Healthcare HHCM Mat Antenna Coil Electrical Specification

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Healthcare Division
Healthcare Research, Development and Engineering

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Abstract

This document provides a brief description and an electrical specification for the Healthcare HHCM Mat Antenna coil and the assembled antenna. This document also provides a brief analysis of early production data to measure the antenna assembly's tuning performance.

Document Purpose

Provide an electrical specification for the Healthcare HHCM Mat Antenna coil and antenna assembly.

Revision History

Revision	Description	ECO	Date	DWN	CHKD	APP
0	Initial Release	TBD	12/14/22	SNODGDA	TBD	TBD

Terms, Acronyms and Abbreviations

mH	Millihenries
pF	Pico Farads
Ω	Ohms
σ	Sigma - 1 Standard Deviation (SD)
OOK	On Off Keying (Modulation)
PCB	Printed Circuit Board or Printed Wiring Board (PWB)

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1. Coil Description

The Mat Antenna coil is a copper wire flat spiral (racetrack) near-field antenna. It is intended for transmitting an OOK modulated signal with a 125 kHz carrier frequency. Series tuning capacitors are required to make the coil resonated at 125 kHz.

Figure 1. *Prototype flat spiral coil antenna*

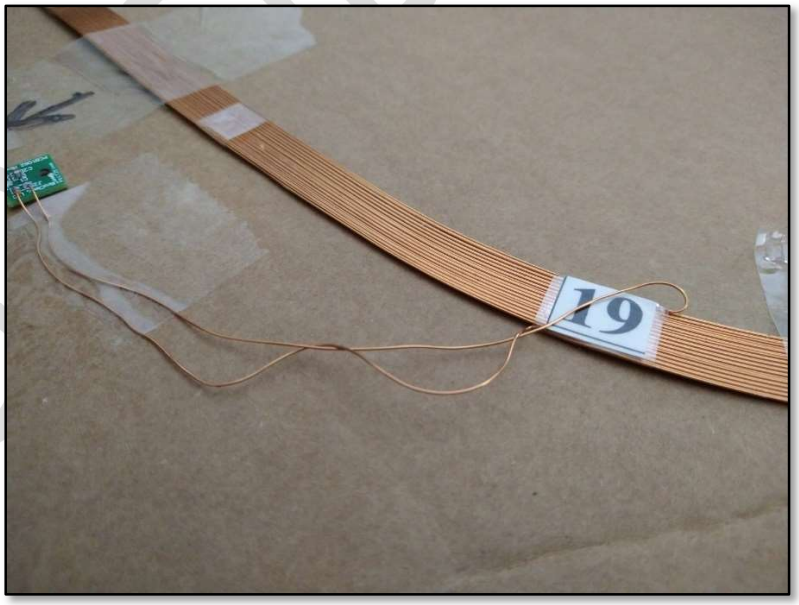

Figure 2. *Closeup of prototype flat spiral coil antenna*

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For production, the antenna coil is sandwiched between two thin polyester sheets.

Figure 3. *Production prototype flat spiral coil antenna*

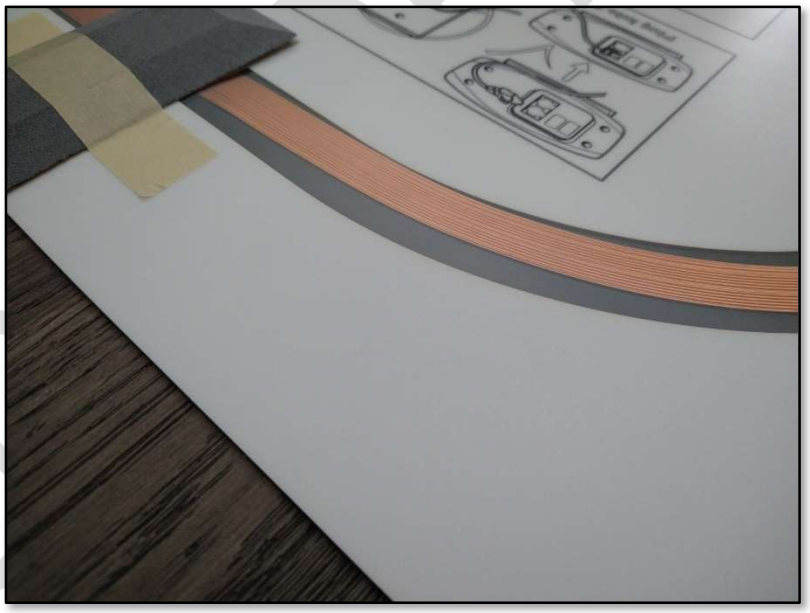

Figure 4. *Closeup of production prototype flat spiral coil antenna*

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2. Electrical Specification

2.1 Coil Specification

Healthcare HHCM Mat Antenna Coil Electrical Specification	
Wire	Solid single copper conductor 24 AWG annealed magnet wire with Polyurethane 180º F insulation meeting MW 82, IEC 60317-51
Turns	30 ±0
Inductance	1.62mH ±0.15mH
Approximate Wire Length	61.1m (200.5 feet)
DC Resistance	5.4Ω ±0.2Ω
Lead Length	152.4mm ±5.0mm (6.0 inches ±0.2 inch) with insulation striped 6.3mm (0.25 inch) from ends and tinned

Table 1. *Healthcare HHCM mat antenna coil electrical specification*

NOTE:
The manufacturer must supply a computer file in MS Excel or CSV format with the following data for each production build.

- Measured inductance value for each unit to a precession of no less than two decimal places in millihenries.
- Measured DC resistance value for each unit to a precession of no less than two decimal places in Ohms.

2.2 Coil Drawing and Dimensions

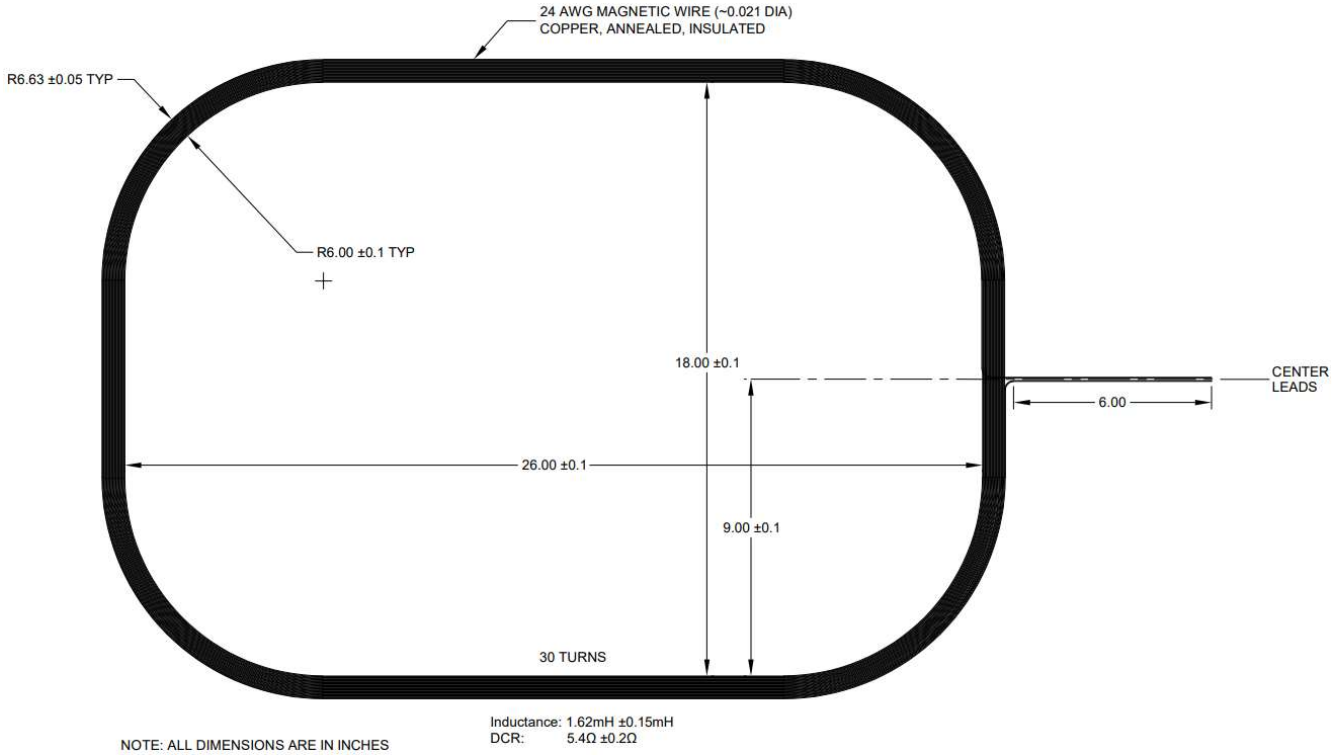

Figure 5. *Dimensioned coil drawing*

2.3 Tuning Capacitor Specification

The 53004204 PCB assembly is connected in series with the coil. The 53004204 PCB assembly tuning capacitor specification is shown here due to its critical nature in causing the coil to resonate at the required frequency.

53004204 and 53004205 PCB Assembly Tuning Capacitor Specification	
C1	910pF, ±5%, 50V, C0G/NP0, 0603
C2	75pF, ±5%, 50V, C0G/NP0, 0603
C3	Not Installed
Total	985pF
Resonate Frequency	125 kHz ±5 kHz

Table 2. *53004204 and 53004205 PCB assembly tuning capacitor specification*

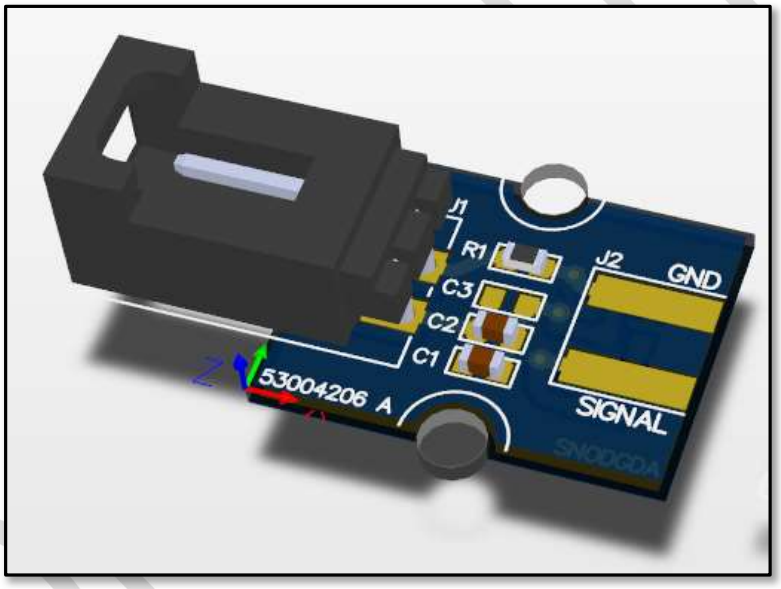

Figure 6. *53004204 PCB assembly*

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3. Antenna Assembly Tunning Performance

On 10/05/22, SSI Electronics produced 106 mat antenna assemblies using 60 coils manufactured by CO-E and 46 coils manufactured by Aviton. Part of SSI's production procedure is to test and verify the resonant frequency of each antenna. Due to the construction of SSI's floor, where testing is conducted, there is a known detuning offset of -5 kHz. Therefore, SSI's target resonant frequency specification is 120 kHz ±5 kHz. As can be seen in the figures below, all antennae fell within the specification. It was observed and noted that there was a 1.47 kHz difference of average resonant frequency between the two coil manufacturers.

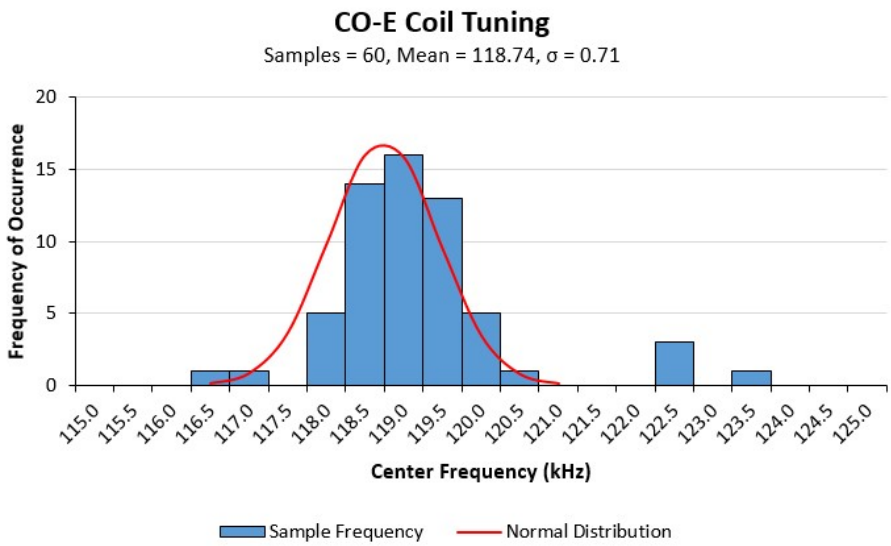

Figure 7. *Tuning results for coils manufactured by CO-E*

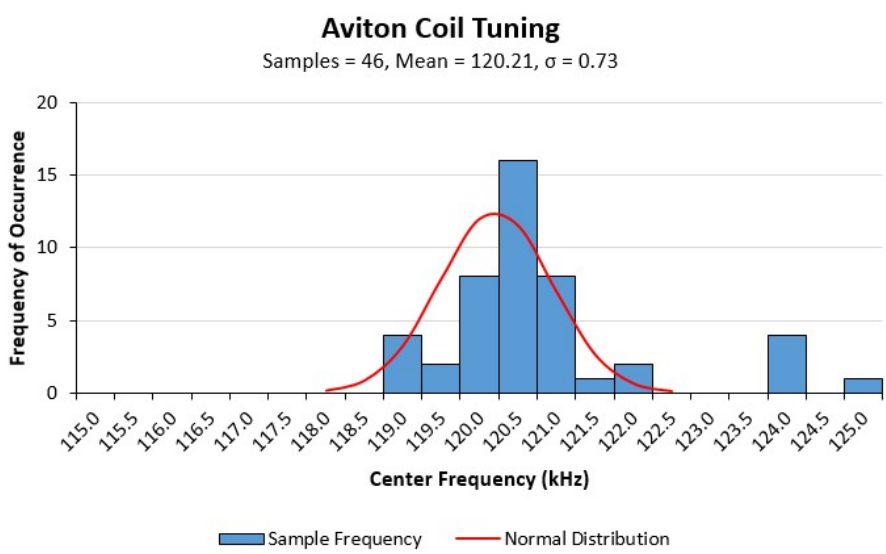

Figure 8. *Tuning results for coils manufactured by Aviton*

The worst-case standard deviation (σ) was found to be 0.73 kHz. ±3σ is ±2.19 kHz, which falls well within the specification of ±5.0 kHz and should typically include 99.7% of all samples. It was observed and noted that there were several outliers. However, the outliers still fell within the ±5.0 kHz specification.