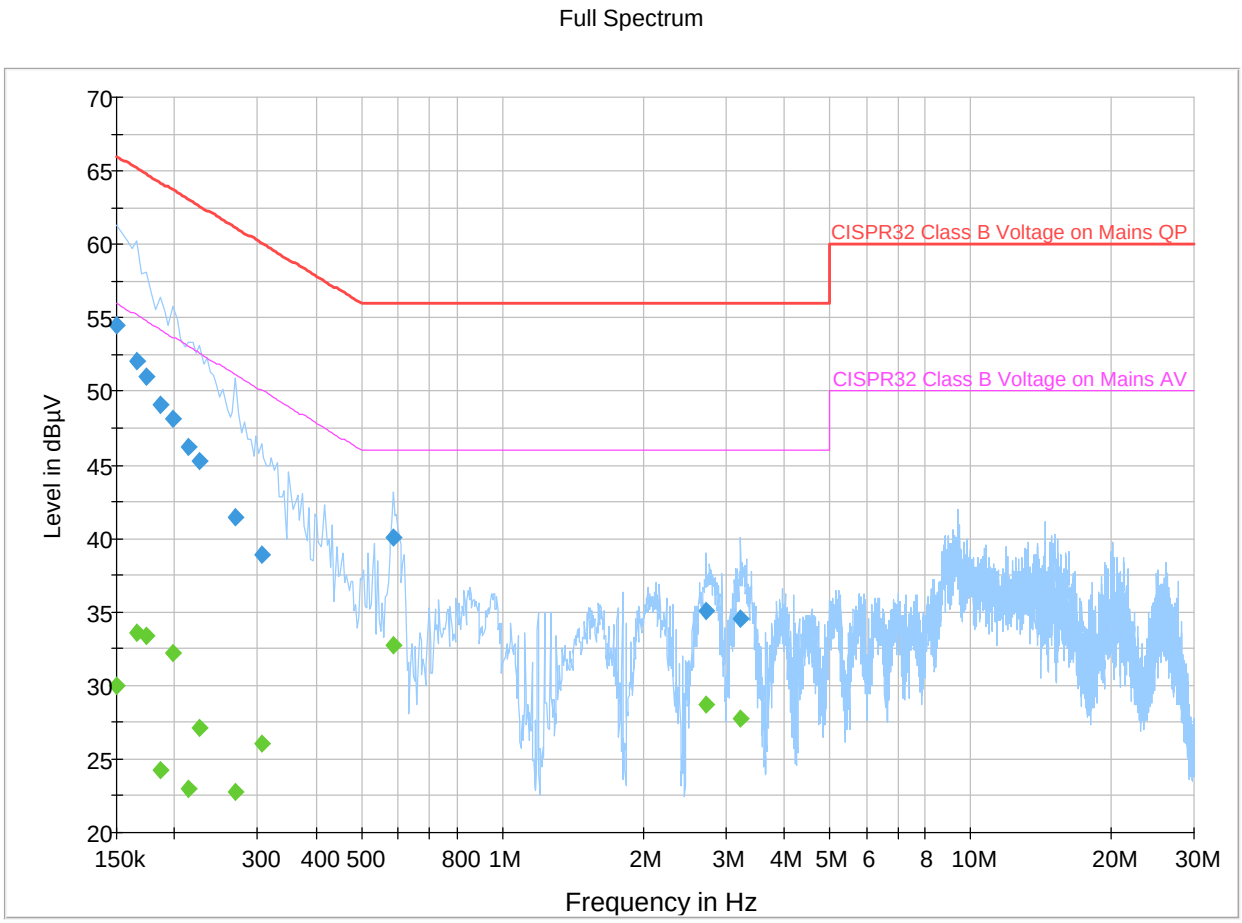
Notes: NCR - no calibration required

Table 8.2-2: Clause 8.4 – AC mains power input/output ports software details

Manufacturer of Software	Details
ETS-Lindgren	TILE! Version 6.0.4.548

Notes: None

8.2.5 Test data



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-1: Clause 8.4 – AC mains power input/output ports spectral plot on phase and neutral lines

8.2.5 Test data, continued

Table 8.2-3: Clause 8.4 – AC mains power input/output ports (Quasi-Peak and CAverage) results

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	29.94	56.00	26.06	5000.0	9.000	L1	ON	19.6
0.150000	54.55	---	66.00	11.45	5000.0	9.000	L1	ON	19.6
0.166000	---	33.60	55.16	21.55	5000.0	9.000	L1	ON	19.6
0.166000	52.09	---	65.16	13.07	5000.0	9.000	L1	ON	19.6
0.174000	---	33.41	54.77	21.36	5000.0	9.000	L1	ON	19.6
0.174000	51.02	---	64.77	13.75	5000.0	9.000	L1	ON	19.6
0.186000	---	24.26	54.21	29.96	5000.0	9.000	L1	ON	19.5
0.186000	49.10	---	64.21	15.12	5000.0	9.000	L1	ON	19.5
0.198000	---	32.25	53.69	21.44	5000.0	9.000	L1	ON	19.5
0.198000	48.11	---	63.69	15.58	5000.0	9.000	L1	ON	19.5
0.214000	---	22.98	53.05	30.07	5000.0	9.000	L1	ON	19.5
0.214000	46.25	---	63.05	16.79	5000.0	9.000	L1	ON	19.5
0.226000	45.26	---	62.60	17.33	5000.0	9.000	N	ON	19.5
0.226000	---	27.08	52.60	25.51	5000.0	9.000	N	ON	19.5
0.270000	---	22.75	51.12	28.36	5000.0	9.000	L1	ON	19.5
0.270000	41.40	---	61.12	19.72	5000.0	9.000	L1	ON	19.5
0.306000	38.91	---	60.08	21.17	5000.0	9.000	L1	ON	19.5
0.306000	---	26.07	50.08	24.01	5000.0	9.000	L1	ON	19.5
0.586000	---	32.73	46.00	13.27	5000.0	9.000	N	ON	19.4
0.586000	40.06	---	56.00	15.94	5000.0	9.000	N	ON	19.4
2.730000	---	28.67	46.00	17.33	5000.0	9.000	N	ON	19.4
2.730000	35.12	---	56.00	20.88	5000.0	9.000	N	ON	19.4
3.238000	---	27.80	46.00	18.20	5000.0	9.000	N	ON	19.3
3.238000	34.56	---	56.00	21.44	5000.0	9.000	N	ON	19.3

Notes: [1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

8.2.6 Setup photos

Figure 8.2-2: Clause 8.4 – AC mains power input/output ports setup photo

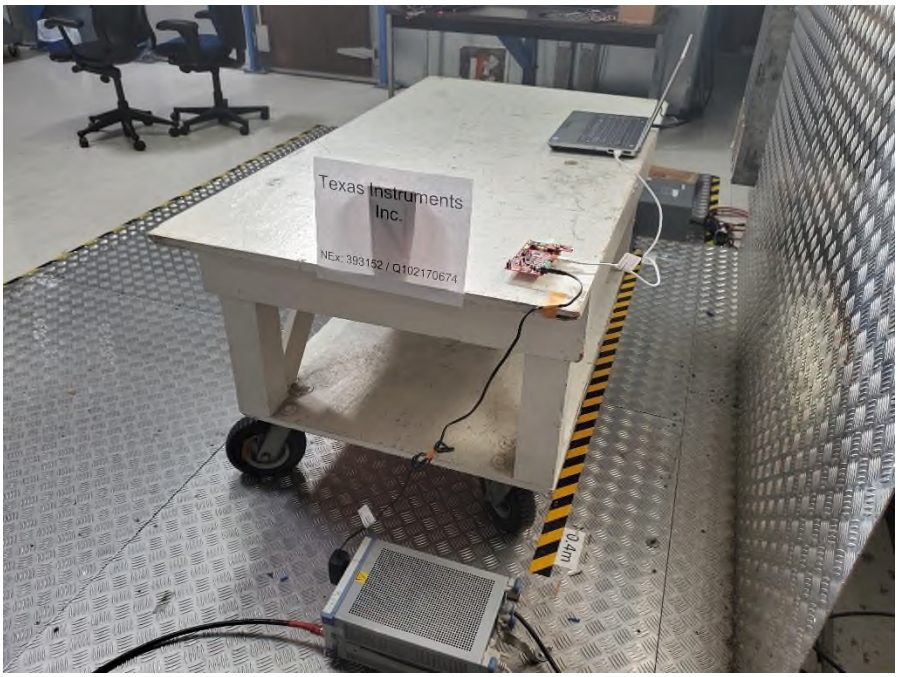


Figure 8.2-3: Clause 8.4 – AC mains power input/output ports setup photo

8.3 Clause 8.5 – Harmonic current emissions (AC mains input port)

8.3.1 References

EN 61000-3-2: 2014

8.3.2 Test summary

Verdict	Pass		
Test date	February 18, 2020	Temperature	20 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1004 mbar
Test location	Ground Plane	Relative humidity	54 %

8.3.3 Notes

AC adapter powered at 230Vac/50Hz

8.3.4 Setup details

Port under test	AC Mains
Measurement time	20 min

Table 8.3-1: Clause 8.5 – Harmonic current emissions (AC mains input port) equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
AC/DC Power Source Analyzer	Ametek	9003iX	1851	1 year	5/17/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.3-2: Clause 8.5 – Harmonic current emissions (AC mains input port) test software details

Manufacturer of Software	Details

Notes: None

8.3.5 Test data, continued

Measurement data

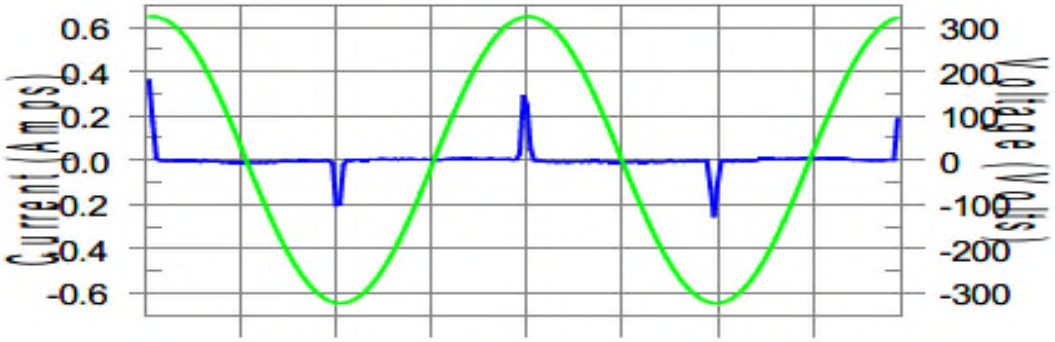
California Instruments 2/18/2020
San Diego, California 4:11 PM

Harmonics – Class-A per Ed. Ed. 5.0 (2018)(Run time)

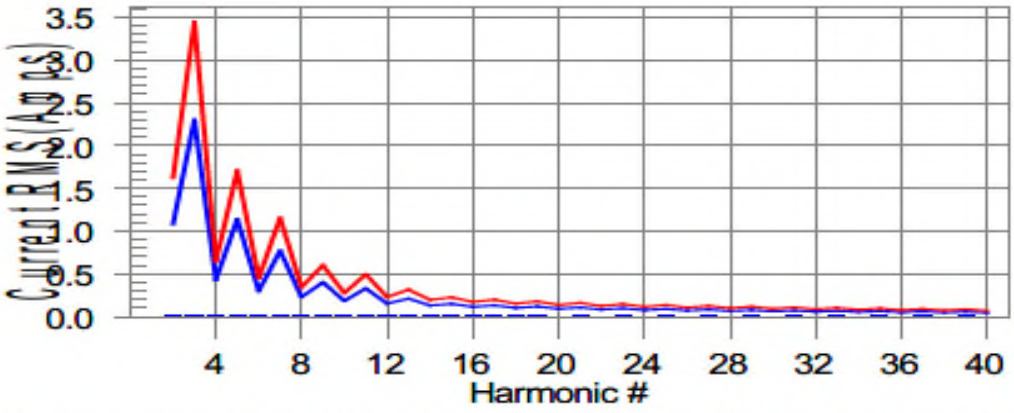
EUT: Evaluation Board - IWR6843AOPEVM **Tested by: L.Sayasane**
Test category: Class-A per Ed. 5.0 (2018) (European limits) **Test Margin: 100**
Test date: 2/18/2020 **Start time: 3:50:11 PM** **End time: 4:10:21 PM**
Test duration (min): 20 **Data file name: H-000229.cts_data**
Comment: NEx: 393152
Customer: Texas Instruments Inc.

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass **Worst harmonics H23-6.2% of 150% limit, H23-9.2% of 100% limit**

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8.3.6 Test data, continued

Measurement data, continued

California Instruments
San Diego, California

2/18/2020
4:11 PM

Current Test Result Summary (Run time)

EUT: Evaluation Board - IWR6843AOPEVM **Tested by: L.Sayasane**
Test category: Class-A per Ed. 5.0 (2018) (European limits) **Test Margin: 100**
Test date: 2/18/2020 **Start time: 3:50:11 PM** **End time: 4:10:21 PM**
Test duration (min): 20 **Data file name: H-000229.cts_data**
Comment: NEx: 393152
Customer: Texas Instruments Inc.

Test Result: Pass **Source qualification: Normal**
THC(A): 0.046 **I-THD(%): 274.0** **POHC(A): 0.021** **POHC Limit(A): 0.251**

Highest parameter values during test:

V_RMS (Volts):	229.95	Frequency(Hz):	50.00
I_Peak (Amps):	0.371	I_RMS (Amps):	0.049
I_Fund (Amps):	0.017	Crest Factor:	7.547
Power (Watts):	3.6	Power Factor:	0.318

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.002	1.080	N/A	0.003	1.620	N/A	Pass
3	0.015	2.300	0.7	0.015	3.450	0.4	Pass
4	0.002	0.430	N/A	0.003	0.645	N/A	Pass
5	0.015	1.140	1.3	0.015	1.710	0.9	Pass
6	0.002	0.300	N/A	0.003	0.450	N/A	Pass
7	0.014	0.770	1.9	0.015	1.155	1.3	Pass
8	0.002	0.230	N/A	0.003	0.345	N/A	Pass
9	0.014	0.400	3.5	0.014	0.600	2.3	Pass
10	0.002	0.184	N/A	0.003	0.276	N/A	Pass
11	0.014	0.330	4.1	0.014	0.495	2.7	Pass
12	0.002	0.153	N/A	0.003	0.230	N/A	Pass
13	0.013	0.210	6.2	0.013	0.315	4.1	Pass
14	0.002	0.131	N/A	0.003	0.197	N/A	Pass
15	0.012	0.150	8.2	0.012	0.225	5.5	Pass
16	0.002	0.115	N/A	0.003	0.173	N/A	Pass
17	0.011	0.132	8.7	0.012	0.198	5.9	Pass
18	0.002	0.102	N/A	0.002	0.153	N/A	Pass
19	0.011	0.118	9.0	0.011	0.178	6.1	Pass
20	0.002	0.092	N/A	0.002	0.138	N/A	Pass
21	0.010	0.107	9.2	0.010	0.161	6.2	Pass
22	0.002	0.084	N/A	0.002	0.125	N/A	Pass
23	0.009	0.098	9.2	0.009	0.147	6.2	Pass
24	0.002	0.077	N/A	0.002	0.115	N/A	Pass
25	0.008	0.090	9.1	0.008	0.135	6.1	Pass
26	0.002	0.071	N/A	0.002	0.107	N/A	Pass
27	0.007	0.083	8.7	0.007	0.125	6.0	Pass
28	0.002	0.066	N/A	0.002	0.099	N/A	Pass
29	0.006	0.078	8.3	0.007	0.116	5.7	Pass
30	0.002	0.061	N/A	0.002	0.092	N/A	Pass
31	0.006	0.073	7.7	0.006	0.109	5.3	Pass
32	0.001	0.058	N/A	0.002	0.086	N/A	Pass
33	0.005	0.068	N/A	0.005	0.102	N/A	Pass
34	0.001	0.054	N/A	0.002	0.081	N/A	Pass
35	0.004	0.064	N/A	0.004	0.096	N/A	Pass
36	0.001	0.051	N/A	0.002	0.077	N/A	Pass
37	0.003	0.061	N/A	0.003	0.091	N/A	Pass
38	0.001	0.048	N/A	0.001	0.073	N/A	Pass
39	0.003	0.058	N/A	0.003	0.087	N/A	Pass
40	0.001	0.046	N/A	0.001	0.069	N/A	Pass

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8.3.7 Test data, continued

Measurement data, continued

California Instruments 2/18/2020
San Diego, California 4:11 PM

Voltage Source Verification Data (Run time)

EUT: Evaluation Board - IWR6843AOPEVM **Tested by: L.Sayasane**
Test category: Class-A per Ed. 5.0 (2018) (European limits) **Test Margin: 100**
Test date: 2/18/2020 **Start time: 3:50:11 PM** **End time: 4:10:21 PM**
Test duration (min): 20 **Data file name: H-000229.cts_data**
Comment: NEx: 393152
Customer: Texas Instruments Inc.

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	229.95	Frequency(Hz):	50.00
I_Peak (Amps):	0.371	I_RMS (Amps):	0.049
I_Fund (Amps):	0.017	Crest Factor:	7.547
Power (Watts):	3.6	Power Factor:	0.318

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.026	0.460	5.67	OK
3	1.037	2.069	50.09	OK
4	0.074	0.460	15.99	OK
5	0.042	0.920	4.60	OK
6	0.058	0.460	12.54	OK
7	0.050	0.690	7.19	OK
8	0.013	0.460	2.77	OK
9	0.093	0.460	20.30	OK
10	0.003	0.460	0.68	OK
11	0.048	0.230	20.69	OK
12	0.011	0.230	4.72	OK
13	0.020	0.230	8.82	OK
14	0.003	0.230	1.42	OK
15	0.022	0.230	9.65	OK
16	0.004	0.230	1.87	OK
17	0.012	0.230	5.14	OK
18	0.014	0.230	6.13	OK
19	0.017	0.230	7.44	OK
20	0.007	0.230	2.99	OK
21	0.013	0.230	5.52	OK
22	0.004	0.230	1.84	OK
23	0.012	0.230	5.42	OK
24	0.005	0.230	2.20	OK
25	0.012	0.230	5.09	OK
26	0.004	0.230	1.64	OK
27	0.008	0.230	3.69	OK
28	0.003	0.230	1.14	OK
29	0.009	0.230	3.94	OK
30	0.009	0.230	4.01	OK
31	0.011	0.230	4.61	OK
32	0.003	0.230	1.09	OK
33	0.009	0.230	3.95	OK
34	0.004	0.230	1.93	OK
35	0.007	0.230	3.22	OK
36	0.004	0.230	1.56	OK
37	0.011	0.230	4.73	OK
38	0.003	0.230	1.35	OK
39	0.007	0.230	3.18	OK
40	0.005	0.230	2.04	OK

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8.3.8 Setup photos

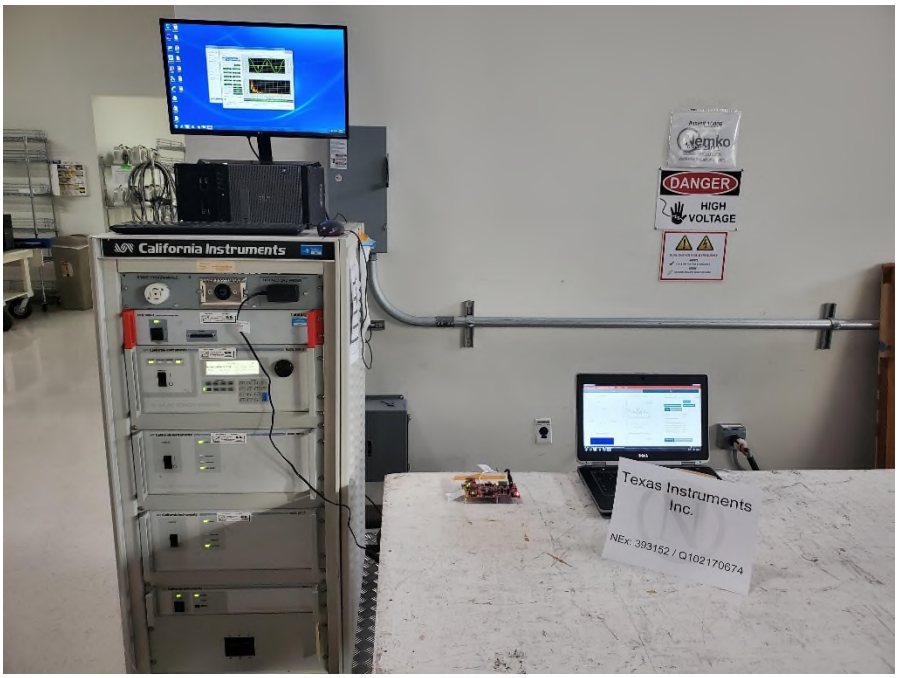

Figure 8.3-1: Clause 8.5 – Harmonic current emissions (AC mains input port) setup photo

8.4 Clause 8.6 – Voltage fluctuations and flicker (AC mains input port)

8.4.1 References

EN 61000-3-3: 2013

8.4.2 Test summary

Verdict	Pass		
Test date	February 18, 2020	Temperature	20 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1004 mbar
Test location	Ground Plane	Relative humidity	54 %

8.4.3 Notes

Tested on AC Mains 230VAC/50Hz

8.4.4 Setup details

Port under test	AC Mains
Measurement time	20 min

Table 8.4-1: Clause 8.6 – Voltage fluctuations and flicker (AC mains input port) equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
AC/DC Power Source Analyzer	Ametek	9003iX	1851	1 year	5/17/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.4-2: Clause 8.6 – Voltage fluctuations and flicker (AC mains input port) test software details

Manufacturer of Software	Details

Notes: None

8.4.5 Test data, continued

Measurement data

California Instruments 2/18/2020
San Diego, California 4:35 PM

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

EUT: Evaluation Board - IWR6843AOPEVM Tested by: L.Sayasane
Test category: All parameters (European limits) Test Margin: 100
Test date: 2/18/2020 Start time: 4:12:46 PM End time: 4:33:19 PM
Test duration (min): 20 Data file name: F-000230.cts_data
Comment: NEx: 393152
Customer: Texas Instruments Inc.

Test Result: Pass Status: Test Completed

Pst_t and limit line European Limits

Plt and limit line

Parameter values recorded during the test:

Vrms at the end of test (Volt):	229.87			
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.00	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.064	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.035	Test limit:	0.650	Pass

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8.4.6 Setup photos

Figure 8.4-1: Clause 8.6 – Voltage fluctuations and flicker (AC mains input port) setup photo

8.5 Clause 9.2 – Radio frequency electromagnetic field (0.08 to 6 GHz)

8.5.1 References

EN 61000-4-3: 2006 + A1: 2008 + A2: 2010

8.5.2 Test summary

Verdict	Pass		
Test date	February 19, 2020	Temperature	22 °C
Test engineer	Enrique Hernández, EMC Test Engineer	Air pressure	1005 mbar
Test location	RFI Chamber	Relative humidity	55 %

8.5.3 Notes

Tested on AC Mains 230VAC/50Hz

8.5.4 Setup details

Table 8.5-1: Clause 9.2 – Radio frequency electromagnetic field (0.08 to 6 GHz) equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal Generator	Agilent	E8254A	836	1 year	10/15/2020
Antenna, High Gain, Log Periodic	Amplifier Research	ATR80M6G	E1227	NCR	NCR
RF Amplifier	Amplifier Research	500W1000M5	740	NCR	NCR
RF Amplifier	Amplifier Research	6051G6	E1176	NCR	NCR
Field Monitor	ETS-Lindgren	HI-6100	1724	NCR	NCR
Field Probe	ETS-Lindgren	HI-6005	1793	1 year	3/28/2020

Notes: NCR - no calibration required

Table 8.5-2: Clause 9.2 – Radio frequency electromagnetic field (0.08 to 6 GHz) test software details

Manufacturer of Software	Details
ETS-Lindgren	TILE! Version 6.0.4.548

Notes: None

8.5.5 Test data

Table 8.5-3: Clause 9.2 – Radio frequency electromagnetic field (0.08 to 6 GHz) results

Step size increment	1 %
Dwell time[1]	3 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT position facing antenna	Front side, back side, left side and right side

Frequency range, MHz[2]		Test level, V/m	Comments
80	6000	3	No degradation

Notes:
1The dwell time at each frequency was not less than the time necessary for the EUT to be exercised and to be able to respond. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.
2The exclusion band for immunity testing shall be calculated as follows:
- Lower limit of exclusion band = lowest allocated band edge frequency -5 %;
- Upper limit of exclusion band = highest allocated band edge frequency +5 %.

8.5.6 Setup photo

Figure 8.5-1: Clause 9.2 – Radio frequency electromagnetic field (0.08 to 6 GHz) setup photo

8.6 Clause 9.3 – Electrostatic discharge

8.6.1 References

EN 61000-4-2: 2009

8.6.2 Test summary

Verdict	Pass		
Test date	February 20, 2020	Temperature	20 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1008 mbar
Test location	ESD Room	Relative humidity	54 %

8.6.3 Notes

Tested on AC Mains 230VAC/50Hz

8.6.4 Setup details

Table 8.6-1: Clause 9.3 – Electrostatic discharge equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
ESD Test Equipment	HV Technologies, Inc.	ESD3000/ESD300RM32/E	E1303	1 year	12/4/2020

Notes: NCR - no calibration required

8.6.5 Test data

Table 8.6-2: Clause 9.3 – Electrostatic discharge results

EUT setup configuration:	Table top	
ESD repetition rate:	1 pulse per second	
Discharges:	10 contact discharges and 10 air discharges at each polarity	
Contact discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	N/A	Not Applicable
Indirect discharge	**Test voltage (±kV)**	**Comments**
HCP (all sides)	2, 4	No degradation
VCP (all sides)	2, 4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: None

8.6.6 Test data, continued

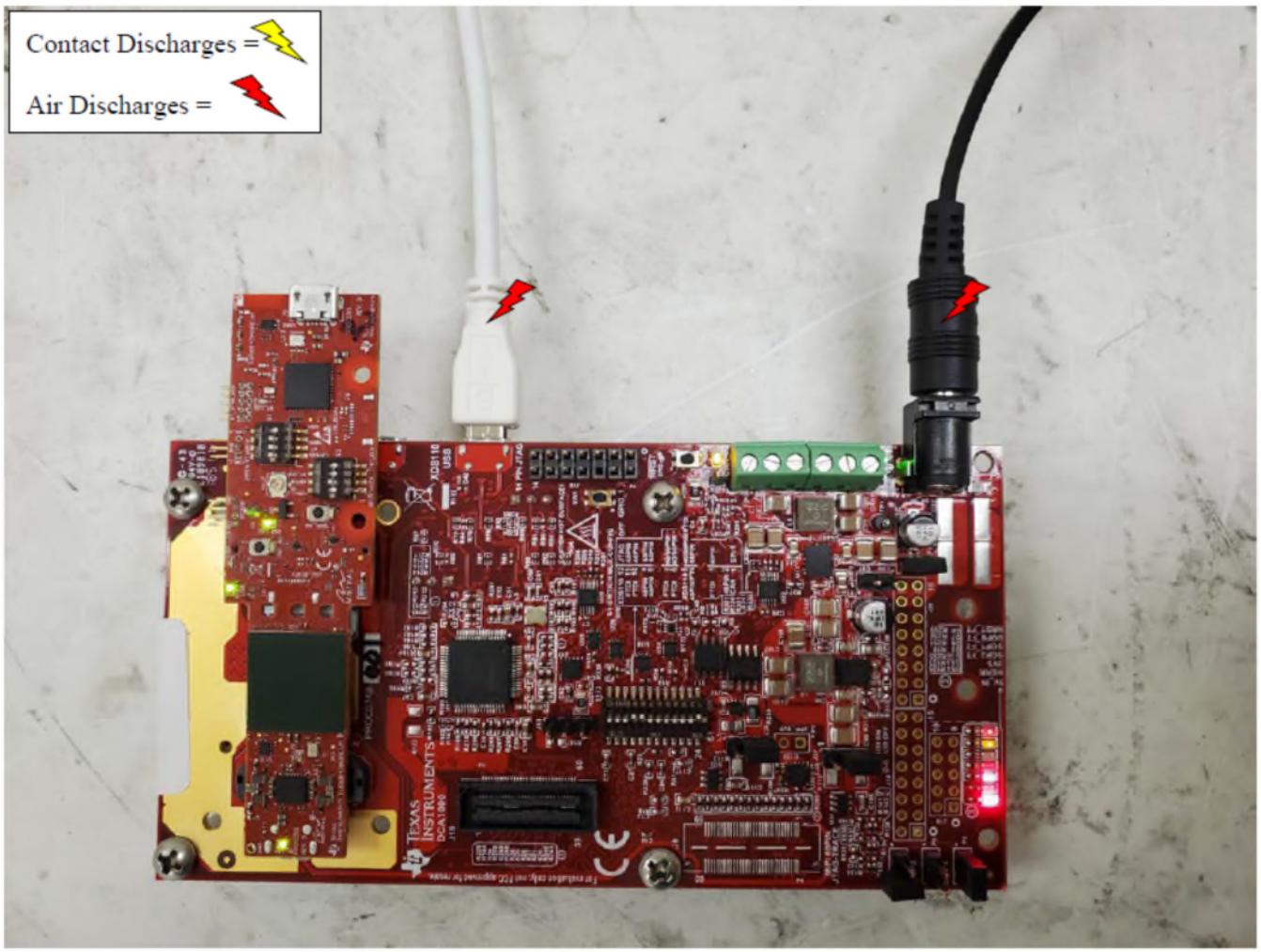

Figure 8.6-1: Clause 9.3 – Electrostatic discharge location point's photo

Red points = contact discharge
Green points = air discharge

8.6.7 Setup photo

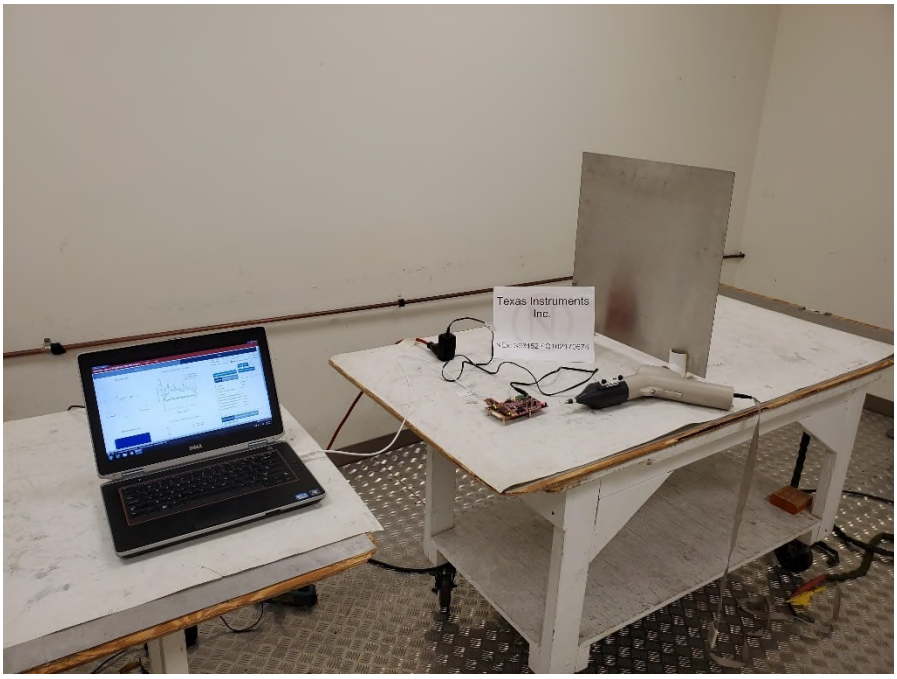

Figure 8.6-2: Clause 9.3 – Electrostatic discharge setup photo

8.7 Clause 9.4 – Fast transients, common mode

8.7.1 References

EN 61000-4-4: 2004 + A1: 2010

8.7.2 Test summary

Verdict	Pass		
Test date	February 19, 2020	Temperature	21 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1007 mbar
Test location	Ground Plane	Relative humidity	52 %

8.7.3 Notes

AC adapter powered at 230Vac/50Hz

8.7.4 Setup details

Table 8.7-1: Clause 9.4 – Fast transients, common mode equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Main Frame	Teseq-AG	NSG 3060	E1124	1 year	8/22/2020
CDN	Teseq-AG	CDN 3061	E1125	1 year	8/22/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.7-2: Clause 9.4 – Fast transients, common mode test software details

Manufacturer of Software	Details
TESEQ	Advanced Test Solution for EMC, Version 1.3.2

Notes: None

8.7.5 Test data

Table 8.7-3: Clause 9.4 – Fast transients, common mode results

Wave shape (Tr / Td):	5/50 ns (Tr = rise time, Td= duration time)
Repetition frequency:	5 kHz
Burst duration:	15 ms
Burst period:	300 ms
Test duration:	60 s

Port	Test voltage (±kV)	Comments
AC input[1]	1.0	See NOTE 6
DC input[2 and 4]	N/A	Not Applicable
XDS110_USB port[3 and 5]	N/A	Not Applicable
FTDI_USB port[3 and 5]	N/A	Not Applicable

Notes:
[1]Transient applied asynchronous (relation to power supply)
[2]The test voltage was applied simultaneously between a ground reference plane and all of the power supply terminals and the protective or functional earth port on the EUT cabinet
[3]The test voltage was applied via capacitive coupling clamp
[4] Applicable to DC ports of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m.
[5] Applicable to signal, telecommunication and control ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m
[6] During test, the data images on monitoring PC freeze. After test, the operator needs to reboot the card and reload program to bring the card to prior test condition (active images). According to Texas Instruments Incorporated clarification, "The board is an evaluation platform meant for evaluating the features and capability of the IWR6843AOPEVM and on-board antenna. Therefore, having to reset the board to recover to full functionality after an incidence of fast transient is acceptable."

8.7.6 Setup photos

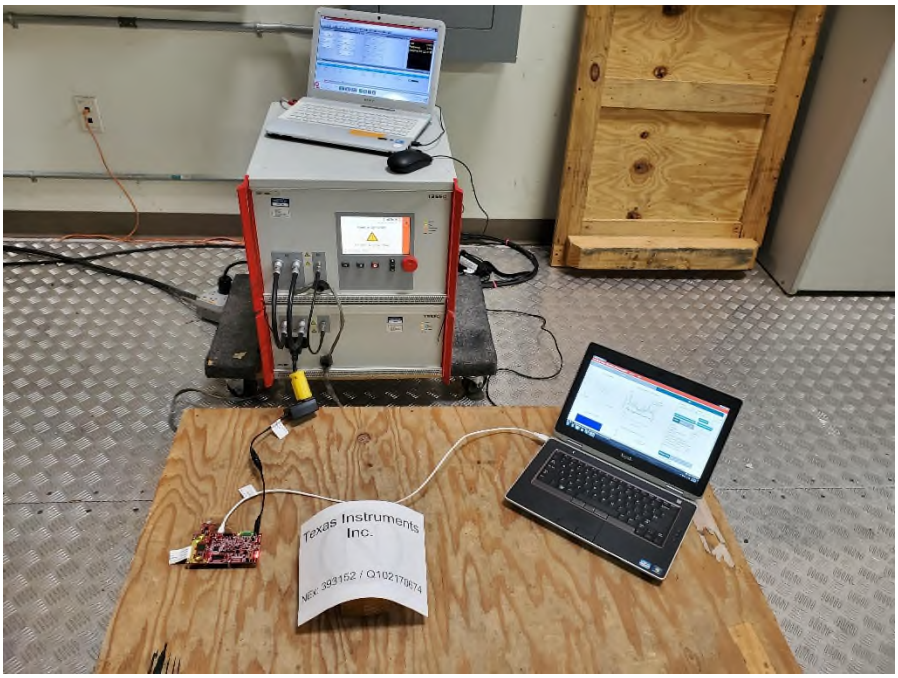

Figure 8.7-1: Clause 9.4 – Fast transients, common mode setup photo

8.8 Clause 9.5 – Radio frequency, common mode

8.8.1 References

EN 61000-4-6: 2009

8.8.2 Test summary

Verdict	Pass		
Test date	February 19, 2020	Temperature	21 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1007 mbar
Test location	Ground Plane	Relative humidity	52 %

8.8.3 Notes

Tested on AC Mains 230VAC/50Hz

8.8.4 Setup details

Table 8.8-1: Clause 9.5 – Radio frequency, common mode equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal Generator	Hewlett Packard	8656B	1182	1 year	4/2/2020
RF Amplifier	Ophir	GRF5048	E1255	NCR	NCR
Attenuator, 6dB	Centric RF	C4N1009-6	E1233	NCR	NCR
CDN	FCC	FCC-801-M3-16	E1241	1 year	7/17/2020
CDN	FCC	FCC-801-T2	E1243	1 year	8/9/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.8-2: Clause 9.5 – Radio frequency, common mode test software details

Manufacturer of Software	Details
ETS-Lindgren	TILE! Version 6.0.4.548

Notes: None

8.8.5 Test data

Table 8.8-3: Clause 9.5 – Radio frequency, common mode results

Frequency range:	0.15–80 MHz
Step size increment:	1 %
Dwell time[1]:	3 s
Signal level:	3 V_{RMS}
Modulation:	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave

Ports investigated	Coupling method	50 Ω termination point	Comments
AC Mains[1]	CDN	Auxiliary CDN	No degradation
DC input[2 and 4]	N/A	N/A	Not Applicable
XDS110_USB port[3 and 5]	N/A	N/A	Not Applicable
FTDI_USB port[3 and 5]	N/A	N/A	Not Applicable

Notes:
[1]The dwell time at each frequency was not less than the time necessary for the EUT to be exercised and to be able to respond. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.
[2]The test voltage was applied simultaneously between a ground reference plane and all of the power supply terminals and the protective or functional earth port on the EUT cabinet
[3]The test voltage was applied via capacitive coupling clamp
[4] Applicable to DC ports of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m.
[5] Applicable to signal, telecommunication and control ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m

8.8.6 Setup photo

Figure 8.8-1: Clause 9.5 – Radio frequency, common mode setup photo

8.9 Clause 9.7 – Voltage dips and interruptions

8.9.1 References

EN 61000-4-11: 2004

8.9.2 Test summary

Verdict	Pass		
Test date	February 18, 2020	Temperature	21 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1005 mbar
Test location	Ground Plane	Relative humidity	54 %

8.9.3 Notes

Tested on AC Mains 230VAC/50Hz

8.9.4 Setup details

Table 8.9-1: Clause 9.7 – Voltage dips and interruptions equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
AC/DC Power Source Analyzer	Ametek	9003iX	1851	1 year	5/17/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.9-2: Clause 9.7 – Voltage dips and interruptions test software details

Manufacturer of Software	Details
California Instruments	AC Source CIGui SII Version 3.0.0

Notes: None

8.9.5 Test data

Table 8.9-3: Clause 9.7 – Voltage dips results

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Port	**Voltage reduction (%)**	**Periods**	**Comments**
AC Mains	100	0.5	No degradation
	100	1	No degradation
	30	25	No degradation

Notes: Changes occurred at the 0 crossings of the voltage waveform

Table 8.9-4: Clause 9.7 – Voltage interruptions results

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Port	**Voltage reduction (%)**	**Periods**	**Comments**
AC Mains	100	250	EUT power cycled. EUT functionality was recover with user intervention. EUT complies per performance criteria (EN 301 489-1, clause 6.2).

Notes: Changes occurred at the 0 crossings of the voltage waveform

8.9.6 Setup photo

Figure 8.9-1: Clause 9.7 – Voltage dips and interruptions setup photo

8.10 Clause 9.8 – Surges

8.10.1 References

EN 61000-4-5: 2006

8.10.2 Test summary

Verdict	Pass		
Test date	February 19, 2020	Temperature	20 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1008 mbar
Test location	Ground Plane	Relative humidity	54 %

8.10.3 Notes

Tested on AC Mains 230VAC/50Hz

8.10.4 Setup details

Table 8.10-1: Clause 9.8 – Surges equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Main Frame	Teseq-AG	NSG 3060	E1124	1 year	8/22/2020
CDN	Teseq-AG	CDN 3061	E1125	1 year	8/22/2020
Multimeter	Fluke	111	809	1 year	9/17/2020

Notes: NCR - no calibration required

Table 8.10-2: Clause 9.8 – Surges test software details

Manufacturer of Software	Details
TESEQ	Advanced Test Solution for EMC, Version 1.3.2

Notes: None

8.10.5 Test data

Table 8.10-3: Clause 9.8 – Surges at input AC power ports results

Open circuit voltage (T_1 / T_2):	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2):	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval:	30 s
Number of pulses:	5 positive and 5 negative

Test port	Coupling	Test voltage (±kV)	Comments
Enter port	Phase to Neutral	0.5, 1	During each strike, support laptop display for "3D Scatter Plot" and "Range Profile" pauses. EUT continue to operate as intended. EUT complies per performance criteria (EN 301 489-1, clause 6.2).
	Phase to ground	N/A	Not Applicable
	Neutral to ground	N/A	Not Applicable

Notes:
- **Phase to neutral coupling :** Surge applied with generator output impedance set to 2 Ω
- **Phase/neutral to ground coupling :** Surge applied with generator output impedance set to 12 Ω
- Surge applied synchronous (relation to power supply): 0, 90, 180, and 270°

Table 8.10-4: Clause 9.8 – Surges at telecommunication ports results

Open circuit voltage (T_1 / T_2):	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2):	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval:	30 s
Number of pulses:	5 positive and 5 negative

I/O signal/control (including functional earth lines)	Coupling	Test voltage (±kV)	Comments
Not Applicable	Line to ground	N/A	Not Applicable

Notes: Surge applied with generator output impedance set to 42 Ω
Shielded Lines: Surge applied with generator output impedance set to 2 Ω

- The test level for telecommunications ports, intended to be directly connected to the telecommunications network via outdoor cables, shall be 1 kV line to ground as given in EN 61000-4-5 [5], however, in telecommunications centres 0,5 kV line to ground shall be used.
- The test level for telecommunication ports, intended to be connected to indoor cables (longer than 10 m) shall be 0,5 kV line to ground.

8.10.6 Setup photo

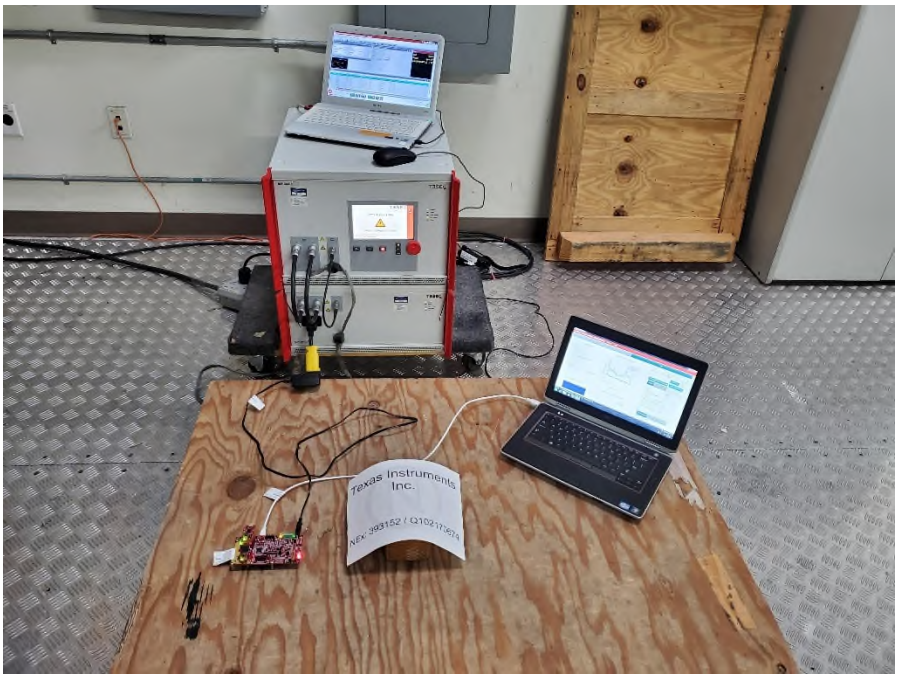

Figure 8.10-1: Clause 9.8 – Surges setup photo

Section 9 EUT photos

9.1 External photos

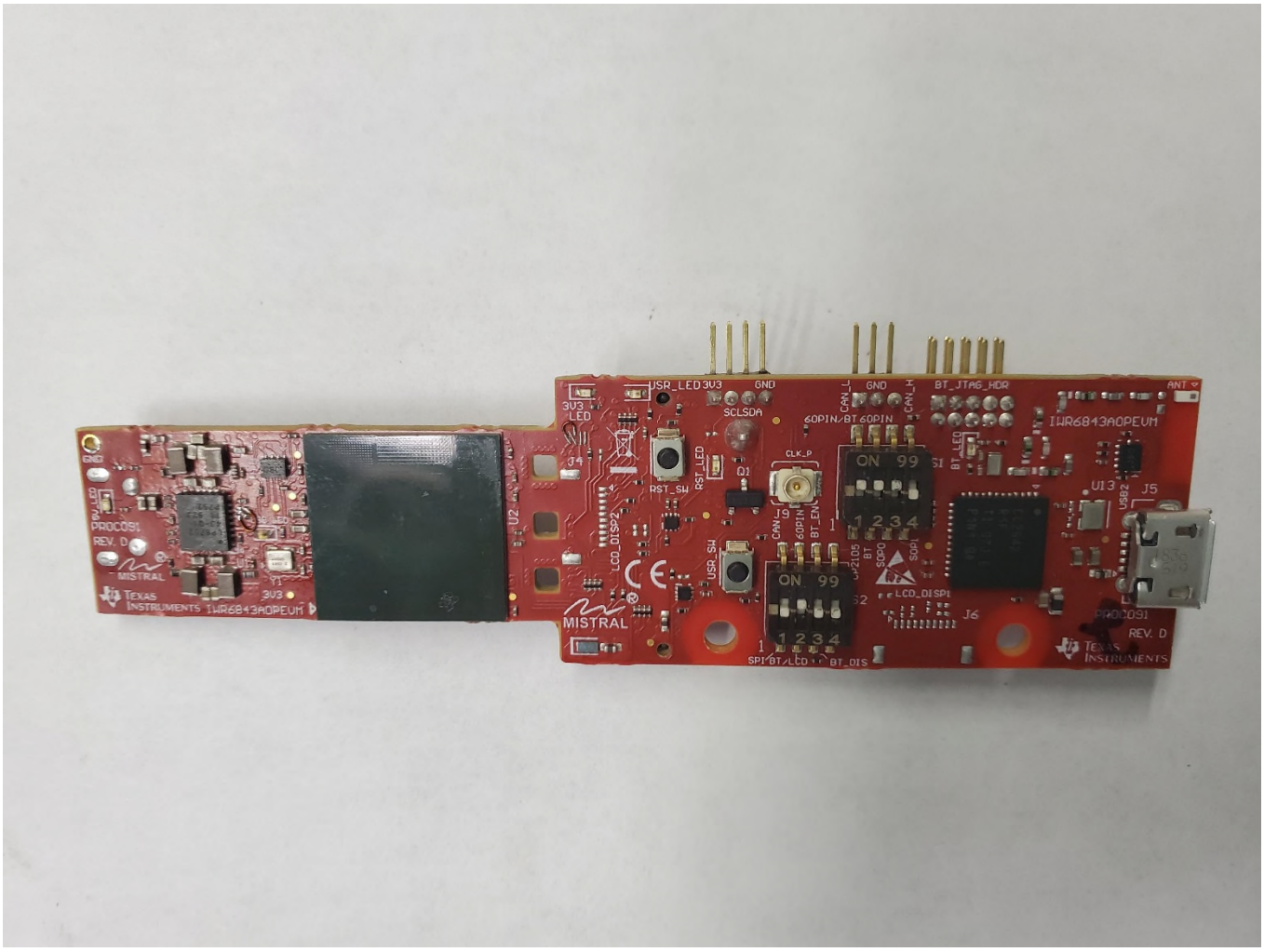

Figure 9.1-1: EUT Board Top view photo

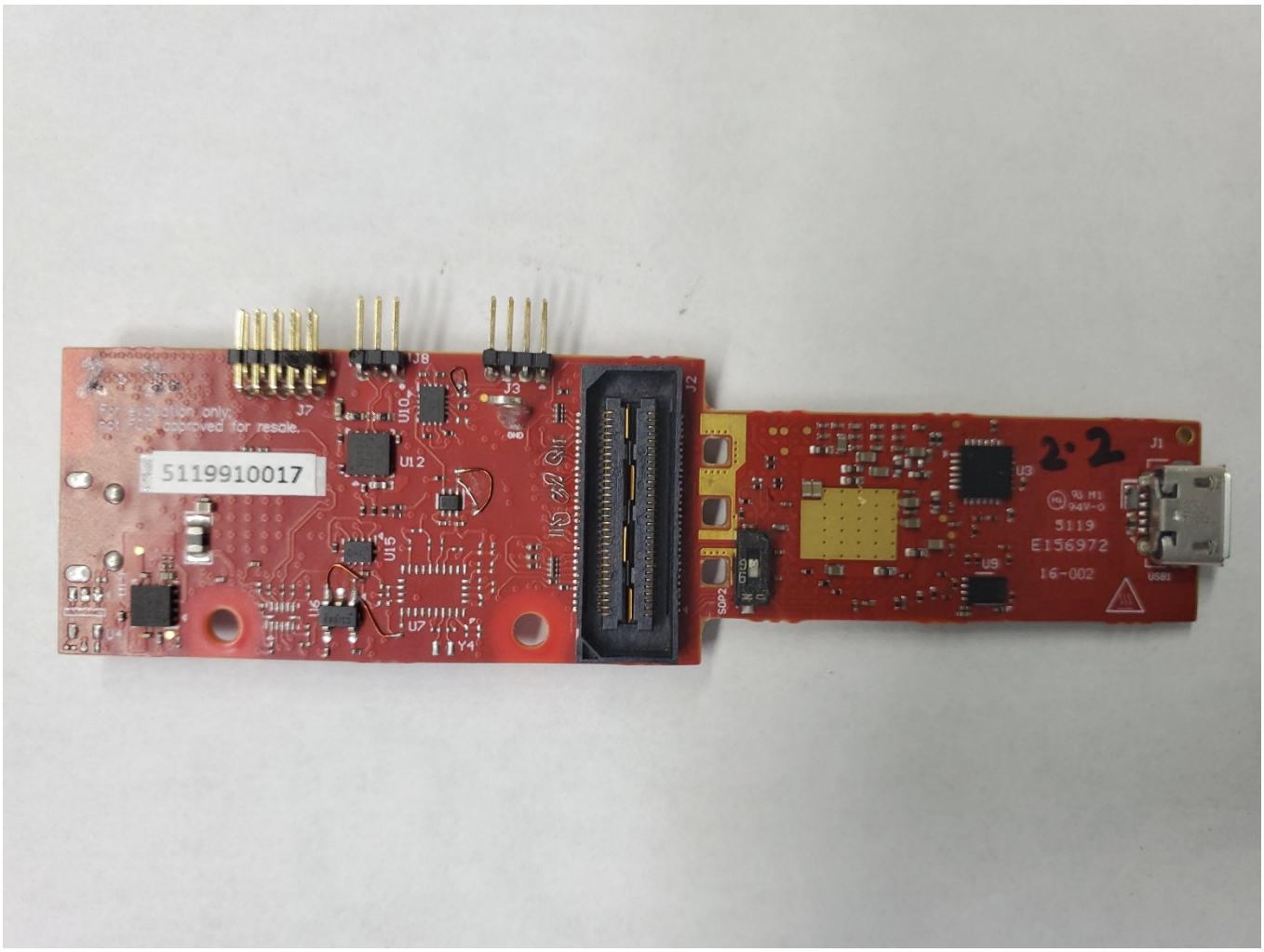

Figure 9.1-2: EUT Board Bottom view photo

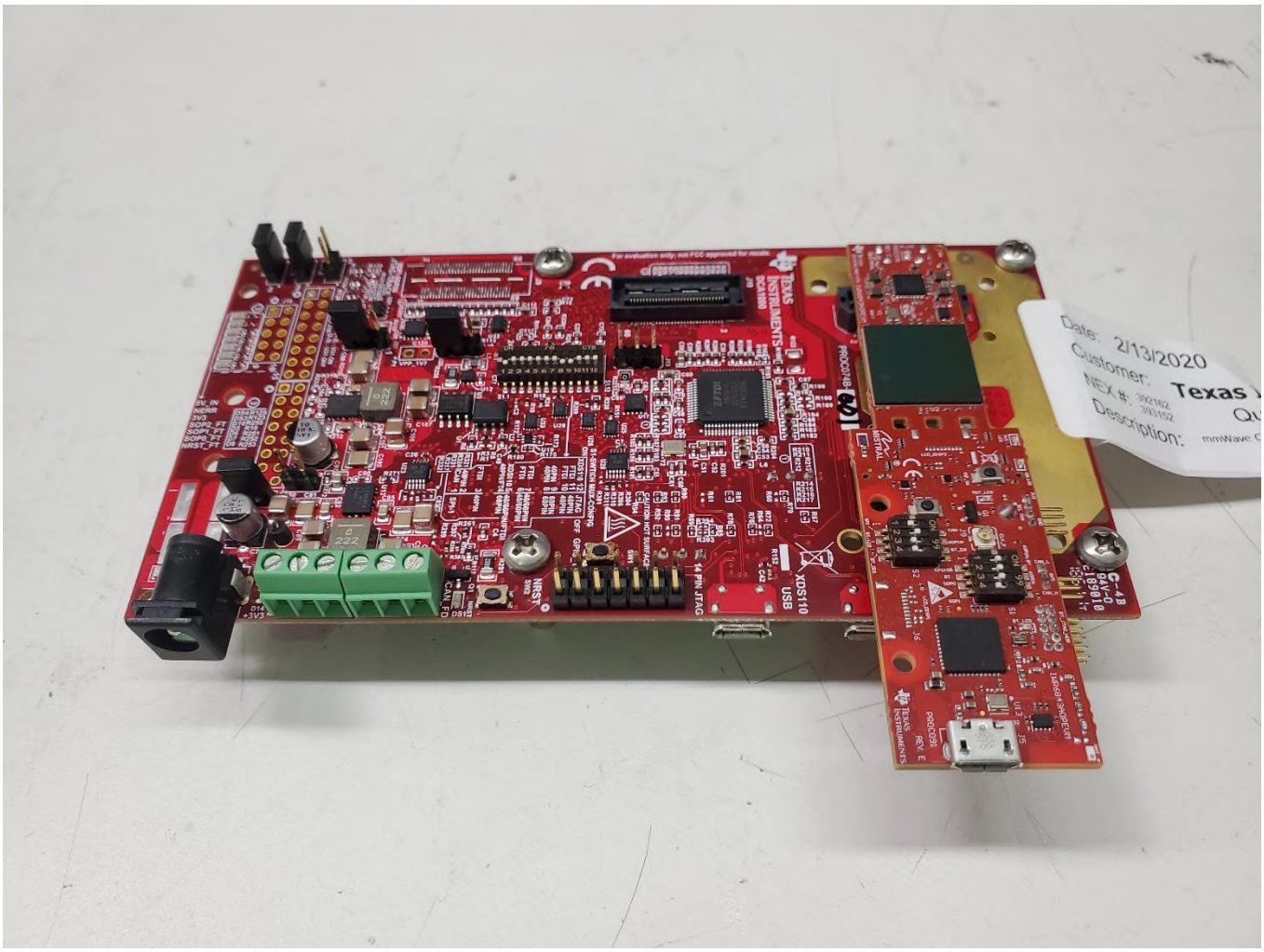

Figure 9.1-3: EUT Configuration Top view photo

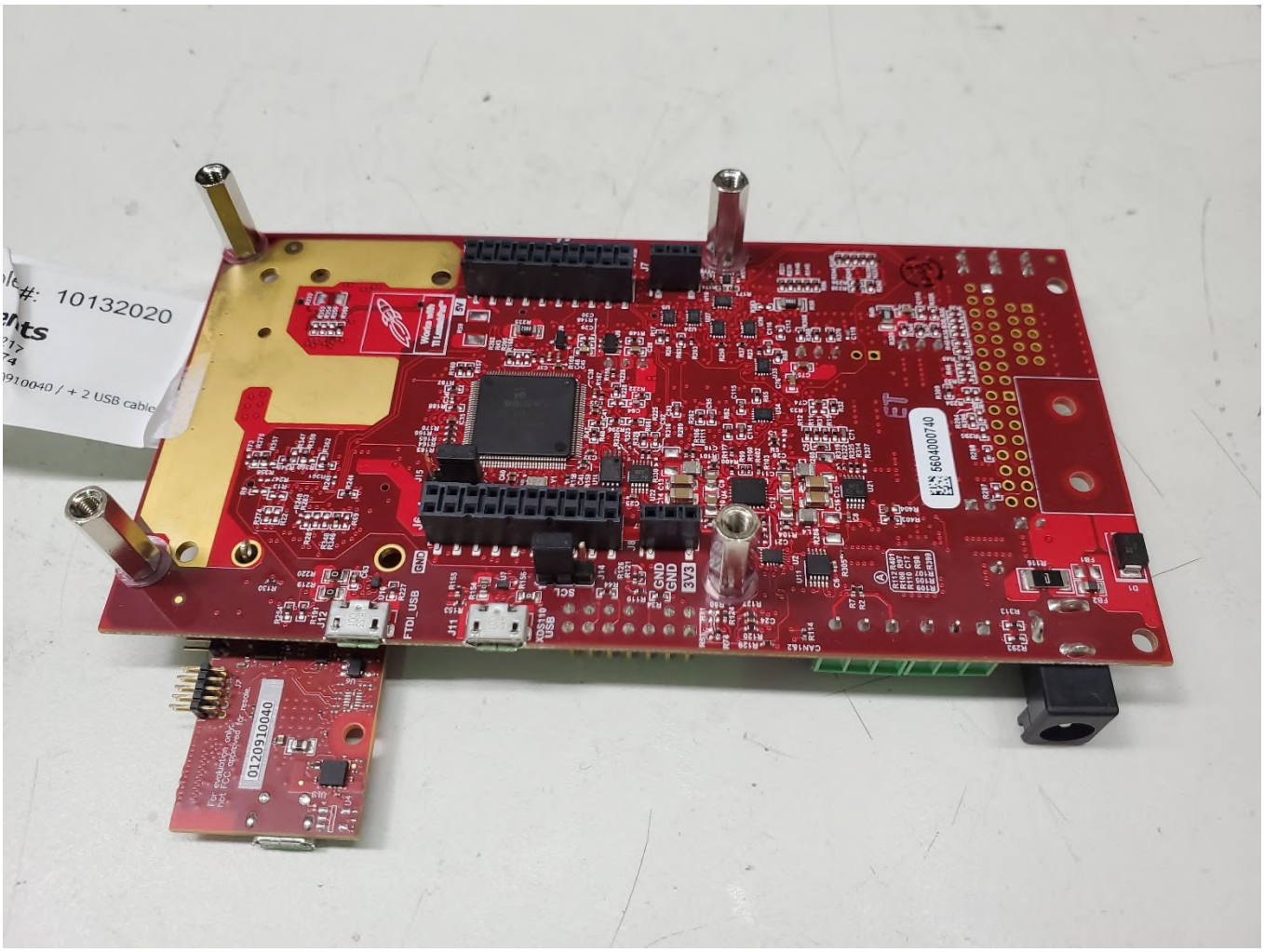

Figure 9.1-4: EUT Configuration Bottom view photo

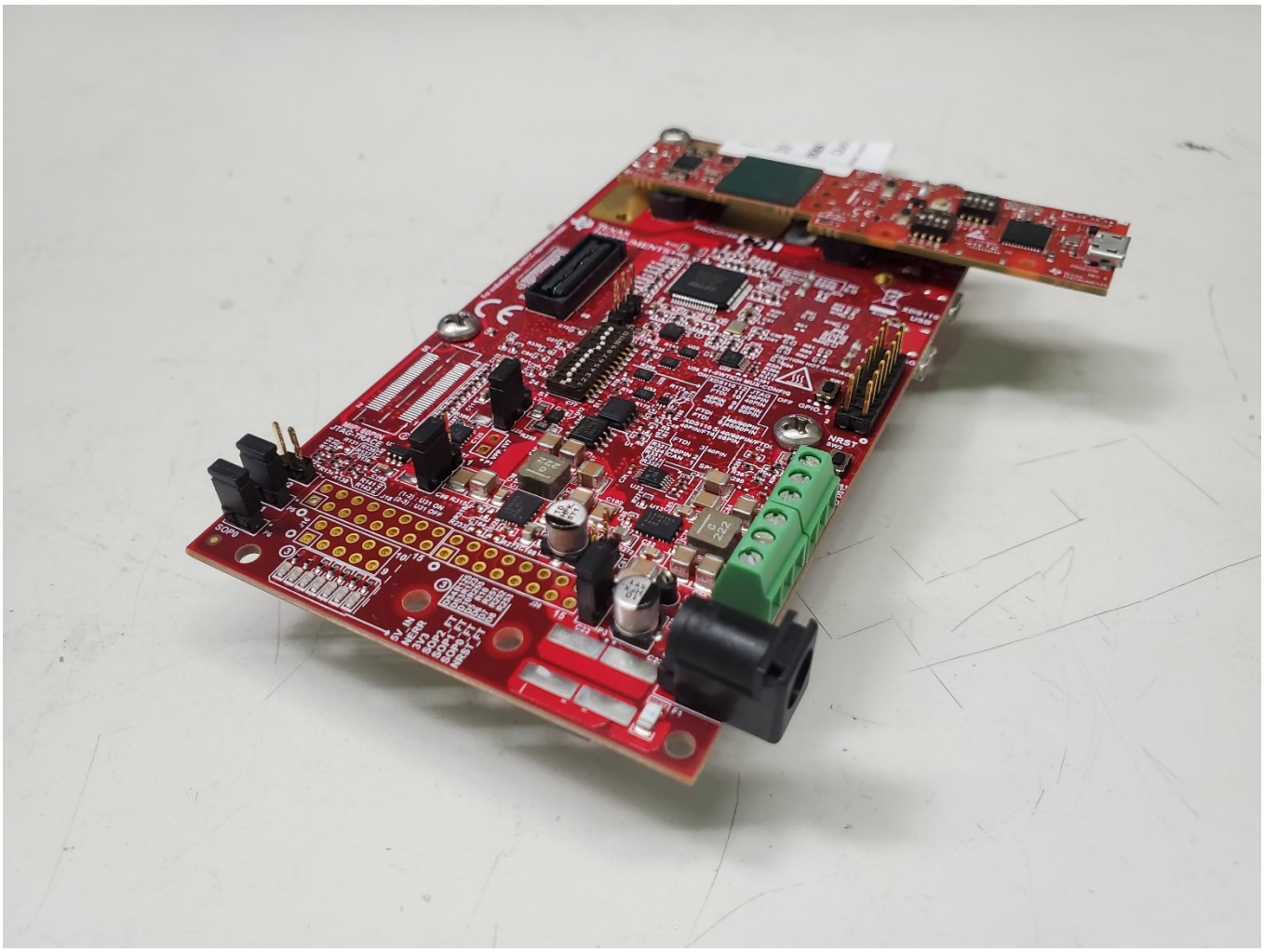

Figure 9.1-5: EUT Configuration Side view photo