Supplementary Material

Facile one-pot synthesis of coumarins linked to 1,2,3-triazoles by combining Sonogashira and CuAAC reaction

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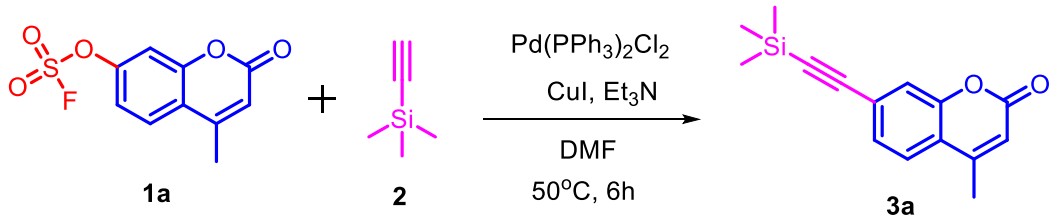
1. General considerations

All chemicals were purchased from commercial suppliers and used as delivered. ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded at 400, 100 and 376 MHz or 600, 150 and 565 MHz respectively. Chemical shifts are reported in parts per million (ppm) and coupling constants in Hertz (Hz). Tetramethylsilane (TMS) (δ = 0.00 ppm) or residual solvent peak in $DMSO_{d6}$ (δ = 2.50 ppm) and $CDCl_3$ (δ = 7.26 ppm) served as internal standard for recording [1]. Molecular weights of unknown compounds were determined by GCMS-QP2010 Ultra gas chromatograph operating at an ionization potential of 70 eV (EI) or Thermo Finnigan LCQ Advantage apparatus (ESI). Microanalyses were performed on PerkinElmer Series II CHNS/O 2400 elemental analyzer. Melting points were determined using a Stuart SMP 3 apparatus. Thin-layer chromatography (TLC) was performed using Merck silica gel 60 F_{254} TLC plates.

2. Experimental section

Procedure for Sonogashira cross-coupling for the synthesis of 3a



1a 2 3a

In a sealed tube with screw cap, coumarin fluorosulfate **1a** (1 mmol, 1 equiv.), trimethylsilylacetylene **2** (1.1 mmol, 1.1 equiv.), CuI (0.1 mmol, 0.1 equiv.), Et_3N (3 mmol, 3 equiv.) and DMF (2 mL) was added. The reaction mixture was degassed for 10 min. under N_2 atmosphere and then $Pd(PPh_3)_2Cl_2$ (0.1 mmol, 0.1 equiv.) was added. The reaction mixture was heated at 50°C for 6 hours. After the completion of reaction monitored by TLC, the reaction mixture was filtered through celite, the filtrate was diluted with water (10 mL) and extracted thrice with ethyl acetate. The combined organic layers were washed with brine, dried in Na_2SO_4 and distilled under reduced pressure to obtain the crude product. The crude was purified by column chromatography in hexane-ethyl acetate to obtain the titled product **3a** as light-yellow solid in 65% yield.

Mp 115-118 °C.

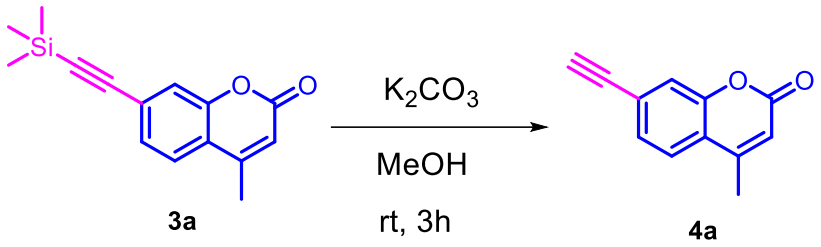
^{1}H NMR (400 MHz, $CDCl_3$): δ = 0.28 (s, 9H, $3CH_3$), 2.43 (d, *J* = 1.2 Hz, 3H, CH_3), 6.29 (d, *J* = 1.2 Hz, 1H, ArH), 7.36 (dd, *J* = 1.6, 8 Hz, 1H, ArH), 7.40 (d, *J* = 1.2 Hz, 1H, ArH), 7.52 (d, *J* = 8 Hz, 1H, ArH).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 0.0, 18.8, 98.5, 103.5, 115.7, 120.2, 120.4, 124.6, 126.9, 128.0, 151.9, 153.4, 160.7.

MS (EI): *m*/*z* (%) = 256 (33) $[M]^+$, 241 (100).

Anal. Calcd for $C_{15}H_{16}O_2Si$: C, 70.27; H, 6.29%; Found: C, 70.51; H, 6.00%.

Procedure for TMS deprotection in the synthesis of 4a



3a **4a**

To the weighed quantity of TMS containing coumarin **3a** (1 mmol, 1 equiv.) in methanol (10 mL) in a Round Bottomed (RB) flask, K_2CO_3 (4.4 mmol, 4.4 equiv.) was added and stirred at room temperature for 3 hours. After the completion of reaction monitored by TLC, the solvent was removed under reduced pressure and water was added to the reaction mixture. The pH of the solution was maintained less than 7 to obtain a solid precipitate. The solid was filtered to obtain the titled alkyne **4a** as pale-yellow solid in 90% yield.

Mp 132-133 °C.

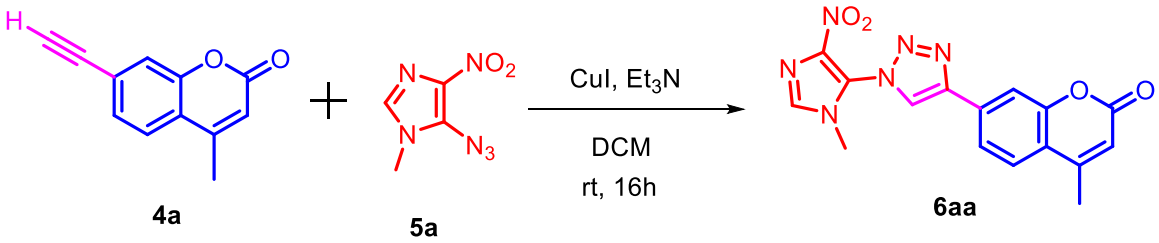
^{1}H NMR (400 MHz, $CDCl_3$): δ = 2.43 (d, *J* = 1.2 Hz, 3H, CH_3), 3.26 (s, 1H, CH), 6.30 (d, *J* = 1.2 Hz, 1H, ArH), 7.39 (dd, *J* = 1.6, 8.4 Hz, 1H, ArH), 7.44 (d, *J* = 1.6 Hz, 1H, ArH), 7.55 (d, *J* = 8.4 Hz, 1H, ArH).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 18.6, 80.5, 82.1, 115.7, 120.4, 120.5, 124.6, 125.6, 127.8, 151.7, 153.2, 160.3.

MS (EI): *m*/*z* (%) = 184 (100) $[M]^+$, 184 (100).

Anal. Calcd for $C_{12}H_8O_2$: C, 78.25; H, 4.38%; Found: C, 78.64; H, 4.36%.

Procedure for triazole synthesis from 4a by CuAAC

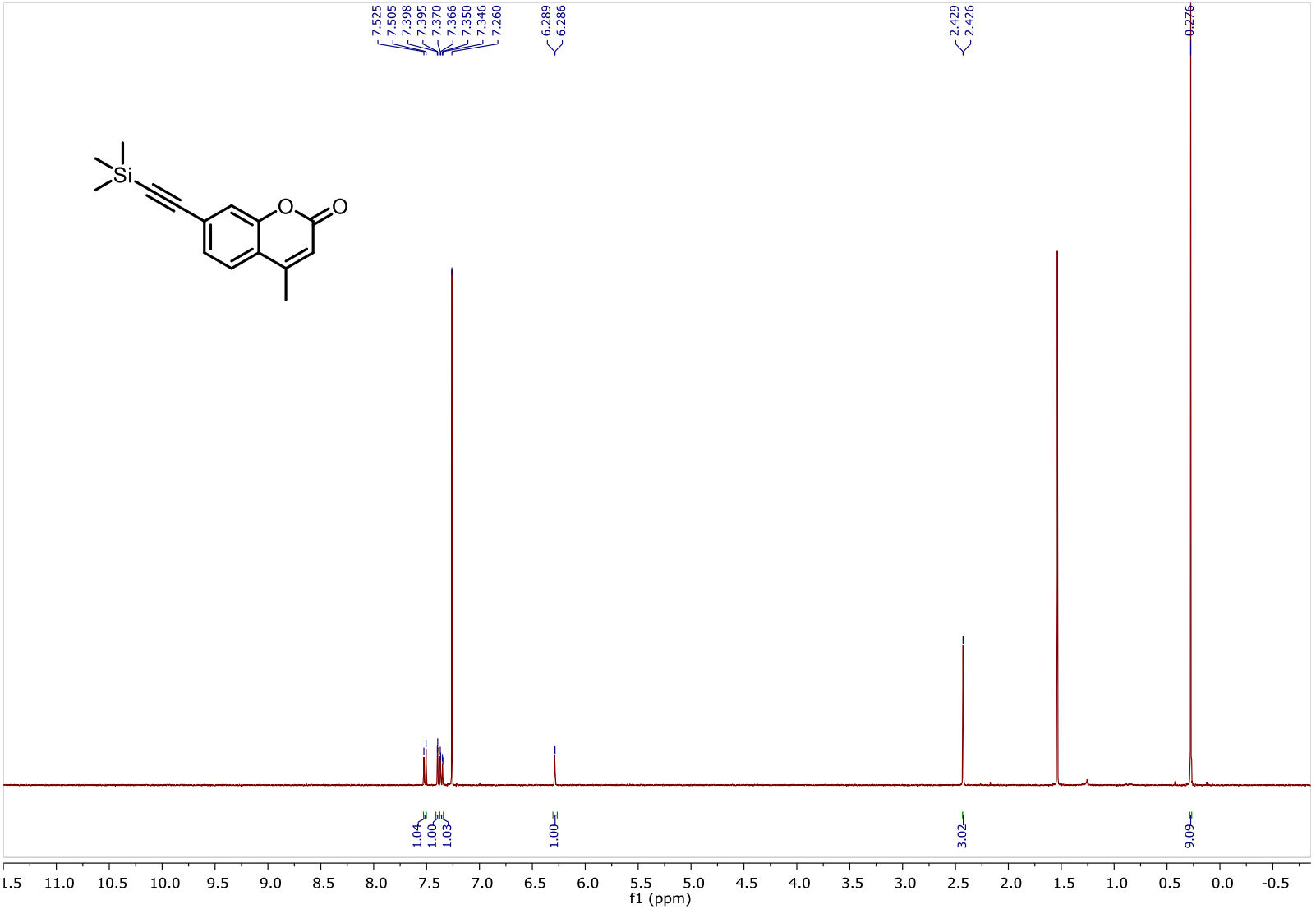


To the weighed quantity of alkyne **4a** (1 mmol, 1 equiv.) in DCM (10 mL) in a Round Bottomed (RB) flask, azide **5a** (1 mmol, 1 equiv.), CuI (0.1 mmol, 0.1 equiv.) and Et_3N (2 mmol, 2 equiv.) was added and stirred at room temperature for 16 hours. After the completion of reaction monitored by TLC, the reaction mixture was diluted with water (15 mL) and extracted thrice with DCM. The combined organic layers were washed with brine, dried in Na_2SO_4 and distilled under reduced pressure to obtain the crude product. The crude was purified by column chromatography in hexane-ethyl acetate to obtain the titled product **6aa** as light brown solid in 85% yield.

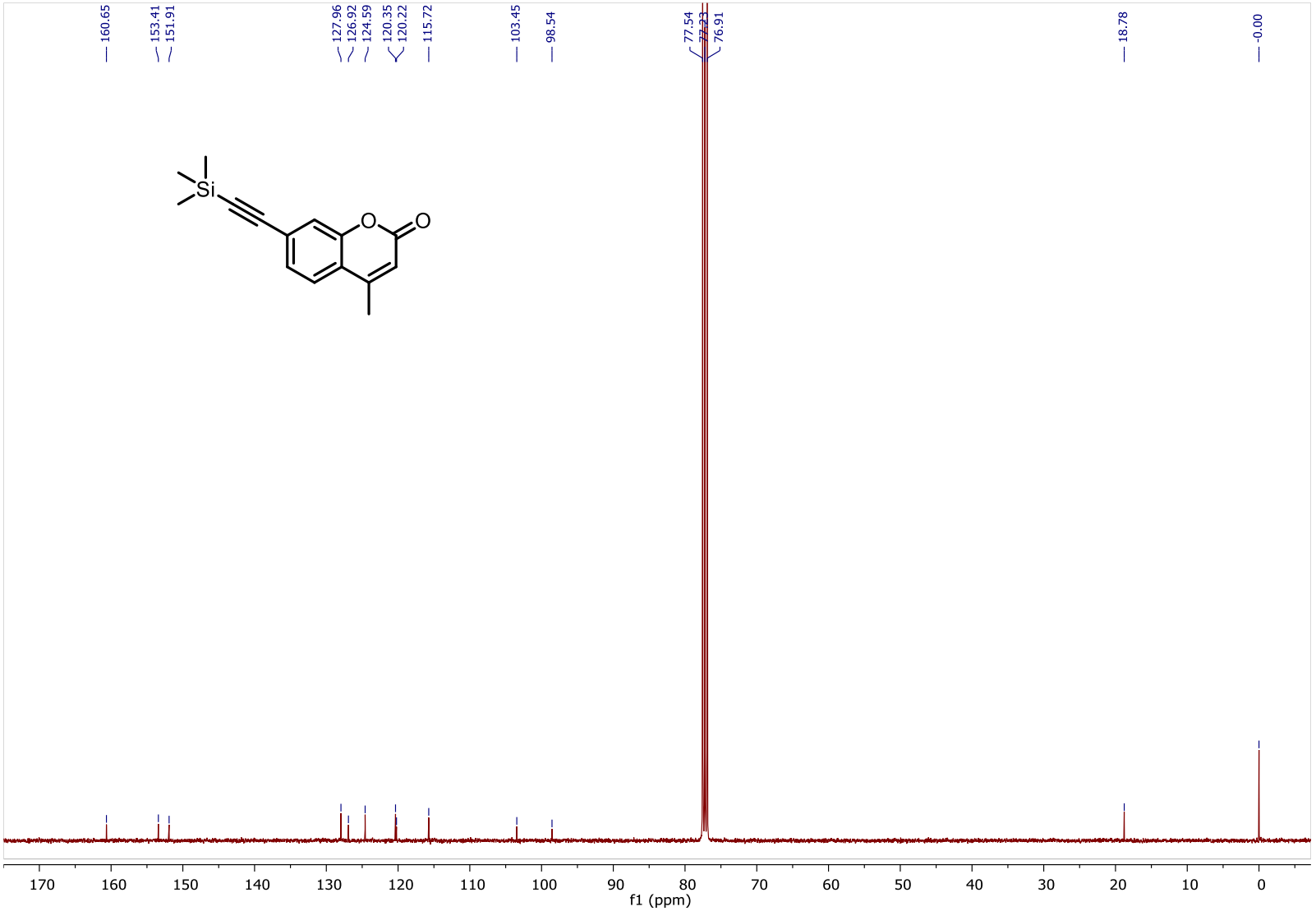
3. References

1. G. R. Fulmer, A. J. M. Miller, N. H. Sherden, H. E. Gottlieb, A. Nudelman, B. M. Stoltz, J. E. Bercaw and K. I. Goldberg, *Organometallics.* 2010, **29**, 2176-2179.

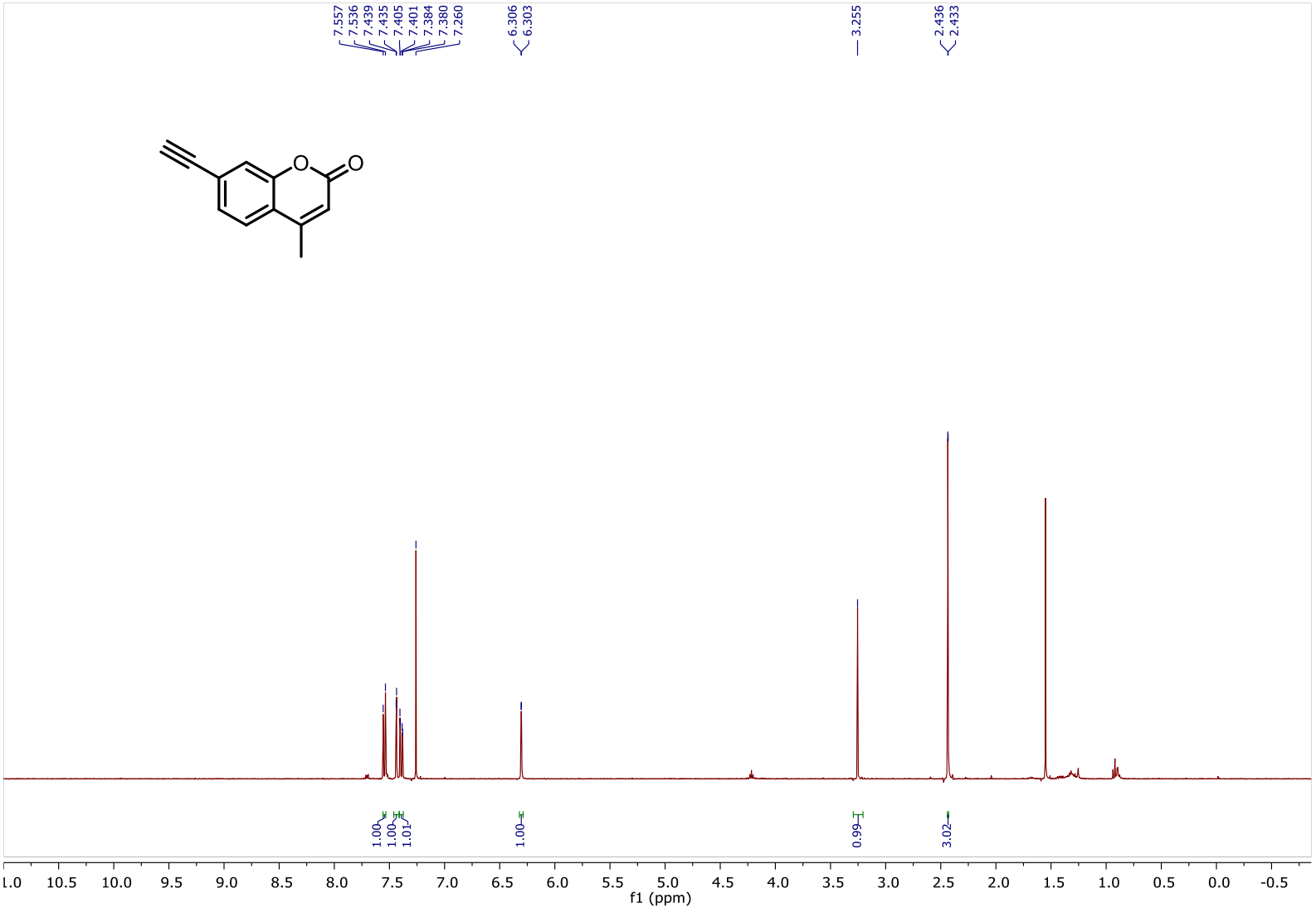
^{1}H NMR of 3a



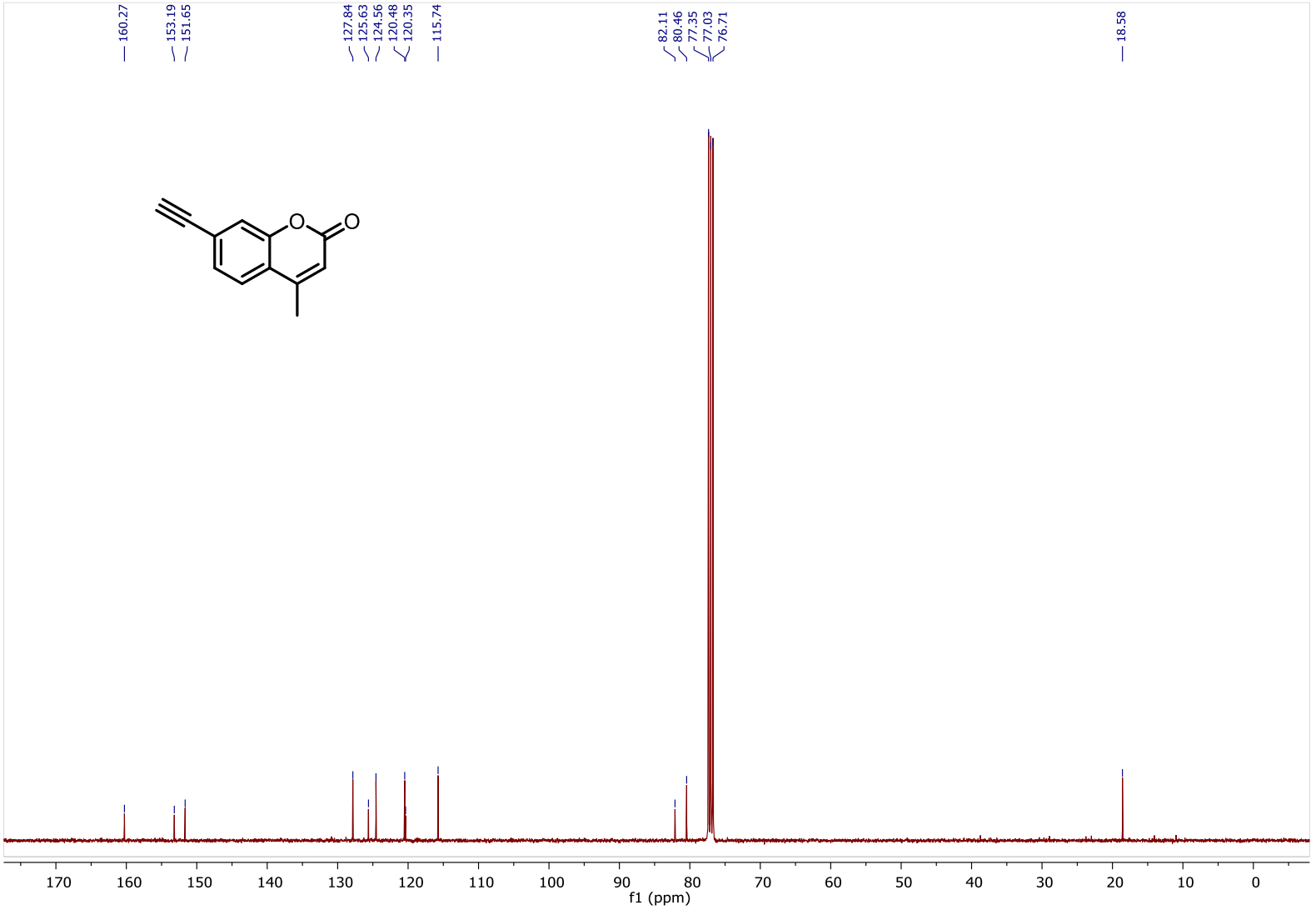
^{13}C NMR of 3a



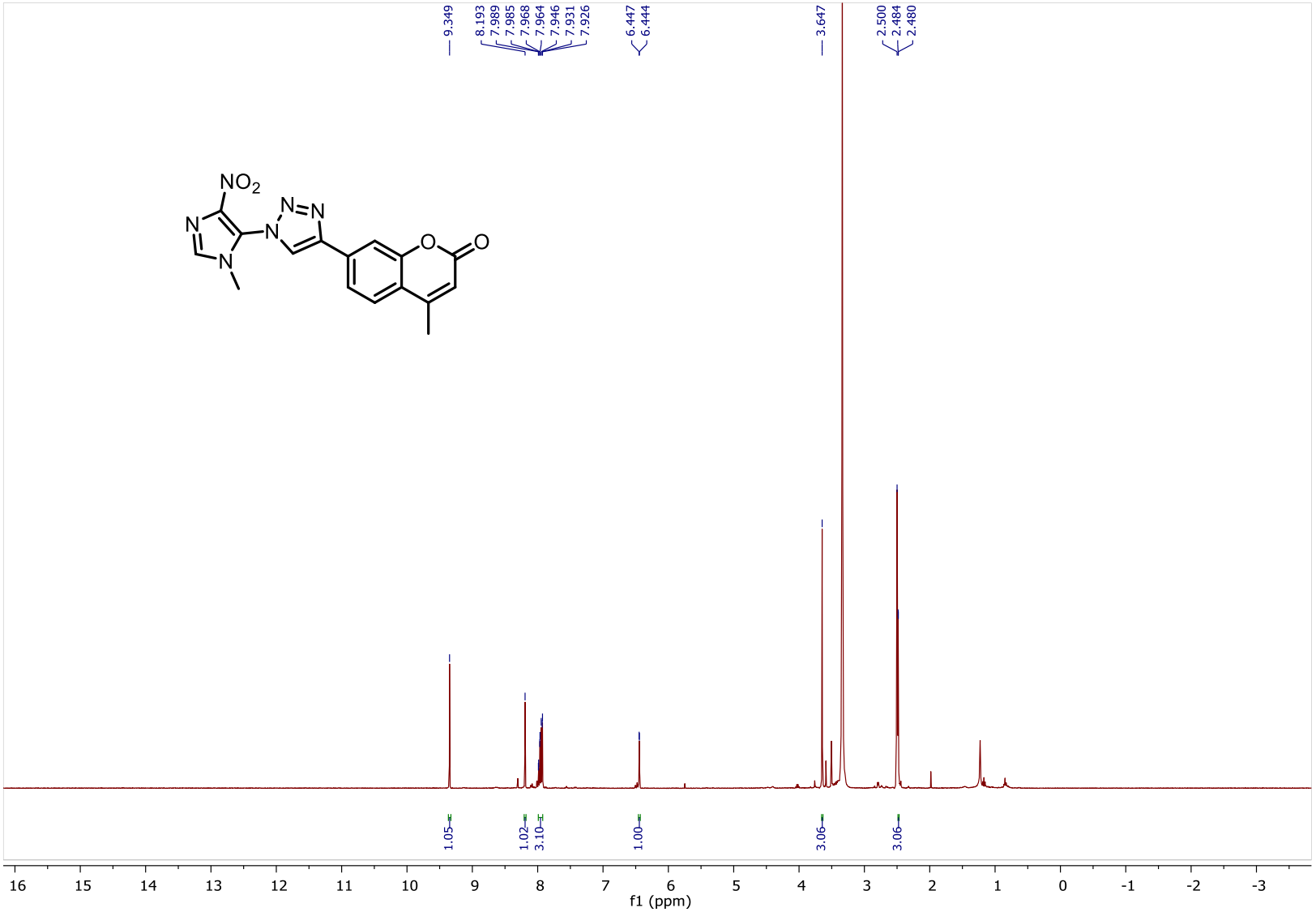
^{1}H NMR of 4a



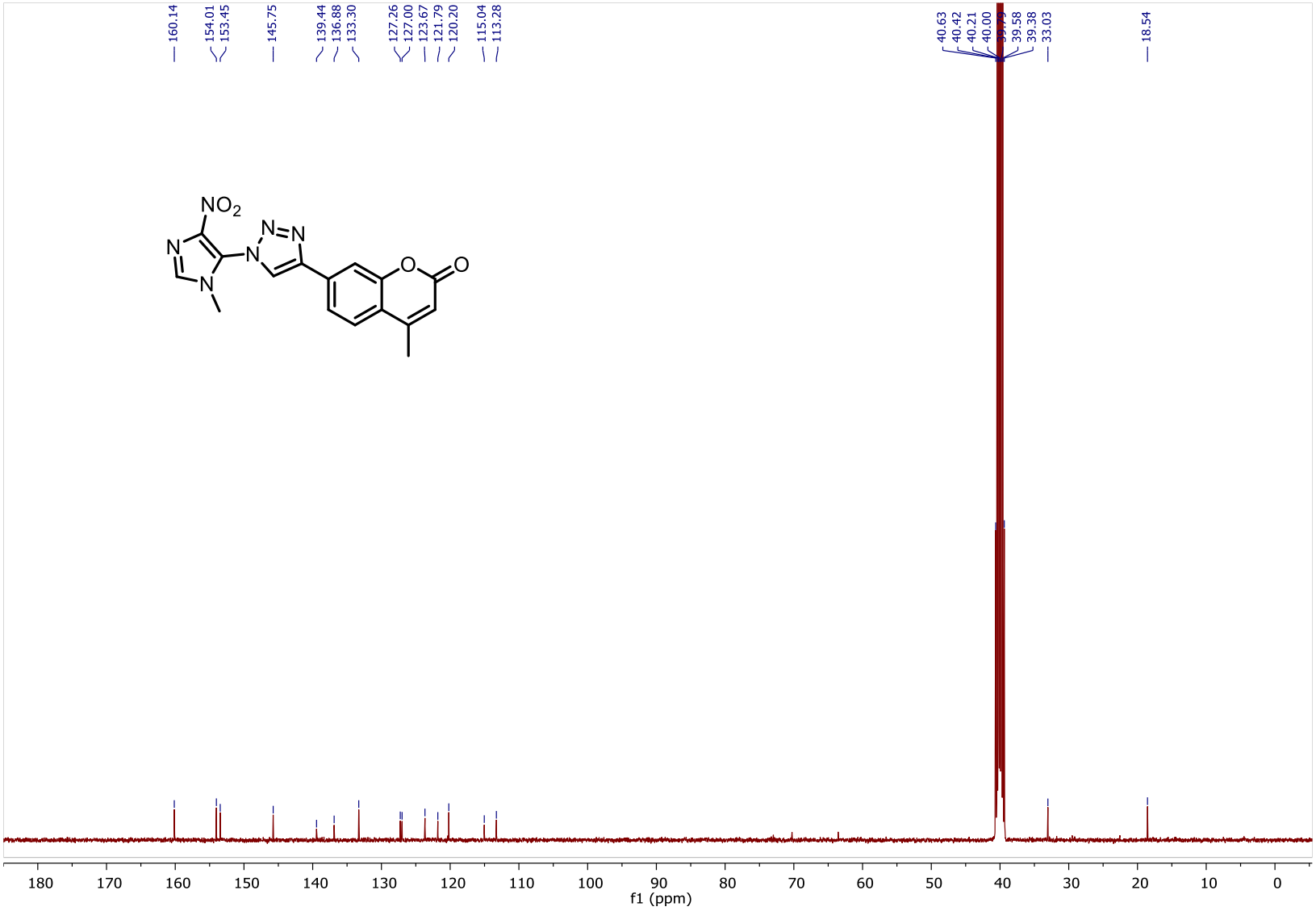
^{13}C NMR of 4a



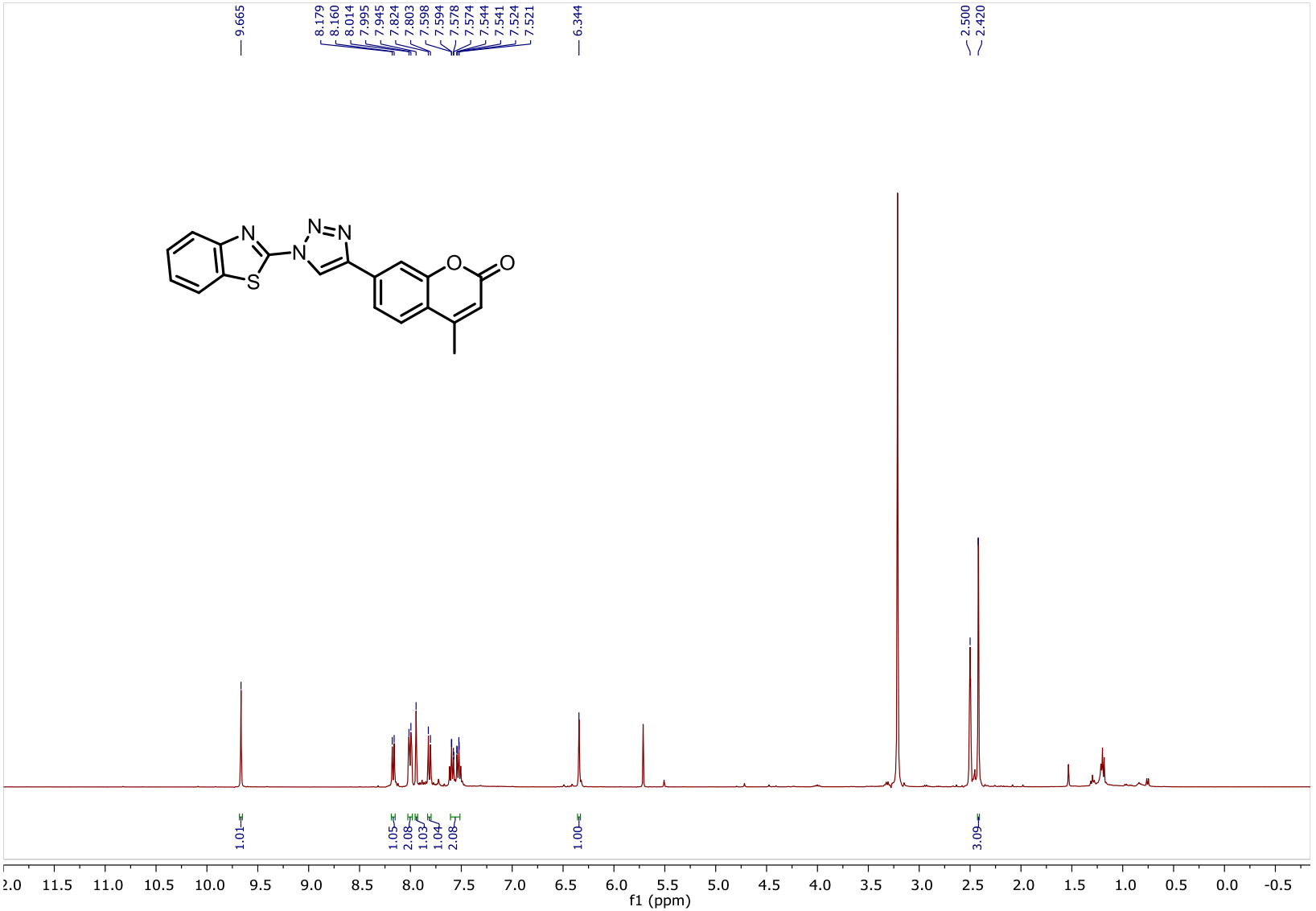
^{1}H NMR of 6aa



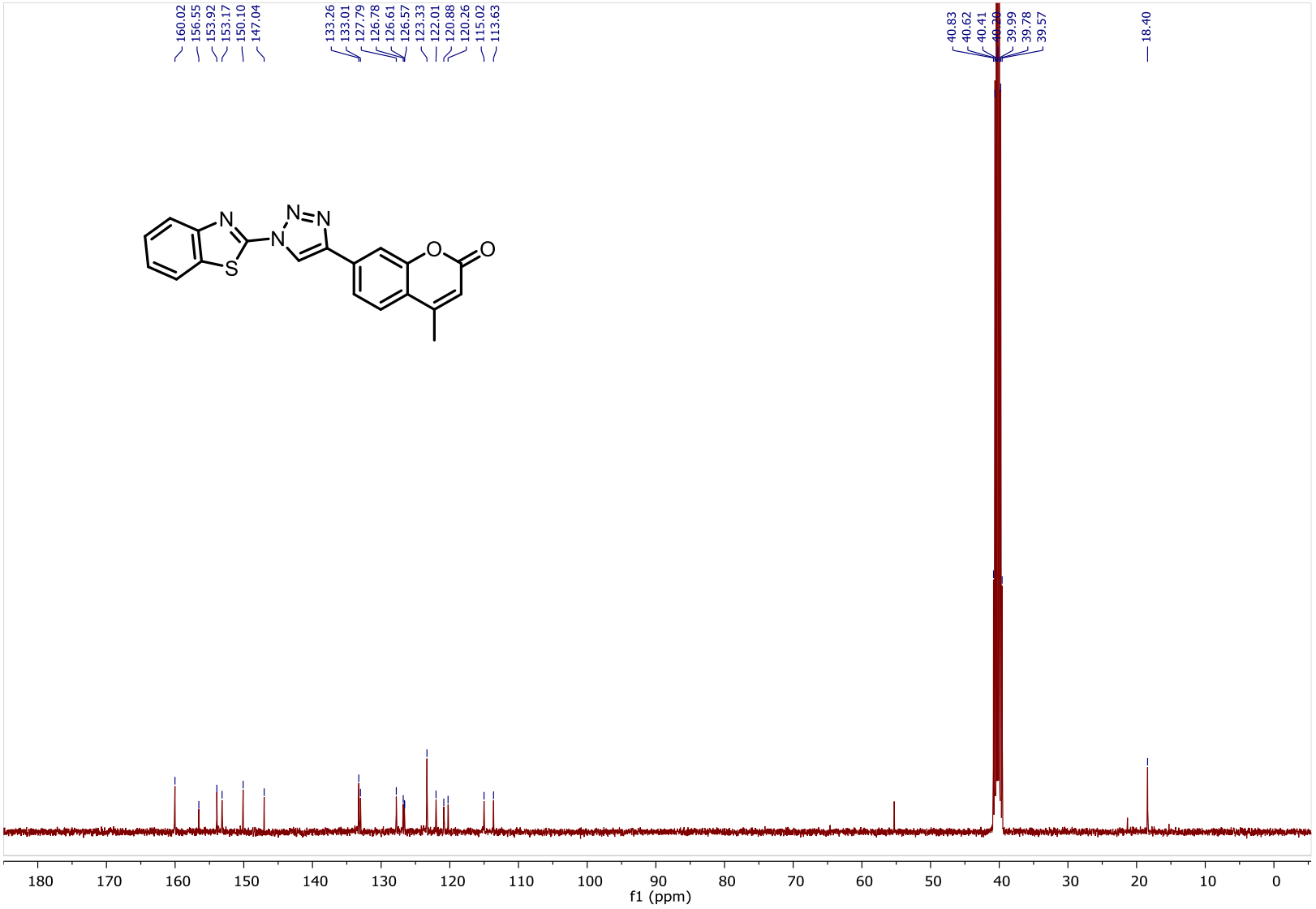
^{13}C NMR of 6aa



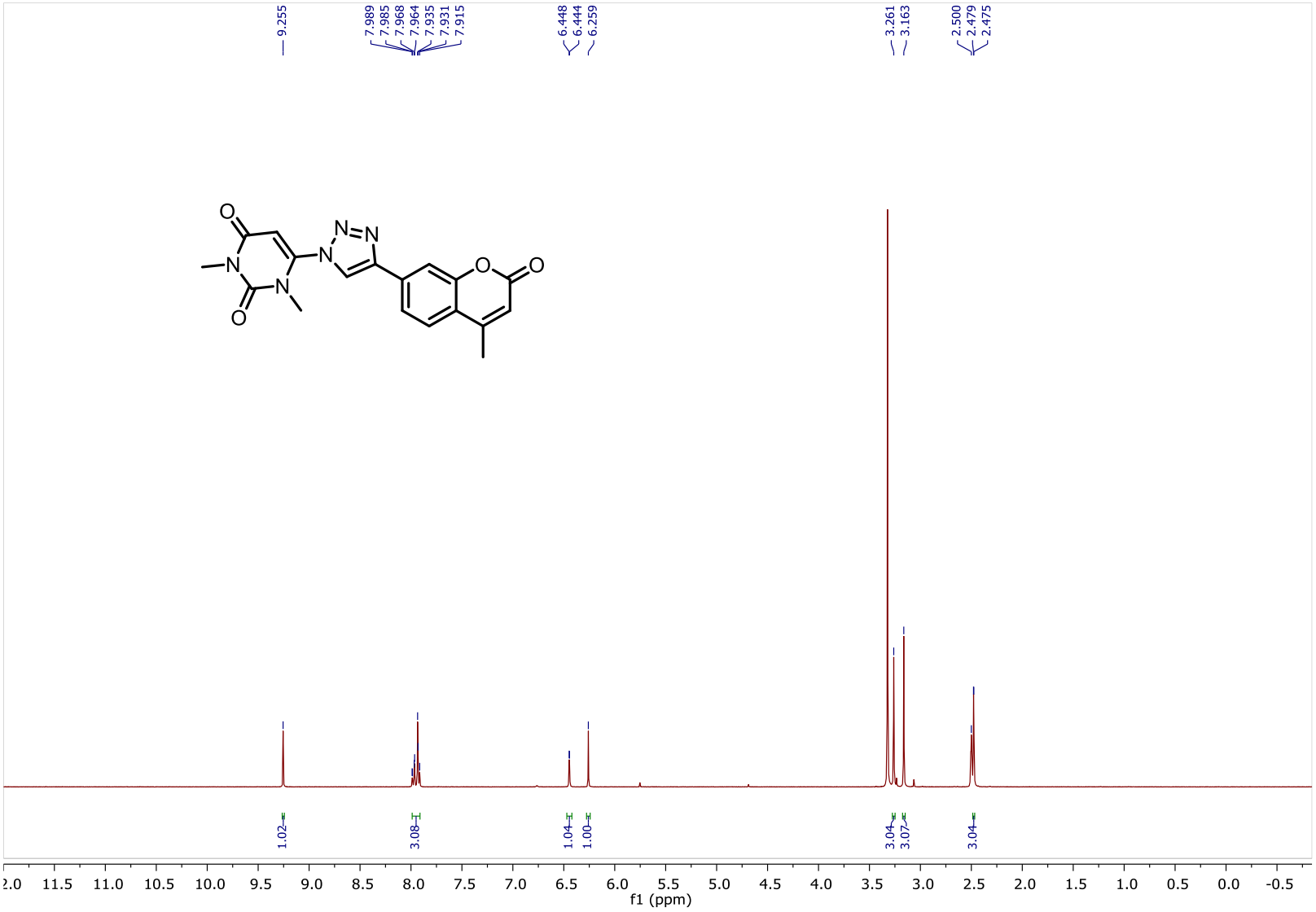
^{1}H NMR of 6ab



^{13}C NMR of 6ab



^{1}H NMR of 6ac



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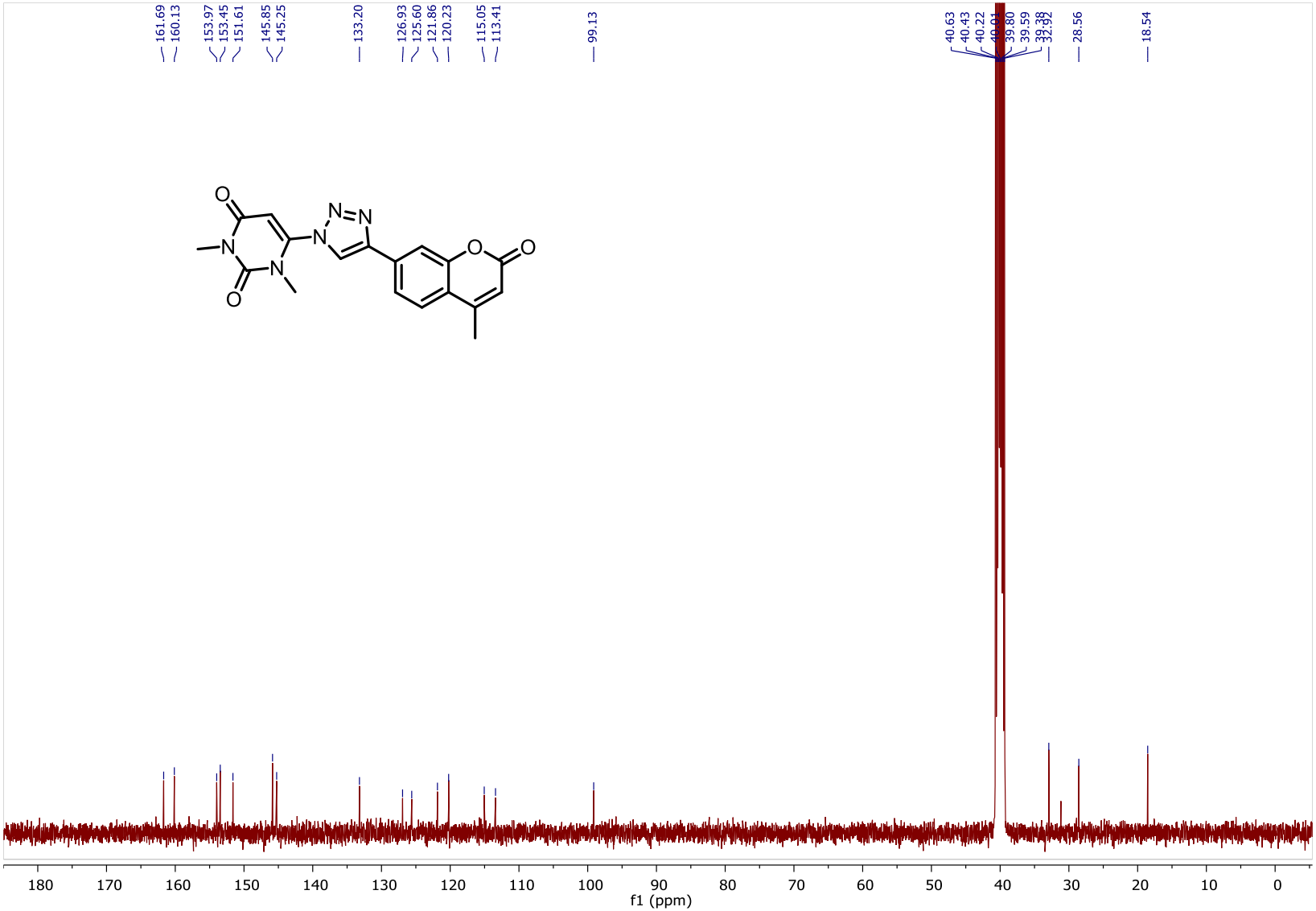
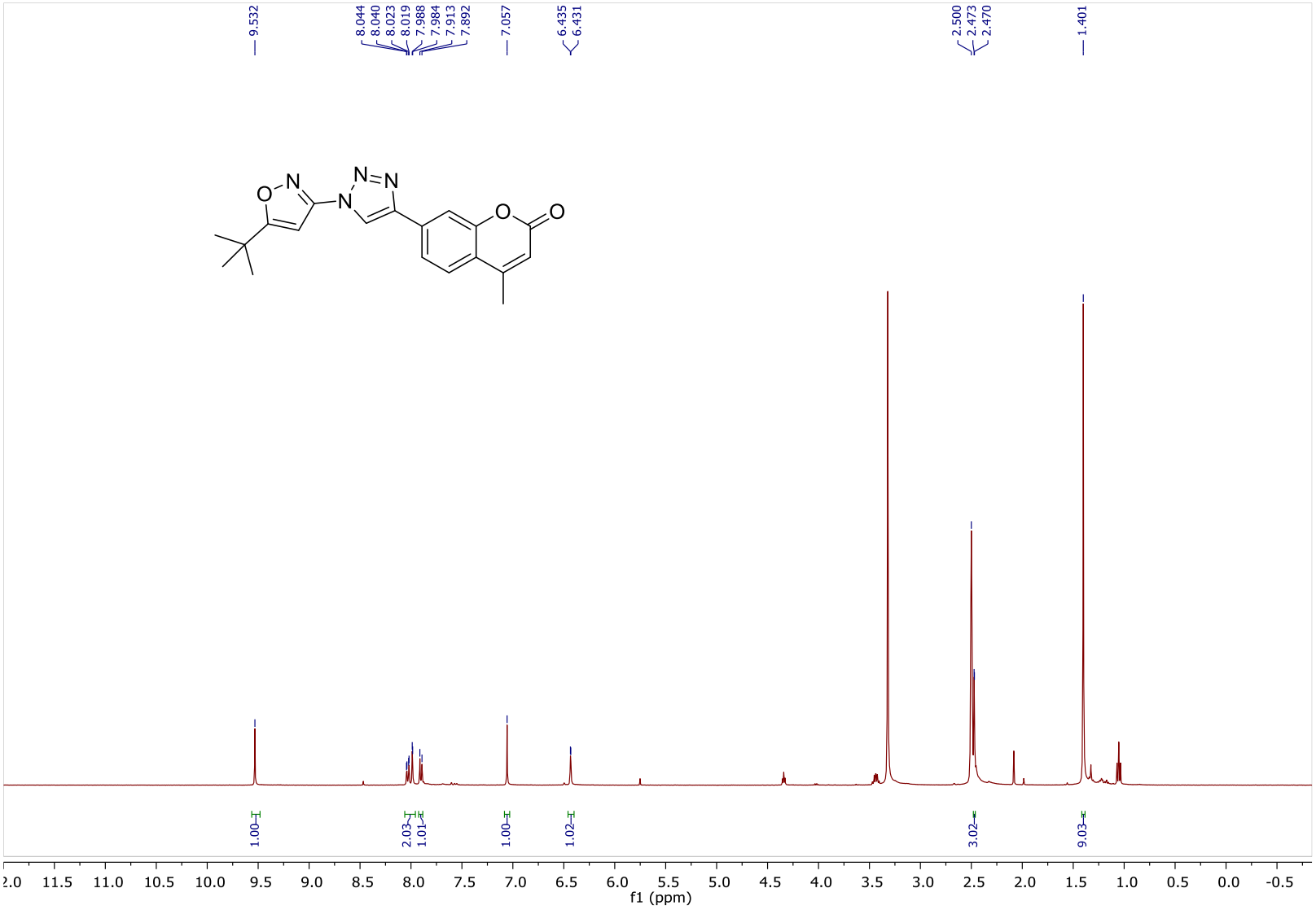
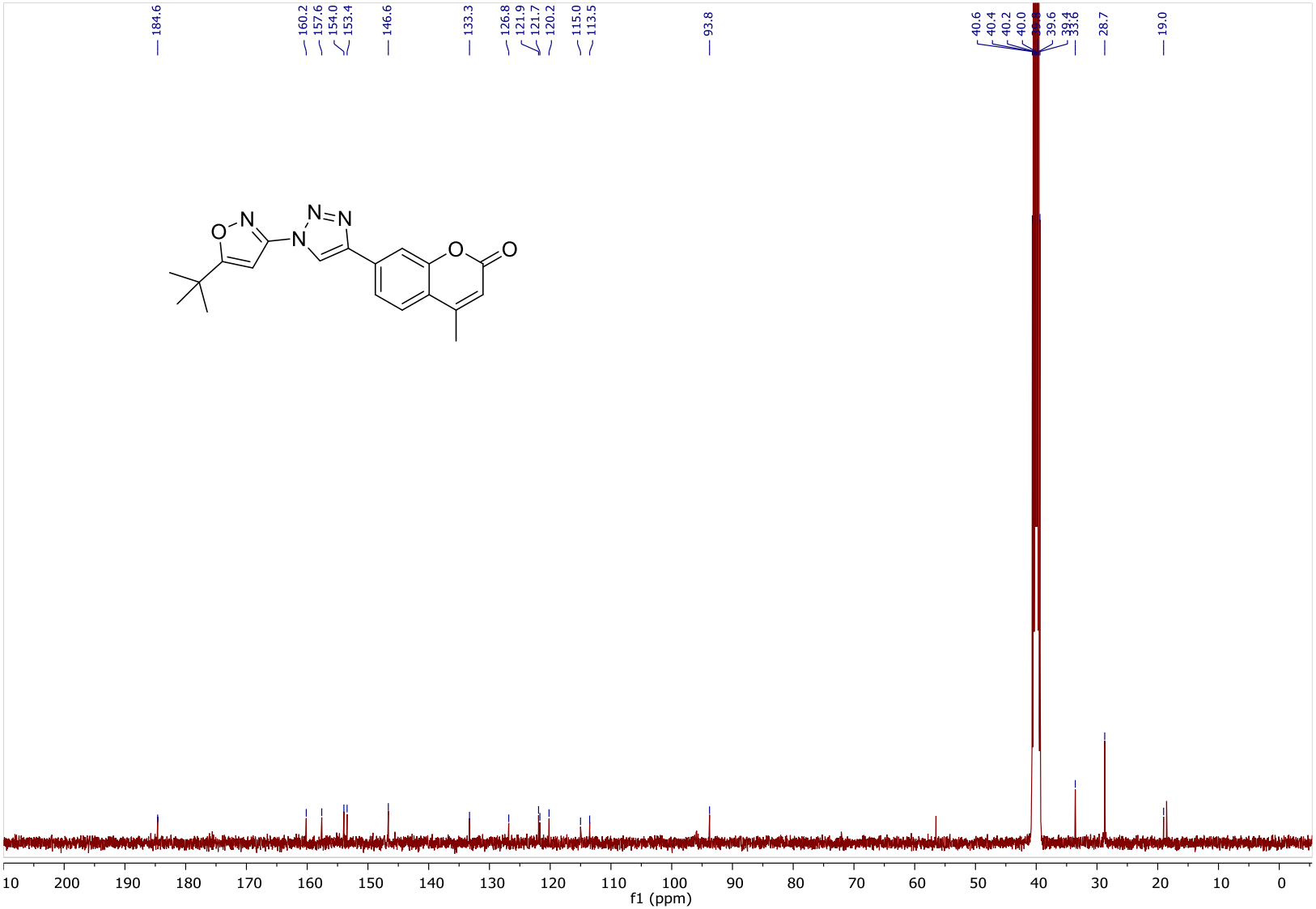


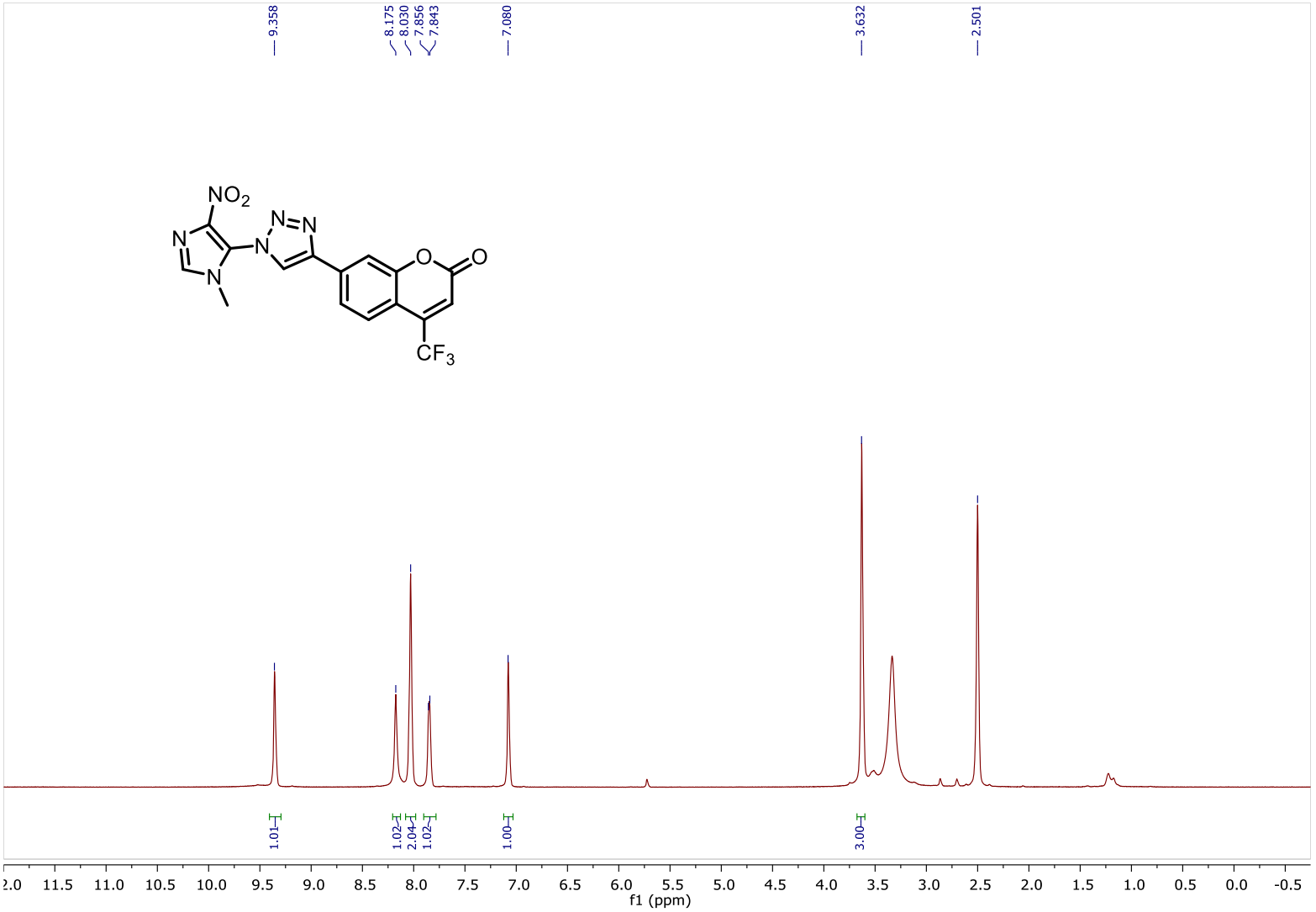
^{1}H NMR of 6ae



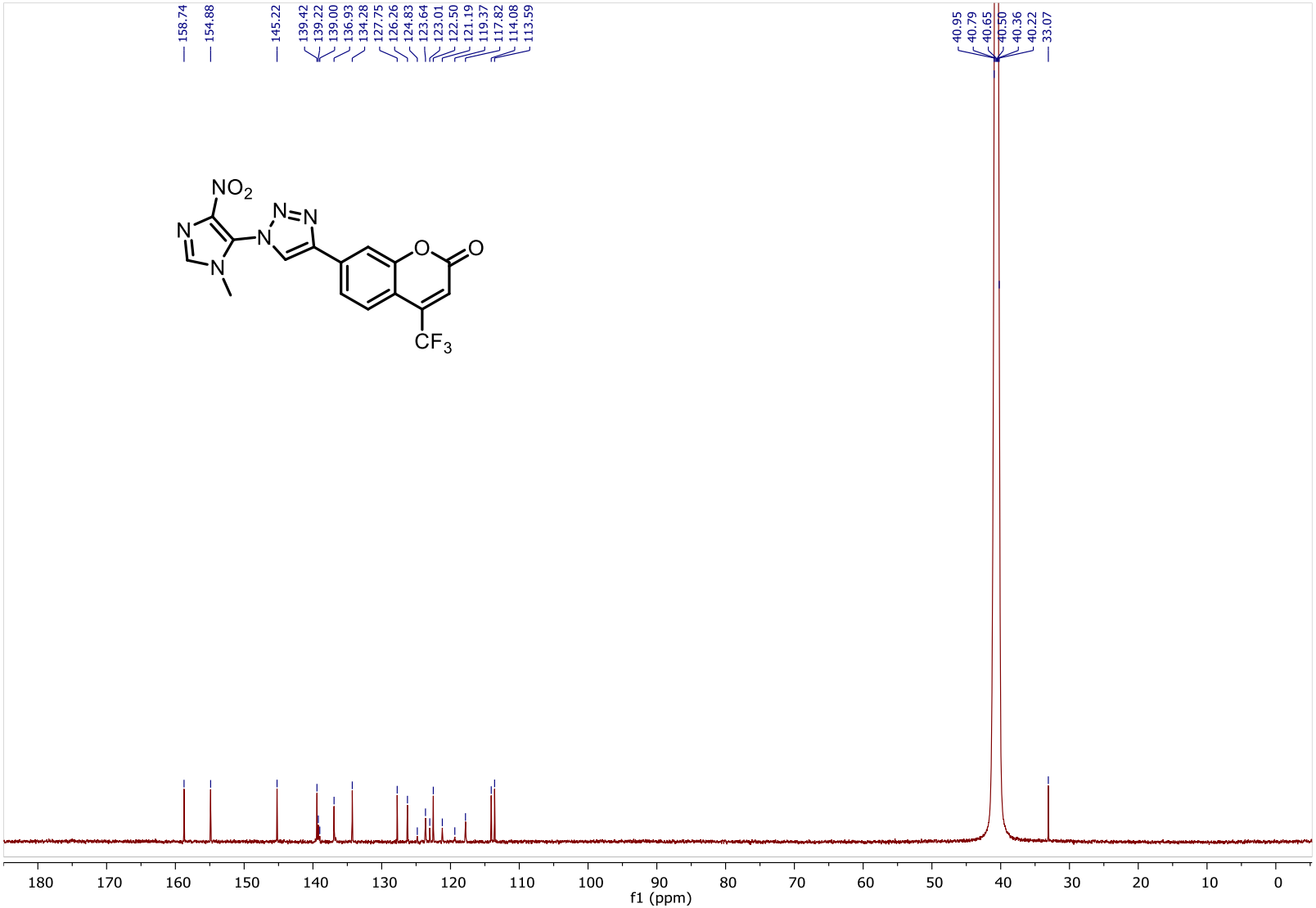
^{13}C NMR of 6ae



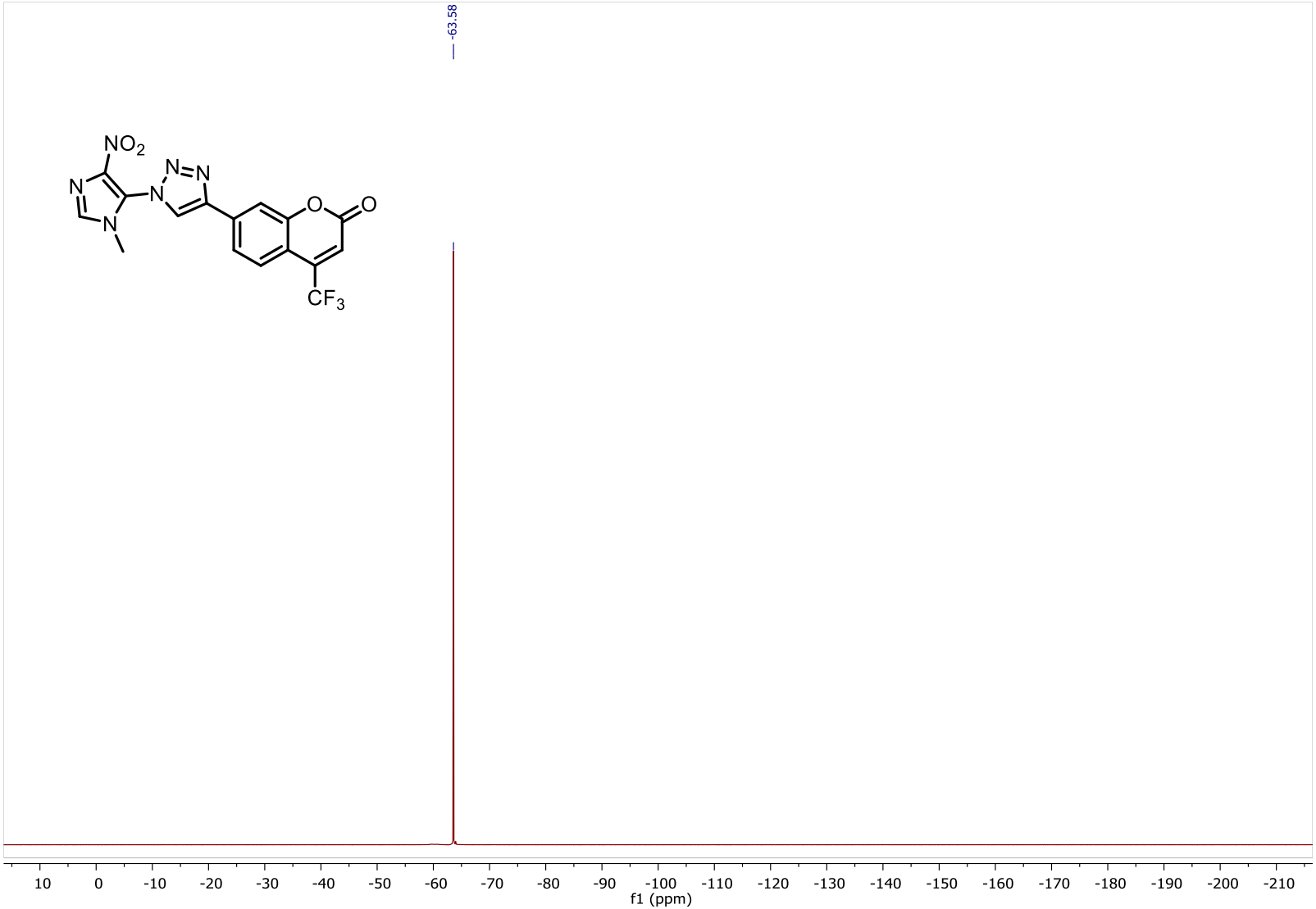
^{1}H NMR of 6ba



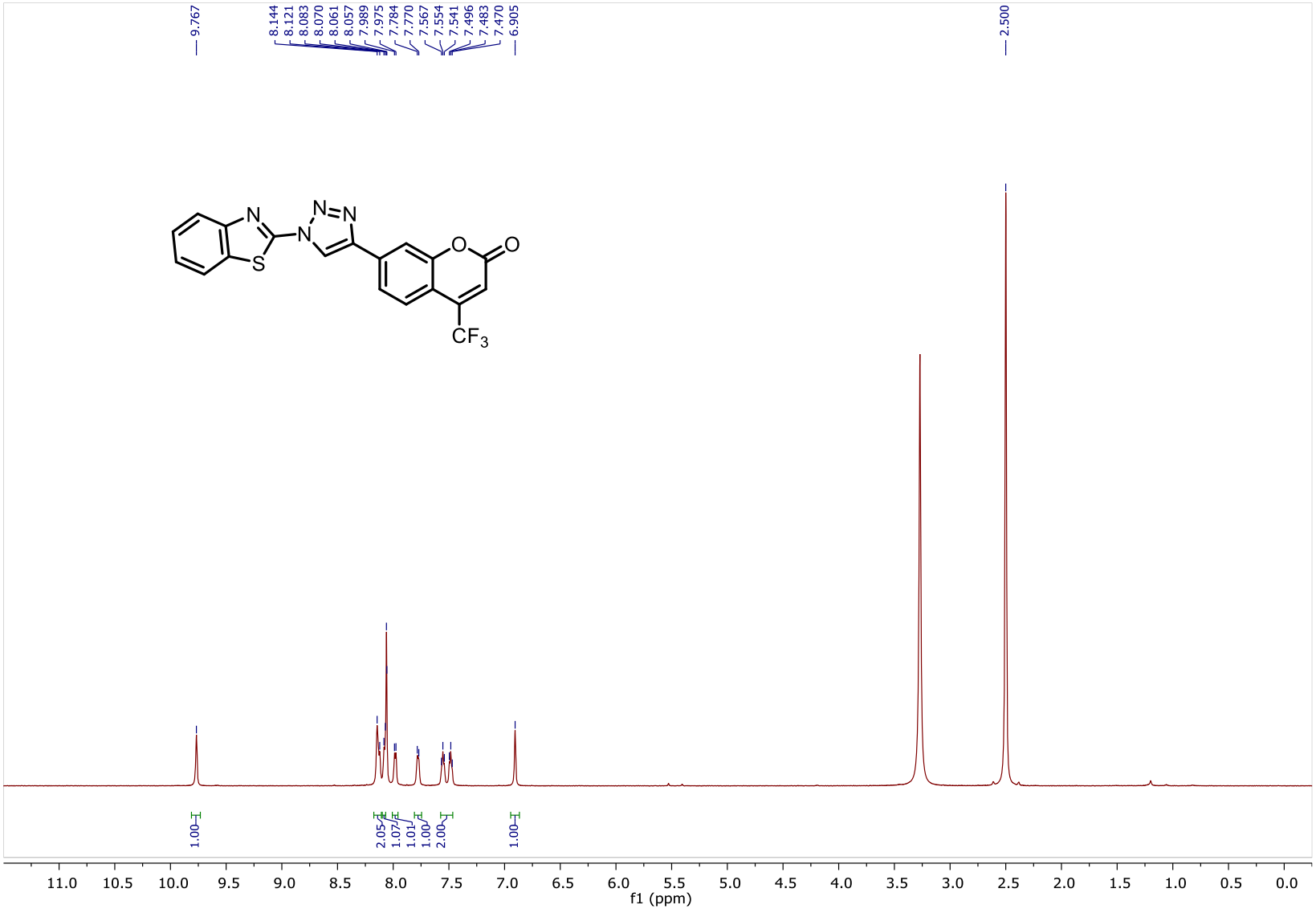
^{13}C NMR of 6ba



^{19}F NMR of 6ba



^{1}H NMR of 6bb



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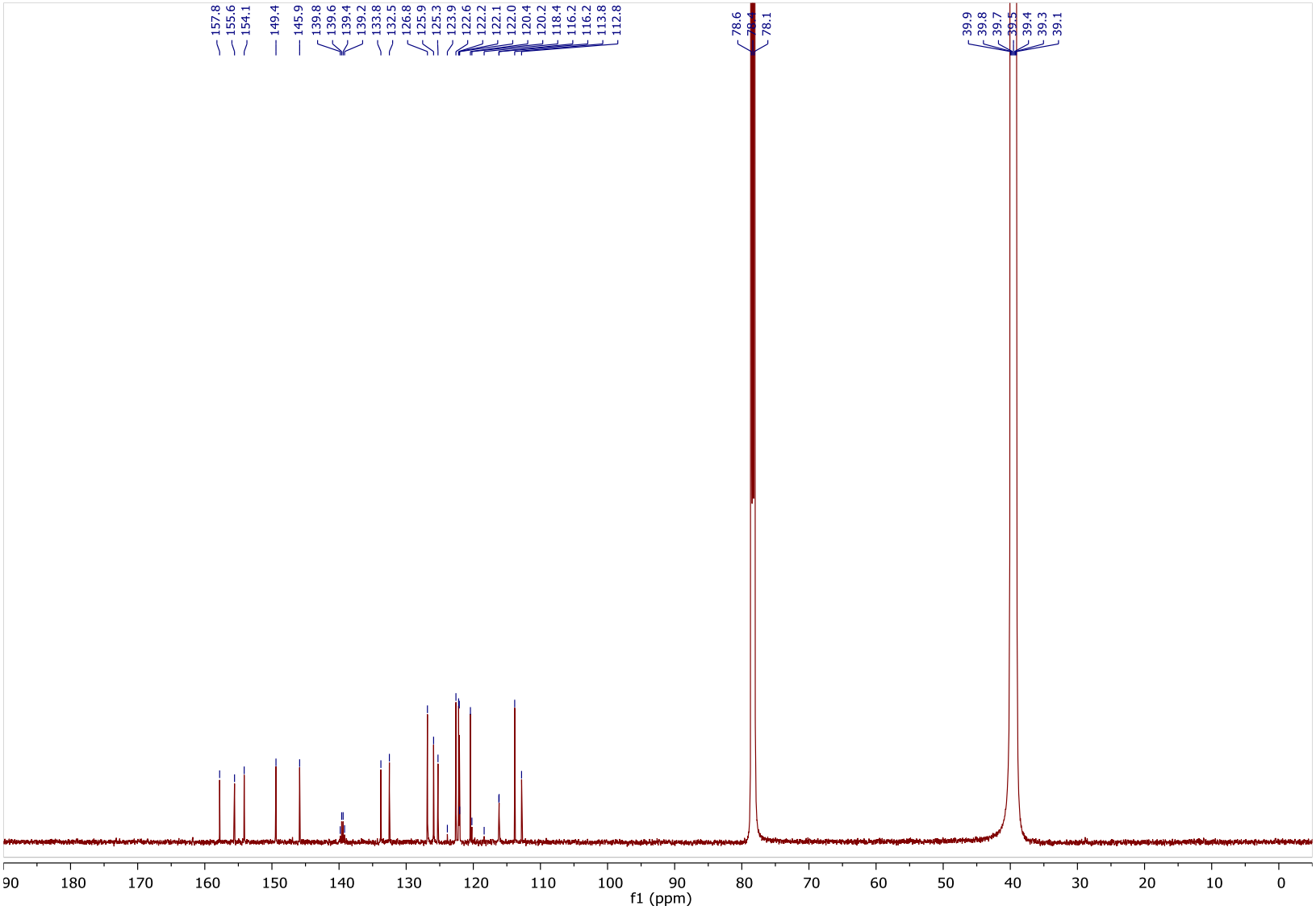

^{19}F NMR of 6bb