

Subject
OB2235R Demo Board Manual

Board Model: AD12V0.5A2235R.00

Doc. No.: OB_DOC_DBM_2235R02



Key features:

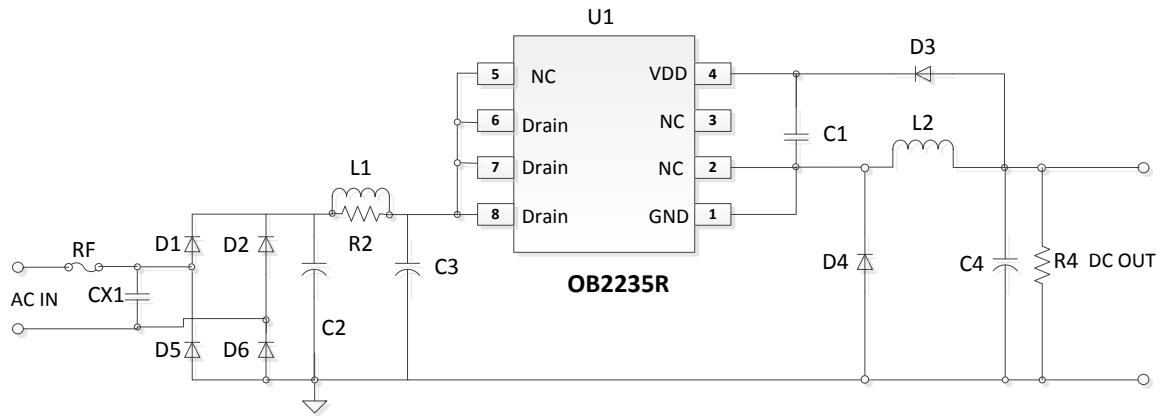
- Lowest possible component count
- Standby power <50mW @264Vac
- Efficiency measured >78% at full load
- Good dynamic response
- Comprehensive protection including output short protection, OTP, OCP etc.

Revision History

Revise Date	Version	Reason/Issue
2019-08-16	00	First issue
2020-06-23	01	Update the inductor design
2020-07-02	02	Update the board schematic

1. Board Information

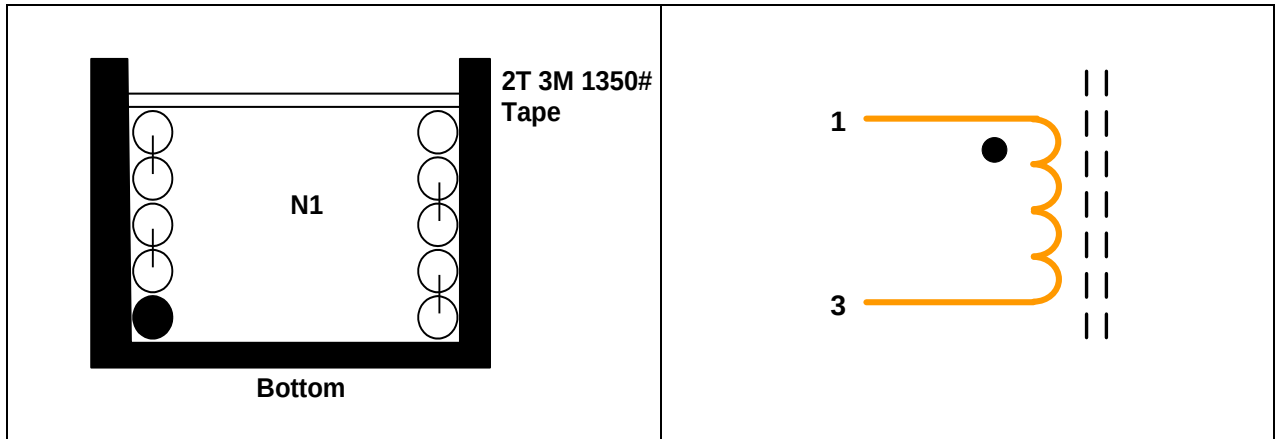
1.1. Board schematic



1.2. Component list

No.	Position	Description	Quantity
1	RF	Resistor fuse 10R/1W	1
2	R4	SMD RES 20K /5% /1206	1
3	CX1	X-cap 104P/X2	1
4	C1	E.C. 4.7uF /50V	1
5	C2, C3	E.C. 4.7uF /400V	2
6	C4	E.C. 470uF /16V	1
7	D1, D2, D5, D6	Diode 1N4007	4
8	D3	Diode M7	1
9	D4	Fast diode ES2J	1
10	L1	Inductor 2.2mH /0510	1
11	L2	Inductor 500uH /EE10	1
12	U1	OB2235R, DIP8	1
	Total		16

1.3. Inductor design



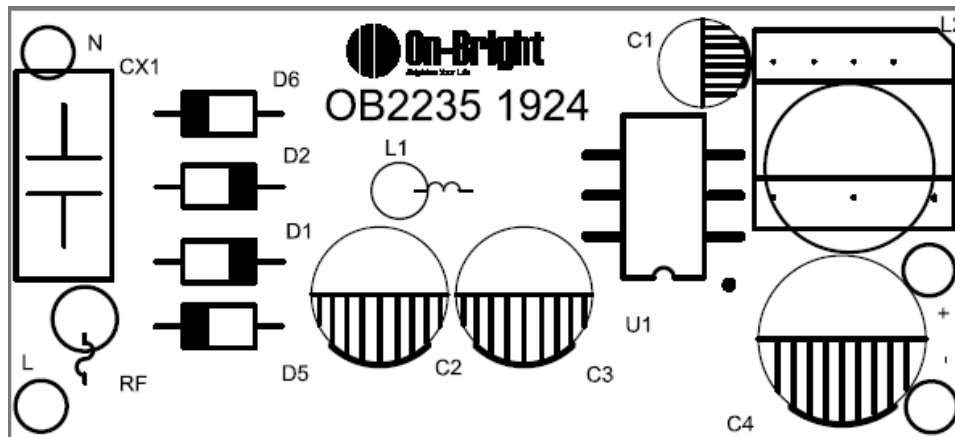
1. Bobbin: EE10

2. Core: TDK PC40.

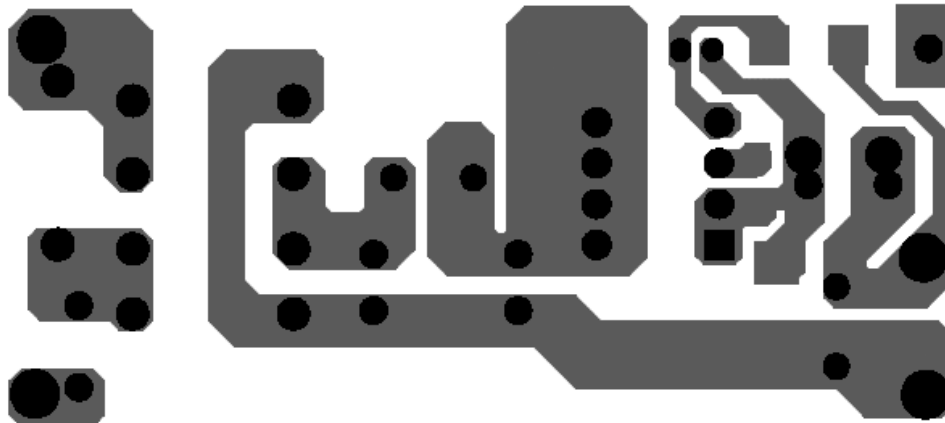
3. L1-3= 500uH (at:10KHz, 1V)

Material	Turns	Inductance & Tolerance
Φ0.27 *1 2UEW	125	500uH ± 7%

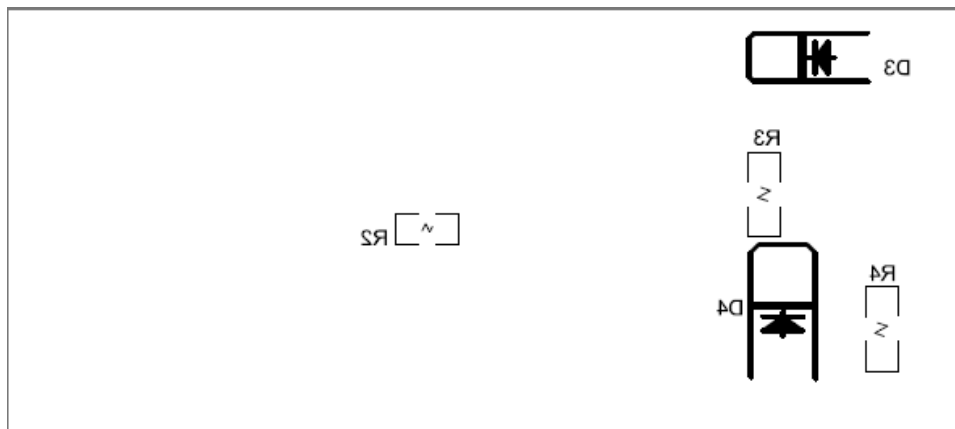
1.4.PCB Gerber File



Top

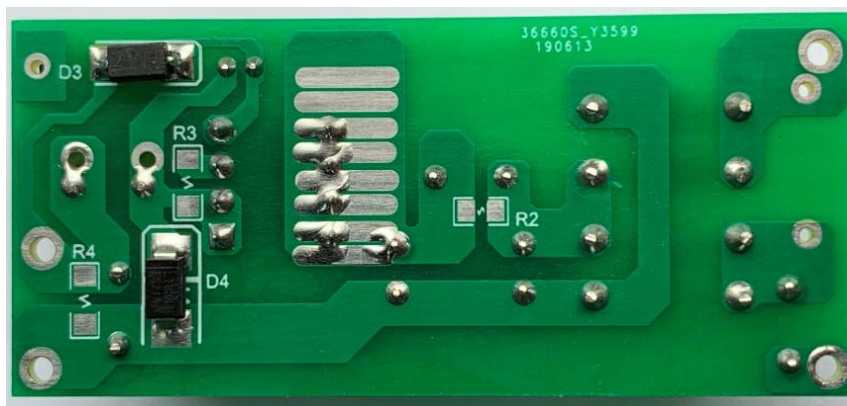


Bottom



Silkscreen Bottom

1.5. Snapshot



2. Converter Specification

2.1. Input Characteristics

- AC input voltage range 90Vac ~ 264Vac
- AC input frequency range 47Hz ~ 63Hz

2.2. Output Characteristics

- Output voltage V_{OUT} 12.0V
- Output current I_{OUT} 500mA
- Operating frequency 40KHz
- Output power 6W

2.3. Performance Function

- Standby Power < 50mW @ 264Vac/50Hz, no load, 25°C
- Efficiency >78%
- Ripple & Noise <100mV

2.4. Protection Function

- Short Circuit Protection Output shut down with auto-restart
- Over Temperature Protection Output shut down with auto-restart
- Over Current Protection Output shut down with auto-restart

3. Performance Evaluation

3.1. Standby Power

Input voltage	P_{IN} (mW)	Spec	Remark
90Vac/60Hz	24	<50mW	Pass
115Vac/60Hz	25		Pass
230Vac/50Hz	32		Pass
264Vac/50Hz	34		Pass

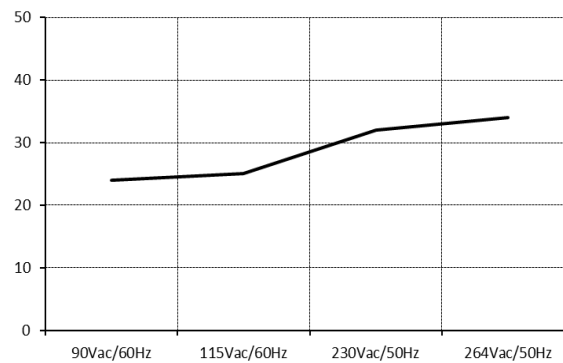


Figure 1. Standby input power

3.2. Efficiency

Input voltage	load 250mA	load 500mA	Spec	Remark
90Vac/60Hz	82.43%	79.40%	>78%	Pass
115Vac/60Hz	83.00%	80.97%		Pass
230Vac/50Hz	82.02%	81.45%		Pass
264Vac/50Hz	81.69%	80.80%		Pass

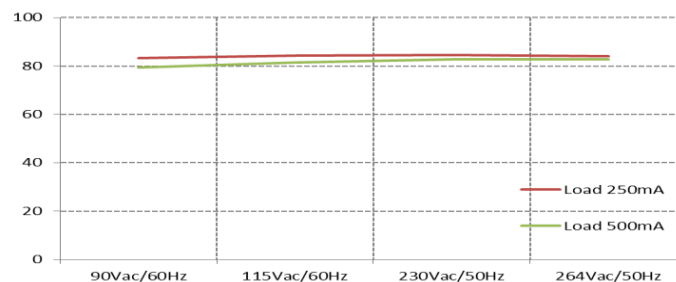


Figure 2. Efficiency @ different load

3.3. Output Voltage

Input voltage	0mA	100mA	200mA	300mA	400mA	500mA	Spec	Remark
90Vac/60Hz	12.80	12.02	11.94	11.88	11.85	11.84	11.0~14.0V	Pass
115Vac/60Hz	12.78	12.01	11.93	11.88	11.85	11.84		Pass
230Vac/50Hz	12.85	12.01	11.92	11.87	11.84	11.83		Pass
264Vac/50Hz	12.88	12.01	11.92	11.87	11.84	11.83		Pass

3.4. Dynamic (Figure 9)

Input voltage	V _{OUT-MAX} (V)	V _{OUT-MIN} (V)	Spec	Remark
90Vac/60Hz	12.60	11.88	11.0~14.0V	Pass
115Vac/60Hz	12.60	11.88		Pass
230Vac/50Hz	12.60	11.88		Pass
264Vac/50Hz	12.60	11.88		Pass

Note: A dynamic loading with low load set at 0mA load lasting for 20ms and high set at 350mA load lasting for 20ms is added to output. The ramp is set at 0.25A/us at transient.

3.5. Over Current Protection & Recovery

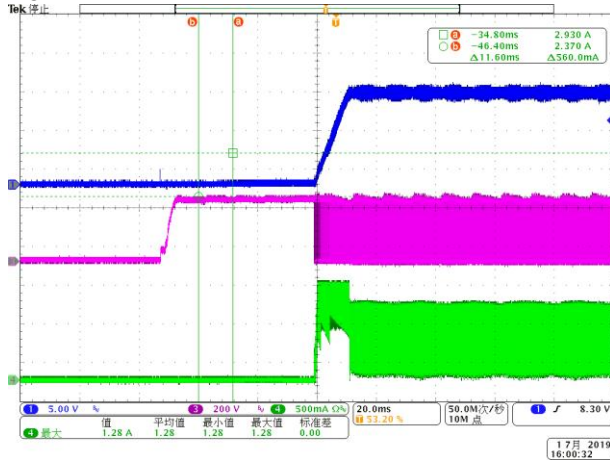
Input voltage	OCP (A)	Recovery (A)	Spec	Remark
90Vac/60Hz	807	801	$\geq 1.1 \cdot I_{OUT}$	Pass
115Vac/60Hz	801	793		Pass
230Vac/50Hz	836	829		Pass
264Vac/50Hz	840	831		Pass

3.6. Ripple & Noise (Figure 7&8)

Input voltage	No load (mV)	Full load (mV)	Spec	Remark
90Vac/60Hz	24	68	<100mV	Pass
115Vac/60Hz	29	68		Pass
230Vac/50Hz	50	86		Pass
264Vac/50Hz	52	92		Pass

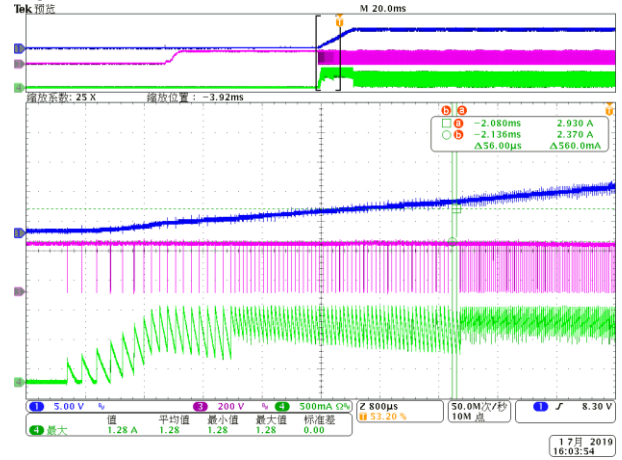
3.7. Waveforms

Figure 3: 230Vac, start at full load



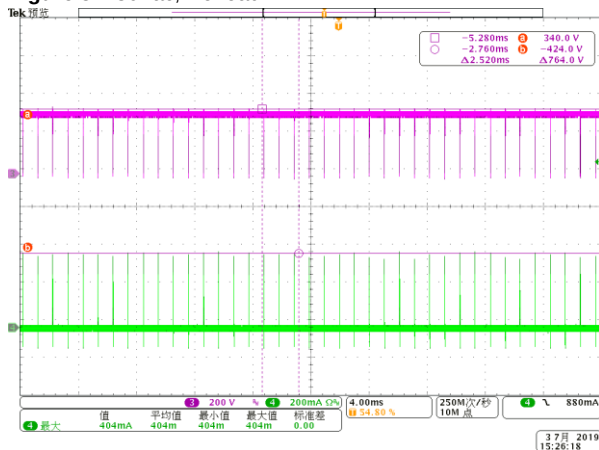
CH1: V_{out} CH3: V_{DS} CH4: $I_{Inductor}$
 230Vac 输入, 满载启动, $V_{DS}=340V$

Figure 4: 230Vac, start at full load



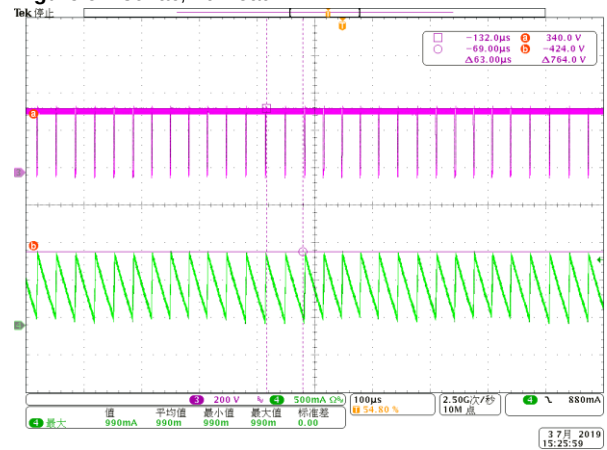
CH1: V_{out} CH3: V_{DS} CH4: $I_{Inductor}$
 230Vac 输入, 满载启动波形展开, $V_{DS}=340V$

Figure 5: 230Vac, No-load



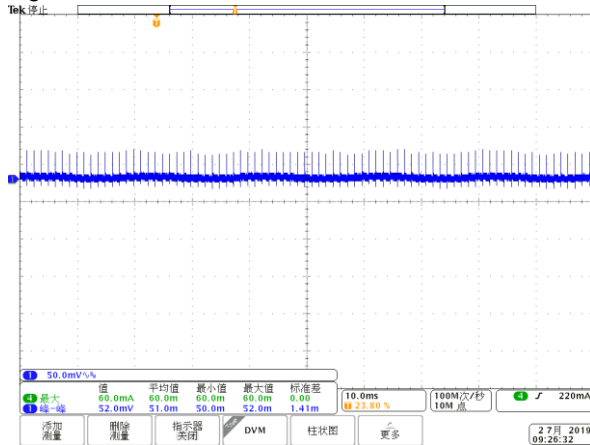
CH3: V_{DS} CH4: $I_{Inductor}$
 230Vac 输入, 空载, $V_{DS}=340V$

Figure 6: 230Vac, Full load



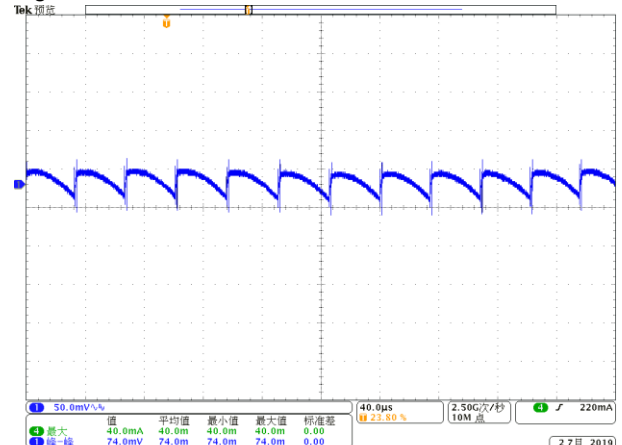
CH3: V_{DS} CH4: $I_{Inductor}$
 230Vac 输入, 满载, $V_{DS}=340V$

Figure 7: 264Vac, No-load

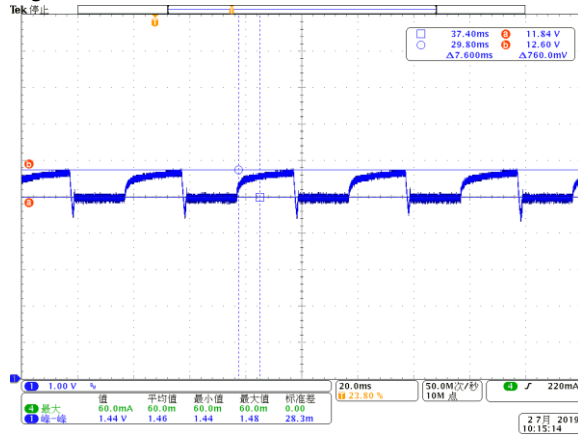


CH1: V_{ripple}
 264Vac 输入, 空载, $V_{ripple}=51mV$

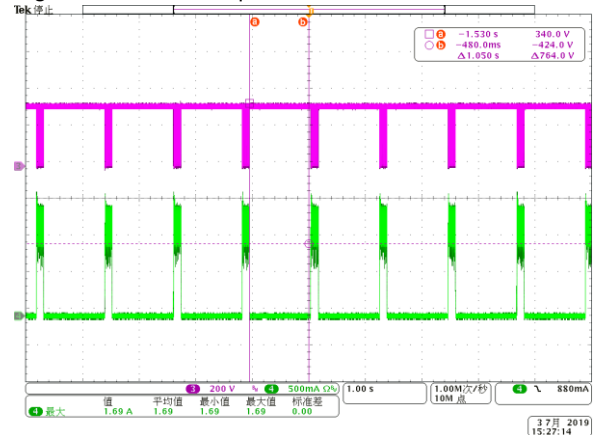
Figure 8: 264Vac, Full load



CH1: V_{ripple}
 264Vac 输入, 满载, $V_{ripple}=92mV$

Figure 9: 230Vac, 0~500mA load


CH1: V_{OUT}
 230Vac 输入, 负载变化, $V_{out} \approx 12.03-12.54V$

Figure 10: 230Vac, Output short to GND


CH3: V_{DS} CH4: $I_{Inductor}$
 230Vac 输入, 输出短路

Input	$V_{DS_MAX}(V)$	Remark
230Vac @ No load	340	Figure 5
230Vac @ Full load	340	Figure 6
230Vac @ Output short	340	Figure10

3.8. Conducted EMI Test (EN55022 CLASS B standard)

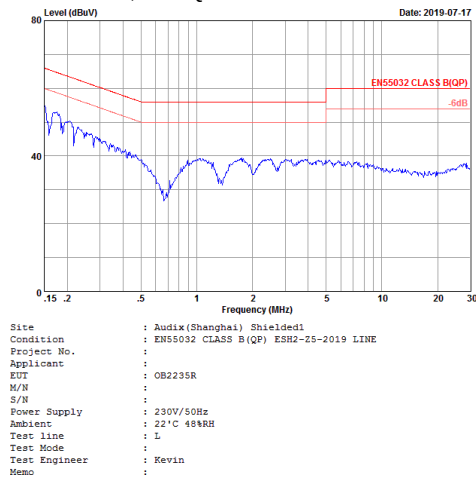
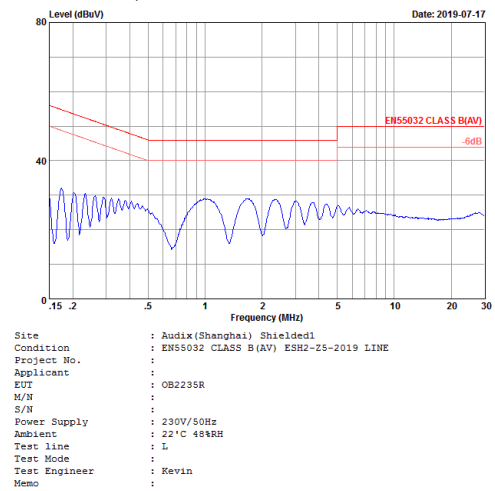
Figure 11: 230Vac, Line QP

Figure 12: 230Vac, Line AVG


Figure 13: 230Vac, Neutral QP

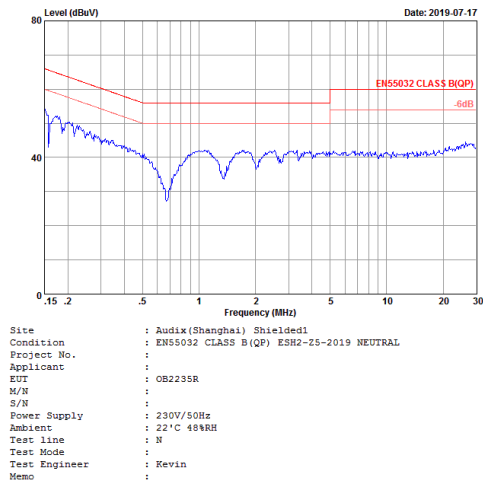
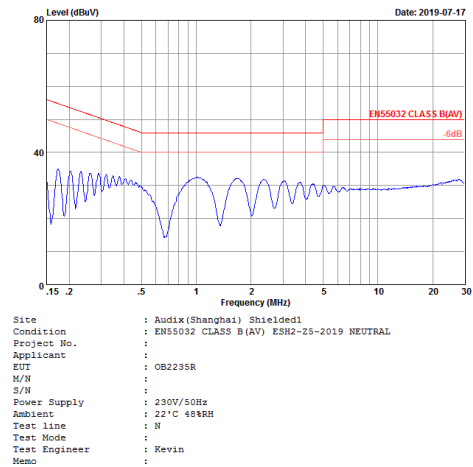


Figure 14: 230Vac, Neutral AVG



3.9. Power Disturbance Test

Figure 15: 230Vac, QP

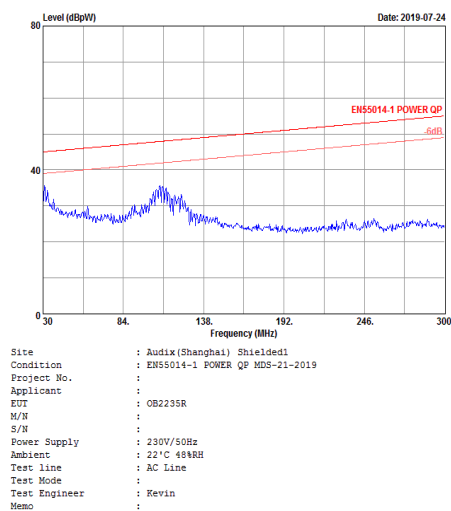
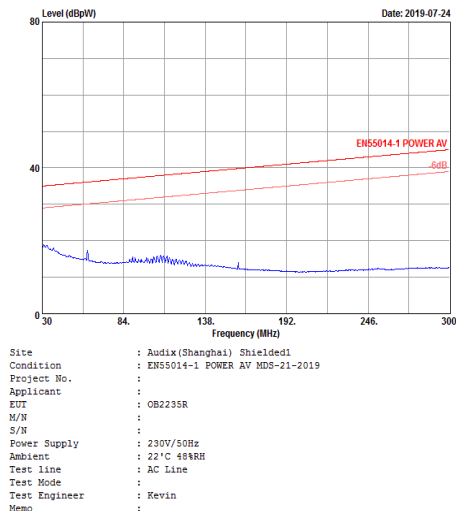


Figure 16: 230Vac, AVG



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