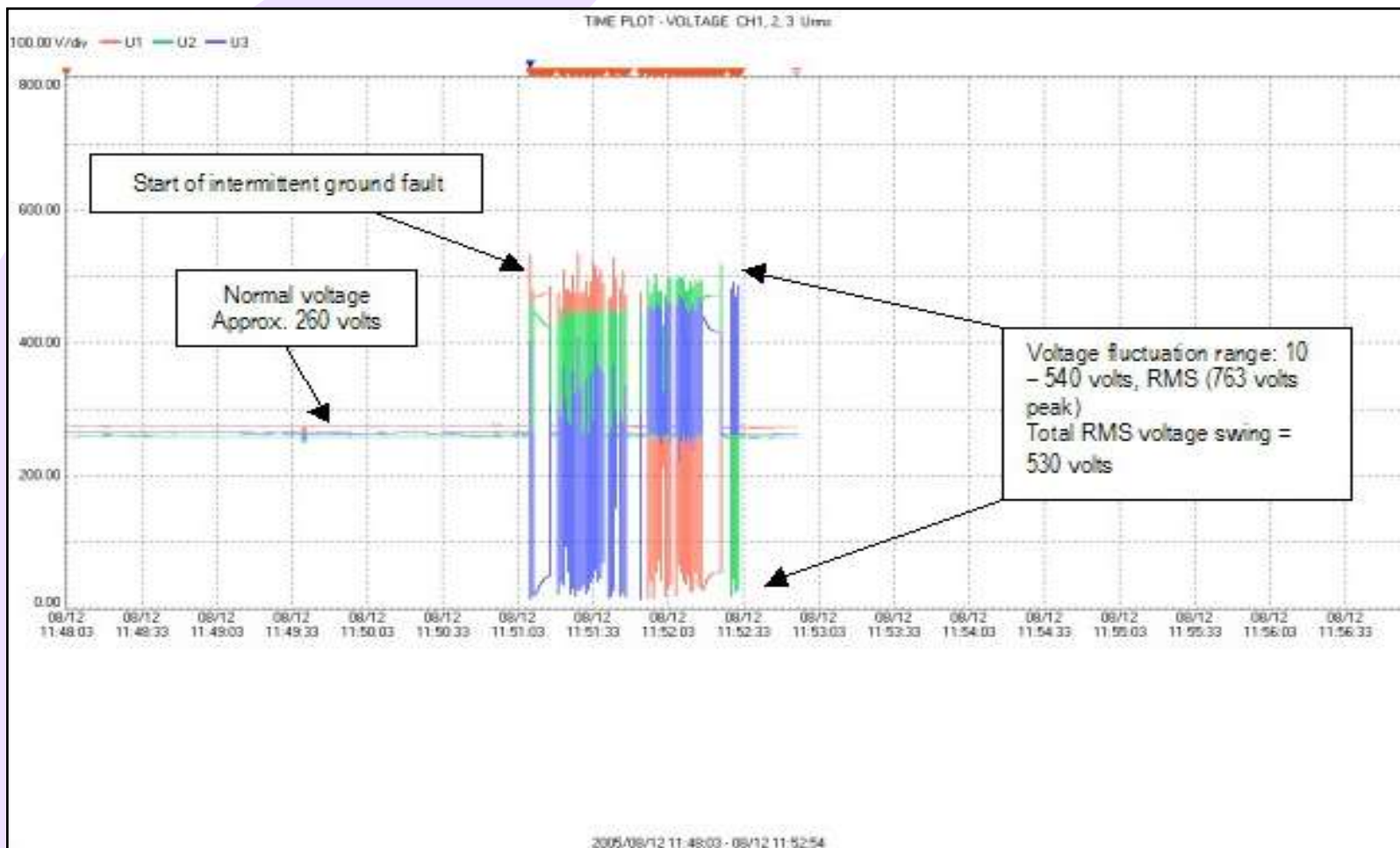


## *PQ Solution*

- **Leverage emerging technology, use passive voltage stabilizer, without active components**
- **Phaseback, electromagnetic voltage stabilizer unit made by Applied Energy, LLC**
  - Trial unit attached to 750-KVA, 450-volt, Delta wound shore tie transformer
  - Severe ground faults manually induced at ship's main electrical switchboard while on shore power
    - Using inductive shorting lead with positive temperature coefficient 51-ohms and 25 ohms cold resistance impedance
- **Initial tests 8/2005 to establish non-protected and protected voltage stability of ship power**

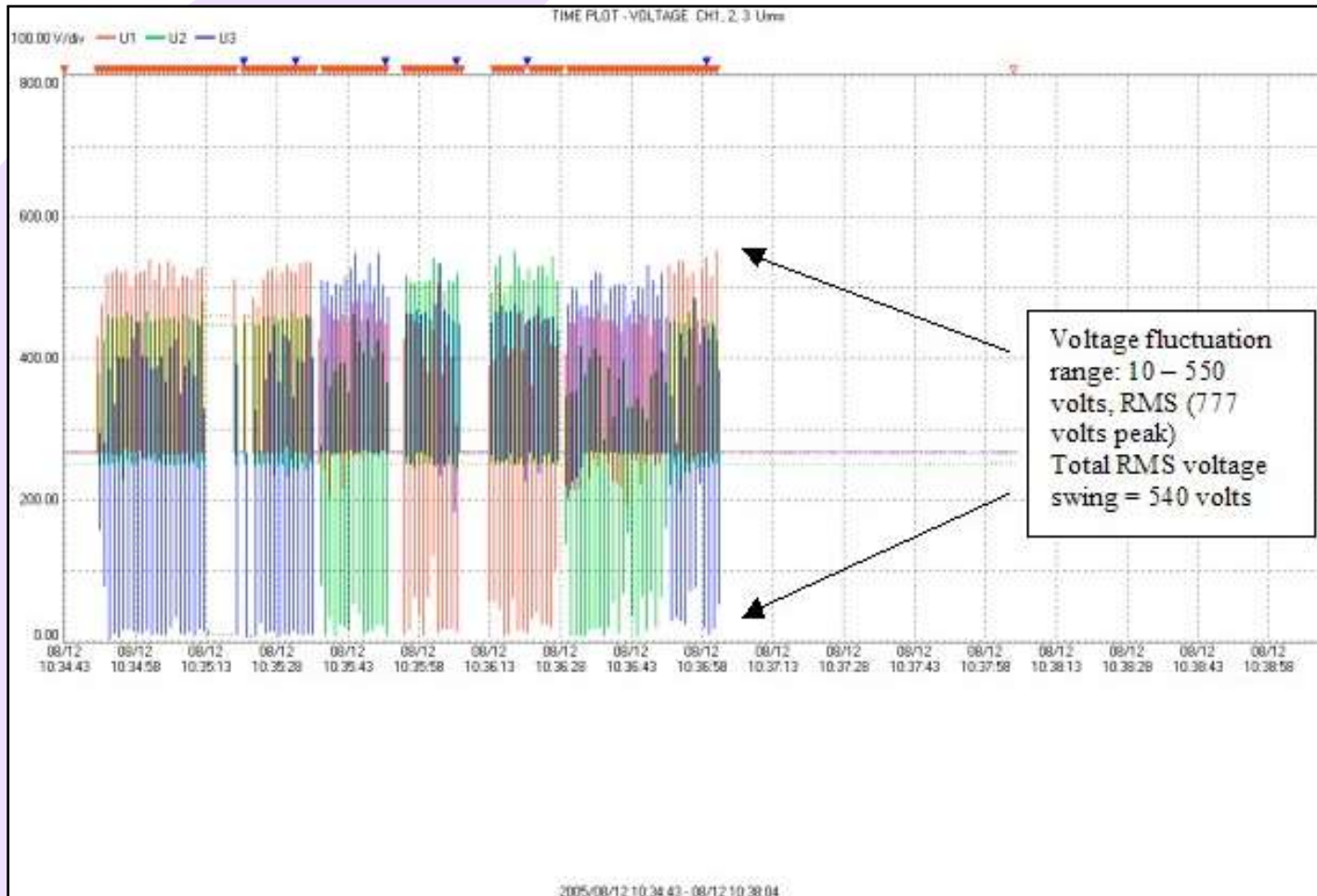
# 51-ohm Induced Ground Fault Without Voltage Stabilization



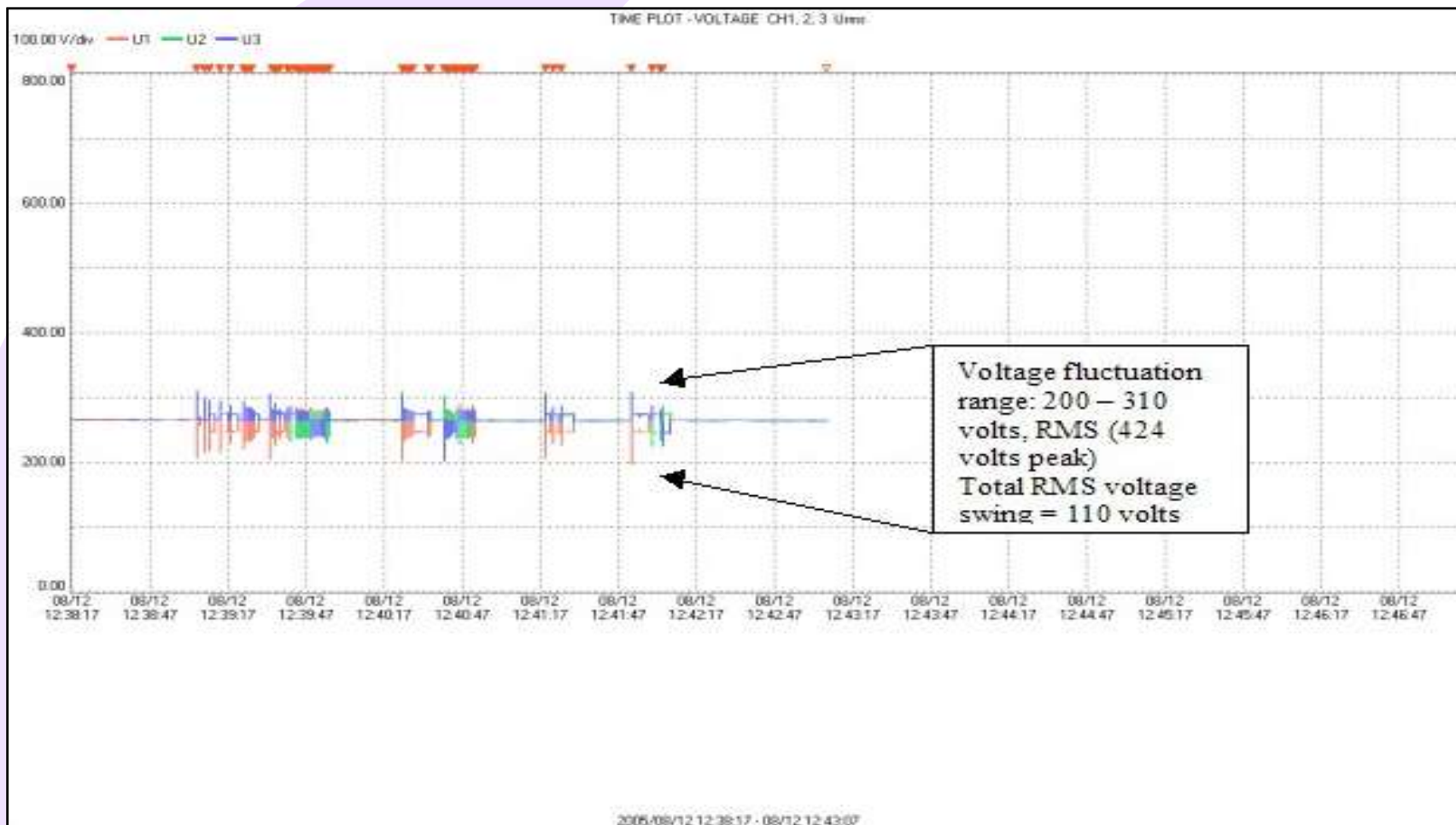
# 51-ohm Induced Ground Fault With Voltage Stabilization



# 25-ohm Induced Ground Fault Without Voltage Stabilization



# 25-ohm Induced Ground Fault With Voltage Stabilization

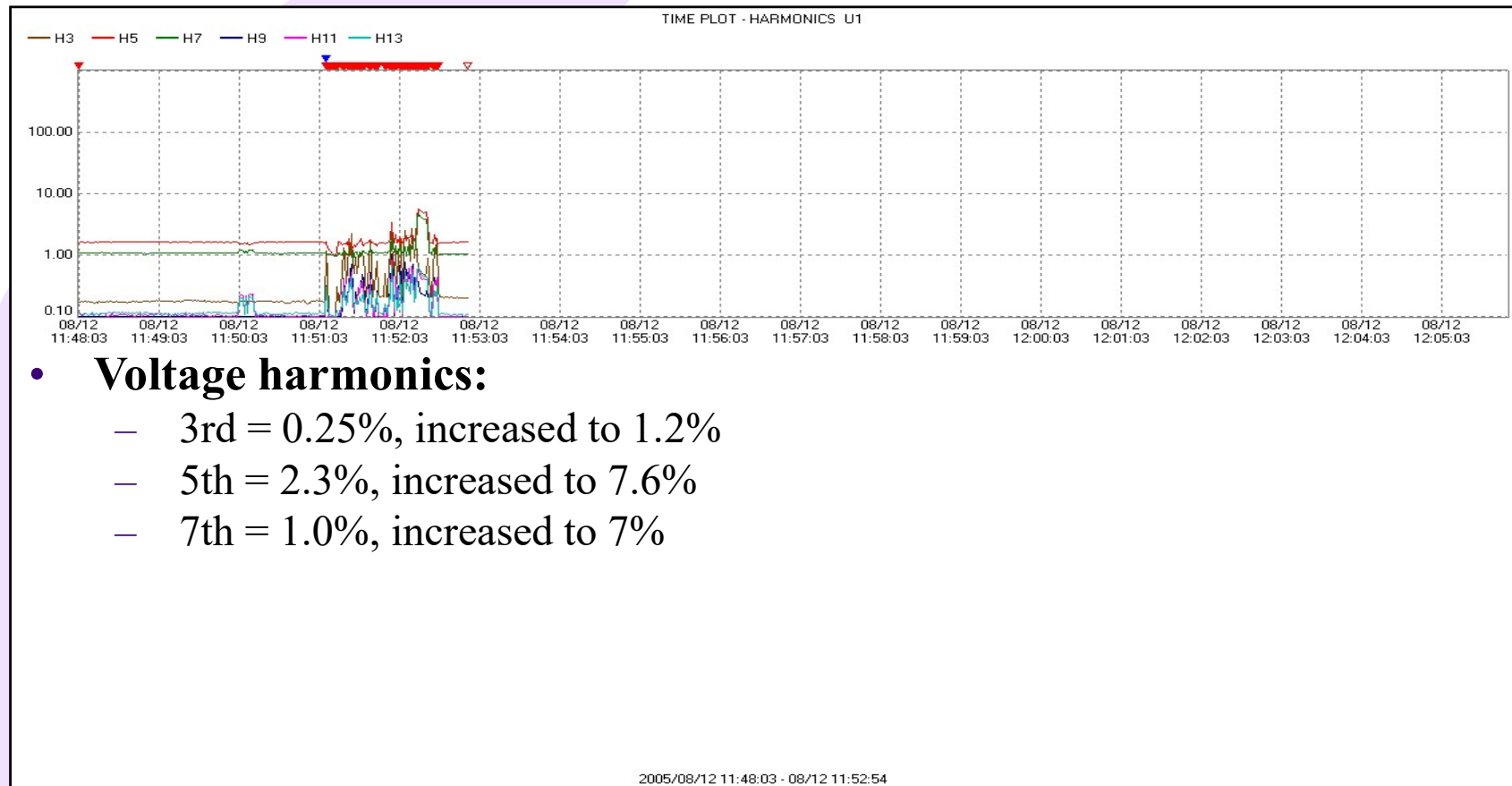


## *Ground Faults are a Harmonic Voltage Source*

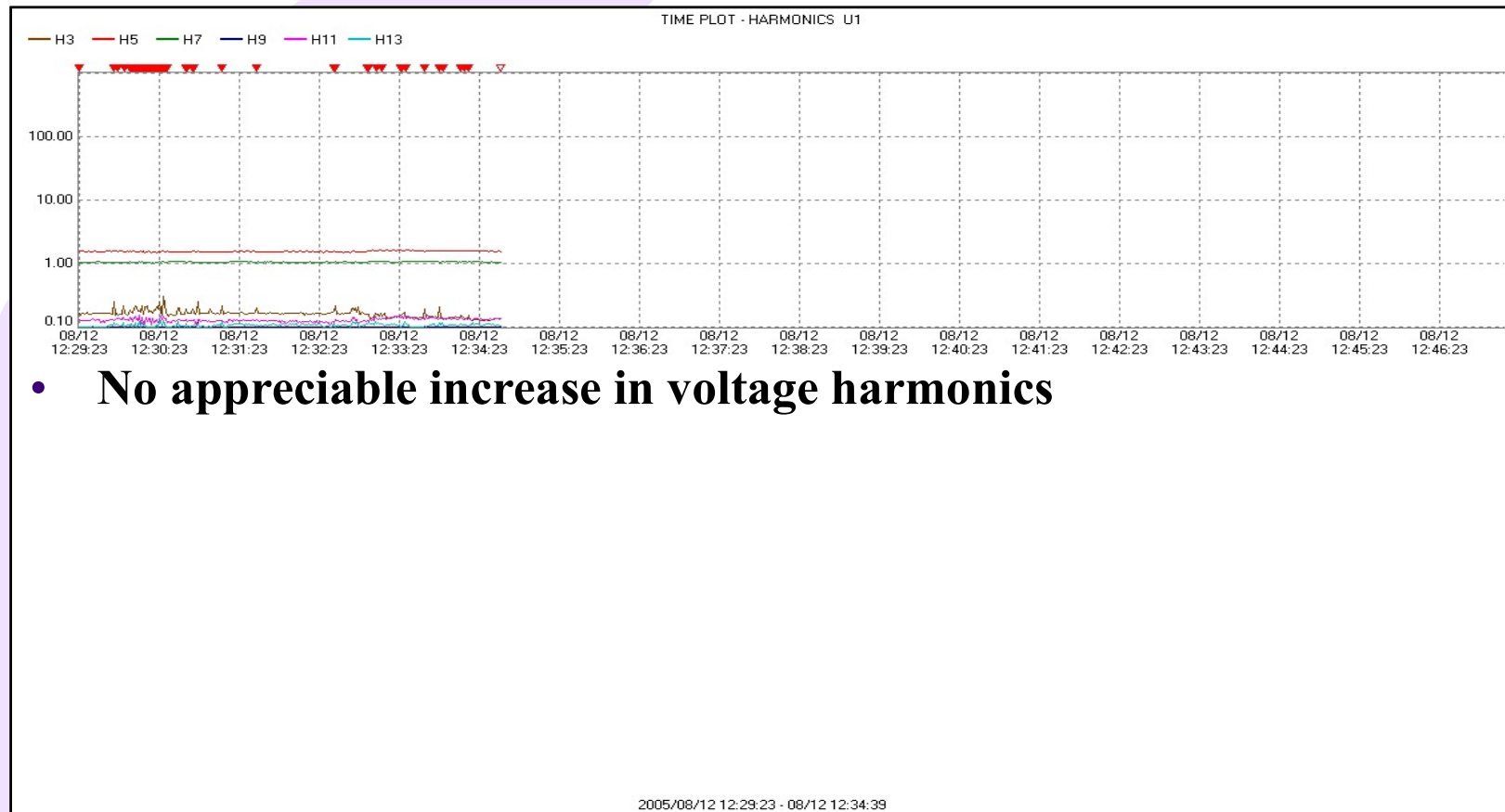
**Another issue related to ground faults is that of harmonics generated by the ground fault. When a ground fault appears on a voltage system, there is an appreciable increase in voltage harmonics. These harmonics tend to circulate among the connected loads where they generate additional heat.**



# Ground-Fault Harmonics Without Voltage Stabilization



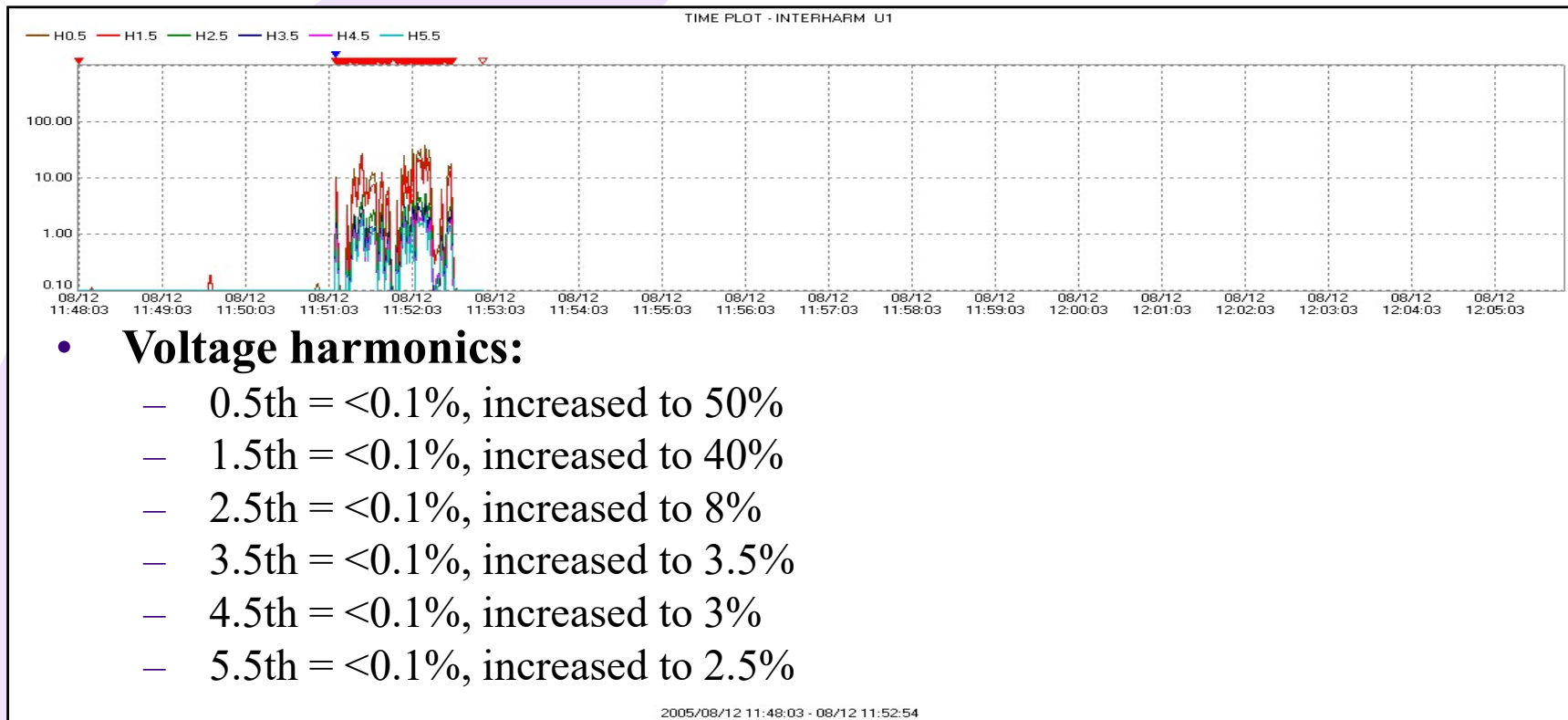
# Ground-Fault Harmonics With Voltage Stabilization



- **No appreciable increase in voltage harmonics**



# Ground-Fault Inter-Harmonics Without Voltage Stabilization



# Ground-Fault Inter-Harmonics With Voltage Stabilization

