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PA-No.: 3017

TEST REPORT No. CTI-PA 3017-1

Zeichen/Ref.: Gra

Applicant: SCHIRTEC AG
 Ignaz-Köck-Straße 10
 1210 Wien



Commission / test items received: 12-2013
 Date(s) of performance of tests: 12-2013 till 01-2014

Type of test item: Air terminal, Model: S-AM

Test specification (standard, test procedure):

Selective tests according to EN 50164-1:2008, clause 6.3 Electrical test / Classification H

Impulse test currents as specified in:
 IEC 61643-11:2011 respectively
 EN 61643-11:2012 – clause 8.1.1

Initial and final verification:
 by measurement of the contact resistance, as close as possible to the connection component and
 the resistance between tip and sphere.

Compiled by: D. Grabovsky

Date: 27-01-2014

Approved by: H. Bachl

Date: 27-01-2014



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The test results presented in this report relate only to the items tested.

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Test procedure:

Three samples of the air terminal were stressed three times by a test current as given in table 1. The time between individual shot allowed the arrangement of the specimen to cool down to approximately ambient temperature.

Table 1: Impulse test current parameters

Nominal values			Tolerances according					
			IEC/EN 61643-1				EN 50164-1	
I_{imp}	Q	W/R	Q -10%	Q +20%	W/R -10%	W/R +45%	W/R -35%	W/R +35%
kA $\pm 10\%$	As	kJ/Ohm	As	As	kJ/Ohm	kJ/Ohm	kJ/Ohm	kJ/Ohm
100	50	2500	45	60	2250	3625	1625	3375

Before the first impulse current application and after the last impulse current application the contact resistance was measured, with a source of at least 10A, as close as possible to the connection component. Additionally the resistance between the terminal tip and sphere was measured to check for any damage or alteration of the internal circuitry.

The air terminal bottom tube was connected via a short down-conductor of appropriate cross section to the impulse generator. The connection between air terminal and down-conductor was done by use of a special clamping unit provided by the manufacturer.

The air terminal tip was connected via a minimum air gap of approx. 3mm to the other output terminal of the generator.

Details and pictures see ANNEX 2.

Test results:

Initial measurement of the contact resistance and resistance between the terminal tip and the sphere. For details see Table 2.

Table 2: Initial and final measurement of contact resistance

	Initial measurement of the contact resistance	Initial measurement of resistance between the terminal tip and the sphere
Sample 1	< 1m Ω	approx. 20M Ω
Sample 2	< 1m Ω	approx. 20M Ω
Sample 3	< 1m Ω	approx. 20M Ω

Application of three current impulses – for details see table 3.
Oscillograms are shown in ANNEX 4.

Table 3: Test current parameters

	I_{imp} [kA]	Q [As]	W/R [MJ/ Ω]
Sample 1			
First Impulse	101,9	51,4	2,76
Second Impulse	101,5	47,4	2,45
Third Impulse	103,8	48,2	2,59
Sample 2			
First Impulse	102,2	50	2,63
Second Impulse	101,5	51	2,68
Third Impulse	104	50	2,69
Sample 3			
First Impulse	104,2	52,6	2,8
Second Impulse	101,8	51,6	2,71
Third Impulse	104,2	51,7	2,79

Final measurement of the contact resistance and resistance between the terminal tip and the sphere on all three samples. For details see table 4.

Table 4: Initial and final measurement of contact resistance

	Final measurement of the contact resistance	Final measurement of resistance between the terminal tip and the sphere
Sample 1	< 1m Ω	approx. 20M Ω
Sample 2	< 1m Ω	approx. 20M Ω
Sample 3	< 1m Ω	approx. 20M Ω

Conclusion:

Visual inspection showed discoloration of tips and current marks due to arc, but no physical damage, no loose parts and no deformation. Photos of the test samples after application of impulses are shown in ANNEX 3.

Comparison of initial and final resistance measurements showed no differences exceeding the measurement accuracy and therefore no indication for any alternation or damage of the internal circuitry.

ANNEX 1

Test sample before the tests.



ANNEX 2

Test arrangement and generator connection

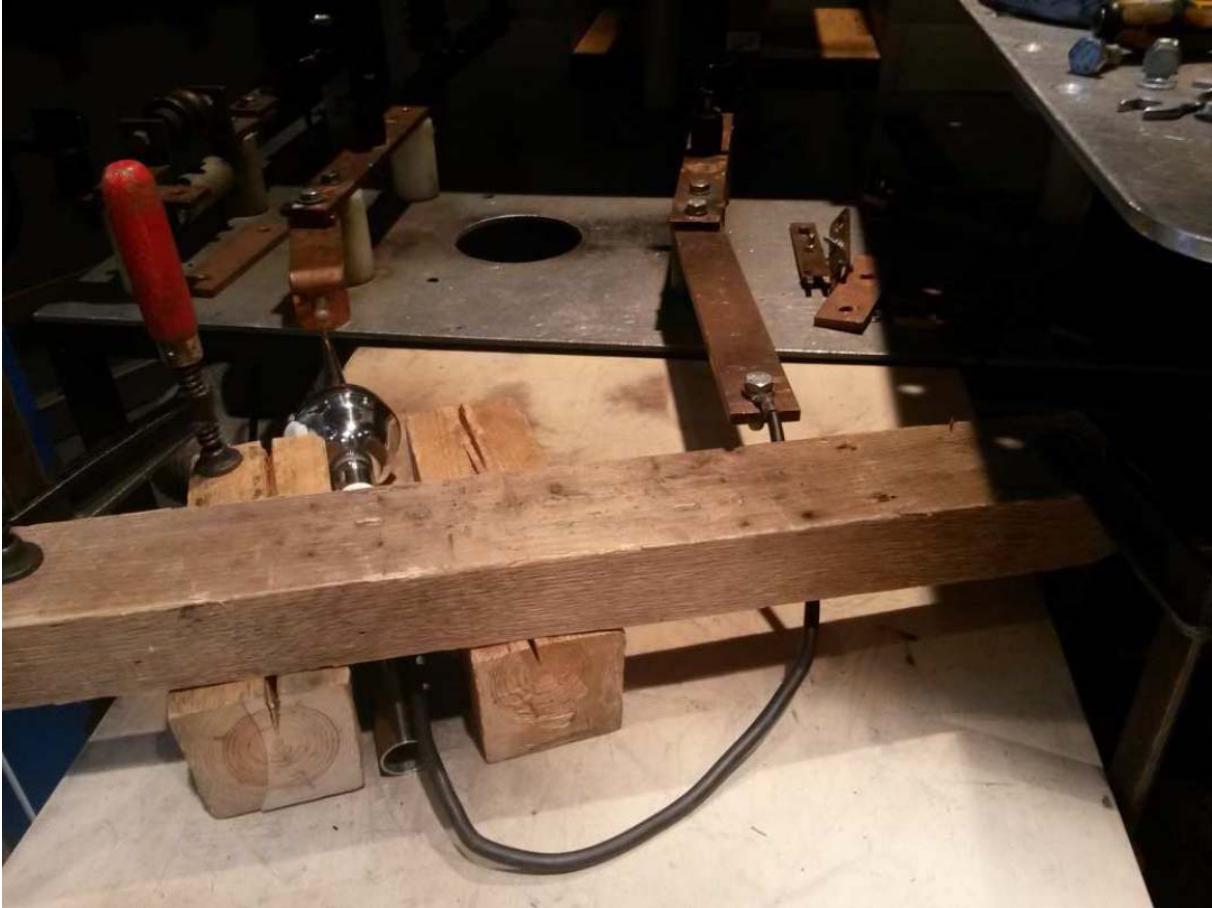
3mm arc gap to generator



Ground connection to generator



Sample connected to generator



ANNEX 3

Test samples after the tests:



Tips of test samples showed discoloration and current marks due to arc.

Zoom Sample 1:



Zoom Sample 2:

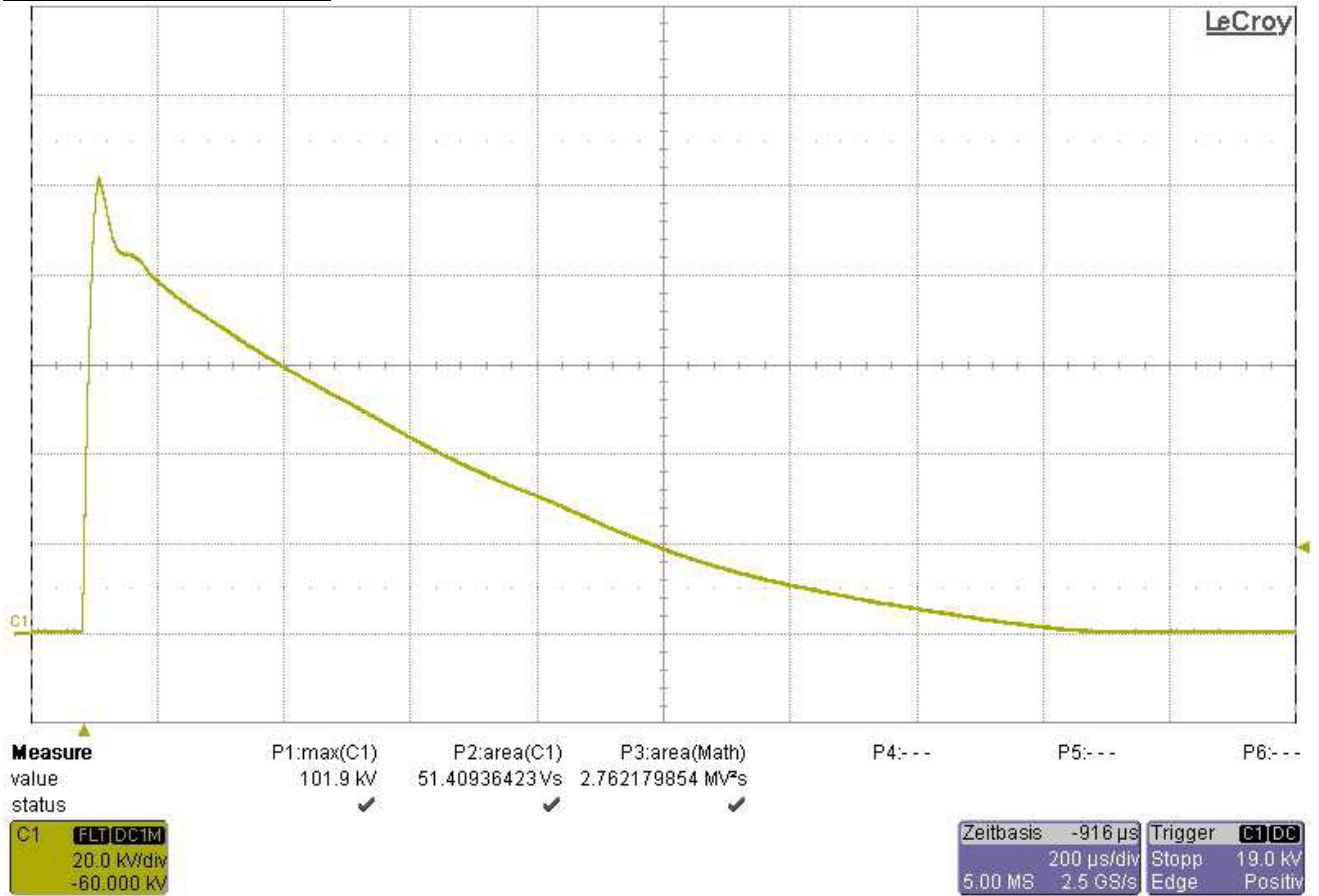


Zoom Sample 3:



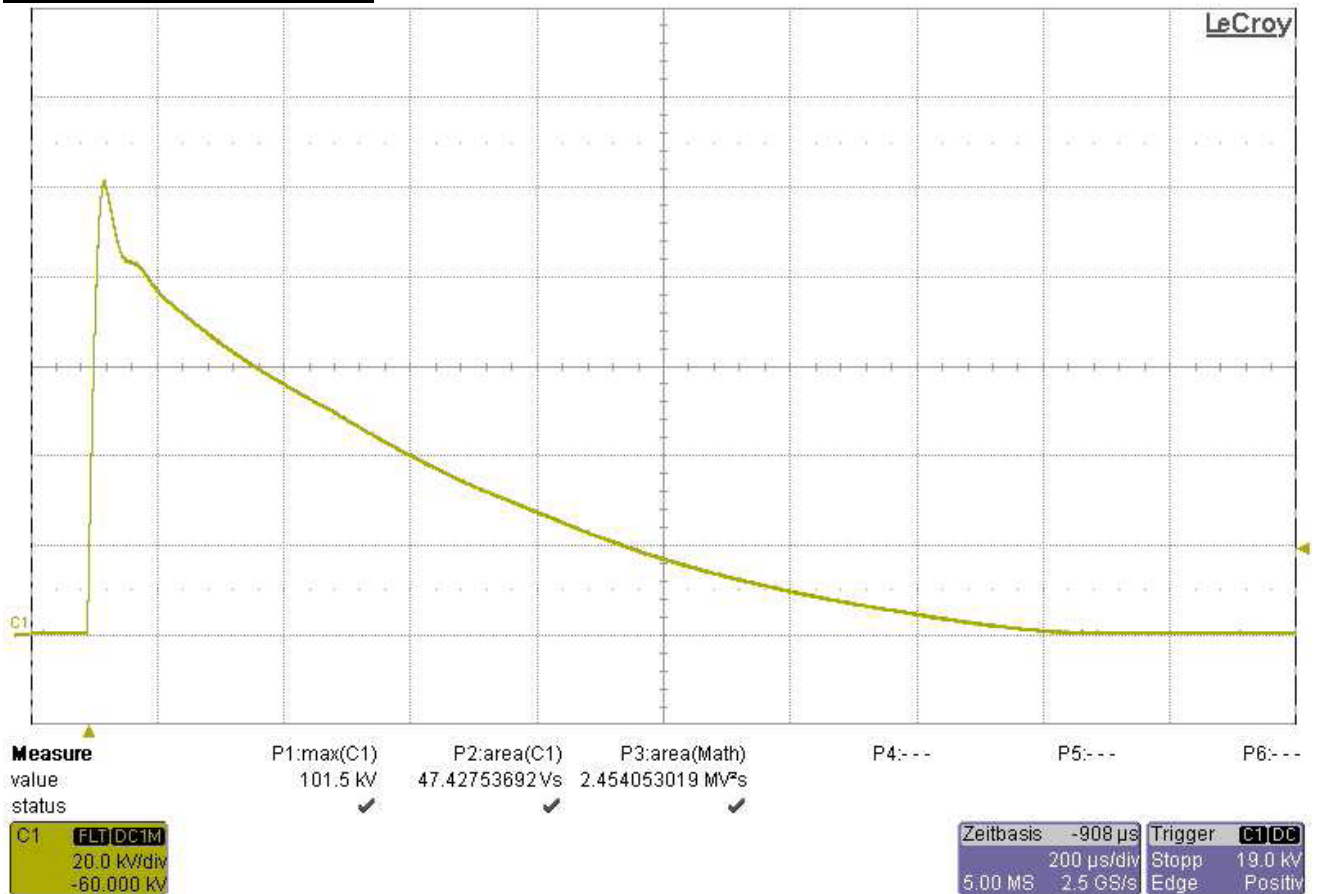
ANNEX 4

Sample 1, First impulse



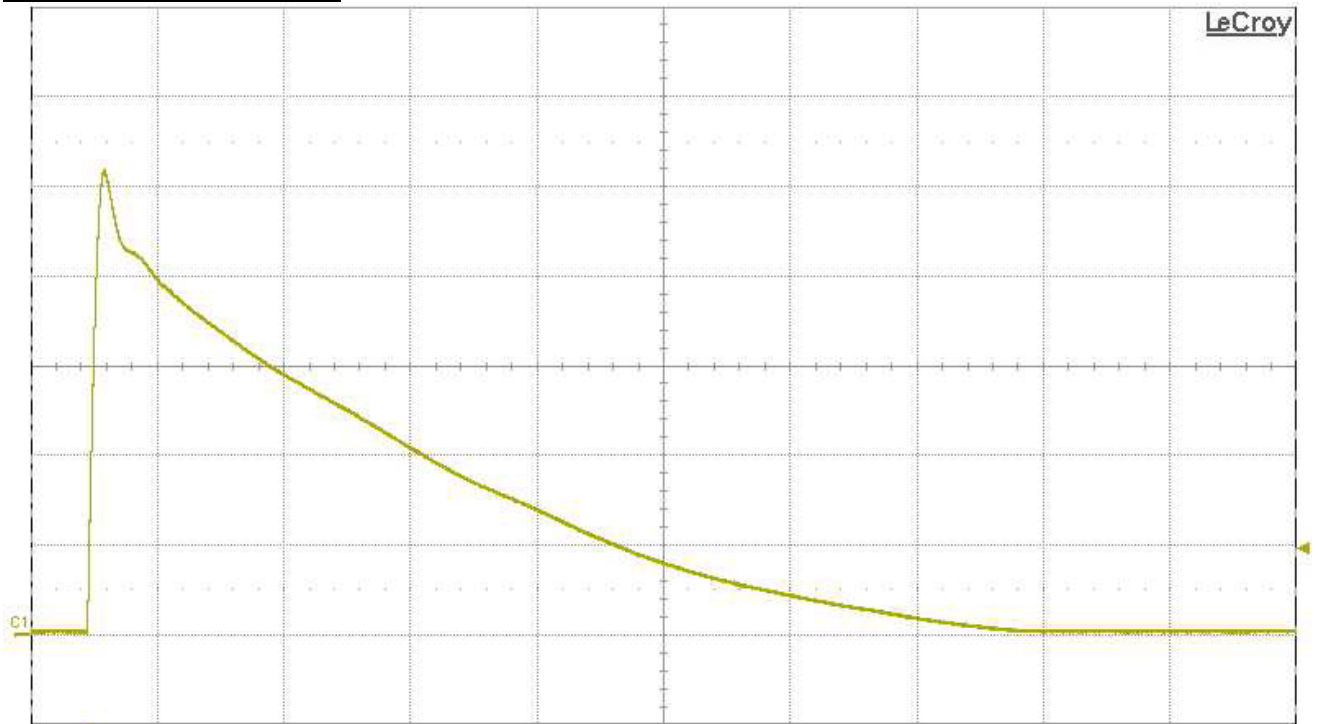
$I_{imp} = 101,9kA$, $Q = 51,4As$, $W/R = 2,76MJ/\Omega$

Sample 1, Second impulse



$I_{imp} = 101,5kA$, $Q = 47,4As$, $W/R = 2,45MJ/\Omega$

Sample 1, Third impulse



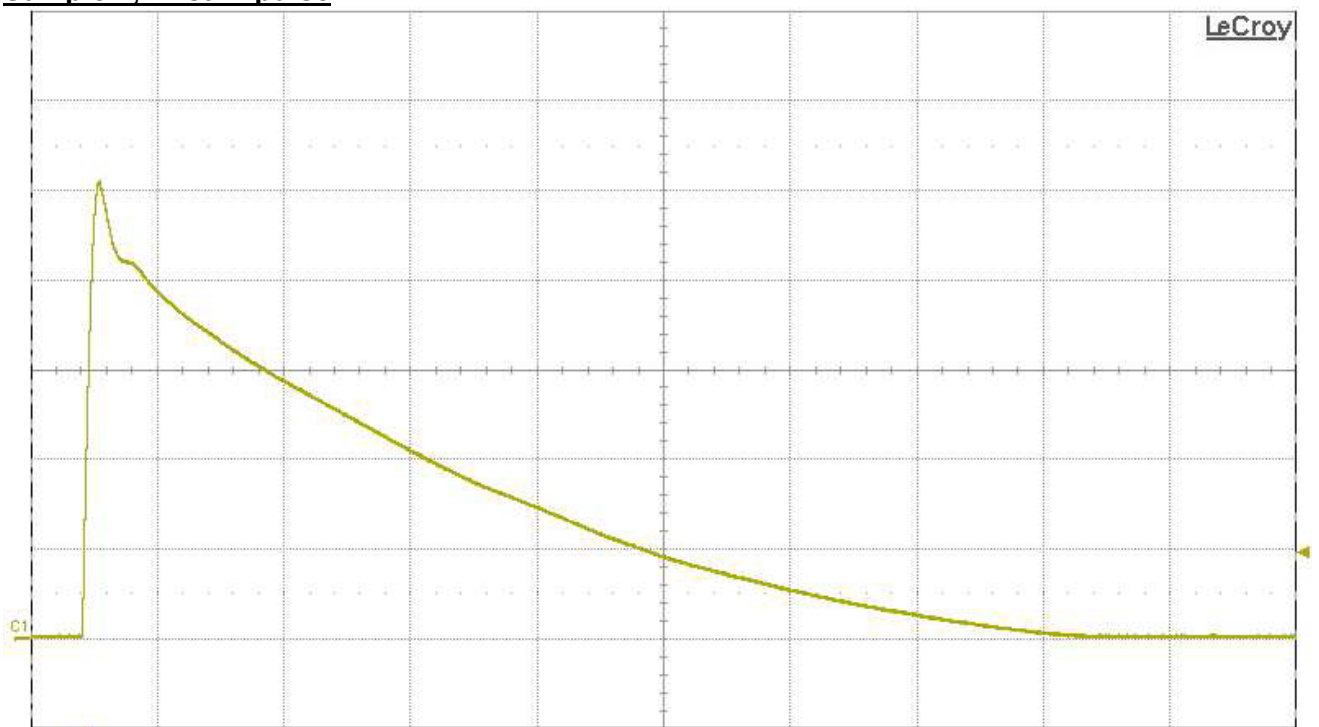
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value:	103.8 kV	48.16565865 Vs	2.593477057 MV ² s			
status:	✓	✓	✓			

C1 FLT|DC1M
20.0 kV/div
-60.000 kV

Zeitbasis -908 µs Trigger C1|DC
200 µs/div Stopp 19.0 kV
5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 103,8\text{kA}$, $Q = 48,2\text{As}$, $W/R = 2,59\text{MJ}/\Omega$

Sample 2, First impulse



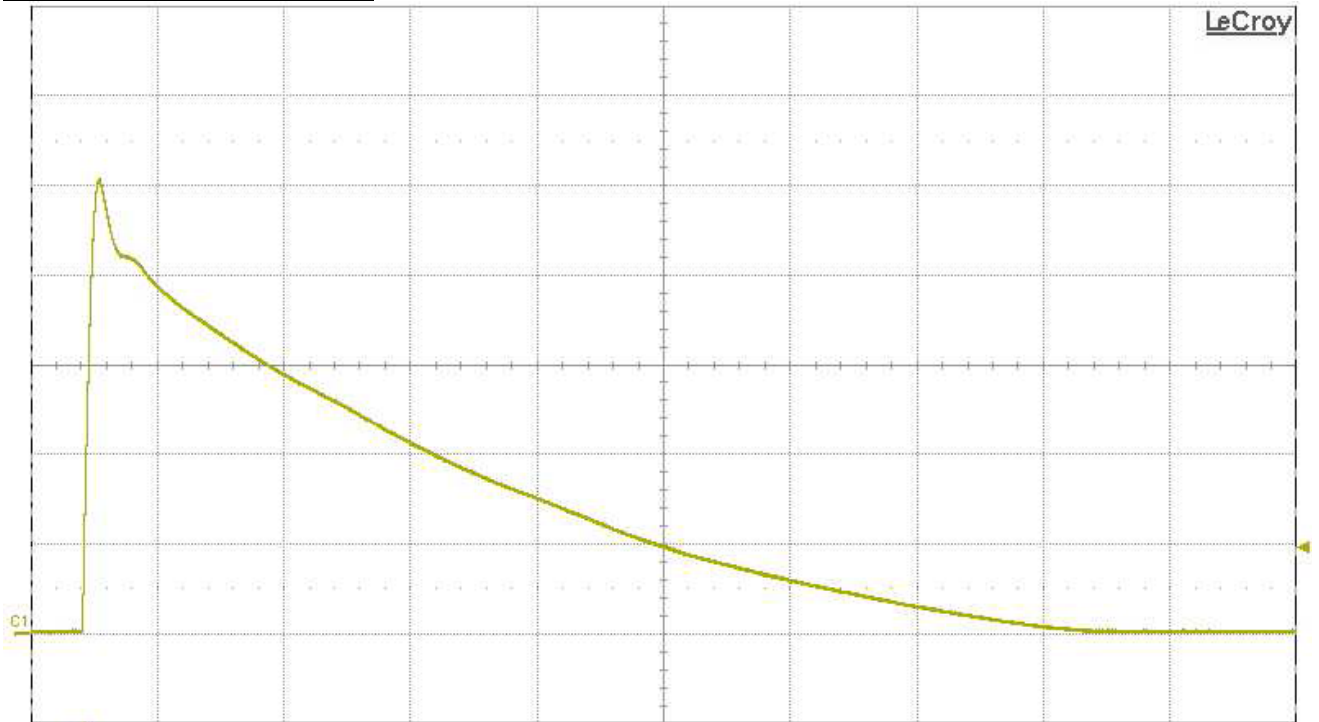
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value:	102.2 kV	49.95968950 Vs	2.630297589 MV ² s			
status:	✓	✓	✓			

C1 FLT|DC1M
20.0 kV/div
-60.000 kV

Zeitbasis -916 µs Trigger C1|DC
200 µs/div Stopp 19.0 kV
5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 102,2\text{kA}$, $Q = 50\text{As}$, $W/R = 2,63\text{MJ}/\Omega$

Sample 2, Second impulse



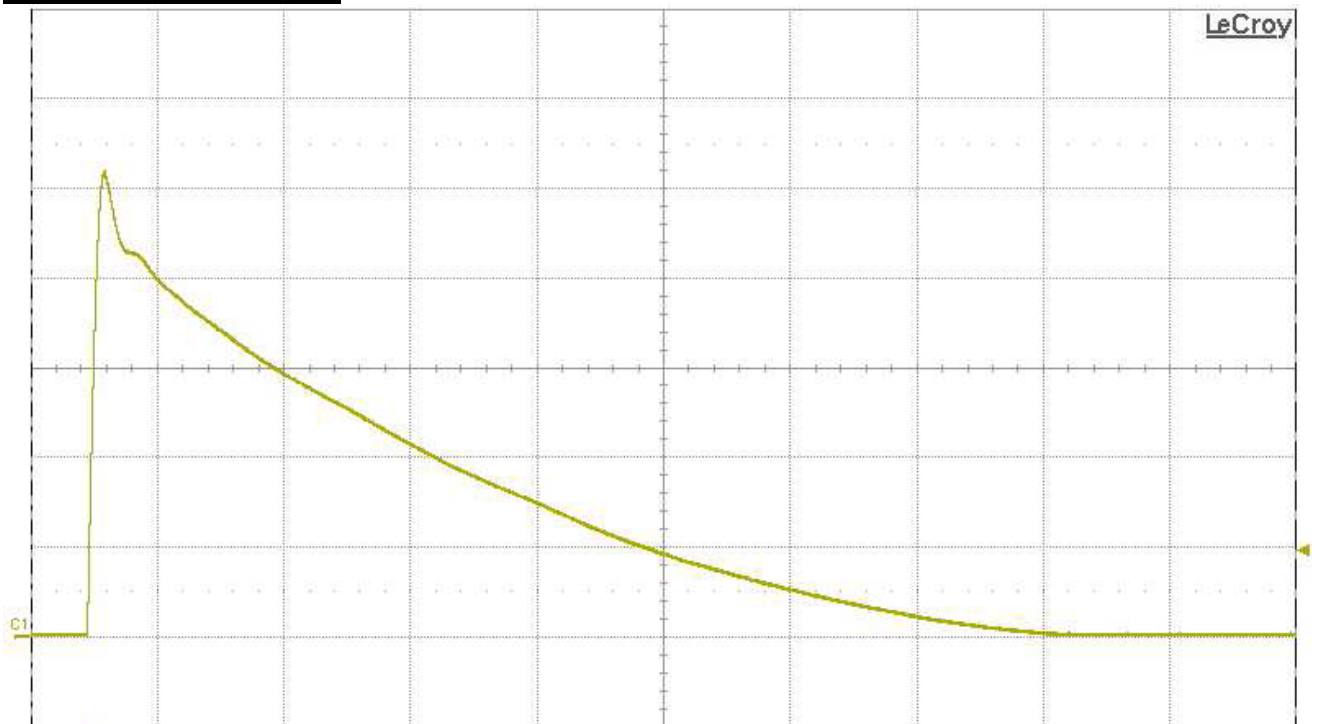
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value	101.5 kV	50.99028849 Vs	2.677032822 MV ² s			
status	✓	✓	✓			

C1 **FLT|DC1M**
 20.0 kV/div
 -60.000 kV

Zeitbasis -916 μ s Trigger **C1|DC**
 200 μ s/div Stopp 19.0 kV
 5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 101,5kA, Q = 51As, W/R = 2,68MJ/\Omega$

Sample 2, Third impulse



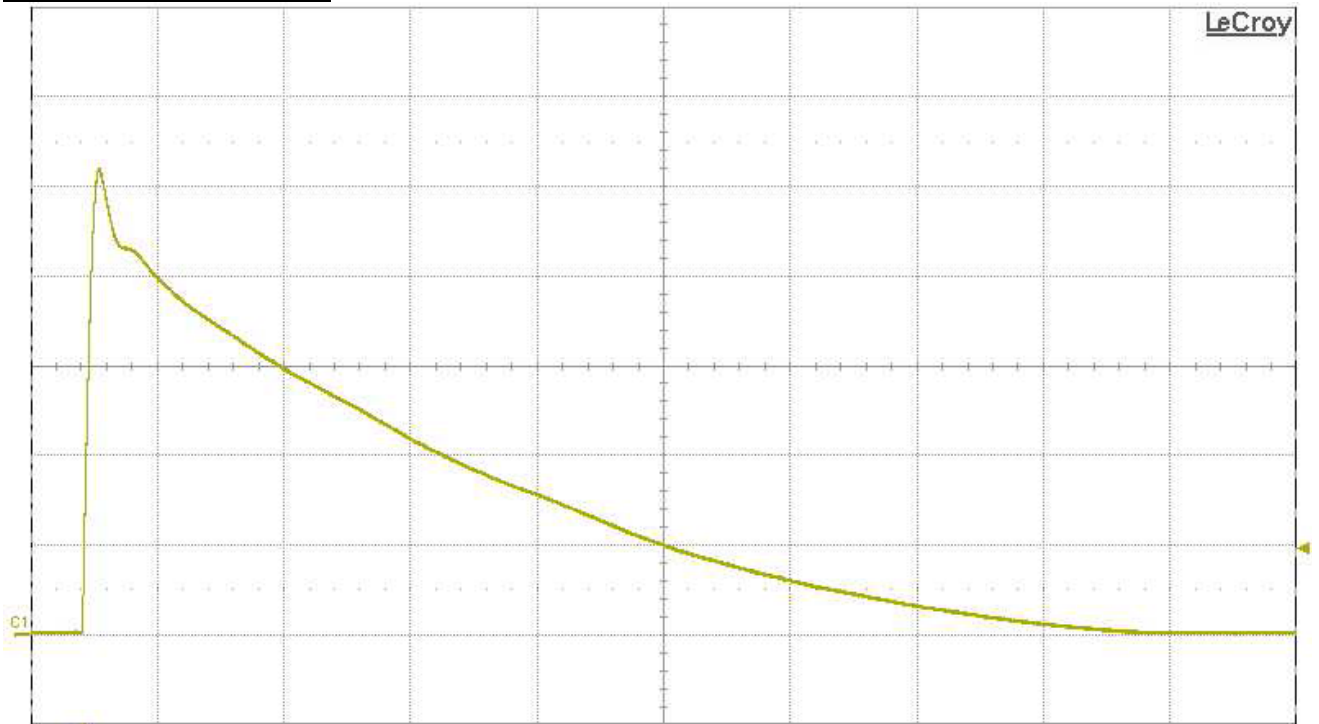
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value	104.0 kV	49.98418474 Vs	2.691956188 MV ² s			
status	✓	✓	✓			

C1 **FLT|DC1M**
 20.0 kV/div
 -60.000 kV

Zeitbasis -908 μ s Trigger **C1|DC**
 200 μ s/div Stopp 19.0 kV
 5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 104kA, Q = 50As, W/R = 2,69MJ/\Omega$

Sample 3, First impulse



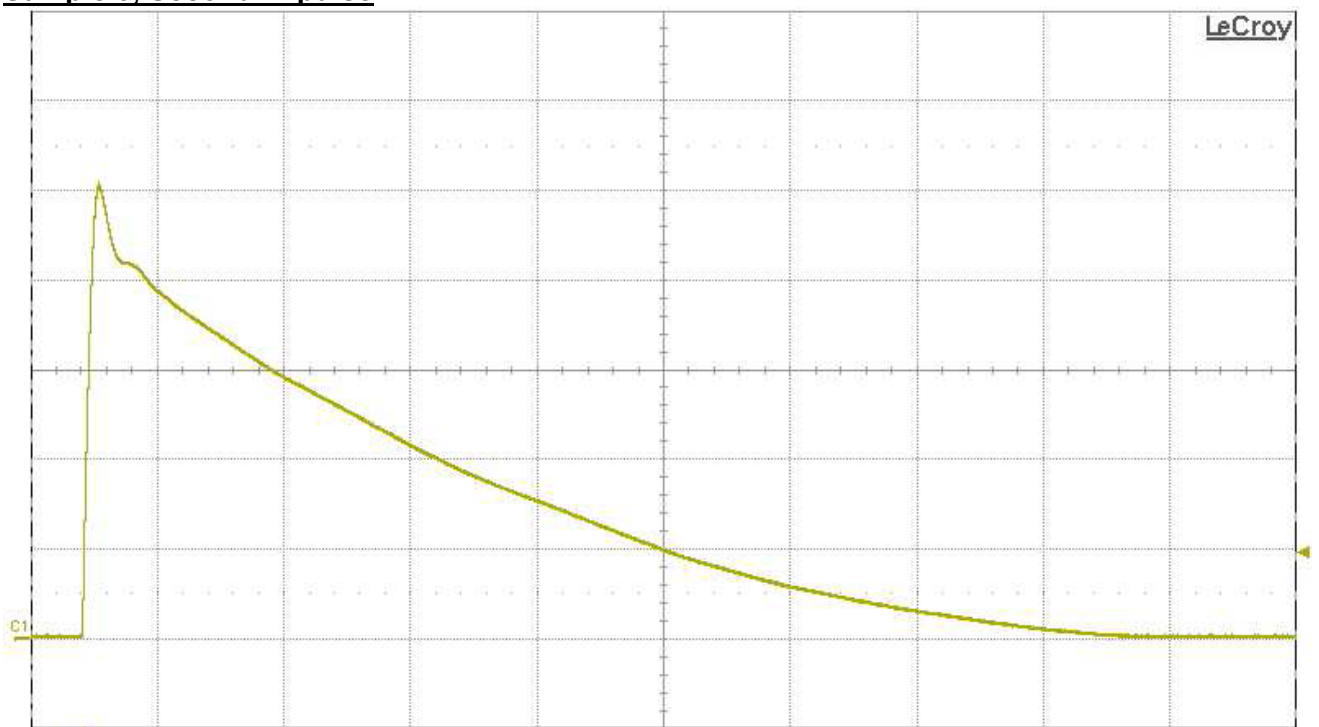
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value:	104.2 kV	52.55740402 Vs	2.823271081 MV ² s			
status:	✓	✓	✓			

C1 FLT|DC1M
20.0 kV/div
-60.000 kV

Zeitbasis -916 µs Trigger C1|DC
200 µs/div Stopp 19.0 kV
5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 104,2\text{kA}$, $Q = 52,6\text{As}$, $W/R = 2,82\text{MJ}/\Omega$

Sample 3, Second impulse



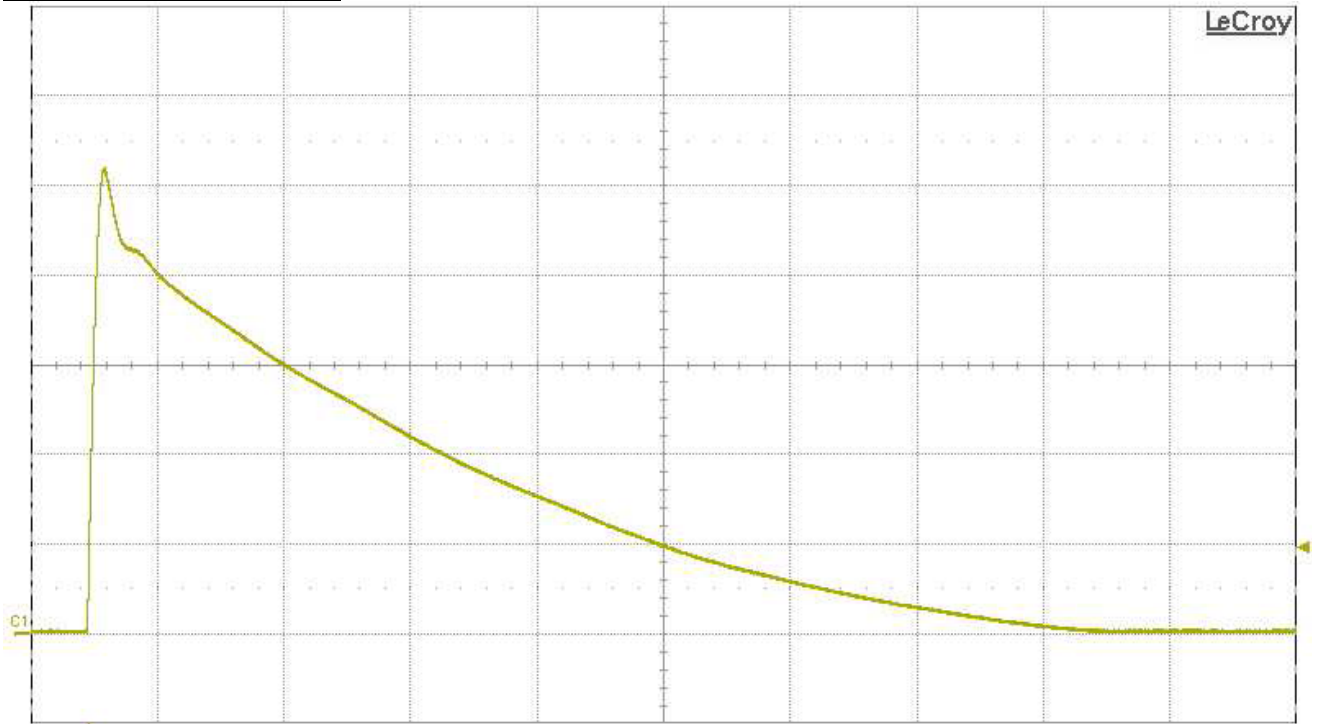
Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value:	101.8 kV	51.56879258 Vs	2.714972674 MV ² s			
status:	✓	✓	✓			

C1 FLT|DC1M
20.0 kV/div
-60.000 kV

Zeitbasis -916 µs Trigger C1|DC
200 µs/div Stopp 19.0 kV
5.00 MS 2.5 GS/s Edge Positiv

$I_{imp} = 101,8\text{kA}$, $Q = 51,6\text{As}$, $W/R = 2,71\text{MJ}/\Omega$

Sample 3, Third impulse



Measure	P1:max(C1)	P2:area(C1)	P3:area(Math)	P4:---	P5:---	P6:---
value	104.2 kV	51.66799481 Vs	2.787725426 MV ² s			
status	✓	✓	✓			

C1 FLT DC1M
20.0 kW/div
-60.000 kV

Zeitbasis -908 µs
200 µs/div
5.00 MS 2.5 GS/s
Trigger C1 DC
Stopp 19.0 kV
Edge Positiv

$I_{imp} = 104,2\text{kA}$, $Q = 51,7\text{As}$, $W/R = 2,79\text{MJ}/\Omega$