1 TYPICAL APPLICATION

- Below shows some blocks connected between power source and DC/DC module. Install the circuit of the block which is required.
- Each block has individual function and should be placed on the corresponding location.
- If CEMI is an Aluminum electrolytic capacitor and connected in parallel with CEMS, The capacitance we recommended for meeting EMS requirements could be CEMS pluses CEMI.

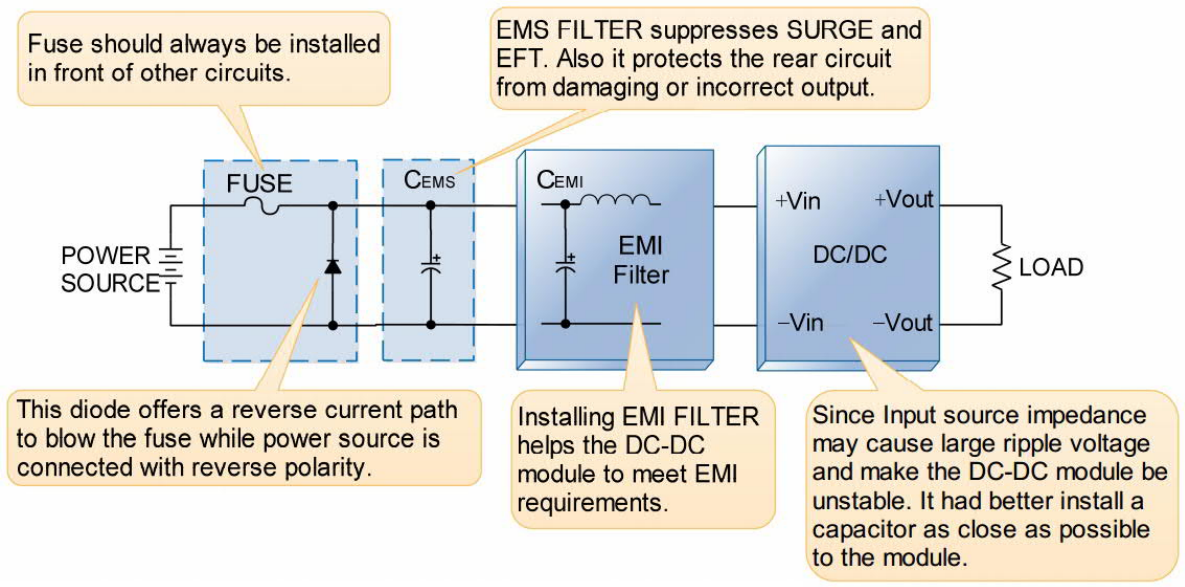


Fig. 1-1 Typical Application

2 LINE PROTECTIONS

Fuse

- The DC/DC converter is not internally fused. An input line fuse must always be used.
- Fuses should be installed in front of each module when multiple DC/DC converters connect to the same power source.

Modules	Fuse Rating (A)	Fuse Type
SDS(H)05-24□□□W	1.25	Slow-Blow
SDS(H)05-48□□□W	0.63	Slow-Blow

Table 2-1 FUSE Selection

- According to actual current value, calculating fuse ratings base on the following equations:

  $I_{FUSE} \geq I_{in} / (\text{Rerating} \times \text{Safety margin})$

  $\text{Melting } I^2t = I^2_{PULSE,act} \cdot t / 0.22$

  Where

  I_{FUSE} is current rating of fuse.

  I_{in} is actual value of input current.

  Rerating is percentage of fuse rating base on ambient temperature. Fuse rating is variety under different ambient temperature.

  Safety margin is percentage of fuse rating set by user.

  Melting I^2t is pulse energy rating of fuse.

  $I_{PULSE,act}$ is actual input pulse current.

  t is the width of the input pulse current.

Reverse Input Voltage Protection

- Avoid the reverse polarity input voltage; otherwise, it will damage the DC/DC converter.
- It is likely to protect the module from the reverse input voltage by installing an external diode.
- The diode can blow the line fuse to protect DC/DC converter.
- Recommend using Schottky diode for reverse input voltage protection.

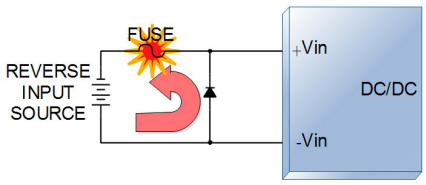


Fig. 2-1 Reverse Input Voltage Protection

Model	Voltage Rating of the Diode	Current Rating of the Diode
SDS(H)05-24□□□W	60V	1~1.5 x Fuse Rating
SDS(H)05-48□□□W	100V	

Table. 2-2 Reverse Protection Diode Selection

3 EMS CONSIDERATIONS

- The module can meet EMS requirements as below.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.

Parameter	Conditions		Level
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV	Perf. Criteria A
Surge	EN61000-4-5	± 1kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Table 3-1 EMS requirements

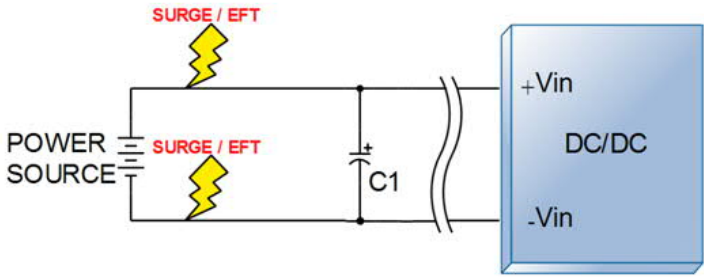


Fig. 3-1 Surge & EFT Protections

- It should be noticed that the current path of the PCB trace. Wrong PCB layout reduces ability of suppressing SURGE or EFT.

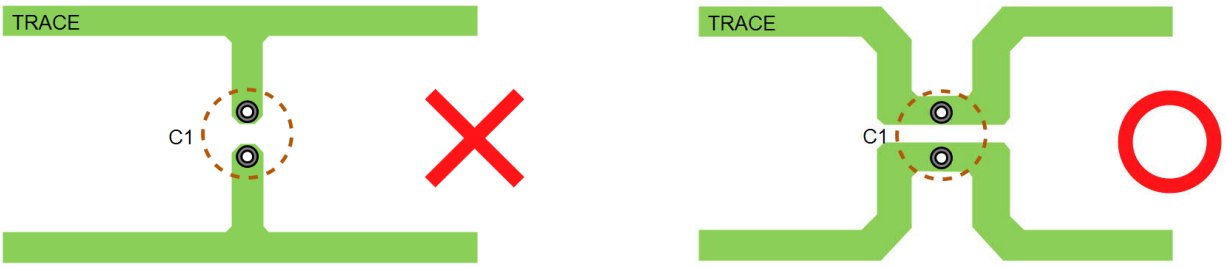


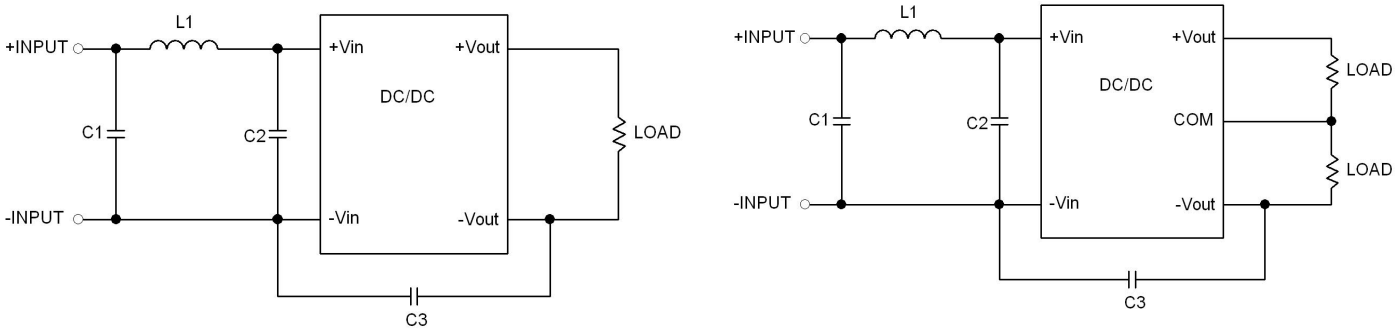
Fig. 3-2 PCB Trace

Model	Component	Specification	Reference
SDS(H)05-24□□□W SDS(H)05-48□□□W	C1	220μF/100V	Nippon Chemi-con KY series

Table 3-2 Surge & EFT Filter

4 EMI CONSIDERATIONS

Recommended external EMI filter for EN55032 Class A

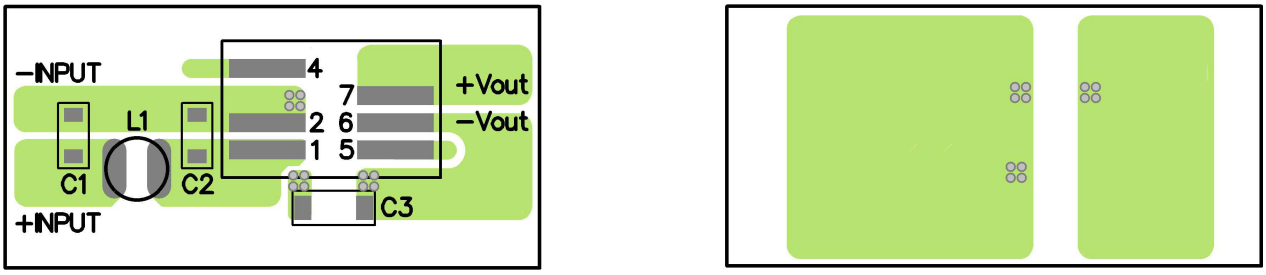


Single Output Dual Output

Fig. 4-1 Recommended EMI Filter for EN55032 Class A

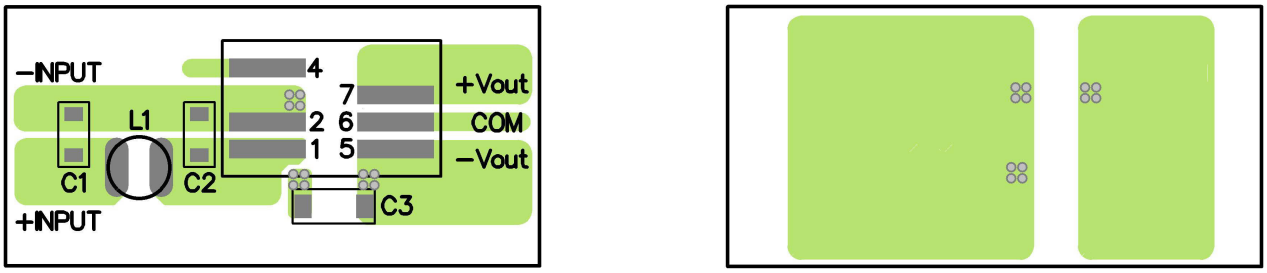
MODEL	C1	C2	C3	L1
SDS(H)05-24□□□W	10μF/50V 1206 MLCC	N/A	330pF/3kV 1808 MLCC	22μH, PMT-132
SDS(H)05-48□□□W	2.2μF/100V 1206 MLCC	2.2μF/100V 1206 MLCC	330pF/3kV 1808 MLCC	68μH, PMT-133

Table 4-1 B.O.M. of External EMI Filter



TOP VIEW BOTTOM VIEW

Fig. 4-2 Recommended Layout Pattern for SDS05W Single Output

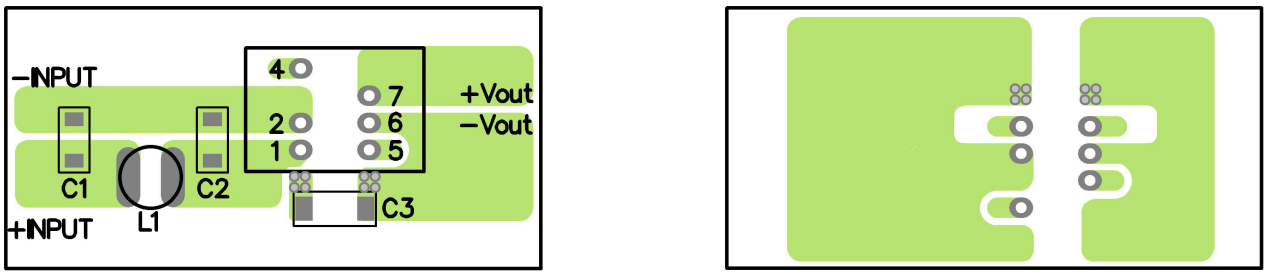


TOP VIEW BOTTOM VIEW

Fig. 4-3 Recommended Layout Pattern for SDS05W Dual Output

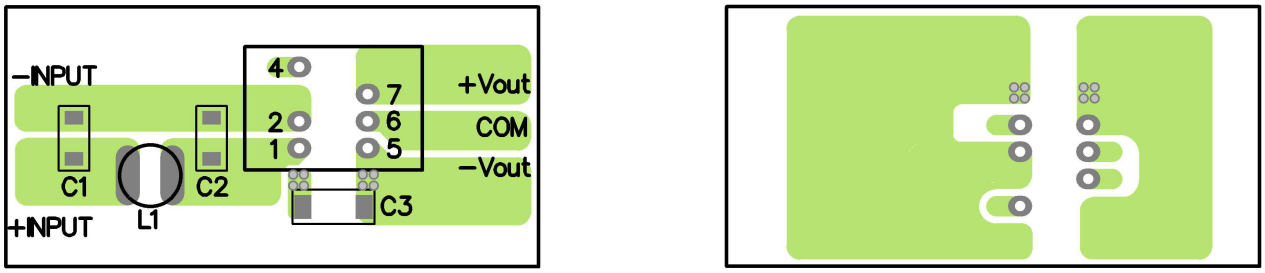
4 EMI CONSIDERATIONS (CONTINUED)

Recommended external EMI filter for EN55032 Class A



TOP VIEW BOTTOM VIEW

Fig. 4-4 Recommended Layout Pattern for SDH05W Single Output

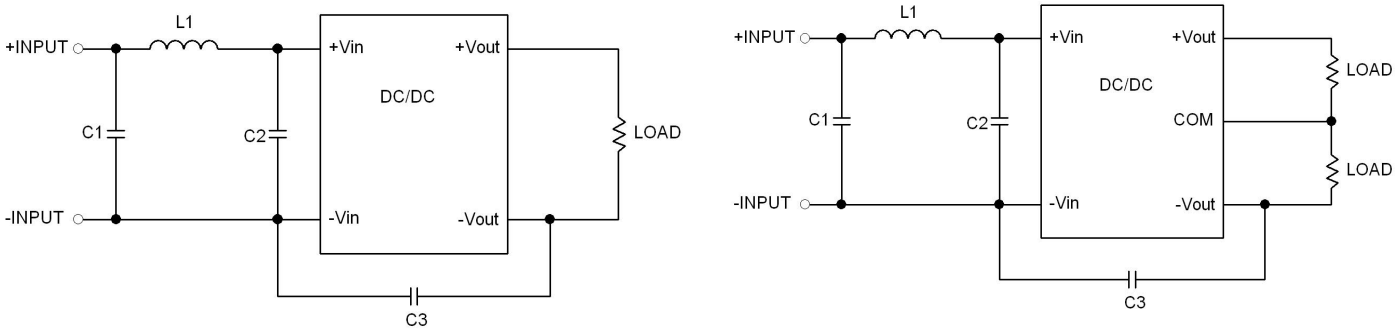


TOP VIEW BOTTOM VIEW

Fig. 4-5 Recommended Layout Pattern for SDH05W Dual Output

4 EMI CONSIDERATIONS (CONTINUED)

Recommended external EMI filter for EN55032 Class B

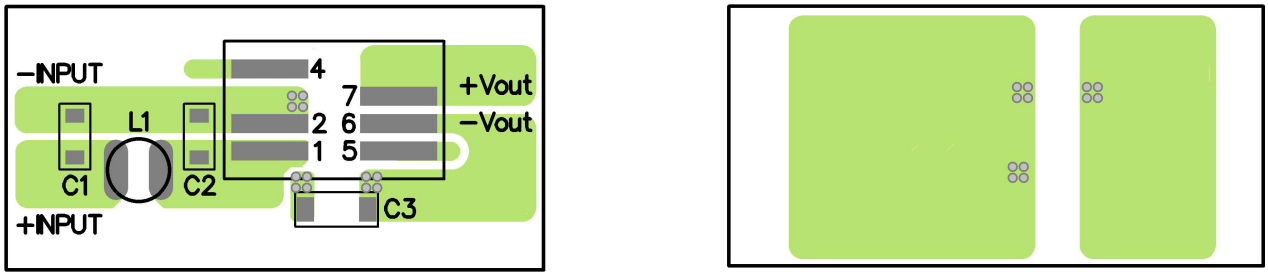


Single Output Dual Output

Fig. 4-6 Recommended EMI Filter for EN55032 Class B

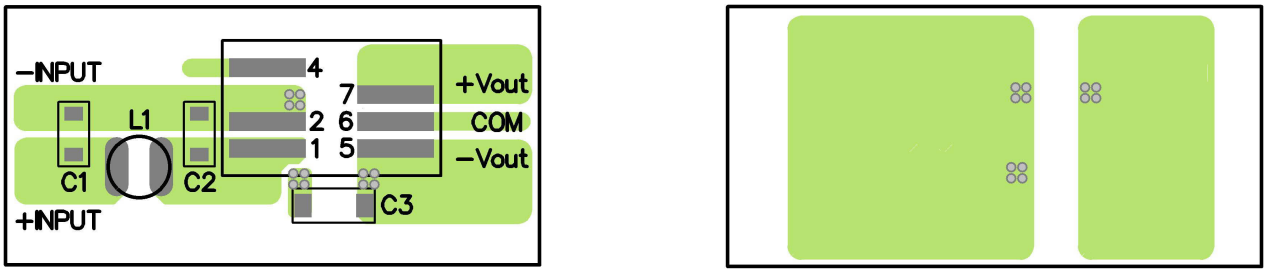
MODEL	C1	C2	C3	L1
SDS(H)05-24□□□W	10μF/50V 1206 MLCC	10μF/50V 1206 MLCC	680pF/3kV 1808 MLCC	22μH, PMT-132
SDS(H)05-48□□□W	4.7μF/100V 1210 MLCC	2.2μF/100V 1206 MLCC	680pF/3kV 1808 MLCC	68μH, PMT-133

Table 4-2 B.O.M. of External EMI Filter



TOP VIEW BOTTOM VIEW

Fig. 4-7 Recommended Layout Pattern for SDS05W Single Output

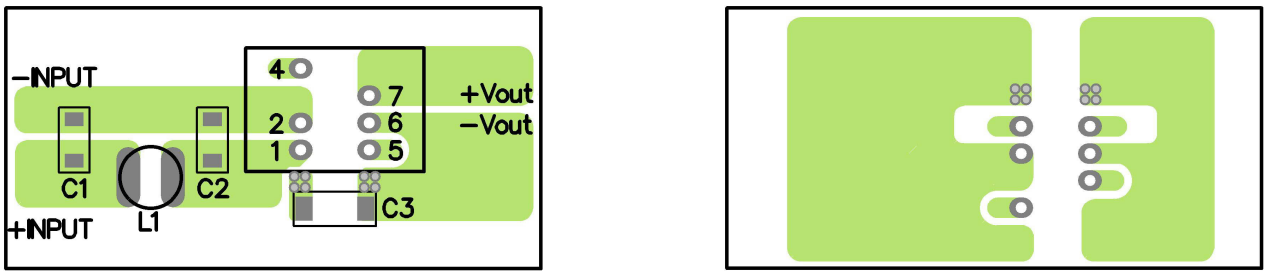


TOP VIEW BOTTOM VIEW

Fig. 4-8 Recommended Layout Pattern for SDS05W Dual Output

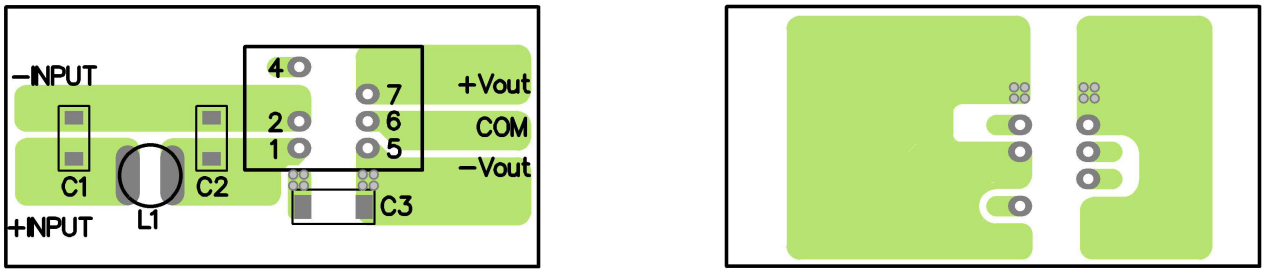
4 EMI CONSIDERATIONS (CONTINUED)

Recommended external EMI filter for EN55032 Class B



TOP VIEW BOTTOM VIEW

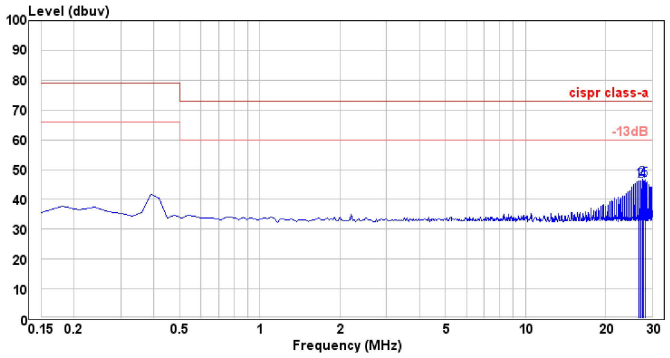
Fig. 4-9 Recommended Layout Pattern for SDH05W Single Output



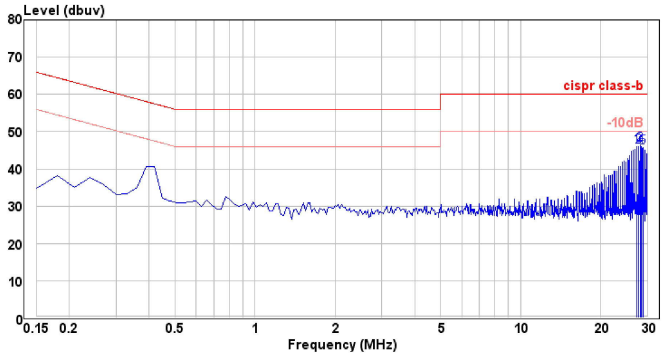
TOP VIEW BOTTOM VIEW

Fig. 4-10 Recommended Layout Pattern for SDH05W Dual Output

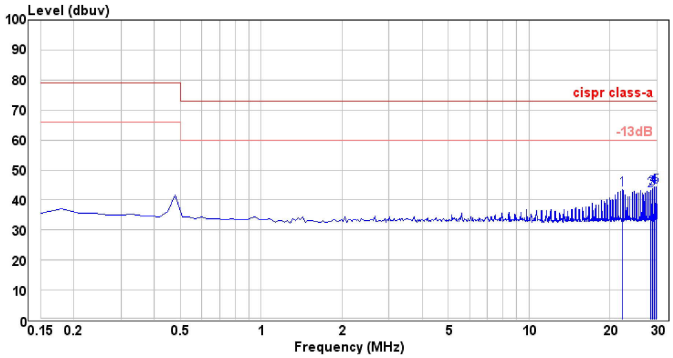
5 EMI TEST RESULTS



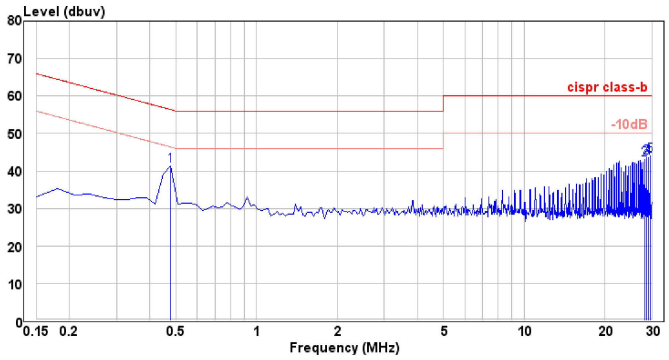
EN55032 Class A Conducted Emission
SDS(H)05-24S3P3W
Vin (nom); Full load.



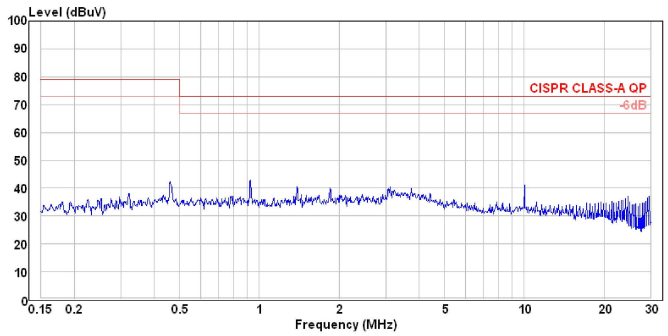
EN55032 Class B Conducted Emission
SDS(H)05-24S3P3W
Vin (nom); Full load.



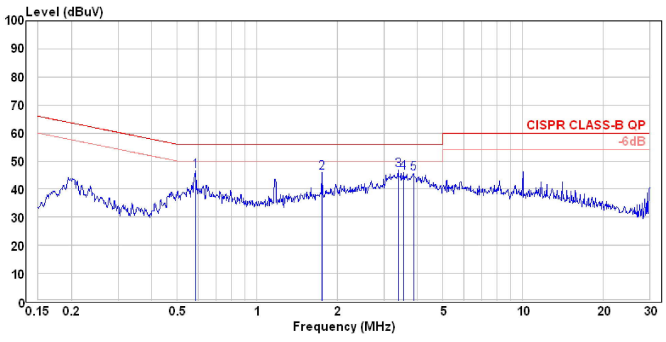
EN55032 Class A Conducted Emission
SDS(H)05-24S05W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-24S05W
Vin (nom); Full load.

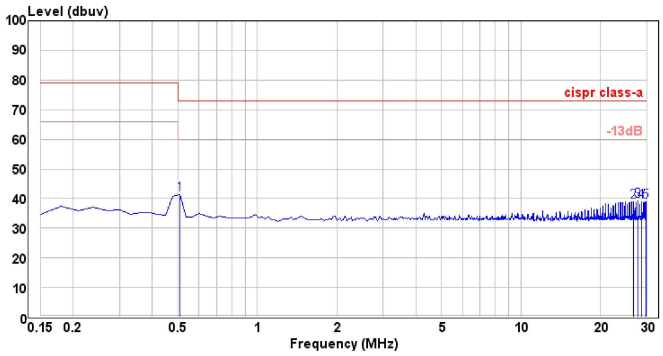


EN55032 Class A Conducted Emission
SDS(H)05-24S09W
Vin (nom); Full load.

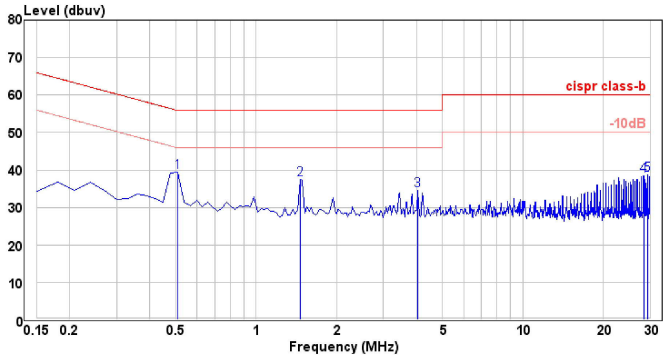


EN55032 Class B Conducted Emission
SDS(H)05-24S09W
Vin (nom); Full load.

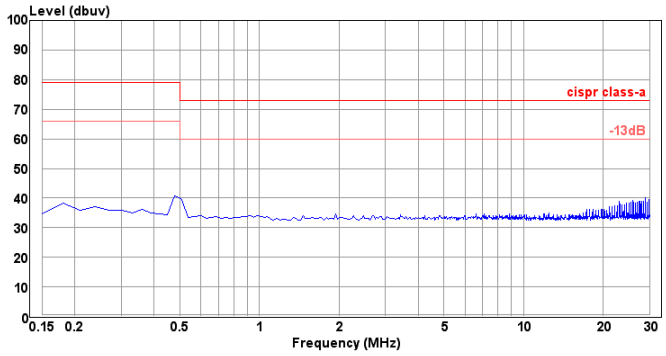
5 EMI TEST RESULTS (CONTINUED)



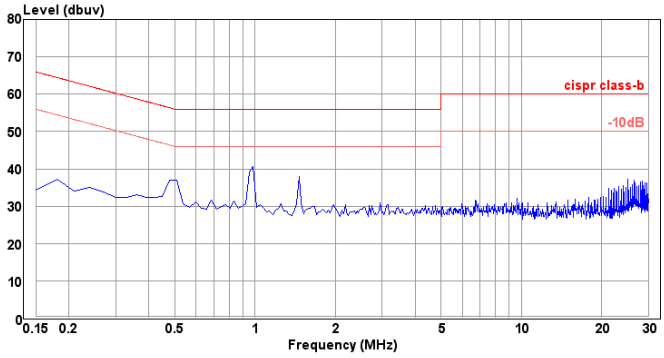
EN55032 Class A Conducted Emission
SDS(H)05-24S12W
Vin (nom); Full load.



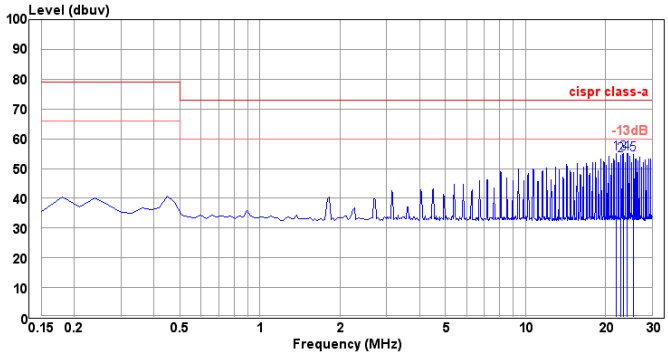
EN55032 Class B Conducted Emission
SDS(H)05-24S12W
Vin (nom); Full load.



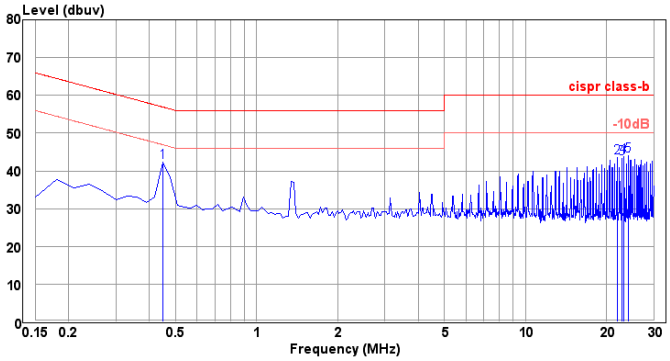
EN55032 Class A Conducted Emission
SDS(H)05-24S15W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-24S15W
Vin (nom); Full load.

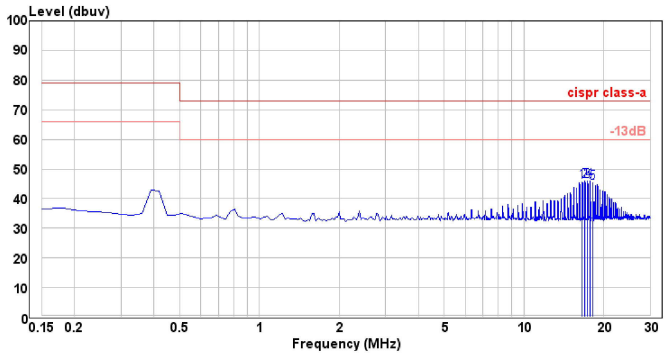


EN55032 Class A Conducted Emission
SDS(H)05-24S24W
Vin (nom); Full load.

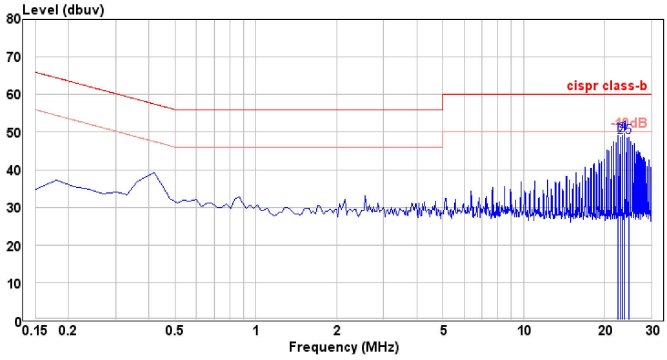


EN55032 Class B Conducted Emission
SDS(H)05-24S24W
Vin (nom); Full load.

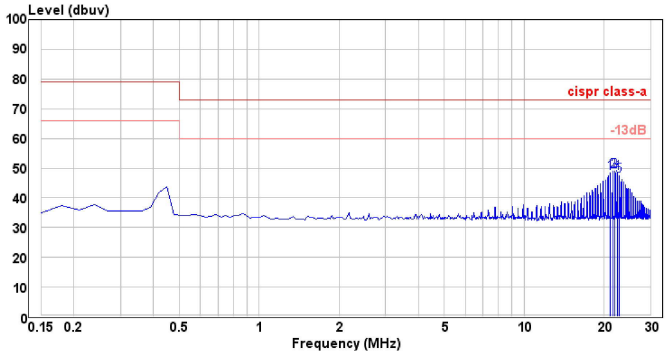
5 EMI TEST RESULTS (CONTINUED)



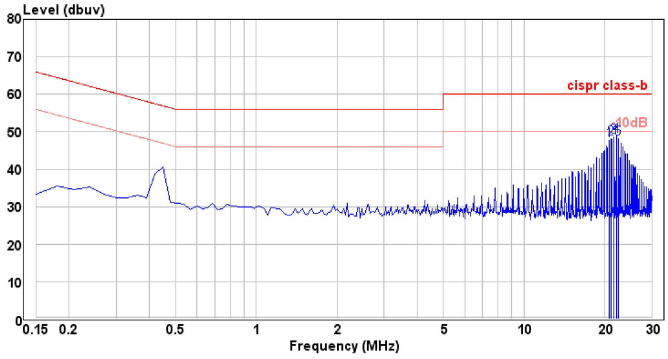
EN55032 Class A Conducted Emission
SDS(H)05-48S3P3W
Vin (nom); Full load.



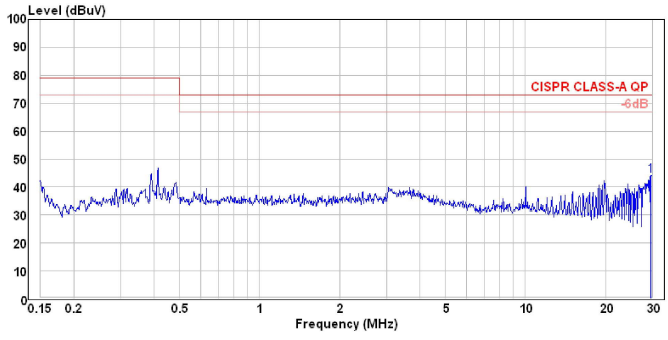
EN55032 Class B Conducted Emission
SDS(H)05-48S3P3W
Vin (nom); Full load.



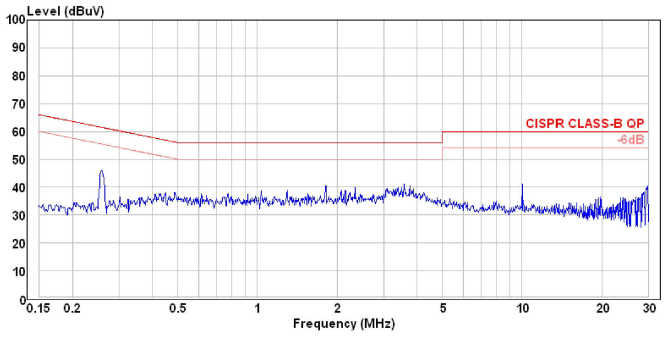
EN55032 Class A Conducted Emission
SDS(H)05-48S05W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-48S05W
Vin (nom); Full load.

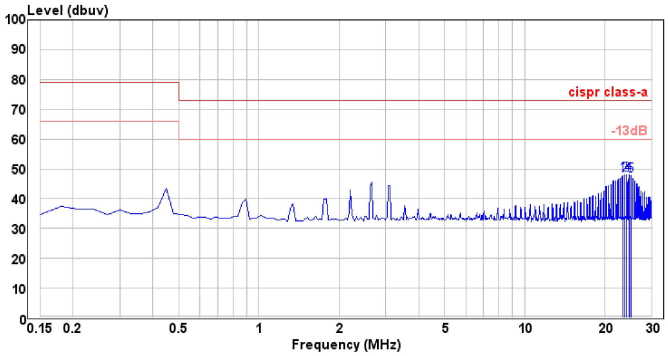


EN55032 Class A Conducted Emission
SDS(H)05-48S09W
Vin (nom); Full load.

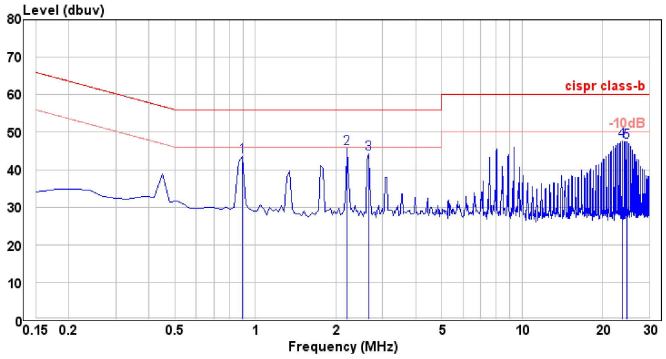


EN55032 Class B Conducted Emission
SDS(H)05-48S09W
Vin (nom); Full load.

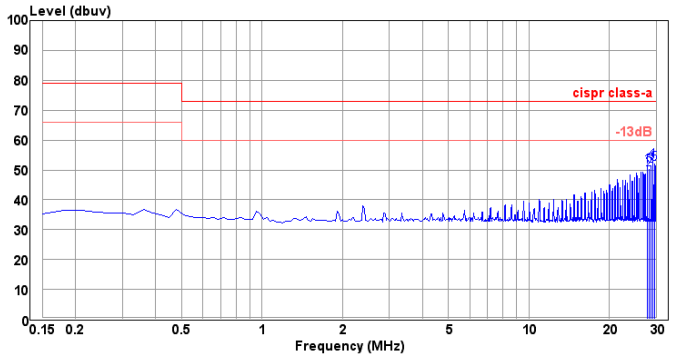
5 EMI TEST RESULTS (CONTINUED)



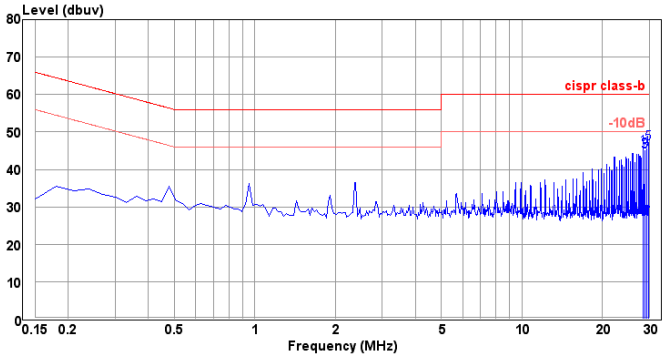
EN55032 Class A Conducted Emission
SDS(H)05-48S12W
Vin (nom); Full load.



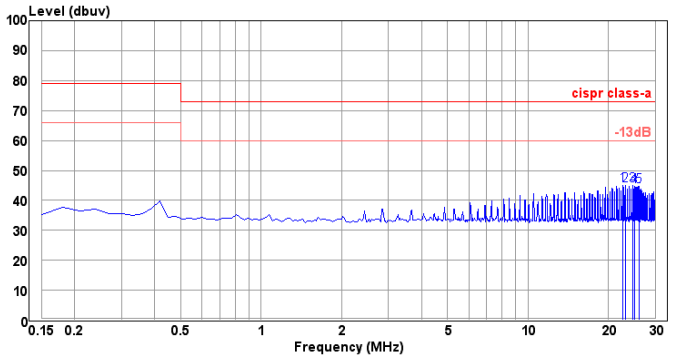
EN55032 Class B Conducted Emission
SDS(H)05-48S12W
Vin (nom); Full load.



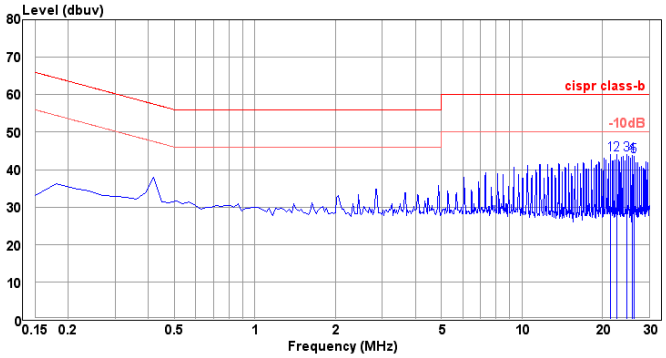
EN55032 Class A Conducted Emission
SDS(H)05-48S15W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-48S15W
Vin (nom); Full load.

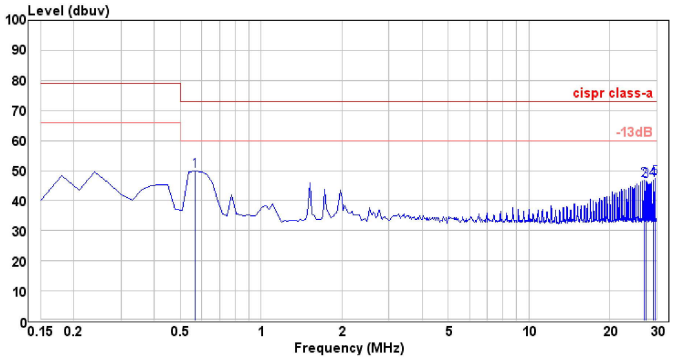


EN55032 Class A Conducted Emission
SDS(H)05-48S24W
Vin (nom); Full load.

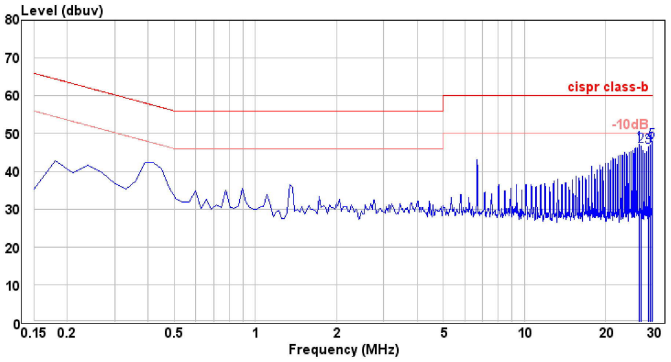


EN55032 Class B Conducted Emission
SDS(H)05-48S24W
Vin (nom); Full load.

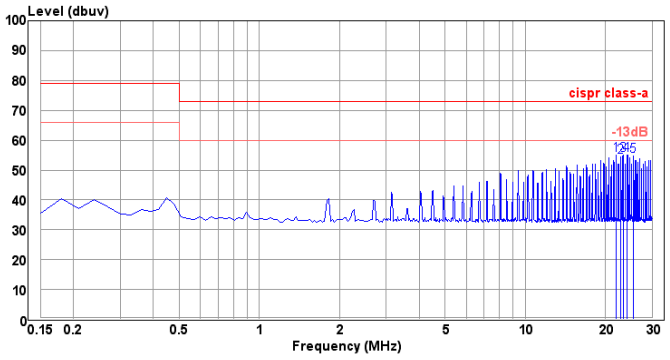
5 EMI TEST RESULTS (CONTINUED)



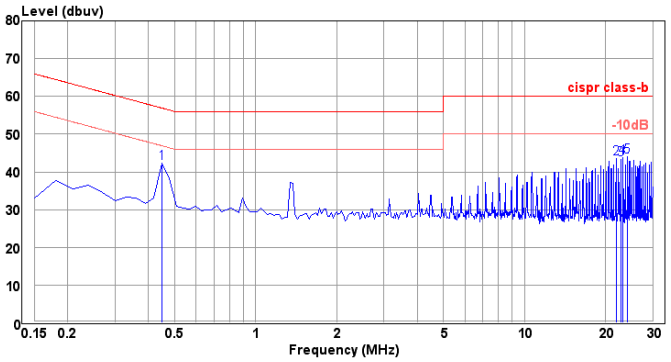
EN55032 Class A Conducted Emission
SDS(H)05-24D05W
Vin (nom); Full load.



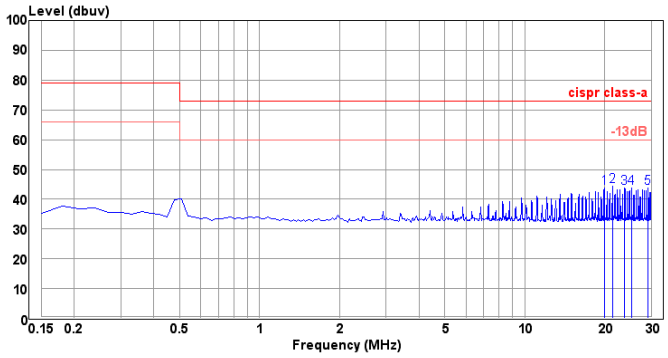
EN55032 Class B Conducted Emission
SDS(H)05-24D05W
Vin (nom); Full load.



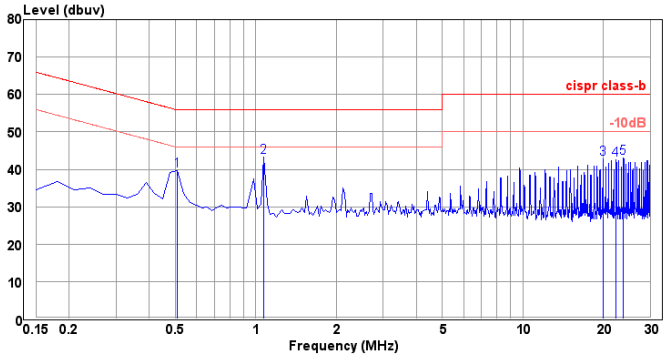
EN55032 Class A Conducted Emission
SDS(H)05-24D12W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-24D12W
Vin (nom); Full load.

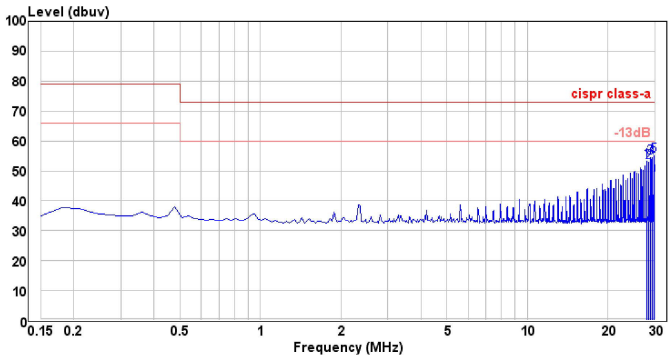


EN55032 Class A Conducted Emission
SDS(H)05-24D15W
Vin (nom); Full load.

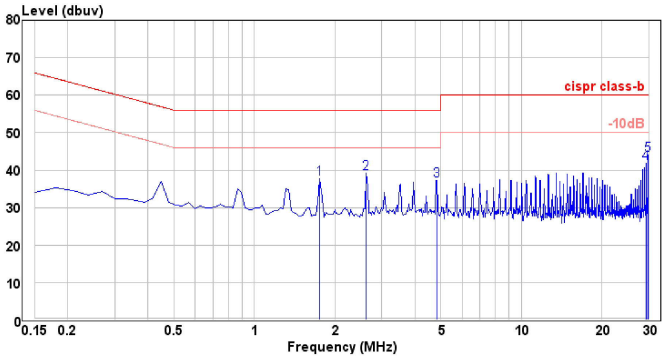


EN55032 Class B Conducted Emission
SDS(H)05-24D15W
Vin (nom); Full load.

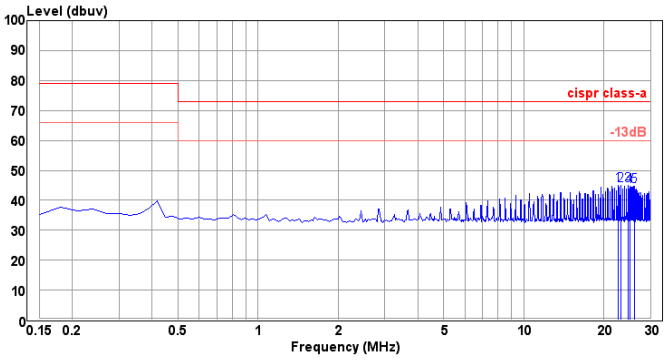
5 EMI TEST RESULTS (CONTINUED)



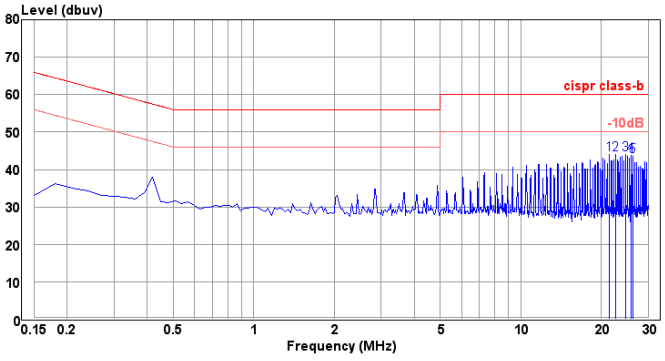
EN55032 Class A Conducted Emission
SDS(H)05-48D05W
Vin (nom); Full load.



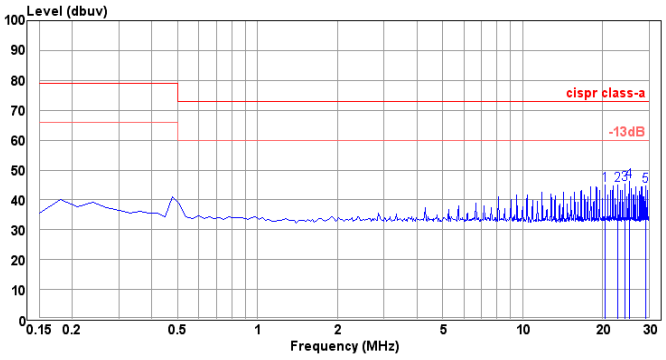
EN55032 Class B Conducted Emission
SDS(H)05-48D05W
Vin (nom); Full load.



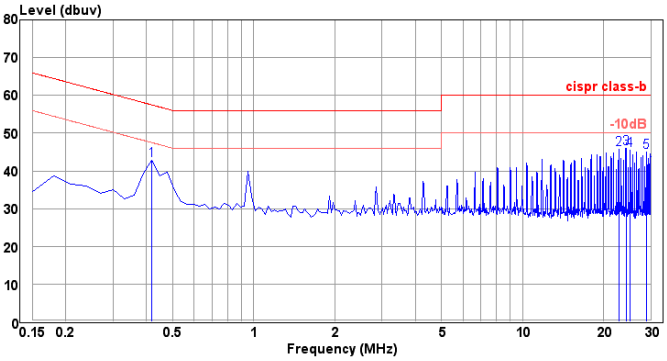
EN55032 Class A Conducted Emission
SDS(H)05-48D12W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-48D12W
Vin (nom); Full load.



EN55032 Class A Conducted Emission
SDS(H)05-48D15W
Vin (nom); Full load.



EN55032 Class B Conducted Emission
SDS(H)05-48D15W
Vin (nom); Full load.