



**WORLDWIDE
ENGINEERING
STANDARDS**

General Specification

GMW3103

General Specification for Electrical/Electronic Components and Subsystems, Electromagnetic Compatibility

Global EMC Component/Subsystem Validation Acceptance Process

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This document applies to the Electromagnetic Compatibility (EMC) design, development and validation of electrical/electronic components and subsystems for passenger vehicles, light duty trucks and medium duty trucks.

This document is one out of a series of three global EMC standards documents that specify EMC test and validation requirements. The complete series consists of the following documents:

- GMW3091, GMW3097, and GMW3103.

1.2 Applicability. Passenger vehicles, light duty trucks and medium duty trucks.

1.3 Remarks. This document specifies the Global EMC Component/Subsystem Validation Acceptance Process to ensure components and subsystems are properly designed, developed and validated prior to vehicle validation.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 7637-2 SAE J2602

2.2 GM Standards/Specifications.

GMW3059 GMW3091 GMW3122
GMW3089 GMW3097 GMW3172

2.3 Additional References.

- EMC Component/Subsystem Technical Specification (CTS/SSTS).
- EMC Test Plan, a template is available from the GM EMC engineer.
- General Motors Component EMC and Environmental Test (CEMENT) Database.
- IHS Inc.: IHS Incorporated, General Motors' Engineering Standards distributor.
- Program Schedule of Engineering Deliverables section of the Statement of Requirements (SOR).

3 Requirements

3.1 Requirements. The Global EMC Component/Subsystem Validation Acceptance Process defined within this document shall be followed for all EMC component/subsystem design, development and validation.

Appendix A: Contains a typical template of the EMC Test Plan. The generic test plan template can be obtained from the responsible GM EMC engineer. The actual test plan will contain modifications of this template, unique to each commodity, as agreed upon by the GM EMC engineer and the supplier. Unless otherwise agreed upon by the GM Design/Release-Responsible Engineer, the EMC Test Plan shall be completed by the supplier and uploaded in the Component EMC and Environmental Test (CEMENT) database within 60 days (less than

12 weeks from supplier sourcing) prior to the start of EMC testing, with the final version required within 10 days prior to the start of testing.

Appendix B: EMC Lessons Learned should be reviewed and considered prior to the first electrical design and layout of the product. Final product designs may or may not incorporate the recommendations.

3.2 Process.

3.2.1 Design, Build, and Validate Design Iteration. The objectives of the Design, Build and Validate Design Iteration phase shown in Figure 1, include component/subsystem design, development and validation. Design validation shall occur during this phase to confirm all EMC technical requirements contained in the Component/Subsystem Technical Specification are met.

An EMC **Detailed Design Review**, shown in Figure 1, shall be conducted for all new components and subsystems and applications, and for revisions to existing components and subsystems that could affect EMC compliance. This process does not apply to carryover components or subsystems. The term **carryover** means that the product qualified for a prior program and is exactly the same product being used for the future program. Modifications, alterations, internal part swaps, hardware and software changes are not considered carryover and must be validated according to the requirements.

Detailed Design Review(s) shall be scheduled and led by the supplier, and attended by the EMC Design Review Team.

The GM Design/Release-Responsible Engineer must be consulted on scheduling and informed of all design review results and supplier action plans. The GM Validation-Responsible Engineer's acceptance of review results and supplier action plans does not relieve the supplier of the obligation to meet contracted performance requirements.

The objectives of the **Detailed Design Review** should be to:

- Review component/subsystem schematic design and circuit board layout.
- Examine any prior relevant analysis, calculations and test results.
- Evaluate potential changes to the component/subsystem design.
- Propose solutions to problems and appropriate revalidation.
- Verify that the proposed design and circuit board layout satisfies component/subsystem EMC technical and validation requirements.

The GM Design/Release-Responsible Engineer may also schedule a design review on his/her own initiative, or upon the advice of a GM EMC engineer. The GM Design/Release-Responsible Engineer may make any appropriate arrangement for leadership of such a review or delegate the actual review activity to other team members.

Supplier Deliverables: Documentation required to be delivered, as one package, to vehicle manufacturer EMC design review team at least ten (10) working days ahead of the scheduled meeting:

- Printed Circuit Board (PCB) Layout.
- Components List.
- Hardware Schematic Drawing.
- Component Placement Drawing.
- Functional Description.
- Interface Description.
- EMC Math Simulation Results (if available).
- EMC Test Reports (if available).
- EMC Test Plan (refer to Appendix A for a template of a typical test plan which may be obtained from the GM EMC engineer).

Note: Actual hardware samples or physical mock-up for visual examination is desirable but not required. Electronic documents must be in an editable format compatible with Microsoft Office.

Design Analysis and Performance. Design analysis and performance is a part of the design review. In a design review the supplier shall demonstrate and give technical rationale for the following:

- EMC filter design and performance, characterization data for proposed input/output (I/O) filtering, clock circuits, bypassing and decoupling.
- Number of PCB layers in combination with use of selected clock frequency and housing material.
- Identification and protection of critical/susceptible parts to both emission and immunity (including Transient and Electrostatic Discharge (ESD) protection).
- Identification of fundamental operating frequencies: clock rates, switching frequencies, and other potential coherent EMC sources.

Initial EMC test results shall be studied and reviewed, and if not available, identify when review of test results can be done. Some of the data may include:

- Output waveforms for all pulsed, pulse width modulated (PWM), or power outputs indicating the dV/dt , and dI/dt .
- Provide output voltage and current time domain measurements for power outputs and inputs.
- Review results of performed radiated emissions and immunity testing.
- Provide data from other modules which may have used similar components.

Resources needed for a successful EMC design review (other specialists, engineers, purchasing or managers depending on situation and complexity.)

- GM:
 - o EMC Specialist and/or EMC Release Engineer.
 - o Design/Release-Responsible Engineer.
 - o Component/System Responsible Engineer (optional).
 - o Validation-Responsible Engineer (optional).
- Supplier:
 - o Hardware/Design Responsible Engineer.
 - o EMC Engineer/Specialist.
 - o Project/System Responsible Engineer (optional).
 - o Validation Engineer (optional).

3.2.2 Vehicle Validation and Component/Subsystem Production Release. The objectives of the Vehicle Validation and Component/Subsystem Production Release phase shown in Figure 1 include product validation and component/subsystem production release. Component/Subsystem validation re-confirmation of all EMC technical requirements contained in the Component/Subsystem Technical Specification shall occur during vehicle level validation.

The component/subsystem shall pass both the component/subsystem level EMC test(s) and the vehicle level EMC test(s). In the event that the component/subsystem passes the component/subsystem level EMC test(s) but does not pass the vehicle level EMC test(s), the vehicle level test results shall be the determining factor for validation test pass/fail status.

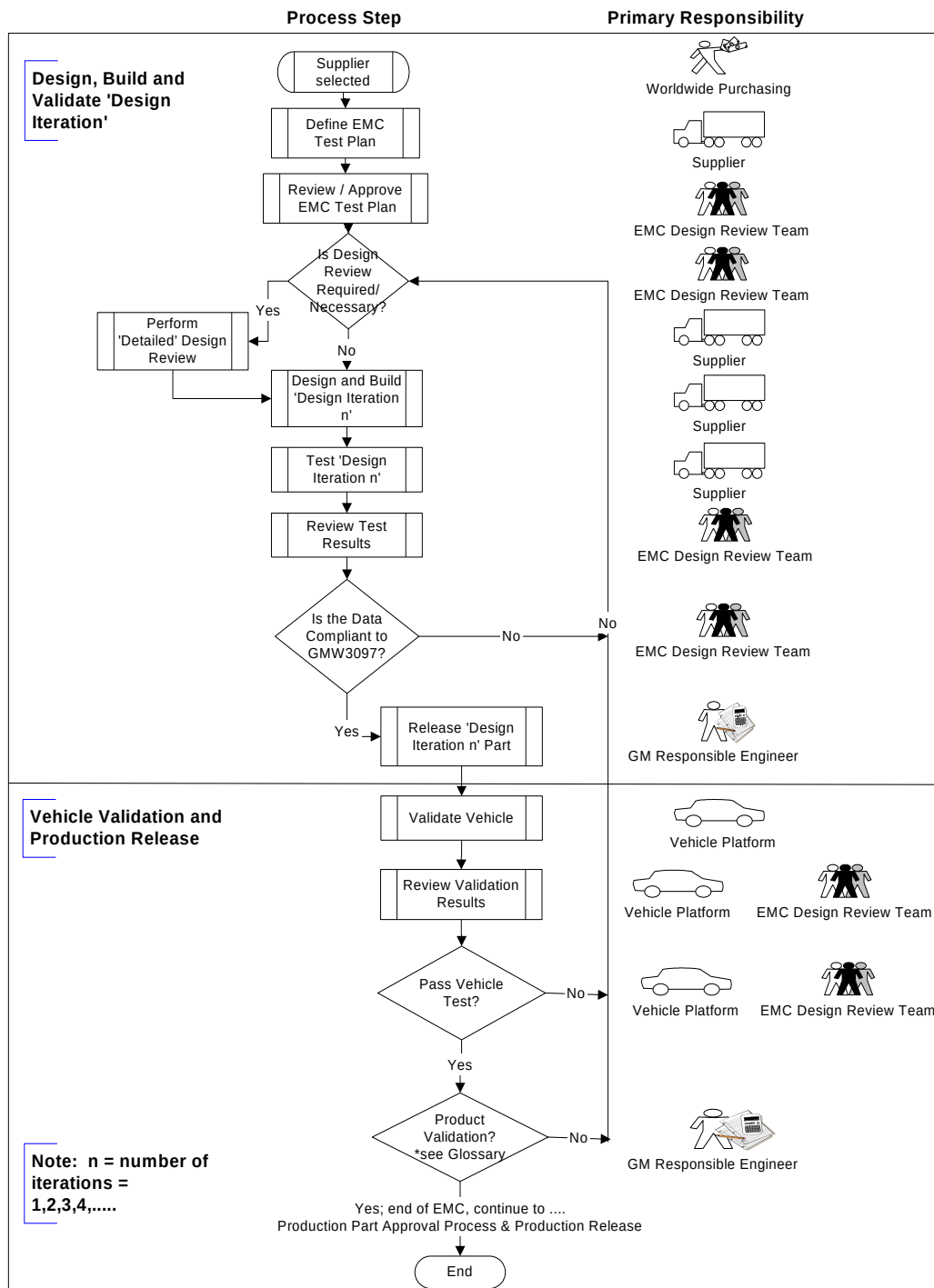


Figure 1: Design, Build, and Validate Design Iteration/Vehicle Validation and Component/Subsystem Production Release

4 Validation

4.1 General. Not applicable.

4.2 Validation Cross Reference Index. Not applicable.

4.3 Supporting Paragraphs. Not applicable.

5 Provisions for Shipping

Not applicable.

6 Notes

6.1 Glossary.

Carryover: The product qualified for a prior program and is exactly the same product being used for the future program. Modifications, alterations, internal part swaps, hardware and software changes are not considered carryover and must be validated according to the requirements.

Design Validation (DV): The process of confirming through analysis, demonstrations, inspections, and/or tests that the product design meets its technical requirements (Subsystem Technical Specification (SSTS), Component Technical Specification (CTS)/component drawing) without including the effects of manufacturing induced variations. Variation will exist in the parts on test, but not representative of the variation from the production process. Design Validation must be complete according to the Program Schedule of Engineering Deliverables section of the Statement of Requirements (SOR).

EMC Design Review Team: The EMC Design Review Team should include as a minimum, the vehicle manufacturer Responsible Engineer with release authority over the product, one or more vehicle manufacturer EMC Engineers, the supplier's EMC expert and members of the supplier's project team directly involved with the design, development and validation of the product.

IHS Inc.: IHS Incorporated, General Motors' Engineering Standards distributor.

Product Validation (PV): The process of confirming through analysis, demonstrations, inspections and/or tests that the product design meets its technical requirements (Vehicle Technical Specification (VTS), SSTS, CTS/component drawing) when including the effects of manufacturing variation. To complete this validation in time to affect pilot, this variation should be simulated in pre-production hardware or analyses, or by exception, with product hardware produced from production tools/equipment.

Shall: Denotes a binding provision; a must.

Should: Denotes preferences when specifying alternatives or desired conformance with objectives, standards, etc.

GM Design/Release-Responsible Engineer: Individual with release authority over the product.

Via: A plated thru-hole on a printed circuit board to route a signal between layers.

6.2 Acronyms, Abbreviations, and Symbols.

-	Negative
λ	Wavelength
[m]	Largest Dimension of Any Discontinuity
+	Positive
μ P	Microprocessor
A/D	Analog to Digital
AC	Alternating Current
ACCY	Accessory (Power Mode)
ADV	Analysis, Development, Validation
ALSE	Absorber Lined Shielded Enclosure
AM	Amplitude Modulation
AN	Artificial Network
B+	Battery (Voltage)
BCI	Bulk Current Injection
BER	Bit Error Rate
BM	Brush Commutated Electric Motor
c	Propagation Velocity of Electromagnetic Wave
C	Capacitance

C	Capacitor
CAN	Controller Area Network
CCC	Capacitive Coupling Clamp
CE	Conducted Emissions
CEMENT	Component EMC and Environmental Test (Database)
CI	Conducted Immunity
CTE	Conducted Transient Emissions
CTS	Component Technical Specification
DC	Direct Current
DCC	Direct Capacitive Coupling
dI/dt	Change in Current (I) with respect to Time
DUT	Device Under Test
DV	Design Validation
dV/dt	Change in Voltage (V) with respect to Time
EEPROM	Electrically Erasable Programmable Read-Only Memory
EICD	Electrical Interface Control Document
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ESR	Effective Series Resistance
EV	Electric Vehicle
f_c	Cutoff Frequency
FET	Field Effect Transistor
GDM	Global Document Management
GM	General Motors
GMLAN	GM Local Area Network
GMNA	General Motors North America
GND	Ground
GPS	Global Positioning System
GSSLT	Global Subsystem Leadership Team
HBM	Human Body Model
HS	High Speed
HS-CAN	High Speed Controller Area Network
HUD	Heads-Up Display
HV	High Voltage
HVAC	Heating Ventilation Air Conditioning
I	Current
I/O	Input/Output
IC	Integrated Circuit
ICS	Integrated Center Stack Display
ID	Identification
IEC	International Electrotechnical Commission
IGN	Ignition (Power Mode)
IPC	Instrument Panel Cluster
ISO	International Organization for Standardization
ITDC	International Technical Development Center

L	Inductance
LED	Light-Emitting Diode
LF	Low Frequency
LIN	Local Interconnect Network
LS	Low Speed
LS-CAN	Low Speed Controller Area Network
MLCC	Multi-Layer Ceramic Capacitors
MOV	Metal Oxide Varistor
n	Number (of Iterations)
N/A	Not applicable
NTC	Negative Temperature Coefficient
PCB	Printed Circuit Board
PDF	Portable Document Format
PEPS	Passive Entry Passive Start
PID	Parameter Identifier
PLL	Phase Locked Loop
PPEI	Platform Powertrain Electrical Interface
PTC	Positive Temperature Coefficient
PV	Product Validation
PWM	Pulse Width Modulated
R	Resistance
R	Resistor
RAM	Random Access Memory
RC	Resistor–Capacitor
RE	Radiated Emissions
RESS	Reserve Energy Storage System
RF	Radio Frequency
RI	Radiated Immunity
RKE	Remote Keyless Entry
RUN	Run (Power Mode)
SAE	SAE International
SDM	Sensing and Diagnostic Module
SMD	Surface Mounted Device
SOR	Statement of Requirements
SSTS	Subsystem Technical Specification
Sw B+	Switched Battery (Voltage)
TPIM	Traction Power Inverter Module
TPMS	Tire Pressure Monitoring System
V	Voltage
VCC	(Integrated Circuit Power Supply)
Vref	Reference Voltage
VTs	Vehicle Technical Specification
WVDC	Working Voltage Direct Current (DC)
XTAL	Crystal

7 Additional Paragraphs

7.1 All parts or systems supplied to this standard must comply with the requirements of GMW3059, **Restricted and Reportable Substances**.

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

GMW3103

9 Release and Revisions

This standard was originated in May 1998. It was first approved in January 2000. It was first published in June 2000.

Issue	Publication Date	Description (Organization)
1	JUN 2000	Initial publication.
2	OCT 2000	Reworked (ITDC)
3	AUG 2001	Reworked. List of tests matched to GMW3091, GMW3094, GMW3097, and GMW3100. More detailed appendices for design review and test plan. Editorial changes. (ITDC)
4	DEC 2003	Reworked. Consolidated appropriate material from GMW3106 (eliminated) into this document, removed Suppliers Questionnaire, moved Appendix "A" into body requirements section, renumbered remaining appendices, modified motor filtering in Lessons Learned appendix, more detailed appendices for design review and test plan. Editorial changes. (GMNA and ITDC)
5	FEB 2004	Editorial revision, typographical errors corrected.
6	JUL 2006	Minor technical changes (addition of GM Approval Number requirement, addition of EMC Design Requirements Checklist in Table A2.2, PWM slew rate recommendations, motor CE transient suppression). Coordinated release with GMW3091 and GMW3097.
7	APR 2012	5 Year Refresh. Added timeline, generic examples, and I/O monitoring and/or test condition expectations. Added note that references the GDM CG3044 publication number for the uncontrolled release version of the editable Appendix A (e.g., EMC Test Plan). Corrections/changes made to Description in Issues 2, 3, 4, 5 and 6 in the Release and Revisions Section. (EMC/ENV GSSLT)
8	JUN 2015	Refresh. Updated the test selection table; clarified some figures for transients and ESD; added text regarding lab permission and supplier acknowledgements, as well as some related to design recommendations. Removed the reference to CG3044. (ADV – Infotainment, Telematics & Displays Validation)

Appendix A

A1 EMC Test Plan

A1.1 Introduction. The EMC Test Plan (See Table A1 in the typical test plan template) requires an approval number to be supplied by GM EMC personnel (either directly or via the CEMENT database application) prior to the start of any testing. Any/all data submitted without this approval number will not be considered for validation (Design Validation (DV) or Product Validation (PV)) approval. All sections shall be included as stated in the outline, only additions of new sections are allowed. If a section is not applicable, this shall be stated in the document after the relevant section description.

Completing the EMC Test Plan requires collaborations between the supplier's Design Engineer along with the supplier's EMC Applications and Test Engineers.

A1.2 Purpose. The purpose of the EMC Test Plan is to develop and document a comprehensive EMC test based on requirements to confirm EMC compliance. The EMC Test Plan also provides a mechanism for ongoing enhancements and improvements to the test methodology that improves vehicle level test correlation.

The EMC Test Plan section documents the Device Under Test (DUT) operation and test procedures. It describes all relevant test setups and procedures to verify the electromagnetic robustness of the design. In some cases, it may make sense to select a specific sample for test that represents the entire DUT family. The EMC Test Plan should contain the justification and rationale for doing this.

In some cases, simulation results may be used as a substitute for actual physical testing. This requires specific prior agreement by the vehicle manufacturer's EMC engineer, and shall be documented in Table A2.

Table A1: Component/Subsystem EMC Test Plan Title Page

Product Name:		Revision Date:	GM Test Plan Approval Number: (see note below)
Product Supplier Name:			
EMC Specification Used: <i>Identify specification and revision number being used.</i>			
Supplier EMC-Responsible Engineer: <i>Provide Name, Email, and Phone Number.</i>		GM EMC-Responsible Engineer: <i>Provide Name, Email, and Phone Number.</i>	
GM Design-Responsible Engineer: <i>Provide Name, Email, and Phone Number.</i>		GM Validation-Responsible Engineer: <i>Provide Name, Email, and Phone Number.</i>	
By submitting this data to GM (via the CEMENT process, or, if necessary, directly to the GM EMC engineer), I certify that the information contained in this test plan is factual including description of the product operation, correct functional classifications, and acceptance criteria. I understand and agree that any subsequent changes to this test plan prior to or during Design Validation (DV) or Product Validation (PV) testing must be communicated to the GM EMC department for their acceptance. I also acknowledge that the test lab(s) personnel are permitted to contact the GM EMC engineer directly if there is any deviation to the approved test plan. Additionally, the test lab(s) personnel are permitted to contact the GM EMC engineer directly if there are any specific questions regarding the test plan. I also recognize that, if there is a deviation to the approved plan and the GM EMC engineer does not agree to the change(s), then the test lab shall mark all data as "DEVELOPMENT – NOT FOR VALIDATION" and the data/report cannot be submitted to GM for approval as DV/PV data. I understand that failure to follow this process will result in non-acceptance of the product's EMC test data by the GM EMC department. I certify that the product samples submitted for EMC testing are of a production representative design and agree to adhere to the CEMENT test plan and data submission milestones unless permission to adjust them is granted by the GM Design-Responsible Engineer.			
Note: Because of the CEMENT database process, the FINAL test plan that is uploaded into CEMENT will be approved by the GM EMC engineer within the tool itself. This actual PDF file cannot be modified by the GM EMC Engineer to include this approval number (which is automatically assigned). Therefore, the GM EMC Engineer shall provide a correspondence (email, fax, etc.) containing the test plan approval number (which may be the number generated by the tool or by the engineer in order to track plans). This correspondence/approval number must be supplied to the EMC test facility prior to the start of any testing. This approval number shall also be referenced on all data/reports submitted to GM, either by the supplier or the testing facility.			

Test Plan Revision History

Date	Description
	Initial Test Plan Release

Modifications to GMW3097

Date	Description

A2 Test Requirements

The following information is provided for the EMC Test Lab in order to understand the requirements for the validation report that the supplier will require for submission to General Motors. This information is taken directly from GMW3097 for those items relevant to the lab.

The supplier is required to submit the applicable validation test results in the format provided by the authorized test laboratory in their entirety without modifications.

All test reports shall include the following elements in addition to the report elements specified in each section:

Note: Each page of the test report must be clearly labeled as a validation report (Design Validation or Product Validation) or as a development report (Development Only – Not for Sign Off). This may be included in a header or footer. For development reports, a watermark (that does not obstruct data) is preferred.

Regarding Test Plan:

- Any deviation from the approved test plan and any applicable standards, including, but not limited to, test setup and test procedure. Any data obtained from testing where there are deviations to the approved test plan and applicable standards that are not approved by the GM EMC Engineer shall not be published in a validation (DV or PV) report.

Regarding Equipment/Setup:

- Internal unique test report number.
- Date(s) of test (for each test performed).

Note: Test results obtained from testing prior to test plan approval shall not be published in a validation report.

- Facility name (including the test site designations where the tests were performed).
- A listing of equipment used for each test run including the manufacturer, make and model, and calibration due dates.
- Test Equipment Software Revision (if test equipment is software controlled).
- Any deviation from the requirements of this engineering standard, including, but not limited to, test setup and test procedure.
- Description of the test setup and equipment used.
- A unique identification number must be assigned to the sample along with a description of the DUT and harness, including Hardware and Software Version. All data must include a reference to the sample tested.
- Block diagram showing the DUT setup, including all lab equipment used to perform the test.

Note: Do not use the simplified block diagrams as found in any of the reference standards. Those figures are generic, by nature, and cannot show the details required by a DUT-specific Test Plan.

- Part number and description of the harness.
- Photographs with sufficient clarity to enable compliance with the test plan to be verified. The details shown in photographs must include, **but not be limited to**, those details described below **as applicable** for each test performed:
 - The DUT, harness, simulator and fiber optic transmitters/modules resting above the ground plane on insulating material.
 - The connections between the battery and the artificial networks (AN).
 - The connections between the simulator and the DUT-side of the ANs.
 - The connections between the DUT and the simulator.
 - The connections between any power supplies and any fiber optic transmitters/modules requiring external supplies.
 - A close-up of the connection of any communication bus fiber optic device to the test harness, including, for instance, the position of Master/Slave switch for the local interconnect network (LIN) Bus (if applicable).
 - Bonding of the negative battery lead to the ground plane.
 - All interfaces that connect to leads exiting test chamber walls.
 - Any DUT monitoring equipment located outside test chambers and its connection through chamber walls.



- j. Bulk Current Injection (BCI) injection clamp supported above the ground plane and the harness routed through the clamp.
- k. Connections between transient generators, monitoring equipment, and the DUT.
- l. Bonding of the transient generator to the ground plane.
- m. Coupling capacitors and the test injection point at the DUT.
- n. The transient capacitive coupling clamp resting on the ground plane, the bonding of the transient generator to the ground plane and the routing of the harness through the clamp.
- o. The connections between the transient generator and the capacitive coupling clamp.
- p. DUT resting above the ground plane on a static dissipative mat (ESD Handling of Devices test).
- q. Bleed-off resistor (R) and its connection to the ground plane (ESD Handling of Devices test).

*(Note: All text or figures shown in **BLUE** or **italics** are for an example purposes only and shall be deleted in the final test plan).*

Determine the required tests for the DUT by determining the appropriate device Category and all applicable tests (per GMW3097, Table 2 and repeated here following Table A2a). For those cases (for complex devices) where multiple Categories/descriptions apply, the applicable tests shall be combined to create a superset of the individual Categories and both categorizations shall be listed. This information must be agreed-upon by the GM EMC Engineer and inserted into Table A2. Provide justification if all samples of the DUT are not subjected to the same test condition. Also, provide justification for any omissions in testing for any of the DUT test modes listed.

Table A2: Test Requirements Summary

Device Category(s) (per Table 2 of GMW3097)							
GMW3097 Paragraph	Test Description	Test Applies?	Number of Samples (Note 1)		DUT Setup Figure(s) (Note 2)	DUT Test Modes (Note 2)	Test Comments
		Yes/No	DV	PV			
Radiated Emission (RE) and Conducted Radio Frequency (RF) Emission (CE) – RE/CE via AN							
3.3.1	RE (ALSE)						
3.3.2	RF_CE via AN						
3.3.3	Magnetic Fields. (PEPS) Low Frequency						
3.3.4	ALSE, Low-Frequency E-Field and H-Field (China EV or Hybrid EV only) ^{Note 3}						
Radiated Immunity – RI							
3.4.1	RI, Bulk Current Injection (BCI)						
3.4.2	RI, Anechoic Chamber						
3.4.3	RI, Reverberation Chamber, Mode Tuning						
3.4.4	RI, Near-Field Portable Transmitters ^{Note 4}						
3.4.5	Immunity to Magnetic Fields						
Transients							
3.5.1	Transient, Conducted Emissions						
3.5.2	CI, Nominal 12 V Lines						
3.5.3	CI, Coupling (CCC or DCC) to I/O (excludes nominal 12 V lines)						
3.5.4	CI, Coupling (CCC/DCC) – (Sensors Only lines)						
3.5.5	CI, Coupling (DCC on I/O and regulated supply lines, 85 V)						
3.5.6	CI, Alternator Direct Capacitor Coupling						
Electrostatic Discharge – ESD							
3.6.1	ESD, Power-On Mode						
3.6.2	ESD, Remote I/O						
3.6.3	ESD, Handling of Devices						

Note 1: Minimum number of test samples is two. All samples tested must pass all applicable tests.

Note 2: This information for this summary table is to be filled-in only after completing the remainder of the test plan.

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June 2015

Page 14 of 47



Documents

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Note 3: This requirement applies only to those high-voltage (HV) components of the electric vehicle (EV) or hybrid EV that are intended for sale or export to China

Note 4: This near-field portable phone requirement applies only to those devices which can be located in the passenger compartment and that are packaged such that an occupant could place a cellular phone in close-proximity to it, such as when placed anywhere in the top of dash, in the center console area, rear console locations, near the occupant's headrests, etc. Examples would include, but are not limited to, the instrument panel cluster (IPC), integrated center stack display (ICS), radio, heads-up display (HUD), heating ventilation air conditioning (HVAC) control module, wireless phone charger, etc.

ALSE	Absorber Lined Shielded Enclosure
CCC	Capacitive Coupling Clamp
CI	Conducted Immunity
DCC	Direct Capacitive Coupling
EV	Electric Vehicle
PEPS	Passive Entry Passive Start
RI	Radiated Immunity

Table A2a: EMC Design Requirements Checklist

GMW3097 Paragraph	Description	Requirement Applicable?	Compliance (Yes/No) (Validate by Inspection)		Comment
		Yes/No	DV	PV	
3.7.1	Restriction of BM Motor Capacitance to Control Switching Transients				
3.7.2	BM Glass Wiper Motors and HVAC Blower Motor and Fuel Pump Motor Capacitance				
3.7.3	Package Protection - Short-Duration Motor Inductors				
3.7.4	Package Protection - Short-Duration BM Motor Transient Voltage Suppression				
3.7.5	Static Charge Bleed-Off Resistor Present (DUTs with DC-Isolated Metallic Cases)				
3.7.6	Package-Protection – NTC/PTC Shunt Capacitor				

BM	Brush Commutated Electric Motor
NTC	Negative Temperature Coefficient
PTC	Positive Temperature Coefficient