POWER Application Note

AN10128 – uMP Series

Installation of uMP Power Supplies for Optimum Radiated EMI Performance

AC-DC

Micro MP

Model #

uMP4T-S2F-S2L-S2Q-IQQ-00-A

Application Overview:

- Installation of uMP power supplies for optimum radiated EMI performance

Description

This AN is shown guideline of Radiated EMI, the principles of good EMC design and an example of uMP4 Conducted Emissions and Radiated Emissions test result.

uMP series PSU's have been designed to meet Class B EMI limits for both CISPR 32 and FCC standards. This is illustrated by the plot of line conducted emissions shown in page 7 and page 8. Furthermore, tests of the uMP in isolation have yielded good radiated emission results as shown in page 9 and page 10.

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Guideline of Radiated EMI

This component-type power supply is intended to be installed in a system enclosure. EMC compliance to appropriate standards must be verified at system-level. Below are some guidelines when testing with the uMP power supply for radiated EMI:

1. Interconnecting cables between output and load are recommended to be twisted together (e.g., one twist for every 1 cm length of cable) for each output and then all output interconnections bundled together to minimize the radiating loop area.
2. Power cords shall be kept as short as possible, with any excess cable bundled in a serpentine manner (not looping on itself) to cancel excess EMI.
3. For multiple outputs, it is best for each output cable to be twisted with ground.
4. Cables shall minimize contact with noisy or noise-sensitive devices.
5. Mains supply wiring shall be routed as far away as possible from PSU load wiring and active electronic circuitry.
6. The load grounding plate (if any) should be electrically bonded to the PSU chassis.
7. Whenever possible, the uMP unit shall be separated from other electronic devices by a sufficient amount of clearance to prevent EMI coupling to and from other devices.
8. AC cabling external to the system enclosure shall use a twisted pair cable not longer than 1.5m.
9. The test set-up for radiated emissions entails the use of fans for a resistive load, it is preferred that ferrite attenuators be installed along the fan power cables nearest to the resistive load.
10. Increased attenuation of the radiated emissions can be achieved by careful design of the apparatus enclosure using conductive metal (e.g., sheet metal) with a minimum thickness of 0.8 mm.
11. System enclosure has to be securely bonded to supply earth connection using a wire (e.g., AWG15/1.5mm2 diameter or larger) connected to the PE terminal of the uMP unit.
12. The case of the PSU shall be securely bonded to the apparatus enclosure. This can be achieved via the PSU mounting fixings.
13. It is recommended that the system enclosure shall not have openings with length exceeding 5mm (diameter/diagonal).

14. Cabling from other equipment form current loops and therefore should have minimum length and enclosed area. Any cables from input sockets to an external terminal block must be as close as possible to each other, avoiding the natural tendency to bend outward.

15. Additional filtering (ferrites) may used to eliminate noise from high frequency circuits, especially for output cable lengths greater than 0.3m.

16. Y-caps may be added from secondary common to power earth to reduce CM EMI.

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Principles of EMC Design

In terms of the radiated emissions, it must be borne in mind that whilst uMP series power supplies are constructed in an electrically conductive chassis, they are, in effect, component type Power Supply Units. The Installation and Operating instructions which are supplied with every uMP model state that the uMP "**is only for inclusion by professional installers within other equipment and must not be operated as a stand-alone product**". This is partly related to safety requirements but also in recognition of the fact that the radiated emissions from the power supply system will be substantially dependent on the nature of the installation. For example, the orientation of the supply and load wiring can have a substantial impact on the emissions.

The principles of good EMC design can be summarized as follows:

1.Build in good EMC from the outset and eliminate poor EMC at source.

The principles of good EMC have been incorporated in the uMP design, as can be seen from the results presented in this application note. Using a PSU which performs well in it's own right, such as Artesyn's uMP range, will greatly reduce the challenges to be met in achieving good system EMC.

2. Take care with grounding and earthing.

It is important to take care with the earthing of system elements to avoid setting up high frequency current loops which will, in turn, cause emissions from the system.

3. Minimize length and area of high frequency current loops.

In addition to the possibility of earth loops, it must be recognized that the load connections from the PSU are, in effect, high frequency current loops. Keeping these connections short and tightly coupled will minimize the radiating effect of these loops and also minimize the coupling effect highlighted in point 4.

4. Minimize coupling of HF circuits to potential external radiators.

The mains input wiring can be viewed as an antenna. Any HF signals coupled to it within the apparatus enclosure will be radiated outside the apparatus enclosure. Good practice, therefore, would be to keep the mains input wiring physically isolated from any circuits carrying high frequency signals, including load connections from the PSU. Where this is not possible, screening of the mains input wiring will have a substantially beneficial effect on minimizing the pick-up. This principle will equally apply to any signal connection intended to pass beyond the apparatus enclosure boundary. For peripheral devices, the choice between placing near the input or the output depends on the sensitivity of the device. Input cables normally radiate at 200MHz while output cables normally radiate at 50MHz

5.Don't allow EMI out.

Any residual radiated emission can be restricted to the apparatus by careful design of the enclosure. A well earthed, conductive enclosure can give sufficient attenuation of radiated emissions. It must be borne in mind, however, that any slots or gaps in the enclosure will allow transmission of radiation at wavelengths below 4 times their length. This means that any such gaps greater than about 75mm in length will be transparent to radiated emissions within the band specified in EN55022.

Further containment of emissions can be achieved by adding capacitive decoupling across any wiring at the boundary of the apparatus. This technique can be used to overcome the effects of pick-up as described in point 4 above and specialized, "feed-through" capacitors are available for this very purpose. Similar benefits can also be achieved by using ferrite clamps or similar specialized suppression devices.

Care must be taken, however, when using EMI filters for mains filtering at the apparatus boundary. Inappropriate selection of such filter elements can cause more problems than they solve, since circuit resonance can be set up between the external filter and the EMI filter built into the PSU for conducted emission suppression. This resonance can lead to the appearance of unexpected "peaks" in the apparatus emissions spectra.

There is no doubt that in order to minimize the impact of achieving good EMC, the installation, construction and wiring of the PSU and the equipment to be powered must be considered from the outset. Too often, the EMC performance of an apparatus is compromised because of insufficient care during the early stages of the system design. By taking care and following good EMC design principles from the start, optimum radiated EMC performance can be achieved with little cost penalty in terms of additional time and expense required to "fix" the EMC once the system functional design is complete.

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Set Up Photos

Photos of testing set up

Radiated emissions test set-up for EUT.
Refer to CISPR 32 for further details

Photo of EUT

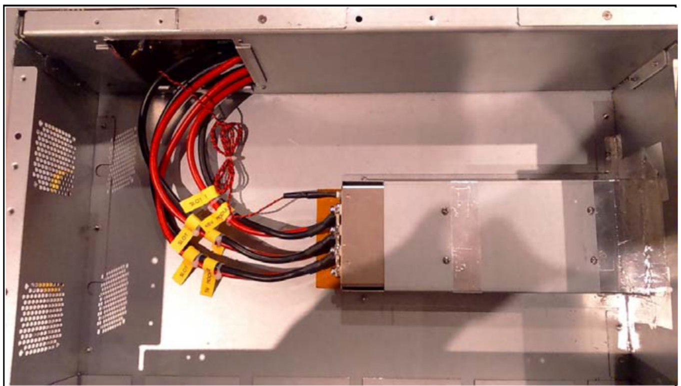

Photo of uMP PSU location in EUT

Photo of resistive load for uMP PSU

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Detail of Test Results

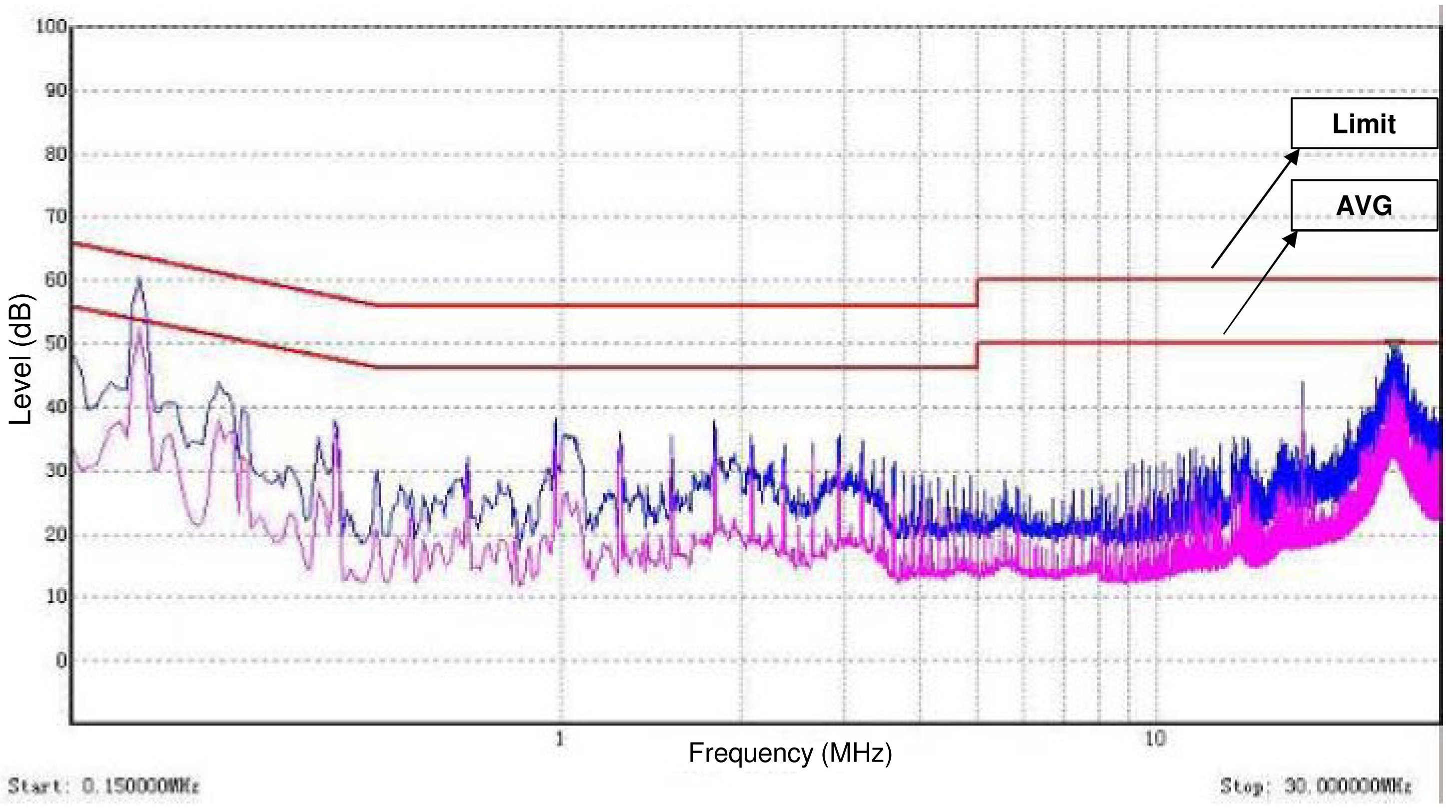
EMI Operation measurement:

Model : uMP4T-S2F-S2L-S2Q-IQQ-00-A

Testing Engineer: EW Engineering

1.Plot of uMP4 Conducted Emissions showing Curve B limits of EN55022

Line:



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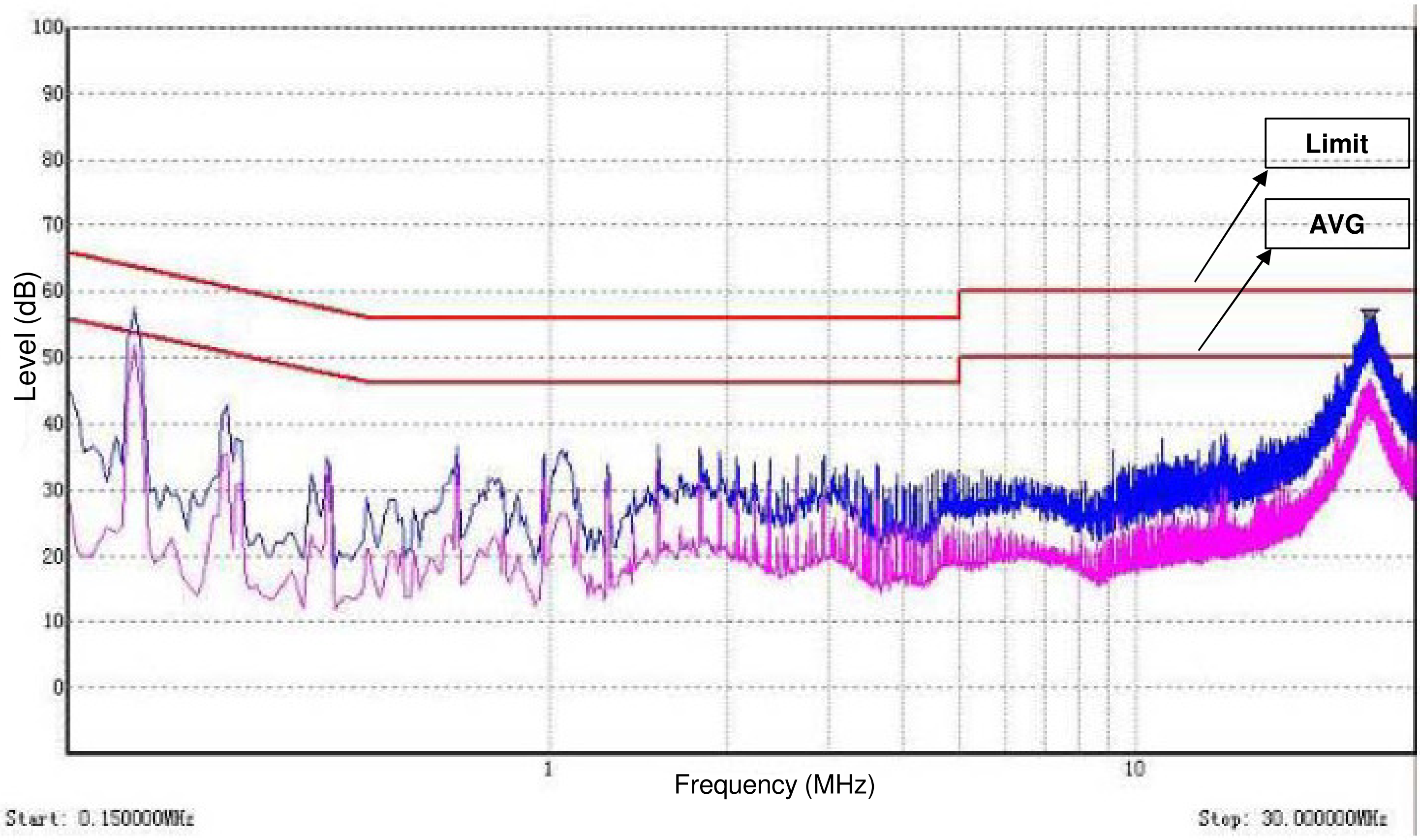
Neutral:



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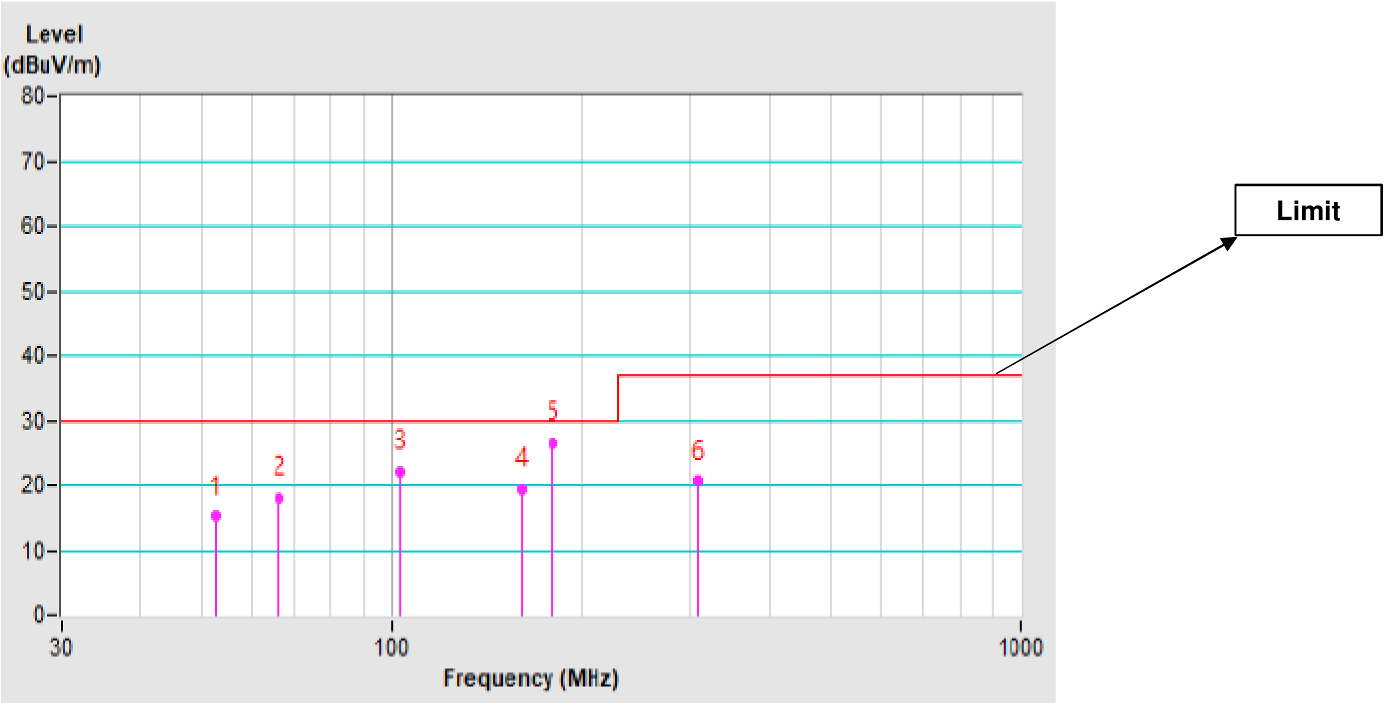
2.Plot of uMP4 Radiated Emissions.

The dotted curves in the above plots represent background emissions detected at the open field test site.

7.1.3	CISPR 32:2015 +Cor 1:2016	Enclosure port	Radiated emission 30-1000 MHz	Minimum passing Class B margin is -3.51 dB at 180.20 MHz	Pass



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