

Component / Subsystem EMC Test Plan Title Page

Product Name: Wireless FES Remote Control	
Product Supplier Name:	Ford Recognized EMC Test Facility(s) used: Dayton T. Brown, Inc., Attn: Mr. Tom Arcati 1195 Church St. Bohemia, NY 11716
Product Design Engineer:	
Product Manager:	Vehicles & Model Year using this product: 07MY U222/228, 07MY U287/288, 07MY P356, 07MY U387/388, 07MY U354
Product Part Number(s): FS-6L2T-18C919-AA	
Product Manufacturing Location(s)	EMC Specification Used: ES-XW7T-1A278-AC
<p><i>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 design verification testing shall be communicated to the FMC EMC department. Any changes or revisions to this test plan after test completion shall require written technical justification and approval by the same EMC department. I understand that failure to follow this process may result in non-acceptance of the product's EMC test data by the FMC EMC department. I also understand and acknowledge that requirements validated via this test plan are relevant only to the specific vehicles that the product is to be fitted to. Use of the product on other vehicle platforms may require additional EMC performance requirements, which will necessitate additional verification testing of the product. I certify that the product samples submitted for EMC testing are of a production representative design. I agree to submit a summary report directly to the FMC EMC department no later than five (5) business days following completion of testing. I also agree to forward a copy of the test laboratory's detailed test report directly to the FMC EMC department within thirty (30) business days following completion of testing.</i></p>	
<p>Supplier Product Design Engineer:</p> <p>_____</p> <p><i>Sign and Date</i></p>	
<p>Supplier Product Manager Concurrence:</p> <p>_____</p> <p><i>Sign and Date</i></p>	
<p>Ford Design & Release Engineer Concurrence:</p> <p><i>Approved, CTP 0583</i></p> <p>_____</p> <p><i>Sign and Date</i></p>	
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<input type="checkbox"/> Aston Martin <input type="checkbox"/> FOA <input type="checkbox"/> FOE <input type="checkbox"/> Jaguar <input type="checkbox"/> Land Rover <input type="checkbox"/> Mazda <input type="checkbox"/> Volvo	
Date Received/ FMC EMC Engineer	Test Plan Tracking Number

Test Plan Revision History

Date	Description
	Initial Test Plan Release

1.0 Introduction

This test covers the Infra-red wireless remote controls that are part of the Ford Family Entertainment System (FES).

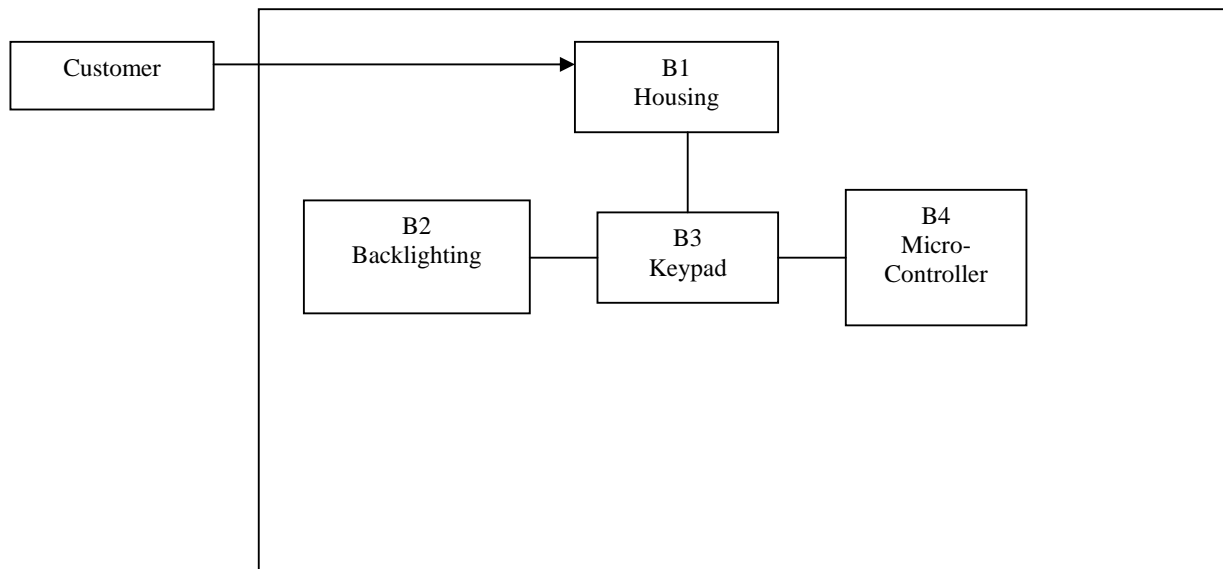
1.1 Product Family Description

The 38-key Infra-red (IR) remote control is used to transmit commands of operation to the (FES).

1.2 Theory of Operation

The FES RC shall communicate using light at 940 nm wavelength in the infra-red spectrum to allow the user full functionality control of the FES without using any of the bezel buttons. The user shall be able to perform all desired functions and access all levels of the menu tree of the system or disc via the remote control. The FES is powered by two AAA batteries and has a 4 bit micro-controller. The FES remote control transmitter uses CMOS technology which enables transmission code outputs of different configurations, multiple custom code output and double push key output. Wake-up is initiated by pressing the power button or function keys.

Remote Control Block Diagram



B1 - Housing

- Top part
- Bottom part
- Battery compartment

B2 – Backlighting

- Lighting Guides
- LED's

B3 – Keypad

- Silicone Pad
- Graphics

B4 – Micro-Controller

- 4 bit micro-controller

1.3 Physical Construction

Remote control housing is made of ABS/PC plastic and the keypad is made of silicone rubber. The physical dimensions are 22 x 198 x 54 mm. The PCB is a single layer FR-1 type and includes an IR-LED and 4-bit micro-controller.



1.4 EMC Specification Release Date

ES-XW7T-1A278-AC (October 10, 2003)
ES-XW7T-1A278-AB (April 30, 1999) used for RI-110 only

1.5 Approved Test Facility

Dayton T. Brown, Inc.
1195 Church Street
Bohemia, NY 11716

1.6 DUT Part Number(s)

FS-6L2T-18C919-AA

1.7 DUT Manufacturer(s)

1.8 DUT Usage

Model Year Vehicle Application(s)

2007MY	U222/228
2007MY	U287/288
2007MY	P356
2007MY	U387/388
2007MY	U354

2.0 EMC Requirements Analysis

2.1 Critical Interface Signals

Signal Description	Voltage/Current Level	Frequency	% Duty Cycle (range)	Other
IR Signal	N/A	38K	30-33%	940 nm

2.2 Potential Sources of Emissions

Signal Source Description	Voltage/Current Level	Frequency	% Duty Cycle (range)	Other
IR Carried Signal	1.9V – 3.6V 5uA – 170mA	38K	30 – 33%	
Microprocessor		4 Mhz (Clock)	33.33%	

2.3 Test Sample / Surrogate Selection

Three samples per the FES Remote Control DV/PV test matrix stated in FS-6L2T-18C919-AA will be utilized for all EMC tests.

3.0 Test Design and Requirements

DUT is a wireless self-powered (2 internal AAA batteries) remote control with no connecting or external wires. Applicable tests are radiated emission, radiated immunity and ESD.

*Special Note – As this DUT is a self-powered device with no external wiring harness that connects to the vehicle, RI 110 is being recommended in place of RI112 to cover the lower frequency ranges between 10Khz – 400Mhz.

3.1 DUT Operating Modes/Functional Classifications

DUT Mode	DUT Functions			Vehicle Operating Modes			
	Class A	Class B	Class C	Off	Accessory	Start	Run
OFF	X			X	X	X	X
ON	X				X		X

Mode Description(s):

OFF mode: Keypad backlight is off. No IR signal is being transmitted to IR receiver.

ON mode: Keypad backlight is on and unit is transmitting an IR signal to receiver.

Function Description(s):

Button	Function	RC6 Code
Power	Power the System On/Off	12
Audio(Language)	Changes the language	75
Subtitles(on/off)	Switches the subtitles On/Off	227
Angle	Select the Angle to view the scene	133
Enter	Selects the high-lighted function that is currently active on the screen	92
Cursor up	Advances cursor up while any menu is active	88
Cursor down	Advances cursor down while any menu is active	89
Cursor left	Advances cursor left while any menu is active	90
Cursor right	Advances cursor right while any menu is active	91
Display	Accesses the on-screen display of FES functions and adjustments	15
Menu	Accesses the DVD disc menu for selection	84
Return	Return to the previous menu screen	131
FF (seek up)	Initial enable shall launch the 4x normal playback speed, subsequent button presses shall toggle to 8X then 32X then back to 4X speed.	40
Rew (seek down)	Initial enable shall launch the 4x normal playback speed, subsequent button presses shall toggle to 8X then 32X then back to 4X speed.	41
Play/Pause	FES shall play current stopped or paused disc, FES shall pause the current disc from play mode	44
Eject	In non-operational mode with disc stored, the disc will be ejected	29
Stop	FES shall stop the disc if in play mode	49
Shuffle	This function causes the tracks of the current disc to be played in a random order	28
Video	Toggle the display input source between FES DVD and FES AUX	67
Media	ACM in Single Play Mode: the FES shall control the media source changes at the ACM ACM in Dual Play Mode: FES shall control rear-seat accessed media source changes at the FES/RSCM as heard through the headphones.	78
Headphone H/P	This key shall toggle between Single and Dual Play	68 (Dual-Play)
Numeric Key 1	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	1
Numeric Key 2	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	2
Numeric Key 3	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	3

Numeric Key 4	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	4
Numeric Key 5	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically (0	5
Numeric Key 6	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	6
Numeric Key 7	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	7
Numeric Key 8	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	8
Numeric Key 9	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	9
Numeric Key 0	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	0
Numeric Key 10+	The Numeric keypad (0-9 & +10) shall enable Track/Chapter selection numerically	120
Cancel/Clear	This key shall cancel/clear the marked memory points	58
Volume up	Single Play: This key shall linearly increase the cabin audio volume. Dual Play: This key shall linearly increase the headphone volume.	16
Volume down	Single Play: This key shall linearly increase the cabin audio volume. Dual Play: This key shall linearly increase the headphone volume.	17
Channel A	This key shall enable an alternate input source via the FES that is output via the Wireless headphones	56
Channel B	This key shall enable an alternate input source via the FES that is output via the Wireless headphones	57

3.2 Test Requirements

Test Description	Test applies (Y/N)	Interface to be tested (S/C ¹)	Operating Mode(s) to be used for indicated test
RI 110	Y	C	ON (functional status I for Level 1 functional status II for Level 2 functional status III for Level 3 functional status II for Level 4) [RI 110 is being performed as an alternate to RI 112 to cover frequency ranges below 400MHz.]
RI 112	N		(Device has no external wires, internal AAA battery powered.)
RI 114	Y	C	ON (functional status I for Level 1 functional status II for Level 2)
RI 130	N		
RI 140	N		
RI 150	N		
CI 210	N		
CI 220	N		
Pulse A1	N		
Pulse A2	N		
Pulse B1	N		
Pulse B2	N		
Pulse C	N		
Pulse D	N		
Pulse E	N		
Pulse F	N		
Pulse G	N		
CI 230	N		
Waveform A	N		
Waveform B	N		
Waveform C	N		
Waveform D	N		
CI 250	N		
CI 260	N		
Waveform A	N		
Waveform B	N		
Waveform C	N		
Waveform D	N		
Waveform E	N		
Waveform F	N		

Test Description	Test applies (Y/N)	Interface to be tested (S/C ¹)	Operating Mode(s) to be used for indicated test
CI 270	N		
- 14 Volt	N		
+19 Volt	N		
+ 24 volt	N		
CI 280			
Handling (DUT not powered)	Y	C	OFF (functional status: IV)
Powered (all except 25 KV)	Y	C	ON (functional status: I for sequence 1-3 II for sequence 4-7)
Powered (25 KV)	N		
RE 310	Y	C	ON (refer to page 15,16 of ES-XW7T-1A278-AC)
CE 410	N		
CE 420	N		

¹ Indicate specific DUT circuits that test applies to.
C (Combined): Circuits are to be tested simultaneously.
S (Separate): Circuits to be tested separately.

3.3 Input Requirements

Electrical Input Signals/Characteristics To Operate DUT in the specified test Mode

DUT Mode	Signal Name	Test	Pin #	Waveform	Amplitude	Freq/PW/DC%	Other
ON	Battery power			DC	3V	0	2xAAA

Non-electrical input signals/characteristics to make DUT functional:

Continuous mechanical actuation of remote control, volume or channel button.

3.4 Output Requirements

Electrical output(s) to monitor and acceptance criteria:

None: 2 internal AAA batteries power DUT, no connection to vehicle.

Non-electrical output(s) to monitor and acceptance criteria

Mode	Function Description	Test	Note 2	Acceptance criterion for function
ON	Backlit Keypad	R1110 R1114 CI280(powered)	N	On
			A	On, for functional status I. For functional status 2-4 light may turn off but unit must return to functional state after disturbance is removed, with minimal user intervention.
ON	IR Signal Beam being Emitted by Remote	R1110 R1114 CI280(powered)	N	On
			A	*Fully Functional, for functional status I. For functional status 2-4, signal may be distorted or interrupted but unit must return to functional state after disturbance is removed, with minimal user intervention.
			N	
			A	

Note 2:

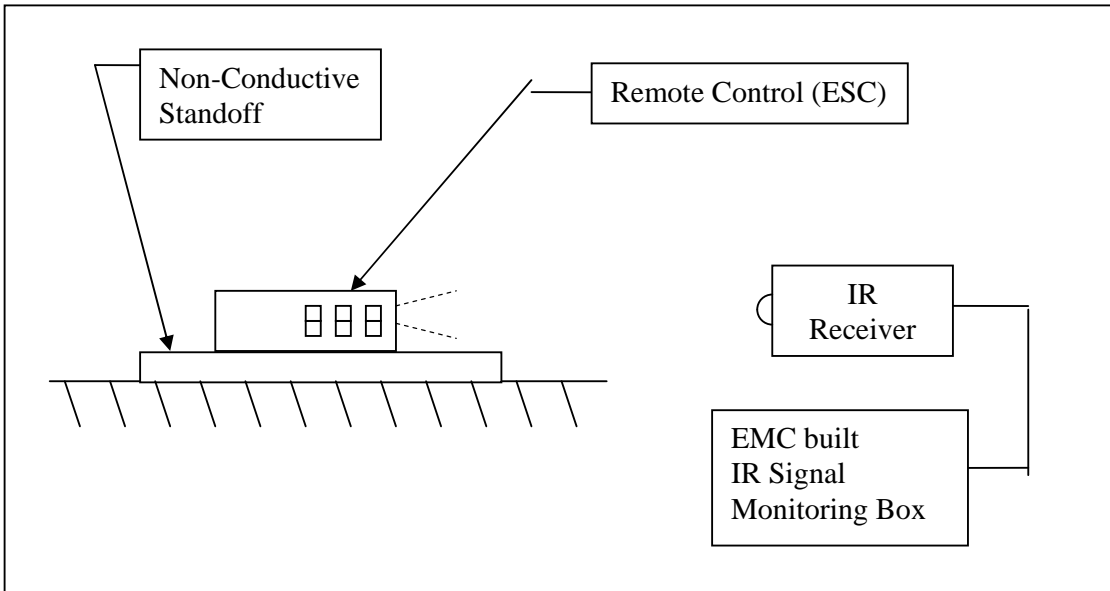
- N** = Nominal Value
- A** = Acceptable Value

*Fully Functional is defined as transmitting the proper Phillips RC6 codes corresponding to the button actuation per table 1.6 of FES Remote Control Assemble document number FS-6L2T-18C919-AA.

3.5 Load Box/Test Support Requirements:

For purposes of EMC testing, the remote control programming allows continuous transmission of the RC6 code for PLAY upon simultaneous pressing of the Language, Shuffle and C (Cancel) keys. Pressing of any key subsequently on the remote keypad shall terminate the transmission.

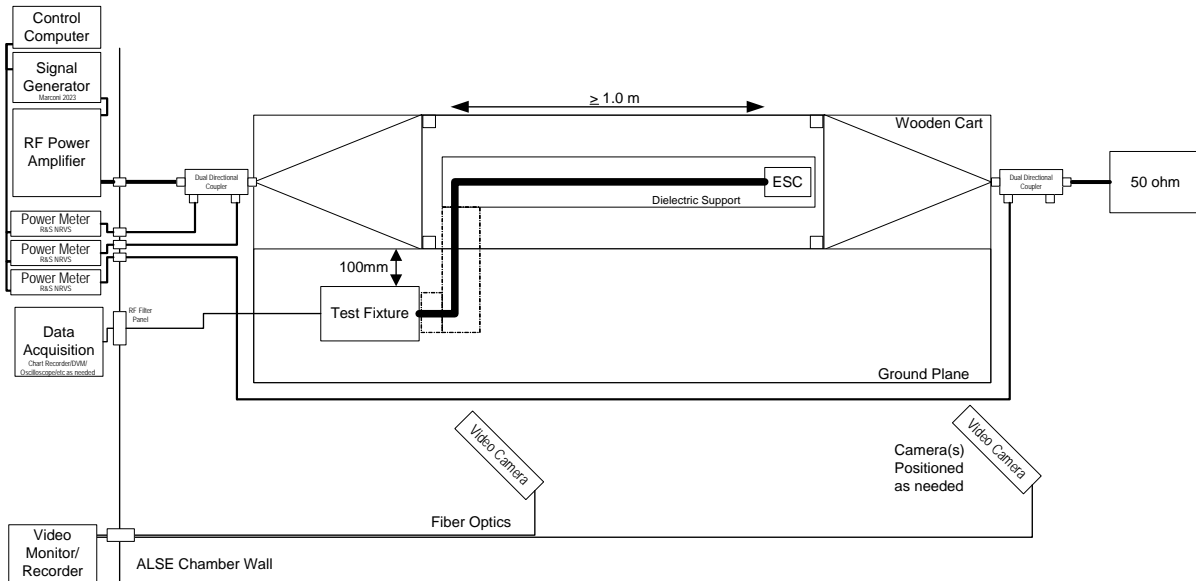
Test Fixture and DUT Setup Block Diagram



Test Equipment List		
Type	Make	Model Number
Signal Generator	Marconi	2023
Signal Generator	HP	83640B
Power Meters	Rhode & Schwartz	NRVS
Triplate	Dayton T.Brown, Inc	N/A
Audio Analyzer	HP	8903
Condenser Microphone	Radio Shack	270-092C
Oscilloscope	Tektronics	TDS3054
Antenna	Amplifier Research	AT1000, AT4002A
Antenna	Electro-Metrics	LPA-25
Antenna	EMCO	3301B,3104,3115
ESD Simulator	Keytek	2000
Amplifiers	M/A-COM	EWAL 1050-13
Amplifiers	Applied Systems	200L
Amplifiers	Logimetrics	A600S
IR Signal Monitor	Electro-Mechanical Co.	N/A
EMI Receiver	Rhode & Schwartz	ESIB40

4.1 RF Immunity (RI 110)

RI 110 Test Set-up

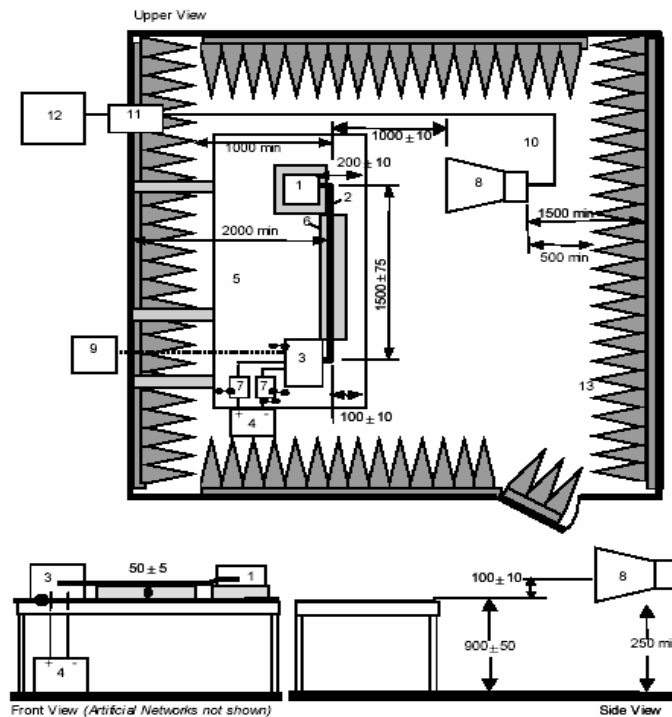


Test Details	Comments
Specified Test Method	The device shall operate as required when exposed to RF electromagnetic field through transmission antenna
Deviations from Specified Test Method	Test is to run from 10KHz through 400MHz.
Harness Configuration	None, unit has internal battery power
DUT Orientation	Remote Controls will be laid flat on non-conductive foam, centered between the bottom and middle plates of the Triplate.
DUT Grounding (case or harness)	DUT placed on insulated support 50 mm above the ground plane
Additional Test Specific Information	None
DUT Monitoring Information	IR signal for PLAY from remote will be monitored via EMC signal box to determine if corresponding RC6 code is being received.

Monitoring/Support Equipment	Make/Model
Monitoring equipment	IR receiver and signal monitoring box, both EMC built.
Recording equipment	N/A (test results manually recorded on data sheets)

4.2 RF Immunity (RI 114)

RI 114 Test Set-up



The figure is adapted from ISO/CD 11452-2. Note: Horn antenna has been moved to sight on the DUT.

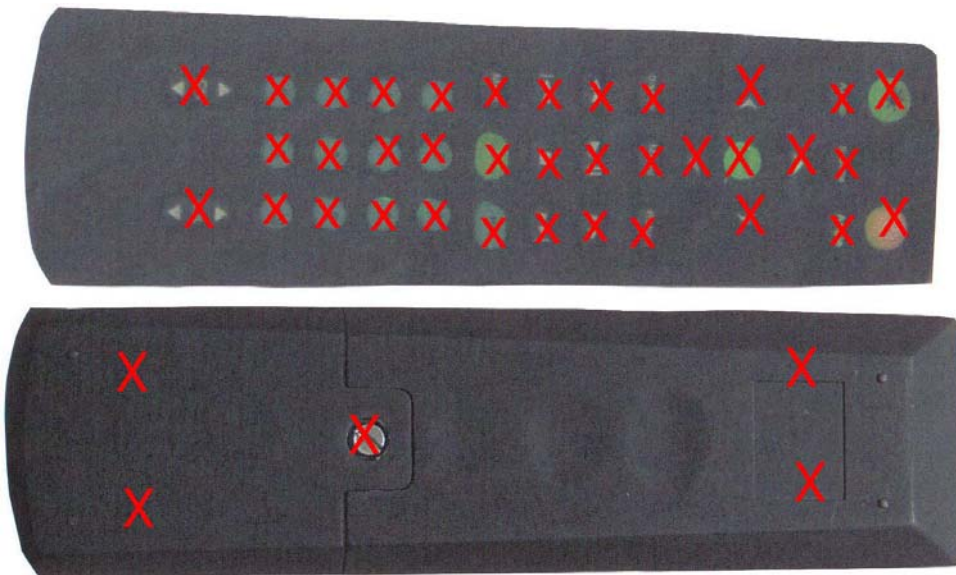
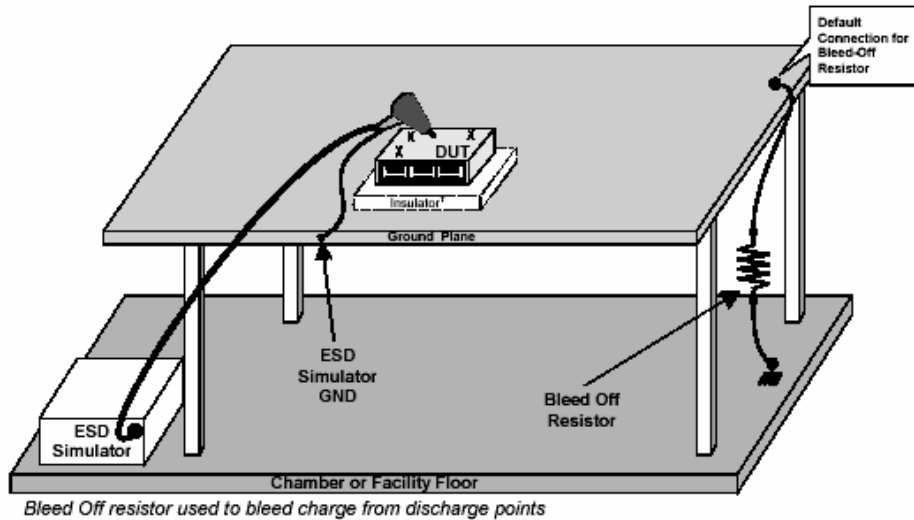
- Key:**
- | | |
|---|---|
| 1 DUT | 8 Transmitting Antenna |
| 2 Test harness | 9 Support /Monitoring Equipment |
| 3 Test Fixture | 10 High quality double-shielded coaxial cable (50Ω) |
| 4 Automotive Battery | 11 Bulkhead connector |
| 5 Ground plane (bonded to shielded enclosure) | 12 RF Generation Equipment |
| 6 Insulated support ($\epsilon_r \leq 1.4$) | 13 RF absorber material |
| 7 Artificial Network | |

Test Details	Comments
Specified Test Method	The device shall operate as required when exposed to RF electromagnetic field through transmission antenna
Deviations from Specified Test Method	None
Harness Configuration	None, DUT has internal battery power.
DUT Orientation	As shown in diagram for section 3.5
DUT Grounding (case or harness)	DUT placed on insulated support 50 mm above the ground plane
Additional Test Specific Information	None
DUT Monitoring Information	IR signal for PLAY from remote will be monitored via EMC signal box to determine if corresponding RC6 code is being received.

Monitoring/Support Equipment	Make/Model
Monitoring equipment	IR receiver and signal monitoring box, both EMC built.
Recording equipment	N/A (test results manually recorded on data sheets)

4.12 Electrostatic Discharge (CI 280: unpowered)

CI 280 Set-up Unpowered

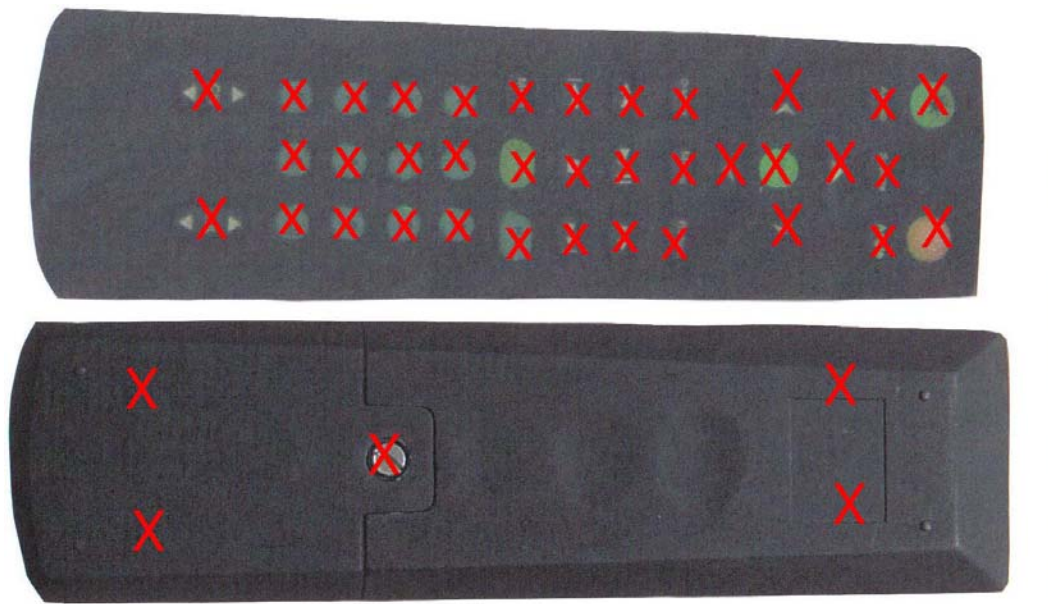
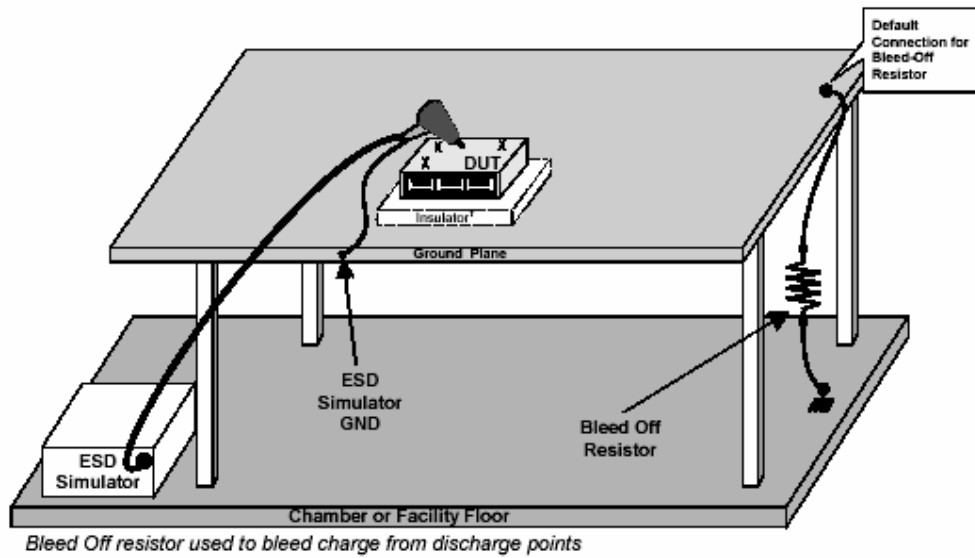


**X – Above denotes ESD Discharge points
(Also battery terminals underneath case, not shown)**

Test Details	Comments
Specified Test Method	The DUT shall be immune to overstress due to Electrostatic Discharge (not powered).
Deviations from Specified Test Method	None
Harness Configuration	None
DUT Orientation	As shown above
DUT Grounding (case or harness)	DUT placed on insulated support 50 mm above the ground plane
Additional Test Specific Information	Remove battery; discharge to battery connector points, all control buttons and case as shown above.
DUT Monitoring Information	None
Monitoring/Support Equipment	Make/Model
Monitoring equipment	N/A
Recording equipment	N/A (test results manually recorded on data sheets)

4.13 Electrostatic Discharge (CI 280: powered)

CI 280 Set-up – Powered



X – Above denotes ESD Discharge points

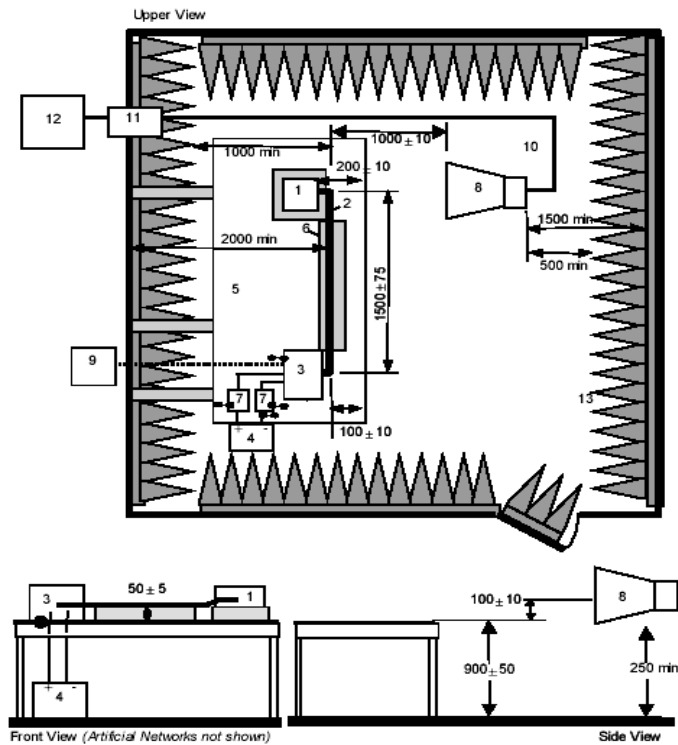
Test Details	Comments
Specified Test Method	DUT shall be immune to overstress due to Electrostatic Discharge (while powered – AAA battery).
Deviations from Specified Test Method	None
Harness Configuration	None unit has internal battery power.
DUT Orientation	As shown above
DUT Grounding (case or harness)	DUT placed on insulated support 50 mm above the ground plane

Additional Test Specific Information	Discharge to case and all controls buttons as shown above.
DUT Monitoring Information	IR signal for PLAY from remote will be monitored via EMC signal box to determine if corresponding RC6 code is being received.

Monitoring/Support Equipment	Make/Model
Monitoring equipment	IR receiver and signal monitoring box, both EMC built.
Recording equipment	N/A (test results manually recorded on data sheets)

4.14 Radiated Emissions (RE310)

RE 310 Test Set-up



Key:

- | | |
|---|---|
| 1 DUT | 8 Receiving Antenna |
| 2 Test harness | 9 Support Equipment |
| 3 Test Fixture | 10 High quality double-shielded coaxial cable (e.g. RG 223) |
| 4 Automotive Battery | 11 Bulkhead connector |
| 5 Ground plane (bonded to shielded enclosure) | 12 Measuring instrument |
| 6 Insulated support ($\epsilon_r \leq 1.4$) | 13 RF absorber material |
| 7 Artificial Network (AN) | |

Test Details	Comments
Specified Test Method	DUT shall not generate RF noise beyond given limits, measured through antenna
Deviations from Specified Test Method	None
Harness Configuration	None unit has internal battery power.
DUT Orientation	As shown in diagram for section 3.5
DUT Grounding (case or harness)	DUT placed on insulated support 50 mm above the ground plane
Additional Test Specific Information	None
DUT Monitoring Information	IR signal for PLAY from remote will be monitored via EMC signal box to determine if corresponding RC6 code is being received.

Monitoring/Support Equipment	Make/Model
Monitoring equipment	IR receiver and signal monitoring box, both EMC built.
Recording equipment	Output from EMI receiver recorded on computer and on printed graphs.

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- ※ 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

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