ALSTOM

TRANSMISSION & DISTRIBUTION
Transformateurs de Mesure

CAPACITOR VOLTAGE TRANSFORMER

CCV 245

TEST CERTIFICATE

N°: 25 877

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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° : **25877**

CAPACITOR VOLTAGE TRANSFORMER

Type :	CCV 245
Serial number :	XE 91 200-01
Highest primary voltage :	245 kV
Power frequency withstand voltage	460 kV
Impulse withstand voltage :	1050 kV
Rated frequency :	50 Hz
Ratio :	220 000 / √3 V // 100 / √3 / 100 / √3 V
Burden and accuracy : 1a - 1n winding	75 VA cl 0.5
2a - 2n winding	75 VA cl 3P
	Simultaneous loaded
Standards :	IEC 186 & 358
Rated voltage factor :	1.5 Un – 30 s
Thermal burden :	500 VA
Rated capacitance at 50 Hz :	4 400 pF – 5 % ; +10 %
Outline drawing :	8 162 976

Montrouge, 16 June 2 000

Executive responsible for the tests

R. TORRES

Technical manager

A. JOUNAY

Quality Manager

V. DENIZEAUX

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ESSAIS REALISES – TETS LIST

N° :	Consistance des essais Table of contents Contenido de las pruebas	Références References Referencias	Page Page Pagina	Conclusion des essais (1) Conclusion
1	Vérification du marquage des bornes . Verification of terminal markings. Rating plate marking.	IEC 186		C
2	Contrôle de précision. Accuracy check.	IEC 186	15	C
3	Mesure de la tangente et de la capacité à fréquence industrielle. Capacitance and tangent of the loss angle.	IEC 358	3	C
4	Mesure des décharges partielles. Partial discharge test.	IEC 358	3	C
5	Essai de tenue à fréquence industrielledu diviseur capacitif. Power frequency test on the capacitor divider.	IEC 358	4	S
6	Essai de tenue à fréquence industrielle de l'élément électro-magnétique . Power frequency test on the electromagnetic unit .	IEC 358	4	S
7	Essai de tenue à fréquence industrielle sur la borne à basse tension. Power frequency test on low voltage terminal.	IEC 358	4	S
8	Essai de tenue à fréquence industrielles sur les enroulements secondaires. Power frequency test on secondary windings.	IEC 358	4	S
9	Essai de tenue aux chocs de foudre. Lightning impulse test.	IEC358 & 60-1	5	S
10	Essai de tenue aux chocs de foudre de l'élément électro-magnétique. Lightning impulse test on the electromagnetic unit.	IEC 358 & 60-1	6	S
11	Essai de tenue en court-circuit secondaire. Short-circuit withstand capability test .	IEC 358	7 - 8	S
12	Vérification de la précision en régime transitoire. Transient response test .	IEC 60044-5 CDV- project	9 - 10	C
13	Essai de ferro-résonnace. Ferro-resonance test.	IEC 186 & IEC 358	11	S
14	Essai d'échauffement. Temperature rise test.	IEC 186	12 - 13	S
15	Mesure du taux de transmission haute fréquence. Measurement of the transmission factor of high frequency overvoltage.	IEC 186 CDV- project	14	S
16	Vérification de la précision au titre des essais individuels de série. Accuracy test.	IEC 186	15 - 16	S
17	Mesure de la capacité et de la conductance parasites de la borne basse tension. Stray capacitance and stray conductance of the low voltage terminal.	IEC 358 Annex B	17	C
18	Mesure de la capacité apparente et de la résistance équivalente série à haute fréquence. High frequency capacitance and equivalent serie resistance.	IEC 358 Annexe B	18	C
19	Determination du coefficient de température. Temperature coefficient determination.	IEC 358	19 to 22	C
20	Essai d'étanchéité du diviseur de tension capacitif. Tightness of capacitor voltage divider.	IEC 358	23	S
21	Vérification de la précision en variation de fréquence. Accuracy test with frequency variation.		94 & 95	C
22	Annexe .Annex. Electrical diagram - Outline drawing		24 to 93 96 - 97	

(1) S : satisfaisant-satisfactory-satisfactorio. C : conforme-conform-conforme.

CAPACITANCE AND LOSSES FACTOR MEASUREMENT

	Tension d'essai *Test voltage* *Tensi'on de prueba*	Tangente δ *Tangent δ* *Tangente δ*	Capacité *Capacitance* *Capacitancia*
Mesures réalisées avant essai diélectrique CT *Measurements before power frequency test on CT* *Mediciònes realizadas antes de la prueba dieléctrica sobre CT*	10 kV	0.71 x 10 - 3	4 590 pF
Mesures réalisées avant essai diélectrique CT *Measurements before power frequency test on CT* *Mediciònes realizadas antes de la prueba dieléctrica sobre CT.*	127 kV	0.55 x 10 - 3	4 589 pF
Mesures réalisées après essai diélectrique CT *Measurements after frequency test on CT.* *Mediciònes realizadas despues de la prueba dieléctrica sobre CT.*	127 kV	0.48 x 10 - 3	4 587 pF

Tests have been done at the ambient temperature of 20 °C ± 2 °C.
Capacitance variations are lower than the one corresponding to a puncture of one element. **The tests are satisfactory.**

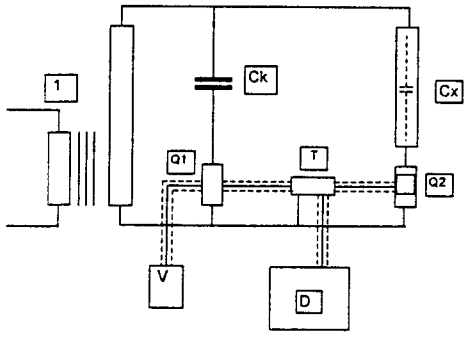
PARTIAL DISCHARGES MEASUREMENTS

Partial discharges measurements are made according to IEC 186 (2-1987) clause 16.4.2 point A, continuously to the power test frequency and according also to IEC 44-4.

Tension de mesure *Voltage measurement* *Tension de mediciòn*		Niveau mesuré en pC *Measured level in pC* *Mediciòn en pC*	Limites en pC *Limits in pC* *Limites en pC*
1.2 Um	294 kV	< 5	10
0.7 Um	171 kV	< 2	2

Test is satisfactory.

DIAGRAM



1:Transformateur élévateur de tension
Ck: Condensateur de couplage
Cx: Objet en essai
T: Transformateur differentiel
Q1: Quadripôle pour DP et mesure de la tension
Q2: Quadripôle pour DP
V: Voltmetre
D: détecteur de DP (Robinson modèle 5)

Set-up transformer
Coupling transformer
Apparatus in test
Differential transformer
Voltage measurement device
DP measurement device
Voltmeter
DP detector (5 Robinson model)

POWER FREQUENCY TESTS

References References Referencias	Consistance des essais Table of contents Contenido de las pruebas	Tension en kV Voltage in kV Tensiòn en kV	Fréquence d'essai en Hz Test frequency Frecuencia en Hz	Durée de l'essai en secondes Duration of test in seconds Duraciòn de la Prueba en en segundos	Conclusion des essais (1) Conclusion Conclusiòn
IEC 60044-2	Essais diélectriques à fréquence industrielle des enroulements secondaires entre eux et la masse . Power frequency test on secondary windings between secondaries and to earth. Ensayo dielectricos de los arrollamientos secundarios entre ellos y la massa.	3	50	60	S
IEC 60044-2	Essais diélectriques sur C total. Power frequency test on C total. Ensayos dielectricos sobre C total.	460	50	60	S
IEC 60044-2	Essais diélectriques entre la borne P2 et la masse. Power frequency test between P2 and to earth. Ensayos dielectricos entre P2 y la massa.	10	50	60	S
IEC 60044-2	Essais diélectriques entre la borne HF et la masse. Power frequency test between HF and to earth. Ensayos dielectricos entre el borne HF y la massa.	10	50	60	S
IEC 60044-2	Essais diélectriques entre les extrèmités de la seif d'accord. Dielectric test on damping impedance medium voltage. Ensayos dielectricos sobre las extremidades del inductor de acorde.	10	300	20	S
IEC 60044-2	Essai diélectrique entre les extrèmités de l'élément électro-magnétique. Power frequency test between the terminals of the electro-magnetic element. Ensayos dielectricos sobre las extremidades del elemento electro-magnetico.	32	300	20	S

(1) S : satisfaisant-satisfactory-satisfactorio. C : conforme-conform-conforme.

Tests done after short-circuit test :

IEC 60044-2	Essais diélectriques à fréquence industrielle des enroulements secondaires entre eux et la masse . Power frequency test on secondary windings between secondaries and to earth. Ensayos dielectricos de los arrollamientos secundarios entre ellos y la massa.	3	50	60	S
IEC 60044-2	Essais diélectriques entre la borne N et la masse. Power frequency test between N and to earth. Ensayos dielectricos entre N y la massa.	4	50	60	S
IEC 60044-2	Essais diélectriques entre les extrèmités de la seif d'accord. Dielectric test on damping impedance medium voltage. Ensayos dielectricos sobre las extremidades del inductor de acorde.	9	300	20	S
IEC 60044-2	Essai diélectrique entre les extrémités de l'élément électro-magnétique. Power frequency test between the terminals of the electro-magnetic element. Ensayos dielectricos sobre las extremidades del elemento electro-magnetico.	29	300	20	S

(1) S : satisfaisant-satisfactory-satisfactorio. C : conforme-conform-conforme

The electromagnetic unit has successfully withstood the required dielectric tests after the short-circuit test.

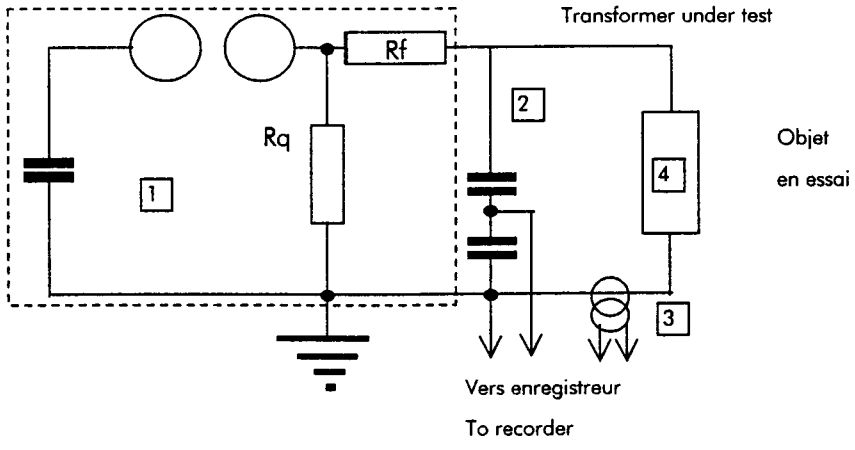
LIGHTNING IMPULSE TEST

The lightning impulse test was performed according to IEC on the complete apparatus n°: XE 91 200-01.
The impulse wave is of the conventional form (approximately 1.2 / 50 µs) according to IEC 60, but a front time of up to 5 µs is acceptable to take into account the high value of the capacitance and the limitations of the testing equipment.
The high voltage is applied between the HV terminal (A), and the HF and N terminals connected to the mass. The LV windings are connected to the mass. The apparatus mass is grounded.
The impulse voltage is measured through a capacitive divider by an impulse voltmeter and recorded.
The current is measured across a wide band current transformer, and recorded.
After calibration impulses at approximately half voltage and 525 kV,

- 15 negative full impulses at 1050 kV, and
- 15 positive full impulses at 1050 kV

have been applied to the apparatus.

TEST DIAGRAM



TEST RESULTS

Examination of the impulse voltage recordings shows that no internal or external flashover has occurred.
The capacitance measurements below taken before and after the test, show that no internal puncture has occurred.

	Tg δ	Capacitance
Measurement before impulse test	0.48 x 10-3	4587 pF
Measurement after impulse test	0.50 x 10-3	4586 pF

Measurements were performed at room temperature of 21 °C ± 2 °C.
The non-significant capacitance change ensures that no puncture has occurred.
The accuracy measurement test taken before and after the test, show that no internal puncture has occurred in the electromagnetic unit (see accuracy results page: 15-16).
The non-significant accuracy measurements change ensures that no puncture has occurred.
See oscillograms in annex: 1, pages: 25 to 41.

The lightning impulse test is satisfactory.

LIGHTNING IMPULSE TEST ON ELECTROMAGNETIC UNIT

The lightning impulse test was performed on the electromagnetic unit n°: XE 91 200-01.
The impulse wave is of the conventional form (approximately 1.2 / 50 μs) according to IEC 60.
The impulse voltage applied is the result of the measured capacitances values C1 and C2 and is calculated as follows:

$$U = 1050 \text{ kV} \times C1 / (C1 + C2)$$

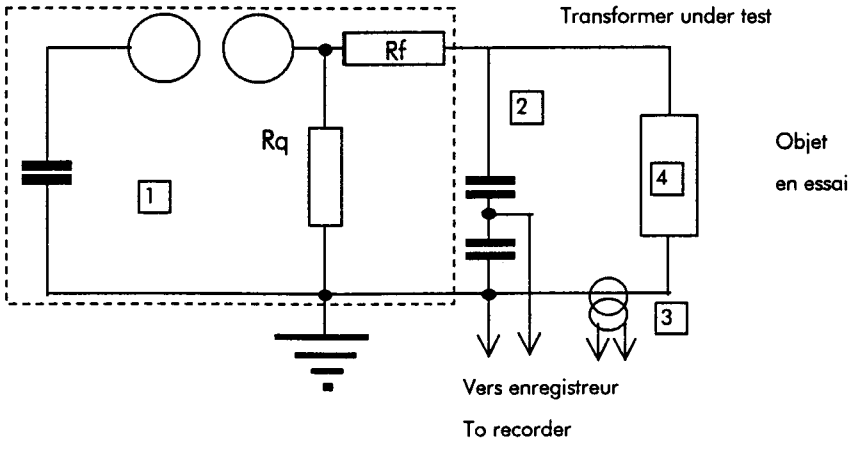
$$U = 1050 \text{ kV} \times 4930 / (4930 + 66510) = 72.4 \text{ kV}$$

The high voltage is applied between the medium voltage transformer terminal, and the HF and N terminals connected to the mass. The LV windings are connected to the mass. The apparatus mass is grounded.
The impulse voltage is measured through a capacitive divider by an impulse voltmeter and recorded.
The current is measured across a wide band current transformer, and recorded.
After calibration impulses at approximately half voltage and 36.2 kV,

- 15 negative full impulses at 72.4 kV, and
- 15 positive full impulses at 72.4 kV

have been applied to the apparatus.

TEST DIAGRAM



TEST RESULTS

Examination of the impulse voltage recordings shows that no internal or external flashover has occurred.
The accuracy measurement test taken before and after the test, show that no internal puncture has occurred (see accuracy results page: 15-16) .

The non-significant accuracy measurements change ensures that no puncture has occurred..
See oscillograms in annex: 1, pages: 42 to 58.

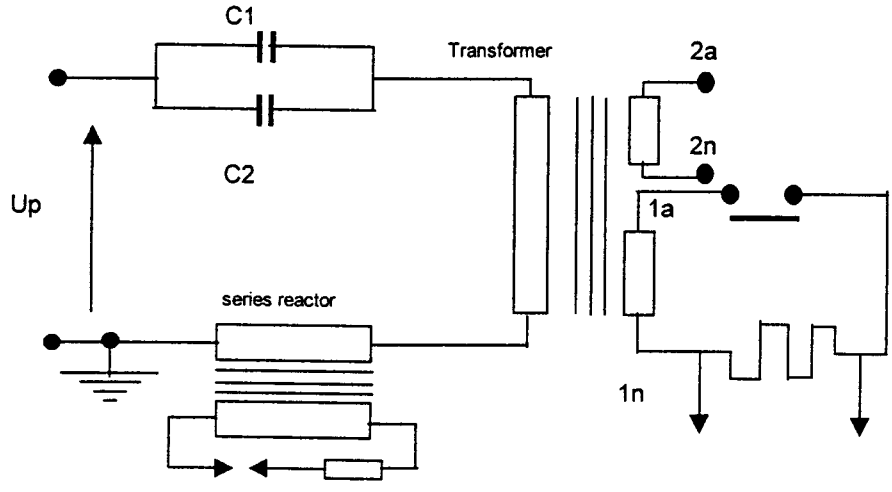
The lightning impulse test is satisfactory.

SHORT-CIRCUIT WITHSTAND CAPABILITY TEST

The capacitor voltage transformer under test is energized from the primary side, connected for the equivalent circuit of THEVENIN. Applied primary voltage Up results from measured capacitance values C1 and C2.
The short-circuit is applied one time between the secondary terminal 1a-1n, and another time on the 2a-2n secondary for a duration of one second.
During the short-circuit, the RMS value of the applied voltage at the transformer terminals shall not be less than the rated voltage. Primary, secondary voltages and secondary current are recorded.

The transformer has passed the test if, after cooling to ambient temperature, it satisfies the following requirements :
a) It is not visibly damaged.
b) Its errors do not differ from those recorded before the tests by more than half the limits of error in its accuracy class.
c) It withstands the dielectric a.c. tests, secondary a.c. test, but with the test voltages reduced to 90% of those given.
d) On examination, the insulation next to the surface of both the primary and the secondary windings does not show significant deterioration (e.g. carbonization).
The examination d) is not required if the current density in the winding does not exceed 160 A/mm² where the winding is of copper of conductivity not less than 97% of the value given in IEC Publication 28.

DIAGRAM:



TESTS VALUES & RESULTS

Test on : 1a – 1n

Rated primary voltage	Vp	220 000/√3	V
Measured capacitance	C1	4 930	pF
Measured capacitance C2	C2	66 510	pF
Rated value for Up = Vp x C1 / (C1 + C2)	Up	8 764	V
Primary voltage measured during the short-circuit:	Up	8 770	V
Measured duration of short-circuit		1.098	s
Measured current on 2a-2n during the short-circuit:		38.8	A (RMS)
Secondary winding conductor section:		6.73	mm²
Current density in secondary winding:		5.76	A/mm²
Calculated primary winding current during short-circuit:		0.038	A (RMS)
Primary winding conductor section:		0.0989	mm²
Current density in primary winding:		0.383	A/mm²
Ambient temperature		21.3	°C
Primary winding resistance at ambient temperature:		1 004	
Secondary winding resistance at ambient temperature:		67.59	m Ω
Primary winding resistance after the short-circuit:		1 006	
Secondary winding resistance after the short-circuit:		67.62	m Ω
Temperature rise on the primary winding:		0.5	°K
Temperature rise on secondary 1a-1n:		0.1	°K

Test on : 2a – 2n

Rated primary voltage	Vp	220 000/√3	V
Measured capacitance	C1	4 930	pF
Measured capacitance C2	C2	66 510	pF
Rated value for Up = Vp x C1 / (C1 + C2)	Up	8 764	V
Primary voltage measured during the short-circuit:	Up	8 770	V
Measured duration of short-circuit		1.12	s
Measured current on 2a-2n during the short-circuit:		38.7	A (RMS)
Secondary winding conductor section:		6.73	mm²
Current density in secondary winding:		5.75	A/mm²
Calculated primary winding current during short-circuit:		0.037	A (RMS)
Primary winding conductor section:		0.0989	mm²
Current density in primary winding:		0.374	A/mm²
Ambient temperature		21.3	°C
Primary winding resistance at ambient temperature:		1 004	
Secondary winding resistance at ambient temperature:		74.19	m Ω
Primary winding resistance after the short-circuit:		1 006	
Secondary winding resistance after the short-circuit:		74.25	m Ω
Temperature rise on the primary winding:		0.5	°K
Temperature rise on secondary 1a-1n:		0.2	°K

CONCLUSIONS

After test, the electromagnetic unit is not visibly damaged.
Accuracy results and dielectric tests have been found to conform.
The examination d) is not required.
See oscillograms in annex 1, pages : 59-60.

The test is satisfactory

TRANSIENT RESPONSE TEST

DESCRIPTION

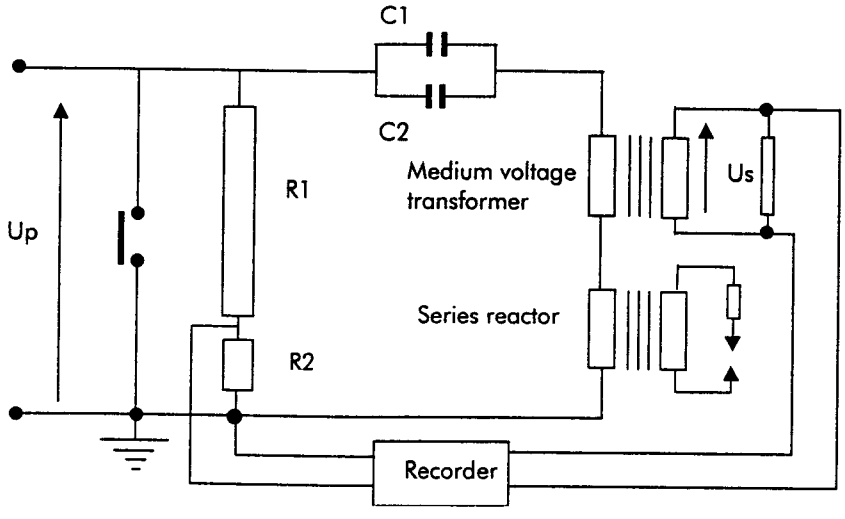
The test is performed according to IEC 186 (1987) clauses 46 & 52.
The transient response test is performed on the capacitor voltage transformer connected for the equivalent circuit of THEVENIN.
Capacitors C1 and C2 of the divider are of the same construction (identical elements contained in 1 or 2 capacitor units).
Their measured capacitance are:

C1= 4 930 pF C2= 66 510 pF

The natural frequency of this divider is higher than 1 MHz (deducted from the high-frequency capacitance and the equivalent series resistance measurements).
Thus, the main condition of IEC 186, Appendix B, allowing tests on the equivalent circuit are fulfilled.
The rated primary voltage for the equivalent circuit Up results from measured capacitance values:

Up= 127 000 x (4 930 / (4 930 +66 510) = 8764 Volt.

DIAGRAM:



A synchronous closer ensures the short-circuiting of the high voltage at the zero passage or at the peak of the primary voltage.
Up is given by a HV resistor divider (R2/R1).
Measurements are performed on secondary 2a-2n for protective purposes. The burdens used are of series type and have a power factor of 0.8. Secondary voltage Us and primary voltage Up are recorded.
The capacitor voltage transformer is operated at rated primary voltage.
The test is performed twice at the zero passage and twice at the peak of the primary voltage at 25%, 100% of rated burden and for total simultaneous burden.

TRANSIENT RESPONSE RESULTS

Burden	18.75 VA	75 VA	75 VA (+ 75 VA)
Error 20ms after the short-circuit at zero passage	5.5 %	6.7 %	8.1 %
Error 20ms after the short-circuit at peak value	≤ 1 %	1.2 %	2.2 %

CONCLUSION

20 ms after the short-circuit, the secondary output voltage must be less than 10% of the peak value before the short-circuit.
The transient response test results are **conform** to IEC requirement:

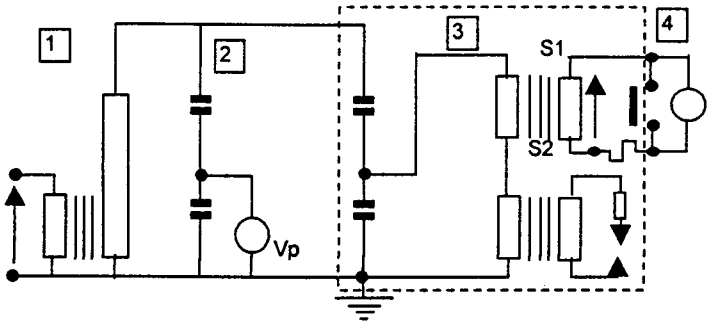
See recordings in annex 1, pages : 61 to 71.

FERRO-RESONANCE TEST

TEST CONDITIONS

The ferro-resonance test is carried out on a complete capacitor voltage transformer by short-circuiting the secondary terminals for at least 100 ms by means of a contactor.
The power source voltage Up is recorded through a high voltage capacitive divider. During the short-circuit, the voltage of the power source does not differ by more than 10 % from the voltage before the short-circuit and remains substantially sinusoidal.
The secondary voltage Vs is recorded with a high impedance equipment which represents a burden not exceeding 5 VA.

The short-circuit current is recorded through a shunt located in series in the short-circuit loop. The impedance of the short-circuit loop is sufficiently low so that the voltage drop over it, measured directly at the secondary terminals, is less than 10 % of the voltage before the short-circuit.



1-	Elévateur de tension	Step-up transformer
2-	Diviseur capacitif	Capacitor divider
3-	Transformateur condensateur de tension en essai	CVT under test
4-	Ensemble electromagnétique	Electromagnetic unit
5-	Contacteur	Contactor

TEST RESULTS

The test was performed 10 times at 80 %, and 30 times at 120 % of the rated primary voltage. 200 ms after the short-circuit is suddenly removed, the peak of the secondary voltage does not differ from its normal value by more than 10 %.

The test was repeated 10 times at 150 % of the rated primary voltage. After the short-circuit is suddenly removed, ferro-resonance does not sustain for more than 2 s.

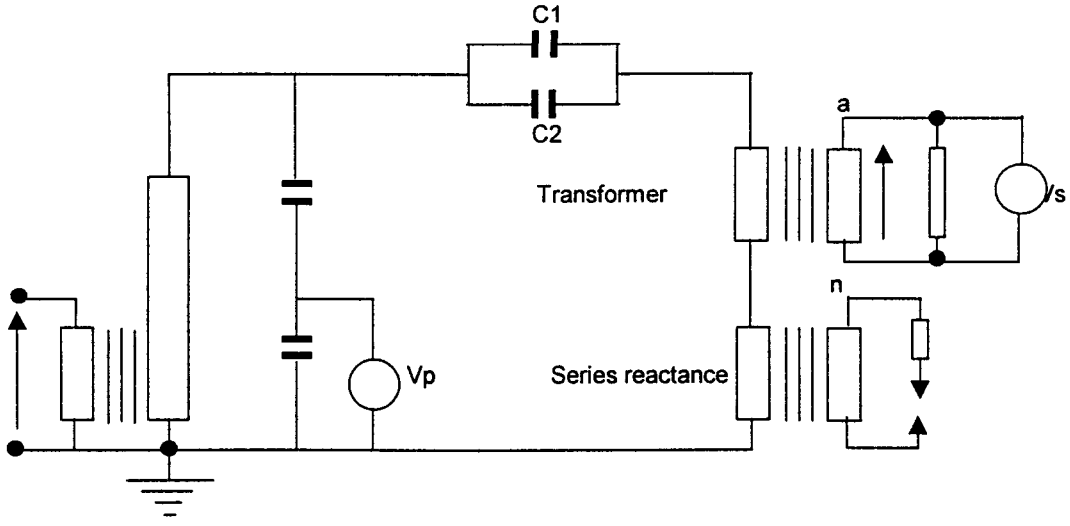
See recordings in annex1, pages: 72 to 89.

Ferro-resonance test is satisfactory.

TEMPERATURE RISE TEST

Apparatus under test n° : XE 91 200-01
The temperature rise test is performed on the electromagnetic unit of the capacitor voltage transformer, connected for the equivalent circuit of THEVENIN.
The rated primary voltage for the equivalent circuit results from measured values of capacitances C1 and C2.
C1 = 4 930 pF
C2 = 66 510 pF
Up = 220 000 /√3 x C1 / (C1+ C2) = 8 764 V

Diagram:



The temperature rises of reactor, primary and secondary transformer windings are measured by the increase in resistance method. The oil temperature rise is measured by thermocouples.
The winding temperature rise is calculated by the following formula which includes ambient temperature variation:

$$\Delta T = (Tf - Tai) = (Rf - Ri) \times (234.5 + Tai)/ (Ri + (Tai - Taf)$$

The parameters are:

Tai - initial ambient temperature
Taf – final ambient temperature
Tf – final winding temperature
Rai – initial resistance of the winding
Rf – final resistance of the winding

TEMPERATURE RISE TEST

TEST SEQUENCE

1. Measurements of resistances at ambient temperature.

2. Test at a voltage factor of 1.5 Un for 30 s with an accuracy burden, starting with cold conditions.
   Both secondaries are simultaneously loaded with their respective accuracy burden of 75 VA and 75 VA.

3. Test at a voltage factor of 1.2 Un with their respective accuracy burden, up to stable thermal conditions.
4. Test at Un with the thermal burden of 500 VA, applied to the 2a-2n secondary; this test is made continuously to the 1.2 Un test during 8 hours.

Note: Burdens are constituted of pure resistances adjusted at 44.4 Ω for 75 VA, and 8.66 Ω for the 500 VA.

RESULTS

	1 Initial values	2 1.5 Un 2 x 75VA 30s	3 1.2 Un 2 x 75VA 23 h 15 mn	4 Un 500 VA 8h	
Resistance of transformer secondary winding 1a-1n	67.59	65.79	71.38	71.85	mΩ
Resistance of transformer secondary winding 2a-2n	74.19	74.23	80.00	80.52	mΩ
Resistance of transformer primary winding	1005	1018	1105	1110	Ω
Resistance of reactor winding	407.4	407.4	426.5	425.8	Ω
Ambient temperature	21.3	21.3	19.3	20.4	°C
Oil temperature	21.3	21.3	30.6	29.5	°C
Temperature rise for secondary winding 1a-1n		0.7	16.3	17	°K
Temperature rise for secondary winding 2a-2n		0	22.5	23.2	°K
Temperature rise for primary winding		4.3	30.5	30.6	°K
Temperature rise for reactor winding		0	14	12.5	°K
Winding temperature rise limit		10	65	65	°K
Oil temperature rise		0	11.3	9.1	°K
Oil temperature rise limit		10	55	55	°K

Note: According to the cooling curves, corrections for measurement delay time have been made when necessary.

Temperature rises are lower than the allowed limits.

See curves in annex 1, pages : 90-91.

The temperature rise test is satisfactory.

MEASUREMENT OF THE TRANSMISSION FACTOR OF HIGH FREQUENCY OVERVOLTAGE

Test conditions :

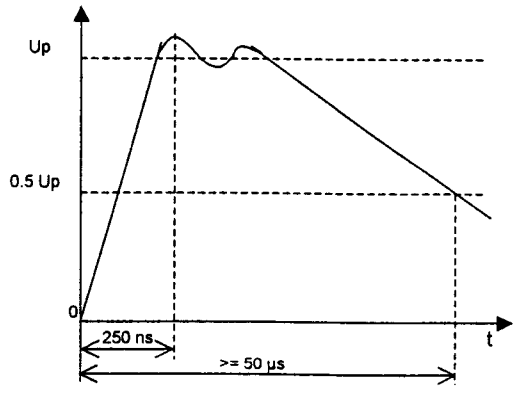
Low voltage impulses (U1) shall be applied between one of the primary terminals connected together and earth.
The terminals of the secondary windings intented to be earthed shall be connected to the frame and to earth.
The transmitted voltage (U2), shall be measured at the burden terminals using a high impedance device of bandwidth equal or higher than 100 MHz(ex : oscilloscope probe) which reads the peak value.
The overvoltages transmitted to the secondary winding (Us) when the specified overvoltages (Up) is applied to the primary winding shall be calculated as follows :

$$Us = (U2 / U1) \times Up$$

With : $Up = (1.6 \times \sqrt{2}\ Um) / \sqrt{3} = (1.6 \times \sqrt{2} \times 245000) / \sqrt{3} = 320$ kV
And $Us \leq 1.6$ kV
The wave shape caracteristics for capacitor voltage transformer for air-insulated substation are :

- Front time (T1) : 0.25 μs ± 20 %
- Time to half value (T2) : ≥ 50 μs
- In case of oscillations on he crest, a mean curve should be drawn, and the maximum amplitude of this curve is considered as the peak value U1 for the calculation of the transmitted voltage.

Diagram :



Wave shape

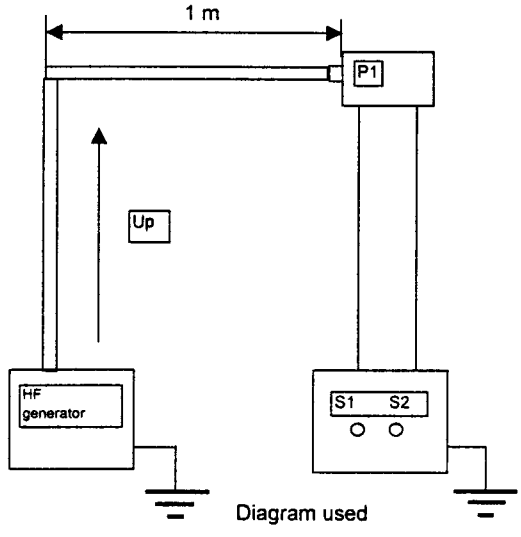


Diagram used

Result measurements :

Up primary voltage applied	Us on 1a –1n	Us on 2a –2n
300 V	0.556 V	0.632 V
Secondary HF transmitted overvoltage calculated for rated value.	**1 112 V**	**1 264 V**

Us shall be less than 1.6 kV, so the test results are satisfactory.

See oscillograms in annex 1, pages : 92-93.

ACCURACY TEST RESULTS

Initial measurements on apparatus n° : XE 91 200-01

Appareil N° : **Serial N° :** **Aparato N° :**	**Couplage et circuit** **Coupling and circuits** **Acoplamiento y Arrollamiento**	**Charge en VA et cos φ : 0.8** **Burden in VA and Power factor** **Carga en VA Y cos φ : 0.8**		**Nombre de Un** **Times rated Primary** **Fracción de Un**	**Erreur de rapport en %** **Ratio error in %** **Error de relación en %**	**Déphasage en Minutes** **Phase error in minutes** **Desfasaje en Minutos**	**Observations** **Notes** **Oservaciones**
XE 91 200-01	1a-1n	75 VA	75*	1.2	-0.19	+2	
				1	-0.19	+2.5	
				0.8	-0.19	+3	
		75 VA	0*	1.2	+0.02	+2	
				1	+0.03	+2	
				0.8	+0.03	+2.5	
		18. 75 VA	0*	1.2	+0.31	+0.5	
				1	+0.32	+0.5	
				0.8	+.32	+0.5	
	2a-2n	75	75*	1.5	-0.23	+5	
				1.2	-0.17	+4.5	
				1	-0.16	+5	
				0.8	-0.16	+5	
				0.02	-0.10	+8.5	
		75 VA	0*	1.5	-0.03	+6.5	
				1.2	+0.05	+4	
				1	+0.05	+4	
				0.8	+0.05	+4.5	
				0.02	+0.11	+7.5	
		18. 75 VA	0*	1.5	+0.24	+5	
				1.2	+0.32	+1	
				1	+0.33	+1	
				0.8	+0.33	+1	
				0.02	+0.34	+3	

- Simultaneous burden on the other secondary winding

ACCURACY TEST RESULTS

Measurements after lighning impulse test on apparatus n° : XE 91 200-01

Appareil N° : **Serial N° :** **Aparato N° :**	**Couplage et circuit** **Coupling and circuits** **Acoplamiento y Arrollamiento**	**Charge en VA et cos φ : 0.8** **Burden in VA and Power factor** **Carga en VA Y cos φ : 0.8**		**Nombre de Un** **Times rated Primary** **Fracción de Un**	**Erreur de rapport en %** **Ratio error in %** **Error de relación en %**	**Déphasage en Minutes** **Phase error in minutes** **Desfasaje en Minutos**	**Observations** **Notes** **Oservaciones**
XE 91 200-01	1a-1n	75 VA	75*	1.2 1 0.8	-0.19 -0.19 -0.19	+1.5 +2 +2.5	
		75 VA	0*	1.2 1 0.8	+0.02 +0.03 +0.03	+1.5 +1.5 +2	
		18. 75 VA	0*	1.2 1 0.8	+0.31 +0.31 +0.32	0 0 +0.5	
	2a-2n	75	75*	1.5 1 0.02	-0.19 -0.14 +0.08	+4.5 +4 +7.5	
		75 VA	0*	1.5 1 0.02	-0.03 +0.05 +0.08	+4.5 +4 +5.5	
		18. 75	0*	1.5 1 0.02	+0.27 +0.33 +0.32	+4 +0.5 +1.5	

- Simultaneous burden on the other secondary winding

Measurements after short-circuit test.

Appareil N° : **Serial N° :** **Aparato N° :**	**Couplage et circuit** **Coupling and circuits** **Acoplamiento y Arrollamiento**	**Charge en VA et cos φ : 0.8** **Burden in VA and Power factor** **Carga en VA Y cos φ : 0.8**		**Nombre de Un** **Times rated Primary** **Fracción de Un**	**Erreur de rapport en %** **Ratio error in %** **Error de relación en %**	**Déphasage en Minutes** **Phase error in minutes** **Desfasaje en Minutos**	**Observations** **Notes** **Oservaciones**
XE 91 200-01	1a-1n	75 VA	75*	1.2 1 0.8	-0.20 -0.20 -0.19	+1 +1.5 +2	
		75 VA	0*	1.2 1 0.8	+0.01 +0.02 +0.02	+1 +1.5 +2	
		18. 75 VA	0*	1.2 1 0.8	+0.28 +0.28 +0.29	+0.5 +0.5 +0.5	
	2a-2n	75	75*	1.5 1 0.02	-0.25 -0.17 -0.09	+4 +3.5 +8	
		75 VA	0*	1.5 1 0.02	-0.04 +0.04 +0.11	+4 +3.5 +6.5	
		18. 75	0*	1.5 1 0.02	+0.17 +0.33 +0.33	+1 +1 +2.5	

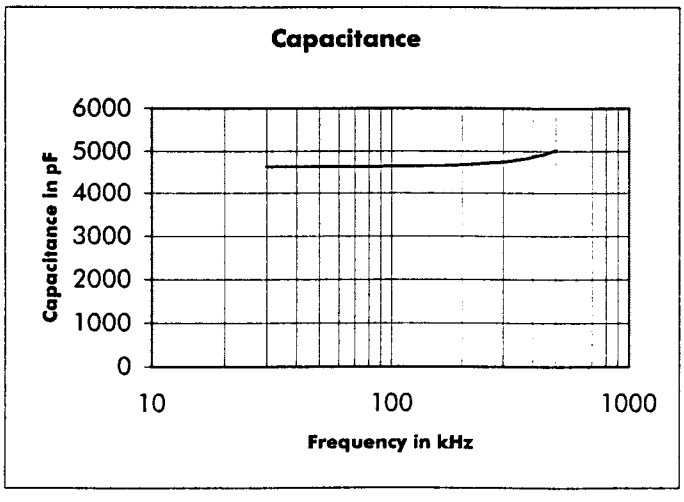
Accuracy test is satisfactory.

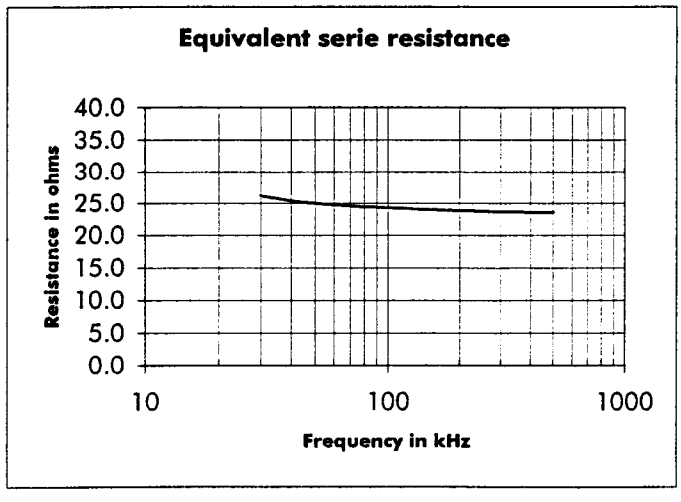
HIGH FREQUENCY CAPACITANCE AND EQUIVALENT SERIES RESISTANCE

Apparatus in test n° : XE 91 200 - 01
Measurements are taken on a complete apparatus. The measured values of the capacitance between the line and low-voltage terminals shall not deviate by more than – 20% to + 50% from the rated capacitance. The measured values of the equivalent series resistance between the same terminals shall not exceed 40 Ω at any frequency.
These measurements have to be made on the carrier frequency range 30 kHz to 500 kHz.

F kHz	Cs pF	R Ω	ΔC / C %
30	4651	26.1	0
40	4653	25.3	0
50	4653	25.0	0
60	4653	24.7	0
80	4653	24.4	0.1
100	4659	24.2	0.2
150	4673	24.0	0.5
200	4697	23.8	1.0
250	4728	23.7	1.7
300	4768	23.6	2.5
333	4801	23.6	3.2
400	4877	23.5	4.9
480	4992	23.5	7.3
500	5025	23.5	8.0

The test is satisfactory





Resonance frequency

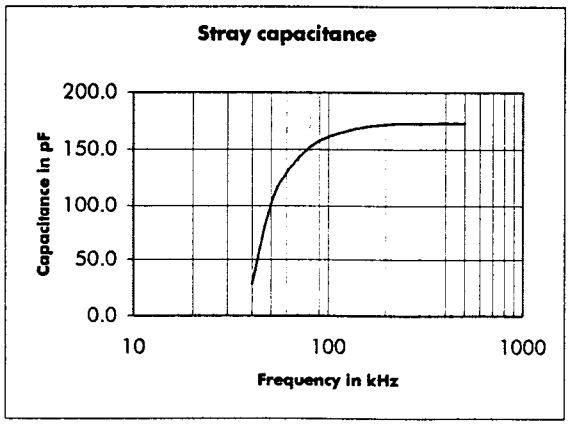
Resonance frequency is calculated from these measurements and is at least 1.85 MHz.

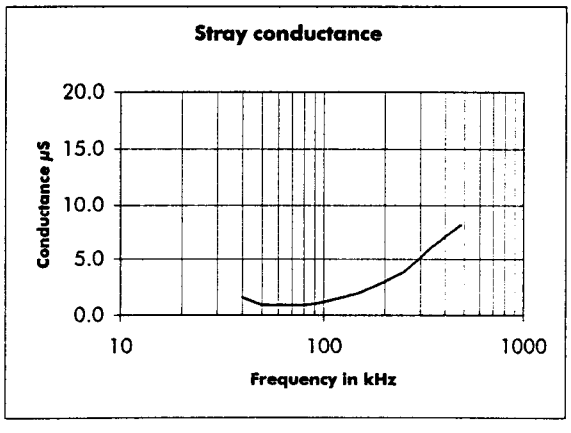
STRAY CAPACITANCE AND STRAY CONDUCTANCE OF THE LOW VOLTAGE TERMINAL

Measurements are taken on a complete apparatus .The values of the stray capacitance and the stray conductance, measured at any frequency in the carrier frequency range, shall not exceed 200 pF and 20 µS respectively.
These measurements have to be made on the carrier frequency range 30 kHz to 500 kHz.

F kHz	Cp pF	G µS
30	----------	---------
40	28.2	1.6
50	100.8	0.9
60	129.1	0.9
80	152.1	0.9
100	161.4	1.2
150	169.5	2.0
200	172.2	3.0
250	173.1	3.9
300	173.0	5.1
333	173.1	5.9
400	173.3	7.0
480	173.0	8.1
500	173.3	12.3

The test is satisfactory





DETERMINATION OF THE TEMPERATURE COEFFICIENT

Test is made according with IEC 358, and done on model capacitor available with the climatic encloser .
The model is composed with 18 elements having the same clamping construction as the capacitor under consideration.
The the applied voltage to capacitance and loss angle tangent measurement is of 16 kV and 50 Hz frequency.
It represents % of the rated voltage of the apparatus.
Temperature measurements are :

-40 , -25, -10, +5, +20, +35, +50, +65 °C

and after thermal stablisation .

The voltage is applied to the capacitor only for the period time necessary for taking the measurements.

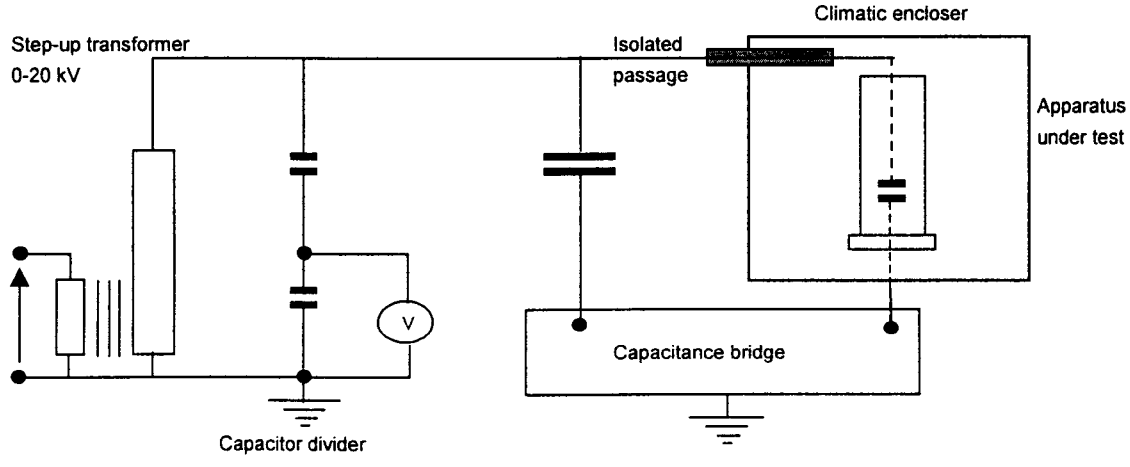
TEMPERATURE COEFFICIENT CALCULATION

The temperature coefficient is calculated for each temperature interval Δt, according with the IEC 358 § 3.28 definition.

$$Kc = (1/ Co) x (\Delta C / \Delta t) \qquad \text{where : } \Delta t = T2 - T1 \quad \text{et } \Delta C = C2 - C1$$

- T2 : final temperature of the interval
- T1 : initial temperature of the interval
- C2 : measured capacitance at T2
- C1 : measured capacitance at T1
- Co : measured capacitance at 20 °C

DIAGRAM USED

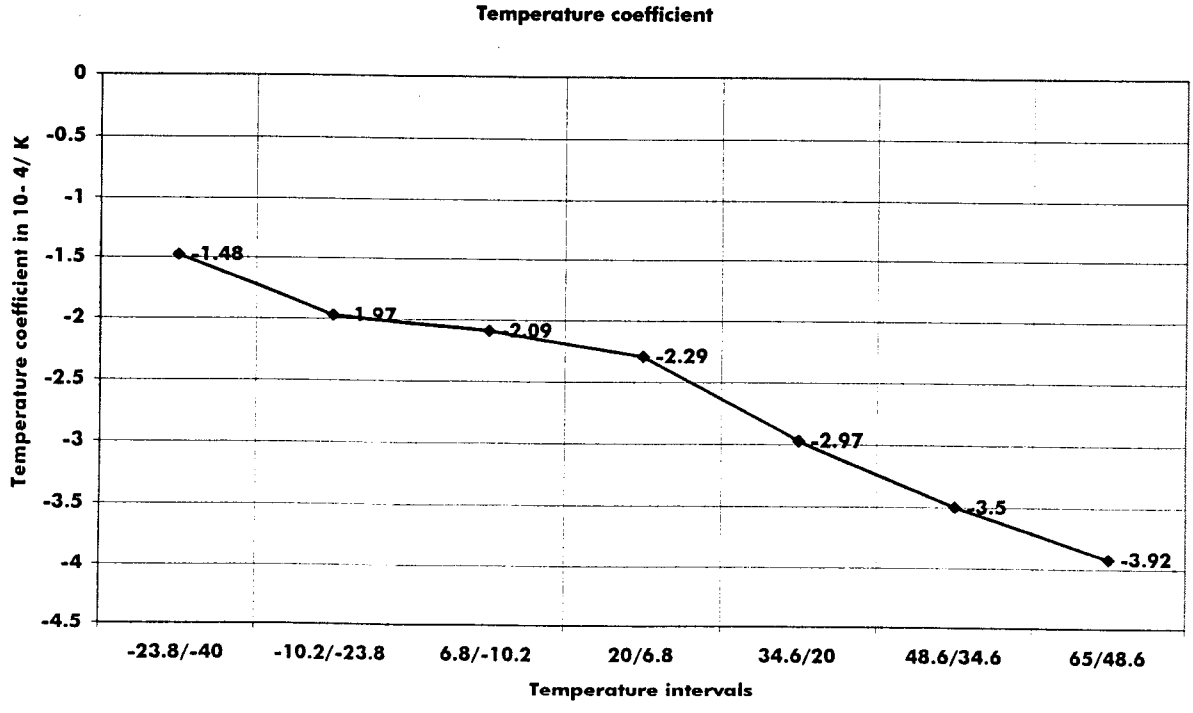


RESULTS

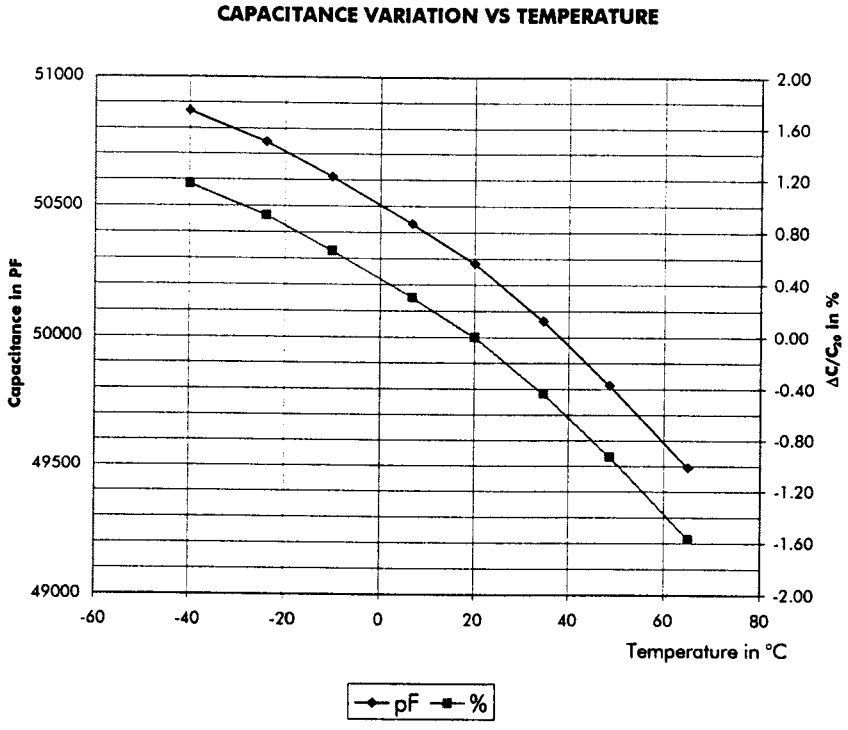
U applied	10 000 V		16 000 V		
Temperature °C	Capacitance pF	Tangent δ 10-3	Capacitance (pF) pF	Tangent δ 10-3	Kc 10-4 / °C
-40	50864	1.86	50868	1.863	
-23.8	50740	1.245	50747	1.243	-1.485
-10.2	50605	0.949	50612	0.946	-1.970
6.8	50424	0.777	50433	0.770	-2.090
20	50274	0.707	50281	0.707	-2.290
34.6	50054	0.674	50063	0.652	-2.970
48.6	49804	0.693	49816	0.637	-3.500
65	49480	0.774	49493	0.715	-3.920

The temperature coefficient derived from the measurements shall not exeed kc ≤ 0.001per degree Celsius.
Test is conform .

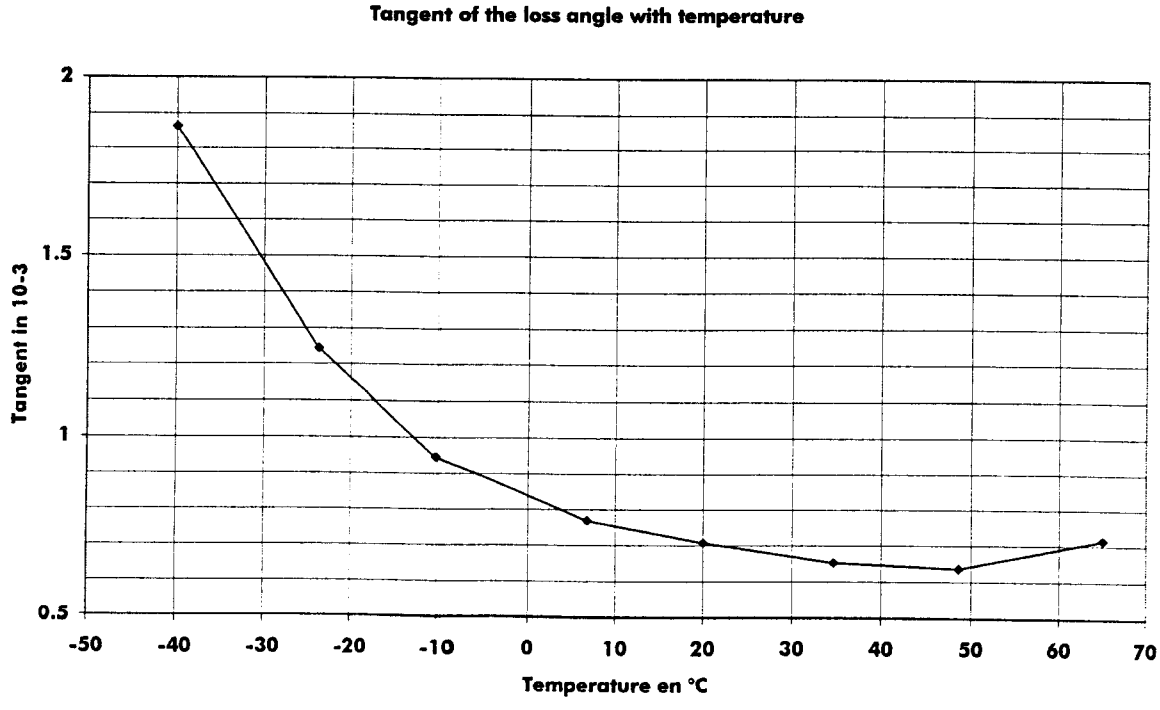
Capacitance temperature coefficient kc variations (mesured at 16 kV (C20 = 50 281)



Capacitance variations according with temperature

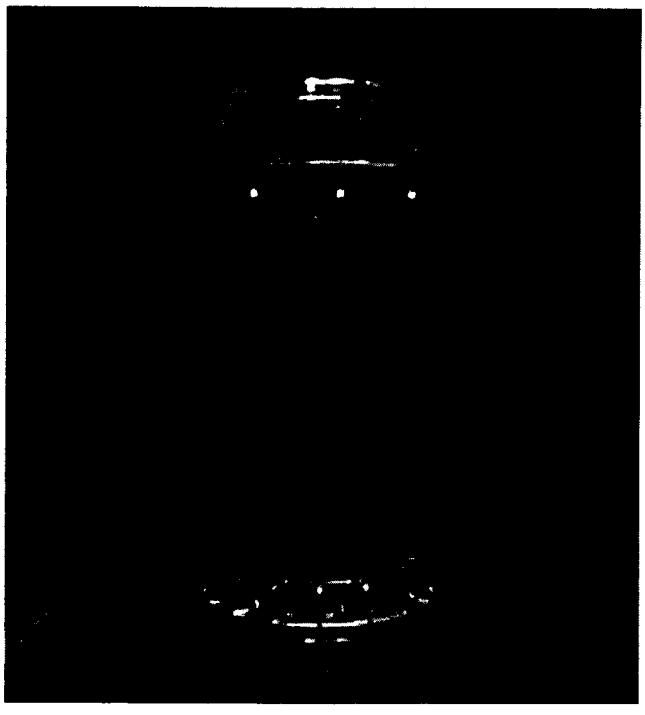


Loss angle variation according with temperature



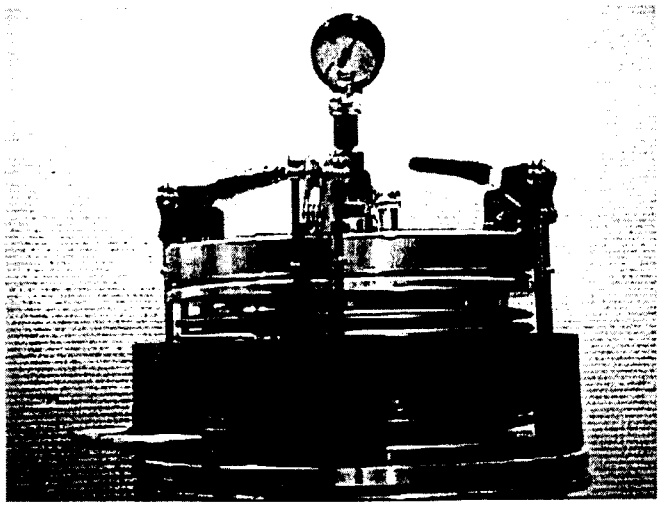
COEFFICIENT TEMPERATURE DETERMINATION

Model used to make the test :



TIGTHNESS OF CAPACITOR VOLTAGE DIVIDER

The test is made on the capacitor voltage divider before mounting on electromagnetic unit .
Pressure applied of 1 ± 0.1 bar above the the operating pressure, is maintained during 8 hours inside the capacitor voltage divider .
After this time there is no evident leakage on the electromagnetic unit so the test is satisfactory.



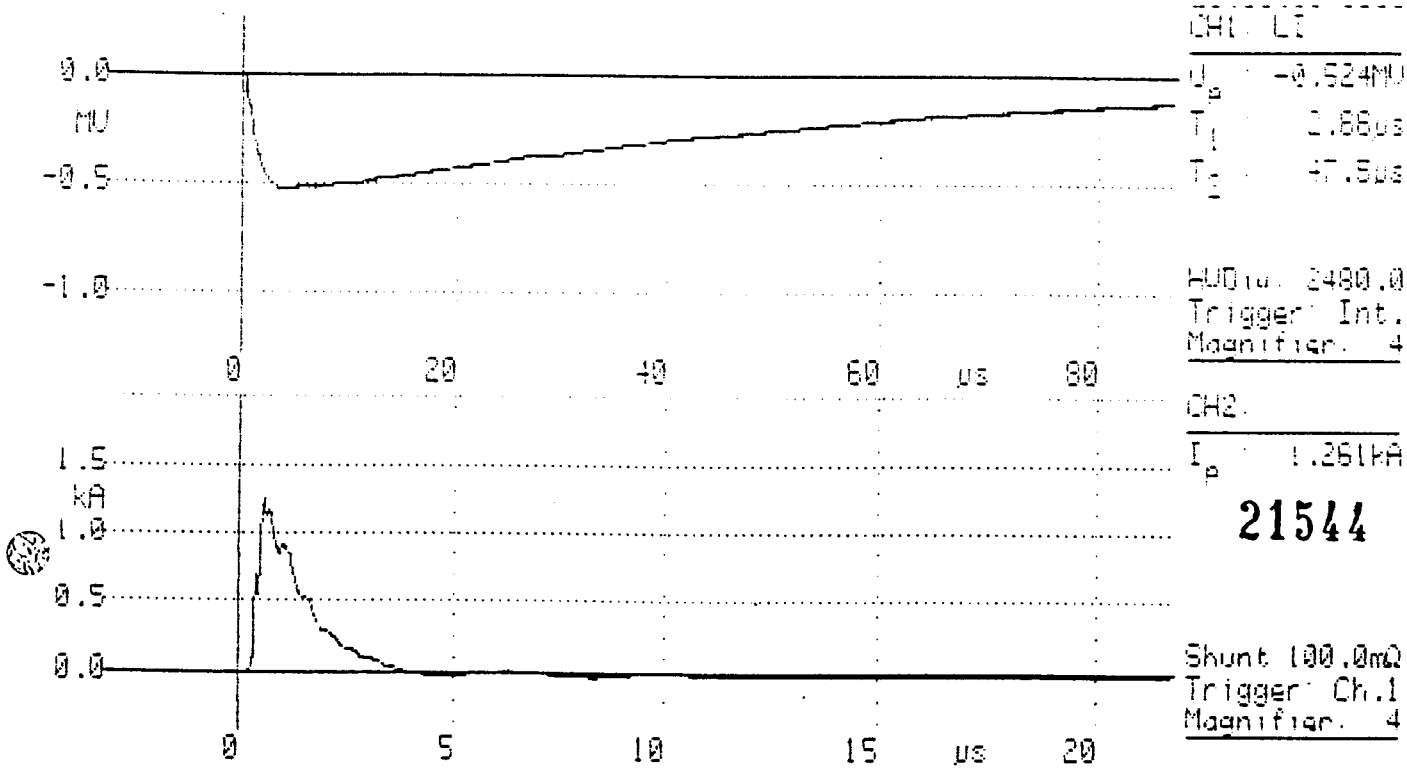
Annex 1

ALSTOM

ALSTOM T&D Transformateurs de Mesure SA
au capital de 14 000 000 F
Siège social : 51, avenue Jean Jaurès
BP 380 92541 Montrouge Cedex France
343 074 092 RCS Nanterre
APE 311 A - TVA FR 05 343 074 092

CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

LIGHTNING IMPULSE TEST - CCV 245 N° : XE 91200 -01



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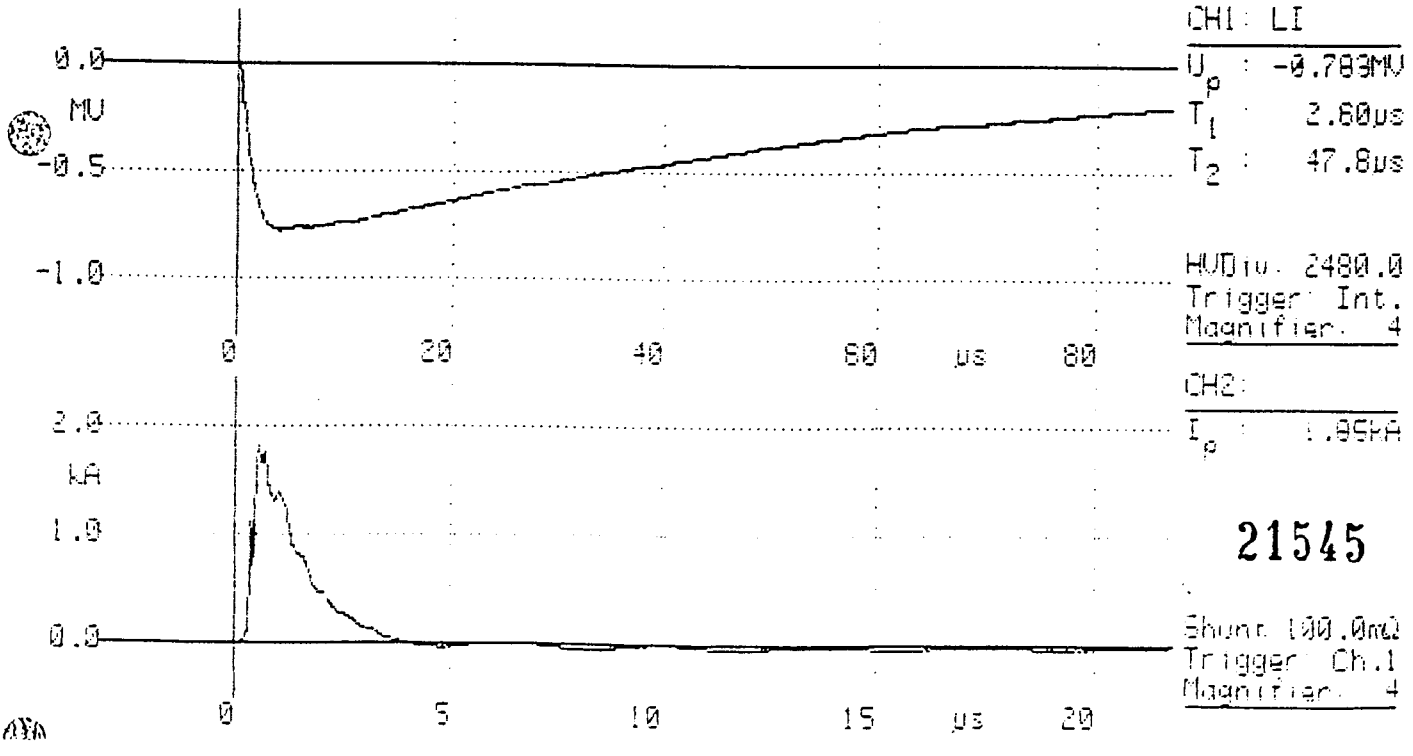

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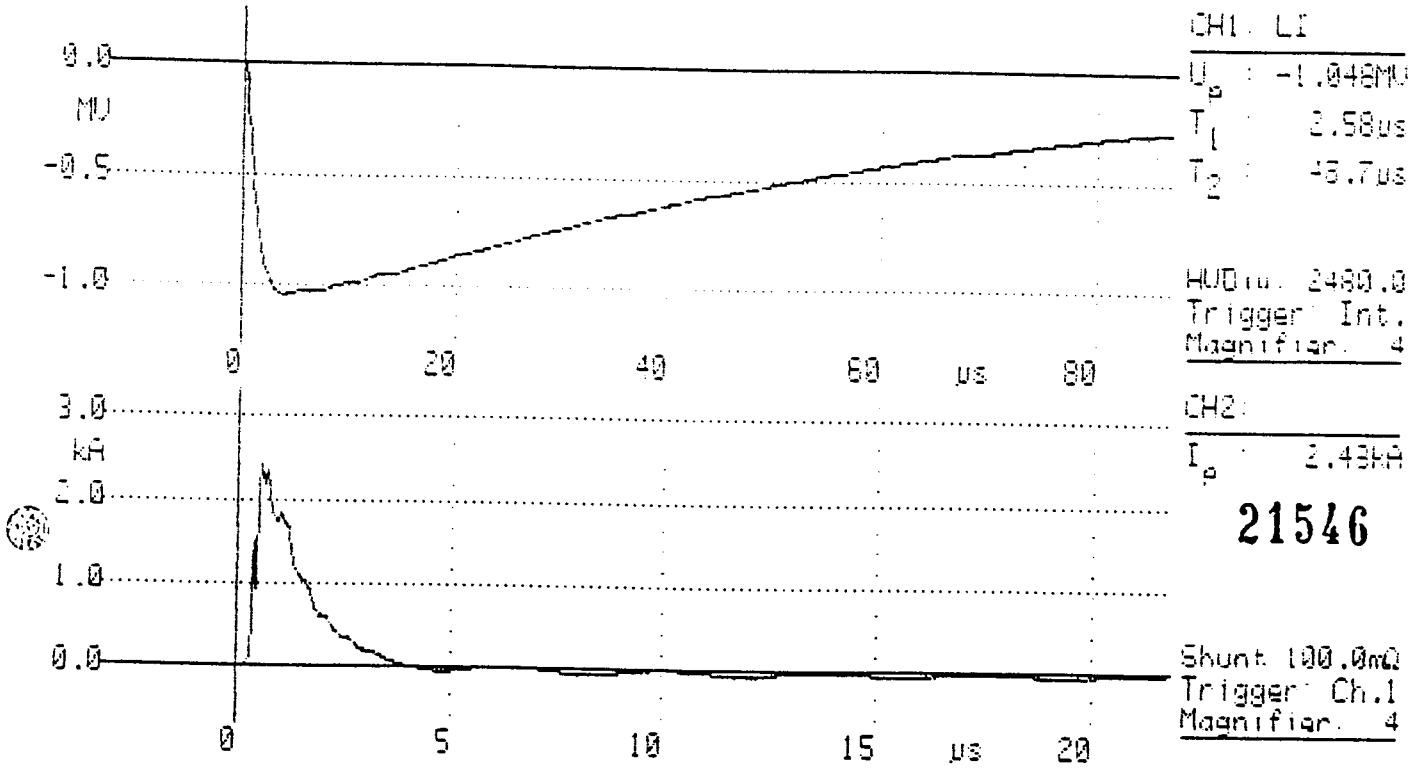
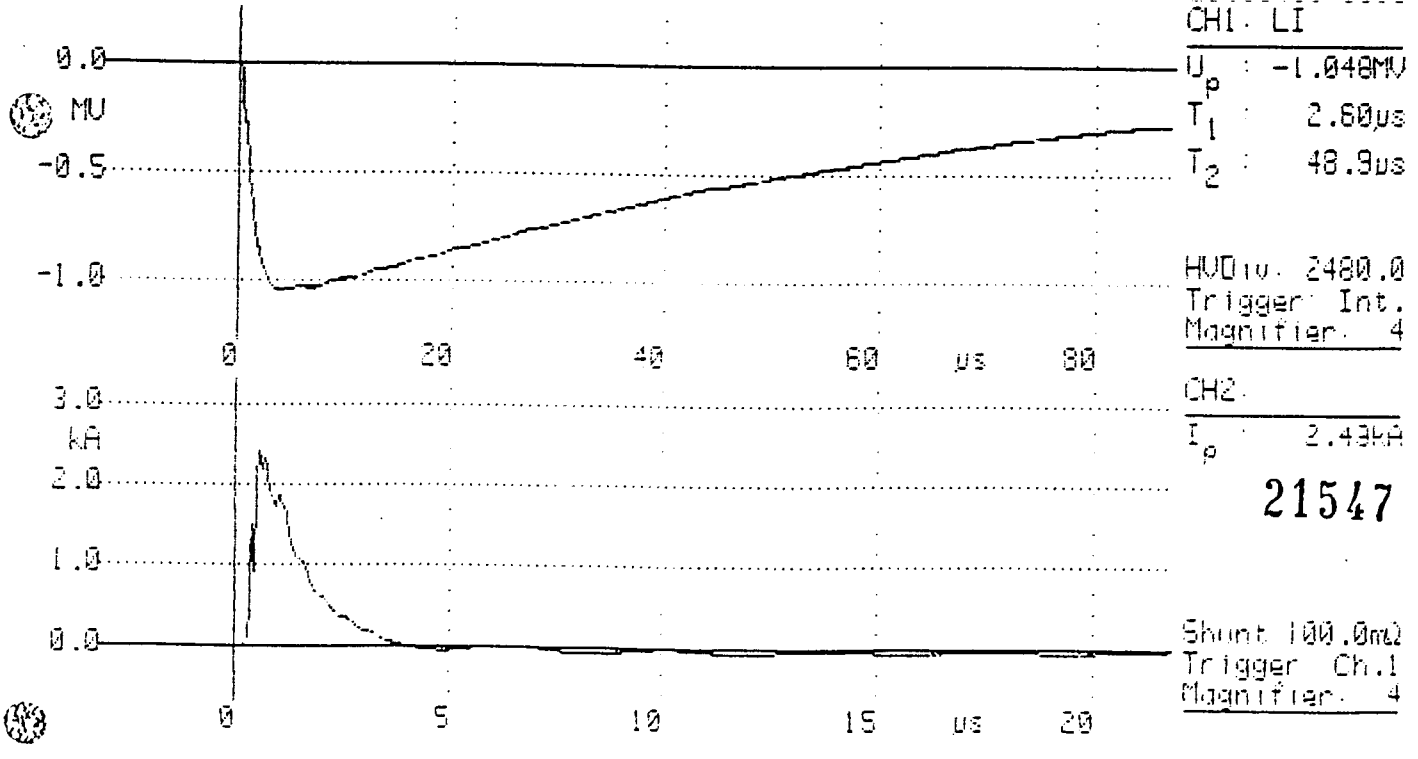
LIGHTNING IMPULSE TEST - CCV 245 N° : XE 91200 -01





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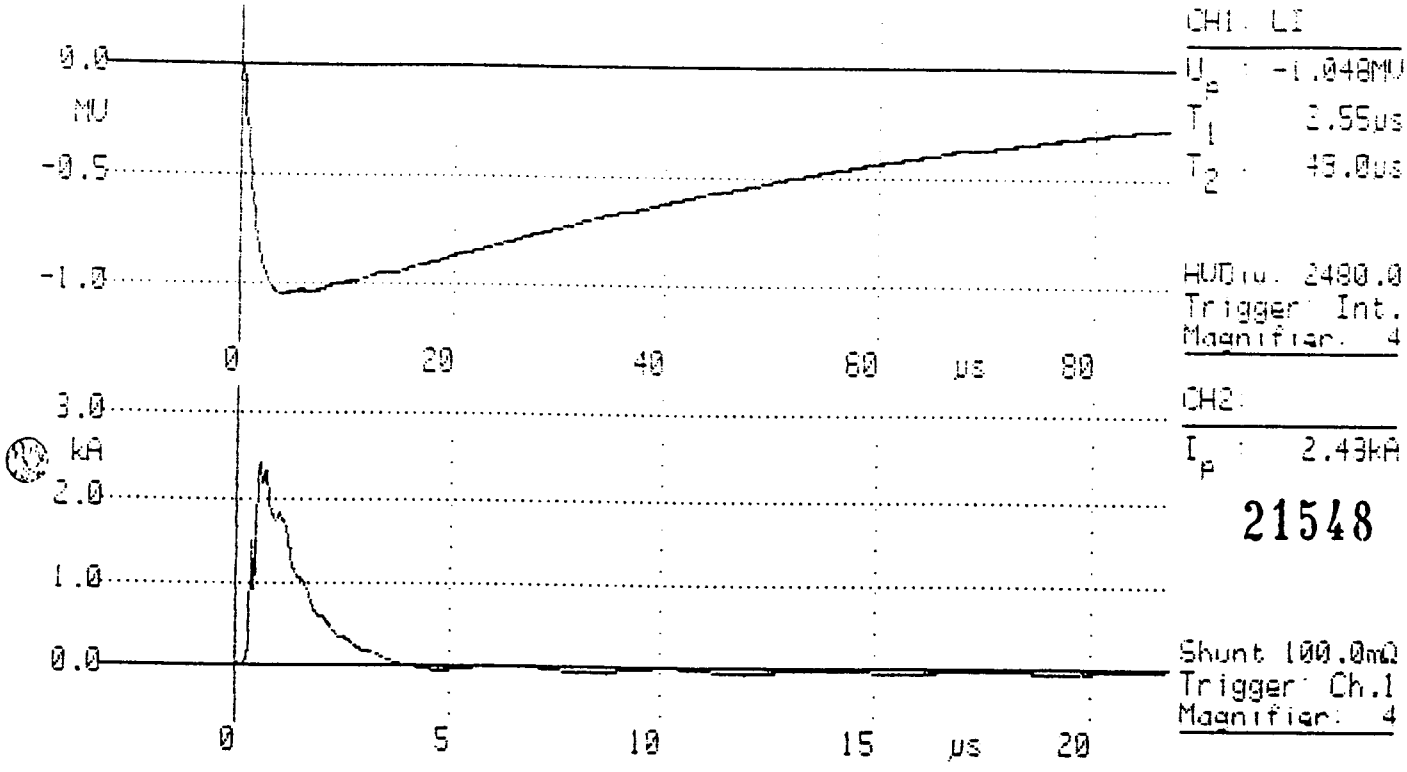

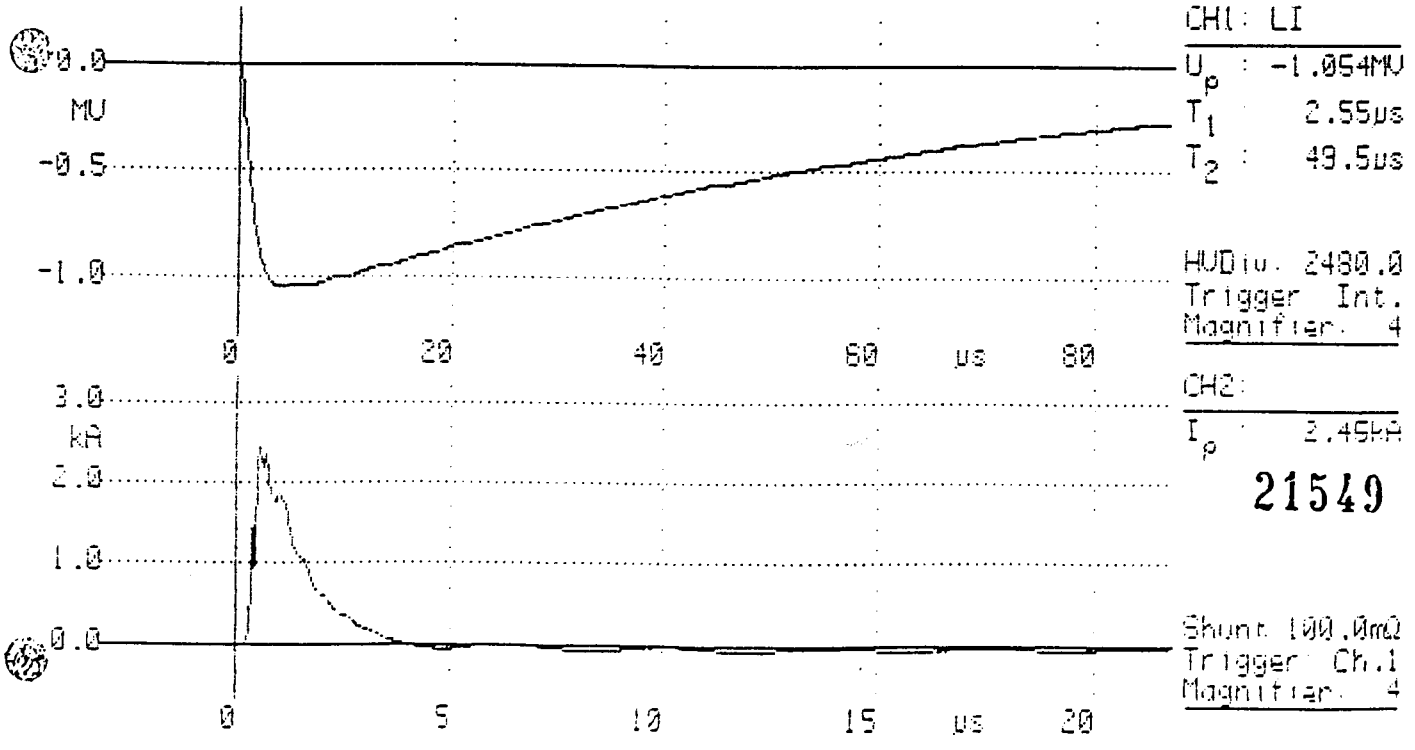

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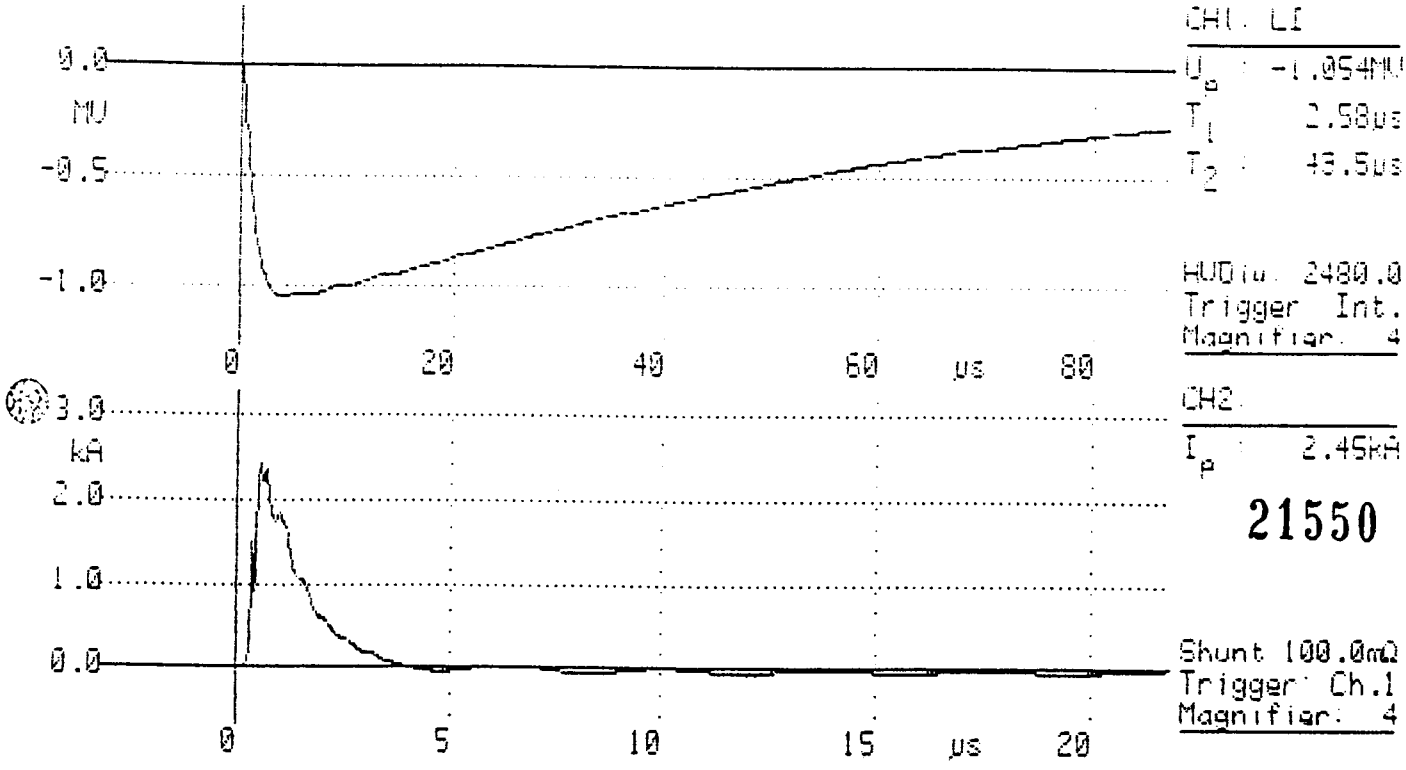

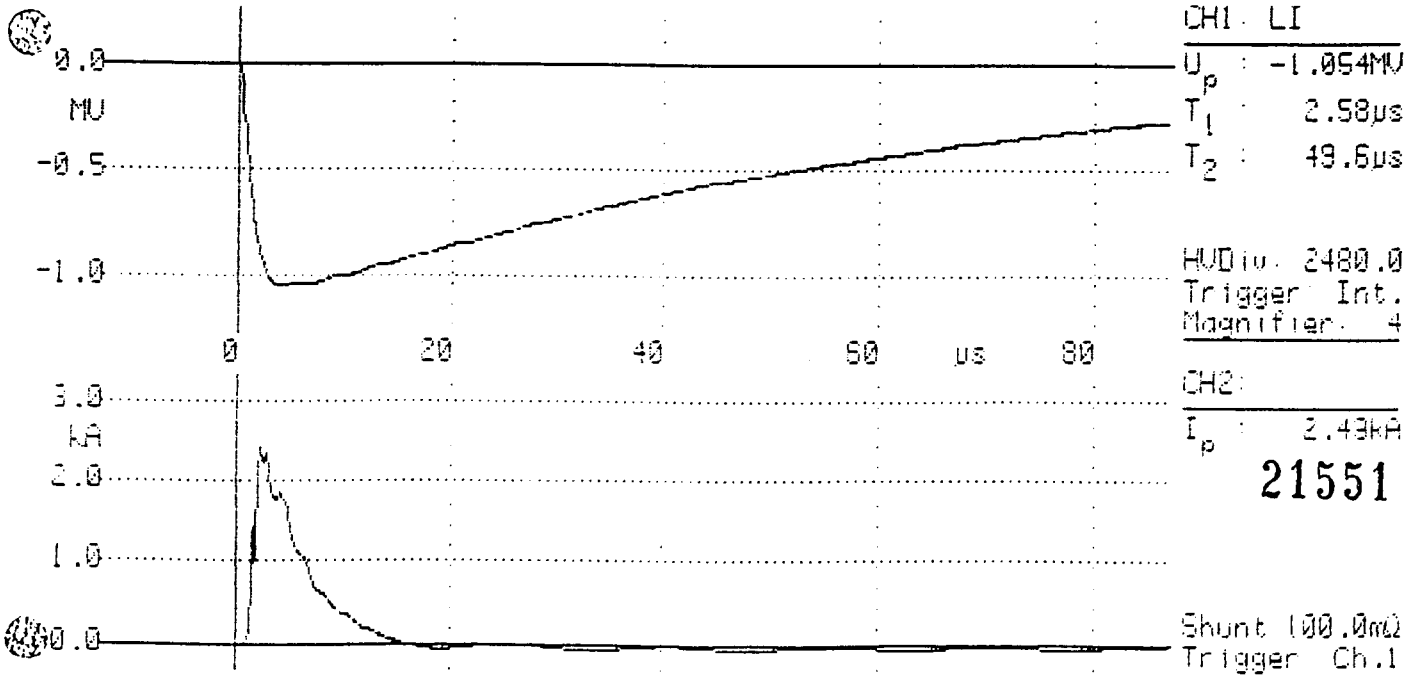

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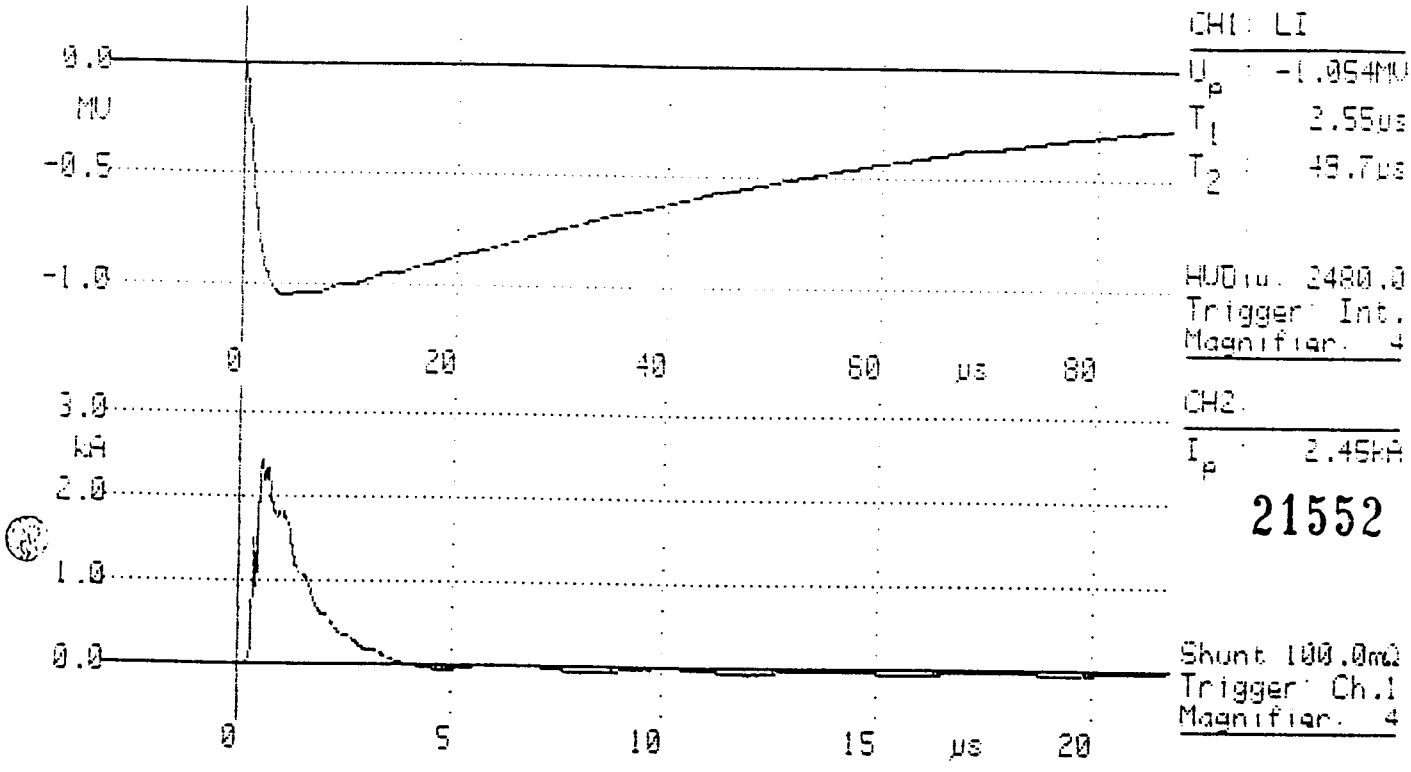

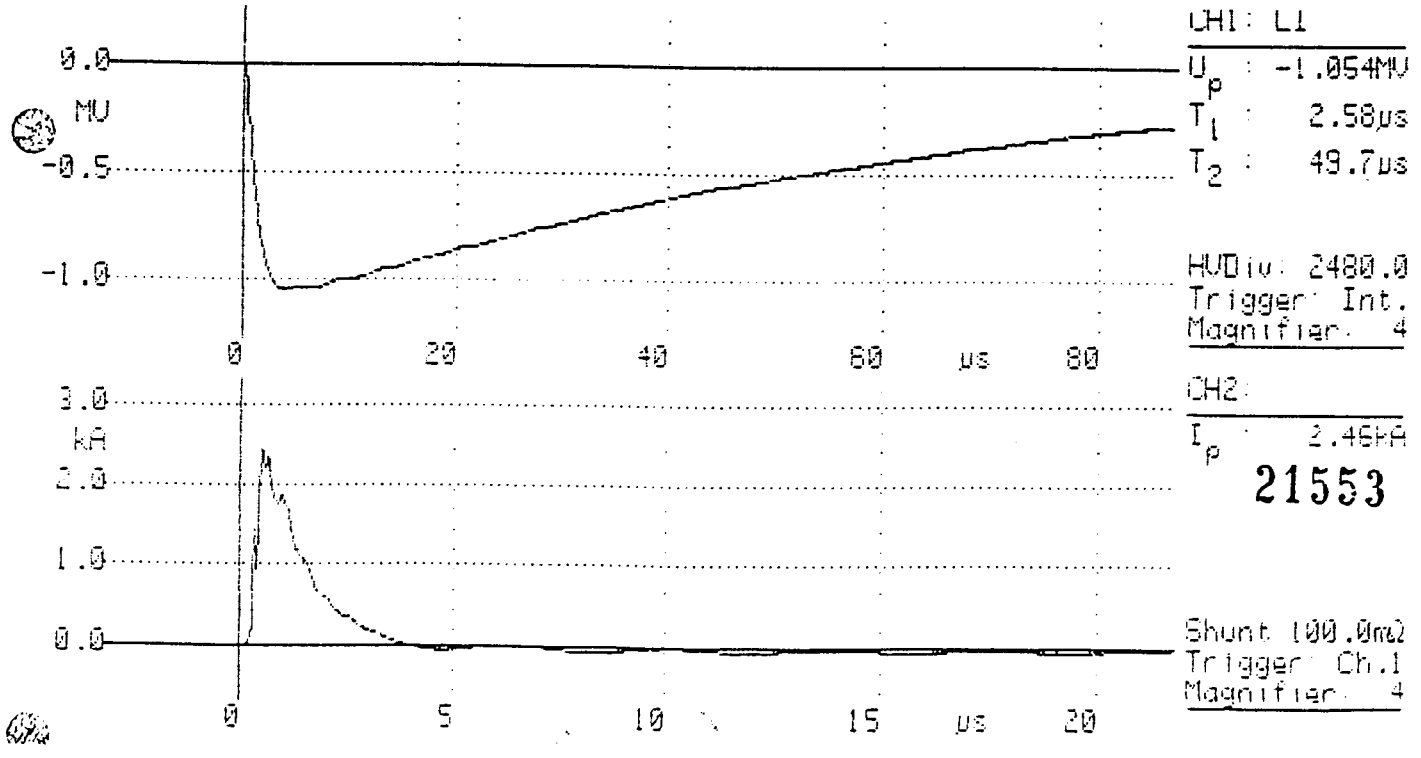

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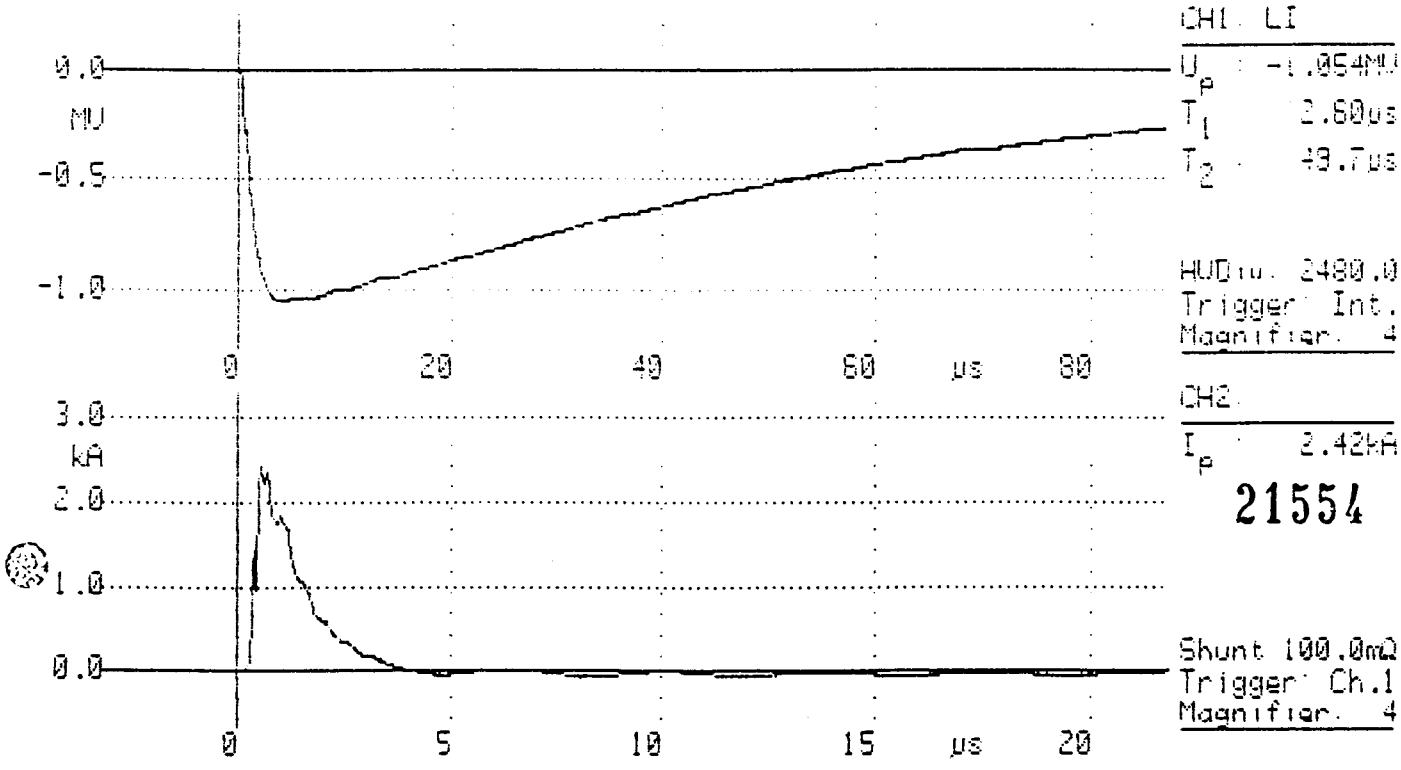

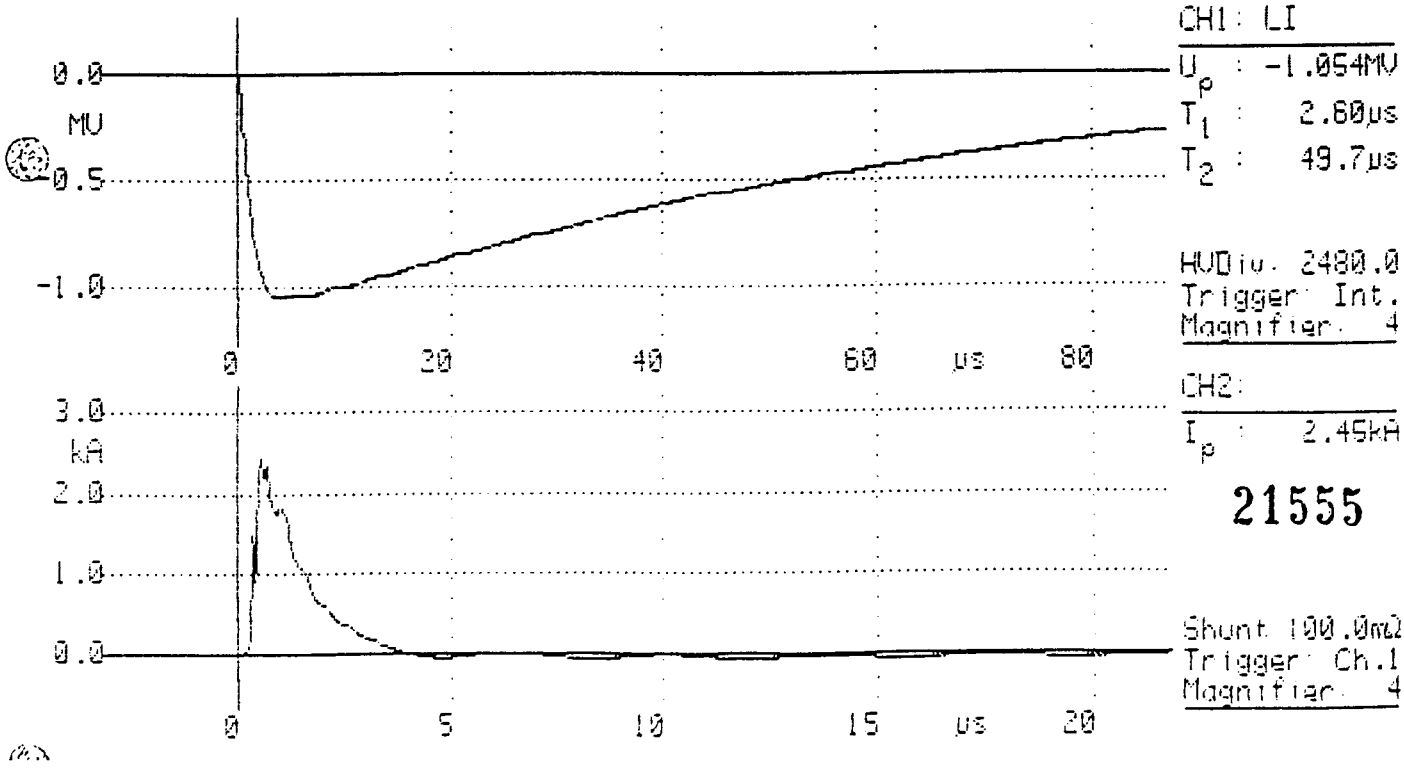

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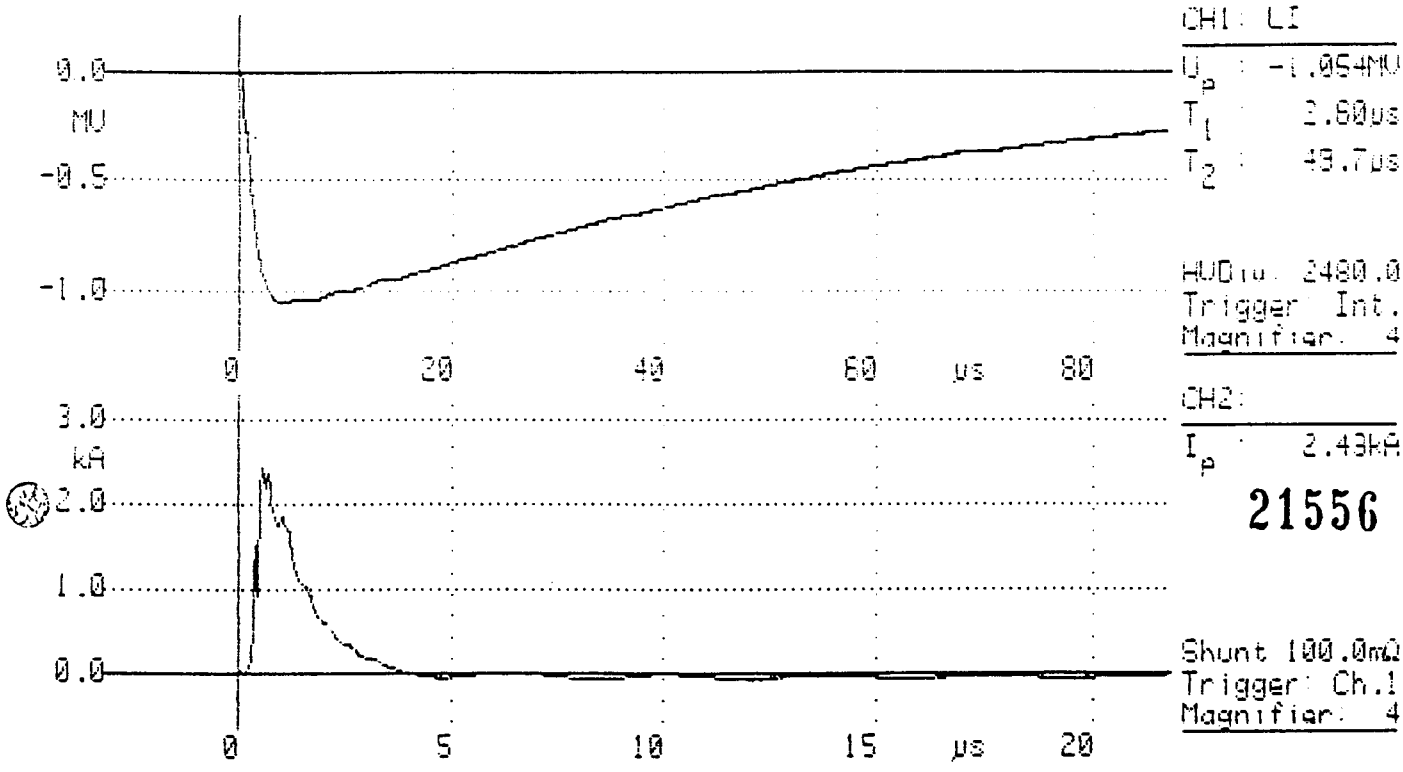

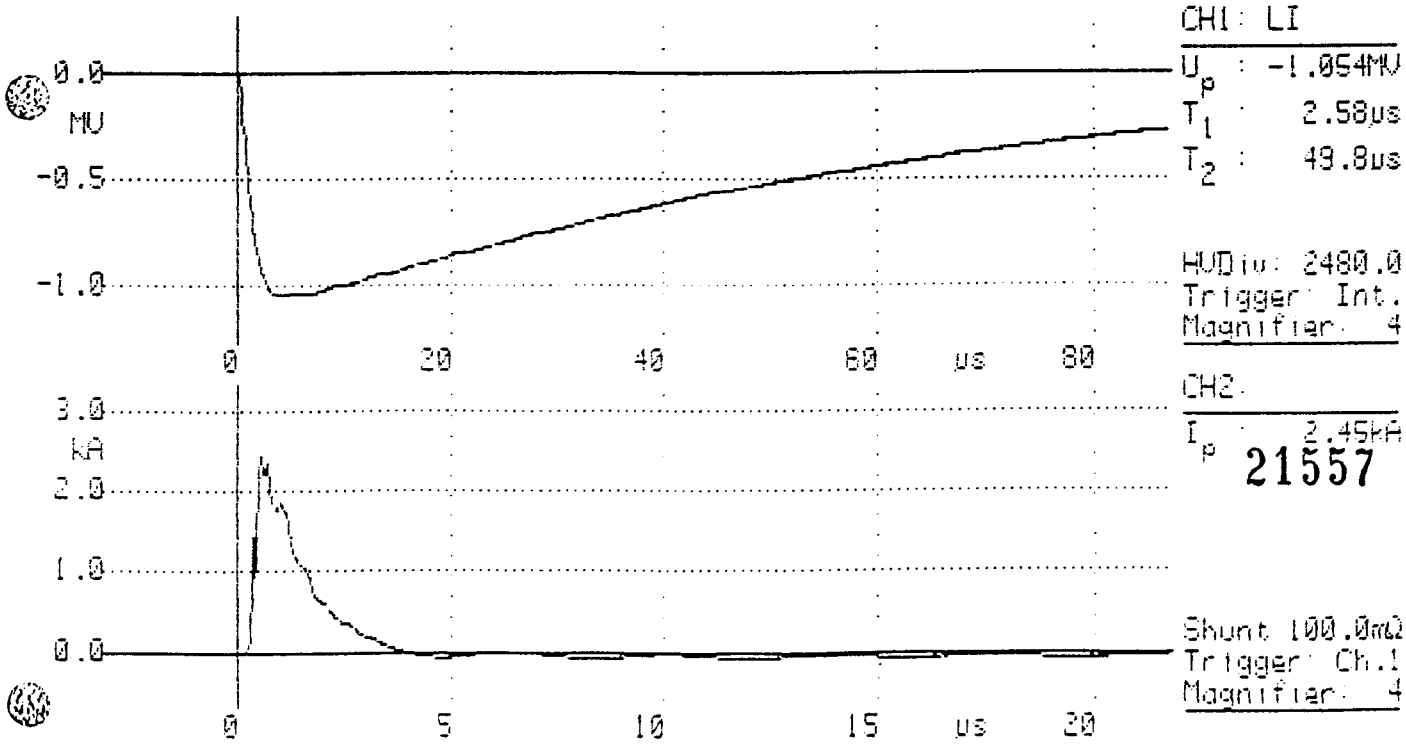

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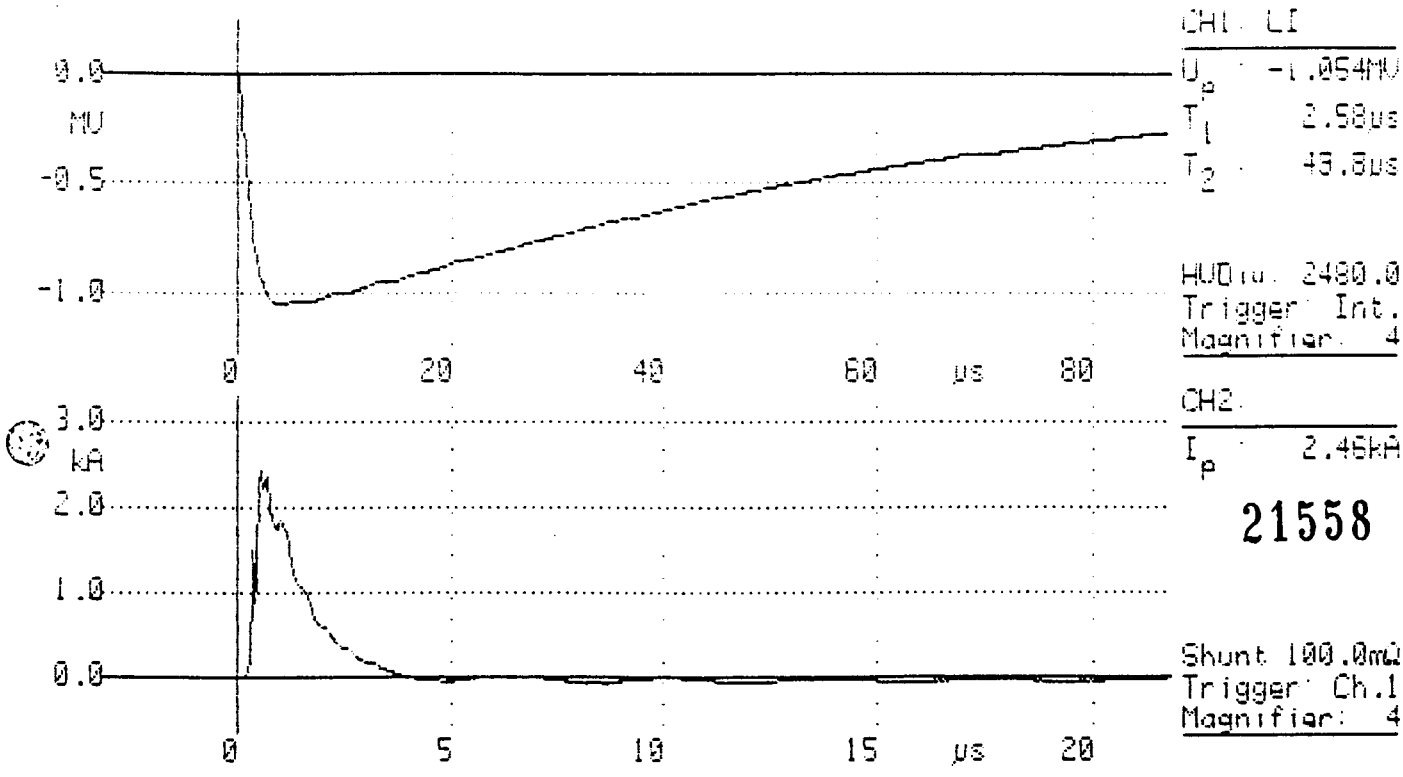
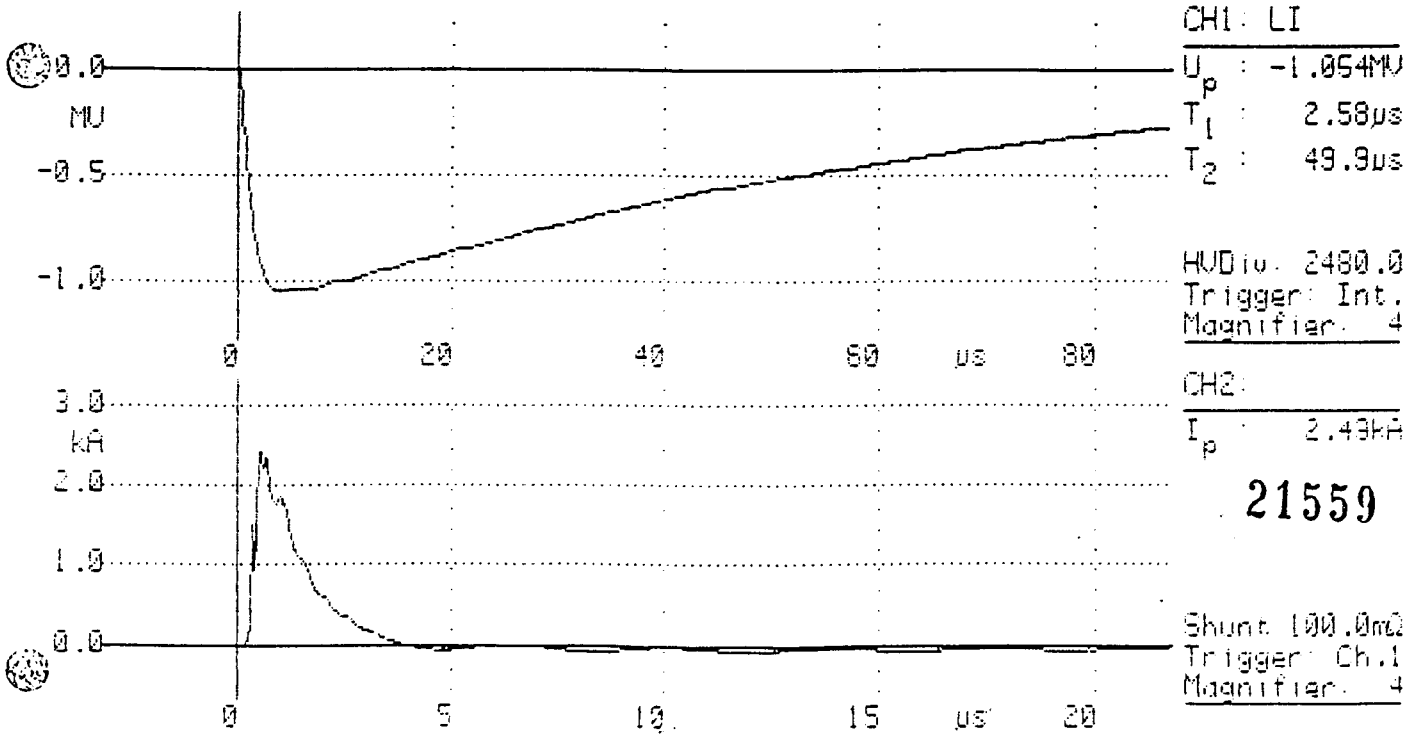
LIGHTNING IMPULSE TEST - CCV 245 N° : XE 91200 -01





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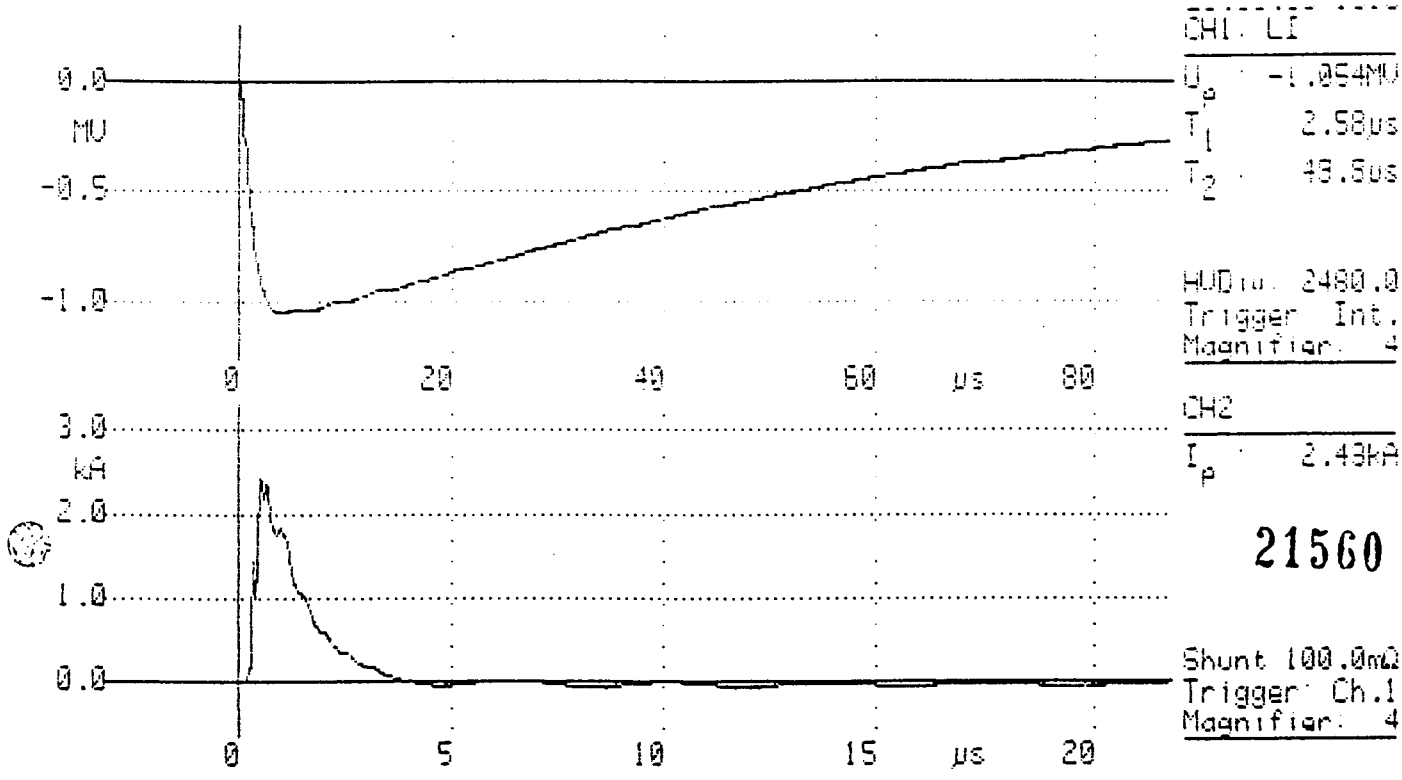
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

LIGHTNING IMPULSE TEST - CCV 245

N° : XE 91200 -01



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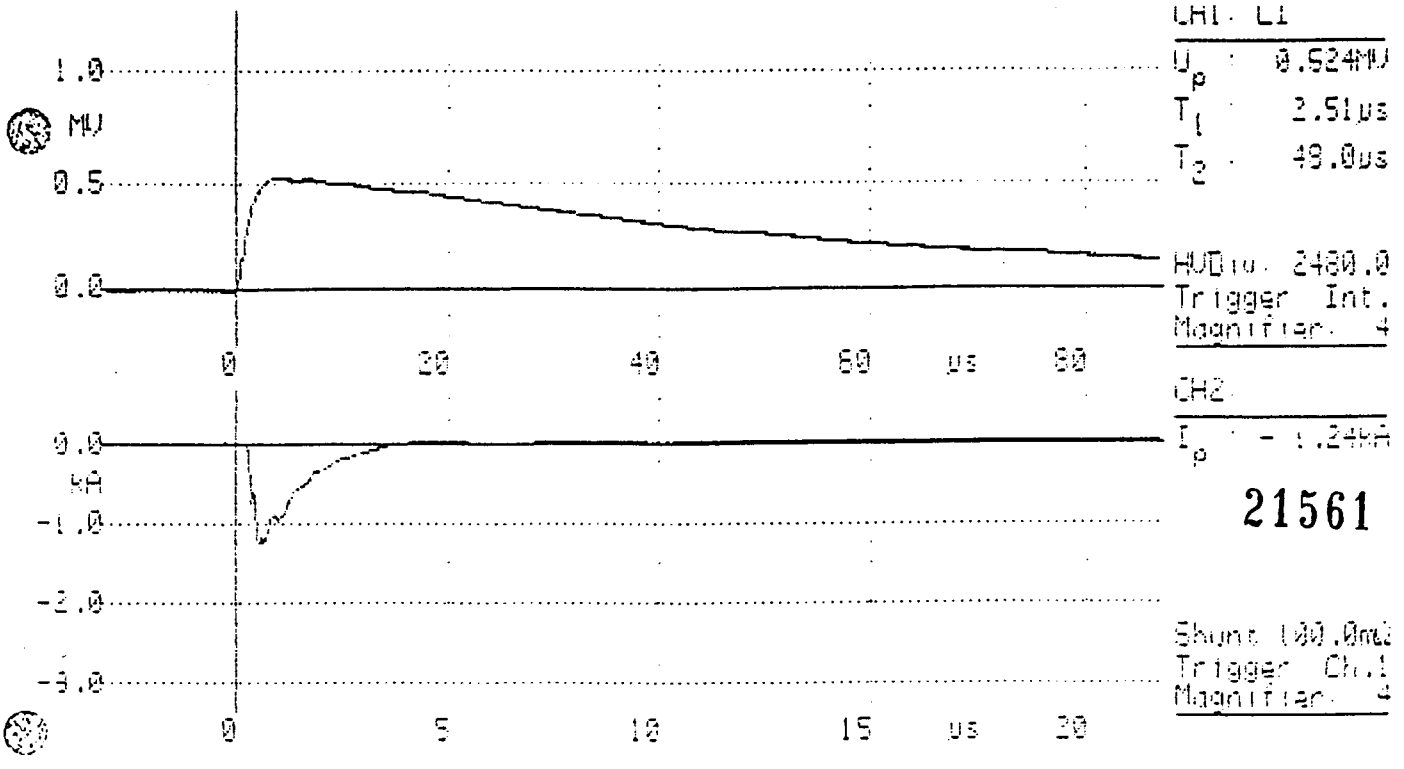

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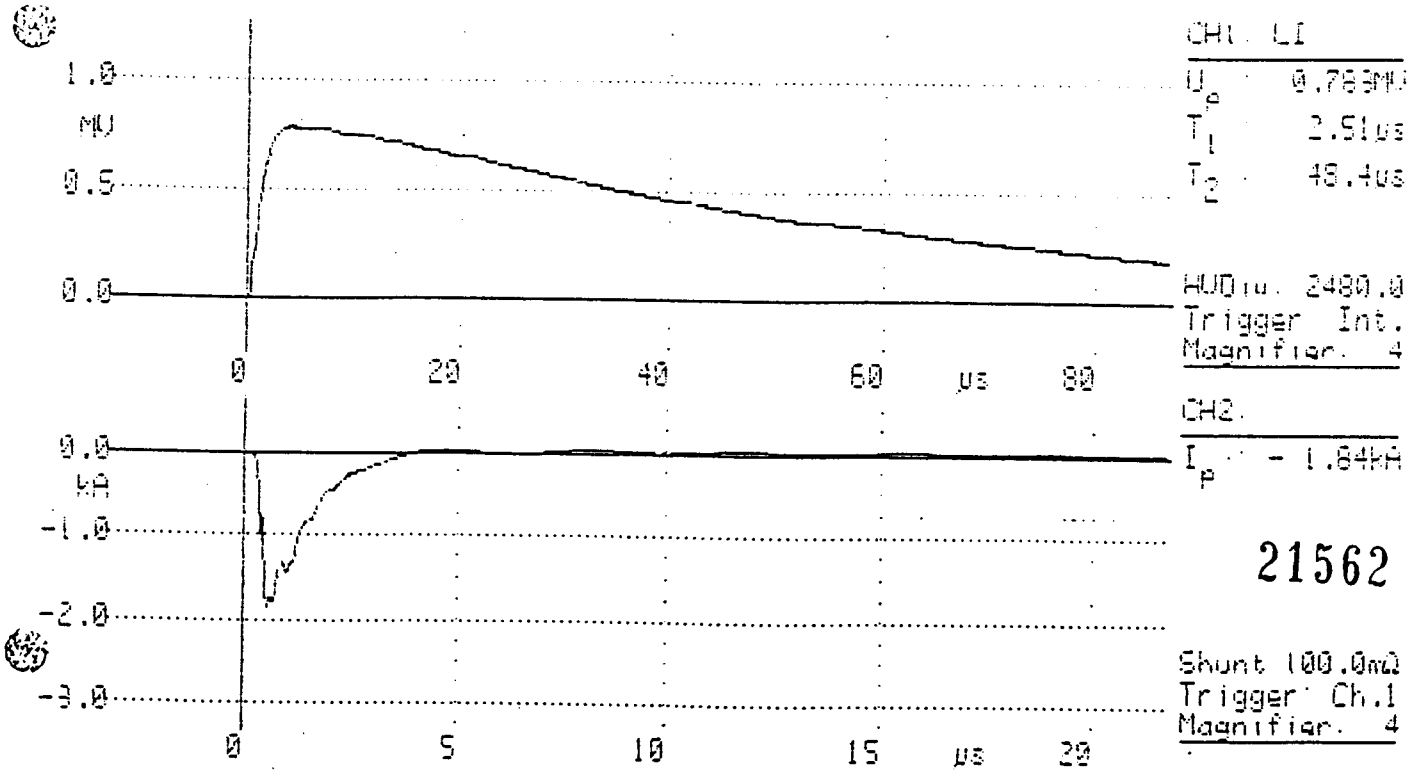

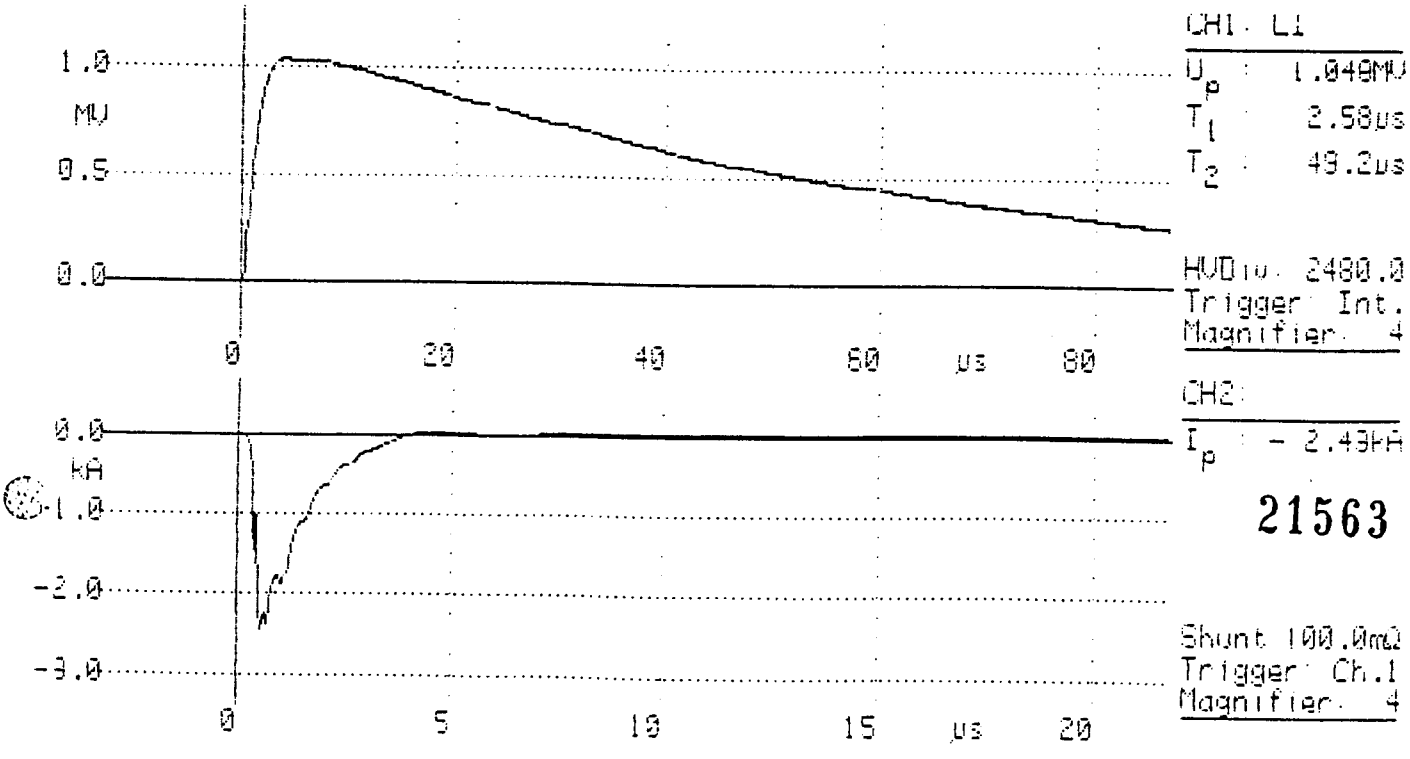

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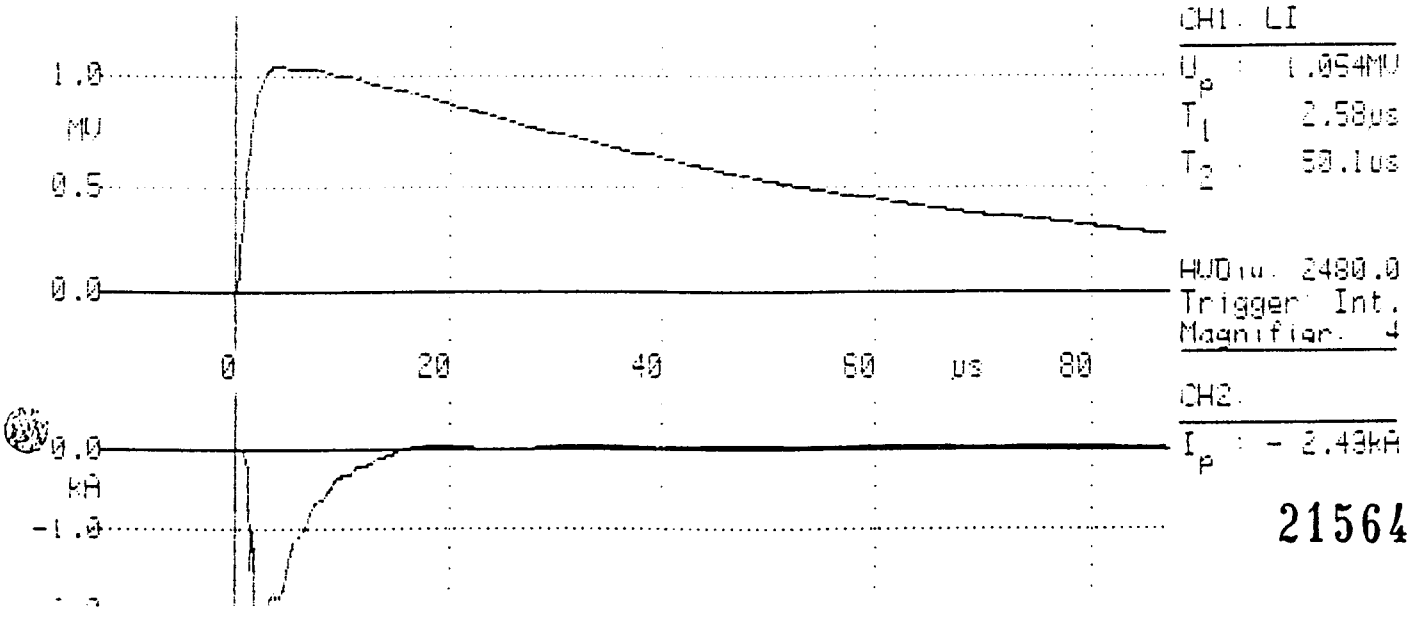

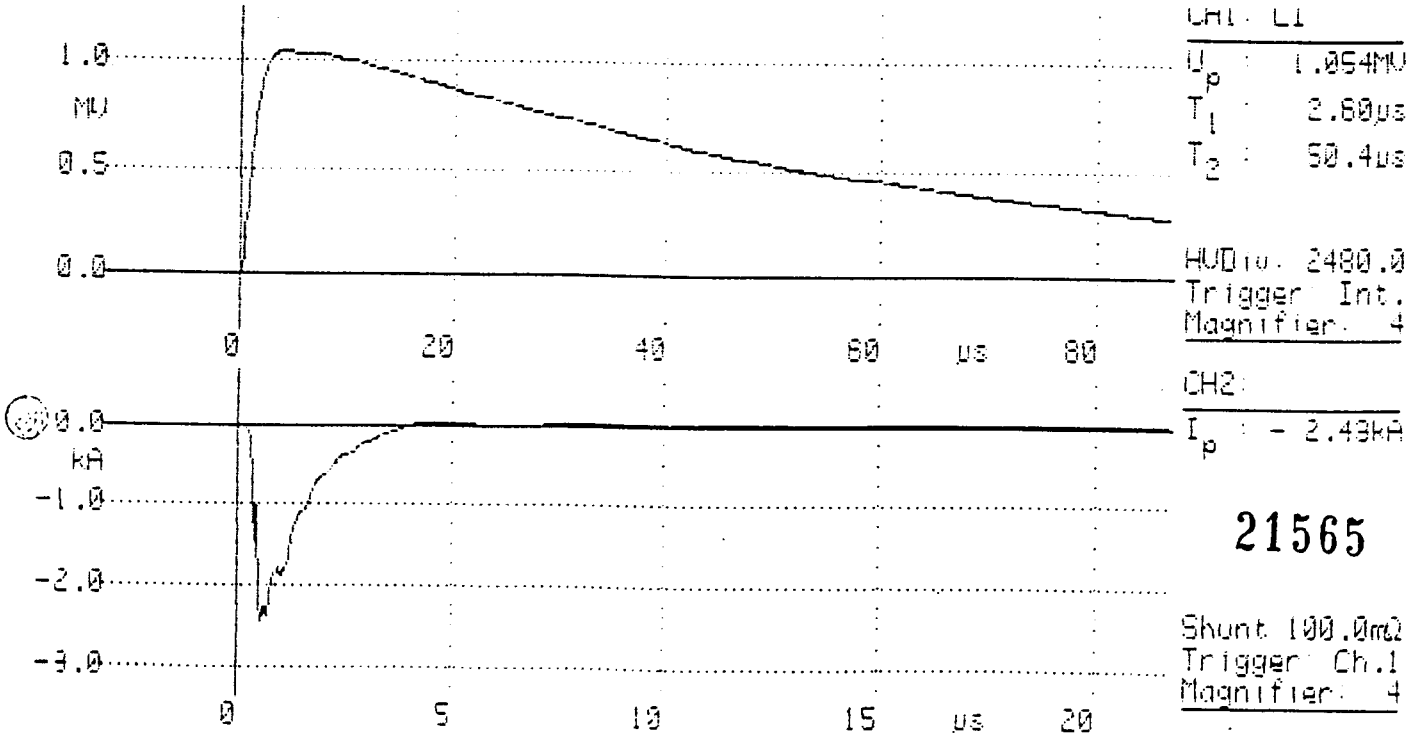

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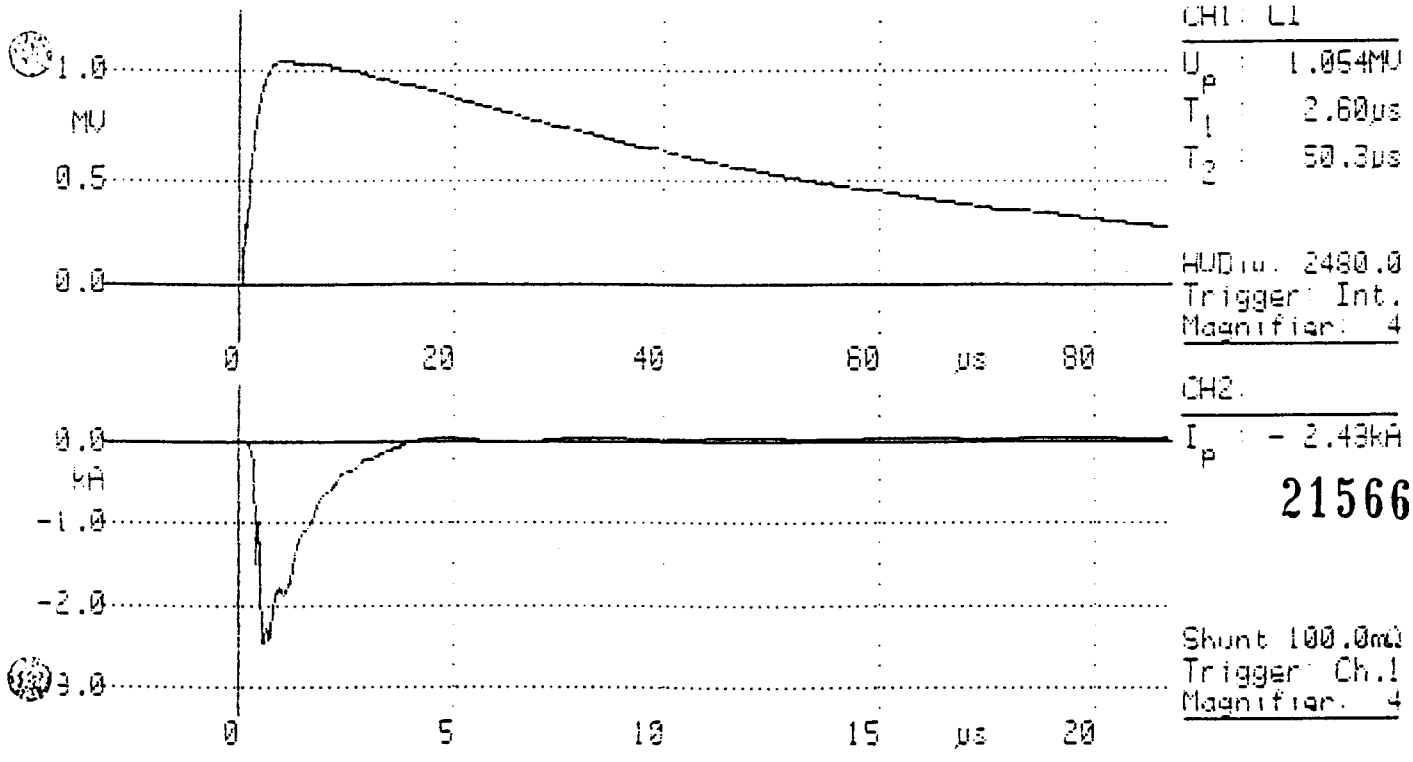

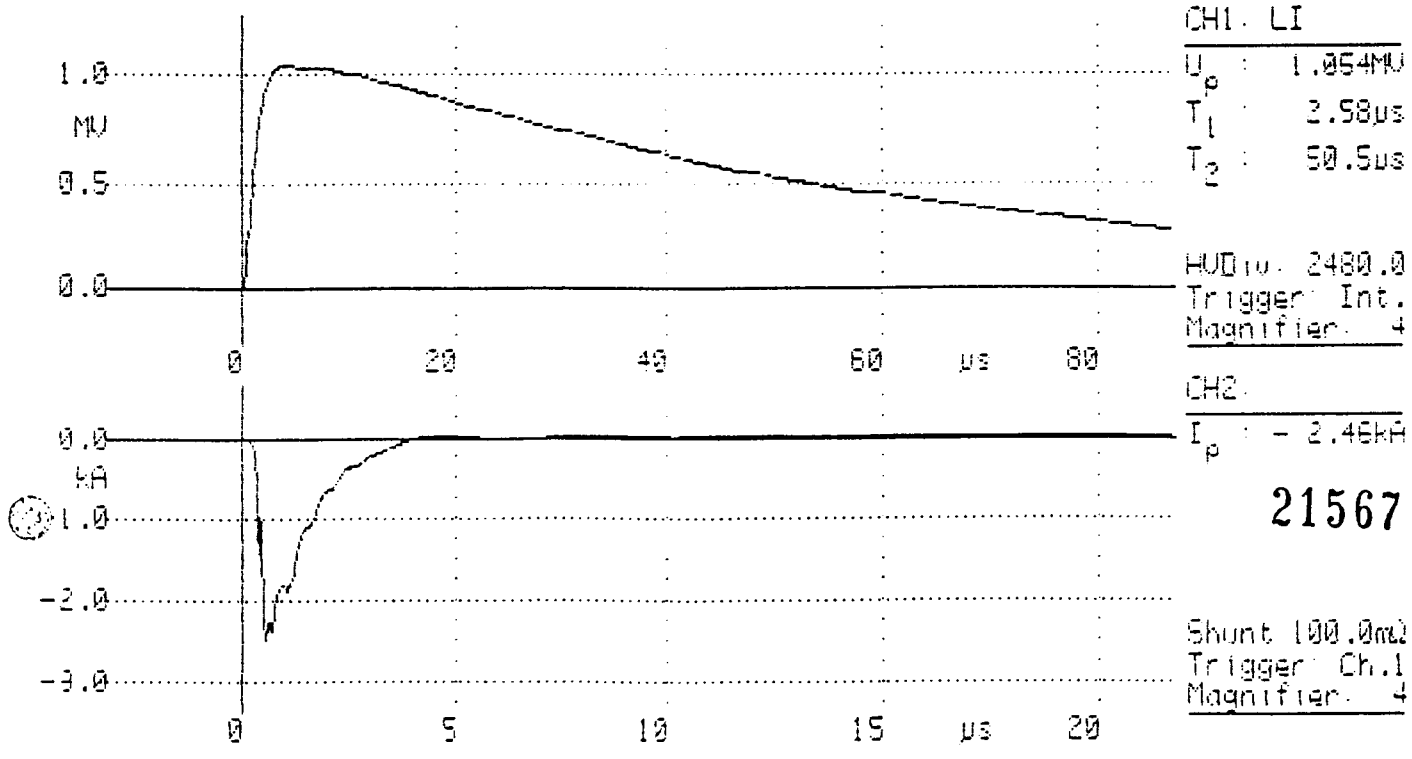

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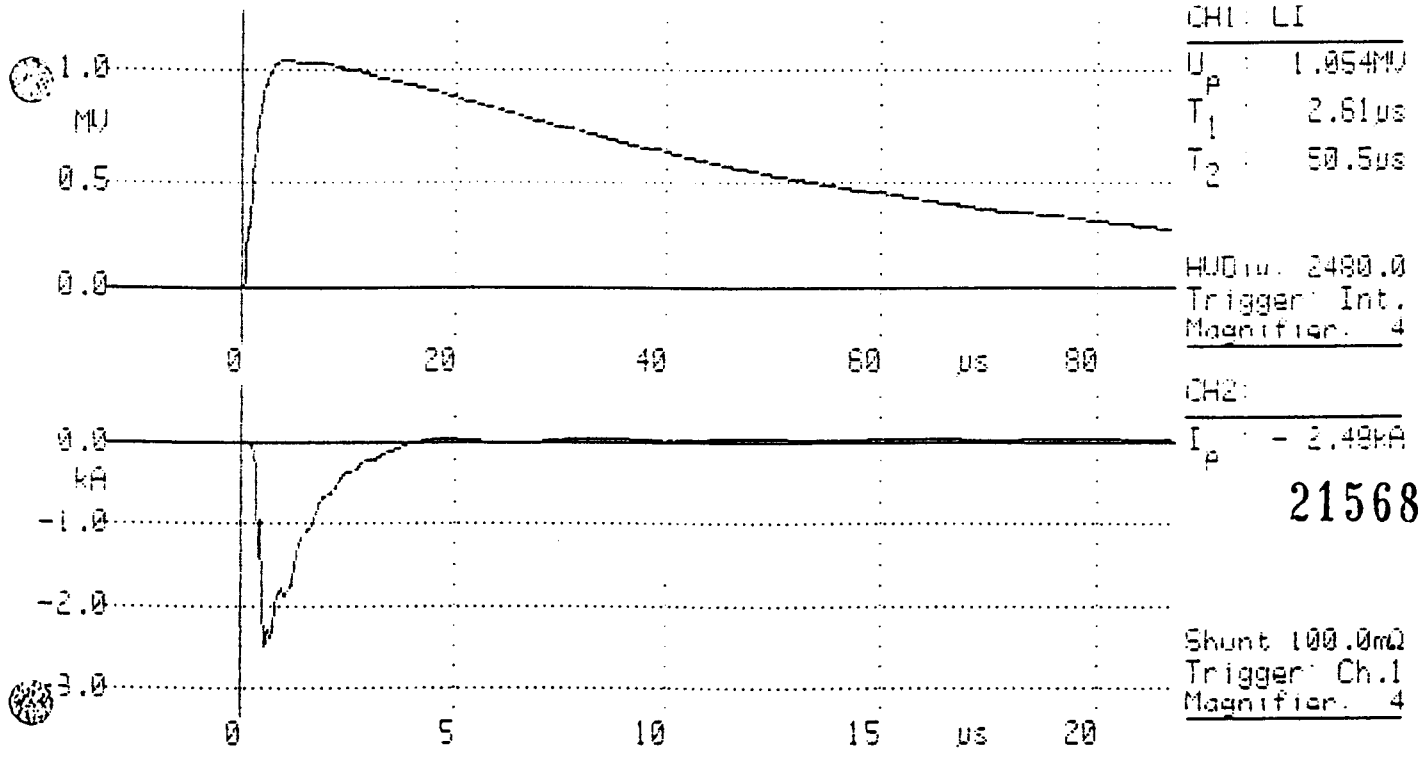

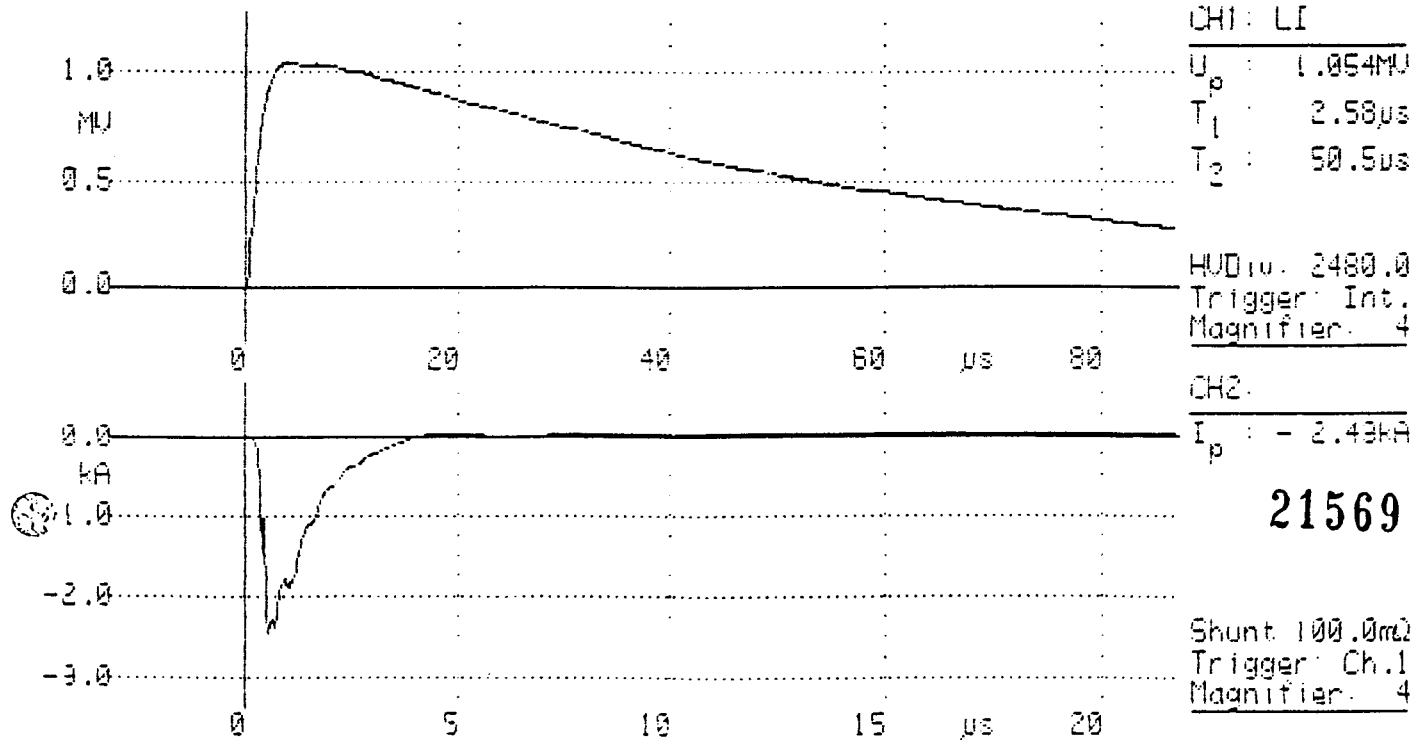

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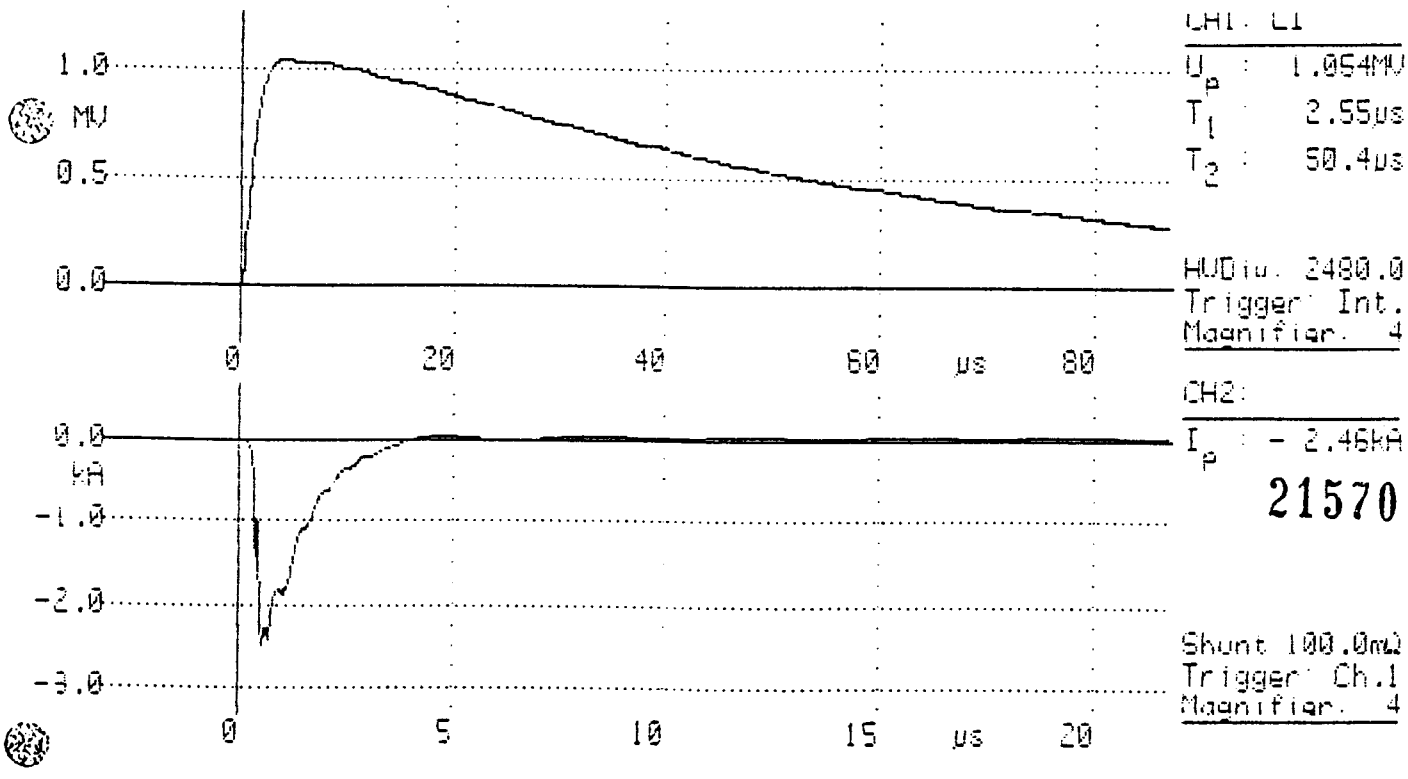

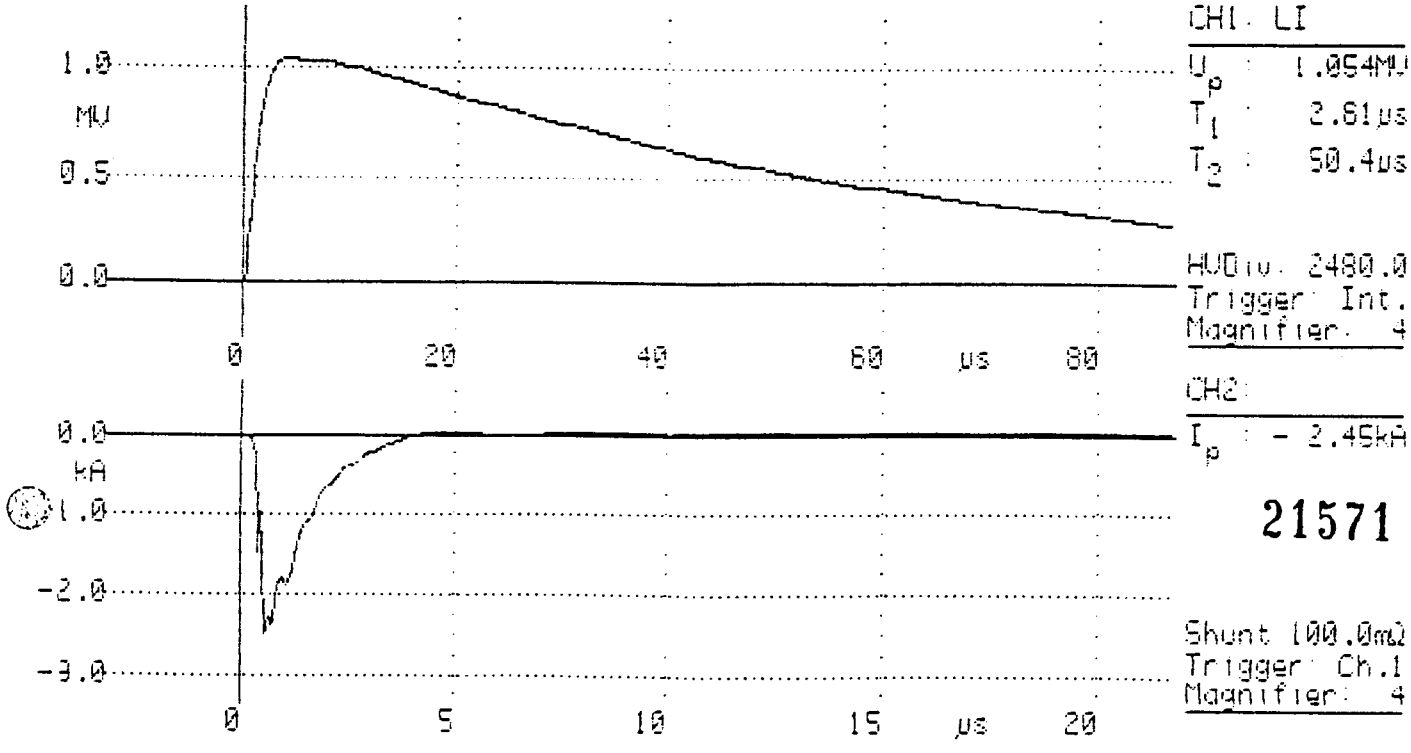

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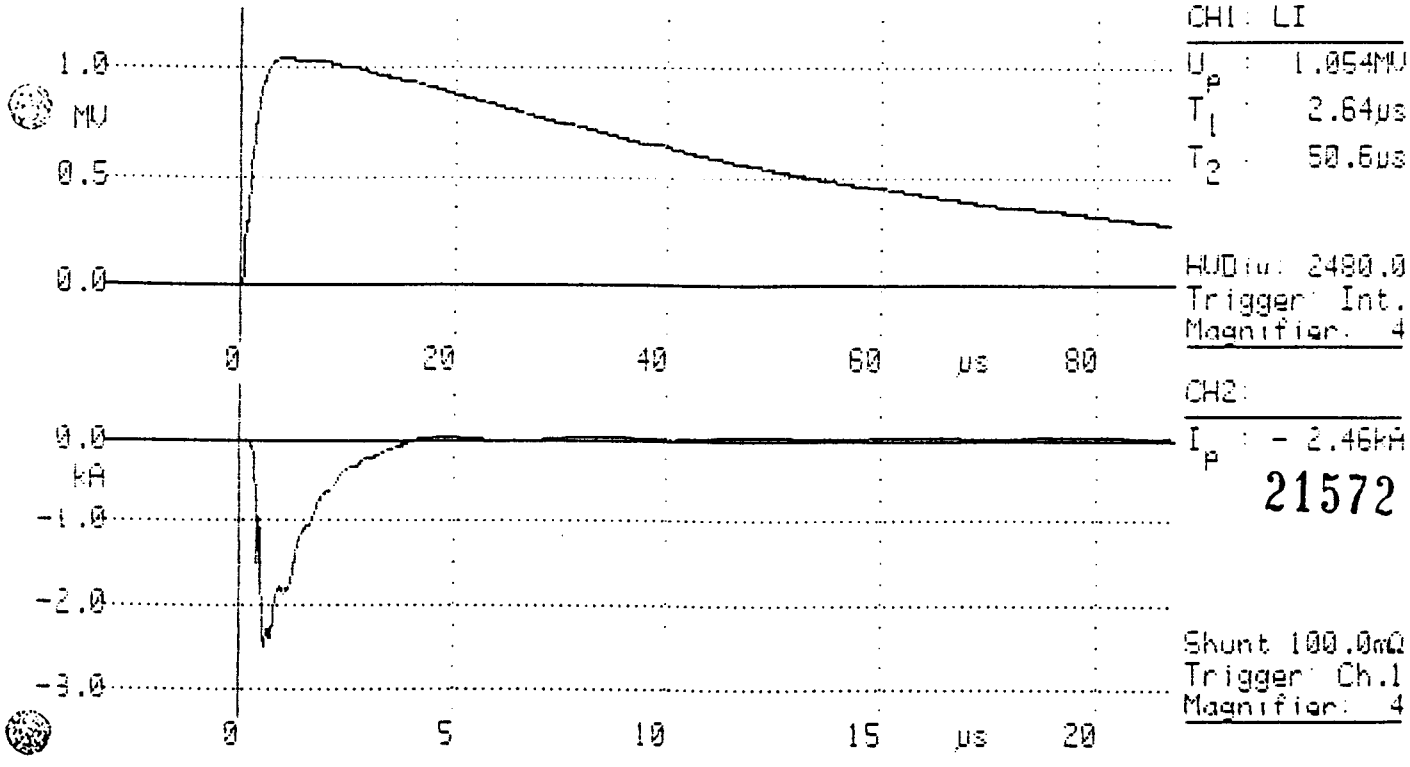

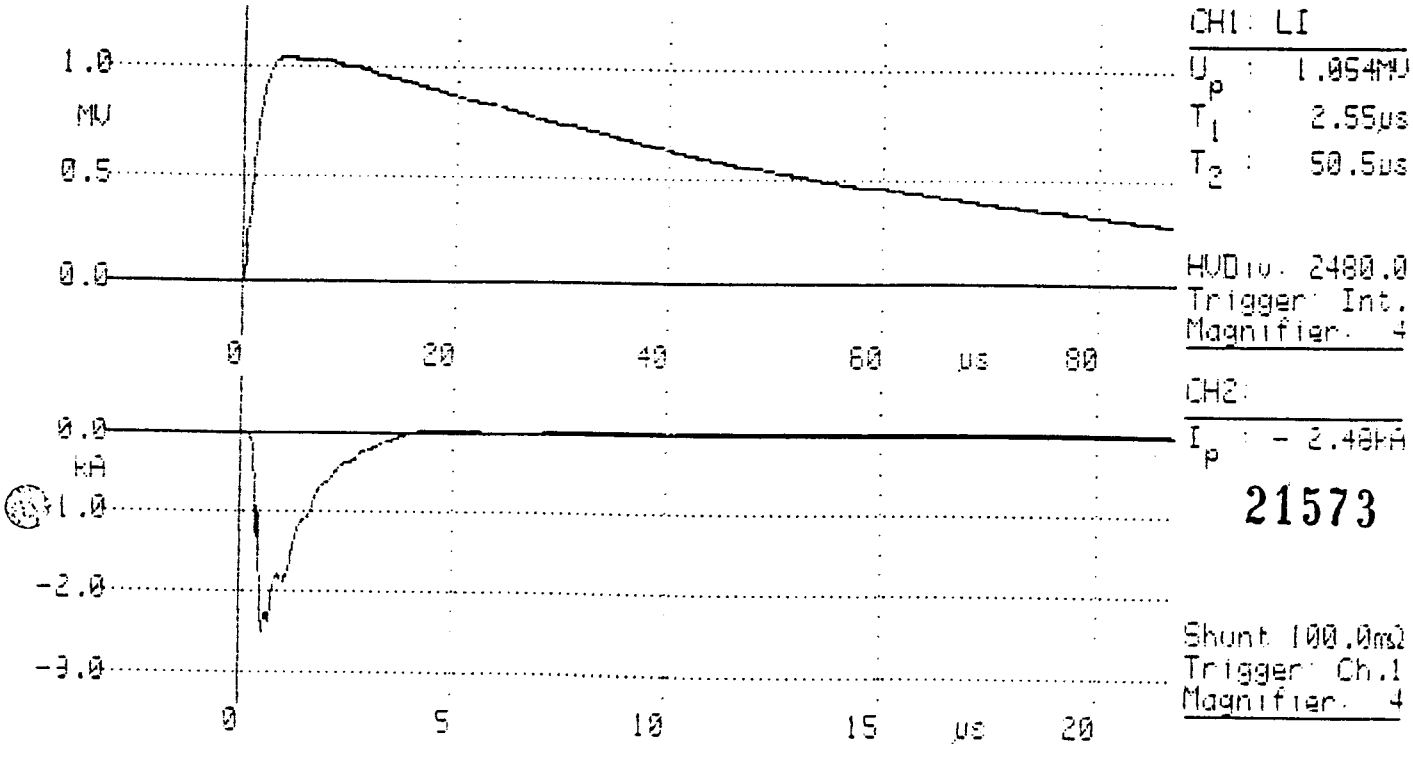

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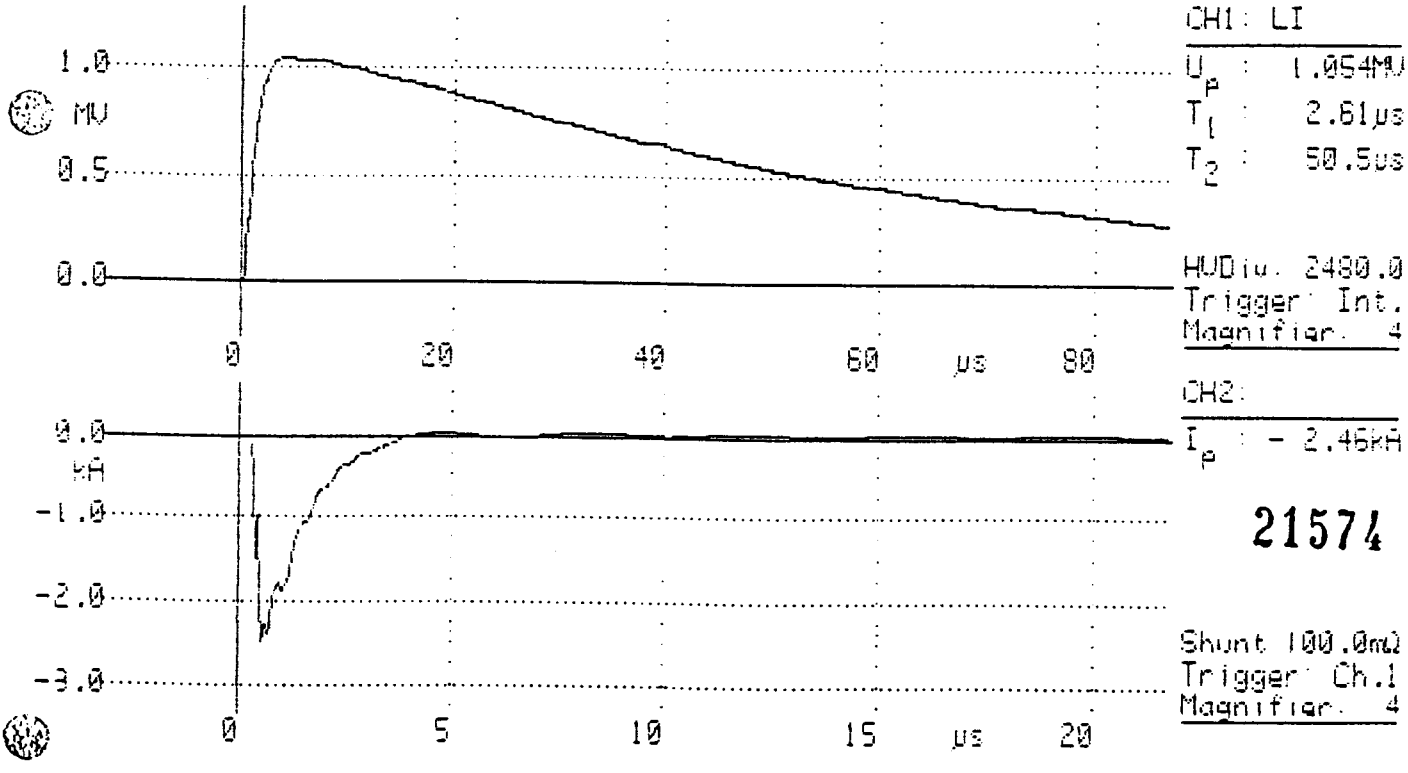

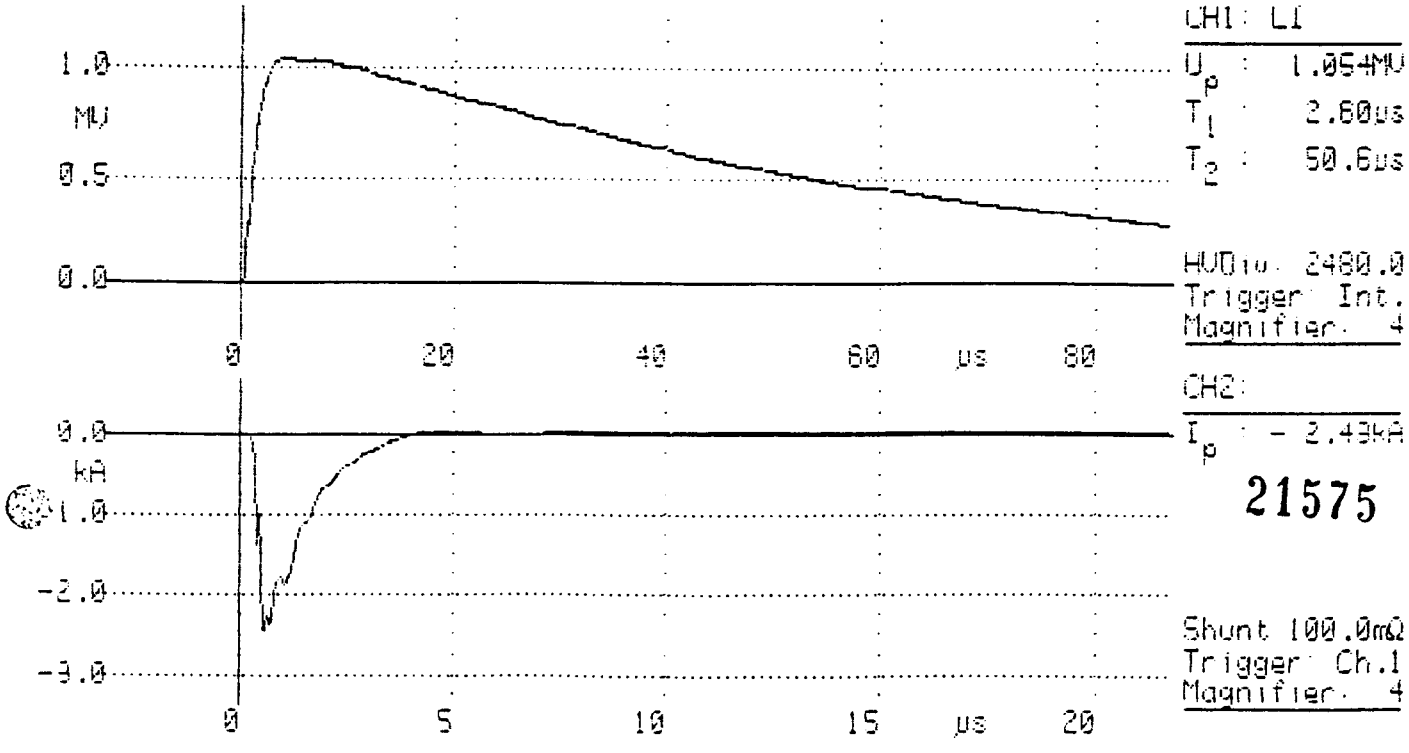

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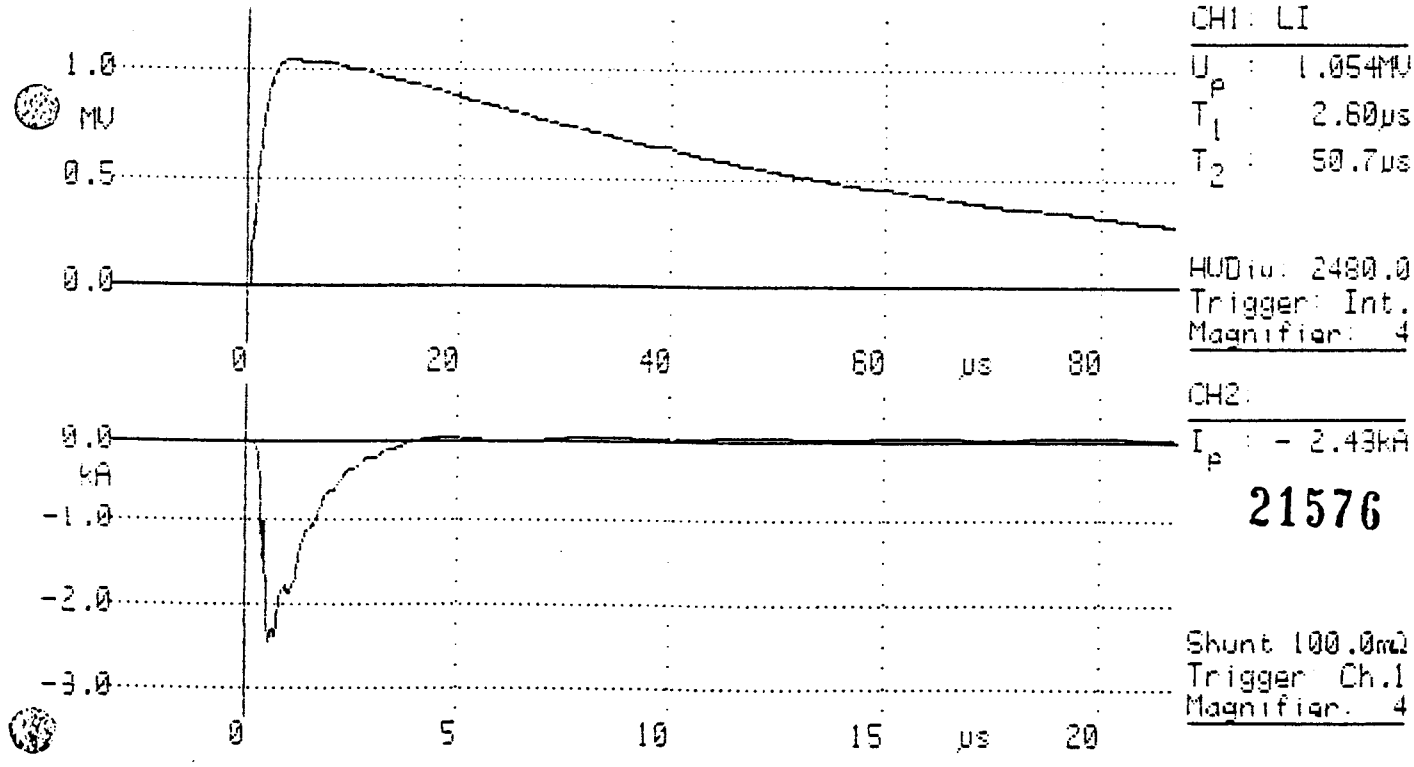

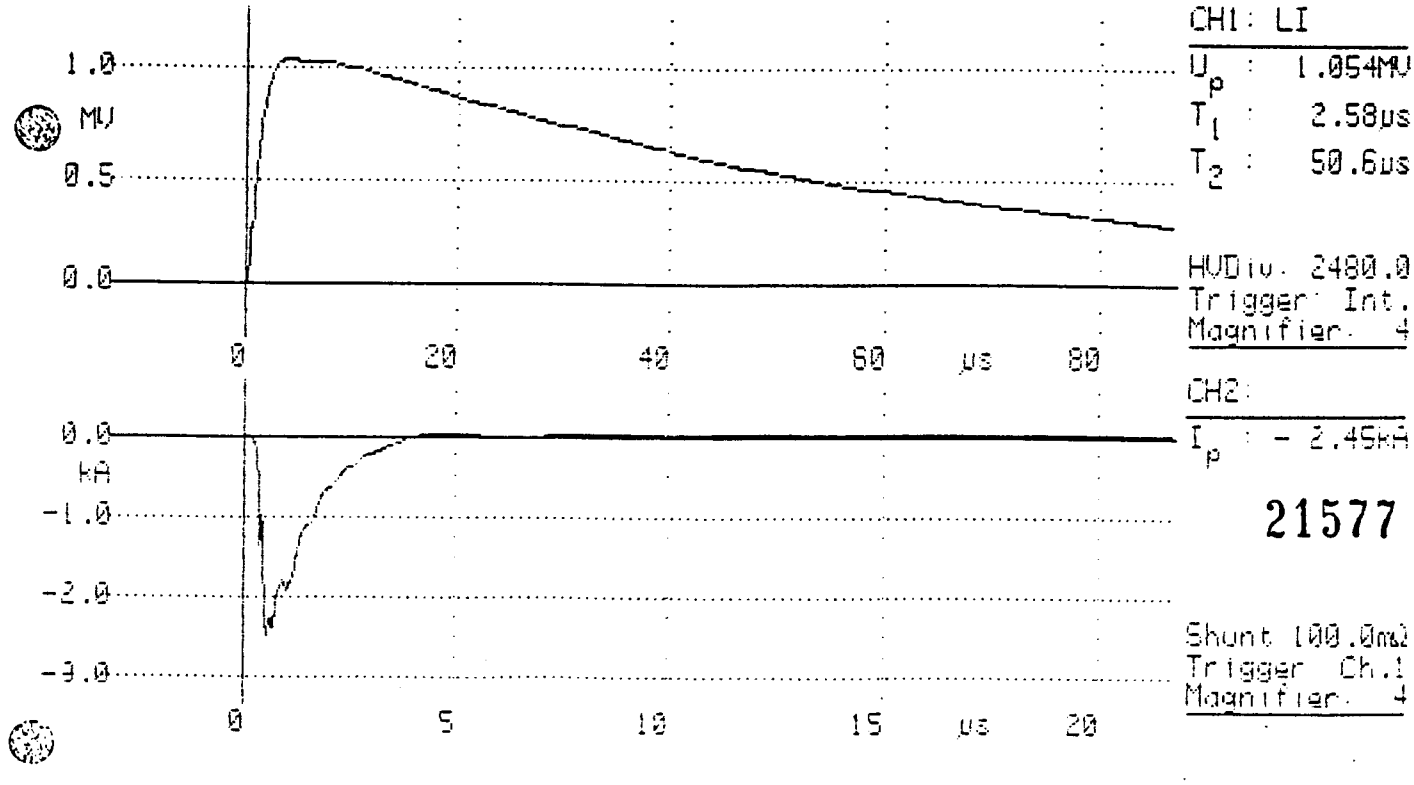

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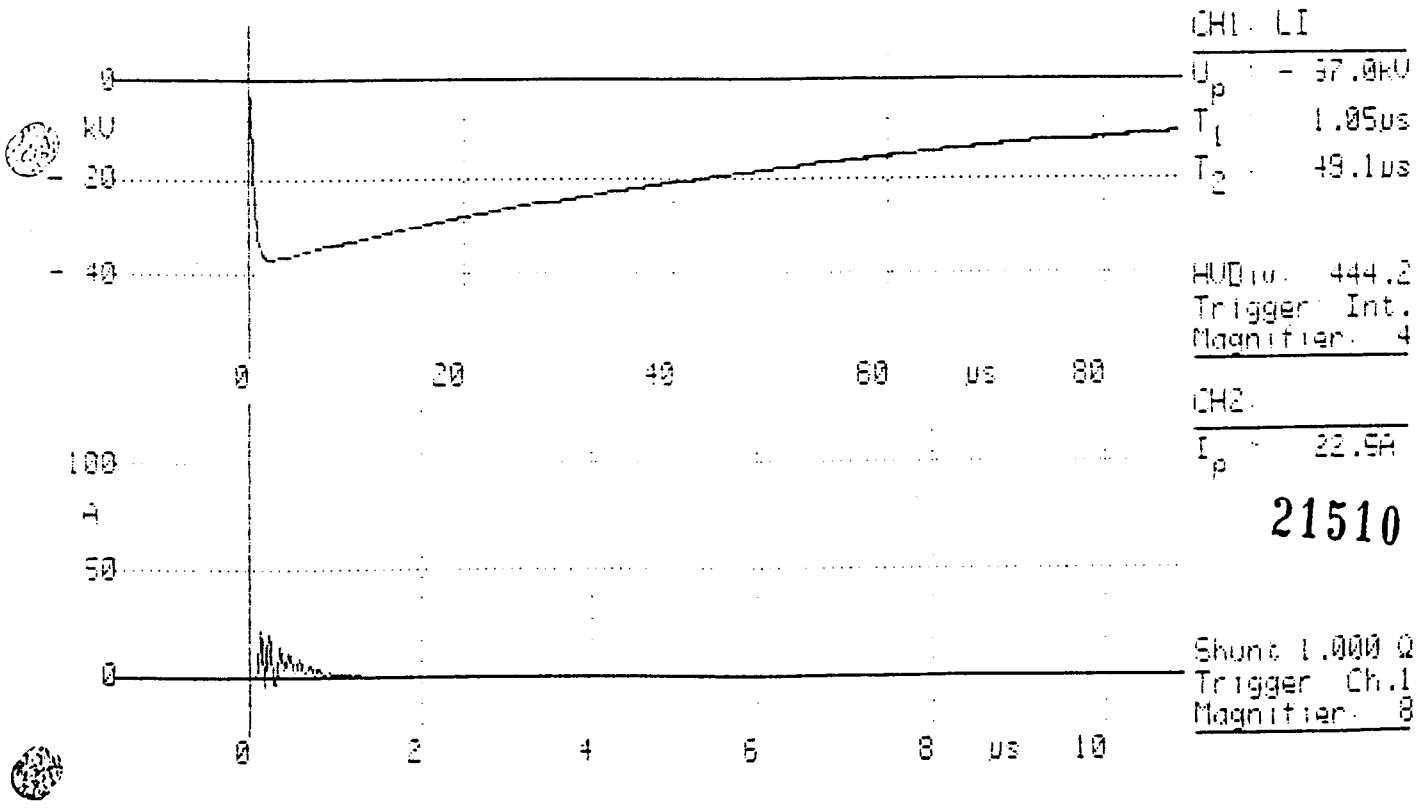

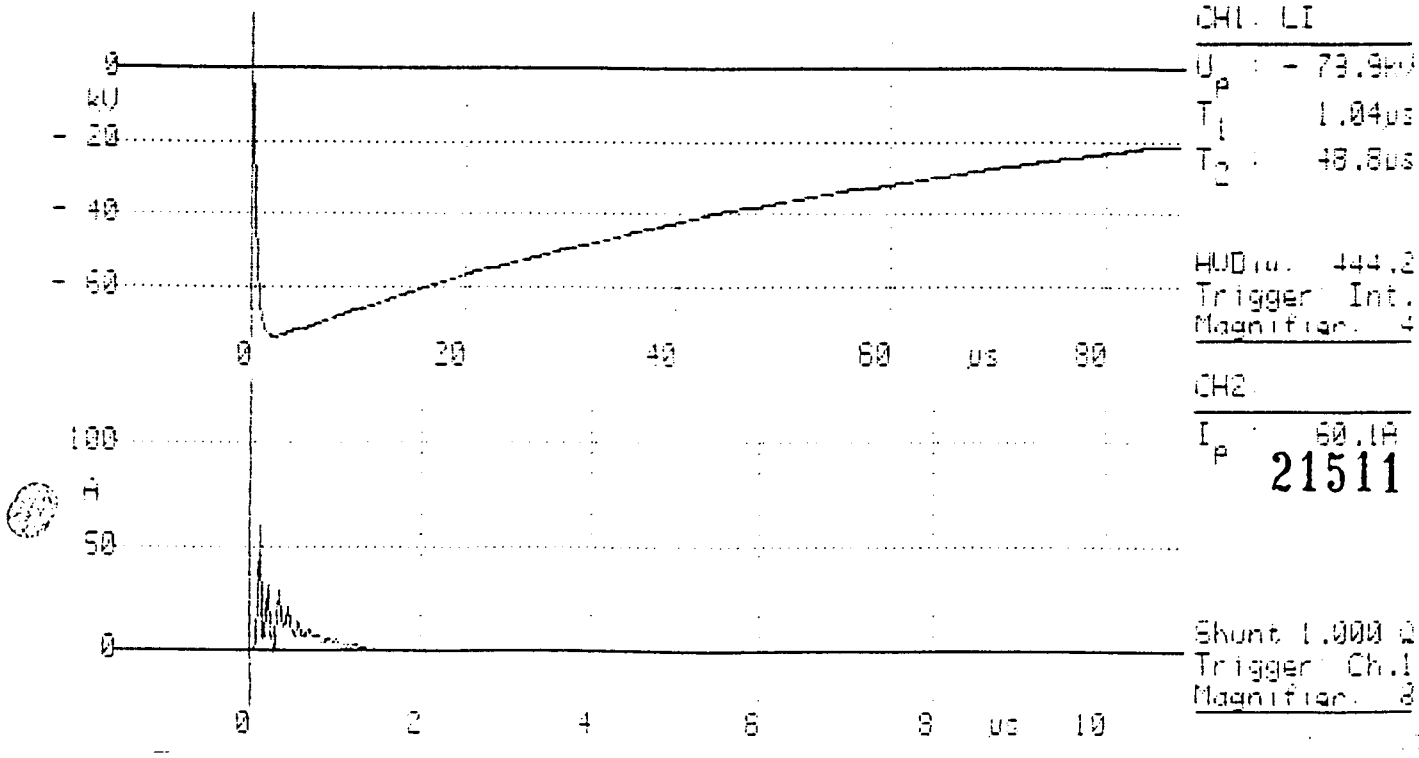

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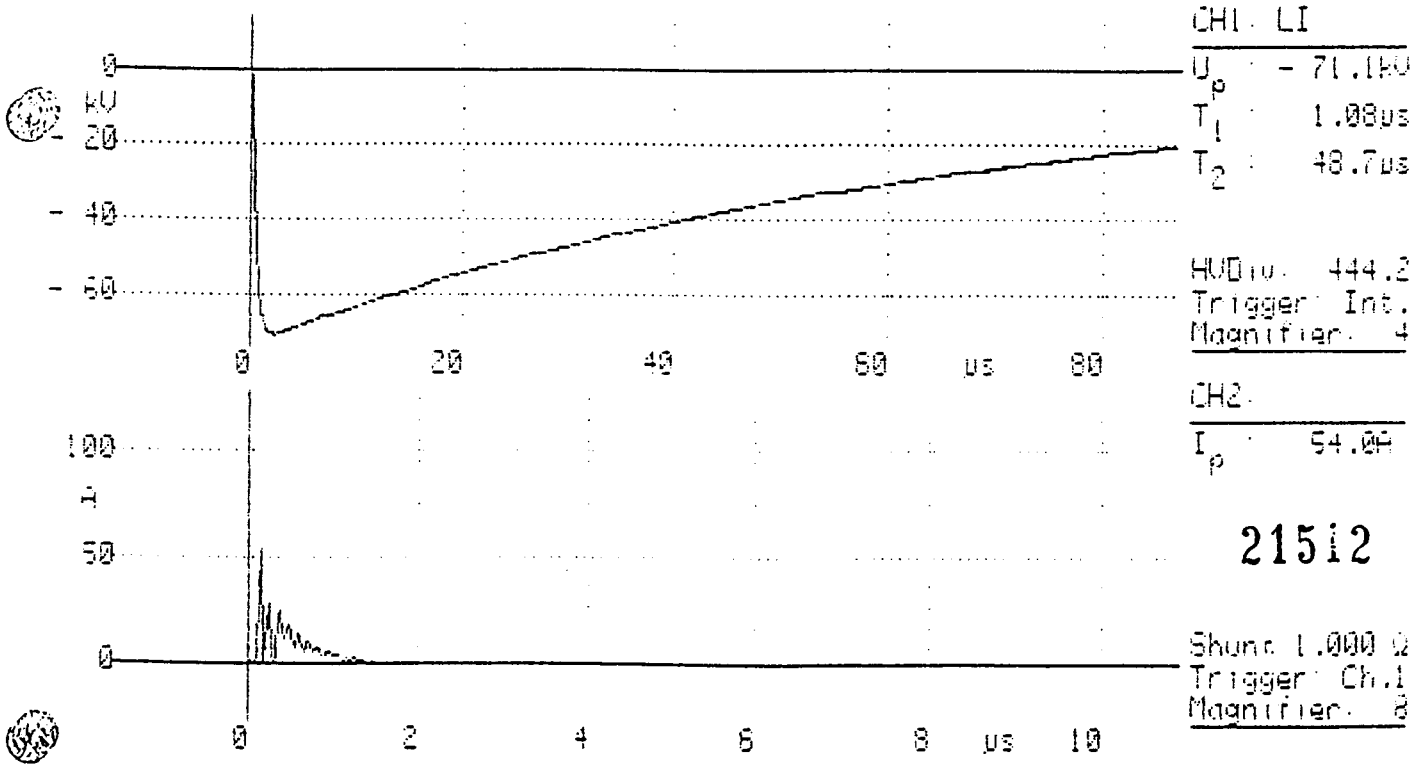

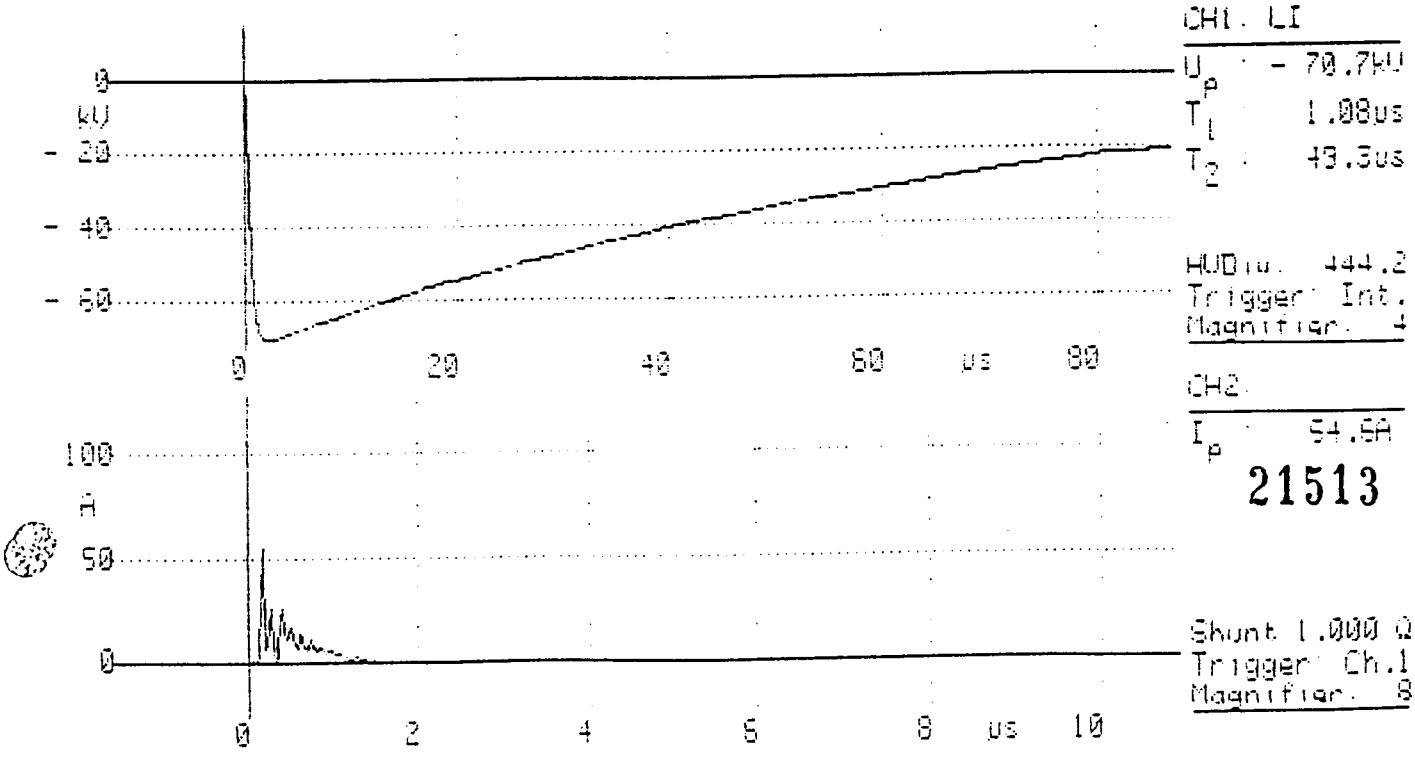

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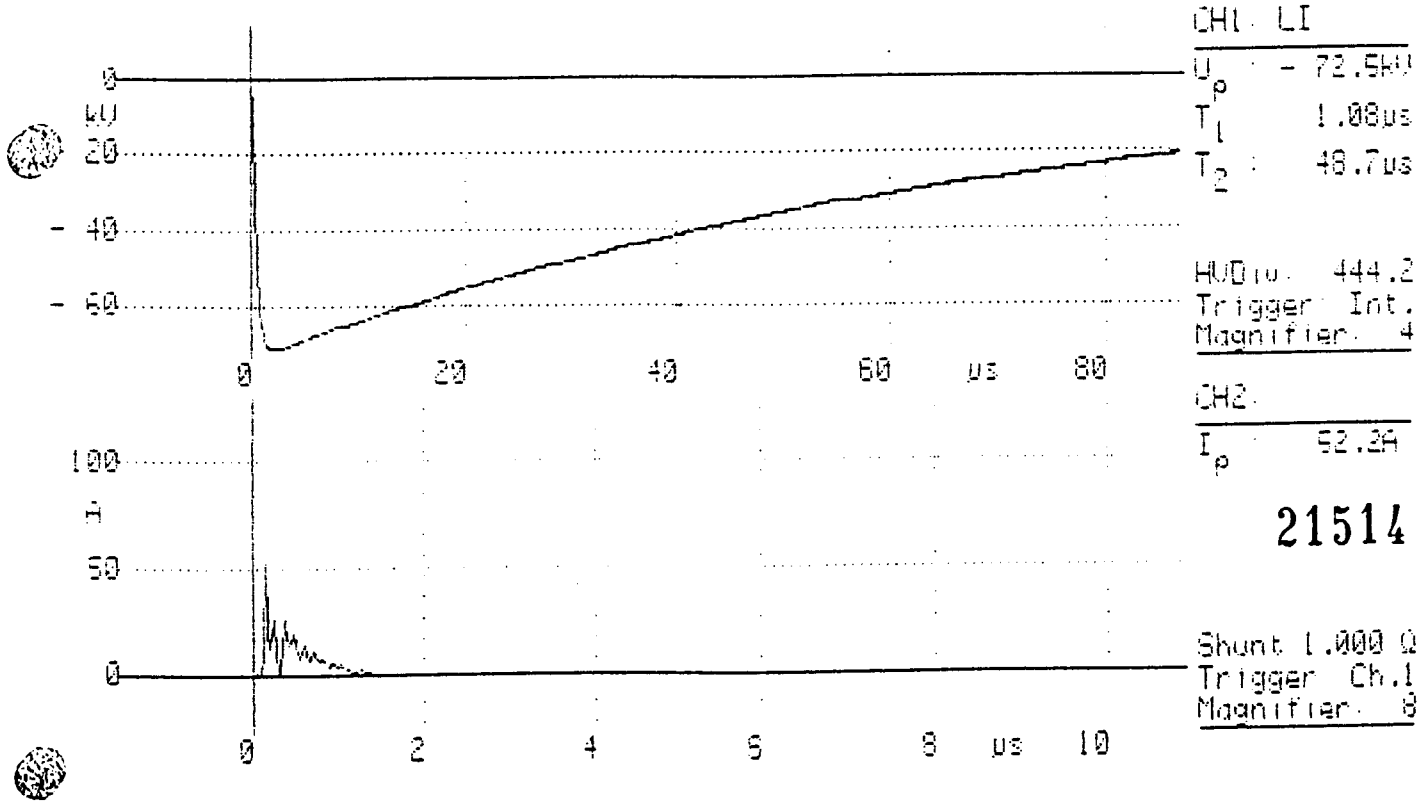

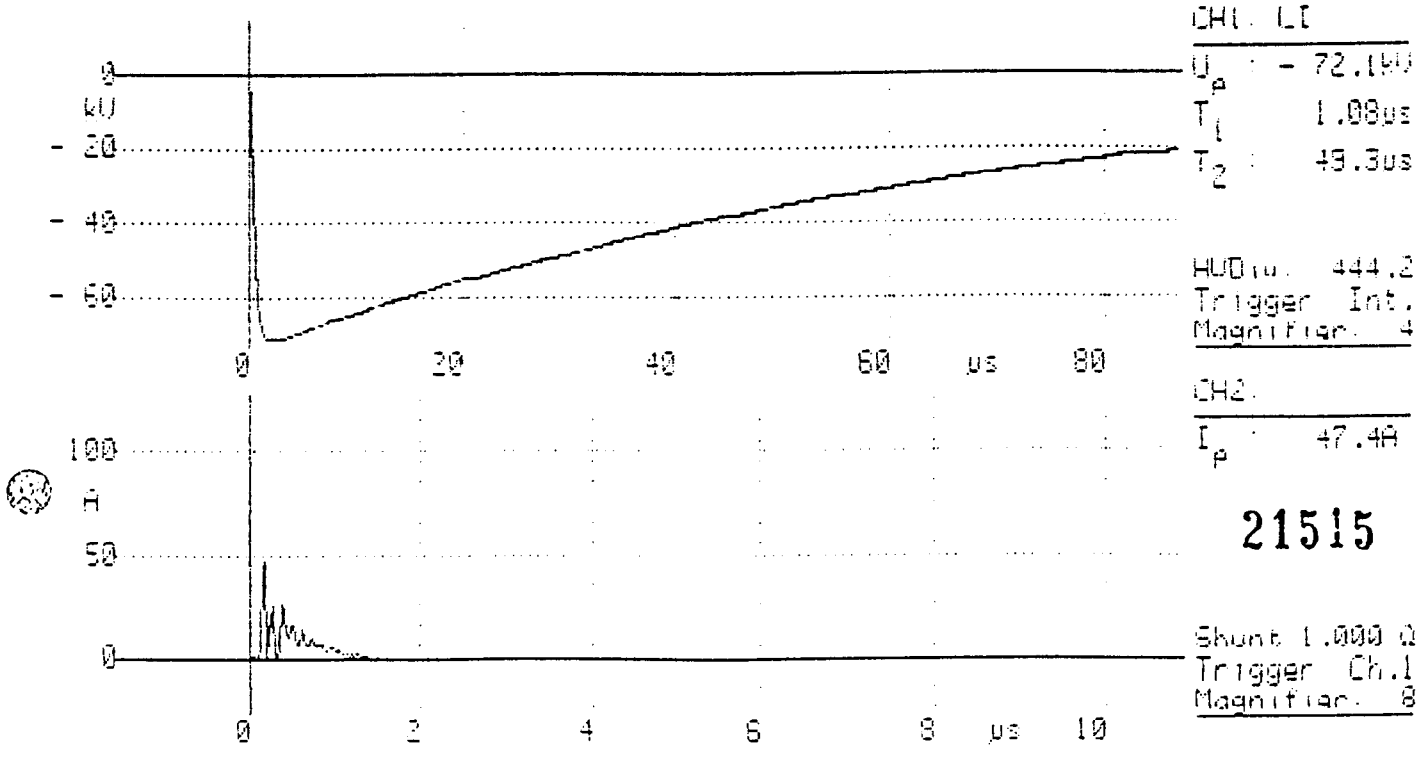

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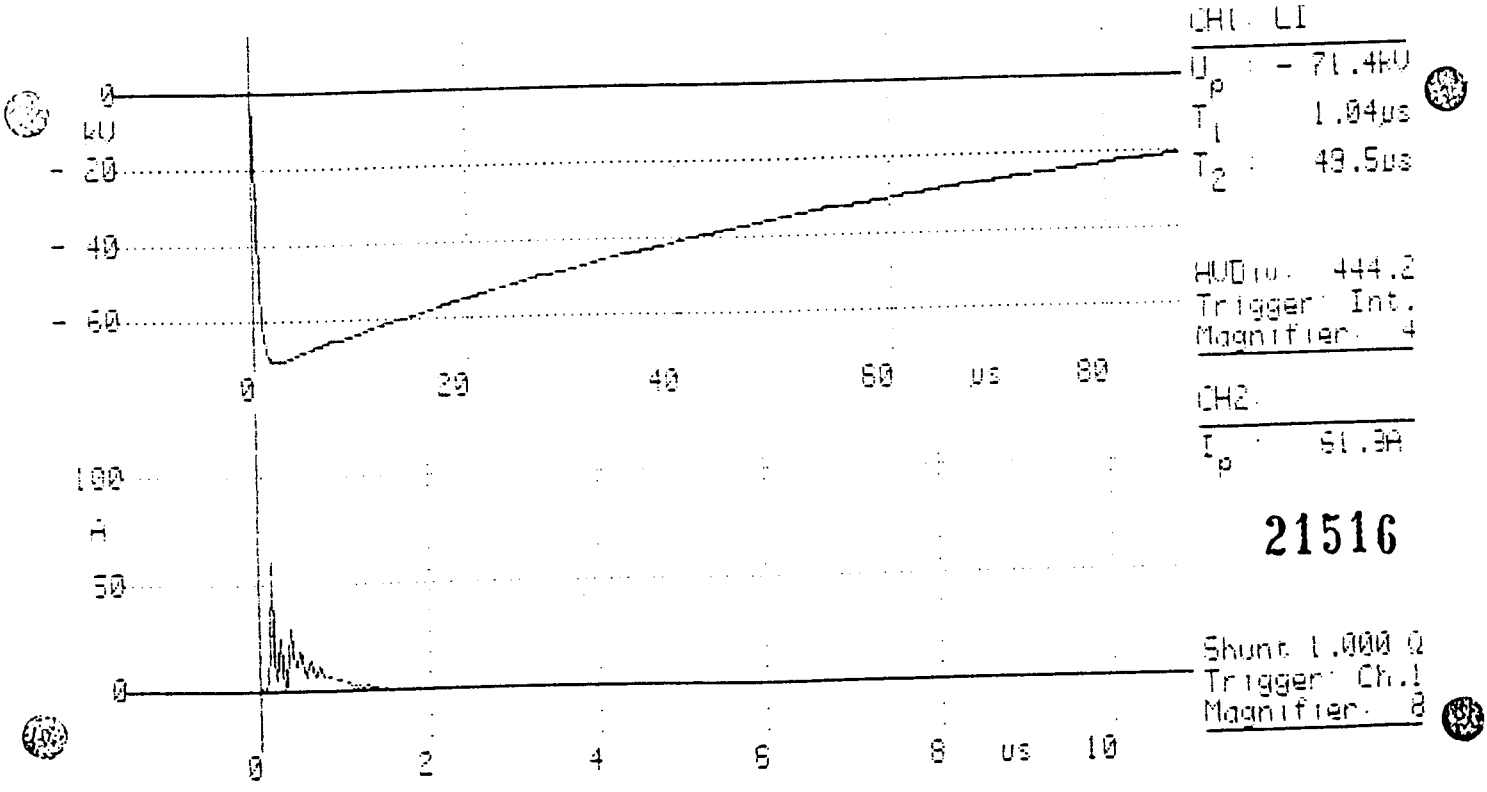

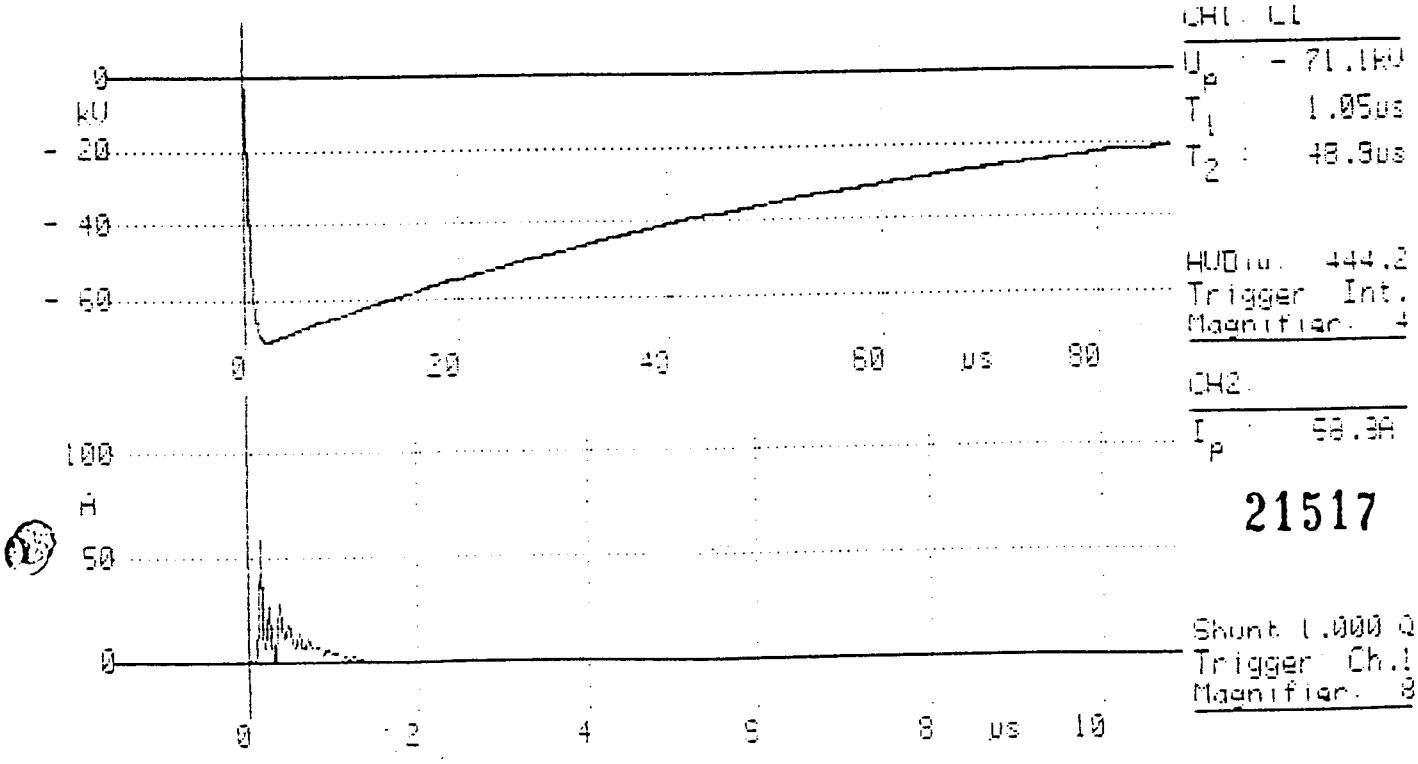

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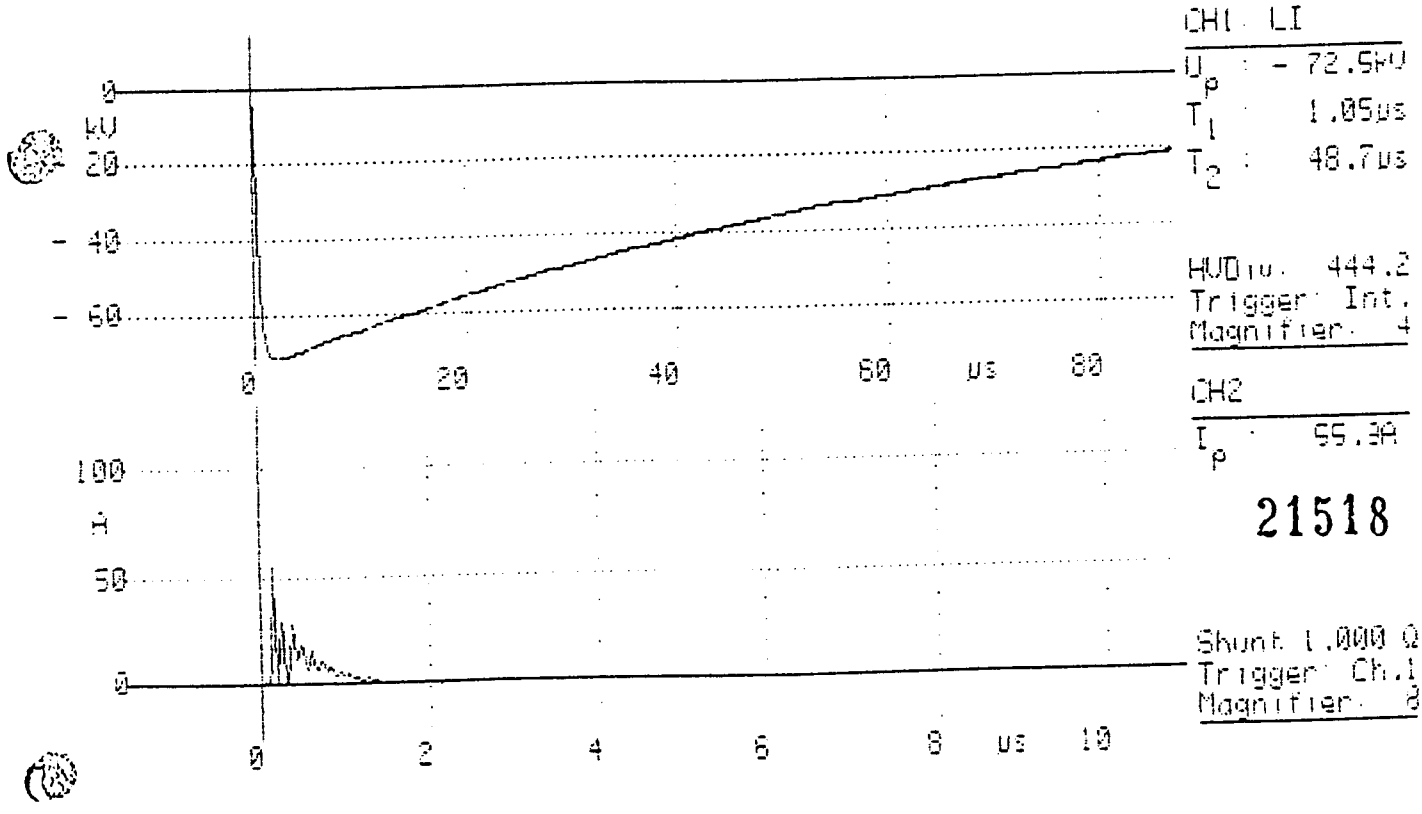

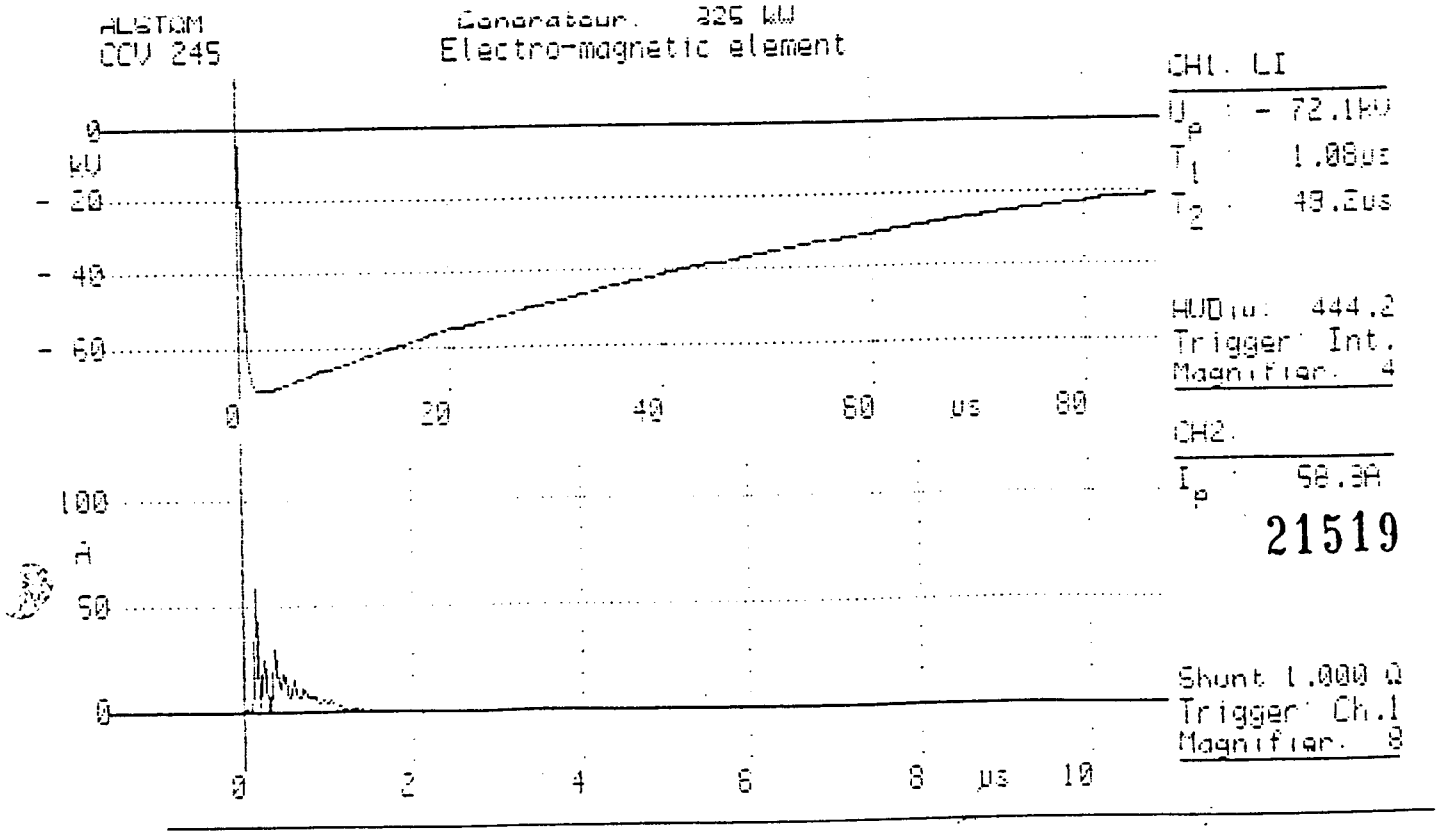

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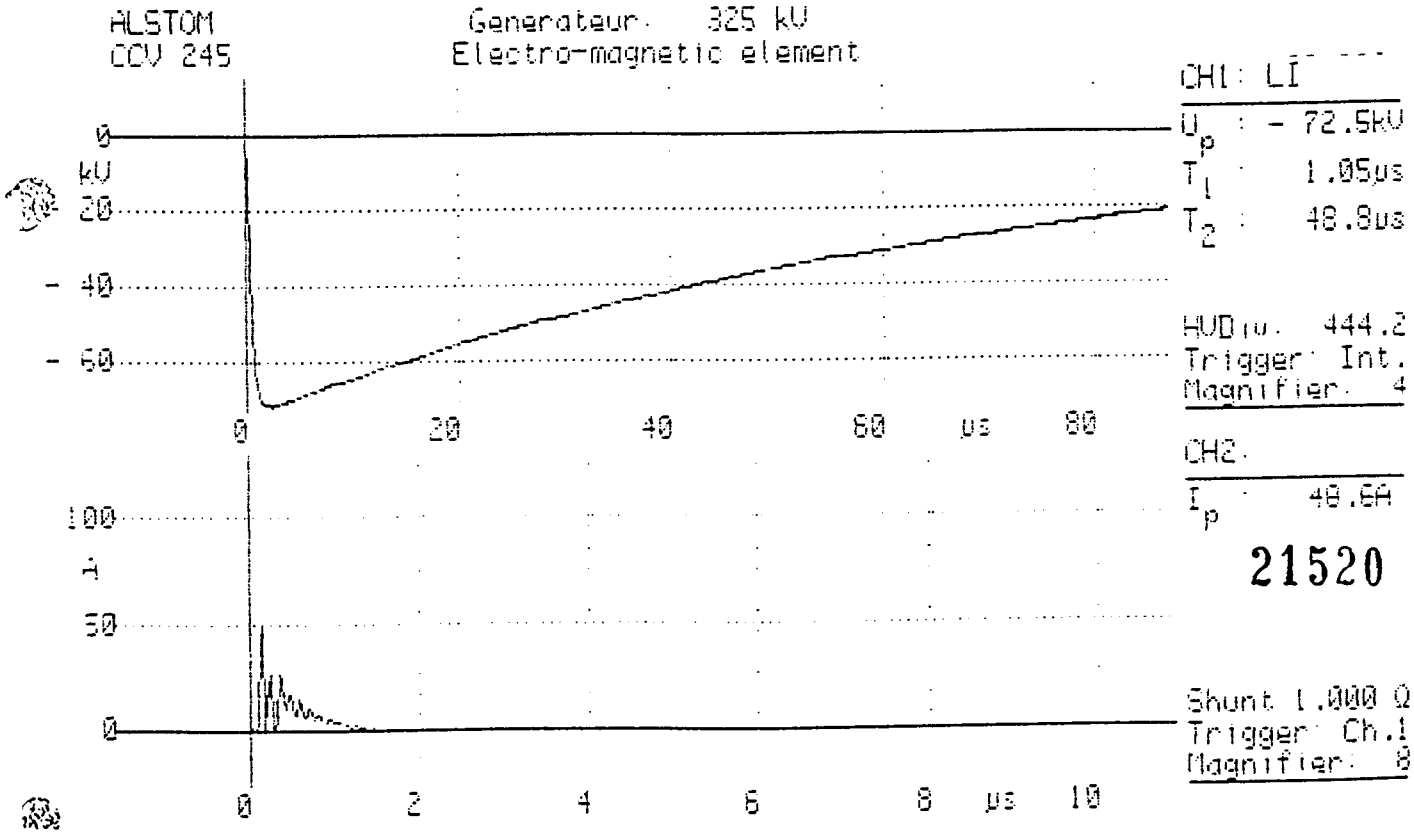

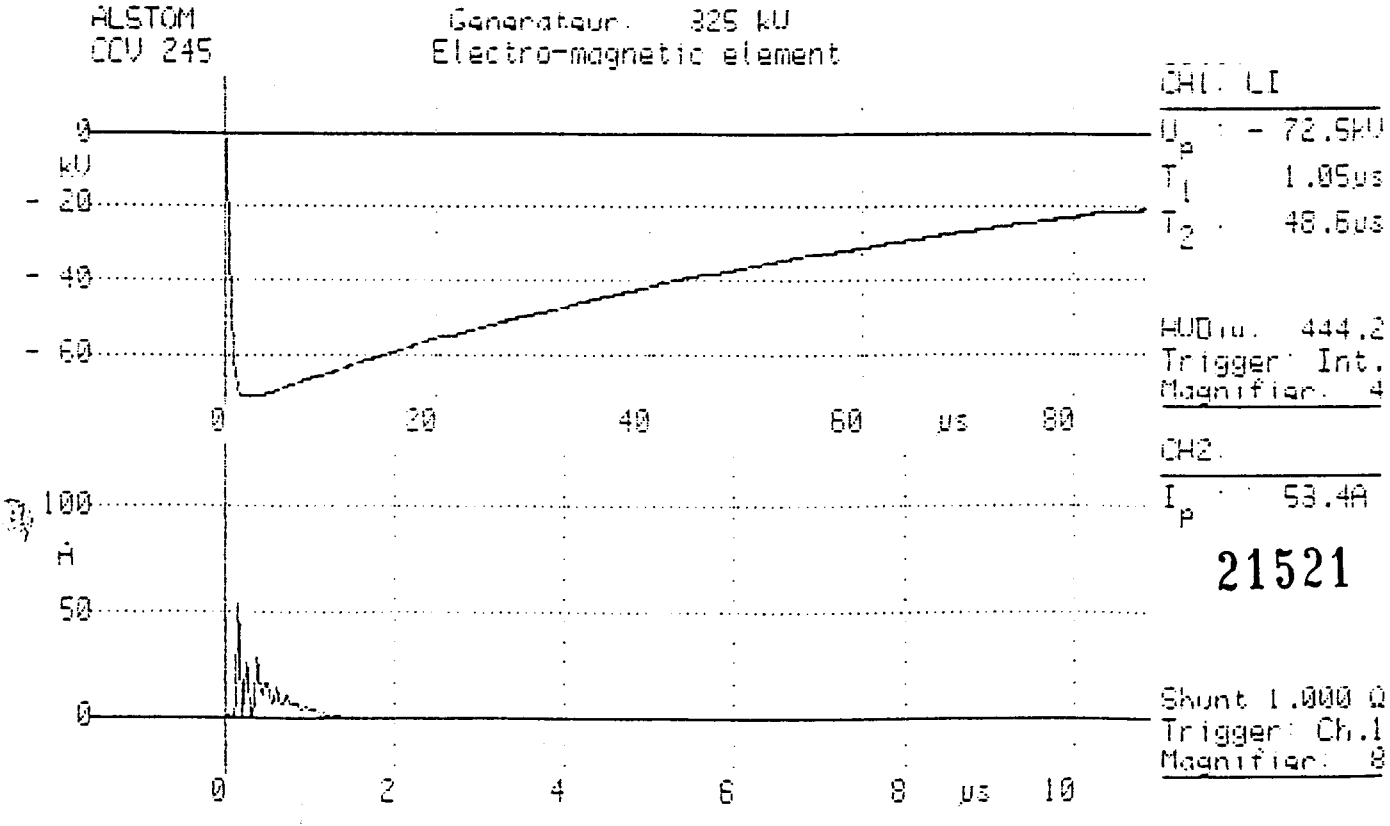

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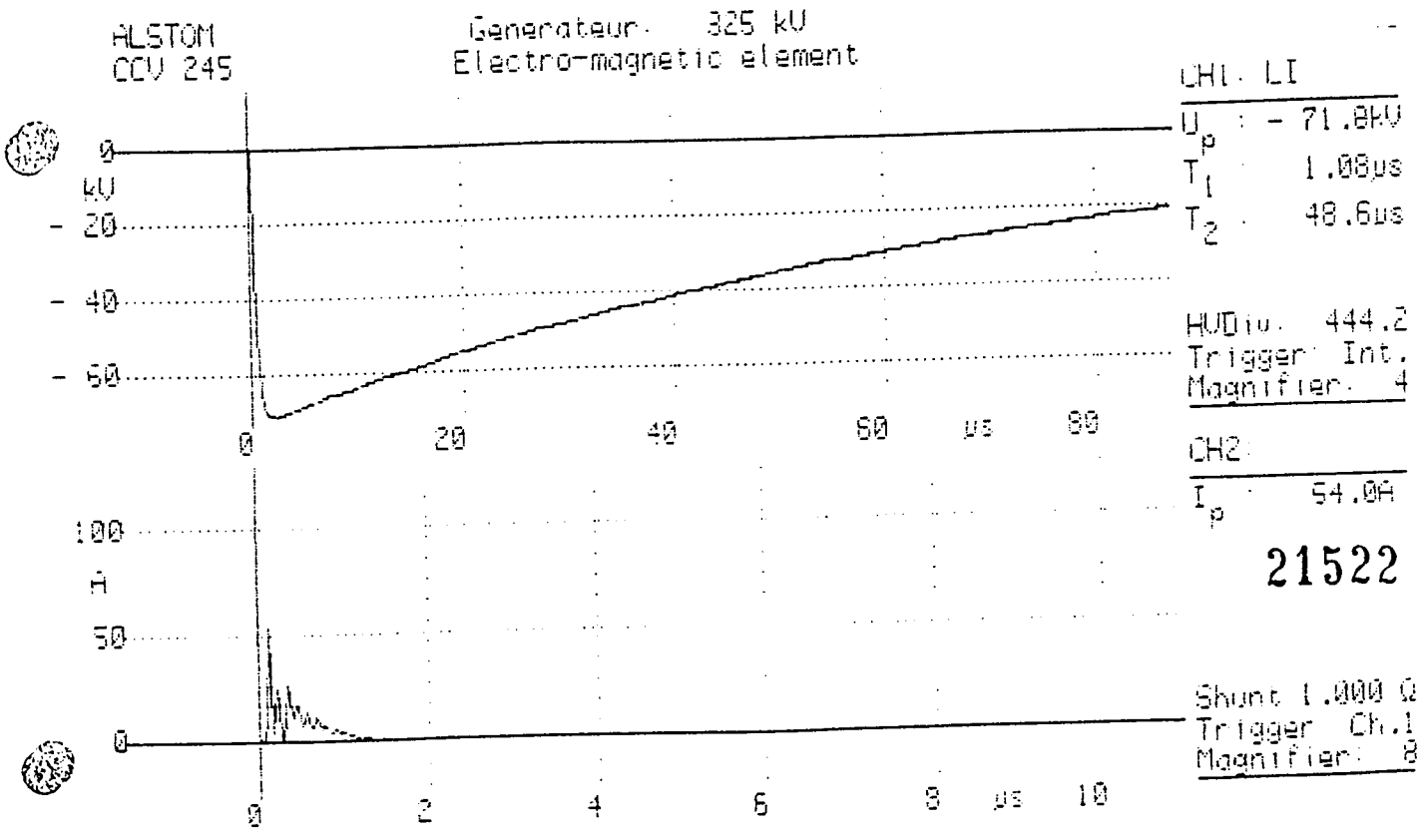

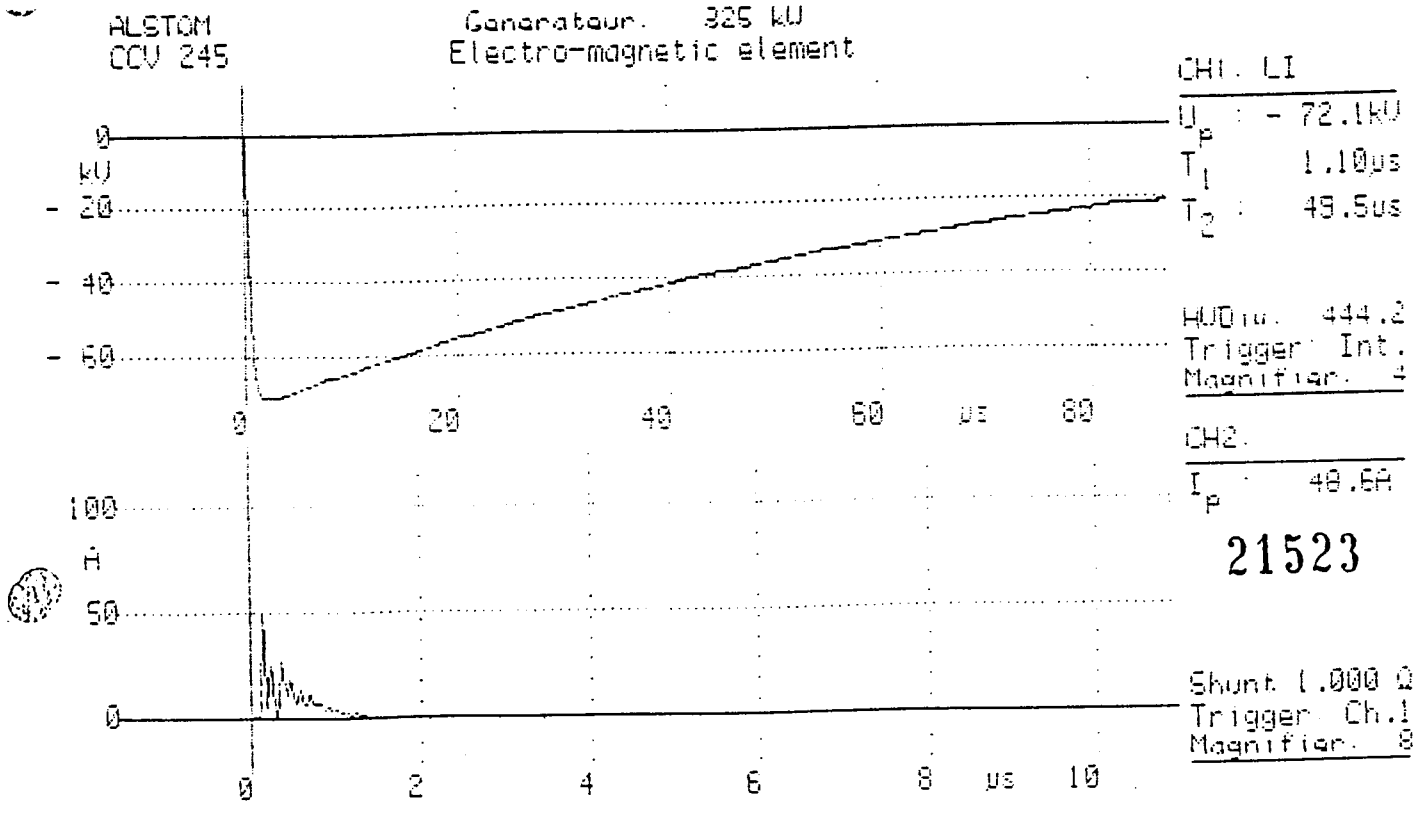

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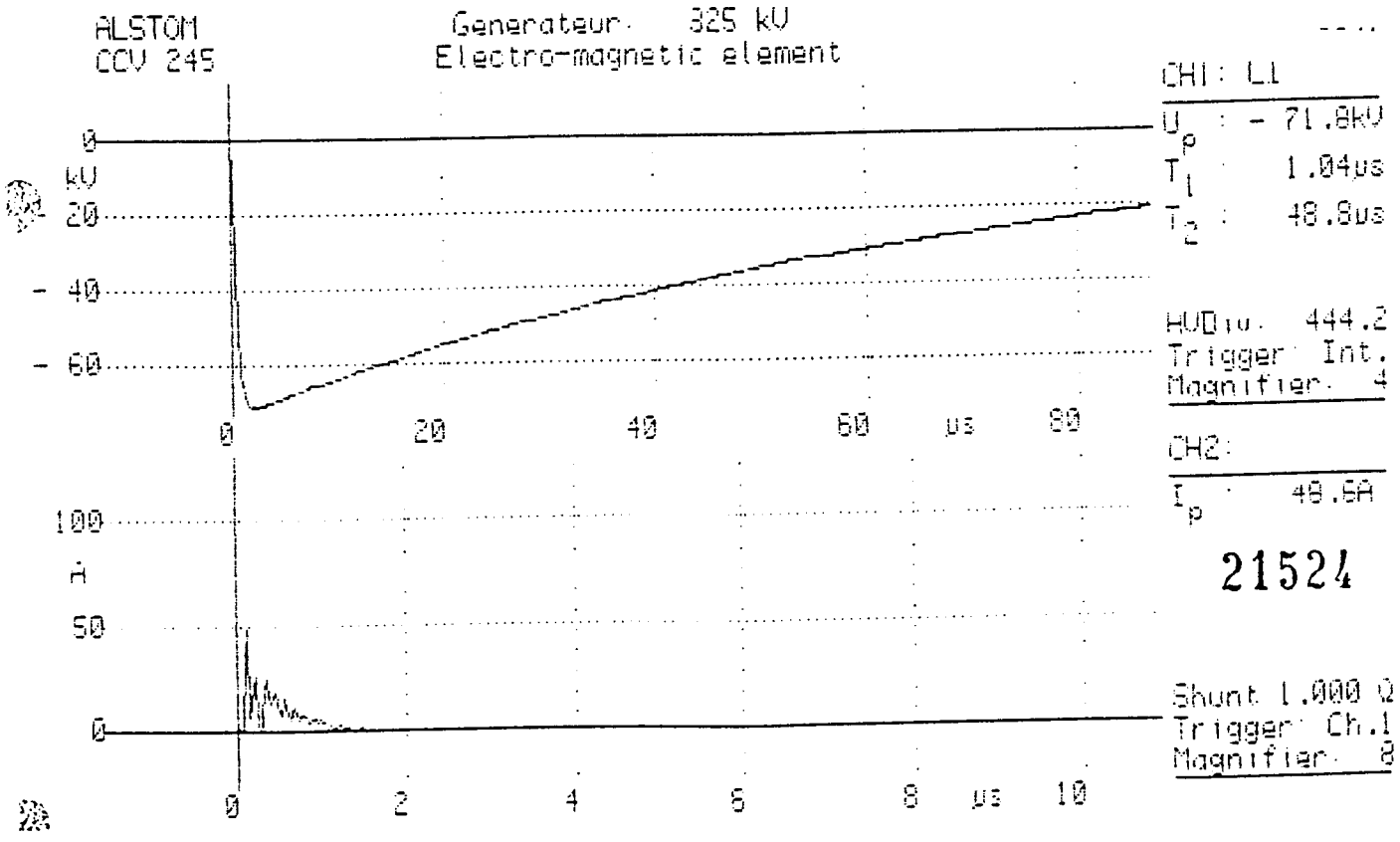

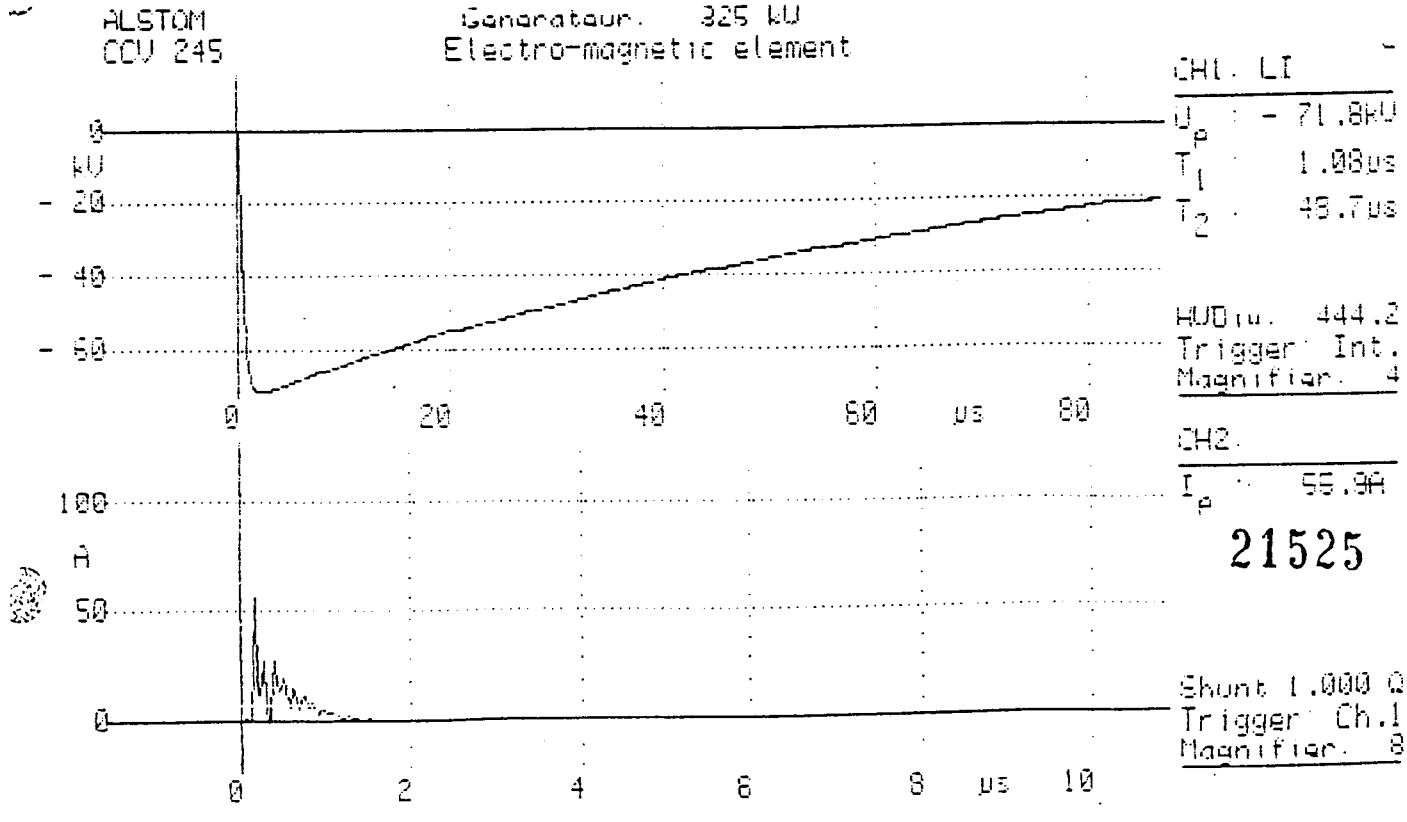

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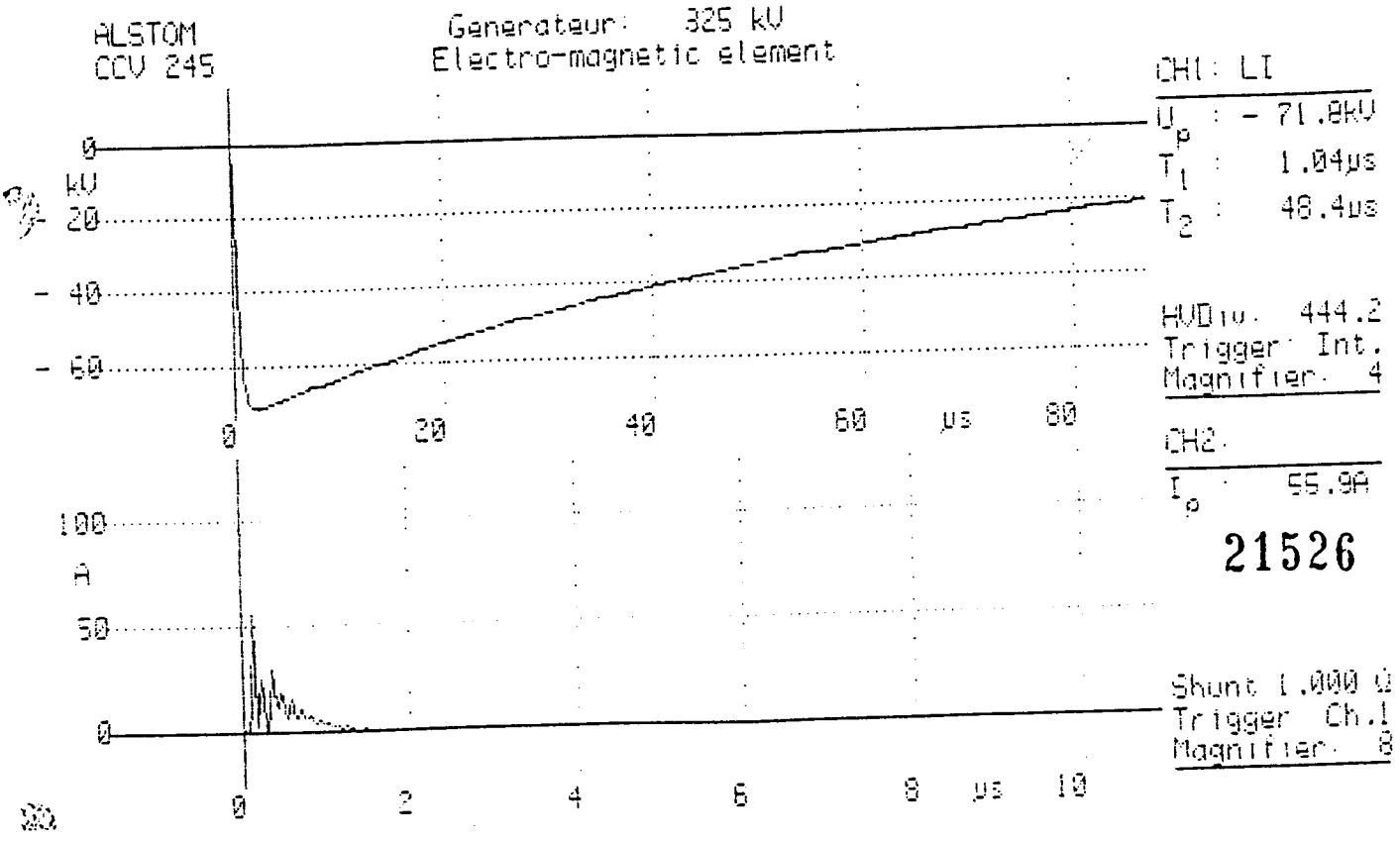

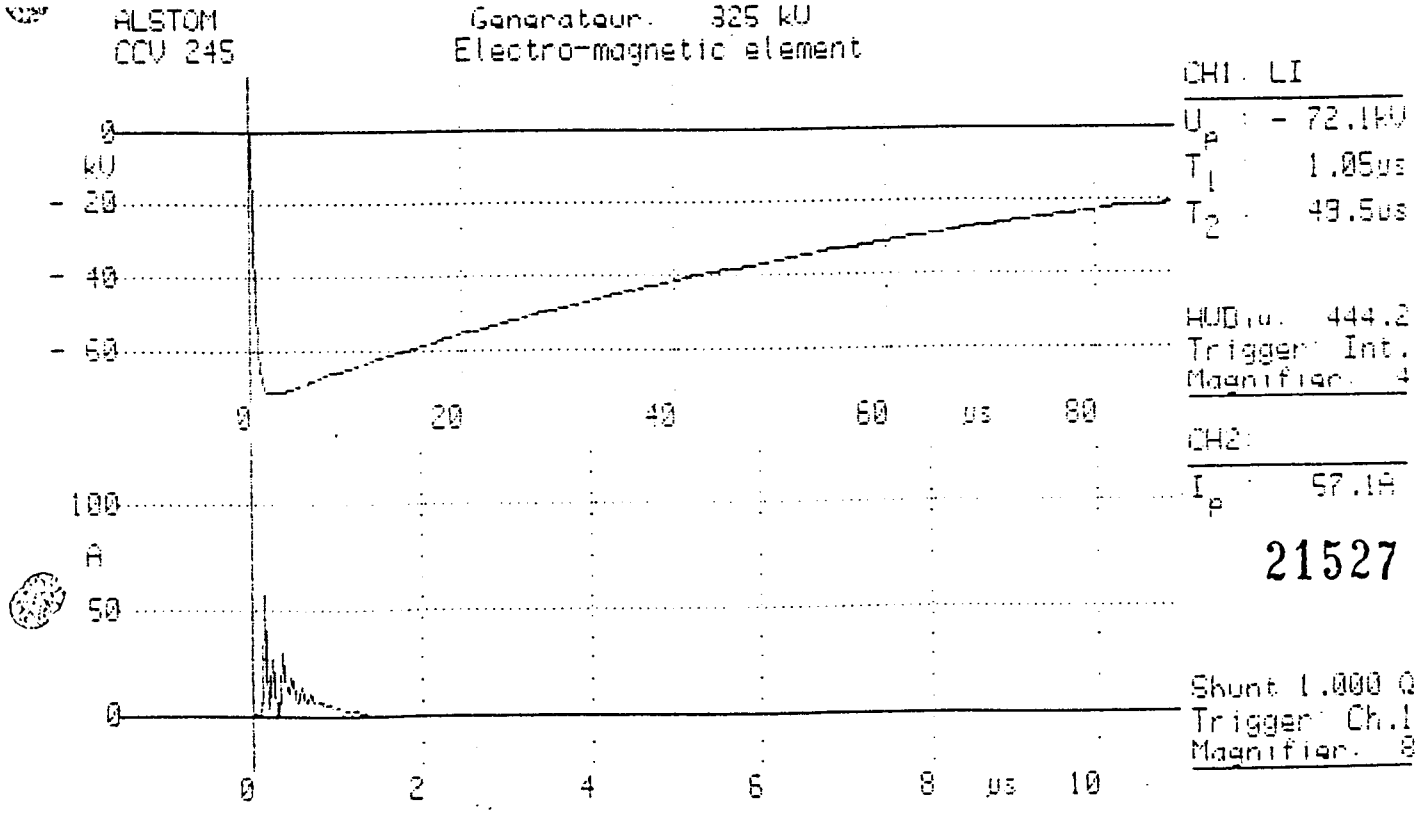

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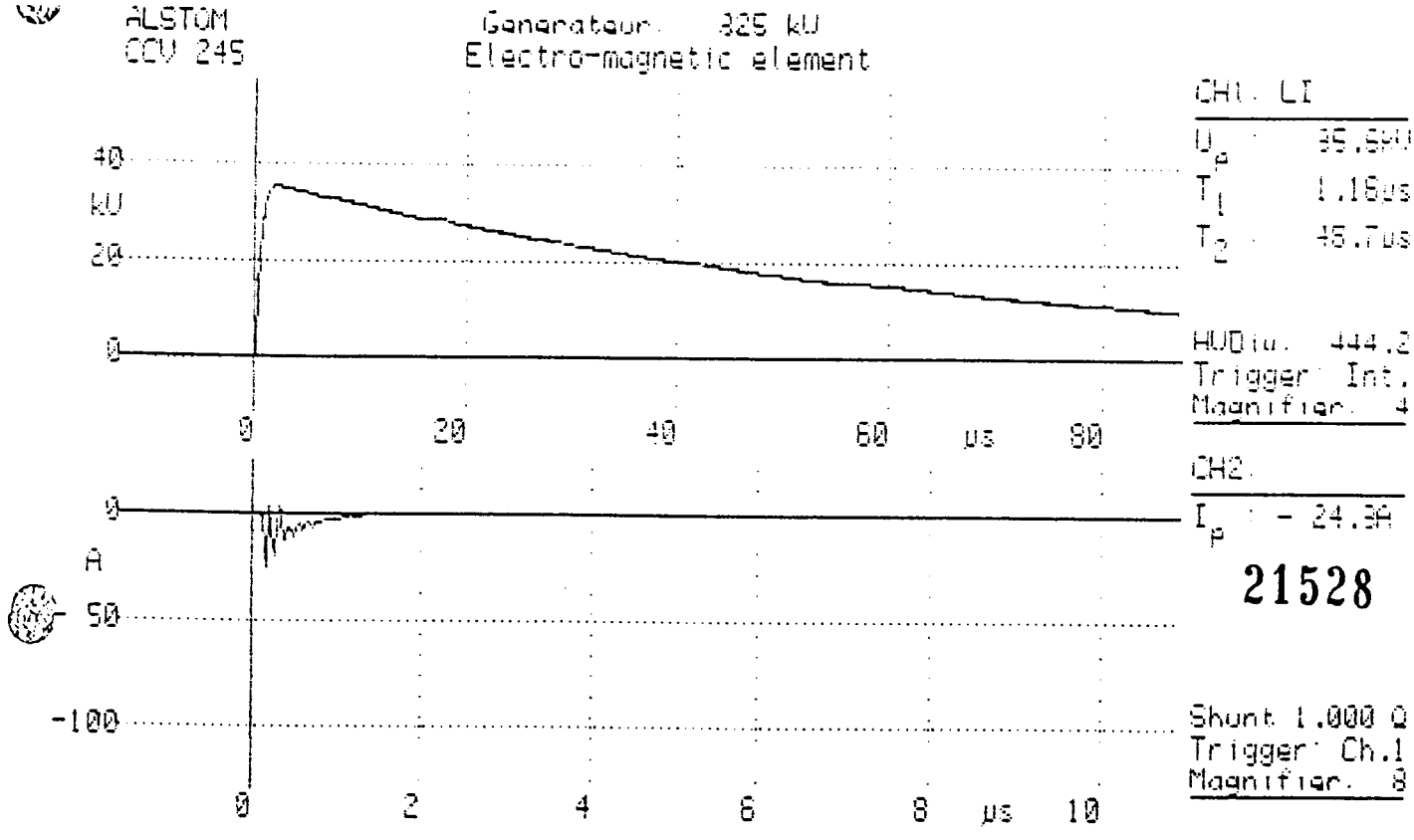

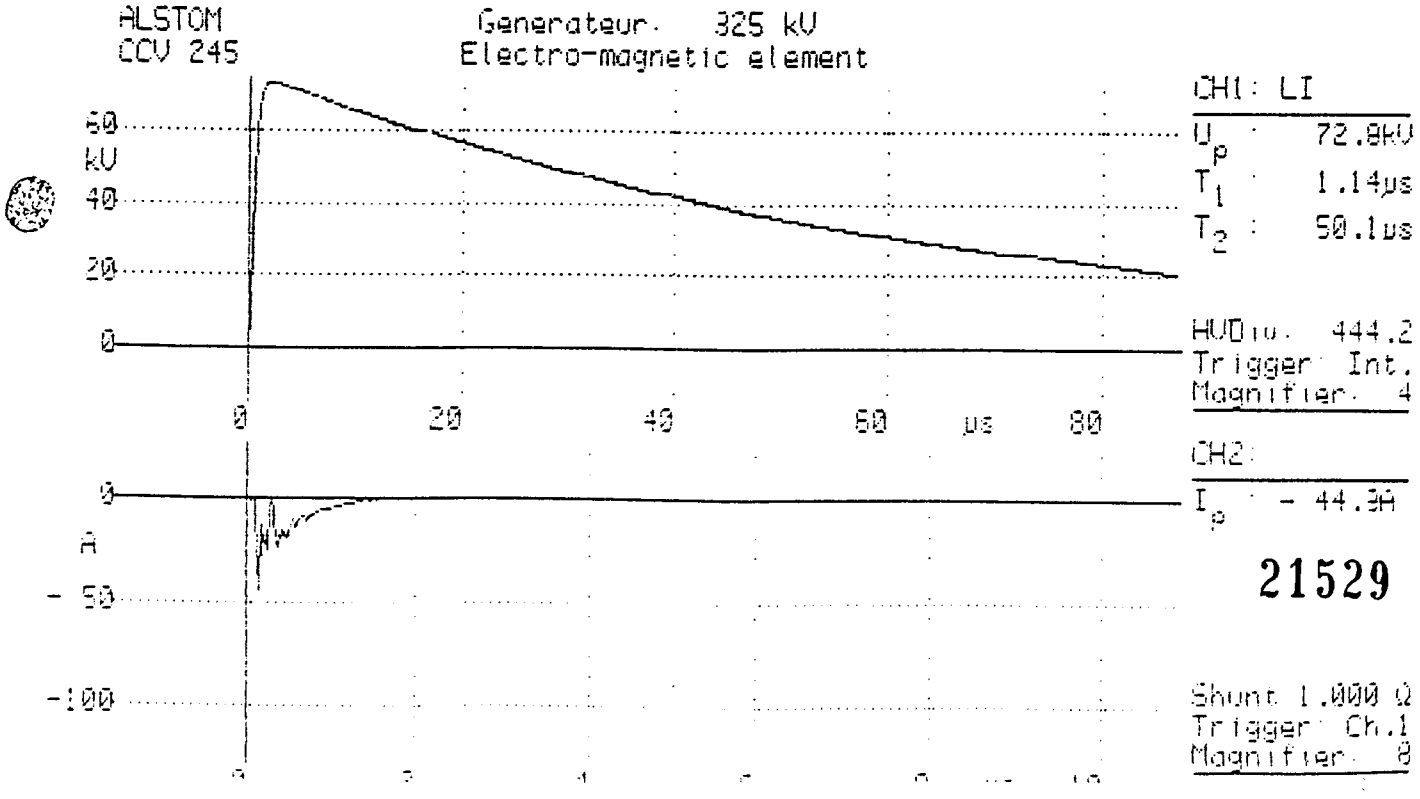

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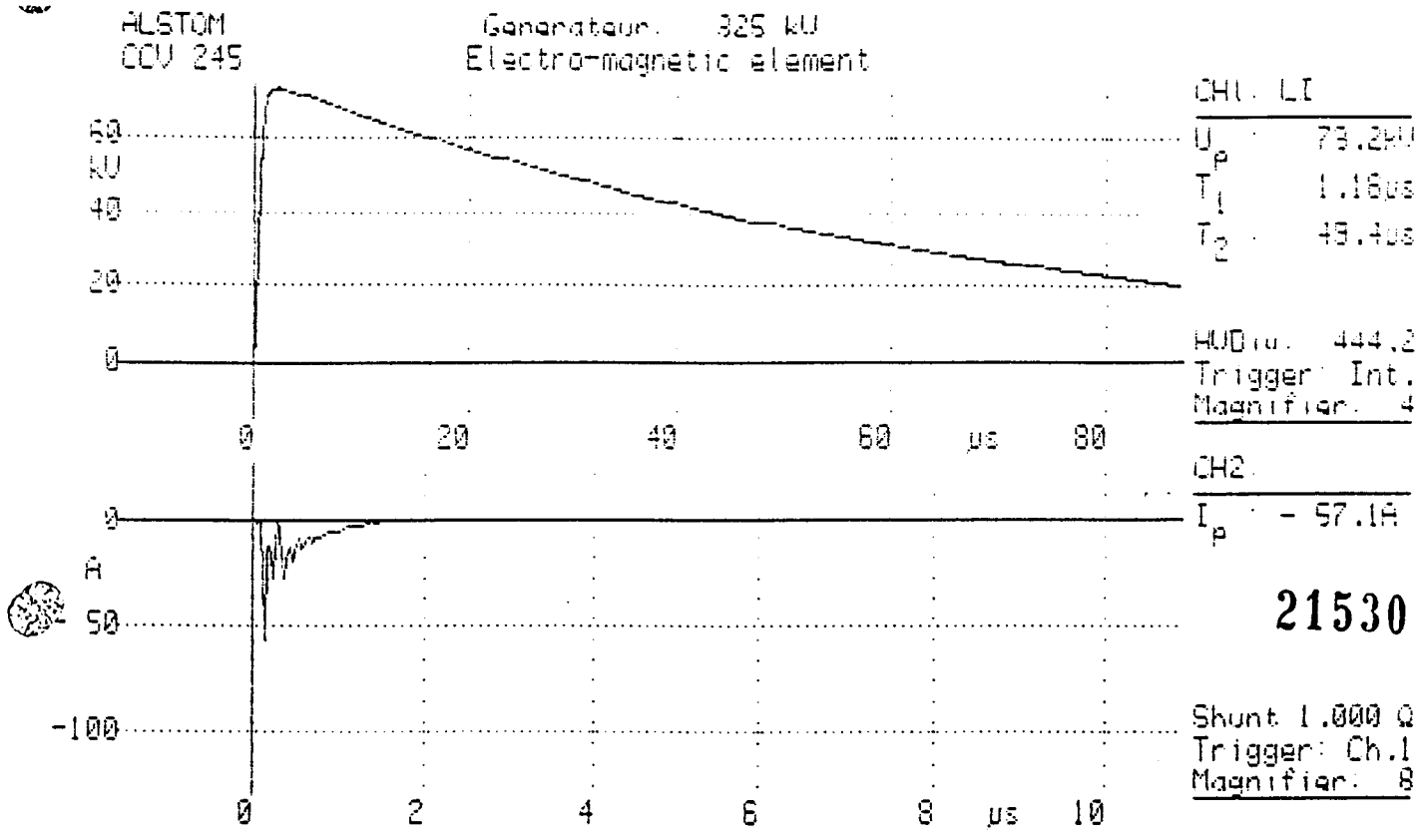

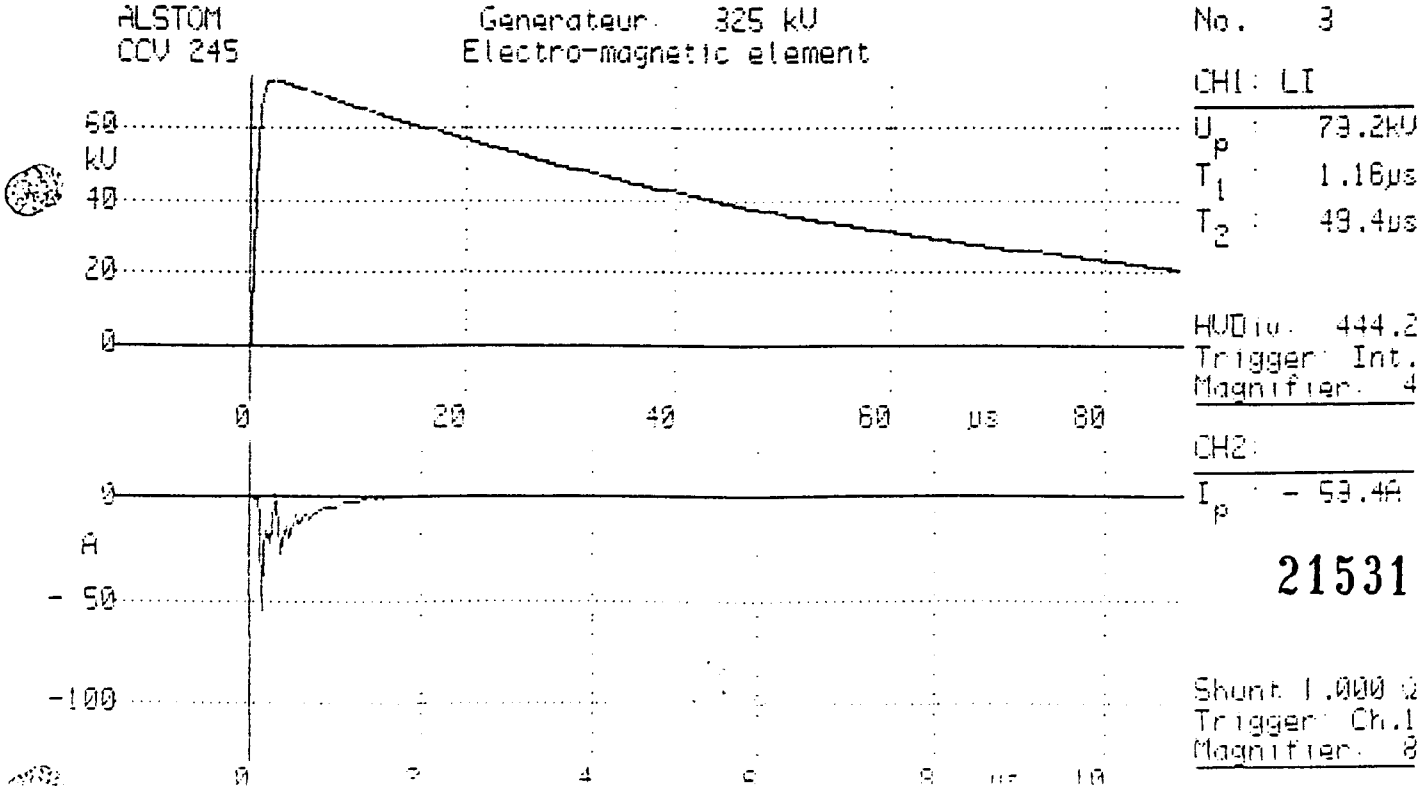

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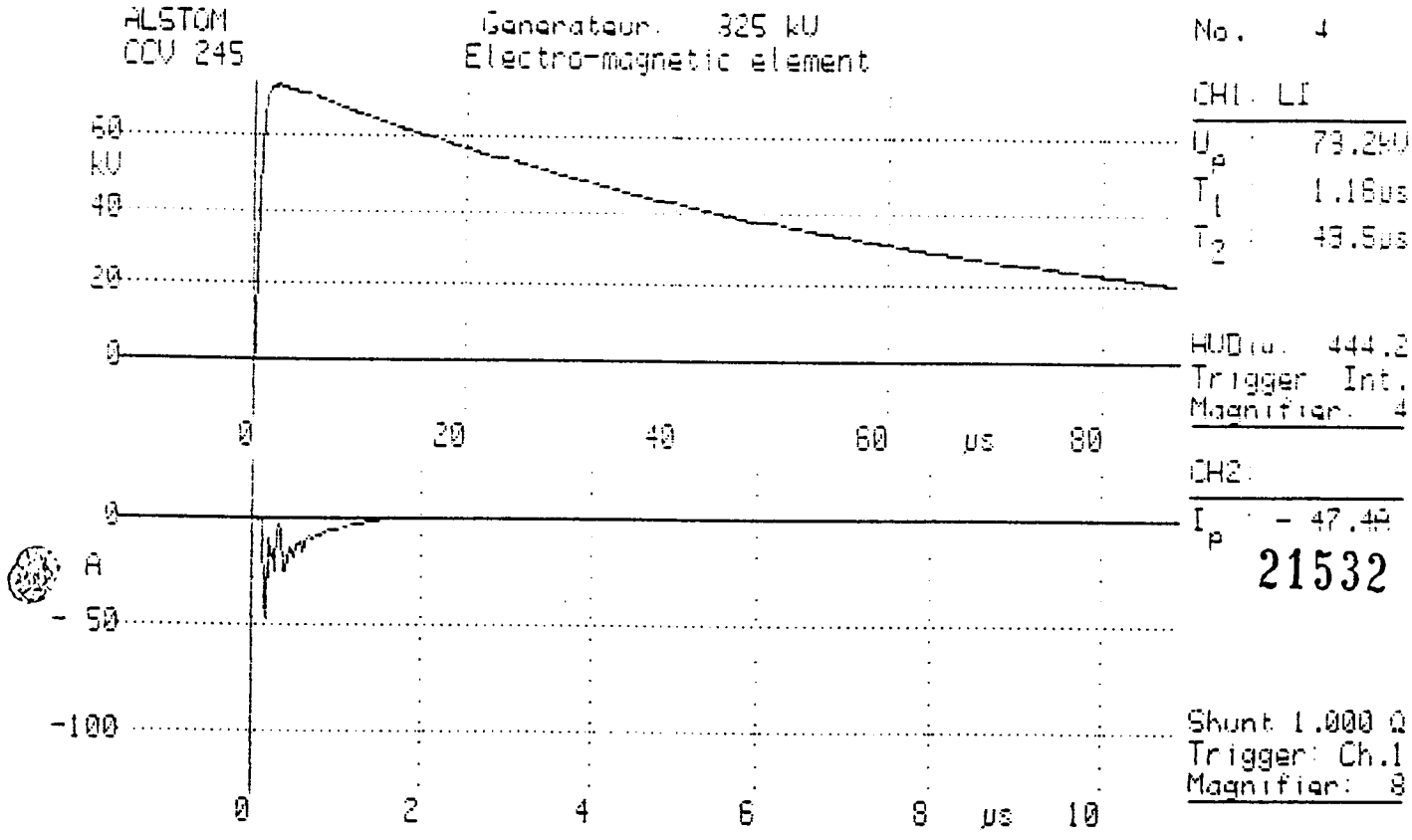

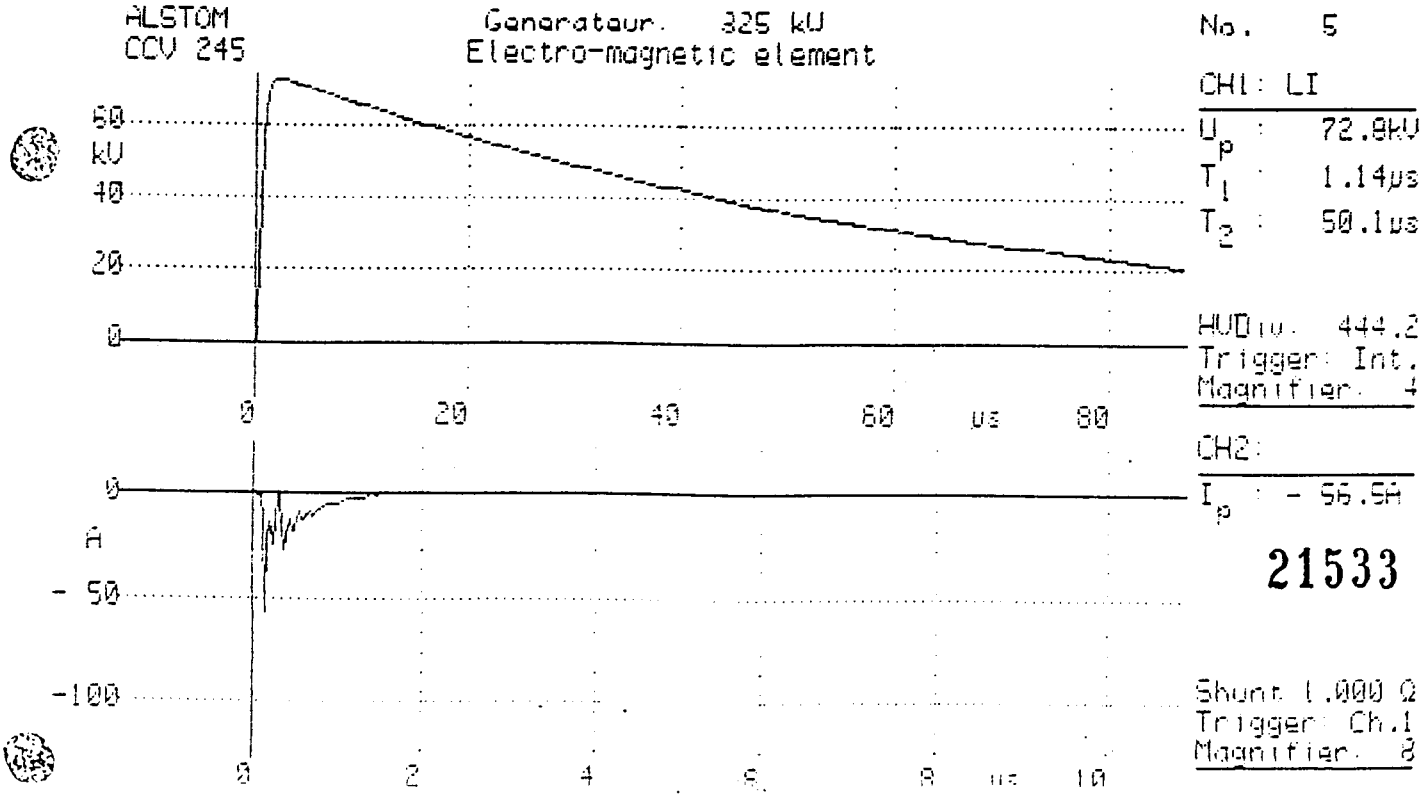

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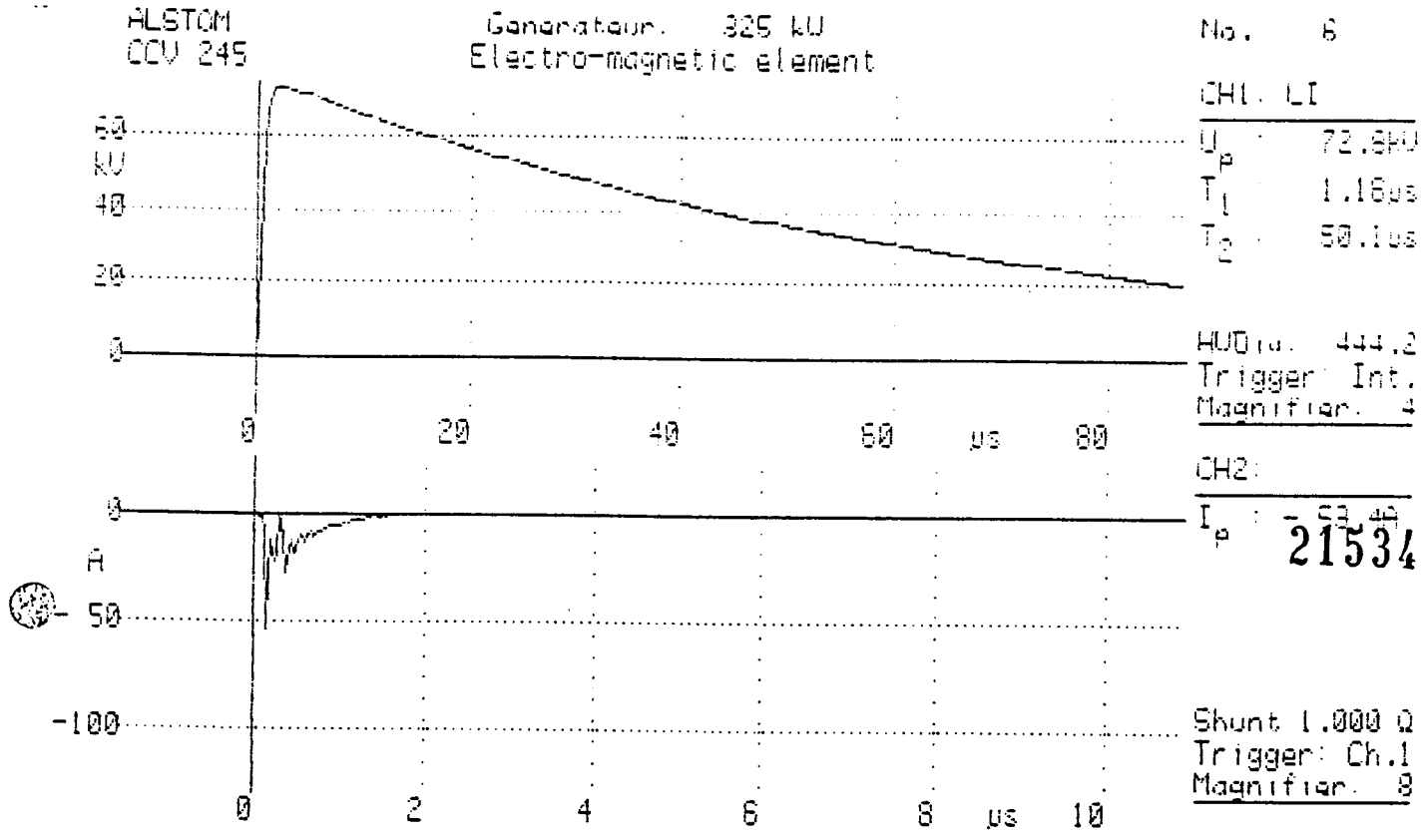

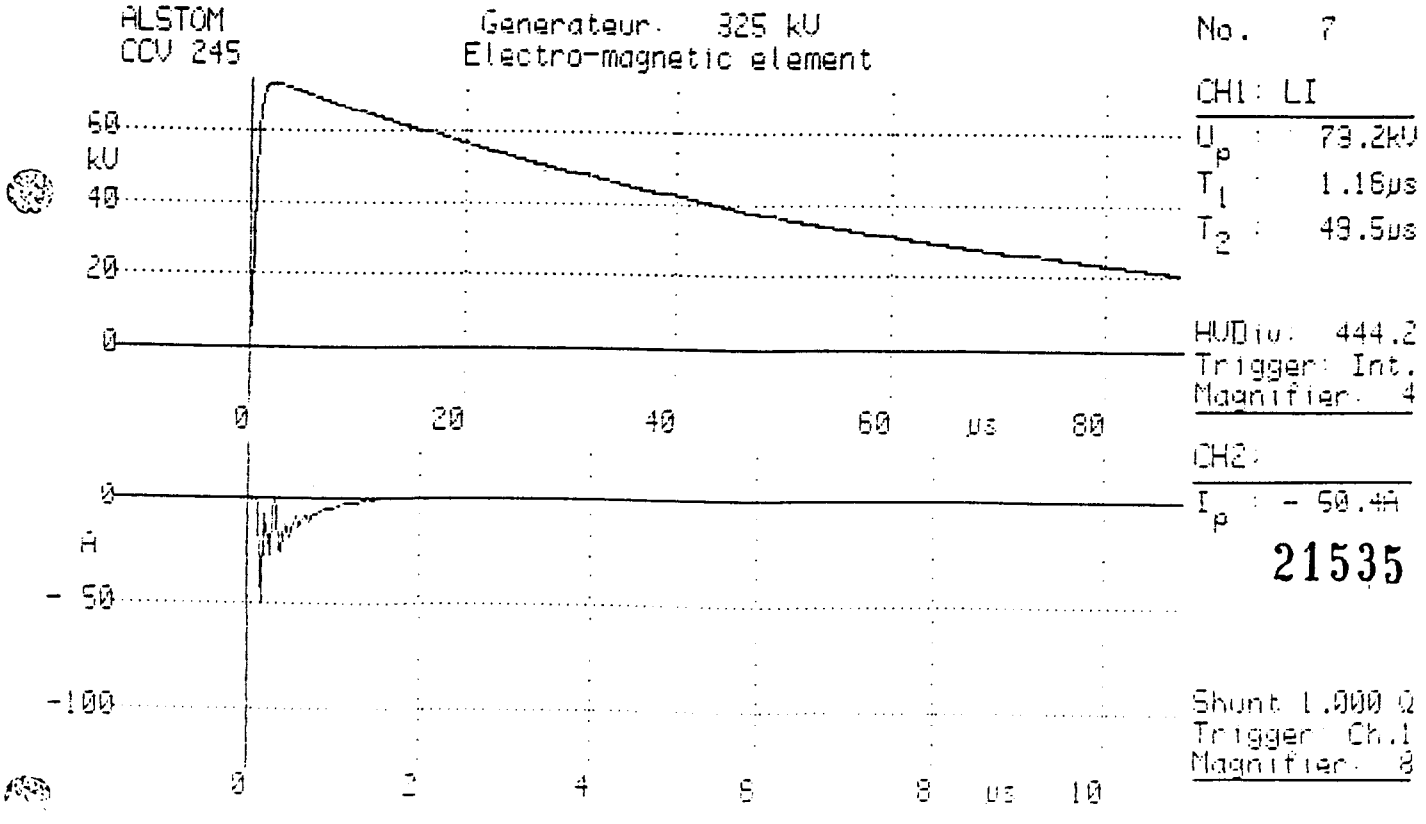

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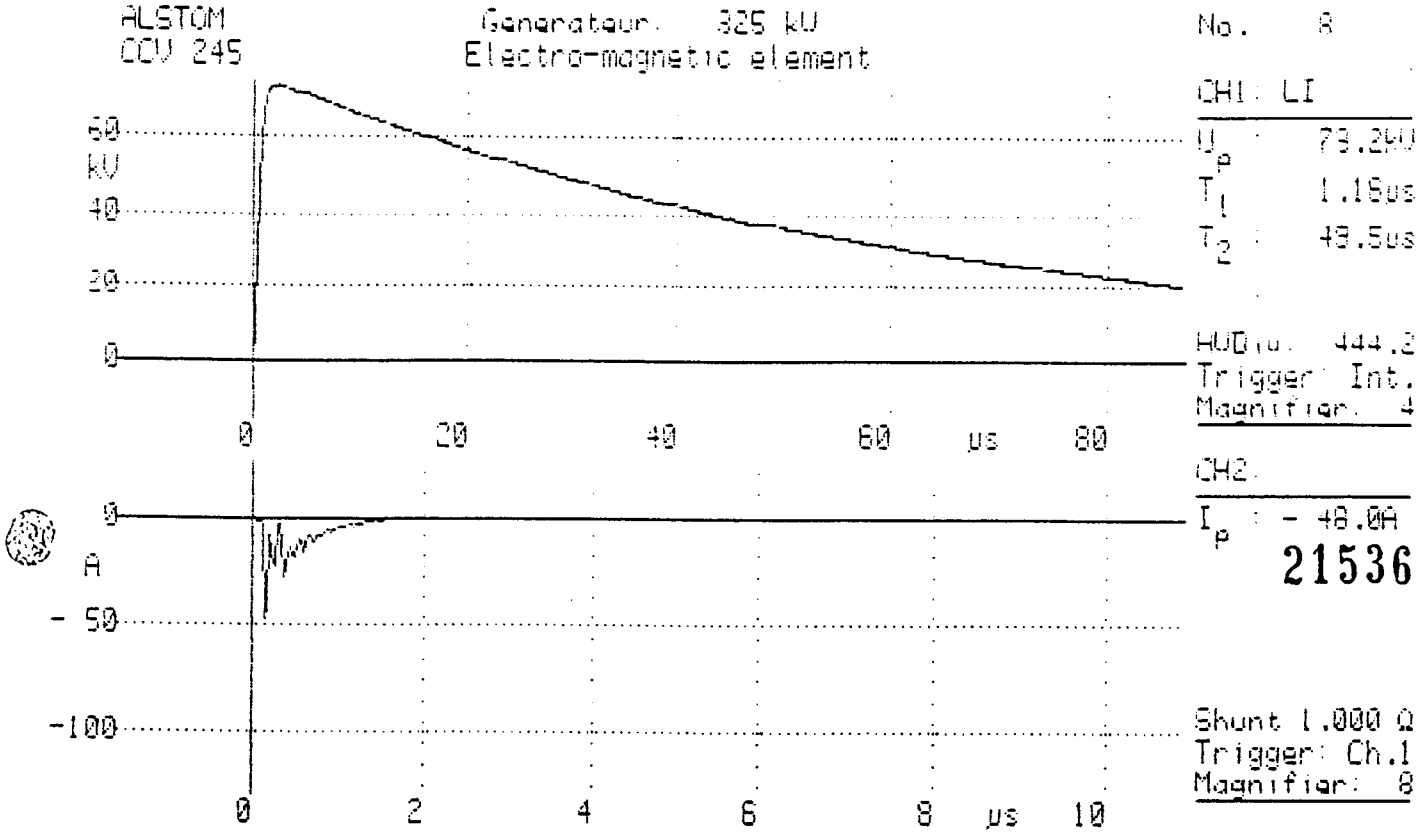
au capital de 14 000 000 F
Siège social : 51, avenue Jean Jaurès
BP 380 92541 Montrouge Cedex France
343 074 092 RCS Nanterre
APE 311 A - TVA FR 05 343 074 092

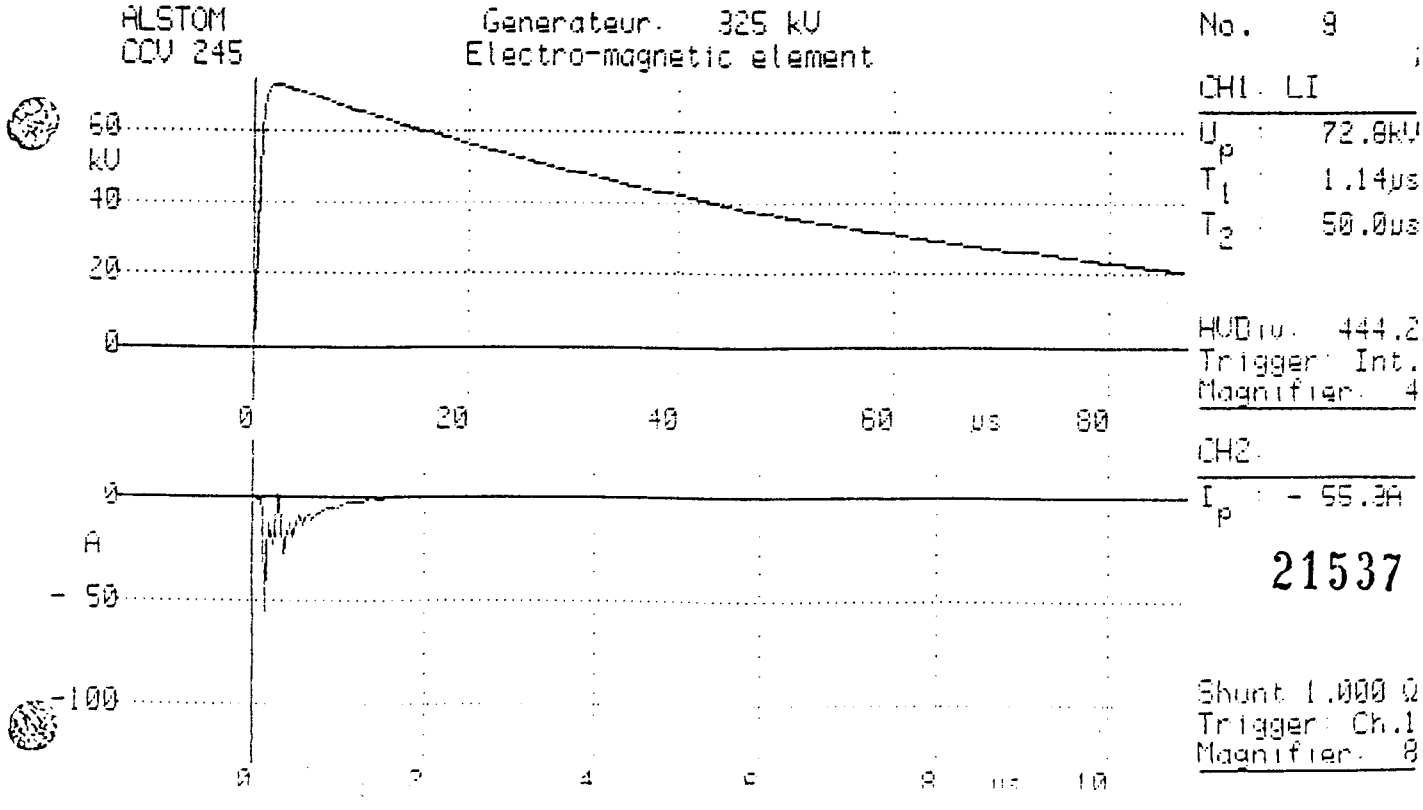
ALSTOM

CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

Electromagnetic unit lightning impulse test - CCV 245

N° : XE 91200 -01





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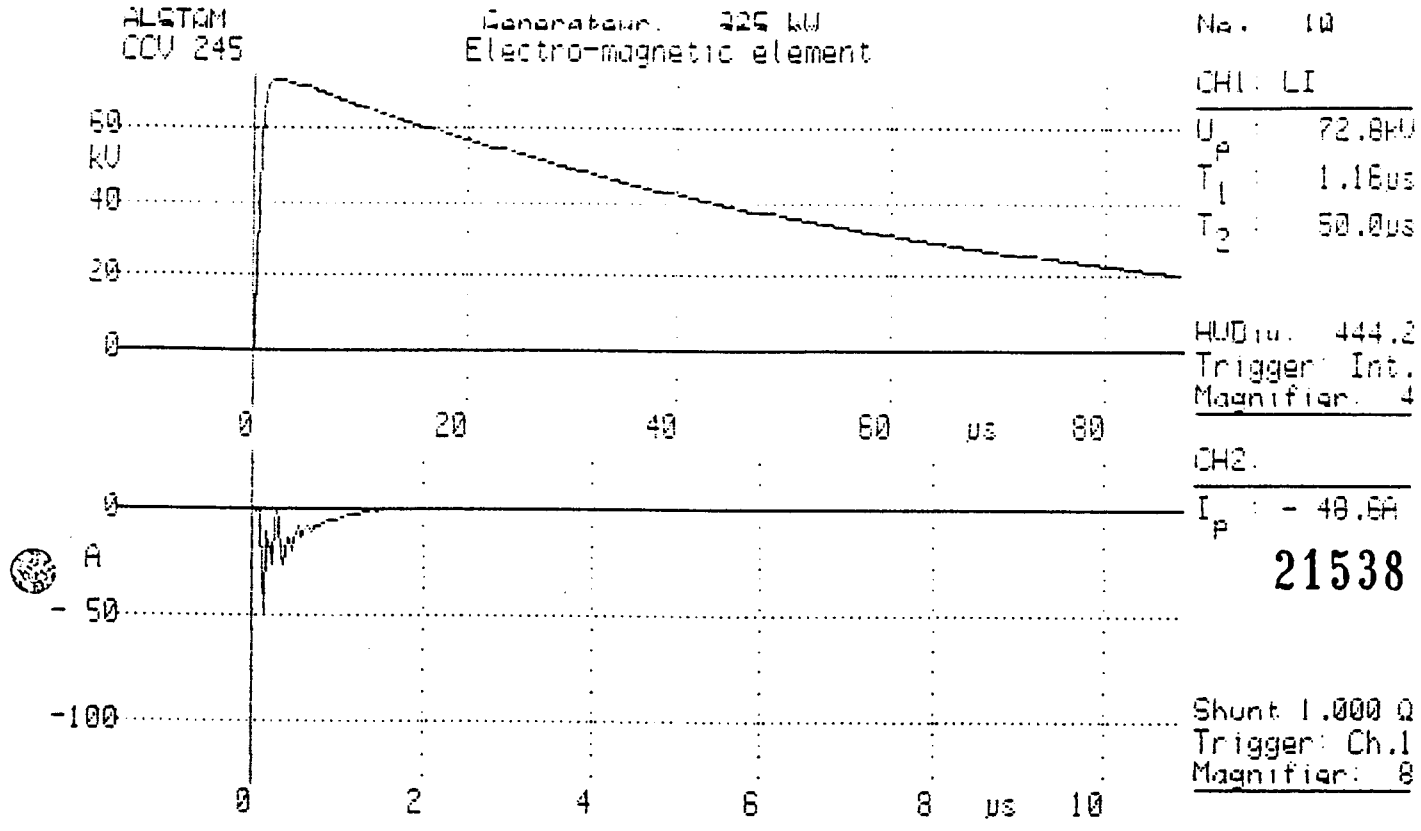
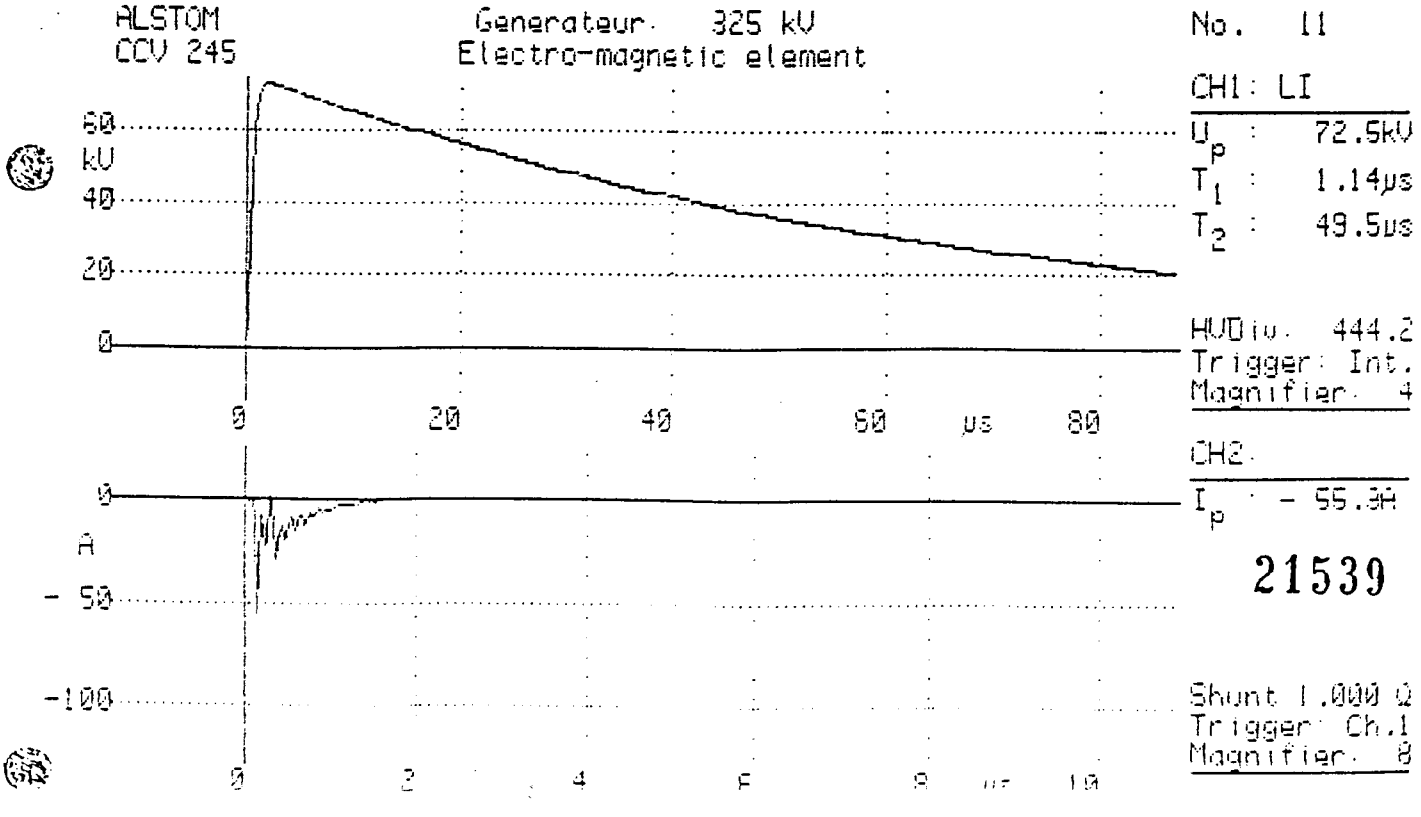
PROTOCOLO DE PRUEBAS N° :

Electromagnetic unit lightning impulse test - CCV 245

N° : XE 91200 -01





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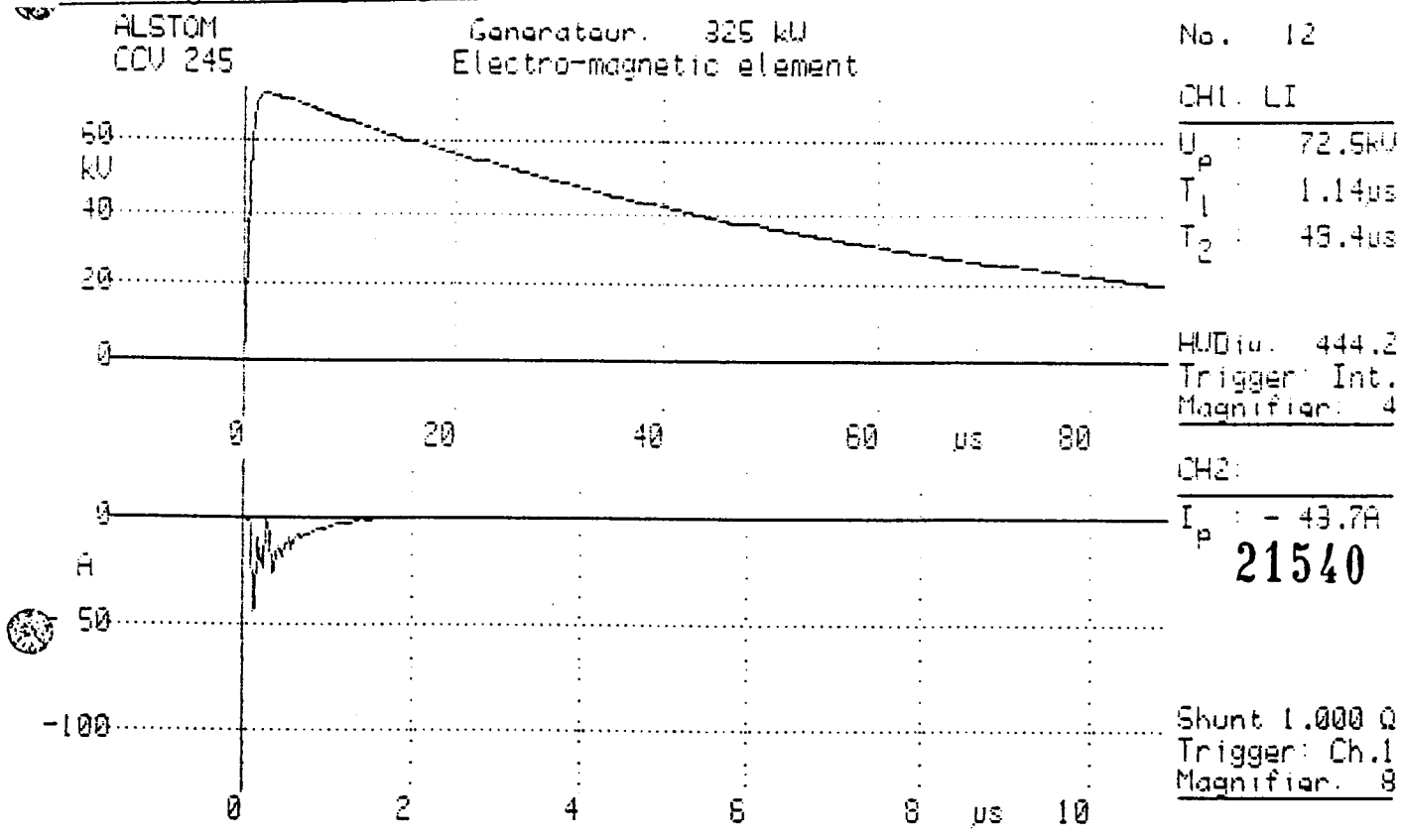
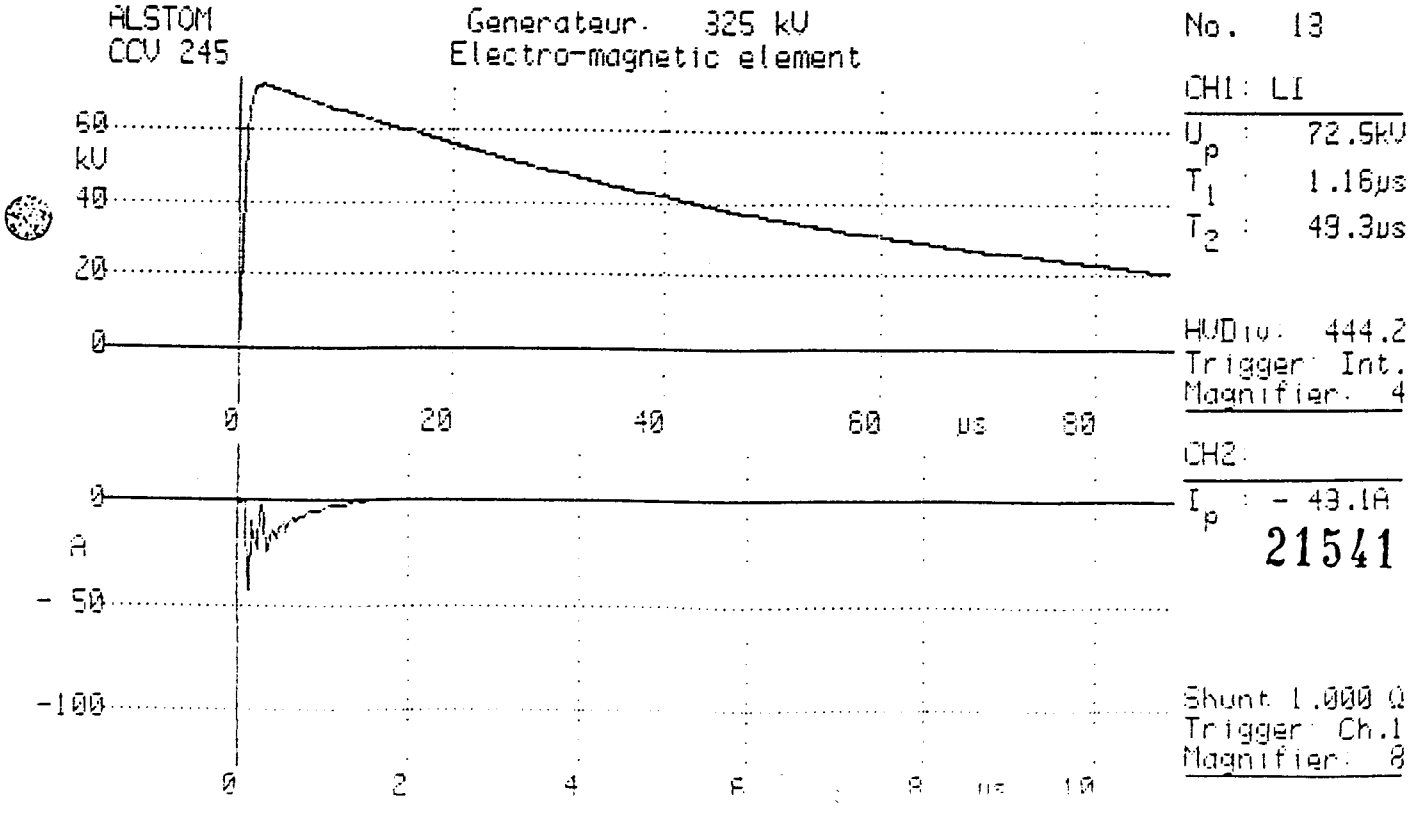
Electromagnetic unit lightning impulse test - CCV 245 N° : XE 91200 -01





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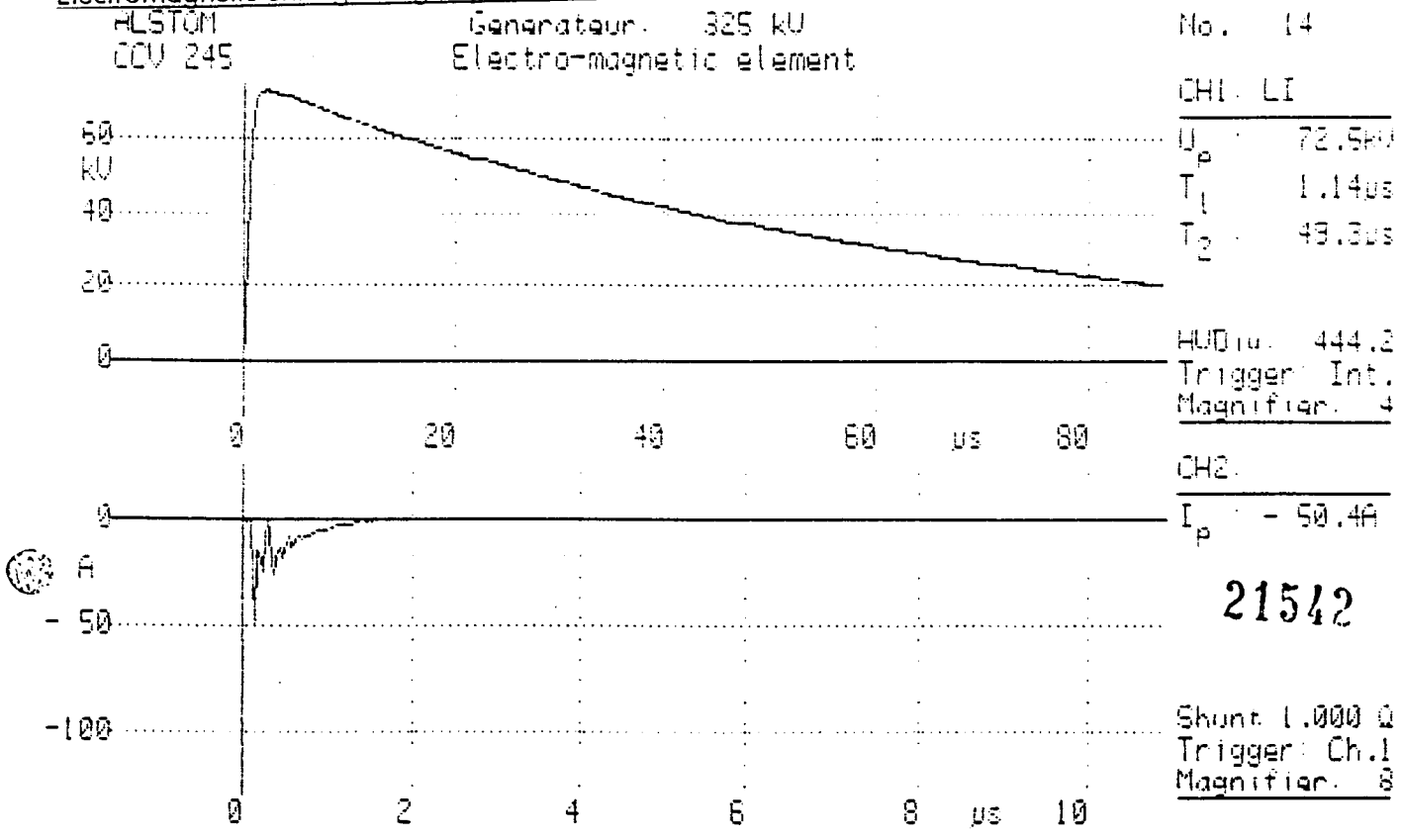
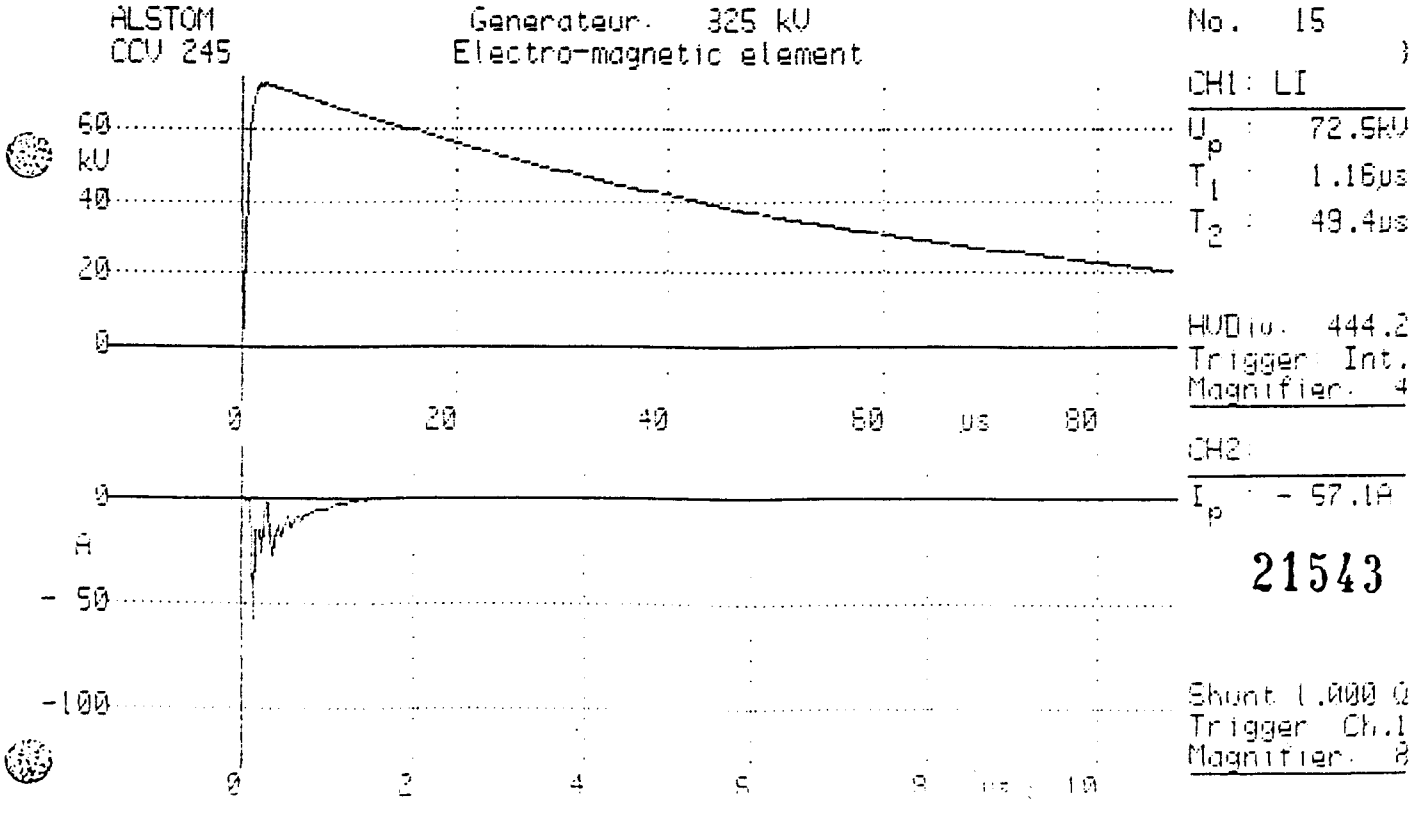
PROTOCOLO DE PRUEBAS N° :

Electromagnetic unit lightning impulse test - CCV 245

N° : XE 91200 -01





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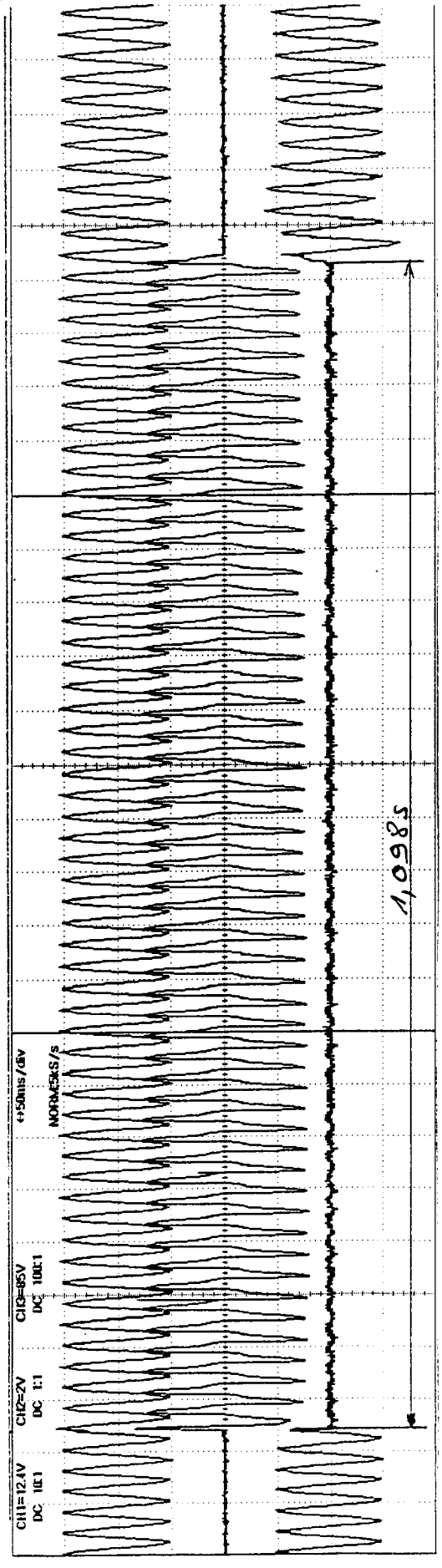
SHORT-CIRCUIT WITHSTAND CAPABILITY TEST
CCV 245
N°: Xe 91200-01
Secondary winding : 1a – 1n



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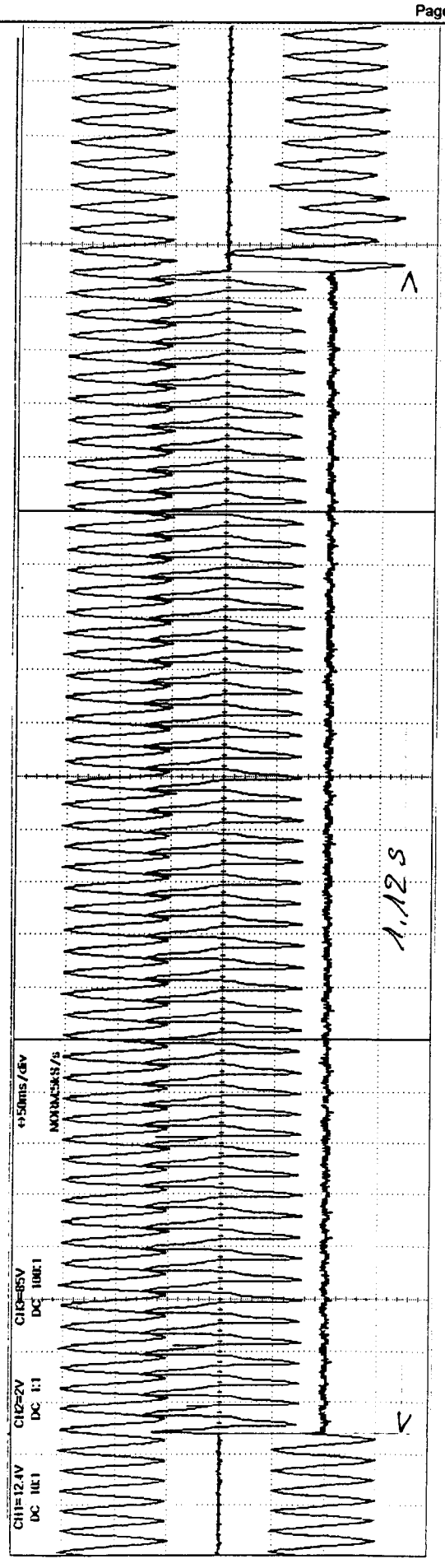
CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

SHORT-CIRCUIT WITHSTAND CAPABILITY TEST
CCV 245
N°: XE 91200-01
Secondary winding : 2a – 2n



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CERTIFICAT D'ESSAI N° :
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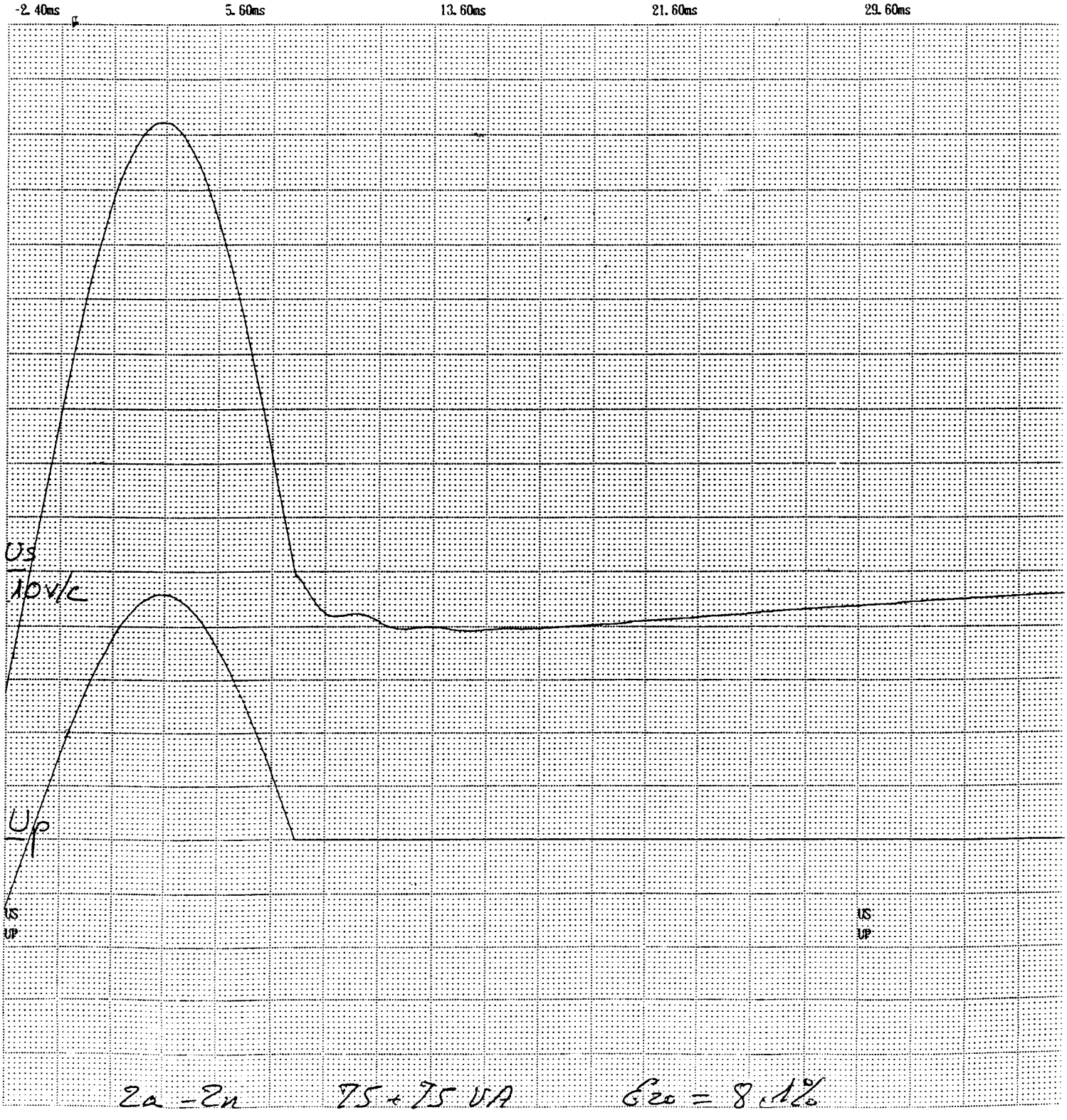
PROTOCOLO DE PRUEBAS N° : **25877**

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Zero voltage	Burden: 75 VA+75 VA	Error at 20 ms: 8.1 %



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CERTIFICAT D'ESSAI N° :
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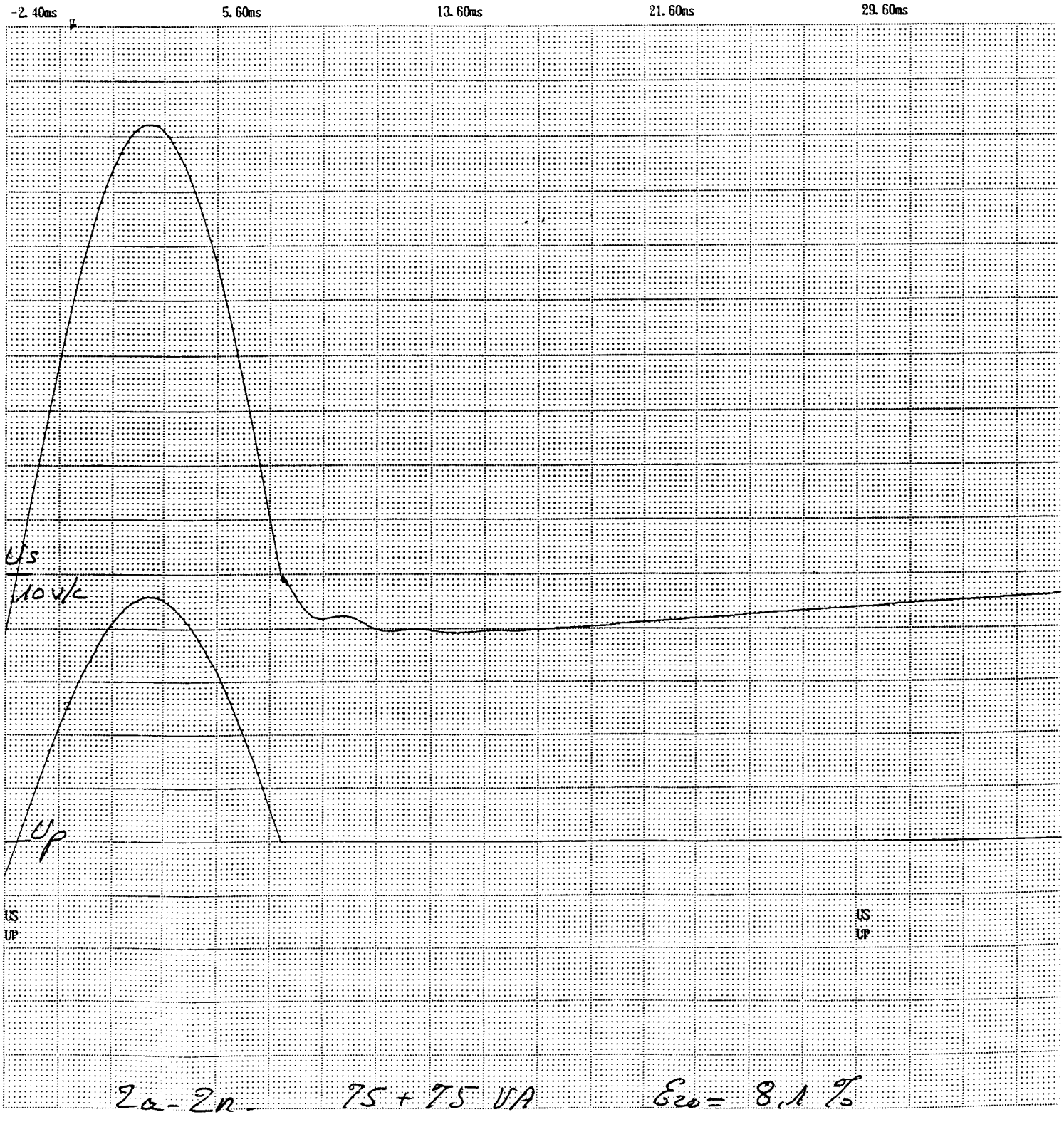
TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Zero voltage	Burden: 75 VA+75 VA	Error at 20 ms: 8.1 %



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CERTIFICAT D'ESSAI N° :
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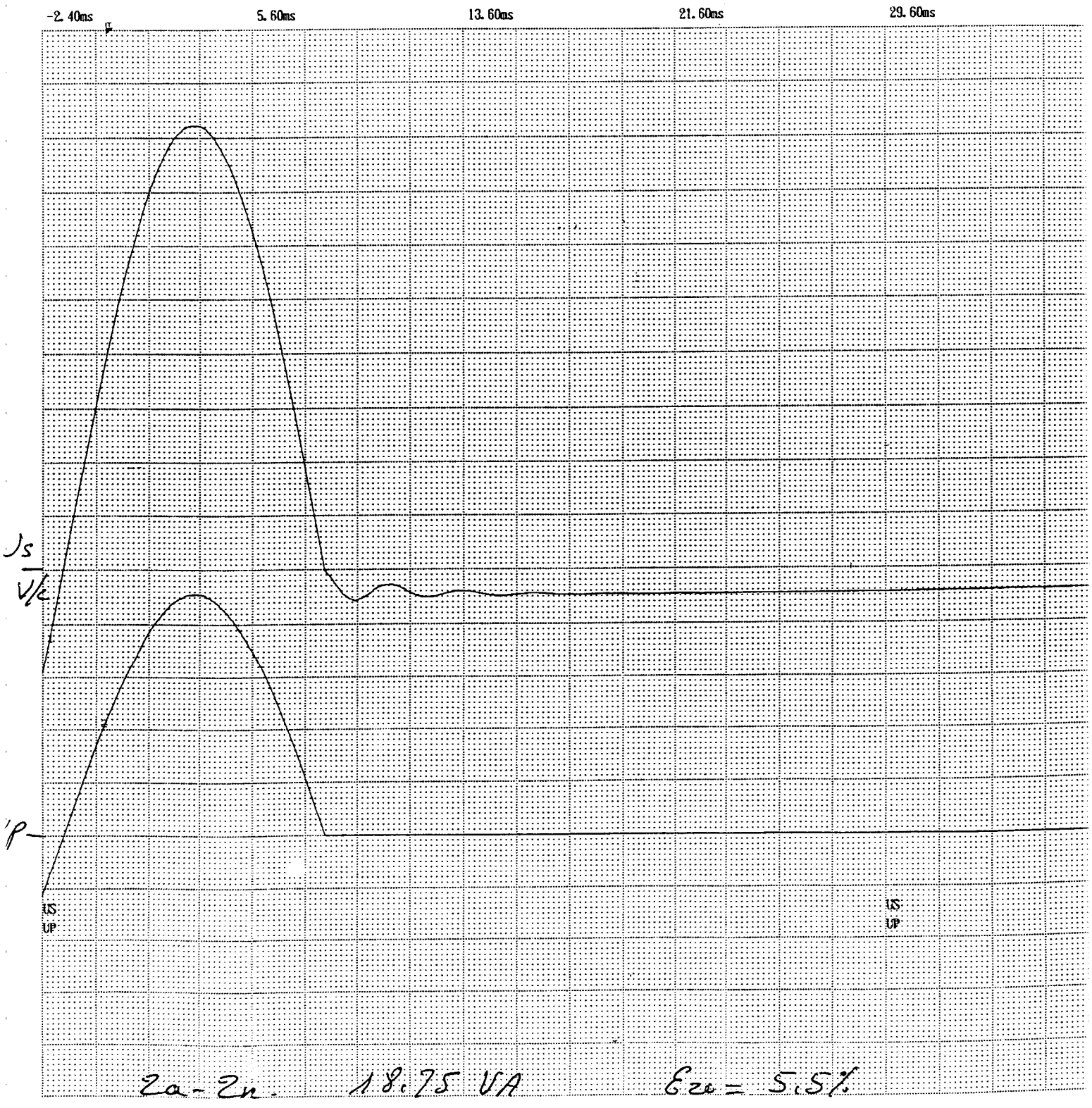
PROTOCOLO DE PRUEBAS N° : **25877**

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Zero voltage	Burden: 18.75 VA	Error at 20 ms: 5.5 %



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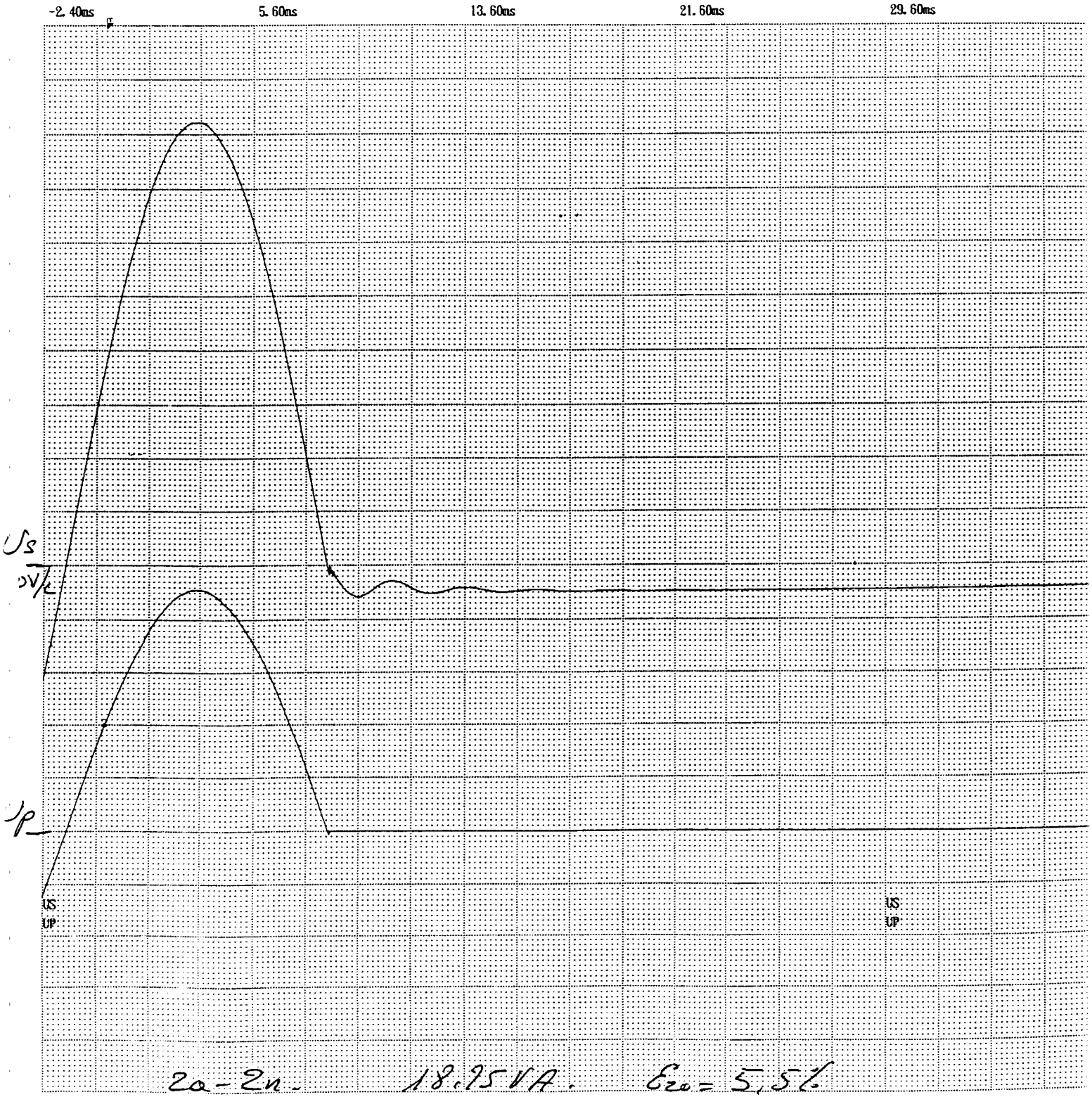
TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Zero voltage	Burden: 18.75 VA	Error at 20 ms: 5.5 %



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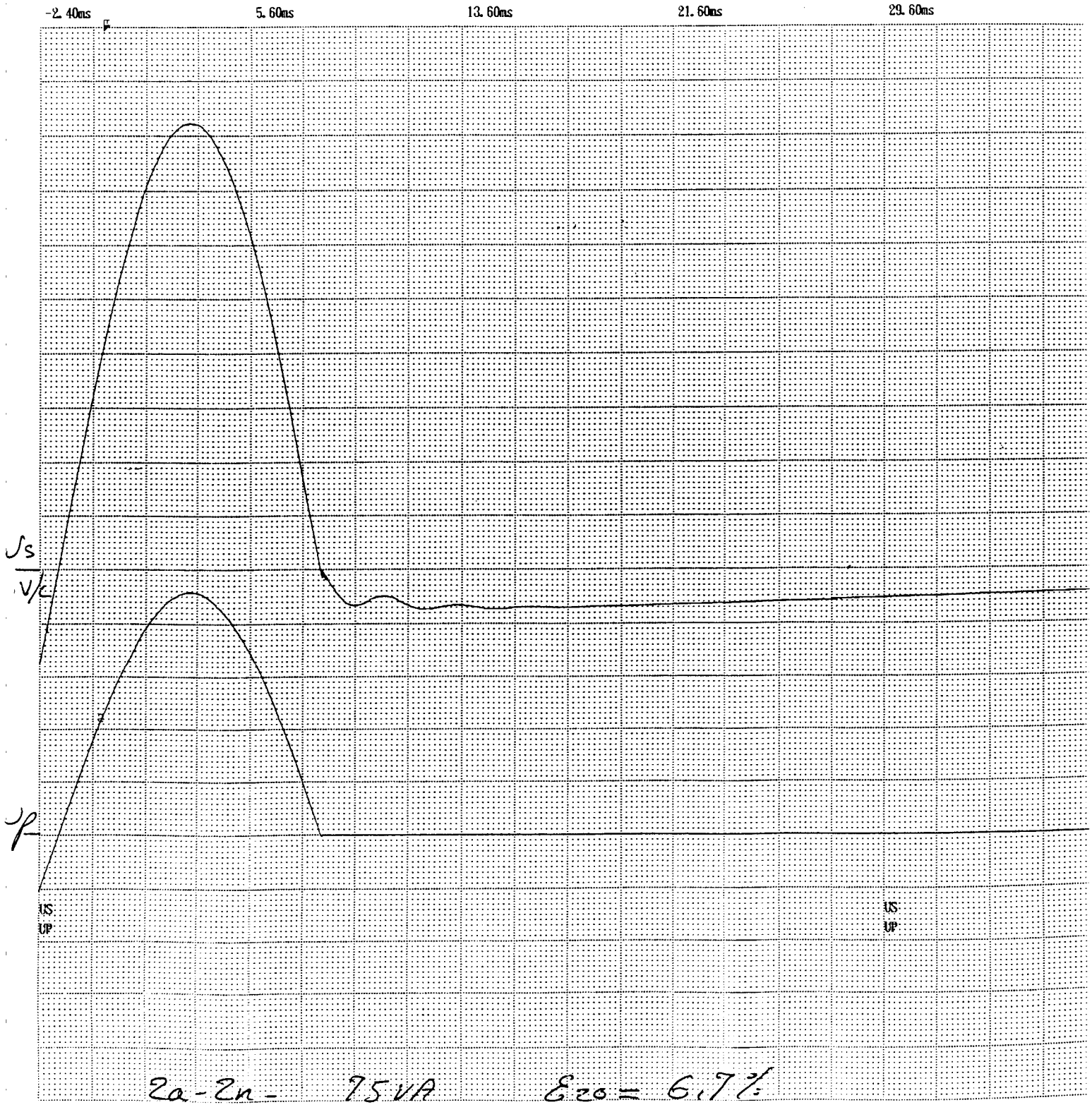
CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° : **25877**

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n Zero voltage	Burden: 75 VA	Error at 20 ms: 6.7 %



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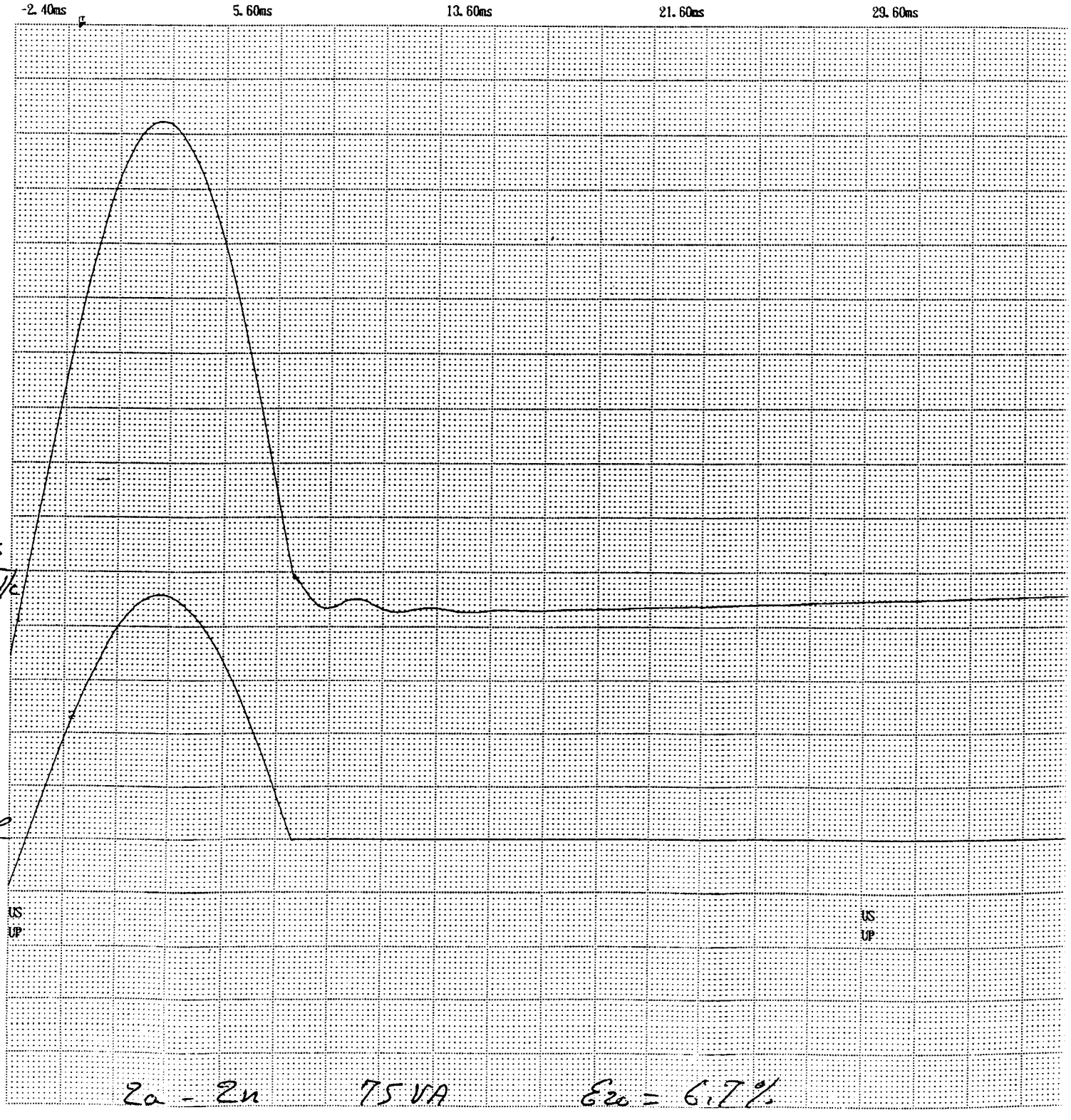
TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Zero voltage	Burden: 75 VA	Error at 20 ms: 6.7 %



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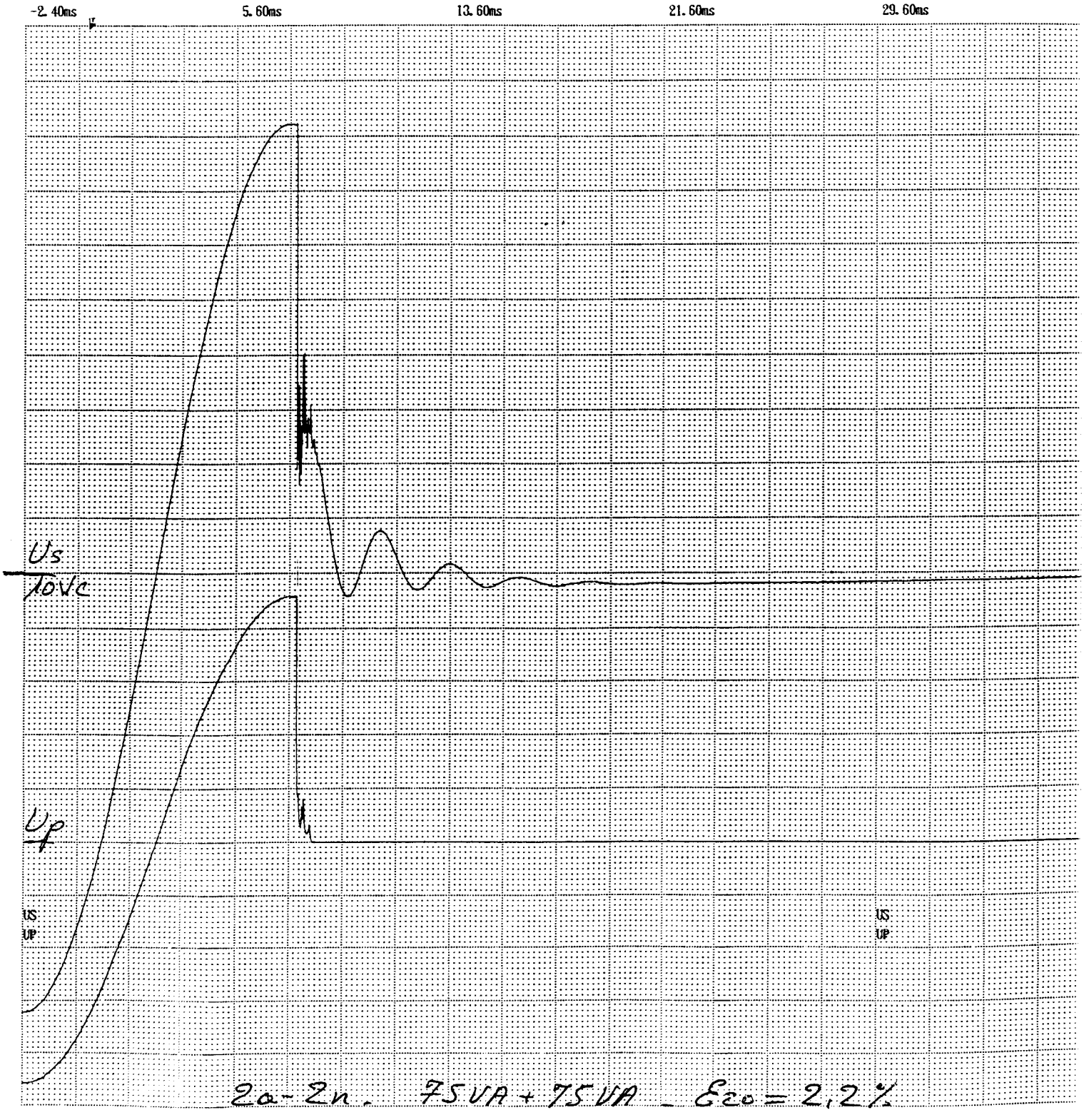
PROTOCOLO DE PRUEBAS N° : **25877**

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Max voltage	Burden: 75 VA + 75 VA	Error at 20 ms: 2.2 %



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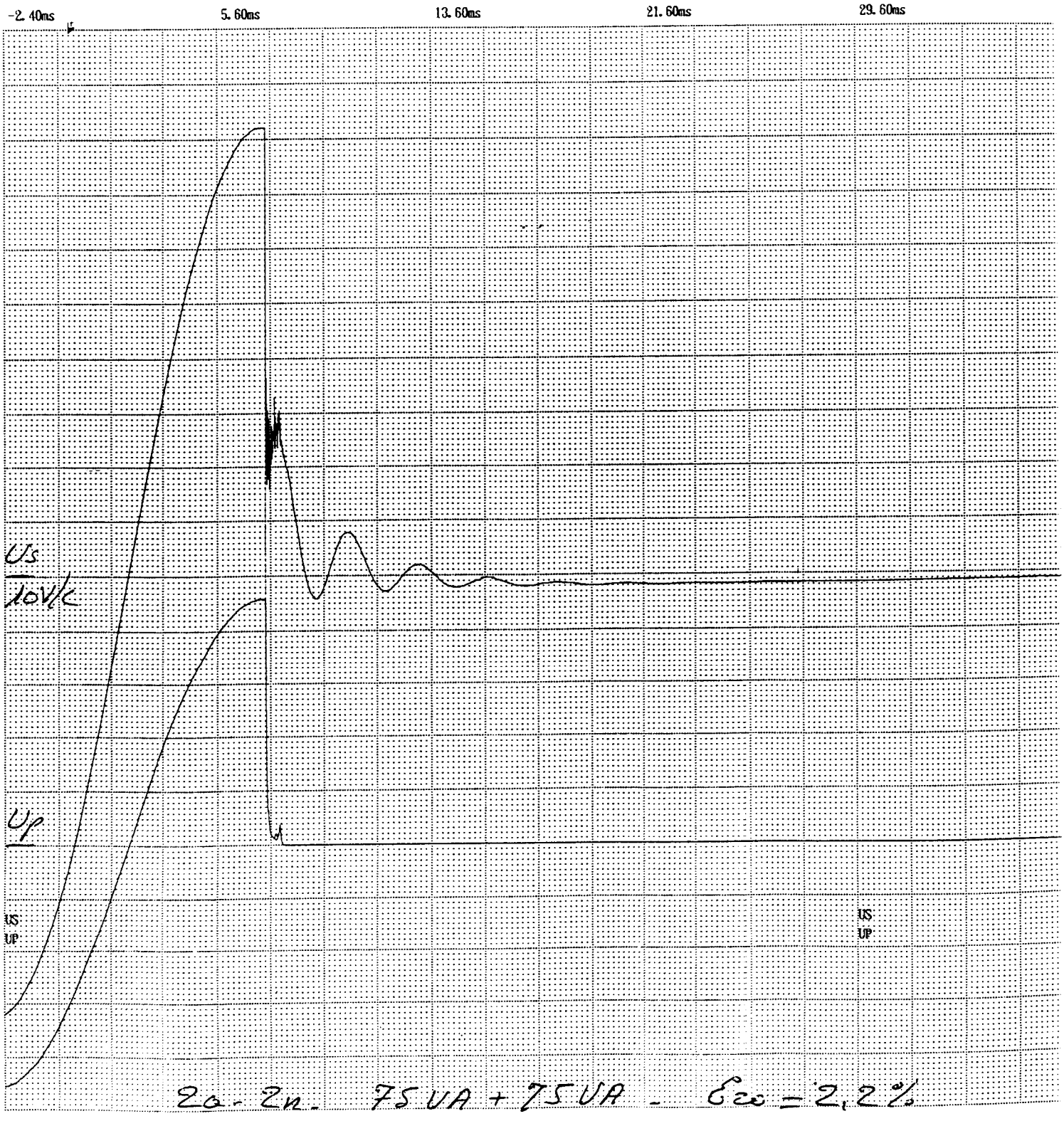
CERTIFICAT D'ESSAI N° : **25877**
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° :

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Max voltage	Burden: 75 VA + 75 VA	Error at 20 ms: 2.2 %



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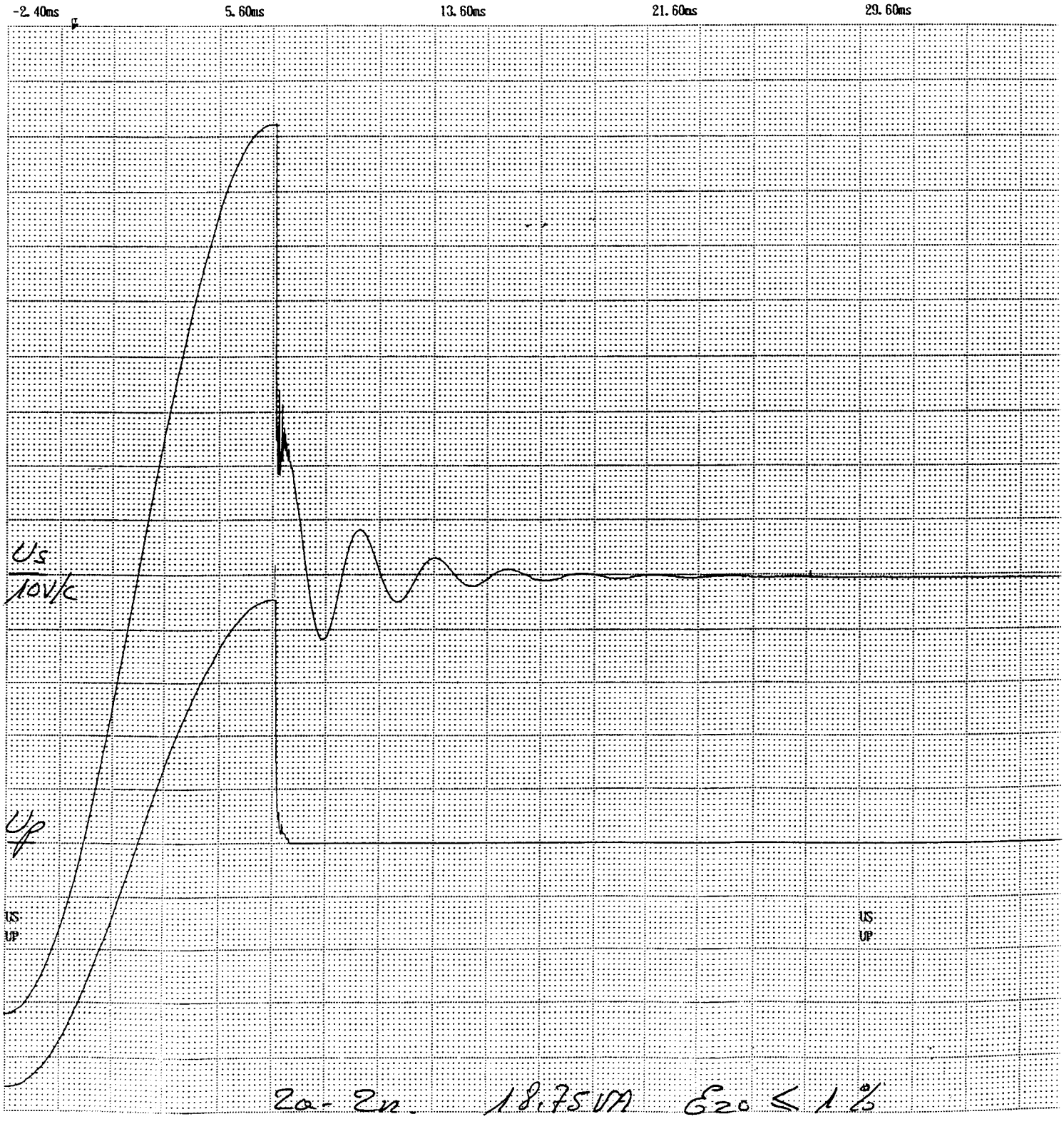
CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° : **25877**

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Max voltage	Burden: 18.75 VA	Error at 20 ms: ≤ 1 %



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CERTIFICAT D'ESSAI N° :
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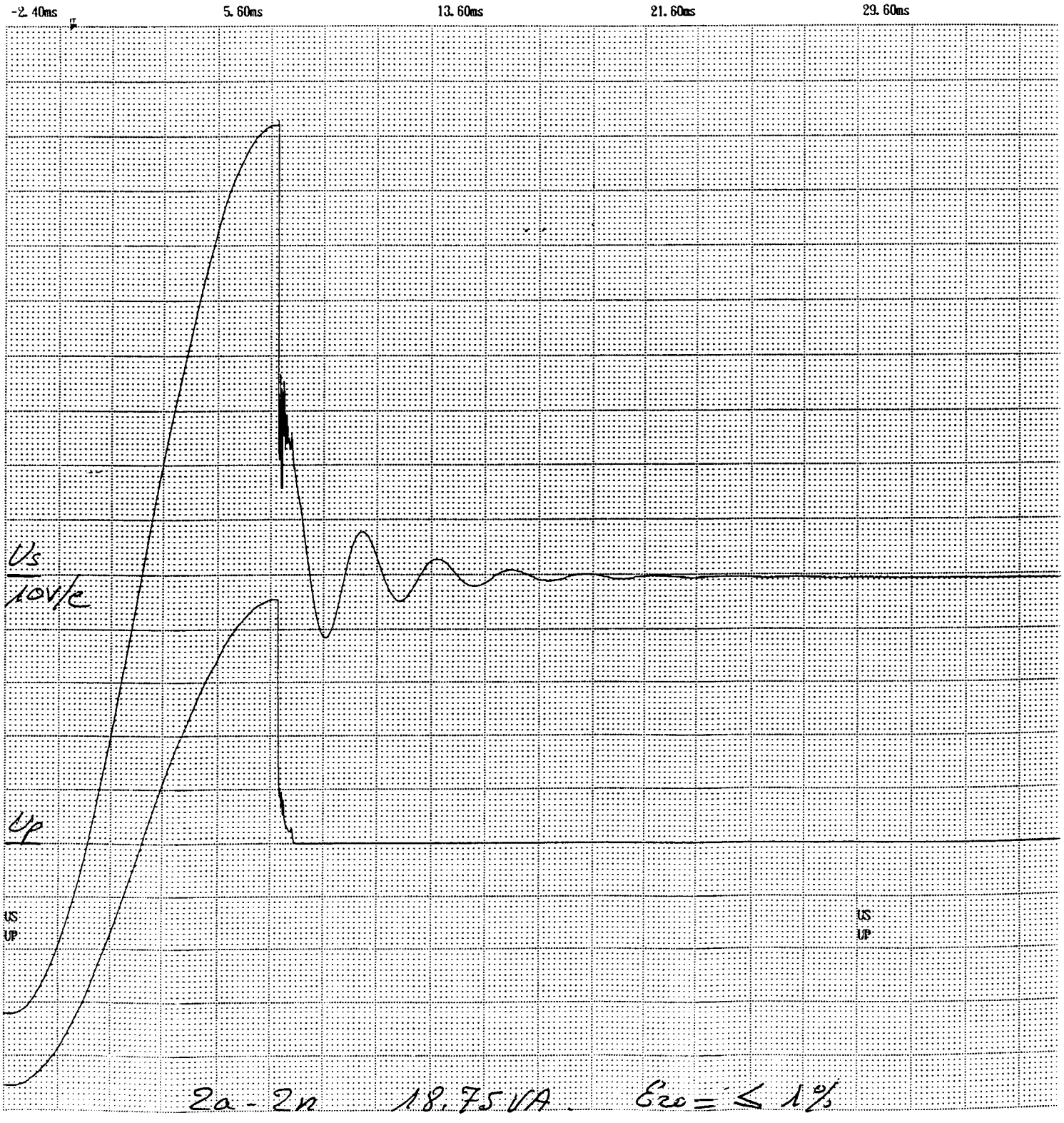
TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Max voltage	Burden: 18.75 VA	Error at 20 ms: ≤ 1 %



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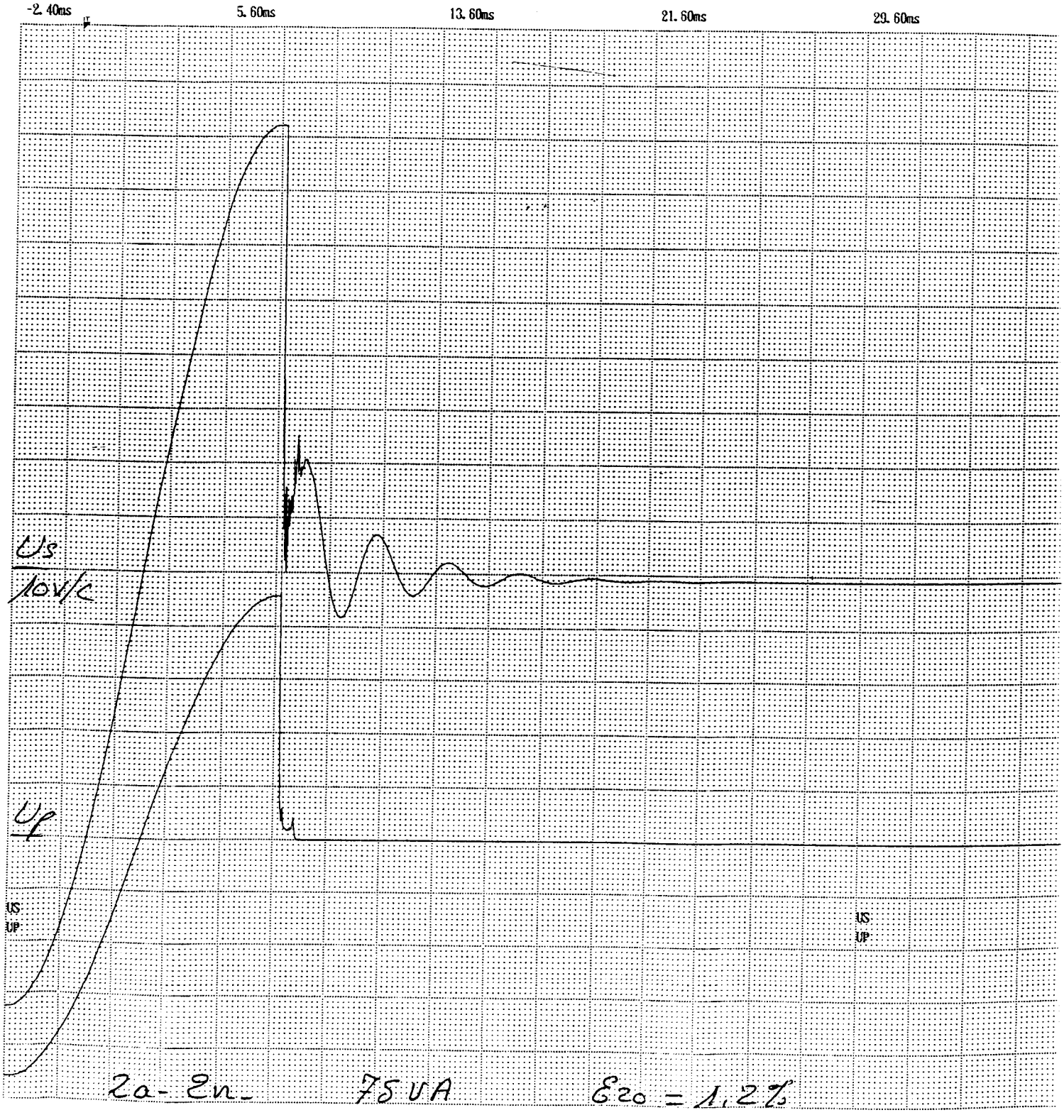
CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

TRANSIENT RESPONSE TEST
CCV 245

Circuit: 2a-2n		
Max voltage	Burden: 75 VA	Error at 20 ms: 1.2 %



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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° : **25 877**

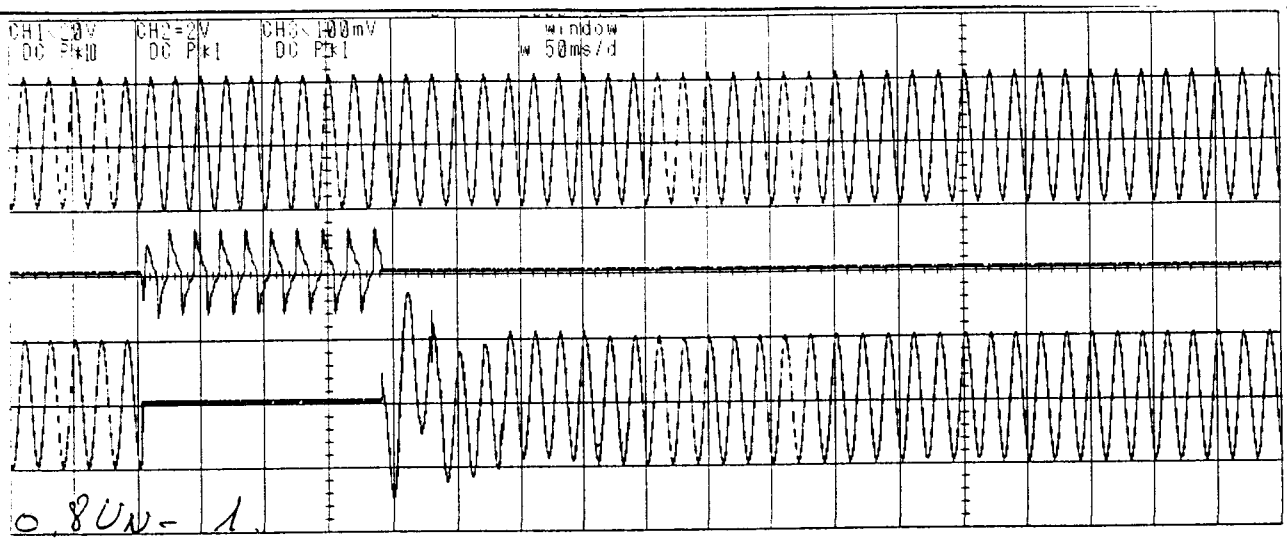
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 0.8 Un

Up :

Is : 100 A/div

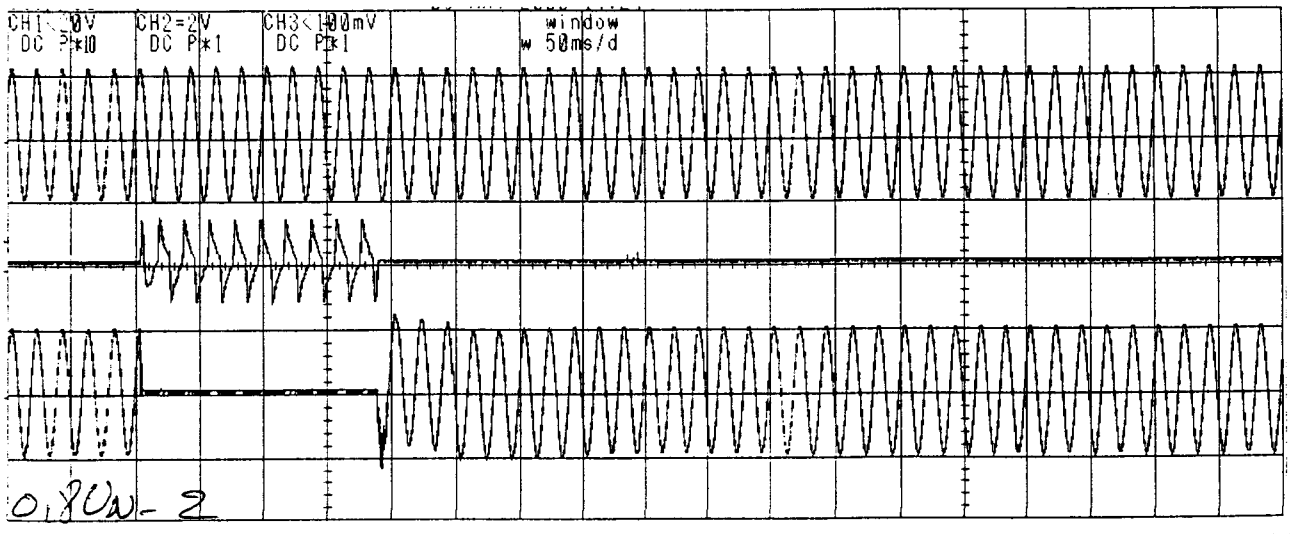
Us :



Up :

Is : 100 A/div

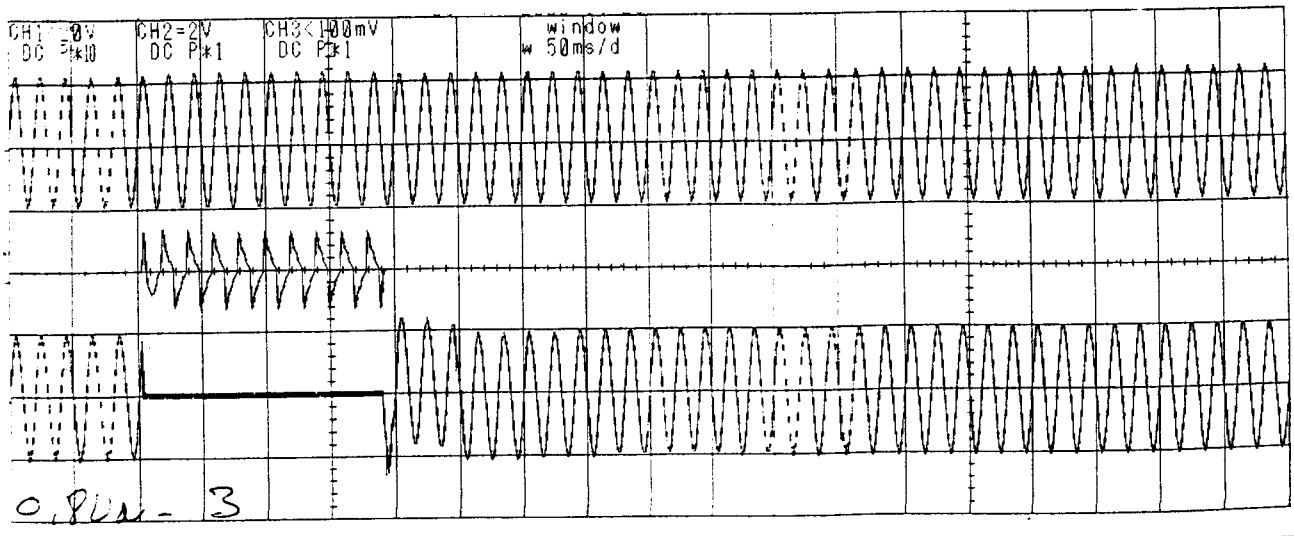
Us :



Up :

Is : 100 A/div

Us :



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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25 877**
PROTOCOLO DE PRUEBAS N° :

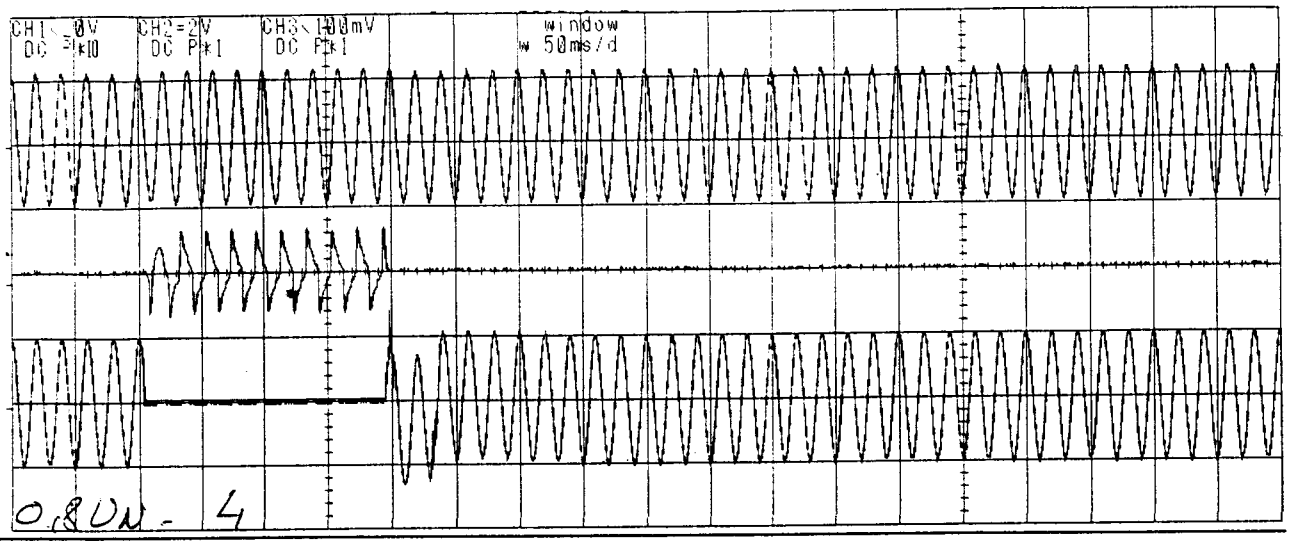
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 0.8 Un

Up :

Is : 100 A/div

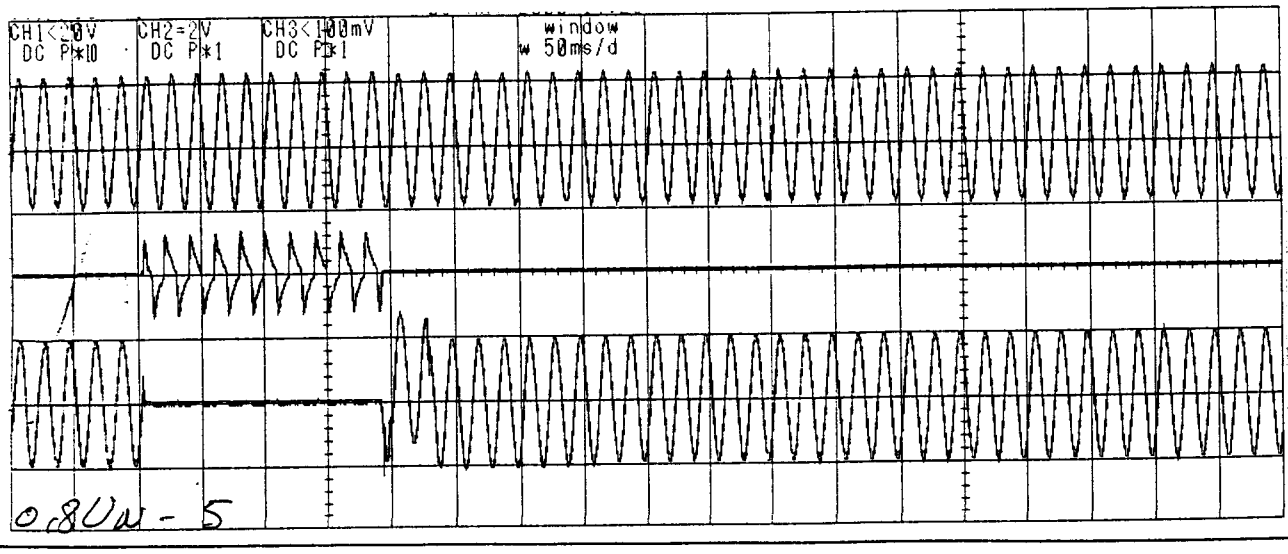
Us :



Up :

Is : 100 A/div

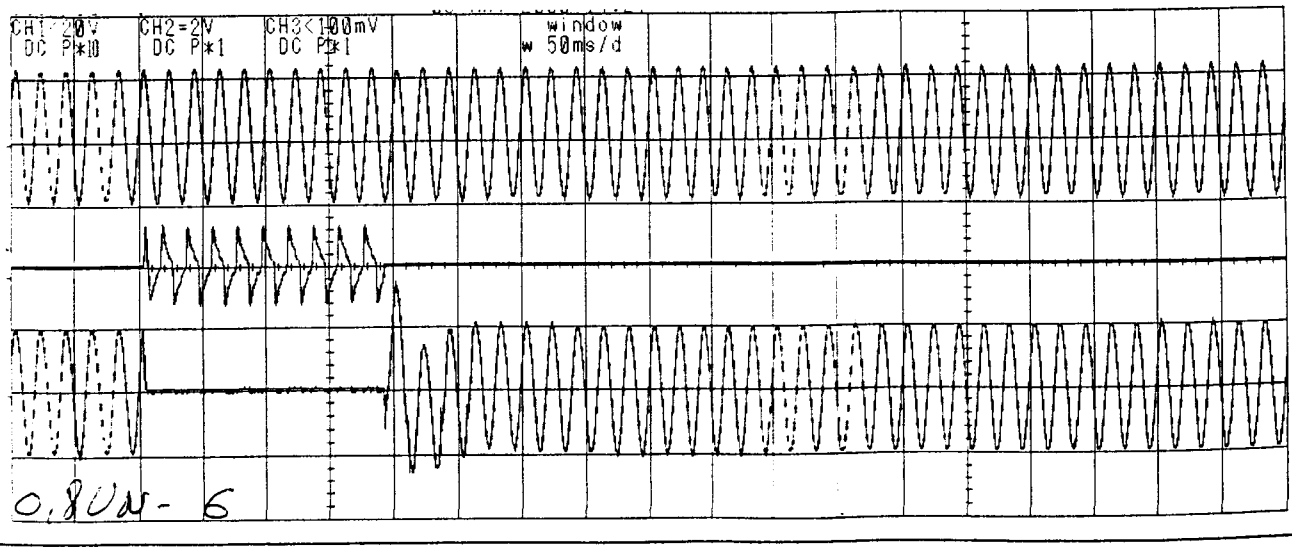
Us :



Up :

Is : 100 A/div

Us :



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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25 877**
PROTOCOLO DE PRUEBAS N° :

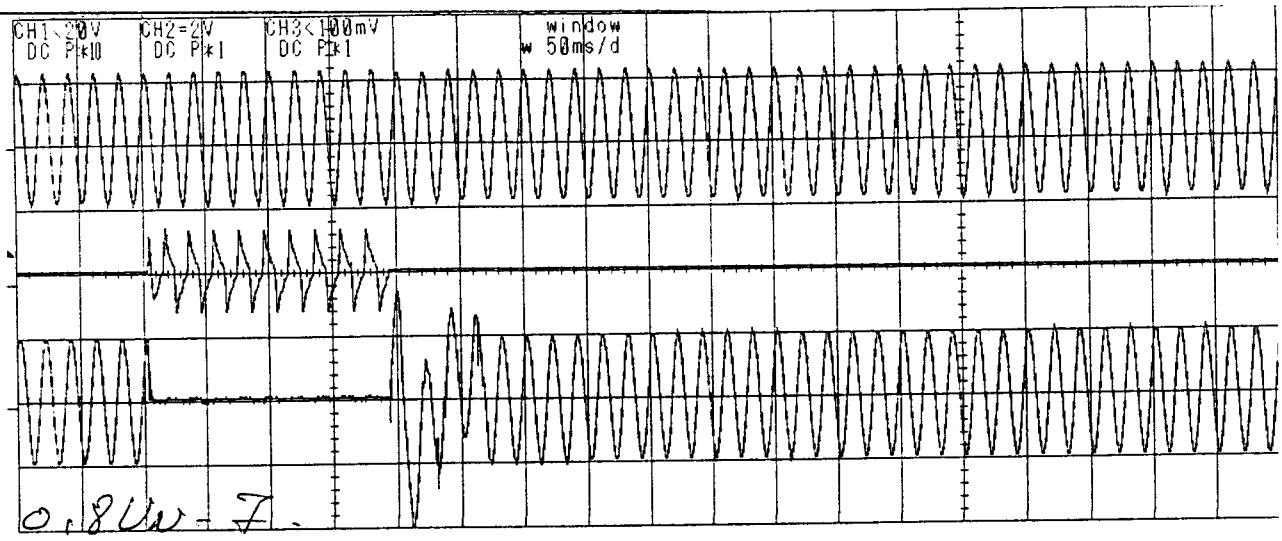
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 0.8 Un

Up :

Is : 100 A/div

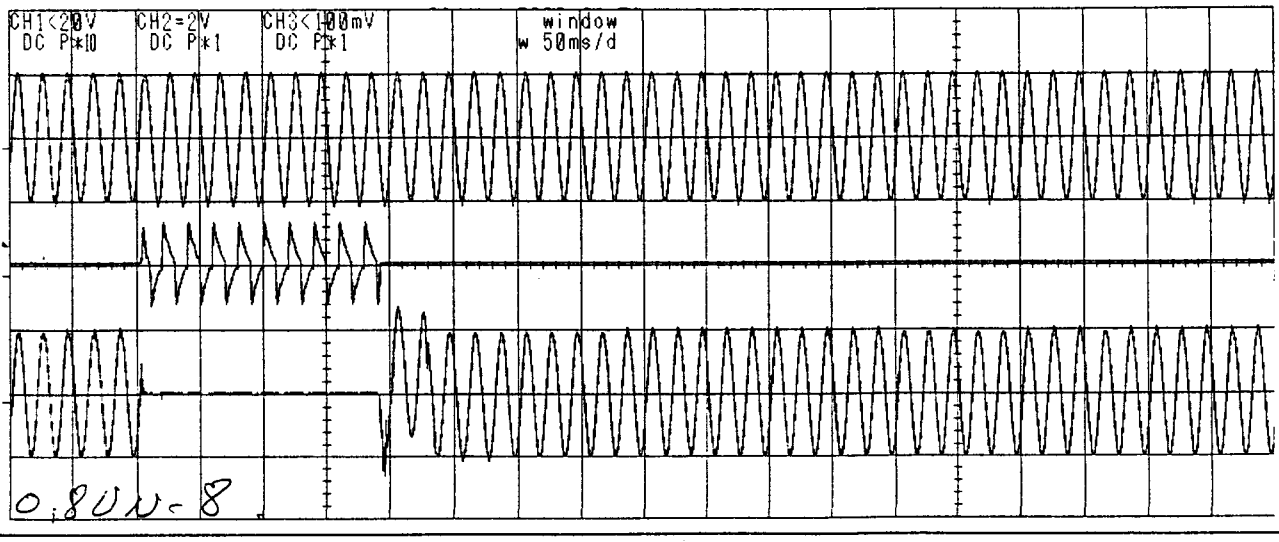
Us :



Up :

Is : 100 A/div

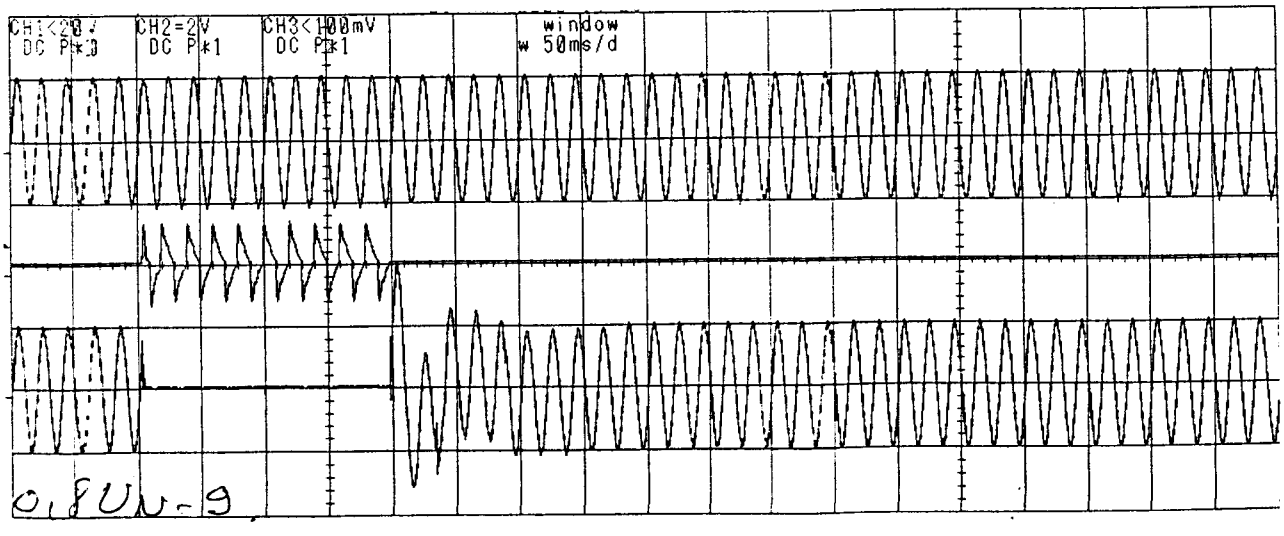
Us :



Up :

Is : 100 A/div

Us :



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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° :
PROTOCOLO DE PRUEBAS N° : **25 877**

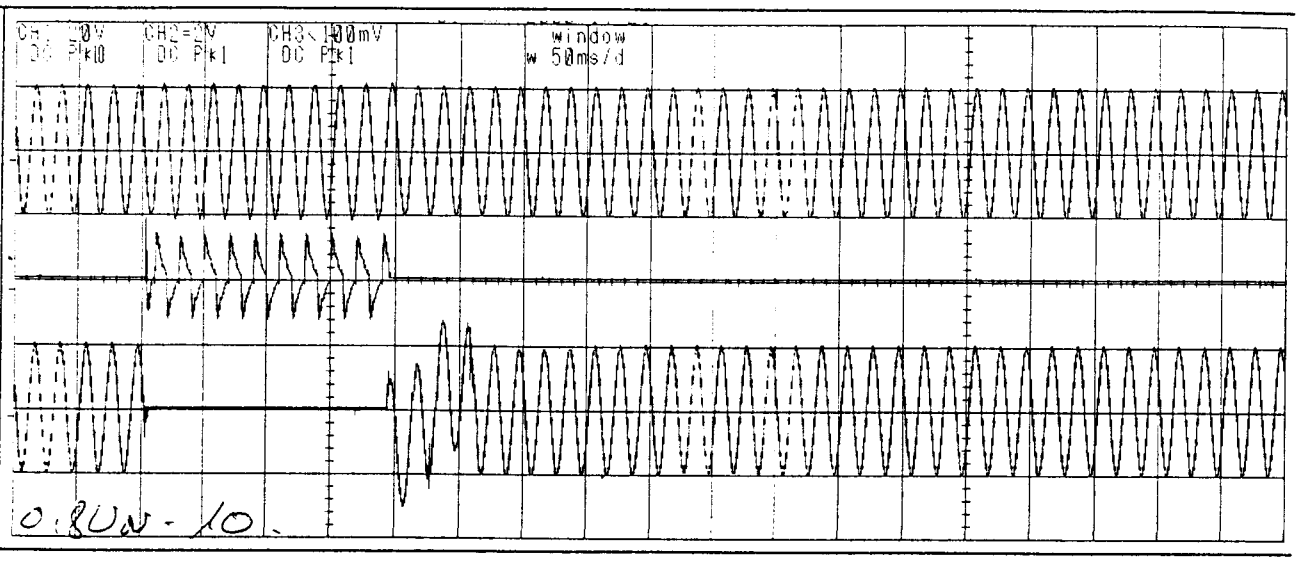
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 0.8 Un

Up :

Is : 100 A/div

Us :



Up :

Is : 100 A/div

Us :

Up :

Is : 100 A/div

Us :

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CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25 877**
PROTOCOLO DE PRUEBAS N° :

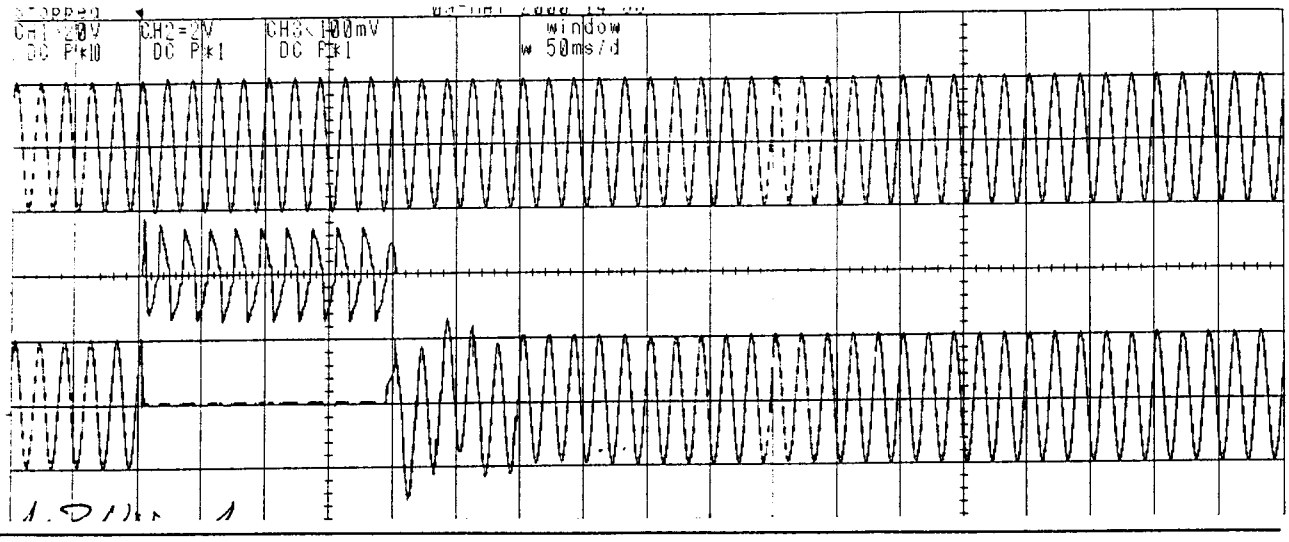
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 1.2 Un

Up :

Is : 100 A/div

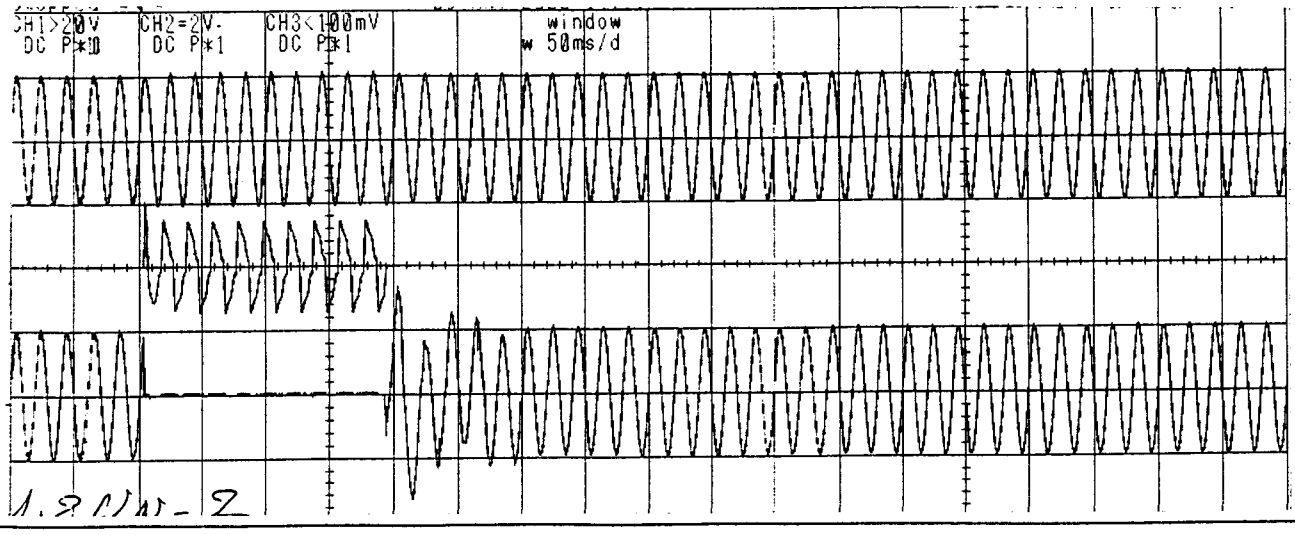
Us :



Up :

Is : 100 A/div

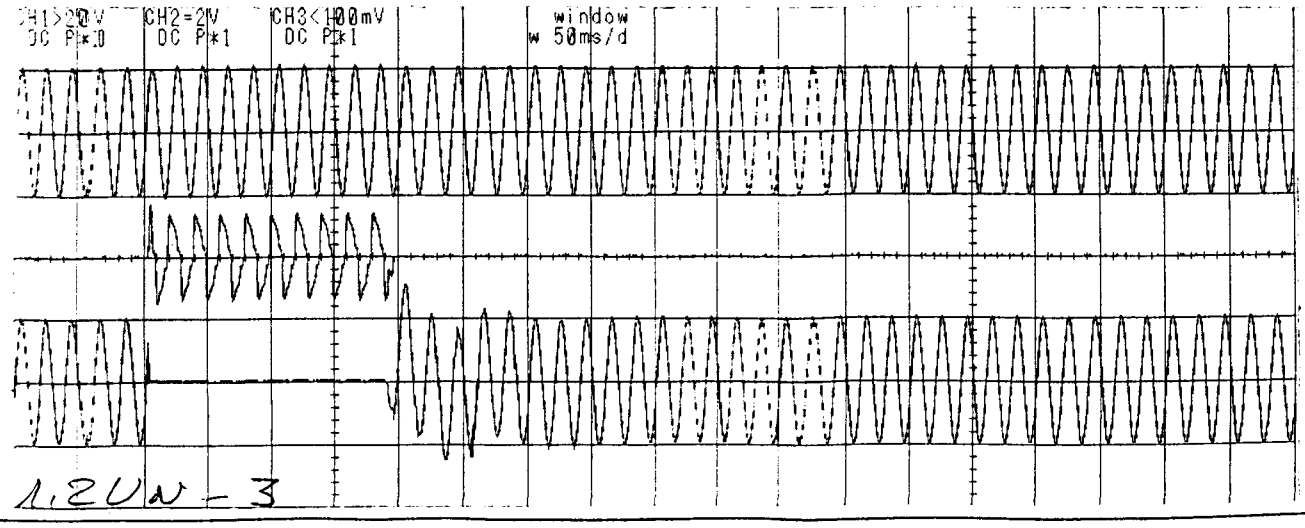
Us :



Up :

Is : 100 A/div

Us :



ALSTOM

ALSTOM T&D Transformateurs de Mesure SA
au capital de 14 000 000 F
Siège social : 51, avenue Jean Jaurès
BP 380 92541 Montrouge Cedex France
343 074 092 RCS Nanterre
APE 311 A - TVA FR 05 343 074 092

CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25 877**
PROTOCOLO DE PRUEBAS N° :

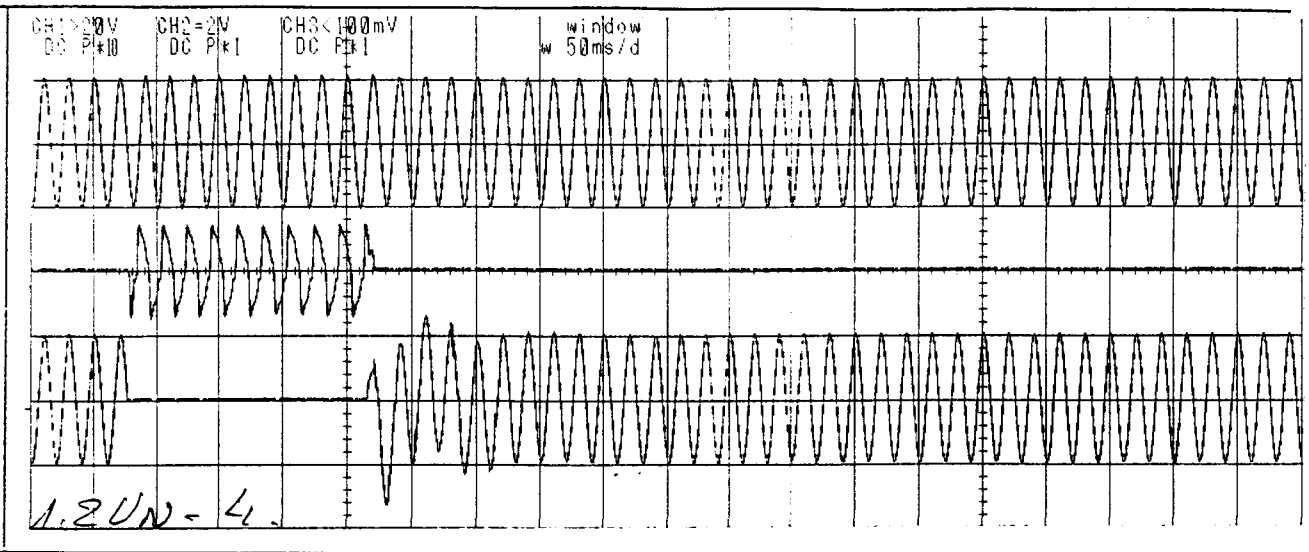
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 1.2 Un

Up :

Is : 100 A/div

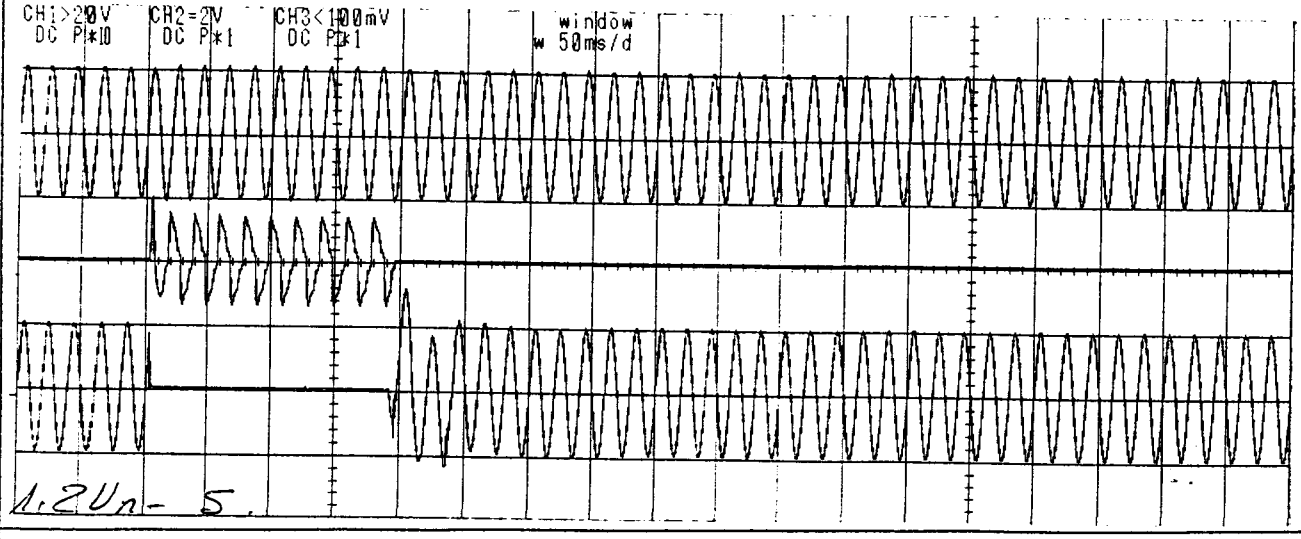
Us :



Up :

Is : 100 A/div

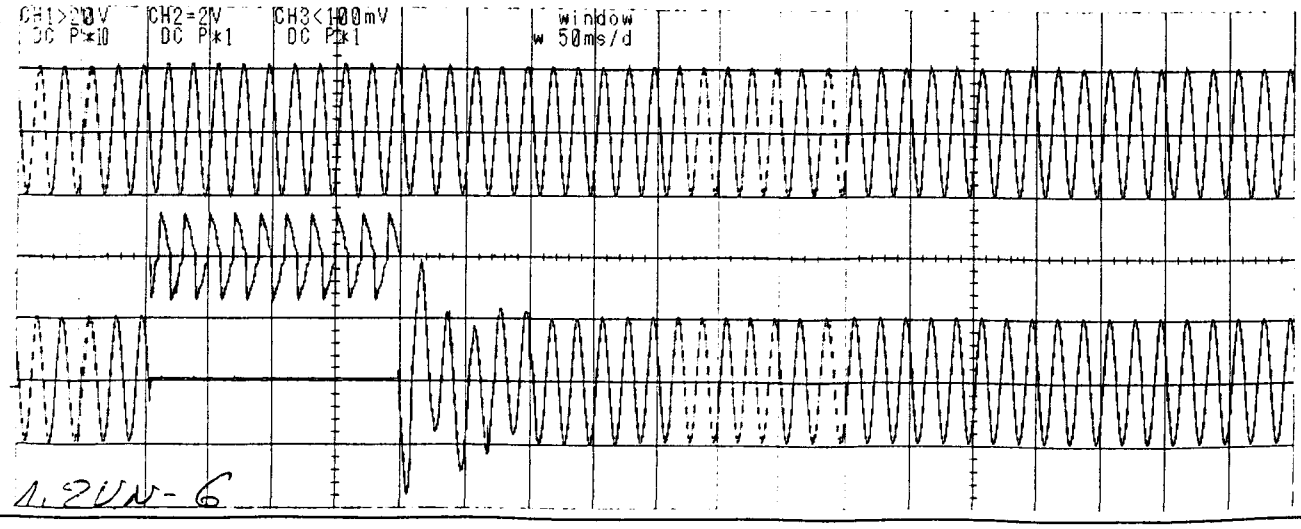
Us :



Up :

Is : 100 A/div

Us :



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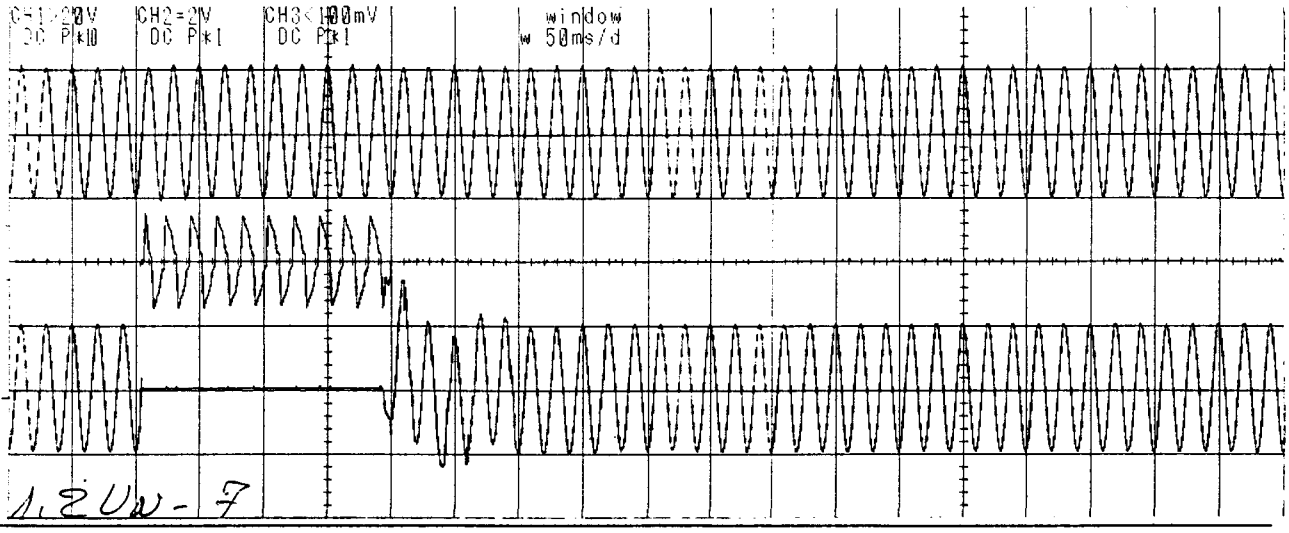
Is : 100 A/div

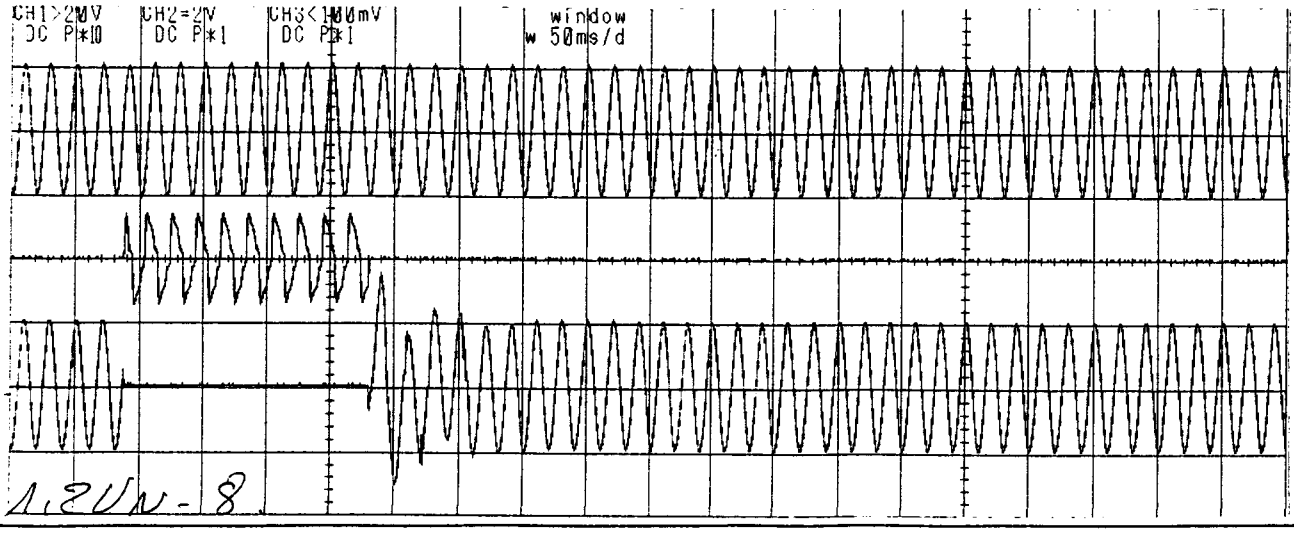
Us :



Up :

Is : 100 A/div

Us :



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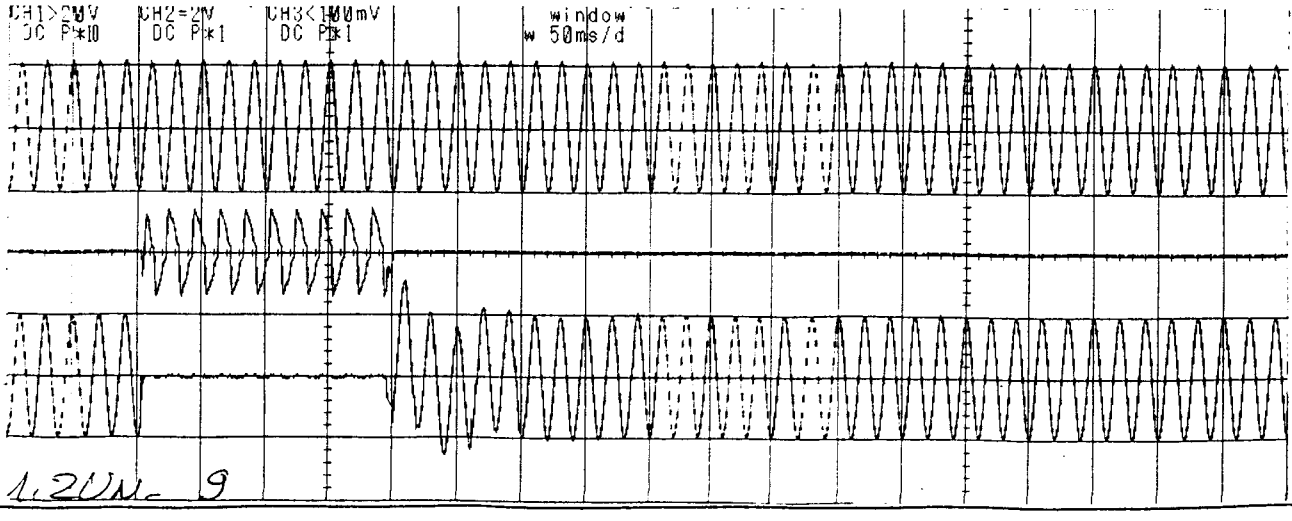
Is : 100 A/div

Us :



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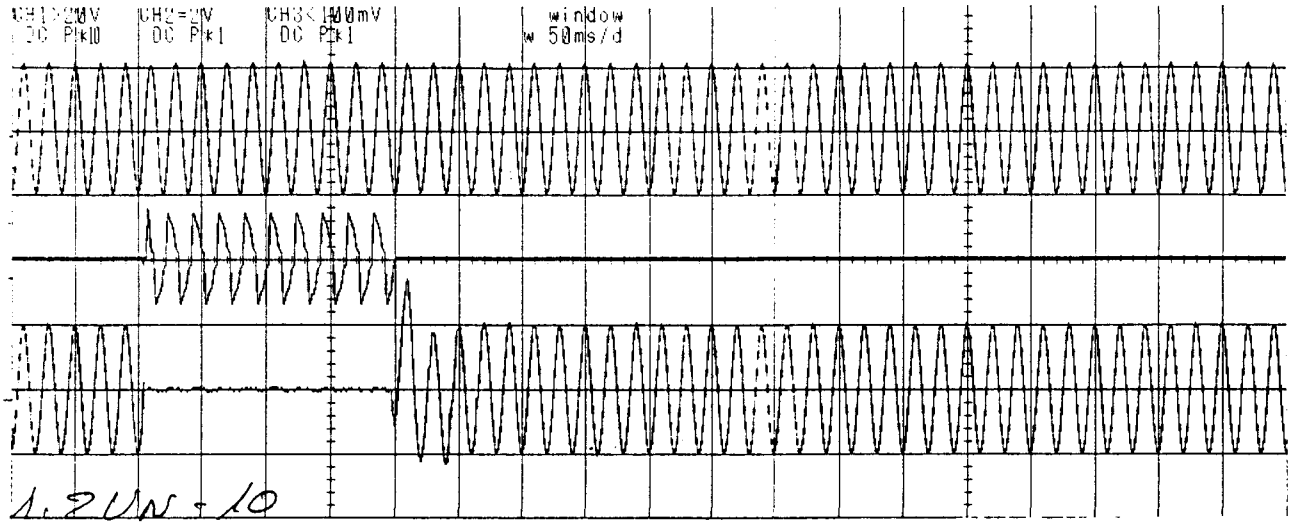

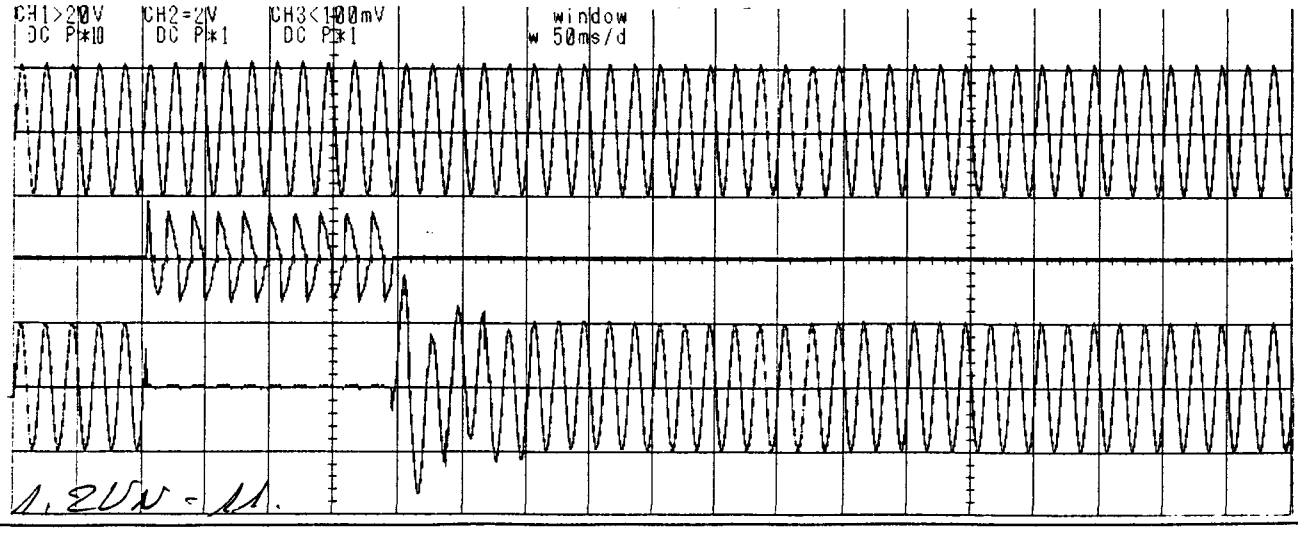

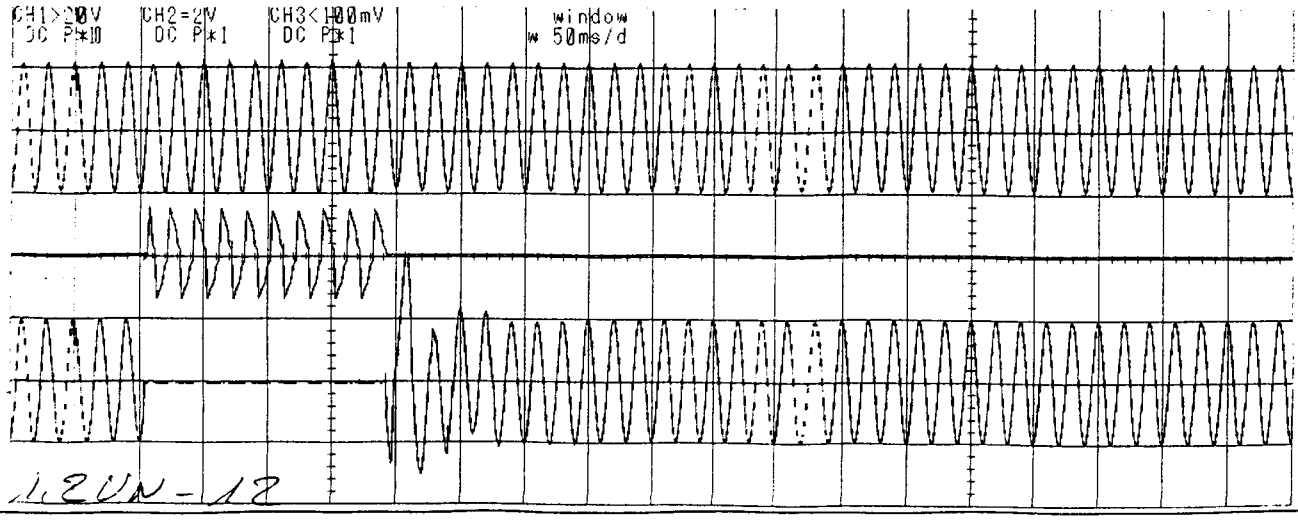

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FERRO-RESONANCE TEST – 1.2 Un

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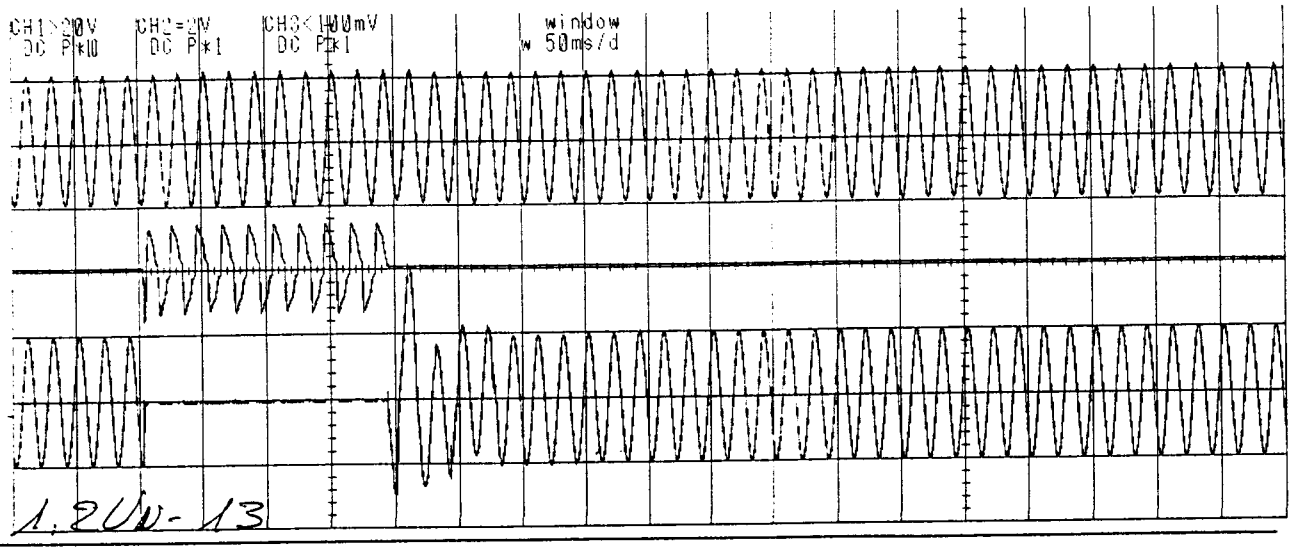
Us :



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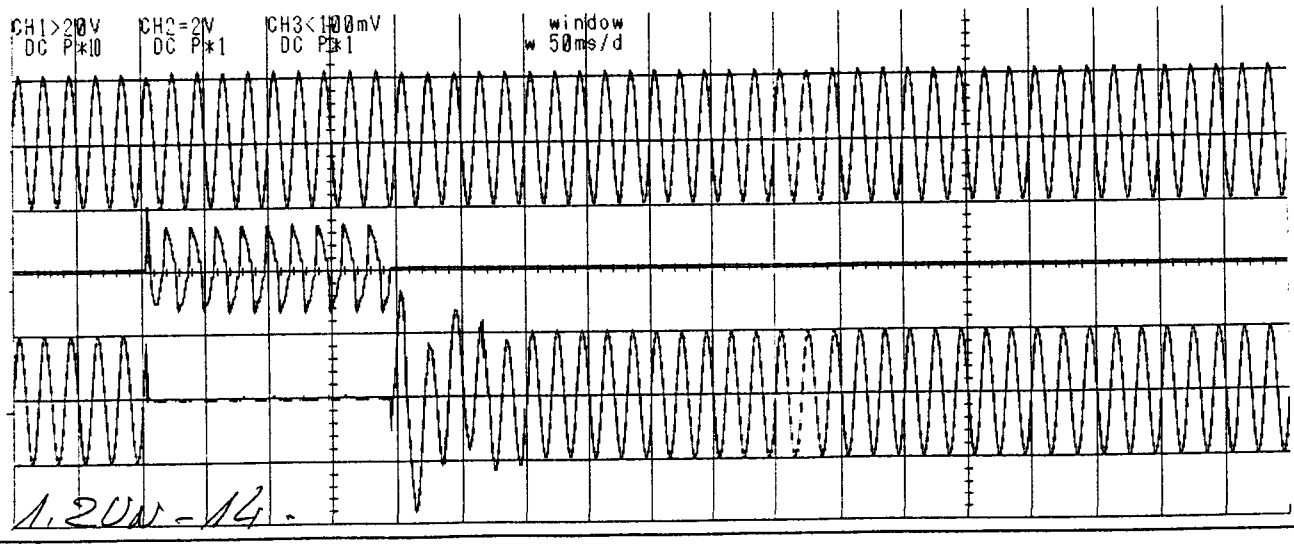
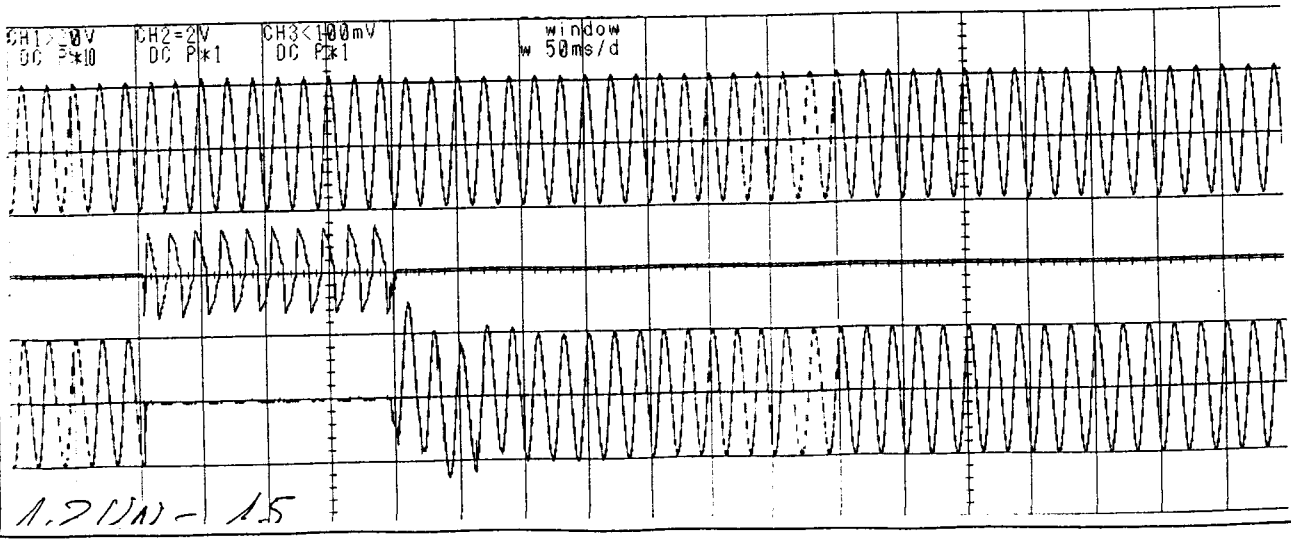
Is : 100 A/div
Us :



Up :
Is : 100 A/div
Us :



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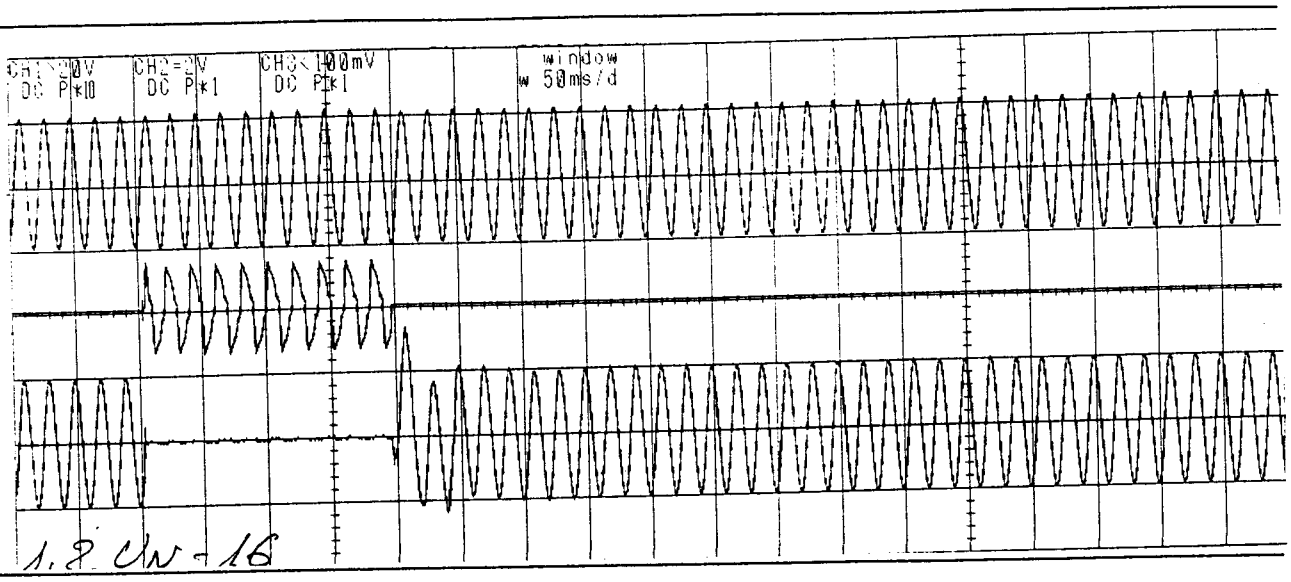
Is : 100 A/div
Us :



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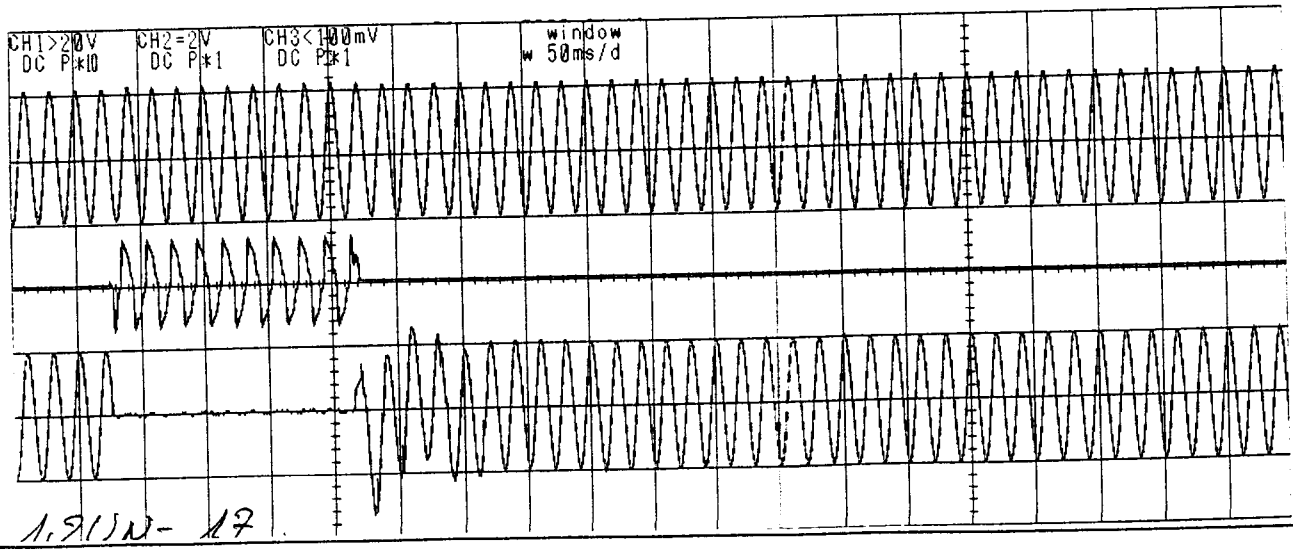
Is : 100 A/div
Us :



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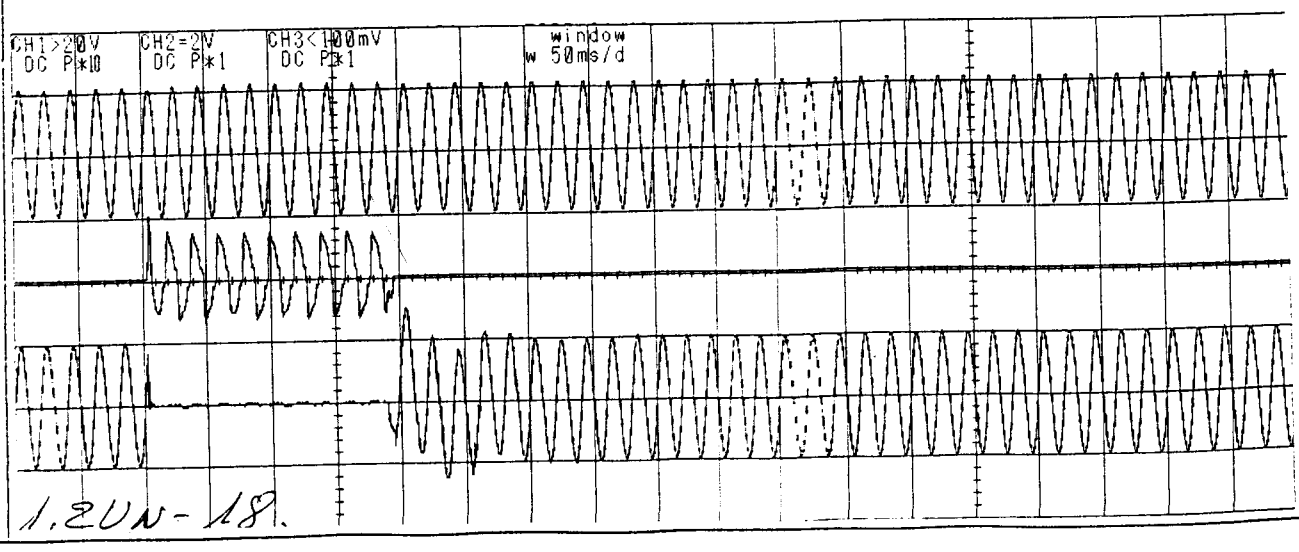
Is : 100 A/div
Us :



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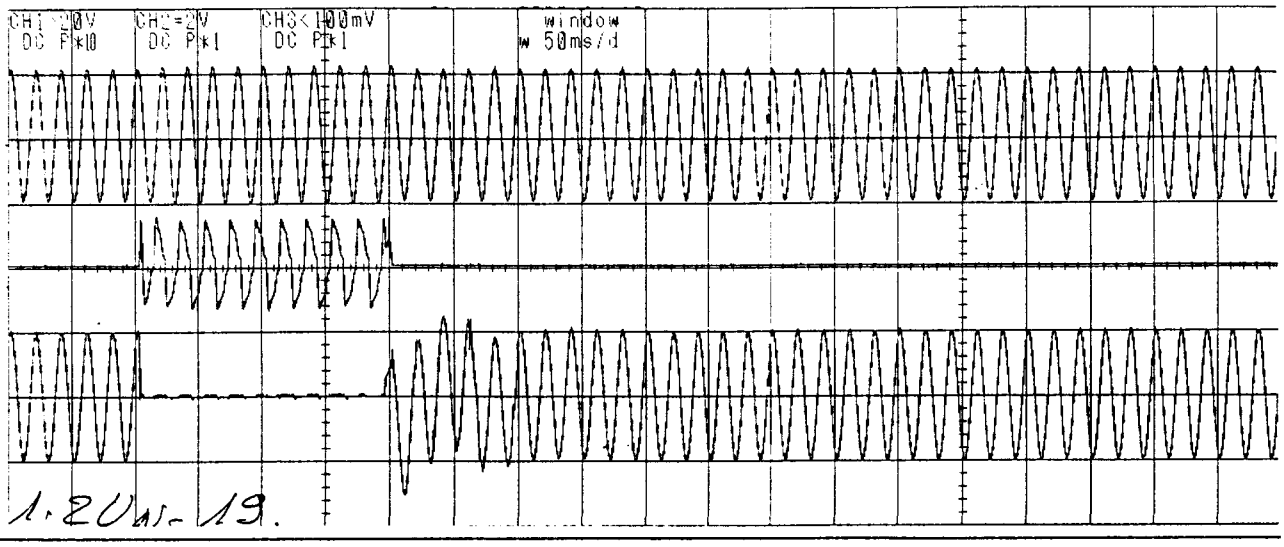
Is : 100 A/div

Us :



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Is : 100 A/div

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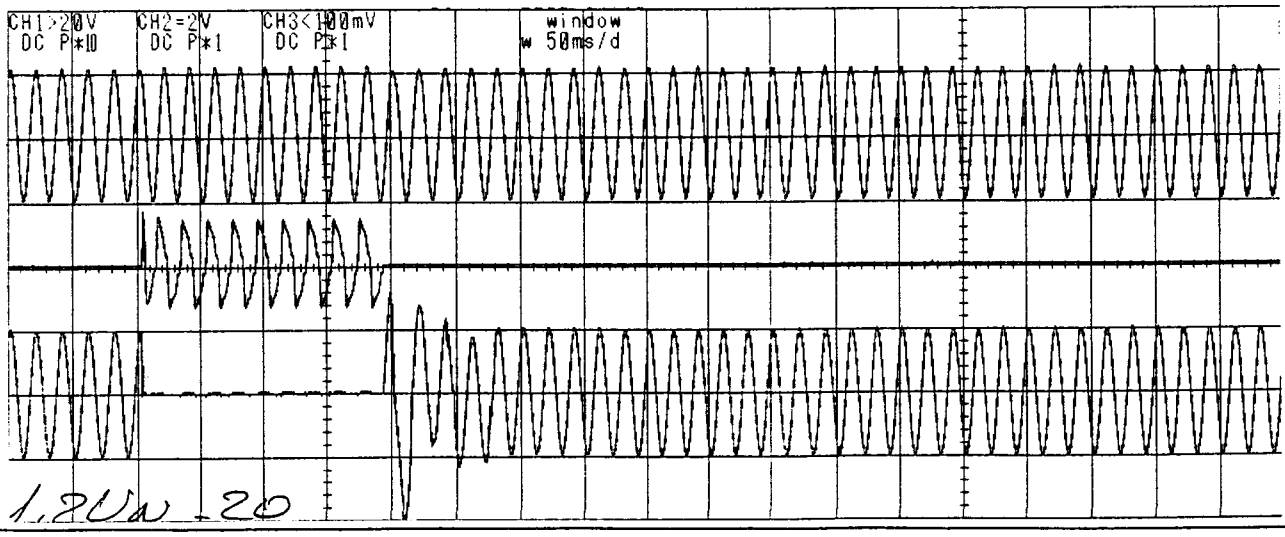

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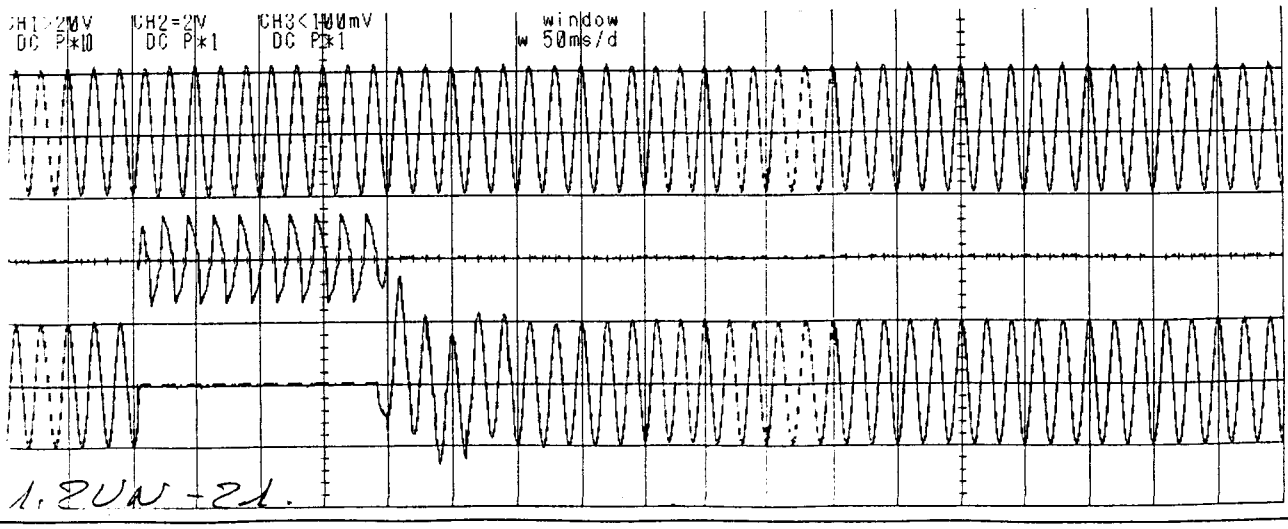

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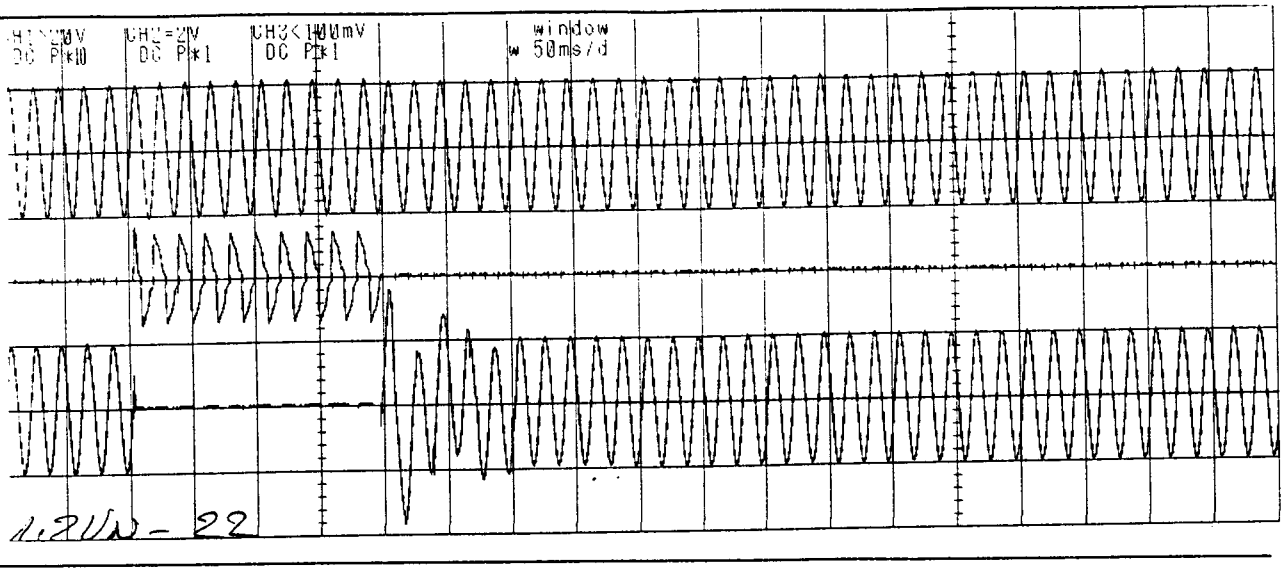
Is : 100 A/div

Us :



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Is : 100 A/div

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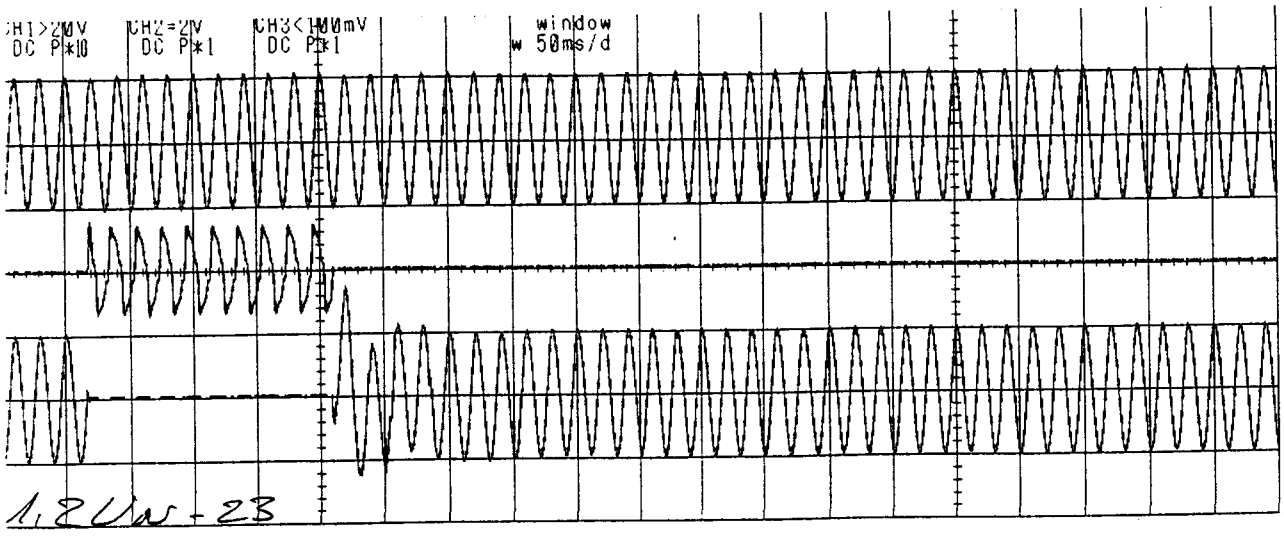

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Is : 100 A/div

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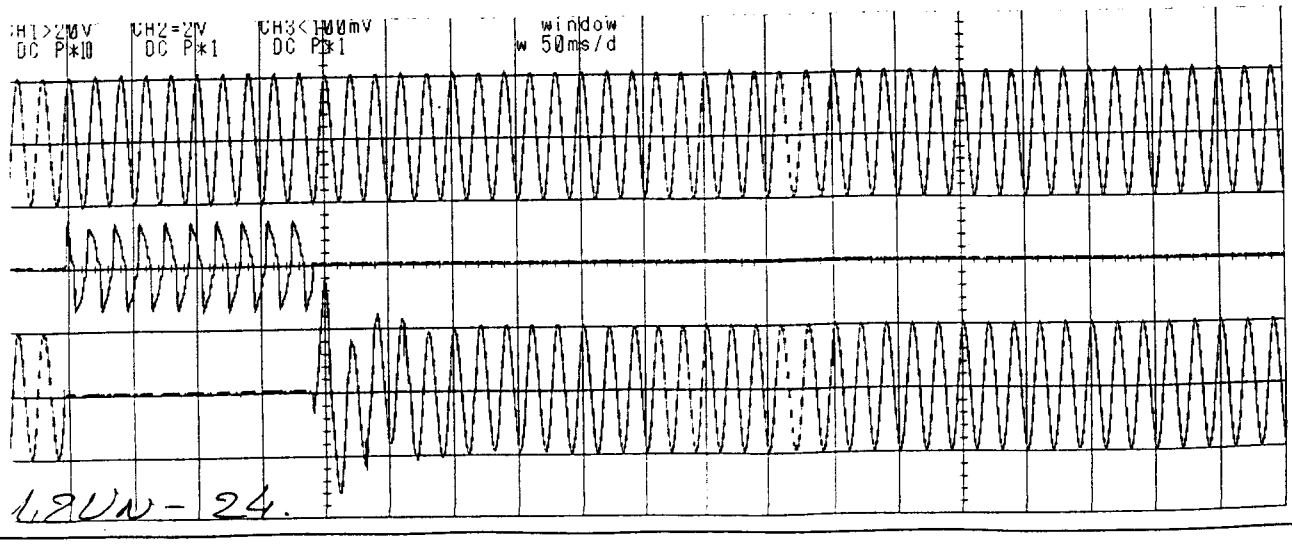

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PROTOCOLO DE PRUEBAS N° :

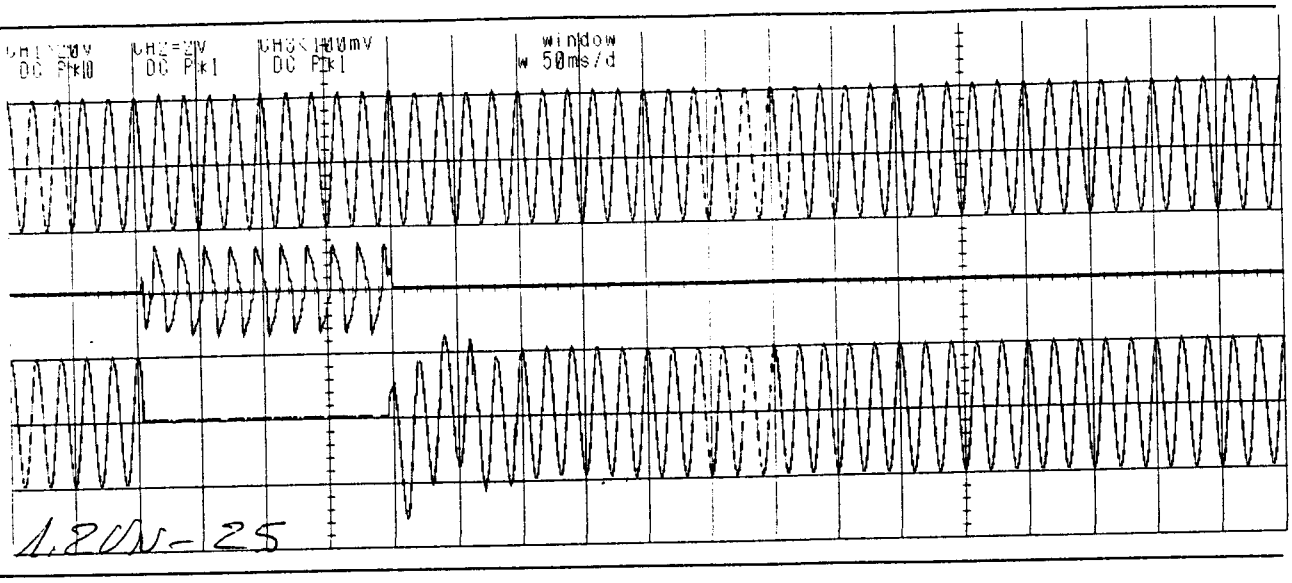
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 1.2 Un

Up :

Is : 100 A/div

Us :



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Is : 100 A/div

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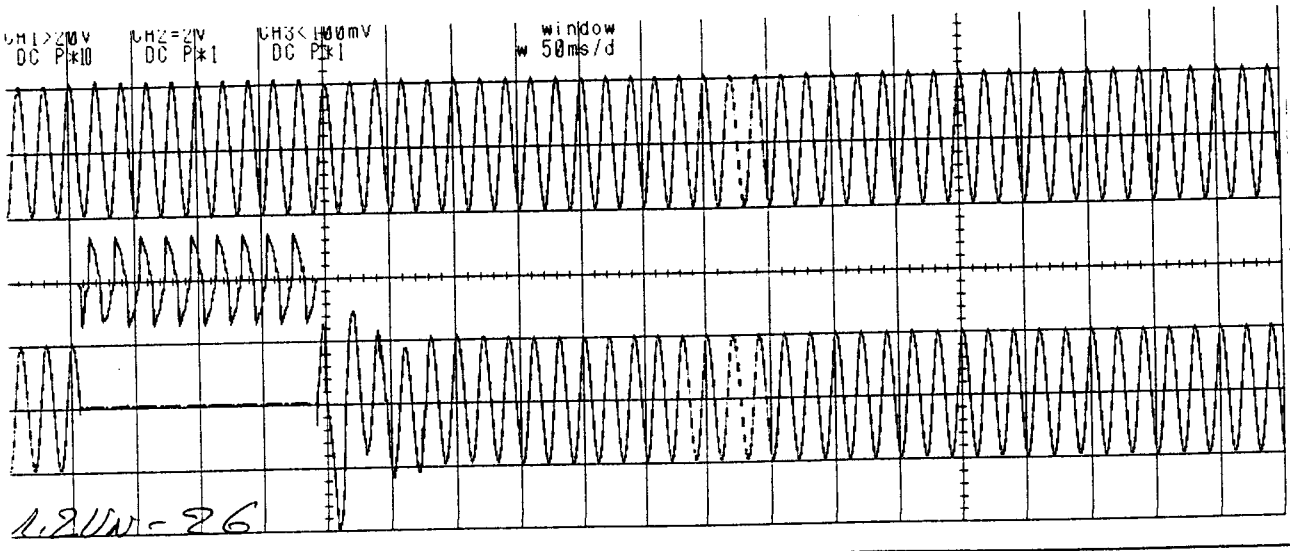
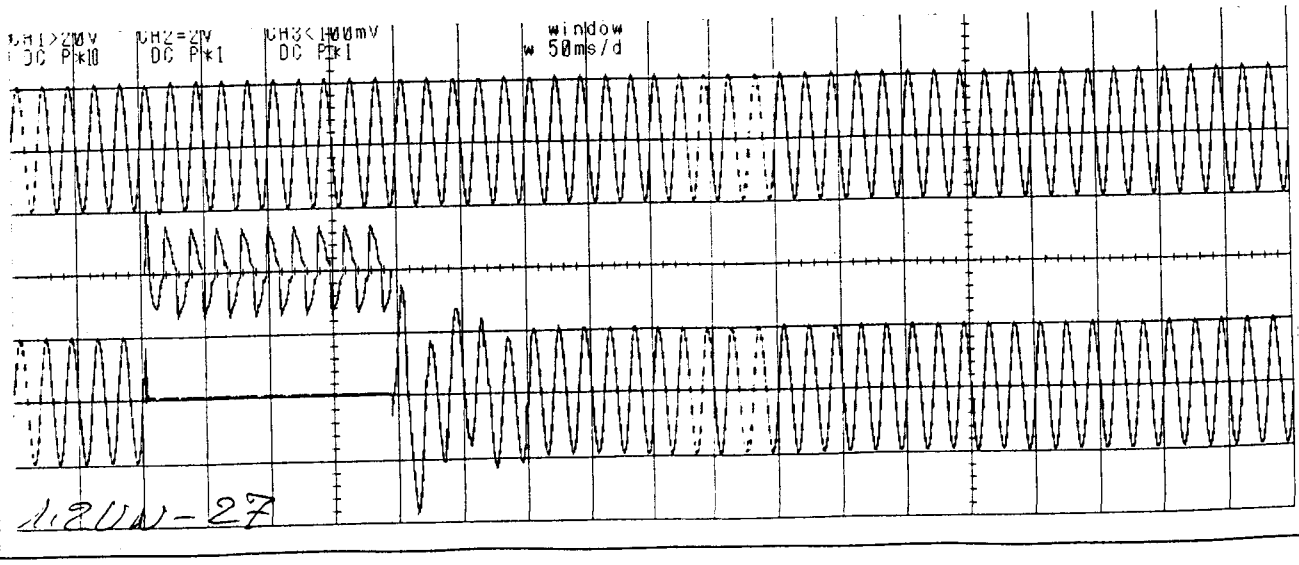


Up :

Is : 100 A/div

Us :



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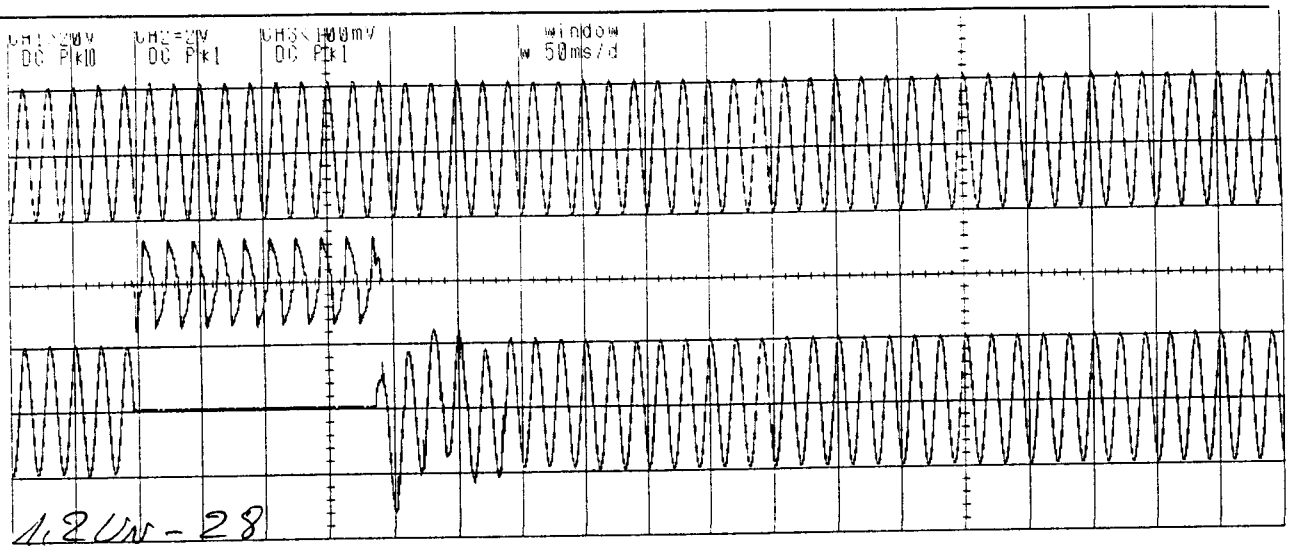
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 1.2 Un

Up :

Is : 100 A/div

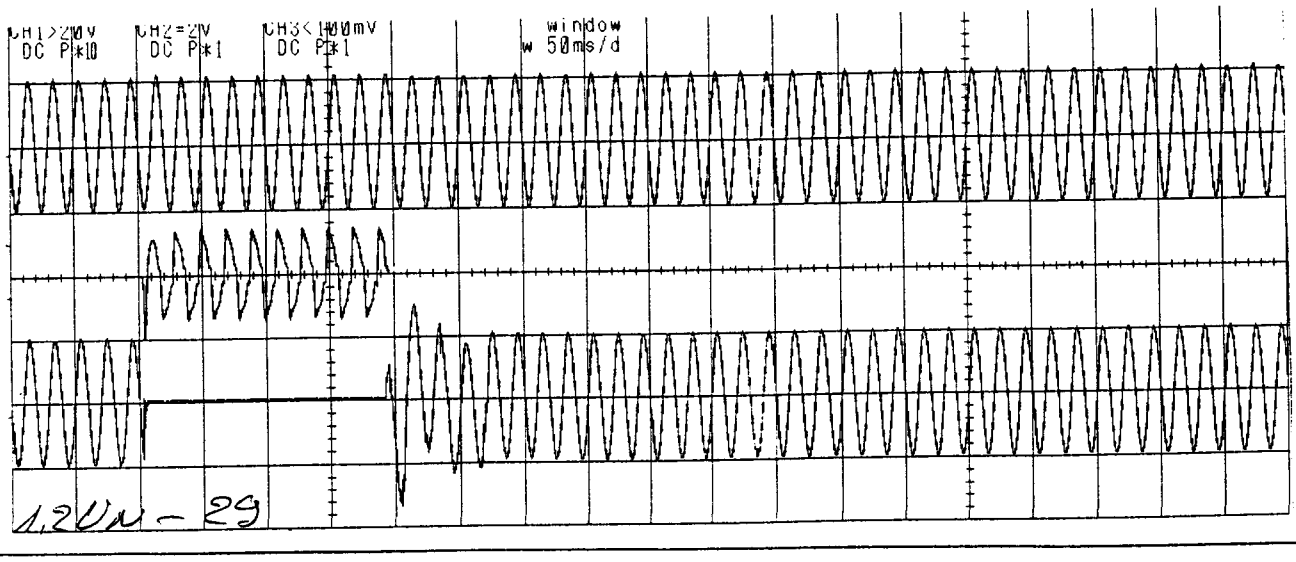
Us :



Up :

Is : 100 A/div

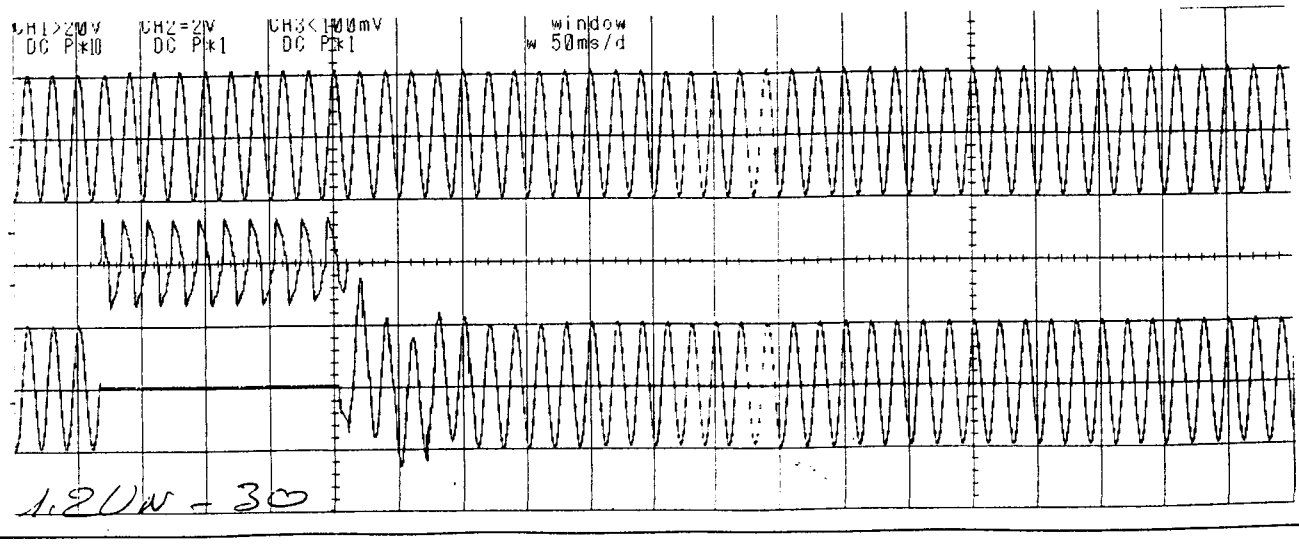
Us :



Up :

Is : 100 A/div

Us :



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PROTOCOLO DE PRUEBAS N° :

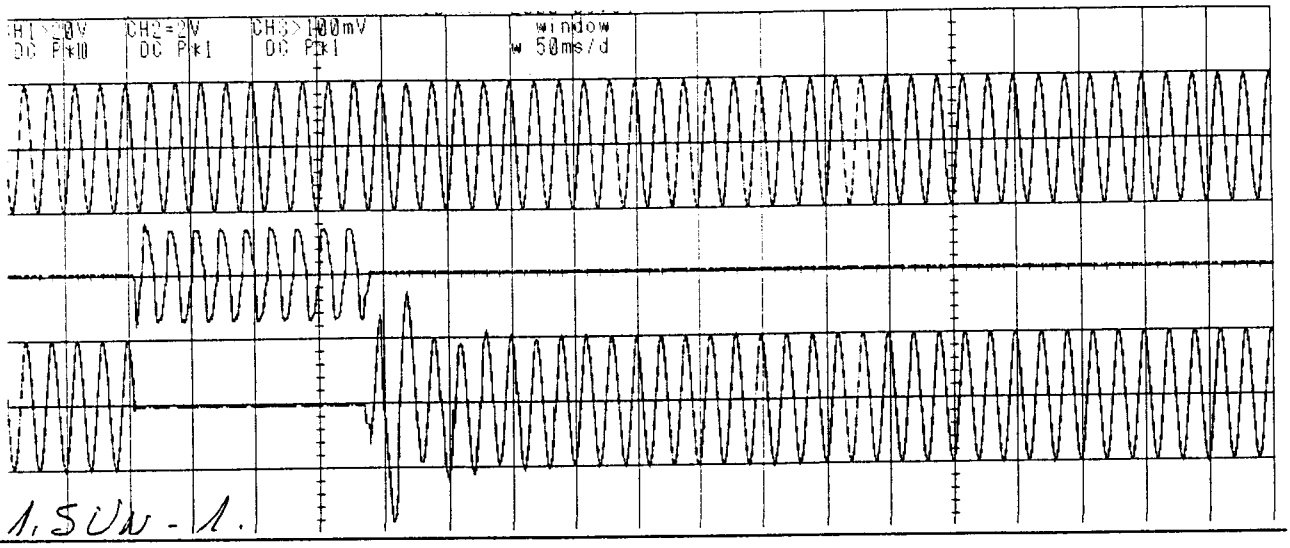
Apparatus n° : CCV 245

FERRO-RESONANCE TEST – 1.5 Un

Up :

Is : 100 A/div

Us :



Up :

Is : 100 A/div

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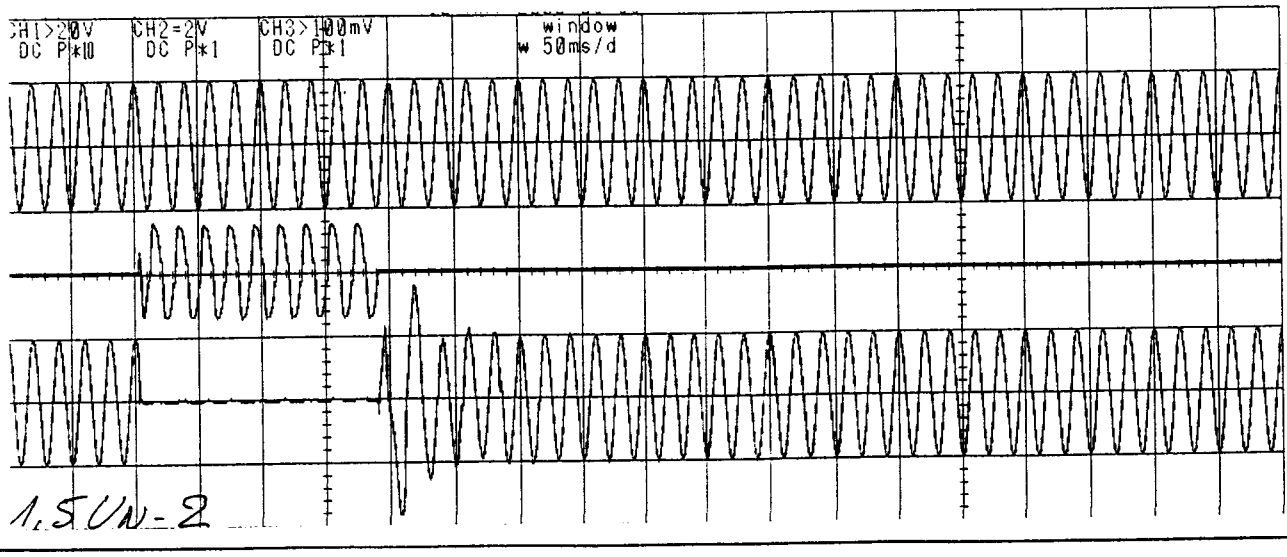
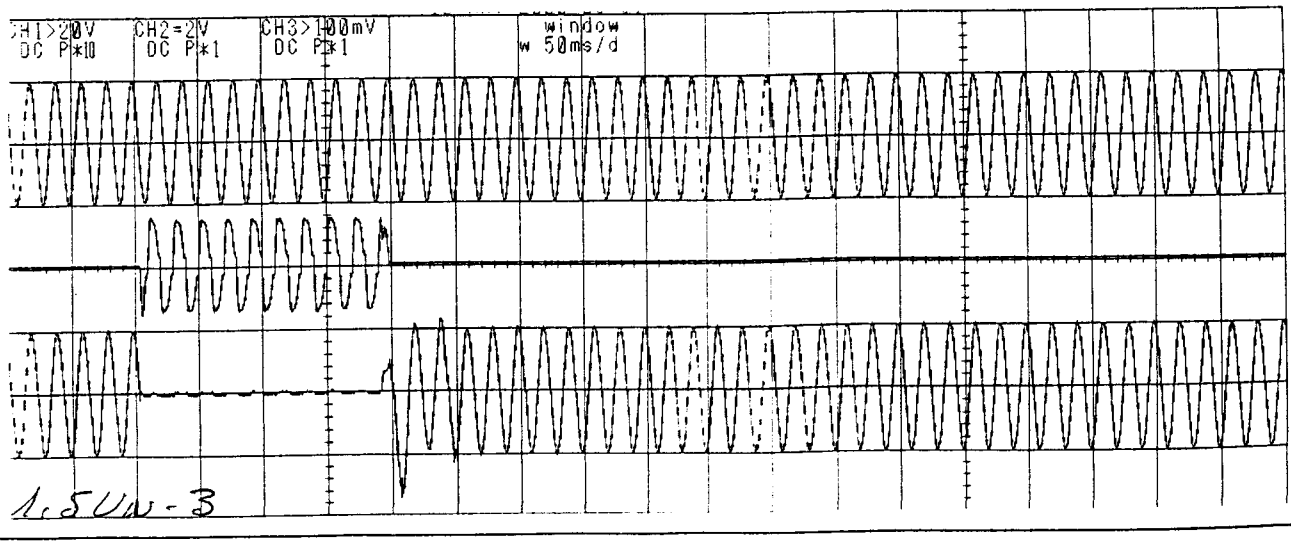


Up :

Is : 100 A/div

Us :



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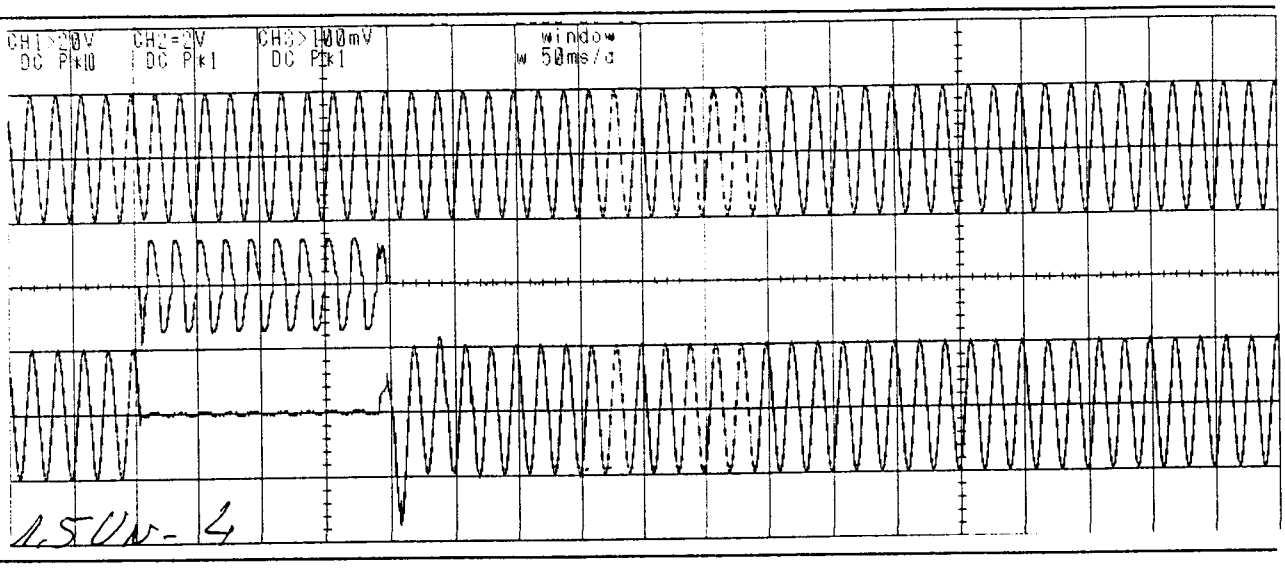
Up :

Is : 100 A/div

Us :



Up :

Is : 100 A/div

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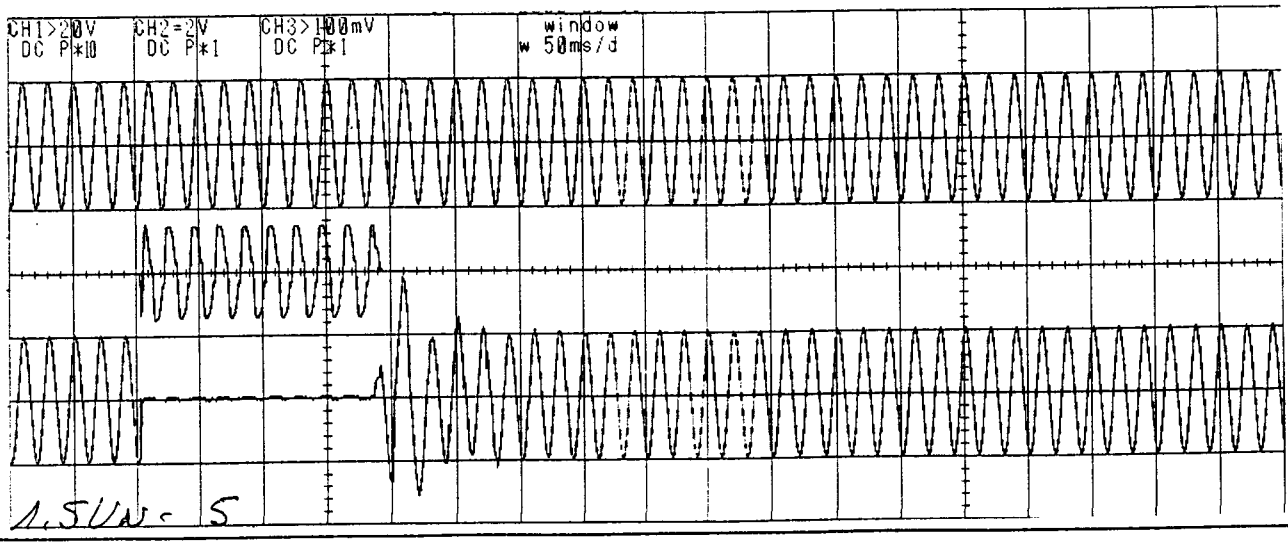
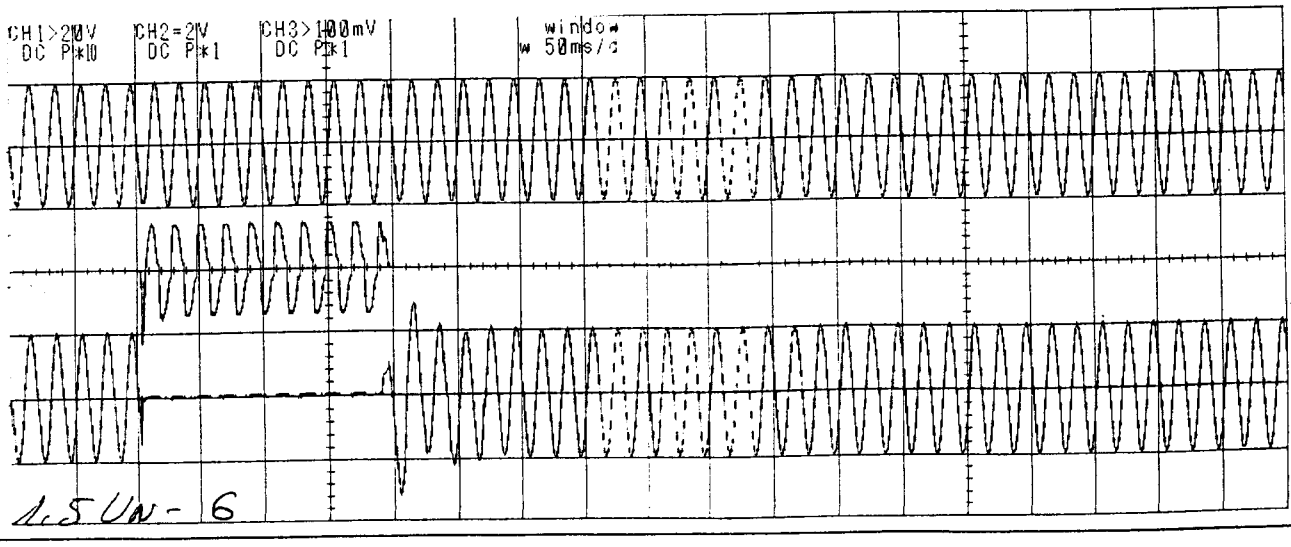


Up :

Is : 100 A/div

Us :



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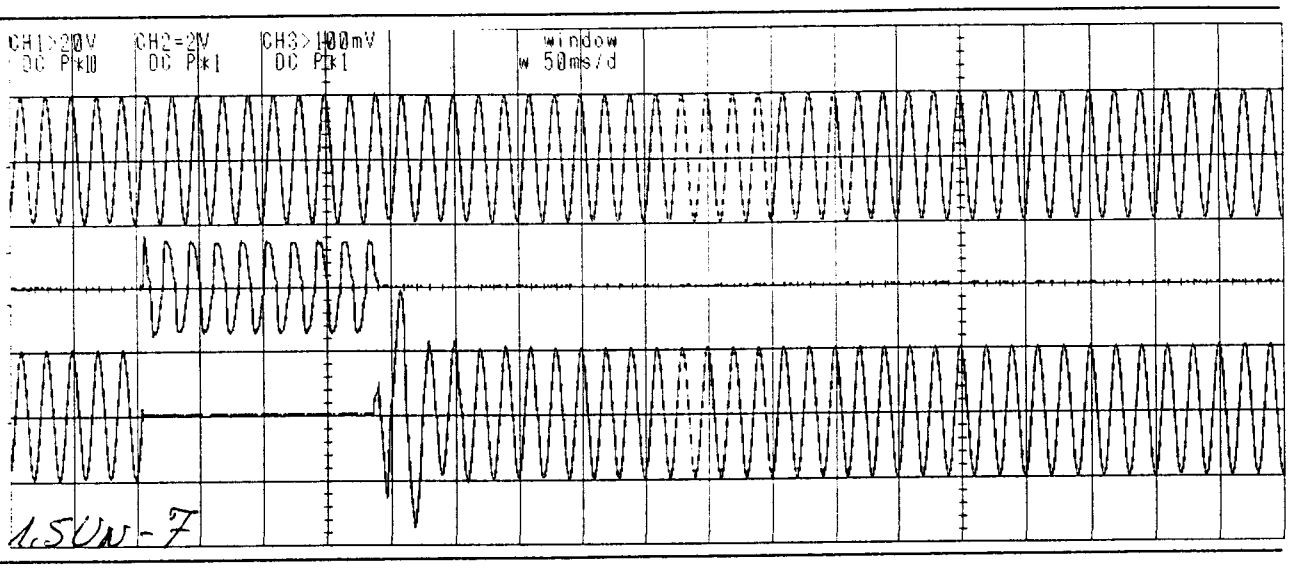
Us :



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Is : 100 A/div

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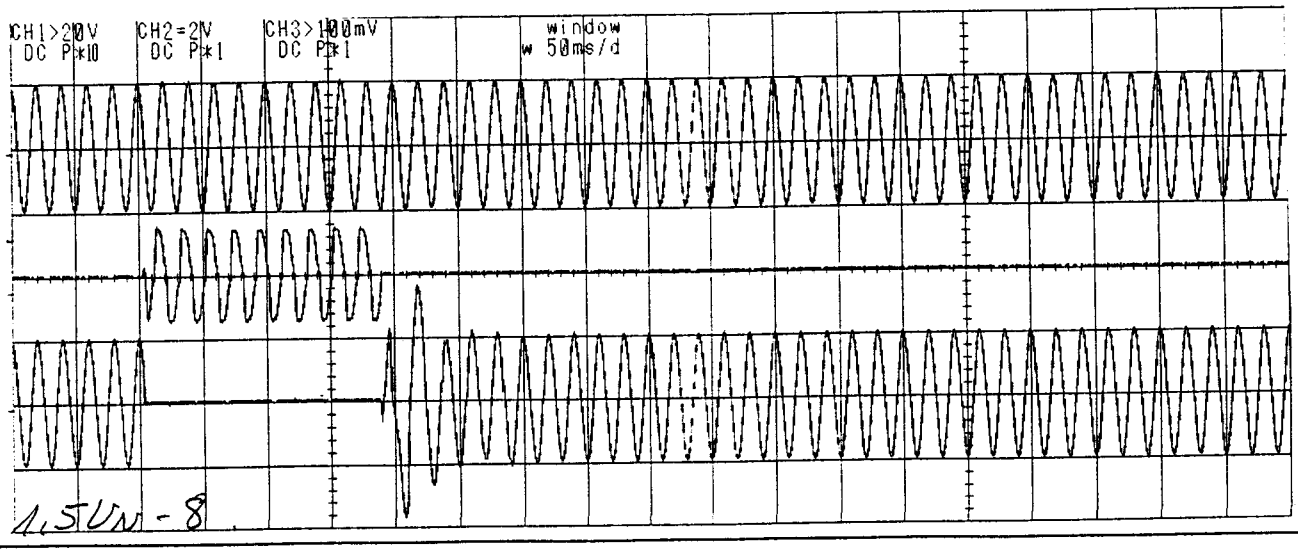
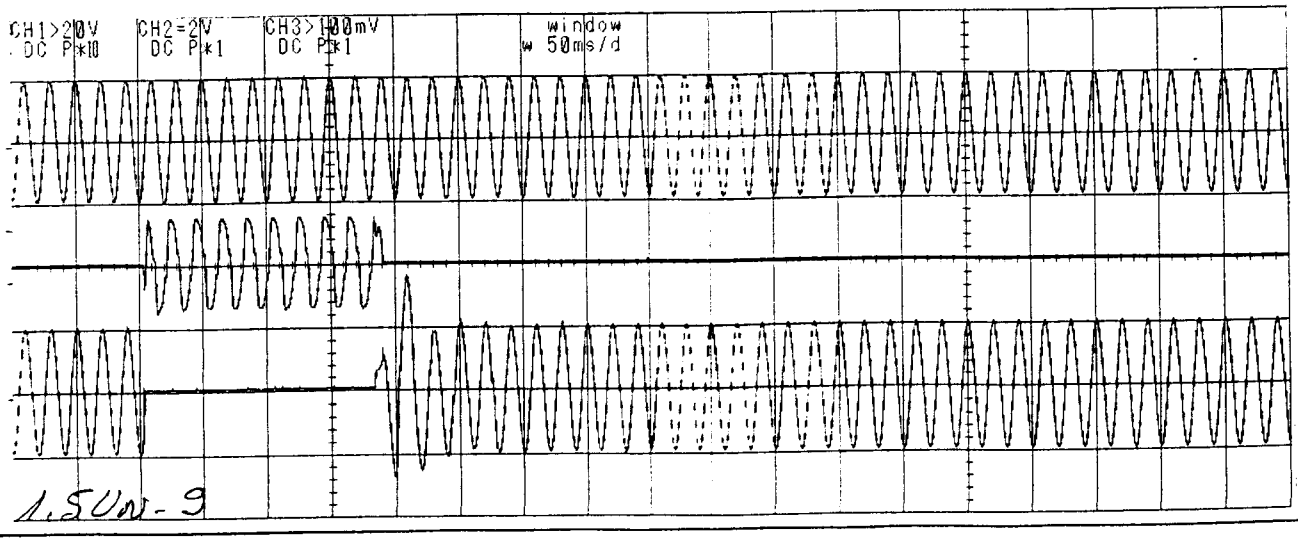


Up :

Is : 100 A/div

Us :



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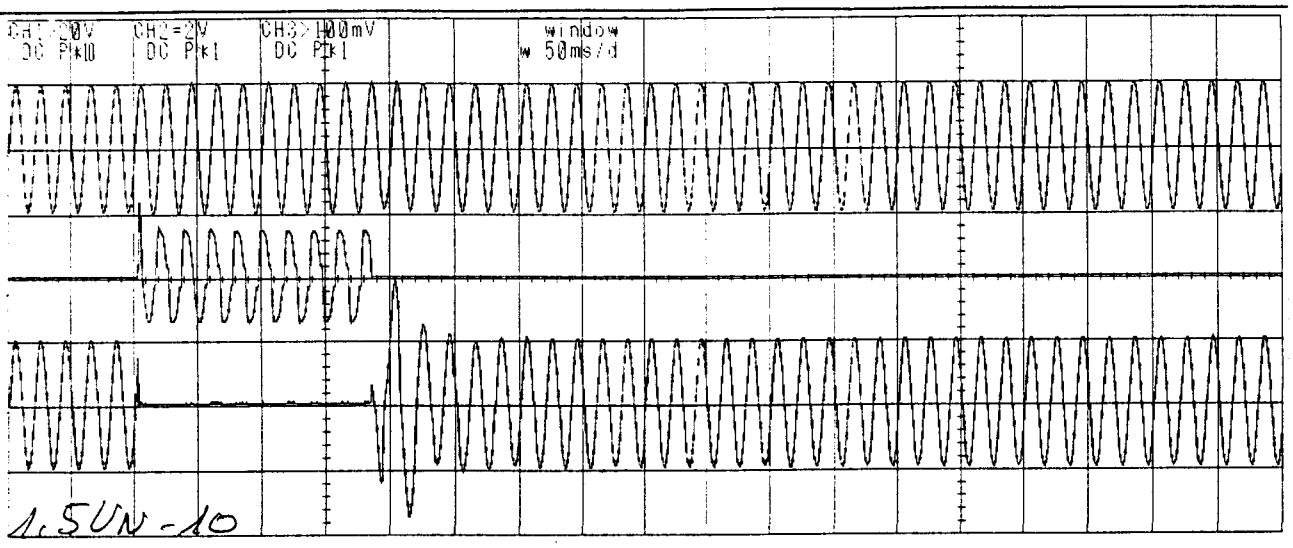
Up :

Is : 100 A/div

Us :



Up :

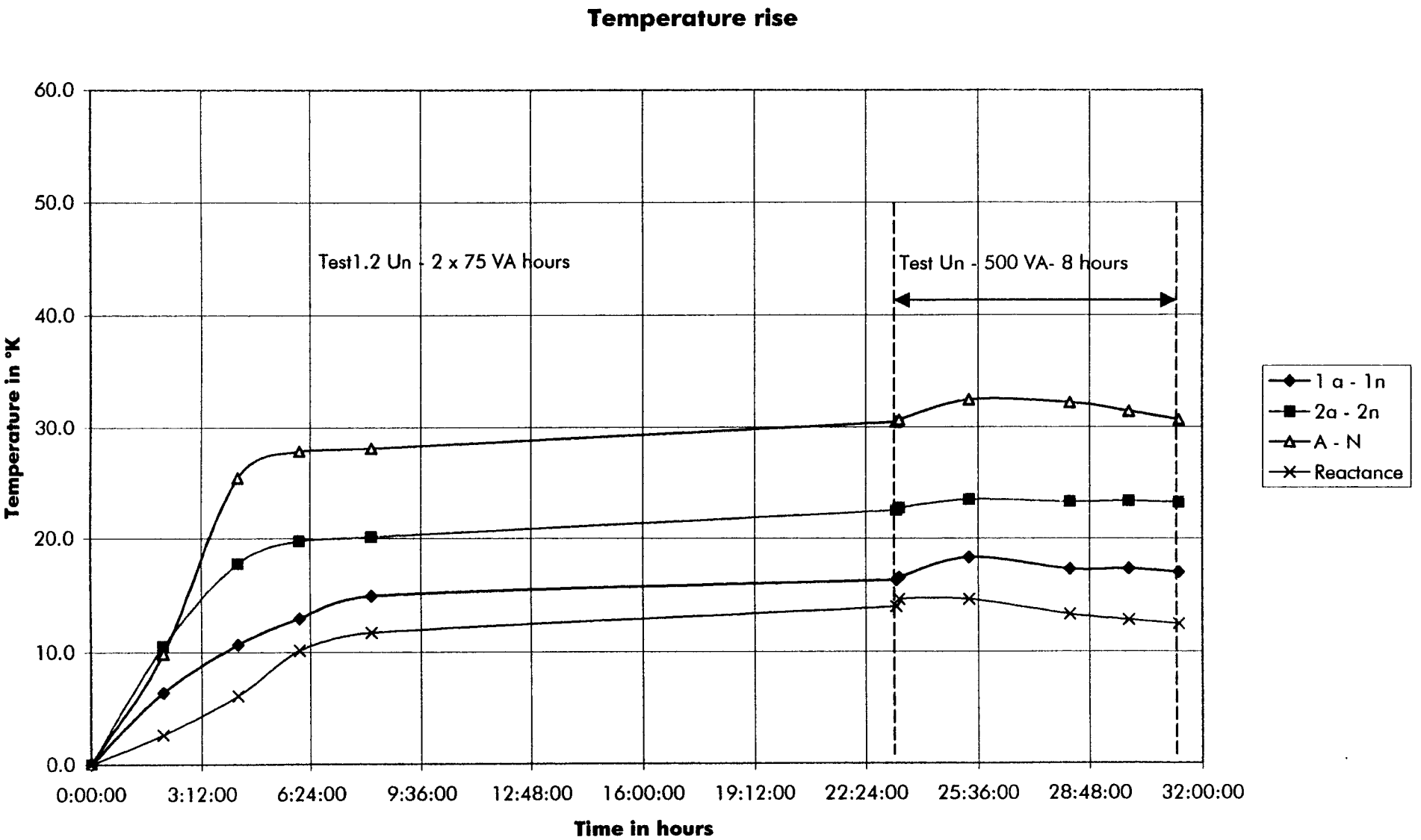
Is : 100 A/div

Us :

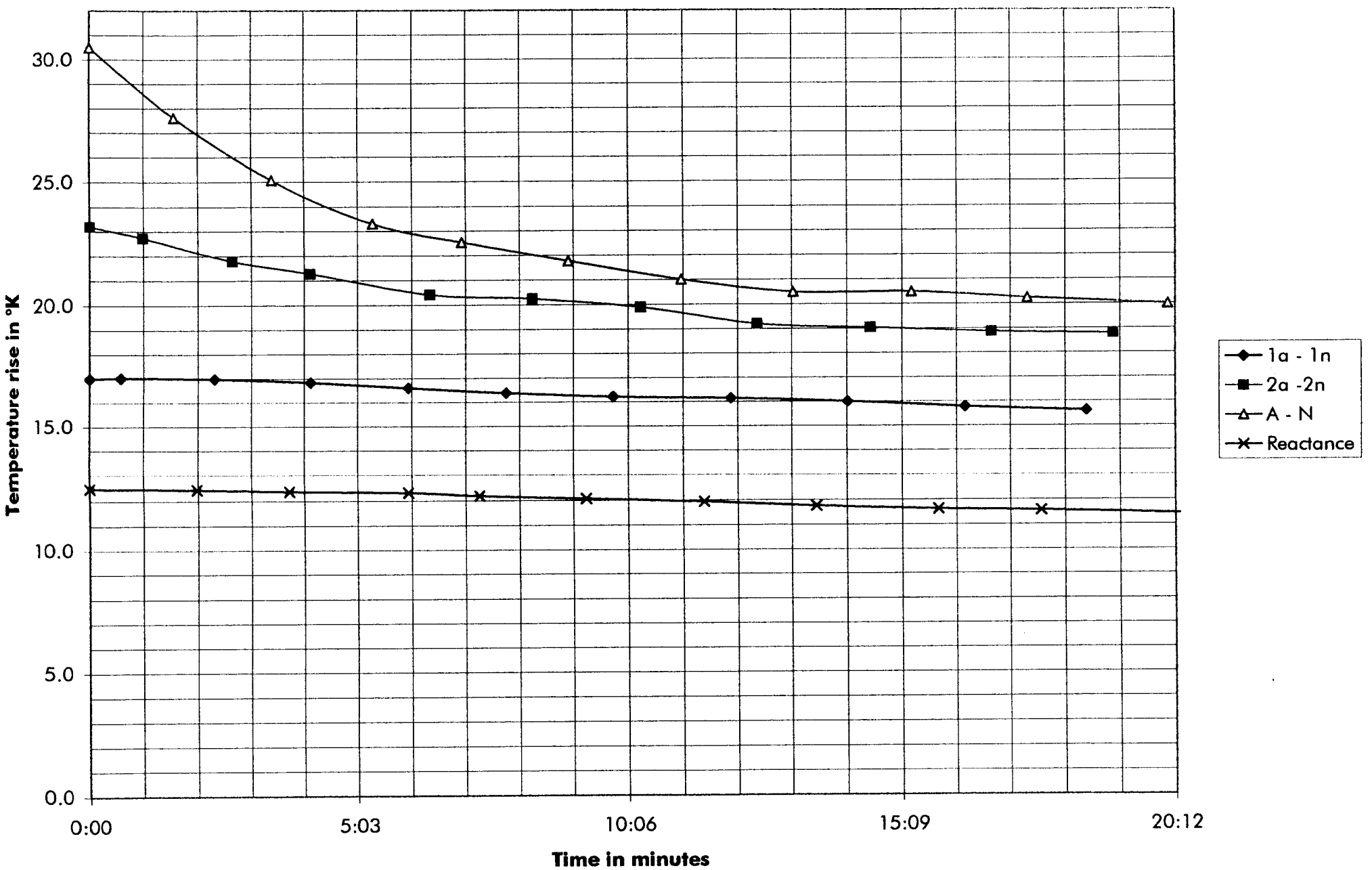
Up :

Is : 100 A/div

Us :


Temperature rise
Temperature in °K
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0:00:00
3:12:00
6:24:00
9:36:00
12:48:00
16:00:00
19:12:00
22:24:00
25:36:00
28:48:00
32:00:00
Time in hours
Test1.2 Un - 2 x 75 VA hours
Test Un - 500 VA- 8 hours
1 a - 1n
2a - 2n
A - N
Reactance

Cooling curve - CCV 245



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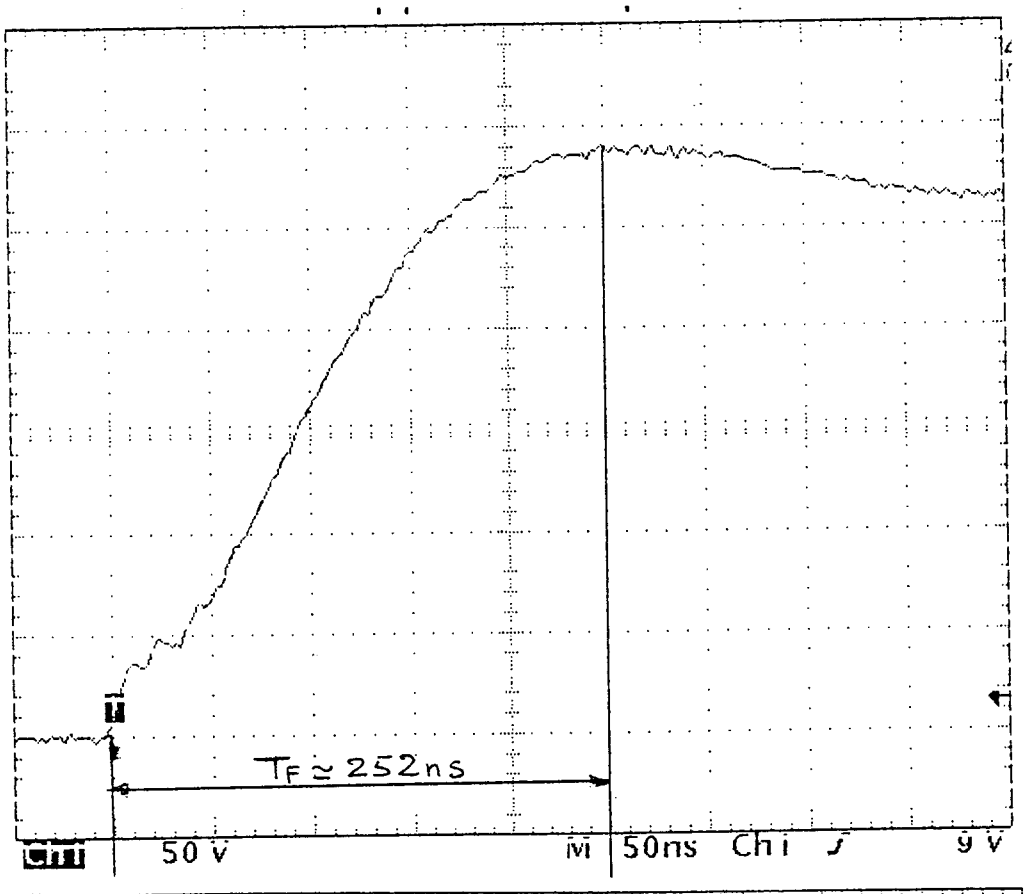
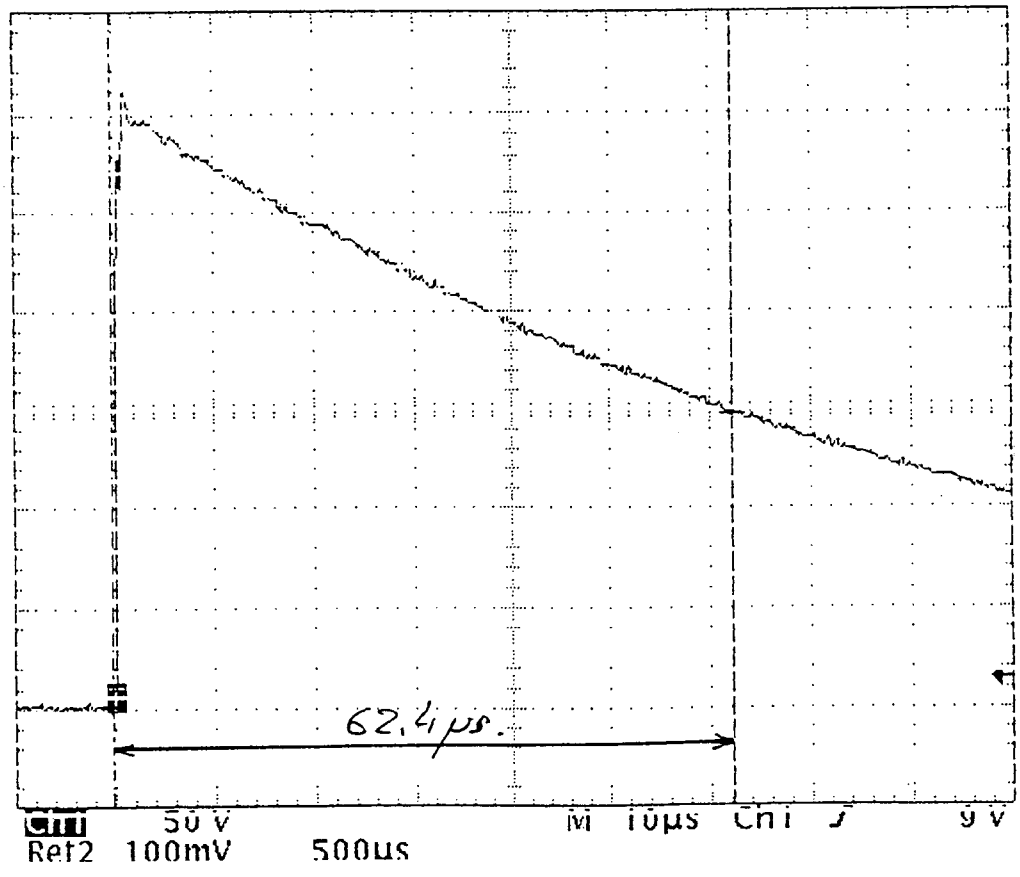
CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
~~PROTOCOLO DE PRUEBAS N° :~~

MEASUREMENT OF THE TRANSMISSION FACTOR OF HIGH FREQUENCY OVERVOLTAGE

Primary voltage applied : Û1 = 300 V Tf ≈ 252 ns Tq = 62.4 µs



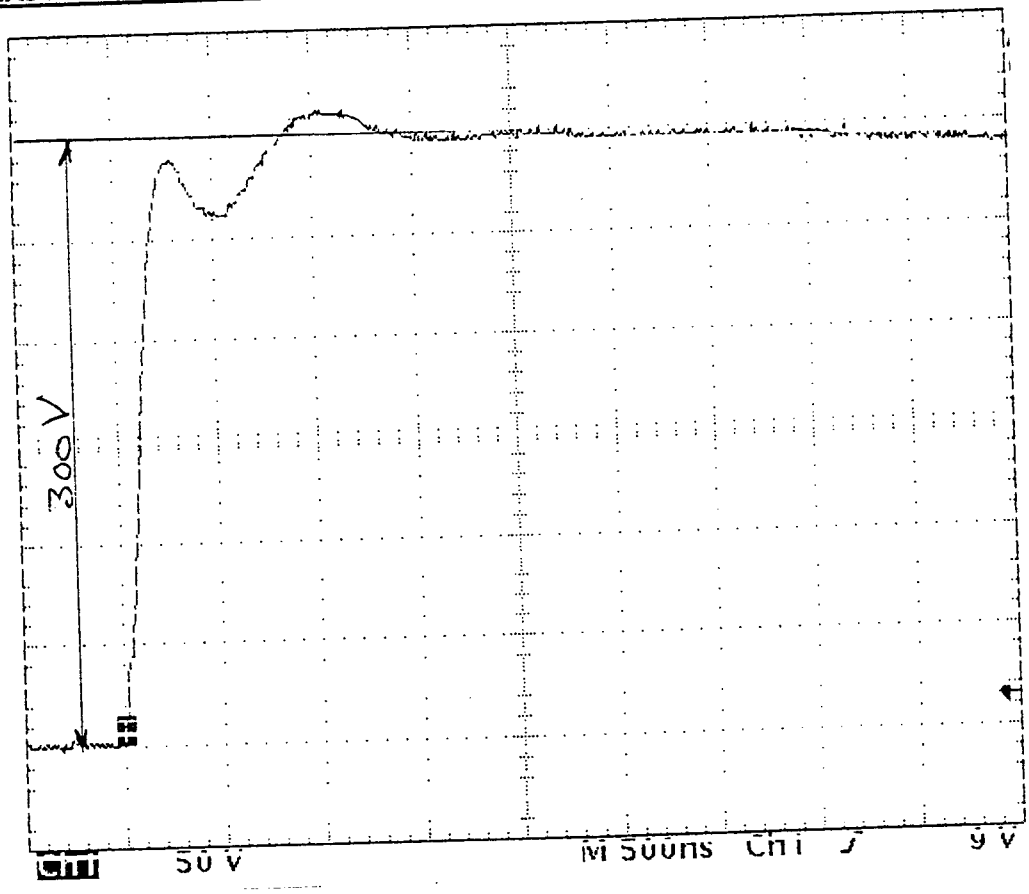


ALSTOM

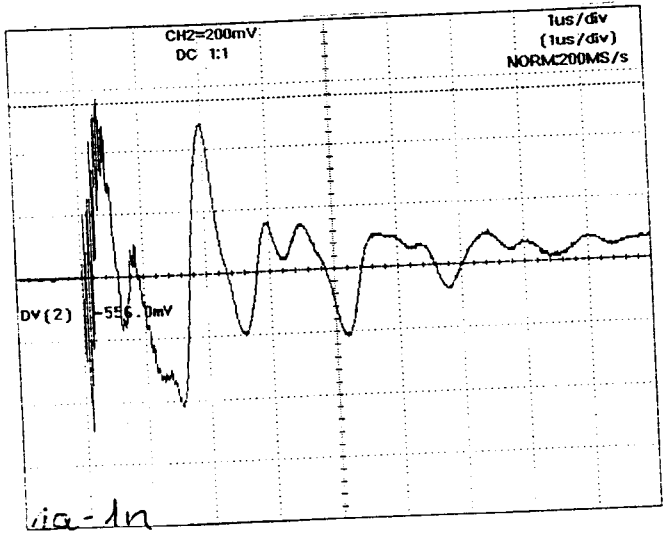
ALSTOM T&D Transformateurs de Mesure SA
au capital de 14 000 000 F
Siège social : 51, avenue Jean Jaurès
BP 380 92541 Montrouge Cedex France
343 074 092 RCS Nanterre
APE 311 A - TVA FR 05 343 074 092

CERTIFICAT D'ESSAI N° :
TEST CERTIFICATE N° : **25877**
PROTOCOLO DE PRUEBAS N° :

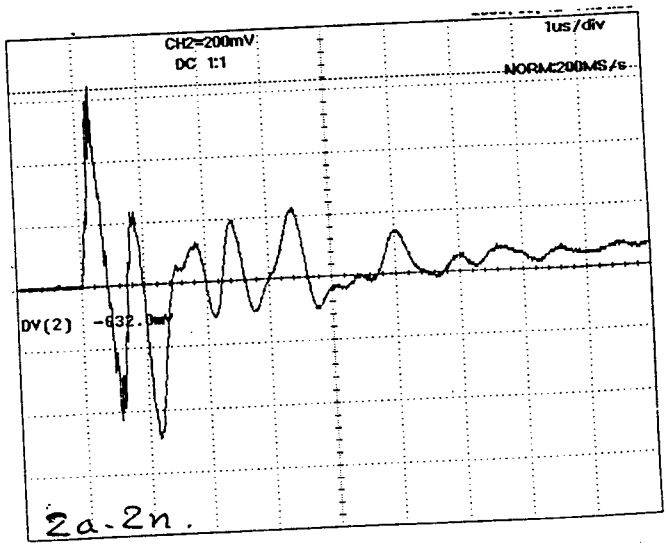
MEASUREMENT OF THE TRANSMISSION FACTOR OF HIGH FREQUENCY OVERVOLTAGE



U2 (1a –1 n) = 0.556 V
Us (1a –1 n) = **1112 V**



U2 (2a –2 n)= 0.632 V
Us (2a –2 n) = **1264 V**



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ACCURACY TEST RESULTS

Measurements on apparatus n° : XE 91 200-01 with frequency variations

Protective winding

Appareil N° °: Serial N° : Aparato N° :	Couplage et circuit Coupling and Circuits Acoplamiento y Arrollamiento	Charge en VA et cos φ : 0.8 Burden in VA and Power factor Carga en VA Y cos φ : 0.8		Nombre de Un Times rated Primary Fracción de Un	Erreur de rapport en % Ratio error in % Error de relación en %	Déphasage en minutes Phase error in minutes Desfasaje en Minutos	Limits	
							Ratio error in %	Phase error in minutes
XE 91 200-01	2a-2n	75 VA	75*	1.5	+0.45	+45	3	120
				1	+0.35	+40	3	120
				0.05	+0.40	+46	3	120
				0.02	+0.40	+52	6	240
		75 VA	0*	1.5	+0.40	+32	3	120
	47.6 Hz			1	+0.35	+38	3	120
				0.05	+0.40	+34	3	120
				0.02	+0.65	+34	6	240
		18. 75 VA	0*	1.5	+0.39	+22	3	120
				1	+0.38	+16.5	3	120
				0.05	+0.50	+20	3	120
				0.02	+0.60	+22	6	240
		75 VA	75*	1.5	+0.25	+37	3	120
				1	+0.25	+35	3	120
				0.05	+0.35	+38	3	120
				0.02	+0.40	+40	6	240
		75 VA	0*	1.5	+0.25	+28	3	120
	48 Hz			1	+0.24	+24	3	120
				0.05	+0.25	+29	3	120
				0.02	+0.35	+33	6	240
		18. 75	0*	1.5	+0.32	+18	3	120
				1	+0.35	+14.5	3	120
				0.05	+0.40	+17	3	120
				0.02	+0.55	+23	6	240
		75 VA	75*	1.5	+0.22	+30	3	120
				1	+0.22	+27	3	120
				0.05	+0.26	+31	3	120
				0.02	+0.30	+33	6	240
		75 VA	0*	1.5	+0.06	+15	3	120
	49 Hz			1	+0.12	+13	3	120
				0.05	+0.22	+17.5	3	120
				0.02	+0.22	+18	6	240
		18. 75 VA	0*	1.5	+0.22	+8.5	3	120
				1	+0.32	+7	3	120
				0.05	+0.36	+10.5	3	120
				0.02	+0.36	+12.5	6	240
		75 VA	75*	1.5	-0.25	+4	3	120
				1	-0.17	+3.5	3	120
				0.05	-0.11	+7.5	3	120
				0.02	-0.09	+8	6	240
		75 VA	0*	1.5	-0.04	+4	3	120
	50 Hz			1	+0.04	+3.5	3	120
				0.05	+0.10	+5.5	3	120
				0.02	+0.11	+6.5	6	240
		18. 75 VA	0*	1.5	+0.17	+1	3	120
				1	+0.33	+1	3	120
				0.05	+0.34	+2	3	120
				0.02	+0.33	+2.5	6	240

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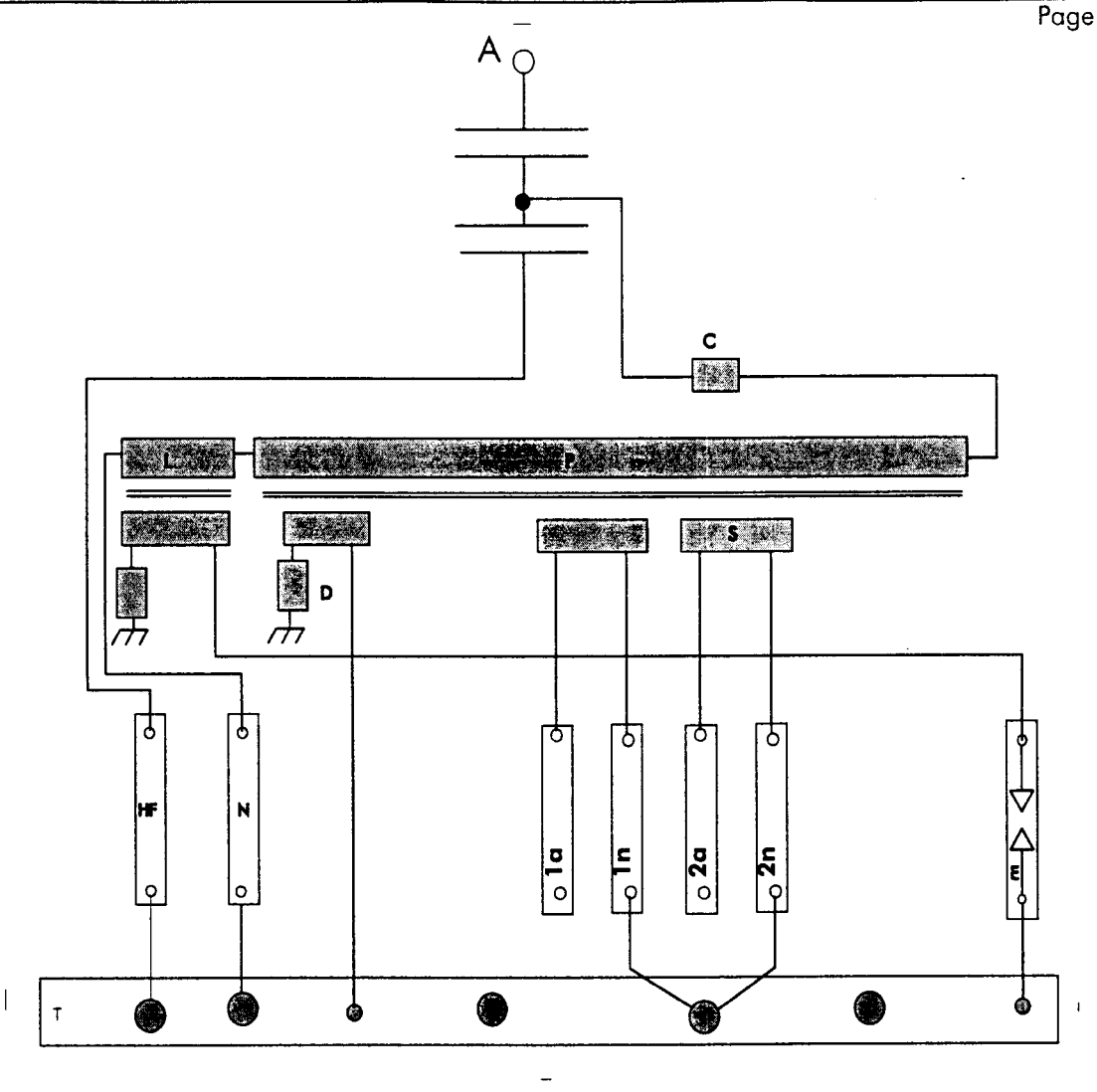
ACCURACY TEST RESULTS

Appareil N° °: Serial N° : Aparato N° :	Couplage et circuit Coupling and Circuits Acoplamiento y Arrollamiento	Charge en VA et cos φ : 0.8 Burden in VA and Power factor Carga en VA Y cos φ : 0.8		Nombre de Un Times rated Primary Fracción de Un	Erreur de rapport en % Ratio error in % Error de relación en %	Déphasage en minutes Phase error in minutes Desfasaje en Minutos	Limits Ratio error in %	Limits Phase error in minutes
	2a-2n	75 VA	75*	1.5	-0.37	-12	3	120
				1	-0.38	-13.5	3	120
				0.05	-0.36	-8	3	120
				0.02	-0.36	-9.5	6	240
	51.2 Hz	75 VA	0*	1.5	0	-6.5	3	120
				1	-0.5	-8	3	120
				0.05	-0.02	-2.5	3	120
				0.02	-0.03	-0.5	6	240
		18. 75 VA	0*	1.5	+0.36	-3	3	120
				1	+0.29	-6.5	3	120
				0.05	+0.26	-4.5	3	120
				0.02	+0.32	-1	6	240

Accuracy winding

Appareil N° °: Serial N° : Aparato N° :	Couplage et circuit Coupling and Circuits Acoplamiento y Arrollamiento	Charge en VA et cos φ : 0.8 Burden in VA and Power factor Carga en VA Y cos φ : 0.8		Nombre de Un Times rated Primary Fracción de Un	Erreur de rapport en % Ratio error in % Error de relación en %	Déphasage en minutes Phase error in minutes Desfasaje en Minutos	Limits Ratio error in %	Limits Phase error in minutes
XE 91 200-01	1a-1n	75 VA	75*	1.2	-0.09	+9.5		
				1	-0.08	+11	0.5	20
				0.8	-0.08	+11		
	49.4 Hz	75 VA	0*	1.2	+0.07	+7.5		
				1	+0.07	+7.	0.5	20
				0.8	+0.07	+7.5		
		18. 75 VA	0*	1.2	+0.30	+4		
				1	+0.30	+4	0.5	20
				0.8	+0.30	+4.5		
	50 Hz	75 VA	75*	1.2	-0.20	+1		
				1	-0.20	+1.5	0.5	20
				0.8	-0.19	+2		
		75 VA	0*	1.2	+0.01	+1.5		
				1	+0.02	+1.5	0.5	20
				0.8	+0.02	+2		
		18. 75 VA	0*	1.2	+0.28	+0.5		
				1	+0.28	+0.5	0.5	20
				0.8	+0.29	+0.5		
	50.6 Hz	75 VA	75*	1.2	-0.32	-7.5		
				1	-0.32	-7.5	0.5	20
				0.8	-0.31	-7.5		
		75 VA	0*	1.2	-0.04	-4.5		
				1	-0.05	-4.5	0.5	20
				0.8	-0.04	-4		
		18. 75 VA	0*	1.2	+0.27	-3.5		
				1	+0.27	-3.5	0.5	20
				0.8	+0.27	-3.5		

Accuracy test is satisfactory



C: Système de blocage	C: Carrier blocking device	C: Sistema de bloqueo
L: Inductance	L: Inductance coil	L: Bobina de compensacion
E: Système de limitation de tension	E: Voltage limiter device	E: Sistema de limitation de tension
P :Primaire du transformateur	P: Primary transformer	P: Primario del transformador
S: Secondaire(s) transfo.	S: Secondary transformer	S: Secundario del transformador
D: système d'amortissement	D: Damping device	D: Sistema de amortiguation
N: Borne BT du dispositif électromagnétique	N: Low voltage terminal of the electromagnetic unit	N: terminal BT del dispositivo elctromagnetico
HF: Borne BT du diviseur capacitif	HF: Low voltaget erminal of the capacitf divider	HF: terminal BT del divisor capacitivo
T: Borne Terre	T: Ground terminal	T: Terminal de tierra
GS HF: Sectionneur HF de mise à la terre	GS HF : HF grounding swicht	GS HF: Cuchilla HF de puesta a tierra
GS MT: Sectionneur MT de mise à la terre	GS MT :MV Grounding switch	GS MT: Cuchilla MT de puesta a tierra
DC: Bobine de drainage	DC: Draining coil	DC: Bobina de drenaje
G: Eclateur HF	G : Spare gap	G : Descargador
F: Fusible	F: fuse	F: Fusible
MCB: Disjoncteur	MCB: Micro circuit breaker	MCB: Disyuntor

Connexions Conexiones - Connection	Rapport / Ratio / Relacion	Puissance et classe Burden-accuracy / Potencia - Clase	F / MCB
1a -1n	220 000 / √3 // 100 / √3 V	75 VA Cl 0.5	
2a - 2n	220 000 / √3 // 100 / √3 V	75 VA Cl 3P	

Nature des modifications	Dessiné	Vérifié	Validé	N° DEM	Date	Ind.
N:\HTC\dataExcel\Ccv\Branchement_Xls\Sans sectionneur\Sans protection\[2_Secondaires.xls]Feuil1	G.Charton	A.Journay			19/01/2001	Z

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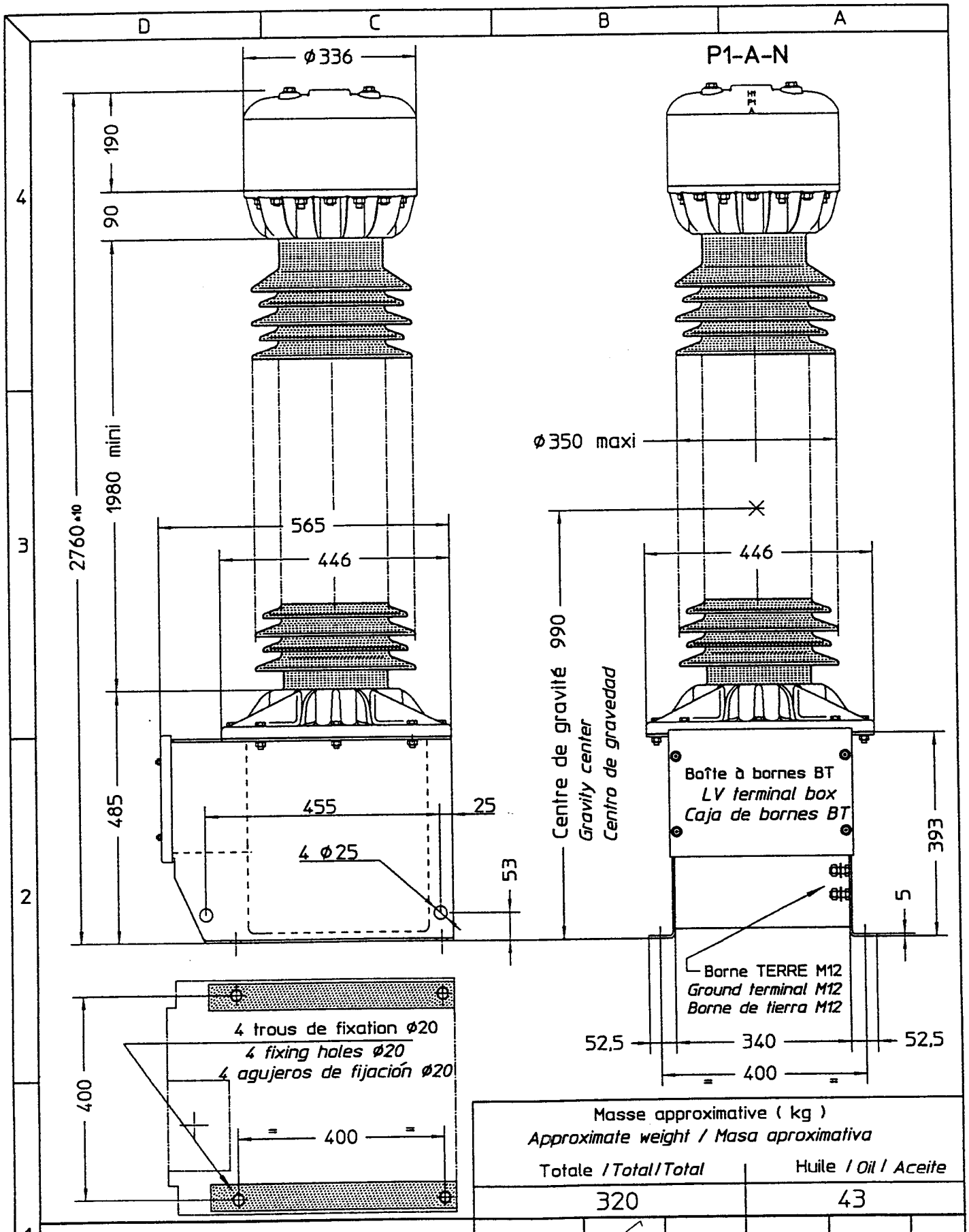
Transformateurs de Mesure

Désignation : SCHEMA DE BRANCHEMENT - ESQUEMA DE CONEXIONES - ELECTRICAL DIAGRAM

Emploi : **CCV 245** **Cn: 4 400 pF** Page : 1 / 1

Format	Échelle		Dossier	Repère	Identification
A4	//		N° C02	DSCB	XE91200 100



Masse approximative (kg) *Approximate weight / Masa aproximativa*	
Totale / *Total* / *Total*	Huile / *Oil* / *Aceite*
320	43

Nature des modifications	Dessiné	Vérifié	Validé	DEM N°	Date	Indice
Création	B. Rascinit	G. Charton		///	13-06-00	Z

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TRANSMISSION & DISTRIBUTION
Transformateurs de Mesure

Désignation: TRANSFORMATEUR CONDENSATEUR DE TENSION
CAPACITOR VOLTAGE TRANSFORMER
TRANSFORMADOR CAPACITIVO DE TENSION
CCV 245

Format	Echelle	Dossier	Repère	Identification
A4	1/10	C 02	DEX	8 162 976

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