AEC-Q105 Display Systems Activity Status & Discussion

Presented By : Steven Sibrel

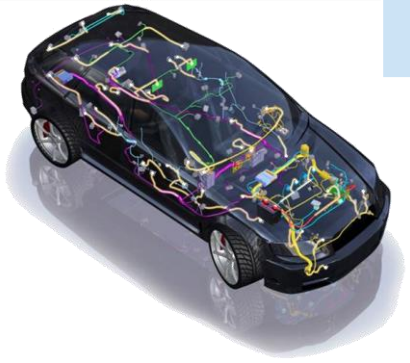
March 31, 2026

Topics

- Task Group (TG) Membership
- Project Goal & Scope
- TG Work Progress Update
- Next Steps…

AEC-Q105 Standard Development Task Group Members

AEC Member Company	Representative	AEC Membership Category
HARMAN (Task Group Chair)	Steve Sibrel	Sustaining Tech Committee
HELLA, a Forvia Company	Matthias Ogonda	Sustaining Tech Committee
John Deere	Joel Mason	Sustaining Tech Committee
John Deere	Trevor Gilles	Sustaining Tech Committee
Texas Instruments	Jorge Gonzales Maciel	Technical Committee Member
SGS-China	Harvey He	Associate Tech Committee
Sharp	Alexander Klein	Guest Committee Member
Aumovio (Continental)	Scott Brown	Sustaining Tech Member
Marelli	Yeesperan Jagesperan	Sustaining Tech Member



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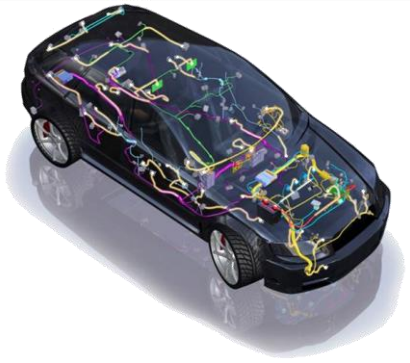
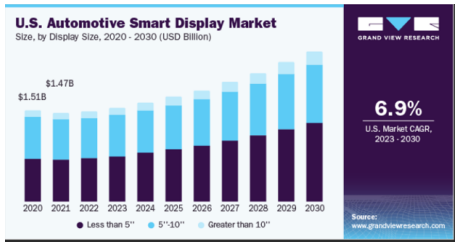
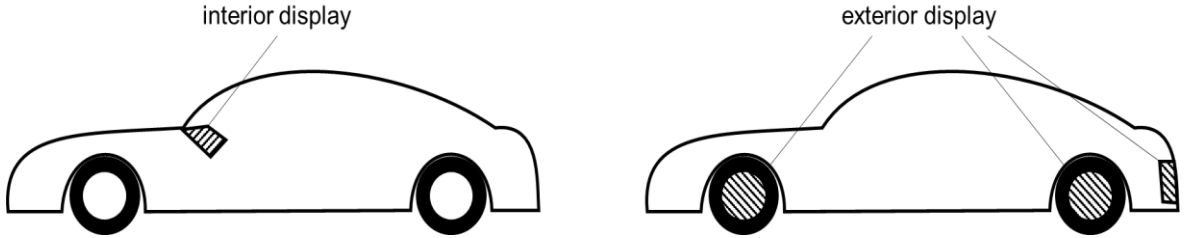


Project Goal & Justification

- **Electronic displays** are common in Automotive applications.
  - The adoption rate of touchscreens in new cars has skyrocketed. As of 2023, over 95% of new vehicles sold globally include at least one LCD touchscreen, up from around 40% in 2015. This is driven by the transition away from physical buttons and dials toward more flexible, software-based control systems that enhance the user interface experience.*
  - Each display application targets specific customer requirements



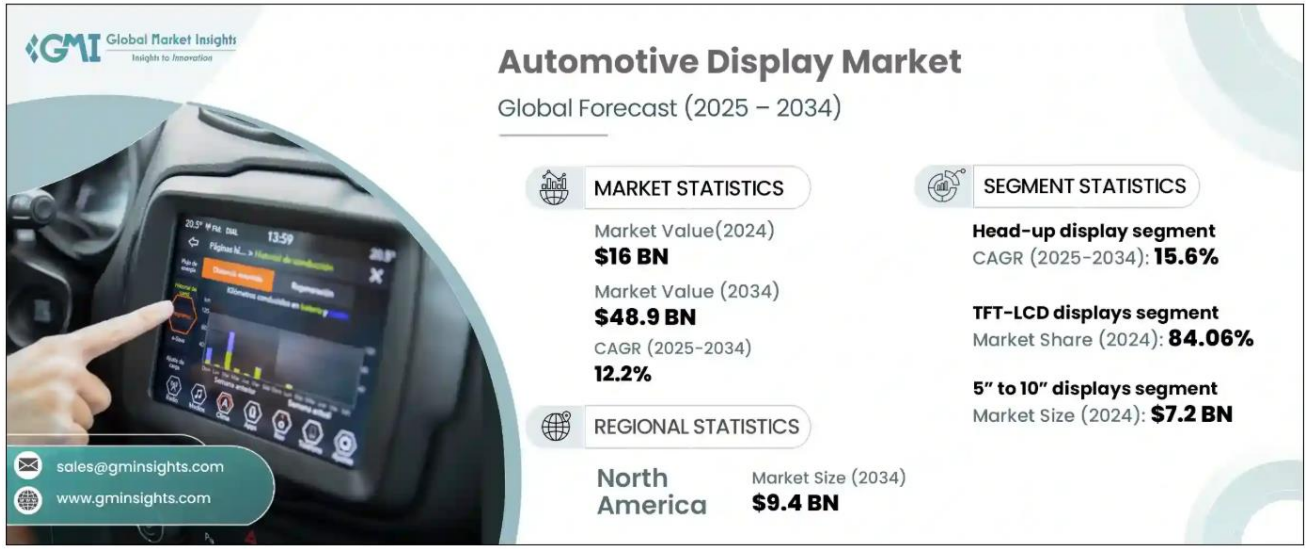
- **No AEC-Q standard is available** for use by automotive display suppliers and users for reference
- Automotive customers & suppliers would benefit from the new qualification standard similar to other AEC-Q standards.
- TG goal is to develop an **Electronic Display System qualification standard for automotive applications**.
  - Includes both interior and exterior displays.

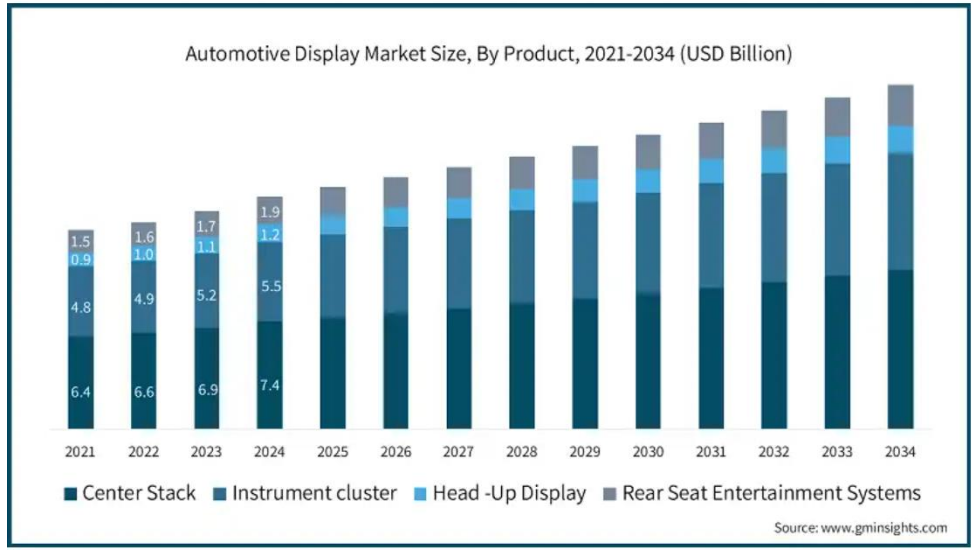


*Source: The Impact of LCD Displays in the Automotive Industry by Jeff Sharon | Sep 25, 2024 Display Enhancements, LCD Component Technology, LCD Solutions https://blog.agdisplays.com/index.php/2024/09/25/the-impact-of-lcd-displays-in-the-automotive-industry/

Project Goal & Justification

- **Electronic displays** are increasing and becoming more important in Automotive applications.
  - The adoption rate of touchscreens in new cars has skyrocketed. New vehicles sold globally typically include at least one LCD touchscreen. This is driven by the transition away from physical buttons and dials toward more flexible, software-based control systems that enhance the user interface experience. Overall Display CAGR increase through 2034 is 12 %.





*Source: Automotive Display Market Size - By Component, By Screen Size, By Display Technology - Global Forecast, 2025 – 2034 Global Market Insights ; Automotive Display Market Size & Share Report, 2025-2034 https://www.gminsights.com/industry-analysis/automotive-display-market

Scope

- A display within the scope of AEC-Q105 is an electro-optical system presenting information to a user in visual format (Text, image, symbols).

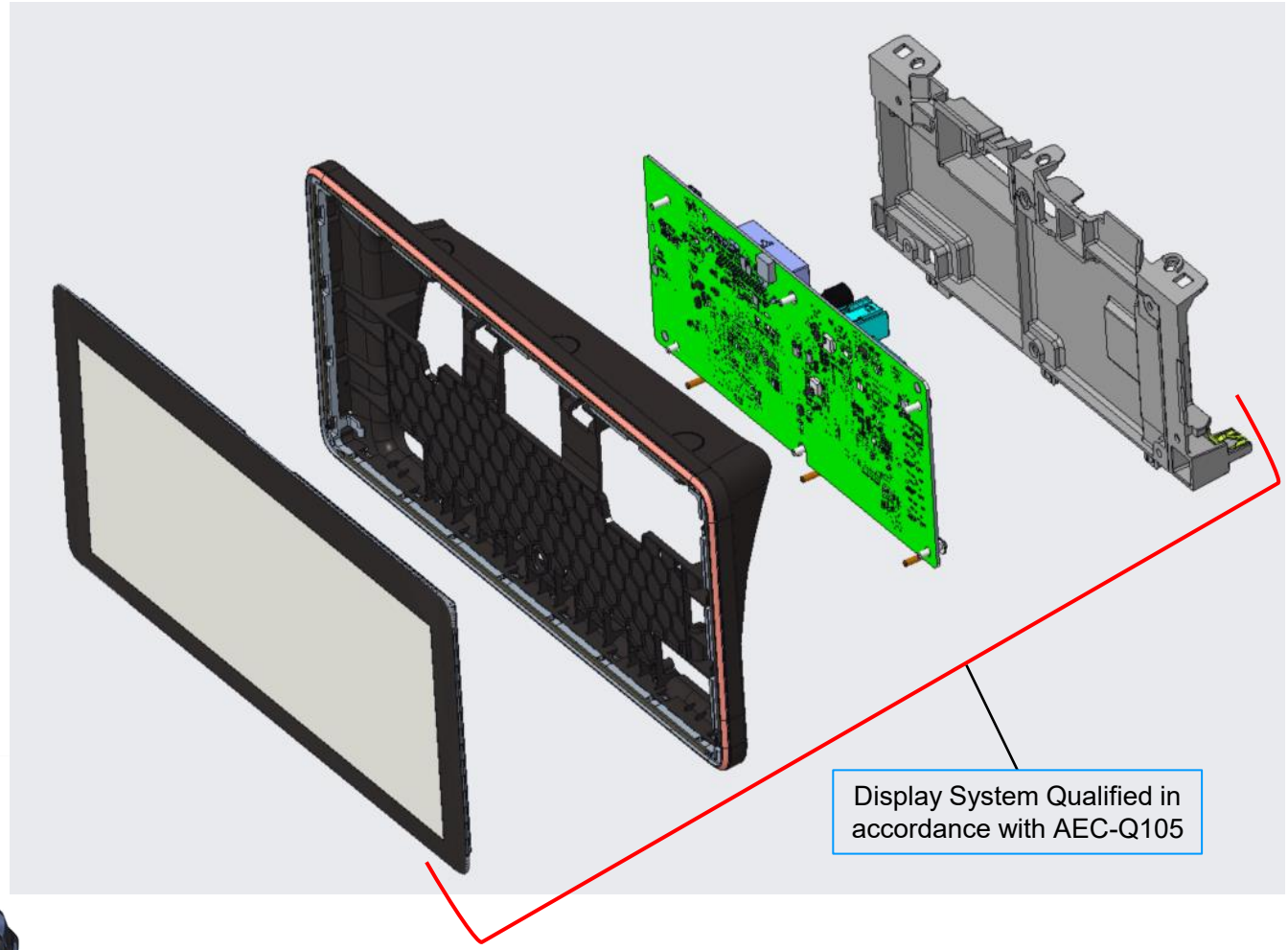
- This information may be provided to the driver inside the car's cabin (**interior display**) or to other road users outside the car (**exterior display**).
- Examples for interior applications using displays are **instrument clusters**, **navigation system**, **HVAC Controller**, **rear view cameras/ mirrors, and heads up displays (HUD).**

- This information may be provided to the drivers and to other road users outside the car (**exterior display**).
- Examples for *possible* exterior display applications are **matrix rear lamps and car-body displays, including license plates**.

Source: ANSYS White paper, Ensuring reliability and Safety of Connected Car Technology

Display System Qualification under AEC-Q105

- The scope of **AEC-Q105 includes** the Display System including **Sub-components** as shown in the figure below.



Automotive Display: Application Challenges and Critical Technologies

Environmental Conditions

- Heat
- Mech. Stress
- Solar Radiation
- Chem. Stress
- Humidity

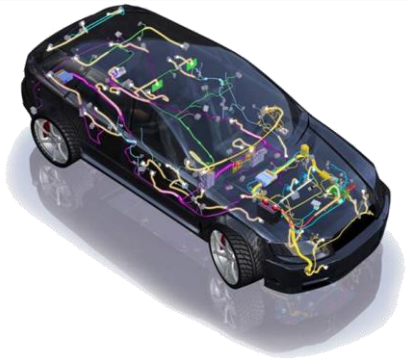
Automotive Display is a Complex electronic System made up of multiple components

Display Applications

- Human Machine Interface
- Touch Sensor
- Vehicle Body (e.g. Matrix Rear-Lamp)

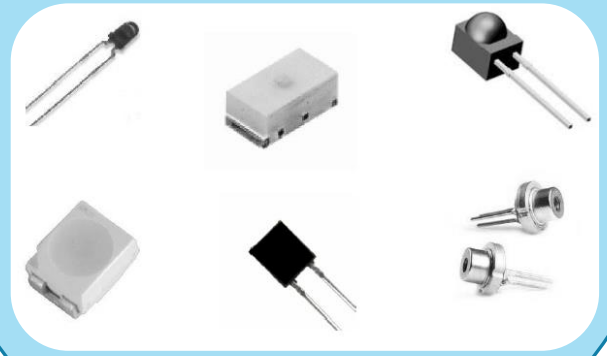
Display Technologies

- LCD
- Mini/Micro LED
- OLED



Challenges

Individual Electronic Components



Source: AEC-Q102

AEC-Q100
AEC-Q101
AEC-Q102
…

Automotive Display is a Complex Electronic System made up of multiple components

The display system may include:
LEDs, ICs, connectors,
sensors, and other subcomponents,
All with different specification requirements

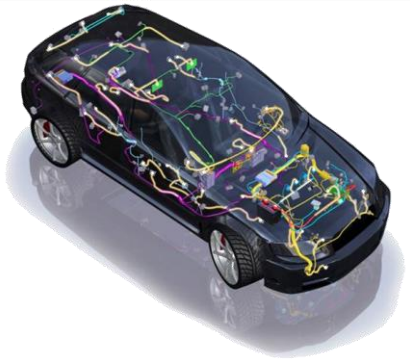
Display Systems, each made up multiple components

Source: ANSYS White paper, Ensuring reliability and Safety of Connected Car Technology

AEC – Q105
Display System Requirements
Based on Tier 1 and OEM

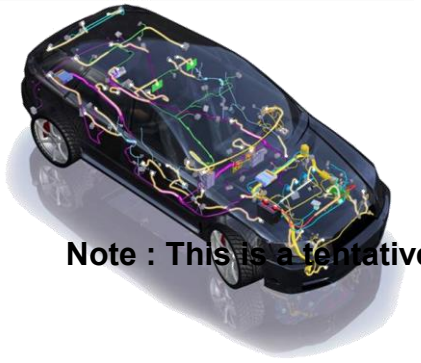
Topic

- Technical Group (TG) Membership
- Project Goal
- Work Progress Update
- Next Steps…



Project Phases and Schedule

- **2026: Develop and release specification for Automotive Display Systems – Target Date Dec 2026**
  - Inputs from samples of OEM and Tier 1 Qualification Specifications
    - Initial Inputs - Completed 2025
    - Re-review - In progress – target date June 2026
  - Develop Appendixes and Reference Tables
    - Test Table, Qual Flow, Change Matrix, QTP – In Progress – 30 % completed – target date June 2026
  - Develop General Text for specification
    - Initial draft – Completed 2025
    - Team Review – Paused – 50 % completed - target date - July 2026
  - Release Draft for Ballot – July 2026
  - Release Final AEC Q105 specification December 2026

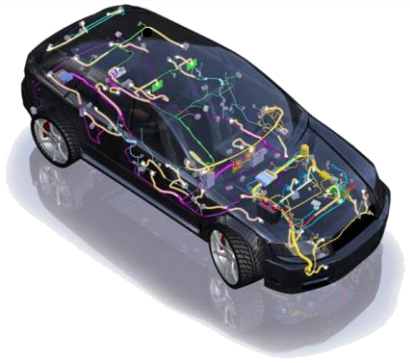


Note : This is a tentative timeline subject to change

Plans and Open Discussion Points

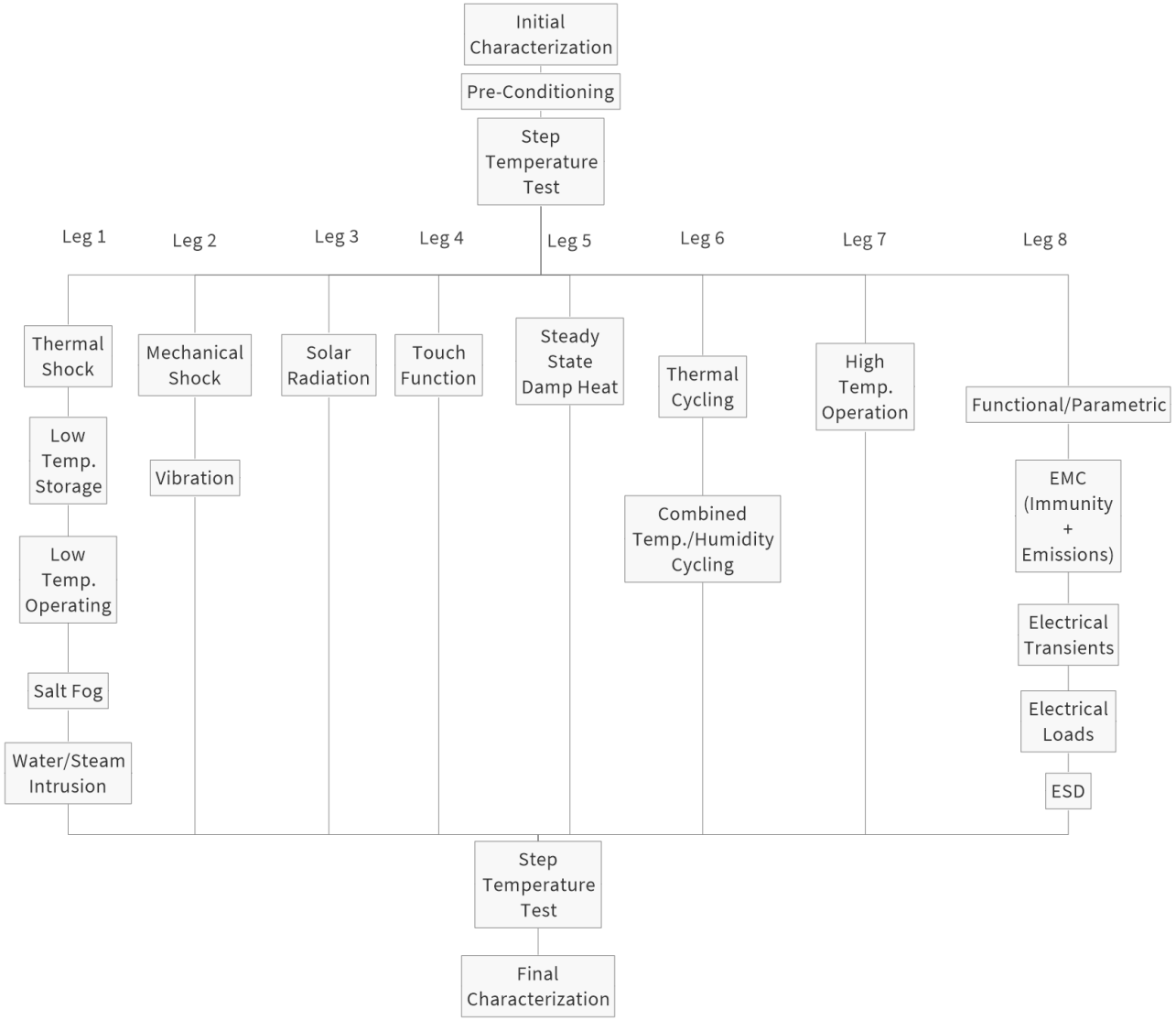
- **Grades**
  - Is there a requirement for grades? If so, would grades be based on temperature range only or with other factors – size, application?
- **Generic Data**
  - Currently there does not appear to be a need for generic or family data (any known uses of this in industry?)
- **Sub Assemblies**
  - Subassemblies would be covered in subsequent Appendixes or sub documents (based on usage of the general specification)
  - Is sub assembly company and site required in any documentation such as the Qualification Test Plan (QTP) Header for traceability
- **Sample Sizes and Number of Lots**
  - Might use smaller sample sizes and sometimes one lot (where applicable and/ or for the first release for DV / PV verification testing)
- **Solar Radiation Test**

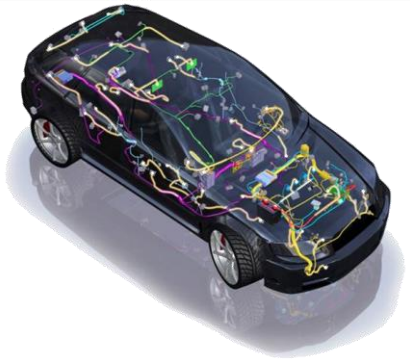
  If DEN 75220 is used, there may be a limited number of qualified Test Labs in North America.
- **Qualification Tests and Test Legs (see next slide)**
  - Additions, deletions, or other changes in sequence (with failure mechanisms identified as proven)



Note : Please give additional inputs to AEC Q105 team members or send to steven.sibrel@harman.com

Display Qualification Test Flow





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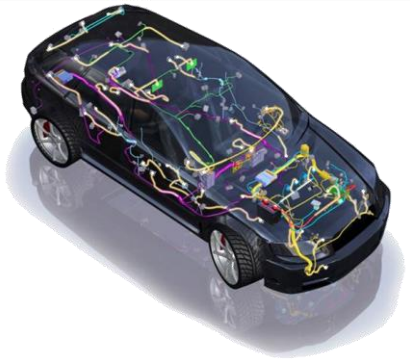


Next Steps

- **Currently In Progress:**
- **Creating Change Matrix, Qualification Test Plan (QTP) and Test Methods Table for AEC Q105**
- **Creating Appendix for Parametric Parameter Requirements and Acceptance Criteria**
- **Aligning Certificate of Design and Construction (CDC) approach with the current plan to standardize this within AEC. If this is not possible this document will be referred to the CDC team to develop with representation from the AEC Q105 team**
- **Reviewing the full AEC Q105 draft specification for additional updates**
- **Integrated 3 new team members. Looking for additional Technical Members with Display expertise.**

  - **Balloting and Specification Release :**
- **Target date for ballot-ready document – July 2026.**
- **Review comments and make updates as needed – September 2026**

  Final Approval and release to AEC Website – December 2026

THANK YOU FOR YOUR ATTENTION!

QUESTIONS?

Backup Slides for AEC Q105 Display Specification

- **Minimum Parametric Testing and Glossary**
- **Test Matrix Samples**
- **QTP**
- **Draft Specification**

Minimum Parametric Test Parameters and Acceptance Criteria

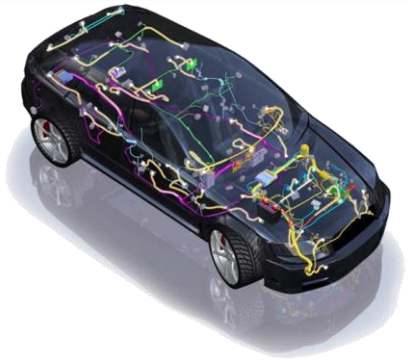
- **Draft Table samples**

- **Glossary**

Parameter & Definition

Parameter	Definition
1. Luminance	The luminous intensity per unit area of the display surface, measured in cd/m² (candela per square meter). It is a core indicator of the brightness of the displayed image and directly affects visibility in automotive environments.
2. Luminance Uniformity	Luminance uniformity describes the degree of brightness consistency across the entire active viewing area of an automotive display. It is a quantitative metric that evaluates how evenly the screen emits light at all measured points, usually calculated by comparing the maximum, minimum, and average luminance values sampled from multiple standard positions on the panel.
3. White Point Shift	White point shift refers to the unintended change in the chromaticity coordinates of the displays white balance under stress conditions such as temperature variation (high/low temperature), prolonged operation, voltage fluctuation, or component aging.

Draft Parametric Table 030926



Note : These are samples only from a draft table. This is not the final recommendation.

Minimum Parametric Test Parameters and Acceptance Criteria

- **Testing at Room Temperature**

Parameters to measure at room temperature

Parameter	Acceptance criteria	Remark
1. Luminance	+/- 15% according to initial value	To measure at nominal operating voltage and standard test pattern (e.g., white full screen). Note: +/- 20% may be acceptable for interior auxiliary displays. Choice of range to be noted in the test report.
2. Luminance Uniformity	Uniformity Ratio = (Minimum Luminance / Average Luminance) × 100%->85% Non-Uniformity = (Maximum Luminance - Minimum Luminance) / Average Luminance	Luminance Uniformity quantifies brightness consistency across the active display area, typically measured using the ANSI 9-point method (center + 4 edges + 4 corners).

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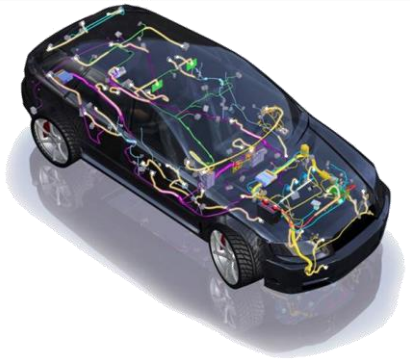
Draft Parametric Table 030926

3. White Point Shift	Δu'v': Distance in CIE 1976 uniform chromaticity scale (perceptually uniform)- Δu'v' ≤ 0.010 ΔCCT: Change in Correlated Color Temperature (Kelvin)- ΔCCT ≤ 200K	White Point Shift refers to chromaticity changes of the display's white balance under stress



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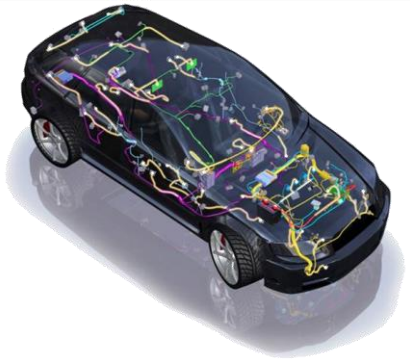
Test Matrix

- **Pre- Testing Evaluation, Pre-Conditioning / Startup tests**

STRESS	ABV	#	SAMPLE SIZE / LOT	NUMBER OF LOTS	TEST METHOD	ADDITIONAL REQUIREMENTS
Initial Electrical Testing	IET	LEG 1-1	See Section 2.3.4	See Section 2.3.4	Appendix 5	Functional and cosmetic inspection requirements according to display specification.
Pre-Conditioning	PC	LEG 1-2	See Section 2.3.4	See Section 2.3.4	refer to standard for high/low temp. storage	High-Temp/Low-Temp Pre-conditioning Test: High-Temp./Low-Temp. storage test, is a pre-conditioning test that precedes a test LEG. 1) Purpose: Thermally stabilize all components of the DUT to the same initial conditions. 2) High-Temp. = Tmax rating for the electronic display (ED) while Low-Temp. = Tmin rating for the electronic display (ED). 3) Test Duration: Two-Cycles of 24-hrs, one of 12-hrs of storage at Tmin and a second of 12-hrs of storage at Tmax
Start Up and Temperature Steps	SUTS	LEG 1-3	See Section 2.3.4	See Section 2.3.4	ISO 16750-4	1) ISO 16750-4 specifies that functional status shall be Class A per ISO 16750-1 2) ISO 16750-4 specifies that the DUT is powered off between the temperature steps. Q104 does not specify this. 3) ISO 16750-4 references -1 and -2 that specify a supply voltage sweep at each temperature step



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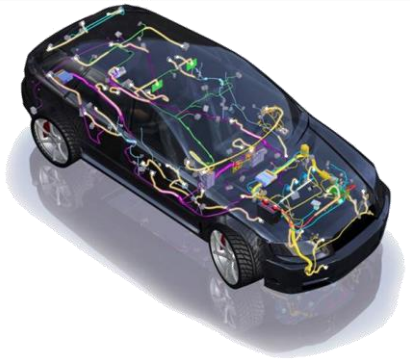
Test Matrix

- **Leg 1 Sample Tests**

STRESS	ABV	#	SAMPLE SIZE / LOT	NUMBER OF LOTS	TEST METHOD	ADDITIONAL REQUIREMENTS
Low Temperature Storage	LTS	LEG 1-3	See Section 2.3.4	See Section 2.3.4	ISO 16750-4	1) Temperature: -40±3°C 2) Test Duration: 1000 hours
Low Temperature Operating	LTO	LEG 1-3	See Section 2.3.4	See Section 2.3.4	ISO 16750-4	1) Temperature: Minimum operating temperature according to the specification 2) Test Duration: 24 hours 3) Continuous operation with cycled pattern: 1 min chess pattern, 1 min full bright, 1 min full dark (see Fig. ??)
Thermal Shock (Unbiased)	TS	LEG 1-4	See Section 2.3.4	See Section 2.3.4	ISO 16750-4 IEC 60068-2-14	Min/Max Temp: -40°C/+85°C, DUT unpowered, Presoak duration at Min Temp: 2-hrs, Soak Duration at Max. Temp: 2-hrs, Soak Duration at Min. Temp: 2-hrs. Transition time: 1-min or less, Number of cycles: 100
Preferred Combined Temp/Humidity Cyclic Test (Biased)	CT_A	LEG 1-5	See Section 2.3.4	See Section 2.3.4	IEC 60068-2-38 Test Z/AD	1) Test Duration: 24 hours 2) Number of cycles: 10 3) Test Cycle: Any 5 of the first 9 cycles must have the dip to Tmin below 0C. 4) Tmax = 65C, Tmin = -10C, Humidity control per spec All functions of the display system must perform as intended during and after the test. Ambient temperature shall be used to control the test.
Steady State Damp Heat (Biased)	DH	LEG 1-6	See Section 2.3.4	See Section 2.3.4	IEC 60068-2-67 Test Cy	1) Test Duration: 1,000 hours (Class III) 2) Number of cycles: 1 3) T = 85C, Rh = 85% All functions of the display system must perform as intended during and after the test. Thermocouples shall be used to monitor the temperature of the solder joints of the display system. Solder joint temperature shall be used to control the test.



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Qualification Test Plan

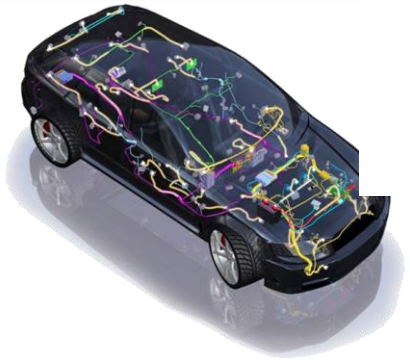
Q105 Qualification Test Plan

Automotive Operating Temperature Range = {Select Grade}

Supplier Name:		**General Specification:**	AEC-Q105 Rev -
Supplier Code:		**Display Technology:**	
Supplier Part Number:		**Display Size:**	
Supplier Contact:		**Supplier Assembly Site:**	
Supplier Family Type:		**Supplier Final Test Site:**	
Device Description:		**Supplier Reliability Signature:**	
PPAP Submission Date:		**User Test ID *:**	
Reason for Qualification:	{Select Reason}	**User Part Number *:**	
Prepared by Signature:	Date:	**User Approval Signature *:**	Date:

* Note: Only required for custom product

Test	#	Reference	Test Conditions	Lots	S.S.	Total	Results Lot/Pass/Fail	Comments: (N/A =Not Applicable)
TEST GROUP A – ACCELERATED ENVIRONMENT STRESS TESTS								
PC	A-1	ISO 16750-4 IEC 60068-2-1	Preconditioning: Test @ Cold/Rm/Hot	3	30	90	of	
SUTS	A-2	ISO16750-4	Start Up and Temperature Steps: Test @ Cold/Rm/Hot	3	30	90	of	
LTS	A-3	ISO16750-4	Low Temperature Storage: Test @ Rm	3	30	90	of	
LTO	A-4	ISO16750-4	Low Temperature Operating: Test @ Cold/Rm	3	30	90	of	
TS	A-5	ISO 16750-4 IEC 60068-2-14	Thermal Shock: Test @ Rm	1	30	30	of	
CT_A	A-6	IEC 60068-2-38 Test Z/AD	Combined Temperature/Humidity Cyclic Test: Test @ Cold/Rm/Hot	1	30	30	of	



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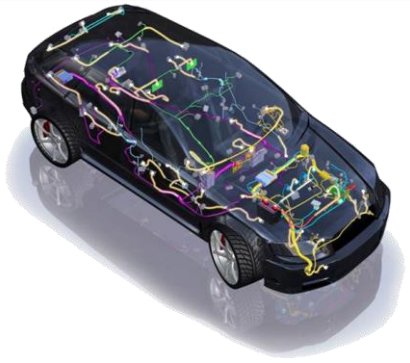
Draft Specification

AEC - Q105 – Initial Release INTERNAL &
Month, Day, Year

Automotive Electronics Council
Component Technical Committee

FAILURE MECHANISM BASED STRESS TEST QUALIFICATION FOR ELECTRONIC DISPLAYS IN AUTOMOTIVE APPLICATIONS

AEC Q105 Draft Spec



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