Controlled Growth of Cu and CuO_x Thin Films from Subvalent Copper Precursors

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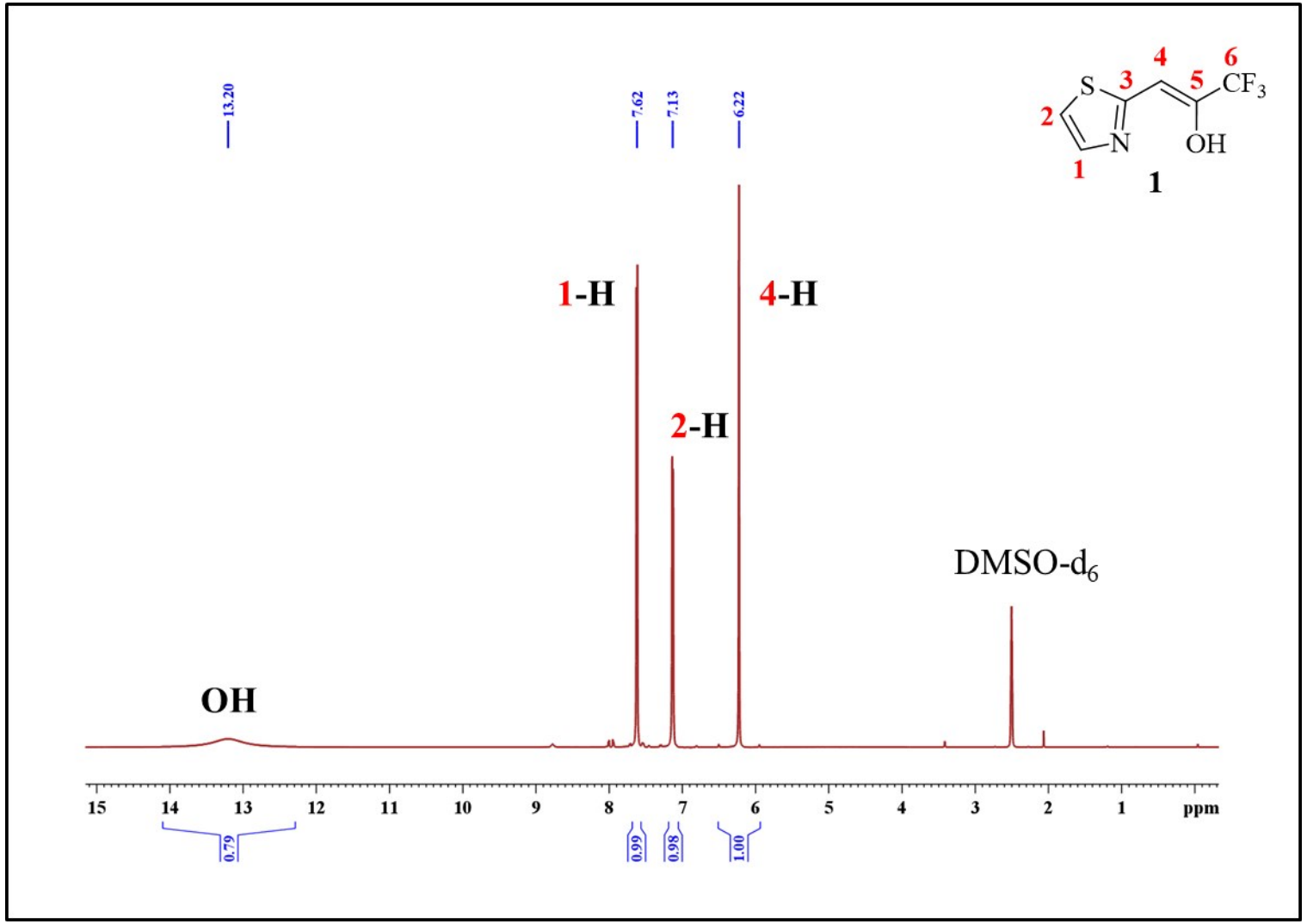

Figure 1: ^{1}H NMR Spectrum of (**2**) in DMSO-d_6 at RT with schematic and arbitrary numbering.

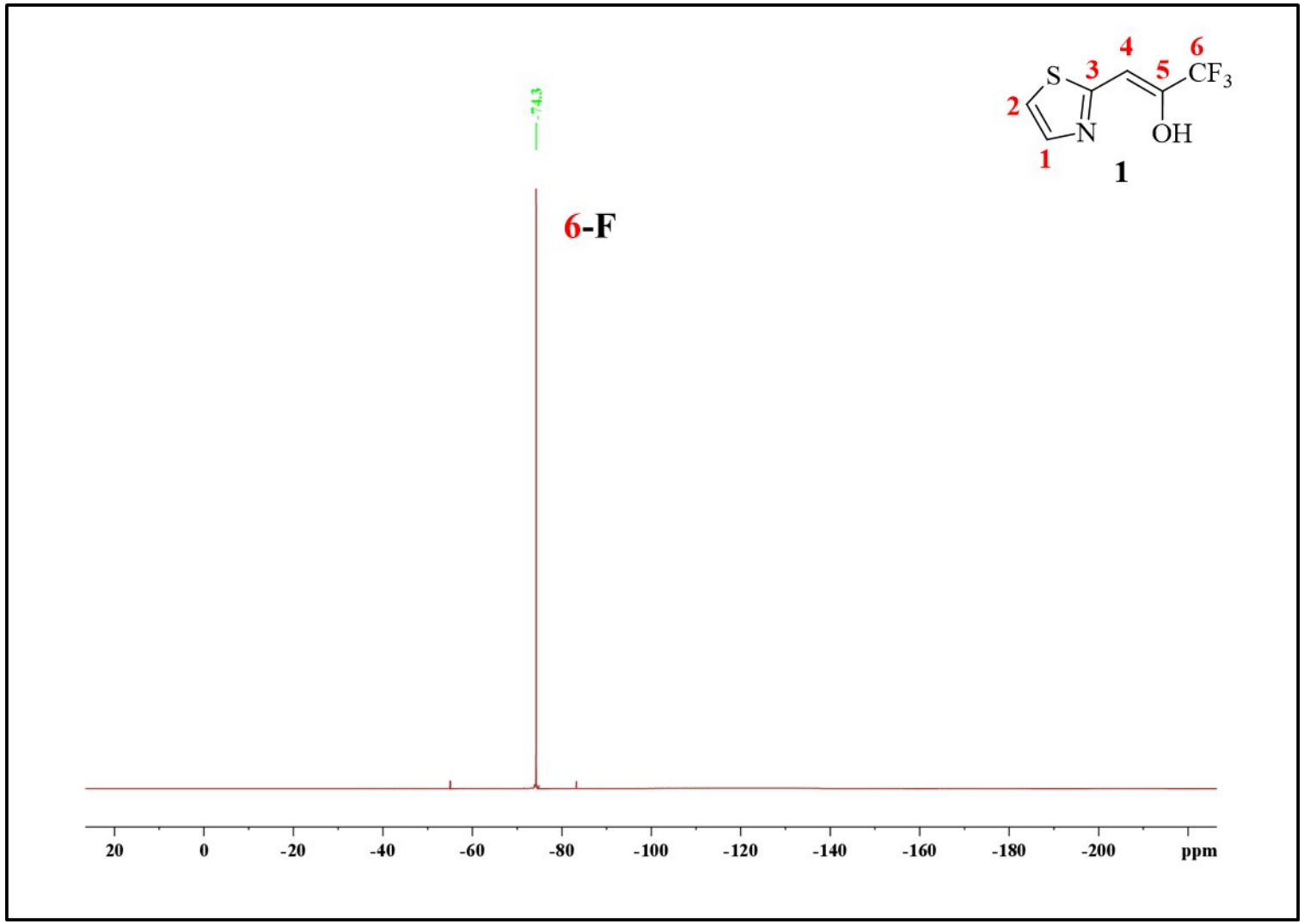

Figure 2: ^{19}F NMR Spectrum of (**1**) in DMSO-d_6 at RT with schematic and arbitrary numbering.

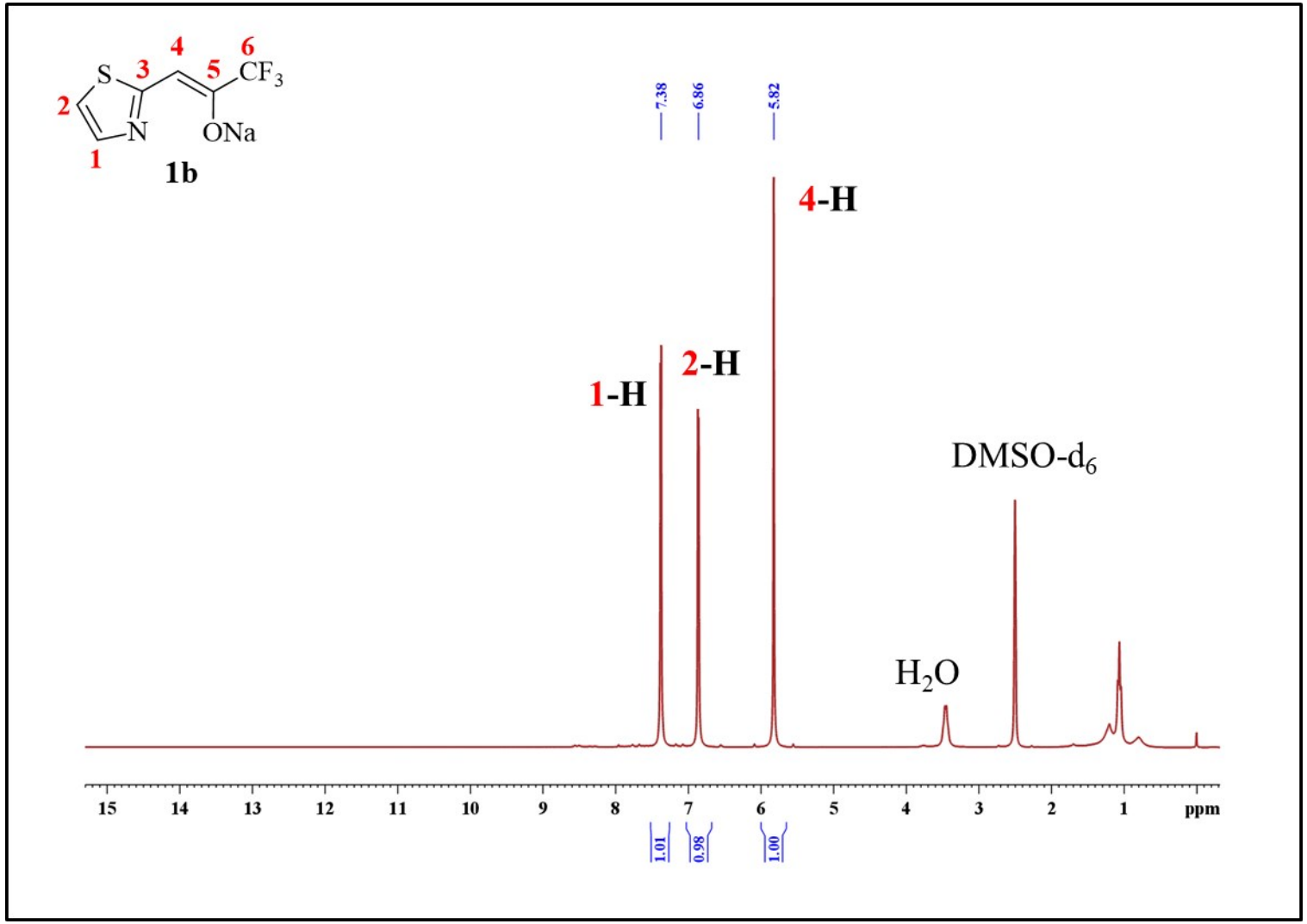

Figure 3: ^{1}H NMR Spectrum of (**1b**) in DMSO-d_6 at RT with schematic and arbitrary numbering.

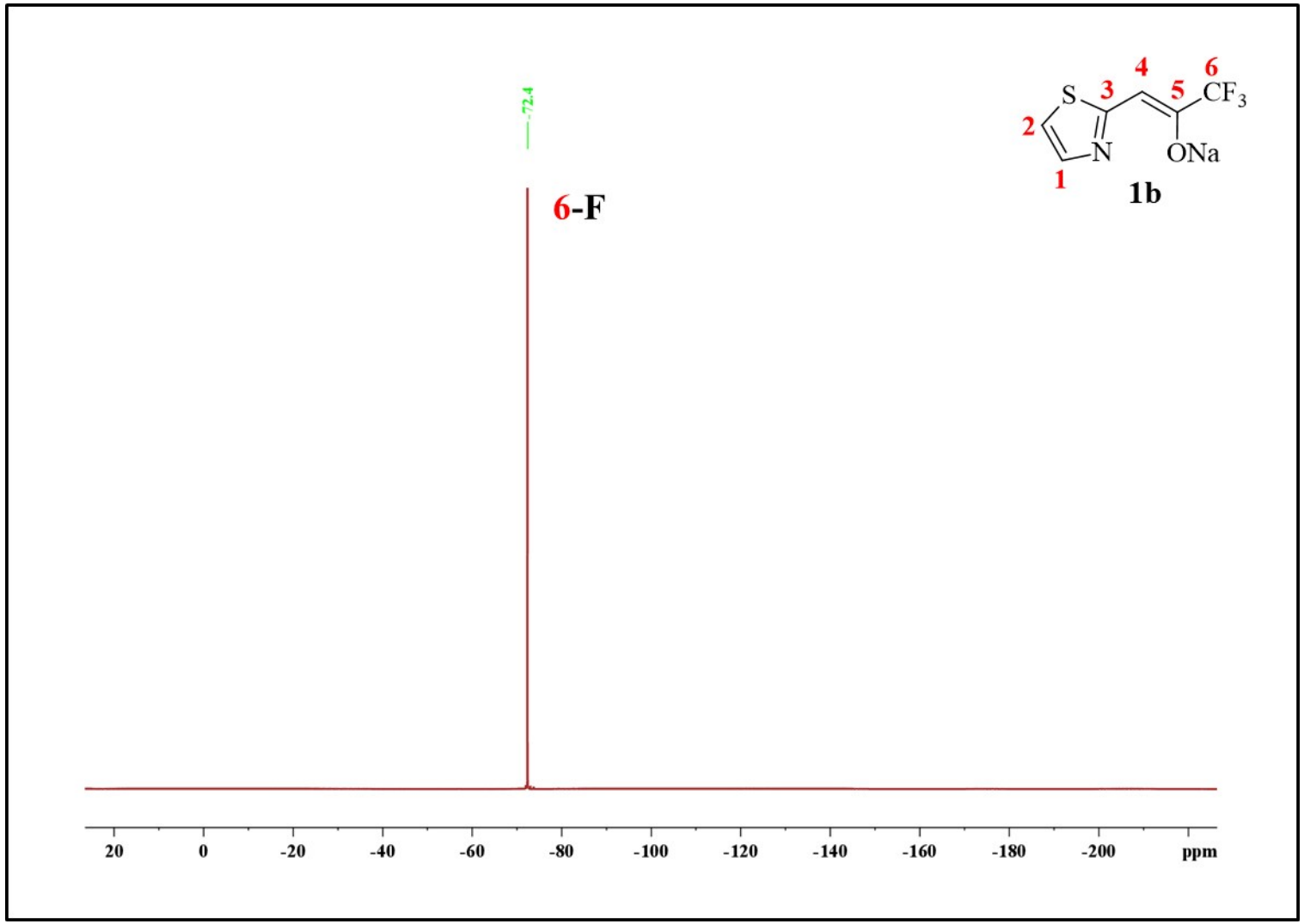

Figure 4: ^{19}F NMR Spectrum of (**1b**) in DMSO-d_6 at RT with schematic and arbitrary numbering.

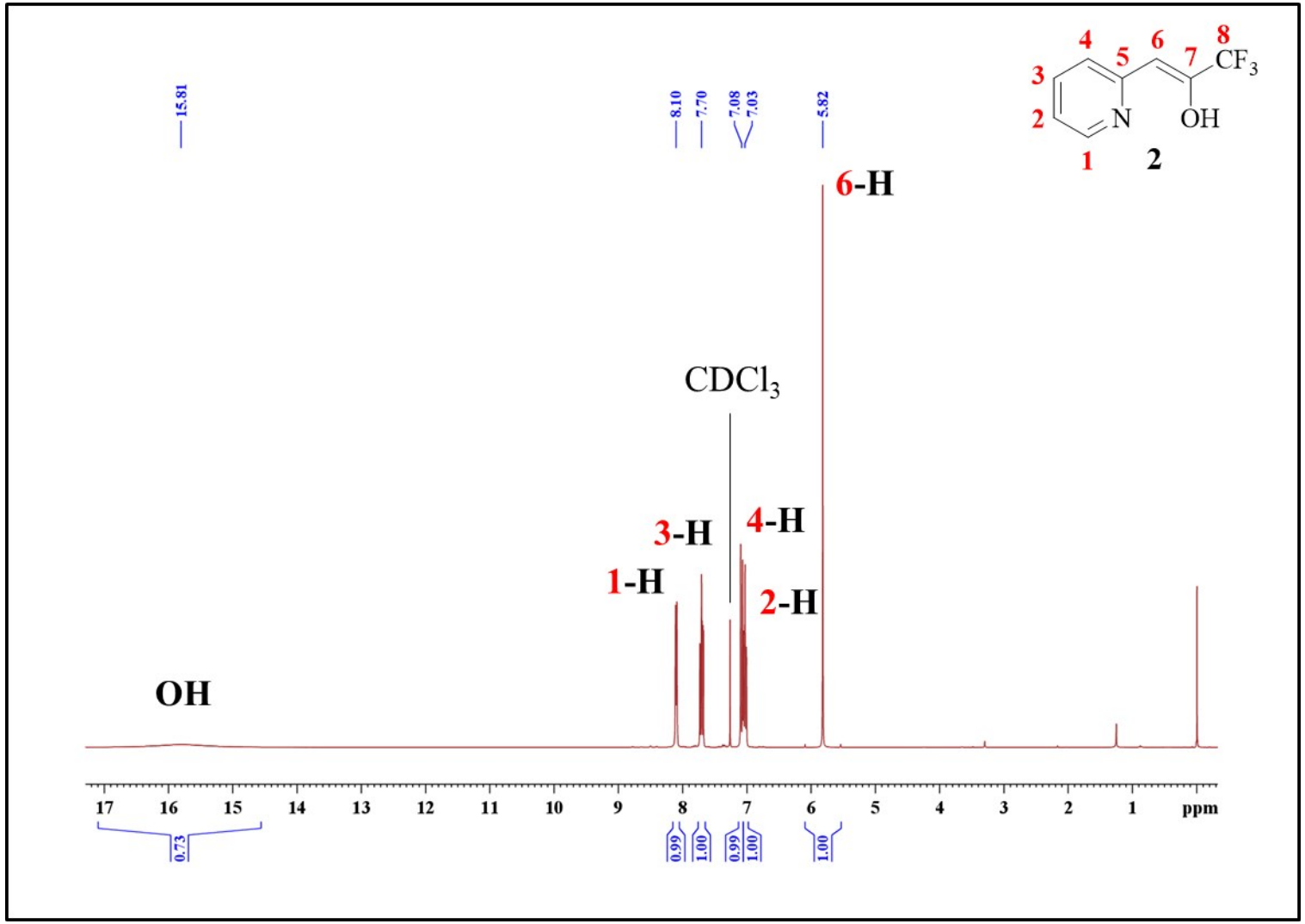

Figure 5: ^{1}H NMR Spectrum of (**2**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

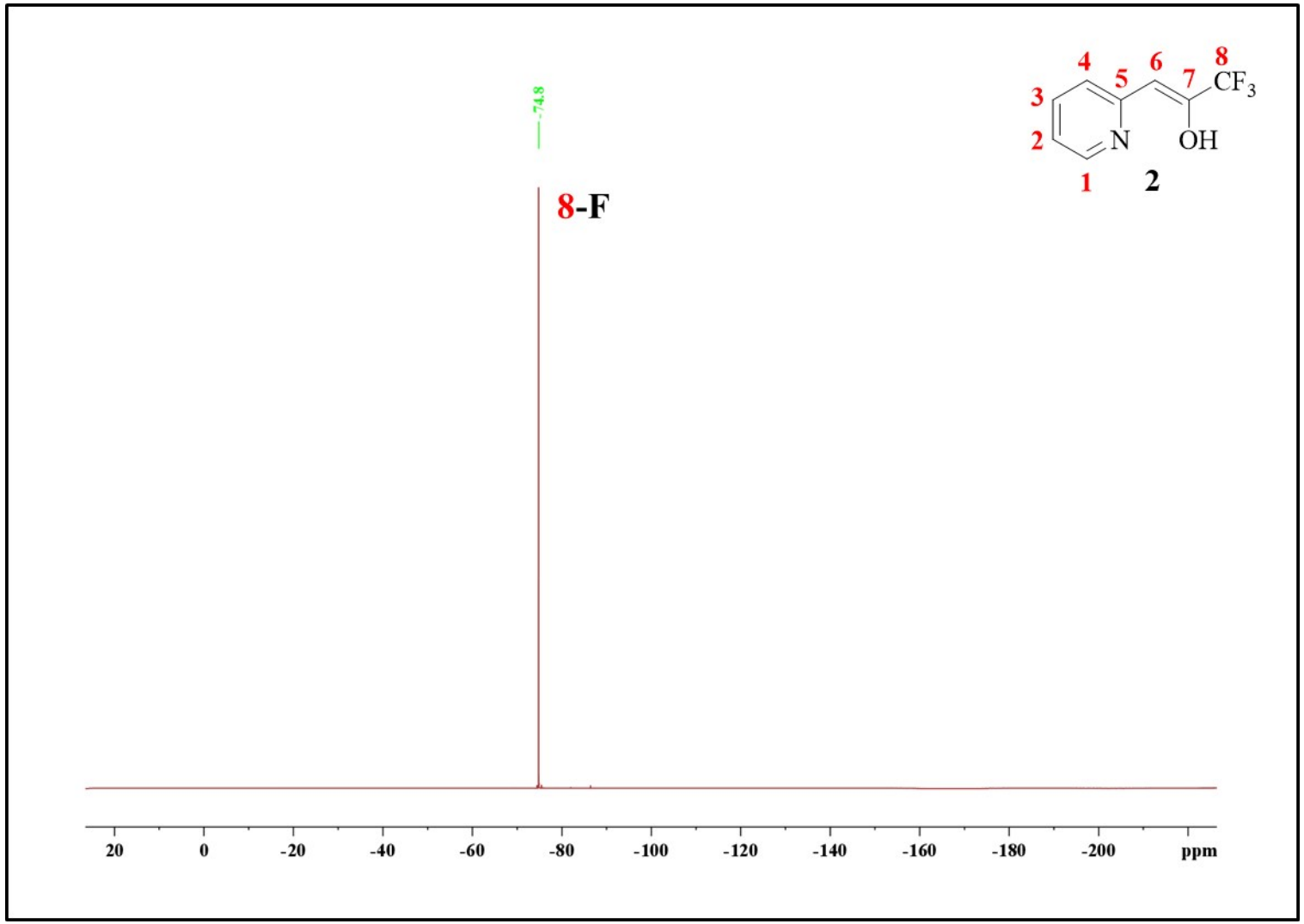

Figure 6: ^{19}F NMR Spectrum of (**2**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

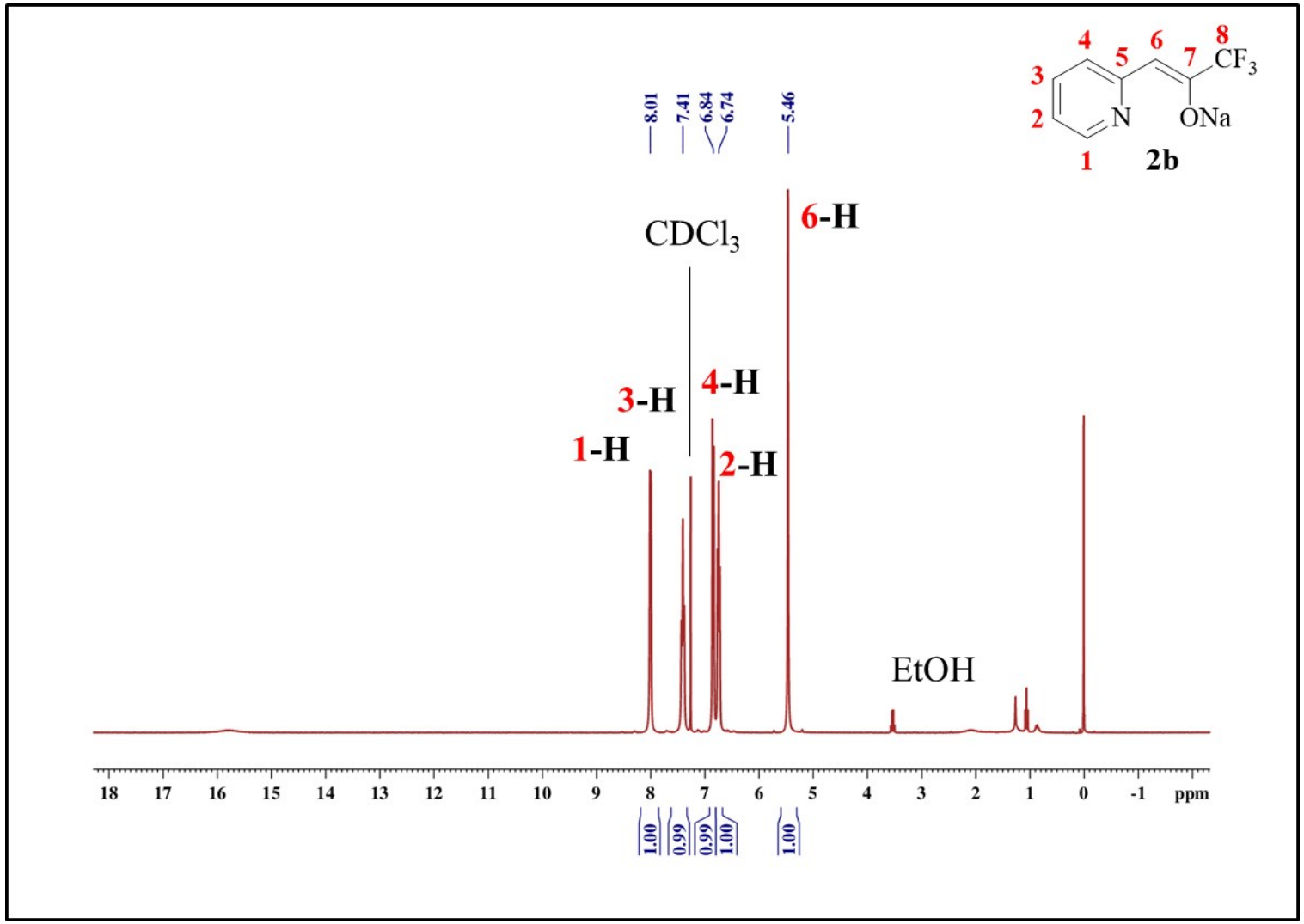

Figure 7: ^{1}H NMR Spectrum of (**2b**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

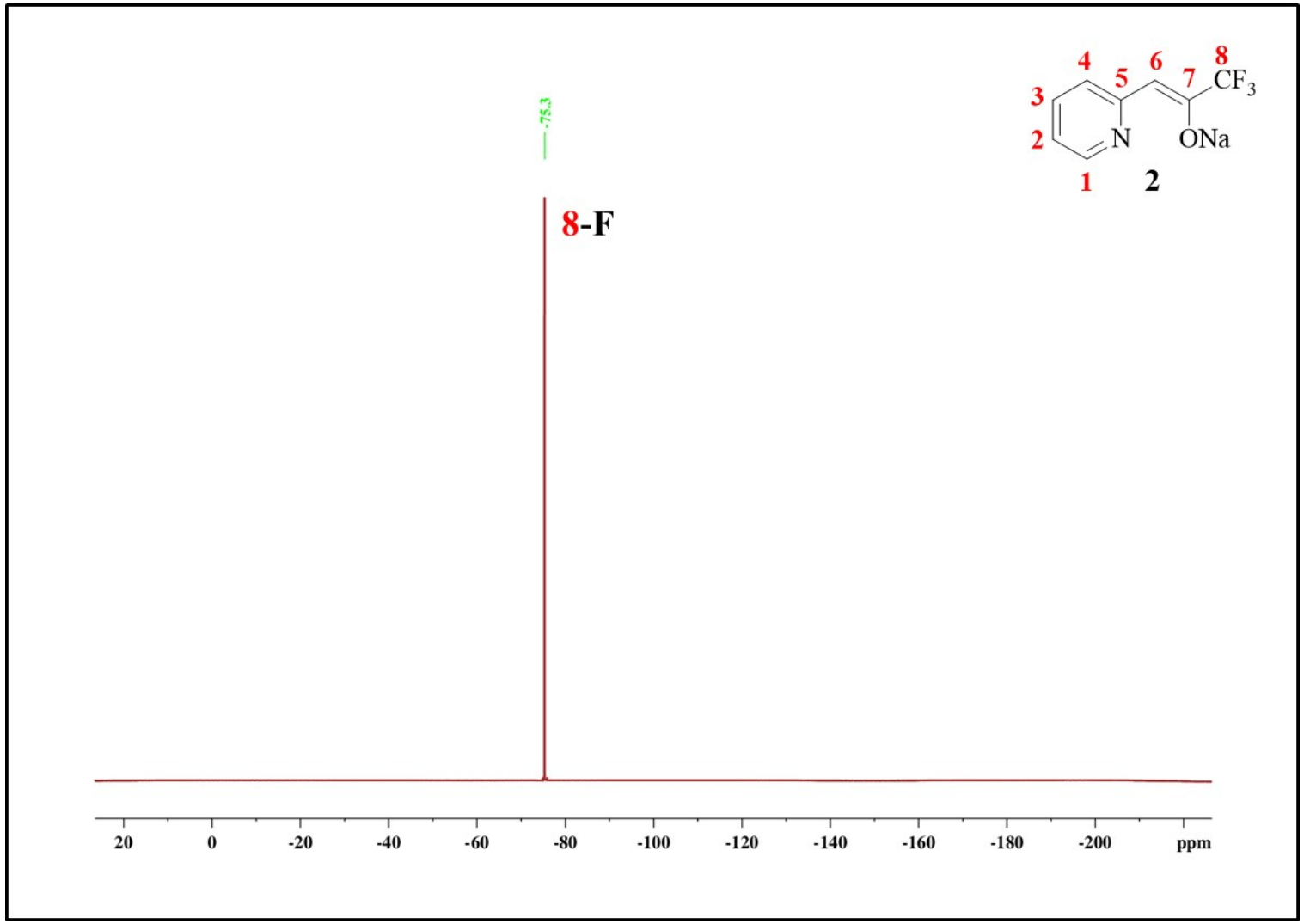

Figure 8: ^{19}F NMR Spectrum of (**2b**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

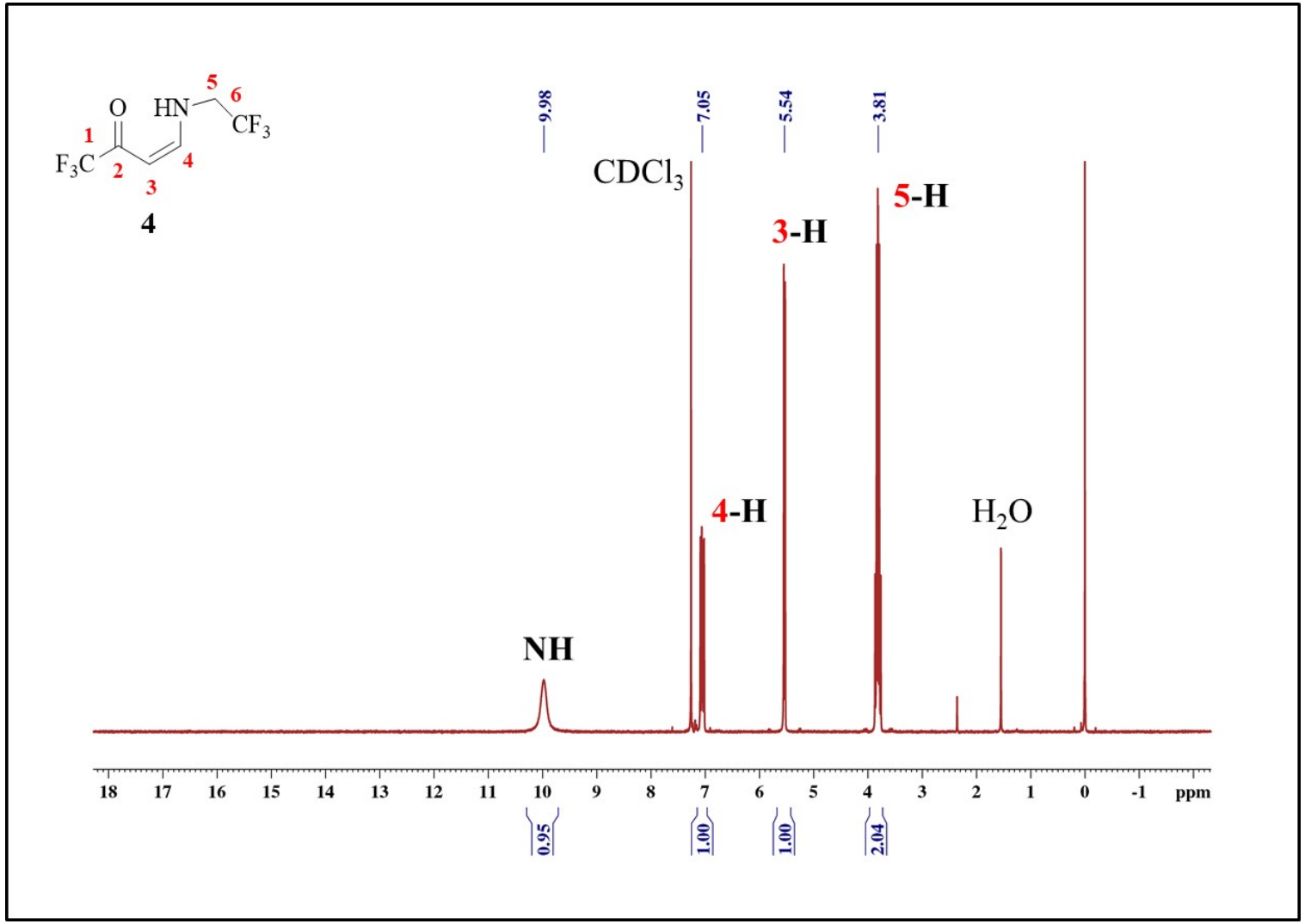

Figure 9: ^{1}H NMR Spectrum of (**4**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

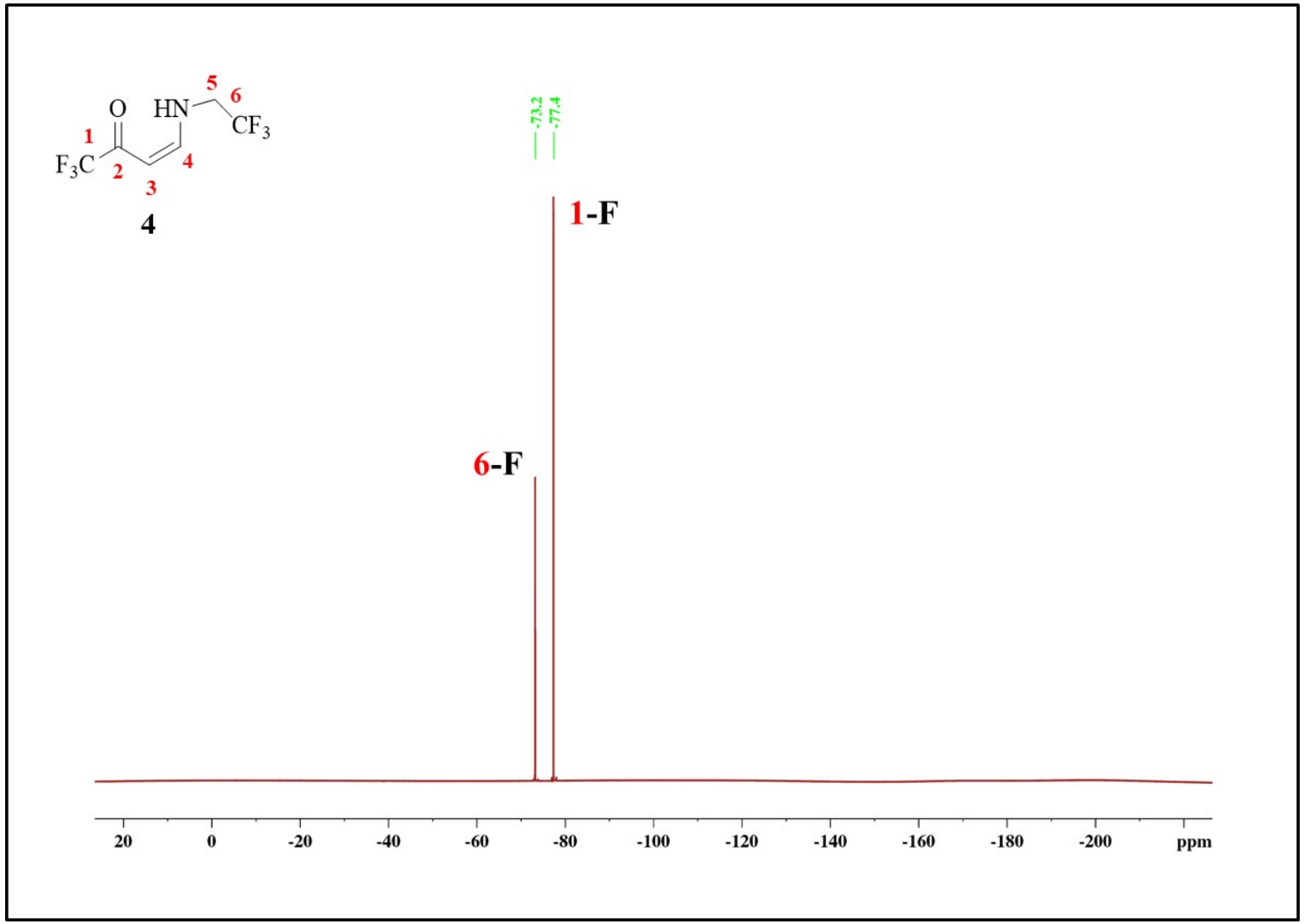

Figure 10: ^{19}F NMR Spectrum of (**4**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

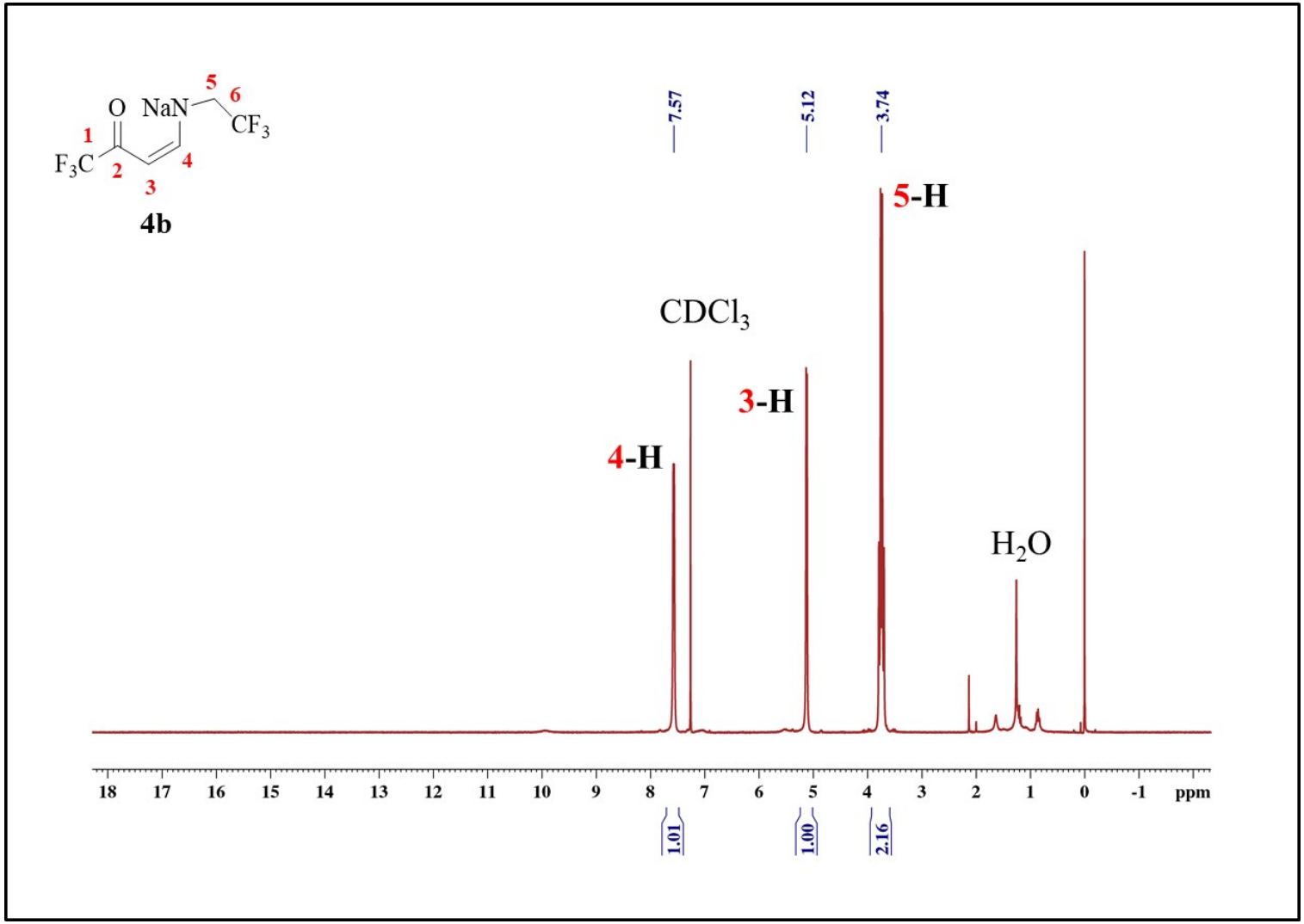

Figure 11: ^{1}H NMR Spectrum of (**4b**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

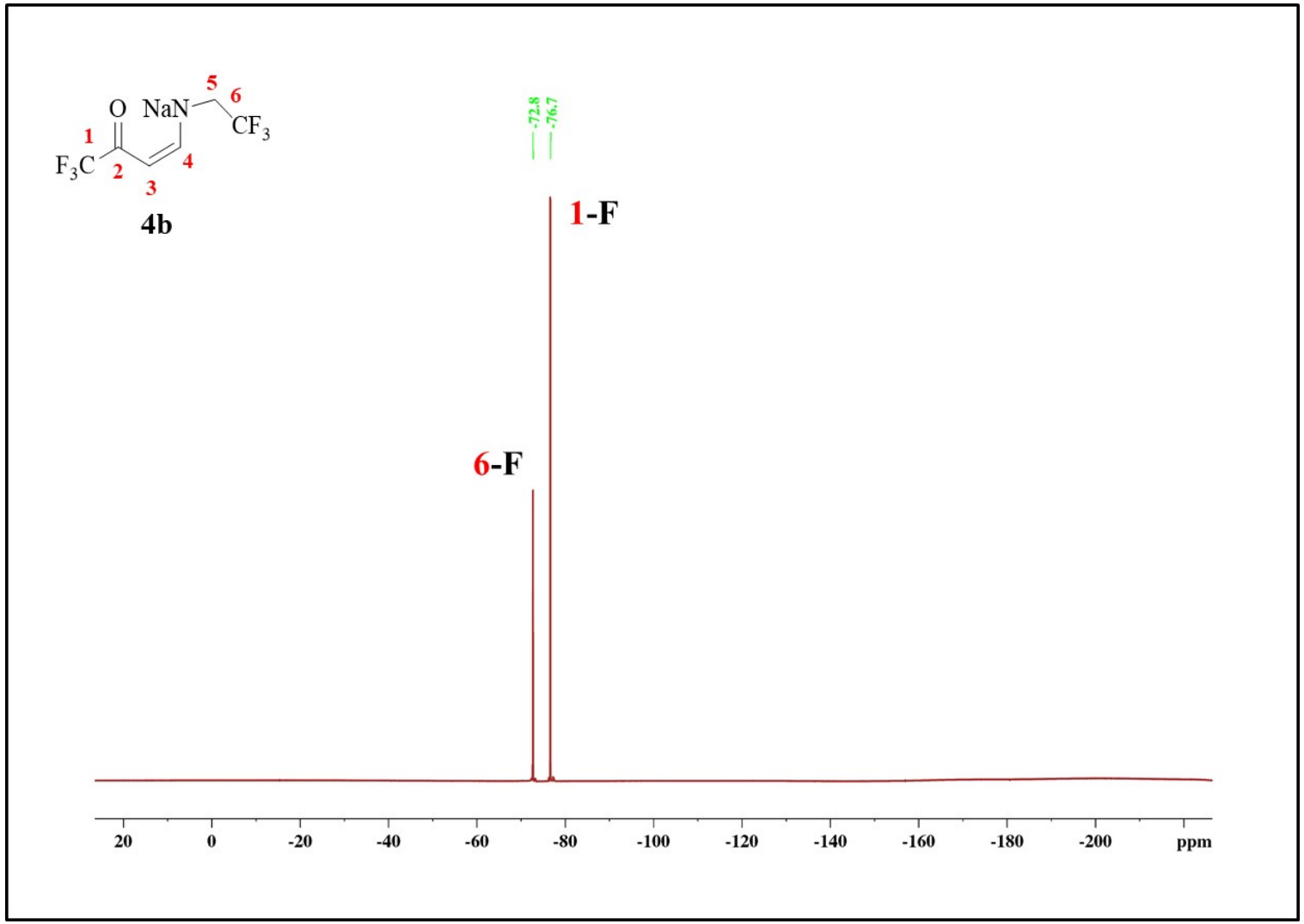

Figure 12: ^{19}F NMR Spectrum of (**4b**) in $CDCl_3$ at RT with schematic and arbitrary numbering.

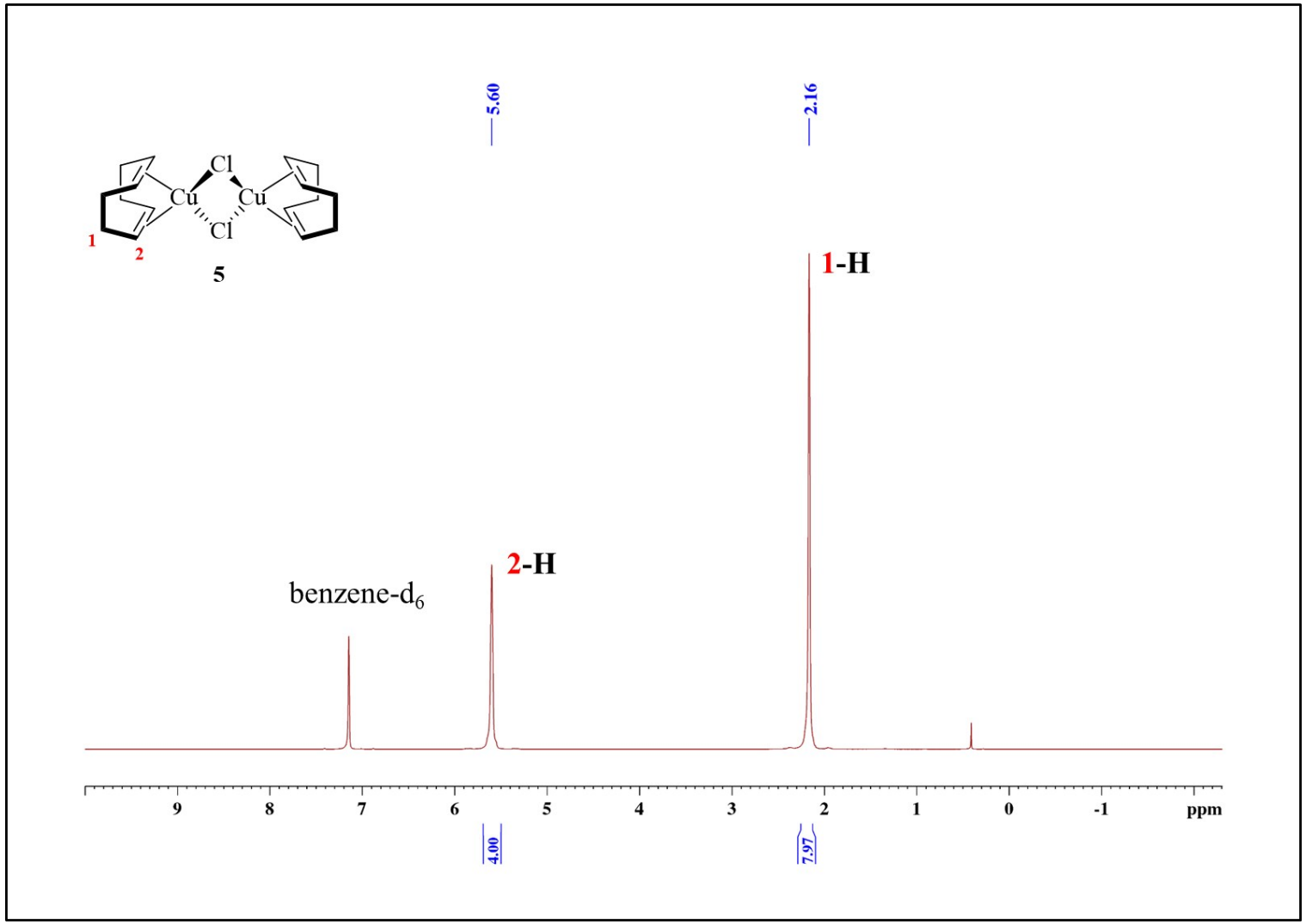

Figure 13: ^{1}H NMR Spectrum of (**5**) in C_6D_6 at RT with schematic and arbitrary numbering.

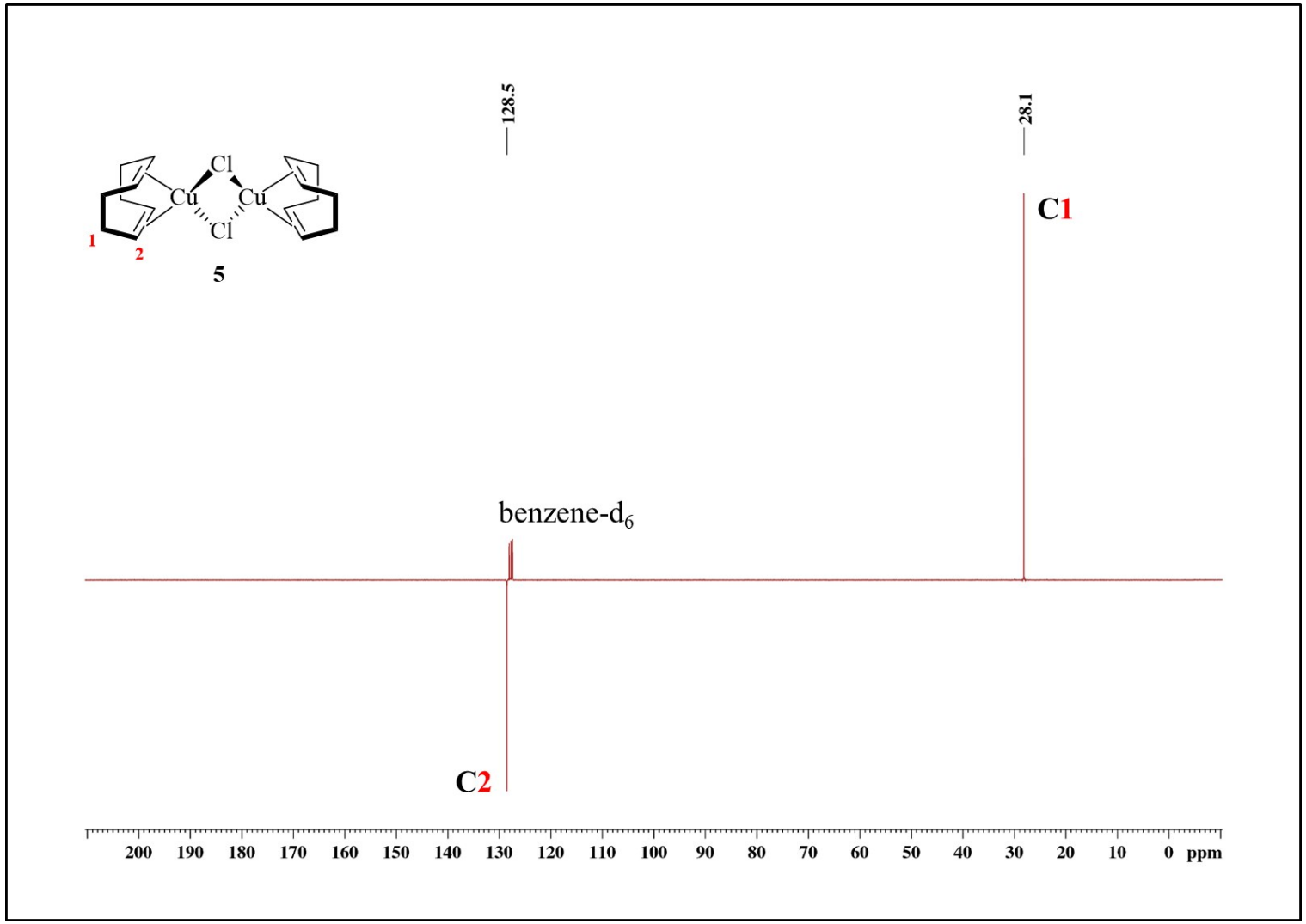

Figure 14: ^{13}C APT Spectrum of (**5**) in C_6D_6 at RT with schematic and arbitrary numbering.

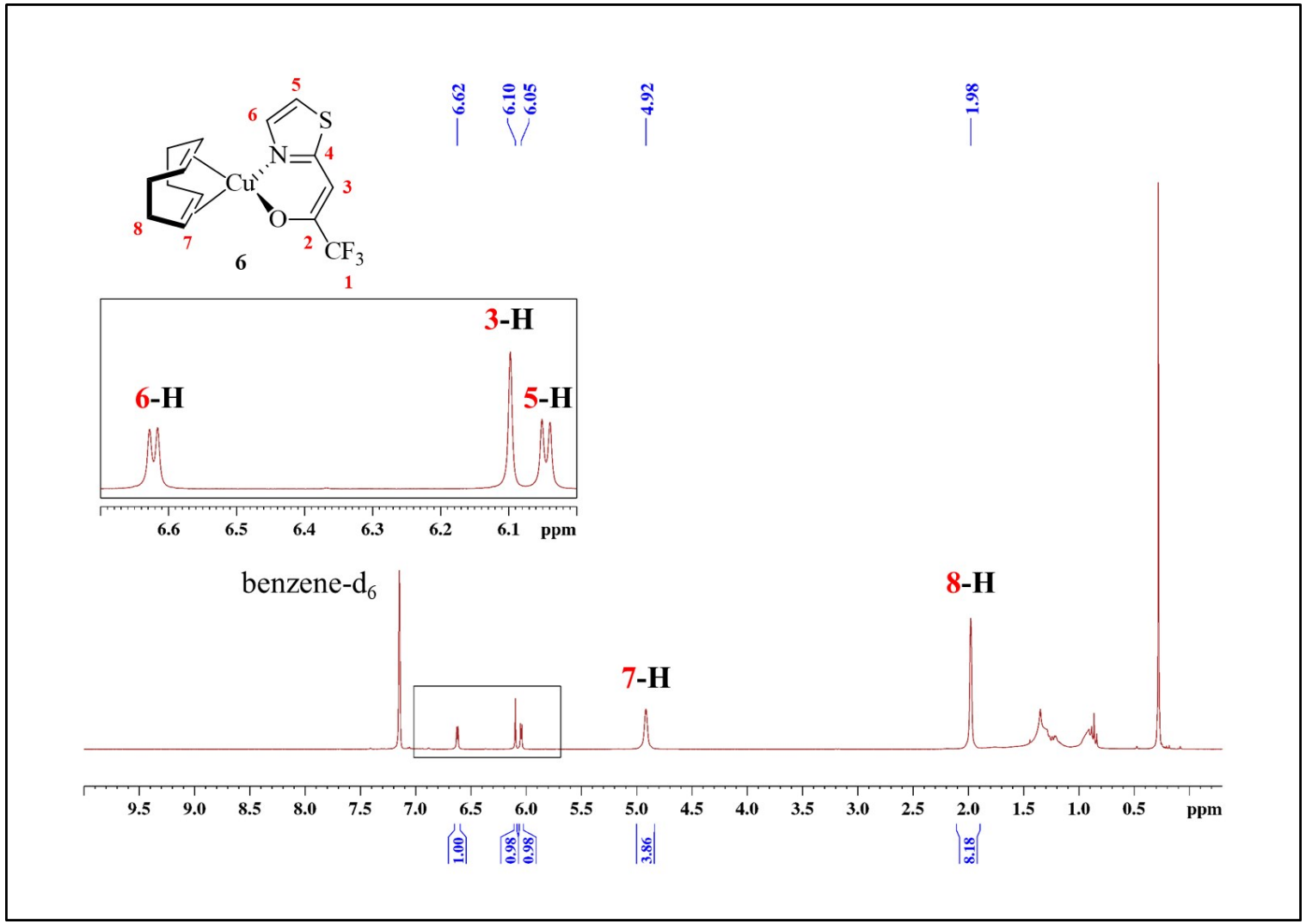

Figure 15: ^{1}H NMR Spectrum of (**6**) in C_6D_6 at RT with schematic and arbitrary numbering

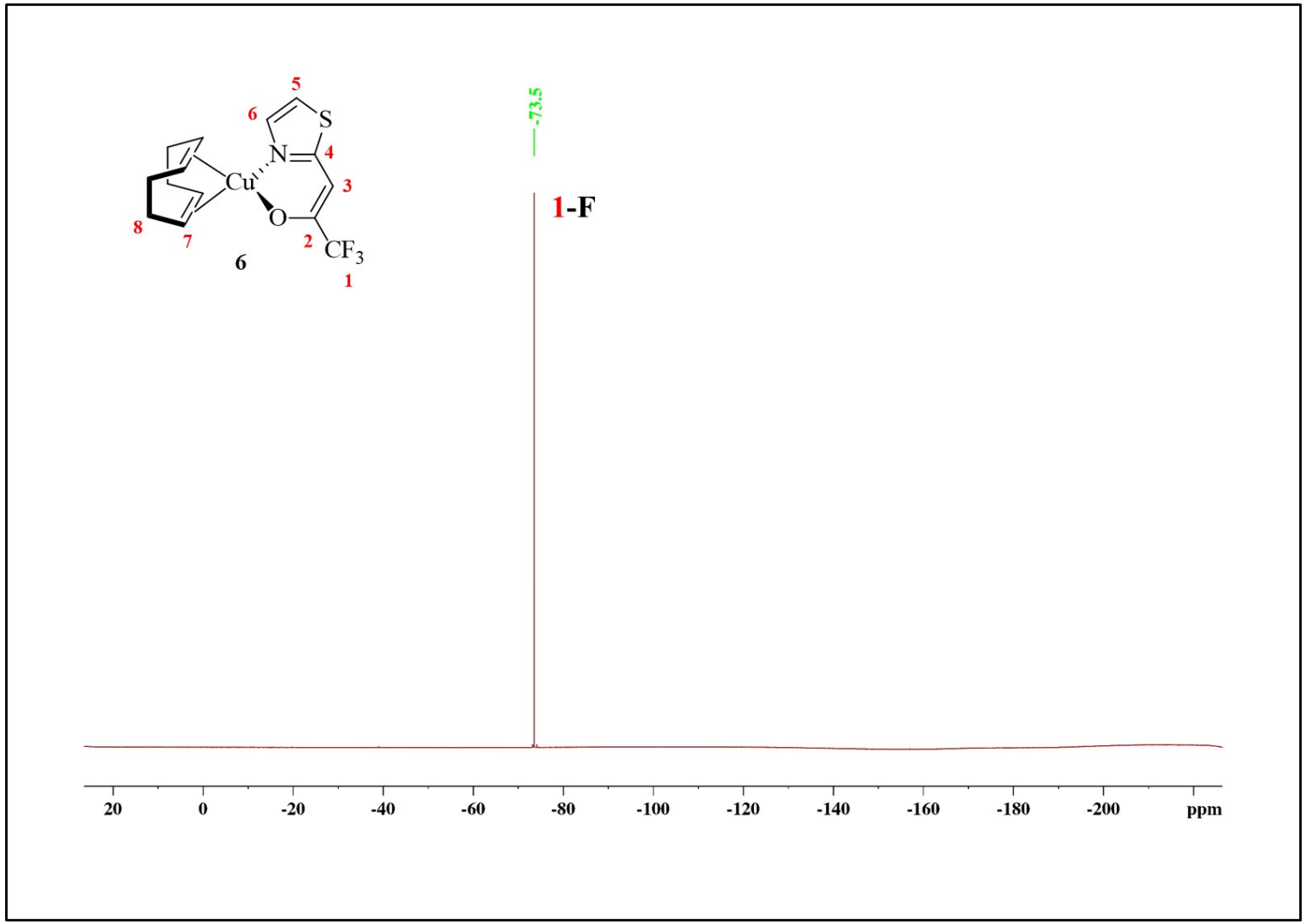

Figure 16: ^{19}F NMR Spectrum of (**6**) in C_6D_6 at RT with schematic and arbitrary numbering.

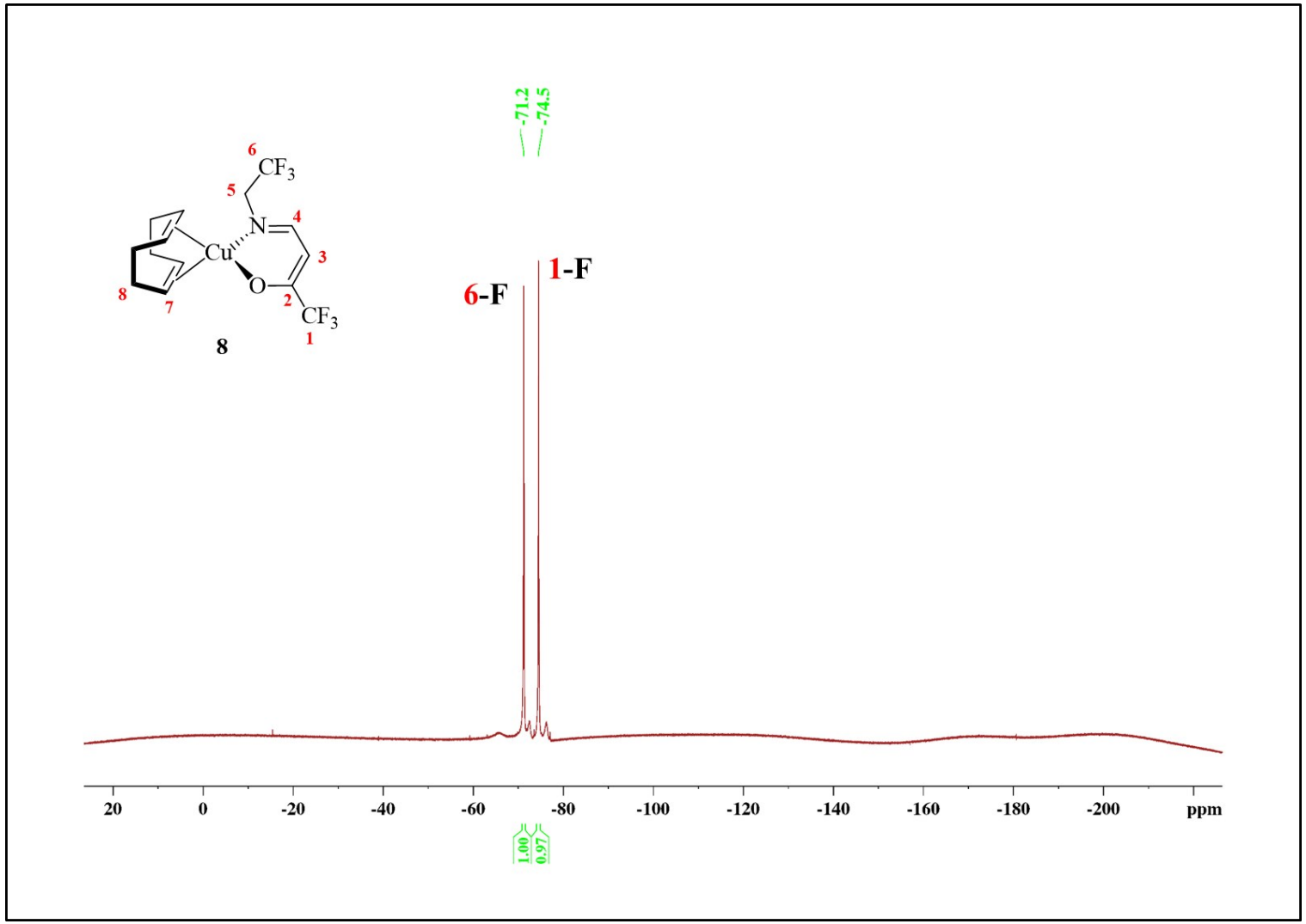

Figure 17: ^{19}F NMR Spectrum of (**8**) in C_6D_6 at RT with schematic and arbitrary numbering.

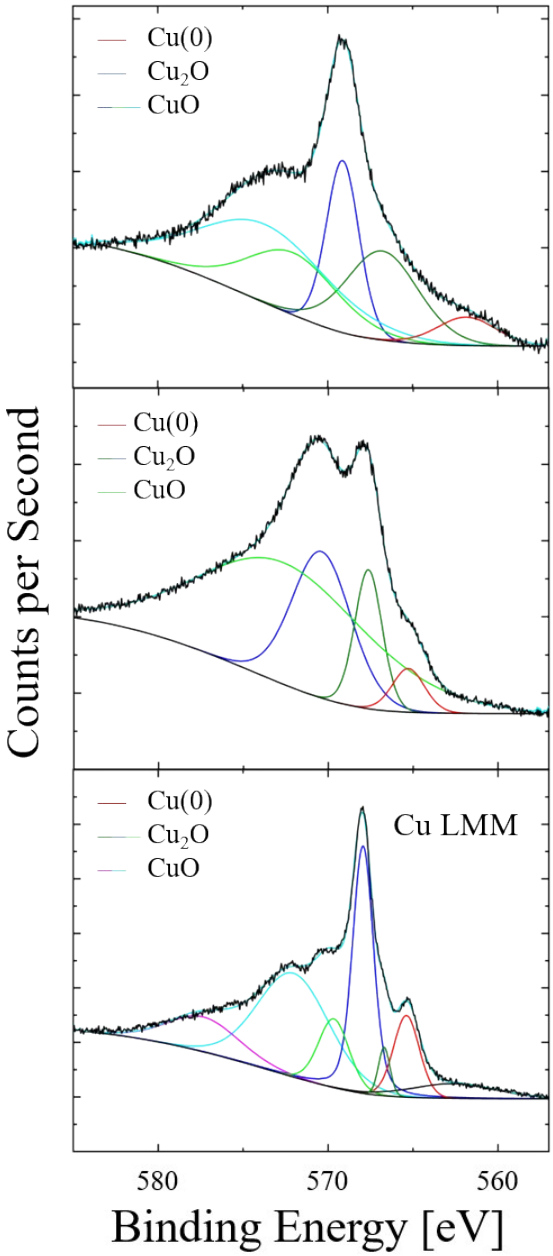

Figure 18: High resolution XPS spectra of Cu LMM Auger peaks of copper-based thin films.

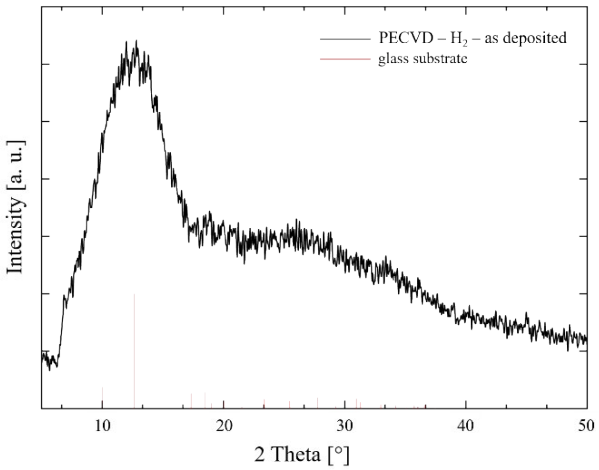

Figure 19: XRD pattern of as deposited copper film using H_2 as reactive gas and glass substrates (red line, ICSD: 79-1912).

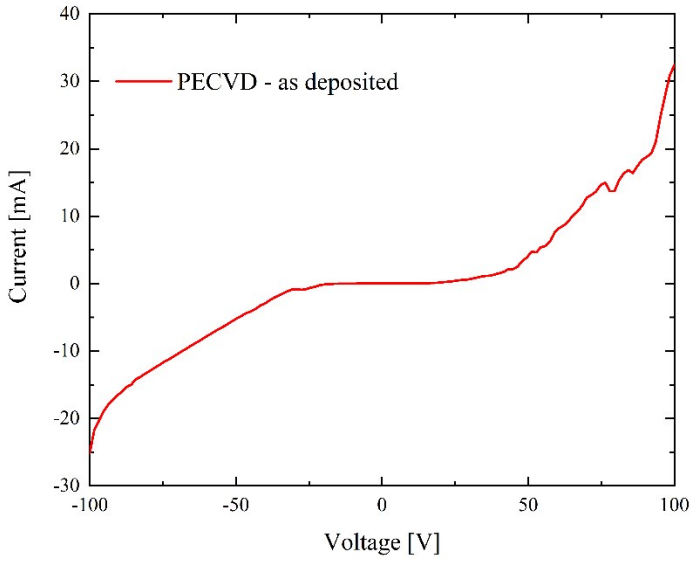

Figure 20: *I-V* curves of as deposited copper film using H_2 as reactive gas and glass substrates.