



## **General Specification for Vehicles, Electromagnetic Compatibility (EMC)**

### **Requirement Part**

## **1 Introduction**

In the event of a conflict between the text of this specification and the documents cited herein, the text of this specification takes precedence.

**Note:** Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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

**1.1 Scope.** This document applies to the Electromagnetic Compatibility (EMC) of passenger vehicles, light duty trucks and medium duty trucks. It is accepted by all parts of General Motors (GM) and, therefore, applicable to all GM automotive products worldwide.

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

GMW3091, GMW3094, GMW3097, GMW3100, GMW3103 and GMW3106

**Note:** All six documents of equal revision are carrying the same release date.

**Note:** During development of this document it was first called GMW12559 and then GMW12001 R.

**1.2 Mission / Theme.** This document specifies the EMC requirements for all GM automotive products when evaluated in accordance with the test procedures of GMW3094.

## **2 References**

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

### **2.1 Normative.**

ICES-002

IEC-CISPR12

IEC 489-3

95/54/EC

### **2.2 GM.**

GMUTS L-6Y-2  
GMW3094  
GMW3100  
GMW3106

GMUTS L-6Y-3  
GMW3097  
GMW3103

**2.3 Additional.** Automobile Type Approval Handbook for Japanese Certification.

## **3 Requirements**

### **3.1 System / Subsystem / Component / Part Definition.**

Subparagraphs were not applicable.

### **3.2 Product Characteristics.**

**3.2.1 Performance Requirements.** The DUT (Device Under Test) shall pass both, the component level tests according to GMW3097 and GMW3100 and the vehicle level tests according to GMW3091 and GMW3094. In the event that a device passes the component level EMC test but does not pass the vehicle level EMC tests, the vehicle level test results will be the determining factor for validation test pass/fail status.

For all tests the more stringent requirement applies at frequency breakpoints.

All deviations which occur during immunity testing shall be recorded.

General Motors will use the following criterion to determine the performance of a DUT during radiated immunity testing according to paragraphs 3.2.1.2.1, Immunity to Electromagnetic Fields from Off-Board Sources, and 3.2.1.2.2, Immunity to On-Board Transmitters on vehicle level.

If a deviation occurs during these radiated immunity tests, the deviation will be classified according to Figure 1.

Figure 1: Performance Criteria for Radiated Immunity Testing

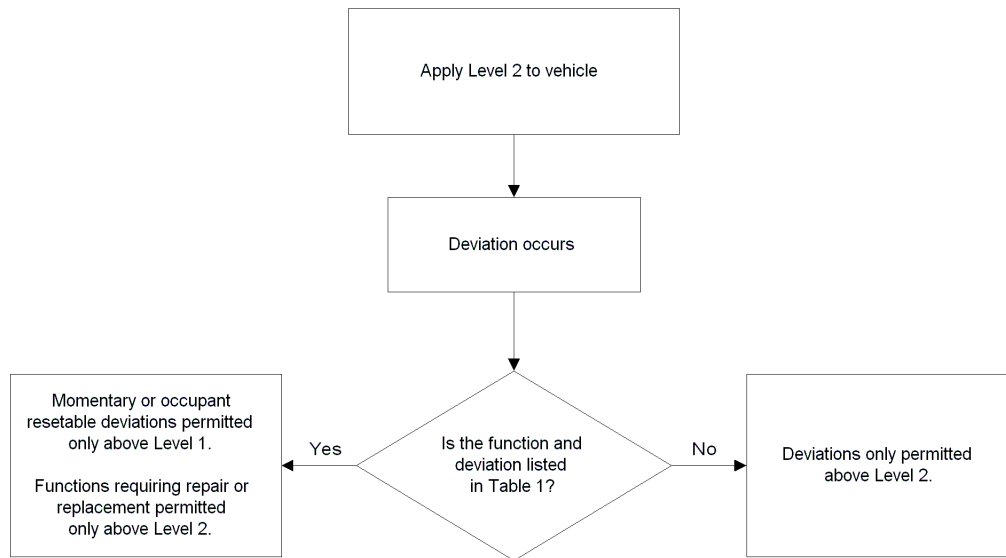


Table 1: List of Level 1 deviations

A deviation of a function which provides convenience or comfort and does not impair or impede the driver's ability to operate and/or control the vehicle and does not require repair or replacement

- Front and rear radio display (non-multifunction)
- Front and rear radio and telephone audio distortion
- Front and rear radio mode change
- CD changer mode change
- Navigation/compass display (non-multifunction) change (except OnStar GPS functions)
- Clock display change
- Trip odo display change
- Courtesy lighting change (except inadvertent illumination)
- Fuel consumption display
- HVAC display (non-multifunction) change
- HVAC mode change (Exception: Must not prevent activation and deactivation of defog function)
- Rear HVAC mode change
- Keyless entry functions (Exception: Inadvertent unlocking or when used as only means of entry, remote start, remote stop)
- Inability to open Sunroof
- Heated windshield operation (when used as redundant defog)
- Cell phone display (non-multifunction) change
- Entertainment audio & display change (VCR, TV, DVD, etc.)

### 3.2.1.1 Radiated Emissions, Vehicle Tests.

#### 3.2.1.1.1 Radiated Emissions at 10 m.

**3.2.1.1.1.1 Requirements.** The field strength of the broadband radiated emissions (broadband as defined in 95/54/EC) produced by the vehicle shall not exceed the limits of 95/54/EC (Regulatory Requirement) when evaluated in accordance with 95/54/EC.

The field strength of the broadband radiated emissions (broadband as defined in IEC CISPR 12) produced by the vehicle shall not exceed the limits of IEC CISPR 12 (10 m test) when evaluated in accordance with GMW3094, 3.2.1.1.1.

**Note:** For broadband radiated emissions, compliance with the limits of IEC CISPR 12 (10 m test) assures compliance with the limits of 95/54/EC (10 m test) and with the limits of ICES-002.

The field strength of the narrowband radiated emissions (narrowband as defined in 95/54/EC) produced by the vehicle shall not exceed the limits of 95/54/EC (Regulatory Requirement) when evaluated in accordance with 95/54/EC.

The electrical system of the vehicle shall comply with the following requirement when evaluated in accordance with the Automobile Type Approval Handbook

for Japanese Certification which states, "The electrical system shall not cause continuous and excessive radio interference. The vehicle shall be regarded as complying with this requirement when it has a radio interference control device (such as high-voltage electric resistive wires, external resistors etc.) for the control of motor vehicle radio noise".

#### 3.2.1.1.2 Interference to On-Board Receivers.

**3.2.1.1.2.1 Requirements.** Narrowband emissions (narrowband as defined in 95/54/EC) shall not exceed the narrowband levels for the antenna terminal voltage specified in 95/54/EC when evaluated in accordance with 95/54/EC.

Spark-generated and non-spark-generated emissions shall not exceed the levels for the antenna terminal voltage specified in Table 2 when evaluated in accordance with GMW3094, 3.2.1.1.2.

Switch pop noise emissions measured with the Pk+ detector shall not exceed the levels for the antenna terminal voltage specified in Table 3 when evaluated in accordance with GMW3094, 3.2.1.1.2.

**Table 2: Requirement Table for Radiated Emissions**

Broadcast Radio Band	Frequency	RBW	De-tector	Limit for non-spark generated emissions	Limit for spark-generated emissions	Comments
	MHz	kHz		dB( $\mu$ V)	dB( $\mu$ V)	
LW radio	0.15...0.3	10	Peak	6	22	only if available in entertainment system
MW radio	0.45...1.75	10	Peak	0	10	
MW image band	1.75...2.635	10	Peak	6	10	
VHF radio	74.5...110	<b>120</b> [100]	Peak	6	28 (35), [26 (33)]	values in ( ) for ignition systems only. Values in [ ] for spectrum analyzers with RBW 100 kHz
VHF image band	110...132	<b>120</b> [100]	Peak	6	28 (35), [26 (33)]	
DAB VHF	171...245	10	Peak	0	10	
DAB L-band	1447...1494	10	Peak	0	10	
SDARS	2308...2362	10	Peak	0	10	only for USA

Broadcast TV Band	Frequency	RBW	Detector	Limit for non-spark generated emissions	Limit for spark generated emissions	Comments
	MHz	kHz		dB( $\mu$ V)	dB( $\mu$ V)	
TV VHF1	40...110	NSG: 10 SG: 120	Peak	6	28, [26]	only if available in entertainment system, Values in [ ] for spectrum analyzers with RBW 100 kHz
TV VHF2	134...228	NSG: 10 SG: 120	Peak	6	28, [26]	only if available in entertainment system, Values in [ ] for spectrum analyzers with RBW 100 kHz
TV UHF	468...944	NSG: 10 SG: 120	Peak	6	28, [26]	only if available in entertainment system, Values in [ ] for spectrum analyzers with RBW 100 kHz

Special Band	Frequency	RBW	Detector	Limit for non-spark generated emissions	Limit for spark generated emissions	Comments
	MHz	kHz		dB( $\mu$ V)	dB( $\mu$ V)	
RKE 315	300...330	10	Peak	6	10	
RKE 433	420...450	10	Peak	6	10	
GPS	1567...1583	10	Peak		20	This value is a threshold only. When exceeded, the requirements of paragraph 3.2.1.1.5 shall apply
GPS	1567...1583	10	AV	0		
Bluetooth	2398 ... 2499	10	Peak	26	30	

Mobile Radio and Phone Band	Frequency	RBW	Detector	Limit for non-spark generated emissions	Limit for spark generated emissions	Comments
	MHz	kHz		dB( $\mu$ V)	dB( $\mu$ V)	
SW mobile radio	2.635...26.5	10	Peak	0	10	only for Australia
CB and 10 m	26.5...30	10	Peak	6	10	
Business 1	32.4...48.8	10	Peak	6	10	
Police 1	32.4...48.8	10	AV	-10		only for PFE in USA
Business 2	66.6...72.7	10	Peak	6	10	
Police 2	66.6...72.7	10	Peak	0	10	only for PFE in Europe or Australia
Business 3	72.7...89	10	Peak	6	10	
Police 3	72.7...89	10	AV	-10		only for PFE in Europe or Australia
2 m Amateur	141...146	10	Peak	6	10	
Business 4	146...164.1	10	Peak	6	10	
Police 4	164.1...177.6	10	Peak	6	10	
Police 4	164.1...177.6	10	AV	-10		only for PFE in Europe or Australia
Police 5	338...362	10	Peak	6	10	only for PFE in China
Government	388...402	10	Peak	10	10	only for PFE in Europe
Police 6	408...432	10	Peak	6	10	
Police 6	408...432	10	AV	-6		only for PFE in Europe or Australia
70 cm Amateur	438...452	10	Peak	0	10	
Phone 1	448...514	10	Peak	0	10	
Phone 2	867...962	10	Peak	0	10	
Phone 3	1475...1503	10	Peak	0	10	only for Japan
Phone 4	1543...1561	10	Peak	0	10	only for Australia
Phone 5	1803...1882	10	Peak	0	10	
Phone 6	1928...1992	10	Peak	0	10	
Phone 7	2108...2172	10	Peak	0	10	

All frequency allocations include guardbands.

Table 3: Requirement Table for Switch Pop Noise

Broadcast Band	Frequency	RBW	Detector	Switch Pop Noise Limit	Comments
	MHz	kHz		dB( $\mu$ V)	
LW radio	0.15...0.3	10	Peak	22	only if available in entertainment system
MW radio	0.45...1.75	10	Peak	19	

All frequency allocations include guardbands.

### 3.2.1.1.3 Subjective Radio Listen Test.

**3.2.1.1.3.1 Requirements.** The vehicle shall comply with GMUTS rating 8 for each test point for spark generated emissions, non-spark generated emissions and switch pop noise sources (e.g. brake light switch, intermittent wiper relays, turn signal relays) when evaluated in accordance with GMW3094, 3.2.1.1.3, using the Subjective Radio Listen Test with 20, 30 or 40 dB( $\mu$ V) receiver antenna terminal voltage.

Additionally, for vehicles intended to be sold in Australia, when using 10 dB( $\mu$ V) antenna terminal voltage

the subjective assessment shall not degrade more than two GMUTS levels when spark generated noise sources are switched on.

### 3.2.1.1.4 Land Mobile Radio Audio Test.

**3.2.1.1.4.1 Requirements.** Radiated emissions shall comply with the requirements of Table 4 when evaluated in accordance with GMW3094, 3.2.1.1.4, using the Land Mobile Radio Audio Test specified in IEC 489-3.

**Note:** This requirement is optional and may be called out for specific vehicle programs.

Table 4: Requirements for the Land Mobile Radio Audio Test

Frequency MHz	Maximum RF level to achieve required SINAD $\mu$ V		Required SINAD dB
	RF initial (sources off)	RF final (sources on)	
45.68; 45.72; 45.80; 45.84	0.5	1.0	12
47.02; 47.04; 47.06; 47.08; 47.10; 47.12; 47.14; 47.16; 47.18; 47.20; 47.22; 47.24; 47.26; 47.28; 47.30; 47.32; 47.34	0.5	1.0	12
150.995; 151.010; 151.025; 151.040; 151.055; 151.070; 151.085; 151.100; 151.115; 151.130; 151.185; 151.385	0.5	1.0	12
154.950; 155.370; 156.045; 156.060; 156.075; 156.105; 156.120; 156.135; 156.180	0.5	1.0	12

**Note:** SINAD applies to both spark generated and non-spark generated noise sources.

### 3.2.1.1.5 GPS Jamming Test.

**3.2.1.1.5.1 Requirements.** Radiated emissions of spark generated noise sources shall comply with

the requirements of Table 5 when evaluated in accordance with GMW3094, 3.2.1.1.5, using the GPS jamming test.

Table 5: Requirements for the GPS Jamming Test

C/N <sub>0</sub> Initial (noise sources off)	C/N <sub>0</sub> Requirement (noise sources on)	Comments
36 dBHz	degradation < 2 dB	Expect some variation (e.g. +/- 1 dB of baseline signal with reliable satellite simulators)

**3.2.1.2 Radiated Immunity, Vehicle Tests.**

when evaluated in accordance with GMW3094, 3.2.1.2.1.

**3.2.1.2.1 Immunity to Electromagnetic Fields from Off-Board Sources.**

**3.2.1.2.1.1 Requirements.** Vehicle functions may only deviate above the levels according to Table 6,

**Table 6: Requirement Levels applicable to the Performance Criteria for the Immunity to Electromagnetic Fields from Off-Board Sources**

Frequency	Level 1	Level 2	General Modulation
100 kHz...30 MHz	50 V/m	100 V/m	CW, off/on, on/off, AM 80%
>30 MHz...1 GHz	35 V/m	70 V/m	CW, off/on, on/off, AM 80%
>1 GHz...1.3 GHz	15 V/m	30 V/m	CW, off/on, on/off, AM 80%
>1.3 GHz...2.3 GHz	15 V/m	30 V/m	CW, off/on, on/off

Frequency	Level 1	Level 2	Communications Modulation
800 MHz...1 GHz	15 V/m	30 V/m	Pulse PRR=50 Hz, PD=6.67 ms, Pulse PRR=217 Hz, PD=0.57 ms
1.42 GHz...1.51 GHz	15 V/m	30 V/m	Pulse PRR=50 Hz, PD=6.67 ms
1.7 GHz...2.3 GHz	15 V/m	30 V/m	Pulse PRR=50 Hz, PD=6.67 ms, Pulse PRR=217 Hz, PD=0.57 ms

Frequency	Level 1 (peak)	Level 2 (peak)	Radar Modulation
1.2 GHz...1.4 GHz	170 V/m	600 V/m	Radar pulse packets PRR=300 Hz, PD=3 $\mu$ s, with only 50 pulses output every 1 s
2.7 GHz...3.1 GHz	105 V/m	210 V/m	Radar pulse packets PRR=300 Hz, PD=3 $\mu$ s, with only 50 pulses output every 1 s
5.4 GHz...5.7 GHz	55 V/m	110 V/m	Radar pulse packets PRR=300 Hz, PD=3 $\mu$ s, with only 50 pulses output every 1 s
9.3 GHz...9.57 GHz	125 V/m	250 V/m	Radar pulse packets PRR=300 Hz, PD=6 $\mu$ s, with only 25 pulses output every 1 s

**Note:** For off/on and on/off modulation the following requirements apply: Maximum overshoot 0.5 dB, maximum rise time 3 ms, minimum power step 20 dB.

The following requirement can be used alternatively for tests carried out in Milford Proving Ground until completion of the new EMC test facility:

Vehicle functions may only deviate above the levels according to Table 7 when evaluated in accordance with GMW3094, 3.2.1.2.1, using GMUTS L-6Y-3.

**3.2.1.2.2 Immunity to On-Board Transmitters.**

**3.2.1.2.2.1 Requirements.** Vehicle functions may only deviate above the levels according to Table 8 when evaluated in accordance with GMW3094, Paragraph 3.2.1.2.2.

**Table 7: Requirement Levels applicable to the Performance Criteria for the Immunity to Electromagnetic Fields from Off-Board Sources**

Frequency range	Level 1	Level 2
100 kHz...9.57 GHz	40 V/m	100 V/m

**Table 8: Requirement Levels applicable to the Performance Criteria for the Immunity to On-Board Transmitters**

Frequency in MHz	Level 1	Level 2	Modulation
1.8...2.0	100 W	150 W	CW, off/on, on/off
3.5...4.0	100 W	150 W	CW, off/on, on/off
7.0...7.3	100 W	150 W	CW, off/on, on/off
10.1...10.15	100 W	150 W	CW, off/on, on/off
14.0...14.35	100 W	150 W	CW, off/on, on/off
18.07...18.17	100 W	150 W	CW, off/on, on/off
21.0...21.45	100 W	150 W	CW, off/on, on/off
24.89...24.99	100 W	150 W	CW, off/on, on/off
26.18...28.0	100 W	150 W	CW, off/on, on/off
28.0...29.7	100 W	150 W	CW, off/on, on/off
30...50	60 W	120 W	CW, off/on, on/off
50...54	60 W	120 W	CW, off/on, on/off
60...87	50 W	100 W	CW, off/on, on/off
120...130	50 W	100 W	CW, off/on, on/off
144...174	80 W	160 W	CW, off/on, on/off
220...225	60 W	120 W	CW, off/on, on/off
380...390	25 W	50 W	CW, off/on, on/off
400...410	25 W	50 W	CW, off/on, on/off
420...450	60 W	120 W	CW, off/on, on/off
450...470	50 W (Note 1)	100 W (Note 1)	CW, off/on, on/off
470...510	50 W	100 W	CW, off/on, on/off
806...815	30 W (Note 1)	60 W (Note 1)	CW, off/on, on/off
820...849	18 W (Note 1)	35 W (Note 1)	CW, off/on, on/off, pulse PRR=50 Hz, PD=6.67 ms
851...960	30 W (Note 1)	60 W (Note 1)	CW, off/on, on/off, pulse PRR=217 Hz, PD=0.57 ms
1240...1300	10 W	10 W	CW, off/on, on/off
1429...1453	10 W	10 W	CW, off/on, on/off, pulse PRR=50 Hz, PD=6.67 ms
1477...1525	5 W	10 W	CW, off/on, on/off
1710...1785	10 W	10 W	CW, off/on, on/off, pulse PRR=217 Hz, PD=0.57 ms
1805...1910	10 W	10 W	CW, off/on, on/off, pulse PRR=217 Hz, PD=0.57 ms
1920...1980	10 W	10 W	CW, off/on, on/off, pulse PRR=100 kHz, PD=5 μs

Note 1: Power levels for antenna positions inside the passenger compartment of the vehicle shall not exceed 35 W, power levels for antenna positions inside the trunk of the vehicle shall not exceed 10 W.



**Note:** For off/on and on/off modulation the following requirements apply: Maximum overshoot 0.5 dB, maximum rise time 3 ms, minimum power step 20 dB.

### 3.2.1.2.3 Immunity to Power Line Magnetic Fields.

**3.2.1.2.3.1 Requirements.** Vehicle functions may only deviate above 50  $\mu$ T (RMS) when evaluated in accordance with GMW3094, 3.2.1.2.3.

### 3.2.1.3 Conducted Transient Emissions and Immunity (CE/CI), Vehicle Tests.

#### 3.2.1.3.1 CE/CI, Operator Test.

**3.2.1.3.1.1 Requirements.** Operator perceivable deviations shall not occur and diagnostic trouble codes shall not be stored in electrical/electronic devices when the vehicle is evaluated in accordance with GMW3094, 3.2.1.3.1.

### 3.2.1.4 Electrostatic Discharge (ESD), Vehicle Test.

#### 3.2.1.4.1 Immunity to ESD.

**3.2.1.4.1.1 Requirements.** The vehicle functions may deviate according to Table 9 when evaluated in accordance with GMW3094, 3.2.1.4.1.

**Table 9: Requirements for the Immunity to Electrostatic Discharge**

Type of Discharge	Level	Deviations
Air Discharge, C = 330 pF	$\pm 4$ kV	No deviations allowed
Contact Discharge, C = 330 pF	$\pm 4$ kV	No deviations allowed
Air Discharge, C = 330 pF	$\pm 6$ kV	No deviations allowed
Contact Discharge, C = 330 pF	$\pm 6$ kV	Only momentary self-recoverable deviations allowed
Air Discharge, C = 330 pF	$\pm 8$ kV	Only momentary self-recoverable deviations allowed
Contact Discharge, C = 330 pF	$\pm 8$ kV	Only momentary self-recoverable deviations allowed
Air Discharge, C = 330 pF	$\pm 15$ kV	Only momentary self-recoverable deviations allowed
Air Discharge, C = 150 pF	$\pm 25$ kV	Only momentary self-recoverable deviations allowed

## 4 Validation

**4.1 General.** This paragraph defines the acronyms, abbreviations and special terms used in this section.

Validation Method:

- A Analysis
- D Demonstration
- I Inspection
- T Test

Validation Type:

*DV* Design Validation

*PV* Product Validation

The subsystem and/or component level validation must precede the initiation of vehicle validation.

**4.2 Validation Cross Reference Index.** The Validation Cross Reference Index (VCRI), Table 10, maps the vehicle requirements to the associated validation procedures. The VCRI identifies the applicable validation procedures, the method of validation and the validation type. The VCRI is to be used as an input in developing a complete validation plan.

Table 10: Validation Cross Reference Index Electromagnetic Compatibility, Vehicle Tests

GMW3091 Requirement Paragraph	Title	GMW3094 Procedure Paragraph	Validation Method	Validation Type
3.2.1.1.1	Radiated Emissions at 10 m	3.2.1.1.1	T, I	DV, PV
3.2.1.1.2	Interference to On-Board Receivers	3.2.1.1.2	T	DV, PV
3.2.1.1.3	Subjective Radio Listen Test	3.2.1.1.3	T	DV, PV
3.2.1.1.4	Land Mobile Radio Audio Test	3.2.1.1.4	T	DV, PV
3.2.1.1.5	GPS Jamming Test	3.2.1.1.5	T	DV, PV
3.2.1.2.1	Immunity to Electromagnetic Fields from Off-Board Sources	3.2.1.2.1	T	DV, PV
3.2.1.2.2	Immunity to On Board Transmitters	3.2.1.2.2	T	DV, PV
3.2.1.2.3	Immunity to Power Line Magnetic Fields	3.2.1.2.3	T	DV, PV
3.2.1.3.1	CE/CI, Operator Test	3.2.1.3.1	T	DV, PV
3.2.1.4.1	Immunity to ESD	3.2.1.4.1	T	DV, PV

## 5 Provisions for Shipping

Not applicable.

## 6 Notes

6.1 Glossary. Not applicable.

6.2 Acronyms, Abbreviations and Symbols.

AM Amplitude Modulation

AV Average

C/N<sub>0</sub> Carrier to Noise in GPS signal, typically measured in dBHz

CB Citizen Band

CB Citizen Band

CD Compact Disc

CE Conducted Transient Emissions

CI Conducted Transient Immunity

CTS Component Technical Specification

CW Continuous Wave

DAB Digital Audio Broadcast

DARS Digital Audio Radio System

DIS Draft International Standard

DUT Device under Test

DVD Digital Versatile Disc

EC European Community

EMC Electromagnetic Compatibility

ESD Electrostatic Discharge

GM General Motors

GMUTS General Motors Uniform Test Specification

GPS Global Positioning System

HVAC Heating Ventilation and Air Conditioning

ICES Interference-Causing Equipment Standard

IEC International Electrotechnical Commission  
CISPR Comité International Spécial des Perturbations Radioélectrique (International Special Committee on Radio Interference)

ISO International Organization for Standardization

ITDC International Technical Development Center

LW Long Wave

MW Medium Wave

NB Narrowband

NSG Non-Spark generated noise source

PD	Pulse Duration
PFE	Police / Fire / Emergency Service
PK	Peak
PRR	Pulse Repetition Rate
RBW	Resolution Bandwidth
RF	Radio Frequency
RKE	Remote Keyless Entry
RMS	Root Mean Square
SG	Spark Generated noise source
SINAD	Signal to Noise And Distortion
SDARS	Satellite Digital Audio Radio Service
SW	Short Wave
VCR&TV	Video Cassette Recorder & Television
VHF	Very High Frequency
VTS	Vehicle Technical Specification

## 7 Additional Paragraphs

Not applicable.

## 8 Coding System

This specification shall be referenced in other documents, drawings, VTS, CTS, etc. as follows:

GMW3091

Where

GMW	GM Worldwide
3091	Sequential number
	Class: General Specification
	Type: All Vehicle
	Category: Electrical Architecture

**Example:**

"Requirements to GMW3091"

## 9 Release and Revisions

**9.1 Release.** The specification was first approved in APR 1999.

It has been prepared by the GM Global EMC Committee.

### 9.2 Revisions.

Rev.	Date	Description (Org.)
A	APR 1999	New, was also called "revision 1" (GMNA)
B	OCT 1999	Declassification, Specification is no longer classified as GM Confidential, was also called "revision 1" (GMNA)
C	JUN 2000	Format Revision, was also called "revision 1" (GMNA)
D	OCT 2000	Reworked, was also called "revision 2" (ITDC)
E	AUG 2001	Reworked, is also called "revision 3". Changes against revision October 2000 (revision 2): Radiated Emissions: GPS requirements changed, GPS Jamming test added. Radiated Immunity: List of Level 1 deviations changed, requirements for off-board sources changed, requirements for on-board sources trunk position added. Conducted Emissions: Transient analysis eliminated. Conducted Immunity: Load dump test eliminated, transient injection eliminated. All paragraphs: Editorial changes and clarifications. (ITDC)

## 射频和天线设计培训课程推荐

易迪拓培训([www.edatop.com](http://www.edatop.com))由数名来自于研发第一线的资深工程师发起成立,致力并专注于微波、射频、天线设计研发人才的培养;我们于 2006 年整合合并微波 EDA 网([www.mweda.com](http://www.mweda.com)),现已发展成为国内最大的微波射频和天线设计人才培养基地,成功推出多套微波射频以及天线设计经典培训课程和 ADS、HFSS 等专业软件使用培训课程,广受客户好评;并先后与人民邮电出版社、电子工业出版社合作出版了多本专业图书,帮助数万名工程师提升了专业技术能力。客户遍布中兴通讯、研通高频、埃威航电、国人通信等多家国内知名公司,以及台湾工业技术研究院、永业科技、全一电子等多家台湾地区企业。

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### 射频工程师养成培训课程套装

该套装精选了射频专业基础培训课程、射频仿真设计培训课程和射频电路测量培训课程三个类别共 30 门视频培训课程和 3 本图书教材;旨在引领学员全面学习一个射频工程师需要熟悉、理解和掌握的专业知识和研发设计能力。通过套装的学习,能够让学员完全达到和胜任一个合格的射频工程师的要求...

课程网址: <http://www.edatop.com/peixun/rfe/110.html>

### 手机天线设计培训视频课程

该套课程全面讲授了当前手机天线相关设计技术,内容涵盖了早期的外置螺旋手机天线设计,最常用的几种手机内置天线类型——如 monopole 天线、PIFA 天线、Loop 天线和 FICA 天线的设计,以及当前高端智能手机中较常用的金属边框和全金属外壳手机天线的设计;通过该套课程的学习,可以帮助您快速、全面、系统地学习、了解和掌握各种类型的手机天线设计,以及天线及其匹配电路的设计和调试...

课程网址: <http://www.edatop.com/peixun/antenna/133.html>



### WiFi 和蓝牙天线设计培训课程

该套课程是李明洋老师应邀给惠普 (HP) 公司工程师讲授的 3 天员工内训课程录像,课程内容是李明洋老师十多年工作经验积累和总结,主要讲解了 WiFi 天线设计、HFSS 天线设计软件的使用,匹配电路设计调试、矢量网络分析仪的使用操作、WiFi 射频电路和 PCB Layout 知识,以及 EMC 问题的分析解决思路等内容。对于正在从事射频设计和天线设计领域工作的您,绝对值得拥有和学习! ...

课程网址: <http://www.edatop.com/peixun/antenna/134.html>



## CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出,是最全面、系统、专业的 CST 微波工作室培训课程套装,所有课程都由经验丰富的专家授课,视频教学,可以帮助您从零开始,全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装,还可超值赠送 3 个月免费学习答疑...

课程网址: <http://www.edatop.com/peixun/cst/24.html>



## HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程,是迄今国内最全面、最专业的 HFSS 培训教程套装,可以帮助您从零开始,全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装,更可超值赠送 3 个月免费学习答疑,随时解答您学习过程中遇到的棘手问题,让您的 HFSS 学习更加轻松顺畅...

课程网址: <http://www.edatop.com/peixun/hfss/11.html>

## ADS 学习培训课程套装

该套装是迄今国内最全面、最权威的 ADS 培训教程,共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解,并多结合设计实例,由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS,迅速提升个人技术能力,把 ADS 真正应用到实际研发工作中去,成为 ADS 设计专家...

课程网址: <http://www.edatop.com/peixun/ads/13.html>



### 我们的课程优势:

- ※ 成立于 2004 年,10 多年丰富的行业经验,
- ※ 一直致力并专注于微波射频和天线设计工程师的培养,更了解该行业对人才的要求
- ※ 经验丰富的一线资深工程师讲授,结合实际工程案例,直观、实用、易学

### 联系我们:

- ※ 易迪拓培训官网: <http://www.edatop.com>
- ※ 微波 EDA 网: <http://www.mweda.com>
- ※ 官方淘宝店: <http://shop36920890.taobao.com>