



REPUBLIK ÖSTERREICH

Bundesministerium für
Verkehr, Innovation und Technologie



Mitteilung

ausfertigende Stelle:

**BUNDESMINISTERIUM FÜR VERKEHR, INNOVATION
UND TECHNOLOGIE, Radetzkystraße 2, A-1031 Wien**

- über die - Erteilung der Genehmigung
 - ~~Erweiterung der Genehmigung~~
 - ~~Versagung der Genehmigung~~
 - ~~Zurücknahme der Genehmigung~~
 - ~~endgültige Einstellung der Produktion~~ ²⁾

für einen Typ einer elektrischen / elektronischen Unterbaugruppe nach der Regelung Nr. 10.05

Communication

issued by:

**BUNDESMINISTERIUM FÜR VERKEHR, INNOVATION
UND TECHNOLOGIE, Radetzkystraße 2, A-1031 Wien**

- concerning - ~~Approval granted~~
 - ~~Approval extended~~
 - ~~Approval refused~~
 - ~~Approval withdrawn~~
 - ~~Production definitely discontinued~~ ²⁾

of a type of electrical/electronic sub-assembly with regard to Regulation n° 10.05

GZ. BMVIT-790.102/0009-IV/ST5/2018

Nummer der Genehmigung E12*10R05/01*0083*00
Approval n°

Nummer der Erweiterung 00
Extension n°

- | | |
|--|---|
| 1. Marke (Handelsmarke des Herstellers) <i>Make (trade name of manufacturer)</i> | Hella |
| 2. Typ und allgemeine Handelsbezeichnung <i>Type and general commercial description(s):</i> | PB1000C-2 |
| 3. Art der Kennzeichnung des Typs, falls am Fahrzeug/am Bauteil/an der einzelnen technischen Einheit (2) eine Aufschrift vorhanden ist <i>Means of identification of type, if marked on the vehicle/component/separate technical unit: 2/</i> | Laserkennzeichnung <i>Laser marking</i> |
| 3.1. Stelle, an der diese Kennzeichnung angebracht ist <i>Location of that marking</i> | siehe Zeichnung "LEUCHTE ZR 0/180GR MD 12-24 DT PB1C" <i>see drawing "LEUCHTE ZR 0/180GR MD 12-24 DT PB1C"</i> |
| 4. Fahrzeugklasse <i>Category of vehicle</i> | --- |
| 5. Name und Anschrift des Herstellers <i>Name and address of manufacturer</i> | Hella Fahrzeugteile Austria GmbH Fabriksgasse 2 A-7503 Großpetersdorf |
| 6. Bei Bauteilen und einzelnen technischen Einheiten: Stelle, an der das ECE-Genehmigungszeichen angebracht wird, und Art der Anbringung <i>In the case of components and separate technical units, location and method of affixing of the ECE approval mark:</i> | siehe Zeichnung "LEUCHTE ZR 0/180GR MD 12-24 DT PB1C" <i>see drawing "LEUCHTE ZR 0/180GR MD 12-24 DT PB1C"</i> |
| 7. Anschrift des Montagebetriebs (Anschriften der Montagebetriebe) <i>Address(es) of assembly plant(s)</i> | Hella Fahrzeugteile Austria GmbH Fabriksgasse 2 A-7503 Großpetersdorf |
| 8. Zusätzliche Angaben (falls zutreffend) <i>Additional information (where applicable)</i> | siehe Anlage <i>see appendix</i> |
| 9. Technischer Dienst, der die Prüfungen durchführt <i>Technical Service responsible for carrying out the tests</i> | Seibersdorf Labor GmbH A-2444 Seibersdorf |
| 10. Datum des Prüfberichts / <i>Date of test report</i> | 25.10.2017 |
| 11. Nummer des Prüfberichts / <i>No. of test report</i> | EMV-E 140/17 |

- | | | |
|-----|---|-------------------------------------|
| 12. | Etwaige Bemerkungen / <i>Remarks (if any)</i> | siehe Anlage / <i>see appendix</i> |
| 13. | Ort / <i>Place</i> | Wien |
| 14. | Datum / <i>Date</i> | 26.03.2018 |
| 15. | Unterschrift <i>Signature</i> | Dipl.-Ing. Dr. Friedrich Forsthuber |
| 16. | Das Verzeichnis der Unterlagen, die bei der Genehmigungsbehörde eingereicht wurden und auf Anforderung erhältlich sind, ist dieser Mitteilung beigefügt. <i>The index to the information package lodged with the Approval Authority, which may be obtained on request, is attached.</i> Informationsdokument No. PB1000C-2 (5 Seiten / <i>pages</i>) Prüfbericht / test report No. EMV-E 140/17 (41 Seiten / <i>pages</i>) | |
| 17. | Gründe für die Erweiterung/ <i>reasons for extension</i> | --- |

Anlage zu dem Mitteilungsblatt Nr.E12*10R05/01*0083*00 betreffend die Typgenehmigung einer elektrischen/elektronischen Unterbaugruppe nach der Regelung Nr. 10.05
Appendix to type-approval communication form No.E12*10R05/01*0083*00 concerning the type-approval of an electrical/electronic sub-assembly under Regulation No. 10.05

- | | | |
|-------|---|---|
| 1 | Zusätzliche Angaben / <i>Additional information</i> | --- |
| 1.1 | Nennspannung der elektrischen Anlage <i>Electrical system rated voltage</i> | 12/24 V, Anschluss an Masse negativ <i>12/24 V. negative ground (2)</i> |
| 1.2 | Diese elektrische/elektronische Unterbaugruppe kann mit folgenden Einschränkungen bei jedem Fahrzeugtyp verwendet werden <i>This ESA can be used on any vehicle type with the following restrictions</i> | --- |
| 1.2.1 | Etwaige Einbaubedingungen / <i>Installation conditions, if any</i> | --- |
| 1.3 | Diese elektrische/elektronische Unterbaugruppe kann nur bei folgenden Fahrzeugtypen verwendet werden <i>This ESA can be used only on the following vehicle types</i> | --- |
| 1.3.1 | Etwaige Einbaubedingungen / <i>Installation conditions, if any</i> | --- |
| 1.4 | Angabe des (der) genauen Prüfverfahren(s) und der Frequenzbereiche bei der Ermittlung der Störfestigkeit (bitte das genaue Verfahren nach Anhang 9 angeben) <i>The specific test method(s) used and the frequency ranges covered to determine immunity were: (Please specify precise method used from Annex 9)</i> | Siehe Prüfbericht EMV-E 140/17 Seiten 11 bis 24 <i>See test report EMV-E 140/17 pages 11 to 24</i> |
| 1.5 | Zugelassenes/anerkanntes Prüflaboratorium (im Sinne dieser Regelung), das die Prüfung durchführt <i>Laboratory accredited to ISO 17025 and recognized by the Approval Authority responsible for carrying out the tests</i> | Seibersdorf Labor GmbH A-2444 Seibersdorf |
| 2 | Bemerkungen / <i>Remarks</i> | --- |

-
- | | |
|----|--|
| 1) | Kennzahl des Landes, das die Genehmigung erteilt/erweitert/versagt/zurückgenommen hat (siehe die Vorschriften über die Genehmigung in der Regelung). |
| 2) | Nichtzutreffendes streichen. |
| 1) | <i>Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).</i> |
| 2) | <i>Strike out what does not apply.</i> |

Informationsdokument für die Typgenehmigung einer elektrischen/elektronischen Unterbaugruppe hinsichtlich der elektromagnetischen Verträglichkeit
Information document for type approval of an electric/electronic sub-assembly with respect to electromagnetic compatibility

| | | |
|---|---|---|
| 1 | Fabrikmarke (Handelsmarke des Herstellers): / Make (trade name of manufacturer): | Hella |
| 2 | Typ: / Type | PB1000C-2 |
| Gegebenenfalls Aufschlüsselung der Varianten/Versionen innerhalb des Typs / coding of variants/versions within the type, if applicable | | |
| 3 | Art der Kennzeichnung des Typs, sofern am Bauteil/an der selbständigen technischen Einheit eine Aufschrift vorhanden ist(1): Means of identification of type, if marked on the component/separate technical unit (1): | Merkmale MerkmaleEnglisch See drawing "LEUCHTE ZR 0/180GR MD12-24 DT PB1C" Siehe Zeichnung "LEUCHTE ZR 0/180GR MD12-24 DT PB1C " |
| 3.1 | Stelle, an der die Kennzeichnung angebracht ist: Location of that marking: | See drawing "LEUCHTE ZR 0/180GR MD12-24 DT PB1C" Siehe Zeichnung „LEUCHTE ZR 0/180GR MD12-24 DT PB1C" |
| 4 | Name und Anschrift des Herstellers: Name and address of manufacturer: | Hella Fahrzeugteile Austria GmbH Fabriksgasse 2 7503 Großpetersdorf Österreich |
| | Gegebenenfalls Name und Anschrift des Beauftragten des Herstellers: Name and address of authorised representative, if any: | ----- |
| 5 | Bei Bauteilen und selbstständigen technischen Einheiten: Stelle, an der das Genehmigungszeichen angebracht wird, und Art der Anbringung: In the case of components and separate technical units, location and method of affixing of the approval mark: | Laserkennzeichnung an jedem Gerät, Kennzeichnungsstelle siehe Zeichnung "LEUCHTE ZR 0/180GR MD12-24 DT PB1C" Laser marking on each device, location see drawing "LEUCHTE ZR 0/180GR MD12-24 DT PB1C" |
| 6 | Name und Anschrift der Fertigungsstätte(n): Name and adress(es) of assembly plant(s): | Hella Fahrzeugteile Austria GmbH Fabriksgasse 2 7503 Großpetersdorf Österreich |
| 7 | Diese elektrische/elektronische Unterbaugruppe wird als Bauteil/ selbständige technische Einheit (2) genehmigt. This ESA shall be approved as a component/STU (2): | Component |
| 8 | Mögliche Beschränkungen der Verwendung und Einbaubedingungen: / Any restrictions of use and conditions for fitting: | ----- |
| 9 | Nennspannung der elektrischen Anlage: 12V/24V, pos/neg (2) Masse / Electrical system rated voltage: 12V/24V, positive/negative (2) ground | 12V/24V (+) / Masse (-) |

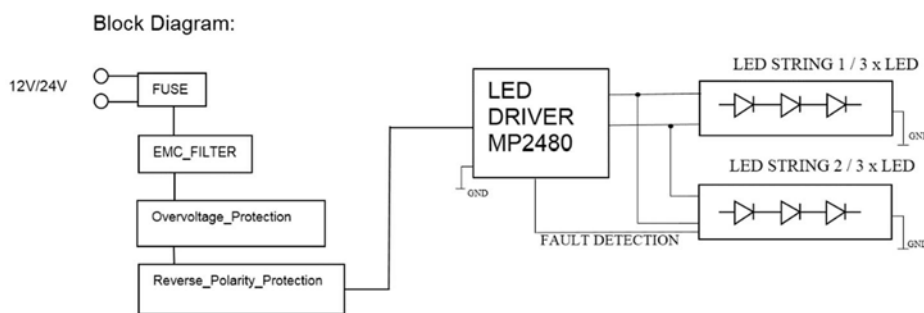


Anlage 1 / Appendix 1

Beschreibung der elektrischen/elektronischen Unterbaugruppe, die ausgewählt wurde, den Typ zu repräsentieren (elektronisches Blockschaltbild und Verzeichnis der wichtigsten Bauteile, die die elektrische/elektronische Unterbaugruppe bilden (z.B.: Fabrikname und Art des Mikroprozessors, Kristall usw.). / *Description of the ESA chosen to represent the type (electronic block diagram and list of main component constituting the ESA (e.g. make and type of microprocessor, crystal, etc.).*

Bei der elektronischen Unterbaugruppe (EUB) handelt es sich um einen Rückfahrscheinwerfer.

The Electric/Electronic sub-assambly (ESA) is a reversing lamp.



Beilage zu Anlage 1:

| Nr. | Dokument | Bezeichnung | Datum |
|-----|-------------------------|---|------------|
| 1 | Technical Specification | Technical Specification for device type PB1000C-2 | 19.02.2018 |
| 2 | Alternative variations | Alternative variations for device type PB1000C-2 | 19.02.2018 |
| 3 | Drawing | LEUCHTE ZR 0/180GR MD12-24 DT PB1C | 19.12.2016 |

Anlage 2 / Appendix 2

Für die Ausstellung des Typpergenehmigungsbogens vom Hersteller eingereichte(r) Prüfbericht(e) eines nach ISO 17025 akkreditierten und von der Genehmigungsbehörde anerkannten Prüflabors. / *Relevant test report(s) supplied by the manufacturer from a test laboratory accredited to ISO 17025 and recognized by the Approval Authority for the purpose of drawing up the type approval certificate.*

Prüfbericht von Seibersdorf Labor GmbH mit der Prüfberichtsnummer EMV-E 140/17 vom 25.10.2017

(1) Enthalten die Merkmale zur Typidentifizierung Zeichen, die für die Typbeschreibung des Fahrzeugs, des Bauteils oder der selbständigen technischen Einheit gemäß diesem Beschreibungsbogen nicht wesentlich sind, so sind diese Schriftzeichen in den betreffenden Unterlagen durch das Symbol „?“ darzustellen (Beispiel ABC??123??). / *If the means of identification of type contains characters not relevant to describe the component or separate technical unit types covered by this information document, such characters shall be represented in the documentation by the symbol "?" (e.g. ABC??123??).*

(2) Nichtzutreffendes streichen. / *Delete where not applicable.*



Hella Fahrzeugteile Austria GmbH

TECHNICAL SPECIFICATION for device type PB1000C-2

Resp.: HFA-D-E / SK

Date: 19.02.2018

Proposed functions.....: Reversing lamp unit with LED light source used on vehicles with a nominal voltage of 12V and 24V.

Remarks.....:

Alternative variations.....: See on the enclosed document

Equipment.....: See on the enclosed drawing

Trade mark: Hella



Specification of the system:

| Function | Type | PDM change number | Layout Identification number |
|----------------|--------------------|-------------------|------------------------------|
| Reversing lamp | LED-Reversing lamp | | |

LED- work lamp unit:

- Housing or Base plate - Material, Surface..... -: Plastic die cast, see drawing
- Reflector - material, Surface..... -: plastic, metalized
- Lens - material -: Glass or Plastic, inside and outside the lens polished
- Light source holder, Execution, Material, Surface: -: LED - light source: 6 single Chip LED placed on PCB
- Producing an electrical connection: -: LED light source and driver electronic placed on the same PCB
- A male connector or harness on the module, see the drawing
- EMI Casing: -: thermal conductive plastic
- Heat sink: -: Housing is used as heat sink
- Sealing of the harness delivery to the reflector/housing..... -: With the defined male connector or harness on the module or glued harness
- Fastening of the cooling unit to the light unit: -: Mounting of the light unit to cooling system via heat conducting foil

Hella Fahrzeugteile Austria GmbH



Hella Fahrzeugteile Austria GmbH

A-7503 Großpetersdorf, Fabriksgasse 2

Fabriksgasse 2
A-7503 Großpetersdorf / Austria

**Bundesministerium für Verkehr,
Innovation und Technologie
Sektion II - Typgenehmigung**

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1030 Wien**

Ihr Zeichen / Your ref.: Ihre Nachricht vom / Your letter of:

Unser Zeichen / Our ref.:
HFA-D-E / SK

Datum / Date:
19.02.2018

Alternative variations for device type PB1000C-2

- With different parts for mounting the device (lamp) on vehicle's body for connecting individual device or lamp parts with each other without an affect for the operation of the lamp.
- with insignificant different execution and design of optical ineffective device parts at basically same model type,
- with different connectors, harnesses or harness connections or harness leads without an affect for the EMC-properties or optical and photometric characteristics of the lamp,
- with different kinds of fastening or adjustment devices without an affect for the EMC-properties or optical and photometric characteristics of the lamp
- with different types of housing without an affect for the EMC-properties or optical and photometric characteristics of the lamp,
- with different surfaces and / or colours of the optical ineffective device (lamp) part without an affect for the corrosion prevention and without an affect for the EMC-properties or optical and photometric characteristics of the lamp,
- with a lens, in which the crossing between the sectors with different ineffective contour only insignificant differences shows,
- with different electrical connections or contact touch without an affect for the EMC-properties or optical and photometric characteristics of the lamp
- with in design, colouring or material different sealing at same quality and effect,
- with additional and different markings or foreign approval signs or customer trademarks without an affect for the optical and photometric quality and effect.

Firmensitz:

A-7503 Großpetersdorf, Fabriksgasse 2

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FB Nr.: FN 91310 f; UID Nr.: ATU 57753602; Landesgericht: A-7000 EISENSTADT ARA Nr.: 5600; DVR: 044351

Bank / Bankers

Creditanstalt BLZ 11000

Kto.Nr. 0185-66661/00 BIC: BKAUATWW

IBAN: AT90 1100 0018 5666 6100

Bank Bgld. BLZ 51000

Kto.Nr. 91413372900 BIC: EHBBAT2E

IBAN: AT77 5100 0914 1337 2900

Deutsche Bank

BLZ 41670027

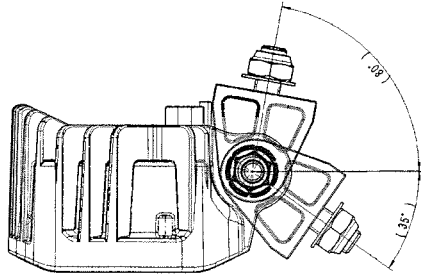
Kto.Nr. 6010383

BIC: DEUTDE3B416 IBAN: DE49 4167 0027 0601 0383 00



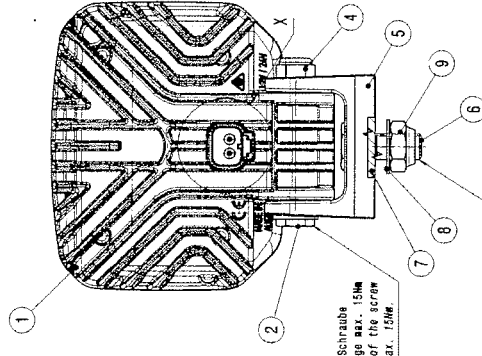
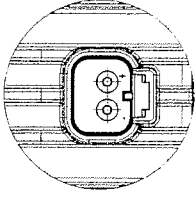
TECHNISCHE AENDERUNGEN VORBEHALTEN!
SUBJECT TO TECHNICAL CHANGES!
 Gewichtstoleranz nach Heila-M2020
 Weight tolerance according to Heila-M2020
 Dekorative Beurteilung nach Heila-M67025
 Decorative assessment according to Heila-M67025
 Zonenbeurteilung gem. AA HFA-16-004
 Zone assessment acc. AA HFA-16-004

VERTIKALE VERSTELLBARKEIT
VERTICAL SWIVELLING



Tolerierung nach DIN EN ISO 8015
 Tolerance definition according to DIN EN ISO 8015
 Umweltsystem Heila-M2010-02 ist zu beachten
 Heila Environmental Standard No 2010-02 to be considered

ANSICHT / VIEW X
M / SCALE 2:1



Anzugmoment der Schraube
 bei Montage max. 15 Nm
 fastening torque of the screw
 at installation max. 15 Nm

empfohlenes Anzugmoment
 bei Montage bei M10 Mutter
 recommended fastening torque
 at assembly on vehicle: 30 Nm at M10 nut

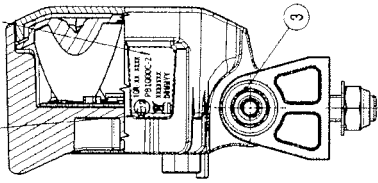
Special Characteristics and Inspection Characteristics nach HW20037, Ausgabe 2015-07-27

Gesamtanzahl der Special Characteristics and Inspection Characteristics:
 SC/S - Sicherheitsrelevante Merkmale = -
 SC/L - Zulassungsrelevante gesetzliche und behördliche Merkmale = 01
 SC/F - Forderungen und Funktionen betreffende Merkmale = -
 IC/P - Inspection Characteristics = ...

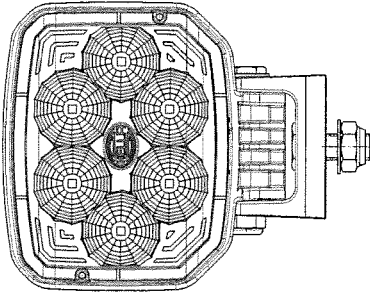
Special Characteristics and Inspection Characteristics according to HW20037, Issue 2015-07-27

Total number of Special Characteristics and Inspections Characteristics:
 SC/S - Special Characteristics related to safety = -
 SC/L - Special Characteristics related to legal and regulatory requirements = 01
 SC/F - Special Characteristics related to functions and requirements = -
 IC/P - Inspection Characteristics = ...

Lasergravur in diesem Bereich:
 Laser engraving in this area



ANSICHT OHNE ABSCHLUSSSCHEIBE
VIEW WITHOUT LENS



Notwendige Scheinwerfer Absicherung bei 12V und 24V Bordspannung 5A!
 work lamp requires a 5A fuse protection at 12V and 24V wiring system voltage!

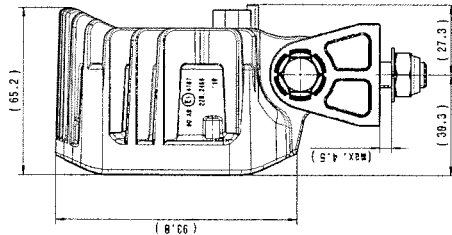
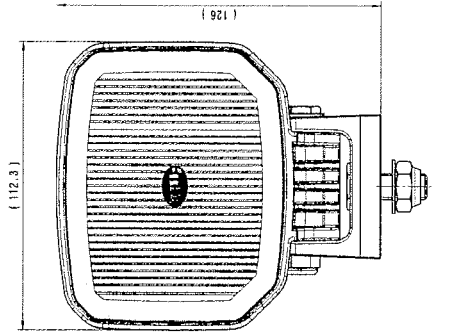
0° und 180° Montage möglich
 0° and 180° mounting possible

Leuchten Funktion
 Light function
 Typgenehmigung
 Type approval

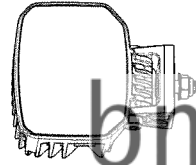
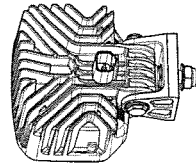
SC/L P5
 Rücklichtschleimverfärbung
 Reversing Lamp
 ECC-R33-00

SC/L P5
 EW/VEC
 ECC-R10

Halter kann wahlweise
 von links oder rechts montiert werden
 bracket can be
 mounted left or right



ISOANSICHT / ISOVIEW
M / SCALE: 1:2



ECE R10-Genehmigungszeichen
 ECE R10-approval mark
 300mm
 h=4/3
 h=4/2



E12*10R05/01*008

DEUTSCH Standard: Sp.1: 81A, 990.285-127
 DEUTSCH Standard: Sp.2: 80A, 990.285-127
 Gometkap DEUTSCH Sp.1: 90H, 990.316-021
 Rubbercap DEUTSCH Sp.2: 90H, 990.316-021
 nicht in Lieferumfang enthalten
 not included in delivery

| Part No. | Part Name | Material | Quantity | Unit | Part No. | Part Name | Material | Quantity | Unit |
|-----------|-------------------|----------|----------|------|-----------|-------------------|----------|----------|------|
| 992104-45 | GAL ZINK 2138 F/T | | 1 | | 991347-45 | PP schwarz | | 1 | |
| 991347-45 | PP schwarz | | 1 | | 990074-45 | PA66 G550 schwarz | | 1 | |
| 990074-45 | PA66 G550 schwarz | | 1 | | 127288-45 | PA66 G550 schwarz | | 1 | |
| 991872-45 | GAL ZINK 2138 F/T | | 1 | | 130822-45 | GAL ZINK 2138 F/T | | 1 | |
| 130822-45 | GAL ZINK 2138 F/T | | 1 | | 220447-10 | vis Werkstoff | | 1 | |
| 220447-10 | vis Werkstoff | | 1 | | | | | | |

| Part No. | Part Name | Material | Quantity | Unit |
|-----------|-------------------|----------|----------|------|
| 992104-45 | GAL ZINK 2138 F/T | | 1 | |
| 991347-45 | PP schwarz | | 1 | |
| 990074-45 | PA66 G550 schwarz | | 1 | |
| 127288-45 | PA66 G550 schwarz | | 1 | |
| 991872-45 | GAL ZINK 2138 F/T | | 1 | |
| 130822-45 | GAL ZINK 2138 F/T | | 1 | |
| 220447-10 | vis Werkstoff | | 1 | |

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 www.hella.de



ACCREDITED TESTING LABORATORY (NR. 312)
for Electromagnetic Compatibility
Notified body No. 0438 according to EMC-Directive and Radio Equipment Directive

TEST REPORT NR. EMV-E 140/17

Subject: UN/ECE Regulation No. 10 -
Revision 5
Including all published erratums and amendments

The summary of the results can be found on page 2.

Ordered by: HELLA Fahrzeugteile Austria GmbH

Address: Fabriksgasse 2
7503 Großpetersdorf
Austria

On: PB1000C-2

This report contains the pages 1 to 41.

Authorized person:


Ing. Thomas Nakovits

Test performed by:


Ing. Markus Winkler, MSc

Date: 2017-10-25
Internal Order Number: EMC/E-2242_5

Comments:

The testing result refers exclusively to the testing subject.

The production or transmission of extracts of the present report is subject to authorization by the testing laboratory.

1. Summary of all measurements and tests

| Emission measurements according to UN/ECE Regulation 10 | | | | |
|---|----------------------------------|--------------------|---------------------|--------|
| Norm. Reference | Term | Type | Details see chapter | Result |
| CISPR 25 | Radiated emissions – ALSE method | Broadband | 4.1 | PASS |
| | | Narrowband | | PASS |
| ISO 7637-2 | Conducted emissions | Voltage transients | 4.2 | PASS |

Table 1: Summary emission measurements

| Immunity tests according to UN/ECE Regulation 10 | | | |
|--|---|---------------------|--------|
| Norm. Reference | Environmental phenomena | Details see chapter | Result |
| ISO 11452-4 | Bulk current injection (BCI) | 4.3 | PASS |
| ISO 11452-2 | Radio-frequency electromagnetic fields - Absorber lined shielded enclosure (ALSE) | 4.4 | PASS |
| ISO 7637-2 | Electrical transients conduction along supply lines only | | |
| | Test pulse 1 | 4.5 | PASS |
| | Test pulse 2a | | PASS |
| | Test pulse 2b | | PASS |
| | Test pulse 3a | | PASS |
| | Test pulse 3b | | PASS |
| | Test pulse 4 | | PASS |

Table 2: Summary immunity tests

| | |
|------|--|
| PASS | The ESA meets the requirements of the standard |
| FAIL | The ESA does not meet the requirements of the standard |
| n.a. | The Test is not applicable |
| n.p. | The Test was not performed |

Table 3: General definitions for the report

All indications of Pass/Fail in this report are opinions expressed by Seibersdorf Laboratories based on interpretations and/or observations of test results.

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3. General information

3.1. Electronic Sub-Assembly (ESA)

ESA: PB1000C-2
Serial No.: 2261716220.464-0513197
Hardware Version: C01
Year of manufacturing: 2017

Manufacturer: HELLA Fahrzeugteile Austria GmbH
Address: Fabriksgasse 2
7503 Großpetersdorf
Austria

Description: LED work lamp
Dimensions: See Figure 1 (in mm)

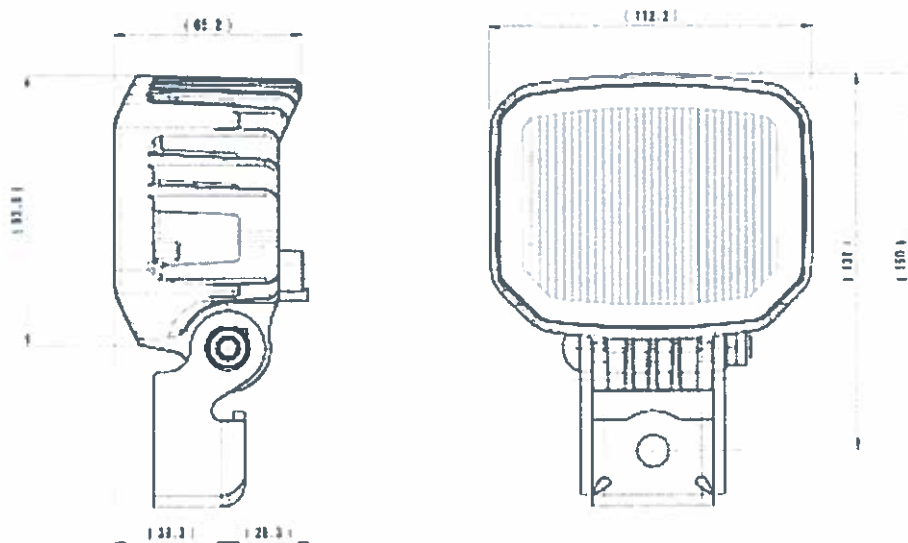


Figure 1: Dimensions of the ESA

3.4. Standards / Documents

- [1] **UN/ECE Regulation No. 10, Revision 5**
16 October 2014
Agreement
Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions.
- [2] **UN/ECE Regulation No. 10, Revision 5 – Amendment 1**
28 October 2016
Supplement 1 to the 05 series of amendments –
Date of entry into force 8 October 2016.
- [3] **CISPR 25:2002 + Corrigendum:2004**
Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices-
Limits and methods of measurement
- [4] **ISO 11452-1:2005 + Amd1:2008**
Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy –
Part 1: General principles and terminology
- [5] **ISO 11452-2:2004**
Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 2: Absorber-lined shielded enclosure
- [6] **ISO 11452-4:2005 + Corrigendum1:2009**
Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy –
Part 4: Bulk current injection (BCI)
- [7] **ISO 7637-2:2004**
Road vehicles – Electrical disturbances from conduction and coupling –
Part 2: Electrical transient conduction along supply lines only

3.5. Date and location of the measurements and tests

Date: 28 September – 11 October 2017

Location: Automotive component test chamber
high frequency laboratory 2
EMC-Test Laboratory
A-2444 Seibersdorf
Austria

Temperature: 21°C – 24°C

Humidity: 50% - 60 % rel.

4.1.3. Results

12 V system:

| Type | Frequency range [MHz] | Polarization | Data see chapter 5.3 | Result |
|---------------------------------|-----------------------|--------------|----------------------|--------|
| Broadband BB / Narrowband NB | 30 – 200 | Horizontal | Chart 1 | PASS |
| | | Vertical | Chart 2 | PASS |
| | 200 – 1000 | Horizontal | Chart 3 | PASS |
| | | Vertical | Chart 4 | PASS |

Table 6: Results

24 V system:

| Type | Frequency range [MHz] | Polarization | Data see chapter 5.3 | Result |
|---------------------------------|-----------------------|--------------|----------------------|--------|
| Broadband BB / Narrowband NB | 30 – 200 | Horizontal | Chart 5 | PASS |
| | | Vertical | Chart 6 | PASS |
| | 200 – 1000 | Horizontal | Chart 7 | PASS |
| | | Vertical | Chart 8 | PASS |

Table 7: Results

4.2. Conducted emissions measurement - voltage transients

4.2.1. Equipment

E0191, E1052A-M

Detailed information see chapter 5.1

4.2.2. Procedure and setup

The measurement was done in the high frequency laboratory 2 of the EMC-Test Laboratory Seibersdorf.

Measurement procedure and setup were according to ISO 7637-2 and UN/ECE Reg. 10 chapter 6.7 / annex 10.

| | |
|----------------|----------------------------|
| Test method | ISO 7637-2, chapter 4.3 |
| Shunt resistor | 40 Ω |
| Limits | UN/ECE R10 Rev.5 / Table 1 |

Table 8: Parameters

4.2.3. Results

12 V system:

| Measurement setup | Measured peak amplitude [V] | Limit Δ to U_B [V] | Data see chapter 5.3 | Result |
|---|-----------------------------|-----------------------------|----------------------|--------|
| Slow pulses (repetitive transients) | --- | + 75 / - 100 | Chart 9 | PASS |
| Slow pulses (open) (ms range or slower) | + 0.00 / - 14.03 | | Chart 10 | PASS |
| Slow pulses (close) (ms range or slower) | + 9.68 / - 14.03 | | Chart 11 | PASS |
| Fast pulses (repetitive transients) | --- | | Chart 12 | PASS |
| Fast pulses (open) (ns to μ s range) | + 0.00 / - 6.92 | | Chart 13 | PASS |
| Fast pulses (close) (ns to μ s range) | + 16.40 / - 14.03 | | Chart 14 | PASS |

Table 9: Results

24 V system:

| Measurement setup | Measured peak amplitude [V] | Limit Δ to U_B [V] | Data see chapter 5.3 | Result |
|---|-----------------------------|-----------------------------|----------------------|--------|
| Slow pulses (repetitive transients) | --- | + 150 / - 450 | Chart 15 | PASS |
| Slow pulses (open) (ms range or slower) | + 0.00 / - 28.46 | | Chart 16 | PASS |
| Slow pulses (close) (ms range or slower) | + 25.69 / - 28.46 | | Chart 17 | PASS |
| Fast pulses (repetitive transients) | --- | | Chart 18 | PASS |
| Fast pulses (open) (ns to μ s range) | + 0.00 / - 20.95 | | Chart 19 | PASS |
| Fast pulses (close) (ns to μ s range) | + 25.72 / - 28.46 | | Chart 20 | PASS |

Table 10: Results

4.3. Bulk current injection immunity tests – BCI

4.3.1. Equipment

E0207, E0421, E0422, E0712, E0802, E0915, E1373, LE0044, LE0056, LE0059, LE0060, LE0061

Detailed information see chapter 5.1

4.3.2. Procedure and setup

The measurement was done inside the shielded automotive component test chamber of the EMC-Test Laboratory Seibersdorf.

Test procedure and setup were according to ISO 11452-4 and UN/ECE Reg. 10 chapter 6.8 / annex 9.

| | | |
|-----------------------|----------------|----|
| Frequency range [MHz] | 20 – 400 | |
| Test level [mA] | 60 | |
| Test position [mm] | 150 | |
| Modulation | 1 kHz / AM 80% | |
| Step size [MHz] | 20 – 200 | 5 |
| | 200 – 400 | 10 |
| Dwell time [s] | 2 | |

Table 11: Parameters

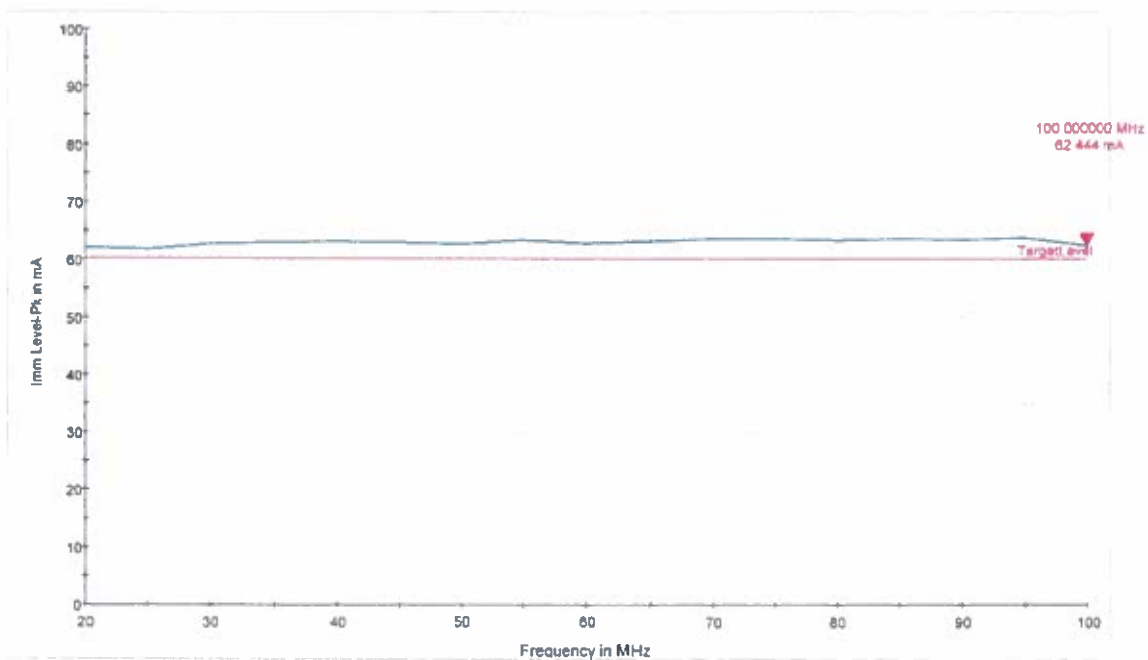


Figure 2: Target level from 20 MHz – 100 MHz

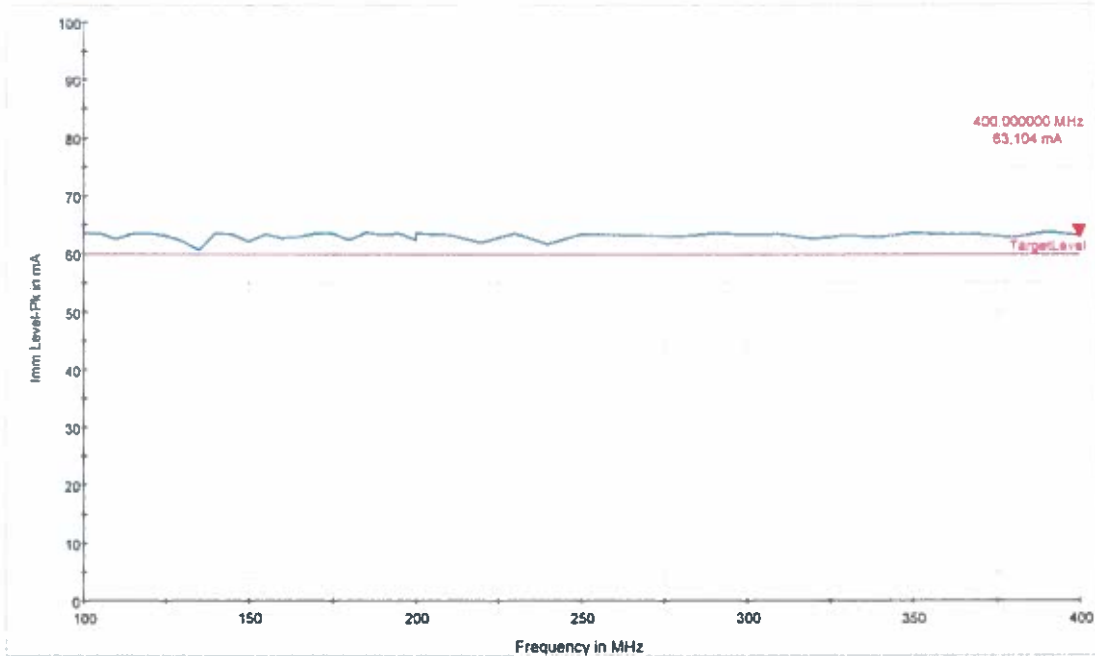


Figure 3: Target level from 100 MHz – 400 MHz

4.3.3. Results

12 V system:

| Test position [mm] | Frequency range [MHz] | Test level [mA] | Criterion ^a | Result |
|--------------------|-----------------------|-----------------|------------------------|--------|
| 150 | 20 – 400 | 60 | A | PASS |

Table 12: Results

24 V system:

| Test position [mm] | Frequency range [MHz] | Test level [mA] | Criterion ^a | Result |
|--------------------|-----------------------|-----------------|------------------------|--------|
| 150 | 20 – 400 | 60 | A | PASS |

Table 13: Results

^a Performance criteria / functional status according to ISO 11452-1 (Annex A)

4.4. Radio-frequency electromagnetic fields – Absorber lined shielded enclosure (ALSE)

4.4.1. Equipment

E0207, E0712, E0717, E0802, E0821, E0915, E1601, E1705, LE0044, LE0056, LE0060, LE0061

Detailed information see chapter 5.1

4.4.2. Procedure and setup

The measurement was done inside the shielded automotive component test chamber of the EMC-Test Laboratory Seibersdorf.

Test procedure and setup were according to ISO 11452-2 and UN/ECE Reg. 10 chapter 6.8 / annex 9.

| | | |
|-----------------------|--|----|
| Frequency range [MHz] | 400 – 800 | |
| Test level [V/m] | 30 | |
| Modulation | 1 kHz / AM 80% | |
| Step size [MHz] | 20 | |
| Dwell time [s] | 2 | |
| Frequency range [MHz] | 800 – 2000 | |
| Test level [V/m] | 30 | |
| Modulation | PM, 577 μ s on, period: 4600 μ s | |
| Step size [MHz] | 800 – 1000 | 20 |
| | 1000 – 2000 | 40 |
| Dwell time [s] | 2 | |

Table 14: Parameters

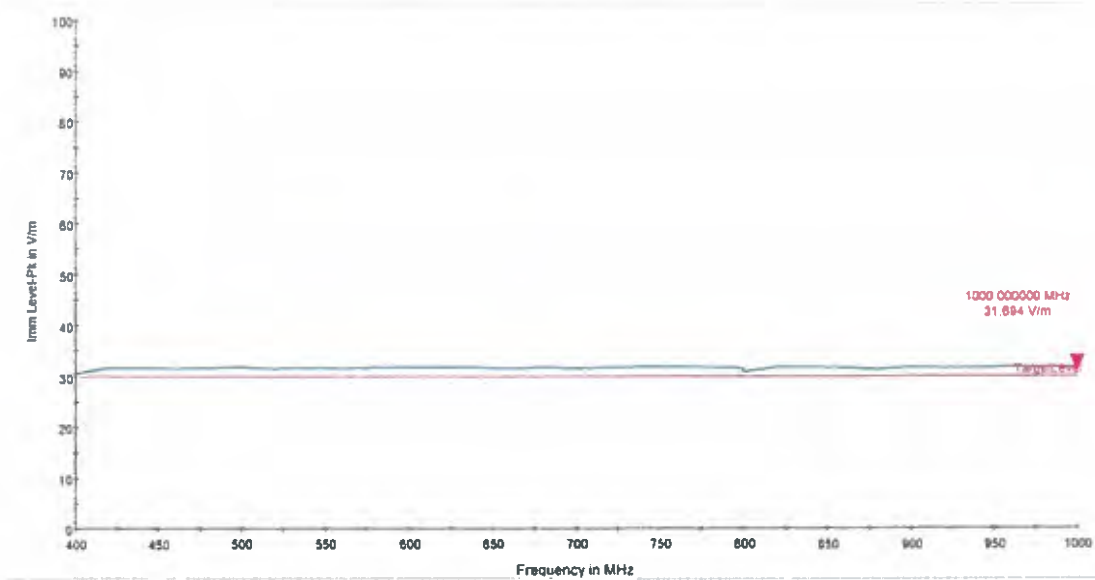


Figure 4: Target level from 400 MHz – 1000 MHz

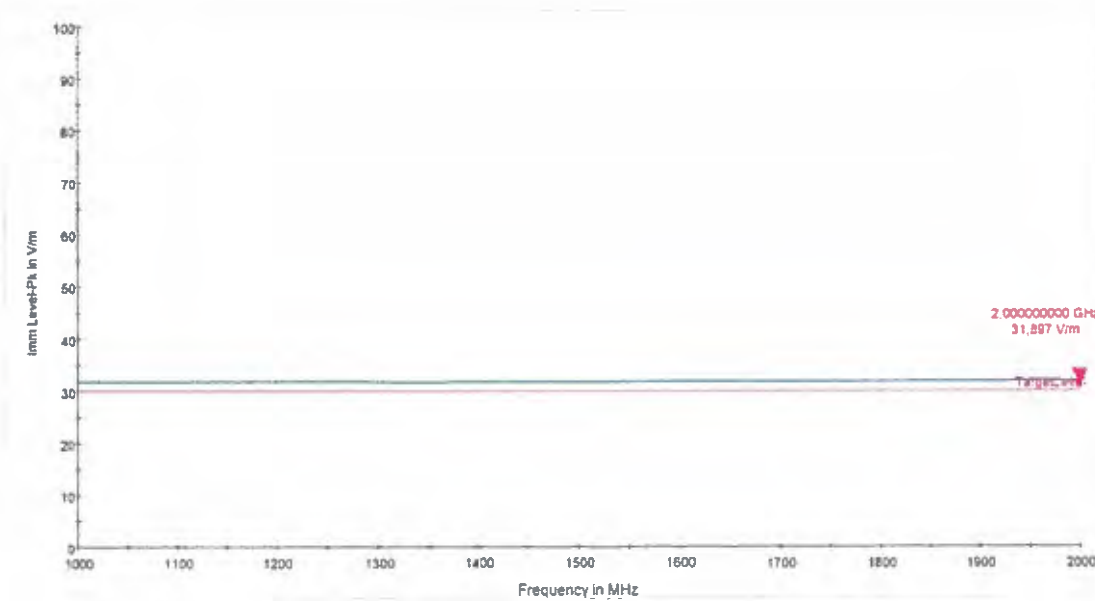


Figure 5: Target level from 1000 MHz – 2000 MHz

4.4.3. Results

12 V system:

| Polarization | Frequency range [MHz] | Test level [V/m] | Criterion ^b | Result |
|-------------------------|-----------------------|------------------|------------------------|--------|
| Horizontal ^c | 400 – 2000 | 30 | A | PASS |
| Vertical | 400 – 2000 | 30 | A | PASS |

Table 15: Results

24 V system:

| Polarization | Frequency range [MHz] | Test level [V/m] | Criterion ^b | Result |
|-------------------------|-----------------------|------------------|------------------------|--------|
| Horizontal ^c | 400 – 2000 | 30 | A | PASS |
| Vertical | 400 – 2000 | 30 | A | PASS |

Table 16: Results

^b Performance criteria / functional status according to ISO 11452-1 (Annex A)

^c According to customer's request

4.5. Electrical transients conduction along supply lines only

4.5.1. Equipment

E0191, E1050A-M
Detailed information see chapter 5.1

4.5.2. Procedure and setup

The test was done inside the high frequency laboratory 2 of the EMC-Test Laboratory Seibersdorf.

Test procedure and setup were according to ISO 7637-2 and UN/ECE Reg. 10 chapter 6.9 / annex 10.

12 V system:

| Test pulse | Test parameters |
|------------|---|
| 1 | $U_s = -75 \text{ V}$, $R_i = 10 \ \Omega$, $t_d = 2 \text{ ms}$, $t_r = 1 \ \mu\text{s}$, $t_1 = 0.5 \text{ s}$, $t_2 = 200 \text{ ms}$, $t_3 < 100 \ \mu\text{s}$ |
| 2a | $U_s = +37 \text{ V}$, $R_i = 2 \ \Omega$, $t_d = 0.05 \text{ ms}$, $t_r = 1 \ \mu\text{s}$, $t_1 = 0.5 \text{ s}$ |
| 2b | $U_s = +10 \text{ V}$, $R_i = 0.05 \ \Omega$, $t_d = 200 \text{ ms}$, $t_r = 1 \text{ ms}$, $t_{12} = 1 \text{ ms}$, $t_6 = 1 \text{ ms}$ |
| 3a | $U_s = -112 \text{ V}$, $R_i = 50 \ \Omega$, $t_d = 0.1 \ \mu\text{s}$, $t_r = 5 \text{ ns}$, $t_1 = 100 \ \mu\text{s}$, $t_4 = 10 \text{ ms}$, $t_5 = 90 \text{ ms}$ |
| 3b | $U_s = +75 \text{ V}$, $R_i = 50 \ \Omega$, $t_d = 0.1 \ \mu\text{s}$, $t_r = 5 \text{ ns}$, $t_1 = 100 \ \mu\text{s}$, $t_4 = 10 \text{ ms}$, $t_5 = 90 \text{ ms}$ |
| 4 | $U_s = -6 \text{ V}$, $U_a = -6 \text{ V}$, $R_i \leq 0.02 \ \Omega$, $t_7 = 15 \text{ ms}$, $t_8 \leq 50 \text{ ms}$, $t_9 = 5 \text{ s}$, $t_{10} = 5 \text{ ms}$, $t_{11} = 5 \text{ ms}$ |

Table 17: Test parameters

24 V system:

| Test pulse | Test parameters |
|------------|---|
| 1 | $U_s = -450 \text{ V}$, $R_i = 50 \ \Omega$, $t_d = 1 \text{ ms}$, $t_r = 3 \ \mu\text{s}$, $t_1 = 2.0 \text{ s}$, $t_2 = 200 \text{ ms}$, $t_3 < 100 \ \mu\text{s}$ |
| 2a | $U_s = +37 \text{ V}$, $R_i = 2 \ \Omega$, $t_d = 0.05 \text{ ms}$, $t_r = 1 \ \mu\text{s}$, $t_1 = 0.5 \text{ s}$ |
| 2b | $U_s = +20 \text{ V}$, $R_i = 0.05 \ \Omega$, $t_d = 200 \text{ ms}$, $t_r = 1 \text{ ms}$, $t_{12} = 1 \text{ ms}$, $t_6 = 1 \text{ ms}$ |
| 3a | $U_s = -150 \text{ V}$, $R_i = 50 \ \Omega$, $t_d = 0.1 \ \mu\text{s}$, $t_r = 5 \text{ ns}$, $t_1 = 100 \ \mu\text{s}$, $t_4 = 10 \text{ ms}$, $t_5 = 90 \text{ ms}$ |
| 3b | $U_s = +150 \text{ V}$, $R_i = 50 \ \Omega$, $t_d = 0.1 \ \mu\text{s}$, $t_r = 5 \text{ ns}$, $t_1 = 100 \ \mu\text{s}$, $t_4 = 10 \text{ ms}$, $t_5 = 90 \text{ ms}$ |
| 4 | $U_s = -12 \text{ V}$, $U_a = -12 \text{ V}$, $R_i \leq 0.02 \ \Omega$, $t_7 = 50 \text{ ms}$, $t_8 \leq 50 \text{ ms}$, $t_9 = 5 \text{ s}$, $t_{10} = 5 \text{ ms}$, $t_{11} = 5 \text{ ms}$ |

Table 18: Test parameters

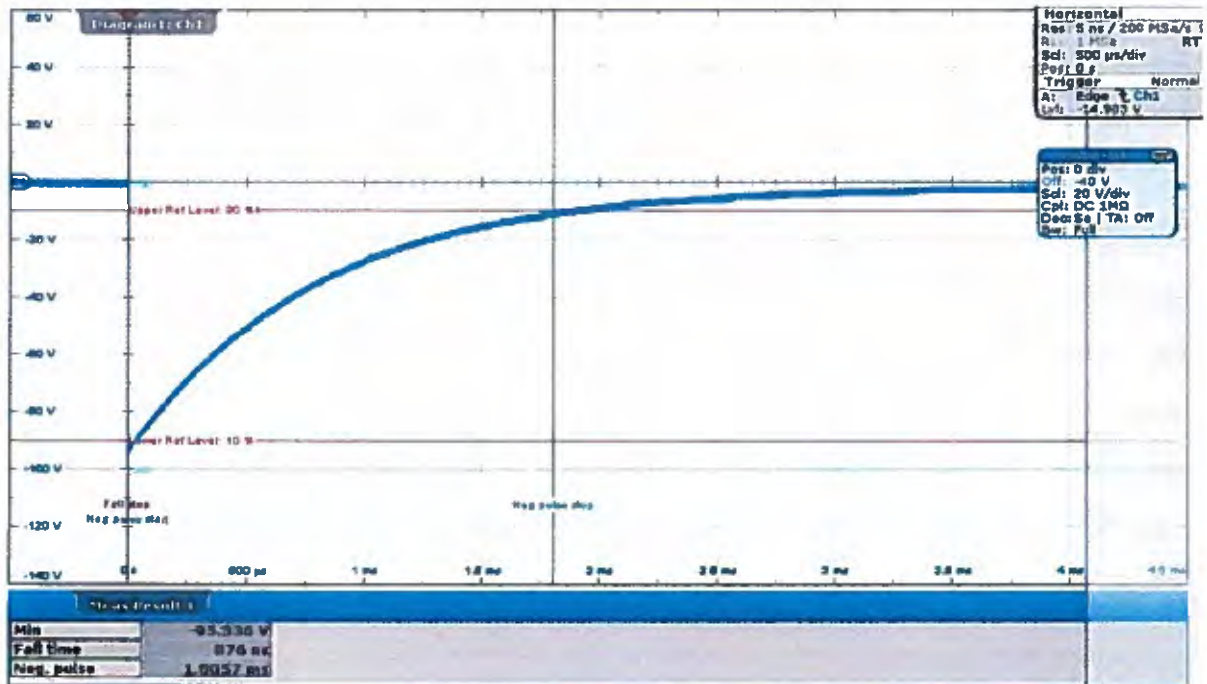


Figure 6: Verification Pulse 1, 12 V, open

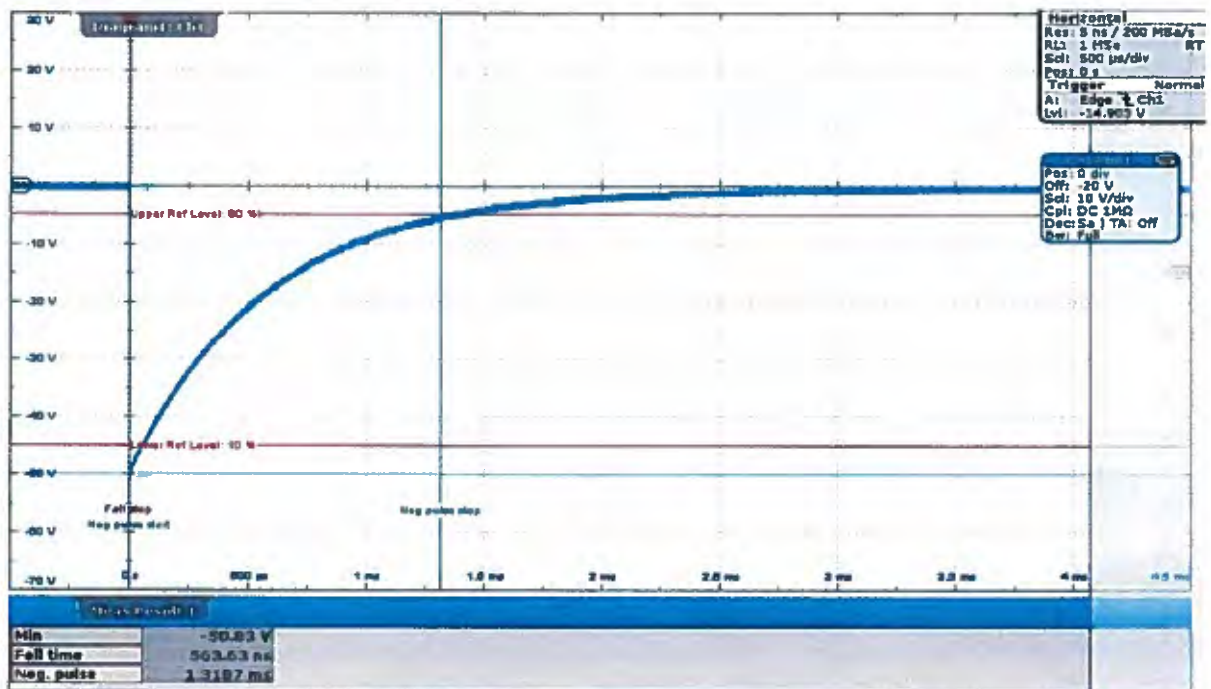


Figure 7: Verification Pulse 1, 12 V, load

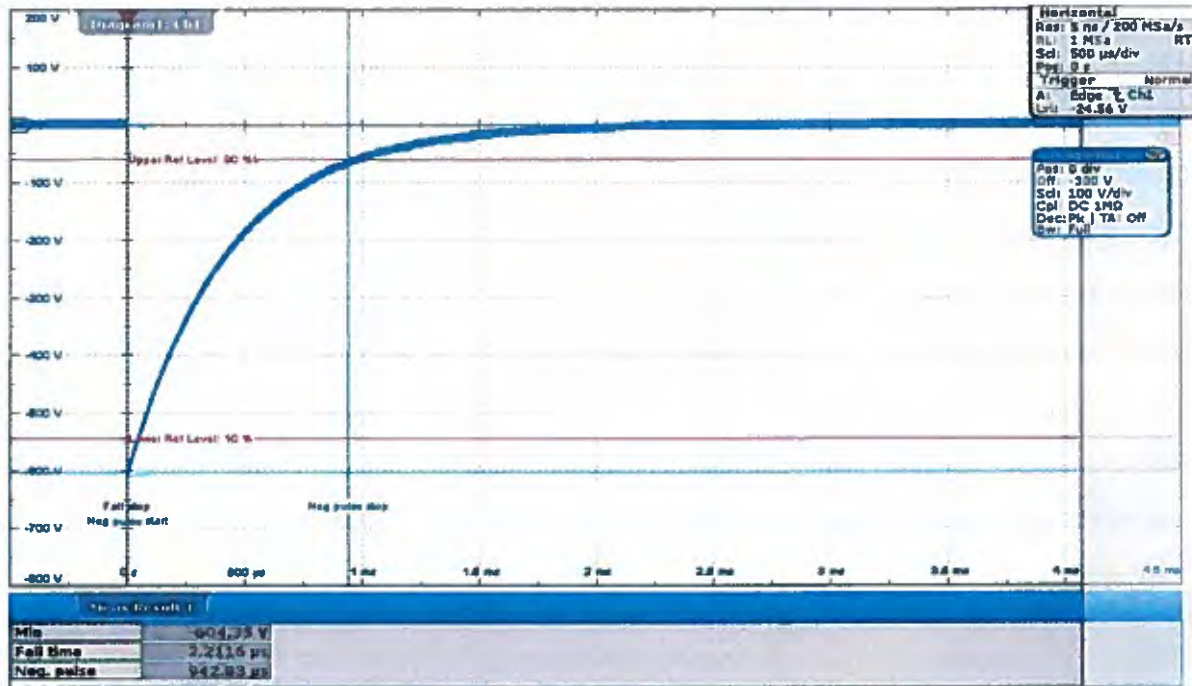


Figure 8: Verification Pulse 1, 24 V, open

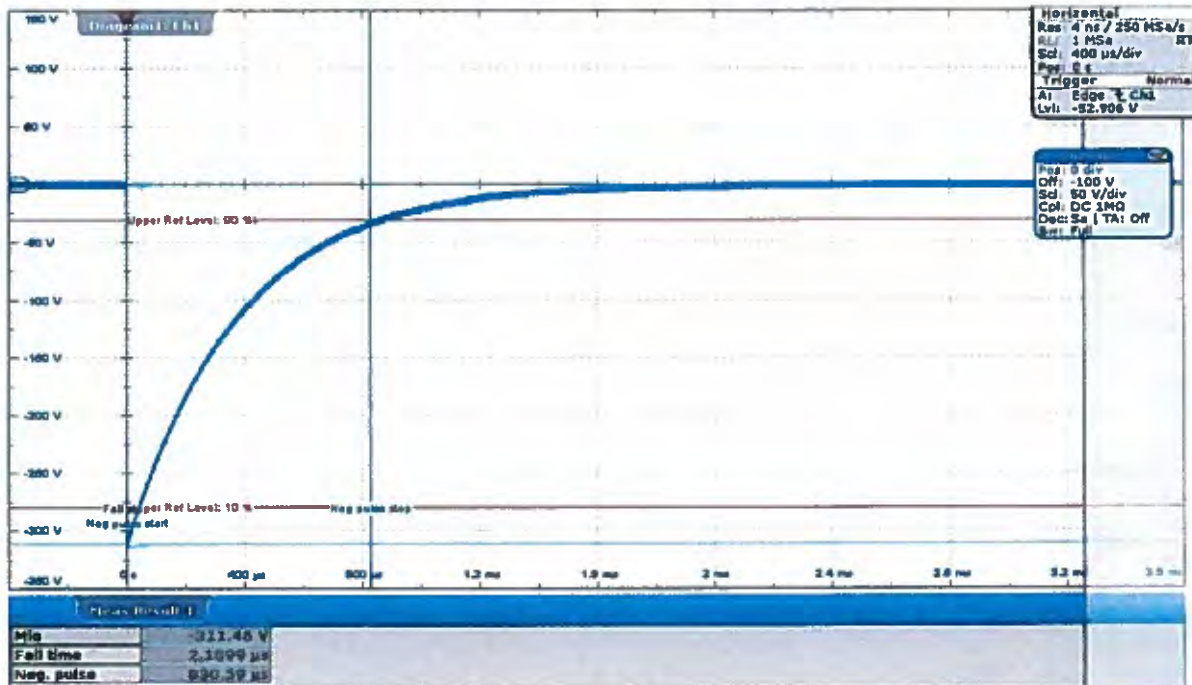


Figure 9: Verification Pulse 1, 24 V, load

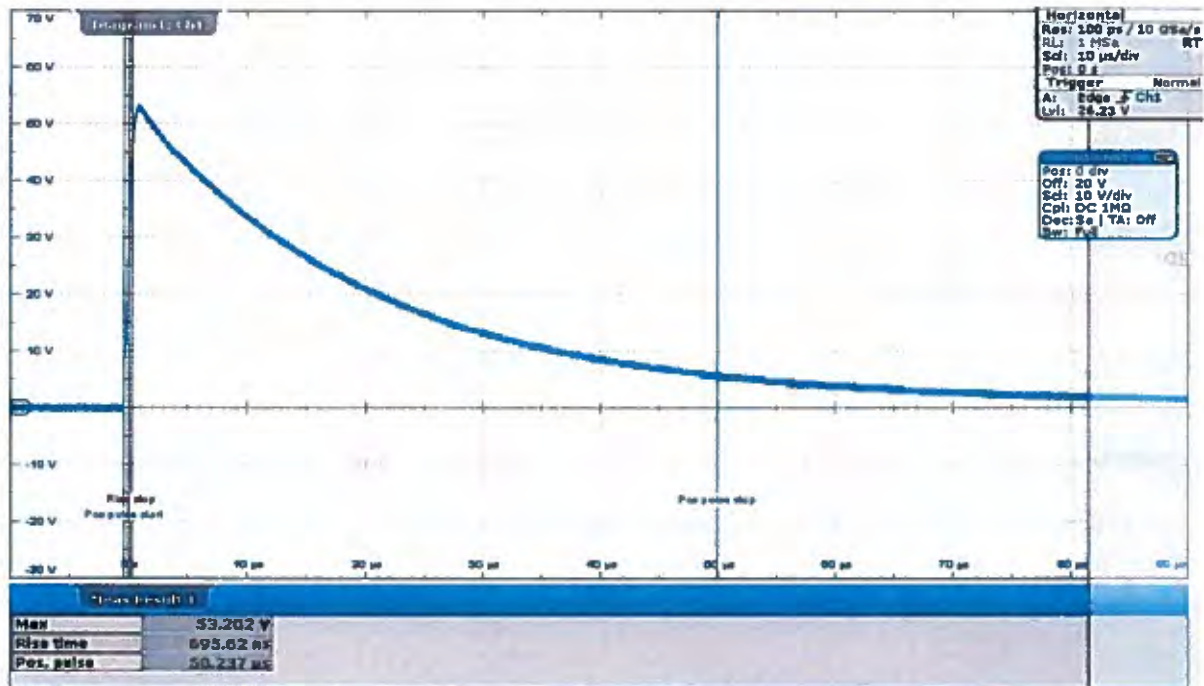


Figure 10: Verification Pulse 2a, 12 V / 24 V, open

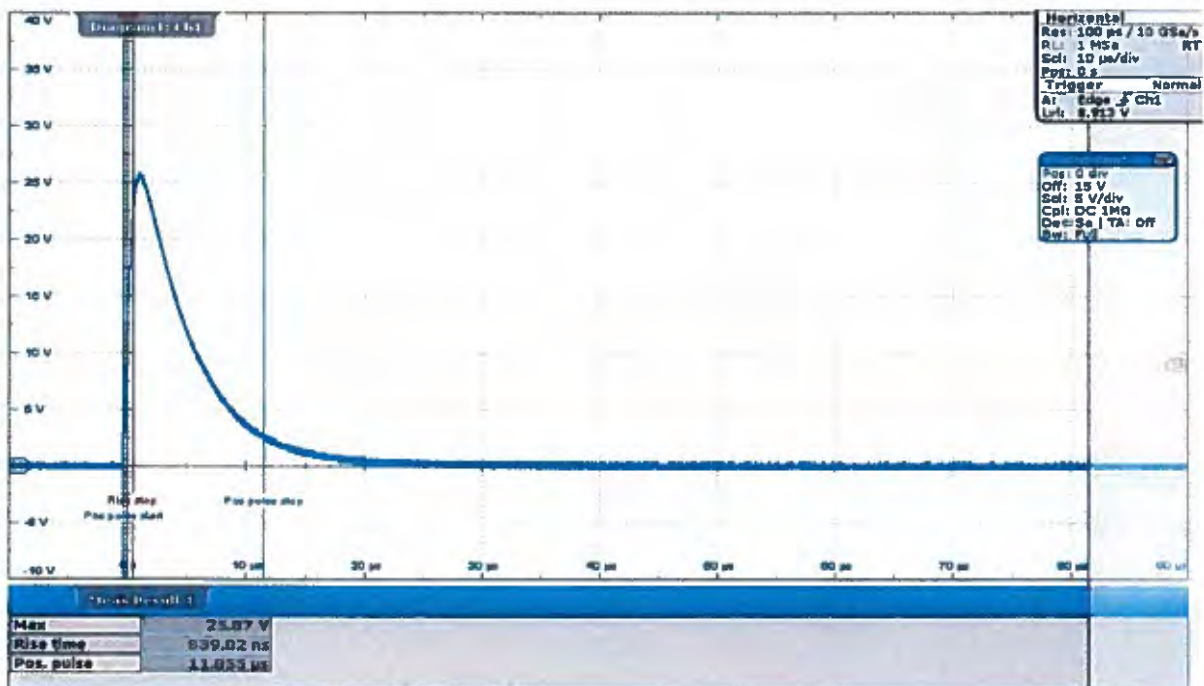


Figure 11: Verification Pulse 2a, 12 V / 24 V, load

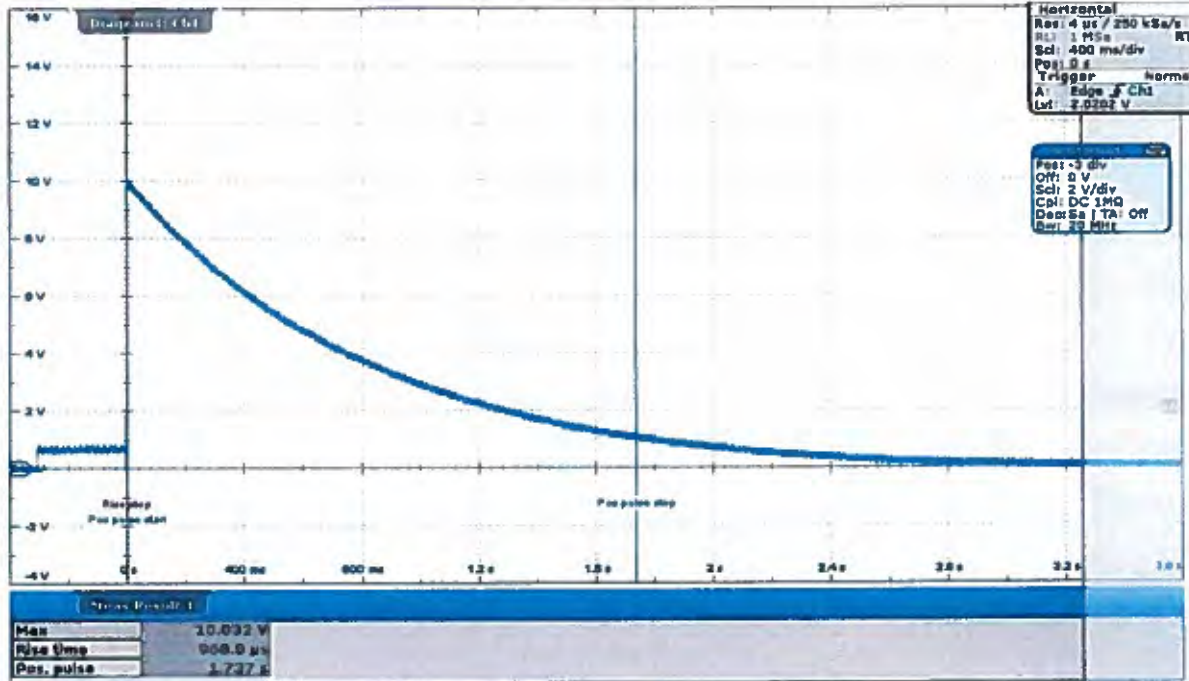


Figure 12: Verification Pulse 2b, 12 V / 24 V, open

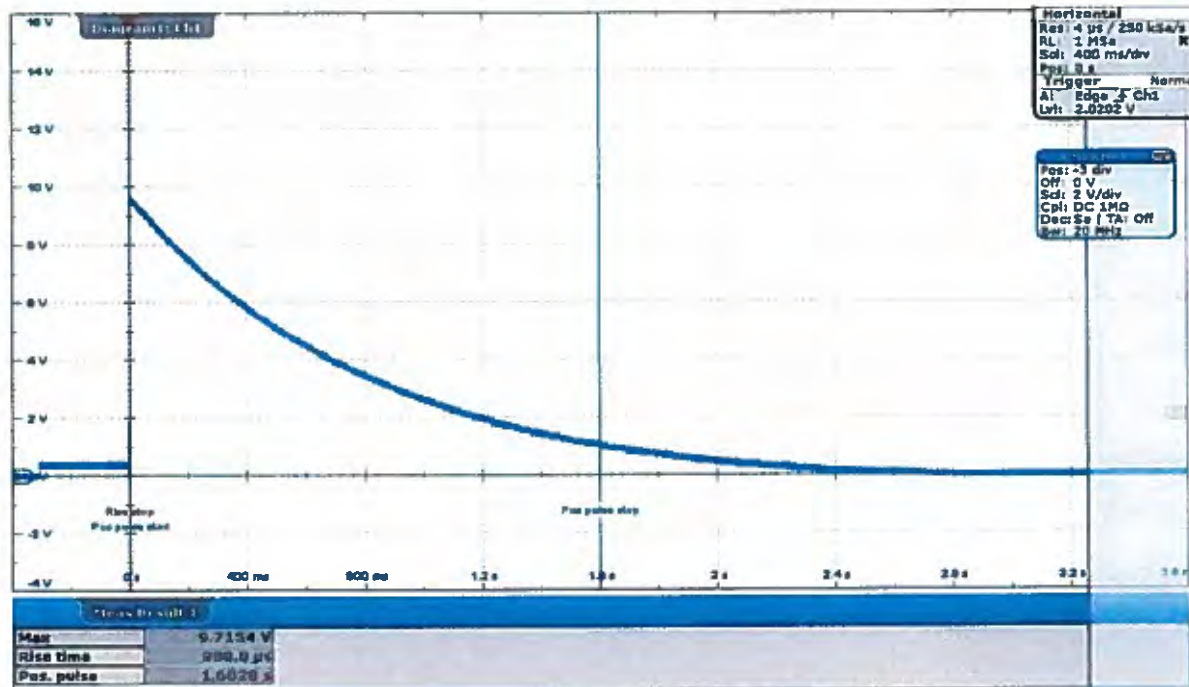


Figure 13: Verification Pulse 2b, 12 V / 24 V, load

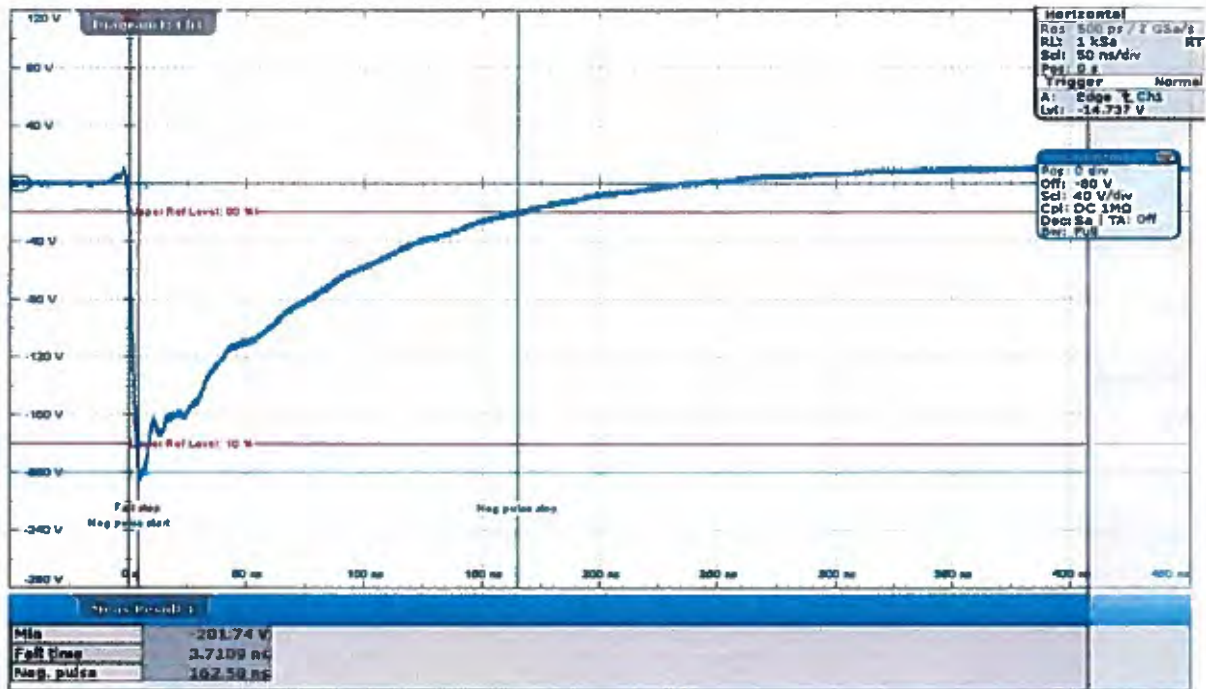


Figure 14: Verification Pulse 3a, 12 V / 24 V, open

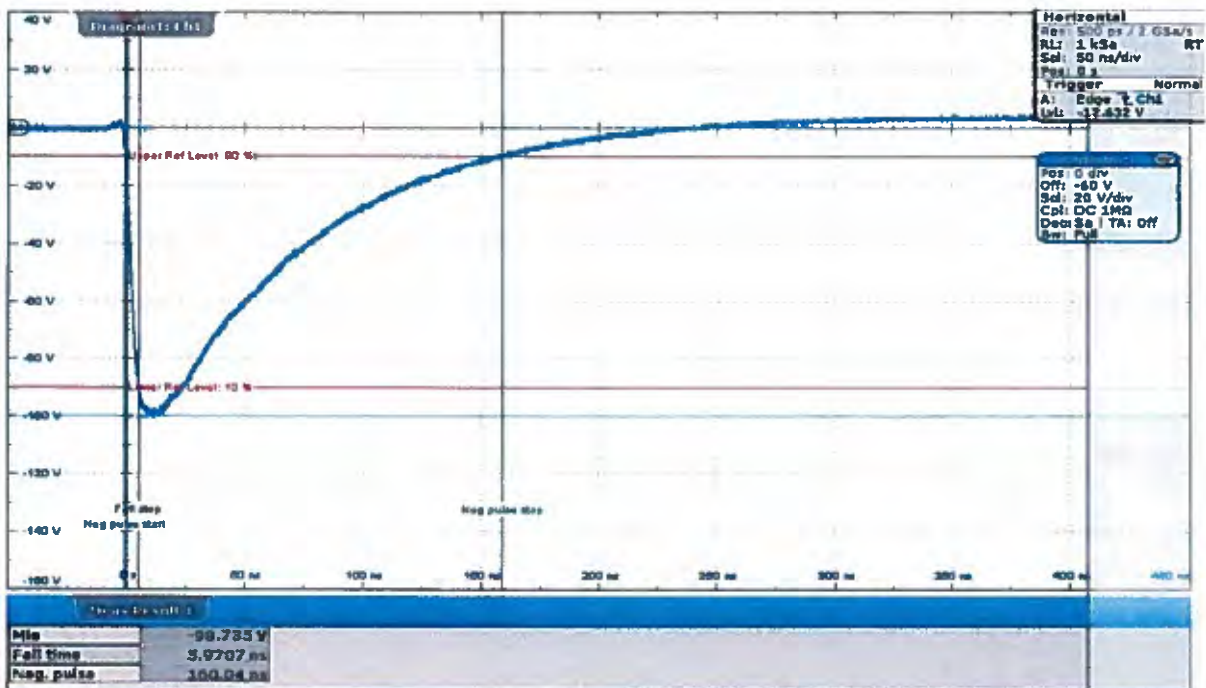


Figure 15: Verification Pulse 3a, 12 V / 24 V, load

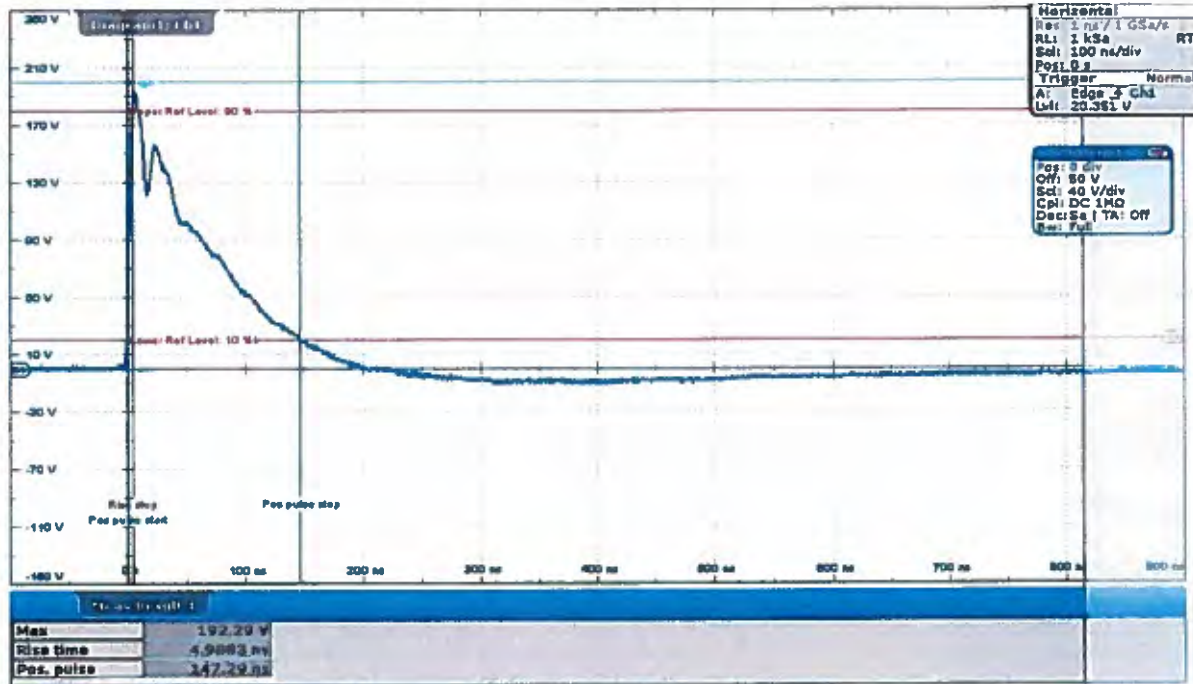


Figure 16: Verification Pulse 3b, 12 V / 24 V, open

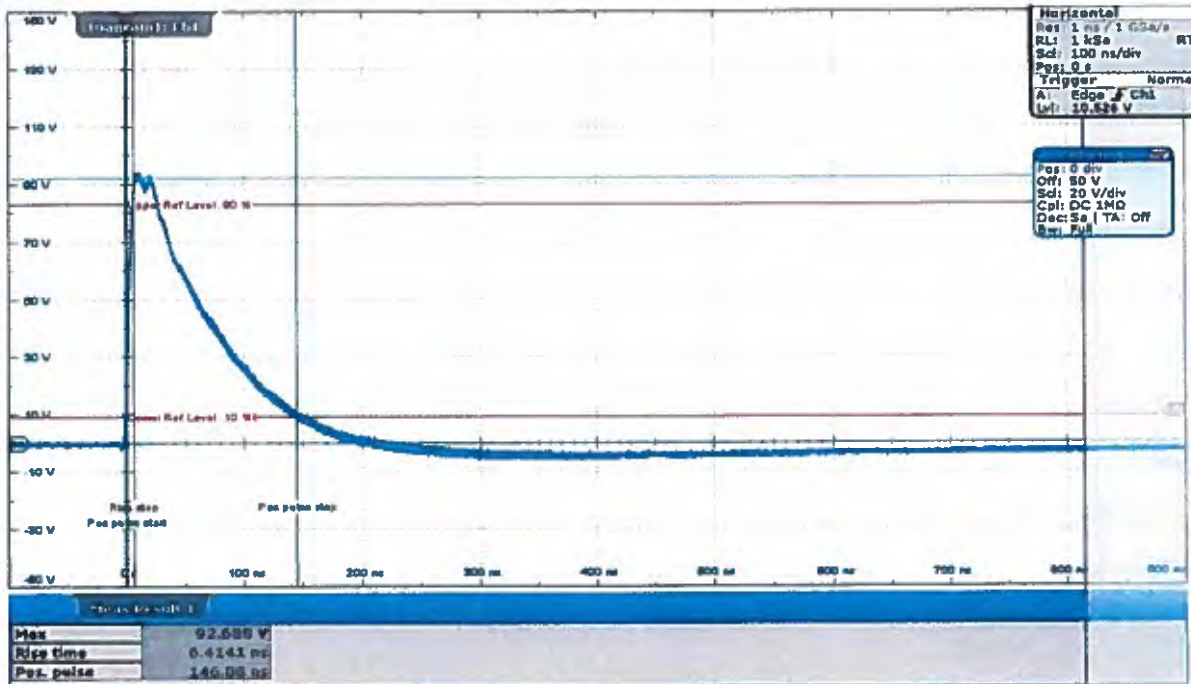


Figure 17: Verification Pulse 3b, 12 V / 24 V, load

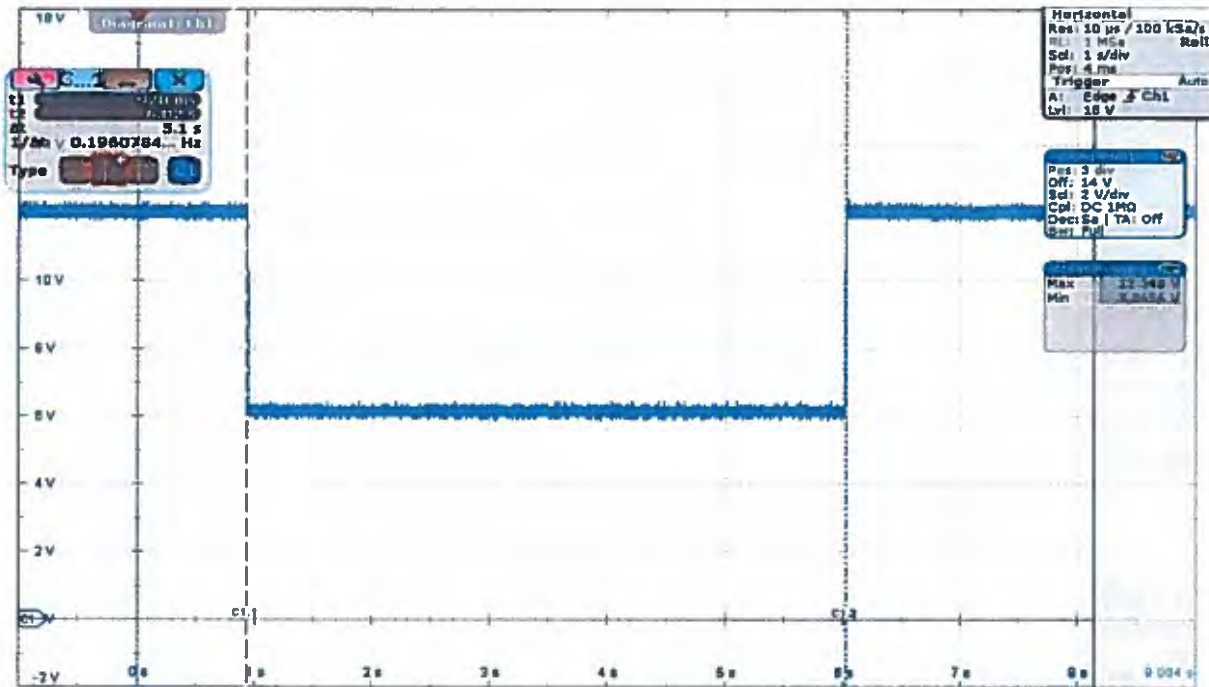


Figure 18: Verification Pulse 4, 12 V (informative)

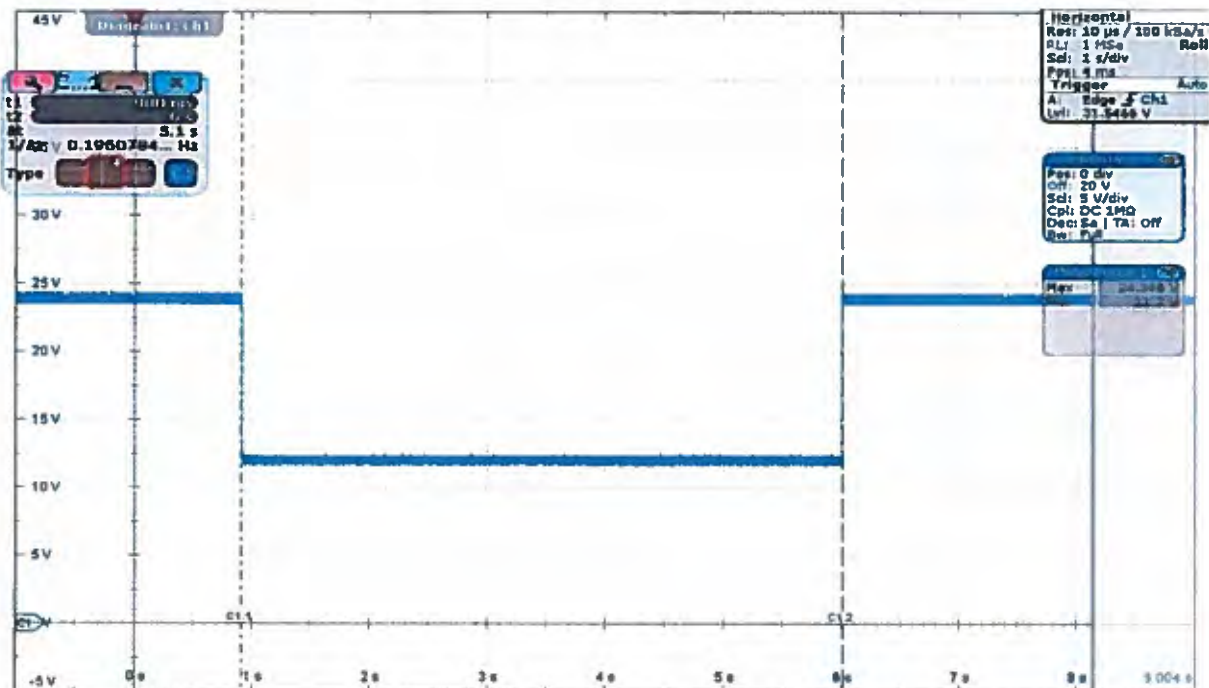


Figure 19: Verification Pulse 4, 24 V (informative)

4.5.3. Results

12 V system:

| Test pulse | Duration / No. of Pulses | Test level [V] | Criterion ^d | | Result |
|------------|-----------------------------|-------------------|------------------------|----------|--------|
| | | | required | achieved | |
| 1 | 5000 pulse | -75 | C | C | PASS |
| 2a | 5000 pulse | +37 | B | A | PASS |
| 2b | 10 pulse | +10 | C | C | PASS |
| 3a | 1 h | -112 | A | A | PASS |
| 3b | 1 h | +75 | A | A | PASS |
| 4 | 1 | -6 | C | C | PASS |

Table 19: Results

24 V system:

| Test pulse | Duration / No. of Pulses | Test level [V] | Criterion ^d | | Result |
|------------|-----------------------------|-------------------|------------------------|----------|--------|
| | | | required | achieved | |
| 1 | 5000 pulse | -450 | C | C | PASS |
| 2a | 5000 pulse | +37 | B | A | PASS |
| 2b | 10 pulse | +20 | C | C | PASS |
| 3a | 1 h | -150 | A | A | PASS |
| 3b | 1 h | +150 | A | A | PASS |
| 4 | 1 | -12 | C | A | PASS |

Table 20: Results

^d Performance criteria / functional status according to UN/ECE R10 Rev.5 Table 2

5. Annex

5.1. Test equipment and ancillary equipment used for the tests

| ID-No. | Identification | Type | SNo | Manufacturer |
|----------|---|--|--|--------------------|
| E0191 | Digital-oscilloscope | RTO1024 | 200392 | Rohde & Schwarz |
| E0207 | Signal Generator | SMB100A | 177948 | Rohde & Schwarz |
| E0421 | Injection Probe | 9142-1N | 945017 | Solar |
| E0422 | Injection Probe | 9144-1N | 935716 | Solar |
| E0569 | Biconical antenna | 93110B | 9603-2369 | EMCO |
| E0717 | Power Amplifier | AR 50S1G4 | 27947 | Amplifier Research |
| E0731 | Pre-Amplifier | AM-1300 | 274711 | Miteq |
| E0802 | Directional coupler | Narda 3020A | 31126 | Narda |
| E0821 | Directional coupler | DC7144 | 27686 | Amplifier Research |
| E0915 | EMC Measurement Software EMC32 | V 10 01 | 100280/101333 | Rohde & Schwarz |
| E1052A-M | Automotive Test System | MT 5511, FT 5531, LD 5550, FLX 5510, DS 5630, PA 5640, TC 5650, FG 5620, CT 5610, PA 5840-300, AES 5501, INA 5500-TL, Autostar | 1418, 1996, 2080, 1031, 1293, 1250, 1218, 1353, 2473, 9121, 1290, 1915, V6.2.2 | Teseq |
| E1147 | Thermo-Hygrometer | Testo | 608-H2 | 66010829 |
| E1373 | Attenuator 3 dB | 1000-A-MFN-3 | 1137 | Bird |
| E1601 | Horn antenna | AT4002A | 28172 | Amplifier Research |
| E1705 | Log periodic antenna | VULP9118C | 9118 C-532 | Schwarzbeck |
| LE0044 | Automotive Component test chamber | ACTC+CR | FF150031 | Frankonia |
| LE0056 | EMI Test Receiver | ESW8 | 100948 | Rohde & Schwarz |
| LE0059 | Broadband Power Amplifier | BBA150-A1300 | 101757 | Rohde&Schwarz |
| LE0060 | Line-Impedance-Stabilization-Network Automotive | NNBM 8124 N | 06055 | Schwarzbeck |
| LE0061 | Line-Impedance-Stabilization-Network Automotive | NNBM 8124 N | 06062 | Schwarzbeck |

Table 21: Catalogue of measurement and test equipment used for the tests

5.2. Photos of the DUT and the configuration

| | |
|---|----|
| Photo 1: Test setup in the anechoic chamber, radiated emissions – ALSE method from 30 to 200 MHz | 27 |
| Photo 2: Test setup in the anechoic chamber, radiated emissions – ALSE method from 200 to 1000 MHz | 27 |
| Photo 3: Test setup in the laboratory 2, conducted emissions – voltage transients..... | 28 |
| Photo 4: Test setup in the anechoic chamber, Bulk current injection (BCI) from 20 to 400 MHz | 28 |
| Photo 5: Test setup in the anechoic chamber, Radio-frequency electromagnetic fields – Absorber lined shielded enclosure (ALSE) from 400 to 1000 MHz..... | 29 |
| Photo 6: Test setup in the anechoic chamber, Radio-frequency electromagnetic fields – Absorber lined shielded enclosure (ALSE) from 1000 to 2000 MHz..... | 29 |
| Photo 7: Test setup in the laboratory 2, Electrical transients conduction along supply lines only | 30 |
| Photo 8: ESA detail | 30 |



**Photo 1: Test setup in the anechoic chamber,
radiated emissions – ALSE method from 30 to 200 MHz**



**Photo 2: Test setup in the anechoic chamber,
radiated emissions – ALSE method from 200 to 1000 MHz**



Photo 3: Test setup in the laboratory 2,
conducted emissions – voltage transients



Photo 4: Test setup in the anechoic chamber,
Bulk current injection (BCI) from 20 to 400 MHz



Photo 5: Test setup in the anechoic chamber, Radio-frequency electromagnetic fields – Absorber lined shielded enclosure (ALSE) from 400 to 1000 MHz



Photo 6: Test setup in the anechoic chamber, Radio-frequency electromagnetic fields – Absorber lined shielded enclosure (ALSE) from 1000 to 2000 MHz



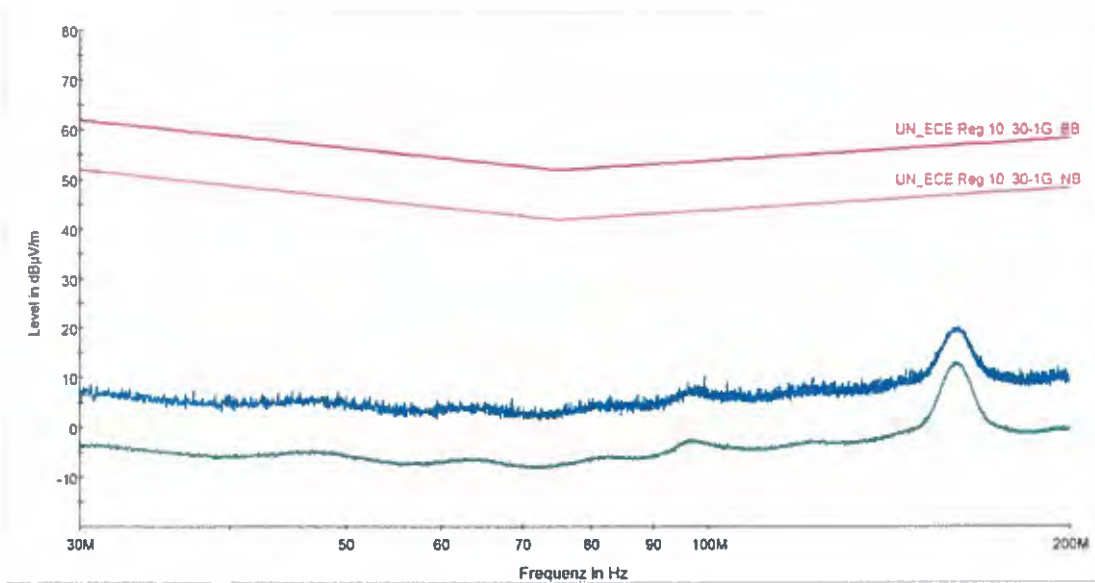
Photo 7: Test setup in the laboratory 2,
Electrical transients conduction along supply lines only



Photo 8: ESA detail

5.3. Charts

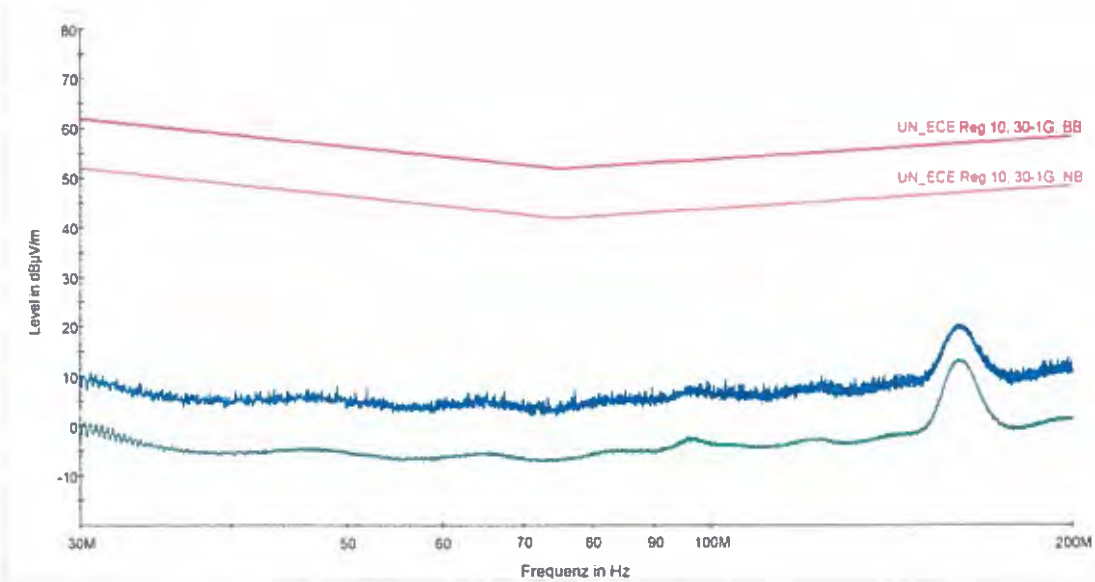
| | |
|--|----|
| Chart 1: Radiated emissions – ALSE method from 30 to 200 MHz, horizontal..... | 32 |
| Chart 2: Radiated emissions – ALSE method from 30 to 200 MHz, vertical..... | 32 |
| Chart 3: Radiated emissions – ALSE method from 200 to 1000 MHz, horizontal..... | 33 |
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| Chart 9: Conducted emissions – voltage transients slow repetitive transients..... | 36 |
| Chart 10: Conducted emissions – voltage transients slow pulses open..... | 36 |
| Chart 11: Conducted emissions – voltage transients slow pulses close..... | 37 |
| Chart 12: Conducted emissions – voltage transients fast repetitive transients..... | 37 |
| Chart 13: Conducted emissions – voltage transients fast pulses open..... | 38 |
| Chart 14: Conducted emissions – voltage transients fast pulses close..... | 38 |
| Chart 15: Conducted emissions – voltage transients slow repetitive transients..... | 39 |
| Chart 16: Conducted emissions – voltage transients slow pulses open..... | 39 |
| Chart 17: Conducted emissions – voltage transients slow pulses close..... | 40 |
| Chart 18: Conducted emissions – voltage transients fast repetitive transients..... | 40 |
| Chart 19: Conducted emissions – voltage transients fast pulses open..... | 41 |
| Chart 20: Conducted emissions – voltage transients fast pulses close..... | 41 |



— AVG_MAXH
 — PK+ _MAXH
 — UN_ECE Reg 10, 30-1G BB
 — UN_ECE Reg 10, 30-1G NB

E-2242_5 Hella 09.10.2017 MCI
 PB 1000C - 2
 12 V
 13 H

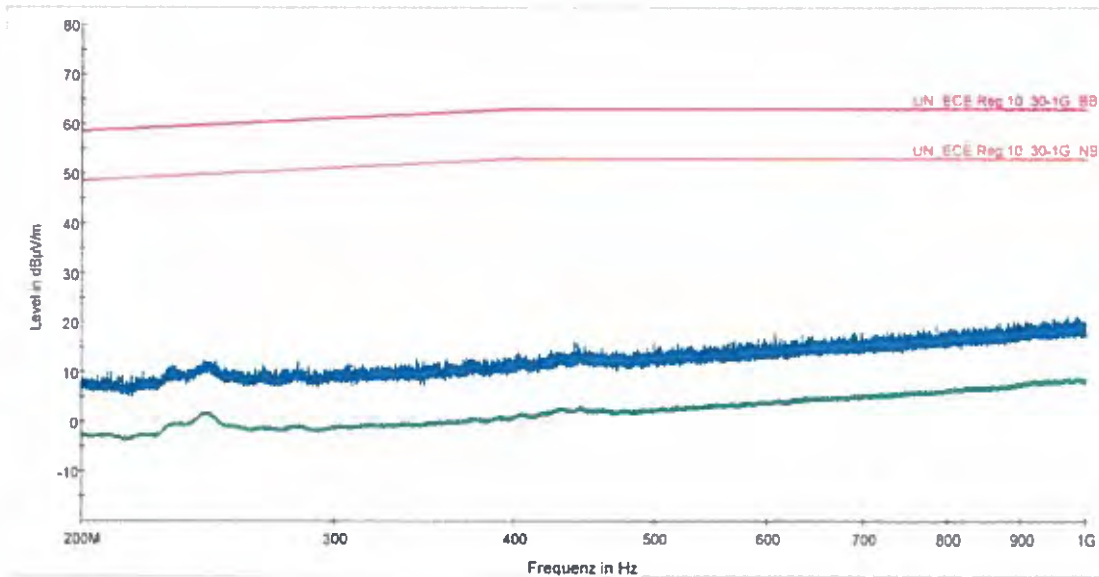
Chart 1: Radiated emissions – ALSE method from 30 to 200 MHz, horizontal



— AVG_MAXH
 — PK+ _MAXH
 — UN_ECE Reg 10, 30-1G BB
 — UN_ECE Reg 10, 30-1G NB

E-2242_5 Hella 09.10.2017 MCI
 PB 1000C - 2
 12 V
 14 V

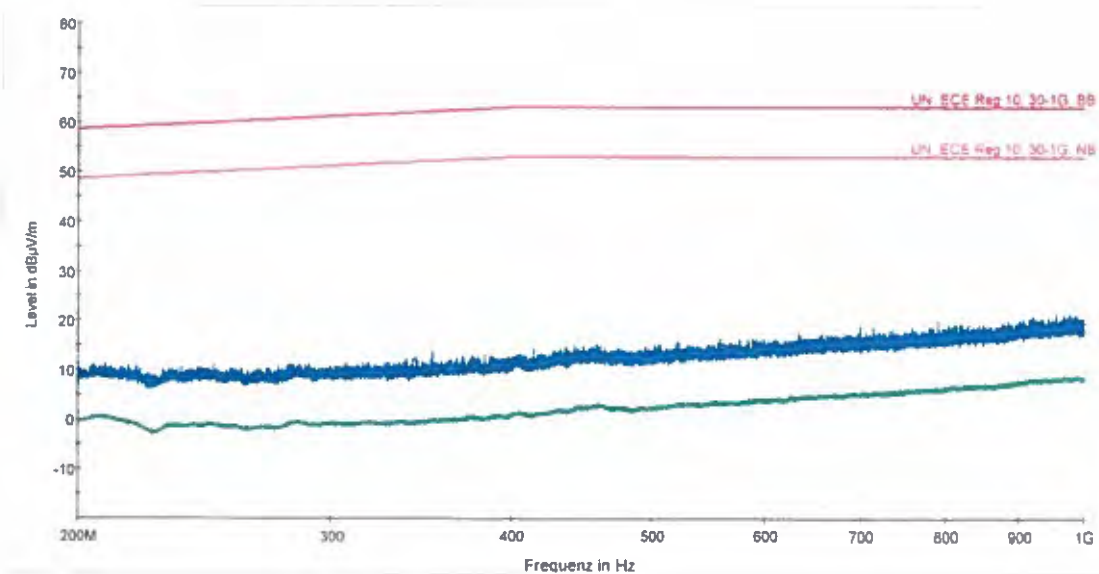
Chart 2: Radiated emissions – ALSE method from 30 to 200 MHz, vertical



— AVG_MAXH
— PK*_MAXH
— UN_ECE Reg 10_30-1G_BB
— UN_ECE Reg 10_30-1G_NB

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PB 1000C - 2
12 V
20 H

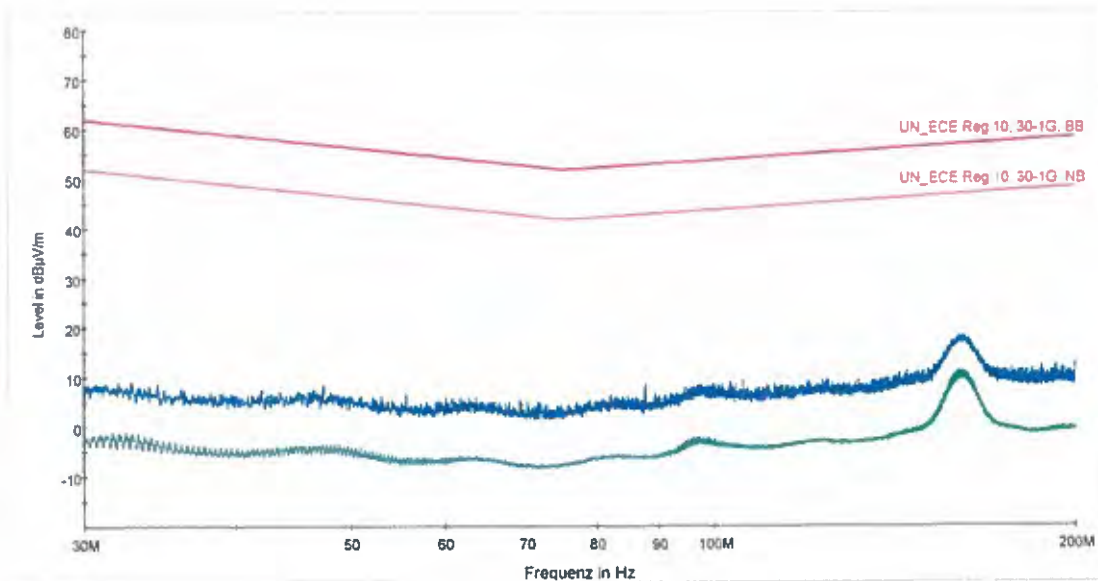
Chart 3: Radiated emissions – ALSE method from 200 to 1000 MHz, horizontal



— AVG_MAXH
— PK*_MAXH
— UN_ECE Reg 10_30-1G_BB
— UN_ECE Reg 10_30-1G_NB

E-2242_5 Hella 09 10 2017 MCI
PB 1000C - 2
12 V
19 V

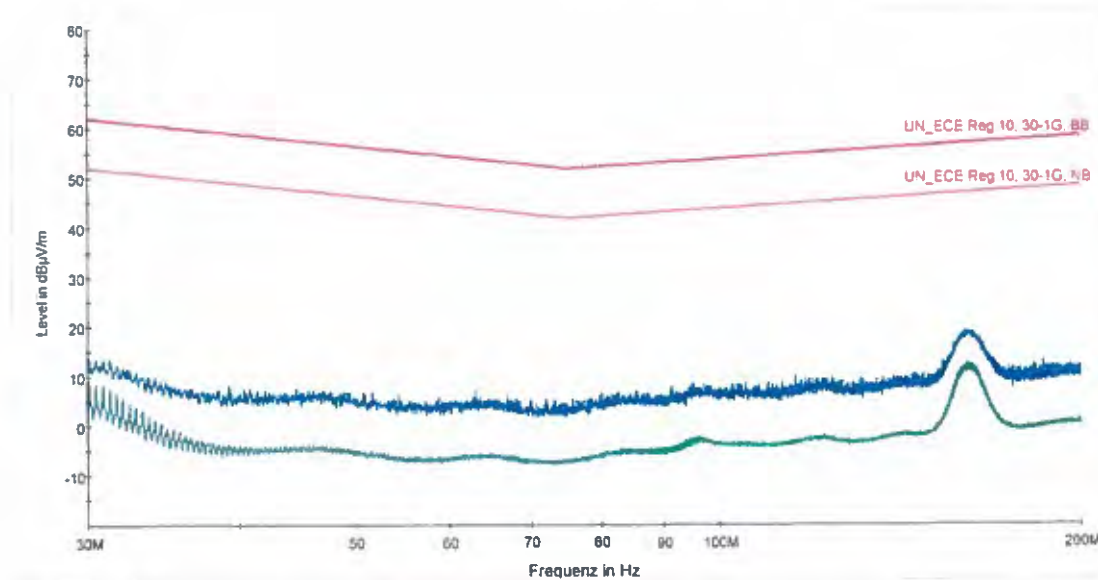
Chart 4: Radiated emissions – ALSE method from 200 to 1000 MHz, vertical



— AVG_MAXH
 — PK*_MAXH
 — UN_ECE Reg 10, 30-1G_BB
 — UN_ECE Reg 10, 30-1G_NB

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 PB 1000C - 2
 24 V
 16 H

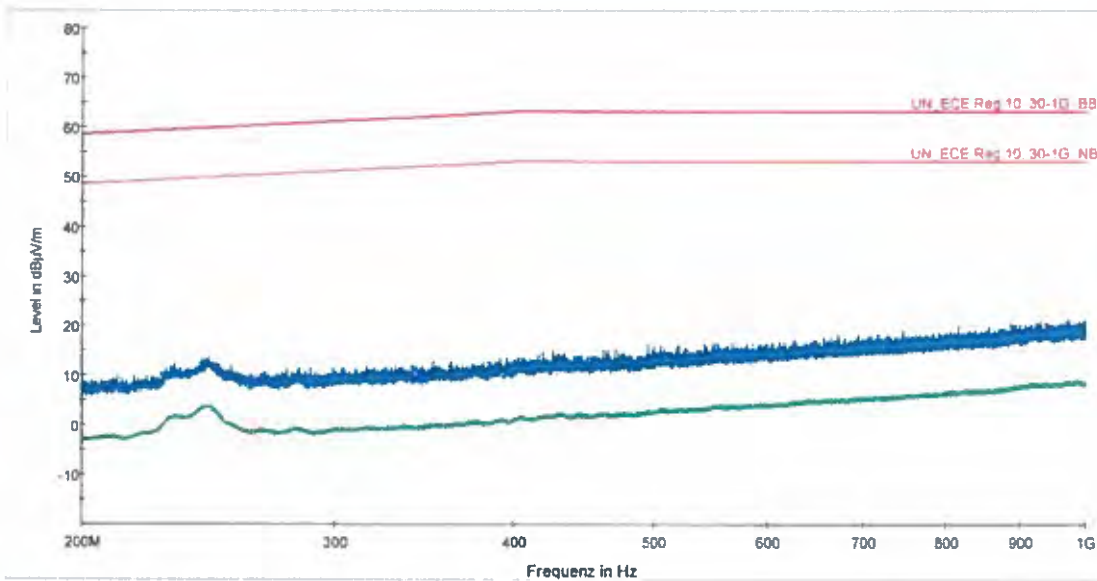
Chart 5: Radiated emissions – ALSE method from 30 to 200 MHz, horizontal



— AVG_MAXH
 — PK*_MAXH
 — UN_ECE Reg 10, 30-1G_BB
 — UN_ECE Reg 10, 30-1G_NB

E-2242_5 Hella 09 10 2017 MC
 PB 1000C - 2
 24 V
 15 V

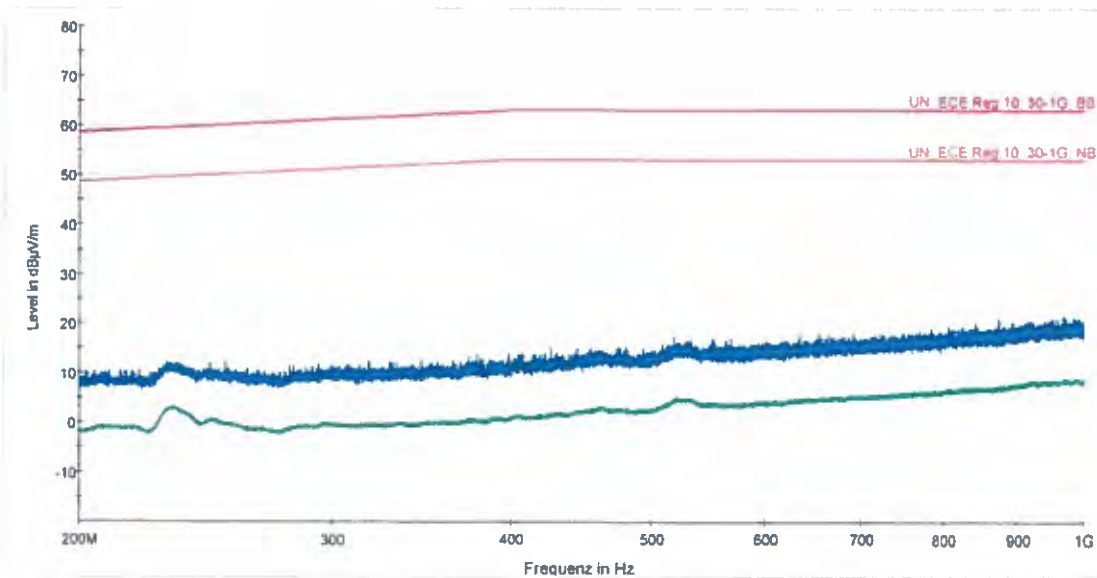
Chart 6: Radiated emissions – ALSE method from 30 to 200 MHz, vertical



— AVG_MAXH
 — PK+_MAXH
 — UN_ECE Reg 10_30-1G_BB
 — UN_ECE Reg 10_30-1G_NB

E-2242_5 Hella 09.10.2017 MCI
 PB 1000C - 2
 24 V
 17 H

Chart 7: Radiated emissions – ALSE method from 200 to 1000 MHz, horizontal



— AVG_MAXH
 — PK+_MAXH
 — UN_ECE Reg 10_30-1G_BB
 — UN_ECE Reg 10_30-1G_NB

E-2242_5 Hella 09.10.2017 MCI
 PB 1000C - 2
 24 V
 18 V

Chart 8: Radiated emissions – ALSE method from 200 to 1000 MHz, vertical

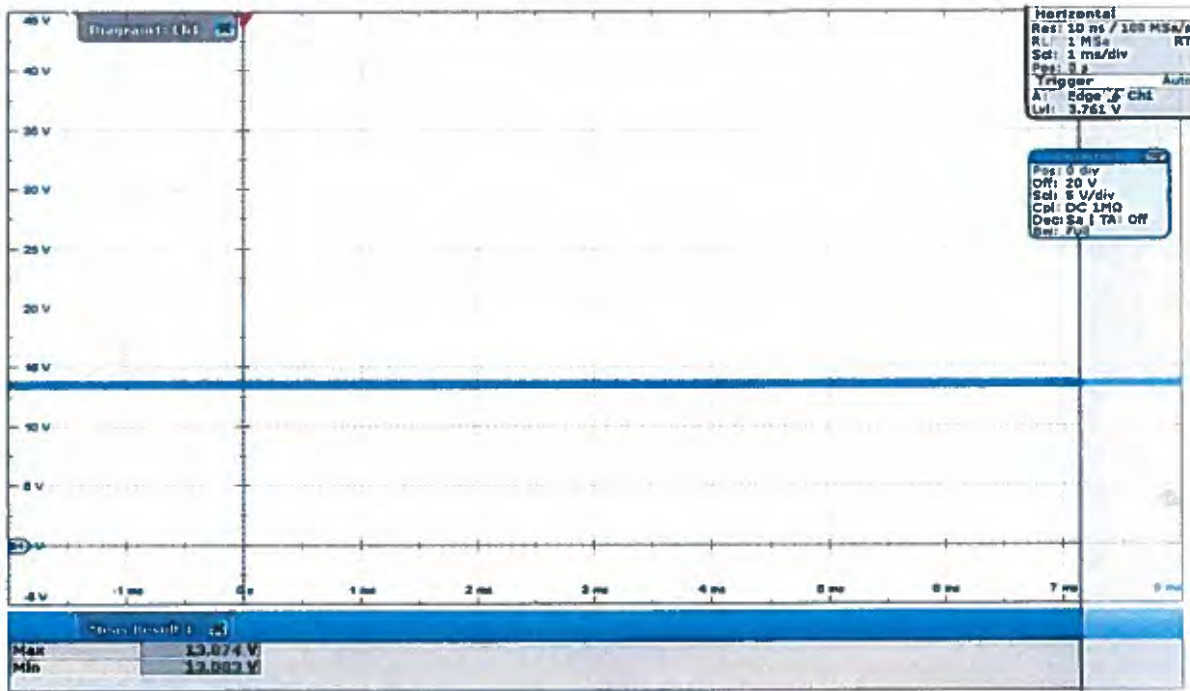


Chart 9: Conducted emissions – voltage transients
slow repetitive transients

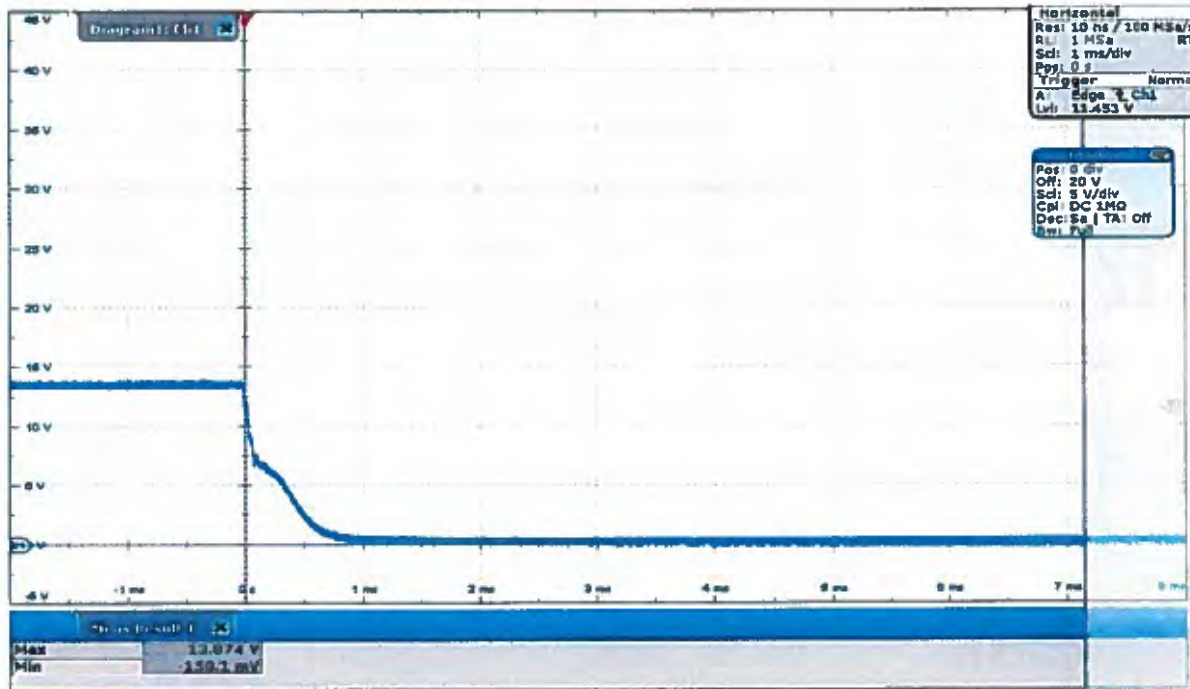


Chart 10: Conducted emissions – voltage transients
slow pulses open

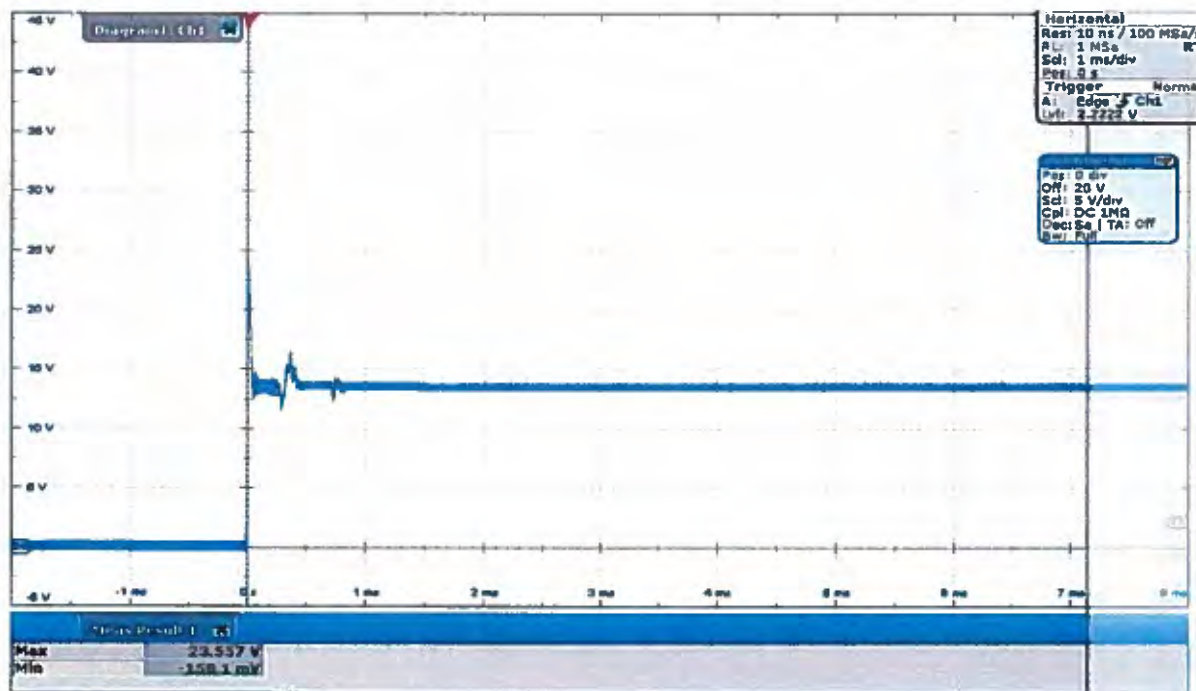


Chart 11: Conducted emissions – voltage transients
slow pulses close

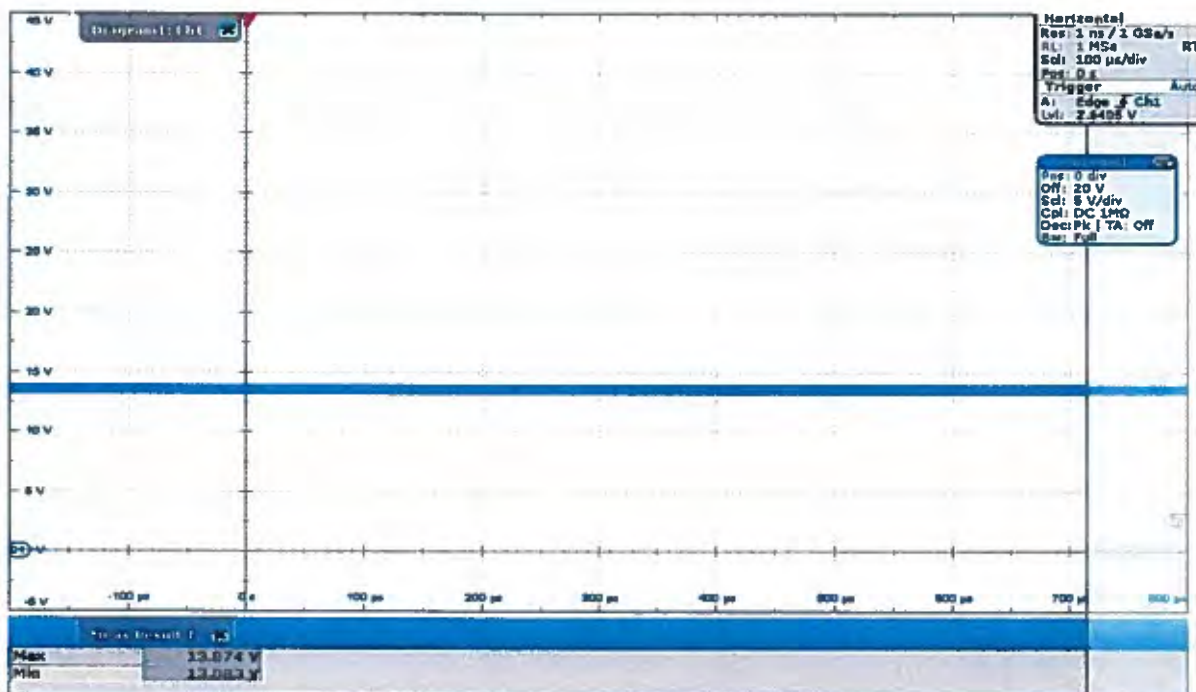


Chart 12: Conducted emissions – voltage transients
fast repetitive transients

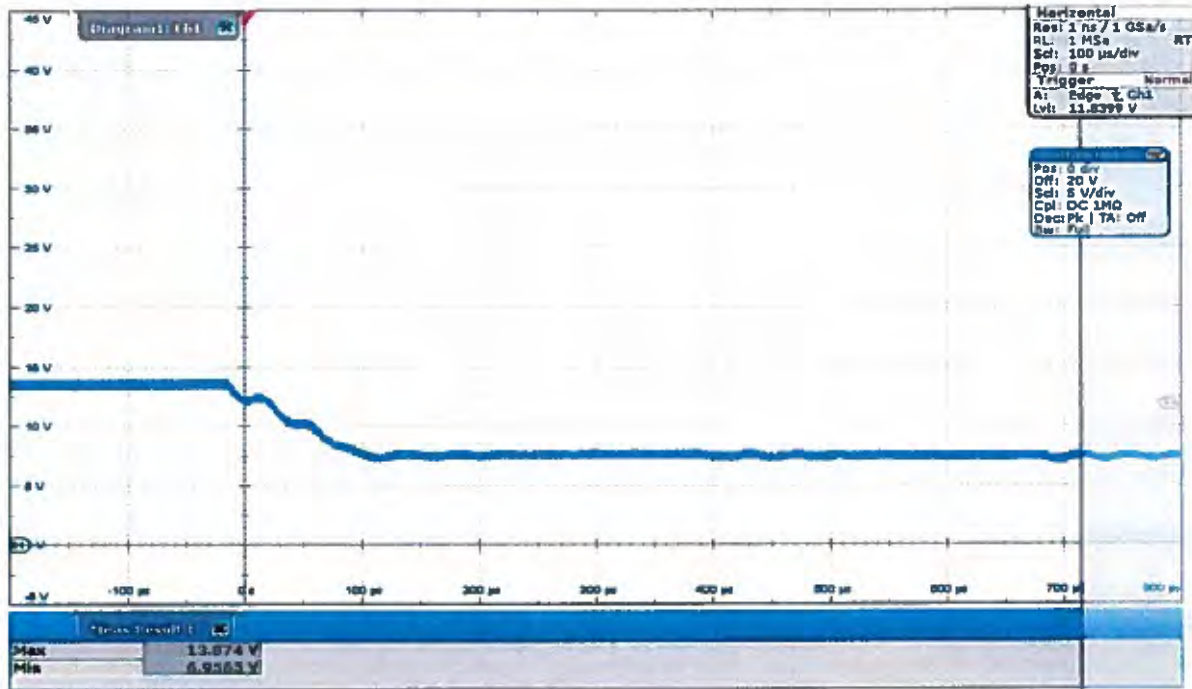


Chart 13: Conducted emissions – voltage transients
fast pulses open

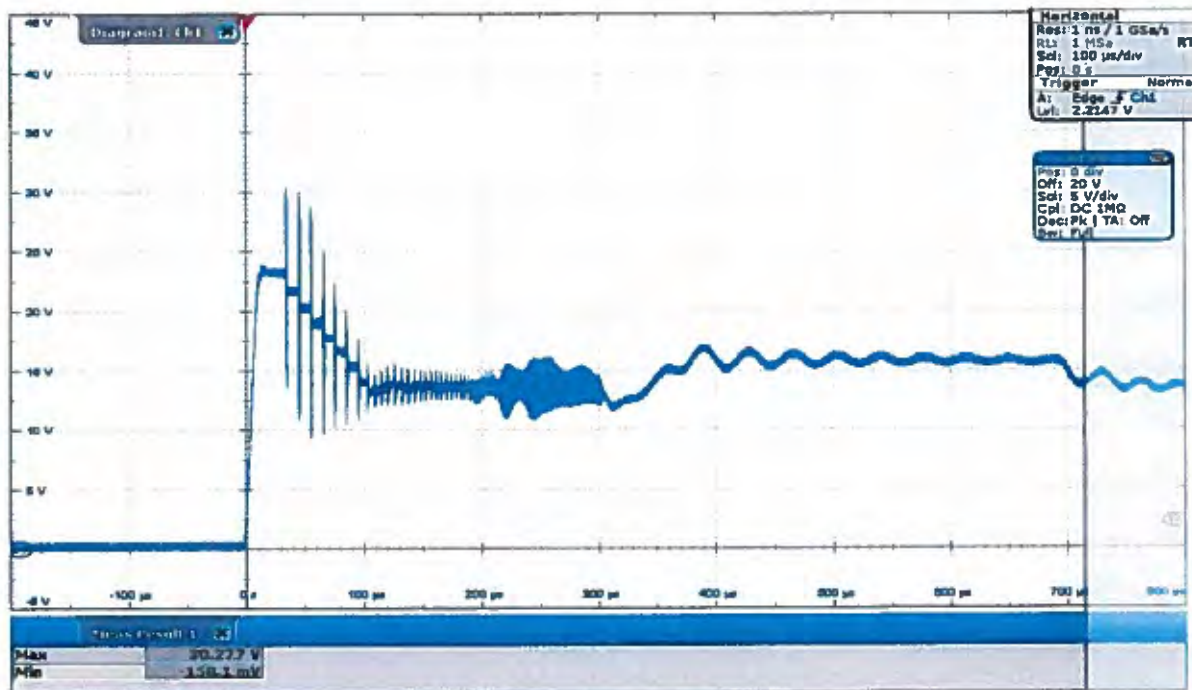


Chart 14: Conducted emissions – voltage transients
fast pulses close

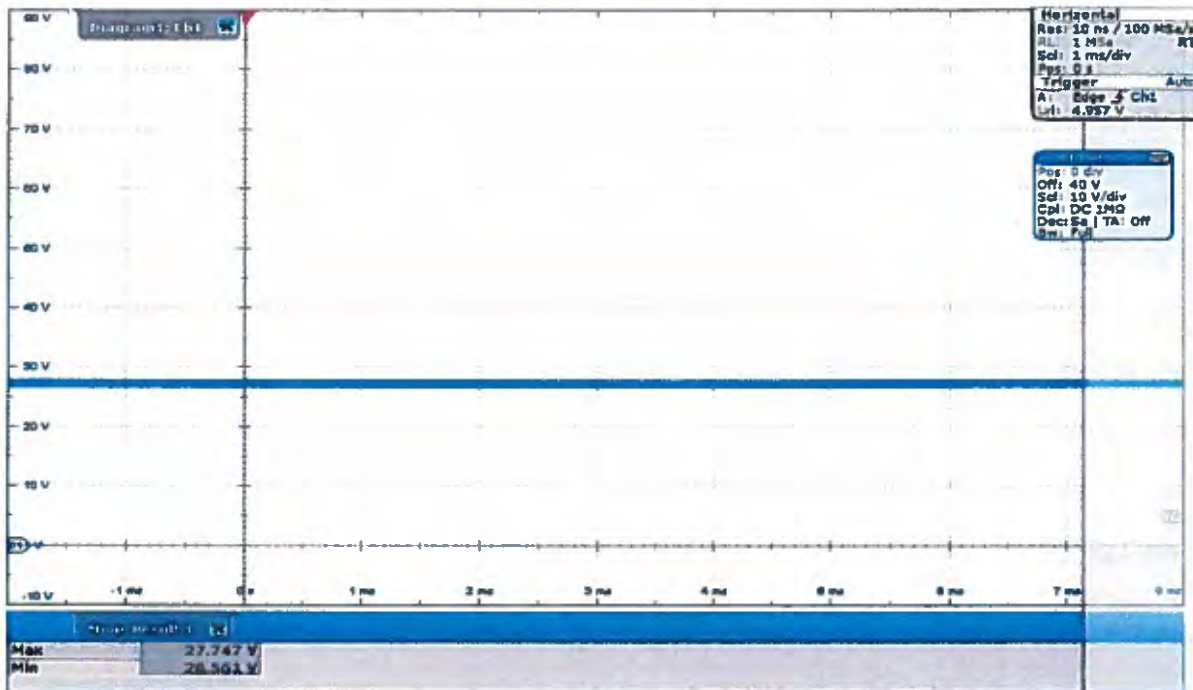


Chart 15: Conducted emissions – voltage transients
slow repetitive transients

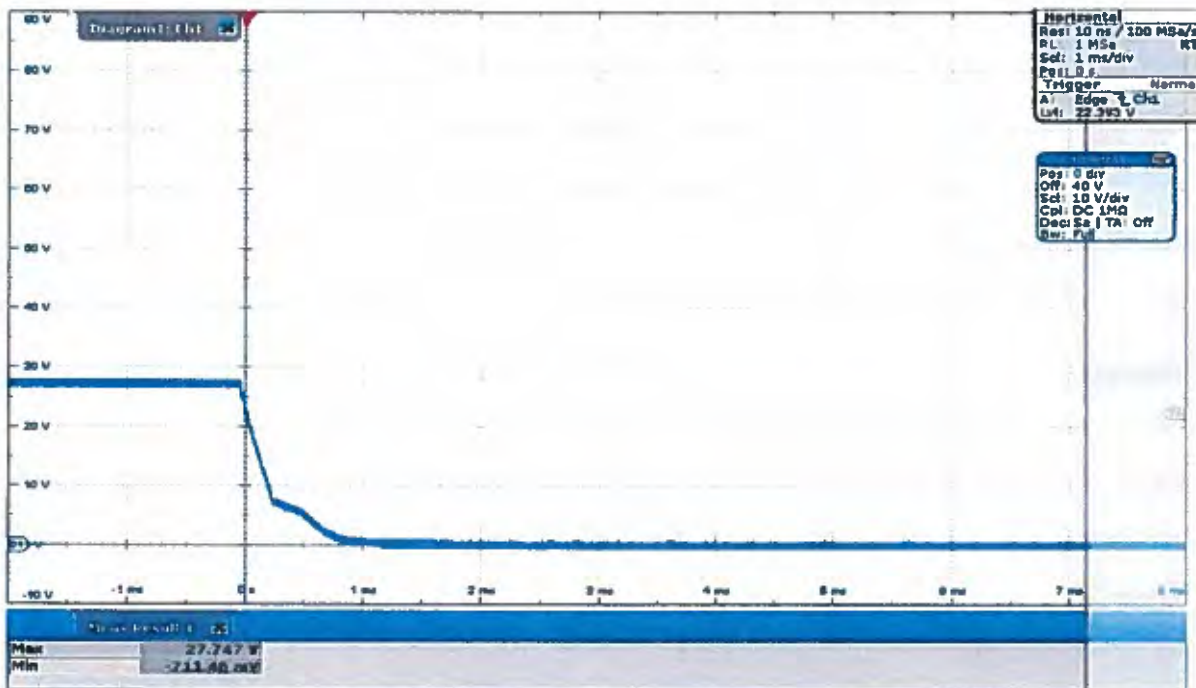


Chart 16: Conducted emissions – voltage transients
slow pulses open

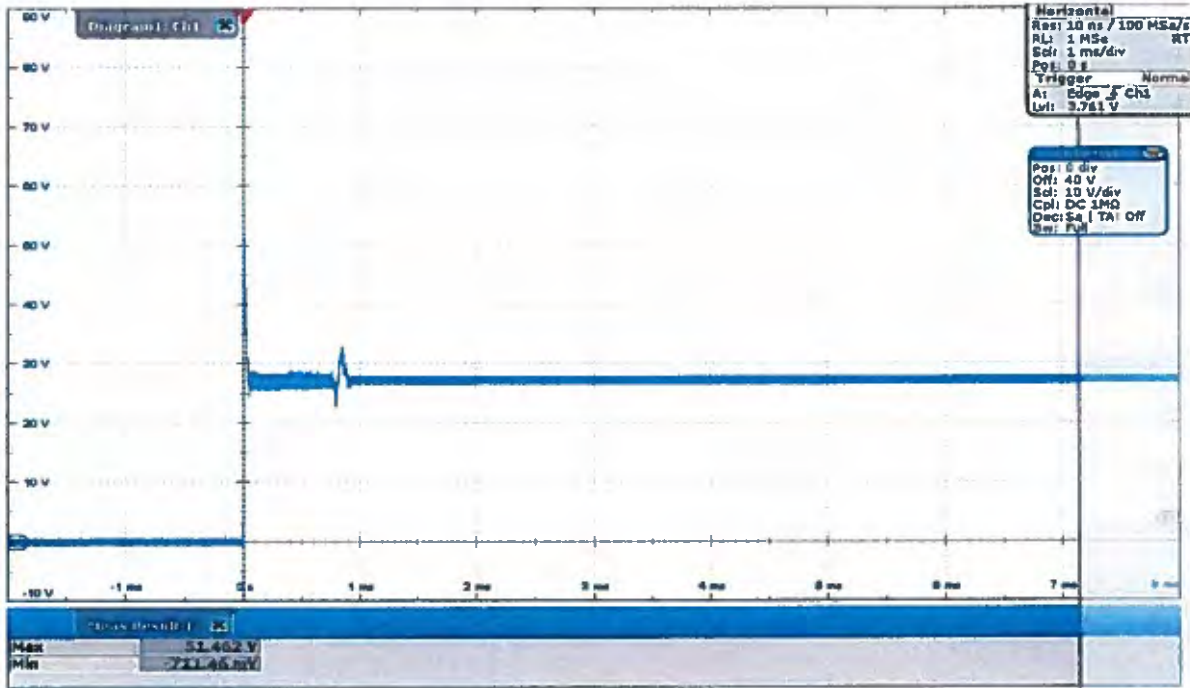


Chart 17: Conducted emissions – voltage transients
slow pulses close

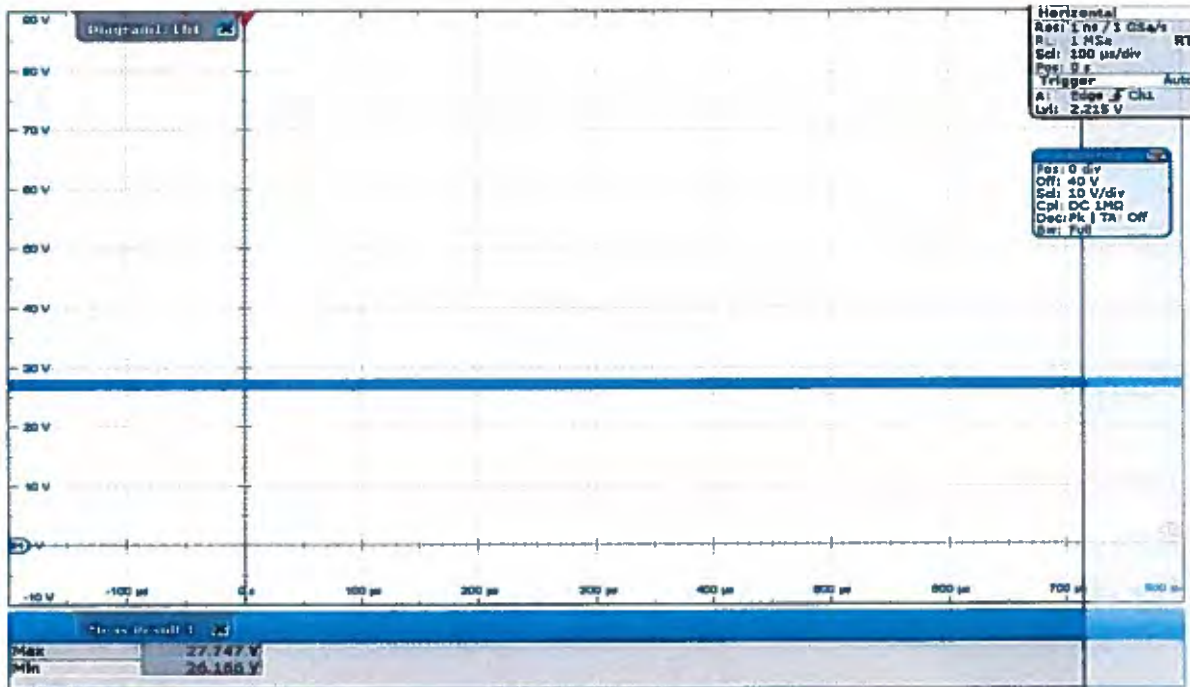


Chart 18: Conducted emissions – voltage transients
fast repetitive transients

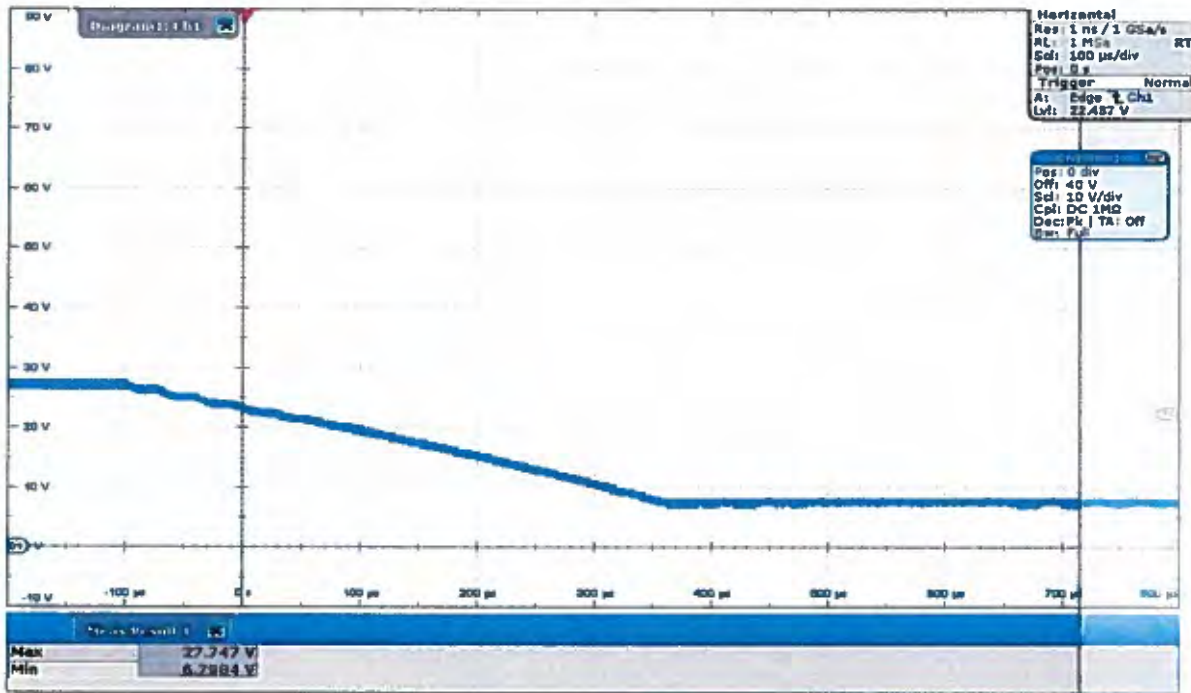


Chart 19: Conducted emissions – voltage transients
fast pulses open

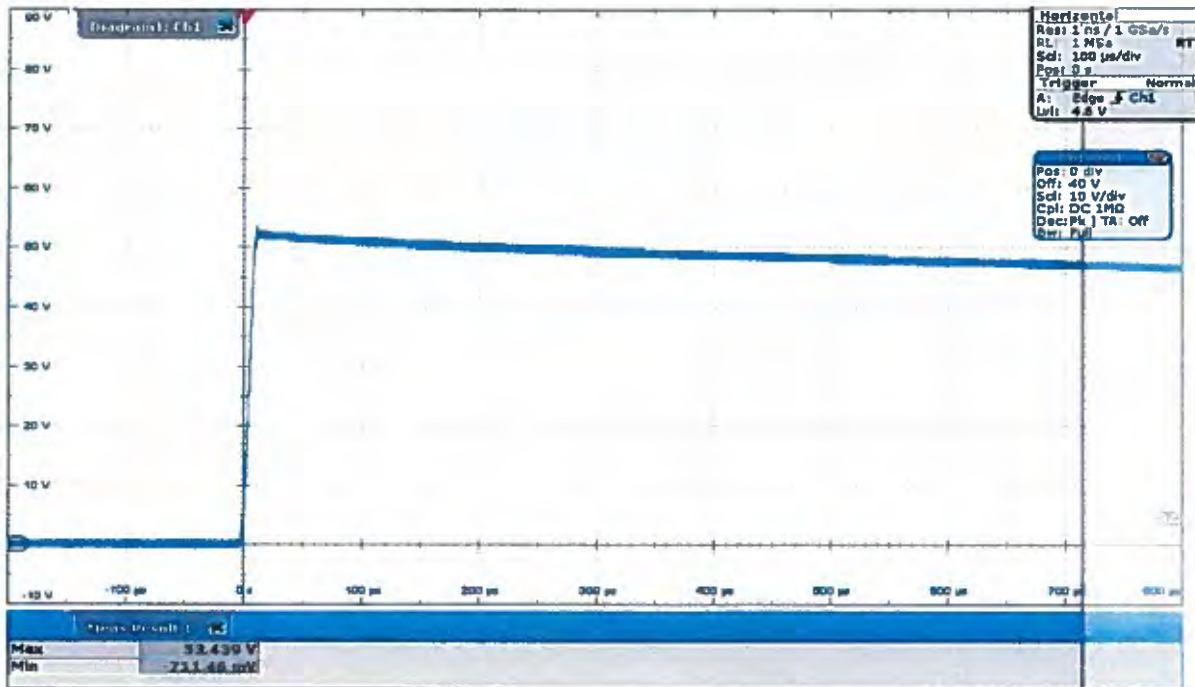


Chart 20: Conducted emissions – voltage transients
fast pulses close

