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ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR AVIGILON CORPORATION
BY QAI LABORATORIES

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American Association for Laboratory Accreditation Certificate Number: 3657.02

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Applicable Test Standards:	FCC Title 47 CFR Part 15: Subpart F RSS-220 Issue 1 RSS-Gen Issue 4

Equipment Tested:	Avigilon Presence Detector
Model Number(s):	APD-S1-D
FCC ID:	2ANC5-APDS1D
IC Certification Number:	23071-ADPS1D
Manufacturer:	Avigilon Corporation

REVISION HISTORY

Date	Report Number	Rev #	Details	Author's Initials
August 24, 2017	E10426-1713_APD	0.0	Initial Release	HZ
August 25, 2017	E10426-1713_APD	1.0	Signed Release	HZ
All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.				

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REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by Avigilon Corporation Tests were conducted on the sample equipment as requested by Avigilon Corporation for the purpose of demonstrating compliance with FCC Title 47 CFR Part 15: Subpart F, RSS-220 Issue 1, and RSS-Gen Issue 4 as agreed upon by Avigilon Corporation as per Quote 17SH08101.

Avigilon Corporation is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise partial list of tests that are required for FCC or IC Declaration of Conformity and can only be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.

Approved by Parminder Singh	Tested by Raj Atwal	Report Prepared by HP Enriquez
Director for the EMC Department	Sr EMC/RF Engineer	EMC Technical Writer

QAI FACILITIES

Founded in 1994 by a group of experienced certification and testing experts, QAI is an independent third-party testing, inspection and certification organization which serves the building industry, government and individuals with cost effective solutions through our in-house capabilities / services, and an established world-wide network of qualified affiliates. To help get your product to market, trust the provider that many leading global manufacturers do: QAI.

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QAI EMC ACCREDITATION

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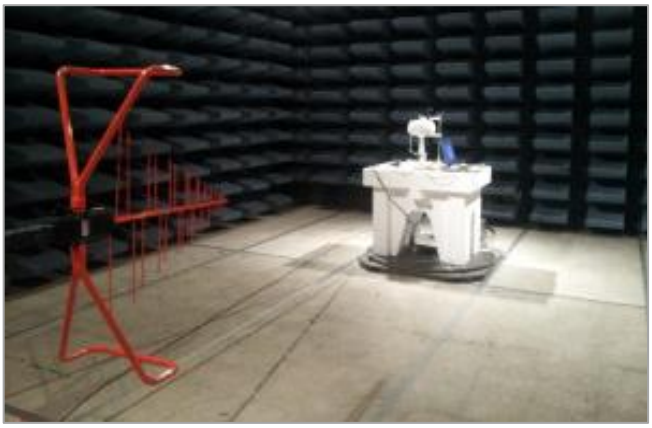
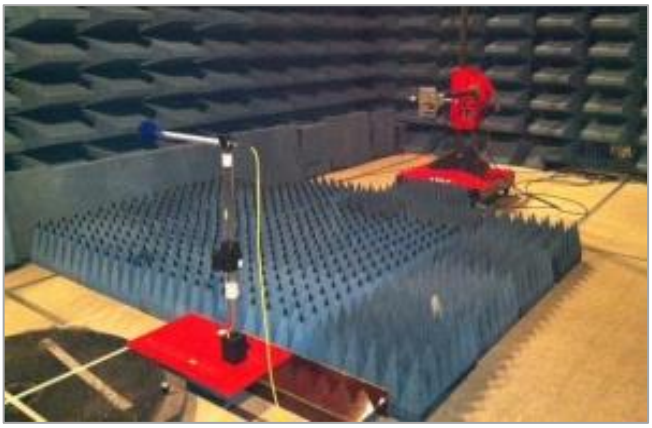
EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	21146-1	3657.02

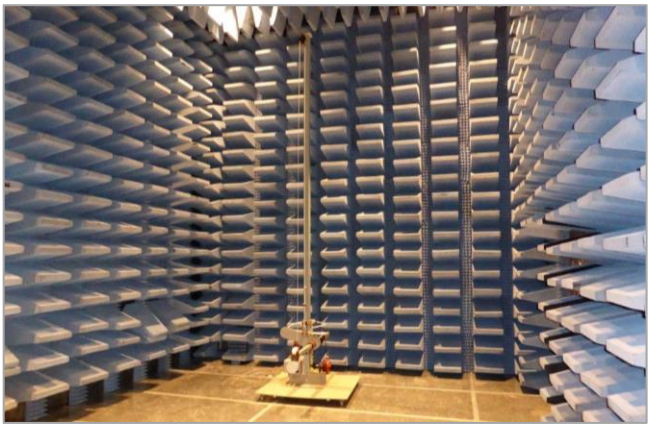
Headquarters & EMC Laboratory in Burnaby, BC



Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC



Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC



Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC

Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC

10m Open Area Test Site (OATS) in British Columbia, Canada

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Section I: EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of "Avigilon Presence Detector" as per Sections 1.2 & 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 17SH08101:

- **FCC Title 47 CFR Part 15, Subpart F** – Ultra-Wideband Operation
  - §15.505 – Cross Reference
  - §15.517 – Technical Requirements for Indoor UWB Systems
- **RSS-220 Issue 1** – Devices Using Ultra-Wideband (UWB) Technology
  - 5.2 – Indoor Communication Devices
- **RSS-Gen Issue 4** – General Requirements and Information for the Certification of Radio Apparatus

1.3 Summary of Results

The following tests demonstrate the testimony to "FCC and IC" Mark Electromagnetic compatibility radio testing for the "Avigilon Presence Detector" device manufactured by Avigilon Corporation.

The following testing was performed pursuant to FCC & IC Radio and RF Emissions Standards

Test Description	Applicable FCC Test Standard	Applicable IC Test Standard	Test Method	Result
Antenna Requirement	Title 47 CFR Part 15: Subpart C §15.203	n/a	n/a	Pass
UWB Bandwidth	Title 47 CFR Part 15: Subpart F §15.503 | §15.517 (b)	RSS-220 Issue 1 5.1(a)	ANSI C63.10-2013	Pass
Peak Emissions within 50 MHz BW	Title 47 CFR Part 15: Subpart F §15.517 (e) | §15.521 (g)	RSS-220 Issue 1 5.2.1(g) | A.4(c)	ANSI C63.10-2013	Pass
Radiated Emissions < 960 MHz	Title 47 CFR Part 15: Subpart F §15.517 (c) Title 47 CFR Part 15: Subpart C §15.209 (a)	RSS-220 Issue 1 5.2.1(c) RSS-Gen Issue 4 8.9	ANSI C63.10-2013	Pass
Radiated Emissions > 960 MHz	Title 47 CFR Part 15: Subpart F §15.517 (c) | §15.517 (d)	RSS-220 Issue 1 5.2.1(d) | 5.2.1(e)	ANSI C63.10-2013	Pass
Conducted Emissions	Title 47 CFR Part 15: Subpart F §15.505 Title 47 CFR Part 15: Subpart C §15.207	RSS-Gen Issue 4 8.8	ANSI C63.4-2014	Pass
Receiver Radiated Emissions	Title 47 CFR Part 15: Subpart F §15.505 Title 47 CFR Part 15: Subpart B §15.109	RSS-Gen Issue 4 7.1	ANSI C63.4-2014	Pass

Section II: EQUIPMENT UNDER TEST (EUT) INFORMATION

2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

EUT – Avigilon Presence Detector

Equipment Under Test (EUT) Information

No.	Item/Description	Manufacturer	Model No.	Serial No.
1	Avigilon Presence Detector (APD) Input Rating: PoE 48VDC, 3W max. MAC 00:18:85:19:AD:12	Avigilon Corporation	APD-S1-D	101707212706
	Xethru Module		n/a	100000008335
2	Avigilon Presence Detector (APD) Input Rating: PoE 48VDC, 3W max. MAC 00:18:85:19:AD:5E	Avigilon Corporation	APD-S1-D	101707212782
	Xethru Module		n/a	100000008506

Note 1: EUT no. 1 is configured to TX mode and is used for the intentional radiator testing.
Note 2: EUT no. 2 is configured to standby mode and is used for the receiver unintentional radiator testing.

EUT Input Power Source Information

No.	Item/Description	Manufacturer	Model No.	Serial No.
1	Power over Ethernet DC Power Input: 100-240VAC, 50/60Hz, 0.43A Output: 48VDC, 0.35A	PowerDsine	PD-3501G/AC	C15046555000001784

Ancillary/Auxiliary Equipment Information

No.	Item/Description	Manufacturer	Model No.	Serial No.
1	Laptop	Dell Inc.	LATITUDE E5440	H3DY012
2	Ethernet Cable (unshielded)	PC Cable World	PG330	n/a
3	Dummy digital IO cable 20AWG, 1m length w/ 50R termination	n/a	n/a	n/a

Transmitter Module Info

Frequency Band	6.5 GHz to 8.0 GHz
Transmit Power	< -14 dBm
Modulation Type	Pulsed
Test Channels	1
Pulse Repetition Frequency	15.1875 MHz
Antenna Description	Planar elliptic differential patch antenna
Antenna Type	directional patch antenna
Antenna Gain	6 dBi

EUT Test Mode/Configuration/Operation During Testing

No.	EUT Test Mode/Configuration/Operation
1	TX Mode
2	Standby Mode

Section III: GENERAL INFORMATION

3.1 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	22-28ºC
Relative Humidity	39.7 - 54.4%

3.2 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1.5 x 10-5 MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1ºC
Humidity	±5 %
DC and low frequency voltages	±3 %

3.3 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

3.4 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	QPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

Corr.(dB) = Antenna factor + Cable loss

Or

Corr.(dB) = Antenna factor + Cable Loss - Amp gain (if pre-amplifier was used)

The final Quasi peak reading shown in the data is calculated by the software using following equation:

Corrected Quasi Peak(dBµV/m) = Raw Quasi Peak Reading + Antenna factor + Cable loss

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	GND	0.6	21.7	66.0

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	GND	0.6	28.8	56.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

The final Quasi peak or Average reading shown in the data is calculated by the software using following equation:

Corr. Quasi Peak/Average Reading (dBµV) = Raw Quasi Peak/Average Reading + Antenna factor + Cable loss

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

Margin(dB) = Limit – Quasi-Peak or Average reading

3.5 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.3.

Emissions Test Equipment

Manufacturer	Model	Description	Serial No.	Calibration Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	2017-Sep-24
Sunol Sciences	DRH-118	Horn Antenna 1GHz-18GHz	A050905	2019-Mar-10
ETS Lindgren	6502	Active Loop Antenna 10kHz – 30MHz	2178	2017-Aug-21
ETS Lindgren	2165	Turntable	00043677	N/A
ETS Lindgren	2125	Mast	00077487	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	2017-Nov-20
Fischer	FCC-LISN-50-25-2-08	LISN (150kHz-30MHz)	2041	2018-Nov-19
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use

Note: *Equipment listed above have 3 years calibration interval.*

Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Test Software

Section IV: TEST RESULTS

4.1 Antenna Requirement

Date Performed:

August 16, 2017

Test Standard:

- Title 47 CFR Part 15: Subpart C, §15.203

Test Method:

- n/a

Requirement(s):

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Result:

A directional patch antenna is integrate and permanently attached in the printed circuit board of the EUT.
The EUT meets the antenna requirement.

4.2 UWB Bandwidth

Date Performed:

August 21 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.503 | §15.517(b)
- RSS-220 Issue 1, 5.1(a)

Test Method:

- ANSI C63.10-2013

Requirement(s):

- §15.503
  - For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.
  - Center frequency. The center frequency, f_C, equals $(f_H + f_L)/2$.
  - Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L)/ (f_H + f_L)$.
  - An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.
- §15.517(b)
  - The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

Result:

The EUT complies with the applicable standard.

Data/Plot:

f_M	7.227 GHz
f_L	6.518 GHz
f_H	8.040 GHz
at -10dB BW	1.522 GHz
Fractional BW	0.209
Result	○ The measured UWB bandwidth and fractional bandwidth are greater than or equal the required limit. ○ The UWB bandwidth of the system is contained between the frequency range 3100 MHz and 10600 MHz ○ PASS.

4.3 Peak Emissions

Date Performed:

August 16, 17, 18, 21 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.517 (e)
- Title 47 CFR Part 15: Subpart F, §15.521 (g)
- RSS-220 Issue 1, 5.2.1 (g)
- RSS-220 Issue 1, A.4(c)

Test Method:

- ANSI C63.10-2013

Requirement(s):

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521

> *§15.521(g) -* When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

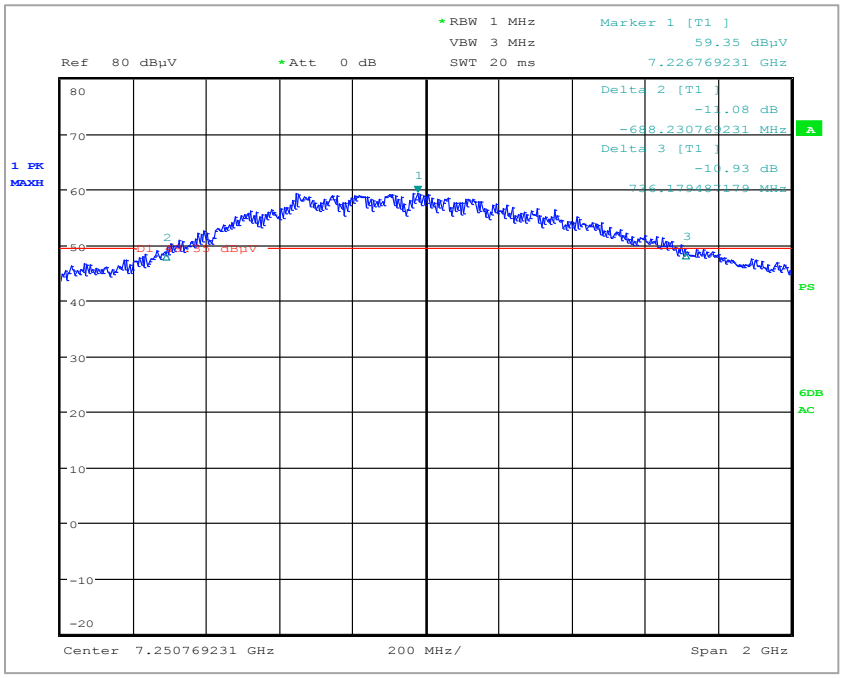
Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

Data/Plot:



Plot 1: Peak Emissions Measurement

Table 1: Fundamental and spurious emissions measurement data

frequency	7.227 GHz
Measured PWR	59.35 dBµV/m
Antenna Factor	35.5 dB
Cable	7.8 dB
Pre-amp	-34.9 dB
Distance Factor	-9.54 dB
Corrected PWR	58.21 dBµV/m
Required Limit	61.22 dBµV/m
Result	○ The measured corrected power in dBµV/m is less than the required limit by 3.01 dB. ○ PASS.

4.4 Radiated Emissions below 960 MHz

Date Performed:

August 16, 17, 18, 21 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.517 (c)
- Title 47 CFR Part 15: Subpart C, §15.209 (a)
- RSS-220 Issue 1, 5.2.1 (c)
- RSS-Gen Issue 4, 8.9

Test Method:

- ANSI C63.10-2013

Required Limit(s):

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209.

Frequency, *f* (MHz)	Field strength (dBµV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	Refer to the required limits of Section 4.5 of this report
Note 1: The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.	

Method of Measurement:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The operating frequency of the device was measured for all radiated emissions 30 MHz to 960 MHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

Data/Plot:

Test Mode/Configuration/Operation:

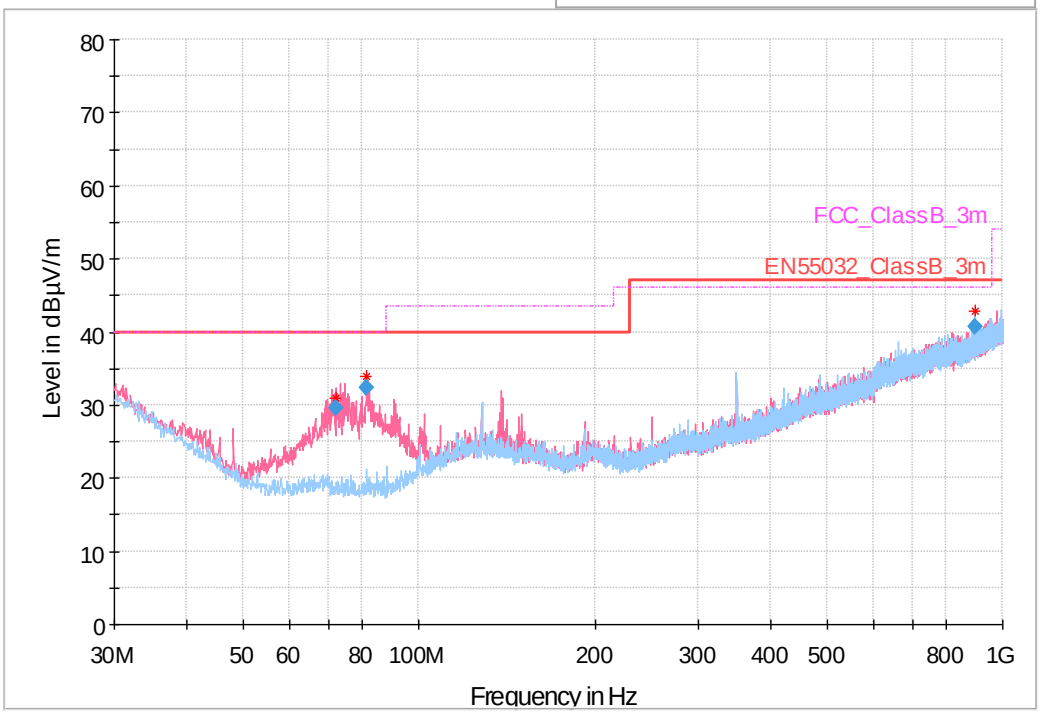
- TX Mode

Frequency Range:

- 30 MHz ↔ 1000 MHz

Legend:

Red Trace → Vertical Pol Reading
Blue Trace → Horizontal Pol Reading



Plot 2: Radiated Emissions (below 1GHz) scanned at 3m SAC

Table 2: Radiated spurious emissions measurement data at frequencies below 1 GHz

Freq. (MHz)	QPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable position (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
71.979400	29.60	1000.0	120.000	120.0	V	111.0	16.8	40.0	10.4
81.177560	32.37	1000.0	120.000	128.0	V	37.0	16.6	40.0	7.63
896.011920	40.66	1000.0	120.000	220.0	H	202.0	33.7	46.0	5.34

4.5 Radiated Emissions above 960 MHz

Date Performed:

August 16, 17, 18, 21 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.517 (c)
- Title 47 CFR Part 15: Subpart F, §15.517 (d)
- RSS-220 Issue 1, 5.2.1 (d)
- RSS-220 Issue 1, 5.2.1 (e)

Test Method:

- ANSI C63.10-2013

Required Limit(s):

The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency, *f* (MHz)	EIRP (dBm)	Field strength @ 3m (dBµV/m)
960 – 1610	-75.3	19.9
1610 – 1990	-53.3	41.9
1990 – 3100	-51.3	43.9
3100 – 10600	-41.3	53.9
Above 10600	-51.3	43.9

In addition to the radiated emission limits specified in the table above, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency, *f* (MHz)	EIRP (dBm)	Field strength @ 3m (dBµV/m)
1164 – 1240	-85.3	9.9
1559 – 1610	-85.3	9.9

Method of Measurement:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The operating frequency of the device was measured for all radiated emissions 960 MHz to the 10th harmonic of the highest fundamental frequency. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

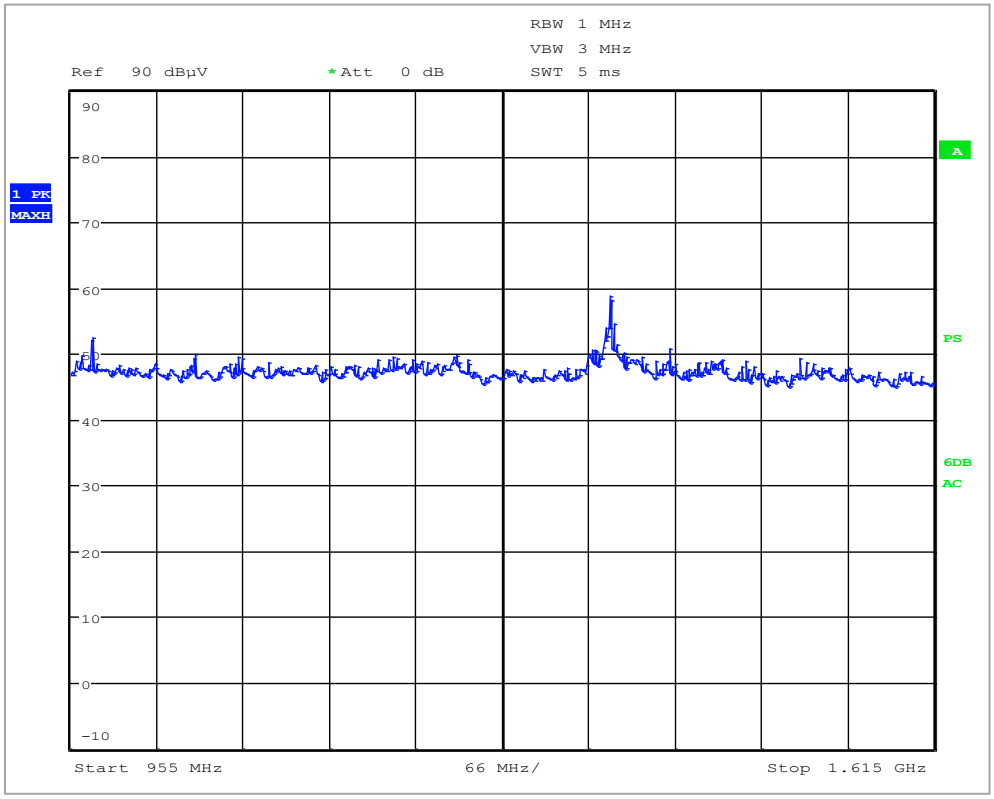
Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

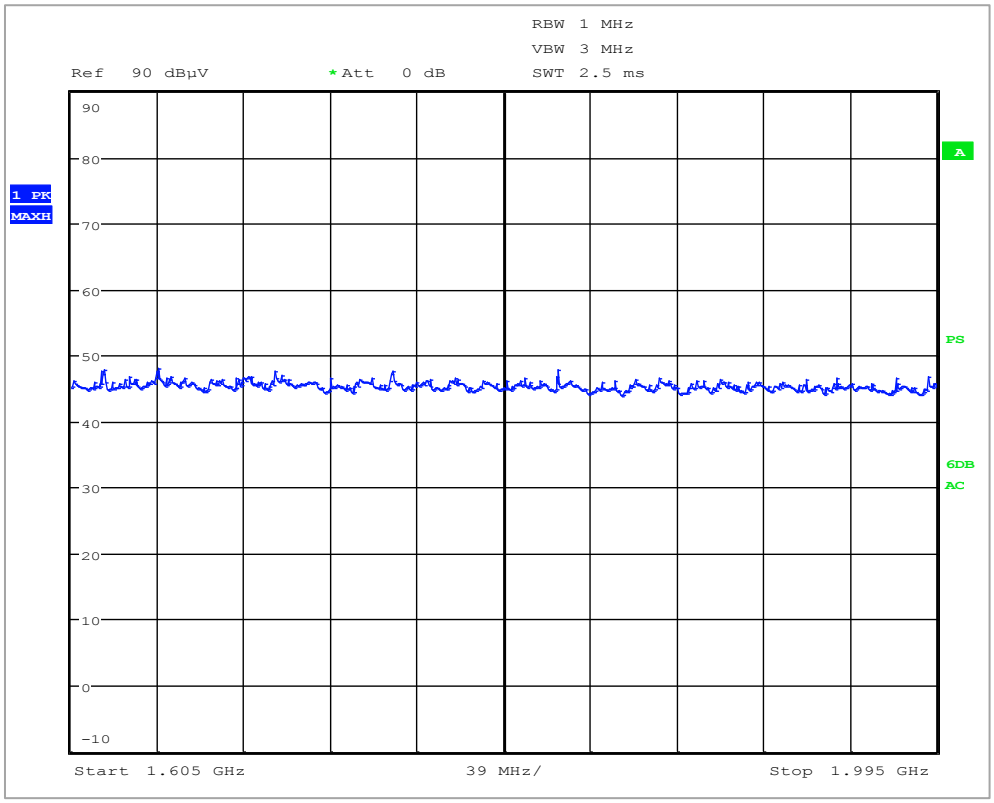
Data/Plot:



Plot 3: Radiated Emissions at frequency range: 960 MHz ↔ 1610 MHz

Remark(s):

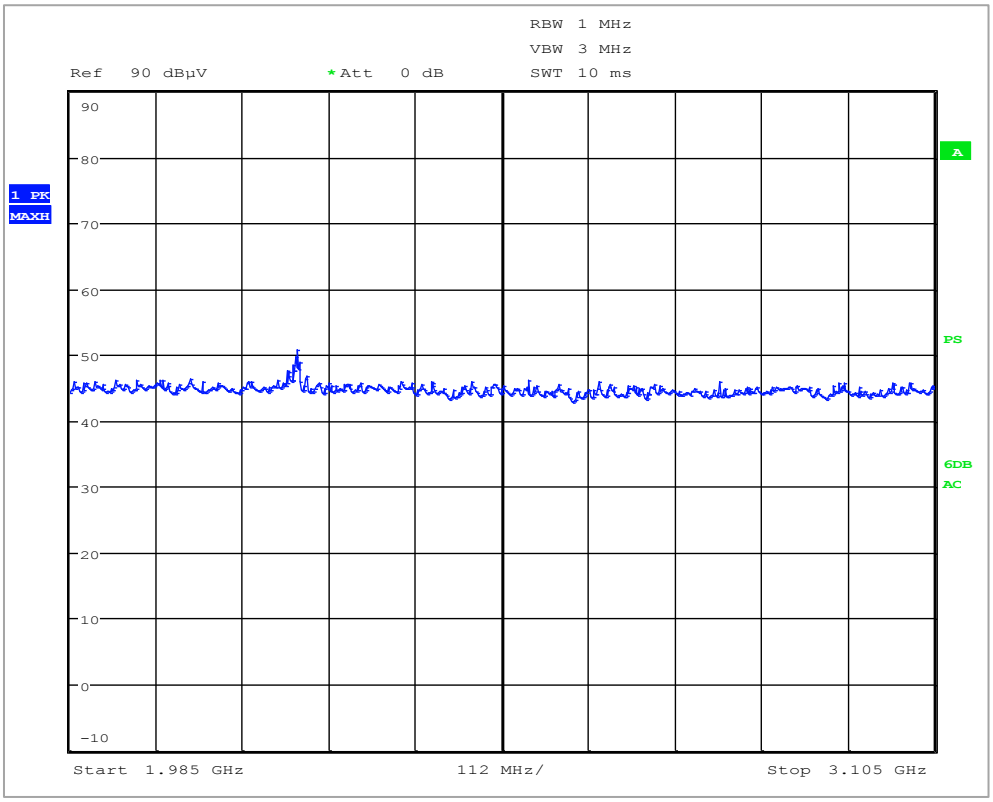
- There were no spurious emissions detected that are related with the UWB radio on the plot above therefore measured data need not to be reported.



Plot 4: Radiated Emissions at frequency range: 1610 MHz ↔ 1990 MHz

Table 3: Radiated spurious emissions measurement data

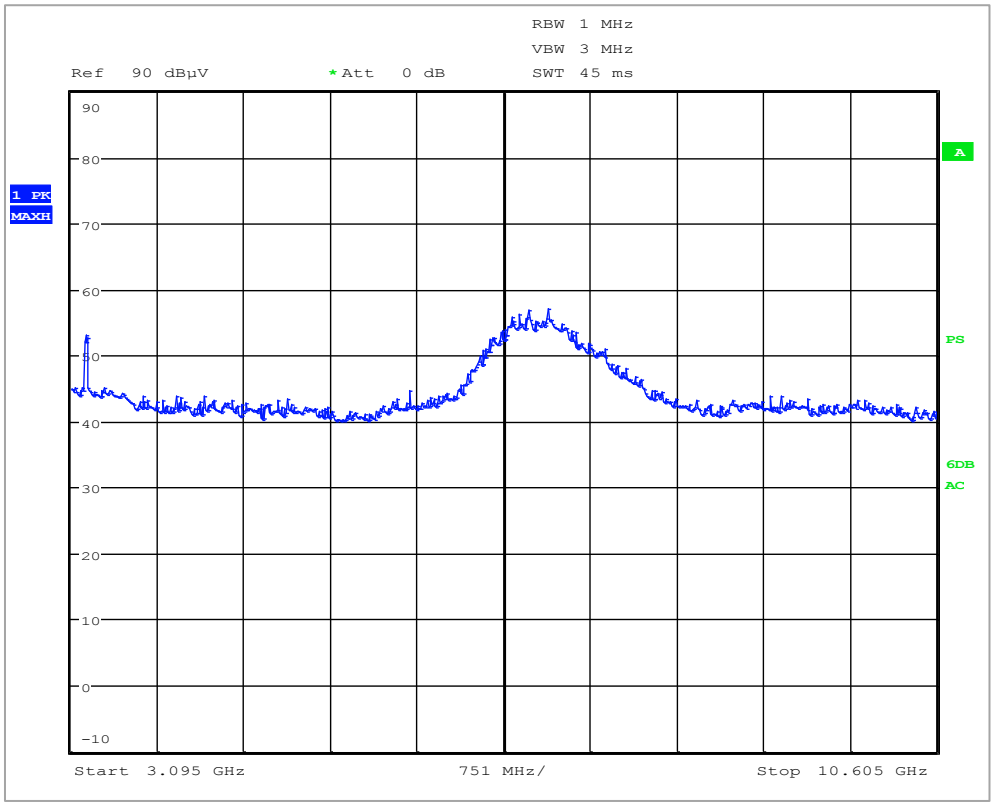
Freq.	Meas. Raw Data		Turn-table	Ant. Height	Ant. Pol.		Distance Factor	Ant. Factor	Cable Factor	Pre-amp	Corrected Data Value		Limit	Margin
MHz	dBµV/m		°	cm	V or H		dB	dB	dB	dB	dBµV/m		dBµV/m	dB
1645.00	52.48		0.00	150.00	H		-9.54	28.70	3.30	-37.40	37.54		41.90	4.36



Plot 5: Radiated Emissions at frequency range: 1990 MHz ↔ 3100 MHz

Remark(s):

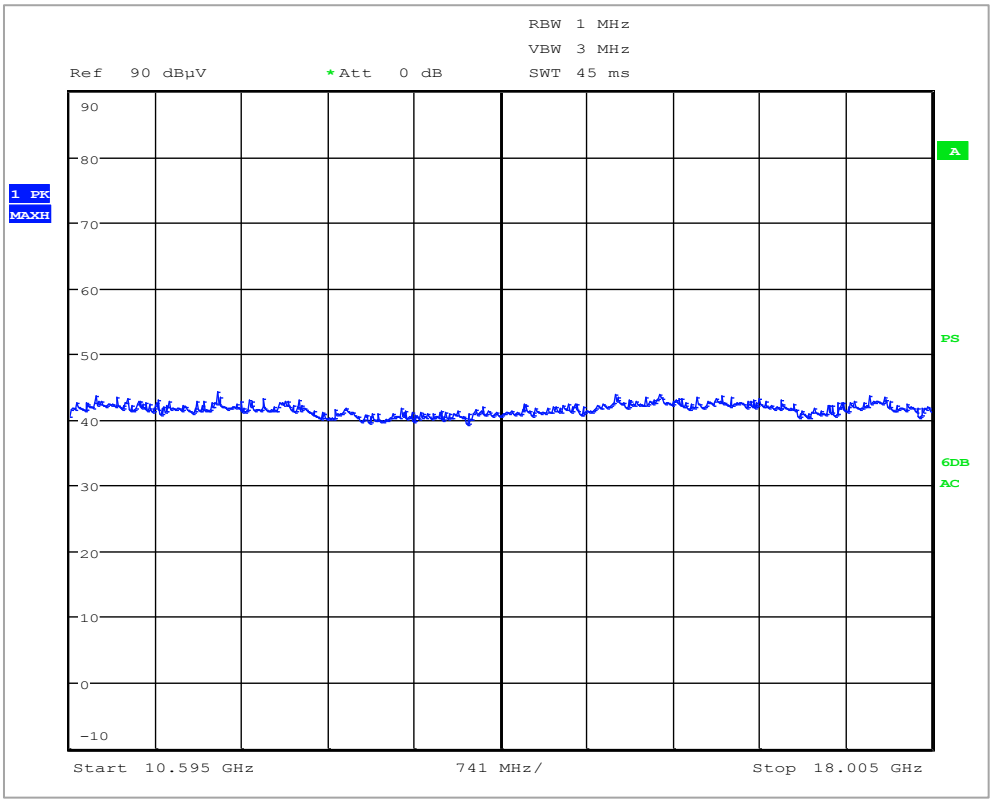
- There were no spurious emissions detected that are related with the UWB radio on the plot above therefore measured data need not to be reported.



Plot 6: Radiated Emissions at frequency range: 3100 MHz ↔ 10600 MHz

Table 4: Radiated spurious emissions measurement data

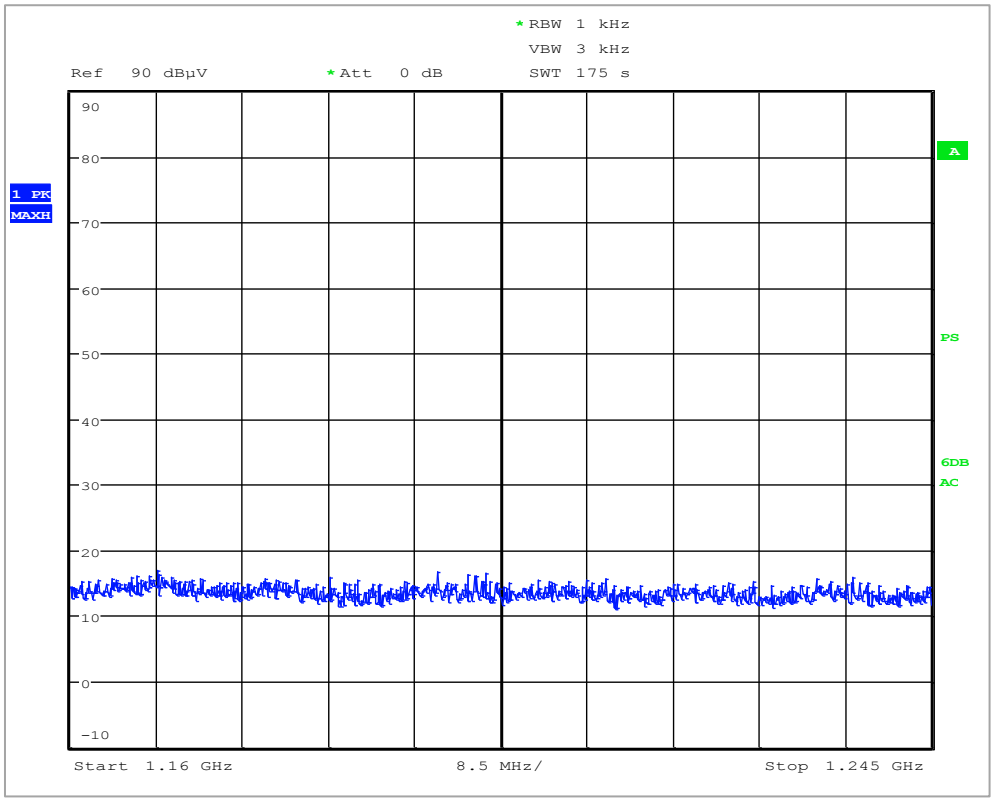
Freq.	Meas. Raw Data		Turn-table	Ant. Height	Ant. Pol.		Distance Factor	Ant. Factor	Cable Factor	Pre-amp	Corrected Data Value		Limit	Margin
MHz	dBµV/m		°	cm	V or H		dB	dB	dB	dB	dBµV/m		dBµV/m	dB
7043.00	52.32		240.00	200.00	H		-9.54	35.60	7.20	-33.30	52.28		53.90	1.62



Plot 7: Radiated Emissions at frequency range: 10600 MHz ↔ 18000 MHz

Remark(s):

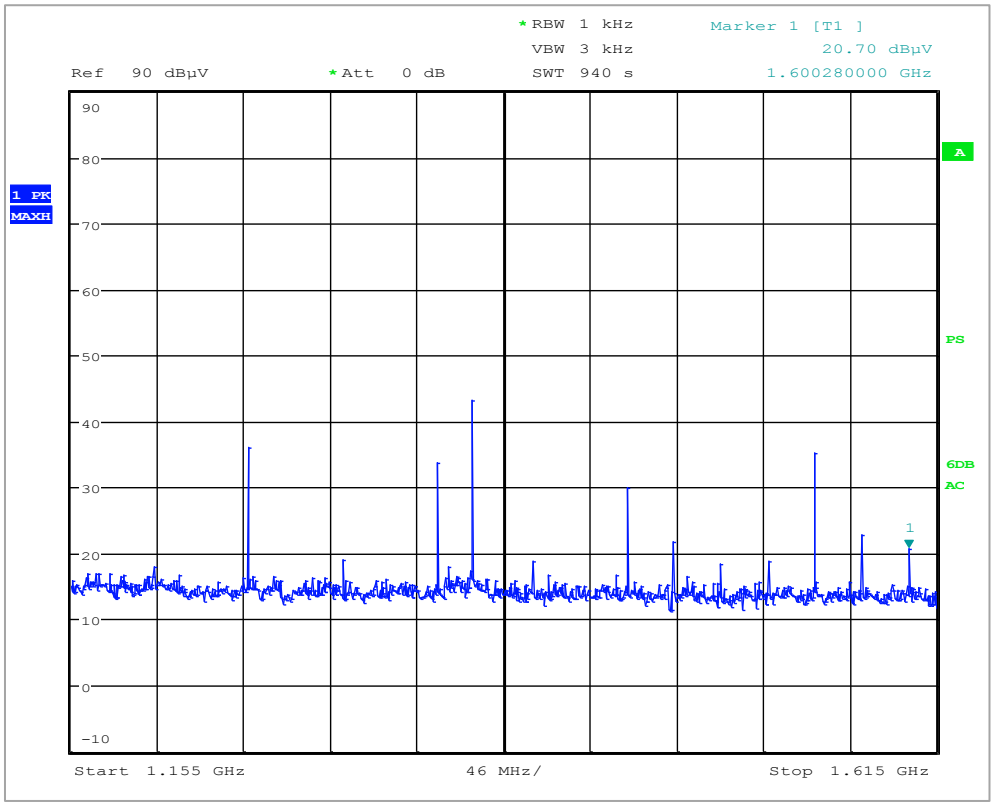
- There were no spurious emissions detected that are related with the UWB radio on the above plot and above 18 GHz therefore measured data need not to be reported.



Plot 8: Radiated Emissions at frequency range: 1164 MHz ↔ 1240 MHz

Remark(s):

- There were no spurious emissions detected that are related with the UWB radio on the above plot therefore measured data need not to be reported.



Plot 9: Radiated Emissions at frequency range: 1159 MHz ↔ 1610 MHz

Table 5: Radiated spurious emissions measurement data

Freq.	Meas. Raw Data		Turn-table	Ant. Height	Ant. Pol.		Distance Factor	Ant. Factor	Cable Factor	Pre-amp	Corrected Data Value		Limit	Margin
MHz	dBµV/m		°	cm	V or H		dB	dB	dB	dB	dBµV/m		dBµV/m	dB
1300.00	19.12		298.1	100.00	V		-9.54	28.70	2.70	-38.00	2.98		9.90	6.92
1400.00	18.89		298.10	100.00	V		-9.54	28.70	3.30	-37.40	3.95		9.90	5.95
1500.00	18.55		298.10	100.00	V		-9.54	28.70	3.30	-37.40	3.61		9.90	6.29
1600.00	20.70		298.10	100.00	V		-9.54	28.70	3.30	-37.40	5.76		9.90	4.14

4.6 Conducted Emissions

Date Performed:

August 21 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.505
- Title 47 CFR Part 15: Subpart C, §15.207
- RSS-Gen Issue 4, 8.8

Test Method:

- ANSI C63.4-2014

Required Limit(s):

For 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 µH/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 boundary between the frequencies ranges.

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5 – 30	60	50
Note 1: *The lower limit shall apply at the transition frequencies.* ***Note 2:*** *The limit decreases linearly with the logarithm of the frequency in the 0.15 to 0.50 MHz*		

Method of Measurement:

Measurements were made using a test receiver with 9kHz bandwidth, CISPR Quasi-Peak and Average detector.

Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

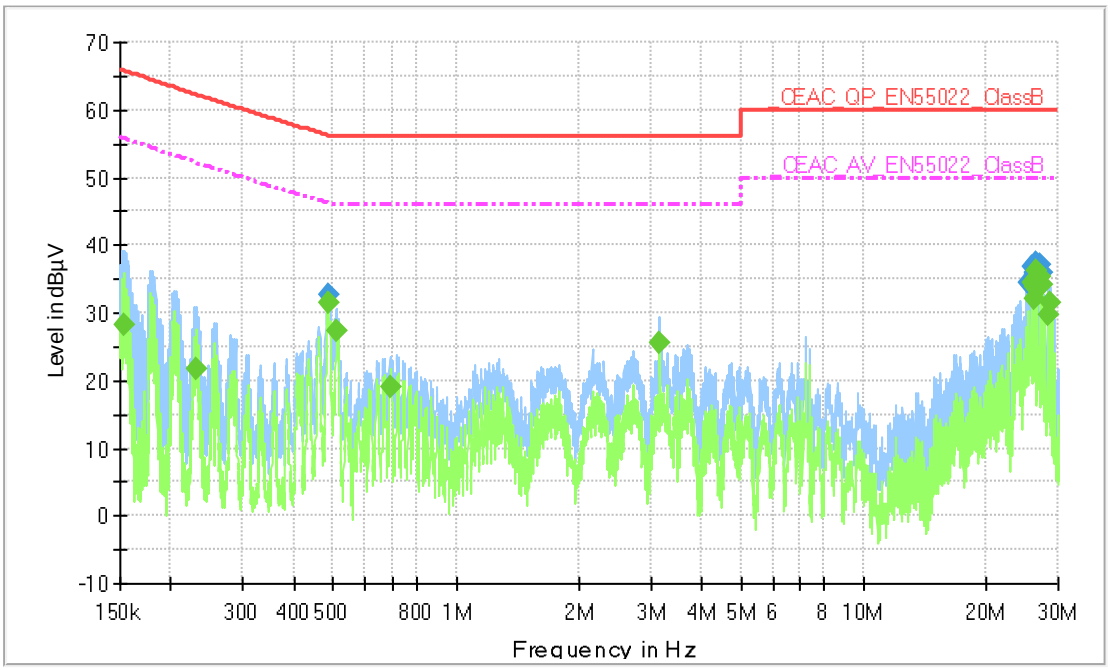
Measurement Data and Plot:

Test Voltage Used:

- Line 1, 120Vac/60Hz

Frequency Range:

- 0.150 MHz ↔ 30 MHz



Plot 10: Conducted Emissions – Line 1, 120Vac/60Hz

Table 6: QPeak Data of Conducted Emissions – Line 1, 120Vac/60Hz

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.488356	32.6	1000.000	9.000	GND	10.2	23.6	56.2
25.326957	34.4	1000.000	9.000	GND	10.5	25.6	60.0
25.760977	36.8	1000.000	9.000	GND	10.6	23.2	60.0
26.045769	35.7	1000.000	9.000	GND	10.6	24.3	60.0
26.333709	35.9	1000.000	9.000	GND	10.6	24.1	60.0
26.624833	37.5	1000.000	9.000	GND	10.6	22.5	60.0
27.054040	37.0	1000.000	9.000	GND	10.6	23.0	60.0
27.490167	35.8	1000.000	9.000	GND	10.6	24.2	60.0

Table 7: Average Data of Conducted Emissions – Line 1, 120Vac/60Hz

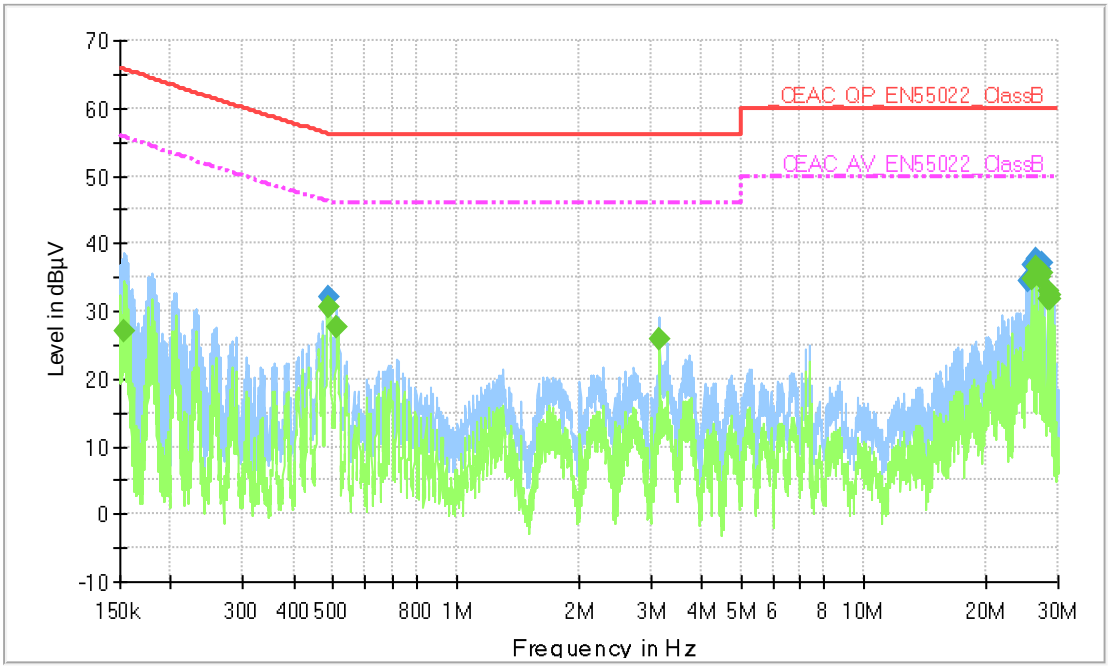
Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154103	28.3	1000.000	9.000	GND	10.5	27.5	55.8
0.231926	21.8	1000.000	9.000	GND	10.4	30.4	52.2
0.485436	31.4	1000.000	9.000	GND	10.2	14.8	46.2
0.510823	27.4	1000.000	9.000	GND	10.2	18.6	46.0
0.692889	19.0	1000.000	9.000	GND	10.2	27.0	46.0
3.164256	25.6	1000.000	9.000	GND	10.3	20.4	46.0
25.760977	34.4	1000.000	9.000	GND	10.6	15.6	50.0
26.045769	32.1	1000.000	9.000	GND	10.6	17.9	50.0
26.333709	33.7	1000.000	9.000	GND	10.6	16.3	50.0
26.624833	36.1	1000.000	9.000	GND	10.6	13.9	50.0
27.054040	35.3	1000.000	9.000	GND	10.6	14.7	50.0
27.490167	34.1	1000.000	9.000	GND	10.6	15.9	50.0
28.497329	29.8	1000.000	9.000	GND	10.6	20.2	50.0
28.640101	31.5	1000.000	9.000	GND	10.6	18.6	50.0

Test Voltage Used:

- Line 2, 120Vac/60Hz

Frequency Range:

- 0.150 MHz ↔ 30 MHz



Plot 11: Conducted Emissions – Line 2, 120Vac/60Hz

Table 8: QPeak Data of Conducted Emissions – Line 2, 120Vac/60Hz

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.487868	32.0	1000.000	9.000	GND	10.2	24.2	56.2
25.326957	34.4	1000.000	9.000	GND	10.5	25.6	60.0
25.760977	36.9	1000.000	9.000	GND	10.6	23.1	60.0
26.624833	37.6	1000.000	9.000	GND	10.6	22.4	60.0
27.054040	36.3	1000.000	9.000	GND	10.6	23.7	60.0
27.490167	37.1	1000.000	9.000	GND	10.6	22.9	60.0

Table 9: Average Data of Conducted Emissions – Line 2, 120Vac/60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.153488	27.1	1000.000	9.000	GND	10.5	28.7	55.8
0.486408	30.7	1000.000	9.000	GND	10.2	15.6	46.2
0.510823	27.5	1000.000	9.000	GND	10.2	18.5	46.0
3.167420	26.0	1000.000	9.000	GND	10.3	20.0	46.0
25.760977	34.6	1000.000	9.000	GND	10.6	15.4	50.0
26.624833	36.6	1000.000	9.000	GND	10.6	13.4	50.0
27.054040	35.2	1000.000	9.000	GND	10.6	14.8	50.0
27.490167	35.7	1000.000	9.000	GND	10.6	14.3	50.0
28.355269	31.8	1000.000	9.000	GND	10.6	18.2	50.0
28.497329	33.0	1000.000	9.000	GND	10.6	17.0	50.0
28.640101	32.5	1000.000	9.000	GND	10.6	17.5	50.0
28.783588	31.8	1000.000	9.000	GND	10.6	18.2	50.0

4.7 Receiver Radiated Emissions

Date Performed:

August 16, 2017

Test Standard:

- Title 47 CFR Part 15: Subpart F, §15.505
- Title 47 CFR Part 15: Subpart B, §15.109
- RSS-Gen Issue 4, 7.1

Test Method:

- ANSI C63.4-2014

Required Limit(s):

Spurious emissions from receivers shall not exceed the radiated limits shown below

Frequency, *f* (MHz)	Field strength (dBµV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0
Note 1: The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.	

Method of Measurement:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The device was measured for all radiated emissions from 30 MHz to 1 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

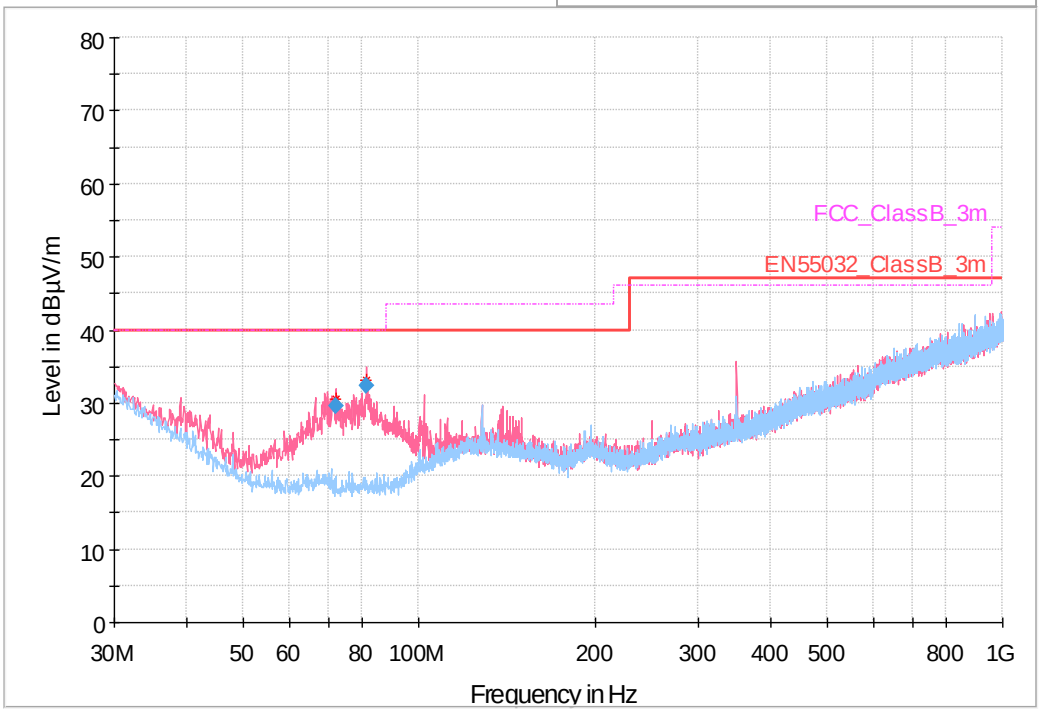
Data/Plot:

Test Mode/Configuration/Operation:

- Standby Mode

Frequency Range:

- 30 MHz ↔ 1000 MHz



Plot 12: Radiated Emissions (below 1GHz) scanned at 3m SAC

Table 10: Radiated spurious emissions measurement data

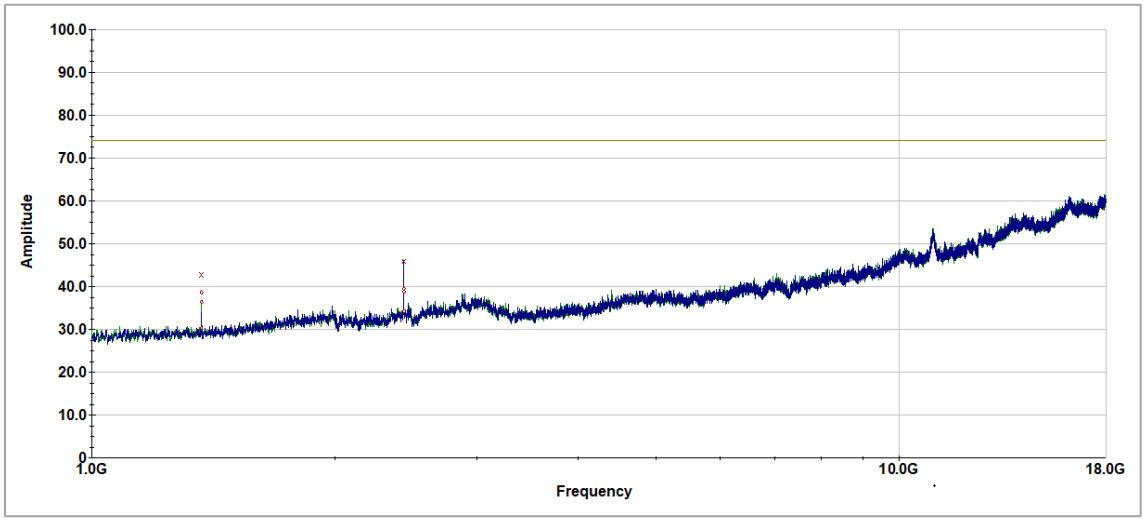
Freq. (MHz)	QPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable position (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
71.967120	29.58	1000.0	120.000	97.0	V	73.0	16.8	40.00	10.42
81.167240	32.33	1000.0	120.000	134.0	V	125.0	16.6	40.00	7.67

Test Mode/Configuration/Operation:

- Standby Mode

Frequency Range:

- 1 GHz ↔ 18 GHz



Plot 13: Radiated Emissions (below 1GHz) scanned at 3m SAC

Remark: *§15.31(o)* - The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

Appendix A: TEST SETUP PHOTOS

Figure 1: Radiated Emissions (below 1 GHz) performed at the SAC Test Setup

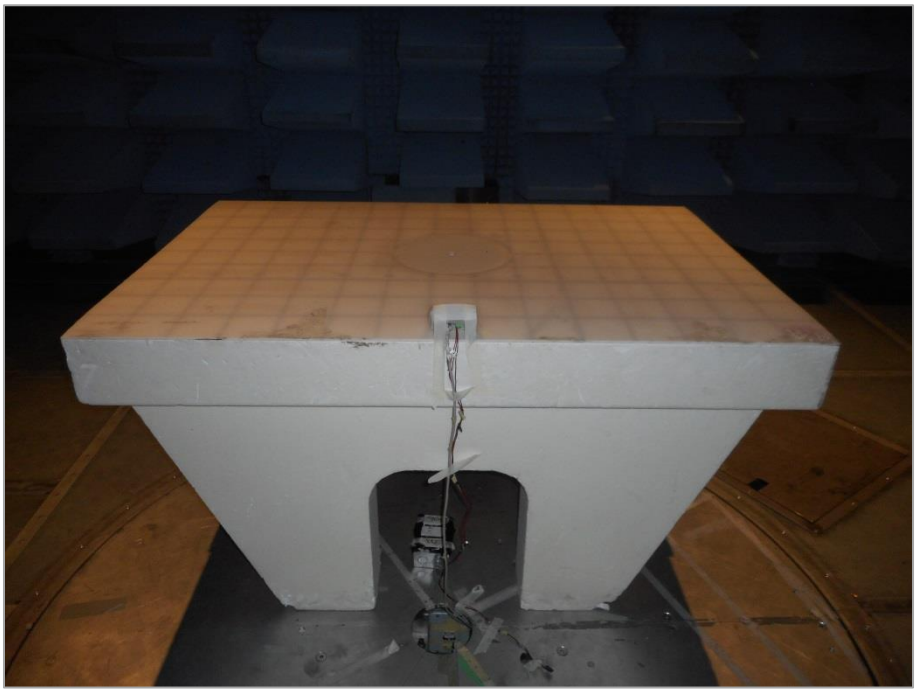


Figure 2: Radiated Emissions (below 1 GHz, close-up view) performed at the SAC Test Setup

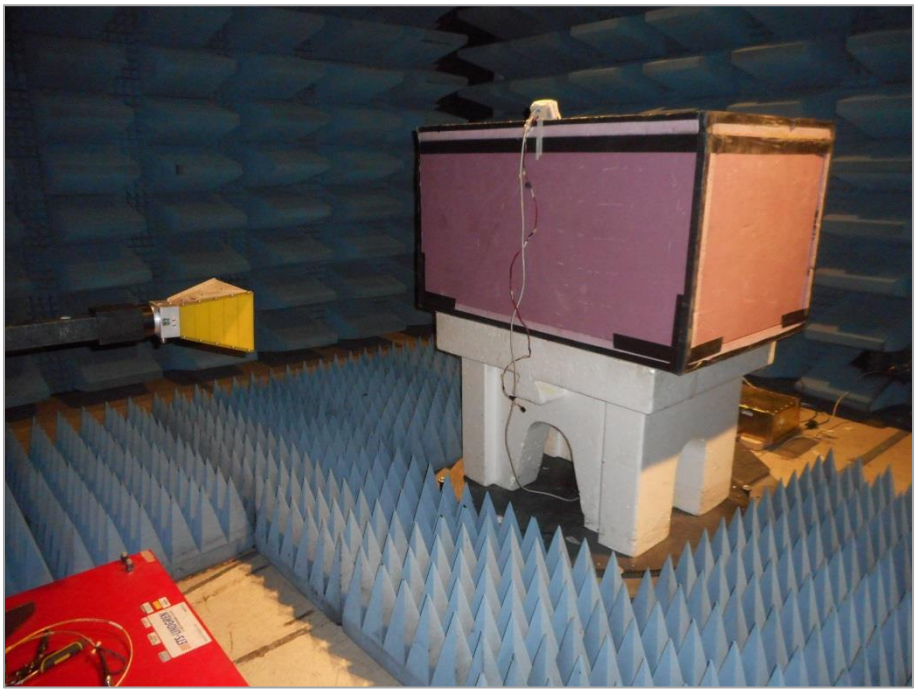


Figure 3: Radiated Emissions (above 1 GHz) performed at the SAC Test Setup

Figure 4: Radiated Emissions (above 1 GHz, close-up view) performed at the SAC Test Setup

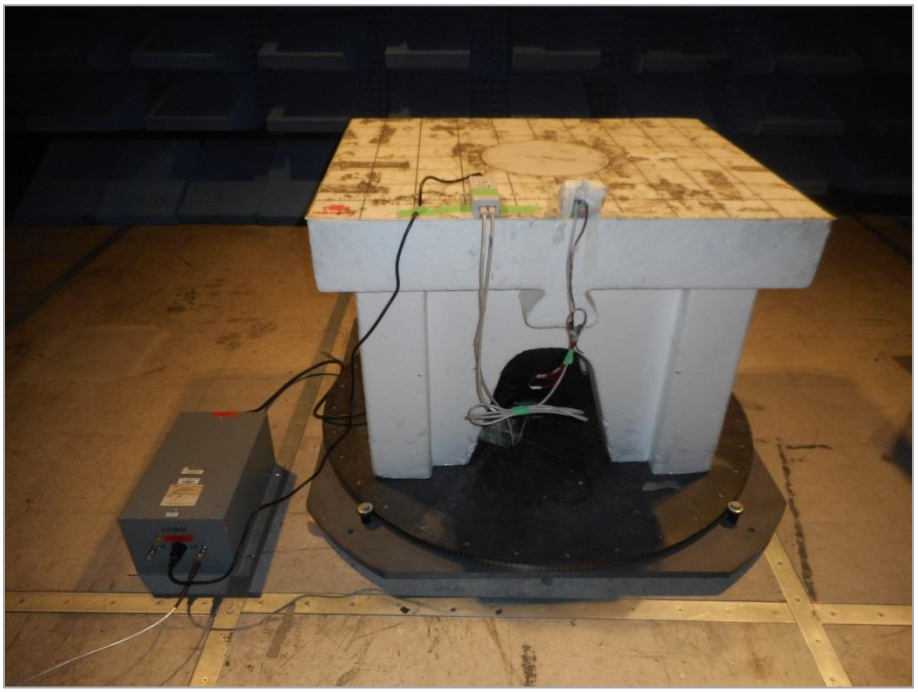


Figure 5: Conducted Emissions Test Setup

Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques
DC	Direct Current
EFT	Electrical Fast Transient
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
IC	Industry Canada
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

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END OF REPORT