

# Correlation between the measured far-field and near-field radiated patterns for specific designs

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## Introduction

The pursuit of enhanced speed and precision in electronic devices necessitates addressing the challenge of mitigating radiated emissions on PCBs. To evaluate this phenomenon, a far-field radiation test (Fig. 2) is conventionally employed. However, as this method does not provide insights into the specific source of the emissions, a complementary near-field radiation test (Figure 1) can be conducted to identify and pinpoint the origin of the emissions.

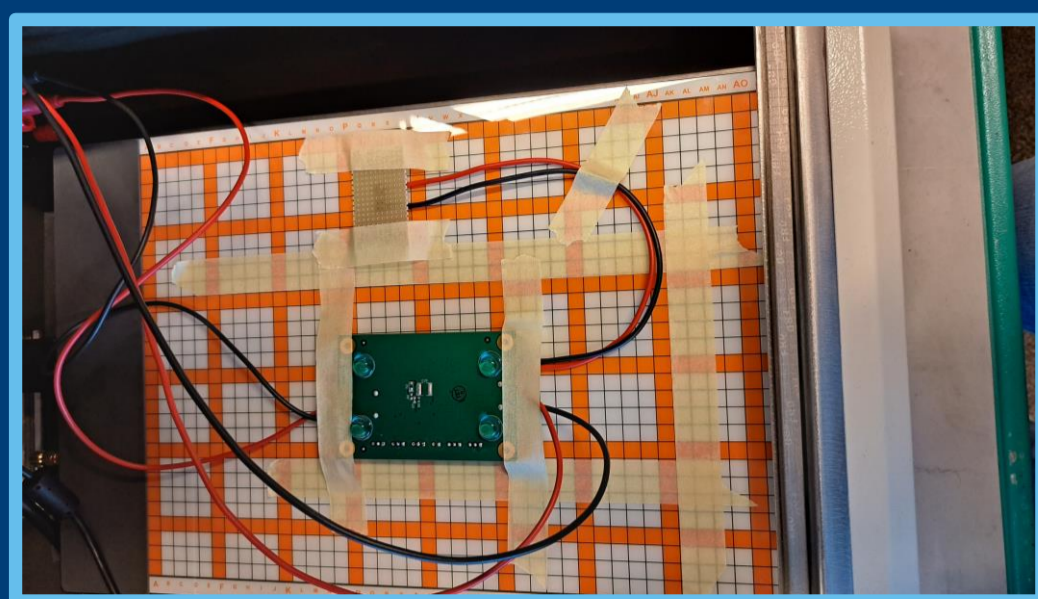


Fig. 1: EMScanner Sensor



Fig. 2: EMC-room

## Methods & Materials

A comprehensive assessment was performed by employing both an evaluation PCB (Fig. 3 and 4) and a self-designed PCB (Fig. 5) to investigate the impact of specific design modifications. One such modification involved increasing the distance between the decoupling capacitor on the PCB. Various tests were carried out to measure and analyze the noise generated by the PCB. An assessment was conducted to gauge the potential for this noise to be picked-up by the GPS-antenna.

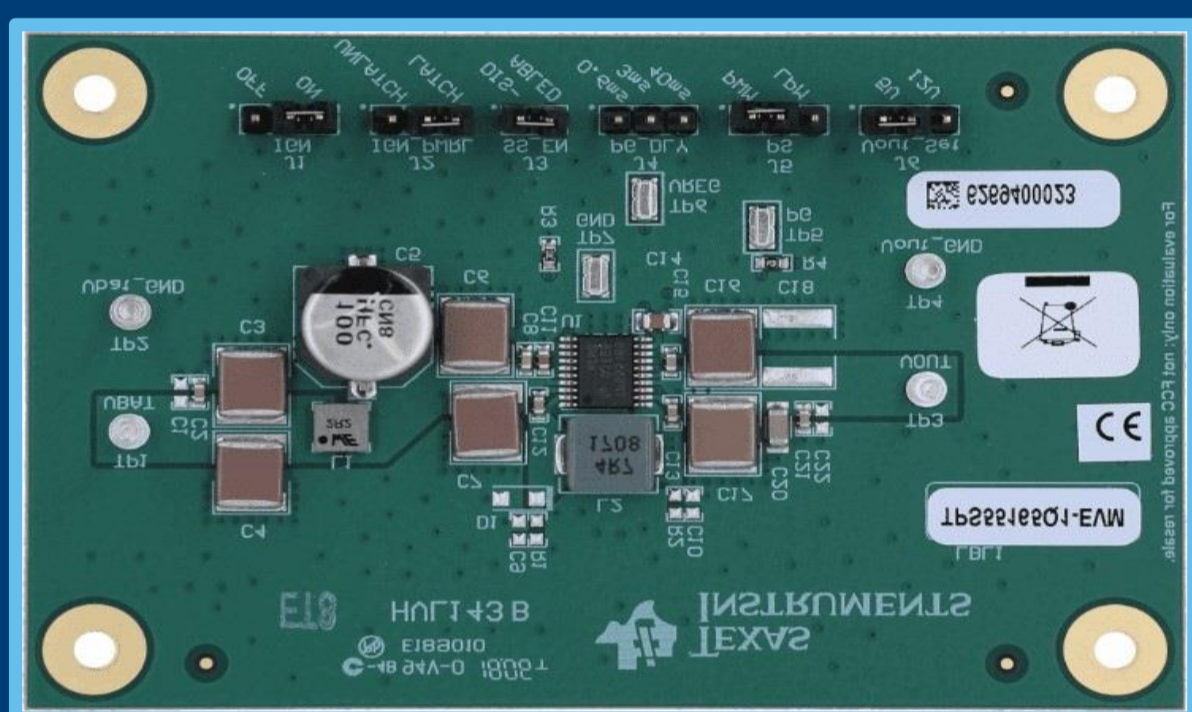


Fig. 4: Evaluation PCB

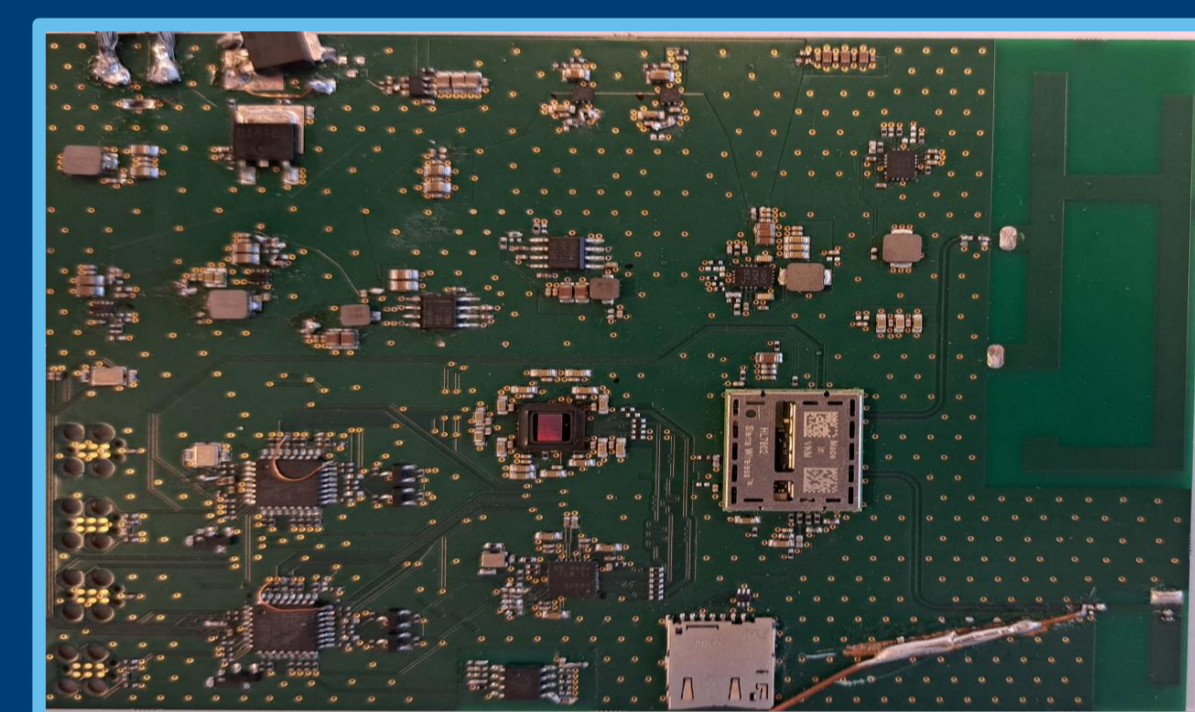


Fig. 5: Designed PCB

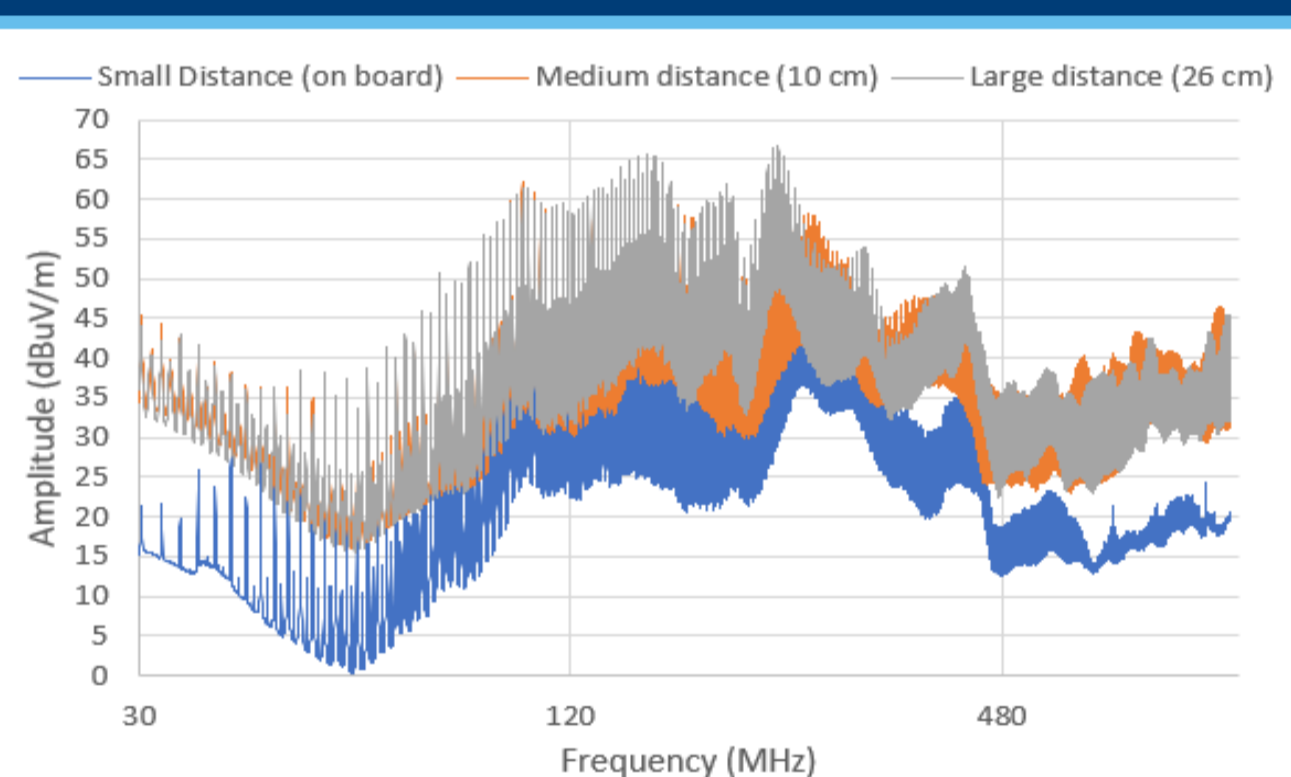


Fig. 6: Far-field distance comparison of a 10 uF decoupling capacitor

Upon comparing the findings obtained from the far-field test (Fig. 6) and the near-field test (Fig. 8), it becomes evident that an increase in peak generation occurs as the decoupling capacitor distance is enlarged and is identified in Fig. 9.

Upon conducting a comparative analysis of the far-field test (Fig. 7) and the near-field test (Fig. 11), it is evident that the noise generation of the PCB is more pronounced in the near-field results. The source is identified in Fig. 10.

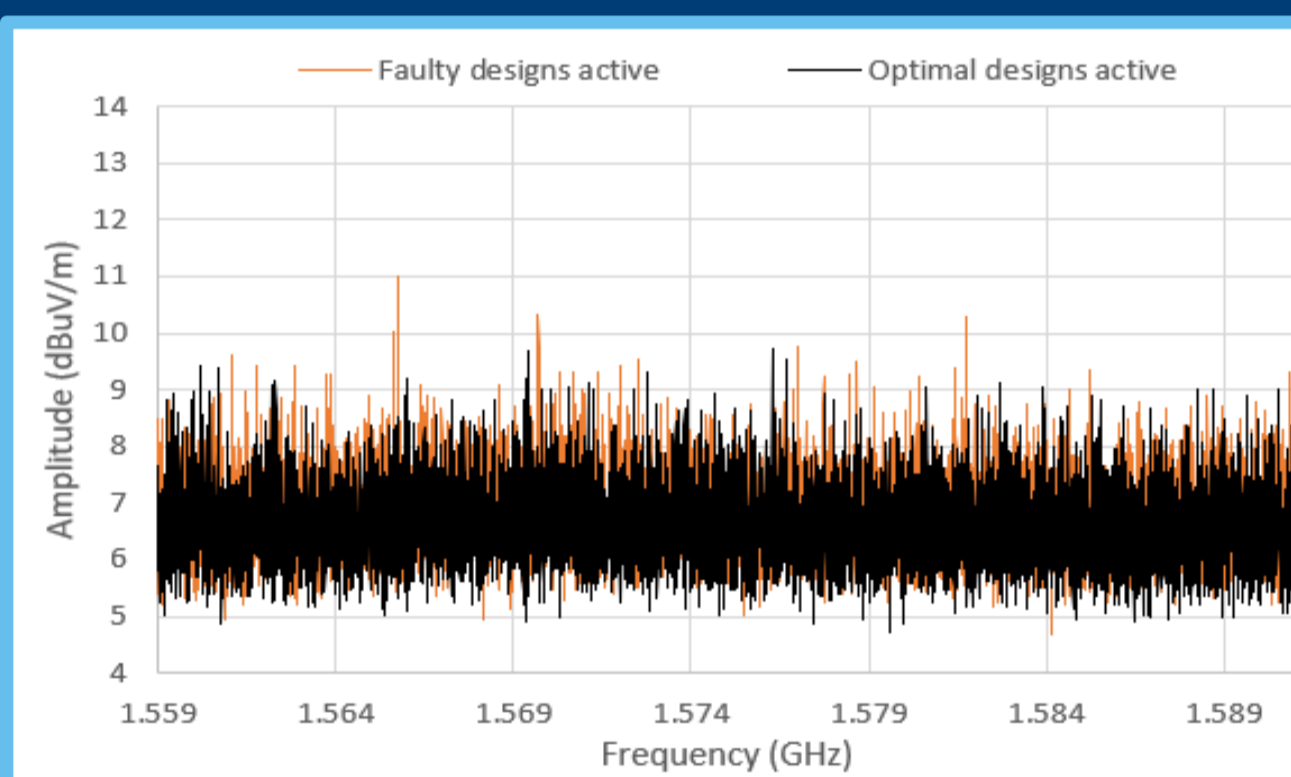


Fig. 7: Far-field noise behavior picked up by the GPS-antenna

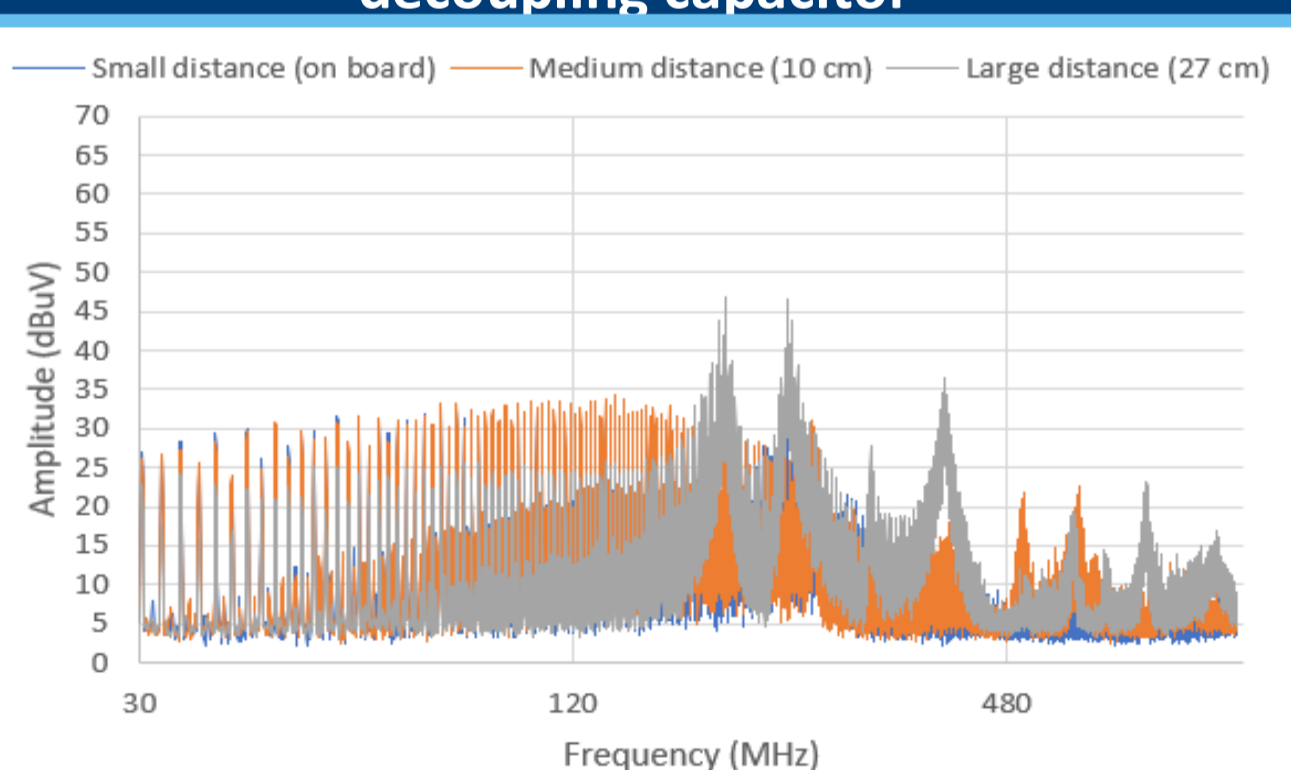


Fig. 8: Near-field distance comparison of a 10 uF decoupling capacitor

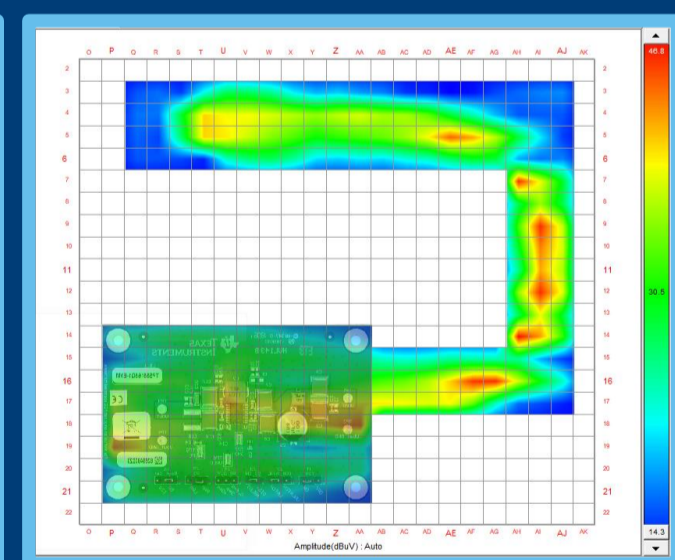


Fig. 9: Frequency response, large distance (27cm)

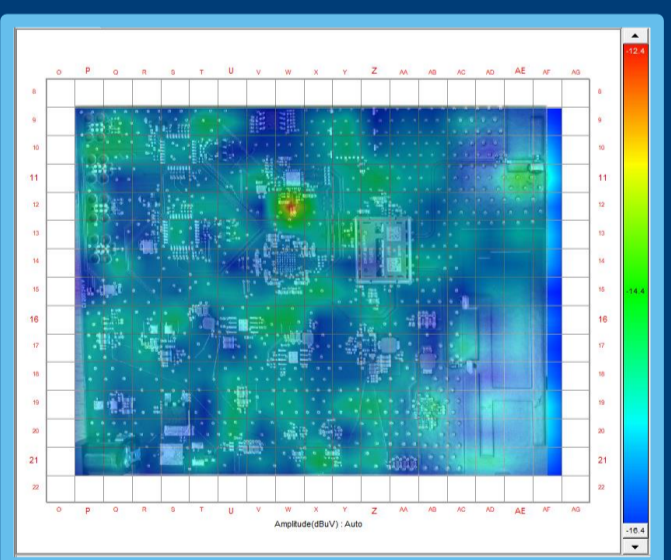


Fig. 10: Frequency response, GPS-antenna

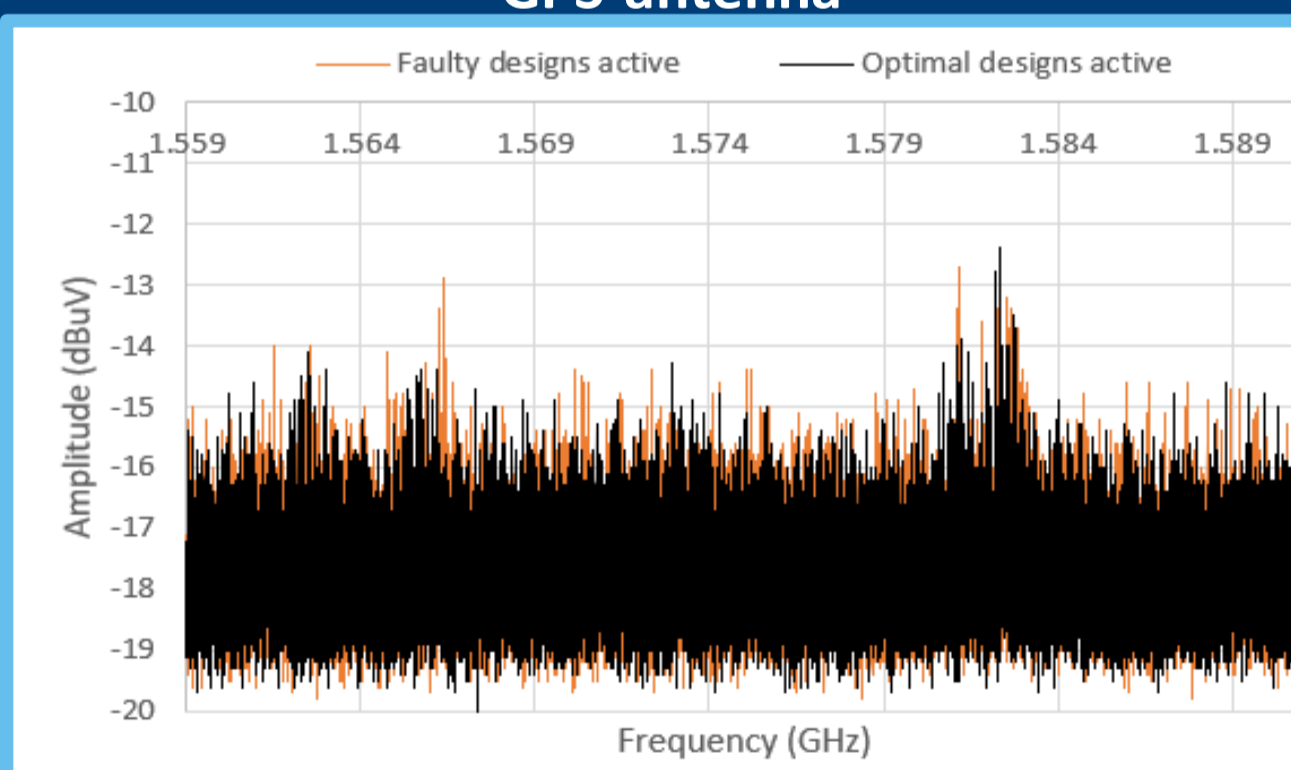


Fig. 11: Near-field noise behavior picked up by the GPS-antenna

## Conclusion

A notable correlation exists between the far-field and near-field radiated emissions in relation to the displacement of the decoupling capacitor. When the capacitor is moved farther from its original position, the severity of the radiation increases. This trend is observed in both the far-field and near-field measurement results.

Regarding the detection of noise patterns captured by the on-board antenna, the near-field measurements exhibit higher sensitivity in identifying these peaks that were generated by the PCB itself. Emphasizing the advantage of employing near-field analysis for this purpose.

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