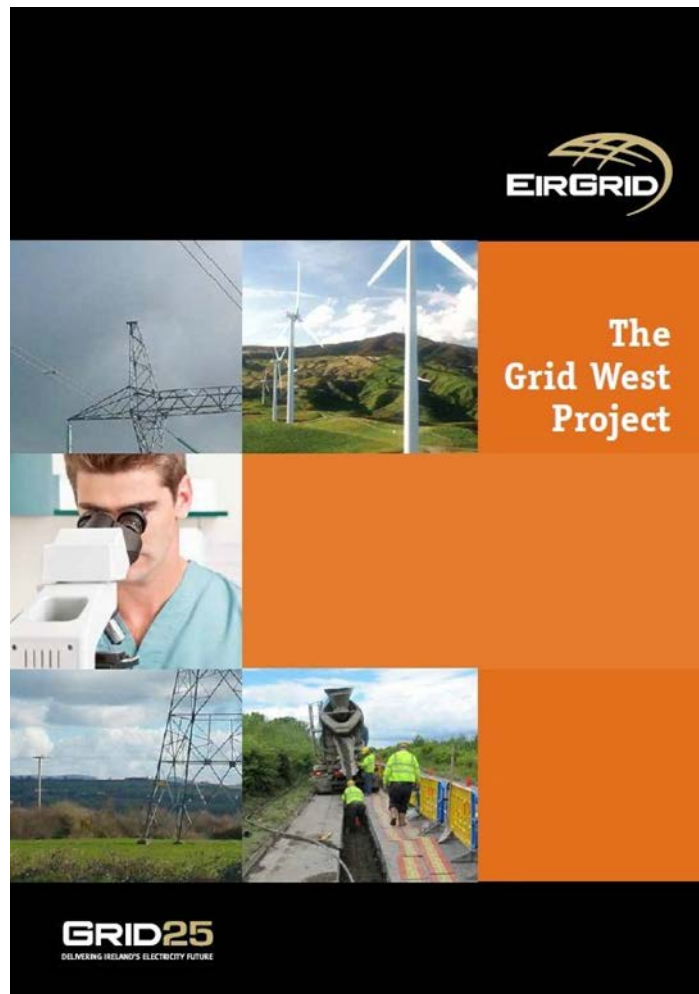


**EirGrid**

**10344 - PSP019 - CABLE STUDIES FOR GRID WEST**

**Partial AC Underground Solution**



**Appendix G – 30 km Split 220kV Cable Solution –  
Summer Valley B Cases**

17/12/2014

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**REPORT AUTHORISATION SHEET**

Client: **EirGrid**  
Project: **10344 - PSP019 - CABLE STUDIES FOR Grid west**  
Report Title **Appendix G – 30 km Split 220kV Cable Solution – Summer Valley B Cases**  
Project Number **10344**  
Report Version **Final Appendix**  
Report Date **17<sup>th</sup> December 2014**

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Version No.	Report Date	Comment	Author	Checked	Authorised
1.0	17/12/14	Initial Issue	CE	AJ	JS

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## 1 RESULTS

Impedance scans and time domain simulations for a total of 30 km of 220 kV cable with sized reactors at both Flagford and North Mayo. The Grid West circuit configuration is as follows: Flagford to North Mayo – 2 km 220 kV Cable/11 km OHL/20 km 220 kV Cable/72 km OHL/2 km Double OHL and in addition to this the Flagford – Srananagh 220 kV circuit is as follows: Flagford to Srananagh – 8 km 220 kV Cable/45 km OHL.<sup>1</sup>

This Appendix will give results for the Summer Valley B scenario and will show there are no technical issues with this solution.

The case results are presented as follows:

- Case 1: (N) Normal Operating Condition
- Case 2: (N-1) Cashla-Flagford Autoreclose onto Fault
- Case 3: (N-1) Flagford-Louth Line Autoreclose onto Fault
- Case 4: (N-1) Flagford-Srananagh Line Trip
- Case 5: (N-1) Trip Grid West Cable
- Case 6: (N-2) Cashla-Flagford Autoreclose onto fault/Flagford-Louth Lines out
- Case 7: (N-2) Cashla-Flagford Line Autoreclose onto Fault/Flagford-Srananagh Cable/Line Out
- Case 8: (N-2) Flagford-Louth Line Autoreclose onto Fault/Flagford-Srananagh Cable/Line Out
- Case 9: (N+1) Energise Grid West Cable

The naming convention from ATP for the Grid West circuit sections are given in Figure 1, these indicate where on the circuit the readings are being taken from:

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<sup>1</sup> For the purposes of clarity, in the Time Domain Simulations shown in all the Appendices, the term ‘N-2’ shown in the graphical figure descriptions refer to an ‘N-1-1’ trip-maintenance situation.

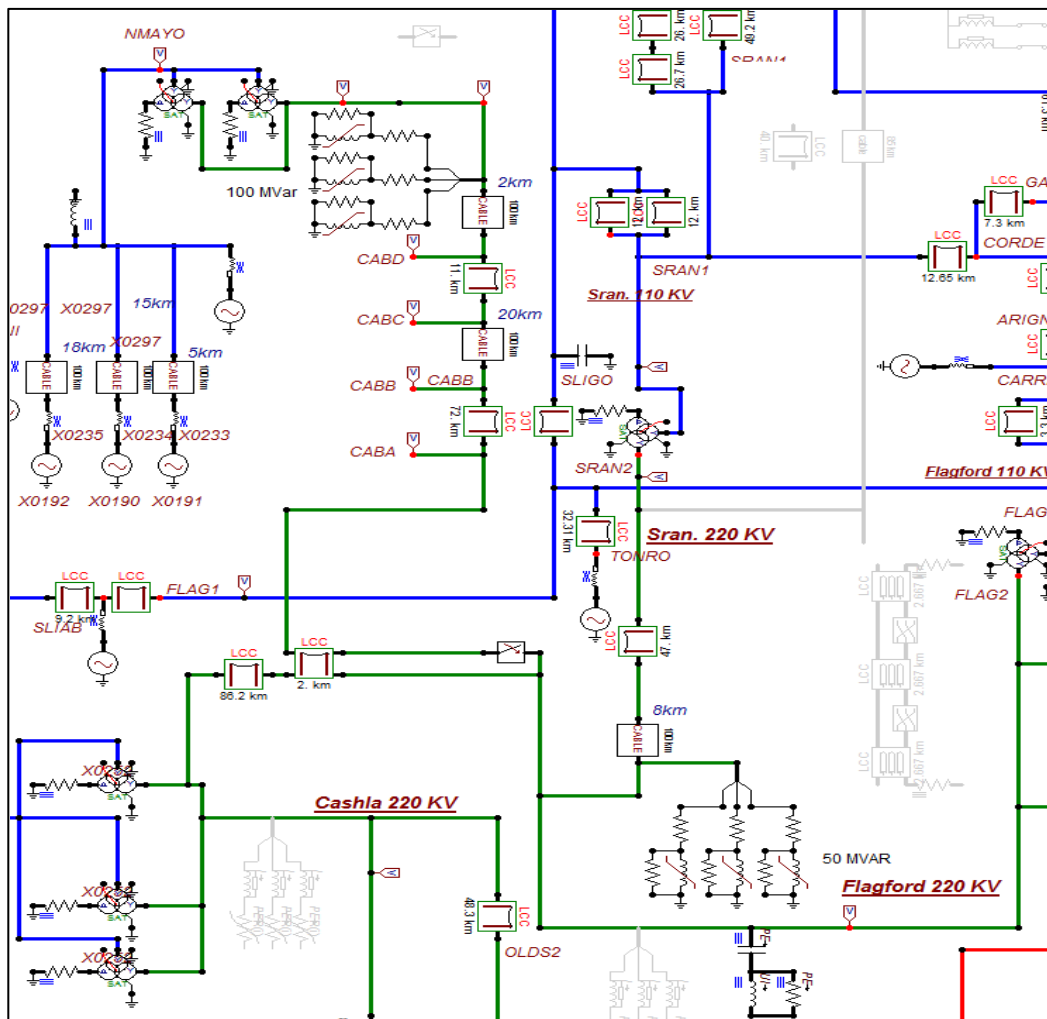


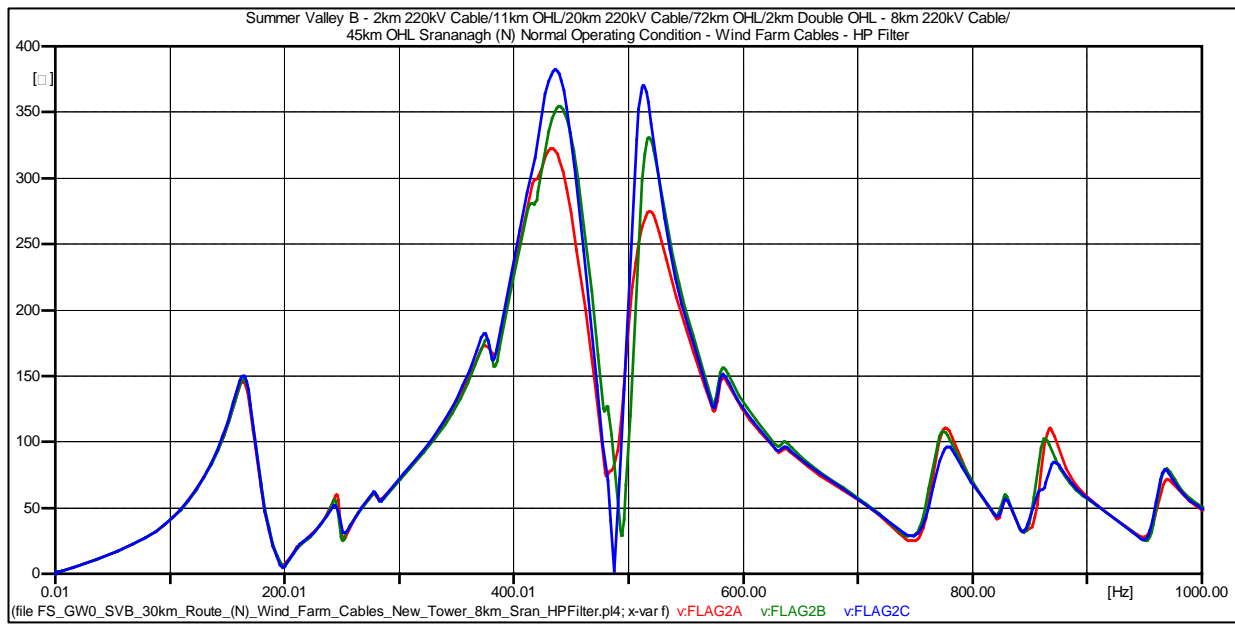
Figure 1: ATP Diagram showing node names and locations

### 1.1 Impedance Scans - Length 30 km – Summer Valley B – Case 1

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

#### Case 1: (N) Normal Operating Condition



**Figure 2: SVB - Length 30 km - (N) Normal Operating Condition**

#### Impedance Scan - Resonance points

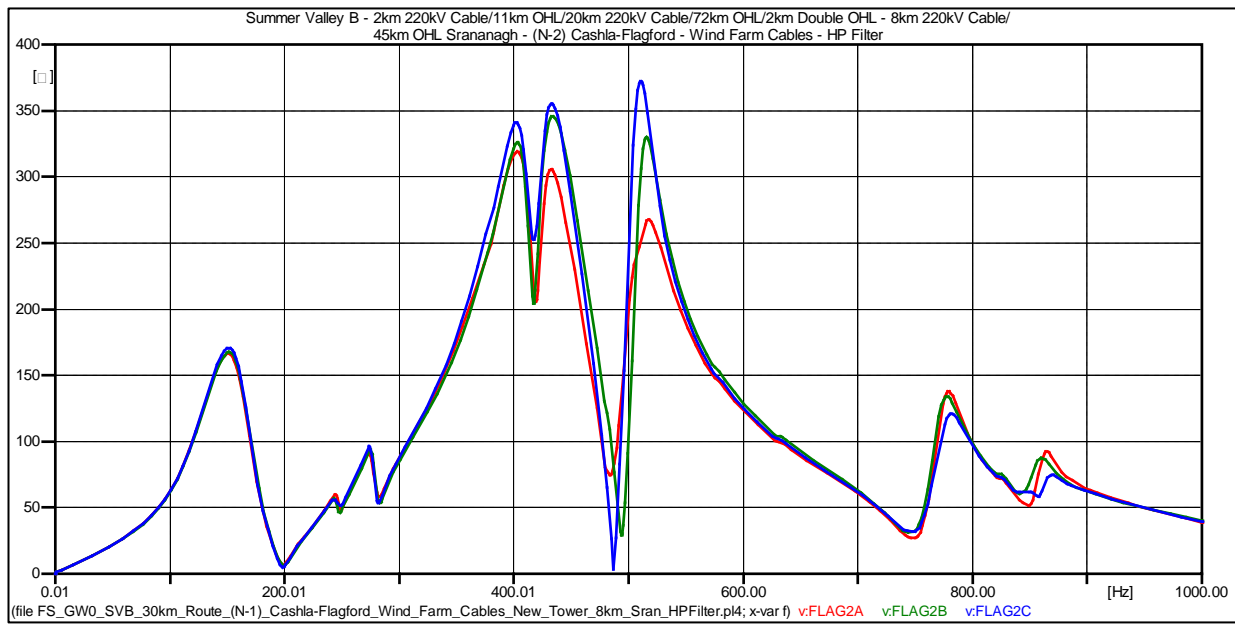
Frequency (Hz)	Impedance (Ω)
164.71	149.99
436.51	382.07
513.31	369.87
777.31	110.31
868.21	109.83
969.31	78.252

## 1.2 Impedance Scans - Length 30 km – Summer Valley B – Case 2

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

### Case 2: (N-1) Cashla-Flagford Line Out



**Figure 3: SVB - Length 30 km - (N-2) Cashla-Flagford Line Out**

### Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
152.71	170.48
402.01	341.15
433.51	355.32
510.31	372.21
779.71	142.73

### **1.3 Time Domain Simulation - Length 30 km – Summer Valley B – Case 2**

Conditions for time domain simulation:

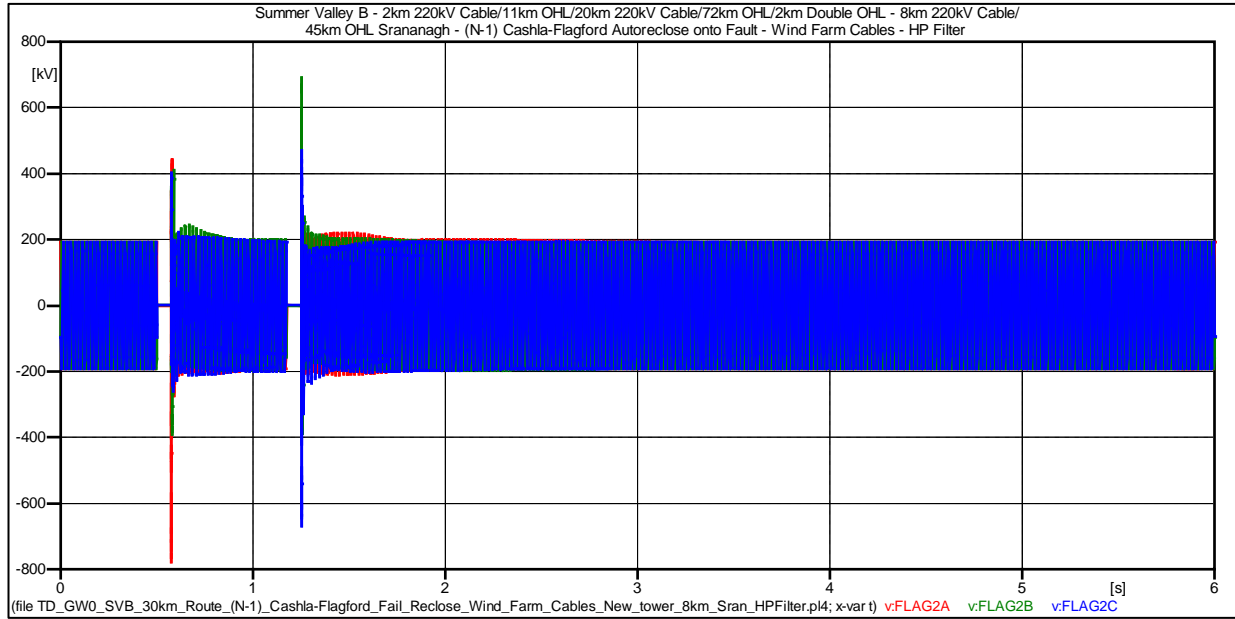
1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500  $\Omega$

#### **Case 2: (N-1) Cashla-Flagford Auto Reclose onto Fault**

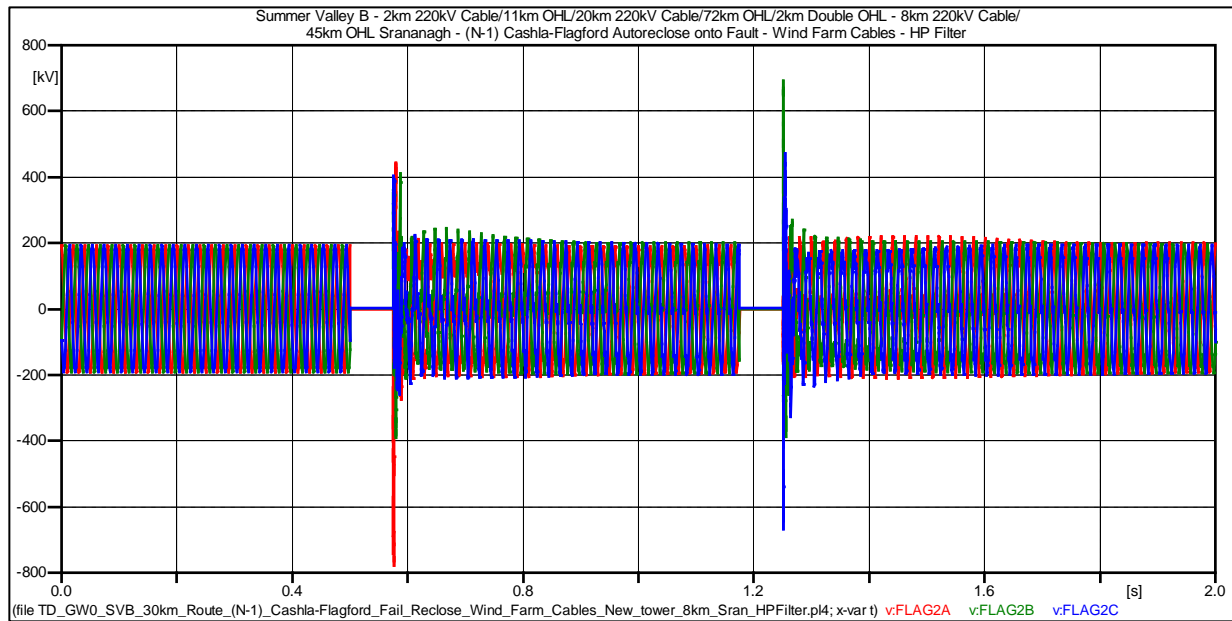
System Conditions:

1. Fault on Flagford side of Cashla - Flagford line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.





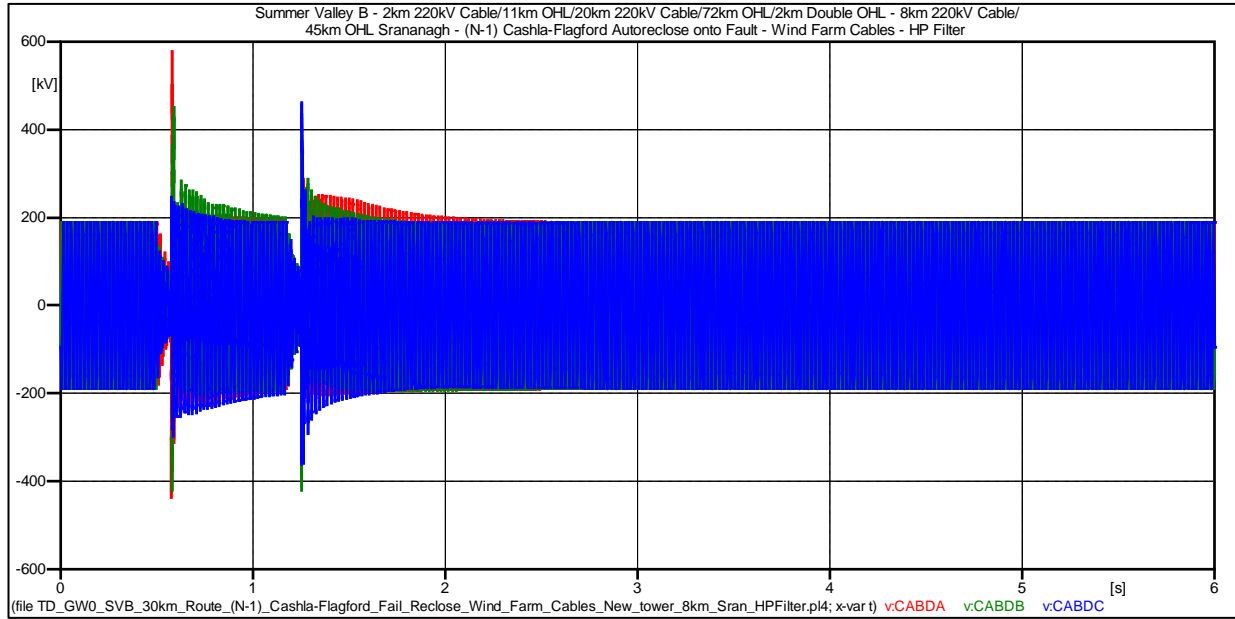
**Figure 4: SVB - Length 30 km – North Mayo – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



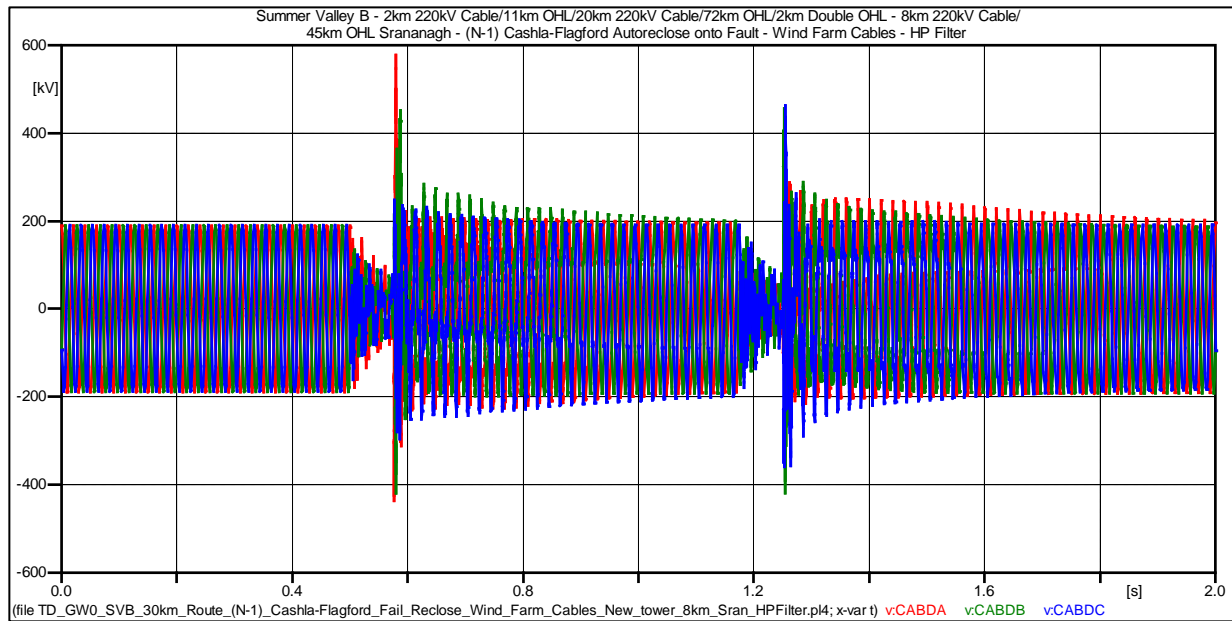
**Figure 5: SVB - Length 30 km – North Mayo – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	779.02 kV (4.3380 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	240.40 kV (1.3386 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



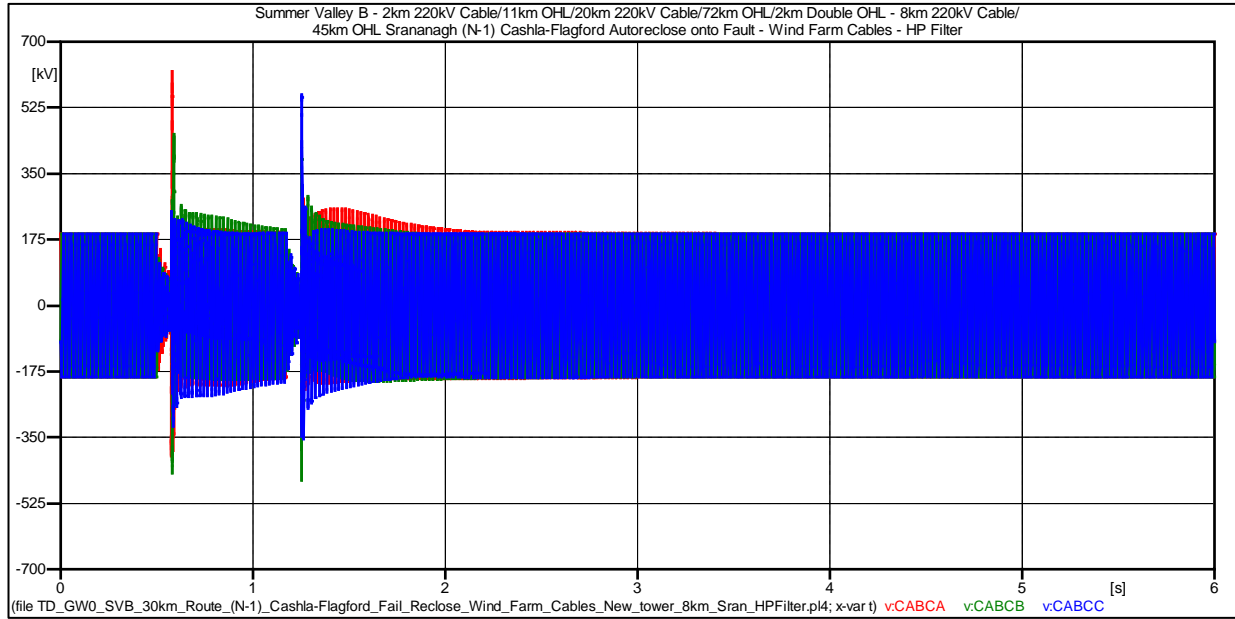
**Figure 6: SVB - Length 30 km – Cable End D – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



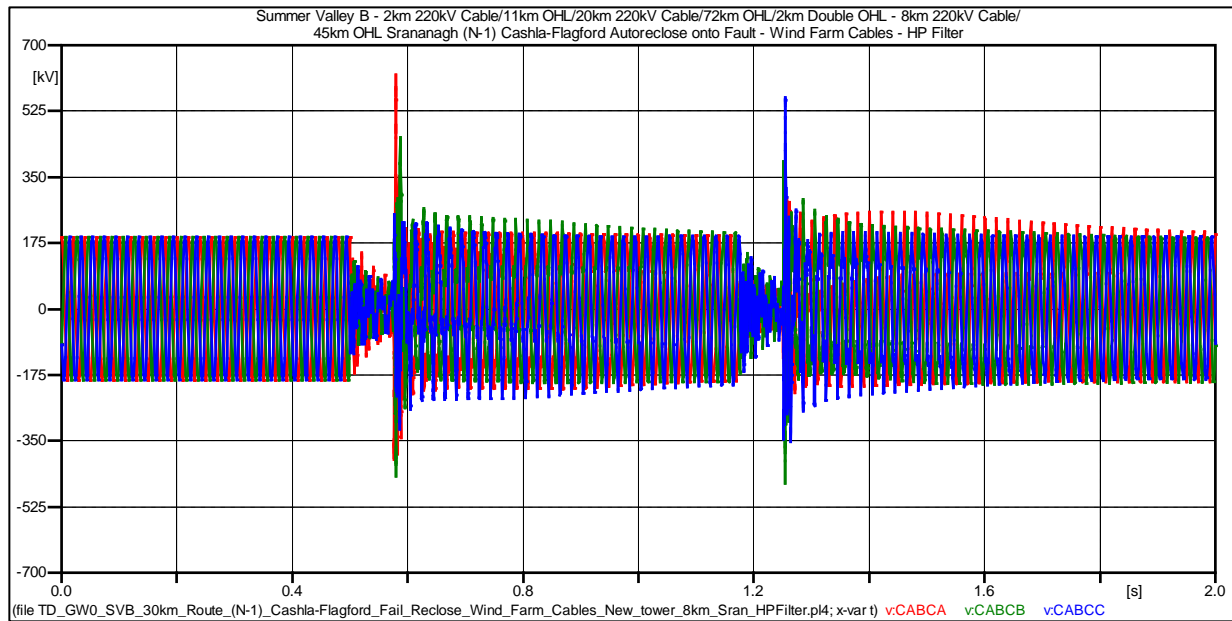
**Figure 7: SVB - Length 30 km – Cable End D – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	578.23 kV (3.2199 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	283.51 kV (1.5787 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



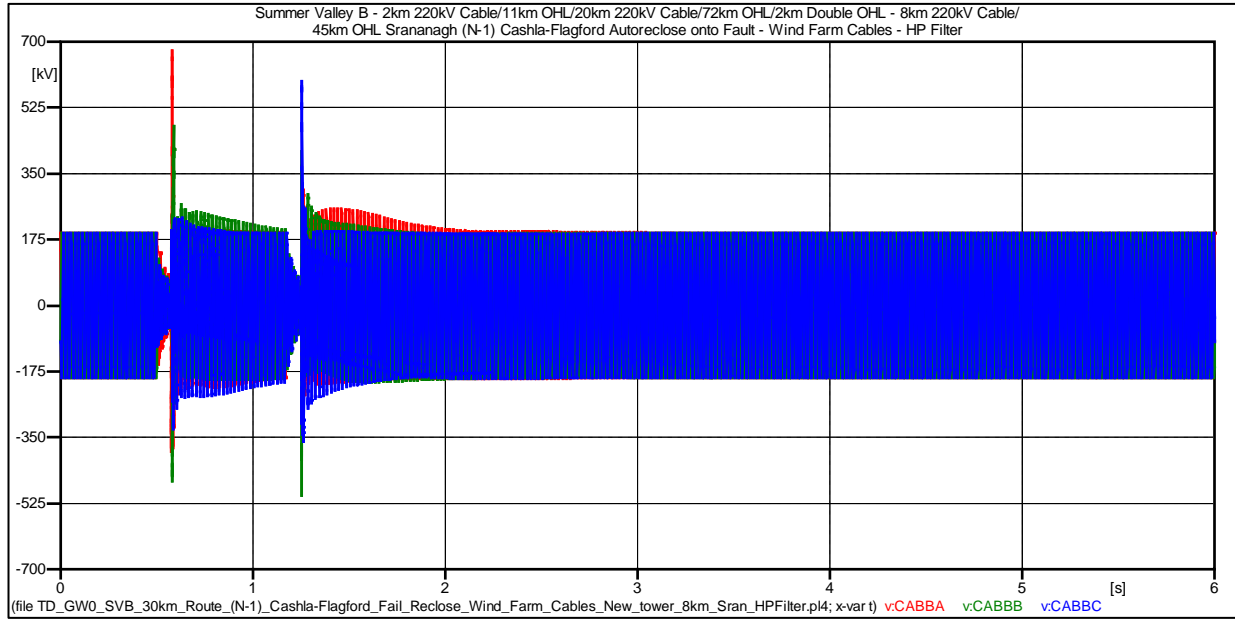
**Figure 8: SVB - Length 30 km – Cable End C – (N-1) Cashla-Flagford Autoreclose onto Fault (0-6s)**



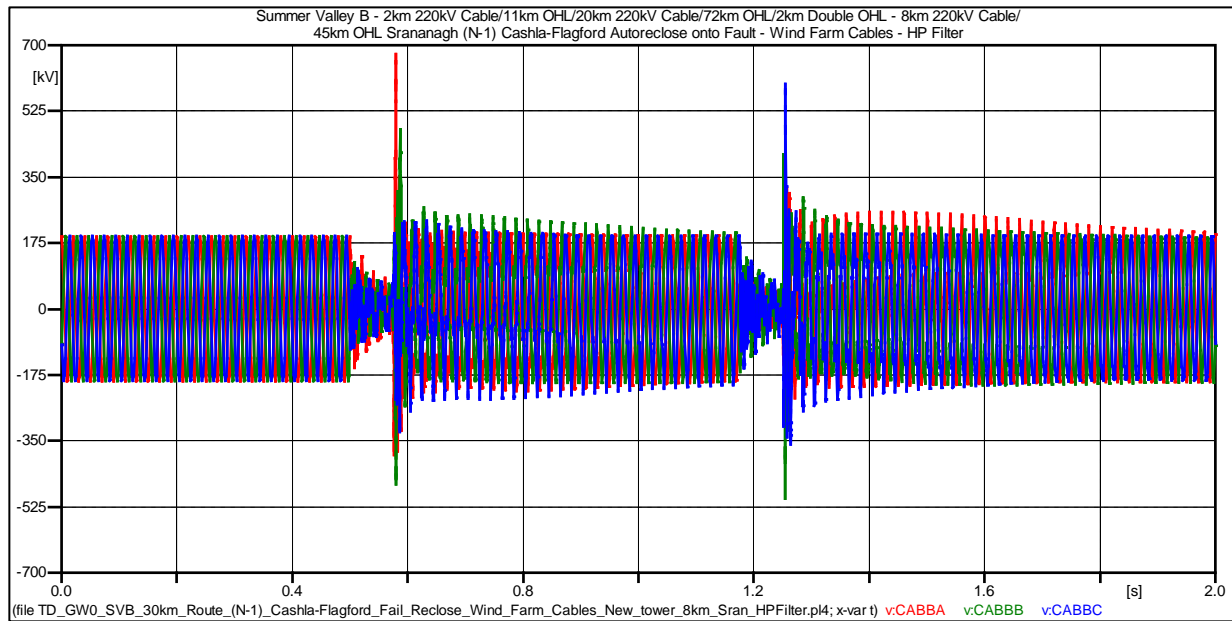
**Figure 9: SVB - Length 30 km – Cable End C – (N-1) Cashla-Flagford Autoreclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	615.59 kV (3.4279 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	253.89 kV (1.4137 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



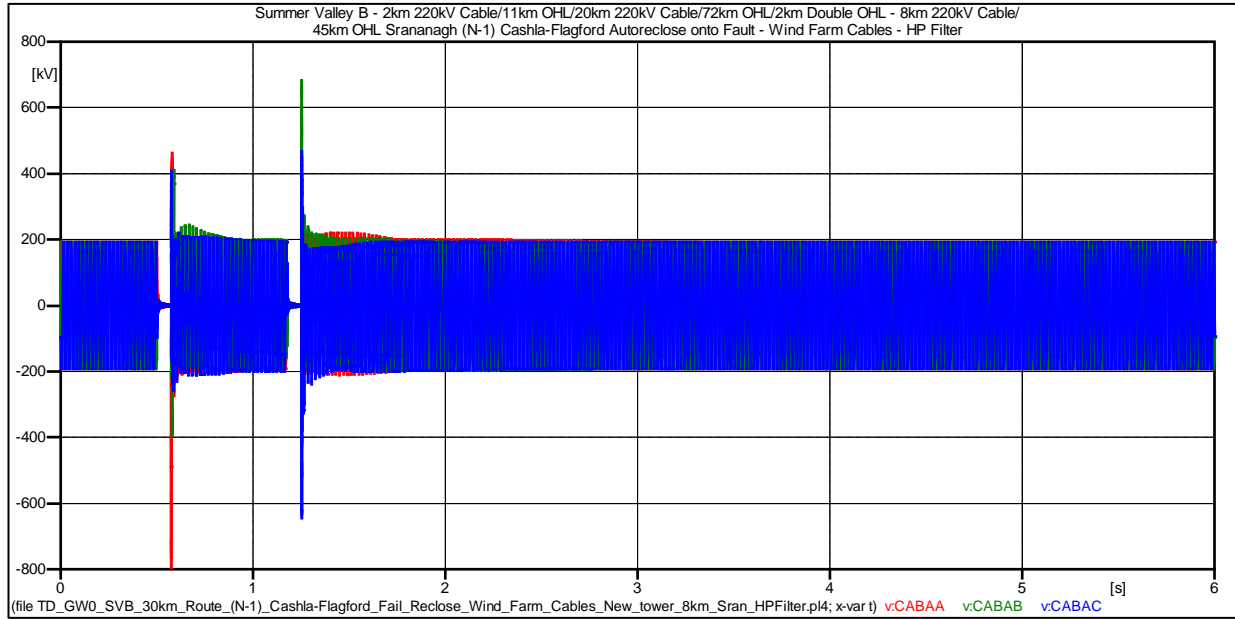
**Figure 10: SVB - Length 30 km – Cable End B – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



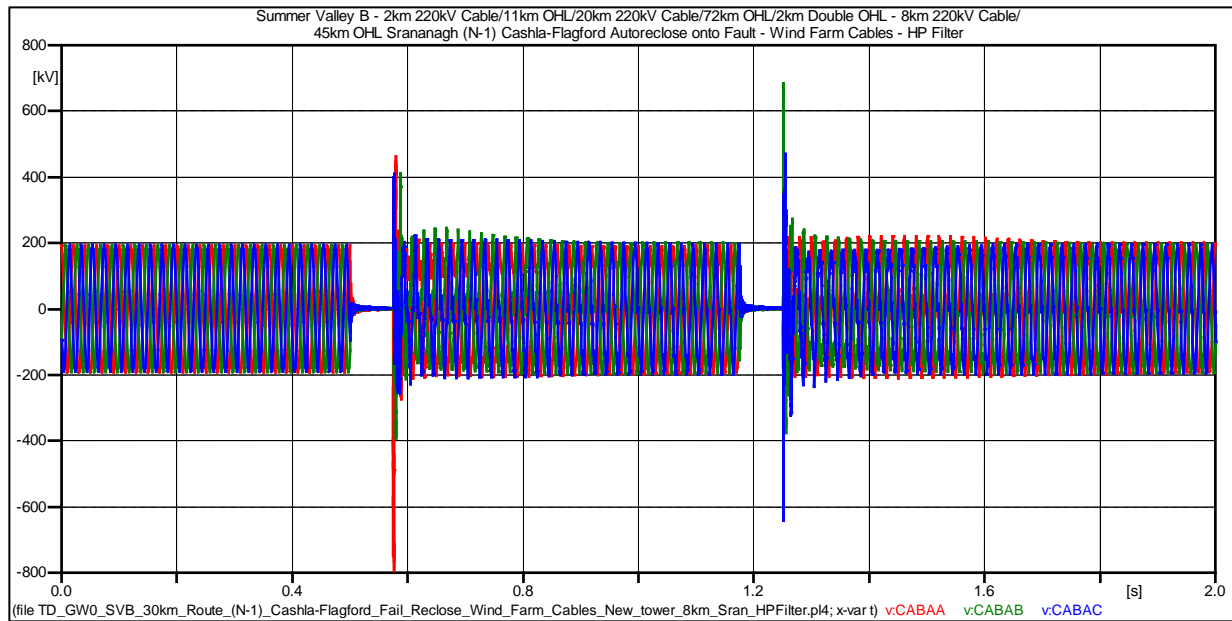
**Figure 11: SVB - Length 30 km – Cable End B – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	653.11 kV (3.6368 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	252.20kV (1.4043 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



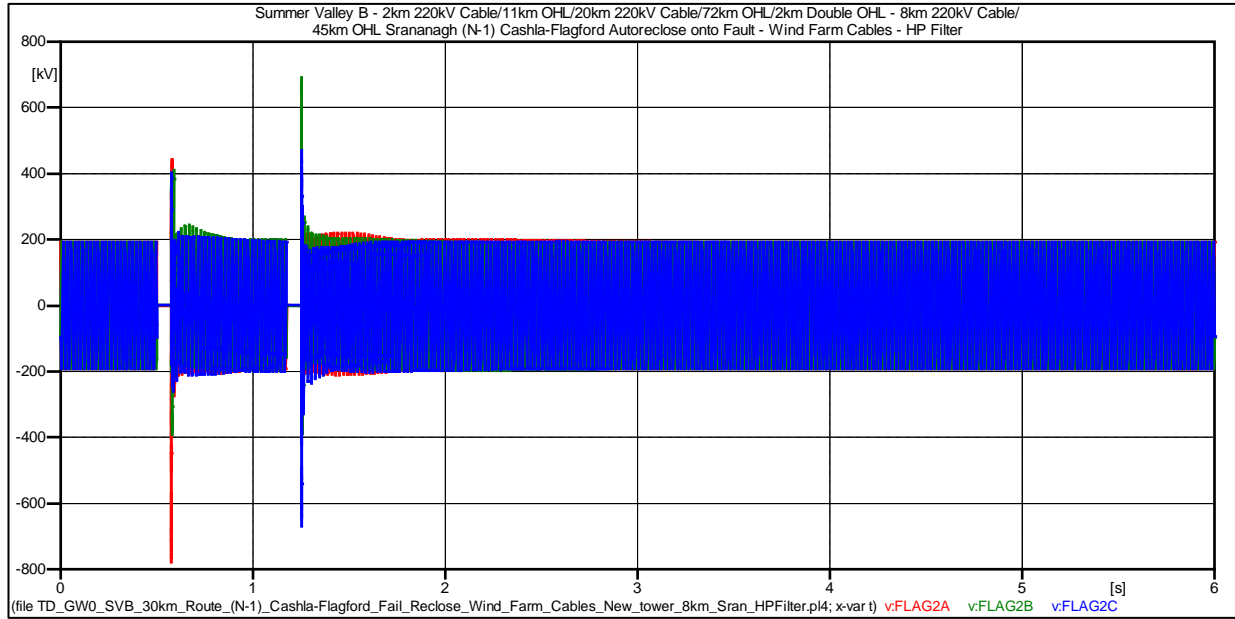
**Figure 12: SVB - Length 30 km – Cable End A – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



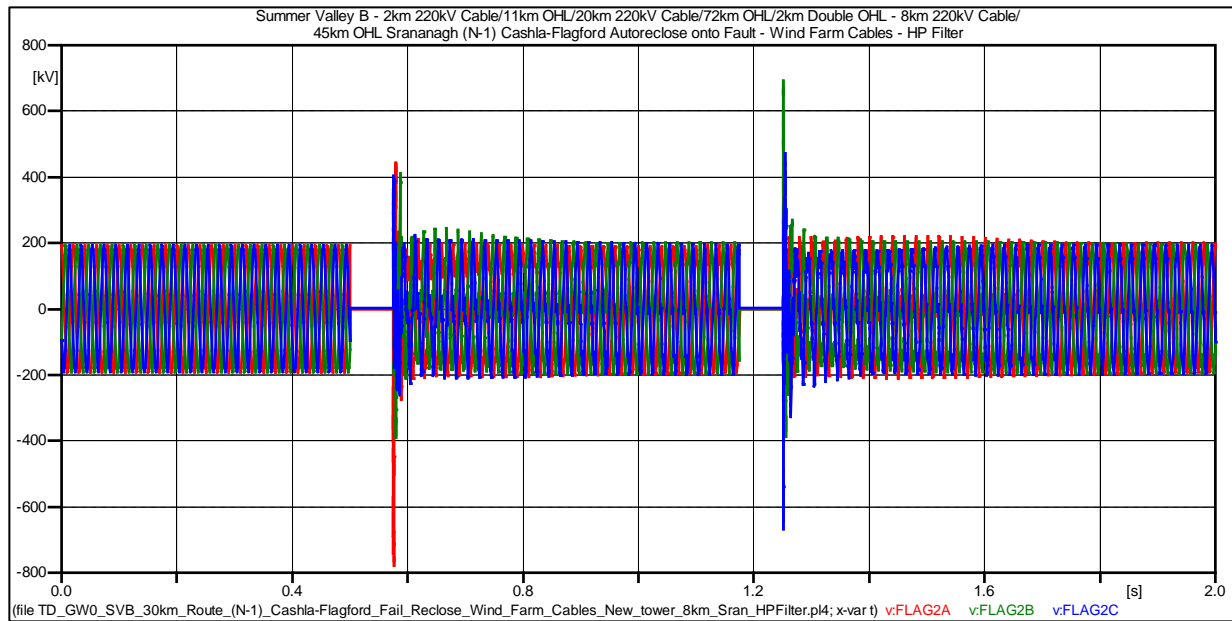
**Figure 13: SVB - Length 30 km – Cable End A – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	800.00 kV (4.4548 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	242.59 kV (1.3508 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



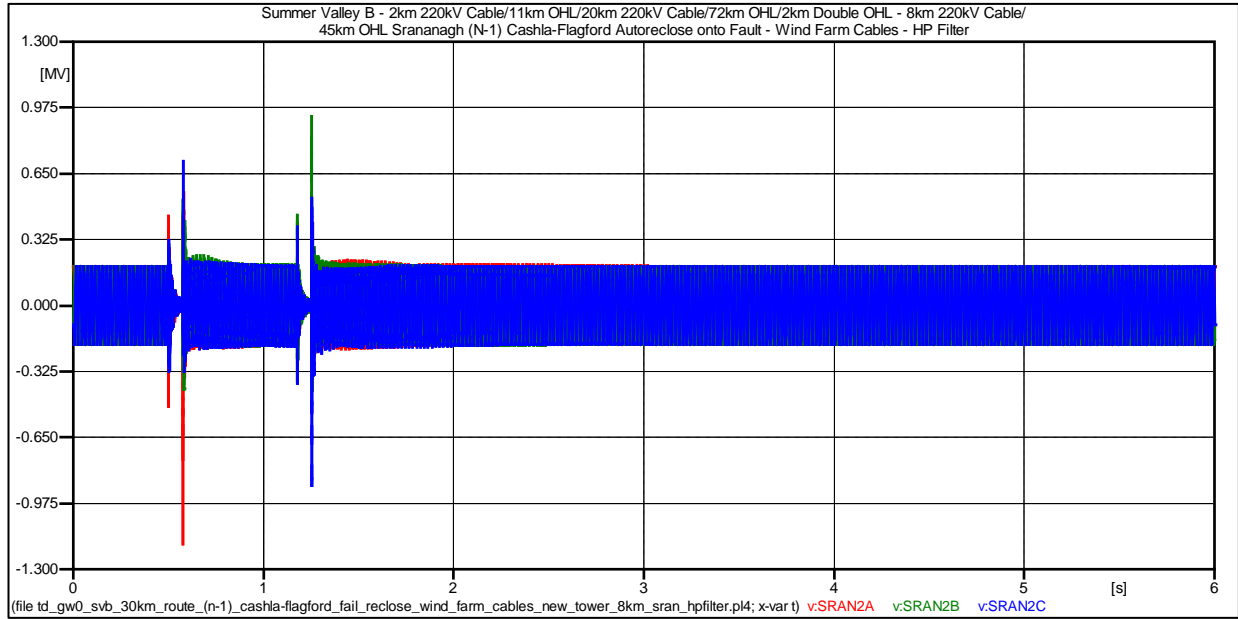
**Figure 14: SVB - Length 30 km – Flagford – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



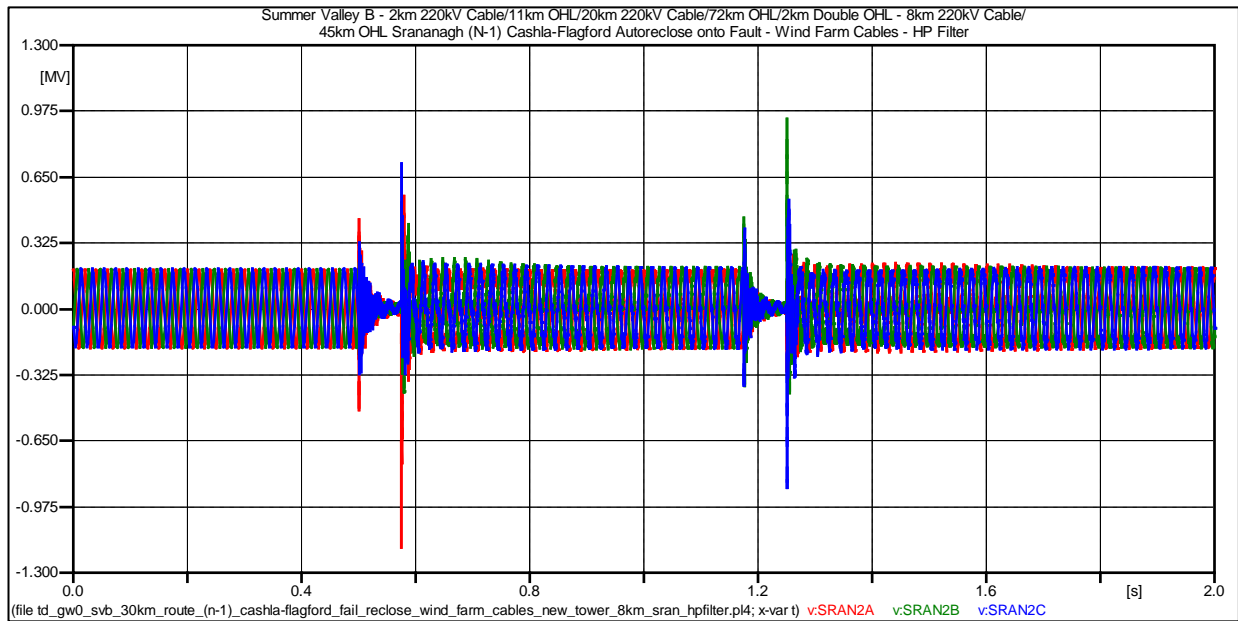
**Figure 15: SVB - Length 30 km – Flagford – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	779.10 kV (4.3384 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	230.27 kV (1.2822 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 16: SVB - Length 30 km –Srananagh – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-6s)**



**Figure 17: SVB - Length 30 km –Srananagh – (N-1) Cashla-Flagford Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	1.17 MV (6.5152 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	250.00 kV (1.3921 pu)	287.32kV (1.6pu)	Pass

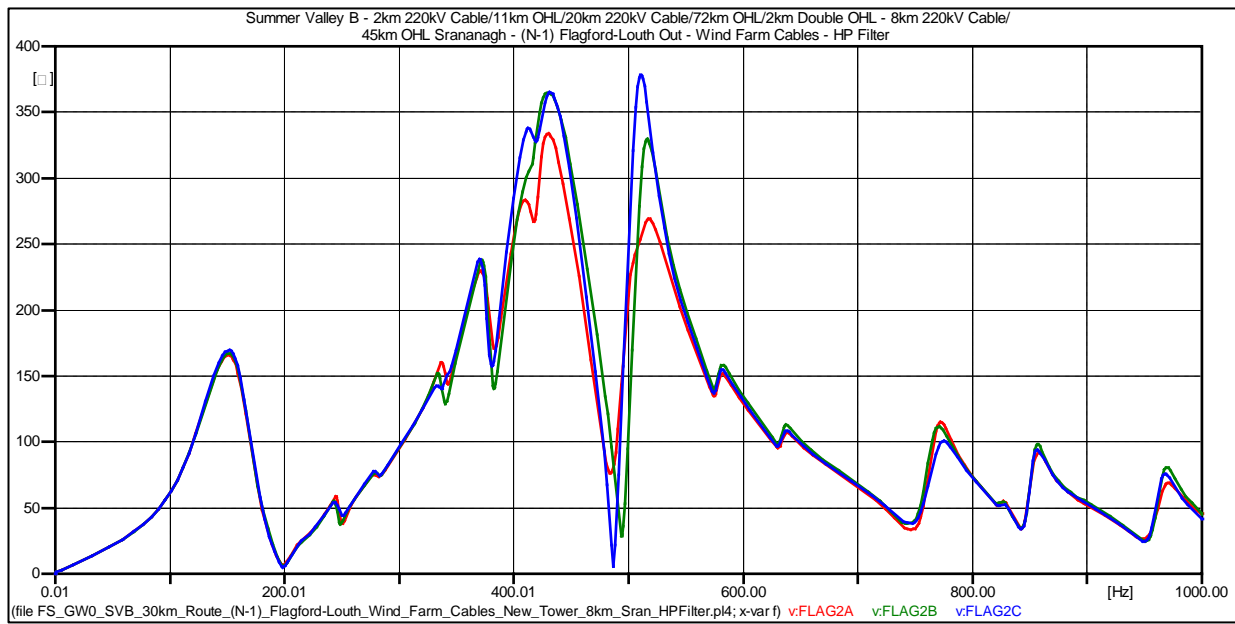
\*Pass can be achieved with surge arrestors

**1.4 Impedance Scans - Length 30 km – Summer Valley B – Case 3**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 3: (N-1) Flagford-Louth Line Out**



**Figure 18: SVB - Length 30 km - (N-1) Flagford-Louth Line Out**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
151.21	169.46
431.11	364.90
510.31	377.86
771.91	99.20
858.01	97.568
970.21	80.52



### **1.5 Time Domain Simulation - Length 30 km – Summer Valley B – Case 3**

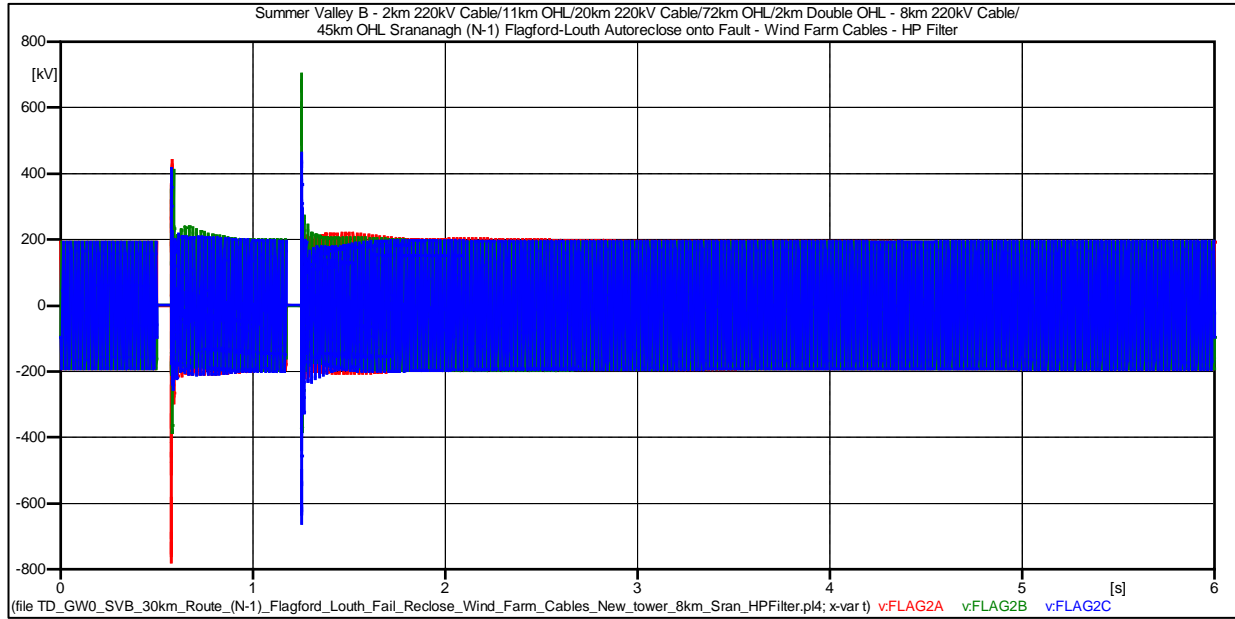
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500  $\Omega$

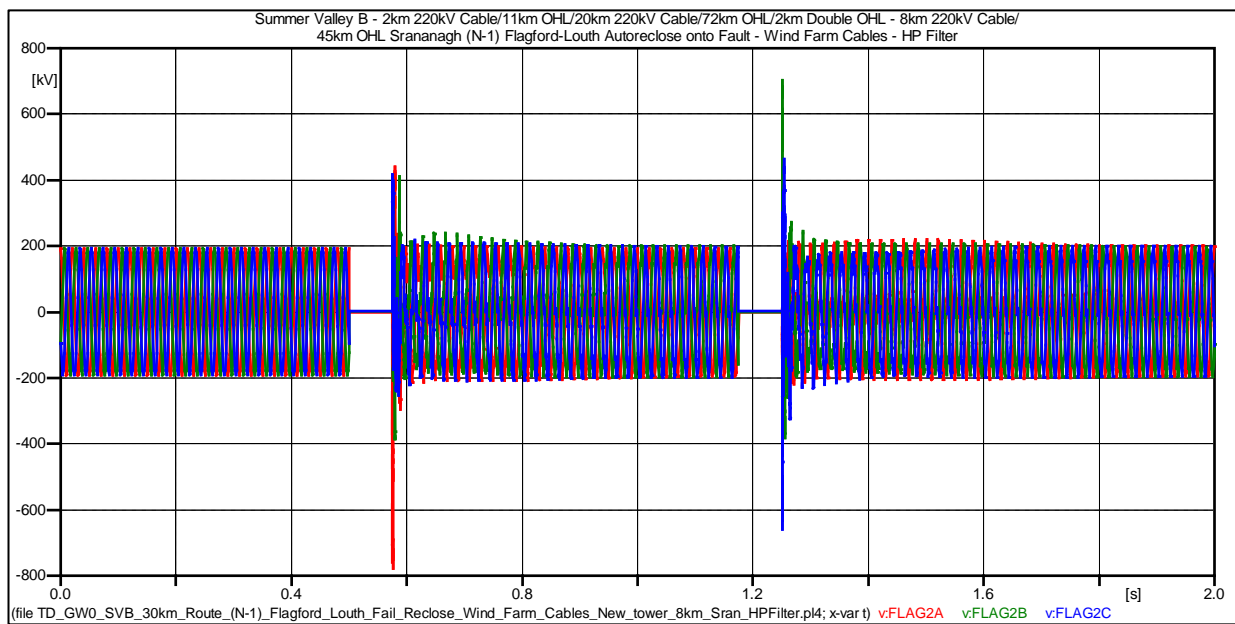
#### **Case 3: (N-1) Flagford-Louth Line Autoreclose onto Fault**

System Conditions:

1. Fault applied on Flagford side of Flagford-Louth line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.



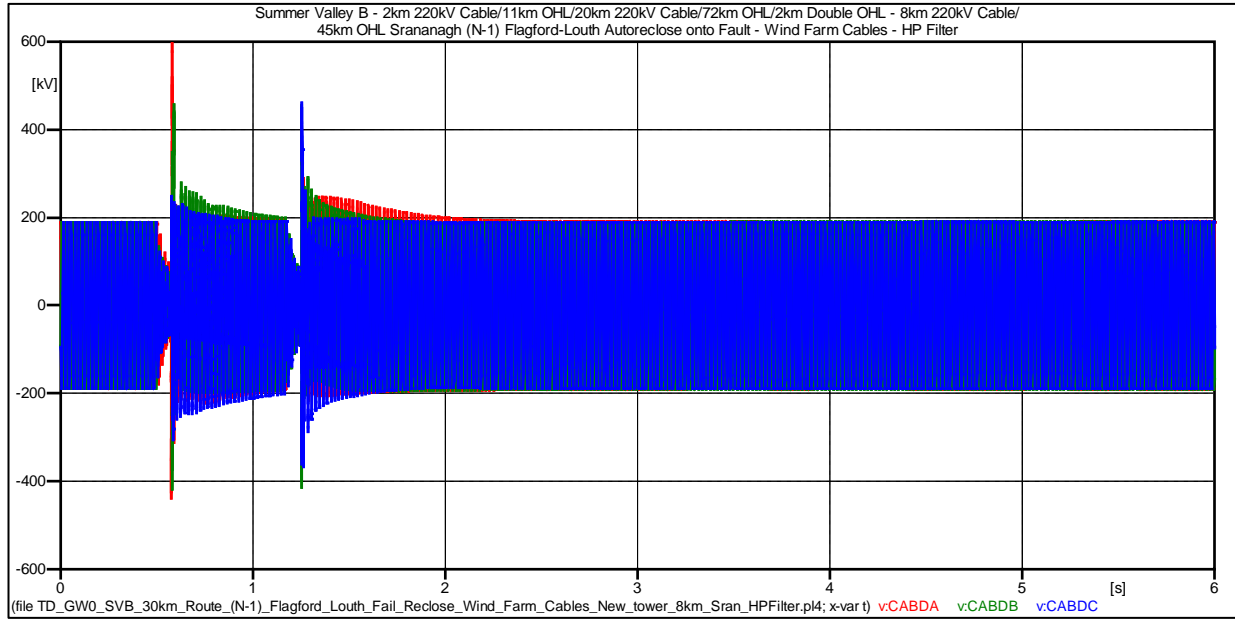
**Figure 19: SVB - Length 30 km – Flagford – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



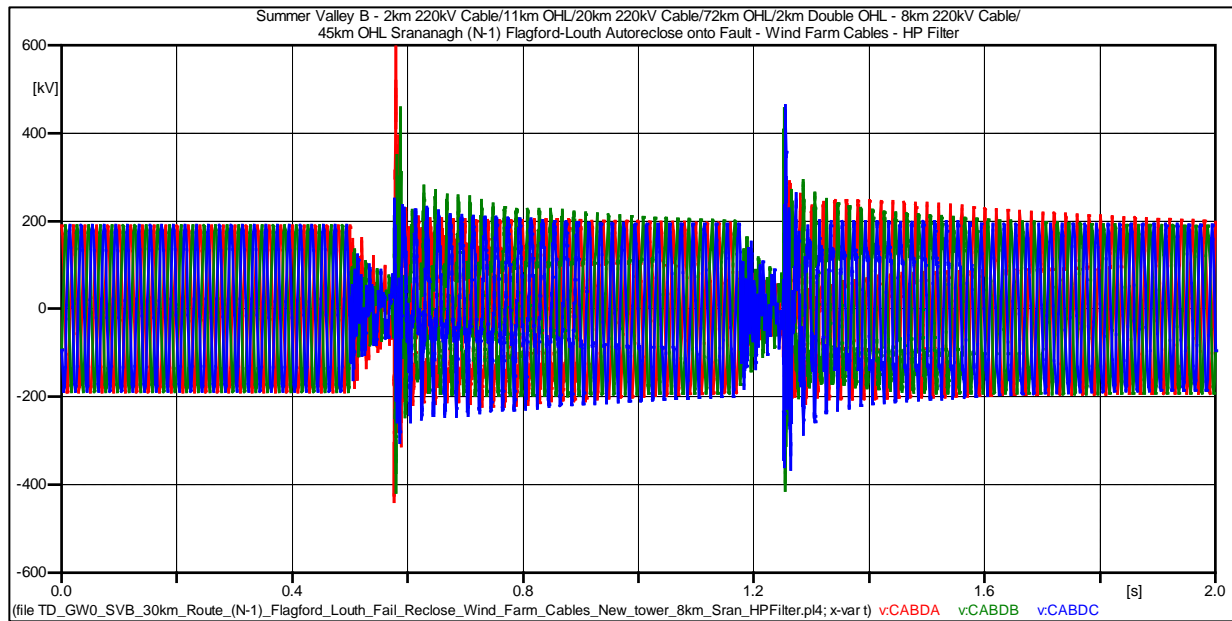
**Figure 20: SVB - Length 30 km – Flagford – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**

Condition	Maximum Value	Limit	Result
Switching	743.38 kV (4.1406 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	216.64 kV (1.2063 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



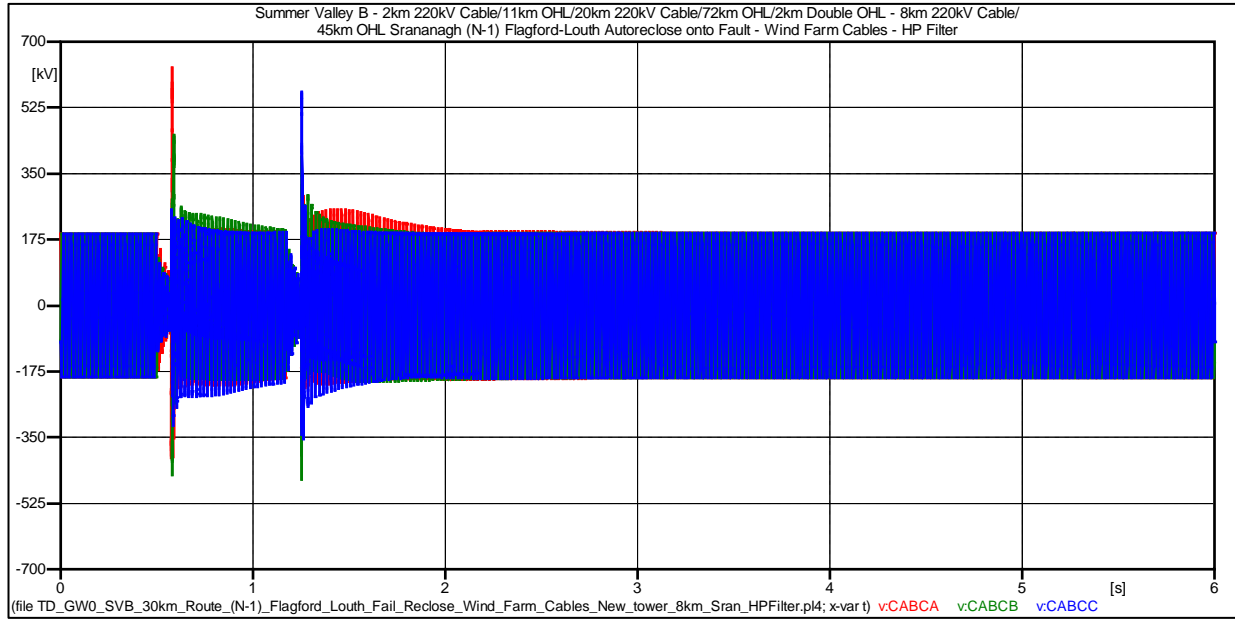
**Figure 21: SVB - Length 30 km – Cable End D – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



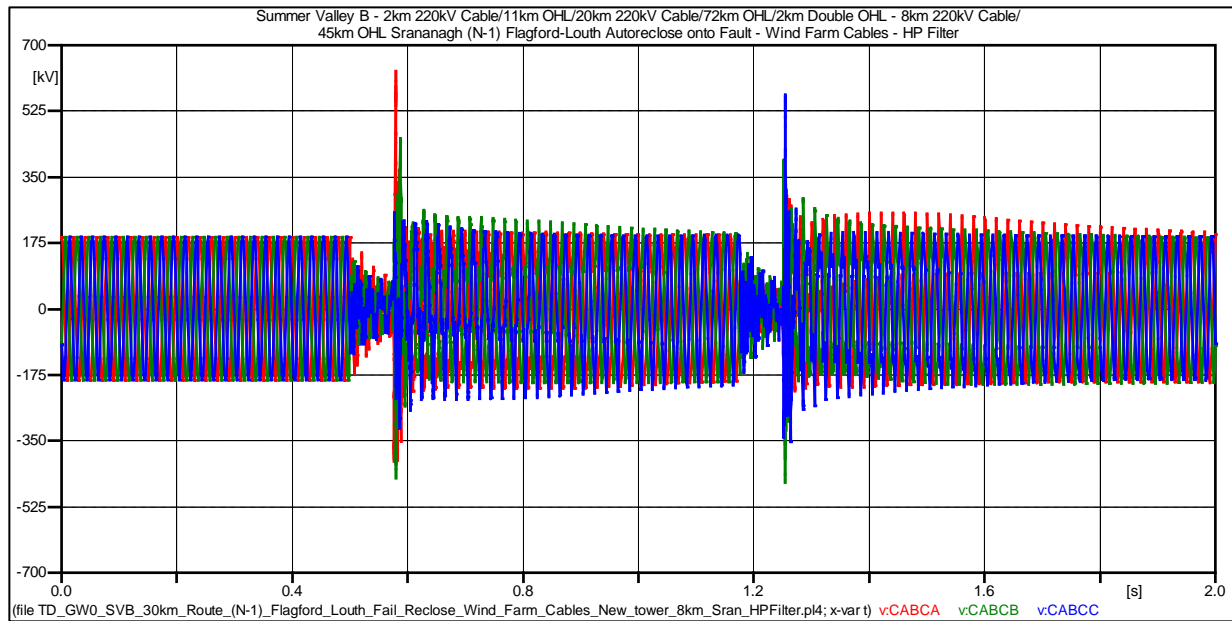
**Figure 22: SVB - Length 30 km – Cable End D – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	600.02 kV (3.3412 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	255.50 kV (1.4227 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



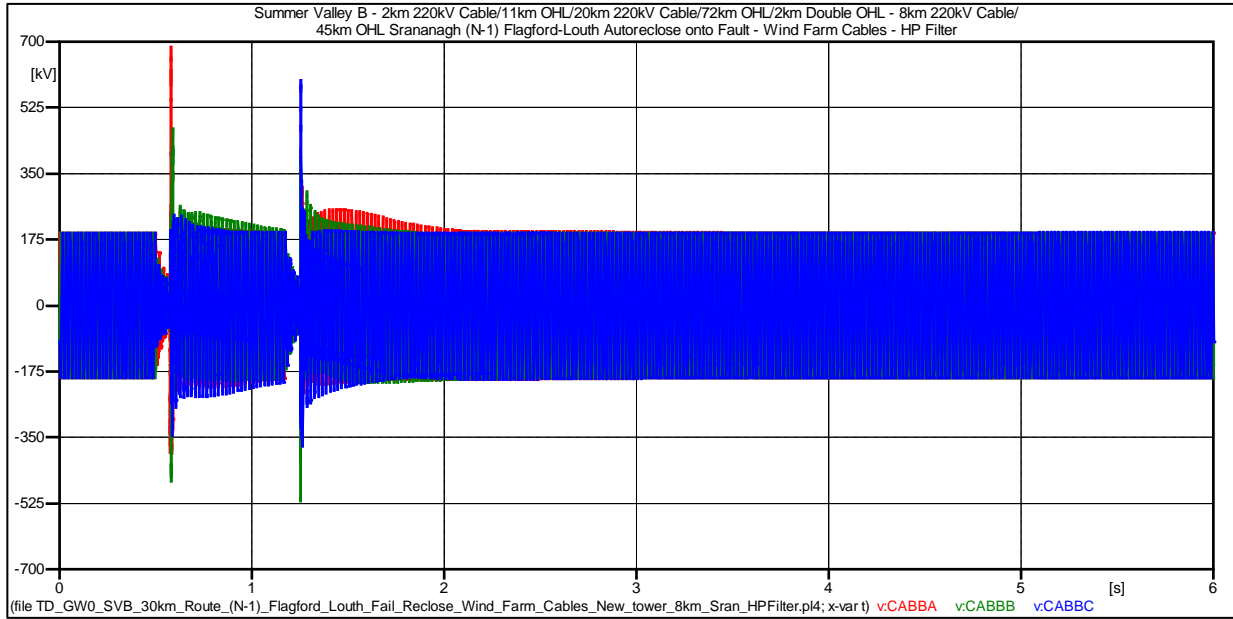
**Figure 23: SVB - Length 30 km – Cable End C – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



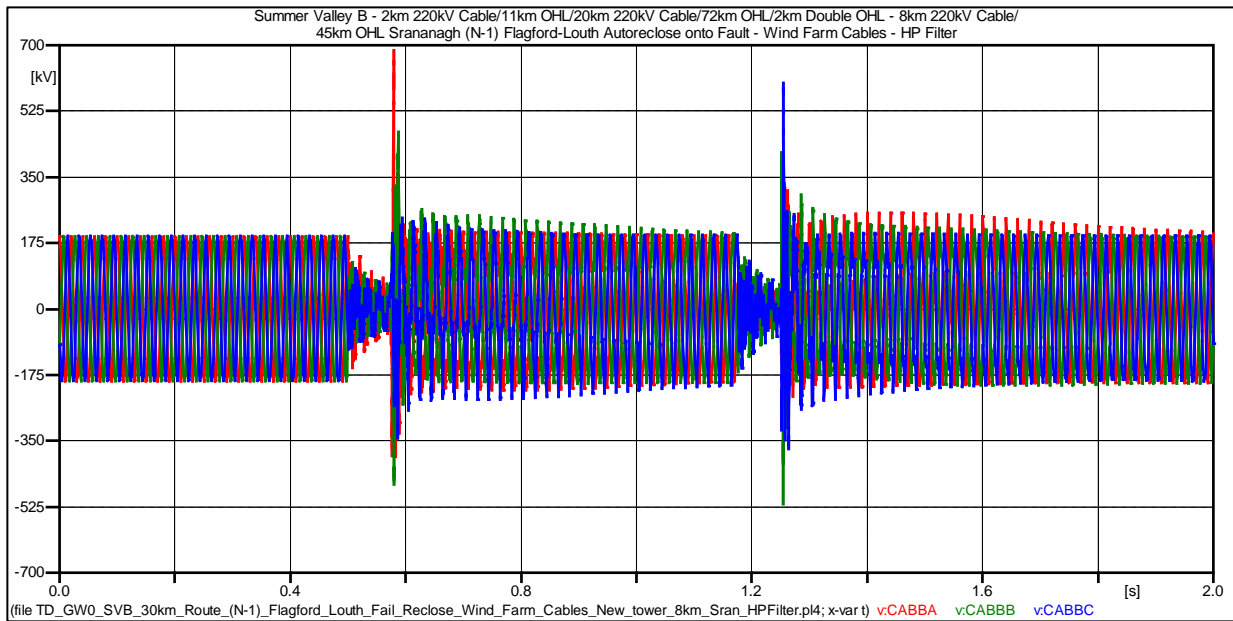
**Figure 24: SVB - Length 30 km – Cable End C – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	627.97 kV (3.4968 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	254.65 kV (1.4180 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



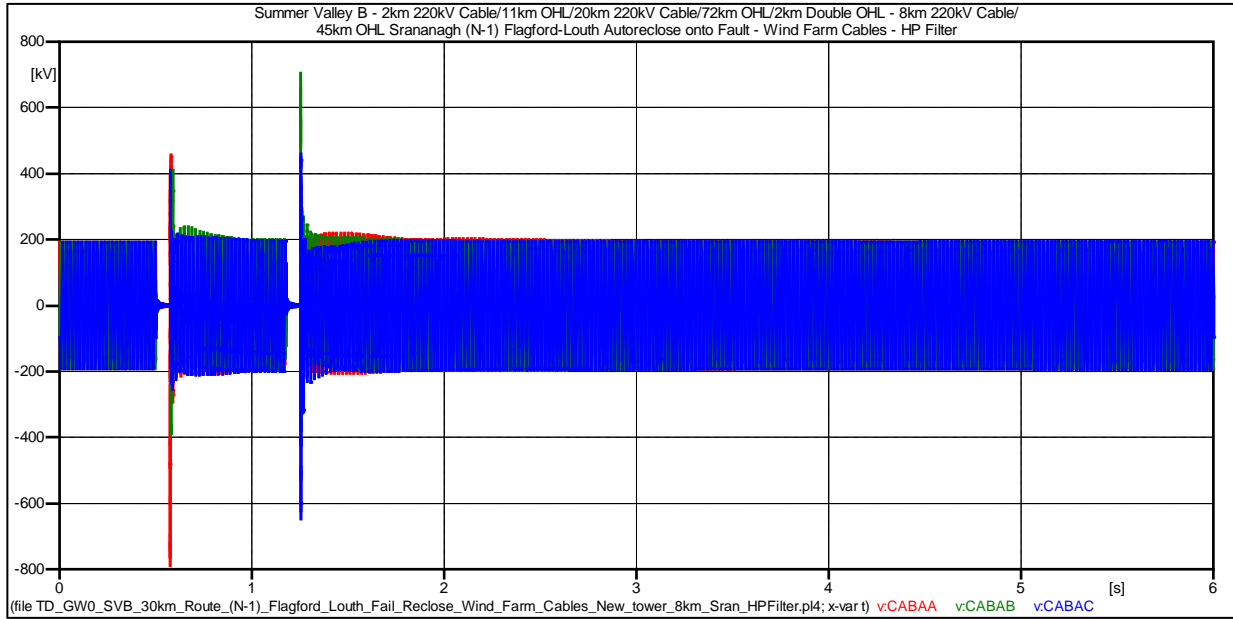
**Figure 25: SVB - Length 30 km – Cable End B – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



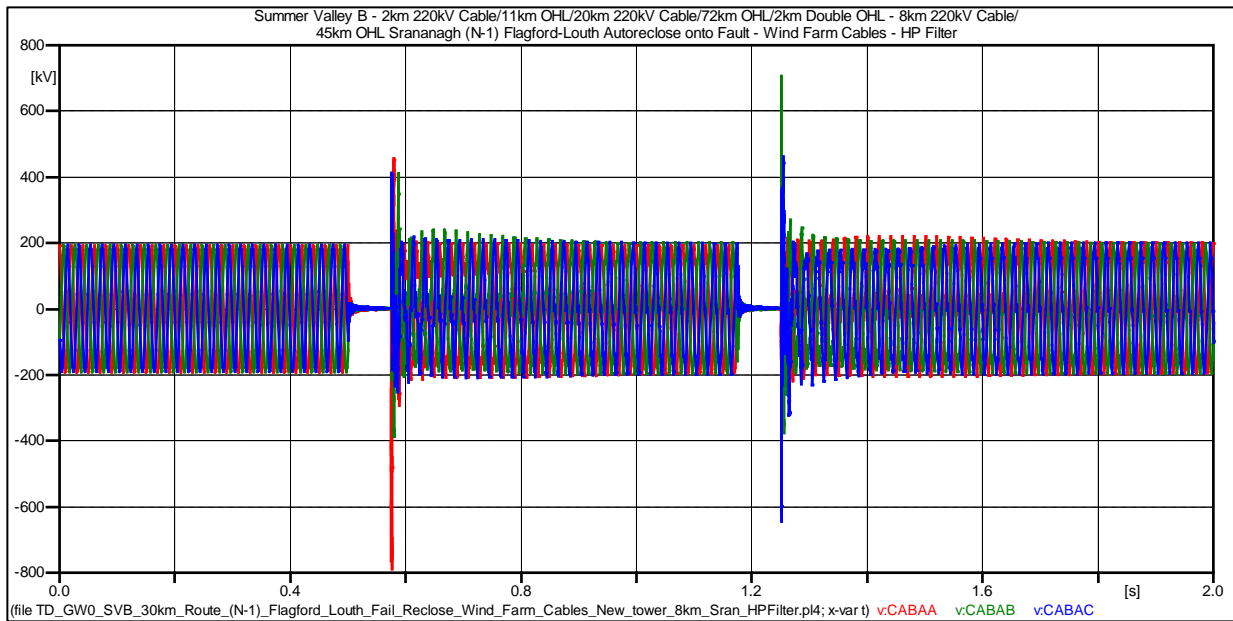
**Figure 26: SVB - Length 30 km – Cable End B – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	671.58 kV (3.7397 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	249.25 kV (1.3879 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



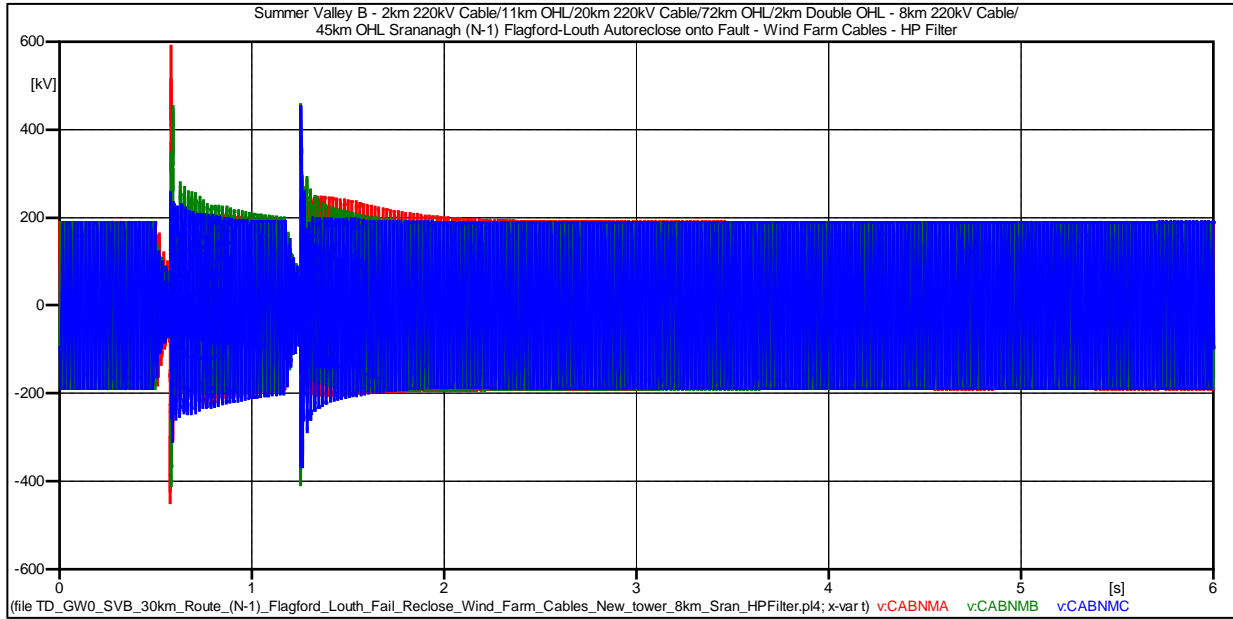
**Figure 27: SVB - Length 30 km – Cable End A – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



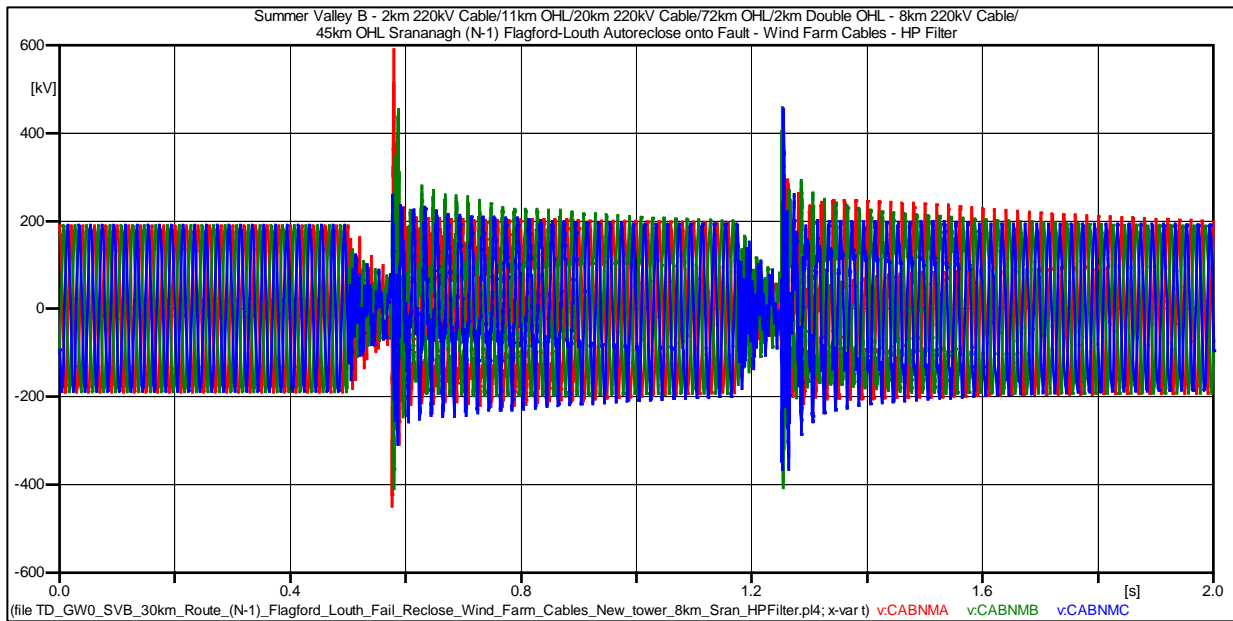
**Figure 28: SVB - Length 30 km – Cable End A – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	690.45 kV (3.8448 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	235.34 kV (1.3105 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



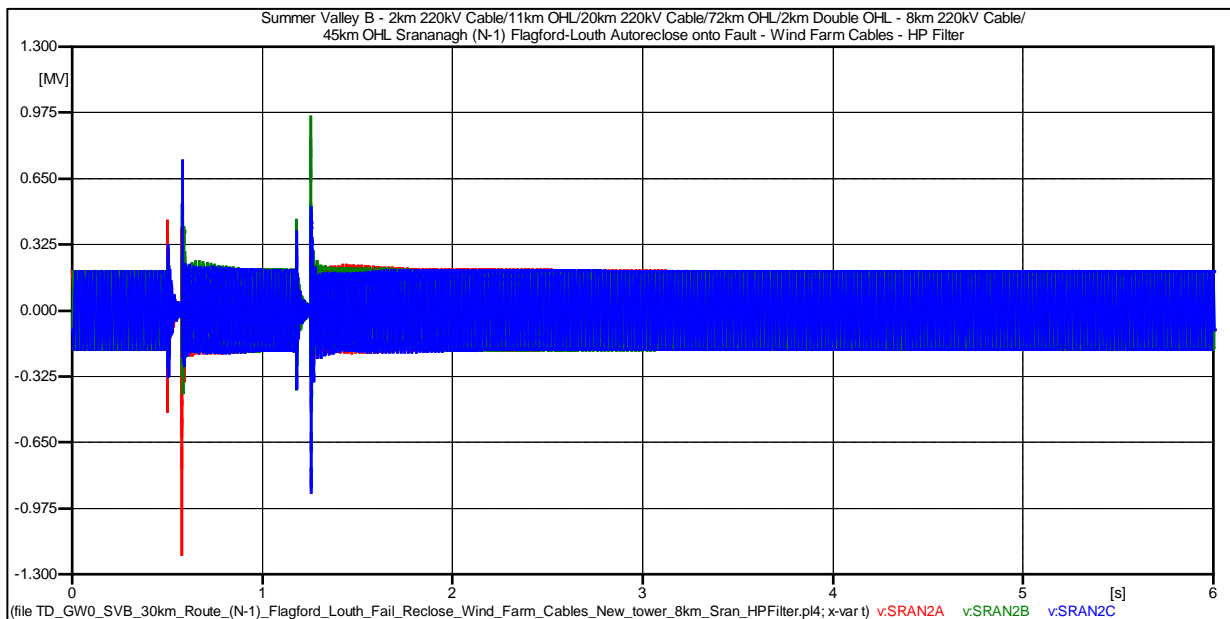
**Figure 29: SVB - Length 30 km – North Mayo – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



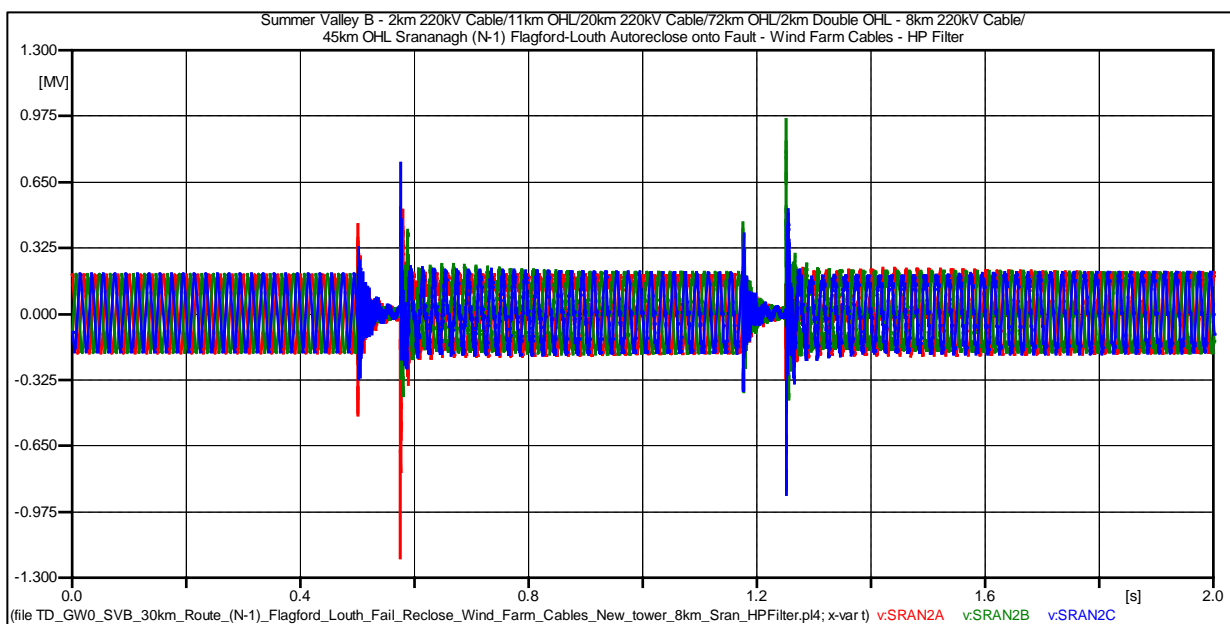
**Figure 30: SVB - Length 30 km – North Mayo – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	590.23 kV (3.2867 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	275.38 kV (1.5420 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 31: SVB - Length 30 km – Srananagh – (N-1) Flagford-Louth Auto Reclose onto Fault (0-6s)**



**Figure 32: SVB - Length 30 km – Srananagh – (N-1) Flagford-Louth Auto Reclose onto Fault (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	1.2017 MV (6.6917 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	275.38 kV (1.5334 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors

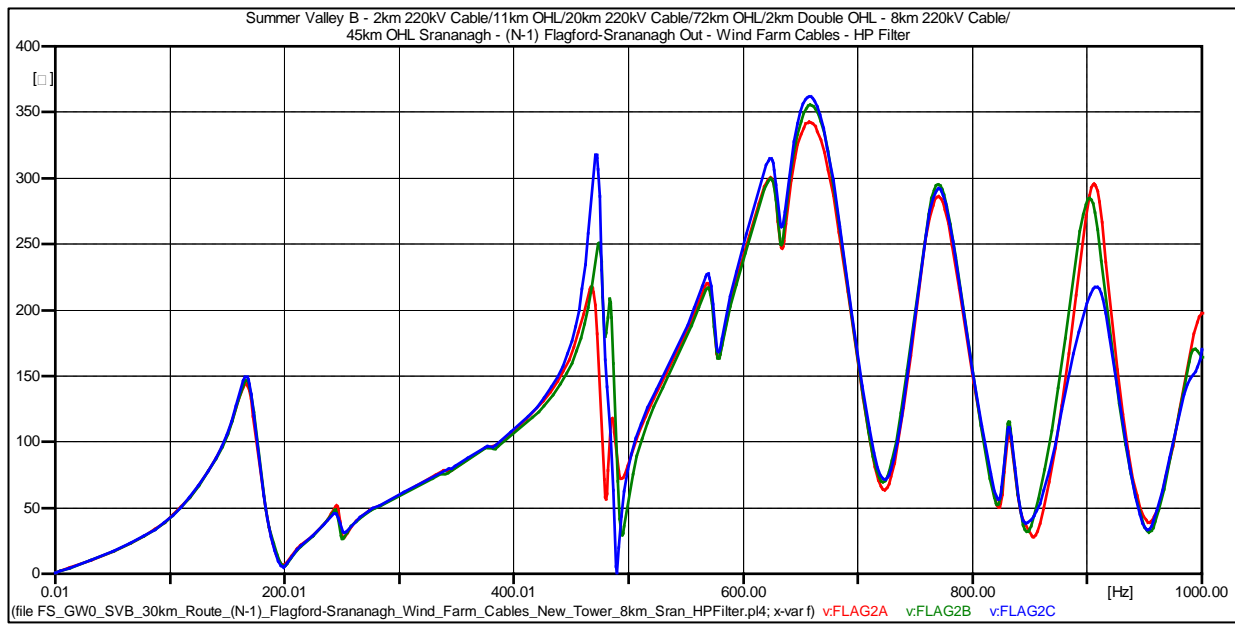


**1.6 Impedance Scans - Length 30 km – Summer Valley B – Case 4**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 4: (N-1) Flagford-Srananagh Cable/Line Out**



**Figure 33: SVB - Length 30 km - (N-1) Flagford-Srananagh Lines Out**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
166.21	149.41
471.91	317.59
658.21	361.90
771.31	294.61
906.61	295.26

### **1.7 Time Domain Simulation - Length 30 km – Summer Valley B – Case 4**

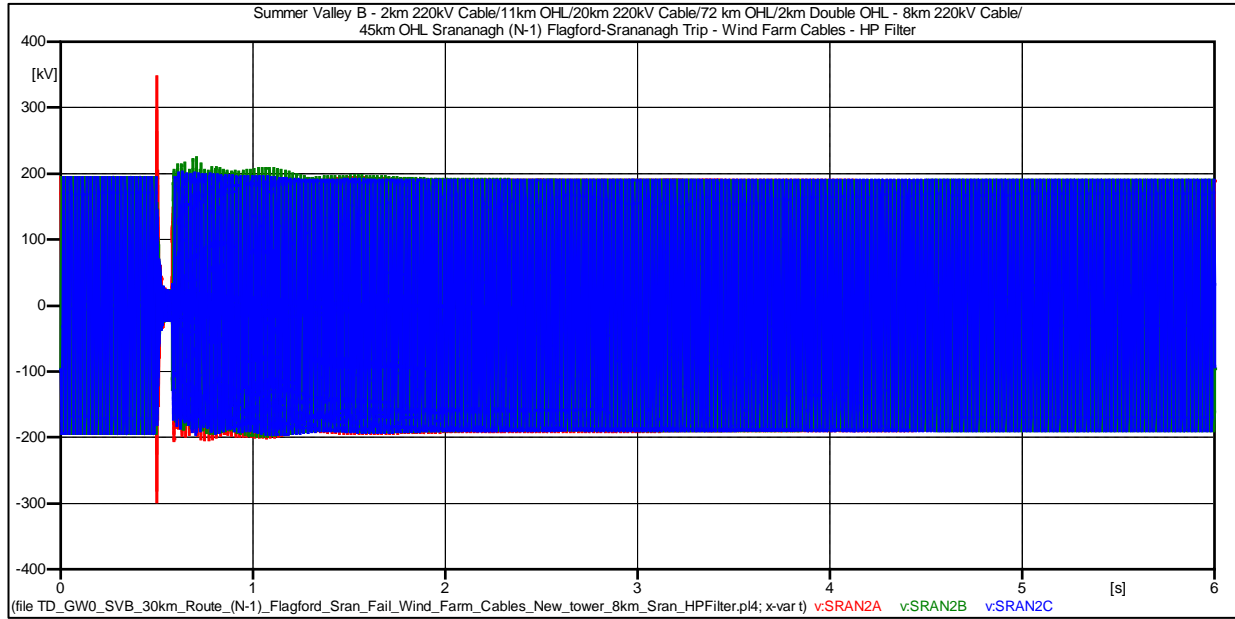
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29  $\mu$ F, 372 mH, 500  $\Omega$

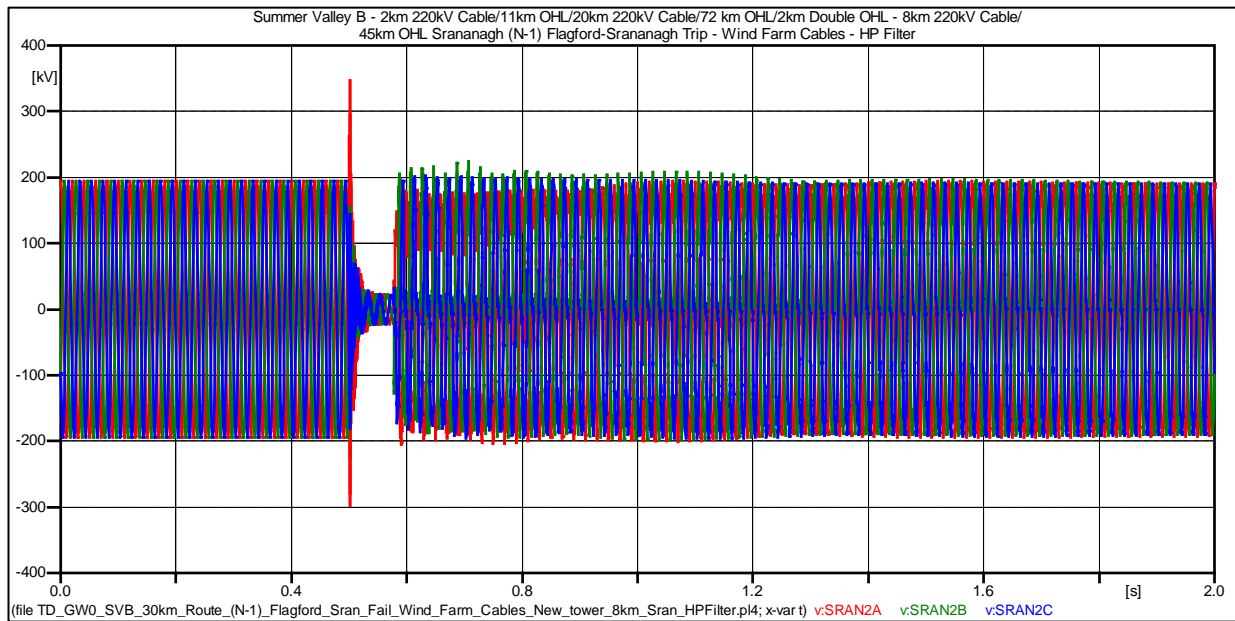
#### **Case 4: (N-1) Flagford-Srananagh Line Trip**

System Conditions:

1. Fault in between the 8km cable and the Flagford-Srananagh line applied at 0.5s, removed at 0.575s.
2. A small load of 0.5MW added to the 220kV system at Srananagh in order to alleviate an ATP modelling issue when a hanging transformer is left following the trip of the Flagford – Srananagh 220 kV line.

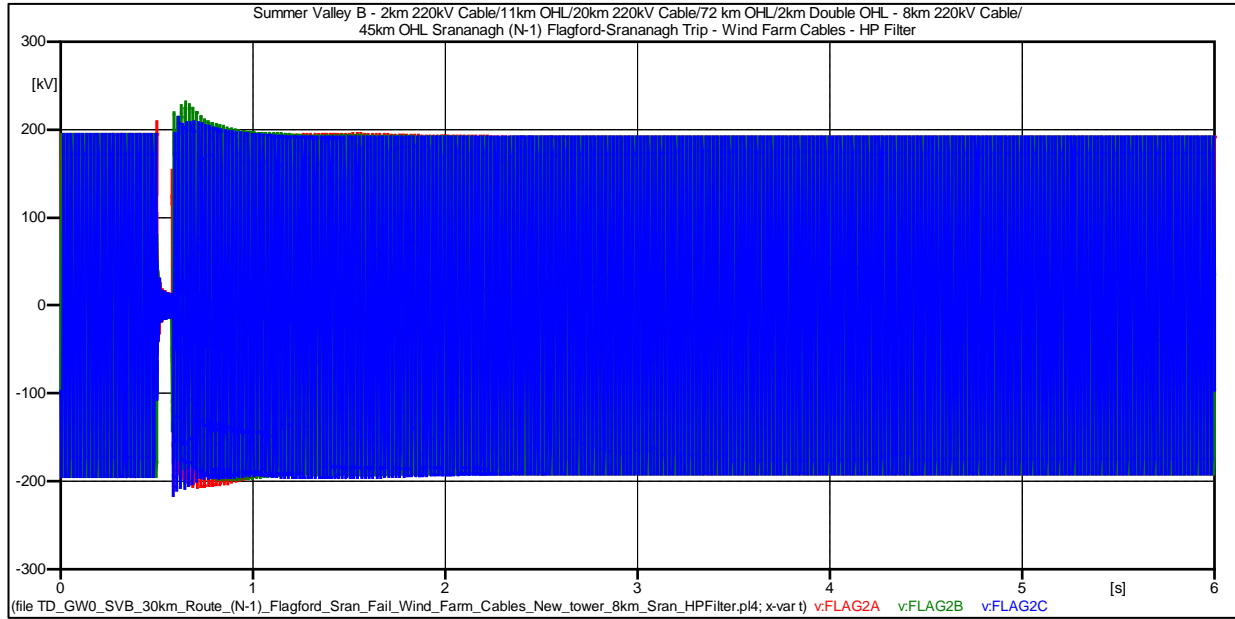


**Figure 34: SVB - Length 30 km – Srananagh – (N-1 Flagford-Srananagh Line Trip (0-6s))**

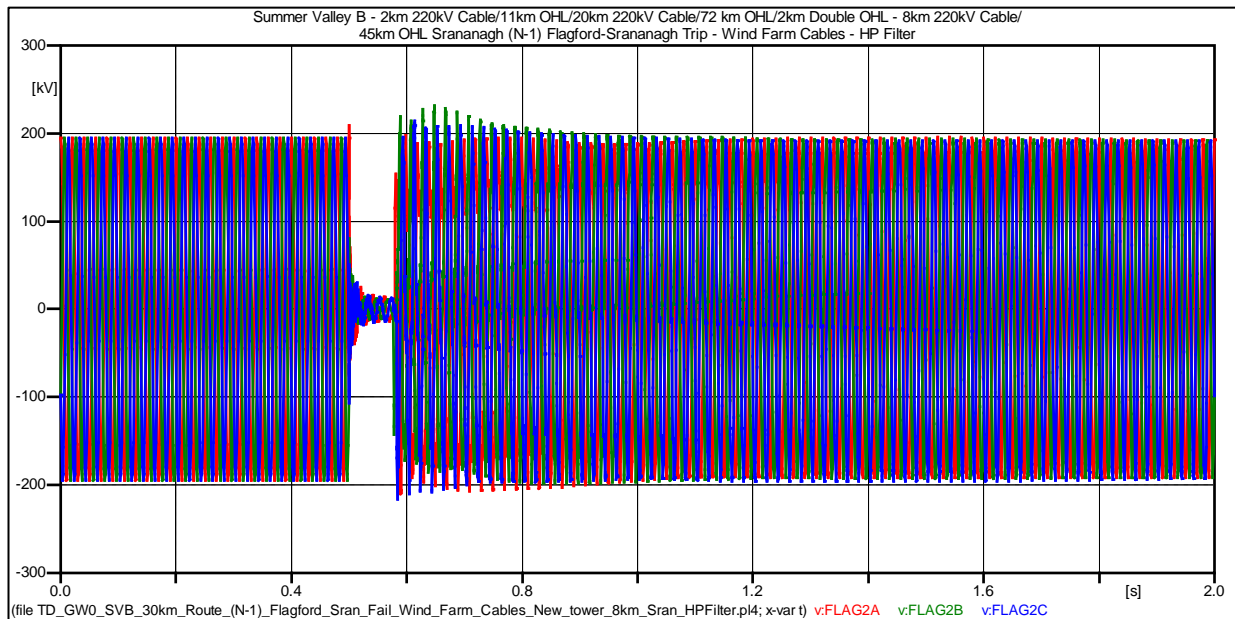


**Figure 35: SVB - Length 30 km – Srananagh – (N-1 Flagford-Srananagh Line Trip (0-2s))**

Condition	Maximum Value	Limit	Result
Switching	346.59 kV (1.9300 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	199.89 kV (1.1131 pu)	287.32kV (1.6pu)	Pass

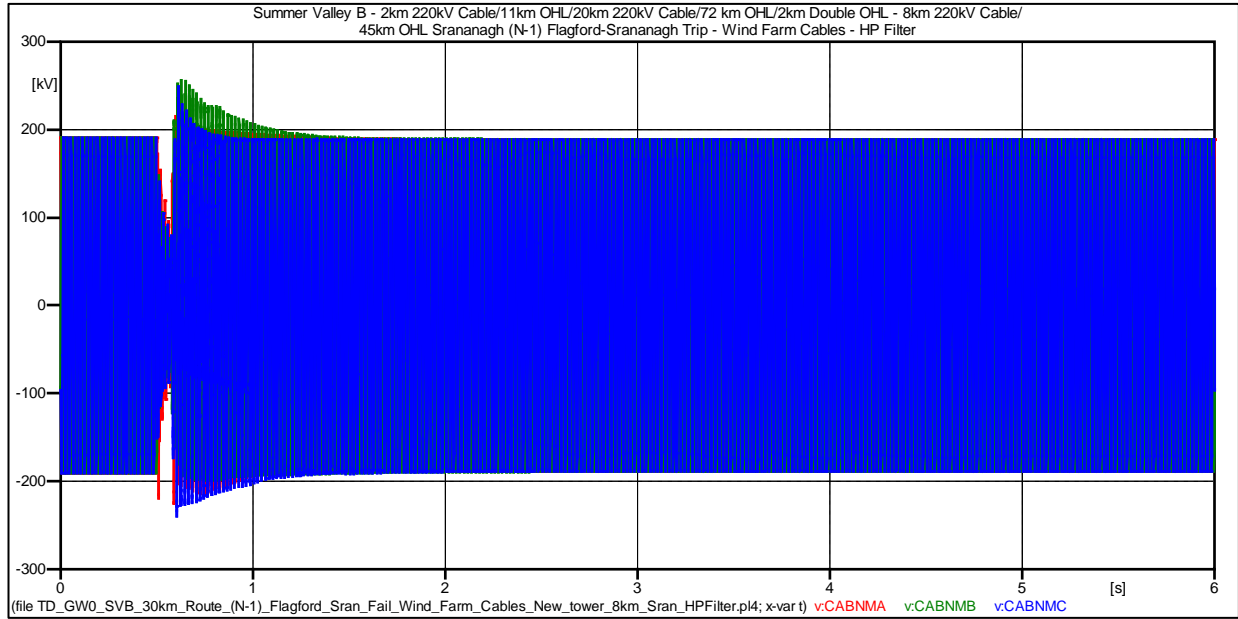


**Figure 36: SVB - Length 30 km – Flagford – (N-1) Flagford-Srananagh Line Trip (0-6s)**

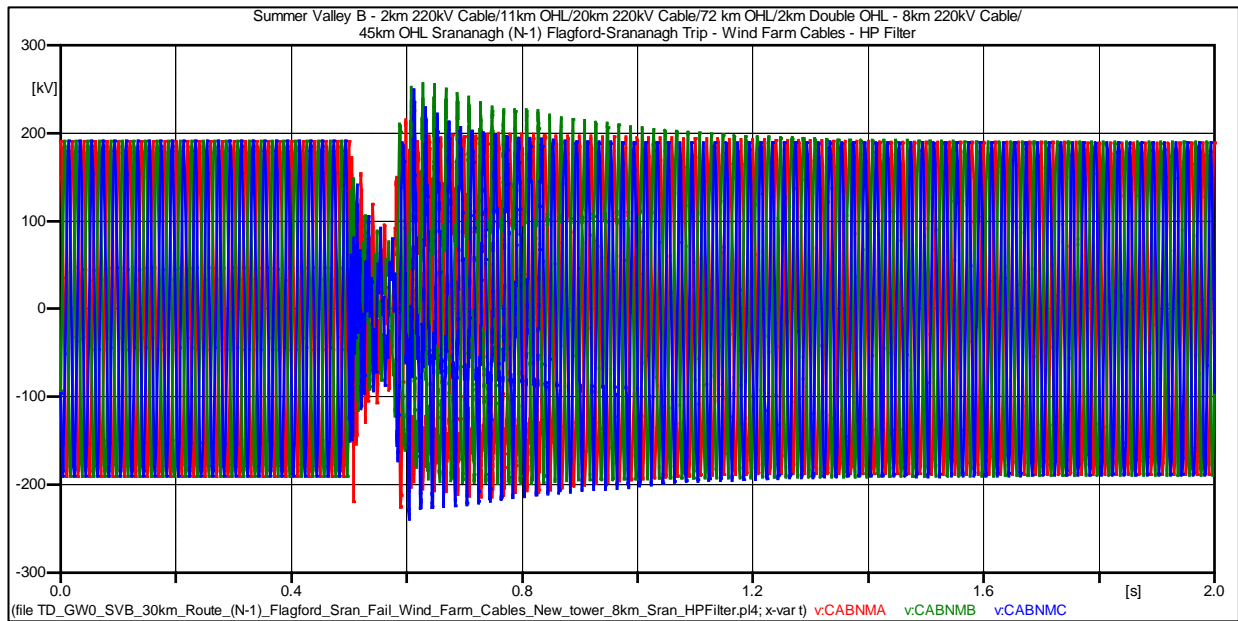


**Figure 37: SVB - Length 30 km – Flagford – (N-1) Flagford-Srananagh Line Trip (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	231.59 kV (1.2896 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	231.89 kV (1.2912 pu)	287.32kV (1.6pu)	Pass

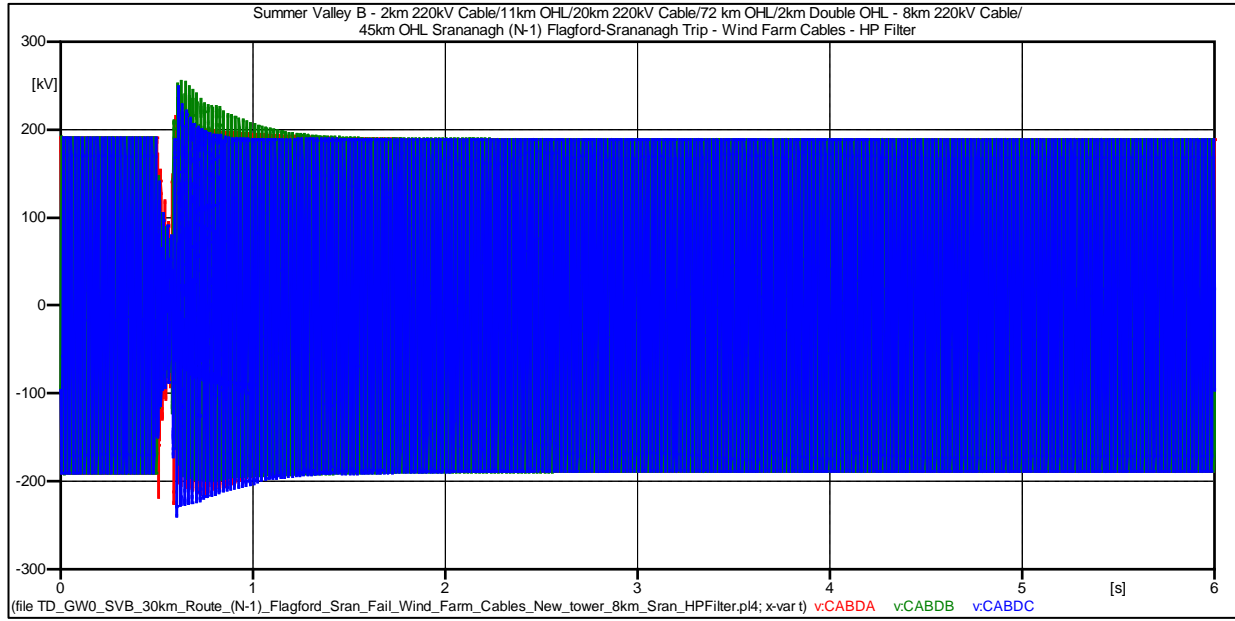


**Figure 38: SVB - Length 30 km – North Mayo – (N-1) Flagford-Srananagh Line Trip (0-6s)**

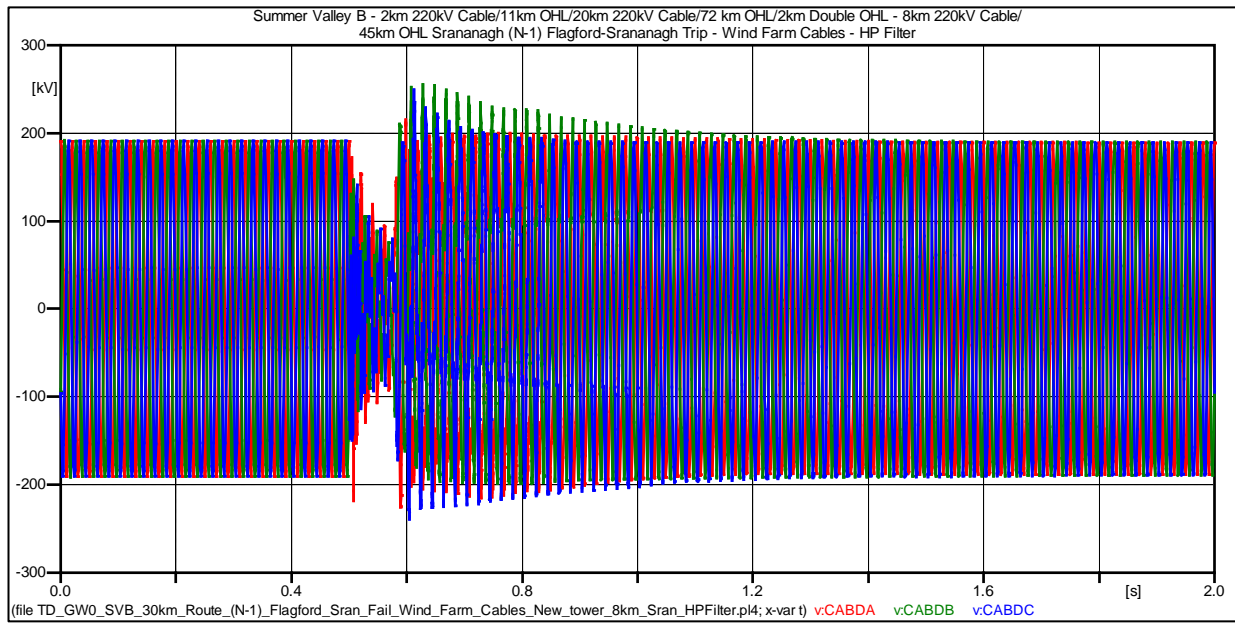


**Figure 39: SVB - Length 30 km – North Mayo – (N-1) Flagford-Srananagh Line Trip (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	251.56 kV (1.4008 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	251.23 kV (1.3989 pu)	287.32kV (1.6pu)	Pass

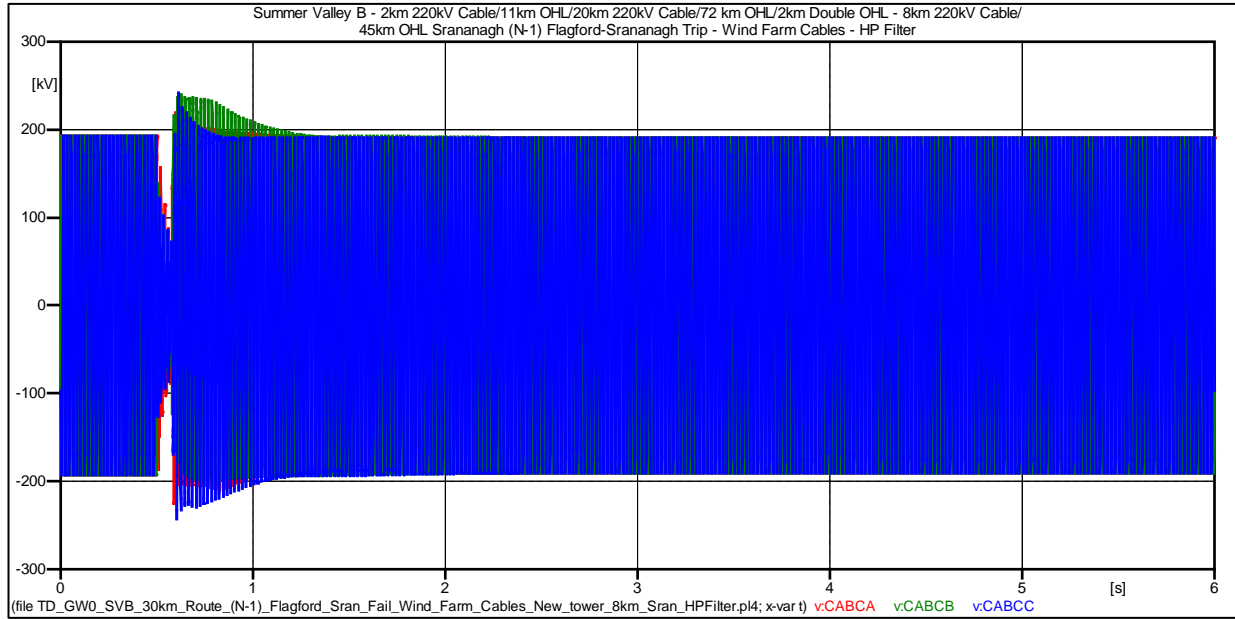


**Figure 40: SVB - Length 30 km – Cable End D – (N-1) Flagford-Srananagh Line Trip (0-6s)**

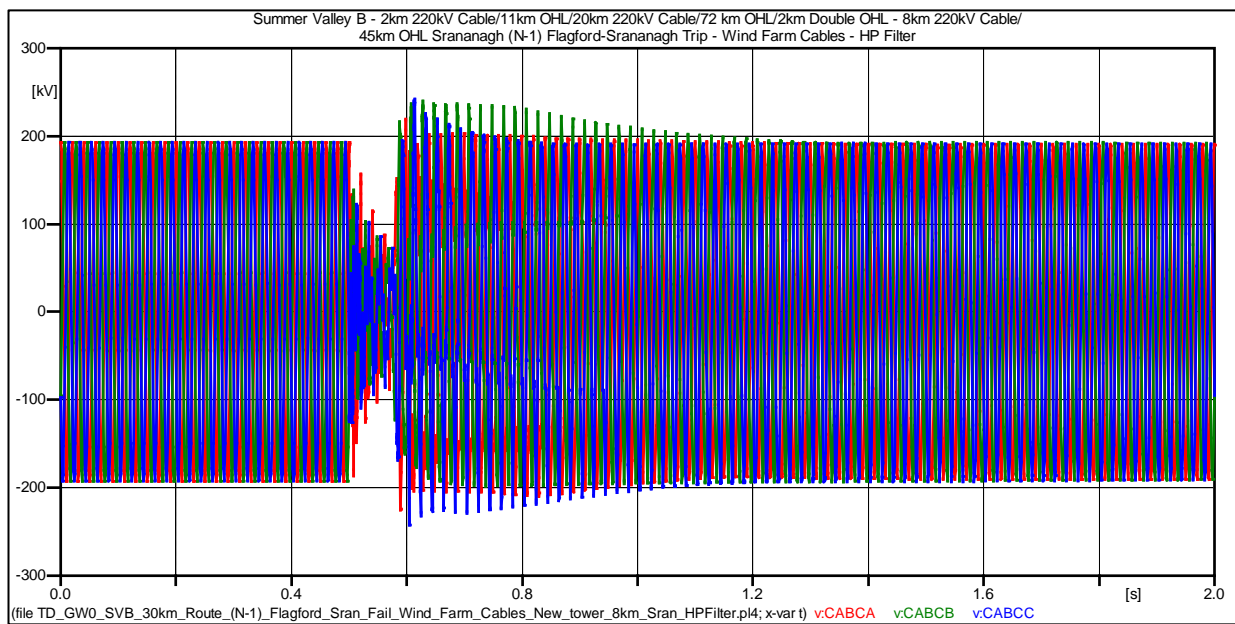


**Figure 41: SVB - Length 30 km – Cable End D – (N-1) Flagford-Srananagh Line Trip (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	243.56 kV (1.3542 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	243.89 kV (1.3581 pu)	287.32kV (1.6pu)	Pass

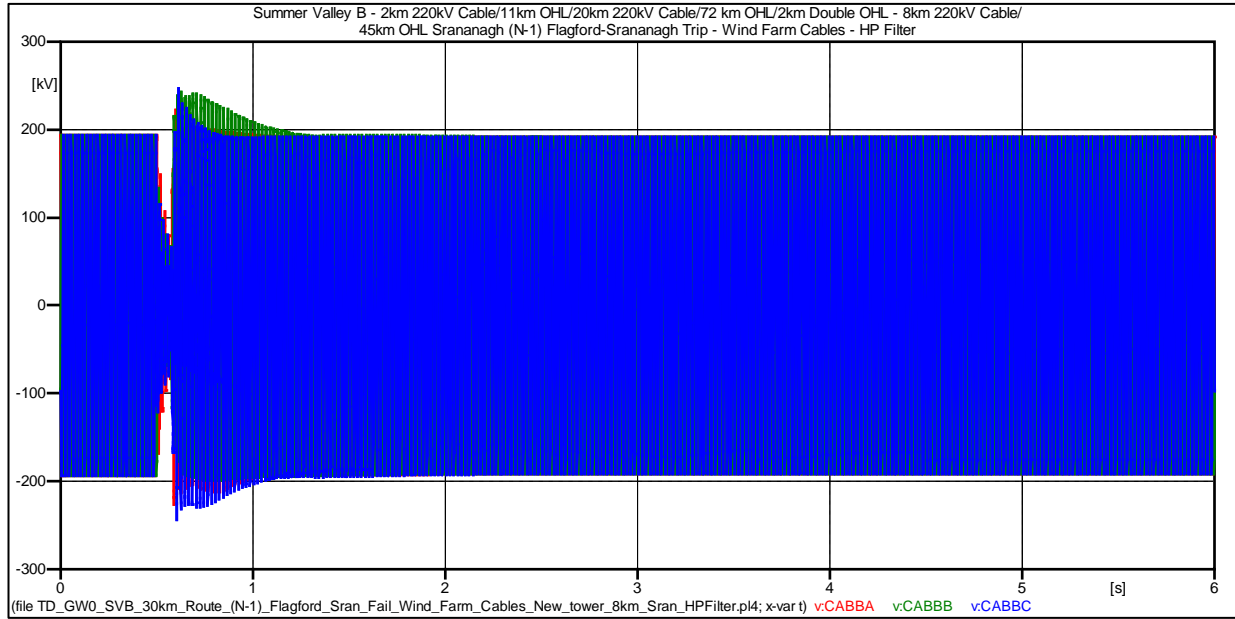


**Figure 42: SVB - Length 30 km – Cable End C – (N-1) Flagford-Srananagh Line Trip (0-6s)**

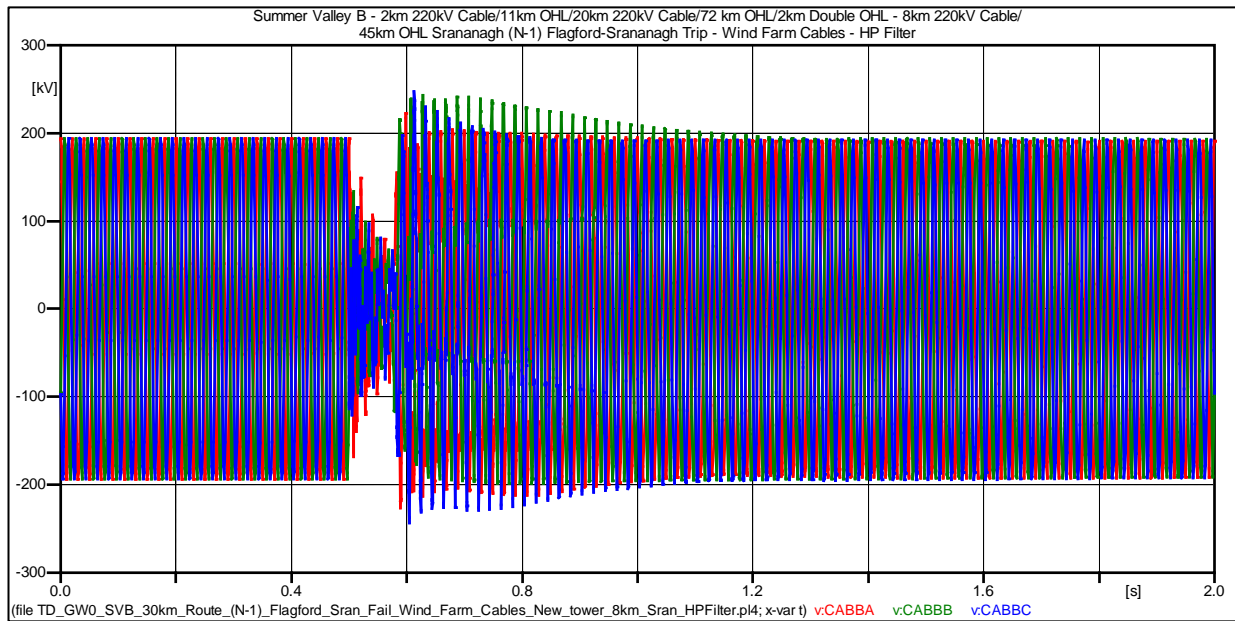


**Figure 43: SVB - Length 30 km – Cable End C – (N-1) Flagford-Srananagh Line Trip (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	210.56 kV (1.060 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	236.59 kV (1.3174 pu)	287.32kV (1.6pu)	Pass



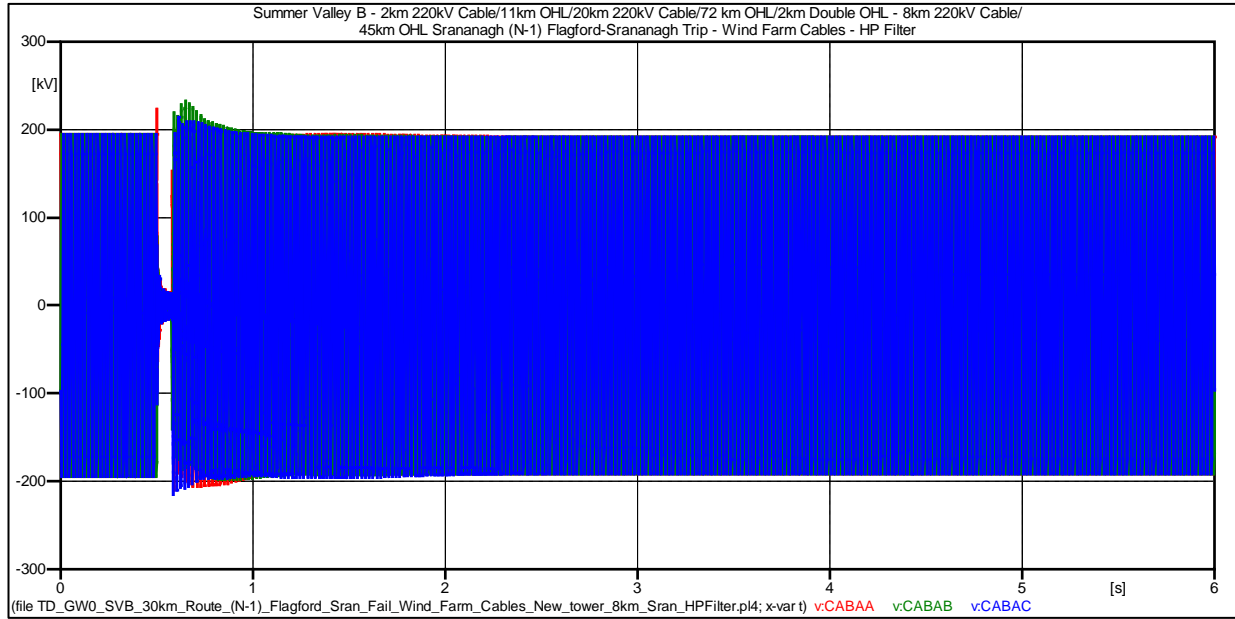
**Figure 44: SVB - Length 30 km – Cable End B – (N-1) Flagford-Srananagh Line Trip (0-6s)**



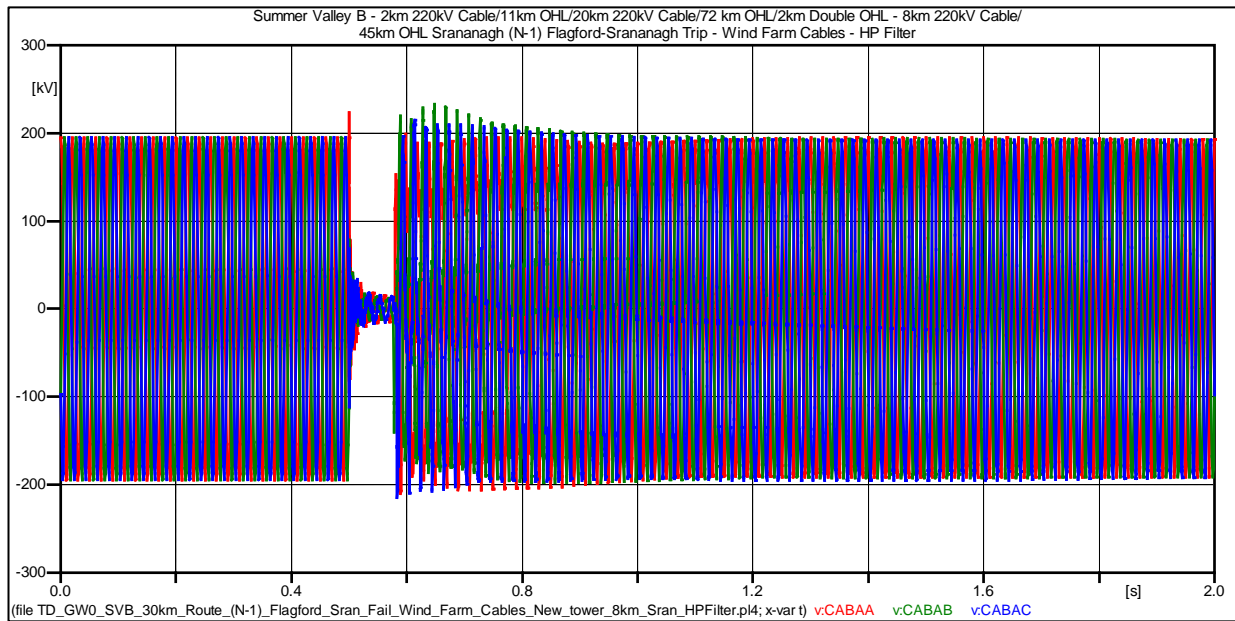
**Figure 45: SVB - Length 30 km – Cable End B – (N-1) Flagford-Srananagh Line Trip (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	242.56 kV (1.3507 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	234.23 kV (1.3043 pu)	287.32kV (1.6pu)	Pass





**Figure 46: SVB - Length 30 km – Cable End A – (N-1) Flagford-Srananagh Line Trip (0-6s)**



**Figure 47: SVB - Length 30 km – Cable End A – (N-1) Flagford-Srananagh Line Trip (0-2s)**

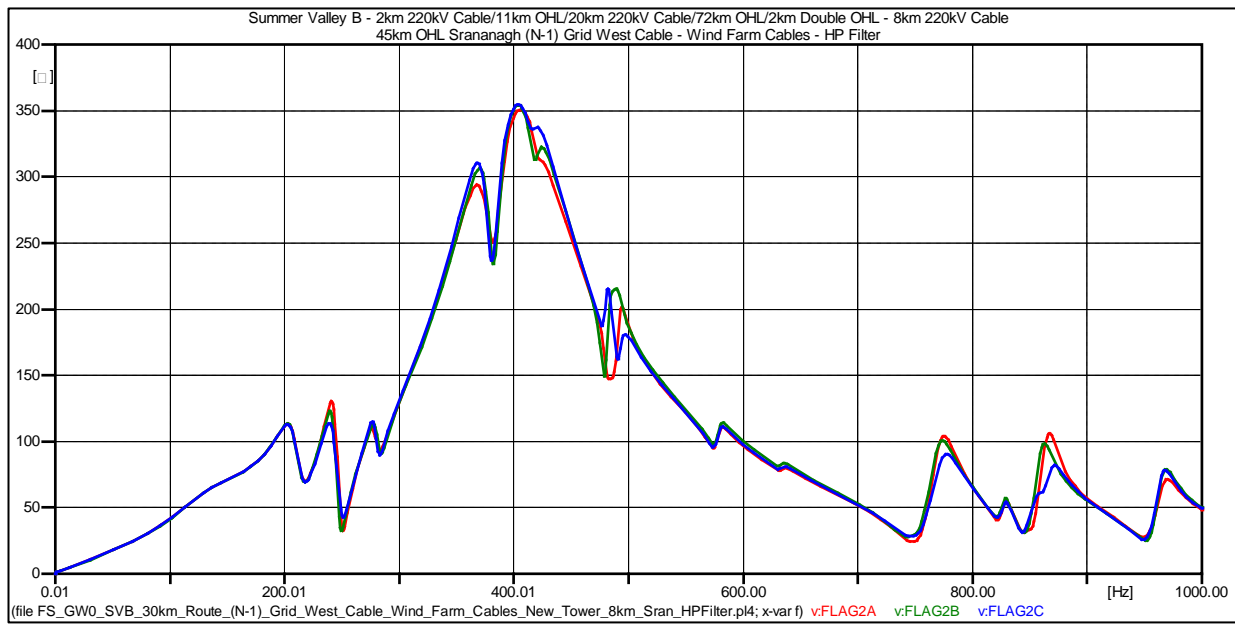
Condition	Maximum Value	Limit	Result
Switching	230.53 kV (1.2837 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	225.25 kV (1.2543 pu)	287.32kV (1.6pu)	Pass

**1.8 Impedance Scans - Length 30 km – Summer Valley B – Case 5**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 5: (N-1) Trip Grid West Cable**



**Figure 48: SVB - Length 30 km - (N-1) Trip Grid West Cable**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
203.11	112.76
242.11	127.47
404.41	354.37
775.21	104.25
868.21	105.63
969.31	78.86

## **1.9 Time Domain Simulation - Length 30 km – Summer Valley B – Case 5**

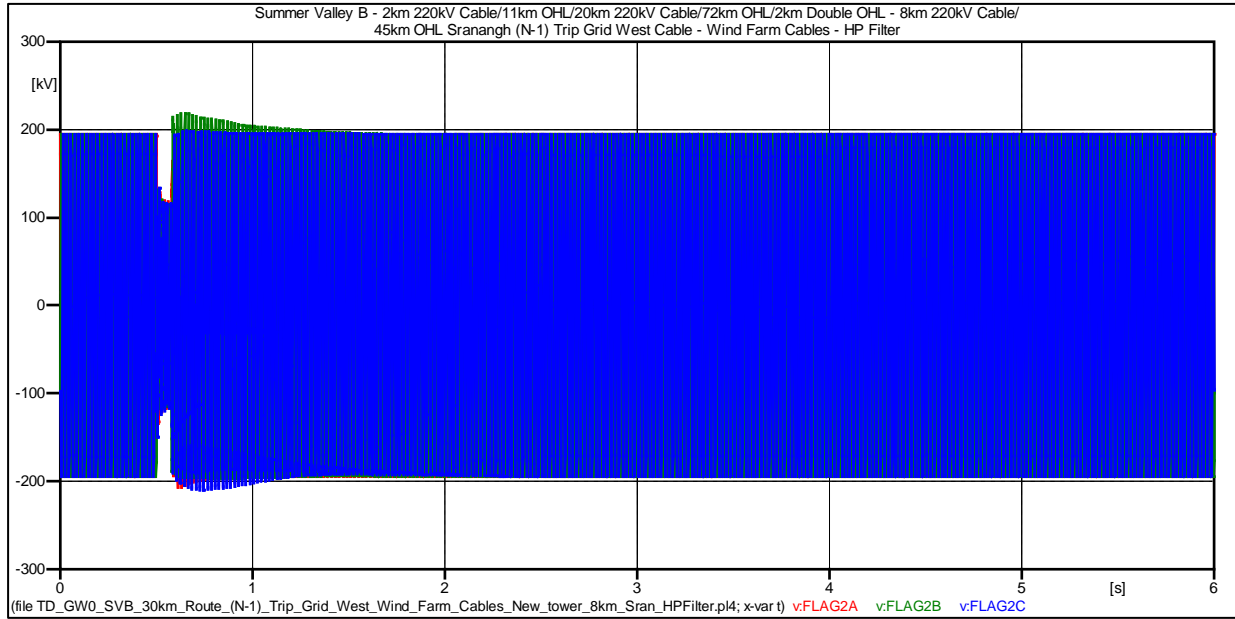
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500  $\Omega$

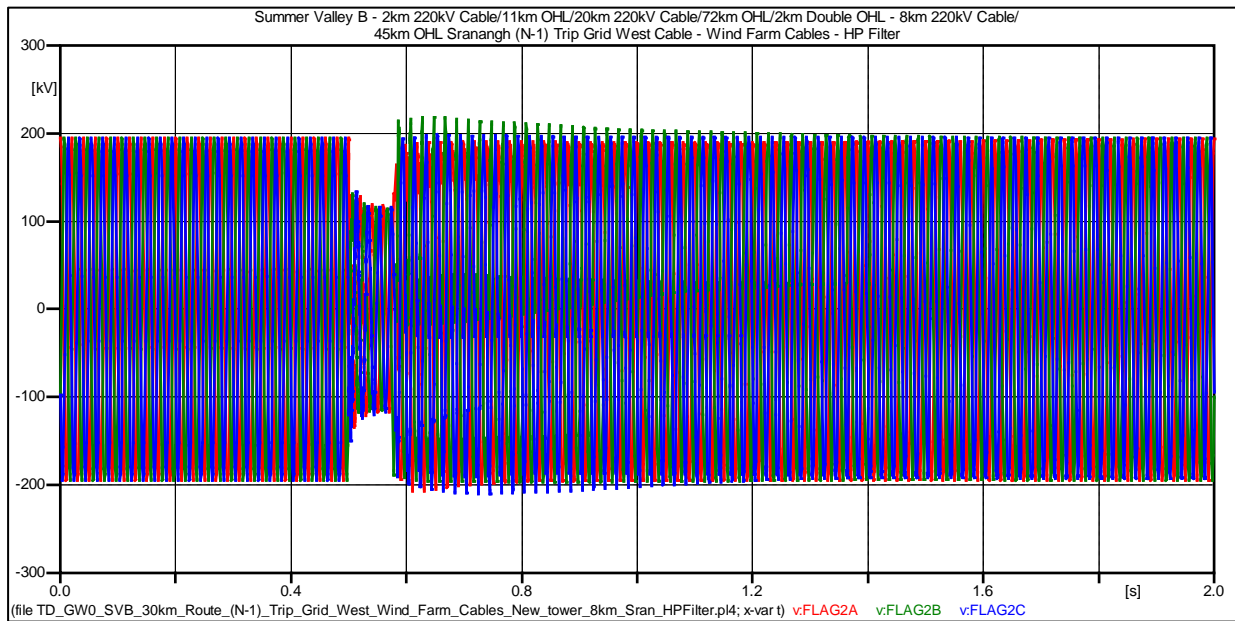
### **Case 5: (N-1) Trip Grid West Cable**

System Conditions:

1. Fault on CABC side of Grid West Cable, applied at 0.5s.
2. Cable tripped at 0.575s.

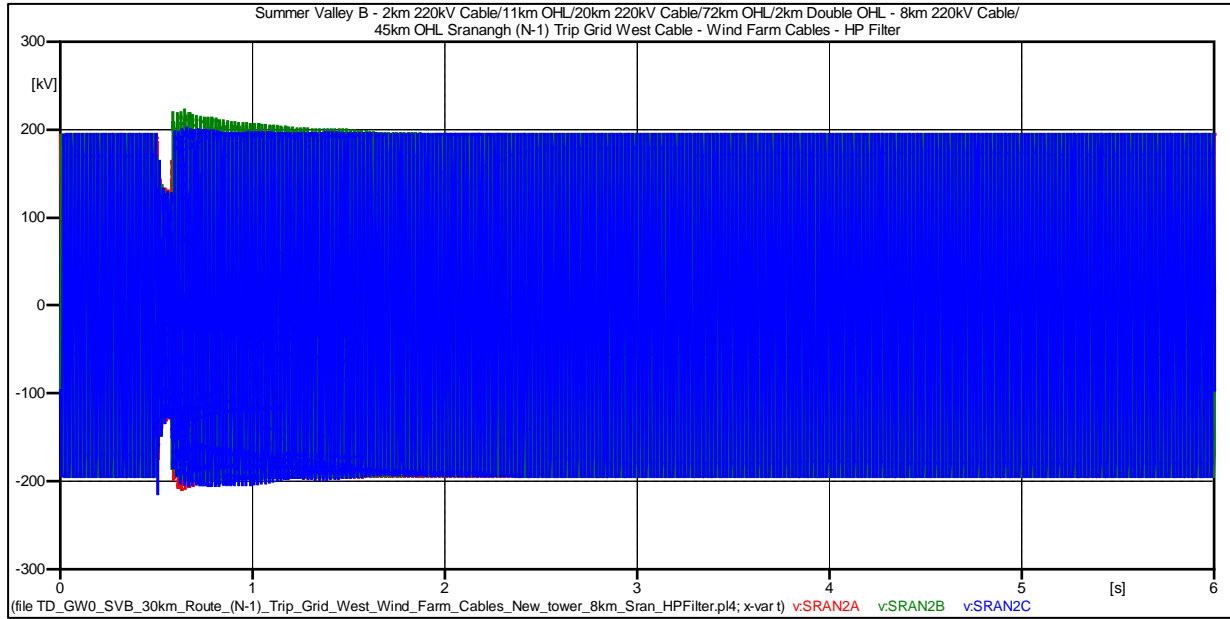


**Figure 49: SVB - Length 30 km – Flagford – (N-1) Trip Grid West Cable (0-6s)**

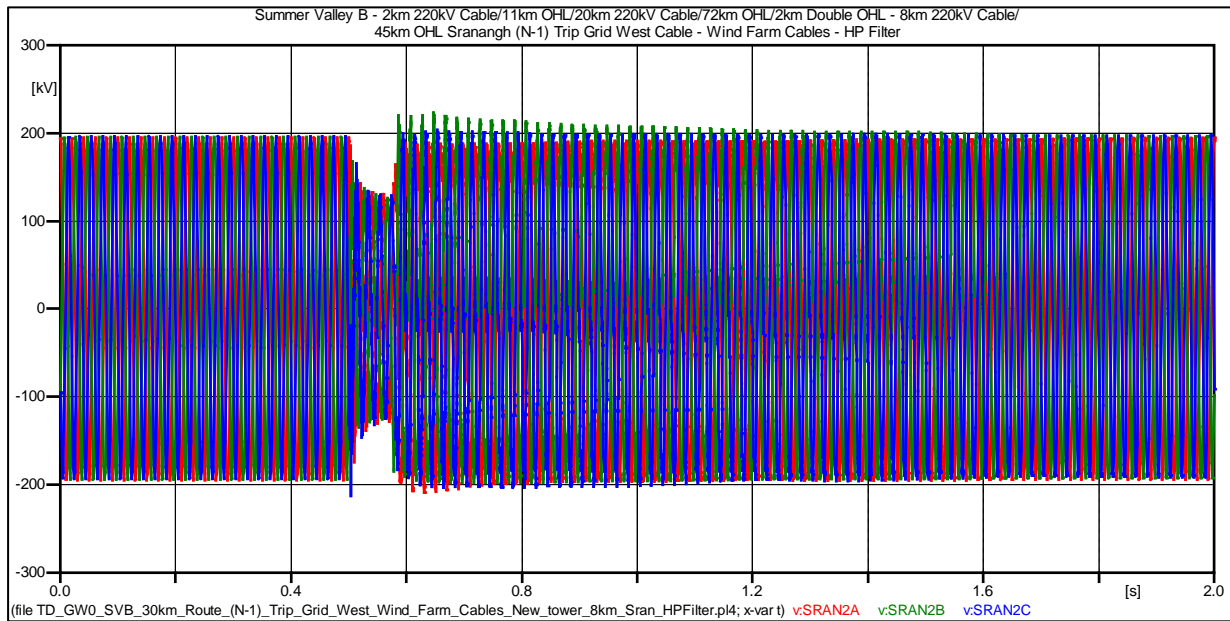


**Figure 50: SVB - Length 30 km – Flagford – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	N/A	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	214.78 kV (1.1959 pu)	287.32kV (1.6pu)	Pass

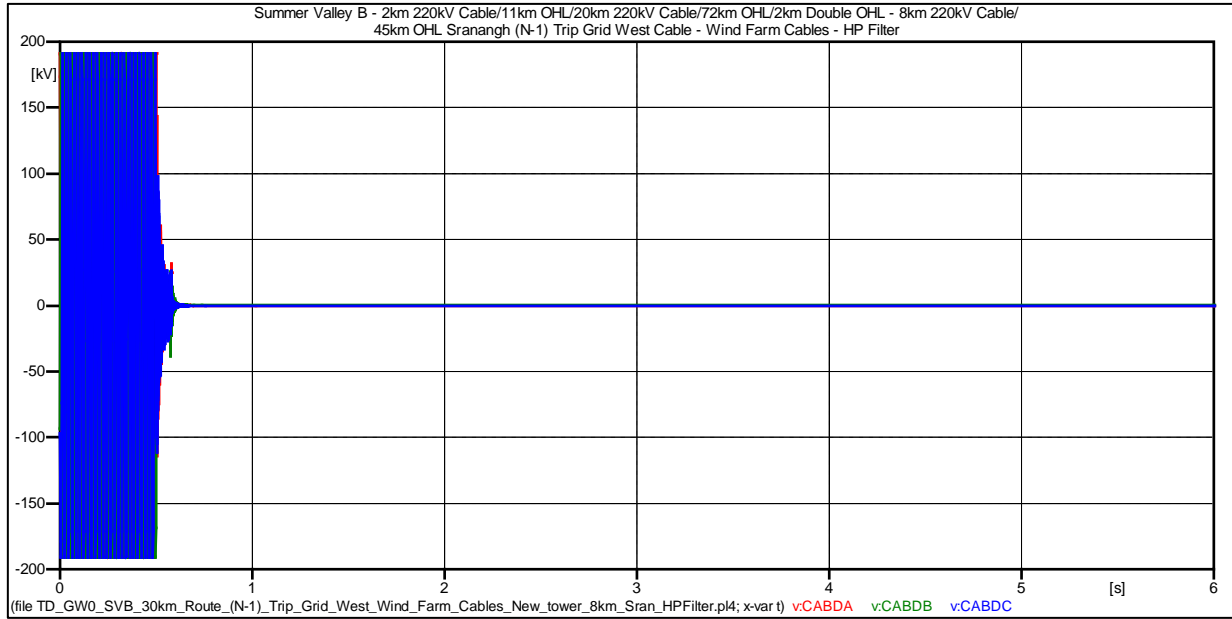


**Figure 51: SVB - Length 30 km – Srananagh – (N-1) Trip Grid West Cable (0-6s)**

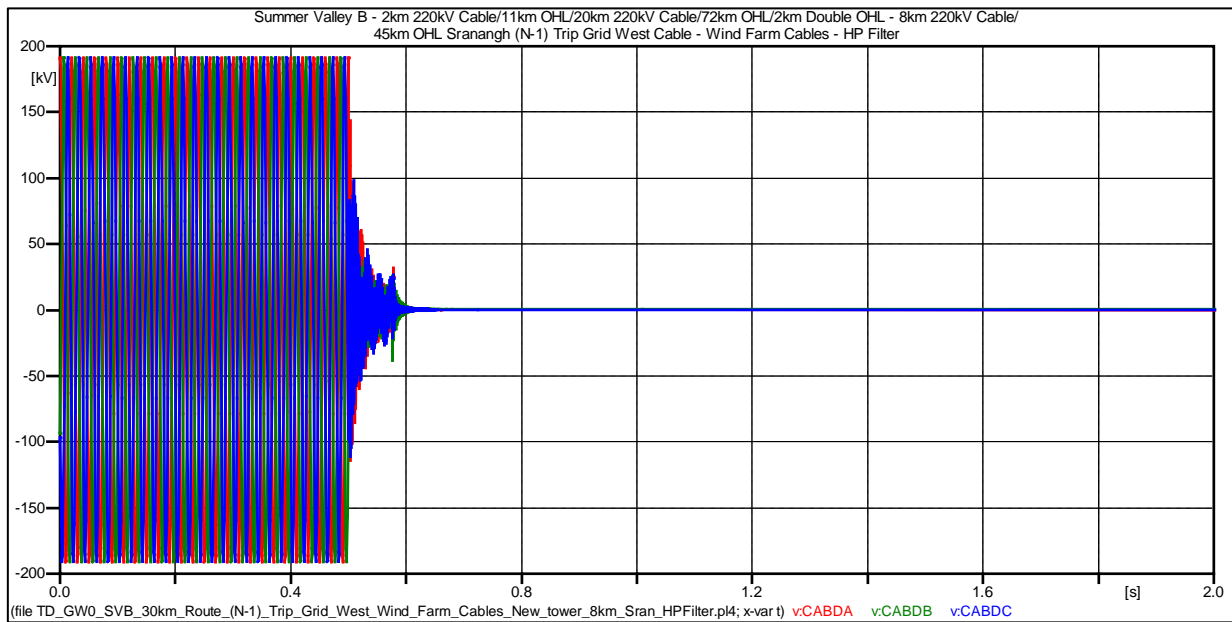


**Figure 52: SVB - Length 30 km – Srananagh – (N-1) Trip Grid West Cable (0-6s)**

Condition	Maximum Value	Limit	Result
Switching	N/A	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	215.69 kV (1.20 pu)	287.32kV (1.6pu)	Pass

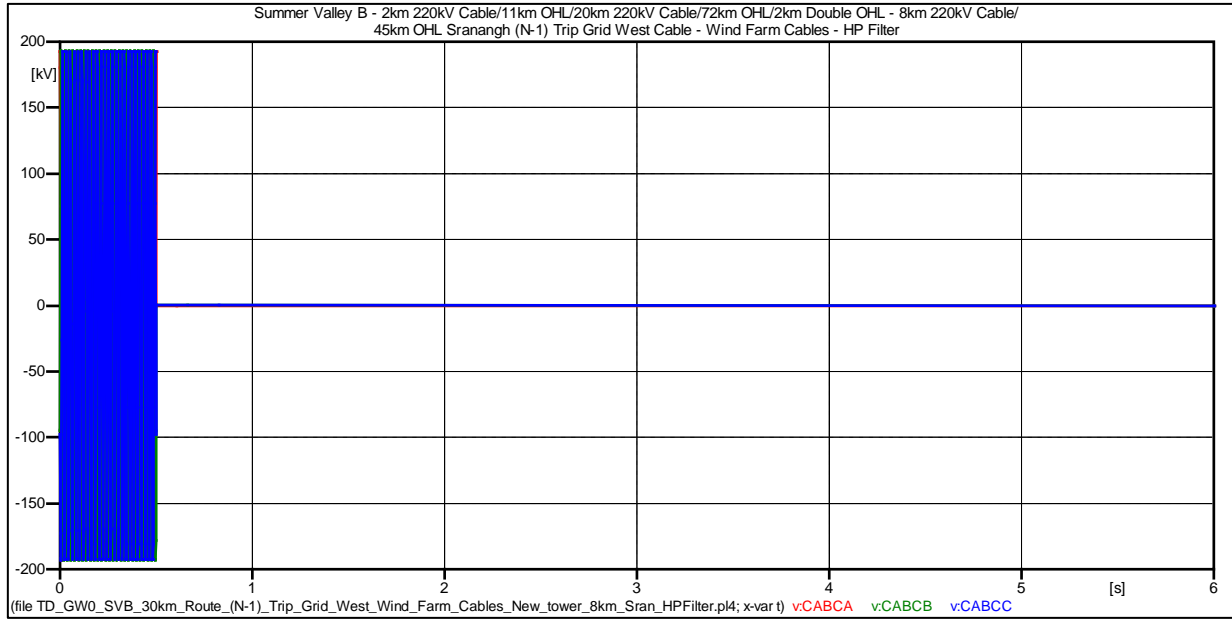


**Figure 53: SVB - Length 30 km – Cable End D – (N-1) Trip Grid West Cable (0-6s)**

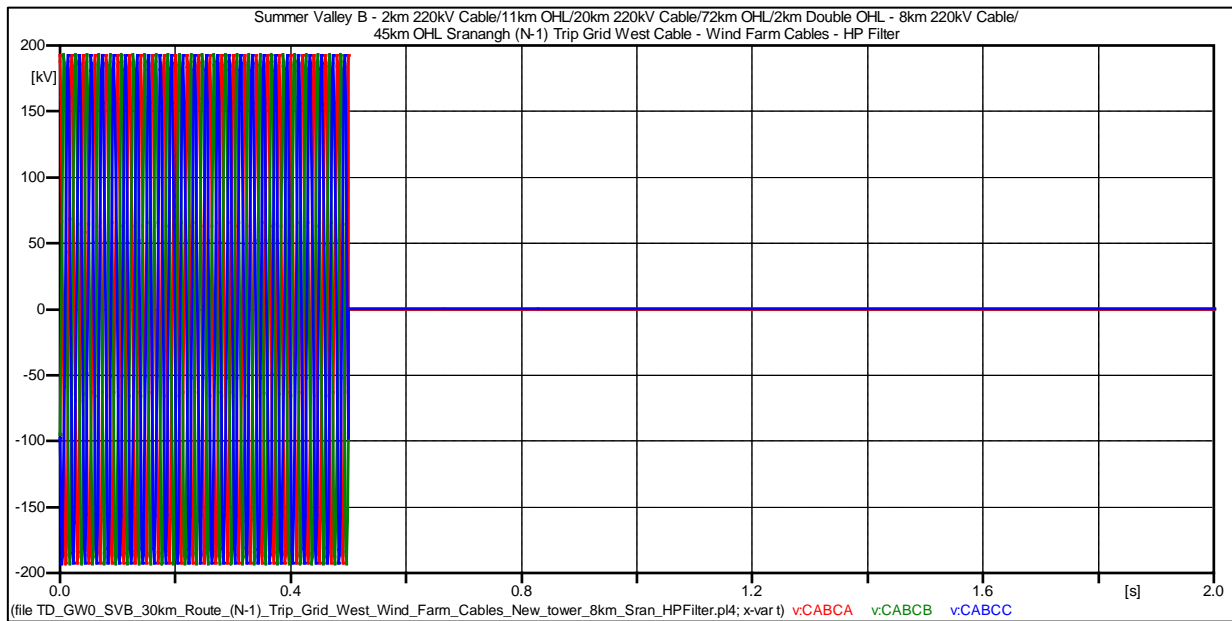


**Figure 54: SVB - Length 30 km – Cable End D – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	N/A	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	N/A	287.32kV (1.6pu)	Pass

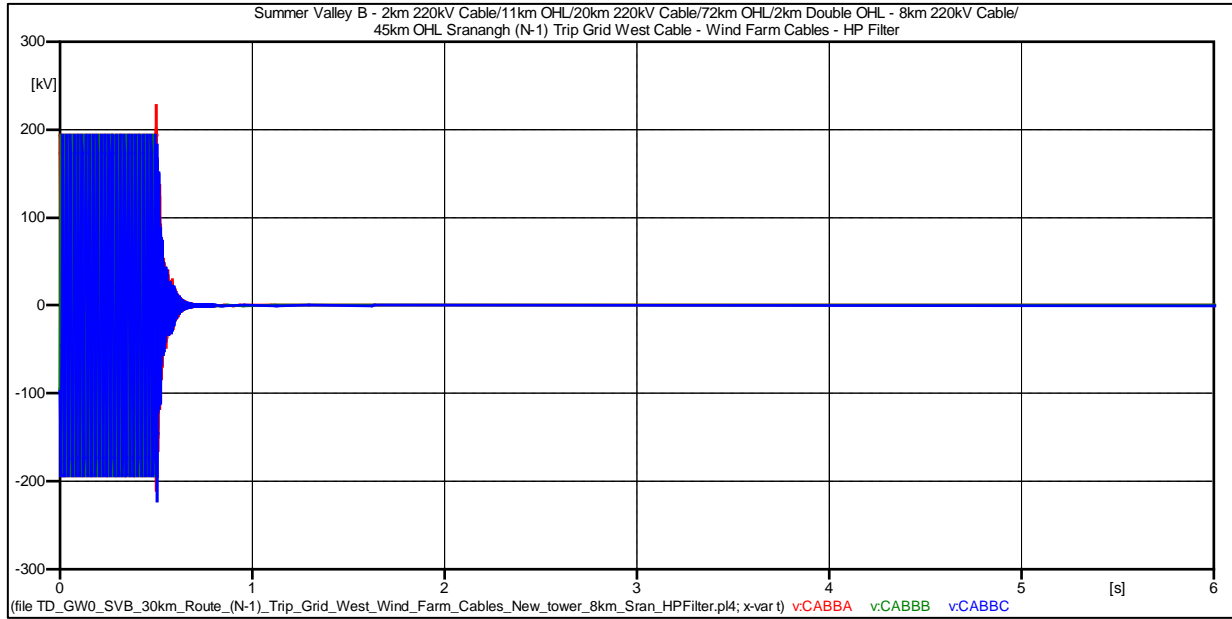


**Figure 55: SVB - Length 30 km – Cable End C – (N-1) Trip Grid West Cable (0-6s)**

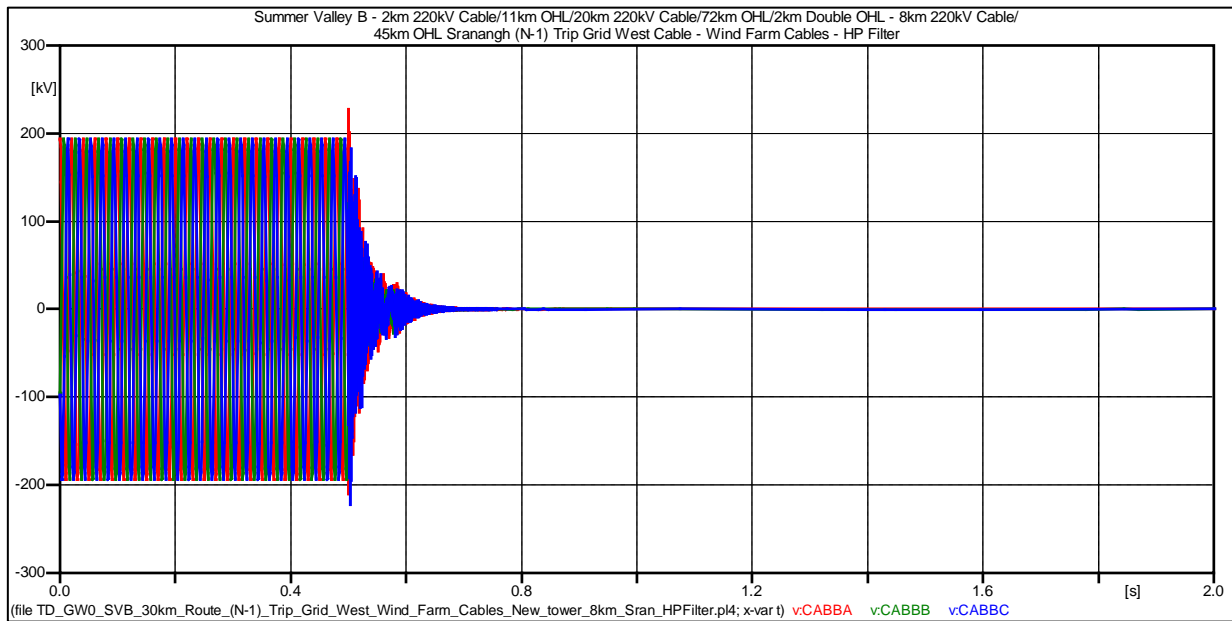


**Figure 56: SVB - Length 30 km – Cable End C – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	N/A	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	N/A	287.32kV (1.6pu)	Pass



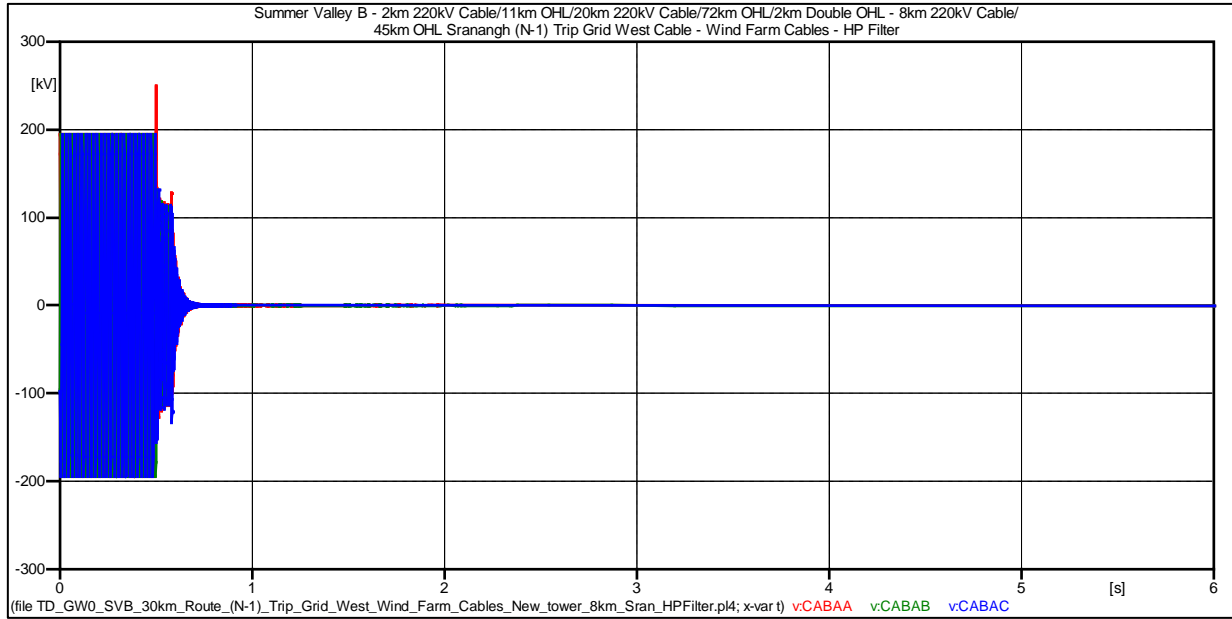
**Figure 57: SVB - Length 30 km – Cable End B – (N-1) Trip Grid West Cable (0-6s)**



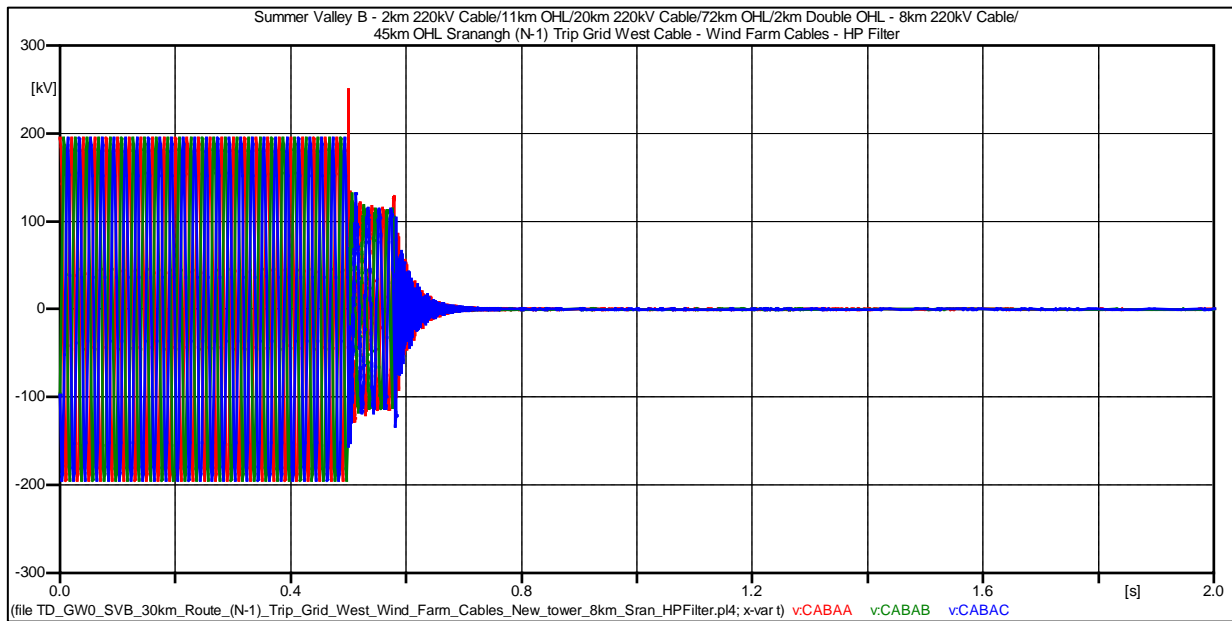
**Figure 58: SVB - Length 30 km – Cable End B – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	230.45 kV (1.2832 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	N/A	287.32kV (1.6pu)	Pass



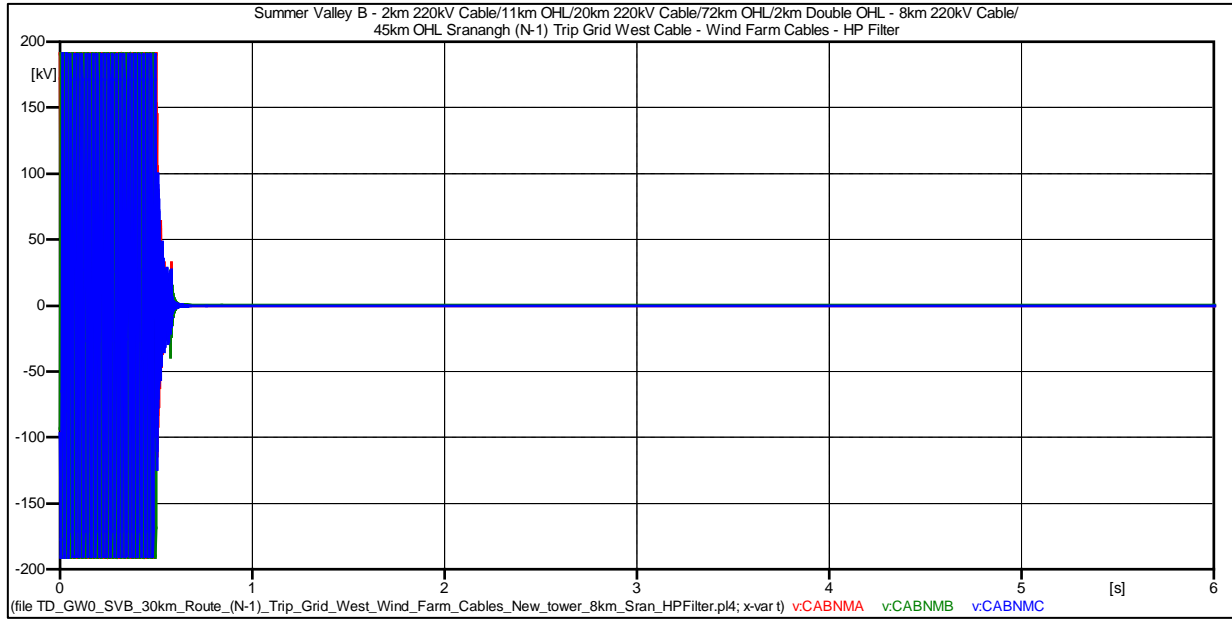


**Figure 59: SVB - Length 30 km – Cable End A – (N-1) Trip Grid West Cable (0-6s)**

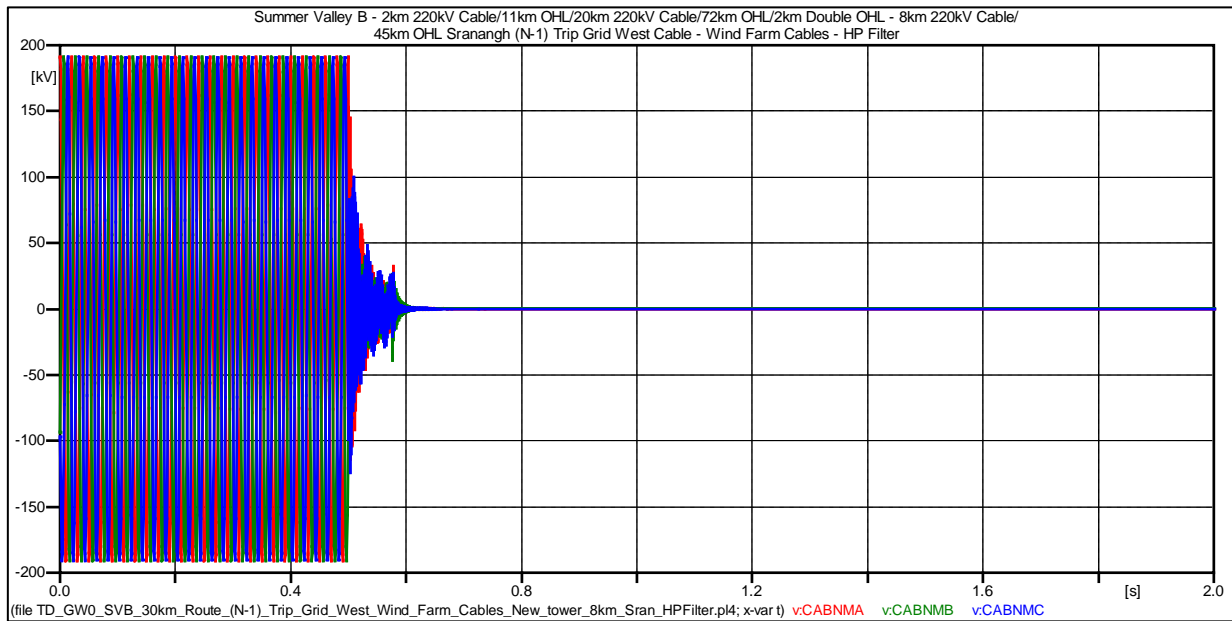


**Figure 60: SVB - Length 30 km – Cable End A – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	250.15 kV (1.3935 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	N/A	287.32kV (1.6pu)	Pass

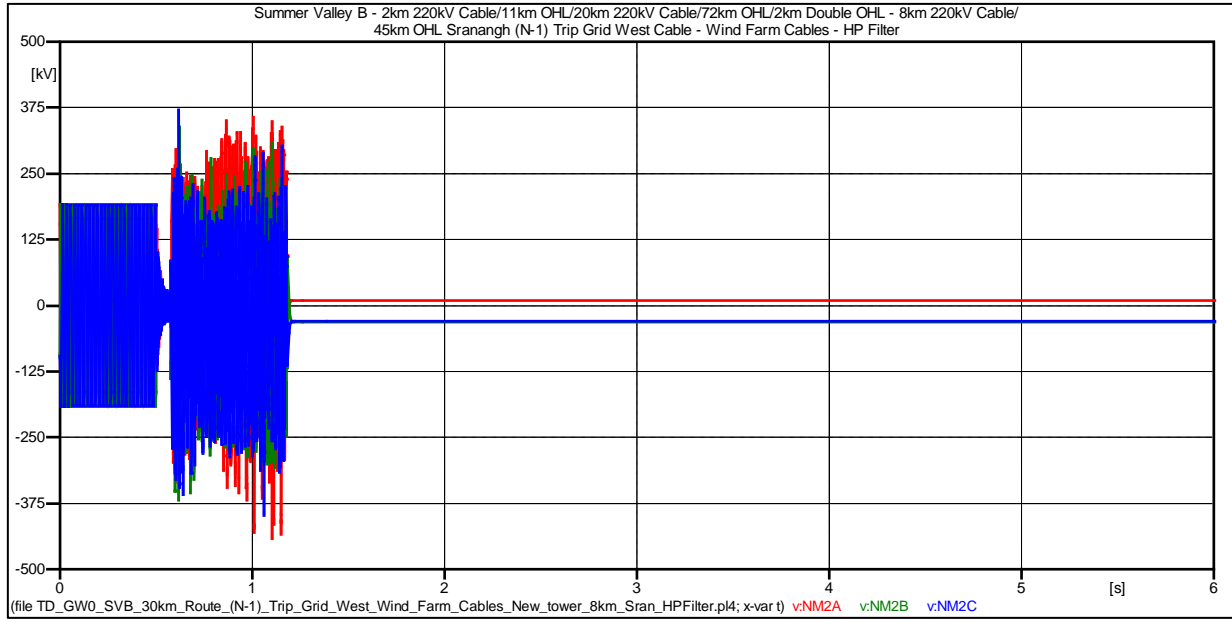


**Figure 61: SVB - Length 30 km – Cable End North Mayo – (N-1) Trip Grid West Cable (0-6s)**

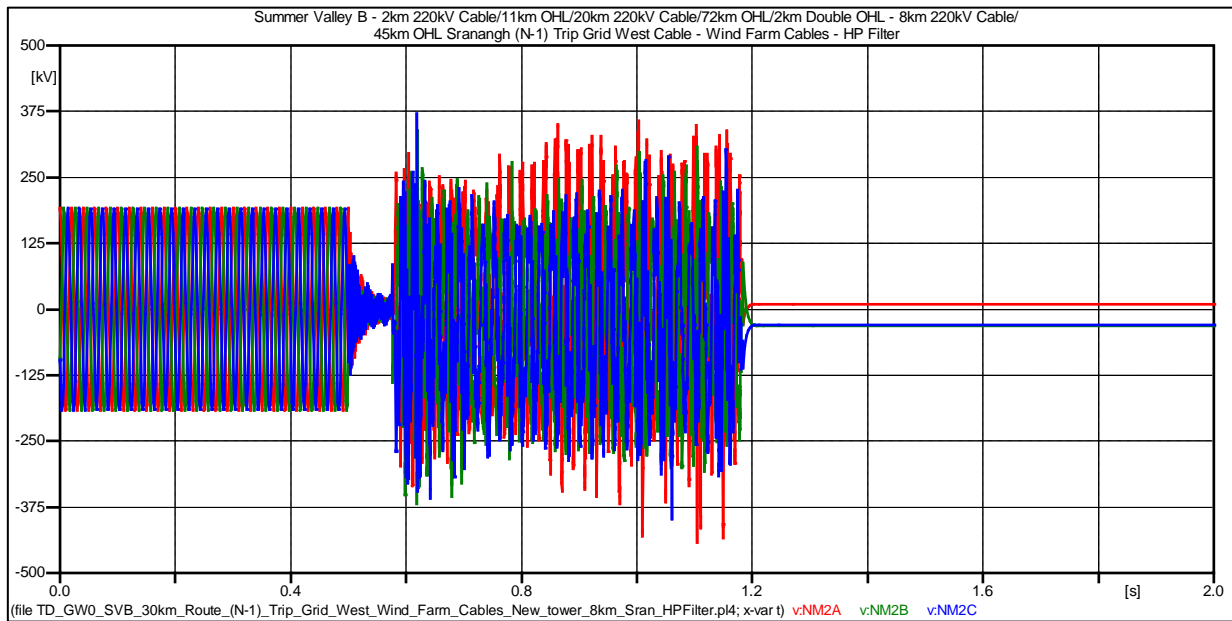


**Figure 62: SVB - Length 30 km – Cable End North Mayo – (N-1) Trip Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	N/A	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	N/A	287.32kV (1.6pu)	Pass



**Figure 63: SVB - Length 30 km – North Mayo – (N-1) Trip Grid West Cable (0-6s)**



**Figure 5: SVB - Length 30 km – North Mayo – (N-1) Trip Grid West Cable (0-2s)**

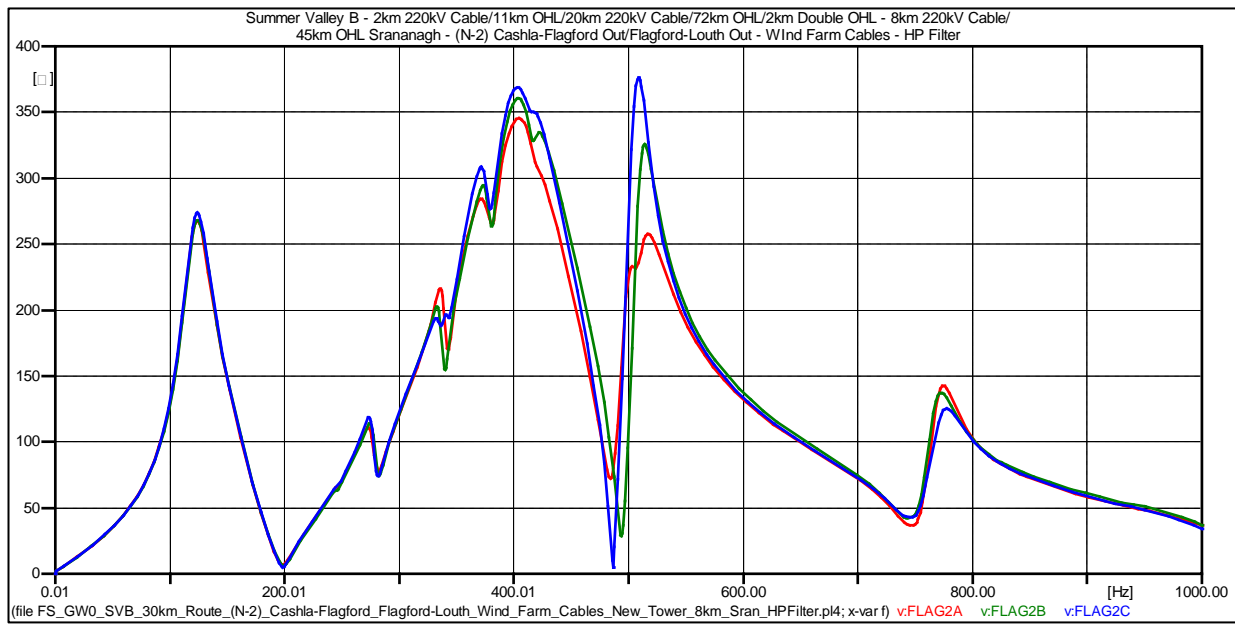
The above transients are produced by the unloaded transformer. In a practical scenario, wind farms would trip on islanding or overvoltage protection. Therefore, this has been simulated by opening a circuit breaker at North Mayo after 500 ms.

**1.10 Impedance Scans - Length 30 km – Summer Valley B – Case 6**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 6: (N-2) Cashla-Flagford/Flagford-Louth Lines Out**



**Figure 64: SVB - Length 30 km - (N-2) Cashla-Flagford/Flagford-Louth Lines Out**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
123.91	273.61
403.51	368.59
509.41	375.68
774.31	142.73

### **1.11 Time Domain Simulation - Length 30 km – Summer Valley B – Case 6**

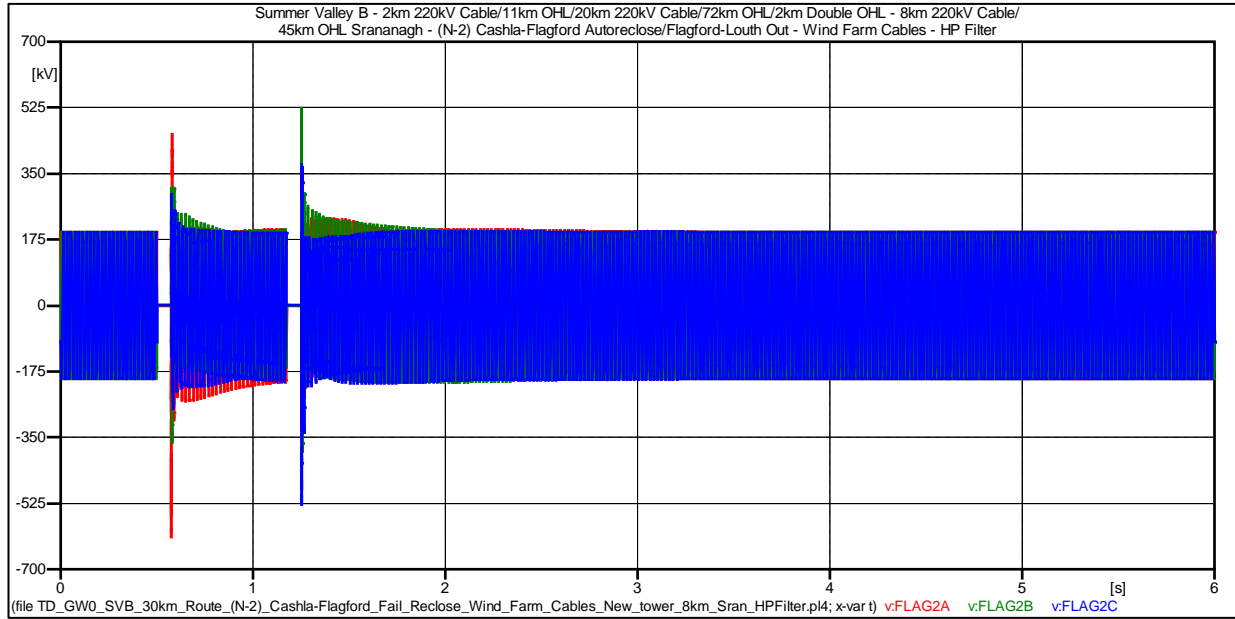
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29  $\mu\text{F}$ , 372 mH, 500  $\Omega$

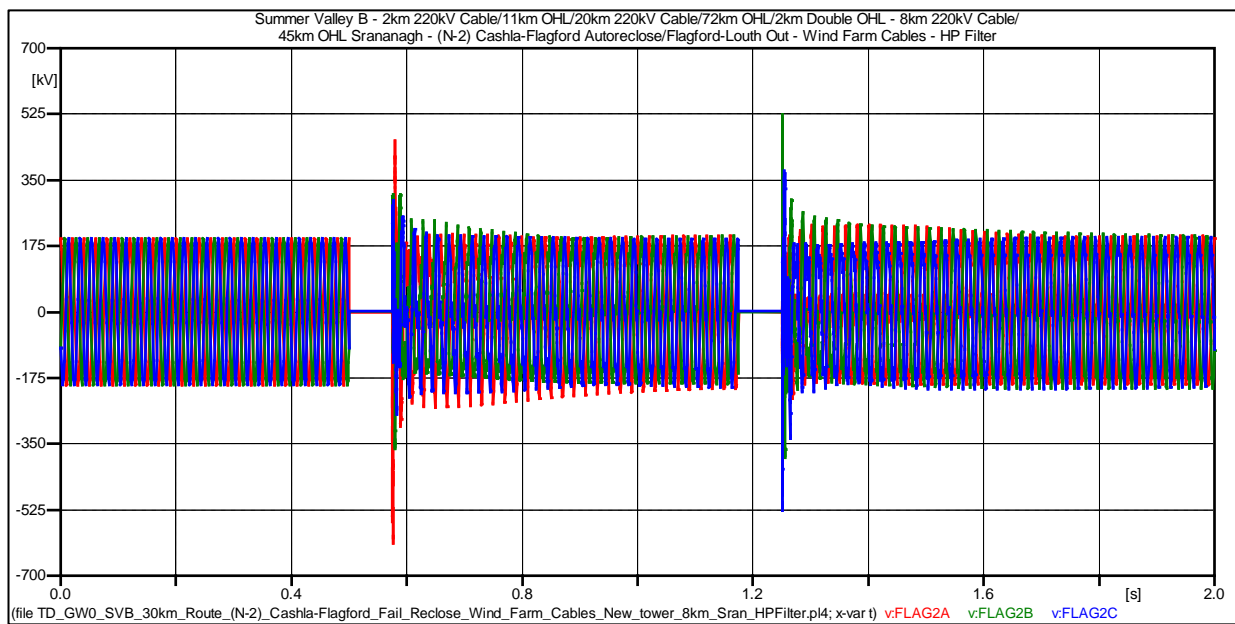
#### **Case 6: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out**

System Conditions:

1. The Flagford – Louth 220 kV line is on an outage. Fault applied on Flagford side of Cashla-Flagford line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.



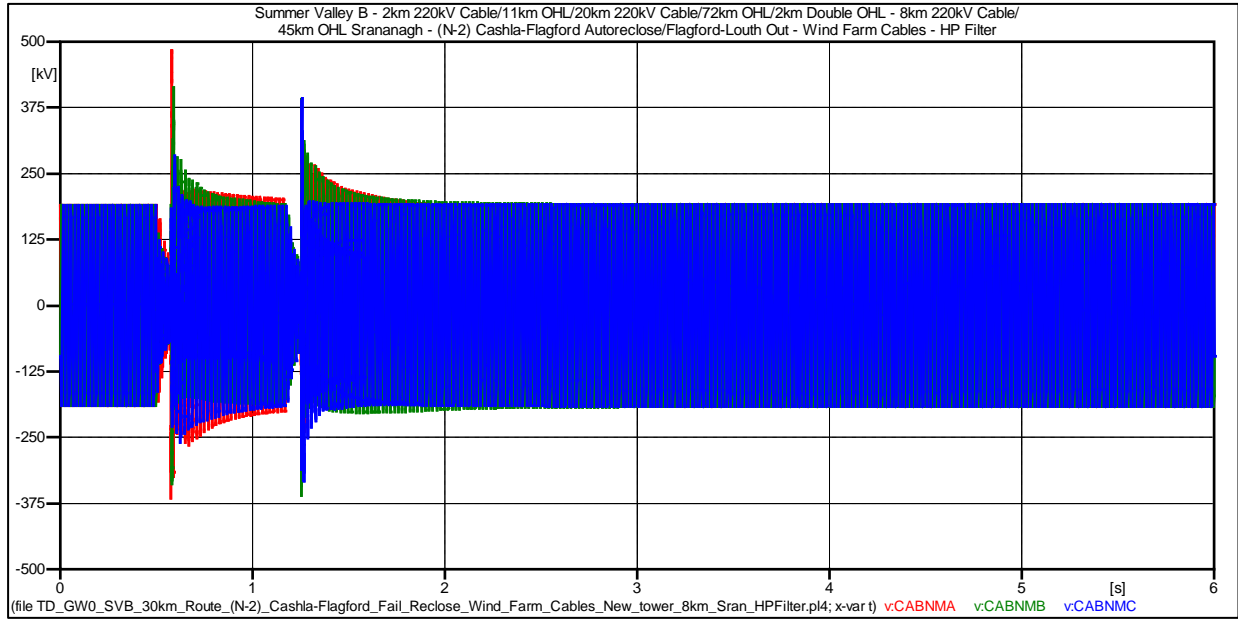
**Figure 65: SVB - Length 30 km – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



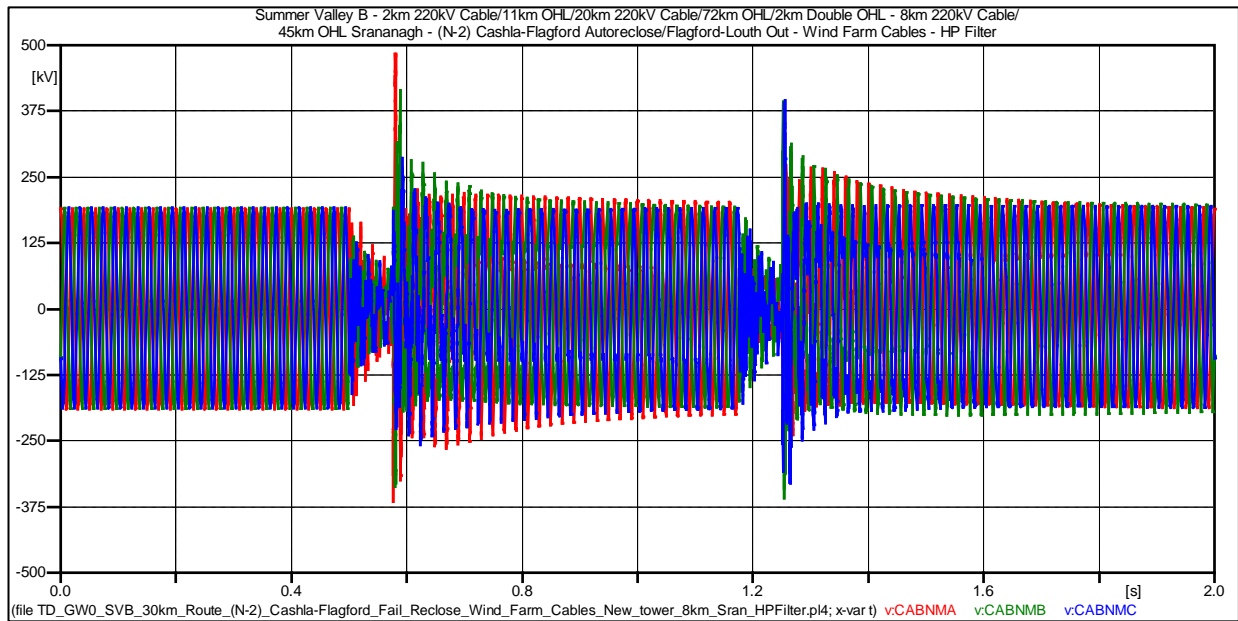
**Figure 66: SVB - Length 30 km – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	525 kV (2.923 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	264.52 kV (1.4729 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



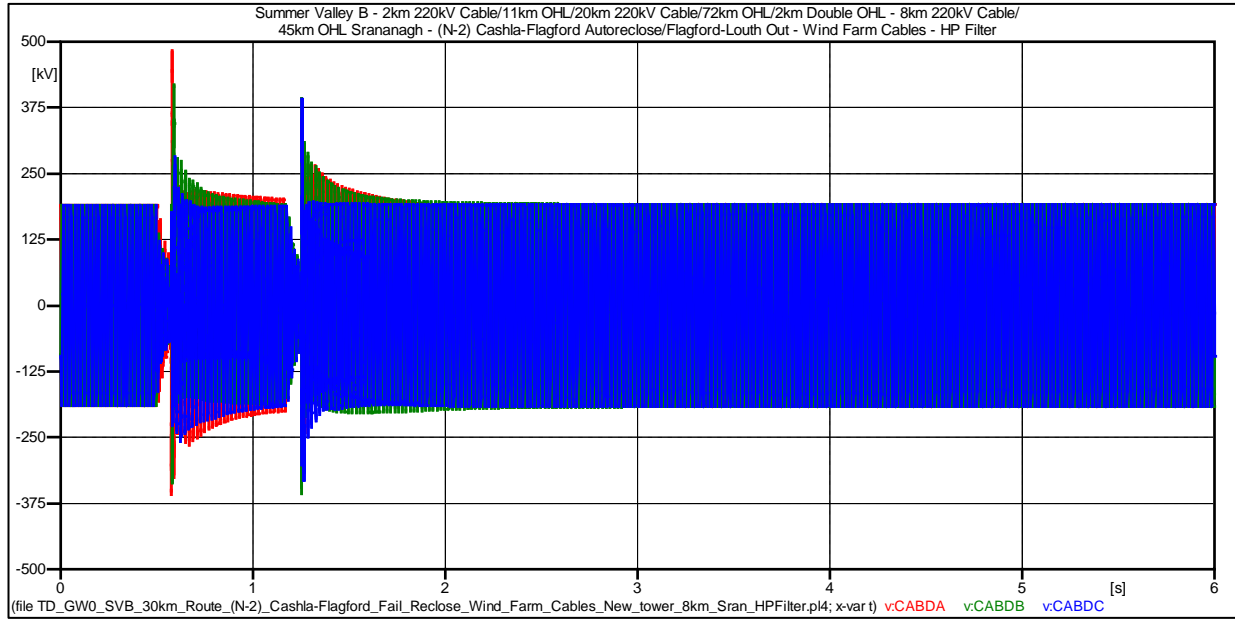
**Figure 67: SVB - Length 30 km – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



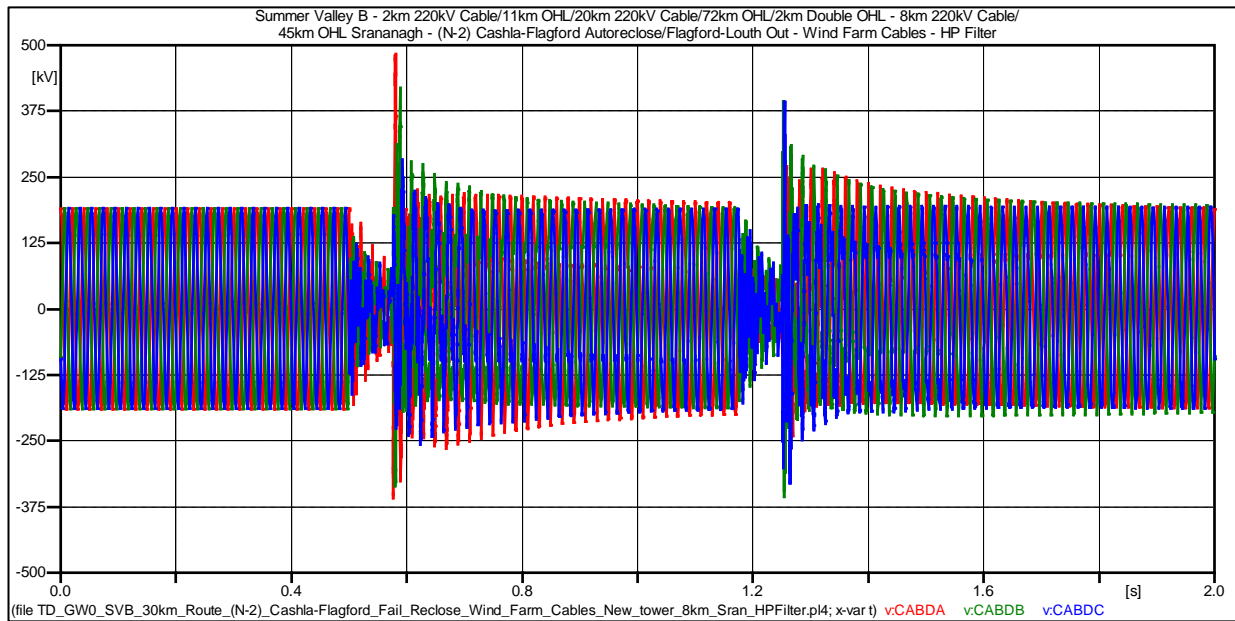
**Figure 68: SVB - Length 30 km –North Mayo– (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	480.02 kV (2.6730 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	287.30 kV (1.6015 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 69: SVB - Length 30 km – Cable Mid-Point D – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**

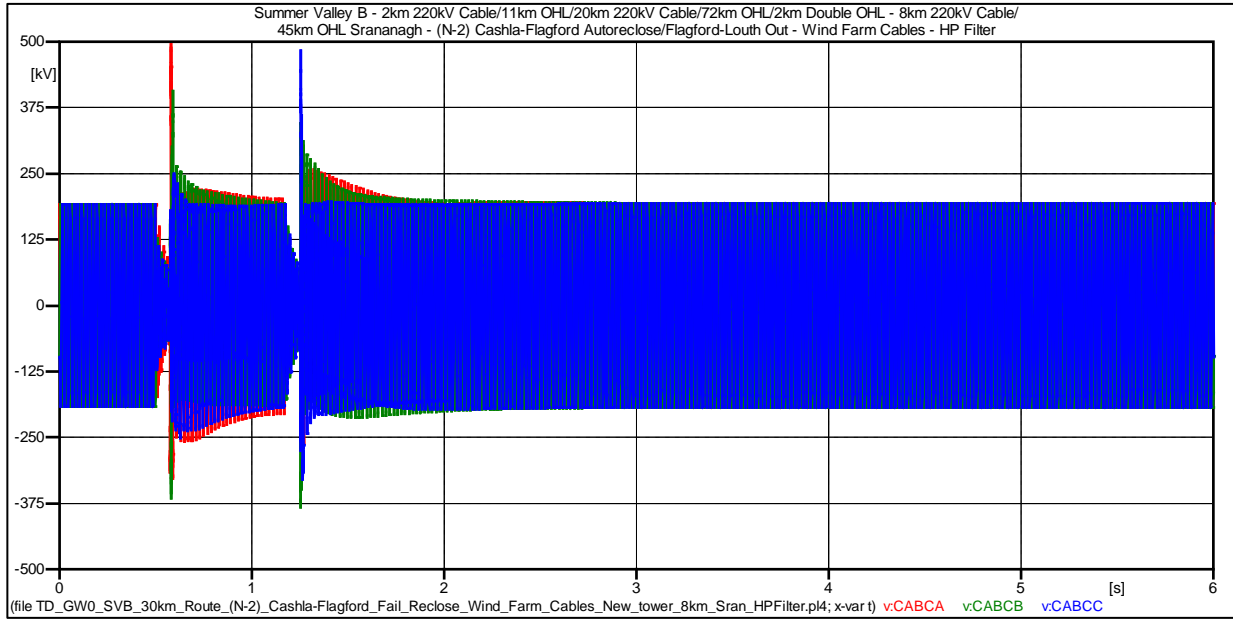


**Figure 70: SVB - Length 30 km – Cable Mid-Point D – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

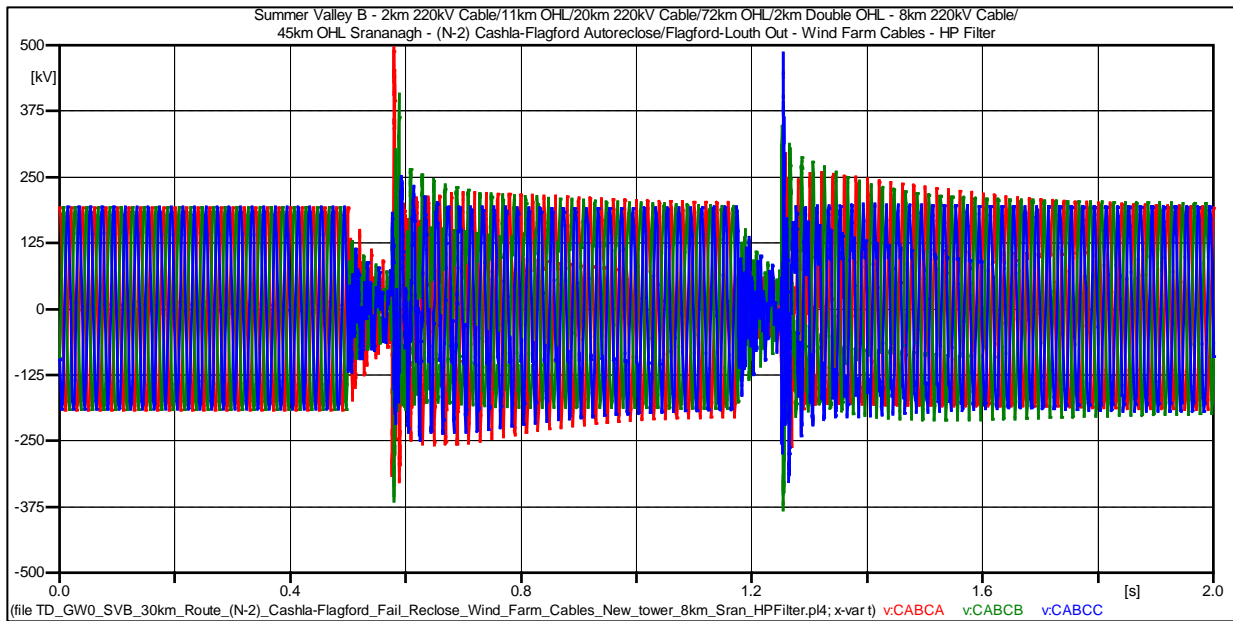
Condition	Maximum Value	Limit	Result
Switching	479.23 kV (2.6686 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	274.89 kV (1.53037 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors





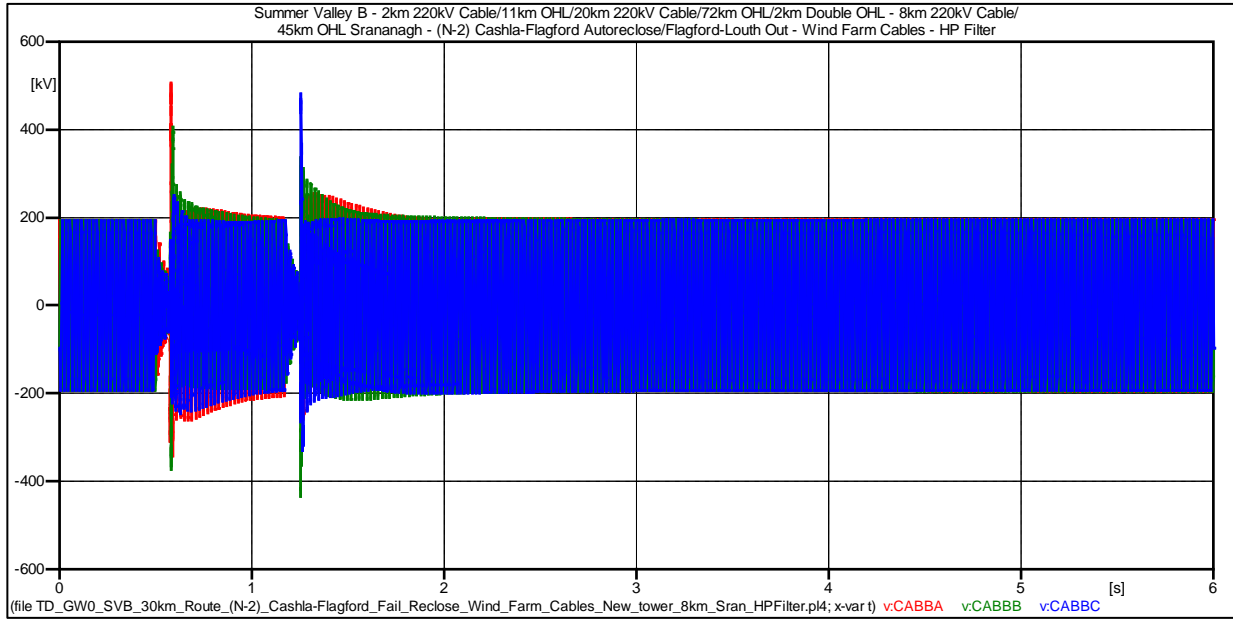
**Figure 71: SVB - Length 30 km – Cable Mid-Point C – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



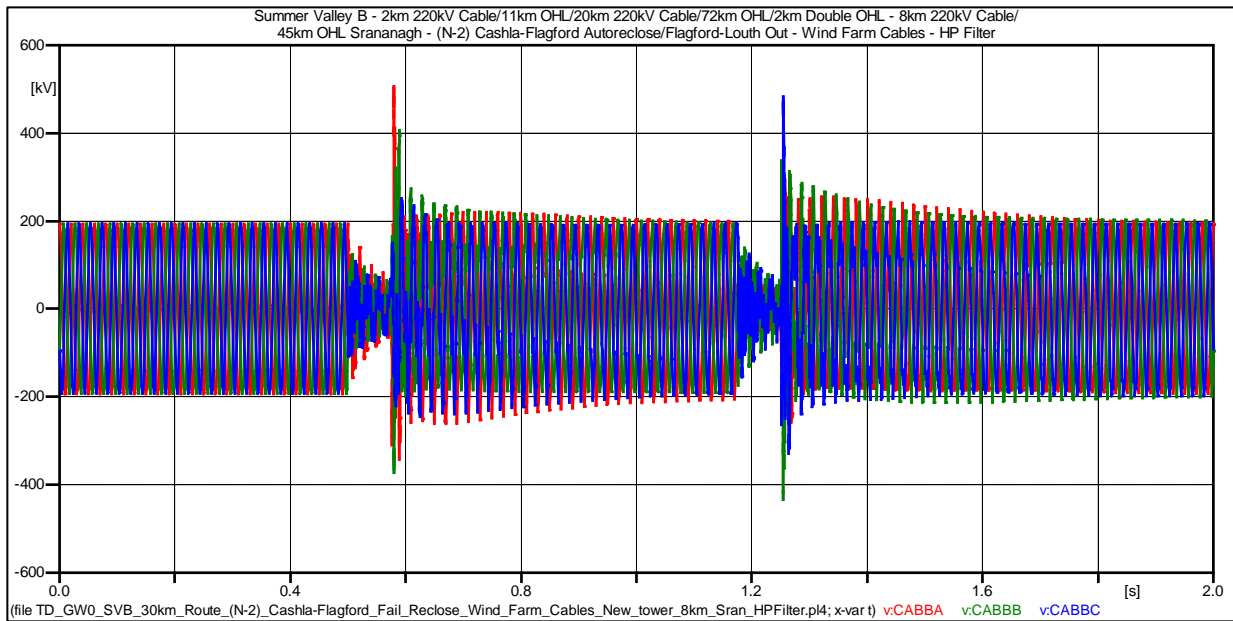
**Figure 72: SVB - Length 30 km – Cable Mid-Point C – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	500.23 kV (2.7855 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	276.25 kV (1.5383 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



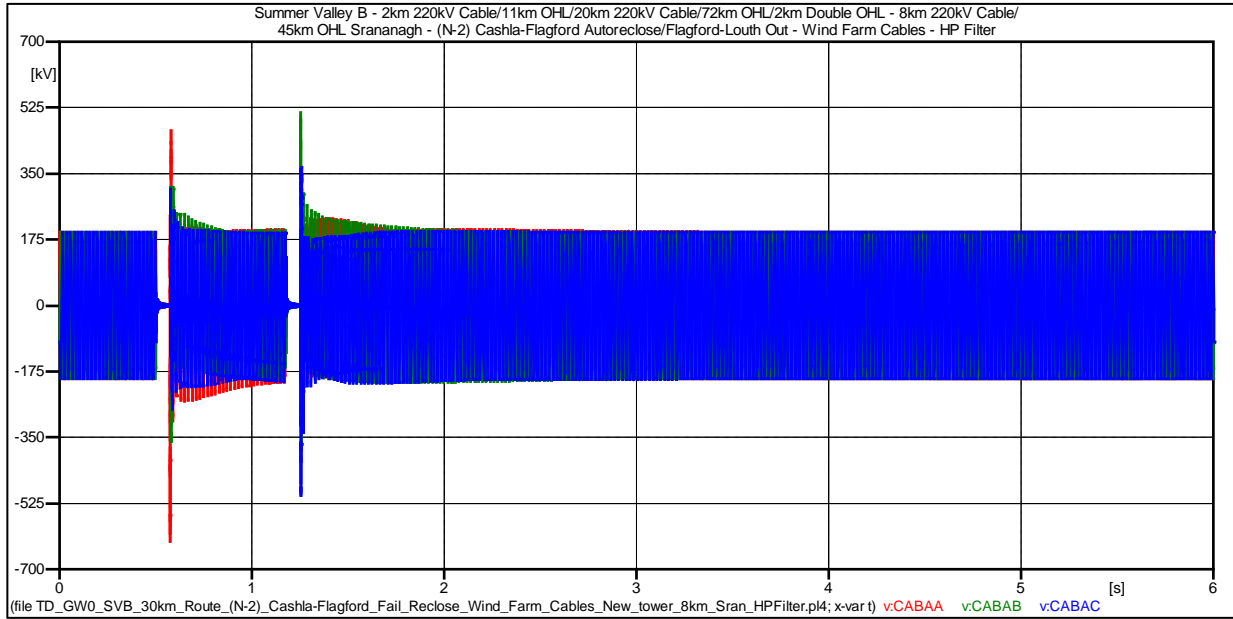
**Figure 73: SVB - Length 30 km – Cable Mid-Point B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



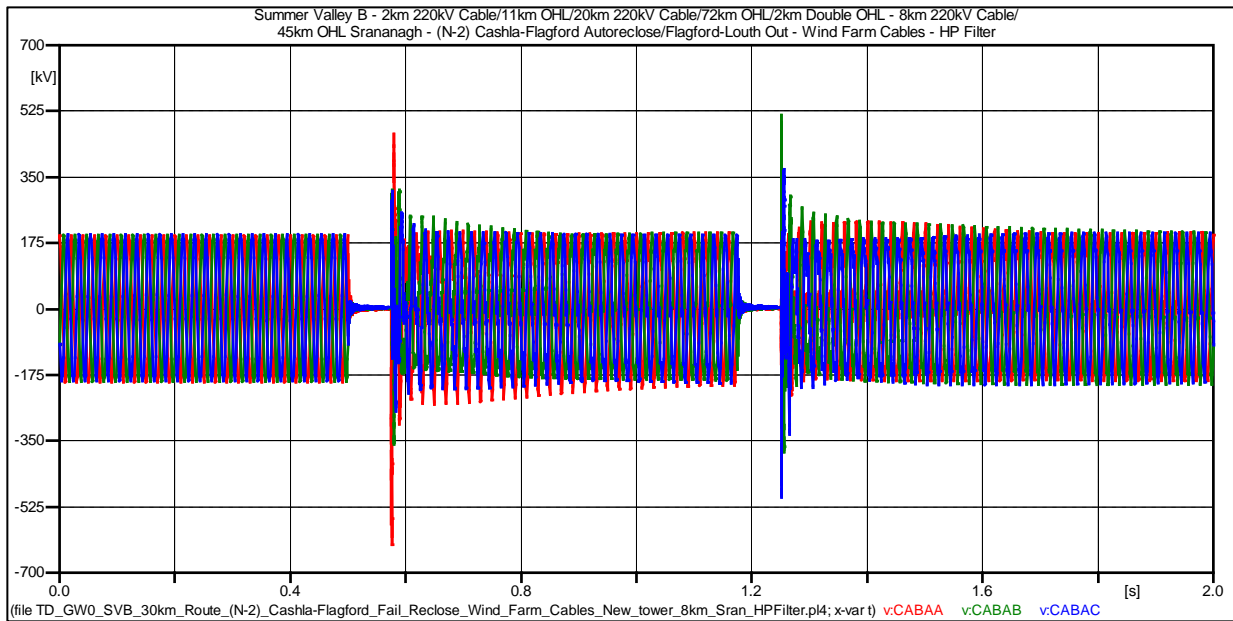
**Figure 74: SVB - Length 30 km – Cable Mid-Point B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	493.40 kV (2.7475 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	268.07 kV (1.4927 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



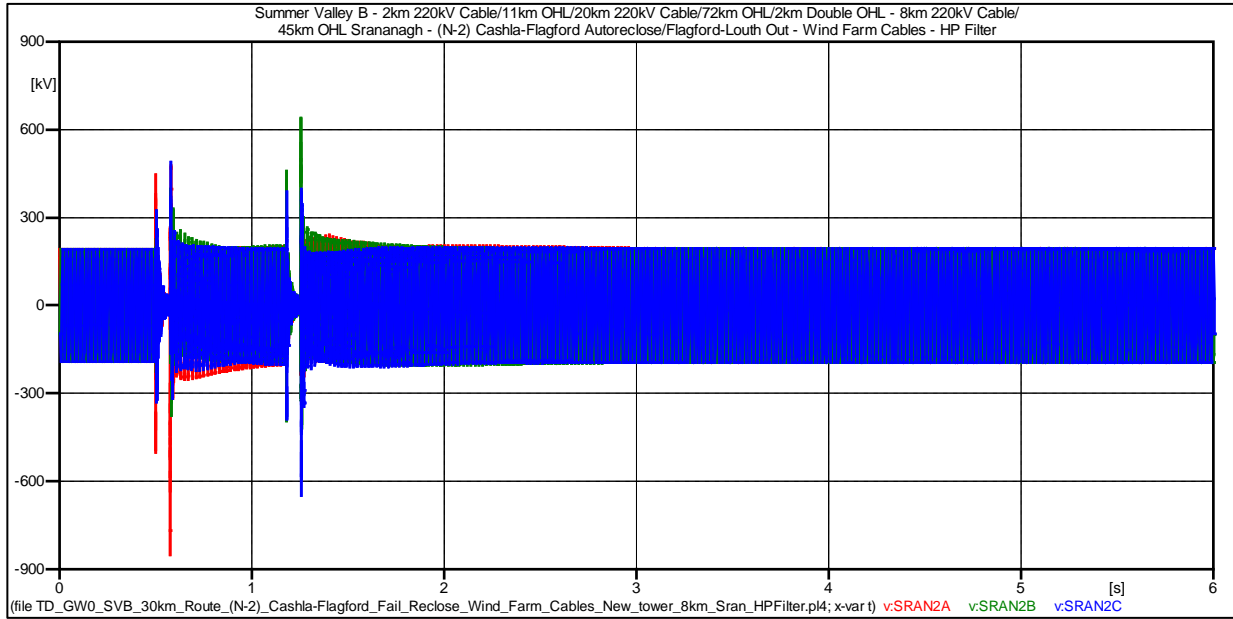
**Figure 75: SVB - Length 30 km – Cable Mid-Point A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



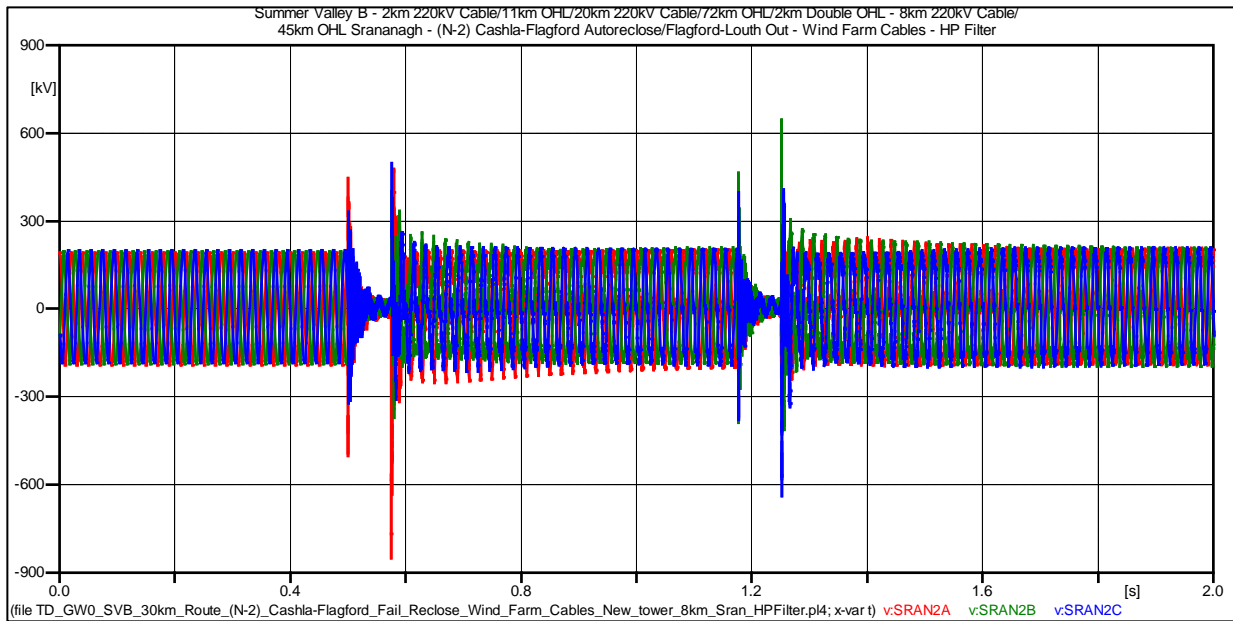
**Figure 76: SVB - Length 30 km – Cable Mid-Point A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	625.10 kV (3.4808 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	247.51 kV (1.3782 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 77: SVB - Length 30 km – Srananagh – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-6s)**



**Figure 78: SVB - Length 30 km – Srananagh – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	849.75 kV (4.7318 pu)	449.07 kV (2.5 pu)	Fail*
Temporary Overvoltage	240.56 kV (1.3396 pu)	287.32kV (1.6pu)	Pass

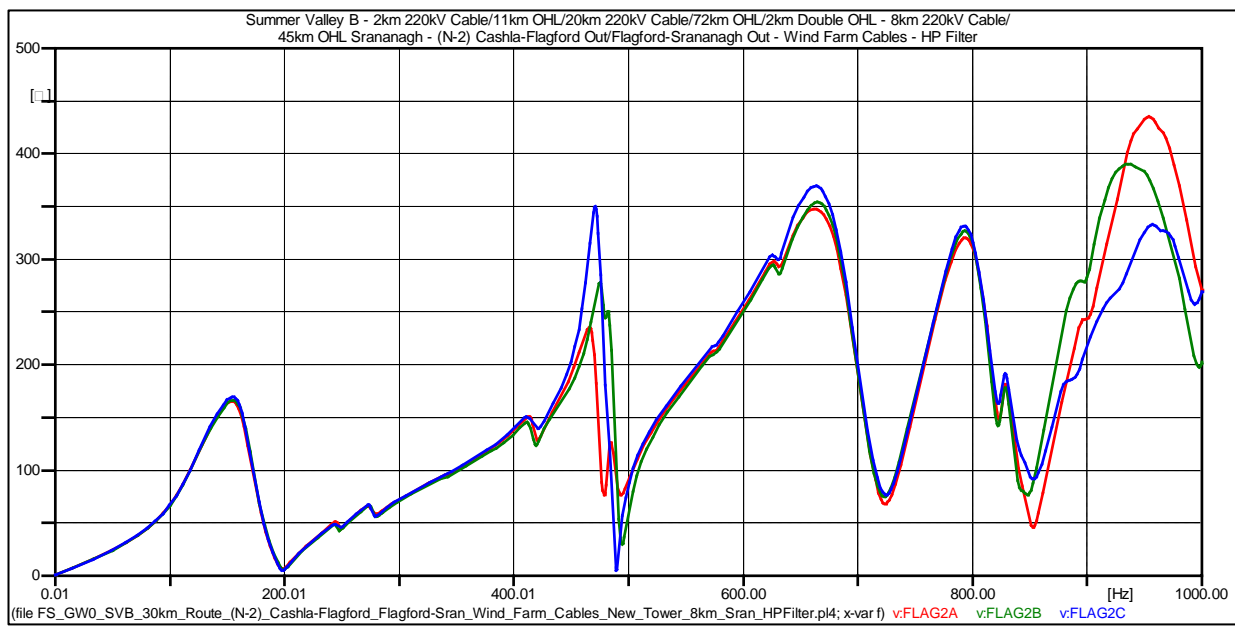
\*Pass can be achieved with surge arrestors

**1.12 Impedance Scans - Length 30 km – Summer Valley B – Case 7**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 7: (N-2) Cashla-Flagford/Flagford-Srananagh Cable/Line Out**



**Figure 79: SVB - Length 30 km - (N-2) Cashla-Flagford/Flagford-Srananagh Lines Out**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
155.11	169.59
471.01	349.69
664.51	369.12
793.81	331.30
955.21	434.90

### **1.13 Time Domain Simulation - Length 30 km – Summer Valley B – Case 7**

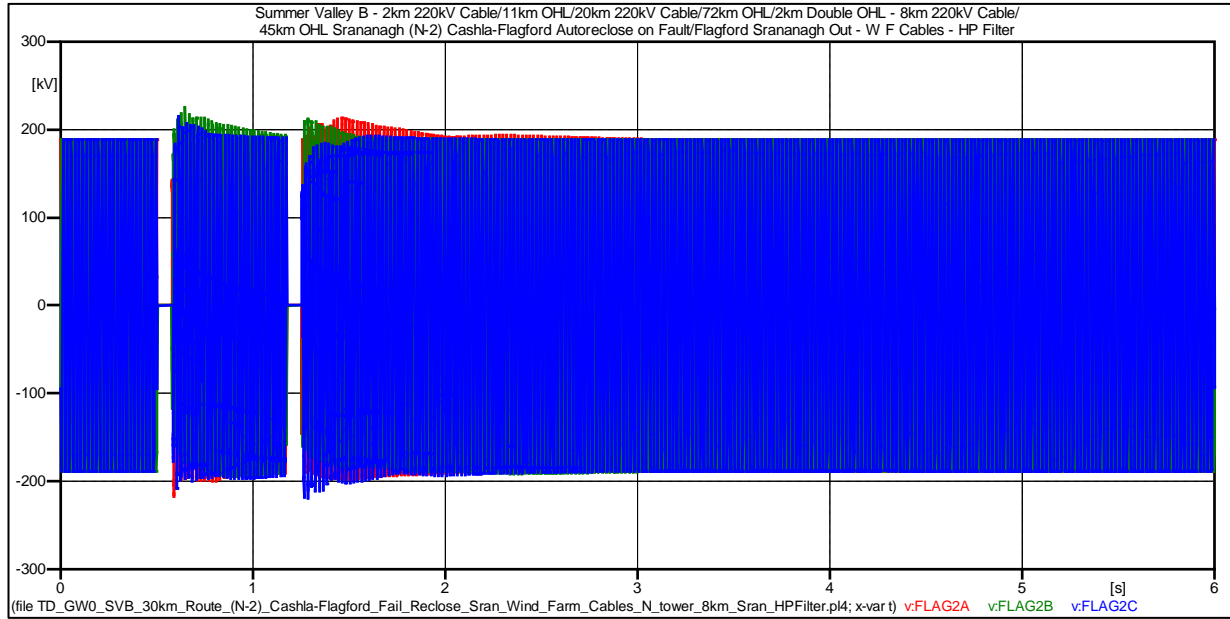
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29  $\mu$ F, 372 mH, 500  $\Omega$

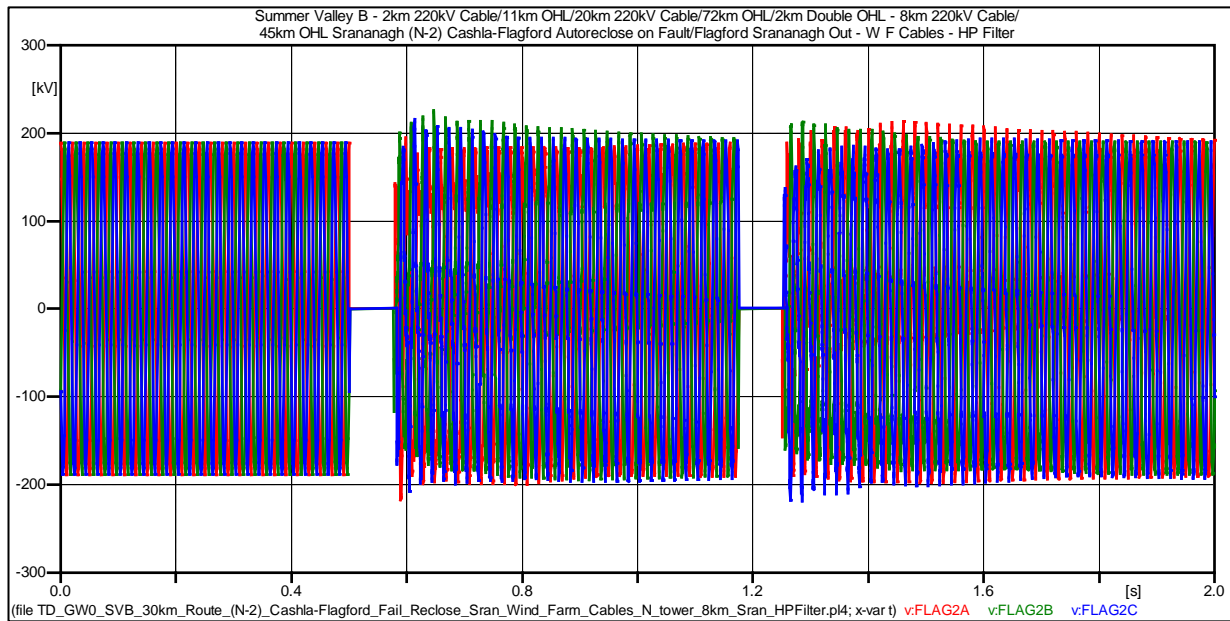
#### **Case 7: (N-2) Cashla-Flagford Line Autoreclose onto Fault/Flagford-Srananagh Cable/Line Out**

System Conditions:

1. The Flagford – Srananagh 220 kV circuit is on an outage. Fault applied on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.



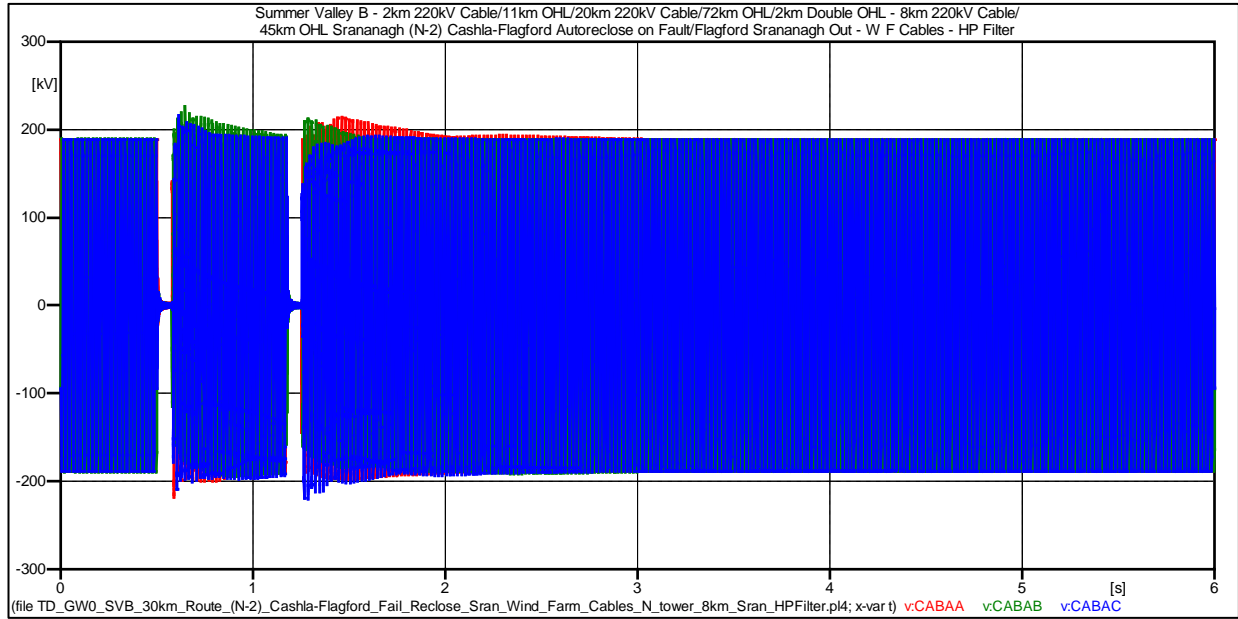
**Figure 80: SVB - Length 30 km – Flagford – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



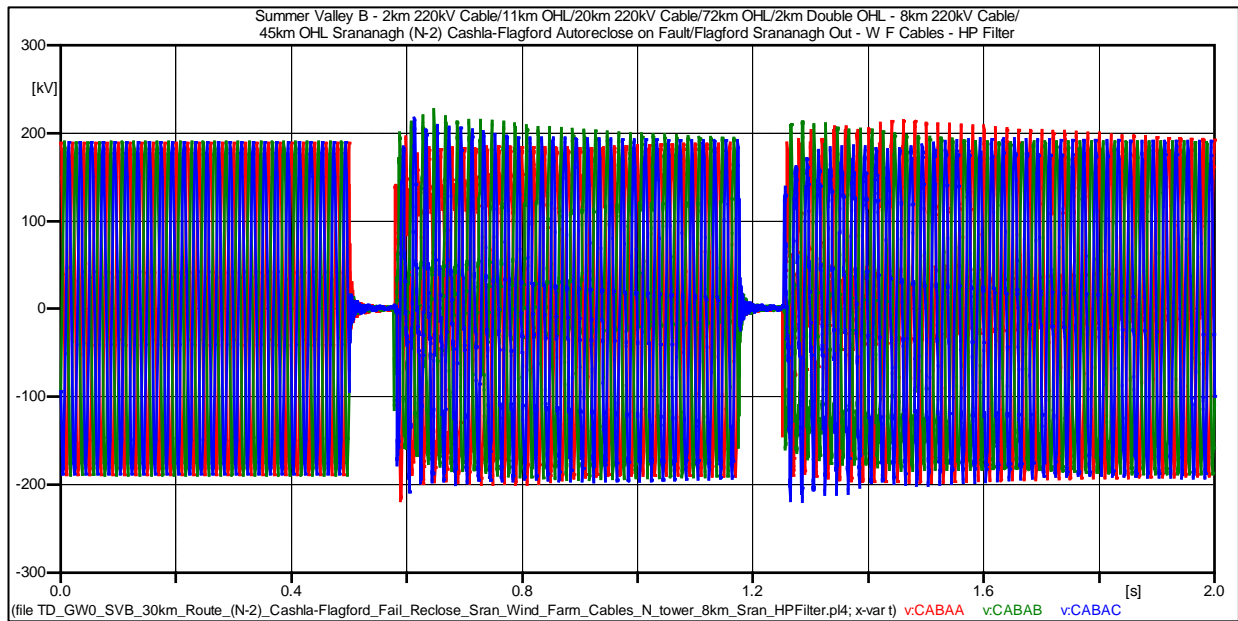
**Figure 81: SVB - Length 30 km – Flagford – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	216.56 kV (1.2059 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	275.38 kV (1.5334 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 82: SVB - Length 30 km – Cable End A – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

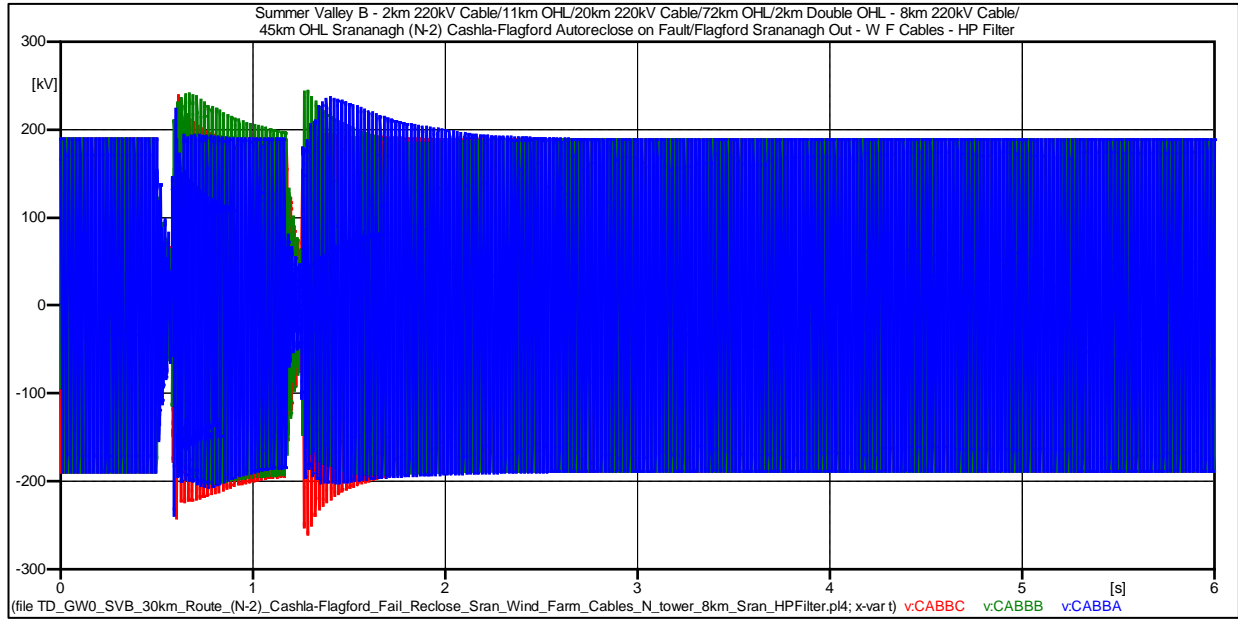


**Figure 83: SVB - Length 30 km – Cable End A – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

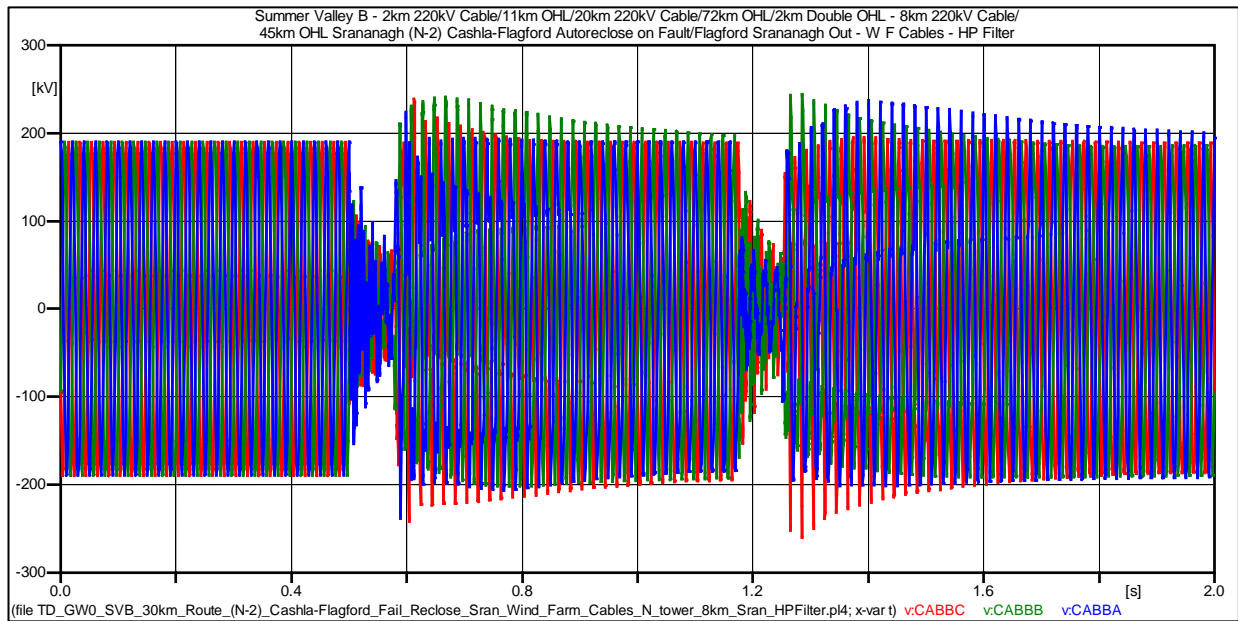
Condition	Maximum Value	Limit	Result
Switching	225.65 kV (1.2565 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	223.56 kV (1.2449 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors





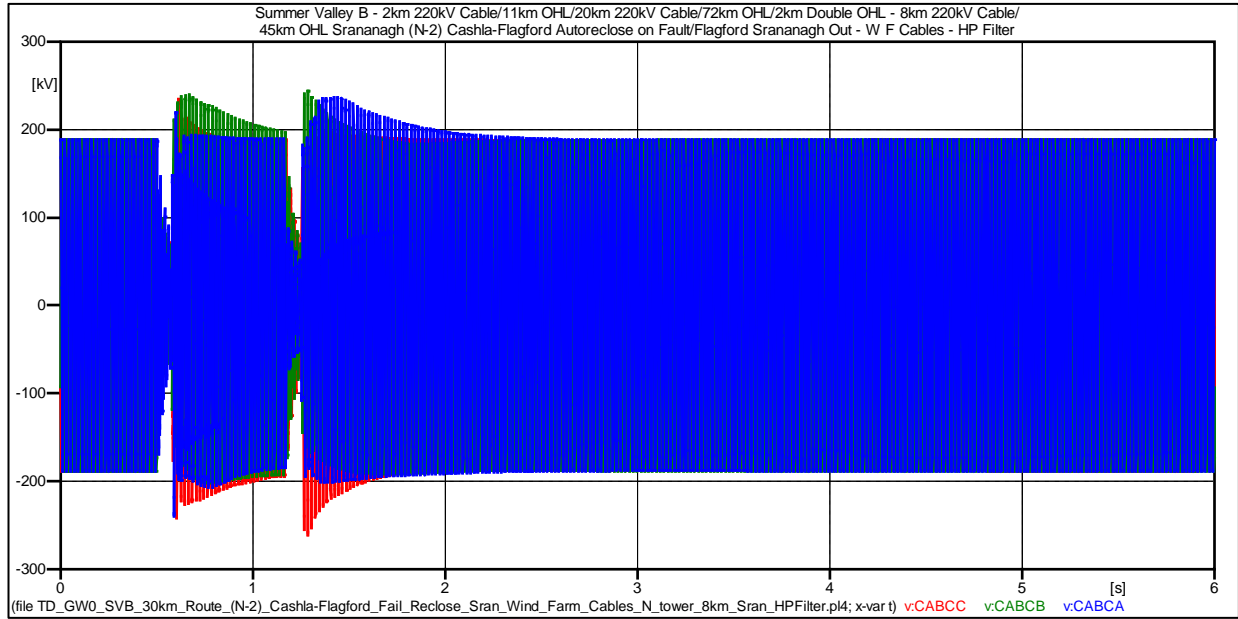
**Figure 84: SVB - Length 30 km – Cable End B – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



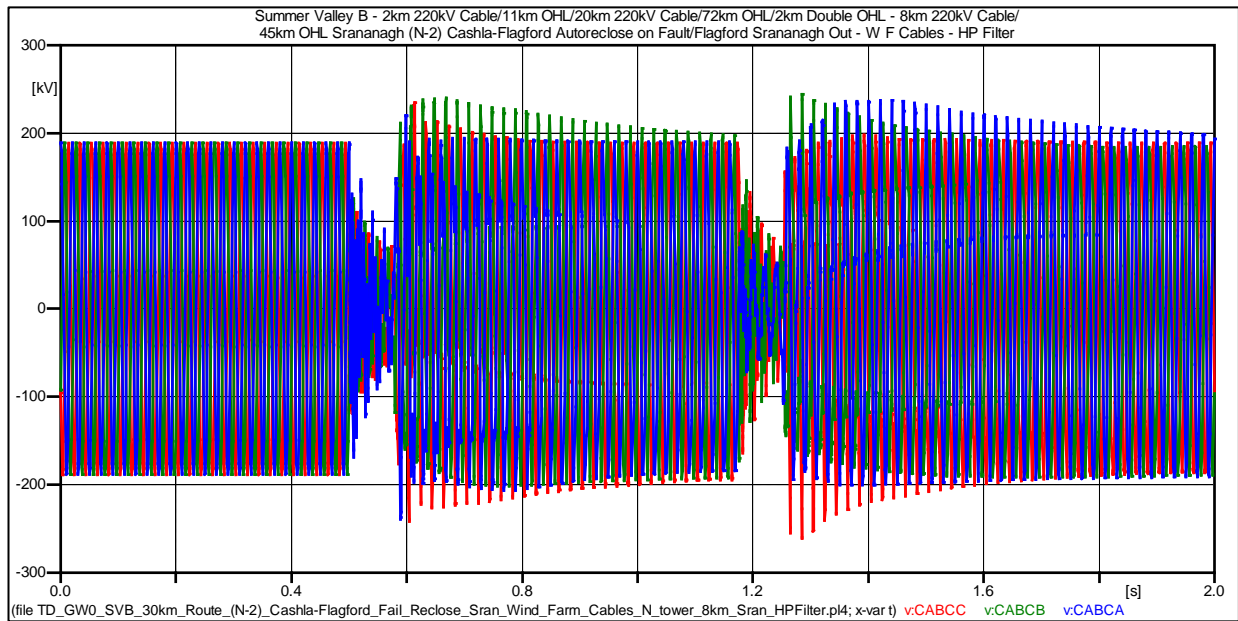
**Figure 85: SVB - Length 30 km – Cable End B – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	260.89 kV (1.4527 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	258.12 kV (1.4373 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



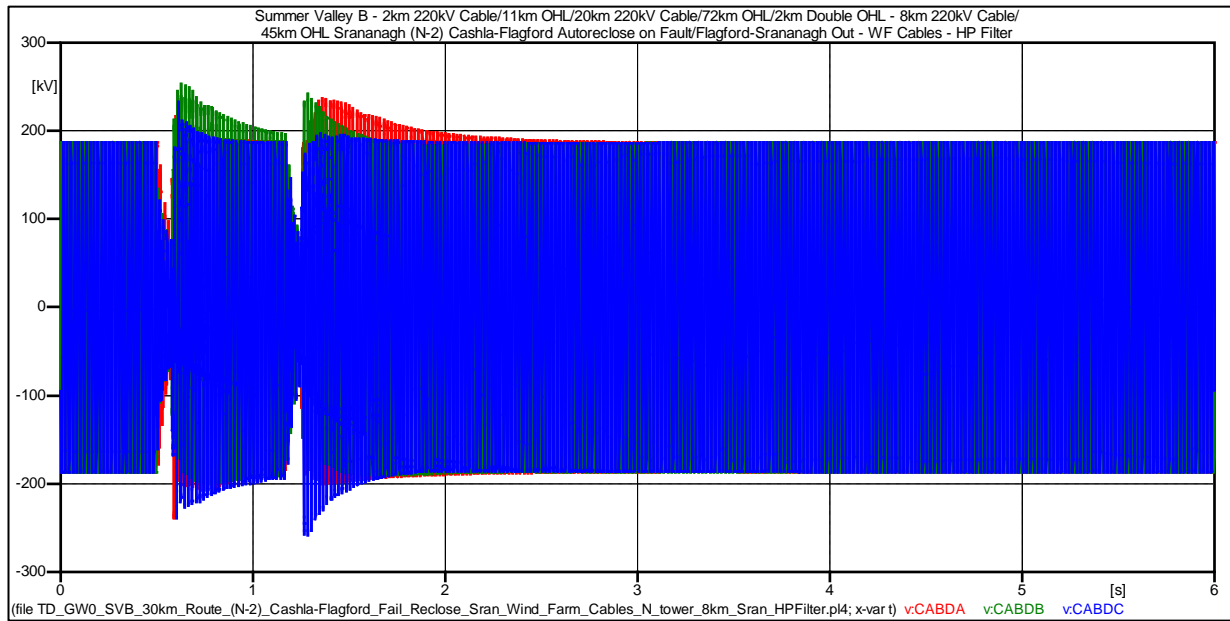
**Figure 86: SVB - Length 30 km – Cable End C – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



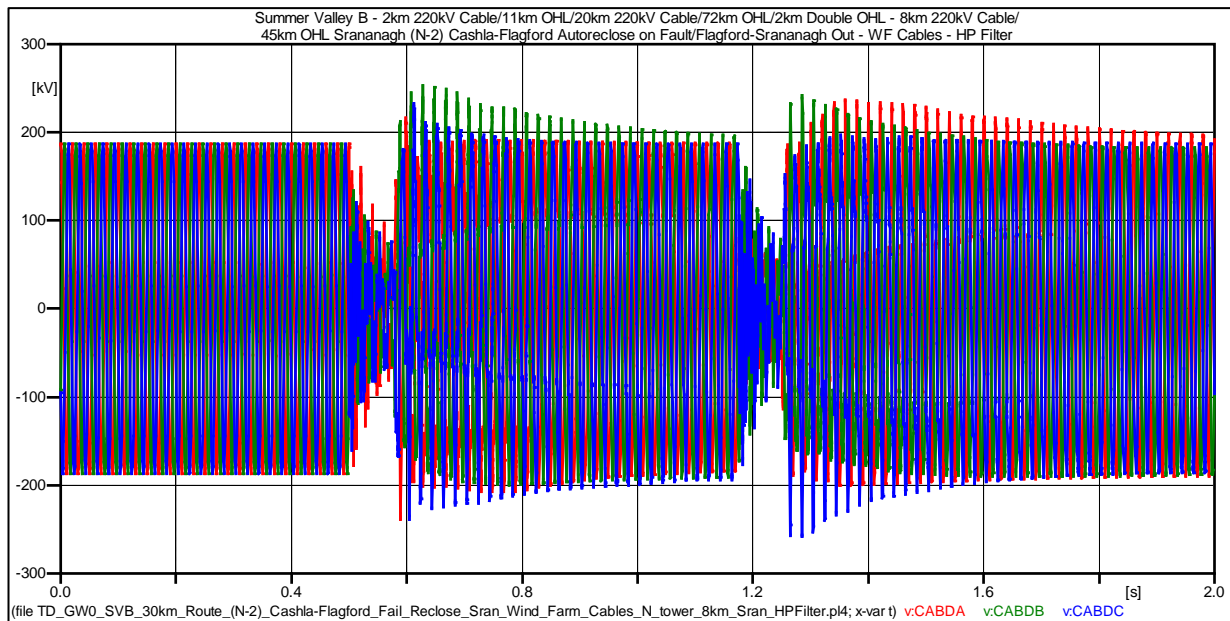
**Figure 87: SVB - Length 30 km – Cable End C – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	260.89 kV (1.4527 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	261.52 kV (1.4562 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



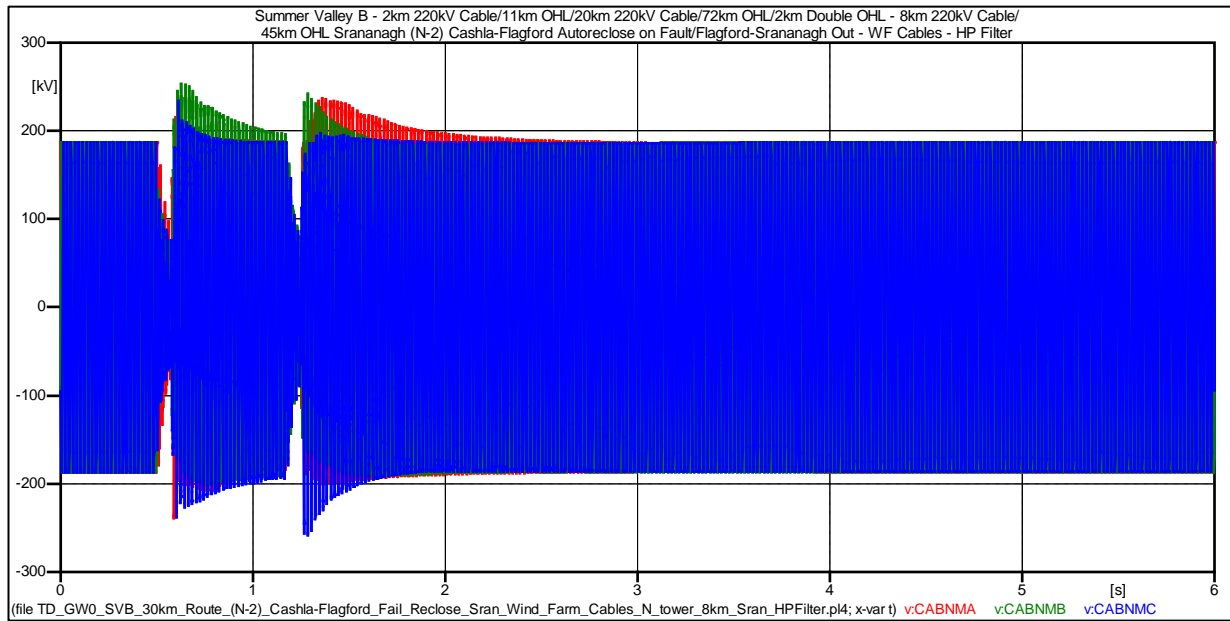
**Figure 88: SVB - Length 30 km – Cable End D – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



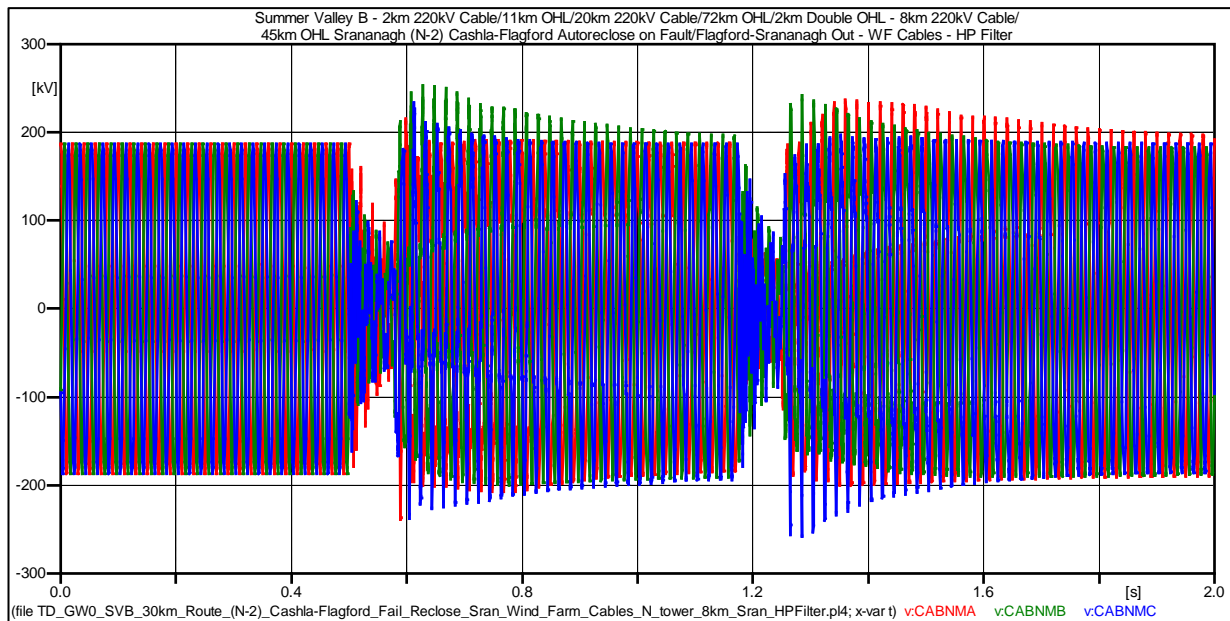
**Figure 89: SVB - Length 30 km – Cable End D – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	252.36 kV (1.4052 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	265.89 kV (1.4806 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



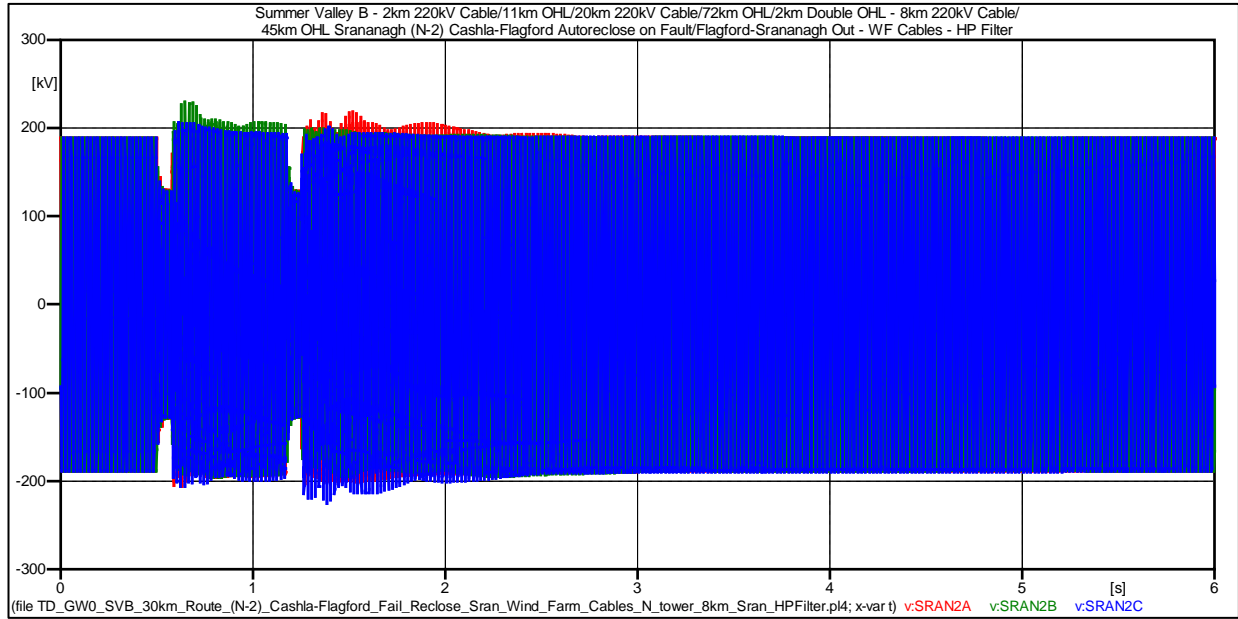
**Figure 90: SVB - Length 30 km – North Mayo – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



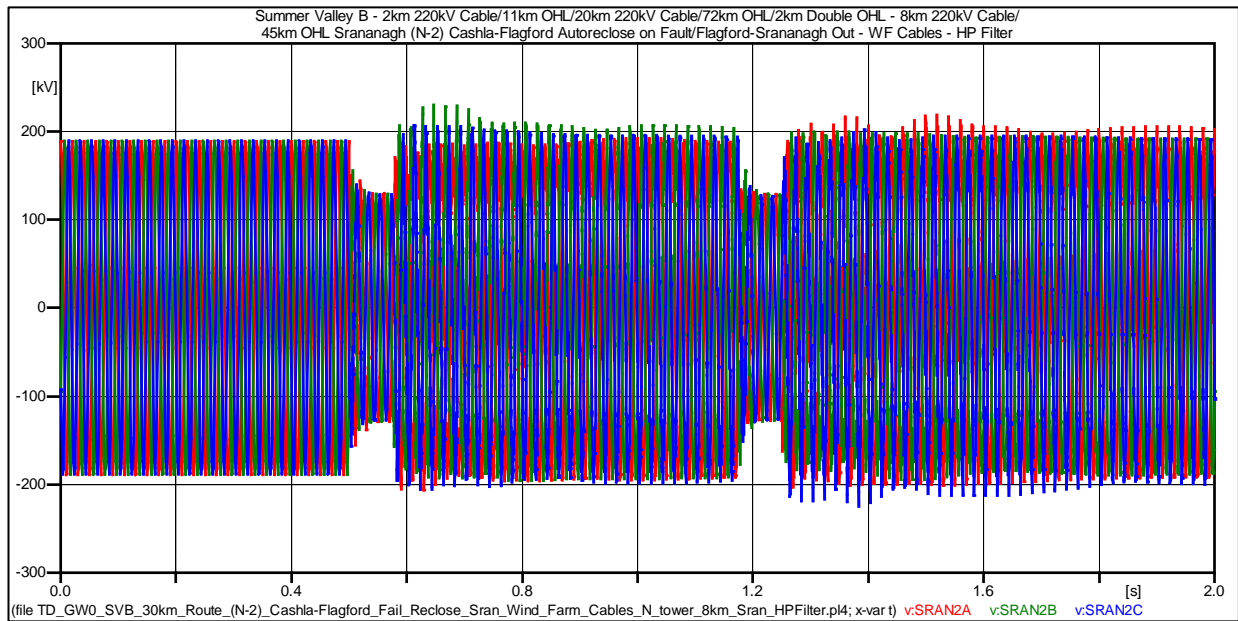
**Figure 91: SVB - Length 30 km – North Mayo – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	260.56 kV (1.4509 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	257.89 kV (1.4360 pu)	287.32kV (1.6pu)	Pass

\*Pass can be achieved with surge arrestors



**Figure 92: SVB - Length 30 km – Srananagh – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



**Figure 93: SVB - Length 30 km – Srananagh – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	225.23 kV (1.2542 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	223.26 kV (1.2432 pu)	287.32kV (1.6pu)	Pass

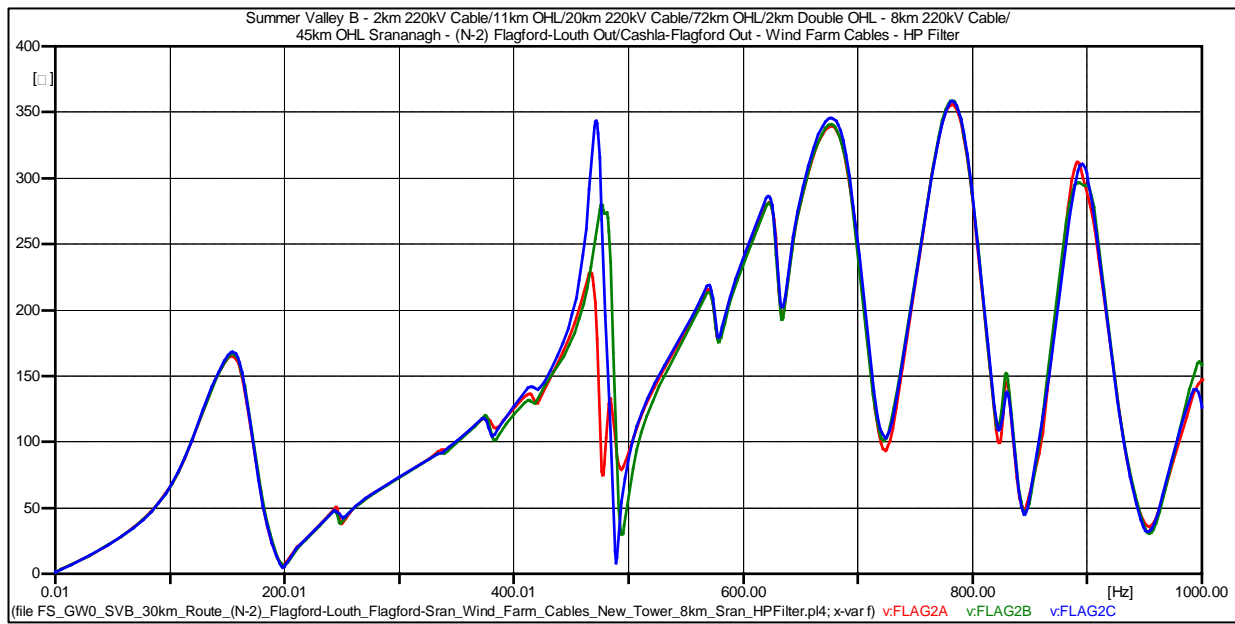
\*Pass can be achieved with surge arrestors

**1.14 Impedance Scans - Length 30 km – Summer Valley B – Case 8**

Conditions for impedance scan:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500 Ω

**Case 8: (N-2) Flagford-Louth/Flagford-Srananagh Cable/Line Out**



**Figure 94: SVB - Length 30 km - (N-2) Flagford-Louth/Flagford-Srananagh Lines Out**

**Impedance Scan - Resonance points**

Frequency (Hz)	Impedance (Ω)
156.01	167.89
471.91	343.19
676.21	345.60
783.01	358.10
896.41	310.05

### **1.15 Time Domain Simulation - Length 30 km – Summer Valley B – Case 8**

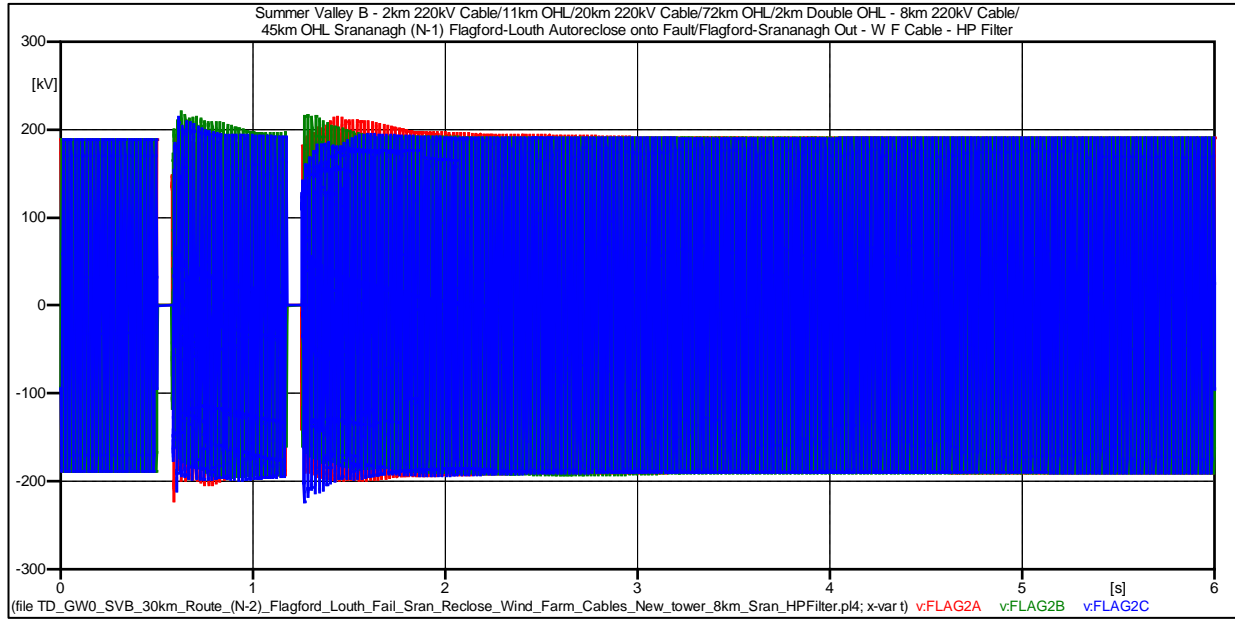
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29 uF, 372 mH, 500  $\Omega$

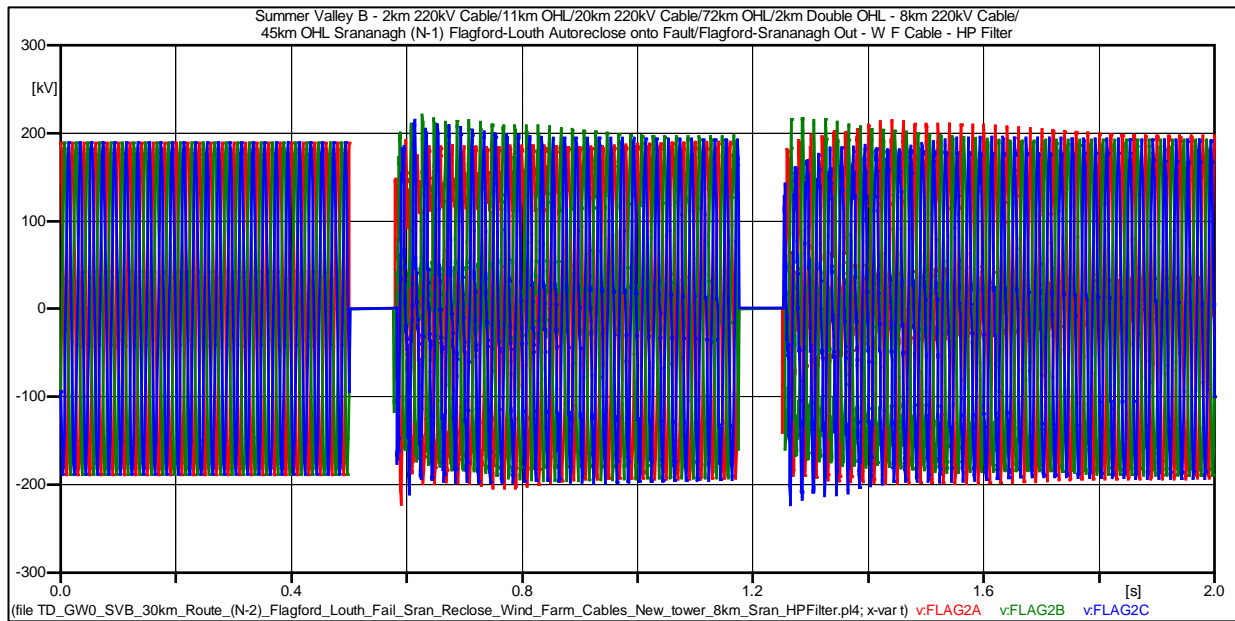
#### **Case 8: (N-2) Flagford-Louth Line Autoreclose onto Fault/Flagford-Srananagh Cable/Line Out**

System Conditions:

1. The Flagford – Srananagh 220 kV circuit is on an outage. Fault applied on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens again at 1.25s.



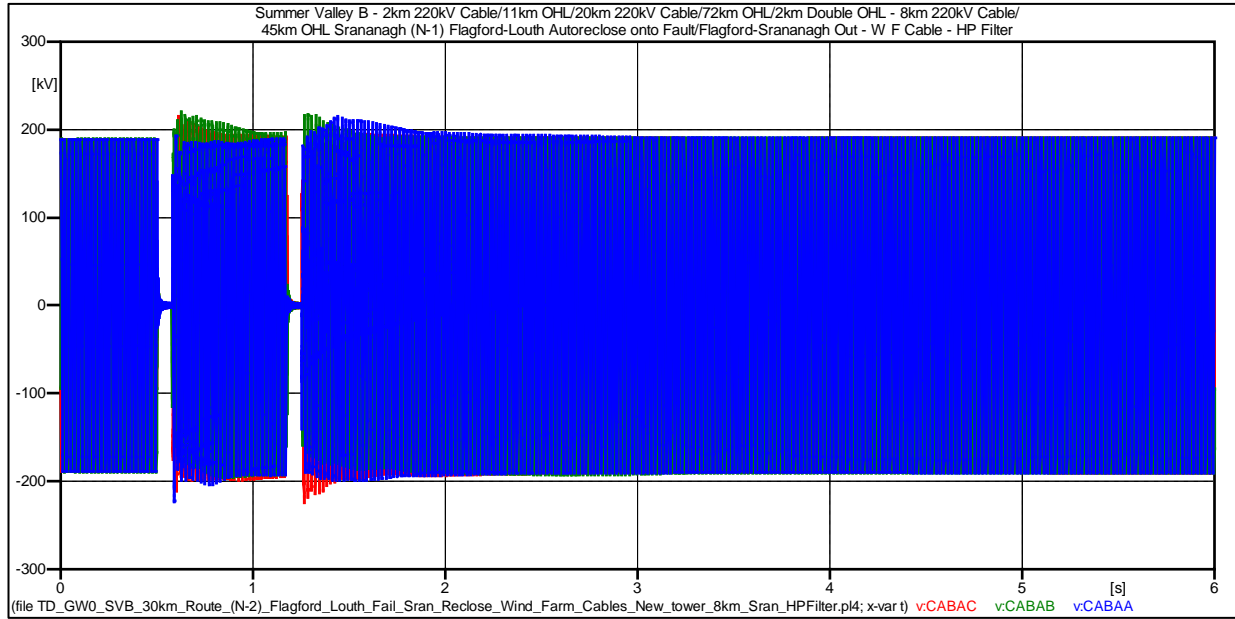
**Figure 95: SVB - Length 30 km – Flagford – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



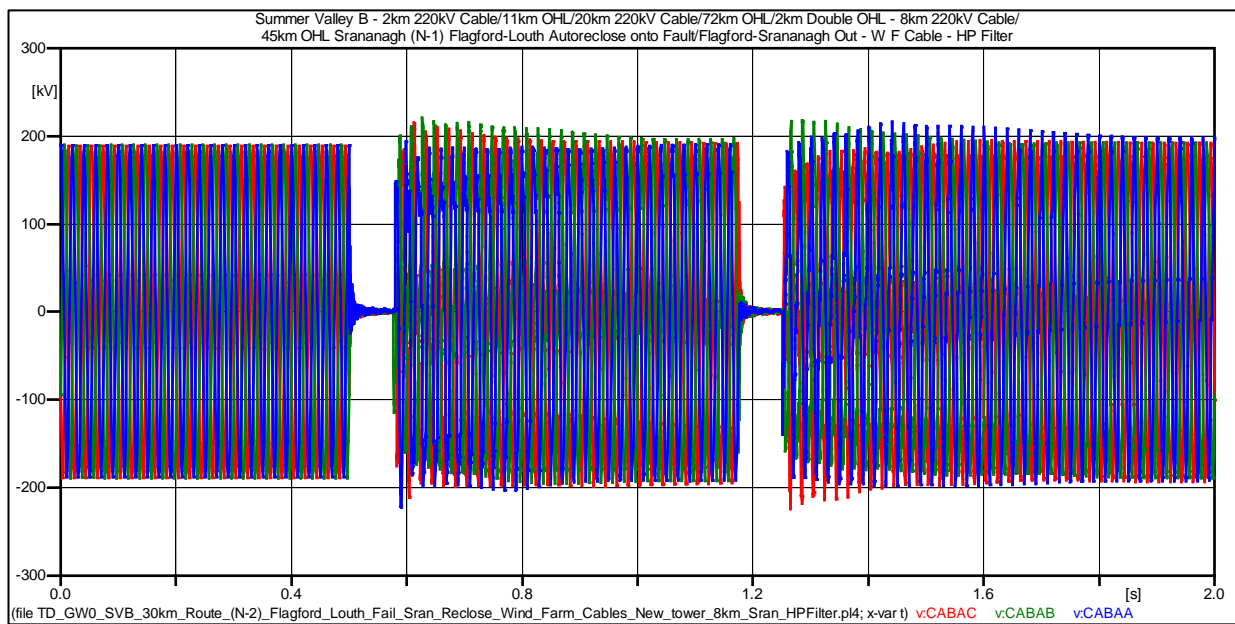
**Figure 96: SVB - Length 30 km – Flagford – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	221.31 kV (1.2323 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	221.26 kV (1.2320 pu)	287.32kV (1.6pu)	Pass



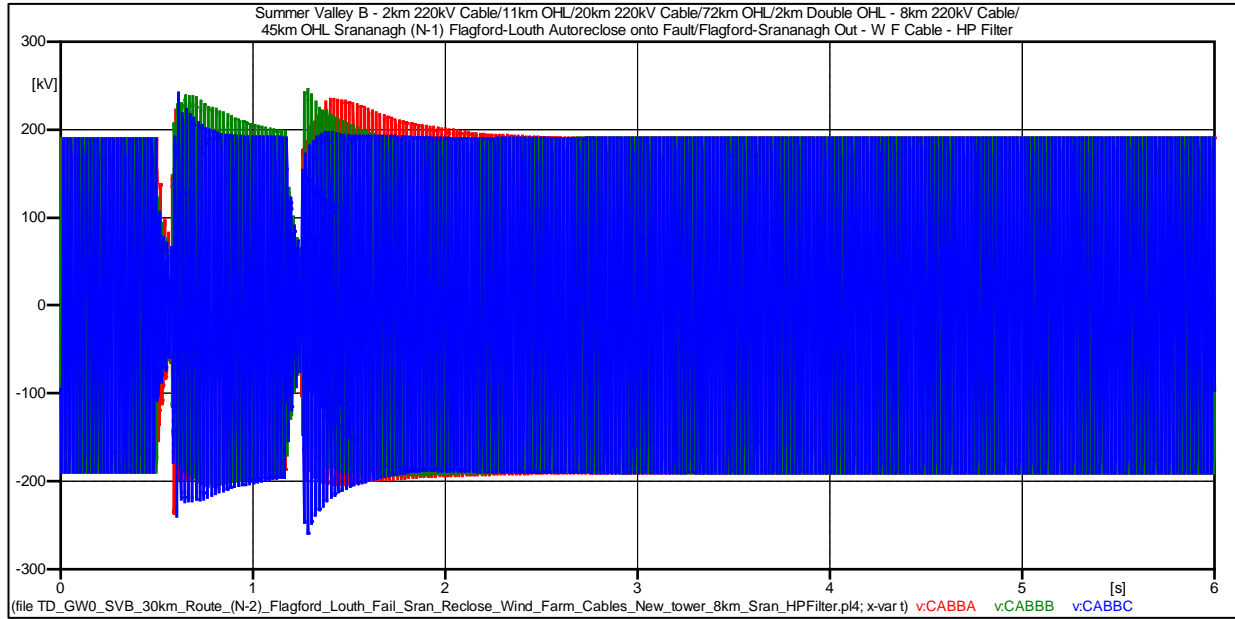


**Figure 97: SVB - Length 30 km – Cable End A – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

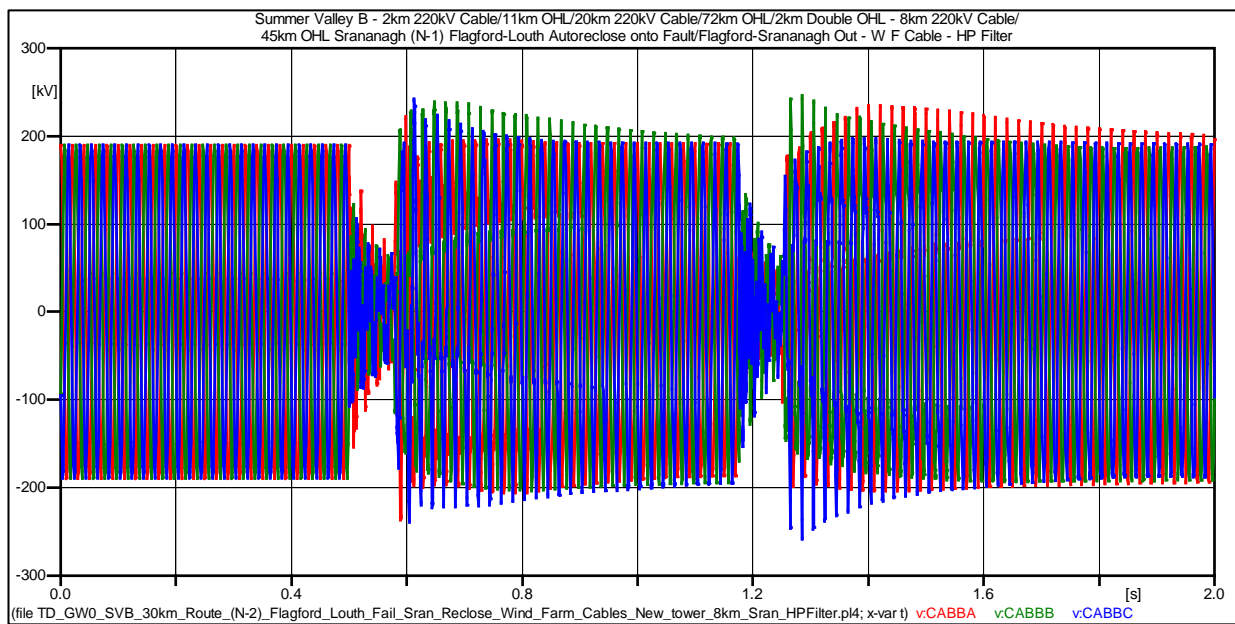


**Figure 98: SVB - Length 30 km – Cable End A – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	221.51 kV (1.2323 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	221.23 kV (1.2320 pu)	287.32kV (1.6pu)	Pass

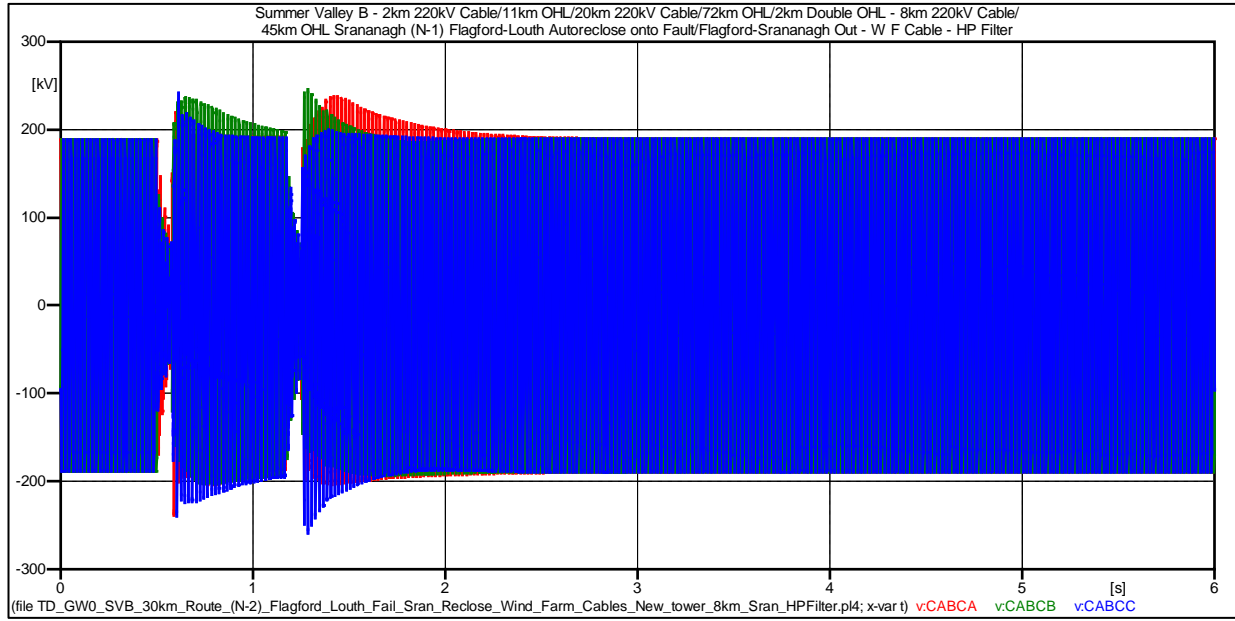


**Figure 99: SVB - Length 30 km – Cable End B – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

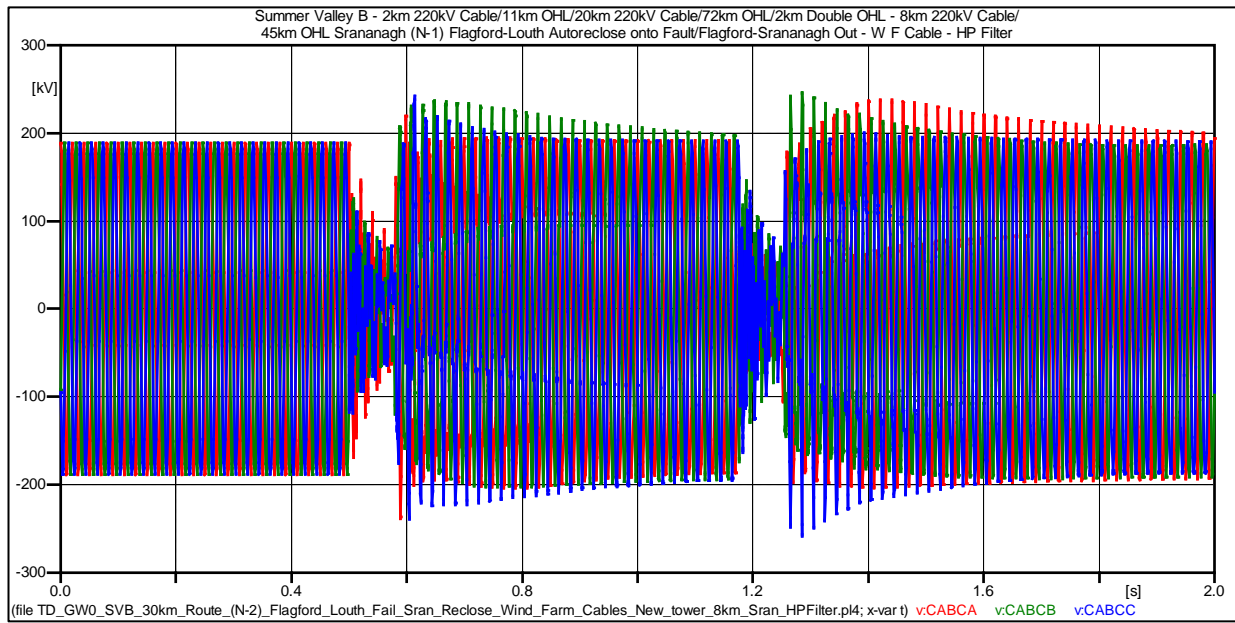


**Figure 100: SVB - Length 30 km – Cable End B – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	249.56 kV (1.3896 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	244.89 kV (1.3636 pu)	287.32kV (1.6pu)	Pass

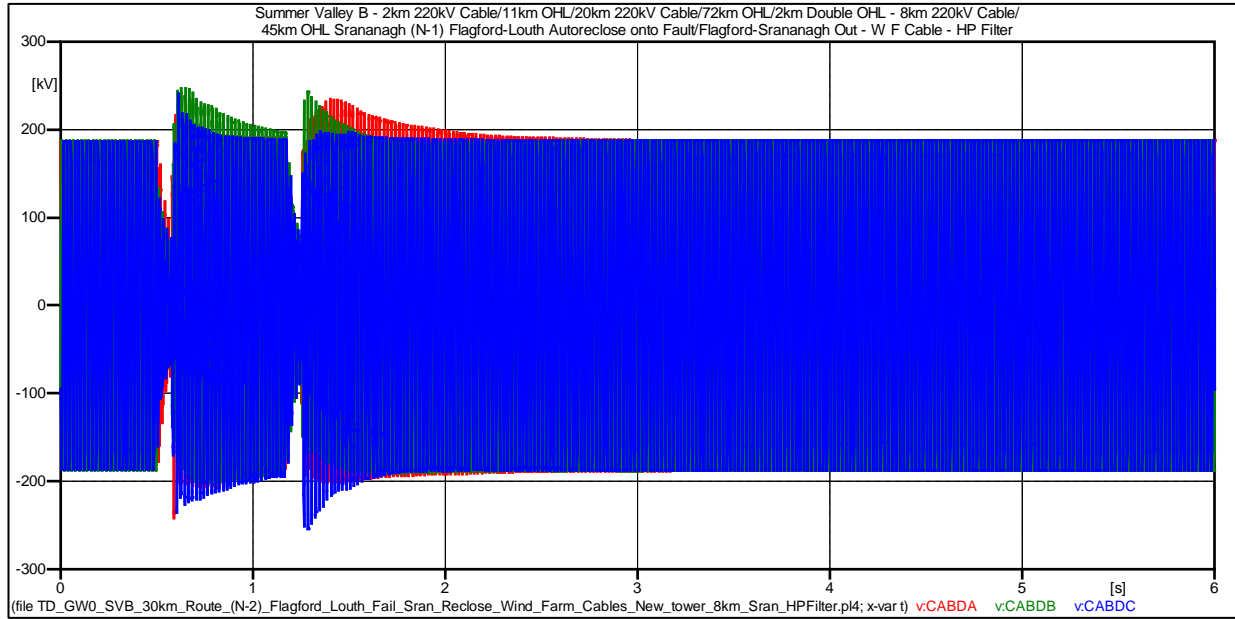


**Figure 101: SVB - Length 30 km – Cable End C – (N-2) Flagford-Louth Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

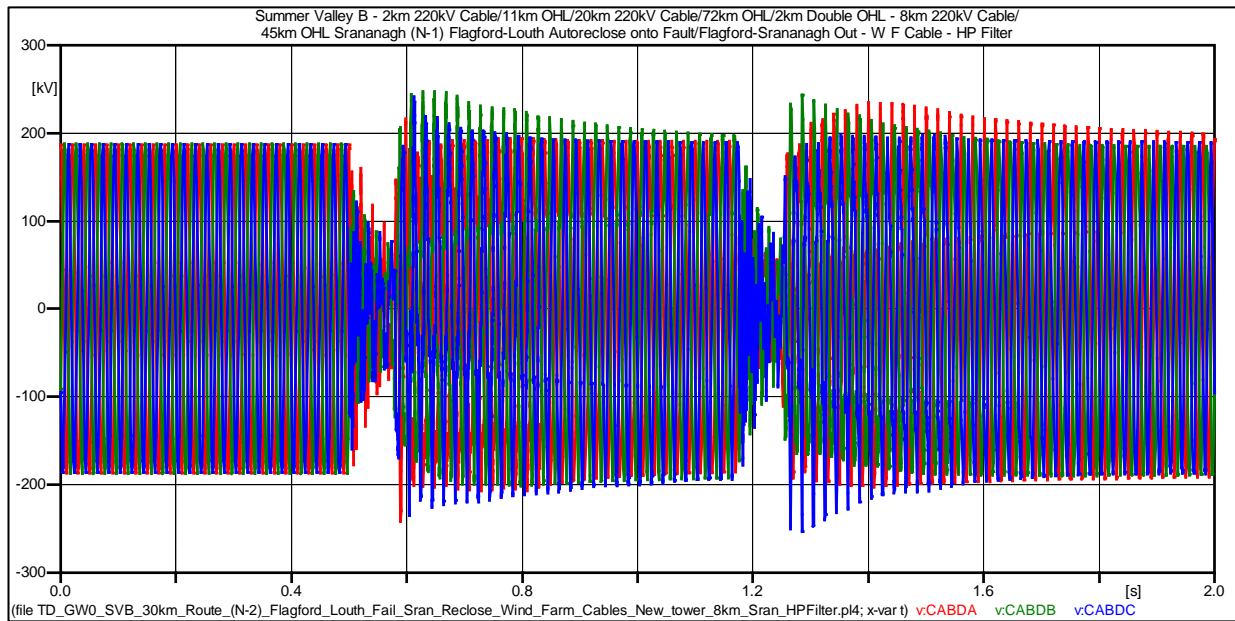


**Figure 102: SVB - Length 30 km – Cable End C – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	257.89 kV (1.4360 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	250.23 kV (1.3934 pu)	287.32kV (1.6pu)	Pass

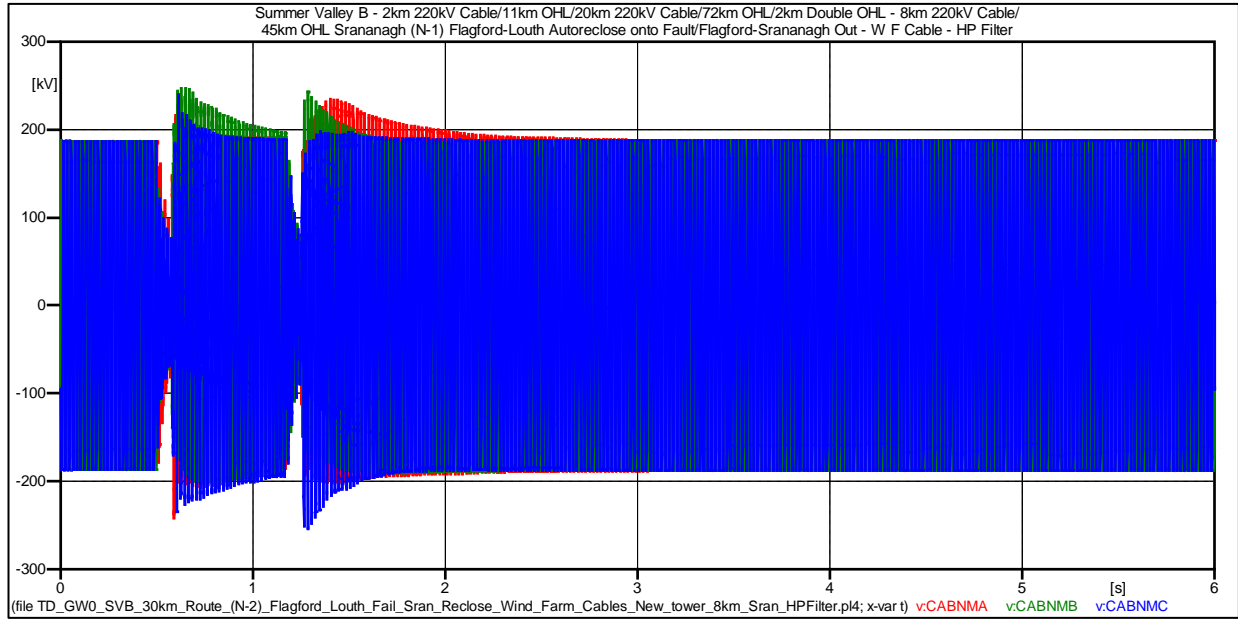


**Figure 103: SVB - Length 30 km – Cable End D – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

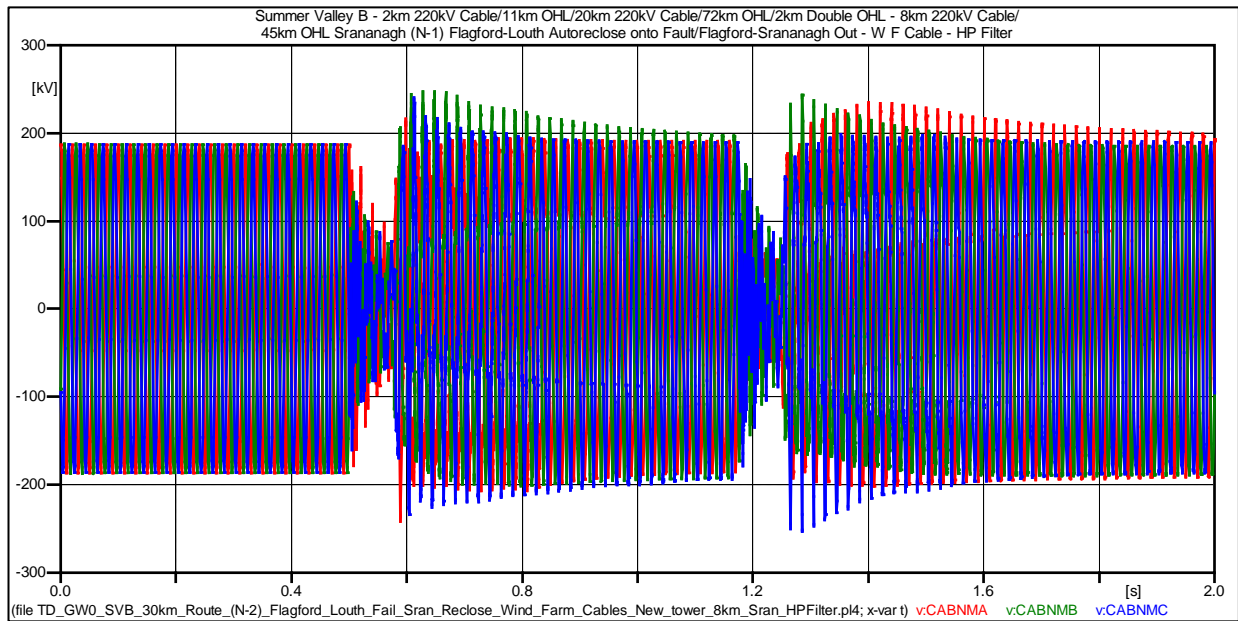


**Figure 104: SVB - Length 30 km – Cable End D – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	254.78 kV (1.4187 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	248.56 kV (1.3841 pu)	287.32kV (1.6pu)	Pass

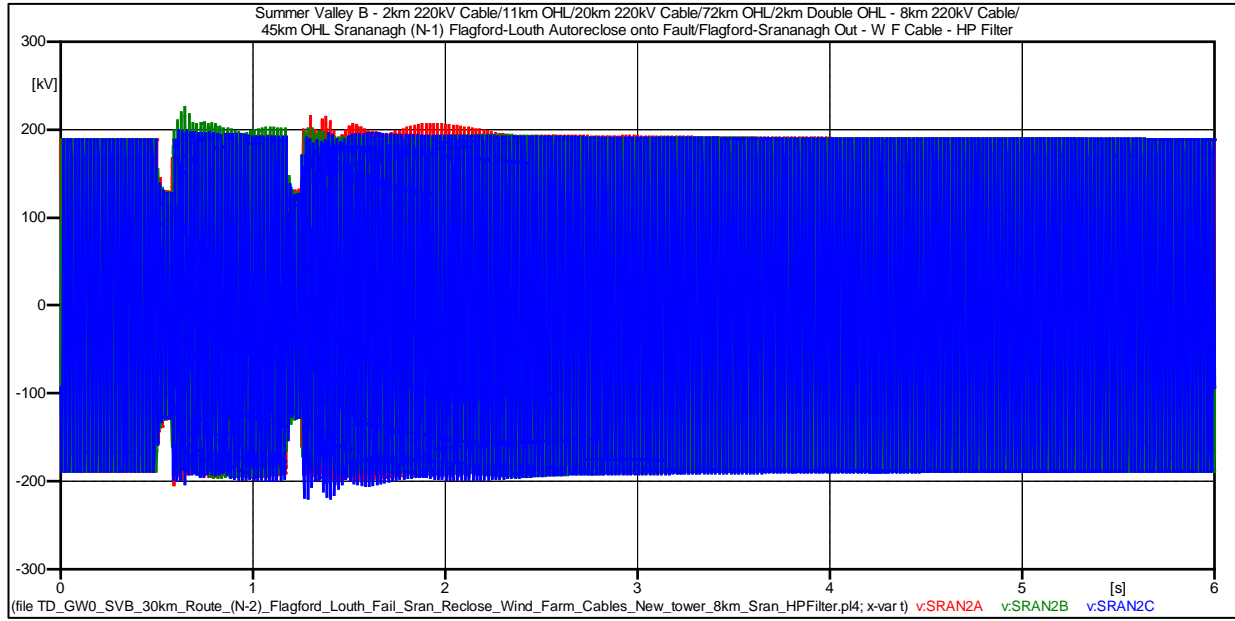


**Figure 105: SVB - Length 30 km – Cable End - North Mayo – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**

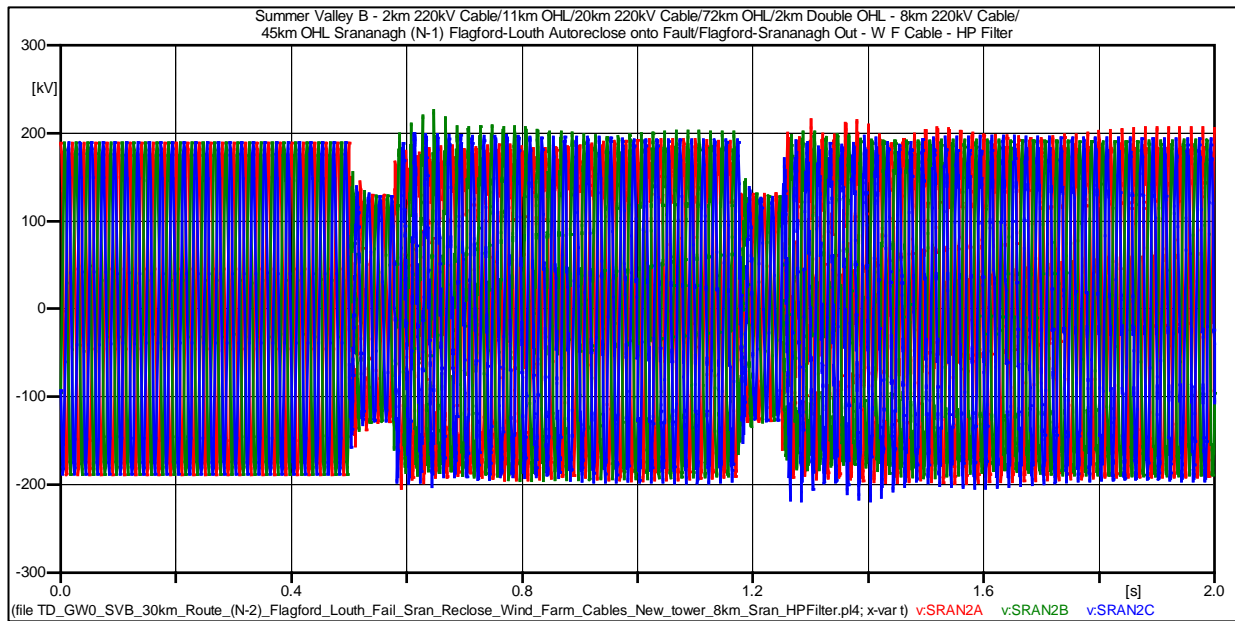


**Figure 106: SVB - Length 30 km – North Mayo – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	230.85 kV (1.2854 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	238.67kV (1.3290 pu)	287.32kV (1.6pu)	Pass



**Figure 107: SVB - Length 30 km – Srananagh – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-6s)**



**Figure 108: SVB - Length 30 km – Srananagh – (N-2) Flagford-Cashla Auto Reclose onto Fault – Flagford-Srananagh Line Out (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	220.12 kV (1.2257 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	218.56 kV (1.2170 pu)	287.32kV (1.6pu)	Pass

### **1.16 Time Domain Simulation - Length 30 km – Summer Valley B – Case 9**

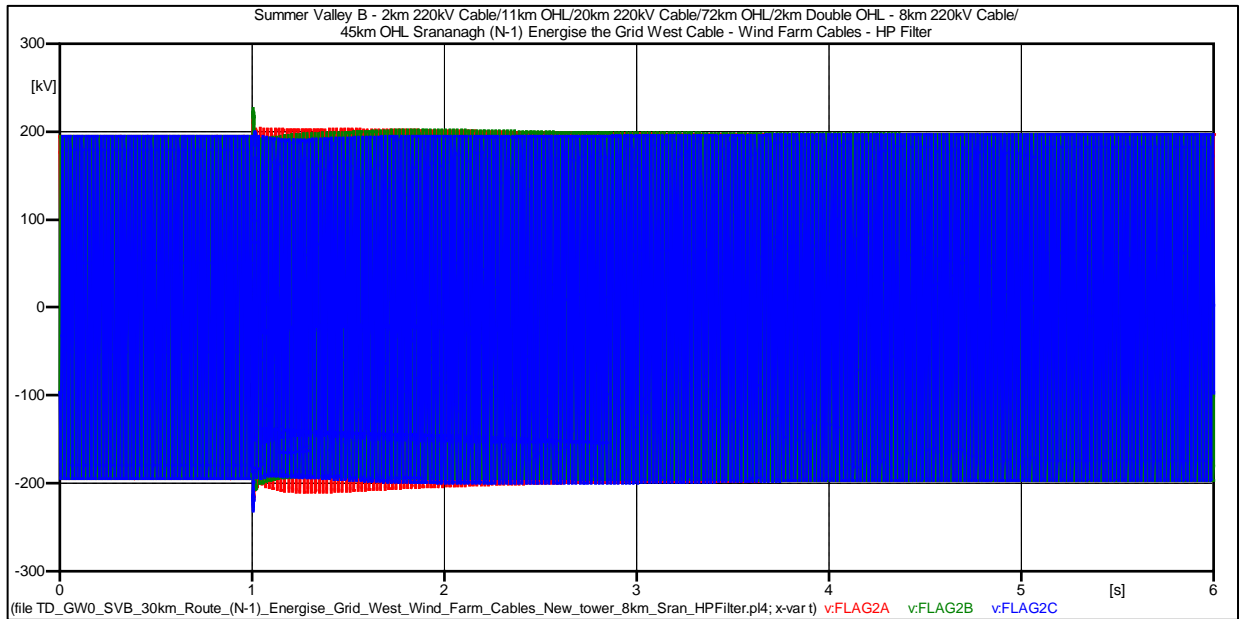
Conditions for time domain simulation:

1. Summer Valley B network
2. North Mayo to Flagford Circuit - 2 km Cable/11 km OHL/20 km Cable/72 km OHL/2 km Double Circuit OHL
3. Srananagh to Flagford Circuit – 8 km Cable/45 km OHL
4. Reactors – North Mayo 100 Mvar/Flagford 50 Mvar
5. Filter – High Pass Filter – 3.29  $\mu\text{F}$ , 372 mH, 500  $\Omega$

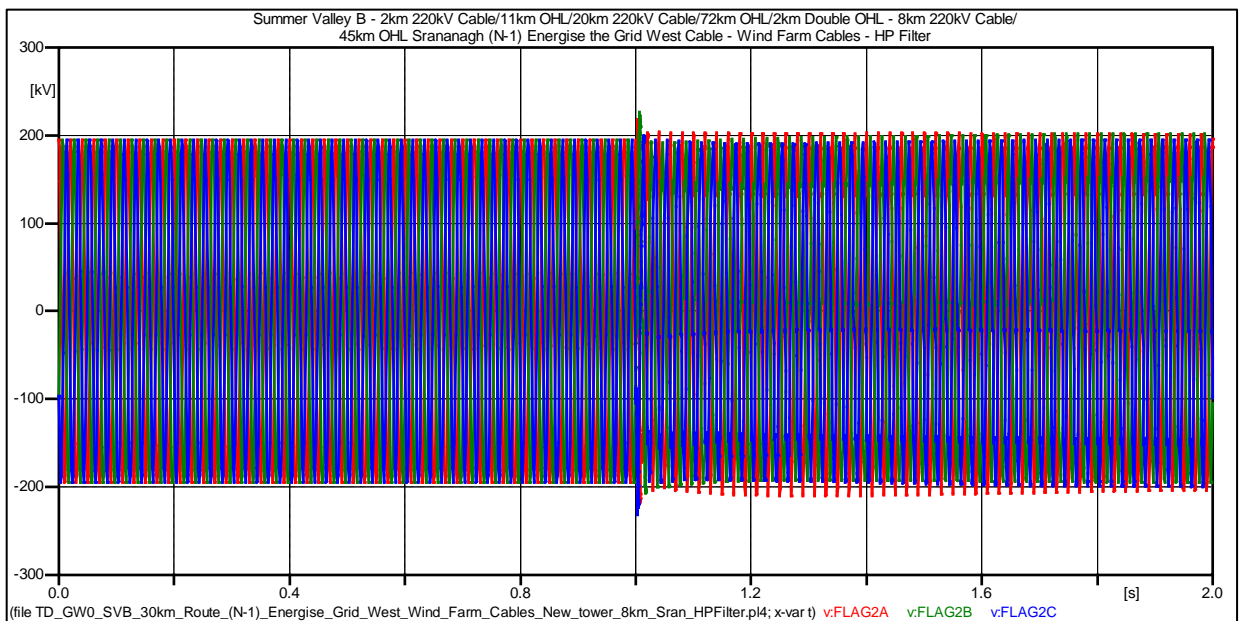
#### **Case 9: Energise Grid West Cable**

System Conditions:

1. Energise the Grid West Cable from Flagford at 1s.



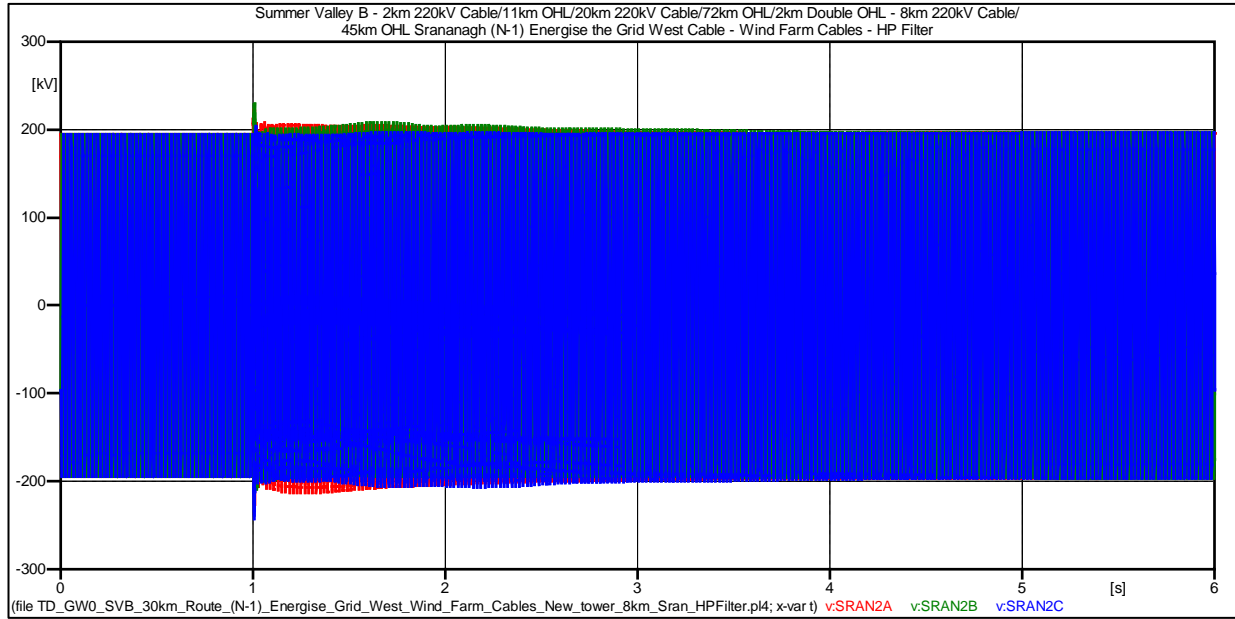
**Figure 109: SVB - Length 30 km – Flagford – Energise Grid West Cable (0-6s)**



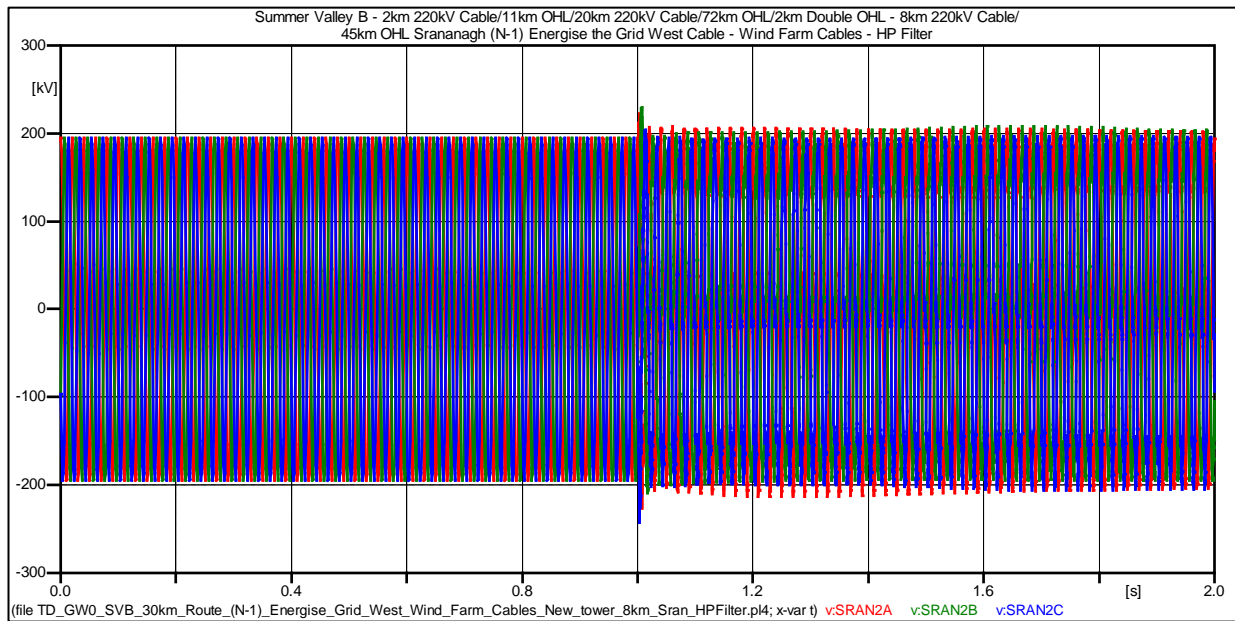
**Figure 110: SVB - Length 30 km – Flagford – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	218.59 kV (1.2182 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	209.78 kV (1.1681 pu)	287.32kV (1.6pu)	Pass



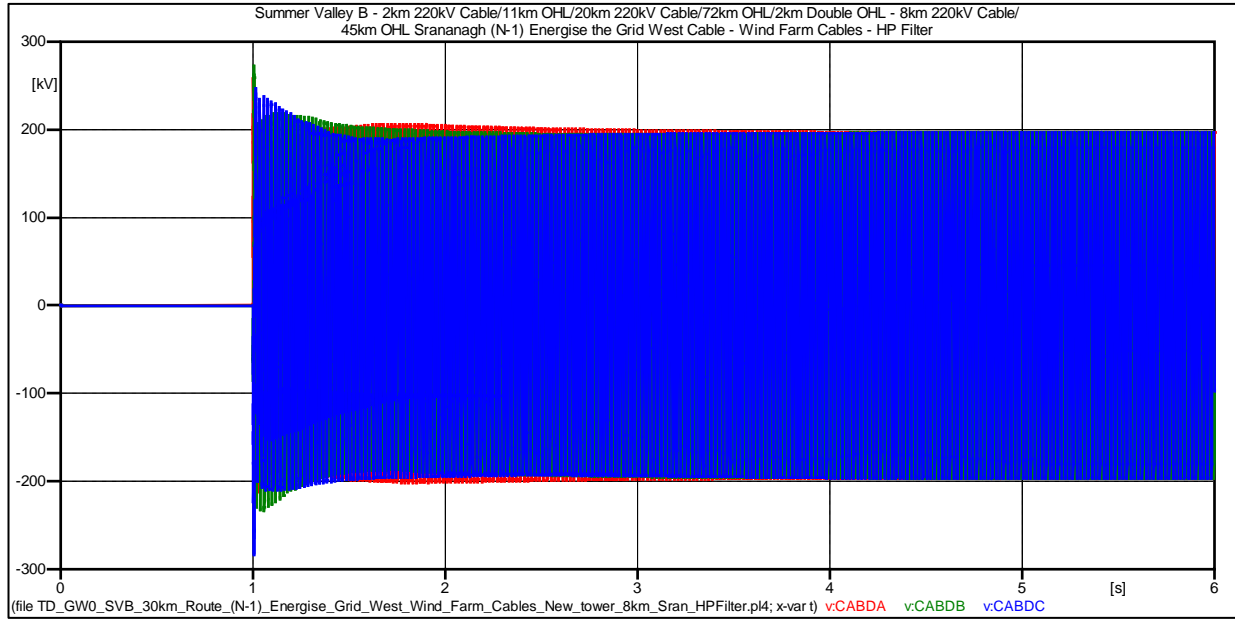


**Figure 111: SVB - Length 30 km – Srananagh – Energise Grid West Cable (0-6s)**

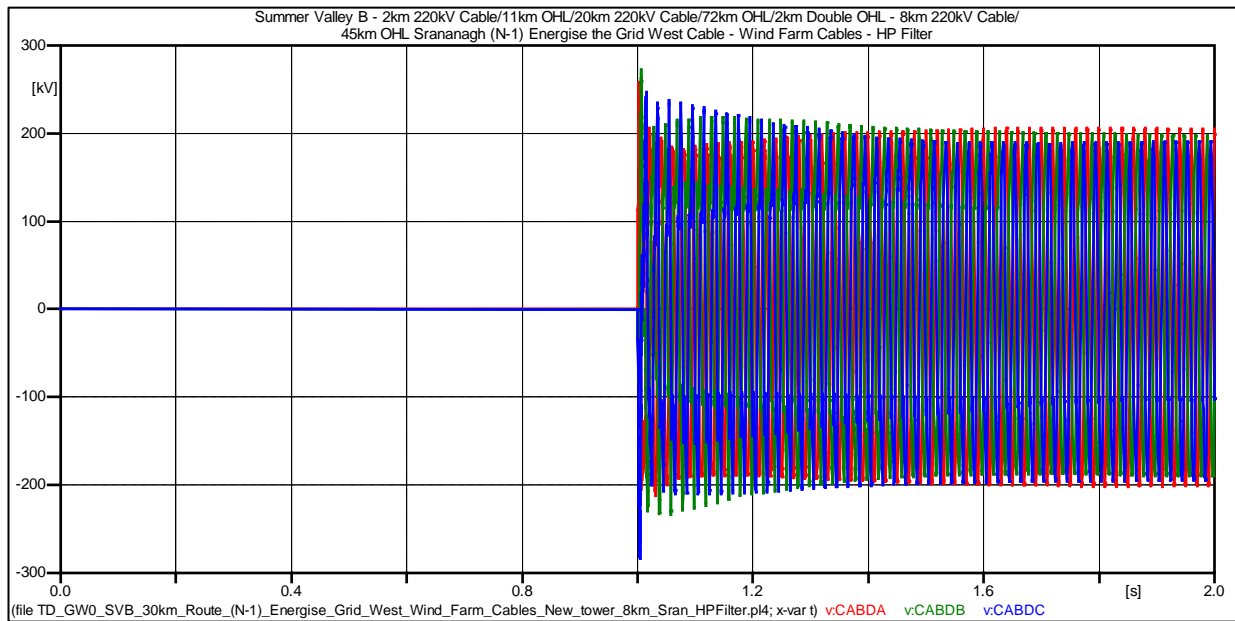


**Figure 112: SVB - Length 30 km – Srananagh – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	238.59 kV (1.3286 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	203.59 kV (1.1337 pu)	287.32kV (1.6pu)	Pass

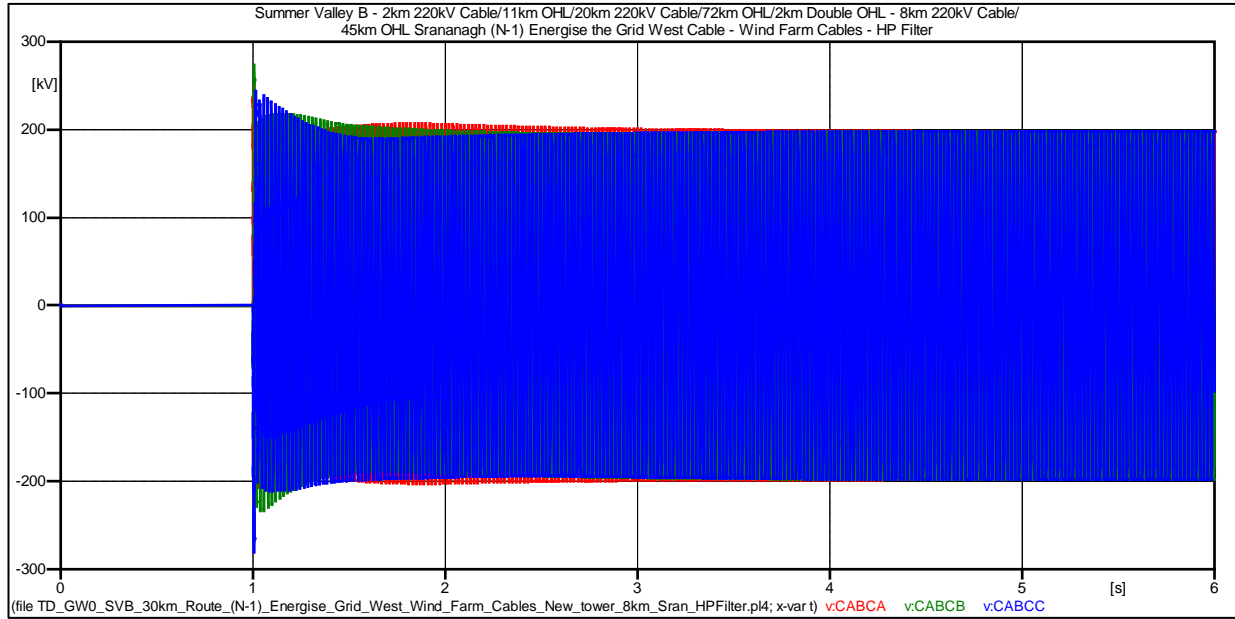


**Figure 113: SVB - Length 30 km – Cable End D – Energise Grid West Cable (0-6s)**

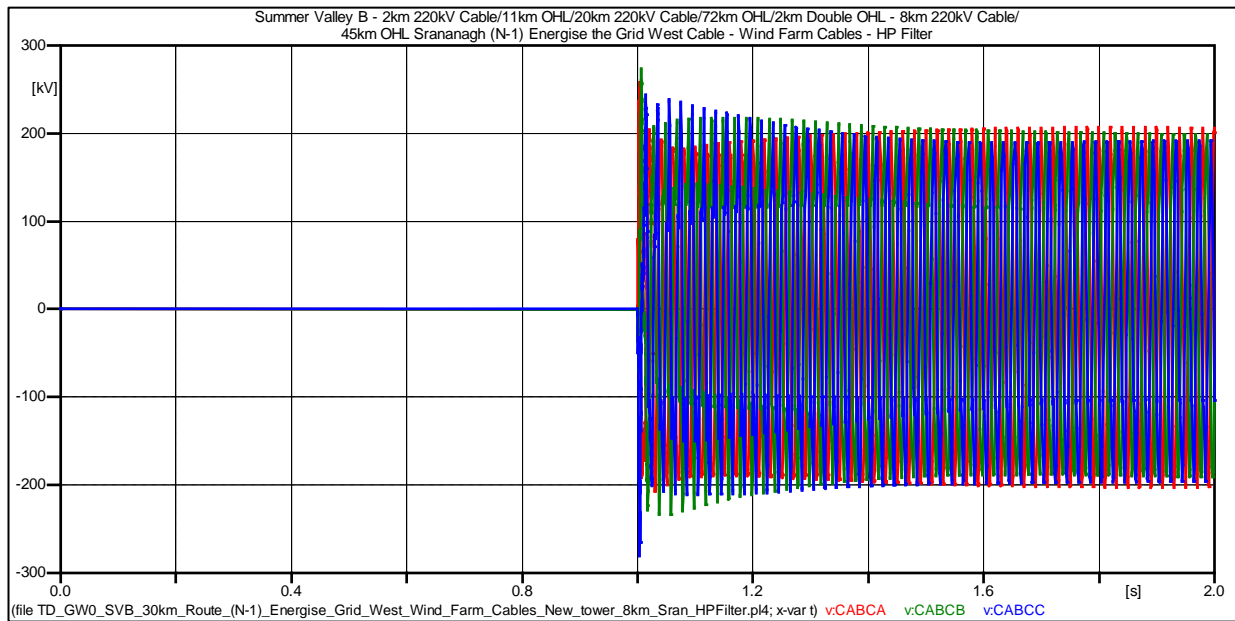


**Figure 114: SVB - Length 30 km – Cable End D – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	280.59 kV (1.5624 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	229.58 kV (1.2784 pu)	287.32kV (1.6pu)	Pass



**Figure 115: SVB - Length 30 km – Cable End C – Energise Grid West Cable (0-6s)**



**Figure 116: SVB - Length 30 km – Cable End C – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	280.04 kV (1.5594 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	238.05 kV (1.3255 pu)	287.32kV (1.6pu)	Pass

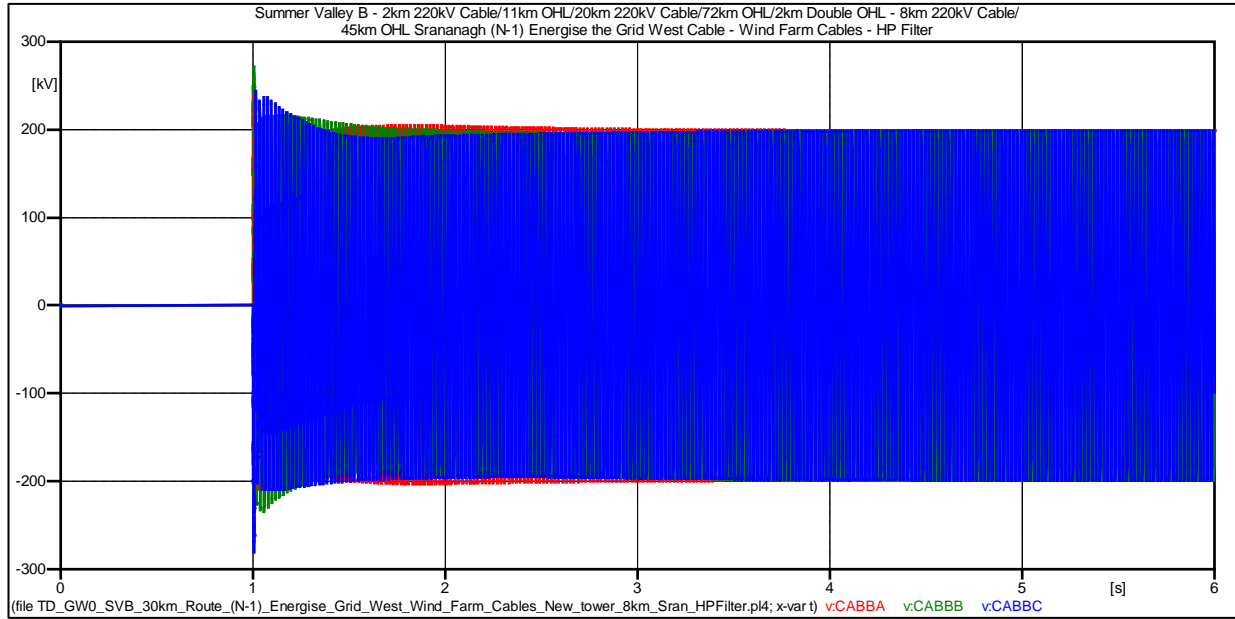


Figure 117: SVB - Length 30 km – Cable End B – Energise Grid West Cable (0-6s)

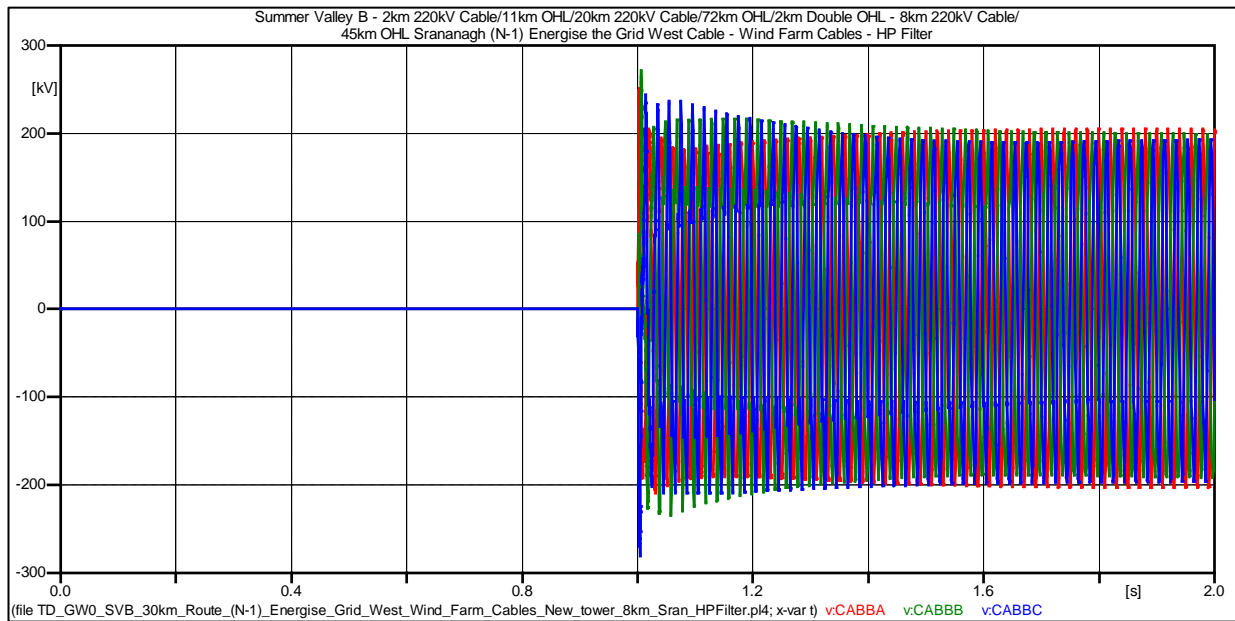
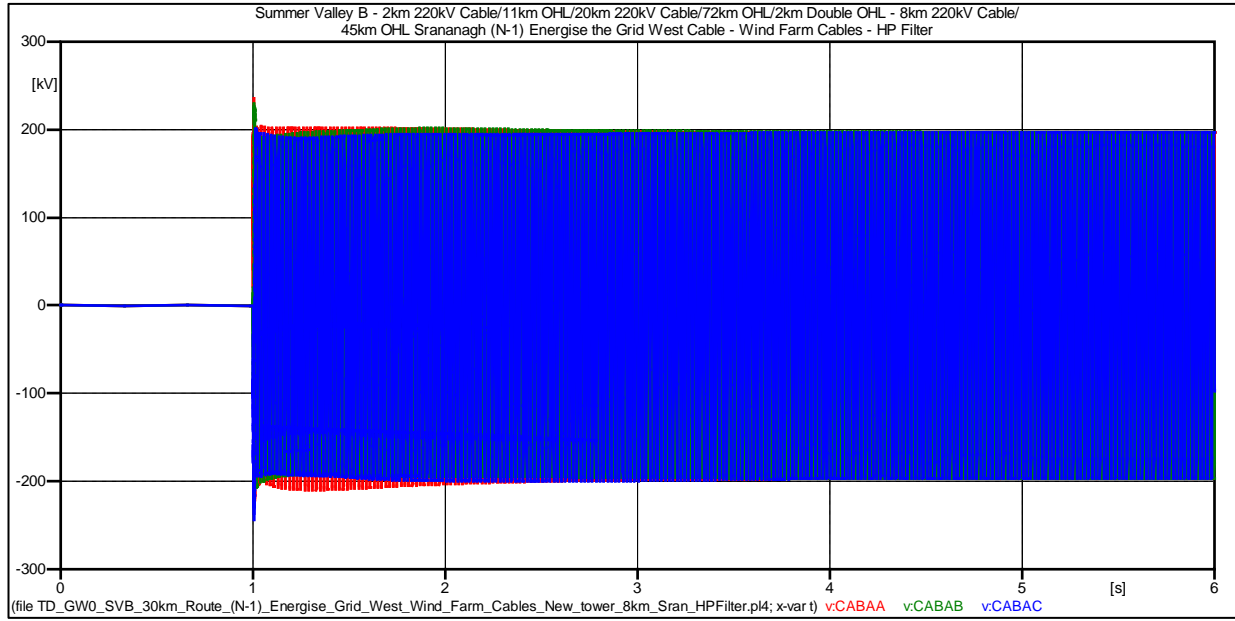
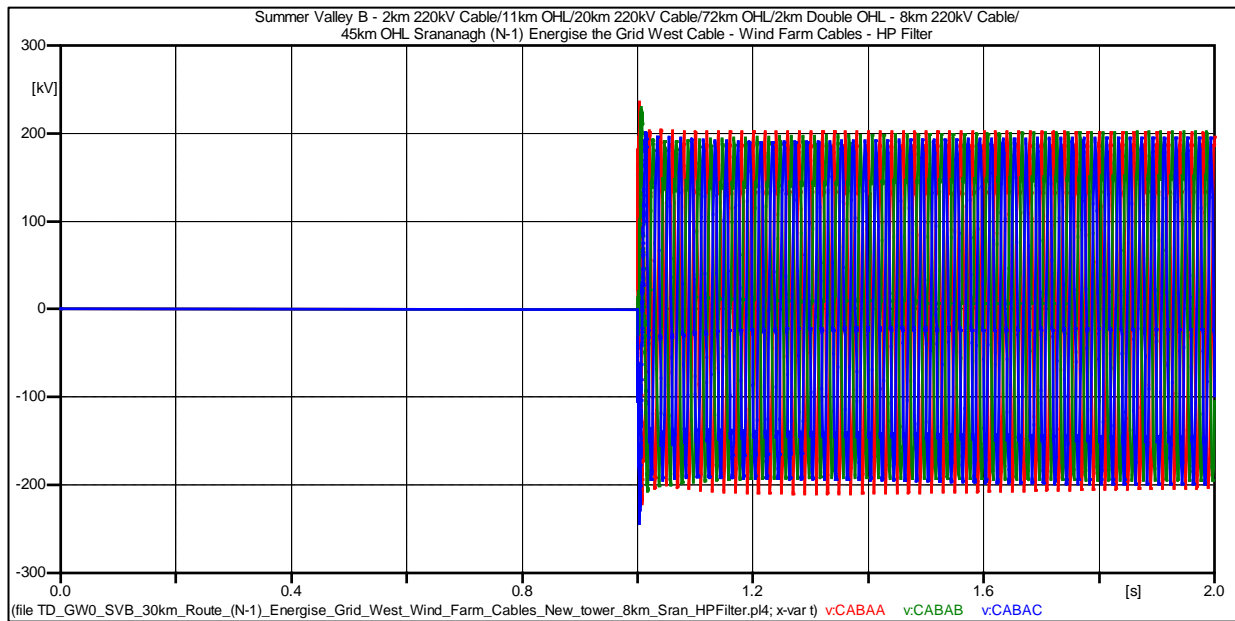


Figure 118: SVB - Length 30 km – Cable End B – Energise Grid West Cable (0-2s)

Condition	Maximum Value	Limit	Result
Switching	279.80 kV (1.5580 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	235.36 kV (1.3106 pu)	287.32kV (1.6pu)	Pass

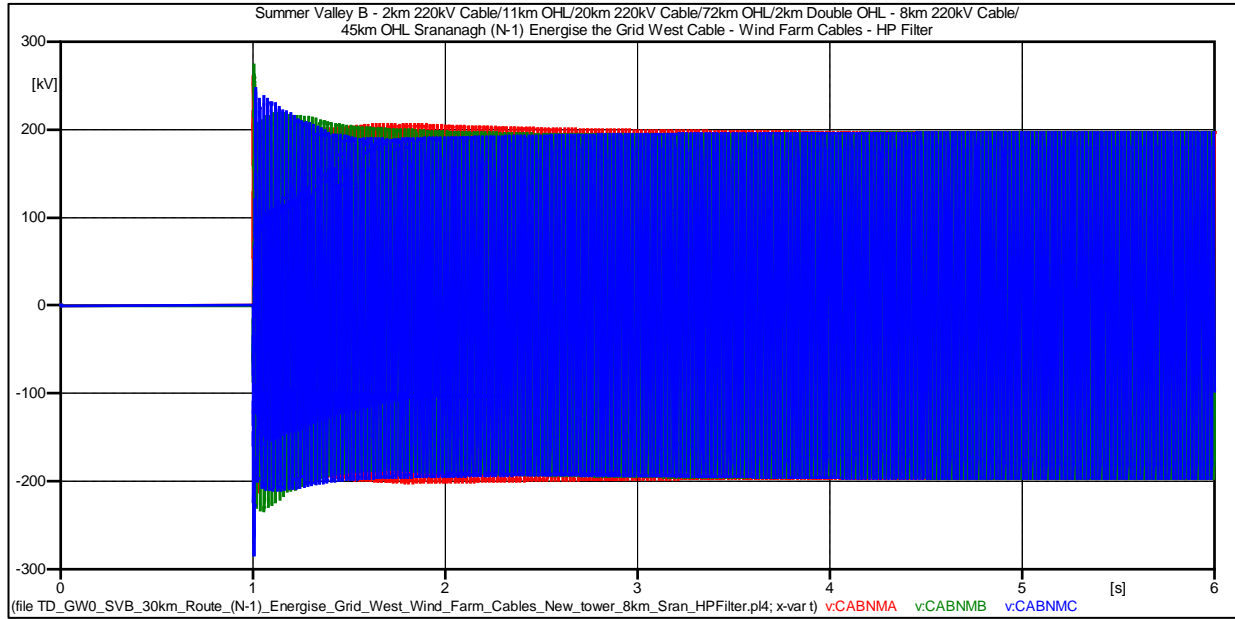


**Figure 119: SVB - Length 30 km – Cable End A – Energise Grid West Cable (0-6s)**

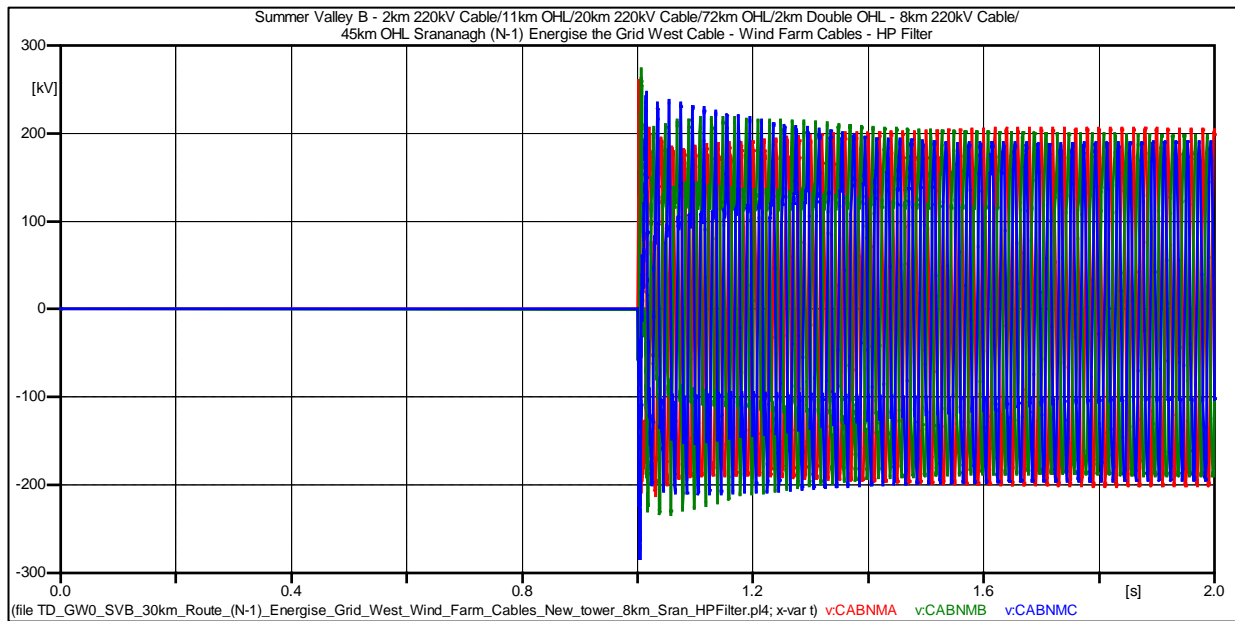


**Figure 120: SVB - Length 30 km – Cable End A – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	221.56 kV (1.2406 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	210.53 kV (1.1723 pu)	287.32kV (1.6pu)	Pass



**Figure 121: SVB - Length 30 km – North Mayo – Energise Grid West Cable (0-6s)**



**Figure 122: SVB - Length 30 km – North Mayo – Energise Grid West Cable (0-2s)**

Condition	Maximum Value	Limit	Result
Switching	283.89 kV (1.5808 pu)	449.07 kV (2.5 pu)	Pass
Temporary Overvoltage	231.75 kV (1.2905 pu)	287.32kV (1.6pu)	Pass