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# Dell 13G PowerEdge Acoustical Performance & Dependencies

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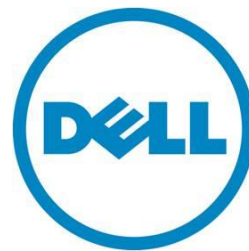
This Dell technical white paper provides reference 13G acoustical data as functions of configurations and operating modes.



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## Overview

Dell focuses on sound quality in addition to sound power level and sound pressure level. Sound quality describes how disturbing or pleasing a sound is interpreted, and Dell references a number of psych acoustical metrics and thresholds in delivering to it. Tone prominence is one such metric. Sound power and sound pressure levels increase with greater populations or higher utilization, while sound quality remains good even as the frequency content changes. A reference for comparison to sound pressure levels for familiar noise sources is given in Table 1. A more extensive description of Dell Enterprise acoustical design and metrics is available in the white paper *Dell Enterprise Acoustics*<sup>1</sup>.

Table 1. Acoustical reference points and output comparisons

| Value measured at<br>your ears |                    | Equivalent familiar noise experience                               |
|--------------------------------|--------------------|--------------------------------------------------------------------|
| LpA, dBA,<br>re 20 µPa         | Loudness,<br>sones |                                                                    |
| 90                             | 80                 | Loud concert                                                       |
| 75                             | 39                 | Data center, vacuum cleaner, voice<br>must be elevated to be heard |
| 60                             | 10                 | Conversation levels                                                |
| 45                             | 4                  | Whispering, open office layout,<br>normal living room              |
| 35                             | 2                  | Quiet office                                                       |
| 30                             | 1                  | Quiet library                                                      |
| 20                             | 0                  | Recording studio                                                   |

## Format

For previous generations of Dell PowerEdge servers, acoustical performance data were provided in product-specific technical guides. In contrast, acoustical data for multiple Dell 13G PowerEdge servers are presented in this single document. Moreover, this is a living document that will be updated as appropriate, e.g., firmware updates, new servers, etc. Two sections accompany each server: one section on configuration-specific measured acoustical performance data and another section on dependencies. Each section notates its most recent update date. The Dell Energy Smart Solution Advisor<sup>2</sup> (ESSA) is another source of Dell PowerEdge acoustical output, but it is a tool that provides values that have been modeled, rather than measured, per input scenario.

<sup>1</sup> [Dell Enterprise Acoustics](#), Chris E. Peterson, Dell, Inc., 2011.

<sup>2</sup> [Dell Energy Smart Solution Advisor](#)

## PowerEdge T630 tower server

### PowerEdge T630 Acoustical Performance Data – last updated July 25, 2014

Consciously designed to scale with configuration and usage, sound from the PowerEdge T630 in minimum configuration will be masked in a quiet office and sound from the T630 in typical configuration will be masked in an open office layout environment. It meets Dell's sound quality requirements.

- Minimally configured<sup>(1)</sup> 3.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 3.8 bels; LpA<sup>(5)</sup> = 24 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 3.8 bels; LpA<sup>(5)</sup> = 25 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 3.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.3 bels; LpA<sup>(5)</sup> = 27 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.9 bels; LpA<sup>(5)</sup> = 33 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 2.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.5 bels; LpA<sup>(5)</sup> = 28 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 37 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Minimum configuration means 1x 85W-6C processor, 1x 4GB DIMM, 1x 3.5" SATA HDD, 1x 495W PSU, No PCI cards, and 2x system fans.
2. Typical configuration means
  - For 3.5" chassis: 1x 85W-8C processor, 4x 8GB DIMM, 6x 3.5" SATA HDD, 2x 750W PSU, 1x PERC H730, 1x dual-port 10GbE NIC, and 2x system fans.
  - For 2.5" chassis: 2x 85W-8C processor, 8x 8GB DIMM, 8x 2.5" 10K SAS HDD, 2x 750W PSU, x PERC H730, 1x dual-port 10GbE NIC, and 6x system fans.
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed on the standard ISO 7779 table (75 cm height).
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO7779 table and acoustic transducer is at front operator position, ref ISO7779 (2010 Section 8.6.1, Position P4.)

### PowerEdge T630 Acoustical Dependencies – last updated July 25, 2014

- **System thermal profile selected in BIOS:** The system default setting is "Power Optimized (DAPC)", which is, in general, lower fan speed and acoustics. If "Performance Optimized" is selected, fan speed and acoustics will become higher.
- **Processor power:**
  - Configurations with "low-power" processors (which have lower temperature limits than standard processors), e.g., Intel® Xeon® E5-2650L v3/E5-2630L v3 processors at 65W, under moderate or heavy utilization, will be about twice as loud as typical configurations.
  - Configurations increase in loudness as processor power increases from that in typical configurations.
- **Types of storage devices:**
  - **Hard disk drives (HDDs):**
    - Lower-speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
    - Loudness increases with the following progression of drives: SATA (2.5" or 3.5"), 2.5" 10K, 2.5" 15K, 3.5" 15K.
  - **Solid state drives (SSDs):**
    - Solid state drives are not themselves audible.
    - However, a configuration with PCIe SSDs requires more airflow for cooling and will be significantly louder than a typical configuration. Under highly stressed conditions, the sound power level may go up to 7.4 bels, which is not recommended for usage in office environments.
- **Quantity of hard disk drives and solid state drives:** for the reasons outlined below, higher acoustics accompany an increase in quantity of hard disk drives:

- Airflow needs, hence acoustics, increase with the number of drives. For example, a T630 2.5" configuration with 16 HDDs and two system fans will be twice as loud in idle condition as one with four drives (5.7 bels vs. 4.7 bels).
  - Acoustics related to the HDD itself (read and write noise) increases with the number of HDDs installed.
- **Quantity of PCIe cards:** Fan speeds, and hence acoustics, increase when greater than two PCIe cards are installed.
- **GPGPU cards:**
  - A configuration with any GPGPU card will be significantly louder (approximately twice as loud) than the typical configuration.
  - This is especially true when GPGPU cards are installed in a T630 18x 3.5" chassis. The idle sound power level will be higher than 6.0 bels, and so not recommended to be used in an office environment.
- **Non-RAID setup:** If a system is configured as "Non-RAID", the hard disk drives' temperature reading will be lost. The fan speed will be higher to ensure sufficient cooling for the hard disk drives, increasing loudness.

## PowerEdge R730 rack server

### PowerEdge R730 Acoustical Performance Data – last updated July 25, 2014

Consciously designed to scale with configuration and usage, sound from the PowerEdge R730 in minimal configuration is sufficiently quiet to be masked in open office layout environments. It meets Dell's sound quality requirements.

- Minimally configured<sup>(1)</sup> 2.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.7 bels; LpA<sup>(5)</sup> = 28 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 33 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 3.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.7 bels; LpA<sup>(5)</sup> = 28 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 33 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 2.5" chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.7 bels; LpA<sup>(5)</sup> = 28 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.8 bels; LpA<sup>(5)</sup> = 39 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Minimum configuration means 1x 85W-6C processor [Intel® Xeon® E5-2609 V3], 1x 4GB DIMM, 1x Client SSD, 1x 495W PSU, No PCI cards, and 6x system fans.
2. Typical configuration means
  - For 3.5" chassis: 2x 105W-10C processor [Intel Xeon E5-2660 v3], 8x 8GB DIMM, 6x 3.5" SATA HDD, 2x 750W PSU, 1x PERC H730 mini mono, 1x Intel Xeon 1GbE NDC card, 1x 1GbE NIC card, and 6 system fans
  - For 2.5" chassis: 2x 105W-10C processor [Intel Xeon E5-2660 v3], 8x 8GB DIMM, 8x 2.5" 10K SAS HDD, 2x 750W PSU, 1x PERC H730 mini mono, 1x PERC H830 (external), 1x Intel Xeon 1GbE NDC card, 1x 1GbE NIC card, and 6 system fans
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO 9296 (1988) and measured in accordance with ISO 7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above reflective floor.
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO 7779 table and acoustic transducer is at front standing operator position, ref ISO 7779 (2010 Section 8.6.1, Position P1.)

### PowerEdge R730 Acoustical Dependencies – last updated February 25, 2015

- **System thermal profile selected in BIOS:** The system default setting is "Power Optimized (DAPC)", which means, in general, lower fan speed/noise level. If "Performance Optimized" is selected, fan speed/noise level will become higher.
- **Processor power:**
  - Configurations with "low-power" processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W, under moderate or heavy utilization, will be about twice as loud as typical configurations.

- Configurations increase in loudness as processor power increases from that in typical configurations.
- **Types of storage devices:**
  - **Hard disk drives:**
    - Lower-speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
    - Loudness increases with the following progression of drives: SATA (2.5" or 3.5"), 2.5" 10K, 2.5" 15K, 3.5" 15K.
  - **Solid state drives:**
    - Solid state drives are not themselves audible.
    - However, a configuration with PCIe SSDs requires more airflow for cooling and will be significantly louder than a typical configuration. Under highly stressed conditions, the sound power levels may go up to 7.0 bels.
- **Quantity of hard disk drives:** Acoustics related to the HDD itself (read/write noise) increases with the number of HDDs installed.
- **GPGPU cards:** A configuration with any GPGPU card will be significantly louder (about twice as loud) than the typical configuration.

## PowerEdge R730xd rack server

### PowerEdge R730xd Acoustical Performance Data – last updated July 25, 2014

The PowerEdge R730xd acoustics are appropriate for open office layout environments in typical configurations but are low enough for an office environment in minimum configuration. It meets Dell's sound quality requirements.

- Minimally configured<sup>(1)</sup> 2.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.1 bels; LpA<sup>(5)</sup> = 31 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.2 bels; LpA<sup>(5)</sup> = 32 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 3.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.1 bels; LpA<sup>(5)</sup> = 32 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 6.1 bels; LpA<sup>(5)</sup> = 43 dBA; No prominent tones<sup>(6)</sup>
- Typically configured<sup>(2)</sup> 2.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.1 bels; LpA<sup>(5)</sup> = 32 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 6.2 bels; LpA<sup>(5)</sup> = 41 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Minimum configuration means 1x 85W-6C processor [Intel Xeon E5-2609 V3], 1x 4GB DIMM, 1x Client SSD, 1x 495W PSU, No PCI cards, and 6x system fans.
2. Typical configuration means
  - For 3.5" chassis: 2x 85W-8C processor [Intel Xeon E5-2630 v3], 8x 8GB DIMM, 10x 3.5" SATA HDD, 2x 750W PSU, 1x PERC H730 mini mono, 1x Intel 1GbE NDC card, and 6 system fans
  - For 2.5" chassis: 2x 85W-8C processor [Intel Xeon E5-2630 v3], 8x 8GB DIMM, 12x 2.5" 10k SAS HDD, 2x 750W PSU, 1x PERC H730 mini mono, 1x Intel 1GbE NDC card, 1x 1GbE NIC card, and 6 system fans
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO 9296 (1988) and measured in accordance with ISO 7779 (2010). The system is placed in a 24U rack enclosure, 25cm above reflective floor.
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO 7779 table and acoustic transducer is at front standing operator position, ref ISO 7779 (2010 Section 8.6.1, Position P1.)

### PowerEdge R730xd Acoustical Dependencies – last updated February 25, 2015

- **Chassis types:** The idle fan speeds and acoustics generally depend on chassis types — shown as below from the quietest to the loudest:
  - 24x 2.5" chassis
  - 12x 3.5" chassis
  - 8x 3.5" + 18x 1.8" SSD chassis

- **System thermal profile selected in BIOS:** The system default setting is "Power Optimized (DAPC)", which means, in general, lower fan speed/noise level. If "Performance Optimized" is selected, the fan speed/noise level will become higher.
- **Processor power:**
  - Configurations with "low-power" processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W, under moderate or heavy utilization, will be about twice as loud as typical configurations.
  - Configurations increase in loudness as processor power increases from that in typical configurations.
- **Types of storage devices:**
  - **Hard disk drives:**
    - Lower speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
    - Loudness increases with the following progression of drives: SATA (2.5" or 3.5"), 2.5" 10K, 2.5" 15K, 3.5" 15K.
  - **Solid state drives:**
    - Solid state drives are not themselves audible.
    - However, a configuration with PCIe SSD requires more airflow for cooling and will be significantly louder than a typical configuration. Under highly stressed conditions, the sound power levels may go up to 7.0 bels.
- **Quantity of hard disk drives and solid state drives:** for the reasons outlined below, higher acoustics accompany an increase in quantity of hard disk drives:
  - Airflow needs, hence acoustics, increase with number of drives. For example, a R730xd 3.5" configuration with 16 drives will be about 50% louder in idle condition than one with four drives (6.2 bels vs. 5.6 bels).
  - Acoustics related to the HDD itself (read/write noise) increases with the number of HDDs installed.

## PowerEdge R630 rack server

### PowerEdge R630 Acoustical Performance Data – last updated February 25, 2015

The PowerEdge R630 is quiet enough for an office (typical and minimum configurations). It meets Dell's sound quality requirements.

- Minimally configured<sup>(1)</sup> 8x 2.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 3.9 bels; LpA<sup>(6)</sup> = 25 dBA; No prominent tones<sup>(7)</sup>
  - Operating<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 4.1 bels; LpA<sup>(6)</sup> = 29 dBA; No prominent tones<sup>(7)</sup>
- Typically configured<sup>(2)</sup> 8x 2.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 4.7 bels; LpA<sup>(6)</sup> = 32 dBA; No prominent tones<sup>(7)</sup>
  - Operating<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 5.0 bels; LpA<sup>(6)</sup> = 33 dBA; No prominent tones<sup>(7)</sup>
- Feature-rich configured<sup>(3)</sup> 10x 2.5" chassis in 23 ± 2 °C ambient
  - Idle<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 6.4 bels; LpA<sup>(6)</sup> = 43 dBA; No prominent tones<sup>(7)</sup>
  - Operating<sup>(4)</sup>: LwA-UL<sup>(5)</sup> = 6.4 bels; LpA<sup>(6)</sup> = 43 dBA; No prominent tones<sup>(7)</sup>

#### Footnotes:

1. Minimum configuration means 1x 85W-6C processor (Intel Xeon E5-2609 v3), 1x 4GB DIMM, 1x 2.5" SATA SSD, 1 x 495W PSU and no PCI cards.
2. Typical configuration means 2x 105W-10C processor (Intel Xeon E5-2660 v3), 8x 8GB DIMM, 4x 2.5" 10K SAS HDD, 2x 750W PSU and PERC H730 mini mono cards.
3. Feature-rich configuration means 2x 135W-12C processor (Intel Xeon E5-2690 v3), 16x 16GB DIMM, 8x 2.5" 15K SAS HDD, 2x 1100W PSU, FC8 dual-port HBA and PERC H730 mini mono cards.
4. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
5. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
6. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above reflective floor
7. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO7779 table and acoustic transducer is at front standing operator position, ref ISO7779 (2010 Section 8.6.1, Position P1)

## PowerEdge R630 Acoustical Dependencies – last updated July 25, 2014

- **System thermal profile selected in BIOS:** The system default setting is “Power Optimized (DAPC)”, which is in general lower fan speed/ noise level. If “Performance Optimized” is selected, the fan speed/ noise level will become higher.
- **Processor power:**
  - Configurations with “low-power” processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W, under moderate or heavy utilization, will be about twice as loud as typical configurations.
  - Configurations increase in loudness as processor power increases from that in typical configurations.
- **Types of storage devices:**
  - **Hard disk drives:**
    - Lower-speed hard disk drives (e.g., 7.2K RPM SATA) are generally quieter than 10K/15K RPM SAS drives.
    - Loudness increases with the following progression of drives: SATA, SAS 10K, SAS 15K.
  - **Solid state drives:**
    - Solid state drives are not themselves audible.
    - However, a configuration with PCIe SSDs requires more airflow for cooling and will be louder than a typical configuration. Under highly stressed conditions, the sound power levels may go up to 8.0 bels.
- **Types of PCIe cards:** Configurations with any of the cards below installed will have higher fan speeds and thus, be louder than typical configuration: 10/40GbE NIC or PERC H730.

## PowerEdge T430 tower server

### PowerEdge T430 Acoustical Performance Data – last updated February 4, 2015

Consciously designed to scale with configuration and usage, sound from the PowerEdge T430 in typical configuration will be masked in an open office layout environment. It meets Dell’s sound quality requirements.

- Typically configured<sup>(1)</sup> 3.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.5 bels; LpA<sup>(5)</sup> = 28 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.6 bels; LpA<sup>(5)</sup> = 31 dBA; No prominent tones<sup>(6)</sup>
- Feature-rich configured<sup>(2)</sup> 2.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 36 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.7 bels; LpA<sup>(5)</sup> = 38 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Typical configuration means 3.5” chassis: 2x 85W-8C processor, 2x 8GB DIMM, 4x 3.5” SATA HDD, 2x 750W PSU, 1x PERC H330, 1x dual-port 1GbE NIC, and 1x system fan.
2. Feature-rich configuration means 3.5” chassis: 2x 105W-8C processor, 2x 8GB DIMM, 4x 3.5” SATA HDD, 2x 750W PSU, 1x PERC H330, 1x dual-port 1GbE NIC, and 1x system fan.
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO 9296 (1988) and measured in accordance with ISO 7779 (2010). The system is placed on the standard ISO 7779 table (75 cm height).
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO 7779 table and acoustic transducer are located at front operator position.

## PowerEdge T430 Acoustical Dependencies – last updated October 31, 2014

- **Chassis types:** 3.5” chassis is generally quieter than 2.5” chassis
- **System thermal profile selected in BIOS:** The system default setting is “Power-optimized (DAPC)”, which is in general lower fan speed and acoustics. If “Performance Optimized” is selected, fan speed and acoustics will become higher.

- **Processor power:**
  - Configurations with “low-power” processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W/55W, under moderate or heavy utilization, will be about twice as loud as typical configurations.
- **Types of hard disk drives:**
  - Lower speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
  - Loudness increases with the following progression of drives: SATA (2.5” or 3.5”), 2.5” 10K, 2.5” 15K, 3.5” 15K.
  - High-speed drives (10K RPM/15K RPM) require more airflow for cooling, hence higher acoustics
- **Quantity of hard disk drives:** for the reasons below, higher acoustics accompany an increase in quantity of hard disk drives:
  - Airflow needs, hence acoustics, increase with number of drives. For example, a T430 3.5” configuration with 8 HDDs and one system fan will be just noticeably louder in idle condition as one with four drives (4.8 bels vs. 4.5 bels).
  - Acoustics related to the HDD itself (read and write noise) increases with the number of HDDs installed.
- **Mellanox® 10GbE and 40GbE NIC cards:** Requires much higher airflow and will result in significantly higher acoustics, which is not recommended for office environment usage.
- **GPGPU cards:** A configuration with any GPGPU card will be significantly louder than the typical configuration.

## PowerEdge R530 rack server

### PowerEdge R530 Acoustical Performance Data – last updated February 4, 2015

Consciously designed to scale with configuration and usage, sound from the PowerEdge R530 in typical and feature-rich configurations is sufficiently quiet to be masked in open office layout environments. It meets Dell’s sound quality requirements.

- Typically configured<sup>(1)</sup> 3.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.2 bels; LpA<sup>(5)</sup> = 33 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 35 dBA; No prominent tones<sup>(6)</sup>
- Feature-rich configured<sup>(2)</sup> 3.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.2 bels; LpA<sup>(5)</sup> = 33 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 35 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Typical configuration means 3.5” chassis: 2x 85W-8C processor, 8x 8GB DIMM, 3x 3.5” SATA HDD, 2x 2.5” 10K SAS HDDs, 2x 750W PSU, 1x PERC H730 mini mono, 5 system fans
2. Feature-rich configuration means 3.5” chassis: 2x 120W-12C processor, 8x 16GB DIMM, 6x 3.5” SATA HDD, 2x 2.5” 10K SAS HDDs, 2x 750W PSU, 1x PERC H730 mini mono, 1x dual-port 10GbE NIC, 5 system fans
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above reflective floor.
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO7779 table and acoustic transducer are located at front and rear bystander positions

### PowerEdge R530 Acoustical Dependencies – last updated October 31, 2014

- **System thermal profile selected in BIOS:** The system default setting is “Power Optimized (DAPC)”, which generally means lower fan speed/noise level. If “Performance Optimized” is selected, the fan speed/noise level will become higher.

- **Processor power:**
  - Configurations with “low-power” processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W/55W, under moderate or heavy utilization, will be about twice as loud as typical configurations.
- **Types of hard disk drives:**
  - Lower speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
  - Loudness increases with the following progression of drives: SATA (2.5” or 3.5”), 2.5” 10K, 2.5” 15K, 3.5” 15K.
- **Quantity of hard disk drives:**
  - Acoustics related to the HDD itself (read/write noise) increases with the number of HDDs installed.
- **Mellanox 10GbE and 40GbE NIC cards:** Require much higher airflow and will result in significant higher acoustics, which is not recommended for office environment usage.
- **GPGPU cards:** A configuration with any GPGPU card will be twice as loud as typical configuration.

## PowerEdge R430 rack server

### PowerEdge R430 Acoustical Performance Data – last updated February 4, 2015

Consciously designed to scale with configuration and usage, sound from the PowerEdge R430 in typical and feature-rich configurations is sufficiently quiet to be masked in open office layout environments. It meets Dell’s sound quality requirements.

- Typically configured<sup>(1)</sup> 2.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.6 bels; LpA<sup>(5)</sup> = 27 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.5 bels; LpA<sup>(5)</sup> = 40 dBA; No prominent tones<sup>(6)</sup>
- Feature-rich configured<sup>(2)</sup> 2.5” chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 4.7 bels; LpA<sup>(5)</sup> = 31 dBA; No prominent tones<sup>(6)</sup>
  - Operating<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 5.3 bels; LpA<sup>(5)</sup> = 36 dBA; No prominent tones<sup>(6)</sup>

#### Footnotes:

1. Typical configuration means 2x 85W-8C processors, 8x 8GB DIMM, 4x 2.5” 10K SAS HDD, 2x 550W PSU and PERC H330 mini mono cards.
2. Feature-rich configuration means 2x 120W 12C processors, 8x 16GB RDIMM, 8x 2.5” 10K SAS, 2x 550W PSU, 1x PERC H730 mini mono, 1x dual-port 10GbE NIC
3. Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO 9296 (1988) and measured in accordance with ISO 7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above reflective floor
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The system is placed in center of ISO 7779 table and acoustic transducer are located at front and rear bystander positions

### PowerEdge R430 Acoustical Dependencies – last updated October 31, 2014

- **System thermal profile selected in BIOS:** The system default setting is “Power Optimized (DAPC)”, which is in general lower fan speed/ noise level. If “Performance Optimized” is selected, the fan speed/ noise level will become higher.
- **Processor power:**
  - Configurations with “low-power” processors (which have lower temperature limits than standard processors), e.g., Intel Xeon E5-2650L v3/E5-2630L v3 processors at 65W/55W, under moderate or heavy utilization, will be slightly louder than typical configurations.
- **Types of hard disk drives:**
  - Lower speed hard disk drives (e.g., 7.2K RPM SATA, 10K RPM SAS) are generally quieter than 15K RPM SAS drives.
  - Loudness increases with the following progression of drives: SATA (2.5” or 3.5”), 2.5” 10K, 2.5” 15K, 3.5” 15K.

- **Quantity of hard disk drives:**
  - Acoustics related to the HDD itself (read/write noise) increases with the number of HDDs installed.
- **Types of PCIe cards**
  - Mellanox 10GbE and 40GbE NIC cards: Require much higher airflow and will result in significantly higher acoustics, which is not recommended for office environment usage.
  - PowerEdge RAID Controller (PERC) cards: Acoustics will increase if any (mini) PERC card is installed.

## PowerEdge C4130 server

### PowerEdge C4130 Acoustical Performance Data – last updated March 11, 2015

The PowerEdge C4130 requires higher fan operation for optimizing system performance; hence, the acoustical output is most appropriate for data center usage, (i.e., environments in which people standing next to each other must elevate their voices to be heard and cannot discern speech on a telephone.)

- Idle<sup>(1)</sup>: LwA-UL<sup>(4)</sup> = 6.4 bels; LpA<sup>(5)</sup> = 48 dBA; audible but not objectionable tones<sup>(6)</sup>
- Operating-Processor<sup>(2)</sup>: LwA-UL<sup>(4)</sup> = 6.4 bels; LpA<sup>(5)</sup> = 48 dBA; audible but not objectionable tones<sup>(6)</sup>
- Operating-Max<sup>(3)</sup>: LwA-UL<sup>(4)</sup> = 8.5 bels; LpA<sup>(5)</sup> = 69 dBA; audible but not objectionable tones<sup>(6)</sup>

#### Footnotes:

1. Idle means the state in which the product is doing nothing but running OS
2. Operating-Processor means only processor is under normal (50%) stressing condition
3. Operating-Max means both processor and GPU are under fully stressing condition
4. LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).
5. LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above reflective floor
6. Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The acoustic transducers are located at front and rear bystander position. The system is placed in a 42U rack enclosure, 75cm above the reflective floor

### PowerEdge C4130 Acoustical Dependencies – last updated 11 Mar 2015

- **Ambient temperature:** The fan speed increases when system is located in a higher ambient temperature environment, hence, higher acoustics.
- **Types of processor and GPGPU cards:** High-power processor/GPGPU cards will result in higher acoustics.
- **Operating condition:** System acoustics are highly dependent on the workload of GPGPU.
- **System thermal profile selected in BIOS:** The system default setting is "Power Optimized (DAPC)", which in general means lower fan speed and acoustics. If "Performance Optimized" is selected, fan speed and acoustics will become higher.

## Blades and Sleds in the PowerEdge FX2, M1000e and VRTX

Most combinations of server nodes in the PowerEdge FX2 chassis or PowerEdge M1000e blade enclosure will result in acoustical output that is most appropriate for data center usage, i.e., environments in which people standing next to each other must elevate their voices to be heard and cannot discern speech on a telephone. However, Dell provides “Enhanced-Acoustics” configurations which will make the system quieter in operating condition.

FX2 with PowerEdge FM120 server nodes and PowerEdge VRTX with PowerEdge M630 “Enhanced-Acoustics” configurations will result in acoustical output that will be masked in an open office layout environment.

The PowerEdge FD332 storage block requires more airflow to cool drives and RAID controllers, and hence results in higher acoustics. Typically, when the FD332 is installed in the FX2, acoustical levels under idle and HDD-active conditions will be approximately twice as loud as the FX2 without any FD332 storage blocks.

### PowerEdge FX2 – last updated March 6, 2015

- FC830 Typical configuration<sup>(1)</sup> with Enhanced-Acoustics configuration in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.4 bels; LpA<sup>(4)</sup> = 35 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 7.2 bels; LpA<sup>(4)</sup> = 51 dBA; audible but not objectionable tones<sup>(5)</sup>
- FC830 Typical configuration<sup>(1)</sup> (without Enhanced-Acoustics) in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.4 bels; LpA<sup>(4)</sup> = 35 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 7.5 bels; LpA<sup>(4)</sup> = 53 dBA; audible but not objectionable tones<sup>(5)</sup>
- FC630 Typical configuration<sup>(1)</sup> with Enhanced-Acoustics- configuration in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.5 bels; LpA<sup>(4)</sup> = 36 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 6.7 bels; LpA<sup>(4)</sup> = 46 dBA; audible but not objectionable tones<sup>(5)</sup>
- FC630 Typical configuration<sup>(1)</sup> (without Enhanced-Acoustics) in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.5 bels; LpA<sup>(4)</sup> = 36 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 7.5 bels; LpA<sup>(4)</sup> = 53 dBA; audible but not objectionable tones<sup>(5)</sup>
- FC430 Typical configuration<sup>(1)</sup> in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 6.4 bels; LpA<sup>(4)</sup> = 44 dBA; audible but not objectionable tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 6.7 bels; LpA<sup>(4)</sup> = 46 dBA; audible but not objectionable tones<sup>(5)</sup>
- FM120 Typical configuration<sup>(1)</sup> in FX2 chassis in  $23 \pm 2$  °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.0 bels; LpA<sup>(4)</sup> = 33 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.0 bels; LpA<sup>(4)</sup> = 33 dBA; no prominent tones<sup>(5)</sup>
- FD332 Typical configuration<sup>(1)</sup> in FX2 chassis with other computing sleds in  $23 \pm 2$  °C ambient

| Sled combinations                                    |                     | 1x FC830<br>2x FD332                | 1x FC630<br>1x FD332     | 1x FC630<br>1x FD332     | 1x FC630<br>3x FD332     | 4x FC430<br>2x FD332     |
|------------------------------------------------------|---------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| FD332 HDD Q'ty                                       |                     | 10x 2.5" 10K<br>SAS HDDs            | 10x 2.5" 10K<br>SAS HDDs | 16x 2.5" 15K<br>SAS HDDs | 16x 2.5" 15K<br>SAS HDDs | 10x 2.5" 10K<br>SAS HDDs |
| Sound Power<br>Level<br>LwA-UL <sup>(3)</sup> (bels) | idle                | 5.4                                 | 6.0                      | 6.0                      | 6.2                      | 7.0                      |
|                                                      | HDDs Active         | 5.6                                 | 6.1                      | 6.5                      | 6.6                      | 7.0                      |
|                                                      | Processor<br>Active | 7.5                                 | 7.5                      | 7.5                      | 7.5                      | 7.0                      |
| Sound Pressure<br>Level<br>LpA <sup>(4)</sup> (dBA)  | idle                | 36                                  | 41                       | 41                       | 42                       | 50                       |
|                                                      | HDDs Active         | 37                                  | 42                       | 46                       | 47                       | 50                       |
|                                                      | Processor<br>Active | 53                                  | 53                       | 53                       | 47                       | 50                       |
| Prominent Tone <sup>(5)</sup>                        |                     | Audible but not objectionable tones |                          |                          |                          |                          |

*Footnotes:*

1. *Typical configuration means:*
  - a. FC830: 4x 105W-10C processor, 32x 16GB DIMM, 4x 2.5" 10D SAS HDD, 1x PERC H730
  - b. FC630: 2x 105W-10C processor, 8x 8GB DIMM, 2x 2.5" 10K SAS HDD, 1x PERC H330
  - c. FC430: 2x 105W-10C processor, 8x 8GB DIMM, 2x 2.5" SSD
  - d. FM120: 4x 20W-8C processor, 8x 8GB DIMM, 4x 2.5" SATA HDD
  - e. FD332: 10x 2.5" 10K SAS HDD, Dual-ROC controller
2. *Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.*
3. *LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).*
4. *LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above the reflective floor*
5. *Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The acoustic transducers are located at front and rear bystander position. The system is placed in a 24U rack enclosure, 75 cm above reflective floor,*

## PowerEdge M1000e – last updated March 6, 2015

- M830 Typical configuration<sup>(1)</sup> in M1000e chassis in 23 ± 2 °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 7.0 bels; LpA<sup>(4)</sup> = 50 dBA; Audible but not objectionable tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 8.0 bels; LpA<sup>(4)</sup> = 57 dBA; Audible but not objectionable tones<sup>(5)</sup>
- M630 Typical configuration<sup>(1)</sup> in M1000e chassis in 23 ± 2 °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 7.1 bels; LpA<sup>(4)</sup> = 50 dBA; Audible but not objectionable tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 8.0 bels; LpA<sup>(4)</sup> = 57 dBA; Audible but not objectionable tones<sup>(5)</sup>

### Footnotes:

1. *Typical configuration means:*
  - a. M830: 4x 105W-10C processor, 32x 16GB DIMM, 4x 2.5" 10D SAS HDD, 1x PERC H730
  - b. M630: 2x 105W-10C processor, 16x 8GB DIMM, 2x 2.5" 10K SAS HDD, 1x PERC H330
2. *Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.*
3. *LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).*
4. *LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a 42U rack enclosure, 25 cm above the reflective floor*
5. *Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The acoustic transducers are located at front and rear bystander position. The system is placed in a 42U rack enclosure, 75 cm above the reflective floor*

## PowerEdge VRTX – last updated March 6, 2015

- M830 Typical configuration<sup>(1)</sup> with Enhanced-Acoustics configuration in VRTX chassis in 23 ± 2 °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.4 bels; LpA<sup>(4)</sup> = 34 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.5 bels; LpA<sup>(4)</sup> = 35 dBA; no prominent tones<sup>(5)</sup>
- M630 Typical configuration<sup>(1)</sup> with Enhanced-Acoustics configuration in VRTX chassis in 23 ± 2 °C ambient
  - Idle<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.5 bels; LpA<sup>(4)</sup> = 35 dBA; no prominent tones<sup>(5)</sup>
  - Operating<sup>(2)</sup>: LwA-UL<sup>(3)</sup> = 5.7 bels; LpA<sup>(4)</sup> = 37 dBA; no prominent tones<sup>(5)</sup>

### Footnotes:

1. *Typical configuration means:*
  - a. M830: 4x 105W-10C processor, 32x 16GB DIMM, 4x 2.5" 10D SAS HDD, 1x PERC H330
  - b. M630: 2x 105W-10C processor, 16x 8GB DIMM, 2x 2.5" 10K SAS HDD, 1x PERC H330
2. *Idle means the state in which the product is doing nothing but running OS, and values for Operating are the maximum of acoustical output for active HDDs or active processors.*
3. *LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).*
4. *LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed on the floor beside the standard table*
5. *Prominent tone: Criteria of D.6 and D.11 of ECMA-74 12th ed. (2012) are followed to determine if discrete tones are prominent. The acoustic transducers are located at front and rear bystander position. The system is placed on the floor beside the standard table*