CUS250M

EVALUATION DATA

Template	260711 iss 2
DWG. No.	260910 iss 1

TDK·Lambda

Index

Terminology Used:

	Definition	
Vin	…….	Input voltage
Vout	…….	Output voltage
Iin	…….	Input current
Iout	…….	Output current
Ta	…….	Ambient temperature
F	…….	Frequency

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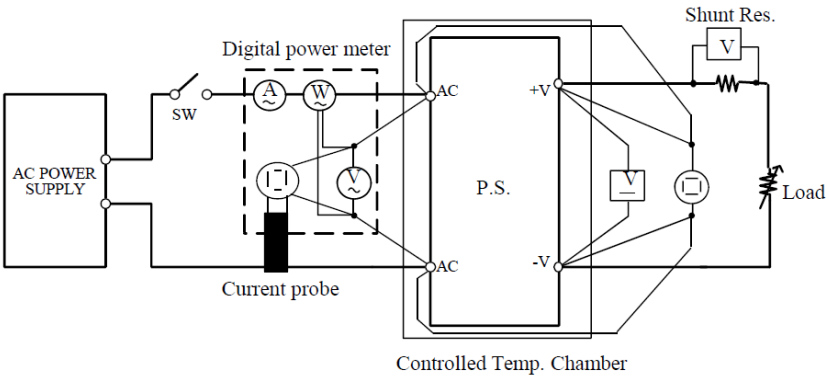
Website: https://uk.tdk-lambda.com

1. Evaluation Method

1.1 Circuit used for determination

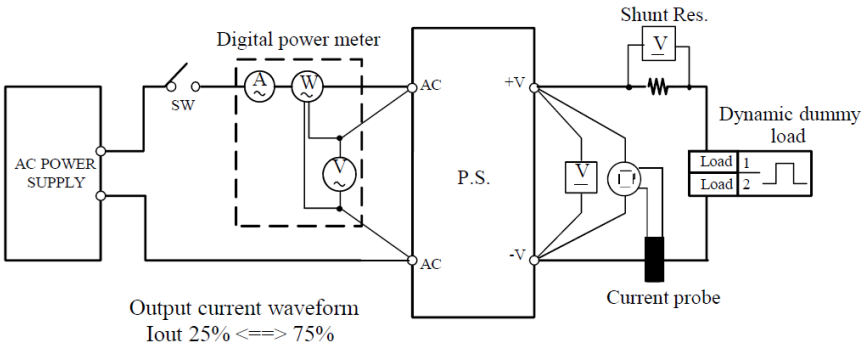
Circuit 1 used for determination

Steady state data
Over current protection (OCP) characteristics
Over voltage protection (OVP) characteristics
Output rise characteristics
Output fall characteristics
Hold up time characteristics
Response to brownout characteristics
Input current harmonics
Input current

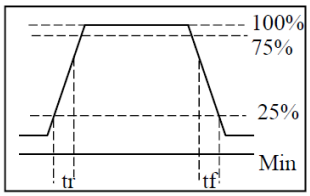


Circuit 2 used for determination

Dynamic load response characteristics

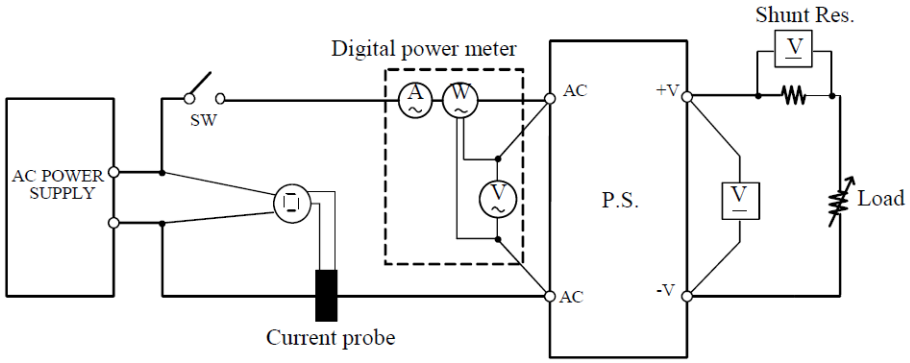


Output current waveform
Iout 25% <==> 75%



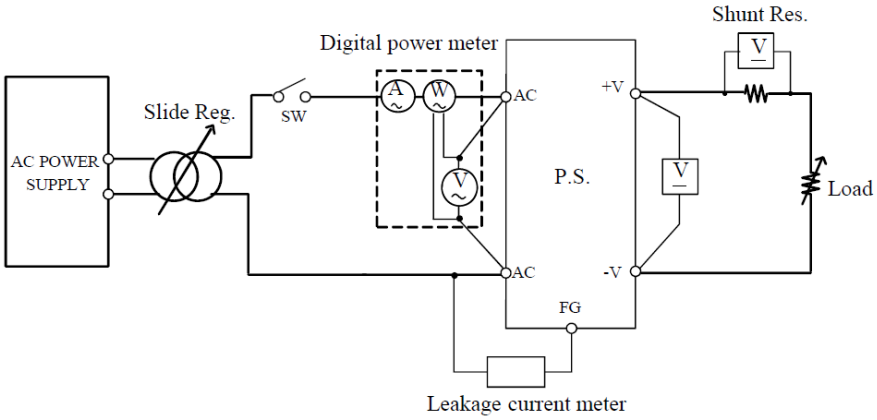
Circuit 3 used for determination

Inrush current waveform



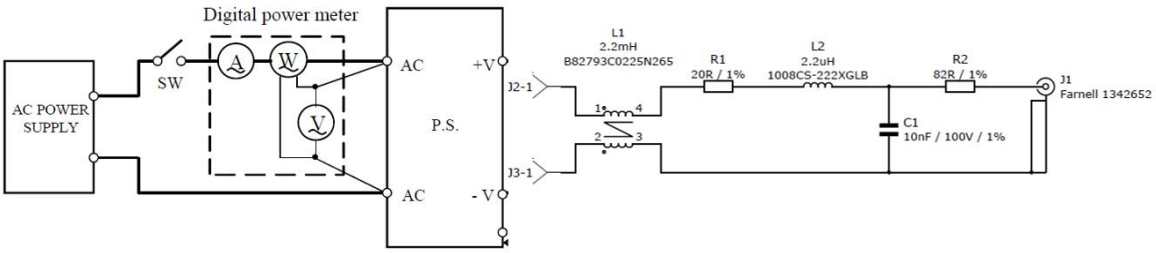
Circuit 4 used for determination

Leakage current characteristics



Circuit 5 used for determination

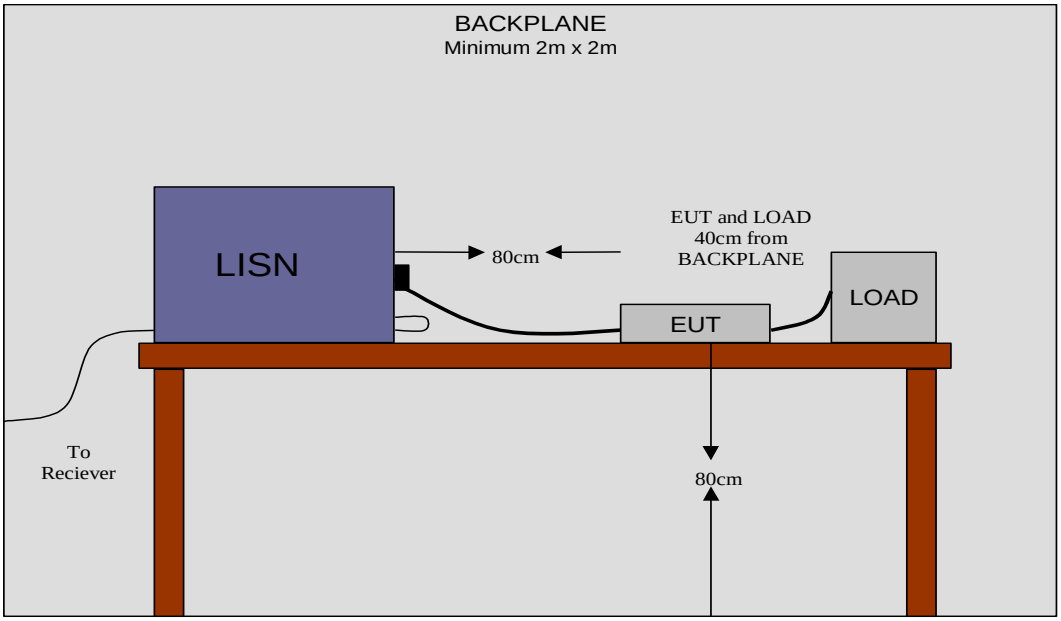
Output ripple and noise waveform



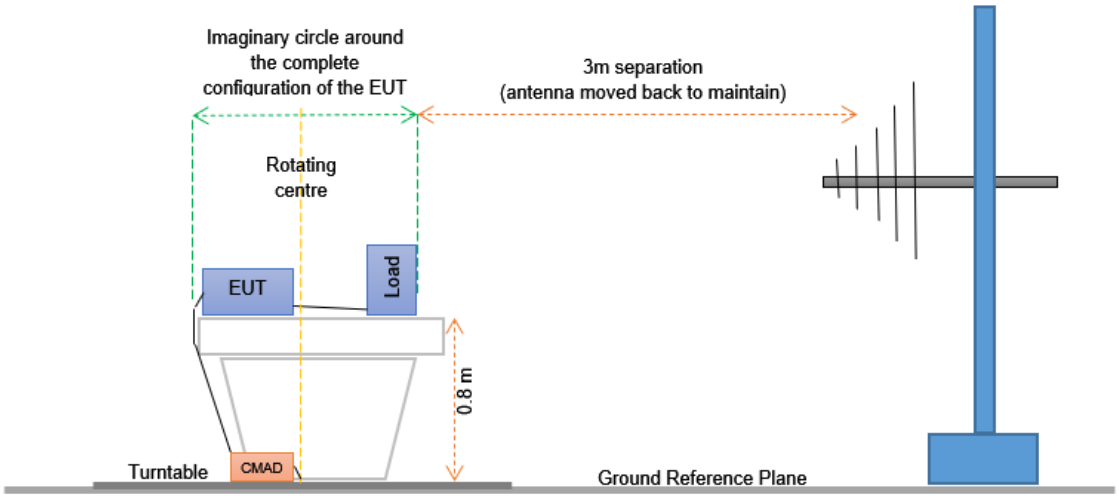
Configuration used for determination

Electro-Magnetic interference characteristics

(a) Conducted Emissions



(b) Radiated Emissions



1.2 List of equipment used

1.3

	Equipment Used	Manufacturer	Model No.
1	Thermal Chamber	Thermotron	SE-300-2-2
2	AC Source	Chroma	61505
3	Power Analyser	Vitrek	PA900
4	Chroma Mainframe	Chroma	63334A
5	Chroma Mainframe	Chroma	63334A
6	Oscilloscope	Rhode & Schwarz	RTM3004
7	Current Probe	Agilent	1146B
8	Current Probe	Agilent	1146B
9	Differential Probe	Keysight	N2791A
10	RF Receiver	Rhode & Schwarz	ESR 17
11	LISN	Rhode & Schwarz	ESH3-Z5
12	Pulse Limiter	Rhode & Schwarz	ESH3-Z2
13	Cable		EMI-RF-5
14	Cable		EMI-RF-6
15	RF Receiver	Rhode & Schwarz	ESR 16
16	Antenna	Schwarzbeck-Mess	VULB 9166
17	Antenna Mast	Maturo	AM 4.0
18	Turntable	Maturo	TT 2.0 SI
19	Control Unit	Maturo	MCU
20	Semi-Anechoic Chamber	TRS	3m SAC
21	CMAD	Chase	CEC-8110
22	Cable		EMI-RF-1
23	Cable		EMI-RF-2
24	Cable		EMI-RF-3
25	Cable		EMI-RF-8
26	Leak Current HiTester	Hioki	ST5541

2. Characteristics

2.1 Steady state data

(1) Regulation – line and load, temperature drift / Start up and Drop out voltage

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1 Regulation – line and load Condition Ta: 25°C

Iout \ Vin	85Vac	110Vac	230Vac	264Vac	Line Regulation	
0%	12.016	12.017	12.017	12.016	1mV	0.01%
50%	12.011	12.004	12.004	12.005	7mV	0.06%
100%	11.996	11.991	11.991	11.992	3mV	0.03%
Load Regulation	20mV	26mV	26mV	24mV		
	0.16%	0.22%	0.22%	0.20%		

2 Temperature drift Condition Vin: 240Vac
Iout: 100%

Ta	-30°C	25°C	55°C	Temperature Stability	
12.000	11.976V	11.992V	11.976V	16mV	0.133%

3 Start-up voltage and Dropout voltage Condition Ta: 25°C
Iout: 100%

Start-up voltage (Vin)	74Vac
Dropout Voltage (Vin)	74Vac

(2) Efficiency vs. Output current

Conditions: Vin : 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta : 25°C

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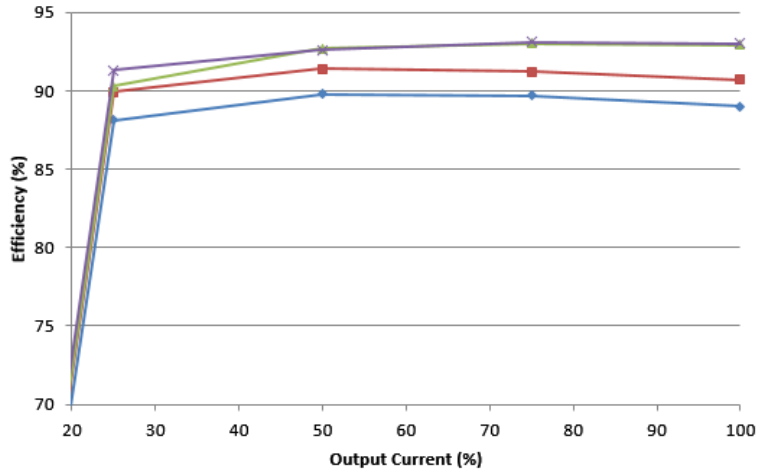
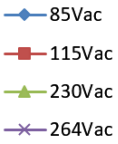


(3) Input current vs. Output current

Conditions: Vin : 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta : 25°C



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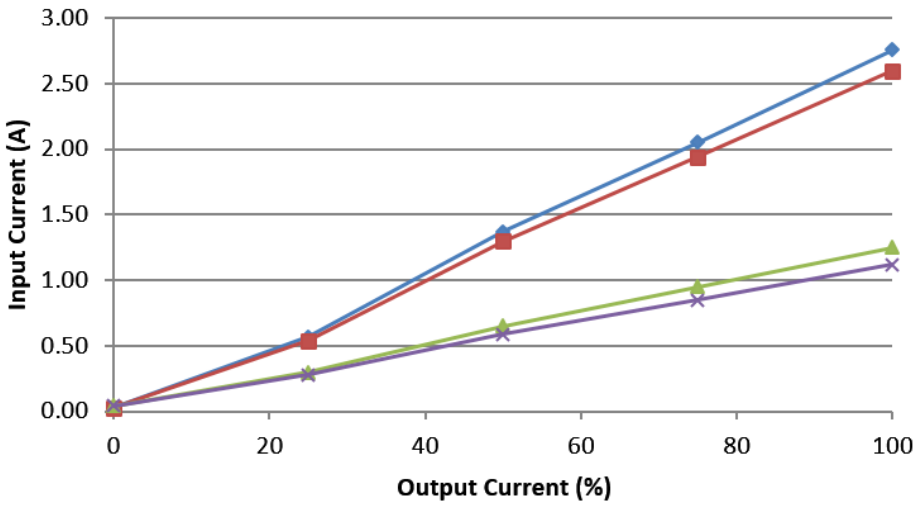
Vin	Input Current				
	Iout: 0%	Iout: 25%	Iout: 50%	Iout: 75%	Iout: 100%
85Vac	0.03A	0.57A	1.37A	2.05A	2.76A
115Vac	0.03A	0.54A	1.30A	1.94A	2.60A
230Vac	0.04A	0.30A	0.65A	0.95A	1.25A
264Vac	0.04A	0.28A	0.59A	0.85A	1.12A



(4) Input power vs. Output current

Conditions: Vin : 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta : 25°C

85Vac
115Vac
230Vac
264Vac

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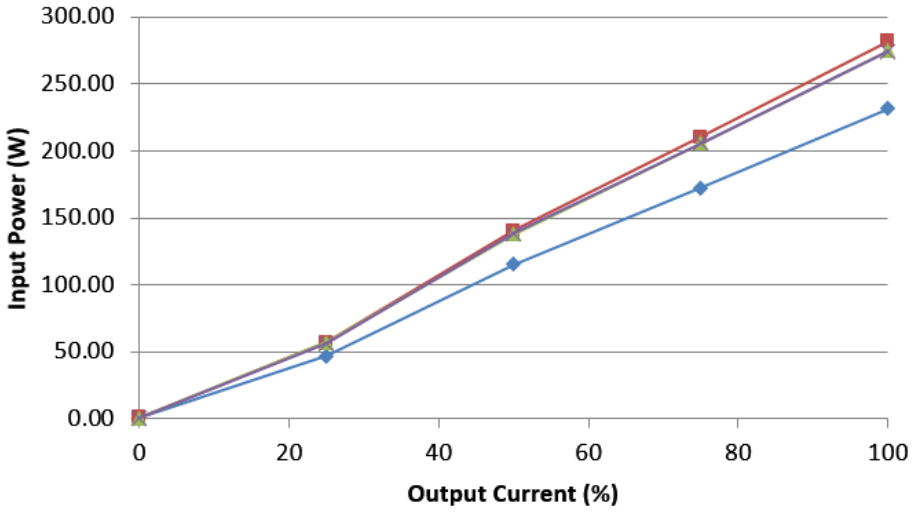
Vin	Input Power				
	Iout: 0%	Iout: 25%	Iout: 50%	Iout: 75%	Iout: 100%
85Vac	1.0W	47.1W	115.2W	172.2W	231.3W
115Vac	1.0W	57.3W	140.4W	210.2W	282.1W
230Vac	0.7W	57.4W	138.2W	205.9W	274.9W
264Vac	0.7W	56.3W	138.4W	205.7W	274.5W



(5) Input power vs. Output current (Unit inhibited)

Conditions: Vin : 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta : 25°C

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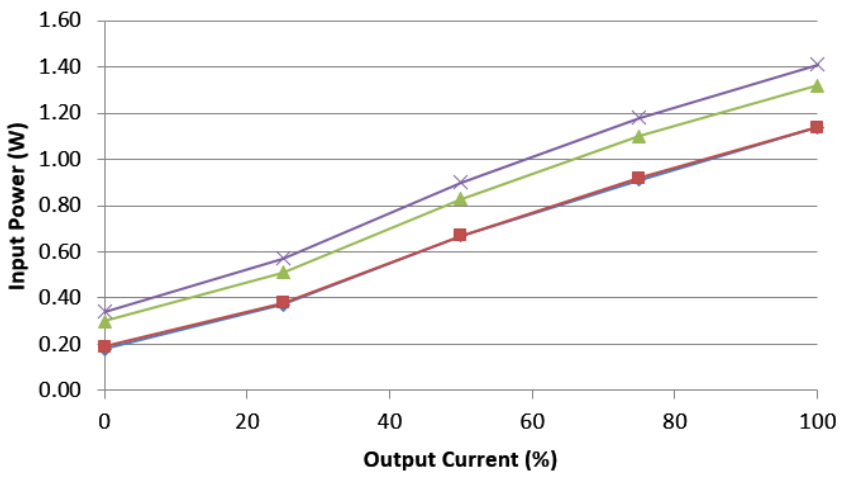
Vin	Input Power (Standby Channel)				
	Iout : 0%	Iout: 25%	Iout: 50%	Iout: 75%	Iout: 100%
85Vac	0.2W	0.4W	0.7W	0.9W	1.1W
115Vac	0.2W	0.4W	0.7W	0.9W	1.1W
230Vac	0.3W	0.5W	0.8W	1.1W	1.3W
264Vac	0.3W	0.6W	0.9W	1.2W	1.4W



2.2 Warm up voltage drift characteristics

Conditions: Vin: 230Vac
Iout: 100%
Ta: 25°C

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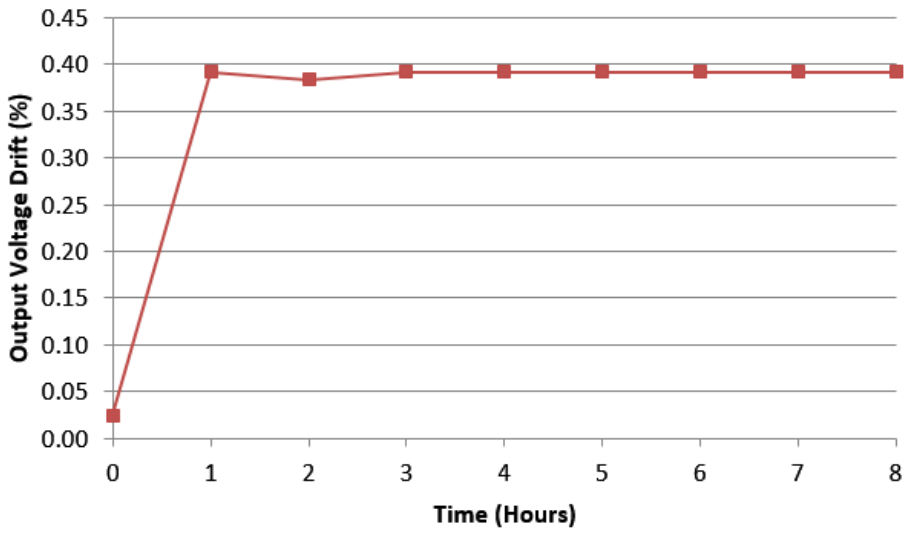

2.3 Over current protection (OCP) characteristics

Conditions: Vin: 110Vac
Ta: -30°C
25°C
60°C

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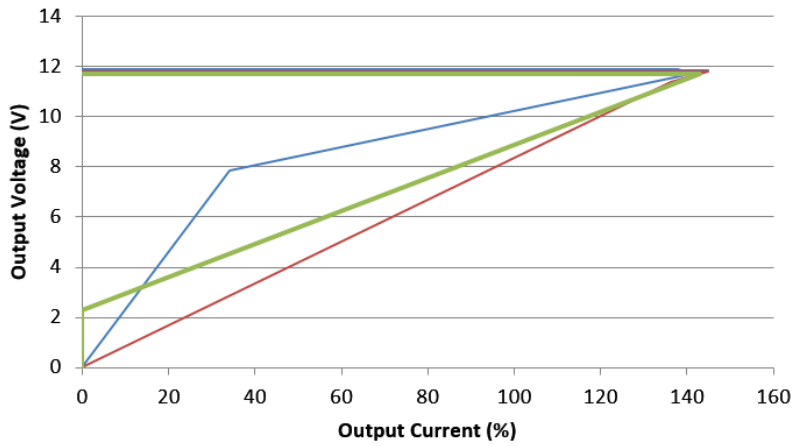

2.4 Over voltage protection (OVP) characteristics

Conditions: Vin: 100Vac
Iout: 100%
Ta: 25°C

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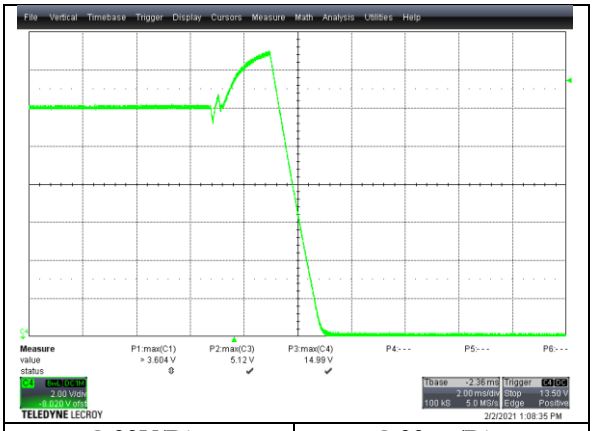

2.00V/Div	2.00ms/Div

2.5 Output rise characteristics

Conditions: Vin: 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta: 25°C
Iout: 0%
: 100%

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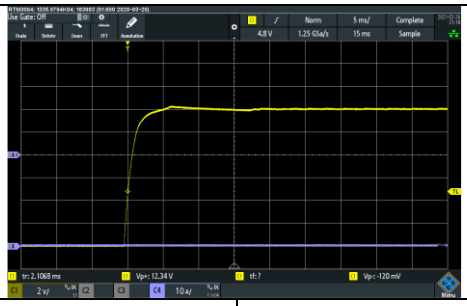
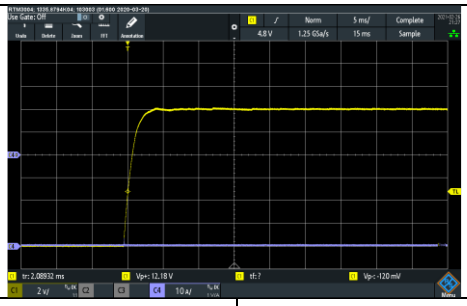
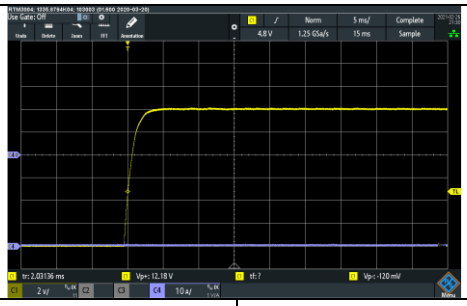
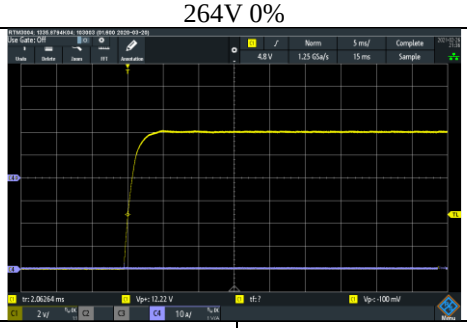
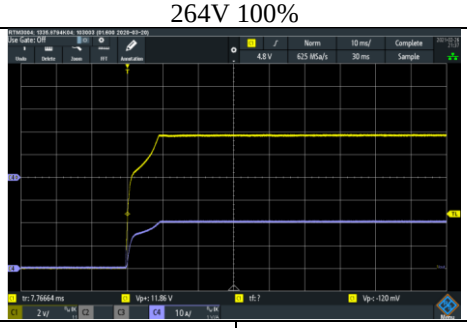
85V 0%		85V 100%	
			
2V/Div	5ms/Div	2V/Div	10ms/Div
115V 0%		115V 100%	
			
2V/Div	5ms/Div	2V/Div	10ms/Div
230V 0%		230V 100%	
			
2V/Div	5ms/Div	2V/Div	10ms/Div
264V 0%		264V 100%	
			
2V/Div	5ms/Div	2V/Div	10ms/Div

2.6 Output Fall Characteristics

Conditions: Vin: 85Vac
: 115Vac
: 230Vac
: 264Vac
Ta: 25°C
Iout: 0%
: 100%

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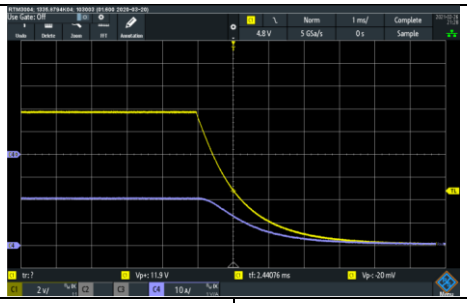
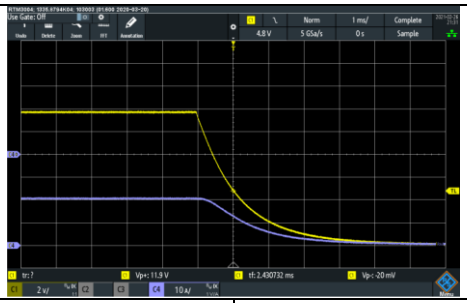
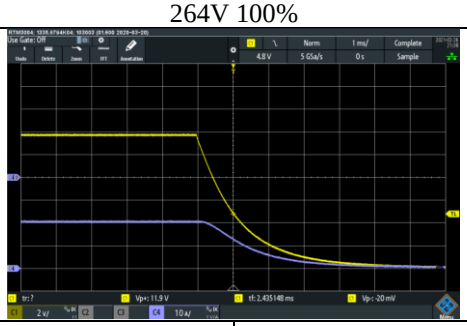
85V 100%	
	
2V/Div	1ms/Div
115V 100%	
	
2V/Div	1ms/Div
230V 100%	
	
2V/Div	1ms/Div
264V 100%	
	
2V/Div	XXms/Div

2.7 Hold up time characteristics

Conditions: Vin: 115Vac
: 230Vac
Ta: 25°C

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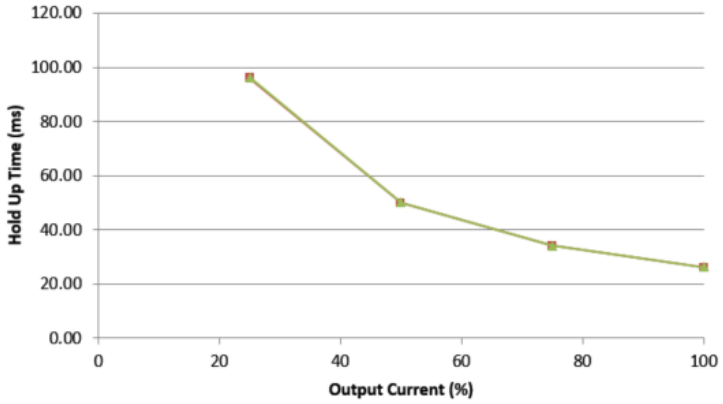

2.8 Dynamic load response characteristics

Conditions: Vin: 100Vac
264Vac
Ta: 25°C
Iout: 25%↔75%
(tr = tf = 50μS)
f :10Hz
:100Hz

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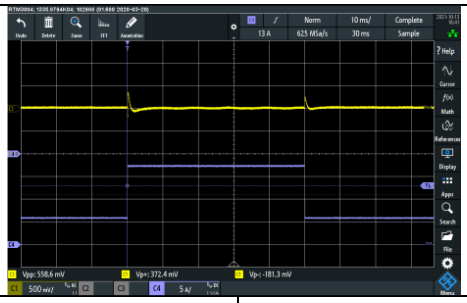
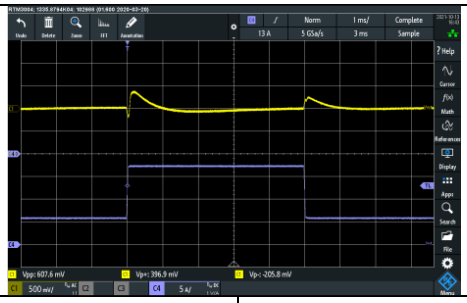
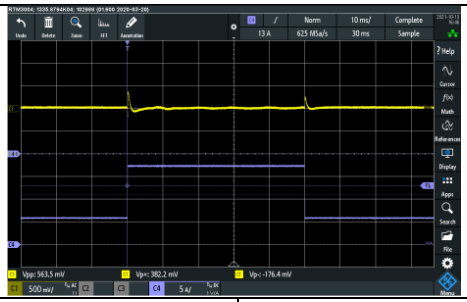
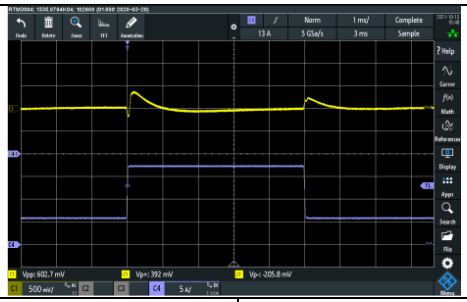
<table>
<tr><td colspan="2">100V 10Hz</td><td colspan="2">100V 100Hz</td></tr>
<tr><td colspan="2">  </td><td colspan="2">  </td></tr>
<tr><td>500mV/Div</td><td>10ms/Div</td><td>500mV/Div</td><td>1ms/Div</td></tr>
<tr><td>+3.103% (deviation)</td><td>-1.511% (deviation)</td><td>+3.308% (deviation)</td><td>-1.715% (deviation)</td></tr>
<tr><td colspan="2">264V 10Hz</td><td colspan="2">264V 100Hz</td></tr>
<tr><td colspan="2">  </td><td colspan="2">  </td></tr>
<tr><td>500mV/Div</td><td>10ms/Div</td><td>500mV/Div</td><td>1ms/Div</td></tr>
<tr><td>+3.183% (deviation)</td><td>-1.470% (deviation)</td><td>+3.266% (deviation)</td><td>-1.715% (deviation)</td></tr>
</table>

2.9 Response to brownout characteristics

Conditions: Vin: 110Vac
Iout: 100%
Ta: 25°C

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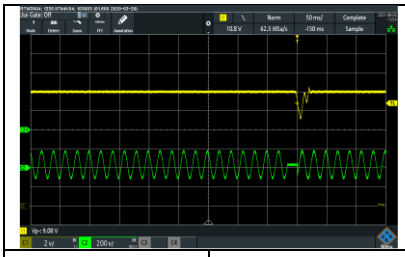
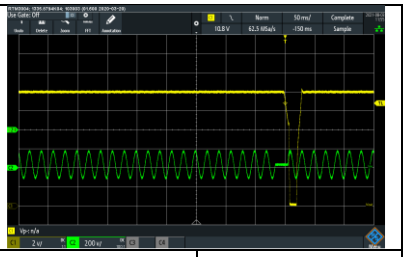
Performance parameters: A - The shortest interruption time for the output to drop below the regulation band
B – The interruption time for the output to drop down to 20 – 40 % of nominal
C – The interruption time for the output to drop down to <20% of nominal

		Not Witnessed			
2V/DIV	50mS/Div	-V/DIV	-mS/Div	2V/DIV	50mS/Div
A		B		C	

Conditions: Vin: 230Vac
Iout: 100%
Ta: 25°C

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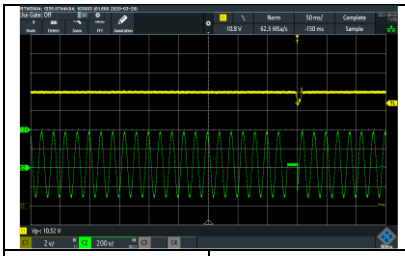
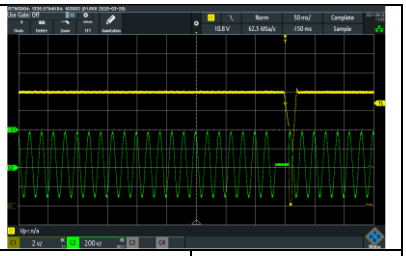
Performance parameters: A - The shortest interruption time for the output to drop below the regulation band
B – The interruption time for the output to drop down to 20 – 40 % of nominal
C – The interruption time for the output to drop down to <20% of nominal

		Not Witnessed			
2V/DIV	50mS/Div	-V/DIV	-mS/Div	2V/DIV	50mS/Div
A		B		C	

2.10 Inrush Current Waveform

Conditions: Vin: 230Vac
Iout: 100%
Ta: 25°C

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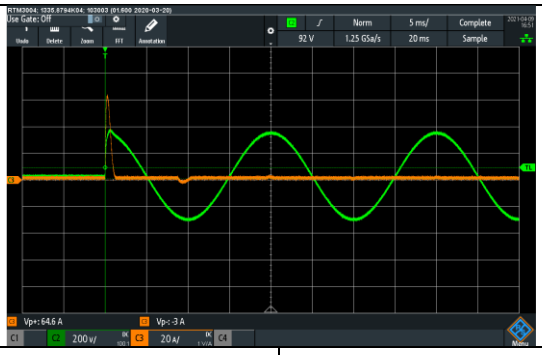		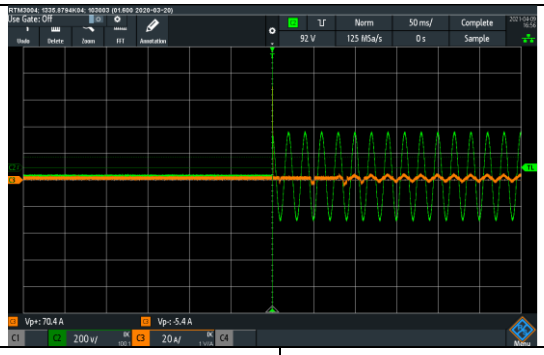	
20A/Div	5ms/Div	20A/Div	50ms/Div
Switch on phase angle 0°		Switch on phase angle 90°	

Conditions: Vin: 264Vac
Iout: 100%
Ta: 25°C

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		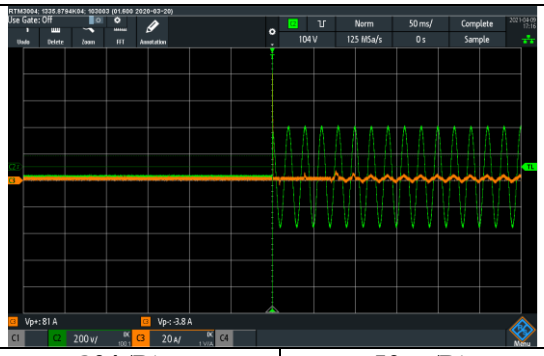	
20A/Div	5ms/Div	20A/Div	50ms/Div
Switch on phase angle 0°		Switch on phase angle 90°	

2.11 Input current harmonics

Conditions: Vin: 110Vac
Iout: 100%
Ta: 25°C

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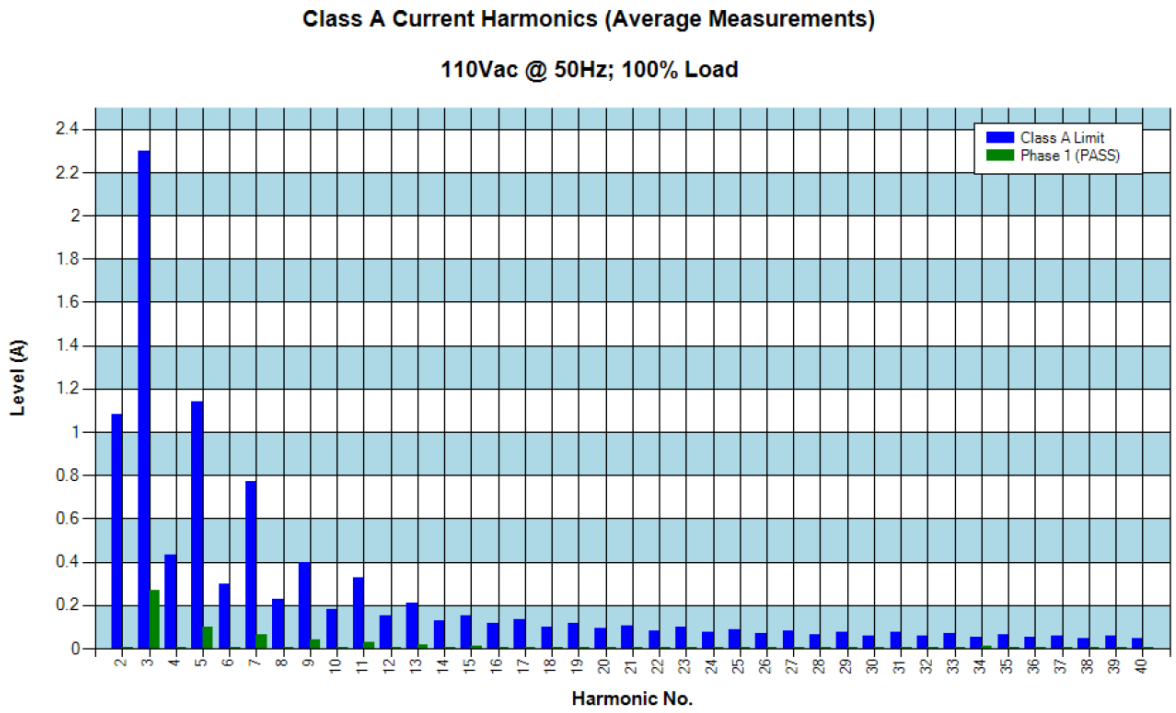
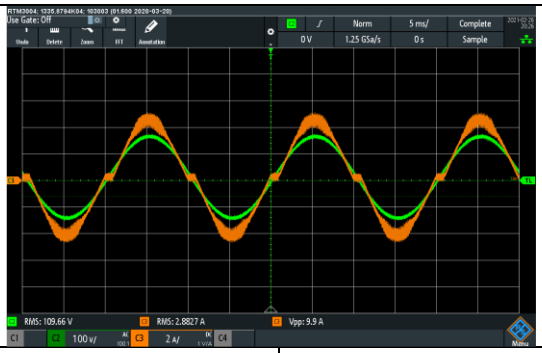
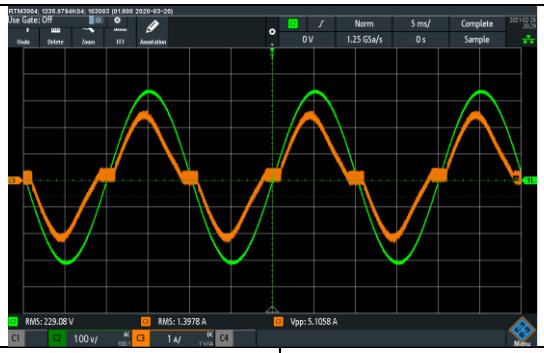


2.12 Input current waveform

Conditions: Iout: 100%
Ta: 25°C

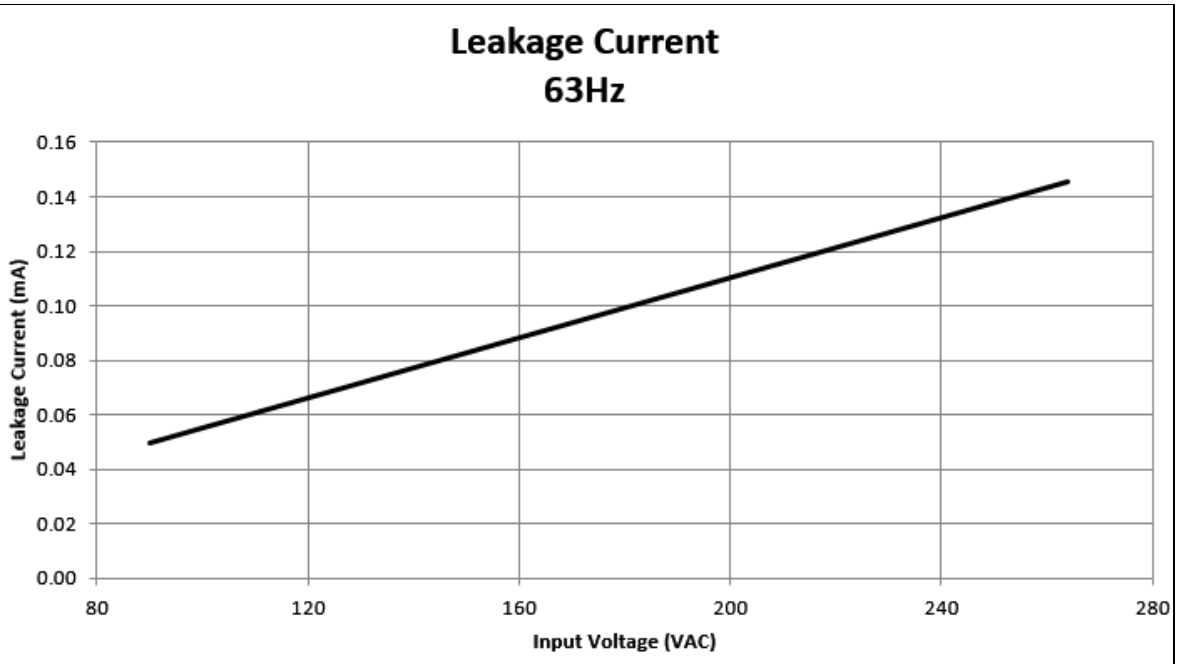
CUS250M-12

			
2A/Div	5ms/Div	1A/Div	5ms/Div
Vin: 110V		Vin: 230V	

2.13 Leakage current characteristics

Conditions: Iout: 0%
Iout: 100%
Ta: 25°C

CUS250M-12

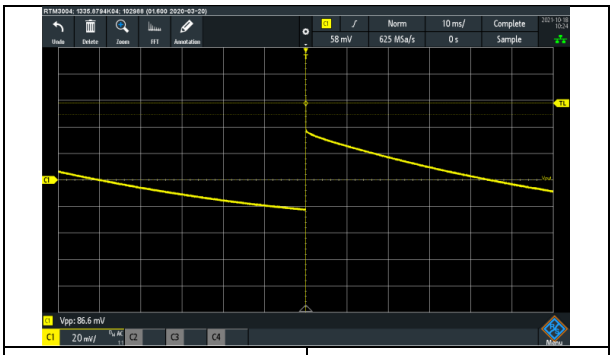


Frequency: 63Hz

2.14 Output ripple and noise waveform

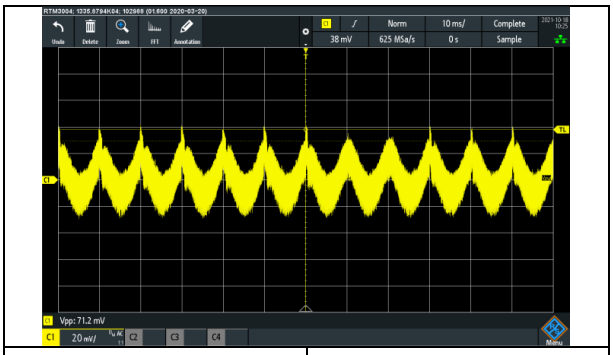
Conditions: Vin: 100Vac
Iout: 0%
Ta: 25°C

CUS250M-12



20mV/Div	10ms/Div

Conditions: Vin: 115Vac
Iout: 100%
Ta: 25°C



20mV/Div	10ms/Div

2.15 Electro-Magnetic Interference characteristics

Conducted Emissions

Conditions: Vin: 230Vac
Iout: 100%
Ta: 25°C
QP Limit:
AVE Limit:

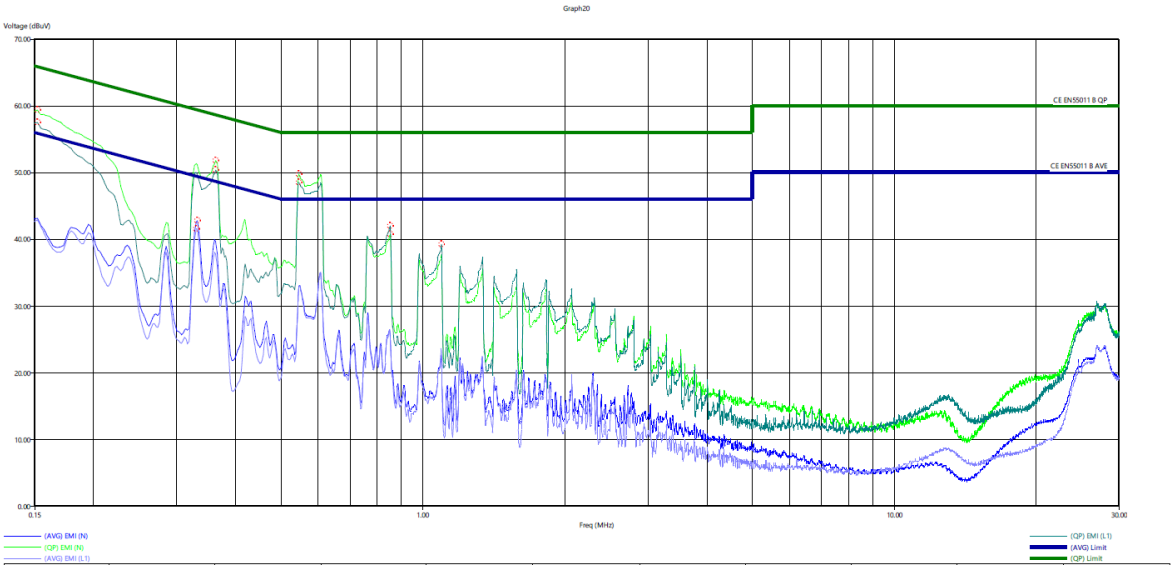
CUS250M-12

Live

Point A (0.55MHz)		
Ref Data	Limit (dBµV)	Measure (dBµV)
QP	56.00	48.49
AVE	46.00	32.88

Neutral

Point B (0.55MHz)		
Ref Data	Limit (dBµV)	Measure (dBµV)
QP	56.00	49.76
AVE	46.00	33.01



2.16 Electro-Magnetic Interference characteristics

Radiated Emissions

Conditions: Vin: 230Vac
Iout: 100%
Ta: 25°C
Horizontal:
Vertical:

CUS250M-12

Point A (31.2MHz)		
Ref Data	Limit (dBµV/m)	Measure (dBµV/m)
QP	40.00	25.05