2024.04.15
JA5IUQ

Consideration of end-fed antenna
Conversion loss of LC circuit impedance matching type matching box

1. Introduction

I would like to report on the measurement of the conversion loss of the LC circuit impedance matching type matching box for a 50MHz end-fed antenna.

The output sides of the two matching boxes were connected to each other, and the propagation characteristics (S21) were measured using nanoVNA + nanoVNA Saver in the form of 50Ω → high impedance → 50Ω.

As a result, it was found that conversion loss of less than 0.5dB (bandwidth 700kHz) per unit can be expected.

2. Matching boxes and measurement system

(1) Matching boxes overview

Table 2.1 shows an overview of the two matching boxes used in the test. the Photo is shown in Photo 2.1 and the circuit configuration is shown in Fig.2.1.

Table 2.1 matching boxes

	Coil			Capacitor		
Matching boxes	diameter／Wire diameter[㎜]	turn [times]	inductance [μH]	type	capacitance [μH]	resonant frequency[MHz]
A	Φ24/φ1.2	6	1.21	ツイストペア	8.23	50.1
B	Φ24/φ1.2	6	1.22	ツイストペア	8.23	50.1

Measured by AA－55 ZOOM(at 50.00MHz)

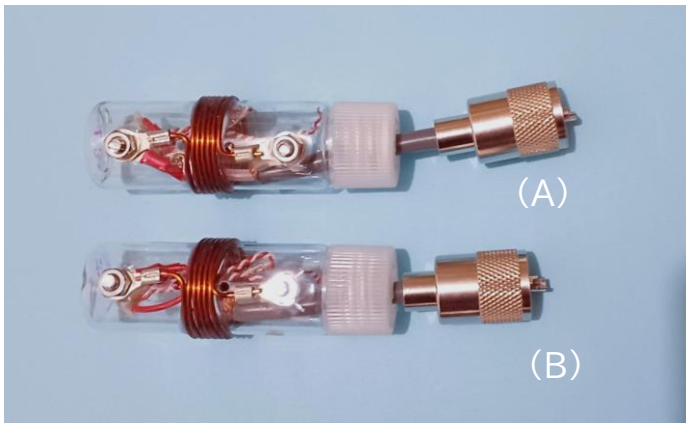

Photo 2.1 Matching boxes

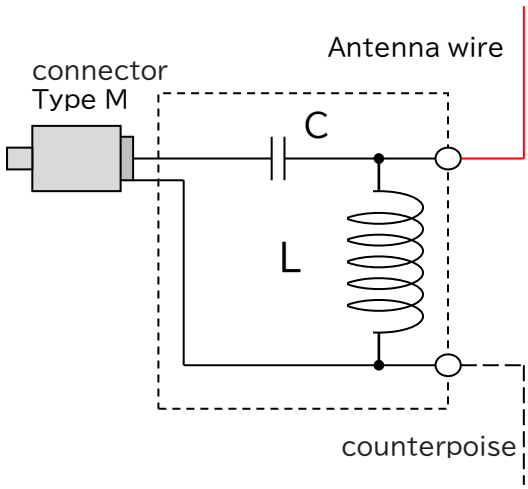

Fig.2.1 Circuit configuration

(2) Characteristics of matching box (A)

A summary of the field test results for matching box (A) is shown in Fig.2.2 and 2.3. In the test, a 273cm antenna wire stretched perpendicular to the ground was used.

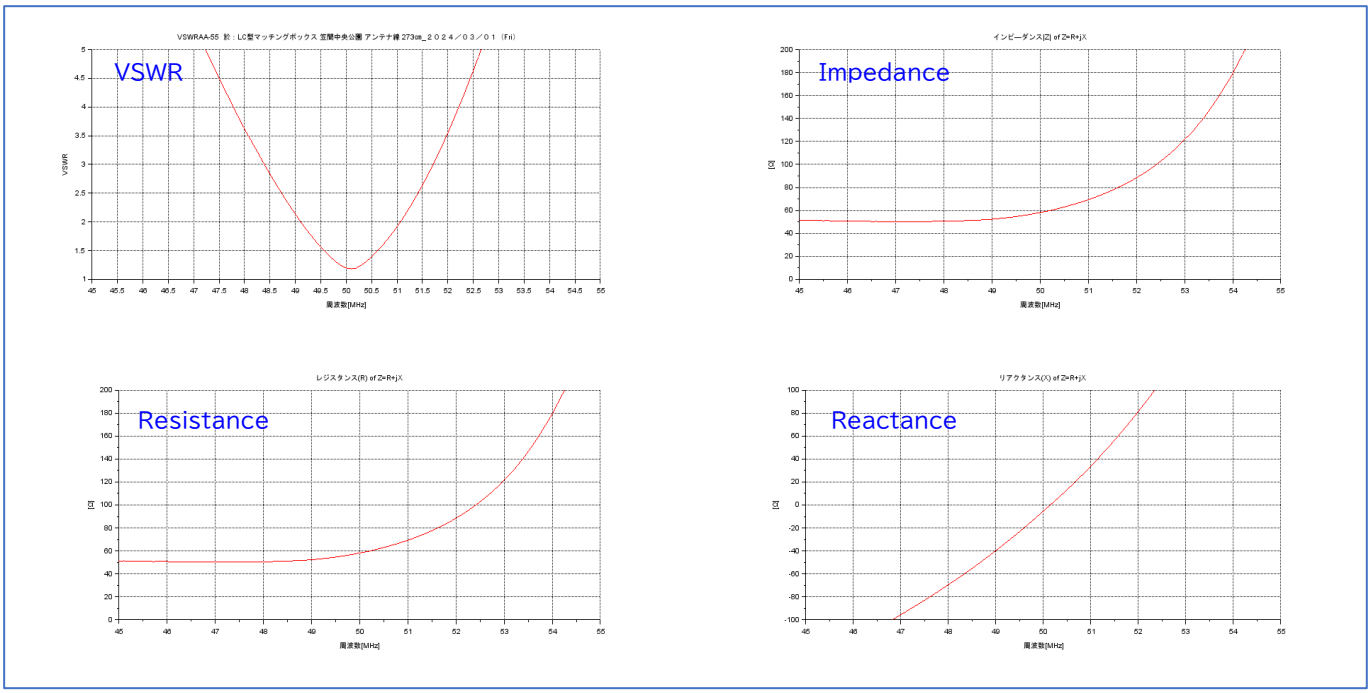

Fig.2.2 Characteristics of matching box (A) (VSWR, Z, R, X)

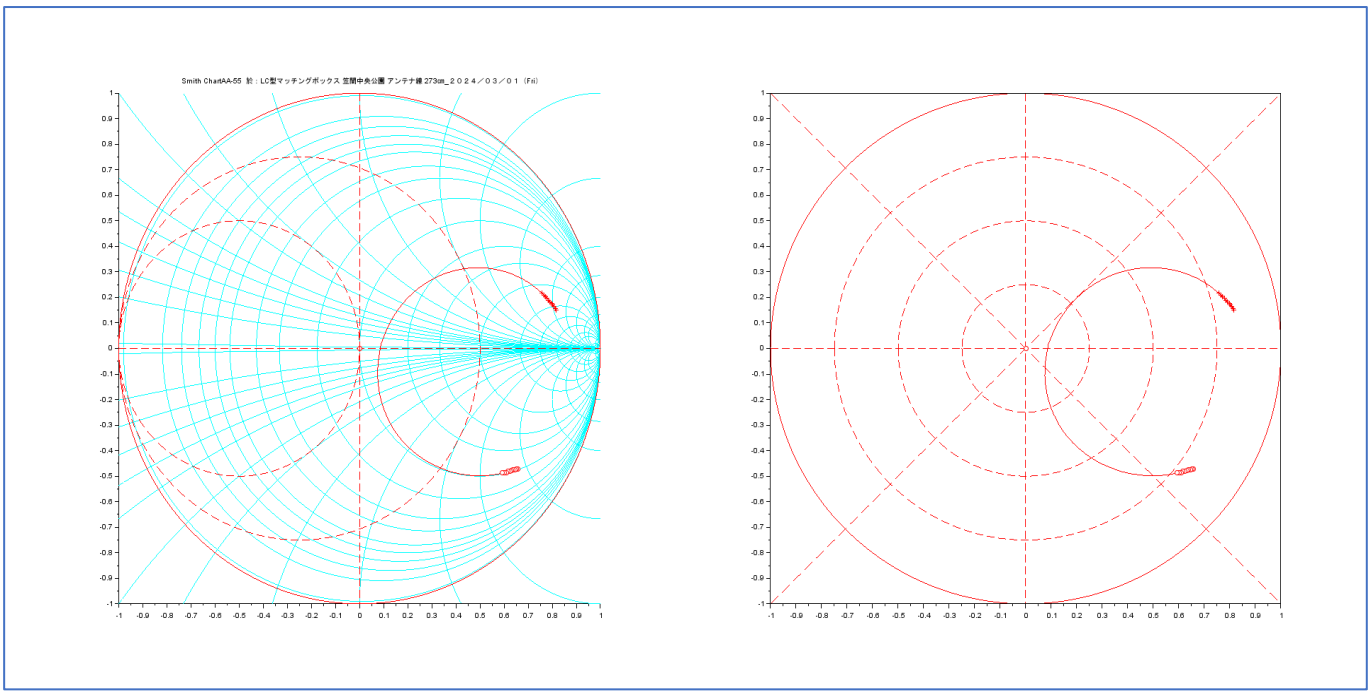

Fig.2.3 Characteristics of matching box (A)(Smith Chart)

(3) Characteristics of matching box (B)

A summary of the field test results for matching box (B) is shown in Fig.2.4 and 2.5. In the test, a 273cm antenna wire stretched perpendicular to the ground was used.

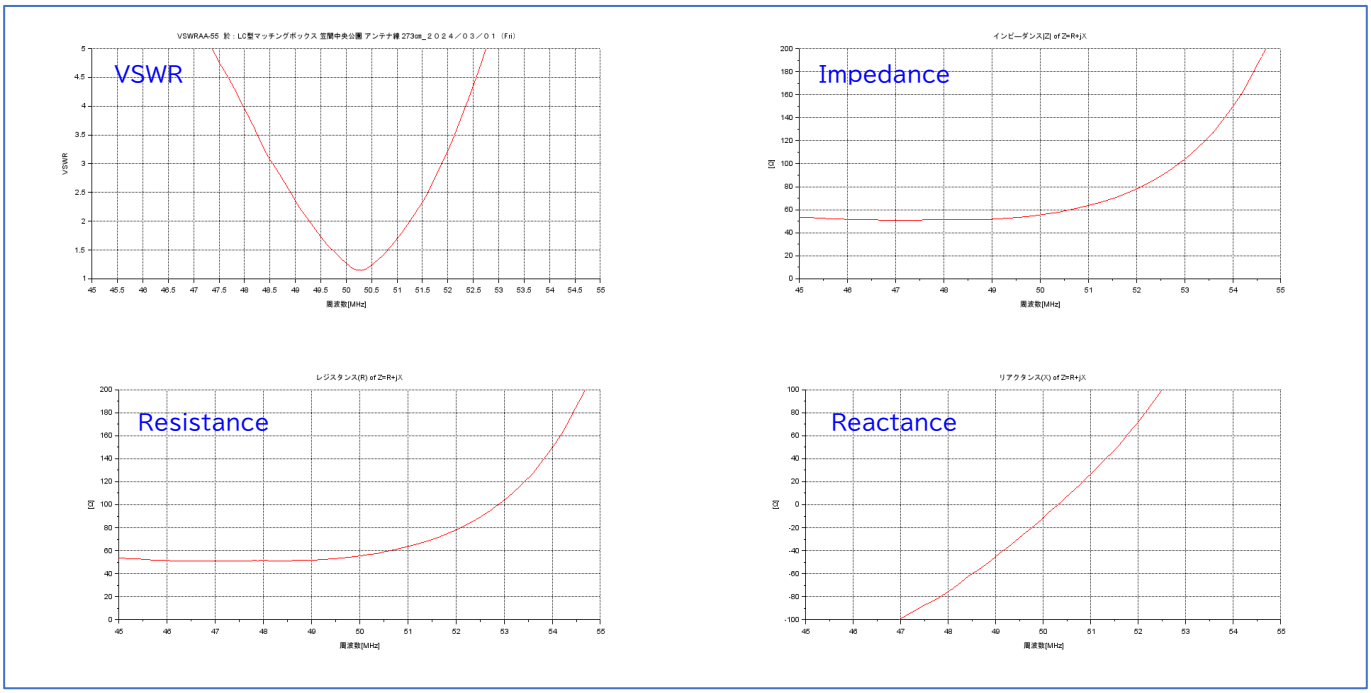

Fig.2.4 Characteristics of matching box (B) (VSWR, Z, R, X)

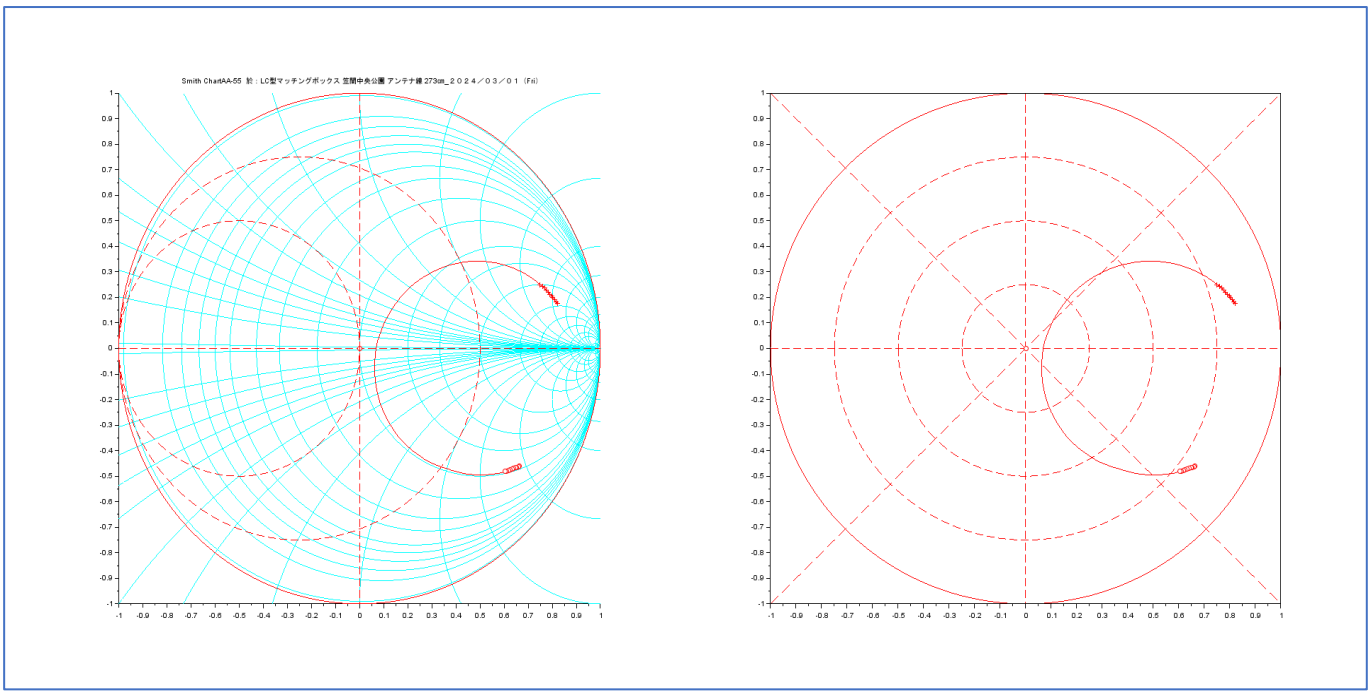

Fig.2.5 Characteristics of matching box (B)(Smith Chart)

(4) Measurement system

The configuration of the measurement system is shown in Figure 2.6. Photo 2.2 shows the actual measurement situation.

In the measurements, I controlled the nanoVNA via the nanoVNA Saver app on a PC and acquired propagation characteristic (S21) data.

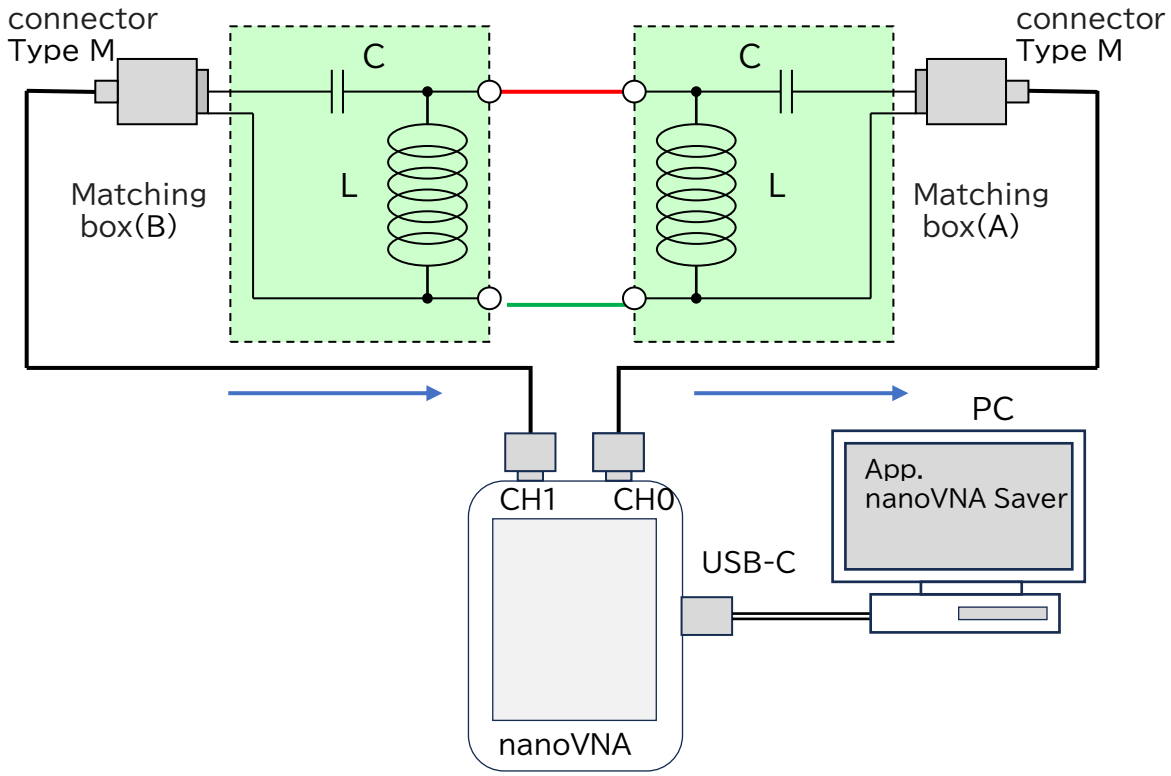

Fig.2.6 measurement system

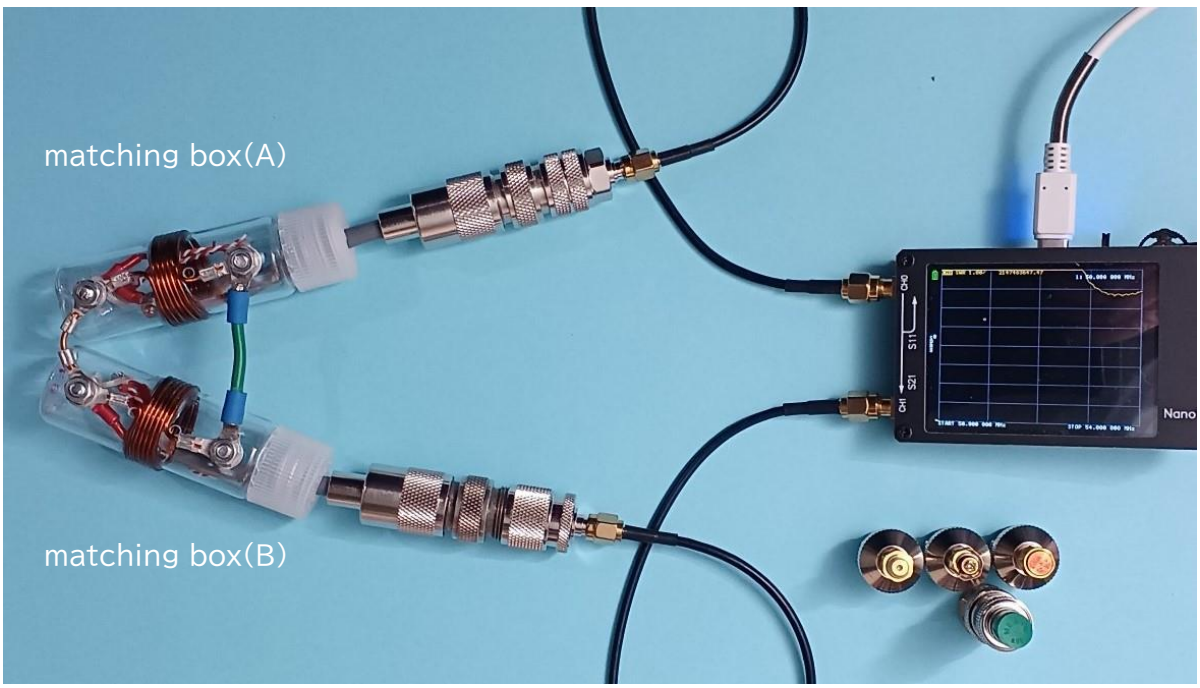

Photo 2.2 measurement situation

3. Measurement result

The measurement results (screenshot of nanoVNA Saver) in the frequency range 1 to 101MHz are shown in Figure 3.1. In Figure 3.1, the upper left graph (red) shows S21 (dB), and the lower left graph also shows S21 (antilog number).

Figure 3.2 shows a zoomed-in view of the upper right graph (frequency range 50-54MHz), and Figure 3.3 shows a zoomed-in view of the lower right graph. From these graphs, it can be seen that the two matching boxes suppressed the minimum loss to less than 0.9 dB in the 50 MHz band, and less than 1.0 dB in the 700 kHz bandwidth in the band.

Therefore, it can be seen that the conversion loss is less than 0.5dB with a bandwidth of 700kHz per matching box.

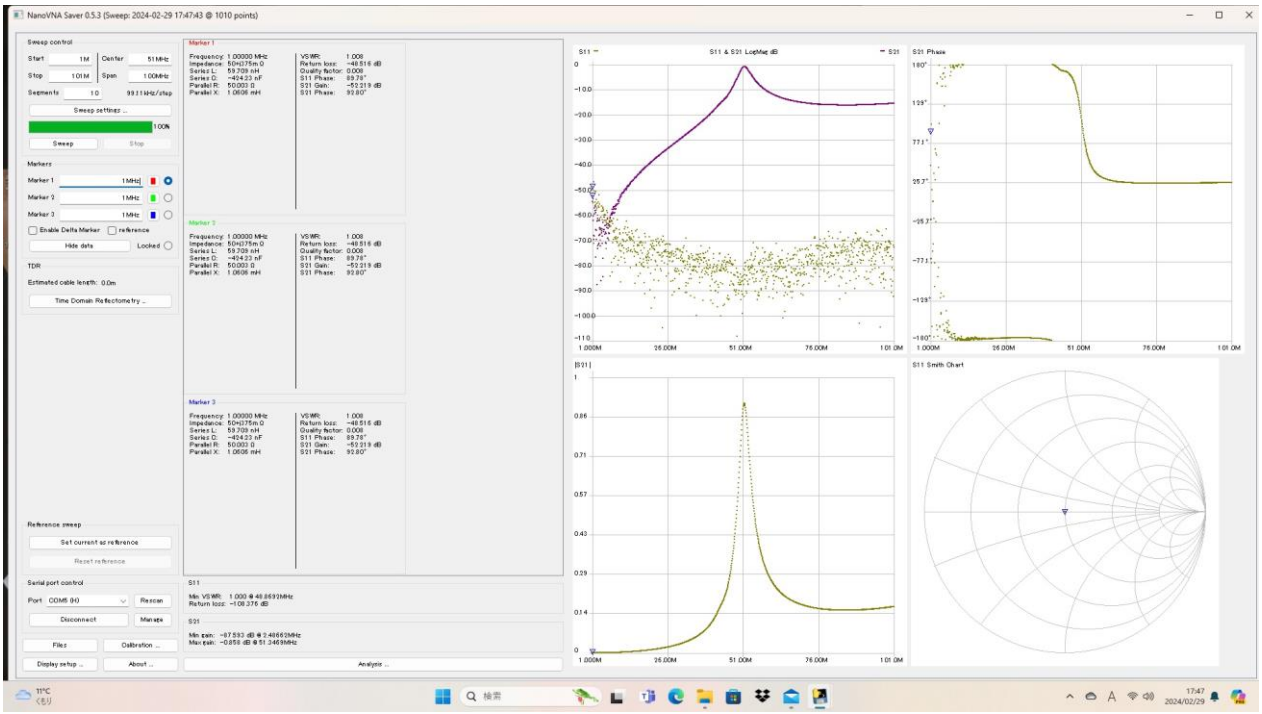

Fig.3.1 Measurement results

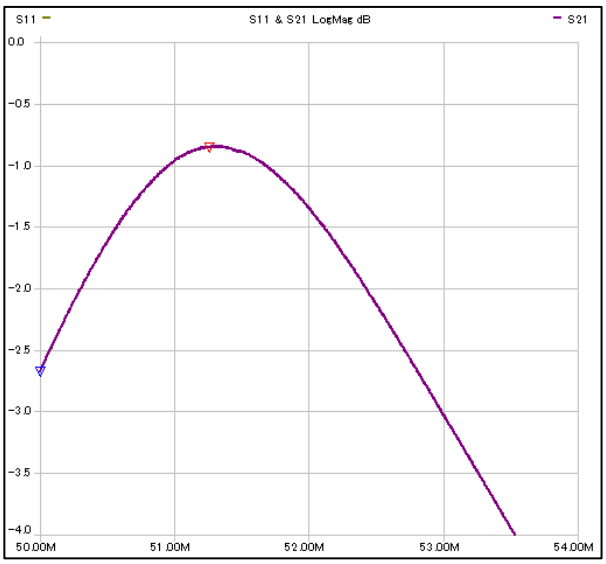

Fig.3.2 Measurement result (zoomed up) dB

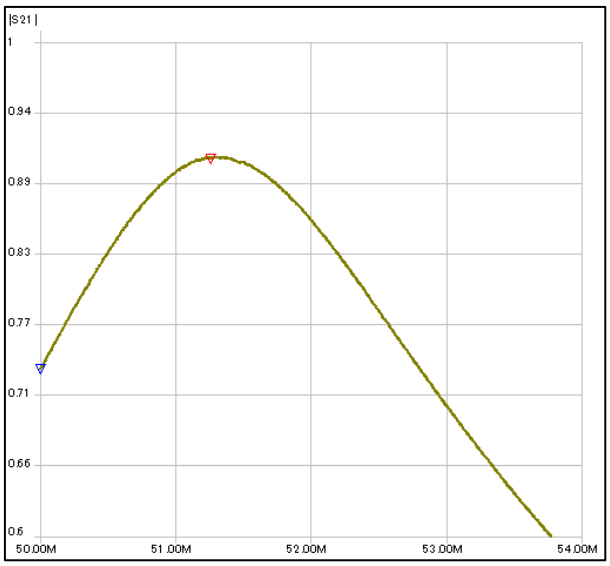

Fig.3.3 Measurement result (zoom up) Antilog

4. Afterword

I measured the conversion loss of an LC circuit impedance matching box for a 50MHz end-fed antenna.

As a result, it was found that a conversion loss of 0.5 dB or less could be obtained for each matching box at a bandwidth of 700 kHz in the 50 MHz band. (Center frequency is adjustable)

This time, I was able to try out nanoVNA's original functionality as a network analyzer for the first time.

Also, for the first time, I was able to control nanoVNA and acquire data using the nanoVNS Saver app on my computer. Using nanoVNA alone has the appeal of being able to easily and maneuverably acquire data. On the other hand, if we connect it to a computer and use it via nanoVNS Saver, it was confirmed that although the mobility is lost, the drawback of nanoVNS's small screen is compensated for, and data can be acquired comfortably and the acquired data can be saved.