

PRÜFBERICHT zur Information des Auftraggebers

Test Report for the Information of the applicant

Aktenzeichen: <i>File reference:</i>	248000-1181-0011/175701	
Auftraggeber <i>Applicant:</i>	OBO Bettermann GmbH & Co.KG Hueingser Ring 52 D-58710 Menden, Germany	
Hersteller <i>Manufacturer</i>	OBO Bettermann GmbH & Co.KG Hueingser Ring 52 D-58710 Menden, Germany	
Produkt: <i>Product:</i>	Überspannungsschutzgerät <i>Surge protective device</i>	
Typenbezeichnung: <i>Model / Type ref.</i>	V20-C 3-PH-1000 V20-C 3-PHFS-1000	
Geprüft in Anlehnung an: <i>Tested on the basis of:</i>	EN 50539-11:2013-03 Abschnitte 6.2.8 / 7.4.2 / 7.4.4 / 7.4.5 / 7.8.1 Subclause 6.2.8 / 7.4.2 / 7.4.4 / 7.4.5 / 7.8.1	
Eingangsdatum des Prüfobjekts und Zustand:	26.10.2012 / Zustand: neu	
<i>Date of receipt of test item and condition:</i>	2012-10-26 / condition: new	
Prüfdatum: <i>Date of test:</i>	26.10.2012 bis 14.12.2012 2012-10-26 bis 2012-12-14	
Prüfört: <i>Place of test:</i>	IPH GmbH Landsberger Allee 378A D-12681 Berlin Germany	OBO Bettermann GmbH & Co.KG Hueingser Ring 52 D-58710 Menden Germany
Bewertung: <i>Test result:</i>	positiv positive	



Dieser Prüfbericht enthält das Ergebnis einer einmaligen Untersuchung an dem zur Prüfung vorgelegten Erzeugnis. Muster dieses Erzeugnisses wurden geprüft, um die Übereinstimmung mit den aufgeführten Normen bzw. Abschnitten von Normen festzustellen.

This test report contains the result of a singular investigation carried out on the product submitted. Samples of this product were tested to found the accordance with the listed standards or clauses of standards resp.

Der Prüfbericht berechtigt Sie nicht zur Benutzung eines Zertifizierungszeichens des VDE und berücksichtigt ausschließlich die Anforderungen der oben genannten Regelwerke.

The test report does not entitle for the use of a VDE Certification Mark and considers solely the requirements of the specifications mentioned above.

Wenn gegenüber Dritten auf diesen Prüfbericht Bezug genommen wird, muss dieser Prüfbericht in voller Länge an gleicher Stelle verfügbar gemacht werden.

Whenever reference is made to this test report towards third party, this test report shall be made available on the very spot in full length.

Dieser Prüfbericht besteht aus 16 Seiten und folgenden Anhängen:

This test report consists of 16 pages and the following attachments:

Anhang 1 / Attachment 1	OBO-V20C3PHFS1000-Ures-121026
Anhang 2 / Attachment 2	OBO-V20C3PHFS1000-Ures-121214
Anhang 3 / Attachment 3	175701
Anhang 4 / Attachment 4	OBO-V20C3PHFS1000-ltotal-121026

VDE Prüf- und Zertifizierungsinstitut GmbH
Testing and Certification Institute
Section CC2



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i.A. Thomas Kohushölter

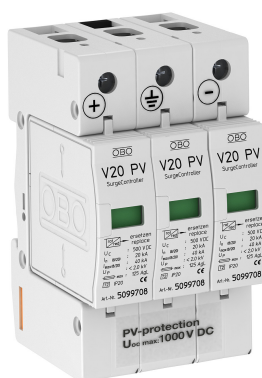


1. Allgemeines: 1. General matters:

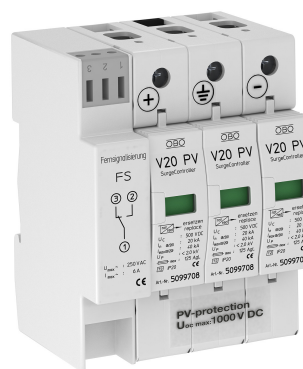
Fotodokumentation:

Photograph documentation:

V20-C 3-PH-1000



V20-C 3-PHFS-1000



Bemessungswerte:

Ratings:

Höchste Dauerspannung für PV-Anwendungen

Maximum continuous operating voltage for PV application

Typ

Type

Nennableitstrom

Nominal discharge current

Schutzpegel

Voltage protection level

Kurzschlussfestigkeit

Short-circuit current rating

Schutzleiterstrom

Residual current

SPD Ausfallverhalten

SPD overload behaviour

Gesamtableitstrom

Total discharge current

Schutzpfad

Modes of protection

Folgestrom

Follow current

Dauerbetriebsstrom für PV-Anwendungen

continuous operating current for PV application

U_{CPV} : 1000 V

PV Type II, spannungsbegrenzendes SPD

PV Type II, voltage switching type SPD

I_n = 20 kA

U_p = 4 kV

I_{SCPV} = 100 A

I_{PE} : < 1 mA a.c. / < 0,1 mA d.c.

OCM

I_{Total} : 40 kA 8/20

+/-, +/PE, -/PE

I_f ≤ 5 A

I_{CPV} < 0,1 mA



2. Ergebnisse

2. Test Results

2.1 Dauerbetriebsstrom I_{CPV} (Abschnitt 6.2.8)

2.1 Continuous operating current I_{CPV} (Clause 6.2.8)

Die Prüflinge sind an die maximale Dauerspannung U_{CPV} angeschlossen. Der Strom zwischen den Anschlüssen (+) und (-) wird gemessen.

The test samples are connected to U_{CPV} . The current between (+) and (-) is measured.

Connection to DC source			Measured I_{CPV}		
Terminals			Test specimen		
(+)	(PE)	(-)	1 ODT 1	2 ODT 2	3 ODT 3
+	NC	-	0,273 μA	0,340 μA	0,300 μA
+	+	-	0,386 μA	0,470 μA	0,412 μA
+	-	-	0,403 μA	0,460 μA	0,418 μA

NC - not connected



2.2 Schutzleiterstrom I_{PE} (Abschnitt 7.4.2)

2.2 Residual current I_{PE} (Clause 7.4.2)

Die Prüflinge sind wie für den bestimmungsgemäßen Gebrauch entsprechend der Herstellervorgaben montiert und werden an folgende Spannungsquellen angeschlossen:

- DC-Spannungsquelle, Maximale Dauerspannung U_{CPV}
- AC-Spannungsquelle, sinusförmige Spannung (50 Hz), Scheitelwert entspricht U_{CPV}

Der Schutzleiterstrom durch den PE-Anschluss (AC und DC) wird gemessen.

The test samples are mounted for normal use according to the manufacturer's instructions. The following power sources are applied to the test samples:

- *d.c.-source, U_{CPV}*
- *a.c.-source, sinusoidal voltage (50 Hz), peak value corresponds to U_{CPV}*

The residual current flowing through the PE-terminal (a.c and d.c.) is recorded.

Test voltage	Mode of protection under test	Test specimen		
		1 ODT 1	2 ODT 2	3 ODT 3
a.c.	(+) - (PE)	332 μ A	324 μ A	330 μ A
	(-) - (PE)	333 μ A	320 μ A	322 μ A
d.c.	(+) - (PE)	0,282 μ A	0,300 μ A	0,293 μ A
	(-) - (PE)	0,282 μ A	0,319 μ A	0,275 μ A

Der gemessene Schutzleiterstrom überschreitet die Herstellerangabe nicht.
Herstellerangabe: $I_{PE} = 1$ mA a.c. ; $I_{PE} = 0,1$ mA d.c.

The measured residual current does not exceed the value specified by the manufacturer
Value specified by the manufacturer: $I_{PE} = 1$ mA a.c. ; $I_{PE} = 0,1$ mA d.c.



2.3 Arbeitsprüfung (Abschnitt 7.4.5) 2.3 Operating duty test (Clause 7.4.5)

2.3.1 Leckstrommessung vor der Arbeitsprüfung (Tabelle 6 – E)

2.3.1 Measurement of leakage current before operating duty test (Table 6 – E)

Die Prüfmuster sind entsprechend den Herstellervorgaben an eine Spannungsquelle mit der maximalen Dauerspannung U_{CPV} angeschlossen. Der Strom zwischen den Anschlüssen (+) und (PE) wird gemessen.

The test samples are connected as for normal use according to the manufacturer's instructions to a power supply at the maximum continuous operating voltage (U_{CPV}).

The current that flows through the terminals (+) and (PE) is measured.

1 ODT 1	2 ODT 2	3 ODT 3
0,282 μ A	0,300 μ A	0,293 μ A

2.3.2 Bestimmung der Begrenzungsspannung vor der Arbeitsprüfung (Abschnitt 7.4.4)

2.3.2 Determination of limiting voltage before operating duty test (Clause 7.4.4)

Die Bestimmungen der Reststoßspannung erfolgt mit zwei 8/20-Stoßstromimpulsen, mit I_n positiver und negativer Polarität.

Determination of the residual voltage with two 8/20 current impulses, one of positive polarity and one of negative polarity, with I_n

Polarity	1 ODT 1	2 ODT 2	3 ODT 3
positive	3,11 kV	3,11 kV	3,12 kV
negative	3,11 kV	3,15 kV	3,11 kV

Die Parameter sind den Oszillogrammen 13, 14, 15, 19, 20 und 21 aus Anhang „OBO-V20C3PHFS1000-Ures-121026“ entnommen.

The measured parameters are given in the oscillograms no. 13, 14, 15, 19, 20 and 21 in attachment “OBO-V20C3PHFS1000-Ures-121026”

Gemessene Begrenzungsspannung: 3,15kV
Measured Limiting voltage: 3,15kV



2.3.3 Arbeitsprüfung (Abschnitt 7.4.5.2)

2.3.3 Operating duty test (Clause 7.4.5.2)

Die Prüflinge sind an eine Spannungsquelle nach 7.2.5.2 angeschlossen und werden in drei Gruppen mit je fünf Stromimpulsen (8/20) mit I_n beaufschlagt.

While the test samples are connected to a voltage source according to 7.2.5.2 three groups of five current impulses (8/20) with I_n are applied.

$U_{DC\ OC} = 973\ V$

$I_p = 274\ A$

(siehe Oszillogramm Nr. 2128057 im Anhang 175701)
(see Oscillogram no. 2128057 in attachment 175701)

Test specimen	Impulse no.	Oscillogram no.	Follow current	Thermal stability	
				I_{CPV}	$I_{CPV+5min}$
1 ODT 1	1	2128069	0,0 A	-	-
	2	2128070	0,0 A	-	-
	3	2128071	0,0 A	-	-
	4	2128072	0,0 A	-	-
	5	2128073	0,0 A	-	-
1 ODT 1	6	2128083	0,0 A	-	-
	7	2128084	0,0 A	-	-
	8	2128085	0,0 A	-	-
	9	2128086	0,0 A	-	-
	10	2128087	0,0 A	-	-
1 ODT 1	11	2128099	0,0 A	-	-
	12	2128100	0,0 A	-	-
	13	2128101	0,0 A	-	-
	14	2128102	0,0 A	-	-
	15	2128103	0,0 A	23 μA	15 μA



Test specimen	Impulse no.	Oscillogram no.	Follow current	Thermal stability	
				I _{CPV}	I _{CPV+5min}
2 ODT 2	1	2128074	0,0 A	-	-
	2	no record	0,0 A	-	-
	3	2128075	0,0 A	-	-
	4	2128076	0,0 A	-	-
	5	2128077	0,0 A	-	-
2 ODT 2	6	2128088	0,0 A	-	-
	7	2128089	0,0 A	-	-
	8	2128090	0,0 A	-	-
	9	2128091	0,0 A	-	-
	10	2128092	0,0 A	-	-
2 ODT 2	11	2128104	0,0 A	-	-
	12	2128105	0,0 A	-	-
	13	2128106	0,0 A	-	-
	14	2128107	0,0 A	-	-
	15	2128108	0,0 A	16 µA	11 µA

Test specimen	Impulse no.	Oscillogram no.	Follow current	Thermal stability	
				I _{CPV}	I _{CPV+5min}
3 ODT 3	1	2128078	0,0 A	-	-
	2	2128079	0,0 A	-	-
	3	2128080	0,0 A	-	-
	4	2128081	0,0 A	-	-
	5	2128082	0,0 A	-	-
3 ODT 3	6	2128093	0,0 A	-	-
	7	2128094	0,0 A	-	-
	8	2128095	0,0 A	-	-
	9	2128096	0,0 A	-	-
	10	2128097	0,0 A	-	-
3 ODT 3	11	2128109	0,0 A	-	-
	12	2128110	0,0 A	-	-
	13	no record	0,0A	-	-
	14	2128111	0,0 A	-	-
	15	2128112	0,0 A	40 µA	25 µA

Die zugehörigen Oszillogramme befinden sich in Anhang 175701.
The oscillograms are listed in attachment 175701.



2.3.4 Bestimmung der Begrenzungsspannung nach der Arbeitsprüfung (Tabelle 6 – D)

2.3.4 Determination of limiting voltage after operating duty test (Table 6 - D)

Bestimmungen der Reststoßspannung mit zwei 8/20-Stoßstromimpulsen, mit I_n positiver und negativer Polarität.

Determination of the residual voltage with two 8/20 current impulses, one of positive polarity and one of negative polarity, with I_n

Polarity	1 ODT 1	2 ODT 2	3 ODT 3
positive	3,16 kV	3,20 kV	3,13 kV
negative	3,18 kV	3,19 kV	3,08 kV

Die Parameter sind den Oscillogrammen 1, 2, 3, 4, 5 und 6 aus Anhang „OBO-V20C3PHFS1000-Ures-121214“ entnommen.

The measured parameters are given in the oscillograms no. 1, 2, 3, 4, 5 and 6 in attachment „OBO-V20C3PHFS1000-Ures-121214“

Gemessene Begrenzungsspannung: 3,20 kV

Measured Limiting voltage: 3,20 kV

2.3.5 Leckstrommessung nach der Arbeitsprüfung (Tabelle 6 – E)

2.3.5 Measurment of leakage current after operating duty test (Table 6 – E)

Die Prüfmuster sind entsprechend den Herstellervorgaben an eine Spannungsquelle mit der maximalen Dauerspannung U_{CPV} angeschlossen. Der Strom zwischen den Anschlüssen (+) und (PE) wird gemessen.

The test samples are connected as for normal use according to the manufacturer's instructions to a power supply at the maximum continuous operating voltage (U_{CPV}).

The current that flows through the terminals (+) and (PE) is measured.

1 ODT 1	2 ODT 2	3 ODT 3
0,933 μ A	0,941 μ A	0,861 μ A

Der gemessene Strom überschreitet den Wert von 1 mA nicht.

The current does not exceed a value of 1 mA.



2.4 Prüfung des Gesamtableitstromes von mehrpoligen SPDs (Abschnitt 7.8.1)

2.4 Total discharge current test for multipole SPDs (Clause 7.8.1)

2.4.1 Leckstrommessung vor der der Prüfung des Gesamtableitstromes (Tabelle 6 – E)

2.4.1 Measurement of leakage current before total discharge current test (Table 6 – E)

Die Prüfmuster sind entsprechend den Herstellervorgaben an eine Spannungsquelle mit der maximalen Dauerspannung U_{CPV} angeschlossen. Der Strom, der durch jeden Anschluss fließt, wird gemessen.

The test samples are connected as for normal use according to the manufacturer's instructions to a power supply at the maximum continuous operating voltage (U_{CPV}).

The current that flows through each terminal is measured.

Connection to DC source			Measured leakage current		
Terminals			Test specimen		
(+)	(PE)	(-)	13 Itotal 1	14 Itotal 2	15 Itotal 3
+	NC	-	0,262 μ A	0,310 μ A	0,345 μ A
+	+	-	0,383 μ A	0,434 μ A	0,491 μ A
+	-	-	0,364 μ A	0,406 μ A	0,444 μ A

NC - not connected

2.4.2 Prüfung des Gesamtableitstromes

2.4.2 Total discharge current test

Die Prüflinge werden mit dem vom Hersteller ausgewiesenen Gesamtableitstrom I_{Total} beaufschlagt zwischen den Anschlüssen (+)+(-) - (PE).

The test samples are tested with I_{Total} , declared by the manufacturer, between (+)+(-) - (PE).

Die Parameter und Oszillogramme sind im Anhang „OBO-V20C3PHFS1000-Itotal-121026“ aufgeführt.

The parameters and oscillograms are given in attachment “OBO-V20C3PHFS1000-Itotal-121026”



2.4.3 Bestimmung der Begrenzungsspannung nach der Prüfung des Gesamtableitstromes (Tabelle 6 – D)

2.4.3 Determination of limiting voltage after total discharge current test (Table 6 - D)

Die Bestimmungen der Reststoßspannung erfolgt mit zwei 8/20-Stoßstromimpulsen mit I_n in positiver und negativer Polarität.

The determination of the residual voltage is performed with two 8/20 current impulses with I_n , one of positive polarity and one of negative polarity.

Mode of protection	Polarity	13 ltotal 1	14 ltotal 2	15 ltotal 3
(+) - (-)	positive	3,11 kV	3,14 kV	3,12 kV
	negative	3,16 kV	3,16 kV	3,12 kV
(+) - (PE)	positive	3,11 kV	3,11 kV	3,11 kV
	negative	3,12 kV	3,10 kV	3,12 kV
(-) - (PE)	positive	3,14 kV	3,11 kV	3,10 kV
	negative	3,18 kV	3,11 kV	3,11 kV

Die Parameter sind den Oszillogrammen 4, 5, 6, 10, 11, 12, 16, 17, 18, 22, 23, 24, 25, 26, 27, 28, 29 und 30 aus Anhang „OBO-V20C3PHFS1000-Ures-121026“, entnommen.

The measured parameters are given in the oscillograms no. 4, 5, 6, 10, 11, 12, 16, 17, 18, 22, 23, 24, 25, 26, 27, 28, 29 and 30 in attachment “OBO-V20C3PHFS1000-Ures-121026”.

Gemessene Begrenzungsspannung: 3,18 kV

Measured Limiting voltage: 3,18 kV

2.4.4 Leckstrommessung nach der der Prüfung des Gesamtableitstromes (Tabelle 6 – E)

2.4.4 Measurment of leakage current after total discharge current test (Table 6 – E)

Die Prüfmuster sind entsprechend den Herstellervorgaben an eine Spannungsquelle mit der maximalen Dauerspannung U_{CPV} angeschlossen. Der Strom, der durch jeden Anschluss fließt, wird gemessen.

The test samples are connected as for normal use according to the manufacturer's instructions to a power supply at the maximum continuous operating voltage (U_{CPV}). The current that flows through each terminal is measured.



Connection to DC source			Measured leakage current		
Terminals			Test specimen		
(+)	(PE)	(-)	13 Itotal 1	14 Itotal 2	15 Itotal 3
+	NC	-	0,613 μ A	0,708 μ A	0,760 μ A
+	+	-	1,020 μ A	1,110 μ A	1,231 μ A
+	-	-	1,055 μ A	0,989 μ A	1,152 μ A

NC - not connected

Der Strom, der durch jeden Anschluss fließt, überschreitet den Wert von 1 mA nicht.

The current that flows through each terminal does not exceed a value of 1 mA.



3. Prüf- und Messmittelliste

3. Test equipment and measuring instruments

1. Lightning current generator (LCG):

Capacitance $C_{\max}$: 50 μF
 Charge voltage $U_{\text{charge max}}$: 100 kV
 Impulse current $I_{\max}$: 200 kA
 Waveshape: 8/20 and 10/350

Shunt of the lightning current generator:

Manufacturer: Hilo Test GmbH, Stutensee
 Type: ISM 200P/0.4 spez
 Serial-no: 4203
 Ident.-no: P606006
 Nominal resistance R_N : 0,4 m Ω
 Tolerance: $\pm 1 \%$
 Impulse current $I_{\max}$: 200 kA
 Specific energy: $56 \cdot 10^6 \text{ A}^2\text{s}$
 Bandwidth: 2 MHz
 Risetime T_a : 175 ns
 Last calibration: 2012-01-12
 Next calibration: 2015-01-11

Voltage Probe:

Differential Voltage Divider consisting of two voltage probes (T1, T2)

Ident.-no:	P600005		
Setting:	10/20 kV 0 dB	10/20 kV 20dB	10/20 kV 40dB
Ratio T1:	1170/2340	11350/23200	112500/228000
Ratio T2:	1090/2230	11000/22400	112000/228000
Accuracy:	$\pm 3 \%$		
Maximum measurable voltages:	0,3/0,6 kV	3/6 kV	10/20 kV
Last calibration:	2012-02-23		
Next calibration:	2013-02-22		



2. Oscilloscope:

Manufacturer: Agilent
 Type: 54624A
 Serial-no: MY40002936
 Ident.-no: P603007
 Channels: 4
 Bandwidth: 100 MHz
 Sampling rate: 200 MSa/s
 Last calibration: 2012-08-21
 Next calibration: 2014-08-21

Voltage Probe:

Manufacturer: Agilent Technologies
 Type: 10074C
 Ident.-no: P610007
 Bandwidth: 100 MHz
 Rise Time: 3,5 ns
 Attenuation ratio: 10:1
 Maximum input: 500 Vpk CAT I 400 Vpk CAT II
 Input resistance: 10 MΩ
 Input capacitance: 15 pF
 Last calibration: 2012-08-21
 Next calibration: 2014-08-21

3. Power Analyzer:

Manufacturer: LEM Norma
 Type: Norma 4000 – PP30
 Serial-no: U711497BA
 Ident.-no: P608001
 Bandwidth: 1 MHz
 Sampling rate: 102 kHz
 Last calibration: 2012-08-28
 Next calibration: 2014-08-28



4. Digital multimeter:

Manufacturer:	Agilent
Type:	34410A
Serial-no:	MY47004368
Ident.-no:	P601019
Display:	6 ½ Digits
Sampling rate:	1000 s ⁻¹
Last calibration:	2011-08-29
Next calibration:	2013-08-28

5. Standard current monitor:

Manufacturer:	Pearson Electronics Inc.
Model:	101
Serial-no:	93319
Ident.-no:	P607001
Max. impulse current:	50 kA
Max. impulse charge:	2,5 As
Max. continuous current:	200 A
Bandwidth:	4 MHz
Output:	10 mV/A
Last calibration:	2011-09-05
Next calibration:	2013-09-04

6. Voltage source:

Manufacturer:	fug Elektronik GmbH
Appellation:	Mittelspannungs-Netzgerät
Type:	MCN 140-2000
Facility-no:	81 08 583 01
Ident.-no:	P 602007
Maximum voltage:	2000 V _{DC}
Maximum current:	60 mA
Last calibration:	2011-04-12
Next calibration:	2013-04-11



IPH Prüf-/Messmittel

IPH-Inventarnummer

Koaxial-Shunt 5kA, 10V	9128/88
A/D Wandlermodul BE 256/634 I	10025/94/2
Spannungsteiler MST 10 - V	11283/07
A/D Wandlermodul BE 256/634 I	10116/96
Koaxial-Shunt 5kA, 10V	9315/89
A/D Wandlermodul BE 256/634 I	10125/96
Spannungsteiler MST 10 - V	11283/07
A/D Wandlermodul BE 256/634 I	10025/94/4
Koaxial-Shunt 5kA, 10V	9130/88
A/D Wandlermodul BE 256/634 I	10025/94/3
Spannungsteiler MST 10 - V	11283/07
A/D Wandlermodul BE 256/634 I	10112/96
Spannungsteiler MST 10 - V	11283/07
A/D Wandlermodul BE 256/634 I	10120/96
Koaxial-Shunt 1kA, 10V	9212/89
A/D Wandlermodul BE 256/634 I	10025/94/2
Spannungsteiler MST 10 - V	11283/07
A/D Wandlermodul BE 256/634 I	10124/96
Koaxial-Shunt 200kA, 10V	9135/88
A/D Wandlermodul BE 256/634 I	10125/96
Spannungsteiler P6015A	11852/10
A/D Wandlermodul BE 256/634 I	10117/96
Person Current Monitor 4418	11049/04
A/D Wandlermodul BE 256/634 I	10085/95/1
Koaxial-Shunt 10kA, 10V	9053/88
A/D Wandlermodul BE 256/634 I	10025/94/4
Koaxial-Shunt 1kA, 10V	9212/89
A/D Wandlermodul BE 256/634 I	10025/94/4



Testname: OBO-V20C3PHFS1000-Ures-121026

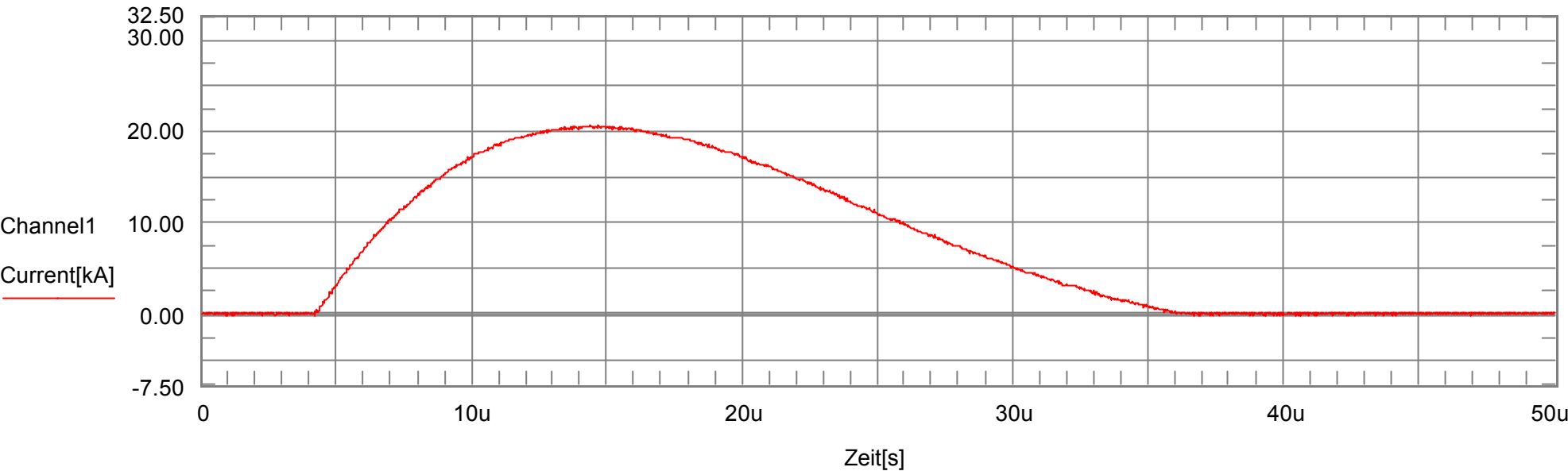
Date: 26.10.2012 11:46:04

Counter	Sample	Path	Polarity	Channel1: Current			Channel2: Voltage
				Peak Value	Front Time	Time To Half Value	U _{res}
1	12 Up 3	(+) to (-)	positive	20.7 kA	7.79 µs	20.9 µs	3.1 kV
2	10 Up 1			20.6 kA	7.65 µs	21 µs	3.15 kV
3	11 Up 2			20.7 kA	7.8 µs	20.9 µs	3.11 kV
4	13 Itotal 1			20.6 kA	7.86 µs	20.9 µs	3.11 kV
5	14 Itotal 2			20.7 kA	7.84 µs	20.9 µs	3.14 kV
6	15 Itotal 3			20.7 kA	7.79 µs	20.9 µs	3.12 kV
7	10 Up 1		negative	20.6 kA	7.84 µs	21.1 µs	3.21 kV
8	11 Up 2			20.6 kA	7.86 µs	20.9 µs	3.11 kV
9	12 Up 3			20.6 kA	7.74 µs	21 µs	3.15 kV
10	13 Itotal 1			20.6 kA	7.71 µs	21.1 µs	3.16 kV
11	14 Itotal 2			20.6 kA	7.8 µs	21 µs	3.16 kV
12	15 Itotal 3			20.7 kA	7.96 µs	21 µs	3.12 kV
13	1 ODT 1	(+) to (PE))	positive	20.8 kA	7.84 µs	20.9 µs	3.11 kV
14	2 ODT 2			20.5 kA	7.75 µs	20.8 µs	3.11 kV
15	3 ODT 3			20.6 kA	7.76 µs	20.9 µs	3.12 kV
16	13 Itotal 1			20.6 kA	7.74 µs	20.8 µs	3.11 kV
17	14 Itotal 2			20.7 kA	7.79 µs	20.9 µs	3.11 kV
18	15 Itotal 3			20.6 kA	7.83 µs	20.9 µs	3.11 kV
19	1 ODT 1		negative	20.6 kA	7.75 µs	21 µs	3.11 kV
20	2 ODT 2			20.6 kA	7.77 µs	20.9 µs	3.15 kV
21	3 ODT 3			20.7 kA	7.88 µs	21 µs	3.11 kV
22	13 Itotal 1			20.6 kA	7.8 µs	21 µs	3.12 kV
23	14 Itotal 2			20.5 kA	7.76 µs	21 µs	3.1 kV
24	15 Itotal 3			20.6 kA	7.89 µs	20.9 µs	3.12 kV
25	13 Itotal 1	(-) to (PE))	positive	20.4 kA	7.75 µs	21 µs	3.14 kV
26	14 Itotal 2			20.6 kA	7.81 µs	21 µs	3.11 kV
27	15 Itotal 3			20.7 kA	7.83 µs	20.9 µs	3.1 kV
28	13 Itotal 1		negative	20.7 kA	7.74 µs	21 µs	3.18 kV
29	14 Itotal 2			20.6 kA	7.75 µs	20.8 µs	3.11 kV
30	15 Itotal 3			20.7 kA	7.77 µs	20.8 µs	3.11 kV
31	10 Up 1	(+) to (-)	negative	40.4 kA	8.4 µs	21.8 µs	3.69 kV
32	11 Up 2			40.4 kA	8.42 µs	21.8 µs	3.61 kV
33	12 Up 3			40.4 kA	8.42 µs	21.8 µs	3.62 kV

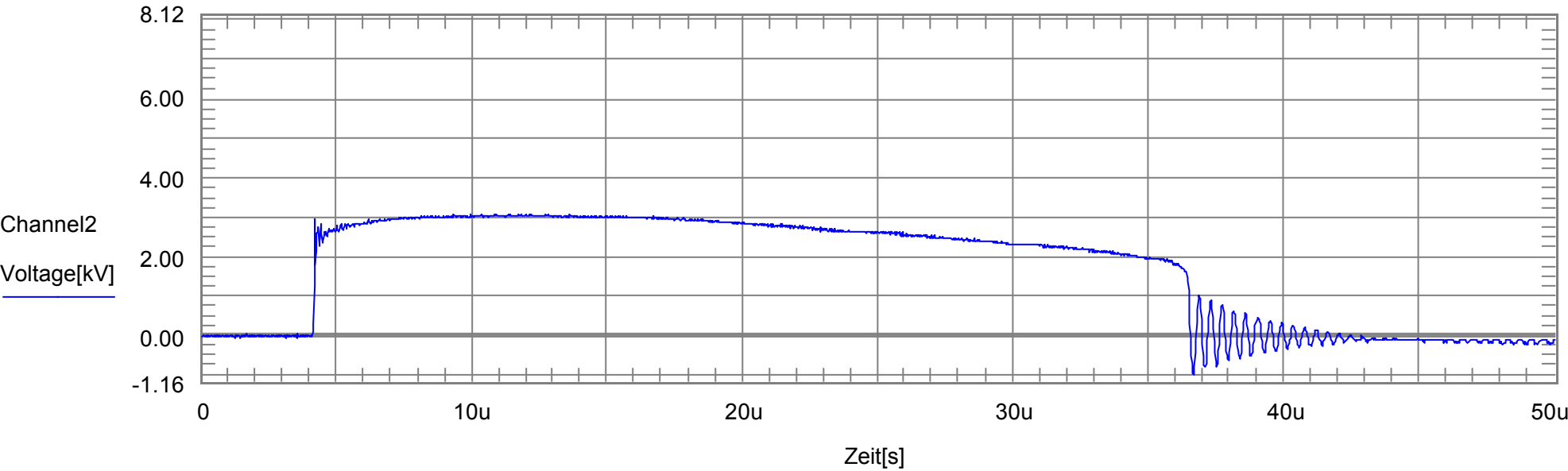
For the oscillograms no. 6, 8, 10, 11, 12, 22, 24 and 26, the measured peak value of channel 2 is not the residual voltage. The mentioned oscillograms show a spike in the voltage graph at current beginning that is caused by the switching element (air spark gap) of the lightning current generator and that has to be neglected. Therefore, the measured residual voltage is pointed out in the relevant oscillograms.

26/Oct/2012 09:24:45

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 1



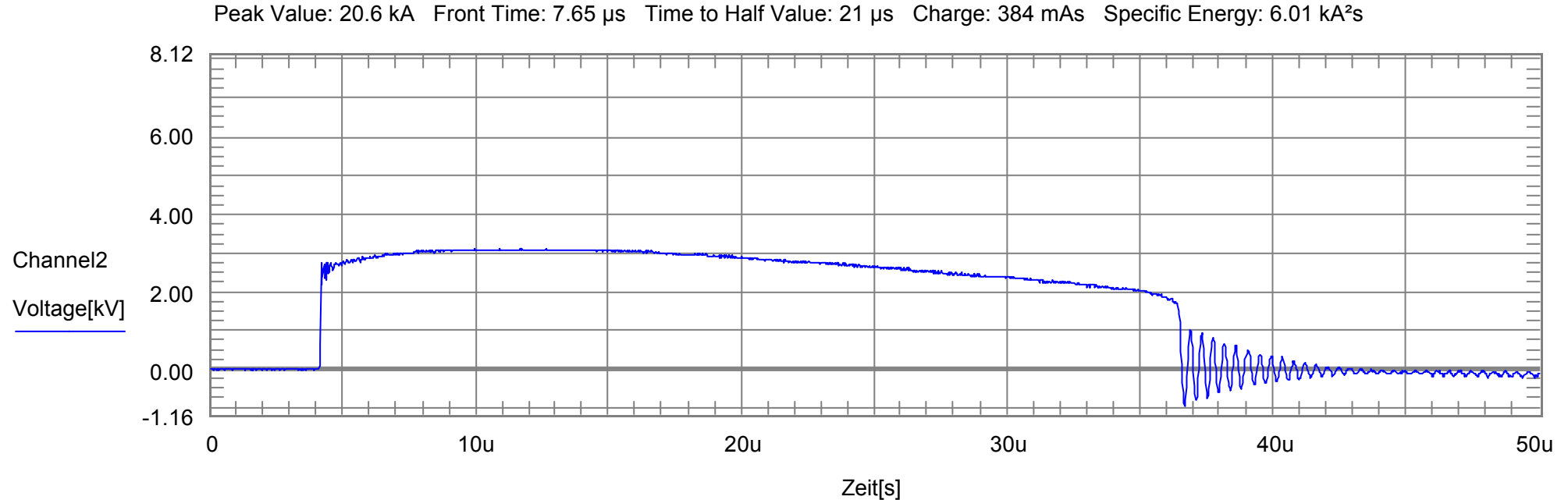
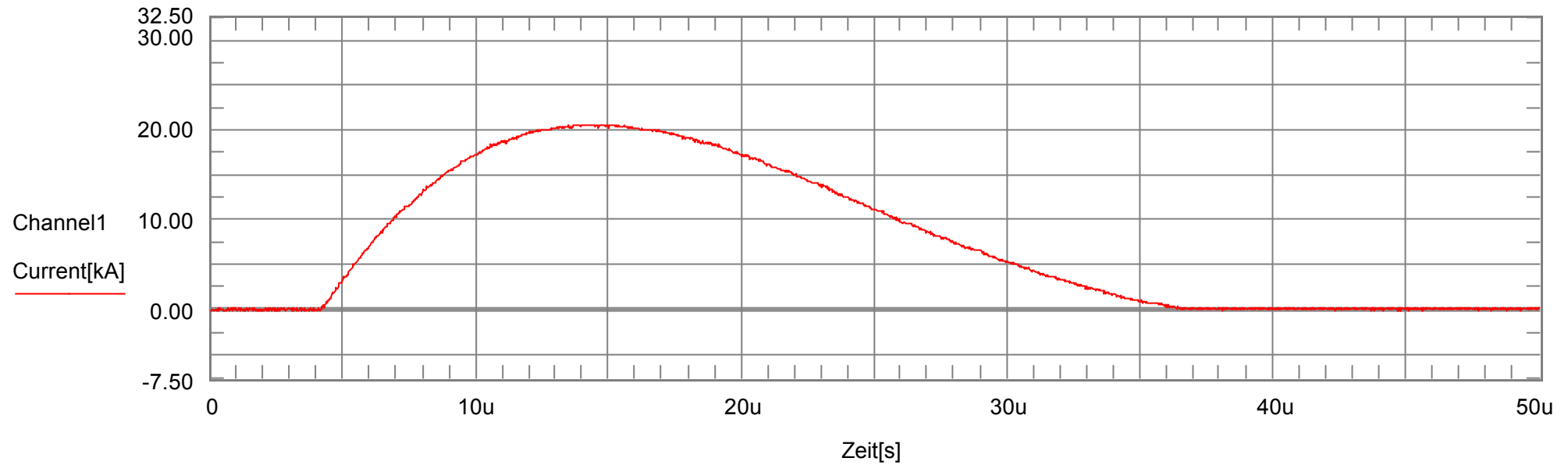
Peak Value: 20.7 kA Front Time: 7.79 μ s Time to Half Value: 20.9 μ s Charge: 380 mAs Specific Energy: 5.94 kA²s



Peak Value: 3.1 kV Front Time: 2.08 μ s Time to Half Value: 32.2 μ s

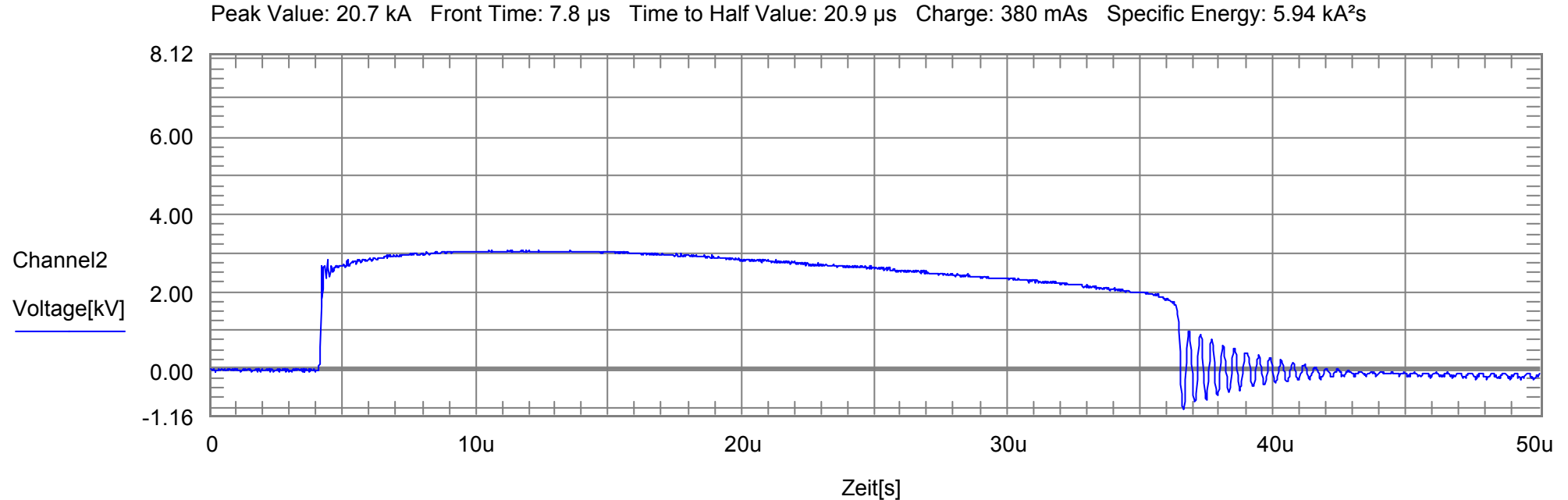
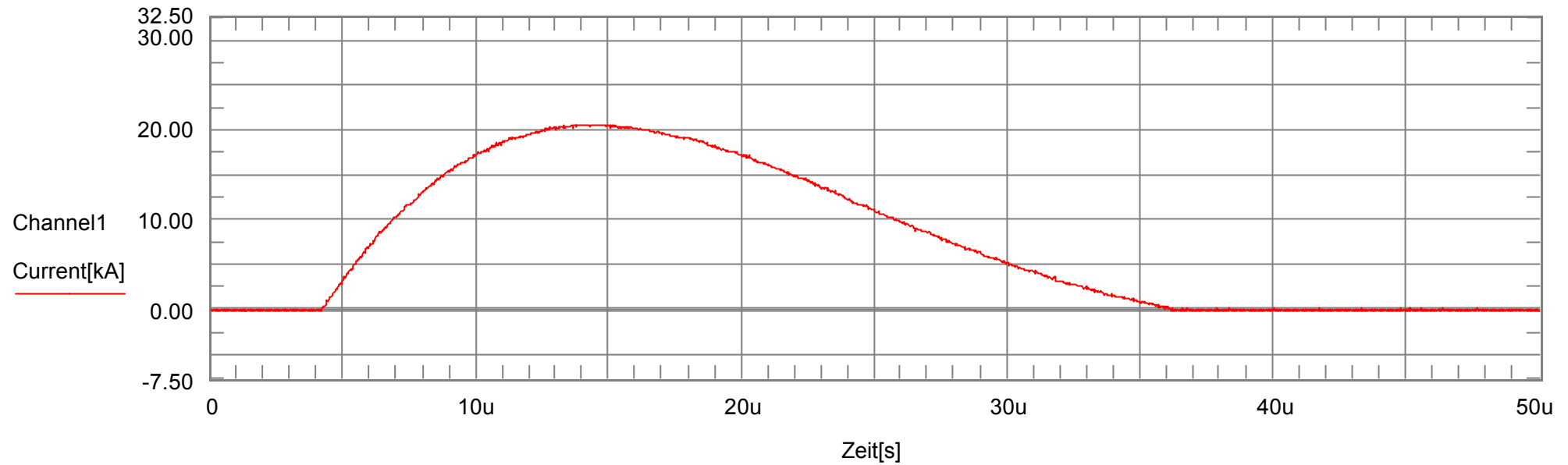
26/Oct/2012 09:30:21

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 2



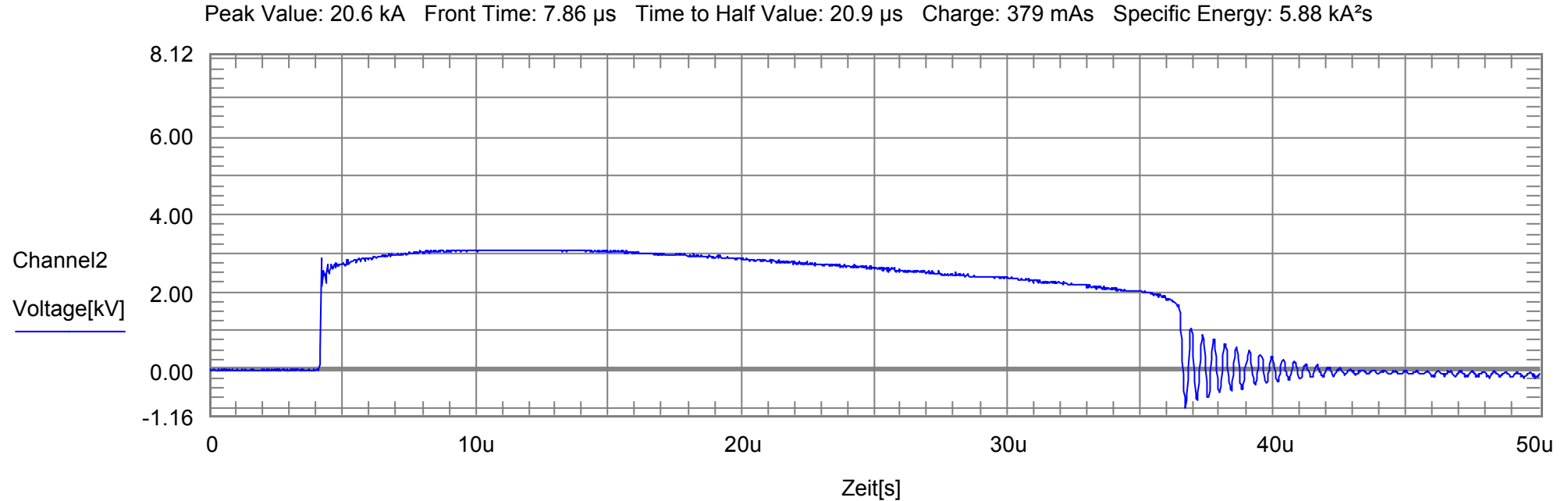
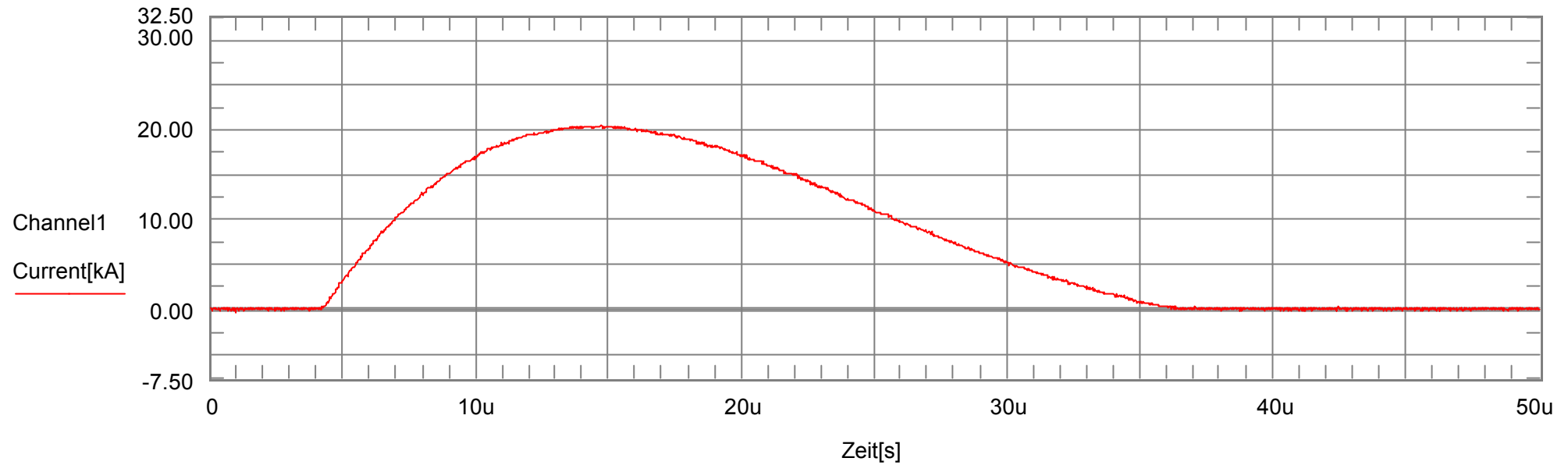
26/Oct/2012 09:33:19

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 3



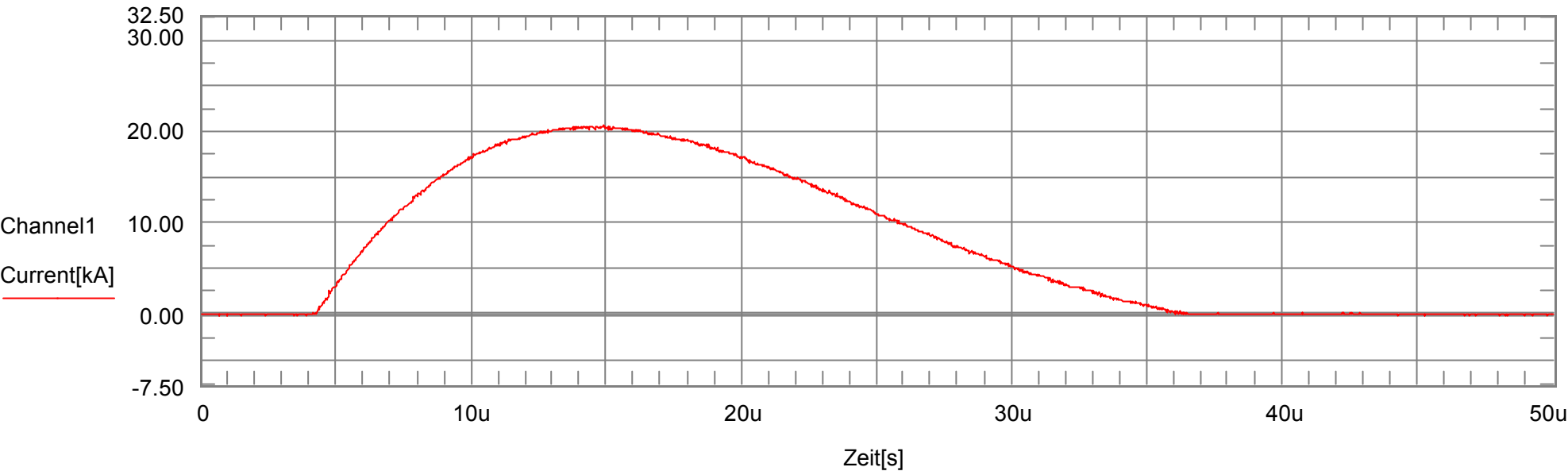
26/Oct/2012 09:36:50

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 4

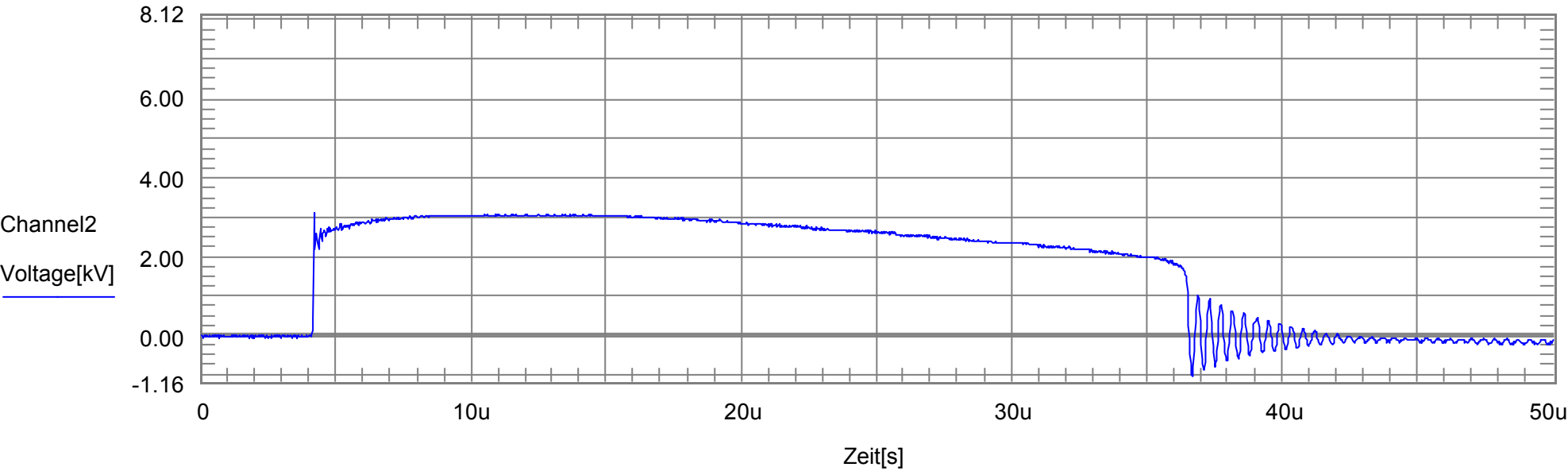
Peak Value: 3.11 kV Front Time: 2 μ s Time to Half Value: 32.3 μ s

26/Oct/2012 09:42:22

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 5



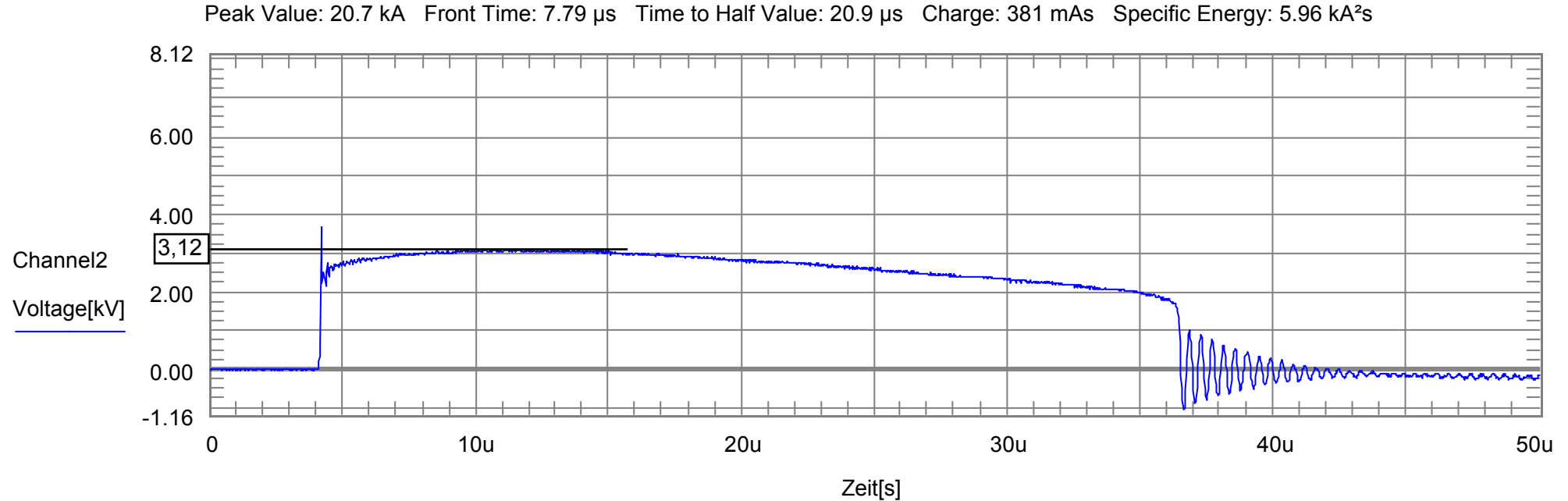
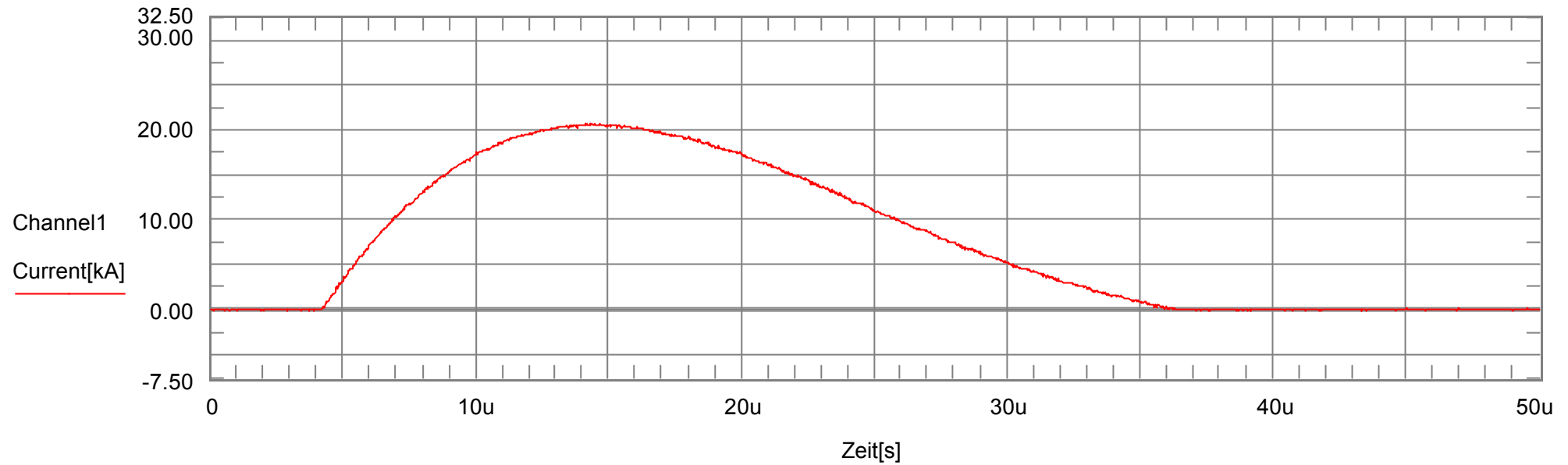
Peak Value: 20.7 kA Front Time: 7.84 μ s Time to Half Value: 20.9 μ s Charge: 380 mAs Specific Energy: 5.91 kA²s



Peak Value: 3.14 kV Front Time: 2.55 μ s Time to Half Value: 32.2 μ s

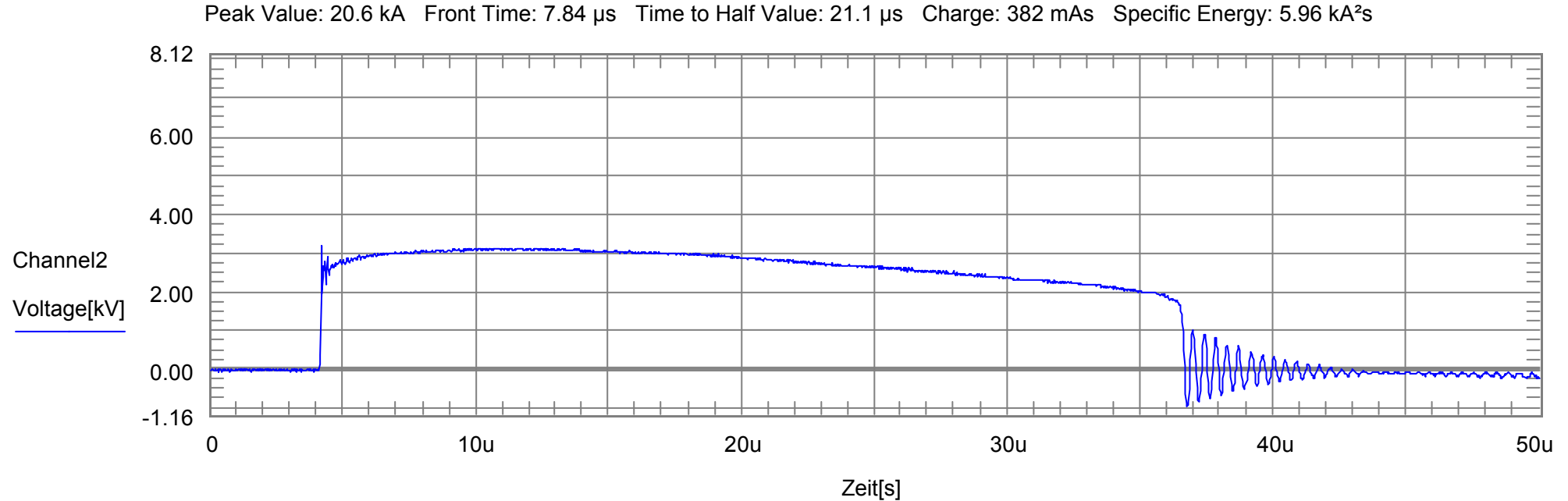
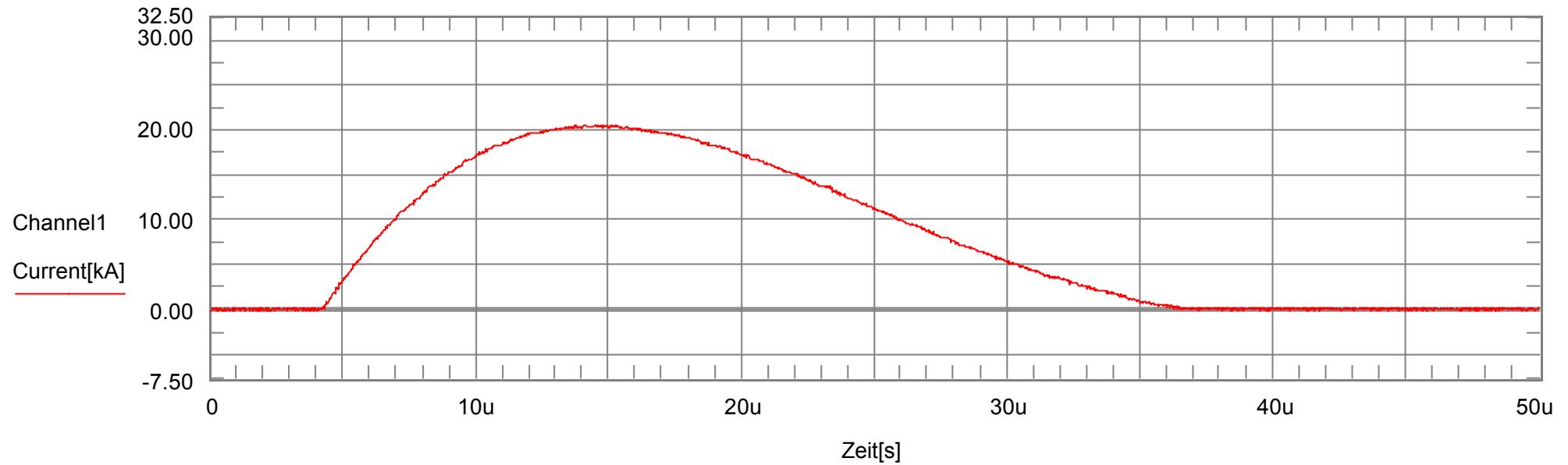
26/Oct/2012 09:46:31

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 6



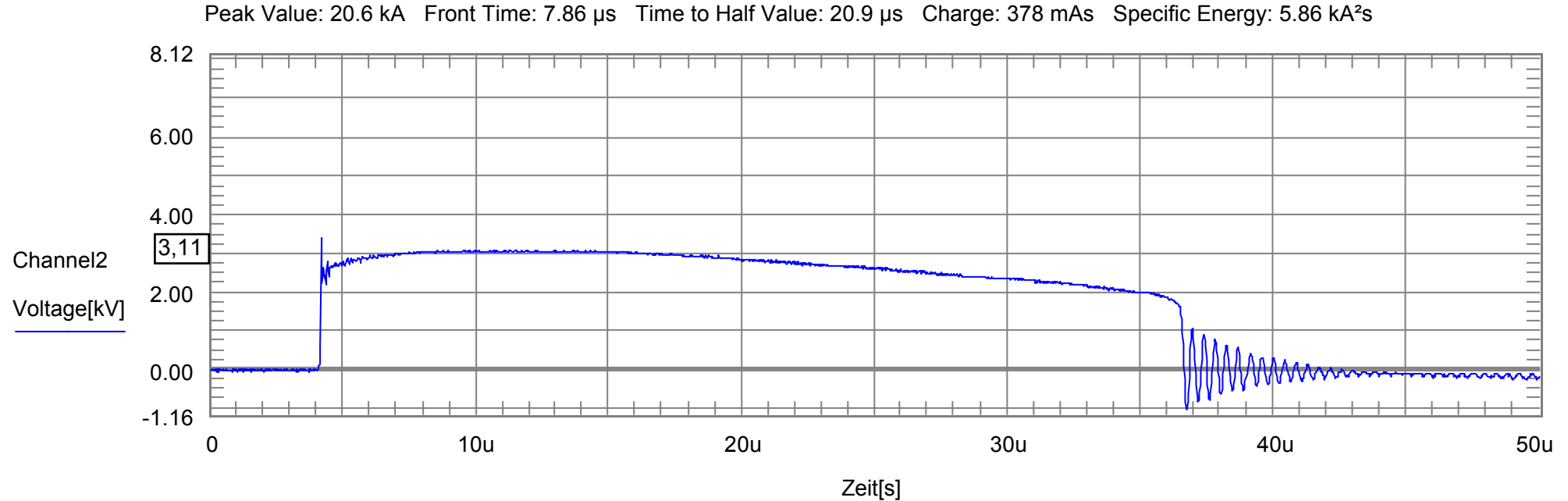
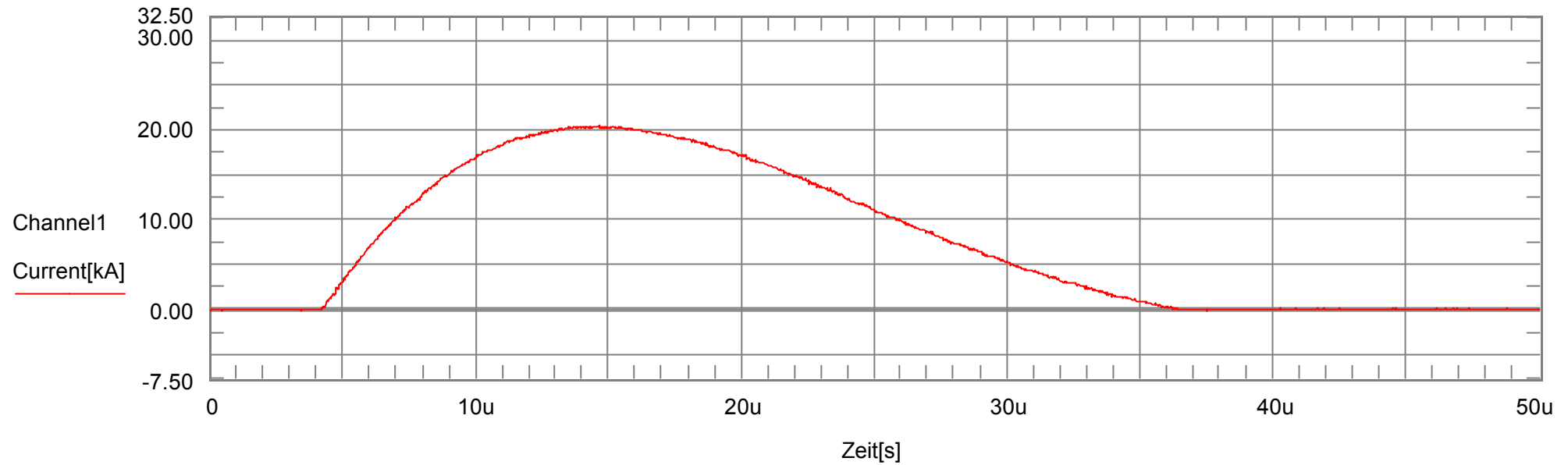
26/Oct/2012 09:54:53

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 7



26/Oct/2012 09:58:03

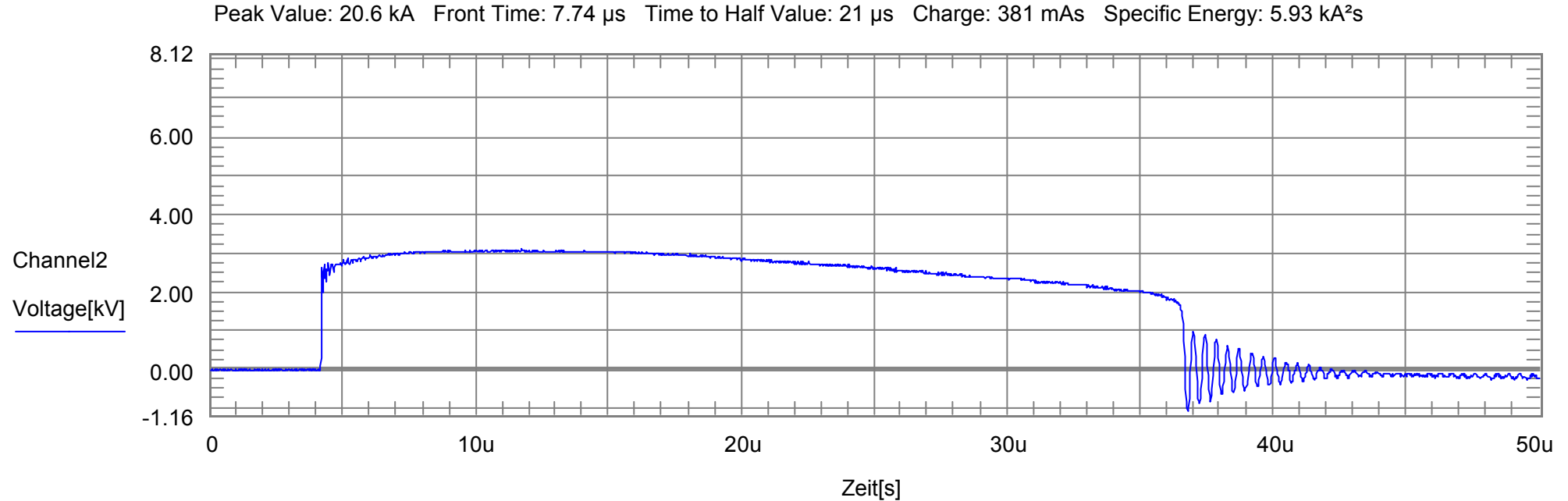
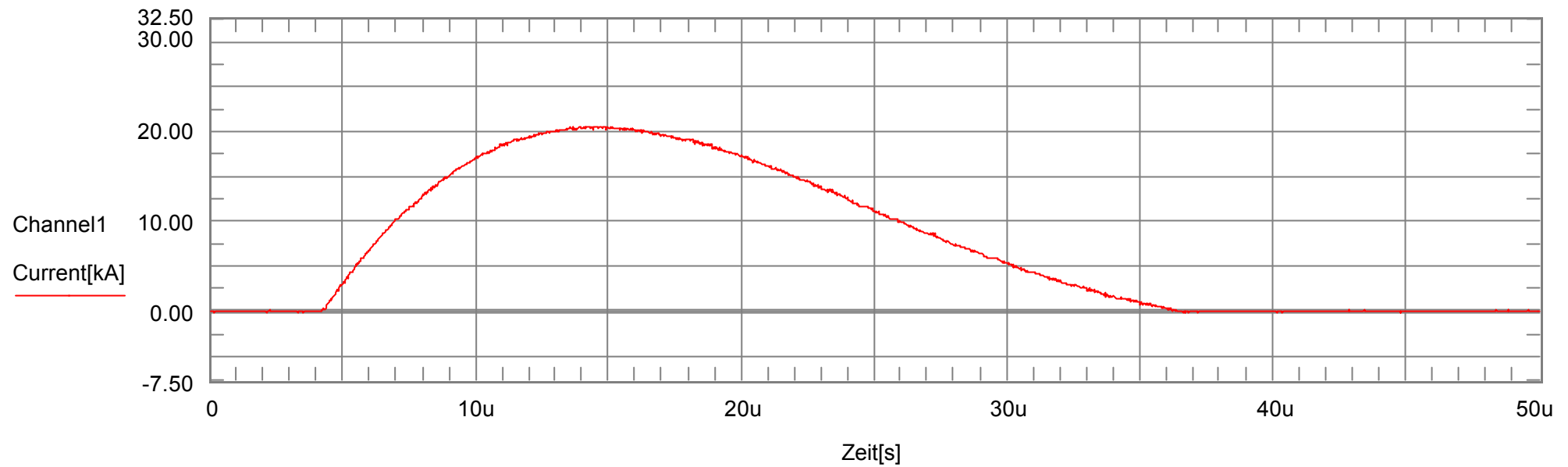
Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 8



Peak Value: 3.43 kV Front Time: 0 μ s Time to Half Value: 0 μ s

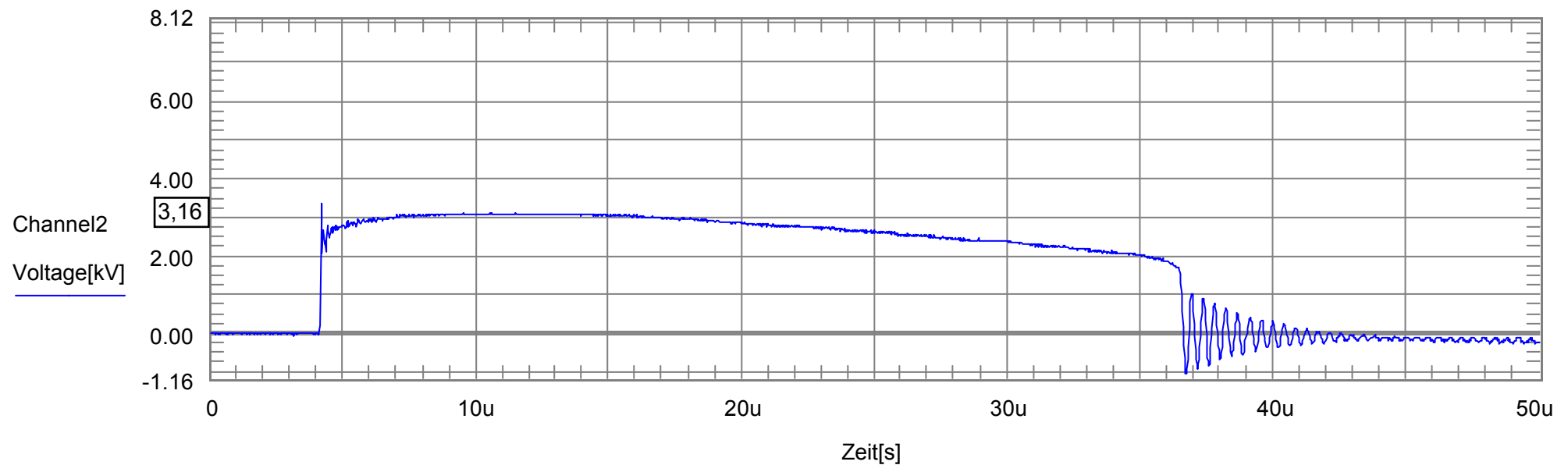
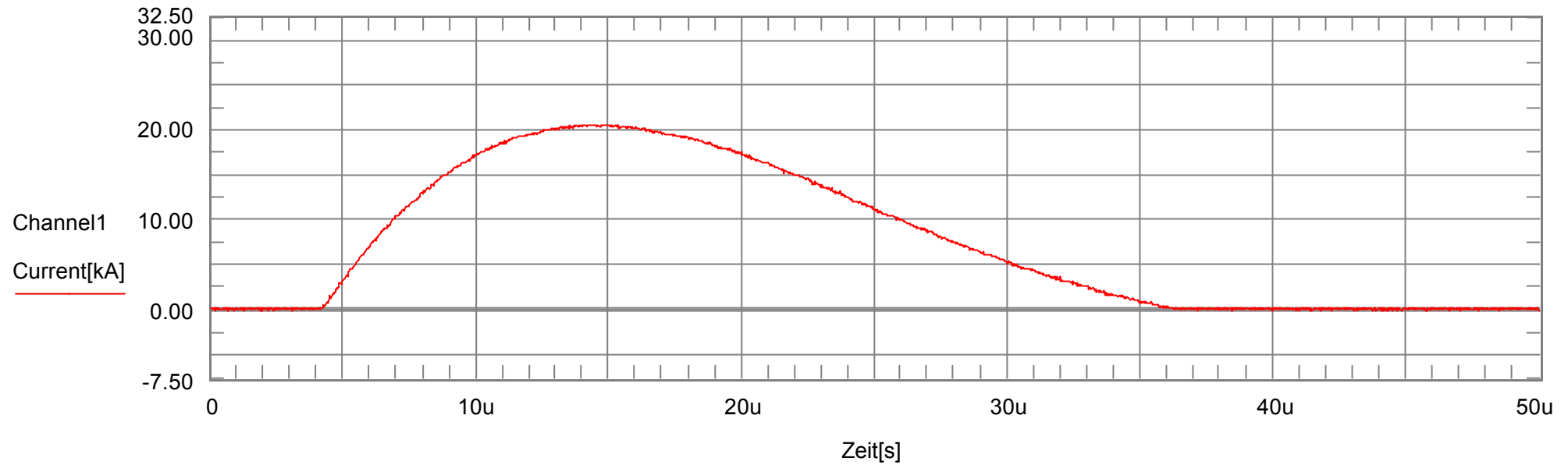
26/Oct/2012 10:01:21

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 9

Peak Value: 3.15 kV Front Time: 2.07 μ s Time to Half Value: 32.3 μ s

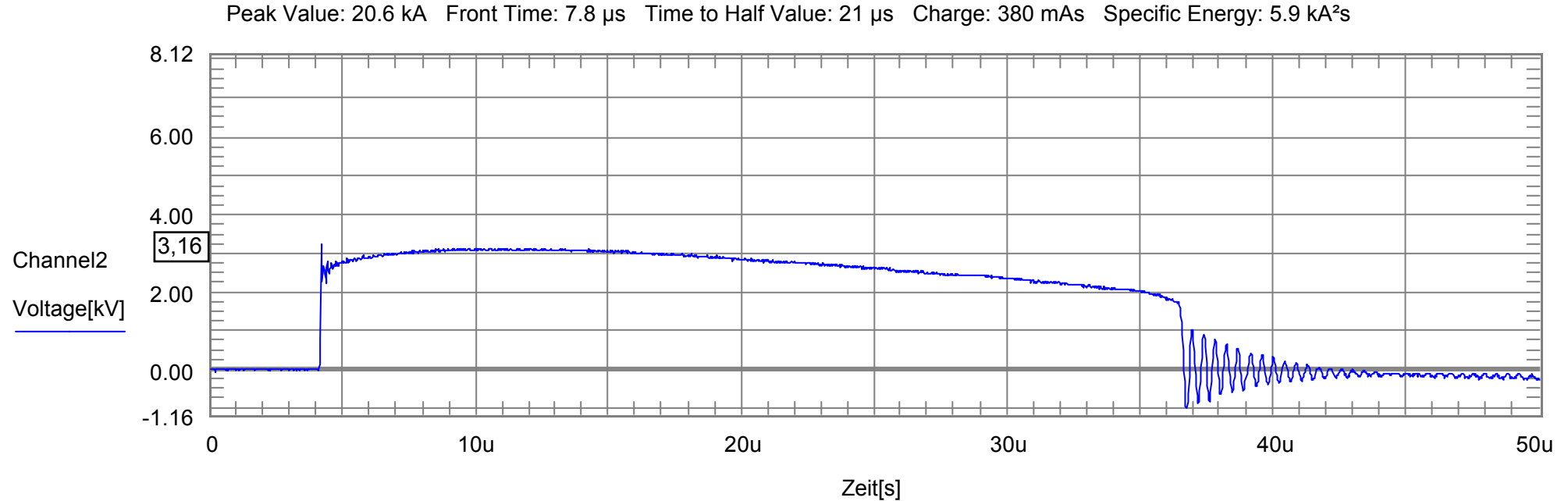
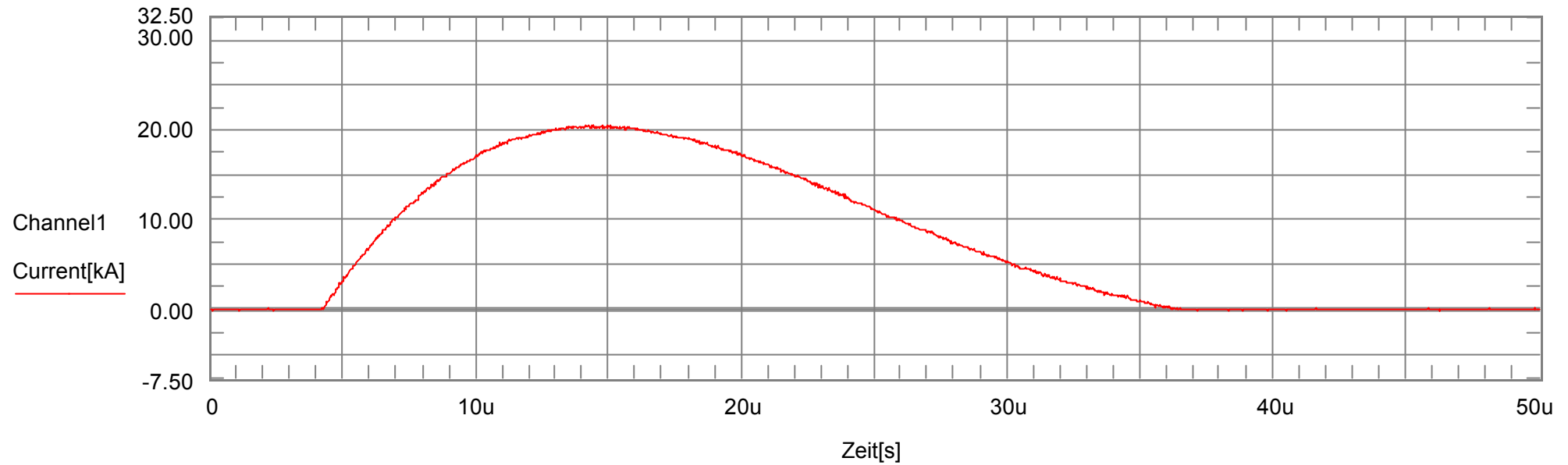
26/Oct/2012 10:03:37

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 10



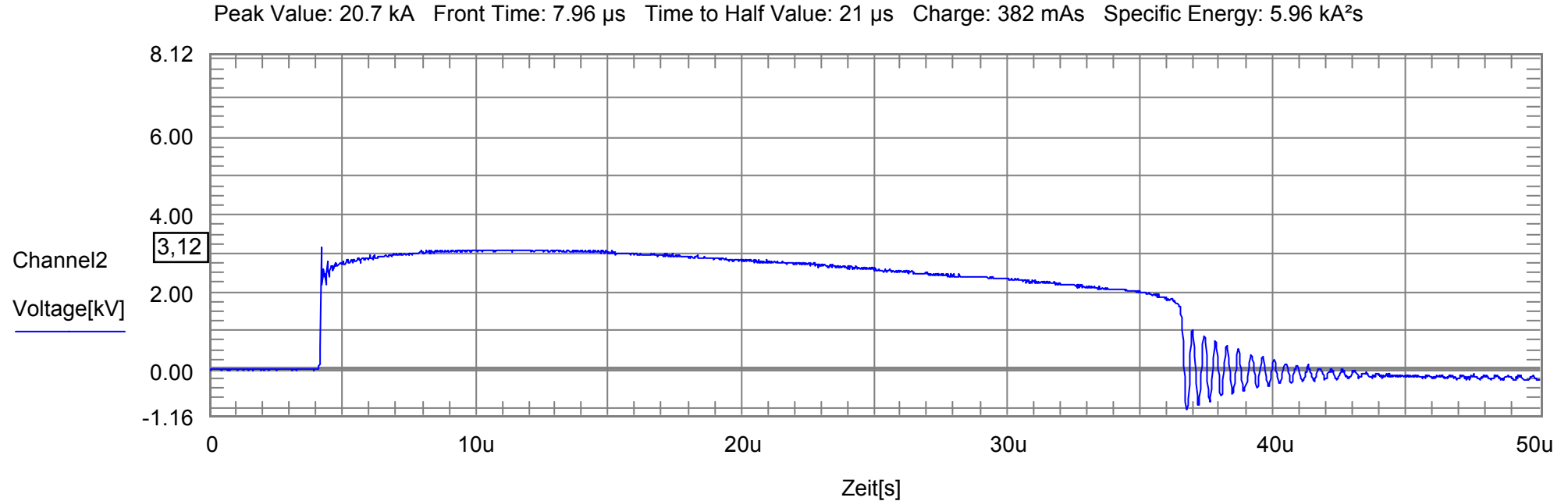
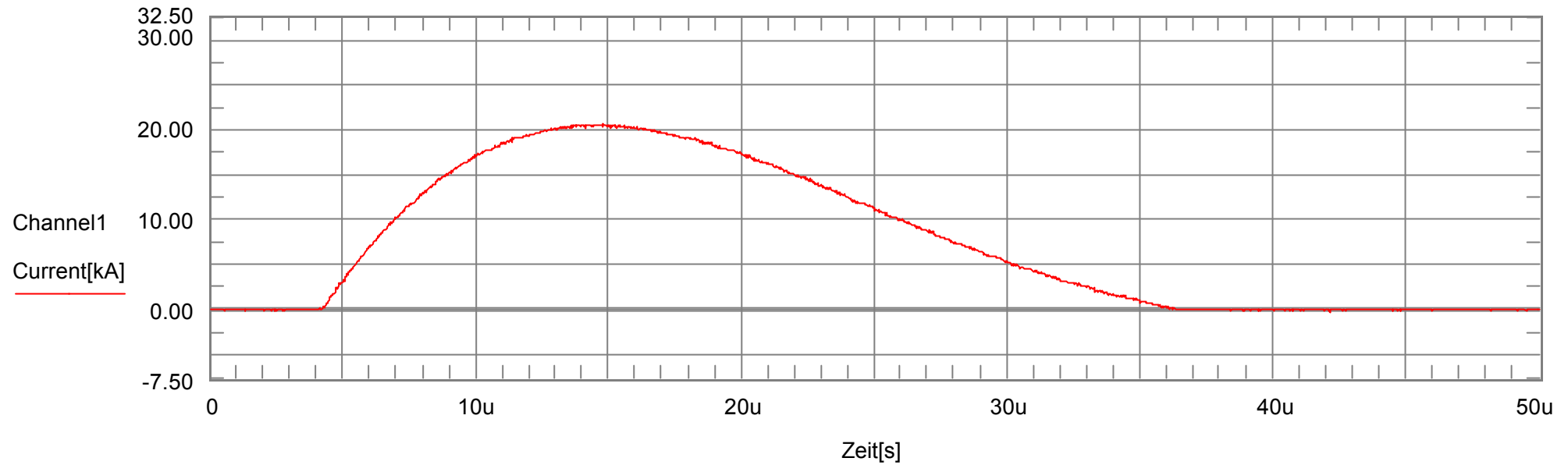
26/Oct/2012 10:08:24

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 11



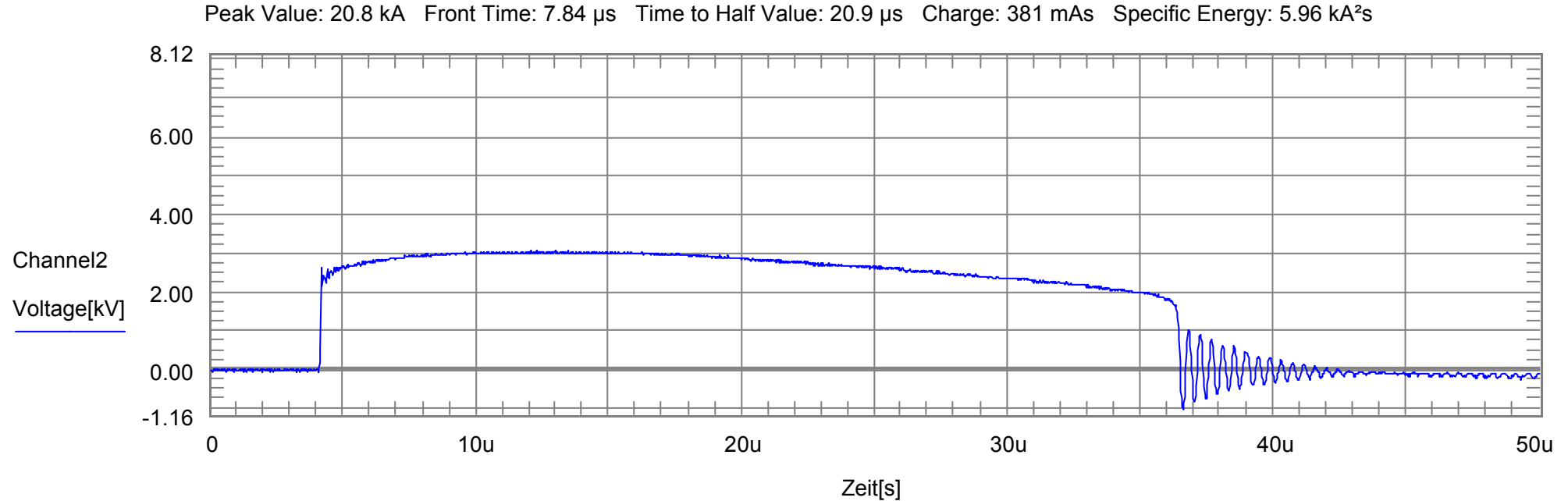
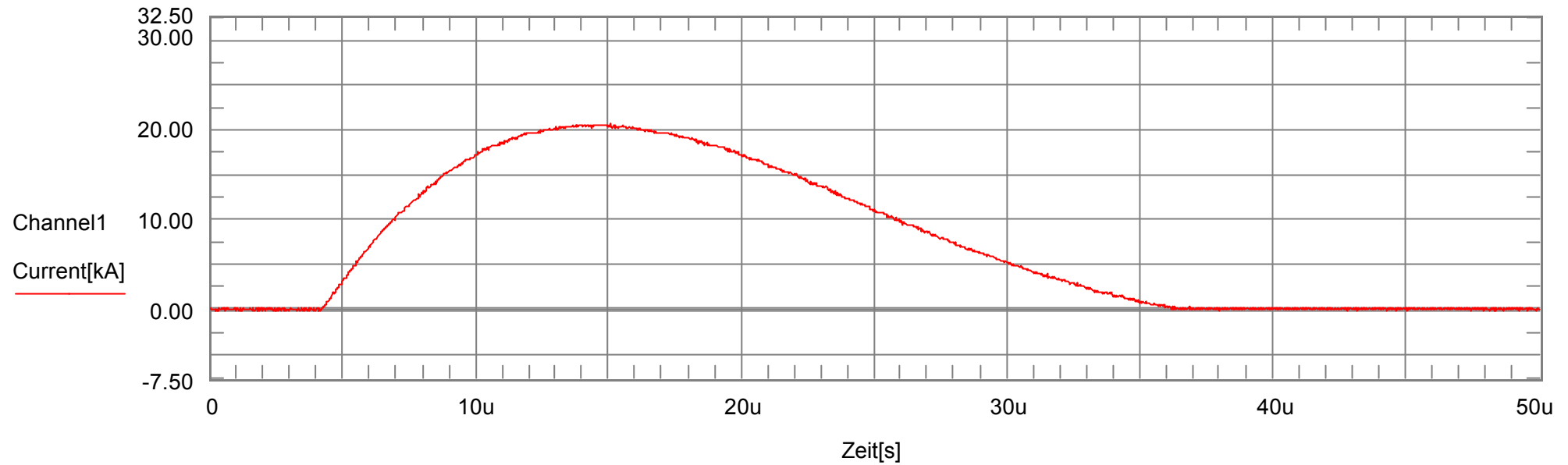
26/Oct/2012 10:11:06

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 12



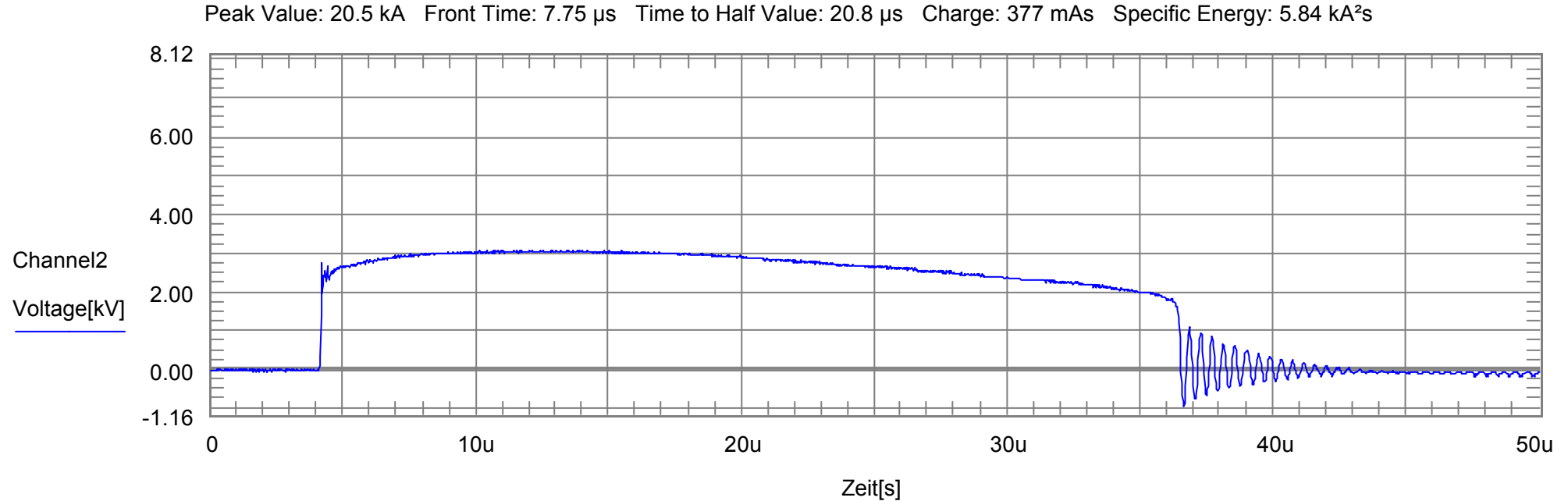
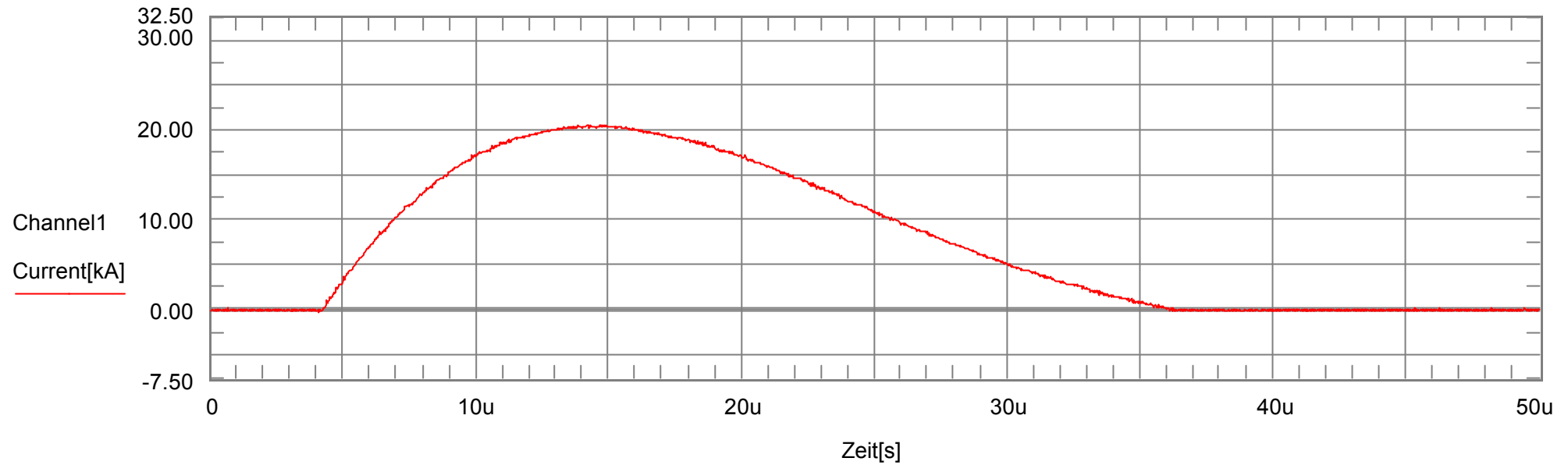
26/Oct/2012 10:17:29

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 13



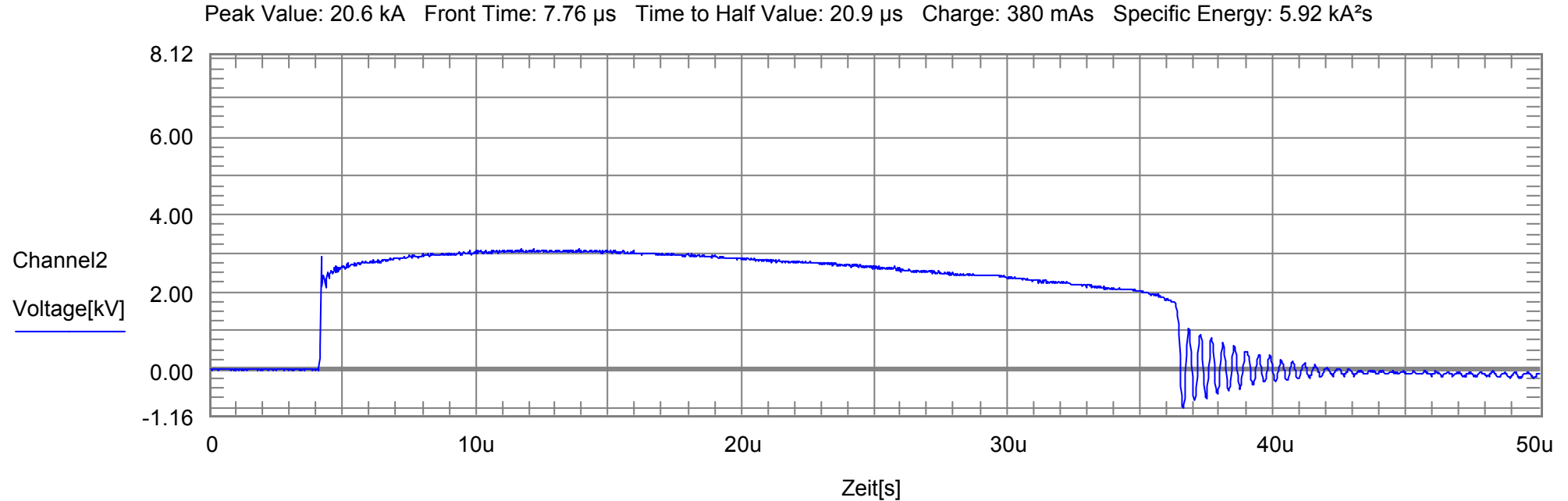
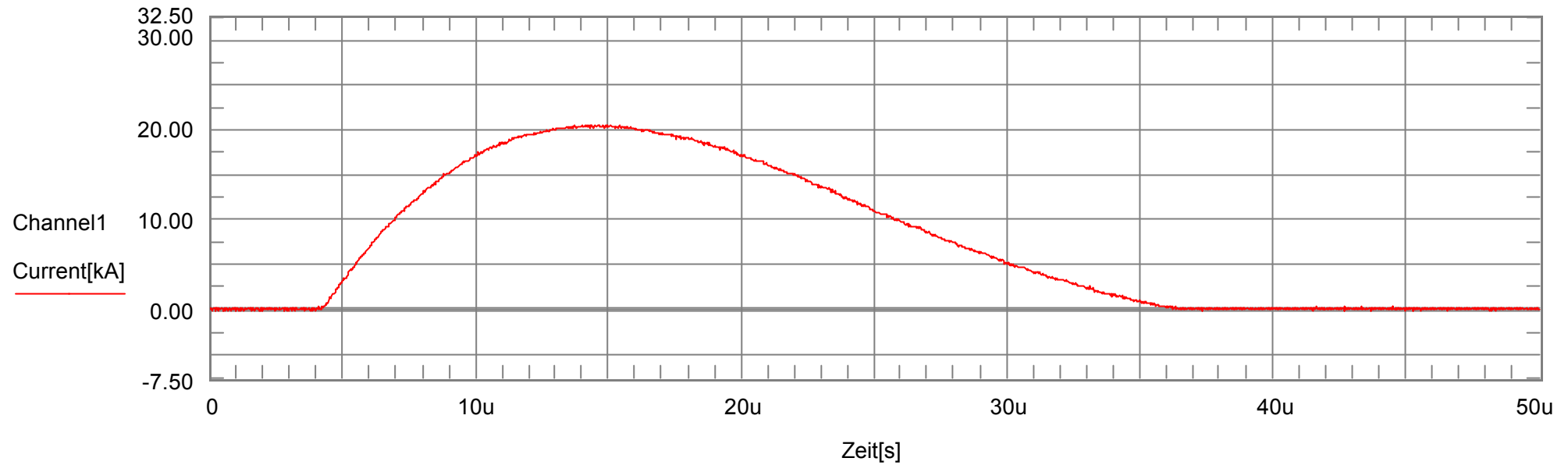
26/Oct/2012 10:20:47

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 14



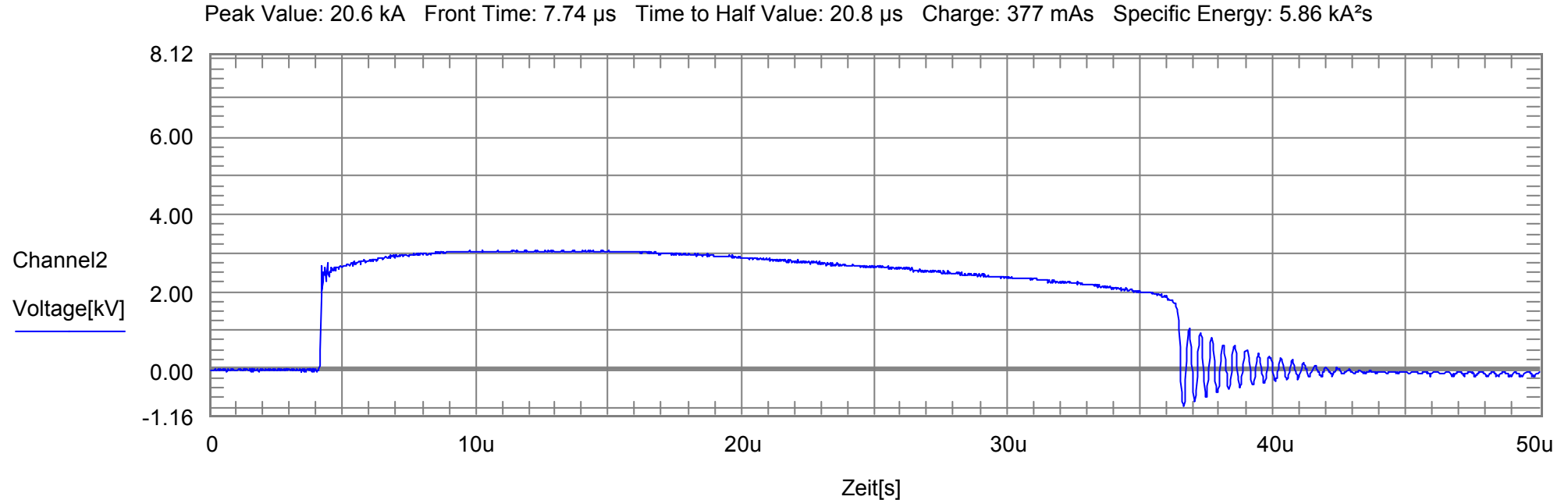
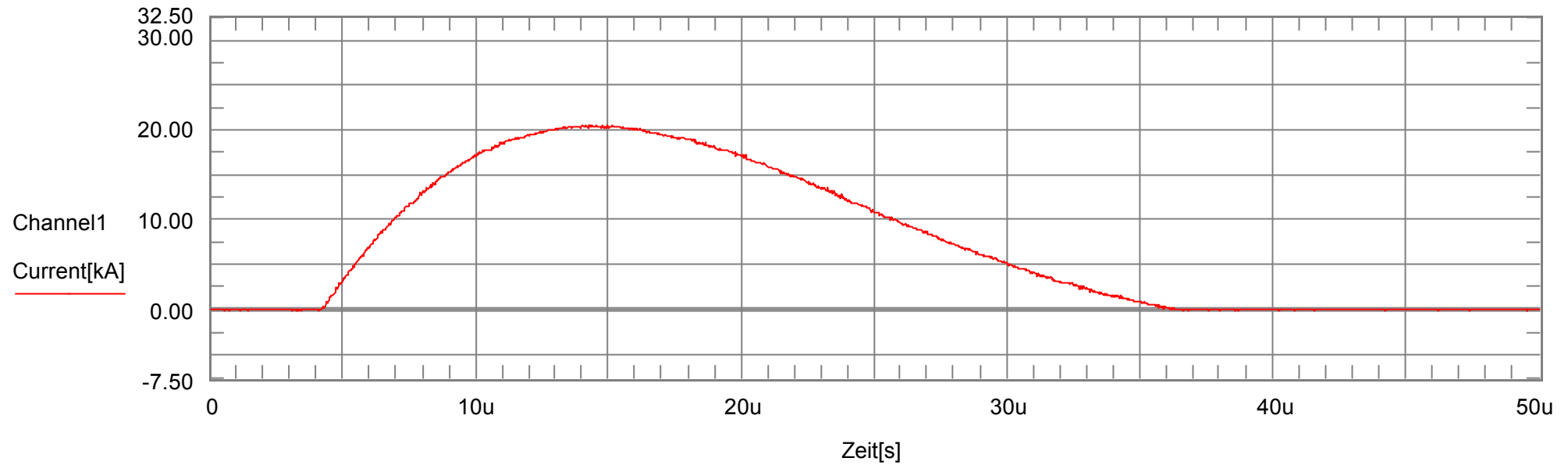
26/Oct/2012 10:23:08

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 15



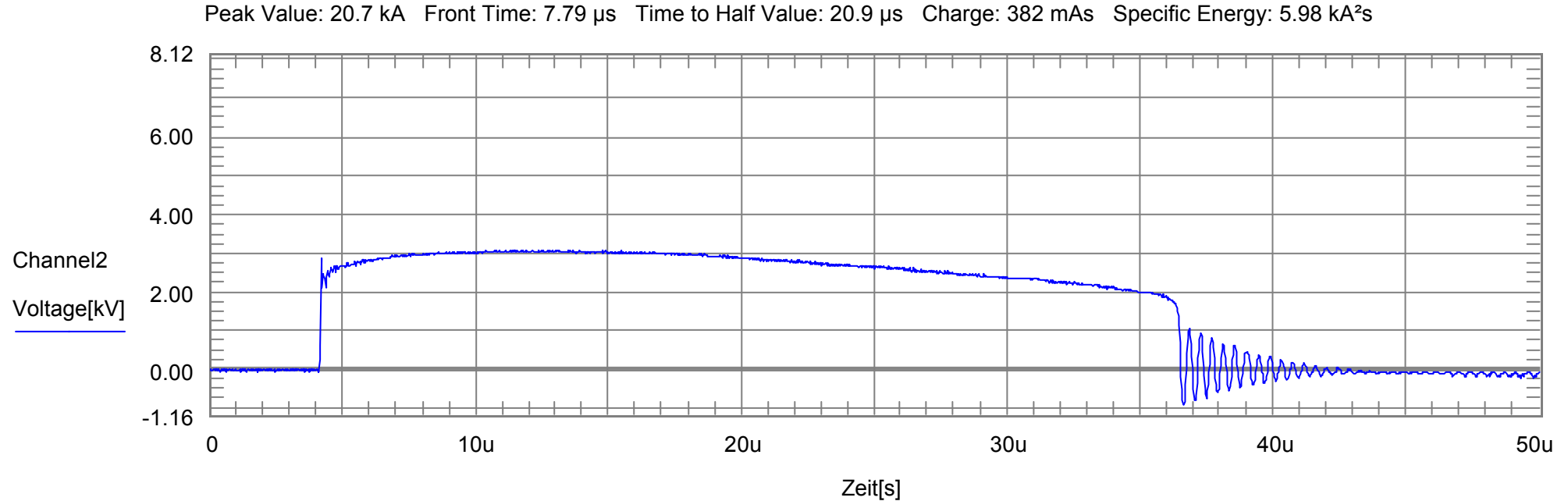
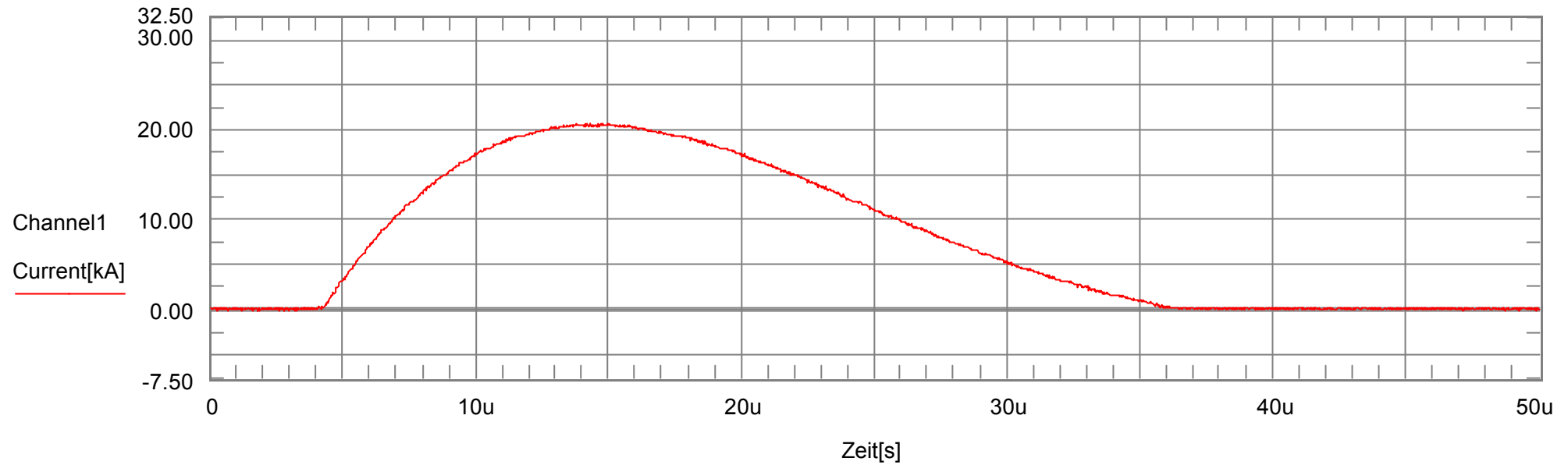
26/Oct/2012 10:25:27

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 16



26/Oct/2012 10:27:49

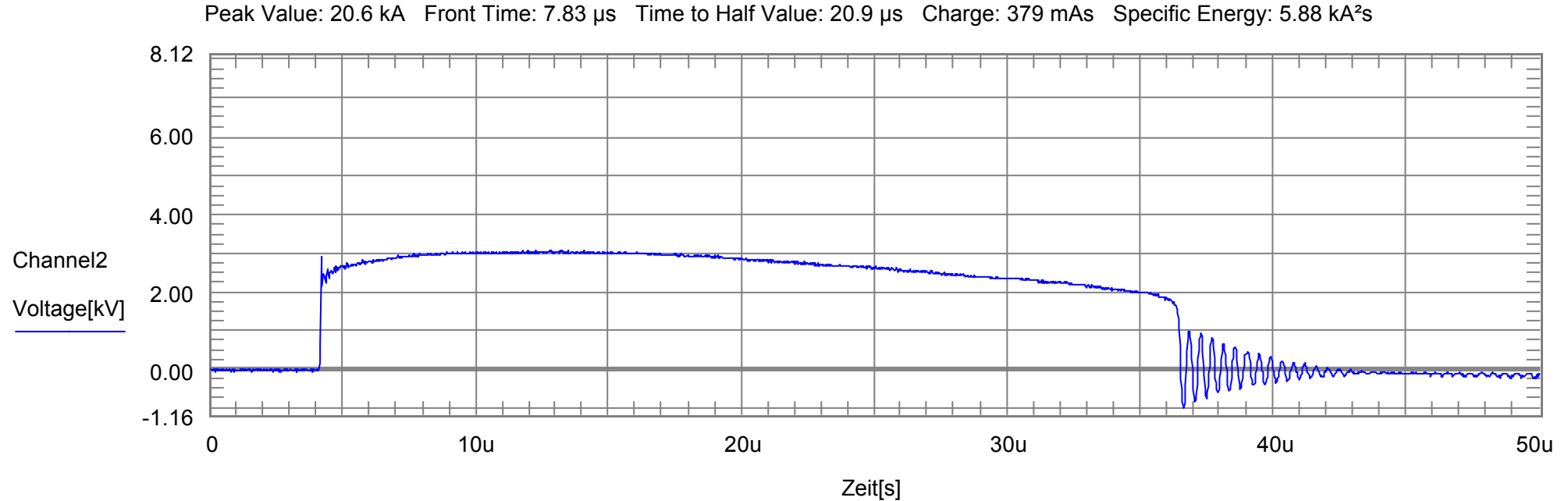
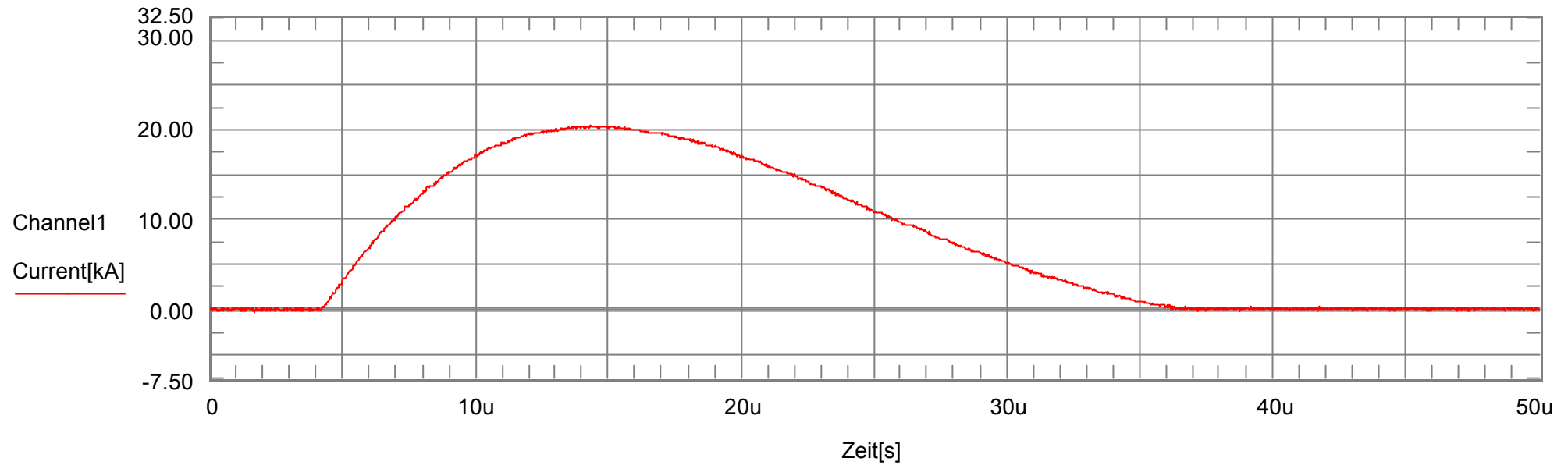
Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 17



Peak Value: 3.11 kV Front Time: 2.62 μs Time to Half Value: 32.2 μs

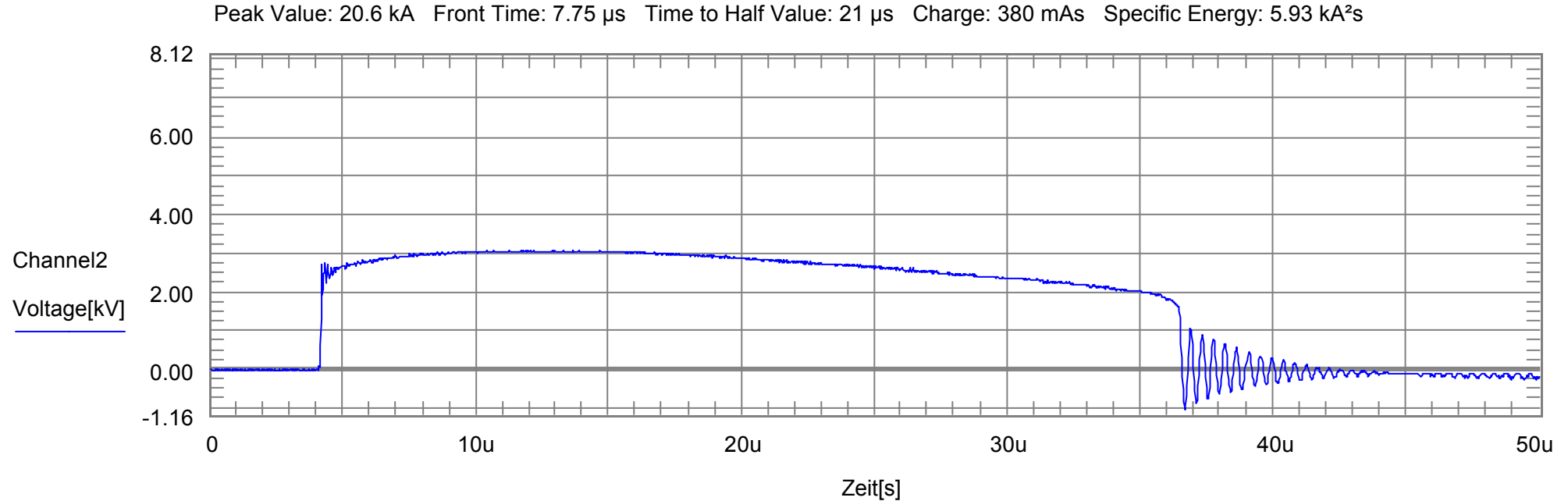
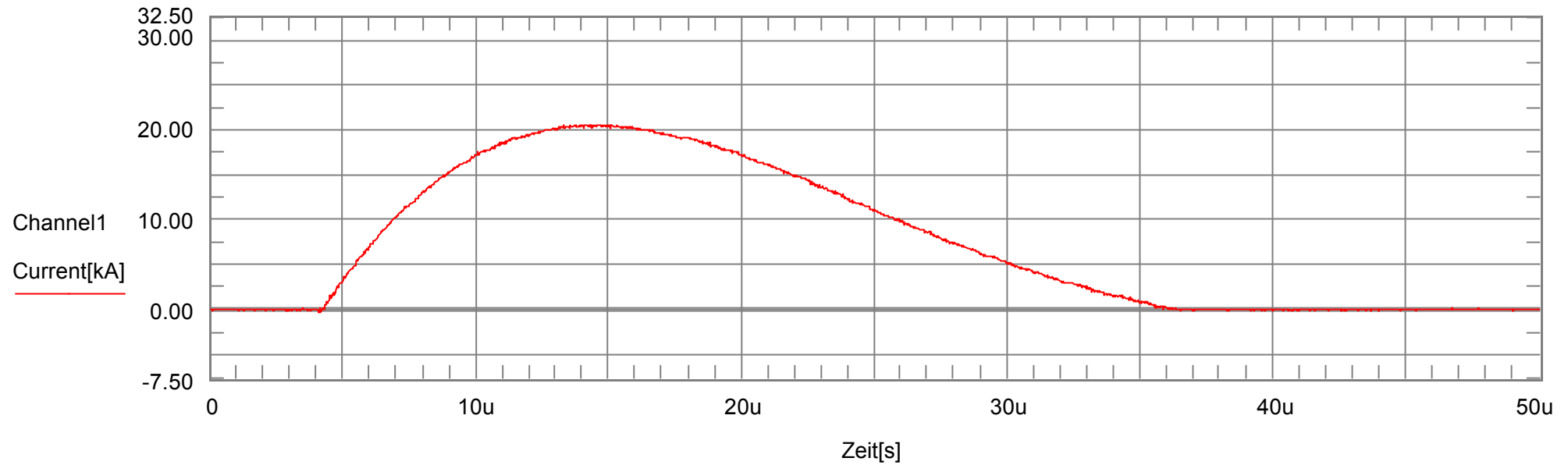
26/Oct/2012 10:29:58

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 18

Peak Value: 3.11 kV Front Time: 3 μ s Time to Half Value: 32.2 μ s

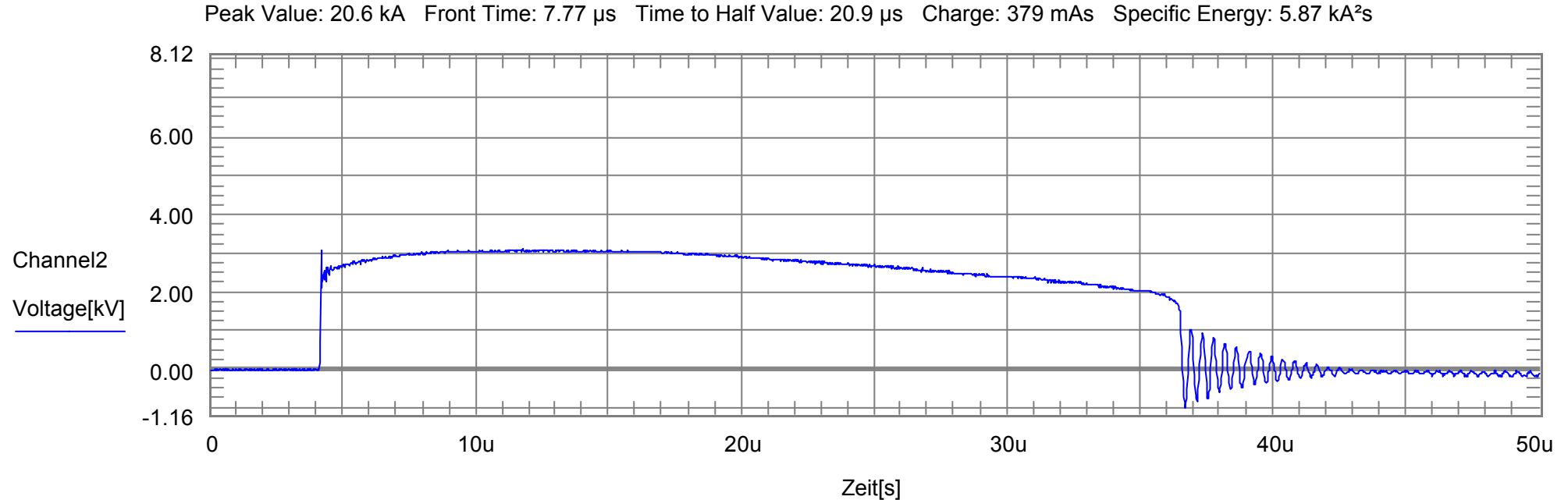
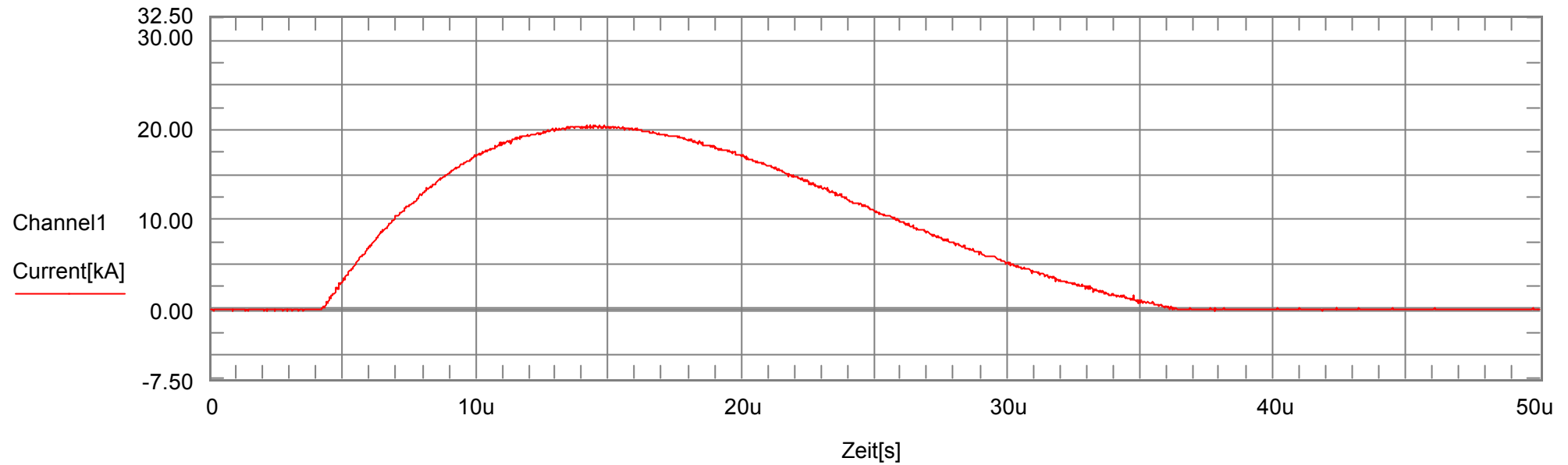
26/Oct/2012 10:34:35

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 19

Peak Value: 3.11 kV Front Time: 2.81 μ s Time to Half Value: 32.2 μ s

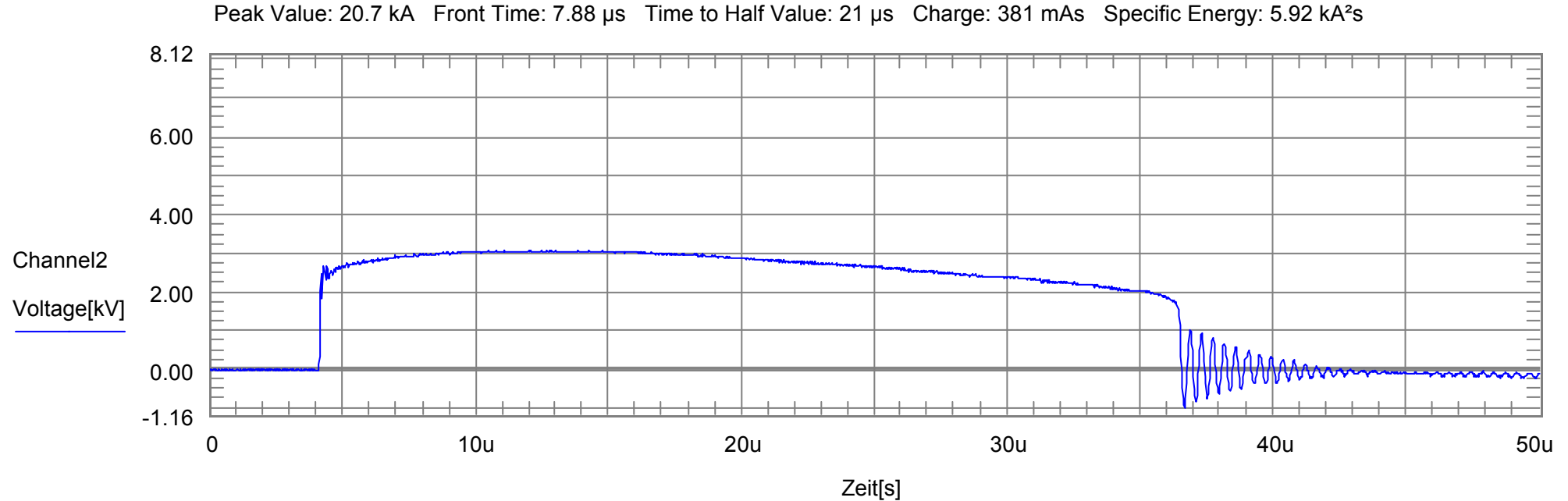
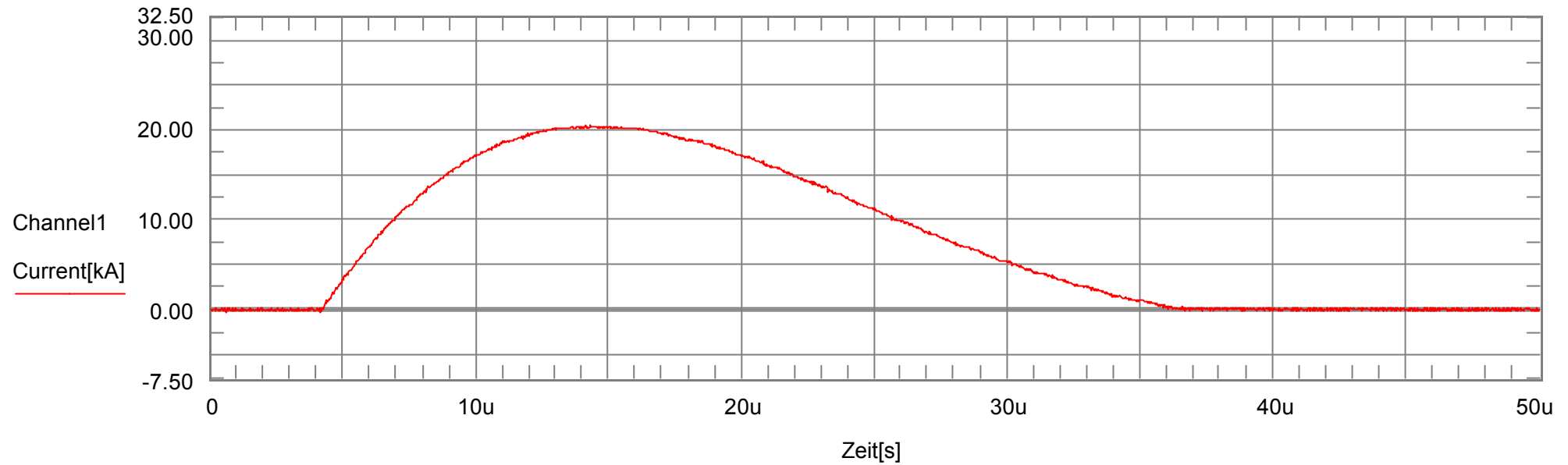
26/Oct/2012 10:38:19

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 20

Peak Value: 3.15 kV Front Time: 3.01 μ s Time to Half Value: 32.3 μ s

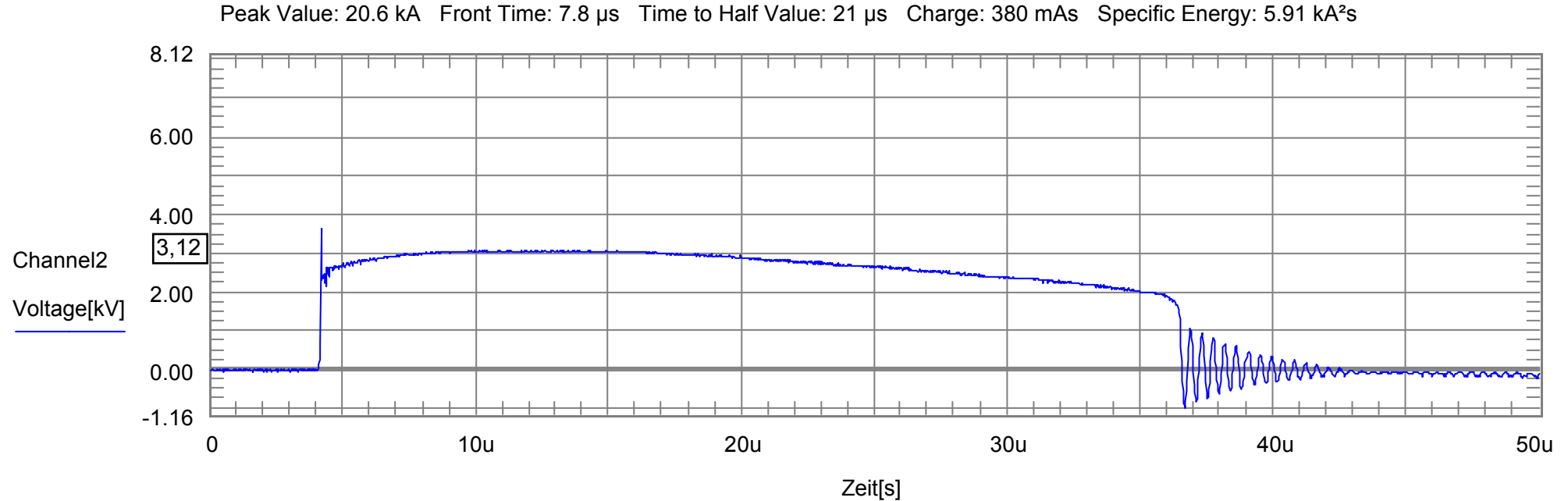
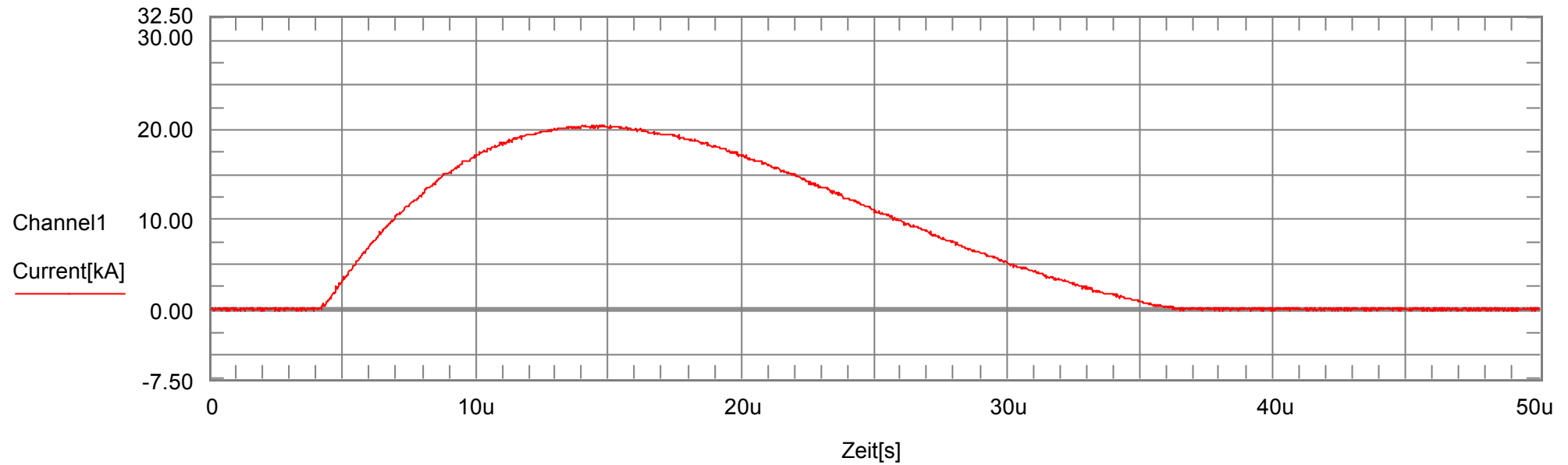
26/Oct/2012 10:43:08

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 21



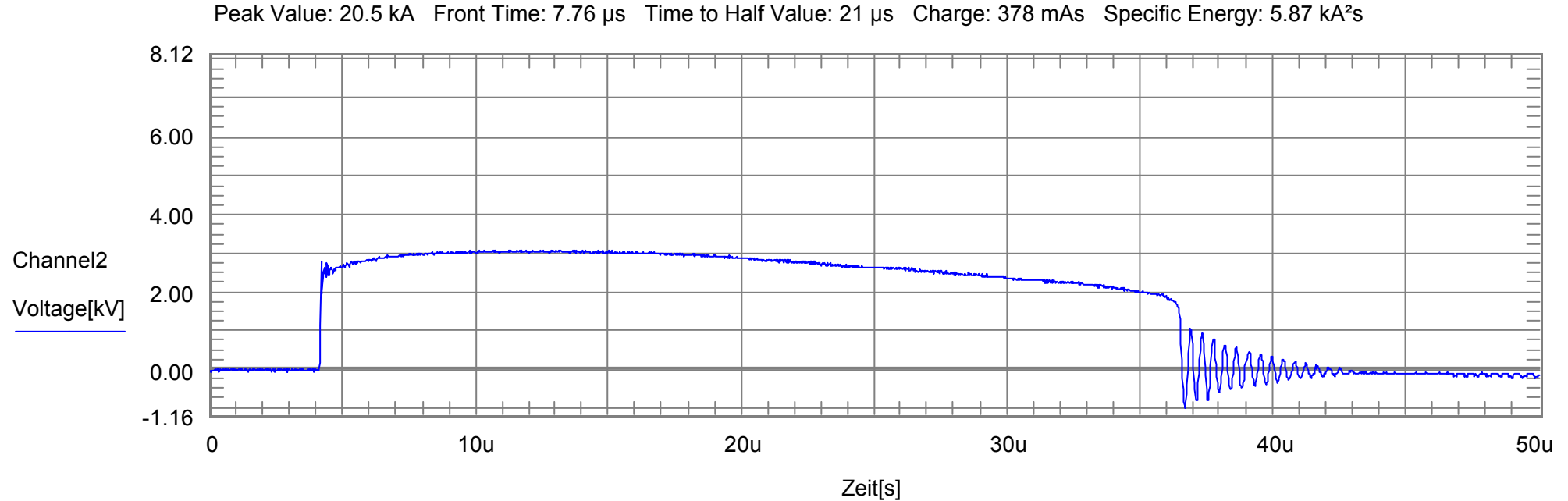
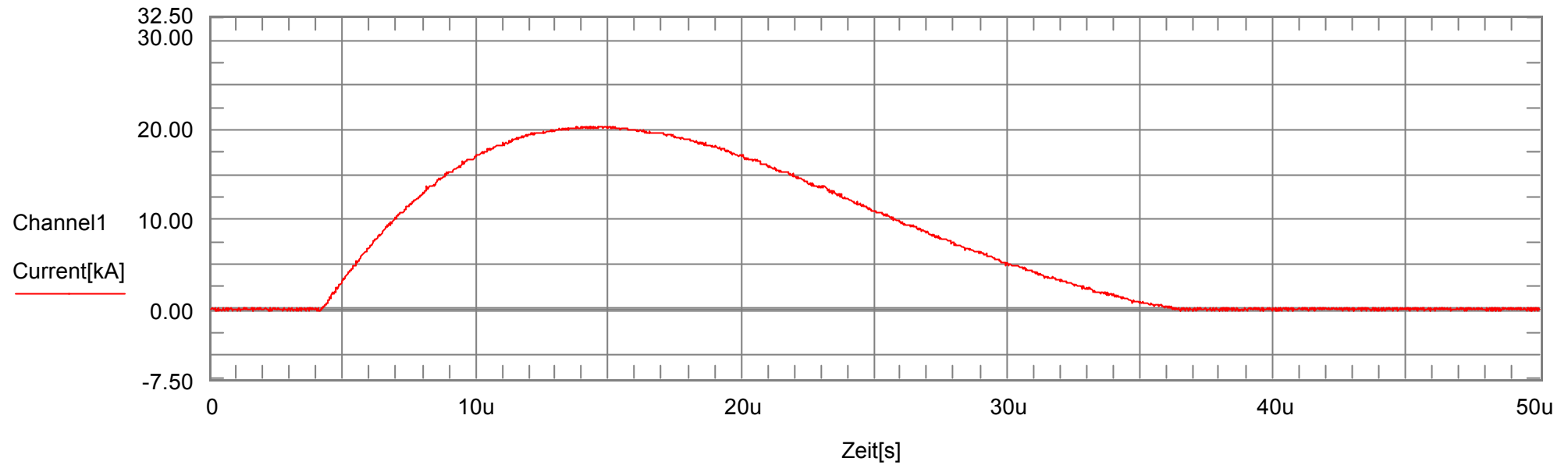
26/Oct/2012 10:46:00

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 22



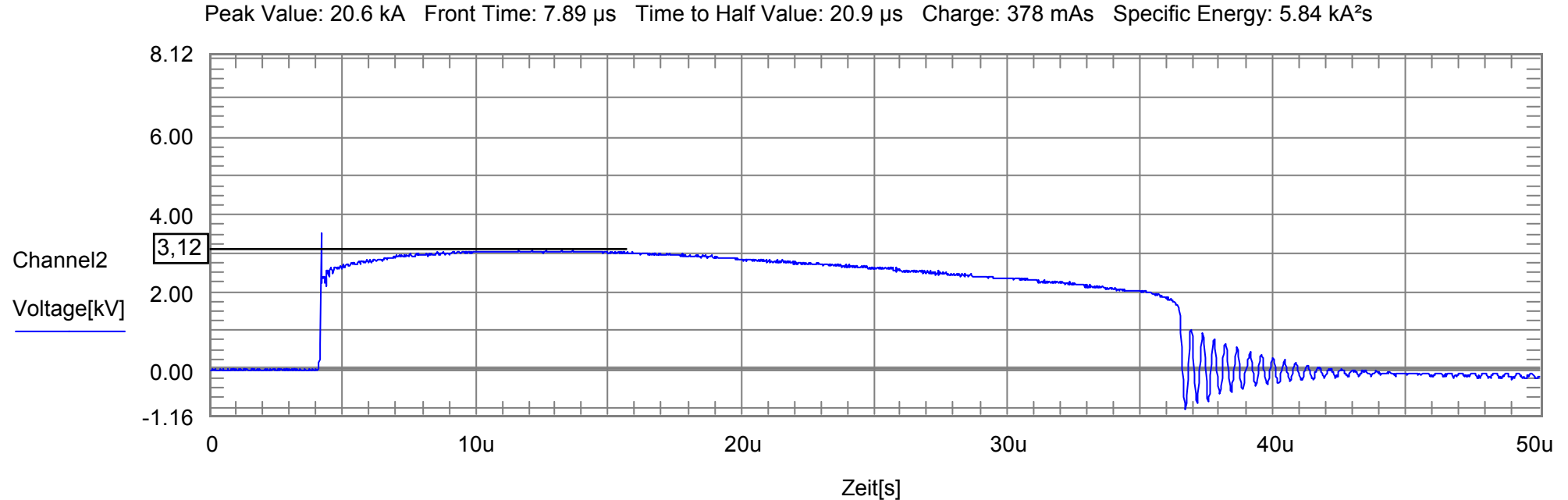
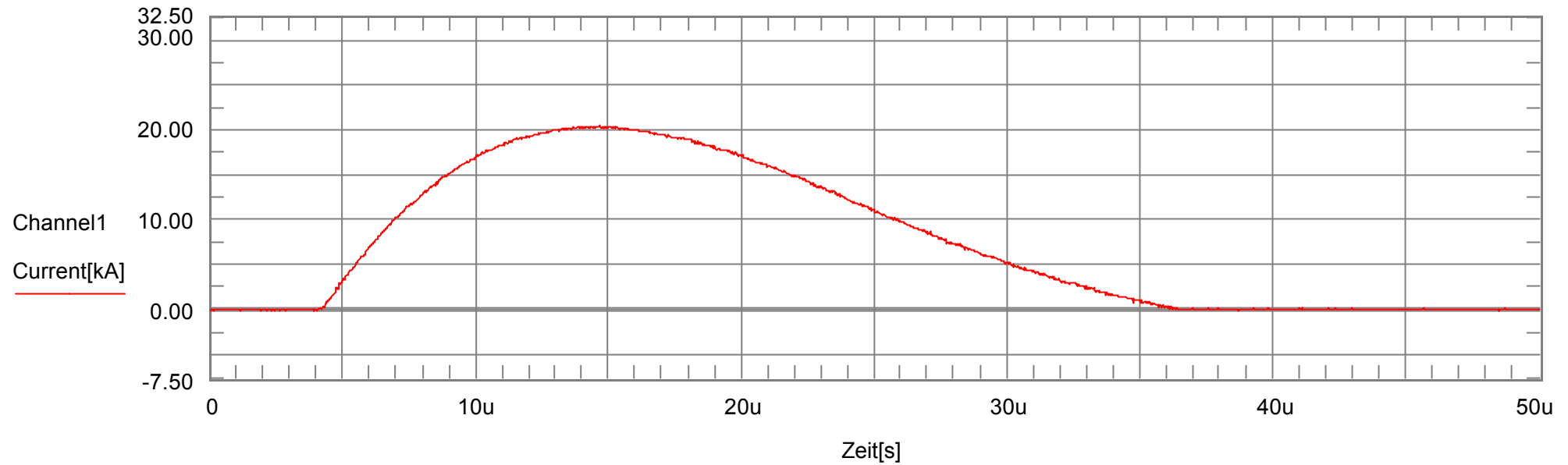
26/Oct/2012 10:49:43

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 23

Peak Value: 3.1 kV Front Time: 2.52 μ s Time to Half Value: 32.2 μ s

26/Oct/2012 10:52:12

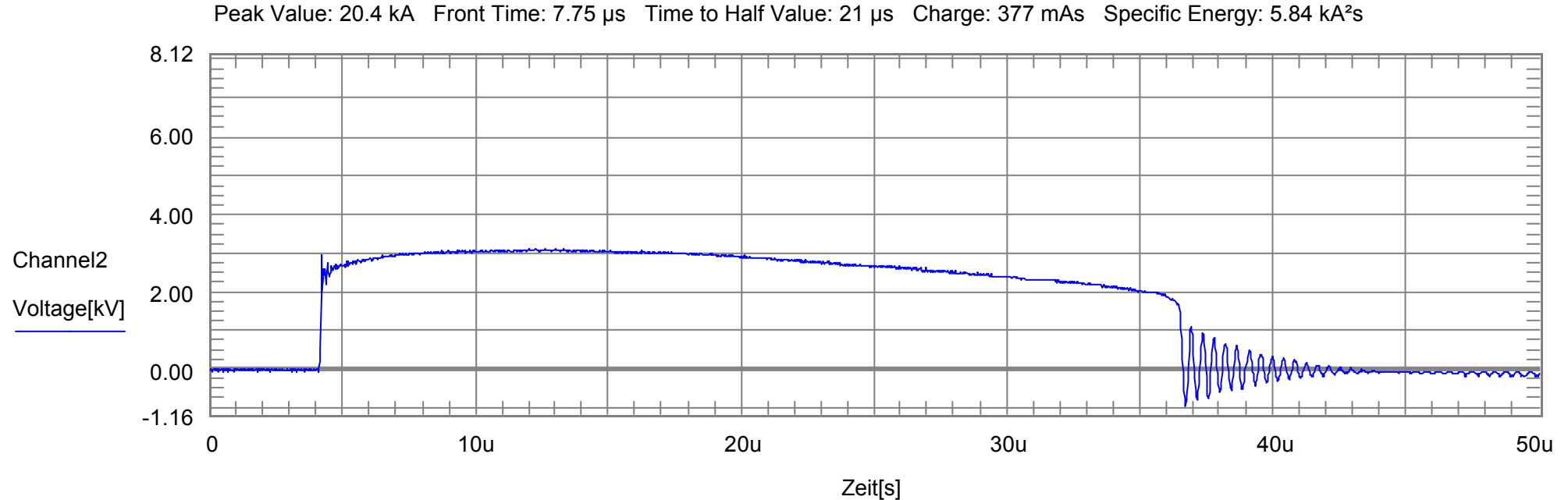
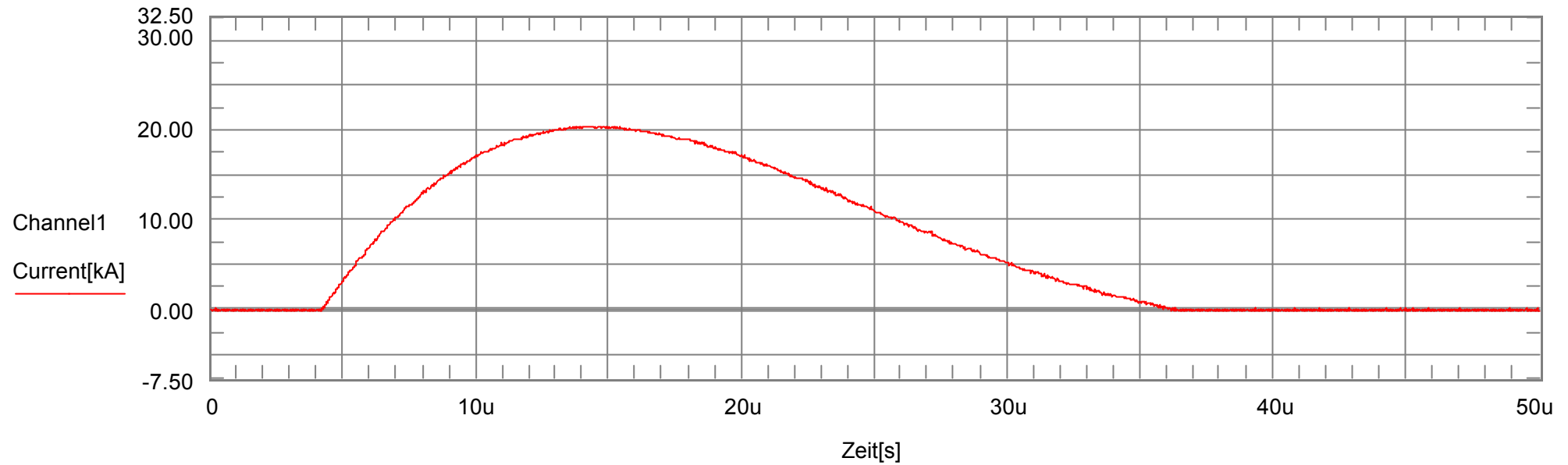
Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 24



Peak Value: 3.55 kV Front Time: 0 μs Time to Half Value: 0 μs

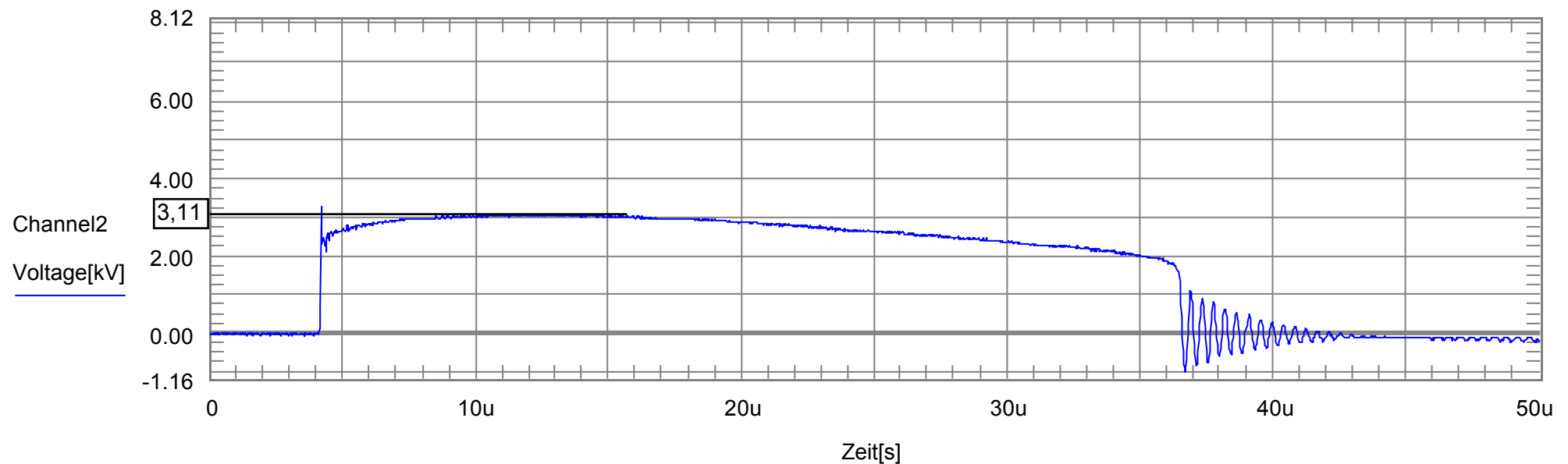
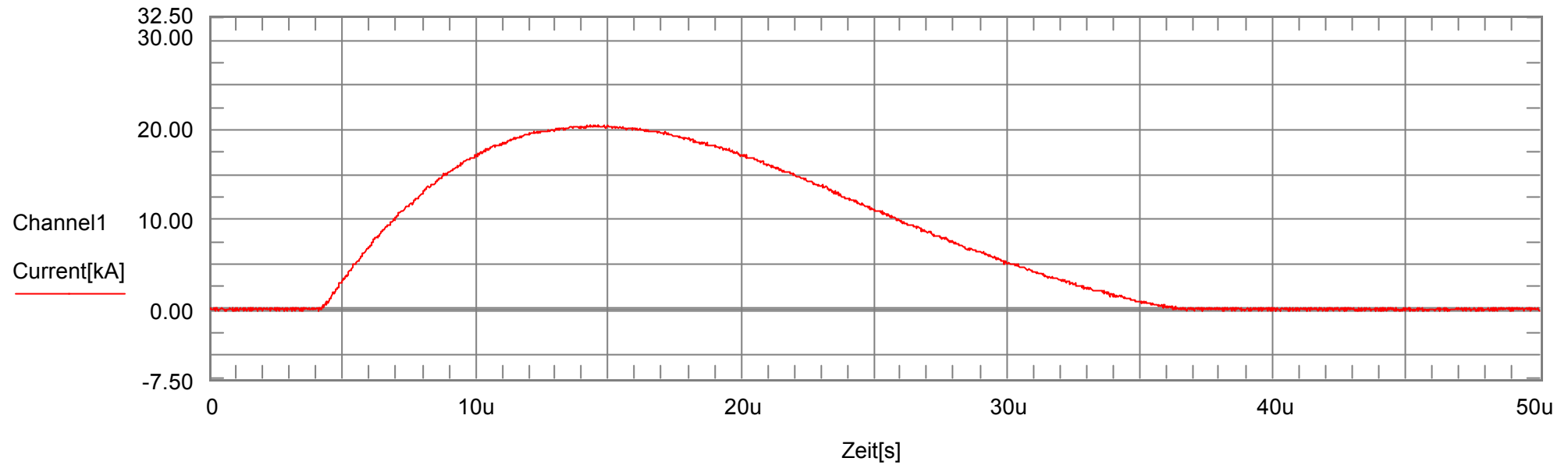
26/Oct/2012 10:56:50

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 25

Peak Value: 3.14 kV Front Time: 2.75 μ s Time to Half Value: 32.3 μ s

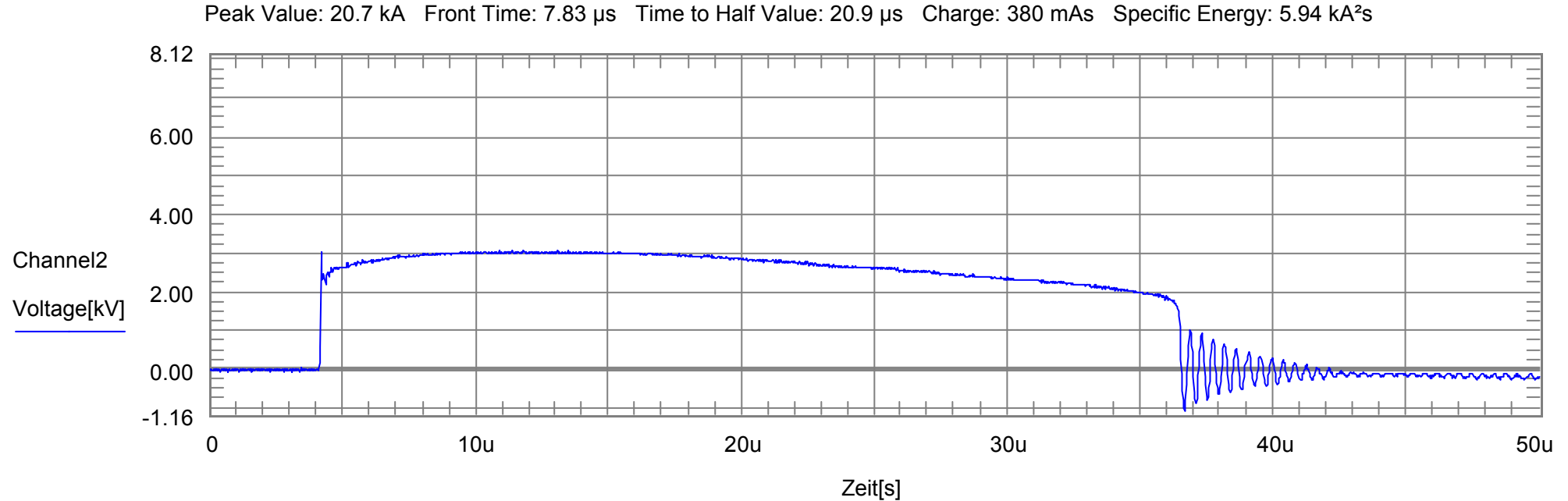
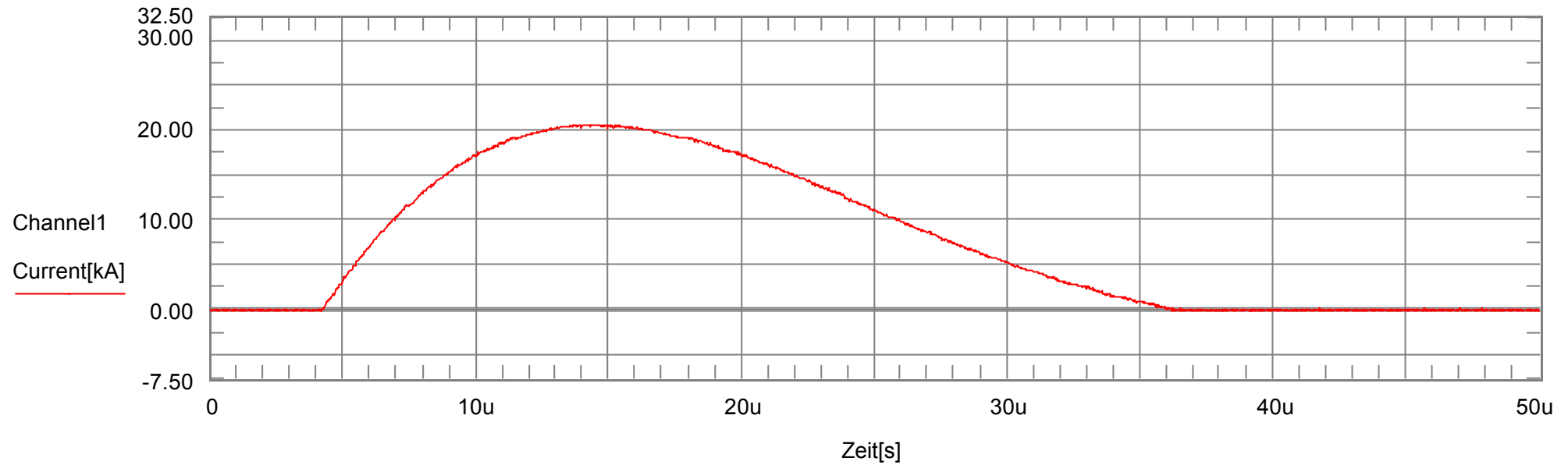
26/Oct/2012 10:59:30

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 26



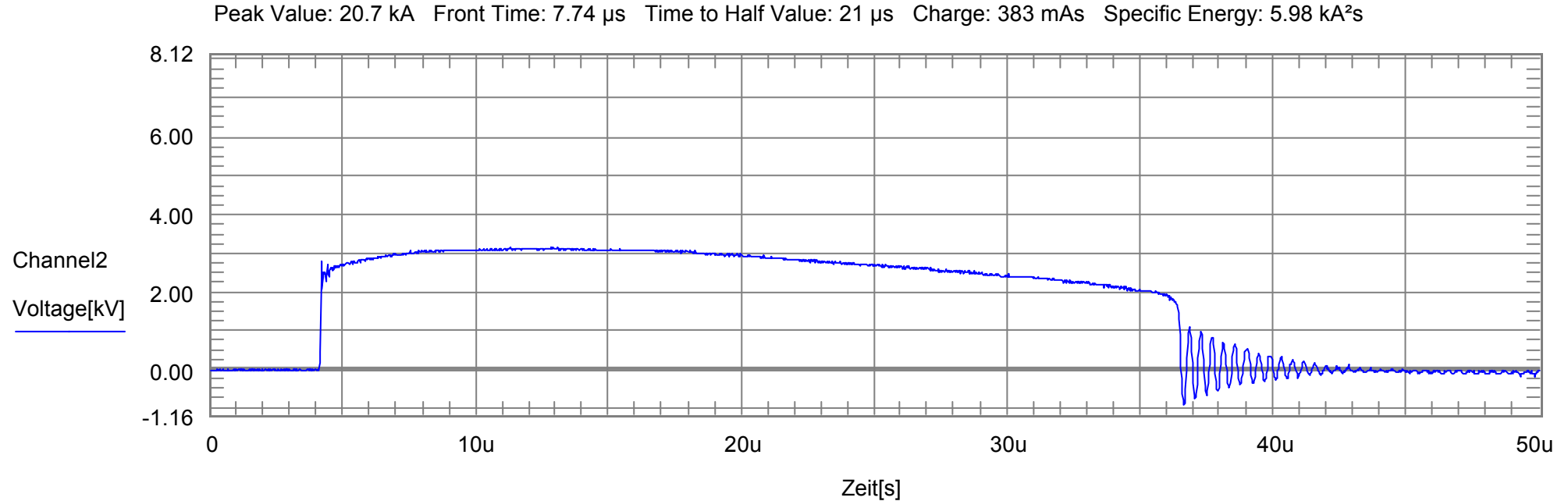
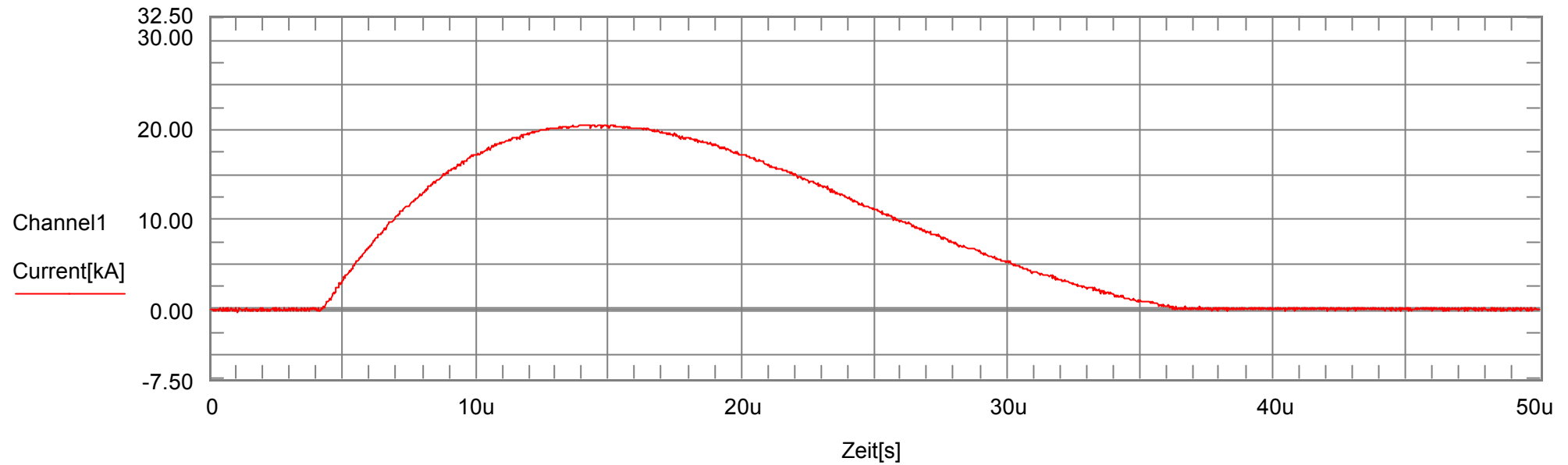
26/Oct/2012 11:03:21

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 27



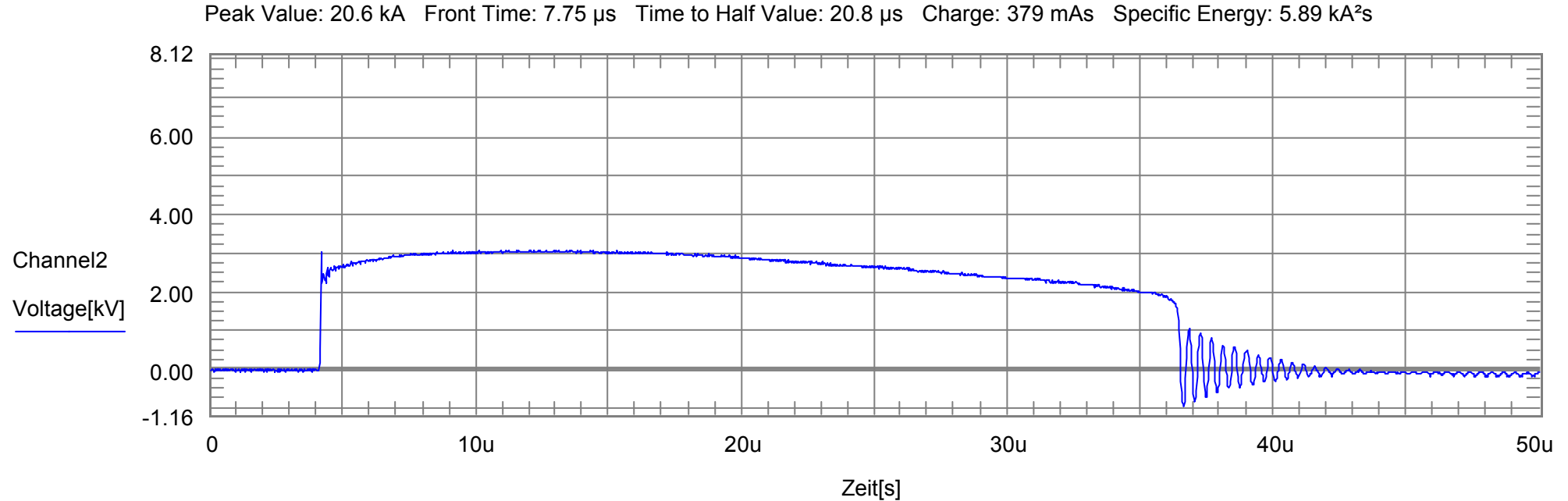
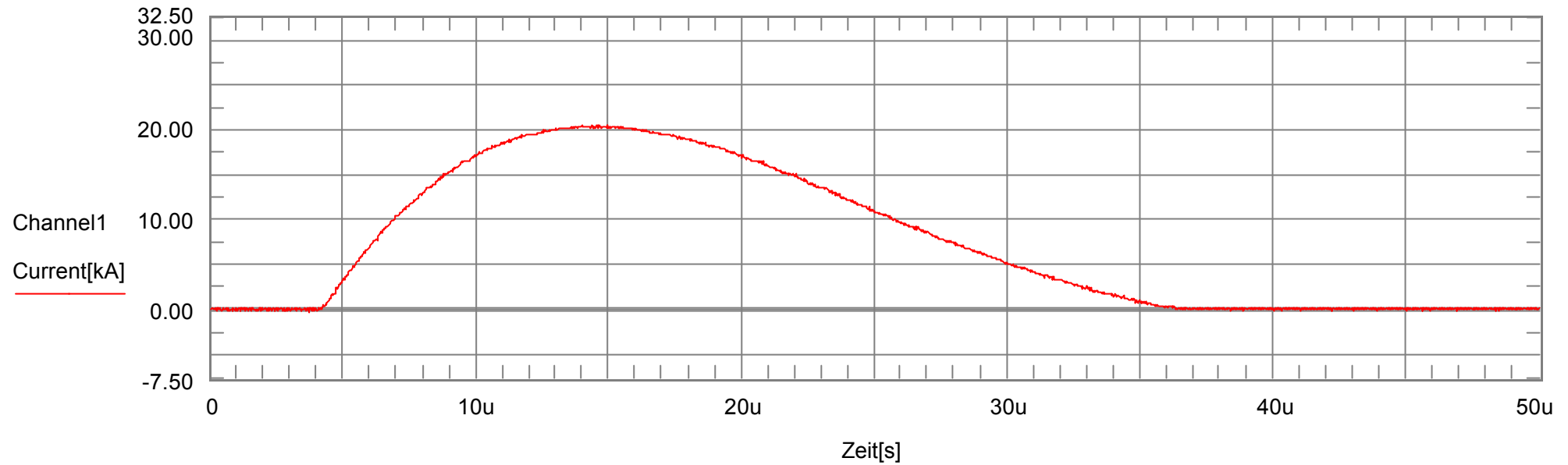
26/Oct/2012 11:08:56

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 28

Peak Value: 3.18 kV Front Time: 3.05 μ s Time to Half Value: 32.2 μ s

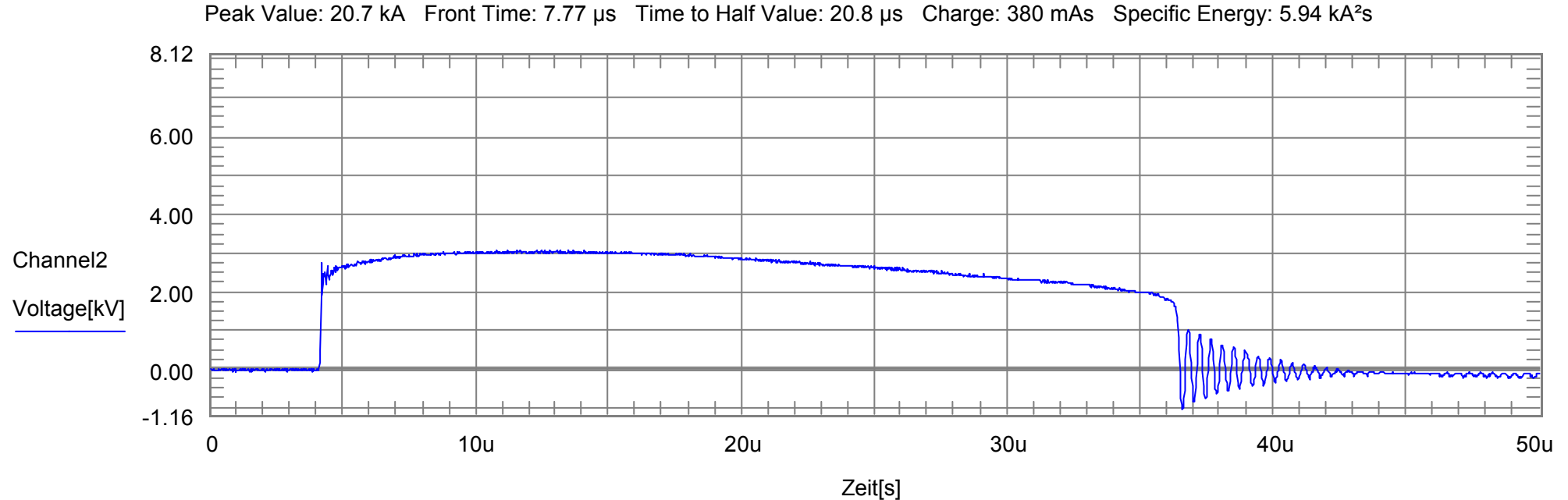
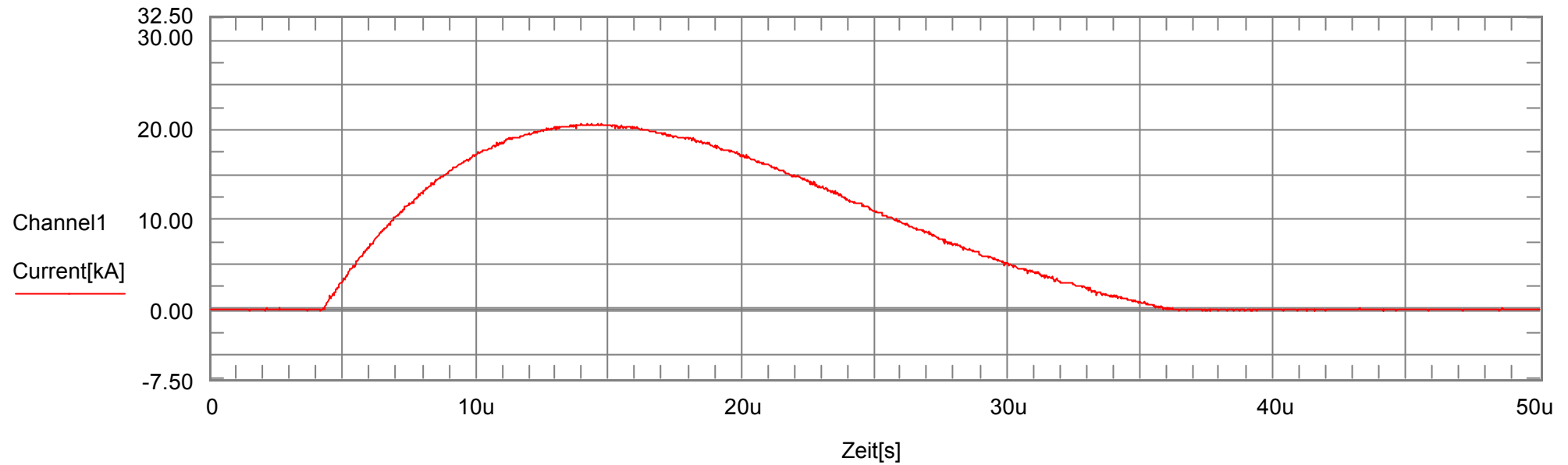
26/Oct/2012 11:12:03

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 29



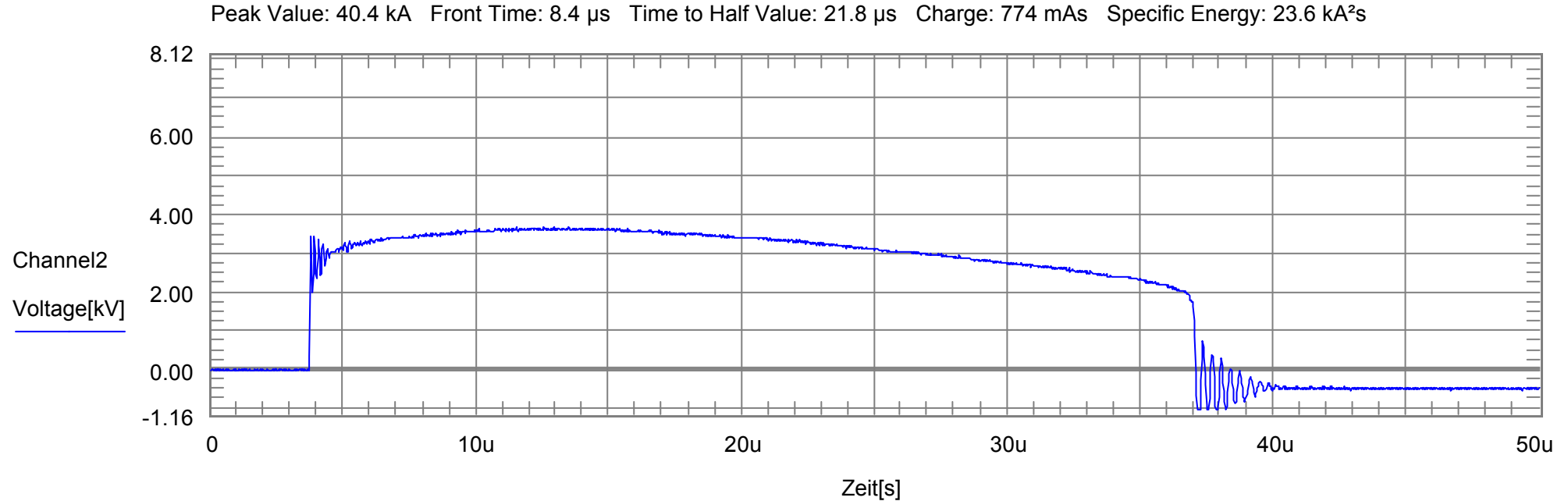
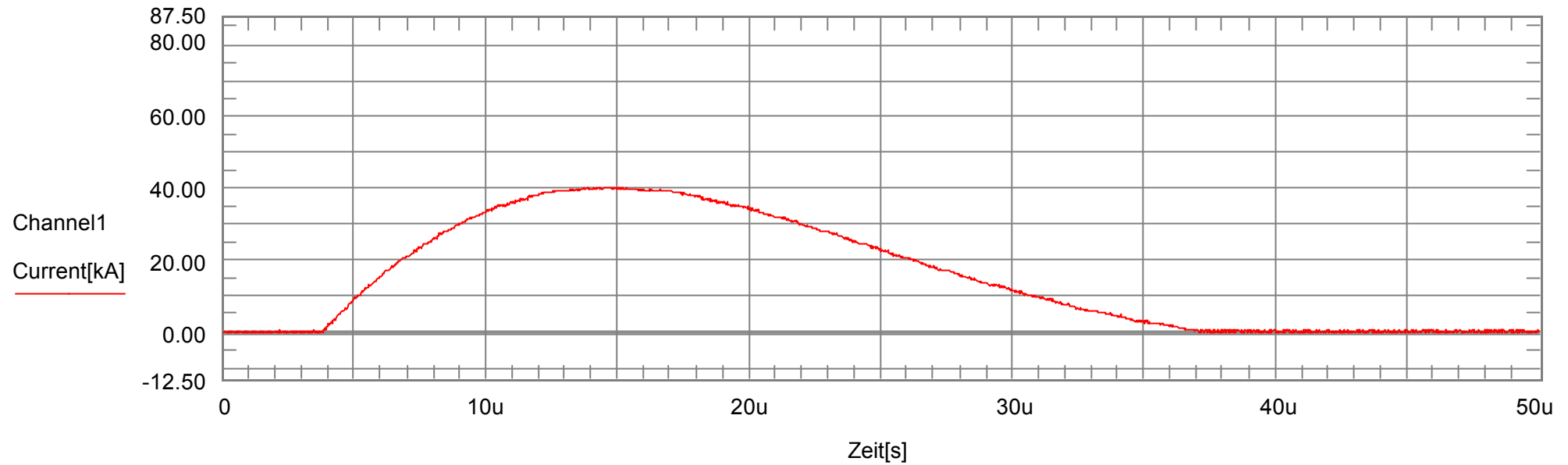
26/Oct/2012 11:15:52

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 30

Peak Value: 3.11 kV Front Time: 2.97 μ s Time to Half Value: 32.1 μ s

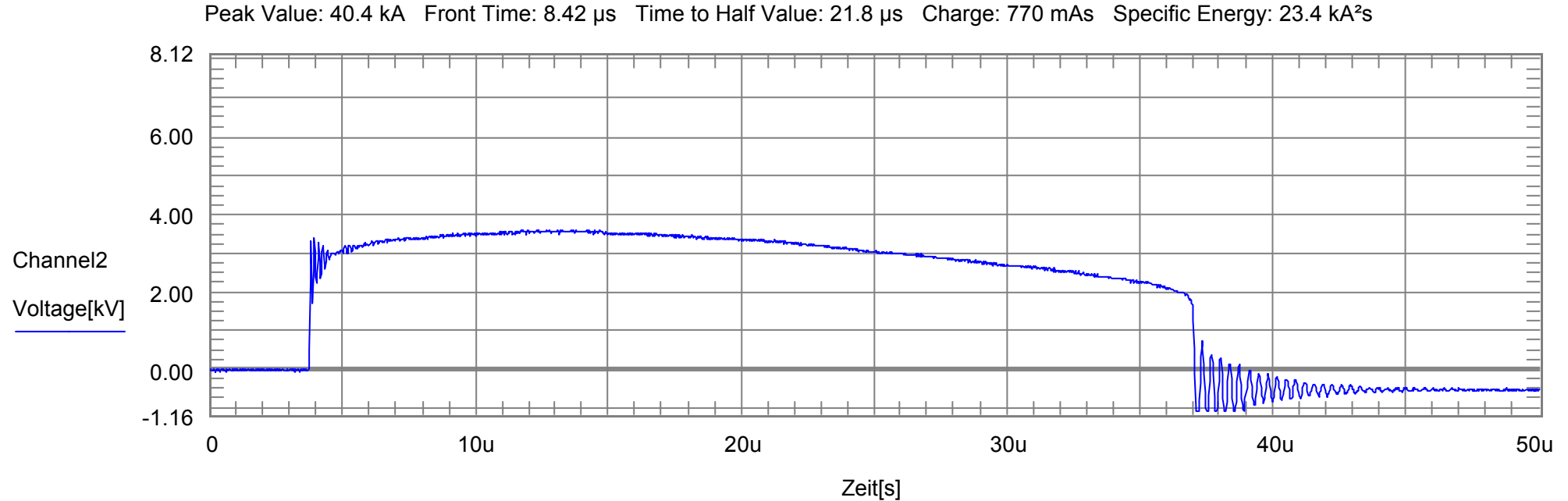
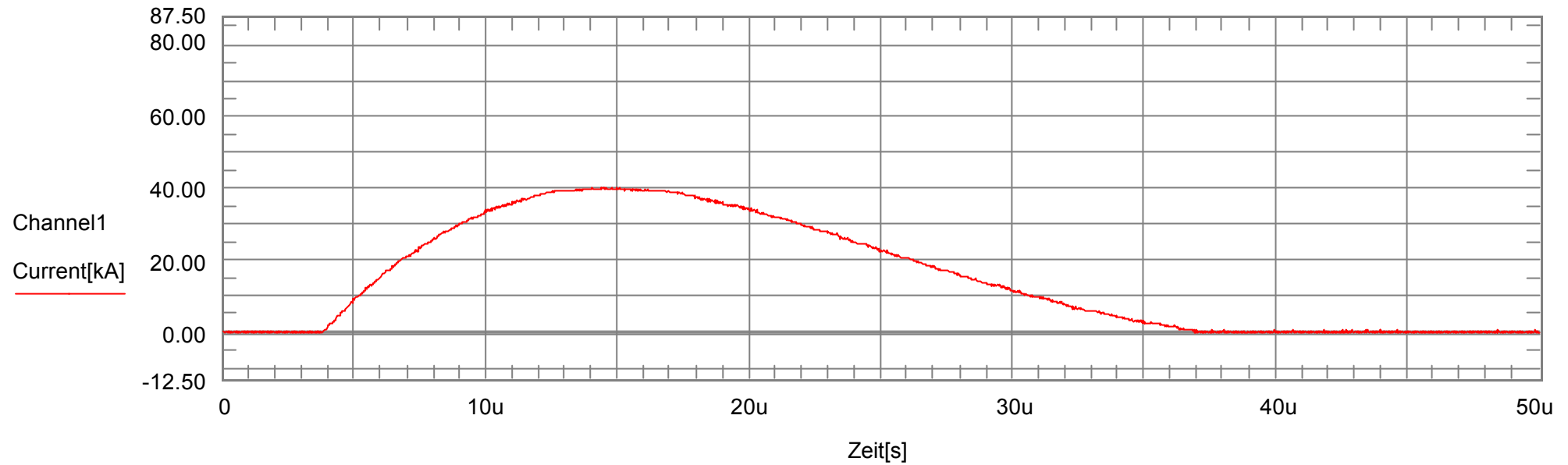
26/Oct/2012 11:39:20

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 31



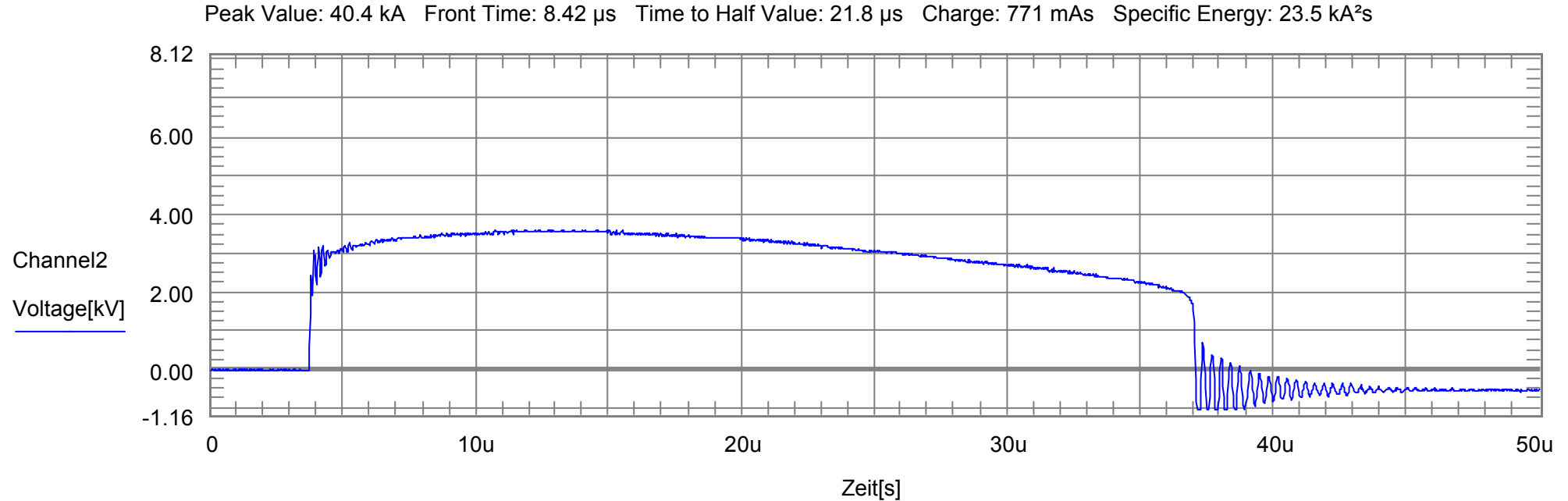
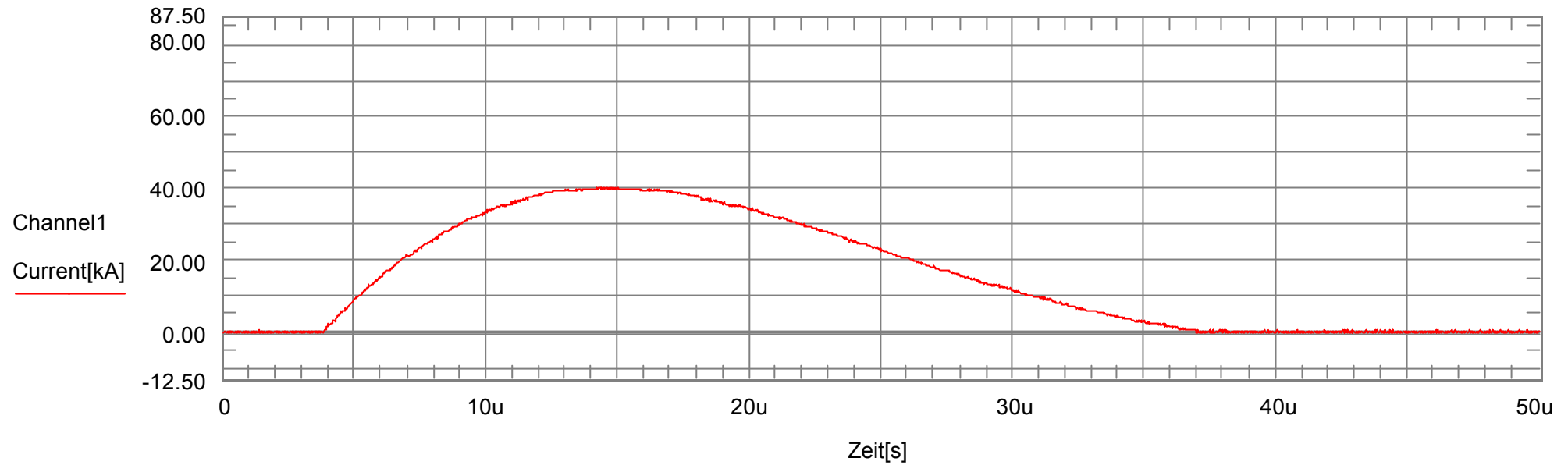
26/Oct/2012 11:43:01

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 32

Peak Value: 3.61 kV Front Time: 3.83 μ s Time to Half Value: 33.1 μ s

26/Oct/2012 11:46:04

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121026 Aufnahme-Nr.: 33

Peak Value: 3.62 kV Front Time: 3.57 μ s Time to Half Value: 33.1 μ s

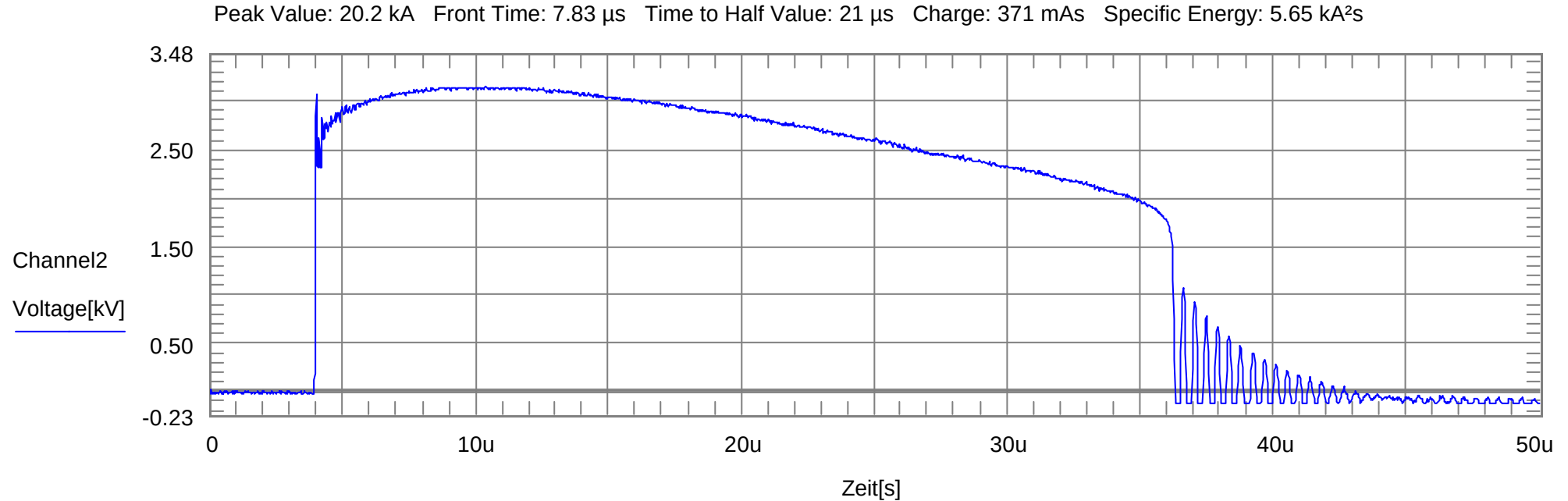
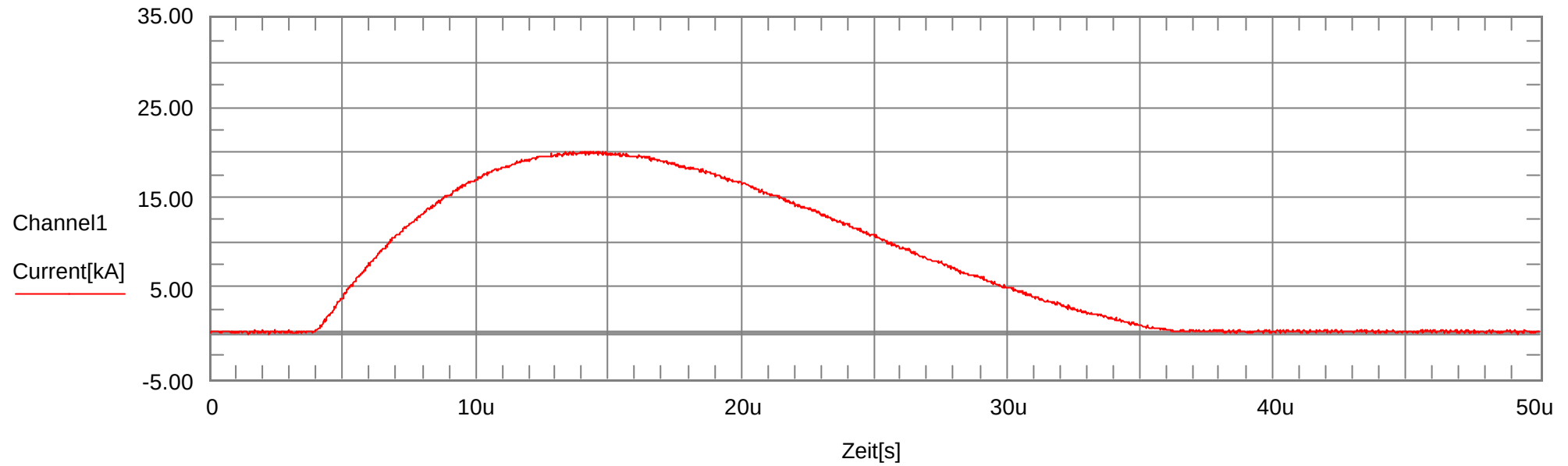
Analysen

Testname: OBO-V20C3PHFS1000-Ures-121214						Date: 14.12.2012 8:58:46	
Counter	Sample	Path	Polarity	Channel1: Current			Channel2: Voltage
				Peak Value	Front Time	Time To Half Value	U _{res}
1	1 ODT 1	(+) to PE	positive	20.2 kA	7.83 µs	21 µs	3.16 kV
2	2 ODT 2			20.2 kA	7.92 µs	21 µs	3.2 kV
3	3 ODT 3			20.4 kA	8.02 µs	20.9 µs	3.13 kV
4	1 ODT 1		negative	20.2 kA	7.8 µs	21 µs	3,18 kV
5	2 ODT 2			20.2 kA	7.83 µs	21 µs	3.19 kV
6	3 ODT 3			20.2 kA	7.89 µs	21 µs	3,08 kV

For the oscillograms no. 4 and 6, the measured peak value of channel 2 is not the residual voltage. The mentioned oscillograms show a spike in the voltage graph at current beginning that is caused by the switching element (air spark gap) of the lightning current generator and that has to be neglected. Therefore, the measured residual voltage is pointed out in the relevant oscillograms.

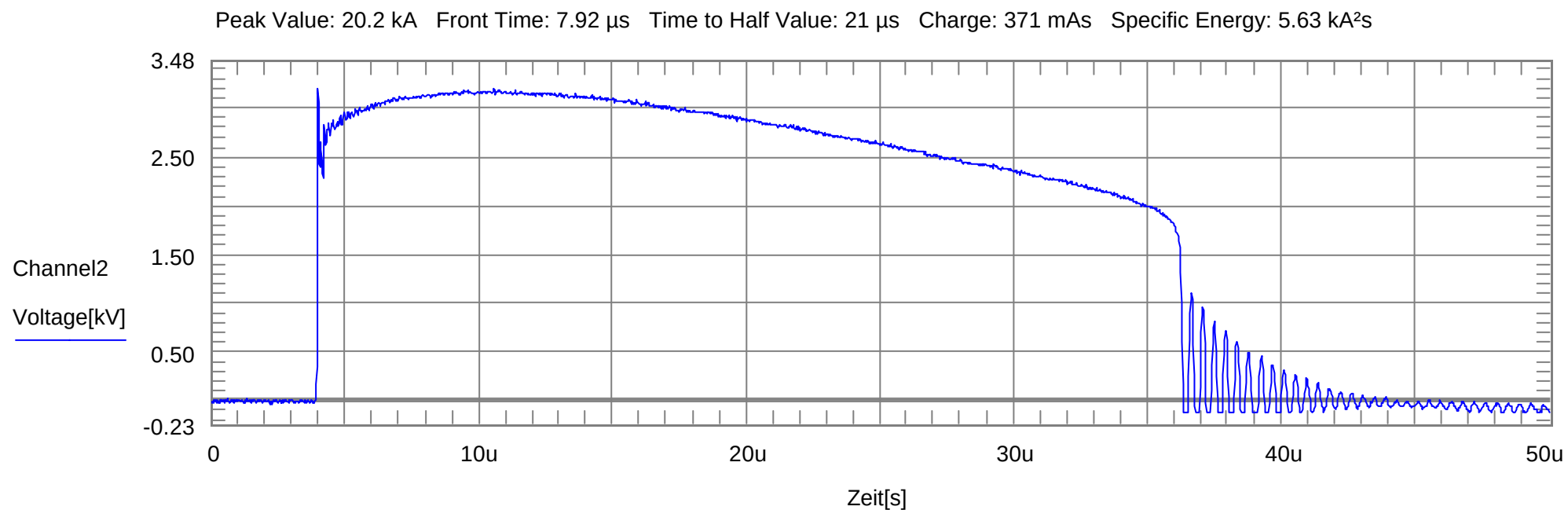
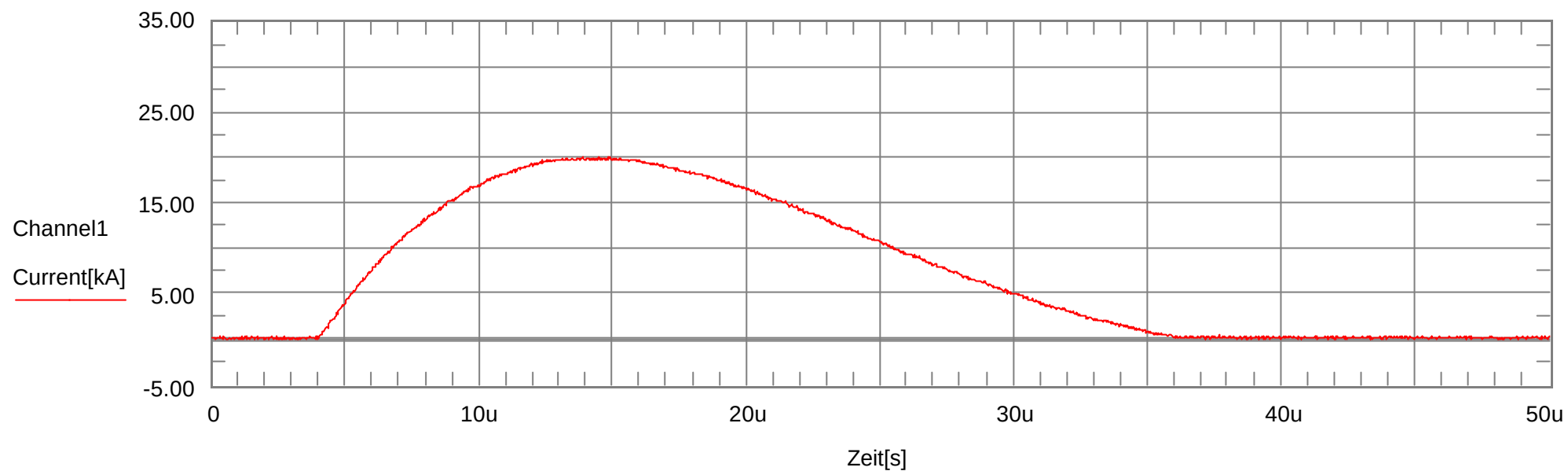
14/Dec/2012 08:41:08

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 1



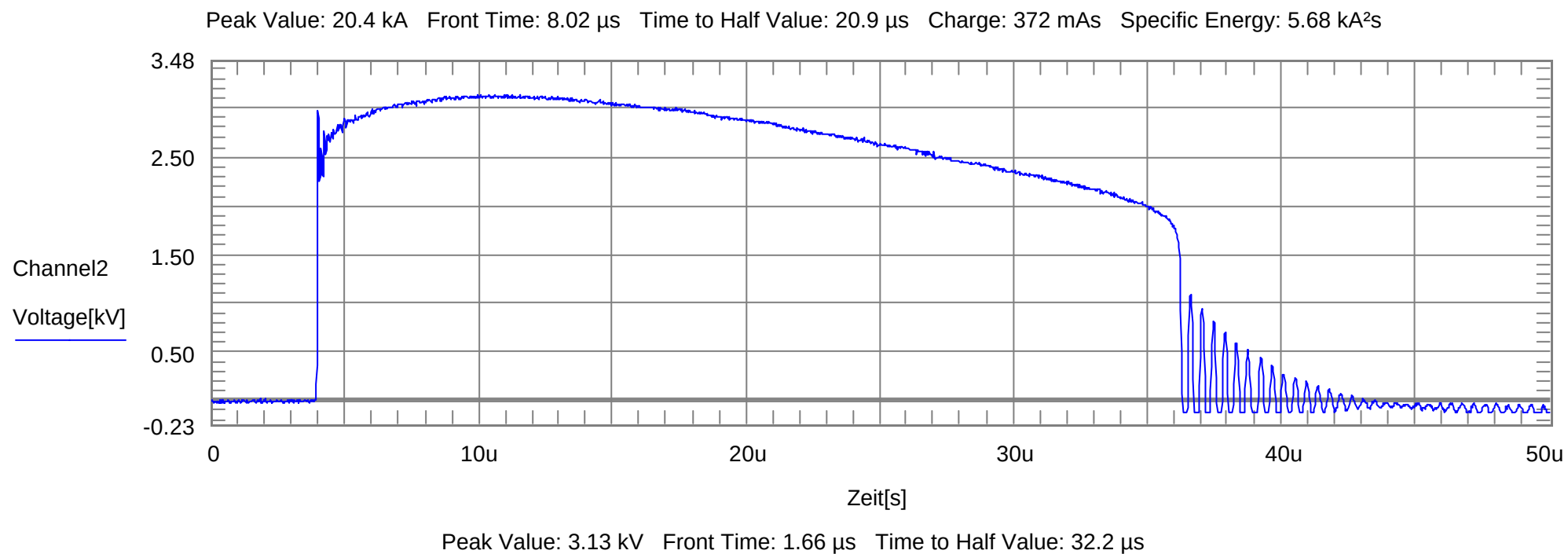
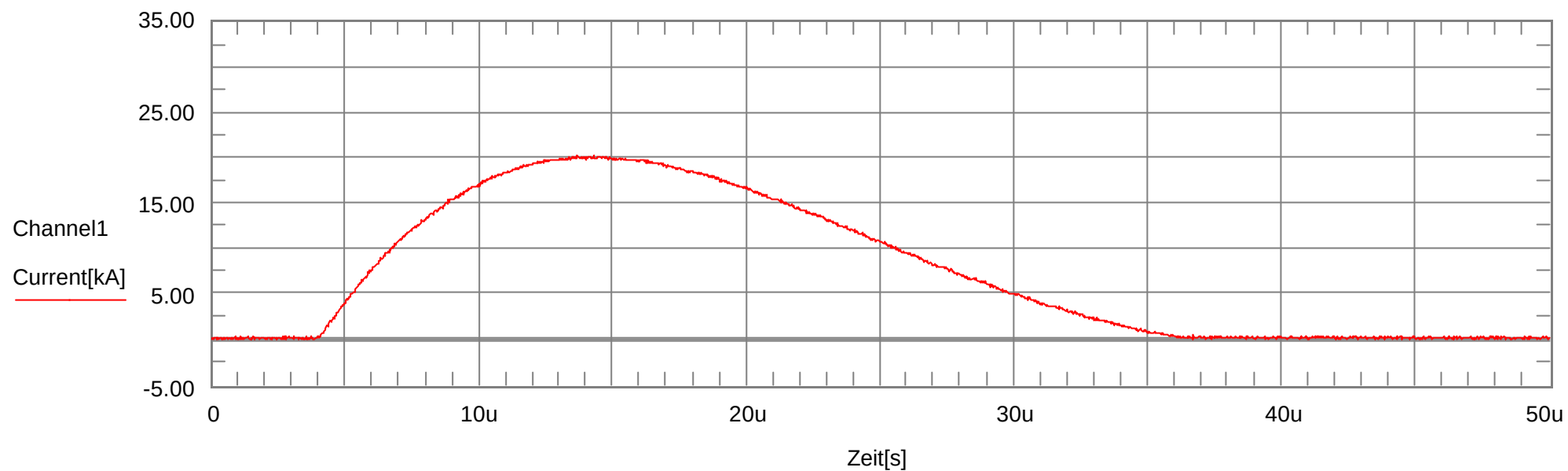
14/Dec/2012 08:45:55

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 2

Peak Value: 3.2 kV Front Time: 1.68 μ s Time to Half Value: 32.2 μ s

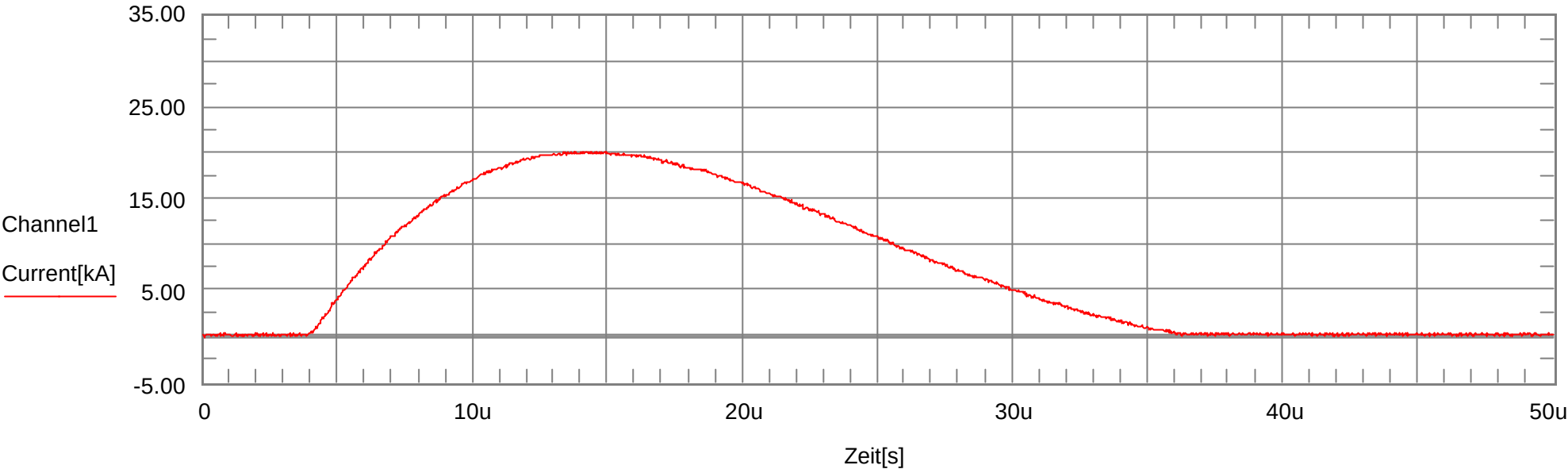
14/Dec/2012 08:48:12

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 3

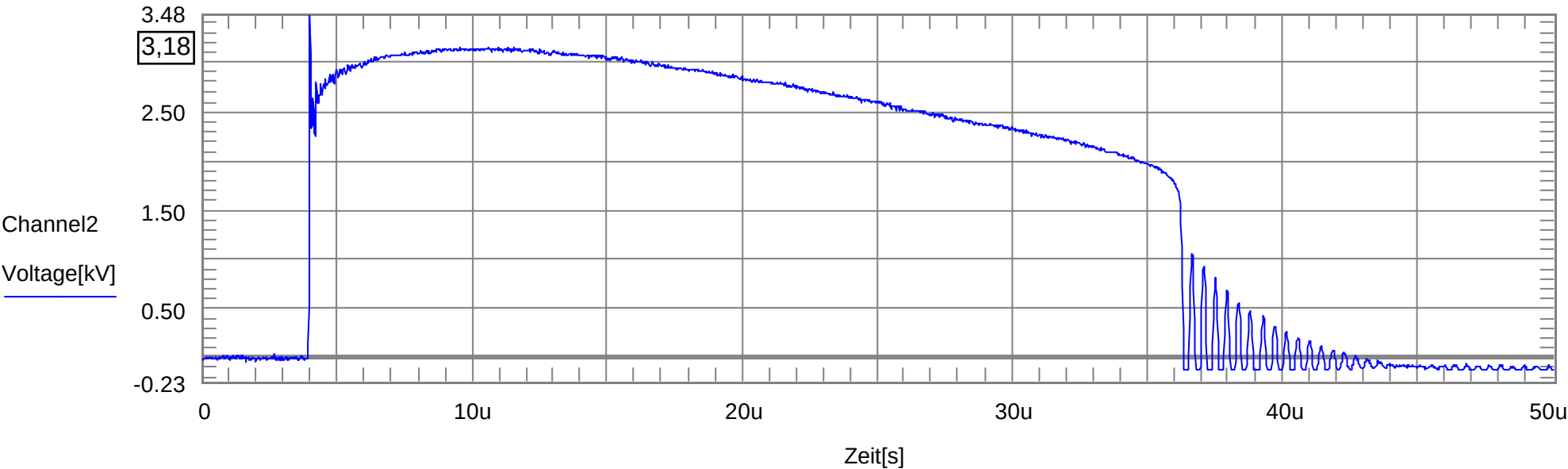


14/Dec/2012 08:53:53

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 4



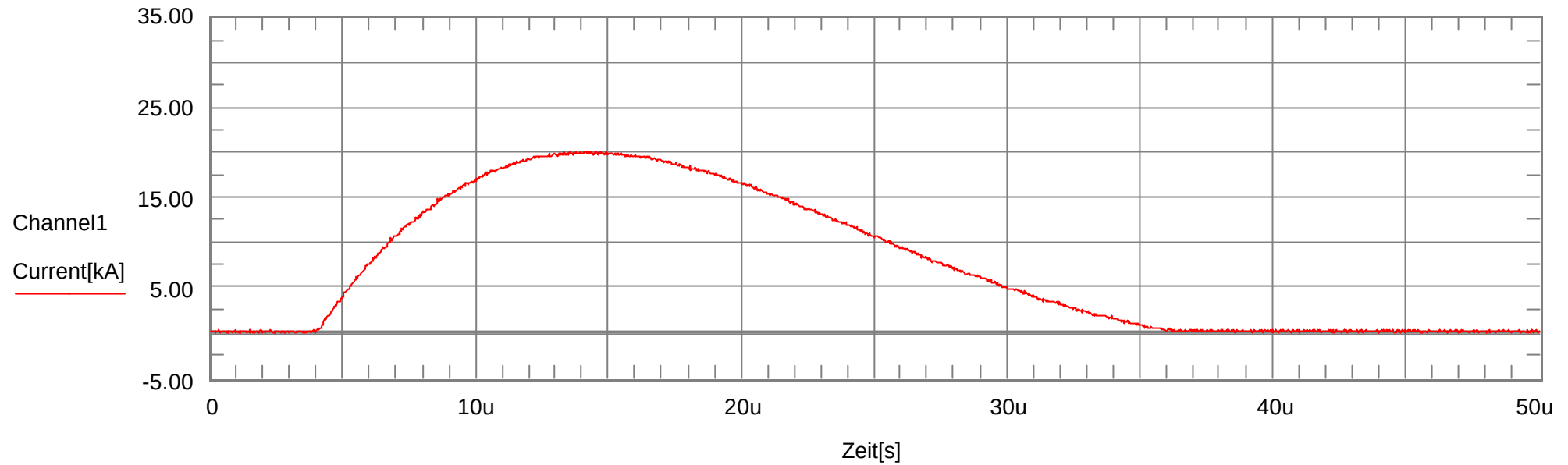
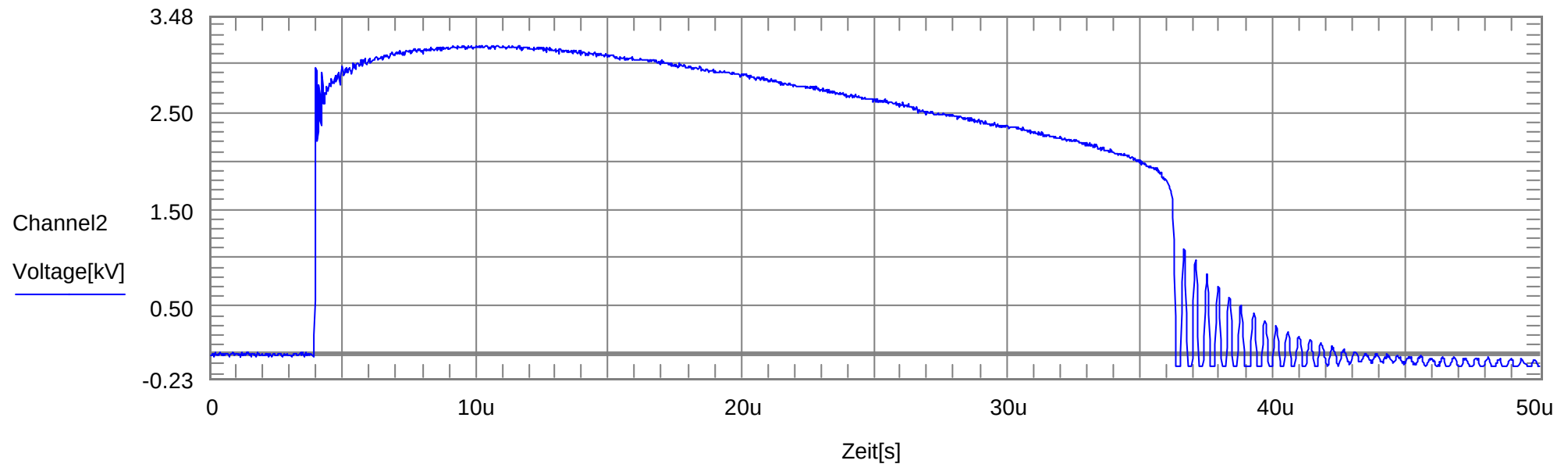
Peak Value: 20.2 kA Front Time: 7.8 μ s Time to Half Value: 21 μ s Charge: 373 mAs Specific Energy: 5.69 kA²s



Peak Value: 3.47 kV Front Time: 7.98 μ s Time to Half Value: 32.1 μ s

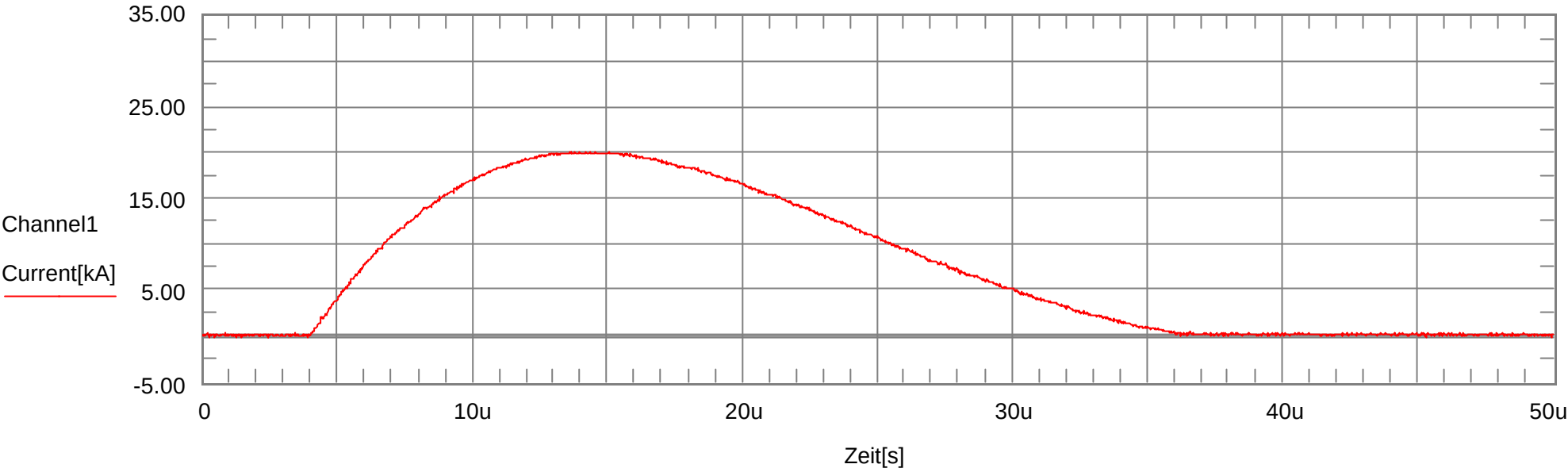
14/Dec/2012 08:56:29

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 5

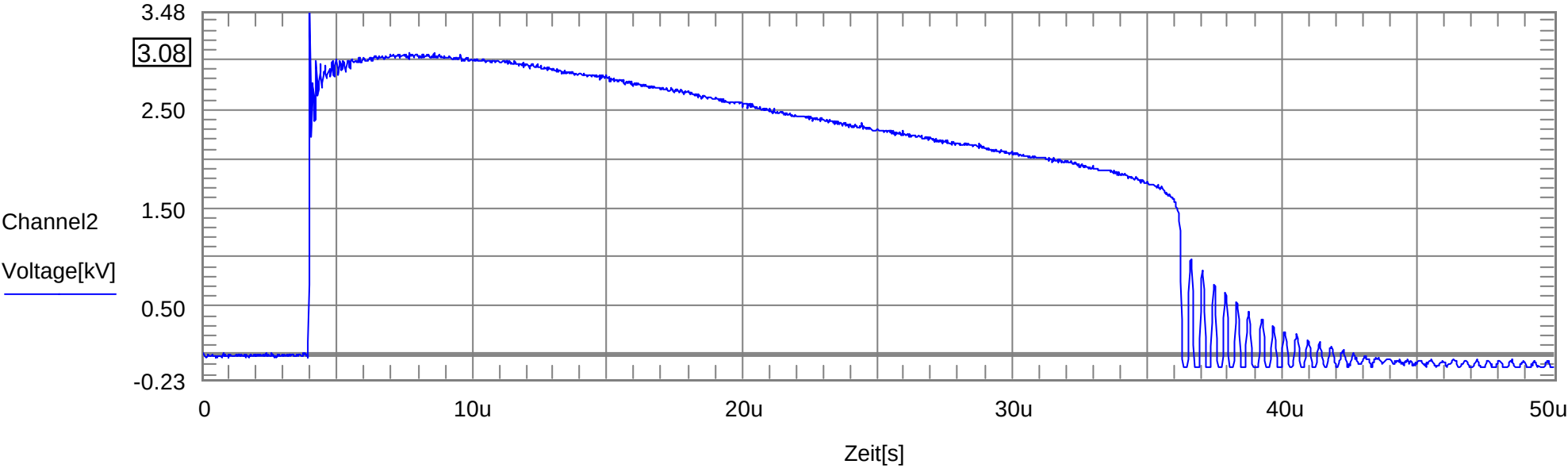
Peak Value: 20.2 kA Front Time: 7.83 μ s Time to Half Value: 21 μ s Charge: 372 mAs Specific Energy: 5.66 kA²sPeak Value: 3.19 kV Front Time: 1.63 μ s Time to Half Value: 32.2 μ s

14/Dec/2012 08:58:46

Prüfsequenz: OBO-V20C3PHFS1000-Ures-121214 Aufnahme-Nr.: 6



Peak Value: 20.2 kA Front Time: 7.89 μs Time to Half Value: 21 μs Charge: 372 mAs Specific Energy: 5.65 kA²s



Peak Value: 3.54 kV Front Time: 0 μs Time to Half Value: 0 μs

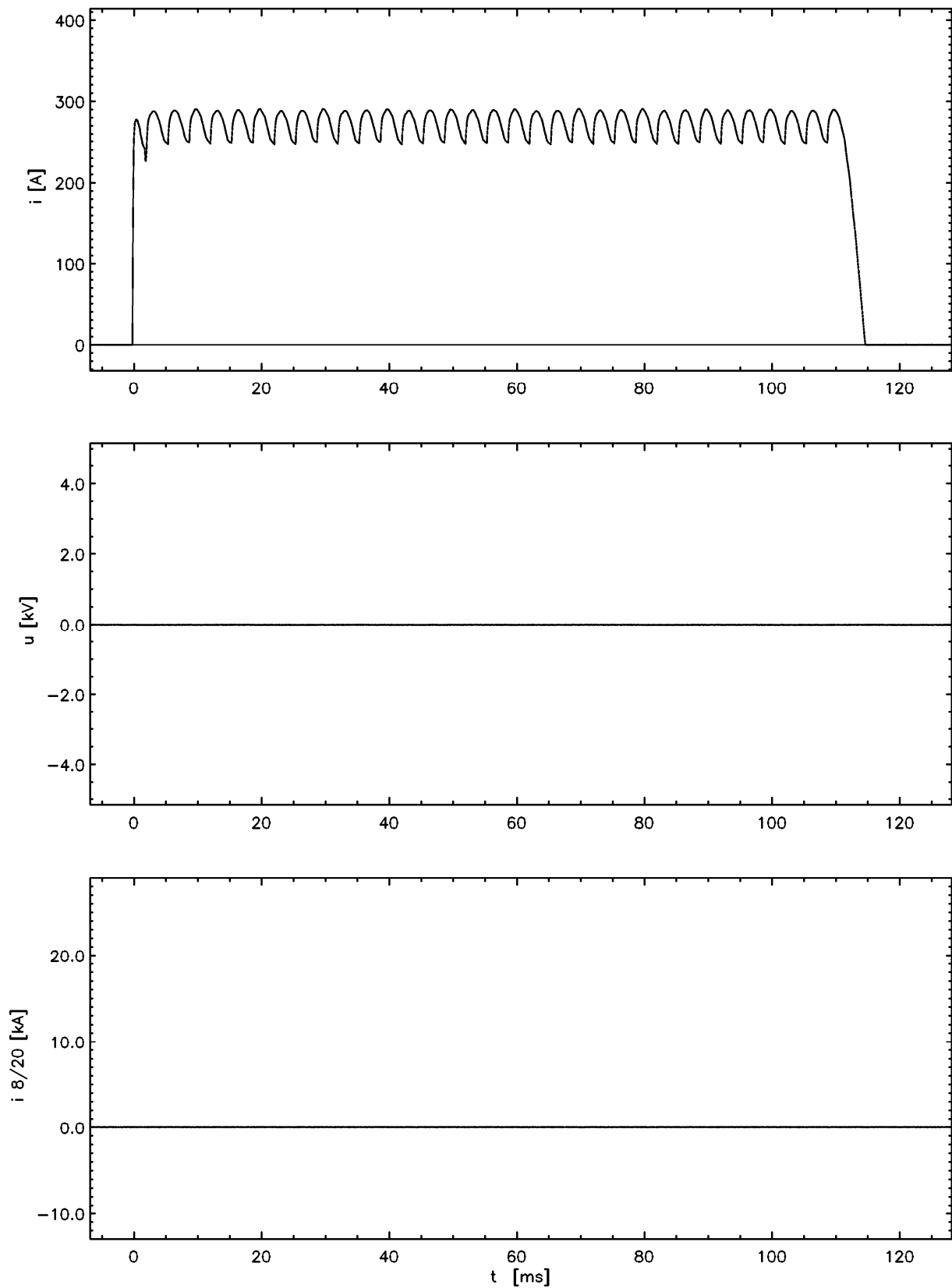


VDE: 248000-1181-0011/175701-4167543
IPH: 1999.2121350

Test engineer: Rai. Borchert
Date of testing: 2012-12-05

Page 1

Test-No. 2128057

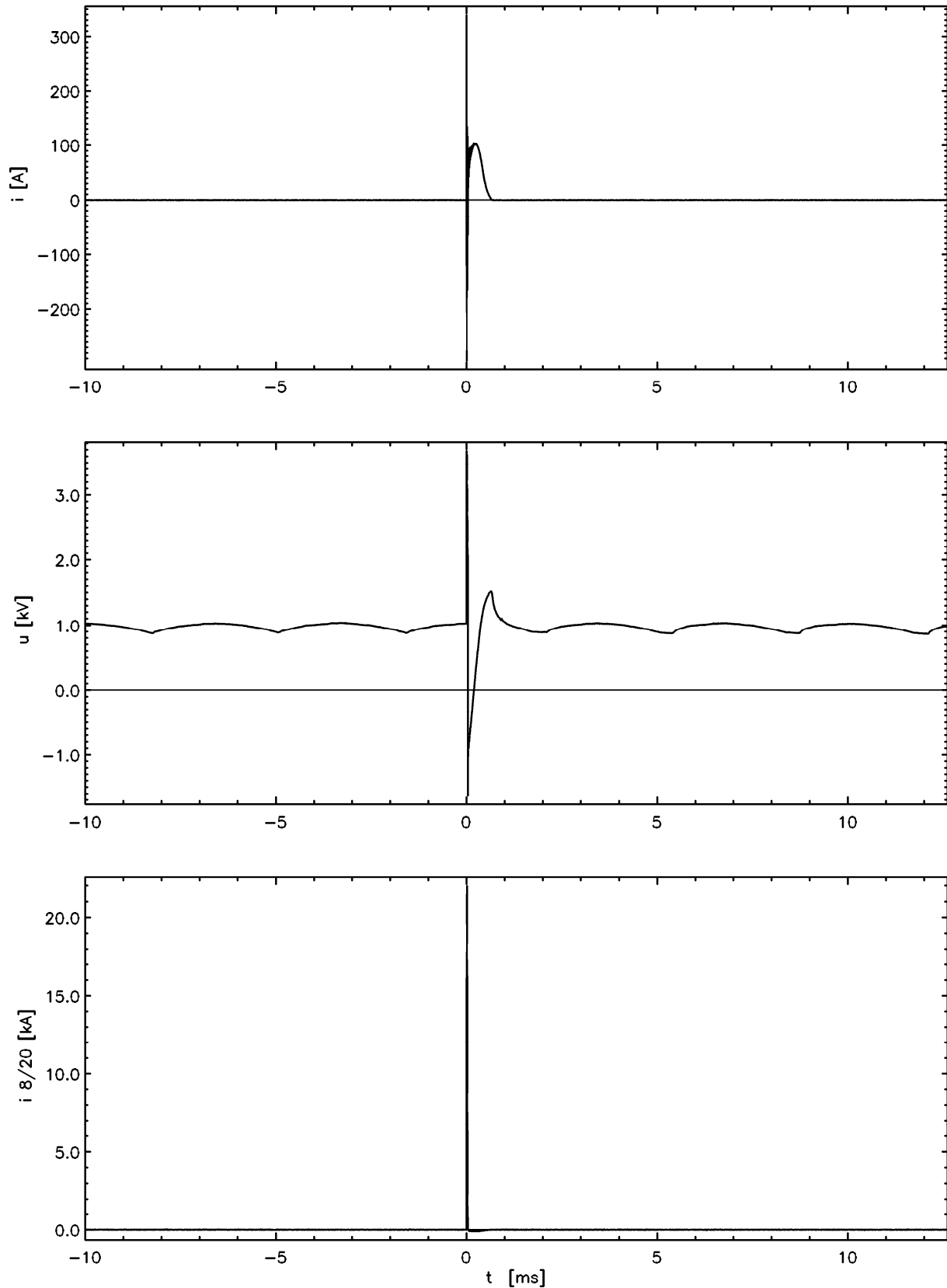


VDE: 248000-1181-0011/175701-4167543
 IPH: 1999.2121350

Test engineer: Rai. Borchert
 Date of testing: 2012-12-05

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Test-No. 2128102

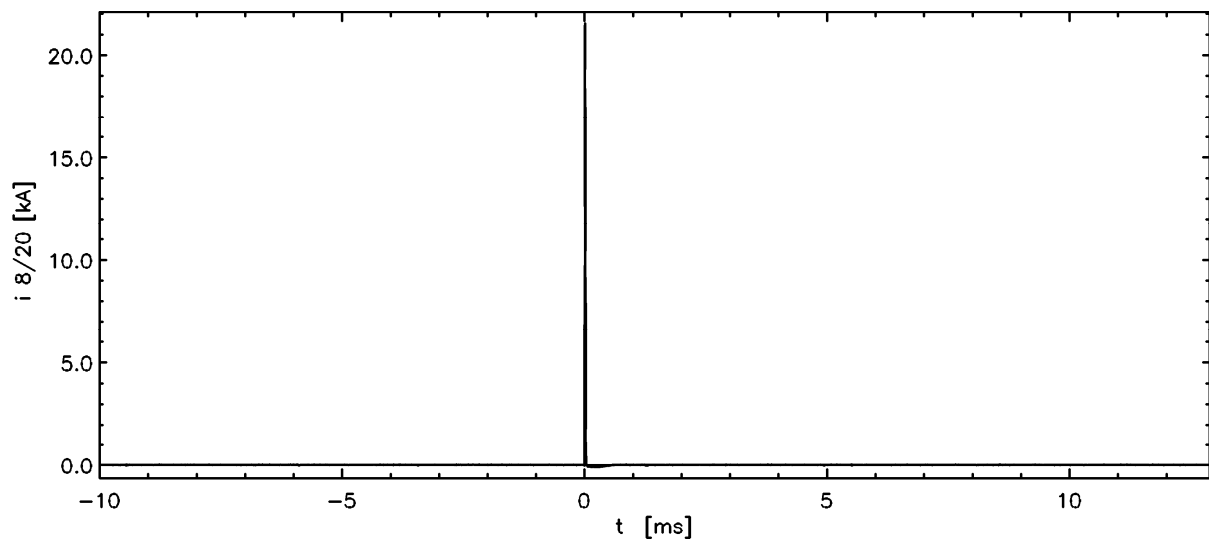
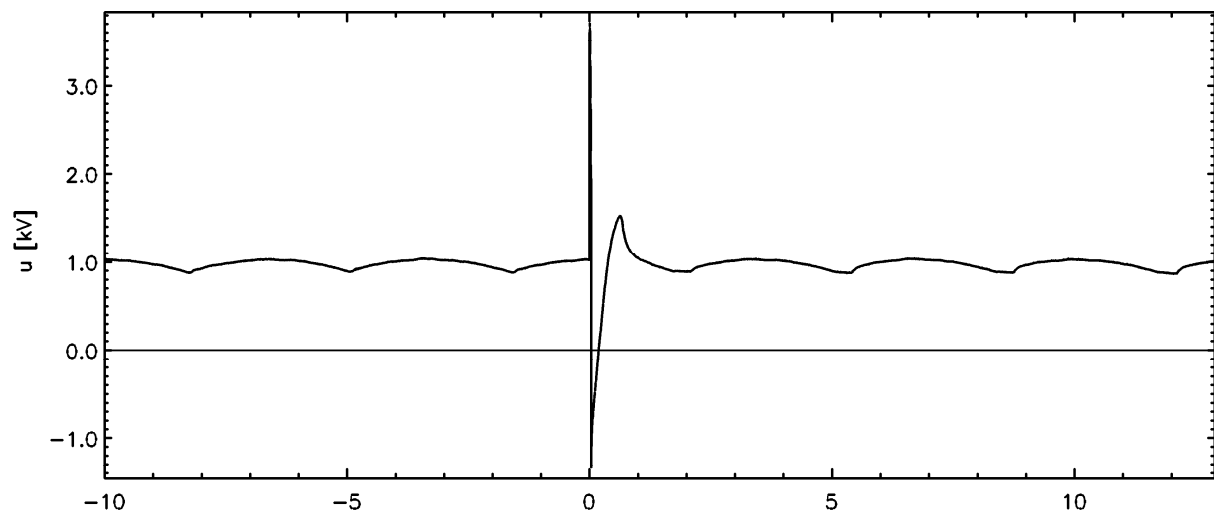
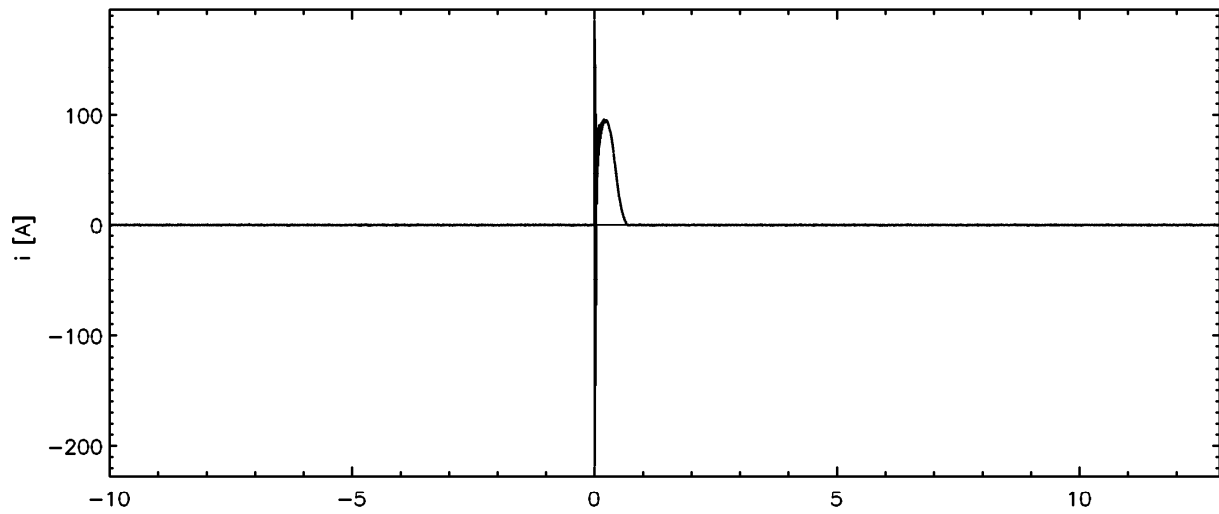


VDE: 248000-1181-0011/175701-4167543
 IPH: 1999.2121350

Test engineer: Rai. Borchert
 Date of testing: 2012-12-05

Page 3

Test-No. 2128107

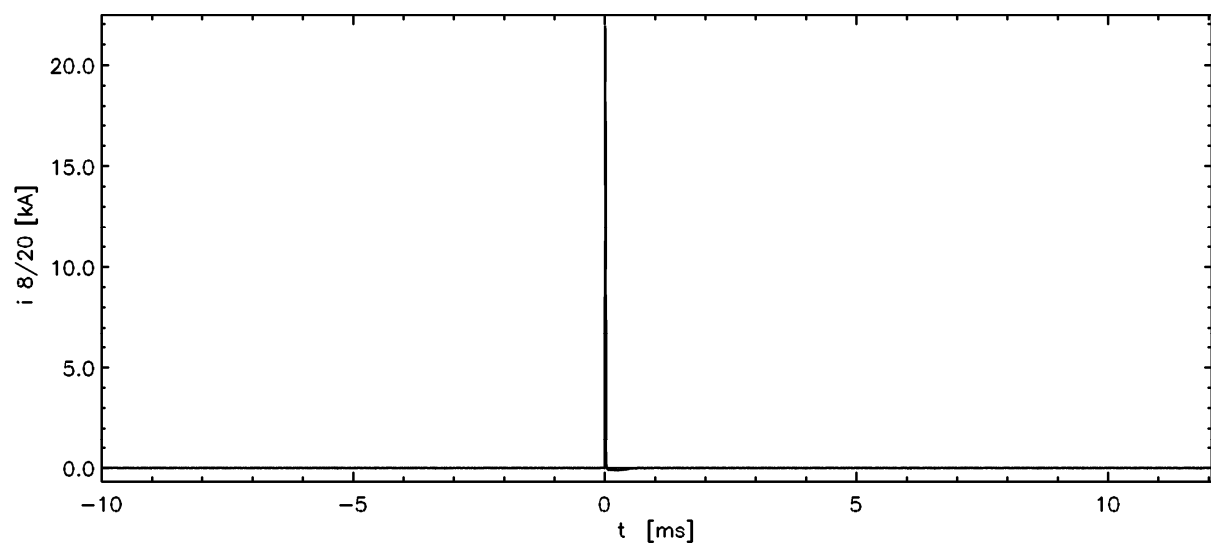
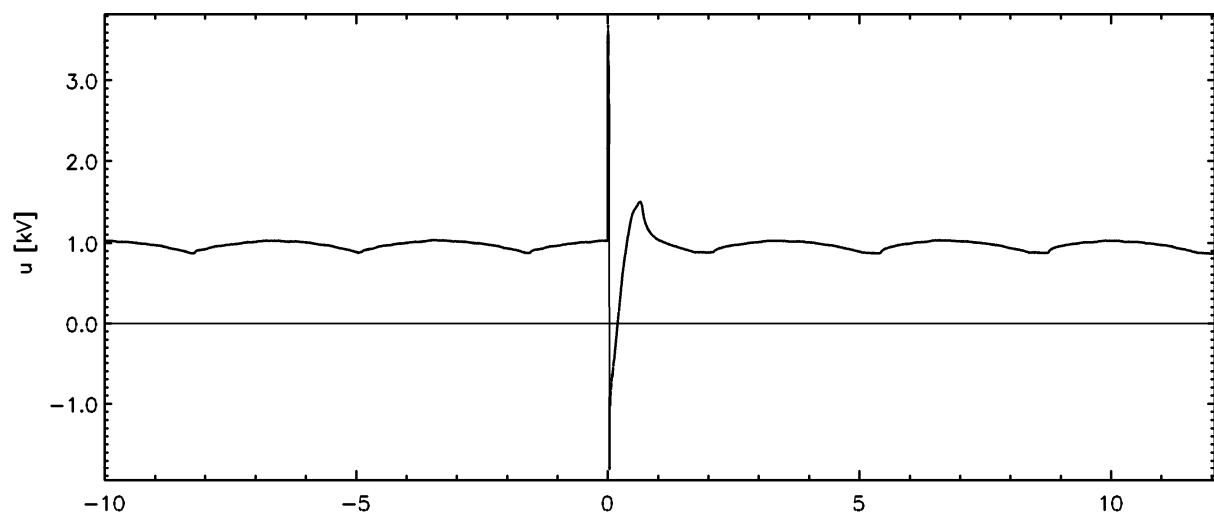
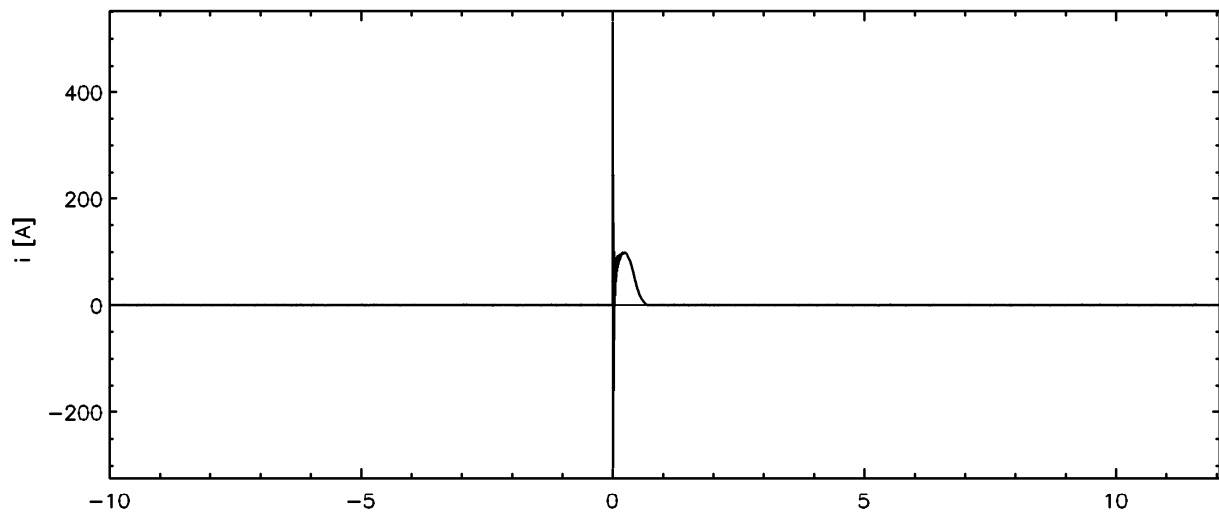


VDE: 248000-1181-0011/175701-4167543
 IPH: 1999.2121350

Test engineer: Rai. Borchert
 Date of testing: 2012-12-05

Page 4

Test-No. 2128112



Analysen

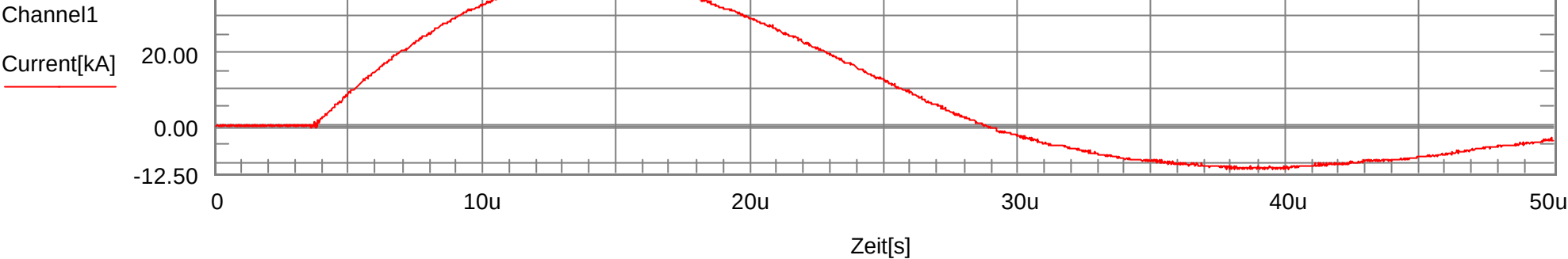
Testname: OBO-V20C3PHFS1000-Itotal-121026					Date: 26.10.2012 8:37:16		
Counter	Sample	Channel1: Current I_{Total}			Channel2: Current I		
		Peak Value	Front Time	Time To Half Value	Peak Value	Front Time	Time to Half Value
1	13 Itotal 1	40 kA	8.31 μ s	18.6 μ s	19.8 kA	8.08 μ s	18.5 μ s
2	14 Itotal 2	40 kA	8.41 μ s	18.6 μ s	19.8 kA	8.09 μ s	18.5 μ s
3	15 Itotal 3	40 kA	8.32 μ s	18.6 μ s	19.9 kA	8.13 μ s	18.5 μ s

Channel 1 is measured with P606006 (shunt of the lightning current generator: ISM 200P/0.4 spez) and shows the total discharge current.

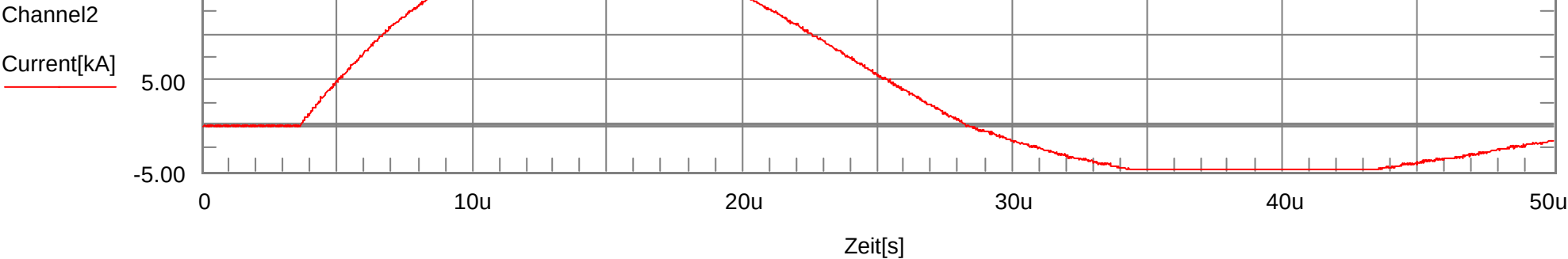
Channel 2 is measured with P607001 (Pearson current monitor 101) and P610007 (voltage probe: Agilent 10074C) and shows the part of the discharge current through the Terminal (-).

26/Oct/2012 08:26:14

Prüfsequenz: OBO-V20C3PHFS1000-Itotal-121026 Aufnahme-Nr.: 1



Peak Value: 40 kA Front Time: 8.31 μs Time to Half Value: 18.6 μs Charge: 781 mAs Specific Energy: 20.5 kA²s



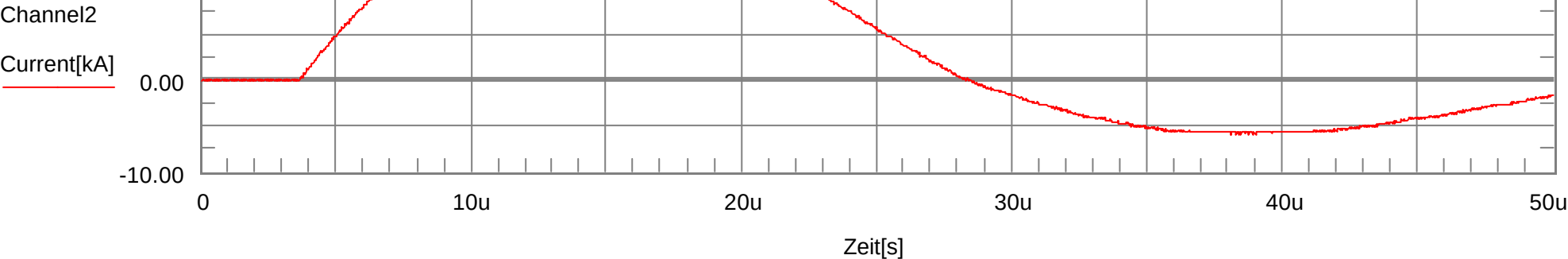
Peak Value: 19.8 kA Front Time: 8.08 μs Time to Half Value: 18.5 μs Charge: 385 mAs Specific Energy: 5.01 kA²s

26/Oct/2012 08:31:46

Prüfsequenz: OBO-V20C3PHFS1000-Itotal-121026 Aufnahme-Nr.: 2



Peak Value: 40 kA Front Time: 8.41 μ s Time to Half Value: 18.6 μ s Charge: 779 mAs Specific Energy: 20.3 kA²s



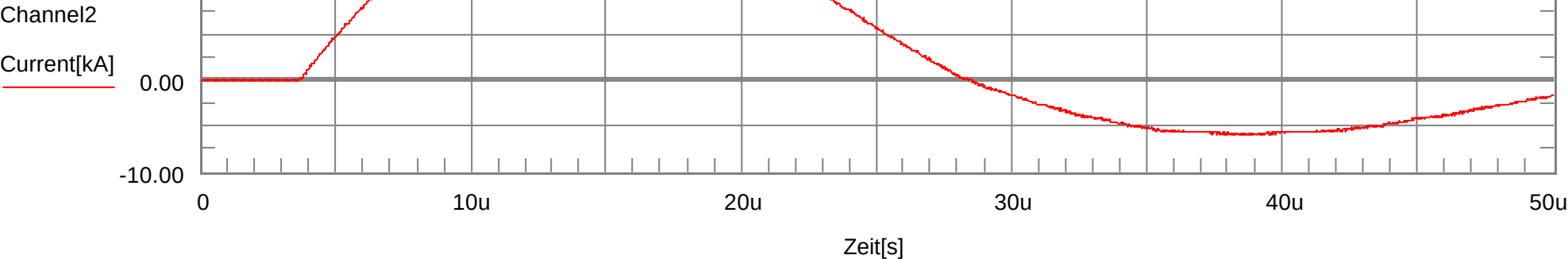
Peak Value: 19.8 kA Front Time: 8.09 μ s Time to Half Value: 18.5 μ s Charge: 393 mAs Specific Energy: 5.08 kA²s

26/Oct/2012 08:37:16

Prüfsequenz: OBO-V20C3PHFS1000-Itotal-121026 Aufnahme-Nr.: 3



Peak Value: 40 kA Front Time: 8.32 μ s Time to Half Value: 18.6 μ s Charge: 783 mAs Specific Energy: 20.6 kA²s



Peak Value: 19.9 kA Front Time: 8.13 μ s Time to Half Value: 18.5 μ s Charge: 396 mAs Specific Energy: 5.15 kA²s