Reviewer 2
Authors’ reply:
The authors would like to express our sincere appreciation to the Associate Editor and reviewers for their time and efforts in providing valuable comments and suggestions. The reviewers’ comments had been carefully studied and we have revised our manuscript to address all the concerns being raised.

Point 1: In this work the authors present an optimal permutation of power transmission lines to reduce electro-magnetic influence at high technology nano-Fab. In this study, the magnetic field was lessened by the mirror array power cable system, and a simulation of results predicted the best permutations to decrease electromagnetic interference (EMI) value below 0.4 mG at working space without any shielding.

General comment: Although the aim of this work is interesting, this manuscript should be reworked to enhance its quality and impact. In particular, the authors should better explain what is the “Ideal of permutation system”

Author Response and action: The authors would like to thank the reviewer for most constructive comments.

Generally, they are hundreds of high-power electric cables in the semiconductor manufacturing industries which emits high amount of Electromagnetic Interference (EMI) due to this it creates a large disturbance in proper functioning of interior equipment and huge damage to human health. In this investigation we find the best way to decrease the Electromagnetic Interference (EMI) by the ideal permutation with three phase four cable system.

Through the theoretical study and numerical simulation, we predict the best permutation for mitigating EMI noise from three-phase electric power lines system without any shielding system down to 1.2 mG in 3.0 m distance from applying I=150 A at 60 Hz with 12 series cable tray system. Followed through the discussions, this study indicated different and new perspectives with before opinions of some researcher. The measured magnetic field values on the nano-Fab are in good agreement with this simulation results. These good results give more confident to apply in new building nano-Fab system. Furthermore, this innovation will cost down for EMI shielding at high technology nano-Fab especially for 40 (and below) nanometer process.

Due to this work, the electromagnetic impact was lessened by ideal permutation
without contributing or utilizing extra employment and equipment’s. We have achieved best results with the combination of theoretical, simulated model and experimental results. These outcomes can progressively achieve better results as we have tested them in new nano-Fab framework. Besides, this advancement will cost down for EMI protecting at high innovation nano-Fab.

An ideal permutation is a permutation chosen uniformly at random from all the available permutations.

In this work, the following are the possible permutations available for nano fab base permutation and ideal case permutations.

Point 2: Section “2. Theoretical Study and Simulation Models”

The authors should add theoretical and simulation studies, which seem to be not present within the current version of this section. Are there some important formulas to recall? Please insert this information for interested readers.

Author Response and action: Thanks you for your suggestion. We have added and modified or text under section 2 theoretical and simulation models in page number 2. In this work there are no important formulas. The modified content is presented below for your reference.

Three-phase electrical power is a commonly used method to generate, transmit, and distribute alternating current electrical power. This method is similar to the polyphase system, which is a common method of transmitting energy from electrical networks.
around the world. In general, the three-phase system is more economical, prompting many fabs to use three-phase power systems [39]. A three-phase power system provides more power density than a single-phase system at the same voltage, making it a less expensive process with a smaller wiring size. On top of that, it is easy to reduce harmonic currents and load balancing. This system is used for electric motors and high power tools because it optimizes the use of electrical capacity to increase power efficiency. The phase angle between each phase is not always zero and depends on the load type [40]. However, the phase change or phase shift (2π / 3) between each phase and the relative phase angle between the phases is -120 degrees. The reason for this phase change is spatial displacement.

Point 3: Section: 3. Results and Discussion

I suggest to split into two different sections this paragraph: Results, where all achieved results are presented without comments, Discussion, where all the achieved new results are compared to the current state of the art. Please rework these sections accordingly. All figures should of high resolution and quality. All the captions should be meaningful “per se”: please improve accordingly.

Figure 5. Magnetic field distribution at Nano-Fab by using Nano-Fab permutation

Figure 6. Magnetic field distribution at Nano-Fab by using an ideal power cable permutation system

Author Response and action: Thank you for your suggestion. At present section 3 is divided as follows for ease understanding of paper by the readers. We have used the captions as suggested by reviewer.

3.1. Experimental Results
3.2. Simulated Results and
3.3. Discussion

Point 4: These figures are not totally clear. Please improve the captions and the explanation. Where are the claimed “simulations”. Could the authors show the value of the magnetic field in all the points through FE simulations? Please rework accordingly. Lines: “From this study, the ideal permutation technique helps in reducing the EMI of Nano Fab. From the above trend curve, Fig.12 and Fig.13 clearly show that there is a huge improvement in reducing the magnetic field distribution along Y-axis. The ideal permutation case 1 shows the best electromagnetic interference along Y-axis”

Author Response and action: Thank you for your suggestion. We have used the
From this study, the ideal permutation technique can help reduce the EMI of the nano-fab. From the above trend line, Figures 12 and 13 clearly show a significant improvement in reducing the distribution of the magnetic field along the Y-axis. The ideal permutation case shows the best electromagnetic interference along the Y-axis.

EMI is in this case the electrical noise induced in the wiring by nearby power lines. Electromagnetic interference can interfere with signal transmission. This can have an impact on the machines around the manufacturing industry, causing them to malfunction and losing actual data. Figure 14 shows the implementation of a three-phase four-wire permutation system on a nano-fab. Based on the above-simulated data and real data, the ideal permutation system gives better results in reducing the magnetic field distribution and helps us to minimize the effects of the high magnetic field in nano-fab environments. Figure 15 shows the practical implementation of the ideal permutation system and the ways to measure EMI at different locations from 0.5m to 3m to the ground (near the cable tray system). The changes are highlighted in yellow in page number 9 and page number 10.