Supporting Information

A regio- and stereoselective Heck-Matsuda process for construction of γ-aryl allylsulfonyl fluorides

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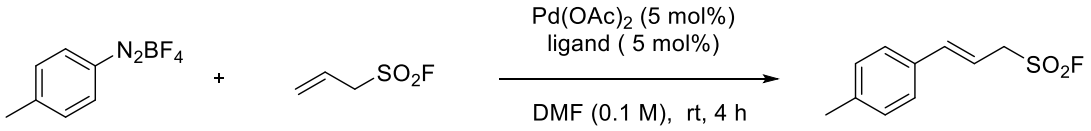
1. General Information

All reactions were carried out in oven or flame-dried glassware under air atmosphere. Unless otherwise noted, solvents and reagents were used as purchased without further purification. The reactions were magnetically stirred and monitored by thin layer chromatography. Yields refer to chromatographically and spectroscopically pure compounds. ^{1}H, ^{19}F and ^{13}C NMR spectra were recorded in $CDCl_3$ at 500 MHz (^{1}H NMR), 471 MHz (^{19}F NMR) and 126 MHz (^{13}C NMR) on a Bruker Avance 500 spectrometer. Chemical shifts are reported in parts per million relative to TMS using the residual solvent signal as internal standard ($CDCl_3$,7.26 and 77.2 ppm) and coupling constants are given in hertz (Hz). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, m = multiplet.

2. Optimization of the Reaction Conditions.

Table S1: Screening the Ligand[a]

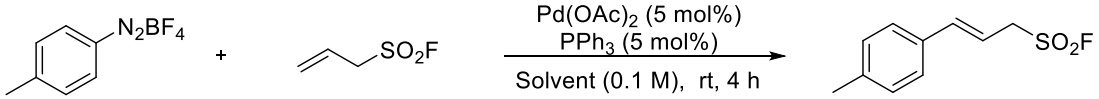


1a **2a** **3a**

Entry	Ligand	Yield(**3a**, %)
1	dppe	60
2	dppp	59
3	dppb	36
4	dppf	trace
5	PCy_3	61
6	**PPh_3**	**66**
7	Xantphos	61
8	2-(Diphenylphosphino)-biphenyl	58
9	/	55

[a]Reaction conditions: arenediazonium tetrafluoroborate (**1a**, 0.2 mmol), $Pd(OAc)_2$ (5 mol%) and liagand (5 mol%) were dissolved in DMF (0.1 M, 2.0 mL). Then the prop-2-ene-1-sulfonyl fluoride (0.4 mmol, 2.0 eq.) was added at room temperature. The resulting mixture was stirred for 4 h at room temperature. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 6.1 min, λ_{max} = 258.3 nm, acetonitrile / water = 80 : 20 (v / v))

Table S2: Screening the Solvent[a]

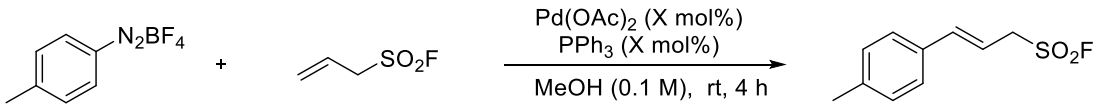


1a **2a** **3a**

Entry	Solvent	Yield (**3a**, %) [b]
1	**MeOH**	**71**
2	H_2O	trace
3	DMSO	trace
4	DMF	66
5	DMA	51
6	MeCN	trace
7	1,4-dioxane	trace
8	THF	trace
9	Acetone	16

[a]Reaction conditions: arenediazonium tetrafluoroborate (**1a**, 0.2 mmol), $Pd(OAc)_2$ (5 mol%) and PPh_3 (5 mol%) were dissolved in solvent (0.1 M, 2.0 mL). Then the prop-2-ene-1-sulfonyl fluoride (0.4 mmol, 2.0 eq.) was added at room temperature. The resulting mixture was stirred for 4 h at room temperature. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 6.1 min, λ_{max} = 258.3 nm, acetonitrile / water = 80 : 20 (v / v))

Table S3: Screening of the catalyst loading[a]

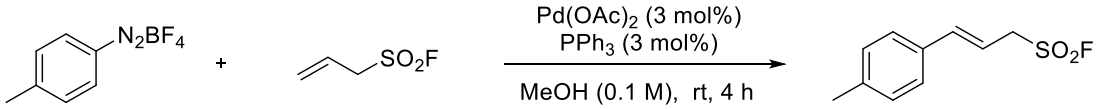


1a **2a** **3a**

Entry	X (mol%)	Yield (**3a**, %) [b]
1	1	50
2	2	61
3	**3**	**72**
4	5	71
5	10	64

[a]Reaction conditions: arenediazonium tetrafluoroborate (**1a**, 0.2 mmol), $Pd(OAc)_2$ (X mol%) and PPh_3 (X mol%) were dissolved in MeOH (0.1 M, 2.0 mL). Then the prop-2-ene-1-sulfonyl fluoride (0.4 mmol, 2.0 eq.) was added at room temperature. The resulting mixture was stirred for 4 h at room temperature. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 6.1 min, λ_{max} = 258.3 nm, acetonitrile / water = 80 : 20 (v / v))

Table S4: Screening of the prop-2-ene-1-sulfonyl fluoride loading[a]

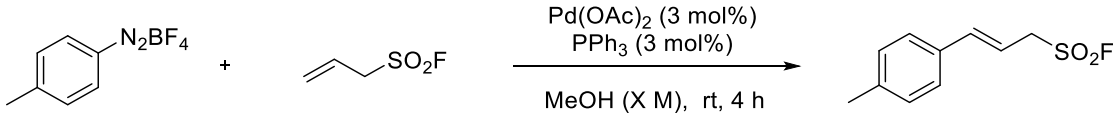


1a **2a** **3a**

Entry	**2a** (X equiv.)	Yield (**3a**, %) [b]
1	**1.1**	**78**
2	1.2	78
3	1.5	76
4	2.0	72
5	3.0	63

[a]Reaction conditions: arenediazonium tetrafluoroborate (**1a**, 0.2 mmol), $Pd(OAc)_2$ (3 mol%) and PPh_3 (3 mol%) were dissolved in MeOH (0.1 M, 2.0 mL). Then the prop-2-ene-1-sulfonyl fluoride (X eq.) was added at room temperature. The resulting mixture was stirred for 4 h at room temperature. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 6.1 min, λ_{max} = 258.3 nm, acetonitrile / water = 80 : 20 (v / v))

Table S5: Screening of the reaction concentration[a]



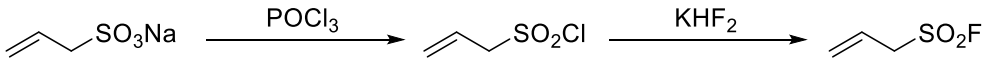
1a **2a** **3a**

Entry	Concentration (X M).	Yield (**3a**, %) [b]
1	0.05	75
2	**0.1**	**78**
3	0.2	72
4	0.4	66

[a]Reaction conditions: arenediazonium tetrafluoroborate (**1a**, 0.2 mmol), $Pd(OAc)_2$ (3 mol%) and PPh_3 (3 mol%) were dissolved in MeOH (X M). Then the prop-2-ene-1-sulfonyl fluoride (0.22 mmol, 1.1 eq.) was added at room temperature. The resulting mixture was stirred for 4 h at room temperature. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 6.1 min, λ_{max} = 258.3 nm, acetonitrile / water = 80 : 20 (v / v)).

3. General Procedures.

3.1 Procedure for the synthesis of prop-2-ene-1-sulfonyl fluoride (2a).

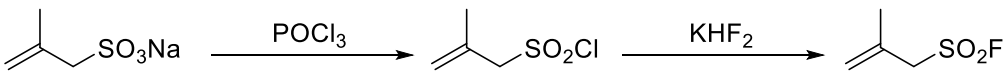


2a

Step 1: Sodium allylsulfonate (100 g, 0.69 mol) and phosphorus oxychloride (329 g, 2.15 mol) were added to a 500 mL flask.The mixture was heated to 120 ℃ and refluxed for four hours. Then distilled out most of the phosphorus oxychloride. The solution was then poured into 500 mL of ice water and allowed to stand for 10 min in order to hydrolyze the phosphorus oxychloride. prop-2-ene-1-sulfonyl chloride was extracted with three 150 mL portions of methylene chloride. The combined methylene chloride extracts were washed with 200 mL of water, two 100 mL portions of 5% sodium bicarbonate, and finally with 100 mL of water. The solvent was evaporated to give crude prop-2-ene-1-sulfonyl chloride, which was used directly in the next step.

Step 2: KHF_2 (112 g, 1.43 mol) was added to 300 mL water and a nearly saturated KHF_2 solution formed after 1 h, when the solution approached room temperature. At this point, the crude prop-2-ene-1-sulfonyl chloride generated from the previous step was all added to KHF_2 solution. With continued stirring, the mixture was stirred for 2 h at room temperature. The reaction mixture was extracted with three 100 mL portions of methylene chloride, and the combined organic phase was washed with brine, dried over anhydrous Na_2SO_4, and concentrated using a rotary evaporator to give crude prop-2-ene-1-sulfonyl fluoride. Further distillation at 90 °C under reduced pressure with a water pump helped to remove the impurities and gave pure prop-2-ene-1-sulfonyl fluoride as a colorless liquid (52.8 g, 61% yield over two steps).

3.2 Procedure for the synthesis of 2-methylprop-2-ene-1-sulfonyl fluoride (2b).



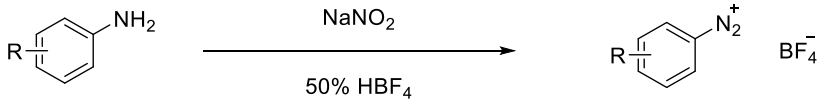
2b

Step 1: Sodium 2-methylprop-2-ene-1-sulfonate (30 g, 0.19 mol) and phosphorus oxychloride (100 g, 0.65 mol) were added to a 250 mL flask. The mixture was heated to 120 ℃ and refluxed for 12 h. Then distilled out most of the phosphorus oxychloride. The solution was then poured into

300 mL of ice water and allowed to stand for 10 min in order to hydrolyze the phosphorus oxychloride. 2-methylprop-2-ene-1-sulfonyl chloride was extracted with three 50 mL portions of methylene chloride. The combined methylene chloride extracts were washed with 50 mL of water, two 100 mL portions of 5% sodium bicarbonate, and finally with 50 mL of water. The solvent was evaporated to give crude 2-methylprop-2-ene-1-sulfonyl chloride, which was used directly in the next step.

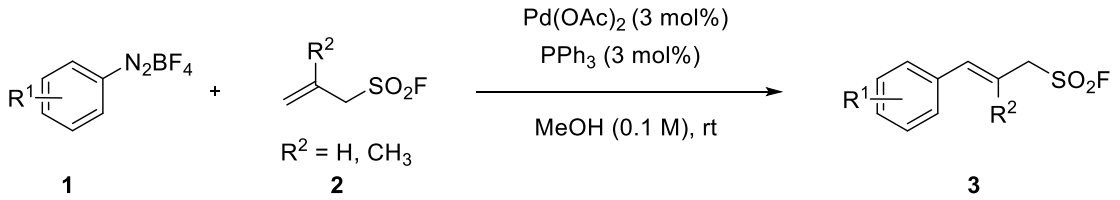
Step 2: KHF_2 (108 g, 1.38 mol) was added to 300 mL water and a nearly saturated KHF_2 solution formed after 1 h, when the solution approached room temperature. At this point, the crude prop-2-ene-1-sulfonyl chloride generated from the previous step was all added to KHF_2 solution. With continued stirring, the mixture was stirred for 12 h at room temperature. The reaction mixture was extracted with three 30 mL portions of methylene chloride, and the combined organic phase was washed with brine, dried over anhydrous Na_2SO_4, and concentrated using a rotary evaporator to give crude 2-methylprop-2-ene-1-sulfonyl fluoride. Further distillation at 120 °C under reduced pressure with a water pump helped to remove the impurities and gave pure 2-methylprop-2-ene-1-sulfonyl fluoride as a colorless liquid (5.6 g, 21% yield over two steps).

3.3 Preparation of aryldiazonium salts:



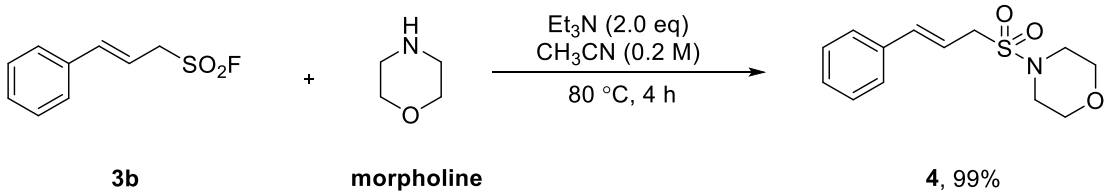
The aniline (10 mmol) was added to a mixture of 50% fluoroboric acid (3 mL) and distilled water (3 mL) in ice bath. To this solution, an ice-cold solution of sodium nitrite (704 mg, 10.2 mmol) in distilled water (3 mL) was added. After stirring for 30 mins, the precipitate was collected on a hirch funnel and washed with small amount of ice-cold distilled water. The solid was dissolved in acetonitrile and precipitated with slow addition of ethyl ether. Solids were obtained after repeat this trituration two to three times.

3.4 General procedure for palladium catalyzed Heck-Matsuda coupling of arenediazonium tetrafluoroborate and allylsulfonyl fluoride.



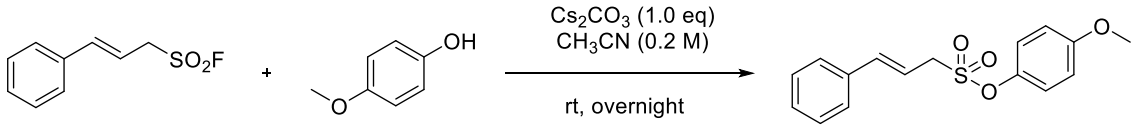
Diazonium tetrafluoroborate (**1**, 1 mmol), $Pd(OAc)_2$ (3 mol %, 6.7 mg) PPh_3 (3 mol%, 7.9 mg) and MeOH (0.1 M, 10.0 mL) were added to an oven-dried reaction tube (30 mL). Then the allylsulfonyl fluoride (**2**, 1.1 eq.) was added at room temperature. The resulting mixture was stirred at room temperature. After completion of reaction was monitored by TLC analysis, the mixture was concentrated under reduced pressure. The crude was purified by flash column chromatography with petroleum ether/ethyl acetate (40:1 to 3:1, v/v) to give the corresponding pure product.

3.5 Procedure for synthesis of sulfonamide from morpholine.



Morpholine (2.0 mmol, 2.0 eq., 174.2 mg) and triethylamine (2.0 mmol, 2.0 eq., 202.4 mg) were added to a stirred solution of (*E*)-3-phenylprop-2-ene-1-sulfonyl fluoride (**3b**, 1.0 mmol, 200.2 mg) dissolved in acetonitrile (2 mL) and the resulting mixture reacted at 80 ℃ for 4 h. The reaction was concentrated to dryness and the residue was further purified by column chromatography on silica gel by gradient elution with petroleum ether/ethyl acetate (2:1, v/v) as eluent to obtain pure sulfonamide **4** as white solid (265 mg, 99% yield).

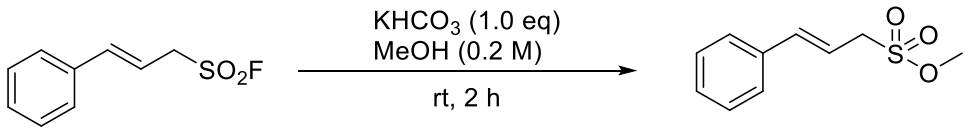
3.6 Procedure for synthesis of sulfonate from 4-methoxyphenol.



3b **4-methoxyphenol** **5**, 97%

(*E*)-3-phenylprop-2-ene-1-sulfonyl fluoride (**3b**, 1.0 mmol, 200.2 mg), 4-methoxyphenol (1.1 mmol, 1.1 eq., 136.5 mg), cesium carbonate (1.0 mmol, 1.0 eq., 325.8 mg) were added in a solution of acetonitrile (2 mL) and reacted at room temperature for 12 h. The reaction mixture was extracted with ethyl acetate (3×20 mL) and the combined organic layers was dried over anhydrous sodium sulfate, filtered and concentrated under reduced pressure. The crude product was further purified by column chromatography on silica gel by gradient elution with petroleum ether/ethyl acetate (10:1, v/v) as eluent to obtain pure sulfonate **5** as white solid (296 mg, 97% yield).

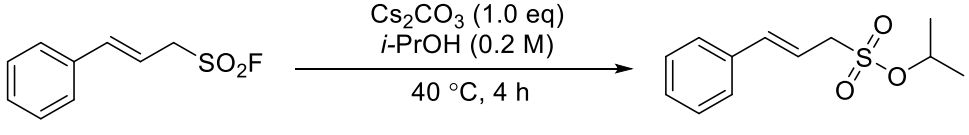
3.7 Procedure for synthesis of sulfonate from methanol.



3b **6a**, 95%

(*E*)-3-phenylprop-2-ene-1-sulfonyl fluoride (**3b**, 1.0 mmol, 200.2 mg), $KHCO_3$ (1.0 mmol, 1.0 eq., 100.1 mg) were added in a solution of methanol (2 mL) and reacted at 25 ℃ for 2 h. The reaction mixture was extracted with ethyl acetate (3×20 mL) and the combined organic layers was dried over anhydrous sodium sulfate, filtered and concentrated under reduced pressure. The crude product was further purified by column chromatography on silica gel by gradient elution with petroleum ether/ethyl acetate (10:1, v/v) as eluent to obtain pure sulfonate **6a** as white solid (202 mg, 95% yield).

3.8 Procedure for synthesis of sulfonate from isopropanol.

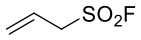


3b **6b**, 67%

(*E*)-3-phenylprop-2-ene-1-sulfonyl fluoride (**3b**, 1.0 mmol, 200.2 mg), Cs_2CO_3 (1.0 mmol, 1.0 eq., 325.8 mg) were added in a solution of isopropanol (2 mL) and reacted at 40 ℃ for 4 h. The

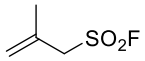
reaction mixture was extracted with ethyl acetate (3×20 mL) and the combined organic layers was dried over anhydrous sodium sulfate, filtered and concentrated under reduced pressure. The crude product was further purified by column chromatography on silica gel by gradient elution with petroleum ether/ethyl acetate (10:1, v/v) as eluent to obtain pure sulfonate **6b** as white solid (161 mg, 67% yield).

4. Characterization.



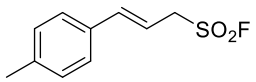
2a

Prop-2-ene-1-sulfonyl fluoride (**2a**). Colorless oil. **^{1}H NMR (500 MHz, $CDCl_3$)**: δ 5.95-5.87 (m, 1H), 5.61 (d, J = 5.2 Hz, 1H), 5.58 (d, J = 12.1 Hz, 1H), 4.09-4.07 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.0-51.9 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 126.7, 122.2, 55.0 (d, J = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_3H_5FO_2S$ $[M+H]^+$ 125.0152, found 125.0154.



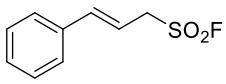
2b

2-methylprop-2-ene-1-sulfonyl fluoride (**2b**). Colorless oil. **^{1}H NMR (500 MHz, $CDCl_3$)**: δ 5.33-5.32 (m, 1H), 5.25 (s, 1H), 4.04 (dd, J_1 = 3.3 Hz, J_2 = 0.4 Hz, 2H), 1.99 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 54.4 (s, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 131.1, 122.7, 58.7 (d, J = 16.4 Hz), 22.1. **ESI-HRMS** (m/z) calculated for $C_4H_7FO_2S$ $[M+H]^+$ 139.0224, found 139.0224.



3a

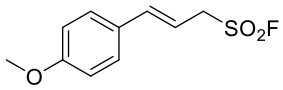
(*E*)-3-(p-tolyl)prop-2-ene-1-sulfonyl fluoride (**3a**). White solid, 155 mg, 72% yield. mp: 70-72℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.33 (d, J = 7.9 Hz, 2H), 7.18 (d, J = 7.9 Hz, 2H), 6.79 (d, J = 15.7Hz, 1H), 6.17-6.10 (m, 1H), 4.23-4.21 (m, 2H), 2.37 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.71-51.67 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 141.0, 139.5, 132.3, 129.7, 127.0, 111.0, 55.0 (d, J = 18.2 Hz), 21.4. **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_2S$ $[M+H]^+$ 215.0759, found 215.0761.



3b

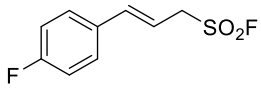
(*E*)-3-phenylprop-2-ene-1-sulfonyl fluoride (**3b**). White solid, 138 mg, 69% yield. mp: 49-51℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.45-7.43 (m, 2H), 7.40-7.33 (m, 3H), 6.83 (d, J = 15.9 Hz, 1H), 6.23-6.17 (m, 1H), 4.25-4.23 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$):** δ 52.0-51.9 (m, -SO_2F). **^{13}C**

NMR (126 MHz, $CDCl_3$): δ 141.1, 135.1, 129.3, 129.0, 127.1, 112.2, 54.8 (d, J = 18.1 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_9FO_2S$ $[M+H]^+$ 201.1160, found 201.1164.



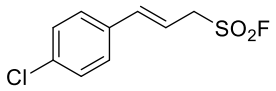
3c

(*E*)-3-(4-methoxyphenyl)prop-2-ene-1-sulfonyl fluoride (**3c**). Yellow solid, 121 mg, 53% yield. mp: 65-68℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.37 (d, J = 8.7 Hz, 2H), 6.89 (d, J = 8.8 Hz, 2H), 6.76 (d, J = 15.7 Hz, 1H), 6.07-6.01 (m, 1H), 4.23-4.20 (m, 1H), 3.83 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$):** δ 51.5-51.4 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 160.6, 140.6, 128.5, 127.8, 114.4, 109.6, 55.5, 55.0 (d, J = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_3S$ $[M+H]^+$ 231.0559, found 231.0562.



3d

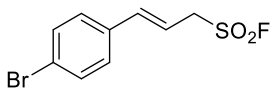
(*E*)-3-(4-fluorophenyl)prop-2-ene-1-sulfonyl fluoride (**3d**). Yellowish solid, 205 mg, 94% yield. mp: 45-47℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.42-7.39 (m, 2H), 7.08-7.04 (m, 2H), 6.79 (d, J = 15.9 Hz, 1H), 6.14-6.08 (m, 1H), 4.24-4.22 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.93-51.92, (m, -SO_2F), -111.5--115.6 (m, -ArF). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 163.3 (d, J = 249.8 Hz), 139.9, 131.3 (d, J = 3.7 Hz), 128.8 (d, J = 9.1 Hz), 116.0 (d, J = 21.8 Hz), 111.9 (d, J = 2.7 Hz), 54.7 (d, J = 18.1 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_8F_2O_2S$ $[M+H]^+$ 219.0965, found 219.0966.



3e

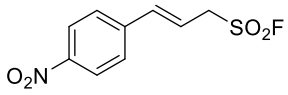
(*E*)-3-(4-chlorophenyl)prop-2-ene-1-sulfonyl fluoride (**3e**). White solid, 208 mg, 89% yield. mp: 74-76℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.36-7.32 (m, 4H), 6.78 (d, J = 15.9 Hz, 1H), 6.20-6.14 (m, 1H), 4.25-4.22 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.15-52.10 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 139.8, 135.2, 133.5, 129.2, 128.3, 112.9, 54.7 (d, J = 18.1 Hz). **ESI-HRMS**

(m/z) calculated for $C_9H_8ClFO_2S$ $[M+H]^+$ 235.0656, found 235.0657.



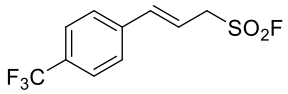
3f

(*E*)-3-(4-bromophenyl)prop-2-ene-1-sulfonyl fluoride (**3f**). White solid, 218 mg, 78% yield. mp: 87-89℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.49 (d, *J* = 8.4 Hz, 2H), 7.29 (d, *J* = 8.4 Hz, 2H), 6.76 (d *J* = 15.9 Hz, 1H), 6.21-6.15 (m, 1H), 4.24-4.22 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.2-52.1 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 139.8, 133.9, 132.1, 128.5, 123.4, 113.0, 54.7 (d, *J* = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_8BrFO_2S$ $[M+H]^+$ 279.0052, found 279.0002.



3g

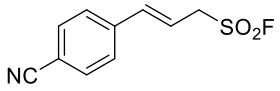
(*E*)-3-(4-nitrophenyl)prop-2-ene-1-sulfonyl fluoride (**3g**). Yellow solid 137 mg, 56% yield. mp: 119-120℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.23 (d, *J* = 8.5 Hz, 2H), 7.58 (d, *J* = 8.4 Hz, 2H), 6.91 (d, *J* = 15.7 Hz, 1H), 6.41-6.35 (m, 1H), 4.32-4.29 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 53.02-52.97 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 148.1, 141.1, 138.7, 127.8, 124.3, 117.1, 54.4 (d, *J* = 18.1 Hz). ESI-HRMS (m/z) calculated for $C_9H_8FNO_4S$ $[M+H]^+$ 246.0200, found 246.0226.



3h

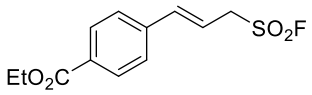
(*E*)-3-(4-(trifluoromethyl)phenyl)prop-2-ene-1-sulfonyl fluoride (**3h**). yellowish solid, 151 mg, 56% yield. mp: 52-54℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.63 (d, *J* = 8.1 Hz, 2H), 7.53 (d, *J* = 8.1 Hz, 2H), 6.87 (d, *J* = 15.9 Hz, 1H), 6.33-6.27 (m, 1H), 4.28-4.26 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.5 (s, -SO_2F), -62.8 (s, -CF_3). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 139.6, 138.4, 131.1, (q, *J* = 32.7 Hz), 127.3, 126.0 (q, *J* = 3.6 Hz), 124.0 (q, *J* = 272.0 Hz), 115.1, 54.6 (d, *J* = 18.2 Hz).

ESI-HRMS (m/z) calculated for $C_{10}H_8F_4O_2S$ $[M+H]^+$ 269.0200, found 269.0211.



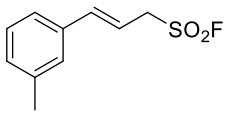
3i

(*E*)-3-(4-cyanophenyl)prop-2-ene-1-sulfonyl fluoride, white solid (**3i**). 129 mg, 57% yield. mp: 99-101 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.66 (d, J = 7.9 Hz, 2H), 7.52 (d, J = 7.9 Hz, 2H), 6.86 (d, J = 15.9 Hz, 1H), 6.36-6.30 (m, 1H), 4.29-4.27 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.9-52.8 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 139.3, 139.1, 132.8, 127.6, 118.6, 116.3, 112.7, 54.4 (d, J = 19.1 Hz). **ESI-HRMS** (m/z) calculated for $C_{10}H_8FNO_2S$ $[M+H]^+$ 226.1860, found 226.1863.



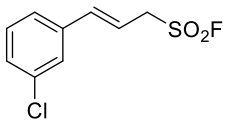
3j

Ethyl (*E*)-4-(3-(fluorosulfonyl)prop-1-en-1-yl)benzoate (**3j**). White solid, 159 mg, 58% yield. mp: 96-98 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.03 (d, J =7.9 Hz, 2H), 7.47 (d, J = 8.0 Hz, 2H), 6.86 (d, J =15.9 Hz, 1H), 6.32-6.26 (m, 1H), 4.38 (q, J = 7.0 Hz, 2H), 4.28-4.26 (m, 2H), 1.40 (t, J =7.0 Hz, 3H). ^{19}F NMR (471 MHz, $CDCl_3$), δ 52.5-52.4 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 166.1, 140.0, 139.1, 131.0, 130.1, 126.9, 114.8, 61.2, 54.6 (d, J = 19.1 Hz), 14.4. **ESI-HRMS** (m/z) calculated for $C_{12}H_{13}FO_4S$ $[M+H]^+$ 273.0545, found 273.0530.



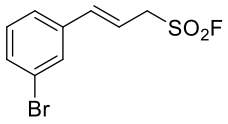
3k

(*E*)-3-(m-tolyl)prop-2-ene-1-sulfonyl fluoride. White solid (**3k**), 133 mg, 62% yield. mp: 32-33℃. **^{1}H NMR (500 MHz, $CDCl_3$):** 7.28-7.22 (m, 3H), 7.16 (d, J =7.2 Hz, 1H), 6.80 (d, J = 15.7 Hz, 1H), 6.21-6.15 (m, 1H), 4.24-4.22 (m, 2H), 2.37 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.8-51.7 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 141.2, 138.6, 135.0, 130.1, 128.8, 127.7, 124.3, 111.9, 54.9 (d, J = 18.2 Hz), 21.4. **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_2S$ $[M+H]^+$ 215.0055, found 214.9909.



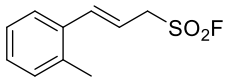
3l

(*E*)-3-(3-chlorophenyl)prop-2-ene-1-sulfonyl fluoride (**3l**). Yellowish solid, 210 mg, 89% yield. mp: 44-46 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.42 (s, 1H), 7.32-7.29 (m, 3H), 6.77 (d, *J* = 15.8 Hz, 1H), 6.24-6.18 (m, 1H), 4.25-4.23 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.32-52.28 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 139.6, 136.8, 135.0, 130.2, 129.3, 127.0, 125.3, 113.9, 54.6 (d, *J* = 18.1 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_8ClFO_2S$ $[M+H]^+$ 235.1740, found 235.1741.



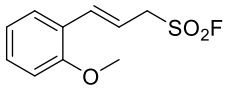
3m

(*E*)-3-(3-bromophenyl)prop-2-ene-1-sulfonyl fluoride (**3m**). Yellow solid, 236 mg, 85% yield. mp: 45-47 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.57 (s, 1H), 7.46 (d, *J* =7.9 Hz, 1H), δ = 7.34 (d, *J* =7.6 Hz, 1H), 7.24 (t, *J* =7.8 Hz, 1H), 6.76 (d, *J* =15.7 Hz, 1H), 6.23-6.17 (m, 1H), 4.25-4.23 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.35-52.30 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 139.5, 137.1, 132.2, 130.5, 129.9, 125.7, 123.1, 113.9, 54.6 (d, *J* = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_8BrFO_2S$ $[M+H]^+$ 278.9989, found 279.0971.



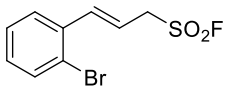
3n

(*E*)-3-(o-tolyl)prop-2-ene-1-sulfonyl fluoride. White soild (**3n**), 141 mg, 66% yield. mp: 36-38℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.46 (d, *J* =7.4 Hz, 1H), 7.25-7.18 (m, 3H), 7.08 (d, *J* =15.7 Hz, 1H), 6.11-6.05 (m, 1H), 4.28-4.25 (m, 2H), 2.38 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.71-51.67 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 139.2, 136.2, 134.3, 130.7, 129.2, 126.5, 126.2, 113.6, 55.0 (d, *J* = 18.2 Hz), 19.8. **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_2S$ $[M+H]^+$ 215.0740, found 215.0740.



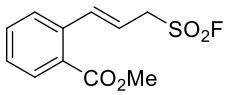
3o

(*E*)-3-(2-methoxyphenyl)prop-2-ene-1-sulfonyl fluoride (**3o**). Colorless oil, 172 mg, 75% yield. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.44 (d, *J* =7.7 Hz, 1H), 7.31 (t, *J* =7.7 Hz, 1H), 7.13 (d, *J* =15.8 Hz, 1H), 6.96 (t, *J* =7.5 Hz, 1H), 6.91 (d, *J* =8.4 Hz, 1H), 6.28-6.22 (m, 1H), 4.26-4.23 (m, 2H), 3.87 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.61-51.56 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 157.3, 136.3, 130.4, 127.8, 124.0, 120.9, 112.6, 111.2, 55.6, 55.5 (d, *J* = 17.2 Hz). **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_3S$ $[M+H]^+$ 231.0540, found 231.0538.



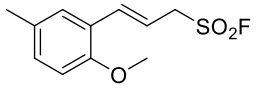
3p

(*E*)-3-(2-bromophenyl)prop-2-ene-1-sulfonyl fluoride (**3p**). White solid, 180 mg, 65% yield. mp: 57-59 °C. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.59 (d, *J* =8.1 Hz, 1H), 7.55 (d, *J* =7.8Hz, 1H), 7.33 (t, *J* =7.6 Hz, 1H), 7.22-7.18 (m, 2H), 6.18-6.12 (m, 1H), 4.31-4.28 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.31-51.27 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 139.7, 135.1, 133.3, 130.5, 127.9, 127.6, 124.1, 115.3, 54.7 (d, *J* = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_8BrFO_2S$ $[M+H]^+$ 278.9998, found 279.0918.



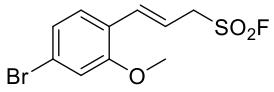
3q

Methyl (E)-2-(3-(fluorosulfonyl)prop-1-en-1-yl)benzoate (**3q**). White solid, 108 mg, 42% yield. mp: 48-50 °C. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.97 (d, *J* =7.7 Hz, 1H), 7.69 (d, *J* =15.7 Hz, 1H), 7.57-7.52 (m, 2H), 7.41 (t, *J* =7.5 Hz, 1H), 6.09-6.03 (m, 1H), 4.30-4.28 (m, 2H), 3.91 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.10-52.06 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 167.4, 140.4, 137.2, 132.7, 130.9, 128.8, 128.7, 128.0, 114.8, 54.8 (d, *J* = 18.2 Hz), 52.4. **ESI-HRMS** (m/z) calculated for $C_{11}H_{11}FO_4S$ $[M+H]^+$ 259.0500, found 259.0504.



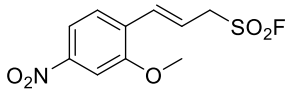
3r

(*E*)-3-(2-methoxy-5-methylphenyl)prop-2-ene-1-sulfonyl fluoride (**3r**). White Solid, 176 mg, 72% yield. mp: 55-57 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.25 (d, J =8.4Hz, 1H), 7.12-7.09 (m, 2H), 6.80 (d, J =8.4 Hz, 1H), 6.26-6.20 (m, 1H), 4.25-4.23 (m, 2H), 3.84 (s, 3H), 2.31 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.53-51.50 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 155.3, 136.4, 130.9, 130.1, 128.3, 123.7, 112.3, 111.2, 55.7, 55.5 (d, J = 18.2 Hz), 20.5. **ESI-HRMS** (m/z) calculated for $C_{11}H_{13}FO_3S$ $[M+H]^+$ 245.1350, found 245.1355.



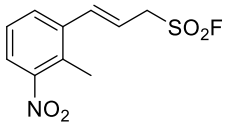
3s

(*E*)-3-(4-bromo-2-methoxyphenyl)prop-2-ene-1-sulfonyl fluoride (**3s**). White solid, 192 mg, 62% yield. mp: 80-82 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.26 (d, J =8.1 Hz, 1H), 7.07 (d, J =8.4 Hz, 1H), 7.01-6.96 (m, 2H), 6.24-6.18 (m, 1H), 4.21-4.20 (m, 2H), 3.84 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 51.9-51.8 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$):** δ 157.7, 135.4, 128.8, 124.0, 123.8, 123.1, 114.8, 113.3, 55.9, 55.4 (d, J = 17.2 Hz). **ESI-HRMS** (m/z) calculated for $C_{10}H_{10}BrFO_3S$ $[M+H]^+$ 309.0966, found 309.0970.



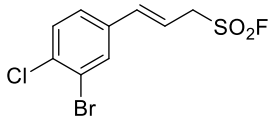
3t

(*E*)-3-(2-methoxy-4-nitrophenyl)prop-2-ene-1-sulfonyl fluoride (**3t**). Yellow solid, 187 mg, 68% yield. mp: 98-99 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.83 (d, J =8.4 Hz, 1H), 7.75 (s, 1H), 7.57 (d, J =8.4 Hz, 1H), 7.14 (d, J = 15.8 Hz, 1H), 6.45-6.39 (m, 1H), 4.31-4.28 (m, 2H), 3.97 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.7-52.6 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 157.4, 148.9, 134.4, 130.4, 128.0, 117.2, 116.1, 106.2, 56.3, 55.0 (d, J = 18.2 Hz). **ESI-HRMS** (m/z) calculated for $C_{10}H_{10}FNO_5S$ $[M+H]^+$ 276.0400, found 276.0400.



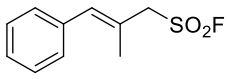
3u

(*E*)-3-(2-methyl-3-nitrophenyl)prop-2-ene-1-sulfonyl fluoride (**3u**). White solid, 178 mg, 69% yield. mp: 69-71 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.75 (d, *J* =7.9 Hz, 1H), 7.63 (d, *J* =7.7 Hz, 1H), 7.35 (t, *J* = 7.9 Hz, 1H), 7.12 (d, *J* = 15.6 Hz, 1H), 6.15-6.09 (m, 1H), 4.31-4.29 (m, 2H), 2.46 (s, 3H). **^{19}F NMR (471 MHz, $CDCl_3$):** δ 52.50-52.46 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 151.5, 138.0, 137.6, 130.7, 130.1, 126.9, 124.4, 117.5, 54.5 (d, *J* = 18.2 Hz), 15.4. **ESI-HRMS** (m/z) calculated for $C_{10}H_{10}FNO_4S$ $[M+H]^+$ 260.0424, found 260.0424.



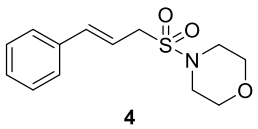
3v

(*E*)-3-(3-bromo-4-chlorophenyl)prop-2-ene-1-sulfonyl fluoride (**3v**). White solid, 197 mg, 63% yield. mp: 61-63 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.67 (s, 1H), 7.43 (d, *J* =8.3 Hz, 1H), 7.29 (d, *J* =8.4 Hz, 1H), δ = 6.73 (d, *J* = 15.7 Hz, 1H), 6.22-6.16 (m, 1H), 4.25-4.23 (m, 2H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 52.53-52.48 (m, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 138.5, 135.2, 135.1, 132.1, 130.7, 126.8, 123.1, 114.4, 54.5 (d, *J* = 19.1 Hz). **ESI-HRMS** (m/z) calculated for $C_9H_7BrClFO_2S$ $[M+H]^+$ 312.9075, found 312.9073.



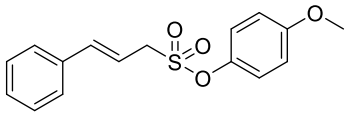
3w

(*E*)-2-methyl-3-phenylprop-2-ene-1-sulfonyl fluoride (**3w**). yellow oil, 95 mg, 44% yield. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.41-7.38 (m, 2H), 7.33-7.30 (m, 3H), δ = 6.72 (s, 1H), 4.19 (d, *J* = 3.0 Hz, 2H), 2.12 (d, *J* = 1.1 Hz, 3H). **^{19}F NMR (471 MHz, $CDCl_3$)**: δ 54.4 (s, -SO_2F). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 136.7, 136.0, 129.1, 128.5, 127.9, 123.5, 61.5 (d, *J* = 16.3 Hz), 18.2. **ESI-HRMS** (m/z) calculated for $C_{10}H_{11}FO_2S$ $[M+H]^+$ 215.0537, found 215.0536.



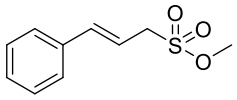
4

4-(cinnamylsulfonyl)morpholine (**4**). White solid, 265 mg, 99% yield. mp: 116-118 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.41-7.39 (m, 2H), 7.37-7.34 (m, 2H), 7.32-7.29 (m, 1H), 6.69 (d, *J* = 15.9 Hz, 1H), 6.26-6.20 (m, 1H), 3.89 (d, *J* = 7.4 Hz, 2H), 3.72-3.71 (m, 4H), 3.35-3.34 (m, 4H). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 138.5, 135.7, 128.9, 128.8, 126.8, 116.1, 66.8, 54.4, 46.5. **ESI-HRMS** (m/z) calculated for $C_{13}H_{17}NO_3S$ $[M+H]^+$ 269.1066, found 268.1061.



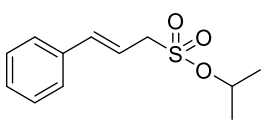
5

4-Methoxyphenyl (*E*)-3-phenylprop-2-ene-1-sulfonate (**5**). White solid, 296 mg, 97% yield. mp: 69-73 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.42 (d, *J* = 7.6 Hz, 2H), 7.36 (t, *J* = 7.4 Hz, 2H), 7.33-7.30 (m, 1H), 7.21 (d, *J* = 8.5 Hz, 2H), 6.90 (d, *J* = 8.6 Hz, 2H), 6.76 (d, *J* = 15.7 Hz, 1H), 6.30-6.24 (m, 1H), .4.11 (d, *J* = 7.3 Hz, 2H), 3.80 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 158.5, 142.8, 139.6, 135.6, 128.91, 128.87, 126.9, 123.3, 115.0, 114.5, 55.8, 54.2. **ESI- HRMS** (m/z) calculated for $C_{16}H_{16}O_4S$ $[M+H]^+$ 305.0995, found 309.0904.



6a

Methyl (*E*)-3-phenylprop-2-ene-1-sulfonate (**6a**). White solid, 202 mg, 95% yield. mp: 44-46 ℃. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.42 (d, *J* = 7.3 Hz, 2H), 7.35 (t, *J* = 7.4 Hz, 2H), 7.31-7.29 (m, 1H), 6.73 (d, *J* = 15.9 Hz, 1H), 6.25-6.19 (m, 1H), .4.01 (d, *J* = 7.5 Hz, 2H), 3.93 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 139.1, 135.6, 128.84, 128.82, 126.8, 114.8, 56.4, 54.1. **ESI-HRMS** (m/z) calculated for $C_{10}H_{12}O_3S$ $[M+H]^+$ 213.1084, found 213.1081.

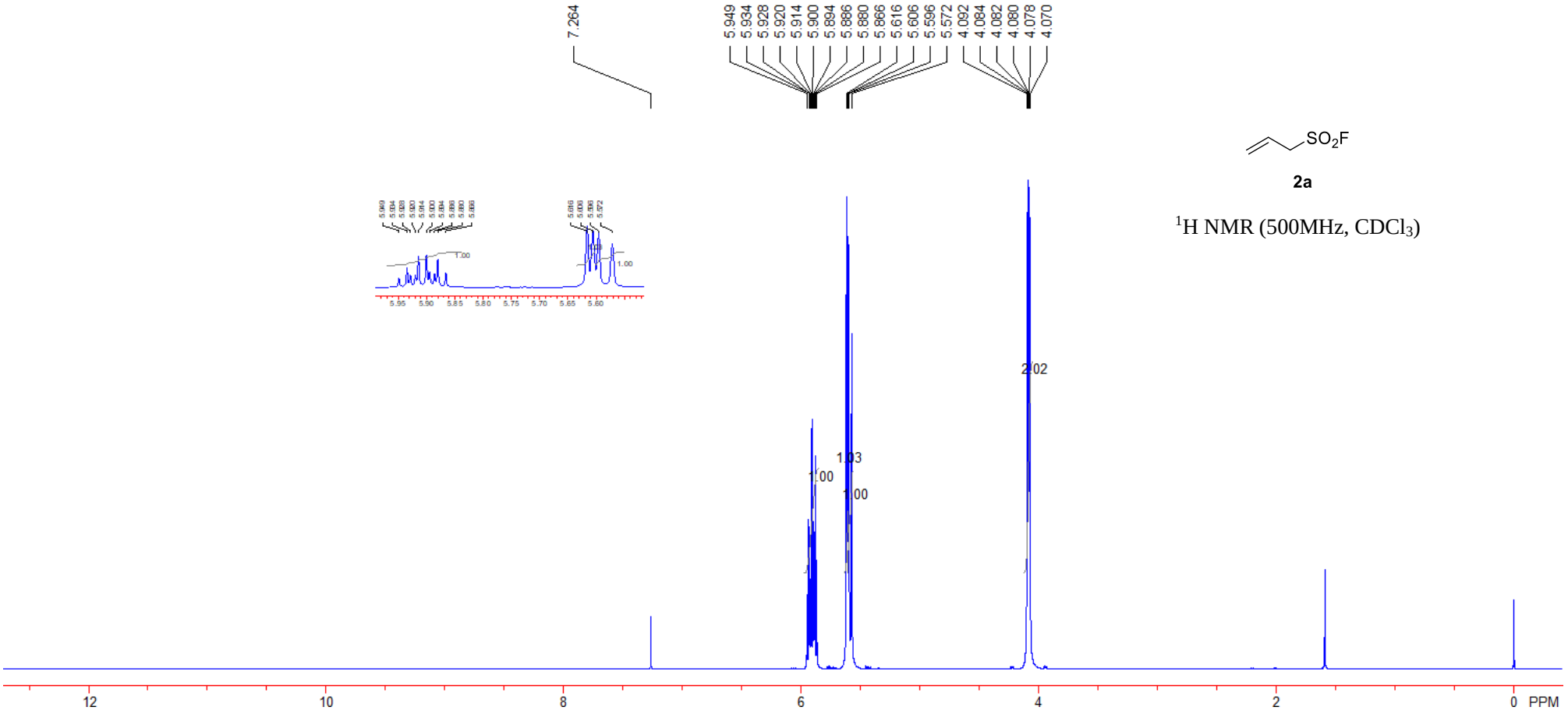


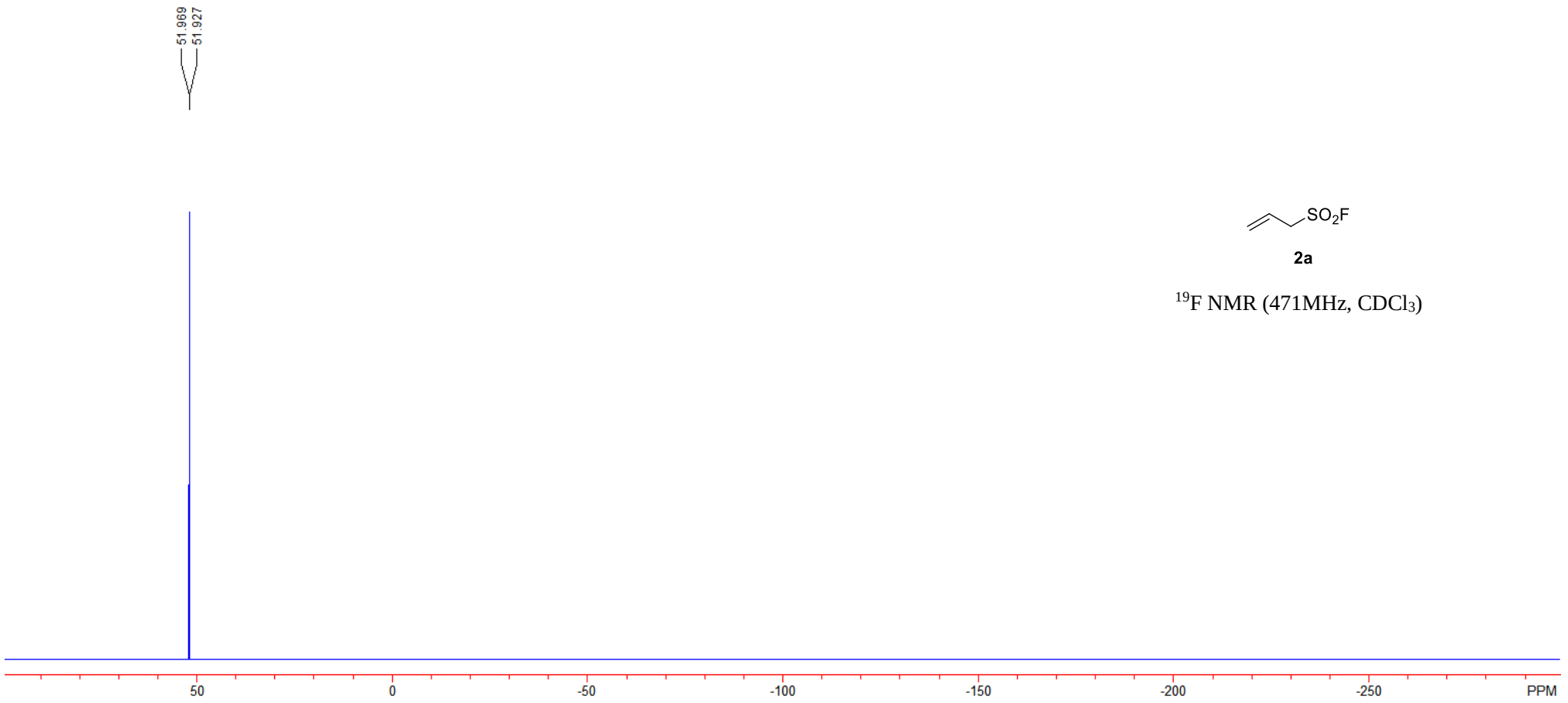
6b

Isopropyl (*E*)-3-phenylprop-2-ene-1-sulfonate (**6b**). White solid, 160 mg, 67% yield. mp:

76-78 °C. **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.41 (d, *J* = 7.7 Hz, 2H), 7.35 (t, *J* = 7.4 Hz, 2H), 7.31-7.29 (m, 1H), 6.71 (d, *J* = 15.9 Hz, 1H), 6.25-6.19 (m, 1H), 4.99-4.94 (m, 1H), 3.96 (d, *J* =7.5 Hz, 2H), 1.41 (d, *J* = 6.1 Hz, 6H). **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 138.9, 135.8, 128.9, 128.8, 126.8, 115.4, 77.7, 55.6, 23.3. **ESI-HRMS** (m/z) calculated for $C_{12}H_{16}O_3S$ $[M+H]^+$ 241.1885, found 241.1861.

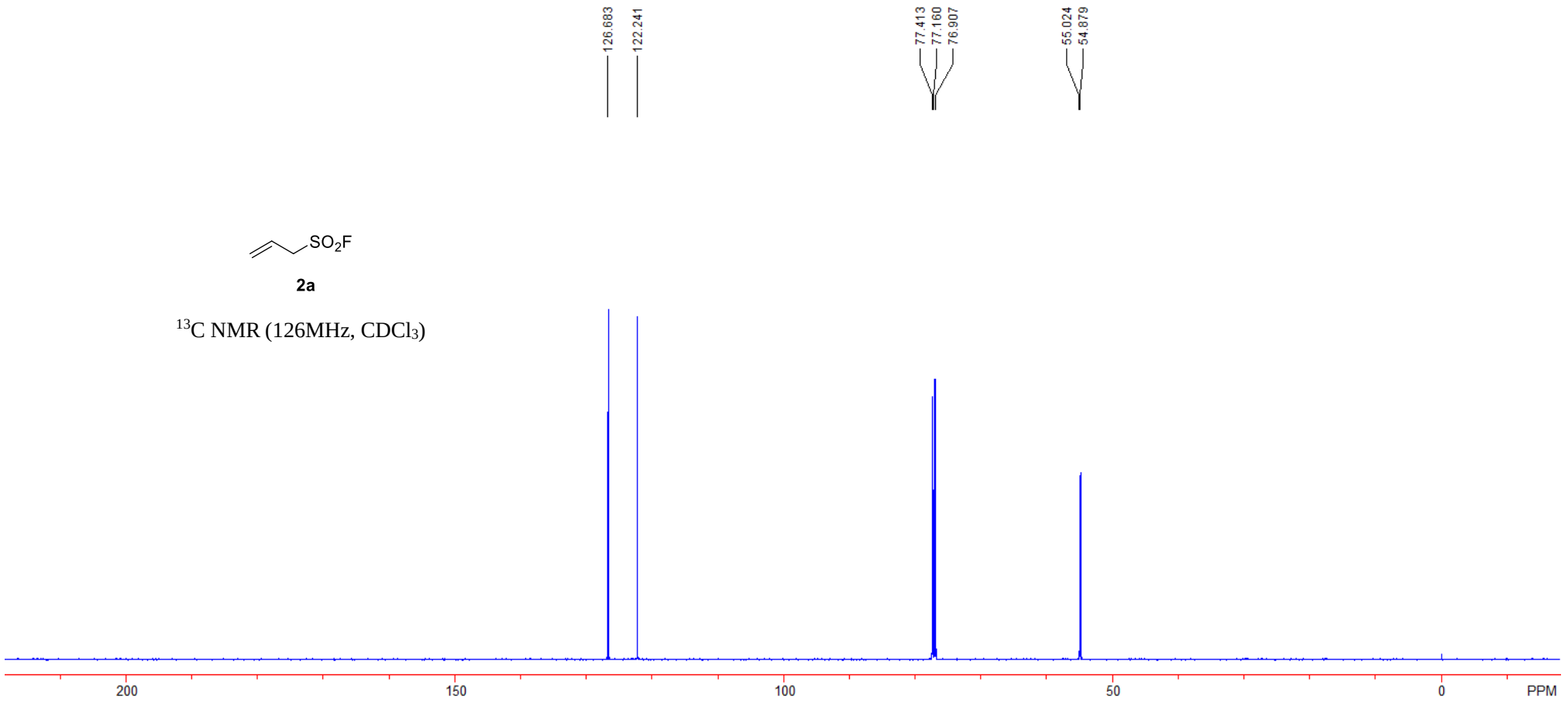
5. NMR spectra.

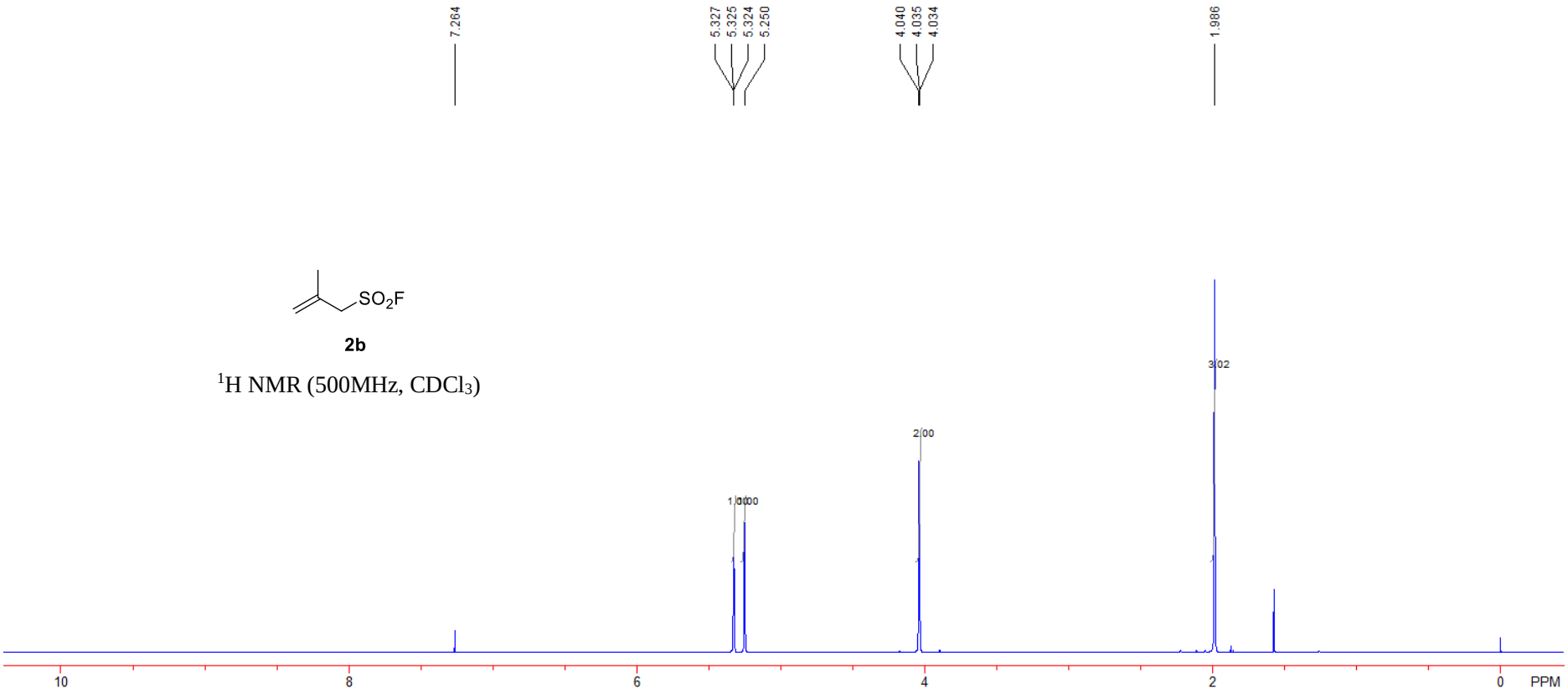


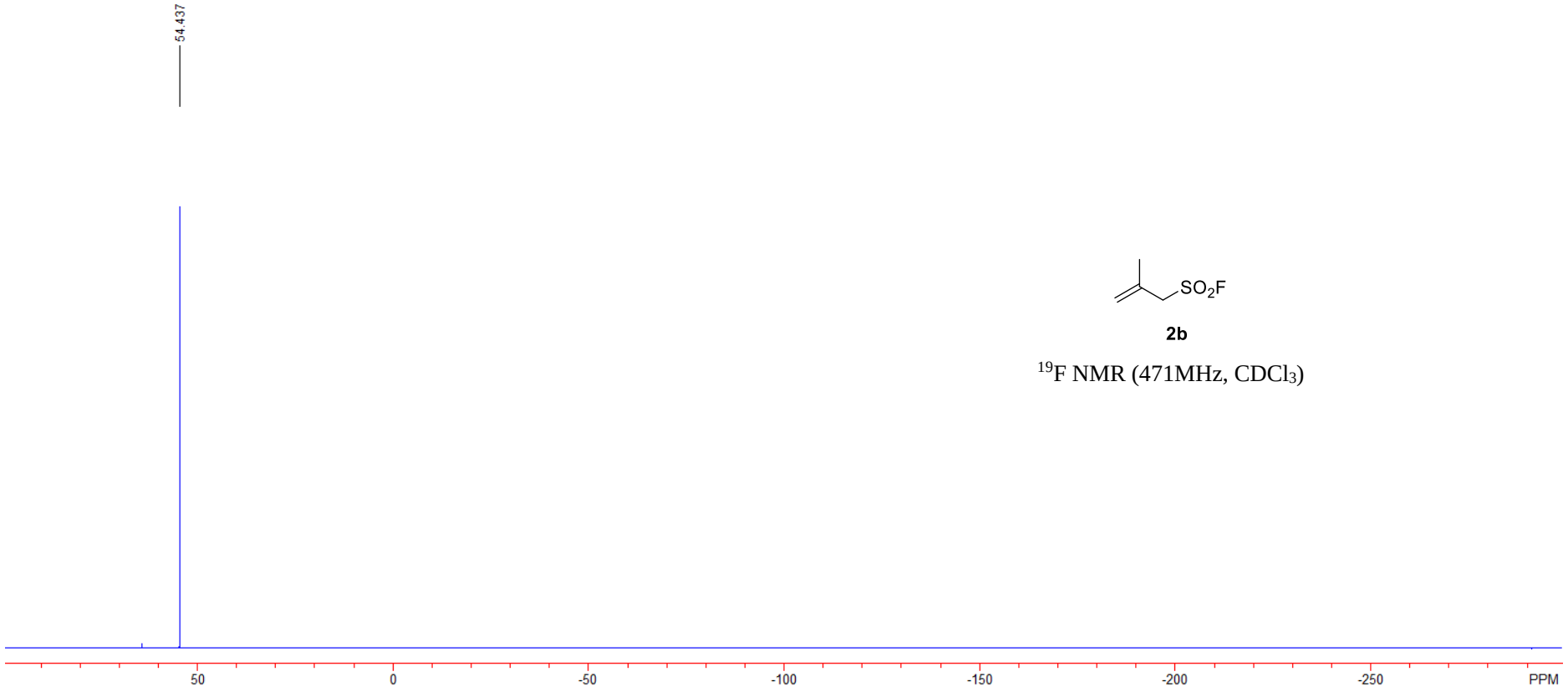


2a

^{19}F NMR (471MHz, $CDCl_3$)

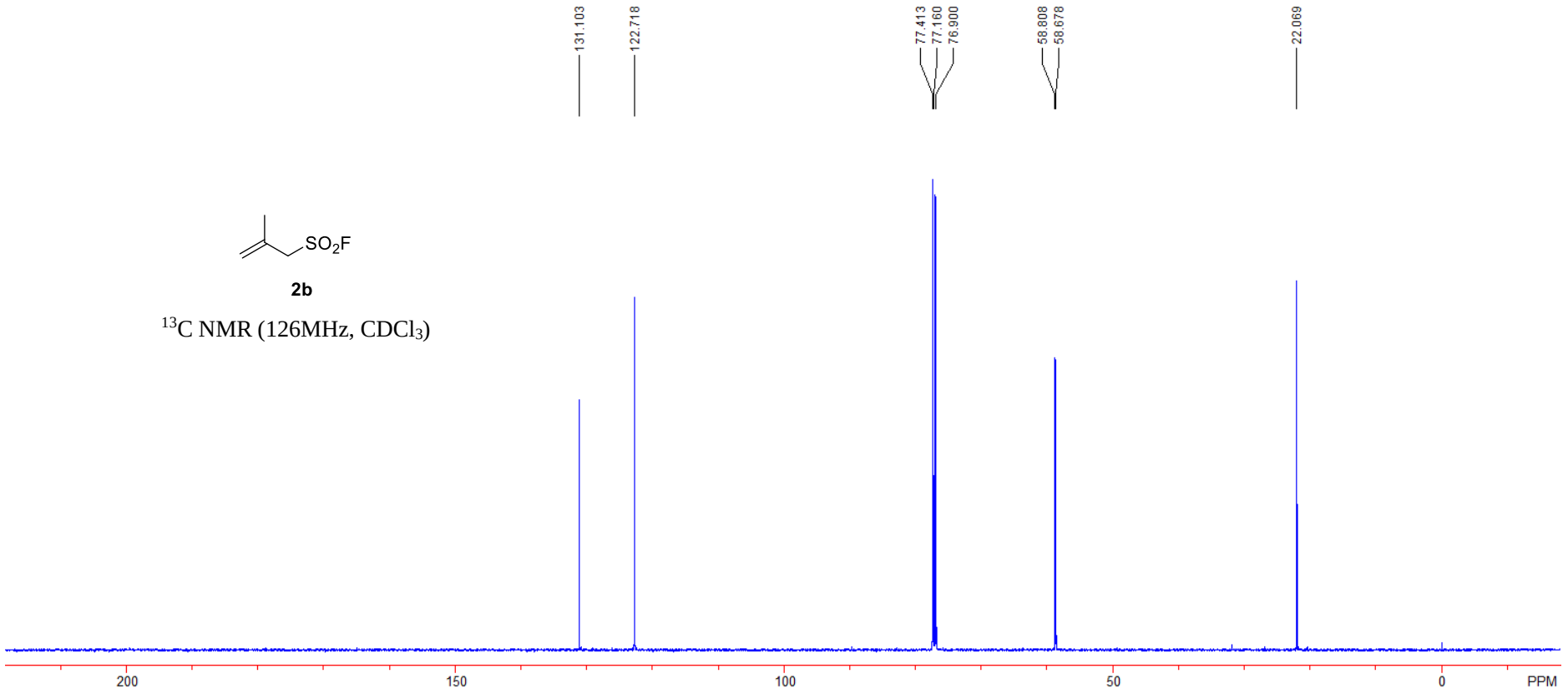

126.683
122.241
77.413
77.160
76.907
55.024
54.879
SO2F
2a
13C NMR (126MHz, CDCl3)
200
150
100
50
0
PPM


7.264
5.327
5.325
5.324
5.250
4.040
4.035
4.034
1.986
SO2F
2b
1H NMR (500MHz, CDCl3)
3.02
2.00
1.0000
10
8
6
4
2
0
PPM



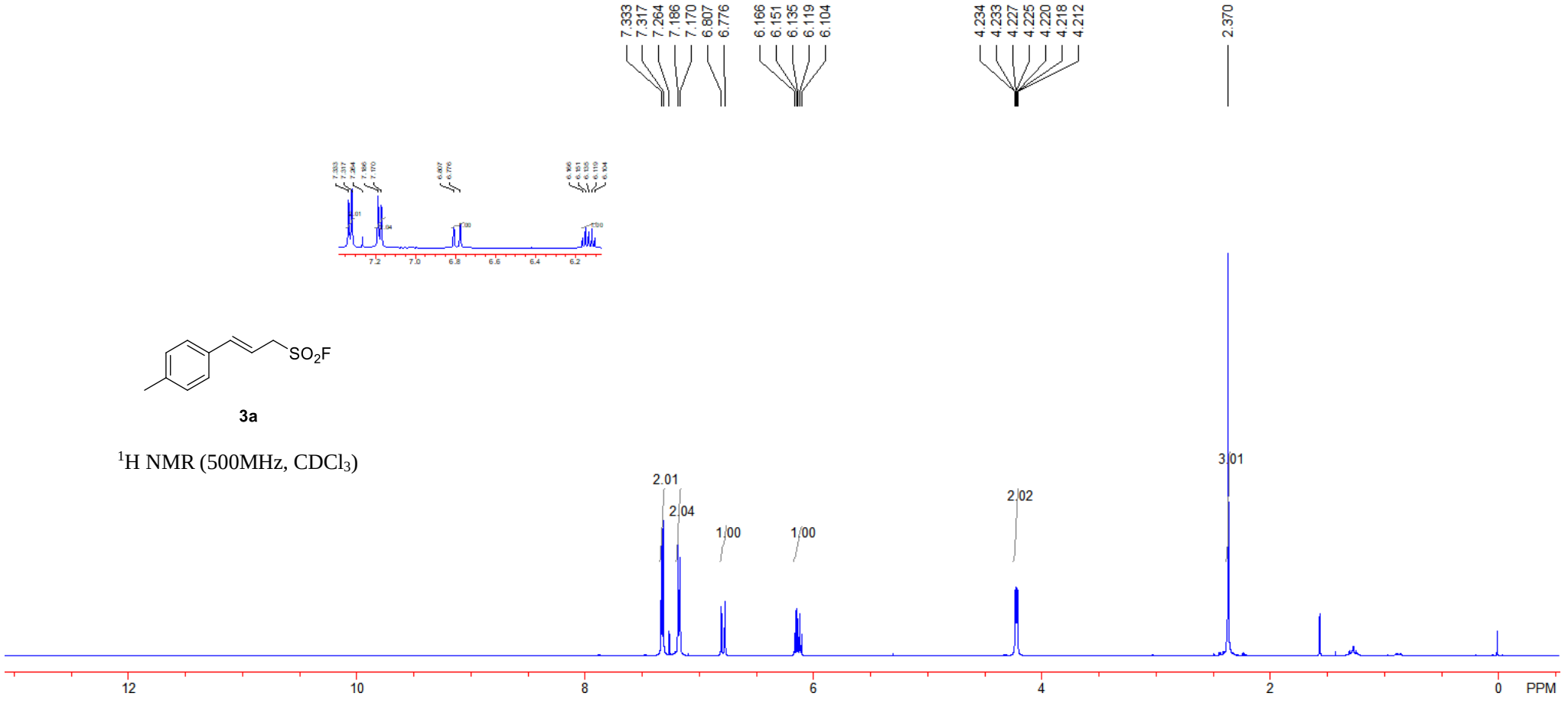
2b

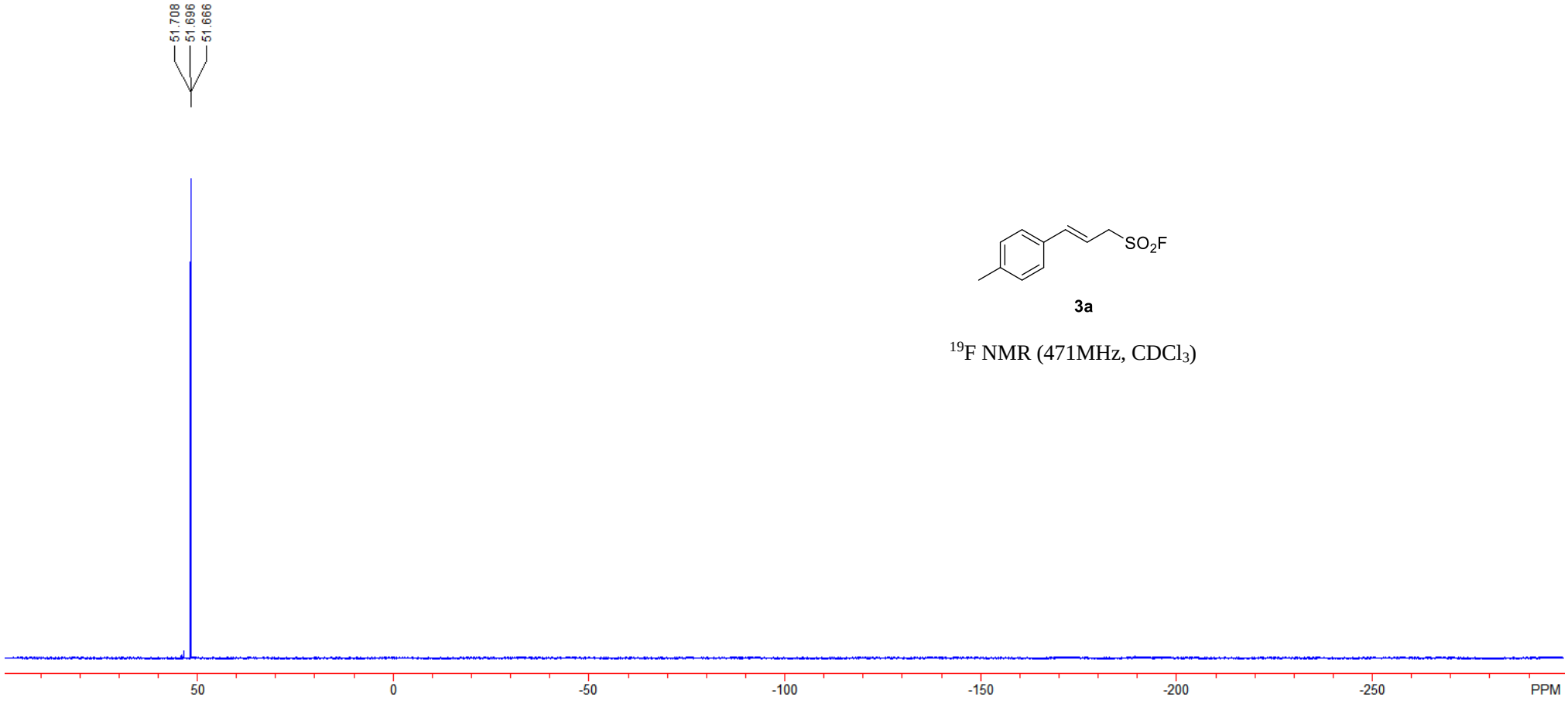
^{19}F NMR (471MHz, $CDCl_3$)



2b

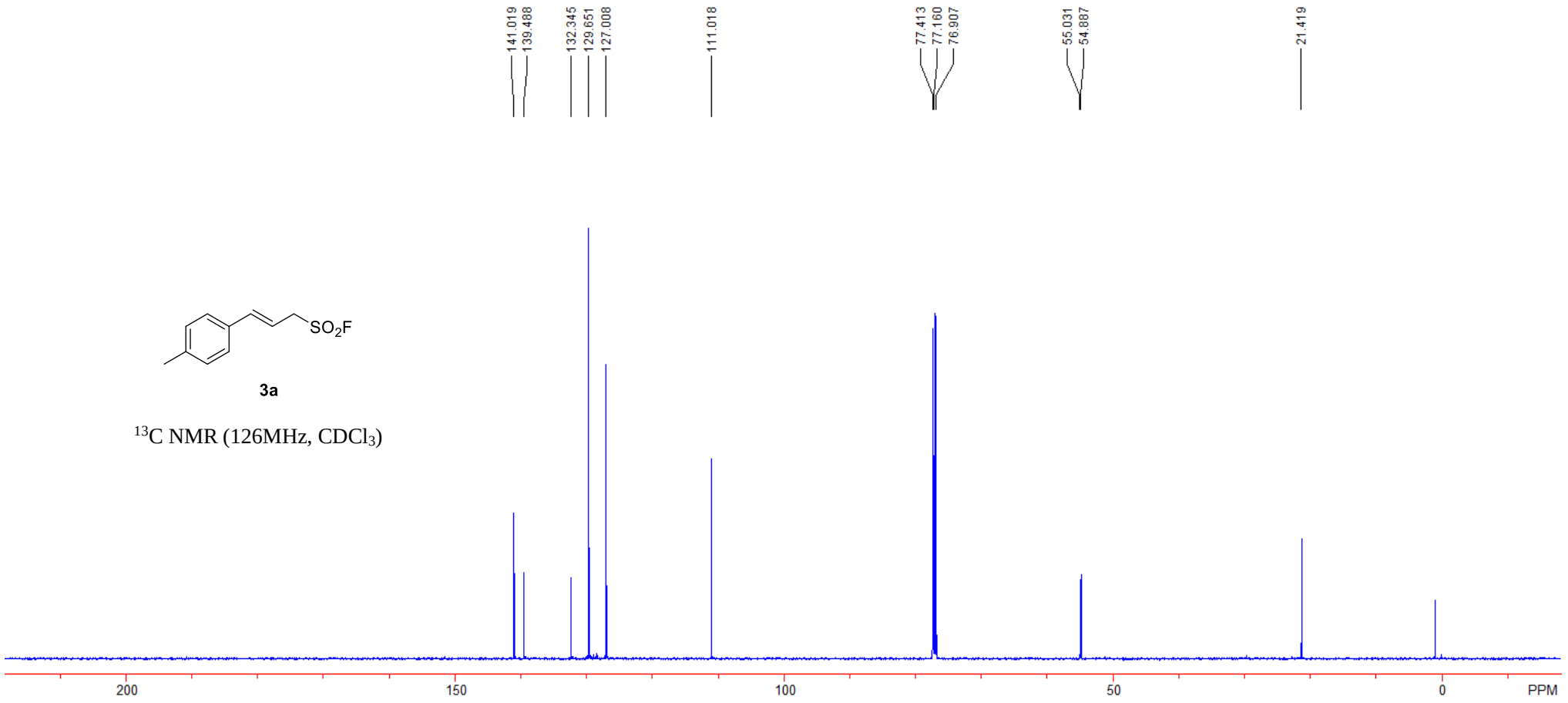
^{13}C NMR (126MHz, $CDCl_3$)


7.333
7.317
7.264
7.186
7.170
6.807
6.776
6.166
6.151
6.135
6.119
6.104
4.234
4.233
4.227
4.225
4.220
4.218
4.212
2.370
SO2F
3a
1H NMR (500MHz, CDCl3)
2.01
2.04
1.00
1.00
2.02
3.01
12
10
8
6
4
2
0
PPM



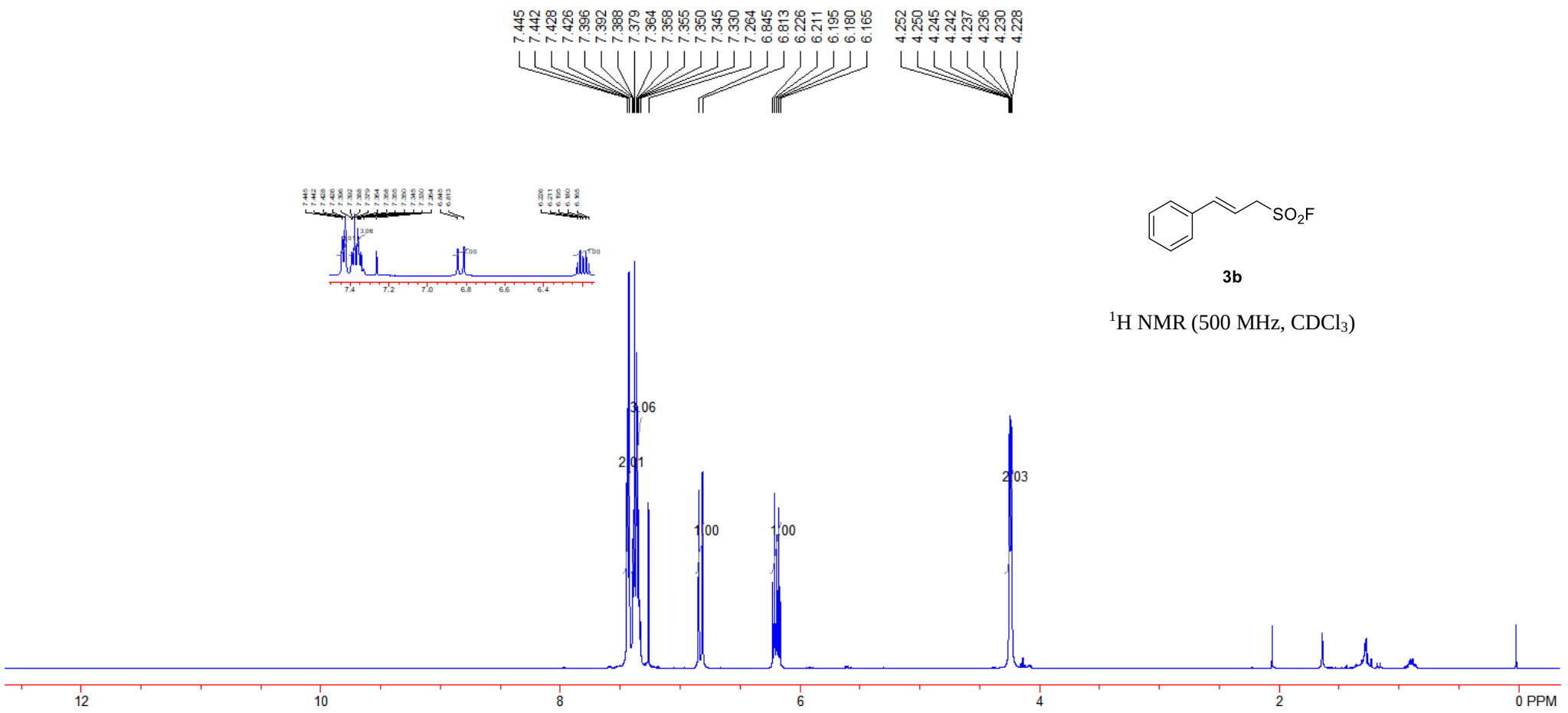
3a

^{19}F NMR (471MHz, $CDCl_3$)



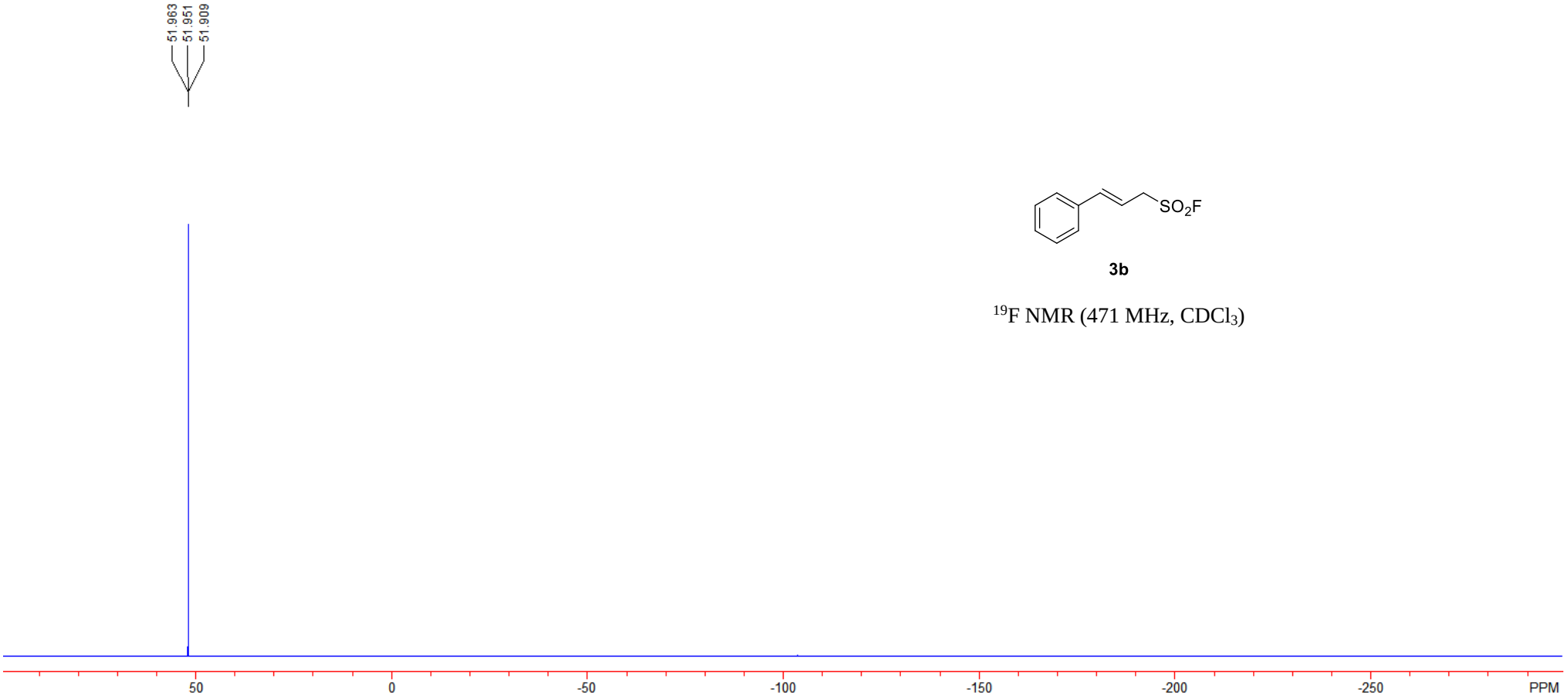
3a

^{13}C NMR (126MHz, $CDCl_3$)



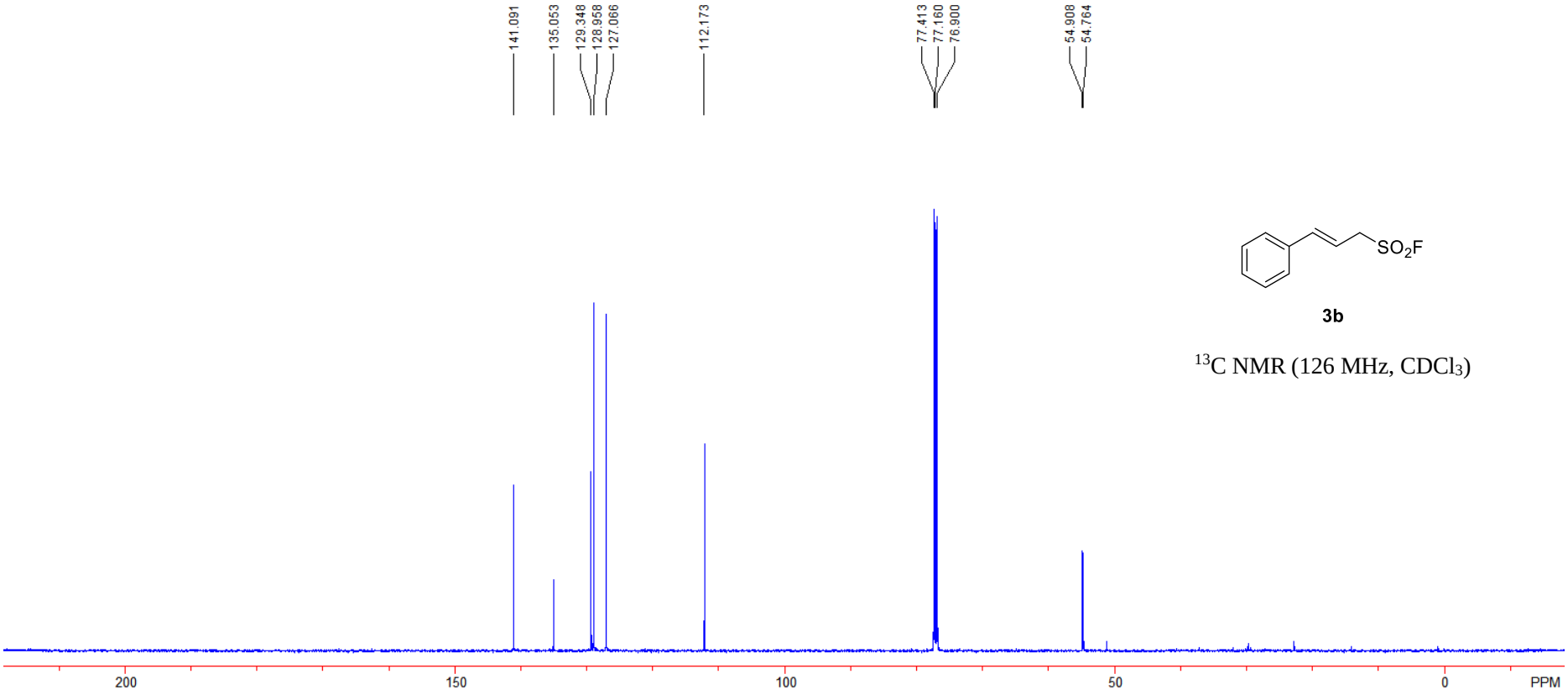
3b

^{1}H NMR (500 MHz, $CDCl_3$)



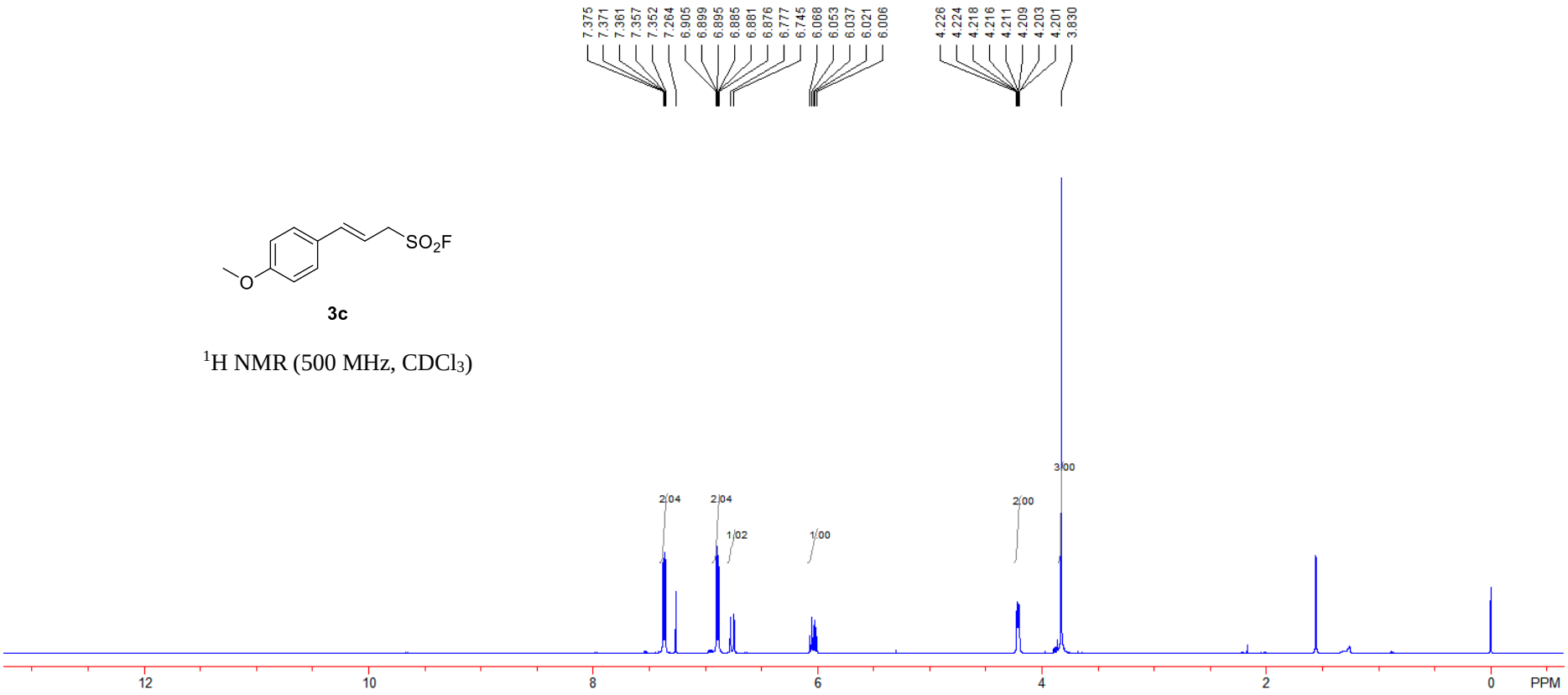
3b

^{19}F NMR (471 MHz, $CDCl_3$)

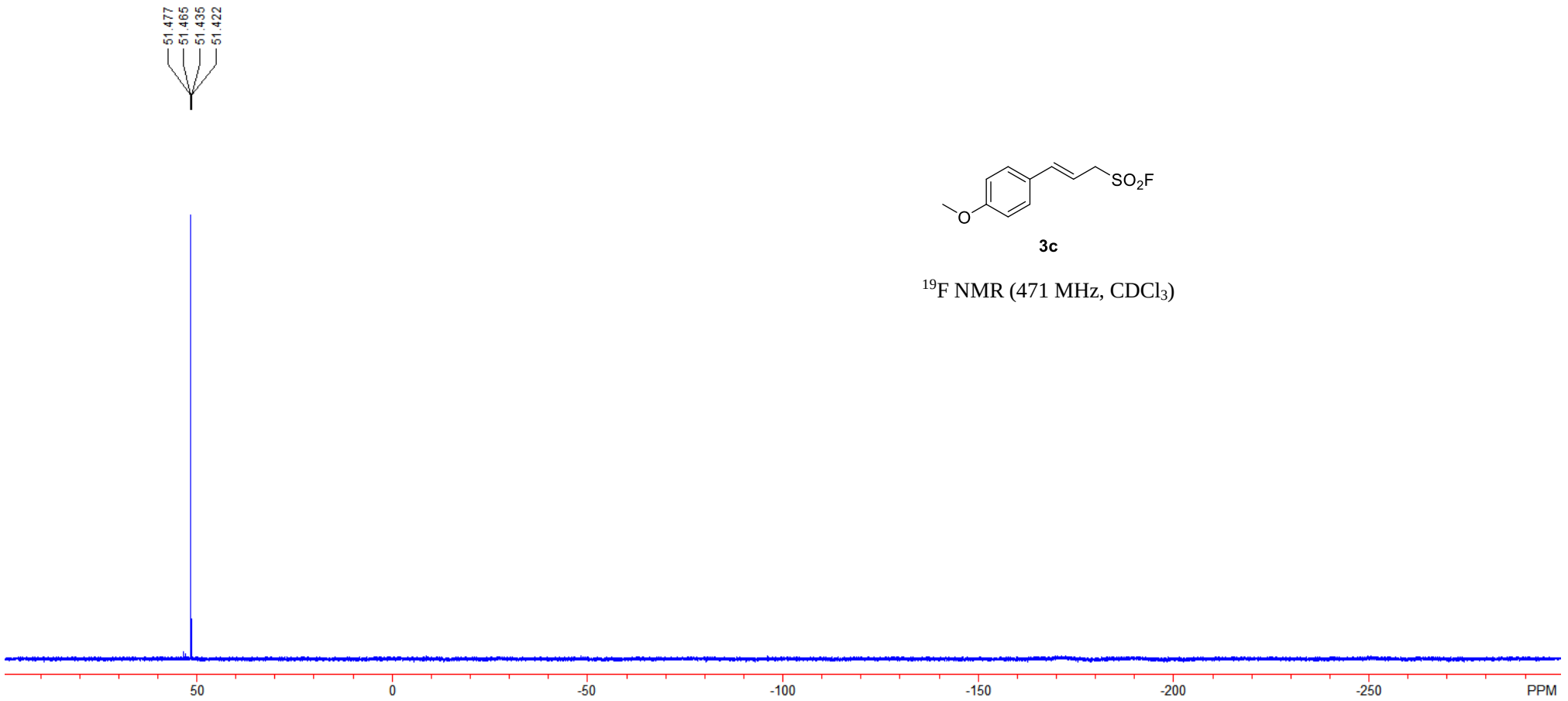


3b

^{13}C NMR (126 MHz, $CDCl_3$)

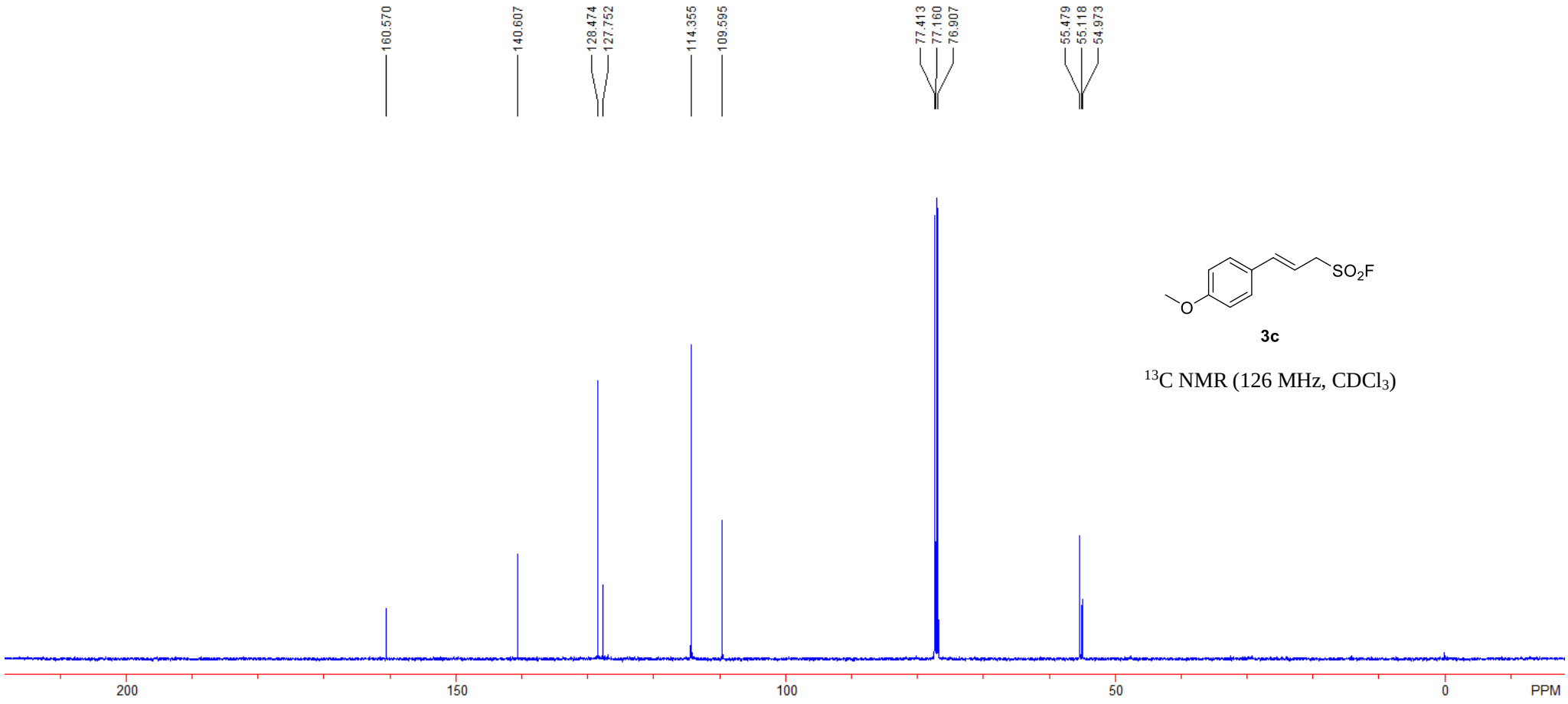


^{1}H NMR (500 MHz, $CDCl_3$)



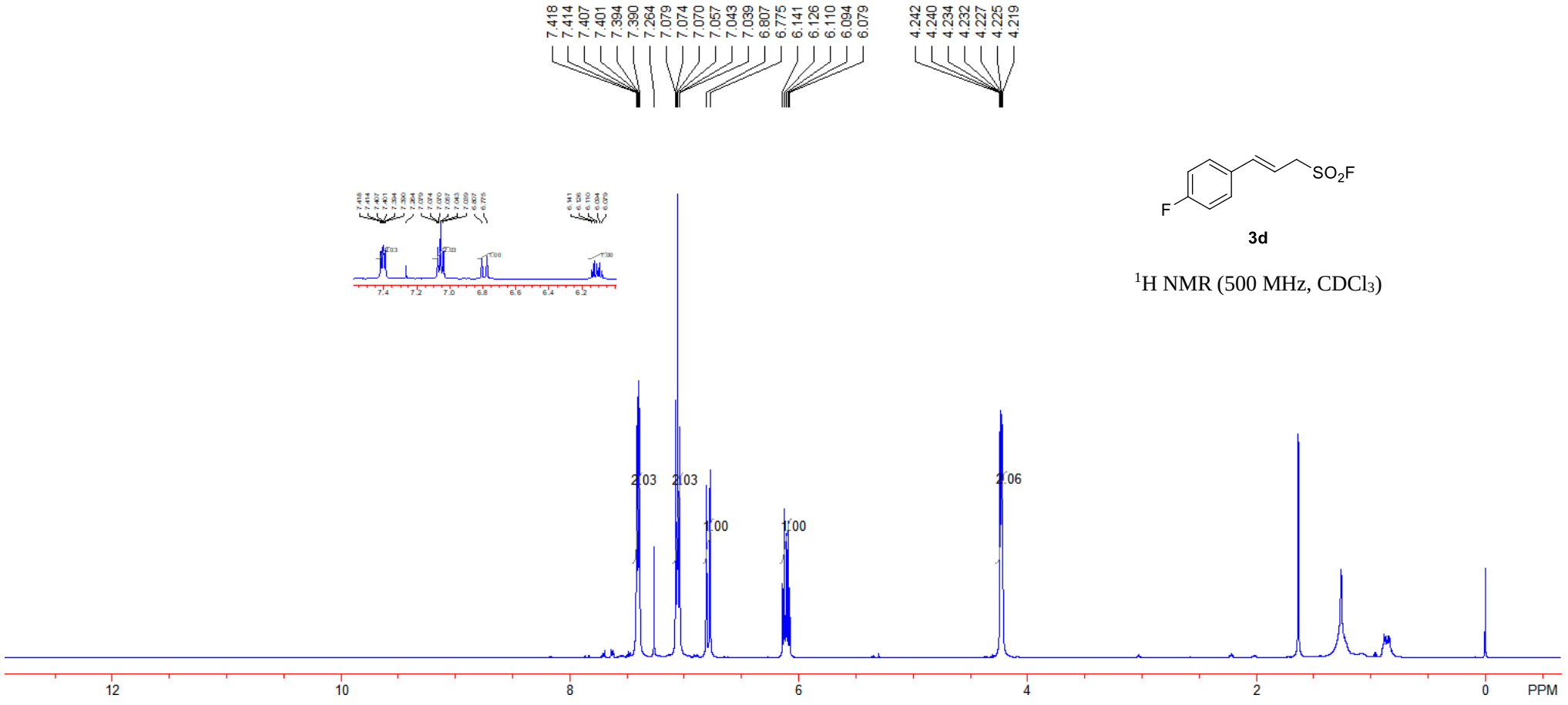
3c

^{19}F NMR (471 MHz, $CDCl_3$)



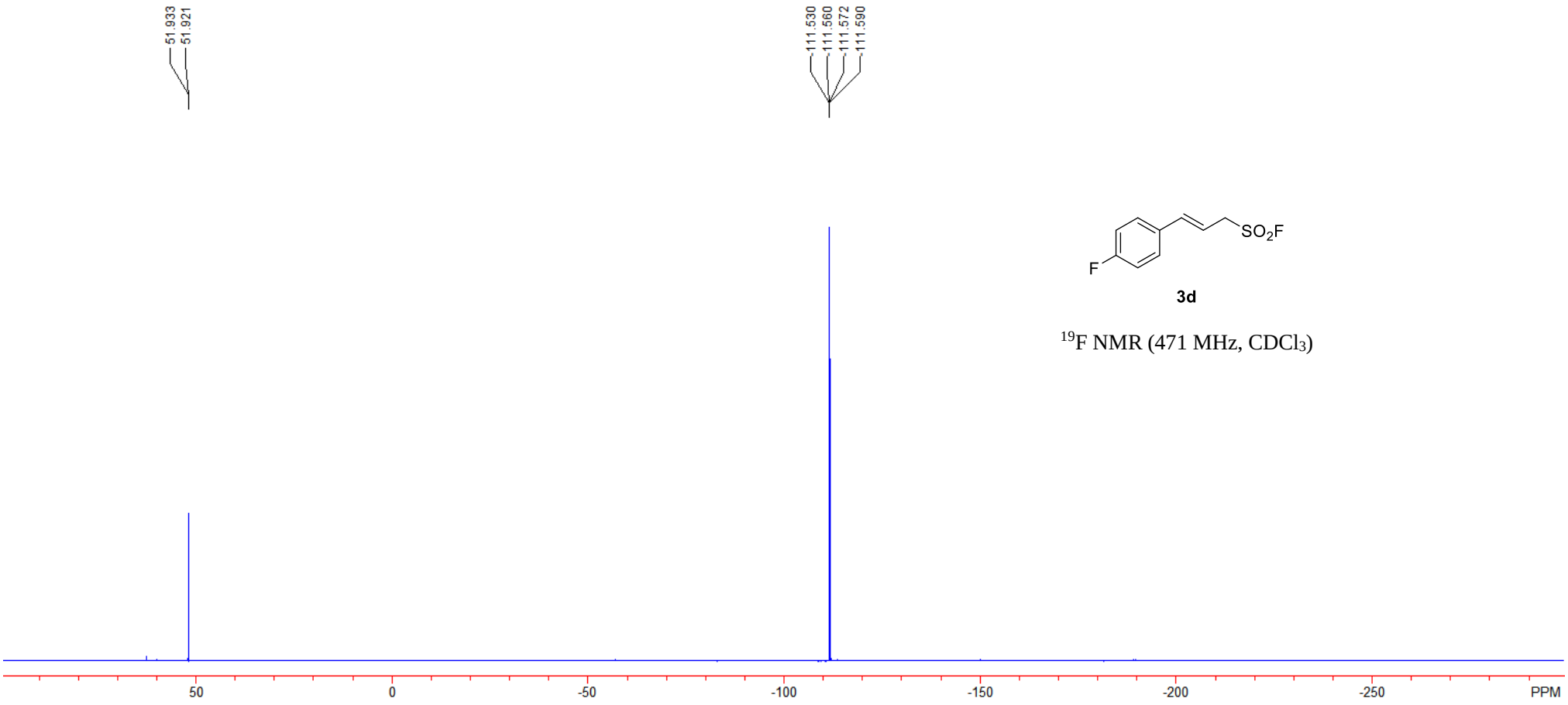
3c

^{13}C NMR (126 MHz, $CDCl_3$)



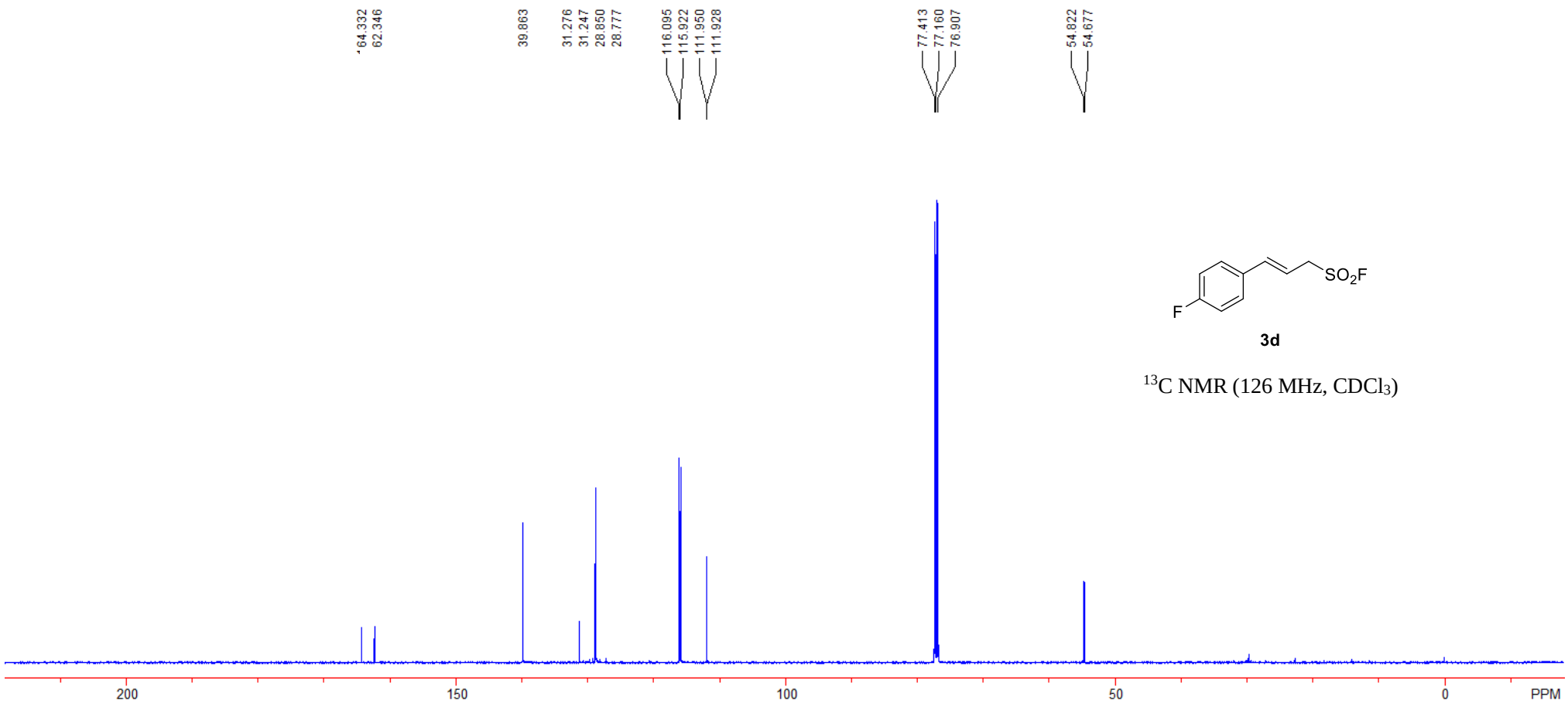
3d

^{1}H NMR (500 MHz, $CDCl_3$)



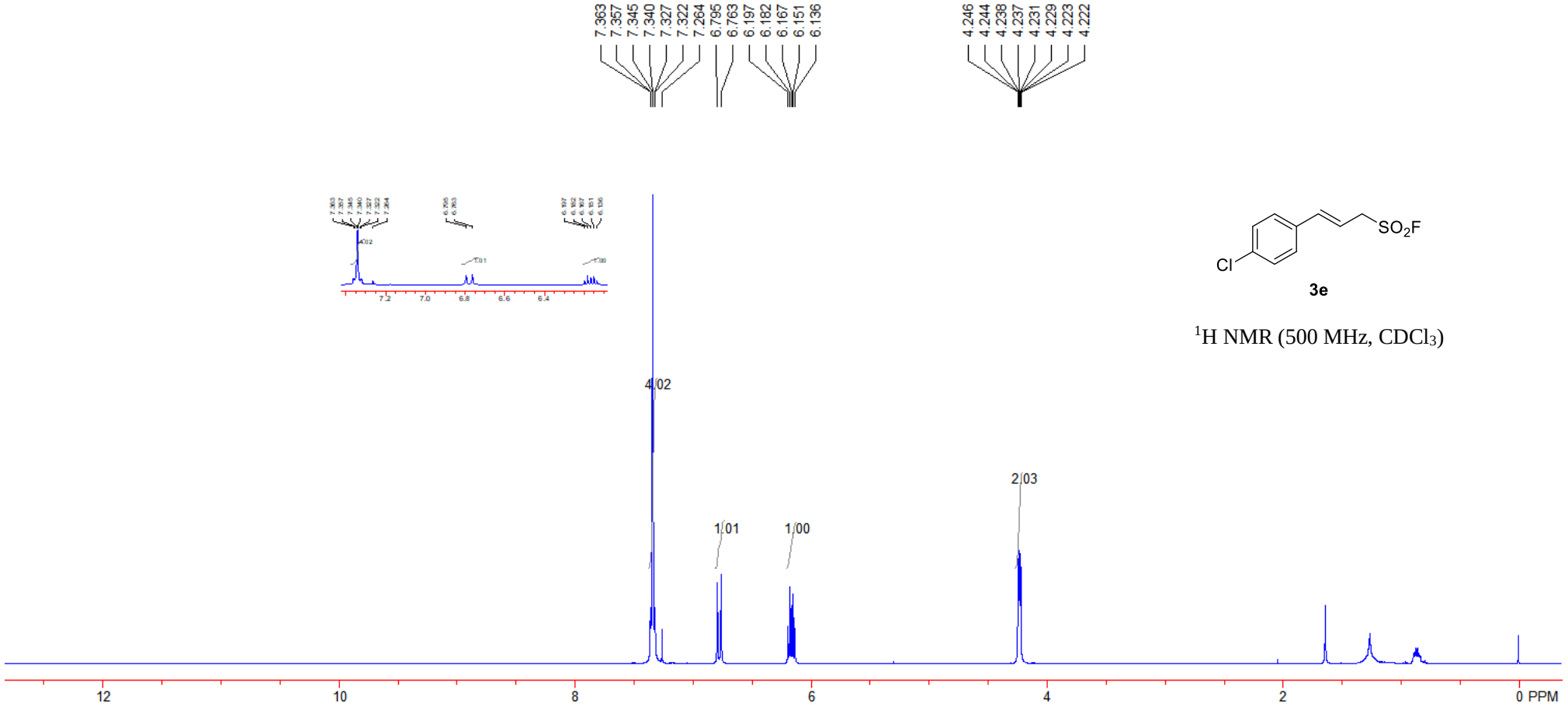
3d

^{19}F NMR (471 MHz, $CDCl_3$)



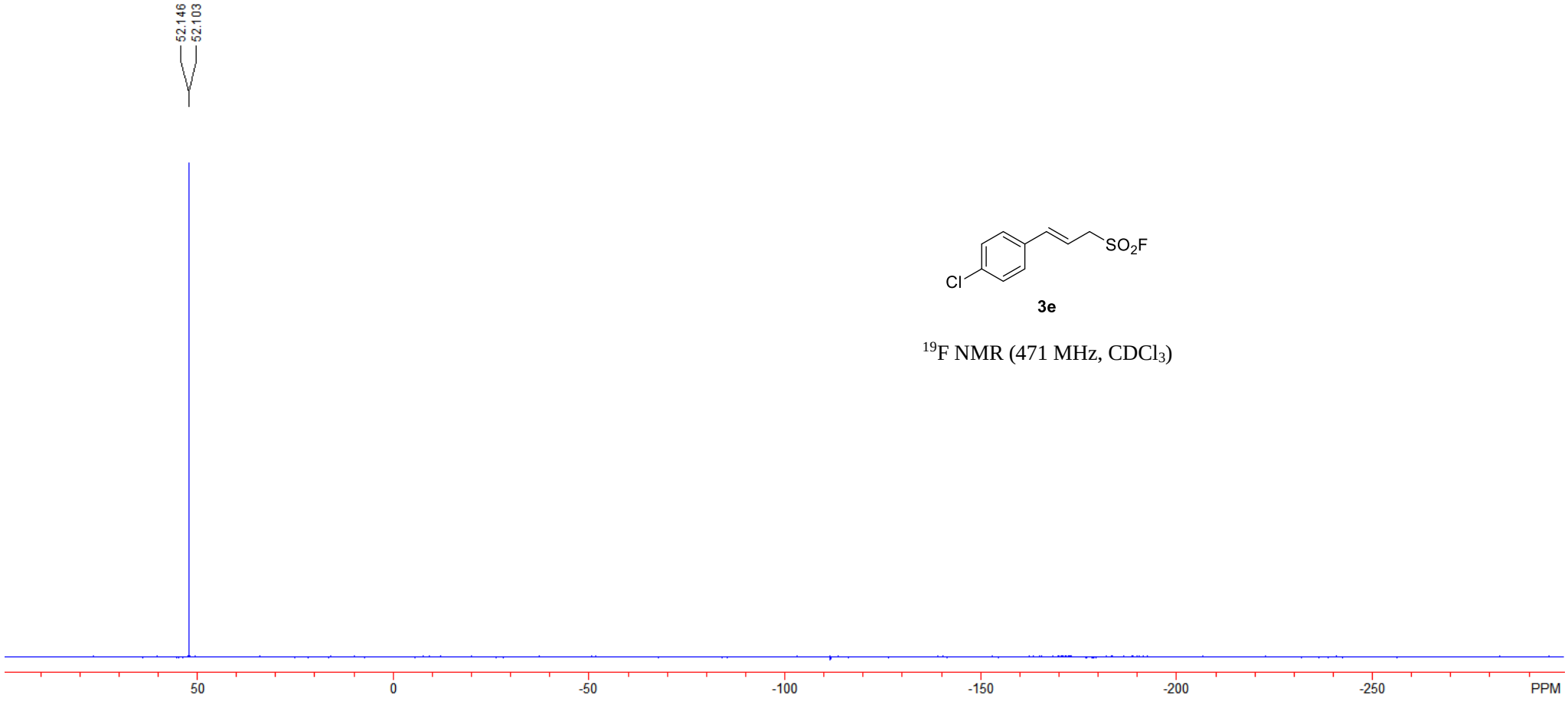
3d

^{13}C NMR (126 MHz, $CDCl_3$)



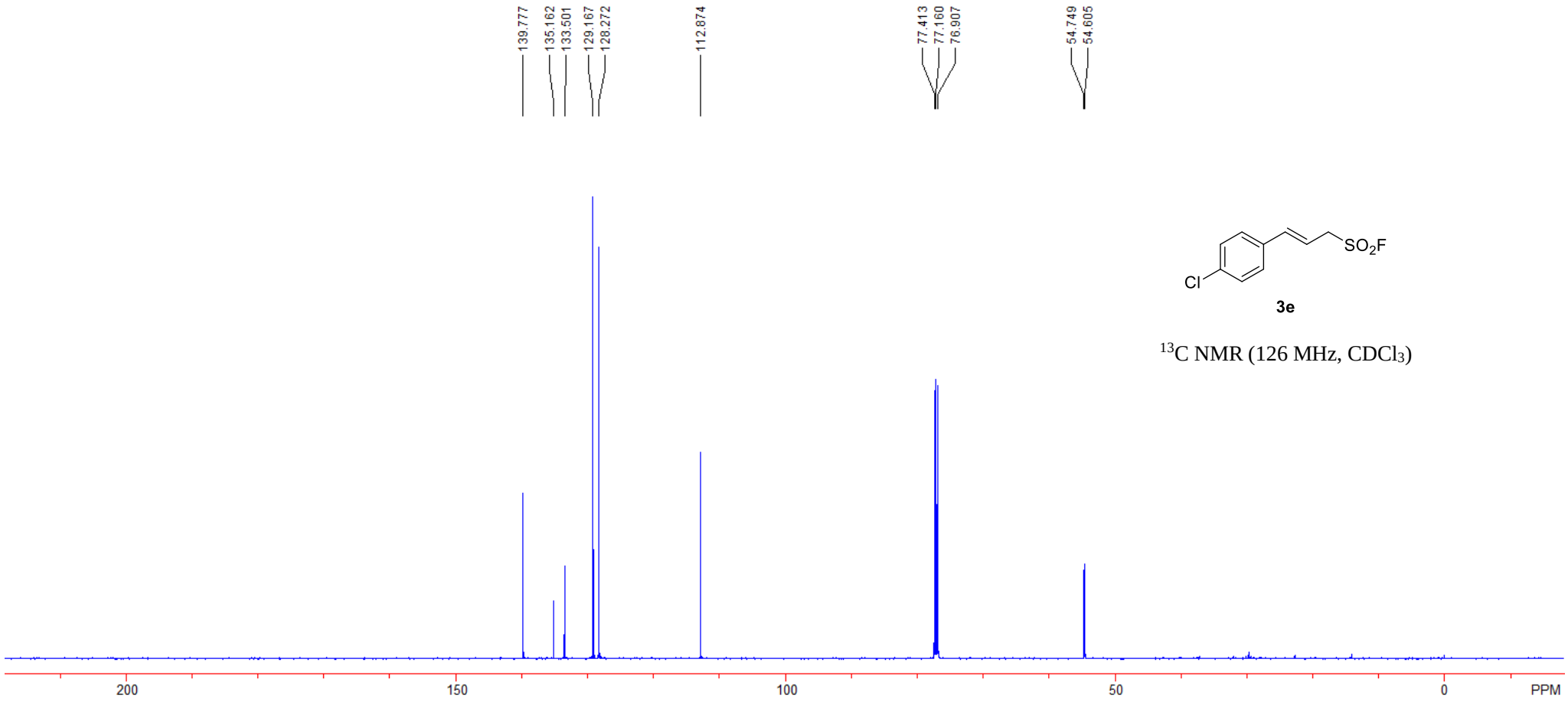
3e

^{1}H NMR (500 MHz, $CDCl_3$)



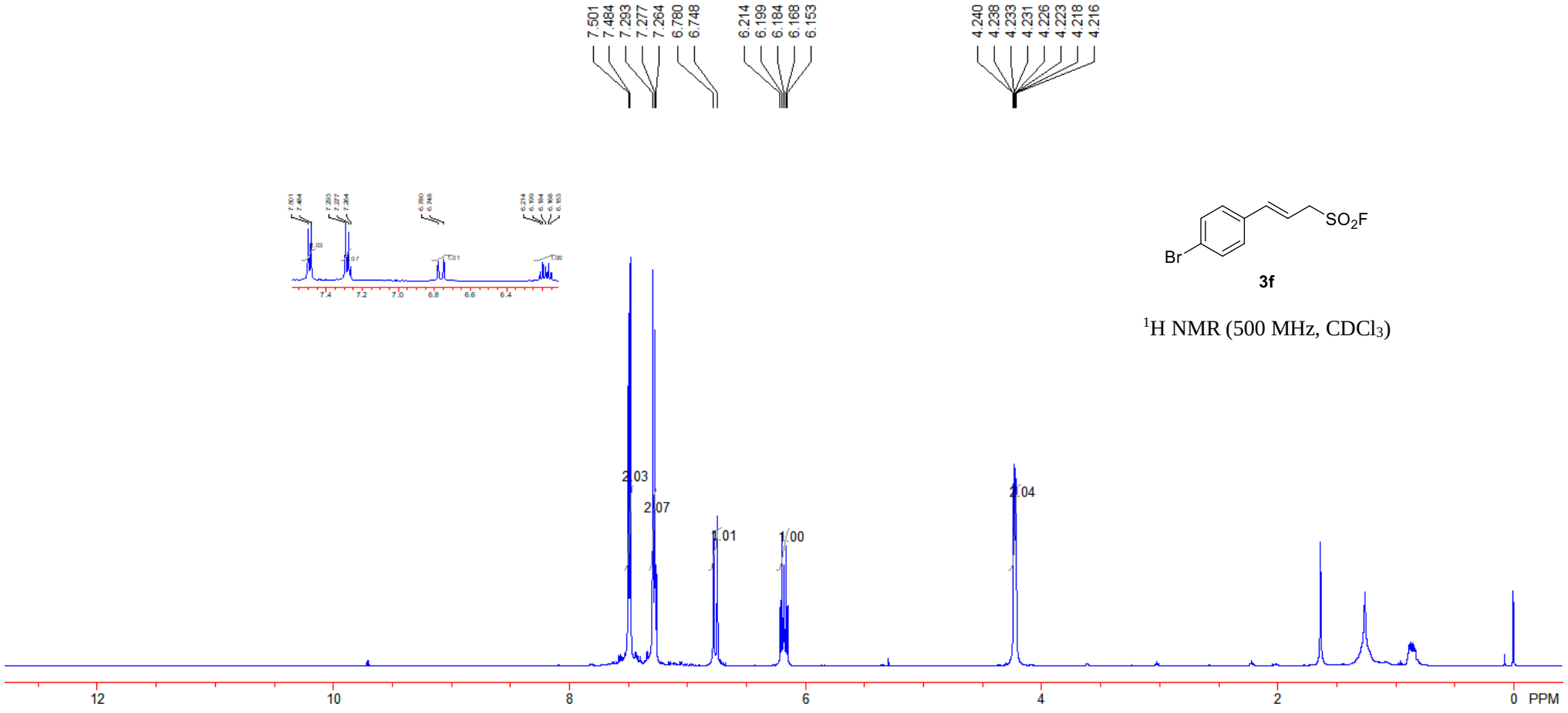
3e

^{19}F NMR (471 MHz, $CDCl_3$)



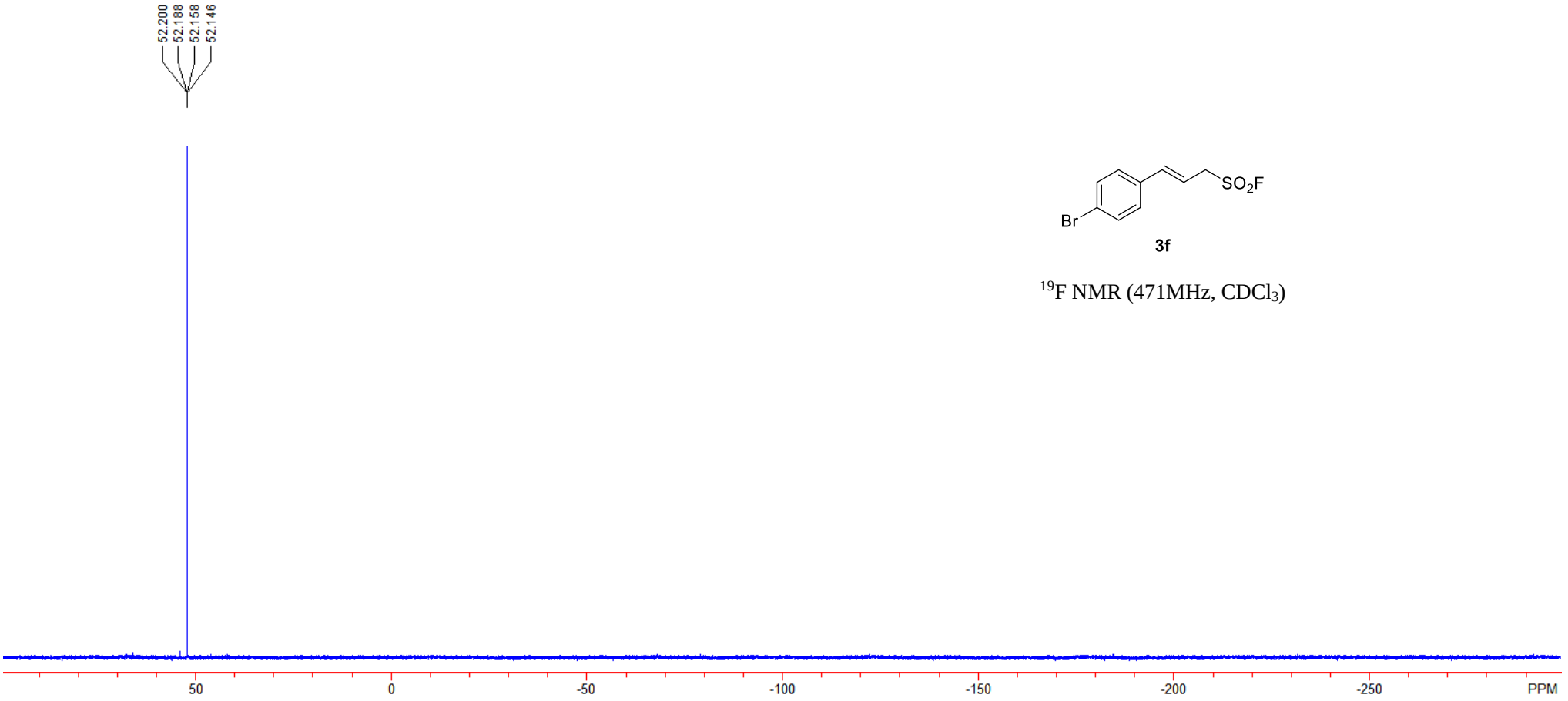
3e

^{13}C NMR (126 MHz, $CDCl_3$)



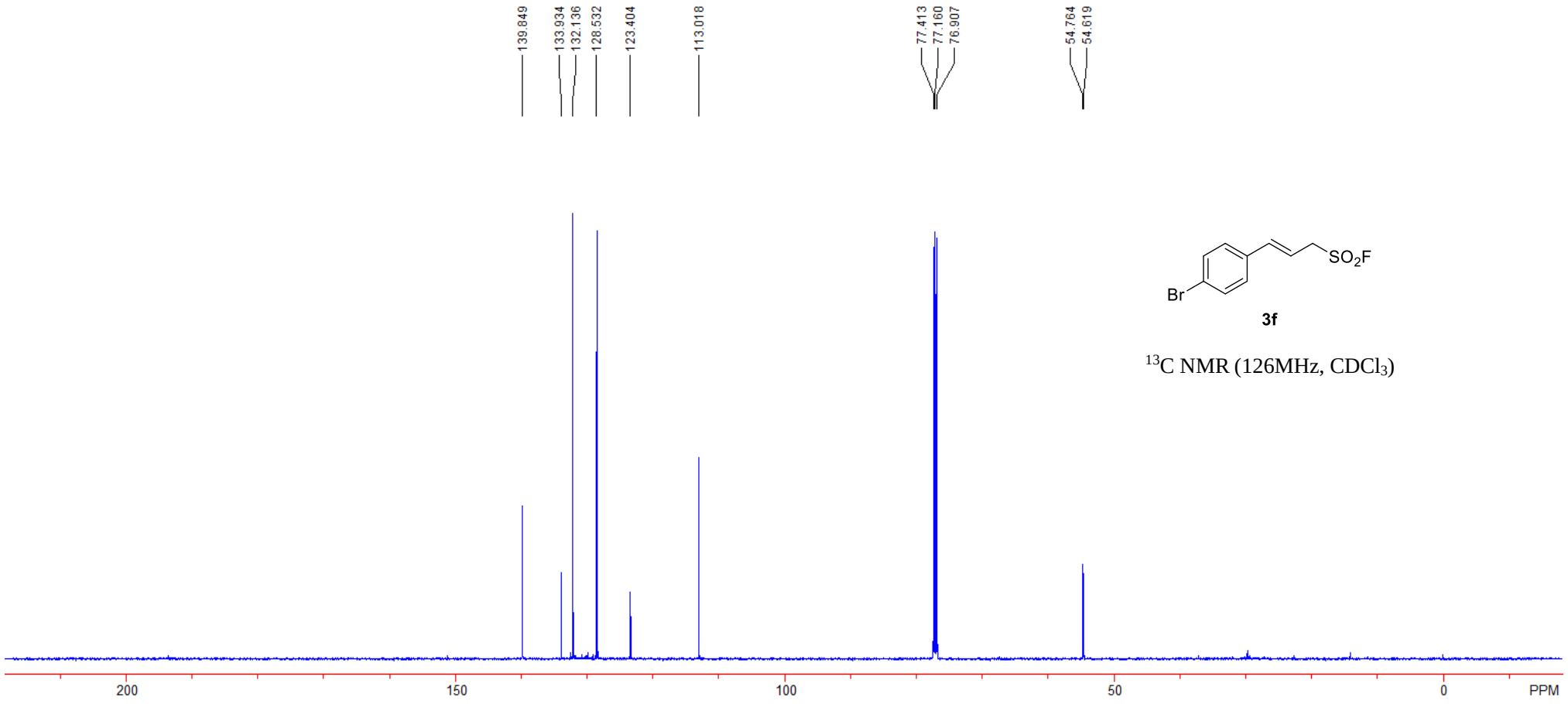
3f

^{1}H NMR (500 MHz, $CDCl_3$)



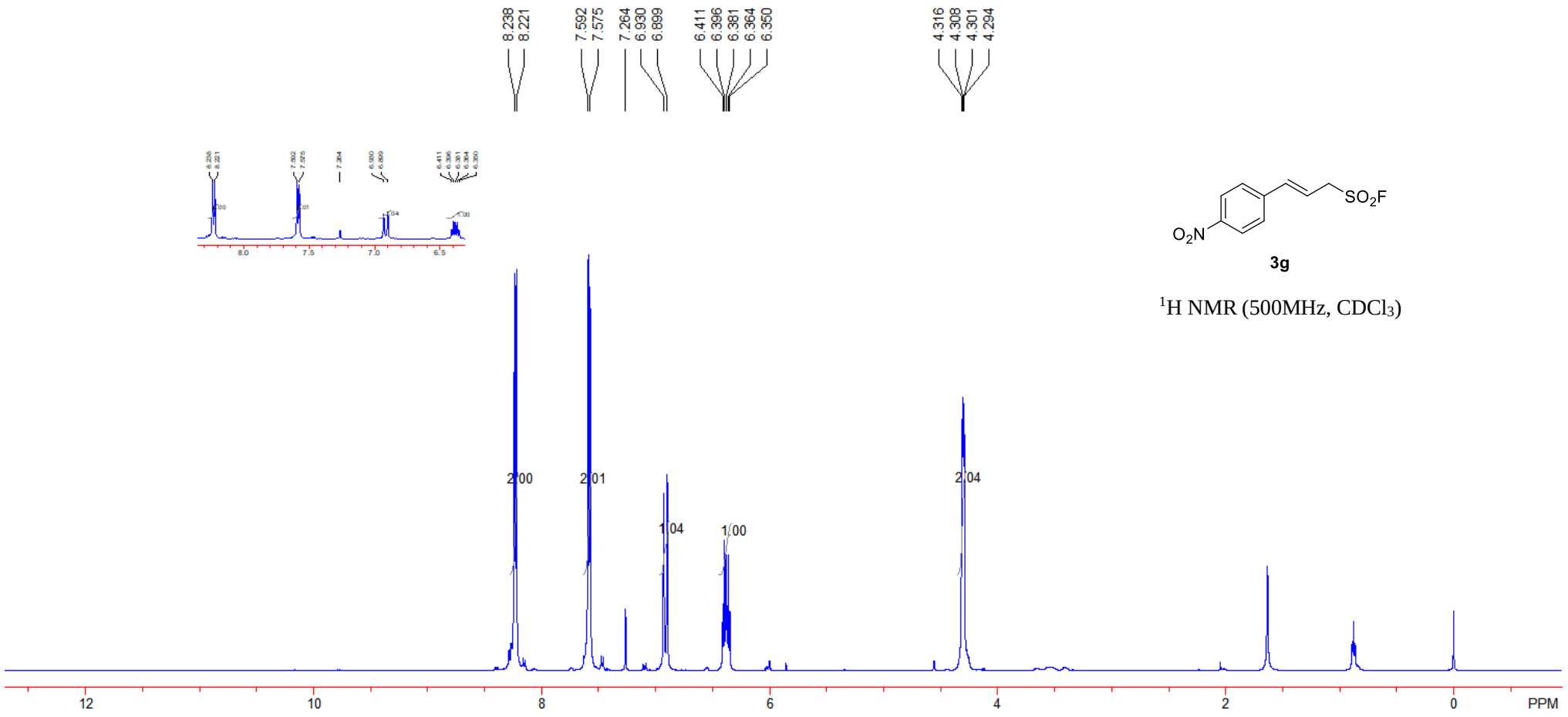
3f

^{19}F NMR (471MHz, $CDCl_3$)



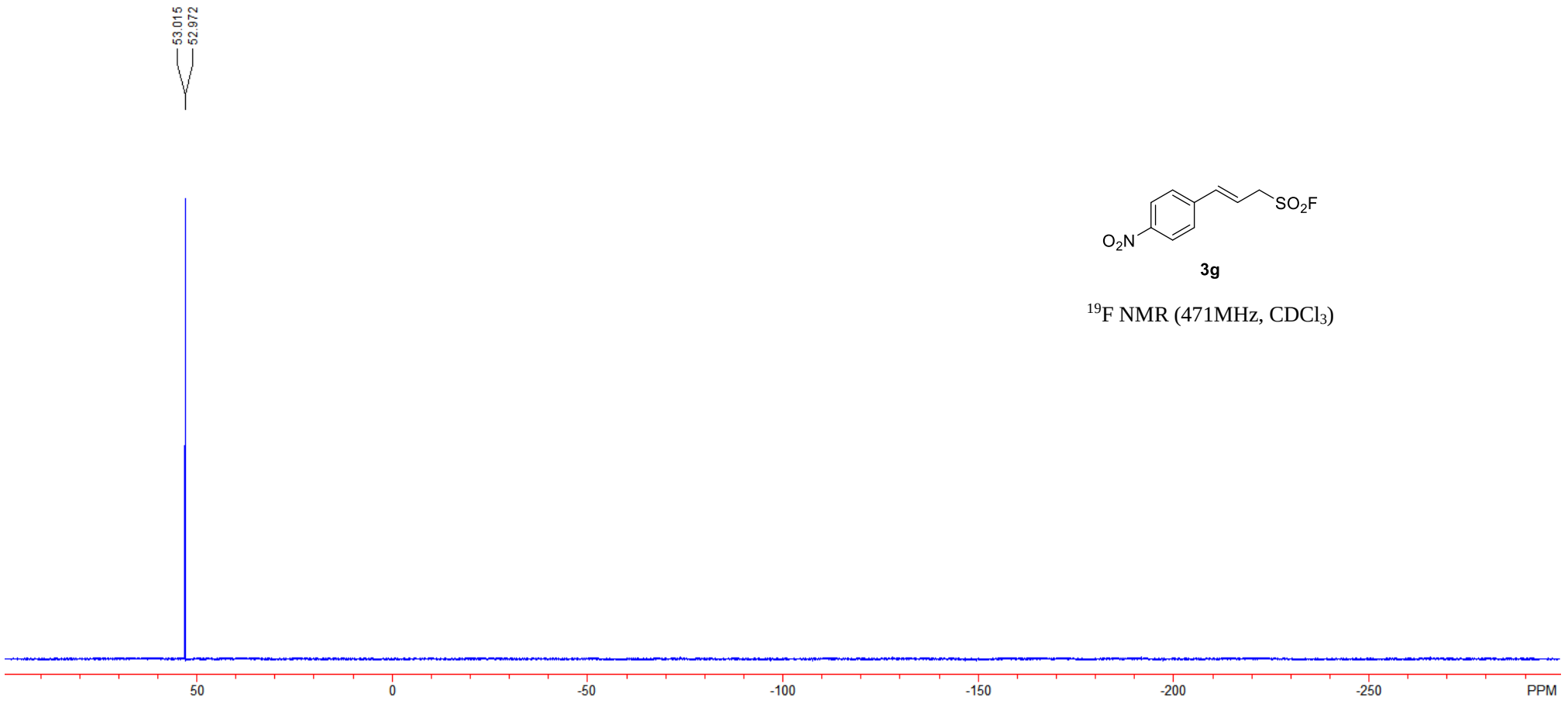
3f

^{13}C NMR (126MHz, $CDCl_3$)



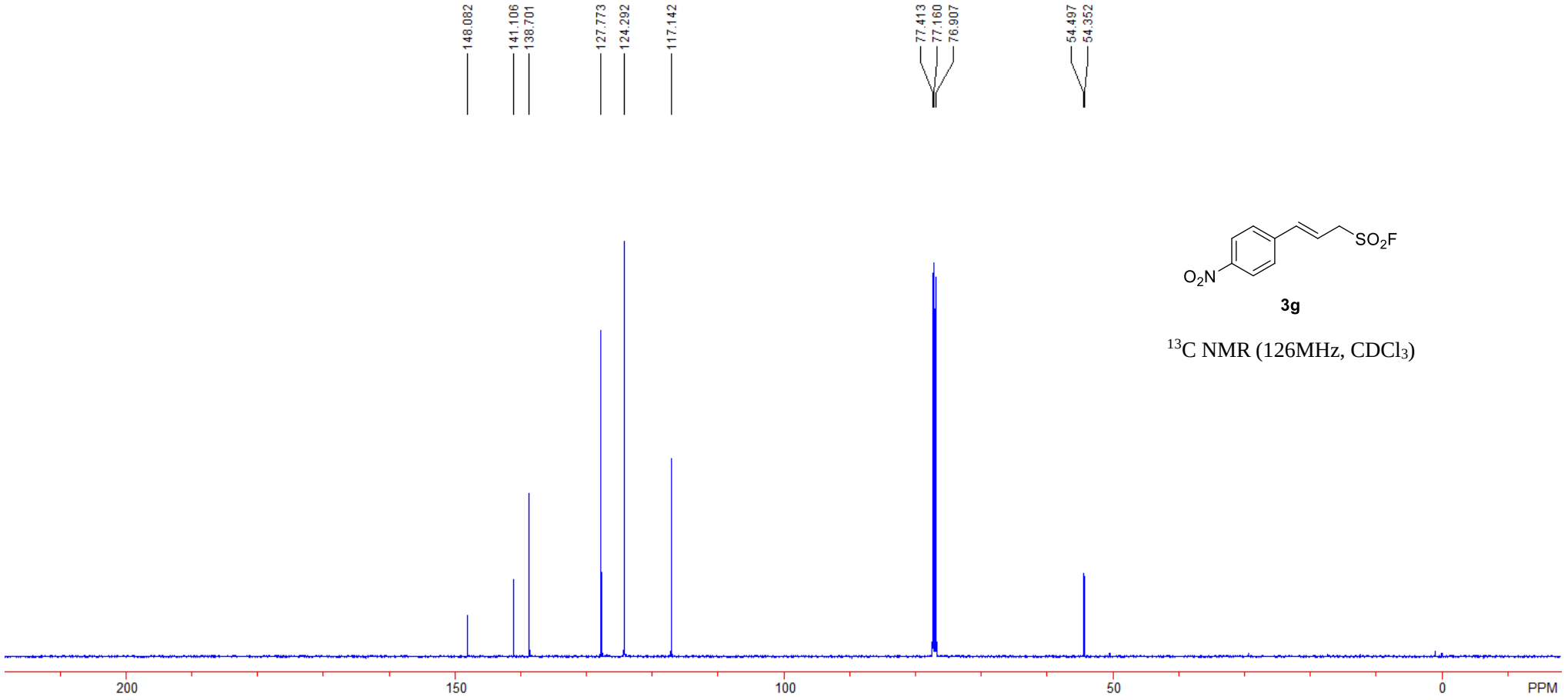
3g

^{1}H NMR (500MHz, $CDCl_3$)



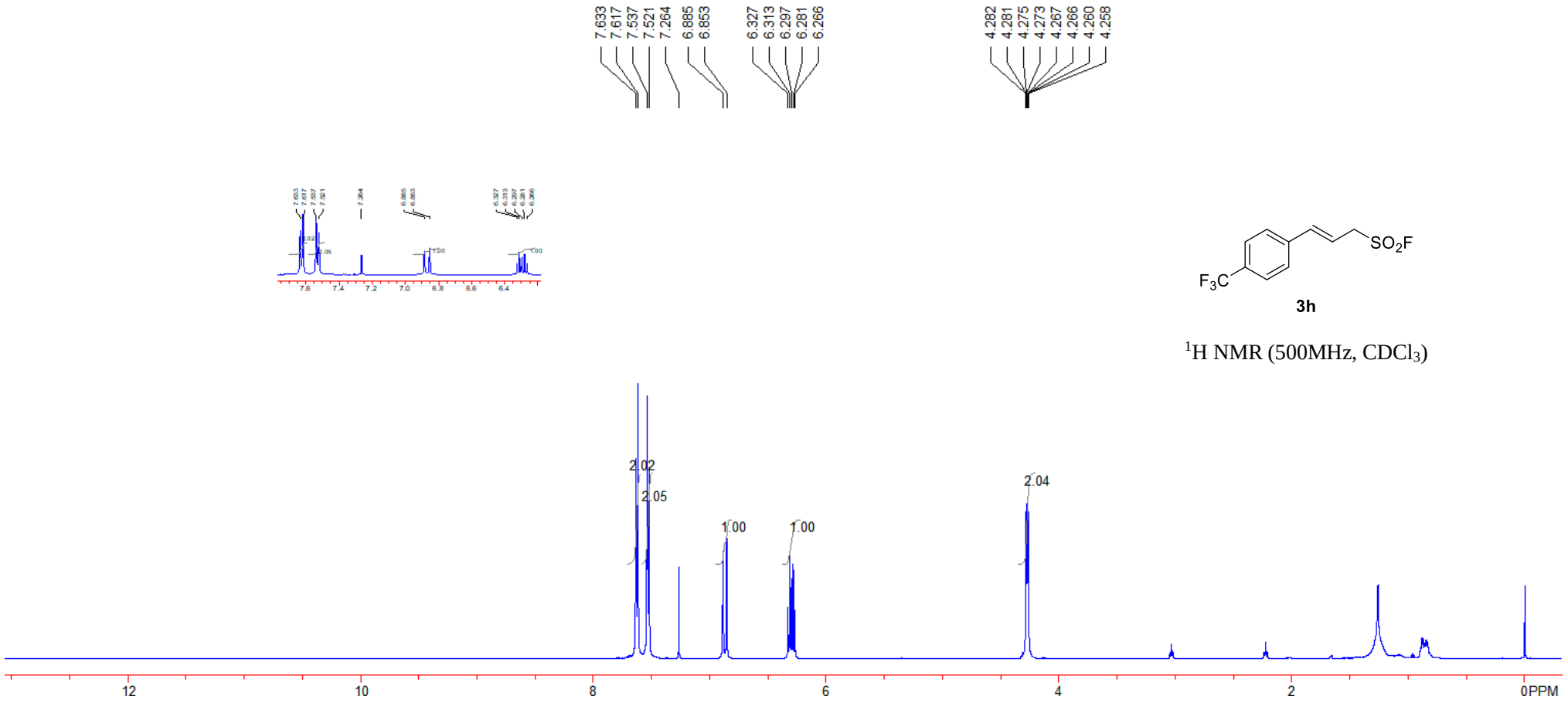
3g

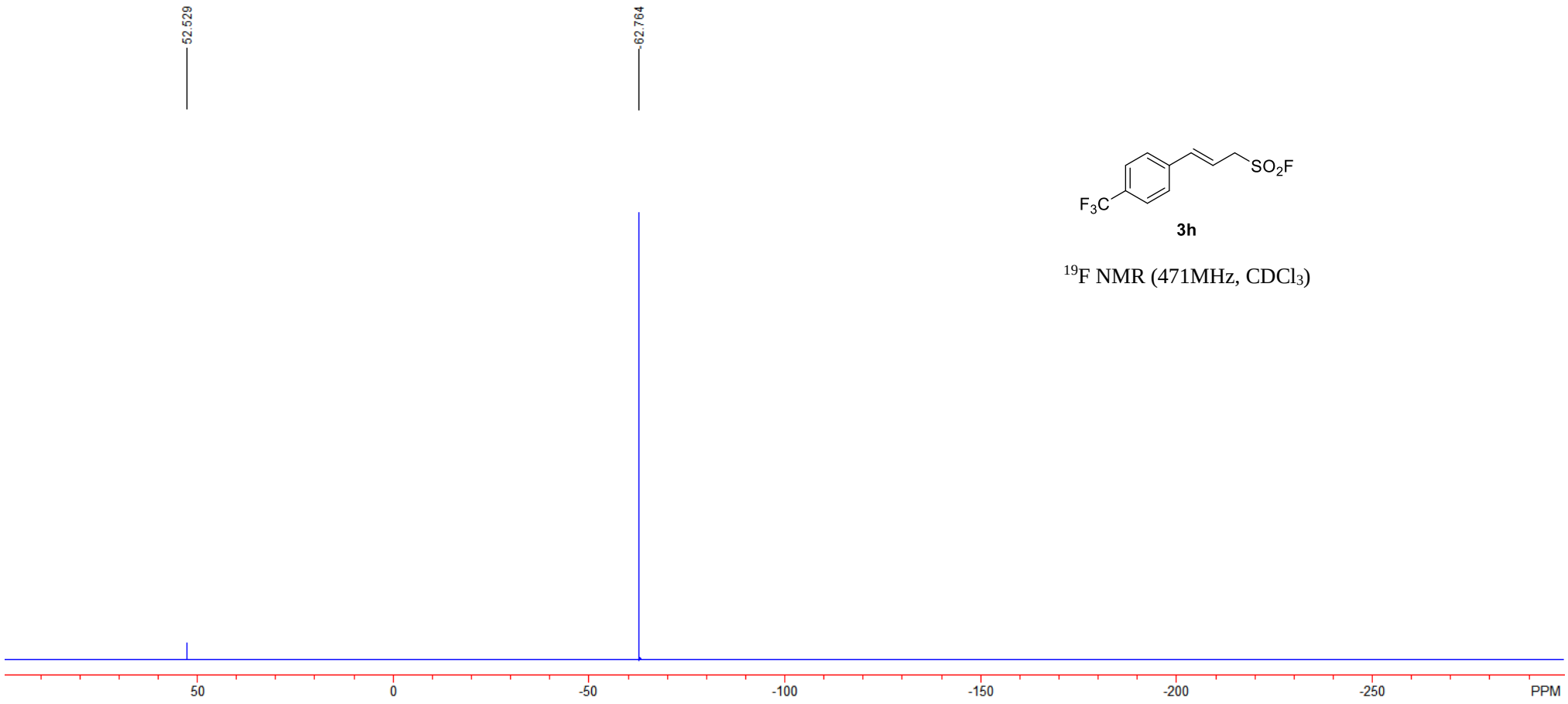
^{19}F NMR (471MHz, $CDCl_3$)



3g

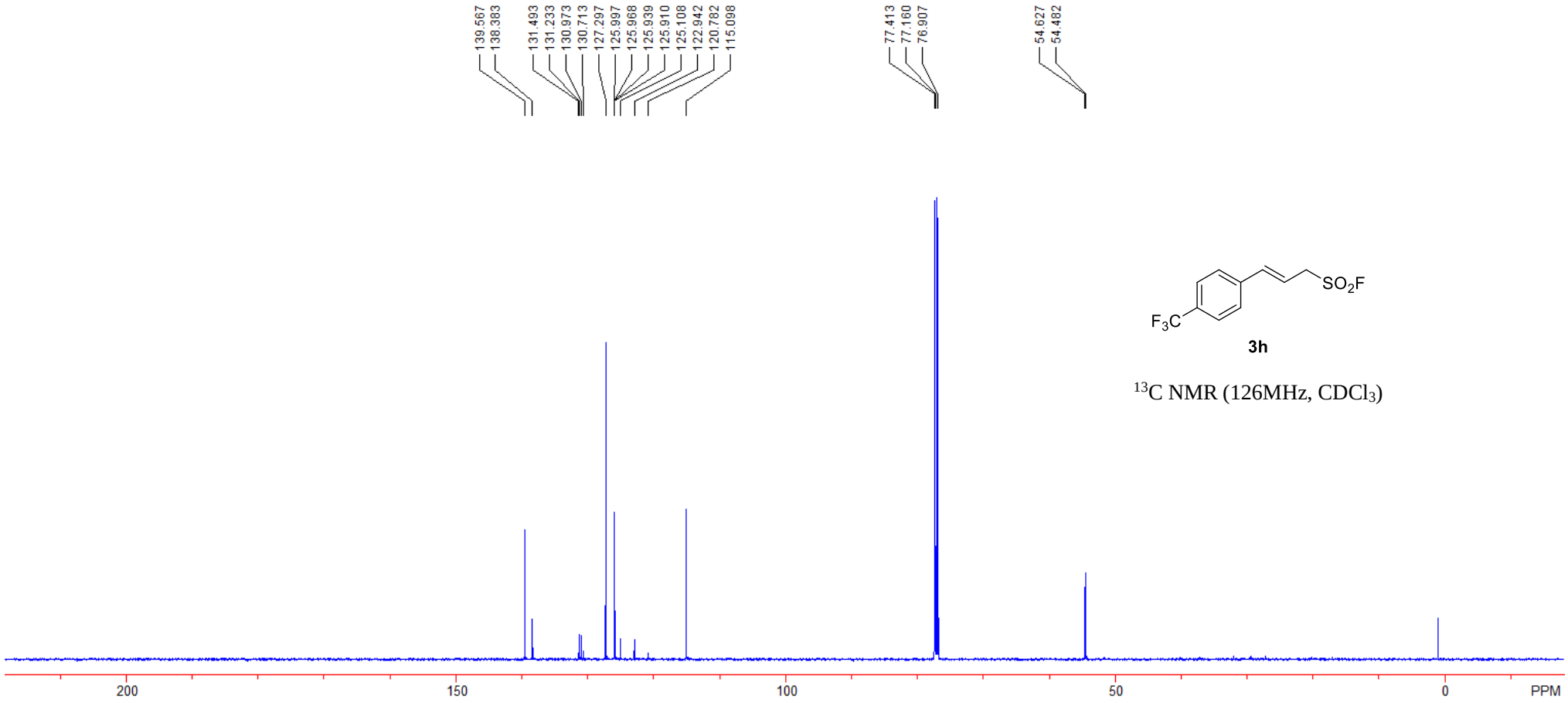
^{13}C NMR (126MHz, $CDCl_3$)


7.633
7.617
7.537
7.521
7.264
6.885
6.853
6.327
6.313
6.297
6.281
6.266
4.282
4.281
4.275
4.273
4.267
4.266
4.260
4.258
SO2F
F3C
3h
1H NMR (500MHz, CDCl3)
2.02
2.05
1.00
1.00
2.04
12
10
8
6
4
2
0PPM



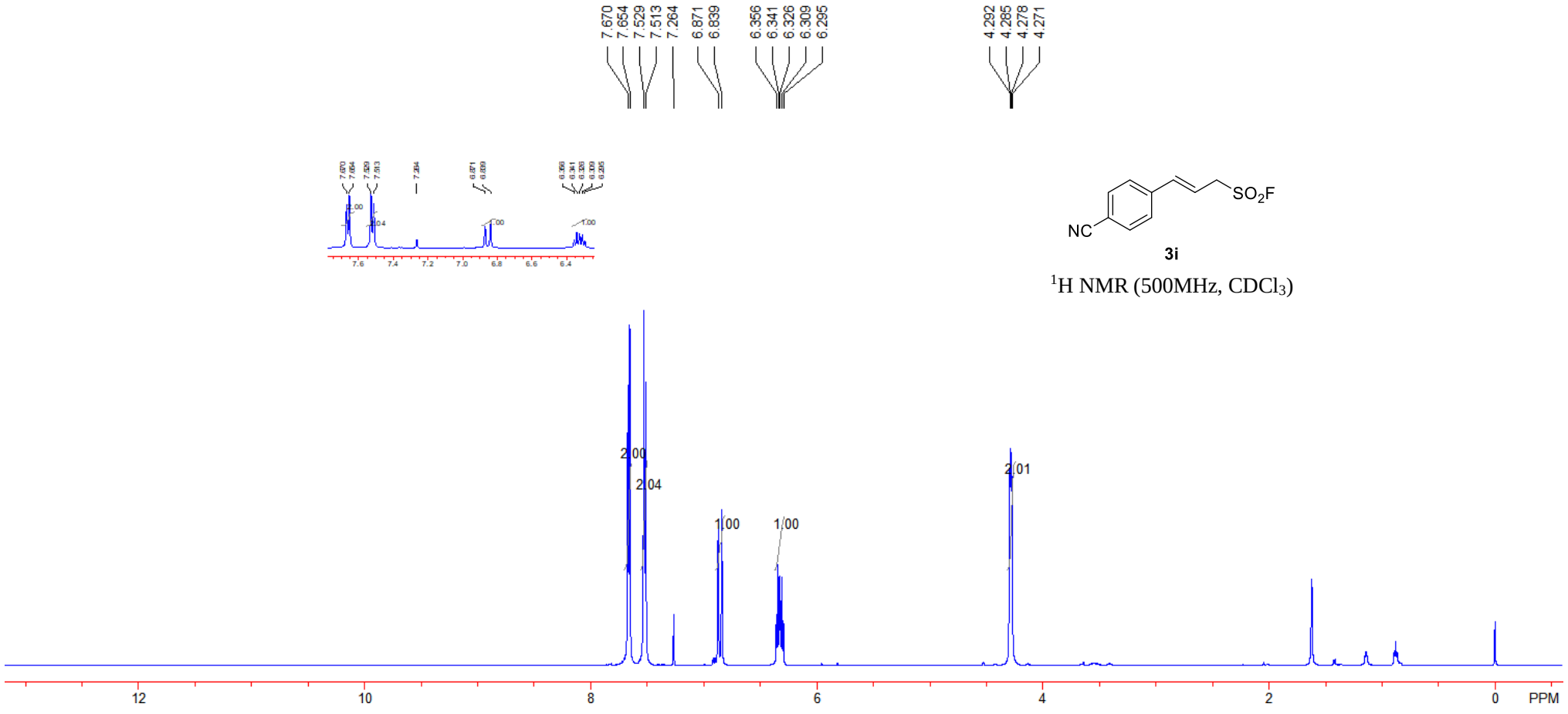
3h

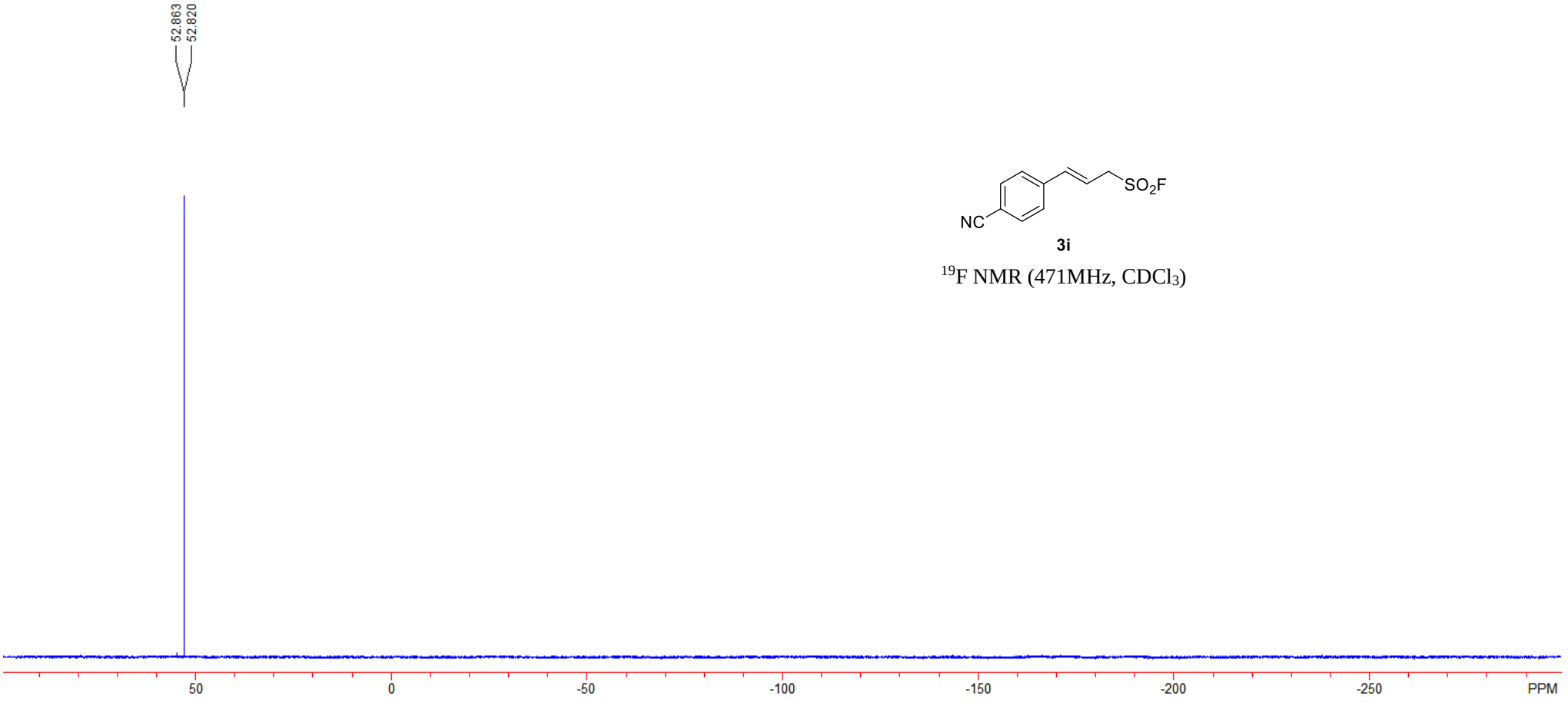
^{19}F NMR (471MHz, $CDCl_3$)



3h

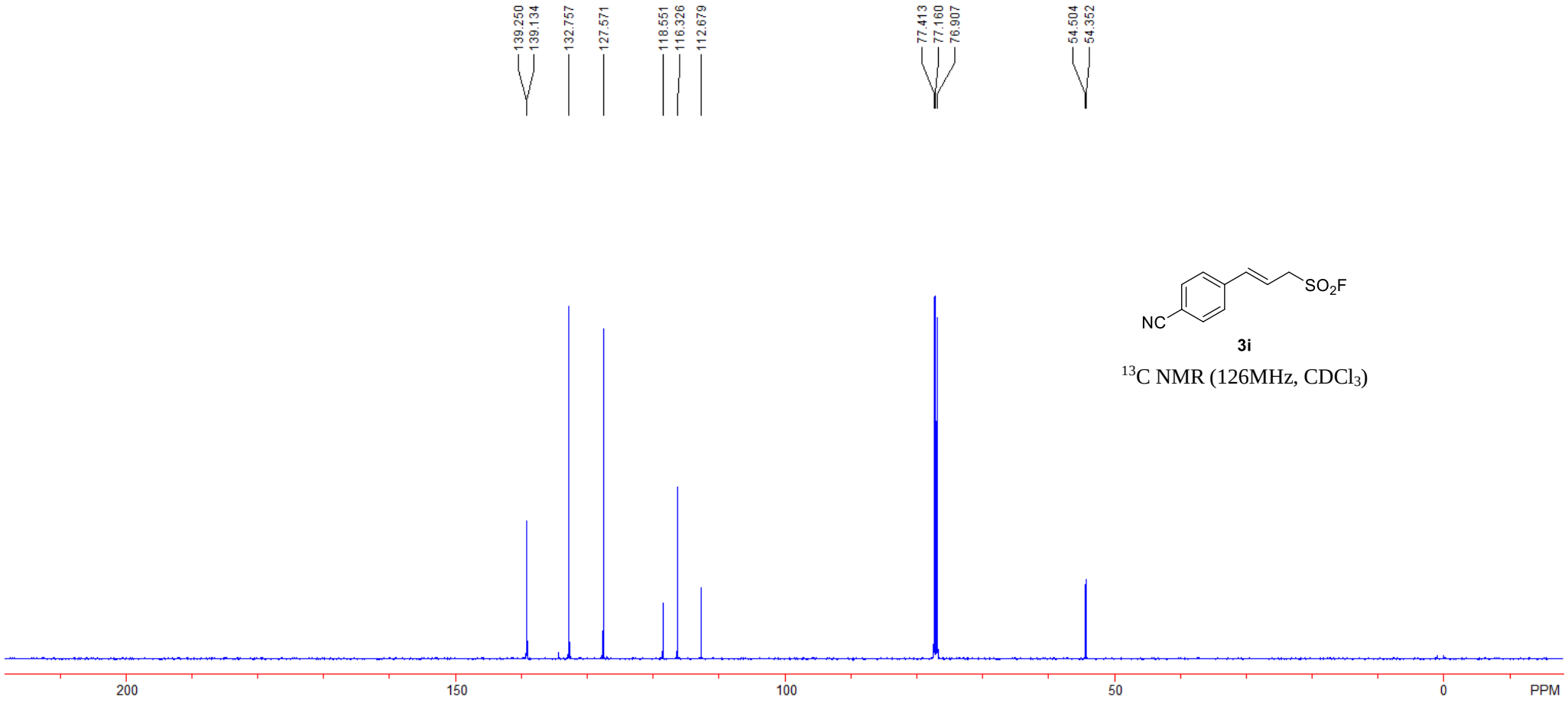
^{13}C NMR (126MHz, $CDCl_3$)


7.670
7.654
7.529
7.513
7.264
6.871
6.839
6.356
6.341
6.326
6.309
6.295
4.292
4.285
4.278
4.271
NC
SO2F
3i
1H NMR (500MHz, CDCl3)
2.00
2.04
1.00
1.00
2.01
12
10
8
6
4
2
0
PPM



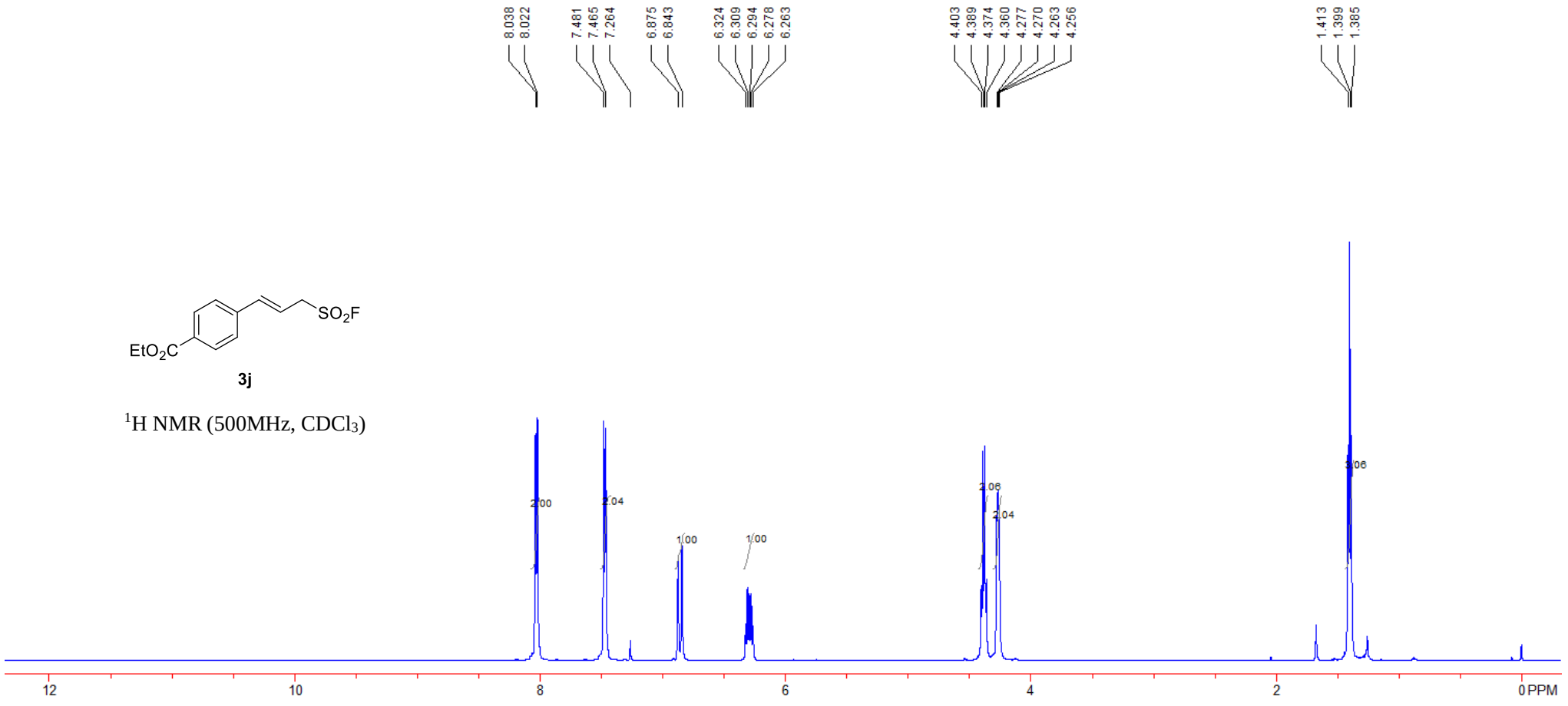
3i

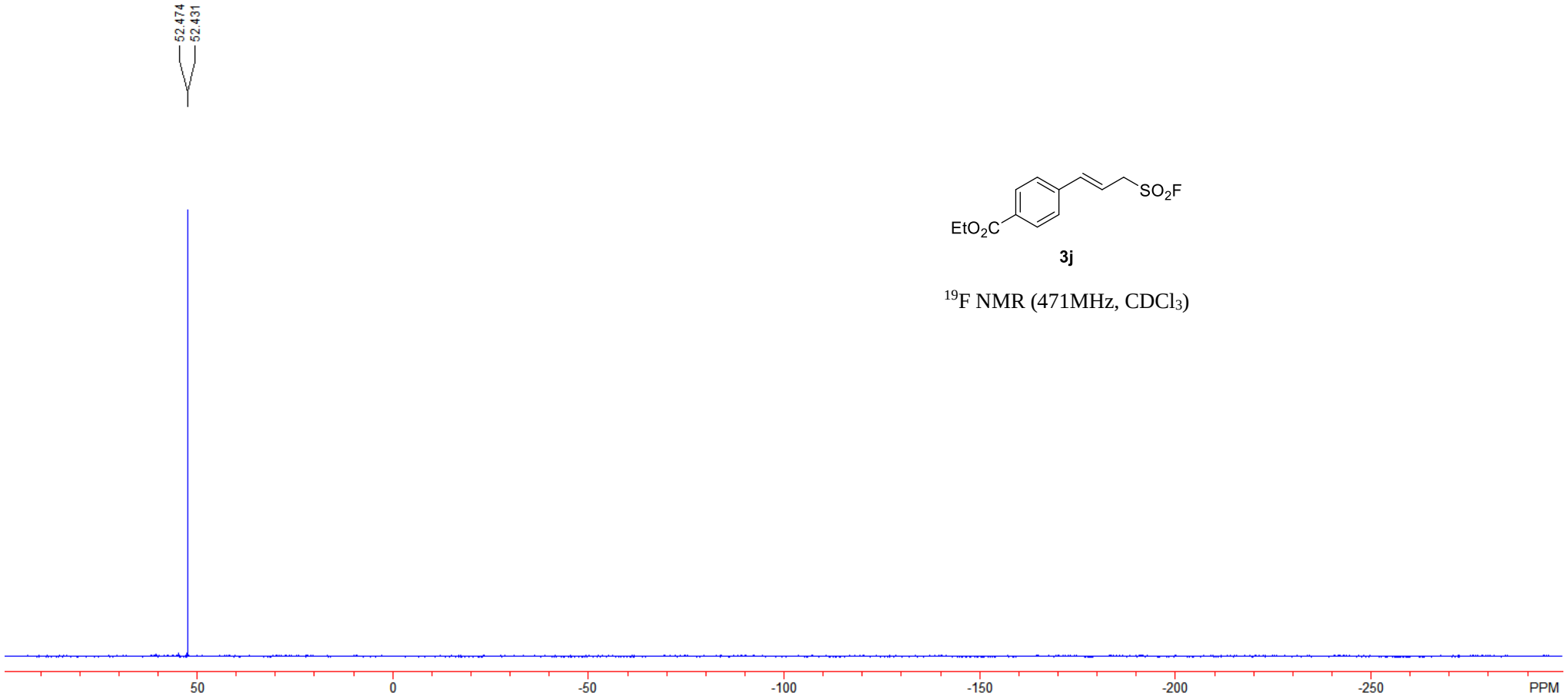
^{19}F NMR (471MHz, $CDCl_3$)



3i

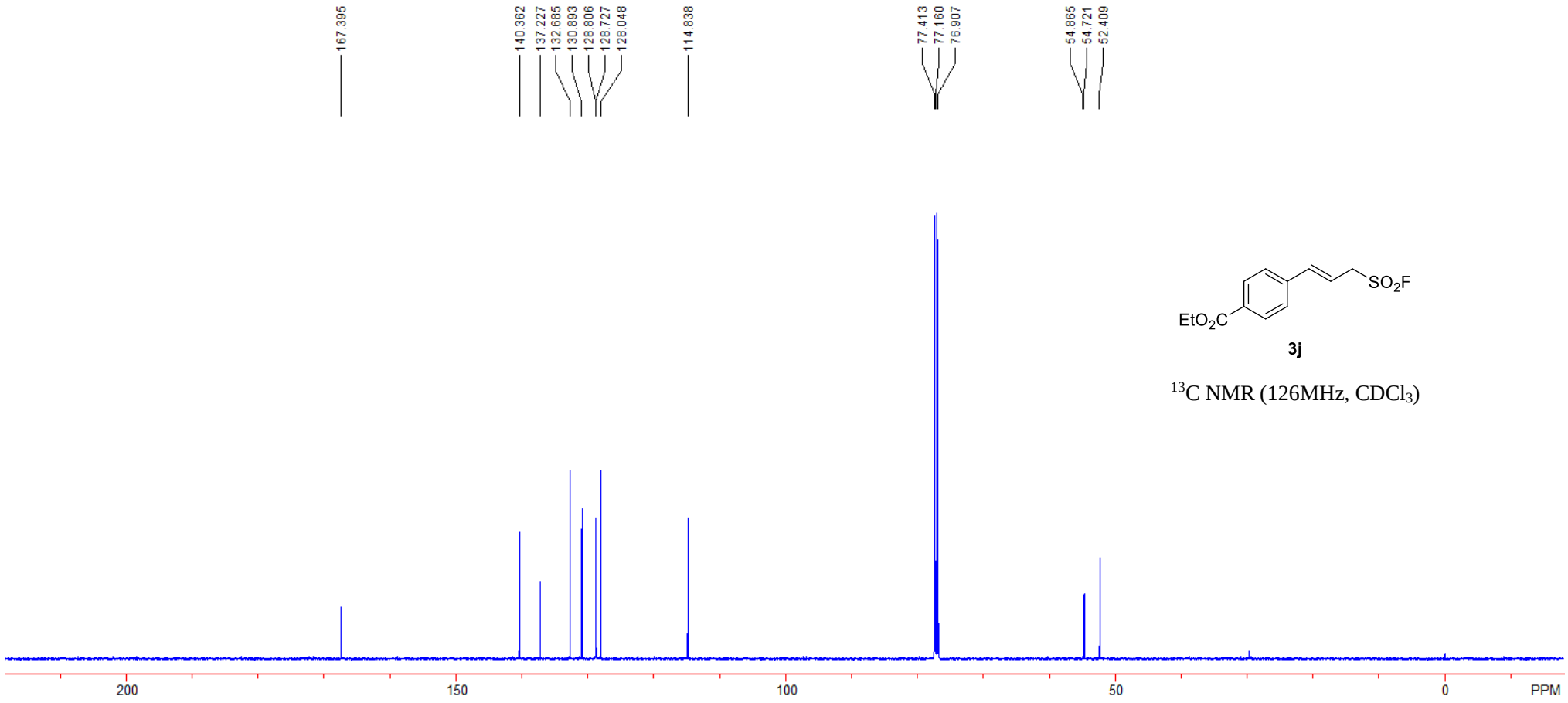
^{13}C NMR (126MHz, $CDCl_3$)


8.038
8.022
7.481
7.465
7.264
6.875
6.843
6.324
6.309
6.294
6.278
6.263
4.403
4.389
4.374
4.360
4.277
4.270
4.263
4.256
1.413
1.399
1.385
SO2F
EtO2C
3j
1H NMR (500MHz, CDCl3)
2.00
2.04
1.00
1.00
2.06
2.04
3.06
12
10
8
6
4
2
0 PPM



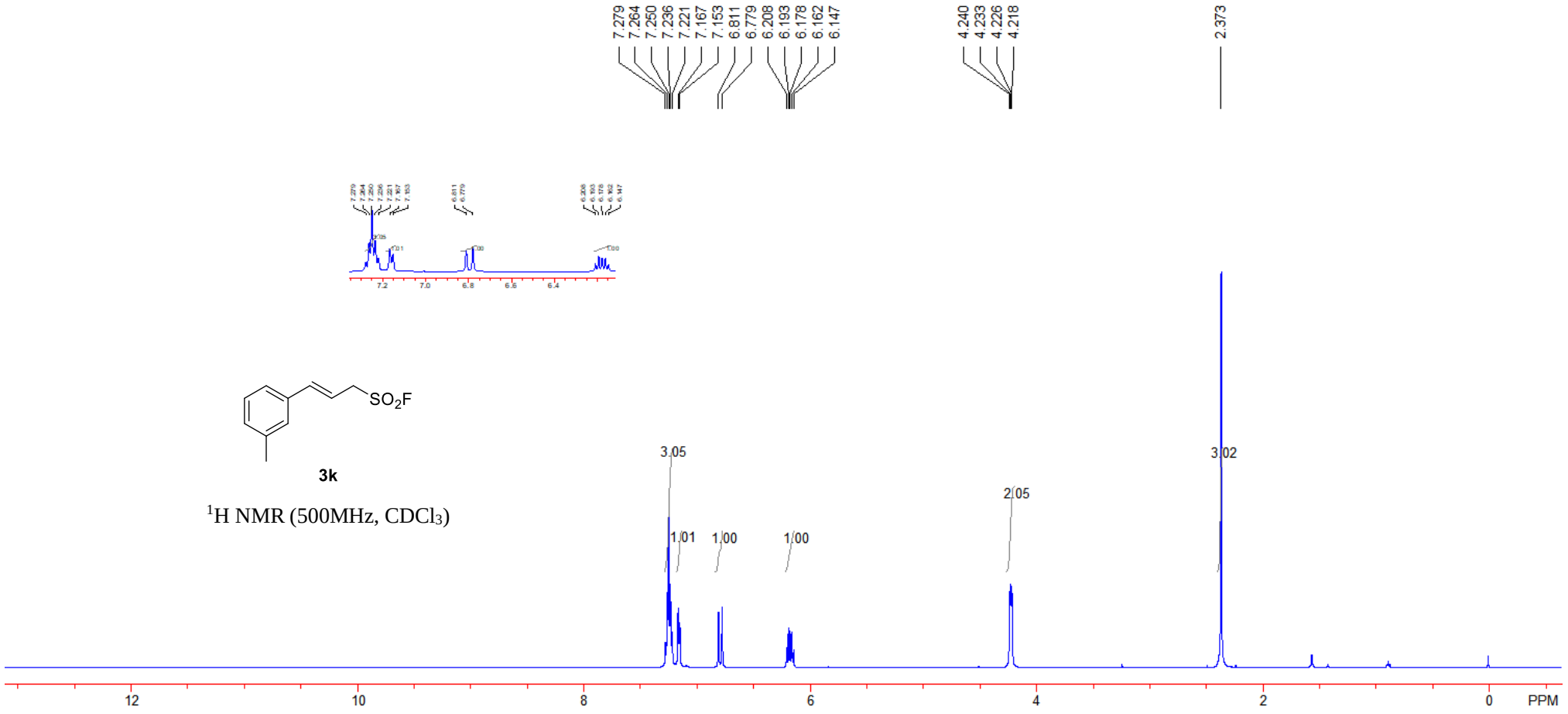
3j

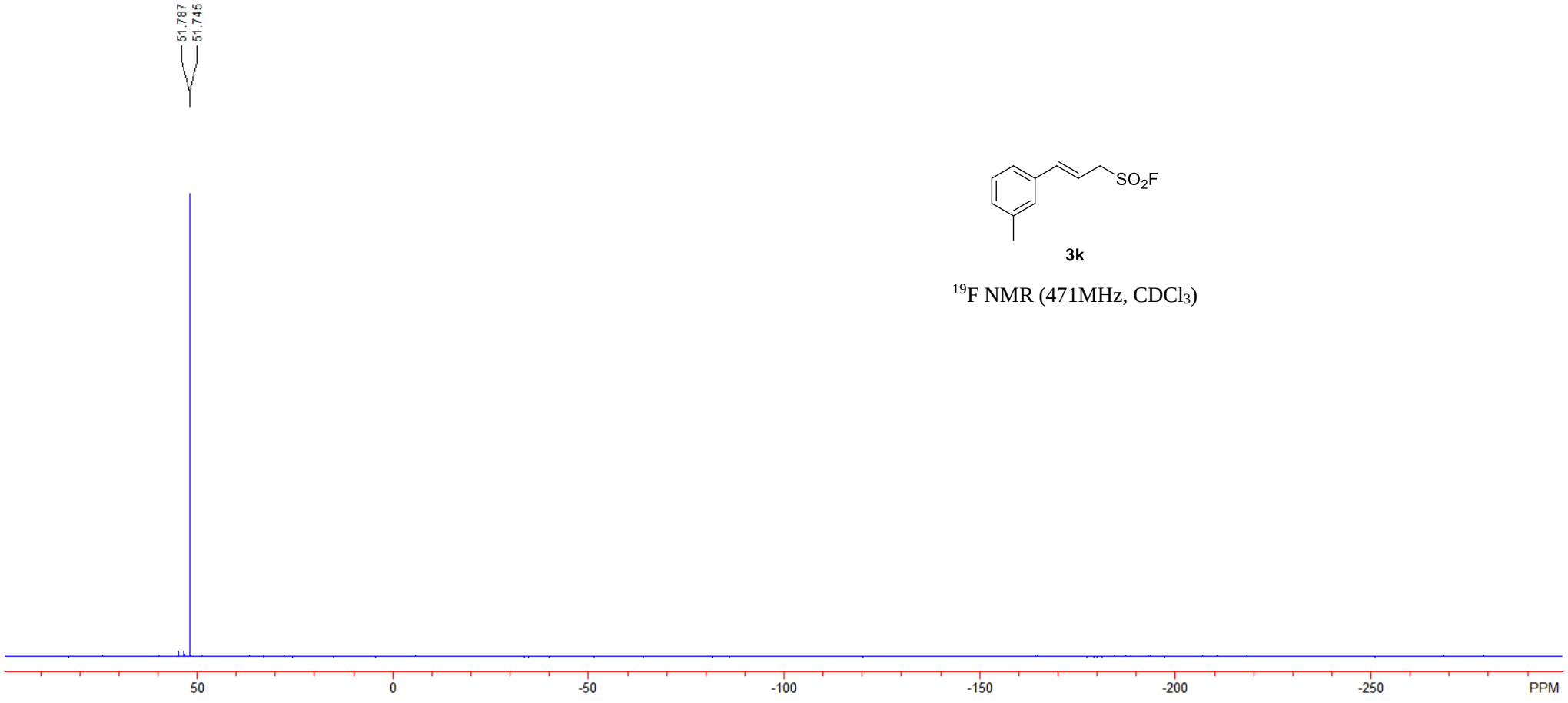
^{19}F NMR (471MHz, $CDCl_3$)



3j

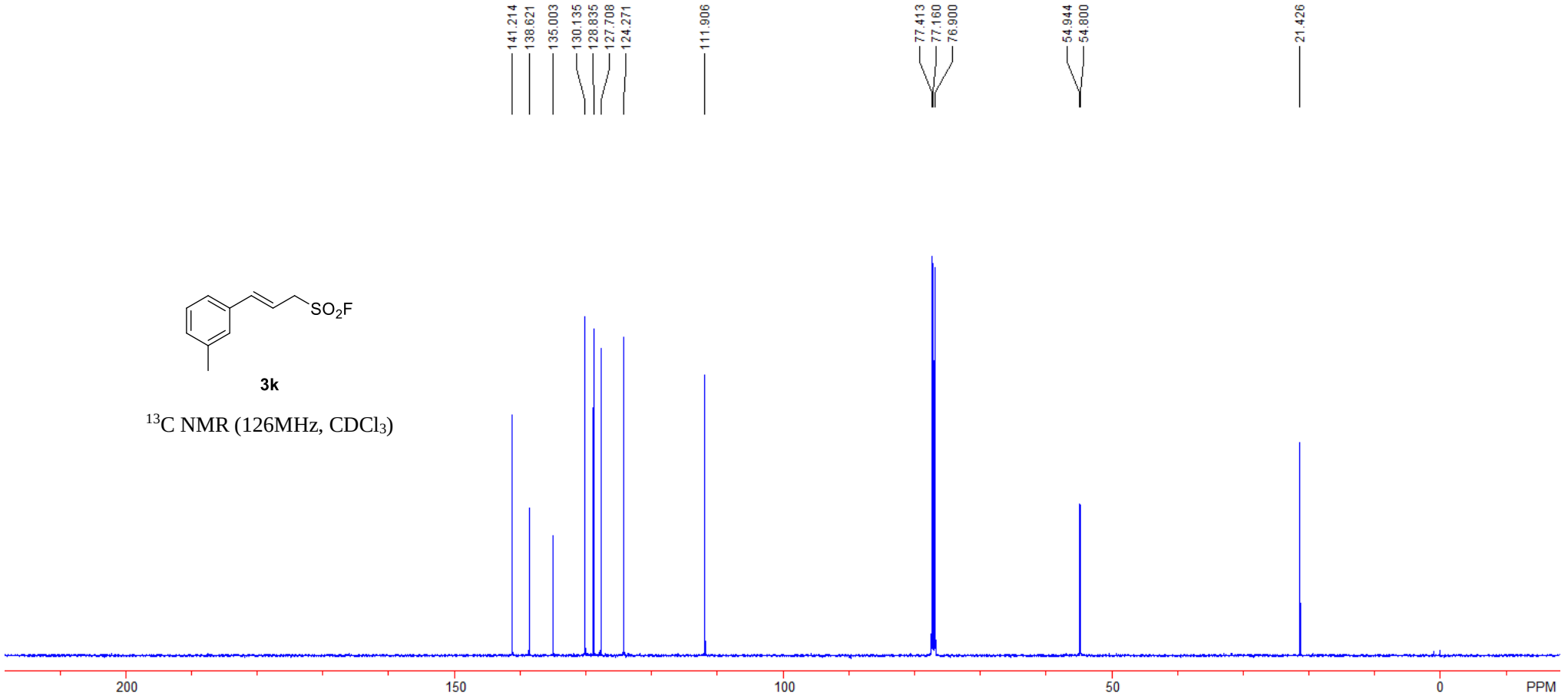
^{13}C NMR (126MHz, $CDCl_3$)


7.279
7.264
7.250
7.236
7.221
7.167
7.153
6.811
6.779
6.208
6.193
6.178
6.162
6.147
4.240
4.233
4.226
4.218
2.373
SO2F
3k
1H NMR (500MHz, CDCl3)
3.05
1.01
1.00
1.00
2.05
3.02
12
10
8
6
4
2
0
PPM



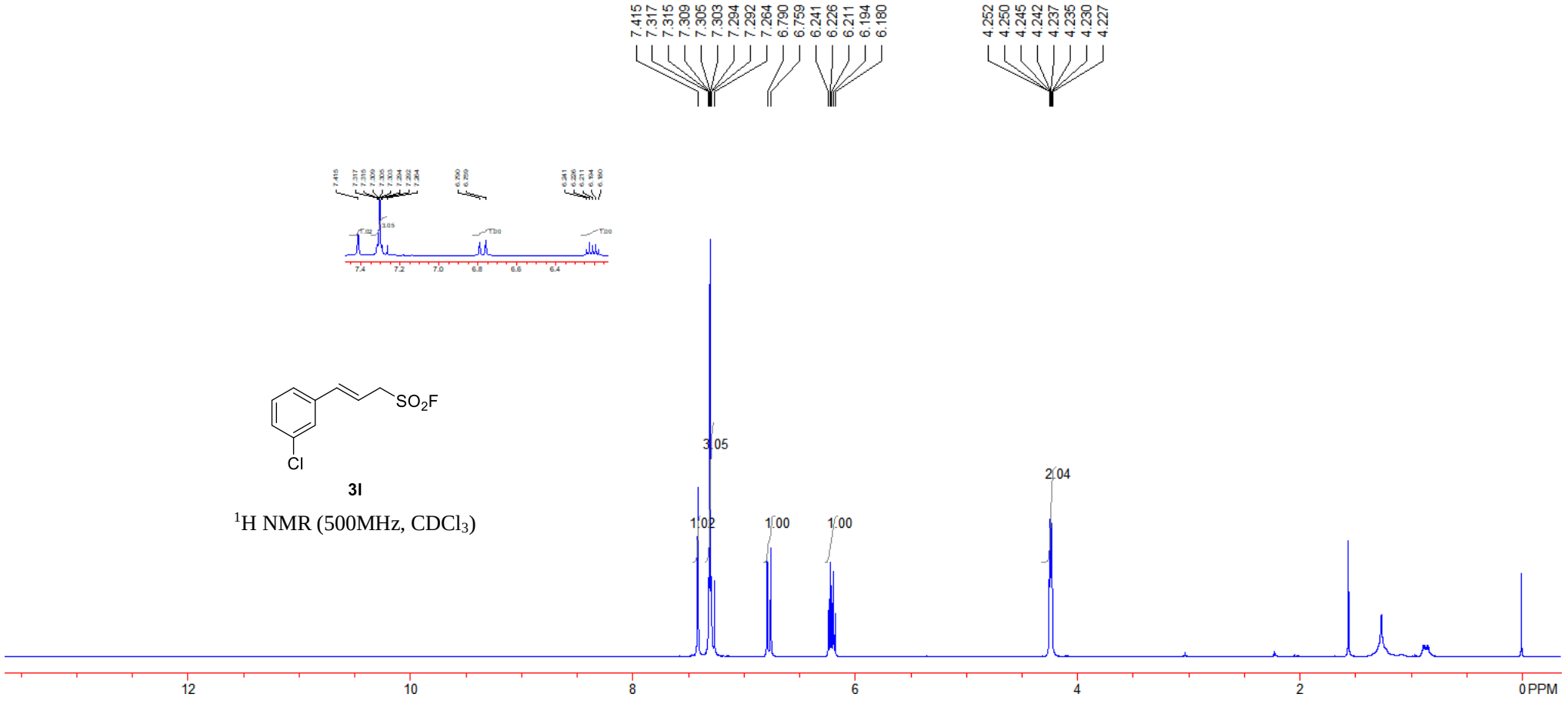
3k

^{19}F NMR (471MHz, $CDCl_3$)



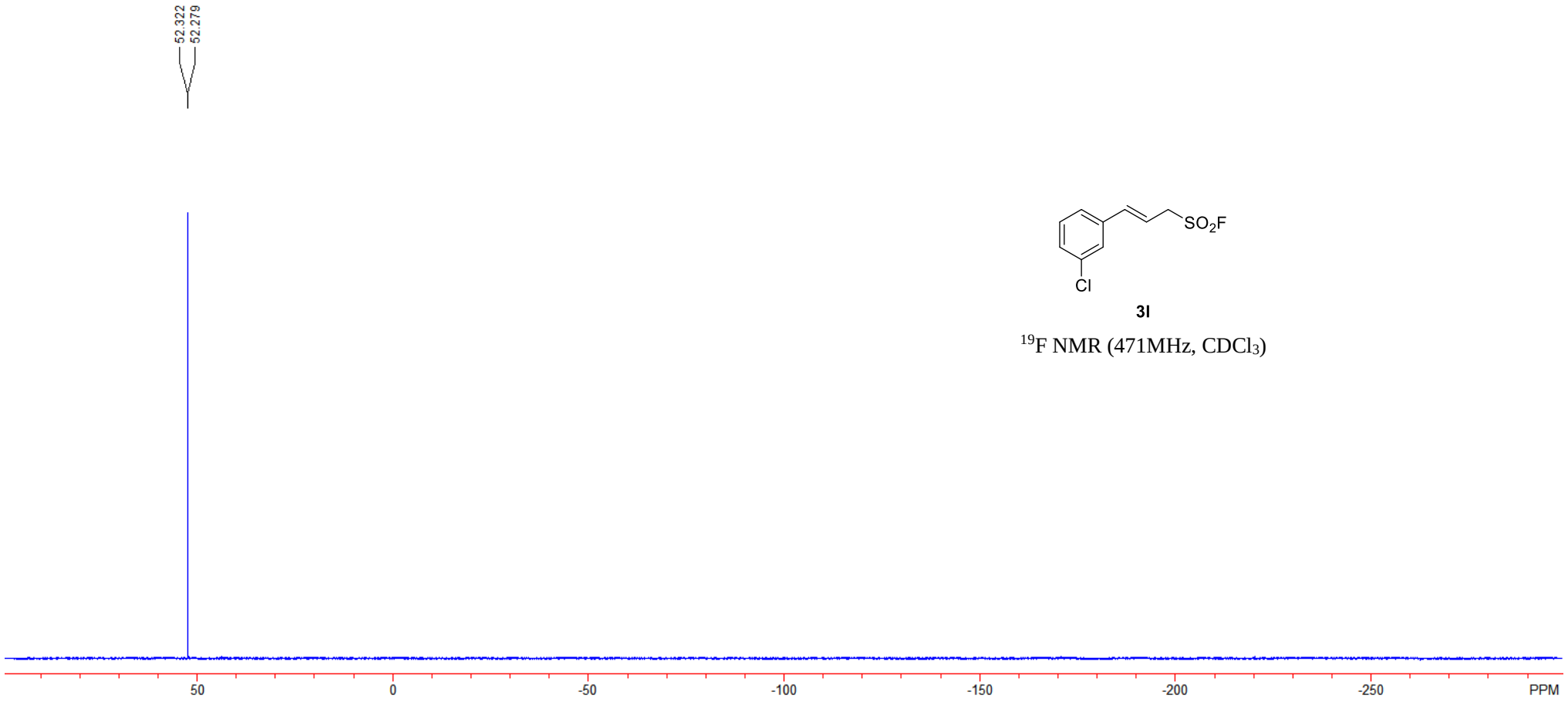
3k

^{13}C NMR (126MHz, $CDCl_3$)



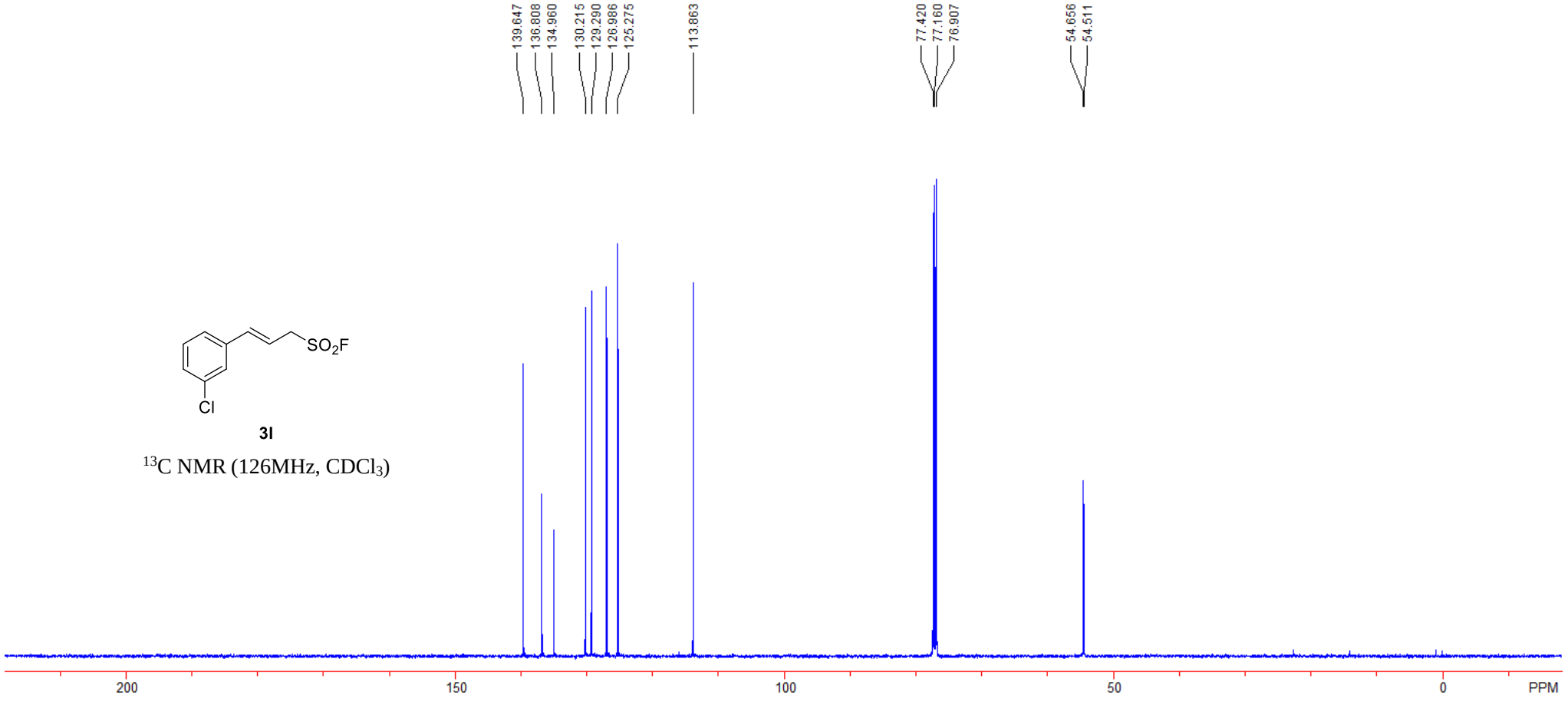
3l

^{1}H NMR (500MHz, $CDCl_3$)



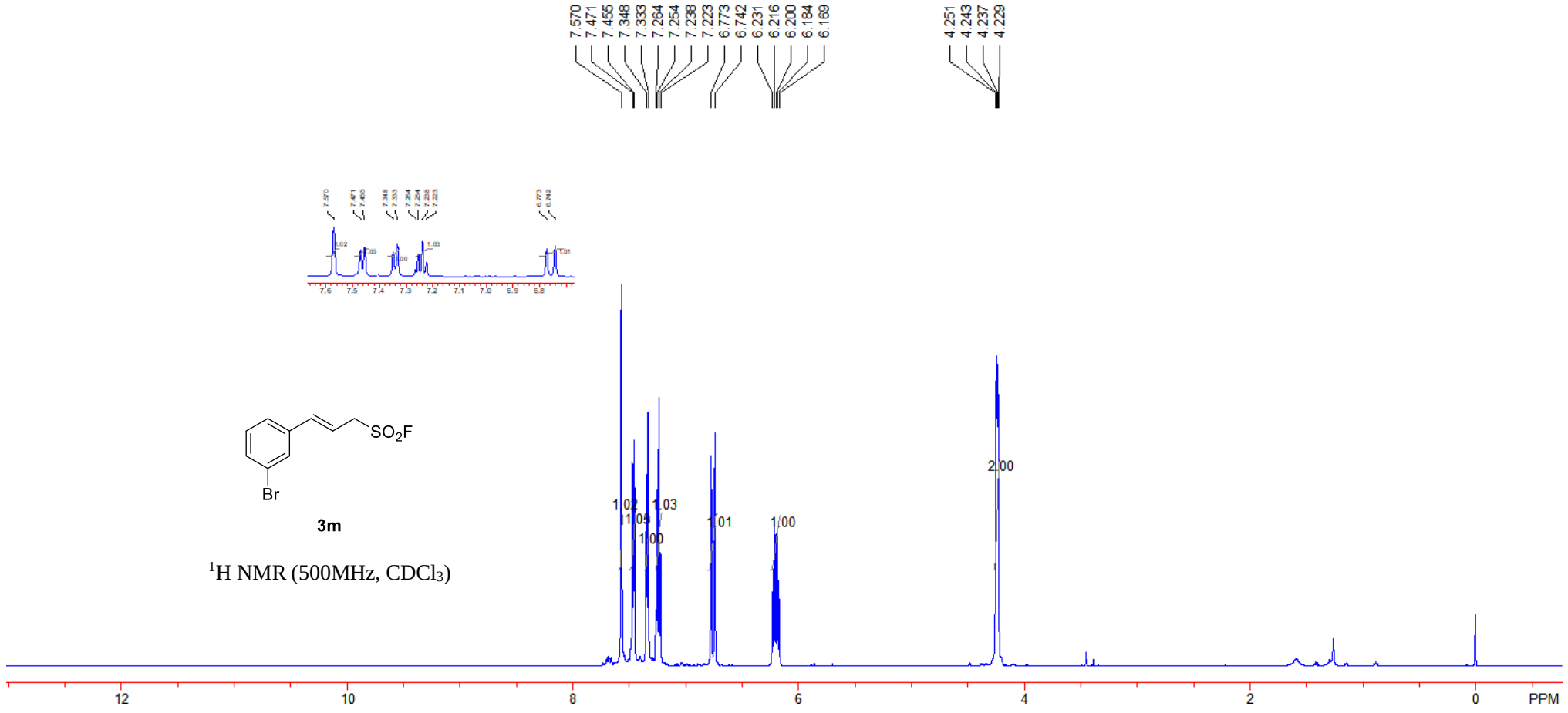
3l

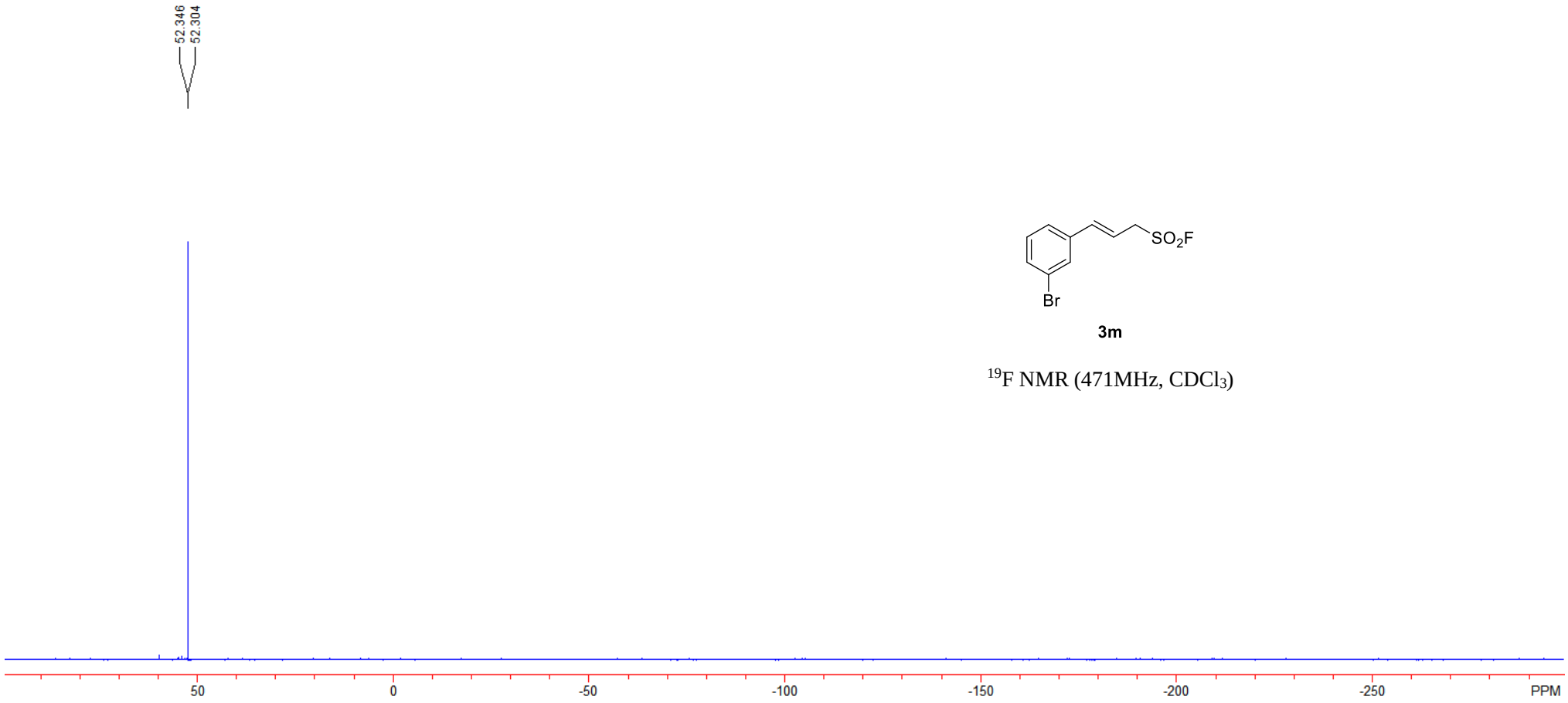
^{19}F NMR (471MHz, $CDCl_3$)



3l

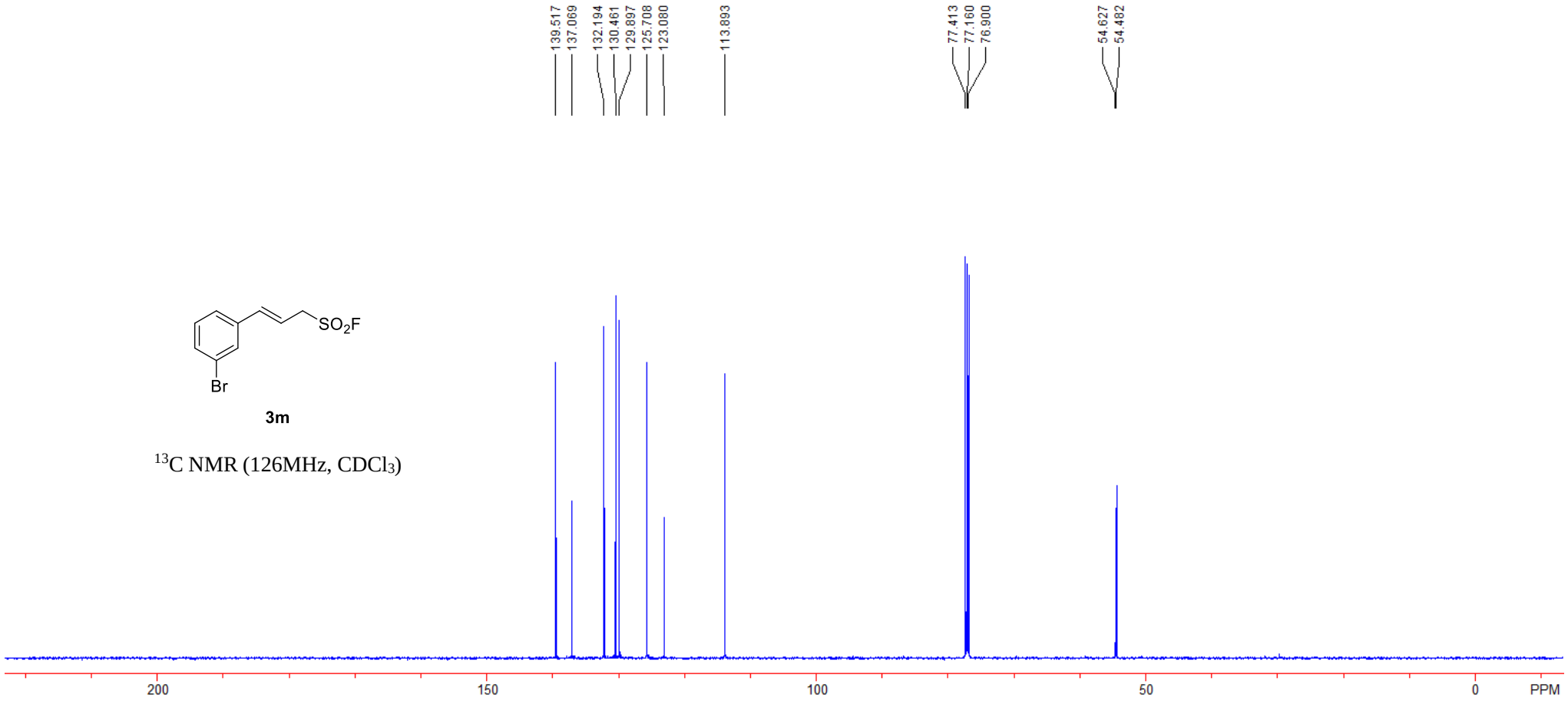
^{13}C NMR (126MHz, $CDCl_3$)


7.570
7.471
7.455
7.348
7.333
7.264
7.254
7.238
7.223
6.773
6.742
6.231
6.216
6.200
6.184
6.169
4.251
4.243
4.237
4.229
SO2F
Br
3m
1H NMR (500MHz, CDCl3)
1.02
1.05
1.00
1.03
1.01
1.00
2.00
12
10
8
6
4
2
0
PPM



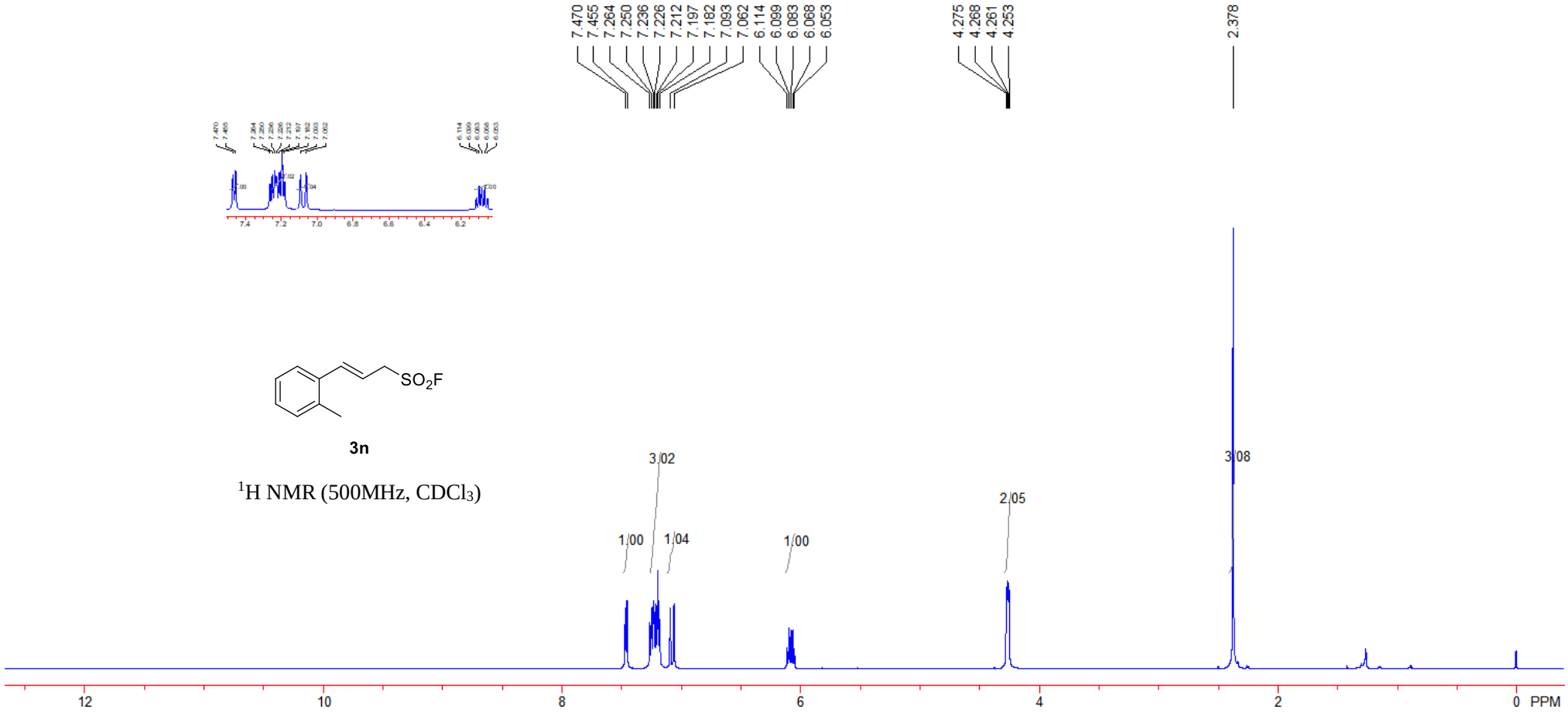
3m

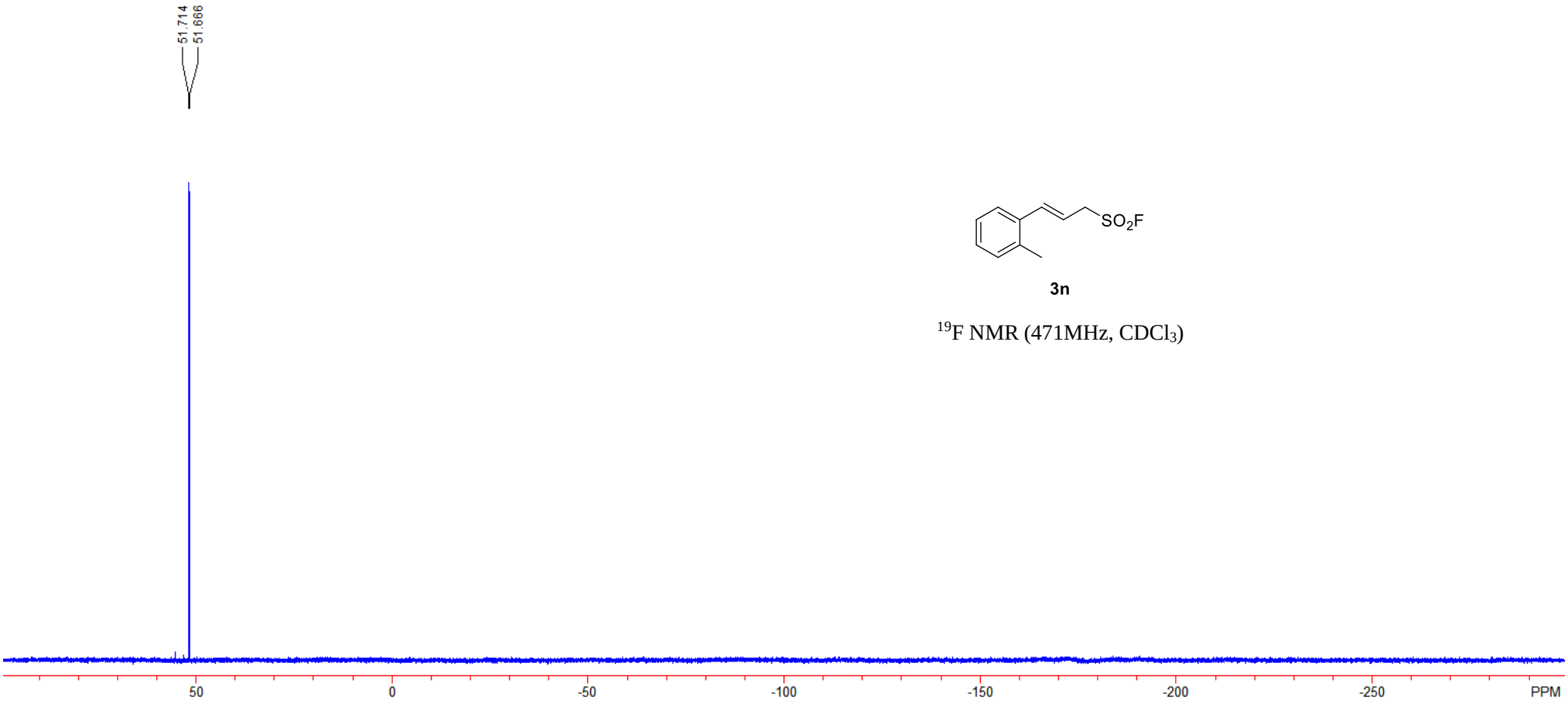
^{19}F NMR (471MHz, $CDCl_3$)



3m

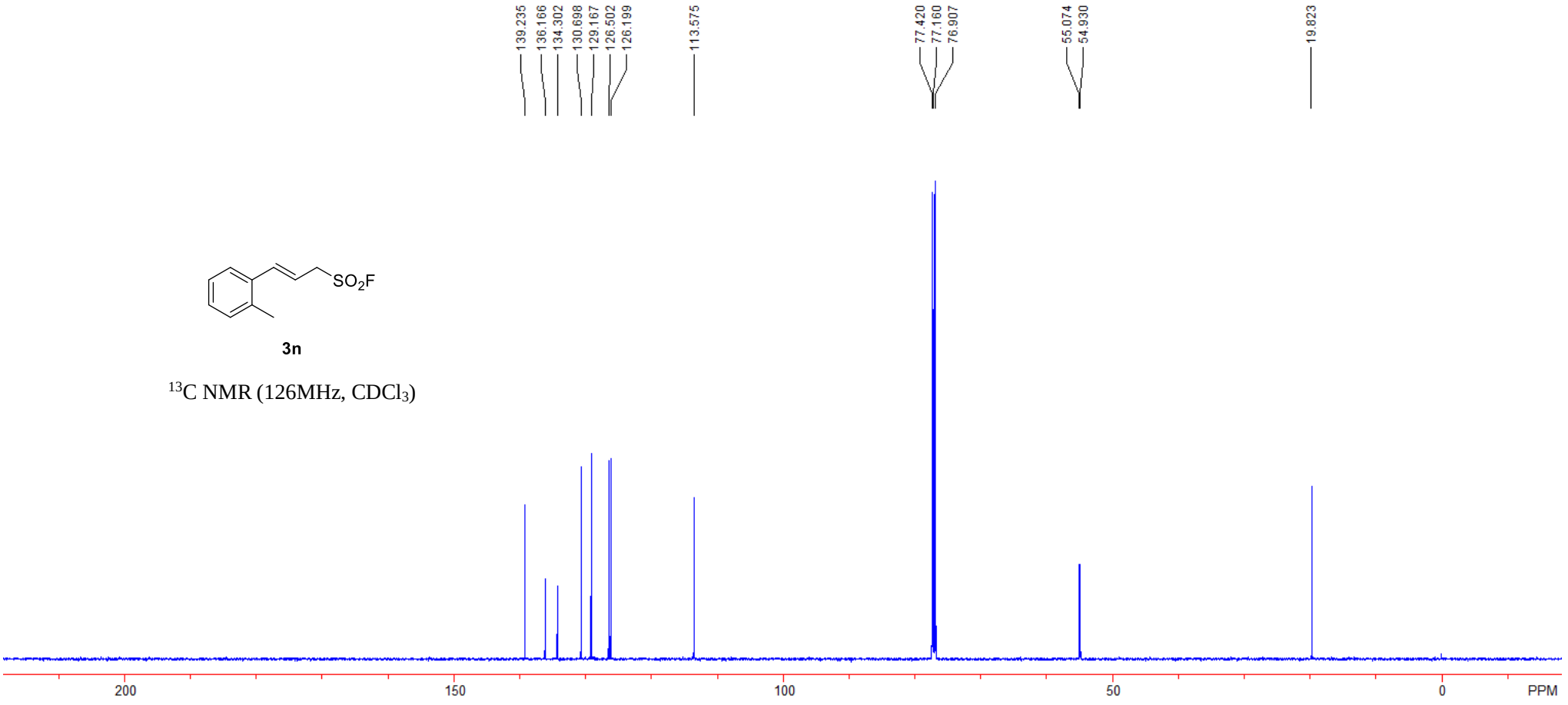
^{13}C NMR (126MHz, $CDCl_3$)


7.470
7.455
7.264
7.250
7.236
7.226
7.212
7.197
7.182
7.093
7.062
6.114
6.099
6.083
6.068
6.053
4.275
4.268
4.261
4.253
2.378
SO2F
3n
1H NMR (500MHz, CDCl3)
1.00
3.02
1.04
1.00
2.05
3.08
12
10
8
6
4
2
0 PPM



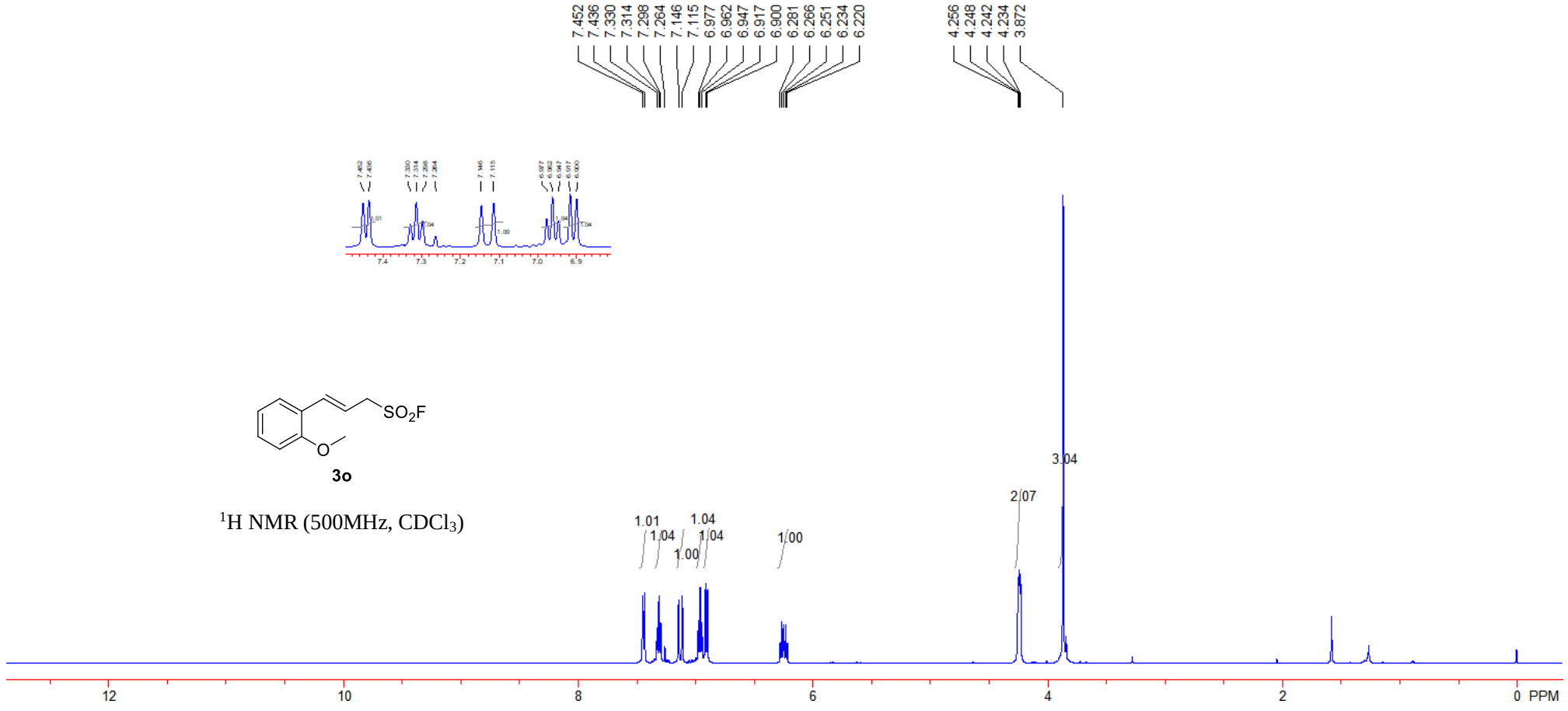
3n

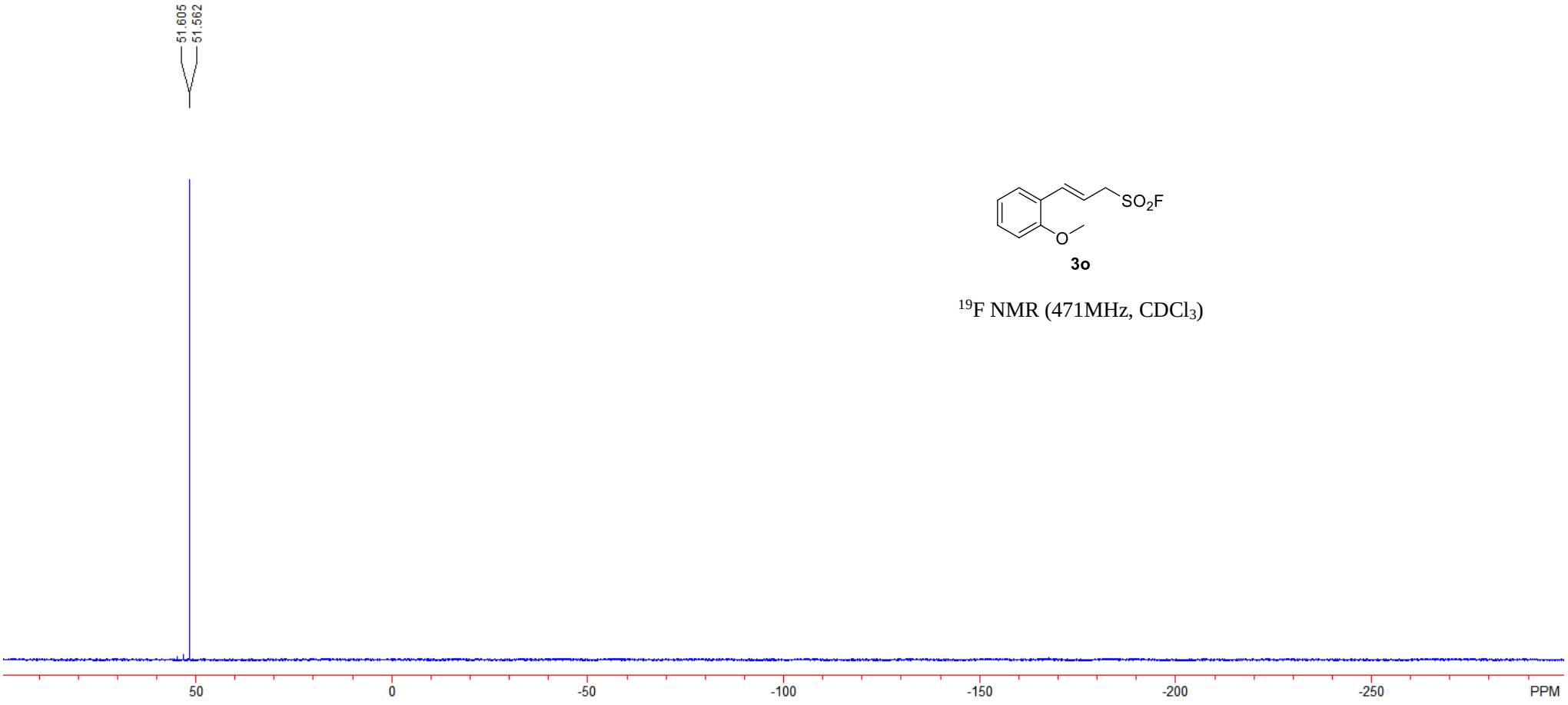
^{19}F NMR (471MHz, $CDCl_3$)



3n

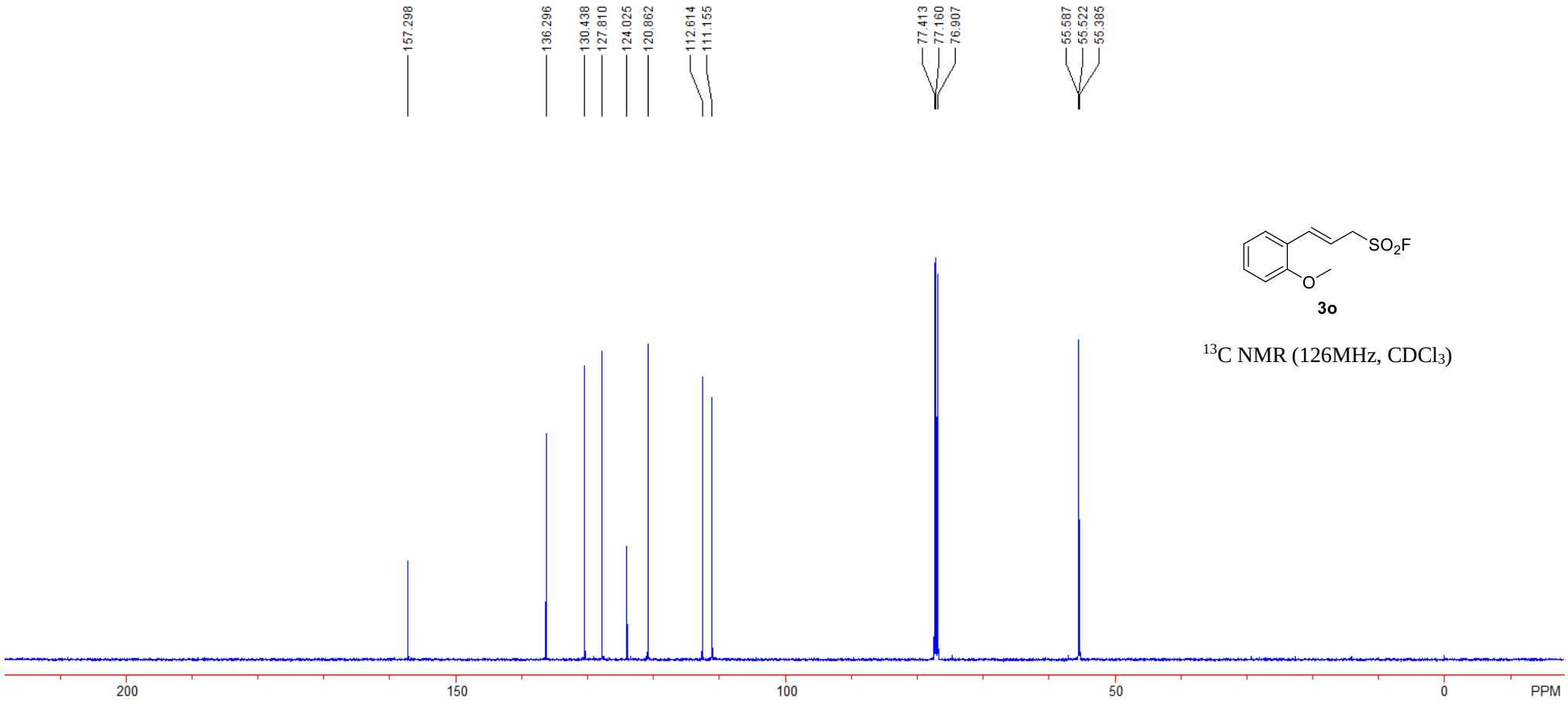
^{13}C NMR (126MHz, $CDCl_3$)

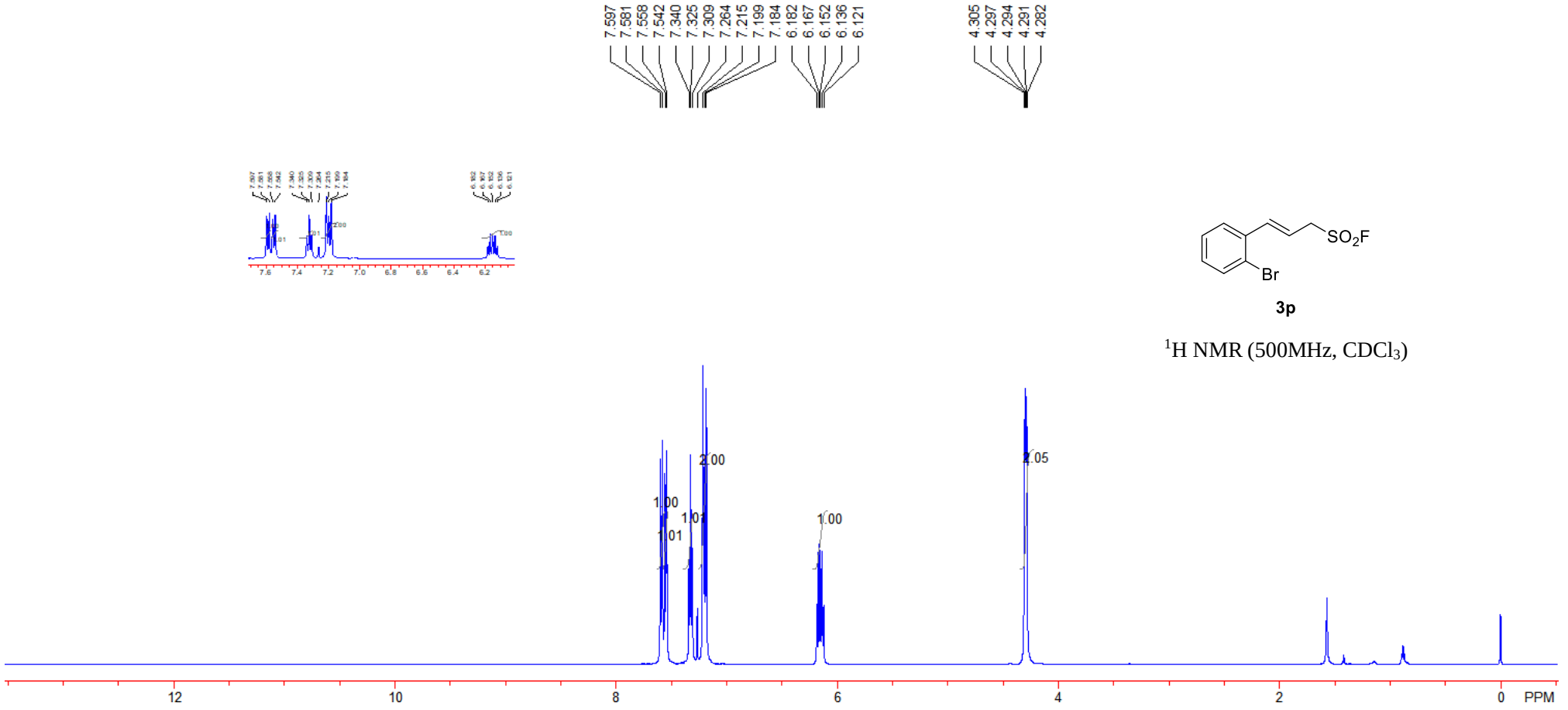

7.452
7.436
7.330
7.314
7.298
7.264
7.146
7.115
6.977
6.962
6.947
6.917
6.900
6.281
6.266
6.251
6.234
6.220
4.256
4.248
4.242
4.234
3.872
SO2F
O
3o
1H NMR (500MHz, CDCl3)
1.01
1.04
1.04
1.04
1.00
1.00
2.07
3.04
12
10
8
6
4
2
0 PPM

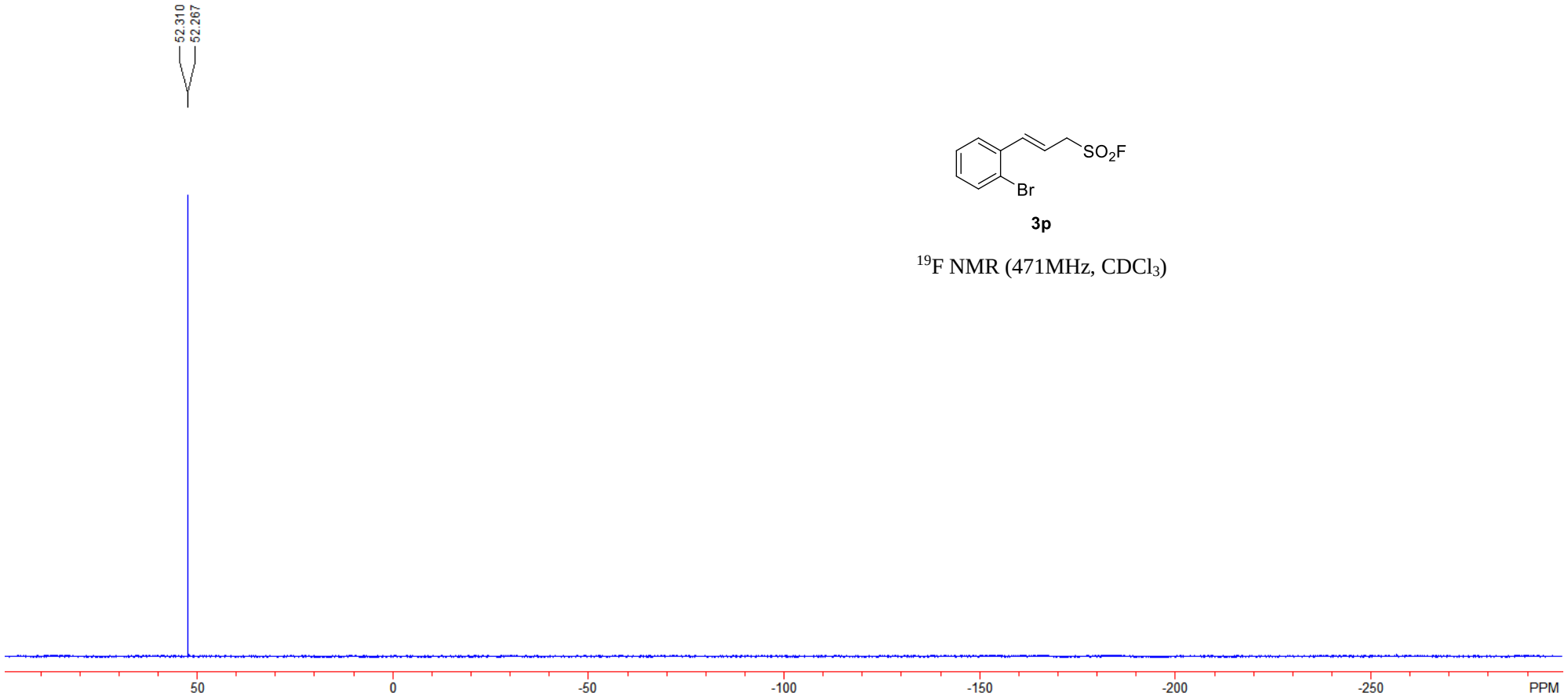


3o

^{19}F NMR (471MHz, $CDCl_3$)

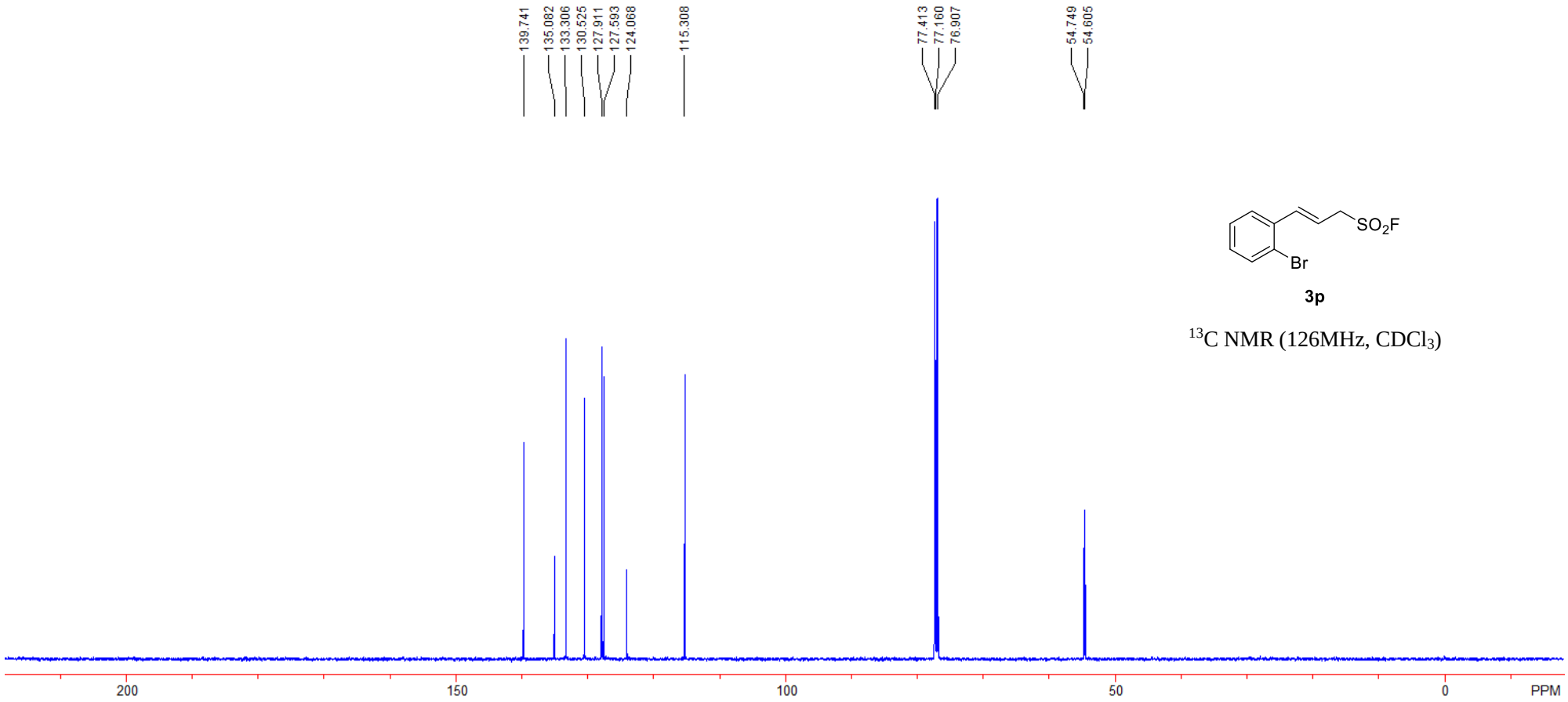

157.298
136.296
130.438
127.810
124.025
120.862
112.614
111.155
77.413
77.160
76.907
55.587
55.522
55.385
SO2F
O
3o
13C NMR (126MHz, CDCl3)
200
150
100
50
0
PPM


7.597
7.581
7.558
7.542
7.340
7.325
7.309
7.264
7.215
7.199
7.184
6.182
6.167
6.152
6.136
6.121
4.305
4.297
4.294
4.291
4.282
SO2F
Br
3p
1H NMR (500MHz, CDCl3)
1.00
1.01
1.01
2.00
1.00
2.05
12
10
8
6
4
2
0
PPM



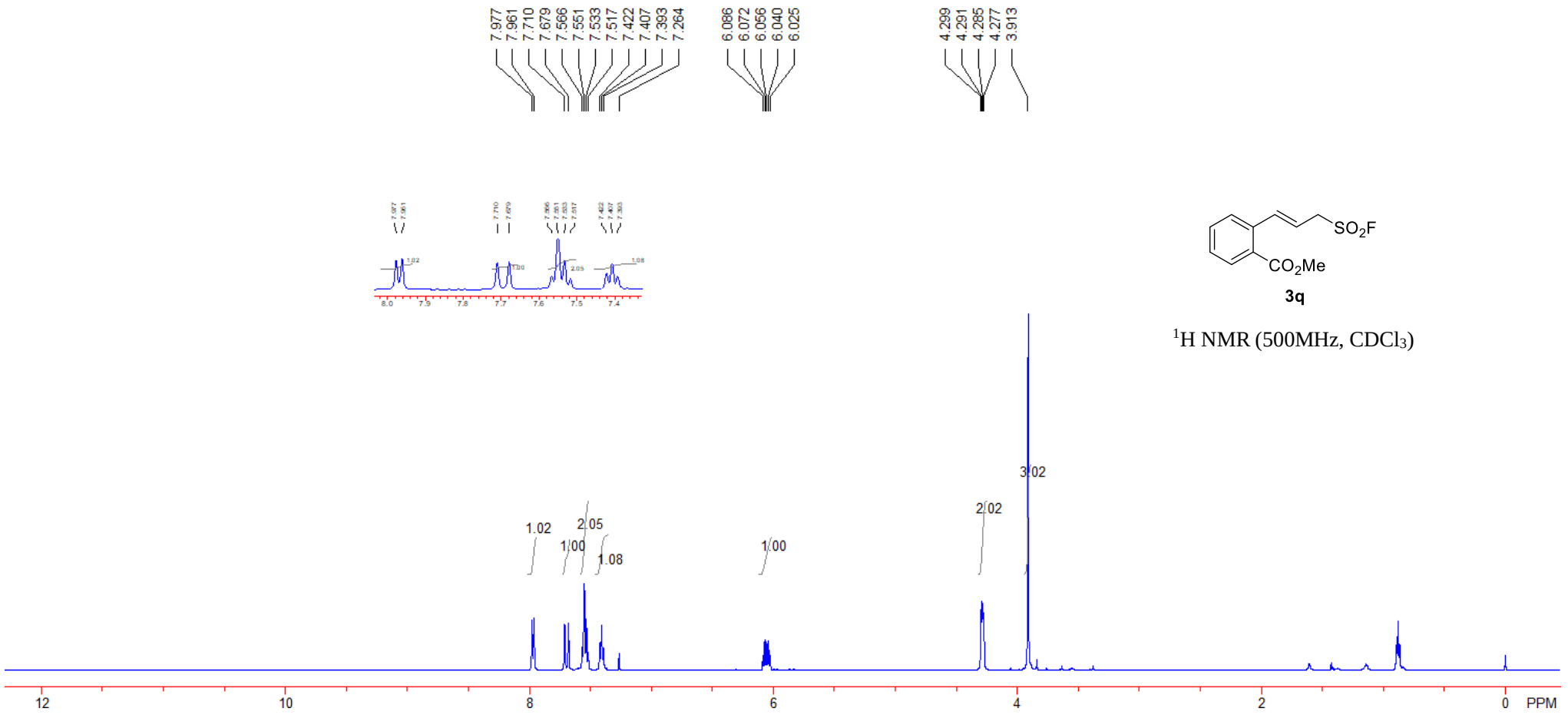
3p

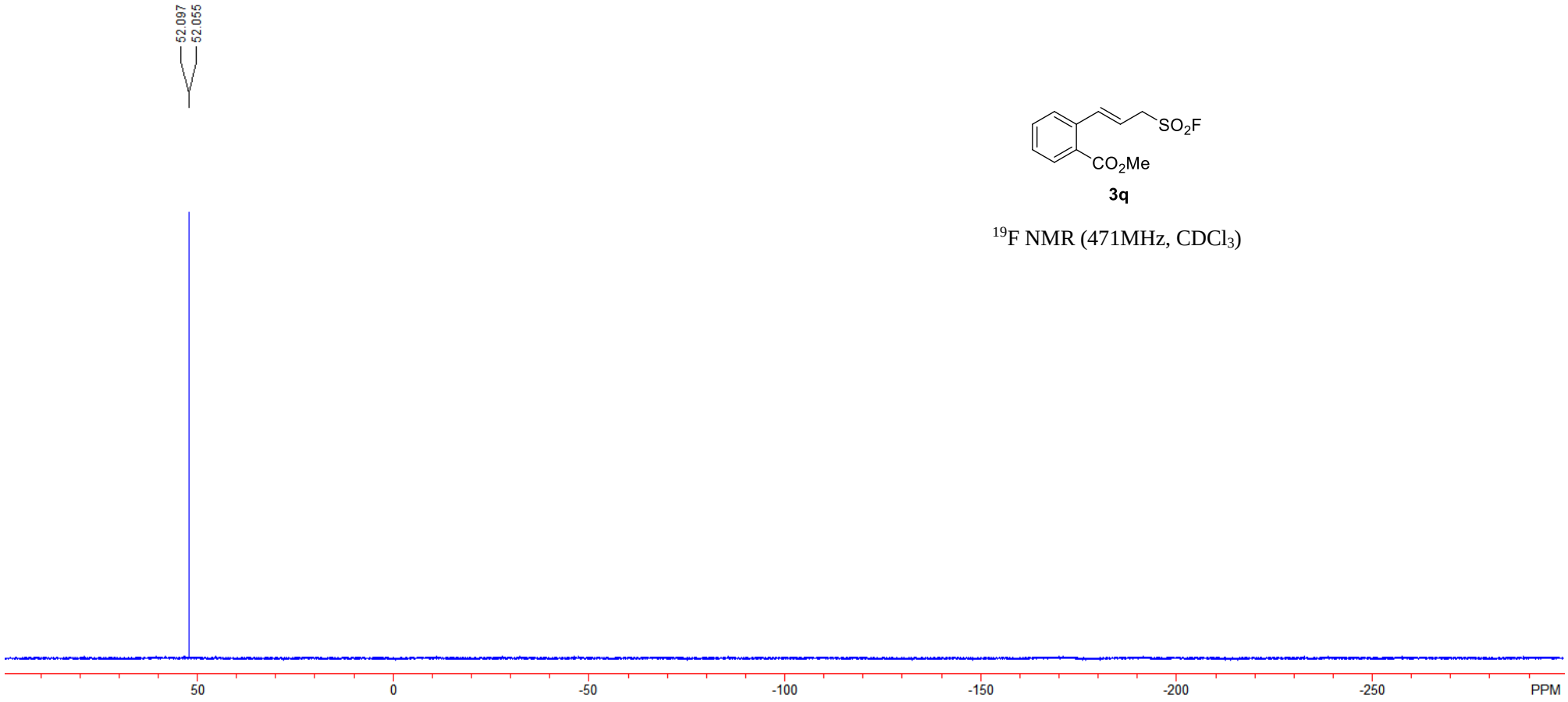
^{19}F NMR (471MHz, $CDCl_3$)



3p

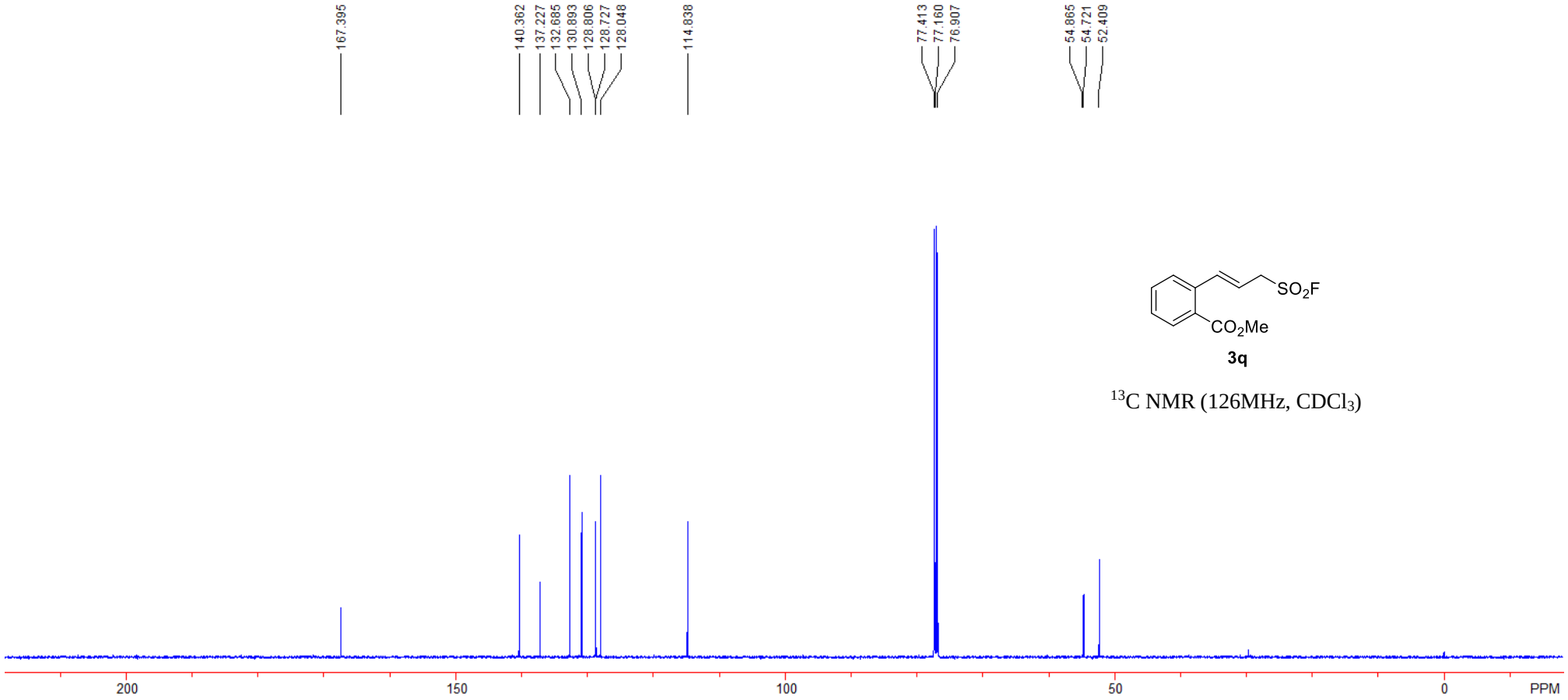
^{13}C NMR (126MHz, $CDCl_3$)


7.977
7.961
7.710
7.679
7.566
7.551
7.533
7.517
7.422
7.407
7.393
7.264
6.086
6.072
6.056
6.040
6.025
4.299
4.291
4.285
4.277
3.913
SO2F
CO2Me
3q
1H NMR (500MHz, CDCl3)
1.02
2.05
1.00
1.08
1.00
2.02
3.02
12
10
8
6
4
2
0
PPM



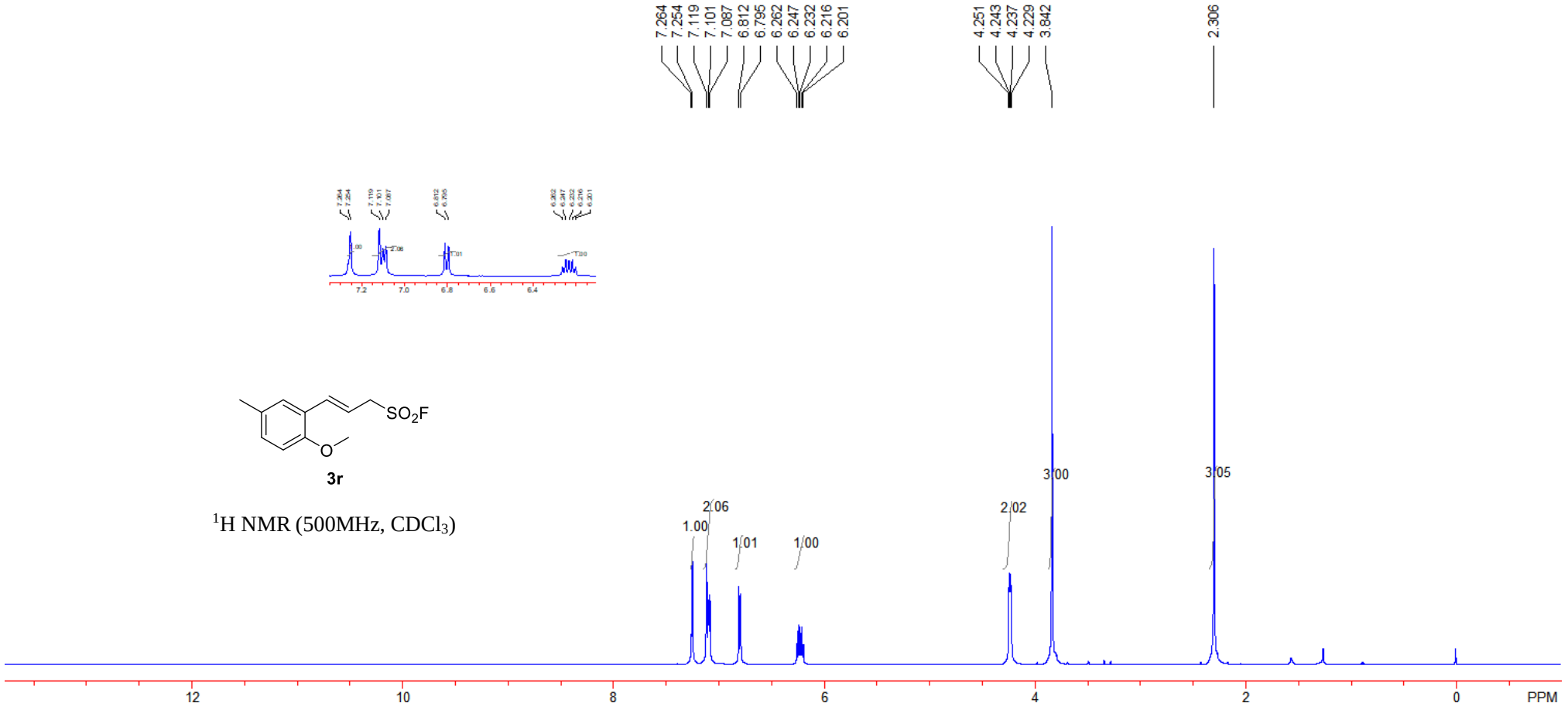
3q

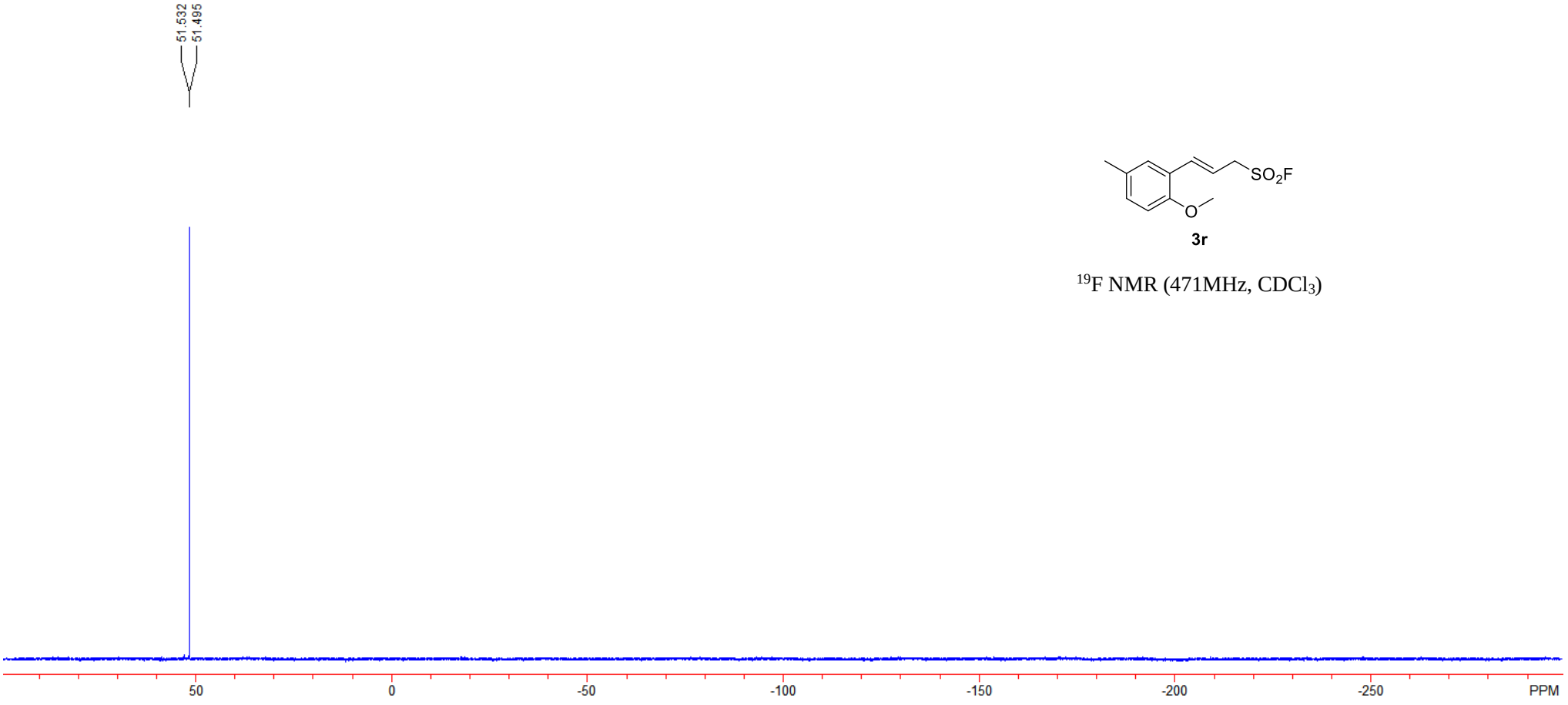
^{19}F NMR (471MHz, $CDCl_3$)



3q

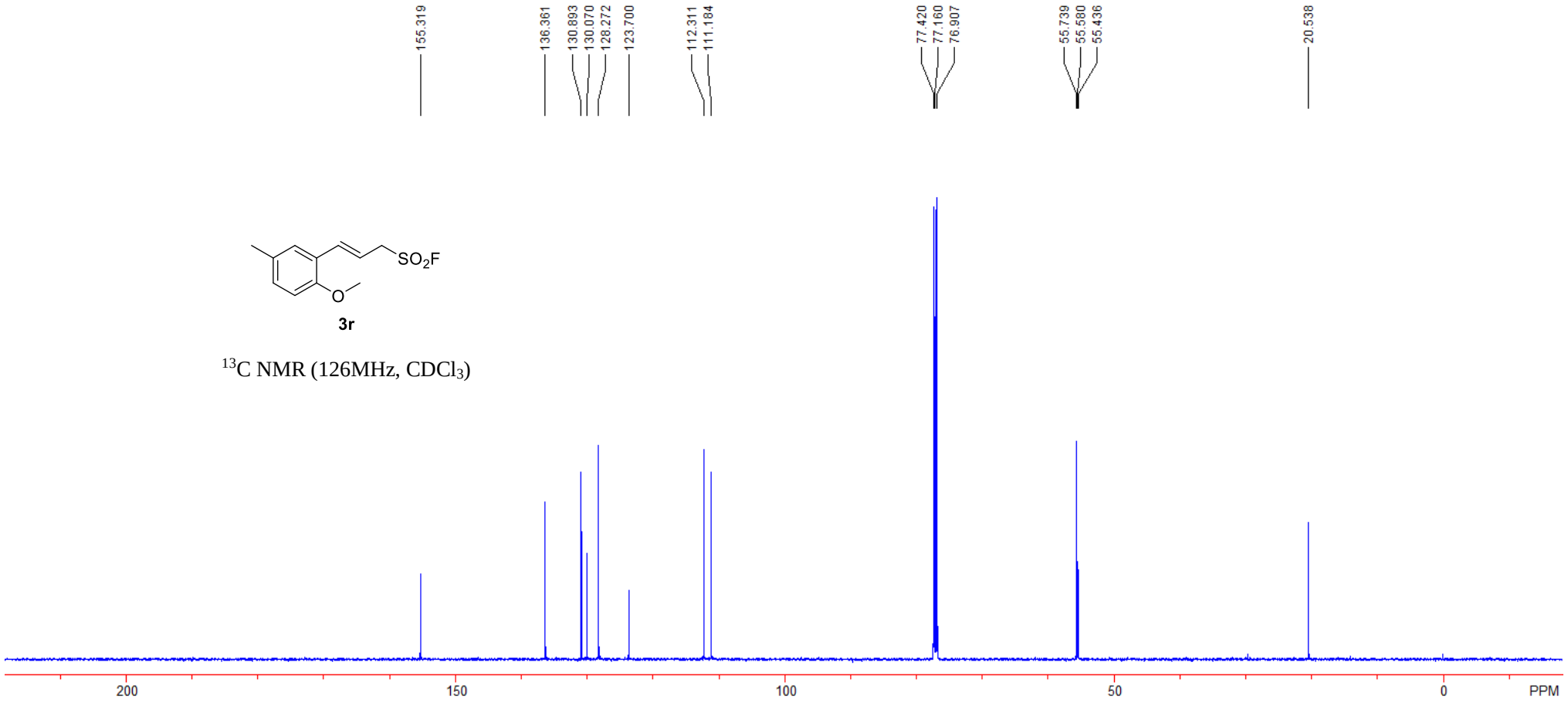
^{13}C NMR (126MHz, $CDCl_3$)


7.264
7.254
7.119
7.101
7.087
6.812
6.795
6.262
6.247
6.232
6.216
6.201
4.251
4.243
4.237
4.229
3.842
2.306
SO2F
O
3r
1H NMR (500MHz, CDCl3)
1.00
2.06
1.01
1.00
2.02
3.00
3.05
12
10
8
6
4
2
0
PPM



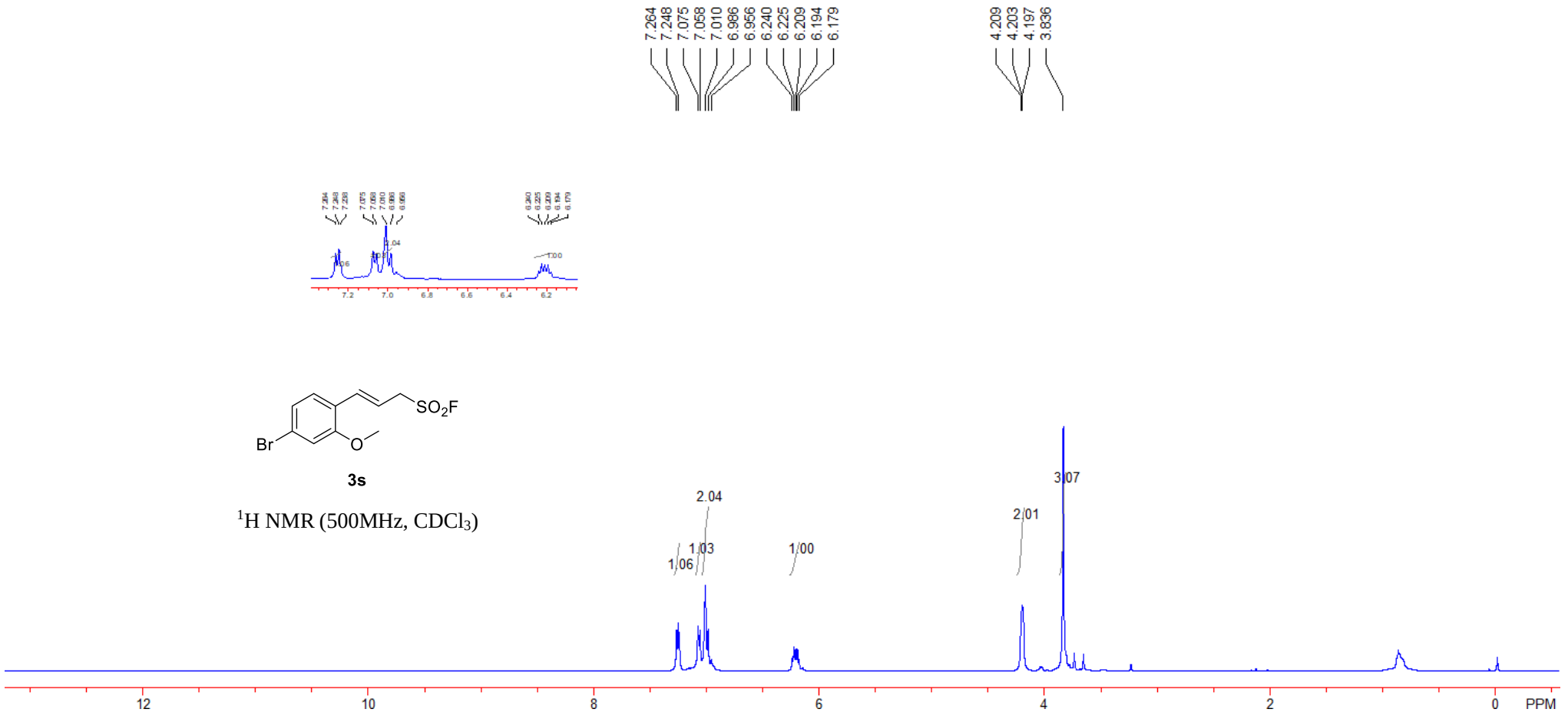
3r

^{19}F NMR (471MHz, $CDCl_3$)



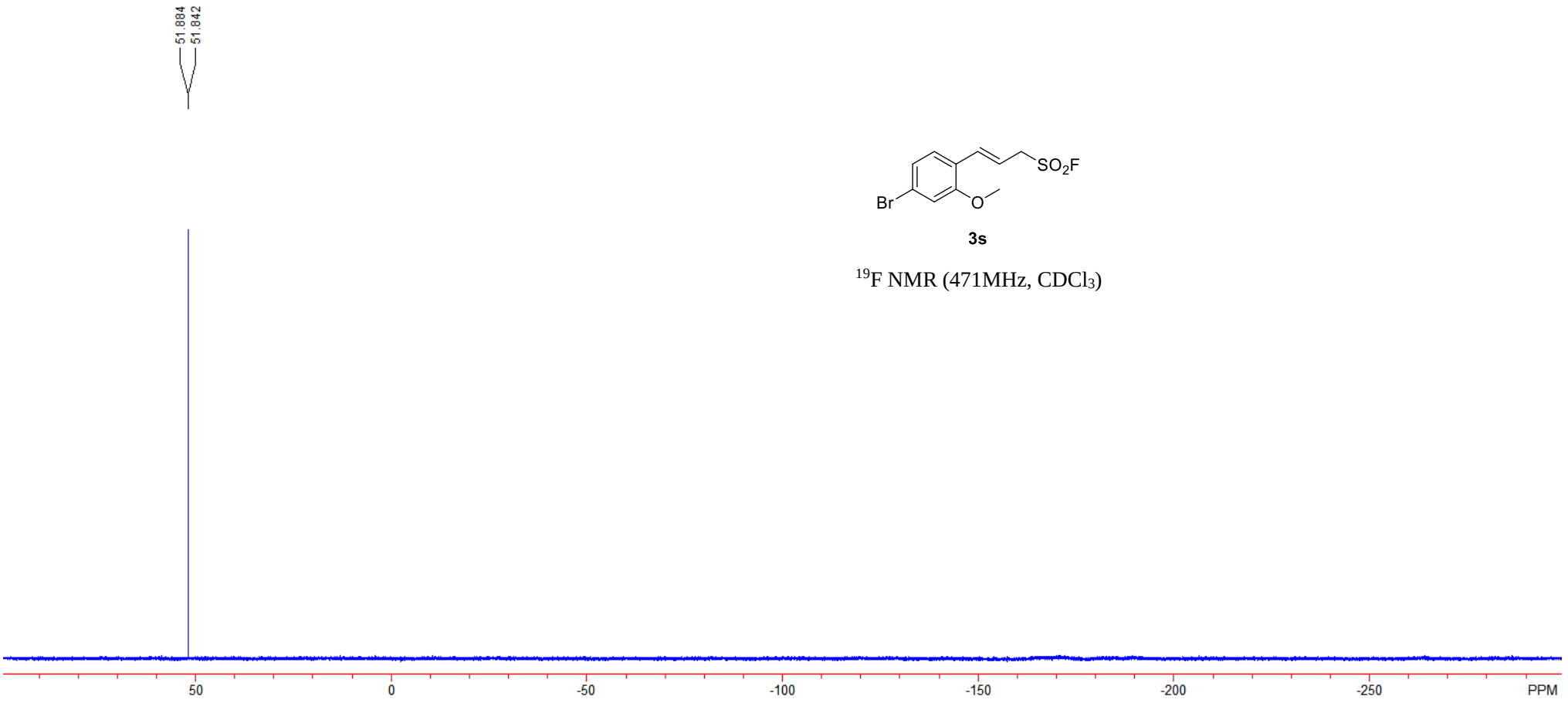
3r

^{13}C NMR (126MHz, $CDCl_3$)



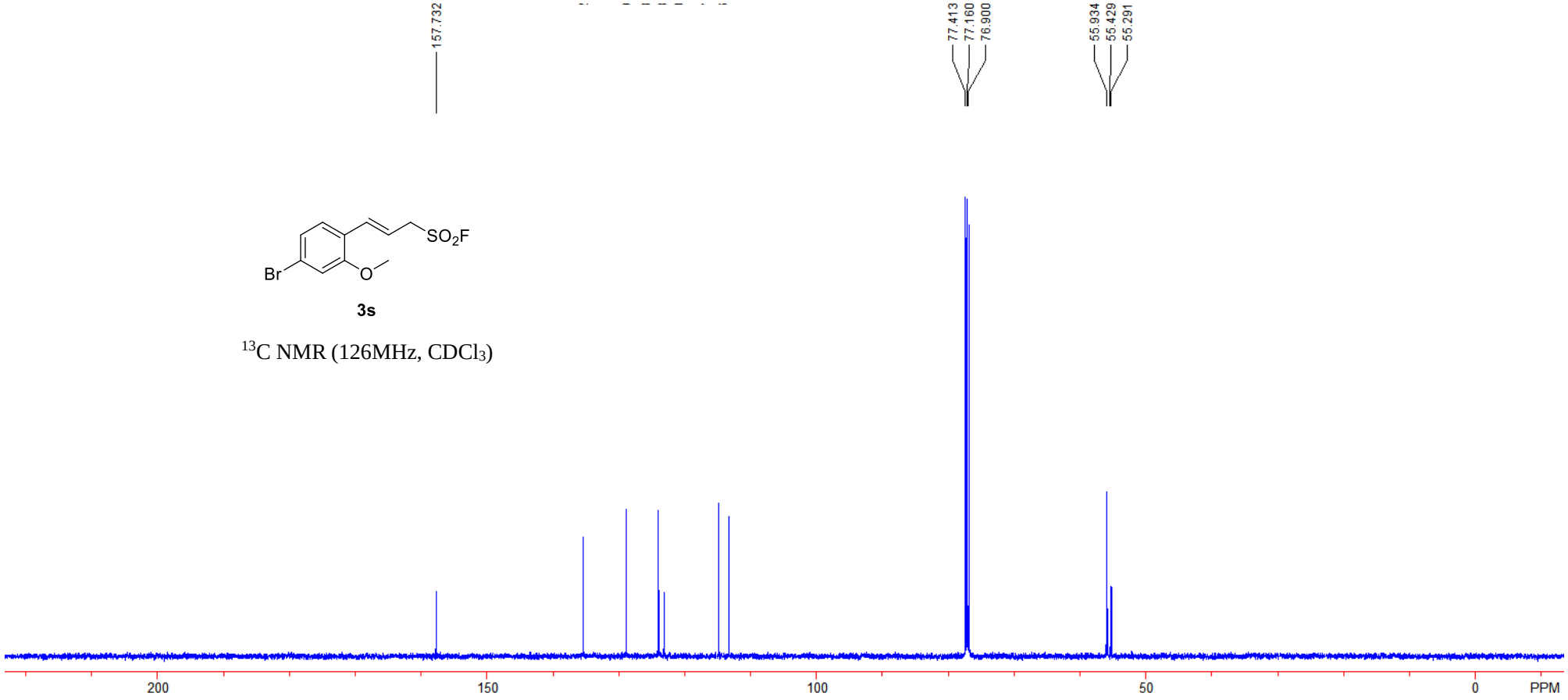
3s

^{1}H NMR (500MHz, $CDCl_3$)



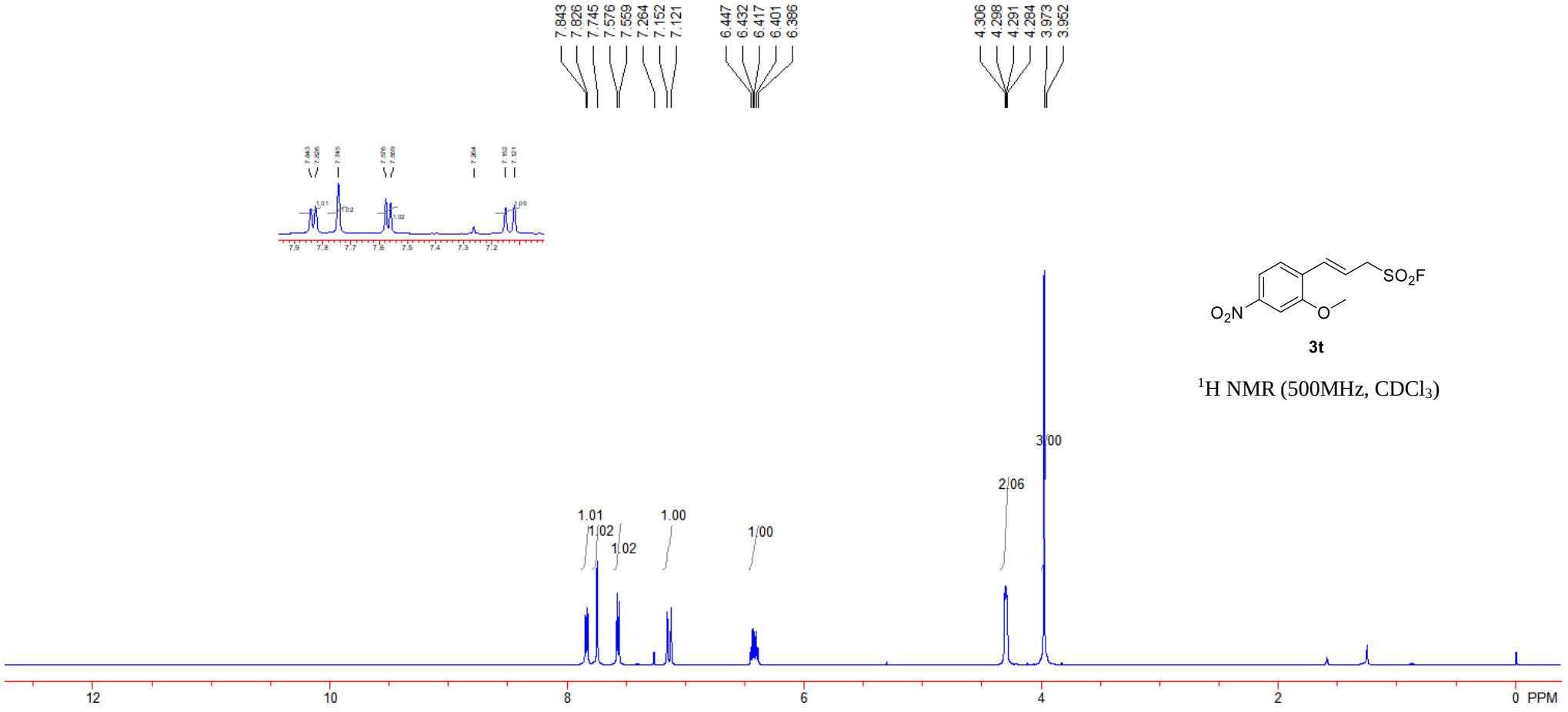
3s

^{19}F NMR (471MHz, $CDCl_3$)



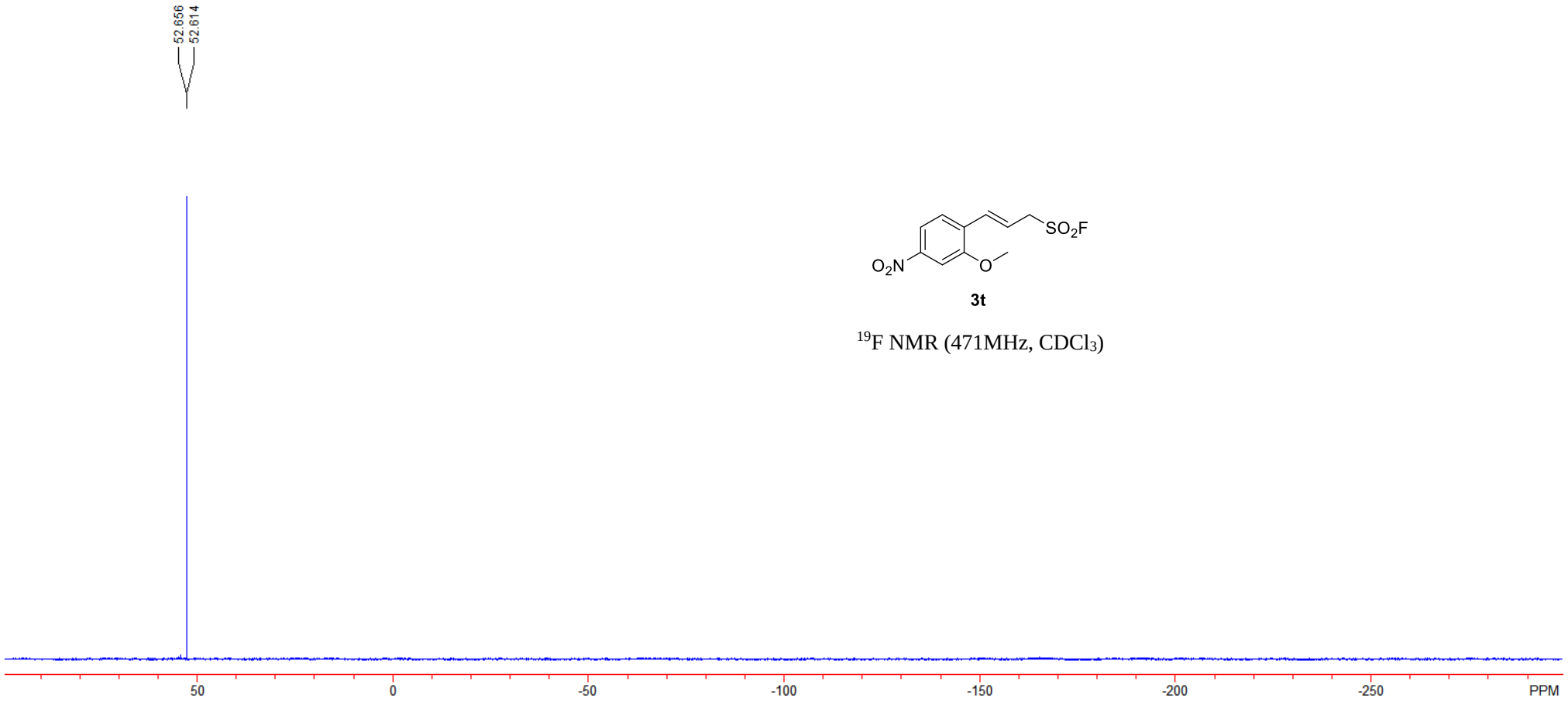
3s

^{13}C NMR (126MHz, $CDCl_3$)



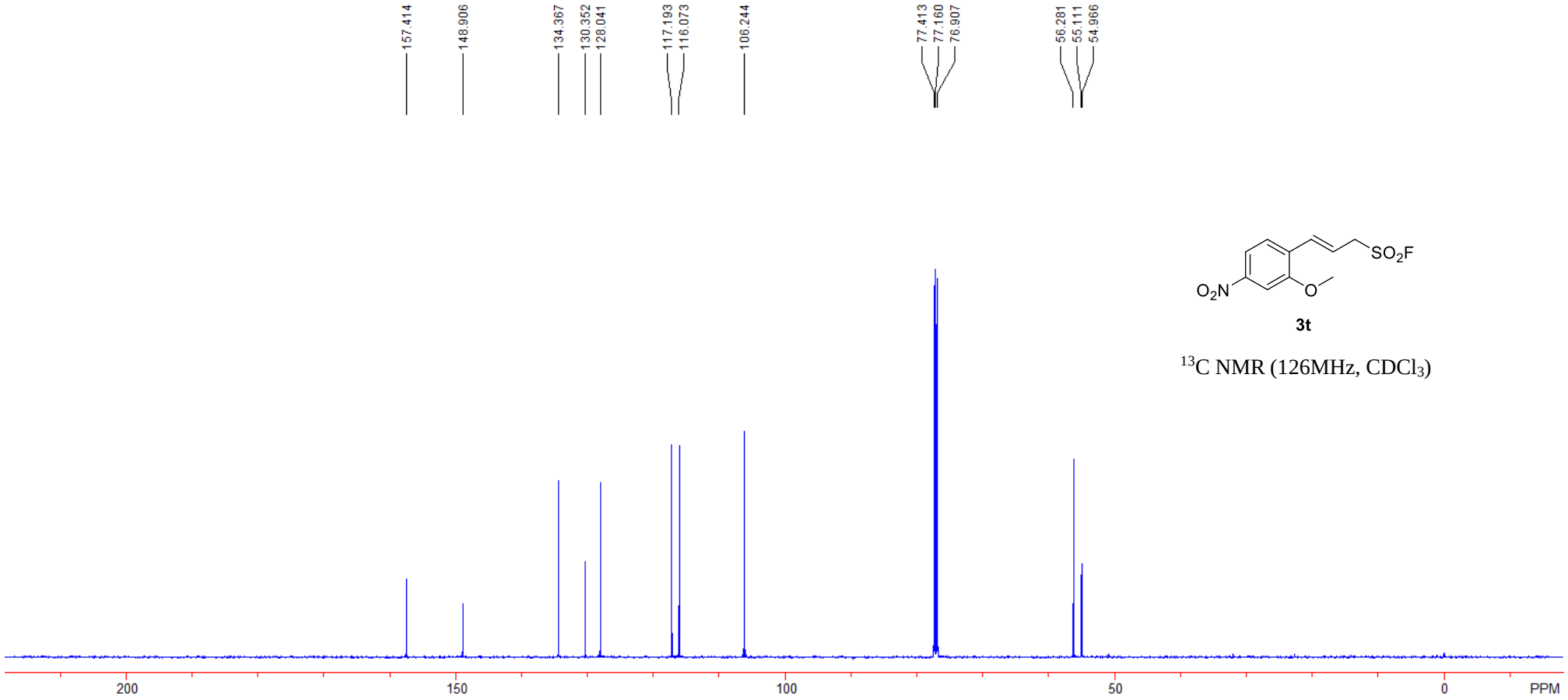
3t

^{1}H NMR (500MHz, $CDCl_3$)



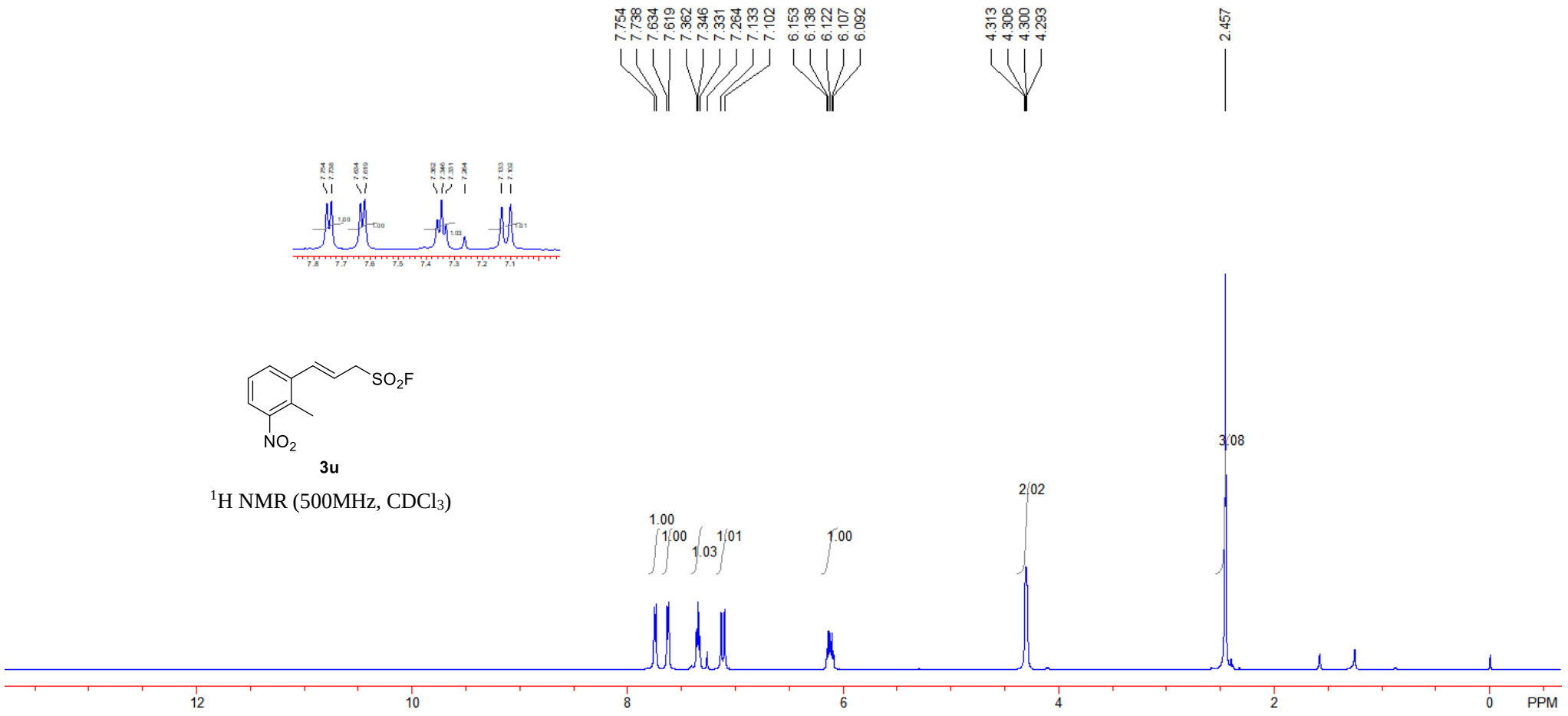
3t

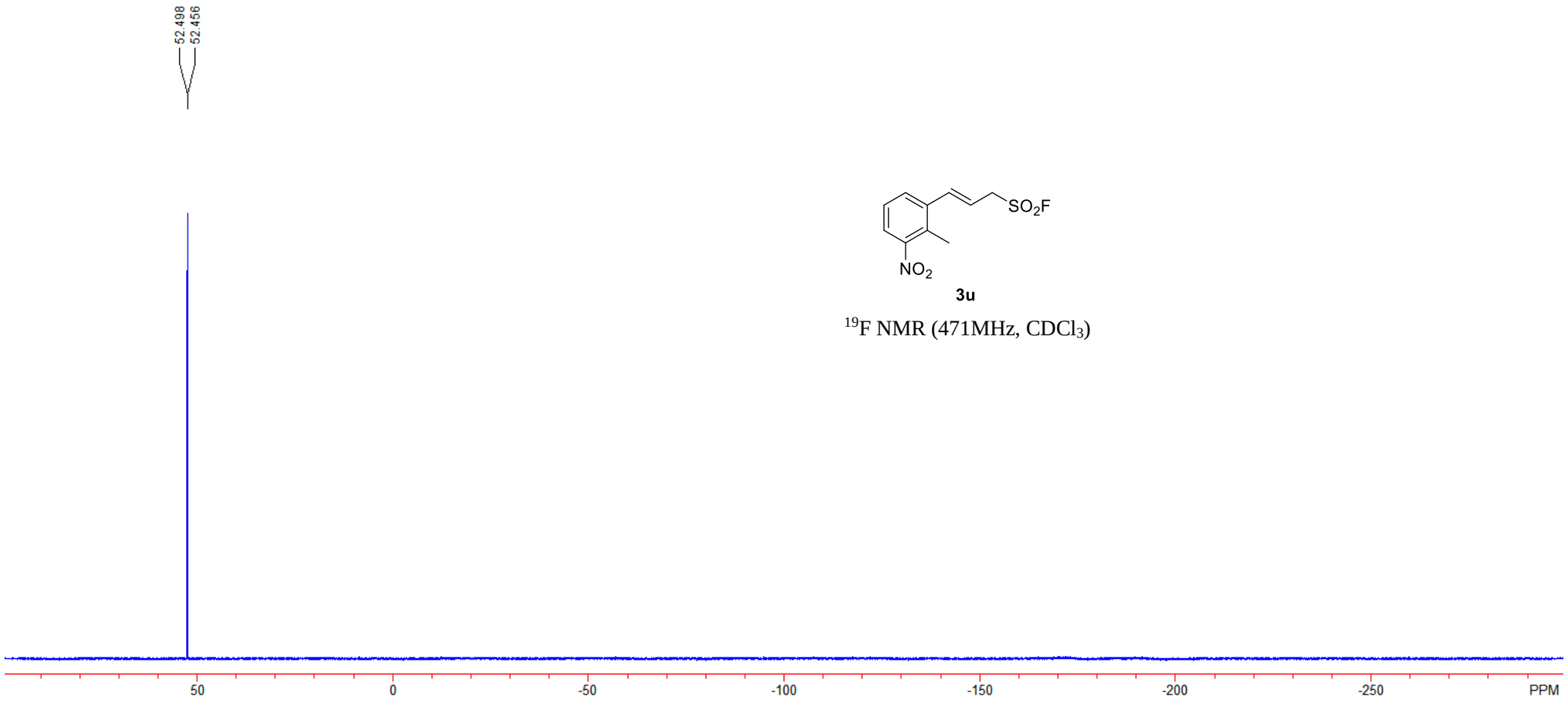
^{19}F NMR (471MHz, $CDCl_3$)



3t

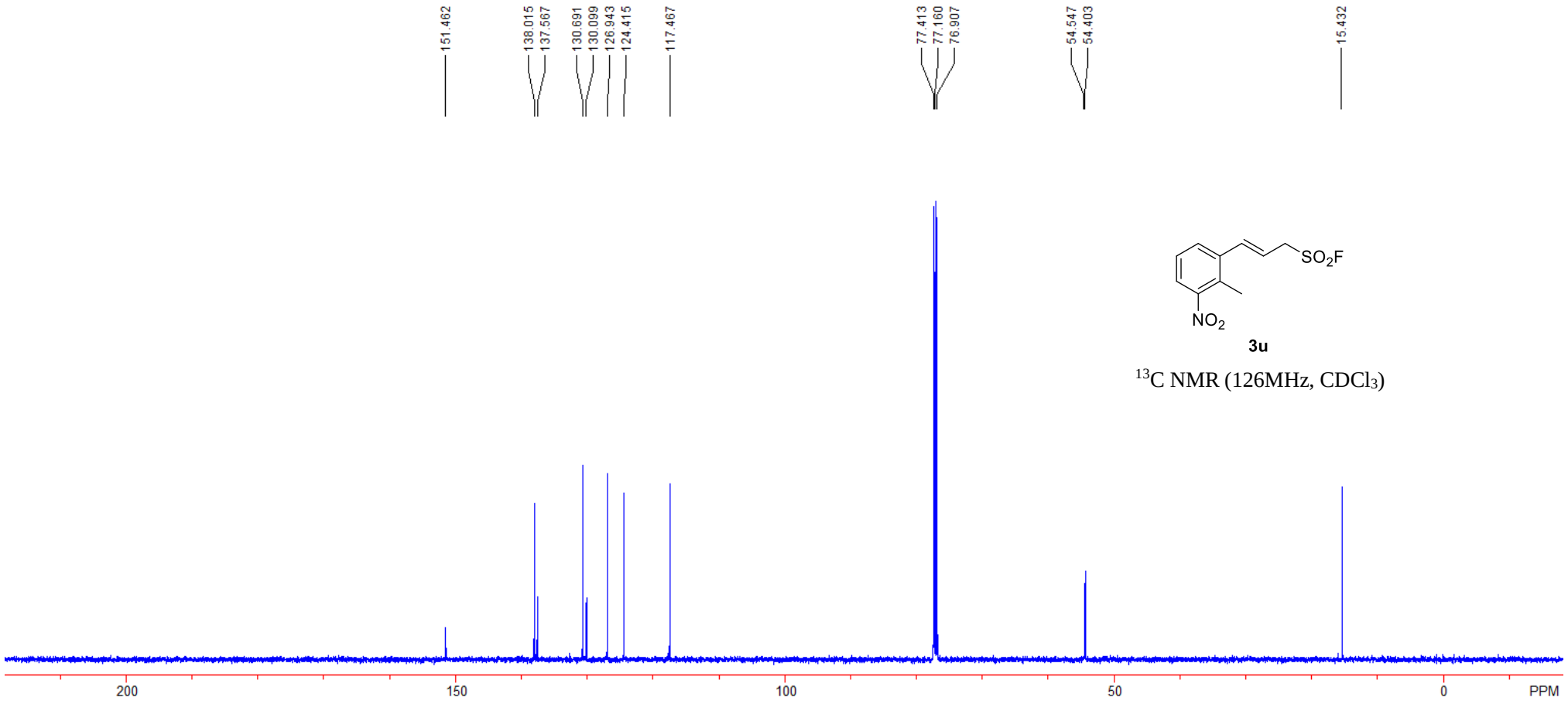
^{13}C NMR (126MHz, $CDCl_3$)


7.754
7.738
7.634
7.619
7.362
7.346
7.331
7.264
7.133
7.102
6.153
6.138
6.122
6.107
6.092
4.313
4.306
4.300
4.293
2.457
SO2F
NO2
3u
1H NMR (500MHz, CDCl3)
1.00
1.00
1.03
1.01
1.00
2.02
3.08
12
10
8
6
4
2
0
PPM



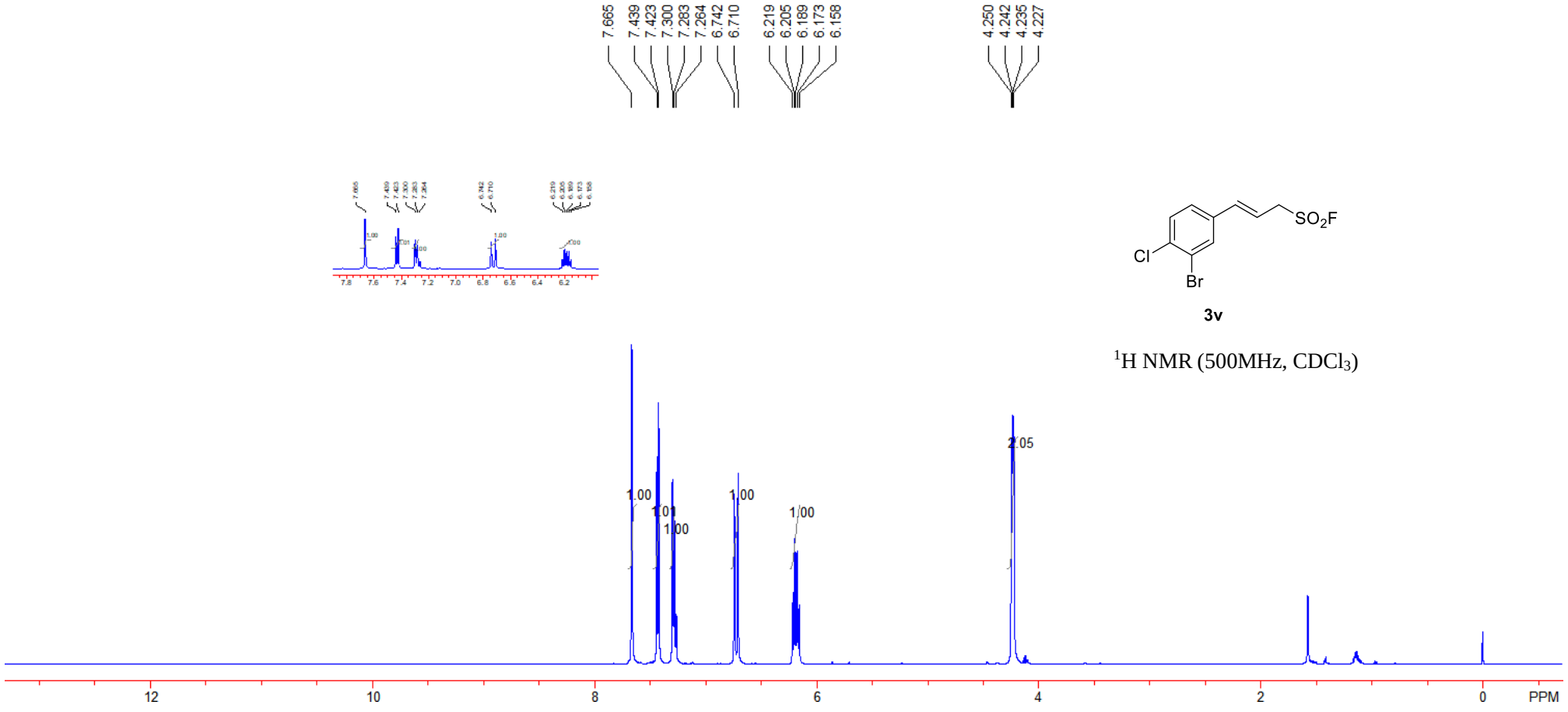
3u

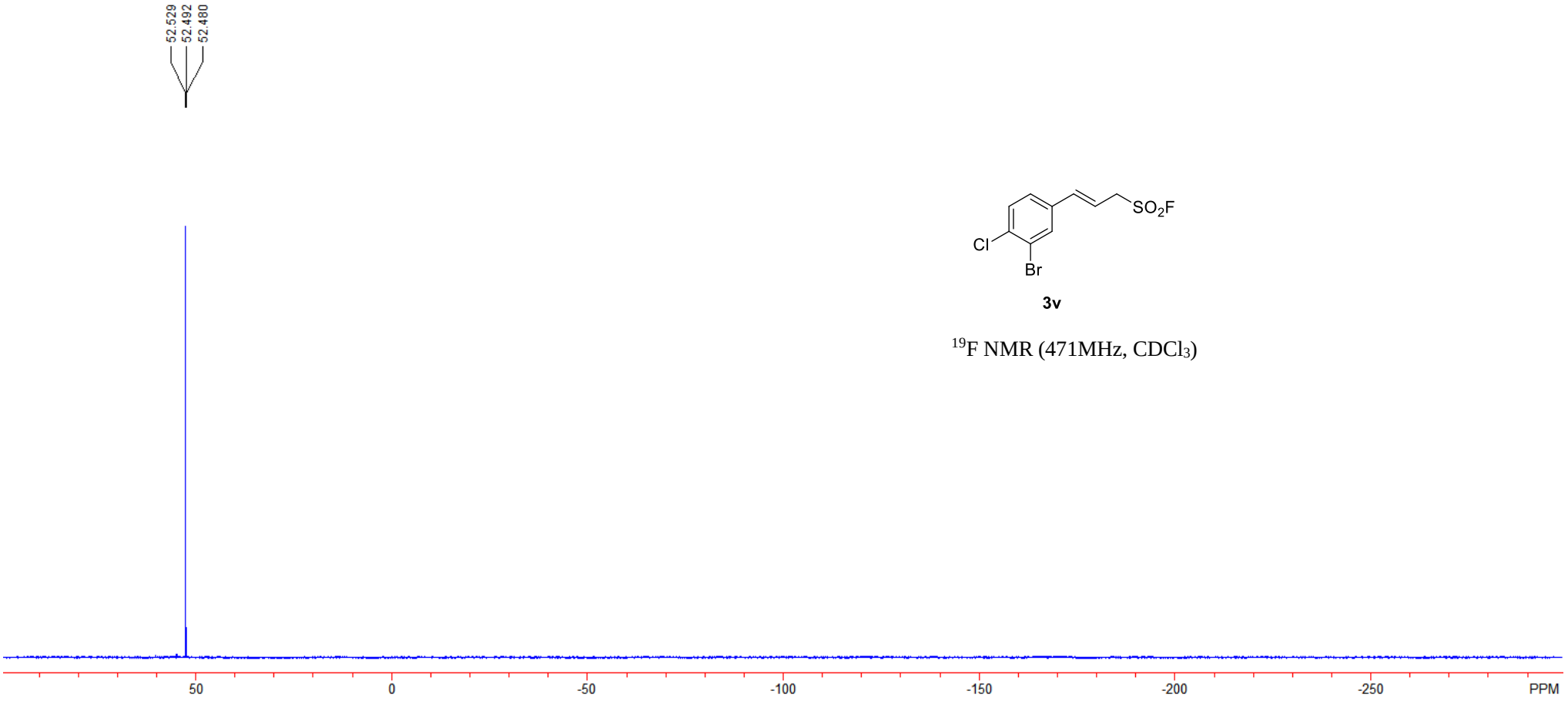
^{19}F NMR (471MHz, $CDCl_3$)



3u

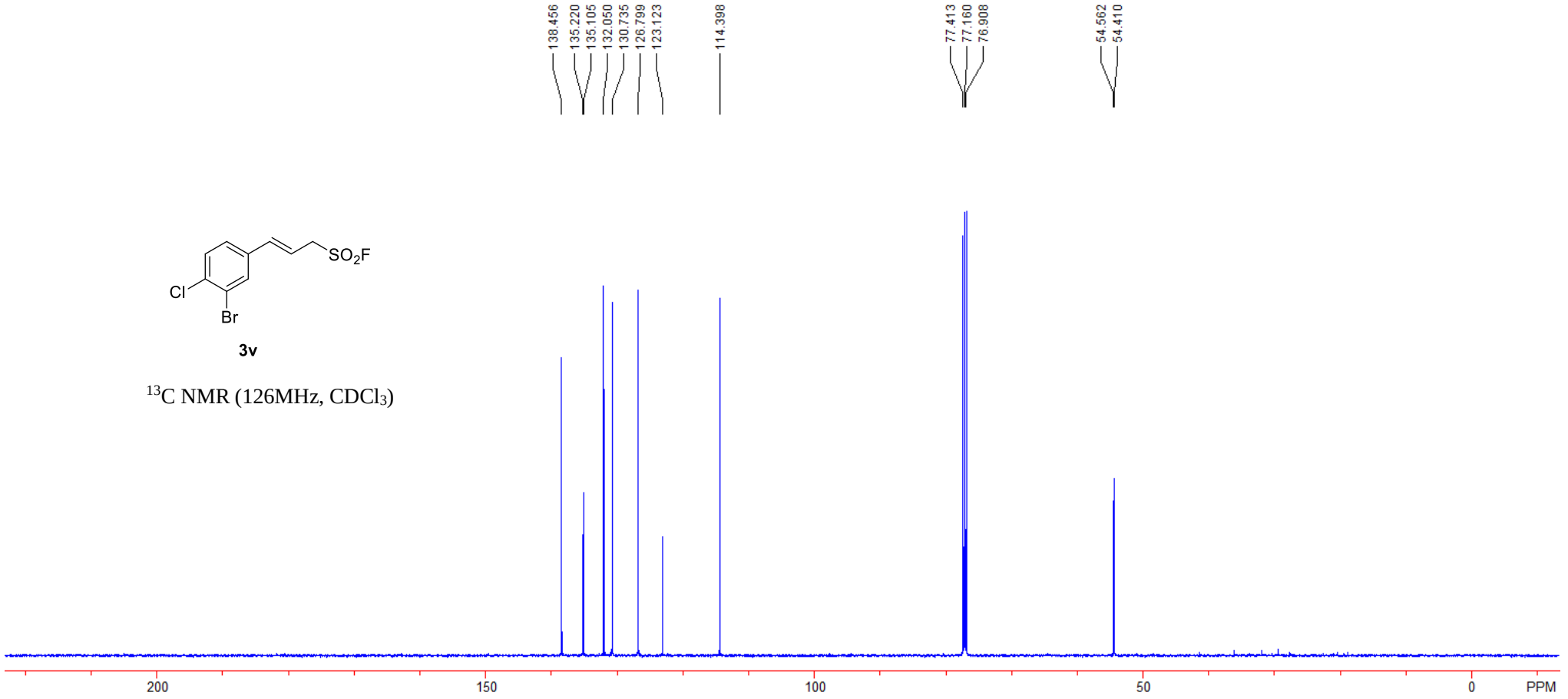
^{13}C NMR (126MHz, $CDCl_3$)


7.665
7.439
7.423
7.300
7.283
7.264
6.742
6.710
6.219
6.205
6.189
6.173
6.158
4.250
4.242
4.235
4.227
Cl
Br
SO2F
3v
1H NMR (500MHz, CDCl3)
1.00
1.01
1.00
1.00
1.00
2.05
12
10
8
6
4
2
0
PPM



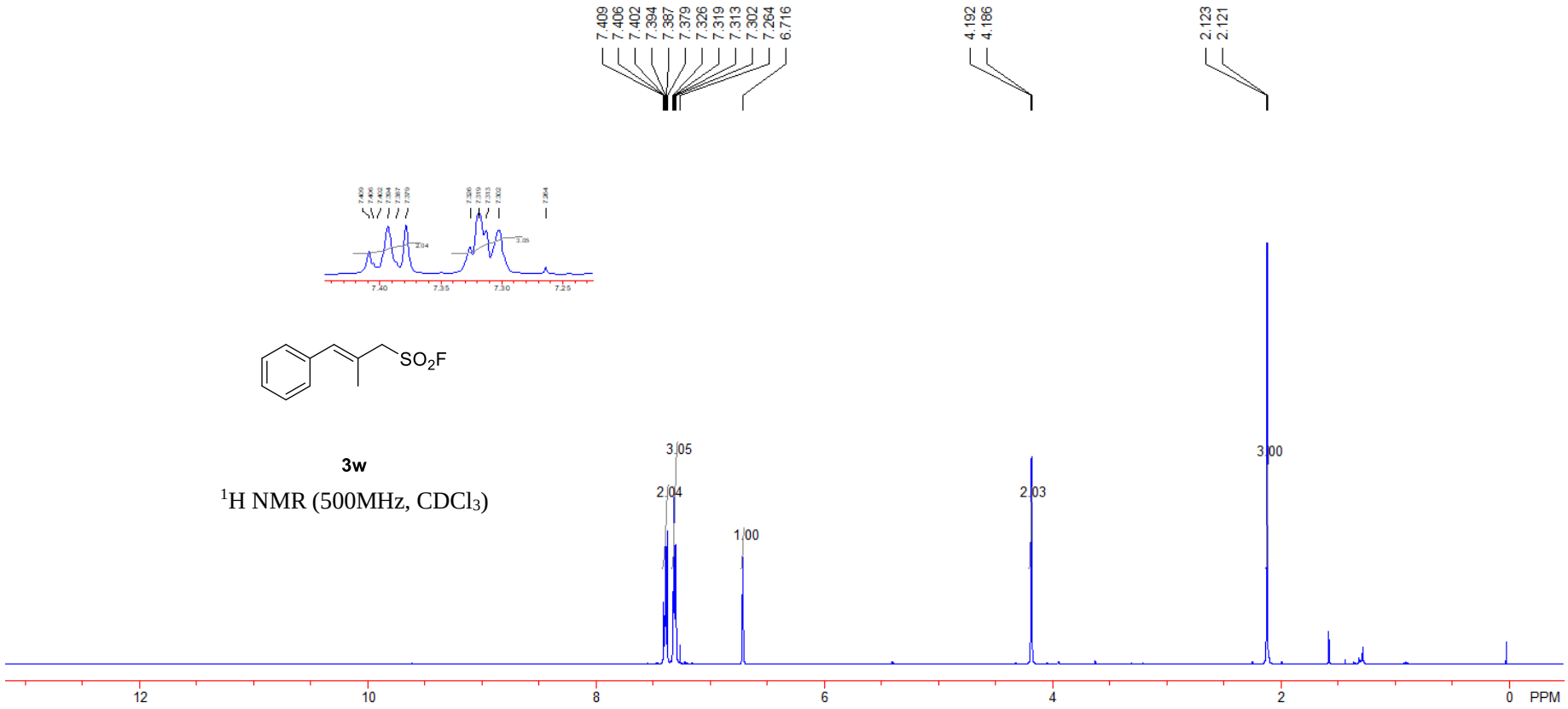
3v

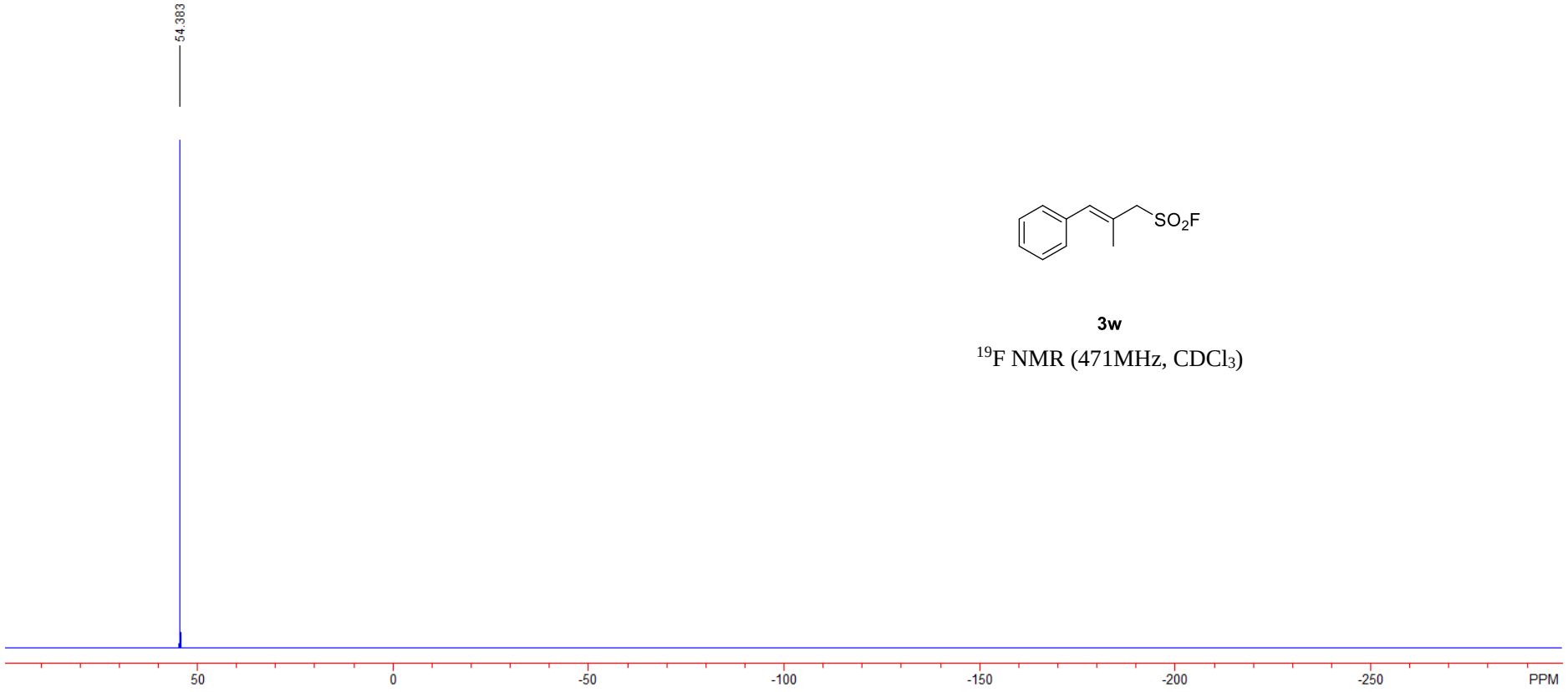
^{19}F NMR (471MHz, $CDCl_3$)



3v

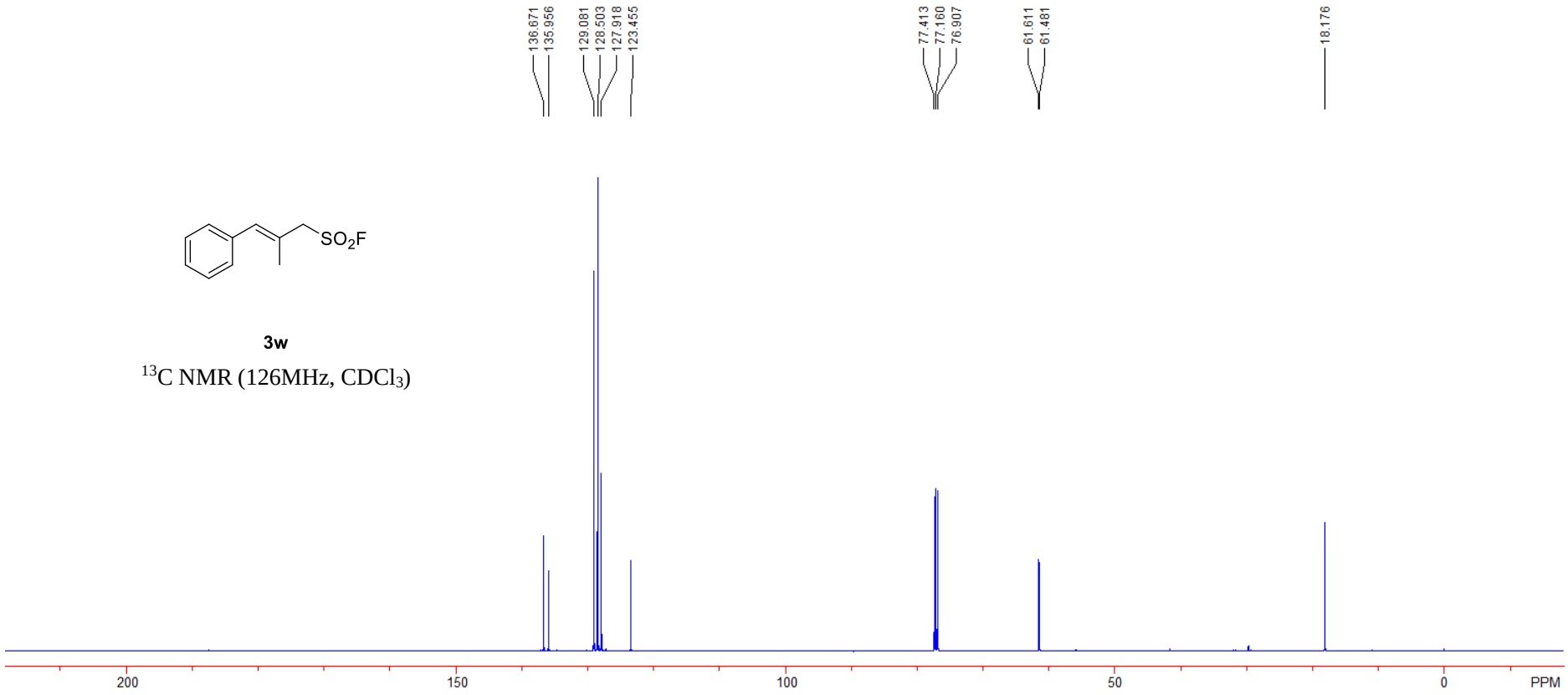
^{13}C NMR (126MHz, $CDCl_3$)


7.409
7.406
7.402
7.394
7.387
7.379
7.326
7.319
7.313
7.302
7.264
6.716
4.192
4.186
2.123
2.121
SO2F
3w
1H NMR (500MHz, CDCl3)
3.05
2.04
1.00
2.03
3.00
12
10
8
6
4
2
0
PPM



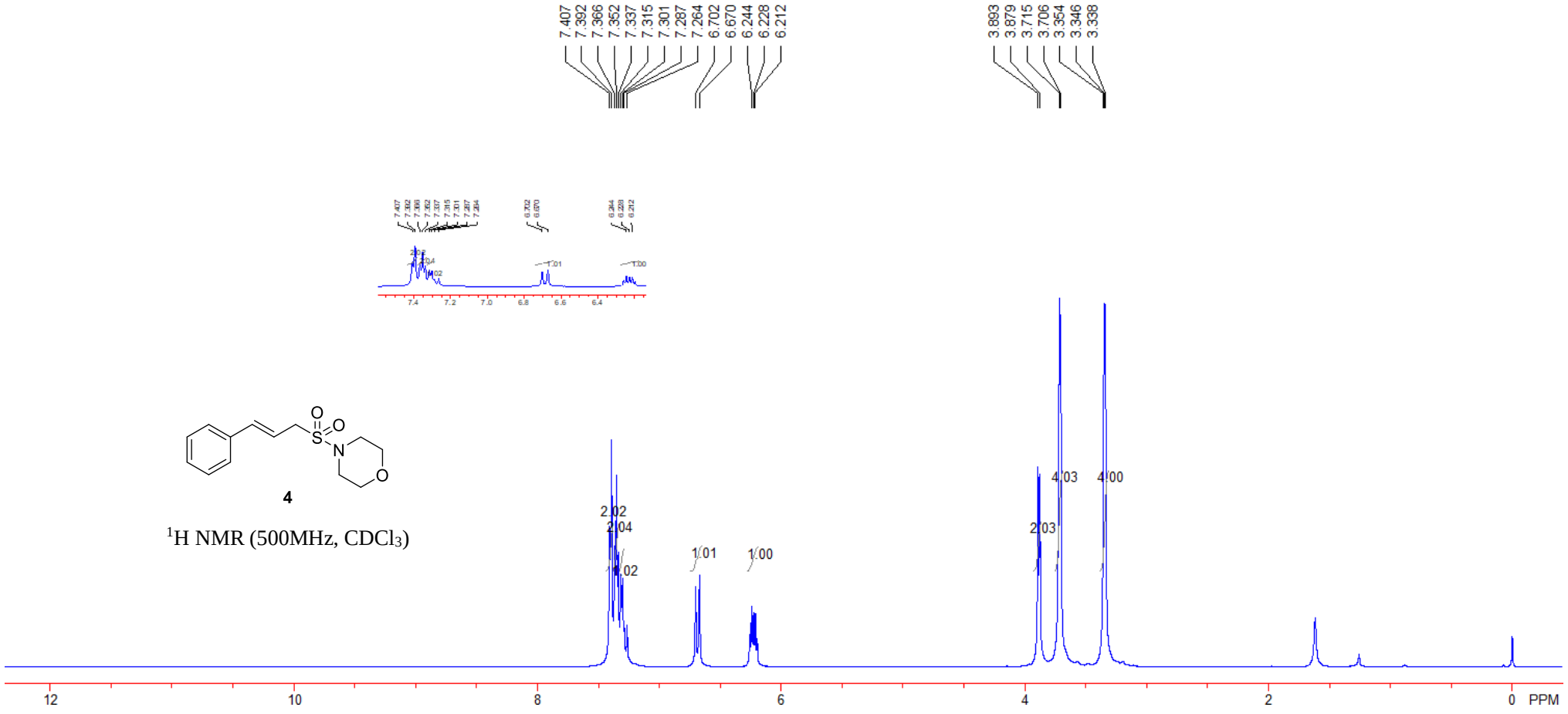
3w

^{19}F NMR (471MHz, $CDCl_3$)



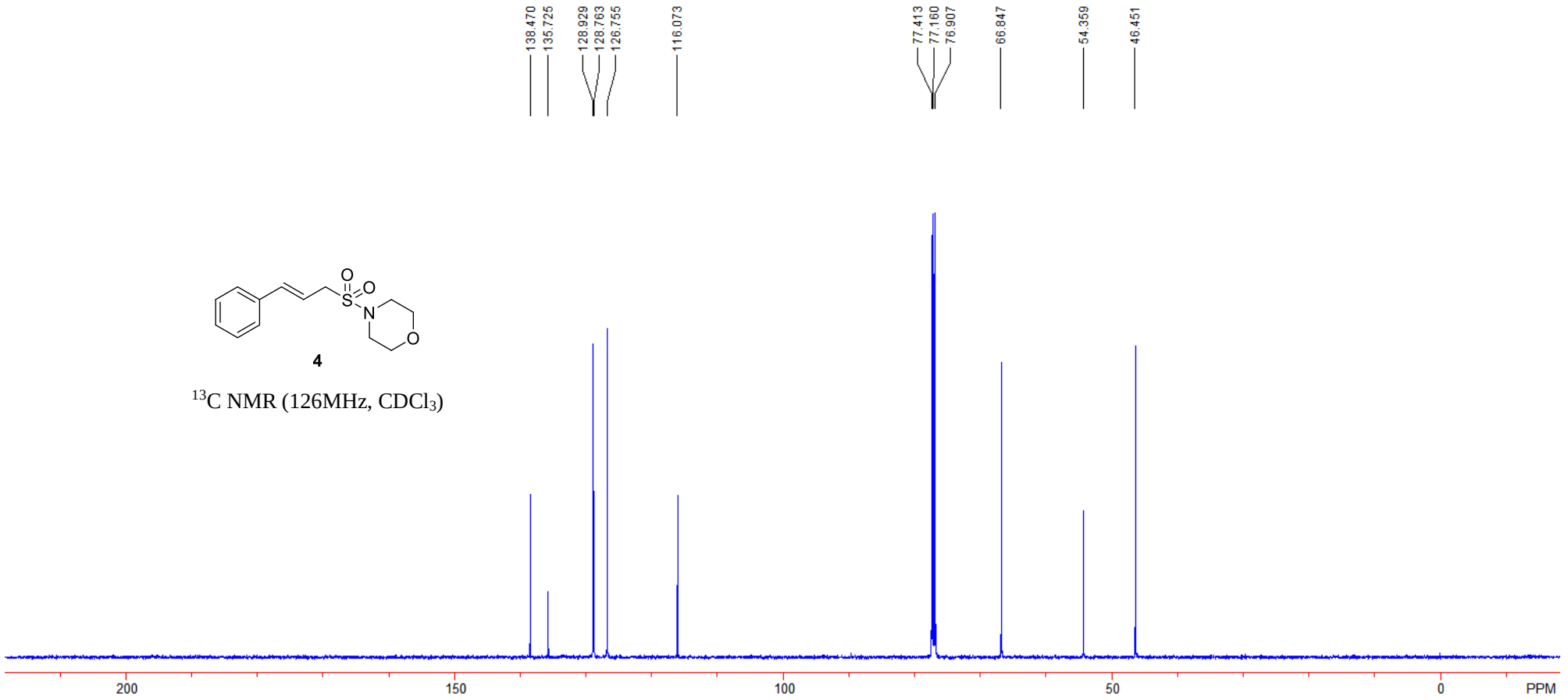
3w

^{13}C NMR (126MHz, $CDCl_3$)



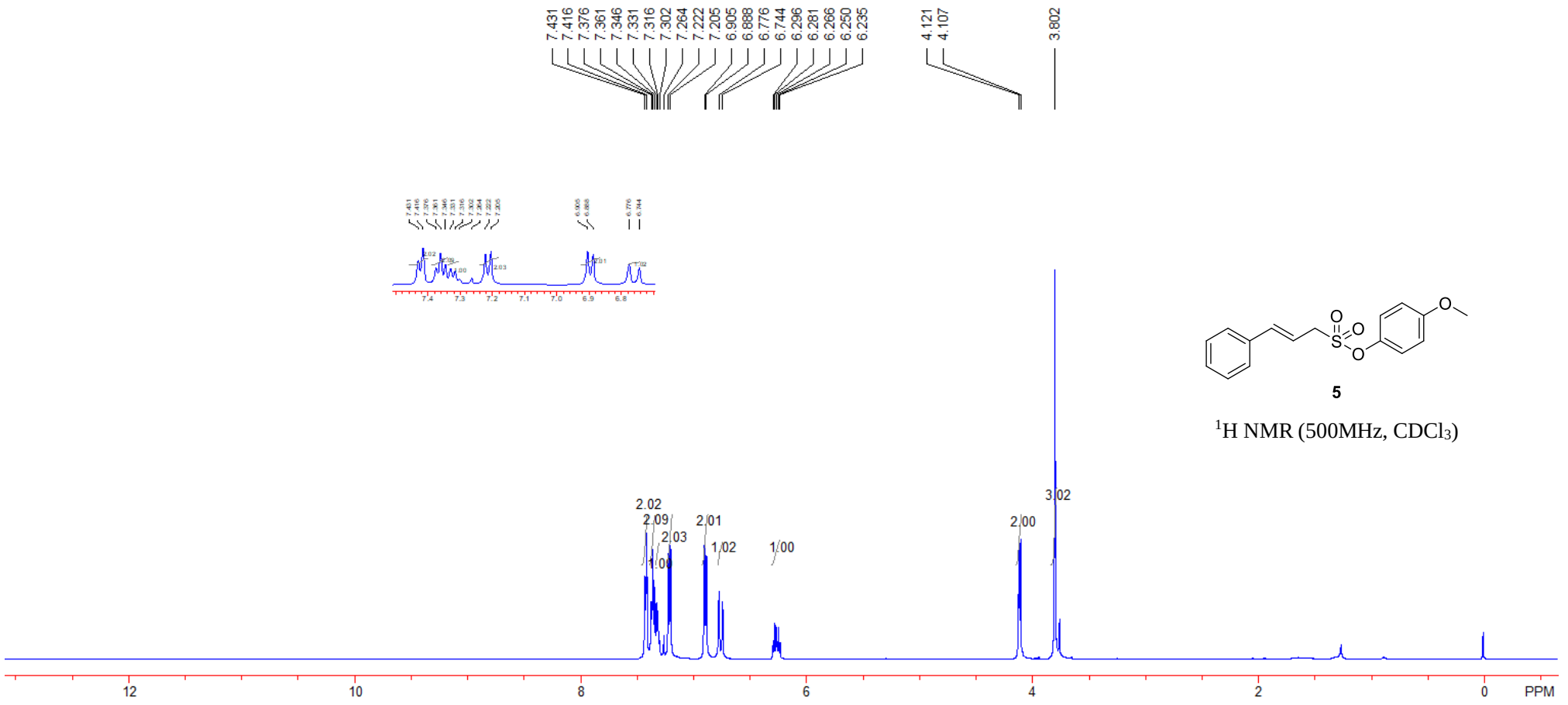
4

^{1}H NMR (500MHz, $CDCl_3$)



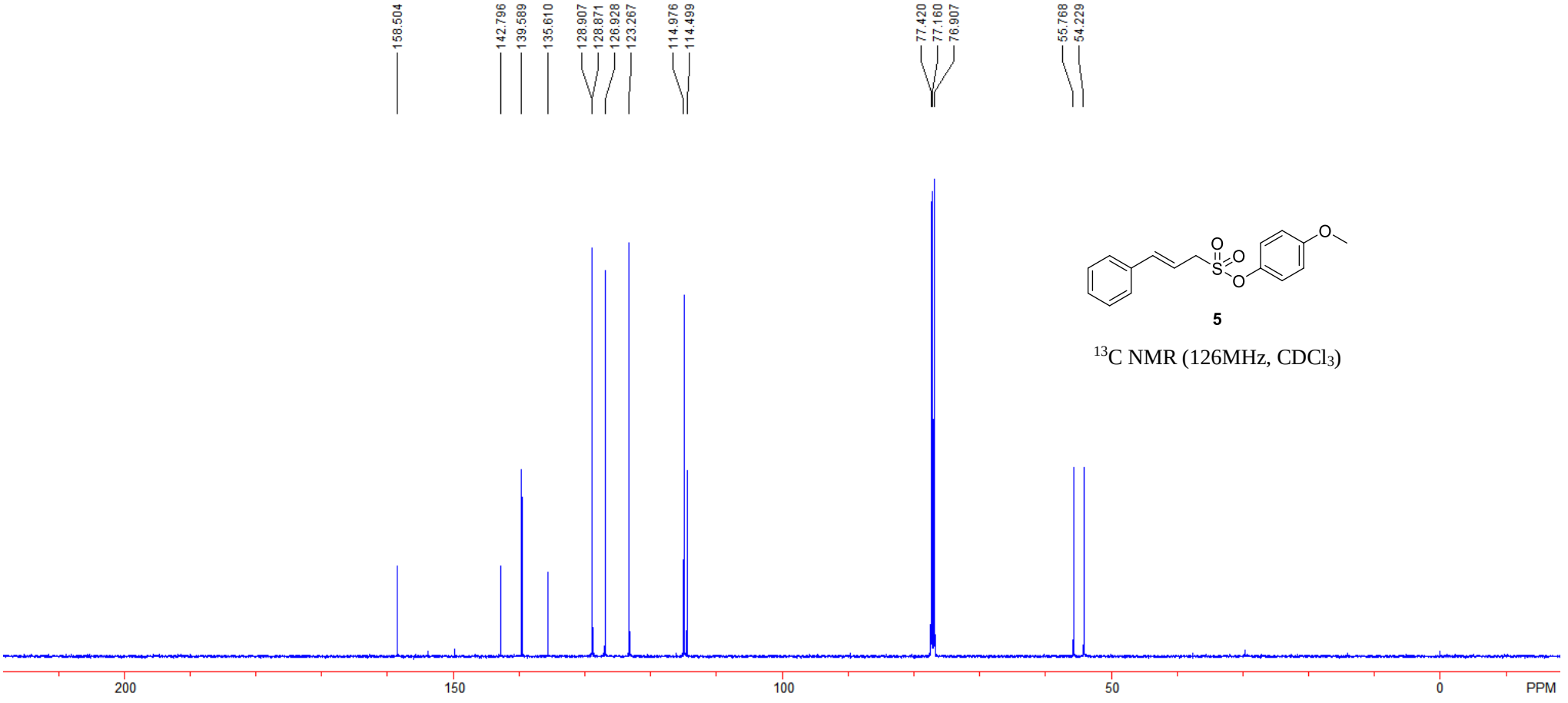
4

^{13}C NMR (126MHz, $CDCl_3$)



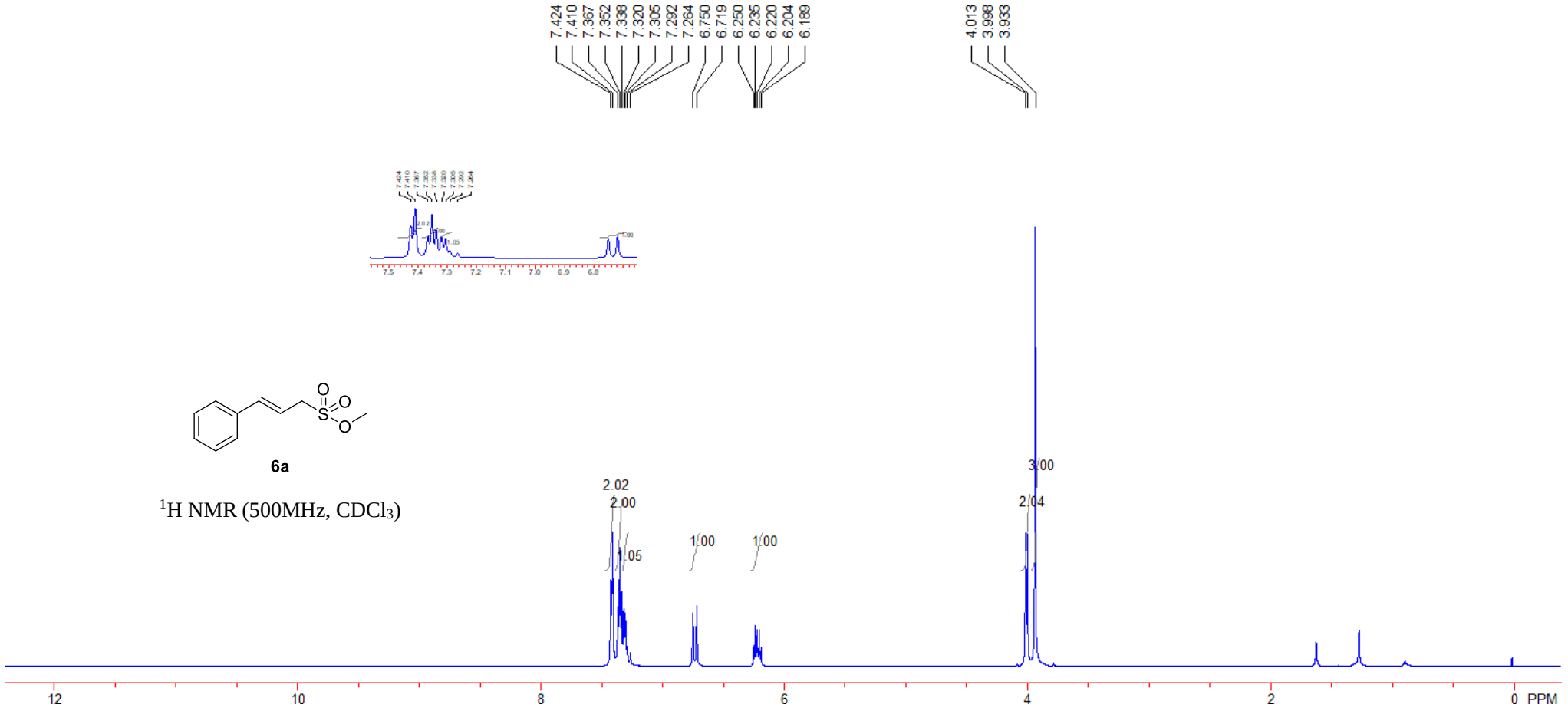
5

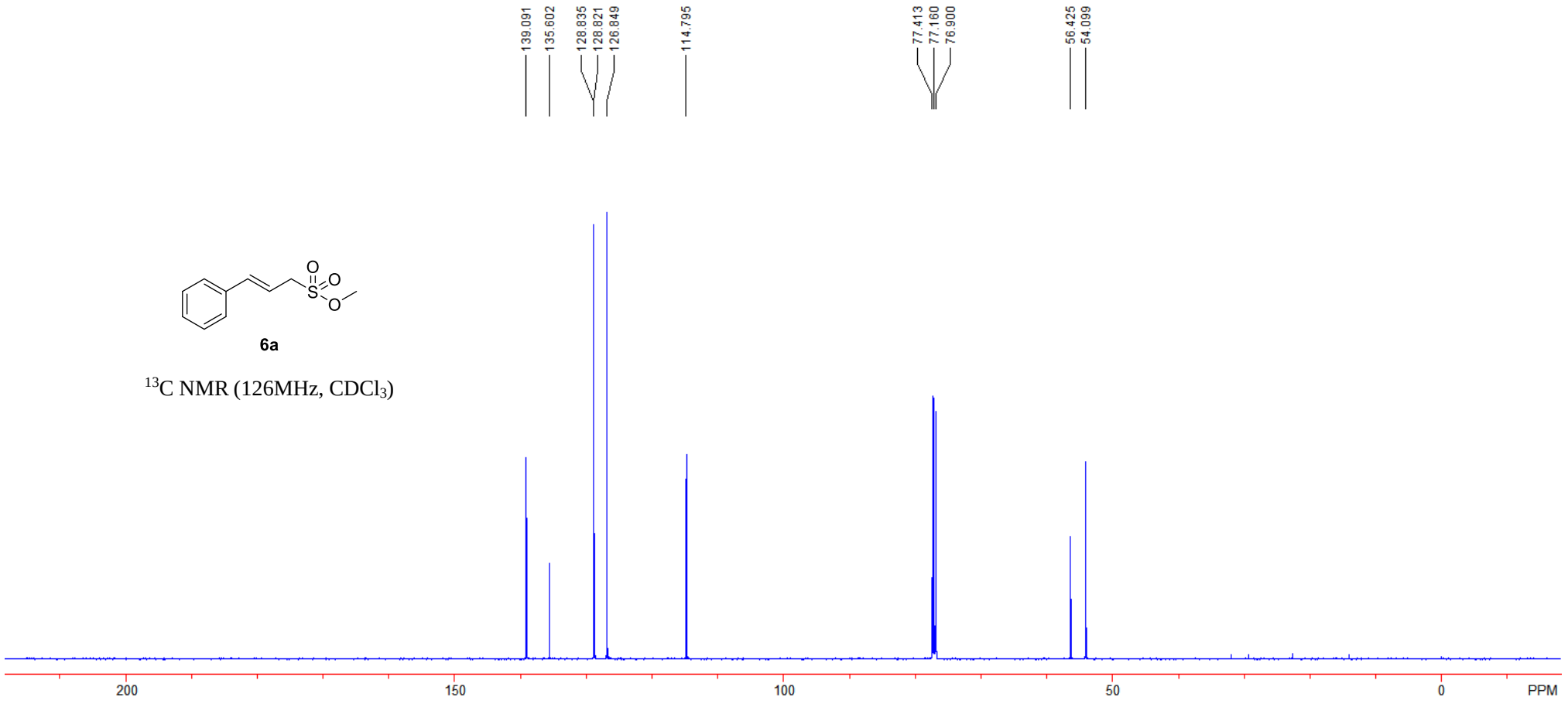
^{1}H NMR (500MHz, $CDCl_3$)



5

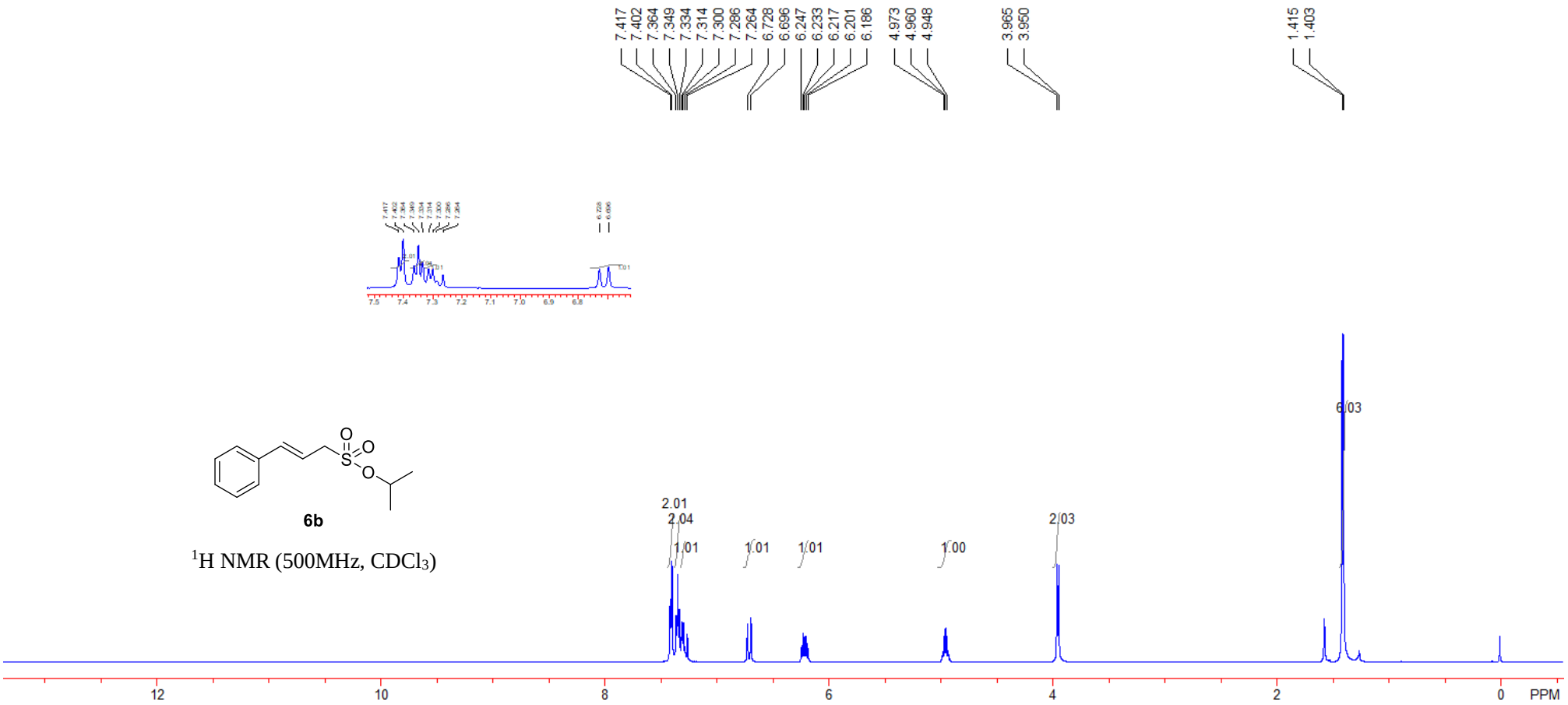
^{13}C NMR (126MHz, $CDCl_3$)

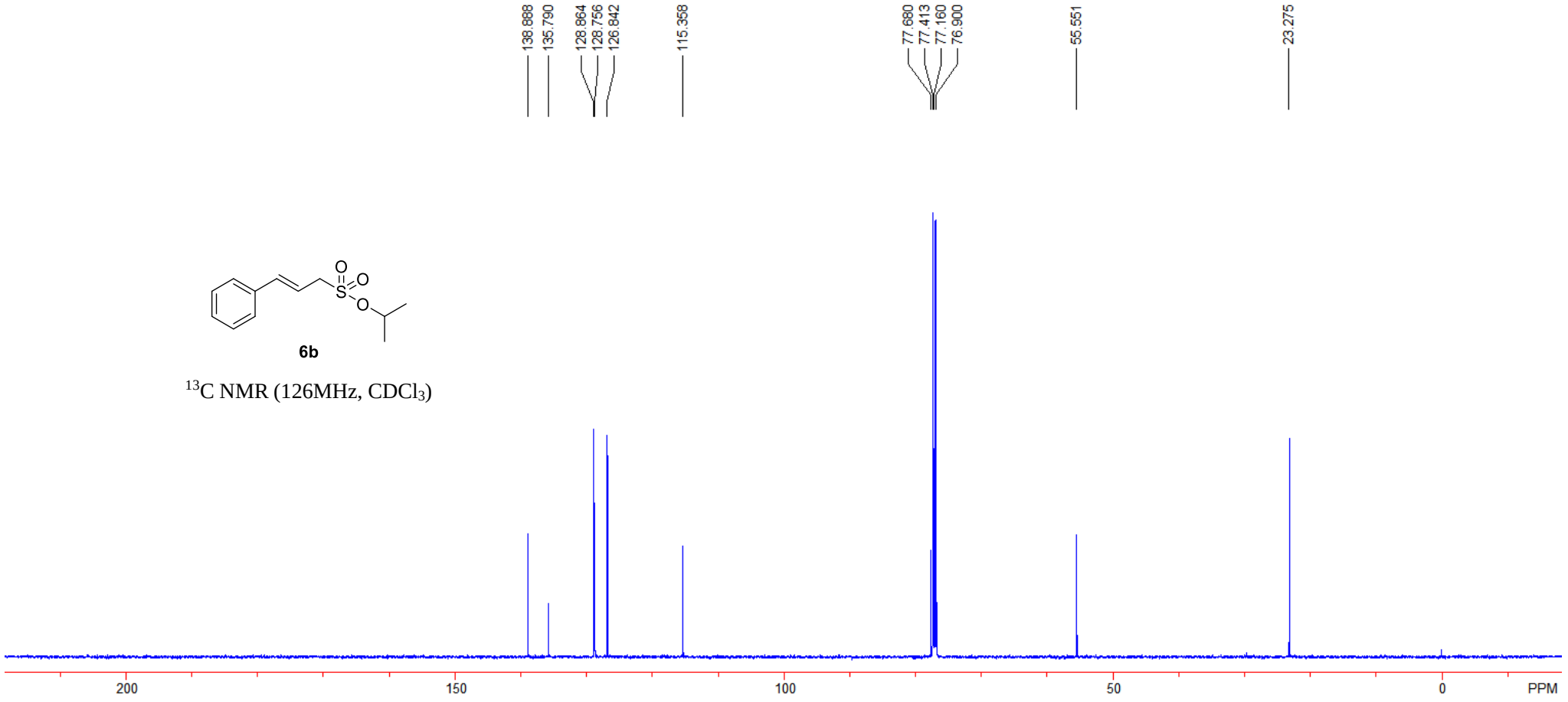

7.424
7.410
7.367
7.352
7.338
7.320
7.305
7.292
7.264
6.750
6.719
6.250
6.235
6.220
6.204
6.189
4.013
3.998
3.933
O
O
S
O
O
6a
^{1}H NMR (500MHz, CDCl$_3$)
2.02
2.00
1.05
1.00
1.00
3.00
2.04
12
10
8
6
4
2
0 PPM



6a

^{13}C NMR (126MHz, $CDCl_3$)

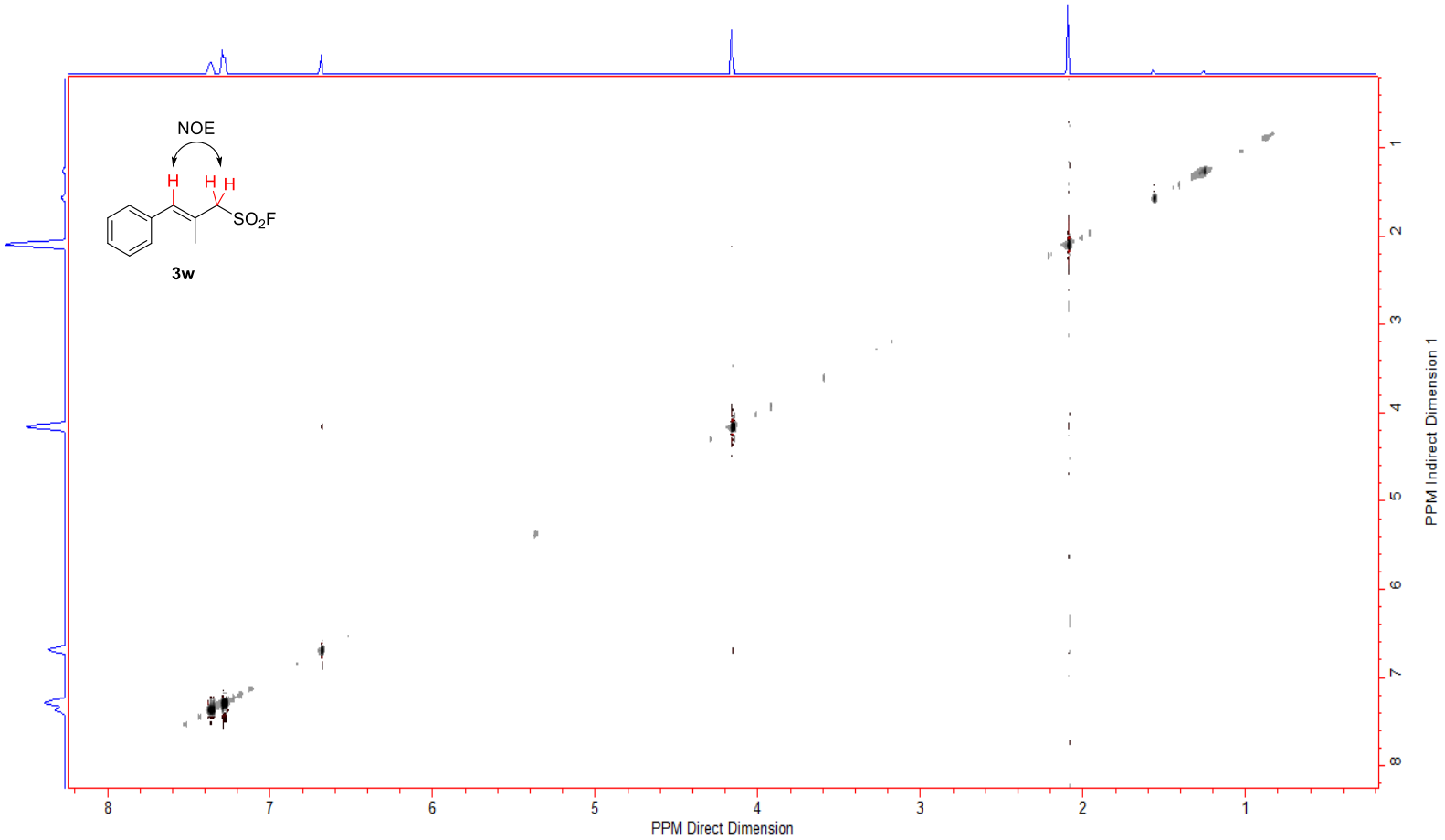

7.417
7.402
7.364
7.349
7.334
7.314
7.300
7.286
7.264
6.728
6.696
6.247
6.233
6.217
6.201
6.186
4.973
4.960
4.948
3.965
3.950
1.415
1.403
6b
1H NMR (500MHz, CDCl3)
2.01
2.04
1.01
1.01
1.01
1.00
2.03
6.03
12
10
8
6
4
2
0
PPM



6b

^{13}C NMR (126MHz, $CDCl_3$)

6. NOESY of (*E*)-2-methyl-3-phenylprop-2-ene-1-sulfonyl fluoride (3w)



NOESY spectrum of compound 3w (in $CDCl_3$)