

<i>Company</i>	ITRenew	<i>Document No</i> EMC CE TR: Leopard V2 (Quanta)	
<i>Document</i>	EMC Test Report	<i>Issue</i> 1	<i>Date</i> 15 October 2020
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Leopard V2 (Quanta)

EMC TEST REPORT

IN ACCORDANCE WITH THE
EUROPEAN UNION'S DIRECTIVE ON EMC
2014/30/EU



ITRenew
8356 Central Ave.
Newark, CA 94560
USA

TESTS PERFORMED BY
Montrose Compliance Services, Inc.
2353 Mission Glen Dr.
Santa Clara, CA 95051-1214
Phone and FAX: 408-247-5715

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Montrose Compliance Services Inc.
2353 Mission Glen Dr.
Santa Clara, CA 95051-1214

CERTIFICATE OF LABORATORY ASSESSMENT – ISO/IEC 17025:2017

I hereby certify that:

The measurements shown in this test report were made in accordance with the procedures indicated and submitted as Annex C within a corresponding Technical File.

All measurements were performed by me or by trained and qualified EMI test engineers and technicians working under my supervision.

The environment and configuration of the referenced test article during EMC evaluations performed at ITRenew's facility in Newark, California and is representative of the worst-case conditions that can be reasonably anticipated at customer locations using this type of equipment.

Test results are valid for the item tested, and similar results can be expected for production units tested under equivalent conditions.

Product compliance is the responsibility of the company, therefore the test and equipment modes of operation represented in this report were agreed upon by the company, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample tested.

This report shall not be reproduced, except in full, without the permission of ITRenew.

Authorization:

Mark I. Montrose

Mark I. Montrose
 EMC Consultant and Owner

Date: 15 October 2020

Certificate of Assessment	
Presented by	
Dr.-Ing. Diethard Hansen ISO/IEC 17025 Laboratory Assessor EURO EMC SERVICE (EES) Dr. Hansen Consulting CH-8966 Berikon, Bültenhofstr. 39, Switzerland	
to	
Montrose Compliance Services, Inc. 2353 Mission Glen Dr. Santa Clara, California 95051-1214, USA	
In my opinion, Montrose Compliance Services, Inc. complies with the requirements of ISO/IEC 17025:2017 Ed. 3 "General requirements for the competence of testing and calibration laboratories."	
This assessment demonstrates technical competence and operation of the company along with an appropriate Quality Management System for the scope and locations described in the accompanying schedule that forms an essential part of this certificate.	
Certificate Number: US-2018-01	
 Dr.-Ing. Diethard Hansen	EURO EMC SERVICE (EES) Dr.-Ing. D. Hansen Berikon, CH CH-8966 Berikon, Bültenhofstr. 39 Switzerland Tel/Fax +41 (0)59 639 79 81
Date of Issue 1 July 2018 Valid until 1 July 2023	
<small>Dr.-Ing. Diethard Hansen, ISO/IEC 17025 Laboratory Assessor EURO EMC SERVICE (EES) Consulting Dr. Hansen, CH-8966 Berikon, Switzerland, 39 EES@euro-emc-service.ch www.euro-emc-service.com</small>	

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1.0 INTRODUCTION

Montrose Compliance Services, Inc. has developed EMC procedures for *in situ* testing of industrial equipment. These procedures have been reviewed by a European Notified Body based in the United Kingdom and deemed acceptable for showing compliance with the emissions and the immunity requirements of EMC Directive (2014/30/EU) for the European Union (EU), when incorporated as part of a Technical File.

A copy of ITRenew's Test Plan is provided in a corresponding a Technical File. This test report is provided as an attachment within that Technical File, located in the Annex section. Emissions tests are based on the methods of EN 55032. Immunity tests are based on the methods and test procedures described in EN 61000-6-1.

2.0 DESCRIPTION OF THE EQUIPMENT UNDER TEST

System Name: Leopard V2 (Quanta)
Serial Number: Multiple components, each identical in one large rack configuration without overall serial number
Location: Newark, CA

System Components

The Leopard V2 (Quanta) system contains the following major assemblies detailed below.

Description
• PDU assembly
• Leopard V2 server
• Network switch
• Power shelves

3.0 ENVIRONMENTAL CONDITIONS DURING TEST

Temperature: 74°F (23°C) - Measured

Relative Humidity: 68% - Measured

4.0 TESTS PERFORMED

A.1	EN 55011:2016	Radiated Emissions (Enclosure)	15 October 2020
A.2	EN 55011:2016	Conducted Emissions	15 October 2020
B.1	EN 61000-4-2:2009	ESD (Enclosure)	15 October 2020
B.2	EN 61000-4-3:2006	Radiated Susceptibility	15 October 2020
B.3	EN 61000-4-4:2012	Electrical Fast Transient / Burst	N/A (waived per test plan). See Section B.3
B.4	EN 61000-4-5:2014	Surge	N/A (waived per test plan). See Section B.4
B.5	EN 61000-4-6:2013	Conducted Susceptibility	N/A (waived per test plan). See Section B.5
B.6	EN 61000-4-8:2009	Magnetic Field Susceptibility	N/A (waived per test plan). See Section B.6
B.7	EN 61000-4-11:2004	Voltage Deviation, Short	N/A (waived per test plan). See Section B.7

5.0 SUMMARY OF RESULTS

A.1	EN 55011:2016	Radiated Emissions (Enclosure)	Complies
A.2	EN 55011:2016	Conducted Emissions	Complies
B.1	EN 61000-4-2:2009	ESD (Enclosure)	Complies
B.2	EN 61000-4-3:2006	Radiated Susceptibility	Complies
B.3	EN 61000-4-4:2012	Electrical Fast Transient / Burst	N/A (waived per test plan). See Section B.3
B.4	EN 61000-4-5:2014	Surge	N/A (waived per test plan). See Section B.4
B.5	EN 61000-4-6:2013	Conducted Susceptibility	N/A (waived per test plan). See Section B.5
B.6	EN 61000-4-8:2009	Magnetic Field Susceptibility	N/A (waived per test plan). See Section B.6
B.7	EN 61000-4-11:2004	Voltage Deviation, Short	N/A (waived per test plan). See Section B.7

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6.0 EUT CONNECTOR/CABLE LIST

No.	From module	To module	Description	Length (m)
1	Facility	Rack System	Power Cord (Shielded)	3
2	Facility	Rack System	Fiber Optic Cables	Various

7.0 SYSTEM TEST CONFIGURATION

The system was configured for testing in a typical fashion (as a normally used by a typical user). The EUT was tested in the normal (native) operating mode to represent worst-case results during the final qualification test. All disk drives were operating in both read and write mode (diagnostic test program).

7.1 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system modules in a manner similar to a typical use.

7.2 Equipment Modifications

No modifications were made to ensure the EUT would be compliant with applicable limits and requirements.

8.0 JUSTIFICATION FOR IN SITU TESTING

Due to the practical considerations dictated by the size and installation requirements including AC input mains power, testing was performed in situ at the applicant's location.

9.0 FAILURE CRITERIA

The failure criteria specified by ITRenew for immunity testing are:

Application program should continue to operate without any interruption or corruption.

10.0 MODIFICATIONS REQUIRED FOR COMPLIANCE

No modifications during compliance testing in order to bring the product into compliance.

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11.0 LIMITATIONS IN THE TEST ENVIRONMENT

The photos provided in this section show the environment that the EUT is located within and the space available for placement of antennas.

Front Area for In Situ Testing



Side and Rear of EUT



Rack Configuration for Testing (Front and Rear)



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TEST RESULTS

A.1 RADIATED EMISSIONS (ENCLOSURE PORT) Frequency Range: 30 MHz – 6 GHz EN 55032:2015, Class A, Tables A2 & A3

Test Date 15 October 2020

Test Performed by Mark Montrose

Test Locations Refer to photograph showing antenna placement

Test Distance:

- 3-meters front and rear of EUT.
- Testing on both sides was deemed unnecessary due to installation of assemblies internal to the rack and that all items in the rack are already EMC compliant. This test is to ensure that a combination of multiple assemblies bundled together continues to meet the essential requirements of the EMC Directive.
- There is a metal panel over existing internal Faraday shielded enclosures of previously CE certified assemblies, not provided for this test (open rack). Per engineering analysis, testing of the sides is not required as the unit is compliant when measured on both front and rear which also do not have metal panel covers. Engineering analysis predicts there should be no EMI from the sides of the rack assembly.
- Antenna height is 1.2 meters

Test Specification: EN 55032, Table 5

Equipment Used to Perform Tests

Description	Manufacturer	Model	S/N	Cal Date	Cal Due
Spectrum Analyzer	Rohde & Schwarz	FSL6	101333	2/22/19	2/22/21
Biconical Antenna	AH Systems	SAS-200/530, 542	1084	11/22/19	11/22/21
Log Periodic	AH Systems	SAS-200/510	1469	11/22/19	11/22/21
Horn Antenna	AH Systems	SAS-571	2209	9/8/19	9/8/21

Test Procedures

Montrose Compliance Services, Inc. EMC Test Procedures, Section A.1

Deviations from Written Test Plan or Test Procedures

None except for antenna distance and locations

Photographs of Test

Provided herein

Results Summary: Radiated Emissions

See test results. Complies with Class A limits

Measurement Uncertainty Calculations

Attempts to calculate measurement uncertainty using Type B evaluation is not possible for the following reasons.

1. Testing is performed in a manufacturing and engineering environment.
2. Site characterization is not possible thus uncertainty data will not be valid.
3. No ground plane was available, except for the metal support rebar internal to the concrete floor.
4. Measured data was taken in the near-field, which may not correlate with far-field conditions.

The measurement uncertainty of the spectrum analyzer, coaxial cable and antenna with k=2 factor (95%) is 3.04dB. This measurement uncertainty number does not include the test environment that would significantly increase measurement uncertainty.

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Front of EUT – 3 m antenna distance (30 MHz – 1 GHz)

Frequency MHz	Peak Reading dB μ V/m	10m-Limit dB μ V/m	Distance Factor dB	Corrected Limit dB μ V/m	Delta dB	Antenna Polarization
72.9	45.2	40	10.5	50.5	-5.3	Vertical
113.8	41.5	40	10.5	50.5	-9.0	Horizontal
113.9	36.1	40	10.5	50.5	-14.4	Vertical
120.0	41.0	40	10.5	50.5	-9.5	Horizontal
120.0	41.8	40	10.5	50.5	-8.7	Vertical
125.0	40.3	40	10.5	50.5	-10.2	Horizontal
125.0	37.4	40	10.5	50.5	-13.1	Vertical
145.0	38.7	40	10.5	50.5	-11.8	Horizontal
145.2	43.8	40	10.5	50.5	-6.7	Vertical
150.0	38.1	40	10.5	50.5	-12.4	Horizontal
150.8	39.2	40	10.5	50.5	-11.3	Horizontal
168.0	33.1	40	10.5	50.5	-17.4	Horizontal
170.1	38.6	40	10.5	50.5	-11.9	Vertical
171.2	33.3	40	10.5	50.5	-17.2	Horizontal
180.3	35.8	40	10.5	50.5	-14.7	Horizontal
200.0	39.0	40	10.5	50.5	-11.5	Horizontal
200.0	40.7	40	10.5	50.5	-9.8	Vertical
224.0	37.2	40	10.5	50.5	-13.3	Horizontal
240.0	33.3	47	10.5	57.5	-24.2	Horizontal
240.0	38.3	47	10.5	57.5	-19.2	Vertical
250.0	44.0	47	10.5	57.5	-13.5	Horizontal
250.0	46.6	47	10.5	57.5	-10.9	Vertical
265.6	35.5	47	10.5	57.5	-22.0	Vertical
283.0	33.5	47	10.5	57.5	-24.0	Horizontal
283.0	40.9	47	10.5	57.5	-16.6	Vertical
297.0	33.1	47	10.5	57.5	-24.4	Horizontal
300.0	44.7	47	10.5	57.5	-12.8	Horizontal
300.0	43.6	47	10.5	57.5	-13.9	Vertical
312.5	45.9	47	10.5	57.5	-11.6	Vertical
312.5	31.9	47	10.5	57.5	-25.6	Horizontal
350.0	45.2	47	10.5	57.5	-12.3	Vertical
350.0	41.0	47	10.5	57.5	-16.5	Horizontal
400.0	49.0	47	10.5	57.5	-8.5	Vertical
400.0	46.4	47	10.5	57.5	-11.1	Horizontal
440.0	40.3	47	10.5	57.5	-17.2	Horizontal
444.4	40.7	47	10.5	57.5	-16.8	Vertical
625.0	53.9	47	10.5	57.5	-3.6	Vertical
650.0	51.6	47	10.5	57.5	-5.9	Vertical
650.0	44.9	47	10.5	57.5	-12.6	Horizontal
666.8	45.4	47	10.5	57.5	-12.1	Vertical
700.0	44.4	47	10.5	57.5	-13.1	Vertical
781.2	50.0	47	10.5	57.5	-7.5	Horizontal
792.0	44.9	47	10.5	57.5	-12.6	Vertical
860.0	51.9	47	10.5	57.5	-5.6	Horizontal
900.0	46.4	47	10.5	57.5	-11.1	Vertical

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Front of EUT – 3 m antenna distance: (1 GHz - 6 GHz)

Frequency GHz	Peak Reading dB μ V/m	Peak Limit dB μ V/m	Peak Margin dB	Average Reading dB μ V/m	Average Limit dB μ V/m	Average Margin dB	Antenna Polarization
1.09	53.4	76	-22.6	49.8	56	-6.2	Vertical
1.09	56.4	76	-19.6	48.7	56	-7.3	Horizontal
1.41	52.0	76	-24.0	46.6	56	-9.4	Vertical
1.72	52.2	76	-23.8	44.5	56	-11.5	Vertical
1.73	62.5	76	-13.5	51.6	56	-4.4	Horizontal
1.88	56.5	76	-19.5	46.7	56	-9.3	Horizontal
1.93	52.6	76	-23.4	50.3	56	-5.7	Vertical
1.95	61.9	76	-14.1	50.2	56	-5.8	Horizontal
2.12	48.6	76	-27.4	46.2	56	-9.8	Vertical
2.12	49.7	76	-26.3	46.3	56	-9.7	Horizontal
No signals above 3 GHz observed within 20 dB of the specification limit, peak							

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Biconical Antenna – Front of EUT



Log Periodic Antenna – Front of EUT



Horn Antenna – Front of EUT



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Rear of EUT – 3 m antenna distance (30 MHz – 1 GHz)

Frequency MHz	Peak Reading dB μ V/m	10m-Limit dB μ V/m	Distance Factor dB	Corrected Limit dB μ V/m	Delta dB	Antenna Polarization
113.8	39.3	40	10.5	50.5	-11.2	Vertical
113.8	40.0	40	10.5	50.5	-10.5	Horizontal
120.0	40.3	40	10.5	50.5	-10.2	Vertical
120.0	41.0	40	10.5	50.5	-9.5	Horizontal
146.8	37.1	40	10.5	50.5	-13.4	Vertical
150.0	36.2	40	10.5	50.5	-14.3	Horizontal
170.0	33.1	40	10.5	50.5	-17.4	Horizontal
170.2	38.5	40	10.5	50.5	-12.0	Vertical
180.2	34.9	40	10.5	50.5	-15.6	Horizontal
180.3	35.3	40	10.5	50.5	-15.2	Vertical
200.0	38.7	40	10.5	50.5	-11.8	Vertical
200.0	37.6	40	10.5	50.5	-12.9	Horizontal
240.0	34.7	47	10.5	57.5	-22.8	Vertical
240.0	33.8	47	10.5	57.5	-23.7	Horizontal
250.0	44.7	47	10.5	57.5	-12.8	Vertical
250.0	46.7	47	10.5	57.5	-10.8	Horizontal
265.5	35.7	47	10.5	57.5	-21.8	Vertical
270.3	42.3	47	10.5	57.5	-15.2	Vertical
282.9	36.7	47	10.5	57.5	-20.8	Horizontal
288.0	35.4	47	10.5	57.5	-22.1	Vertical
300.0	41.5	47	10.5	57.5	-16.0	Vertical
300.0	43.2	47	10.5	57.5	-14.3	Horizontal
312.4	39.2	47	10.5	57.5	-18.3	Vertical
312.5	40.3	47	10.5	57.5	-17.2	Horizontal
350.0	39.6	47	10.5	57.5	-17.9	Horizontal
350.0	42.7	47	10.5	57.5	-14.8	Vertical
400.0	42.9	47	10.5	57.5	-14.6	Horizontal
400.0	45.8	47	10.5	57.5	-11.7	Vertical
443.3	41.4	47	10.5	57.5	-16.1	Horizontal
450.0	38.5	47	10.5	57.5	-19.0	Horizontal
468.7	44.9	47	10.5	57.5	-12.6	Vertical
480.0	35.3	47	10.5	57.5	-22.2	Vertical
650.0	40.7	47	10.5	57.5	-16.8	Horizontal
650.0	46.6	47	10.5	57.5	-10.9	Vertical
666.6	43.4	47	10.5	57.5	-14.1	Vertical
700.0	37.9	47	10.5	57.5	-19.6	Horizontal
700.0	42.9	47	10.5	57.5	-14.6	Vertical
860.0	45.1	47	10.5	57.5	-12.4	Vertical

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Rear of EUT – 3 m antenna distance: (1 GHz - 6 GHz)

Frequency GHz	Peak Reading dB μ V/m	Peak Limit dB μ V/m	Peak Margin dB	Average Reading dB μ V/m	Average Limit dB μ V/m	Average Margin dB	Antenna Polarization
1.09	47.4	76	-28.6	43.5	56	-12.5	Horizontal
1.09	46.5	76	-29.5	43.9	56	-12.1	Vertical
1.25	47.8	76	-28.2	39.2	56	-16.8	Vertical
1.40	49.7	76	-26.3	46.4	56	-9.6	Vertical
1.67	50.4	76	-25.6	46.7	56	-9.3	Horizontal
1.95	63.2	76	-12.8	51.2	56	-4.8	Horizontal
1.96	55.8	76	-20.2	51.8	56	-4.2	Vertical
1.98	57.2	76	-18.8	53.9	56	-2.1	Horizontal
1.98	58.5	76	-17.5	52.9	56	-3.1	Vertical
2.0	52.6	76	-23.4	41.6	56	-14.4	Horizontal
2.12	51.1	76	-24.9	47.2	56	-8.8	Horizontal
2.32	49.6	76	-26.4	47.9	56	-8.1	Horizontal
No signals above 3 GHz observed within 20 dB of the specification limit, peak							

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Biconical Antenna – Rear of EUT



Log Periodic Antenna – Rear of EUT



Horn Antenna – Rear of EUT



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The photographs below show the metal enclosure of the system's sides both with and without an external cover panel and the double level of shielding it provides to the rack assembly. Both right and left sides are identical. There are no cable assemblies in this area. By engineering analysis there will be no radiated emissions from the sides of the EUT.



Front View Closeup



Rear View Closeup



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Note regarding measured emissions – Antenna Distance Correction Factor

#: For radiated emissions, the limit is to be increased linearly in accordance with the following formula if the measurement distance is less than 10 meters:

$$\text{New limit (dB}\mu\text{V/m)} = \text{Published limit (dB}\mu\text{V/m)} + 20 \log 10/(\text{new distance [m]})$$

The "Distance Factor" in the emissions table is calculated as:
10 m to 3 m, an increase of 10.5 dB is added to the specification limit.

Specification Limit from EN 55032:2015

**Table A.2 – Requirements for radiated emissions at frequencies up to 1 GHz
for class A equipment**

Table clause	Frequency range MHz	Measurement			Class A limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type / bandwidth	
A2.1	30 to 230	OATS/SAC	10	Quasi Peak / 120 kHz	40
	230 to 1 000				47
A2.2	30 to 230	OATS/SAC	3		50
	230 to 1 000				57
A2.3	30 to 230	FAR	10	Quasi Peak / 120 kHz	42 to 35
	230 to 1 000				42
A2.4	30 to 230	FAR	3		52 to 45
	230 to 1 000				52
Apply only A2.1 or A2.2 or A2.3 or A2.4 across the entire frequency range.					

**Table A.3 – Requirements for radiated emissions at frequencies above 1 GHz
for class A equipment**

Table clause	Frequency range MHz	Measurement			Class A limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type / bandwidth	
A3.1	1 000 to 3 000	FSOATS	3	Average / 1 MHz	56
	3 000 to 6 000				60
A3.2	1 000 to 3 000			Peak / 1 MHz	76
	3 000 to 6 000				80
Apply A3.1 and A3.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1.					

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A.2 CONDUCTED EMISSIONS (Input AC Power Port)

Frequency Range: 0.150 - 30 MHz

EN 55032:2015, Class A, Table A.9

Test Date: 15 October 2020

Test Performed by: Mark Montrose

Test Point: AC mains plug to the facility

Input Power: 480 VAC, 3-phase, 50/60 Hz, 30A

Equipment Used to Perform Tests

Description	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSL6	101333	2/22/19	2/22/21
Voltage Probe	Solar	9533-1	973412	1/7/17	N/A

Test Procedures

Montrose Compliance Services, Inc. EMC Test Procedures, Section A.2

Deviations from Written Test Plan or Test Procedures

None

Results Summary

Refer to the plots provided on the following pages – Complies with Class A limits

Test Results – AC Mains Input

Freq. Range MHz	Quasi-Peak Limit dB μ V	Line 1 dB μ V	Line 2 dB μ V	Line 3 dB μ V
0.150-0.500	79	239 kHz	180 kHz	299 kHz
0.500-30.0	73	70.04 dB μ V Peak	69.22 dB μ V Peak	70.85 dB μ V Peak

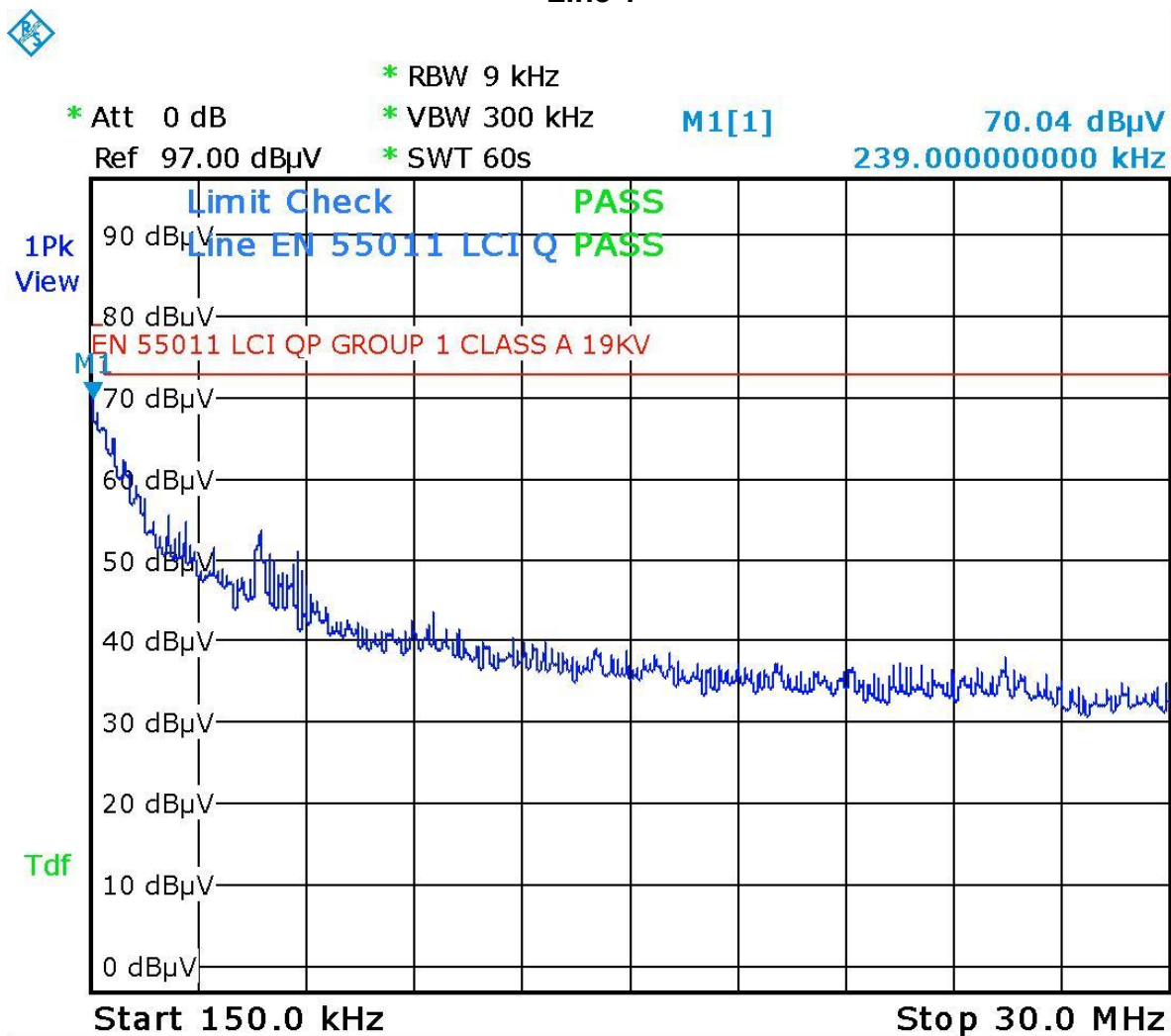
Note: All power supplies, network servers and controllers are CE compliant to the EMC Directive, integrated into a single rack assembly.

Measurement Uncertainty

Measurement uncertainty is 1.04 dB as calculated using a k=2 factor (95% certainty).

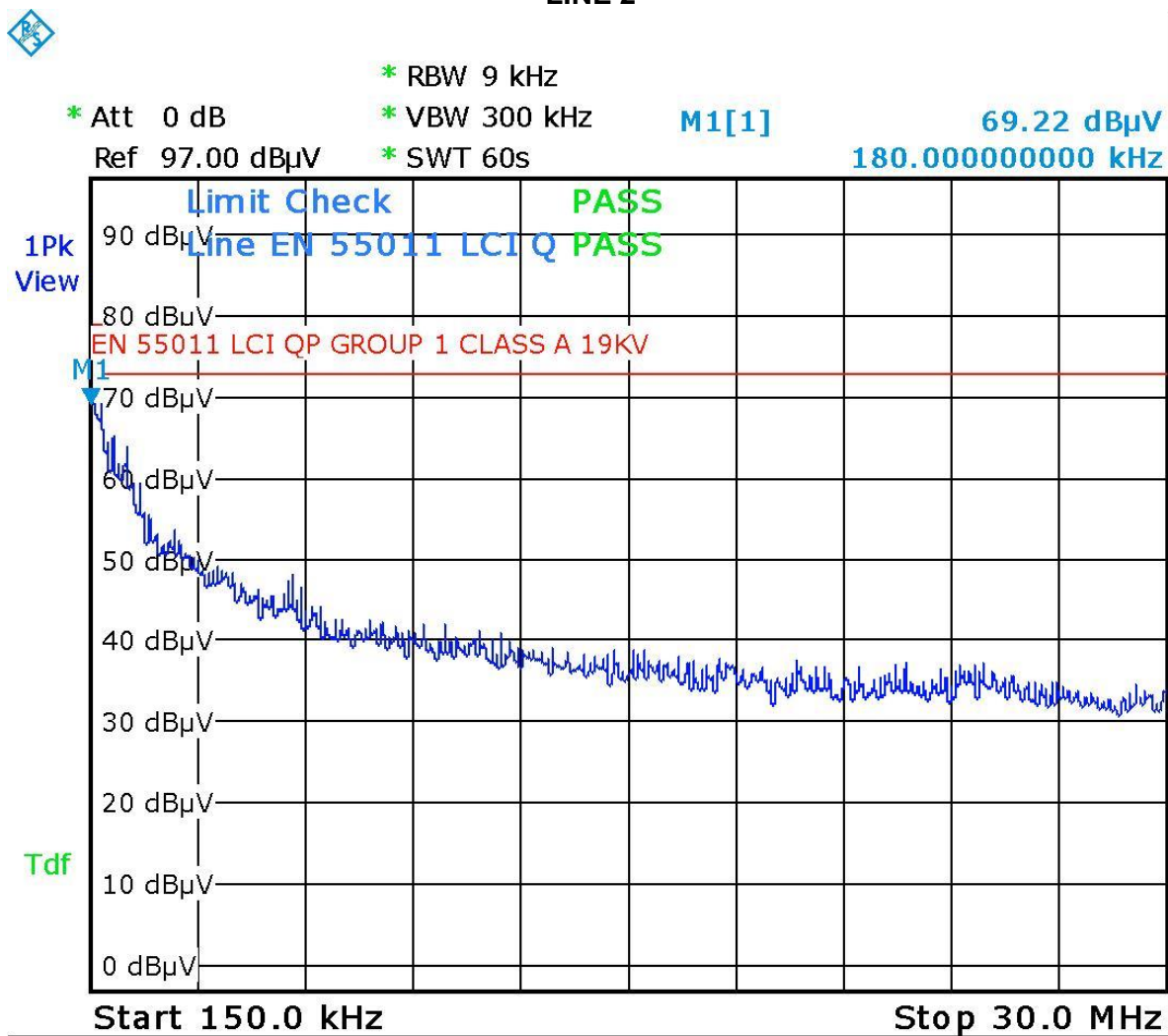
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Line 1



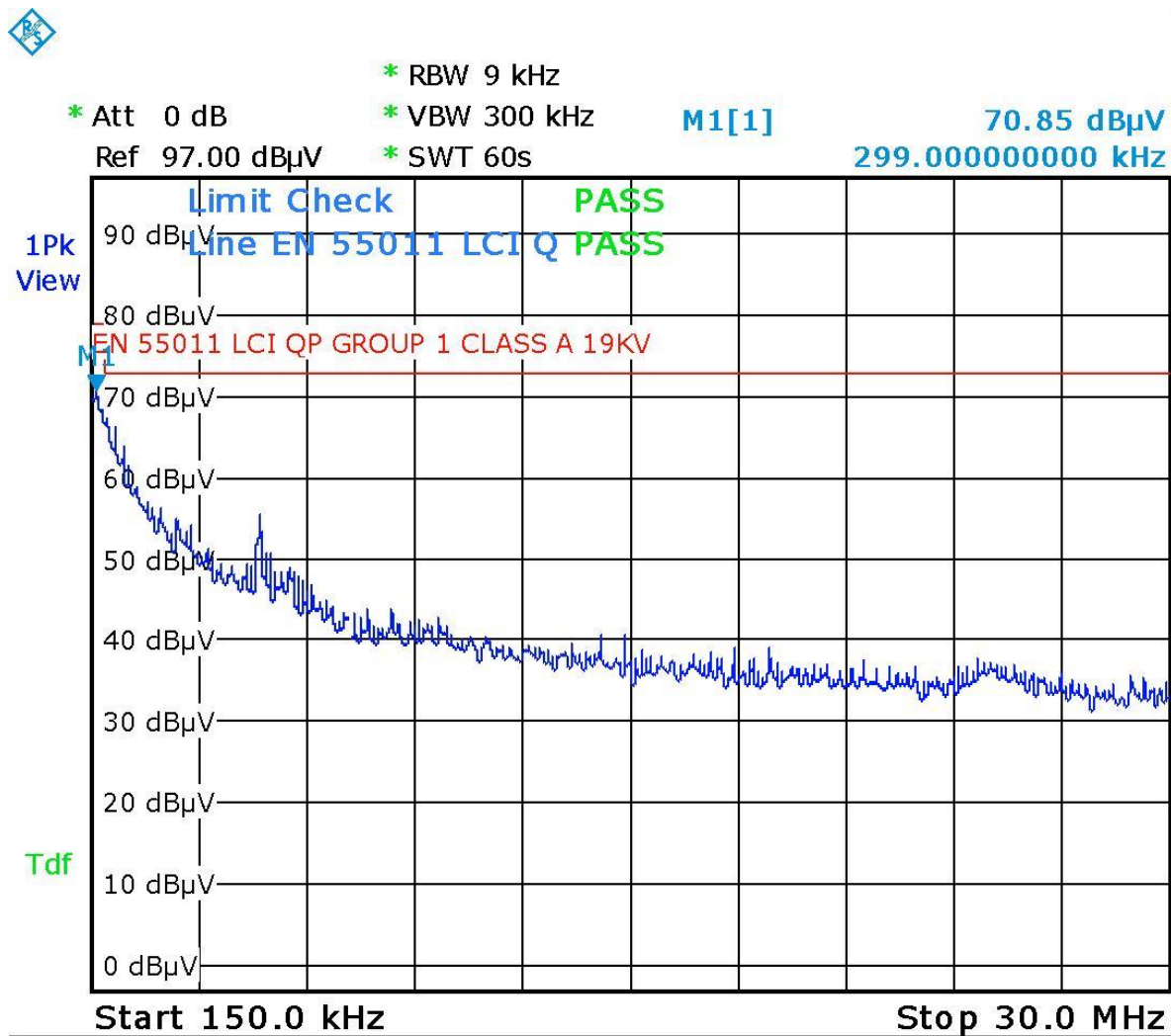
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LINE 2



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LINE 3



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Specification Limit - EN 55032:2015

Table A.9 – Requirements for conducted emissions from the AC mains power ports of Class A equipment

Applicable to				
1. AC mains power ports (3.1.1)				
Table clause	Frequency range MHz	Coupling device (see Table A.8)	Detector type / bandwidth	Class A limits dB(μV)
A9.1	0,15 to 0,5	AMN	Quasi Peak / 9 kHz	79
	0,5 to 30			73
A9.2	0,15 to 0,5	AMN	Average / 9 kHz	66
	0,5 to 30			60
Apply A9.1 and A9.2 across the entire frequency range.				

Photographs of Line Probe Placement Location



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Acceptance Criteria for Immunity Tests

Loss of function, as defined by ITRenew, includes aborting any process, system shut down or fluctuation of data to the point where performance is affected.

Criteria A The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the apparatus is used as intended. In some cases, the performance level may be replaced by a permissible loss of performance. If the minimum performance level or permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user may reasonable expect from the apparatus if used as intended.

Examples include:

No apparent affects; Minor effects (such as dots or lines) to the display terminal which do not affecting the operational process or the accuracy of the processing.

Criteria B The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below *a performance level specified by the manufacturer when the apparatus is used as intended*. In some cases, the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. If the minimum performance level or permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user may reasonable expect from the apparatus if used as intended.

Examples include:

System may show non-critical manufacturing operation failures as long as the equipment continues to operate within specification once the test has ceased or has been restarted. Examples of non-critical failures include: Warning or caution messages which pause the process as a result of the introduction of the noise. The operator needs only to acknowledge the message and restart the process as required. Loss of programming function is an acceptable criterion as long as no hardware damage occurs.

EUT Operation (software, monitoring for failure, general operation and times)

Conditioning speeds and cycles are programmable. All test conditions will be recorded on test data sheets. No upset in the control system should be observed except where the master computer alerts the operator to a problem that may develop and for which operator intervention is required to restart the process. Minor error messages are permitted as long as the system continues to operate in a normal cycle and no harmful results are observed.

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B.1 ELECTROSTATIC DISCHARGE IMMUNITY (ESD IMMUNITY) (EN 61000-4-2:2009)

**Test Severity: +/- 2 kV contact discharge
+/- 4 kV air discharge**

Test Date: 15 October 2020

Test Performed by: Mark Montrose

Test Locations - Refer to list of actual test locations

All user accessible locations on the system

Test Levels

- 4 kV contact discharge, +/- polarity, 1 second between discharges, 50 discharges per location.
- Air discharge testing not possible due to size of the EUT and in situ test limit limitations.

Equipment Used to Perform Tests

Description	Manufacturer	Model	S/N	Cal. Date	Cal. Due
ESD Simulator	Schaffner	NSG 435	1136	4/4/20	4/4/22

Test Procedures

Montrose Compliance Services, Inc. EMC Test Procedures, Section B.1

Deviations from Written Test Plan or Test Procedures

None

System Parameter Monitored for Susceptibility

Process screens were monitored for error messages and out of tolerance readings. Error message log examined.

Test Results

Meets the requirements of: Criterion A. System operates normally after test.

See Table B1a, Direct Air Discharge and Table B1b, Contact Discharge, for test results.

Photographs of Test

Provided herein

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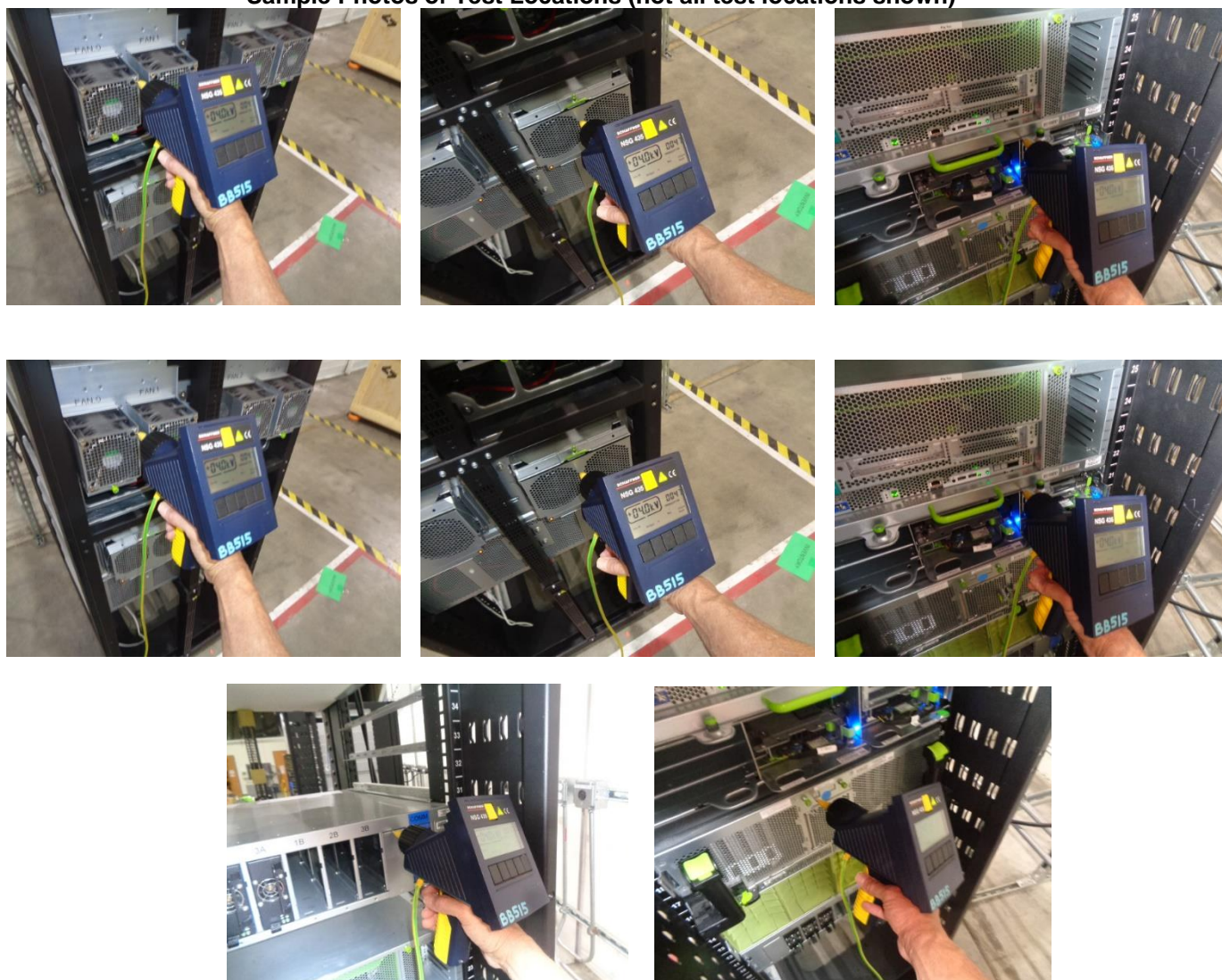
B.1 Electrostatic Discharge Immunity (cont.)

Table B1a - Direct Air Discharge		
Location of Discharge	Voltage +/- kV	Result
Not performed		N/A

Table B1b - Contact Discharge		
Location of Discharge (all user accessible locations)	Voltage +/- kV	Result
Rack frame	+/- 1, 2, 4 kV	No disruption
Rear and front power supply assembly	+/- 1, 2, 4 kV	No disruption
Front of different servers	+/- 1, 2, 4 kV	No disruption
Rear of different servers	+/- 1, 2, 4 kV	No disruption

Note: The EUT is to be located in a light industrial environment with many other data servers.

Sample Photos of Test Locations (not all test locations shown)



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B.2 RADIO-FREQUENCY ELECTROMAGNETIC FIELD IMMUNITY (EN 61000-4-3:2006)

Test Severity: 3 V/m, 80% modulation at 1 kHz

Frequency Range: 80-1000 MHz,

Alternate test frequencies: 27 MHz (AM), 154 MHz (FM,) 462 MHz (FM), 2500 MHz

Test Date: 15 October 2020

Test Performed by: Mark Montrose

Test Locations

Periphery of the machine

Test Levels

Actual levels determined by measuring the transmitted power output using a spectrum analyzer, biconical and log periodic antenna.

Equipment Used to Perform Tests

Description	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSL6	101333	2/22/19	2/22/21
Biconical Antenna	AH Systems	SAS-200/530, 542	1084	11/22/19	11/22/21
Log Periodic	AH Systems	SAS-200/510	1469	11/22/19	11/22/21
Transceiver (27 MHz)	Radio Shack	TRC-222	1370025	Time of Test	
Transceiver (156 MHz)	Radio Shack	TRC-19-1203	41104879	Time of Test	
Transceiver (462 MHz)	Radio Shack	TRC-19-1901	50107965	Time of Test	
Cellular Phone (2400 MHz)	Samsung	Galaxy S10+	4084995533	Time of Test	

Test Procedures

Montrose Compliance Services, Inc. EMC Test Procedures, Section B.2

Deviations from Written Test Plan or Test Procedures

None.

System Parameter Monitored for Susceptibility

Process screens were monitored for error messages and out of tolerance readings.

Test Results

Meets the requirements of: Criterion A. System operates normally during the test.

Photographs of Test

Provided herein

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B.2 Radio-Frequency Electromagnetic Field Immunity (cont.)

Frequency (MHz)	System Response
27 MHz	Normal response, no effect
156 MHz	Normal response, no effect
462 MHz	Normal response, no effect
2500 MHz	Normal response, no effect

Comments

For compliance purposes, transmitters (walkie-talkies) were used. Transmitters simulate the types of RF fields generated by portable transceivers commonly used throughout the world by security personnel, maintenance technicians, and users of cellular telephones. These types of transmitters are the types most likely to be used in the vicinity of semiconductor manufacturing equipment.

The EUT is installed in a controlled environment under strict supervision and security control. Other sensitive semiconductor manufacturing equipment is also located within this same facility, representing multi-million dollar investments. As a requirement, all semiconductor manufacturing equipment must be installed in an electromagnetically clean environment.

Calculation of field strength was determined from measuring the actual field strength from the radios and using the following equation.

$$V / m = 10^{\left(\frac{dBuV / m - 120}{20} \right)}$$

where dBuV / m is measured field strength

Measured field strength calculations 40 cm away from the antenna; calibrate the radios

Radio	Spectrum Analyzer	Antenna Factor	Total (dBμV)	V/m
27 MHz	112 dBμV/m	18	130	3.0
154.65 MHz	116 dBμV/m	14	130	3.0
464 MHz	118 dBμV/m	19	137	7.1
2500 MHz	89 dBμV/m	23.7	112.7	0.5



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Discussion on Waiver of Immunity Test Requirements

From EN 61000-6-2

Generic standards – Immunity for industrial environments

Section 7 of this “Generic” standard allows the manufacturer to waive certain test requirements with regard to performing immunity test requirement if they are not applicable to the EUT per the last paragraph of this section. It is this standard, EN 61000-6-2 that we are testing to and must comply with. The EMC Directive calls out the EN 61000-6-2 standard, “not” the EN 61000-4-x series of test requirements. EN 61000-6-2 however identifies the EN 61000-4-x tests available for conformity testing.

Within EN 61000-6-x are *recommended tests to perform* in order to show compliance with the EMC Directive based on environment of use for immunity purposes. ***The EN 61000-6-2 standard takes priority over the EN 61000-4-x series of tests.*** *Per this legal definition, as long as one justifies not performing a test due to environment of use, compliance with the EMC Directive is assured.*

Section 7 Applicability

The application of tests for evaluation of immunity depends on the particular apparatus, its configuration, its ports, its technology and its operating conditions.

Tests shall be applied to the relevant ports of the apparatus according to Tables 1 to 4. Tests shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of a particular apparatus that some of the tests are inappropriate and, therefore, unnecessary. In such a case, it is required that the decision and justification not to test be recorded in the test report.

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B.3 ELECTRICAL FAST TRANSIENT / BURST (EN 61000-4-4)

ITRenew waives this test for the following reason.

Justification for waiver of this test requirement

This system contains 100% CE processors previously tested and certified compliant. Also, due to the installation of this very expensive data processing rack within a data center that contains numerous other rack assemblies, each very expensive, 100% uptime is required to ensure Internet connections are never disrupted 24/7. All I/O are fiber optic. The only cable is the power cord. Within data centers there are no inductive loads or industrial equipment that could inject an EFT burst into the power distribution network carrying thousands of amperes of current which is a requirement by the owner of these data centers.

If tests are performed, results are for information purposes only. A pass/fail criterion will not be applied to the test results.

B.4 SURGE TESTING (EN 61000-4-5)

ITRenew waives this test for the following reason.

Justification for waiver of this test requirement

This system contains 100% CE compliant products previously tested and certified compliant. Also, due to the installation of this very expensive data processing rack within a data center that contains numerous other rack assemblies, each very expensive, 100% uptime is required to ensure Internet connections are never disrupted 24/7. All I/O are fiber optic. The only cable is the power cord. These facilities are well protected against a surge event to ensure continuous uptime performance. In addition, owners of data centers containing millions of Euros of equipment are provided with UPS system that ensure uptime and to minimize the potential of a surge event from cause functional damage.

If tests are performed, results are for information purposes only. A pass/fail criterion will not be applied to the test results.

B.5 RADIO-FREQUENCY CONDUCTED FIELD IMMUNITY (EN 61000-4-6)

ITRenew waives this test for the following reason.

Justification for waiver of this test requirement

This system contains 100% CE compliant products previously tested and certified compliant. All I/O interfaces are fiber optic, not one cable carrying copper wire is associated with this rack assembly, besides the power cord.

If tests are performed, results are for information purposes only. A pass/fail criterion will not be applied to the test results.

B6. MAGNETIC POWER LINE FIELD SUSCEPTIBILITY (EN 61000-4-8)

ITRenew waives this test for the following reason.

Justification for waiver of this test requirement

There are no components within the system that is susceptible to magnetic power line field disruption.

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B7. VOLTAGE DEVIATION, SHORT INTERRUPTIONS AND VARIATIONS (EN 61000-4-11)

ITRenew waives this test for the following reason.

Justification for waiver of this test requirement

Expensive data centers must ensure all equipment never has downtime, operating 24/7. To ensure the facility never encounters a voltage input situation, UPSs are provided per rack assembly. In addition, all internal power supplies are CE compliant to this test requirement. In addition, it is difficult to vary voltage on 480 VAC three phase connection.

A pass/fail criterion will not be applied to the test results. The voltage tolerance of the system is +/- 5%, far below that of the test specification.

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Equipment Used to Perform Tests

Description	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSL6	101333	2/22/19	2/22/21
Loop Antenna	AH Systems	SAS-563A	408	7/15/19	7/15/21
Biconical Antenna	AH Systems	SAS-200/530, 542	1084	11/22/19	11/22/21
Log Periodic	AH Systems	SAS-200/510	1469	11/22/19	11/22/21
Horn Antenna	AH Systems	SAS-571	2209	9/8/19	9/8/21
Voltage Probe	Solar	9533-1	973412	2/4/18	N/A
ESD Simulator	Schaffner	NSG 435	1136	4/4/20	4/4/22
Transceiver (27 MHz)	Radio Shack	TRC-222	1370025	Time of Test	
Transceiver (156 MHz)	Radio Shack	TRC-19-1203	41104879	Time of Test	
Transceiver (462 MHz)	Radio Shack	TRC-19-1901	50107965	Time of Test	
Cellular Phone (2400 MHz)	Samsung	Galaxy S10+	4084995533	Time of Test	