LaceClips

2.4GHz BLE Passive Testing Report

VERSION	DATE	PAGE	DESCRIPTION	CENTER	DESIGNED	APPROVED
C	24-March-21	All	Feasability Study	SD	Eric Johnson	

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1. Introduction

Using a state-of-the-art anechoic chamber, Taoglas has designed and evaluated the WLA.01 for BLE connectivity in the LaceClips device. This device needs sufficient BLE performance to properly function in the field and real-life application usage. The antenna was tested in a baseline configuration to understand the current functionality and then a matching network was designed to ensure optimal performance. The antennas have been designed to work in close proximity to a battery bank on the device.

Below are general goals for BLE:

- Must support BLE Band (2400-2500MHz)
    - Return Loss should be greater than -5dB at 2450MHz
    - Should have average gain of a minimum of 30% efficiency
- Directionality and Peak Gain should be less than 5.1 dBi
- The Antenna should have good omnidirectional radiation

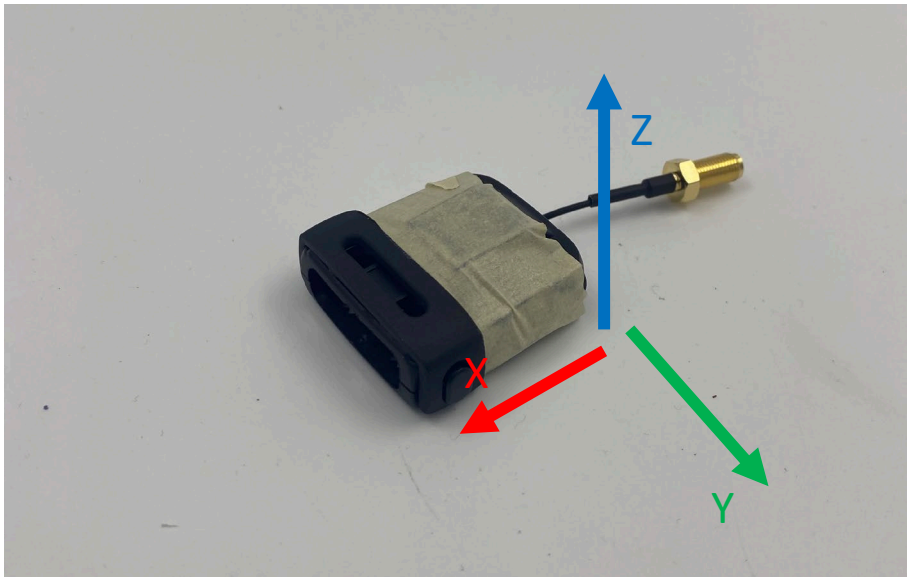

Figure 1: Test Setup

2. Test Setup

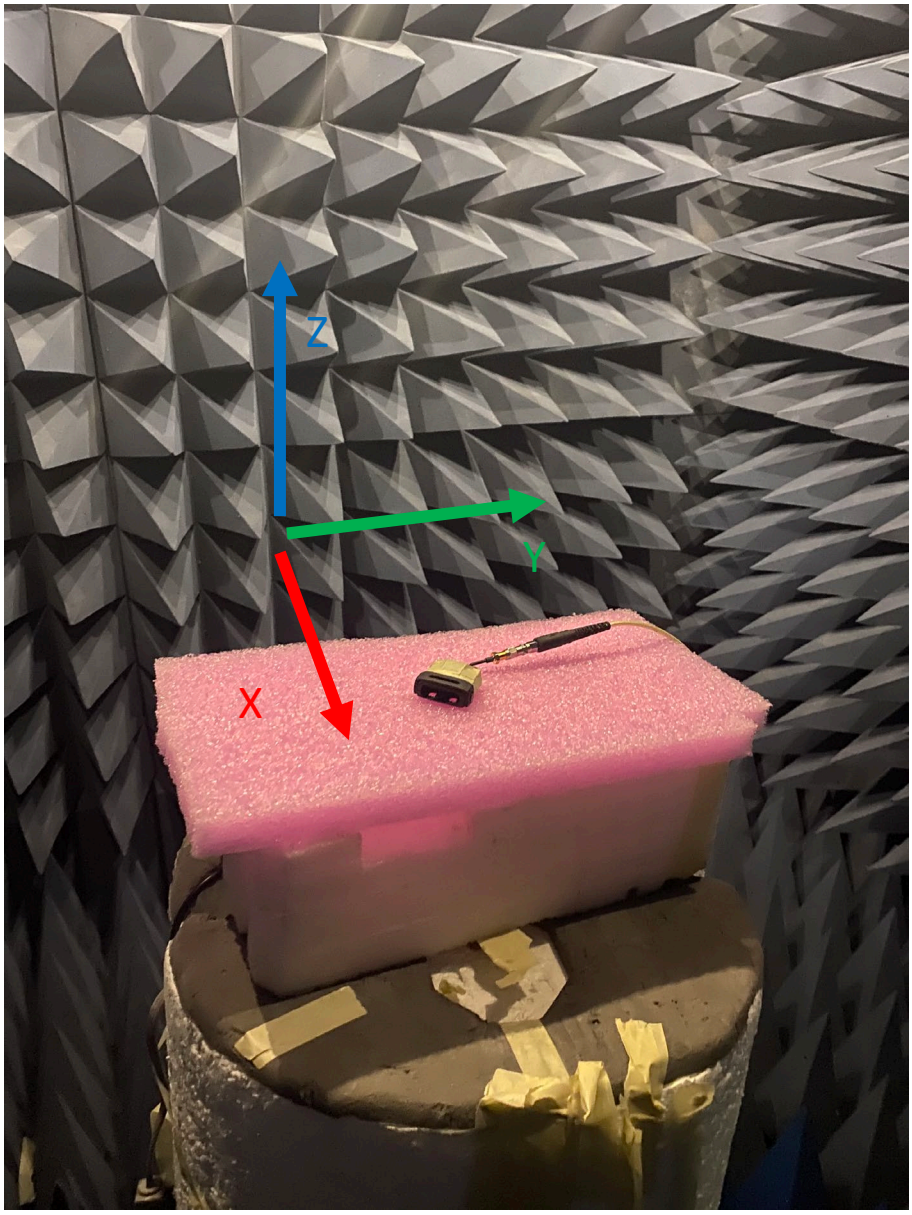

Figure 2: OTA test setup

3. Passive Test Results

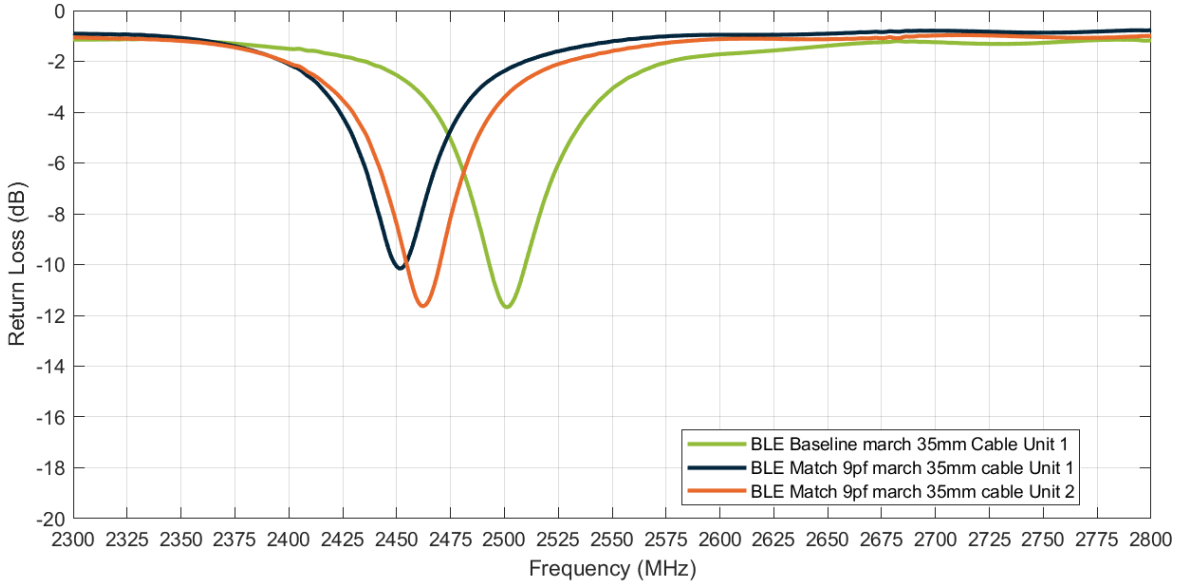

Figure 3: BLE Antenna Return Loss

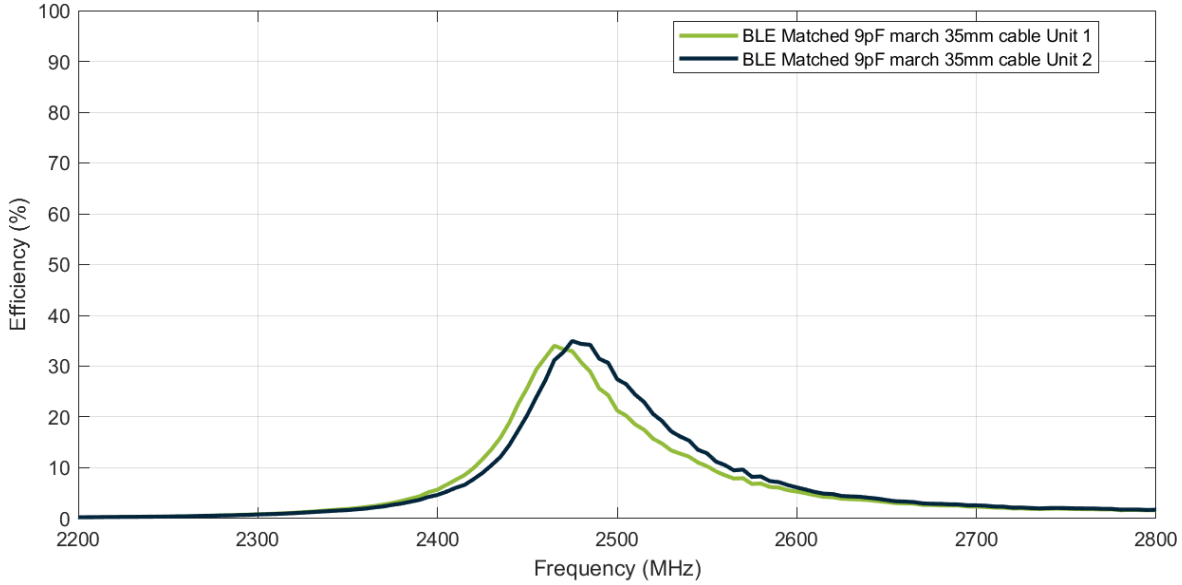

Figure 4: BLE Antenna Efficiency

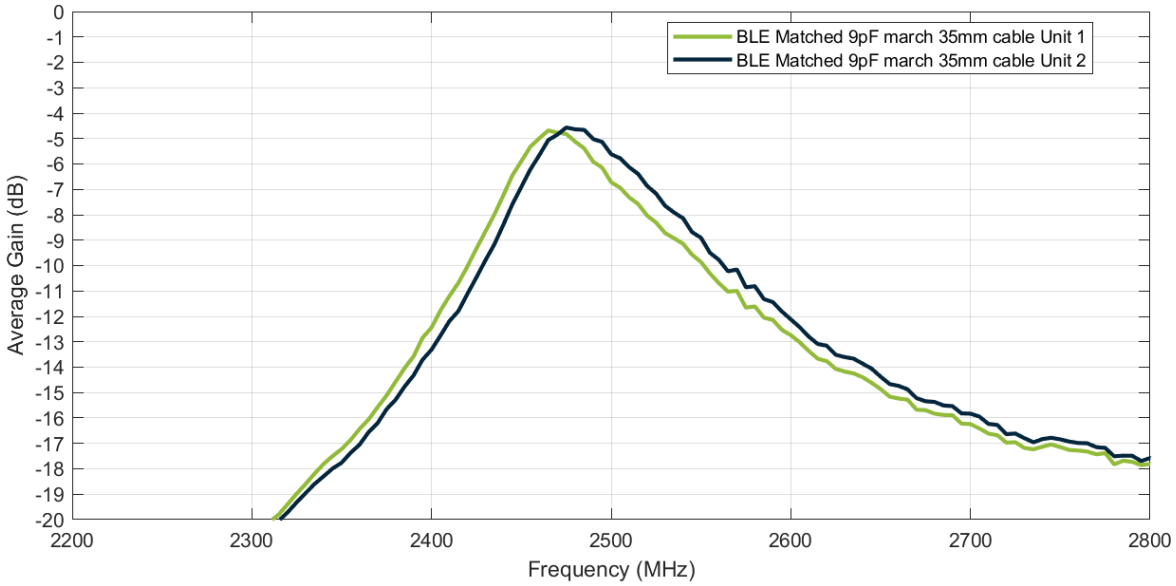

Figure 5: BLE Antenna Average Gain

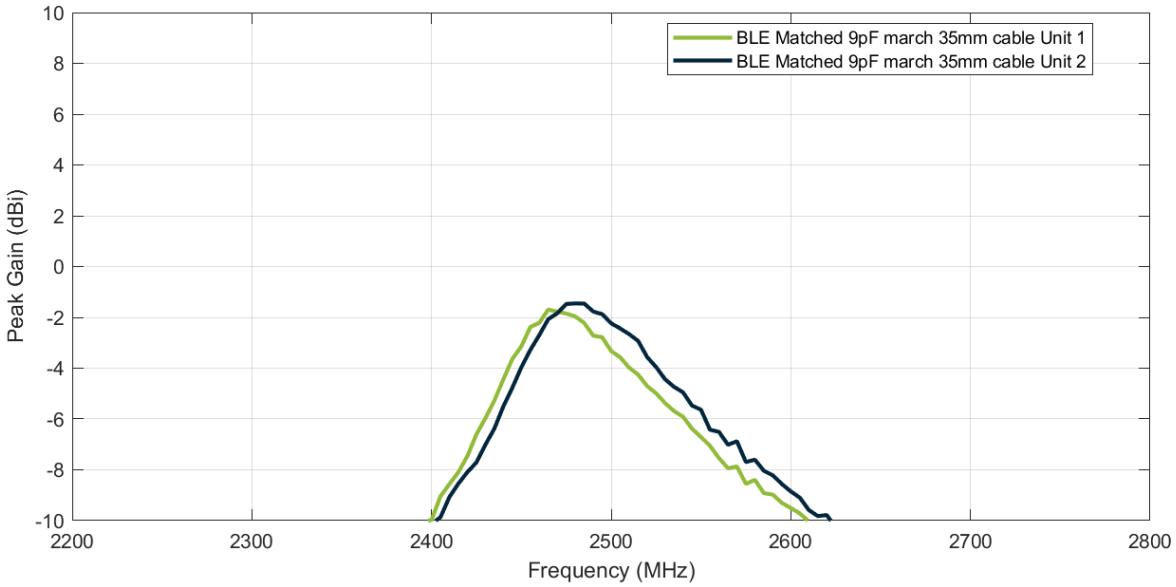

Figure 6: BLE Antenna Peak Gain

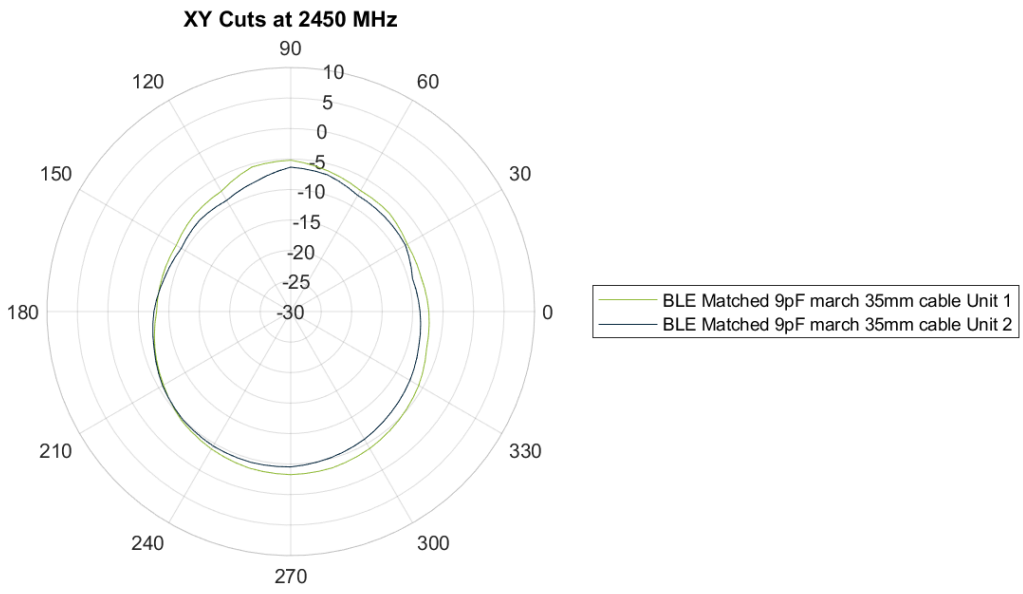

Figure 7: BLE 2D Radiation Patterns

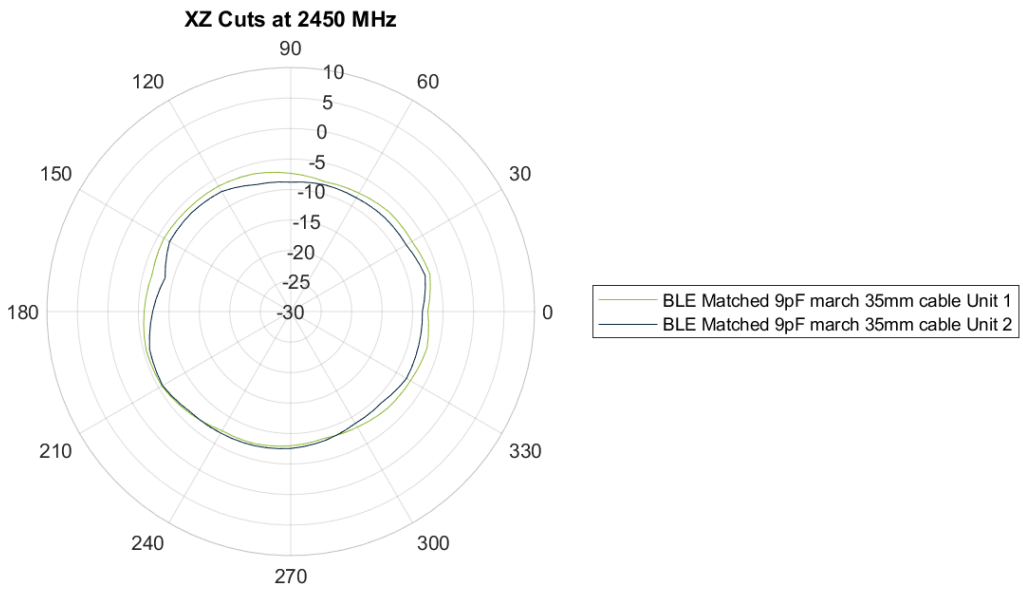

Figure 8: BLE 2D Radiation Patterns

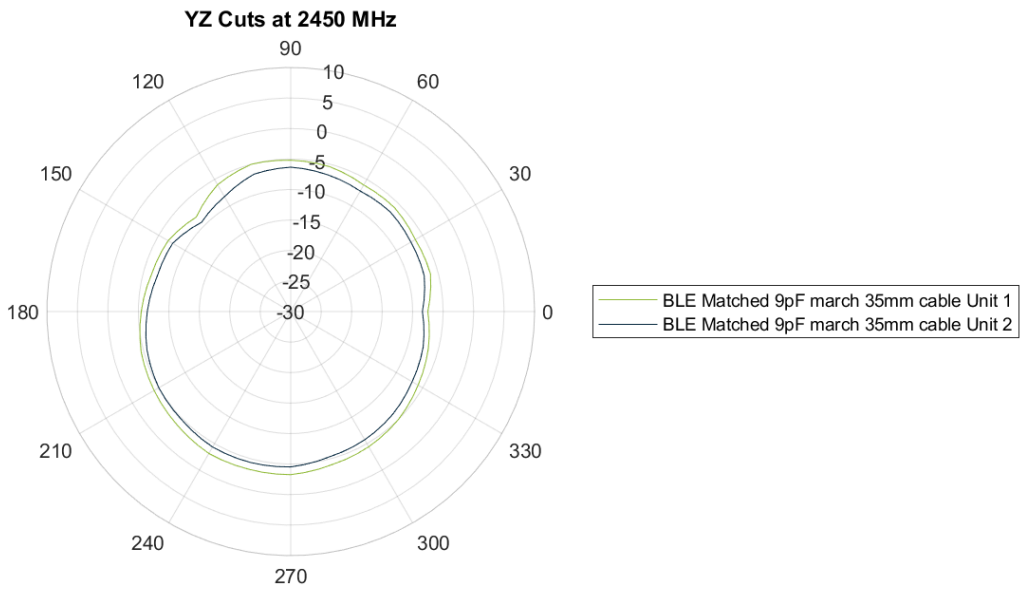

Figure 9: BLE 2D Radiation Patterns

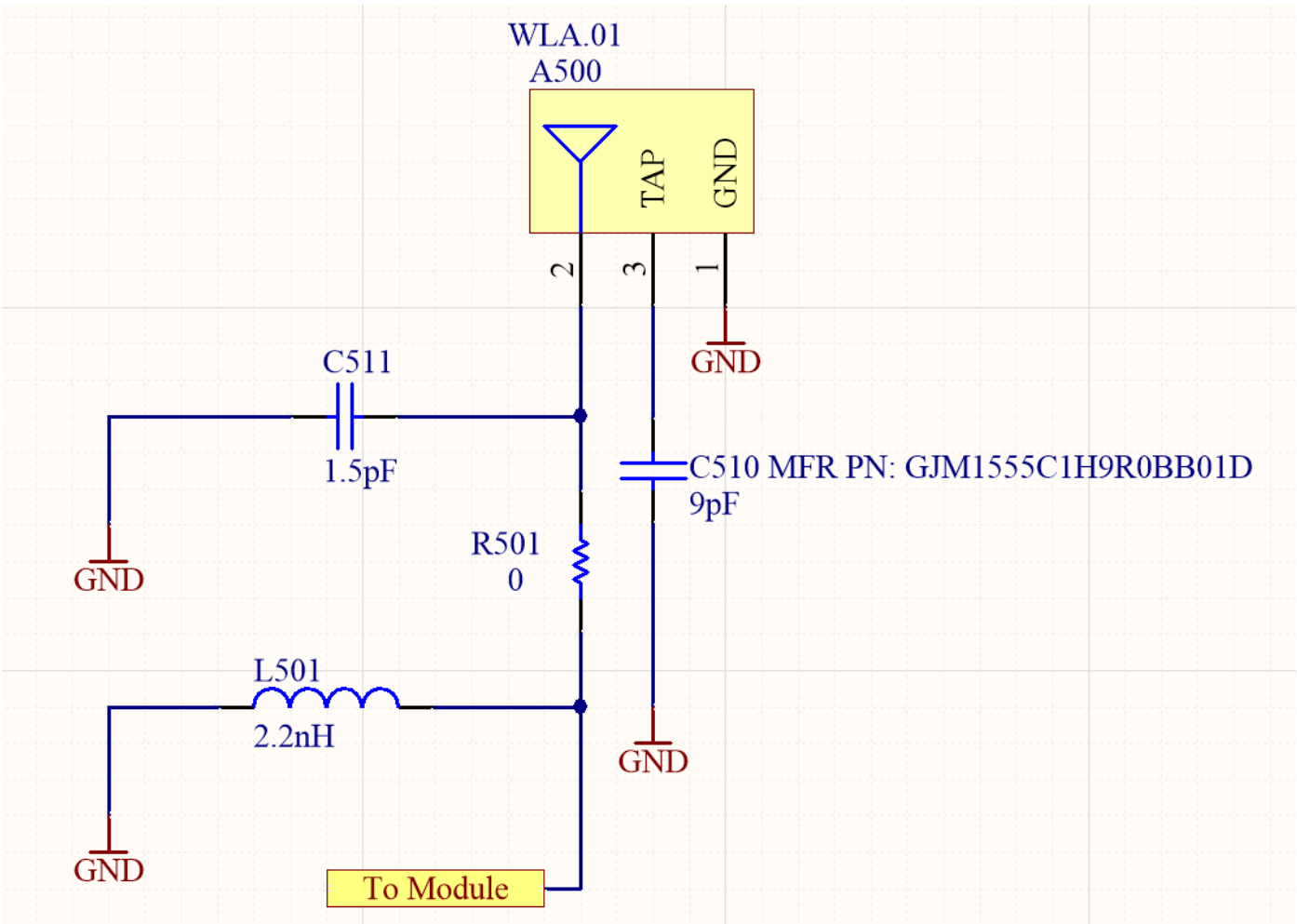

Figure 10: BLE Matching Circuit Recommendation

Figure 11: Test Setup Photo 1

Figure 12: Test Setup Photo 2

5. Conclusion

Based on the recent testing conducted in March 2021, the device needed to be slightly tuned using a new matching network to achieve the desired performance. The test setup can be seen in figures 11 and 12. A short pigtail cable was used to tie into the transmission line on the board.

As shown in figure 3, the return loss of the unit when it was received, is shifted approximately 75MHz higher than the desired center frequency of 2450MHz. After being matched with a 9pF fine tuning capacitor (C510), manufacturer part number used: Murata GJM1555C1H9R0BB01D, the return loss aligns with the 2450MHz center frequency needed for BLE. This matching network was implemented and tested on both units to ensure that the devices are operating correctly and reduce the opportunity for test setup error.

The efficiency on both units tests at a peak of 35% in the center of the BLE band. This performance is inline with what was seen in previous reports, and will provide optimal field and real world performance. The peak gain is less than 0dBi, well under the 5.1dBi limit for FCC requirements.

Taoglas recommends using the new matching network provided in figure 10 above to get optimal performance.

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