

# Performance Testing of the ULTRA device



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## I. Executive Summary

Ultra device (US Pat. App 12596666 - Filed 24 Apr 2008) [1] is a passive device and named as “device for saving power”. Griffith University was requested by a local distributor, UltraEnergy Australia to investigate Ultra devices performance and provide an independent test report.

The investigation was carried out at Power Electronic and Magnetics research Lab, Griffith School of Engineering, Griffith University, and several Ultra devices provided by UltraEnergy Australia were tested under certain conditions by following Ultra devices user guide. Table 1 shows testing items and Ultra devices used for the test.

**Table 1 Testing items and Ultra devices**

Test	Input Power ratings (Labelled)	ULTRA device used
1. Small fridges (HAIER-HBF130WWH)	120 Wx3	0.5 KVA
2. ROYCE three-phase compressor	7 KVA	10 KVA
3. TECO Three-phase induction motor	5.5 KW	5KVA

Two technical reports were completed and submitted to UltraEnergy Australia in May, 2011 and December, 2012 respectively. These technical reports provided with detailed information related to the electrical performance of Ultra devices with several different loads and power ranges. These reports also included testing methods and equipment that were used for ULTRA test. All measured results and data records can be found from those full reports [2,3]. The comparison of power consumptions from the testing results can be found from Table 2.

**Table 2. Comparison of power consumptions (kWh) based on the testing results**

	Power consumption (48 hours) Fridges test	Power consumption (48 hours) Three-phase Compressor test	Power consumption (72 hours) Three-phase TECO test
<b>Without ULTRA</b>	7.443 (KWH)	58.33(KWH)	11.16(KWH)
<b>With ULTRA</b>	7.255 (KWH)	54.62(KWH)	10.61(KWH)
<b>Power Saving</b>	2.53%*	6.36%	4.93%

\* Fridge test was carried out under the closed door condition which was in a fairly constant environment regarding temperature and operated in the low power consumption condition.

In addition, the harmonic measurement has been also carried out. The harmonic suppression is presented from testing results. The waveform of Harmonics Distortion in Voltage with and without Ultra in use is also illustrated in this summery report. The detailed Harmonics Distortion can be found in the technical report [3].

## II. Introduction

ULTRA, designed by Keseco in South Korea and distributed in Australia by UltraEnergy Australia, is claimed to be the world's first product to deliver savings through current improvement technology. Ultra "device for saving power" has stated in US patent application [1] that is: " A device for saving electric power of the present invention comprises a case body; a tourmaline intermediate layer accommodated in the case body, which is a mixture layer of tourmaline power, permanent magnet power and moisture (HO); ionization plates respectively positioned on upper and lower surfaces of the tourmaline intermediate layer interposed there between in the case body; and a conductive plate embedded in the tourmaline intermediate layer".

UltraEnergy Australia approached Griffith University and requested us to carry out independent tests to evaluate the performance of the Ultra device in single and three phase circuits. The test circuits were designed by Griffith and then the Ultra devices were sized and provided by UltraEnergy Australia.

Each of the test circuits consisted of a voltage regulator, digital power meters, data logger, KWH meters and a load source. In the single phase tests, three fridges were used as the load sources, whereas a three phase compressor and motor was used in the three phase test. This report presents the summary of the findings of the tests that was carried out. The detailed information about the experiment can be found in GU full Report 1 [2] which was provided in May, 2011 & the Report 2 [3] in December, 2012. Testing items are illustrated in Table 1:

**Table 1 Device under test (DUT) items list**

Test	Input Power ratings (Labelled)
1. Fridges (HAIER- HBF130WWH)	120 W *x3
2. ROYCE three-phase compressor	7 KVA
3. TECO Three-phase induction motor	5.5 KW

Note: \* Each Item

## III. Measurement Requirements of Ultra Device

Table 2 shows required DUT and Ultra devices under natural indoor environment.

**Table 2 Measurement requirements of Ultra devices**

Test	ULTRA device used
1. Three small fridges (HAIER- HBF130WWH)	0.5 KVA
2. ROYCE three-phase compressor	10 KVA
3. TECO Three-phase motor	5KVA

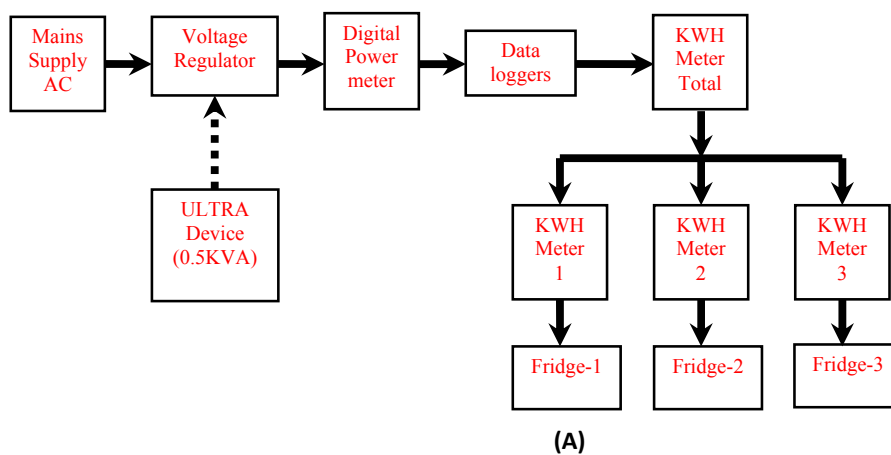
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➤ **Testing equipment used for the measurement**

1. Automatic voltage regulator (APC Line-R LE1200I)
2. Single phase digital power meter (YOKOGAWA WT210) [Basic power accuracy: 0.1%]
3. Kilowatts hour (KWh) meter (MS6115)[ Power accuracy: +/-4% or +/-10W]
4. Three-phase digital power meter (YOKOGAWA WT230)[ Basic power accuracy: 0.1%]
5. Accuenergy IIR data logger (Single and three-phase)[ Accuracy:0.2% ]
6. Jumbo Display Thermometer-Hygrometer (IC7312)[Accuracy:  $\pm 1^{\circ}\text{C}$ ,  $\pm 1.8^{\circ}\text{F}$ ]
7. Humidity and Temperature USB Data logger (DIGITECH QP-6013)[Accuracy:  $\pm 1^{\circ}\text{C}$ ,  $\pm 3.5^{\circ}\text{F}$ ]

**IV. Measurement Set-Up**

Figure 1 -3 show the block diagram of testing circuit for Fridges with 0.5KVA ULTRA device, three- phase motor test with & without 5KVA ULTRA device, and three-phase compressor test with & without 10 KVA ULTRA device. The detailed testing circuit diagrams can be found in technical reports [2-3].

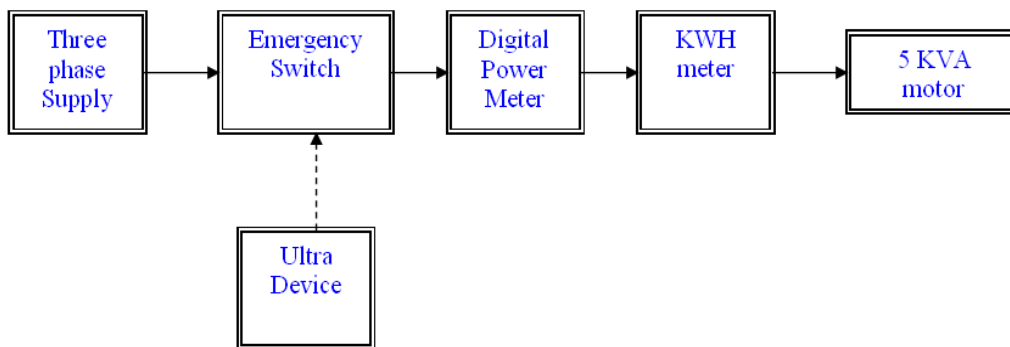


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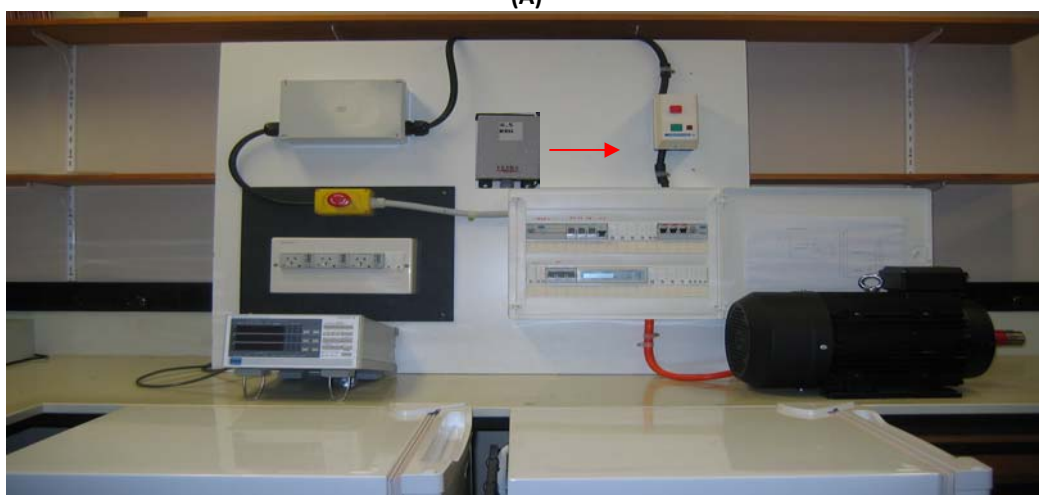


(B)

Fig.1 (A) & (B) Measurement set-up for Fridges with 0.5KVA ULTRA device

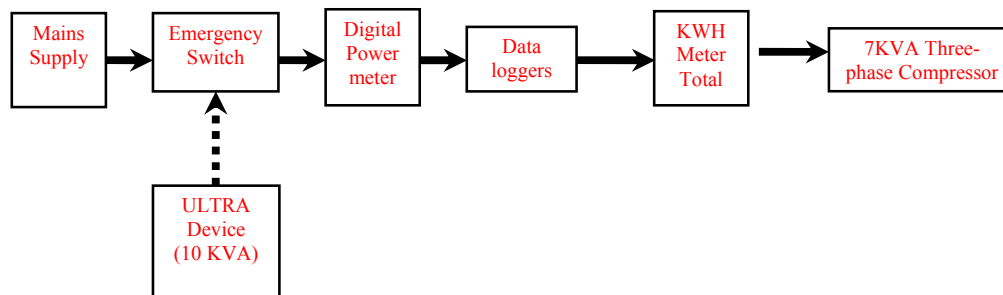


(A)



(B)

Fig.2 (A) & (B) Measurement set-up for three- phase test with & without 5KVA ULTRA device



(A)



(B)

Fig.3 (A) & (B) Measurement set-up for three- phase compressor test with & without 10 KVA ULTRA device.

## V. Testing Results with and without Ultra Device

### 1. Real-time electrical parameter measurement

The following measurement results were obtained from YOKOGAWA WT210 (single phase digital power meter, Basic power accuracy: 0.1%) and YOKOGAWA WT230 (Three phase digital power meter, Basic power accuracy: 0.1%). The detailed measurement record can be found from the Technical report [2]. From Table 3(A) and (B) to Table 5, one can find that the difference between all electrical parameters with and without Ultra is very small.

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**Table 3 (A) Three fridges test measurement results with 0.5 KVA ULTRA**

Record Num	Time	Volts AB	I A	Watt A	VAR A	VA A	PF Total
2	11/5/2011 16:12:07	241.71	1.6668	0.22658	0.32979	0.40085	0.565
289	11/6/2011 16:07:07	241.09	1.6352	0.21441	0.32819	0.39272	0.546
572	11/7/2011 15:42	241.03	1.6467	0.21656	0.32801	0.39466	0.549

**Table 3 (B) Three fridges test measurement results without ULTRA**

Record Num	Time	Volts AB	I A	Watt A	VAR A	VA A	PF Total
1	11/2/2011 16:04	242.48	1.6276	0.20943	0.33142	0.39331	0.532
289	11/3/2011 16:14	242.29	1.6471	0.2176	0.33151	0.39797	0.547
573	11/4/2011 15:54	242.54	1.6467	0.21647	0.33235	0.3979	0.544

**Table 4 (A) Three-phase motor measurement results with 5 KVA ULTRA**

Reading No	1		2	
	Line	$\Sigma$	Line	$\Sigma$
Voltage(V)[V Line]	423		423	
Current(A)[I Line]	1.47		1.49	
Instant Power(KW)		.363		.362
VA(KAVA)		.620		.635
VAR(KAVR)		.503		.511
PF Total		0.581		0.567
Angle	G54.6		G54.1	

**Table 4(B) Three-phase motor measurement results without ULTRA**

Reading No	1		2	
	Line	$\Sigma$	Line	$\Sigma$
Voltage(V) [V Line]	422		421	
Current(A) [I Line]	1.50		1.41	
Instant Power(KW)		.367		.353
VA(KAVA)		.634		.623
VAR(KAVR)		.513		.510
PF Total		0.59		0.58
Angle	G53.6		G54.5	

**Table 5 (A) Three-phase Compressor measurement results with 10 KVA ULTRA**

Reading No	1				2			
	A	B	C	$\Sigma$	A	B	C	$\Sigma$
<b>Phase</b>								
<b>Voltage(V)</b>	243	246	246		244	242	243	
<b>Current(A)</b>	7.36	7.79	7.52		7.57	7.91	7.68	
<b>Instant Power(KW)</b>	.857	.831	.849	2.59	.820	.810	.941	2.77
<b>VA(KVA)</b>	1.82	1.94	1.89	5.54	1.82	1.93	1.98	5.77
<b>VAR(KVR)</b>	1.57	1.69	1.67	4.99	1.65	1.74	1.68	5.13
<b>PF Total</b>	.481	.482	.489	.494	.483	.478	.489	.484

**Table 5(B) Three-phase compressor measurement results without ULTRA**

Reading No	1				2			
	A	B	C	$\Sigma$	A	B	C	$\Sigma$
<b>Voltage(V)</b>	243	248	247		242	244	245	
<b>Current(A)</b>	7.5	7.95	7.87		7.52	7.75	7.83	
<b>Instant Power(KW)</b>	.854	.854	.926	2.63	.852	.910	.980	2.69
<b>VA(KAVA)</b>	1.86	2.02	1.94	5.84	1.87	1.95	1.87	5.53
<b>VAR(KAVR)</b>	1.71	1.81	1.71	5.09	1.64	1.72	1.67	4.86
<b>PF Total</b>	.507	.484	.498	.506	.50	.486	.51	.501

## 2. Power consumptions (kWh) measurement,

Table 6 illustrates a comparison of testing results, where the data was obtained from meter (Kilowatts hour (KWh) meter (MS6115) [Power accuracy: +/-4% or +/-10W]) for three single fridges and data logger meter (Accuenergy IIR data logger (Single and three-phase) [Accuracy: 0.2%]). Detailed measurement results and analysis can be found from technical reports [2-3].

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**Table 6 Comparison of power consumptions (kWh) measurement**

	Power consumption (48 hours) Fridges test	Power consumption (48 hours) Three-phase Compressor test	Power consumption (72 hours) Three-phase Compressor test
<b>Without ULTRA</b>	7.443 (KWH)	58.33(KWH)	11.16(KWH)
<b>With ULTRA</b>	7.255 (KWH)	54.62(KWH)	10.61(KWH)
<b>Power saving (%)</b>	2.53%	6.36%	4.93%

The comparison of real power demand can be seen in Fig. 4 where the data was obtained from Accuenergy IIR data logger.

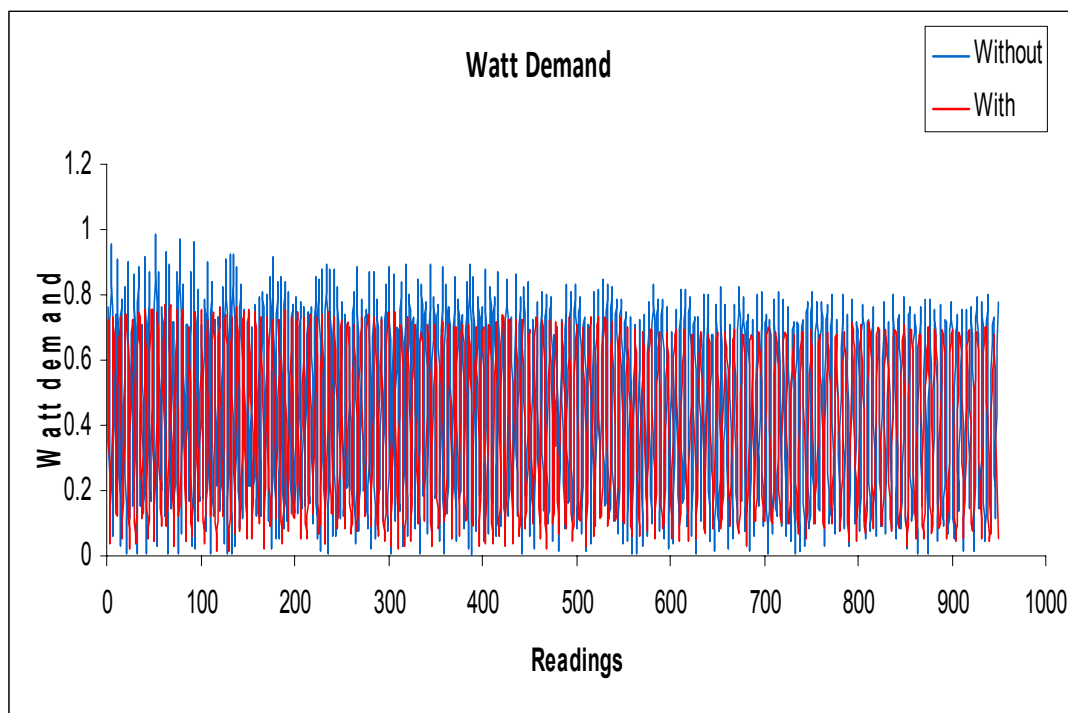


Fig. 4. Comparison of real power demand.

### 3. Harmonic measurements

In this investigation, the harmonic distortion was measured where the harmonic suppression is obvious. The waveform of Total Harmonics Distortion (THD) in Voltage from 3<sup>rd</sup> to 11<sup>th</sup> harmonics with and without Ultra in use is shown in Fig. 5. The harmonic suppression of third harmonic can be also seen in Fig. 6.

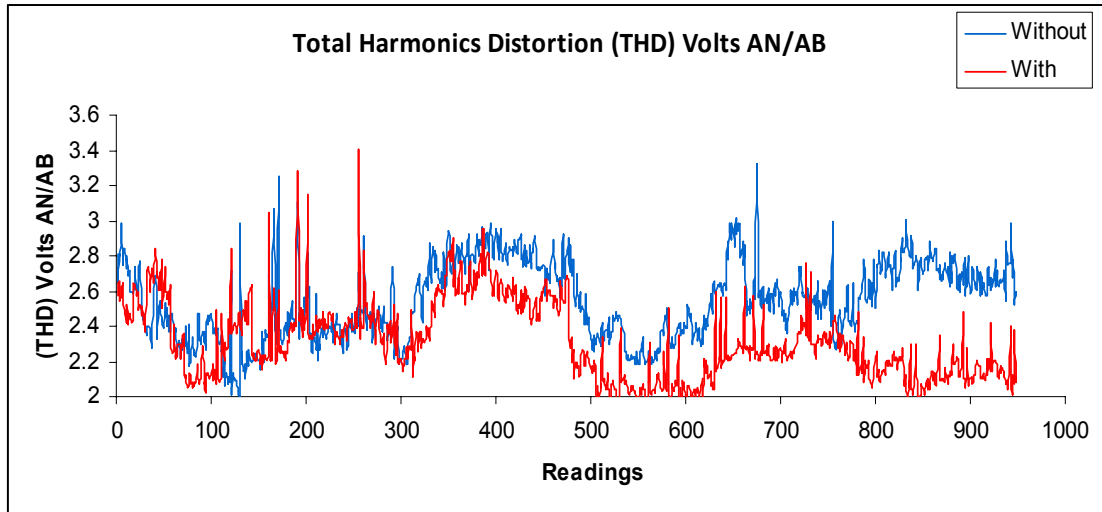


Fig. 5 Total Harmonics Distortion in Voltage from 3<sup>rd</sup> to 11<sup>th</sup> order (Odd)

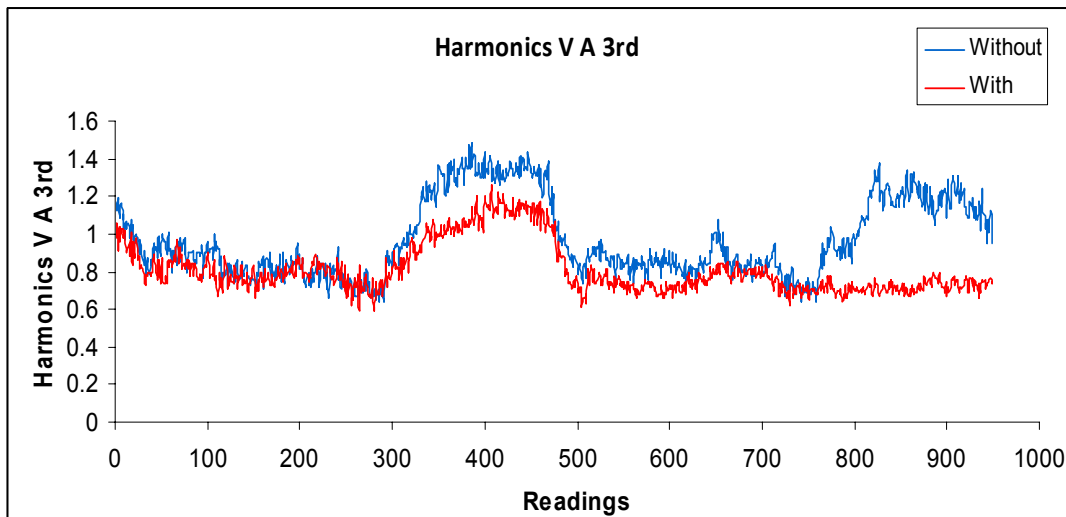


Fig. 6 3<sup>rd</sup> Harmonic Distortion

## VI. Conclusions

The ULTRA device tests were completed for single phase as well as three phase tests. All the tests were done at natural room temperature and humidity. For the fridges the power consumption in these tests was dependent on the room temperature and humidity at the time of the tests. From this test, it has been found that it consumed less which is 2.53 % with Ultra device compared to without ultra device as per our measurement results. The three phase compressor test was run with and without Ultra

A summary report: Performance Testing of the ULTRA device connected in 48 hours format by setting-up 50-50 cycle which means it runs 2 minutes in ON condition and stop for 2 minutes in OFF condition while it releases air. From the measurement result, it has been found that it consumed 6.36 % less with Ultra device compared to without ultra as per our experimental results [3].

The three phase motor test was run with Ultra for 72 hours in the format of 1 hour and 55 mins ON and 5 mins OFF condition. On the other hand, the motor was run for 1hours and 55 mins plus 5 mins OFF without ultra, and measured KWh. From 2 hours, one calculated KWh for 72 hours without ultra because of the constant load characteristics in no load condition. From the measurement result, it has been found that it consumed 4.93 % less with Ultra device compared to without ultra as per our experimental results [2].

## VII. References

1. US Pat. App 12596666 - Filed 24 Apr 2008 3, 2010 (54) DEVICE FOR SAVING ELECTRICAL POWER (76) Inventor: Sung Gwun Choi, Seoul (KR) Correspondence Address: CHRISTOPHER PAUL MITCHELL 888 16TH  
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