



Acoustic Test Report

RM Education*
RM Tower 330*

Lab. Ref: Resea4977



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1. Introduction

This document is designed to report and evaluate the acoustic performance of the **RM Education RM Tower 330**, **Lab. Ref: Resea4977**.

The equipment under test was evaluated by Intel Corporation (UK) Ltd, in their environmental test facility located at:

Intel Corporation (UK) Ltd
Pipers Way
Swindon
United Kingdom

This report also details the configuration of the equipment under test, the test methods used and any relevant modifications where appropriate.

1.1. Documentation Review & Approval

Date of Test Completion 8th October 2013

Date of Report 8th October 2013

Test Engineer

Colin Lee

A handwritten signature in black ink, appearing to read "Colin Lee", written in a cursive style.

2. System Configuration

This section lists the original configuration of the equipment under test.

2.1. Equipment Under Test (EUT).



Figure 2-1 RM Education RM Tower 330

2.2. Thermal Solution



Figure 2-2 EKL Processor Fan Heatsink



3. EUT Configuration.

| Component | Qty | Manufacturer | Model | AA/Serial Number | Description | Location |
|----------------------------|-----|--------------|--|--|--|--|
| System | 1 | RM* | PC 330 Tower | T093182301 | µATX Mini Tower System | N/A |
| Chassis | 1 | Chenbro* | PC31176-H02*13246 | Not Known | µATX Mini Tower Chassis | N/A |
| Power Supply | 1 | AcBel* | PCB029 | PCB02913250000102A | iPower 85 400 | Top rear of chassis |
| Motherboard | 1 | Fujitsu* | D3222-B1 | 42204493 | ATX Q87 Extended Lifecycle Mainboard | N/A |
| Processor | 1 | Intel® | Intel® Core™ i7-4770 CPU (8M Cache, up to 3.90GHz) | N/A | CM8064601464303 | LGA1150 socket |
| Integrated Graphics | 1 | Intel® | Intel® HD Graphics 4600 | N/A | N/A | N/A |
| Processor Thermal Solution | 1 | EKL* | DFr922512CM-010 | N/A | DC 12V fan and heatsink | LGA1150 socket |
| SSD | 1 | Samsung* | Samsung SSD 840 | S14GNEACC31555L | 2.5" 840, 250 GB SSD | Side mounted bay |
| HDD | 1 | Toshiba* | TOSHIBA DT01ACA1 | 830H4JENS | 3.5" DT01ACA, 1000 GB, 7200 RPM HDD | Lower 3.5" bay |
| Optical Drive | 2 | TSSTcorp* | CDDVDW SH-224DB | R93E6YCD4071MZ R93E6YCD4071MY | Super Filemaster | 5.25" bays |
| Memory | 4 | Elixir* | M2X8G64CB8HC5 N-DG | 7722123F D815123E C11C123E 8B11123D | DIMM, DDR3, 8192 MB, 1600 MHz | DIMM A3 DIMM A1 DIMM B4 DIMM B2 |
| Card Reader | 1 | Not known | Not known | 130201724 | Generic card reader for MS/MS Pro Duo, CFI/CFII/MD, SD/MMC/RS MMC, XD/Smart Media and ext. USB | Upper 3.5" Bay |
| Front-Panel Ddaughterboard | 1 | Not known | Not Known | Not known | Generic USB front panel with 2x USB2, 2x USB3, Audio in and Audio out | Front panel |



3.1. Additional information for fans, ferrites, etc fitted in the chassis

| Component | Qty | Manufacturer | Model | Serial Number | Position in chassis |
|-------------|-----|--------------|--------------|------------------------------|---------------------|
| Chassis Fan | 1 | Top Motor* | DF128025SL-3 | 30H080025204 02966D6N0359 | Rear exhaust vent |

3.2. Software

| BIOS Version | Manufacturer | Date | Comments |
|------------------|---|------------|----------|
| V4.6.5.4 R1.10.0 | FUJITSU // American Megatrends Inc.* | 09/16/2013 | |

| Operating System | Manufacturer | Service Pack | 32/64 Bit | Comments |
|------------------------|--------------|--------------|-----------|----------|
| Windows 7 Professional | Microsoft* | SP1 | 64Bit | |



4. Test Methodology

4.1. Test Equipment

Some or all of the following equipment may have been used during this testing:

| Mic S/N | Preamp S/N | Description | Model | Manufacturer | Calibration |
|---------|------------|--|---------------|--------------|-------------|
| 42582 | 47642 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 42454 | 47640 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43767 | 47634 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43764 | 47641 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43763 | 47635 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43770 | 47636 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 42453 | 47631 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43778 | 47637 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43772 | 47638 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43759 | 47639 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43794 | 47632 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |
| 43781 | 47633 | ½" Electret Condenser Mic with ½" Coax Pre-Amplifier | MCE212 / 26CA | GRAS | 26 Nov 12 |

Table 4-1 Microphone data



| Model / Sn | Description | Manufacturer | Calibration |
|-----------------------------|---------------------------------|--------------|-------------|
| NDB1002000A / LCF009675-067 | NetdB 12 channel Analyser | 01dB | 26 Nov 12 |
| 50441997 | 01dB type Cal21 Calibrator | 01dB | 22 Nov 12 |
| dBFA/dBRT | Real-Time Data Logging Software | 01dB | N/A |
| dBFA Power/dBFA Suite | Sound Power Software | SCS | N/A |

Table 4-2 Additional test equipment

4.2. Tolerance/Accuracy

All individual microphones are calibrated prior to each test using a Type 1, 94dB/1kHz PTB approved calibrator. All equipment is calibrated annually by traceable calibration.



5. Test Method

5.1. EUT Location

The EUT is installed in the hemi-anechoic chamber at the centre of the reflecting plane.

5.2. Microphone Positions

A total of 10 microphones are used arranged on a hemispherical measurement surface with a radius of 1.0m as dictated by the characteristic source dimensions (CSD) of the unit under test.

| 1.0m Hemispherical Microphone Array | | | |
|-------------------------------------|-------|-------|------|
| Position | X | Y | Z |
| 1 | 0.16 | -0.96 | 0.22 |
| 2 | 0.78 | -0.60 | 0.20 |
| 3 | 0.78 | 0.55 | 0.31 |
| 4 | 0.16 | 0.90 | 0.41 |
| 5 | -0.83 | 0.32 | 0.45 |
| 6 | -0.83 | -0.40 | 0.38 |
| 7 | -0.26 | -0.65 | 0.71 |
| 8 | 0.74 | -0.07 | 0.67 |
| 9 | -0.26 | 0.50 | 0.83 |
| 10 | 0.10 | -0.10 | 0.99 |

Table 5-1 Microphone positions

5.3. Operation of the EUT during test

With the EUT in place the sound power measurement is calculated over a 15 second period for the two following states:

- EUT at idle
- EUT at full load
- EUT System Level Test

For each of the active operating conditions the EUT is allowed to stabilize for a period of 30 minutes prior to the measurement being taken. The full load condition is generated through the use of the Intel Power Thermal Utility running appropriate processor workloads as defined by Intel specifications.



6. Test Results

6.1. Test Results – Sound Pressure

Background A – Weighted Sound Pressure Levels

| Microphone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------|------|------|------|------|------|------|------|------|------|------|
| dB(A) | 22.8 | 24.1 | 23.7 | 23.9 | 23.2 | 23.5 | 23.4 | 23.7 | 23.9 | 23.3 |

Test condition 1: System at idle A – Weighted Sound Pressure Levels

| Microphone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------|------|------|------|------|------|------|------|------|------|------|
| dB(A) | 34.4 | 32.8 | 32.1 | 32.5 | 32.3 | 33.2 | 33.6 | 32.0 | 32.3 | 34.6 |

Test condition 2: System under load A – Weighted Sound Pressure Levels

| Microphone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------|------|------|------|------|------|------|------|------|------|------|
| dB(A) | 47.7 | 49.1 | 47.5 | 44.5 | 44.0 | 46.0 | 44.5 | 48.2 | 42.6 | 43.1 |

Test condition 3: System Level Test A – Weighted Sound Pressure Levels

| Microphone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------|------|------|------|------|------|------|------|------|------|------|
| dB(A) | 38.0 | 36.2 | 34.4 | 34.7 | 33.1 | 34.8 | 37.3 | 34.1 | 35.7 | 38.1 |

6.2. Test Results – Sound Power

| | L_{WA} B(A) |
|--|----------------------------|
| Test condition 1: System at idle | 4.0 |
| Test condition 2: System under load | 5.4 |
| Test condition 2: System Level Test | 4.4 |

Table 6-1 A – Weighted Sound Power



6.3. Test results - Graphical

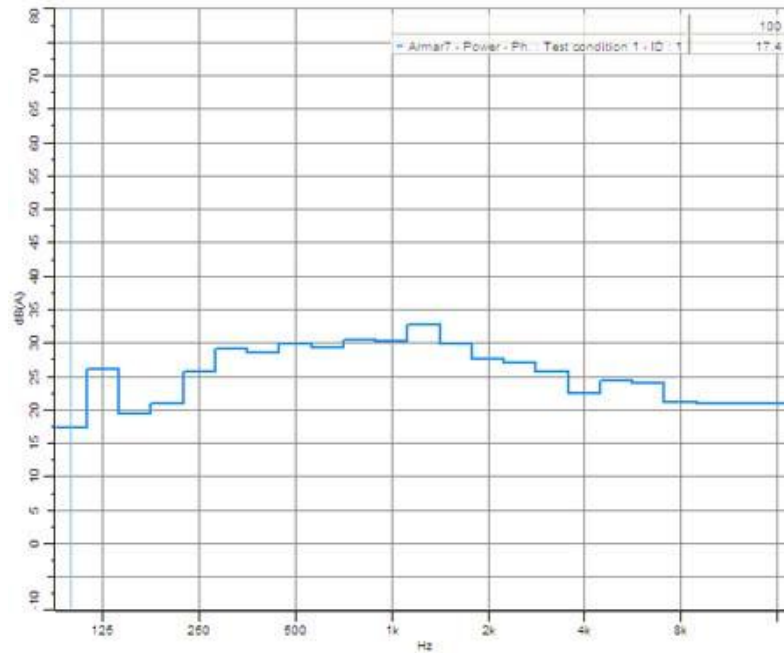


Figure 6-1 Sound Power – system at idle

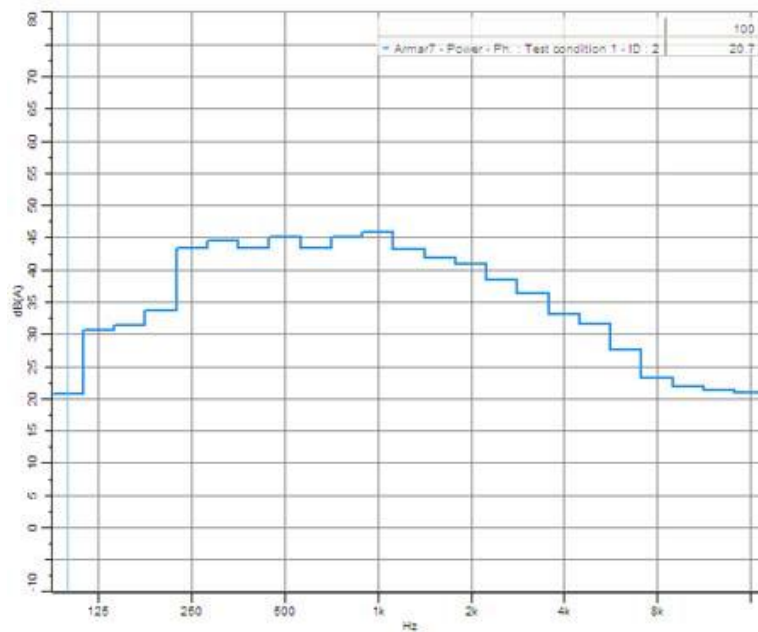


Figure 6-2 Sound Power – system under load

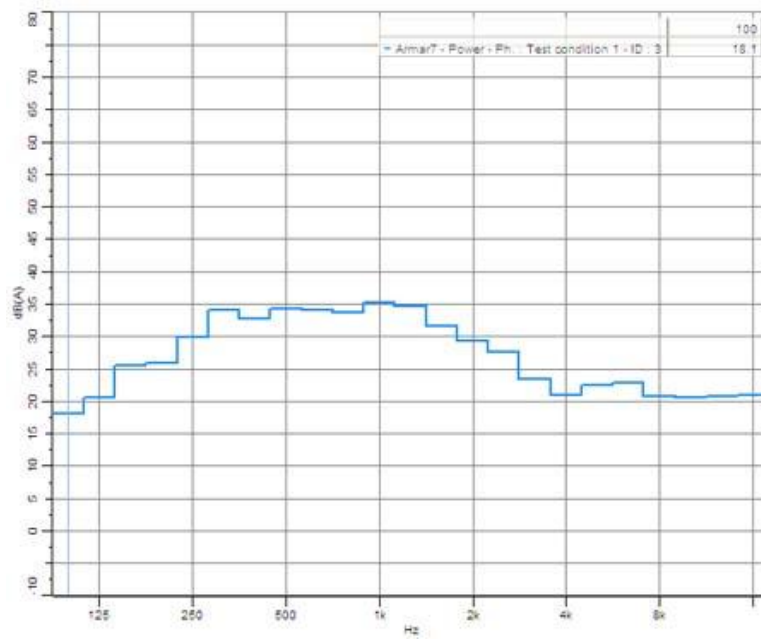


Figure 6-3 Sound Power – System Level Test



6.4. Summary of Issues

A summary of acoustic related test issues is given below. A priority has been assigned to each problem to estimate the potential impact to users. Additionally, there may be some issues that are identified in this report as “FYI” (For Your Information) that may be of interest, but are not considered of high enough priority to be listed in the summary.

- 6.4.1. Priority 1 Critical
None
- 6.4.2. Priority 2 Important
None
- 6.4.3. Priority 3 Future Impact
None
- 6.4.4. FYI
None



7. References

7.1. Acoustic Support Documentation

Refer to the following documentation for more information.

| |
|--|
| ECMA-74 – Measurement of airborne noise emitted by information technology and telecommunications equipment. |
| ISO 7779 – Measurement of airborne Noise Emitted by Information Technology and Telecommunications Equipment. |
| ISO 9296 – Acoustics: Declared noise emission values of computer and business equipment. |
| ISO 3744 – Acoustics: determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane. |
| ISO 3745 – Acoustics: determination of sound power levels of noise sources – Precision methods for anechoic and semi-anechoic rooms. |
| ISO 11201 – Acoustics: Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a workstation and at other specified positions – Engineering method in an essentially free field over a reflecting plane. |
| ECMA-341 – Environmental design considerations for electronic products. |
| ECMA-275 – Measurement of structure-borne vibration induced by small air moving devices. |

Table 7-1