

## TEST REPORT

EUT Number: 58-2266

Equipment Under Test: Rust Protection by I-Guard

Trade Name: I-Guard

Model: E-TRON, ULTIMATE, DEFENDER

Serial Number: -

Reference Number: -

Manufactured by: NAVAKIT CO., LTD.

Customer: NAVAKIT CO., LTD.

Address: 73 Soi Bangprom 37, Bangprom, Taling-Chan, Bangkok 10170

Receipt Date: 17 September 2015

Date of Test: 6 - 8 October 2015

Issued Date of Report: 9 October 2015

Approved by



MR. Anake Meemoosor

Operation Manager

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## 1 SUMMARY OF TESTING

This product was tested and complied according to following specification

Standards: UNECE regulation 10.4 Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility.

Test Item	Test Specification	Test Method	Result
Radiated Emission	UNECE regulation 10.4 Clause 6.5.2	CISPR 25:2002 (Ed. 2.0)	PASS
Immunity Testing (Free Field)	UNECE regulation 10.4 Clause 6.7.2	ISO 11452-2	PASS
Immunity Testing (BCI)	UNECE regulation 10.4 Clause 6.7.2	ISO 11452-4	PASS
Transient Voltage immunity Test	UNECE regulation 10.4 Clause 6.8.1	ISO 7637-2	PASS
Transient Emission Test	UNECE regulation 10.4 Clause 6.9.1	ISO 7637-2	PASS

Note: -

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## 2 TEST PLAN AND DEVIATIONS FROM STANDARD

### 2.1 Test Plan

No.	Test Item	Input Voltage	Mode	Test Port	Test Specification
1	Radiated Emission	13.5 Vdc	A	Enclosure	UNECE regulation 10.4 Clause 6.5.2
2	Immunity Testing (Free Field)	13.5 Vdc	A	Enclosure	UNECE regulation 10.4 Clause 6.7.2
3	Immunity Testing (BCI)	13.5 Vdc	A	Enclosure	UNECE regulation 10.4 Clause 6.7.2
4	Transient Voltage immunity Test	13.5 Vdc	A	DC	UNECE regulation 10.4 Clause 6.8.1
5	Transient Emission Test	13.5 Vdc	A	DC	UNECE regulation 10.4 Clause 6.9.1

### 2.2 Deviations from standard

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### 3 TEST CONDITIONS

#### 3.1 Operation Mode

A: Normal Mode.

#### 3.2 Uncertainty Application

##### 3.2.1 Uncertainty application according to CISPR 16-4-2:2003 for Conducted Emission, Radiated Disturbance and Disturbance Power Testing.

Compliance or Non-Compliance with a disturbance limit was determined in the following manner

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  in table 1, then:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  in table 1, then:

- Compliance is deemed to occur if no measured disturbance, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

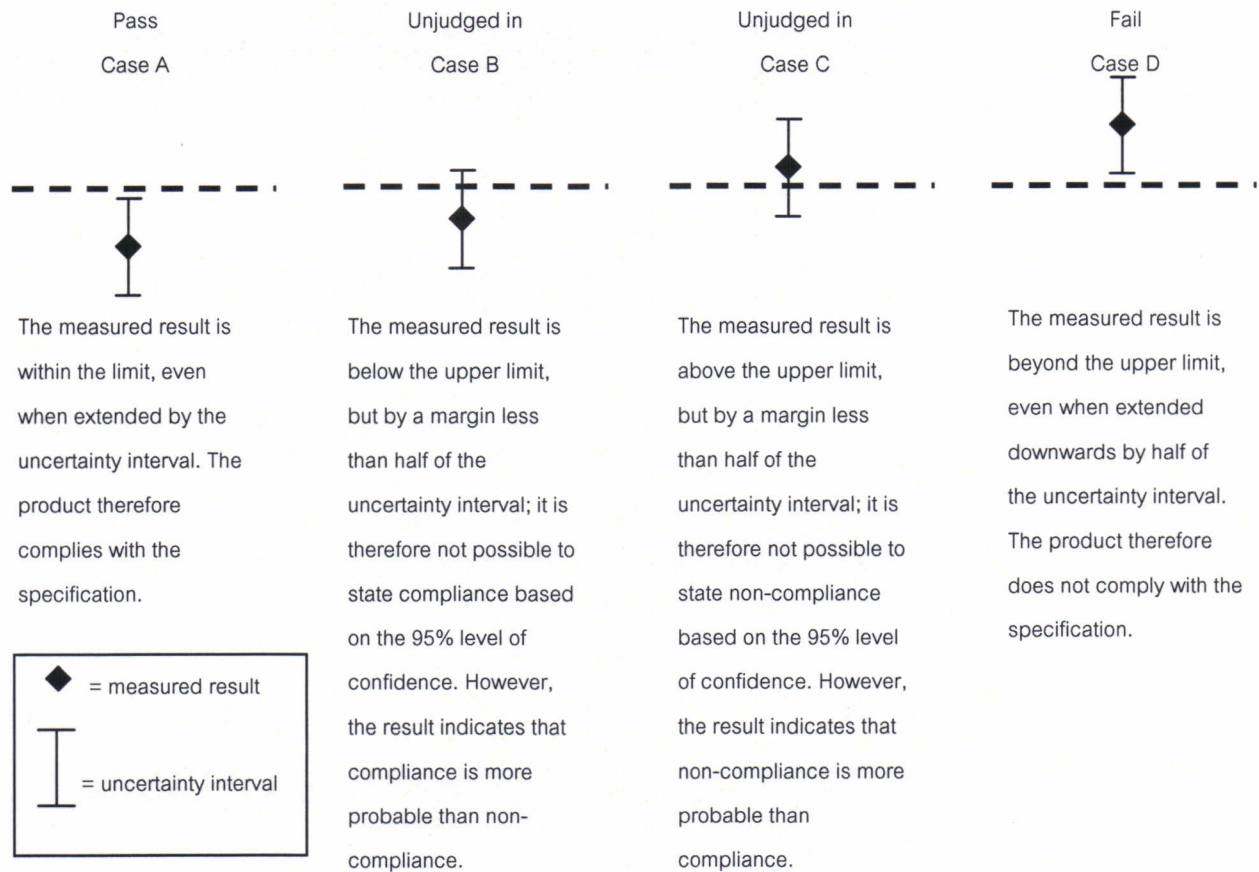
Table 1 - Values of  $U_{cisp}$

Abbreviation	Testing system	Frequency range	$U_{lab}$	$U_{cisp}$	$U_{lab} - U_{cisp}$
CE	Conducted Emission	9 kHz - 150 kHz	2.88	4.00	-1.12
CE	Conducted Emission	150 kHz - 30 MHz	3.49	3.60	-0.11
RE	Radiated Disturbance	30 MHz - 1000 MHz	4.69	5.20	-0.51
PE	Disturbance Power	30 MHz - 300 MHz	2.33	4.50	-2.17

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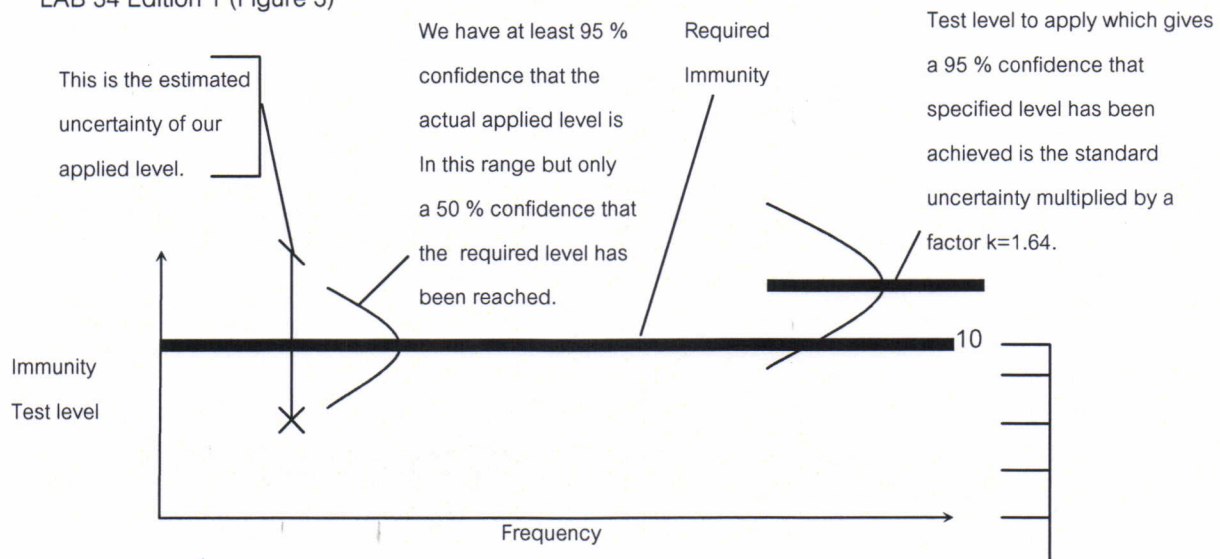
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### 3.2.2 Uncertainty Application according to LAB 34 Edition 1 (Figure 1) for other testing system.



### 3.2.3 Uncertainty Application for immunity testing.

Uncertainty of each test systems are applied for compliance with related standard according to LAB 34 Edition 1 (Figure 3)



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### 3.3 Equipment Classifications

Electronic Modules

### 3.4 Protection Classifications

### 3.5 Performance Criteria of Test Specification

This element describes the operation status of a device during and after exposure to an electromagnetic environment.

- Class A: all functions of a device or system perform as designed during and after exposure to a disturbance.
- Class B: all functions of a device or system perform as designed during exposure; however, one or more of them may go beyond the specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.
- Class C: one or more functions of a device or system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.
- Class D: one or more functions of a device or system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple "operation/use" action.
- Class E: one or more functions of a device or system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

### 3.6 EUT Function Monitoring

The specific phenomena are monitored by LED Lighting.

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#### 4 TEST SYSTEM CONFIGURATION

##### 4.1 EUT Exercise Software

-

##### 4.2 EUT Modifications

-

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## 5 EUT DESCRIPTION

### 5.1 EUT Specification

Input Voltage	13.5 Vdc
Input Current/Power	$\leq 16$ A
Clock/Oscillator	-

### 5.2 EUT Configuration

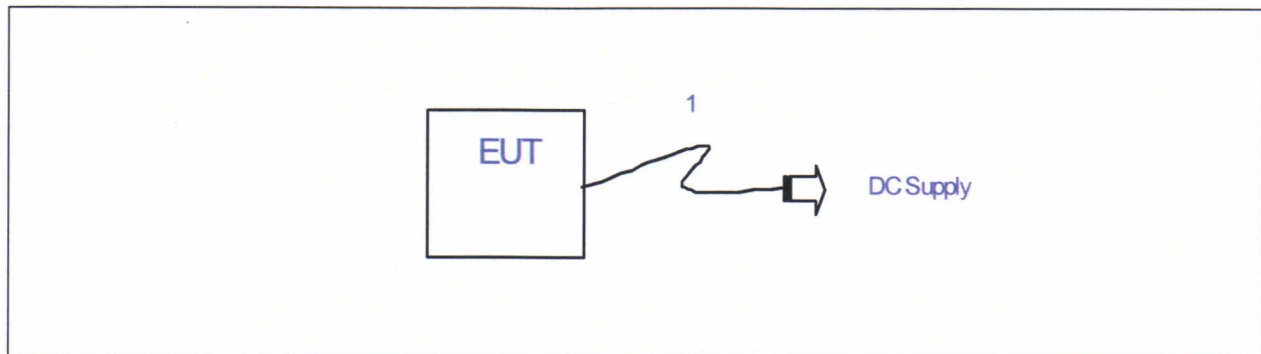


FIGURE 1 - EUT Configuration.

### 5.3 Peripherals Description

Diagram	Description	Trade Name	Model	Serial Number
-	-	-	-	-

### 5.4 Cables Description

Ref	Cable Type	Shield	Length (meters)	Ferrite	Connector	Connection Point 1	Connection Point 2
1	DC Power line	No	1.5	No	DC	EUT	DC Supply

## 6 TEST SETUP AND RESULT

### 6.1 Test Item: Radiated Emission

#### 6.1.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
EMI Test Receiver	Rohde & Schwarz	ESU26	100459	DKD	16-11-15
Amplifier	Sonoma	310 N	186897	NIMT	05-03-16
Bilog Antenna	Schaffner	CBL6141A	4146	UKAS	05-01-17

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty:  $\pm 4.80$  dB

- Test Location: MCDC Room (TRM-004)

- Test Environment

Temperature (°C)	25	Humidity (%)	56
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- Test Setup Description

The requirements of CISPR 25, ALSE method was used for verification of the EUT performance except where noted in this specification.

- The EUT and any electronic hardware in the Test Fixture were powered from an automotive battery. The battery negative terminal shall be connected to the ground plane bench. The battery was located on, or under the test bench.
- The total harness length shall be 1700 mm (+300/-0 mm). Location of the EUT and Test Fixture require that the harness be bent. The harness bend radius was between 90 and 135 degree. The harness was lie on an insulated support 50 mm above the ground plane
- If the outer case of the EUT is metal and can be grounded when installed in the vehicle, the EUT was mounted and electrically connected to the ground plane during the test. If the EUT case is not grounded in the vehicle, the EUT was placed on an insulated support 50mm above the ground plane. The EUT was tested in both vertical and horizontal polarizations.

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● Test Picture

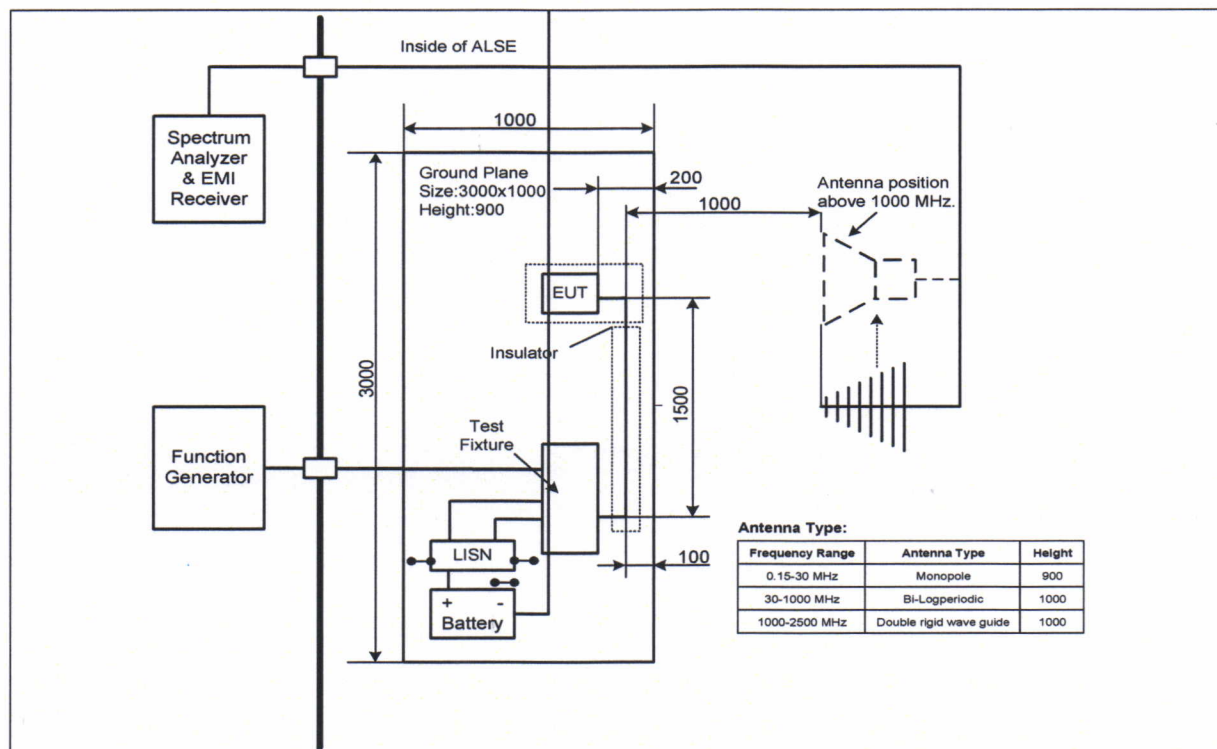


FIGURE 2 - The test setup diagram for Radiated Emission.

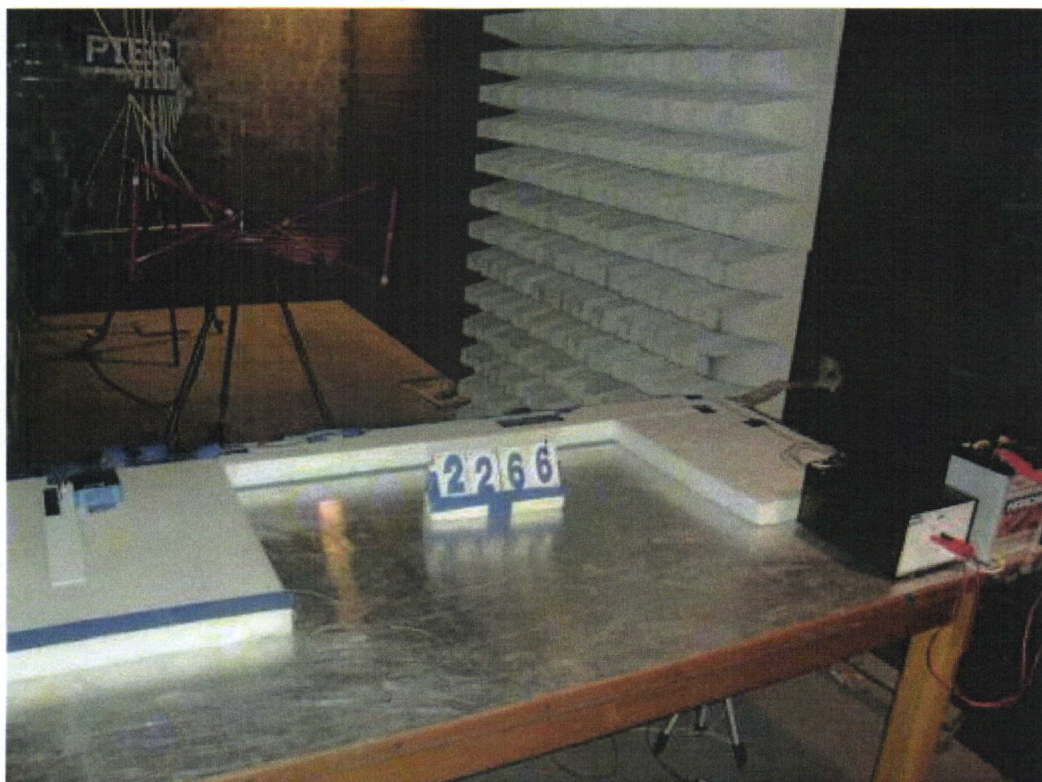


FIGURE 3 - The test setup picture for Radiated Emission.

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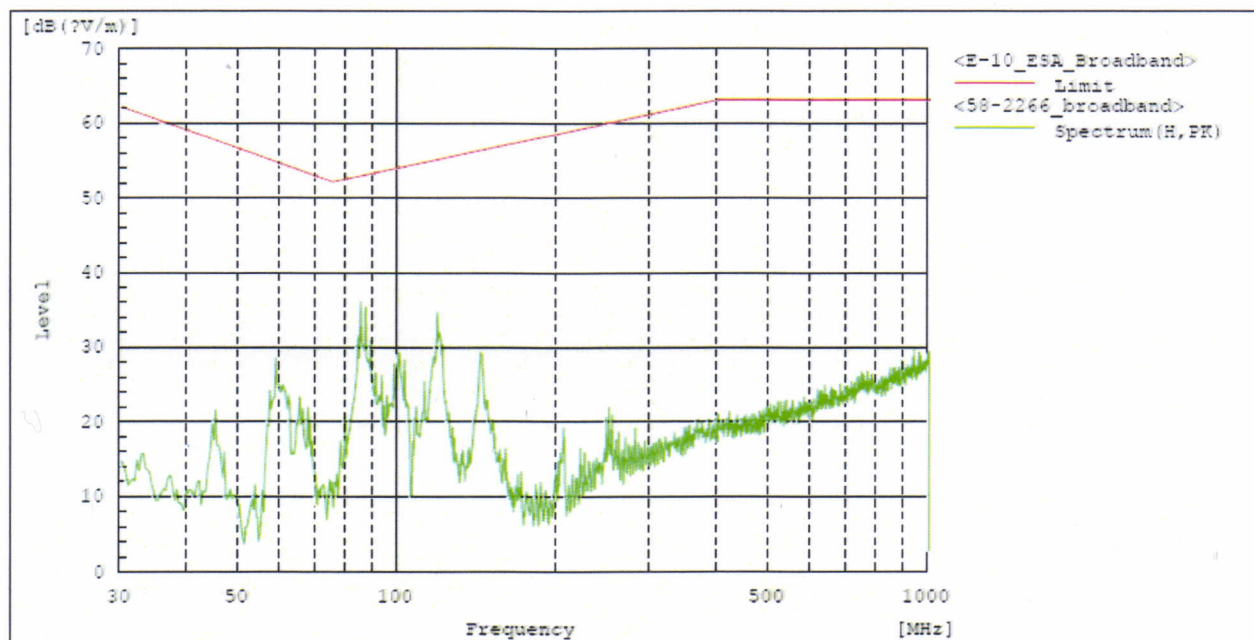
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### 6.1.2 Test Result

Measurement Port	Enclosure	Operation Mode	A (See 3.1)
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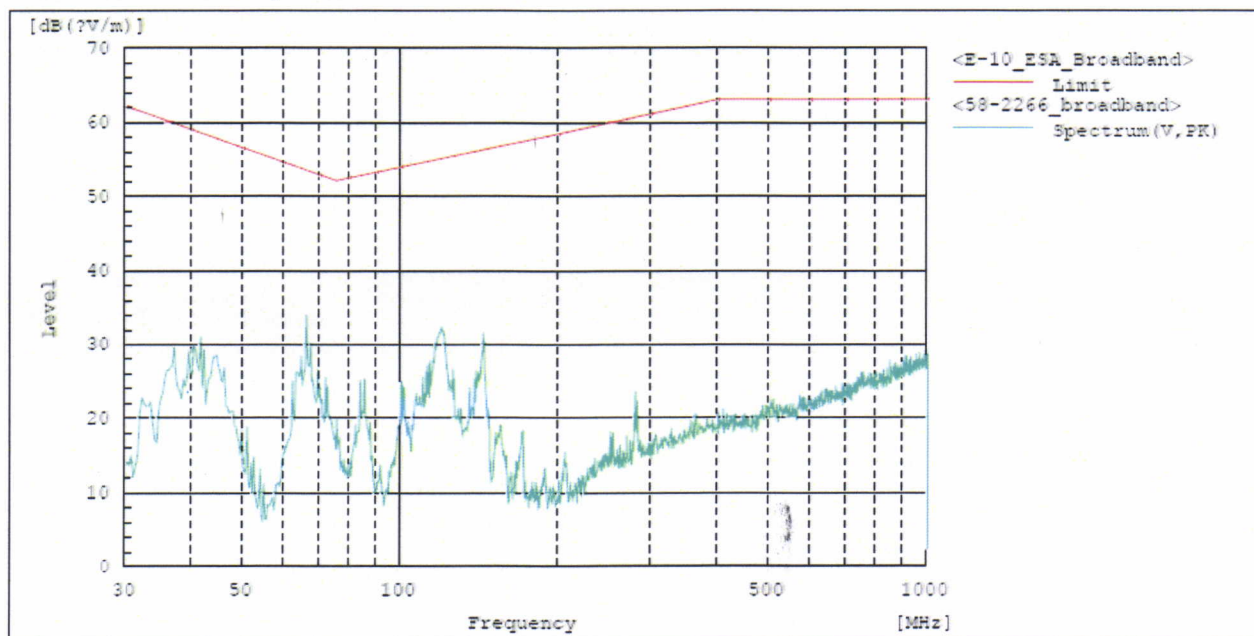
#### Broadband

Test result for horizontal polarization.



Note: This test result is more than 10 dB below the limit line, therefore QP and AV detectors were not performed.

Test result for vertical polarization.



Note: This test result is more than 10 dB below the limit line, therefore QP and AV detectors were not performed.

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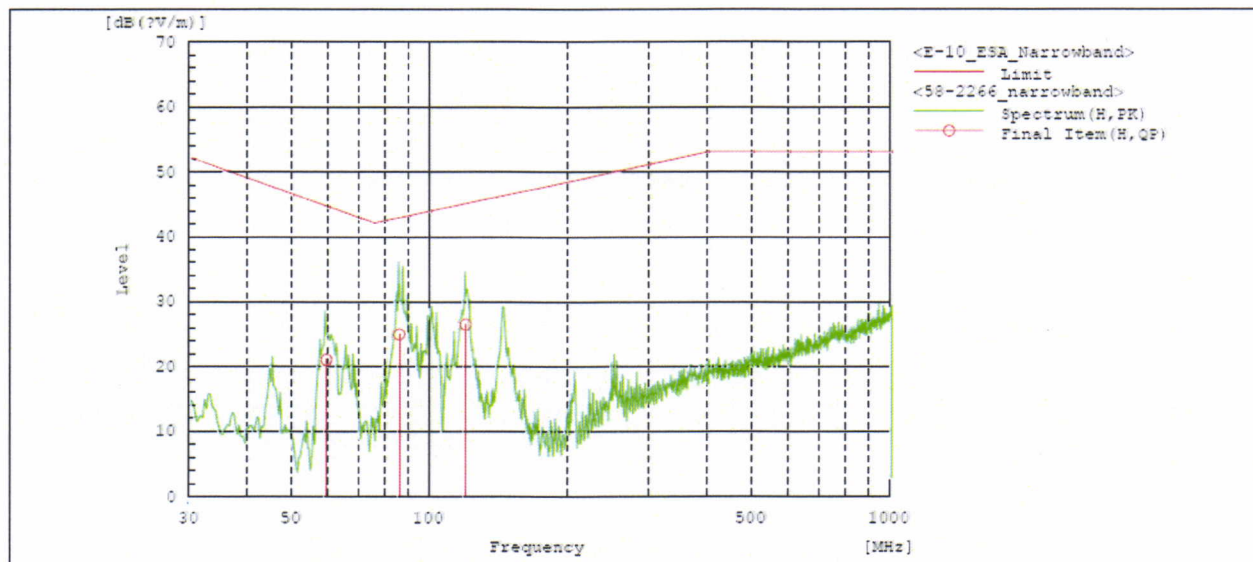
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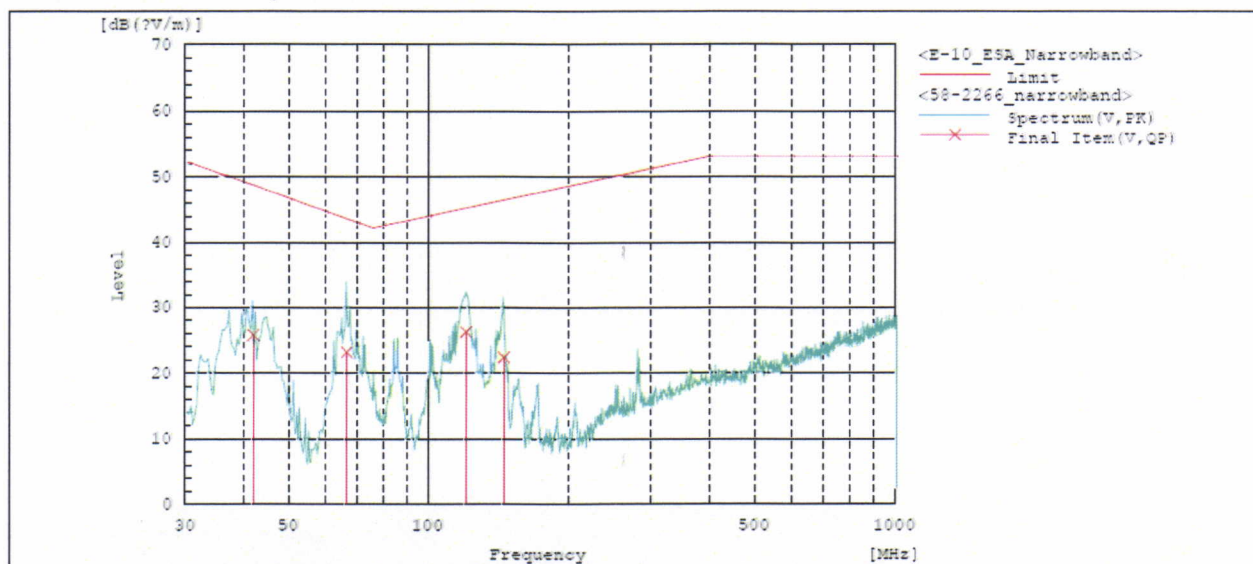
Measurement Port	Enclosure	Operation Mode	A (See 3.1)
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Narrowband

Test result for horizontal polarization.



Test result for vertical polarization.



Measurement Result of Quasi-Peak Detector

No.	Frequency (P)	Reading	c.f	Result	Limit	Margin	Height	Angle
	[MHz]	QP [dB (V/m)]	[dB (1/m)]	QP [dB (V/m)]	[dB (V/m)]	QP [dB]	[cm]	[?]
1	41.512	V 46.8	-21.1	25.7	48.5	22.9	100.0	0.0
2	65.932	V 47.0	-23.9	23.1	43.4	20.4	100.0	0.0
3	118.971	V 46.1	-19.9	26.2	45.0	18.8	100.0	0.0
4	143.361	V 42.8	-20.5	22.3	46.3	24.0	100.0	0.0
5	58.971	H 46.4	-25.5	20.9	44.6	23.7	100.0	0.0
6	84.843	H 44.9	-20.1	24.8	42.8	18.0	100.0	0.0
7	118.476	H 46.3	-19.9	26.4	45.0	18.6	100.0	0.0

**Result: Pass**

Tested by: MR. Poomares Pomsri

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## 6.2 Test Item: Immunity Testing (Free Field)

### 6.2.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Power Meter	Rohde & Schwarz	NRVD	832839/021	NIMT	21-11-15
Signal Generator	Rohde & Schwarz	SMY02	830269/058	NIMT	20-11-15
Bilog Antenna 26MHz – 2GHz	EMCO	3142B	9911-1454	NIST	23-11-15
Power Amplifier	Amplifier Research	250W1000	27380	NIST	23-11-15
Power Amplifier	Amplifier Research	60SIG3	27562	NIST	23-11-15
Power Amplifier	Amplifier Research	250A250A	27450	NIST	23-11-15

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty:  $\pm 1.78$  dB

- Test Location: MCDC Room (TRM-004)

- Test Environment

Temperature (°C)	25	Humidity (%)	55
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● **Test Setup Description**

The EUT and any electronic hardware in Test Fixture were powered from a automotive battery. The battery negative terminal shall be connected to the ground plane bench. The battery may be located on, or under the test bench.

- For frequencies <1000 MHz, the field-generating antenna was positioned in front of the middle of the harness (refer to ISO 11452-2). For frequencies above 1000 MHz, the antenna was moved 750 mm parallel to the front edge of the ground plane towards the EUT. The center of the antenna shall be pointed directly at the EUT instead of the center of the wiring harness.
- The total harness length was 1700 mm (+300/-0 mm). Location of the EUT and Test Figure requires that the harness be bent. The harness bend radius was between 90 and 135 degree. The harness was lie on an insulated support 50 mm above the ground plane.
- If the outer case of the EUT is metal and can be grounded when installed in the vehicle, the EUT was mounted and electrically connected to the ground plane during the bench test. If the EUT case is not grounded in the vehicle, the EUT was placed on an insulated support 50 mm above the ground plane. The EUT was tested in both vertical and horizontal polarizations.

Band	Frequency Range (MHz)	Step frequency (MHz)	Level (V/m)	Modulation
1	80-200	5	30	CW, AM 80%
2	200-400	10	30	CW, AM 80%
3	400-800	20	30	CW, AM 80%
4	800-1000	20	30	CW, PM 577,4600 $\mu$ S
5	1000-2000	40	30	CW, PM 577,4600 $\mu$ S

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The diagram illustrates the test setup for the EUT inside the ALSE. The setup is contained within a large rectangular enclosure labeled "Inside of ALSE".

- Power Amplifiers:** Three "Power Amplifier" blocks are connected to the top of the enclosure.
- Ground Plane:** A "Ground Plane" is located inside the enclosure, with dimensions "Size:3000x1000" and "Height:900".
- EUT:** The Equipment Under Test is positioned on the ground plane, with a "200" unit dimension indicating its width.
- Insulator:** An "Insulator" is shown supporting the EUT.
- Test Fixture:** A "Test Fixture" is connected to the EUT.
- Power Source:** A "Battery" (labeled "+ -") is connected to the test fixture, with a "LISN" (Line Impedance Stabilization Network) in between.
- Measurement Equipment:** A "Function Generator" and an "Oscilloscope or Digital Multi Meter" are connected to the test fixture via "Coaxial cable".
- Monitoring:** A "TV Monitor" is connected to the bottom of the enclosure.
- Antenna:** An antenna is positioned outside the enclosure, with dimensions "1000" (width) and "1500" (height) indicated. The antenna is labeled "Antenna position Above 1000 MHz." and "Antenna Height:1000".
- Monitor Camera:** A "Monitor Camera" is positioned outside the enclosure, with a "1000" unit dimension indicating its width.

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Test Condition

Operation Mode	A (See 3.1)				
Test Level:	30 V/m	Start Frequency:	80 MHz	Stop Frequency:	200 MHz
Step Size:	5 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	30 V/m	Start Frequency:	200 MHz	Stop Frequency:	400 MHz
Step Size:	10 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	30 V/m	Start Frequency:	400 MHz	Stop Frequency:	800 MHz
Step Size:	20 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	30 V/m	Start Frequency:	800 MHz	Stop Frequency:	1000 MHz
Step Size:	20 MHz	Modulation Frequency:	-	Modulation Type:	PM, with 577 $\mu$ S, period 4600 $\mu$ S
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	30 V/m	Start Frequency:	1000 MHz	Stop Frequency:	2000 MHz
Step Size:	40 MHz	Modulation Frequency:	-	Modulation Type:	PM, with 577 $\mu$ S, period 4600 $\mu$ S
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

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6.2.2 Test Result

Frequency	Polarity	Result
80-200 MHz	Vertical	NORM
200-400 MHz	Vertical	NORM
400-800 MHz	Vertical	NORM
	Horizontal	NORM
800-1000 MHz	Vertical	NORM
	Horizontal	NORM
1000-2000 MHz	Vertical	NORM
	Horizontal	NORM

Note: "-" : Not Test

"NORM" : Normal

"AB" : Abnormal

Phenomena Observed/Comments

-

**Result:** *Pass*

Tested by: MR. Poomares pomsri

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### 6.3 Test Item: Immunity Testing (Bulk current injection: BCI)

#### 6.3.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Injection Probe	FCC	120-9 A	202	NIMT	09-06-16
Power Meter	Rohde & Schwarz	NRVD	832839/021	NIMT	21-11-15
Signal Generator	Rohde & Schwarz	SMY02	830269/058	NIMT	20-11-15
Power Amplifier	Amplifier Research	250W1000	27380	NIST	23-11-15
Power Amplifier	Amplifier Research	250A250A	27450	NIST	23-11-15

- Test Uncertainty: -

- Test Location: MCDC Room (TRM-004)

- Test Environment

Temperature (°C)	25	Humidity (%)	55
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● Test Description

Use the calibrated injection probe method (substitution method) according to ISO 11452-4.

- Forward power used as reference parameter for calibration and during the actual test of the EUT.
- Use step frequencies listed and the modulation as specified in the test result.
- All frequency range testing was performed at fixed injection probe positions (150 mm)
- If deviations are observed, the induced current was reduced until the EUT functions normally. Then the induced current shall be increased until the deviation occurs. This level was reported as the deviation threshold.
- The EUT operation mode(s) exercised during testing was conform to that delineated in the EMC test plan.
- A monitor probe is used to adjust the RF current delineated in Table below.

Band	Frequency Range (MHz)	Step frequency (MHz)	Level (mA)	Modulation
1	1-10	1	60	CW, AM 80%
2	10-200	5	60	CW, AM 80%
3	200-400	10	60	CW, AM 80%

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● Test Picture

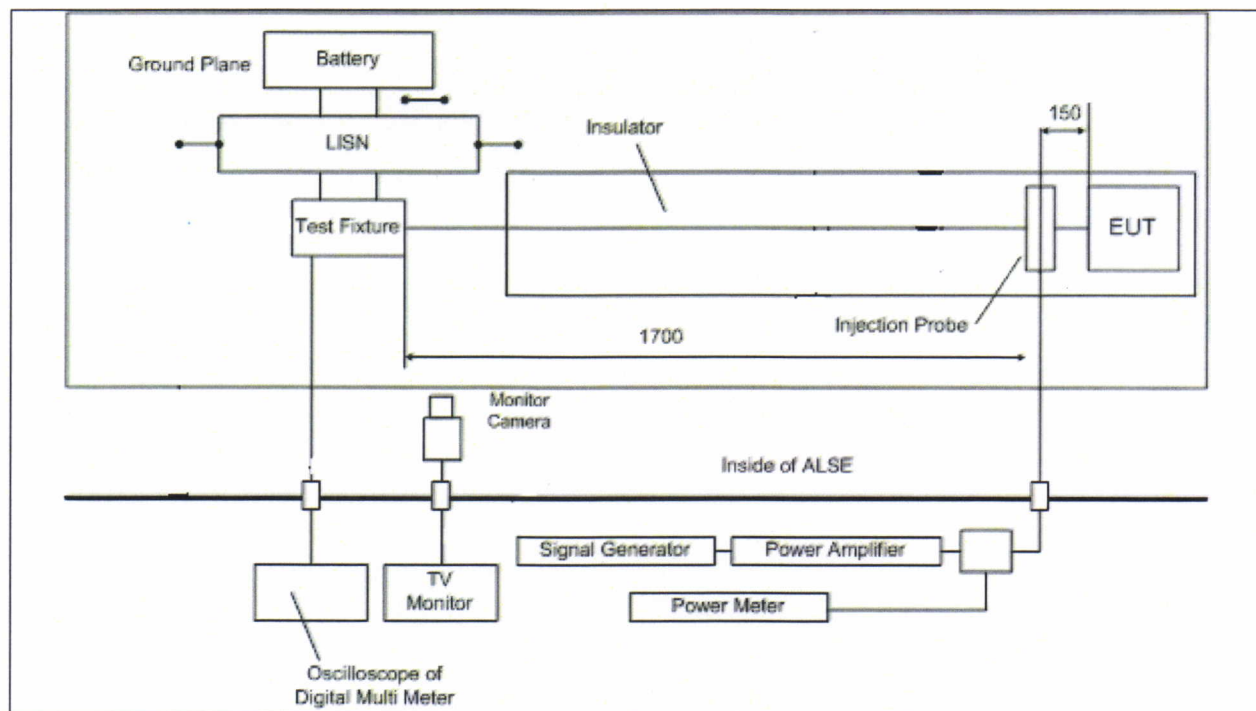


FIGURE 6 - The setup diagram for BCI.



FIGURE 7 - The test setup picture for BCI.

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Test Condition

Operation Mode	A (See 3.1)				
Test Level:	60 mA	Start Frequency:	1 MHz	Stop Frequency:	100 MHz
Step Size:	1 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	60 mA	Start Frequency:	10 MHz	Stop Frequency:	200 MHz
Step Size:	5 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

Operation Mode	A (See 3.1)				
Test Level:	60 mA	Start Frequency:	200 MHz	Stop Frequency:	400 MHz
Step Size:	10 MHz	Modulation Frequency:	1 KHz	Modulation Type:	AM mod, 80%
Step mode:	Linear	Dwell time	3 Sec	Port:	Enclosure

6.3.2 Test Result

Test port	Test Level (mA)	Frequency (MHz)	Step frequency (MHz)	Modulation	Dwell time	Result
Control Line	60	1-10	1	AM 80% with 1kHz	3 Sec.	NORM
Control Line	60	10-200	5	AM 80% with 1kHz	3 Sec.	NORM
Control Line	60	200-400	10	AM 80% with 1kHz	3 Sec.	NORM

Note: "-" : Not Test "NORM" : Normal "AB" : Abnormal

Phenomena Observed/Comments

-

**Result: Pass**

Tested by: Poomares Pomsri

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#### 6.4 Transient Voltage immunity Test (Along Supply Line Only)

##### 6.4.1 Test Setup

###### ● Test Equipment

Equipment Name	Manufacture	Model	S/N	Due date
Fast Transient Generator	TESEQ/Schaffner	NSG5500/FT5530	1292/1353	03-02-16
Automotive Load Dump Simulator	TESEQ/Schaffner	NSG5500/LD5550	1292/2031	03-02-16
Automotive Micro Transient Gen.	TESEQ/Schaffner	NSG5500/MT5511	1292/1364	03-02-16
Automotive Function Generator	TESEQ/Schaffner	NSG5601/FG5620	1333/1317	03-02-16
Power Amplifier	TESEQ/Schaffner	PA 5740	1162	03-02-16
Automotive Switch/LISN	TESEQ/Schaffner	AES5501	1264	03-02-16

###### ● Test Setup Description

Transient voltage stipulated in ISO-7637-2 and show in Table 2 shall be applied to a power supply terminal of a EUT. The unit shall be free from malfunction during the test and suffice the characteristics and performance stipulated in a relative part specification after the test. The EUT configurations for Transient Voltage immunity testing are shown in FIGURE 8 and 9.

Table 2 Criteria of functional status testing

Test pulse number	Immunity test level	Functional status for systems	
		Related to immunity related functions	Not related to immunity related functions
1	III	C	D
2a	III	B	D
2b	III	C	D
3a/3b	III	A	D
4	III	B (for ESA which must be operational during engine start phases) C (for other ESAs)	D

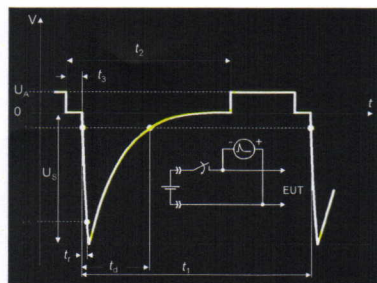
*The tests are made in the AeLA nr. 010, Authorized by TS nr. TL-002 (Finland)*

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### Test Pulse 1

Test Type MT 5511 Pulse 1 ISO (Generic 2 and 6 ms transients)

Sequence Repetition Count 5000



Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	-75V	---	---	---
Pulse Period (t1)	Static	.5 Secs	---	---	---
General	Value				
Rise Time (tr)	1 us				
Output Resistance (Ri)	10 ohms				
Pulse Width (td)	2 ms				
t2	200ms				
Polarity/Coupling	Negative Parallel				
Battery					
Battery State	Under Program Control				
Voltage	13.5 V				
Current Limit	10 A				
End of Test Voltage	13.5 V				

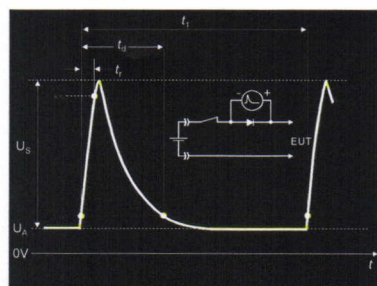
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**Pulse 2a**

Test Type MT 5511 Pulse 2 (Generic 50 us transients)

Sequence Repetition Count 5000



Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	37 V	---	---	---
Pulse Period (t1)	Static	.5 Secs	---	---	---

General	Value
Rise Time (tr)	1 us
Output Resistance (Ri)	2 ohms
Pulse Width (td)	50 us
t2	Not Applicable
Polarity/Coupling	Positive Serial

Battery	
Battery State	On
Voltage	13.5 V
Current Limit	10 A
End of Test Voltage	13.5 V

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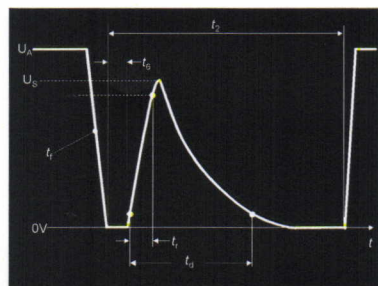
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Pulse 2b

Test Type NSG 5600 Pulse 2B ( SVV )

Sequence Repetition Count 10



Voltage

U<sub>a</sub> 13.5 V

U<sub>s</sub> 10 V

Timing

t<sub>f</sub> 1 mS

t<sub>6</sub> 1 mS

t<sub>r</sub> 1 mS

t<sub>d</sub> 200 mS

t<sub>2</sub> .51 S

t<sub>1</sub> 5 S

Resistance

Resistance 0 ohms

Battery

Current Limit 10 A

End of Test Voltage 13.5 V

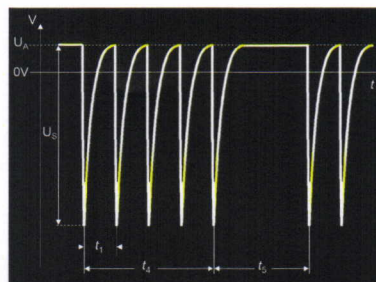
*The tests are made in the AeLA nr. 010, Authorized by TS nr. TL-002 (Finland)*

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Test Pulse 3a

Test Type FT 5530 Pulse 3A/B ( Burst )

Sequence Repetition Hours 1



Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	-112 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General	Value				
Rise Time (tr)	5 ns				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	100 ns				
Burst Interval(t5)	0.09 Seconds				
Output Mode	NORMAL				
No Pulses (t4/t1)					
Burst Duration (t4)	10 mS				
Battery					
Battery State	On				
Voltage	13.5 V				
Current Limit	10 A				
End of Test Voltage	13.5 V				
Polarity					
Polarity	Negative				

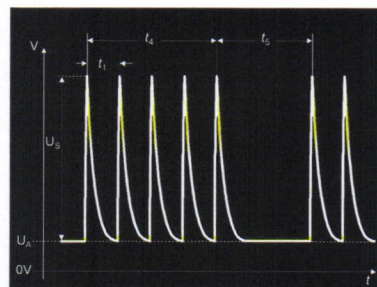
The tests are made in the AeLA nr. 010, Authorized by TS nr. TL-002 (Finland)

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### Test Pulse 3b

Test Type FT 5530 Pulse 3A/B ( Burst )

Sequence Repetition Hours 1



Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	+75 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General		Value			
Rise Time (tr)		5 ns			
Output Resistance (Ri)		50 ohms			
Pulse Width (td)		100 ns			
Burst Interval(t5)		0.09 Seconds			
Output Mode		NORMAL			
No Pulses (t4/t1)					
Burst Duration (t4)		10 mS			
Battery					
Battery State		On			
Voltage		13.5 V			
Current Limit		10 A			
End of Test Voltage		13.5 V			
Polarity					
Polarity		Positive			

*The tests are made in the AeLA nr. 010, Authorized by TS nr. TL-002 (Finland)*

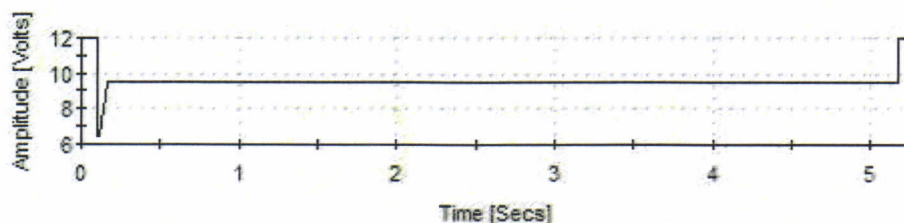
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Test Pulse 4

Test Type Double Arb : Master -> NSG 5600 Pulse 4C ( SVV )

Sequence Repetition Count 1



Segment Number # 1	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	12 Vpp	---
Parameter	Value		
Segment Duration	100 ms		
Segment Number # 2	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	12 Vpp	6 Vpp
Parameter	Value		
Segment Duration	5 ms		
Segment Number # 3	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	6 Vpp	---
Parameter	Value		
Segment Duration	15 ms		
Segment Number # 4	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	6 Vpp	9.5 Vpp

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Parameter	Value		
Segment Duration	50 ms		
Segment Number # 5	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	9.5 Vpp	- - -
Parameter	Value		
Segment Duration	5 Seconds		
Segment Number # 6	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	9.5 Vpp	12 Vpp
Parameter	Value		
Segment Duration	5 ms		
Segment Number # 7	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	12 Vpp	- - -
Parameter	Value		
Segment Duration	100 ms		
Battery:	End of Test:		
Current Limit:	10 A	Voltage:	12 V

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- Test Picture

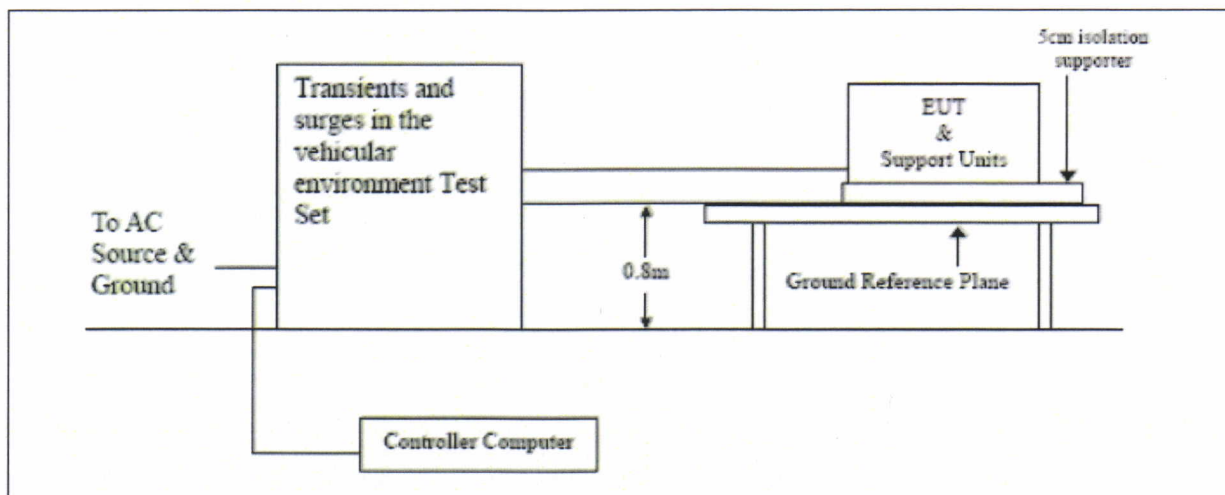


FIGURE 8 - The test setup diagram for Transient

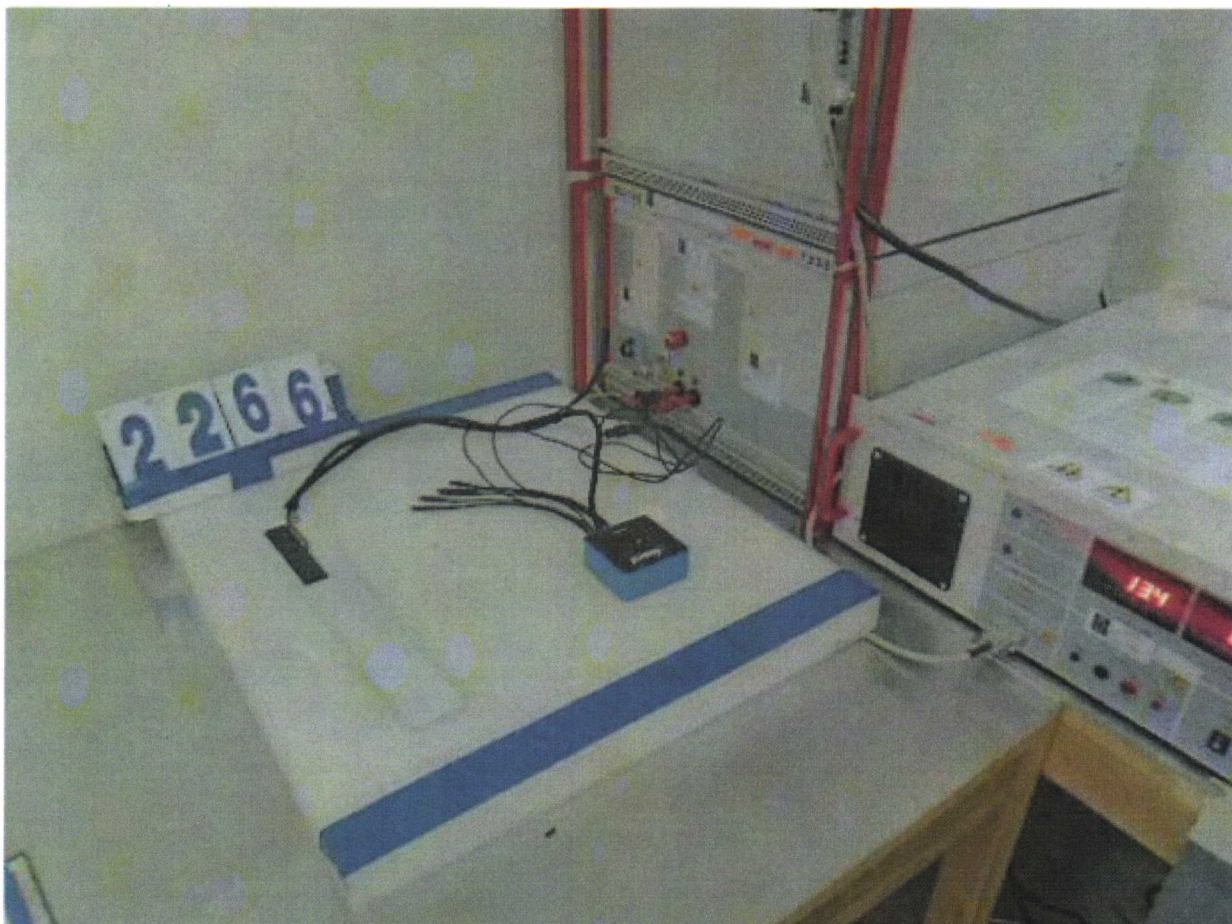


FIGURE 9 - The test setup picture.

*The tests are made in the AeLA nr. 010, Authorized by TS nr. TL-002 (Finland)*

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● Test Result

Test Environment

Temperature (°C)	24	Humidity (%)	55
------------------	----	--------------	----

Test Pulses	Test Level (V)	Test time	Test Result	Phenomena observed/Comments
1	-75	5000Pulses	NORM	-
2a	+37	5000Pulses	NORM	-
2b	+10	10Pulses	NORM	-
3a	-112	1h	NORM	-
3b	+75	1h	NORM	-
4	-6	1Pulses	NORM	-

Note: "-" : Not Test

"NORM" : Normal

"AB" : Abnormal

**Result: Pass**

Tested by: MR. Poomares Pomsri

## 6.5 Transient Emission Test

### 6.5.1 Test Setup

#### ● Test Equipment

Equipment Name	Manufacture	Model	S/N	Due date
Fast Transient Generator	TESEQ/Schaffner	NSG5500/FT5530	1292/1353	03-02-16
Automotive Load Dump Simulator	TESEQ/Schaffner	NSG5500/LD5550	1292/2031	03-02-16
Automotive Micro Transient Gen.	TESEQ/Schaffner	NSG5500/MT5511	1292/1364	03-02-16
Automotive Function Generator	TESEQ/Schaffner	NSG5601/FG5620	1333/1317	03-02-16
Power Amplifier	TESEQ/Schaffner	PA 5740	1162	03-02-16
Automotive Switch/LISN	TESEQ/Schaffner	AES5501	1264	03-02-16
Oscilloscope	YOKOGAWA	DL7440	27D929934H	03-02-16

#### ● Test Setup Description

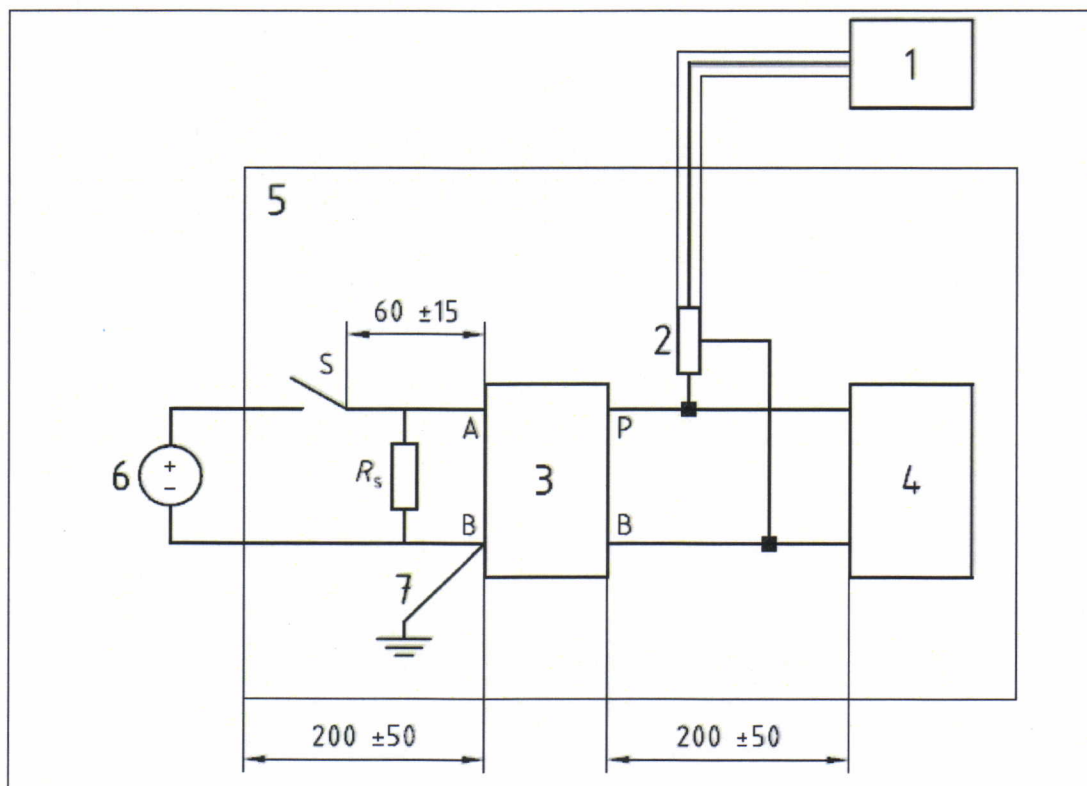
Transient emission test shall be measured by the method designated in ISO-7637-2 and all the values shown in Table 3 shall be sufficed. In an event if the positive and negative amplitude cannot be sufficed due to a problem in design, an evaluation standard should be determined by a negotiation among the parties concerned. The EUT configurations for transient emission test are shown in FIGURE10 and 11.

Table 3 Maximum pulse amplitude for transient emission

Polarity of pulse amplitude	Maximum allowed pulse amplitude	
	Vehicles with 12 V systems	Vehicles with 24 V systems
Positive	+75	+150
Negative	-100	-450

• Test Picture

Slow Pulses



1	oscilloscope or equivalent	5	ground plane
2	voltage probe	6	power supply
3	artificial network	7	Ground connection; length < 100 mm
4	DUT (source of transient)		

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**Fast Pulses**

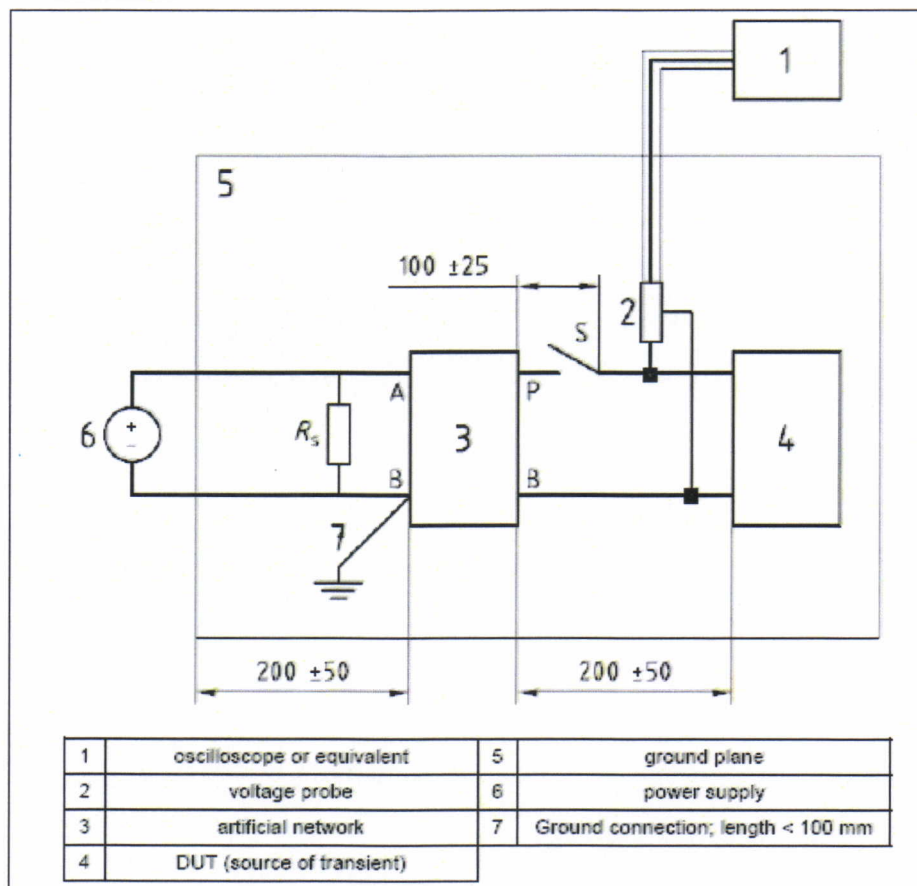


FIGURE 10 - The test setup diagram for Transient emission test.



FIGURE 11 - The test setup picture.

● Test Result

Test Environment

Temperature (°C)	24	Humidity (%)	55
------------------	----	--------------	----

(Slow Pulses)

Items	Limits	Result
Positive Amplitude	+75 V	+9.3 V
Negative Amplitude	-100 V	+6.9 V

(Fast Pulses)

Items	Limits	Result
Positive Amplitude	+75 V	+15.7 V
Negative Amplitude	-100 V	+2.3 V

Phenomena Observed/Comments

-
---

**Result:**    **Pass**

Tested by: MR. Poomares Pomsri

----- End of Report -----

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