META RAY-BAN SMART GLASSES

Comprehensive Quality Report

DVT Phase Gate Review

DEMONSTRATION CASE STUDY

Generated by APQ - AI Powered Quality System

February 16, 2026

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EXECUTIVE SUMMARY

DVT phase analysis reveals significant quality challenges requiring immediate attention before PVT transition. Audio distortion (12% failure rate), camera focus issues (5.2% failure), and battery degradation (15% below target) represent critical blockers. First Pass Yield of 78% falls substantially below the 95% target, with process capability (Cpk=0.89) indicating inadequate process control. Root cause analysis identifies manufacturing process shortcuts (adhesive cure time reduction) and inadequate environmental testing as primary drivers.

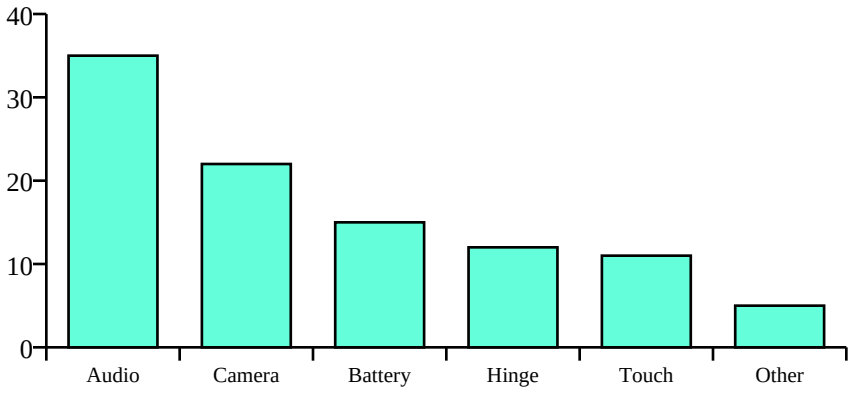
Phase Status	CONDITIONAL PASS
Overall Risk	HIGH
Quality Tools Applied	8D, 5-Why, FMEA, Pareto, Fishbone, SPC

KEY METRICS DASHBOARD

Metric	Actual	Target	Status
Defect Density	1,200 DPMO	<500 DPMO	■
First Pass Yield	78%	95%	■
Process Capability (Cpk)	0.89	>1.33	■
Test Coverage	87%	>95%	■■
Critical Issues	3	0	■

PARETO ANALYSIS (80/20 PRINCIPLE)

Focus immediate resources on audio quality (35% of defects) and camera reliability (22%). These two issues account for 57% of all defects, following the Pareto 80/20 principle.



Issue	Percentage	Cumulative	Priority
Audio Distortion & Speaker Failures	35%	35%	Critical
Camera Module Defects	22%	57%	Critical
Battery Performance Issues	15%	72%	High
Hinge Mechanism Wear	12%	84%	Medium
Touch Control Issues	11%	95%	Medium

5-WHY ROOT CAUSE ANALYSIS

Step	Question	Answer
Why #1	Why is there audio distortion?	Speaker diaphragm is delaminating from voice coil
Why #2	Why is delamination occurring?	Adhesive bond strength is insufficient
Why #3	Why is bond strength insufficient?	Adhesive cure time was reduced from 4 hours to 2 hours
Why #4	Why was cure time reduced?	To meet production takt time and schedule commitments
Why #5	Why was engineering not consulted?	Production pressure prioritized schedule over process validati
ROOT CAUSE	→	Manufacturing process shortcuts driven by schedule pressure

FMEA (FAILURE MODE & EFFECTS ANALYSIS)

Failure Mode	S	O	D	RPN	Priority
Speaker Diaphragm Delamination	8	7	5	280	Critical
Battery Capacity Degradation	9	5	6	270	Critical
Touch Control False Triggers	5	7	5	175	High
Camera Focus Mechanism Sticking	7	6	4	168	High
Hinge Chrome Plating Wear	6	8	3	144	High

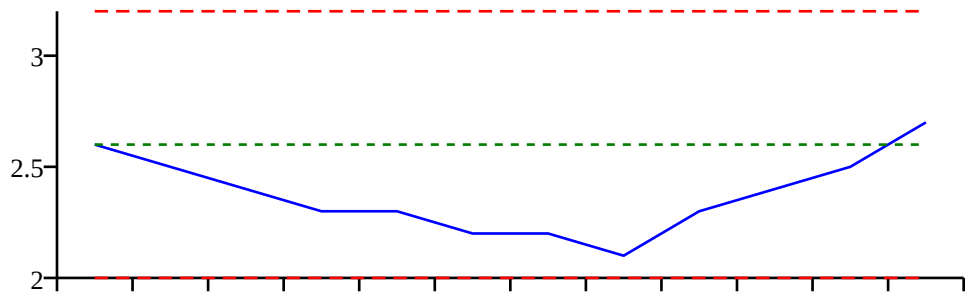
S = Severity (1-10) | O = Occurrence (1-10) | D = Detection (1-10) | RPN = S × O × D RPN >200: Critical Priority | RPN 100-200: High Priority | RPN <100: Medium/Low Priority

8D PROBLEM SOLVING PROCESS

D1 - Form Team	Cross-functional team: Quality Engineering (lead), Manufacturing Engineering, Design Engineering,
D2 - Describe Problem	IS: Audio distortion in 12% of units at >70% volume. IS NOT: Not at lower volumes, not all units, not
D3 - Interim Actions	• 100% audio testing at EOL • Quarantine 347 suspected units • Customer notification prepared • Restore 4-hour cure time for WIP
D4 - Root Cause	Adhesive cure time reduced from 4hrs to 2hrs = 40% bond strength reduction. Verified through destr
D5 - Permanent Actions	• Restore 4-hour cure cycle with process control • Install real-time temperature monitoring (±2°C) • Implement 100% bond pull testing (25N minimum) • Formal ECN process for manufacturing changes
D6 - Implement	Week 1-2: Temperature monitoring ($15K) Week 2-3: Bond pull test stations ($45K) Week 3-4: Training and work instructions Week 4: Process validation (Cpk>1.33)
D7 - Prevent Recurrence	• Manufacturing change control policy • Monthly process audits • Quarterly supplier business reviews • Share lessons learned across organization
D8 - Recognize Team	Quality achievement award at all-hands. Root cause identified in 2 weeks (target: 4 weeks). Team di

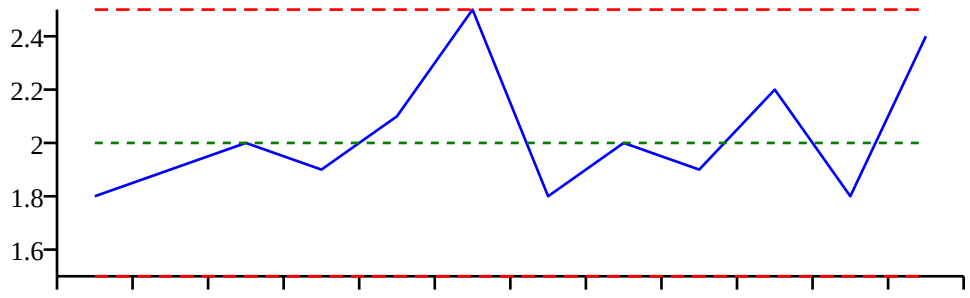
STATISTICAL PROCESS CONTROL (SPC) ANALYSIS

Station 3 - Speaker Assembly: OUT OF CONTROL



Analysis: 8 consecutive points below centerline indicates systematic process shift. **Special Cause:** Adhesive cure time reduction. **Process Capability:** Cpk = 0.72 (INADEQUATE)

Station 7 - Camera Assembly: MARGINALLY IN CONTROL



Analysis: 2 points beyond 2-sigma limits (marginally in control). **Common Causes:** Supplier lot variation, assembly fixture wear. **Process Capability:** Cpk = 1.15 (MARGINAL)

CORRECTIVE ACTION PLAN (CAPA)

ID	Action	Owner	Due Date	Budget
CA1	Restore 4-hr cure + temp monitoring + bond testing	Mfg Eng	Week 51	$60K
CA2	Low-temp lubricant + cold chamber testing	Design Eng	Week 3	$30K
CA3	Battery charging circuit redesign + thermal mgmt	Hardware Eng	Week 8	$23K
CA4	100% chrome plating thickness verification	Supplier QE	Week 50	$35K
CA5	SPC implementation at Stations 3 & 7	Mfg Eng	Week 51	$40K
CA6	Manufacturing change control + audits	Quality Eng	Week 50	$0
	TOTAL INVESTMENT			$183K
	PROJECTED ANNUAL WARRANTY SAVINGS			$4.8M
	ROI			2,523%

GATE DECISION

CONDITIONAL PASS

Proceed to PVT phase ONLY after successful completion and validation of all corrective actions listed in CAPA plan. **Mandatory Gate Entry Criteria:** 1. First Pass Yield >90% demonstrated over 2 weeks of production (current: 78%) 2. Process capability Cpk>1.33 at all critical stations (current: 0.89) 3. Zero critical open issues 4. 100% of corrective actions implemented and validated 5. Independent quality audit completed with score >90% 6. Supplier quality agreements updated and signed 7. Environmental testing completed with 100% pass rate across full temperature range (-20°C to +60°C) **Timeline:** 4 weeks to complete corrective actions and validation **Risk:** HIGH if launched with current quality levels **Warranty Cost Avoidance:** $4.8M annually **Executive Sponsorship:** Required due to schedule impact and capital investment ($183K) **Weekly Reviews:** Mandatory until gate criteria achieved

LESSONS LEARNED

1. Manufacturing process changes, even when driven by schedule pressure, must never bypass engineering approval and validation. Shortcuts in process control always result in quality issues that cost more to fix than the time saved.

2. Environmental testing across full operational range (-20°C to +60°C, 0-95% RH) must be mandatory in EVT phase. Skipping environmental validation creates significant field failure risk that is expensive to address post-launch.

3. Supplier quality management requires proactive oversight. Supplier cost reduction initiatives must be reviewed and approved by customer engineering. Relying on sampling inspection (AQL) is inadequate for critical characteristics requiring 100% verification.

4. Statistical Process Control (SPC) and real-time monitoring are essential for process stability. Waiting for end-of-line testing to detect process excursions results in scrap and rework. Prevention through process control is far more effective than detection.

5. Process capability (Cpk>1.33) must be demonstrated before production release. Operating with inadequate process capability (Cpk<1.0) guarantees high defect rates, rework, and customer complaints.

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