Dranetz-BMI
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Uninterruptible Power Supply Commissioning Case Study

Introduction

The Uninterruptible Power Supply (UPS) is a key element to any critical facility. Due to the critical nature of UPS's they require very thorough testing during commissioning and at other times during their life cycle. Such testing can be conducted by major UPS manufacturers, service companies or end users. Testing includes putting the UPS through its paces by introducing various loads to the output and measuring the response of the UPS to the induced event. Fault recorders and strip chart recorders have been traditionally used for such testing. Even though some testers are still using paper tape recorders, their long recording time was preferred to record continuous AC waveforms on all phases both pre and post of the induced event. In addition some applications require harmonics and other specialized measurements that are not available in these instruments. Traditional Power Quality instruments have been used in parallel to complete the measurement set required. Recorded data from the different instruments is typically compiled and then used to determine if the UPS is performing to manufactures and customer design specifications. Results are often provided to the customer in a form of a final report and included in site acceptance. This can be a laborious process when multiple instruments are used that oftentimes provide paper tape readouts.

Traditional Power Quality (PQ) instruments historically have not been chosen for UPS commissioning applications due to their limited memory. Although they measure the harmonics and other PQ parameters required, they simply did not have the ability to record the long continuous pre and post event capture required by the industry for such applications. However, a new breed of PQ instruments from Dranetz-BMI now provides all of the features required for such testing in one instrument. The PowerXplorer PX5 and sister product, PowerGuide 4400 have standard Fault Recorder and Current Inrush modes built in that were specifically designed for such applications. The 4400 and PX5 are both handheld, lightweight, battery powered instruments with a color touch screen user interface. The user can set up the test and view measured data using the instruments built-in PDA like user interface. Data is recorded directly to compact flash (CF) memory for easy upload to the PC for archiving or analysis using the industry leading DranView software.

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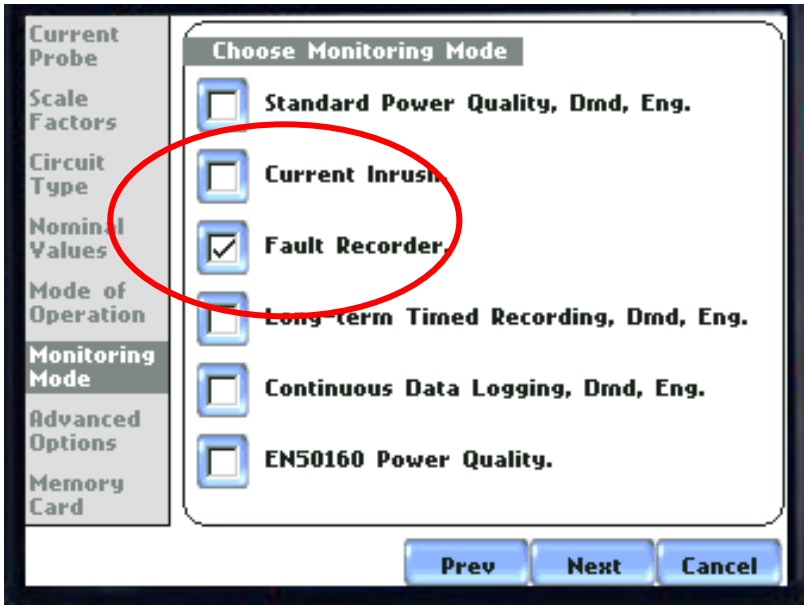

Figure 1 4400/PX5 Monitoring Mode's

These two operating modes are very similar with Fault Recorder mode defaulting to voltage based triggers and Current Inrush mode defaulting to current based triggers. The user has full control over the settings and has the ability to trigger on any channel and can easily mix current and voltage triggers to suit the application. Both instruments have the capability to record up to 10,000 (166 seconds) continuous post event AC cycles on each V&I channel which is more than adequate for UPS application. In addition, a high base sampling rate of 256 samples/cycle provides very detailed and high resolution recording in order to detect even the slightest perturbations in waveshape. This is in addition to all of the PQ features customers expect from Dranetz-BMI products such as waveshape, harmonics, power/demand/energy, and high speed transient capture (PX5 only). Powerful DranView software provides easy to use PC reporting and analysis. The user can zoom into any data of interest and compare it to any other channel recorded for fast data analysis. The built-in report writer can automatically (or manually) produce a report summarizing the data captured. If the user wishes to create their own report data can be easily copied and pasted into any PC application such as Microsoft Word.

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Figure 2 PowerXplorer PX5 (blue) and PowerGuide 4400 (orange).

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UPS Case Study

A major UPS manufacturer purchased a PowerXplorer PX5 for UPS testing. In the past they used a fault recorder combined with a Dranetz-BMI PQ instrument to conduct their testing. The PX5 was chosen as a modern replacement as it has all of the required capabilities in one easy to use handheld instrument. In addition to UPS testing, it gives their technicians a full-featured PQ instrument for use in field troubleshooting and service applications.

A typical UPS startup/commissioning for this manufacturer includes the following tests:

- Load transient testing
  - 0%-25%-0%
  - 0%-50%-0%
  - 0%-75%-0%
  - 0%-100%-0%
- Transfers to bypass
- Transfers to backup generators
- Harmonics evaluation

Below are some actual waveforms and RMS trends captured from a recent customer site commissioning. The PX5 voltage and current channels were directly connected to phases A, B and C of the UPS output to record the UPS response to induced events during testing. The PX5 can trigger on any voltage or current channel (phase A, B, C, Neutral) and can directly trigger on any step load (transient) or other event applied to the UPS. However, the customer chose to use channel D of the PX5 as the trigger source which was configured to trigger on a change in current. This was done to provide an independent trigger channel that can be used on other points in the system during certain parts of the testing such as in the bypass and emergency transfer tests shown below.

Below are some sample waveforms and RMS trends from the successful site commissioning. The data, which is shown in DranView was easily included in a final report to the customer as evidence of the successful installation of the UPS.

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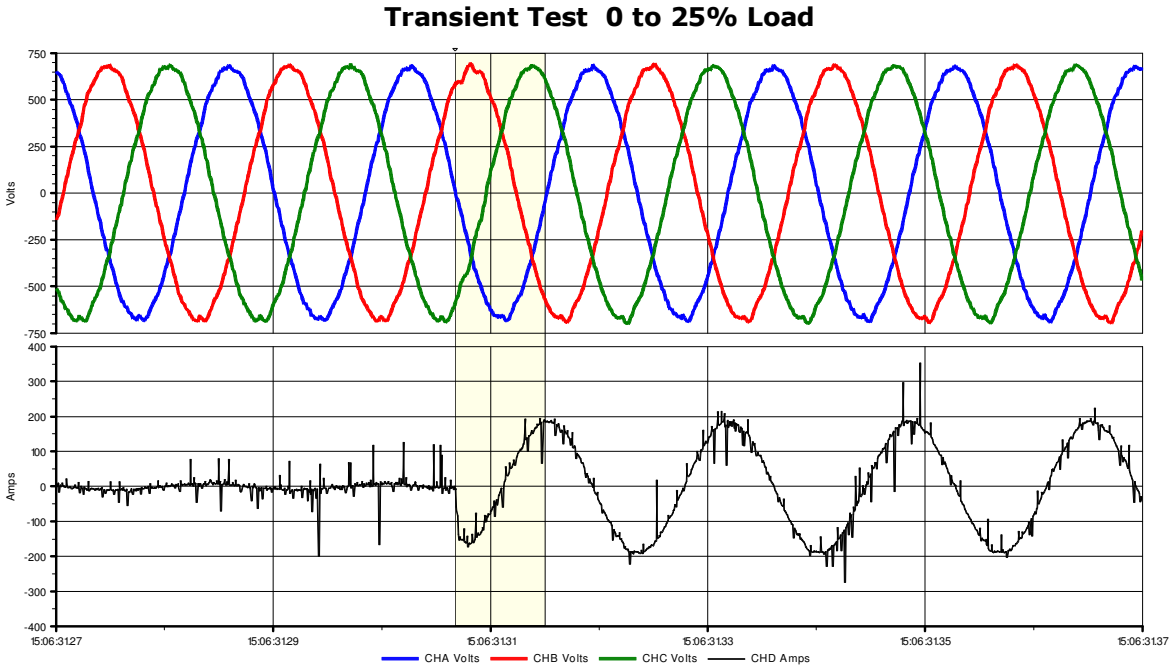

Channel D Amps = Output Current Phase C

Figure 3. 0% to 25% Load Test AC Waveforms

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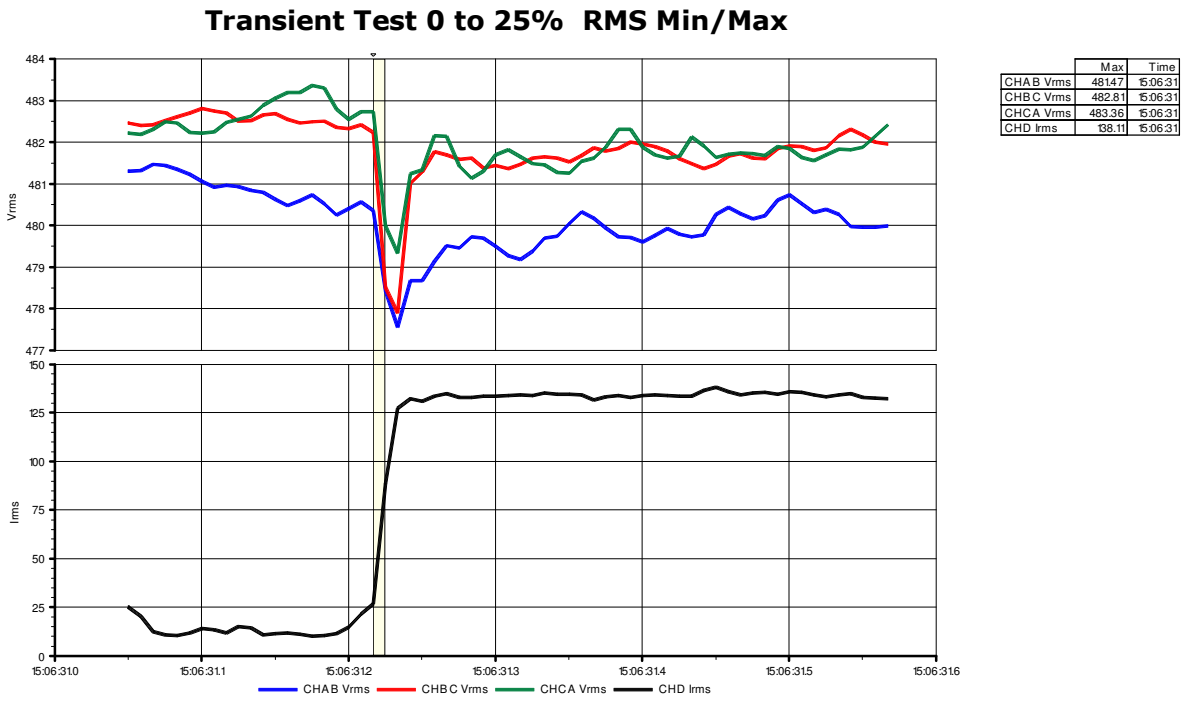

Channel D Irms = Output Current Phase C

Figure 4. 0% to 25% Load Test RMS Trend

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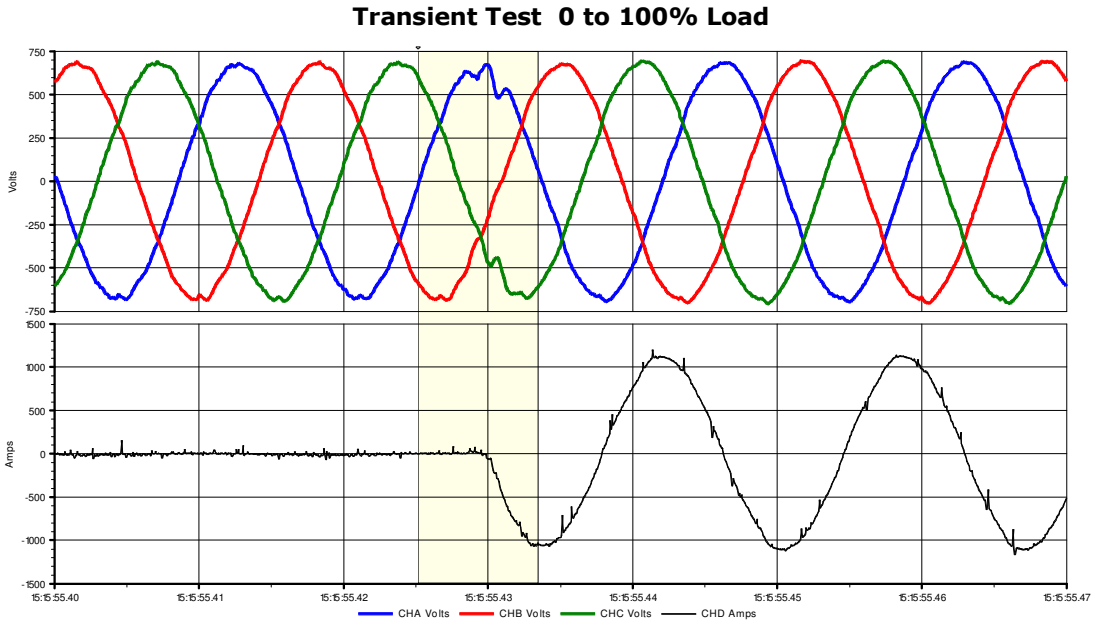
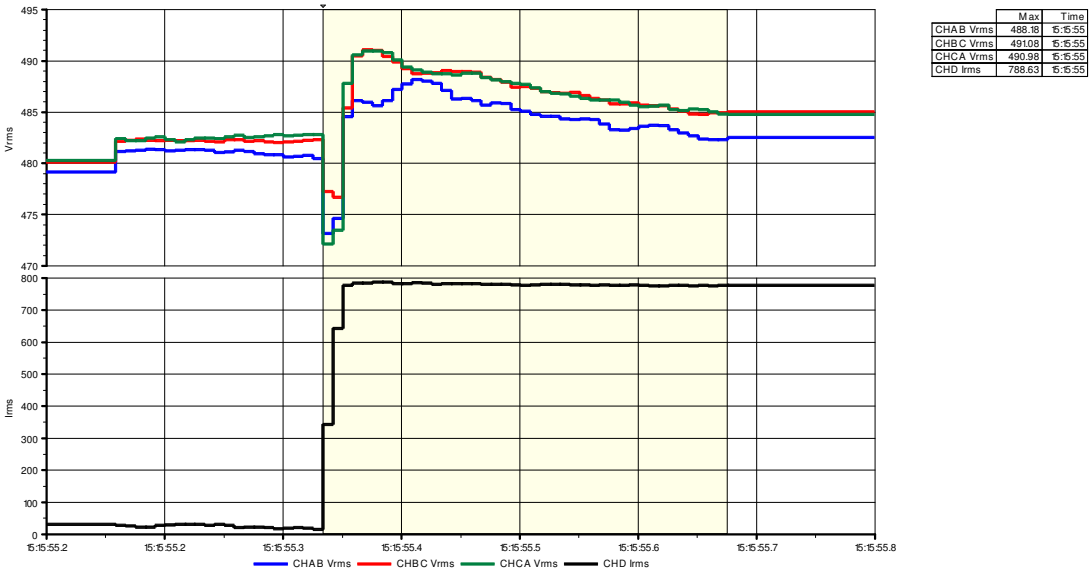


Channel D Amps = Output Current Phase C

Figure 5. 0% to 100% Load AC Waveforms



	Max	Time
CHAB Vrms	488.18	15:15:55
CHBC Vrms	491.08	15:15:55
CHCA Vrms	490.98	15:15:55
CHD Irms	788.63	15:15:55

Channel D Irms = Output Current Phase C

Figure 6. 0% to 100% Load RMS Trend

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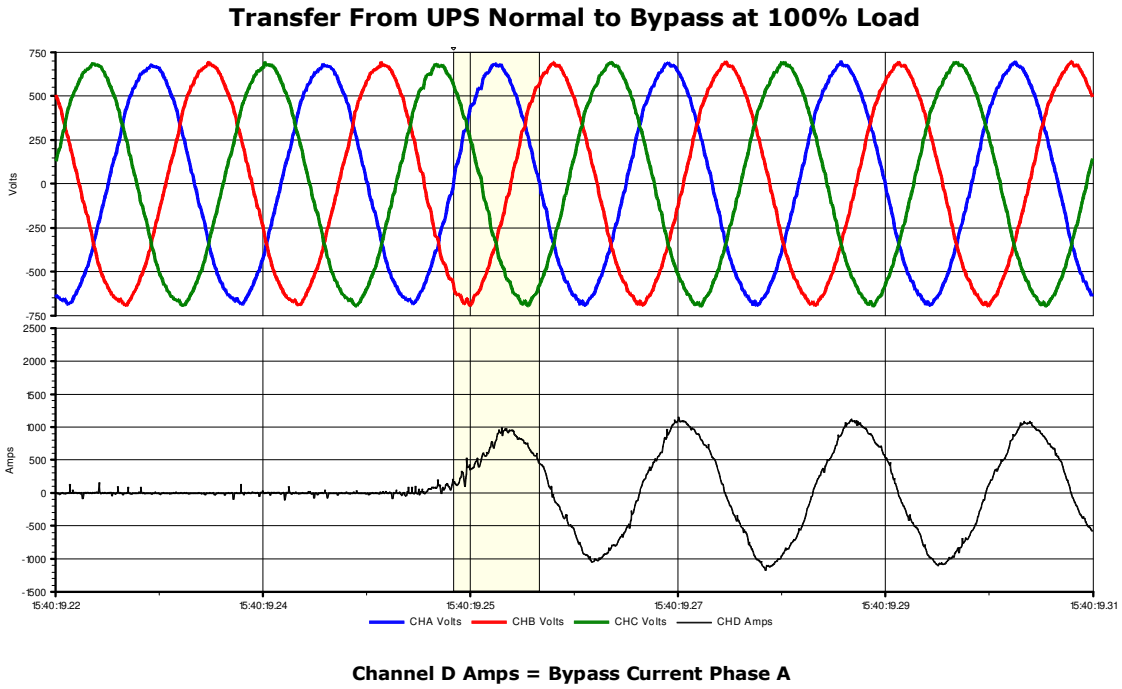

Figure 7. Transfer From UPS to Bypass at 100% Load AC Waveforms

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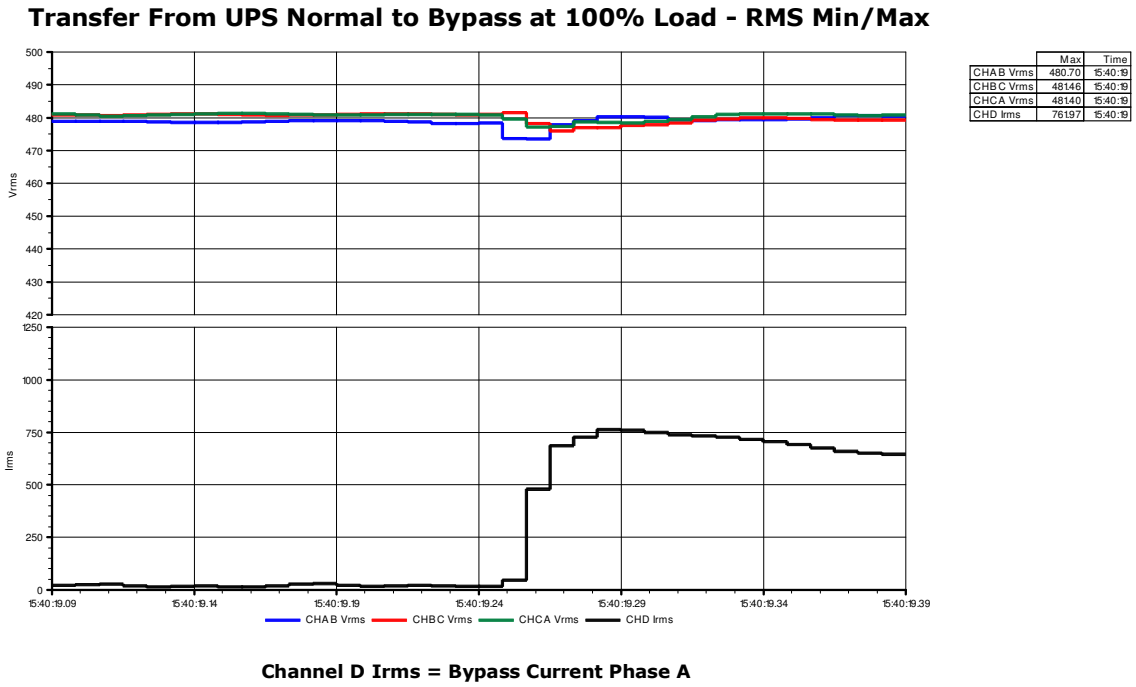

Channel D Irms = Bypass Current Phase A

Figure 8. Transfer From UPS to Bypass at 100% Load RMS Trend

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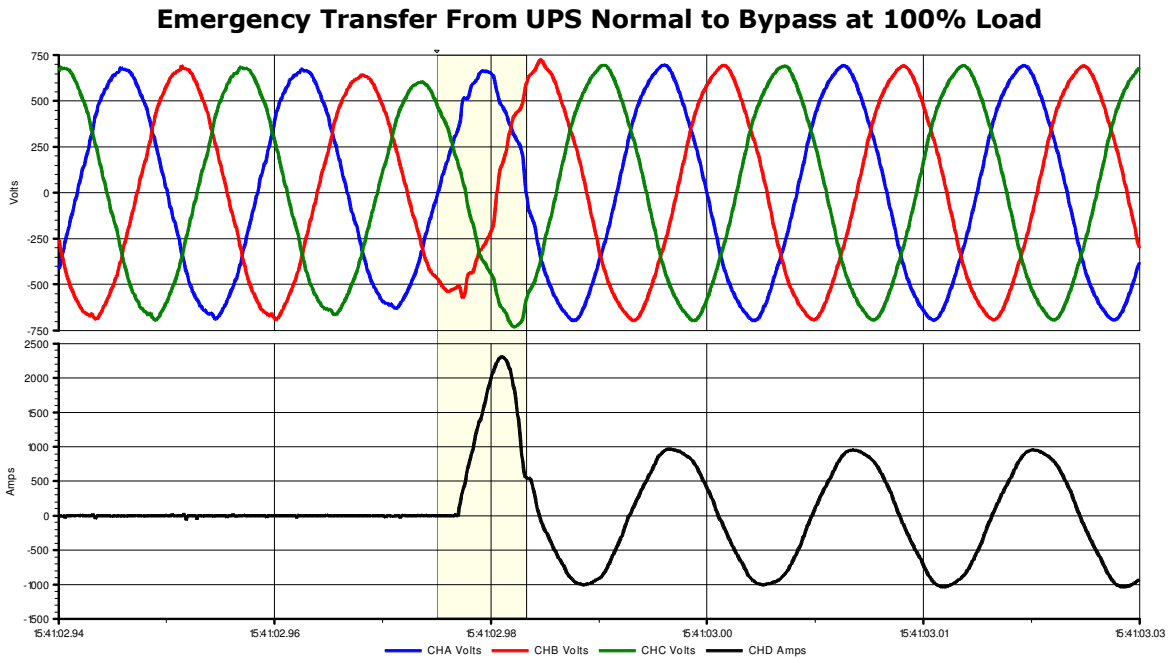

Figure 9. Emergency Transfer From UPS to Bypass AC Waveforms

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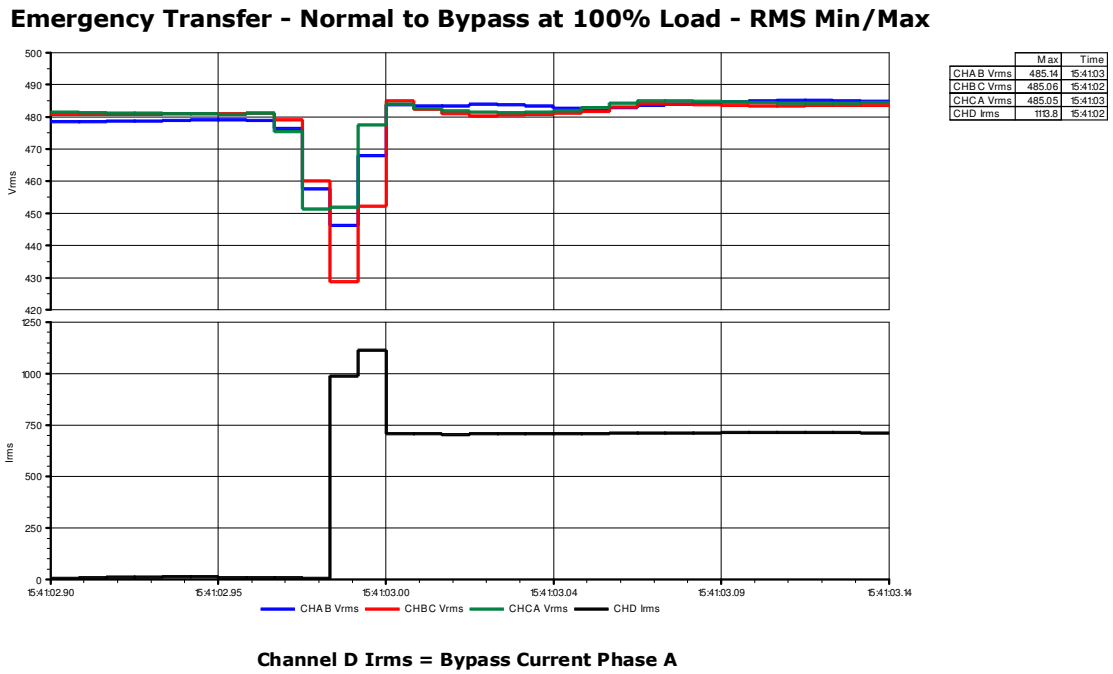

Figure 10. Emergency Transfer From UPS to Bypass RMS Trend