



Tesla AC Powerwall2 ( 4.8 kVA)  
連系協議用資料—代表機試験結果 (50Hz)  
Ver1.0

装置型式：

AC Powerwall2 model: 1092170-xx-y, 2012170-xx-y, 3012170-xx-y



## 1. Summary

Confirmation test on system interconnection protection of this equipment is tested under the test conditions, test methods, and judgment criteria of the following documents.

- JETGR0002-1-10.0 (2019.07) Test method for grid interconnection protection device etc. for compact dispersed power generation system General rules
- JETGR0003-5-8.0 (2019.07) Individual test method such as system interconnection protection device for storage battery system

本装置の系統連系保護の確認試験に関しては、下記資料の試験条件、試験方法、判定基準のもと試験を行う。

- JETGR0002-1-10.0 (2019.07) 小型分散型発電システム用系統連系保護装置等の試験方法通則
- JETGR0003-5-8.0 (2019.07) 蓄電池システム用系統連系保護装置等の個別試験方法

## 2. Sample information 装置シリアル番号

Product 品名	S/N	Remarks 備考
AC Powerwall 2	T1710013744	

### 3. Measurement Device / Equipment List 計測器

Sr. No.	Description 計測器名	Manufacturer メーカー	Model 型名	Serial シリアル	Cal Date 校正日	Cal Due 校正期限日
1	Temperature measurement	Amprobe	THWD-10	TEV22926	9/11/2018	9/11/2020
2	Power Analyzer	Yokogawa	WT3000E	91V119363	1/30/2019	1/30/2020
3	Current Probe	Yokogawa	701930	180828210	3/14/2019	3/14/2020
4	Current Probe	Yokogawa	701930	180899741	3/14/2019	3/14/2020
5	Current Probe	Yokogawa	701930	180828557	3/14/2019	3/14/2020
6	Temperature and Humidity measurement	Vaisala	HM24Probe	L0830459	12/4/2019	12/4/2020
7	Scope	Yokogawa	DL850EV	91U616294	7/11/2019	7/11/2020
8	Differential Probe	Yokogawa	700924	1803231	7/11/2019	7/11/2020
9	Differential Probe	Yokogawa	700924	1803221	7/11/2019	7/11/2020
10	Differential Probe	Yokogawa	700924	1803234	7/11/2019	7/11/2020
11	Temperature and Humidity measurement	Vaisala	HM24Probe	L0830459	12/4/2019	12/4/2020



#### 4. Test Results

Section Number	Test Description	Completion date	Pass/Fail
3.1.3	Direct Current Component Detection Test 直流分検出試験	10/3/2019	Pass
3.2.1	Alternative Current Overvoltage and Undervoltage Test (Magnitude) 交流過電圧及び不足電圧試験（しきい値）	10/3/2019	Pass
3.2.1	Alternative Current Overvoltage and Undervoltage Test (Time) 交流過電圧及び不足電圧試験（時限）	7/18/2019	Pass
3.2.2	Test procedure for Frequency tripping Thresholds 周波数上昇及び低下試験（しきい値）	7/17/2019	Pass
3.2.2	Test procedure for measuring Frequency trip time 周波数上昇及び低下試験（時限）	7/18/2019	Pass
3.2.9.1	Constant-time input blocking Test after power reconnection 1 復電後の一定時間投入阻止試験 1	7/18/2019	Pass
3.2.9.2	Constant-time input blocking Test after power reconnection 2 復電後の一定時間投入阻止試験 2	7/18/2019	Pass
3.2.10	Instantaneous ( Unbalanced) Overvoltage Test 瞬時(不平衡)過電圧試験	10/3/2019	Pass
4.3	Power Factor Operation Test 運転力率試験	10/3/2019	Pass
4.4	Output Harmonic Current Test 出力高調波電流試験	10/3/2019	Pass
4.8	Soft Start Function Test ソフトスタート機能試験	7/18/2019	Pass
5.1	Rapid Input Power Change and Rapid Load Change Test 入力電力急変試験及び負荷急変試験	13/02/2020	Pass
6.3	Instantaneous Voltage Drop Test	01/06/2020	Pass



	瞬時電圧低下試験（FRT 試験）		
6.4	Frequency Fluctuation Test (FRT) 周波数変動試験（FRT 試験）	7/22/2019	Pass
12.1	Switching to Backup operation mode 自立運転切替試験	12/02/2020	Pass
12.2	Automatic switching to backup mode 自立運転自動切替試験	12/02/2020	Pass
12.4	Independent disconnection signal disruption test 自立解列信号途絶試験	12/02/2020	Pass



### 3.1.3 DC Injection Test 直流分検出試験

Test Parameters 設定値

DC Injection	Vac 交流電圧	Prated 出力	Irated 定格電流	Threshold 検出値	Detection Time 検出時間
	101(L-N)	4800W	24A	0.24A	0.5s

Test Result 試験結果：

Phase AB

Actual Set point (A) (1% Irated) 直流分電流	0.24	Pass / Fail 判定
Output Power (kW) (100%) パワコン出力	4800	
Measured Value (A) 計測値	0.228	Pass
Remarks 備考		
Actual Set point (s) (jump from 0% to 110% of DC set point) 直流分電流	0.5s	
Time to Trip (s) Gate block stop 検出時限 (GB 時限)	0.0152	Pass
Time to open the relay (s) 検出時限 (RY 解列時限)	0.01525	Pass
Remarks 備考		



### 3.2.1 Over Voltage And Under Voltage Test 交流過電圧及び不足電圧試験

Over Voltage Test Parameters: 過電圧設定値

	Threshold 検出値	Detection Time 時限	Re-connection Time 再並列阻止時間
OVR	121.2Vrms	1s	10s

OVR detection threshold test:

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement (Vrms) 測定結果	Pass / Fail 判定 (121.2±2.424Vrms)	Remarks 備考
A: 115.14Vrms (95%)↑ B: 101Vrms	-4.8kW	50 Hz	Charge 充電	A	122.3	Pass	
A: 101Vrms B: 115.14Vrms (95%)↑				B	122.138	Pass	
A: 115.14Vrms (95%)↑ B: 115.14Vrms (95%)↑				AB	121.08 121.048	Pass	
A: 115.14Vrms (95%)↑ B: 101Vrms	4.8kW	50 Hz	Discharge 放電	A	120.711	Pass	
A: 101Vrms B: 115.14Vrms (95%)↑				B	122.639	Pass	
A: 115.14Vrms (95%)↑ B: 115.14Vrms (95%)↑				AB	122.198 122.167	Pass	



OVR Time Trips    OVR 検出時限確認及び再投入時間確認：

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement			Pass / Fail 判定 <sup>1</sup> GB success <sup>2</sup> 1.0s±0.1s <sup>3</sup> more than 10s	Remarks 備考
					Gate Block (s) <sup>1</sup> GB 時限	Relay open time (s) <sup>2</sup> Ry 解列時限	Recon time (s) <sup>3</sup> 再並列阻止時間		
AB: 101Vrms →127.26Vrms (105%)↑	-4.8kW	50 Hz	Charge 充電	AB	1.044	1.066	11.271	Pass	
AB: 101Vrms →127.26Vrms (105%)↑	4.8kW		Discharge 放電	AB	1.031	1.061	11.290	Pass	





# Under Voltage Test Parameters 不足電圧設定値

	Threshold 検出値	Detection Time 検出時限	Re-connection Time 再並列阻止時間
UVR	80.8Vrms	1s	10s

## UVR Default detection threshold test UVR 検出レベル確認:

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement (Vrms) 試験結果	Pass / Fail (80.8±1.616Vrms) 判定	Remarks 備考
A: 84.84Vrms (105%)↓ B: 101Vrms	-4.8kW	50 Hz	Charge 充電	A	80.35	Pass	
A: 101Vrms B: 84.84Vrms (105%)↓				B	79.293	Pass	
A: 84.84Vrms (105%)↓ B: 84.84Vrms (105%)↓				AB	80.15 80.122	Pass	
A: 84.84Vrms (105%)↓ B: 101Vrms	4.8kW	50 Hz	Discharge 放電	A	79.23	Pass	
A: 101Vrms B: 84.84Vrms (105%)↓				B	79.53	Pass	
A: 84.84Vrms (105%)↓ B: 84.84Vrms (105%)↓				AB	80.12 80.3	Pass	



UVR Time Trips    UVR 検出時限確認及び再投入時間確認：

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement			Pass / Fail 判定 <sup>1</sup> GB success <sup>2</sup> 1.0s±0.1s <sup>3</sup> more than 10s	Remarks 備考
					Gate Block (s) <sup>1</sup> GB 時限	Relay open time (s) <sup>2</sup> Ry 解列時限	Recon time (s) <sup>3</sup> 再並列阻止時間		
AB:101Vrms→76.76 Vrms(95%)↓	-4.8 kW	50 Hz	Charge 充電	AB	1.015	1.041	11.327	Pass	
AB:101Vrms→193.04 Vrms(95%)↓	4.8 kW		Discharge 放電	AB	1.046	1.066	11.240	Pass	



### 3.2.2 Frequency Functional Test 周波数上昇及び低下試験

#### Over Frequency Test 周波数上昇試験結果

Parameter 設定値:

	Threshold 検出値	Detection Time 検出時限	Reconnect time 再並列阻止時間
OFR	51.5 Hz	1s	10s

#### OFR Detection Threshold Test OFR 検出レベル確認

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement 測定結果	Pass / Fail 判定 (51.5±0.1 Hz)	Remarks 備考
Phase A: 101Vrms Phase B: 101Vrms	- 4.8kW	51Hz↑	Charge 充電	AB	51.541	Pass	
	4.8kW		Discharge 放電	AB	51.516	Pass	



OFR trip time OFR 検出時限確認及び再投入時間確認：

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement			Pass / Fail 判定 <sup>1</sup> GB success <sup>2</sup> 1.0s±0.1s <sup>3</sup> more than 10s	Remarks 備考
					Gate Block (s) <sup>1</sup> GB 時限	Relay open time (s) <sup>2</sup> Ry 解列時限	Recon time (s) <sup>3</sup> 再並列阻止時間		
Phase A: 101Vrms Phase B: 101Vrms	- 4.8kW	50.0Hz →54.075(105%)	Charge 充電	AB	1.026	1.053	11.775	Pass	
	4.8kW		Discharge 放電	AB	1.020	1.050	11.740	Pass	



## Under Frequency Test 周波数低下試験結果

Parameter 設定値 :

	Threshold 整定値	Detection Time 検出時間	Reconnect time 再並列時間
UFR	48.5 Hz	1s	10s

## UFR Detection Threshold Test 検出レベル確認

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement 測定結果	Pass / Fail 判定 (48.5±0.1 Hz)	Remarks 備考
Phase A: 101Vrms Phase B: 101Vrms	- 4.8kW	49Hz ↓	Charge 充電	AB	48.508	Pass	
	4.8kW		Discharge 放電	AB	48.508	Pass	



UFR trip time 検出時限確認及び再投入時間確認：

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement			Pass / Fail 判定 <sup>1</sup> GB success <sup>2</sup> 1.0s±0.1s <sup>3</sup> more than 10s	Remarks 備考
					Gate Block (s) <sup>1</sup> GB 時限	Relay open time (s) <sup>2</sup> Ry 解列時限	Recon time (s) <sup>3</sup> 再並列阻止時間		
Phase A: 101Vrms Phase B: 101Vrms	- 4.8kW	50.0Hz → 46.075Hz↓	Charge 充電	AB	1.011	1.032	11.784	Pass	
	4.8kW		Discharge 放電	AB	1.017	1.047	11.770	Pass	



### 3.2.9.1 Constant-time input blocking Test after power reconnection 1

#### 復電後の一定時間投入阻止試験 1

Parameter 設定値

Reconnection Testing 再並列阻止時間試験	Time Set Point 待機時間
Reconnection Time 1	300s

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Mode 動作モード	Measurement 試験結果	Pass / Fail 判定	Remarks 備考
				Reconnection Time 再並列阻止時間	>300s	
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	50 Hz	Discharge	302.1 s	Pass	
	-4.8 kW		Charge	301.8 s	Pass	

### 3.2.9.2 Constant-time input blocking Test after power reconnection 1

#### 復電後の一定時間投入阻止試験 2

Parameter 設定値:

Reconnection Testing 再並列阻止時間試験	Time Set Point
Reconnection Time 2	300s

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Measurement 試験結果	Pass / Fail 判定	Remarks 備考
				Reconnection Time 再並列阻止時間	>300s	
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	50 Hz	Discharge 放電	301.8 s	Pass	





### 3.2.10 Instantaneous ( Unbalanced) Overvoltage Test - 瞬時(不平衡)過電圧試験

Over Voltage Test Parameters: 過電圧設定値

	Threshold 検出値	Detection Time 時限	Re-connection Time 再並列阻止時間
OVR	121.2Vrms	<1s	10s

OVR detection threshold test OVR 検出レベル確認

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement (Vrms) 測定結果	Pass / Fail 判定 (121.2±2.424Vrms)
A: 109.08Vrms (90%)↑ B: 101Vrms	-4.8kW	50 Hz	Charge 充電	A	123.4	Pass
A: 101Vrms B: 109.08Vrms (90%)↑				B	123.638	Pass
A: 109.08Vrms (90%)↑ B: 101Vrms	4.8kW	50 Hz	Discharge 放電	A	121.377	Pass
A: 101Vrms B: 109.08Vrms (90%)↑				B	121.639	Pass

Instantaneous (Unbalanced) Overvoltage trip time OVR 検出時限確認及び再投入時間確認

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Operation Mode 動作モード	Tested Phase 試験相	Measurement (Time)	Pass / Fail	Remarks 備考
A: 109.08Vrms (90%)↑ B: 101Vrms	-4.8kW	50 Hz	Charge 充電	A	0.852	Pass	
A: 101Vrms B: 109.08Vrms (90%)↑				B	0.863	Pass	
A: 109.08Vrms (90%)↑ B: 101Vrms	4.8kW	50 Hz	Discharge 放電	A	0.841	Pass	
A: 101Vrms B: 109.08Vrms (90%)↑				B	0.896	Pass	



### 4.3 Power Factor 運転力率

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Measurement 試験結果		Pass / Fail 判定	Remarks 備考
			Power 出力電力	PF 力率一定	>0.95	
Phase A: 101Vrms Phase B: 101Vrms	4800 W	50 Hz	4804 W	0.999	Pass	

#### 4.4 Output Harmonic Current 出力高調波電流

AC Voltage 交流電圧	Output Power 出力電力	Frequency 周波数	Phase 試験相	Operation Mode 動作モード	Measurement 試験結果			Pass / Fail 判定	Remarks 備考
					THD % 歪み率	PF 力率	Highest Harm with Order 電流歪率 (各次)	THD<5% PF>0.95 Individual Harmonics<3%	
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	50 Hz	A	Discharge 放電	3.784	1.00	3 <sup>rd</sup> : 2.7937%	Pass	See Below
			B		3.782	1.00	3 <sup>rd</sup> : 2.7939%	Pass	

Detailed reference data of each harmonic (output current distortion ratio)						Rated output current = 24A					
Phase	Order	1	2	3	4	5	6	7	8	9	10
A	Harmonic current A	22.2302	0.0213	0.6216	0.0203	0.4862	0.0201	0.3121	0.0058	0.2014	0.001
	Order	11	12	13	14	15	16	17	18	19	20
	Harmonic current A	0.1498	0.0019	0.1246	0.0011	0.1009	0.0028	0.0794	0.0021	0.0612	0.0025
	Order	21	22	23	24	25	26	27	28	29	30
	Harmonic current A	0.0467	0.0015	0.0331	0.0008	0.0231	0.0007	0.0169	0.0007	0.0144	0.001
	Order	31	32	33	34	35	36	37	38	39	40
	Harmonic current A	0.0088	0.0002	0.0065	0.0007	0.0038	0.0009	0.0041	0.0004	0.0047	0.0008
Phase	Order	1	2	3	4	5	6	7	8	9	10
B	Harmonic current A	22.2117	0.019	0.6211	0.019	0.4853	0.0178	0.3136	0.0042	0.201	0.0019
	Order	11	12	13	14	15	16	17	18	19	20
	Harmonic current A	0.1506	0.0008	0.123	0.0026	0.1028	0.002	0.0795	0.0018	0.0612	0.0024
	Order	21	22	23	24	25	26	27	28	29	30
	Harmonic current A	0.0469	0.0011	0.0334	0.0001	0.0238	0.0016	0.0176	0.0006	0.0136	0.0007
	Order	31	32	33	34	35	36	37	38	39	40
	Harmonic current A	0.0083	0.0013	0.0073	0.0009	0.0043	0.0004	0.0049	0.0003	0.0038	0.001

## 4.8 Soft Start Function Test ソフトスタート機能試験

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	% of output fluctuation		Pass / Fail <sup>1</sup> No Overcurrent <sup>1</sup> Is 150% or less of the rated current, <sup>2</sup> The time exceeding 100% is within 0.5 seconds	Remarks 備考
				Output Fluctuation <sup>1</sup> 出力変動	Time spent over 100% of nominal current (sec) <sup>2</sup>		
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	Discharge 放電	50 Hz	0%	0	Pass	Figure 4.8

Scope Channel Description:

Channel 1\_1: Phase A Current

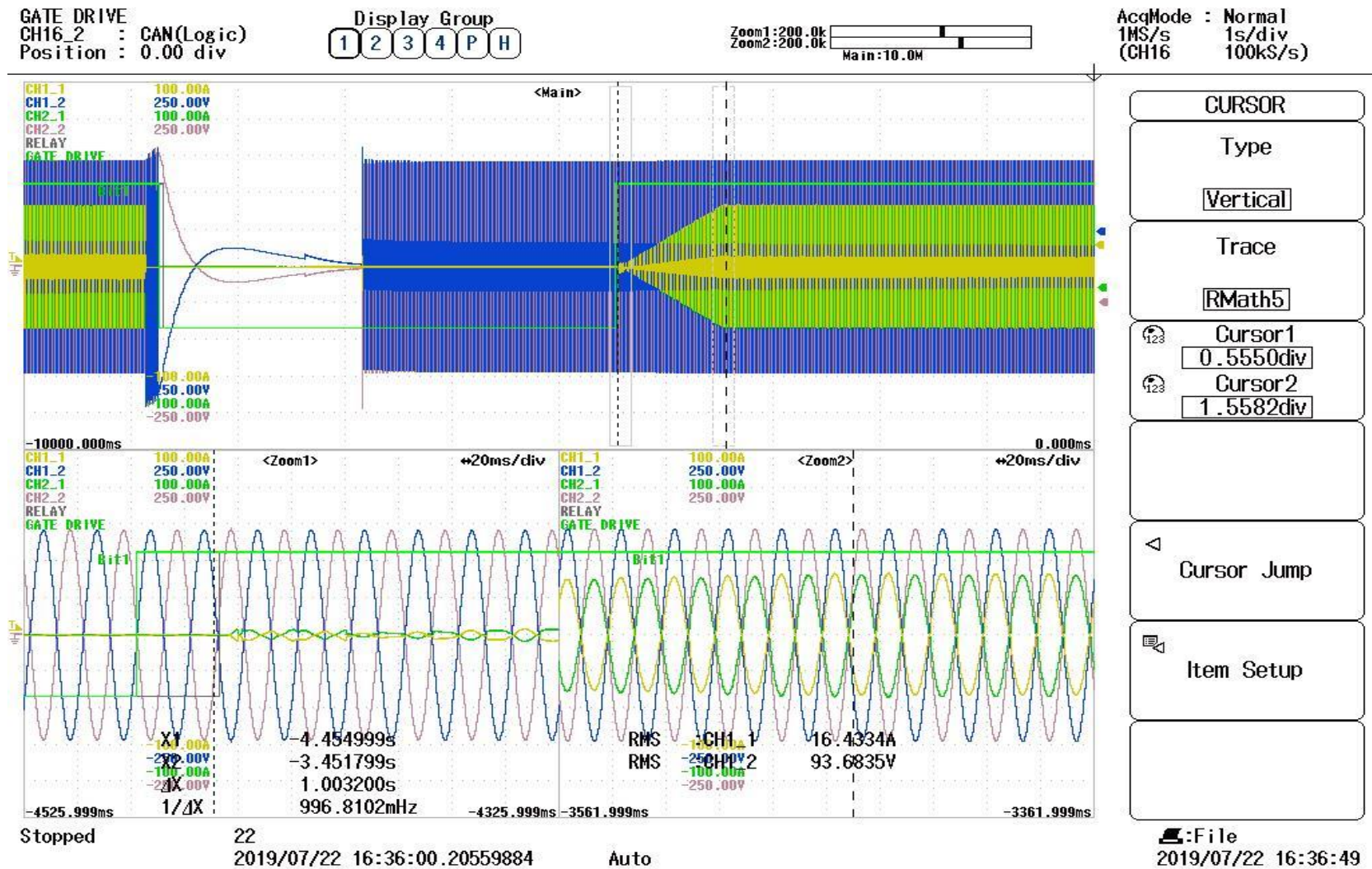
Channel 1\_2: Phase A Voltage

Channel 2\_1: Phase B Current

Channel 2\_2: Phase B Voltage

Relay: Relay Signal

Gate drive: Gate Signal



## 5.1 Rapid Input Power Change and Rapid Load Change Test

### 入力電力急変試験及び負荷急変試験

EUT set power (% of EUT name plate power rating)	Load setting (% of EUT name plate power rating)	Voltage (V) 電圧	Frequency (Hz) 周波数	EUT Power (W)	EUT Power (% of EUT nameplate)	EUT Current (A)	EUT Current (% of EUT nameplate)	time to reach set point (s)	Remarks
50	50	101.603	50.022	2514.5	0.523854167	12.4754	0.52	--	
50	75	102.041	50.023	3415.4	0.711541667	16.8525	0.7021875	0.15	Fig: 5.1.2
50	50	101.69	50.004	2552.9	0.531854167	12.6569	0.527370833	0.25	
50	50	101.855	49.977	2175.1	0.453145833	10.7843	0.449345833	--	
50	25	101.4	50.02	1409.8	0.293708333	7.0379	0.293245833	0.4	Fig: 5.1.3
50	50	101.804	50.008	2350.1	0.489604167	11.6473	0.485304167	0.25	
100	100	103.168	50.008	4646.4	0.97	22.625	0.943	--	
100	0	100.994	50.015	228.5	0.048	1.416	0.06	0.3	Fig: 5.1.1
100	100	102.05	50.01	4530.7	0.943895833	22.26	0.9275	0	



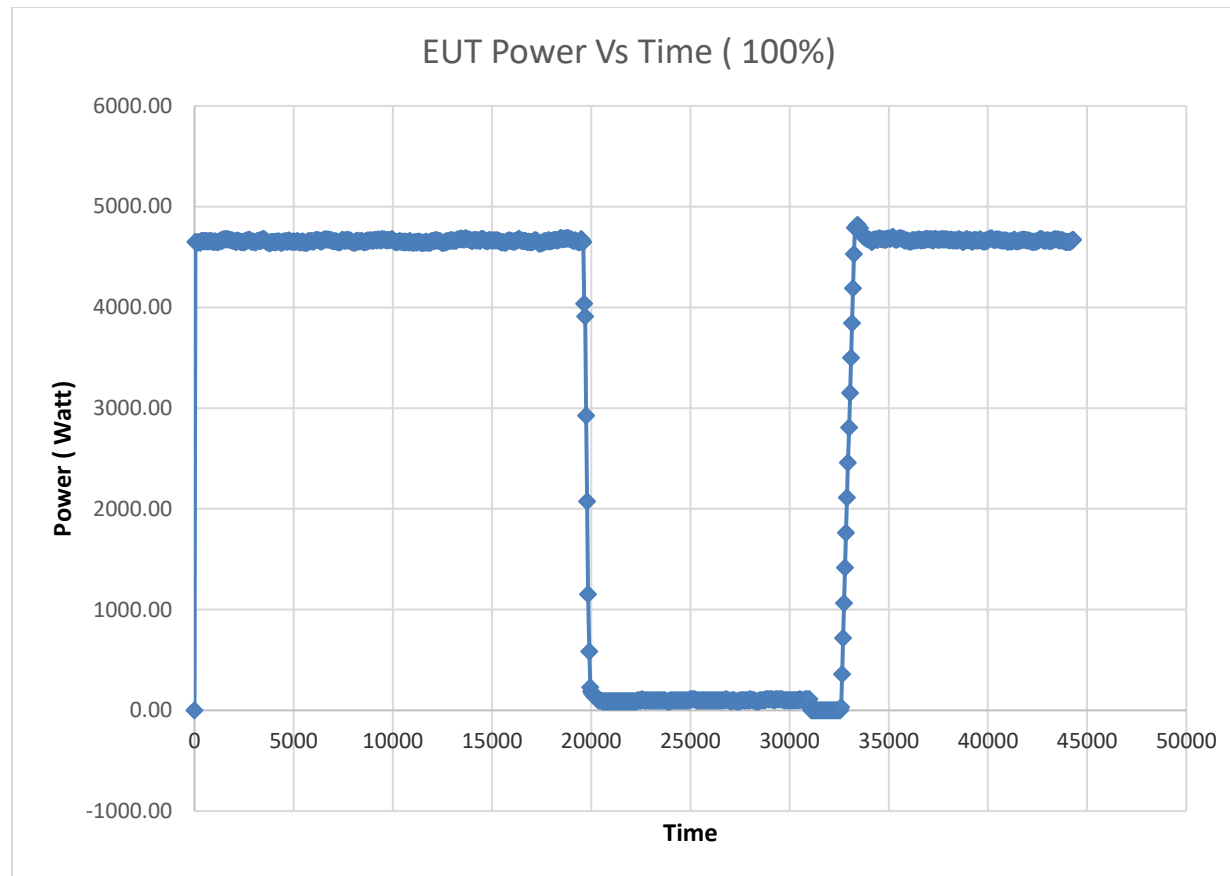


Fig: 5.1.1 Load following from 100% to 0%

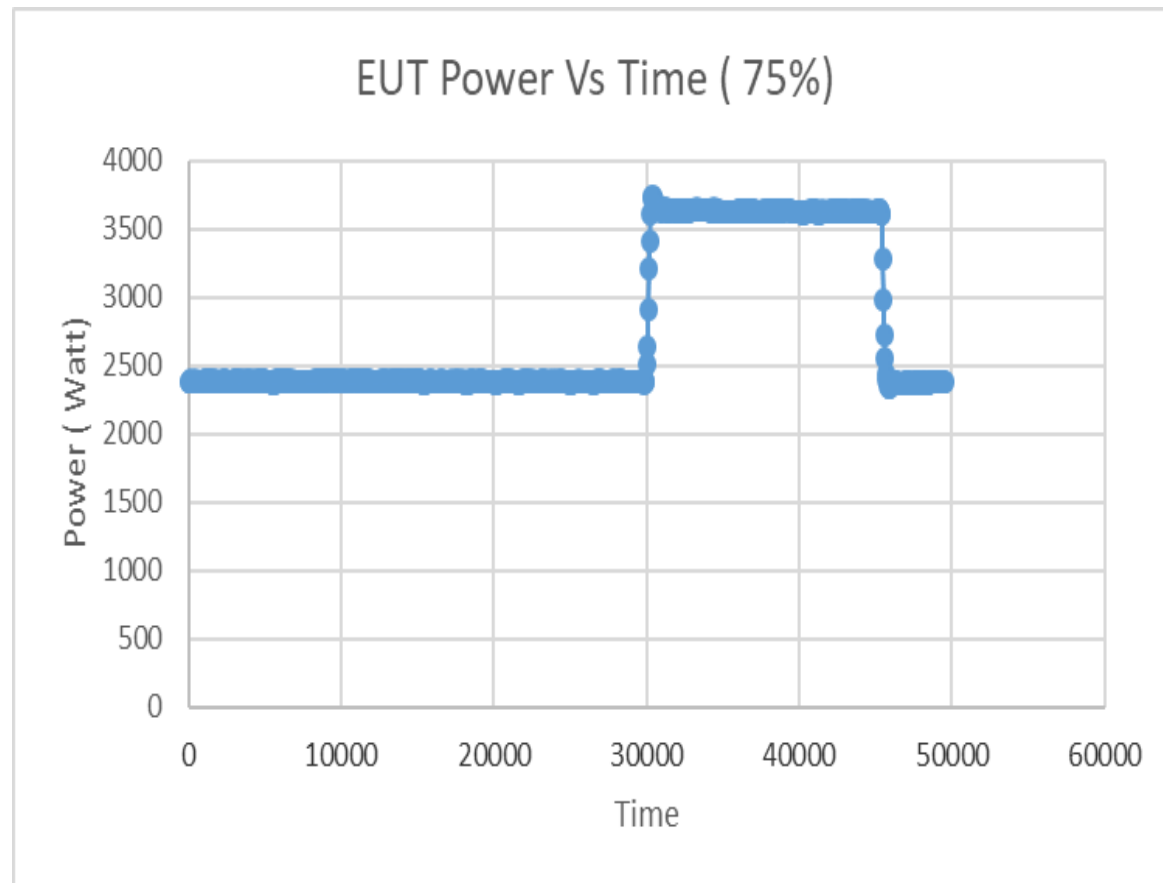


Fig: 5.1.1 Load following from 50% to 75%

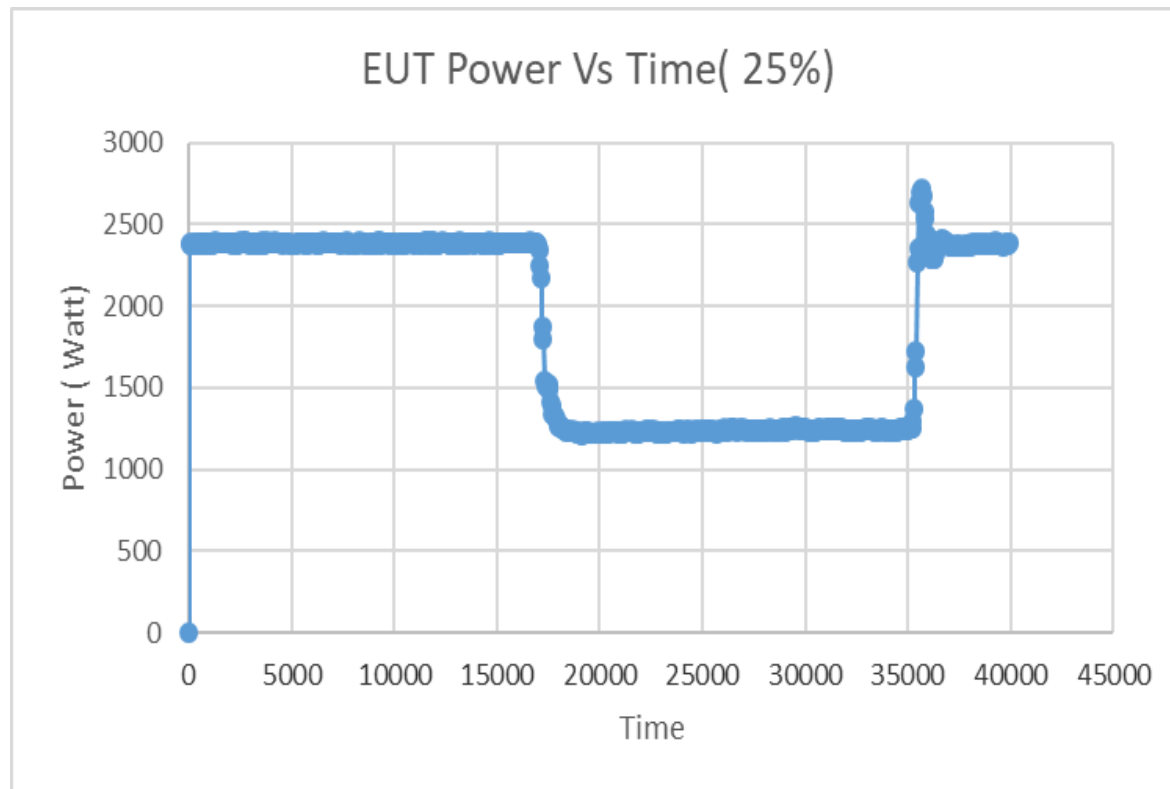


Fig: 5.1.1 Load following from 50% to 25%



### 6.3 Instantaneous Voltage Drop Test 瞬時電圧低下試験 (FRT 試験)

Voltage Drop To 20% (Nominal voltage = 94% Vn = 94.94Vrms) 残電圧 20%時

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of Irated <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続は？		
94.94Vrms (A,B) → 20.2Vrms (A,B) → 94.94Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	18.084 A (75.35%)	0	Yes	Pass	Fig 6.3.1
				45	-	13.824 A (57.60%)	0	Yes	Pass	Fig 6.3.2
				90	-	17.933 A (74.72%)	0	Yes	Pass	Fig 6.3.3



Voltage Drop To 20% (Nominal voltage =  $V_n = 101V_{rms}$ ) 残電圧 20%時

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of $I_{rated}$ <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続は？		
101Vrms (A,B) → 20.2Vrms (A,B) → 101Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	17.7713 A (74.05%)	0	Yes	Pass	
				45	-	17.915 A (74.65%)	0	Yes	Pass	
				90	-	17.68 A (73.67%)	0	Yes	Pass	



Voltage Drop To 20% (Nominal voltage = 106%Vn = 107.06Vrms) 残電圧 20%時

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of Irated <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続は？		
107.06Vrms (A,B) → 20.2Vrms (A,B) → 107.06Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	17.43 A (72.63%)	0	Yes	Pass	
				45	-	16.995 A (70.81%)	0	Yes	Pass	
				90	-	17.937 A (74.74%)	0	Yes	Pass	

Scope Channel Description:  
Channel 1\_1: Phase A Voltage  
Channel 1\_2: Phase A Current  
Channel 2\_1: Phase B Voltage  
Channel 2\_2: Phase B Current

Relay: Relay Signal  
GT\_DR: Gate Signal

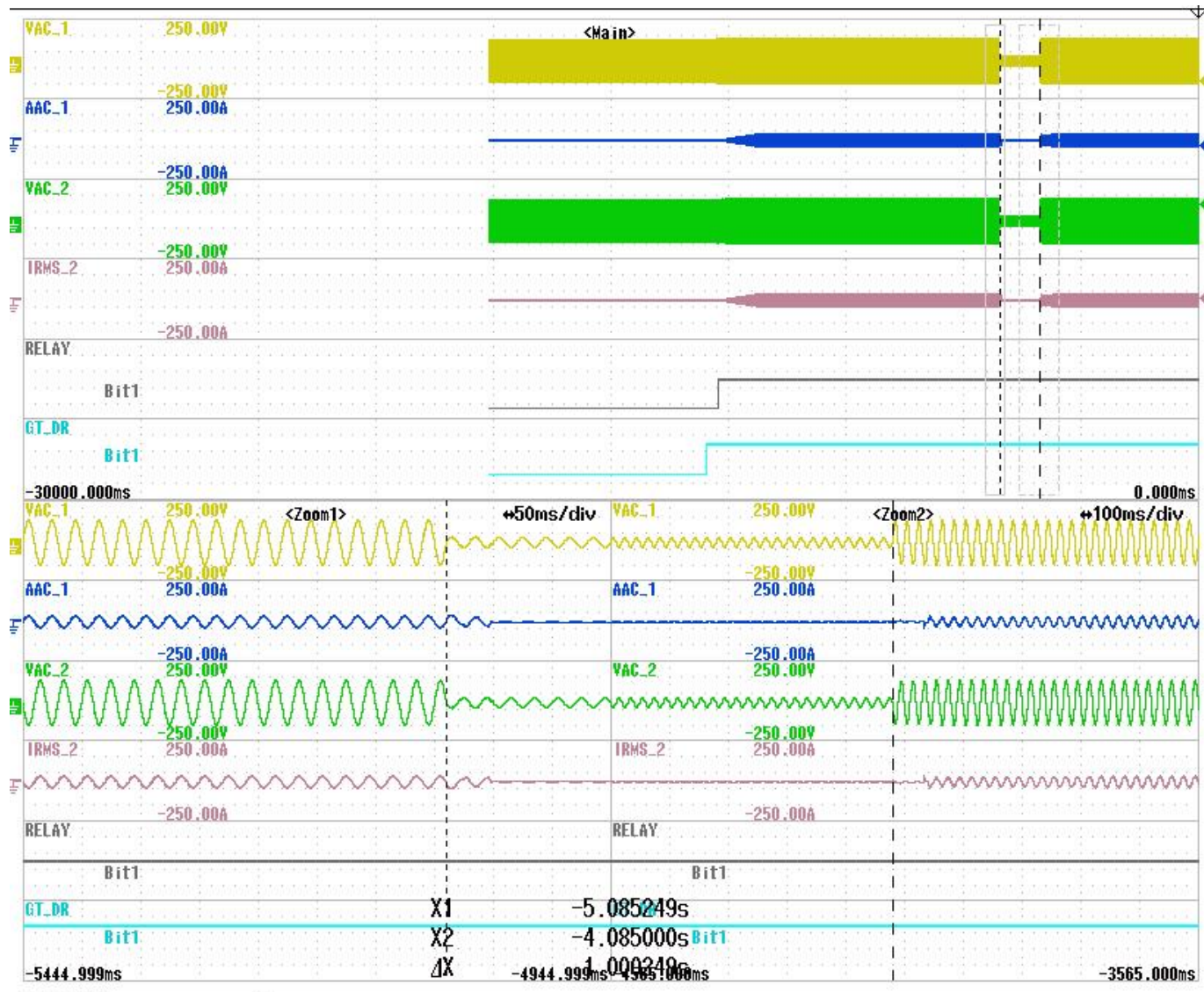


Figure 6.3.1 Instantaneous voltage drop at 0° entry angle (94.94Vrms → 20.2Vrms → 94.94Vrms)

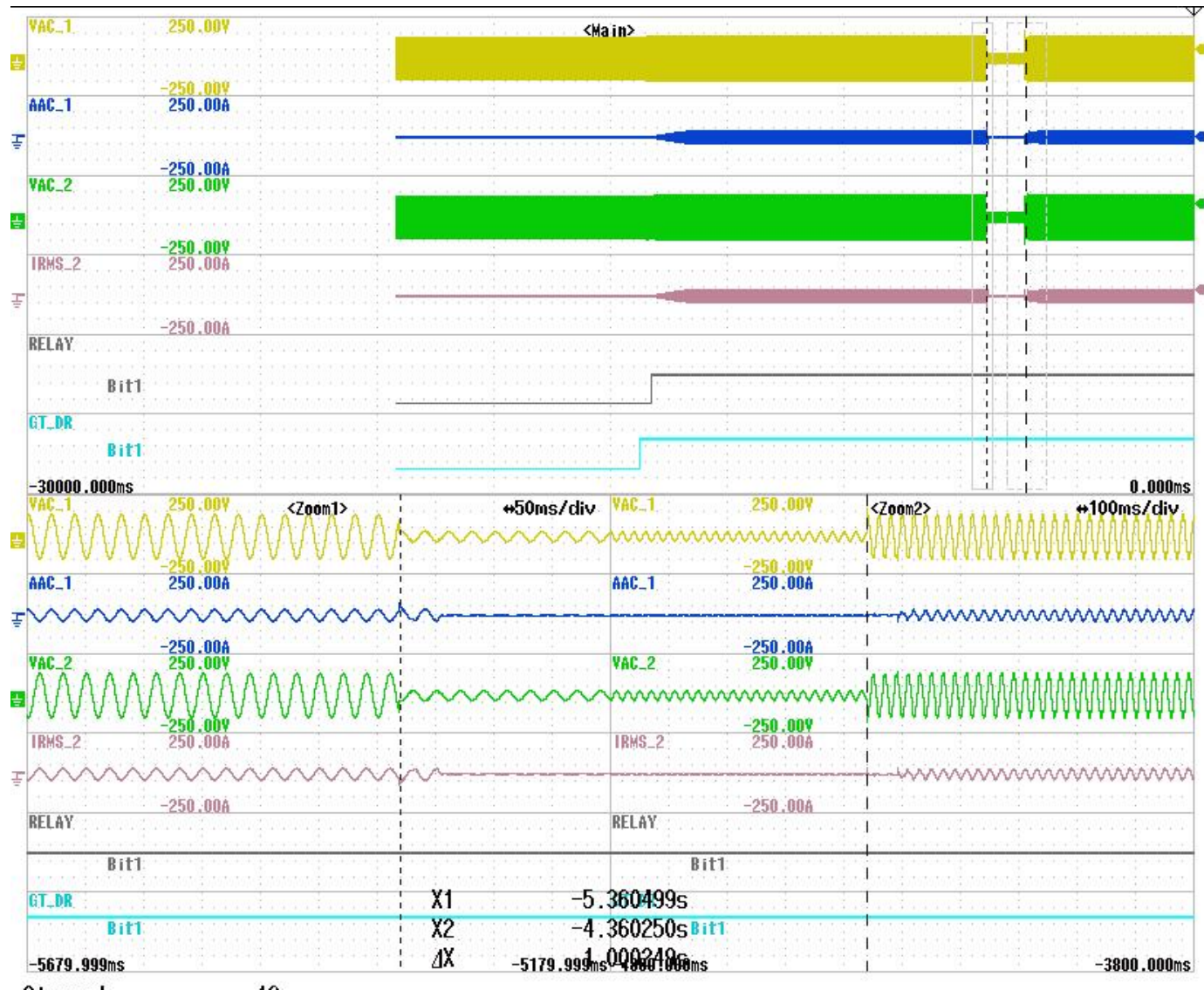


Figure 6.3.2 Instantaneous voltage drop at 45° entry angle (94.94Vrms → 20.2Vrms → 94.94Vrms)



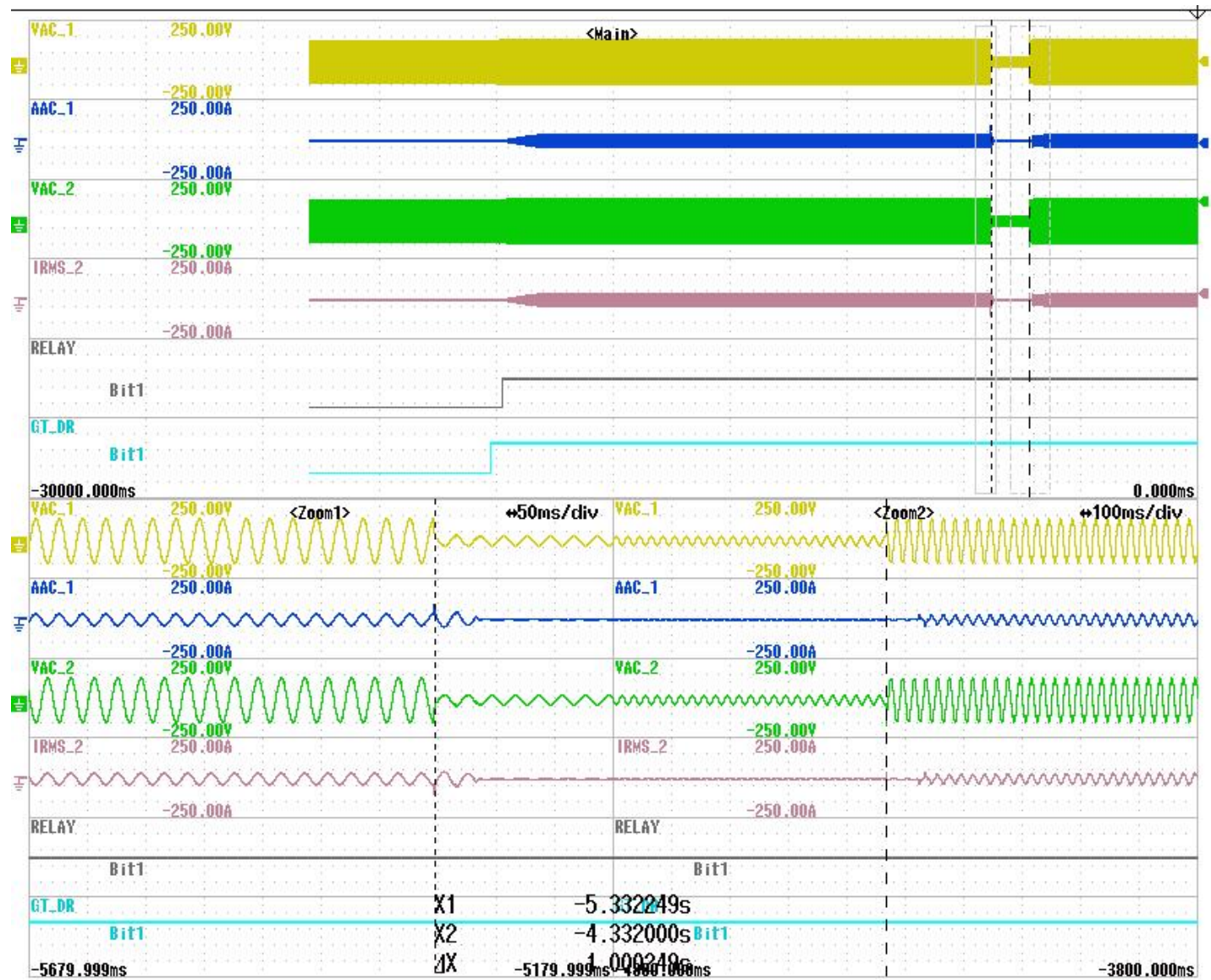


Figure 6.3.3 Instantaneous voltage drop at 90° entry angle (94.94Vrms → 20.2Vrms → 94.94Vrms)



Voltage Drop To 0% (Nominal voltage =  $V_n = 101V_{rms}$ ) 残電圧 0 %

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of $I_{rated}$ <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続は？		
101Vrms (A,B,C) → 0Vrms (A,B,C) → 101Vrms (A,B,C)	4.8 kW	Discharge 放電	50 Hz	0	-	23.3096 (97.12%)	0	Yes	Pass	Fig 6.3.4
				45	-	23.22 (96.75%)	0	Yes	Pass	Fig 6.3.5
				90	-	19.975 (83.23%)	0	Yes	Pass	Fig 6.3.6

Scope Channel Description:  
Channel 1\_1: Phase A Current  
Channel 1\_2: Phase A Voltage  
Channel 2\_1: Phase B Current  
Channel 2\_2: Phase B Voltage

Relay: Relay Signal  
Gate drive: Gate Signal

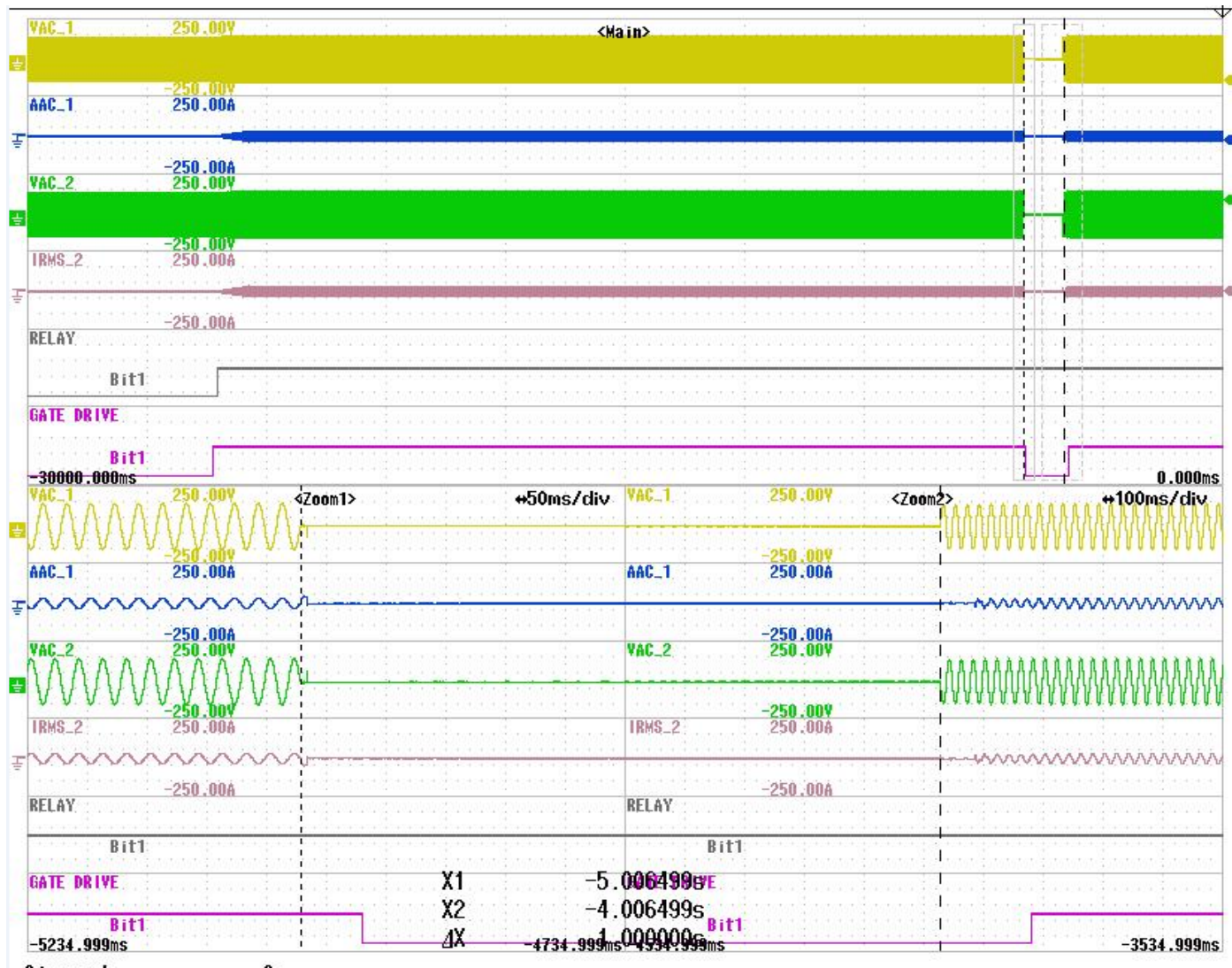


Figure 6.3.4 Instantaneous voltage drop at 0° entry angle (101Vrms → 0Vrms → 101Vrms)

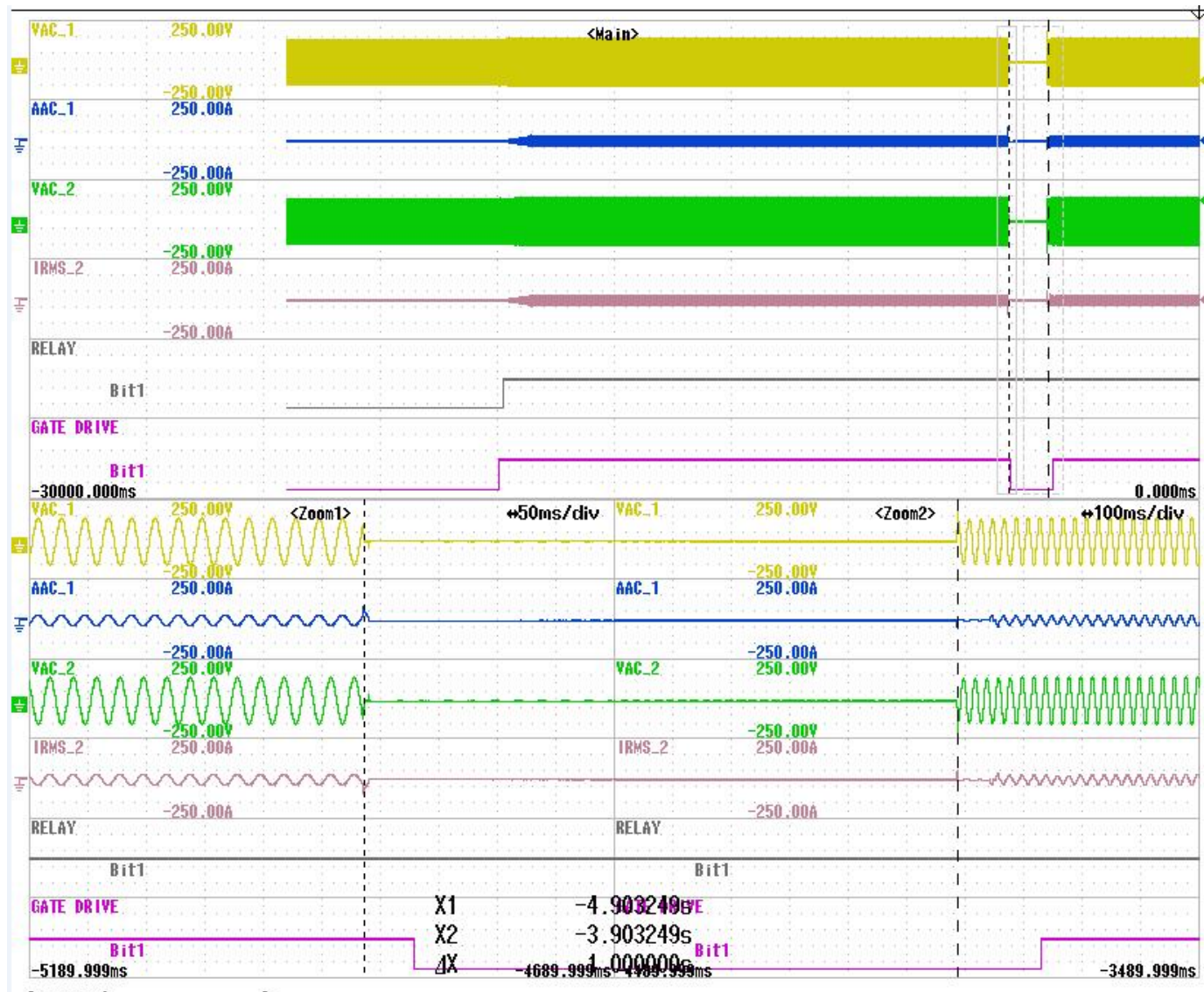


Figure 6.3.5 Instantaneous voltage drop at 45° entry angle (101Vrms → 0Vrms → 101Vrms)



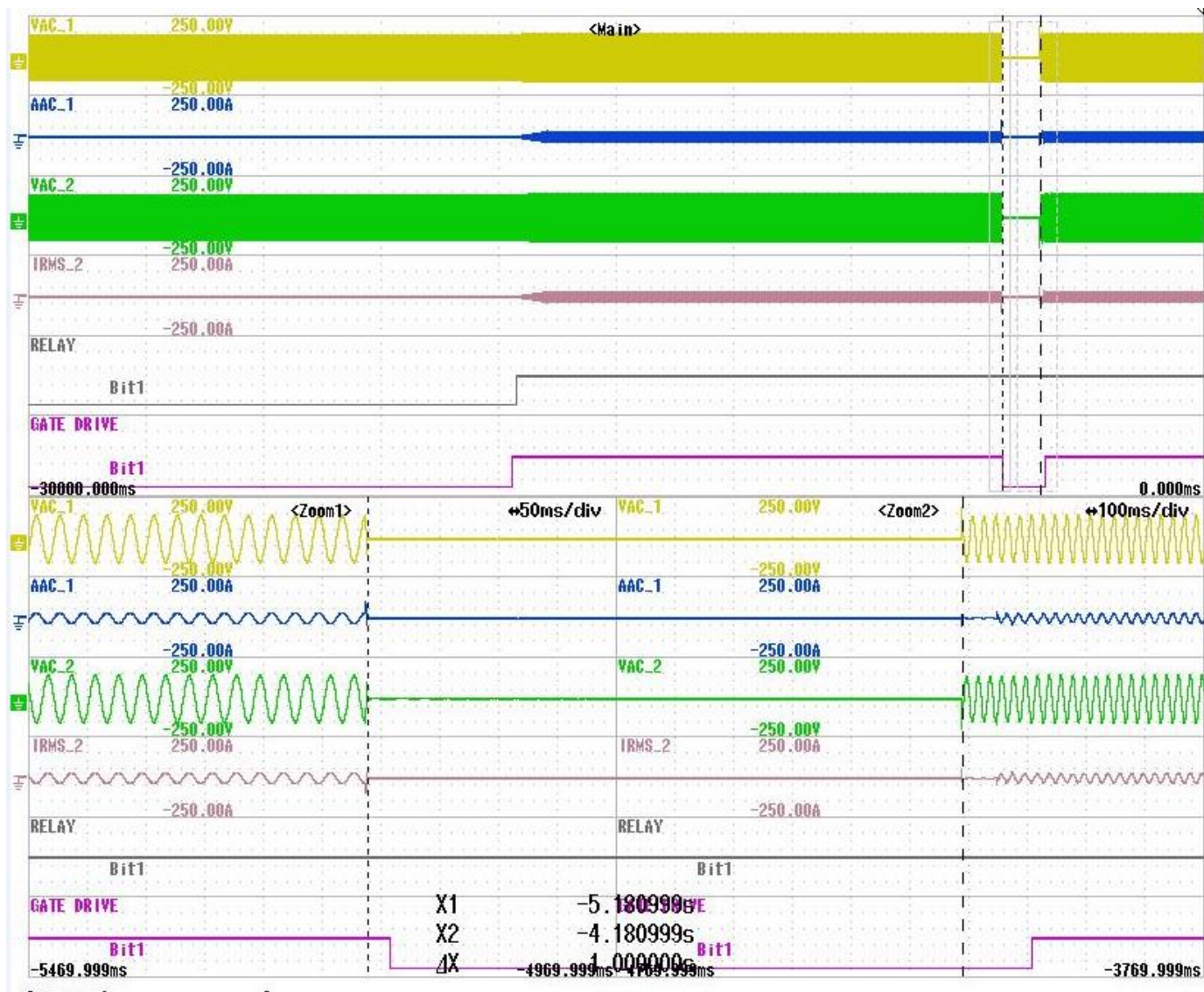


Figure 6.3.6 Instantaneous voltage drop at 90° entry angle (101Vrms → 0Vrms → 101Vrms)



Voltage Drop To 52% (Nominal voltage = 94%Vn = 94.94Vrms) % 残電圧 52 %

Phase jump 0 to 41° 位相変化 41°

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of Irated <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続?		
94.94Vrms (A,B) → 52.52Vrms (A,B) → 94.94Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	20.391 A (84.96%)	0	Yes	Pass	Fig 6.3.7
				45	-	20.462 A (85.26%)	0	Yes	Pass	Fig 6.3.8
				90	-	17.12 A (71.33%)	0	Yes	Pass	Fig 6.3.9



Voltage Drop To 52% (Nominal voltage =  $V_n = 101V_{rms}$ ) % 残電圧 52 %

Phase jump 0 to 41° 位相変化 41°

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of $I_{rated}$ <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続?		
101Vrms (A,B) → 52.52Vrms (A,B) → 101Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	21.62 A (90.08%)	0	Yes	Pass	
				45	-	20.979 A (87.41%)	0	Yes	Pass	
				90	-	16.162 A (67.34%)	0	Yes	Pass	



Voltage Drop To 52% (Nominal voltage = 106%Vn = 107.06Vrms) % 残電圧 52 %

Phase jump 0 to 41° 位相変化 41°

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Entry Angle 位相	Measurement 試験結果				Pass / Fail 判定 <sup>1</sup> <100ms <sup>2</sup> <150% of Irated <sup>3</sup> <500ms	Remarks 備考
					80% Output Recovering time 出力復帰時間	Over Current (A(%)) 過電流値	Time Spent over 100% (ms) 100%を超える時間	Operation is Continuous? 電圧低下後の運転継続?		
107.06Vrms (A,B) → 52.52Vrms (A,B) → 107.06Vrms (A,B)L-N	4.8kW	Discharge 放電	50 Hz	0	-	21.44 A (89.36%)	0	Yes	Pass	
				45	-	21.288 A (88.70%)	0	Yes	Pass	
				90	-	11.061 A (46.09%)	0	Yes	Pass	

Scope Channel Description:  
Channel 1\_1: Phase A Voltage  
Channel 1\_2: Phase A Current  
Channel 2\_1: Phase B Voltage  
Channel 2\_2: Phase B Current

Relay: Relay Signal  
Gate drive: Gate Signal



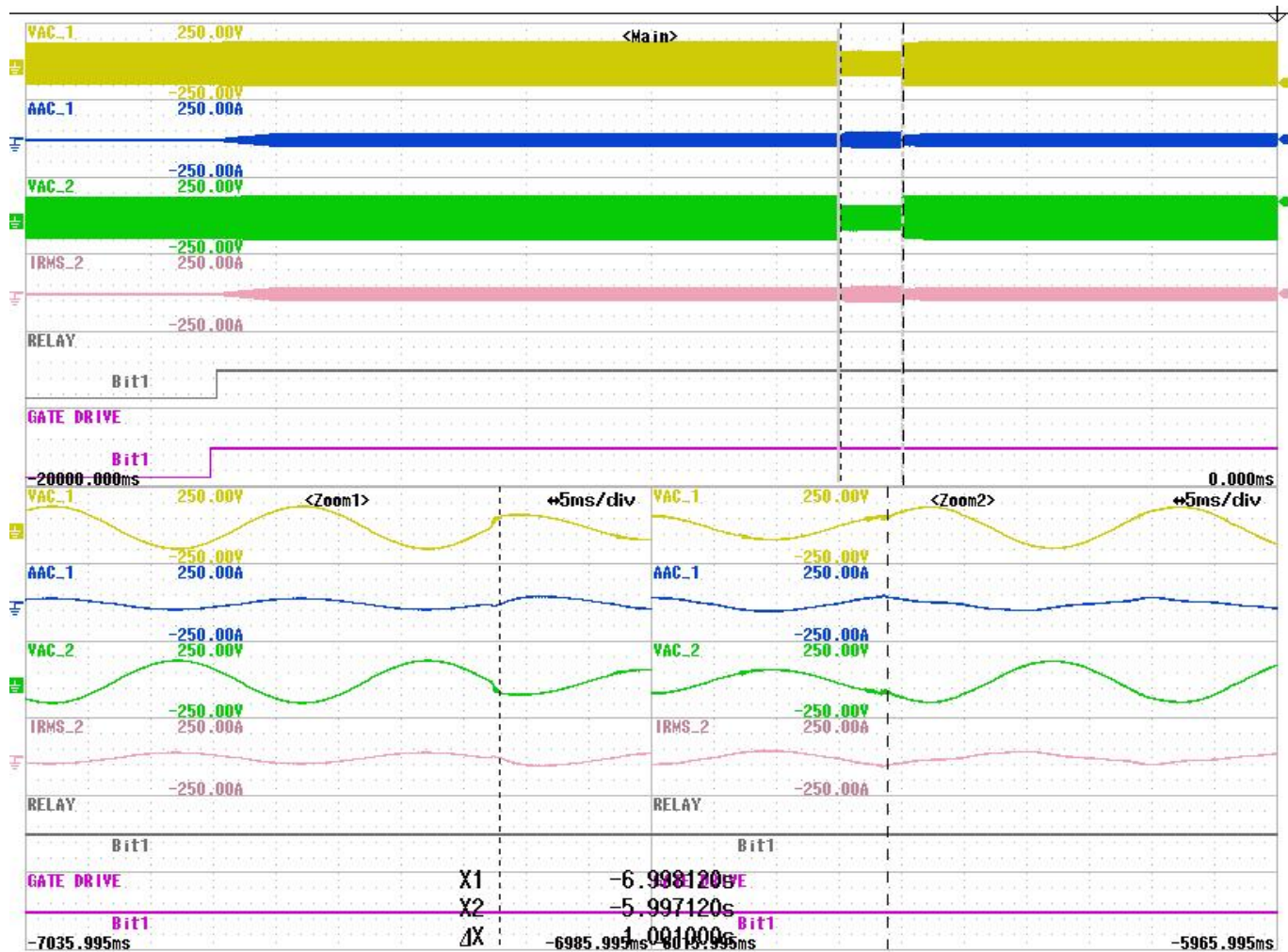


Figure 6.3.7 Instantaneous voltage drop at 0° entry angle (94.94Vrms → 52.52Vrms → 94.94Vrms)



Figure 6.3.8 Instantaneous voltage drop at 45° entry angle (94.94Vrms → 52.52Vrms → 94.94Vrms)

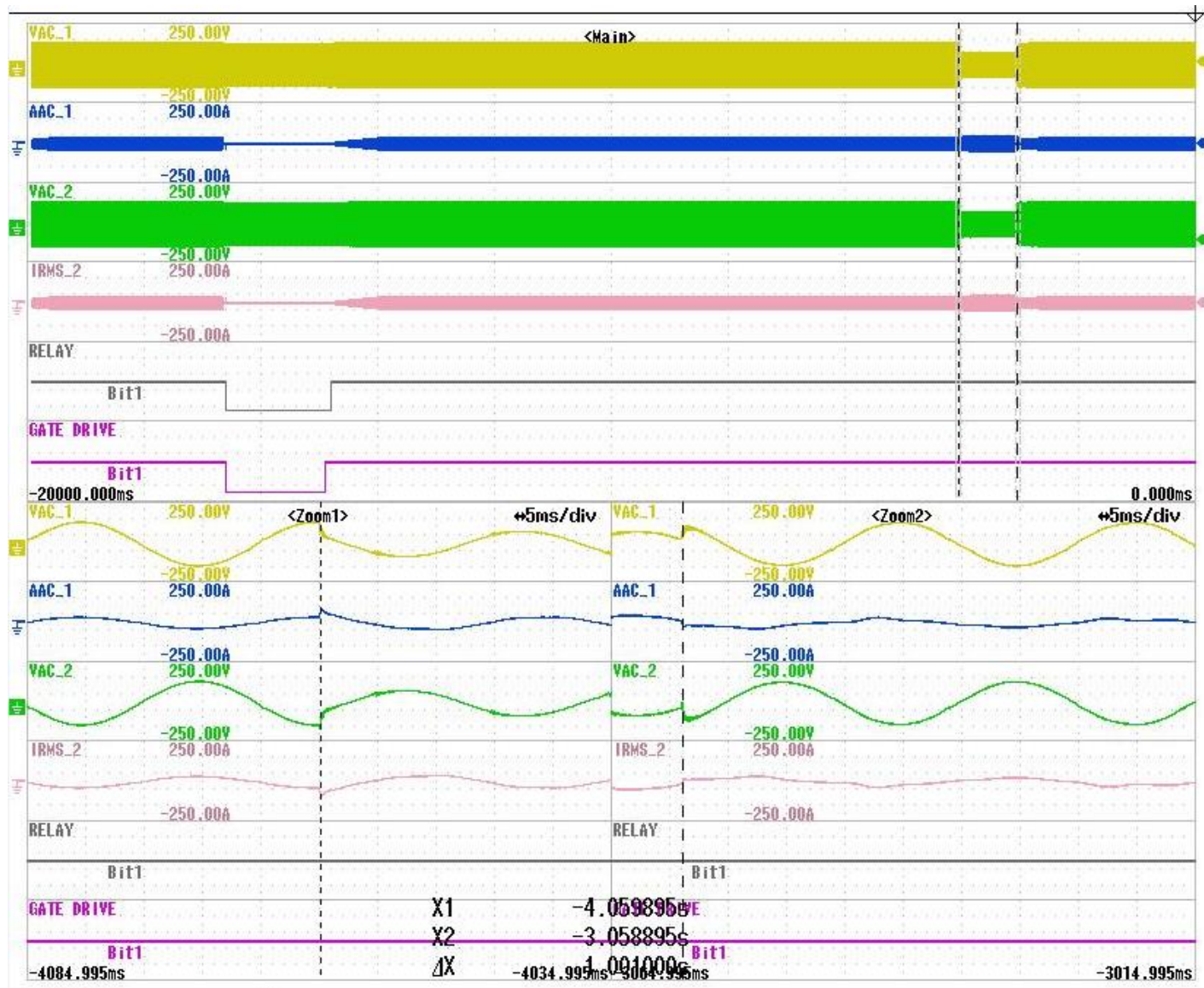


Figure 6.3.9 Instantaneous voltage drop at 90° entry angle (94.94Vrms → 52.52Vrms → 94.94Vrms)



## 6.4 Frequency Step Change Test 周波数変動試験

AC Voltage 交流電圧	Output Power 出力電力	Operation Mode 動作モード	Frequency 周波数	Frequency Change 周波数変動	Frequency Deviation(Hz) 変動周波数(Hz)	Freq. Chang Duration 変動時間	Inverter Continue? 運転継続	Pass / Fail 判定	Remarks 備考
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	Discharge	50 Hz	Step Change	+0.8 Hz	0.06s	Yes	Pass	Figure 6.4.1 – 6.4.2

Scope Channel Description:

Channel 1\_1: Phase A Current

Channel 1\_2: Phase A Voltage

Channel 2\_1: Phase B Current

Channel 2\_2: Phase B Voltage

Relay: Relay Signal

Gate drive: Gate

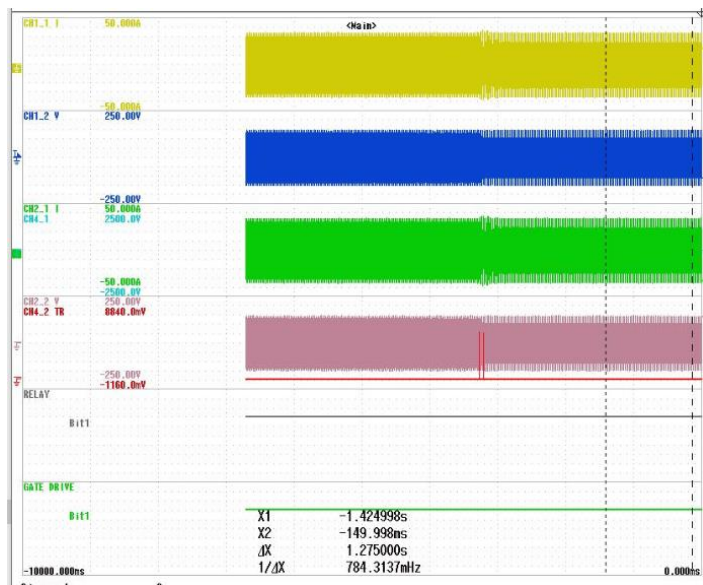


Figure: 6.4.1 Frequency Step Change (50.0Hz  $\rightarrow$  50.8Hz)

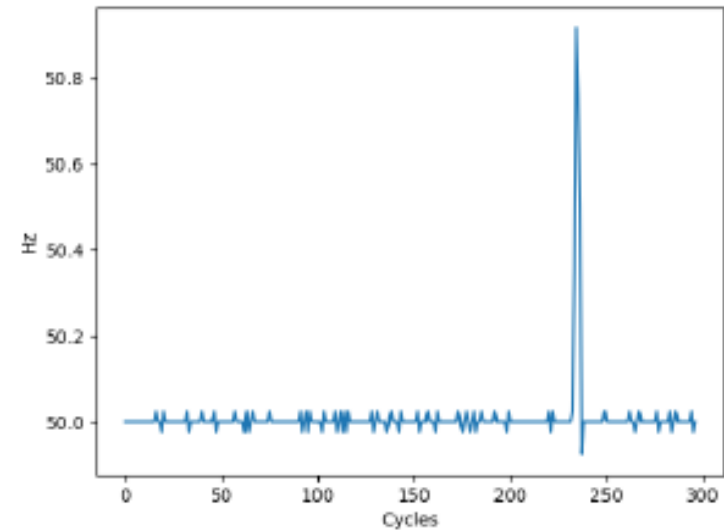


Figure: 6.4.2 Frequency Step Change (50.0Hz  $\rightarrow$  50.8Hz)

Ramp Change: ランプ状変化

AC Voltage 交流電圧	Output Power 出力電力	Mode	Frequency 周波数	Frequency Change 周波数変動	Frequency Deviation 変動周波数	Freq. Chang Duration 変動時間	Continuous operation during Freq. deviation?	Pass / Fail 判定	Remarks 備考
Phase A: 101Vrms Phase B: 101Vrms	4.8 kW	Discharge	50 Hz	Ramp Change ランプ状変化	+1.5	0.75	Yes	Pass	Figure 6.4.3 – 6.4.4
					-2.5	1.25	Yes	Pass	Figure 6.4.5 – 6.4.6

Scope Channel Description:

Channel 1\_1: Phase A Current

Channel 1\_2: Phase A Voltage

Channel 2\_1: Phase B Current

Channel 2\_2: Phase B Voltage

Relay: Relay Signal

Gate drive: Gate



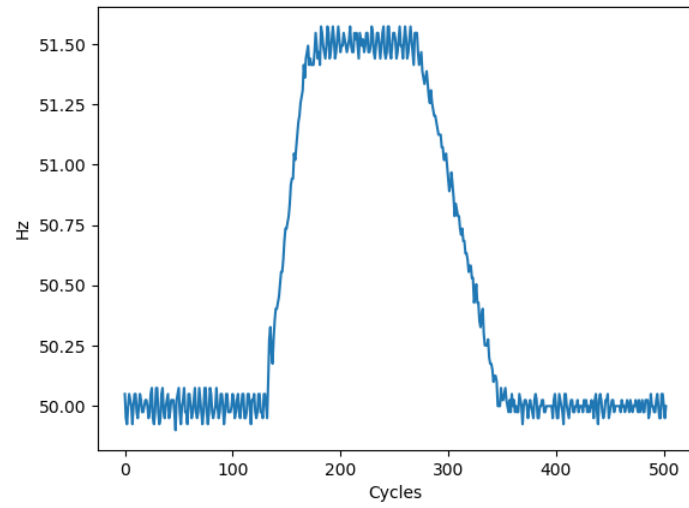


Figure 6.4.3 Frequency Ramp Change (50.0Hz→51.5Hz)

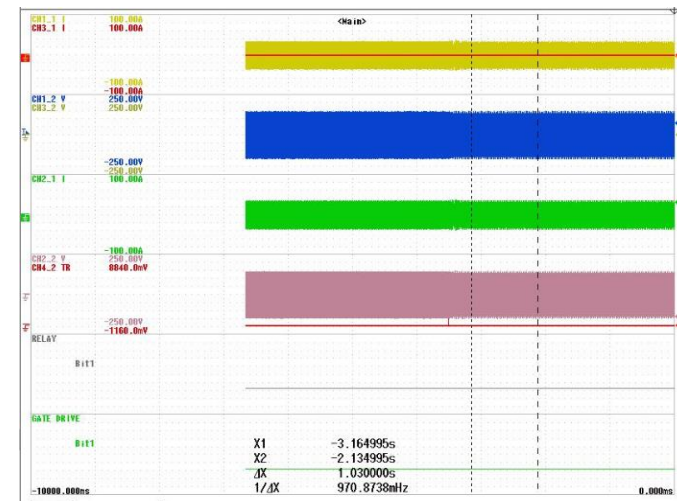


Figure 6.4.4 Frequency Ramp Change (50.0Hz→51.5Hz)

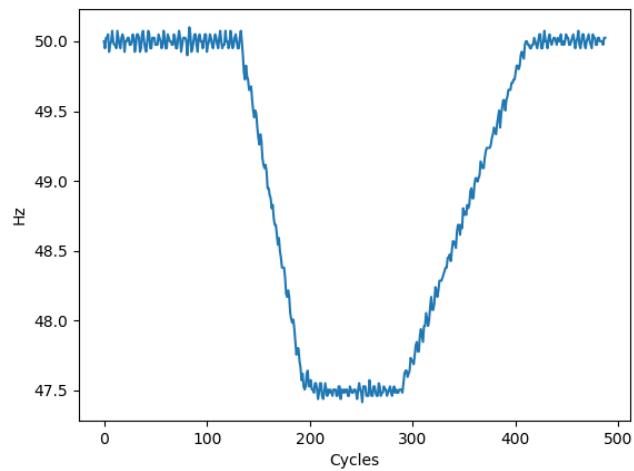


Figure 6.4.5 Frequency Ramp Change (50.0Hz→SHz)

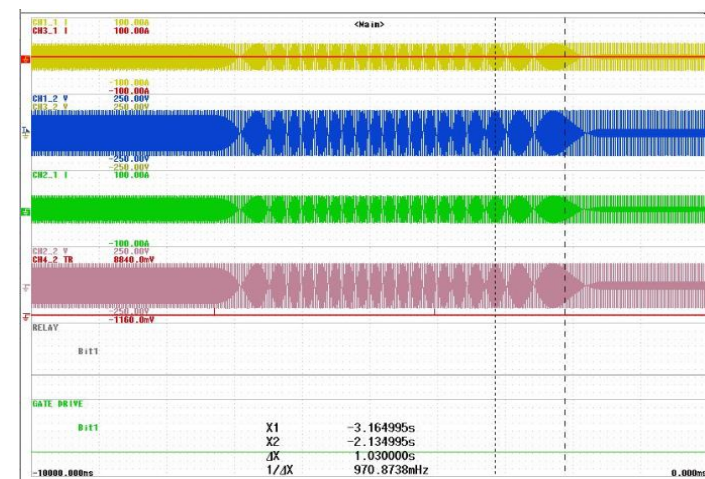


Figure 6.4.6 Frequency Ramp Change (50.0Hz→47.5Hz)



## 12.1 Switching to Backup operation mode 自立運転切替試験

Step (Refer Fig: 12.1.1)	Grid	ACPW	Gate Drive	ACPW Operation mode	Time to Transition (s)	Remarks
1	ON	ON	ON	Normal	--	Fig: 12.1.2
2	OFF	OFF	OFF	Normal	--	--
3	OFF	ON	ON	Backup	4.1	Fig: 12.1.3
4	ON	ON	ON	Backup	301.21	Fig: 12.1.4
5	ON	OFF	OFF/ON	Normal	2.49	Fig: 12.1.5
6	ON	ON	ON	Normal	298.72	Fig: 12.1.6

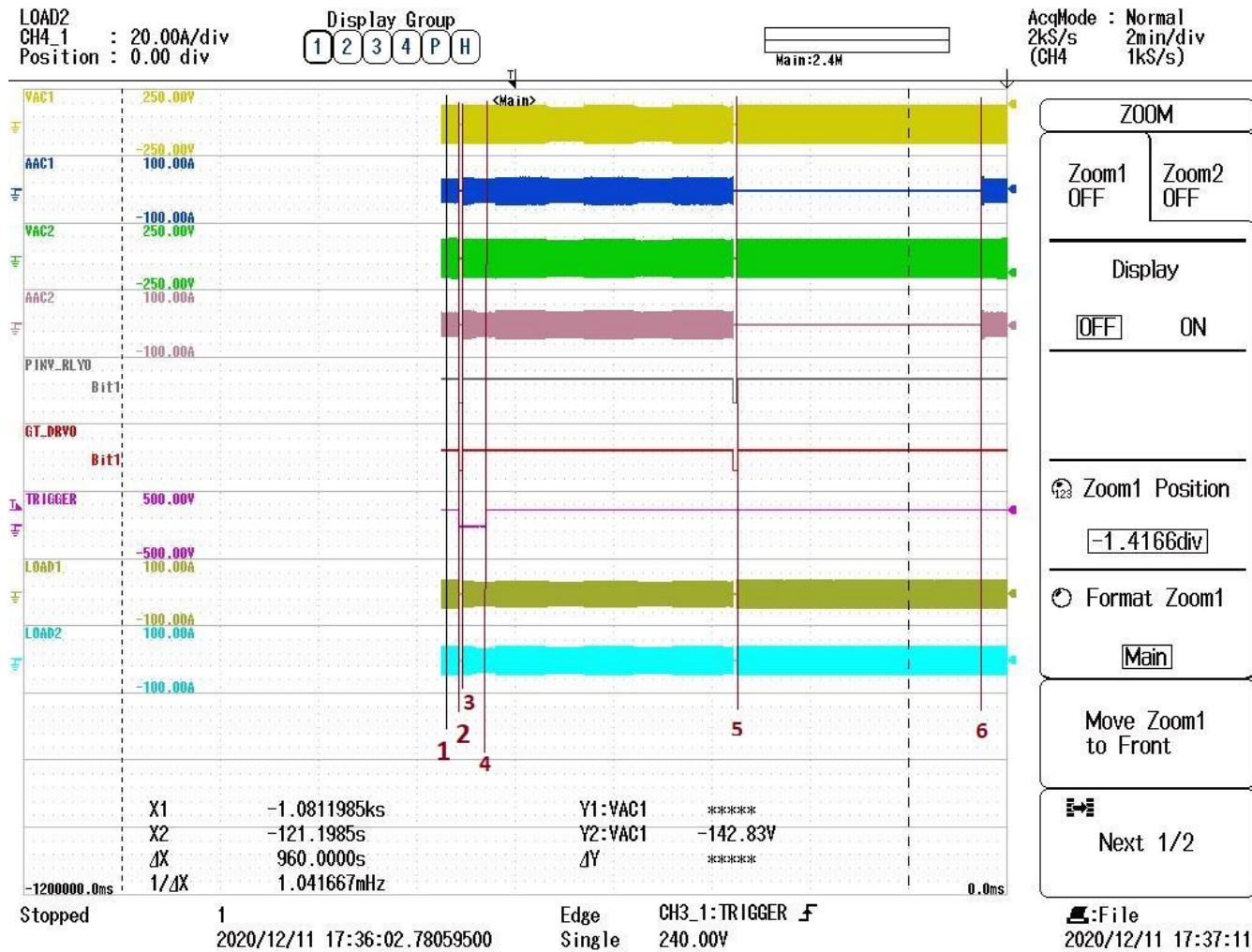


Fig: 12.1.1 Reference

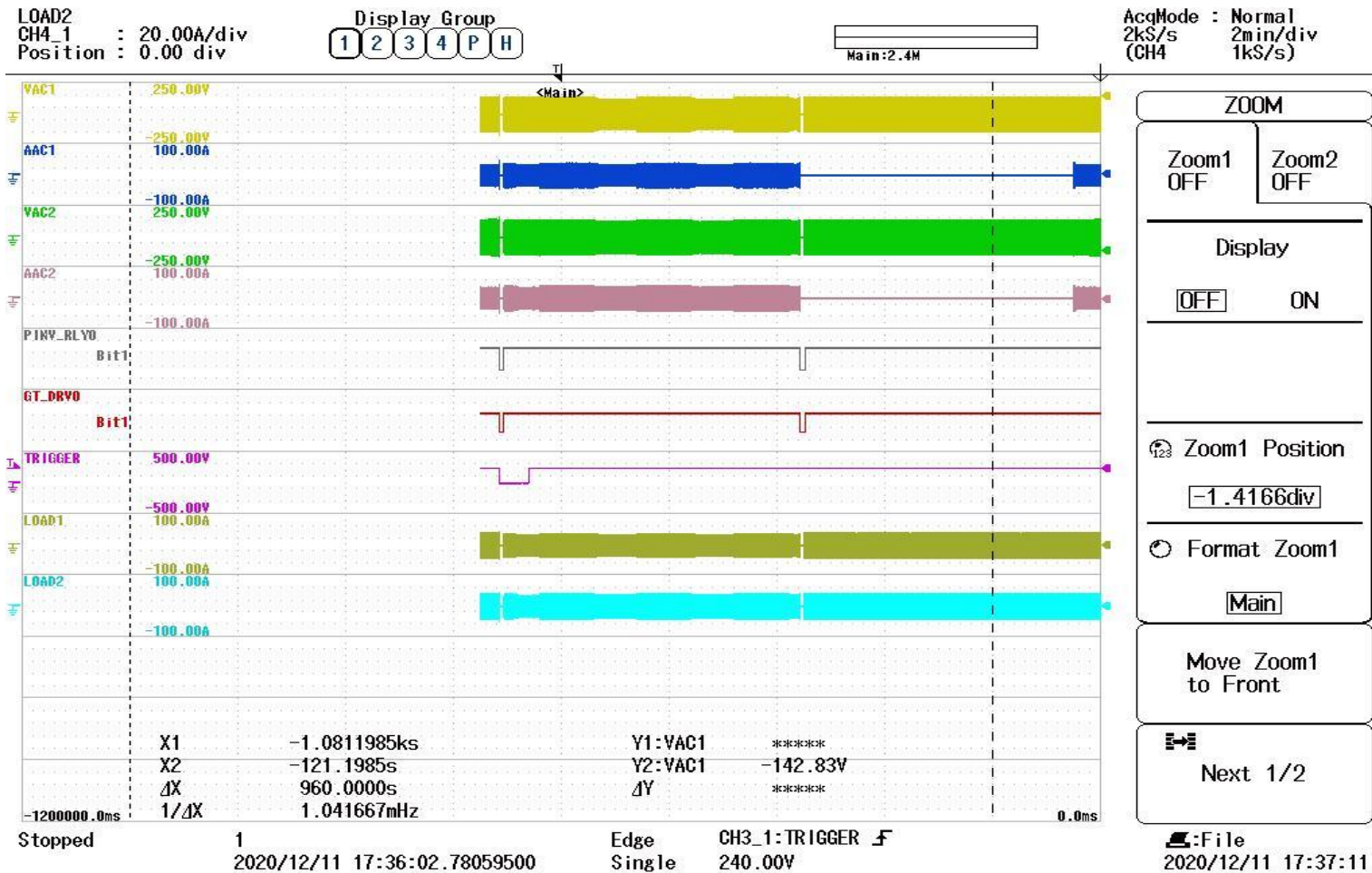


Fig: 12.1.2 Normal Operation

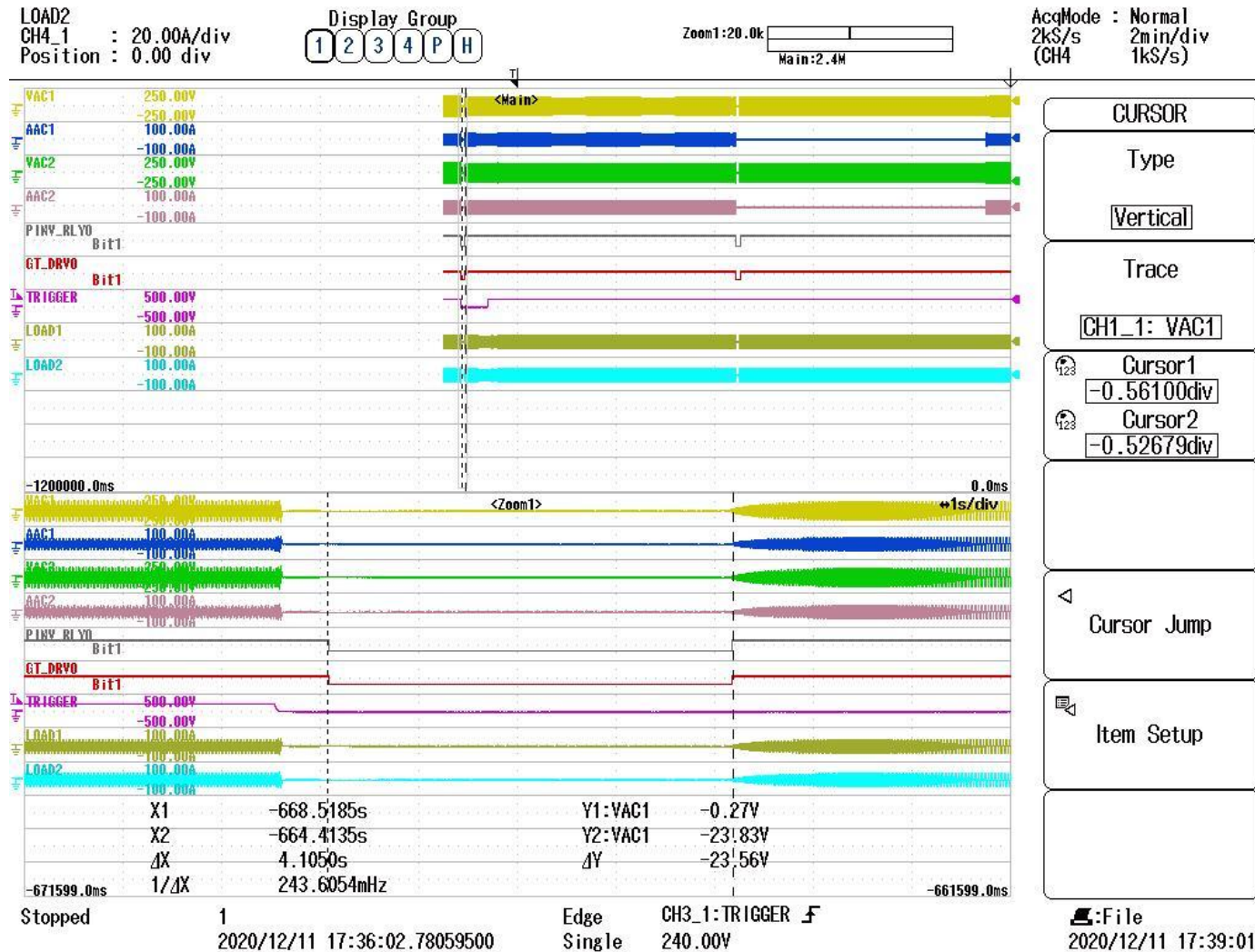


Fig: 12.1.3 Grid Following to Backup Mode:Relay & Gate block signal:Open (4.1scs)

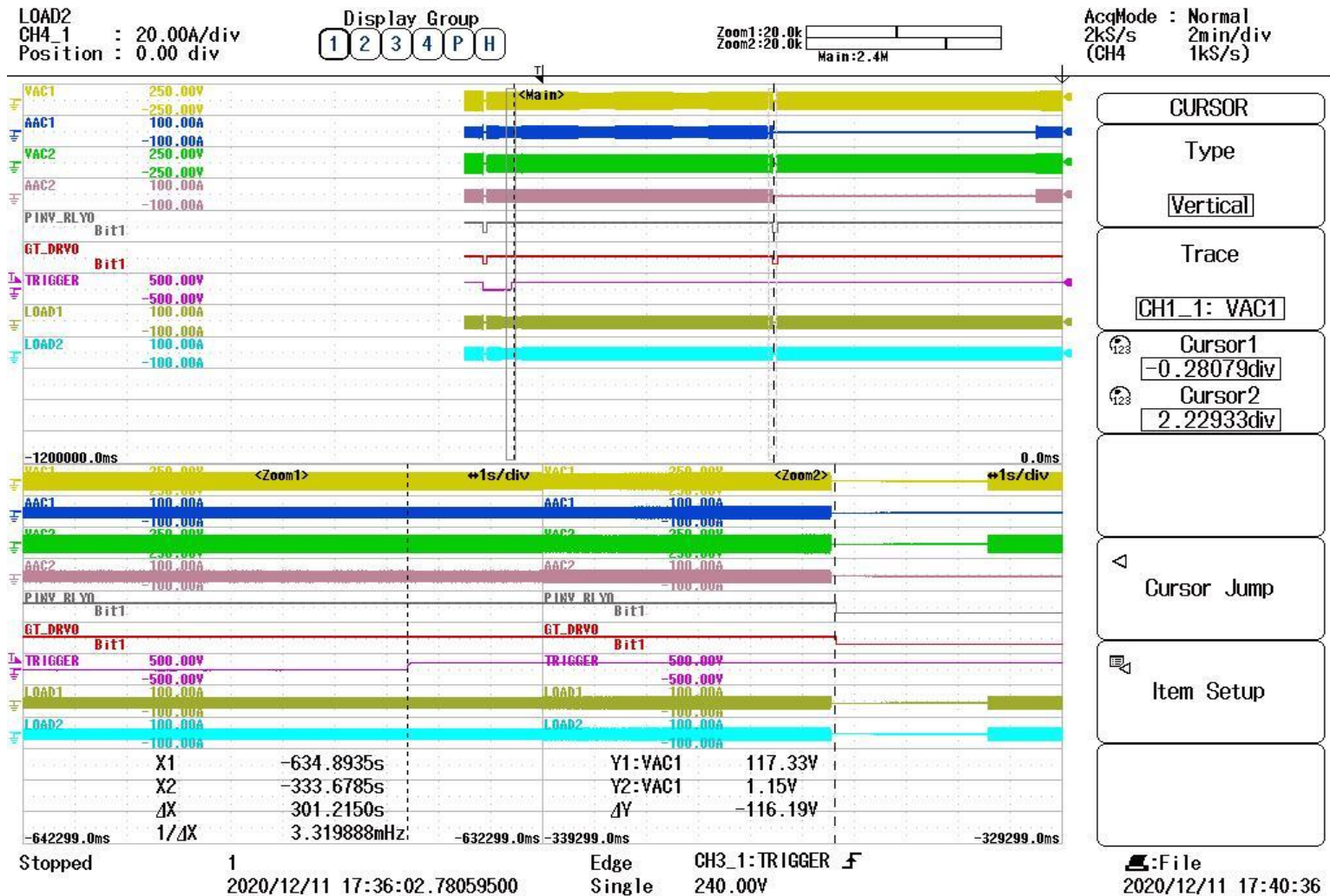


Fig: 12.1.4 Backup to Grid following mode: Relay & Gate block signal:Closed(309.975 secs)



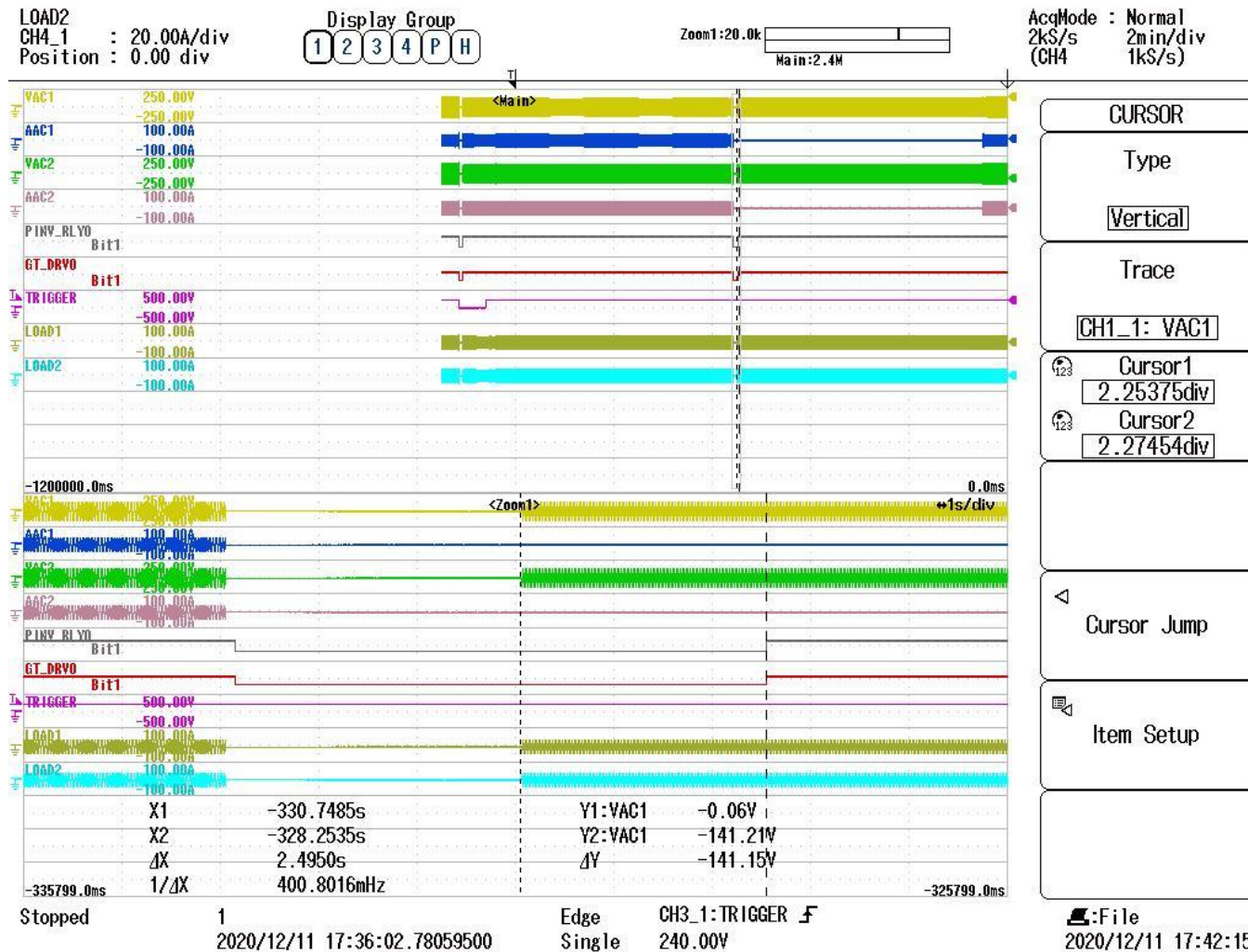


Fig: 12.1.5 Disabled to Grid following mode: Relay & Gate block signal:Open---Closed

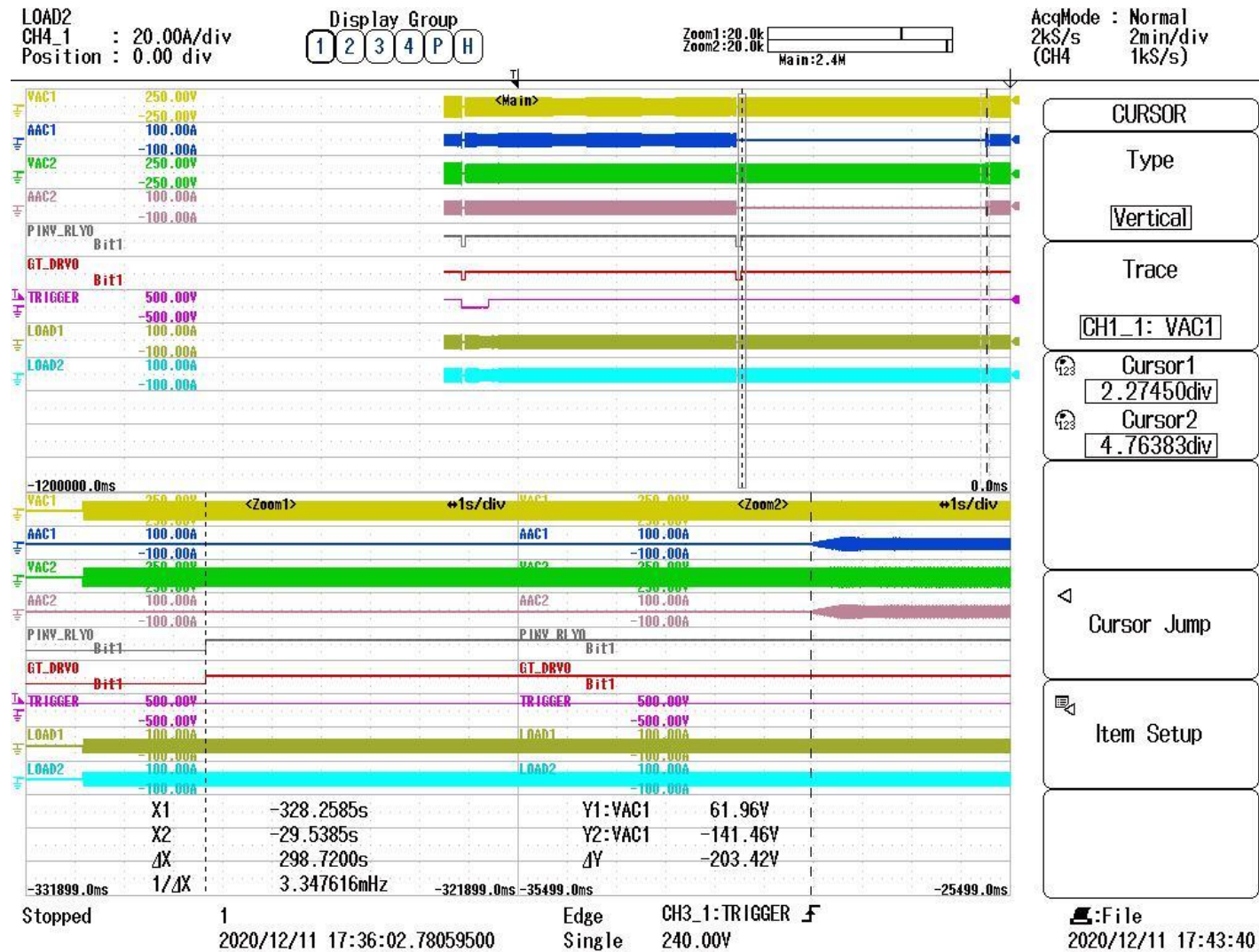


Fig: 12.1.6 Disabled to Grid following mode: Relay & Gate block signal:Closed

## 12.2 Automatic switching to backup mode 自立運転自動切替試験

Load setting (% of EUT name plate power rating)	EUT set power (%of EUT name plate power rating)	Voltage (V) 電圧	Frequency (Hz) 周波数	EUT Power (W)	EUT Power (% of EUT nameplate)	EUT Current (A)	EUT Current (% of EUT nameplate)	Remarks 備考
100	100	99.71	49.993	-0.4	-8.33333E-05	1.0623	0.0442625	Before Backup
100	100	97.32	55.02	4822.3	1.004645833	24.31	1.012916667	After Backup



## 12.4 Independent disconnection signal disruption test 自立解列信号途絶試験

Load setting (% of EUT name plate power rating)	EUT set power (% of EUT name plate power rating)	Voltage (V) 電圧	Frequency (Hz) 周波数	EUT Power (W)	EUT Power (% of EUT nameplate)	EUT Current (A)	EUT Current (% of EUT nameplate)	Remarks 備考
100	100	99.725	50.001	-0.2	-4.167E-05	0.1905	0.0079375	Fig: 12.4.1
100	100	0	0	0	0	0	0	

Load setting (% of EUT name plate power rating)	EUT set power (% of EUT name plate power rating)	Voltage (V) 電圧	Frequency (Hz) 周波数	EUT Power (W)	EUT Power (% of EUT nameplate)	EUT Current (A)	EUT Current (% of EUT nameplate)	Remarks 備考
100	100	98.255	55.022	4648.25	0.9683854	23.529	0.980375	Fig: 12.4.2
100	100	99.292	49.982	-0.1	-2.083E-05	0.1902	0.007925	

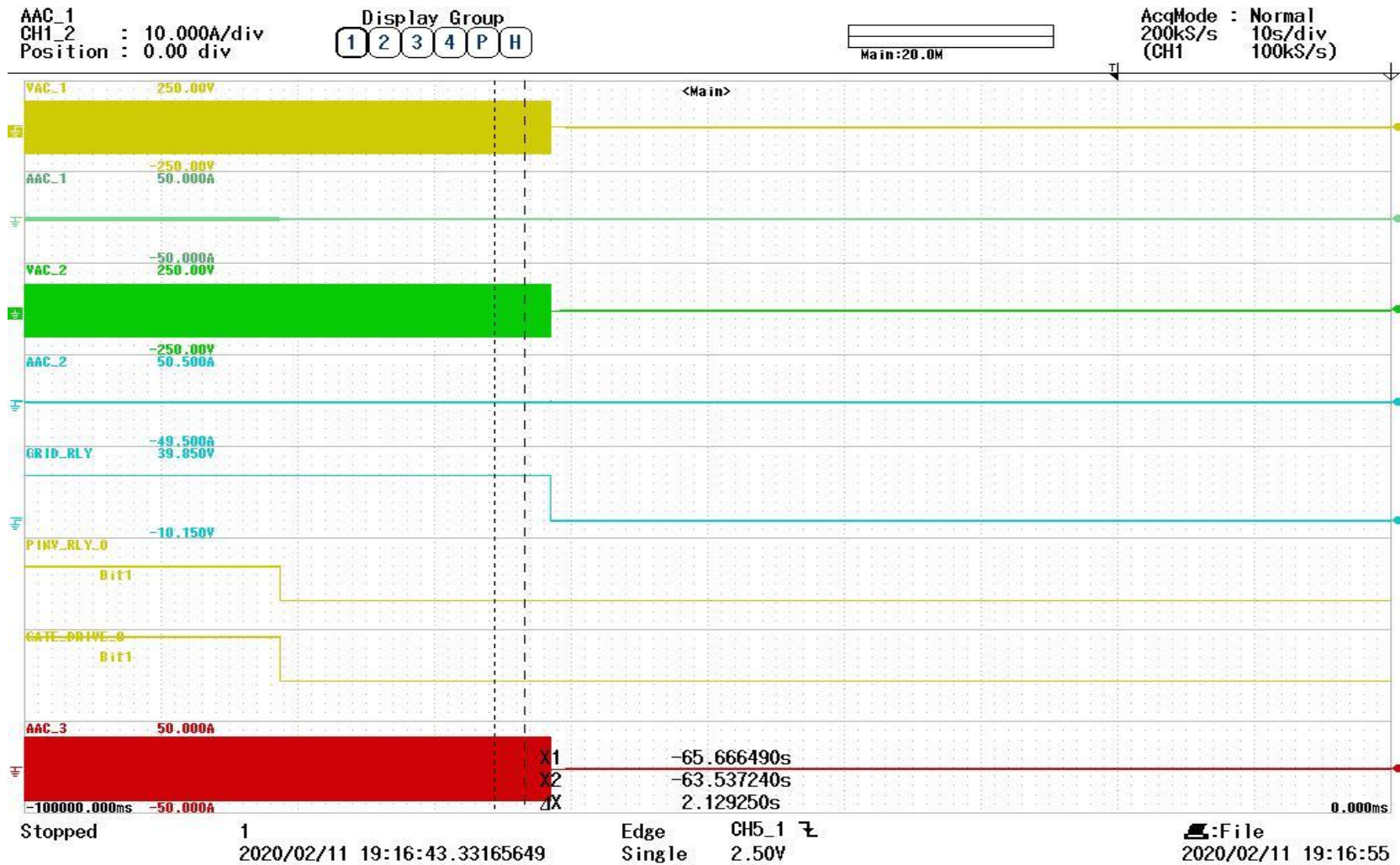


Fig: 12.4.1 Communication removed before backup operation

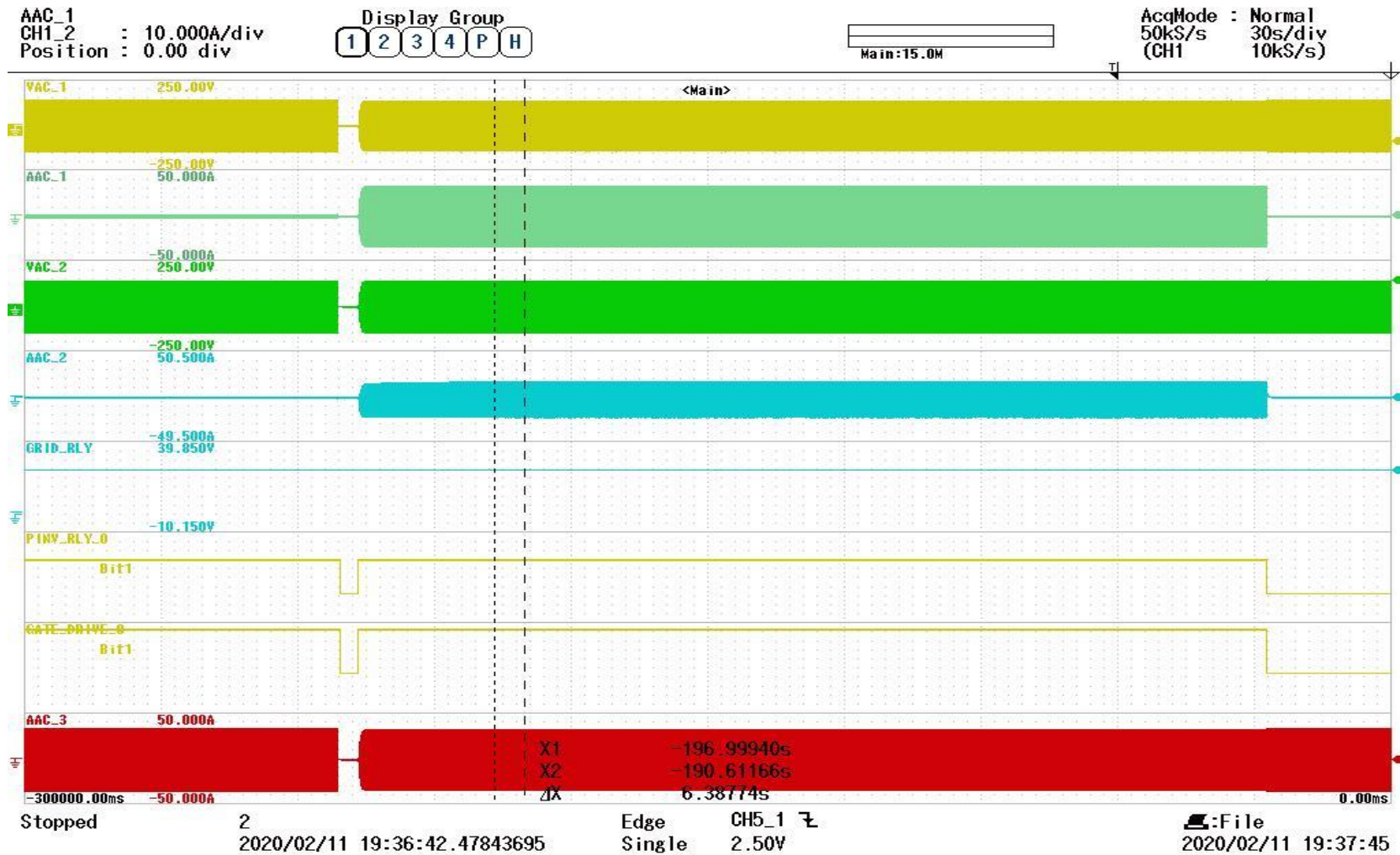


Fig: 12.4.2 Communication removed after backup operation