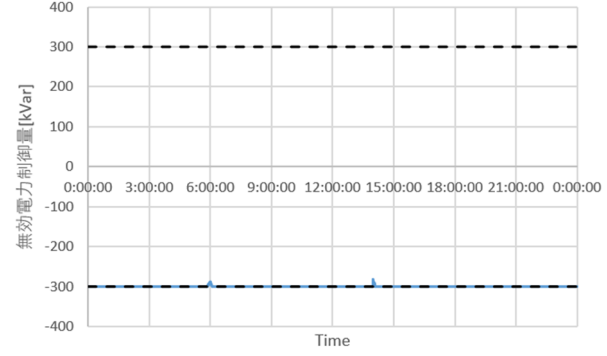
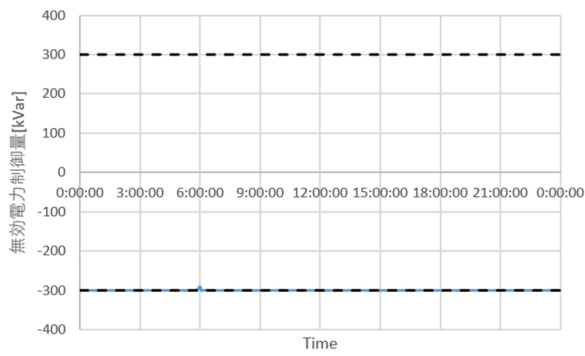
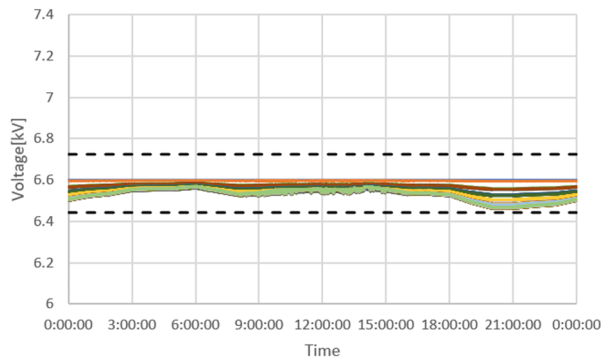
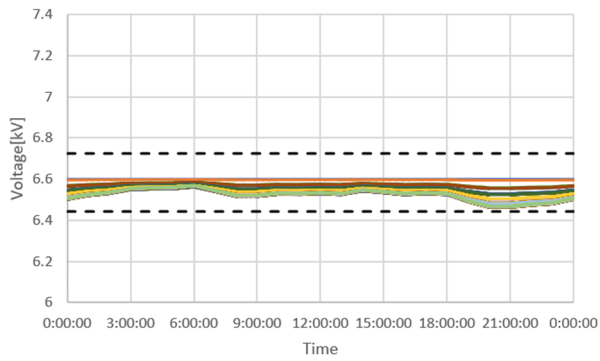


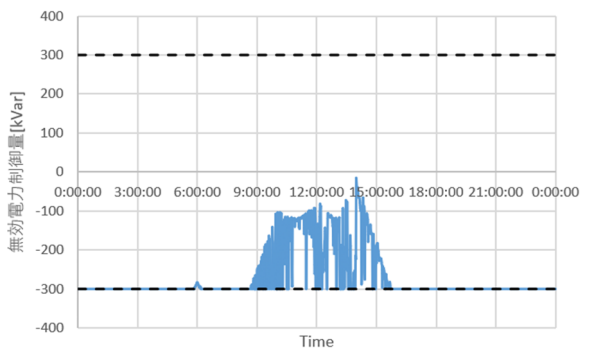
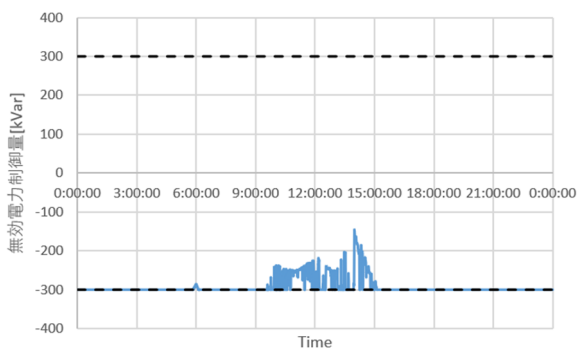
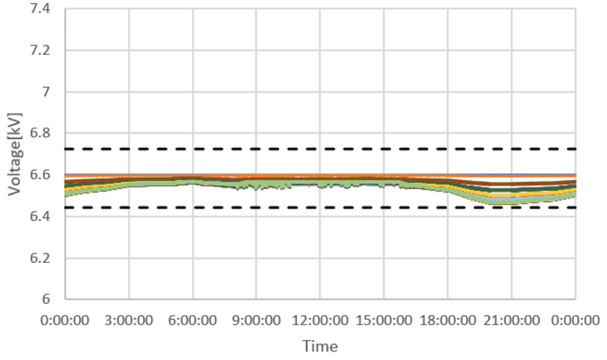
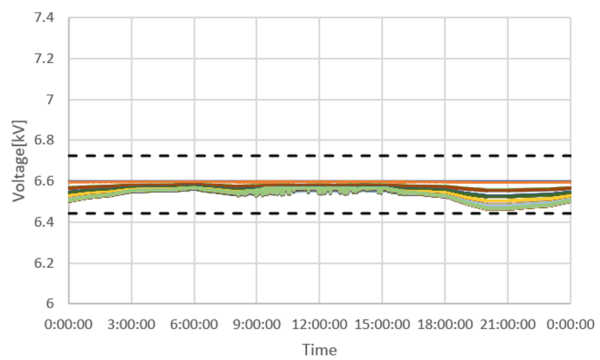
OC2 系統, PV 力率 0.95, 末端集中, SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



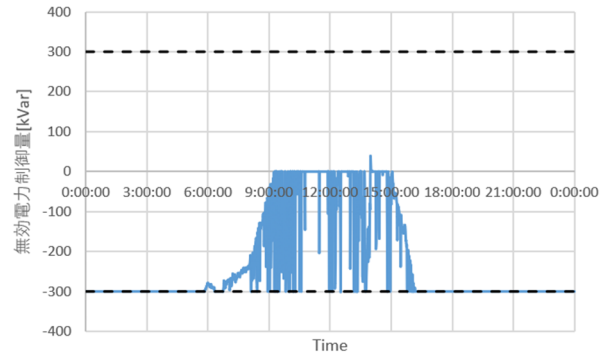
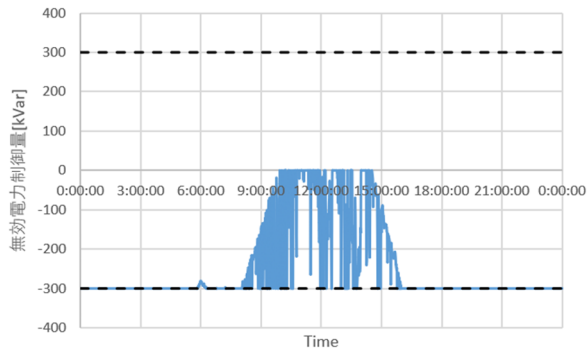
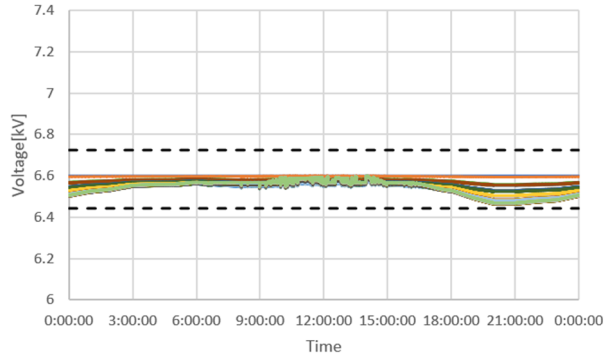
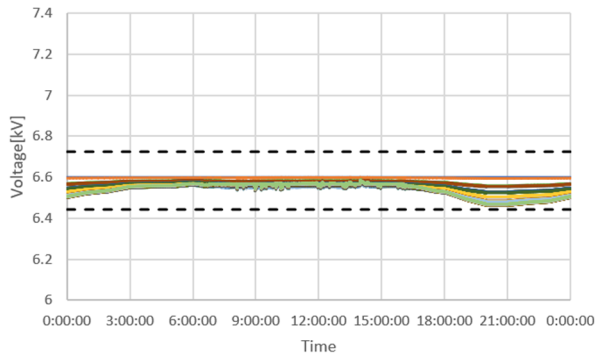
(a) PV 0%

(b) PV 10%



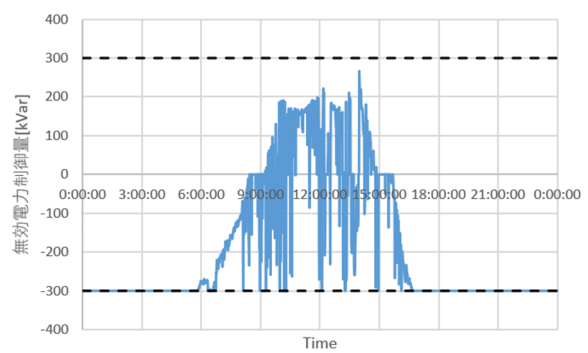
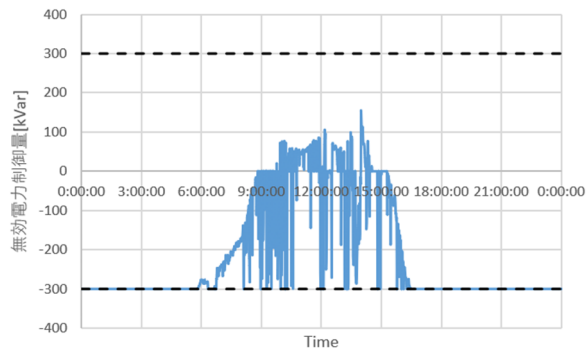
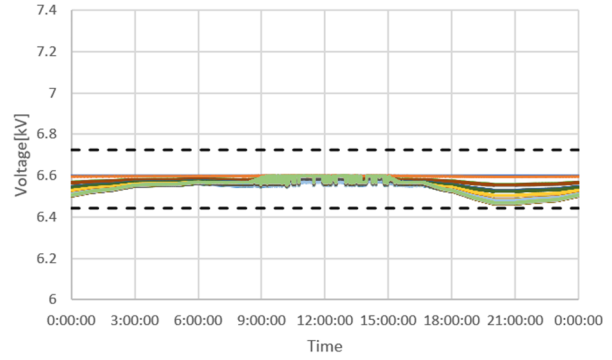
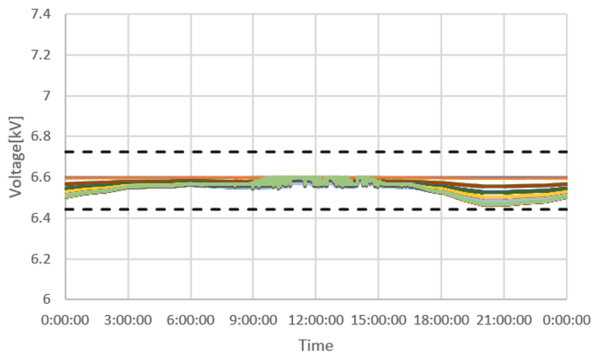
(c) PV 20%

(d) PV 30%



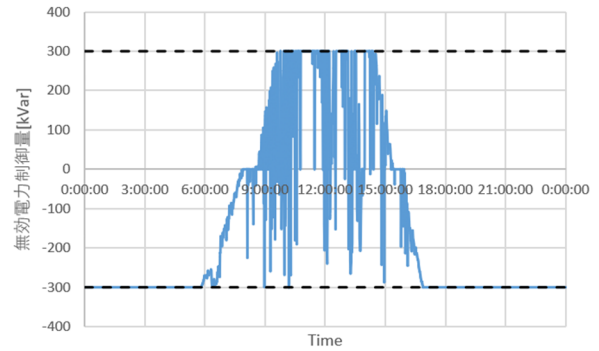
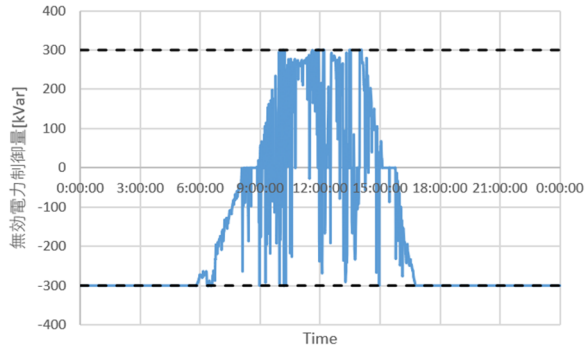
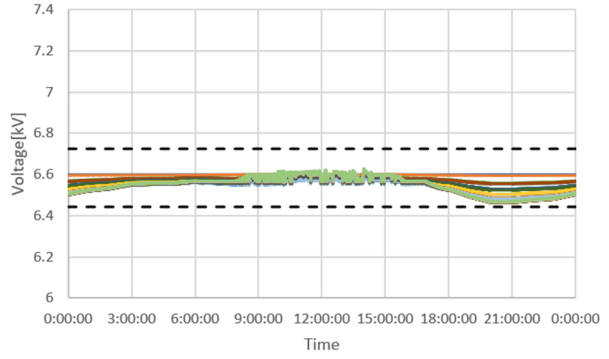
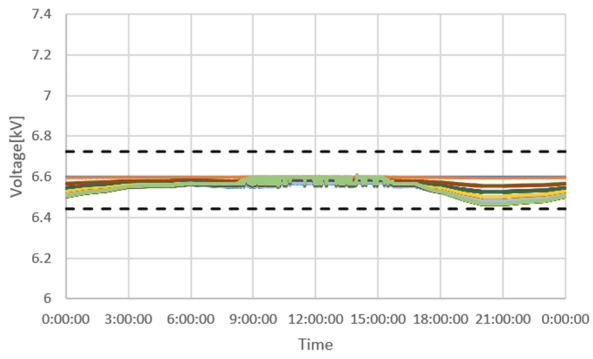
(e) PV 40%

(f) PV 50%



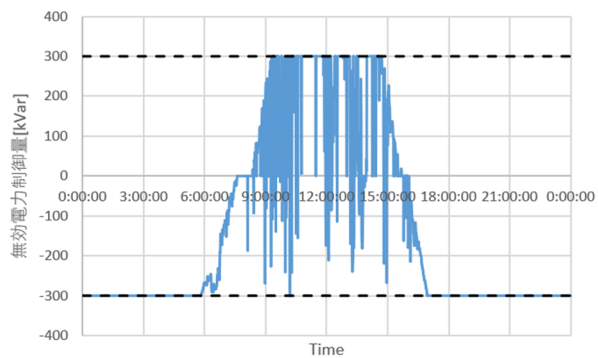
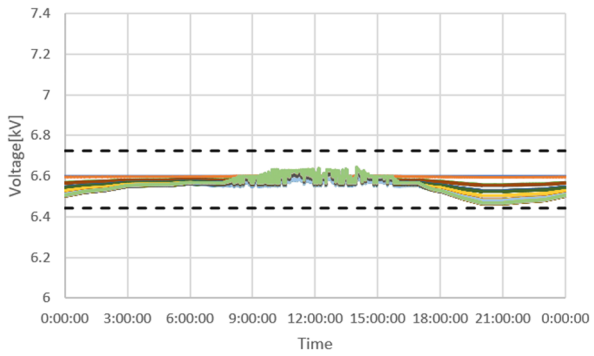
(g) PV 60%

(h) PV 70%



(i) PV 80%

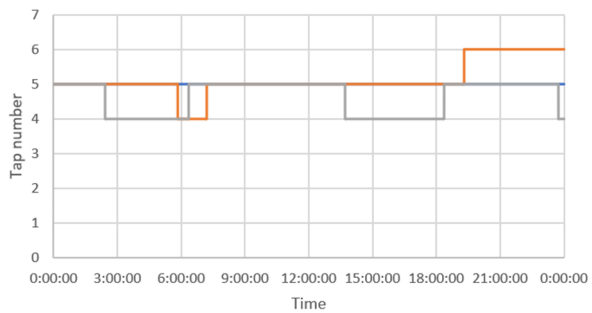
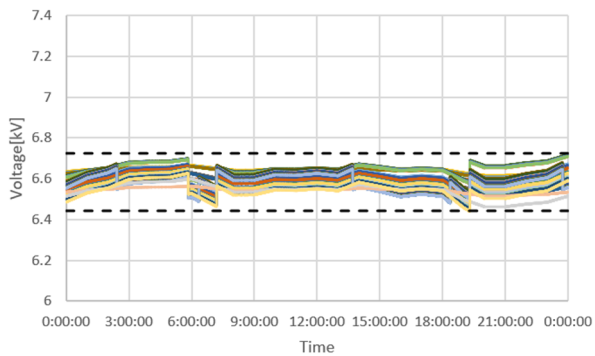
(j) PV 90%



(k) PV 100%

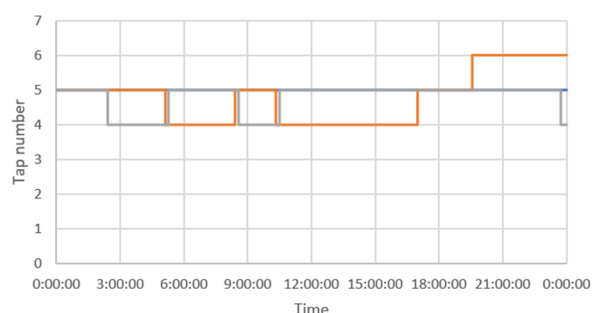
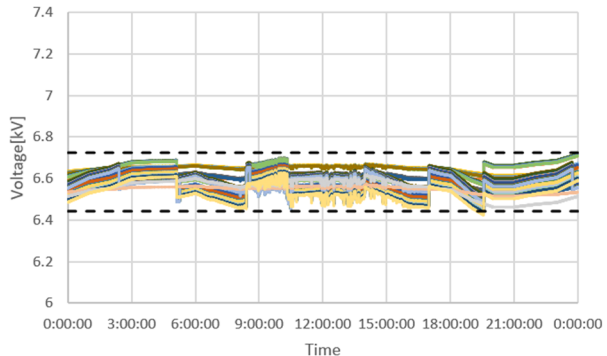
OD22 系統, PV 力率 1.0, 分散配置, SVR-SVR-SVR

(上: 電圧分布, 下: タップ位置)



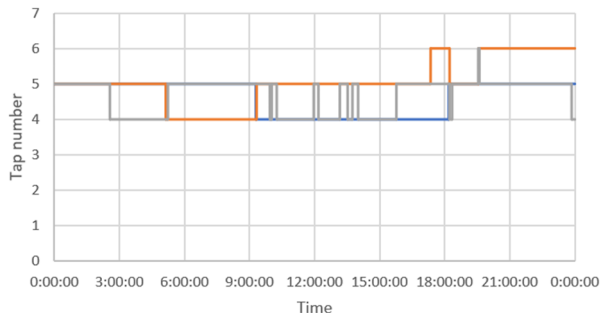
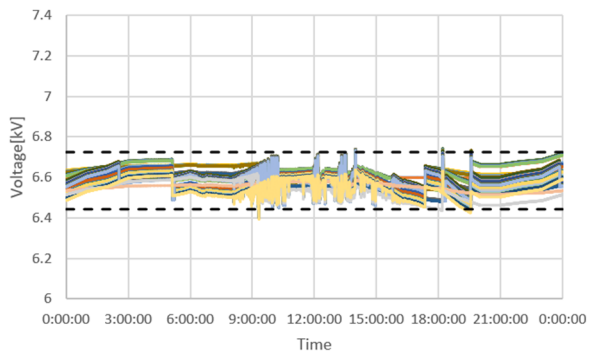
— SVR1 — SVR2 — SVR3

(a) PV 0%



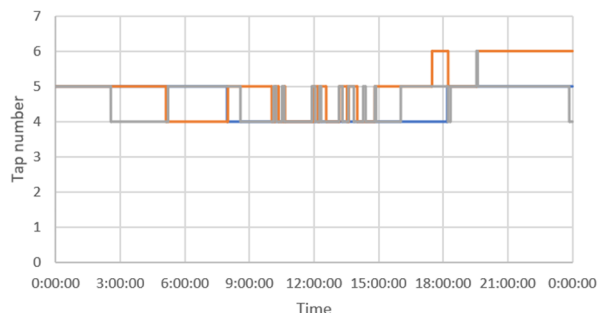
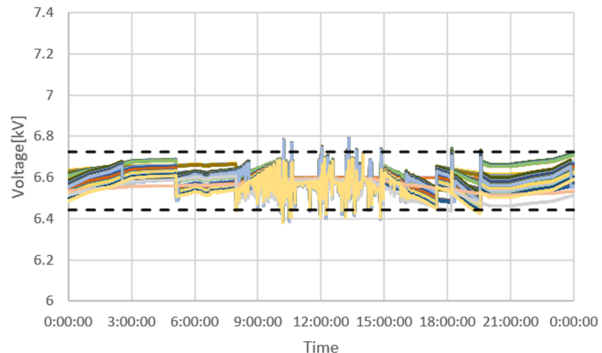
— SVR1 — SVR2 — SVR3

(b) PV 10%



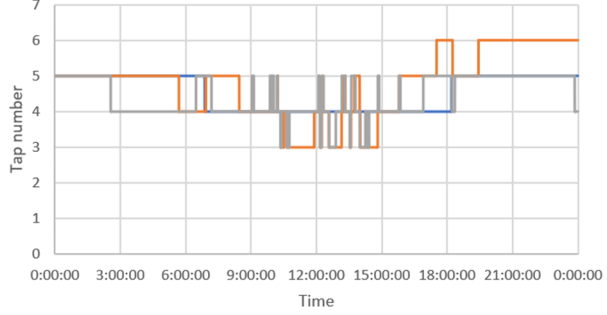
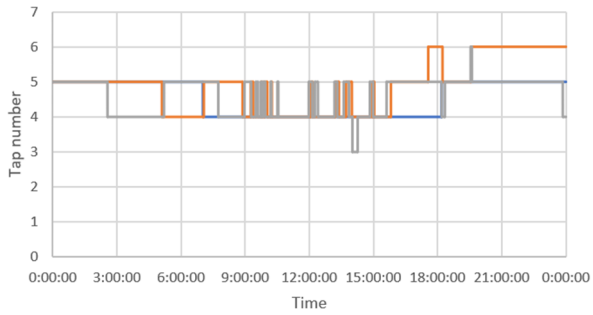
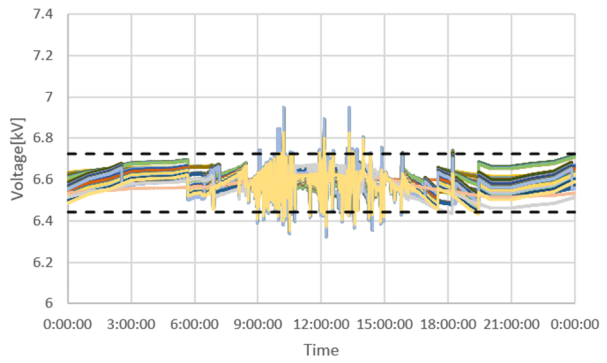
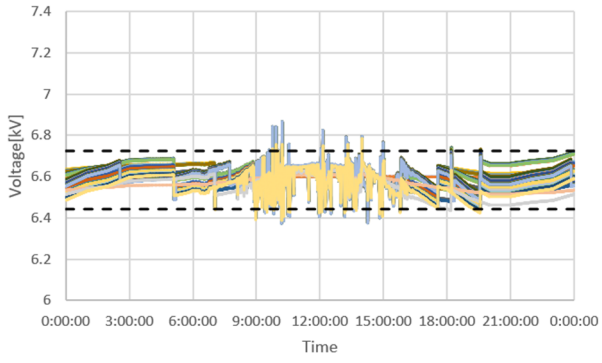
— SVR1 — SVR2 — SVR3

(c) PV 20%



— SVR1 — SVR2 — SVR3

(d) PV 30%

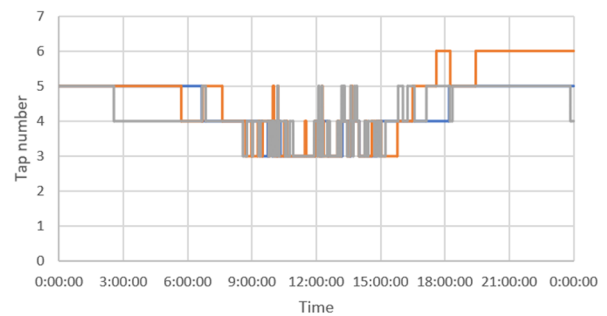
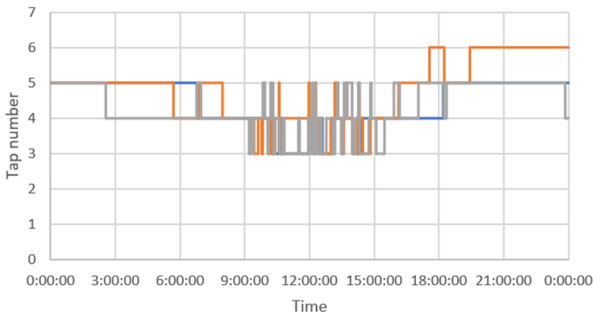
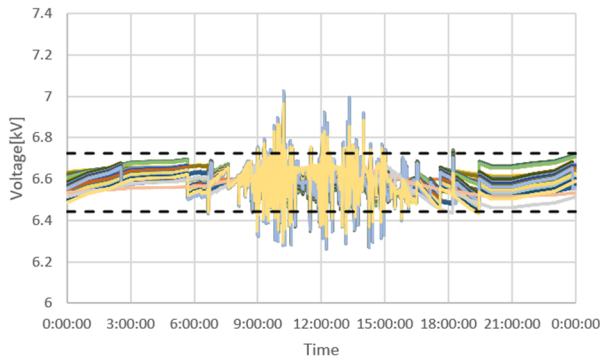
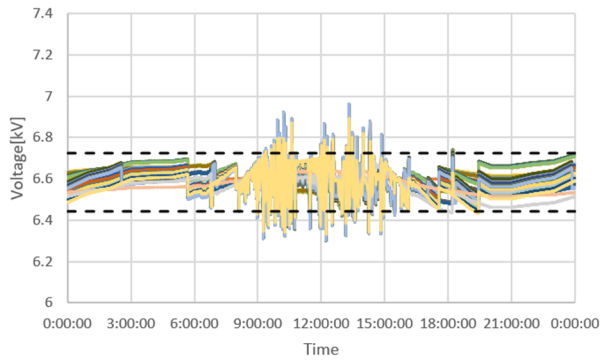


— SVR1 — SVR2 — SVR3

— SVR1 — SVR2 — SVR3

(e) PV 40%

(f) PV 50%

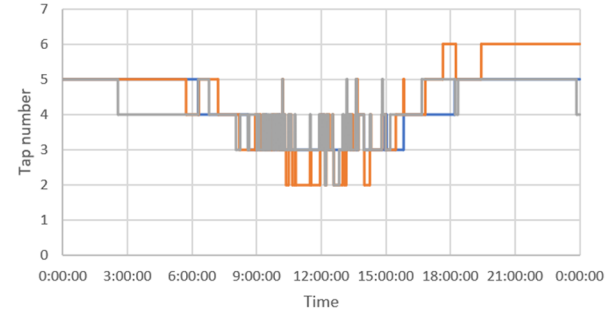
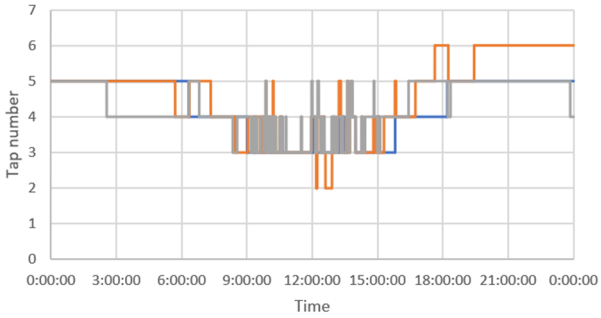
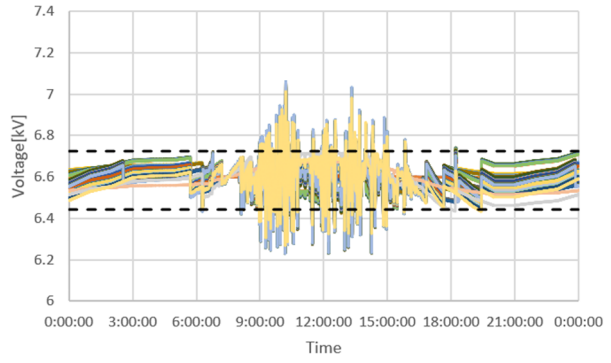
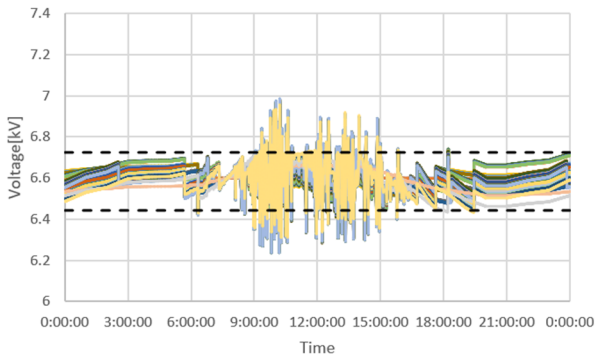


— SVR1 — SVR2 — SVR3

— SVR1 — SVR2 — SVR3

(g) PV 60%

(h) PV 70%

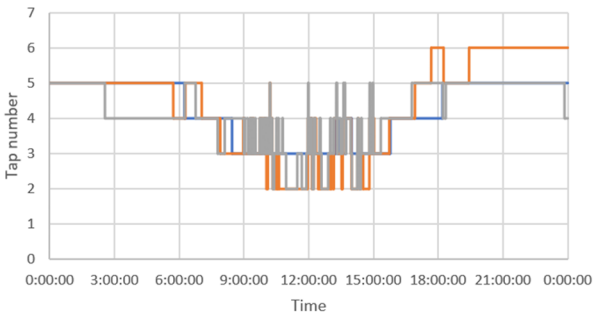
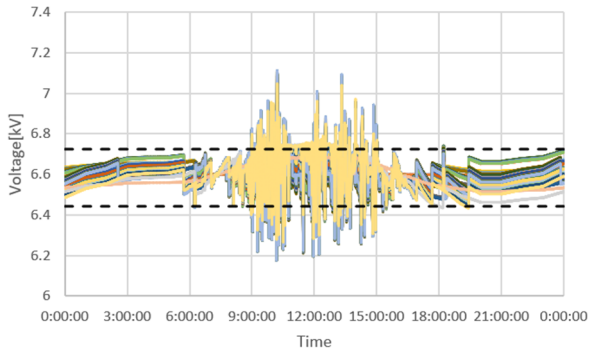


— SVR1 — SVR2 — SVR3

(i) PV 80%

— SVR1 — SVR2 — SVR3

(j) PV 90%

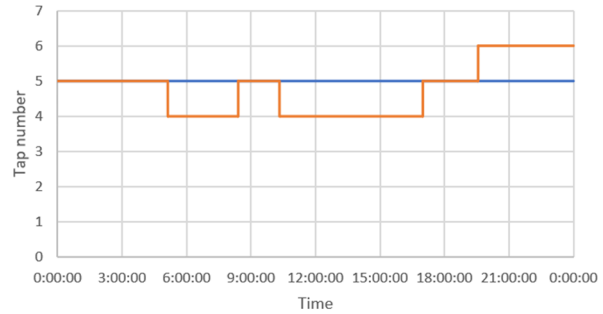
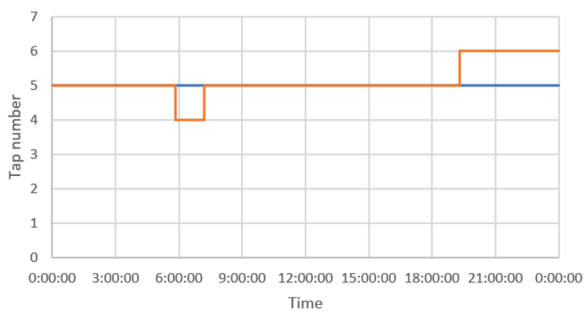
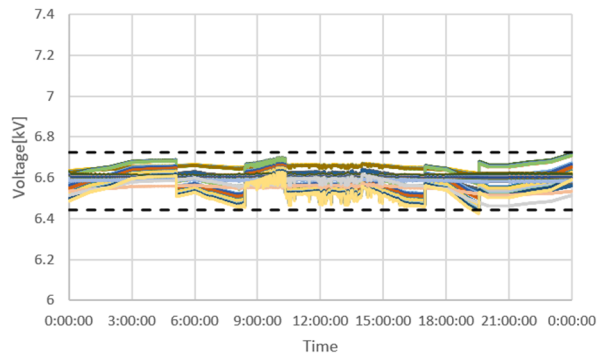
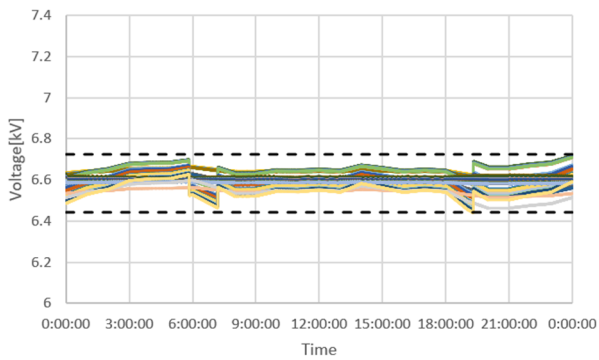


— SVR1 — SVR2 — SVR3

(k) PV 100%

OD22 系統, PV 力率 1.0, 分散配置, SVR-SVR-TVR

(上: 電圧分布, 下: タップ位置)

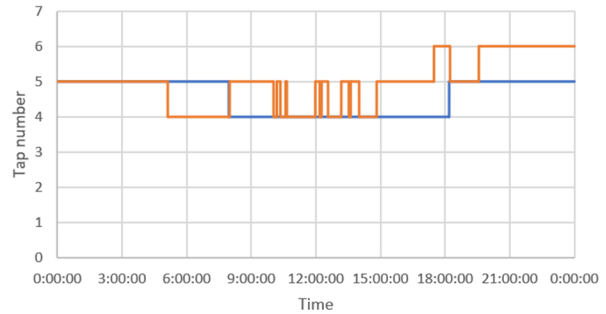
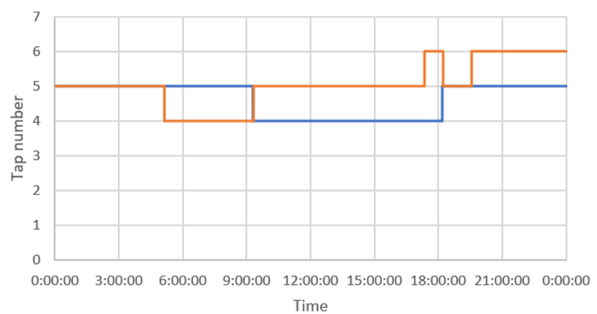
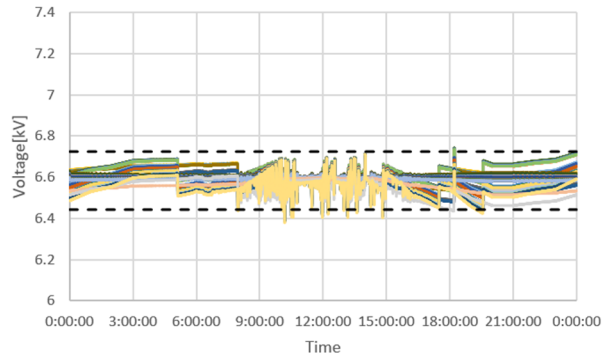
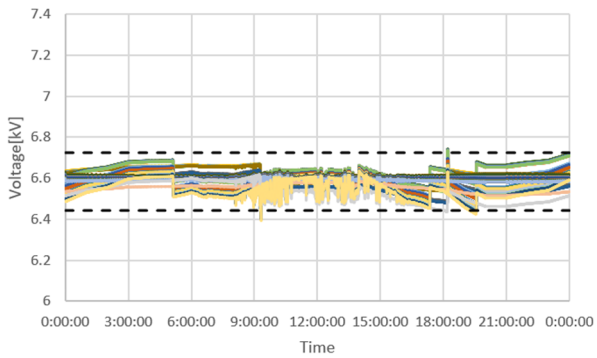


— SVR1 — SVR2

— SVR1 — SVR2

(a) PV 0%

(b) PV 10%

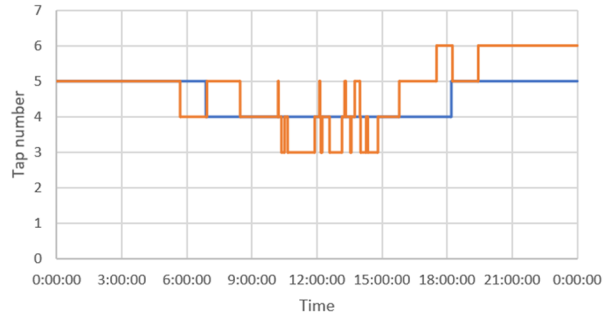
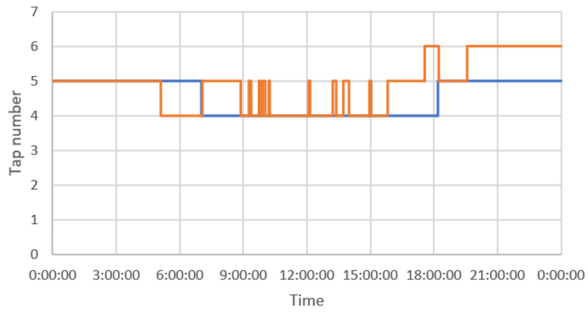
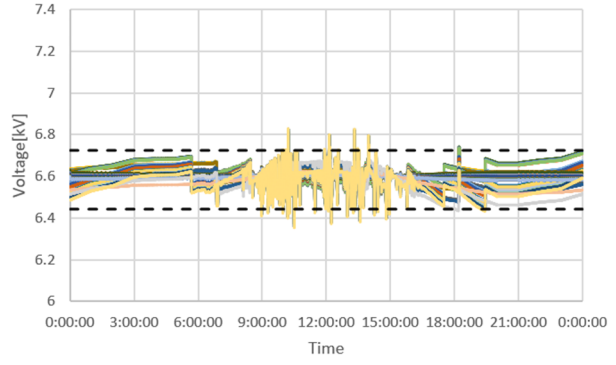
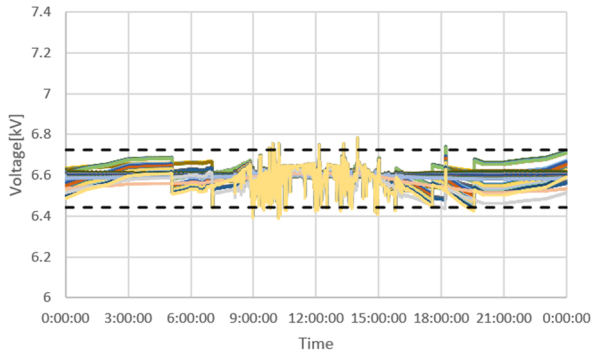


— SVR1 — SVR2

— SVR1 — SVR2

(c) PV 20%

(d) PV 30%

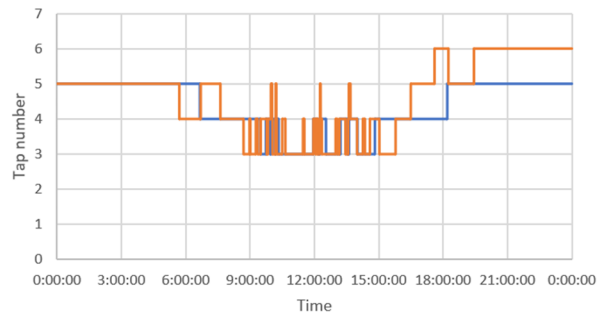
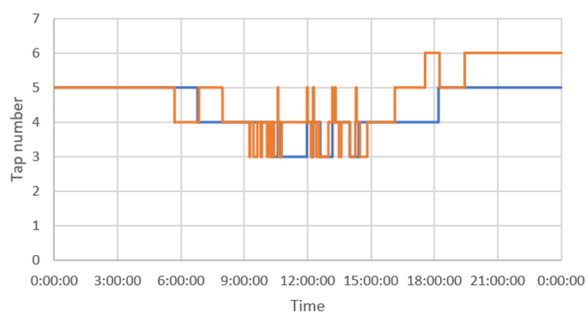
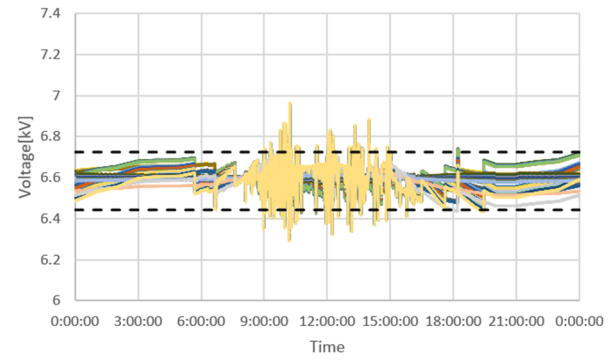
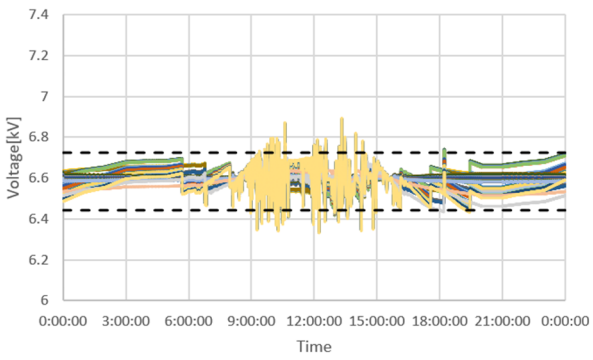


— SVR1 — SVR2

(e) PV 40%

— SVR1 — SVR2

(f) PV 50%



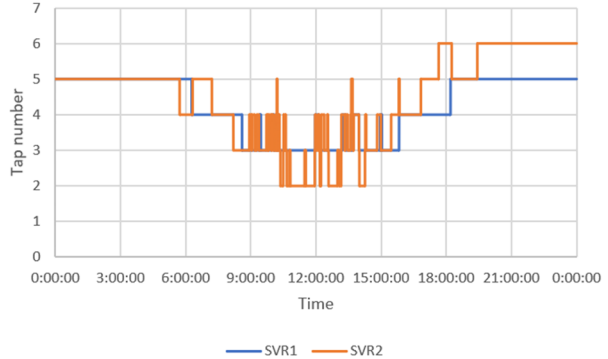
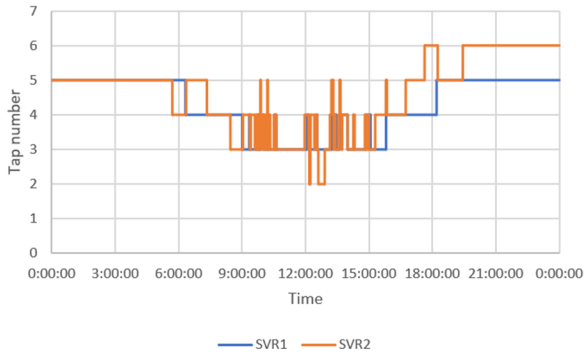
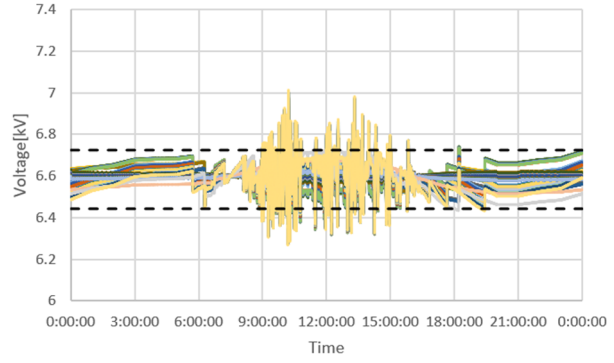
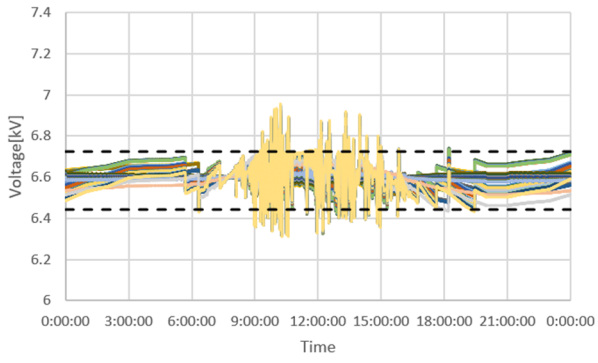
— SVR1 — SVR2

(g) PV 60%

— SVR1 — SVR2

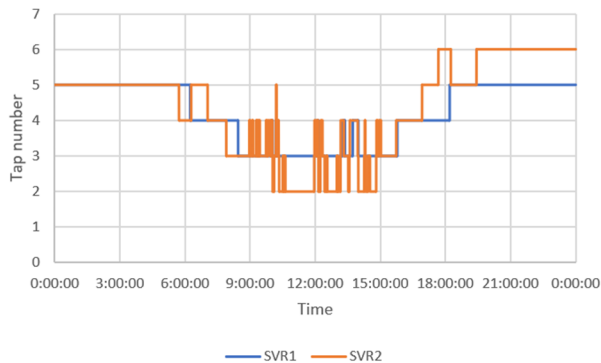
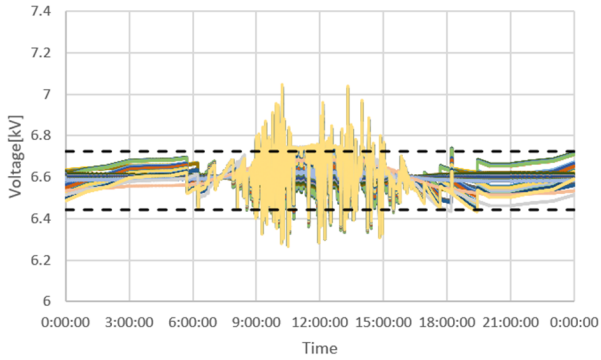
(h) PV 70%





(i) PV 80%

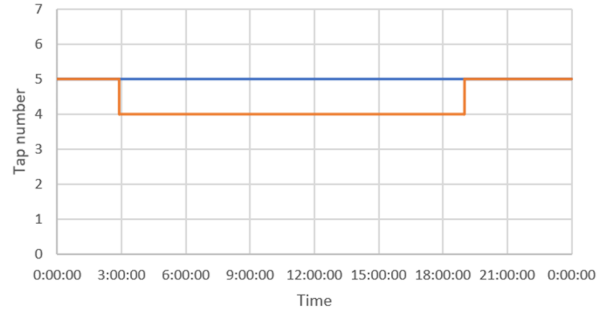
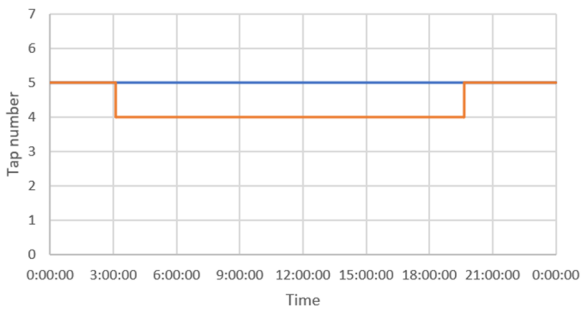
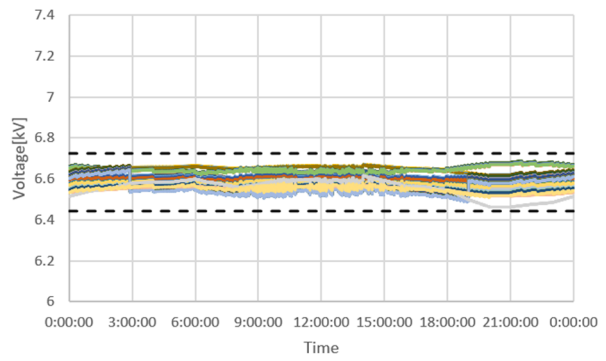
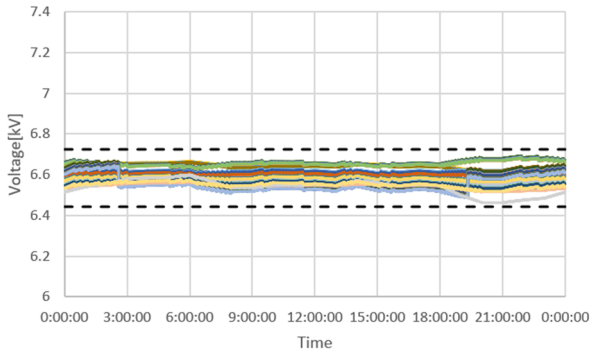
(j) PV 90%



(k) PV 100%

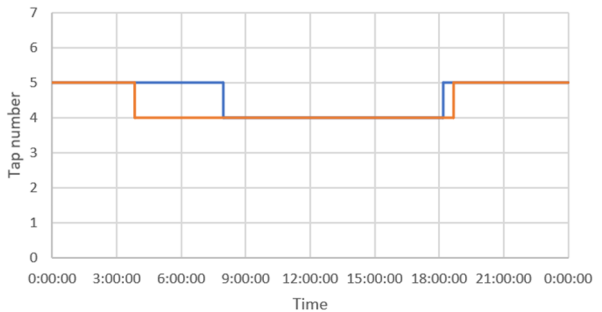
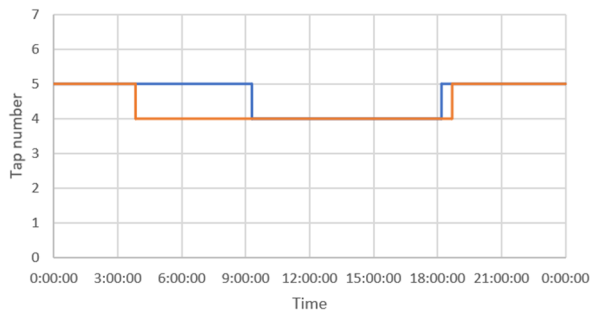
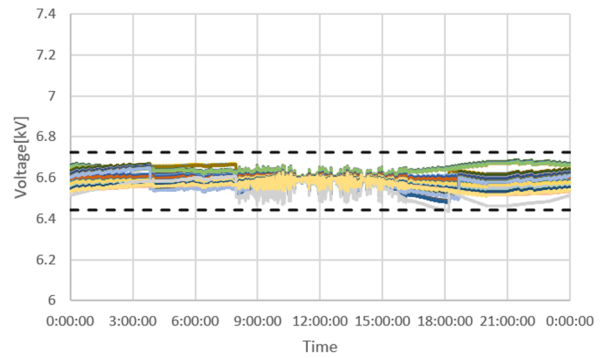
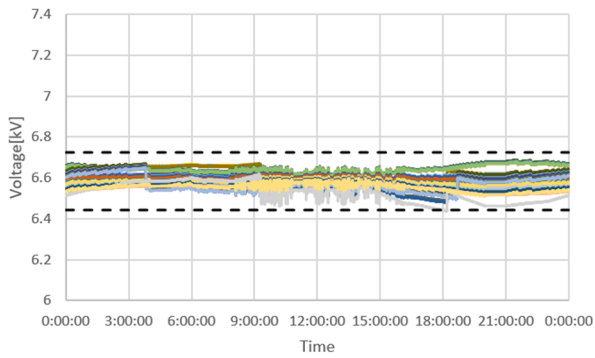
OD22 系統, PV 力率 1.0, 分散配置, SVR-TV R-SVR

(上: 電圧分布, 下: タップ位置)



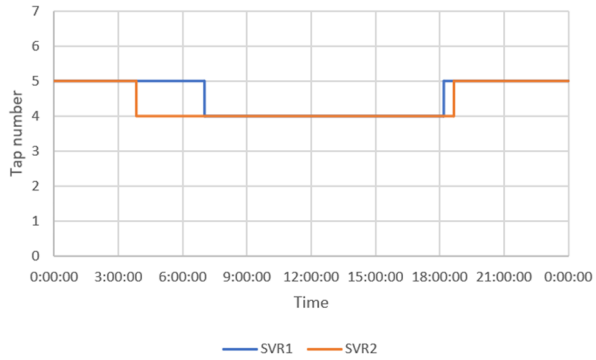
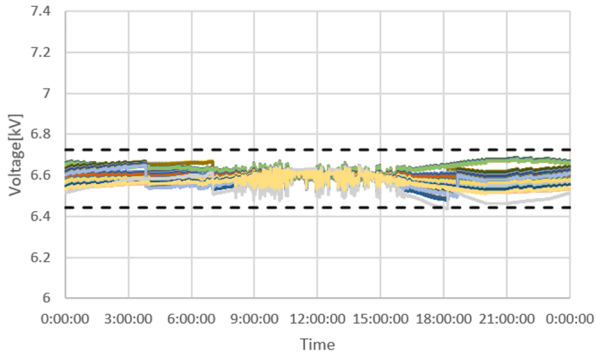
(a) PV 0%

(b) PV 10%

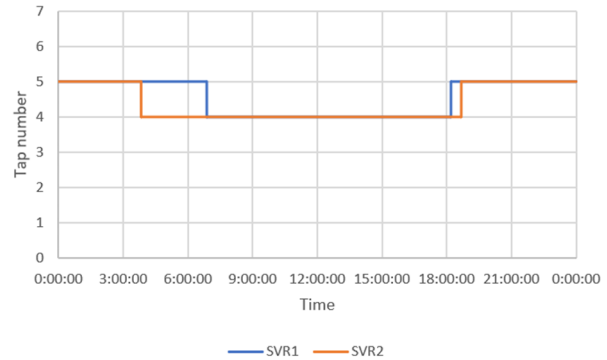
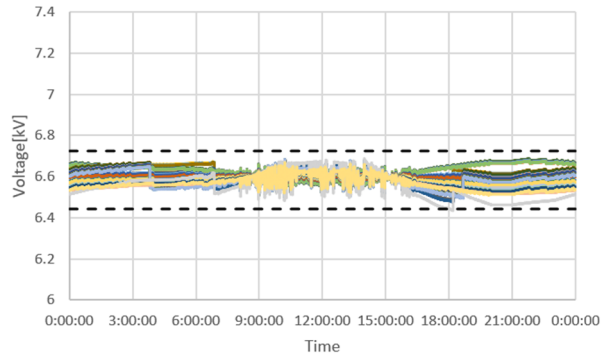


(c) PV 20%

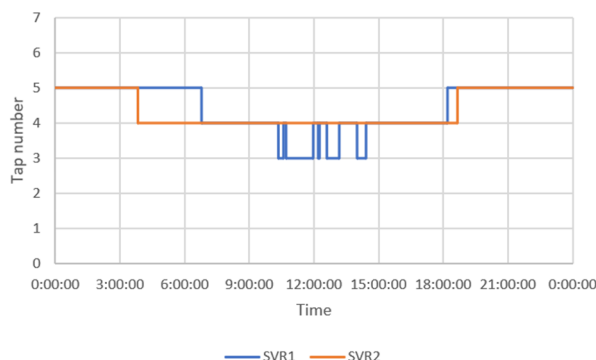
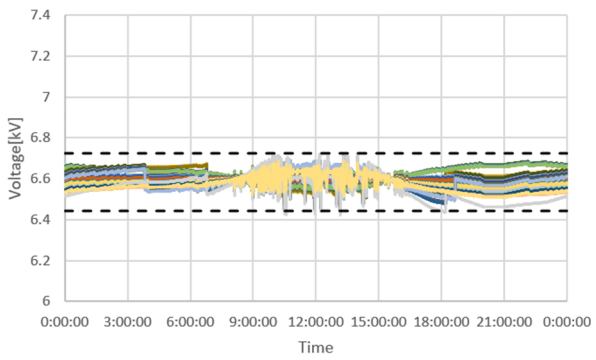
(d) PV 30%



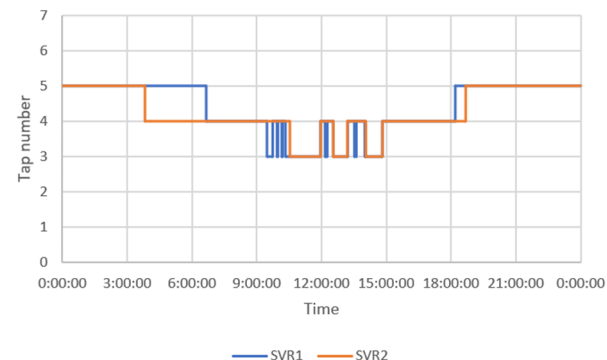
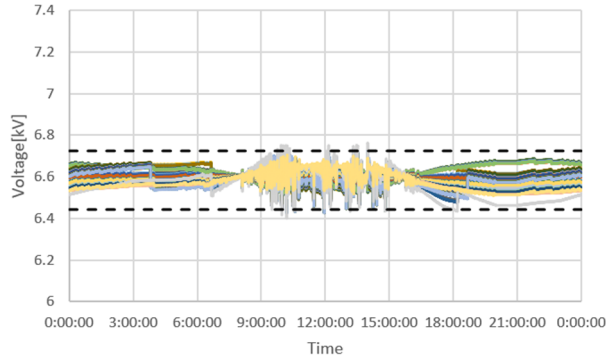
(e) PV 40%



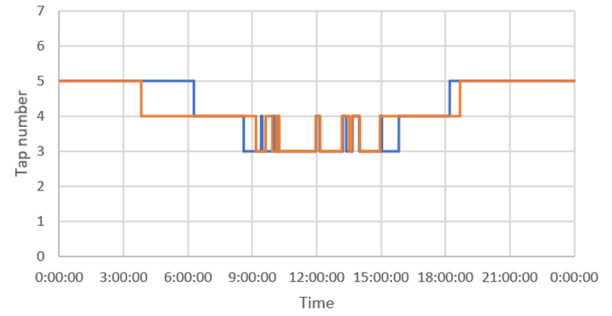
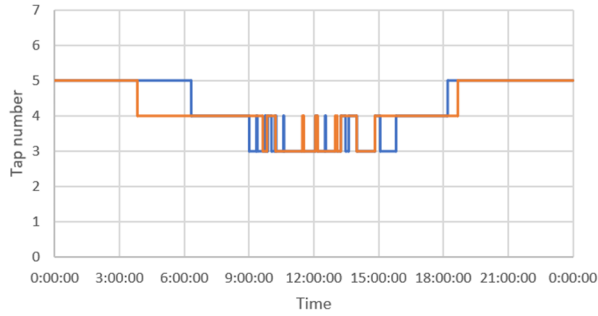
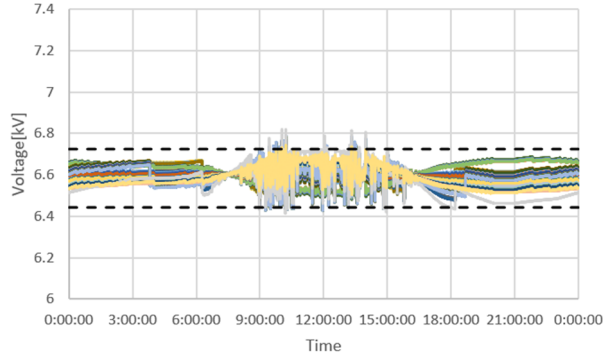
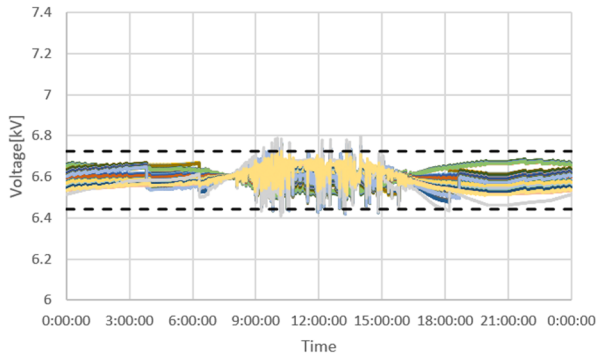
(f) PV 50%



(g) PV 60%



(h) PV 70%

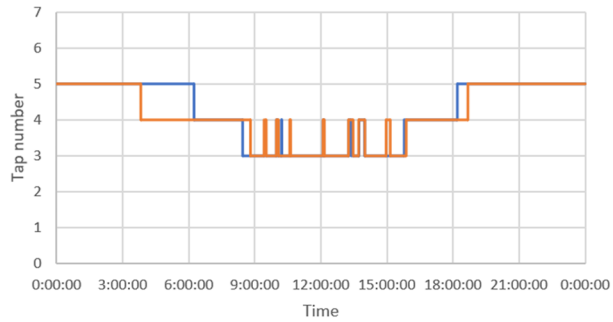
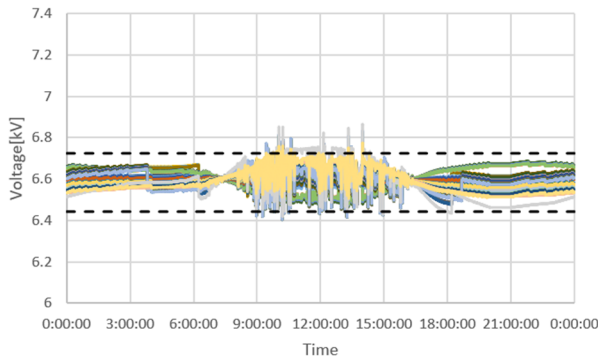


— SVR1 — SVR2

(i) PV 80%

— SVR1 — SVR2

(j) PV 90%

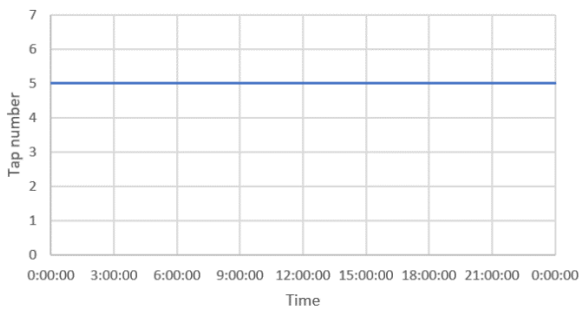
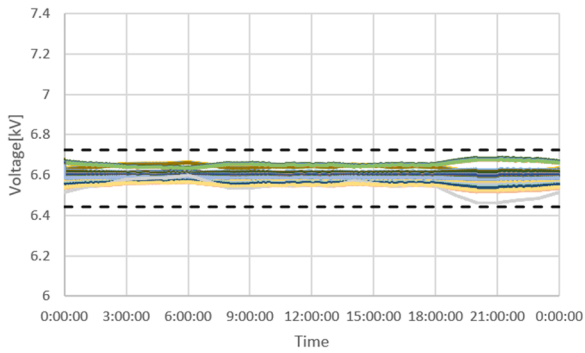


— SVR1 — SVR2

(k) PV 100%

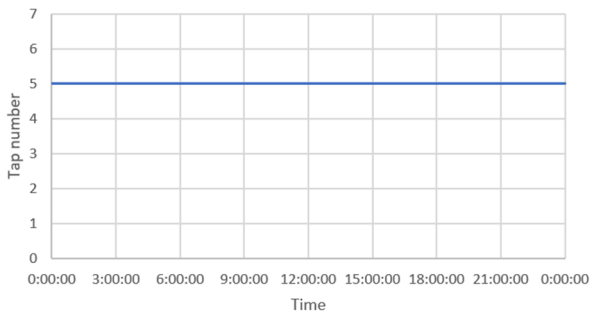
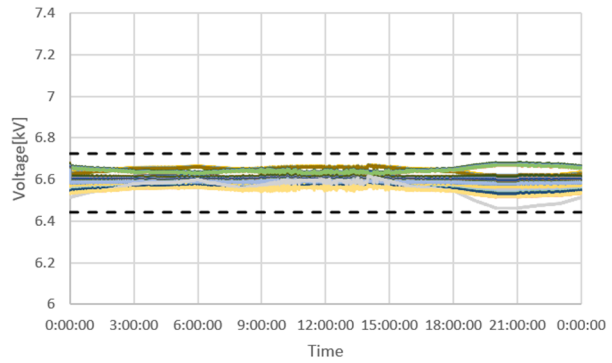
OD22 系統, PV 力率 1.0, 末端集中, SVR-TV<sub>R</sub>-TV<sub>R</sub>

(上: 電圧分布, 下: タップ位置)



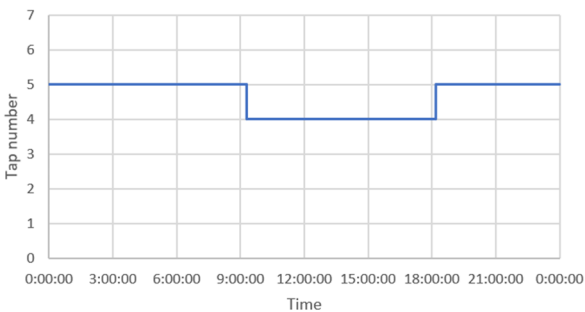
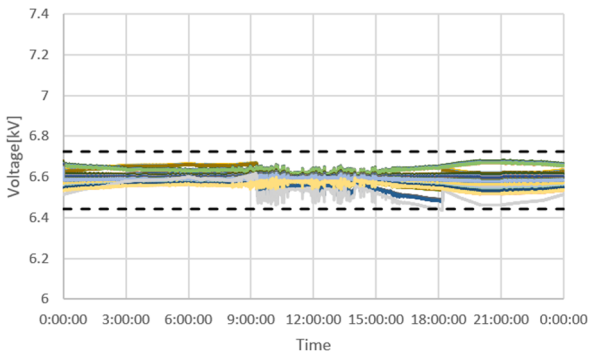
— SVR1

(a) PV 0%



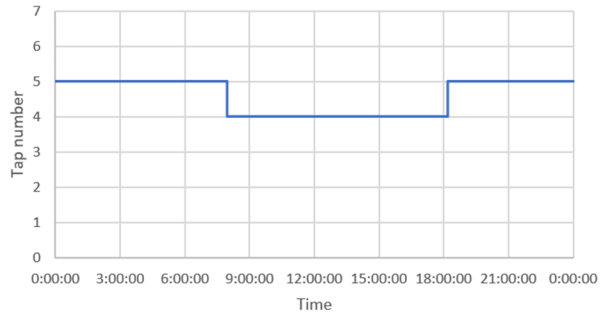
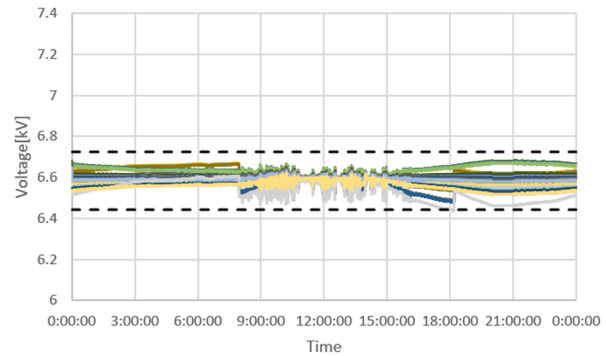
— SVR1

(b) PV 10%



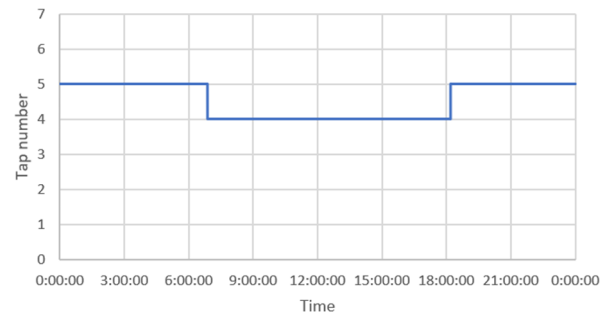
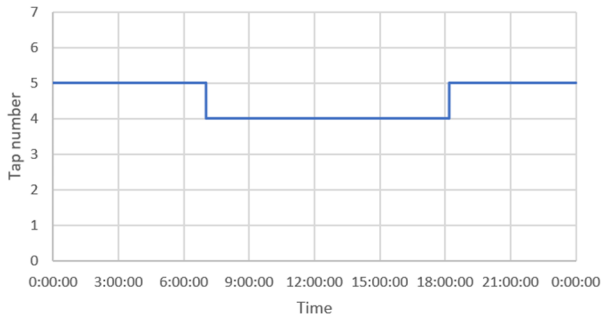
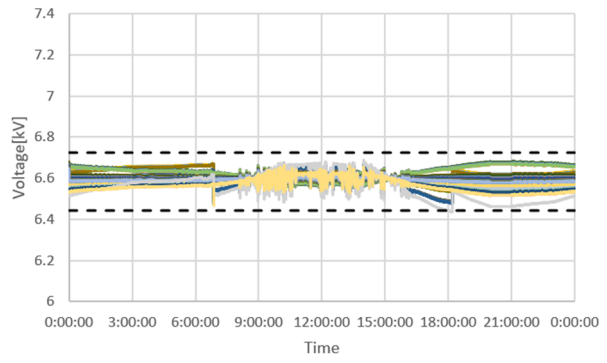
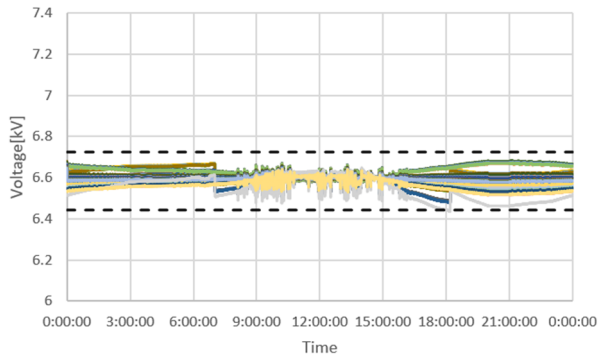
— SVR1

(c) PV 20%



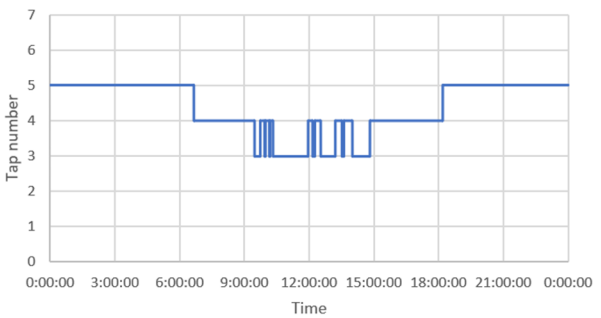
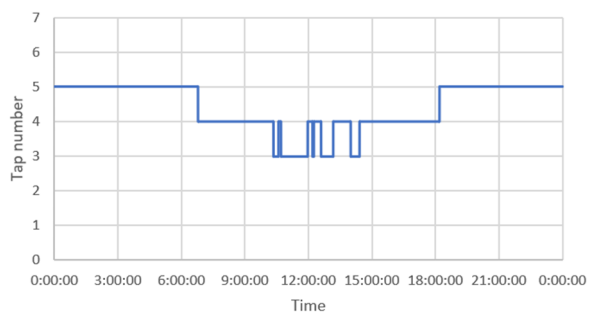
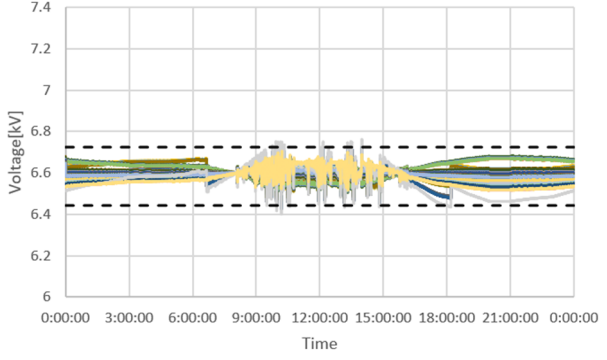
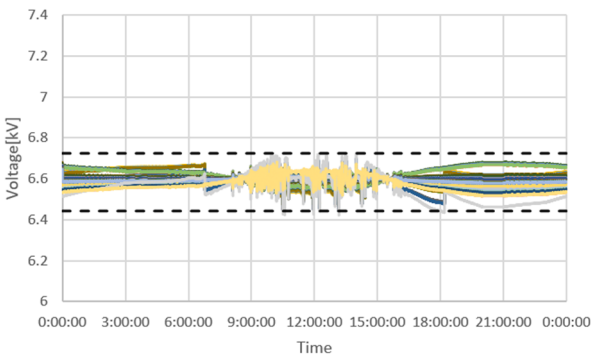
— SVR1

(d) PV 30%



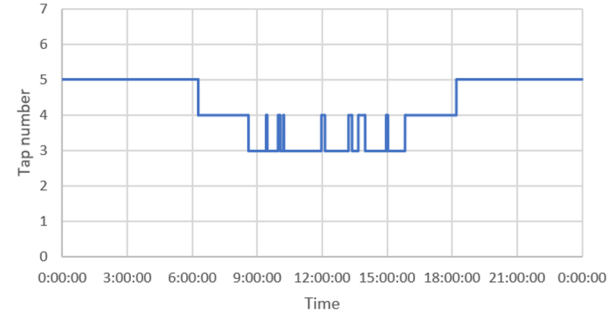
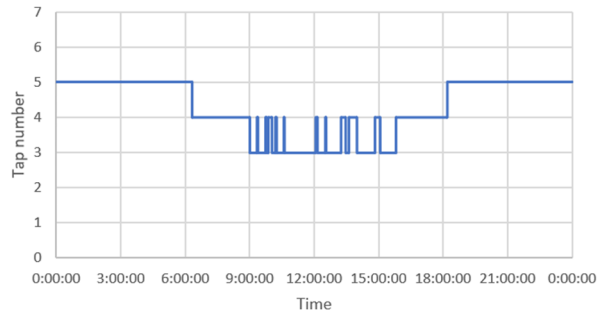
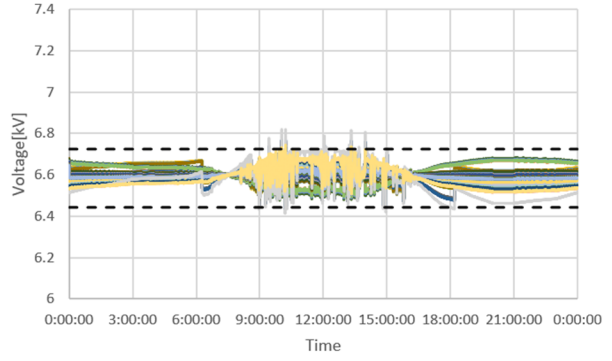
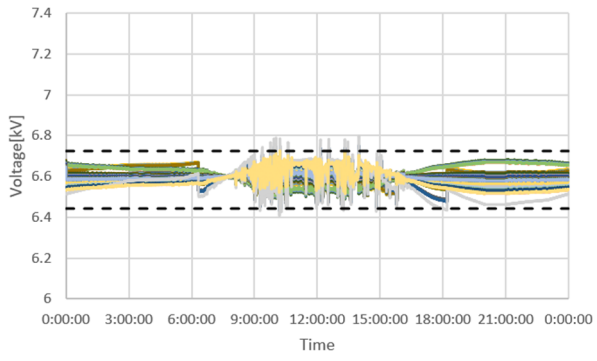
(e) PV 40%

(f) PV 50%



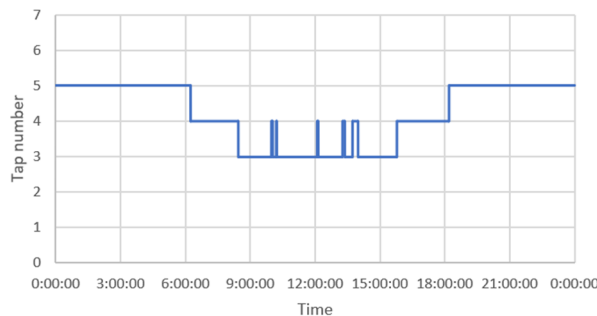
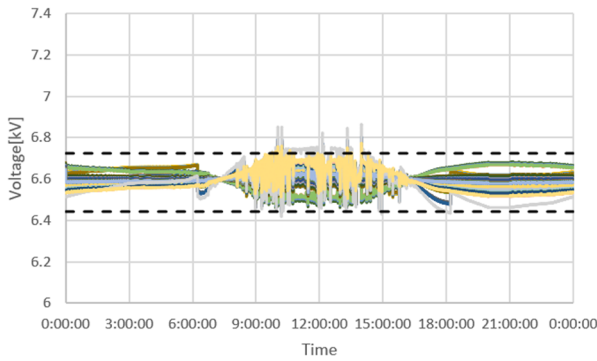
(g) PV 60%

(h) PV 70%



(i) PV 80%

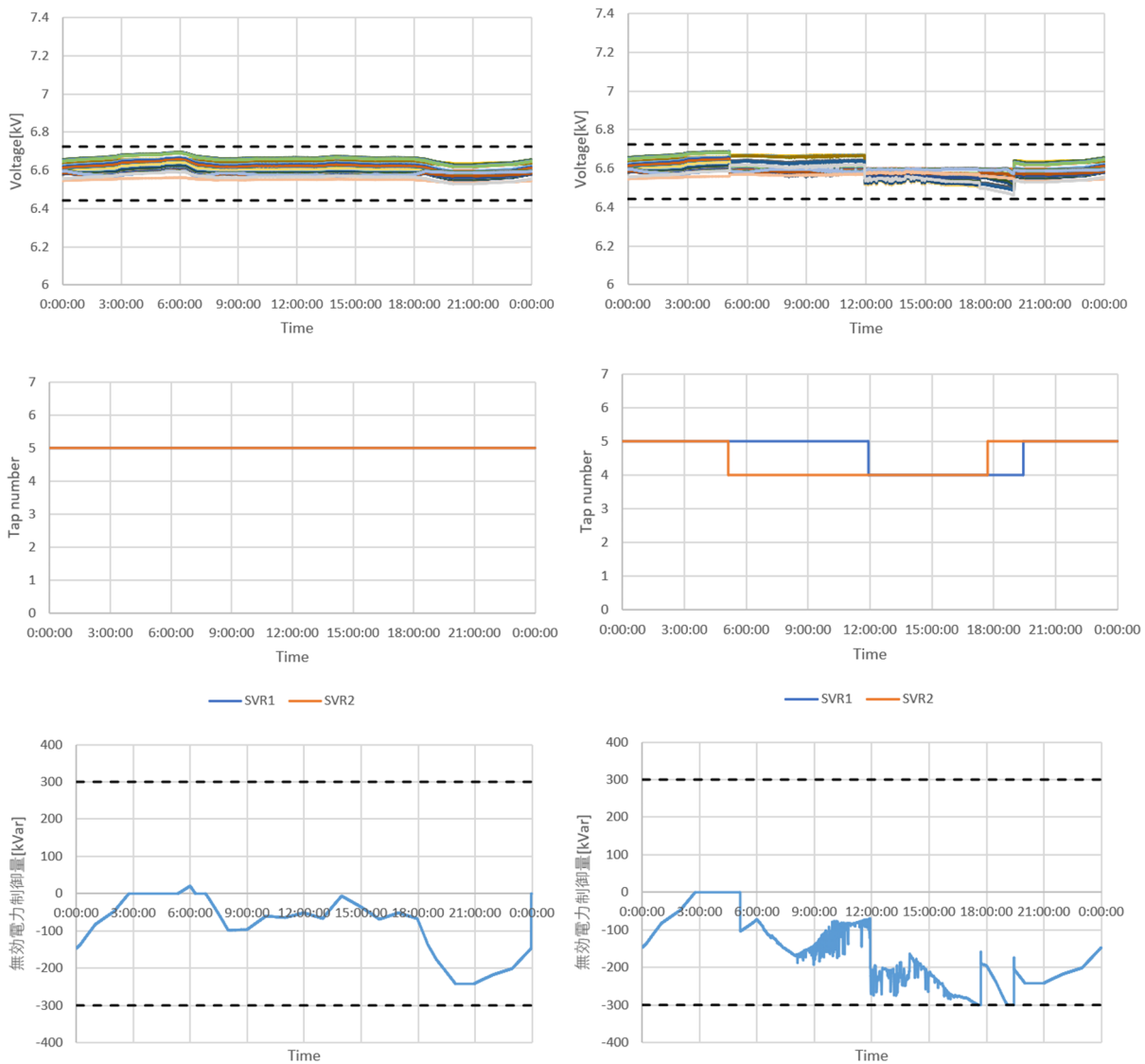
(j) PV 90%



(k) PV 100%

OD22 系統, PV 力率 1.0, 分散配置, SVR-SVR-SVC

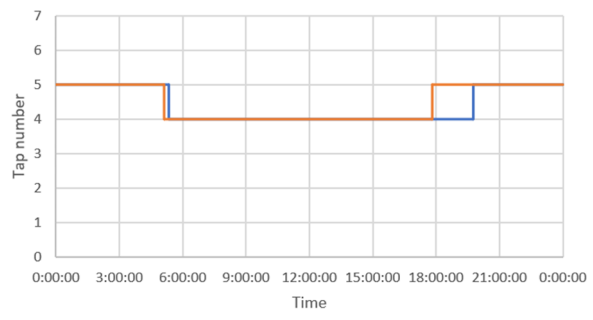
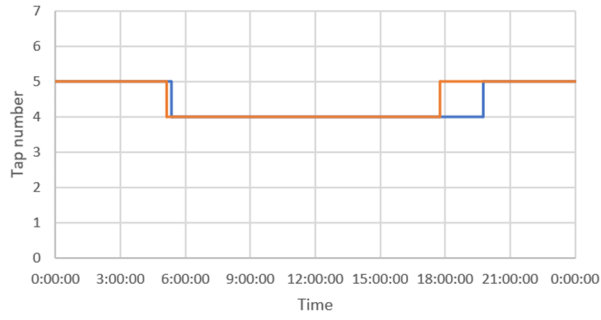
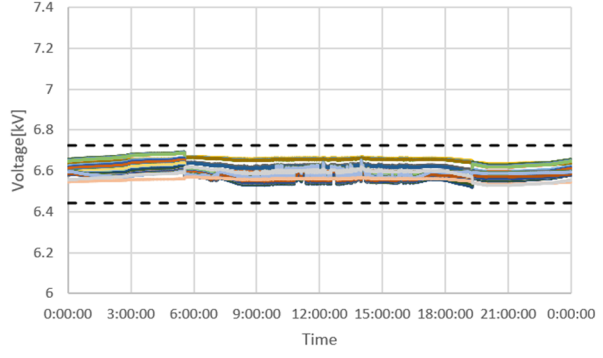
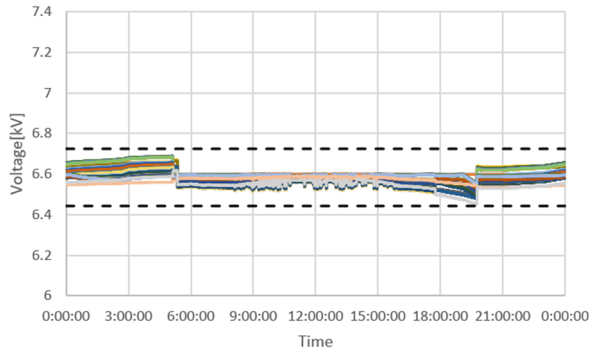
(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



(a) PV 0%

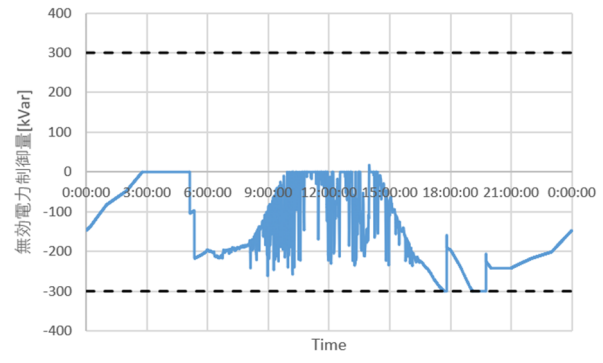
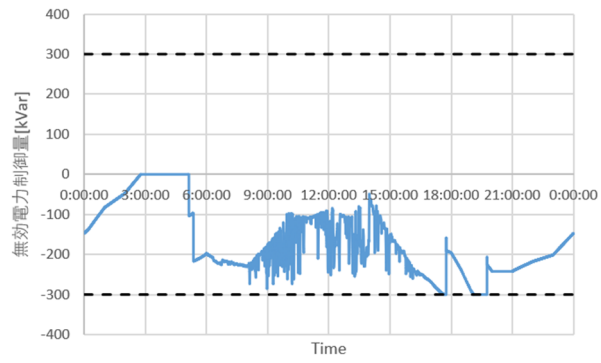
(b) PV 10%





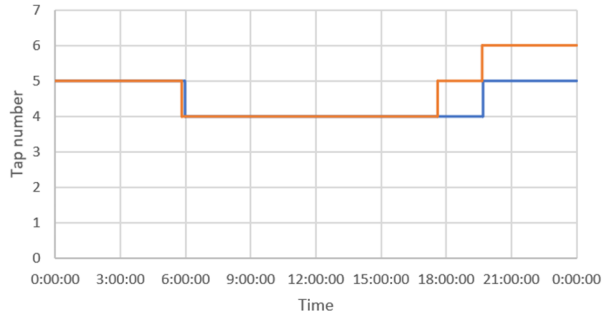
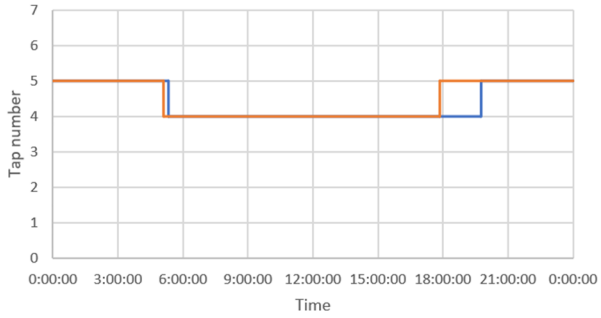
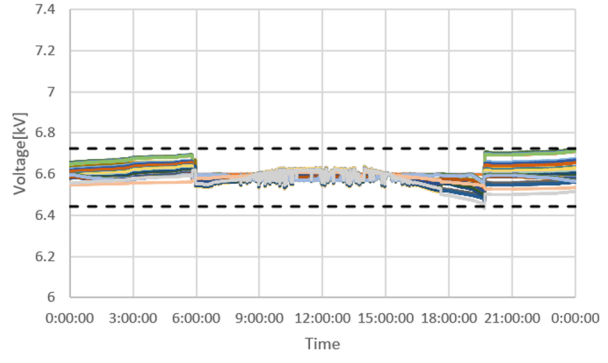
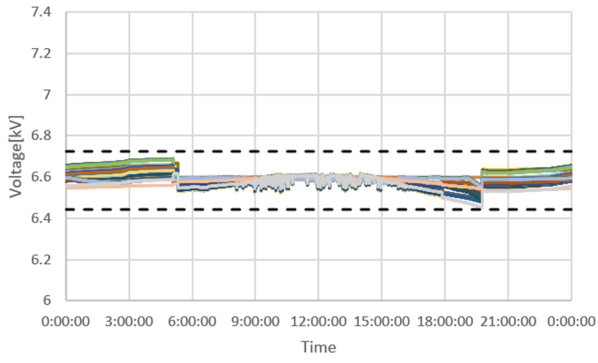
— SVR1 — SVR2

— SVR1 — SVR2



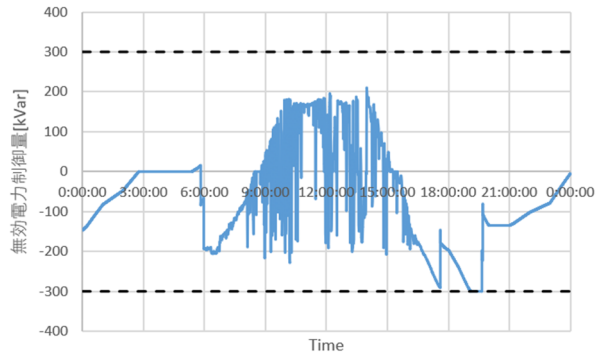
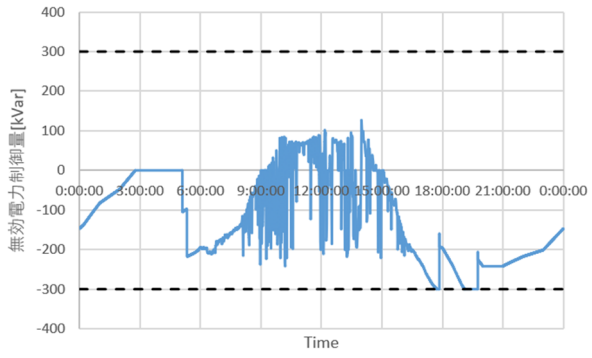
(c) PV 20%

(d) PV 30%



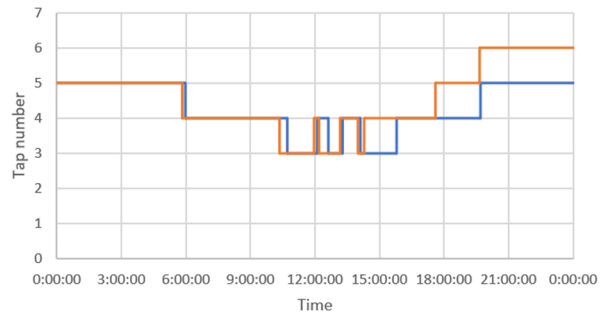
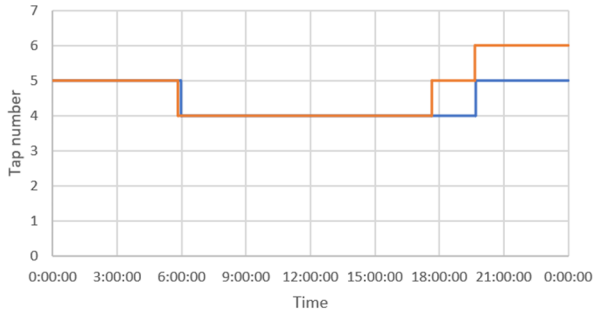
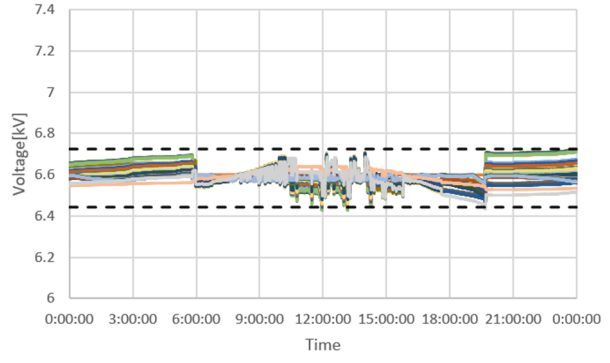
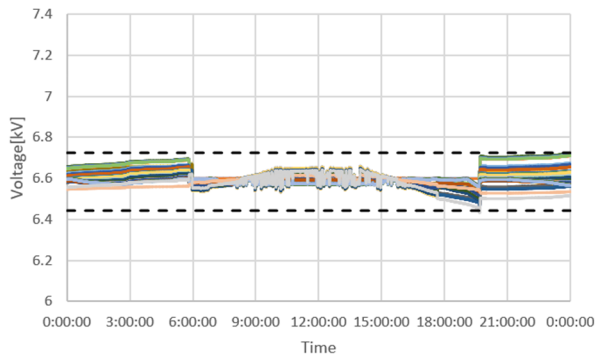
— SVR1 — SVR2

— SVR1 — SVR2



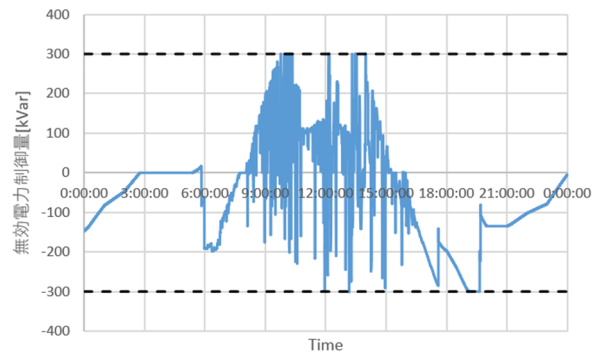
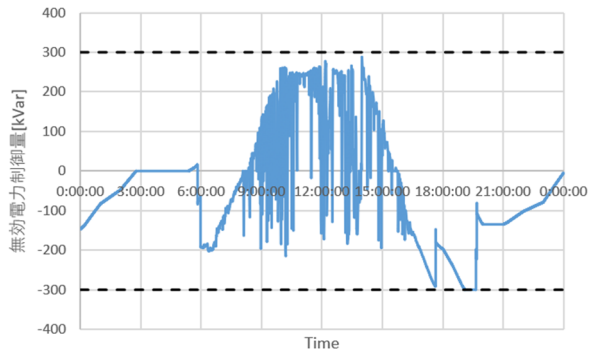
(e) PV 40%

(f) PV 50%



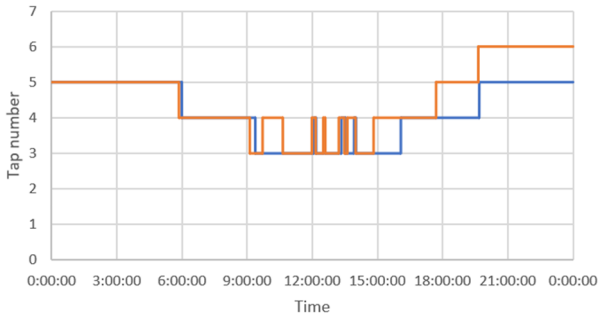
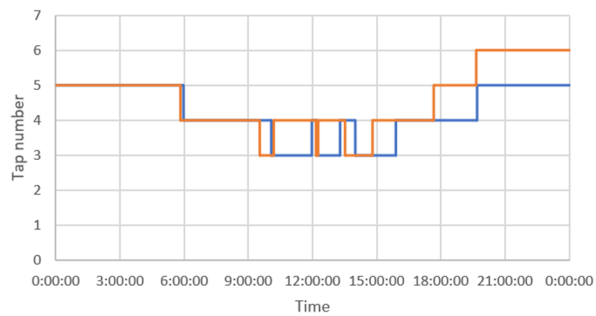
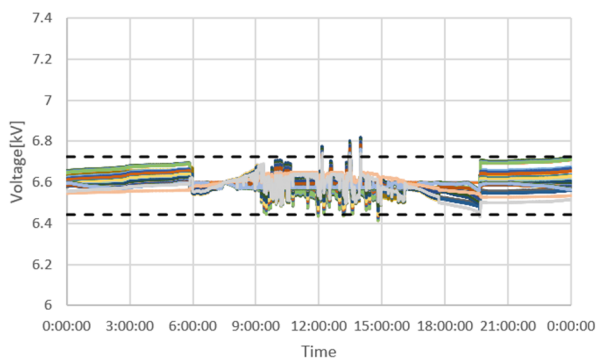
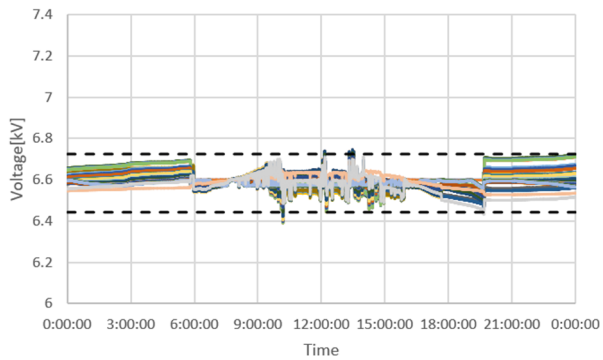
— SVR1 — SVR2

— SVR1 — SVR2



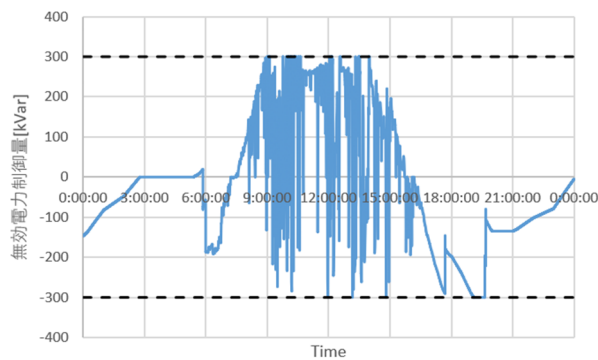
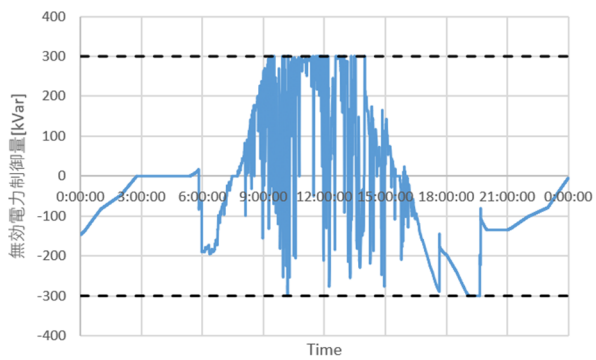
(g) PV 60%

(h) PV 70%



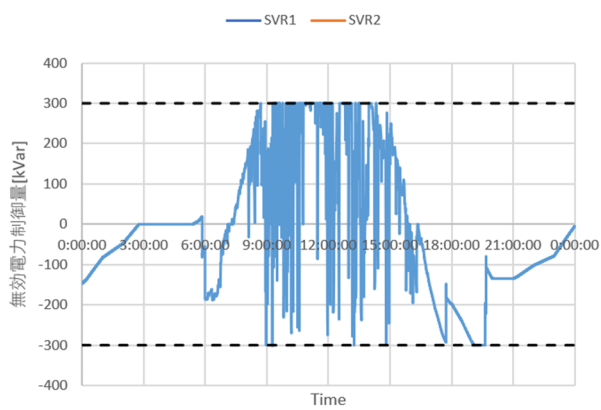
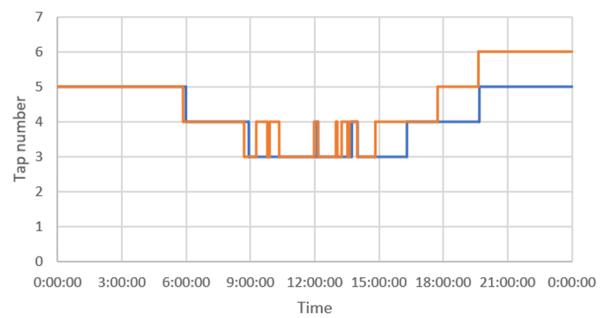
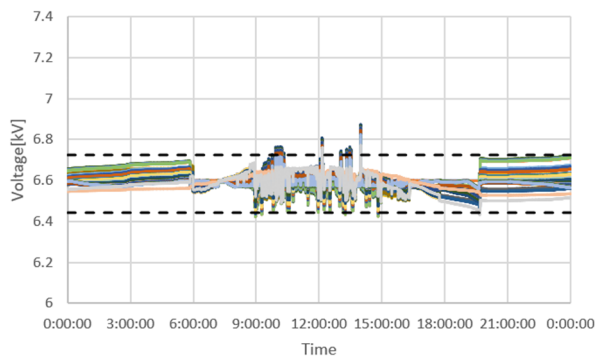
— SVR1 — SVR2

— SVR1 — SVR2



(i) PV 80%

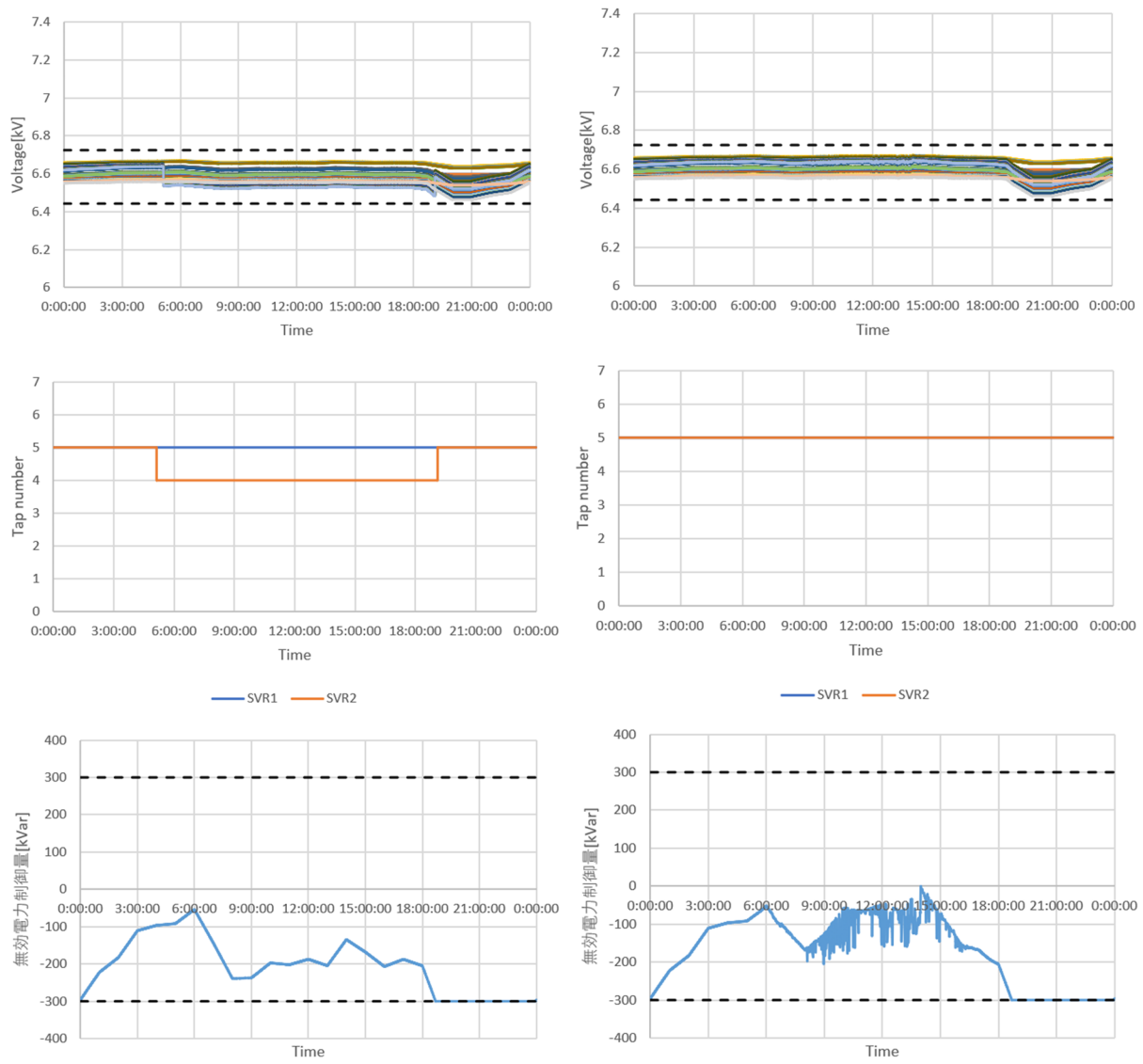
(j) PV 90%



(k) PV 100%

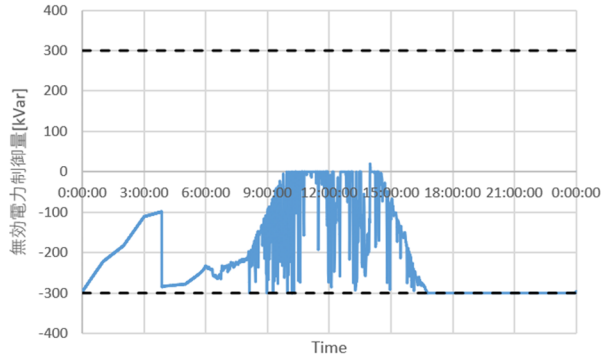
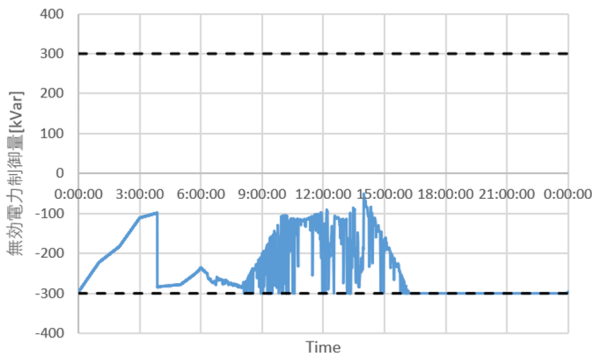
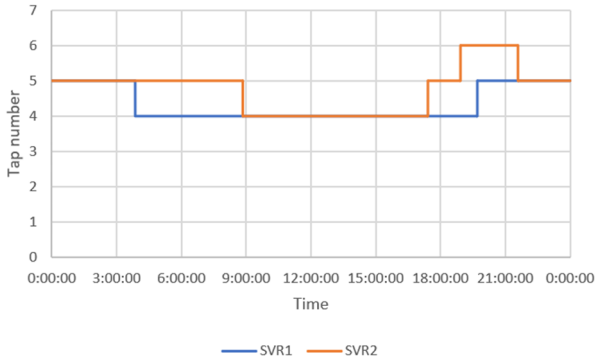
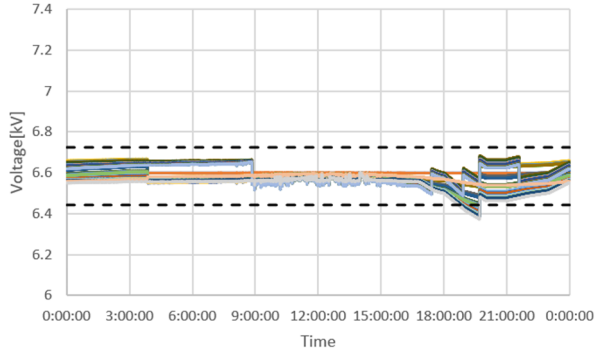
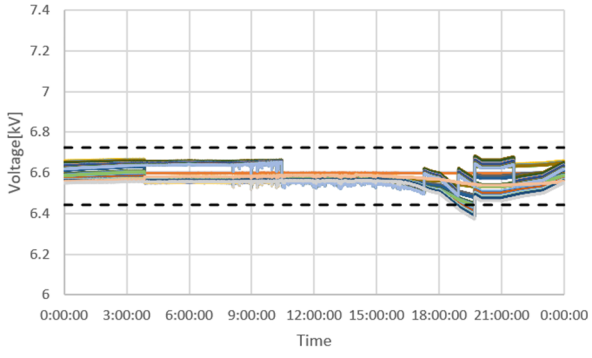
OD22 系統, PV 力率 1.0, 分散配置, SVR-SVC-SVR

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



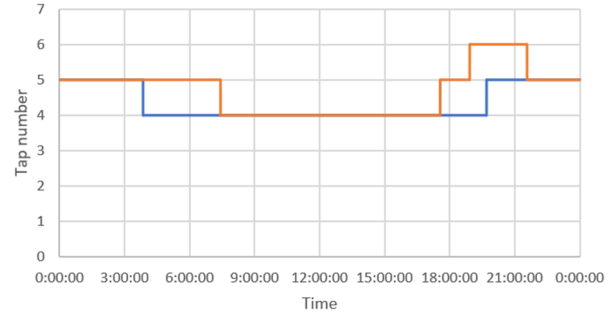
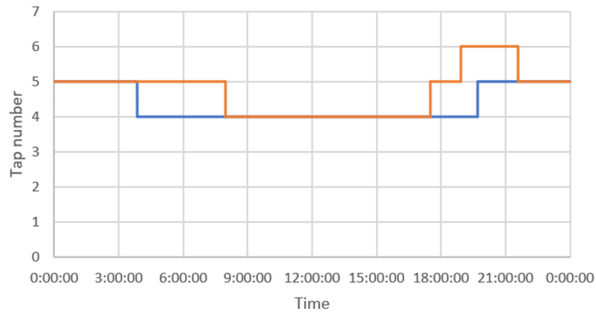
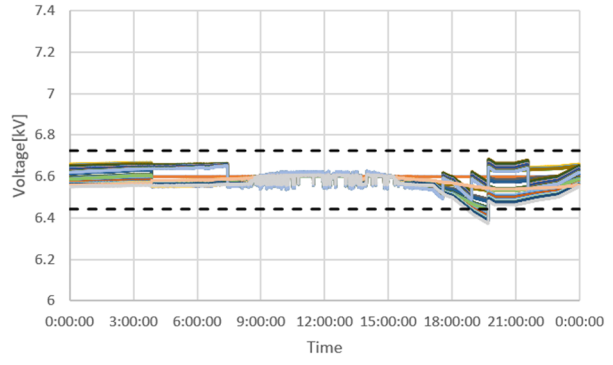
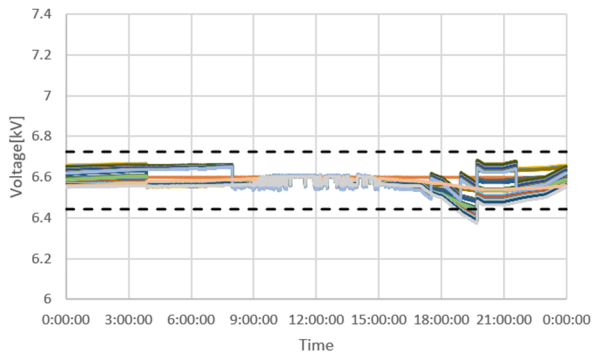
(a) PV 0%

(b) PV 10%



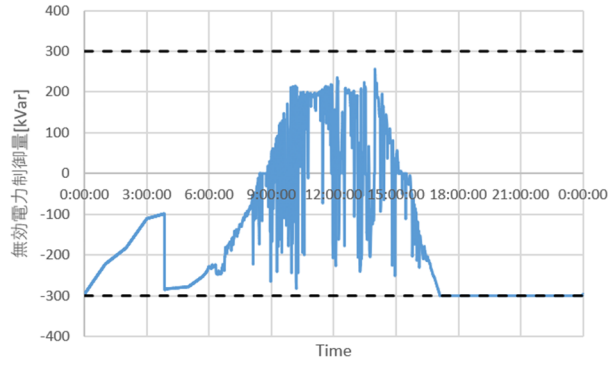
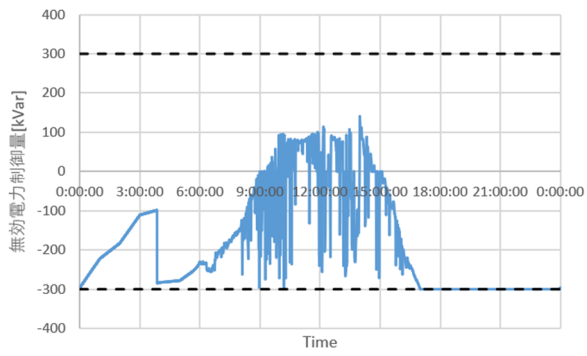
(c) PV 20%

(d) PV 30%



— SVR1 — SVR2

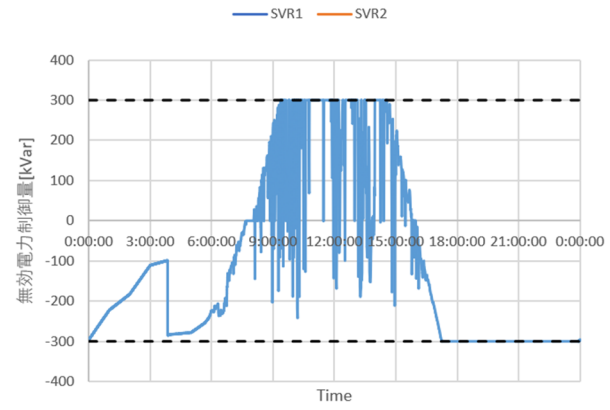
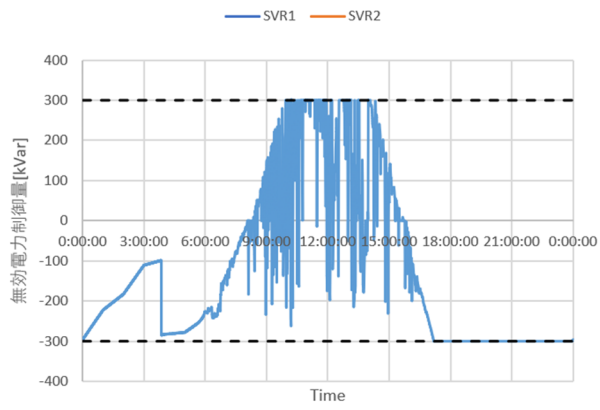
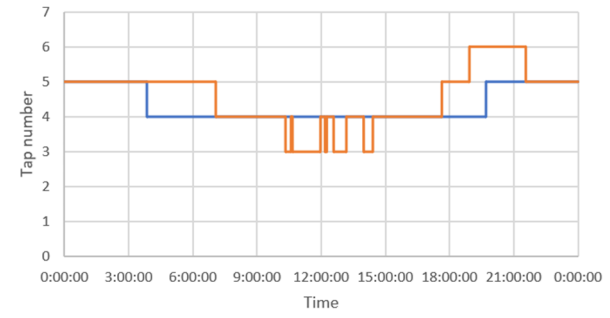
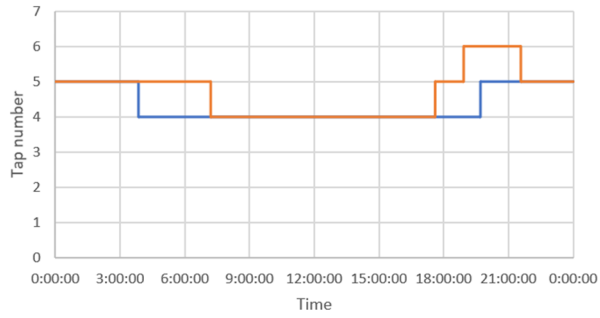
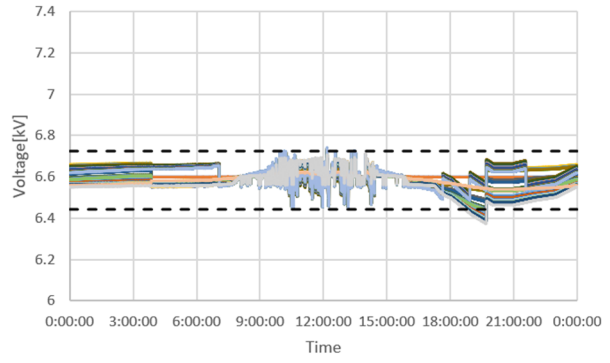
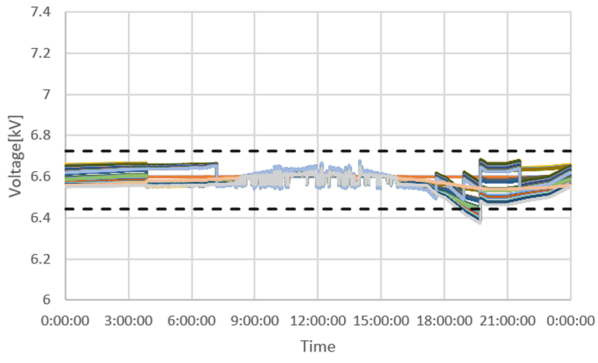
— SVR1 — SVR2



(e) PV 40%

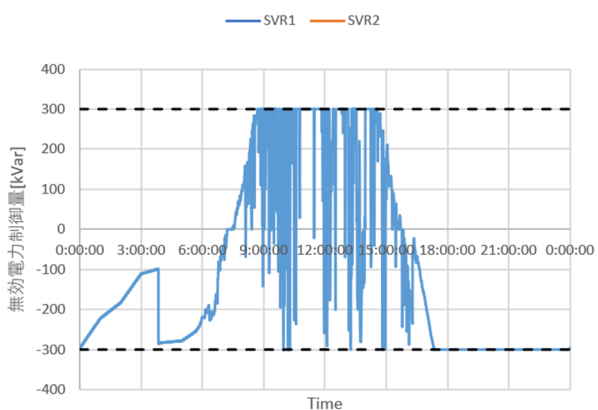
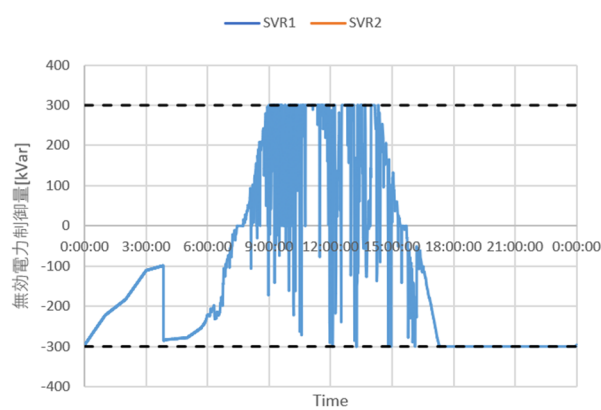
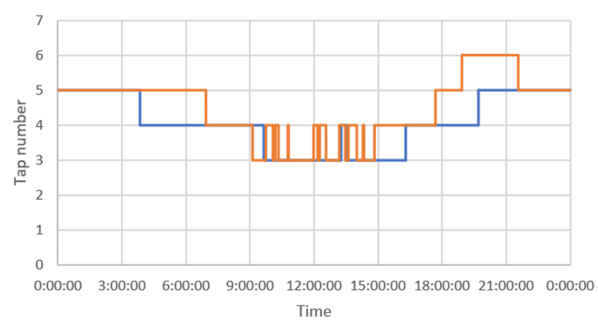
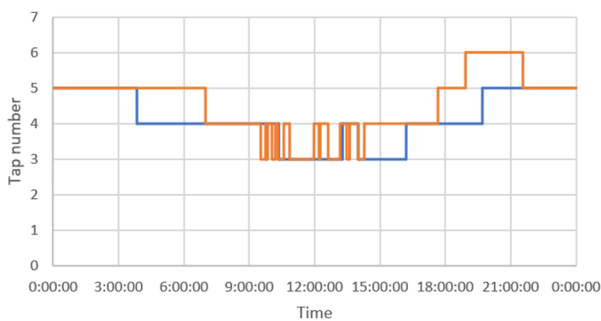
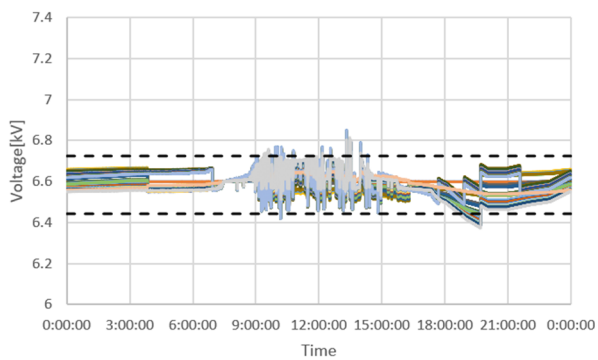
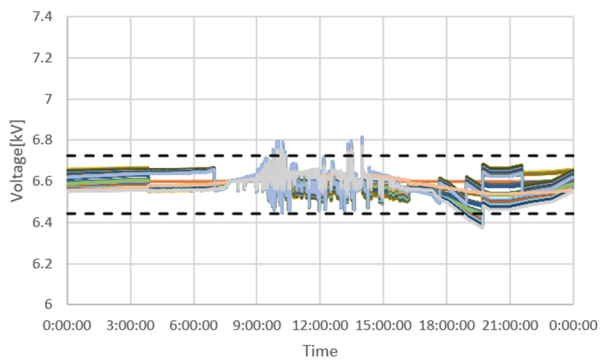
(f) PV 50%





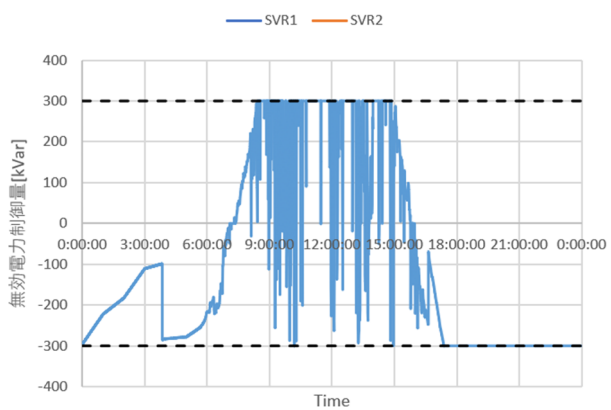
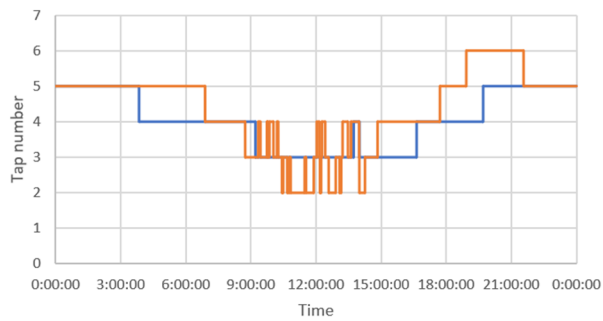
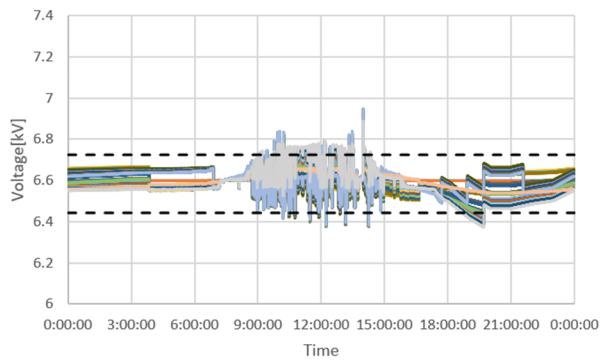
(g) PV 60%

(h) PV 70%



(i) PV 80%

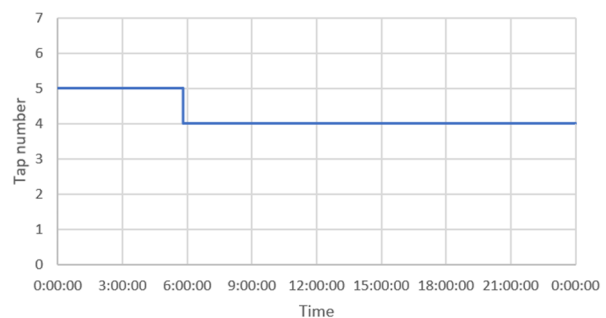
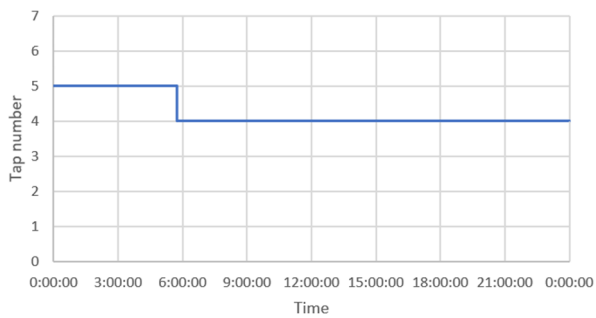
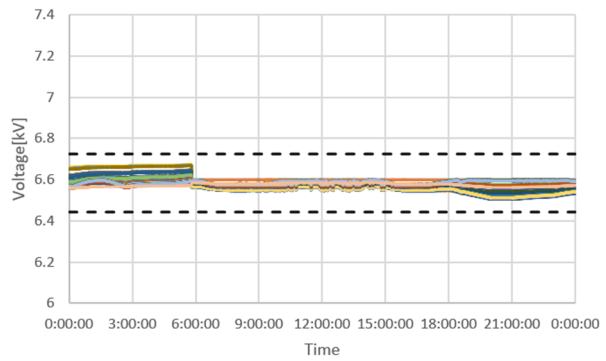
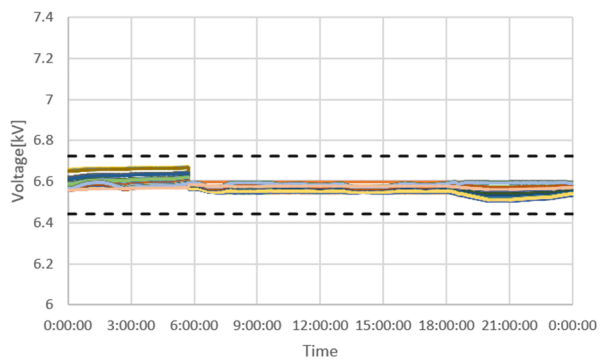
(j) PV 90%



(k) PV 100%

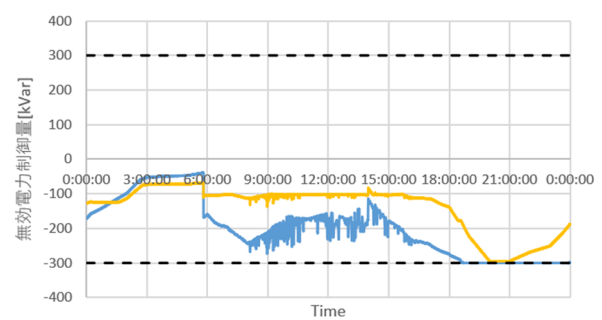
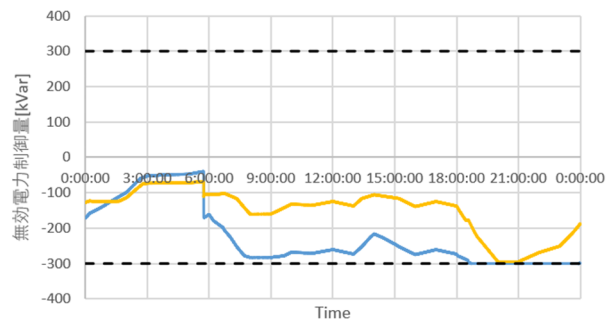
OD22 系統, PV 力率 1.0, 分散配置, SVR-SVC-SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



— SVR1

— SVR1

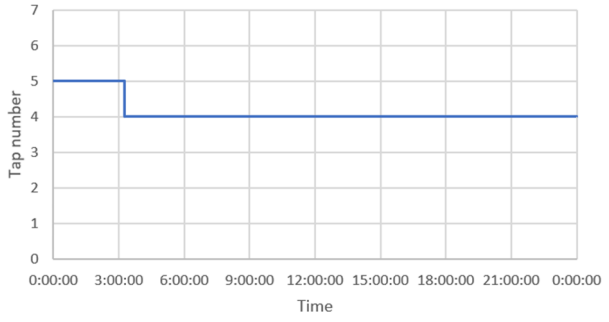
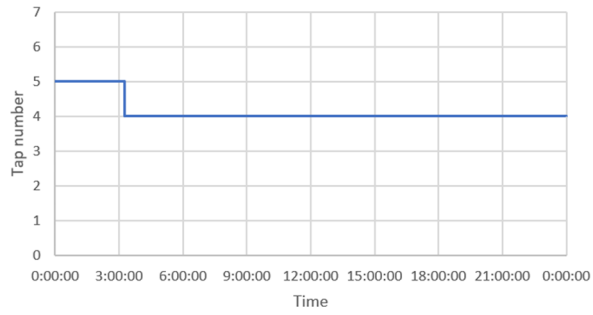
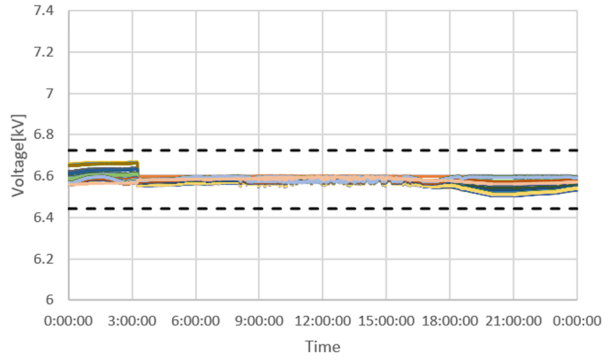
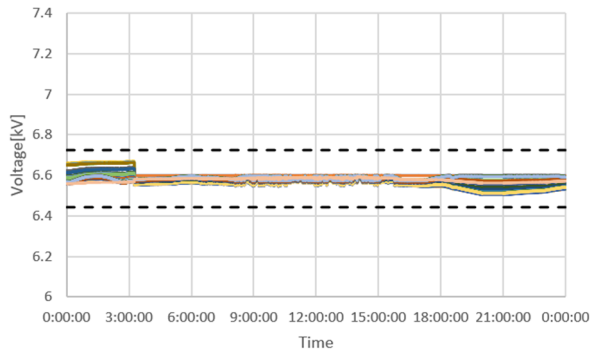


— SVR1 — SVR2

— SVR1 — SVR2

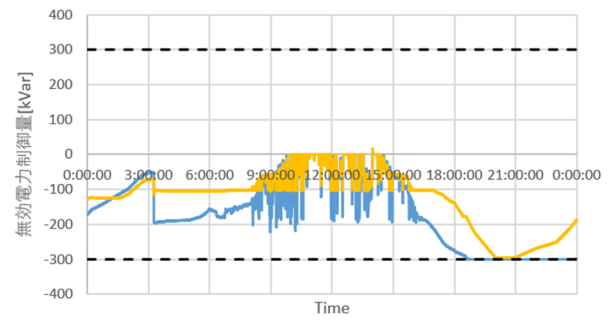
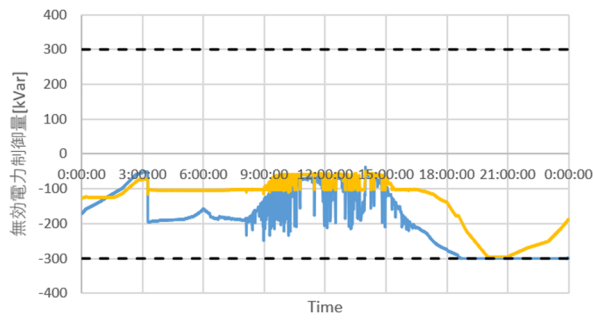
(a) PV 0%

(b) PV 10%



— SVR1

— SVR1

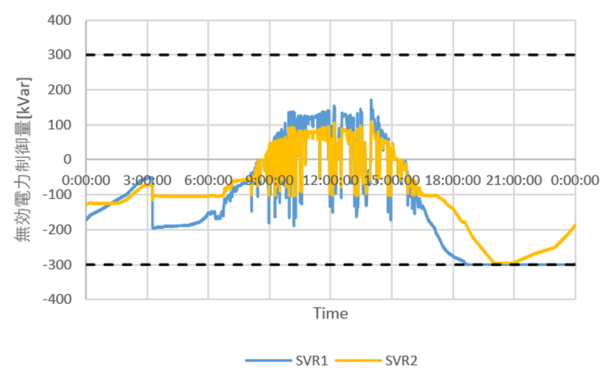
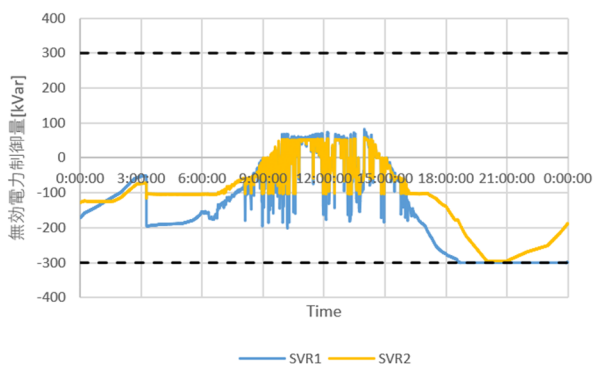
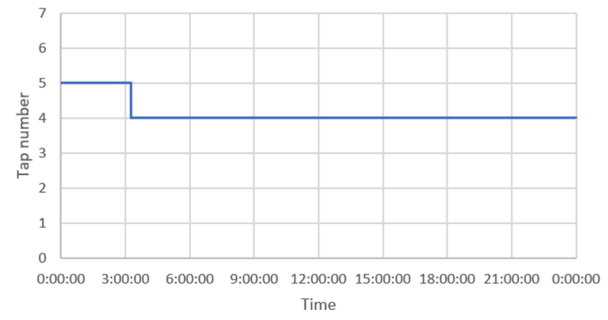
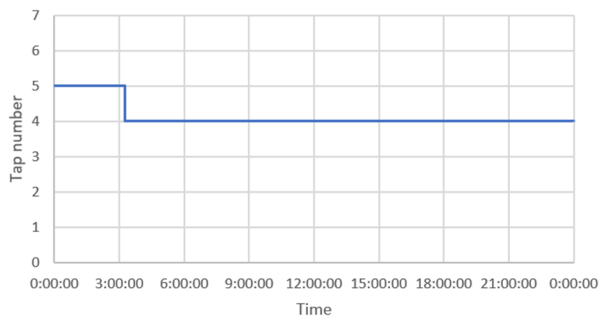
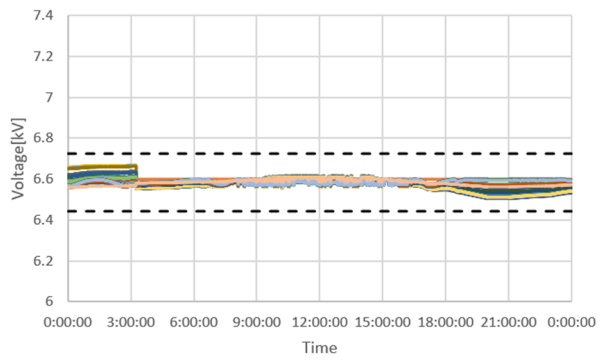
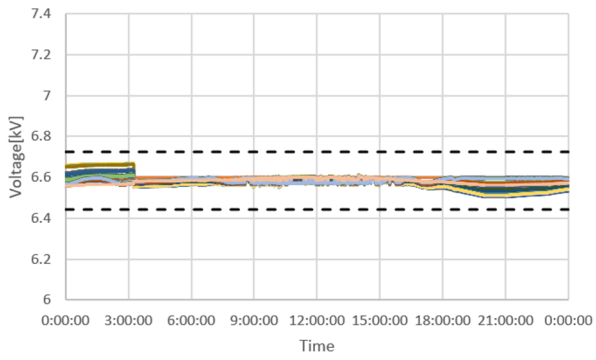


— SVR1 — SVR2

— SVR1 — SVR2

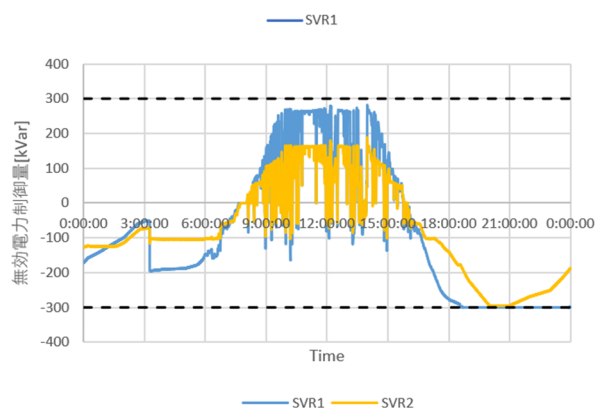
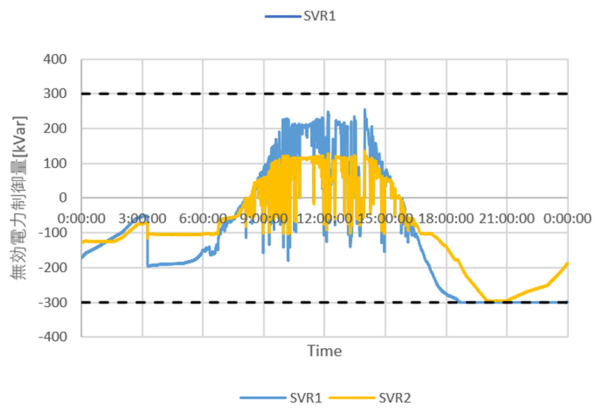
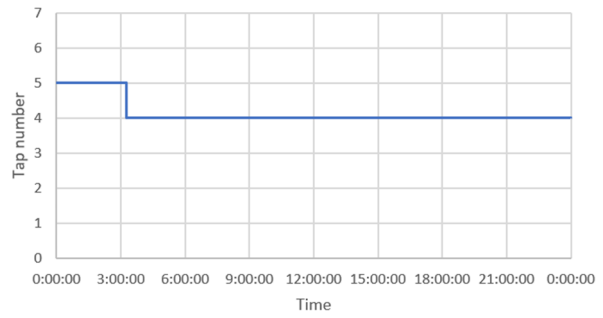
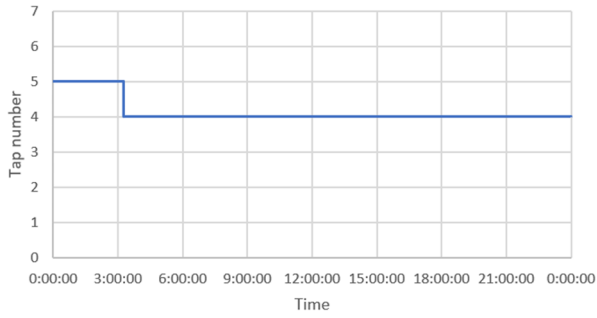
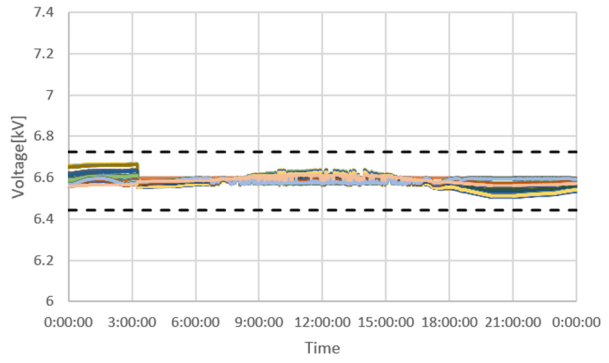
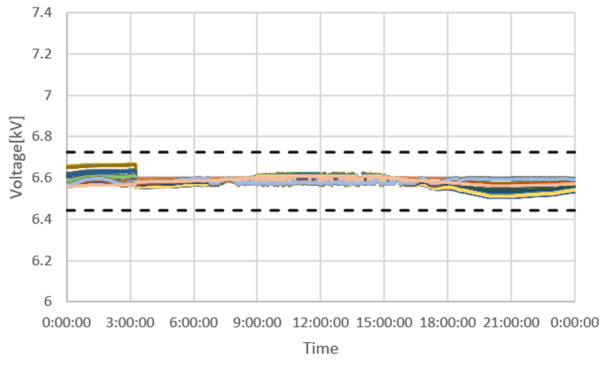
(c) PV 20%

(d) PV 30%



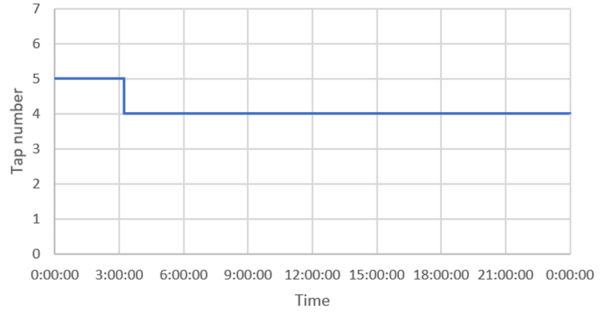
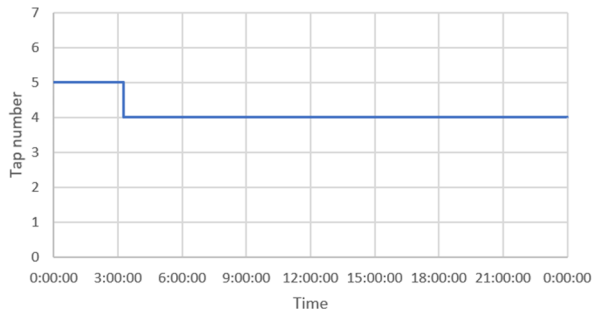
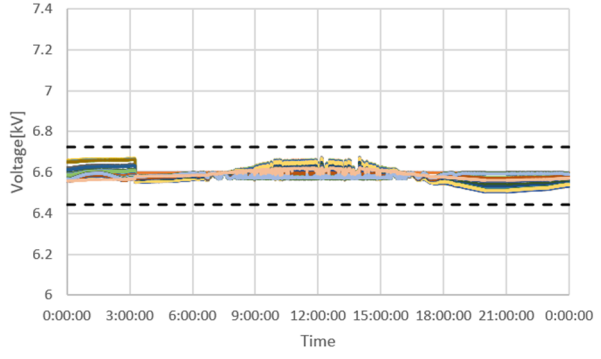
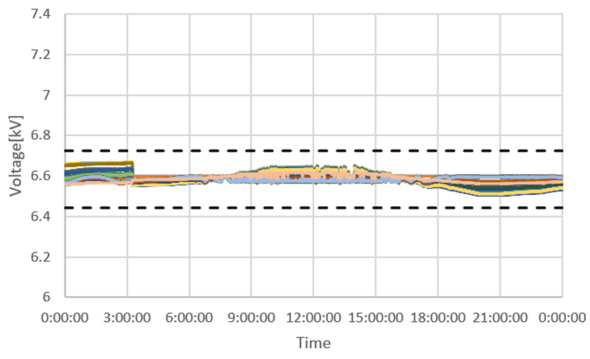
(e) PV 40%

(f) PV 50%



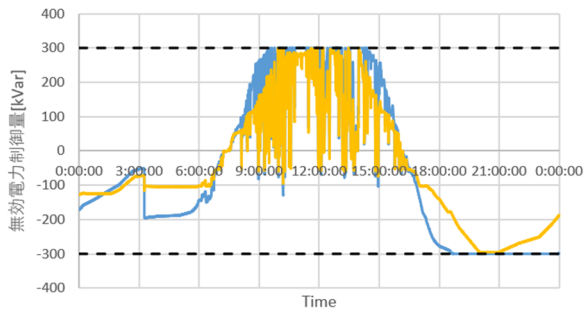
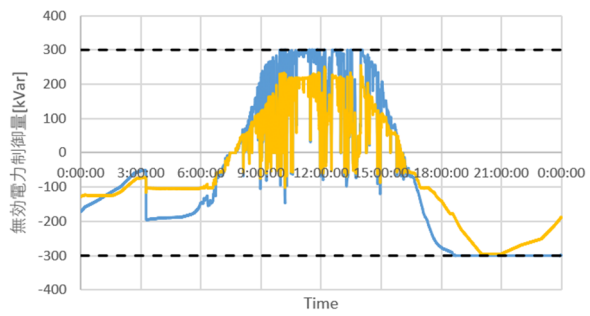
(g) PV 60%

(h) PV 70%



— SVR1

— SVR1



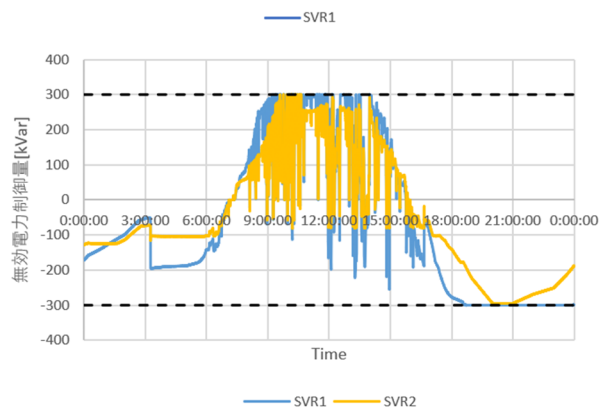
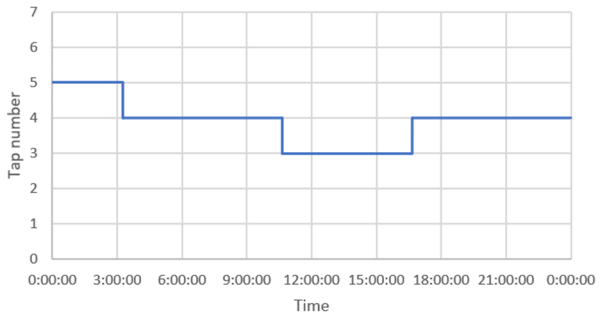
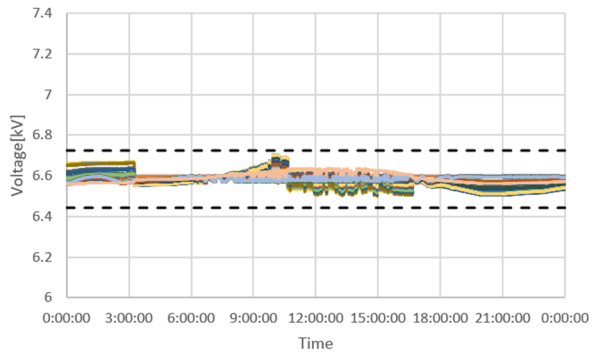
— SVR1 — SVR2

— SVR1 — SVR2

(i) PV 80%

(j) PV 90%

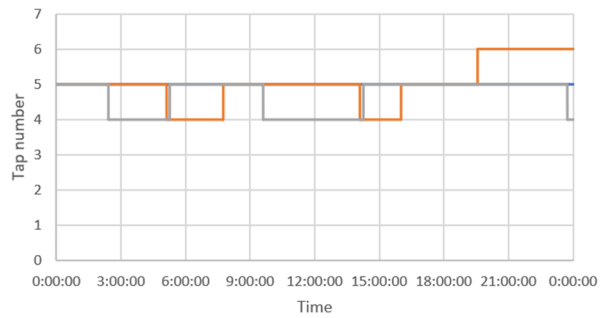
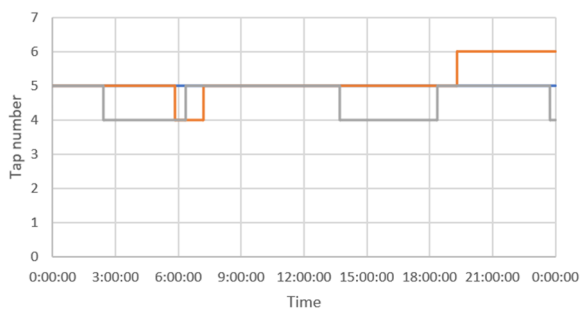
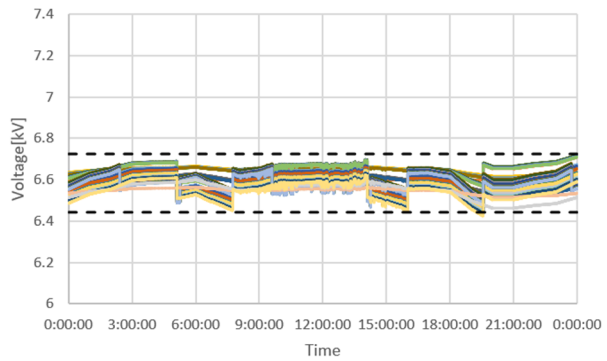
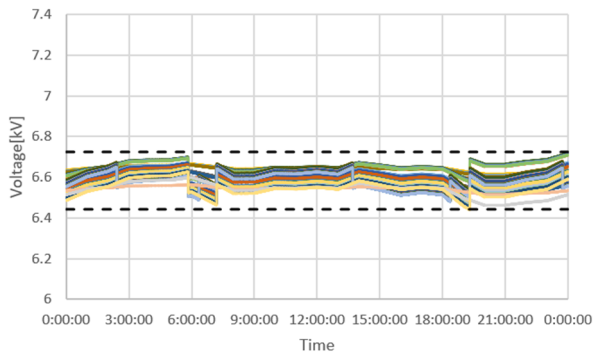




(k) PV 100%

OD22 系統, PV 力率 0.95, 分散配置, SVR-SVR-SVR

(上: 電圧分布, 下: タップ位置)

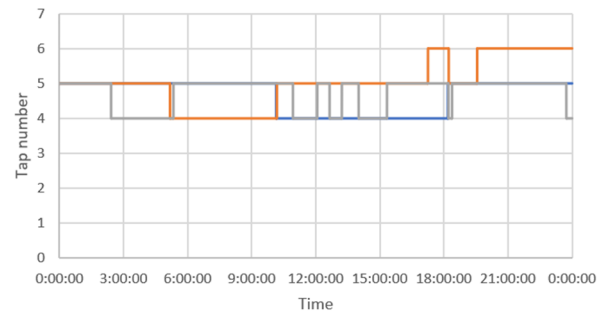
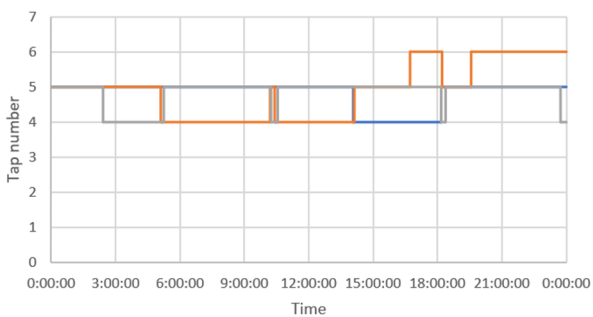
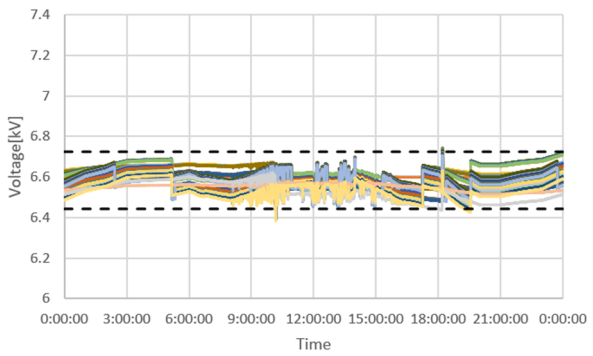
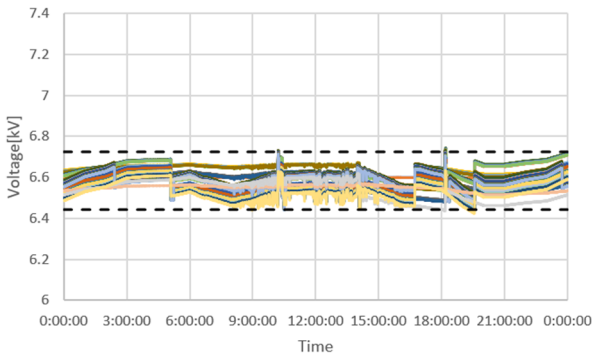


— SVR1 — SVR2 — SVR3

— SVR1 — SVR2 — SVR3

(a) PV 0%

(b) PV 10%

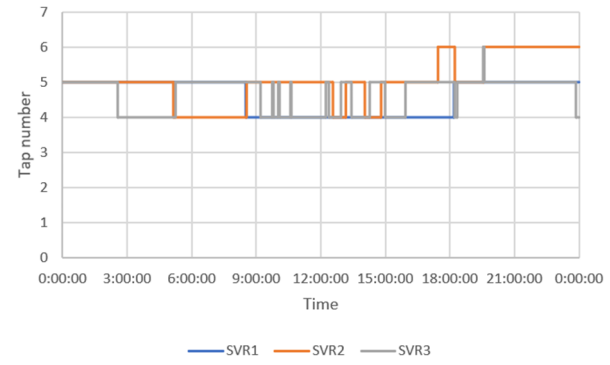
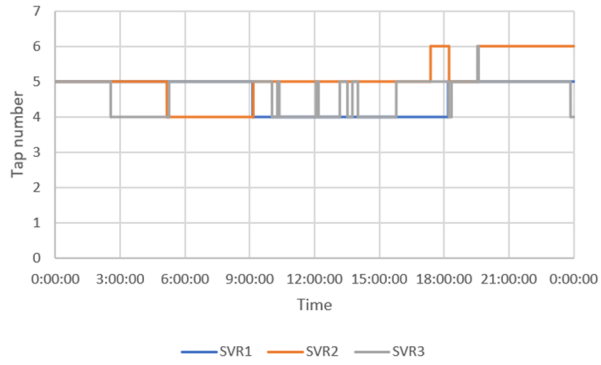
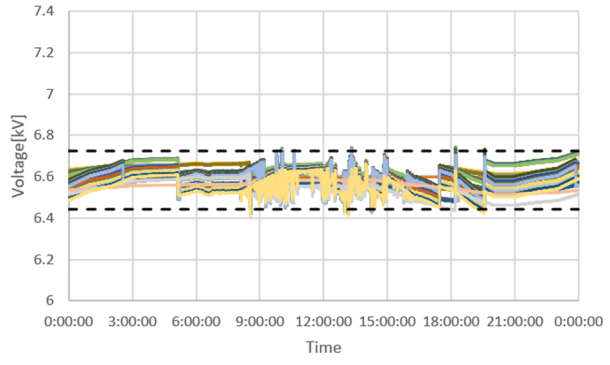
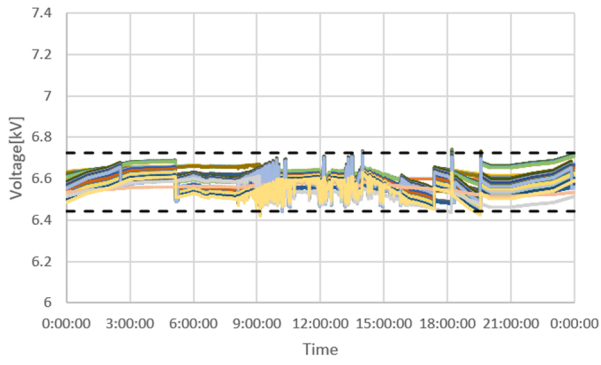


— SVR1 — SVR2 — SVR3

— SVR1 — SVR2 — SVR3

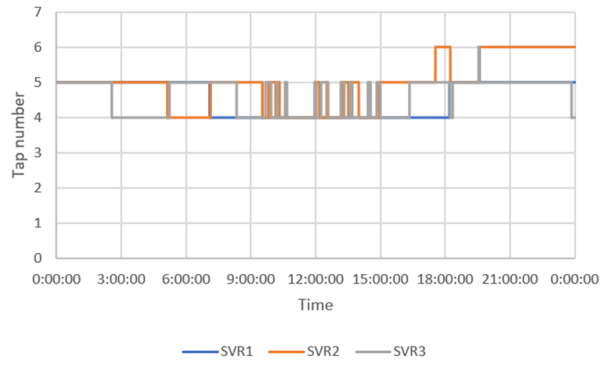
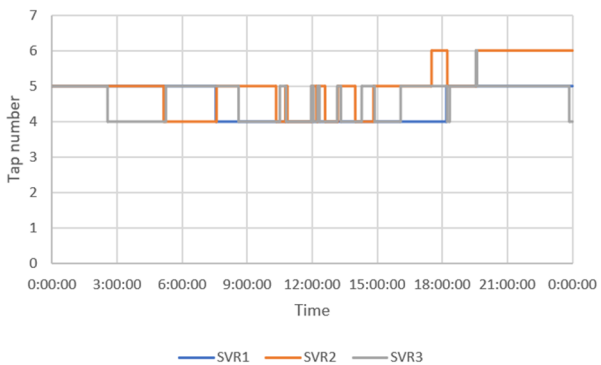
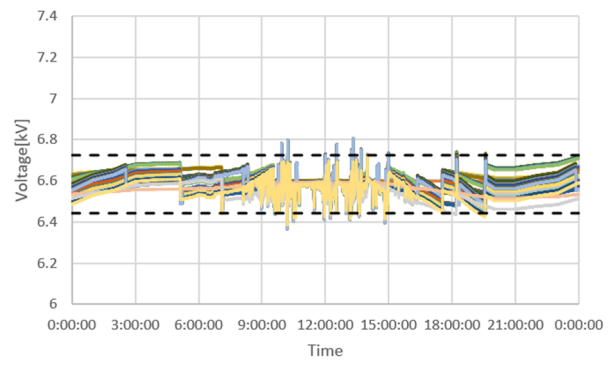
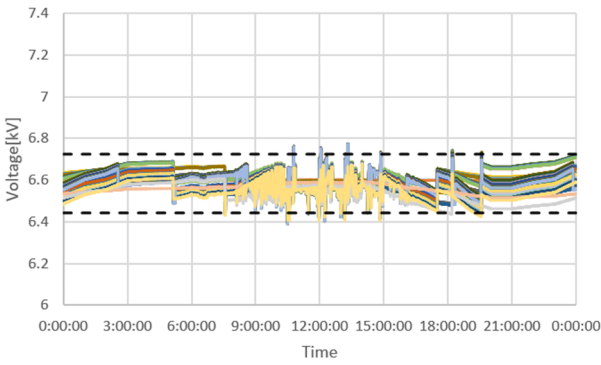
(c) PV 20%

(d) PV 30%



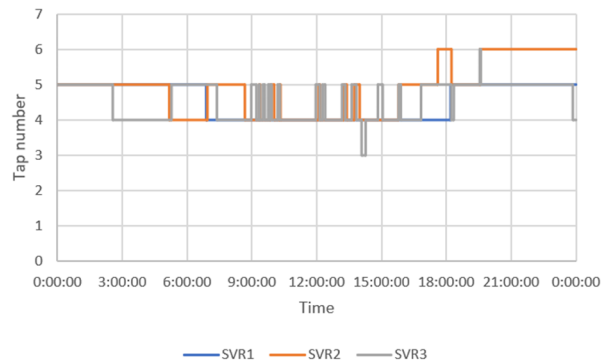
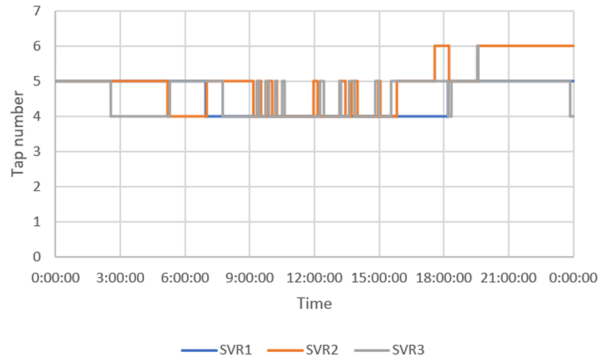
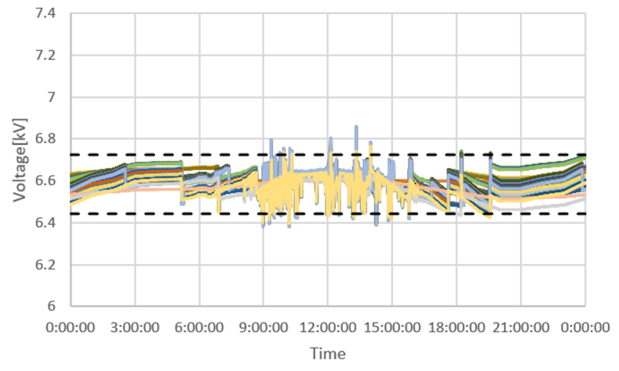
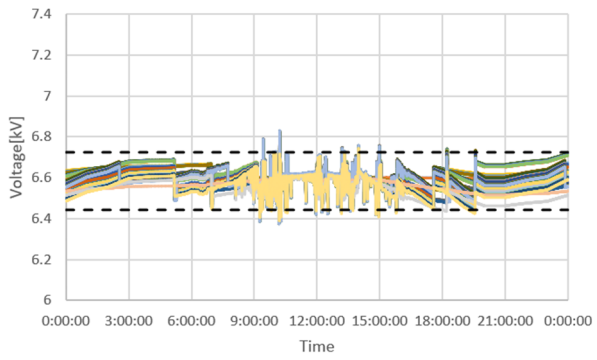
(e) PV 40%

(f) PV 50%



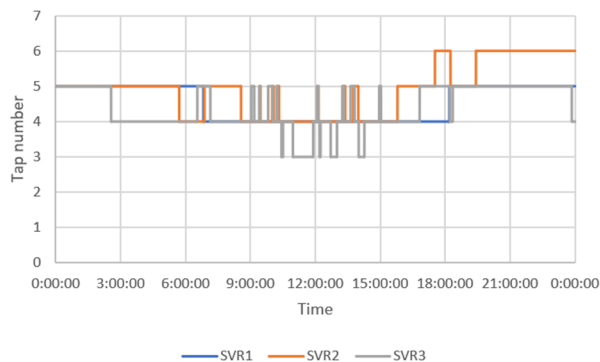
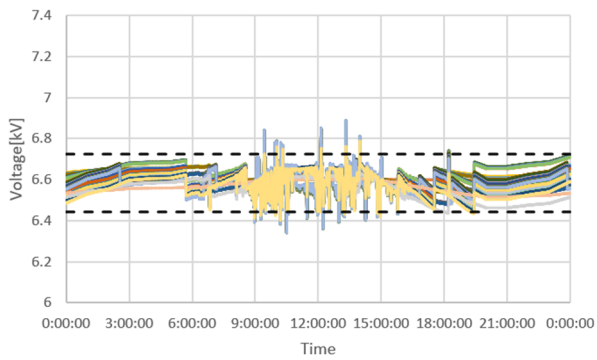
(g) PV 60%

(h) PV 70%



(i) PV 80%

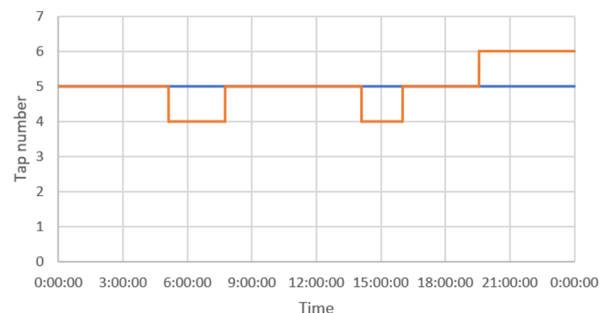
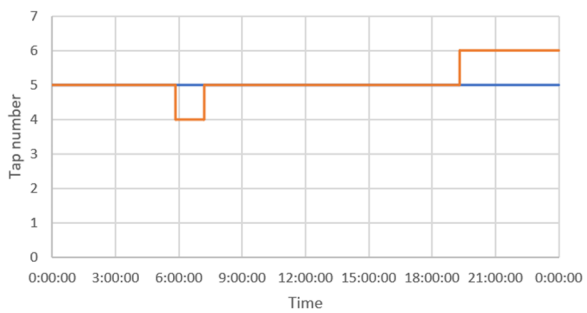
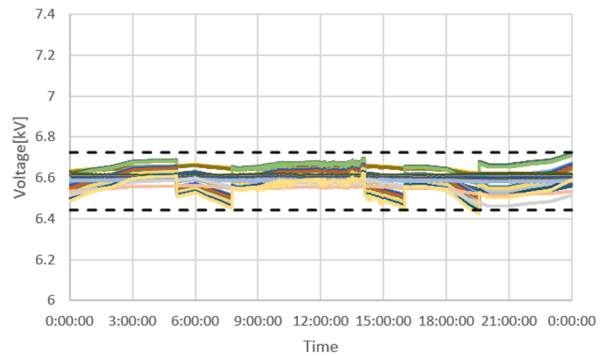
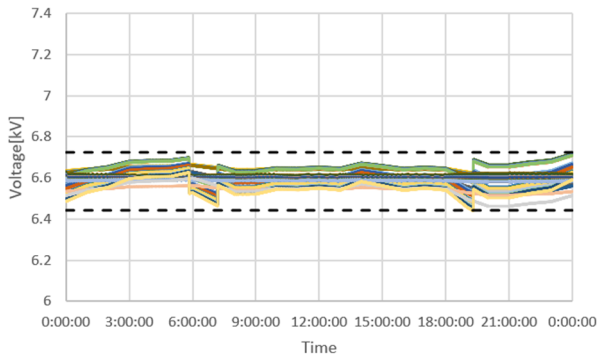
(j) PV 90%



(k) PV 100%

OD22 系統, PV 力率 0.95, 分散配置, SVR-SVR-TVR

(上: 電圧分布, 下: タップ位置)

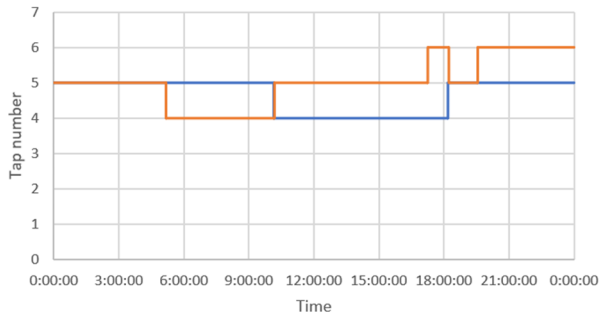
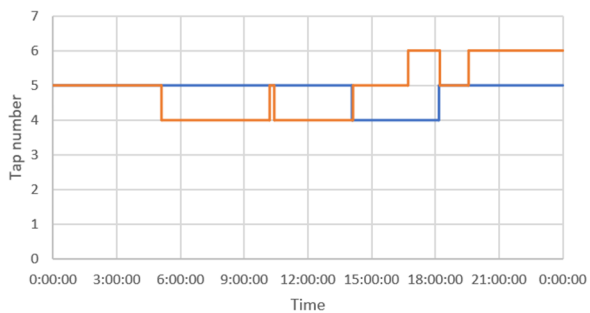
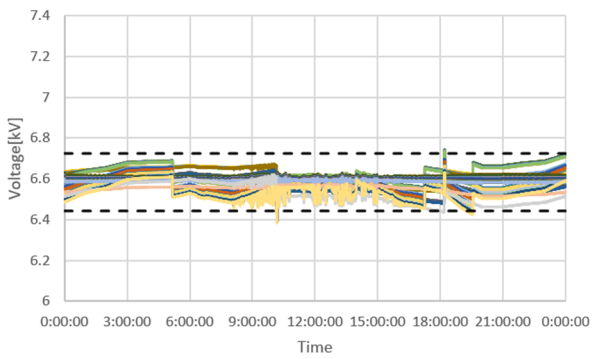
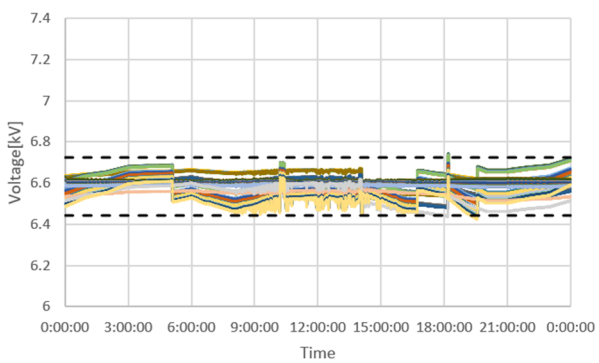


— SVR1 — SVR2

— SVR1 — SVR2

(a) PV 0%

(b) PV 10%

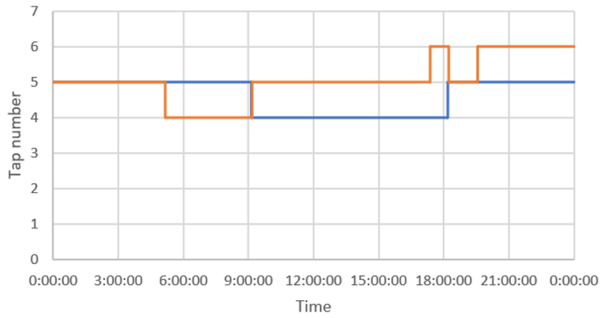
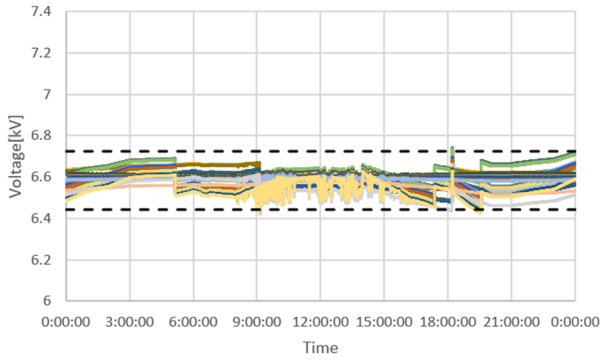


— SVR1 — SVR2

— SVR1 — SVR2

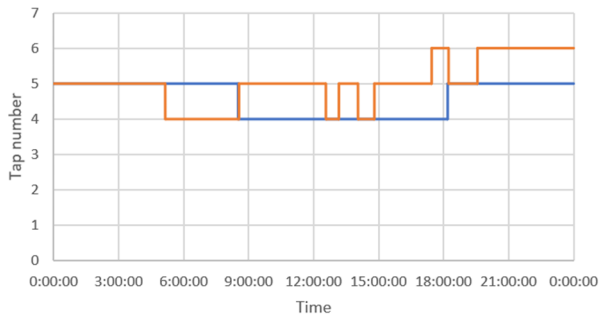
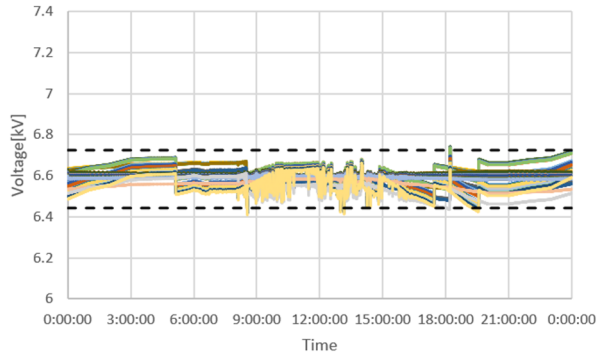
(c) PV 20%

(d) PV 30%



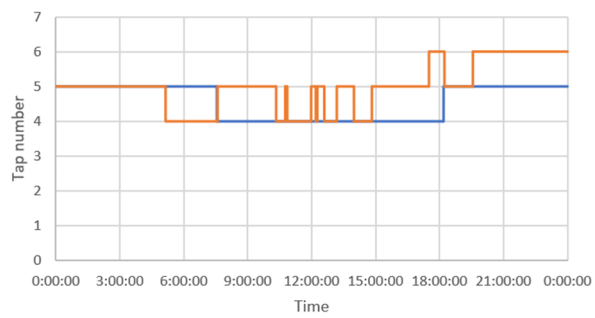
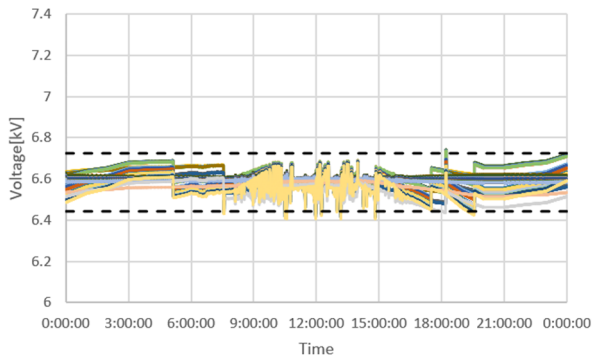
— SVR1 — SVR2

(e) PV 40%



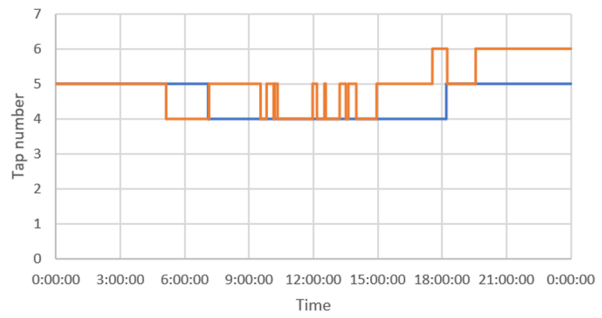
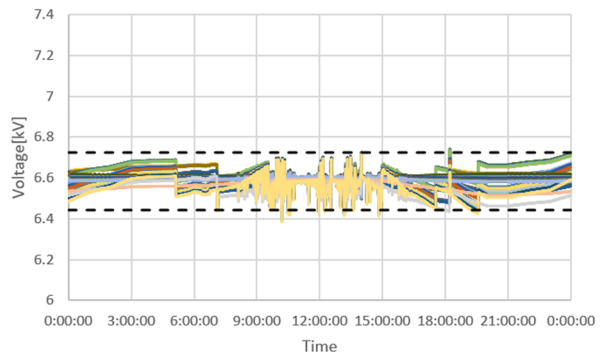
— SVR1 — SVR2

(f) PV 50%



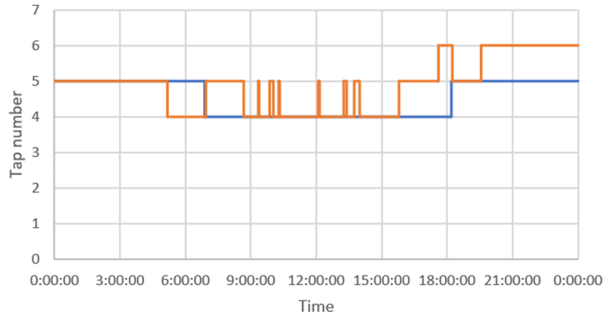
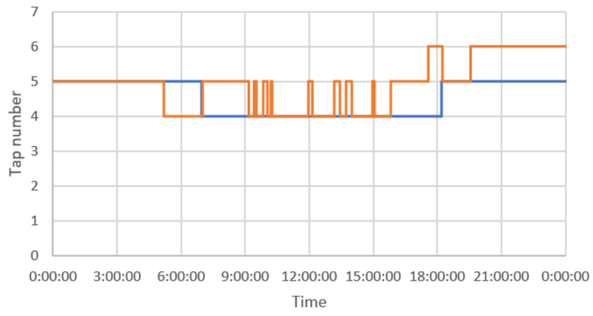
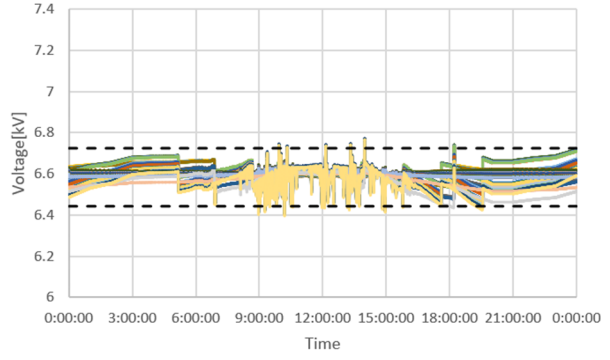
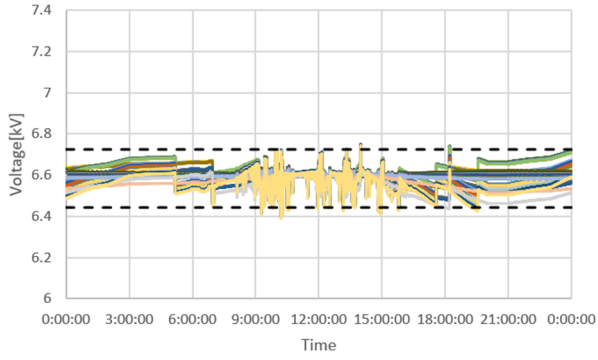
— SVR1 — SVR2

(g) PV 60%



— SVR1 — SVR2

(h) PV 70%

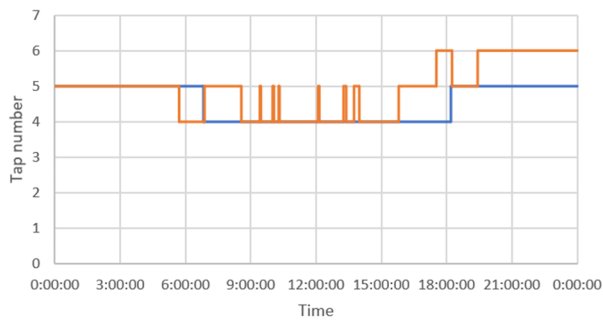
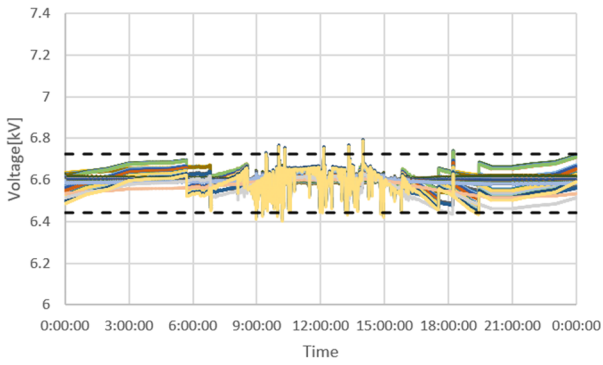


— SVR1 — SVR2

(i) PV 80%

— SVR1 — SVR2

(j) PV 90%

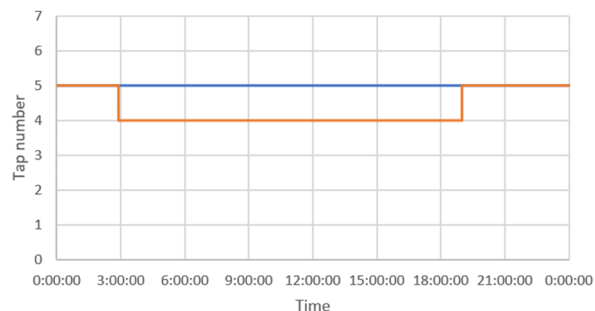
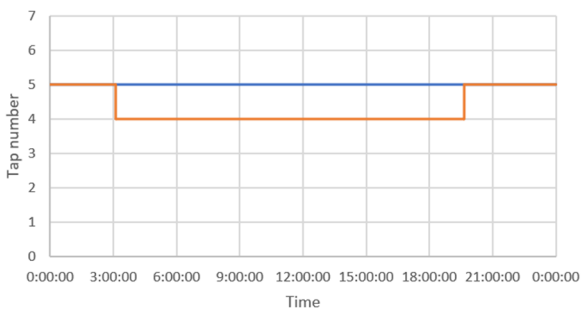
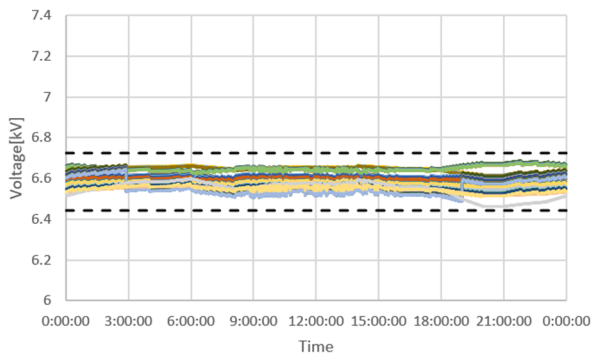
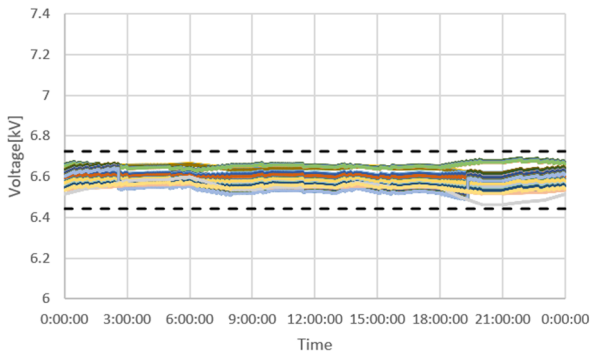


— SVR1 — SVR2

(k) PV 100%

OD22 系統, PV 力率 0.95, 分散配置, SVR-TVSR-SVR

(上: 電圧分布, 下: タップ位置)

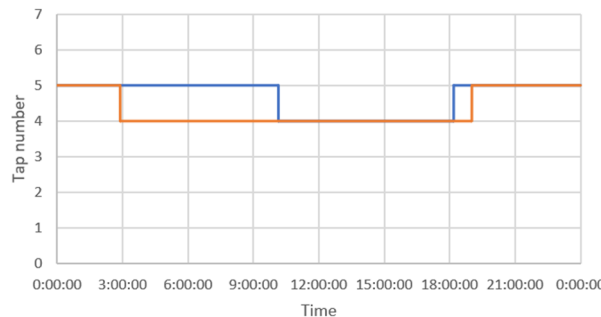
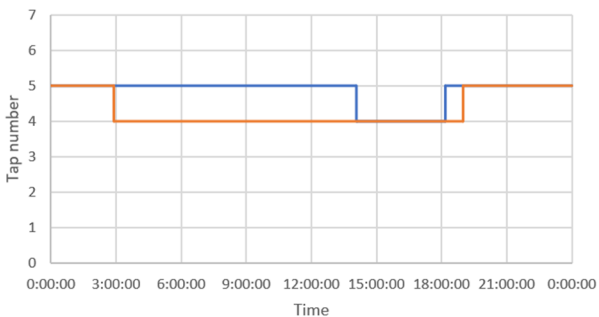
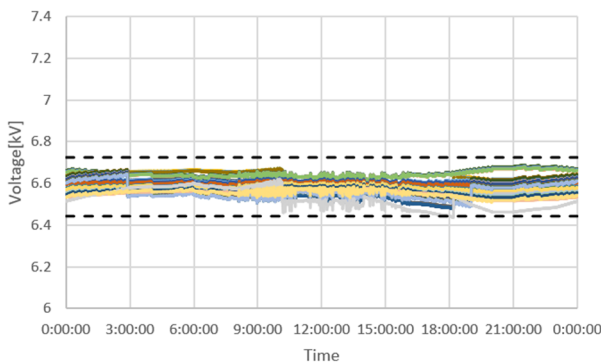
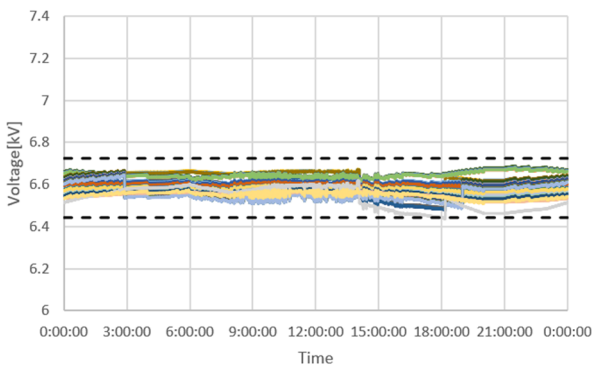


— SVR1 — SVR2

— SVR1 — SVR2

(a) PV 0%

(b) PV 10%



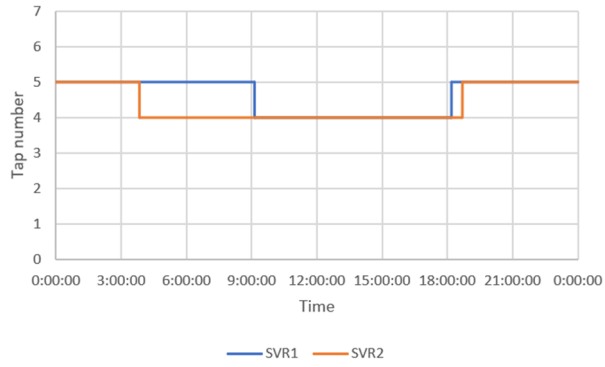
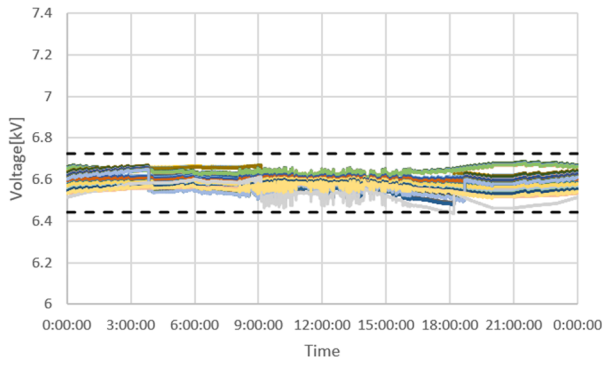
— SVR1 — SVR2

— SVR1 — SVR2

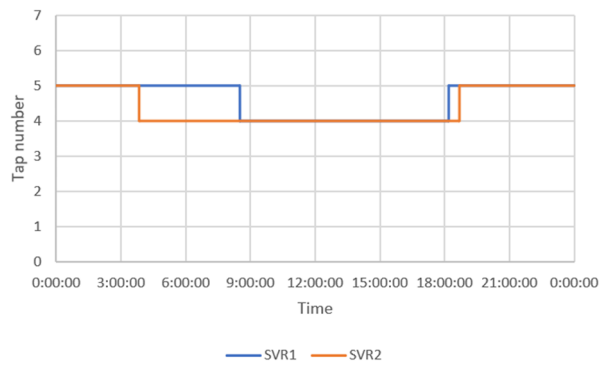
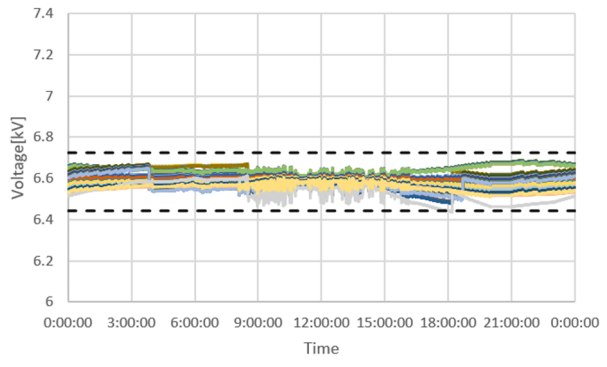
(c) PV 20%

(d) PV 30%

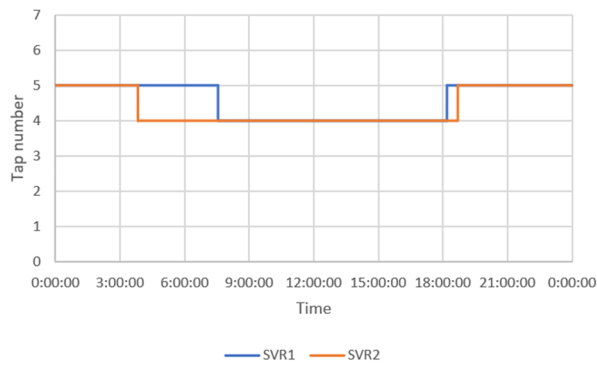
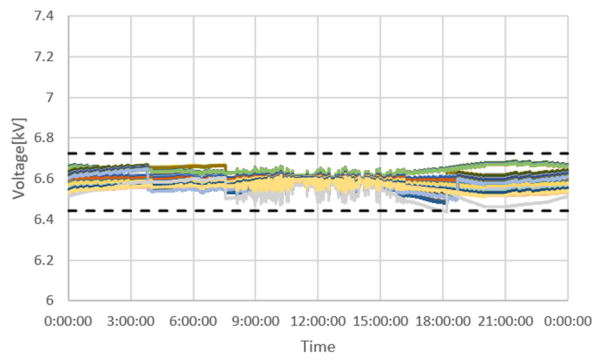




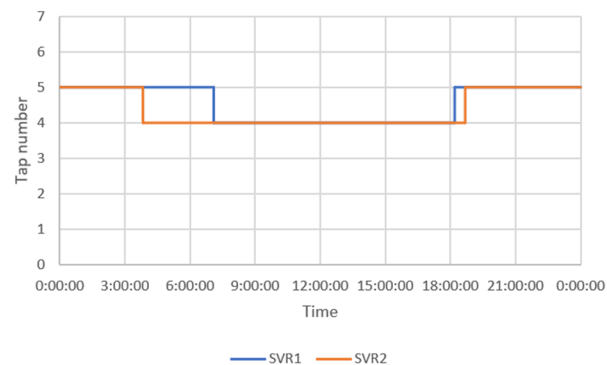
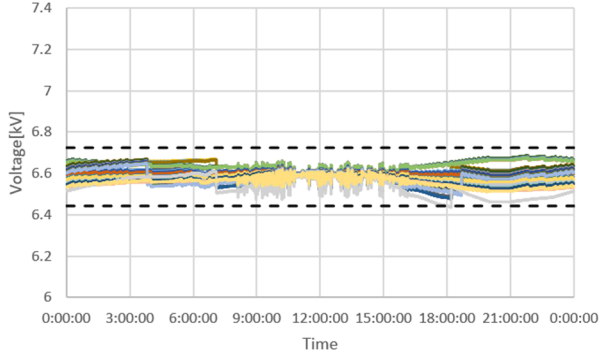
(e) PV 40%



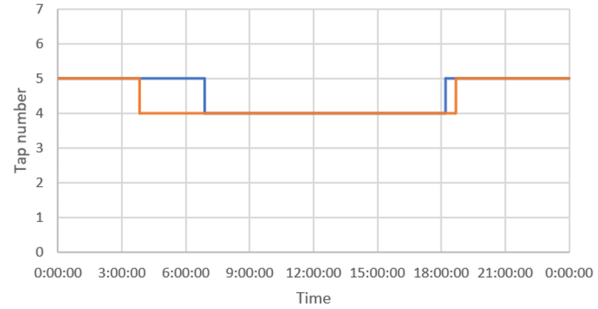
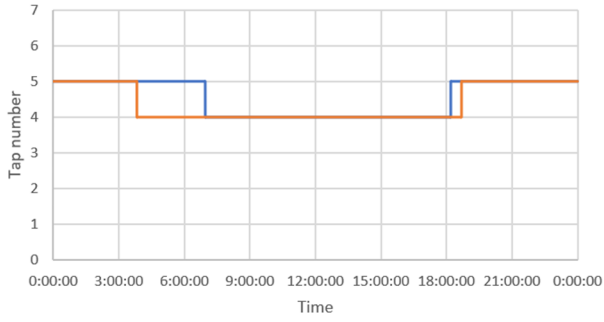
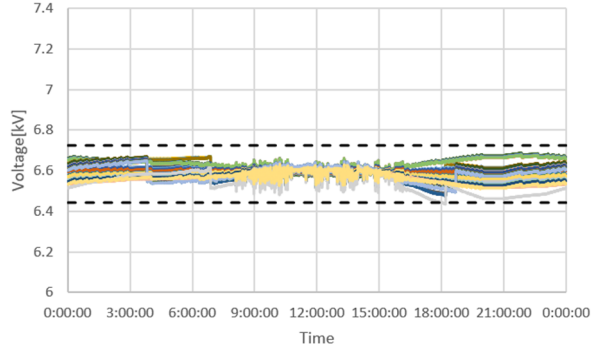
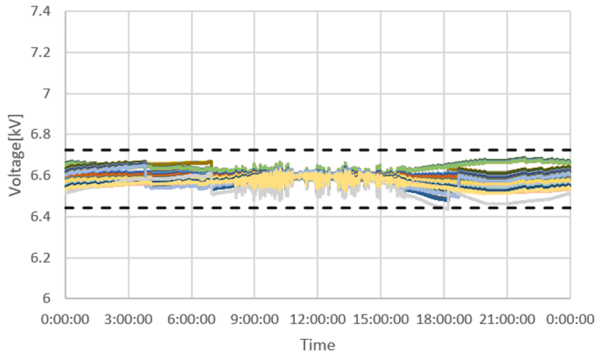
(f) PV 50%



(g) PV 60%



(h) PV 70%

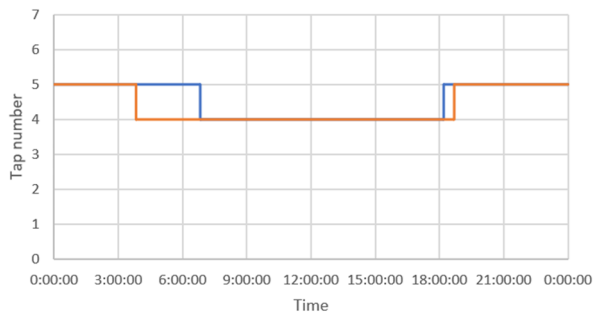
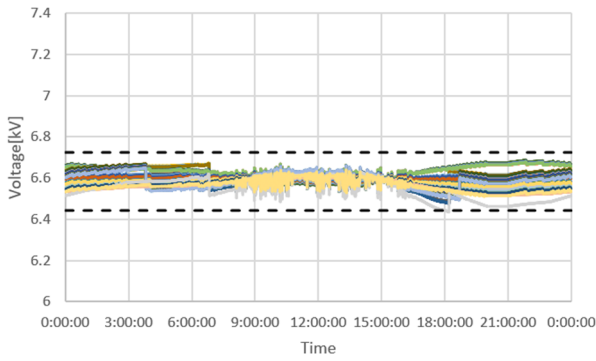


— SVR1 — SVR2

— SVR1 — SVR2

(i) PV 80%

(j) PV 90%

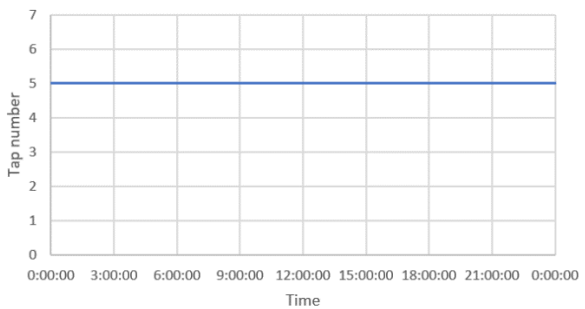
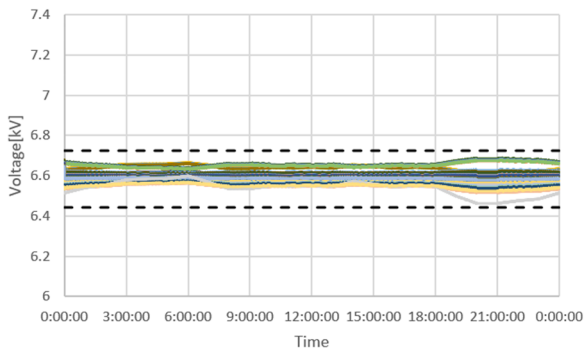


— SVR1 — SVR2

(k) PV 100%

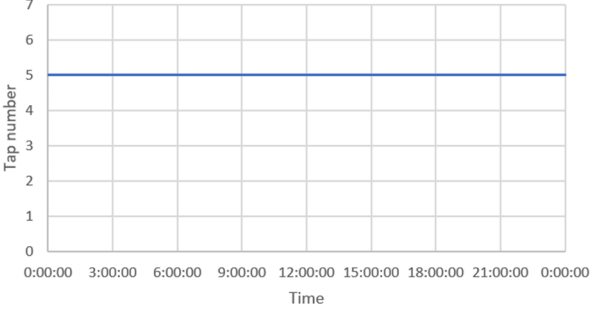
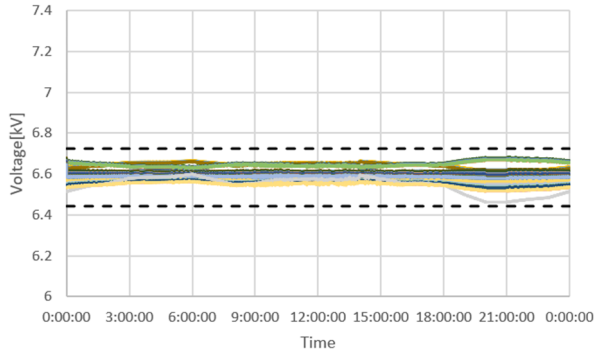
OD22 系統, PV 力率 0.95, 分散配置, SVR-TV R-TV R

(上: 電圧分布, 下: タップ位置)



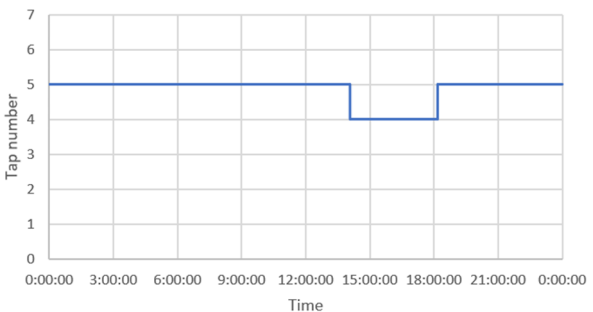
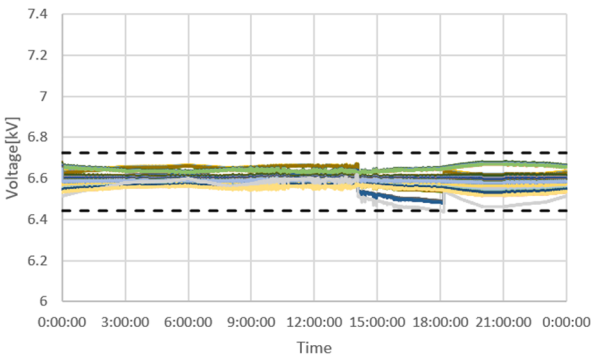
— SVR1

(a) PV 0%



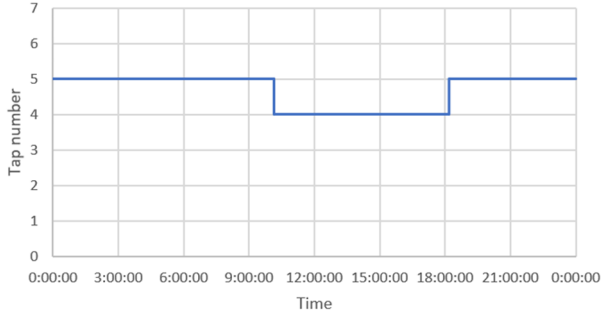
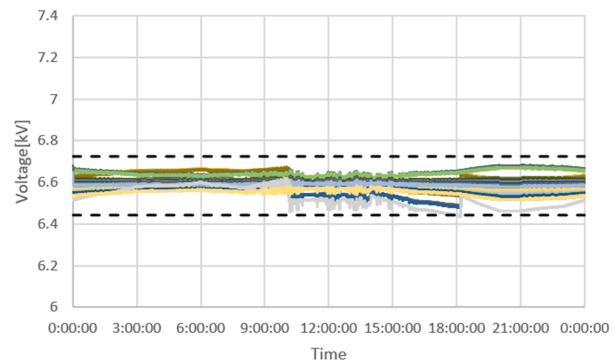
— SVR1

(b) PV 10%



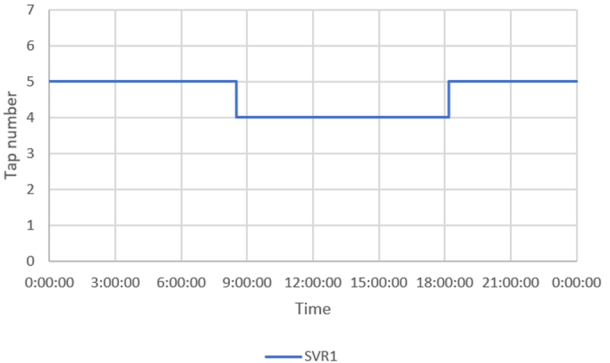
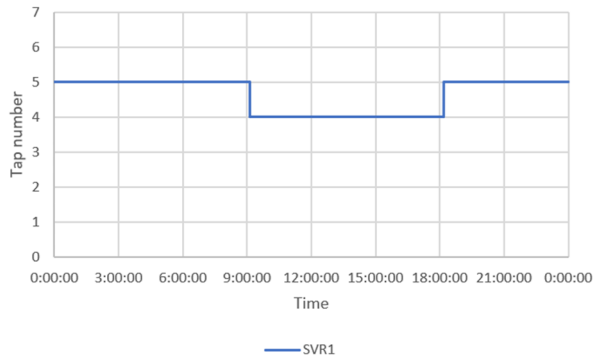
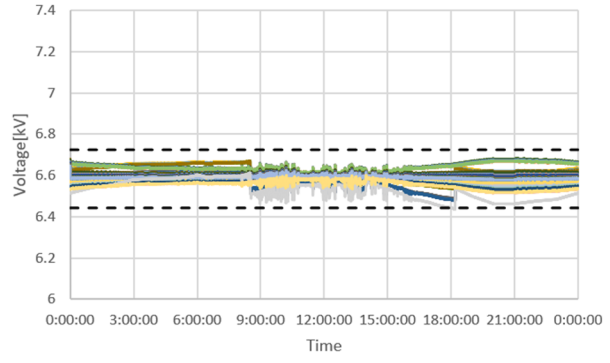
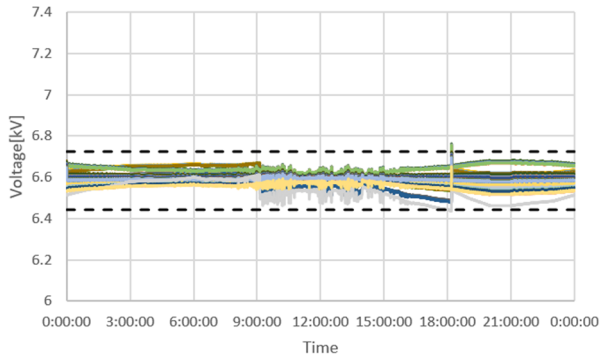
— SVR1

(c) PV 20%



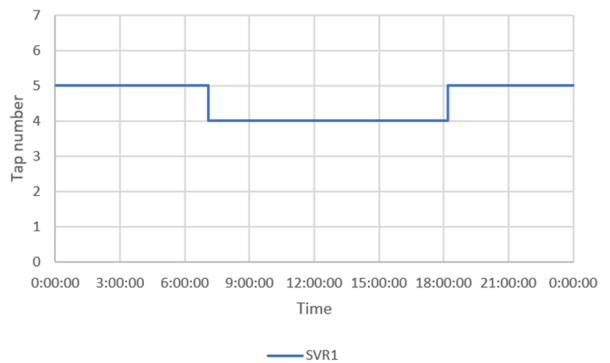
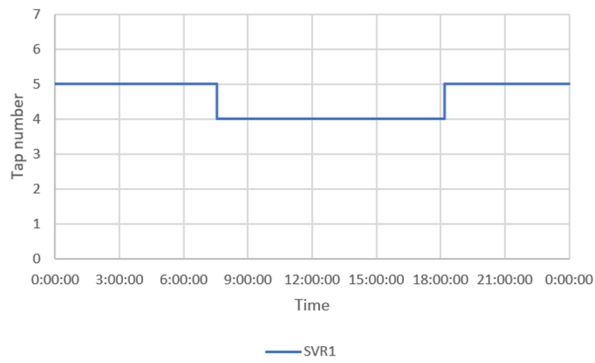
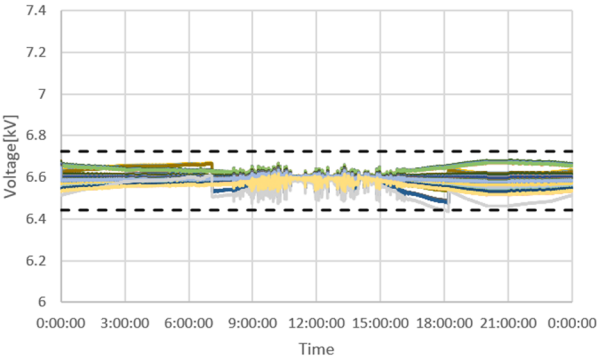
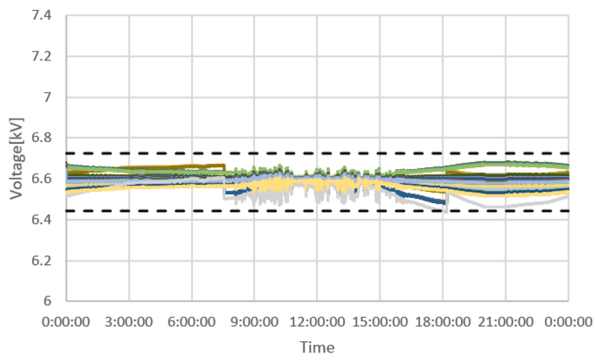
— SVR1

(d) PV 30%



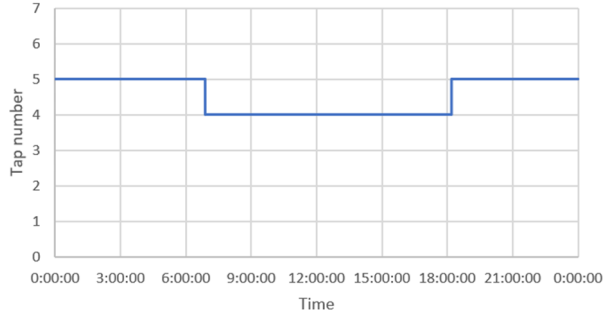
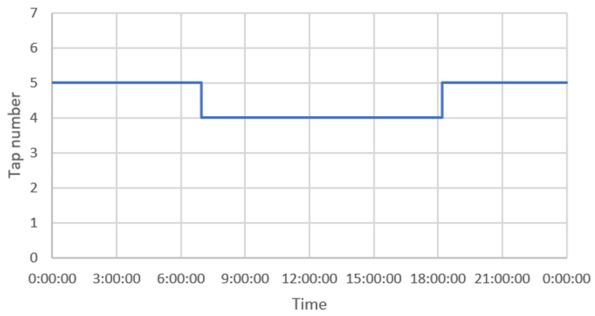
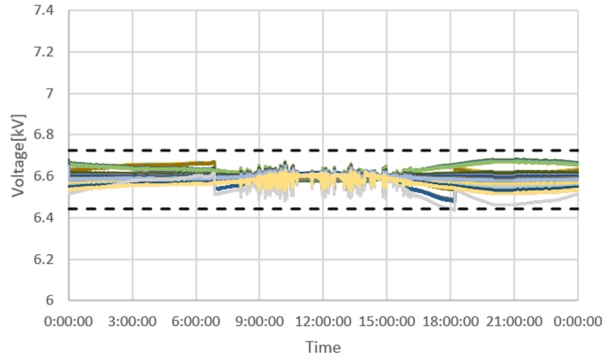
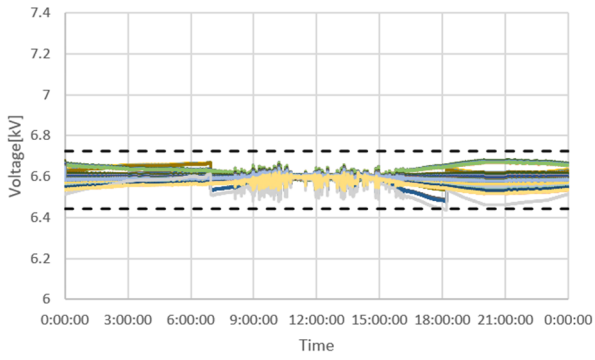
(e) PV 40%

(f) PV 50%



(g) PV 60%

(h) PV 70%

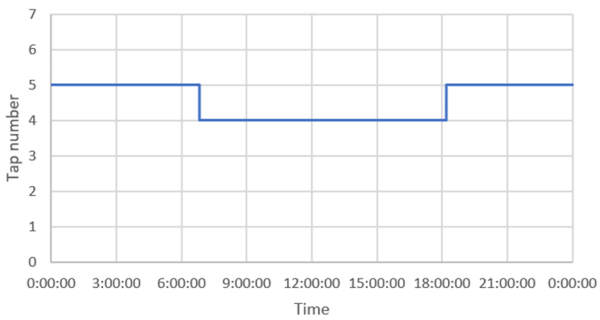
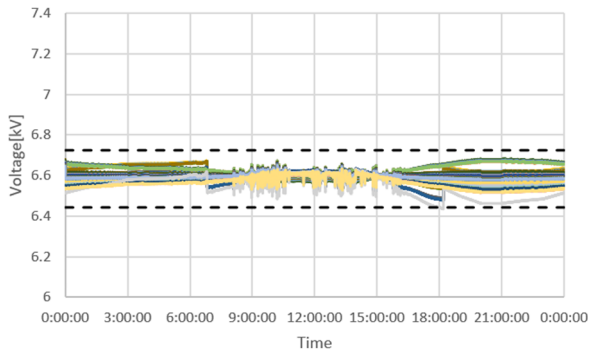


— SVR1

(i) PV 80%

— SVR1

(j) PV 90%

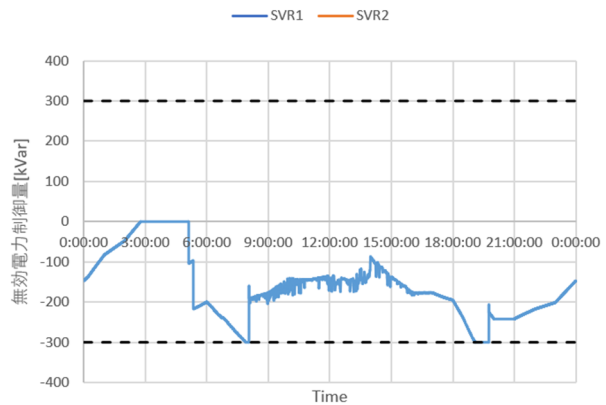
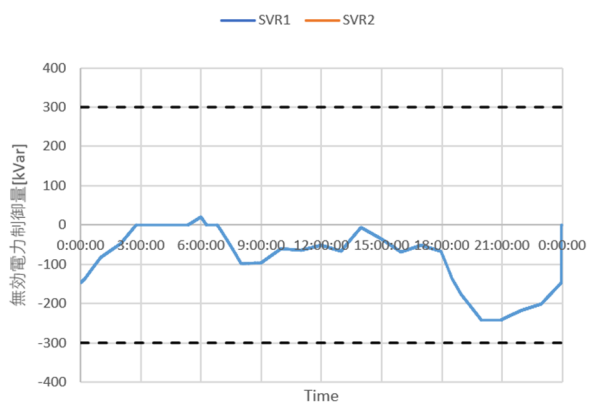
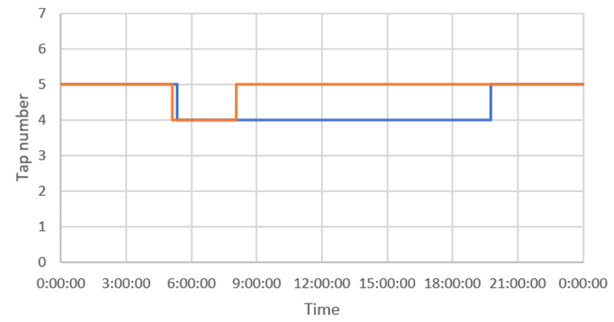
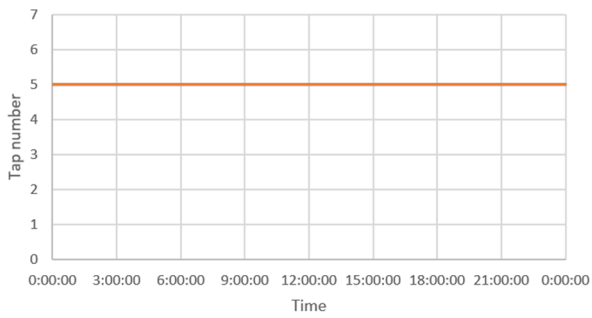
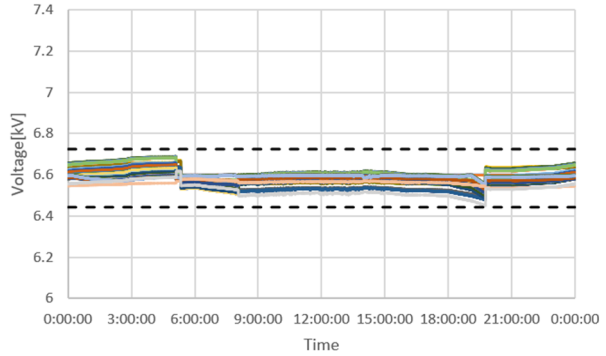
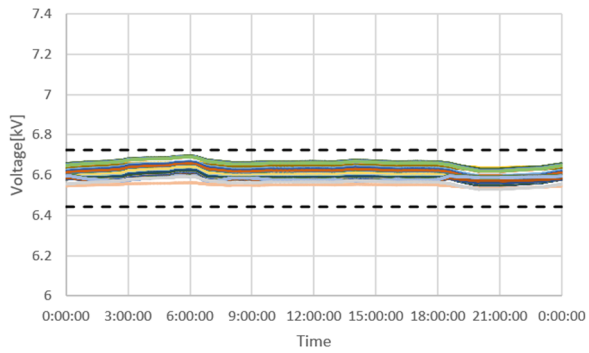


— SVR1

(k) PV 100%

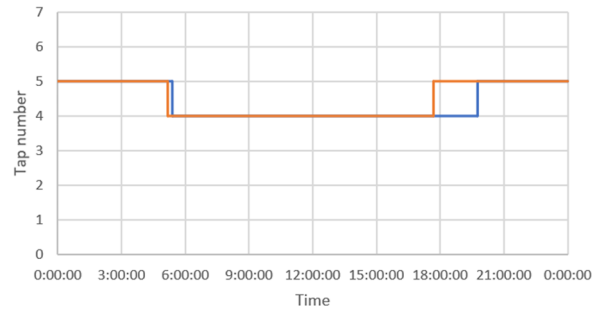
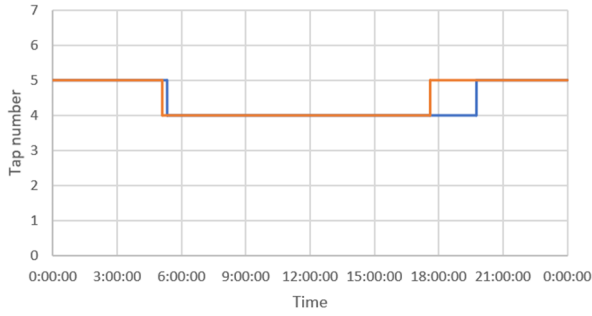
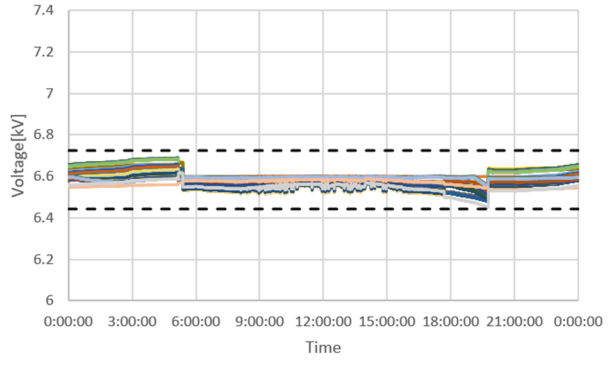
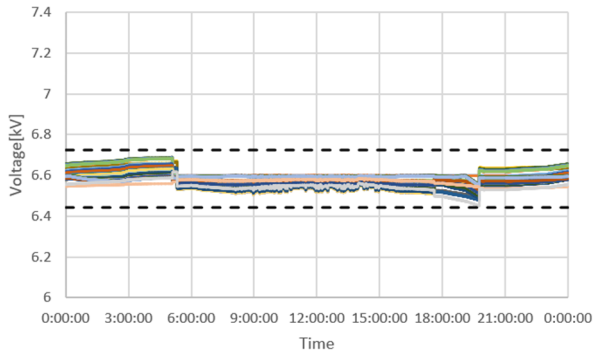
OD22 系統, PV 力率 0.95, 分散配置, SVR-SVR-SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



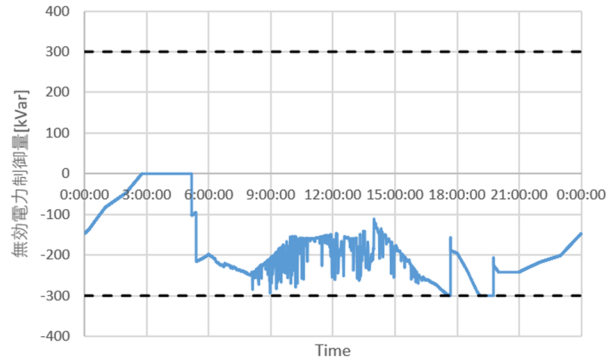
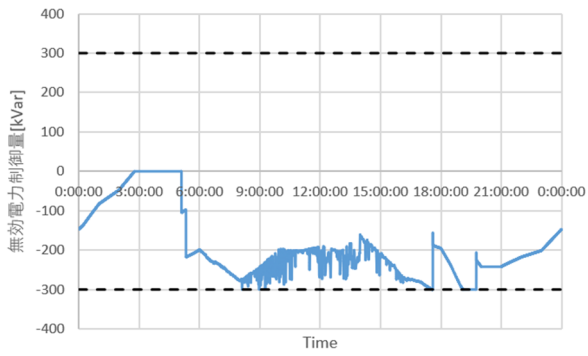
(a) PV 0%

(b) PV 10%



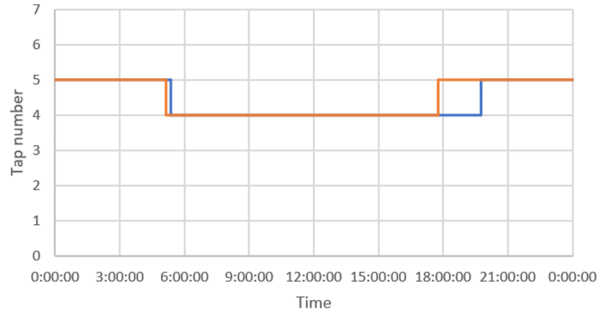
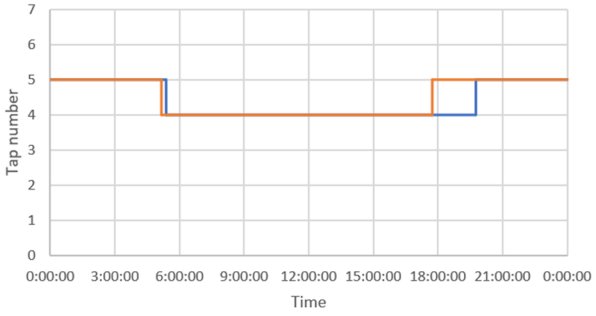
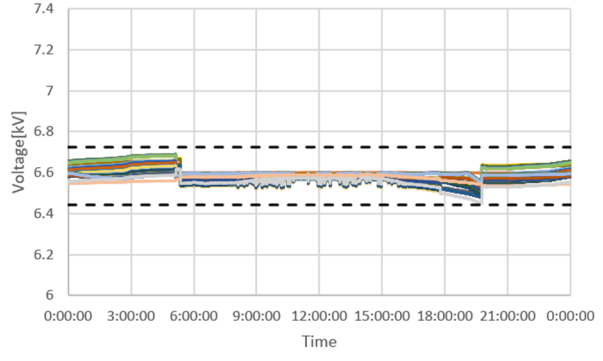
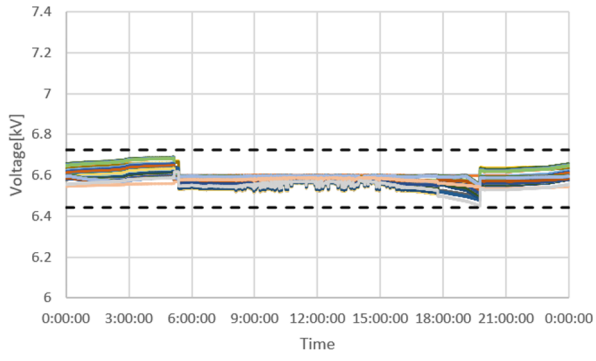
— SVR1 — SVR2

— SVR1 — SVR2



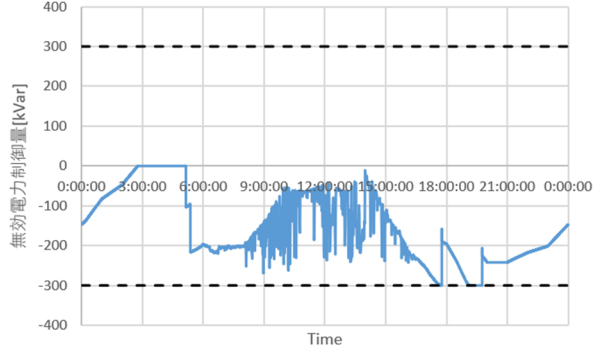
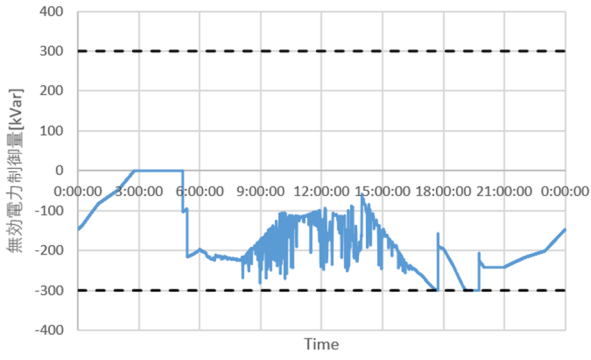
(c) PV 20%

(d) PV 30%



— SVR1 — SVR2

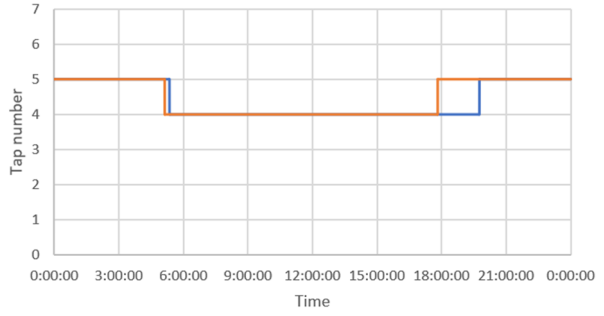
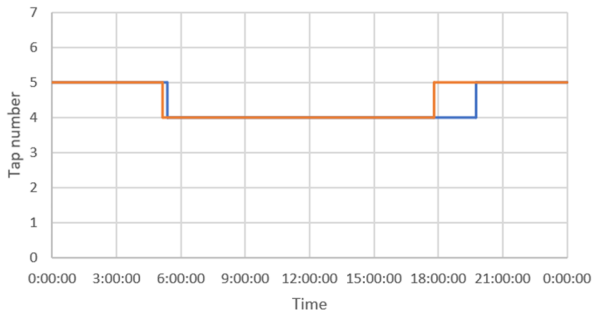
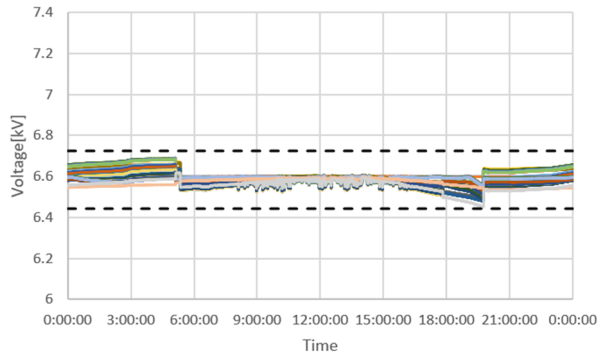
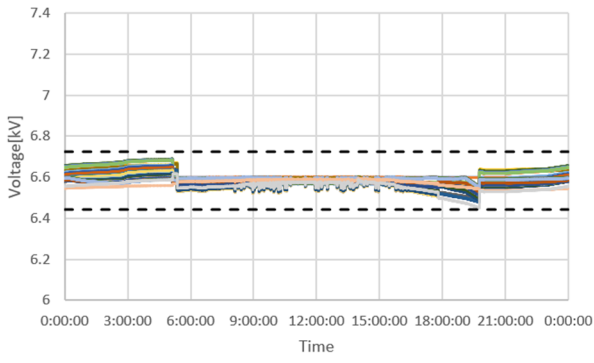
— SVR1 — SVR2



(e) PV 40%

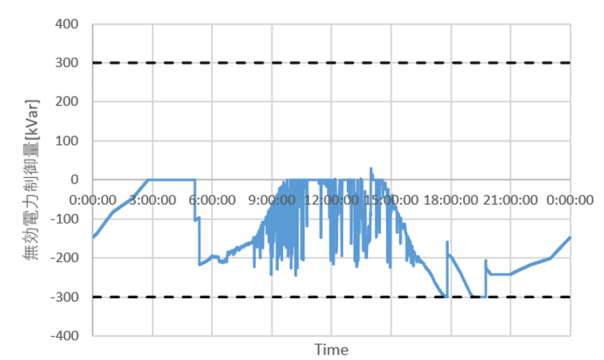
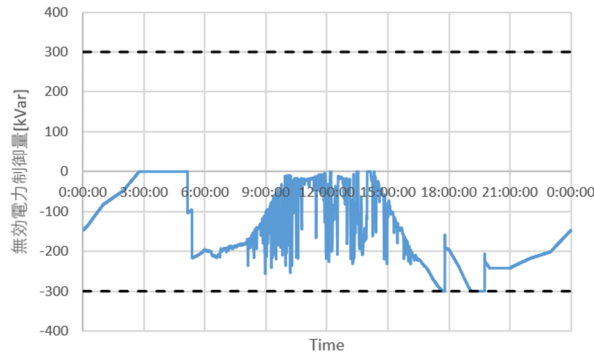
(f) PV 50%





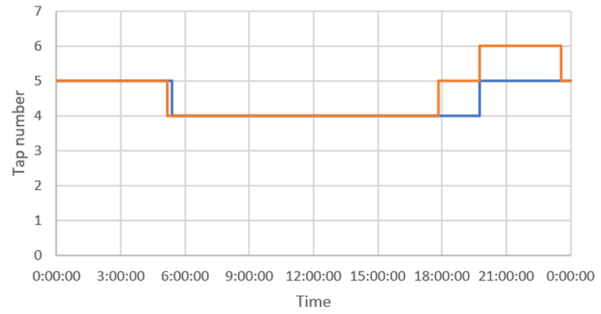
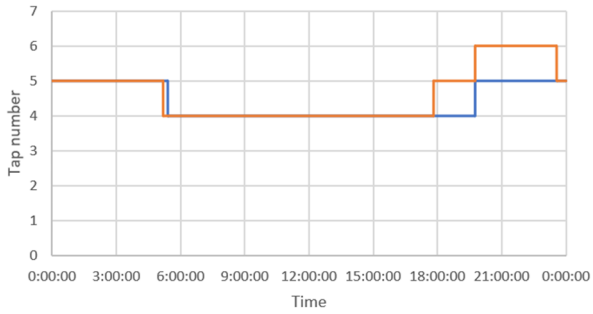
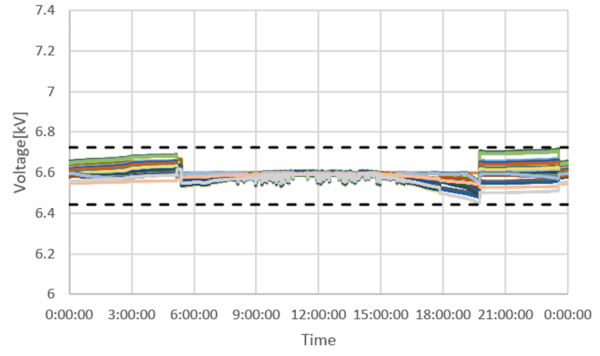
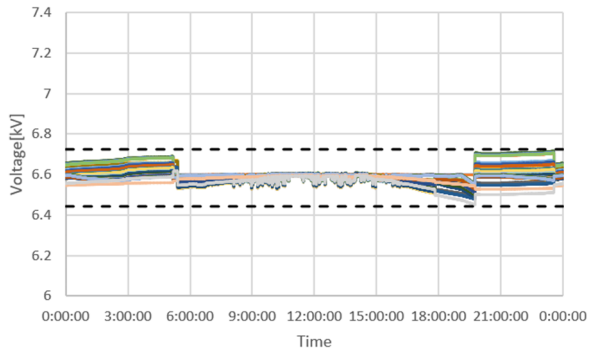
— SVR1 — SVR2

— SVR1 — SVR2



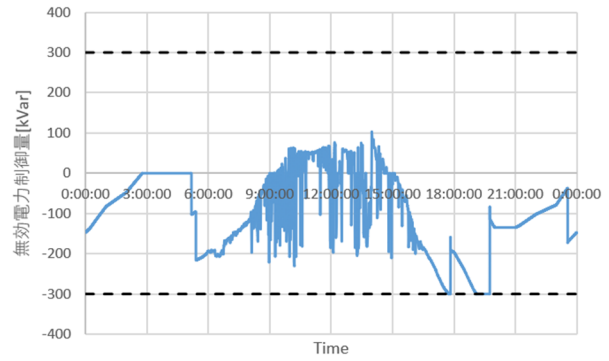
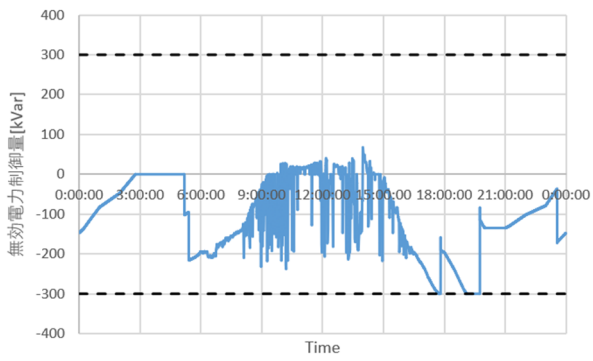
(g) PV 60%

(h) PV 70%



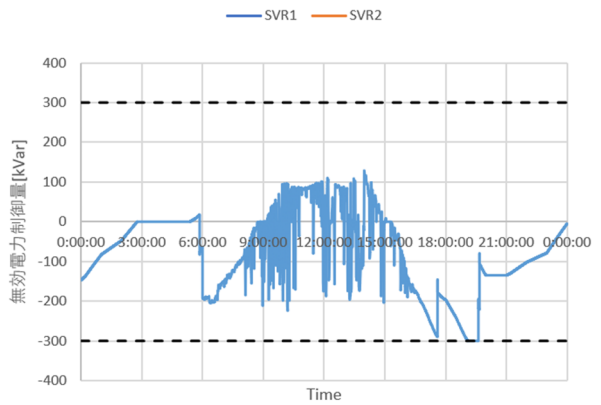
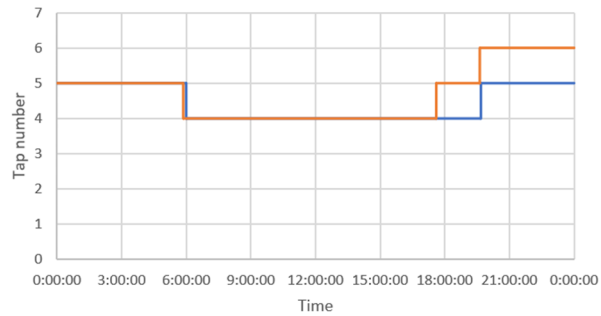
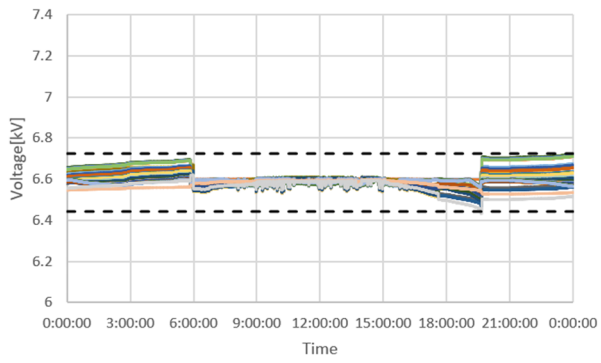
— SVR1 — SVR2

— SVR1 — SVR2



(i) PV 80%

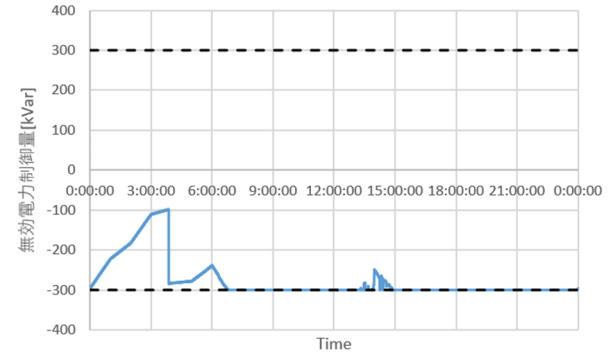
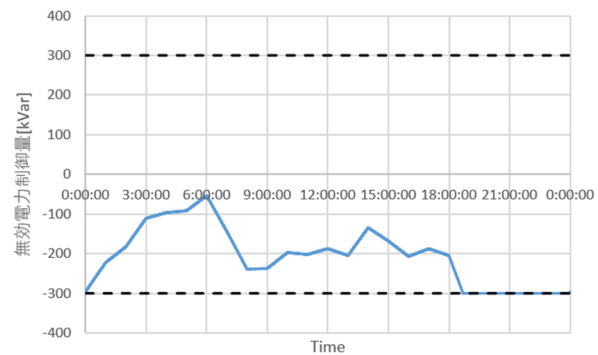
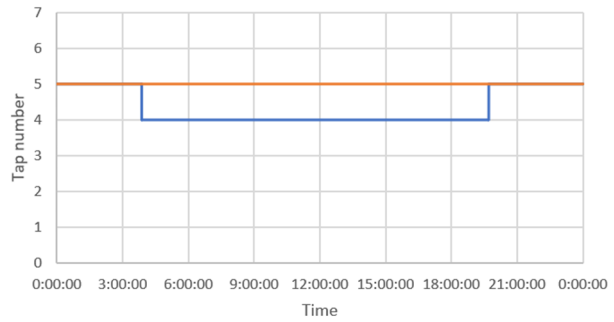
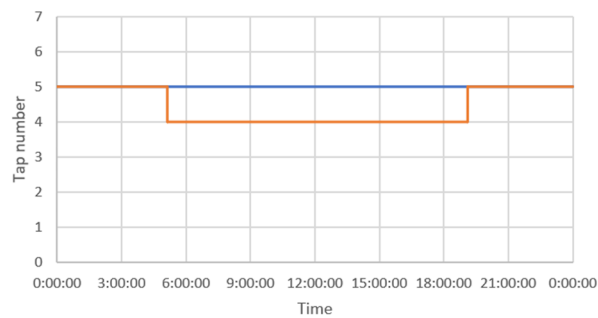
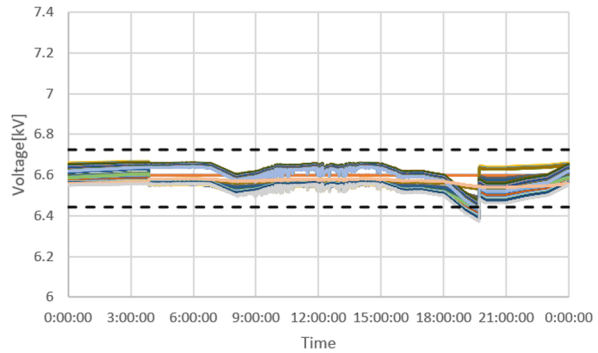
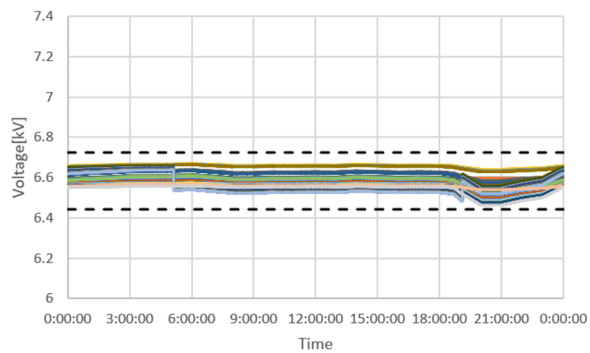
(j) PV 90%



(k) PV 100%

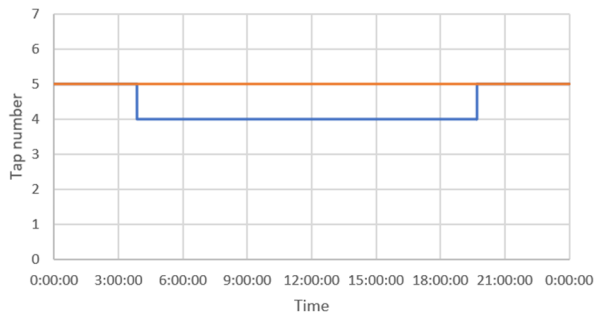
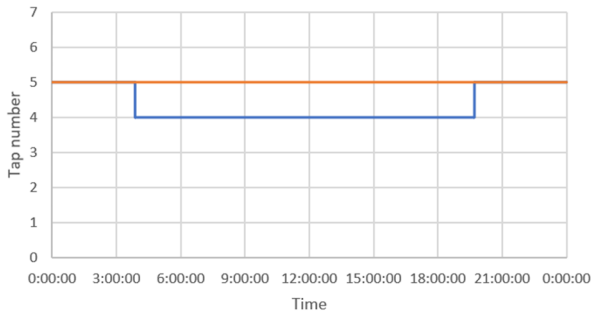
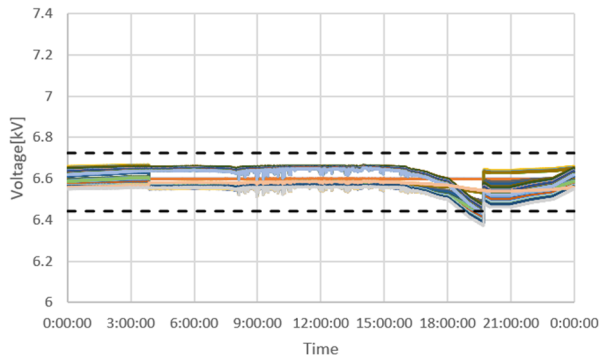
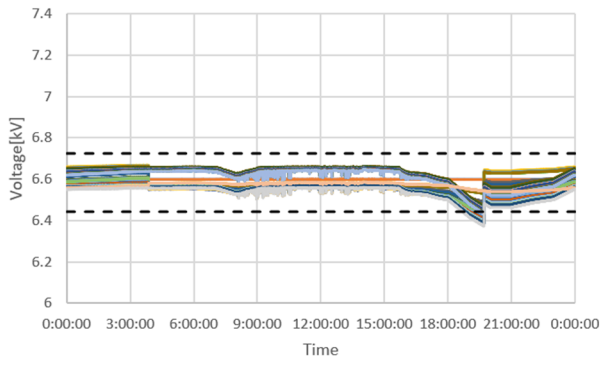
OD22 系統, PV 力率 0.95, 末端集中, SVR-SVC-SVR

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



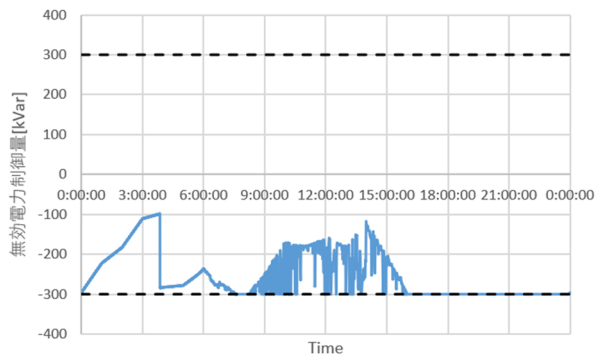
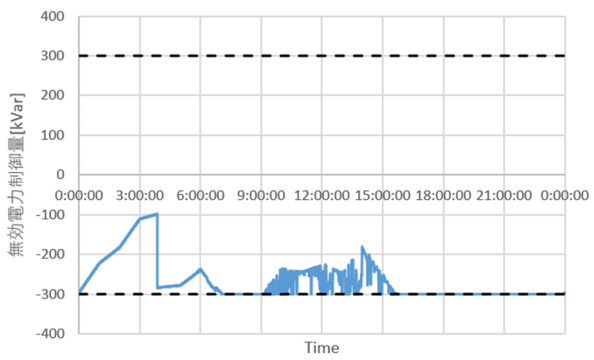
(a) PV 0%

(b) PV 10%



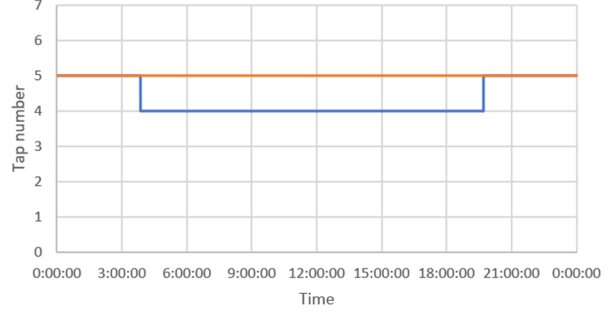
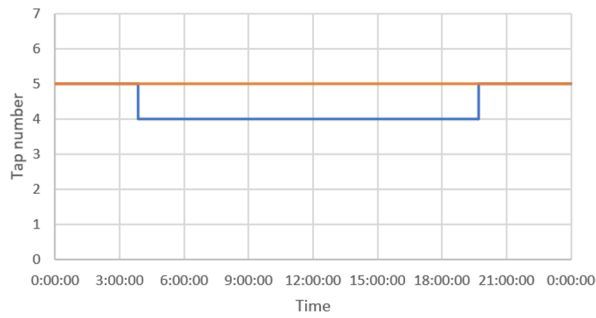
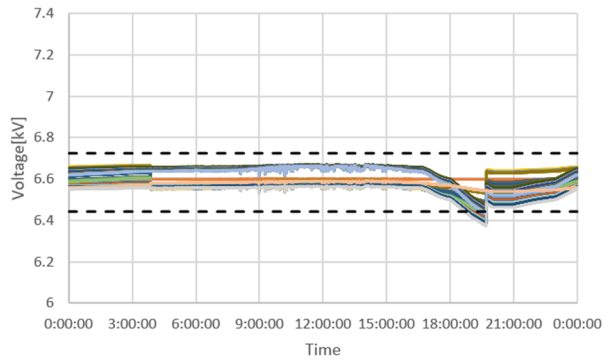
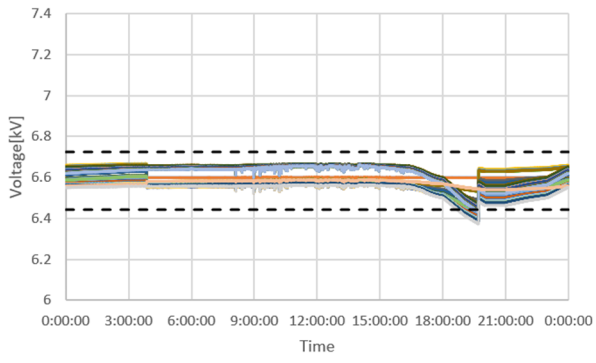
— SVR1 — SVR2

— SVR1 — SVR2



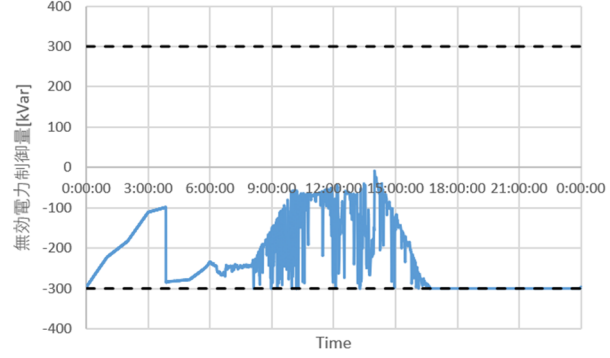
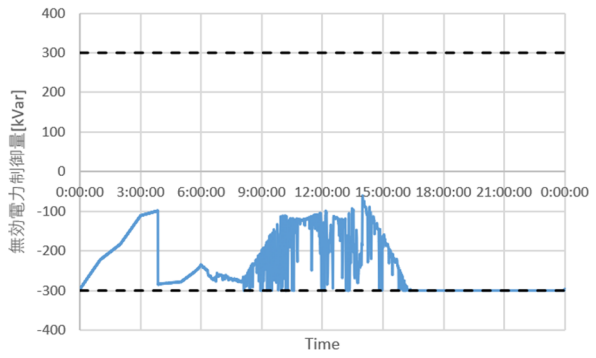
(c) PV 20%

(d) PV 30%



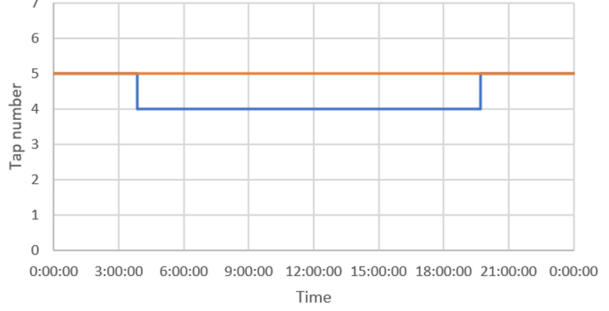
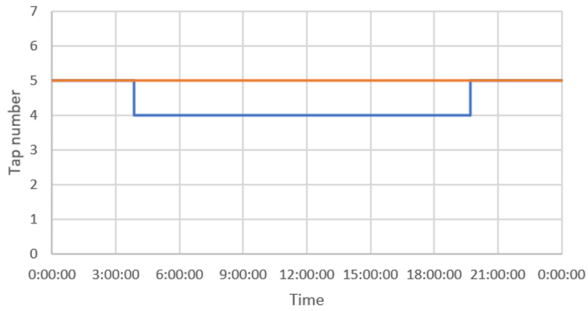
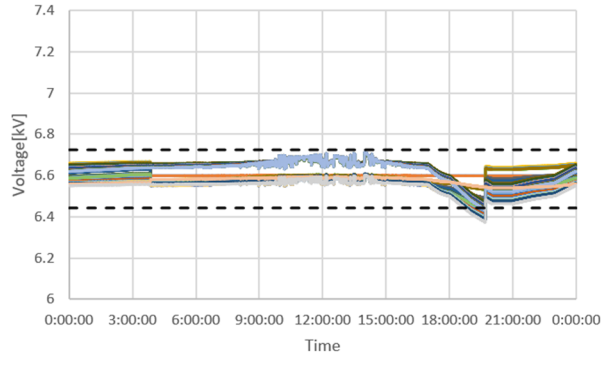
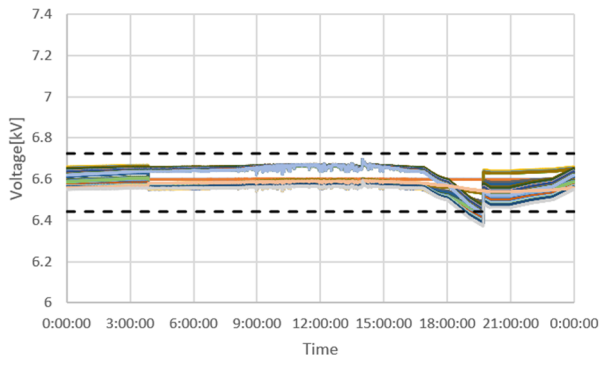
— SVR1 — SVR2

— SVR1 — SVR2



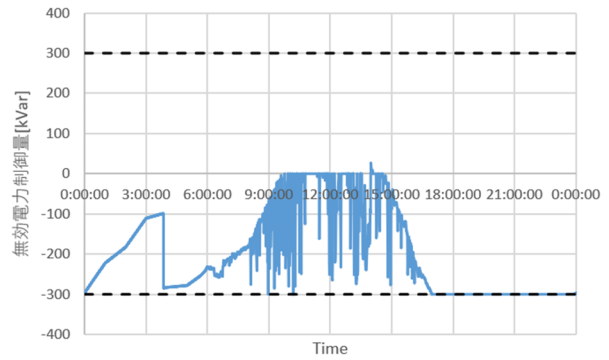
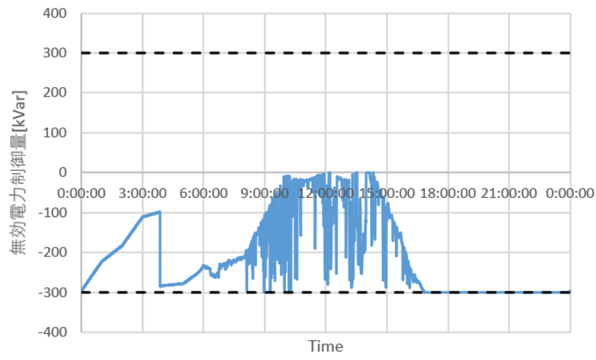
(e) PV 40%

(f) PV 50%



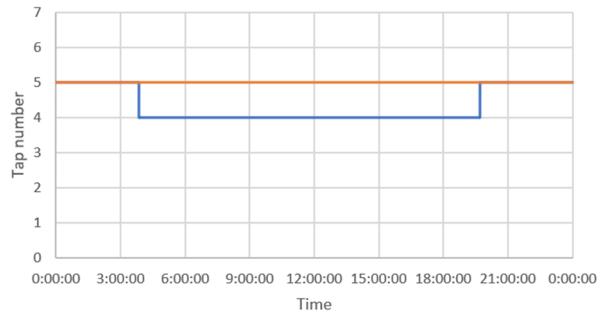
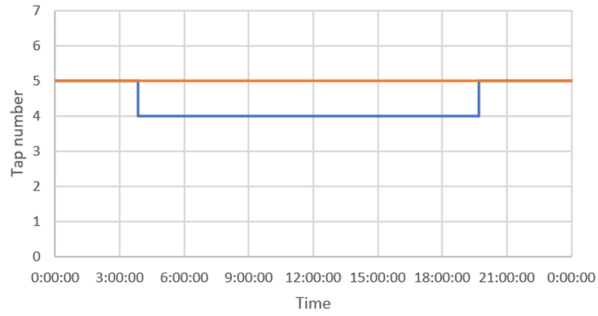
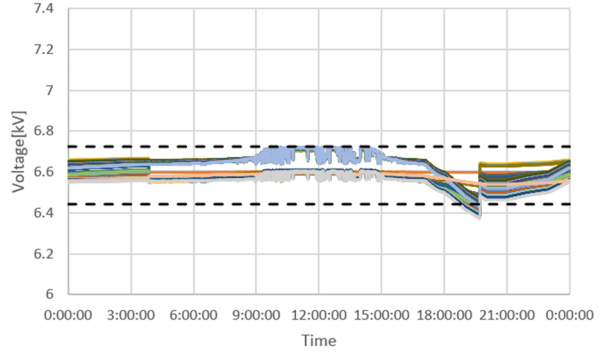
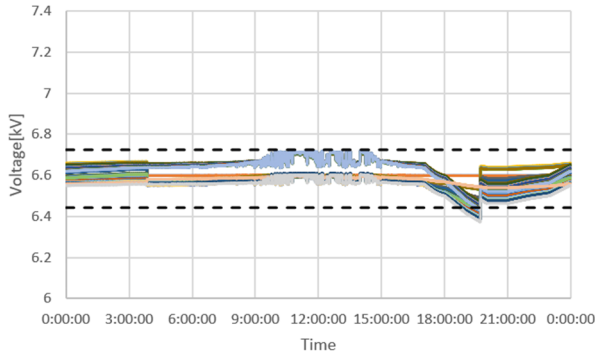
— SVR1 — SVR2

— SVR1 — SVR2



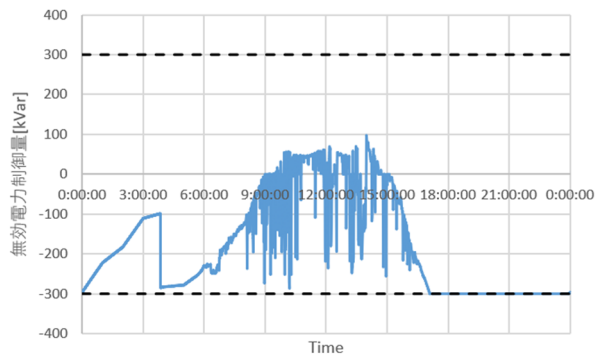
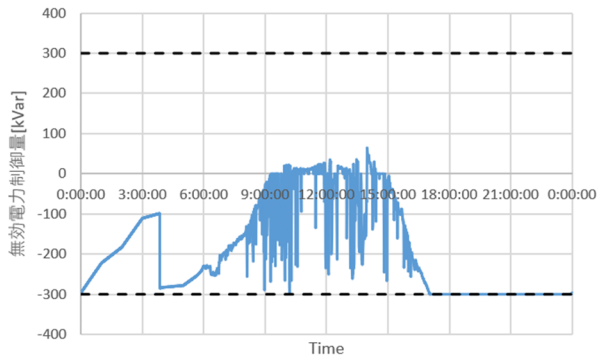
(g) PV 60%

(h) PV 70%



— SVR1 — SVR2

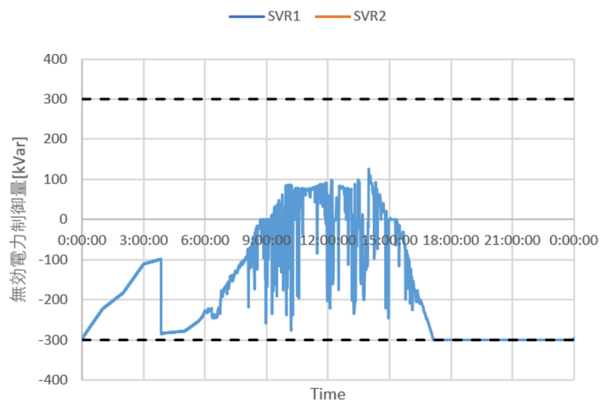
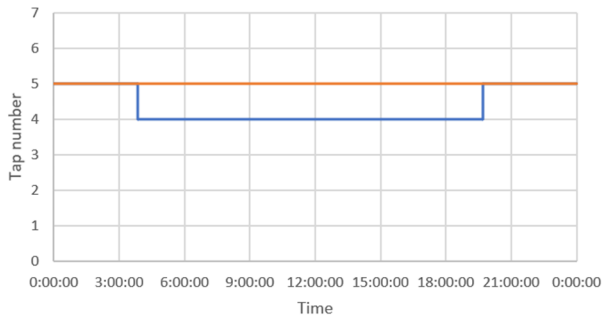
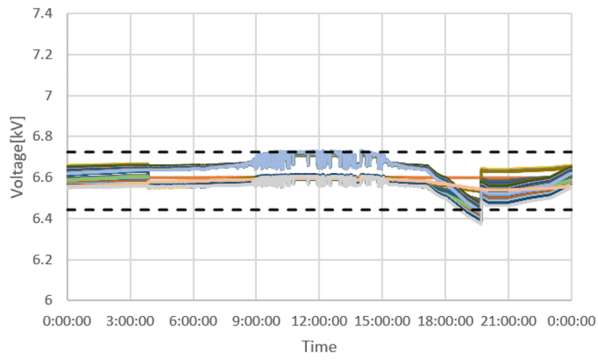
— SVR1 — SVR2



(i) PV 80%

(j) PV 90%

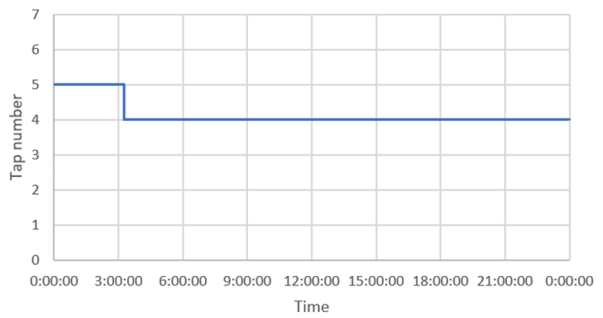
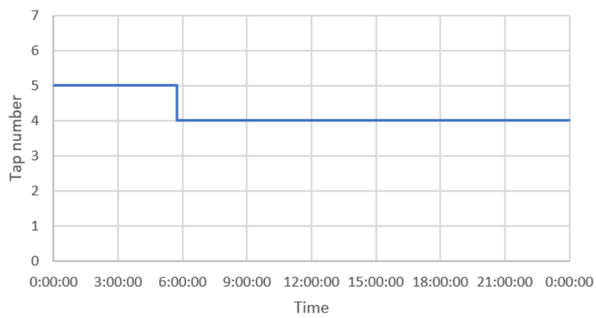
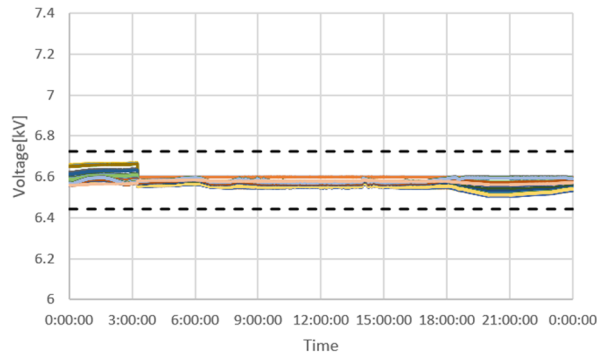
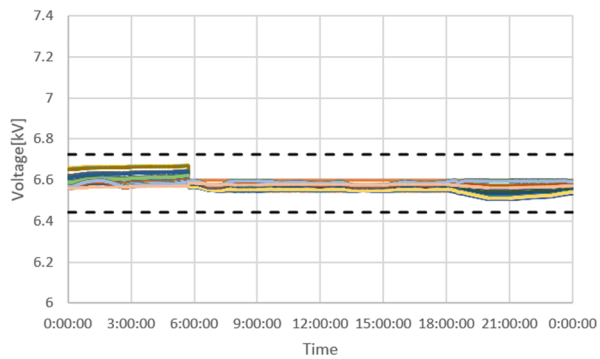




(k) PV 100%

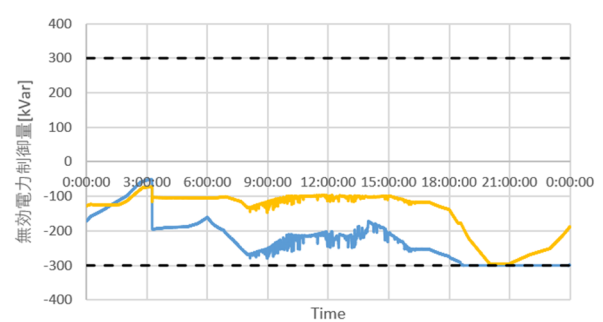
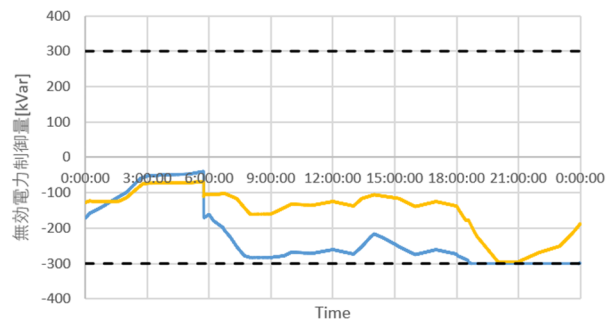
OD22 系統, PV 力率 0.95, 分散配置, SVR-SVC-SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



— SVR1

— SVR1

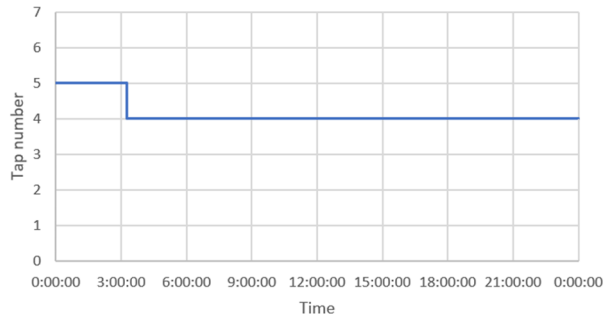
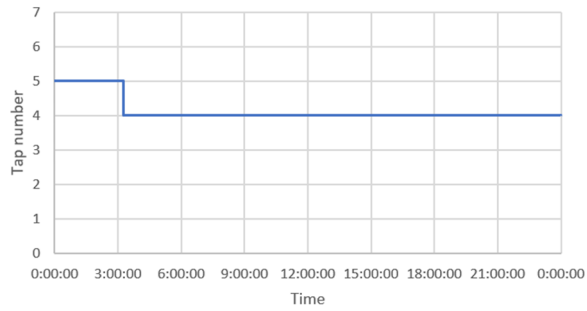
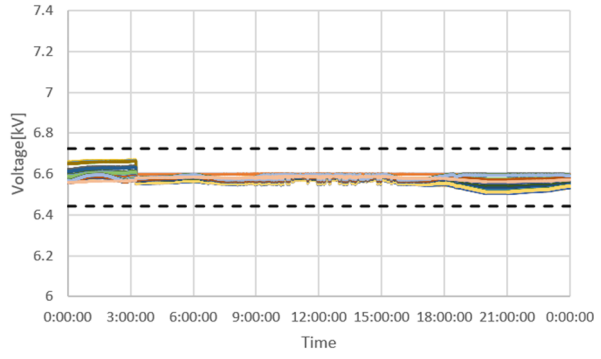
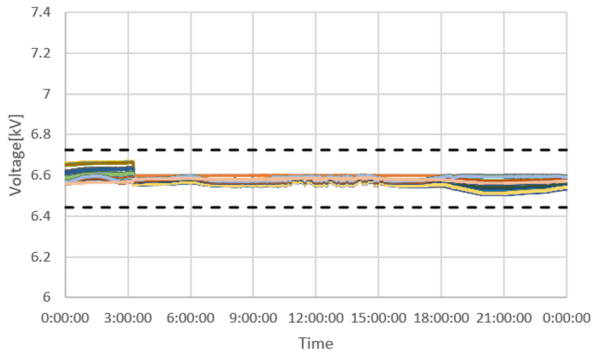


— SVR1 — SVR2

— SVR1 — SVR2

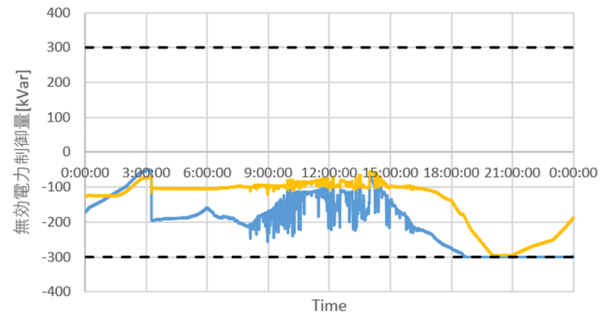
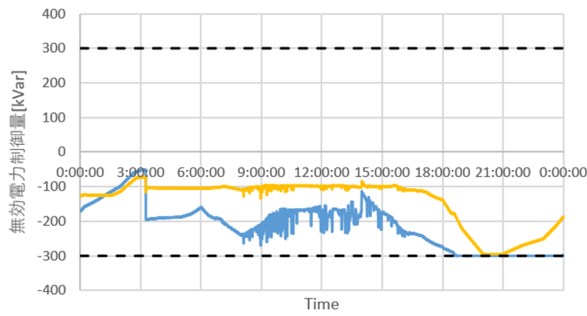
(a) PV 0%

(b) PV 10%



— SVR1

— SVR1

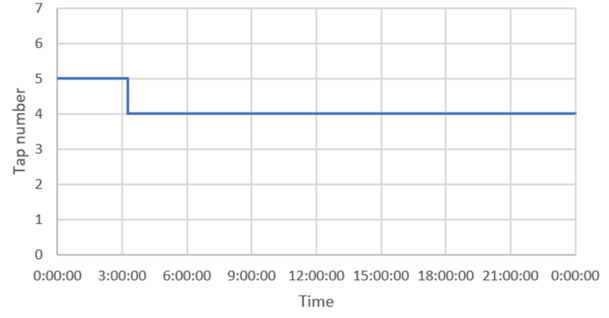
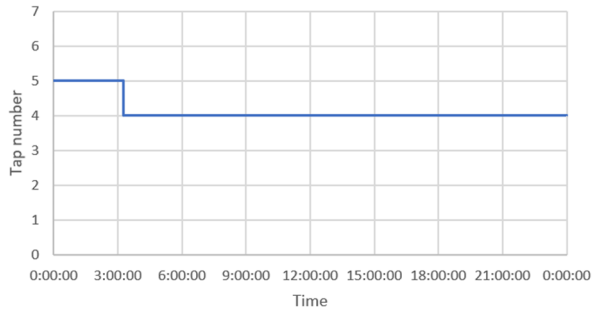
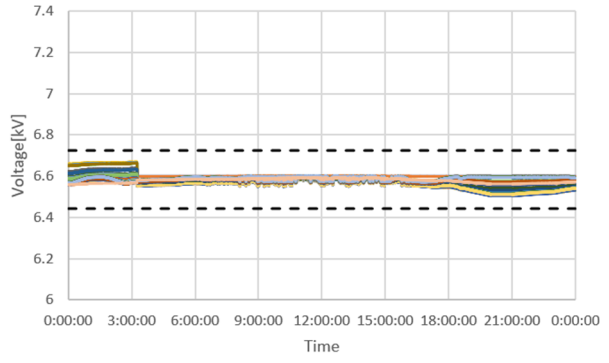
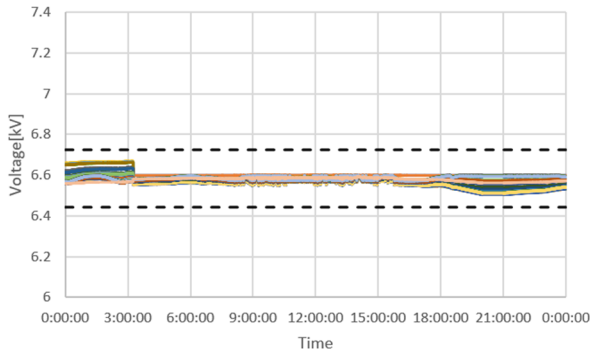


— SVR1 — SVR2

— SVR1 — SVR2

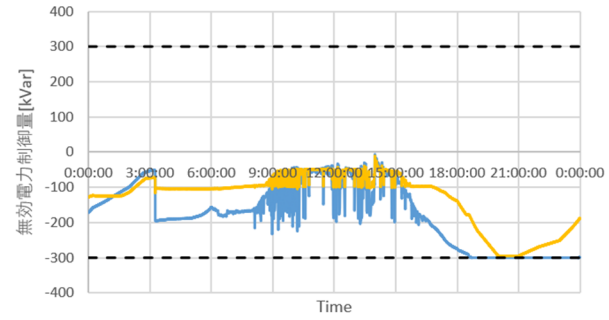
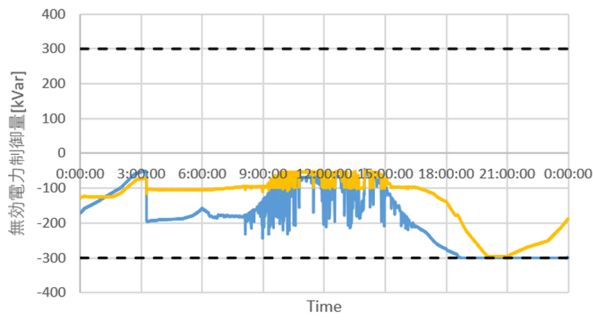
(c) PV 20%

(d) PV 30%



— SVR1

— SVR1

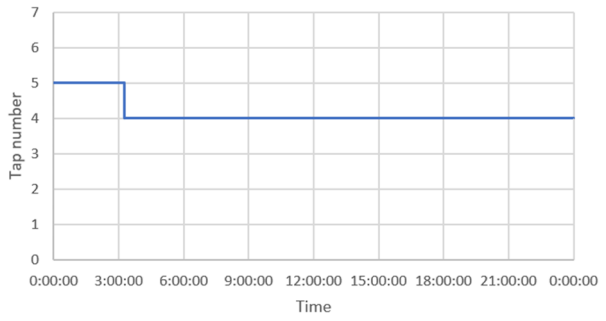
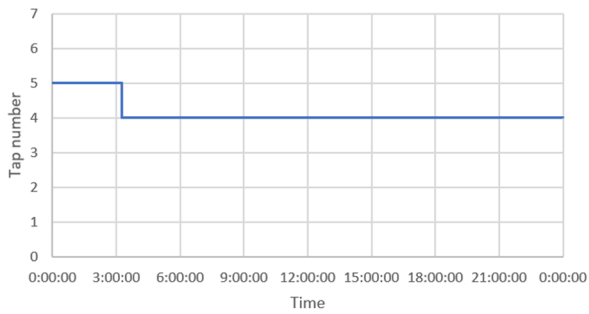
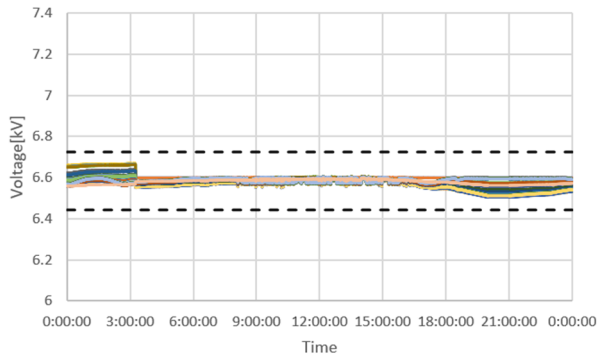
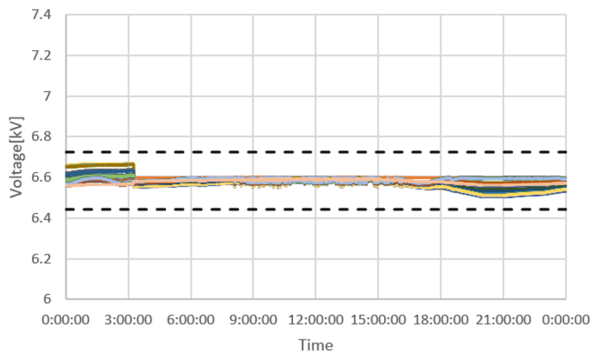


— SVR1 — SVR2

— SVR1 — SVR2

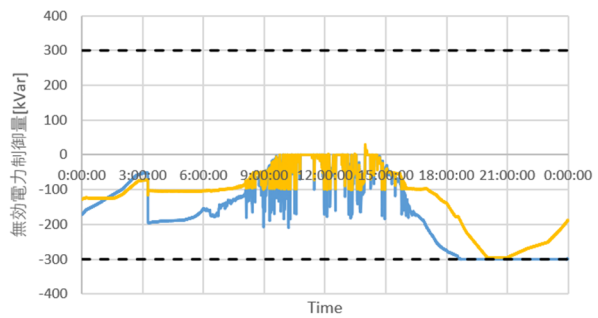
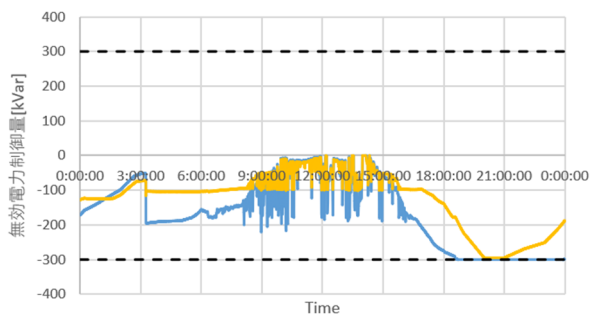
(e) PV 40%

(f) PV 50%



— SVR1

— SVR1

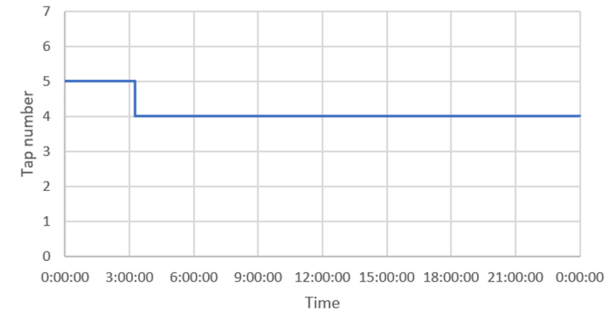
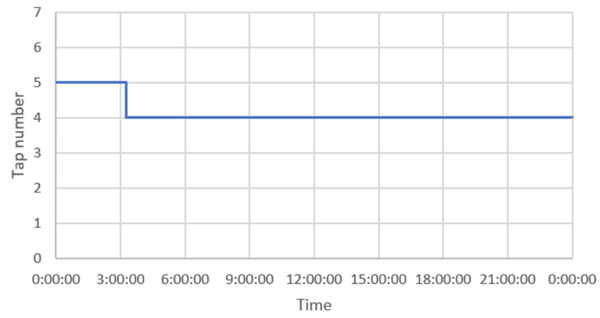
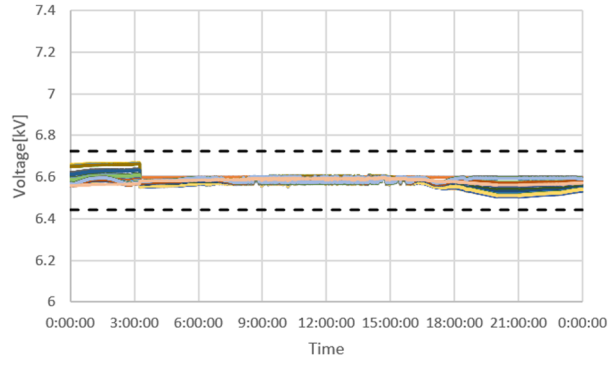
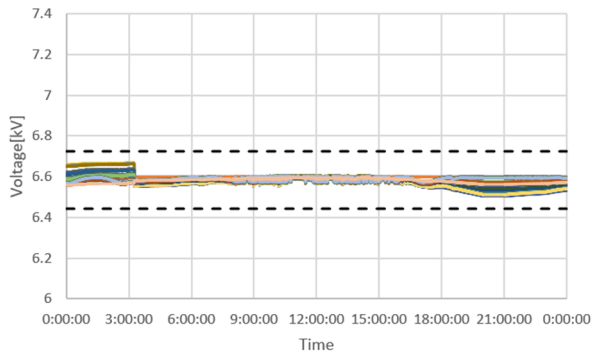


— SVR1 — SVR2

— SVR1 — SVR2

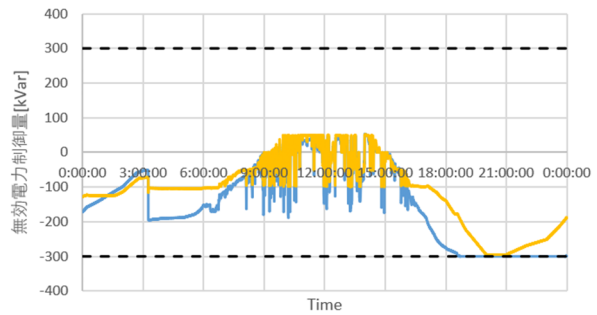
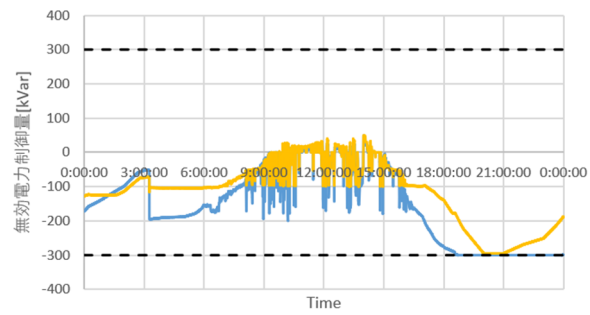
(g) PV 60%

(h) PV 70%



— SVR1

— SVR1

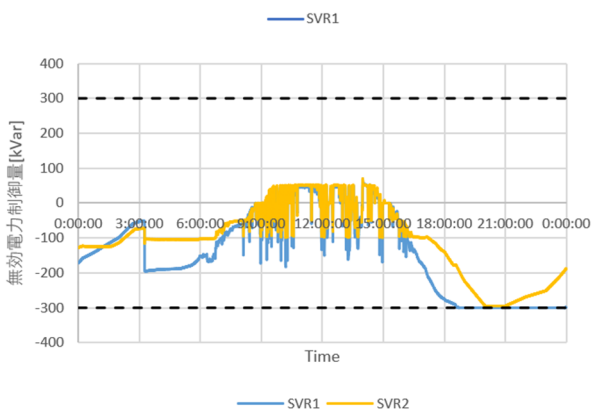
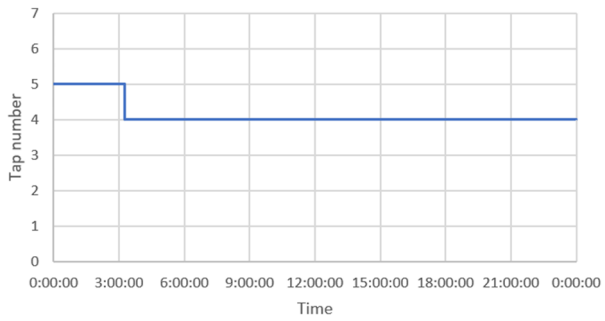
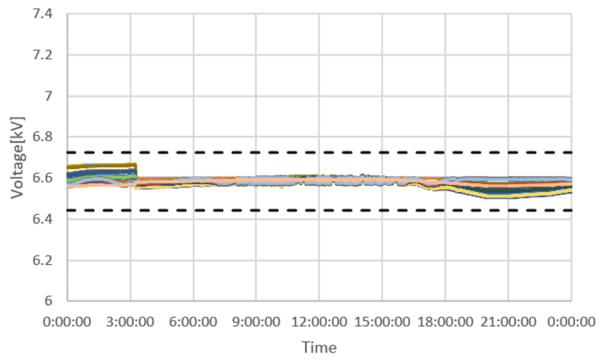


— SVR1 — SVR2

— SVR1 — SVR2

(i) PV 80%

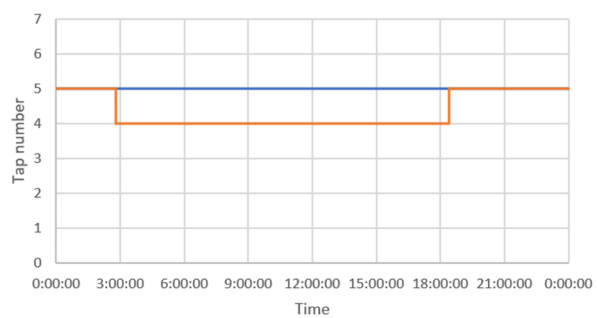
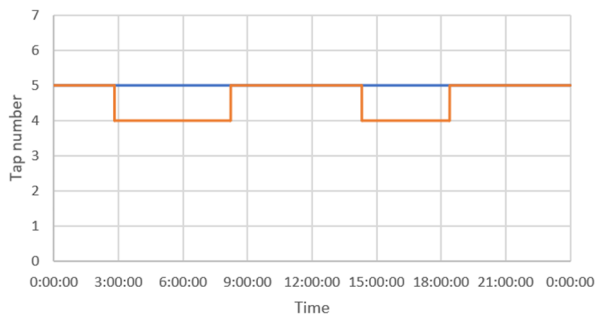
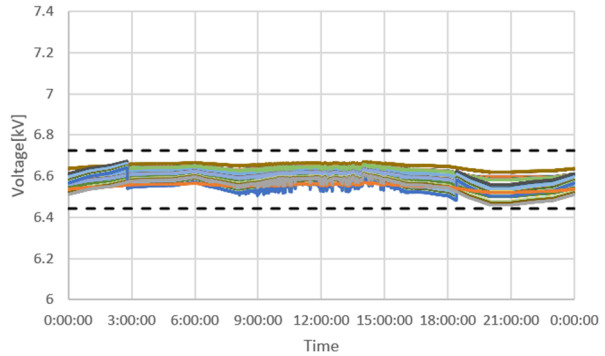
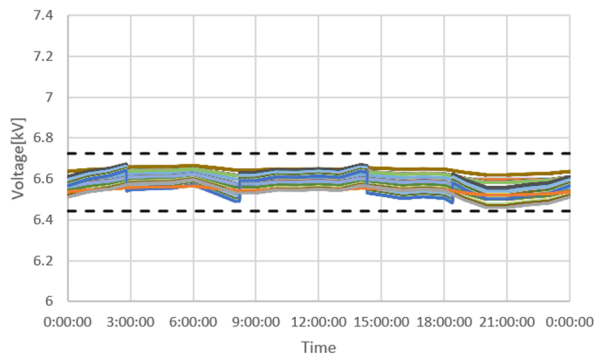
(j) PV 90%



(k) PV 100%

OD21 系統, PV 力率 1.0, 分散配置, SVR-SVR

(上 : 電圧分布, 下 : タップ位置)

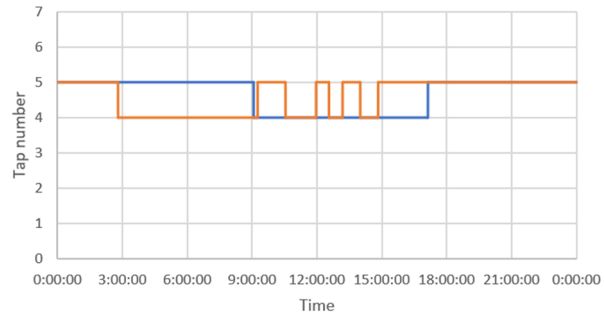
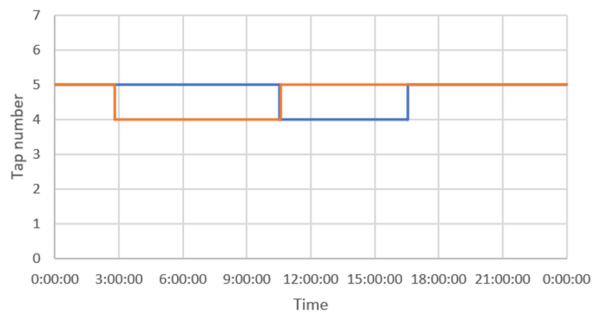
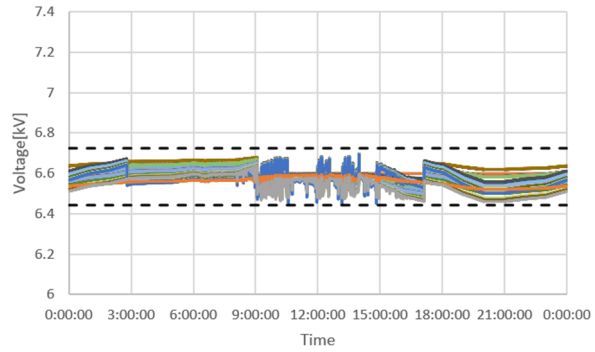
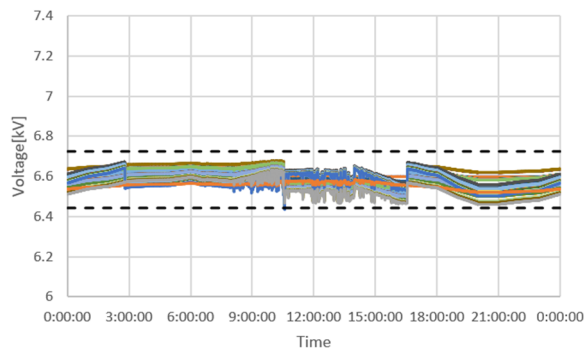


— SVR1 — SVR2

(a) PV 0%

— SVR1 — SVR2

(b) PV 10%



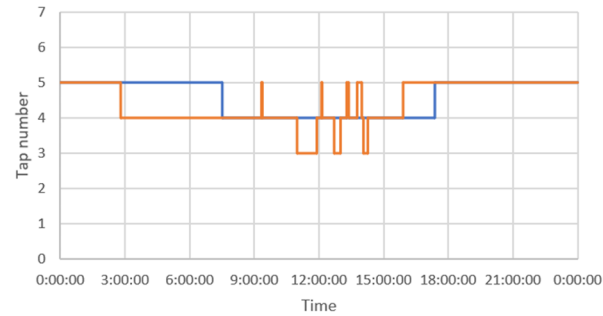
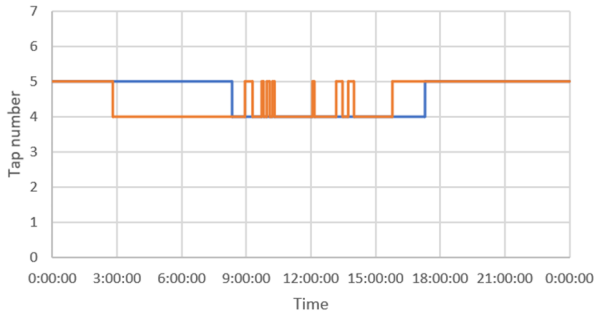
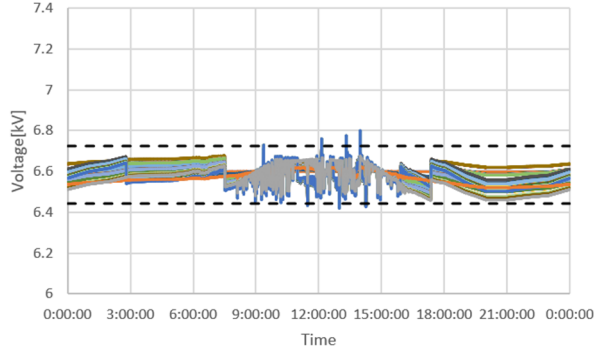
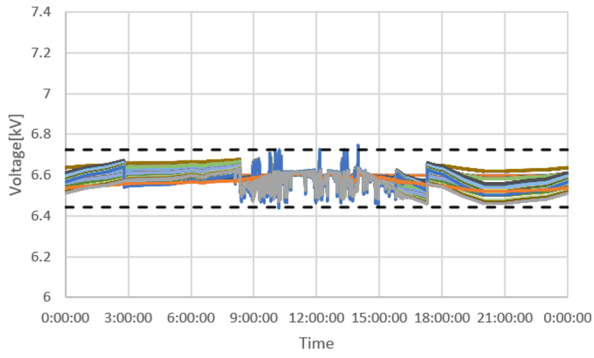
— SVR1 — SVR2

(c) PV 20%

— SVR1 — SVR2

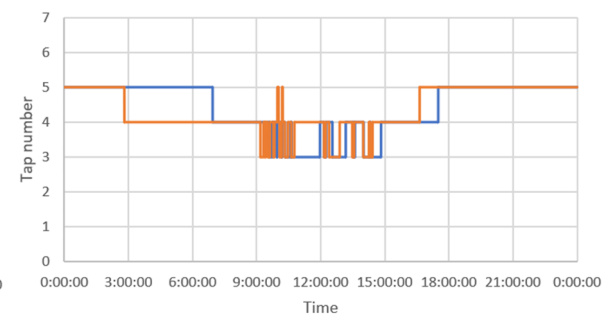
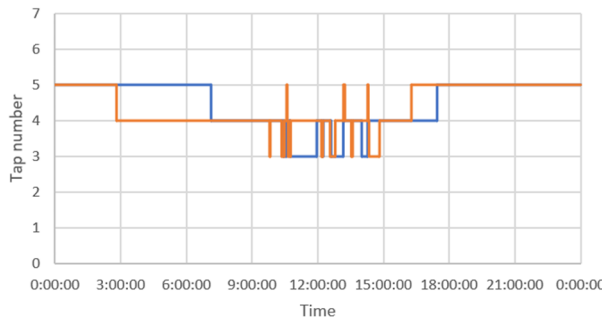
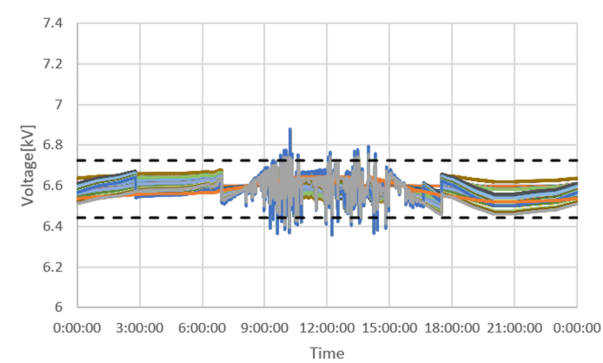
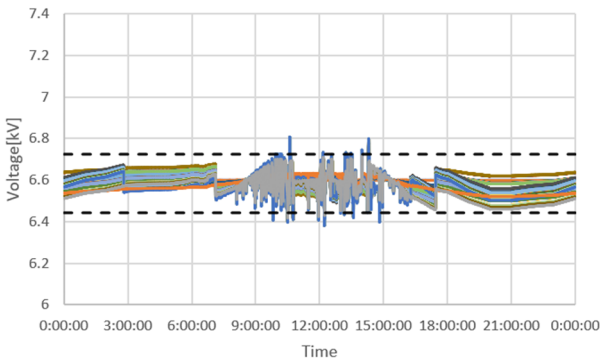
(d) PV 30%





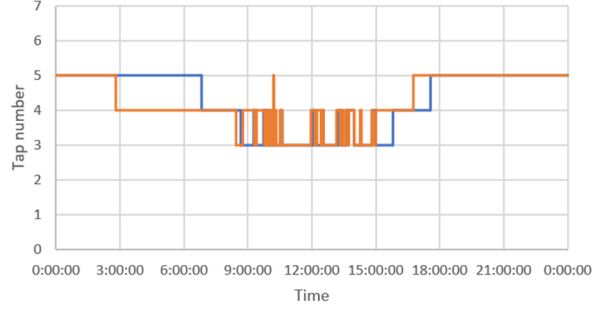
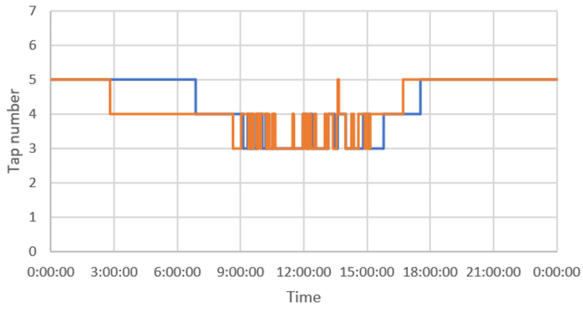
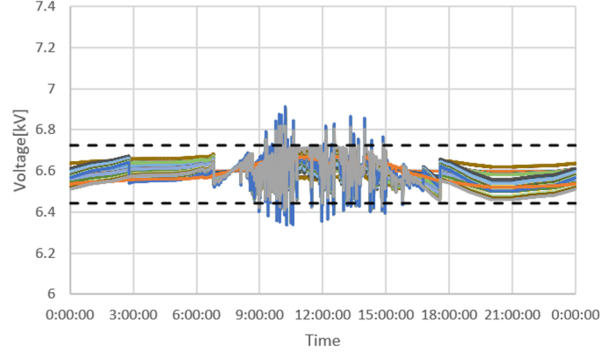
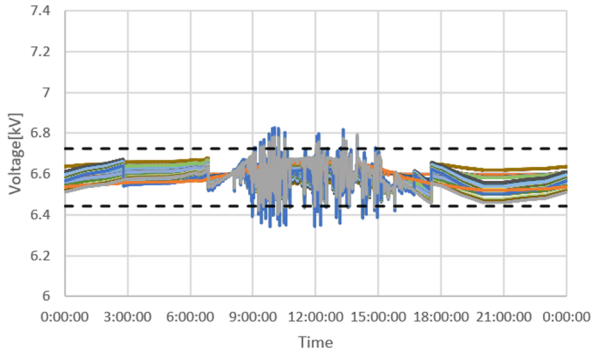
(e) PV 40%

(f) PV 50%



(g) PV 60%

(h) PV 70%

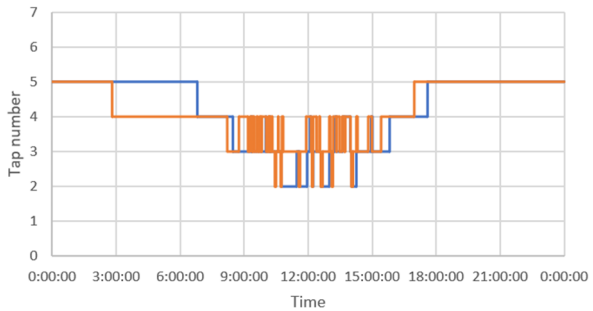
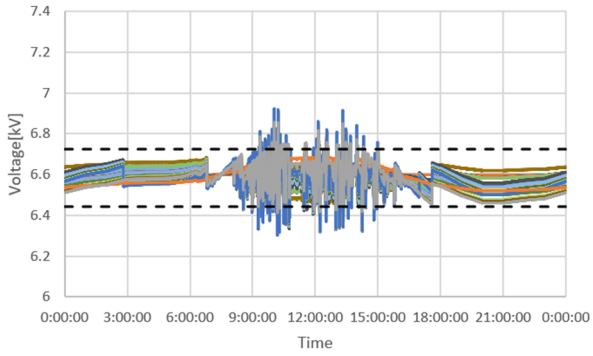


— SVR1 — SVR2

— SVR1 — SVR2

(i) PV 80%

(j) PV 90%

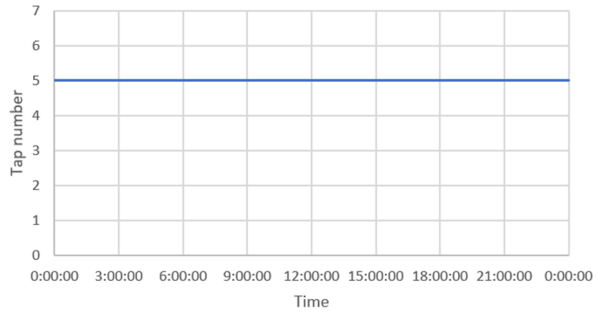
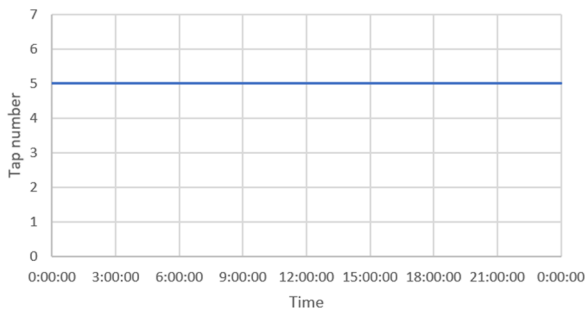
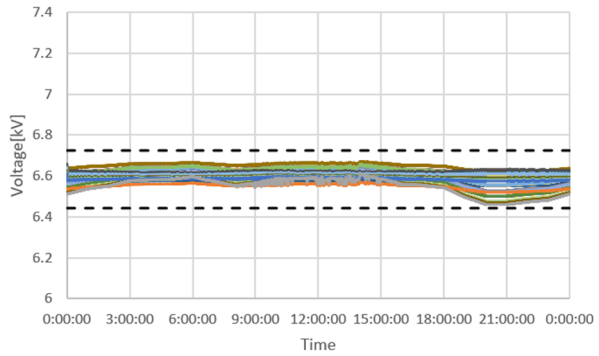
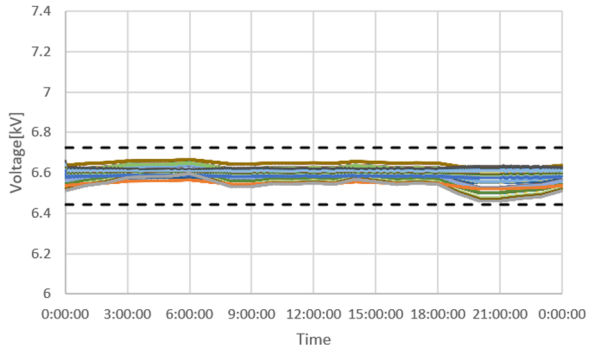


— SVR1 — SVR2

(k) PV 100%

OD21 系統, PV 力率 1.0, 分散配置, SVR-TVV

(上: 電圧分布, 下: タップ位置)

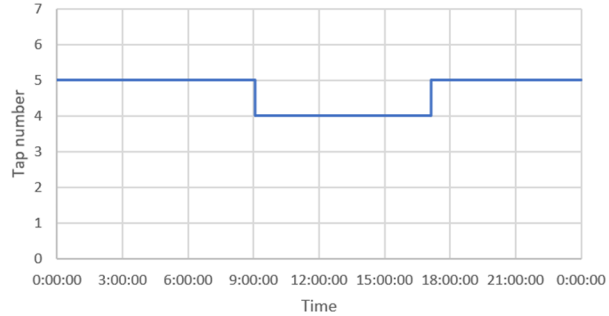
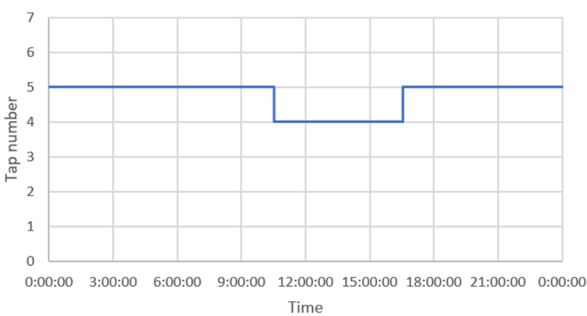
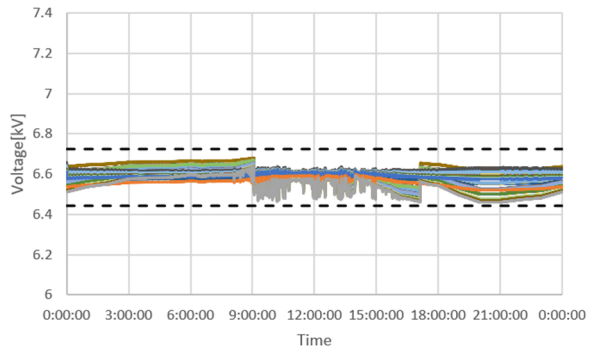
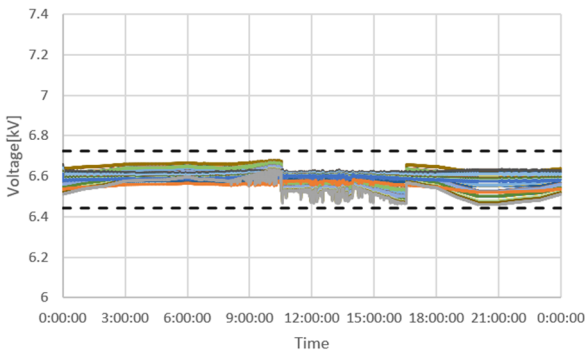


— SVR1

— SVR1

(a) PV 0%

(b) PV 10%

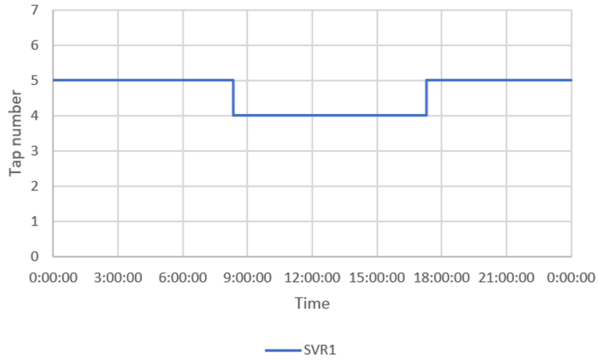
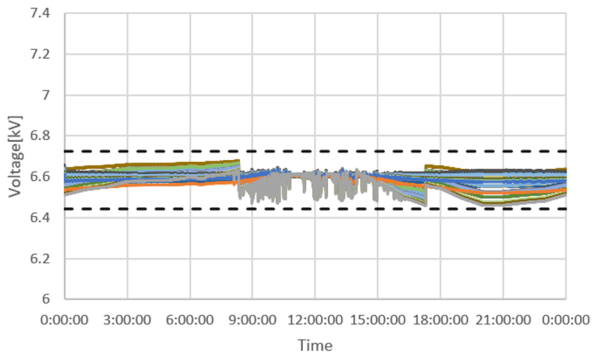


— SVR1

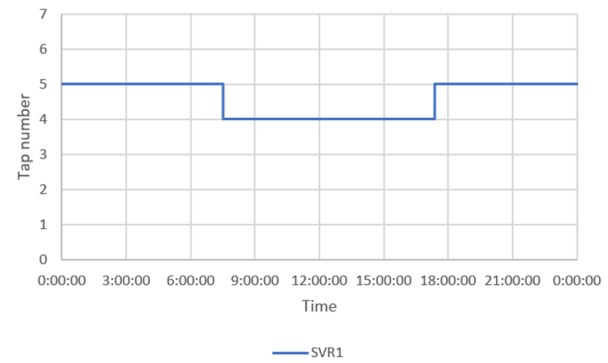
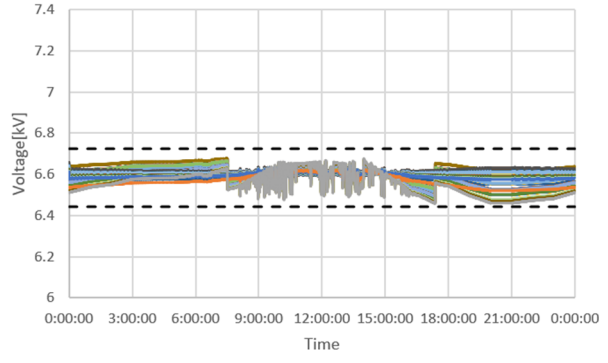
— SVR1

(c) PV 20%

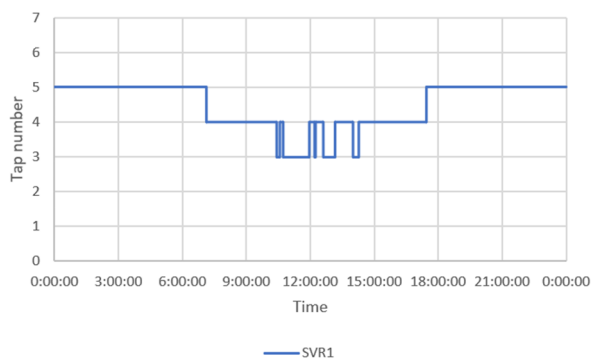
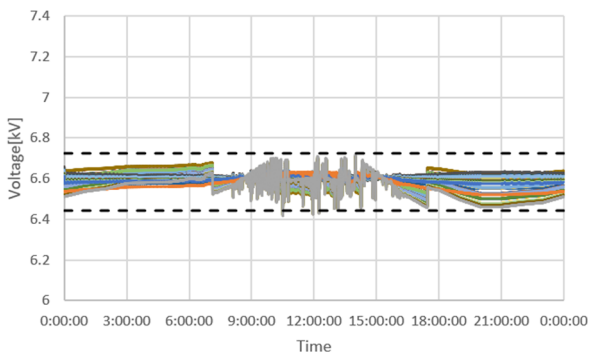
(d) PV 30%



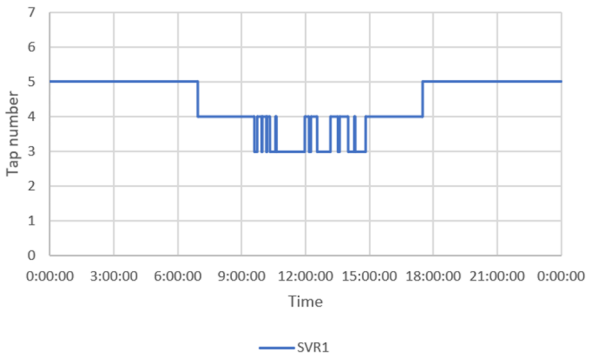
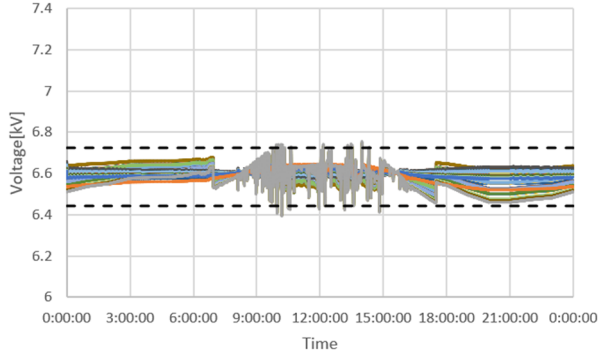
(e) PV 40%



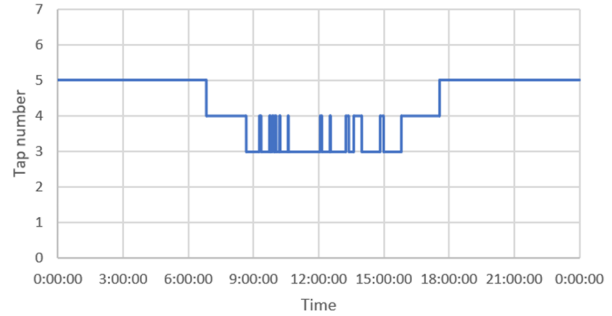
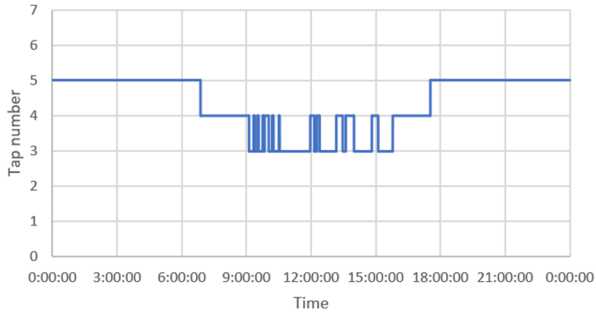
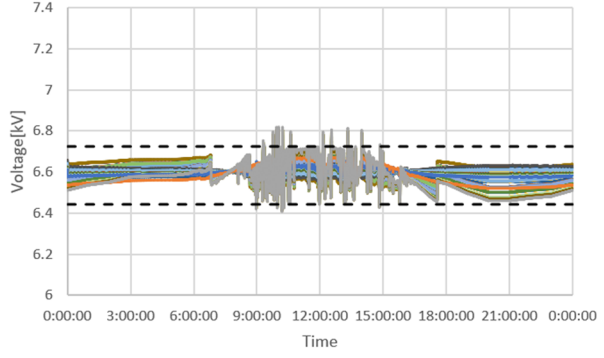
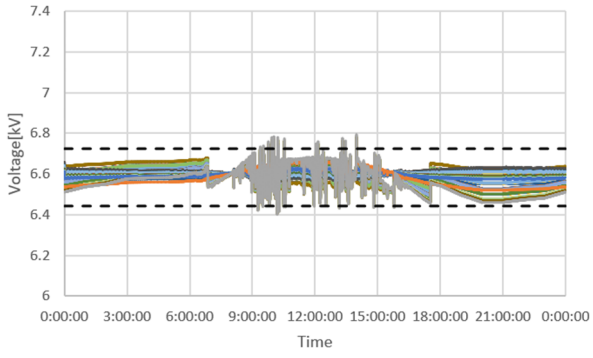
(f) PV 50%



(g) PV 60%

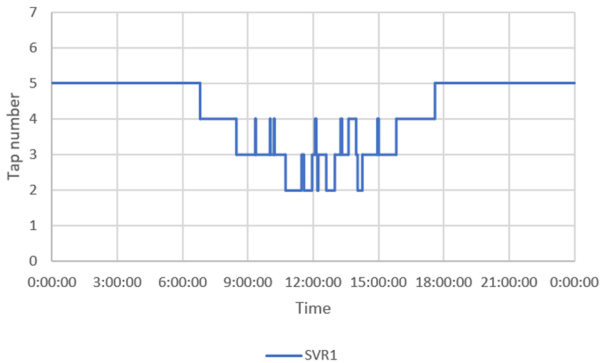
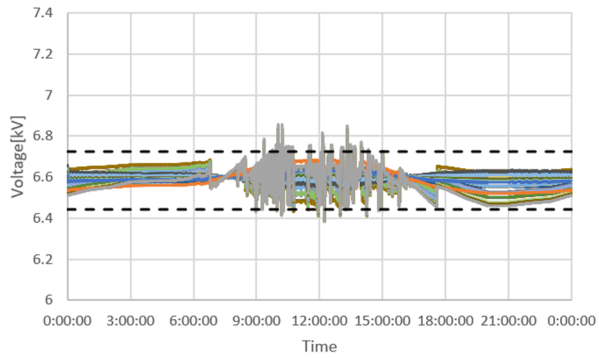


(h) PV 70%



(i) PV 80%

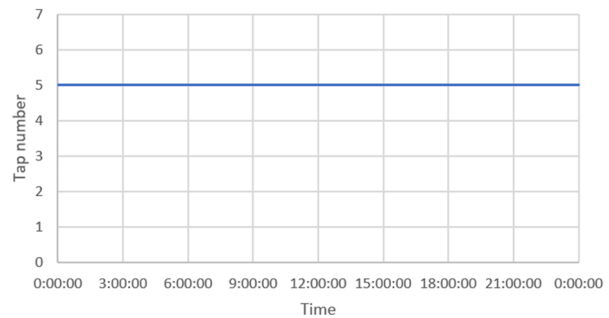
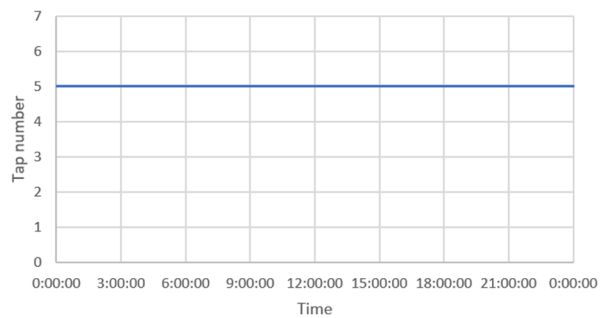
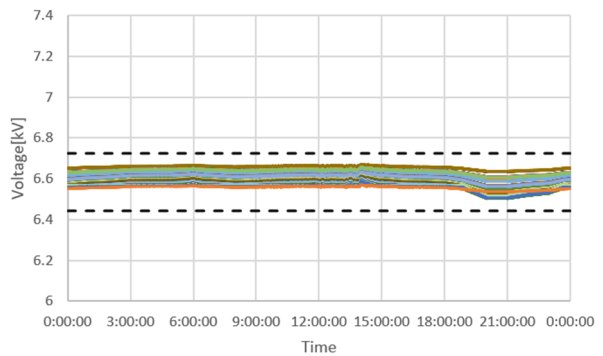
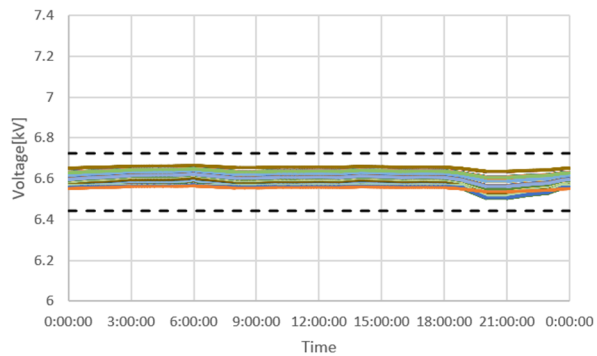
(j) PV 90%



(k) PV 100%

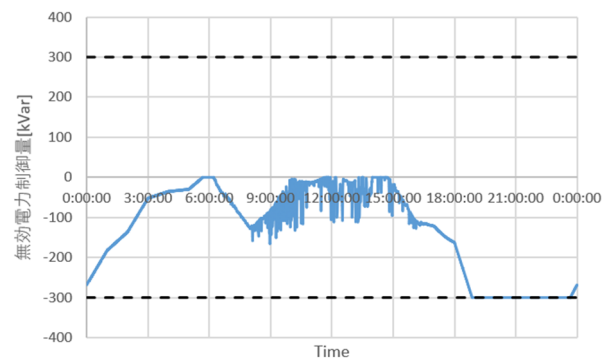
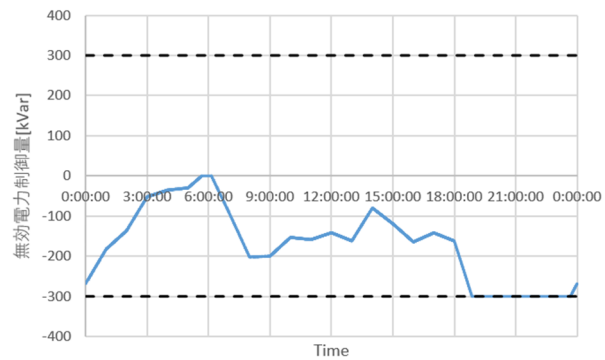
OD21 系統, PV 力率 1.0, 末端集中, SVR-SVC

(上 : 電圧分布, 中 : タップ位置, 下 : SVC の無効電力)



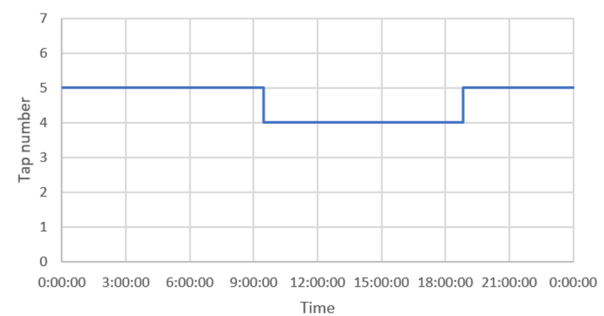
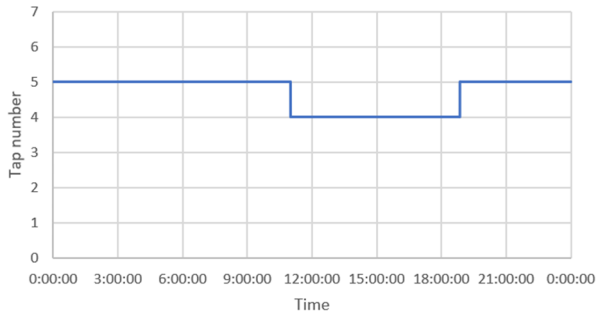
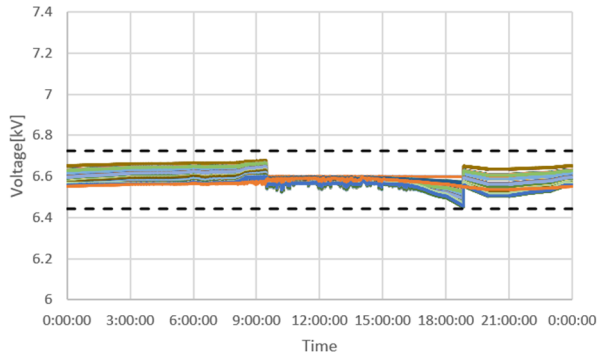
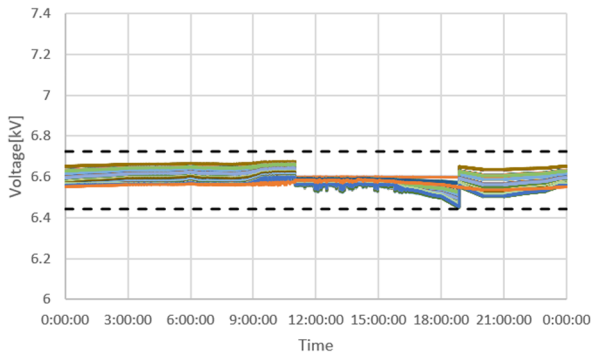
— SVR1

— SVR1



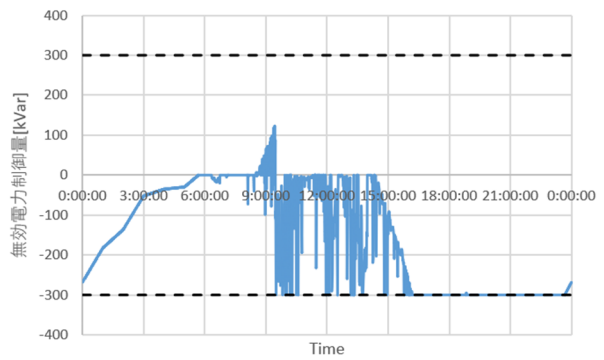
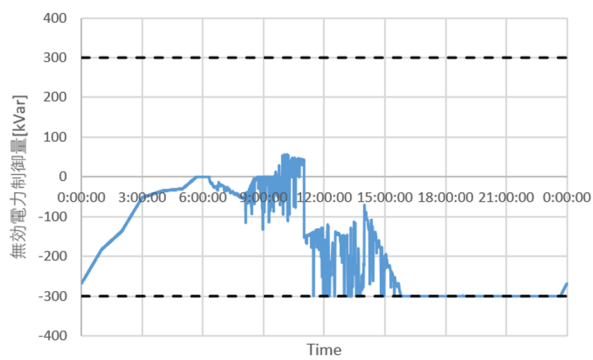
(a) PV 0%

(b) PV 10%



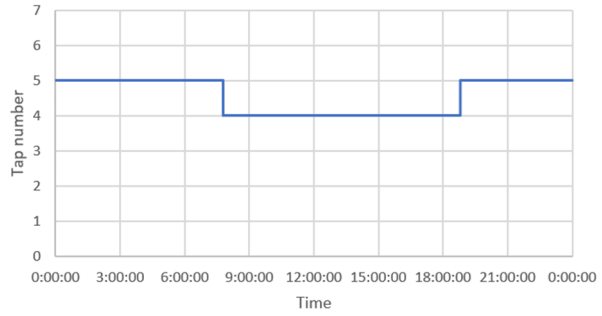
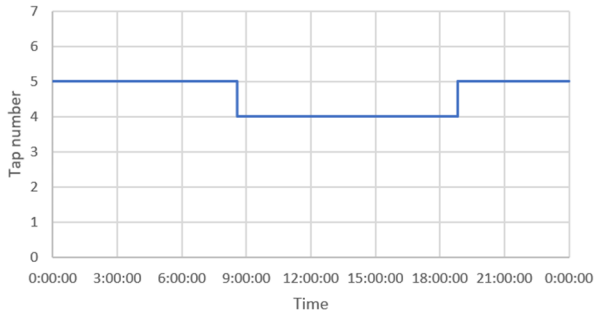
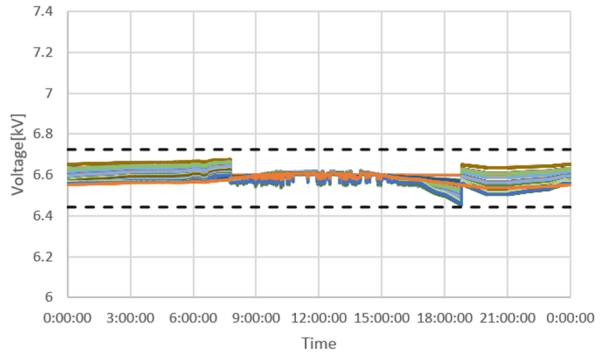
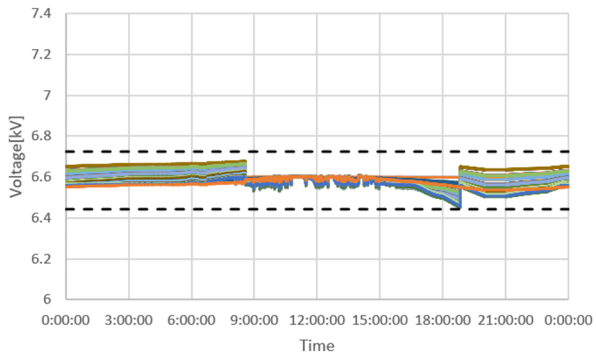
— SVR1

— SVR1



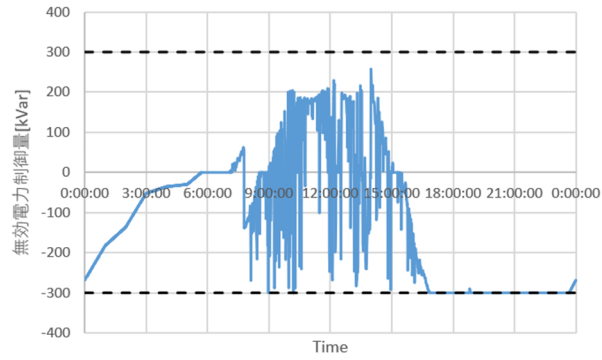
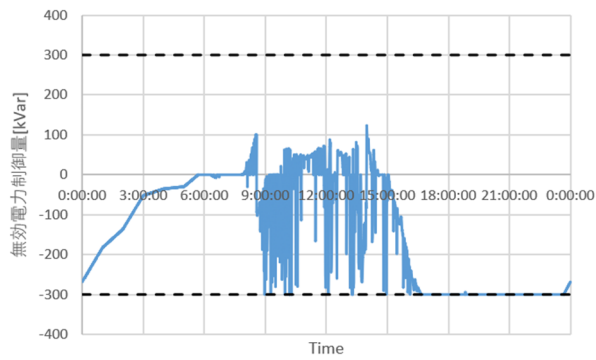
(c) PV 20%

(d) PV 30%



— SVR1

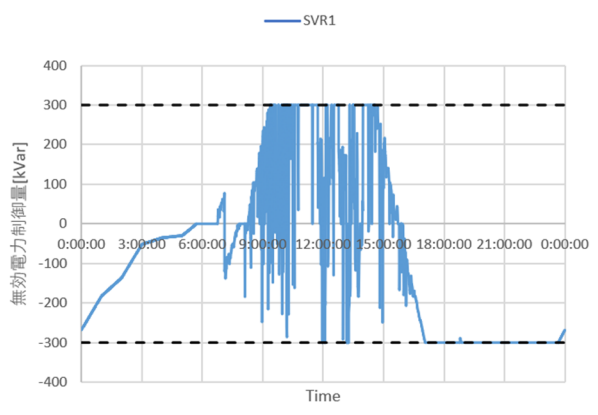
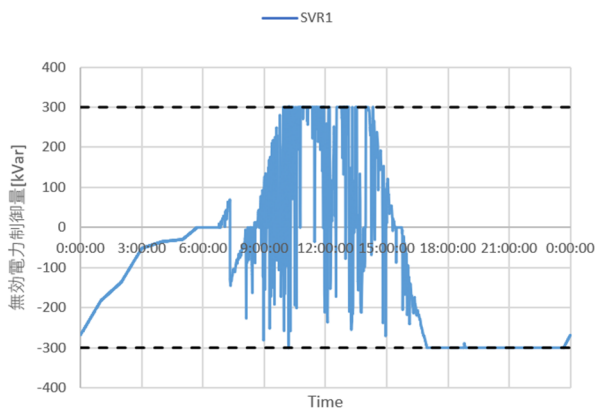
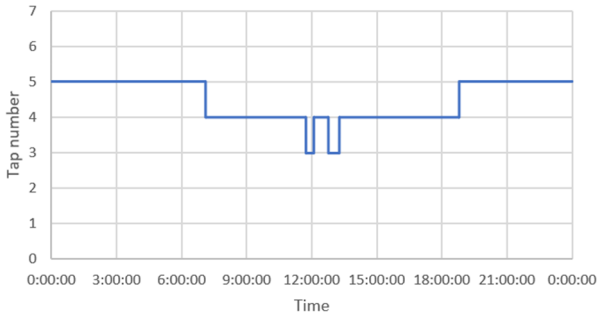
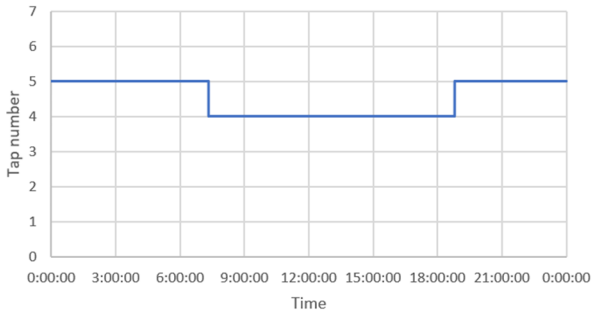
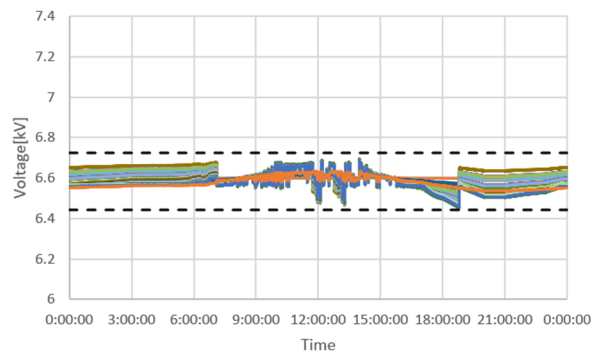
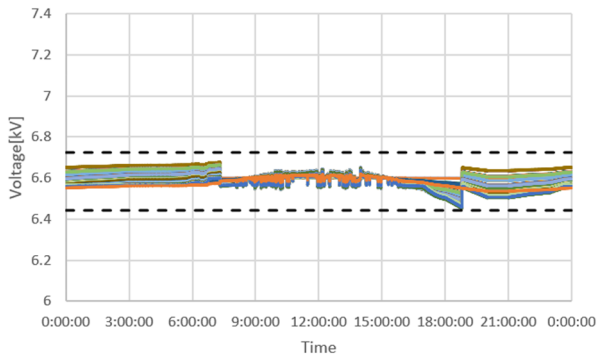
— SVR1



(e) PV 40%

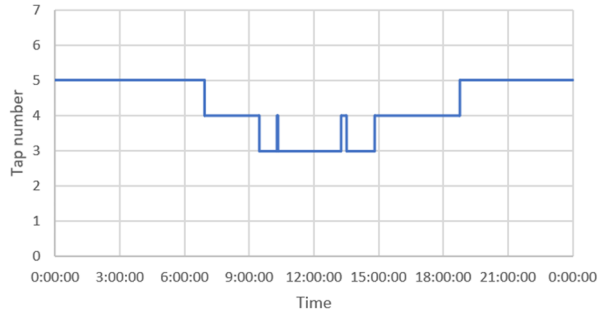
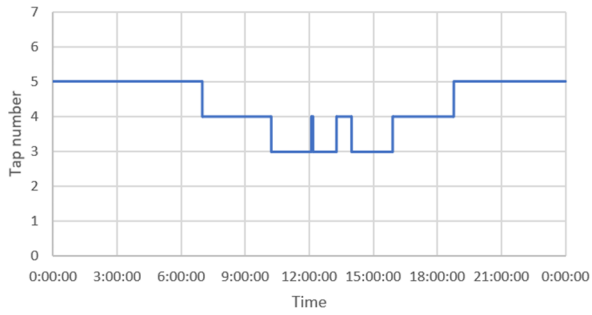
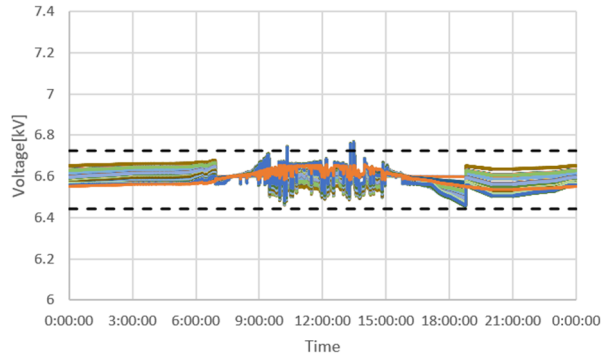
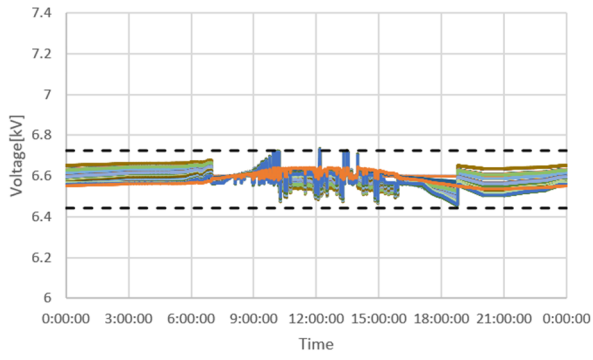
(f) PV 50%





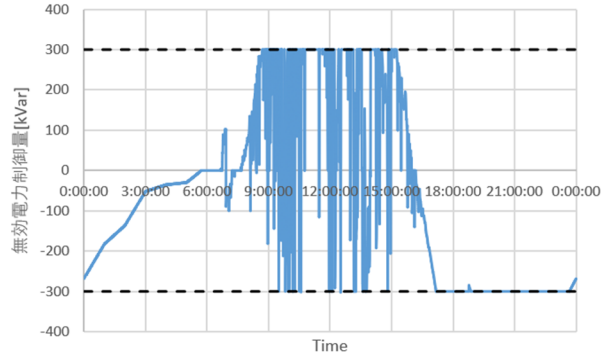
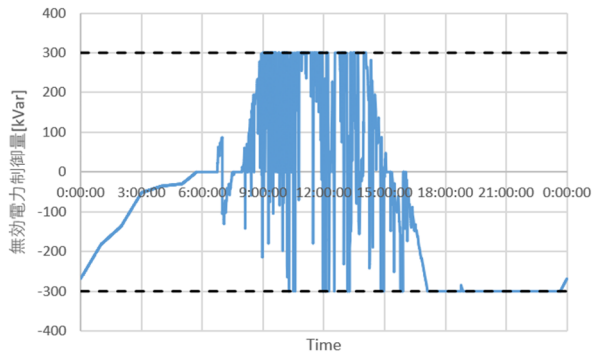
(g) PV 60%

(h) PV 70%



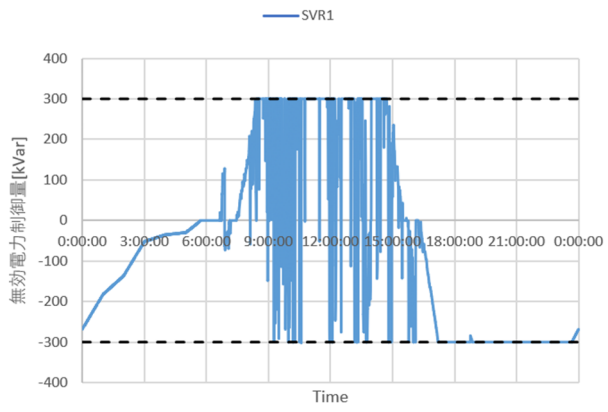
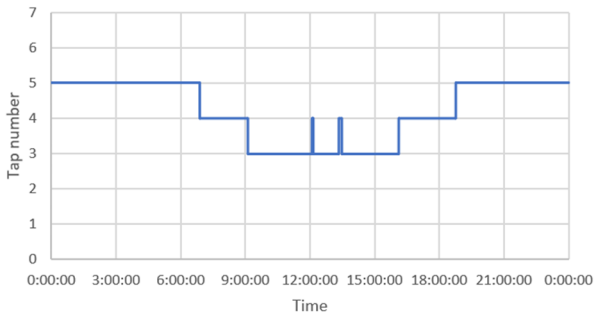
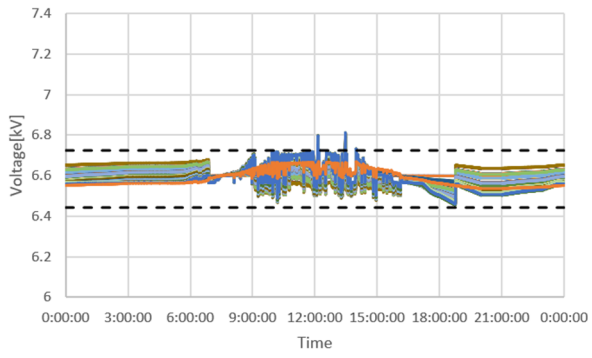
— SVR1

— SVR1



(i) PV 80%

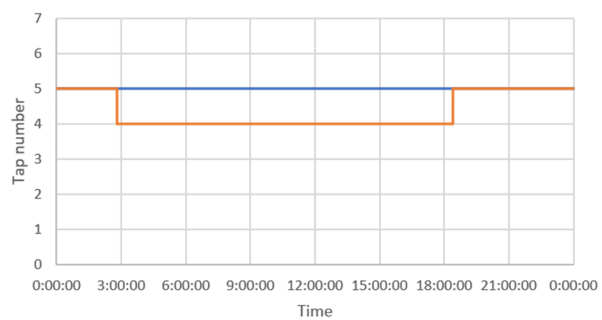
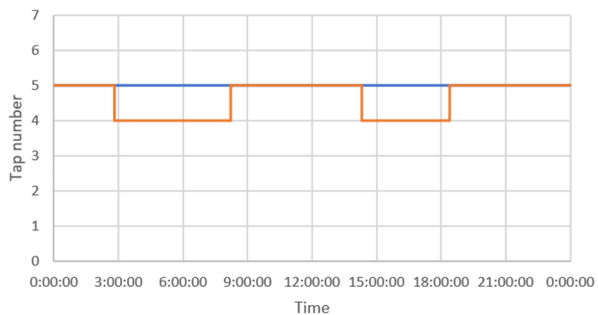
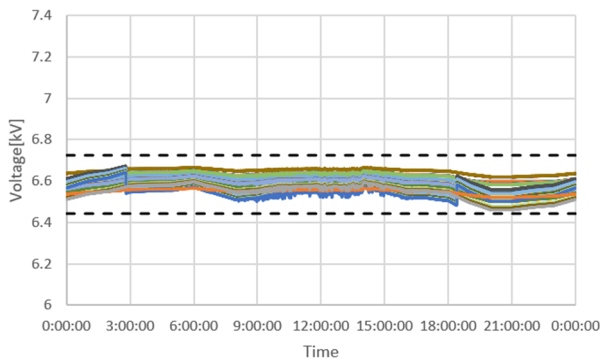
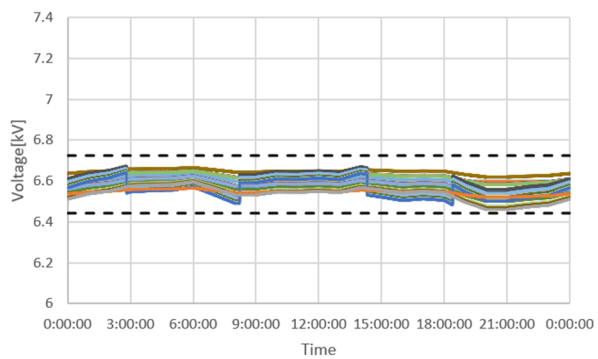
(j) PV 90%



(k) PV 100%

OD21 系統, PV 力率 0.95, 分散配置, SVR-SVR

(上 : 電圧分布, 下 : タップ位置)

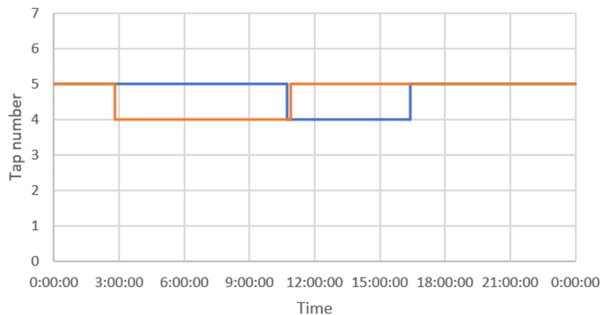
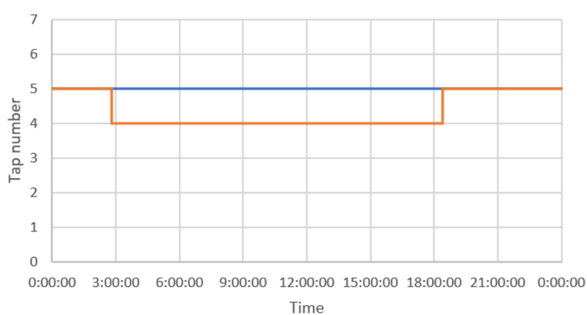
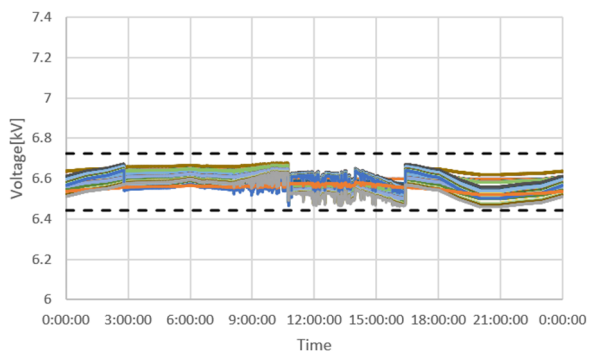
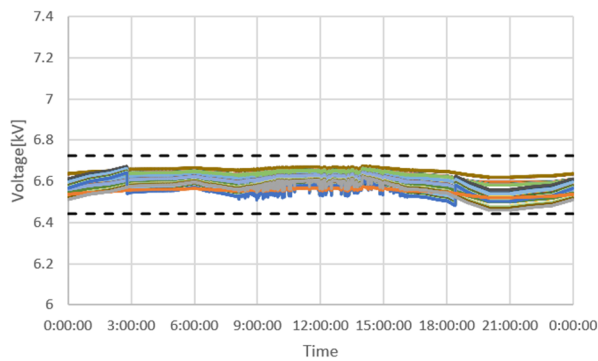


— SVR1 — SVR2

— SVR1 — SVR2

(a) PV 0%

(b) PV 10%

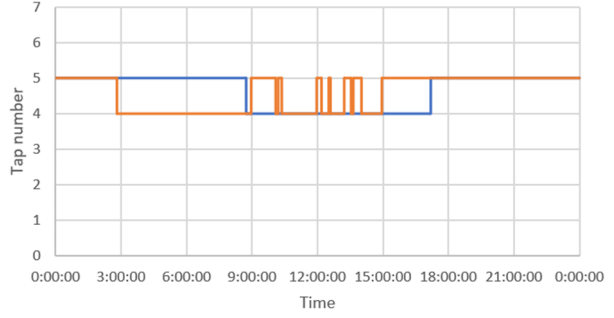
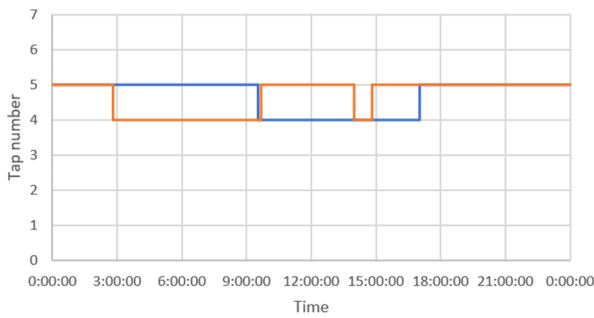
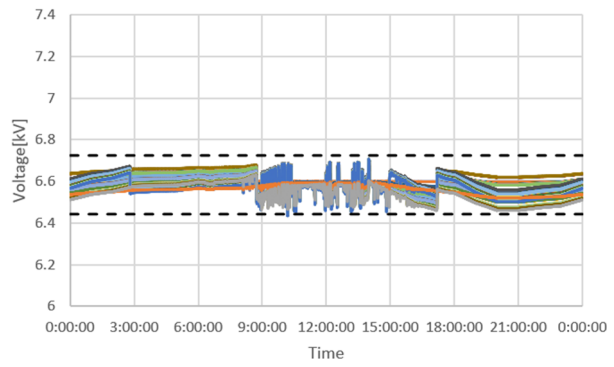
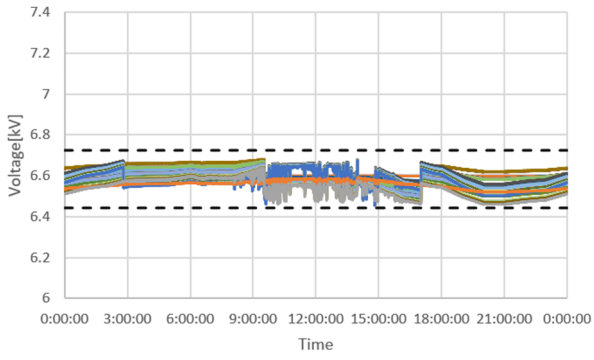


— SVR1 — SVR2

— SVR1 — SVR2

(c) PV 20%

(d) PV 30%

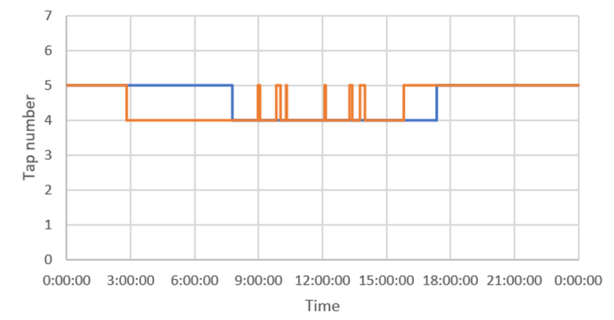
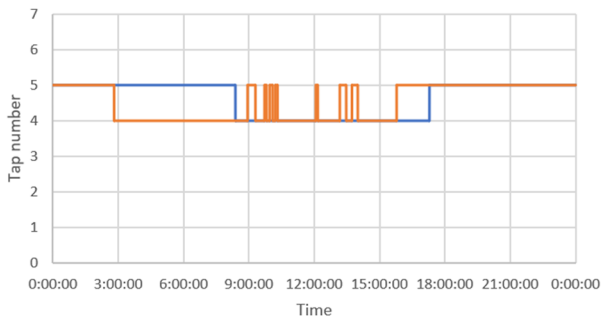
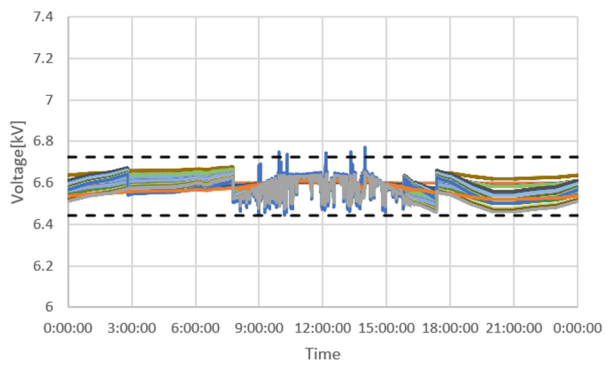
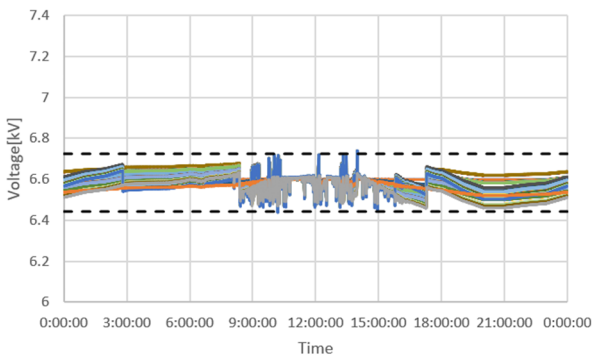


— SVR1 — SVR2

(e) PV 40%

— SVR1 — SVR2

(f) PV 50%

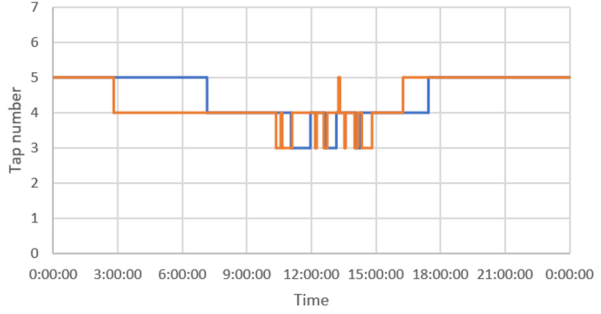
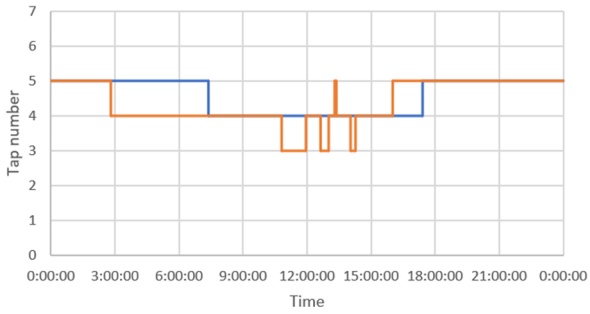
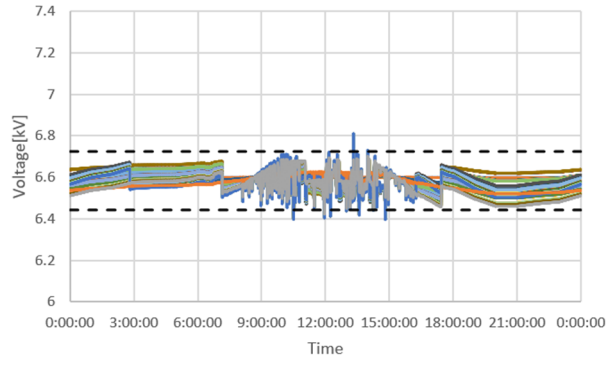
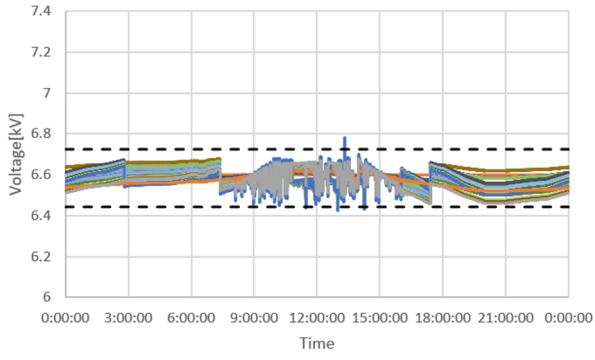


— SVR1 — SVR2

(g) PV 60%

— SVR1 — SVR2

(h) PV 70%

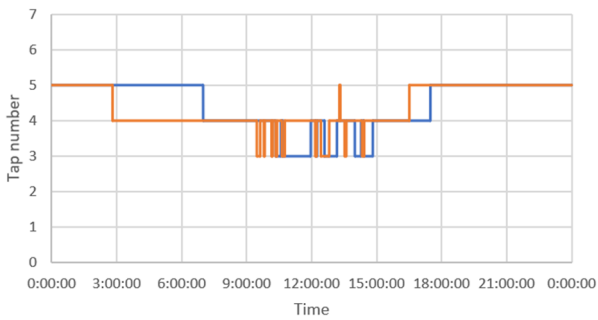
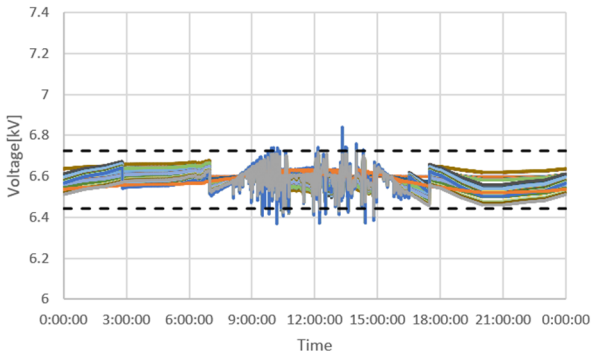


— SVR1 — SVR2

(i) PV 80%

— SVR1 — SVR2

(j) PV 90%

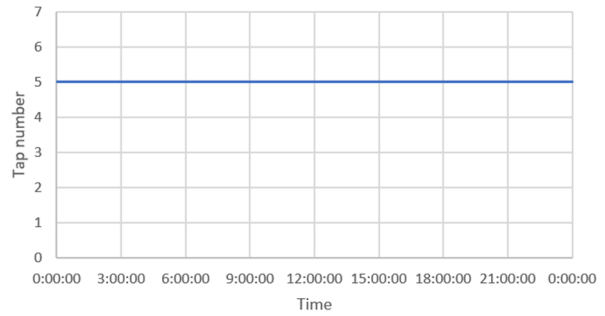
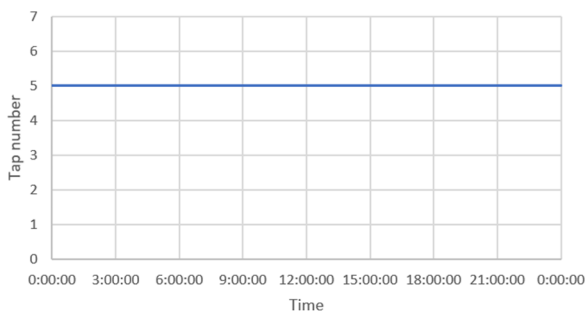
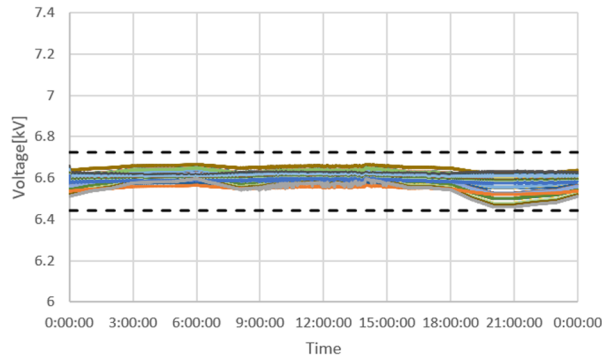
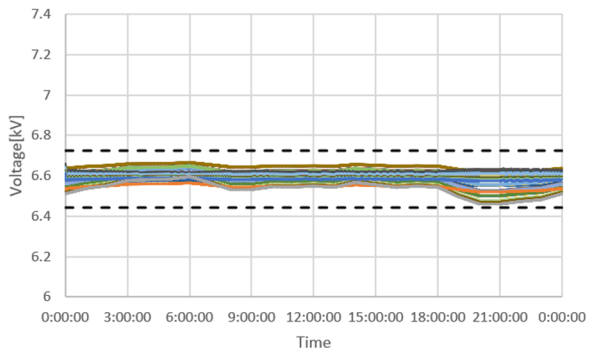


— SVR1 — SVR2

(k) PV 100%

OD21 系統, PV 力率 0.95, 分散配置, SVR-TVV

(上: 電圧分布, 下: タップ位置)

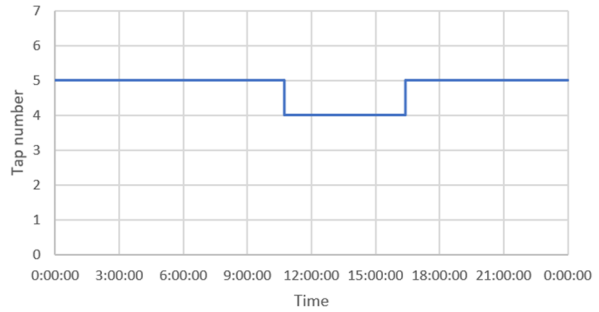
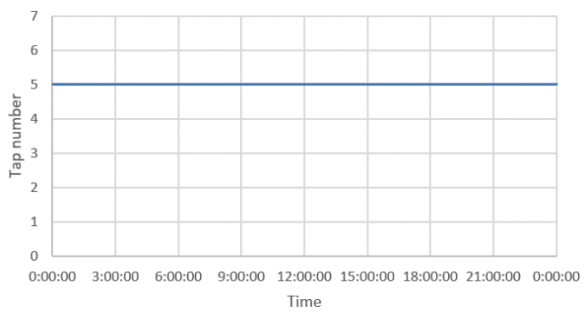
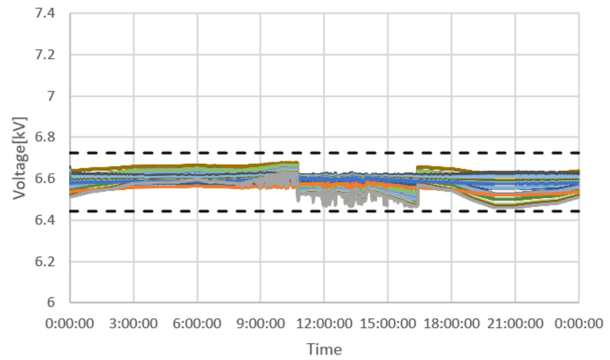
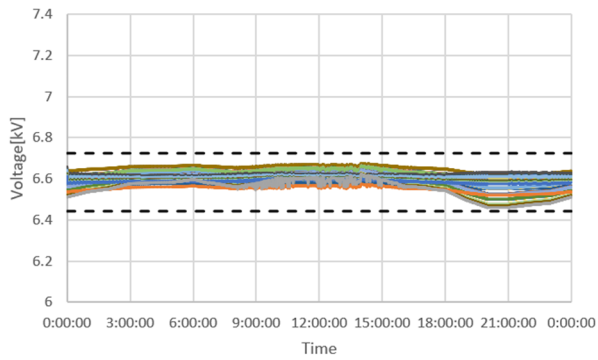


— SVR1

— SVR1

(a) PV 0%

(b) PV 10%

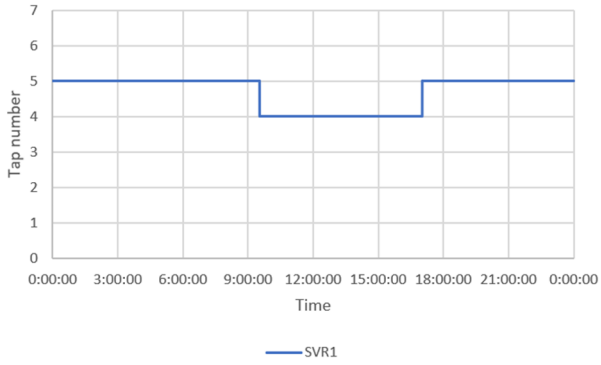
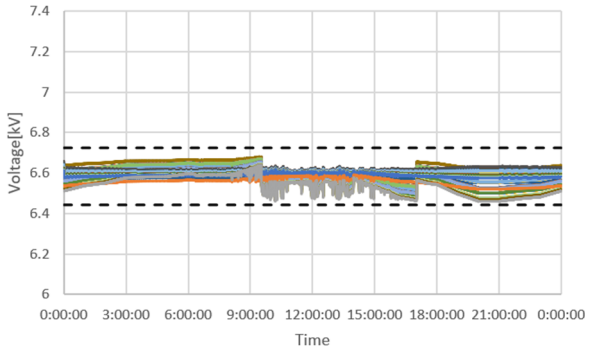


— SVR1

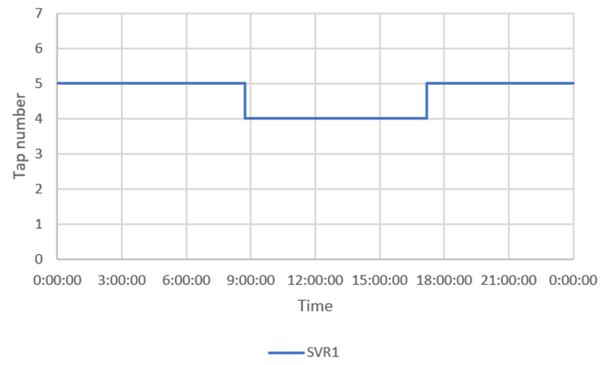
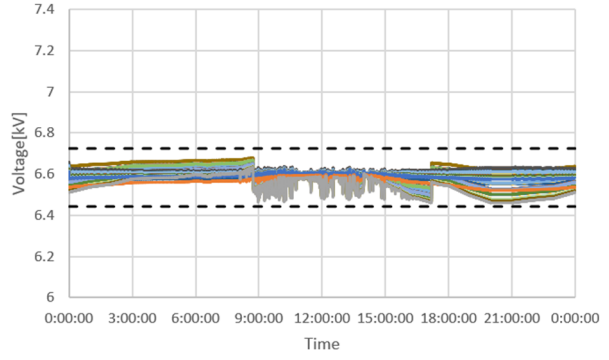
— SVR1

(c) PV 20%

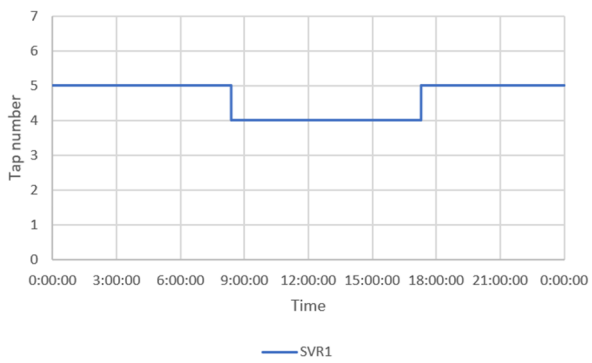
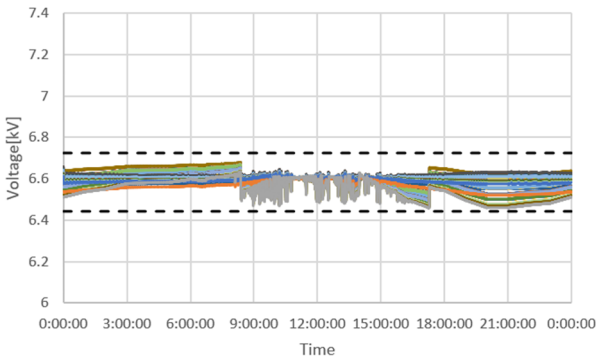
(d) PV 30%



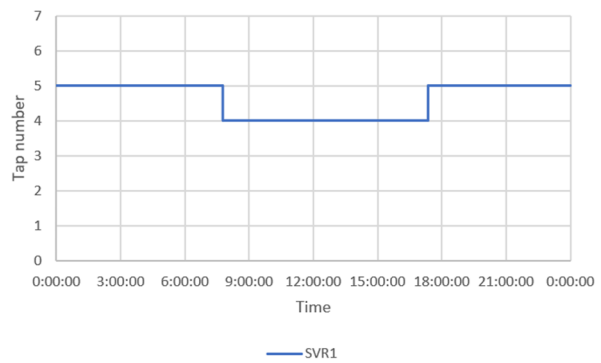
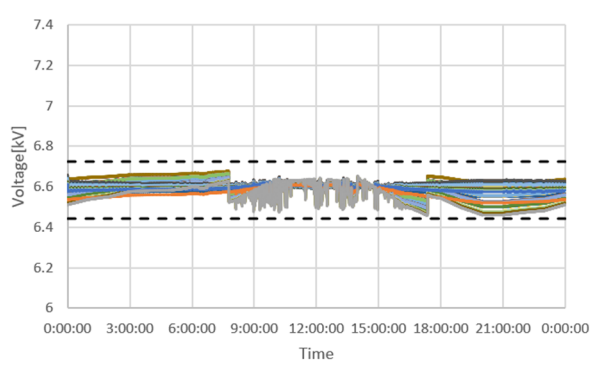
(e) PV 40%



(f) PV 50%

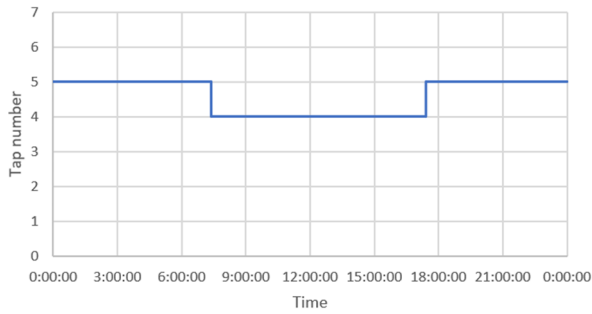
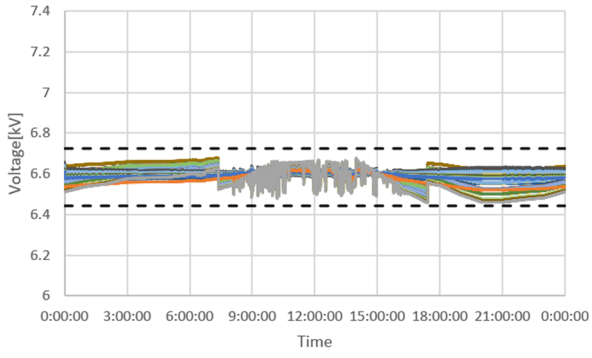


(g) PV 60%



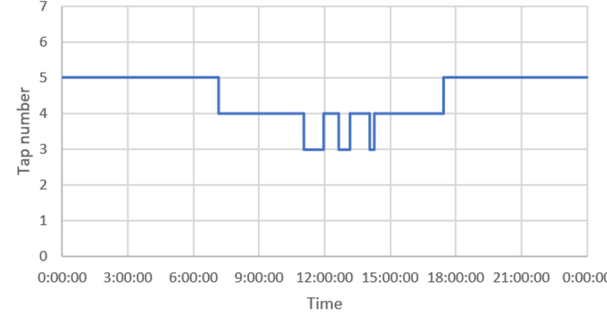
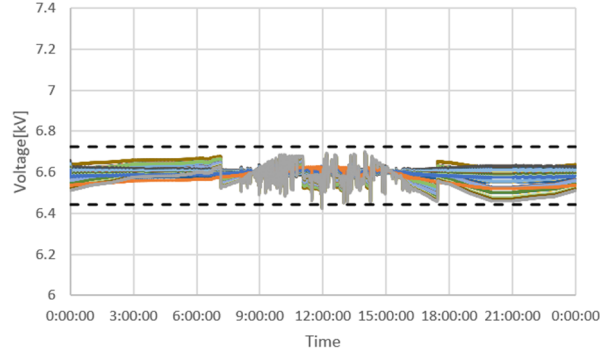
(h) PV 70%





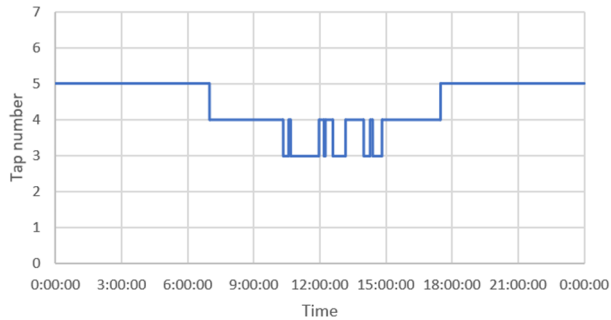
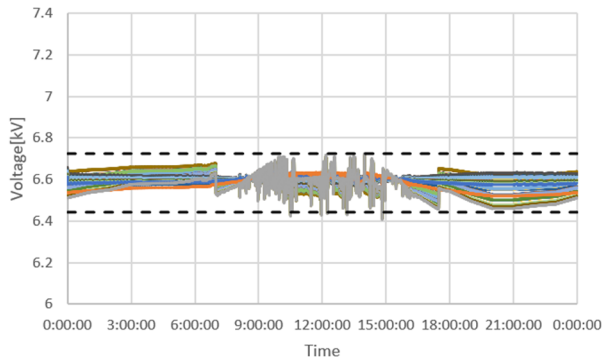
— SVR1

(i) PV 80%



— SVR1

(j) PV 90%

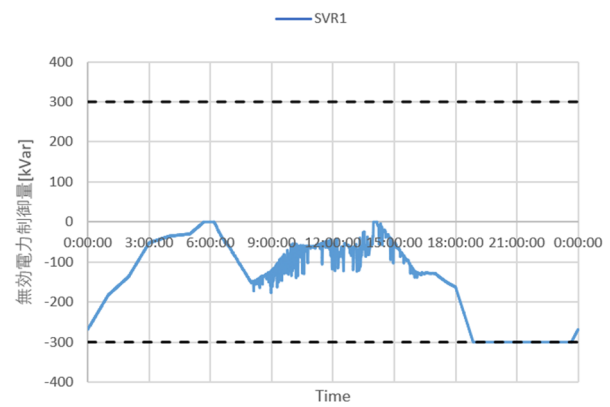
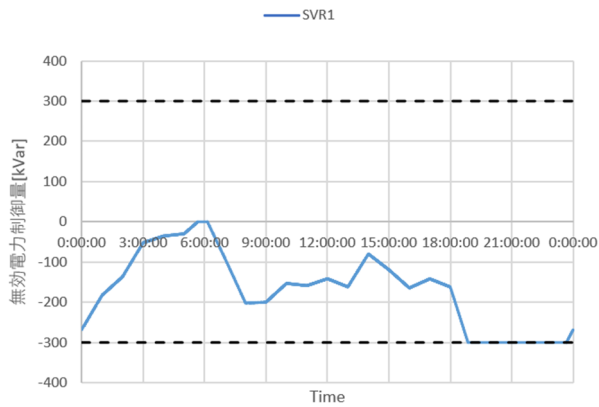
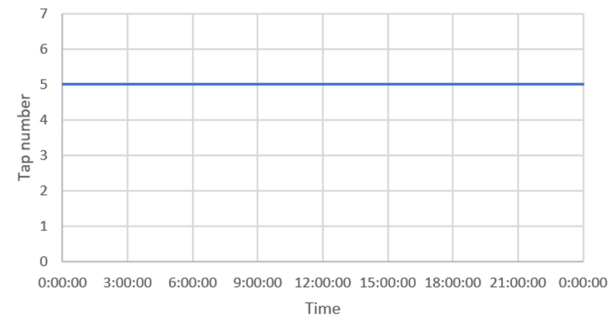
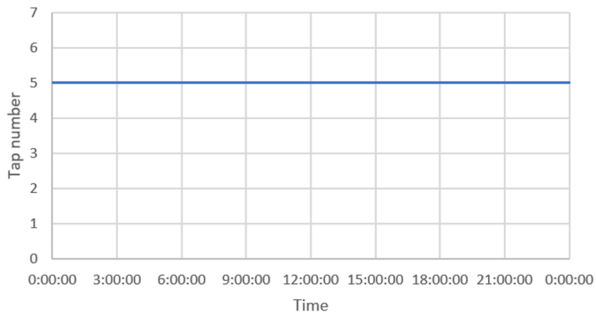
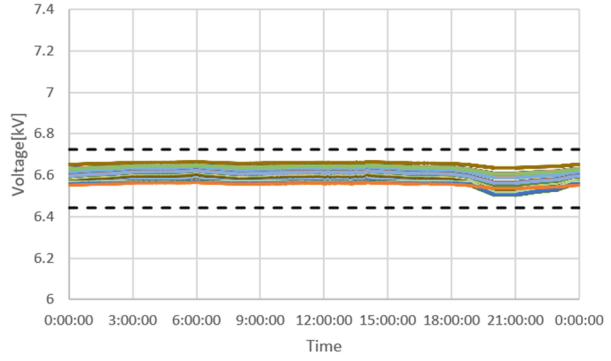
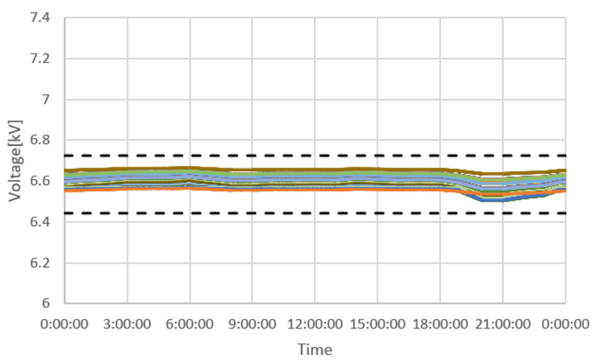


— SVR1

(k) PV 100%

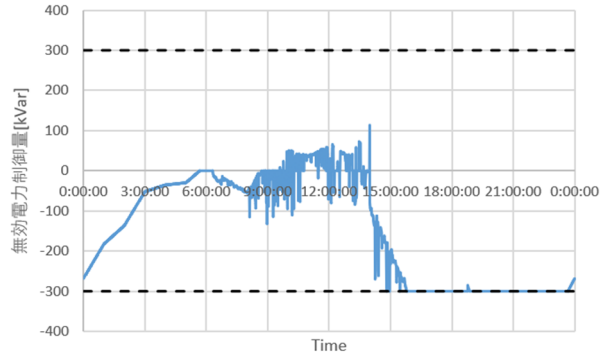
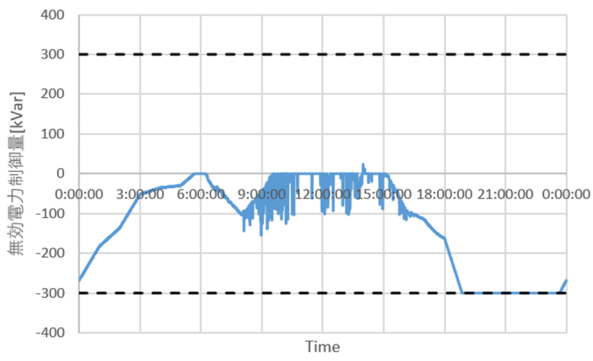
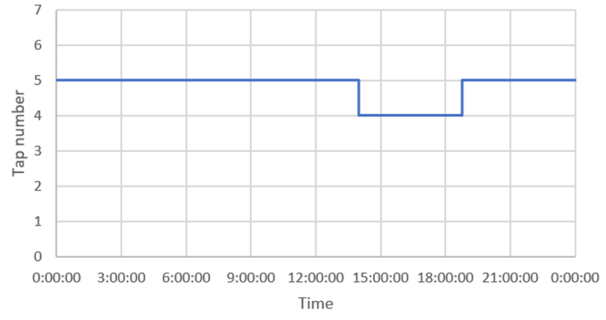
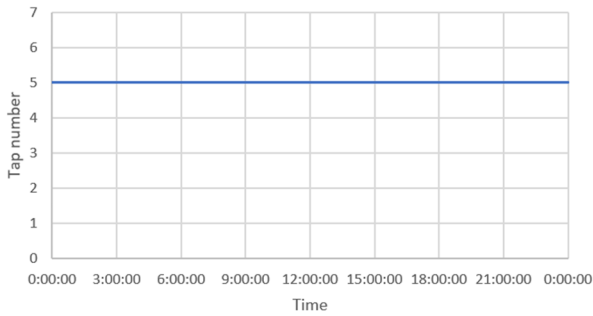
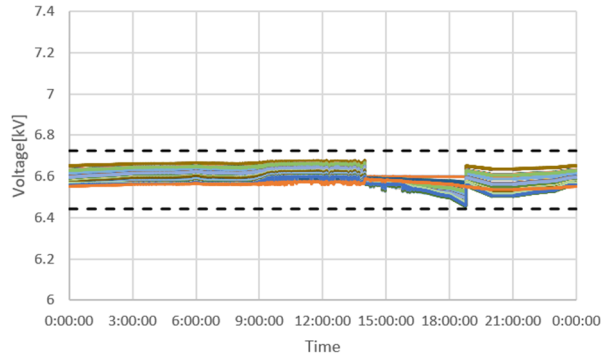
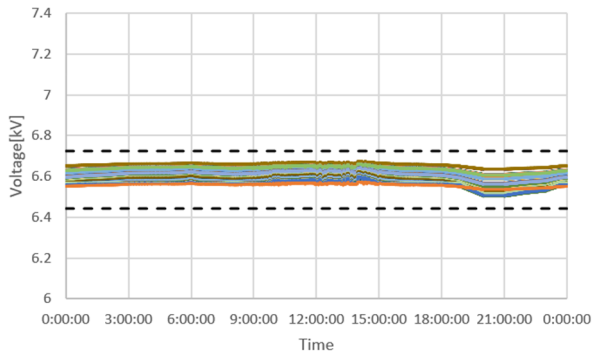
OD21 系統, PV 力率 0.95, 分散配置, SVR-SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



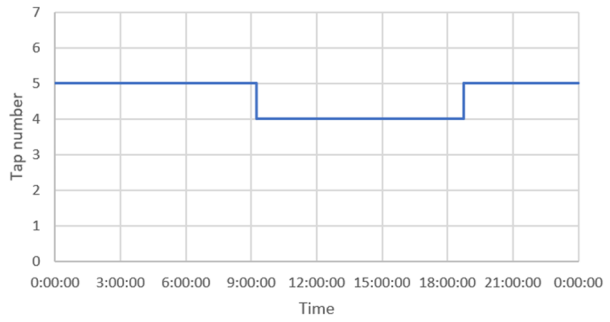
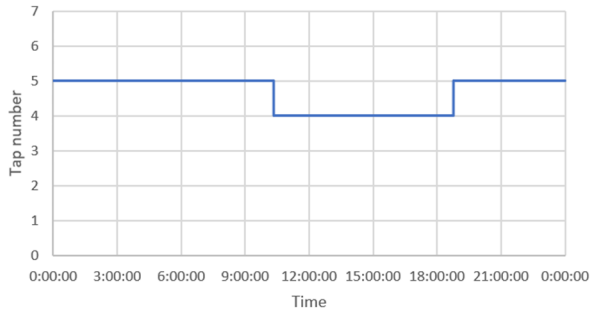
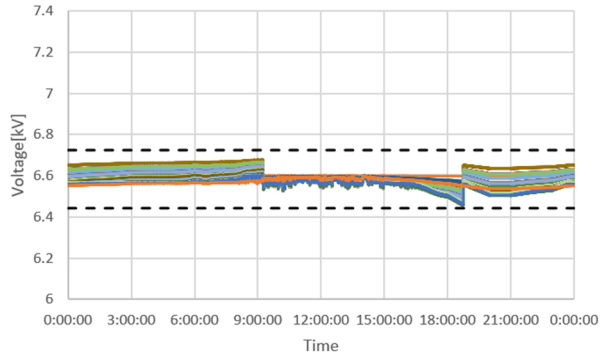
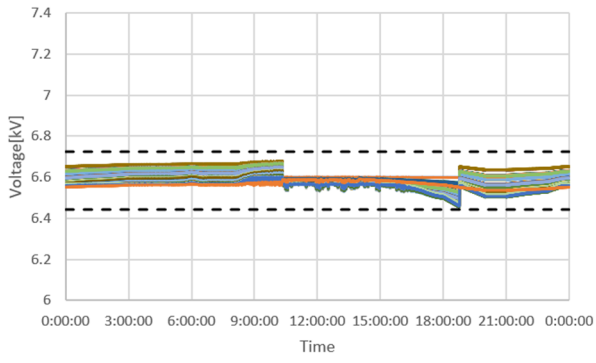
(a) PV 0%

(b) PV 10%



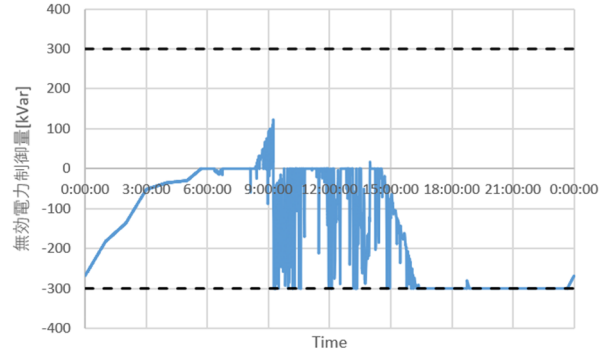
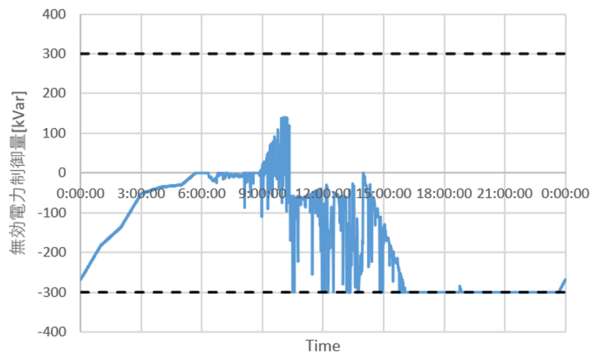
(c) PV 20%

(d) PV 30%



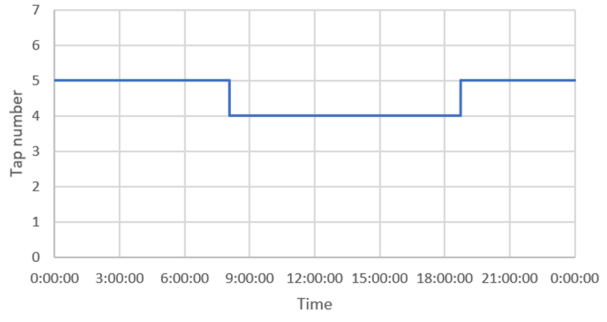
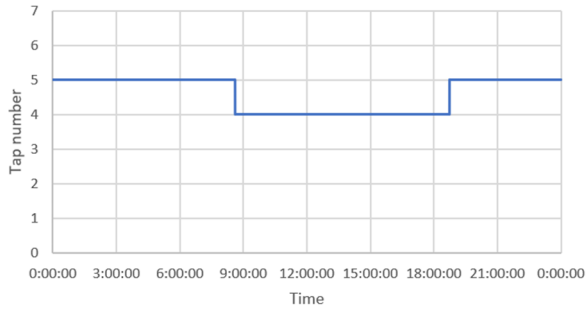
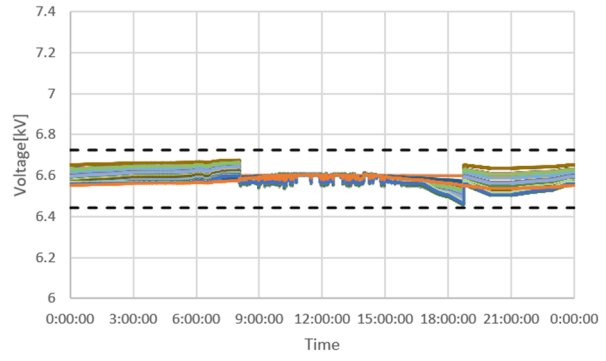
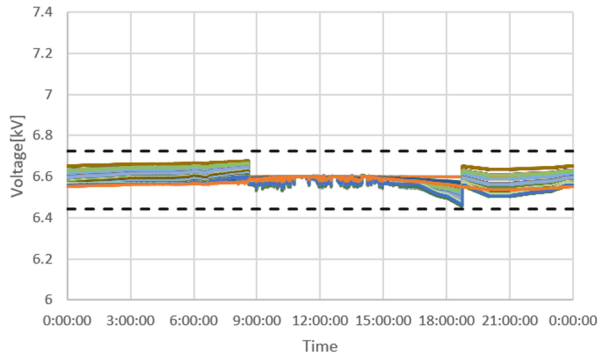
— SVR1

— SVR1



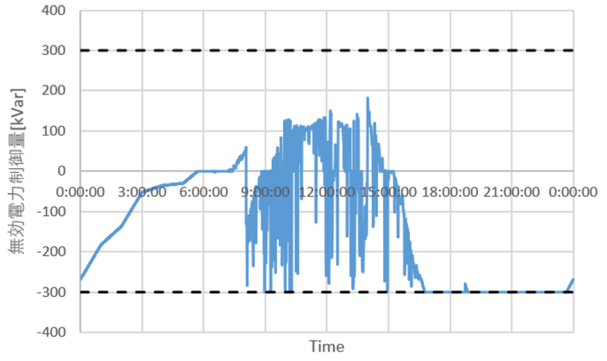
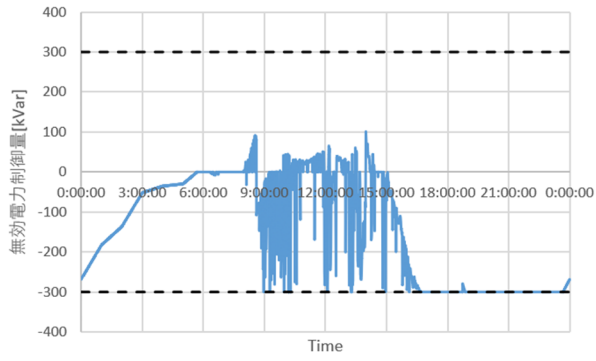
(e) PV 40%

(f) PV 50%



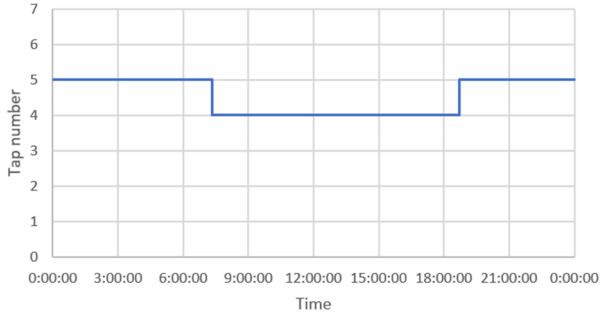
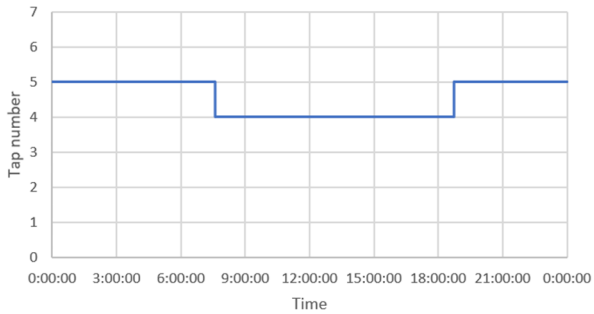
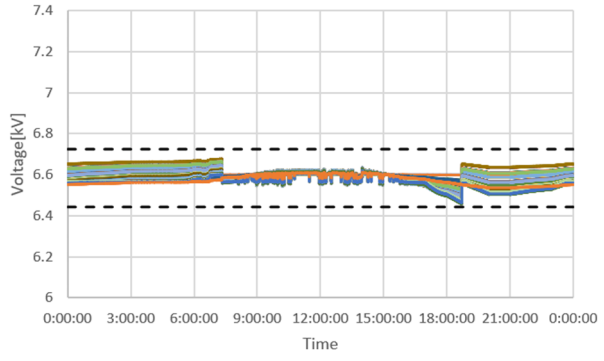
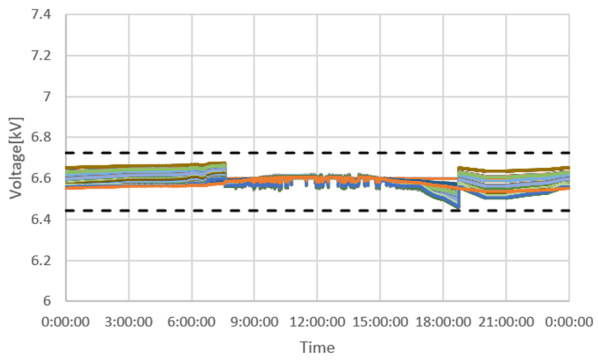
— SVR1

— SVR1



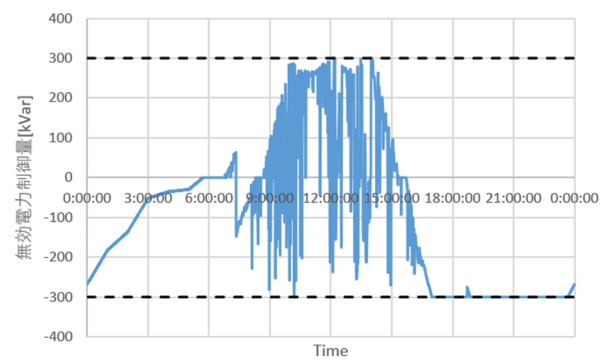
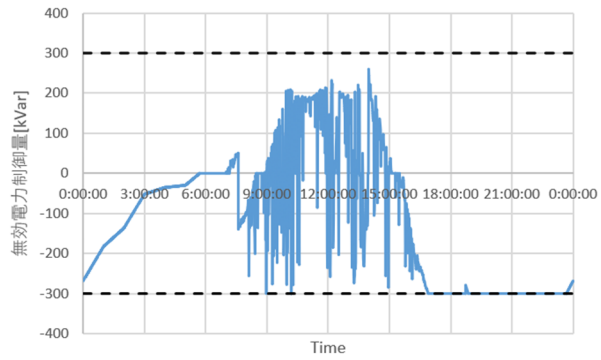
(g) PV 60%

(h) PV 70%



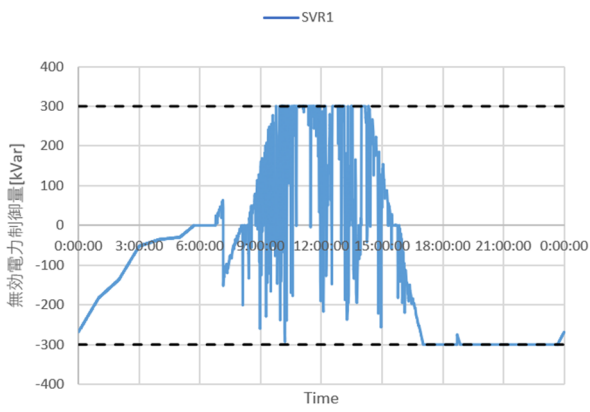
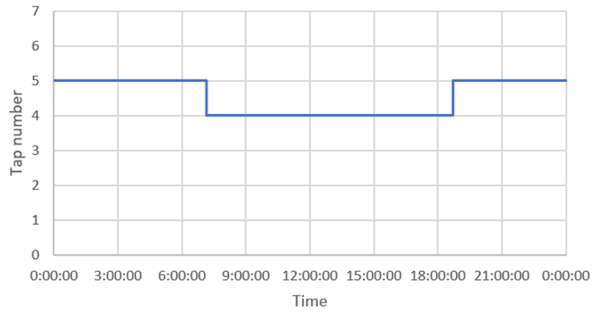
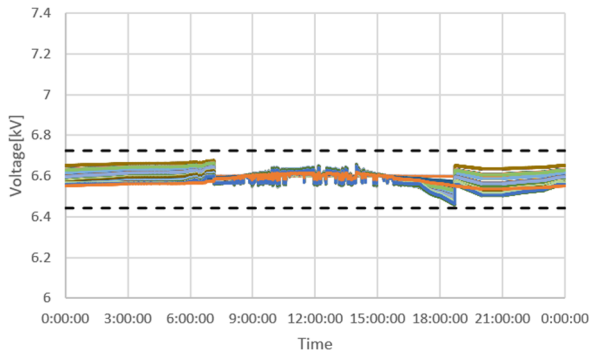
— SVR1

— SVR1



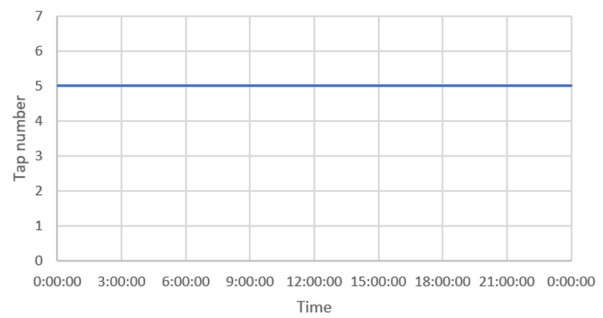
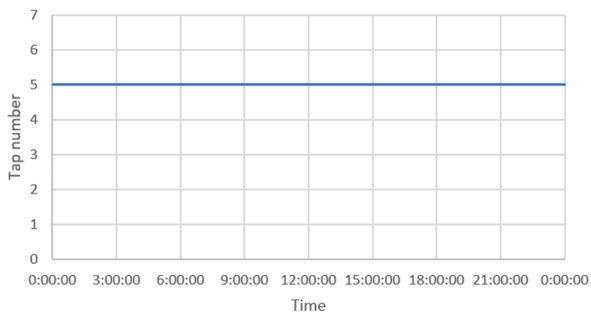
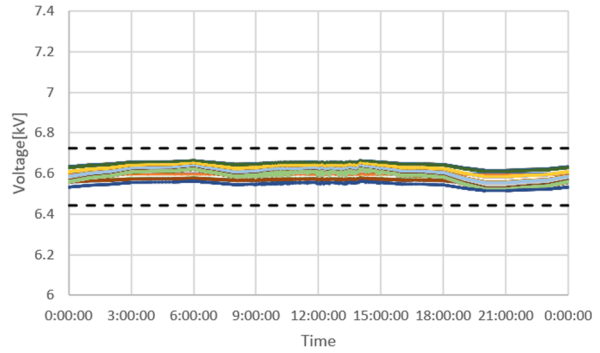
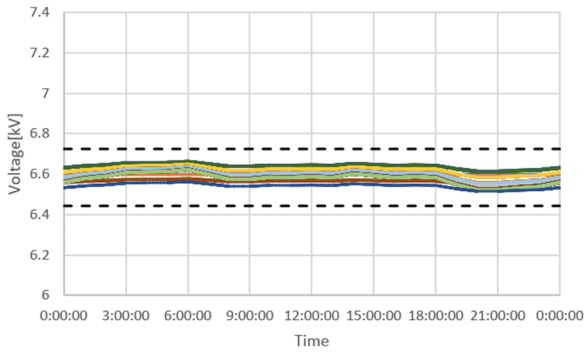
(i) PV 80%

(j) PV 90%



(k) PV 100%

OC2 系統, PV 力率 1.0, 分散配置, SVR  
 (上: 電圧分布, 下: タップ位置)

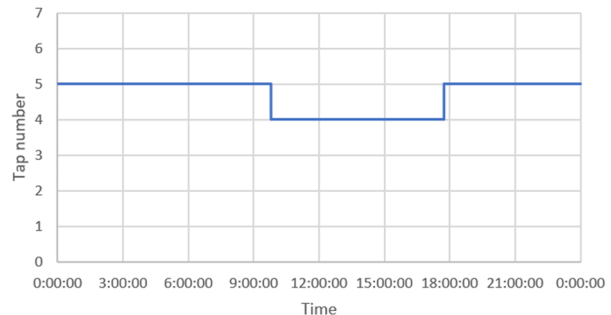
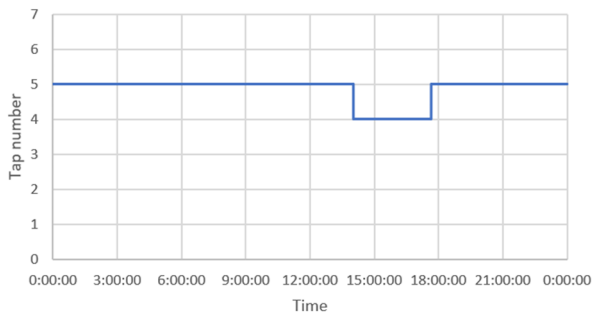
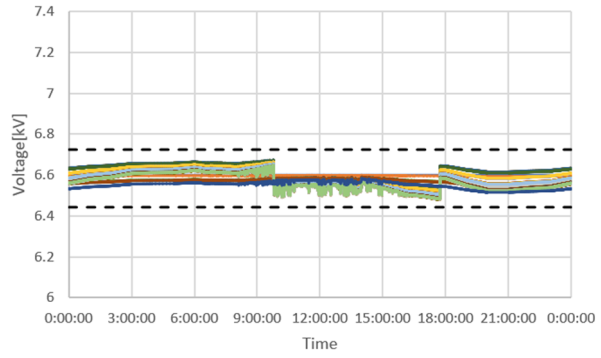
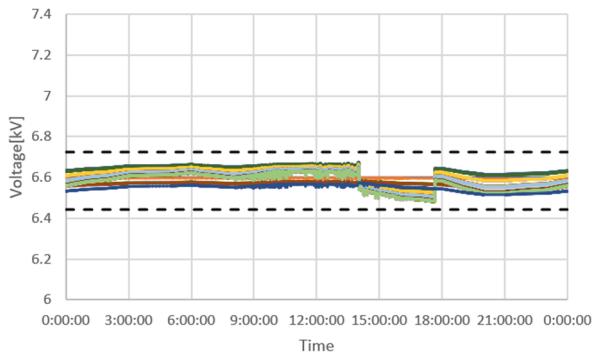


— SVR1

— SVR1

(a) PV 0%

(b) PV 10%



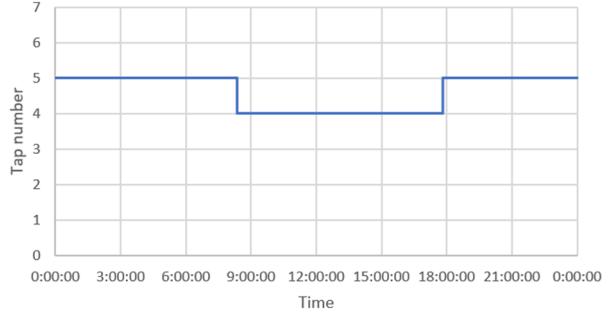
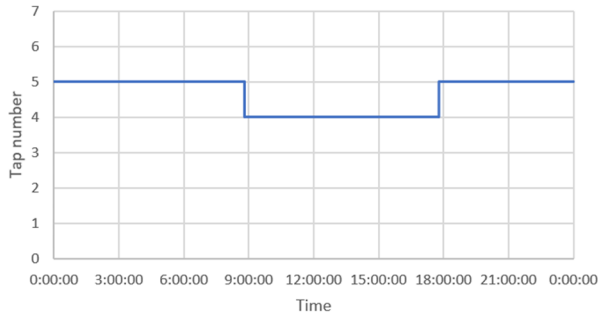
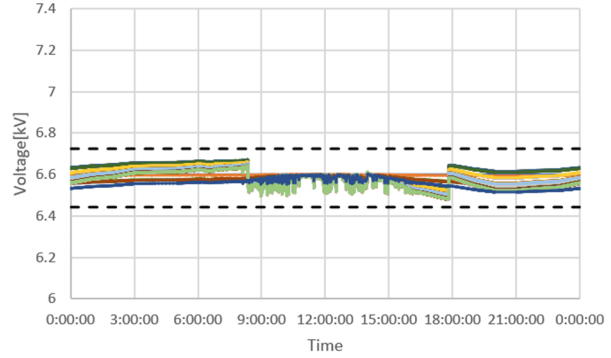
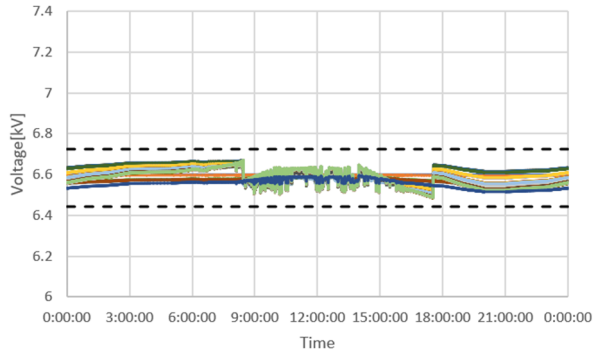
— SVR1

— SVR1

(c) PV 20%

(d) PV 30%



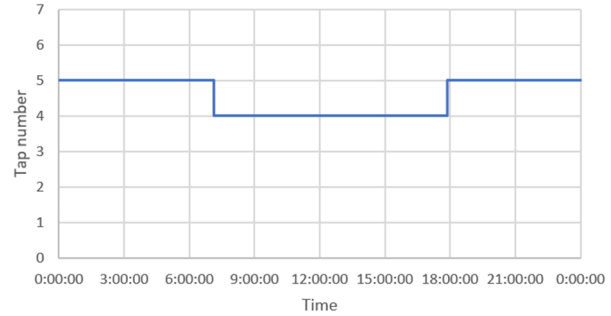
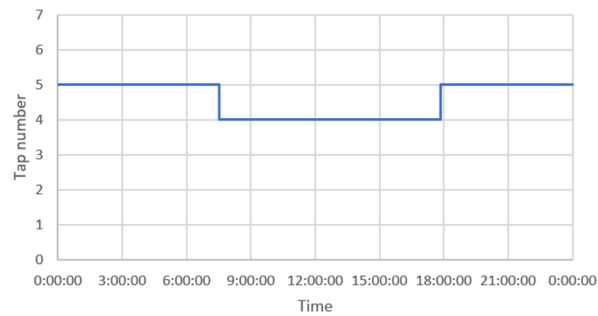
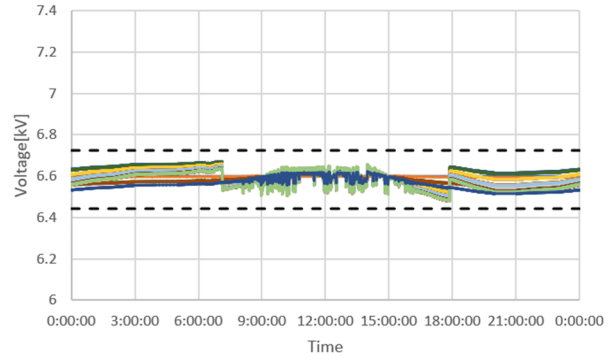
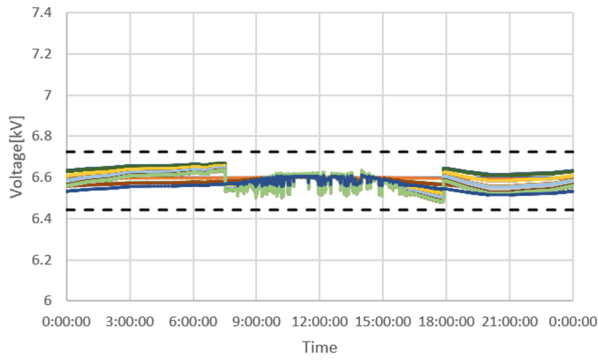


— SVR1

— SVR1

(e) PV 40%

(f) PV 50%

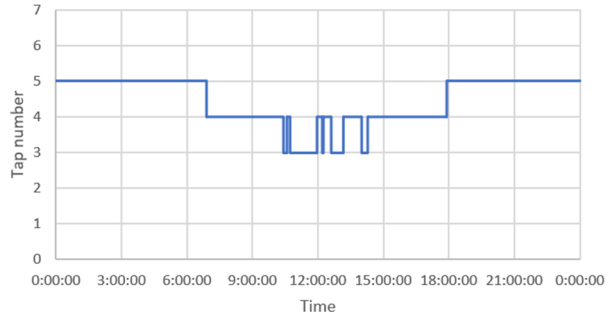
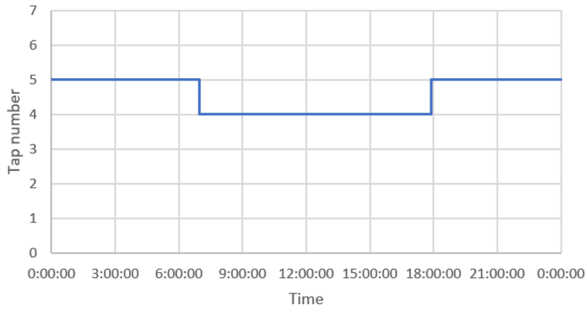
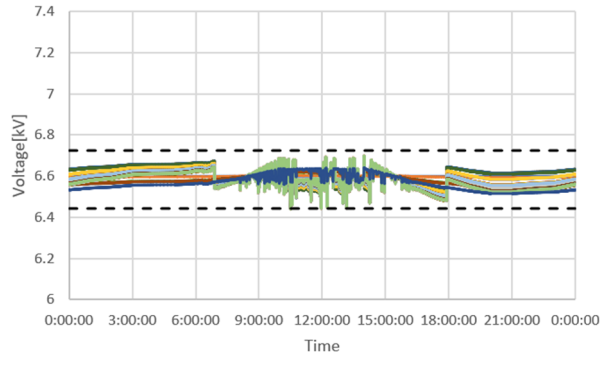
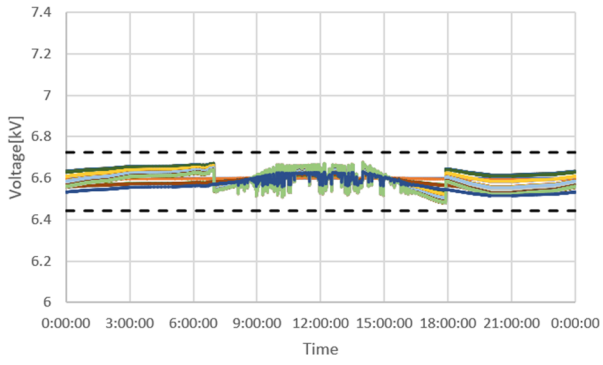


— SVR1

— SVR1

(g) PV 60%

(h) PV 70%

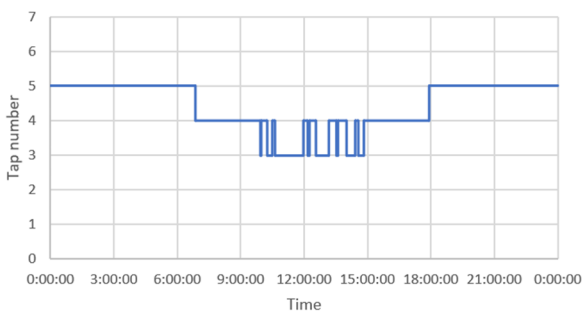
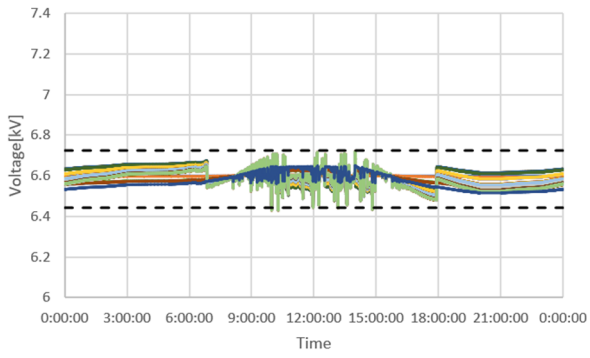


— SVR1

— SVR1

(i) PV 80%

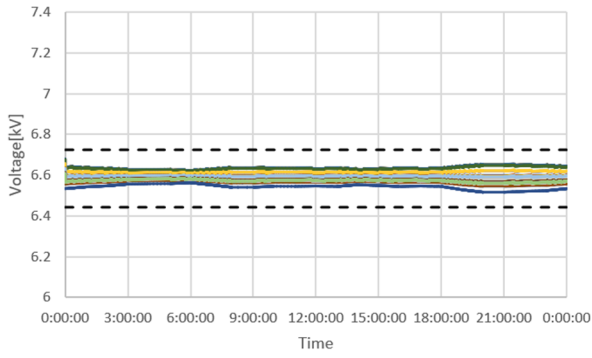
(j) PV 90%



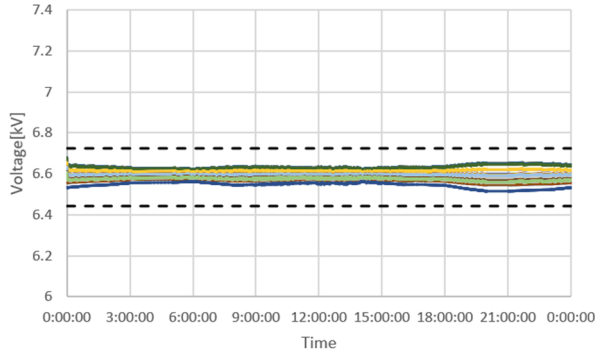
— SVR1

(k) PV 100%

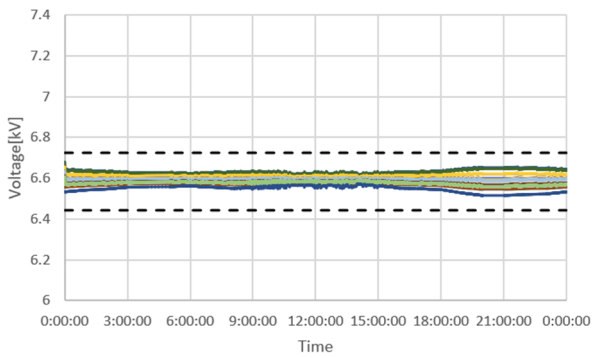
OC2 系統, PV 力率 1.0, 分散配置, TVR  
 (上 : 電圧分布, 下 : タップ位置)



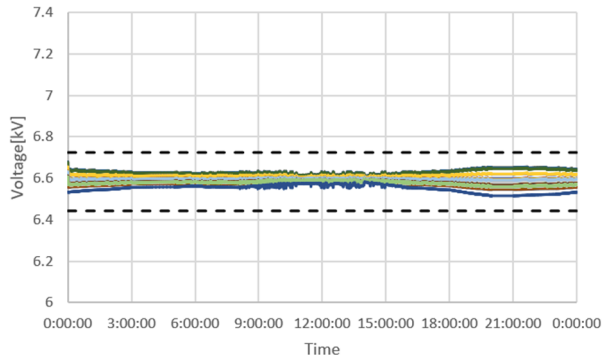
(a) PV 0%



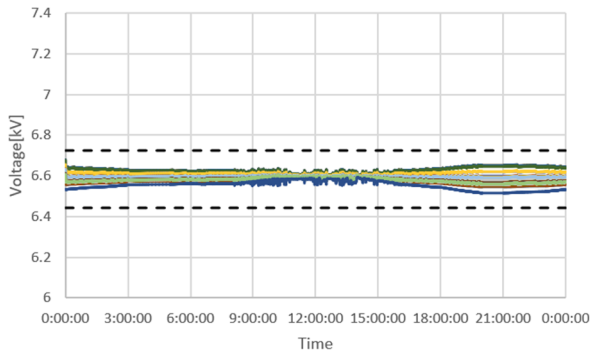
(b) PV 10%



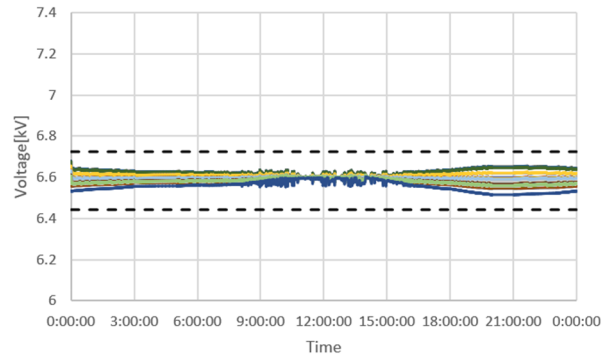
(c) PV 20%



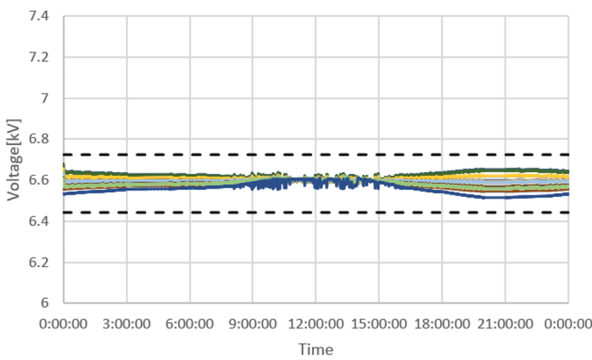
(d) PV 30%



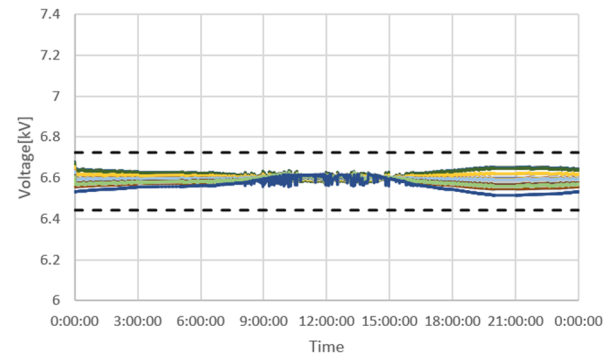
(e) PV 40%



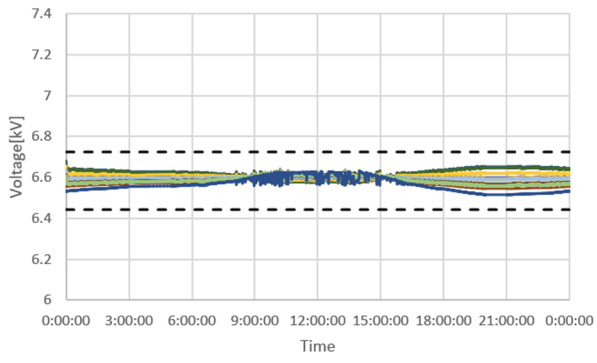
(f) PV 50%



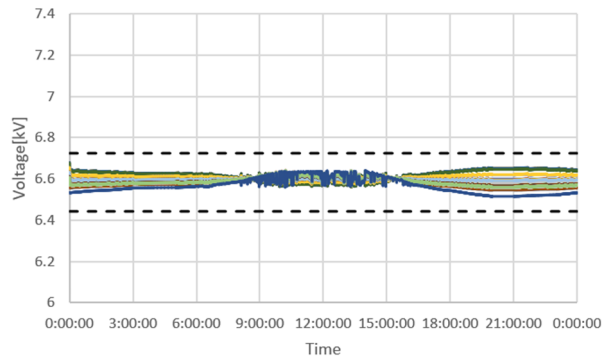
(g) PV 60%



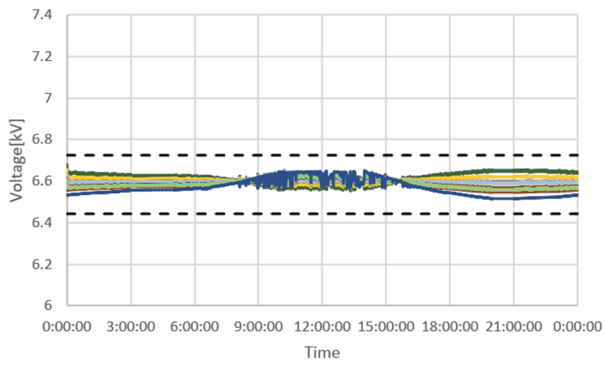
(h) PV 70%



(i) PV 80%



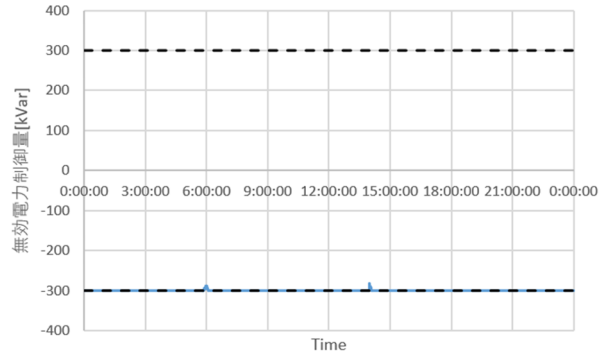
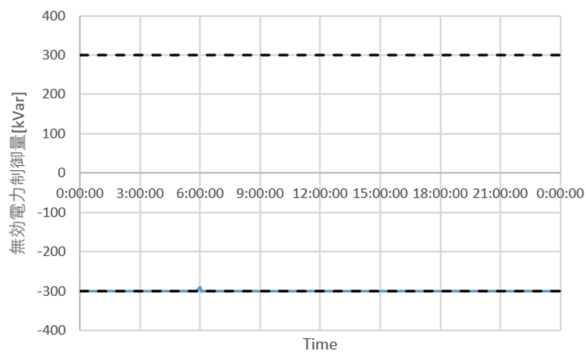
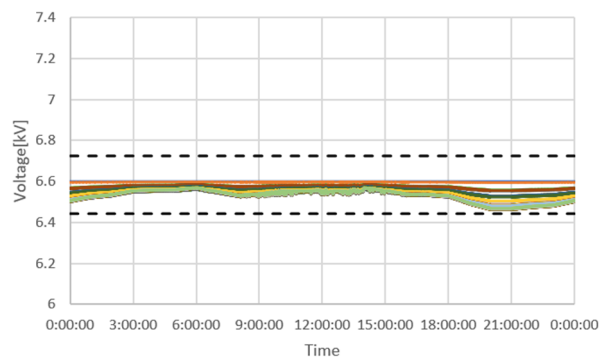
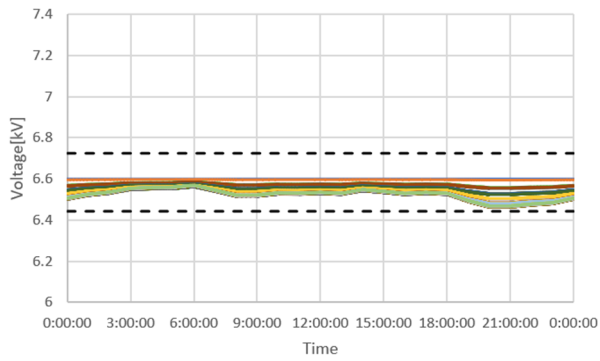
(j) PV 90%



(k) PV 100%

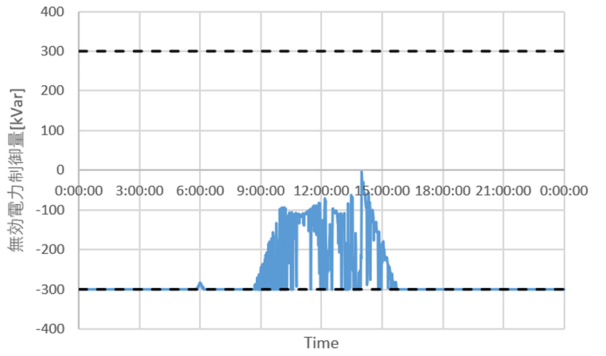
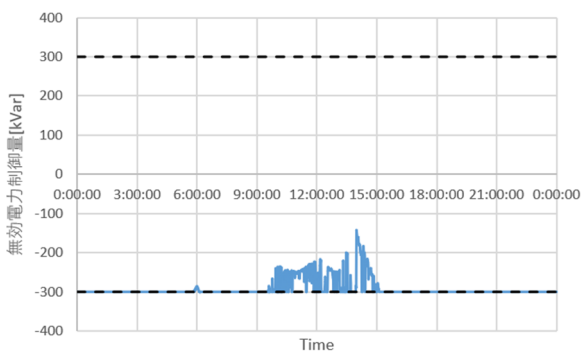
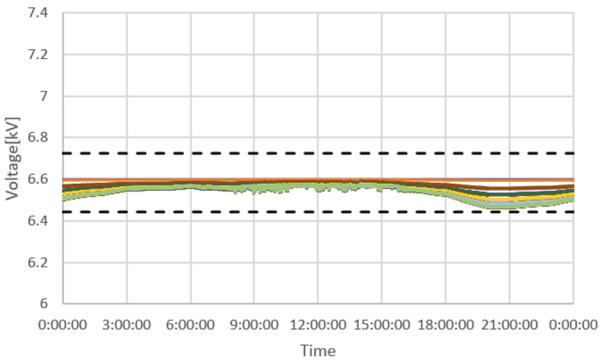
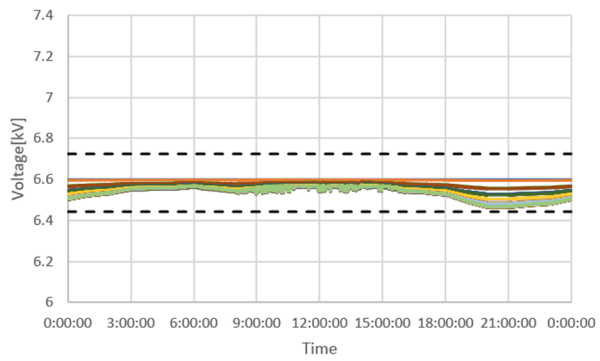
OC2 系統, PV 力率 1.0, 分散配置, SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



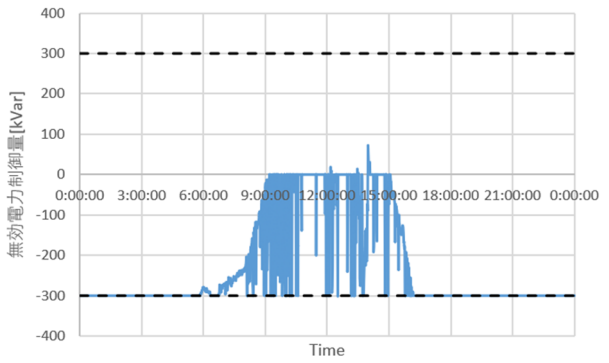
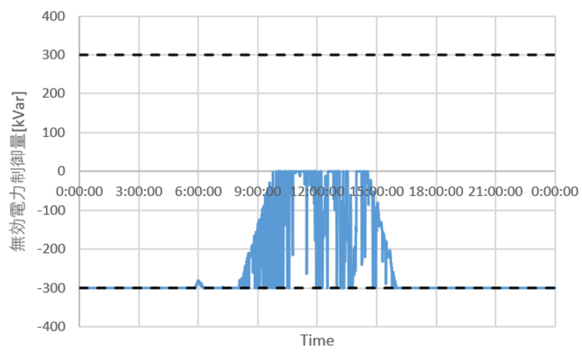
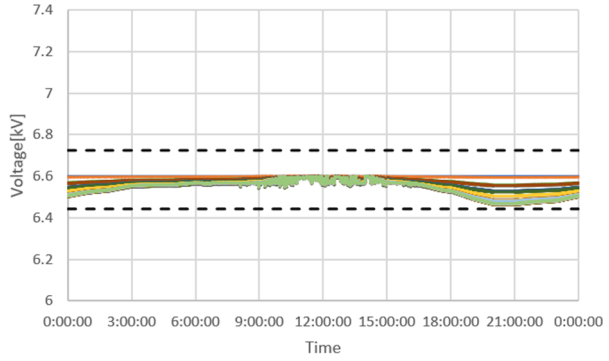
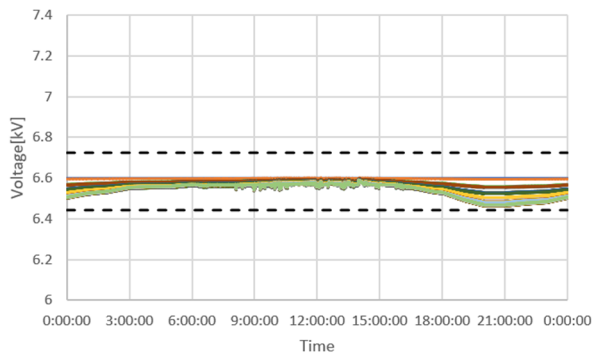
(a) PV 0%

(b) PV 10%



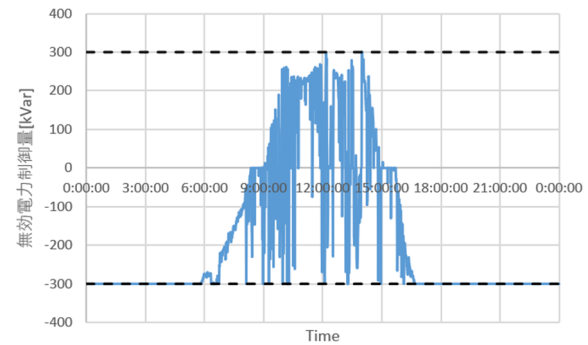
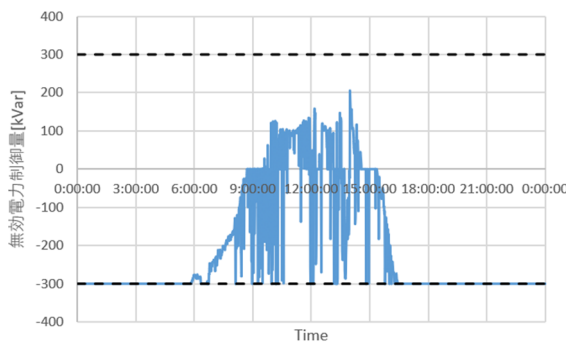
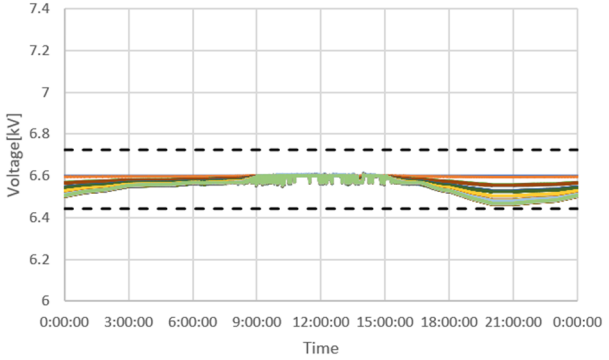
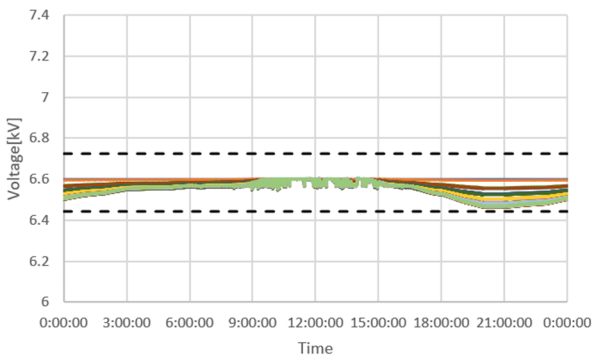
(c) PV 20%

(d) PV 30%



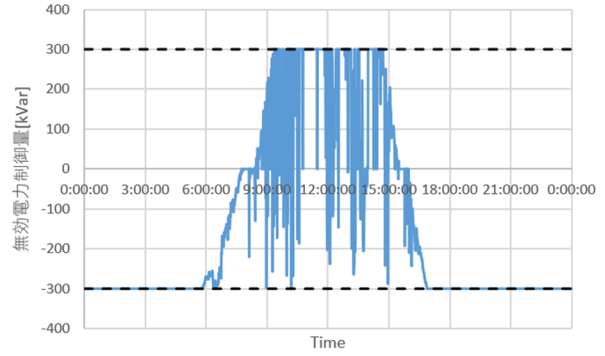
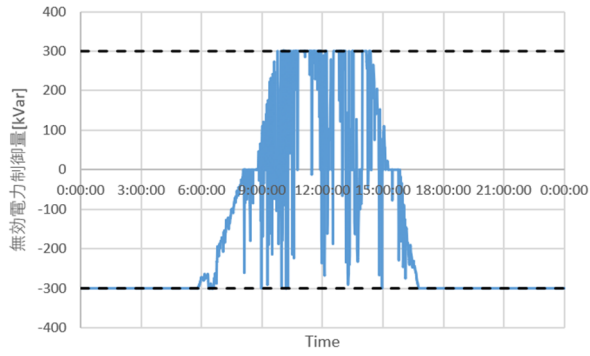
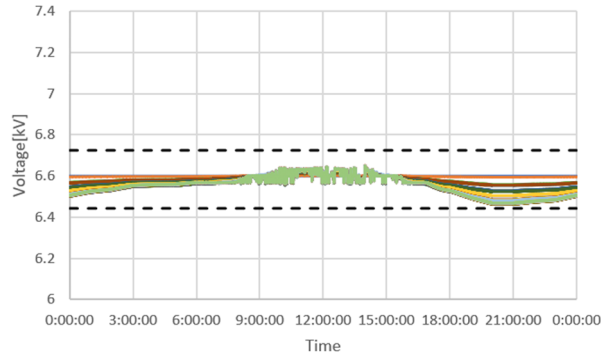
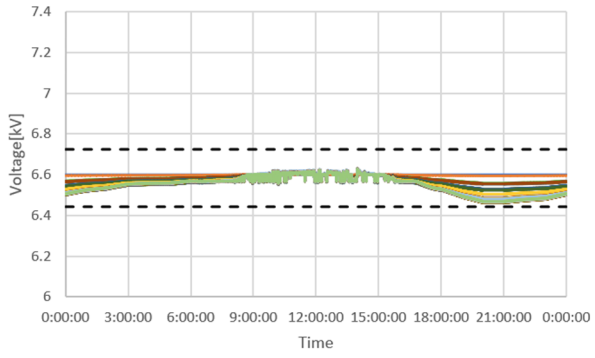
(e) PV 40%

(f) PV 50%



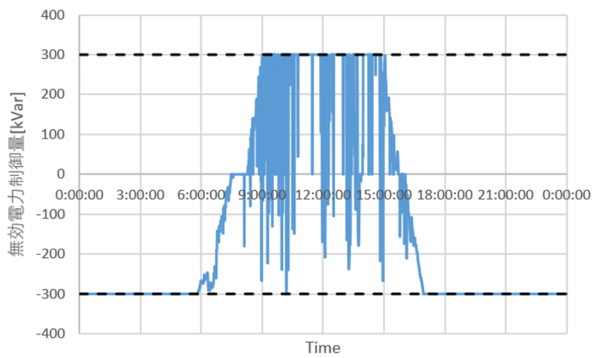
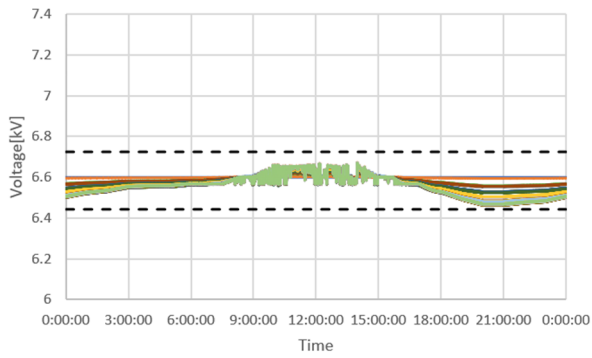
(g) PV 60%

(h) PV 70%



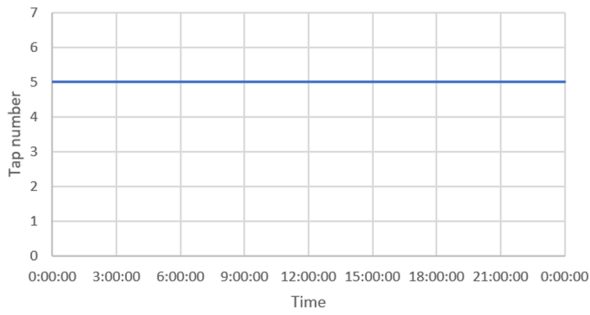
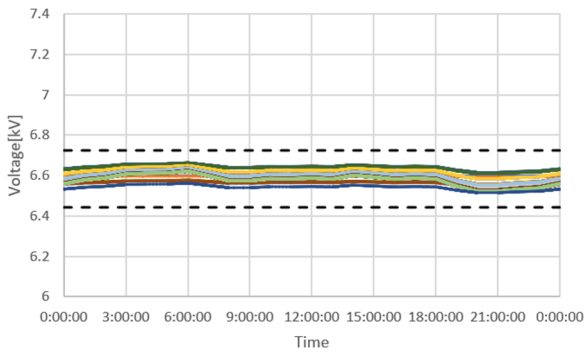
(i) PV 80%

(j) PV 90%



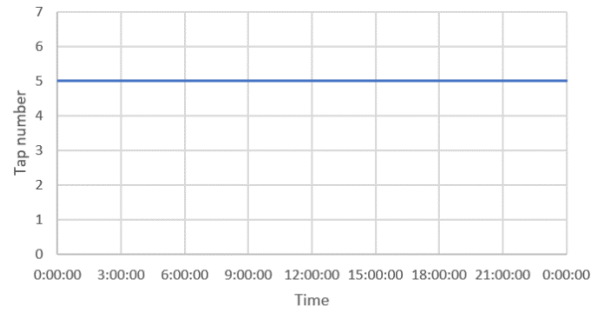
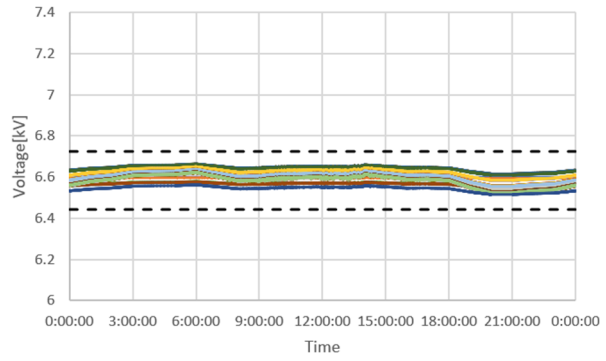
(k) PV 100%

OC2 系統, PV 力率 0.95, 分散配置, SVR  
 (上: 電圧分布, 下: タップ位置)



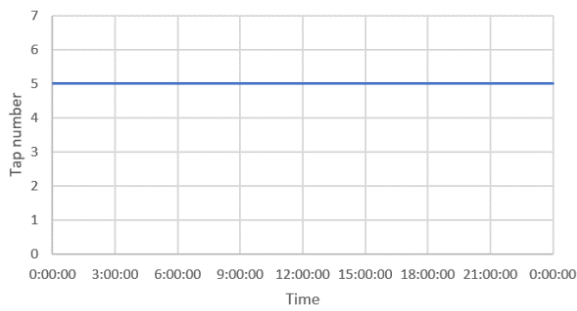
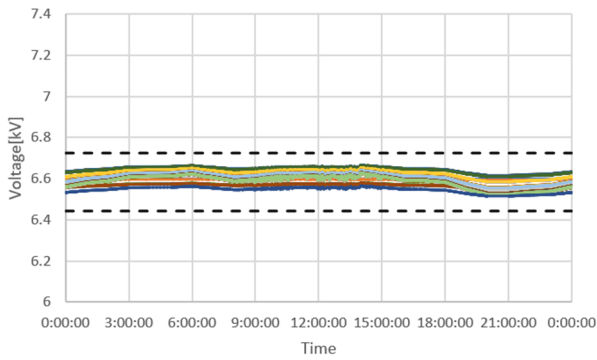
— SVR1

(a) PV 0%



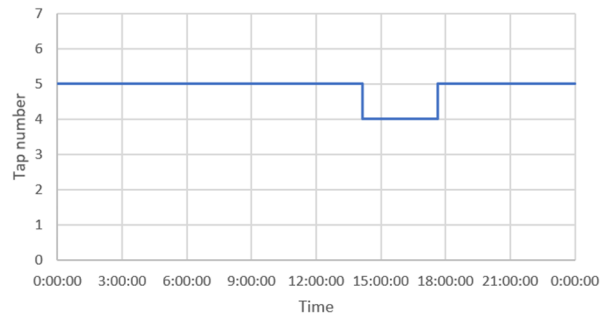
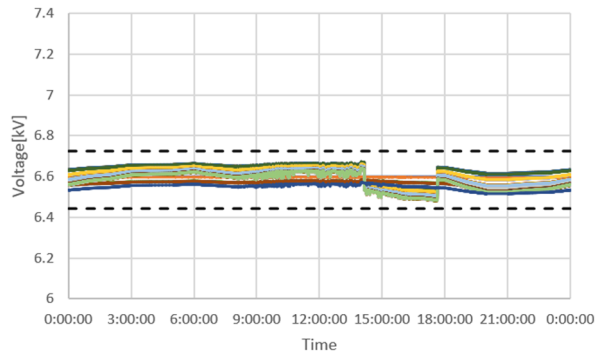
— SVR1

(b) PV 10%



— SVR1

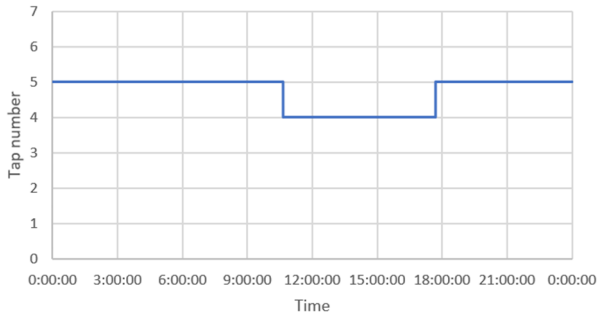
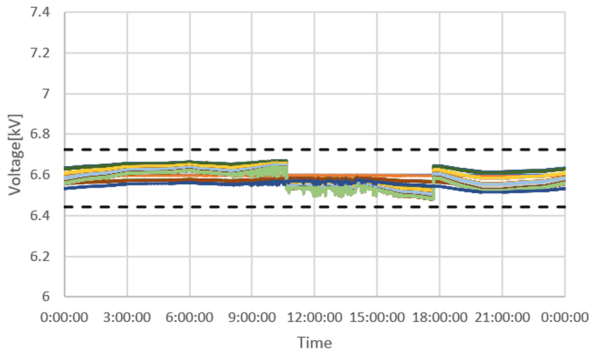
(c) PV 20%



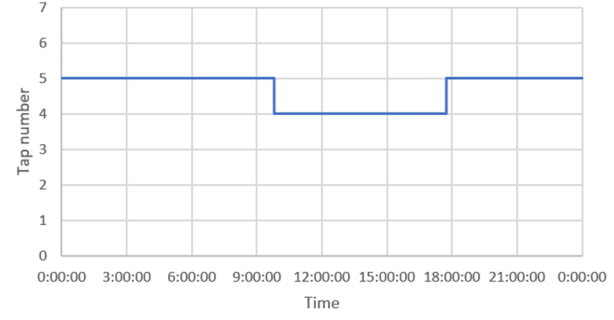
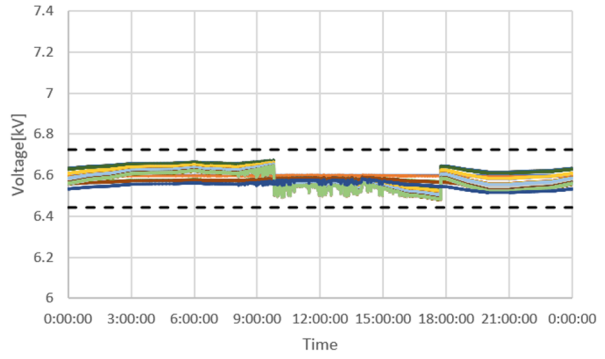
— SVR1

(d) PV 30%

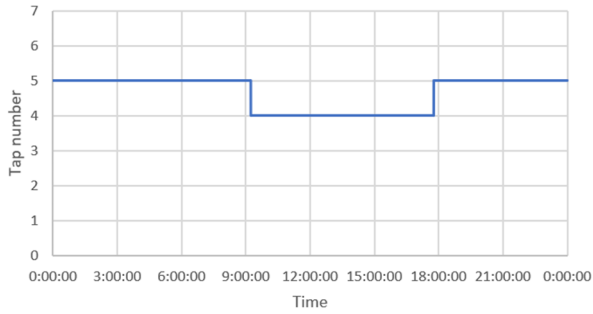
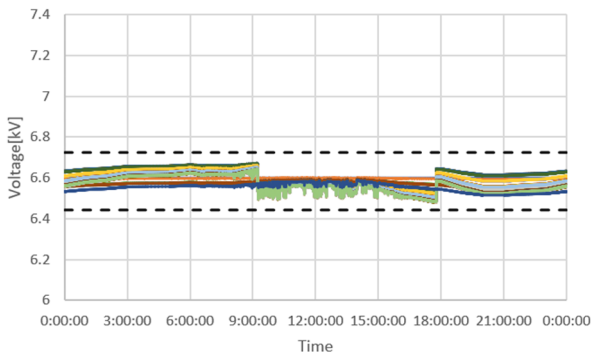




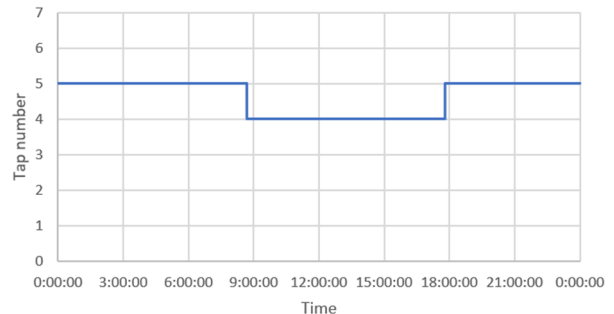
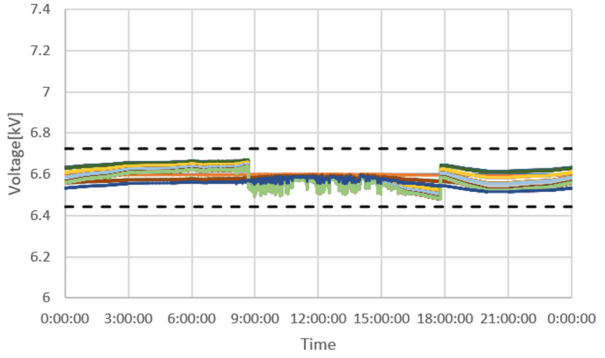
(e) PV 40%



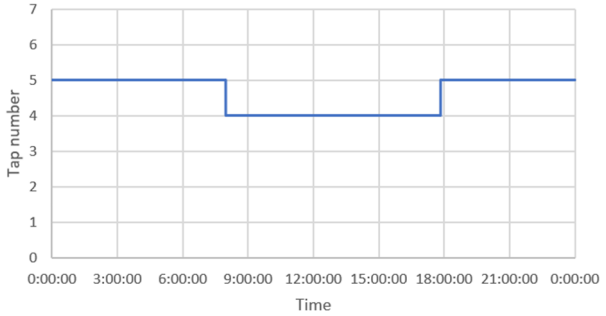
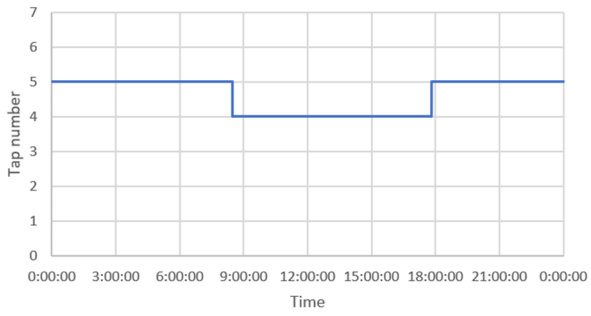
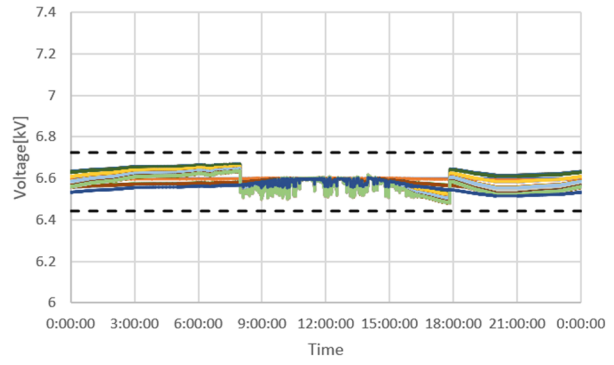
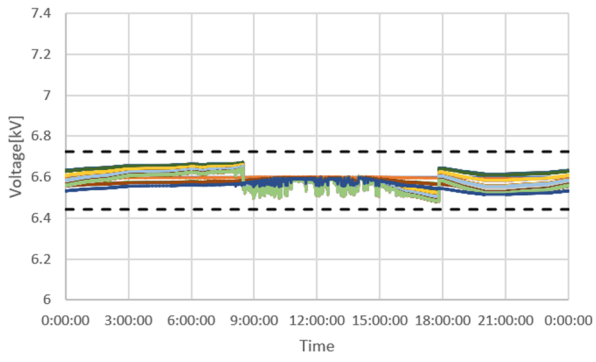
(f) PV 50%



(g) PV 60%

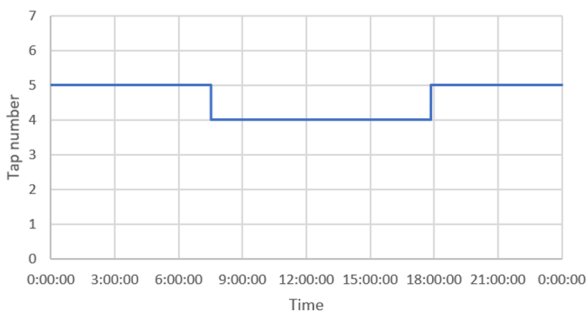
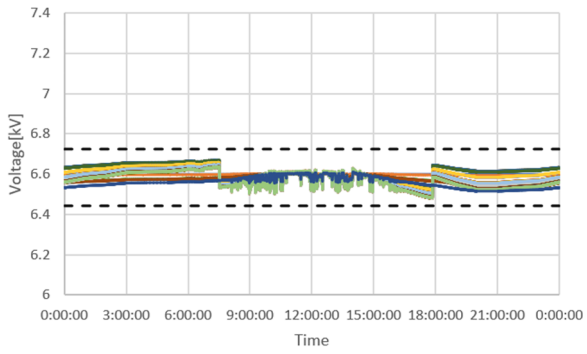


(h) PV 70%



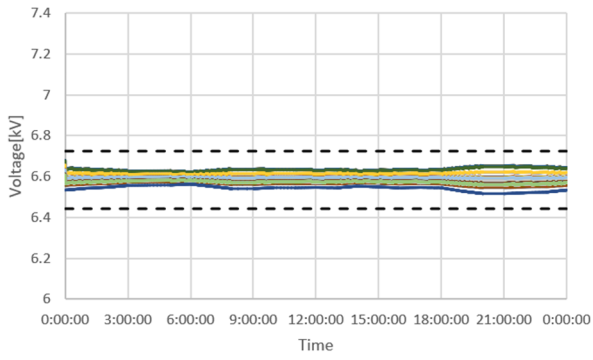
(i) PV 80%

(j) PV 90%

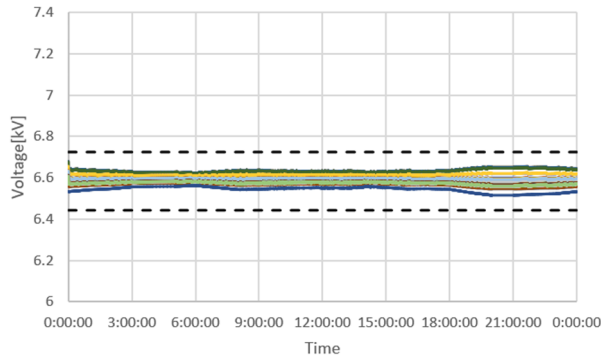


(k) PV 100%

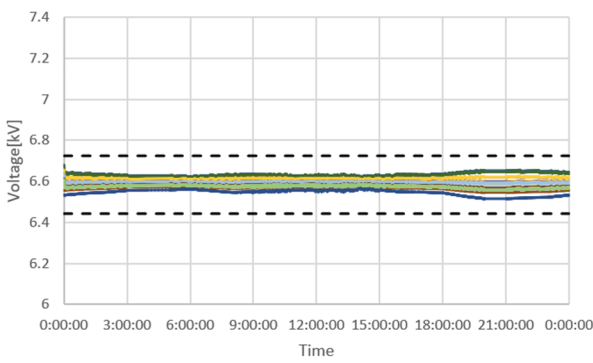
OC2 系統, PV 力率 0.95, 分散配置, TVR  
 (上 : 電圧分布, 下 : タップ位置)



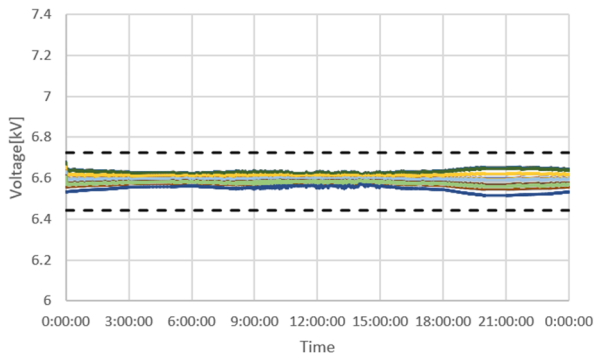
(a) PV 0%



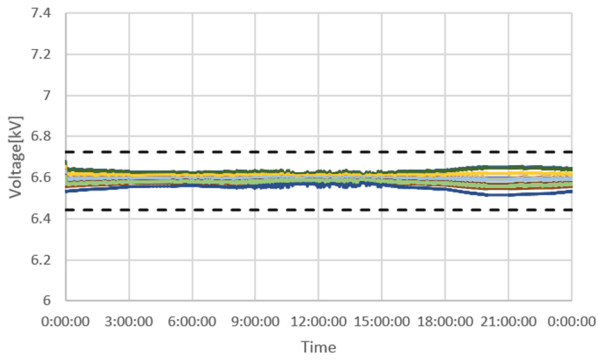
(b) PV 10%



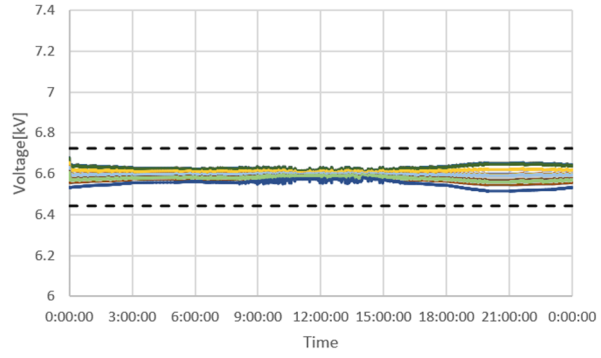
(c) PV 20%



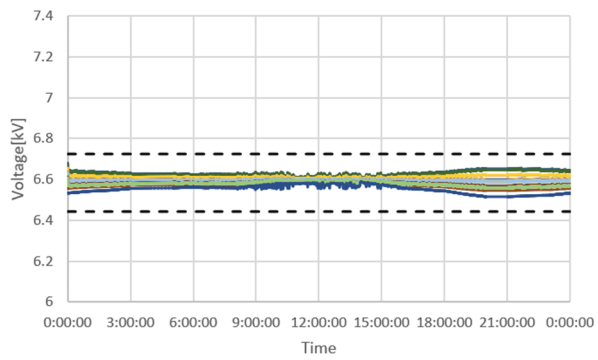
(d) PV 30%



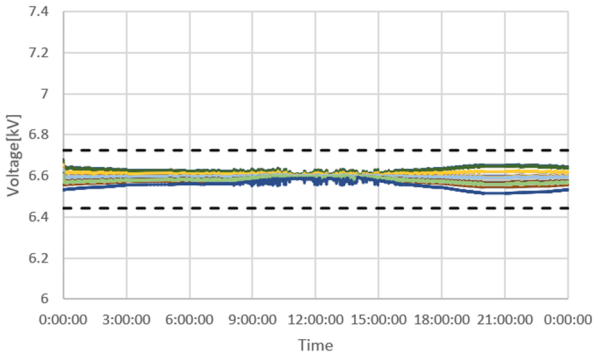
(e) PV 40%



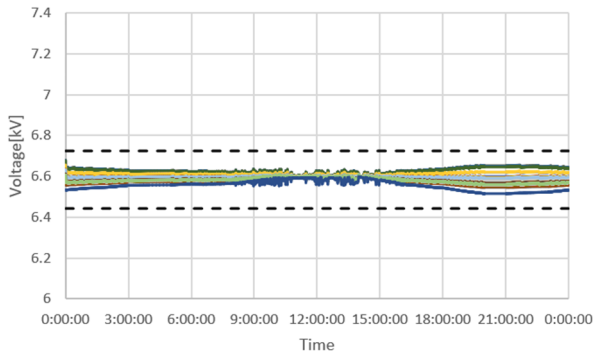
(f) PV 50%



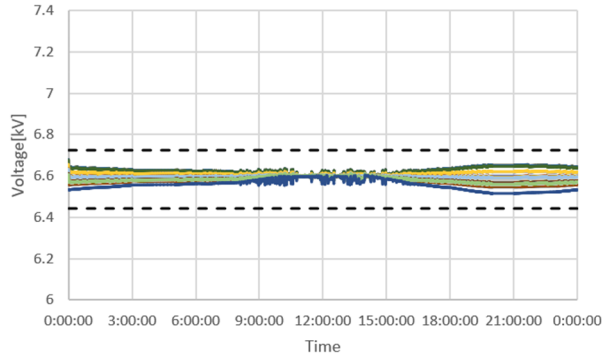
(g) PV 60%



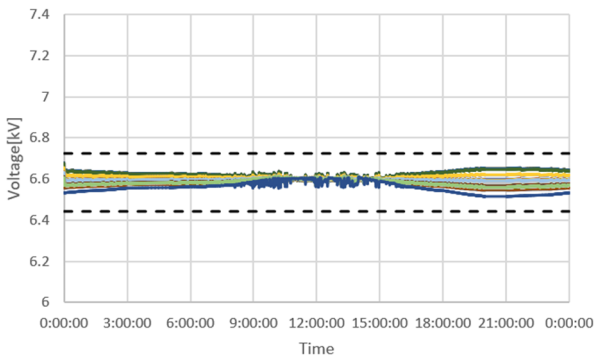
(h) PV 70%



(i) PV 80%



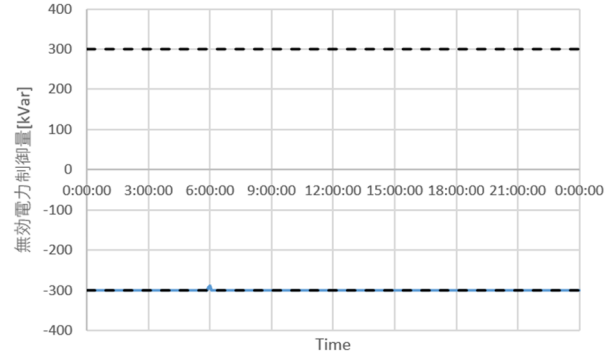
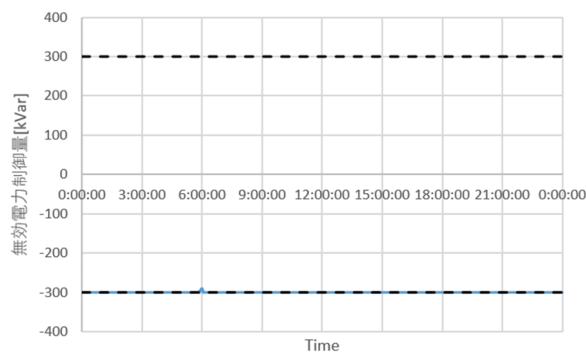
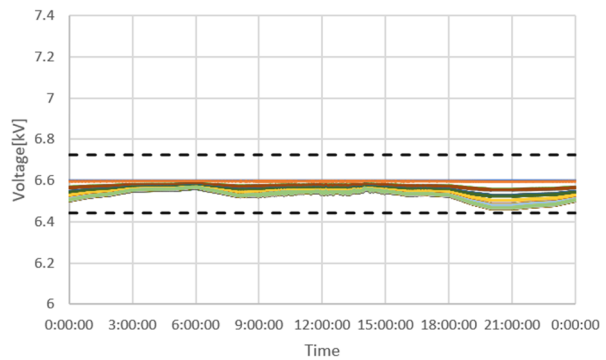
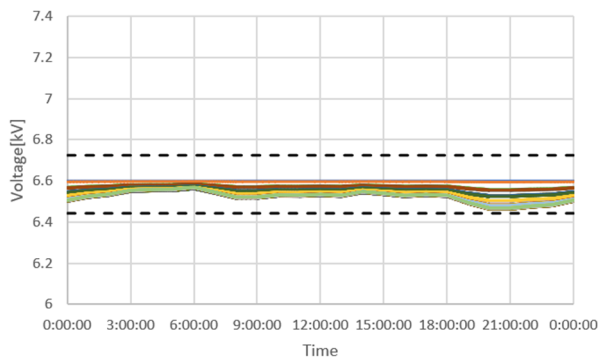
(j) PV 90%



(k) PV 100%

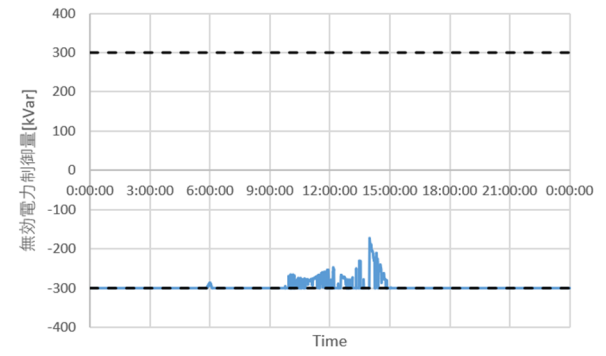
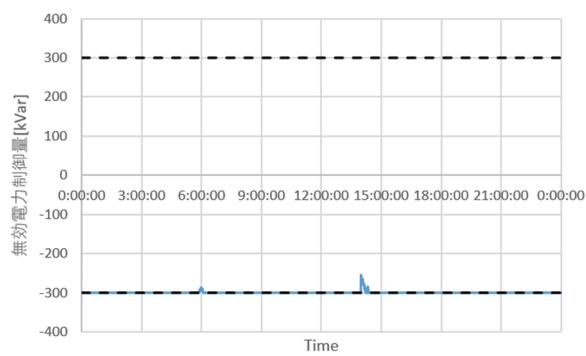
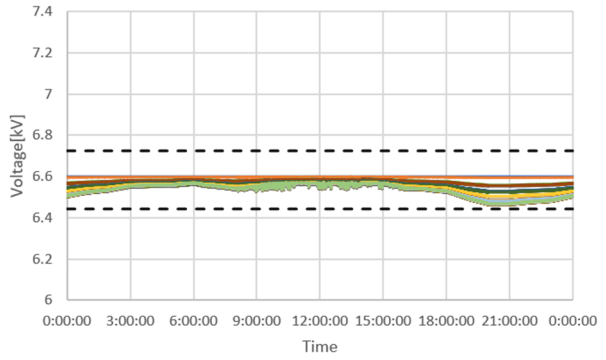
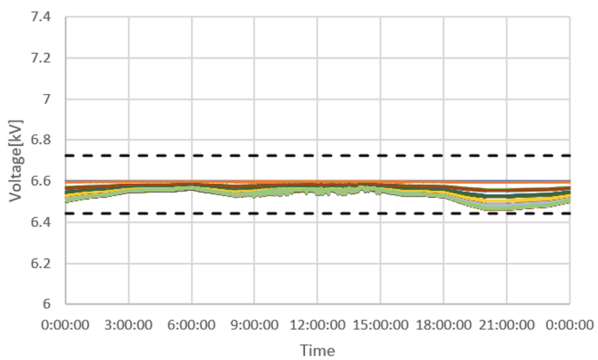
OC2 系統, PV 力率 0.95, 分散配置, SVC

(上: 電圧分布, 中: タップ位置, 下: SVC の無効電力)



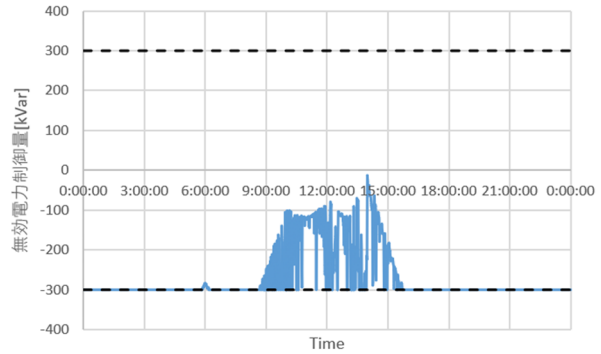
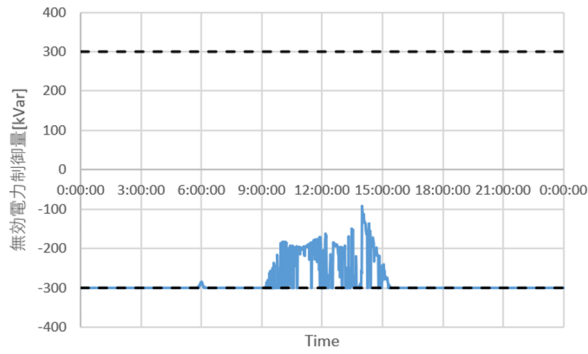
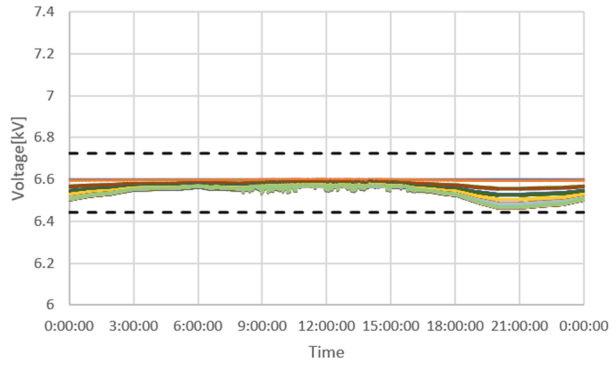
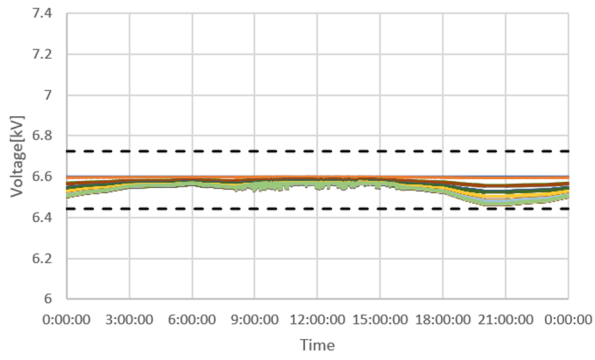
(a) PV 0%

(b) PV 10%



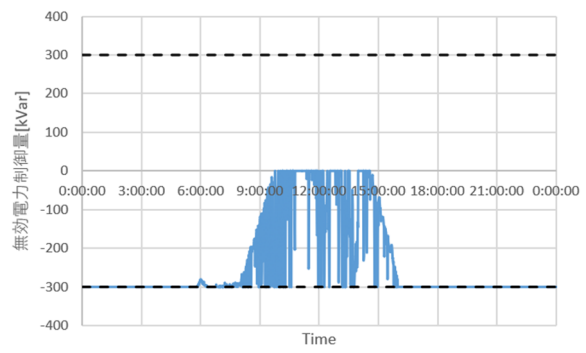
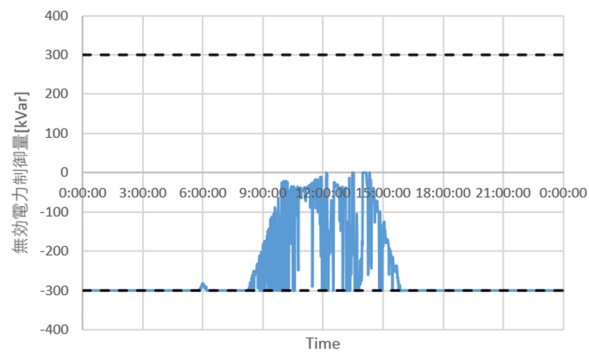
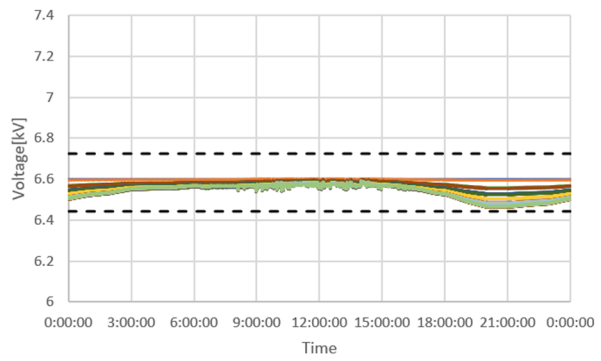
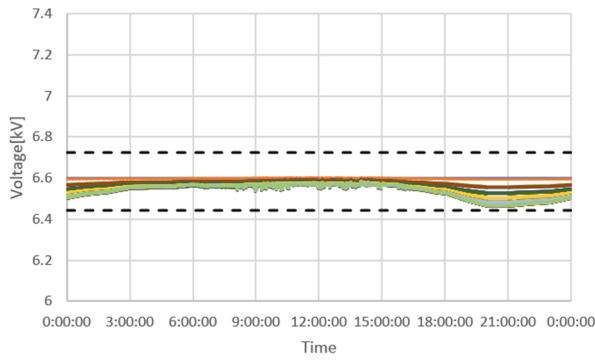
(c) PV 20%

(d) PV 30%



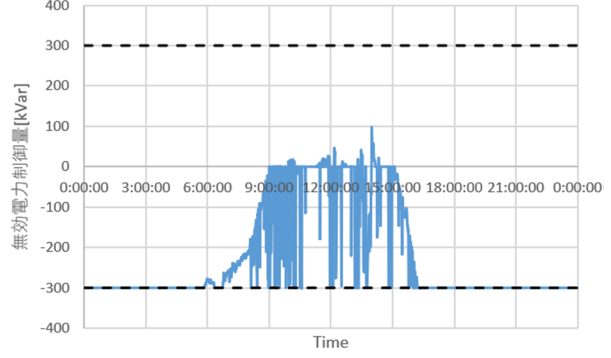
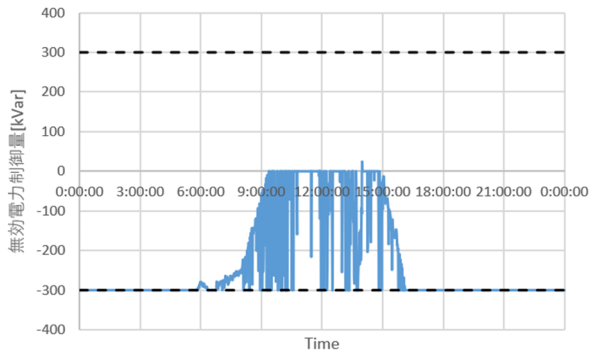
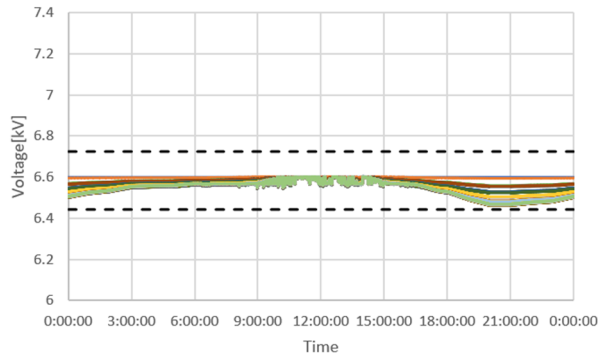
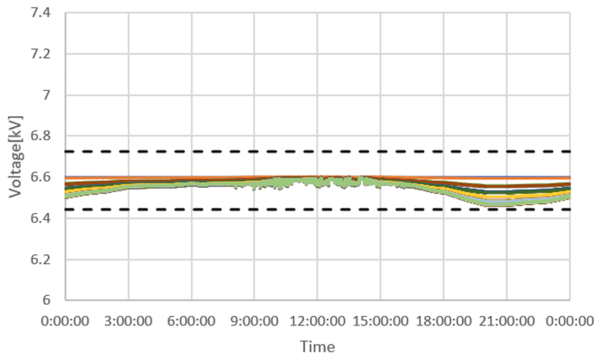
(e) PV 40%

(f) PV 50%



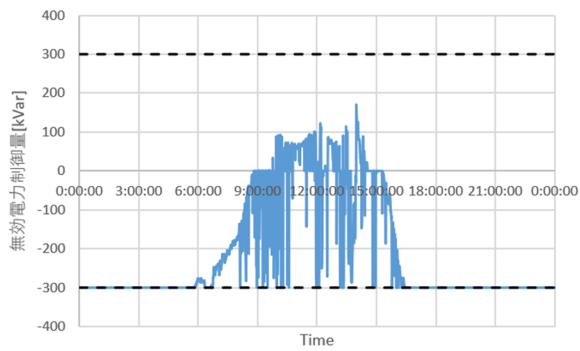
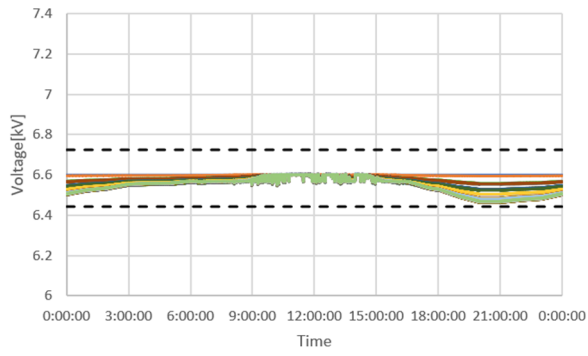
(g) PV 60%

(h) PV 70%



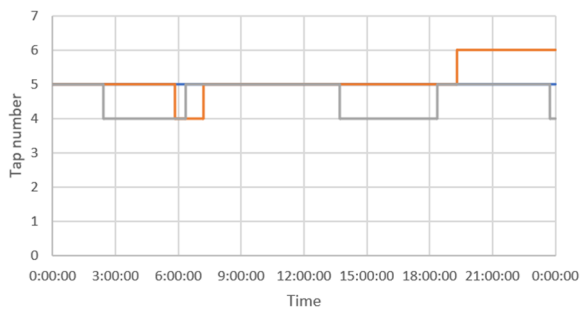
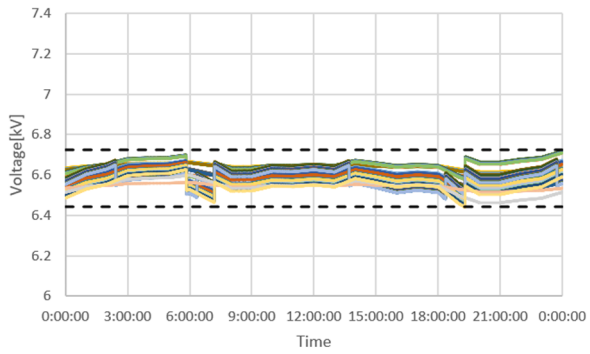
(i) PV 80%

(j) PV 90%

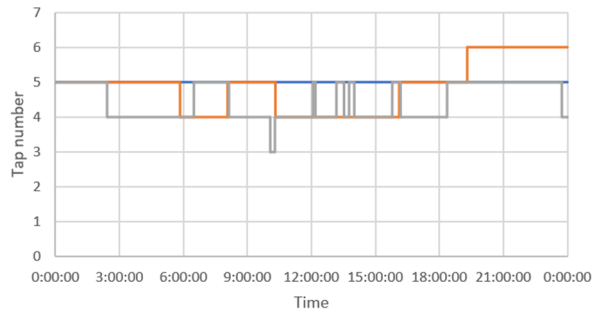
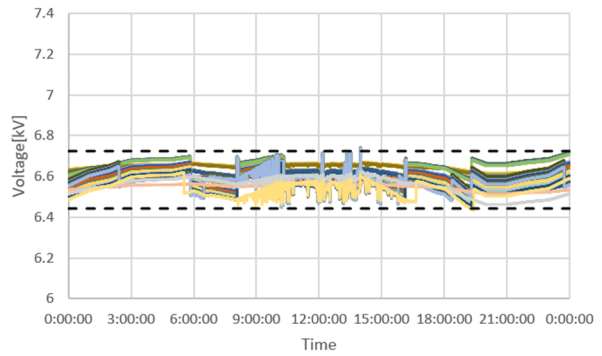


(k) PV 100%

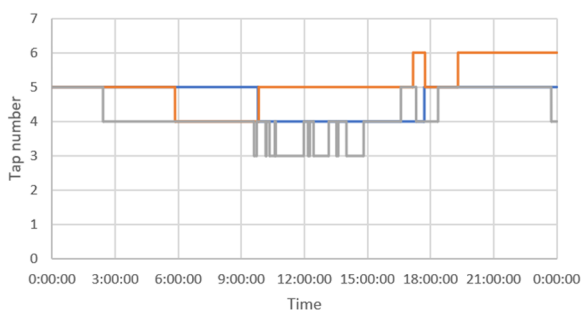
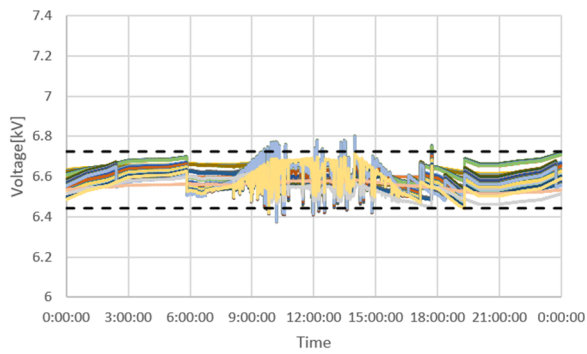
OD22 系統, PV 力率 1.0, 末端集中, SVR-SVR-SVR, LDC パラメータ再計算無し  
 (上: 電圧分布, 下: タップ位置)



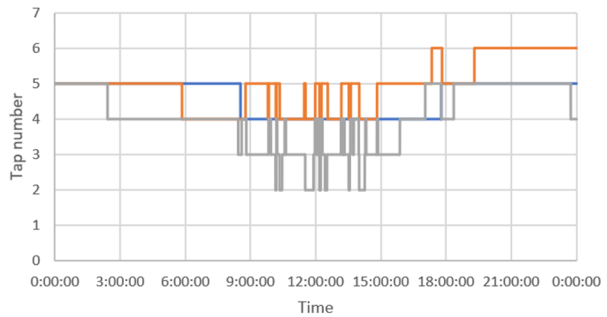
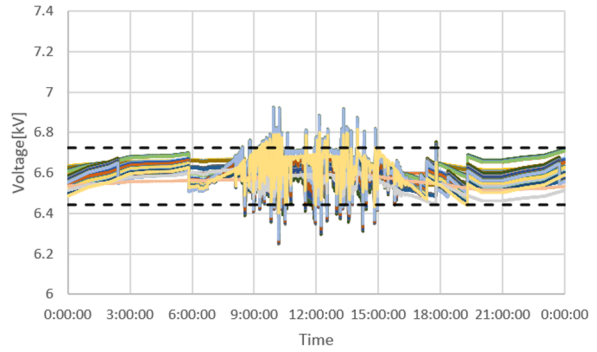
(a) PV 0%



(b) PV 10%

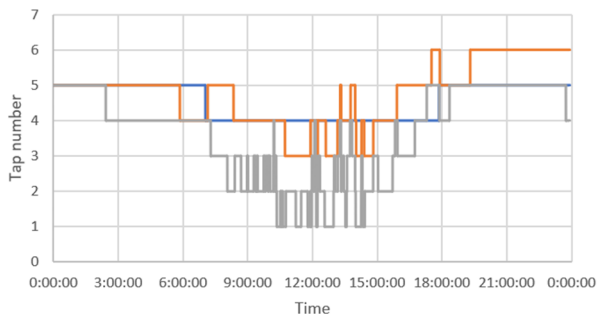
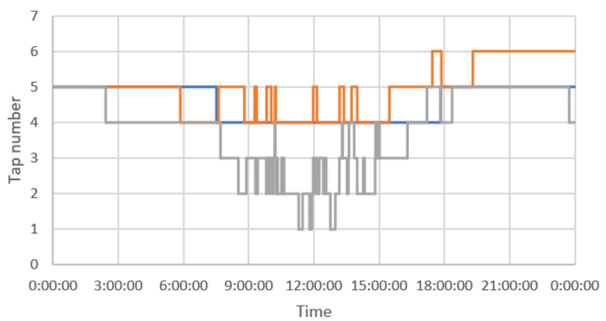
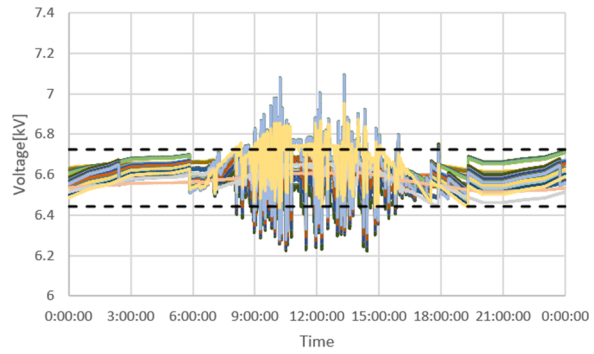
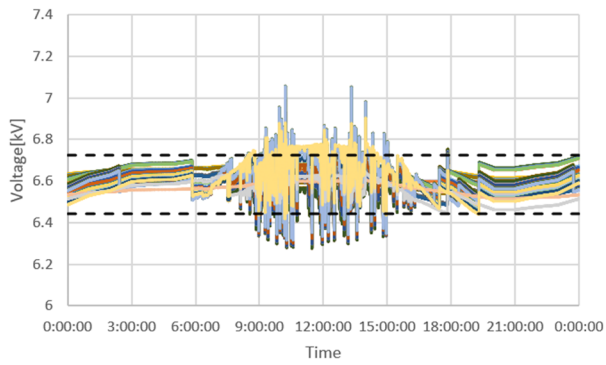


(c) PV 20%



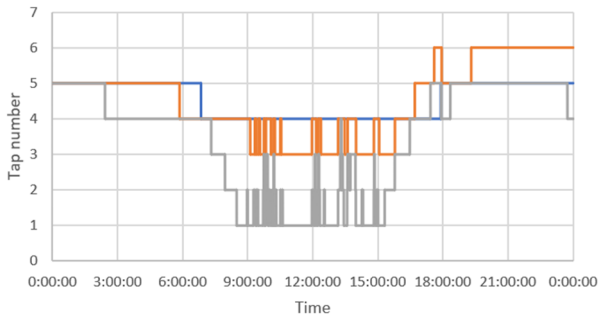
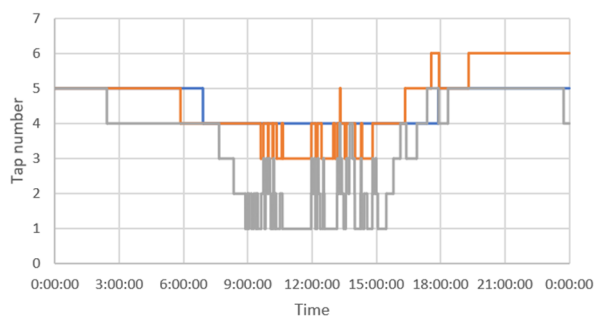
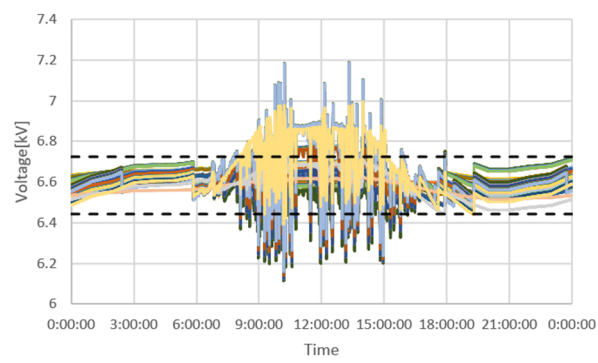
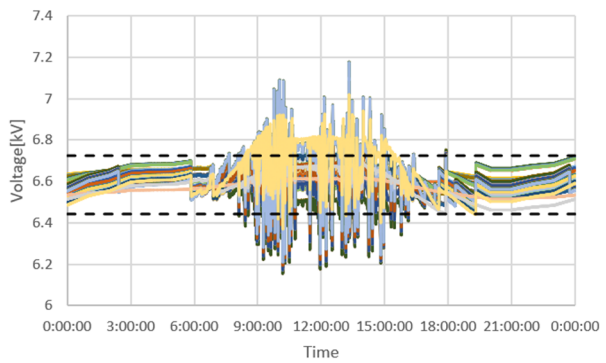
(d) PV 30%





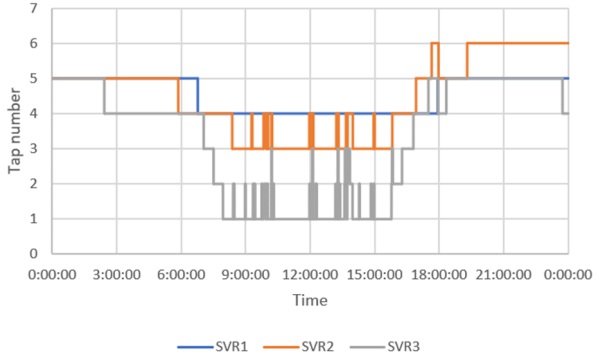
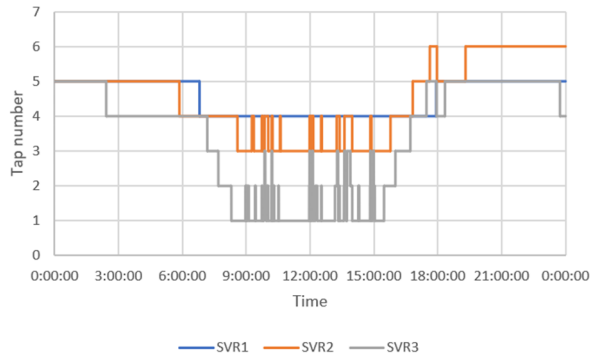
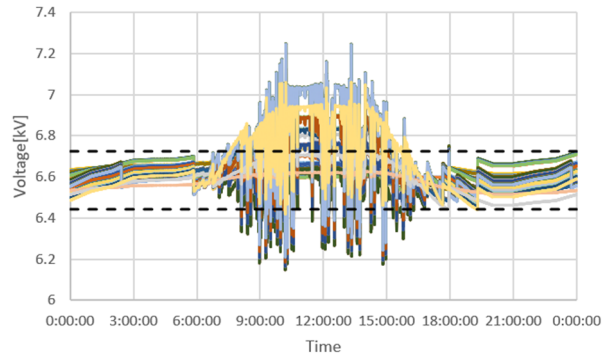
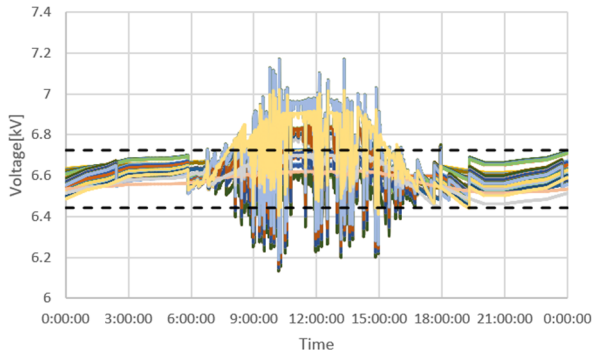
(e) PV 40%

(f) PV 50%



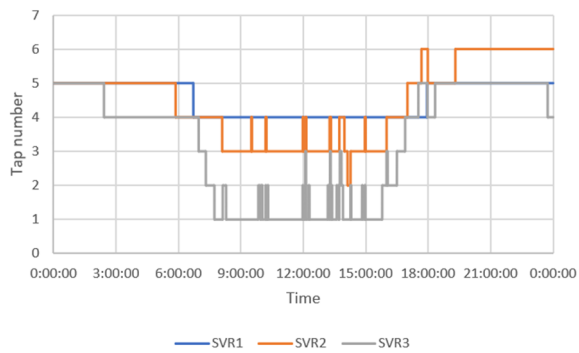
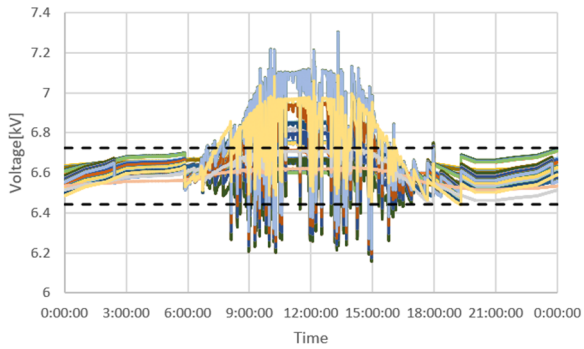
(g) PV 60%

(h) PV 70%



(i) PV 80%

(j) PV 90%



(k) PV 100%

## 付録(2) 模擬グリッドの実験データ

### 1. 検証機器

表付 2-1-1 に本研究開発にて検証対象とした機器を示す。a-1～4 は研究開発項目①富士電機が本事業で開発した自励式 SVC, b は同社の AVR, c-1～4 は北芝電機東芝 ESS が開発した次世代 TVR である。また, d-1～2 は配電系統機器メーカー A 社, B 社にて製造され, 実システムに導入されている自励式 SVC である。各種機器の仕様の一例を表付 2-1-2 から表付 2-1-5 に示す。模擬グリッド試験では, 研究開発項目①が開発した自励式 SVC, 次世代 TVR と, 実システムに導入されている自励式 SVC を対象に試験を実施した。

表付 2-1-1 本事業で検証した機器の一覧表

番号	機種	備考	使用先
a-1	SVC(Si)	試作 1 号機	実験室グリッド試験
a-2	SVC(SiC)	試作 2 号機	模擬グリッド試験
a-3	SVC(SiC)	試作 3 号機	装柱性試験
a-4	SVC(SiC)	試作 4 号機	
b	AVR(Si)	試作 1 号機	実験室グリッド試験
c-1	次世代 TVR(Si)	試作 1 号機	模擬グリッド試験
c-2	次世代 TVR(SiC)	試作 2 号機	模擬グリッド試験・装柱性試験
c-3	次世代 TVR(SiC)	試作 3 号機	模擬グリッド試験
c-4	次世代 TVR(SiC)	試作 4 号機	実グリッド試験
d-1	SVC(Si)	A 社市販 SVC	模擬グリッド試験
d-2	SVC(Si)	B 社市販 SVC	模擬グリッド試験

表付 2-1-2 検証機器 a: 研究開発項目①開発 SiC デバイス使用  
 自励式 SVC(富士電機社製)の仕様の一例  
 (研究開発項目①成果報告書より引用)

定格容量	300kVA
定格電圧	6,600V
構成	SVC 用変圧器+3 レベルインバータ
素子	3.3kVSiC-MOS(1in1)12 個 3.3kVSiC-SBD(1in1) 6 個
冷却	自然冷却
寸法と質量	50Hz 試作機 W 1281mm × D 1120mm × H 2490mm 質量:2,090kg 60Hz 試作機 W 1281mm × D 985mm × H 2318mm 質量:1,790kg
制御機能	<ul style="list-style-type: none"> <li>・電圧変動抑制</li> <li>・不平衡電圧補償</li> <li>・FRT アシスト機能</li> </ul>
付属機能	<ul style="list-style-type: none"> <li>・通信機器との接続 (制御定数の受信と設定)</li> </ul>
写真	

表付 2-1-3 検証機器 c: 研究開発項目①開発 SiC デバイス使用  
次世代 TVR(北芝電機製)の仕様の一例  
(研究開発項目①成果報告書より引用)

定格容量	3000kVA	
定格電圧	6600V	
補償電圧	±300V	
素子	IGBT(2in1)6 個	SiC(1in1)24 個
冷却	自然冷却	
寸法	W1700 mm D1400 mm H2550 mm	W1595 mm D1468 mm H2250 mm
連続電圧補償	可能	
不平衡補償	可能	
力率改善補償	可能	
応答性(補償速度)	即時(100ms 以内)	
切換回数制限	連続補償により, 無し	
連続繰返切替間隔制限	連続補償により, 無し	
短絡電流	定格電流 25 倍 2 秒	
システム概要		
写真		

※CVCは北芝電機株式会社の商標です。

表付 2-1-4 検証機器 d-1:市販自励式 SVC(A 社)の一例

定格補償容量	300kvar (遅れ, 進み)	
相数	3 相	
定格電圧	6600V	
定格周波数	50Hz / 60Hz	
応答時間	電圧制御時	50%補償時間 40msec 以内
		80%補償時間 80msec 以内
冷却方式	強制風冷 (リアクトル, インバータ用半導体素子部)	
	油入自冷 (変圧器部分)	
概略重量	2500kg	
運転方式	電圧制御, 力率制御	

表付 2-1-5 検証機器 d-2:市販自励式 SVC(B 社)の一例

無効電力発生量	進相 300kvar~遅相 300kvar	
定格電圧, 周波数	三相 6600V, 50Hz/60Hz	
電圧調整範囲	6300V~6960V	
線路電圧補償精度	±1.0%以内	
応答時間	30ms	
冷却方式	変圧器部: 油入自冷式密封型	
	電力変換部: 強制風冷式密閉型	
高周波電流含有率	各次 3.0%以下, 総合 5.0%以下	
機能	固定出力, 電圧一定制御, 力率一定制御, SVR 協調制御	
外形寸法, 体積	W1.11m × D1.69m × H2.04m	
質量	2.4t	

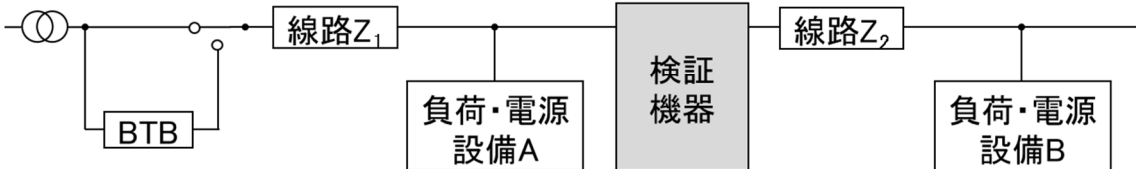
## 2. 試験方法と試験結果

### 2. 1 基本性能

#### 2. 1. 1 機器起動・停止動作の確認

##### 2. 1. 1 ① 機器起動動作

図付 2-2.1.1-1 の手順で検証した結果, 検証機器 c-1, c-2, c-3, d-1, d-2 は正常に起動した。一方, 検証機器 a-2 は, 製造メーカーの設計通りに起動しなかった。

対象	大項目	中項目	小項目
単機	基本性能	機器起動・停止動作の確認	機器起動動作
試験回路			
			
試験手順		試験パラメータ	
①配電線に6kV電圧を印加 ②検証機器の制御電源投入 ③検証機器を起動 ④動作の確認		特になし	

図付 2-2.1.1-1 試験手順(機器起動動作)

## 2. 1. 1②機器停止動作

図付 2-2.1.1-2 の手順で検証した結果、検証機器 c-1, c-2, c-3, d-1, d-2 は正常に停止した。

対象	大項目	中項目	小項目
単機	基本性能	機器起動・停止動作の確認	機器停止動作
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④検証機器を停止</li> <li>⑤動作の確認</li> </ol>		特になし	

図付 2-2.1.1-2 試験手順(機器停止動作)



2. 1. 1③系統復帰時動作:

図付 2-2.1.1-3 の手順で検証した結果, 検証機器 c-1, c-2, c-3, d-1, d-2 は正常に一時停止, 運転復帰した。

対象	大項目	中項目	小項目
単機	基本性能	機器起動・停止動作の確認	系統復帰時動作
試験回路			
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④変電所にて遮断器開放</li> <li>⑤動作の確認</li> <li>⑥変電所にて遮断器投入</li> <li>⑦動作の確認</li> </ol>		
試験パラメータ	特になし		

図付 2-2.1.1-3 試験手順(系統復帰時動作)

2. 1. 1 □通信不能(集中制御)

検証機器 c-1, c-2, c-3, d-1, d-2 全てに通信機能はないため, 試験実施を省略した。

対象	大項目	中項目	小項目
単機	基本性能	機器起動・停止動作の確認	通信不能(集中制御)
試験回路			
試験手順		試験パラメータ	
<ul style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④集中制御モードに切り替え</li> <li>⑤動作の確認</li> <li>⑥通信不能の模擬</li> <li>⑦動作の確認</li> </ul>		特になし	

図付 2-1.1.1-4 試験手順(通信不能)

2. 1. 2機器故障時の動作

2. 1. 2①軽故障発生時動作

図付 2-2.1.2-1 の手順で検証した結果, 検証機器 c-1, c-2, c-3, d-1, d-2 全て軽故障事象発生時に機器が停止, 軽故障事象が解消した後に自動で運転復帰し, 正常に動作した。

対象	大項目	中項目	小項目
単機	基本性能	機器故障時の動作	軽故障発生時動作
試験回路			
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④軽故障の模擬</li> <li>⑤動作の確認</li> </ol>		
試験パラメータ	特になし		

図付 2-2.1.2-1 試験手順(軽故障発生時)

2. 1. 2②重故障発生時動作

図付 2-2.1.2-2 の手順で検証した結果, 検証機器 c-1, c-2, c-3, d-1, d-2 全て重故障事象発生時に機器を停止し, 重故障事象が解消した後も自動で運転復帰せず停止を継続し, 正常に動作した。

対象	大項目	中項目	小項目
単機	基本性能	機器故障時の動作	重故障発生時動作
試験回路			
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④軽故障の模擬</li> <li>⑤動作の確認</li> </ol>		
試験パラメータ	特になし		

図付 2-2.1.2-2 試験手順(重故障発生時)

## 2. 2性能評価

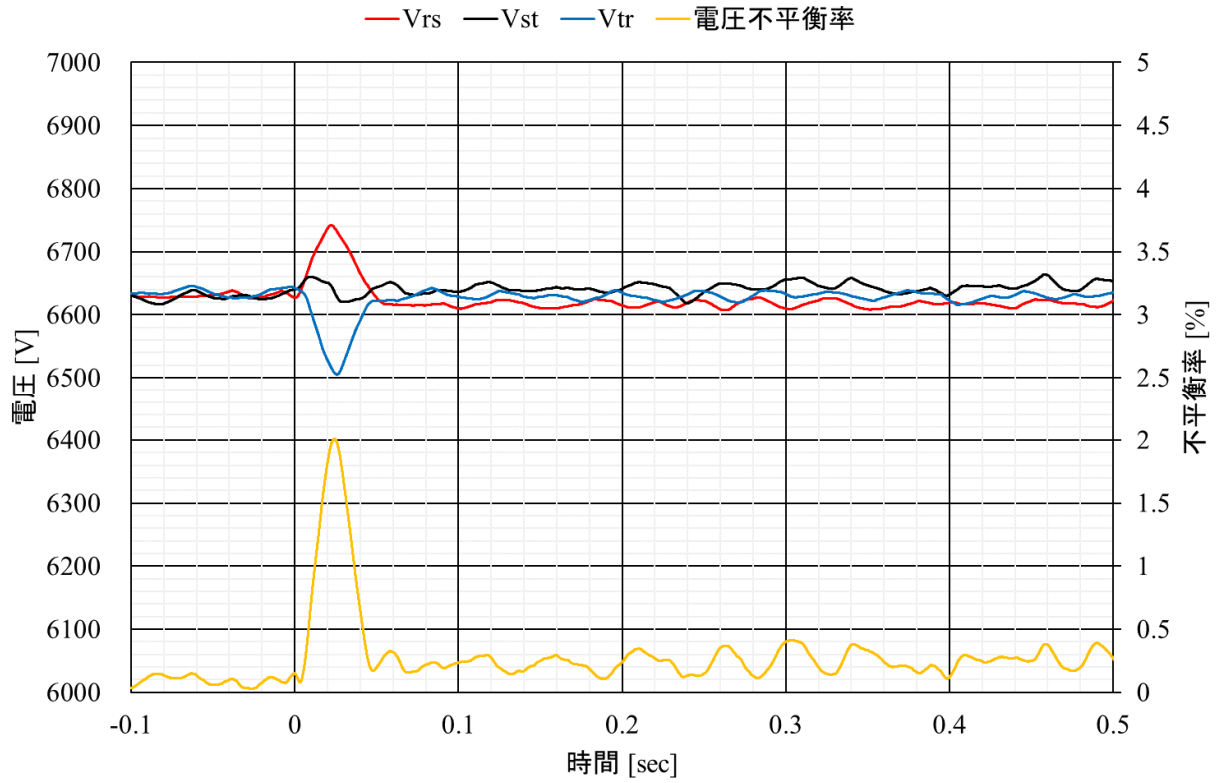
### 2. 2. 1通常運転時の安定性

#### 2. 2. 1□電圧三相不平衡時

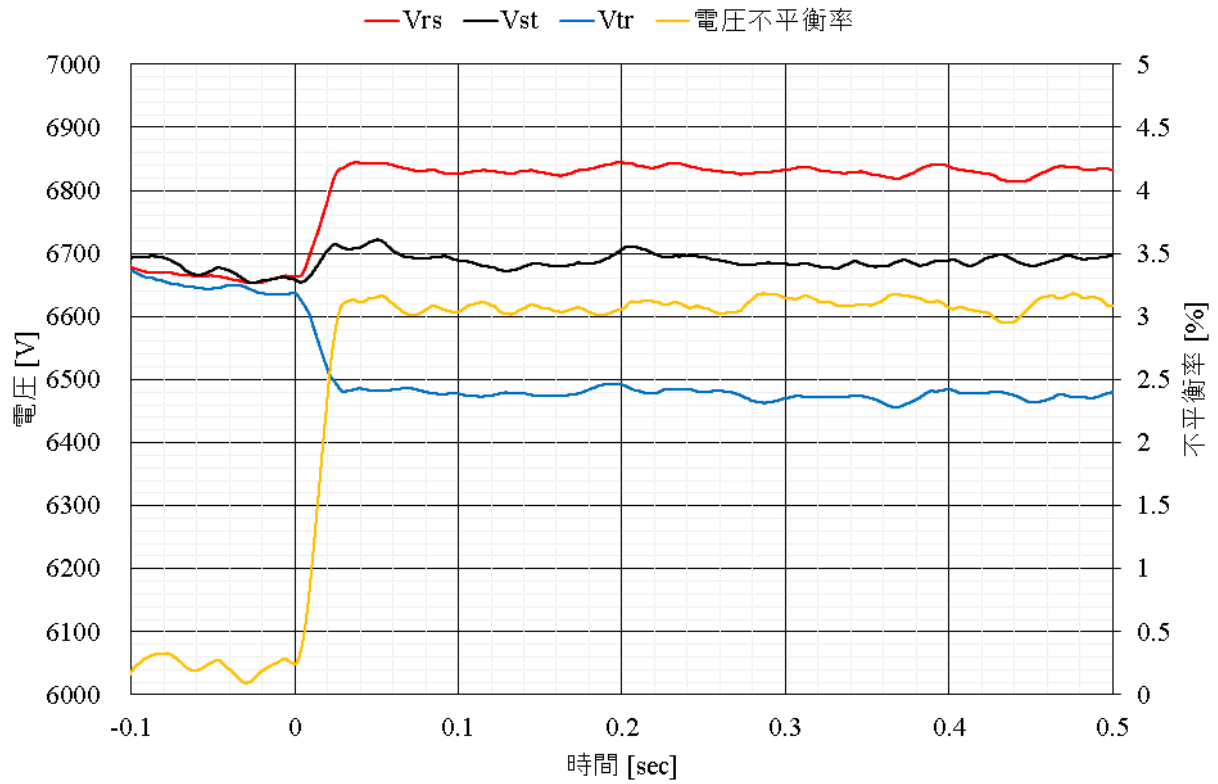
試験手順を図付 2-2.2.1-1 に示す。送出し電圧の 3 つの相電圧の平均値が一定で、電圧不平衡率のみが 3%となるように急変させた場合の結果を図付 2-2.2.1-2, 1 相もしくは 2 相の電圧低下により電圧不平衡率が 3%となるように急変させた場合の結果を図付 2-2.2.1-3 に示す。

対象	大項目	中項目	小項目
単機	性能評価	通常運転時の安定性	電圧三相不平衡時
試験回路			
<p>BTBを用いて送出し電圧不平衡を発生</p>			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④三相平衡⇒三相不平衡</li> <li>⑤動作の確認</li> <li>⑥三相不平衡⇒三相平衡</li> <li>⑦動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix} \times \begin{pmatrix} \text{電圧不平衡率:3\%} \\ \cdot \text{平均電圧一定} \\ \cdot \text{1相低下} \\ \cdot \text{2相低下} \end{pmatrix}$	

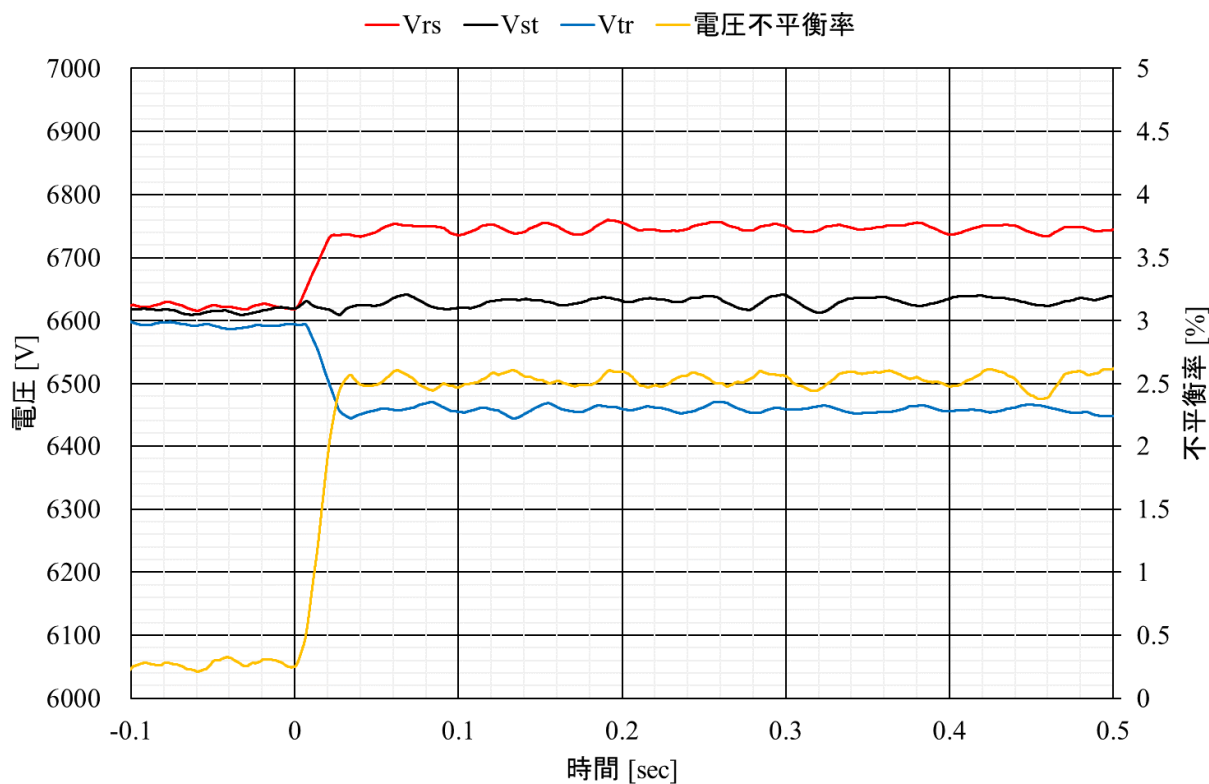
図付 2-2.2.1-1 試験手順(電圧三相不平衡)



(a) 検証機器 c-2 (制御目標電圧 6600V)



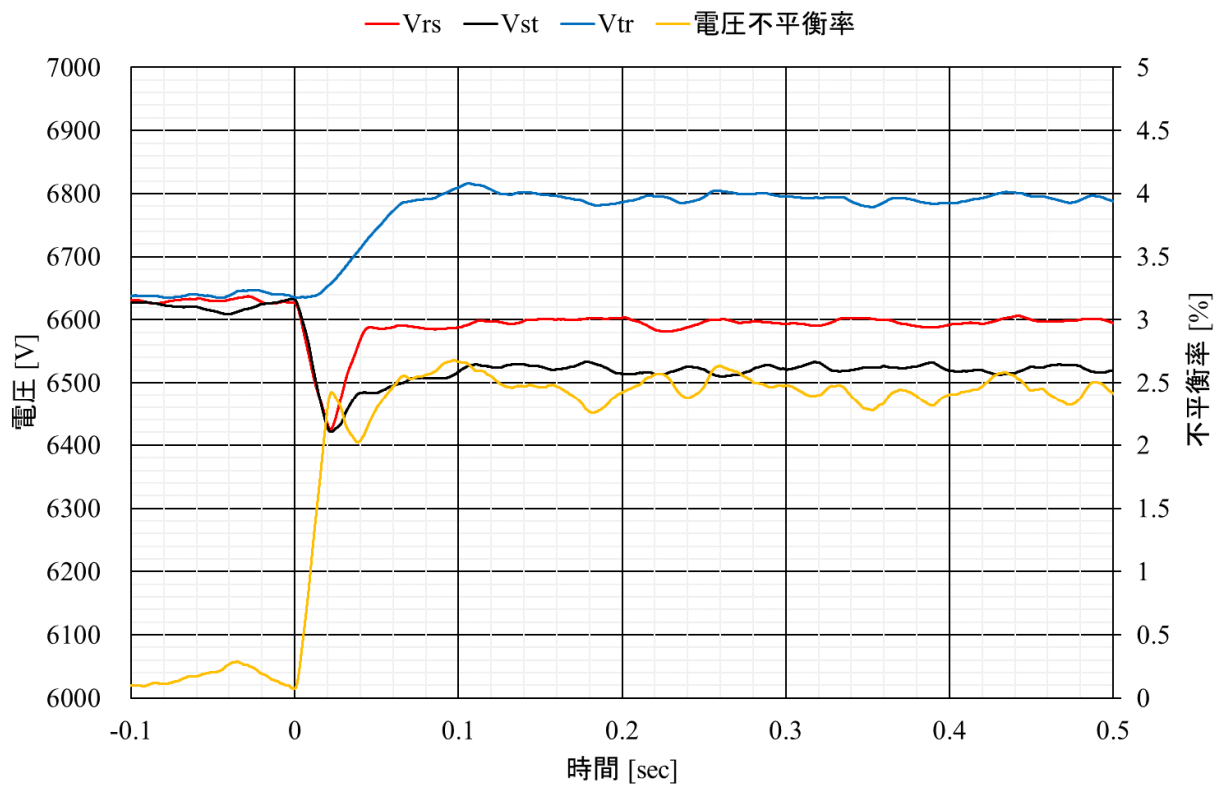
(b) 検証機器 d-1 (制御目標電圧 6600V)



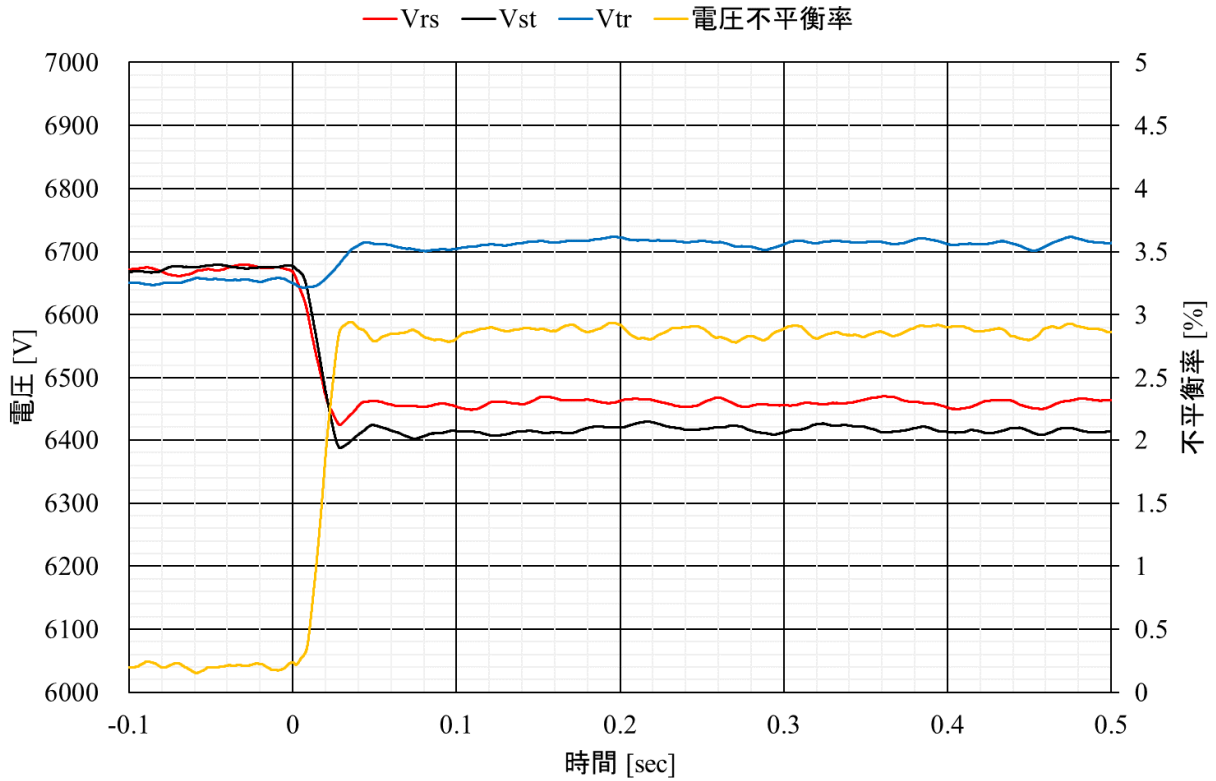
(c) 検証機器 d-2 (制御目標電圧 6600V)

図付 2-2.2.1-2 電圧不平衡時の機器設置地点電圧

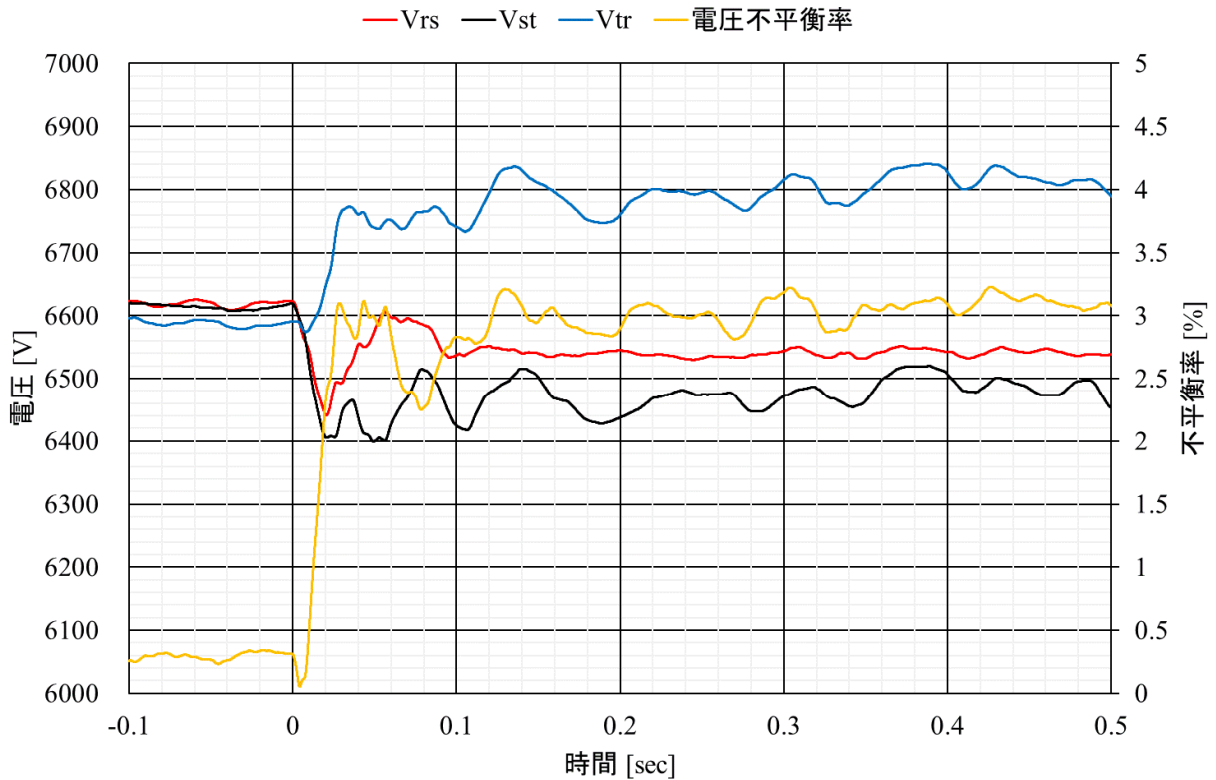
(線路 Z1.5Ω, 負荷 B:R280kW, L100kav, 電圧不平衡条件:不平衡率 3%, 平均電圧一定)



(a) 検証機器 c-2 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6600V)



(c) 検証機器 d-2 (制御目標電圧 6600V)

図付 2-2.2.1-3 電圧不平衡時の機器設置地点電圧

(線路 Z:5Ω, 負荷 B:R280kW, L100kav, 電圧不平衡条件:不平衡率 3%, S 相電圧低下)

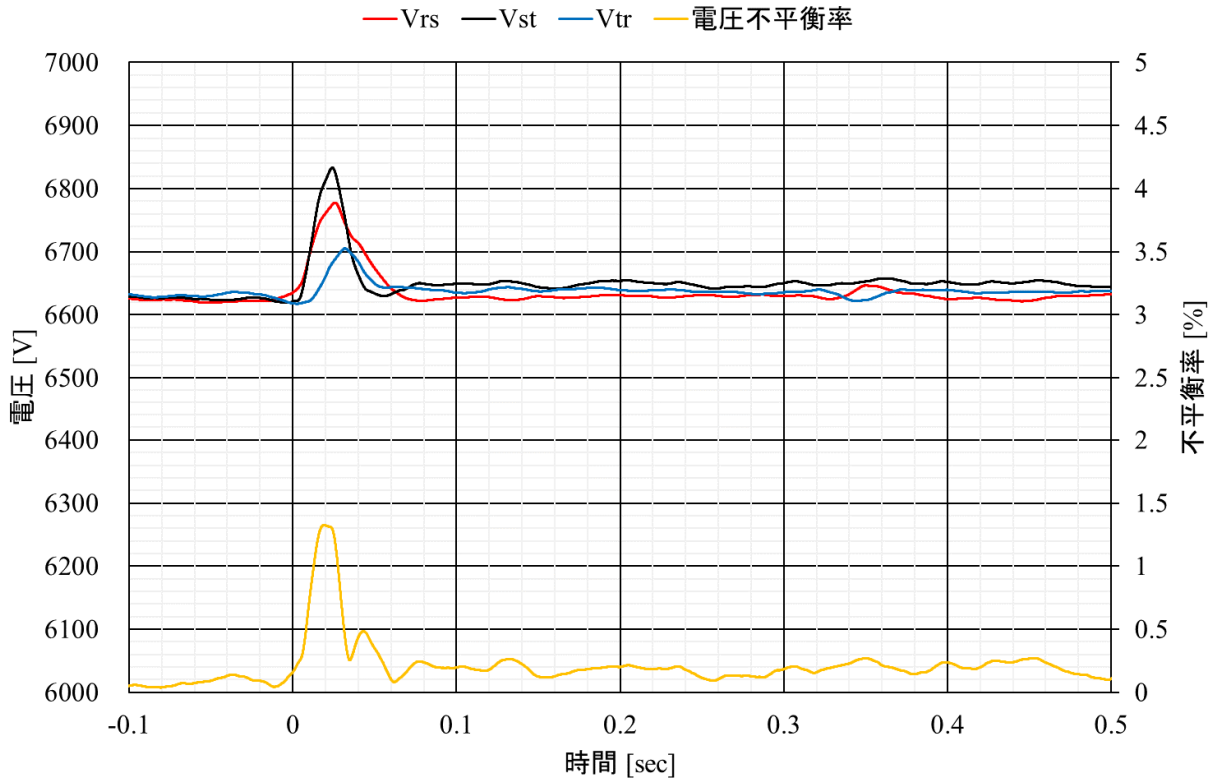


## 2. 2. 1②負荷不平衡時

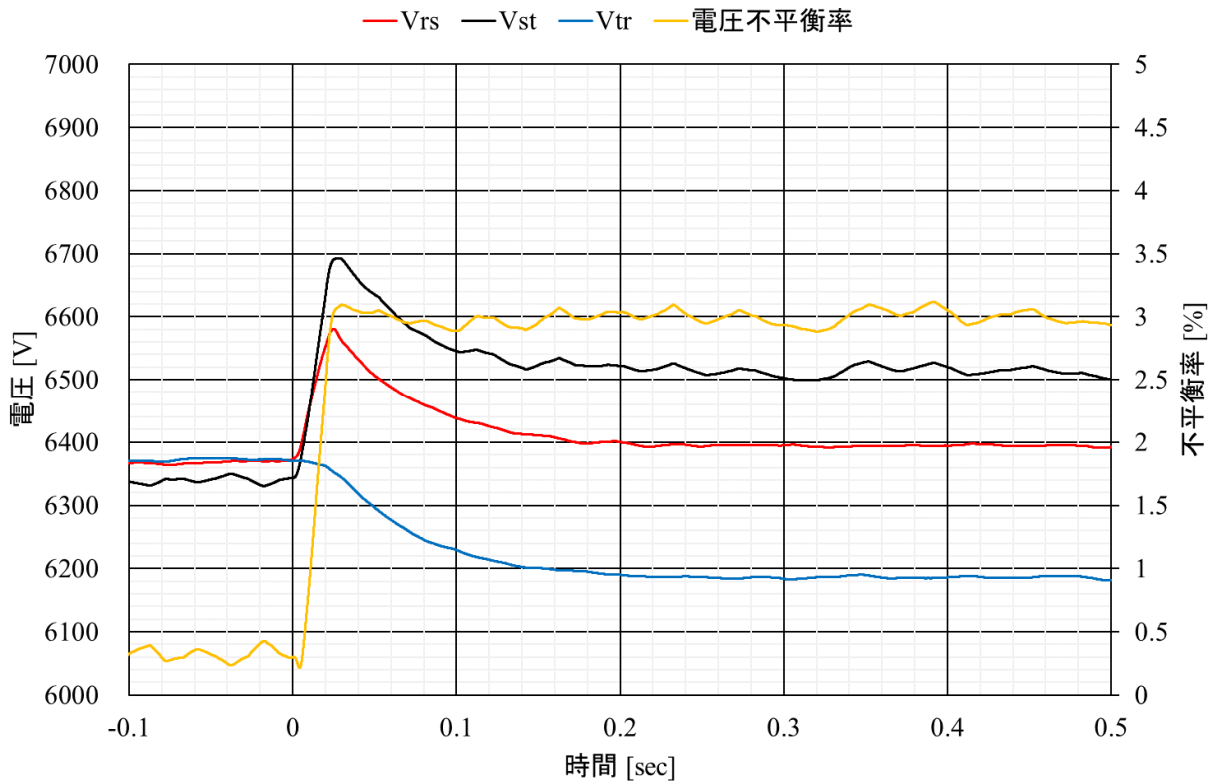
試験手順を図付 2-2.2.1-4, R280kW+L100kvar 負荷を不平衡にさせた場合の結果を図付 2-2.2.1-5 に示す。本図では機器設置地点での線間電圧, 電圧不平衡率を示している。

対象	大項目	中項目	小項目
単機	性能評価	通常運転時の安定性	負荷不平衡時
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④三相平衡⇒三相不平衡</li> <li>⑤動作の確認</li> <li>⑥三相不平衡⇒三相平衡</li> <li>⑦動作の確認</li> </ol>		<p>Z=5Ωとは、R=5Ω、X=5Ωとする</p> $\begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix}$	

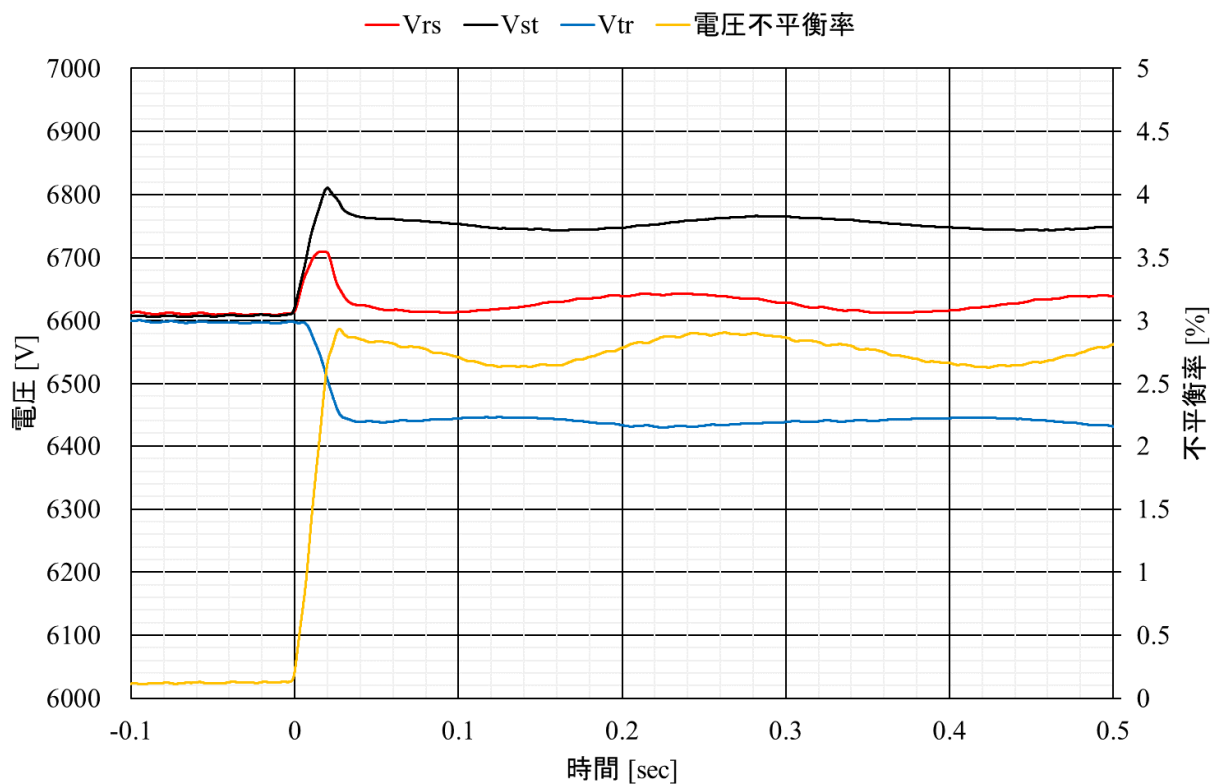
図付 2-2.2.1-4 試験手順(負荷不平衡時)



(a) 検証機器 c-2 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6300V)



(c) 検証機器 d-1 (制御目標電圧 6300V)  
 図付 2-2.2.1-5 負荷不平衡時の機器設置地点電圧  
 (線路 Z1:5Ω, 負荷 B:R280kW, L100kvar)

### 2. 2. 1③高調波発生時

図付 2-2.2.1-6 の手順で検証した結果, 検証機器 c-2, d-1, d-2 ともに高調波を発生させても機器は正常に運転継続することを確認した。

対象	大項目	中項目	小項目												
単機	性能評価	通常運転時の安定性	高調波発生時												
<div style="border: 1px solid black; padding: 10px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">試験回路</th> <td colspan="3"> </td> </tr> <tr> <th style="width: 15%;">試験手順</th> <td colspan="3"> <ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④単独運転検出能動信号注入</li> <li>⑤動作の確認</li> </ol> </td> </tr> <tr> <th style="width: 15%;">試験パラメータ</th> <td colspan="3"> <p style="text-align: right;">Z=5Ωとは、R=5Ω、X=5Ωとする IN: インバータ, SG: 同期発電機</p> <math display="block">  \begin{pmatrix} Z_1 &amp; Z_2 \\ 5\Omega &amp; 0\Omega \\ 10\Omega &amp; 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix} \times \begin{pmatrix} \text{送出し電圧高調波} \\ \text{総合電圧歪率3\%} \\ \text{5次、7次混在} \end{pmatrix}  </math> </td> </tr> </table> </div>				試験回路				試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④単独運転検出能動信号注入</li> <li>⑤動作の確認</li> </ol>			試験パラメータ	<p style="text-align: right;">Z=5Ωとは、R=5Ω、X=5Ωとする IN: インバータ, SG: 同期発電機</p> $  \begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix} \times \begin{pmatrix} \text{送出し電圧高調波} \\ \text{総合電圧歪率3\%} \\ \text{5次、7次混在} \end{pmatrix}  $		
試験回路															
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④単独運転検出能動信号注入</li> <li>⑤動作の確認</li> </ol>														
試験パラメータ	<p style="text-align: right;">Z=5Ωとは、R=5Ω、X=5Ωとする IN: インバータ, SG: 同期発電機</p> $  \begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix} \times \begin{pmatrix} \text{送出し電圧高調波} \\ \text{総合電圧歪率3\%} \\ \text{5次、7次混在} \end{pmatrix}  $														

図付 2-2.2.1-6 試験手順(高調波発生時)

## 2. 2. 2配電系統事故時の動作

### 2. 2. 2①地絡事故

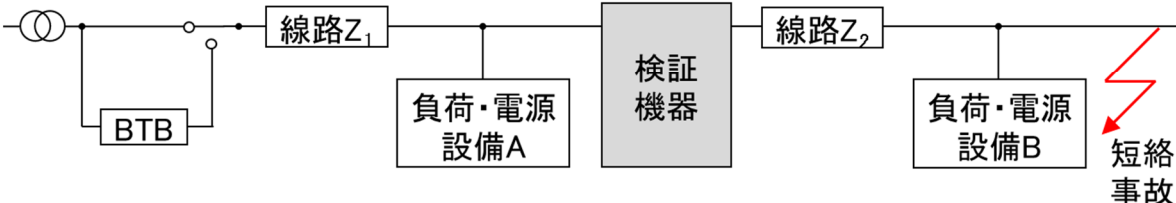
図付 2-2.2.2-1 の手順で検証した結果, 検証機器 c-1, 検証機器 d-1 とともに地絡事故を発生させても機器は異常動作しないことを確認した。

対象	大項目	中項目	小項目
単機	性能評価	配電系統事故時の動作	地絡事故
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④地絡事故発生</li> <li>⑤動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\begin{pmatrix} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{pmatrix} \times \begin{pmatrix} \text{地絡電流} \\ 3.6A (1\mu F/\text{相}) \\ 10.8A (3\mu F/\text{相}) \end{pmatrix}$	

図付 2-2.2.2-1 試験手順(地絡事故)

## 2. 2. 2②短絡事故

図付 2-2.2.2-2 の手順で検証した結果、検証機器 c-1, 検証機器 d-1 とともに地絡事故を発生させても機器は異常動作しないことを確認した。

対象	大項目	中項目	小項目
単機	性能評価	配電系統事故時の動作	短絡事故
試験回路			
<p>SVCの二次側で二相短絡事故を発生させる。変電所の変圧器容量の制約により、短絡電流を限流する必要があることと、各地点の電圧降下を模擬するために、上流と下流に<math>Z=5+j5[\Omega]</math>の場合と上流に<math>Z=10+j10[\Omega]</math>とする。</p>			
試験手順	<p>試験パラメータ <span style="float: right;">Z=5Ωとは、R=5Ω、X=5Ωとする</span></p> $\begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 5\Omega \\ 10\Omega & 0\Omega \\ 0\Omega & 10\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \end{pmatrix}$		
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④短絡事故発生</li> <li>⑤動作の確認</li> </ol>			

図付 2-2.2.2-2 試験手順(短絡事故)

## 2. 2. 2③断線事故

図付 2-2.2.2-3 の手順で検証した結果、検証機器 c-1, 検証機器 d-1, d-2 とともに断線事故を発生させても機器は異常動作しないことを確認した。

対象	大項目	中項目	小項目
単機	性能評価	配電系統事故時の動作	断線事故
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④断線事故発生</li> <li>⑤動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする  $\begin{pmatrix} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{pmatrix}$	

図付 2-2.2.2-3 試験手順(断線事故)

2. 2. 3 事故時運用時の動作

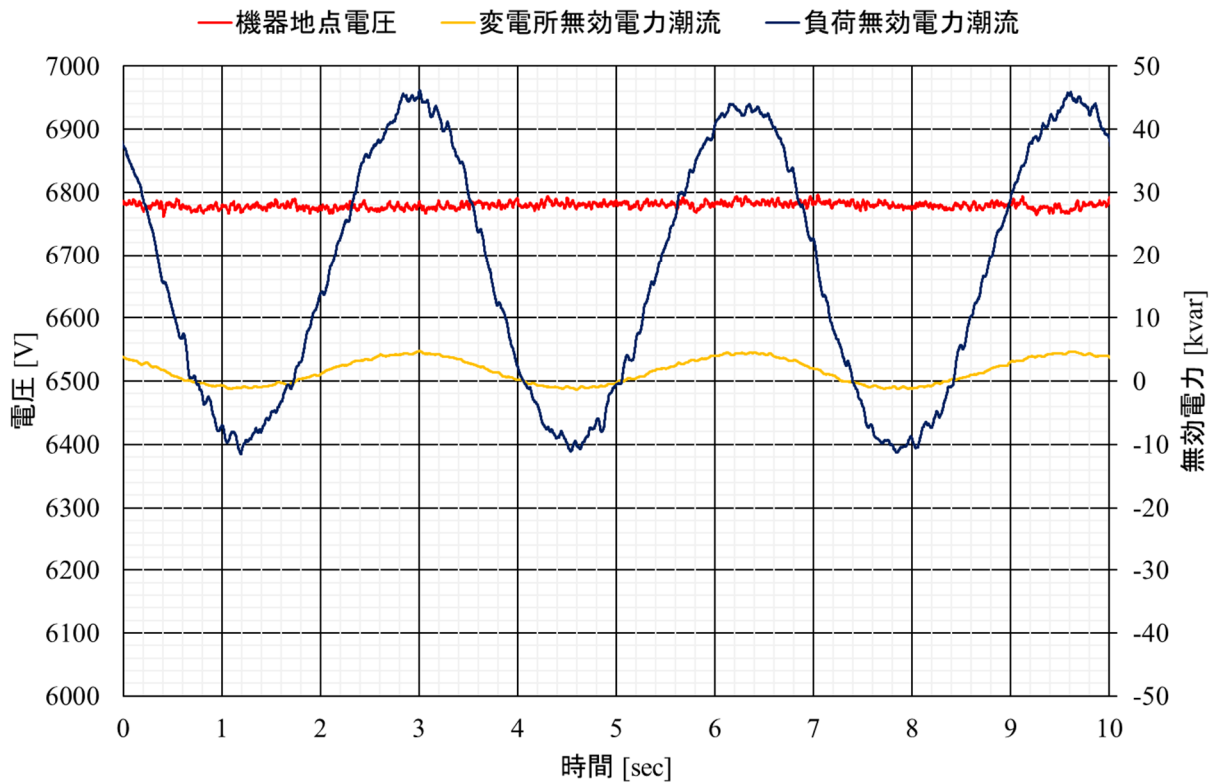
2. 2. 3① 単独運転検出能動信号との協調:

試験手順を図付 2-2.2.3-1, 試験時の機器設置地点電圧, 変電所, 負荷地点での無効電力潮流を図付 2-2.2.3-2 に示す。

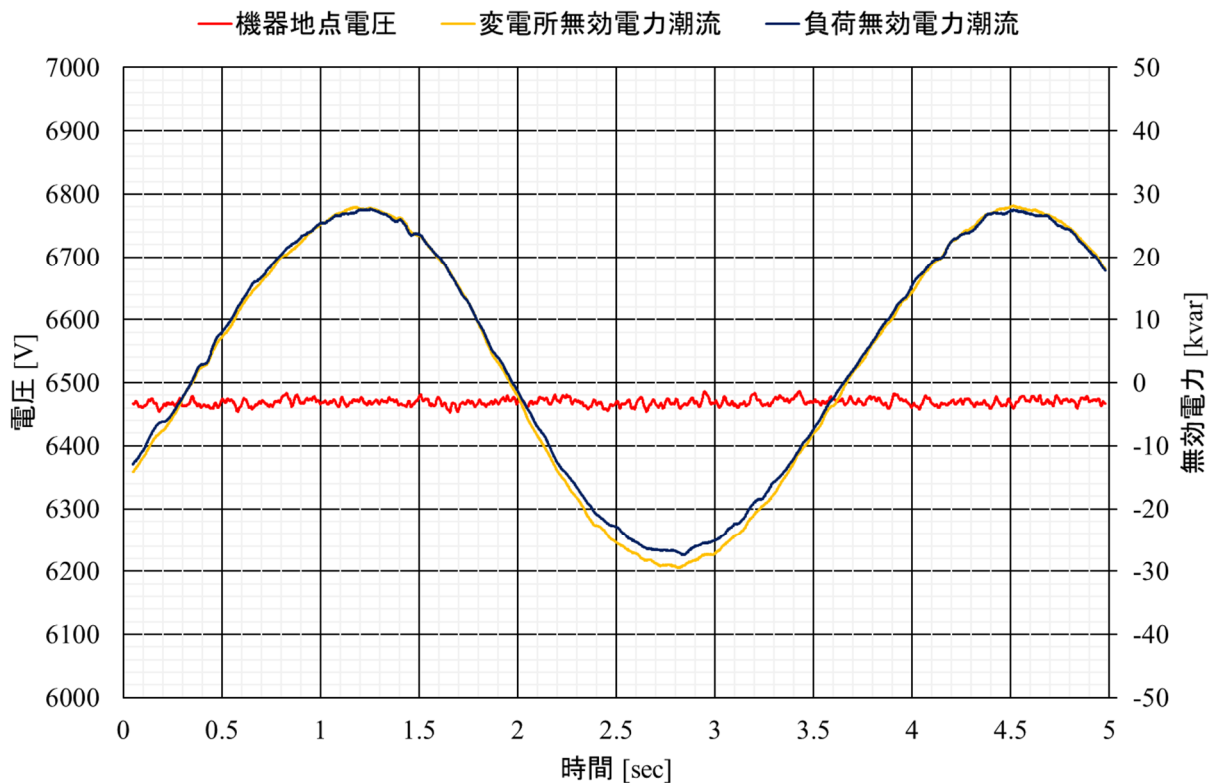
対象	大項目	中項目	小項目
単機	性能評価	事故発生運用時	単独運転検出との協調
試験回路			
試験手順		試験パラメータ	
① 配電線に6kV電圧を印加 ② 検証機器の制御電源投入 ③ 検証機器を起動 ④ 三相平衡⇒三相不平衡 ⑤ 動作の確認 ⑥ 三相不平衡⇒三相平衡 ⑦ 動作の確認		Z=5Ωとは、R=5Ω、X=5Ωとする  $\left( \begin{array}{ccc} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{array} \right) \times \left( \begin{array}{c} \text{電源B} \\ IN200kW(\text{無効電力変動方式}) \\ IN70kW(\text{新型能動方式}) \\ SG150kW(\text{無効電力変動方式}) \end{array} \right)$	

図付 2-2.2.3-1 試験手順(単独運転検出能動信号との協調)

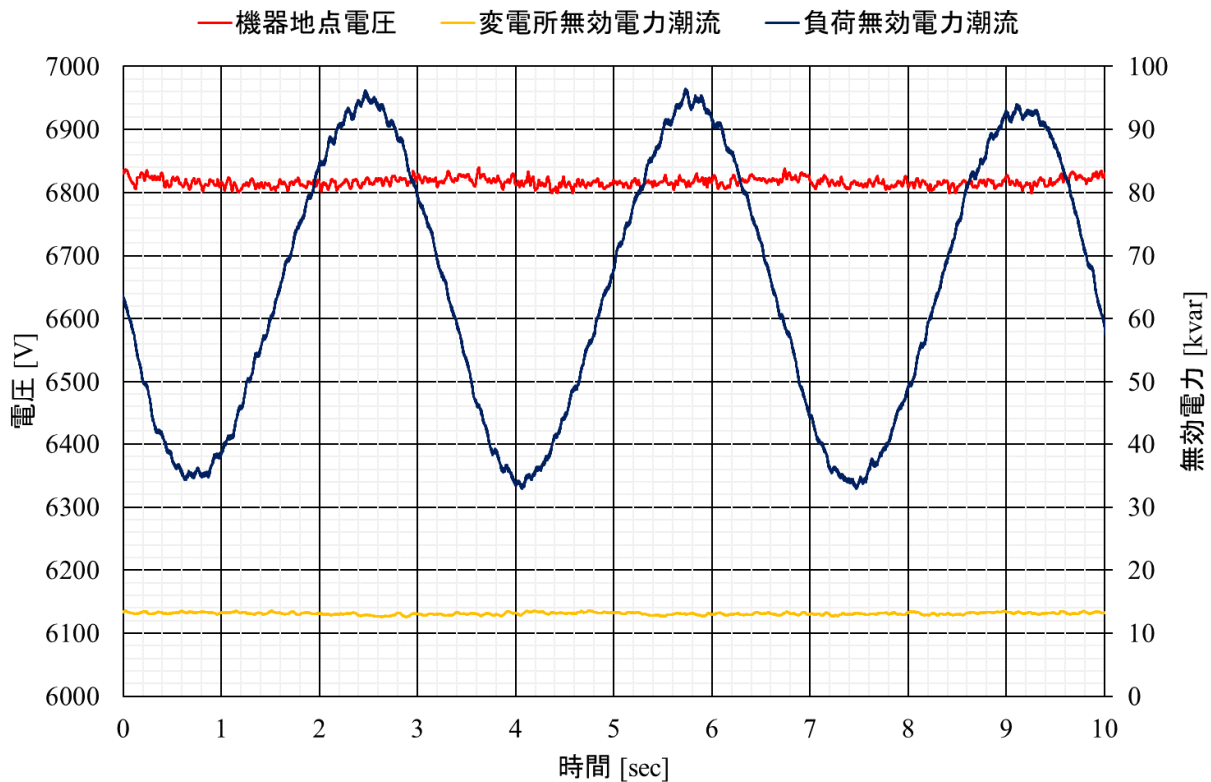




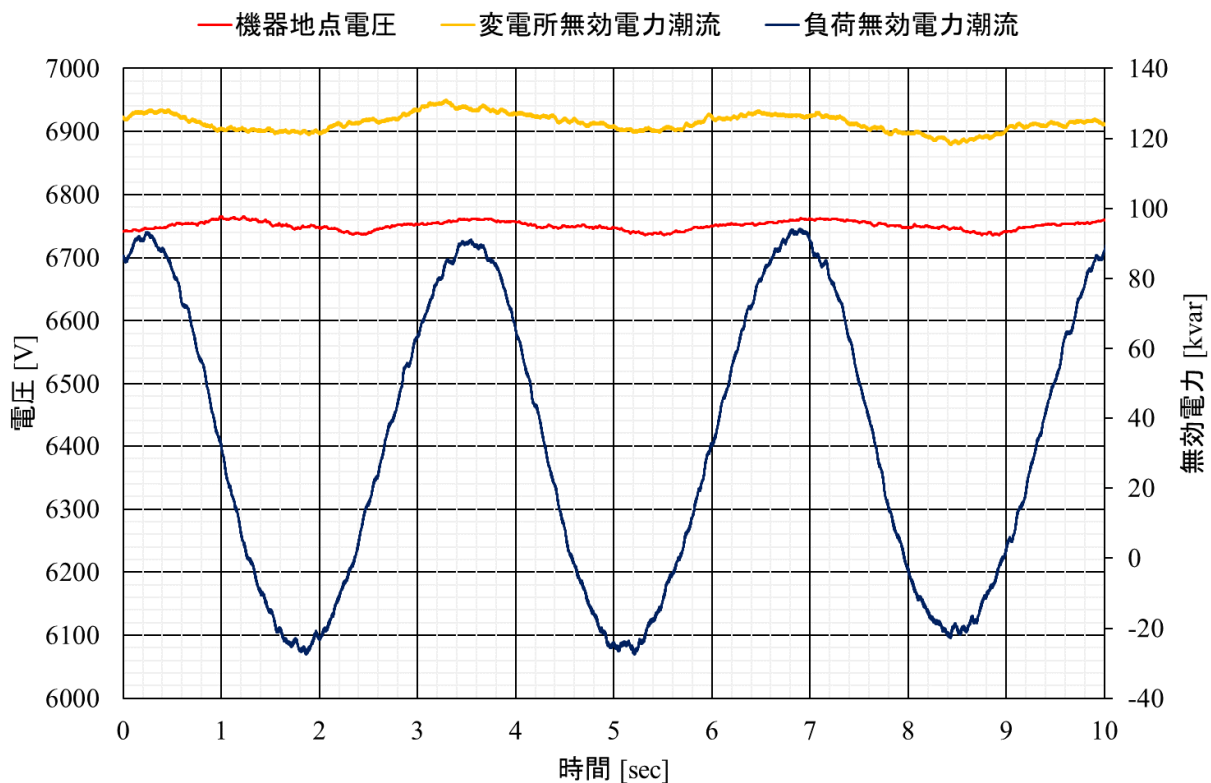
(a) 検証機器 c-2 (制御目標電圧 6800V)



(b) 検証機器 c-2 (制御目標電圧 6500V, 単独運転検出非干渉対応モード)



(c) 検証機器 d-1 (制御目標電圧 6800V)



(d) 検証機器 d-2 (制御目標電圧 6800V)

図付 2-2.2.3-2 負荷不平衡時の機器設置地点電圧と変電所潮流  
 (回転型電源 150kW, 単独運転検出能動信号: 無効電力変動方式, 0.3Hz, 10%)

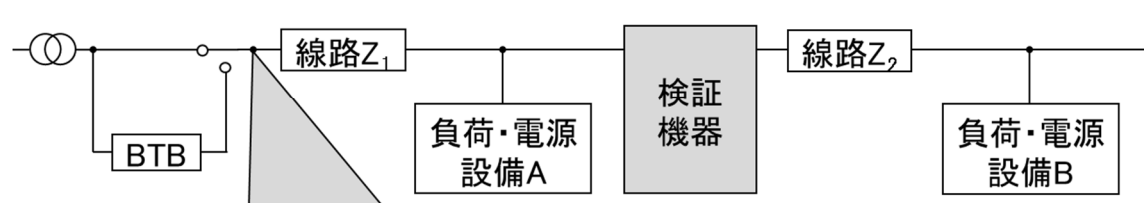
### 2. 2. 3② 単独運転時

試験手順を図付 2-2.2.3-3、各試験条件における単独運転検出時間を表付 2-2.2.3-1 に示す。  
なおこの時間は、複数回実施した試験データを平均化した時間である。

表付 2-2.2.3-1 各試験条件における単独運転検出時間

	機器停止時	機器 c-2、3	機器 d-1	機器 d-2
インバータ電源 (新型能動方式)	0.097 秒	0.106 秒	0.141 秒	0.100 秒
回転型電源 (能動信号なし)	5.887 秒	3.568 秒	4.687 秒	3.106 秒
回転型電源 (無効電力変動方式)	1.403 秒	3.575 秒 (2.031 秒 <sup>※</sup> )	3.680 秒	1.955 秒

※ 改良として具備された単独運転検出非干渉モードにて実施。

対象	大項目	中項目	小項目
単機	性能評価	事故発生運用時	単独運転時
試験回路	 <p>送り出し部で潮流0(有効潮流=0、無効潮流=0)に調整し、遮断器を開放して、単独運転を発生。</p>		
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④分散型電源投入</li> <li>⑤負荷投入・調整 (変電所送り出し潮流P=0, Q=0)</li> <li>⑥変電所遮断器の開放</li> <li>⑦動作の確認</li> </ol>		
試験パラメータ	<p>Z=5Ωとは、R=5Ω、X=5Ωとする。 IN: インバータ, SG: 同期発電機</p> <p> <math>\left( \begin{matrix} Z_1 &amp; Z_2 \\ 5\Omega &amp; 0\Omega \end{matrix} \right) \times \left( \begin{matrix} \text{電源B} \\ \text{IN200kW(無効電力変動方式)} \\ \text{IN70kW(新型能動方式)} \\ \text{SG150kW(無効電力変動方式)} \end{matrix} \right) \times \left( \begin{matrix} \text{負荷B} \\ \text{送り出し部で潮流0} \\ \text{(有効潮流=0、無効潮流=0)} \\ \text{になるようR負荷、} \\ \text{C負荷を投入} \end{matrix} \right)</math> </p> <p> <math>\times \left( \begin{matrix} \text{SVCの有無} \\ \text{無しの場合} \\ \text{有りの場合} \end{matrix} \right) \times 1\text{ケースにつき3回実施}</math> </p>		

図付 2-2.2.3-3 試験手順(単独運転時)

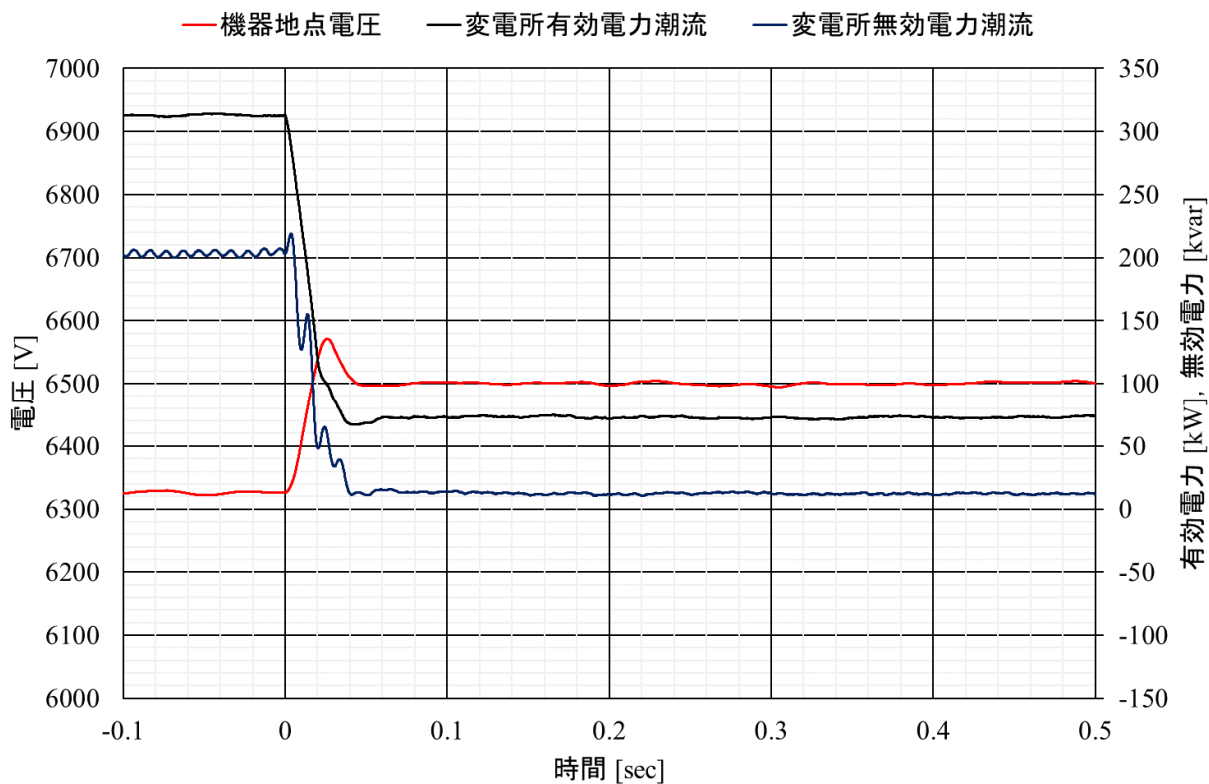
## 2.2.4 ループ切替時の動作

### 2.2.4① ループイン・ループアウト時

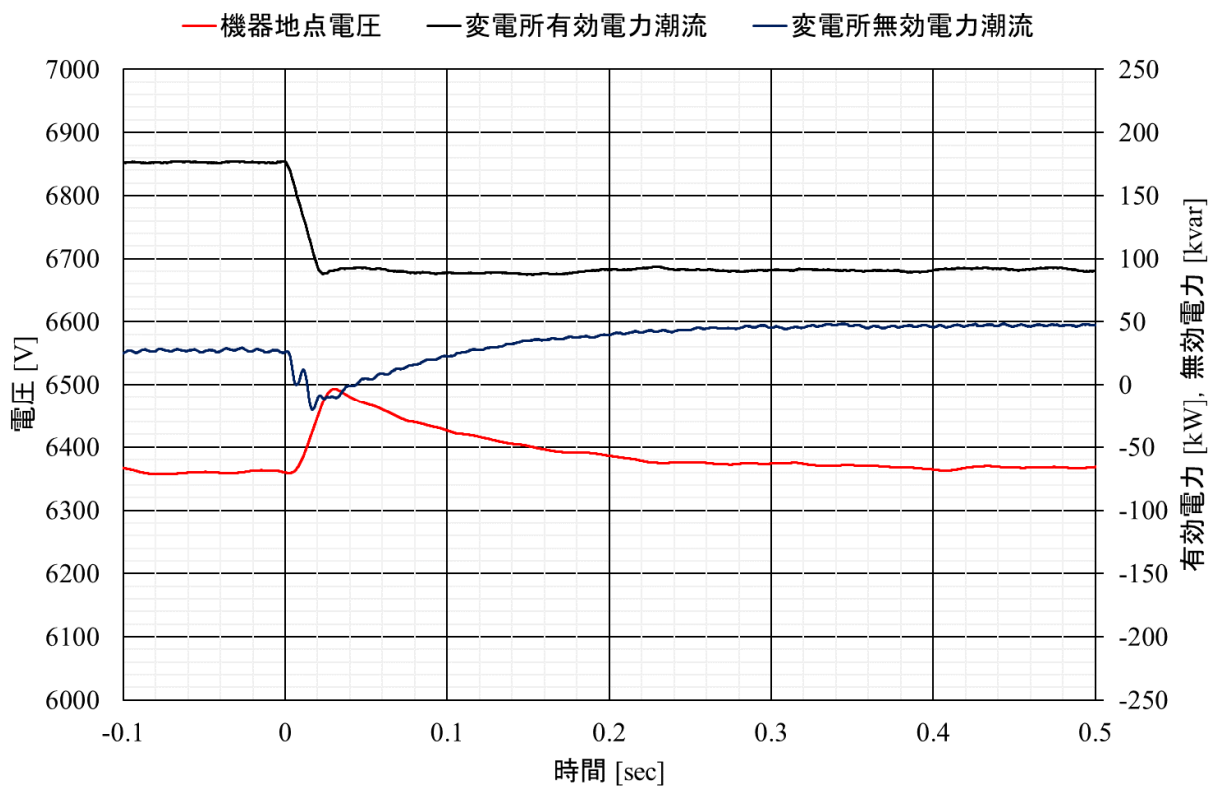
試験手順を図付 2-2.2.4-1, ループイン時の機器設置地点電圧, 変電所, 負荷地点での無効電力潮流を図付 2-2.2.4-2 に示す。

対象	大項目	中項目	小項目																
単機	電圧制御	ループ切替時動作	ループイン・ループアウト動作																
試験回路																			
試験手順	<ol style="list-style-type: none"> <li>① 配電線に6kV電圧を印加</li> <li>② 検証機器の制御電源投入</li> <li>③ 検証機器を起動</li> <li>④ 負荷投入</li> <li>⑤ 開閉器e投入(ループイン)</li> <li>⑥ 動作の確認</li> <li>⑦ 開閉器f開放(ループアウト, 変電所方向反転)</li> <li>⑧ 動作の確認</li> </ol>																		
試験パラメータ	<p>Z=5Ωとは、R=5Ω、X=5Ωとする。</p> <table border="0"> <tr> <td>配電線①</td> <td>Z<sub>4</sub></td> <td>Z<sub>3</sub></td> <td>負荷量</td> </tr> <tr> <td></td> <td>5Ω</td> <td>0Ω</td> <td>R280kW+L300kvar</td> </tr> <tr> <td>配電線②</td> <td>Z<sub>4</sub></td> <td></td> <td>負荷量</td> </tr> <tr> <td></td> <td>5Ω</td> <td></td> <td>C150kVar</td> </tr> </table> <p> <span style="font-size: 2em;">×</span> (SVCの有無)         <span style="margin-left: 2em;">×</span> (変電所方向)       </p> <p>         ・無しの場合          ・有りの場合       </p> <p>         ・反転しない場合          ・反転する場合       </p>			配電線①	Z <sub>4</sub>	Z <sub>3</sub>	負荷量		5Ω	0Ω	R280kW+L300kvar	配電線②	Z <sub>4</sub>		負荷量		5Ω		C150kVar
配電線①	Z <sub>4</sub>	Z <sub>3</sub>	負荷量																
	5Ω	0Ω	R280kW+L300kvar																
配電線②	Z <sub>4</sub>		負荷量																
	5Ω		C150kVar																

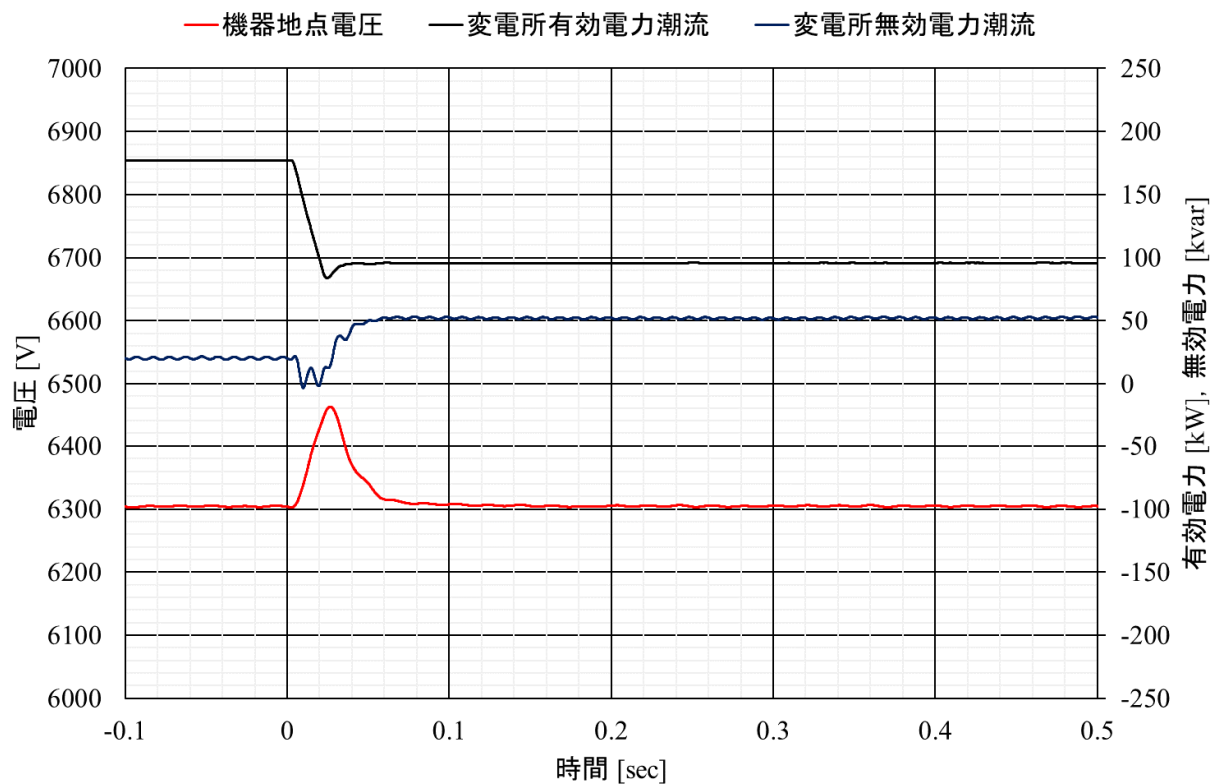
図付 2-2.2.4-1 試験手順(ループイン・ループアウト時)



(a) 検証機器 c-3 (制御目標電圧 6300V、  
線路 Z1:5Ω、負荷 B:R280kW、L300kvar、線路 Z4:5Ω、負荷 C:C150kvar)



(b) 検証機器 d-1 (制御目標電圧 6300V、  
線路 Z1:5Ω、負荷 B:R180kW、L200kvar、線路 Z4:5Ω、負荷 C:C150kvar)



(c) 検証機器 d-2 (制御目標電圧 6300V、  
 線路 Z1:5Ω、負荷 B:R180kW、L200kvar、線路 Z4:5Ω、負荷 C:C150kvar)  
 図付 2-2.2.4-2 ループイン時の機器設置地点電圧と変電所潮流

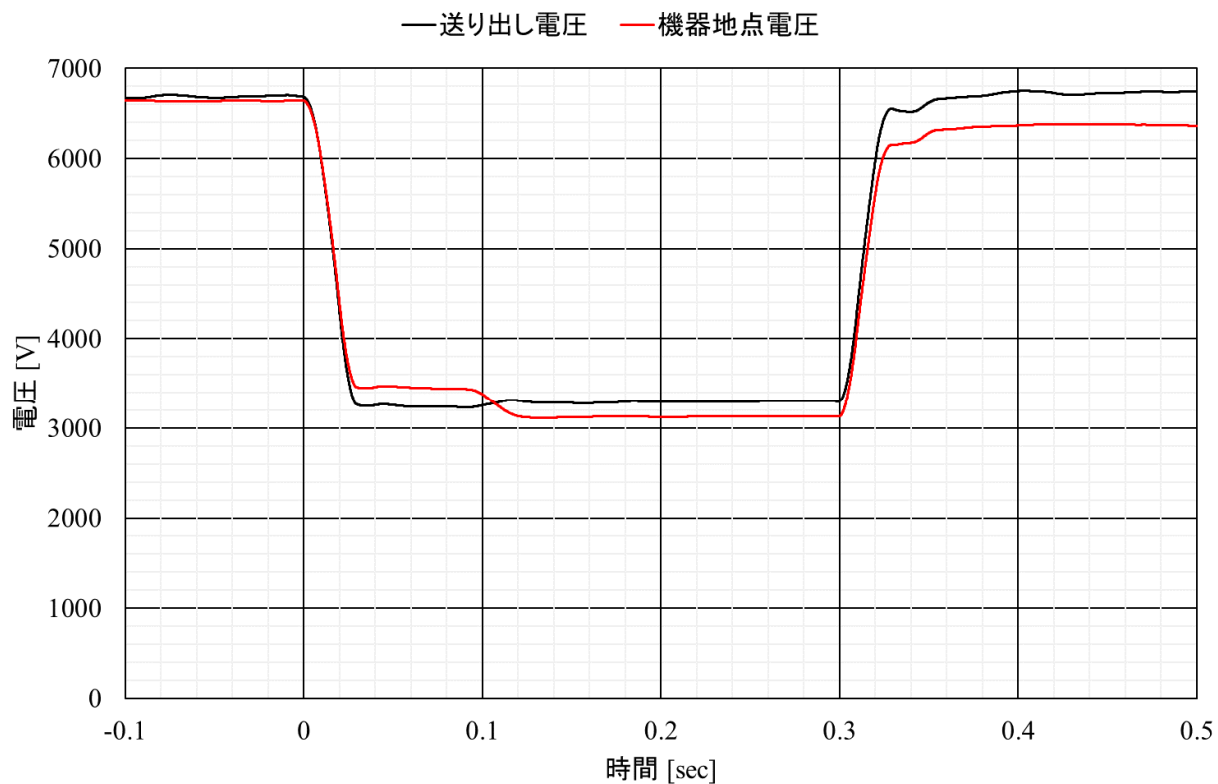
## 2. 2. 5 電力系統擾乱時の動作

### 2. 2. 5① 瞬時電圧低下時:

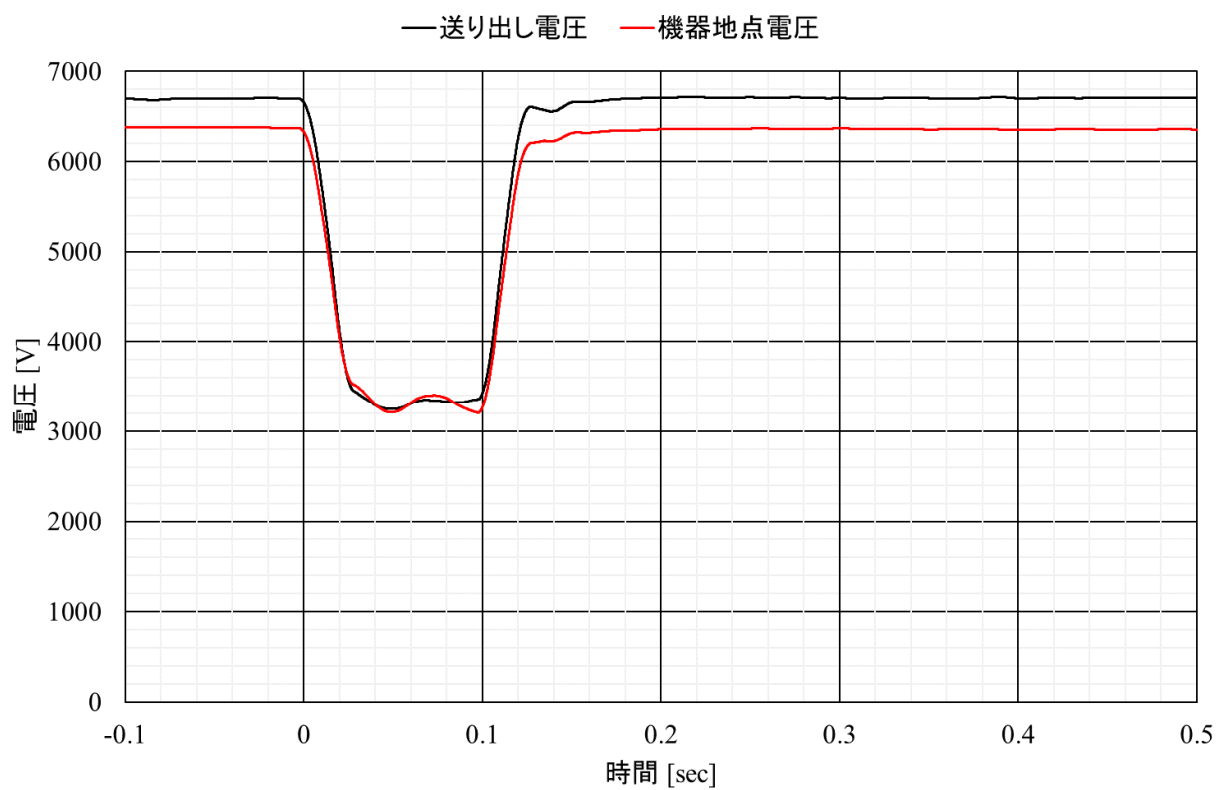
試験手順を図付 2-2.2.5-1, 瞬時電圧低下時の機器設置地点電圧を図付 2-2.2.5-2 に示す。

対象	大項目	中項目	小項目
単機	性能評価	電圧系統擾乱時の動作	瞬時電圧低下
試験回路			
試験手順	<p>①配電線に6kV電圧を印加                  ②検証機器の制御電源投入                  ③検証機器を起動                  ④瞬時電圧低下発生                  ⑤動作の確認</p>		
試験パラメータ	<p>Z=5Ωとは、R=5Ω、X=5Ωとする</p> $\begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix} \times \begin{pmatrix} \text{瞬低時} \\ \text{残電圧} \\ 50\% \\ 20\% \\ 0\% \end{pmatrix} \times \begin{pmatrix} \text{瞬低時} \\ \text{継続時間} \\ 300msec \\ 1sec \end{pmatrix}$		

図付 2-2.2.5-1 試験手順(瞬時電圧低下時)

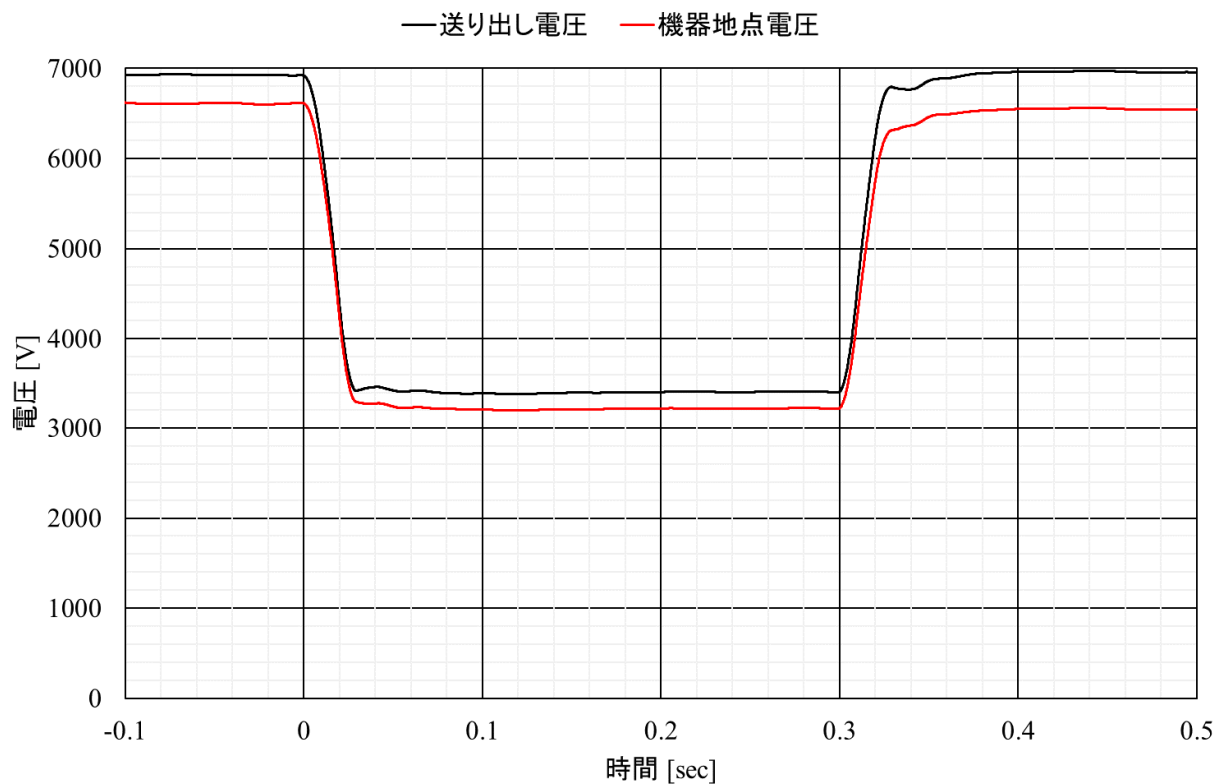


(a) 検証機器 c-2 (制御目標電圧 6300V, 瞬時電圧低下継続時間 0.3sec)



(b) 検証機器 d-1 (制御目標電圧 6300V, 瞬時電圧低下継続時間 0.1sec)





(c) 検証機器 d-2 (制御目標電圧 6600V, 瞬時電圧低下継続時間 0.3sec)

図付 2-2.2.5-2 ループイン時の機器設置地点電圧と変電所潮流  
 (線路 Z1:5Ω、負荷 B:R180kW、L200kvar、瞬時電圧低下時残電圧 50%)

2. 2. 5② 周波数ステップ変動時:

図付 2-2.2.5-3 の手順で検証した結果, 検証機器 c-1, 検証機器 d-1, d-2 とともに周波数ステップ変動を発生させても機器は異常動作しないことを確認した。

対象	大項目	中項目	小項目
単機	性能評価	電圧系統擾乱時の動作	周波数ステップ変動時
試験回路			
試験手順	<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④周波数変動発生</li> <li>⑤動作の確認</li> </ol>		
試験パラメータ	<p>Z=5Ωとは、R=5Ω、X=5Ωとする</p> $\left( \begin{array}{ccc} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{array} \right) \times \left( \begin{array}{c} \text{周波数変動} \\ \cdot +0.8\text{Hzステップ} \\ \cdot -0.8\text{Hzステップ} \end{array} \right)$		

図付 2-2.2.5-3 試験手順(周波数ステップ変動時)

2. 2. 5③ 周波数ランプ変動時:

図付 2-2.2.5-4 の手順で検証した結果, 検証機器 c-1, 検証機器 d-1, d-2 とともに周波数ランプ変動を発生させても機器は異常動作しないことを確認した。

対象	大項目	中項目	小項目
単機	性能評価	電圧系統擾乱時の動作	周波数変動(ランプ)
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④周波数変動発生</li> <li>⑤動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする  $\left( \begin{array}{ccc} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{array} \right) \times \left( \begin{array}{c} \text{周波数変動} \\ \cdot +2\text{Hz/secランプ} \\ \cdot -2\text{Hz/secランプ} \end{array} \right)$	

図付 2-2.2.5-4 試験手順(周波数ランプ変動時)

## 2.3. 電圧制御

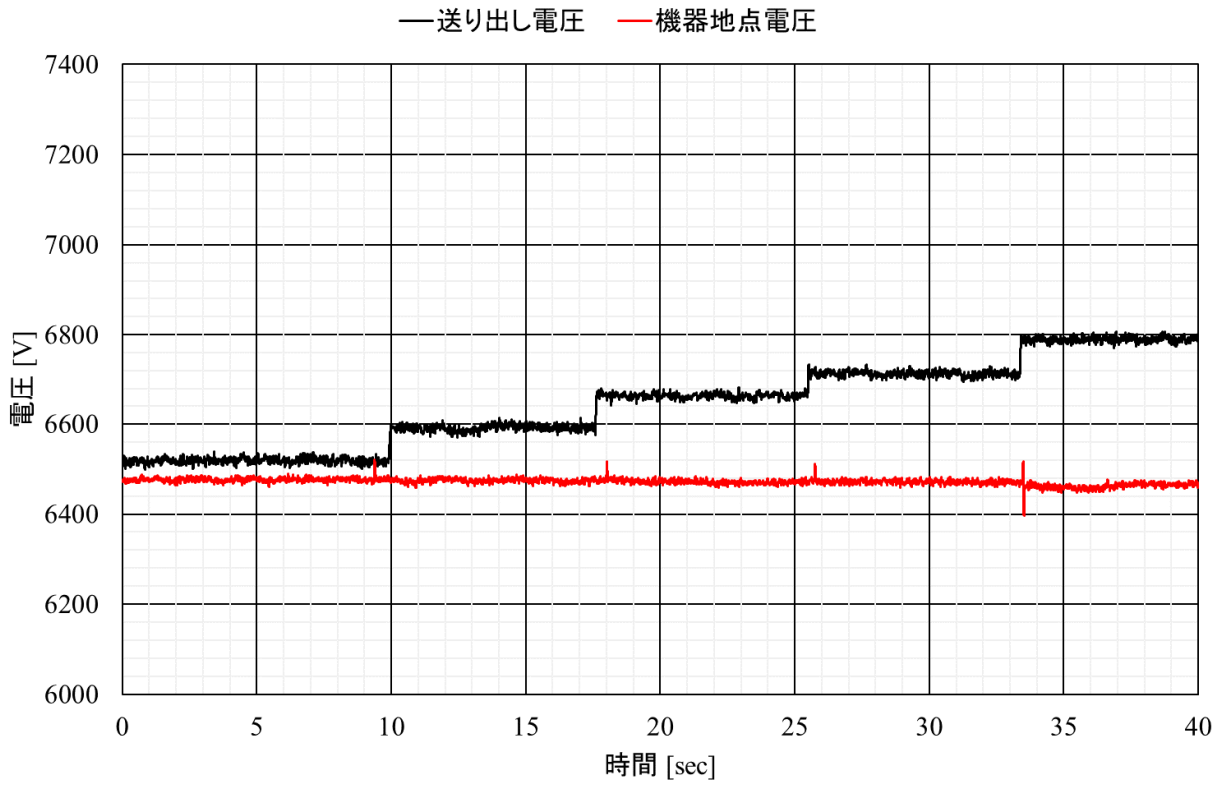
### 2.3.1 通常運転

#### 2.3.1① LRT タップ動作時:

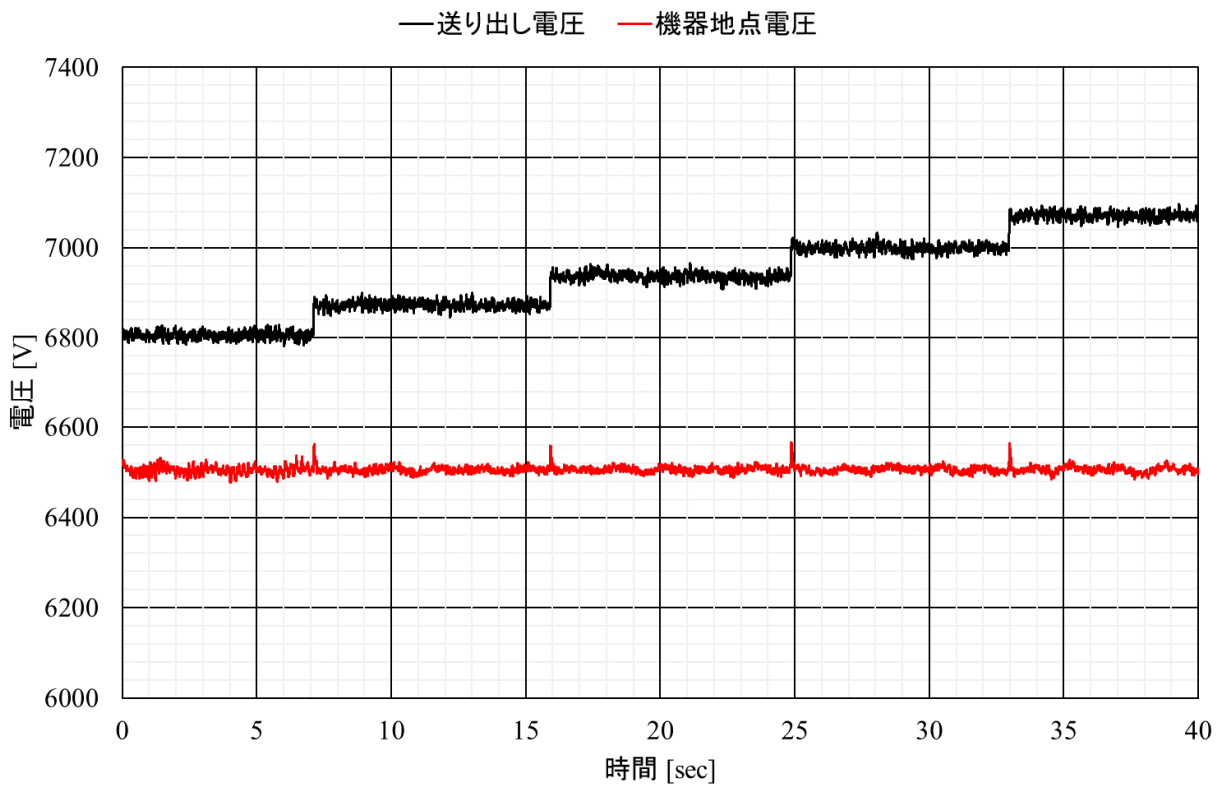
試験手順を図付 2-2.3.1-1, LRT タップ上昇動作時の機器設置地点電圧を図付 2-2.3.1-2, LRT タップ降下時の結果を図付 2-2.3.1-3 に示す。

対象	大項目	中項目	小項目
単機	電圧制御	通常運転時の安定性	LRTのタップ動作時
試験回路			
試験手順		試験パラメータ	
①配電線に6kV電圧を印加 ②検証機器の制御電源投入 ③検証機器を起動 ④LRT 66kV/6.6⇒75Vタップ上げ <b>⑤動作の確認</b> ⑥75Vタップ下げ <b>⑦動作の確認</b>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\begin{pmatrix} Z_1 & Z_2 \\ 3\Omega & 0\Omega \\ 5\Omega & 0\Omega \\ 5\Omega & 5\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix}$	

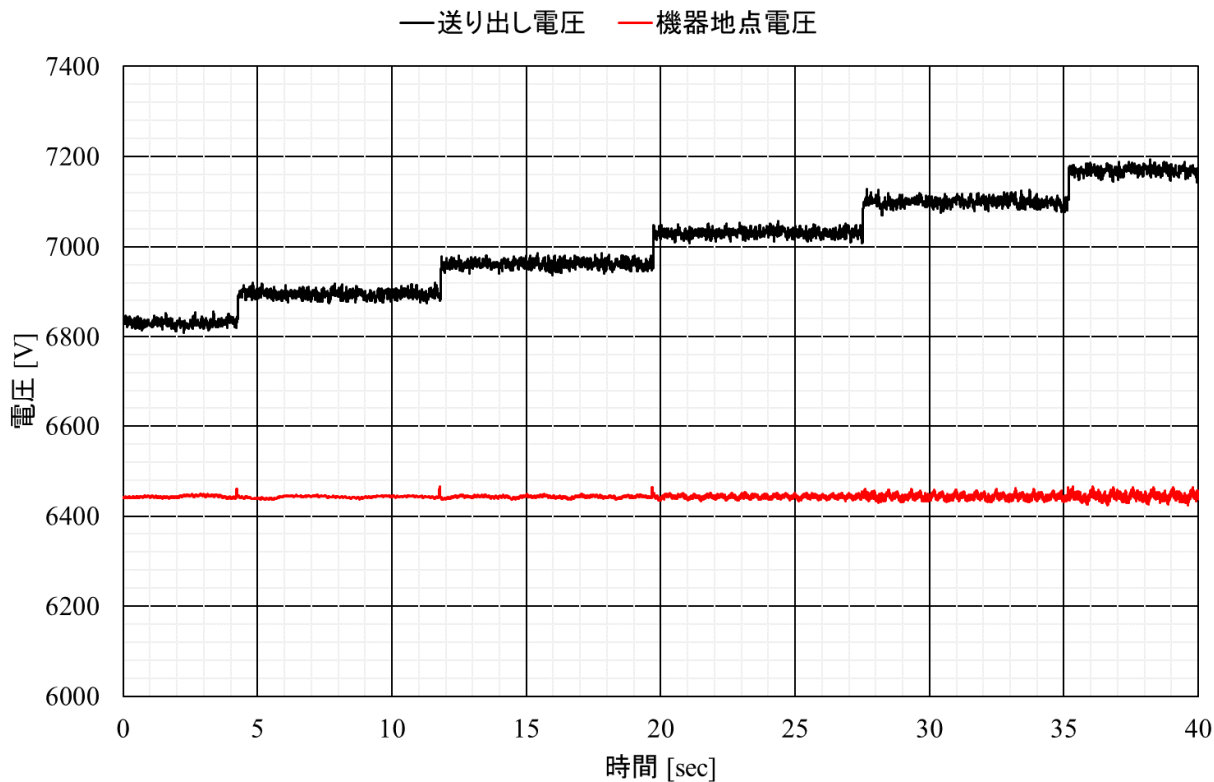
図付 2-2.3.1-1 試験手順(LRT タップ動作時)



(a) 検証機器 c-2 (制御目標電圧 6500V)

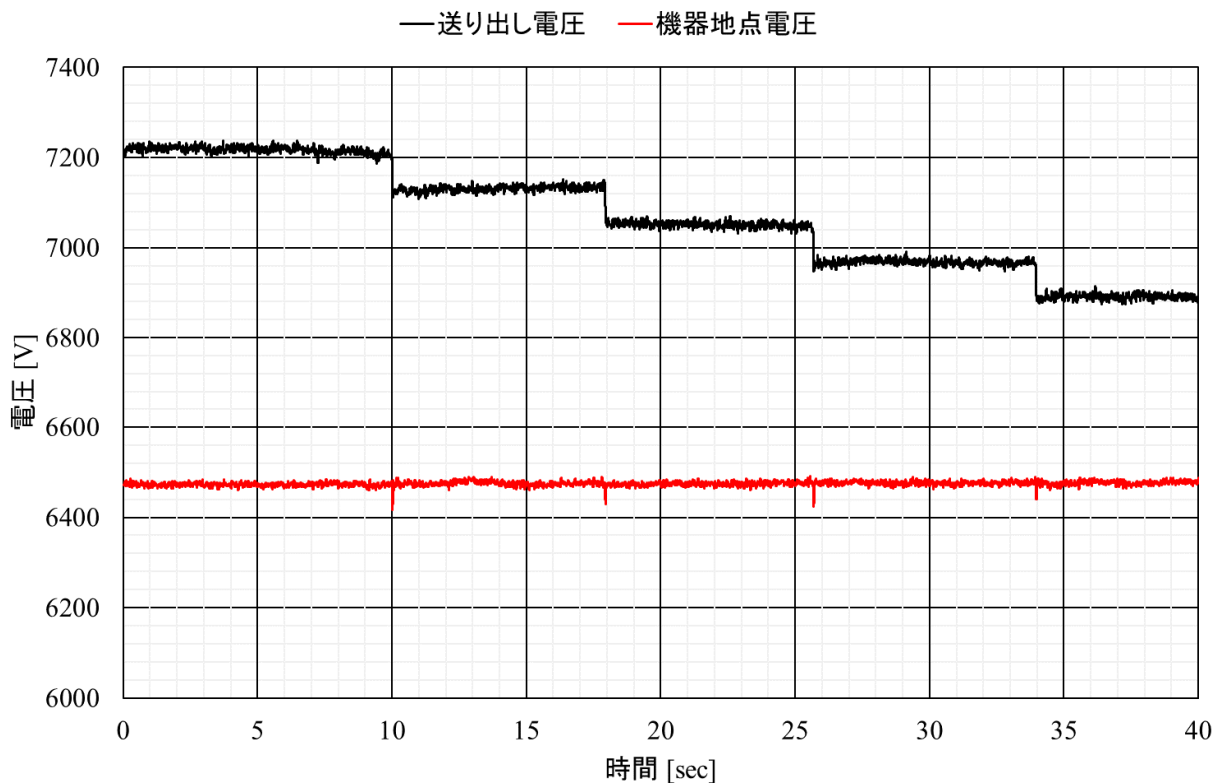


(b) 検証機器 d-1 (制御目標電圧 6500V)

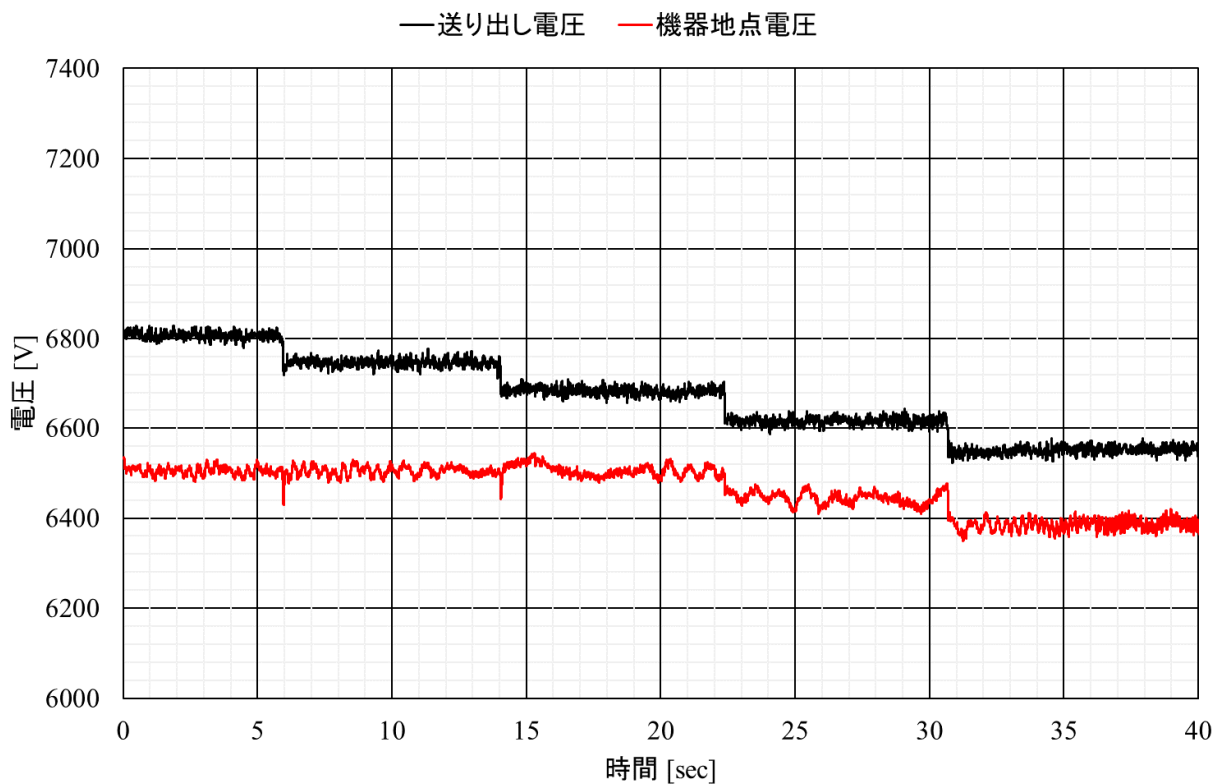


(c) 検証機器 d-2 (制御目標電圧 6500V)

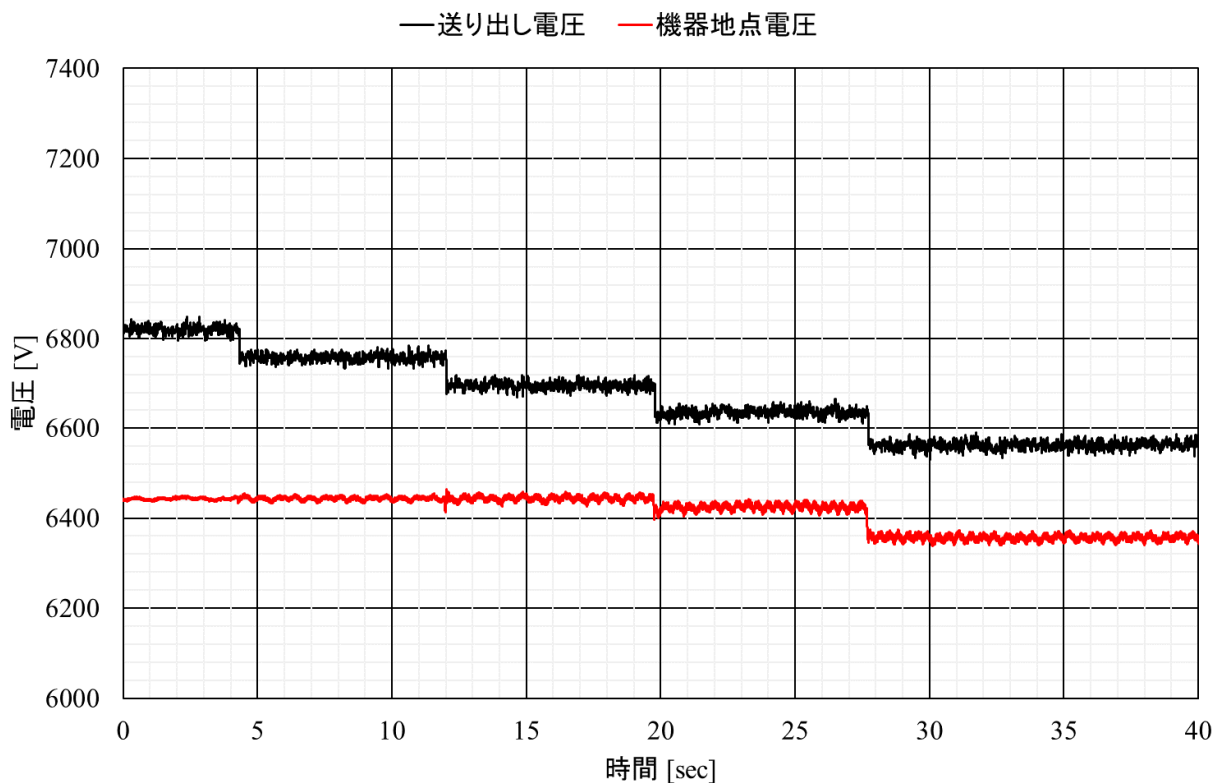
図付 2-2.3.1-2 LRT タップ上昇動作時の機器設置地点電圧  
(線路 Z1:5Ω、負荷 B:R280kW、L100kvar)



(a) 検証機器 c-2 (制御目標電圧 6500V)



(b) 検証機器 d-1 (制御目標電圧 6500V)



(c) 検証機器 d-2 (制御目標電圧 6500V)

図付 2-2.3.1-3 LRT タップ降下動作時の機器設置地点電圧  
(線路 Z1:5Ω、負荷 B:R280kW、L100kvar)

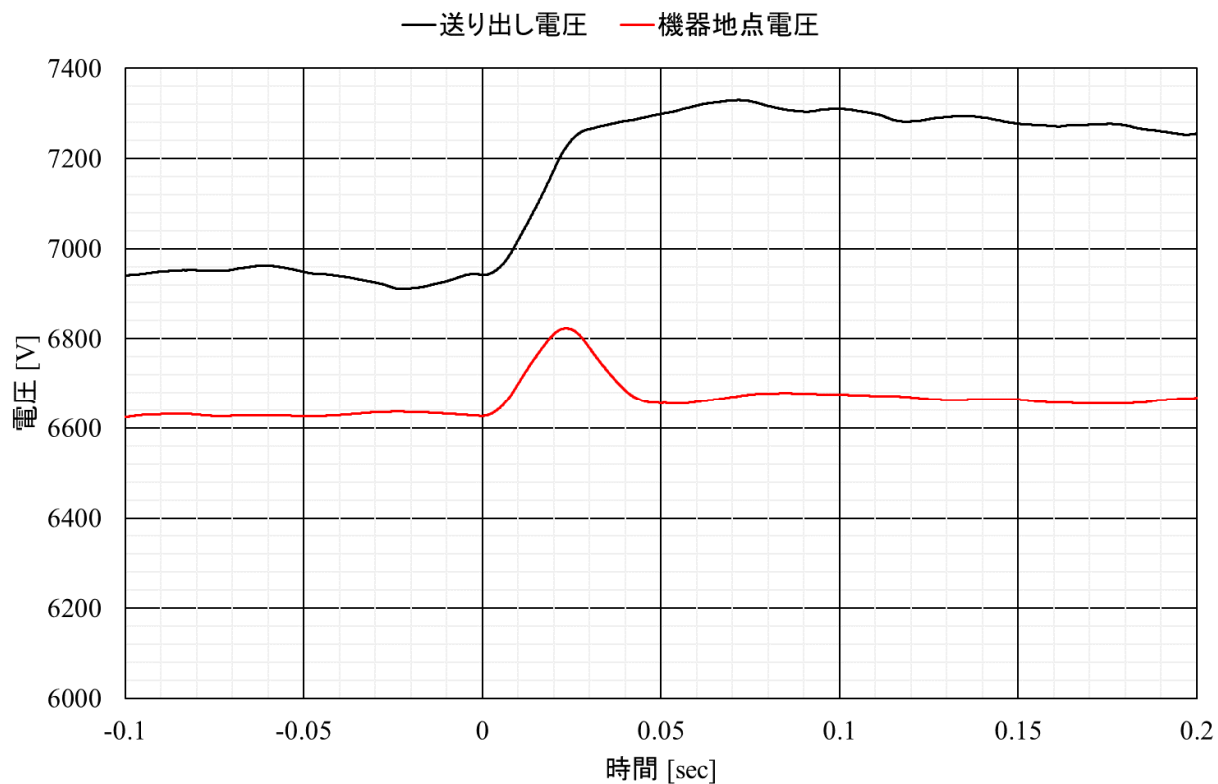
2.3.1② 電圧ステップ変化時:

試験手順を図付 2-2.3.1-4, 電圧ステップ変化時の機器設置地点電圧を図付 2-2.3.1-5 に示す。

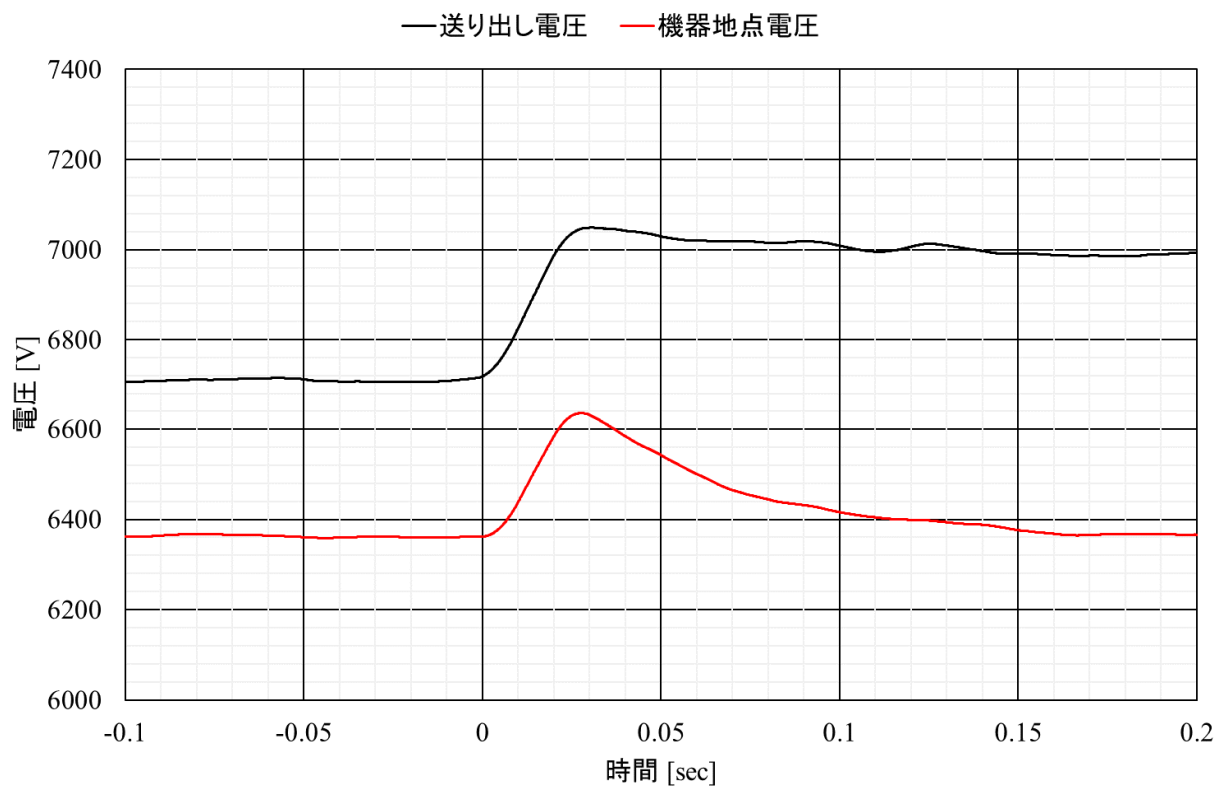
対象	大項目	中項目	小項目
単機	電圧制御	通常運転時の安定性	電圧ステップ変化
試験回路			
<p>BTBを用いて ±300V電圧変動を発生</p>			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④電圧ステップ変化(上げ300V)</li> <li>⑤動作の確認</li> <li>⑥電圧ステップ変化(下げ300V)</li> <li>⑦動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\begin{pmatrix} Z_1 & Z_2 \\ 3\Omega & 0\Omega \\ 5\Omega & 0\Omega \\ 5\Omega & 5\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix}$	

図付 2-2.3.1-4 試験手順(電圧ステップ変化時)

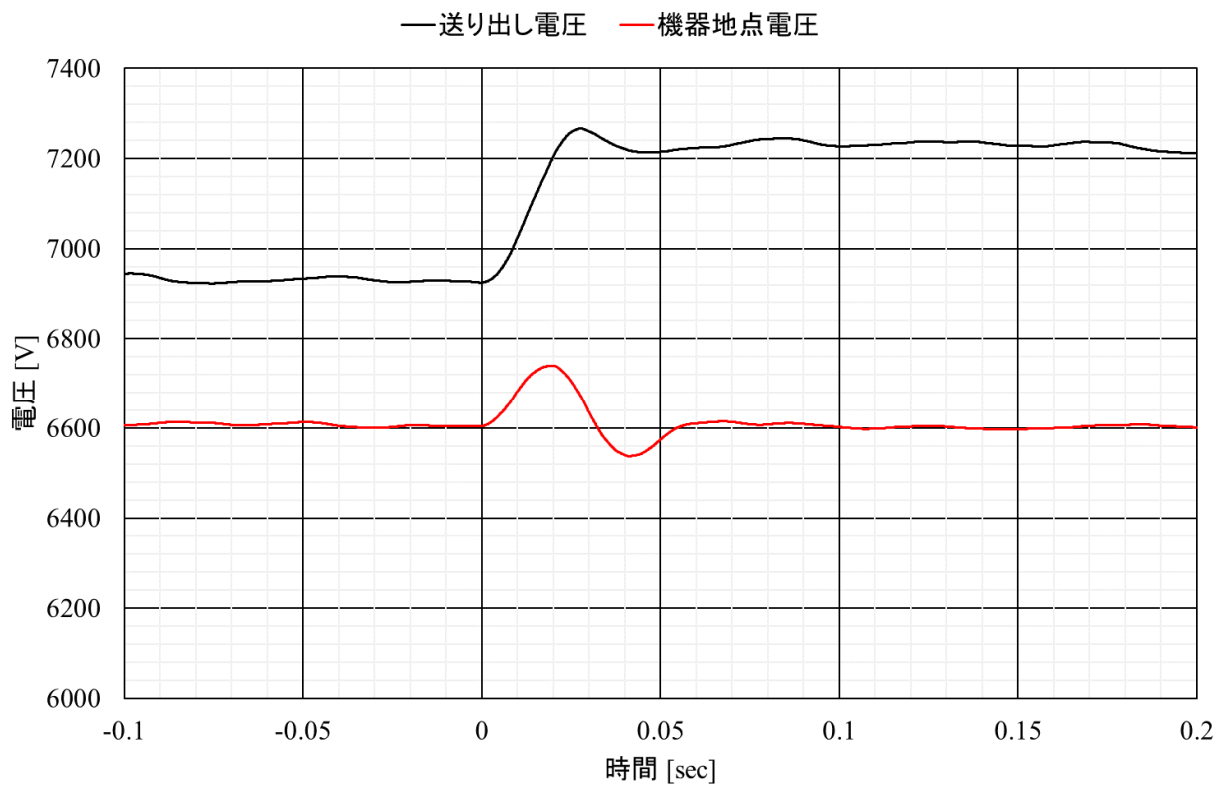




(a) 検証機器 c-2 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6300V)



(c) 検証機器 d-2 (制御目標電圧 6600V)  
 図付 2-2.3.1-5 電圧ステップ変化時の機器設置地点電圧  
 (線路 Z1:5Ω、負荷 B:R280kW、L100kvar)

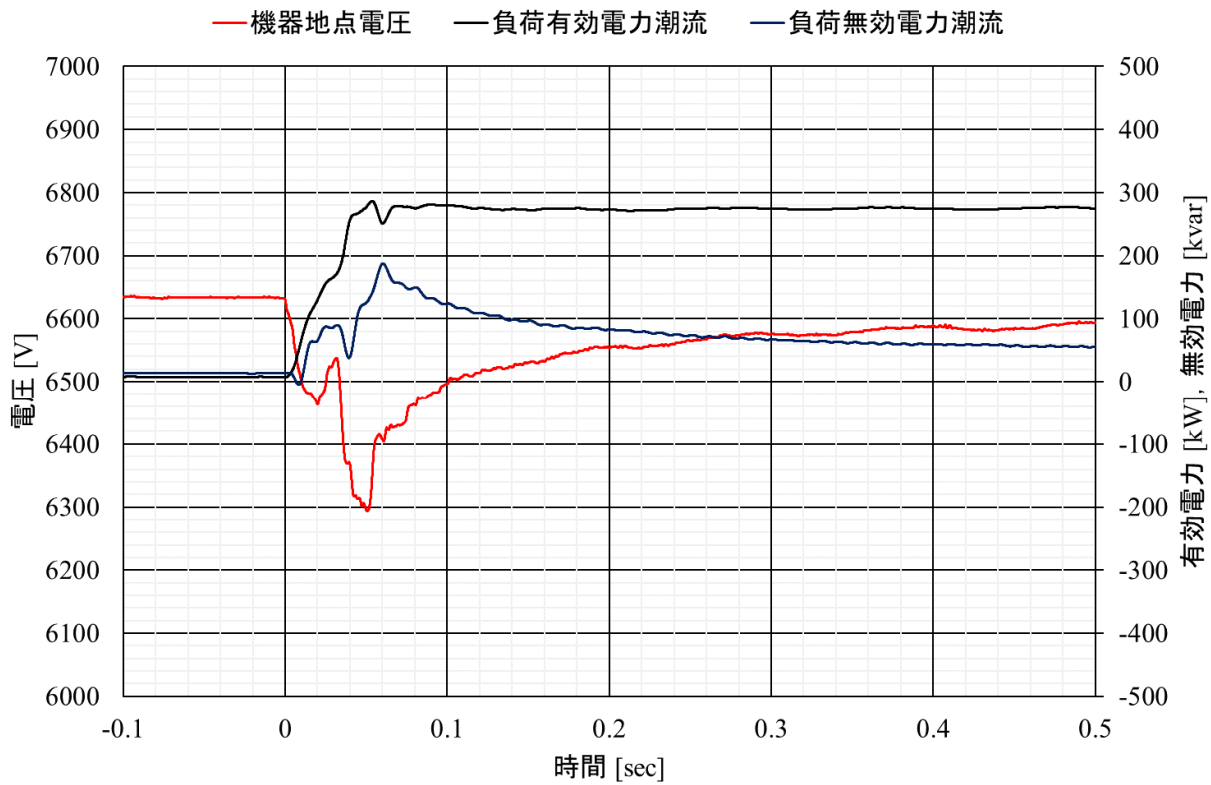
## 2.3.2 負荷特性による影響

### 2.3.2① 負荷の投入・開放時:

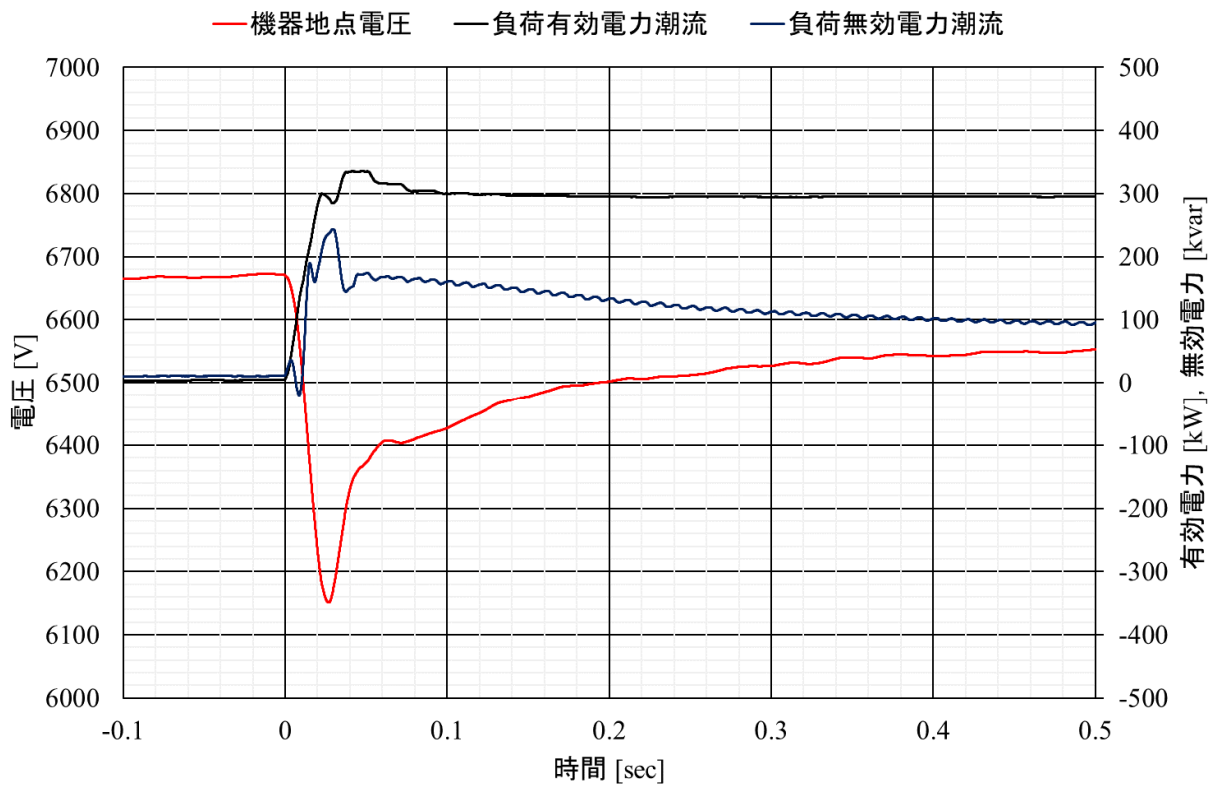
試験手順を図付 2-2.3.2-1, 負荷投入時の機器設置地点電圧を図付 2-2.3.2-2, 負荷開放時の結果を図付 2-2.3.2-3 に示す。

対象	大項目	中項目	小項目
単機	電圧制御	負荷特性による影響	負荷の投入・開放
試験回路			
試験手順		試験パラメータ	
①配電線に6kV電圧を印加 ②検証機器の制御電源投入 ③検証機器を起動 ④無負荷⇒負荷投入 ⑤動作の確認 ⑥負荷投入⇒無負荷 ⑧動作の確認		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\begin{pmatrix} Z_1 & Z_2 \\ 3\Omega & 0\Omega \\ 5\Omega & 0\Omega \\ 5\Omega & 5\Omega \\ 10\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ R280kW \\ R280kW+L100kvar \\ R280kW+C100kvar \\ R560kW \\ R560kW+L200kvar \\ R560kW+C200kvar \end{pmatrix}$	

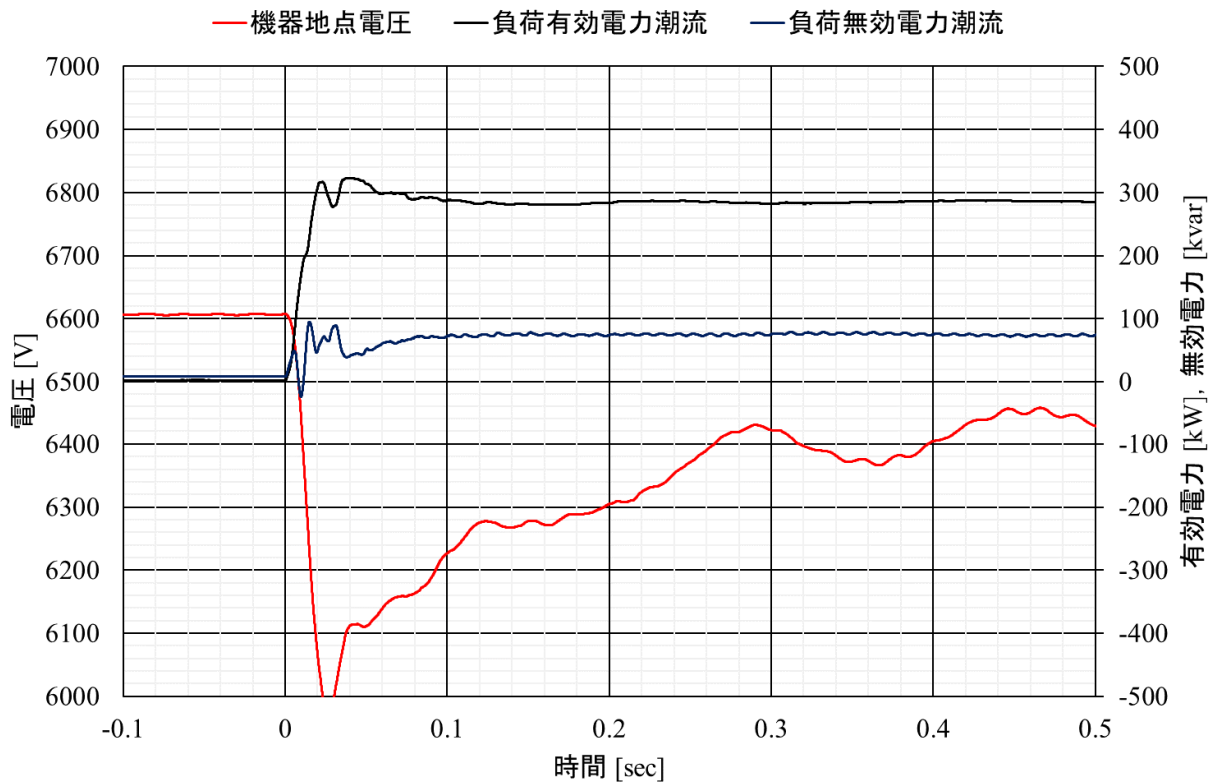
図付 2-2.3.2-1 試験手順(負荷の投入・開放時)



(a) 検証機器 c-2 (制御目標電圧 6600V)

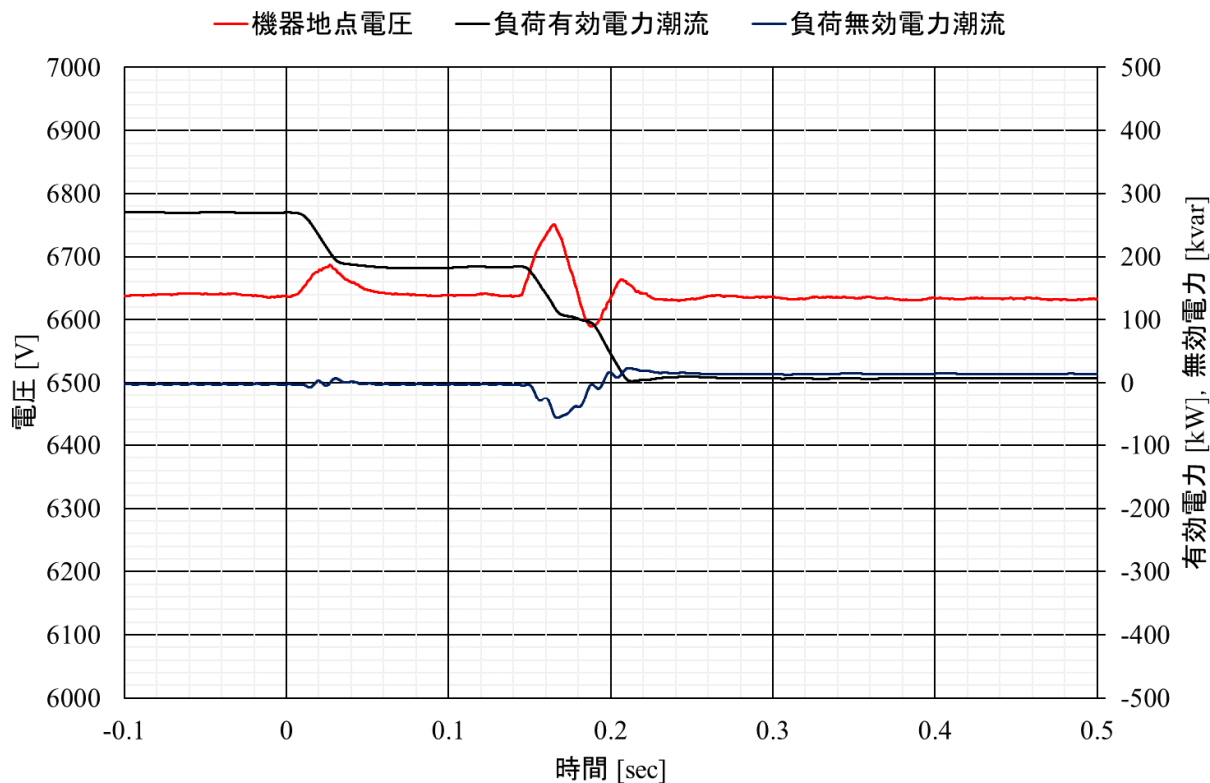


(b) 検証機器 d-1 (制御目標電圧 6600V)

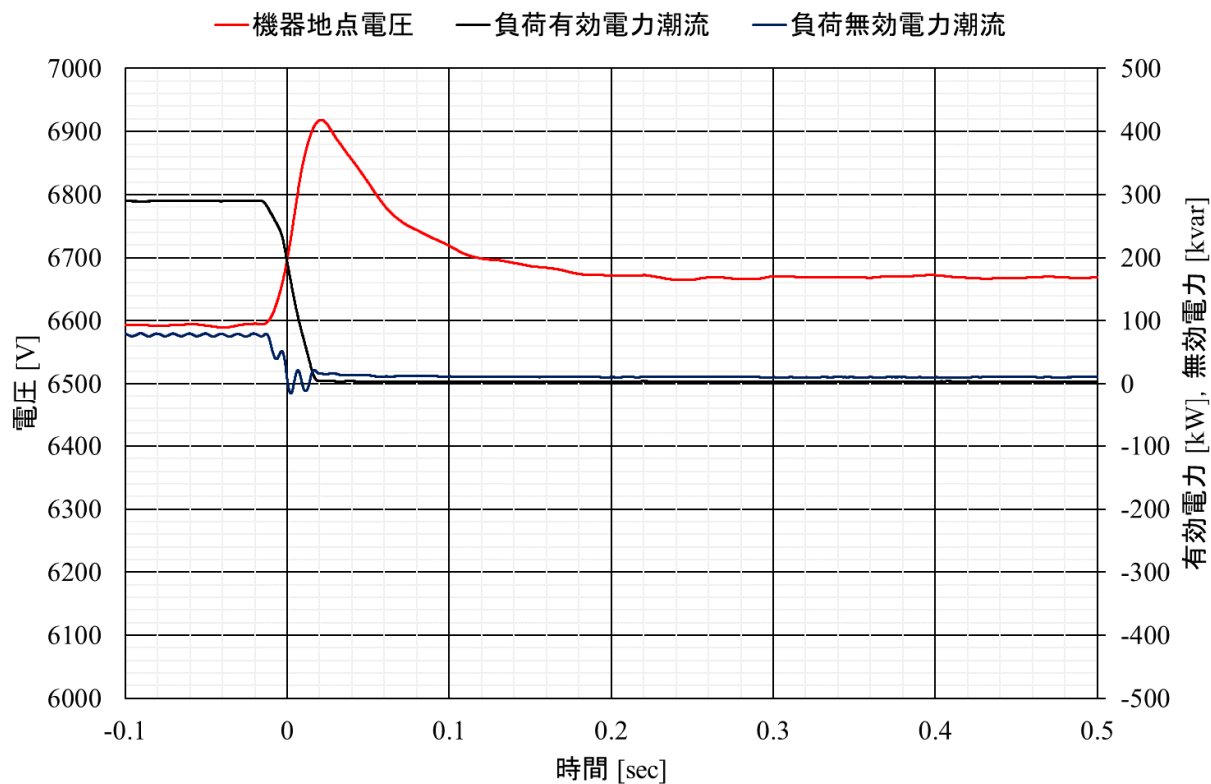


(c) 検証機器 d-2 (制御目標電圧 6600V)

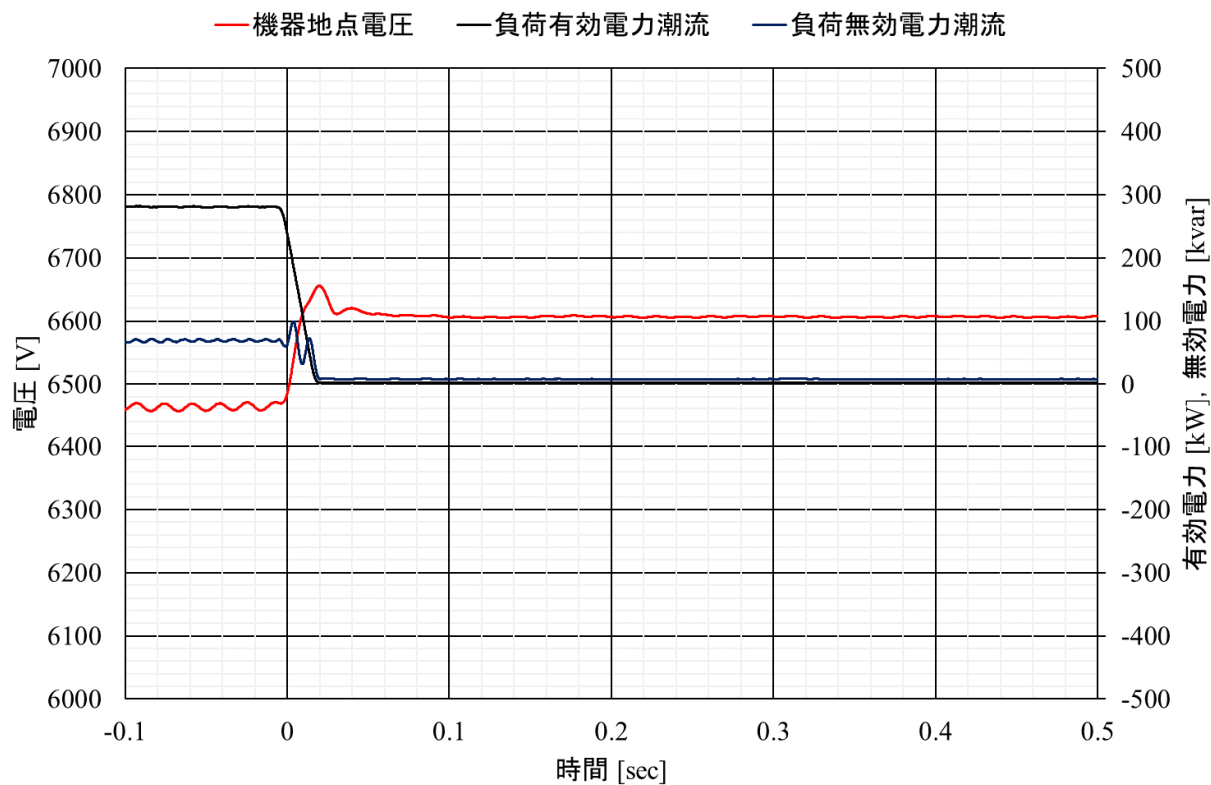
図付 2-2.3.2-2 負荷投入時の機器設置地点電圧と負荷潮流  
(線路 Z1:5Ω, 負荷 B:R280kW, L100kav)



(a) 検証機器 c-2 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6600V)



(c) 検証機器 d-2 (制御目標電圧 6600V)

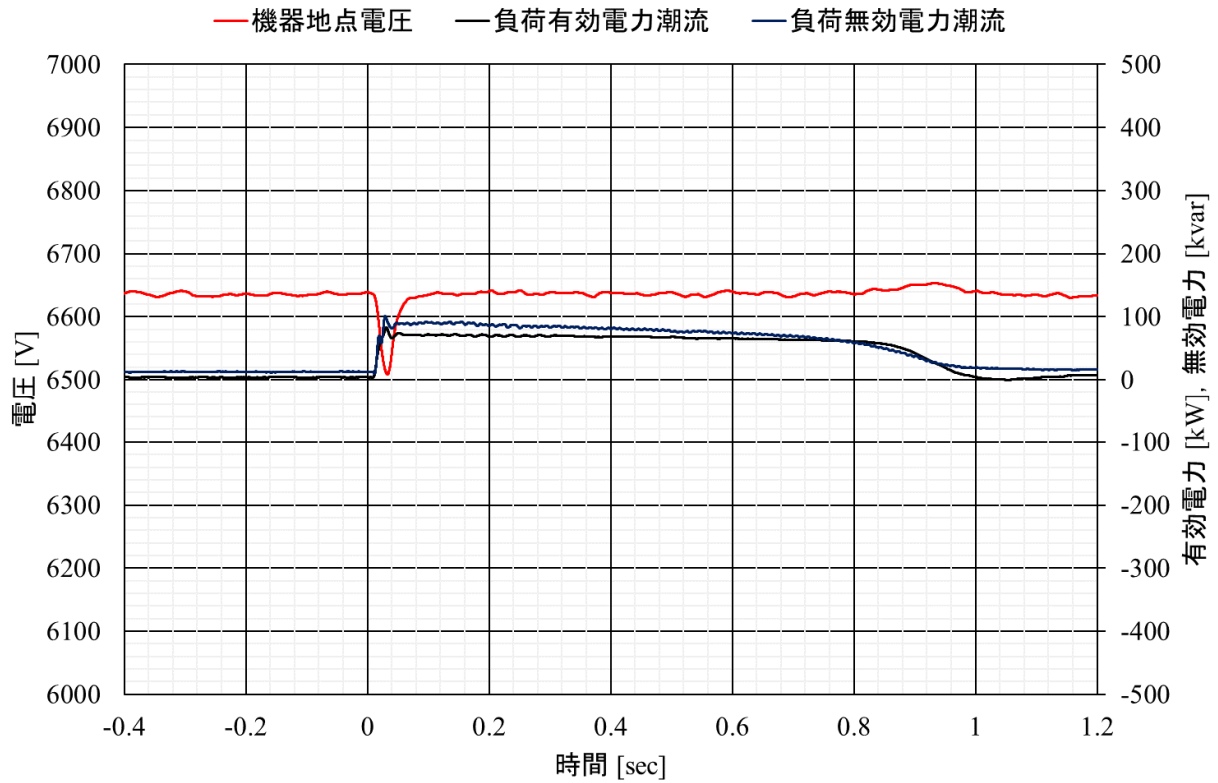
図付 2-2.3.2-3 負荷開放時の機器設置地点電圧と負荷潮流  
(線路 Z1:5Ω, 負荷 B:R280kW, L100kav)

2.3.2② モータ負荷:

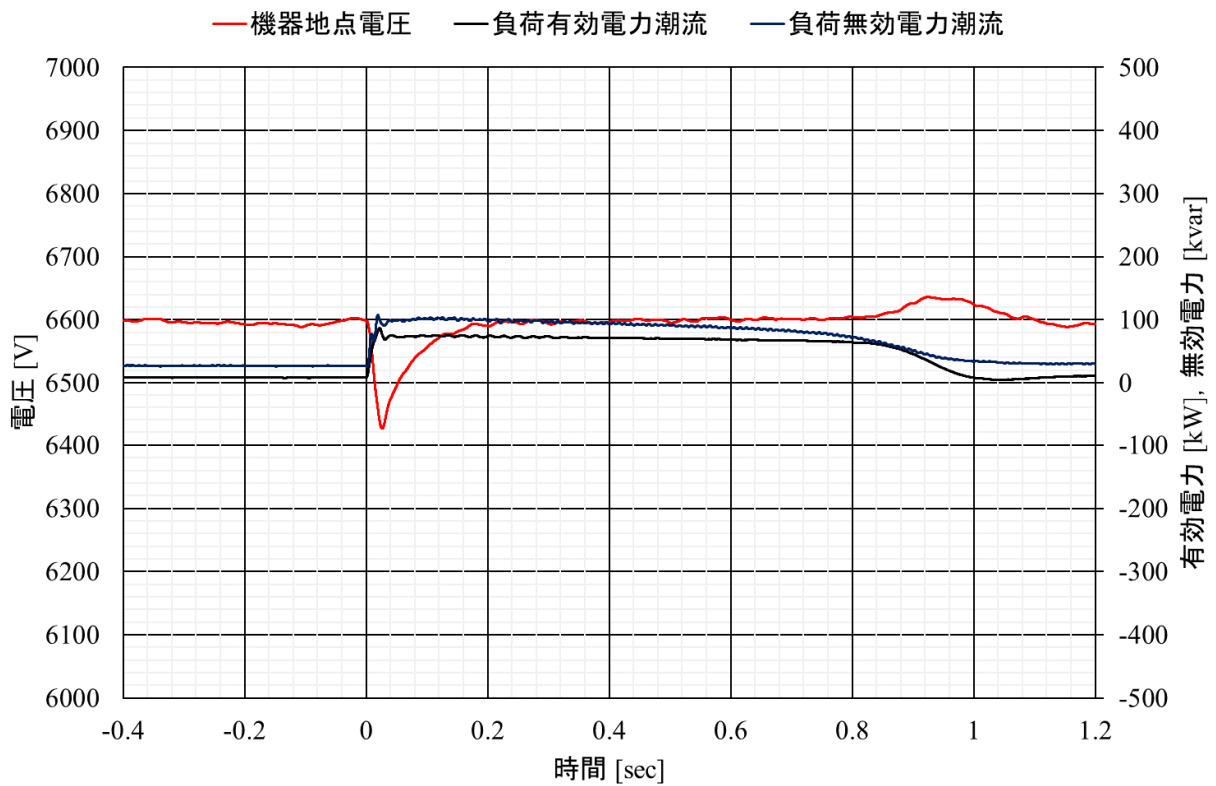
試験手順を図付 2-2.3.2-4, 負荷投入時の機器設置地点電圧を図付 2-2.3.2-5, 負荷開放時の結果を図付 2-2.3.2-6 に示す。

対象	大項目	中項目	小項目
単機	電圧制御	負荷特性による影響	モータ負荷
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④無負荷⇒負荷投入</li> <li>⑤動作の確認</li> <li>⑥負荷投入⇒無負荷</li> <li>⑦動作の確認</li> </ol>		<p>Z=5Ωとは、R=5Ω、X=5Ωとする</p> $\begin{pmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \end{pmatrix} \times \begin{pmatrix} \text{負荷B} \\ \text{モータ負荷40kW} \\ \text{R280kW+モータ負荷40kW} \\ \text{R560kW+モータ負荷40kW} \end{pmatrix}$	

図付 2-2.3.2-4 試験手順(モータ負荷)

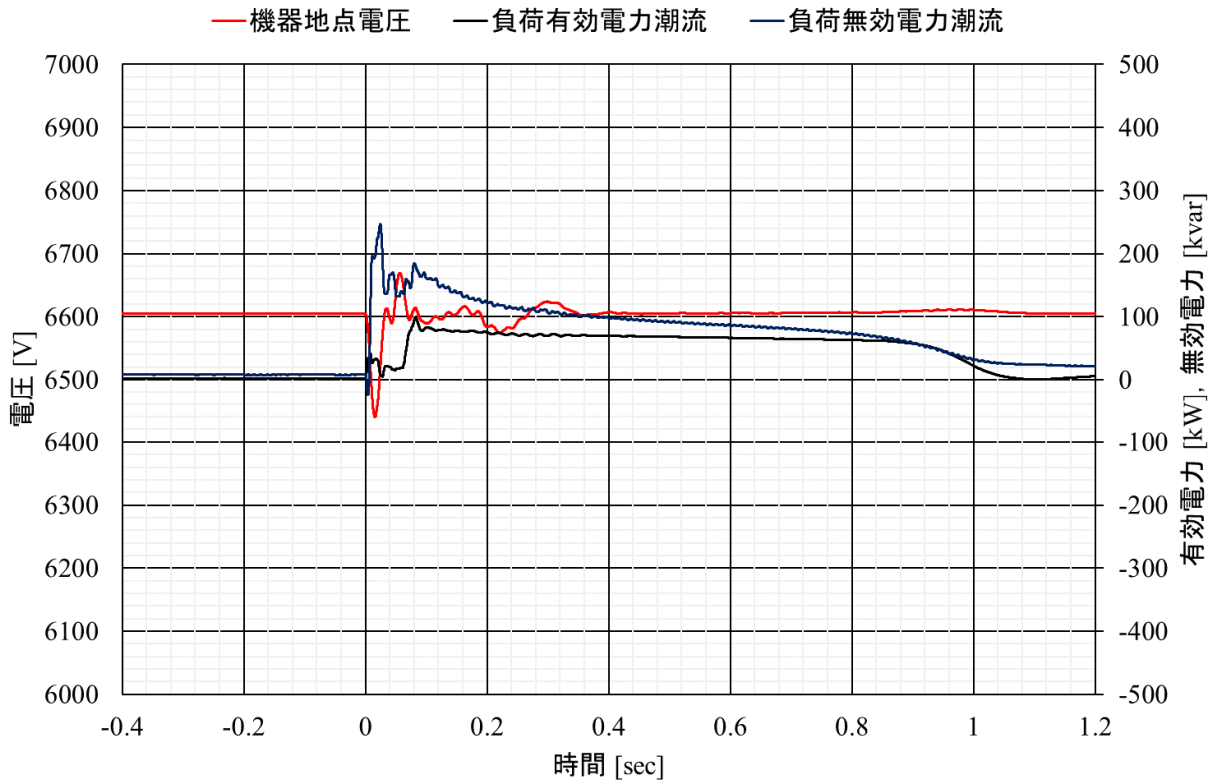


(a) 検証機器 c-3 (制御目標電圧 6600V)



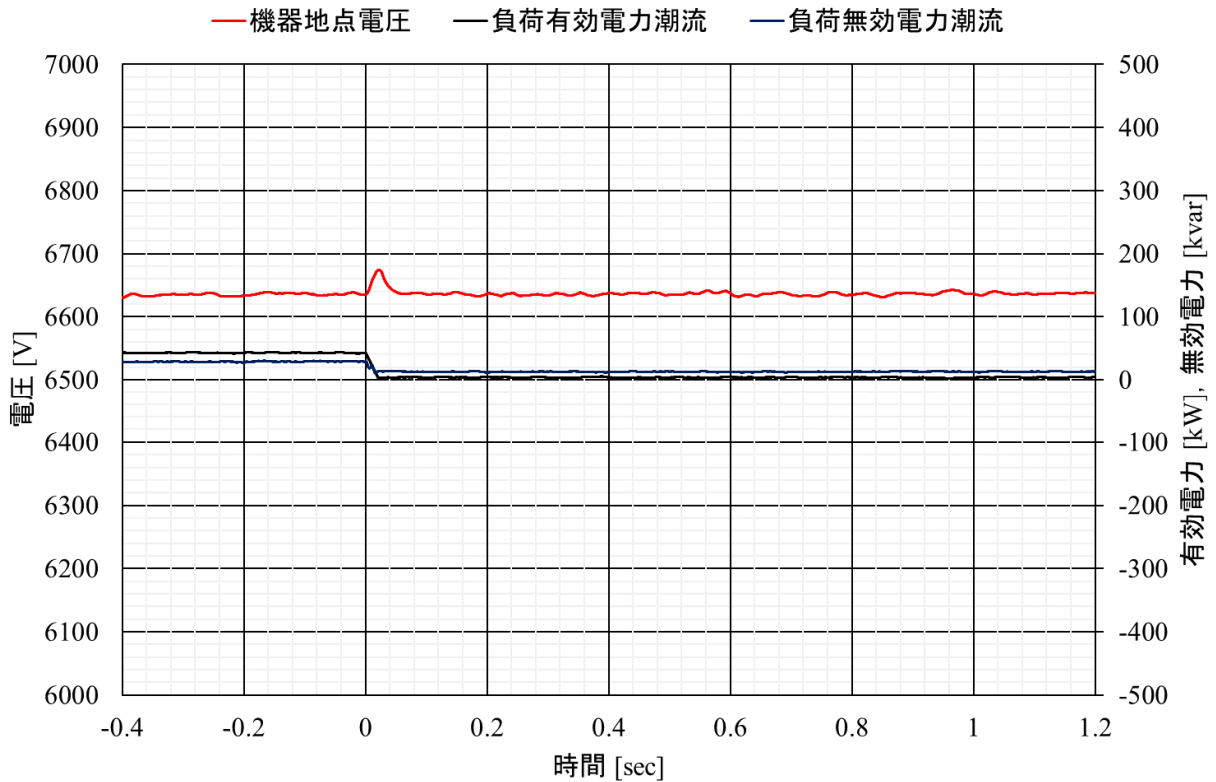
(b) 検証機器 d-1 (制御目標電圧 6600V)



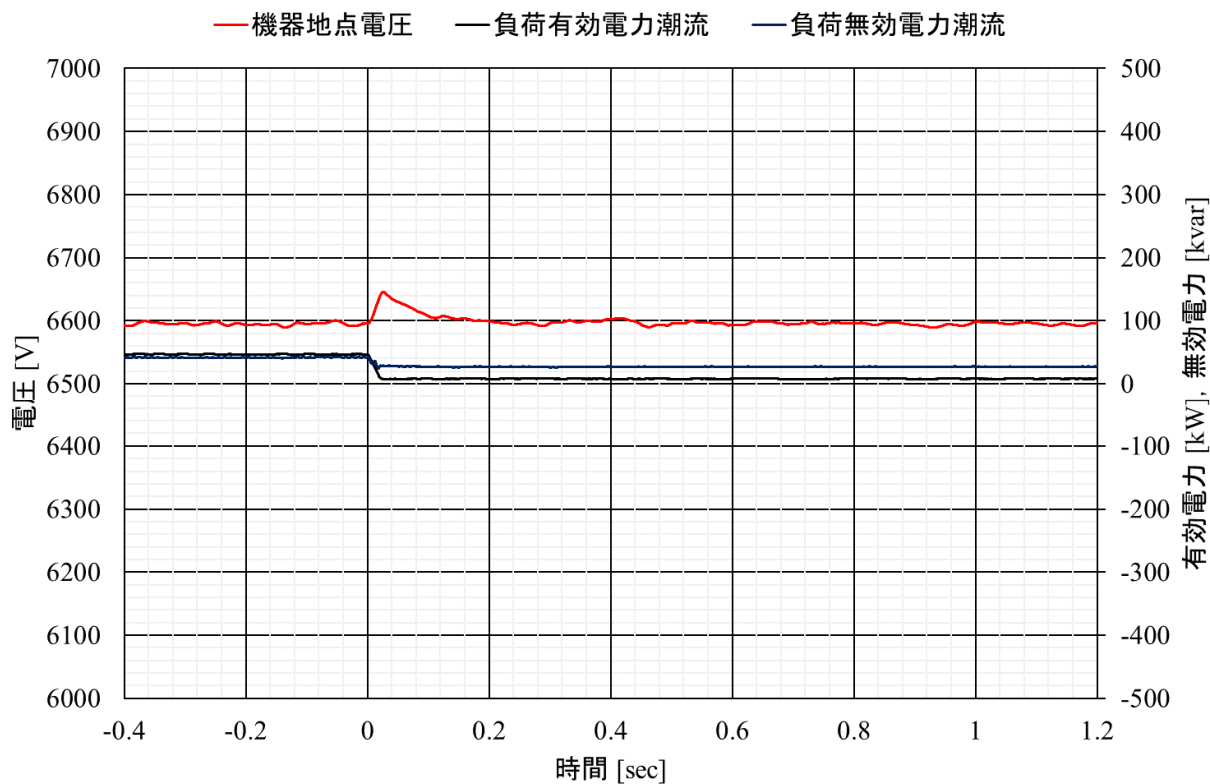


(c) 検証機器 d-2 (制御目標電圧 6600V)

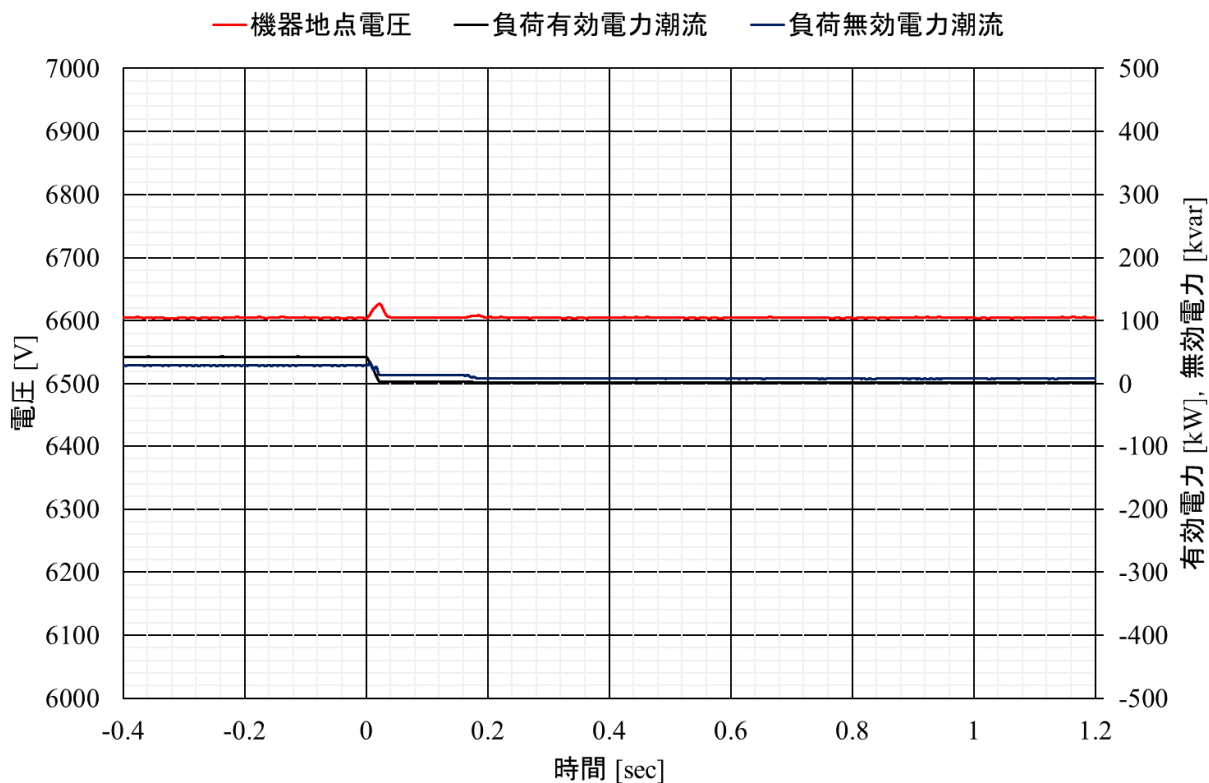
図付 2-2.3.2-5 モータ負荷投入時の機器設置地点電圧と負荷潮流  
(線路 Z1:5Ω, 負荷 B:モータ負荷 40kW)



(a) 検証機器 c-3 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6600V)



(c) 検証機器 d-2 (制御目標電圧 6600V)

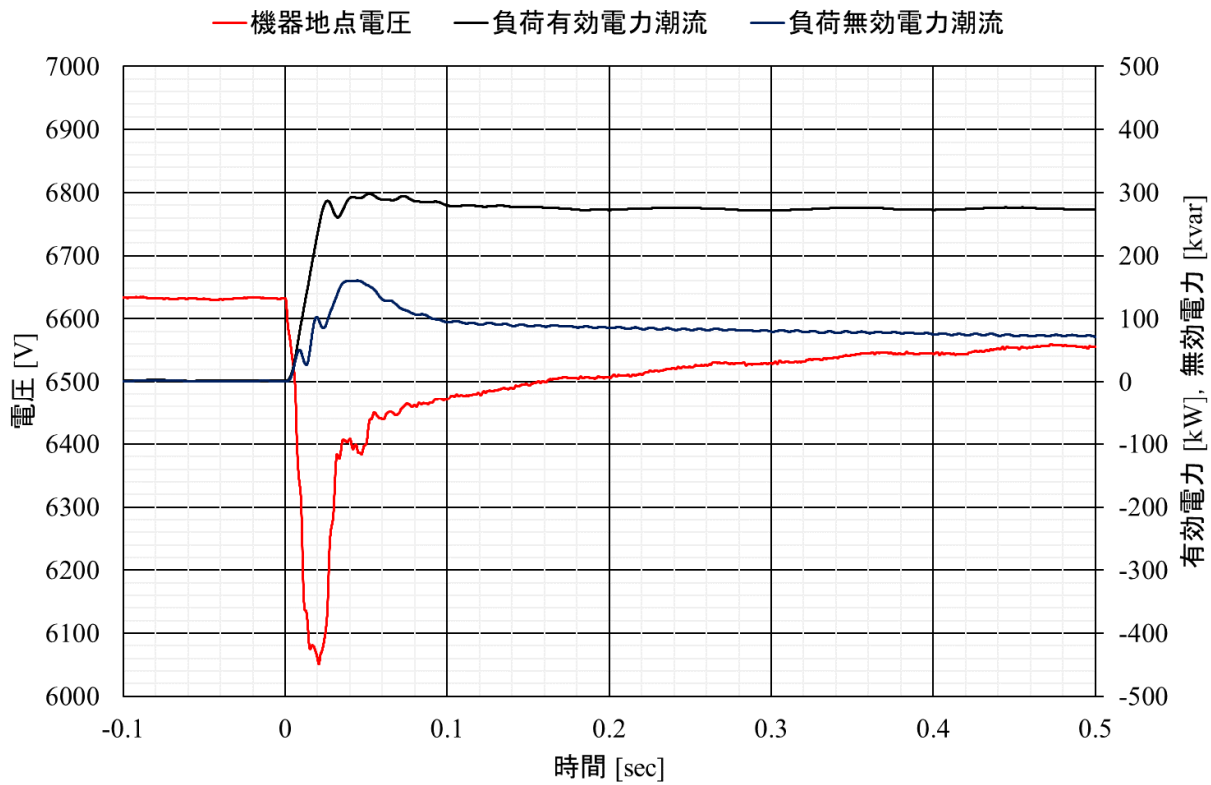
図付 2-2.3.2-6 モータ負荷投入時の機器設置地点電圧と負荷潮流  
(線路 Z1:5Ω, 負荷 B:モータ負荷 40kW)

### 2.3.2③変圧器投入インラッシュ

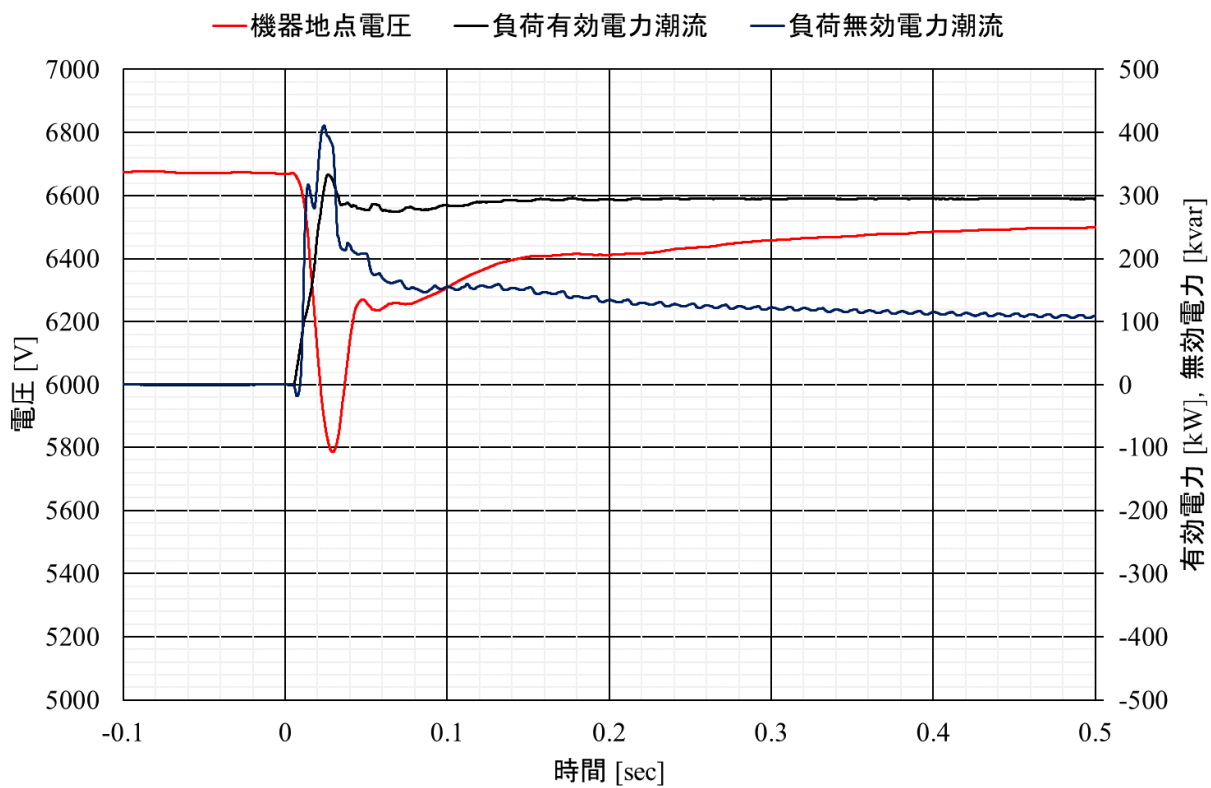
試験手順を図付 2-2.3.2-7, 変圧器投入インラッシュ時の機器設置地点電圧を図付 2-2.3.2-8 に示す。

対象	大項目	中項目	小項目
単機	電圧制御	負荷特性による影響	変圧器投入インラッシュ
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④無負荷⇒負荷投入(変圧器励磁)</li> <li>⑤動作の確認</li> <li>⑥負荷投入⇒無負荷</li> <li>⑦動作の確認</li> </ol>		<p>Z=5Ωとは、R=5Ω、X=5Ωとする</p> $\begin{bmatrix} Z_1 & Z_2 \\ 5\Omega & 0\Omega \end{bmatrix} \times \begin{bmatrix} \text{負荷B} \\ R280kW+L100kvar+\text{変圧器}300kVA \times 3\text{台} \\ R560kW+L200kvar+\text{変圧器}300kVA \times 3\text{台} \end{bmatrix}$	

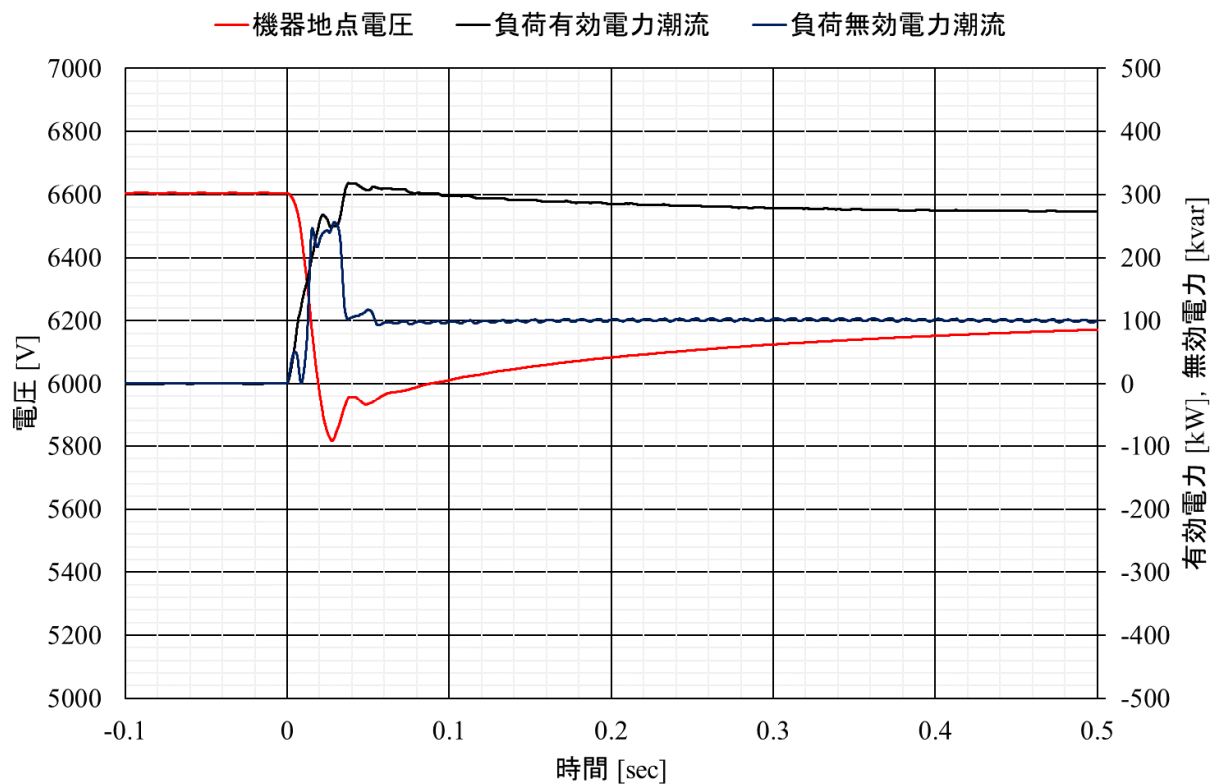
図付 2-2.3.2-7 試験手順(変圧器投入インラッシュ)



(a) 検証機器 c-2 (制御目標電圧 6600V)



(b) 検証機器 d-1 (制御目標電圧 6600V)



(c) 検証機器 d-2 (制御目標電圧 6600V)

図付 2-2.3.2-8 モータ負荷投入時の機器設置地点電圧と負荷潮流  
(線路 Z1:5Ω, 負荷 B:R280kW、L100kvar、変圧器 300kVA3 台)

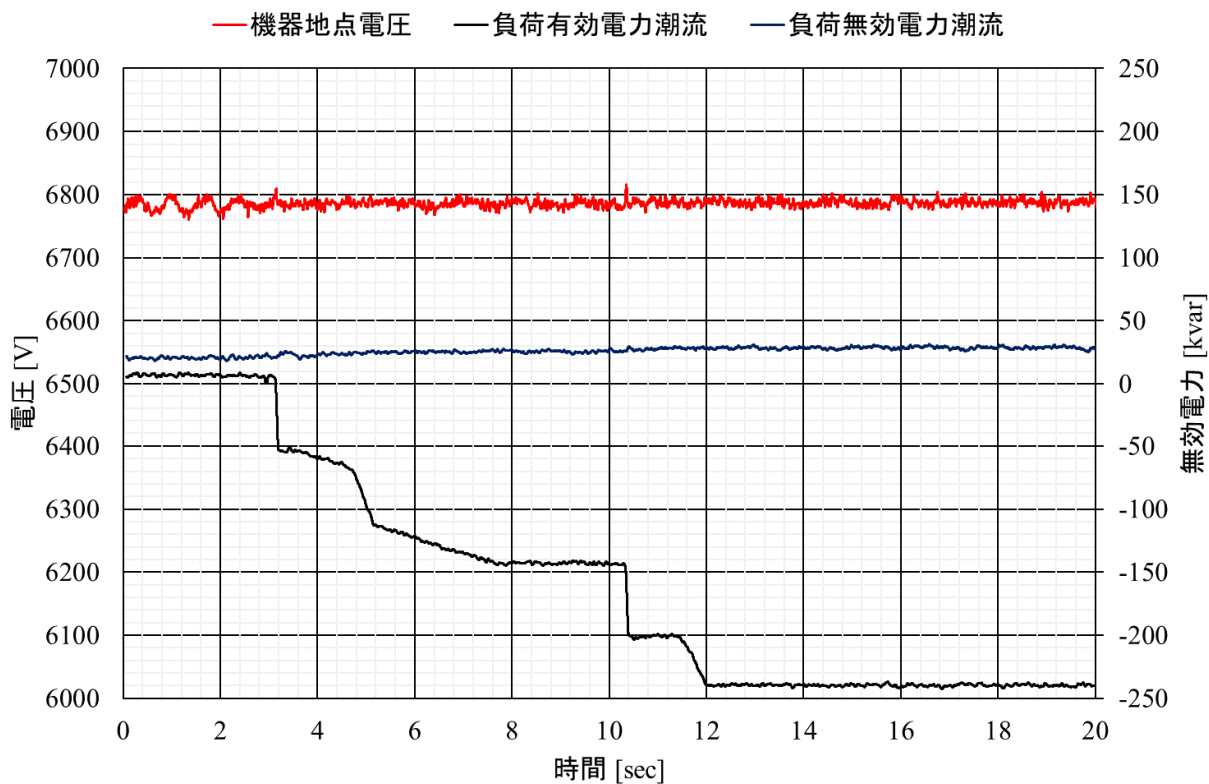
## 2.3.3 分散型電源の発電特性による影響

### 2.3.3① 分散型電源の起動・停止時

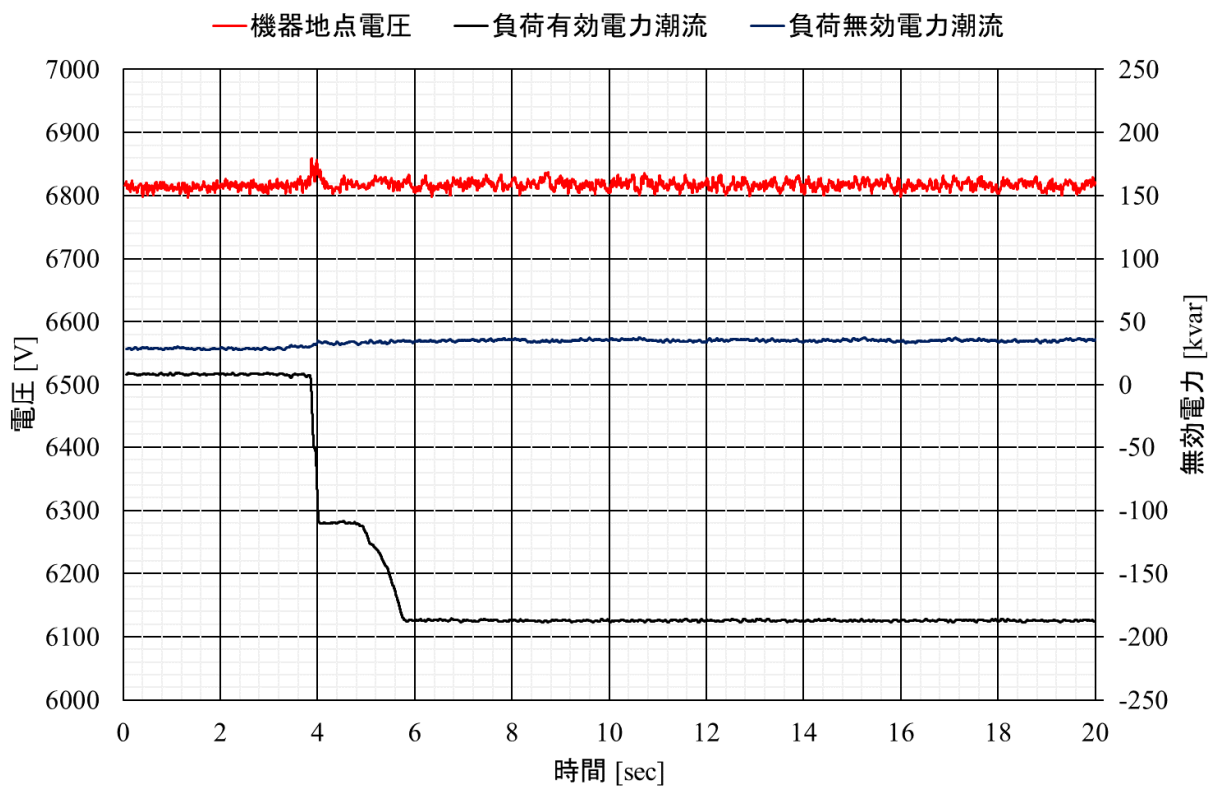
試験手順を図付 2-2.3.3-1、インバータ型電源起動時の機器設置地点電圧を図付 2-2.3.3-2、インバータ型電源停止時の機器設置地点電圧を図付 2-2.3.3-3 に示す。また、回転型電源起動時の機器設置地点電圧を図付 2-2.3.3-4、回転型電源停止時の機器設置地点電圧を図付 2-2.3.3-5 に示す。

対象	大項目	中項目	小項目
単機	電圧制御	分散型電源の発電特性による影響	分散型電源の起動・停止
試験回路			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③負荷の投入</li> <li>④検証機器を起動</li> <li>⑤分散型電源を定格出力運転</li> <li>⑥動作の確認</li> <li>⑦分散型電源を運転停止</li> <li>⑧動作の確認</li> </ol>		$  \begin{matrix}  Z_1 & Z_2 \\  3\Omega & 0\Omega \\  5\Omega & 0\Omega \\  5\Omega & 5\Omega \\  10\Omega & 0\Omega  \end{matrix}  \times  \begin{matrix}  \text{負荷・電源B} \\  R280kW+L100kvar+IN200kW \\  R280kW+L100kvar+SG150kW \\  IN200kW \\  IN400kW \\  SG150kW \\  SG270kW  \end{matrix}  $ <p>Z=5Ωとは、R=5Ω、X=5Ωとする IN: インバータ, SG: 同期発電機</p>	

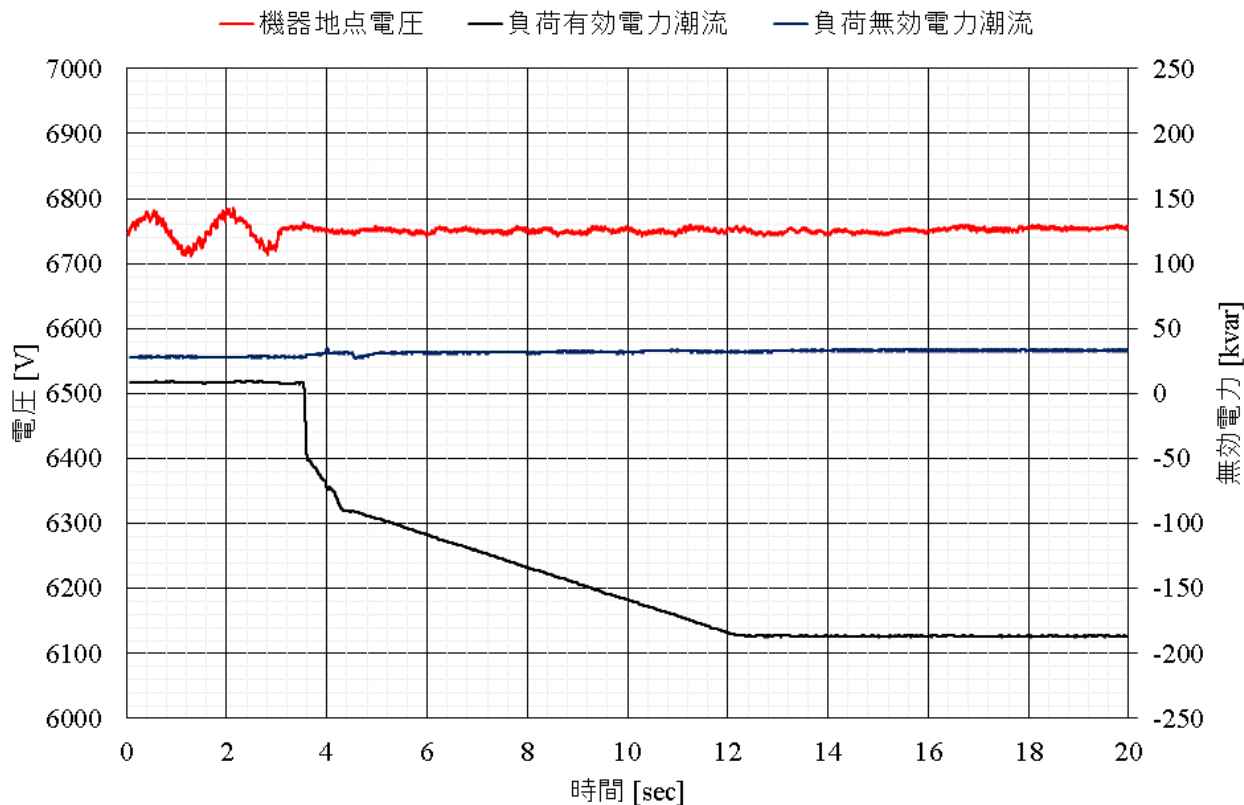
図付 2-2.3.3-1 試験手順(分散型電源の起動・停止時)



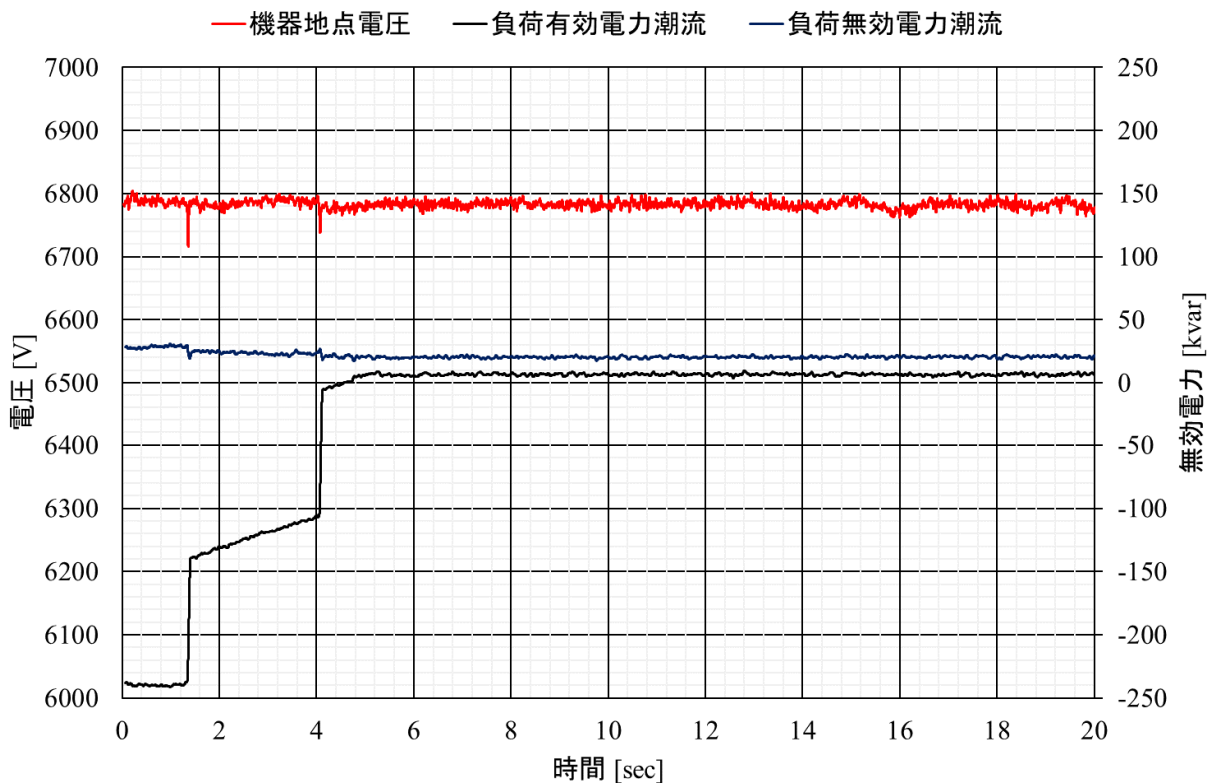
(a) 検証機器 c-3 (制御目標電圧 6800V、インバータ型電源 250kW)



(b) 検証機器 d-1 (制御目標電圧 6800V、インバータ型電源 200kW)

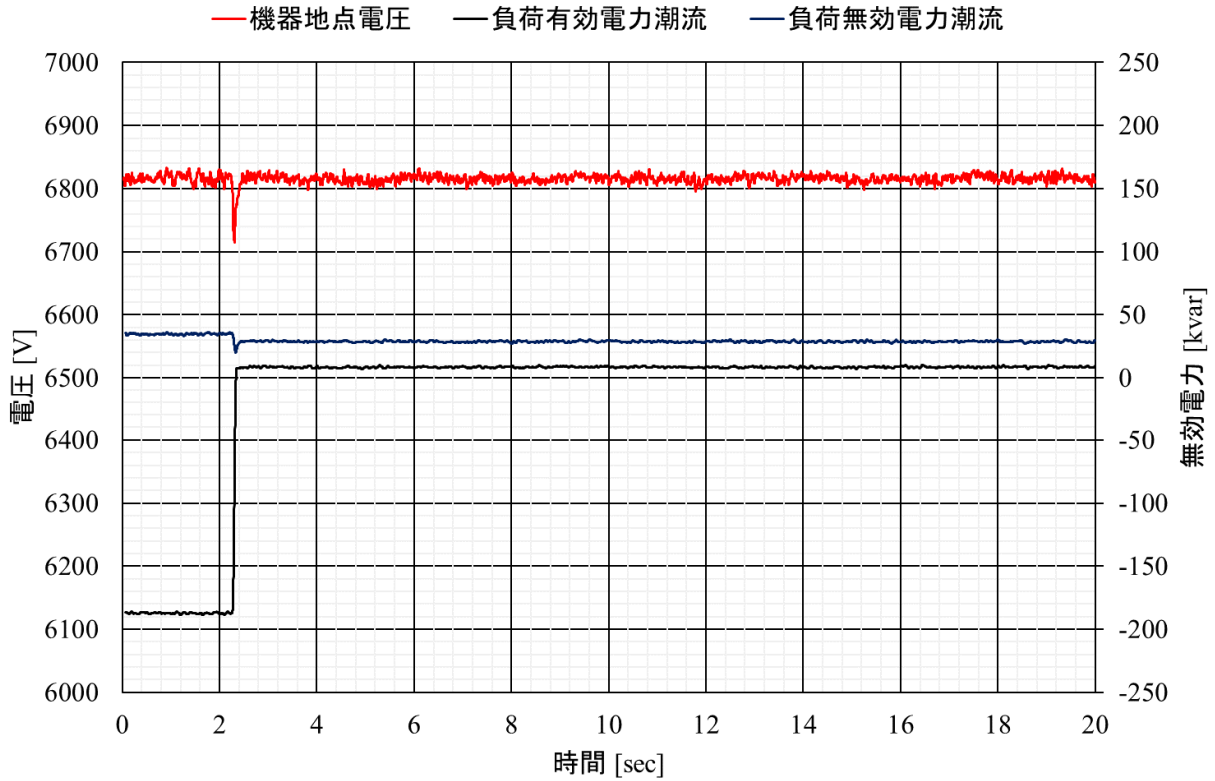


(c) 検証機器 d-2 (制御目標電圧 6750V、インバータ型電源 200kW)  
 図付 2-2.3.3-2 インバータ型電源起動時の機器設置地点電圧と負荷潮流

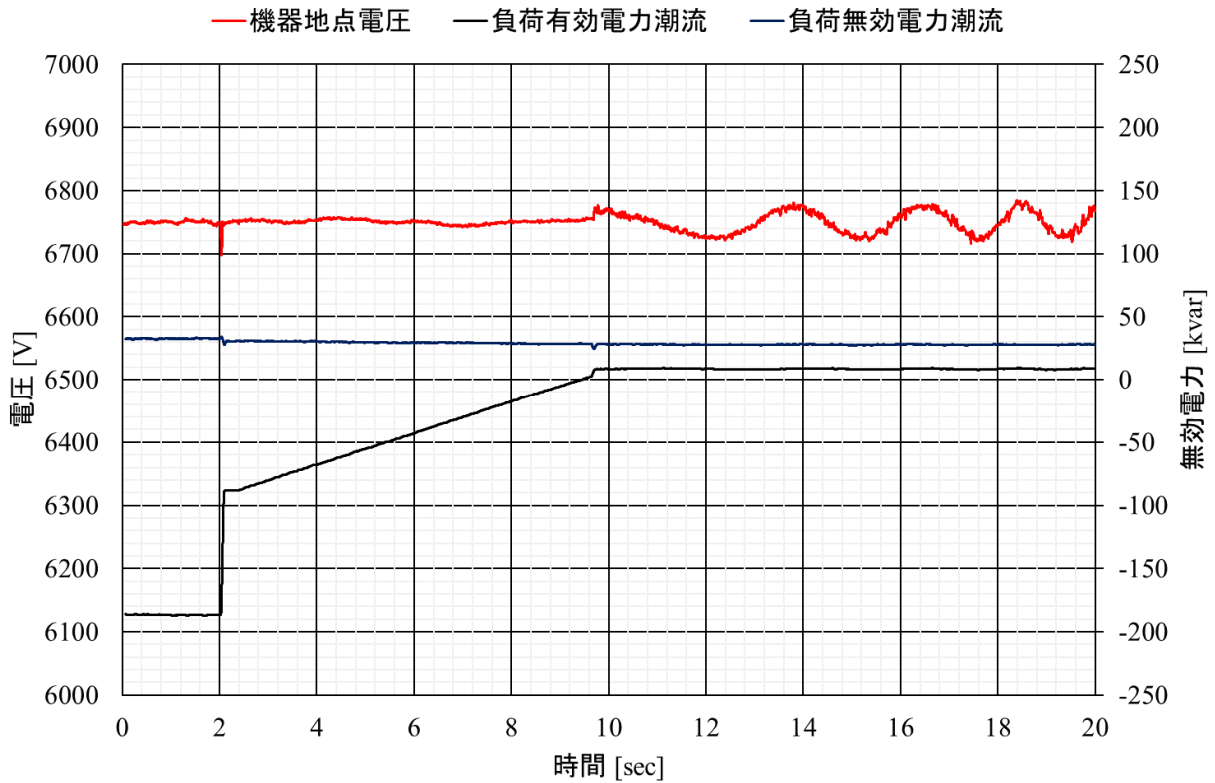


(a) 検証機器 c-3 (制御目標電圧 6800V)



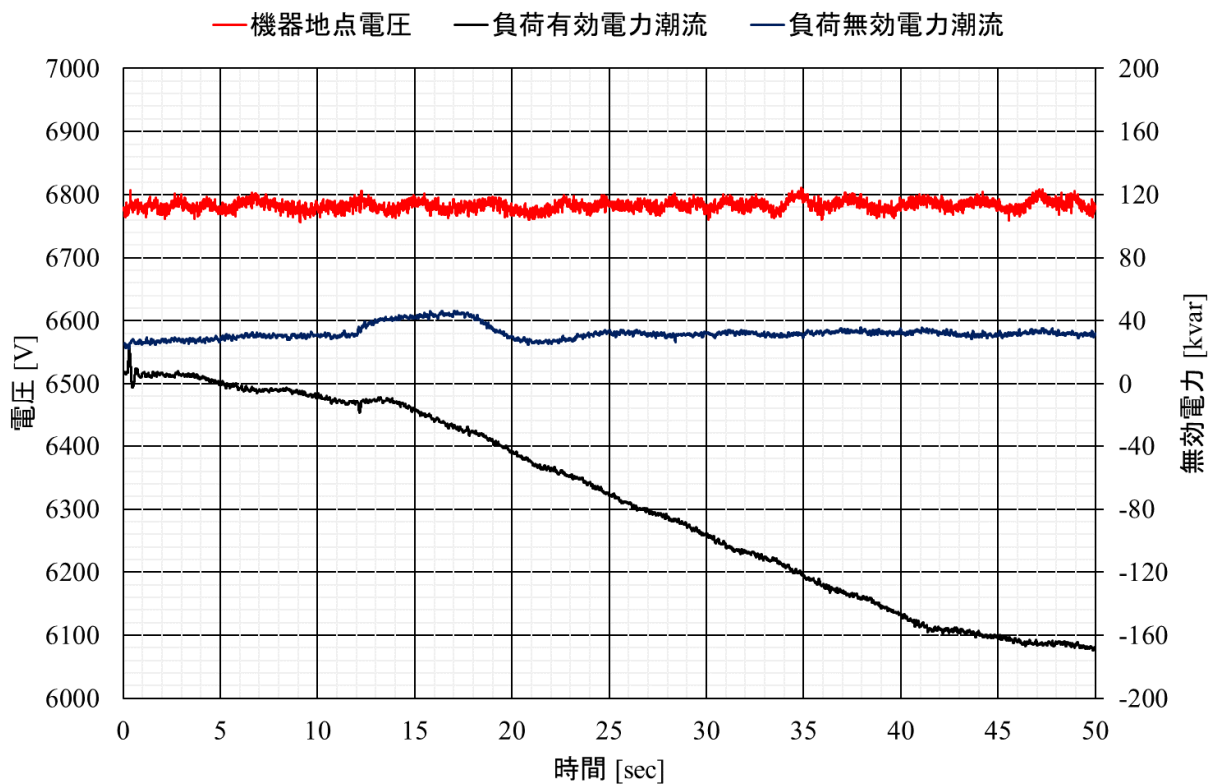


(b) 検証機器 d-1 (制御目標電圧 6800V、インバータ型電源 200kW)

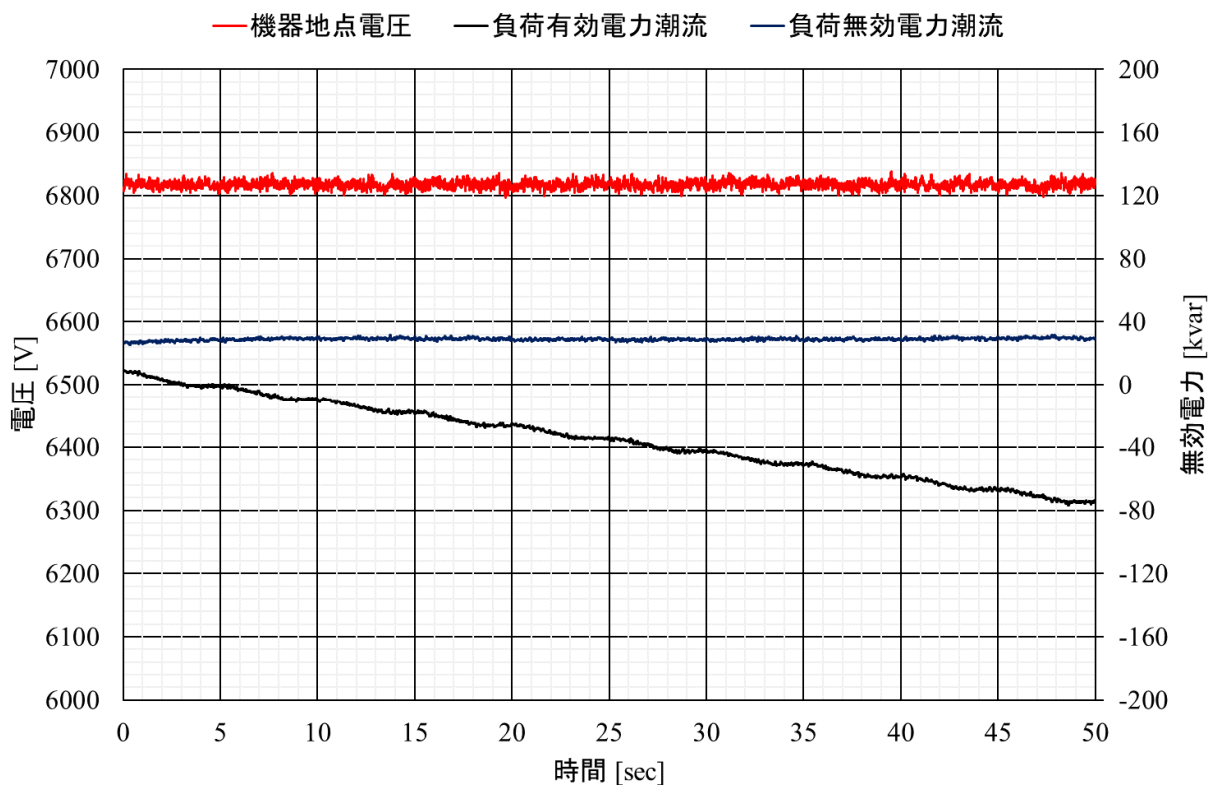


(c) 検証機器 d-2 (制御目標電圧 6750V、インバータ型電源 200kW)

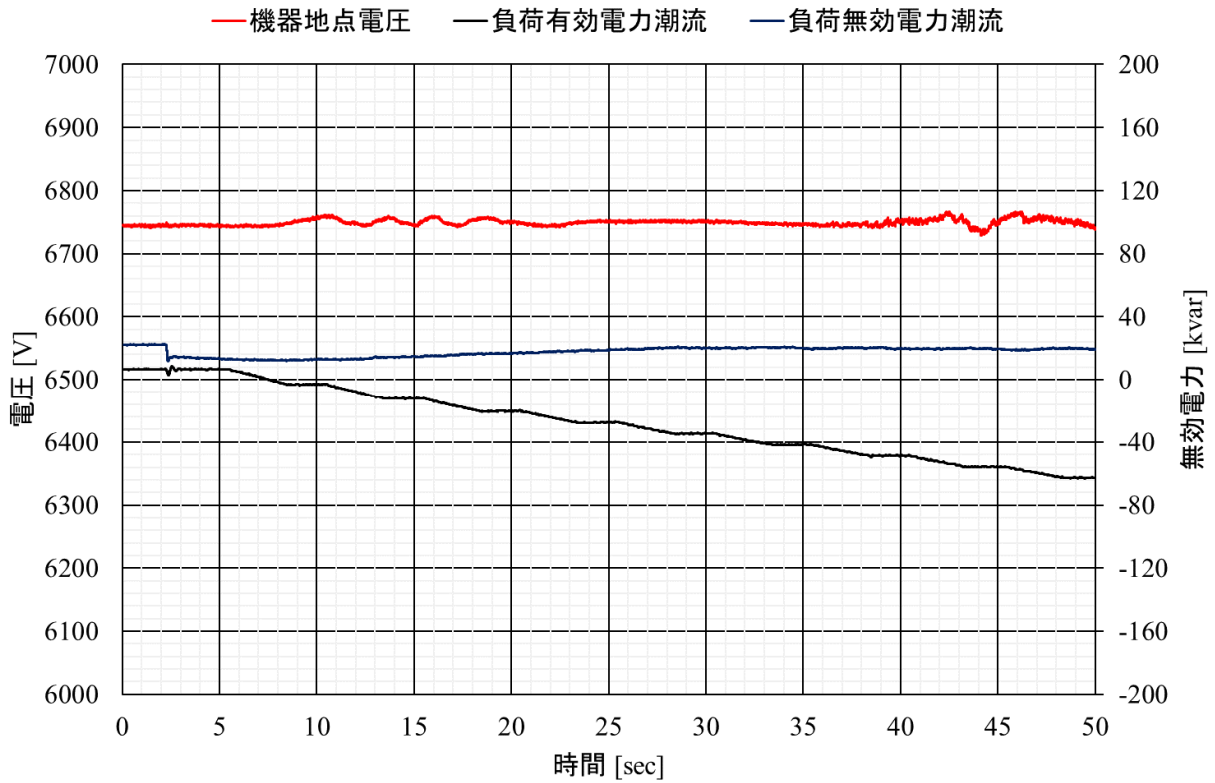
図付 2-2.3.3-3 インバータ型電源停止時の機器設置地点電圧と負荷潮流



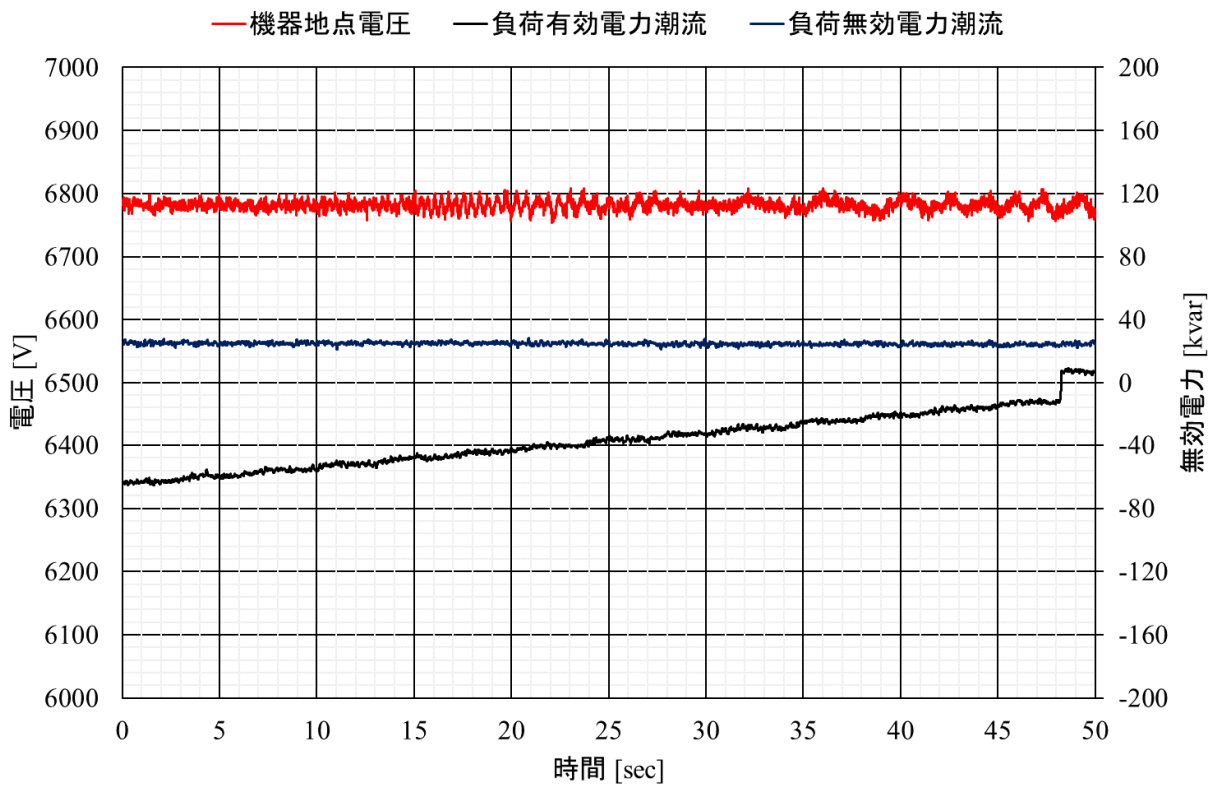
(a) 検証機器 c-3 (制御目標電圧 6800V、回転型電源 150kW、120kW)



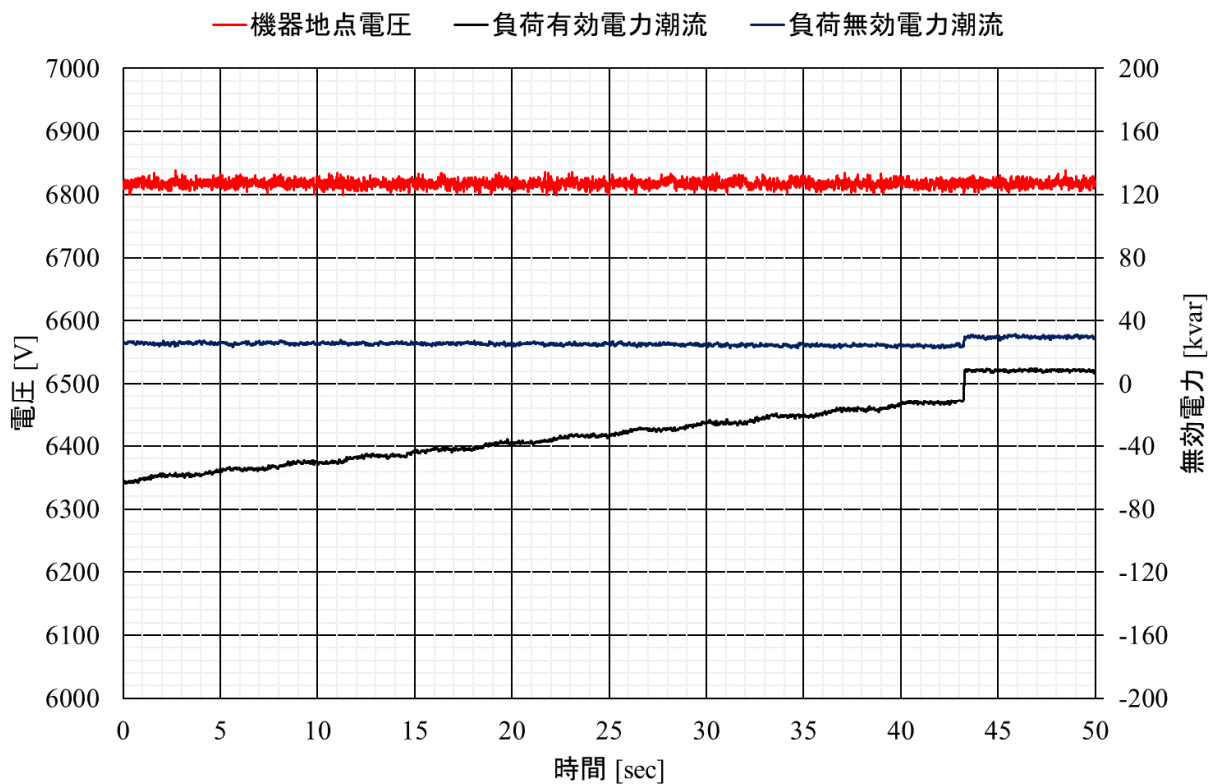
(b) 検証機器 d-1 (制御目標電圧 6800V、回転型電源 150kW)



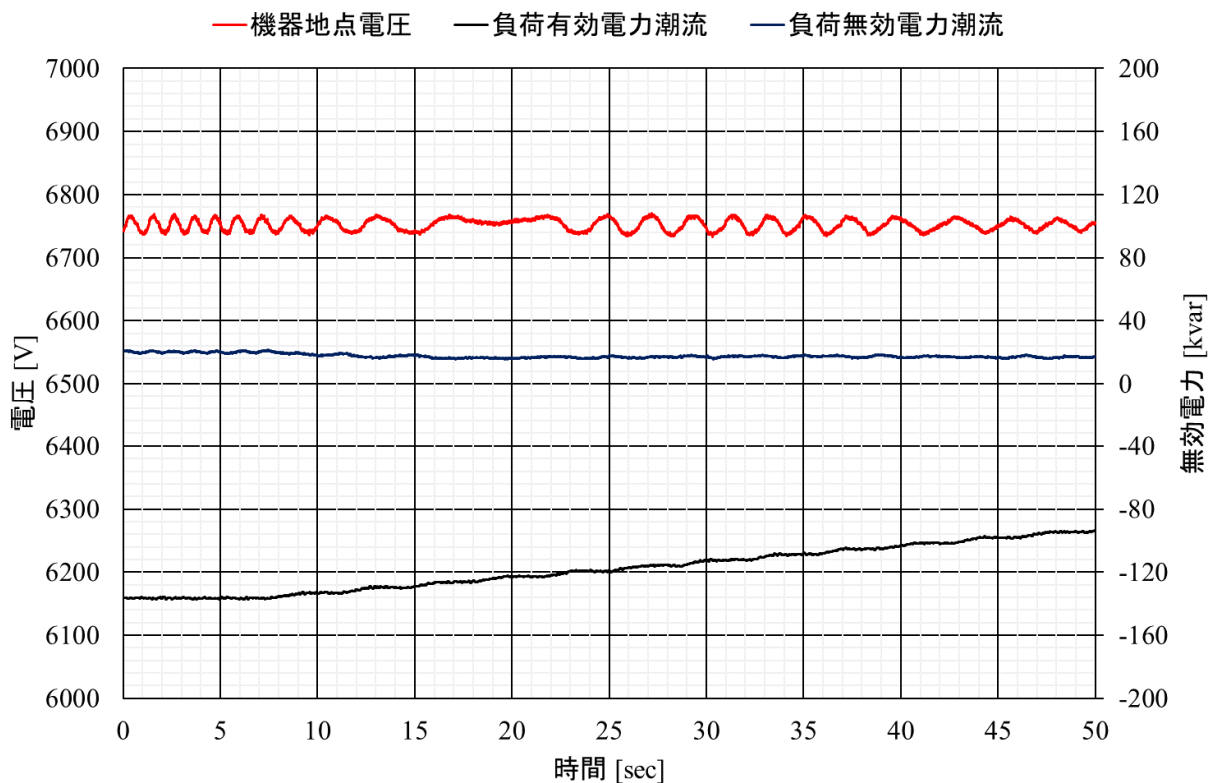
(c) 検証機器 d-2 (制御目標電圧 6800V、回転型電源 150kW)  
 図付 2-2.3.3-4 回転型電源起動時の機器設置地点電圧と負荷潮流



(a) 検証機器 c-3 (制御目標電圧 6800V、回転型電源 150kW、120kW)



(b) 検証機器 d-1 (制御目標電圧 6800V、回転型電源 150kW)



(c) 検証機器 d-2 (制御目標電圧 6800V、回転型電源 150kW)

図付 2-2.3.3-5 回転型電源停止時の機器設置地点電圧と負荷潮流

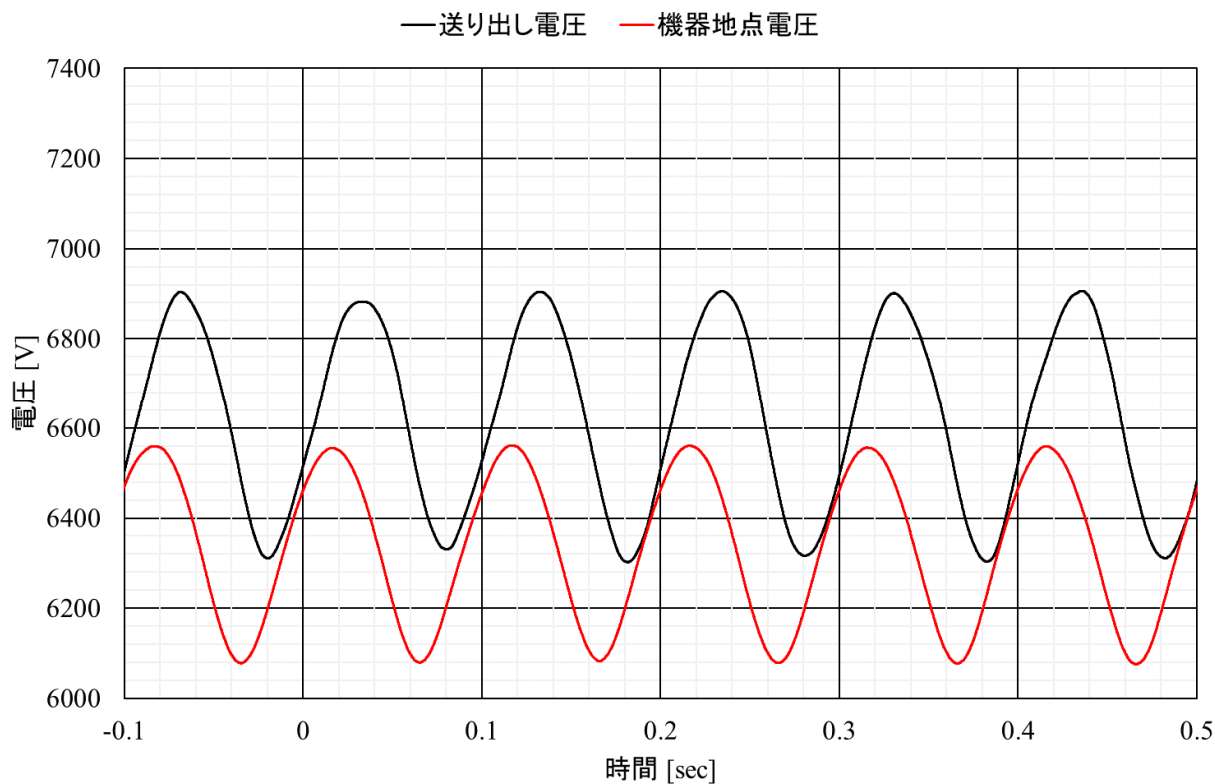
## 2. 3. 4フリッカへの有効性確認

### 2. 3. 4①フリッカ発生時

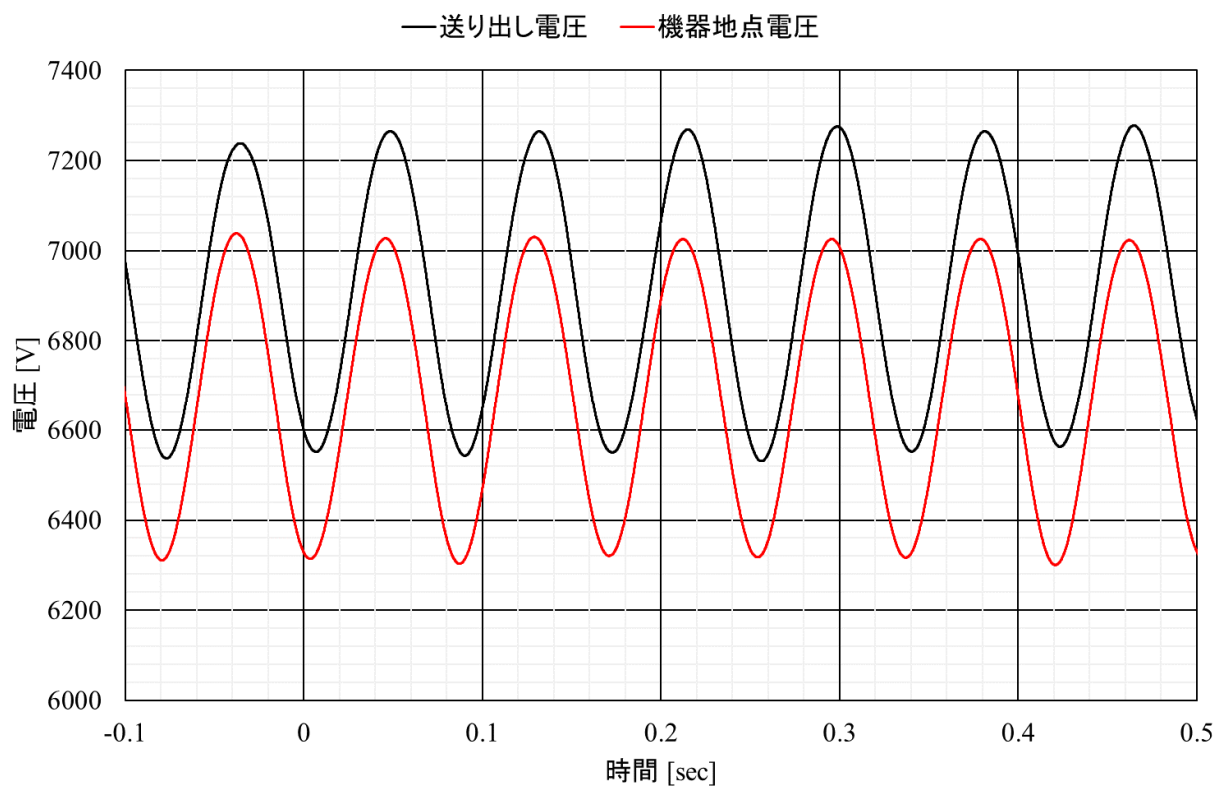
試験手順を図付 2-2.3.4-1、送り出し電圧フリッカ発生時の機器設置地点電圧を図付 2-2.3.4-2、  
図付 2-2.3.4-3 に示す。

対象	大項目	中項目	小項目
単機	性能評価	電圧系統擾乱時の動作	フリッカ(送出し電圧)
試験回路			
<p>BTBを用いて任意の電圧変動を発生</p>			
試験手順		試験パラメータ	
<ol style="list-style-type: none"> <li>①配電線に6kV電圧を印加</li> <li>②検証機器の制御電源投入</li> <li>③検証機器を起動</li> <li>④電圧変動(フリッカ)発生</li> <li>⑤動作の確認</li> </ol>		$Z=5\Omega$ とは、 $R=5\Omega$ 、 $X=5\Omega$ とする $\left[ \begin{array}{ccc} Z_1 & Z_2 & \text{負荷B} \\ 5\Omega & 0\Omega & R280kW+L100kvar \end{array} \right] \times \left[ \begin{array}{c} \text{変動幅} \\ \cdot 60V \\ \cdot 120V \\ \cdot 300V \\ \cdot 600V \end{array} \right] \times \left[ \begin{array}{c} \text{変動幅} \\ \cdot 10Hz \end{array} \right]$	

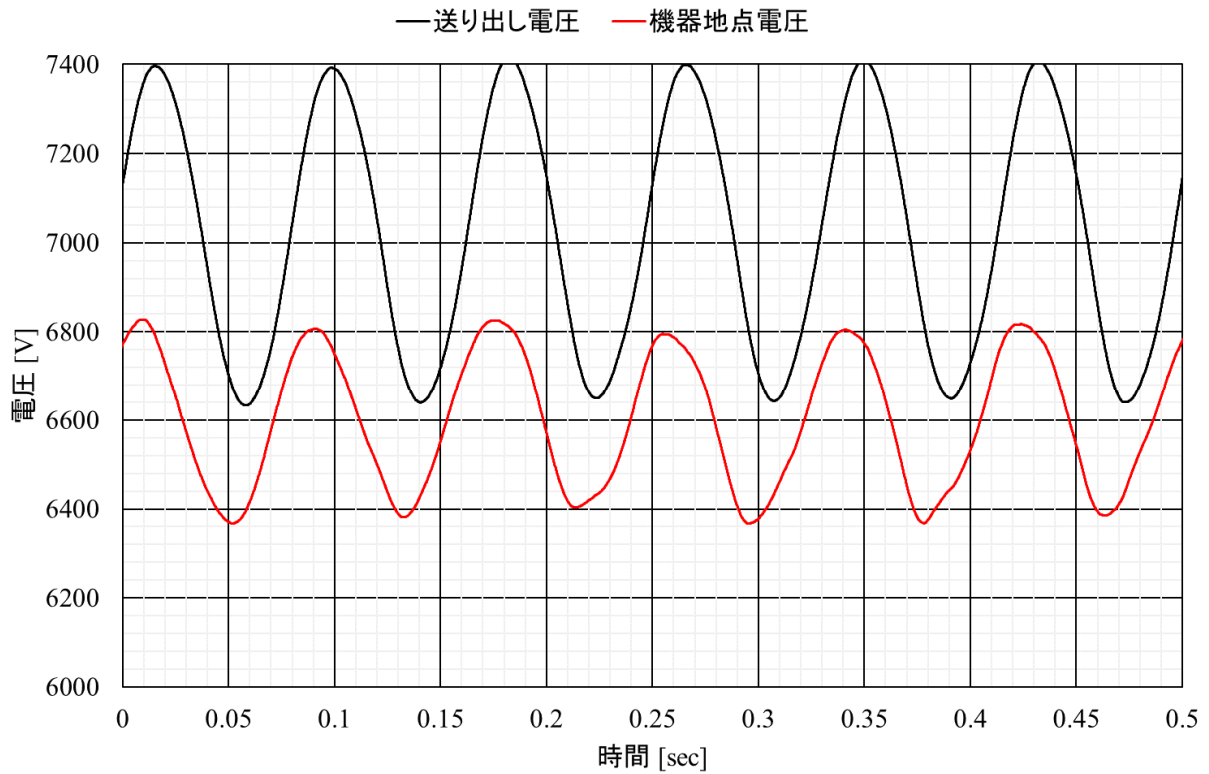
図付 2-2.3.4-1 試験手順(フリッカ発生時)



(a) 検証機器 c-2 (制御目標電圧 6300V)



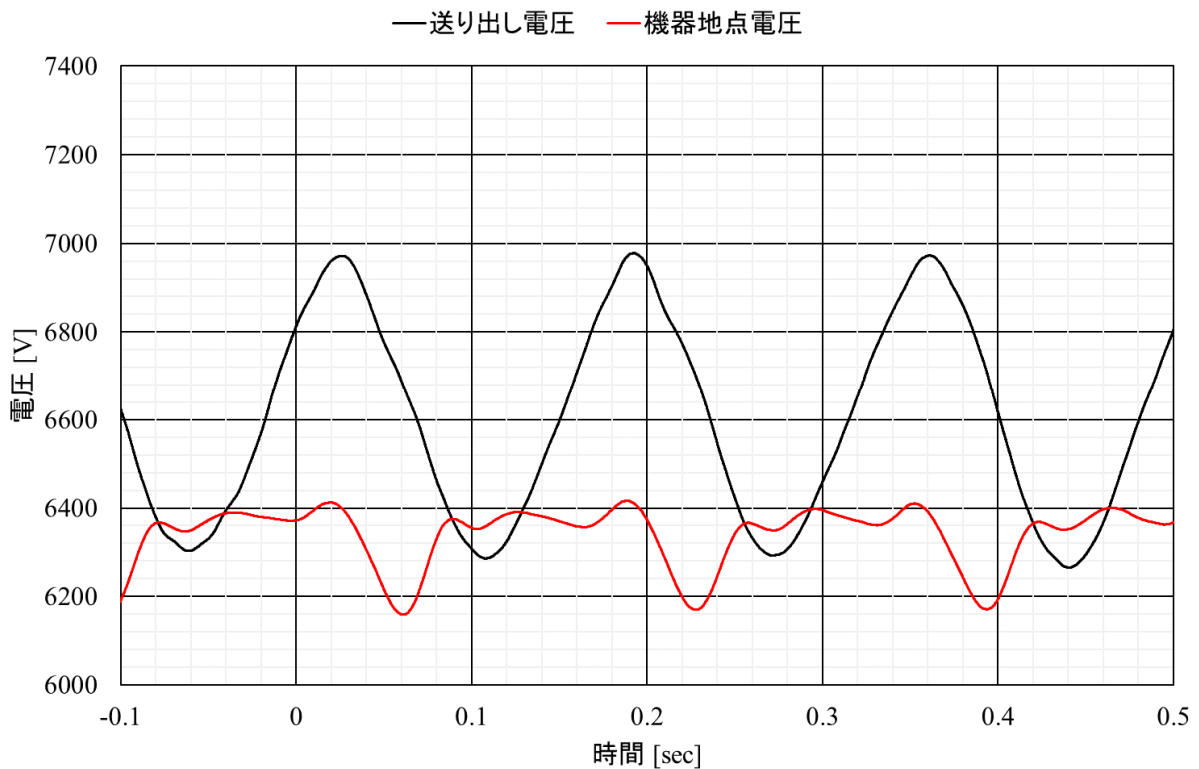
(b) 検証機器 d-1 (制御目標電圧 6600V)



(c) 検証機器 d-2 (制御目標電圧 6600V)

図付 2-2.3.4-2 送り出し電圧フリッカ発生時の電圧変動

(線路 Z1:5Ω, 負荷 B:R280kW, L100kav, 電圧フリッカ条件:変動幅±300V, 変動周期 10Hz)



図付 2-2.3.4-3 送り出し電圧フリッカ発生時の電圧変動

(線路 Z1:5Ω, 負荷 B:R280kW, L100kav, 電圧フリッカ条件:変動幅±300V, 変動周期 6Hz)

検証機器:c-2, フリッカ補償モード)

契約管理番号：14101445-0  
契約管理番号：14101446-0  
契約管理番号：14101447-0