

**Subject**  
**OB2151 Demo Board Manual**

Board Model: Car charger 5.2V3.4A2151.03  
 Doc. No.: OB\_DOC\_DBM\_215103



**Key features:**

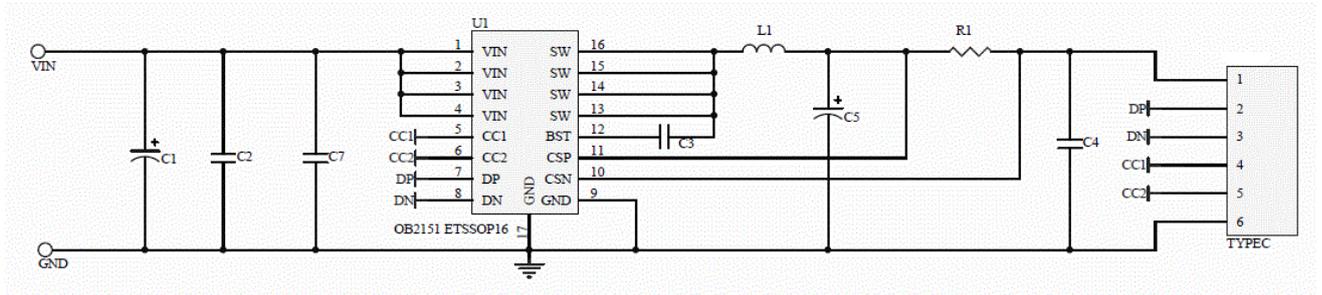
- Supports QC2.0/QC3.0, AFC, PE2.0, FCP1.0 Fast Charge protocols.
- Support Apple, and BC1.2 protocols.
- Support 5.2V/3.4A, 9V/2A, 12V/2A.
- Support Type-C Interface.
- Support PD3.0 5V/9V/12V protocols.
- Support Apple PD 20W protocols (9V/2.22A)
- Up to 92% efficiency at  $V_{CSN}$  5.2V 3.4A,  $V_{IN}$  12V.
- Built-in Cable Compensation.
- Multi-Stage Short Circuit Protection and Hiccup Mode
- $V_{in}/V_{csn}$  Over Voltage Protection and Over Temperature Protection
- Radiation EMI requirement with more than 6dB margin

## Revision History

Revise Date	Version	Reason/Issue
2019-07-15	00	First issue
2019-08-08	01	Change Package
2019-09-23	02	Change Pin Out
2020-09-08	03	Support Apple PD 20W protocols (9V/2.22A)

## 1. Board Information

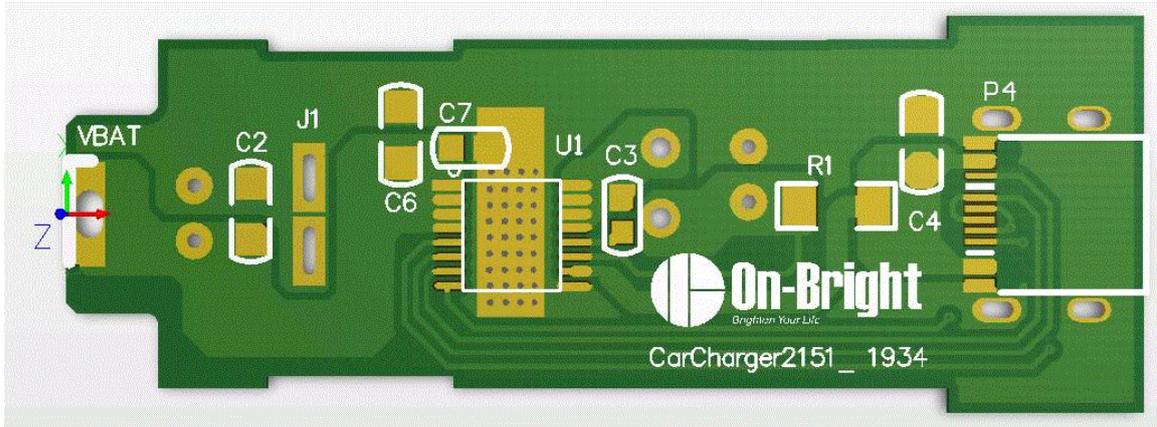
### 1.1 Board schematic



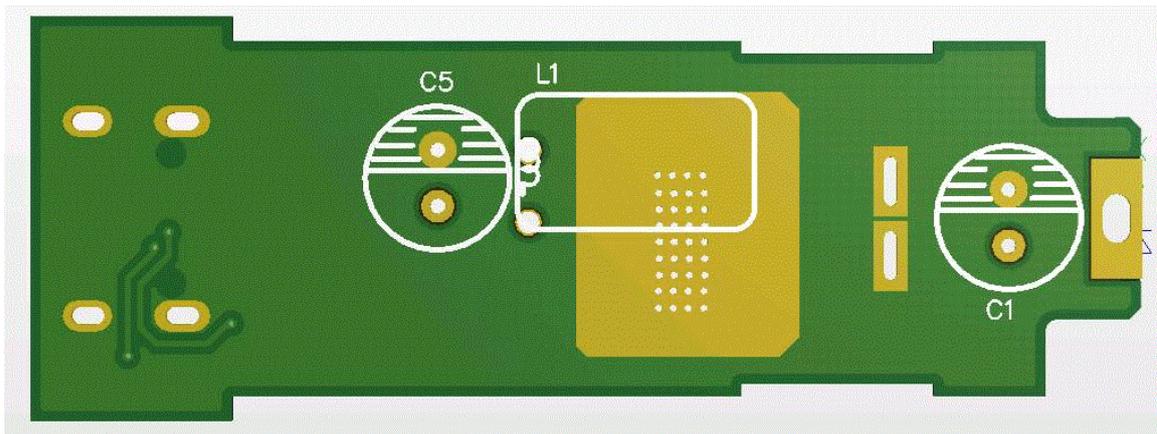
### Component list

No.	Position	Description	Quantity
1	R1	SMD RES 0R01 /1% /1206 合金材质， 双面黑色	1
2	C1	E.C. 100uF/35V,10*6,Aishi,1510JPET,RS105°C	1
3	C2	SMD CAP 10nF/50V 0805	1
4	C3	SMD CAP 680nF/25V 0603	1
5	C4	SMD CAP 100nF/25V 0805	1
6	C5	E.C. 220uF/25V,10*6, Aishi,1822JPET,RS105°C	1
7	C6	NC	
8	C7	SMD CAP 3.3nF/50V 0603	1
9	L1	Inductor 22uH, 铁硅铝 044-125,12*6*4, Φ0.7*20TS,18mohm	1
10	U1	OB2151, ETSSOP16	1
11	PCB	Carcharger2151 1934	1
	Total		10

## 1.2 PCB Gerber File

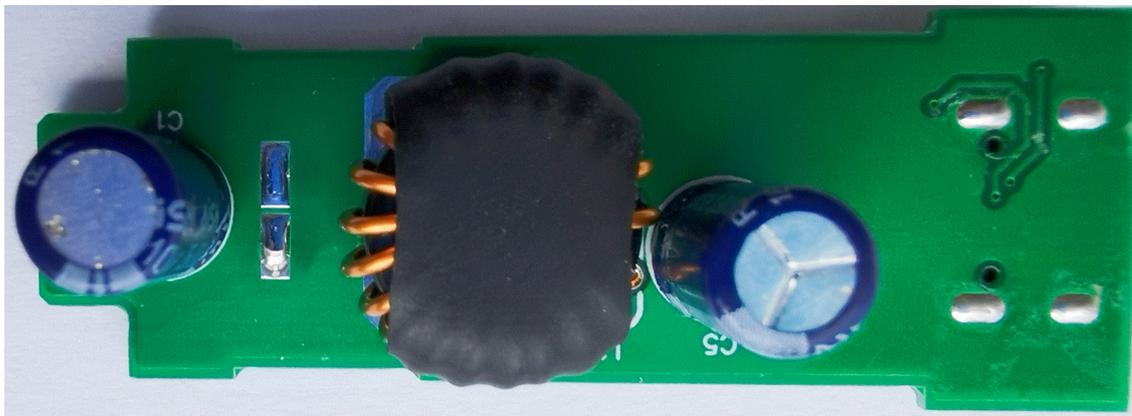


TOP



Bot

1.3 Snapshot



## 2. Converter Specification

### 2.1 Input Characteristics

input voltage range                      8-32Vdc

### 2.2 Output Characteristics

output voltage & current                5.2V3.4A/ 9V2A/ 12V2A

Operating frequency                    160KHz

### 2.3 Performance Function

Efficiency                                    UP to 97%

Ripple & Noise                            <200mV

### 2.4 Protection Function

Vin UVLO                                    Shut down with auto-restart

Vin OVP                                        Shut down with auto-restart

Output OVP                                  Shut down with auto-restart

OTP     Shut down with auto-restart

OCP    Shut down with auto-restart

Output SCP                                  Shut down with auto-restart

### 3. Performance Evaluation

#### 3.1 VIN UVLO

		Test result	Spec	Remark
UVLO	OFF	7.49V	7.2-7.8V	pass
	ON	6.94V	6.8-7.2V	pass

#### 3.2 VIN OVP

		Test result	Spec	Remark
OVP	OFF	32.3V	31.6-32.8V	pass
	ON	33V	32.8-34V	pass

### 3.3 Efficiency

Burn in 2 min., PCB End's Efficiency.

#### 3.3.1 Vo=5.2V/3.4A

VIN (V)	25%	50%	75%	100%	AVG
12	95.59	94.90	93.61	92.65	94.19
24	91.02	91.93	91.41	90.34	91.18

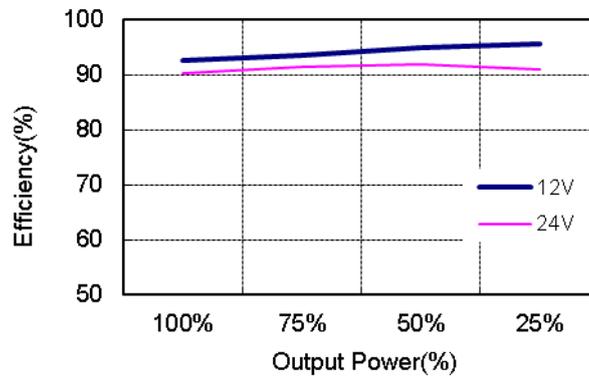


Figure 1. Efficiency @Buck CV mode 5.2V/3.4A

### 3.3.2 Vo=9V2A

VIN (V)	25%	50%	75%	100%	AVG
12	97.31	97.53	97.28	96.89	97.25
24	92.07	93.73	94.61	94.47	93.72

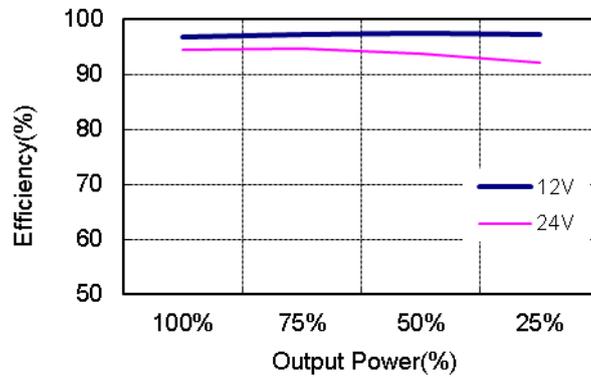


Figure 2: Efficiency @Buck CV mode 9V/2A

### 3.3.3 Vo=12V2A

VIN (V)	25%	50%	75%	100%	AVG
12	98.18	98.21	97.99	97.61	98.00
24	93.97	95.29	95.41	95.69	95.09

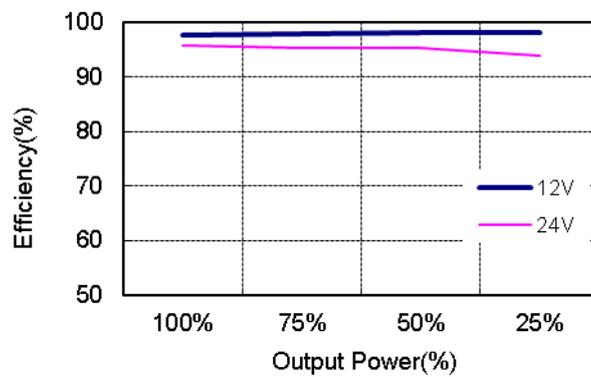


Figure 3: Efficiency @Buck CV mode 12V/2A

### 3.3 Output Voltage & Current

VIN=12V/24V, Vo=5.2V

Figure5 : CV

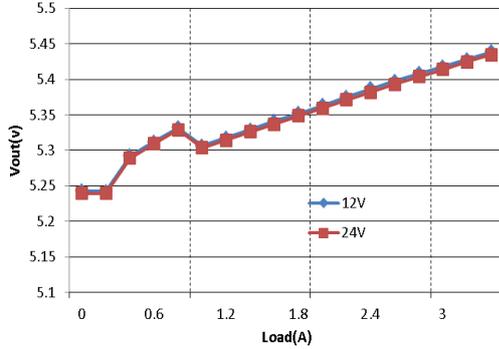
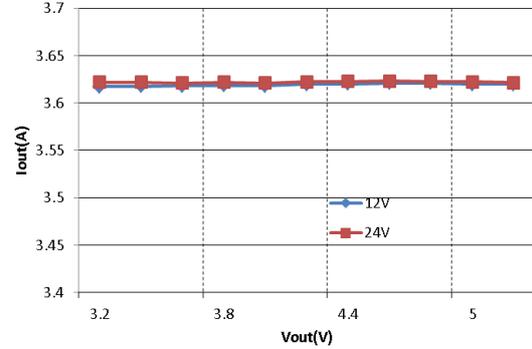


Figure6 : CC



VIN=12V/24V, Vo=9V

Figure7 : CV

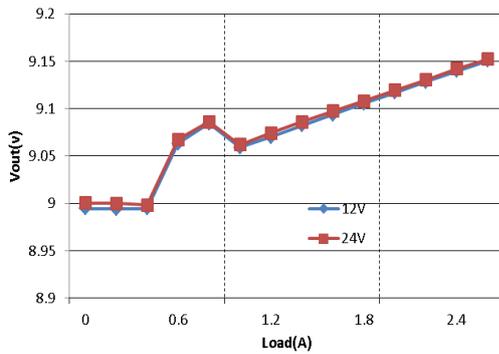
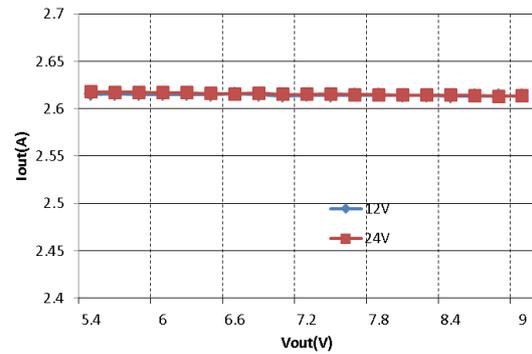


Figure8 : CC



VIN=12V/24V, Vo=12V

Figure9 : CV

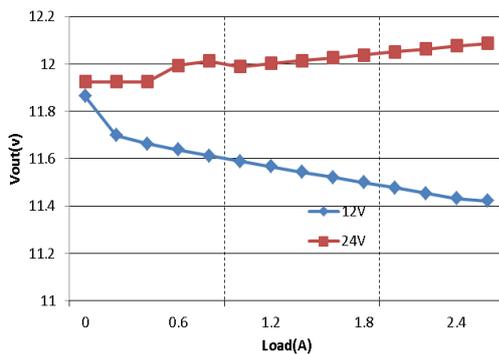
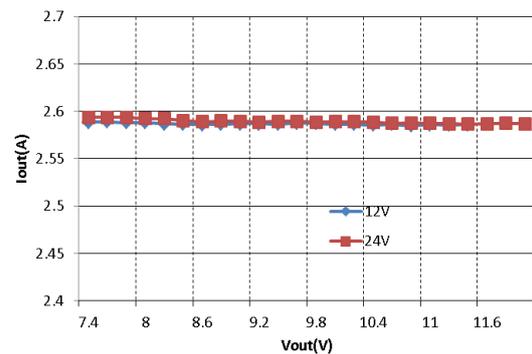


Figure10 : CC



### 3.4 Ripple & noise

PCB END with 104 cap

V<sub>in</sub>=12V

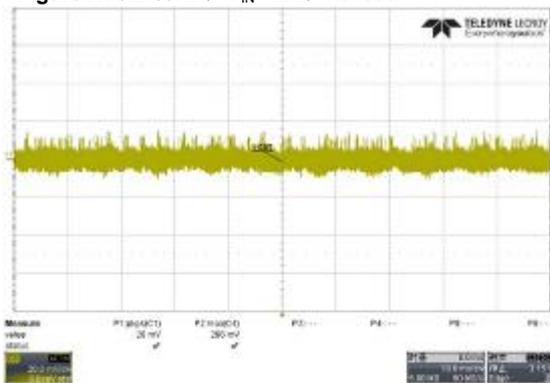
V <sub>o</sub>	Ripple&noise (mv)	
	0	100%
5.2V/3.4A	26	101
9V/2A	30	73
12V/2A	76	27

V<sub>in</sub>=24V

V <sub>o</sub>	Ripple&noise (mv)	
	0	100%
5.2V/3.4A	43	161
9V/2A	37	133
12V/2A	38	133

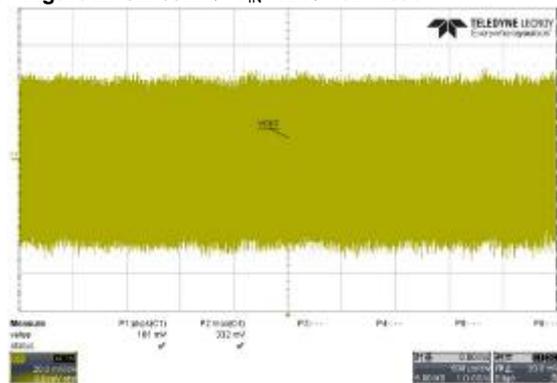
V<sub>in</sub> 12V

Figure11: 5.2V/3.4A, V<sub>IN</sub>=12V, no-load



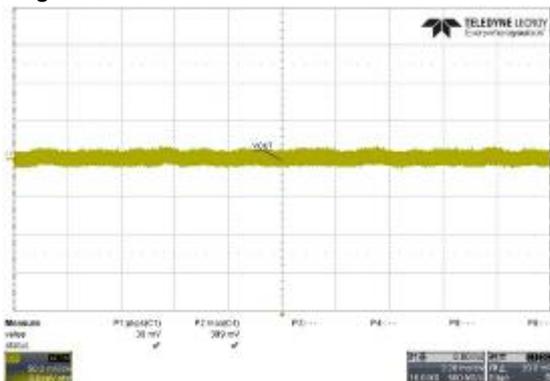
CH1: V<sub>ripple</sub>

Figure12: 5.2V/3.4A, V<sub>IN</sub>=12V, full load



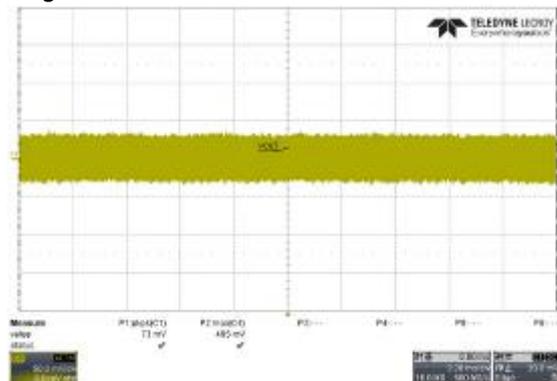
CH1: V<sub>ripple</sub>

Figure13: 9V/2A, V<sub>IN</sub>=12V, no-load



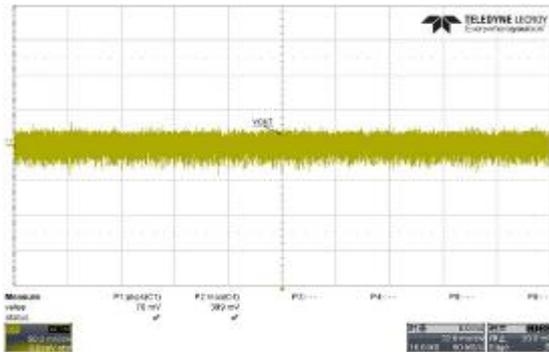
CH1: V<sub>ripple</sub>

Figure 14: 9V/2A, V<sub>IN</sub>=12V, full load



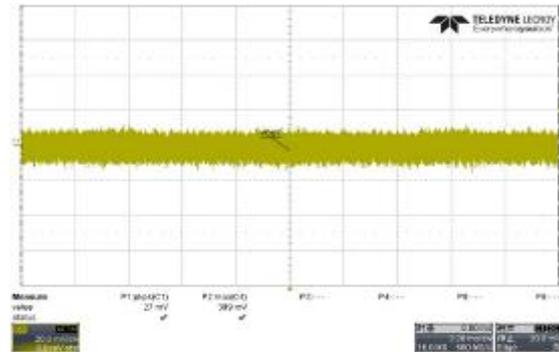
CH1: V<sub>ripple</sub>

Figure 15: 12V/2A,  $V_{IN}=12V$ , no-load



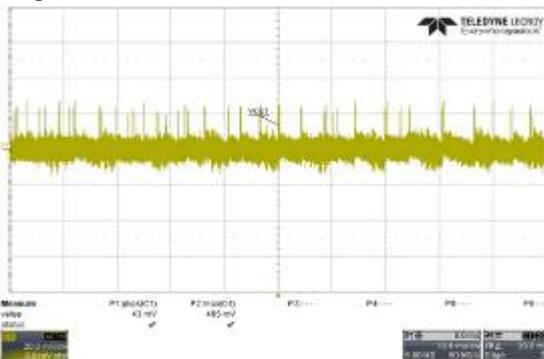
CH1:  $V_{ripple}$   
 $V_{IN}=24V$

Figure 16: 12V/2 A,  $V_{IN}=12V$ , full load



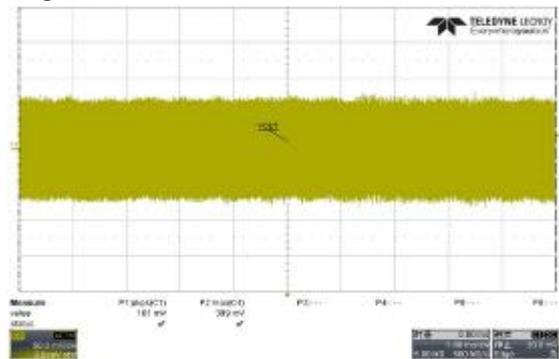
CH1:  $V_{ripple}$

Figure 17: 5.2V/3.4A,  $V_{IN}=24V$ , no-load



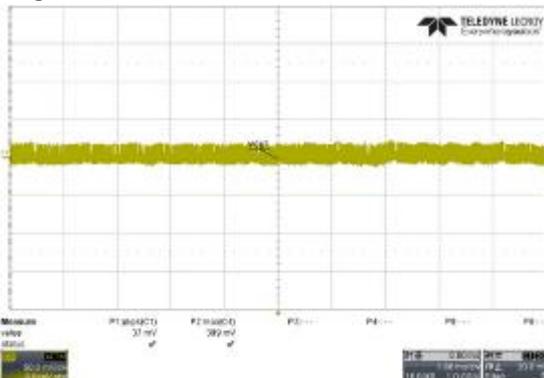
CH1:  $V_{ripple}$

Figure 18: 5.2V/3.4A,  $V_{IN}=24V$ , full load



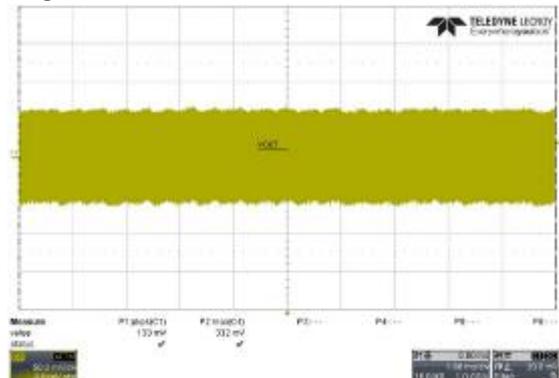
CH1:  $V_{ripple}$

Figure 19: 9V/2A,  $V_{IN}=24V$ , no-load



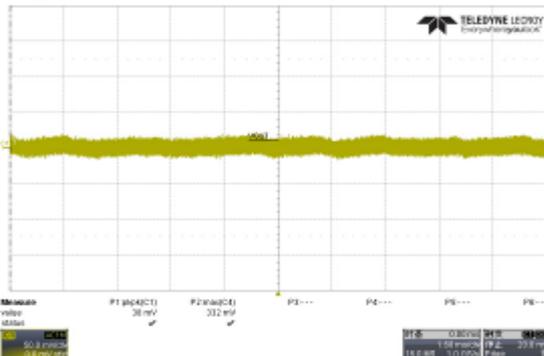
CH1:  $V_{ripple}$

Figure 20: 9V/2A,  $V_{IN}=24V$ , full load



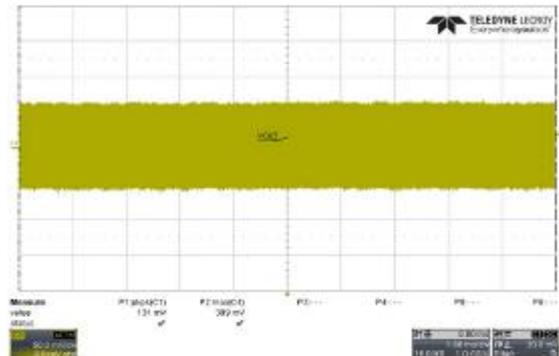
CH1:  $V_{ripple}$

Figure 21: 12V/2A,  $V_{IN}=24V$ , no-load



CH1:  $V_{ripple}$

Figure 22: 12V/2A,  $V_{IN}=24V$ , full load

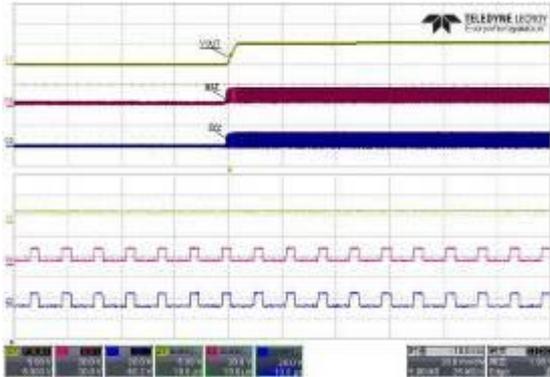


CH1:  $V_{ripple}$

### 3.5 Waveforms

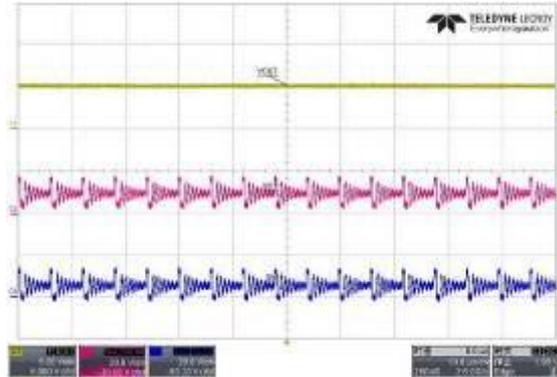
#### 3.5.1 VO=5.2V start/normal/output short/CC mode waveforms

Figure 23: 5.2V/3.4A, VIN=12V, Start full load



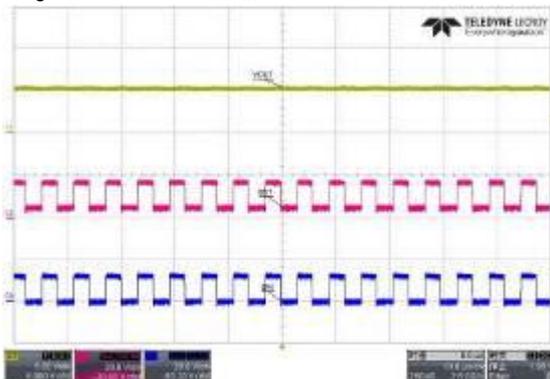
CH1: V<sub>OUT</sub> CH2: BST CH3: SW

Figure 24: 5.2V/3.4A, VIN=12V, Normal, no load



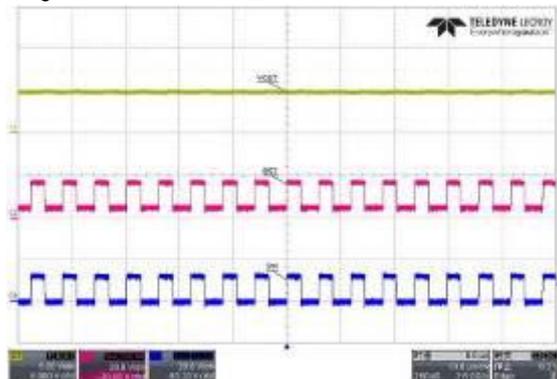
CH1: V<sub>OUT</sub> CH2: BST CH3: SW

Figure 25: 5.2V/3.4A, VIN=12V, full load



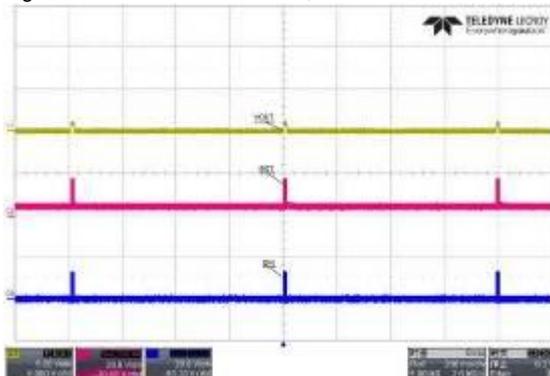
CH1: V<sub>OUT</sub> CH2: BST CH3: SW

Figure 26: 5.2V/3.4A, VIN=12V, cc mode



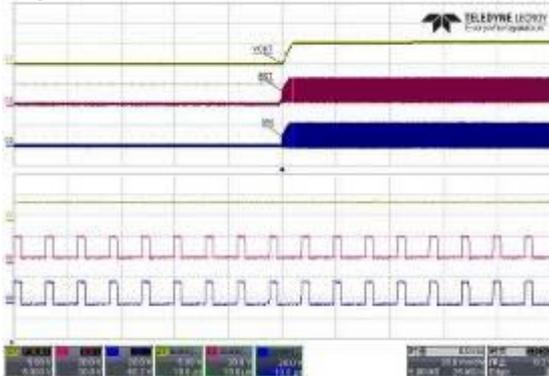
CH1: V<sub>OUT</sub> CH2: BST CH3: SW

Figure 27: 5.2V/3.4A, VIN=12V, short



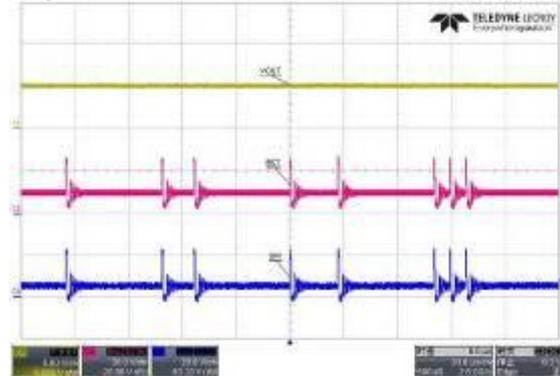
CH1: V<sub>OUT</sub> CH2: BST CH3: SW

Figure 28: 5.2V/3.4A,  $V_{IN}=24V$ , Start full load



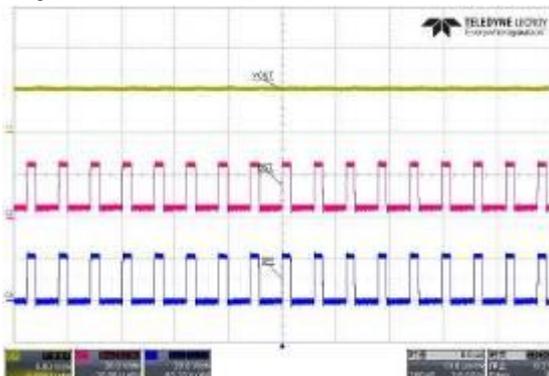
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 29: 5.2V/3.4A,  $V_{IN}=24V$ , Normal, no load



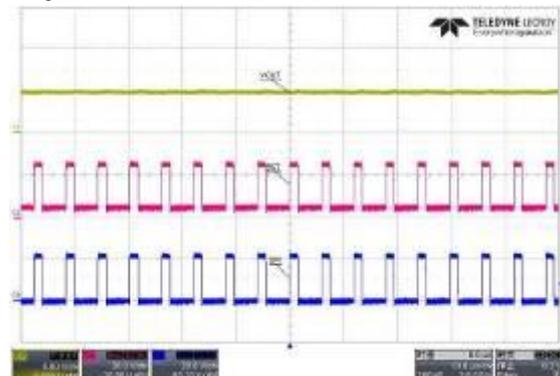
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 30: 5.2V/3.4A,  $V_{IN}=24V$ , full load



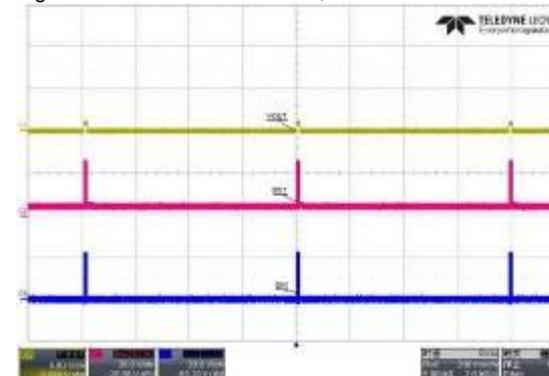
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 31: 5.2V/3.4A,  $V_{IN}=24V$ , cc mode



CH1:  $V_{OUT}$  CH2: BST CH3: SW

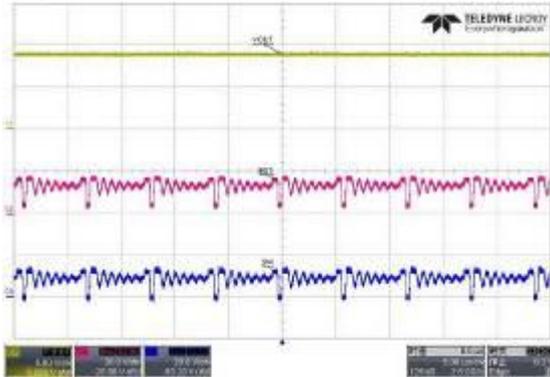
Figure 32: 5.2V/3.4A,  $V_{IN}=24V$ , short



CH1:  $V_{OUT}$  CH2: BST CH3: SW

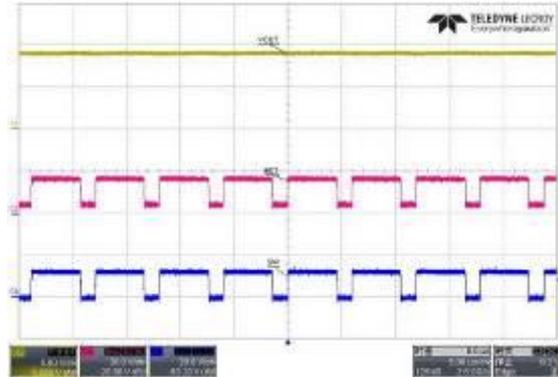
### 3.5.2 $V_o=9V$ start/normal/output short/CC mode waveforms

**Figure 33:** 9V/2A,  $V_{IN}=12V$ , Normal no load



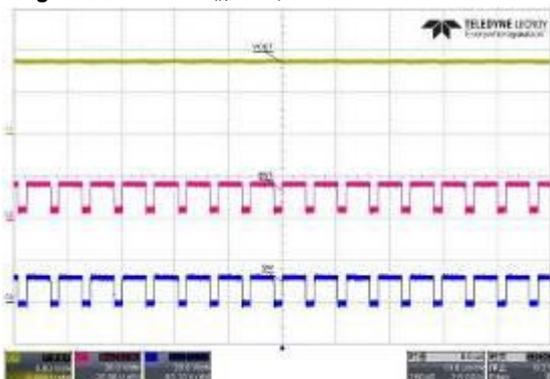
CH1:  $V_{OUT}$  CH2: BST CH3: SW

**Figure 34:** 9V/2A,  $V_{IN}=12V$ , full load



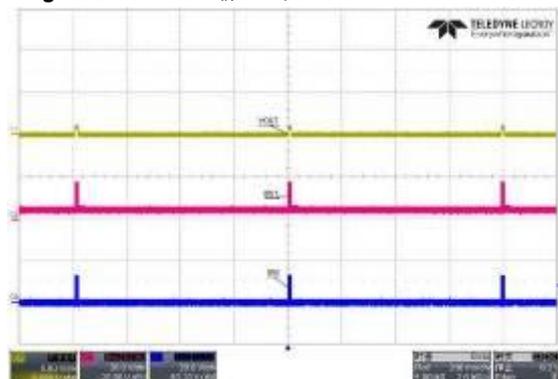
CH1:  $V_{OUT}$  CH2: BST CH3: SW

**Figure 35:** 9V/2A,  $V_{IN}=12V$ , cc mode



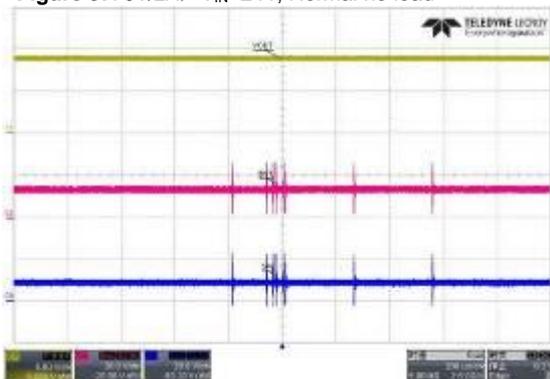
CH1:  $V_{OUT}$  CH2: BST CH3: SW

**Figure 36:** 9V/2A,  $V_{IN}=12V$ , short



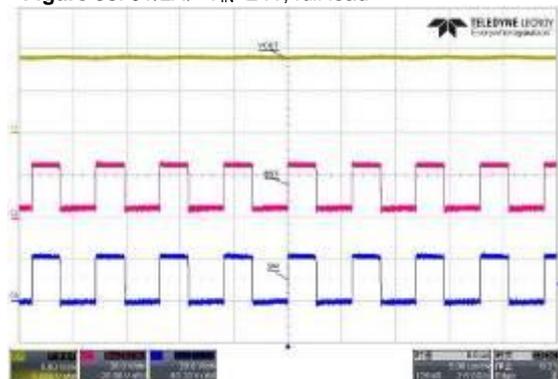
CH1:  $V_{OUT}$  CH2: BST CH3: SW

**Figure 37:** 9V/2A,  $V_{IN}=24V$ , Normal no load



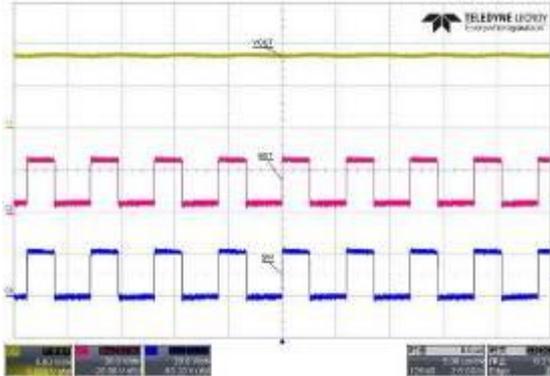
CH1:  $V_{OUT}$  CH2: BST CH3: SW

**Figure 38:** 9V/2A,  $V_{IN}=24V$ , full load



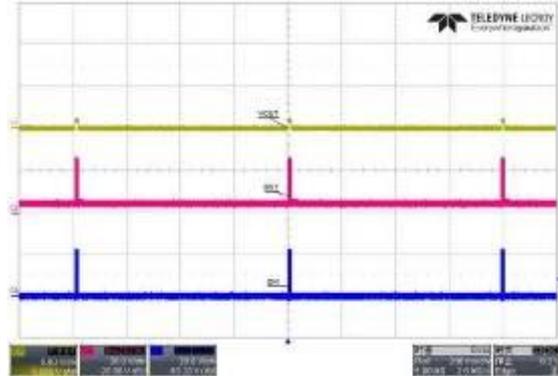
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 39: 9V/2A,  $V_{IN}=24V$ , cc mode



CH1:  $V_{OUT}$  CH2: BST CH3: SW

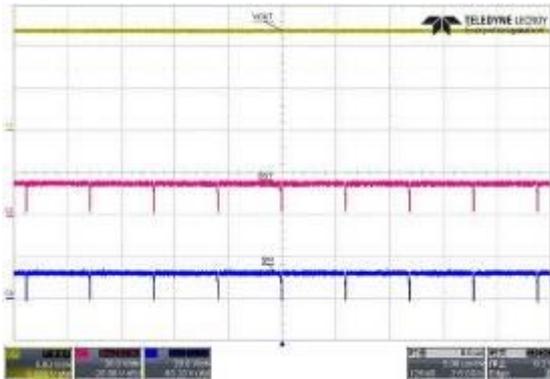
Figure 40: 9V/2A,  $V_{IN}=24V$ , short



CH1:  $V_{OUT}$  CH2: BST CH3: SW

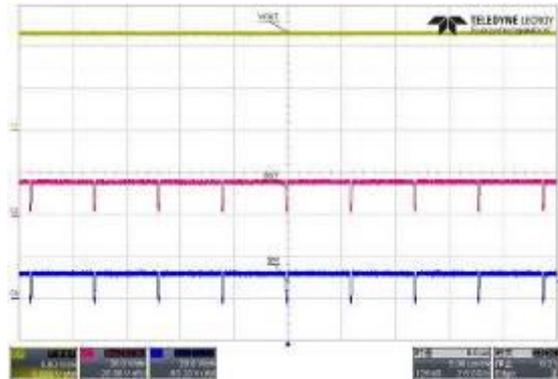
### 3.6.3 $V_o=12V$ start/normal/output short/CC mode waveforms

Figure 41: 12V/2A,  $V_{IN}=12V$ , Normal no load



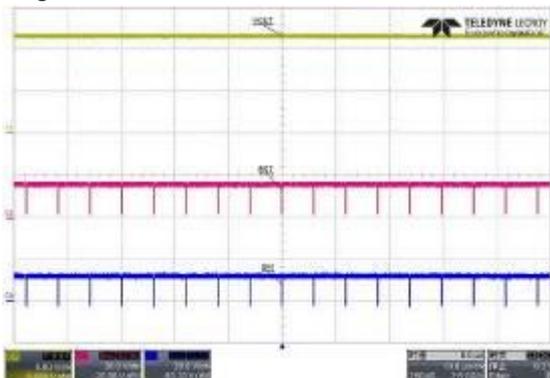
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 42: 12V/2A,  $V_{IN}=12V$ , full load



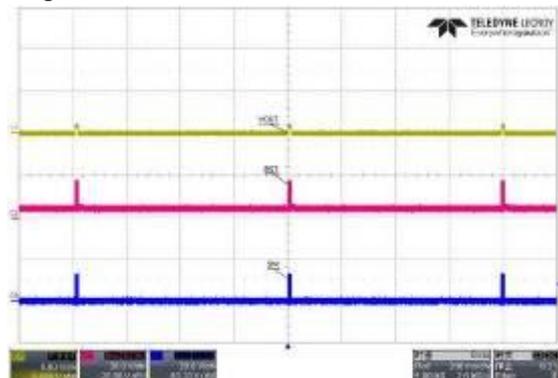
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 43: 12V/2A,  $V_{IN}=12V$ , CC mode



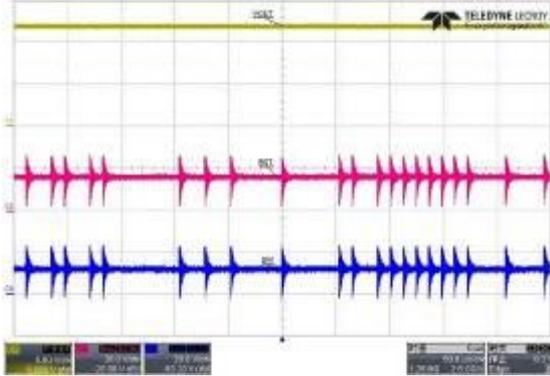
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 44: 12V/2A,  $V_{IN}=12V$ , short



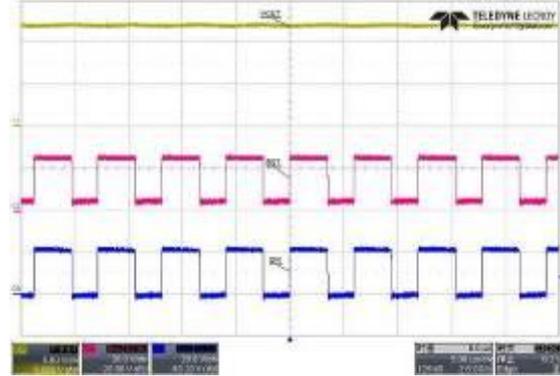
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 45: 12V/2A,  $V_{IN}=24V$ , no load



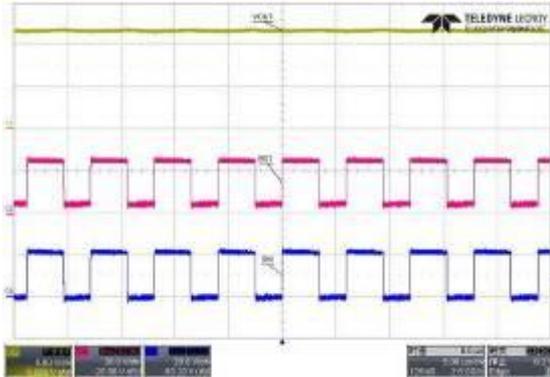
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 46: 12V/2A,  $V_{IN}=24V$ , full load



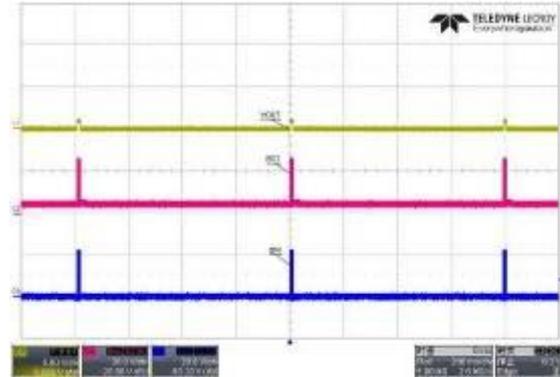
CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 47: 12V/2A,  $V_{IN}=24V$ , cc mode



CH1:  $V_{OUT}$  CH2: BST CH3: SW

Figure 48: 12V/2A,  $V_{IN}=24V$ , short



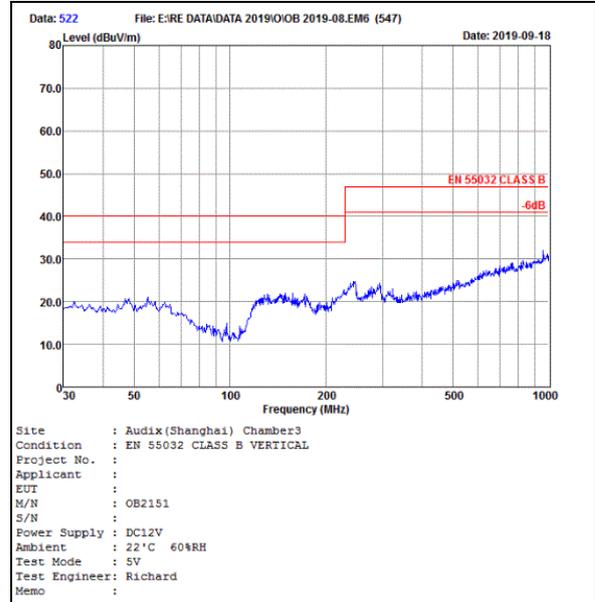
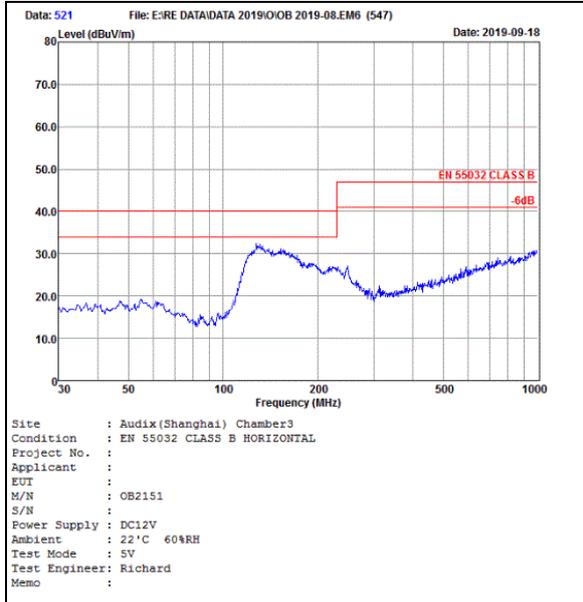
CH1:  $V_{OUT}$  CH2: BST CH3: SW

### 3.7 Radiation EMI Test

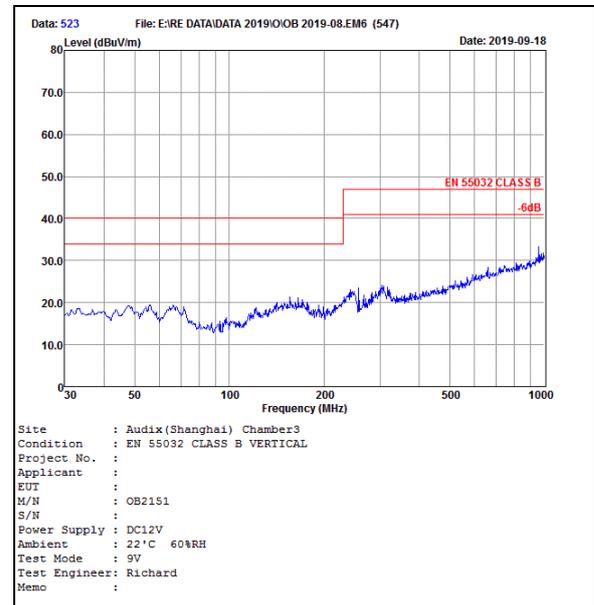
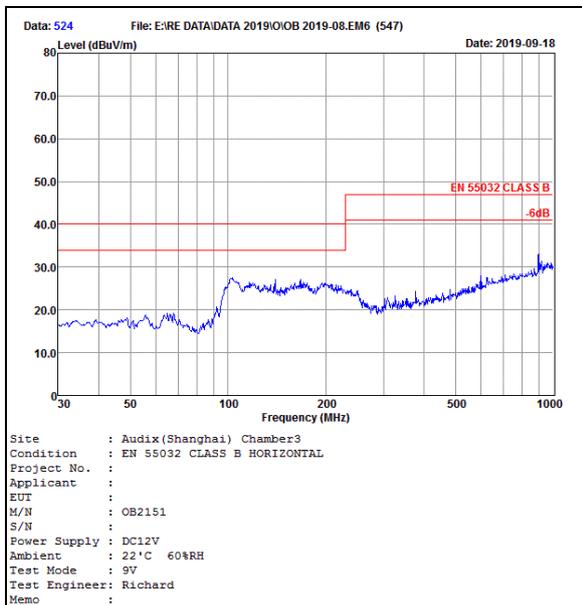
#### EN55022 CLASS B @ full load report

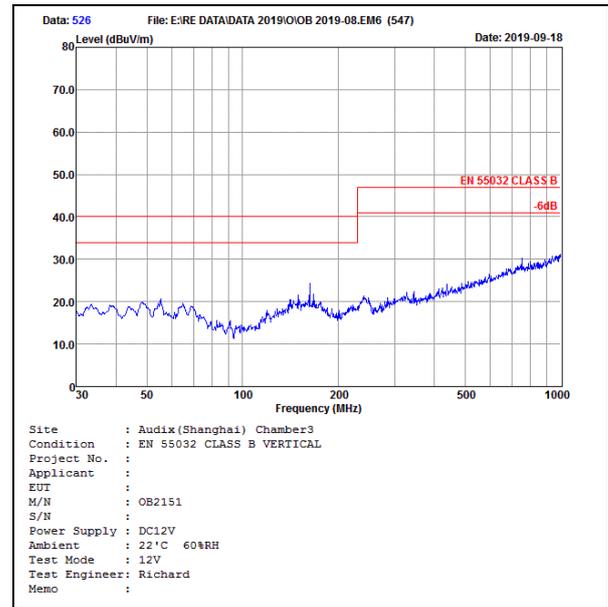
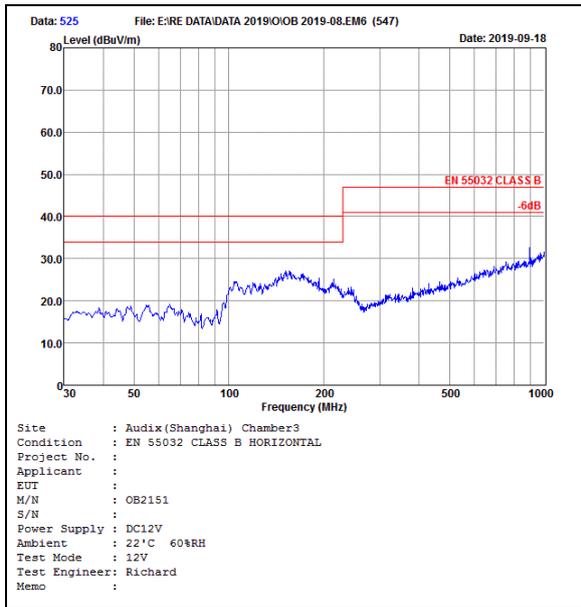
The Power supply passed EN55032 Class B EMI requirement with more than 6dB margin @ VIN 12V

#### Vo 5.2V3.4A @ full load report



#### Vo 9V2A @ full load report



**Vo 12V2A @ full load report**


### 3.8 Thermal Test

Test method: Input Voltage 12V/24V, Output power 5.2V/3.4A, Ambient temperature 40°C.

IC Temperature rise as follows:

Input Voltage (V)	IC Temperature (°C) @ LOAD=5.2V/3.4A
12	96
24	116

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