

1. PART ONE – GENERAL

1.1. SECTION INCLUDES

- A. Sound masking system

1.2. REFERENCES

- A. ASTM E1374-06 (11) – Standard Guide for Open Office Acoustics and Applicable ASTM Standards
- B. ASTM E1573-09 – Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels
- C. ASTM E1130-08 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index
- D. ASTM E2638 – Standard Test Method for Objective Measurement of Speech Privacy Provide by Closed Rooms
- E. Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274)

1.3. PERFORMANCE AND DESIGN REQUIREMENTS

A. System Architecture

1. The system shall be of a SmartSMS-Net Soft dB networked decentralized architecture with addressable masking devices distributed throughout the installation area.
2. The sound masking system shall be arranged into zones that will allow the system to be fine tuned and comply with the performance specifications defined in Section 1.3.B.4.
 - a. A zone is defined as an acoustically uniform environment. The typical number of speakers per zone varies from 1 to 6 speakers depending on the design. The number of speakers per zone in the open area can be increased up to 30 speakers as long as the system meets the performance and requirements defined in Section 1.3.B.4.
 - b. Each zone shall be individually addressable and controllable for both volume and spectrum for fine tuning of the system.
 - c. An automatic equalization process shall be used for each zone.

B. Sound Masking Generating System

1. The system shall use digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.
2. Sound masking generator shall include an automatic calibration process on 340 narrow bands or third-octave bands from 100Hz to 6.3kHz based on DSP technology.
3. The masking sound shall be generated via a truly-random, non-deterministic digital process with no repeat cycle.
4. The system shall provide independently controllable masking zones that efficiently allow the ability to control and monitor the operation of each zone and provide:

- a. A third-octave equalizer per zone with minimum 18 bands, ranging from 100Hz to 6 300Hz;
- b. Possibility to select specific spectrum for each masking zone;
- c. Definition of the sound masking spectrum by increment of 0,1 dB in each 1/3 octave band;
- d. An independent masking volume control providing minimum 0.1 dBA volume increments and an output range of 35 to 85 dBA @ 1m from the loudspeaker;
- e. A temporary mute function for the masking output;
- f. The ability to completely disable the masking output;
- g. Possibility to provide a masking volume ramp-up function of up to 4 weeks to facilitate the introduction of the system in the buildings that are already occupied.
- h. The system shall provide a function to allow a gradual ramp up of masking volume each time power is applied

C. System Control and Software

1. The system shall include LAN, USB and Wireless communication capability. The configuration and the adjustment of the system shall be made with a PC or a tablet connected by a wireless connection. The wireless connection is required only during the configuration of the system (not required for operation) and can be turned off if required.
2. The sound masking system shall include graphical software interface that integrates the design, setup, and calibration stages directly on the office layout plan.
3. When adjustment needs to be made on the sound masking system, the operator shall be able to make the changes directly from the area that needs modification. The operator control PC or tablet shall be able to communicate with the system by wireless.

D. Sound Masking Systems Acoustical Performance

1. The preferred target sound masking frequency spectrum to be used shall be the one shown in Table 1 and in Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274) for each zone
 - a. The frequency contour provided shall be maintained at different dBA target levels by equally applying the positive or negative difference, between the nominal 45 dBA level and the target dBA level, to each of the one-third octave frequency band's dB level, so as to equally shift the entire contour. (e.g. A target level of 42 dBA, will require shifting the entire 45 dBA spectrum down equally by 3 dB in each of the 1/3 octave frequency bands)

**Table 1: Optimal Sound Masking Spectrum (ref. Bradley, NRCC-46274 report)
– Nominal 45 dBA Contour**

1/3 Octave Band Center Frequency	1/3 Octave dB Sound Levels (overall = 45 dBA nominal)
Hz	dB
100	42.5
125	42
160	41.5
200*	41.5
250*	41
315*	40.5
400*	*39.5
500*	38.5
630*	37.5
800*	37
1,000*	35.5
1,250*	33.5
1,600*	31
2,000*	28.5
2,500*	26.5
3,150*	23.5
4,000*	21.5
5,000*	19.5

** The Articulation Index (which defines speech intelligibility) uses only the frequencies noted above*

2. Base line masking sound levels levels for each location type shall be as follows:
 - a. **45 dBA** in open plan areas. (or as defined by the acoustician)
 - b. **42 dBA** in enclosed rooms (or as defined by the acoustician)
3. The supplier shall setup the sound masking system to meet acoustical performance requirements when HVAC systems are functioning under what is considered a “normal” mode of operation for occupied periods.
 - a. It is the client’s responsibility to ensure HVAC systems are operating as required during sound masking system’s scheduled commissioning.
 - b. The supplier shall not be responsible to meet acoustical performance requirements in locations where, existing background noise exceeds sound masking spectrum levels, and/or where building design details or other constraints prevent its proper installation, setup and operation.
4. The spectrum should be verified and adjust to match target spectrum for every 100 square meters at a minimum in open area and in 15% of enclosed rooms. The measurement shall be performed at representative locations 1.5m above floor level 1m away from demising partitions and walls or large reflecting surfaces, in concordance with ASTM E1573 measurement procedures.

5. After adjustment, the system shall provide spatial uniformity within the tolerances provide below when adaptative control is off:
 - a. It Overall dBA levels measured within zones and in enclosed rooms shall be within **+/- 1 dBA**, of the specified target level for the combined mechanical and sound masking level;
 - b. Uniformity in any third-octave band shall vary no more than;
 - c. **+/- 2 dB**, from the 1/3 octave band contour levels defined in Table 1 from 100Hz to 200Hz;
 - d. **+/- 1,0 dB**, from the 1/3 octave band contour levels from 200Hz to 5000Hz;
 - e. In the situation where building background noise exceeds the target spectrum, special attention should be taken to identify the source;
6. Upon completion of installation, and final setup the supplier shall provide a report to client of the sound masking systems acoustical performance.

E. Adaptive Volume Control for Sound Masking Level

To optimise the efficiency of sound masking and the acoustical confort of the occupant, the sound masking system shall include an adaptative volume control system for each zone.

1. This adaptive volume system should allow an automatic real-time volume adjustment of the masking sound level based on the level of ambient noise in zones.
2. Upon completion of installation, and final setup the supplier shall provide a report to client of the sound masking systems acoustical performance.
3. The ambient noise shall be measured with sensors installed in the zones. The controller shall have the ability to increase or lower the masking sound according to the variation of the ambient noise in the zones by measuring in real time the discrepenses between L10% and L90% of the ambient noise.
4. Variations rates shall be adjustable from 0.01dB/sec to 0,1 dB/sec steps and the variation should be updated at least every 15 sec to avoid any perceptible change in masking sound level.
5. The minimum and maximum sound masking level of the adaptive volume control shall be programmable.
6. The typical adaptive volume limits shall be 45 dBA +/-3 dB and shall be be fully programmable. This typical set up shall allow the system to decrease to 42 dBA when the space is quiet and allow it to increase in real-time by non-perceptible increments to a maximum of 48 dBA during high-activity periods.
7. The masking volume in each zone shall be controlled independently.
8. History of the active volume control shall be recorded on a 7 days period to allow the performance of the system to be analyzed.

F. Calendar-Based Programmable Timer Function

1. The system shall include a calendar-based programmable timer function to:
 - a. Put the masking system in sleep mode during nighttime for energy saving;
 - b. Provide an acclimation of the office workers over days or weeks;

- c. To provide masking volume adjustment according to day time activity (if the systems do not include the automatic adaptive volume control technology;
 2. Timer schedules shall be assigned to an individual or group of sound masking zones.
 3. The system shall allow independent timer schedules for each day of the week.
 4. The system shall allow variable rates of volume adjustment as low as 0,01 dB/sec.
- G. In-Room occupant Control (Optional)
 1. The system shall allow for the option to include a specified number of wall mounted, in-room controls giving the facility occupants manual controls over the loudspeaker volume in designated room or zone.
- H. Diagnostic Performance (Optional)
 1. Upon initial configuration, the system shall allow the ability to monitor that each networked device is communicating with the project manager software.
 2. The system shall provide a function for locating loudspeakers from below the ceiling, producing an audible tone burst.
 3. Diagnostics shall be viewable from the project manager software.
 4. The check-up list to monitor shall be selected by user.
 5. The system shall provide the ability to automatically generate, store and/or send via an external network monitoring reports with the status of all networked devices. The system shall be able to
 - a. Send report of errors to client-defined email addresses
 - b. Store reports in client-defined folder
 6. The system shall be capable of generating reports in printed and editable electronic formats.
- I. Security Performance
 1. The system shall provide:
 - a. Password-protected access to the project manager software.
 - b. storage of settings in memory in each networked masking device, which shall be maintained during power outages
 2. The sound masking system shall be designed to perform as a stand-alone system therefore totally independent from the customer's LAN infrastructure and therefore not gather, store or communicate any relevant information except from low level electronic signals from the controllers to the speakers or sensors.
 - a. The only exception allowed would be when the customer requires that the sound masking system to interface with their Building Automation Software then the sound masking system shall offer an option to connect the controller to the customer's network through an RJ-45 connector or WIFI.

1.4. SUBMITTALS

- A. Product Data: Manufacturer's Specifications and Installation Instructions.
 - 1. System Design: schematics of the system showing quantity and location of components, related cabling and accessories.
 - 2. Warranty Documents: warranty documents covering the system components.

1.5. QUALITY ASSURANCE

- A. System Design: Performed by an approved manufacturer representative.
- B. Installer Qualifications: Approved by manufacturer representative and are trained with the specified components or have demonstrated experience with the installation of similar products to those specified.
- C. System Adjustment: Done by an approved manufacturer representative or trained contractor.

1.6. REGULATORY TESTING AND CERTIFICATIONS

- A. The relevant system components shall conform to:
 - 1. UL 60065 / ULC 60065 – Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General
 - 2. FCC – EN 55103-1&2 – Audio, Video and Entertainment Lighting Control

1.7. DELIVERY, STORAGE AND HANDLING

- A. Protect from moisture during shipping, storage and handling.
- B. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.
- C. Inspect manufacturer's packages upon receipt.
- D. Handle packages carefully.

1.8. WARRANTY AND MAINTENANCE

- A. Provide a written warranty that the system components installed shall be free from defects in parts or assembly for a 5-year period from date of first use (the date of system initialization).

2. PART TWO - EXECUTION

2.1. SYSTEM DESIGN

- A. Design system according to manufacturer's specifications.

2.2. EXAMINATION

- A. Ensure that facility build out is at a stage suitable for the system installation.
- B. Ensure that facility is constructed according to plans, including wall locations, ceiling types and plenum barriers.
- C. Ensure that the plenum height is appropriate as per manufacturer's recommendations and as per plan.
- D. Ensure power requirements have been provided as per plan.
- E. Ensure sufficient space for centrally located components is available as per plan and manufacturer's specifications.
- F. Ensure any third-party components required to be interfaced with the system have been provided.

2.3. PERMITS

- A. Obtain necessary permits for installation work.

2.4. INSTALLATION

- A. Follow all applicable codes for the area.
- B. Follow manufacturer's recommendations regarding installation.
- C. Follow the system design for location of loudspeakers and wiring.
- D. Record any necessary changes to the system design on the plan.
- E. Ensure that supplementary materials used meet applicable safety standards.

2.5. FIELD QUALITY CONTROL

- A. Ensure that plenum heights meet the minimum recommended by the manufacturer for the loudspeakers.
- B. Ensure that the distance between the top of the loudspeaker and the deck meets manufacturer's minimum specifications.
- C. Ensure that loudspeakers are suspended in a level manner.
- D. Minimize obstructions to loudspeakers, to the extent possible.
- E. Ensure cables are properly supported in the ceiling.
- F. Ensure cables are securely terminated.

2.6. SYSTEM CONFIGURATION AND ADJUSTMENT

- A. Follow manufacturer's recommendations for system settings as found in the User Manual.

2.7. CLEANING

- A. Ensure that empty packaging is removed. *** Please recycle ***
- B. Ensure that any material waste is removed.
- C. Ensure the system components are clean and presentable where required.

2.8. DEMONSTRATION AND TRAINING

- A. Demonstrate operational system to customer by walking the space.
- B. Demonstrate functionality of the system to the customer or customer's representative.
- C. Provide any training to customer's representative that may be required under the terms of the contract to maintain and/or operate the system or any optional devices (e.g., in room controls)
- D. Special training may be provided for sound masking systems monitoring software, when operation requires monitoring for speech security requirements.

3. PART THREE – MANUFACTURER

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