

**Subject**  
**OB2238R Demo Board Manual**

Board Model:AD18V0.5A2238R.00  
Doc. No.: OB\_DOC\_DBM\_2238R02



**Key features:**

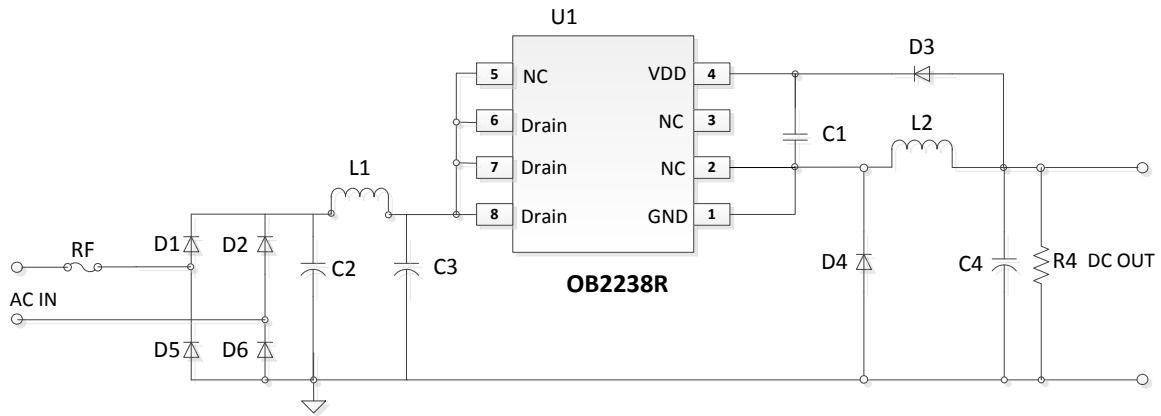
- Lowest possible component count
- Standby power <75mW @264Vac
- Efficiency measured >70% at full load
- Good dynamic response
- Comprehensive protection including output short protection, OTP, OCP etc.

## Revision History

Revise Date	Version	Reason/Issue
2019-11-20	00	First issue
2019-12-18	01	Update the photo of demo board
2020-07-06	02	Update board schematic

## 1. Board Information

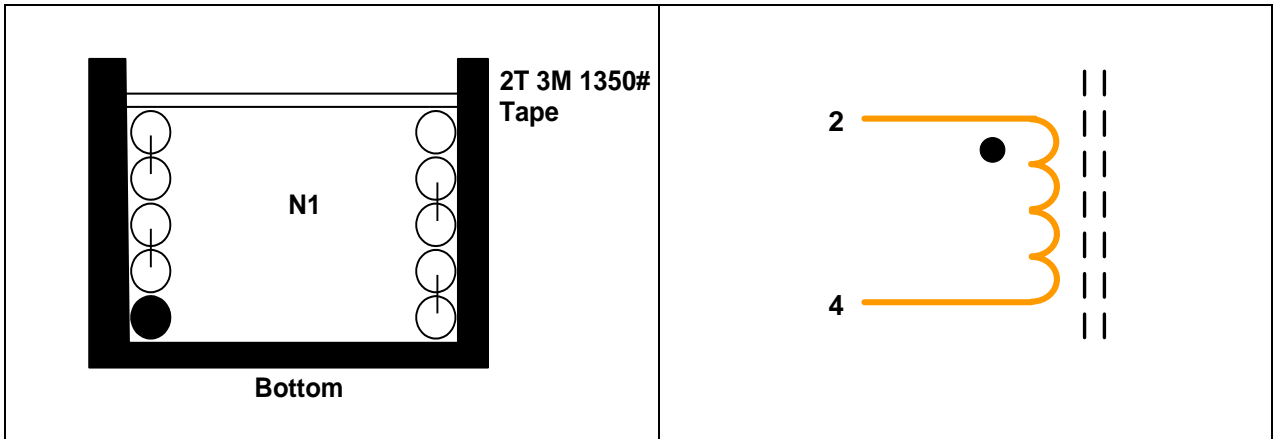
### 1.1. Board schematic



### 1.2. Component list

No.	Position	Description	Quantity
1	RF	Resistor fuse 10R/1W	1
2	R4	SMD RES 20K /5% /1206	1
3	C1	E.C. 4.7uF /50V	1
4	C2, C3	E.C. 4.7uF /400V	2
5	C4	E.C. 470uF /25V	1
6	D1, D2, D5, D6	Diode 1N4007	4
7	D3	Diode M7	1
8	D4	Fast diode ES2J	1
9	L1	Inductor 2.2mH /0510	1
10	L2	Inductor 500uH /EE13	1
11	U1	OB2238R, DIP8	1
	Total		15

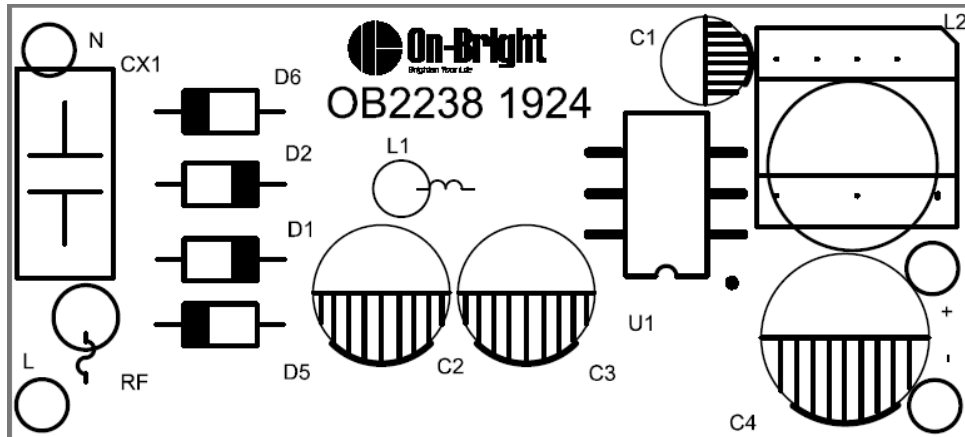
### 1.3. Inductor design



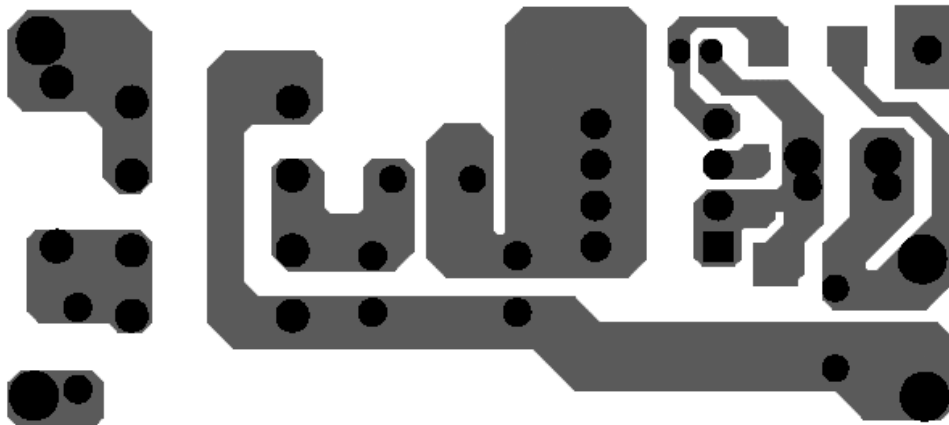
1. Bobbin: EE13
2. Core: TDK PC40.
3. L2-4= 500uH (at:10KHz, 1V)

Material	Turns	Inductance & Tolerance
Φ0.30 *1 2UEW	95	500uH ± 7%

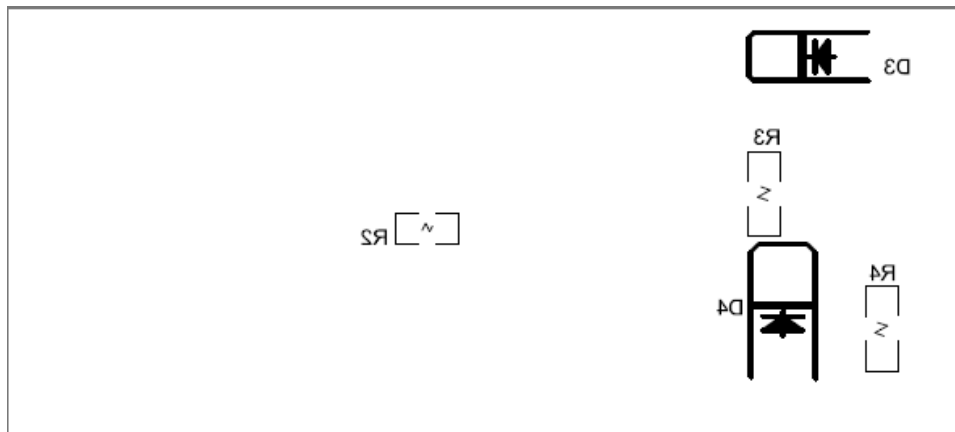
1.4.PCB Gerber File



Top

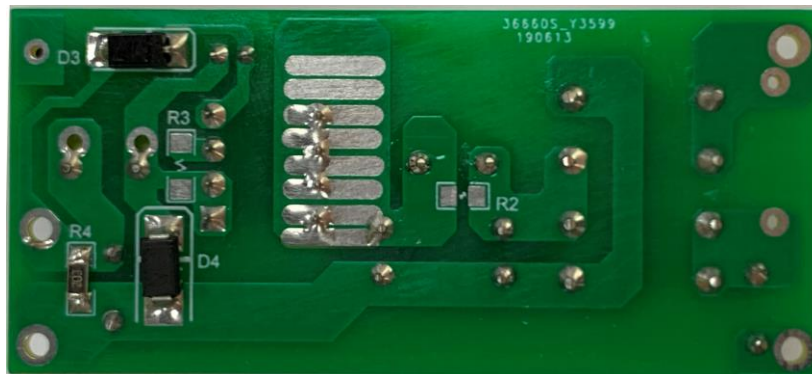


Bottom



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  $V_{OUT}$                     18.0V
- Output current  $I_{OUT}$                     500mA
- Operating frequency                    40KHz
- Output power                                9W

### **2.3. Performance Function**

- Standby Power                            < 75mW @ 264Vac/50Hz, no load, 25°C
- Efficiency                                    >70%
- Ripple & Noise                            <120mV

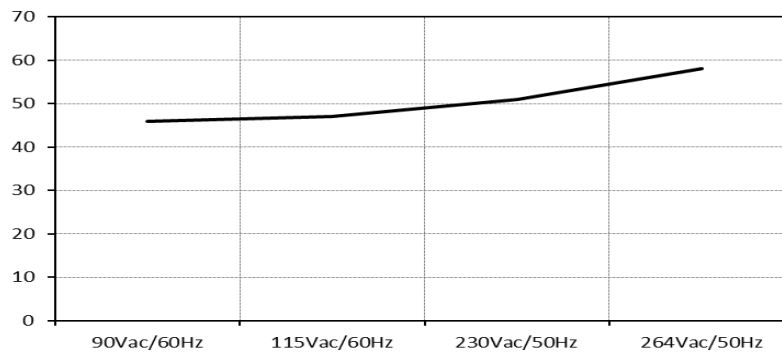
### **2.4. Protection Function**

- 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

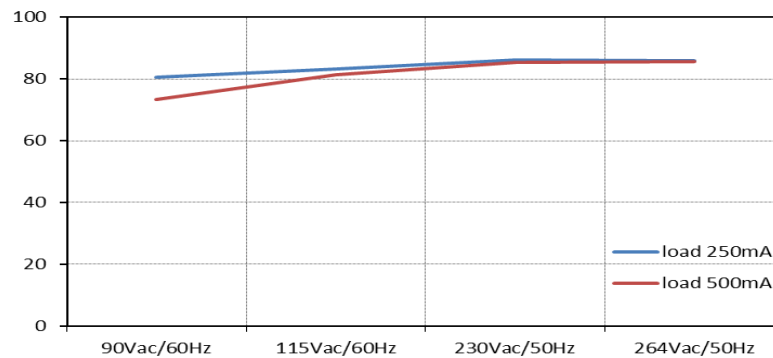
Input voltage	$P_{IN}$ (mW)	Spec	Remark
90Vac/60Hz	46	<75mW	Pass
115Vac/60Hz	47		Pass
230Vac/50Hz	51		Pass
264Vac/50Hz	58		Pass



**Figure 1. Standby input power**

#### 3.2. Efficiency

Input voltage	load 250mA	load 500mA	Spec	Remark
90Vac/60Hz	80.47%	73.42%	>70%	Pass
115Vac/60Hz	83.20%	81.22%		Pass
230Vac/50Hz	86.27%	85.46%		Pass
264Vac/50Hz	85.97%	85.50%		Pass



**Figure 2. Efficiency @ different load**

### 3.3. Output Voltage

Input voltage	0mA	100mA	200mA	300mA	400mA	500mA	Spec	Remark
90Vac/60Hz	18.93	18.05	17.93	17.86	17.81	17.79	17.0~20.0V	Pass
115Vac/60Hz	18.94	18.07	17.95	17.87	17.82	17.81		Pass
230Vac/50Hz	19.03	18.08	17.97	17.89	17.85	17.83		Pass
264Vac/50Hz	19.09	18.08	17.97	17.90	17.85	17.83		Pass

### 3.4. Dynamic (Figure 9)

Input voltage	V <sub>OUT-MAX</sub> (V)	V <sub>OUT-MIN</sub> (V)	Spec	Remark
90Vac/60Hz	18.82	17.92	17.0~20.0V	Pass
115Vac/60Hz	18.82	17.92		Pass
230Vac/50Hz	18.78	17.86		Pass
264Vac/50Hz	18.78	17.86		Pass

*Note: A dynamic loading with low load set at 0mA load lasting for 20ms and high set at 500mA 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 (mA)	Recovery (mA)	Spec	Remark
90Vac/60Hz	763	759	$\geq 1.1 \cdot I_{OUT}$	Pass
115Vac/60Hz	843	837		Pass
230Vac/50Hz	946	941		Pass
264Vac/50Hz	959	954		Pass

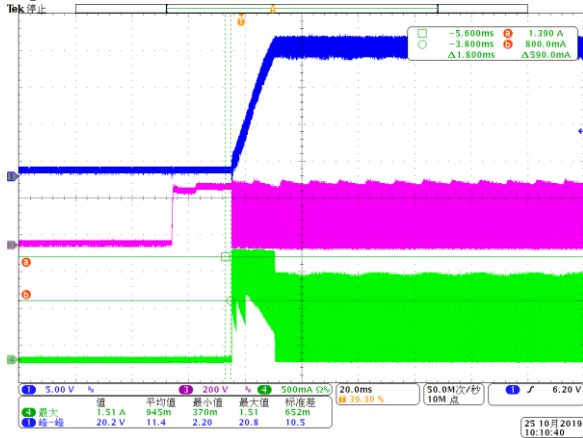
### 3.6. Ripple & Noise (Figure 7&8)

Input voltage	No load (mV)	Full load (mV)	Spec	Remark
90Vac/60Hz	24	78	<120mV	Pass
115Vac/60Hz	28	70		Pass
230Vac/50Hz	46	90		Pass
264Vac/50Hz	46	96		Pass



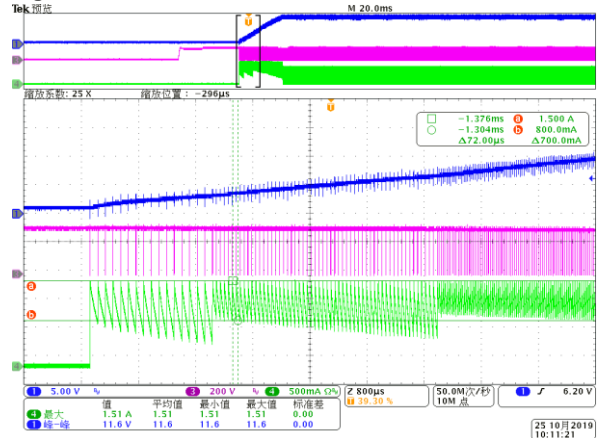
## 3.7. Waveforms

Figure 3: 230Vac, start at full load



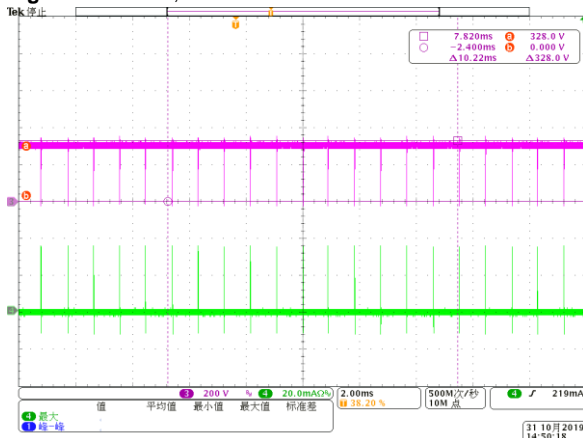
CH1:  $V_{out}$  CH3:  $V_{DS}$  CH4:  $I_{Inductor}$   
230Vac 输入, 满载启动,  $V_{DS}=340V$

Figure 4: 230Vac, start at full load



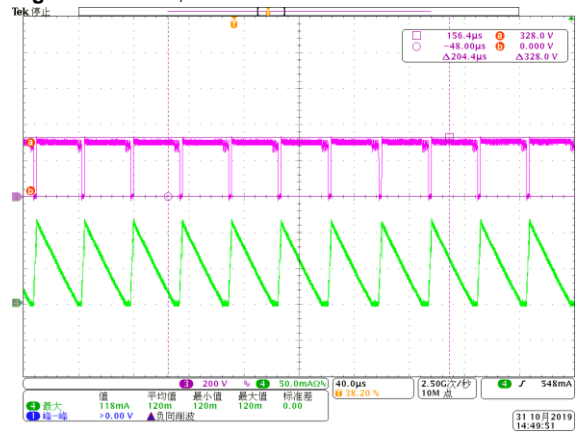
CH1:  $V_{out}$  CH3:  $V_{DS}$  CH4:  $I_{Inductor}$   
230Vac 输入, 满载启动波形展开,  $V_{DS}=340V$

Figure 5: 230Vac, No-load



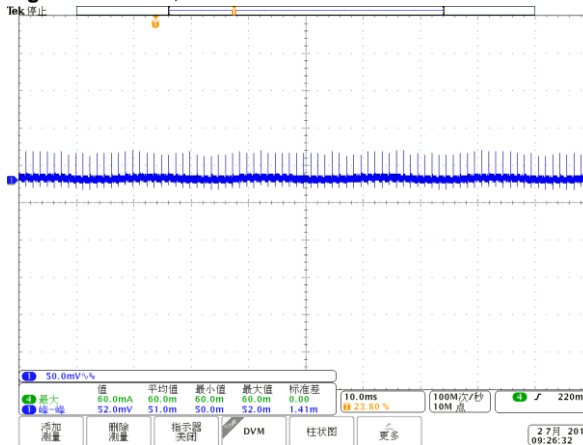
CH3:  $V_{DS}$  CH4:  $I_{Inductor}$   
230Vac 输入, 空载,  $V_{DS}=340V$

Figure 6: 230Vac, Full load



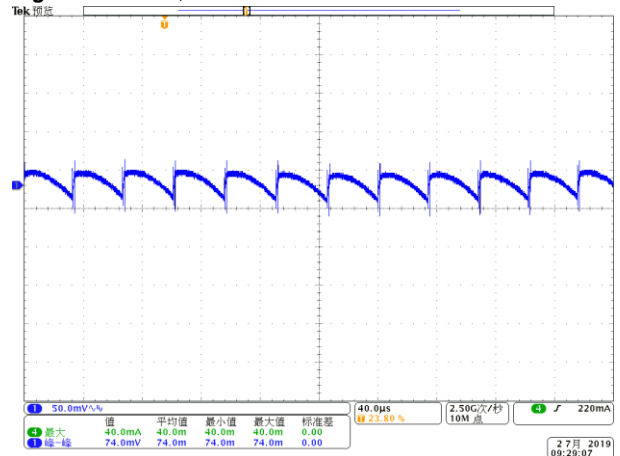
CH3:  $V_{DS}$  CH4:  $I_{Inductor}$   
230Vac 输入, 满载,  $V_{DS}=340V$

Figure 7: 264Vac, No-load



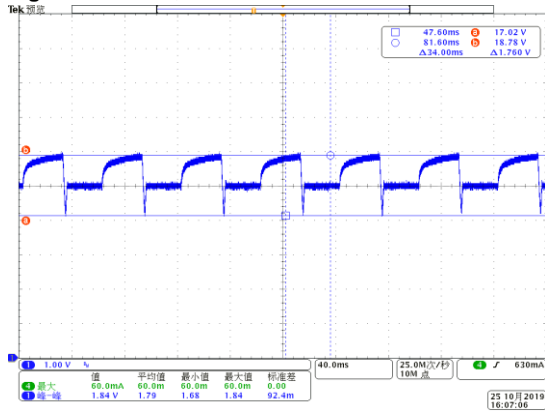
CH1:  $V_{ripple}$   
264Vac 输入, 空载,  $V_{ripple}=46mV$

Figure 8: 264Vac, Full load



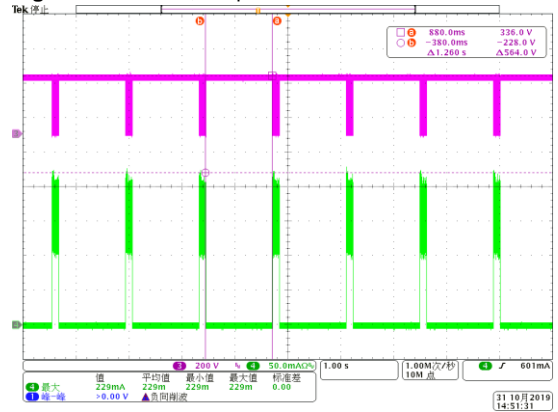
CH1:  $V_{ripple}$   
264Vac 输入, 满载,  $V_{ripple}=96mV$

**Figure 9:** 230Vac, 0~500mA load



CH1:  $V_{OUT}$   
230Vac 输入, 负载变化,  $V_{out} = 17.86-18.78V$

**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 (EN55032 CLASS B standard)

Figure 11: 230Vac, Line QP

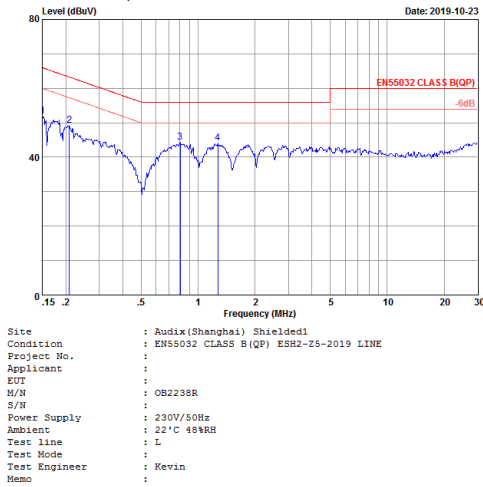


Figure 12: 230Vac, Line AVG

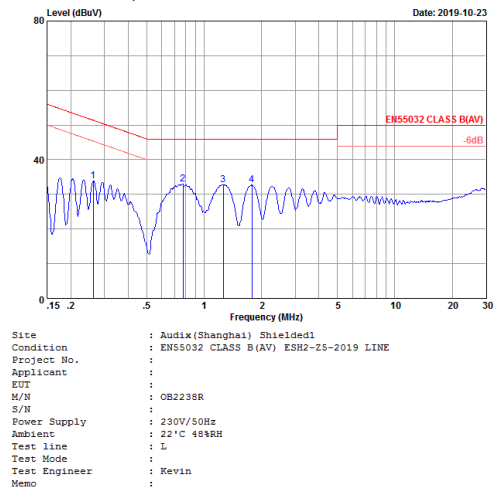


Figure 13: 230Vac, Neutral QP

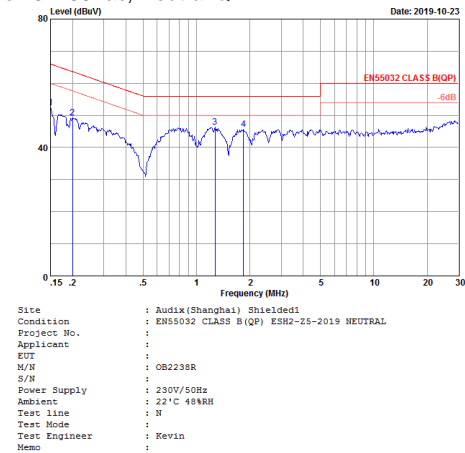
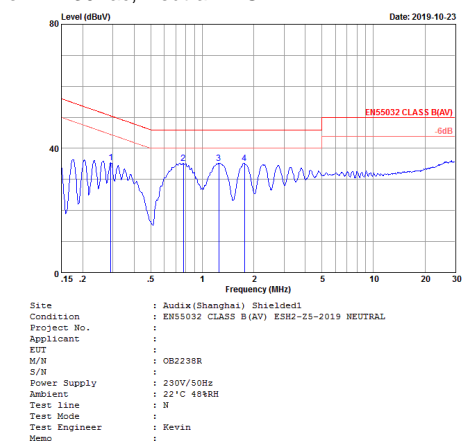


Figure 14: 230Vac, Neutral AVG



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