

**Altisonus
KVG Laboratories
Kansas Audio Works
Union Sound Works**

LOUDSPEAKER QUALITY CONTROL

GENERAL PROCEDURES

Build Quality Verification:

- Cabinet Visual Checks Before Assembly: Check squareness, joinery integrity, excess glue, finish for blemishes. Look for presence and appearance of brightwork, badges, placards, and fitments.
- Prototype Rapid Internal Volume Check: Confirm specified volume with packing peanuts.
- Terminals: Verify orientation, legends, electrical properties, absence of oxidation or contamination, lack of mechanical defects, and air seal integrity.
- Wiring harness shall exhibit no inductive reactance. Series resistance shall not exceed 0.005 Ohms. Capacitive reactance shall be within 1% of bogey values for the model.

Driver Pre-Assembly Checks:

- Polarity: 1.5V battery “pop test.” All drivers move forward with positive voltage. WARNING: Certain drivers may be damaged by the application of DC; OMIT THIS TEST IN THOSE INSTANCES. Use Type NJ/C11 acoustic polarity tester instead.
- DCR Check: Measured R_e at terminals should be within specified tolerances. Repeat for each driver. WARNING: Certain drivers may be damaged by the application of DC; OMIT THIS TEST IN THOSE INSTANCES. Measure impedance with Type NJ/FW1 24 Bit sigma-delta D/A Converter tester instead.
- Reactance Check: Inductance, Measured L_e at terminals should be within specified tolerances. Repeat for each driver.
- Impedance Sweep: Stimulus range 10 cps to 20,000 cps. Impedance curve at terminals should be within specified tolerances. Repeat for each driver.
- Amplitude Response: Apply pink noise stimulus at 2.83 VAC RMS for 1 Hour. Connect to FFT and run Amplitude Response curve with microphone 6” on axis. Measured amplitude response should be within specified tolerances. Repeat for each driver.
- THD/IMD: Apply stimulus as defined in the manual for the test instrument. Position microphone as directed in the manual for the test instrument. THD/IMD must not equal the specified limits of the individual driver; i.e., THD/IMD must always be less than the driver specified ratings. A driver that equals the specified rating will be rejected.
- Woofer Thermal Proof Test: Stimulus 30 min filtered pink noise 25 cps to 2000 cps, 20W RMS. Check voice coil temperature <120-degrees F, no “burned wire smell.” This predicts longterm life. Replace woofer if it fails the test.

Crossover Pre-Assembly Checks (if present):

- Check connections for errors. Correct as needed.
- Check component mounts for loose or mis-oriented components. Correct as needed.
- Install dummy loads NJ/DLx across all output terminals.
- Apply pink noise stimulus at 2.83 VAC RMS. Connect output to FFT analyzer and verify amplitude response falls off at the specified turnover frequencies, and at the specified rate. Verify phase shift and polarity at outputs.
- Place crossover on vibration table while viewing the outputs on FFT analyzers; observe for any wavering or deviation and confirm stability of the signal.
- Check L pad or autoformer is within 2% of specifications.
- Check Baffle-Step Compensator is within 5% of specifications, if present.
- Check High-Pass Filter is within 5% of specifications, if present.
- Confirm time response of protective appliance, if present.
- Thermal Proof Test: Stimulus full spectrum pink noise at rated power for 1 hour. Temperature must not exceed 20% of component thermal ratings. This predicts longterm life.

Final Assembly Checks

- Conditions: Following completion of the loudspeaker.
- Follow the Procedure for Adjusting Acoustic Damping, described in SCHEDULE ND/277 ACOUSTIC DAMPING ADJUSTMENT, before proceeding.
- Air Seal Integrity: Sweep Stimulus from 20 cps to 300 cps. If any rattling, buzzing, or humming is audible check cabinet and driver thoroughly. Common failure points include driver mounts, driver gaskets, woofer surround failures, seals for vents or removable panels, connector panels, and PA speaker pole mount fitments. Loose grille frames will also rattle if not installed securely.
- Test electrical assemblies for continuity, correct frequency division, baffle-step compensation, or other parameters as appropriate.
- Verify Acoustic Measurements (See following).
- Verify Mutuality Test (See following).
- Verify Subjective Listening Tests (See following).

Acoustic Measurements

- Initial Conditions: 1 Watt, 1 meter, on-axis.
- Amplitude Response: Stimulus FFT Chirp 20 cps to 20,000 cps, gated with 1/24th octave smoothing as instructed by the test instrument. Confirm results are within specifications.
- Off-axis Amplitude Responses: Repeat measurements at the left and right extents of 30°, 60°, and 90° included angles horizontally. Confirm results are within specifications.
- Pay close attention to the crossover regions, check the tweeter crossover region for absence of a trough exceeding 2 dB.
- Cepstrum: Confirm results are within specifications.
- Sensitivity: Confirm results are within specifications.
- IMD/THD: FFT Chirp stimulus, increase power to 90dB SPL unweighted at 4 feet on axis. Confirm results are within specifications.
- Vent Airflow Turbulence (if present): Stimulus 42Hz sinus at 90dB SPL unweighted at 4 feet on axis. Listen for audible noises. Pitot Anemometer should verify airflow velocity is within specification. Run a Cepstrum plot on the sound radiating from the vent. No frequency should be radiated that is more than one and a half octaves above the tuning frequency. If any lower midrange, or higher, frequencies are measured radiating from the vent you will need to install an auxiliary sound absorber behind the vent that does not block airflow.
- Aperiodic Flow Resistor: Stimulus FFT Chirp impedance sweep. FFT Chirp Amplitude Response. Correlate the Amplitude Response and impedance plots; if both is not within specification adjust the density and the flow resistor, repeat FFT Chirp Impedance Sweep.

Mutuality Test

- Predicates: Stereo Panorama Calibration Tape SRA 77/SP or equivalent. Stereo Panorama Auditor Map SRA 77/MAP or equivalent.
- 1. Position a pair of loudspeakers under test in the room following the position guide.
- 2. With no auditors present, adjust the playback level with track one on the tape so that the sound pressure level is 85 dB at the listening position.
- 3. Bring in each auditor one at a time. Instruct them that they are listening to a reference tape that will last 10 minutes. Hand the auditor a blank copy of the Map and instruct them to place an X where they think each instrument is located and a circle or oval around the X to indicate how large they think the instrument is.
- 4. After each auditor has listened to the tape and filled out their map: Compare the results to the actual reference Map. Perform statistical analysis to determine the magnitude of positional and size-perception errors. Express the error in Angular Degrees.

Subjective Listening Tests

- Voice: Male and female vocals. Listen to the region between 1,000 cps and 2,000 cps (Notes between B5 and C7) for chestiness, boxiness or honk. Absence of sibilance.
- Choirs, Vocal Quartets: should sound extremely natural and human yet with the sense of size and power of a live performance. Lyrics should be clearly defined, articulate, and easy to distinguish. No sibilance must be present. Listen especially for a subtle modulation distortion or “beat frequency” phenomenon that can occur with massed vocals. You should be able to hear the acoustic environment.
- Bass: Kick drum, upright bass. Listen for note overhang, cardboard sound on kick, woody growl on bass. Attack should feel “fast.”
- Bass Guitar: Listen for note overhang, electric growl, sense of solidity and power. Attack should feel “fast.” Woofer should mute if “Smoke On The Water” is played.
- High Hats, Cymbal: Lack of splashiness, should sound metallic with the subtle crack of the stick hit.
- Snare: Crisp yet resonant no sense of a plastic sound.
- Toms: you should hear a sharp attack, rich and full of resonance. Toms should sound big.
- Acoustic Guitar: you should hear a lack of boxiness or boominess, well defined notes, sense of body resonance, and wood textures.
- Electric Guitar: because of the wide range of tones supplied to electric guitars, listen for depth, and the overall textures, note definition should be clear, except in cases of very heavy distortion, such as in heavy metal music. In that case, you’re looking for a strong powerful sound.
- Piano: You should be able to hear the initial attack of the note crisply and cleanly and a full sustained resonance. The character of the instrument should change from pianissimo to fortissimo, and that change should be readily apparent. If the recording includes mechanical noise of the piano, you should be able to hear that mechanical noise. Overall sound must be well defined, and not muffled. The piano should not sound artificial.
- Violin: The “dugga-dugga-dugga” of bowing should be well defined and immediately evident, even in a dense mix. The overall sounds should have an absence of harshness or a sense of feeling strained. The rich complex resonance should be easily discernible.
- Brass: Resonant without harshness.
- French horn: The ultimate midrange challenge, should be full, brassy, and resonant without harness, strained sound, or audible mechanical stress of the speaker.
- Leslie Organ (Hammond B3): the swells should be rich and full and prominent; overall tone, rich and melodic, sometimes sweet, depending on the settings.
- Pipe Organ: the room acoustics should be just as prominent as the organ you should be able to hear every rank in a good recording position of each pipe; the effect of the acoustics on the sound of the organ should be discernible not just a vague reverb.
- Maximum SPL: Play dynamic tracks to 90dB at 4-feet. Listen for compression or mechanical distress.