

AUDITOR GUIDANCE MANUAL – MASTER QUALIFICATION TEST GUIDE (MQTG) AUDIT

Target Audience: Competent Authority Inspectors, Lead FSTD Auditors, Compliance Monitoring Managers (CMM).

Regulatory Basis: Commission Regulation (EU) No 1178/2011 (Part-ORA) & CS-FSTD Issue 1 (ED Decision 2026/008/R).

EXECUTIVE SUMMARY & REGULATORY FRAMEWORK

The Master Qualification Test Guide (MQTG) is the primary reference document used to establish and maintain the technical qualification of a Flight Simulation Training Device (FSTD). Under EASA regulations, maintaining an FSTD qualification requires continuous, structured verification that the device's performance, handling, and system functions remain compliant with its initial qualification basis.

Applicable Regulatory References

- **ORA.FSTD.105(a), (b) Maintaining the FSTD Qualification:** Mandatory progressive running of the complete set of MQTG objective tests and subjective/functional checks over a 12-month period, dated, analysed, evaluated, and retained.
- **ORA.FSTD.240 & AMC1 ORA.FSTD.240(a)(2) Record-keeping:** Mandatory 5-year retention period for recurrent QTG runs, internal subjective test reports, technical logs, audit schedules, and CMS reports.
- **ORA.GEN.150 & GM1 ORA.GEN.150 Findings & Root Cause Analysis:** Identification of root causes, definition of Corrective Action Plans (CAP), and elimination of recurring non-conformances.
- **CS FSTD.GEN.015(17) Definition of Automatic Testing:** Software-driven test scenarios removing human error and ensuring exact repeatability.
- **CS FSTD.QTG.020 & CS FSTD.QTG.025 Conducting & Assessing Objective Tests:** Scripted test execution, open/closed-loop drivers, numerical tolerances, and Essential Match (EM) criteria for recurrent testing.
- **CS FSTD.QB.115 (15.8.1) Automatic Testing Facilities:** Requirement for automated objective testing capabilities.

AUDIT TASK 1: VERIFYING PROGRESSIVE MQTG TESTING (12-MONTH CYCLE)

Regulatory Context & Objective

- Pursuant to ORA.FSTD.105(a), the FSTD qualification certificate holder must run the complete set of MQTG objective tests and subjective/functional checks progressively over a 12-month period.

- Auditors must verify that the operator does not perform "batch testing" (running all tests in the 11th month just prior to the Authority recurrent evaluation). Testing must be distributed into approximately equal three-monthly blocks (quarters) across the 12-month evaluation cycle.

12-MONTH PROGRESSIVE MQTG CYCLE – Each Quarter 25% MQTG – Subjective

Auditor Verification Steps & Checklist

A. Schedule & Sampling Distribution Verification

1. Audit Action: Request the operator's Compliance Monitoring Programme (CMP) audit schedule for the FSTD for the trailing 12 to 36 months (GM1 ORA.FSTD.100(c)(1)(r)).
2. Check: Verify that all objective tests listed in the MQTG index are divided logically into 4 quarterly packages (Q1, Q2, Q3, Q4).
3. Check: Ensure each block contains approximately 25% of the total test suite, covering a balanced cross-section of features:
 - Performance & Handling (Ground, In-Ground Effect, Out-of-Ground Effect)
 - Flight Control Systems & Forces (Static & Dynamic)
 - Cueing Systems (Motion, Visual, Sound, Vibration)
 - System Integration & Transport Delay
4. Verification: Inspect the execution dates on raw computer-generated test runs. Verify that Q1, Q2, Q3, and Q4 runs correspond strictly to their scheduled 3-month windows.

B. Subjective and Functions Testing Verification

1. Audit Action: Request the subjective test logs (CS FSTD.FST.001 / FSTD.FST.020 / FSTD.FST.030).
2. Check: Confirm that functional and subjective tests are also run progressively across the 4 quarters, rather than performed in a single session.
3. Verification: Check that subjective fly-outs are performed by appropriately qualified pilots (e.g., qualified TRI/TRE or designated FSTD evaluator per GM1 ORA.FSTD.100(u)) and documented with signed reports.

C. Record-Keeping & Trend Analysis

1. Audit Action: Review the record-keeping system under ORA.FSTD.240 and AMC1 ORA.FSTD.240(a)(2)(i).

2. Check: Confirm that MQTG test runs (both initial baseline and recurrent runs) are retained in paper or electronic format for at least 5 years.
3. Check: Verify that every recurrent run is dated, signed/validated, marked as analysed and evaluated by the assigned competent person (ORA.FSTD.105(b) and ORA.FSTD.225(b)(4)).

AUDIT TASK 2: EVALUATING AUTOMATED QUALIFICATION TESTING (AQT)

Regulatory Context & Technical Definition

As defined in CS FSTD.GEN.015(17), Automatic Testing means using FSTD testing tools to set up test scenarios where the environment, aircraft configuration, aircraft systems, and control settings are exactly replicated via software scripts. Pilot control inputs are fed from the auto-test system directly into the aircraft and flight models.

Under CS FSTD.QTG.020(a)(1) and CS FSTD.QB.115 (15.8.1), the FSTD should provide automated objective testing capabilities to eliminate human flying errors, ensure exact repeatability, and instantly flag out-of-tolerance results.

Automated Test Execution Flow

1. **Scripted Test Driver:** Automatically runs pre-programmed test inputs to ensure standard, consistent testing.
2. **FSTD Host Engine:** Processes these inputs through the simulator's real-time flight models.
3. **Real-Time Plotting & Auto-Comparison:** Graphs the simulator's output data live and automatically compares it against certified baseline data.
4. **Pass / Fail Check:** Evaluates the comparison to see if any result exceeds acceptable tolerance limits.
5. **Automatic Flag:** Immediately triggers an alarm if the test results are out of tolerance.

Auditor Verification Steps & Checklist

A. AQT Script & Driver Integrity (Automated Qualification Testing)

1. Audit Action: Evaluate the software architecture of the AQT suite (CS FSTD.QTG.020).
2. Check: Verify that test inputs (open-loop, closed-loop, or locked parameters) used in the recurrent AQT scripts are identical to those established in the MQTG baseline (CS FSTD.QTG.020(b)):

- **Open-loop drivers:** Ensure scripts do not alter the shape, timing, or magnitude of control inputs compared to the MQTG baseline (CS FSTD.QTG.020(a)(3)(ii)).
 - **Closed-loop drivers:** Verify that closed-loop drivers are restricted to highly dynamic conditions (e.g., take-off/landing roll) and are not used on primary axes during free-response handling tests (GM1 FSTD.QTG.020(a)(1)(ii)).
3. Check: Verify software version control (CS FSTD.QB.115 (15.9.1)). The AQT script revision number must be recorded on every test output page (CS FSTD.QTG.010(b)(12)).

B. Instant Out-of-Tolerance Flagging Capabilities

1. Audit Action: Observe a live or recorded execution of an AQT run.
2. Check: Confirm that the AQT software automatically compares the newly generated run against:
 - The MQTG baseline (for Essential Match EM evaluation), AND
 - The Validation Data / Numerical Tolerances defined in Subpart D (for initial or specific parameter checks).
3. Check: Verify that the system provides an instant, unambiguous visual flag or report whenever a parameter exceeds the prescribed tolerance band (e.g., automated color-coding, error logs, or exception summaries).
4. Check: Ensure the auto-comparison engine evaluates both primary axis parameters and off-axis cross-coupling parameters (CS FSTD.QTG.015(a)(5)).

C. Prevention of Manual Overrides & Data Manipulation

1. Audit Action: Inspect security permissions within the AQT software (AMC1 ORA.GEN.220(b)(c)).
2. Check: Ensure technicians/operators cannot manually adjust tolerance bands, alter plot scaling, or shift time-history offsets to force a "PASS" result without generating an audit trail.
3. Check: Verify that if a test is re-run manually, the output page explicitly indicates MANUAL RUN instead of AUTOMATIC RUN (CS FSTD.QTG.010(b)(13)(iii)).

AUDIT TASK 3: AUDITING ROOT CAUSE ANALYSIS (RCA) & ELIMINATING THE "HUMAN FACTORS" MISCONCEPTION

The Fundamental Technical Misconception

A critical deficiency in FSTD compliance monitoring is attributing an automated MQTG test failure to "Human Error" (e.g., "Technician pressed the wrong button", "Pilot didn't fly the test correctly", or "Operator error during test execution").

In an Automated Qualification Test (AQT), human pilot inputs are bypassed. The flight dynamics, control loading, and system responses are driven directly by digital scripts and host models. Therefore, an out-of-tolerance plot in an automated MQTG run cannot be caused by human pilot error.

Attributing an AQT plot failure to "Human Error" invalidates the RCA. Auditors must reject such findings and enforce investigations into systemic software, hardware, or data integration failures.

When an automated test detects that a flight simulator's performance falls outside allowed safety limits, technicians must perform a Root Cause Analysis (RCA) to find out why. This diagram breaks down the wrong way versus the right way to investigate that failure.

Trigger Event An automated test detects a performance result that exceeds allowable limits (Out-of-Tolerance Plot).

The Wrong Path: Blaming Human Error (Invalid RCA) Attributing the failure to human operator error is wrong because computer scripts run automated tests, not people.

- **False Excuse:** Claiming the technician ran the wrong script.
- **False Excuse:** Claiming a pilot flew the maneuver poorly (invalid because pilot inputs are automated).
- **False Fix:** Simply "retraining the technician" instead of fixing the simulator.

The Right Path: Investigating System Failures (Valid RCA) A proper investigation focuses strictly on underlying computer or mechanical problems.

- **Software & Data Problems:**
 - Timing Jitter: Processing delays or unstable computer speeds.
 - Model Regression: Unintended software bugs introduced during recent code updates.
 - Corrupted Baseline: Damaged, missing, or altered aircraft data packages.
 - Misaligned Software Load: Running the wrong software version or configuration.

- **Hardware & Sensor Problems:**

- Calibration Drift: Control force systems losing accurate alignment over time.
- Sensor Noise: Electrical interference in motion or position sensors.
- Converter Errors: Faults in converting physical signals into digital computer code.
- Mechanical Wear: Physical slack, loose cables, or worn-out gears in the control hardware.

Why This Matters When an automated test fails, blaming human error masks real machine defects and leads people to re-run tests until they pass by luck. Rejecting human error forces engineers to fix the true software bugs or hardware wear, ensuring the simulator continues to accurately match real aircraft behavior.

Auditor Verification Steps & Checklist

A. Reviewing Historical MQTG Out-of-Tolerance Events

1. Audit Action: Request all internal non-conformances, defect logs, and Compliance Monitoring findings (ORA.GEN.150) related to MQTG testing from the past 12–36 months.
2. Check: Cross-reference out-of-tolerance AQT plots with the corresponding RCA and Corrective Action Plans (CAPs).
3. Filter: Search specifically for root causes listed as "Human Error," "Operator Mistake," "Execution Error," or "Retrained Technician."

B. Challenging Invalid Root Causes & Enforcing Systemic Investigation

If "Human Error" or "Operator Error" is claimed for an automated test failure, the auditor must issue a Finding under ORA.GEN.150(a) for inadequate RCA.

The auditor must mandate that the operator's investigation focus strictly on the following two systemic categories:

1. Systemic Software & Data Integration Failures

- Model Regression: Unintended consequences of a recent software update (e.g., an update to the FMS or Flight Control Computer affecting aerodynamic pitch response).
- Frame Rate / Iteration Jitter: Computation timing glitches, loop execution delays, or task scheduling shifts in the host computer (GM1 FSTD.QTG.025(b)).

- Configuration / Load Control Errors: Incorrect software load installed, corrupt navigation/aerodynamic database, or unapproved script modification (ORA.FSTD.105(c), CS FSTD.QB.115 (15.9.1)).
- Driver / Trim Discrepancies: Closed-loop driver instability, improper initial trim state calculation, or incorrect snapshot initialization (CS FSTD.QTG.020(a)(3)).

2. Hardware & Interface Calibration Failures

- Control Loading System (CLS) Drift: Mechanical wear, transducer decalibration, valve contamination, or force sensor drift causing static/dynamic force out-of-tolerance (CS FSTD.QTG.A.200 / 205).
- Motion / Vibration Sensor Degradation: Accelerometer decalibration, structural resonance, or mechanical slop/backlash in motion actuators (CS FSTD.QTG.A.300 / 305).
- Interface / Conversion Errors: Analog-to-Digital (A/D) or Digital-to-Analog (D/A) card decalibration, bus latency, or voltage offsets.

C. Evaluating Corrective Action Plans (CAPs)

1. Audit Action: Review the CAP defined by the operator (AMC1 ORA.GEN.150(b)).
2. Check: Ensure the CAP eliminates the root cause and prevents recurrence (GM1 ORA.GEN.150).
3. Reject Unacceptable CAPs:
 - ✗ *"Re-ran the test until it passed"* (invalid — represents lucky timing / random pass without resolving the underlying flaw).
 - ✗ *"Briefed engineering staff to be careful when running QTGs"* (invalid — script execution is automated).
4. Accept Valid CAPs:
 - ✓ *"Recalibrated pitch force transducer and updated CLS gain tables; re-ran automated test 2.a.1 showing 100% compliance."*
 - ✓ *"Identified software regression in build v4.2 affecting flap transition drag coefficients; reverted code, patched aerodynamic module, re-baselined AQT script, and verified against MQTG."*

Audit Task 4. AUDITOR COMPREHENSIVE CHECKLIST

Use this table as a formal evaluation sheet during an EASA FSTD Audit of Session 5 (MQTG):

Item #	Inspection Item	Regulatory Reference	Audit Evidence Required	Assessment Criteria (Pass / Fail / Finding)
5.1	Progressive Schedule	ORA.FSTD.105(a) ORA.FSTD.225(b)(4)	CMP Audit Schedule, MQTG quarterly execution logs.	Pass: MQTG tests split into ~4 equal 3-month blocks. Fail/Finding: Batch running >40% of tests in a single quarter.
5.2	Subjective Progressive Checks	ORA.FSTD.105(a) CS FSTD.FST.001	Quarterly subjective evaluation reports signed by TRI/TRE.	Pass: Progressive quarterly subjective fly-outs logged. Fail/Finding: Subjective checks missing or only done annually.
5.3	5-Year Record Retention	ORA.FSTD.240 AMC1 ORA.FSTD.240	Electronic/paper archives of 5 years of recurrent QTGs.	Pass: Complete records accessible for trailing 5 years. Fail/Finding: Missing runs or records discarded early.
5.4	Evaluated & Signed Runs	ORA.FSTD.105(b) ORA.FSTD.225(b)(4)	Signatures/approvals on quarterly test evaluation reports.	Pass: Assigned competent person reviews, dates, and signs each run. Fail/Finding: Raw runs unreviewed or unsigned.
5.5	AQT Automation Integrity	CS FSTD.GEN.015(17) CS FSTD.QB.115 (15.8)	Demonstration of AQT software suite execution.	Pass: Scripts execute setup & inputs automatically without manual intervention. Fail/Finding: Manual flying required for objective tests.
5.6	Automated Tolerance Flagging	CS FSTD.QTG.020 CS FSTD.QTG.025	AQT result summary sheets, live execution flag demonstration.	Pass: Software automatically flags any parameter exceeding EM or numerical limits. Fail/Finding: Visual inspection of plots required to detect errors manually.
5.7	AQT Driver & Script Control	CS FSTD.QTG.020(b) CS FSTD.QB.115 (15.9)	Script revision logs, MQTG baseline comparison.	Pass: AQT drivers match MQTG baselines; version controlled.

Item #	Inspection Item	Regulatory Reference	Audit Evidence Required	Assessment Criteria (Pass / Fail / Finding)
				Fail/Finding: Modified drivers used without rationale/approval.
5.8	Root Cause Analysis (RCA)	ORA.GEN.150 GM1 ORA.GEN.150	Non-conformance records, CAP files for out-of-tolerance runs.	Pass: Investigation identifies software, model, or hardware root causes. Fail/Finding: RCA claims "Human/Operator Error" for an AQT run.
5.9	Prevention of Recurrence	ORA.GEN.150(b) AMC1 ORA.GEN.150(b)	Verification of implemented hardware/software fixes.	Pass: Permanent technical fix implemented and verified. Fail/Finding: "Re-ran until pass" or "Retrained tech" used as CAP.

EXAMPLE AUDIT FINDING TEMPLATES (FOR INSPECTOR USE)

Template 1: Non-Compliance with Progressive Testing Schedule

- Finding Level: Level 2
- Standard Ref: ORA.FSTD.105(a)
- Finding Text: *"Review of the FSTD recurrent evaluation records for [FSTD Serial Number] revealed that 85% of the Master Qualification Test Guide (MQTG) objective tests were executed in Month 11 of the evaluation cycle. The organisation failed to demonstrate that the complete set of MQTG objective tests and subjective checks were run progressively in approximately equal three-monthly blocks over the 12-month period."*

Template 2: Inadequate Root Cause Analysis (Human Factors Misconception in AQT)

- Finding Level: Level 2
- Standard Ref: ORA.GEN.150(a) & GM1 ORA.GEN.150
- Finding Text: *"The Root Cause Analysis (RCA) performed for non-conformance [NC-XXXX], concerning an out-of-tolerance result in automated MQTG test 2.c.1 (Power Change Dynamics), cited 'Operator Error during test execution' as the root cause, and closed the finding by re-running the test. Because test 2.c.1 is an Automated*

Qualification Test (AQT) driven by software scripts where human pilot inputs are bypassed, 'Operator Error' is not a valid root cause. The organisation failed to conduct a proper RCA into underlying systemic software or hardware integration failures."