§18. Reduction of RF Voltage in Liquid Impedance Matching System with Wide Frequency Range

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In the previous section, the calculation results shows that in some frequency range exceeds to 1.5 the RF voltage ratio of the RF standing voltage in the liquid impedance matching system to that near the antenna. Figure 1 shows a typical example of the RF standing voltage distribution from the antenna(0m) to the inlet of the liquid impedance matching system(31m) in the frequency, 43.7MHz. In this figure, the RF wave length becomes shorter than in the liquid. In the same configuration, RF voltage ratio is shown as a function of frequency from 42.9 to 44.0MHz. The RF voltage ratio increases with applied frequency up to 1.35 as shown in Fig.2. We confirmed that the maximum examined RF voltage is 63kV in 10sec and 50kV in 30min. operation in the liquid stub tuner. The increase, however, in RF voltage in the liquid stub tuner may have caused the RF breakdown during high RF power operation. Then we adopted the method of the unbalanced liquid surface level to reduce RF voltage ratio to 1. We change the central liquid position -0.1m to 0.4m at 43.7MHz. When the deviation of the liquid center becomes -0.1m, the RF voltage ratio increases than original value and decreases gradually with the displacement to become to 1 as shown in Fig.3. Figure 4 shows an RF voltage distribution in the case that the displacement is 0.6m and the RF voltage becomes smaller than that near antenna. By this method we managed to reduce the RF voltage ratio to less than 1.

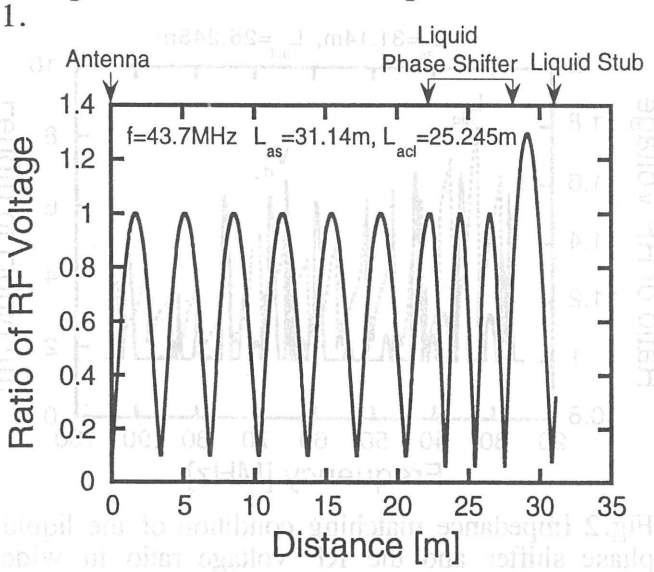

Fig.1 RF voltage distribution at 43.7MHz. The RF voltage is larger than that near antenna.

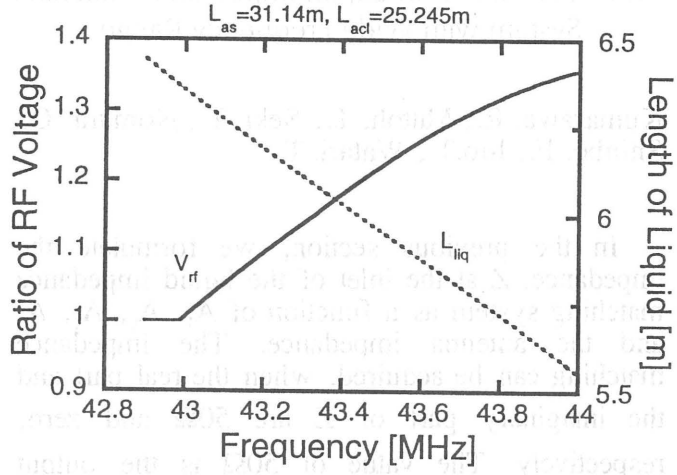

Fig.2 Dependence of RF voltage ratio on applied frequency, from 42.9 to 44.0MHz.

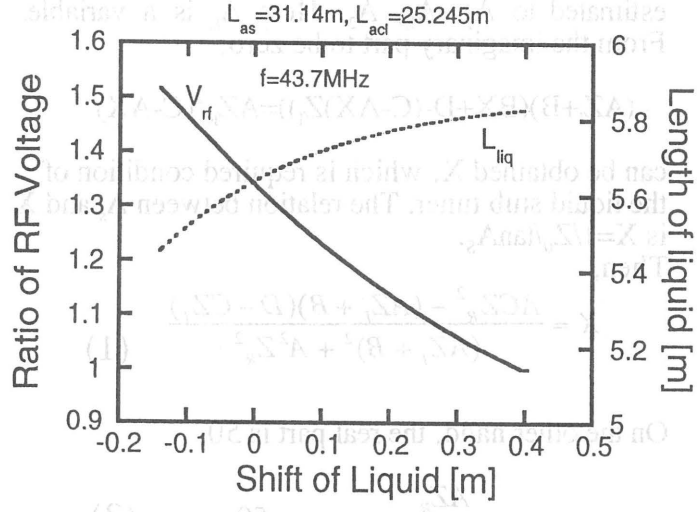

Fig.3 Dependence of RF voltage ratio on the displacement of the liquid center of the liquid phase shifter.

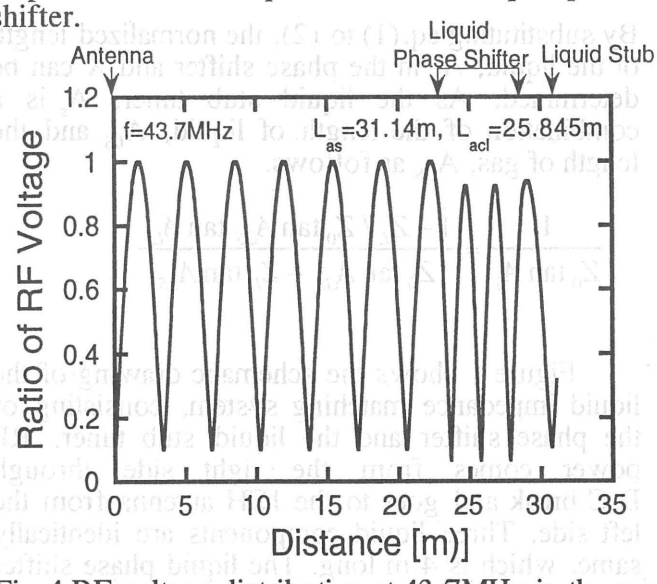

Fig.4 RF voltage distribution at 43.7MHz in the case of shifted liquid center by 0.6m. The RF voltage becomes smaller than that near antenna.