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| Equipment<br>**Big Sur (Quanta)** | Page | |

# Big Sur (Quanta)

# TECHNICAL FILE

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


**ITRenew**
**8356 Central Ave.**
**Newark, CA 94560**
**USA**

# Big Sur (Quanta)

# TECHNICAL FILE

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

**ITRenew**
**8356 Central Ave.**
**Newark, CA 94560**
**USA**

Aidin Aghamiri
VP, Corporate Strategy

# MANUFACTURER

Company: ITRenew
Address: 8356 Central Ave.
Newark, CA 94560
USA

Product Name: Big Sur (Quanta)

Product Classification: Data Processing Equipment (ITE)

Product Environment : Commercial / Light Industrial

Standards Applied: EMC Directive 2014/30/EU
EN 61000-6-1
EN 61000-6-3 (EN 55032, Class A)

## Responsible Party

**USA**
Aidin Aghamiri
VP, Corporate Strategy
8356 Central Ave
Newark, CA 94560
USA

**Europe**
Bâment Aristote - Parc des Algorithmes
Route de l'Orme des Merisiers
91190 Saint-Aubin, France

# TECHNICAL FILE
# AMENDMENT RECORD

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The following have reviewed the Technical File for the above system and certify the accuracy of the contents.

Mark J. Montrose

Date: 15 October 2020

Mark Montrose
EMC Consultant

____________________________

Date: ______________

Aidin Aghamiri
VP, Corporate Strategy

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# 1 INTRODUCTION

## 1.1 PURPOSE OF A TECHNICAL FILE

This document is the Technical File that declares conformity to the essential requirements of Europe's EMC Directive for ITRenew's Big Sur (Quanta) data processing rack system used within a commercial data processing center.

Compliance with the Electromagnetic Compatibility (EMC) Directive (2014/30/EU) is mandatory for all electrical and electronic equipment imported into the European Union after 1 January 1996. The EMC Directive requires that all apparatus to which it applies shall comply with basic protection requirements:

(a) The electromagnetic disturbance generated by the apparatus does not exceed a level allowing radio and telecommunications and other apparatus to operate as intended;

(b) The apparatus has an adequate level or intrinsic immunity to electromagnetic disturbance to enable it to operate as intended.

The Directive allows two routes to compliance:

(1) Manufacturers can test products to the generic or specific standards published in the Official Journal.

(2) Manufacturers may elect to follow the Technical File route.

**Article 14 of the EMC Directive states:**

Compliance of apparatus with the essential requirements set out in Annex I shall be demonstrated by means of either of the following conformity assessment procedures:

(a) internal production control set out in Annex II;

(b) EU type examination that is followed by Conformity to type based on internal production control set out in Annex III.

The manufacturer may choose to restrict the application of the procedure referred to in point (b) of the first paragraph to some aspects of the essential requirements, provided that for the other aspects of the essential requirements the procedure referred to in point (a) of the first paragraph is applied.

**Annex I of the EMC Directive, which is relevant to Article 14 and this Technical File states under Essential Requirements.**

**1. General requirements**

Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure:

(a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

(b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

**2. Specific requirements for fixed installations**

Installation and intended use of components

A fixed installation shall be installed applying good engineering practices and respecting the information on the intended use of its components, with a view to meeting the essential requirements set out in point 1.

## 1.2 TECHNICAL FILE OVERVIEW

The argument for conformity is presented in variant forms described in Section 2. This is based upon three chief criteria:

1. A series of tests carried out upon one or more identified configurations.
2. An analysis of the technical design that demonstrates the incorporation of components or other measures that is beneficial in terms of EMC.
3. Evidence of a quality system that fully describes the product in its design and manufacture and has procedures that can demonstrate adequate engineering control over the build at any stage in the product life-cycle.

The system is subjected to EMC test. Results provided in Annex C (Test Report section). A listing of all modules and parts of the product whose compliance this file seeks to justify is given in Section 2.

In its basic form, the product consists of major components identified in Annex A.

## 1.3 ROUTE TO COMPLIANCE

All relevant apparatus placed on the market after 31 December 1995 is required to comply with the European Union Directive on EMC. The Directive is primary European Union legislation and acts through enacted national legislation to enforce its provisions. All European countries have such legislation in place.

A product may comply with the EMC Directive in two main ways: Self-Declaration or Technical File. For a product in this category, self-certification would involve the testing and certifying of each combination and layout to all relevant standards. In contrast, the Technical File route for compliance is ideally suited to a product where flexibility in configuration and layout is a design feature. Because the Technical File is constructed by analysis of the product design and manufacture as well as testing to an agreed Test Plan, the product does not require re-testing as standards change or evolve. Changes in the intended environment or modifications or additions to the product may however result in a requirement for full or partial retest.

Whether the manufacturer self declares or utilizes the intervention of a Notified Body, the manufacturer must draw up technical documentation to support their claim of compliance; furthermore, under Annex III, item (7), of the EMC Directive, products may need to be retested as standards change or evolve.

## 1.4 ELECTROMAGNETIC ENVIRONMENT

The system is installed in a commercial or light industrial environment. These facilities are exempt however the equipment internal must comply with the requirements of the EMC Directive. This unit are installed in a controlled environment. The actual electrical and electromagnetic environment in which the system operates is a mixture of that found in the industrial and light industrial sectors. This is discussed in Section 3 of this document (Technical Rationale) where an analysis of the operating environment is provided. The important features and details of the operating environment particular to this system is described and related to a series of proposed tests with associated appropriate test levels. This forms an important basis for supporting evidence in the manufacturer's claim for conformity with the protection requirements of the European Union Directive on EMC.

## 1.5 DECLARATION OF COMPLIANCE

Based on the documentation provided in this Technical File, supported by test data, ITRenew hereby claims compliance with all of the essential requirement of European Union’s EMC Directive 2014/30/EU.

# 2 EQUIPMENT DESCRIPTION

The Big Sur (Quanta) system consists of several major components and assemblies:

**1. Open Rack 41 OU Open Compute Rack**

- Tool-free installation, easy deployment and maintenance.
- Open Rack with removable cable tray for optimal cable management.
- Compatible with all Open Rack IT systems.
- User friendly with easy operation.
- Containing 18 sets tool-free support brackets per rack; brackets provides 2 OU space and adjustable in 0.5 OU height.
- Contains 4 swivel casters, level feet and anchoring holes, easy to fix with rack under different data center floor conditions.

**2. PDU (Power Distribution Unit)**

- Integrated PDU 208-415 VAC input

**3. Power Shelves**

- Rack mounted power shelf consumes 3 OU space
- Power shelf (6 units at 2100W each)
- Each power shelf supplies 12V/408A to each of the 3 bus bars
- Power zone covers 20 OU of rack space
- Integrated power cell 208-415 VAC input

4. **OCP Compute Node**

- Big Sur module
- Graphic processing unit server (GPU)

**Front View**

**Big Sur Module**


## 2.1 DOCUMENTATION

Both electrical and mechanical drawings are controlled documents and form the basis for compliance of this machine. Any change to these drawings that may significantly affect the EMC performance of the system, upon their implementation, shall be tested or analyzed in accordance with the requirements laid down in Sections 3 and 4 of this Technical File.

## 2.2 DIMENSIONS / POWER REQUIREMENTS

**Delta Open Rack**
Rack Height: 82.7 inch (2,100 mm)
Rack Width: 23.6 inch (600 mm)
Rack Depth: 42 inch (1067 mm)

**Power Requirements**
208-480 VAC, 3-phase, 50/60 Hz, 30 A max

## 2.3 SYSTEM VARIANTS

| Item |
|---|
| Number of disk drives and servers |

## 2.4 SYSTEM OPTIONS

The following hardware and software options are available.

| Item |
|---|
| None |

There are few OEM components internal to the platform. Since the system is evaluated as a single entity, all purchased OEM parts are considered an integral part of the system.

For those items that have an effect on the EMI environment, a third-party option is accepted for use with the system under the following conditions:

- It has been CE-marked with respect to the EMC Directive.
- It is suitable for industrial use.
- The declaration of conformity for the option has been added to Annex A.
- The model type has been included in the list of certified options in Annex A and signed as acceptable by a competent EMC engineer.

## 2.5 INTENDED OPERATING ENVIRONMENT

The system is designed for use in a data center which is installed in a light industrial building at a distance from other commercial facilities for security reasons and to prevent the harmful effect of high-power commercial broadcast stations from causing potential interference. This facility should preclude any external EMI from affecting its operation. The system must be grounded by bonding to the ground connection of the electrical service and at the machine's frame to the well-grounded metallic floor per safety installation requirements.

**Storage Environment**

If the system or any sub-system requires temporary storage in an area other than its operating environment, the following should be maintained.

The system or sub-system must remain in the original shipping package with all plastic coverings in place. The temperature must be maintained at 72°F +/- 25°F (22.2°C +/- 13.8°C). This temperature requirement is necessitated to prevent residual water from freezing in liquid handling components.

## 2.6 COMPONENTS WITH AN AFFINITY TO THE EMC DIRECTIVE

| Part Number | Description |
|---|---|
| SB000434 | Big Sur DDR4 Dual Xeon 2678v3/512GB RAM ECC DDR4@2400MHz/8xK80 GPU/8x960GB SSD/Dual 25Gbe SFP+ PB |
| S000261 | Big Sur BASE 4OU DDR4 w/o CPU/heatsink/memory/storage/NIC PB |
| S000068 | CPU Xeon 2678v3 2.5GHz LGA2011-3 |
| S000263 | CPU Heat Sink LGA2011-3 Big Sur |
| S000226 | 32GB RAM ECC DDR4 @2400Mhz PC4-19200 |
| S000066 | CR2032 Lithium battery |
| S000083 | 25GbE NIC OCP board Dual port SFP28 + mezzanine Leopard V1 and V2 |
| S000380 | Big Sur 2OU metal filler |
| S000368 | Drive 960GB 2.5in SSD SATA |

# 3 ELECTROMAGNETIC COMPLIANCE ASSESSMENT

This section describes the basis for claiming compliance with the European Union Directive on EMC in accordance with the following major points:

1. A detailed discussion of the environment in which system operates.
2. Overview of the EMC Test Plan used to demonstrate compliance with the EMC Directive.
3. Test results are provided in Annex C.

## 3.1 ELECTROMAGNETIC ENVIRONMENT

**Historical Perspective**

There are many products installed throughout the world operating satisfactorily in their environments. The requirements of the Directive do not make the actual threat to the product worse but are more likely to ameliorate the environment as other equipment is brought within the protection requirements of the directive.

While the historical perspective is important in reflecting on the previously recognized threats to the equipment, these threats are growing and changing with the increasing use and operation of more sophisticated and readily available electronic equipment, especially communication devices operating in previously unavailable frequency bands. A re-examination of the current threat is therefore validated and is performed in this section of this Technical File.

The possible major electromagnetic threats to the product are from localized sources such as broadcast transmitters at over 2 km distance, CB radio, amateur radio, cellular telephone and mobile radio including hand-held walkie-talkie radios. Low frequency noise from large AM broadcast transmitters could reveal itself as conducted interference on power and long signal cables.

The threat from transient sources is confined to local effects from electrostatic discharge and power and signal line conducted transient noise.

The system does not contain magnetically sensitive components. There is no identifiable risk to the product from power frequency magnetic fields. Any threat that may occur would be extremely minor, and thus could not affect functional operation of the unit.

## 3.2 EMC CLASSIFICATION

### 3.2 1 Equipment Classification for Emissions

The system is used in commercial or light industrial environments and classified as Information Technology Equipment (ITE).

The relevant harmonized standard for this type of equipment is EN 55032, which was derived by CISPR *(*International *Special Committee on Radio Interference)* principally in order to protect radio communications from undue interference caused by equipment or appliances which generate or use locally radio frequency energy as part of their means of operation.

EN 55032 further defines two classes for the purpose of additional clarification of the emissions limit. Equipment installed in a domestic establishment or directly connected to the public low voltage network that supplies such establishments is required by the standard to meet the tighter Class B emissions limit. Equipment installed in other locations is required to meet Class A limits which this system is installed within.

The system is intended for use in a light industrial environment not using any intentional transmitters. The product is therefore classified as Class A per EN 55032, unintentional radiator.

### 3.2.2 Equipment Classification for Immunity

In determining the electromagnetic phenomena and tests to be applied, guidance has been sought from both published and draft standards and discussion documents. Due consideration has been given to the generic Euro Norme standard for industrial applications, EN 61000-6-2, in defining the performance criteria against which the equipment immunity can be assessed and in identifying pertinent basic standards as a reference for test methods and procedures. A major shortcoming of the generic approach is in the application of one single severity level for particular electrical and electromagnetic phenomena that can, in practice, encompass a wide range over the whole of the very broad industrial environment. This can therefore at best be a compromise between very different conditions at the environmental extremes.

A more focused approach has been determined by taking due account of the actual threat posed to the product in its normal working environment. Additional attention has been paid to the general guidelines for the selection of severity classes contained within the basic standards themselves and by reference to IEC and CENELEC working group publications notably IEC1000-2-5 (Classification of Electromagnetic Environments).

Overall emphasis, however, has been given to the special and particular circumstances pertaining to the installation and operation of the equipment in its normal working environment.

This section provides the basis upon which compliance with the European Union Directive on EMC is demonstrated.

## 3.3 ENVIRONMENTAL CLASSIFICATION

The product is identified as Class A equipment under the Information Technology Equipment (ITE) classification and has been designed for use in commercial or light industrial applications. The environment in which this server is intended to operate is generally well controlled with regard to electromagnetic compatibility.

## 3.4 EMC TESTS

Since the nature of the Technical File is to confirm conformity with the protection requirements of the European Union Directive on EMC, it is necessary to make full provision for the equipment in its normal operating environment. This can or may include tests agreed between the manufacturer and customer as being of equal validity or even more suited to the nature of the equipment and its environment than provided for by the use of CENELEC (*European Committee for Electrotechnical Standardization*) harmonized standards alone. It may also exclude certain tests as not being applicable or necessary as determined by consideration of the design of the product or of the nature of the environment in which it is used.

The EMC Test Plan is contained in Annex B. The date and issue number of the Reference Standard for both emissions and immunity are given within the Test Report.

### 3.4.1 Configuration

Any auxiliary equipment required to perform the tests shall be located outside the influence of the test environment.

All external connections shall be made (including computer interfaces and any other external connections) and terminated in a representative load if they are not connected to the equipment that normally forms the output for the product.

At least one port of each type shall be connected to a device enabling the performance of that circuit to be assessed throughout the test. Variation to the layout and orientation of cables and other items external to the enclosure port shall only be permitted between tests when demanded by limitations of the test site.

The whole assembly when finally configured shall be known as the Equipment Under Test (EUT). A note and photographic record of the layout, including the positioning of test instrumentation where relevant, shall be made and presented with the test report.

All tests shall be carried out on a system comprised of standard production units. All tests shall be carried out on the same system. The EUT shall be available solely for the purposes of EMC testing during the test program. Where tests are performed on prototypes, the differences between the production units and the prototype units shall be clearly defined in the test report. Before the product can be accepted as compliant, drawings shall be produced to implement the modifications which the EMC tests demonstrates are required and an engineering change order shall be raised to authorize the change to production models.

The "worst case" system configuration as determined by maximum emissions and immunity shall be tested.

## 3.5 DESCRIPTION OF TEST SITE

Due to the physical characteristics of system (physical size, weight, power requirements, etc.), in situ testing is required. This Technical File includes all components of the rack assembly.  Tests were performed in a manufacturing and test environment.  It is not possible to transport this rack assembly to a commercial EMC test laboratory thus in situ testing.

In situ testing includes the following concerns:

- Physical arrangement of the test setup
- Limitation in test environment (in situ)
- Auxiliary equipment
- Local environment

For radiated emissions, the limit was increased linearly in accordance with the following formula:

New limit (dBµV/m) = Published limit (dBµV/m) + 20 log (10/new distance [m])

Example:  For a reduction from 10m to 3m, an increase in the limit of 10.5 dB would be added to the measured value.

## 3.6 Cables

All power, signal and control cables used for the system shall be of the type and length specified by the manufacturer or typical of customer usage. Where no maximum length is specified in the manufacturer's literature, a length of 5m shall be used.

The cables shall be connected in accordance with standard installation practice as far as possible.  Excessive length shall be bundled in a non-inductive manner (e.g. figure-eight) as appropriate and in accordance with the relevant test standard.  The cables should be placed parallel to the antenna.  Where cable loops have to be used, the diameter of the loop for each cable-form shall be stated in the test report.

The layout and orientation of cables and other items external to the enclosure port shall be arranged to generate the worst-case emissions. The cable layout shall not be altered between tests.

Any additional EMC measures (e.g. ferrite absorbers, surge arresters, and the like) specified by the installation instructions shall be fitted in accordance with those instructions prior to the tests.

## 3.7 Equipment Requirements

As far as possible, the requirements of CISPR 16-1 shall be complied with. Any deviations from these requirements shall be clearly stated in the test report, with reasons given.

If adequately documented in a test report the use of on-site measurements may be acceptable. The on-site measurements will suffer from a very much less controlled environment, so the actual environment that applies at the time of test should be even more clearly documented than it would be if measurements were being performed in shielded rooms and on an approved Open Area Test Site.  As part of the test report, a marked-up plan of the equipment should be provided to show the apparatus under test in conjunction with its auxiliary support equipment, power supply routing, clearances to other equipment in operation, walls and other obstructions, other reflecting surfaces, antenna positions etc.  All non-compliant emissions should be explained by reference to plots of ambient background levels.

## 3.8 Use of Spectrum Analyzers for Emissions Measurements

EMC emissions measurements have traditionally been performed using EMI receivers. Spectrum analyzers are also capable of performing emissions measurements, but have several inherent disadvantages when compared to EMI receivers:

1. Spectrum analyzers have an open, wide-bandwidth input that can be overloaded in the presence of large EMI signals, whether in-band or out-of-band. Signal overload causes signal compression and frequency shift. This can be prevented with the use of a pre-selector that eliminates out-of-band signals. If a pre-selector is not employed, an external attenuator shall be connected to the input of the spectrum analyzer to detect for overload. The measured signal should be reduced by the value of the attenuator, that is, if a 10dB attenuator is inserted, the measured signal should reduce by 10dB. If the measured signal is not reduced by that factor, this indicates that the receiver is overloaded. When relevant, the test report shall state that this test has been performed.
2. Most spectrum analyzers do not have quasi-peak and average detectors that comply with CISPR 16 requirements. If possible, a quasi-peak adapter should be used which provides the compatibility with CISPR 16.
3. Where the quasi-peak adapter is not used, care must be taken to ensure that the correct resolution and video bandwidths are used and that the sweep time is consistent with the requirements of CISPR 16.
4. Spectrum analyzers are limited in the number of points (typically 400) recorded across the frequency span. This may result in an inadequate resolution. Where necessary, sweeps over smaller frequency spans shall be carried out, particular where the ambient noise is in excess of the emissions limit. Where smaller frequency spans are used and the ambient is in excess of the limit, the ambient measurements shall be made at corresponding frequency spans.

In all cases the test report shall record the following settings of the spectrum analyzer as a minimum:

- Detector type (peak hold, peak, quasi-peak, average)
- Resolution bandwidth
- Video bandwidth
- Sweep time.

### 3.8.1 Operational Considerations

The EUT shall be exercised as fully as possible during the tests in accordance with its functional specification. In case of doubt, pre-scans shall be performed to determine the most appropriate mode that maximizes the particular (radiated or conducted) emissions of the equipment. If modification or replacement of sub-units is considered necessary during the test program this shall be duly noted in the test report.

A record of all test routines and algorithms used to exercise the equipment during the tests shall be maintained.

## 3.9 TEST PROGRAM

Results from in situ tests are provided in Annex C.

### 3.9.1 Radiated Emissions

Emissions are a measure of electrical energy emitted from a product. These emissions are generally from digital switching logic, power supplies, display terminals, I/O interconnects, and the like. Emissions are also identified as Radio Frequency Interference (RFI or EMI).

As the name implies, EMI deals with threats in the RF, or radio frequency, range. Traditionally, this begins at about 10 kHz on the low end and usually extends to 500 to 1000 MHz for commercial applications, and to 40 GHz (radar frequencies) for military or aircraft applications.

The greatest concern for radiated emissions is to prevent harmful interference to radio communication services, aircraft navigation systems, other digital products, process control systems, and home and office electronic equipment, including home entertainment.

The frequency range that is applicable for Information Technology Equipment (ITE) is 30 to 1000 MHz. Measurements are made using a spectrum analyzer and antennas appropriate for the frequency range of interest. Measurements are taken 360 degrees around the test system (four sides for in situ tests) with the antenna at various heights from one to four meters. International procedures for performing emissions testing exist, and must be followed exactly by knowledgeable and experience engineers who are able to ascertain if emission recorded on the spectrum analyzer is the device under test or an ambient signal.

### 3.9.2 Conducted Emissions

Conducted emissions refer to the placement of RF energy into the AC mains distribution network of a building or facility from a device, generally a digital device. This test is also identified as Line Conducted Interference (LCI), and is measured in the frequency range 150 kHz to 30 MHz using a voltage probe, a current probe, or a Line Impedance Stabilization Network (LISN).

Noise may be injected into the AC mains from the switching effects of the power supply (switching transformer), digital logic bouncing the power supply return system, or radiated coupling into the logic or control circuitry of the power supply. This coupled RF energy, radiated or conducted, is observed on the power supply input cord. Use of a line filter removes this conducted emission, or reduces the levels of RF energy to acceptable levels.

### 3.9.3 Electrostatic Discharge

The accumulation of tribo-electric charge occurs when two non-conductive materials are in frictional contact with each other. The amount of charge accumulated is dependent on many factors including the type of material and humidity. The human body can be charged to several kV by such a process. When a conductive surface is approached, the charge may be transferred via a spark discharge when the potential gradient exceeds the breakdown threshold of air. The effects of a discharge of several kV can range from catastrophic damage to sensitive components to temporary malfunction due to secondary discharge effects such as re-radiation into an enclosure or onto sensitive circuitry.

Since an operator may approach and make contact with the machine, there is a real threat from ESD. However, the electronics control circuits are mounted in a metal cabinet that encloses the electronic assemblies, cables and terminals and thus protects these from operator contact. The area of direct contact is therefore limited to the outside surfaces of the machine and the controls.

In order to effectively simulate and assess the immunity of the product to an ESD event, a of tests is arranged in accordance with an internationally agreed set of procedures and test methods. An accepted test method involves an air discharge from an ESD gun where the rounded tip of the probe is used to simulate a human finger. However, the most critical parameter in the ESD event is the rate of change of discharge current. In this regard the air discharge suffers from several disadvantages, notably that the effective discharge current is strongly dependent on factors such as speed of approach to the target and relative humidity of the surroundings. A more predictable and therefore more reproducible discharge is obtained by a contact discharge method where the ESD gun, fitted with a sharp, pointed tip, is placed in contact with the target before firing.

The contact discharge tip shall not penetrate protective coatings, which are intended to provide insulation. In this and other cases where contact discharge cannot be applied, air discharge to 4kV shall be tested. Direct discharge to connector pins shall not be performed.

When air discharge is performed, the discharge must be to a horizontal coupling plane at the bottom of the equipment and/or vertical coupling plane to the side of the equipment. At least 10 discharges at a test level of 4kV of each polarity shall be applied.

Test points shall be identified with a description of the type and number of discharges applied and any effects noted. Test points shall include but not be limited to:

- Areas around apertures and slots in the enclosure
- Exposed operator controls
- Fixing hardware
- All connector shells and cable screens (where used).

This is the preferred method employed for the tests carried out on the EUT. Where contact discharge cannot be achieved, an air discharge is used.

This test is performed in accordance with standard EN 61000-4-2.

### 3.9.4 Radiated RF Immunity

Threats to the product are from local transmitting sources, principally mobile security radios. These typically have an output power rating of not more than 5 Watt. Some threat may also exist from other sources such as CB (see section 3.3.6) and amateur radio, military and broadcast communications and cellular telephones. These have limited frequency bands within the range of 80MHz to 1000MHz plus 2.45 and 5.8 GHz. The radio frequency intensity in the vicinity will also be limited by control of access and the operation of such transmitters within the immediate vicinity prohibited.

Site location and corresponding proximity to large AM or FM transmitters will be not less than 5km (reference IEC1000-2-5). The level of field Effective Radiated Power (ERP) that produces can be estimated as follows, related to field and distance as:

$$ERP = \frac{E^2 r^2}{30}$$

Where E is the field strength in V/m and r is the distance from the transmitting source in meters.

$$E = \frac{\sqrt{30ERP}}{r}$$

a 50kW transmitter the field at 5km is 0.2V/m. For a 500kW transmitter at the same distance the corresponding field is still less than 1V/m. However, the directivity of the antenna, type of terrain, weather and other environmental factors can affect this. The IEC1000-2-5 simplistically regards all antennas as dipoles in its table of output powers for various source types. This is contained in Annex B of that document. Here the field from a 500kW transmitter is shown as 1V/m at 5km and up to 3V/m at 1.5km. The maximum field from this type of transmission source is therefore unlikely to exceed 3V/m under worse case conditions.

On basis of previous empirical work (*ERA/Edf*) the field from a walkie-talkie is statistically averaged to be

$$E = \frac{3\sqrt{P}}{d}$$

$$= 7Vm^{-1} \quad 5W \text{ at } 1m$$

The difference between this level and the theoretical level (16V/m) derived by assumption of a uniform area of illumination from a dipole antenna is mostly due to absorption of energy by the human operator of such a device and other relative inefficiencies in the antenna such as the absence of a solid ground plane.

The possible level of radiated interference from adjacent equipment located in the same room or nearby is considered to be less than that from these intentional transmitters since such equipment is also limited in its radio frequency emission profile to levels considerably below that which would form a realistic threat to the machine. A level of 37dBµV/m at 30m equates to only 66dBµV/m at 1m ignoring near field effects. This is less than 0.5V/m at 1m. Any induction effects that did exist would be limited by enclosure materials, which fall off rapidly (inversely with the cube) with separation distance.

Cables emanating from equipment can act as antennae. Cable-to-cable coupling is minimized by layout and separation guidelines. Upper frequency coupling (above 80MHz) is well simulated by radiated electromagnetic field testing onto the system including enclosure and cables. Optimum coupling onto machine cables with a typical length of 1m to 3m will be in the mid-VHF to lower-UHF frequency range.

In lieu of the frequency sweep, use of radios (transceivers) may be substituted. Use of radios simulates actual conditions that would be present in a controlled commercial or light industrial environment. Typical radio frequencies and those that would be used by security personnel and others include: 27-40/150-174/450-474/1200-3800 MHz.

If radios are used in place of the frequency sweep, the field strength of the radios must be recorded at a specific distance away from the EUT. Details on the calibration procedure and field strengths must be provided within the Test Report. This test is performed in accordance with standard EN 61000-4-3.

### 3.9.5 Electrical Fast Transients

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.

EFT is applied to the following ports in accordance with EN 61000-4-4 with no noticeable errors:

- AC mains port: ±2 kV, 5/50 $t_{rise}/t_{fall}$ (ns), 5 kHz repetition frequency
- DC input and output ports: ±1.0 kV, 5/50 $t_{rise}/t_{fall}$ (ns), 5 kHz repetition frequency
- Signal and control lines: ±1.0 kV, 5/50 $t_{rise}/t_{fall}$ (ns), 5 kHz repetition frequency

<u>Justification for waiver of this test requirement</u>

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. 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.

### 3.9.6 Surge

Surge is a significant threat to long cables only. In the case of critical data processing equipment, the only ports at risk are the mains input port. An assessment of the environment in which the machines operate based on IEC 1000-2-5 leads to the following threat levels:

- AC mains port: ±2 kV, 1.2/50 (8/20) $t_{rise}/t_{fall}$ (μs), Common Mode
  ±1 kV, 1.2/50 (8/20) $t_{rise}/t_{fall}$ (μs), Differential Mode
- DC input and output ports: ±0.5 kV, 1.2/50 (8/20) $t_{rise}/t_{fall}$ (μs)

A combination wave generator should be used to apply a total of 5 surges in common mode and differential mode to the applicable amplitude. This test is performed in accordance with standard EN 61000-4-5.

<u>Justification for waiver of this test requirement</u>

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.

### 3.9.7 Conducted RF Immunity

A 3Vrms conducted RF immunity signal over the frequency range 150 kHz to 80 MHz is applied to the following cables that exceed 3m length in accordance with EN 61000-4-6:

- AC mains port: 0.150-80 MHz, 10 V(*rms*), 80% AM at 1 kHz (AM modulated)
- DC input and output ports: 0.150-80 MHz, 10 V(*rms*), 80% AM at 1 kHz (AM modulated)
- Signal and control lines: 0.150-80 MHz, 10 V(*rms*), 80% AM at 1 kHz (AM modulated)

This test demonstrates the immunity a data processing system equipment to conducted RF threats up to 80 MHz. The immunity for higher frequencies is demonstrated by the RF radiated field test.

<u>Important Note</u>
It must be noted that the test voltage given in the above specification is the open circuit (EMF) voltage to be applied. Paragraph 6.4.1 and Annex A, paragraphs A1 and A3 in EN 61000-4-6 indicate how the test levels are set up in both 150/50Ω and 50Ω systems to compensate for the loading effect. Paragraph 7.3 of EN 61000-4-6 indicates how the current injected into the line can be monitored to ensure that the equipment is not over-tested.

If the current probe injection method is used, the calibration data (input power to the probe versus test voltage) shall be included in the test report. The number of calibration points shall be selected to ensure that between points the voltage measured at the port of the current probe calibration jig varies by no more than 1dB with a constant input to the power amplifier. A minimum of 5 points per decade shall be provided. For variations in excess of 1dB, the input to the amplifier shall be adjusted to restore the test voltage to its original value. The frequency and the voltage measured on the forward power port of the coupler shall be noted.

When performing the test, at each calibration point the signal generator output shall be adjusted to ensure that the forward power into the RF coupler matches the calibration value. A typical calibration set up is shown below in when using only one test receiver.

<u>Rationale for lower test limit:</u>
RF voltages are injected onto power lines and I/O cables using current probes. This test is intended to simulate RF voltages induced onto system cables and power lines by RF fields produced by nearby radio transmitters and other radiating RF sources. The 3 V level is more representative of a commercial environment than the 10 V level called out in EN 61000-6-2. This is due to the unique environment the equipment in located and operated in.

<u>Justification for waiver of this test requirement</u>
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.

### 3.9.8 Radiated Magnetic Power Frequency Field

Information Technology Equipment shall be subjected to a magnetic field of 10 A/m at 50Hz. The test shall be performed in accordance with EN 61000-4-8.

Justification for waiver of this test requirement
There are no components within the system that is susceptible to magnetic power line field disruption.

### 3.9.9 Voltage Deviation, Short Interruptions and Variations

The public low voltage supply is subject to diurnal variation and to dips and brown outs that may cause disruption to the equipment itself or cause corruption to its controlling software. These effects may also be present on industrial supplies where other machinery or systems are co-located or installed. Motors and other heavy loads can cause significant sag in the network before the supply can compensate.

| | AC Power - Input | | |
|---|---|---|---|
| | ***Deviation from $U_{nom}$*** | ***Duration*** | ***Performance Criterion*** |
| Voltage Dips | -30% | 10ms | B |
| | -60% | 100ms | C |
| Voltage Interruption | -95% to -100% | 5s | C |
| Voltage Variation | +10%, -15% | 15min | A |

Testing of voltage dips, interruptions and variations shall be carried out in accordance with EN61000-4-11.
Note: This standard does not apply to equipment:

- With a rated input >16 A;
- With a dc power source.

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.

### 3.10 EMC Design Control Procedures

Depending on the nature and scope of this section, non-compliance with EMC test requirements will be handled in one or more of the following ways.

a. Modifications will be made to bring the non-compliant device or devices into compliance. The modifications will then be incorporated in manufacturing.
b. For equipment obtained from outside manufacturers, the manufacturer will be required to correct the problem and incorporate the modifications into the design.
c. Instructions will be included in the installation manual on how corrective action should be implemented on-site at the end-user's location (such as isolation transformers, specially constructed shielded room, restricted use of transmitting devices such as radios and walkie-talkies around the system).
d. The installation instructions will describe conditions under which the system is susceptible, including a description how system behaves during those conditions.

### 3.11 Monitoring

The equipment under test shall be observed for signs of susceptibility that degrades performance. Malfunctions that occur should be recorded and shall include, but not be limited to the following:

- Abnormal processing operations
- Audible noise due to internal arcing
- Equipment hardware failures, such as fuse rupture, or operation of overload devices
- Actual component damage
- Visual corruption of displays or printed images
- False or intermittent operation of indicators, alarms or trip circuits
- Loss of data from memory or data corruption

In general, all test measurement apparatus and equipment used to externally exercise the EUT shall be removed from the immediate environment of the test area during testing. Where adverse results are obtained in a test it shall be determined that the effect is due to the response of the EUT alone and not to any undue influence on or by monitoring devices or other test equipment. All malfunctions and any reduction in performance shall be recorded in the test report.

#### 3.11.1 Radiated Field Monitoring

The method of monitoring the field at the EUT should be considered. This is particularly important, as the relative size of the EUT is significant in comparison with the dimensions of the test environment. The method used shall be fully described in the Test Report.

#### 3.11.2 Visual Monitoring

Test personnel should be aware of the limitations of any video camera equipment used where such equipment may itself be subject to test fields inside a screened enclosure, if used.

#### 3.11.3 Electronic Monitoring

The EUT shall be operated using operational software during both emissions and immunity testing. The software cycles the complete unit through its normal operating functions. All errors in the operation cycle shall be reported.

### 3.12 Test Report Contents

The test report must contain as a minimum the following:

1. Name and address of the person or organization performing the tests and the location of the tests (including address, building number, test bay, etc.).
2. Unique identification of the report and of each page and the total number of pages (1 of X).
3. Name and address of the manufacturer (Division's address).
4. Full description and unambiguous identification of the items tested.
   Comment: Brief system description, system number, model and serial numbers of supporting equipment, as well as any pertinent customer special equipment. A drawing of the test requirement should be included in the report, marked up appropriately and referred to in the text.
5. Condition of item(s) being tested (production, pre-production, prototype, new, used, refurbished).
6. Identification of the specifications and methods used, full details including test procedures to be supplied as an addendum.
7. Any deviations to the EMC test plan and any other information relevant to the test.
8. The environmental conditions (e.g., temperature and humidity).
9. All raw data, measurements, examinations, and derived results, supported by tables, graphs, sketches and photographs as required to fully establish the EUT and test conditions and disposition.
10. Signature and title of qualified individual performing the EMC testing and individual authorized reviewing the report.
11. A statement that the results only relate to the item(s) tested.
    Comment: Some statement to the effect that similar test results can be expected for production units tested in a similar configurations and conditions.
12. A full and detailed description of the equipment cables, number, types, lengths, interface ports used, layout, and exact disposition of the equipment under test, support equipment, and any other relevant information (e.g., A plan view of the EUT and test setup and preferably photographs).
14. For the EUT, a full and detailed description of modes of operation, dwell or sequence times, and any other relevant information which may affect the method of test (a brief explanation of the process, including temperature, time, pressure, RF power level, etc. should be sufficient).
15. The exact description including version and revision numbers of any software or firmware used to exercise the EUT during test.
16. The test dwell times for emissions, transients, radiated immunity and any other tests where test or measurement time may have an impact with respect to the mode of operation (test equipment setting at the time of the tests) if these specific tests are performed.
    *Comment*:
    For RF immunity testing, use sweep rate of 0.0015 decades per second or slower.
    For RF radiated and conducted emission, how long RF is on for each chamber during process or mode of operation.
    For ESD testing, a minimum of 50 discharges at each location at each polarity must occur at 1-sec. intervals.
17. Full details of any observations made during tests.
18. Location of for radiated emissions antenna and radio transmitters (for radiated immunity) and location where ESD was injected (drawing, diagram or photographs are preferred).
19. Description of test equipment used, including calibration dates.
20. Description of any failures and actions taken or to be taken to identify and/or remedy such failure.

# 4 QUALITY ASSURANCE

ITRenew is not certified to ISO 9001. The company's Quality Control program is a manual and is available for review on request by a jurisdiction having authority or a customer.

## 4.1 Technical File Amendment Procedure

In all cases for the use of changes to the system, the project manager assesses the effect of the change related to electromagnetic compatibility. Where a change is considered to have no significant impact on the EMC characteristics, the authorized engineering signatory releases the change. Where a change does have such implications, it must be referred to a competent EMC engineer for review and/or approval. If the change is of a major type, then the product may be subject to re-qualification.

Where there are changes considered to have EMC implications, a note of the change to the product is noted on this document. This is initialed by the manufacturer to signify that the impact of the change has been considered and appropriate action approved. In some cases, it may be necessary to amend the text or documentation, or parts of this file, to accommodate the scope of the change. If the product requires complete reassessment and retest, a new issue of the Technical File may be considered.

## 4.2 Changes

All design changes as defined in this document will be documented within this Technical File and identified as a revision to the Issue number.

## 4.3 Alternative Sourcing

A third-party option or peripheral may be replaced with another either to improve performance or to reduce costs. These will be acceptable provided the conditions specified in Section 2 are met.

## 4.4 Design Modifications

A modification to the electrical design or mechanical construction may be needed to improve performance or overcome a design limitation. It should be recognized that changes to the mechanical layout of a product could affect EMC/EMI performance. For example, additions or elimination of cutouts or apertures can have a dramatic effect on the screening properties of a metal structural member.

Typical of the changes to be considered relevant to the EMC characteristics include:

- Shielding or screening
- Change in processor clock speed
- Microcircuit technology type
- Power supplies
- Internal loads (real or reactive)
- EMI hardware protection techniques
- Peripheral devices and outlets
- Cable types, routing or layout
- I/O filters
- Grounding methodology.

Changes that are judged to have a significant impact on the electromagnetic compatibility may require a partial or complete retest of the system.

# ANNEX A
# EMC TEST PLAN

Note: The following specifications are identified for reference as well as the limits to be used during testing. The actual methods may deviate due to the nature of the equipment under test; however, these deviations will be noted in the test report.

The date of issue for all standards used for immunity testing is provided in the Test Report (Annex C).

**EMISSIONS (EN 61000-6-3)**

| Reference Standard | Test parameters | Pass Criteria |
|---|---|---|
| EN 55032 | Class A | Mains terminal - Table 1<br>Radiated: Table 5 |

**IMMUNITY (EN 61000-6-1)**

| Reference Standard | Test parameters | Pass Criteria | Comments |
|---|---|---|---|
| EN 61000-4-2 | 2 kV contact<br>4 kV air | EN 61000-6-2, Criteria B | Not Applicable |
| EN 61000-4-3 | 3 V/m: 80-1000 MHz, 80%, 1 kHz (or)<br>27-40/150-174/450-474/890-950 MHz | EN 61000-6-2, Criteria A | Not Applicable |
| EN 61000-4-4 | 1 kV - I/O cables, 2 kV for AC lines<br>5ns $T_r$/ 50ms $T_h$, 5 kHz represent frequency | EN 61000-6-2, Criteria B | Not Applicable |
| EN 61000-4-5 | 2 kV common mode<br>1 kV differential mode | EN 61000-6-2, Criteria B | Not Applicable |
| EN 61000-4-6 | 3 volts, 0.15-80 MHz, 80% mod at 1 kHz | EN 61000-6-2, Criteria A | Not Applicable |
| EN 61000-4-8 | 3 A/m | EN 61000-6-2, Criteria A | Not Applicable |
| EN 61000-4-11 | Power voltage fluctuation of +/- 10% variation | EN 61000-6-2, Criteria A | Not Applicable |

## Acceptance Criteria for Immunity Tests

The function of this system is to provide data processing related to Internet traffic and the world wide web.

**Criteria A** The apparatus shall continue to operate as intended. No degradation of performance of 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 (as defined by ITRenew) or the accuracy of the data displayed along with ANY disruption in the process.

**Criteria B** The apparatus shall continue to operate as intended after the test. No degradation of performance of 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 (as defined by ITRenew). Examples of non-critical failures include: Warning or caution messages which pause the monitoring 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.

***Loss of function***, as defined by ITRenew includes:
- Any loss of data transmission or information
- System shutdown

**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.

# ANNEX B
# TEST RESULTS

This section provides the test results for in situ evaluation provided as a separate document.

# ANNEX C
# LIST OF MANUALS

| Title | Specification |
|---|---|
| Open Compute Project | Open Rack Design Guide v1.1 |
| Open Compute Project | Open Rack Hardware v1.0 |
| Open Compute Project | Open Rack AC and DC gPDUs Hardware v0.3 |
| Open Compute Project | Open Rack Standard V1.1 |
| Open Compute Project | Deploying OCP Hardware in a Collocated Facility |
| Open Compute Project | Inter Motherboard Hardware v2.0 |
| Open Compute Project | QCT Rack System Portfolio |
| Open Compute Project | 4200W @ 12V (N + 1) Redundant Power Shelf Hardware v0.3 |
| WiRack21 Storage | Wiwynn ST7110-30A |
| Quanta | Rackgo X Series F03C |
| Open Rack | Mechanical Specifications V1.8 |

# ANNEX D
# SAMPLE DECLARATION OF CONFORMITY

(Sample Copy – Not for Actual Use)

# Declaration of Conformity

Manufacturer ITRenew
8356 Central Ave
Newark, CA 94560
USA

Represented in the European Community by:

Description: Big Sur (Quanta)
System No.: xxxxxxxx

This declaration of conformity is issued under the sole responsibility of the manufacturer and is in conformity with relevant Union harmonization legislation.

A sample of this product has been assessed against the Essential Health and Safety Requirements of the Machinery, EMC, Low Voltage and RoHS Directives. Based on conformity with these directives, the above product is deemed in compliance with:

- EMC Directive: 2014/30/EU;
  EN 61000-6-3 (EN 55032, Class A)
  EN 61000-6-1
- Low Voltage Directive: 2014/35/EU
- Restriction of Hazardous Substances (RoHS): 2014/65/EU

__________________________ __________________________
(Signed for and on behalf of) (place and date of issue)
(Title)