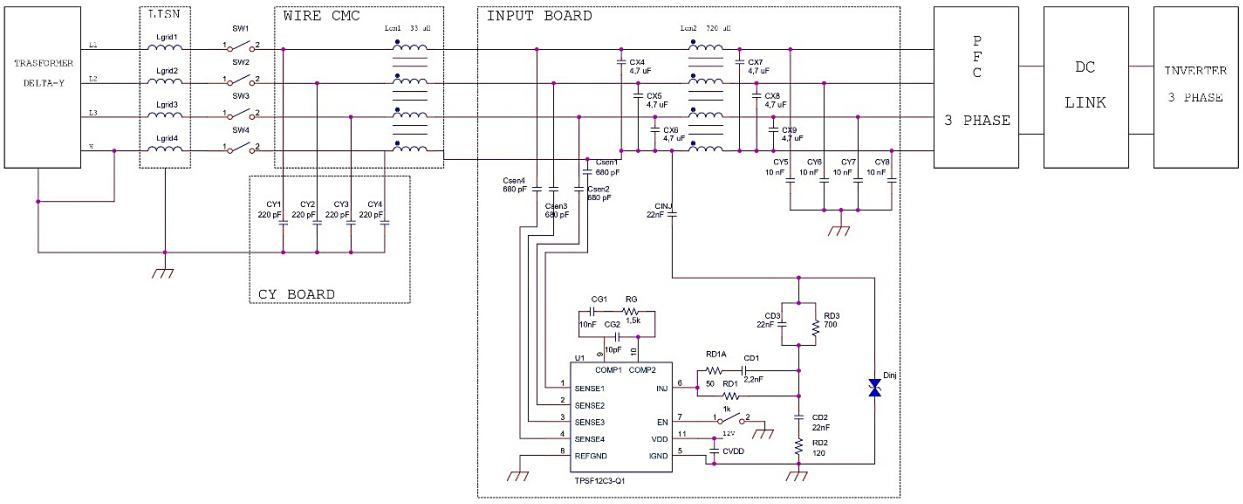
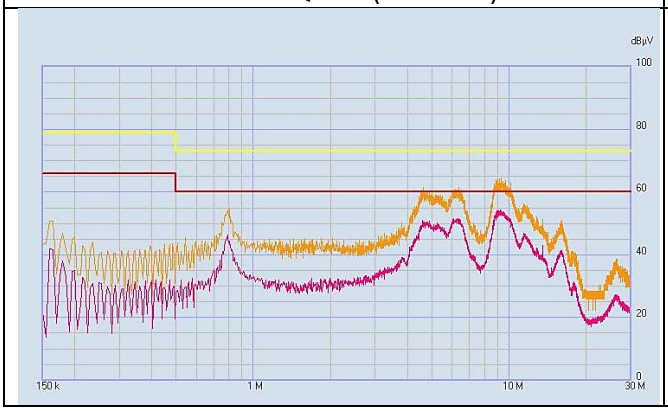
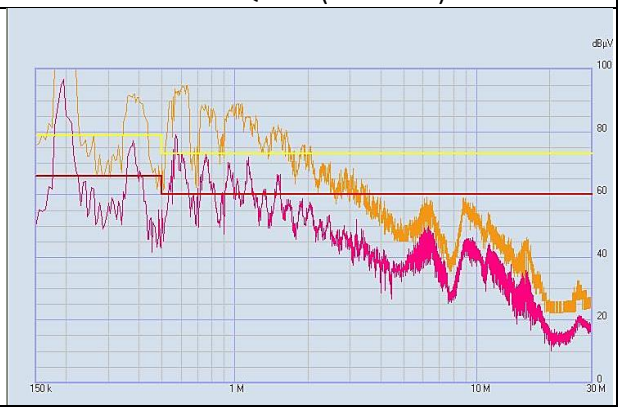
Dear Timothy,

We are trying to implement the integrated TPSF12C3QEVM in the input board of a 20 KVA UPS. Our configuration includes the 3 phases with neutral, with VRMS=230 V, ARMS=29 A and with a switching frequency of 18 KHz. During testing, we didn't use the bypass and the UPS batteries, they were removed.

Main Schematic:

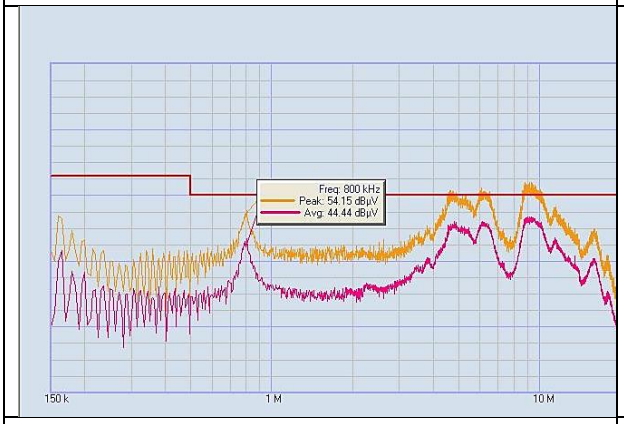
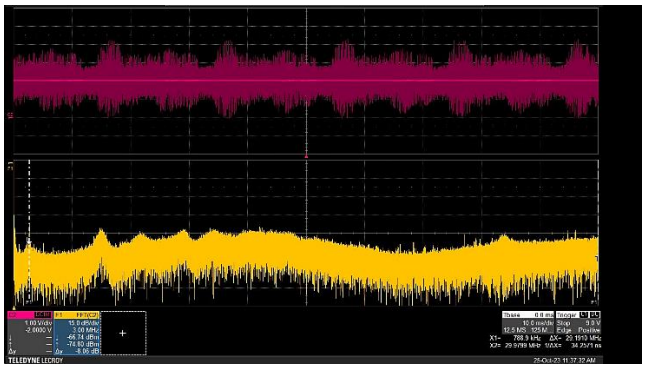
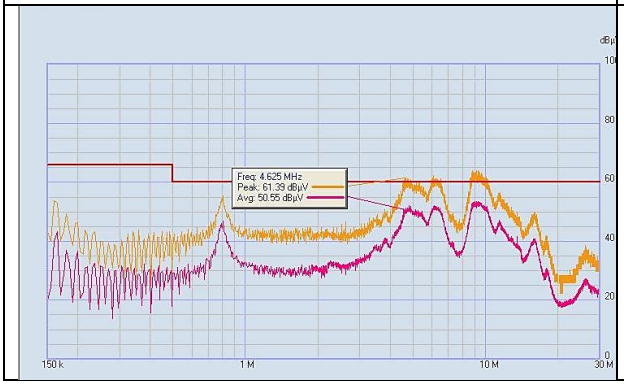
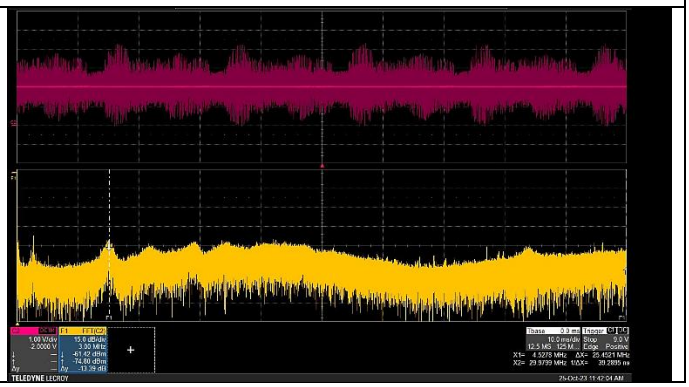


Despite the fact that we have consulted all the documentation available on your official website and used your excel tool to configure the components on the integrated circuit, we were unable to obtain positive results in the EMC tests. I specify that the parameters of the impedances of the chokes have been modified in the tool, inserting those used on the UPS, in order to have a more precise configuration.

UPS without TPSF12C3QEVM (load 60%)	UPS with TPSF12C3QEVM (load 60%)
	

The input board has a Cy capacitance on the mains side equal to 220 pF while on the regulator side it corresponds to 10 nF, as ESR has been kept at 0.5. A LISN with an inductance of 50 µH is used. Both input and output are used common-mode inductors, respectively: ferrite (0.03 mH) and nanocrystalline (0.72 mH).

The detection capacitors, as per your suggestion, were kept at 680 pF while for the injection capacitor it was first tried with 4.7 nF then with 20 nF (always with the mounting of the corresponding configuration provided by the tool). The IC has an external 12 V power supply.

EMI RECEIVER	OSCILLOSCOPE PROBE
800 KHz	800 KHz
	
4.6 MHz	4.6 MHz
	

Given the continuous negative results, open-chain analyses (i.e. with CINJ disconnected) were carried out with the oscilloscope, for the detection part, the probe was placed on the COMP1 pin, noting that the UPS spectrum is correctly detected.

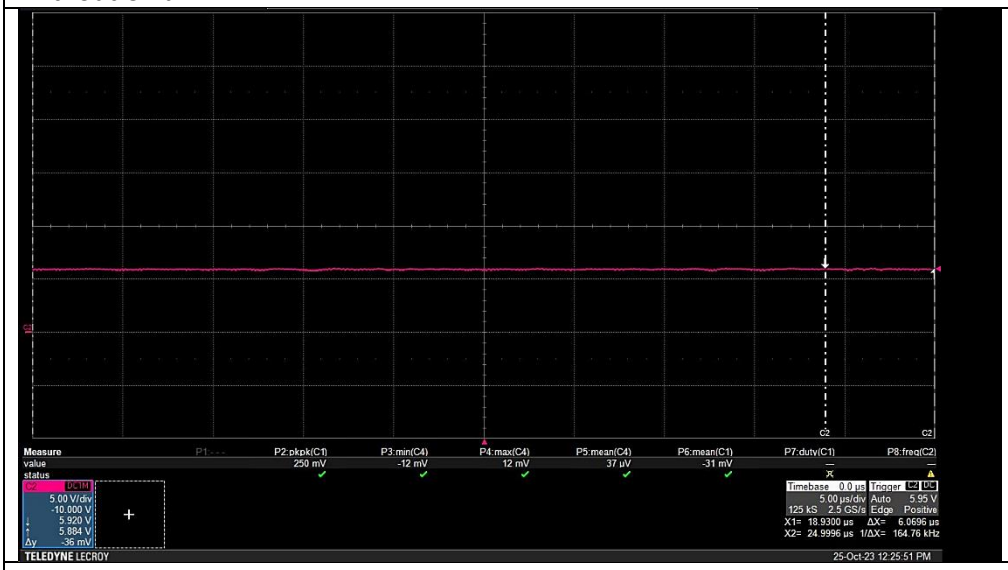
As far as the injection part is concerned, with the mains power off for UPS, the injection outlet was analyzed with the probe by removing the C_{INJ} capacitor, which was stable.

When you leave the capacitor plugged in, with CINJ, you get an oscillating and unstable output ranging from positive to negative saturation, with a resonant frequency of 260 KHz. By trying to change the value of CINJ with the corresponding configuration reported by the tool, however, you do not get any improvements but only a frequency shift.

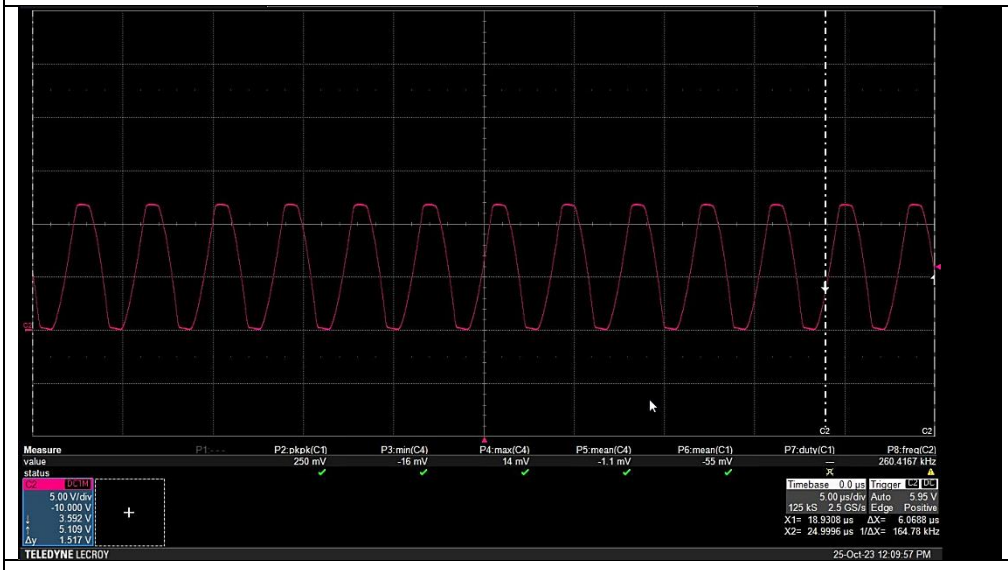
Here are some samples taken with the oscilloscope:

OSCILLOSCOPE PROBE – UPS OFF - ONLY BATTERY FOR IC (12 V)

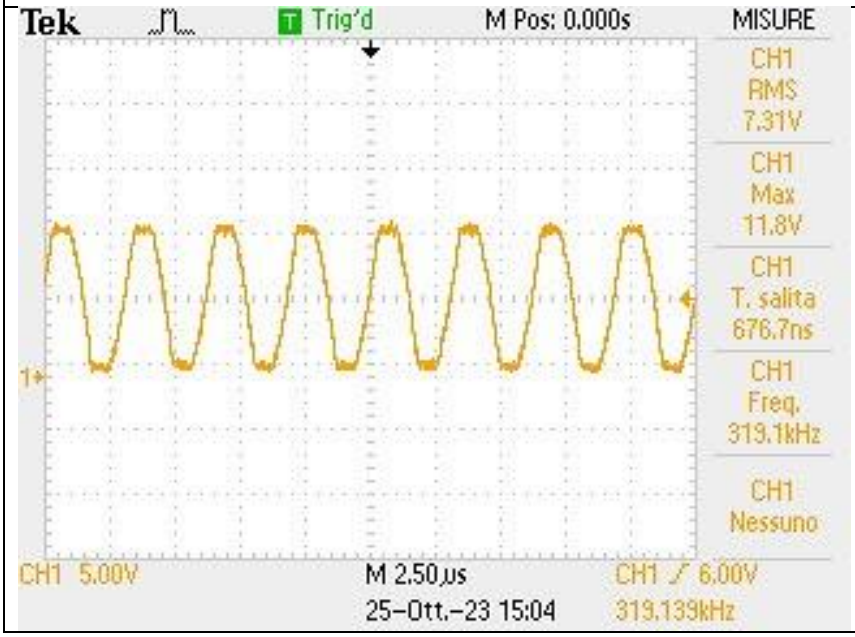
Without CINJ



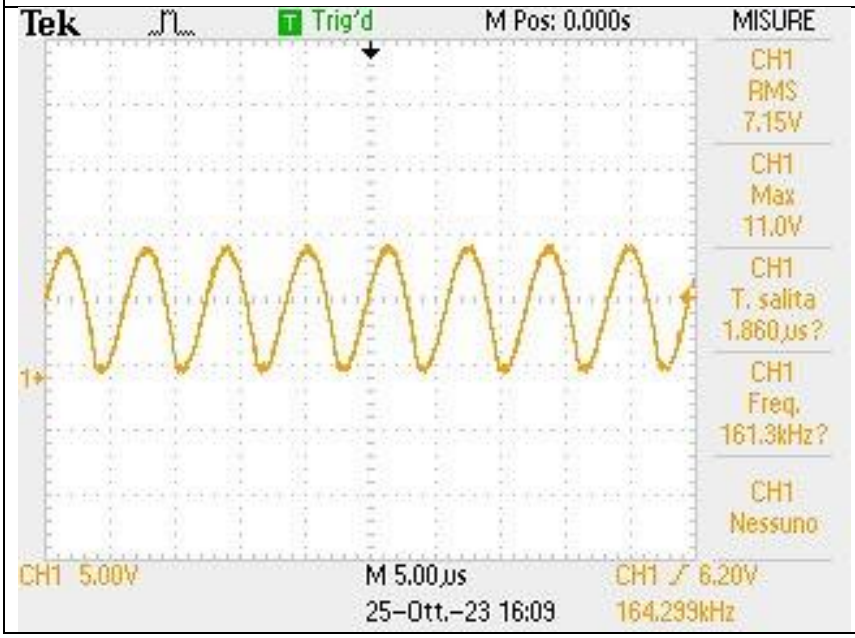
CINJ=20 nF



CINJ=10 nF



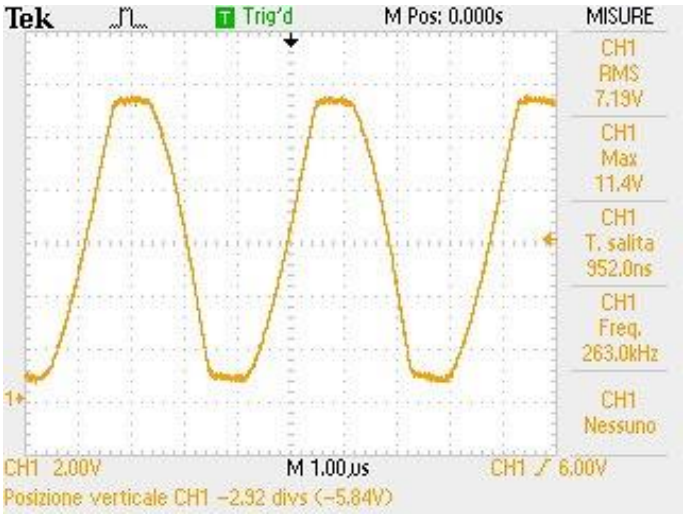
CINJ=100 nF



The use of the 4.7 nF injection capacitor was also attempted, as required by the datasheet but obtaining a frequency of 404 KHz.

It should be noted that all tests were carried out with the neutral-to-ground connection, as required by the EMC test setup EN62040-2.

By way of investigation, again without powering the EUT, we noticed that when opening the input disconnector (in the SW1,2,3,4 scheme) the oscillation disappeared.
Tests were then carried out, changing the neutral grounding points or even removing it without eliminating the resonance. The image illustrates the injection output with CINJ=20 nF, without the neutral-to-ground connection:



We will need your help to understand if there are any precautions that we have not considered or if the device has specific limitations regarding the UPS used. It would be very helpful for us to receive your help to solve the resonance problem.

Looking forward to your kind feedback,

Kind regards