2024.04.10
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Consideration of end-fed antenna
Design of LC circuit impedance matching type end-fed antenna (50MHz band)

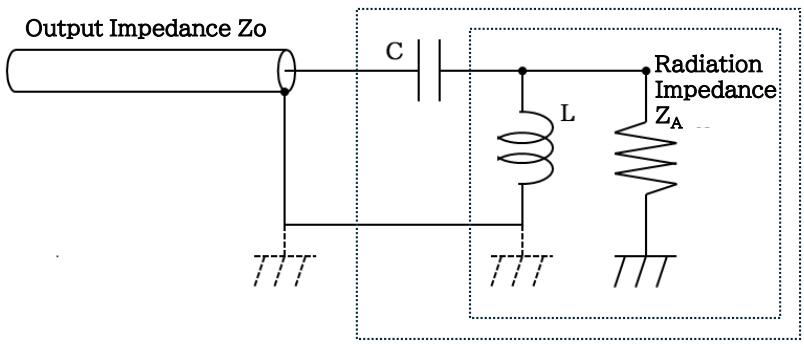
1. Introduction

The impedance characteristics when feeding power from one end of the antenna wire were measured using an antenna analyzer RigExpert AA-55 ZOOM, and when the 266cm antenna wire was installed perpendicular to the ground, the resonant frequency (inductance = 0) was 51.0MHz. The result was that the resistance was 2500 to 3000Ω around that frequency.

So based on this result, I designed an LC impedance matching circuit (for the 50MHz band) to match the output impedance of the transmitter(50Ω) using the LC circuit.

2. Determination of matching circuit and circuit constants

(1) matching circuit



(2) Determination of circuit constants

When the output impedance of the transmitter, the radiation impedance of the antenna, and the set frequency are respectively Zo, Z_A, and ω_0, the relationship between L and C is as follows.

(For the derivation of the formula, see Attachment 1)

$$L = Z_A / \omega_0 \times \sqrt{Zo/(Z_A - Zo)}$$

$$C = 1/(\omega_0 \sqrt{Zo(Z_A - Zo)})$$

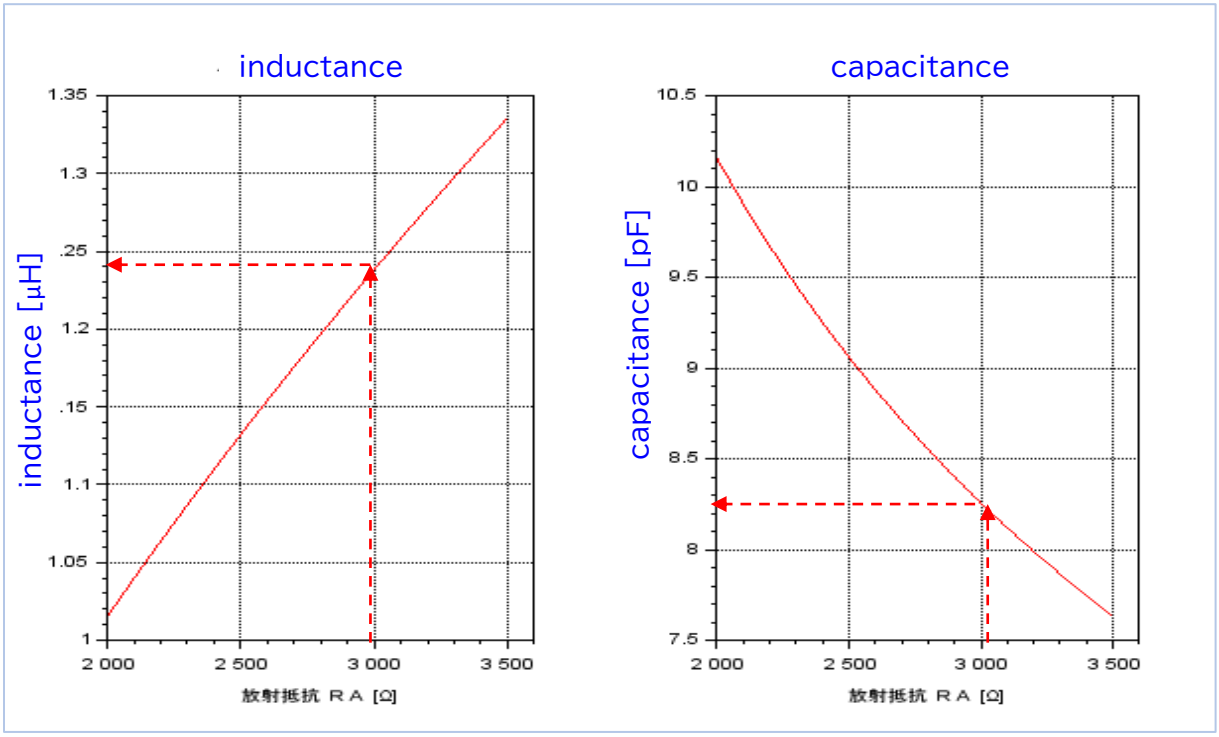
The resonant frequency f_R of these L and C is

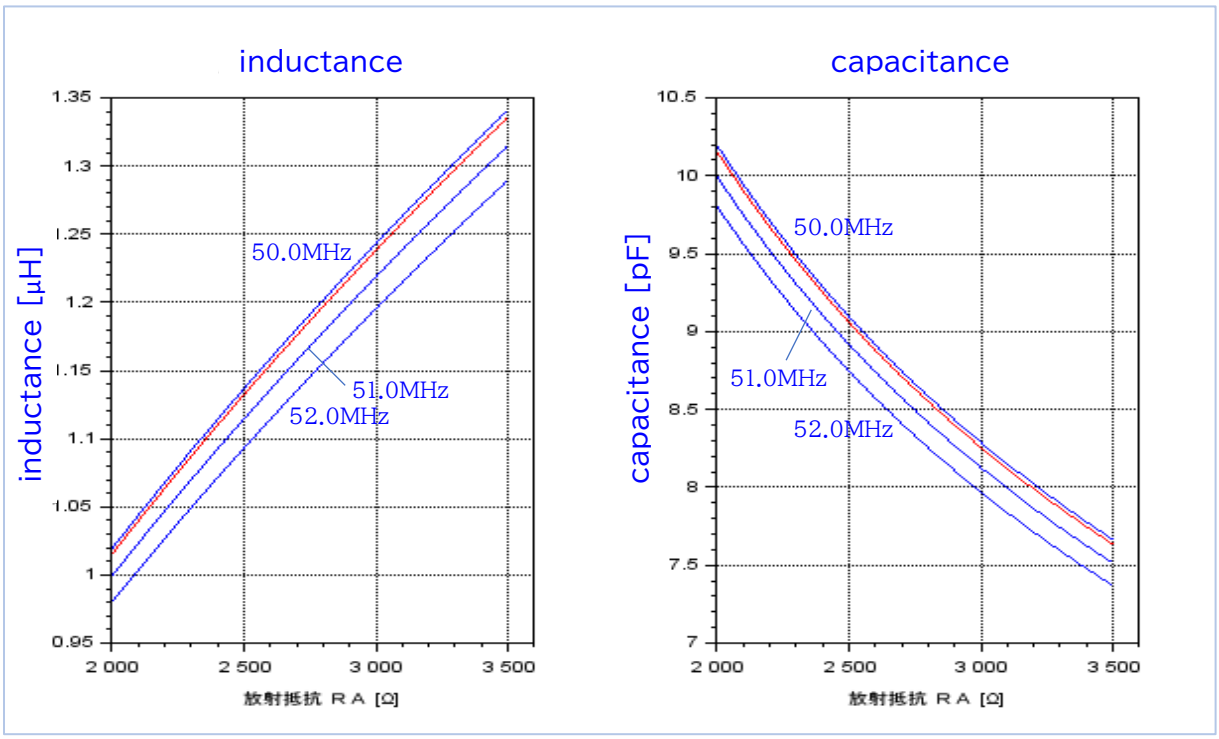
$$f_R = 1/(2\pi\sqrt{LC}) = \omega_0/2\pi \times \sqrt{(Z_A - Zo)/Z_A}$$

Zo=50+j0Ω、Z_A=R_A+j0Ω、when the set frequency is 50.2MHz (ω_0=2π×50.2×10^6), the calculation results for L and C are as follows.

In addition, more detailed calculation results are shown in the graphs.

R_A(Ω)	L(μH)	C(pF)	f_R(MHz)
2000	1.1015	10.153	49.57
2500	1.132	9.058	49.70
3000	1.238	8.255	49.78
3500	1.336	7.633	49.84





3. Afterword

It is known that when the antenna wire is installed perpendicular to the ground, the radiation resistance component is 2500 to 3000Ω around the resonance frequency (reactance = 0).

In the future, I will make an impedance matching circuit with the aim of setting it to 3000Ω, L=1.238μH, C=8.255pF, and fR=49.78MHz.