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IMMUNITY TO RADIATED MAGNETIC FIELDS

MIL-STD-461F:2007, SAE J1113-22:2003, ISO-11452-8:2007, CS-11979:2010, EMC-CS-2009:2010, GMW3097:2006

1. PURPOSE

1.1. To provide specific test method setup configuration instructions in full compliance with OEM specifications and international standards.

2. SCOPE

2.1. To establish consistency and repeatability in test method results using the equipment and technical resources available in EMC laboratory inventory.

3. RESPONSABILITY

3.1. EMC laboratory authorized personnel.
See **201709** *EMC LAB TEST EQUIPMENT COMPETENCY MATRIX* and **201705** *EMC LAB COMPETENCY MATRIX*.

4. EQUIPMENT & MATERIALS

4.1. All test equipment that requires calibration shall be within its calibration period and shall be traceable to A2LA certified labs. EMC lab personnel must ensure that certificates of calibration are obtained when equipment is sent out for calibration or repair. *(See REFERENCES section in document for equipment specific internal procedures and records).*

4.2. **Power supply**
The power supply has an internal resistance, Rs, of < 0,01 Ω d.c. and an internal impedance, Zs, equal to Rs for frequencies < 400 Hz. The output voltage does not deviate more than 1 V from zero to maximum load (including inrush current) and recovers 63 % of its maximum excursion within 100 µs. The superimposed ripple voltage, UR, does not exceed 0,2 V peak-to-peak and has a maximum frequency of 400 Hz. If a standard power supply (with sufficient current capacity) is used in bench testing to simulate the battery, it is important that the low internal impedance of the battery also be simulated. When a battery is used, a charging source is needed to achieve the specified reference levels. Ensure that the charging source does not affect the test.

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Fig.4-1

Tbl.4-1

Idx	Equipment Description	Model	Maker	INV#
1.	Spectrum Analyzer	3588A	HP	1952
2.	Pulse/Function Generator	8116A	HP	1120
3.	Current Probe	AM503 B	TEKTRONIX	1523
4.	Oscilloscope	54504A	HP	0822
5.	Loop Antenna	7604	ETS	1498
6.	Audio Amplifier 200W	AA-SUS	Electro-Metrics	2176
7.	Helmholtz Coil	6403	ETS	
8.	Oscilloscope	TDS784A	TEKTRONIX	2161
9.	Tile Software			

5. TEKTRONIX AM503 CURRENT PROBE CONFIGURATION

5.1. Degaussing the probe removes any residual magnetization from the probe core. Such residual magnetization can induce measurement error. Autobalancing removes unwanted DC offsets in the amplifier circuitry.

5.2. Turn on the Amplifier and allowing a 20-minute warm-up period. Degaussing and auto-balancing should be performed before connecting the probe to a conductor under the test, whenever an overload condition occurs, and whenever the probe is subjected to a strong external magnetic field.

To degauss and auto-balance a current probe, perform these steps:

1. Verify that the current probe is connected to the Amplifier.
2. Remove the current probe from the conductor under test.
3. Lock the probe slide closed (see Figures 2–1 and 2–2).
4. Press the Amplifier PROBE DEGAUSS AUTOBALANCE button.

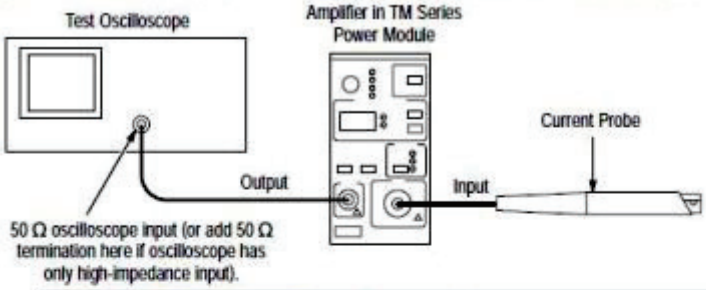
NOTE. The degauss procedure will fail if the Amplifier is not properly connected to an oscilloscope having 50 input impedance. If this occurs, an error code of 266 will be displayed on the Amplifier front panel.

5.3. **Error Code 266:** The Amplifier displays error code 266 when the Amplifier output is not properly terminated into a 50 OHM load. Make sure your amplifier OUTPUT is connected to an oscilloscope input using a 50 OHM BNC cable, and that the oscilloscope input is set to 50 OHM impedance.

Error Code LO: When the internal backup battery becomes weak, the CURRENT/DIV display will momentarily flash the characters LO when the instrument is turned on. If a battery low condition occurs, calibration values in NVRAM may be lost, which can cause the the AM 503B and AM 5030 to fail to meet specifications.

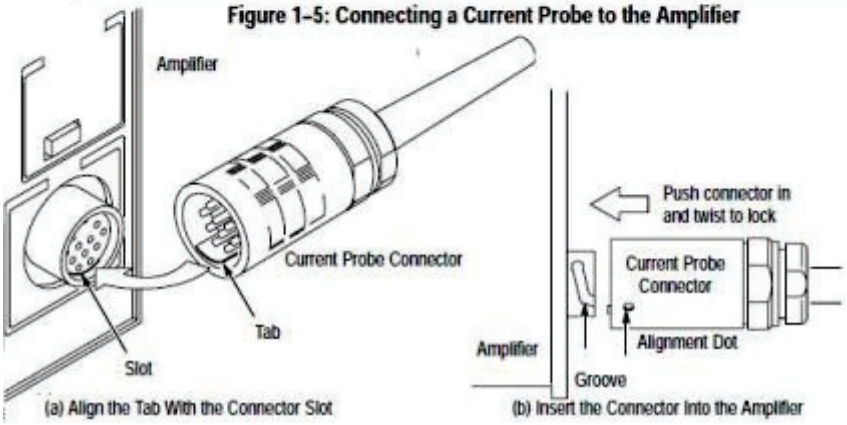
Fig.5-1

Figure 1–1: Configuring the AM 503B and AM 5030 Current Measurement System



CAUTION. *Handle current probes with care. Do not drop a probe or subject it to impact, or the core may crack. Do not connect or disconnect a current probe while the probe is clamped around a live conductor, or while the AM 503B and AM 5030 is powered on, or the probe may suffer electrical damage.*

Figure 1–5: Connecting a Current Probe to the Amplifier



6. SUMMARY OF TEST METHOD

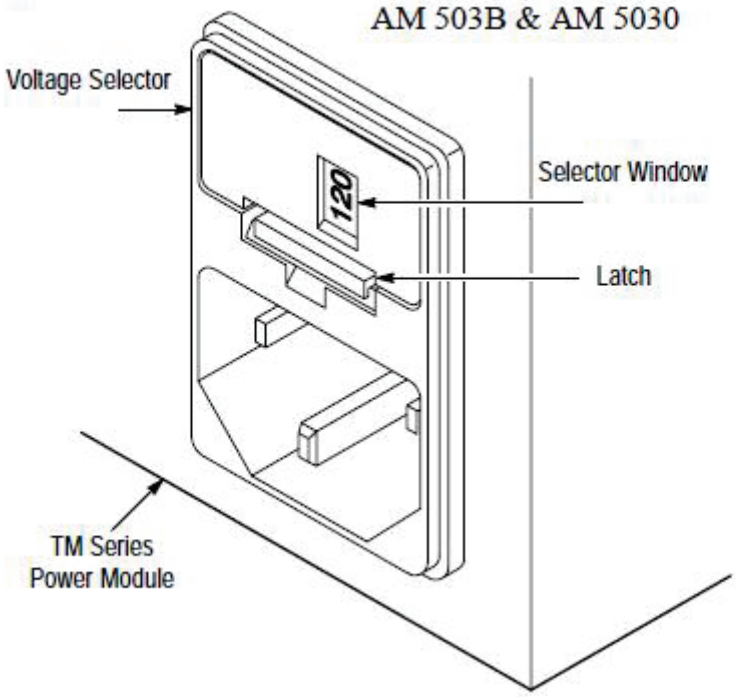
6.1. Evaluates DUT's immunity from conducted transients on power and control circuits connected directly to the vehicle's battery or indirectly by a switch or load (e.g. pull-up resistor).

6.2. The switching of inductive loads connected to the battery supply of vehicles creates both positive and negative pulses which electronics connected to the battery supply must be able to withstand. An example of transient would be the release of stored energy during the operation of a relay and/or other loads connected to the battery while starting and/or turning off the vehicle.

7. SAFETY PRECAUTIONS

7.1. Only EMC laboratory personnel mentioned in 201709 EMC LAB TEST EQUIPMENT COMPETENCY MATRIX is allowed to handle and operate the equipment listed for this test method.

Fig.7-1 **Figure 1–2: TM Series Power Module Voltage Selector**



8. TEST PLAN

8.1. For FlexAutomotive products the EMC test plan is generated using LMS004 and OEM template.

8.2. The test plan should indicate:
1) DUT, harness, I/O loads configuration and position relative to ground plane.
2) DUT activation and monitoring method, expected FPSC, and pass/fail criteria.

8.3. In the absence of an EMC test plan use information provided by the test requester in 201696 INTERNAL TEST REQUEST FORM. This approach is applicable for "engineering development" testing.

9. RECORDS

9.1. **Test reports** including plots and data files are saved over over the LAN in a dedicated folder:
\\nmknt062\apps\e-ecn\emclab\tresult\project#\job#\test group
Example of grouping test results per job#: CTI, CTE, RE, CE, BCI, ESD, TP, PT, TRENDS.

9.2. In a similar manner the EMC **test plans** (TP), **proficiency testing** (PT), **trends** are stored under a **project#\job#** folder.

9.3. The intranet application EMC LAB SCHEDULER database is used to maintain and provide fast access to testing related records. The application is available via this link: **http://nmknt063/emclab/labscheduler/**

10. TEST SETUP PREPARATION

10.1. Prior to start testing verify that all samples are labeled per 900712 EMC LAB LABELS. The default list of required equipment is pull-out at the time the test method is selected (721179 EMC LAB, TEST REPORTS DATABASE).

10.2. A default list of required equipment is pull-out at the time the test method is selected (721179 EMC LAB, TEST REPORTS DATABASE).

10.3. The EMC test operator must ensure the testing is carried out based on the latest OEM specifications. In case of conflict the following documents may over-ride this procedure in order:
1) The latest revision of OEM specification (including corrections).
2) OEM approved EMC test plan, which can over-ride the OEM specification.

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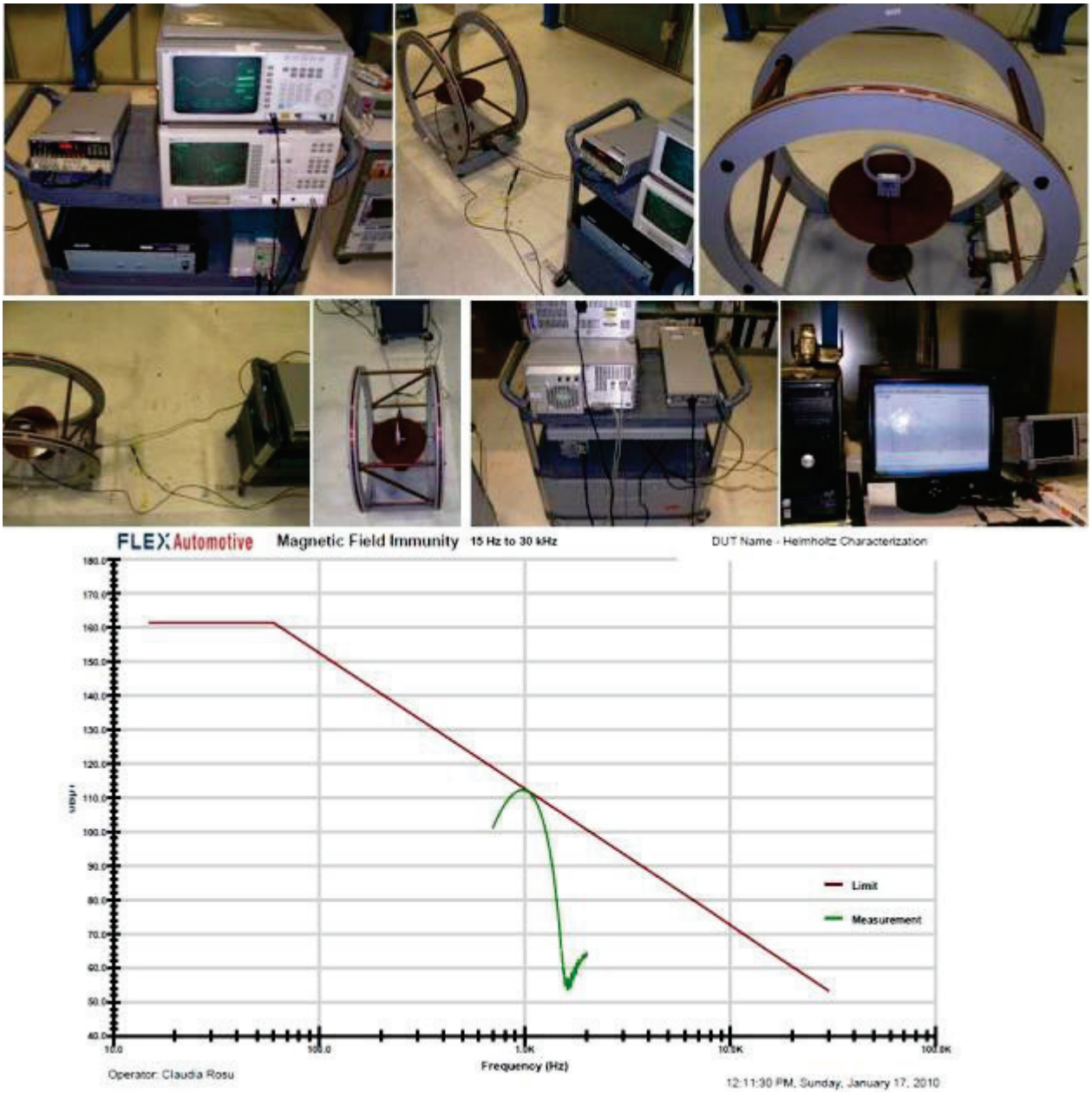
11. MIL-STD-461F:2007 RS101 HELMHOLTZ COIL CHARACTERIZATION

11.1. To generate a flux density of 110 dBpT, a field of 0.26 A/m is required. From manufacturer's data **H = 0.715 x (NI/R)**
»» field **H** [A/m]
»» number of turns per coil **N** = 25
»» coil current **I** [A]
»» coil radius in meters **R** = 0.45 m
Therefore to solve for I: **((.26/.715)/25) x .45 = 6.54 mA**
With a 1 kHz sine wave at 6.54 mA, the result was measured at 108.22 dBpT. Requirement is 110 dBpT ± 3 dB

11.2. Follow instructions provided in MIL-STD-461F (10 December 2007) RS101 (radiated susceptibility, magnetic field, 30 Hz to 100 kHz) paragraph 5.19.4 RS101 alternative test procedures – AC Helmholtz coil.

Fig.11-1



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12. MIL-STD-461F:2007 MAGNETIC FIELD IMMUNITY (RS101)

12.1. Turn on the EUT and allow sufficient time for stabilization.

12.2. Supply the Helmholtz coil with sufficient current to produce magnetic field strengths at least 6 dB greater than the applicable limit.

12.3. Scan the applicable frequency range using the scan rates.

12.4. If susceptibility is noted, select no less than three test frequencies per octave at those frequencies where the maximum indications of susceptibility are present.

12.5. Reposition the Helmholtz coils successively over all areas on each face of the EUT (in all three axes), including exposure of any electrical interface connectors, and repeat the above steps to determine locations and frequencies of susceptibility.

12.6. At each frequency determined above, apply a current to the Helmholtz coil that corresponds to the applicable RS101 limit. Move the coils to search for possible locations of susceptibility with particular attention given to the locations. Ensure the EUT remains centered between the coils, or the coils remain 5 cm from the EUT surface, as applicable. Verify that susceptibility is not present.

Fig.12-1 MIL-STD-461F RS101 10 December 2007

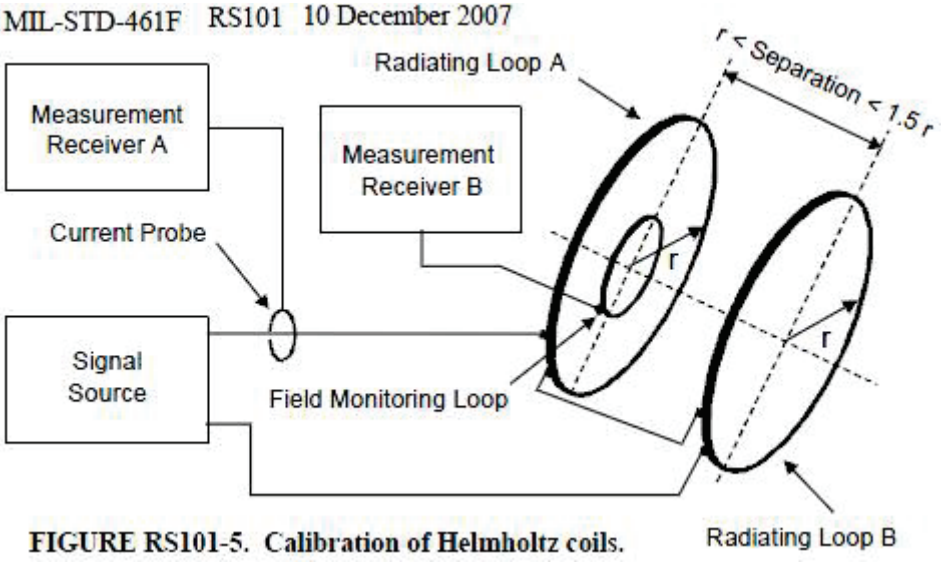

FIGURE RS101-5. Calibration of Helmholtz coils.

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13. SAE J1113-22:2003 MAGNETIC FIELD IMMUNITY

13.1. Calibrate the system by generating the magnetic field, measuring the field using the intensity monitor, and recording the coil current versus field values. Place the DUT in the uniform field region of the Helmholtz coil. Generate the desired magnetic field levels from calibration or calculated values. At each field strength level, expose the DUT for a minimum of 2 s. Monitor the DUT and record the respective magnetic field intensity for: (a) malfunction, (b) degradation of performance, or (c) deviation of parameters beyond tolerances up to the performance levels defined in Appendix A. Repeat the above steps for the other two orientations of the DUT.

Fig.13-1

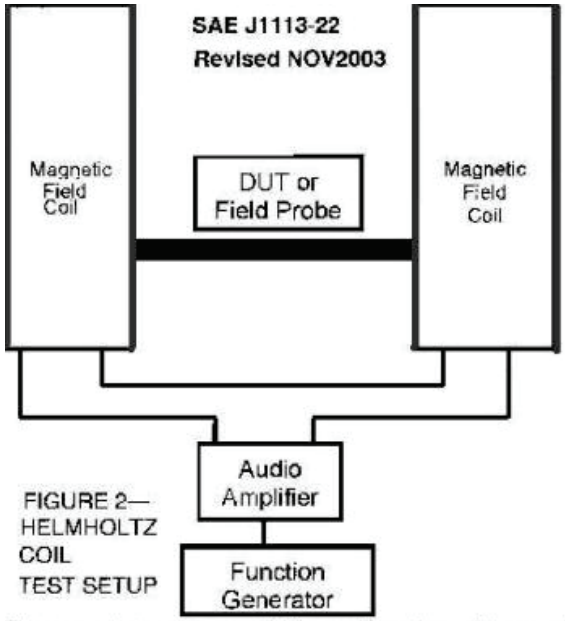

FIGURE 2— HELMHOLTZ COIL TEST SETUP

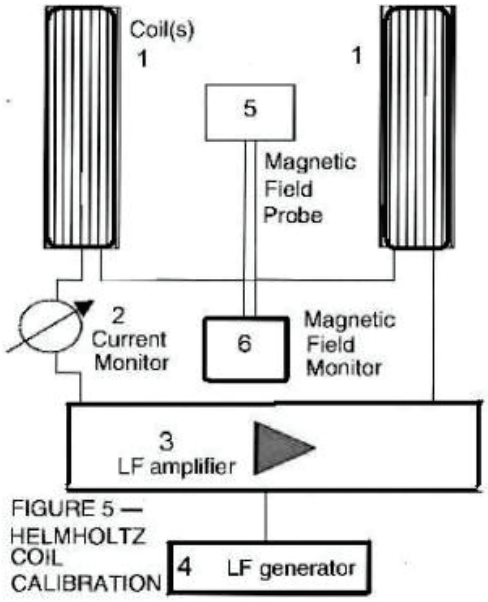

FIGURE 5 — HELMHOLTZ COIL CALIBRATION

The current carrying capability and number of turns of the coil should be selected such that the test specification can be met. The coil should not have a self resonant frequency at or lower than the upper harmonic frequency of 30 kHz.

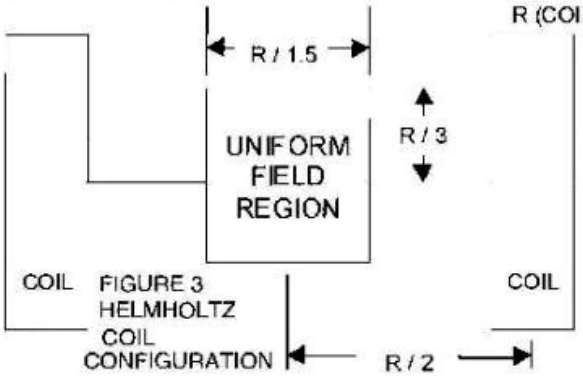

FIGURE 3 HELMHOLTZ COIL CONFIGURATION

For a pair of Helmholtz coils spaced one radius apart, the magnetic flux density at the center of the system is given by

$$B = \mu_0 * H = (8.991 * 10^{-7} * N * I) / R, \text{ (Tesla)}$$

The unperturbed magnetic field at the center of the system is given by

$$H = (0.7155 * N * I)/R, \quad (A/m)$$

where:
N is number of wire turns on a coil
R is coil radius (m)
I is coil current (A)

14. ISO-11452-8:2007 MAGNETIC FIELD IMMUNITY

14.1. Test frequencies: 16,67 Hz, 50 Hz, 60 Hz, 150 Hz and 180 Hz; frequency step sizes (logarithmic or linear) not greater than those specified in ISO 11452-8:2007 Table 1. The step sizes agreed upon by the users of this part of ISO 11452 is documented in the test report.

14.2. If it appears that the susceptibility thresholds of the OUT are very near to the chosen test level, these frequency step sizes should be reduced in the frequency range concerned in order to find the minimum susceptibility thresholds.

14.3. The coils shall not have a self-resonant frequency at or lower than the upper frequency of 150 kHz.

14.4. The current is monitored using a clamp-on probe and an oscilloscope to ensure that true RMS current measurement is made within the frequency range 15 Hz to 150 kHz.

14.5. The magnetic field generator (Helmholtz coil) is placed at least 2 m away from the test apparatus and at a minimum of 1 m from metal surfaces parallel to the plane of the coil(s).

14.6. The power supply complies to ISO 11452-1.

14.7. The test harness is placed on a non-conductive, low permeability support.

14.8. The DUT is positioned in one of its three principal axes (X, Y and Z) on a non-conducting, low permeability (ur = 1) material into the uniform field region of the Helmholtz coil.

14.9. The wiring harness of the DUT shall be routed vertically down and then away from the coils to the support/monitoring equipment.

14.10. All wires in the harness are terminated or open according to the vehicle application. If possible, the actual loads and actuators are used.

14.11. Power may be applied to the DUT via a 5 uH/50 OHM artificial network.

14.12. Prior to the actual test with the DUT present, the coil current required to generate a specific field strength (measured with a magnetic field intensity monitor) is determined for each frequency.

14.13. Generate the desired magnetic field levels from the calculated values. At each frequency, expose the DUT for a minimum of 1 s. Monitor the DUT and record the respective magnetic field intensity for malfunction, degradation of performance, or deviation from predefined tolerances. Repeat the above steps for the other two orientations (X, Y or Z axes) of the DUT.

14.14. The ambient temperature during the test is (23 ± 5) °C.

14.15. The supply voltage during the test is (13,5 ± 0,5) V for 12 V electrical systems.

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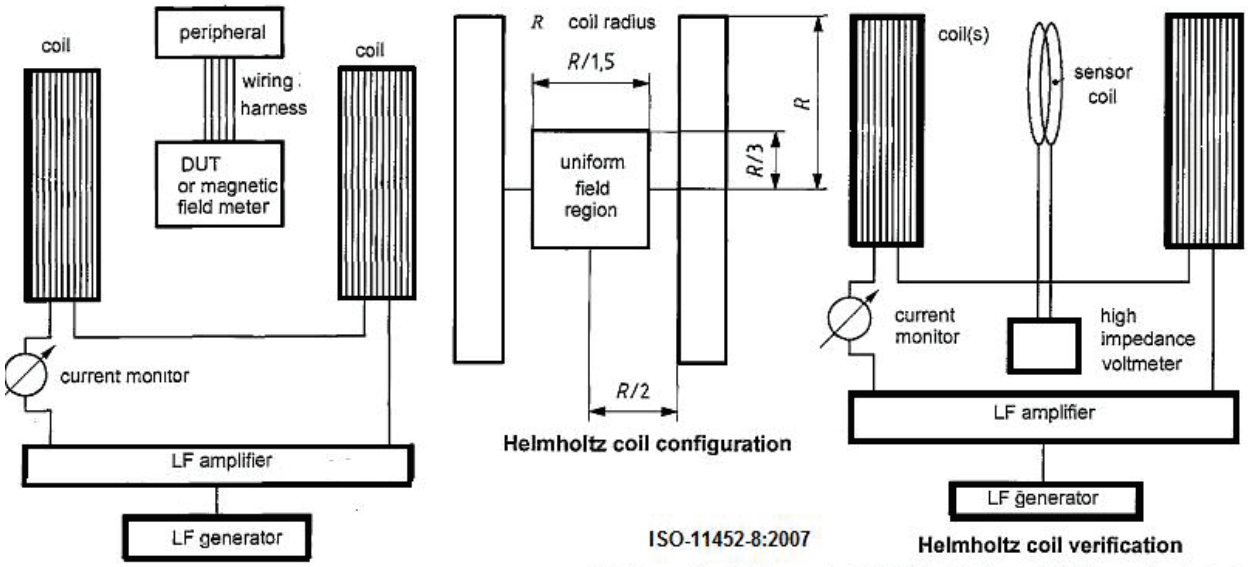
Fig.14-1



ISO-11452-8:2007

Table 1 — Maximum frequency steps sizes

Frequency band kHz	Linear steps kHz	Logarithmic steps %
0,015 to 0,1	0,01	10
0,1 to 1	0,1	10
1 to 10	1	10
10 to 150	10	10

NOTE The 5th harmonic of 16,67 Hz, 50 Hz and 60 Hz can also be tested.

For a pair of Helmholtz coils spaced one radius apart, the magnetic flux density at the centre of the system is $B = \mu_0 H = \frac{8{,}992 \times 10^{-7}\, NI}{R}$

- B is the magnetic flux density, in tesla;
- N is the number of wire turns on the coil;
- R is the coil radius, in metres;
- I is the coil current, in amperes;
- H is the magnetic field, in amperes per metre;
- μ_0 is the magnetic constant, permeability of the vacuum, in henry per metre.

The unperturbed magnetic field, H, at the centre of the system is given by

$$H = \frac{0{,}715\,5 \times NI}{R}$$

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15. DC10614:2005 MAGNETIC FIELD IMMUNITY

15.1. Subcategory MS DUTs shall not be affected by a magnetic flux density of 160 dBpT (dB picotesla) from 15 Hz to 60 Hz and above 60 Hz this flux density shall decrease at a rate of 6 dB per octave to 106 dBpT at 30 kHz. Subcategor y MS DUTs i n severe magnetic environments (e.g. located within 0.5 meter of a battery cable or other power feed carrying 50 A or more of current) shall not be affected by a flux density of 160 dBpT from 15 Hz to 30 kHz.

15.2. Test frequency steps at least 10 per decade (corresponding to a maximum expected Q of 4, equivalent to logarithmic steps of 23.28%). The DUT exposed to a flux density of 160 dBpT from 15 Hz to 60 Hz using a sine wave test signal.

15.3. For DUTs not in a severe magnetic field environment, the DUT is exposed to a 60 Hz square wave test signal that generates 160 dBpT amplitude of the 60 Hz component of the test signal.

15.4. For DUTs not in a severe magnetic field environment, the sine wave scan using the 6 dB per octave decreasing limit shall be performed only if there are effects noted during the square wave test.

15.5. DUTs in severe magnetic environments are tested at 160 dBpT over the full frequency range.

15.6. Bus modules and systems are evaluated for increased ignition off current draw (IOD) resulting from inadvertent wake up from standby or power-down modes during magnetic exposure.

15.7. The Helmholtz coil is used with three mutually orthogonal orientations of the DUT instead of the six positions of the test coil shown in figure below.

Fig.15-1

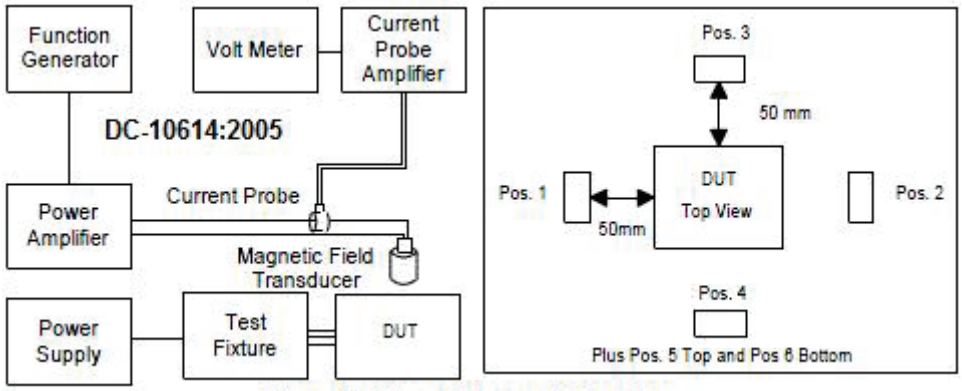

Figure 19: Magnetic Immunity Test Setup

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16. DC11224:2007 MAGNETIC FIELD IMMUNITY

16.1. Use the test setup and procedure shown in DC-10614:2005

Fig.16-1

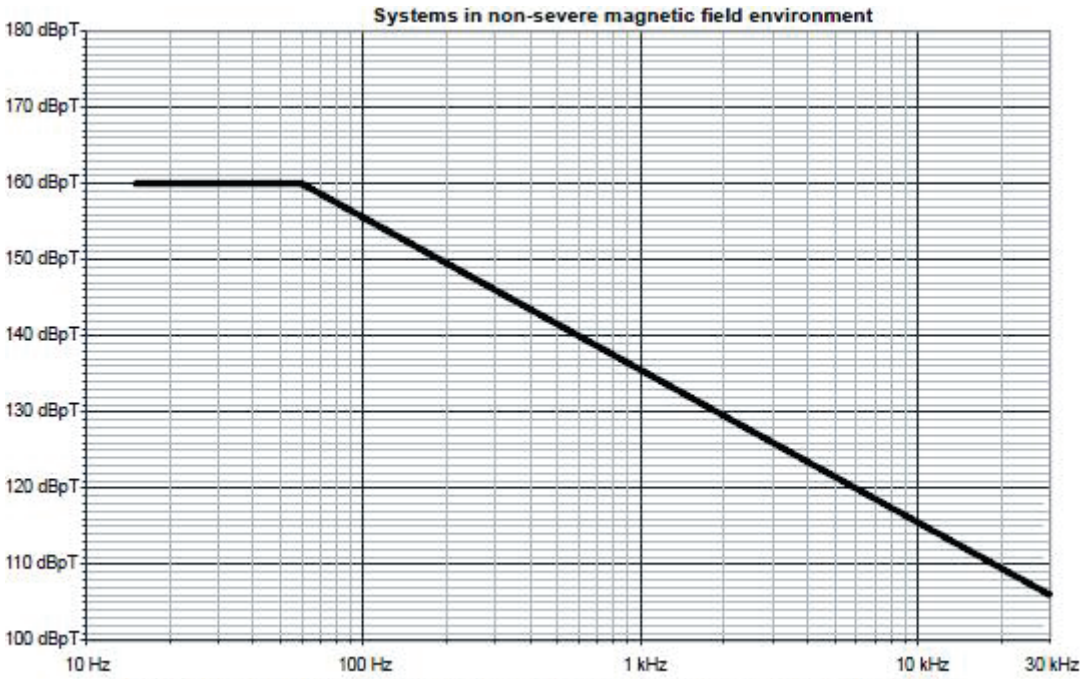

Figure 16: Test Levels for DUTs in a non-severe magnetic field environment

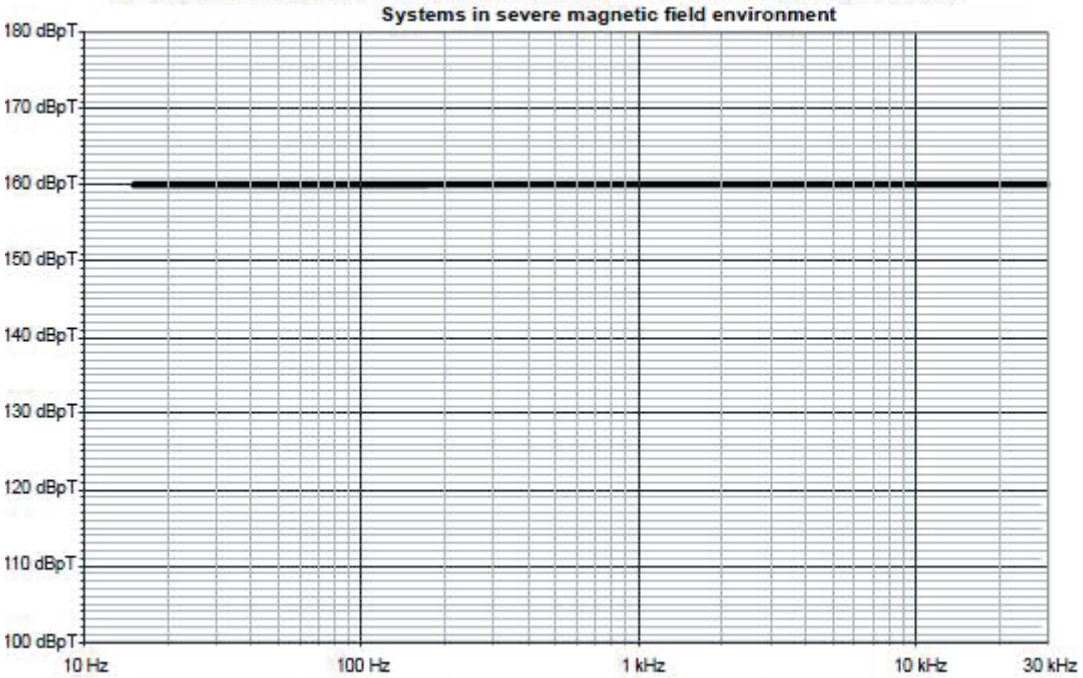

Figure 17: Test Levels for DUTs in a severe magnetic field environment

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17. CS-11809:2009 MAGNETIC FIELD IMMUNITY

17.1. The Magnetic Field Immunity test induces radiated magnetic energy into the DUT and wire harness. The DUT is immunity tested according to ISO 11452-8 from 15 Hz to 30 kHz. The test equipment and test methods shall comply with ISO 11452-1 and ISO 11452-8.

Fig.17-1

TABLE 19: MAGNETIC FIELD IMMUNITY TEST LEVELS AND MODULATION

Frequency Range [Hz]	Level 1 and Level 2 [A/m]	Level 1 and Level 2 [dB pT]	Status
15 to 60	300	172	I
60 to 1800	300/(f[1)]/60)	172- 20 log(f[1)]/60)	I
1800 to 30000	10	142	I
NOTE 1: f is the frequency in Hz			

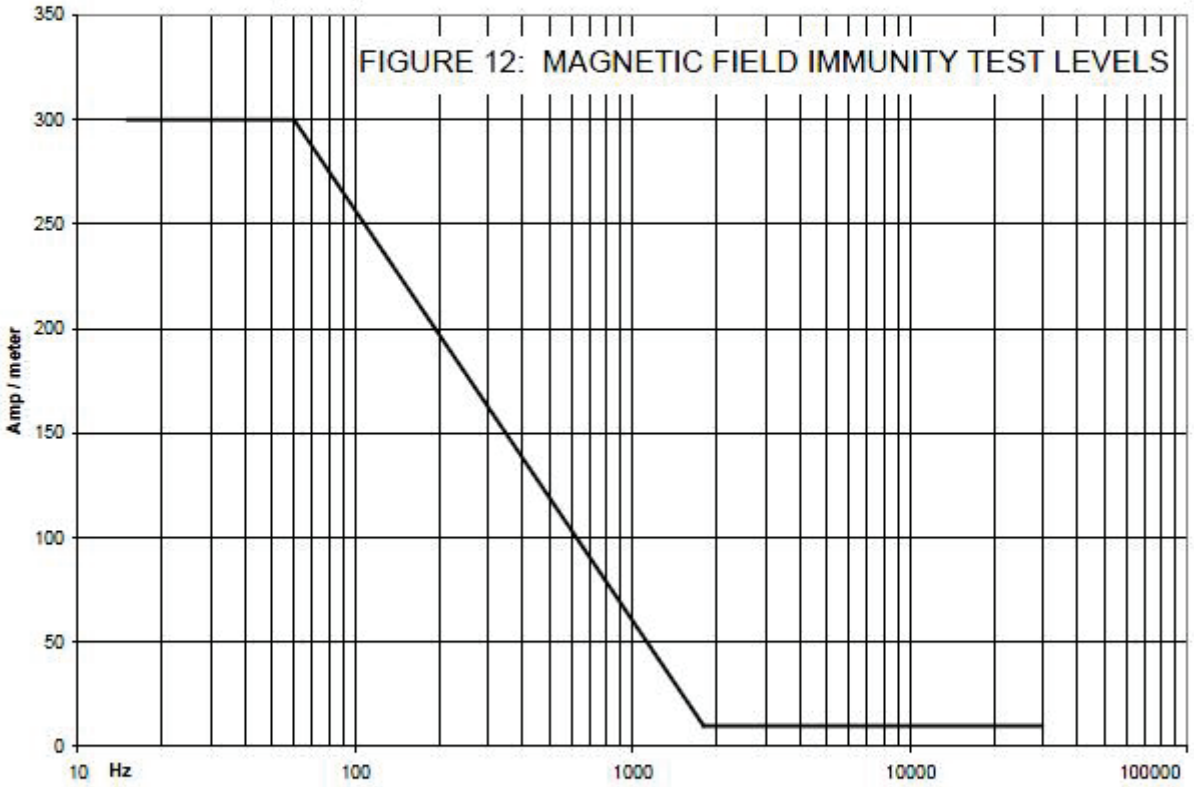

TABLE 16: RF IMMUNITY TEST FREQUENCY RESOLUTION

Frequency [MHz]	Logarithmic Steps [%]
1 - 10	4
10 - 100	3
100 - 1000	2
1000 -3000	1

18. CS-11979:2010 MAGNETIC FIELD IMMUNITY

18.1. The Magnetic Field Immunity test induces radiated magnetic energy into the DUT and wire harness. The DUT shall be immunity tested according to ISO 11452-8:2007 from 15 Hz to 150 kHz with a non-modulated sinusoidal wave (CW), with linear frequency steps:
From 15Hz to 100 Hz frequency step of 5 Hz maximum
From 100Hz to 1000 Hz frequency step of 20 Hz maximum
From 1 kHz to 10 kHz frequency step of 1 kHz maximum
From 10 kHz to 150 kHz frequency step of 10 kHz maximum

Fig.18-1

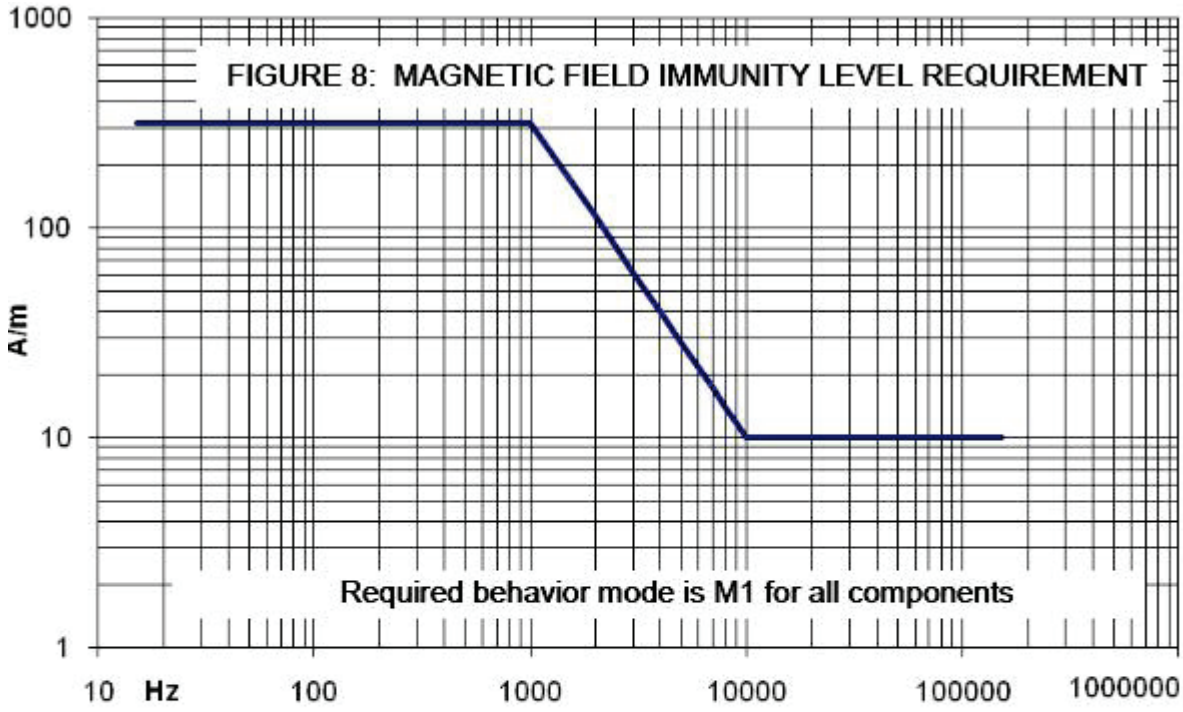

TABLE 25: MAGNETIC FIELD IMMUNITY LEVEL REQUIREMENT			
FREQUENCY (Hz)	LEVEL (A/m)	LEVEL (dBpT)	LEVEL (dbµA/m
15	316	172	170
1k	316	172	170
1k – 10k	316*((f/1000)^-1,5)	172 - (30*log(f/1000))	170 - (30*log(f/1000))
10k	10	142	140
150 k	10	142	140

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19. ES-XW7T-1A278-AC:2003 MAGNETIC FIELD IMMUNITY (RI 140)

19.1. The DUT is placed on a wooden table or insulated table.

19.2. The Test Fixture and other support equipment is mounted to a ground plane, however no portion of the Test Fixture or ground plan shall be closer than 200 mm to the Helmholtz coils.

19.3. The DUT and any electronic hardware in the Test Fixture shall be powered from a automotive battery or a linear power supply.

19.4. The battery or power supply negative terminal is connected to the ground plane bench. The battery/power supply is placed on the floor below or adjacent to the test bench.

19.5. Prior to performing testing of the DUT, characterize the Helmholtz Coil using procedures delineated in MILSTD-461E, RS101.

19.6. Select coil spacing based on the physical dimensions of the DUT.
• For a DUT with dimensions less than one coil radius, the coils shall be separated by one coil radius. Separation between each surface of the DUT and either coil is at least 50 mm
• For a DUT with dimensions greater than one coil radius, the coils are separated such that the plane of the DUT face is at least 50 mm from the plane of either coil and the separation between the two coils does not exceed 1.5 radii.

19.7. Supply the Helmholtz Coil with sufficient current to produce the corresponding magnetic field levels delineated in Table 11-1 at each test frequency listed in Table 11-2.

19.8. Dwell time is at least 2 seconds. Note that a longer dwell time may be necessary if DUT function response times are expected to be longer. This information shall be documented in the EMC test plan.

19.9. Reposition the DUT or Helmholtz coils successively such that the two coils are parallel to each face of the DUT and parallel to the axis of any connector.

19.10. If deviations are observed, the field is reduced until the DUT functions normally. Then the field shall be increased until the deviation occurs. This level shall be reported as deviation threshold.

19.11. If the DUT has magnetic sensors attached to it, separate tests shall be performed exposing only the sensor while verifying correct operation of the DUT (see Figure 11-2).

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Fig.19-1

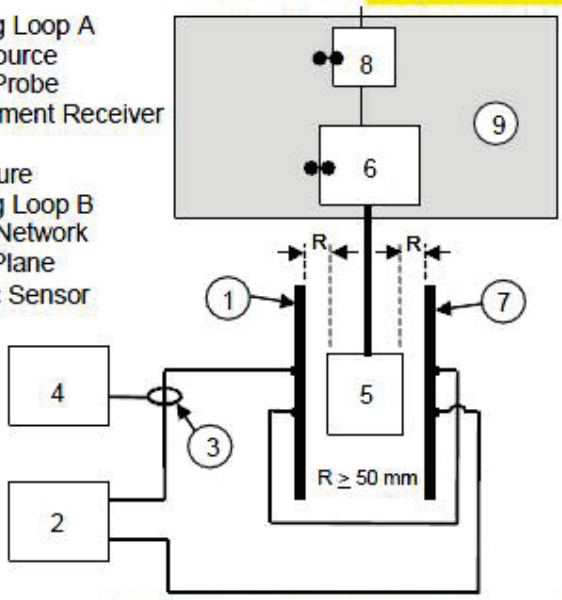
Table 11- 1: Magnetic Field Immunity Requirements

Requirement		Functional Performance Status		
Frequency (Hz)	Level (dBpT RMS)	Class A	Class B	Class C
50 – 340	L = 163 – 39.64*log(*f*/50) (1)	I	I	I
340 – 10,000	L = 130 + 20.43*log(*f*/~~50~~) (1)	I	I	I
600 – 10,000	122 (2)	I	-	-

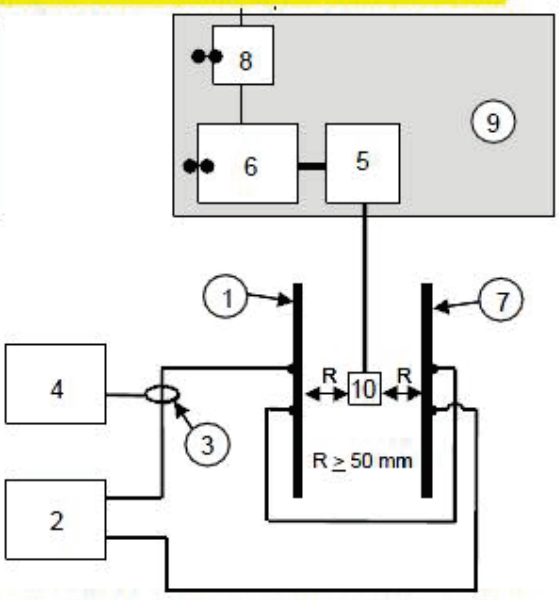
1 f = frequency in Hz
2 Requirement applicable only to audible distortion from multimedia subsystem

Figure 11- 2: Magnetic Immunity Test Set-ups for Helmholtz Coil

1 Radiating Loop A
2 Signal Source
3 Current Probe
4 Measurement Receiver
5 DUT
6 Test Fixture
7 Radiating Loop B
8 Artificial Network
9 Ground Plane
10 Magnetic Sensor



Configuration for Testing DUT only



Configuration for Testing DUT with attached Magnetic Sensors

Table 11- 2: Test Frequency Requirements

Test Frequency Range (Hz)	Frequency Step (Hz)
50 - 100	10
100 – 1,000	20
1000 – 10,000	500

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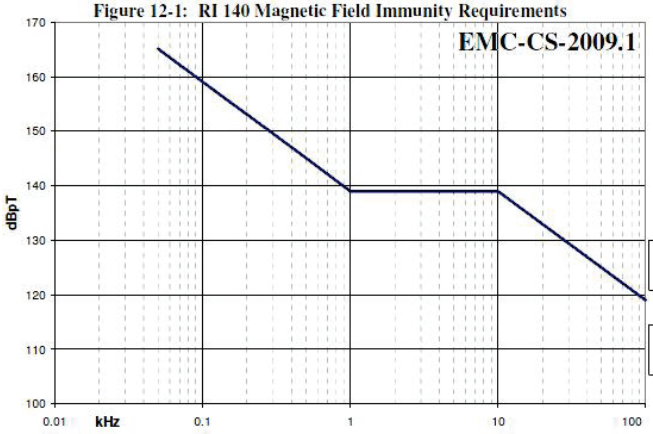
IMMUNITY TO RADIATED MAGNETIC FIELDS

20. EMC-CS-2009:2010 MAGNETIC FIELD IMMUNITY (RI 140)

20.1. Follow ES-XW7T-1A278-AC:2003 procedure with amendments shown in the figure below.

Fig.20-1

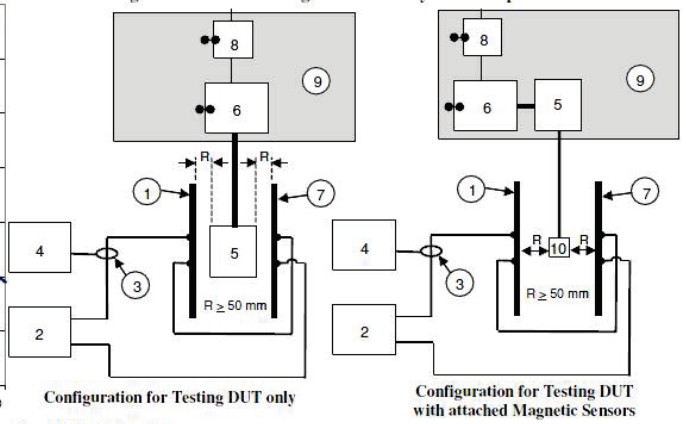
Figure 12-1: RI 140 Magnetic Field Immunity Requirements



Frequency (kHz)	Level (dBpT rms)	Functional Performance Status		
		Class A	Class B	Class C
0.05 - 1	$165 - 20\log\left(f/0.05\right)$ *	I	I	I
1 – 10	139	I	I	I
10 – 100	$139 - 20\log\left(f/10\right)$ *	I	I	I

* f = frequency in kHz

Figure 12-3: RI 140 Magnetic Immunity Test Setups for Helmholtz Coil



1. Radiating Loop A
2. Signal Source
3. Current Probe
4. Measurement Receiver
5. DUT
6. Load Simulator
7. Radiating Loop B
8. Artificial Network
9. Ground Plane
10. Magnetic Sensor

Table 12-1: RI 140 Test Frequency Requirements

Test Frequency Range (kHz)	Frequency Step (kHz)
.05 -1	.05
> 1 – 10	0.5
> 10 - 100	5

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21. GMW3097:2006 MAGNETIC FIELD IMMUNITY

21.1. Immunity to Power Line Magnetic Fields test equipment complies with SAE J1113-22 with the following exceptions:
- Lower operating frequency of the equipment is at least 16 2/3 Hz.
- Upper operating frequency of the equipment is at least 180 Hz.
- Sine wave generator is used.

21.2. Use test methods according to SAE J1113-22 with the following specifications:
- Use the RMS current through the magnetic coils as the reference parameter for calibration and test.
- At each field intensity level expose the DUT for a minimum of 30 s.
- Use the test frequencies and waveforms according to Table 14.

Fig.21-1

Table 14: Magnetic Field Requirements

Frequency (Hz)	Requirement (µT RMS)	Signal Generator Voltage Output Waveform
16 2/3	50	Sine Wave
50		
60		
150	25	
180		

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22. REPORT

22.1. Tabular data showing verification of the calibration of the Helmholtz coil.

22.2. Tabular data, diagrams, or photographs showing the applicable test frequencies and EUT exposure locations/orientations.

22.3. Graphical or tabular data showing frequencies and threshold levels of susceptibility.

22.4. DUT axes for the Helmholtz coil method.

22.5. DUT mode of operation, acceptance criteria, monitoring conditions, test severity levels.

23. PROFICIENCY TESTING

23.1. Follow instructions and scheduler provided in LMS011 EMC LAB PROFICIENCY TESTING PROGRAM.

24. TRENDS

24.1. Follow instruction provided in 721179 EMC LAB, TEST REPORTS DATABASE and 721186 EMC LAB, TRENDS AND STATISTICS.

25. DEFINITIONS

25.1. Use definitions per ISO 11452-1.

25.2. FPSC = Function Performance Status Classification

REFERENCES

LMS007			*EMC LAB, EQUIPMENT CONTROL*
LMS011			*EMC LAB, PROFICIENCY TESTING PROGRAM*
201707			*EMC LAB, APPROVED EQUIPMENT SUPPLERS LIST*
201711			*EMC LAB, EQUIPMENT INVENTORY*
201728			*EMC LAB, APPROVED CALIBRATION SUPPLIERS LIST*
201709			*EMC LAB, TEST EQUIPMENT COMPETENCY MATRIX*
201705			*EMC LAB, COMPETENCY MATRIX*
201696			*INTERNAL TEST REQUEST FORM*
900712			*EMC LAB LABELS*
721179			*EMC LAB, TEST REPORTS DATABASE*
721186			*EMC LAB, TRENDS AND STATISTICS*
201724			*CALIBRATION SUPPLIER EVALUATION FORM*
MIL-STD-461	F	Dec 10, 2007	*REQUIREMENTS FOR THE CONTROL OF ELECTROMAGNETIC INTERFERENCE CHARACTERISTICS OF SUBSYSTEMS AND EQUIPMENT*
SAE J1113-22	2-nd Ed	Nov 2003	*Immunity to Radiated Magnetic Fields*
DC-10614	B	Dec 1, 2005	*EMC Performance Requirements --- Components*
DC-11224	A	Jun 1, 2007	*EMC Performance Requirements --- Components*
CS-11809	A	May 29, 2009	*ELECTRICAL AND EMC PERFORMANCE REQUIREMENTS - E/E COMPONENTS*
CS-11979	A	Apr 13, 2010	*CHRYSLER/FIATELECTRICAL AND EMC PERFORMANCE REQUIREMENTS - E/E COMPONENTS*
ES-XW7T-1A278-AC & corrections	AC	Oct 10, 2003	*Component and Subsystem Electromagnetic Compatibility, Worldwide Requirements and Test Procedures*
EMC-CS-2009.1	1	Feb 11, 2010	*Electromagnetic Compatibility Specification For Electrical/Electronic Components and Subsystems*
ISO 11452-8	1-st Ed	Jul 1, 2007	*Part 8: Immunity to magnetic fields*
ISO 11452-1	3-rd Ed	Feb 1, 2005	*Part 1: General principles and terminology*

REVISION CHANGES

Dec 14, 2009	A	Release		Christian Rosu
Apr 16, 2010	B	Updated references & CS-11979 addition		Christian Rosu
Apr 22, 2010	C	Updated Test Setup section		Christian Rosu

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END-USER FEEDBACK

○ very satisfied ○ satisfied ○ neutral ○ dissatisfied ○ very dissatisfied

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Your opinion is very important for us.

Survey Date