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COMPLIANCE TEST SOLUTIONS

ISO/TS 7637-4

ROAD VEHICLES – ELECTRICAL DISTURBANCES BY CONDUCTION AND COUPLING – PART 4: ELECTRICAL TRANSIENT CONDUCTION ALONG SHIELDED HIGH VOLTAGE SUPPLY LINES ONLY

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06.06.2017

THE WORLD'S SPEED IS OUR BEAT

ISO/TS 7637-4

DKE 767.13.18_2017-0027
ISO/TC22/SC3/WG3 N 2622

ISO/TC22/SC322 N

Date: 2017-03-24

TS 7637-4

ISO/TC 22/SC322/WG 3

Secretariat: JISC

Road Vehicles – Electrical disturbances by conduction and coupling – Part 4: Electrical transient conduction along shielded high voltage supply lines only

Véhicules routiers — Perturbations électriques par conduction et par couplage — Partie 4: Transmission des perturbations électriques par conduction uniquement le long des lignes d'alimentation

ISO/TS 7637-4

1 Scope

This part of ISO 7637 specifies test methods and procedures to ensure the compatibility to conducted electrical transients of equipment installed on passenger cars and commercial vehicles fitted with electrical systems with voltages higher than 60 $V_{d.c.}$ and lower than 1 500 $V_{d.c.}$ and a power-supply isolated from the vehicle-body. It describes bench tests for both, injection and measurement of transients. It is applicable to all types of electrical independent driven, road vehicles (e.g. battery electrical vehicle or hybrid electrical vehicle, plugin hybrid vehicle).

Immunity to voltage ripple (square wave) on high voltage supply lines, typically caused by switching of high currents e. g. in IGBT stages of electrical engine systems or DC-DC-converters. Voltage ripple produce both, common mode and differential mode disturbances (line-to-ground (HV+ or/and HV- to ground) and line-to-line (HV+ to HV-)).

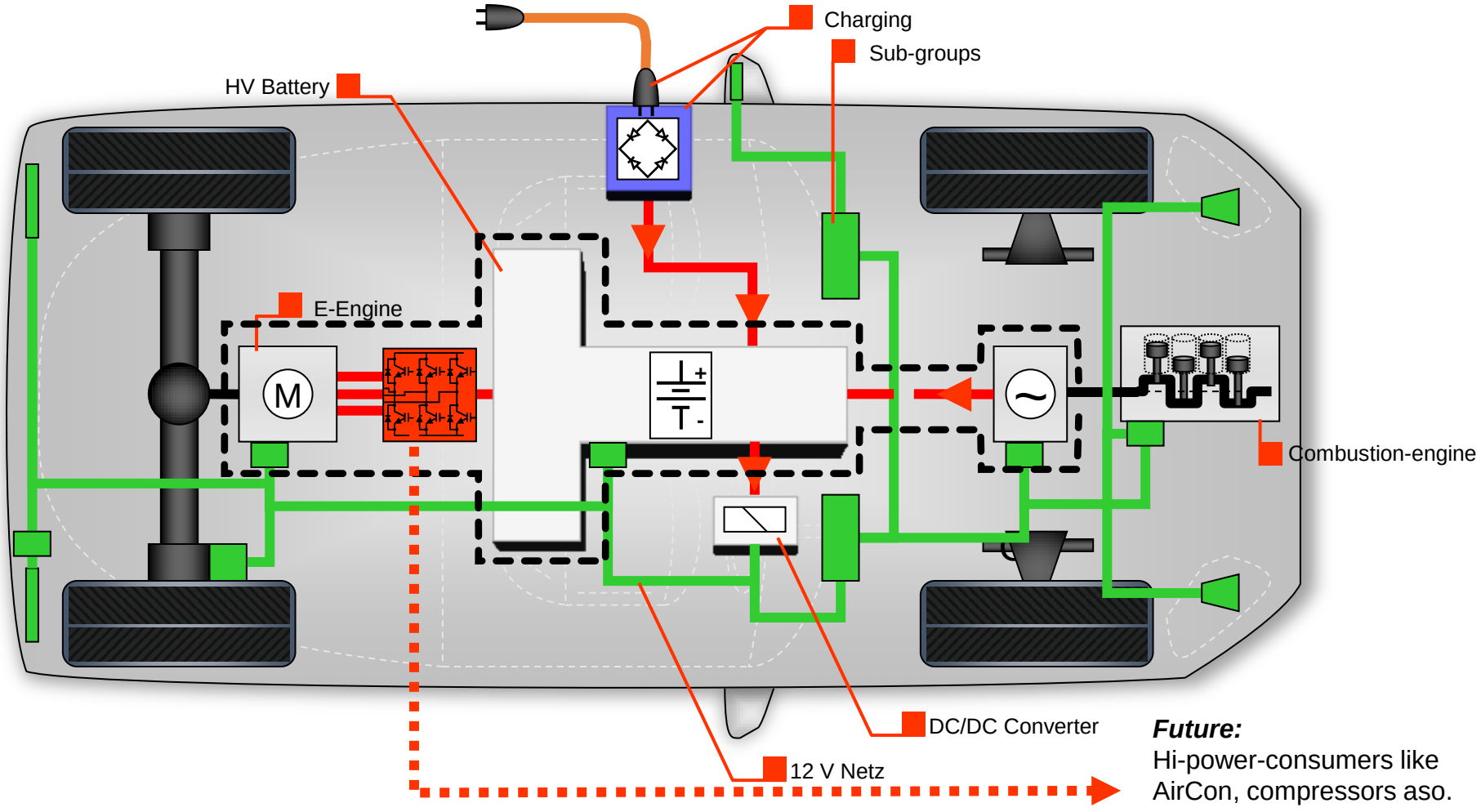
Immunity to Pulsed sinusoidal disturbances on high voltage supply lines are caused by overshoots on square wave signals e.g. produced by interaction of switching IGBTs in high voltage systems with parasitic capacities and inductivities of electrical engines, by DC-DC-converters and any other kind of high voltage switching/commutation.

ISO/TS 7637-4

This working draft specifies different tests on HV-supply lines only

4.4.2	Voltage Ripple (Pulse A)	Line-to-Line Line-to-Ground		Square 1 kHz to 300kHz		
4.4.2	Pulsed Sinusoidal Disturbances (Pulse B)	Line-to-Line Line-to-Ground		Sinus 1-10 MHz		
4.4.3	Low frequency sinusoidal disturbances (Pulse C)	Line-to-Line Line-to-Ground		Sinus 15 Hz - 300kHz		

E-VEHICLE COMPONENTS



Future:
Hi-power-consumers like AirCon, compressors aso.

GENERAL

Methods for measuring the transient emission on shielded high voltage supply lines and test methods for the immunity of devices against transients are given. These tests, called "bench tests", are made in the laboratory.

The bench test methods will provide comparable and reproducible results between laboratories. They also give a test basis for the development of devices and systems and may be used during the production phase.

A bench test method for the evaluation of the immunity of a device against supply line transients may be performed by a test pulse generator; this may not cover all types of transients which can occur in a vehicle. Therefore, all described test pulses are typical pulses.

In special cases, it may be necessary to apply additional test pulses. However, some test pulses may be omitted, if a device, depending on its function or its connection is not influenced by comparable transients in the vehicle. It is part of the vehicle manufacturer's responsibility to define the test pulses required for a specific device.

IT‘S NOT MANDATORY TO TEST ALL 3 PULSES!

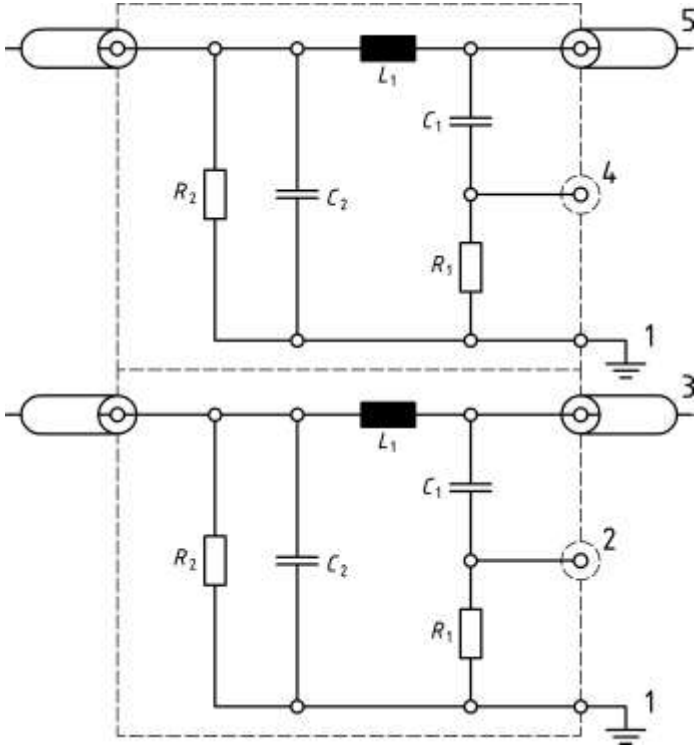
3 TYPES OF TEST PULSES

Experts expect 3 different types of test pulses in E- and Hybrid-cars:

Voltage Ripple (Pulse A)
1 kHz - 300kHz

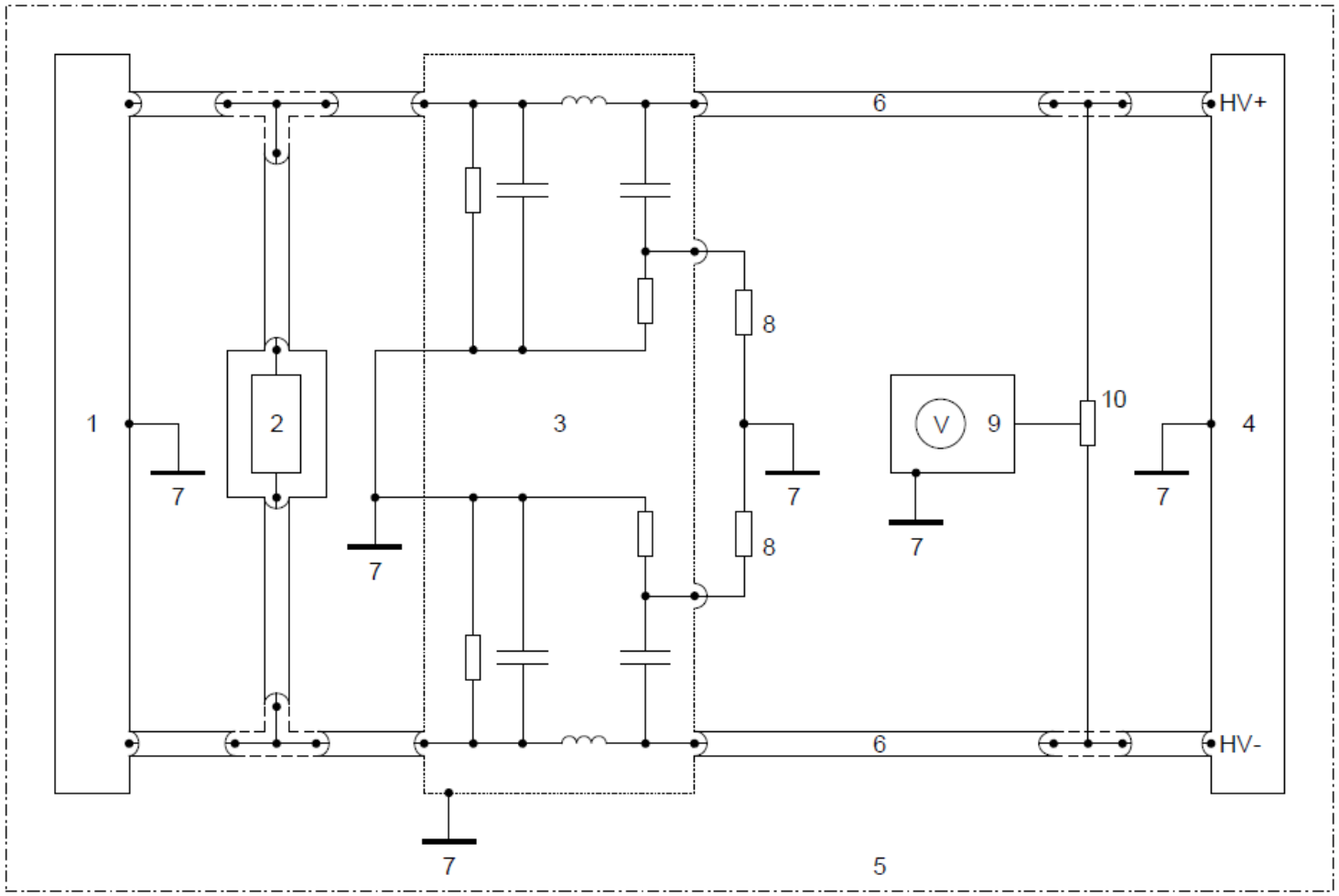
Pulsed Sinusoidal Disturbances (Pulse B)
1-10 MHz

Low frequency sinusoidal disturbances (Pulse C)
Hz 15 Hz - 300kHz



- Need of shielded artificial network
- Substitution-methode speficied for Level-setting off all puses
- Emission has to be tested
- Immunity against EFT/Burst and Surge are deleted

EMISSION ON HV-SUPPLY-LINES



Legende:

1	shielded high voltage power supply
2	load for high voltage battery
3	shielded high voltage artificial network
4	DUT
5	ground plane
6	high voltage supply line (*)
7	ground connection
8	50 Ω termination
9	oscilloscope or waveform acquisition equipment
10	high voltage differential probe

3. HV-AN 150, TESEQ

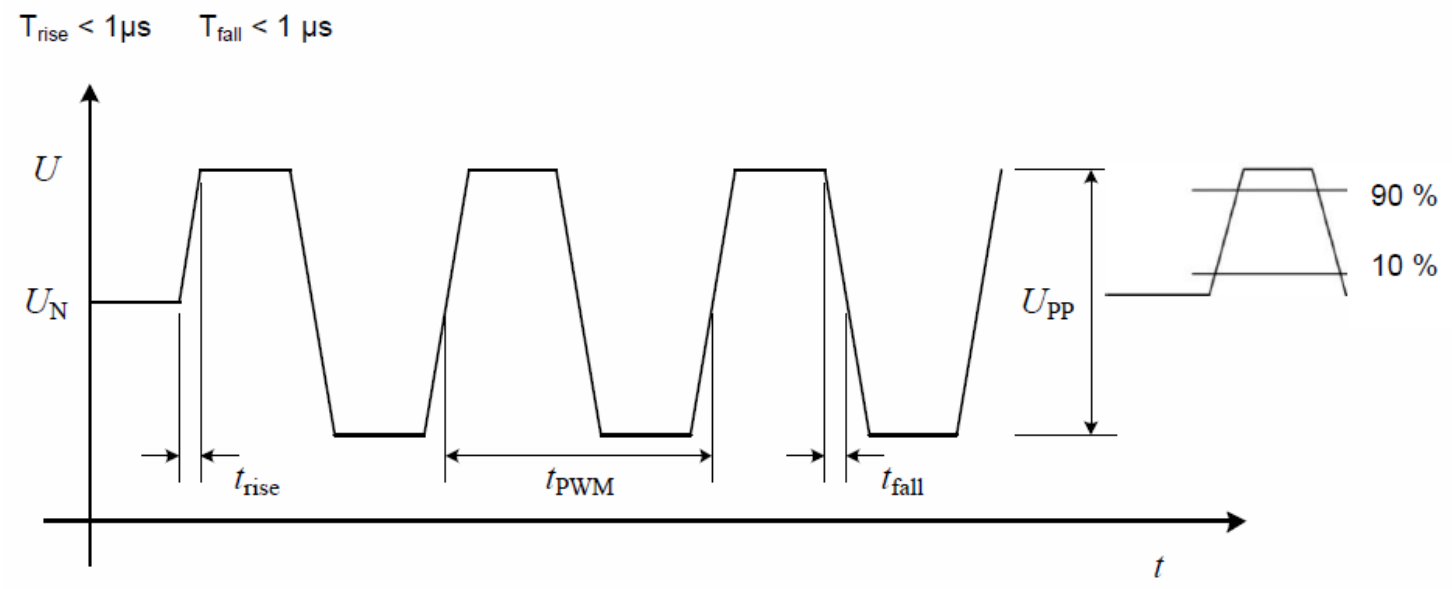
EMISSION ON HV-SUPPLY-LINES

Limits are just roughly defined. Definite limits has to be determined with the OEM.

Table B.1 - Terms and abbreviations

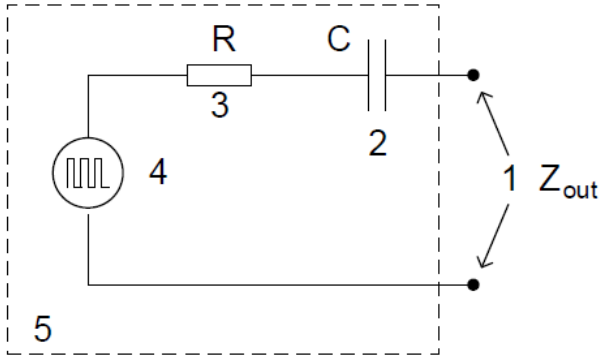
Parameter	Definition see ISO 7637-1	Abbreviation
Peak amplitude	3.12	U_s (U_{S1}, U_{S2})
Pulse duration	3.13.1	t_d
Pulse rise time	3.13.2	t_r
Pulse fall time	3.13.3	t_f
Pulse repetition time	3.14.4	t_1
Burst duration	3.14.1	t_4
Time between bursts	3.14.2	t_5
Burst cycle time	3.14.3	$t_4 + t_5$

TEST PULSE A (VOLTAGE RIPPLE)



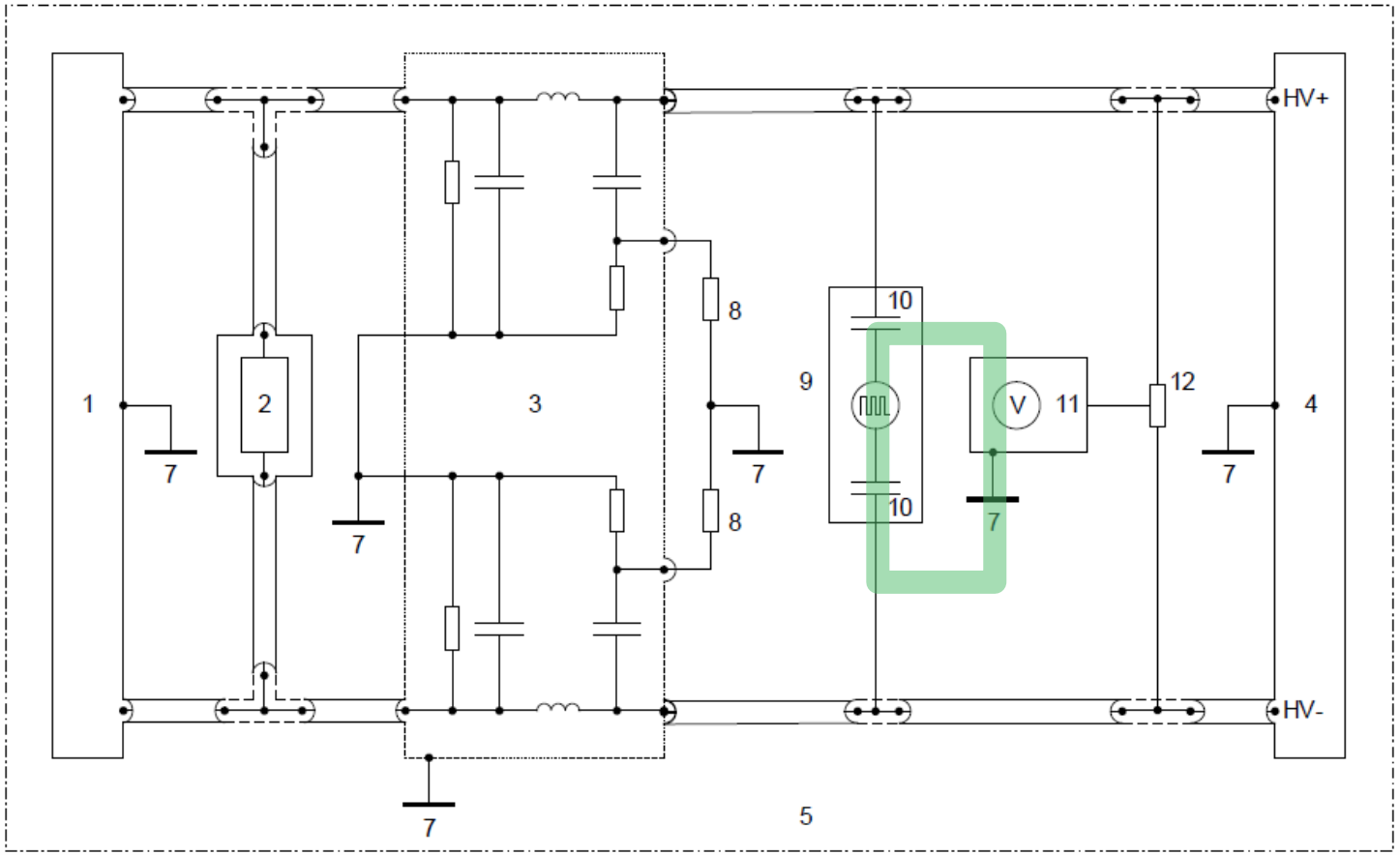
Frequency: 1 kHz to 300 kHz (50% duty cycle)
Z_{out} ≤0.5 Ω
T_{rise}, T_{fall} < 1µs (ohne last, bei 25 Vpp)

Coupling capacitor 120 uF
Calibration in short-circuit
Test level up to 50 Vpp



TEST PULSE A (VOLTAGE RIPPLE), LINE-TO-LINE SETUP

Test setup: Coupling between HV+ and HV-



Legende:

1 shielded high voltage power supply
2 load for high voltage battery
3 shielded high voltage artificial network
4 DUT
5 ground plane
6 high voltage supply line (*)
7 ground connection
8 50 Ω termination
9 square wave generator
10 coupling capacitor connection between generator output and HV lines
11 oscilloscope or equivalent
12 high voltage differential probe

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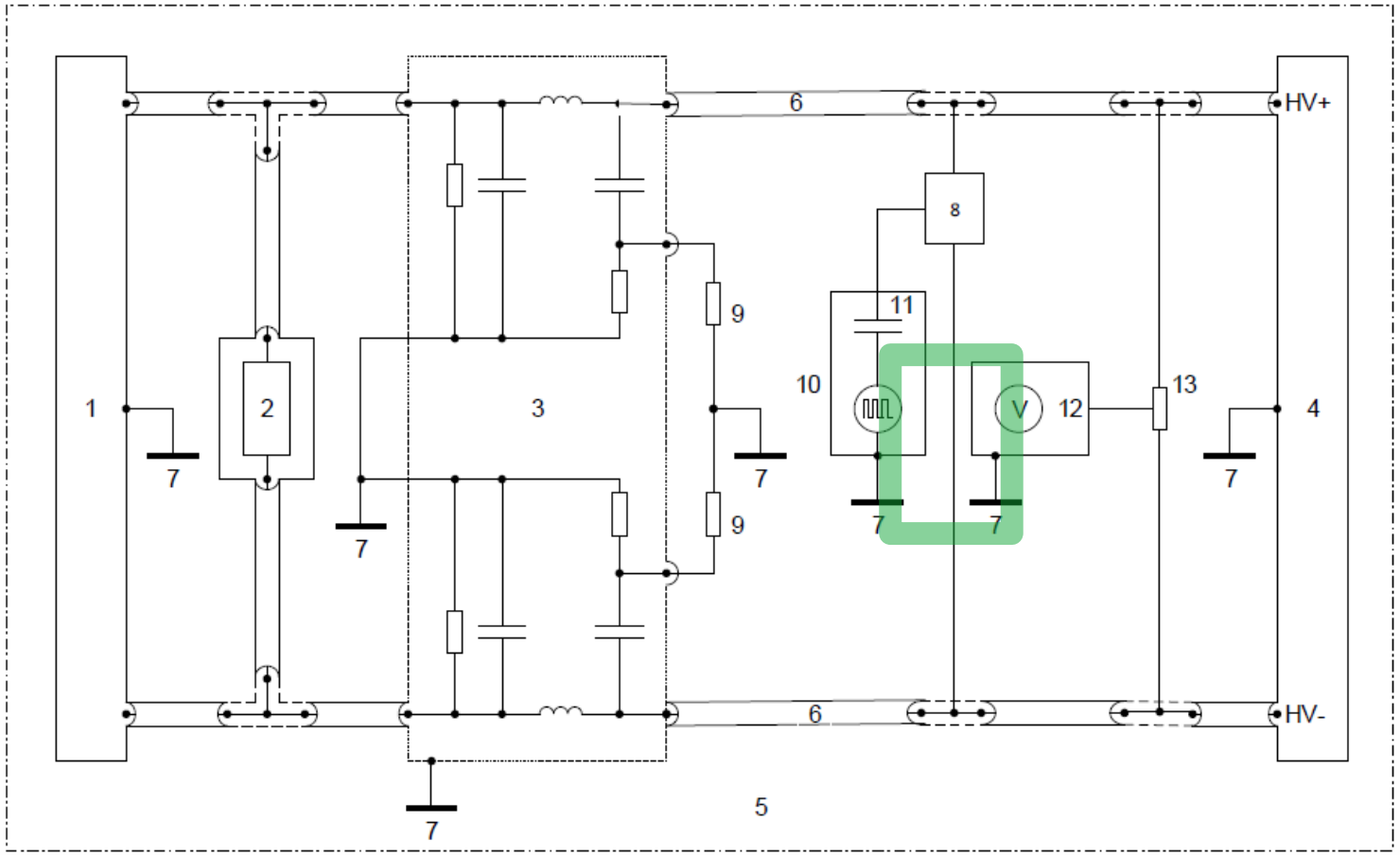
TEST PULSE A (VOLTAGE RIPPLE), LINE-TO-GROUND SETUP

Test setup: Coupling between HV+ to GND and HV- tou GND

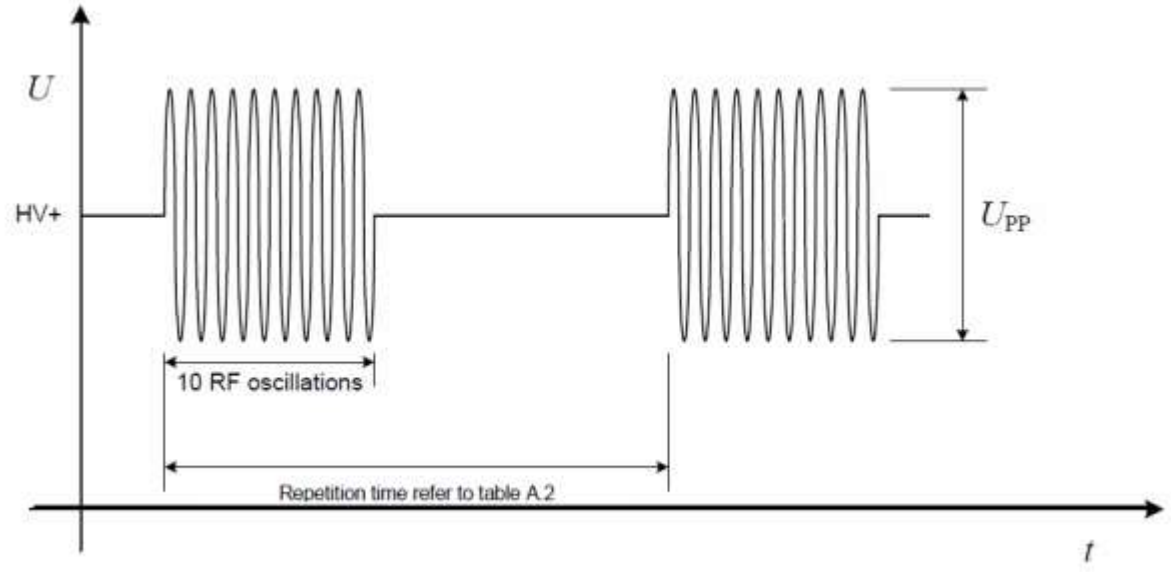


Legende:

1 shielded high voltage power supply
2 load for high voltage battery
3 shielded high voltage artificial network
4 DUT
5 ground plane
6 high voltage supply line
7 ground connection
8 specific coupling network
9 50 Ω termination
10 square wave generator, both terminals shall be isolated to ground
11 coupling capacitorconnection between generator output and HV lines as short as possible.
12 oscilloscope or equivalent
13 high voltage probe

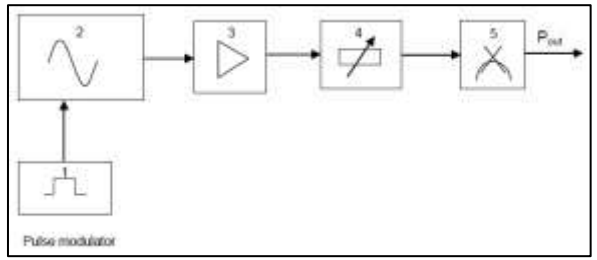
3. HV-AN 150, TESEQ

TEST PULSE B (PULSED SINUSOIDAL DISTURBANCES)



Frequency:	1 bis 10 MHz
Z_{out}	50 Ω
Package-width:	200/100/50 µs

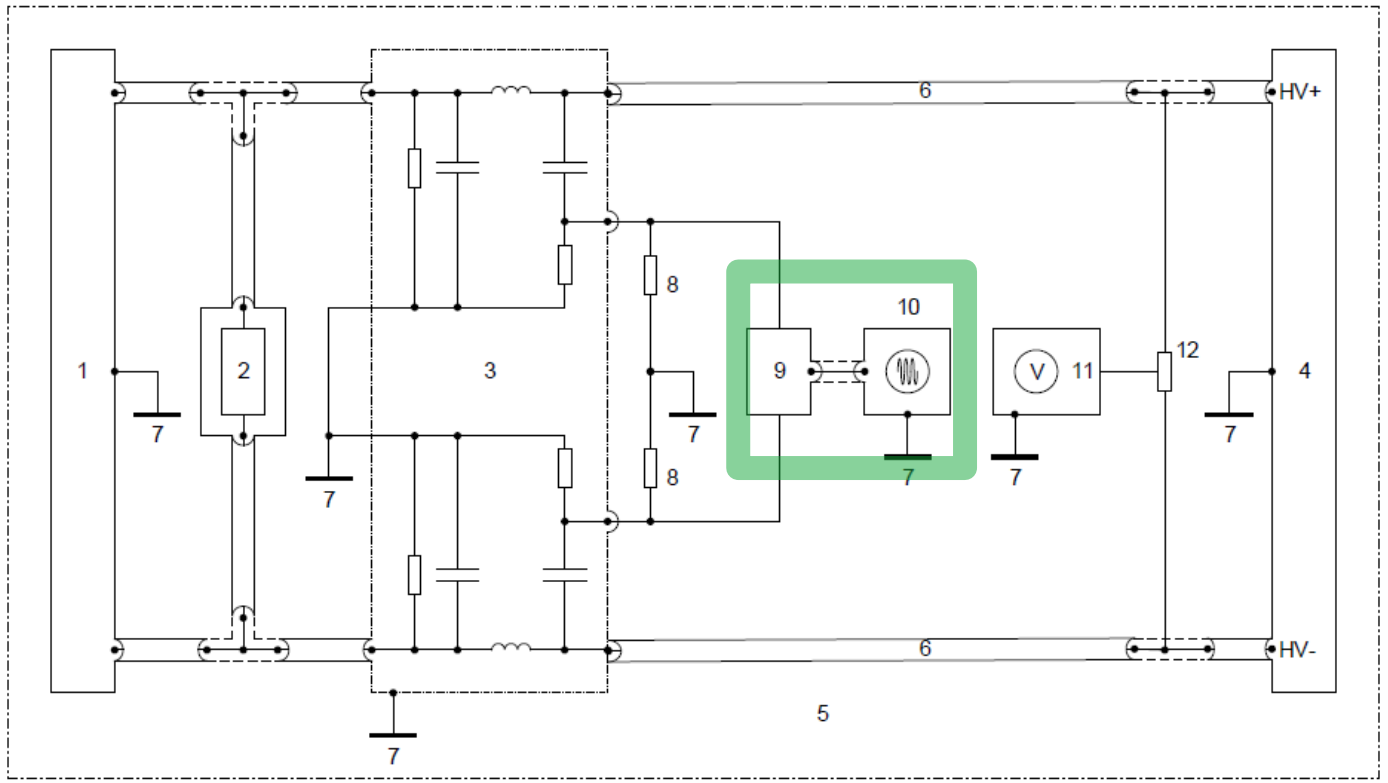
Test level up to 100* Vpp (50 Ω)



Block diagram testgenerator for pulse B

TEST PULSE B (PULSED SINUSOIDAL DISTURBANCES), LINE-TO-LINE SETUP

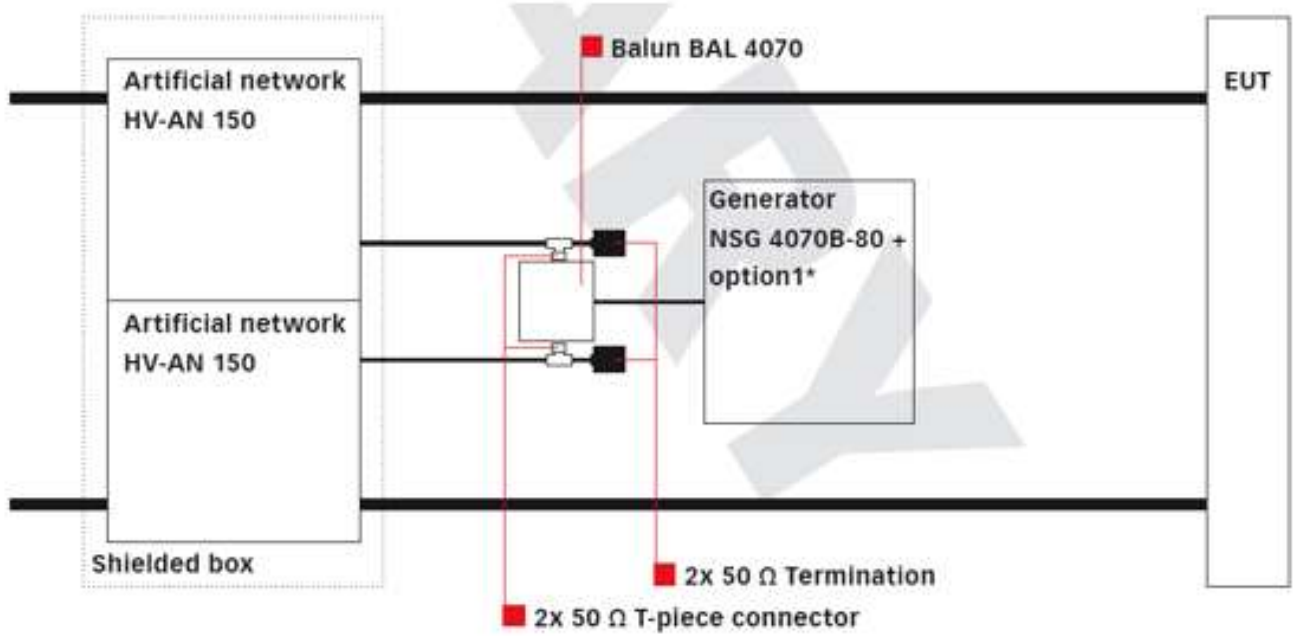
Test setup: Coupling between HV+ and HV-



Legende:

1	shielded high voltage power supply
2	load for high voltage battery
3	shielded high voltage artificial network
4	DUT
5	ground plane
6	High voltage supply line
7	ground connection
8	50 Ω termination
9	balun transformer
10	sine wave generator
11	oscilloscope or equivalent
12	high voltage differential probe

TEST PULSE B (PULSED SINUSOIDAL DISTURBANCES), LINE-TO-LINE SETUP

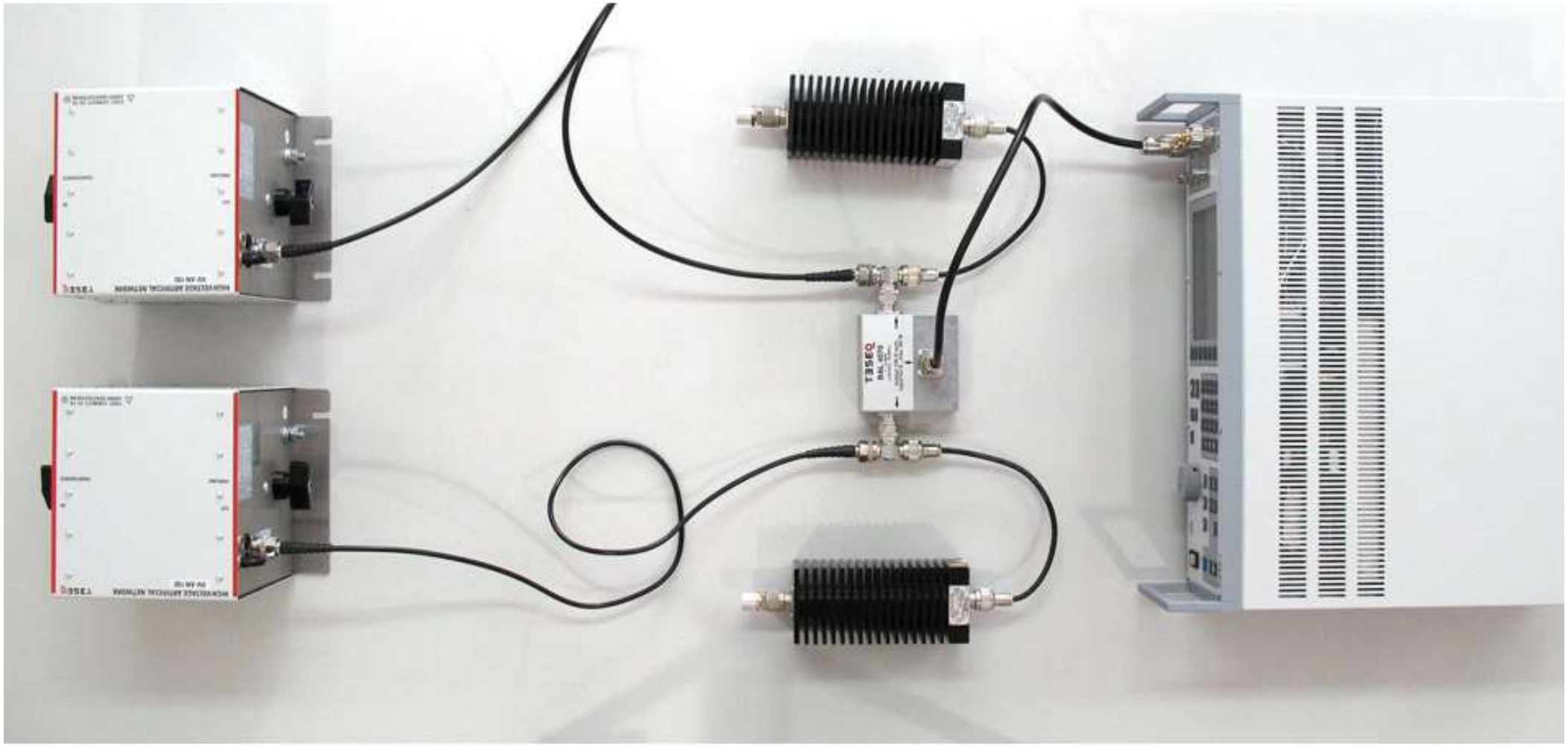


- BALUN FOR PULSED SINUSOIDAL DISTURBANCES TEST ACCORDING ISO 7637-4 (DRAFT VERSION 2015)

- FREQUENCY RANGE 1 MHZ TO 10 MHZ

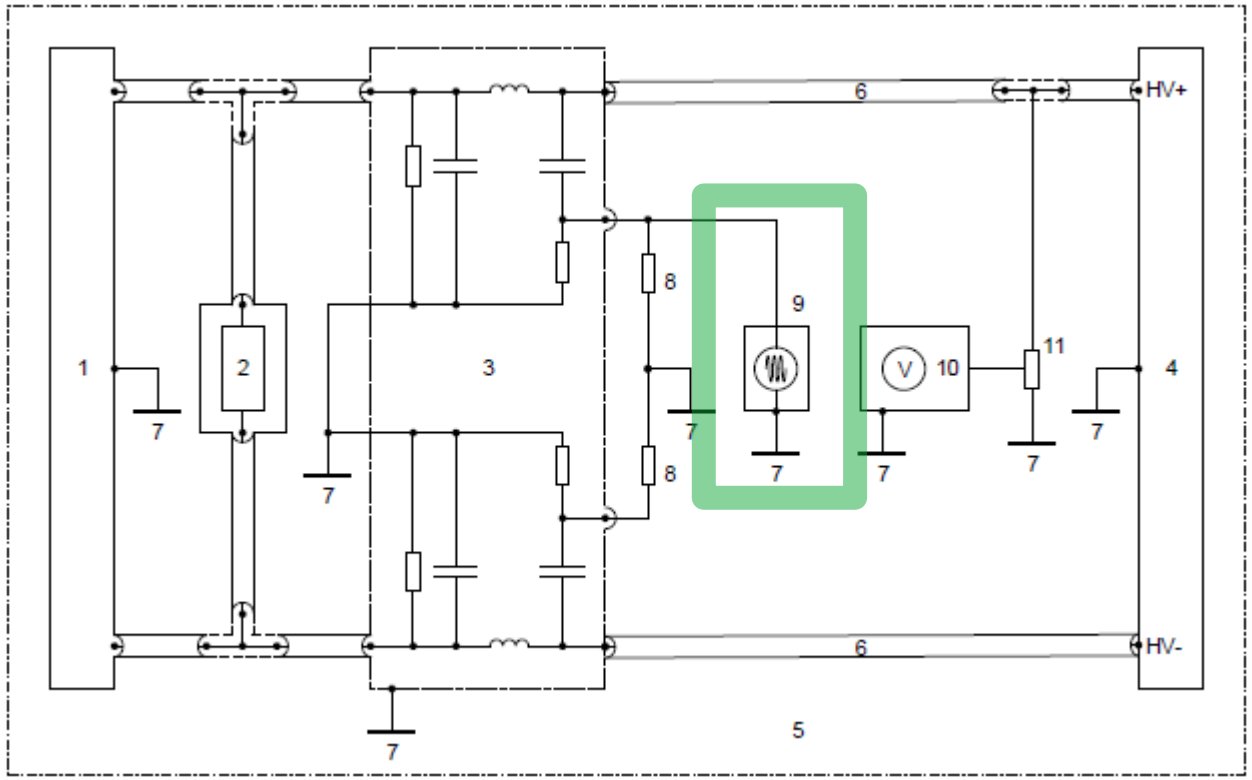
- N SOCKETS INPUT 50 Ω TO OUTPUT 2X N (SYMMETRICAL 100 Ω, SCREENED)

TEST PULSE B (PULSED SINUSOIDAL DISTURBANCES), LINE-TO-LINE SETUP



TEST PULSE B (PULSED SINUSOIDAL DISTURBANCES), LINE-TO-GROUND SETUP

Test setup: Coupling between HV+ to GND and HV- to GND



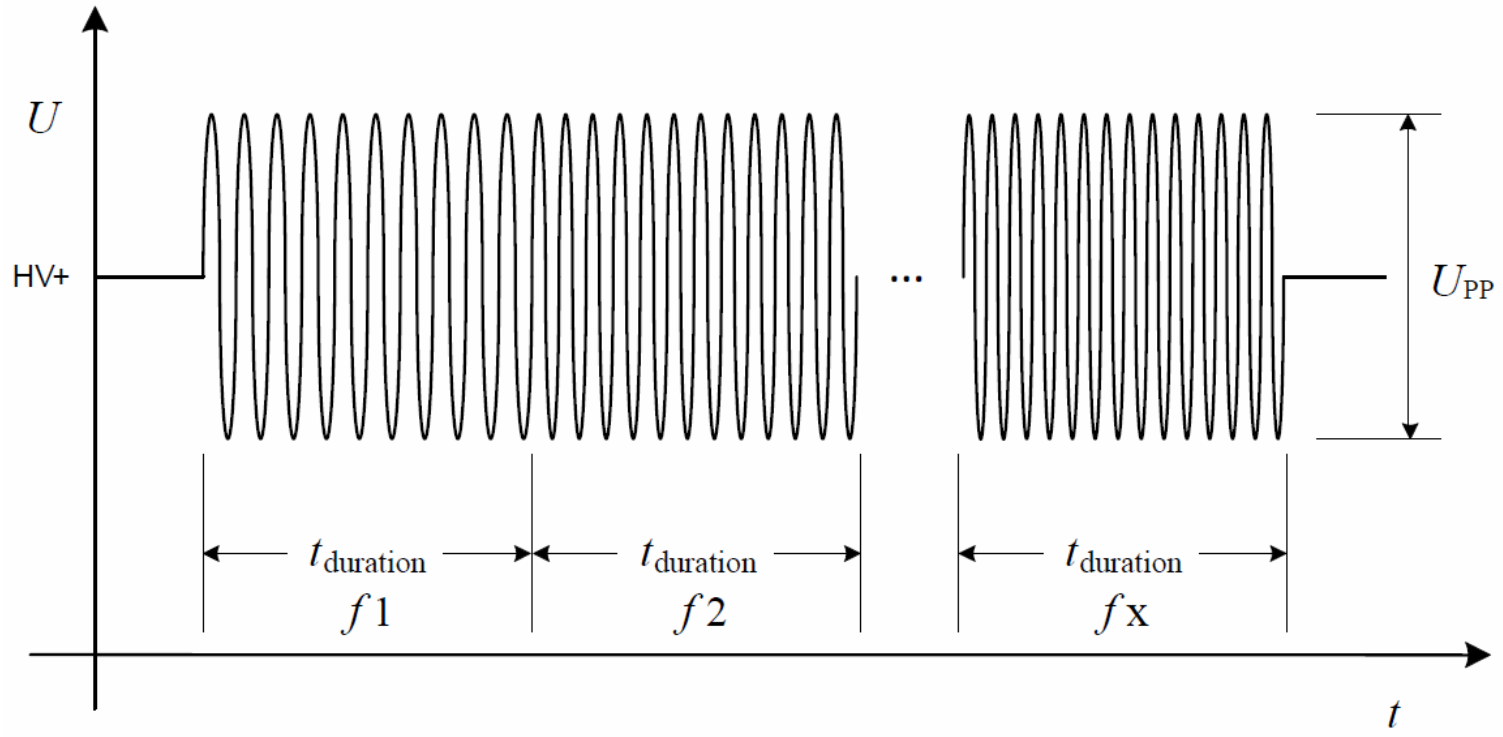
Legende:

1 shielded high voltage power supply
2 load for high voltage battery
3 shielded high voltage artificial network
4 DUT
5 ground plane
6 High voltage supply line
7 ground connection
8 50 Ω termination
9 sine wave generator
10 oscilloscope or equivalent
11 high voltage differential probe

3. HV-AN 150, TESEQ

9. NSG 4070B-80 + OPTION 1

TEST PULSE C (LOW FREQUENCY SINUSOIDAL DISTURBANCES)

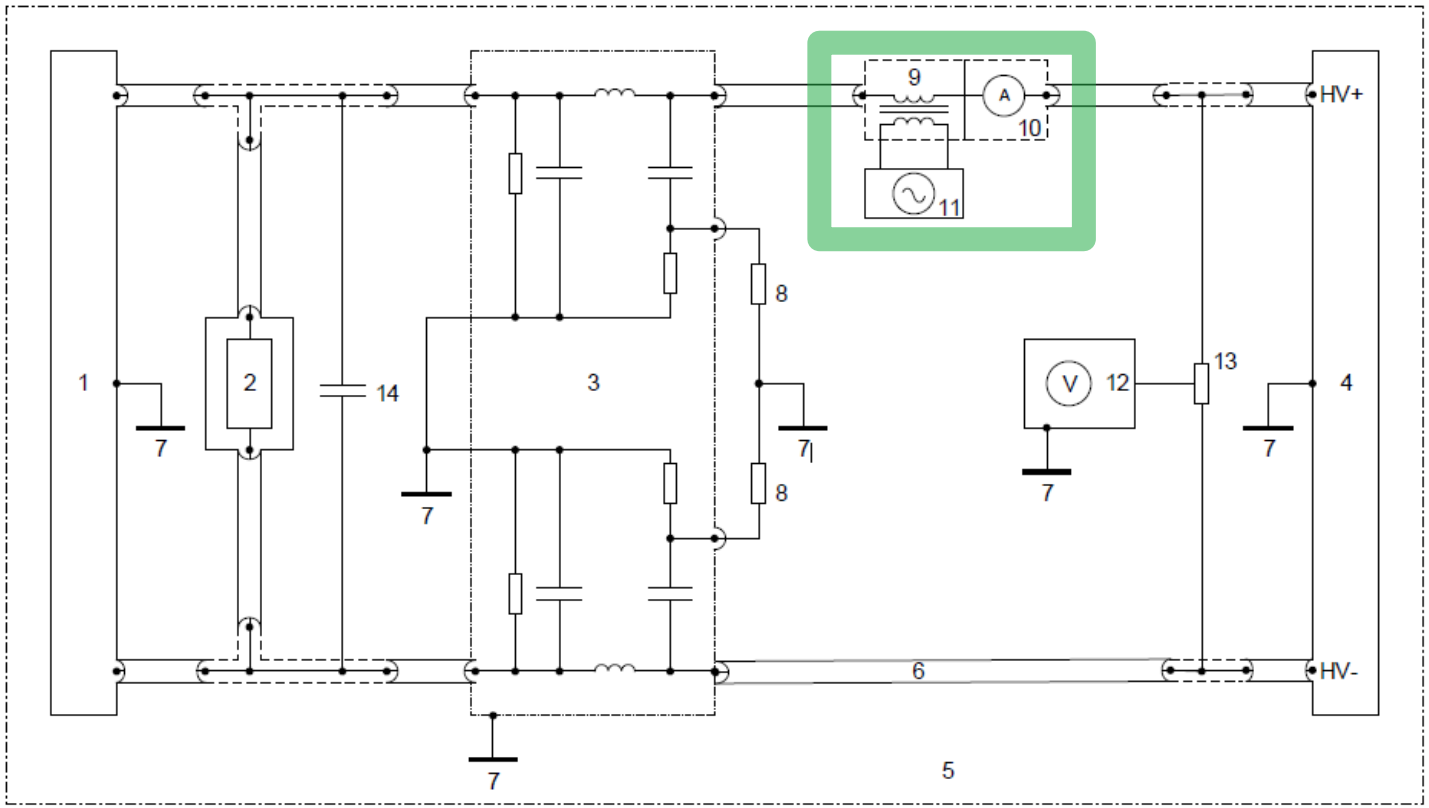


Frequency: 3 kHz to 300 kHz (<3 kHz optional)
Z_{out} 50 Ω
Dwell: 2s per frequence

Test level up to 25 Vpp

TEST PULSE C (LOW FREQUENCY SINUSOIDAL DISTURBANCES)

Test setup: Coupling in HV+ and HV-

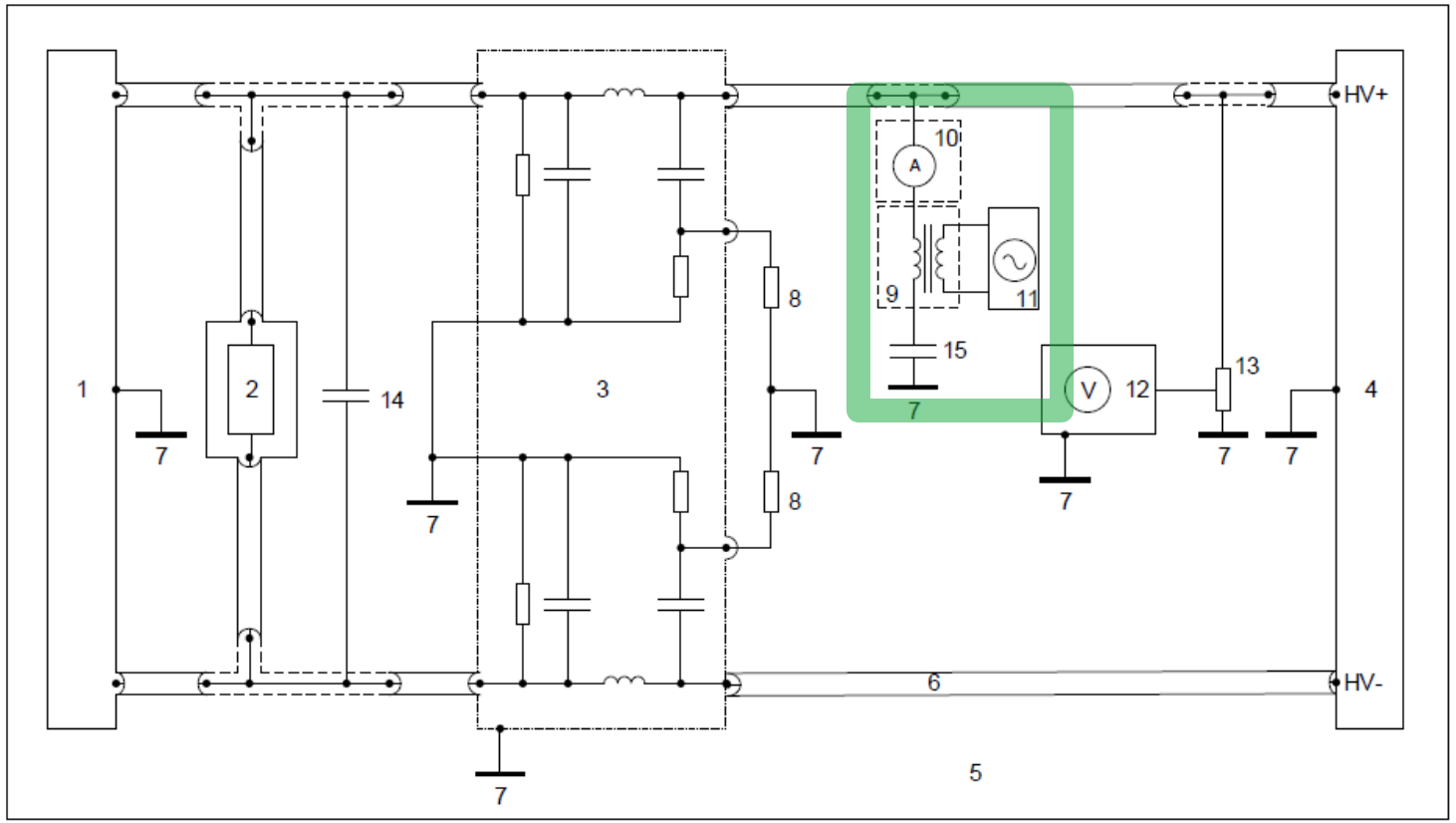


Legende:

1 shielded high voltage power supply
2 load for high voltage battery
3 shielded high voltage artificial network
4 DUT
5 ground plane
6 High voltage supply line
7 ground connection
8 50 Ω termination
9 coupling transformer
10 current monitoring (optional)
11 Low frequency generator
12 oscilloscope or equivalent
13 high voltage differential probe
14 capacitor >100uF if using high voltage power supply instead a battery

TEST PULSE C (LOW FREQUENCY SINUSOIDAL DISTURBANCES), LINE-TO-GROUND SETUP

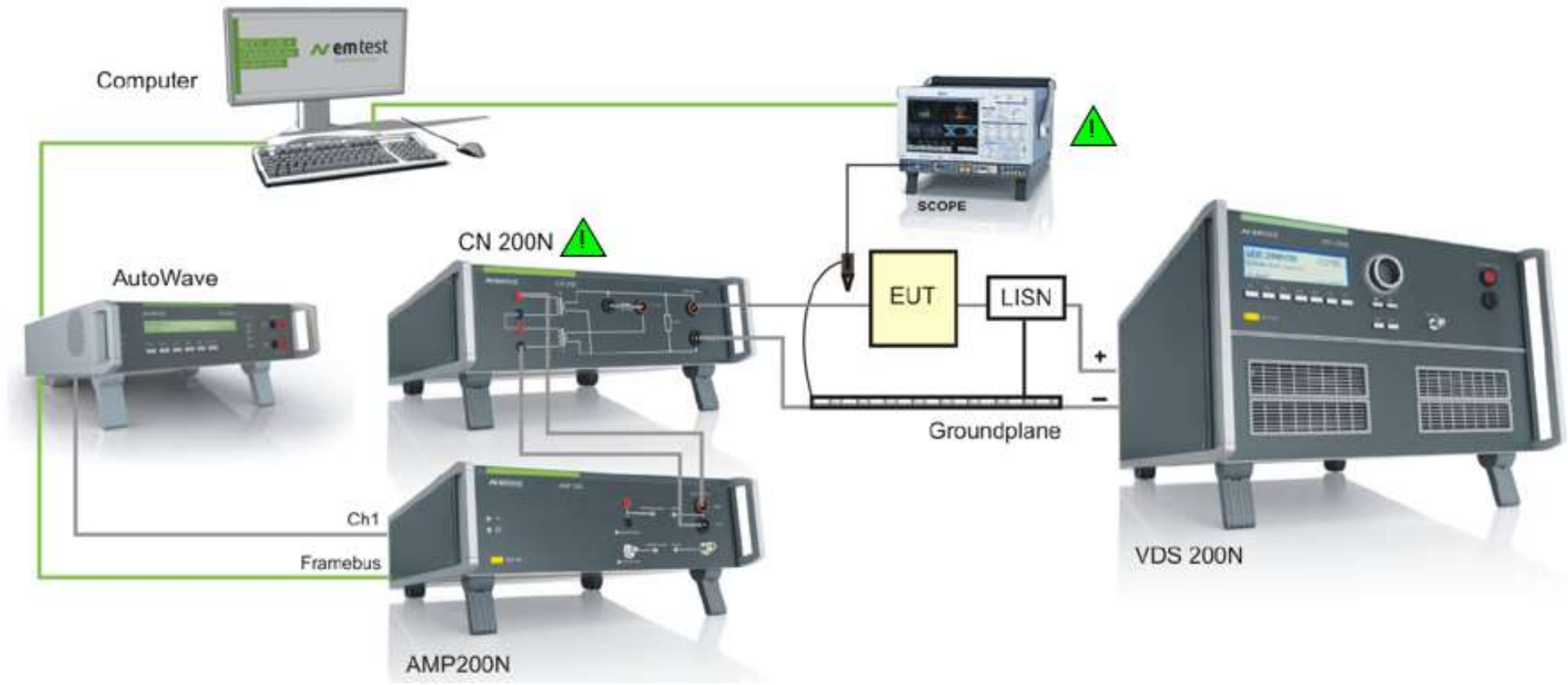
Test setup: Coupling between HV+ to GND and HV- to GND



Legende:

1 shielded high voltage power supply
2 load for high voltage battery
3 shielded high voltage artificial network
4 DUT
5 ground plane
6 High voltage supply line
7 ground connection
8 50 Ω termination
9 coupling transformer
10 current monitoring (optional)
11 Low frequency generator
12 oscilloscope or equivalent
13 high voltage differential probe
14 capacitor >100uF if using high voltage power supply instead a battery
15 capacitor (value shall be adjusted for the frequency which will be used)

TRANSFORMER COUPLED SINE WAVES



MANY THANKS FOR YOUR ATTENTION

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