

Near Field Scanning based Characterization for Wireless Coexistence

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Abstract—In this paper, a near field scanning based method is utilized to characterize wireless coexistence issues in design of a practical electronic device. This device supports multiple wireless communication radios. Based on near field, the radiation at the intermodulation frequency when two different radios both operate are evaluated. Reduction of scanned near field is proved to be an effective method to predict far field reduction.

I. INTRODUCTION

With rapid growth of wireless technologies and integrated circuits (ICs), nowadays more and more radio systems and function subsystems are integrated to a single electronic device. Electromagnetic interference (EMI), desense and wireless coexistence issues arise significantly. Previously, researchers have proposed near field based method to reconstruct equivalent sources to solve EMI, radiated spurious emissions (RSE) and desense problems. In [1], measured near field is used to predict EMI of a heat-sink/IC structure. Based on near field scanning, an equivalent magnetic dipole moment is reconstructed to predict RSE in an electronic device [2]. In [3] and [4], near field scanning measurements are used to build equivalent dipole moment models to predict and solve desense issues. This paper utilizes the near field scanning to solve wireless coexistence issues.

II. METHODOLOGY

This device studied in this paper supports multiple wireless technologies including Zigbee and Bluetooth. When both Zigbee and Bluetooth operate at the same time, it fails radiation compliance limit for 2dB at intermodulation frequency. Assume the transmit frequency of Zigbee radio is f_1 ; the transmit frequency of Bluetooth is f_2 . The radiation failure frequency is at $2*f_1-f_2$. The frequency of $2*f_1-f_2$ is very close to 2.4GHz, which both Zigbee and Bluetooth antennas has good radiation efficiency. At the frequency of $2*f_1-f_2$, the conducted power measured at both RF chains are small.

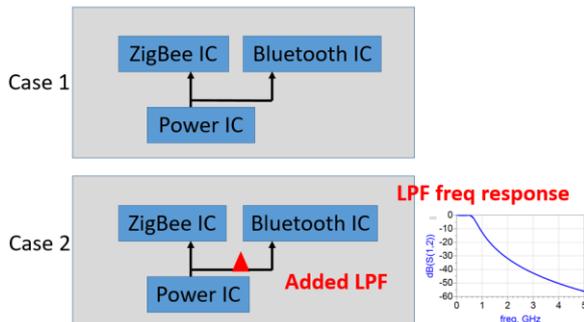


Fig. 1. Simple diagram for original failure device (case 1). the power IC supply both the ZigBee and Bluetooth IC. High frequency isolation is bad. For case2, a low pass filter is added on the power path to provide better isolation at high frequency. The frequency response of the low pass filter is also shown.

It is identified that the isolation between two radio ICs high frequency are not good enough. For the failure device, a simple diagram is shown in case 1 in Figure 1. For case 1, the power IC supply both the ZigBee and Bluetooth IC. The RF signal at fundamental frequency and harmonic frequencies can easily couple from one IC to another IC due to poor isolation. In case 2, a low-pass filter is placed on the power line to provide better high frequency isolation.

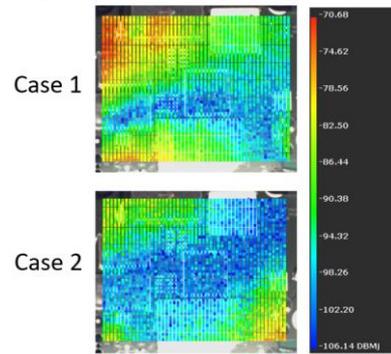


Fig. 2. At intermodulation frequency $2*f_1-f_2$, the scanned Hx for both cases at the same scanning height and conditions are shown.

III. RESULTS AND CONCLUSIONS

For both two cases shown in Fig.1, near field scanning at intermodulation frequency $2*f_1-f_2$ are performed at the same scanning height when both two radios transmit. Hx components for both cases are compared in Figure 2. At intermodulation frequency, near field of case 2 is much weaker than case 1. Far field emission measurements for both case are shown in Table.1. Case 2 far field E field has 7dB reduction compared to case 1. Reduction of scanned near field is proved to be an effective method to predict far field reduction and solve wireless coexistence issues.

TABLE I. RADIATED EMISSION AT INTERMODULATION FREQUENCY

$f=2*f_1-f_2$	Measured E field	Pass/Fail
Case 1	56 dBuV/m	Fail 2 dB
Case 2	49 dBuV/m	Pass 5 dB

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