

Subject
OB2222M Demo Board Manual

Board Model: AD5.0V0.2A2222M.00

Doc. No.: OB_DOC_DBM_2222M02



Key features:

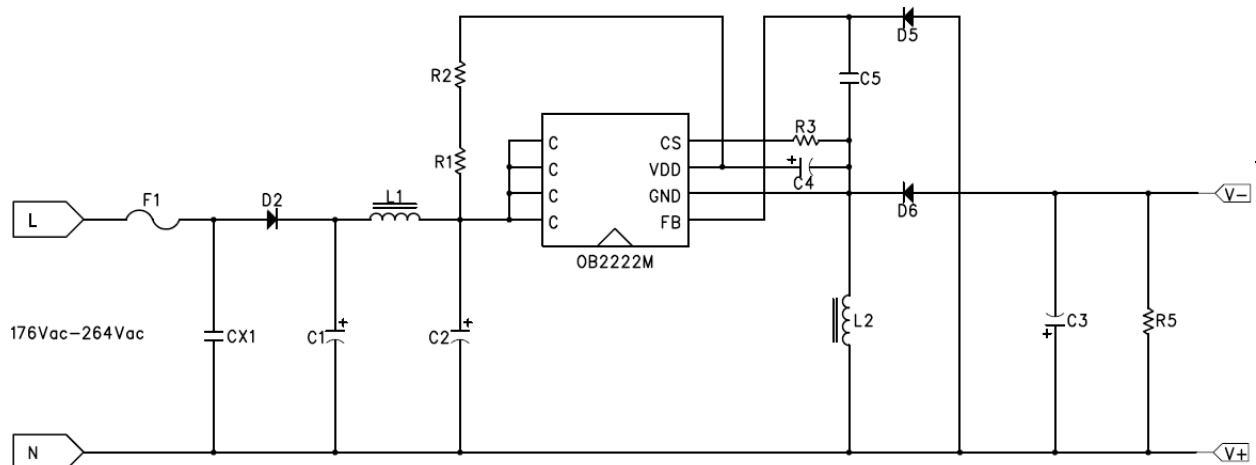
- Lowest possible component count
- Standby power <100mW @264Vac
- Efficiency measured >55% at full load
- Output voltage regulation +/-5%
- Good dynamic response
- Comprehensive protection including output short protection, OTP, etc.

Revision History

Revise Date	Version	Reason/Issue
2014-5-30	00	First issue
2014-6-25	01	Document optimization
2015-2-2	02	System optimization

1. Board Information

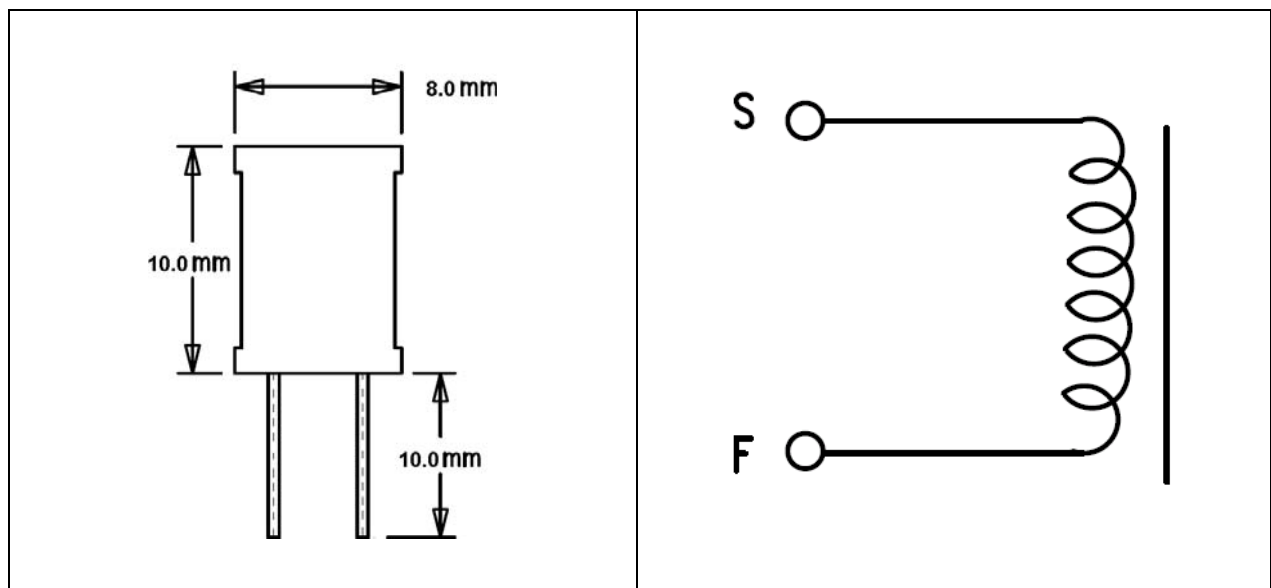
1.1. Board schematic



1.2. Component list

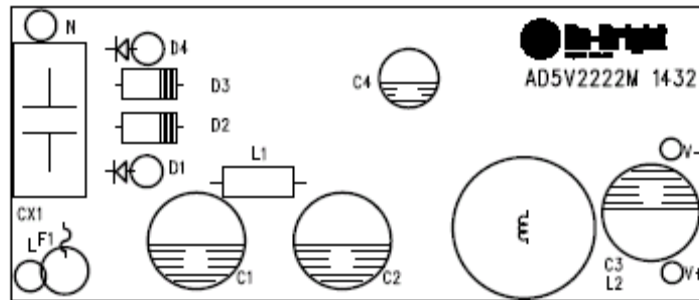
No.	Position	Description	Quantity
1	F1	Resistor fuse 10R/1W	1
2	D2	Diode 1N4007	1
3	D4	Jumper	1
4	D5	Diode M7	1
5	D6	Superfast diode ES1J	1
6	CX1	X-Cap 223P/X2	1
7	C1, C2	E.C. 2.2uF /400V	2
8	C3	E.C. 330uF /10V	1
9	C4	E.C. 4.7uF /50V	1
10	C5	SMD Cap 1uF /25V	1
11	R1,R2	SMD RES 2M /5% /1206	2
12	R3	SMD RES 1R0 /1% /1206	1
13	R5	SMD RES 1K /5% /0805	1
14	U1	OB2222M SOP8	1
15	L1	Inductor 1mH /0510	1
16	L2	Inductor 350uH /Φ8*10	1
	Total		18

1.3. Inductor design

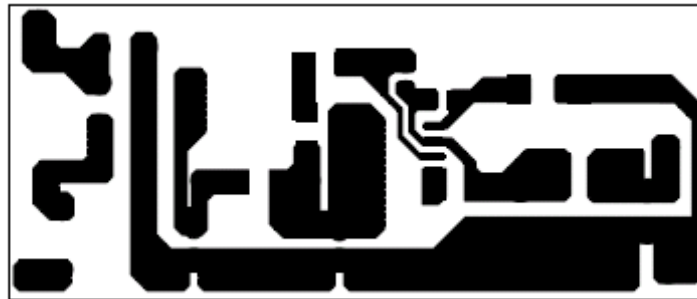


Material	Turns	Inductance & Tolerance
$\Phi 0.25 \times 1$ 2UEW	98	$350\mu\text{H} \pm 10\%$

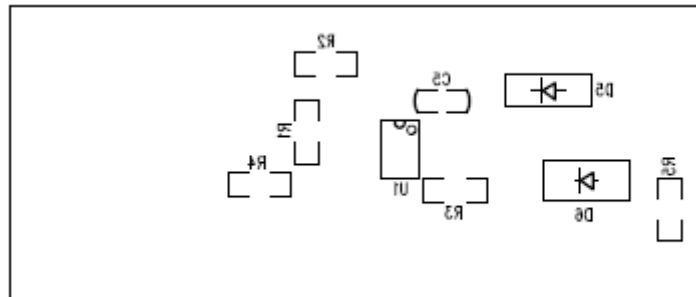
1.4. PCB Gerber File



Top

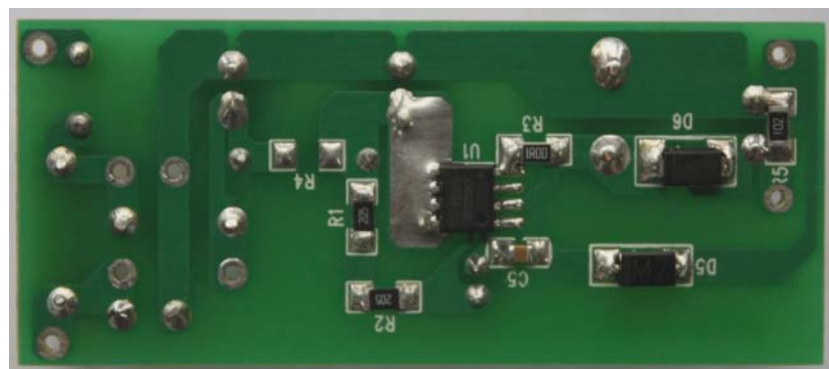


Bottom



Silkscreen Bottom

1.5. Snapshot



2. Converter Specification

2.1. Input Characteristics

- AC input voltage range 176Vac ~ 264Vac
- AC input frequency range 50Hz

2.2. Output Characteristics

- Output voltage V_{OUT} 5.0V
- Output current I_{OUT} 200mA
- Operating frequency 40KHz
- Output power 1.0W

2.3. Performance Function

- Standby Power < 100mW @ 264Vac/50Hz, no-load, 25°C
- Efficiency >55%
- 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

3. Performance Evaluation

3.1. Standby Power

Input voltage	P_{IN} (mW)	Spec	Remark
176Vac/50Hz	60	<100mW	Pass
200Vac/50Hz	65		Pass
230Vac/50Hz	73		Pass
264Vac/50Hz	84		Pass

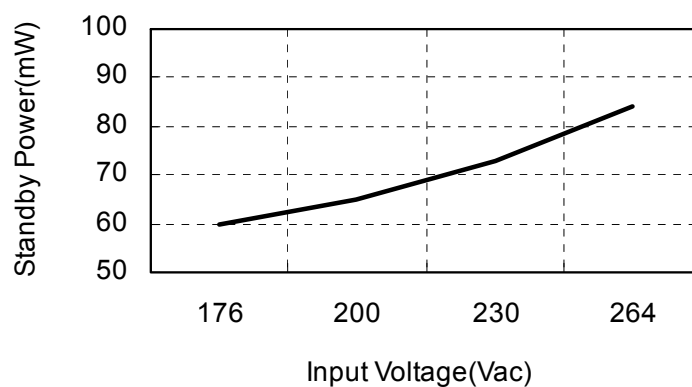


Figure 1. Standby input power

3.2. Efficiency

Input voltage	load 200mA	Spec	Remark
176Vac/50Hz	65.10	>55%	Pass
200Vac/50Hz	64.80		Pass
230Vac/50Hz	64.10		Pass
264Vac/50Hz	63.20		Pass

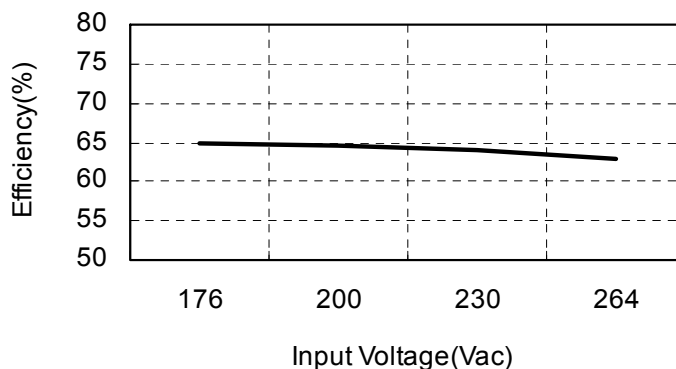


Figure 2. Efficiency @200mA load

3.3. Output Voltage

Input voltage	0mA	5mA	10mA	50mA	100mA	200mA	Spec	Remark
176Vac/50Hz	5.102	5.006	4.974	5.120	5.052	4.964	4.75~5.25V	Pass
200Vac/50Hz	5.108	5.000	4.964	5.080	5.055	4.964		Pass
230Vac/50Hz	5.114	4.999	4.952	4.993	5.053	4.960		Pass
264Vac/50Hz	5.137	5.001	4.947	4.940	5.056	4.960		Pass

3.4. Dynamic (Figure 9)

Input voltage	V _{OUT-MAX} (V)	V _{OUT-MIN} (V)	Spec	Remark
176Vac/50Hz	5.270	4.880	4.5~5.5V	Pass
200Vac/50Hz	5.270	4.870		Pass
230Vac/50Hz	5.270	4.870		Pass
264Vac/50Hz	5.270	4.865		Pass

Note: A dynamic loading with low load set at 5mA load lasting for 5ms and high set at 200mA load lasting for 5ms is added to output. The ramp is set at 0.25A/us at transient.

3.5. Over Current Protection & Recovery

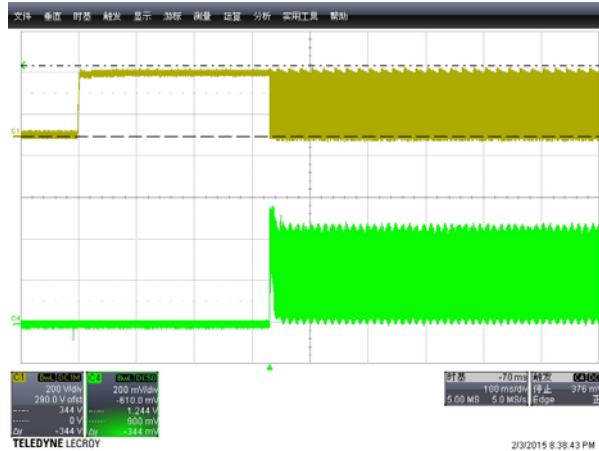
Input voltage	OCP (A)	Recovery (A)	Spec	Remark
176Vac/50Hz	0.285	0.277	$\geq 1.1 \cdot I_{OUT}$	Pass
200Vac/50Hz	0.290	0.286		Pass
230Vac/50Hz	0.293	0.290		Pass
264Vac/50Hz	0.302	0.297		Pass

3.6. Ripple & Noise (Figure 7&8)

Input voltage	No load (mV)	Full load (mV)	Spec	Remark
176Vac/50Hz	20.0	45.0	<100mV	Pass
200Vac/50Hz	19.8	46.0		Pass
230Vac/50Hz	23.8	46.0		Pass
264Vac/50Hz	25.0	45.0		Pass

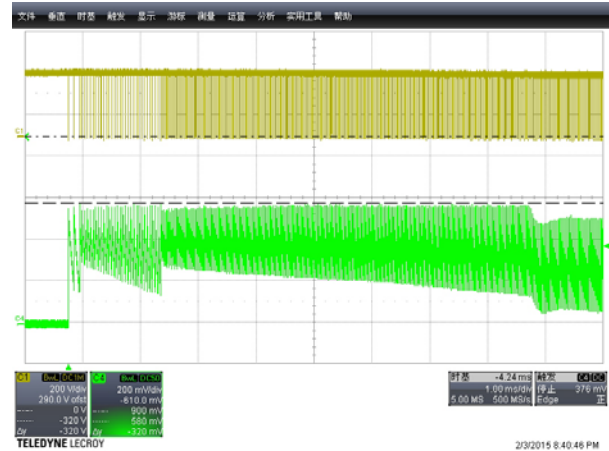
3.7. Waveforms

Figure 3: 230Vac, start at full load



CH1: V_{ds} CH4: $I_{Inductor}$
 230Vac 输入, 满载启动, $V_{ds}=344V$

Figure 4: 230Vac, start at full load



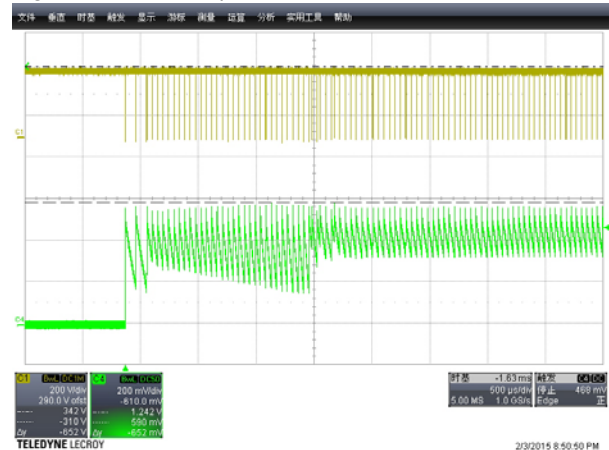
CH1: V_{ds} CH4: $I_{Inductor}$
 230Vac 输入, 满载启动波形展开, $V_{ds}=344V$

Figure 5: 230Vac, output short



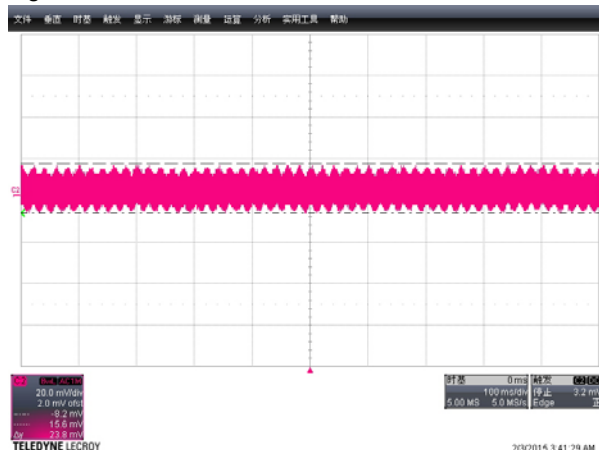
CH1: V_{ds} CH4: $I_{Inductor}$
 230Vac 输入, 输出短路, $V_{ds}=342V$

Figure 6: 230Vac, output short



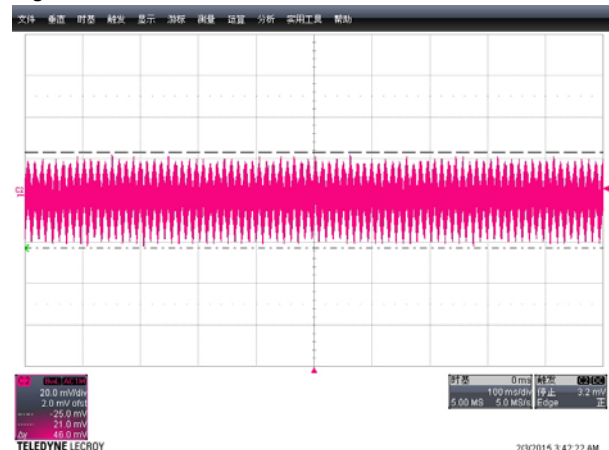
CH1: V_{ds} CH4: $I_{Inductor}$
 230Vac 输入, 输出短路波形展开, $V_{ds}=342V$

Figure 7: 230Vac, no-load

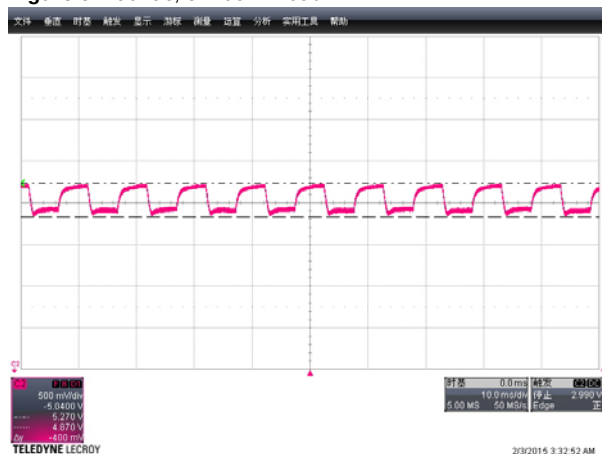


CH2: V_{ripple}
 230Vac 输入, 空载, $V_{ripple}=23.8mV$

Figure 8: 230Vac, full load



CH2: V_{ripple}
 230Vac 输入, 满载, $V_{ripple}=46mV$

Figure 9: 230Vac, 5~200mA load


CH2: V_{out}
 230Vac 输入, 负载变化, $V_{out}=4.87\sim 5.27V$

Figure 10: 264Vac, no-load


CH1: V_{ds} CH4: $I_{inductor}$
 264Vac 输入, 空载, $V_{ds}=396V$

Figure 11: 264Vac, full load


CH1: V_{ds} CH4: $I_{inductor}$
 264Vac 输入, 满载, $V_{ds}=400V$

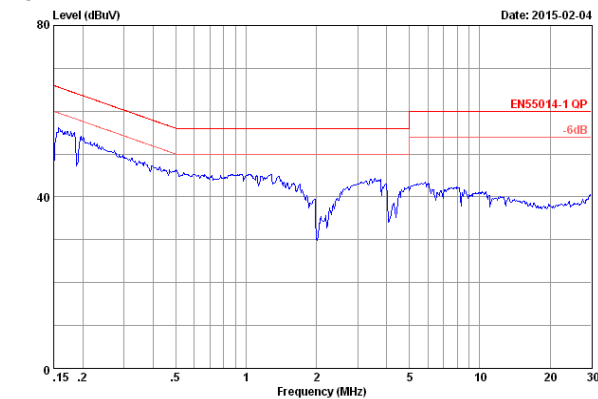
Figure 12: 264Vac, output short


CH1: V_{ds} CH4: $I_{inductor}$
 264Vac 输入, 输出短路, $V_{ds}=396V$

Input	$V_{ds_max}(V)$	Remark
264Vac @ no-load	396	Figure 10
264Vac @ full load	400	Figure 11
264Vac @ output short	396	Figure 12

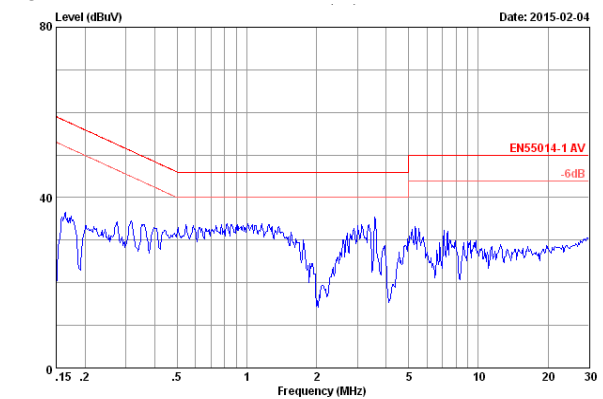
3.8. Conducted EMI Test (EN55014 Class B Standard)

Figure 13: 230Vac, Line QP



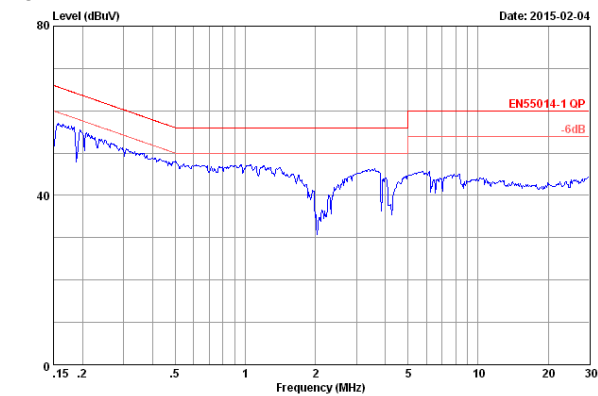
Site : Audix(Shanghai) Shielded1
 Condition : EN55014-1 QP ESH2-25-2014 LINE
 Project No. :
 Applicant :
 EUT : OB2222M
 M/N : DEMO
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : L
 Test Mode :
 Test Engineer : Seven
 Memo :

Figure 14: 230Vac, Line AVG



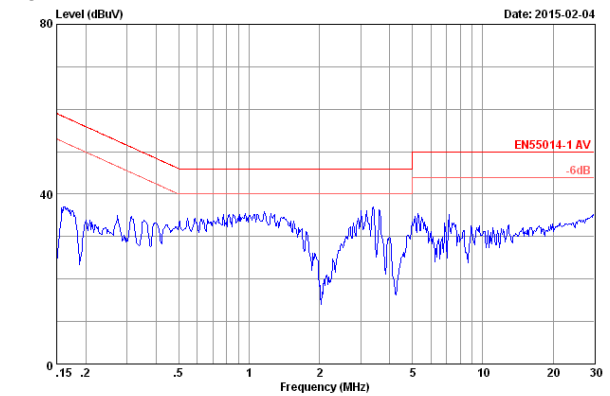
Site : Audix(Shanghai) Shielded1
 Condition : EN55014-1 AV ESH2-25-2014 LINE
 Project No. :
 Applicant :
 EUT : OB2222M
 M/N : DEMO
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : L
 Test Mode :
 Test Engineer : Seven
 Memo :

Figure 15: 230Vac, Neutral QP



Site : Audix(Shanghai) Shielded1
 Condition : EN55014-1 QP ESH2-25-2014 NEUTRAL
 Project No. :
 Applicant :
 EUT : OB2222M
 M/N : DEMO
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : N
 Test Mode :
 Test Engineer : Seven
 Memo :

Figure 16: 230Vac, Neutral AVG



Site : Audix(Shanghai) Shielded1
 Condition : EN55014-1 AV ESH2-25-2014 NEUTRAL
 Project No. :
 Applicant :
 EUT : OB2222M
 M/N : DEMO
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : N
 Test Mode :
 Test Engineer : Seven
 Memo :

3.9. Power Disturbance Test

Figure 17: 230Vac, QP

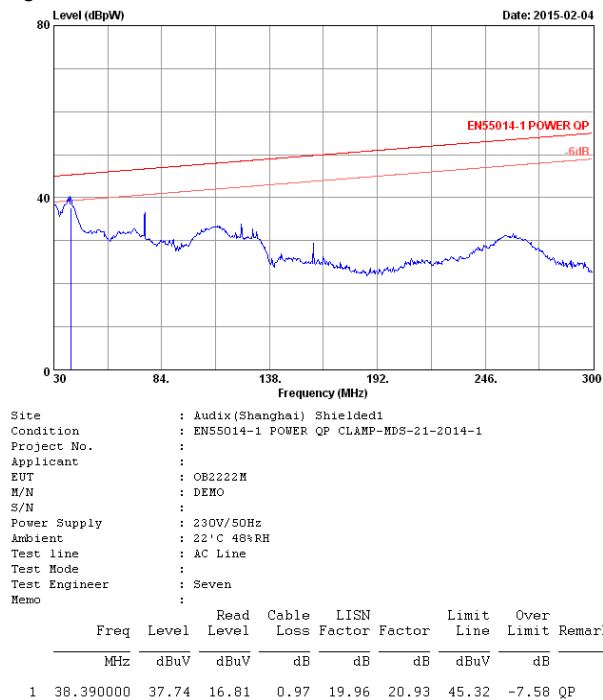
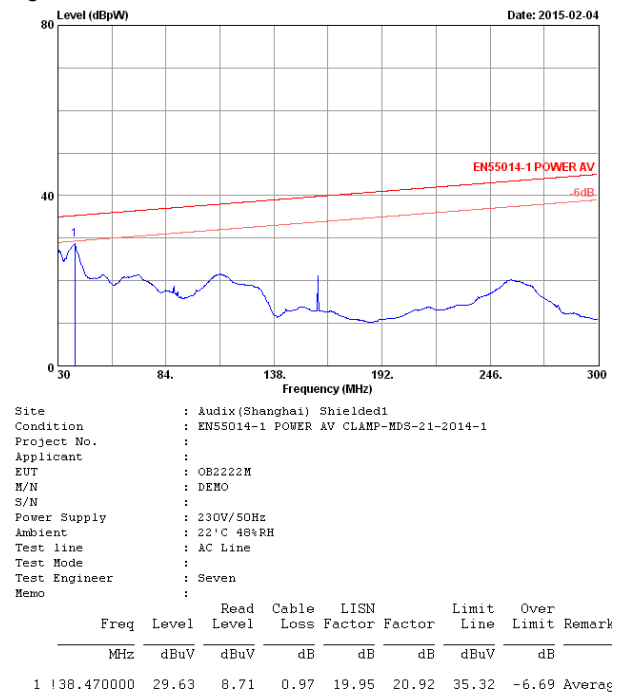


Figure 18: 230Vac, AVG



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