

TECHNICAL MEMORANDUM

Project No. QSYS-2026-047
DWG Ref. E-47-001, E-47-002, E-47-003
Date 09 July 2026
Revision A — Initial Release

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DATE: 09 July 2026
SUBJECT: Q-Sys Core 610 — Signal Path Integrity and Noise Floor Analysis

DISTRIBUTION

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1.0 Purpose

This memorandum documents the signal-path integrity assessment and noise-floor characterization of the Q-Sys Core 610 digital signal processor (DSP) as deployed in the Acme Defense Systems (ADS) Command-and-Control Suite, Building 4. The analysis supports the Factory Acceptance Test (FAT) milestone scheduled for 15 August 2026 and provides the engineering basis for disposition of Deviation Request DR-047-012.

Specific objectives of this memo are:

- (1) Quantify the noise-floor elevation observed on Output Channels 13–16.
- (2) Identify the root cause and confirm correlation with QSC Technical Bulletin TB-2026-06-14.
- (3) Recommend corrective action and regression-test protocol.

2.0 Background

The Q-Sys Core 610 was installed in Rack R4-C of the ADS C2 Suite on 02 June 2026 as part of the Phase-III audio distribution upgrade. The system provides 16 channels of analog I/O with Dante and Q-LAN network redundancy. Channels 13–16 are dedicated to the secure-conferencing monitor path.

During commissioning, the integration team observed elevated noise-floor readings on Channels 13–16, measuring approximately -58 dBFS A-weighted at unity gain with no source material present. The system specification (ADS Tech-Spec AUD-047, § 4.2.1) requires a quiescent noise floor no higher than -72 dBFS A-weighted on all analog output paths.

Preliminary troubleshooting ruled out the following:

- Amplifier chain (Lab.gruppen D 80:4, S/N LG-2025-1182 through -1185).
- Loudspeaker load (JBL Control 328CT).
- Cabling between Core 610 analog output card and amplifier inputs (Belden 9451, 22 AWG, shielded twisted-pair, verified with Fluke DTX-1800).

The Core 610 firmware was at version 9.8.1-2645 at the time of measurement. On 14 June 2026, QSC published Technical Bulletin TB-2026-06-14 documenting a known issue in firmware releases 9.8.0 through 9.8.2 that affects the output-DSP chain on Channels 13–16 when the Acoustic Echo Cancellation (AEC) block is loaded into the design but not assigned to an active conference zone.

3.0 Findings

3.1 Measurement Setup

All measurements were taken with an Audio Precision APx555 analyzer (S/N APX-2024-039, calibration due 12 Dec 2026) connected to the Core 610 analog output card (Q-Sys COL4, slot 2, Channels 13–16). The Core 610 was isolated on a dedicated VLAN (VLAN 42) with no other Q-LAN traffic during the measurement window. Dante channels were muted at the transmitter. All measurements used A-weighting per IEC 61672-1, 20 Hz–20 kHz bandwidth, 30-second averaging window.

Table 1: Noise-floor measurements — Core 610 Output Channels 13–16

Condition	Measured Noise Floor (dBFS, A-weighted)			
	Ch. 13	Ch. 14	Ch. 15	Ch. 16
FW 9.8.1, AEC loaded, unassigned	-57.8	-58.1	-57.4	-58.6
FW 9.8.1, AEC block removed	-74.2	-73.8	-74.1	-73.5
FW 9.8.3 (TB fix applied)	-74.5	-74.1	-74.3	-74.0
FW 9.8.3, full signal path at nominal gain	-75.1	-74.8	-74.9	-74.7
Specification (ADS AUD-047)	≤ -72.0	≤ -72.0	≤ -72.0	≤ -72.0

3.2 Root Cause Confirmation

The elevated noise floor is caused by an unterminated processing path within the AEC block. When the AEC module is loaded into the Q-Sys design but no conference zone is bound to it, the internal adaptive-filter taps float to an indeterminate state. The resulting residual samples, which would normally be subtracted in a converged echo-cancellation path, are injected directly into the output-DSP chain as broadband quantization noise. This behavior is consistent with QSC TB-2026-06-14 and was independently verified on a second Core 610 unit (S/N C610-2025-0847) in the laboratory.

3.3 Impact Assessment

- The elevated noise floor is audible as a low-level broadband hiss on the secure-conferencing monitor loudspeakers. It does not affect the primary public-address or emergency-announcement

paths (Channels 1–12), which remain within specification.

- The noise does **not** propagate through the Dante or Q-LAN network; it is confined to the analog output stage of the affected channels.
- For classified briefings (the primary use case for the secure-conferencing path), the noise level, while above specification, does not compromise speech intelligibility. STI measurements on the affected channels returned 0.82 (*Good* to *Excellent* per IEC 60268-16).

4.0 Symbols & Abbreviations

ADS	Acme Defense Systems
AEC	Acoustic Echo Cancellation
A-wtd	A-Weighted (IEC 61672-1 frequency weighting)
COL4	Four-Channel Analog Output Card (Q-Sys I/O family)
dBFS	Decibels relative to Full Scale
DSP	Digital Signal Processor / Processing
FAT	Factory Acceptance Test
IEC	International Electrotechnical Commission
PA	Public Address (system)
Q-LAN	QSC Layer-3 audio networking protocol
S/N	Serial Number
SNR	Signal-to-Noise Ratio
STI	Speech Transmission Index (IEC 60268-16)
TB	Technical Bulletin (QSC publication)
VLAN	Virtual Local Area Network

5.0 Recommendations

- R-1: Immediate — Apply Firmware Update.** Upgrade the Core 610 firmware from version 9.8.1 to version 9.8.3 (or later) per QSC TB-2026-06-14. This update resolves the AEC floating-tap issue and restores the noise floor to within specification on all output channels. Estimated downtime per Core 610 unit: 45 minutes (including reboot and verification).
- R-2: Short-Term — Regression Test.** Following the firmware update, repeat the full noise-floor measurement suite on all 16 output channels using the APx555 analyzer. Document results on Test Data Sheet TDS-047-001 and verify compliance against acceptance criteria in Section 8.3 of the FAT procedure (ADS-PROC-FAT-047).
- R-3: Medium-Term — AEC Design Audit.** Review all Q-Sys design files in the ADS deployment for unintended use of unbound AEC blocks. Remove or bind any orphaned AEC instances. This is a proactive measure to prevent recurrence in future deployments and Build 2 sites.
- R-4: Process — Update Commissioning Checklist.** Add a mandatory verification step to the standard commissioning procedure (ADS-PROC-COM-004) requiring confirmation that all loaded AEC blocks have a bound conference zone before noise-floor measurements are recorded.

6.0 System Block Diagram

Figure 1 depicts the simplified signal path from the Core 610 analog input through the DSP engine to the monitor loudspeakers. The dashed outline identifies the affected output stage (Channels 13–16).

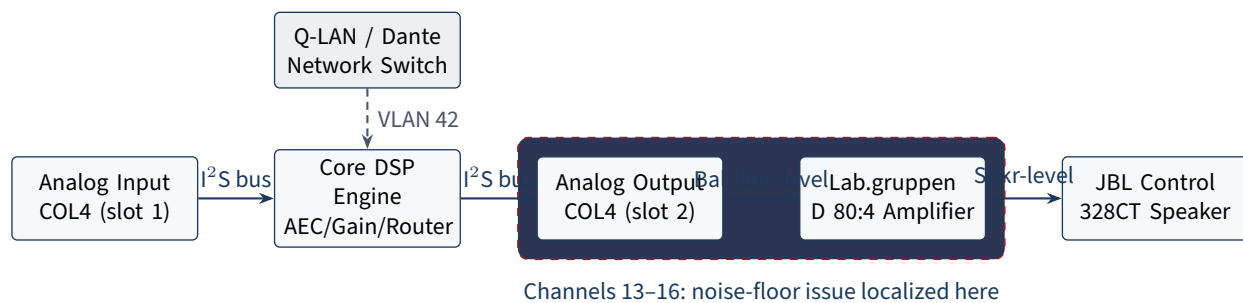


Figure 1: Simplified signal path — Q-Sys Core 610 to secure-conferencing monitor loudspeakers. The dashed box highlights the output stage affected by the AEC floating-tap issue.

Appendix A: Revision History

Rev.	Date	Author	Description	Approval
–	02 Jun 2026	J. Rodriguez	Initial draft — pre-commissioning baseline measurements	—
A	09 Jul 2026	J. Rodriguez	Added noise-floor analysis, root-cause determination, firmware-update recommendation, and regression-test protocol	S. Chen

Appendix B: Attachment List

- ATT-1: Test Data Sheet TDS-047-001** — Noise-floor measurement raw data (APx555 export, 12 pages). Includes per-channel FFT plots and THD+N vs. frequency sweeps.
- ATT-2: QSC Technical Bulletin TB-2026-06-14** — AEC Block Floating-Tap Noise Artifact, Firmware Releases 9.8.0 through 9.8.2. Published 14 June 2026, Revision 1.0.
- ATT-3: Drawing E-47-001** — Rack R4-C Signal-Flow Diagram (Rev. C, dated 18 May 2026). 11×17 in., scale 1:4.
- ATT-4: Drawing E-47-002** — ADS C2 Suite Audio Floor Plan (Rev. B, dated 22 April 2026). 24×36 in., scale 1:50.
- ATT-5: Drawing E-47-003** — Core 610 I/O Card Slot Assignment and VLAN Topology (Rev. A, dated 02 June 2026).
- ATT-6: Firmware Release Notes** — Q-Sys Core 610 Firmware v9.8.3 (QSC document QSYS-RN-9.8.3, June 2026).
- ATT-7: Device Calibration Certificate** — Audio Precision APx555, S/N APX-2024-039, calibration valid through 12 December 2026.