Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

A general protocol for stereoselective construction of enaminyl sulfonyl fluorides

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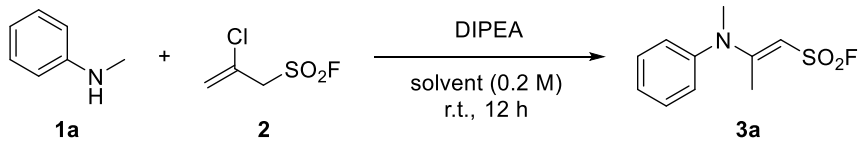
1. General Information

All reactions were carried out under an air atmosphere unless otherwise specified. Reagents used in the reactions were all purchased from commercial sources and used without further purification. Unless otherwise specified, NMR spectra were recorded in $CDCl_3$ or DMSO-d_6 on a 500 MHz (for ^{1}H), 471 MHz (for ^{19}F), and 126 MHz (for ^{13}C) Bruker Avance spectrometer, and were internally referenced to solvent residual signals (note: $CDCl_3$: δ H = 7.264 ppm, δ C = 77.16 ppm; DMSO-d_6: δ H = 2.500 ppm, δ C = 39.52 ppm). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet. All chemical shifts were reported in ppm relative to TMS (0 ppm) as internal standards. The HPLC experiments were carried out on a Waters e2695 instrument (column: *J*&K, RP-C18, 5 μm, 4.6 × 150 mm), and the yields of the products were determined by using the corresponding pure compounds as the external standards. Melting points of the products were measured on a micro melting point apparatus (SGW X-4) and uncorrected. HRMS experiments were performed on a TOF-Q ESI or CI/EI instrument. The coupling constants were reported in Hertz (Hz). The product spots on the thin layer chromatography (TLC) were visualized under ultraviolet light (254 nm or 365 nm) followed by staining with potassium permanganate or phosphomolybdic acid.

2. Optimization of the Reaction Conditions

Table S1 Screening the Solvent[a]

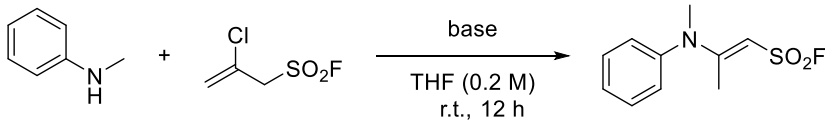


1a **2** **3a**

Entry	Solvent	Yield (3a, %)[b]
1	CH_3CN	62
2	EtOH	35
3	DMSO	71
4	DMF	72
5	Acetone	67
6	1,4-Dioxane	63
7	**THF**	**79**
8	DCM	53
9	Toluene	45
10	H_2O	N.D.

[a]Reaction conditions: a mixture of *N*-Methylaniline (**1a**, 21 mg, 0.2 mmol, 1.0 equiv.), CESF (**2**, 32 mg, 0.2 mmol, 1.0 equiv.) and DIPEA (26 mg, 0.2 mmol, 1.0 equiv.) in solvent (1.0 mL) was stirred at r.t. for 12 h under air. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 3.981 min, λ_{max} = 264.2 nm, water/methanol =30:70 (v/v)). N.D. = Not detectable.

Table S2 Screening the base[a]

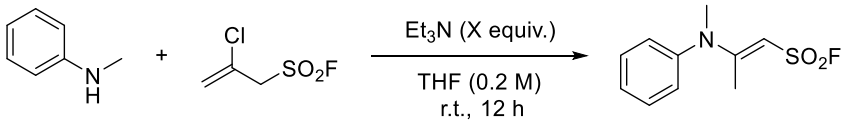


1a **2** **3a**

Entry	Base	Yield (3a, %)[b]
1	DIPEA	79
2	DABCO	52
3	DBU	34
4	TMEDA	87
5	**Et_3N**	**93**
6	Tripropylamine	47
7	$NaHCO_3$	11
8	K_2CO_3	64
9	Cs_2CO_3	76

[a]Reaction conditions: a mixture of *N*-Methylaniline (**1a**, 21 mg, 0.2 mmol, 1.0 equiv.), CESF (**2**, 32 mg, 0.2 mmol, 1.0 equiv.) and base (0.2 mmol, 1.0 equiv.) in THF (1.0 mL) was stirred at r.t. for 12 h under air. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 3.981 min, λ_{max} = 264.2 nm, water/methanol =30: 70 (v/v)). N.D. = Not detectable.

Table S3 Screening the loading of CESF (**2**)[a]

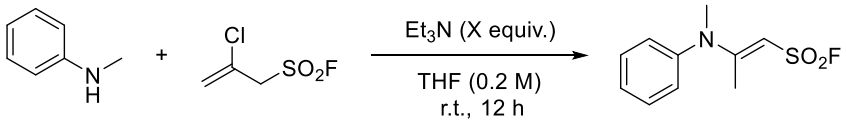


1a **2**, X equiv. **3a**

Entry	X equiv.	Yield (3a, %)[b]
1	1.0	93
2	**1.2**	**97**
3	1.5	95
4	2.0	97

[a]Reaction conditions: a mixture of *N*-Methylaniline (**1a**, 21 mg, 0.2 mmol, 1.0 equiv.), CESF (**2**, X equiv.) and Et_3N (X equiv.) in THF (1.0 mL) was stirred at r.t. for 12 h under air. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 3.981 min, λ_{max} = 264.2 nm, water/methanol =30:70 (v/v)). N.D. = Not detectable.

Table S4 Screening the loading of base[a]

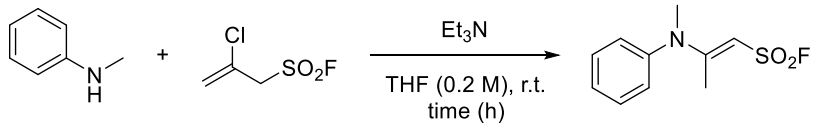


1a **2** **3a**

Entry	Et_3N (X equiv.)	Yield (3a, %)[b]
1	**1.2**	**97**
2	1.4	96
3	1.6	94

[a]Reaction conditions: a mixture of *N*-Methylaniline (**1a**, 21 mg, 0.2 mmol, 1.0 equiv.), CESF (**2**, 38 mg, 0.24 mmol, 1.2 equiv.) and Et_3N (X equiv.) in THF (1.0 mL) was stirred at r.t. for 12 h under air. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 3.981 min, λ_{max} = 264.2 nm, water/methanol =30:70 (v/v)). N.D. = Not detectable.

Table S5 Screening the time of reaction[a]



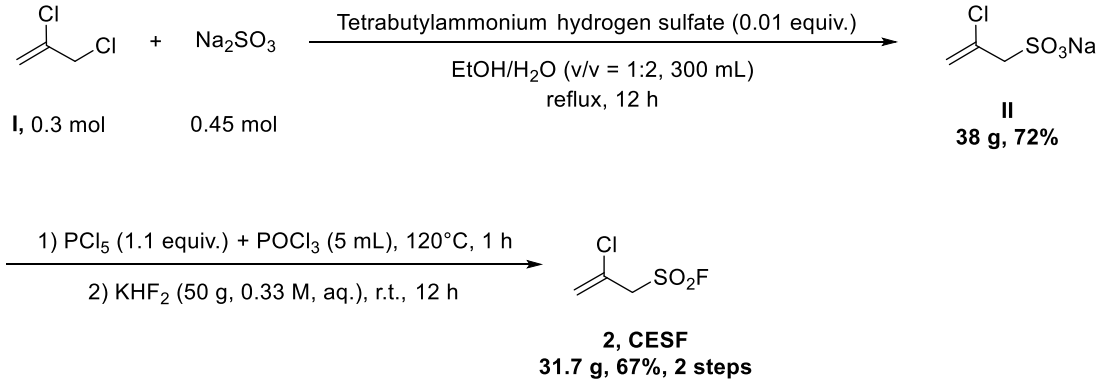
1a **2** **3a**

Entry	Time (h)	Yield (3a, %)[b]
1	0.5	81
2	1.0	89
3	2.0	94
4	**3.0**	**96**
5	6.0	96

[a]Reaction conditions: a mixture of *N*-Methylaniline (**1a**, 21 mg, 0.2 mmol, 1.0 equiv.), CESF (**2**, 38 mg, 0.24 mmol, 1.2 equiv.) and Et_3N (25 mg, 0.24 mmol, 1.2 equiv.) in THF (1.0 mL) was stirred at r.t. for the corresponding time under air. [b]The yield was determined by HPLC using pure **3a** as the external standard (t_R = 3.981 min, λ_{max} = 264.2 nm, water/methanol =30:70 (v/v)). N.D. = Not detectable.

3. Experimental Procedures

3.1 Preparation of 2-chloroprop-2-ene-1-sulfonyl fluoride (CESF)[1][2]

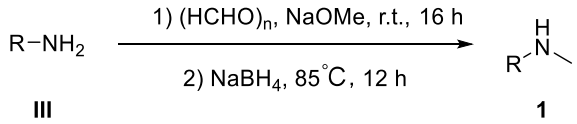


Step 1: 1,2-Dichloro-2-propene (33 g, 0.3 mol), Na_2SO_3 (56 g, 0.45 mol, 1.5 equiv.) and tetrabutylammonium hydrogen sulfate (1.0 g, 0.003 mol, 0.01 equiv.) were added to a solution of EtOH and H_2O (v/v = 1:2, 300 mL) with stirring and heating. The mixture was then refluxed for 12 h and the solvent evaporated in vacuo. To the residue was added EtOH (250 mL), and the mixture was refluxed with stirring for 1 h. After removing some insoluble material by filtration of the hot mixture, the filtrate was cooled. The crystalline sodium 2-chloro-2-propene-1-sulfonate was collected by filtration: 38.0 g (0.216 mol, 72%).

Step 2: A mixture of this sodium salt (38.0 g, 0.216 mol) and PCl_5 (49.5 g, 0.238 mol, 1.1 equiv.) was stirred vigorously until the mixture liquified. The solids remaining on the walls of the bottle were rinsed with phosphorus oxychloride (5 mL), then the mixture was rapidly heated to 120 ℃ for 1 hour, cooled, and poured onto ice with vigorous stirring. Kept the reaction mixture stirring at low temperature and extracted with CH_2Cl_2 (50 mL).The organic phase was washed with ice water, 5% $NaHCO_3$ solution (2×100 mL), then dried, and evaporated in vacuo. The evaporated 2-chloro-2-propene sulfonyl chloride was added dropwise to the solution of KHF_2 (50 g, 0.33 M) with stirring for 12 hours. The reaction mixture was further extracted with CH_2Cl_2 (2×25 mL), then dried, and evaporated in vacuo. 2-Chloroprop-2-ene-1-sulfonyl fluoride (CESF) was distilled under reduced pressure to give colorless oil 31.7 g (**2**, 67%, 2 steps). **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.75 (dd,

J_1 = 2.4 Hz, J_2 = 1.0 Hz, 1H), 5.72 (d, J = 2.5 Hz, 1H), 4.33 (dd, J_1 = 3.8 Hz, J_2 = 0.8 Hz, 2H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 56.4 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 126.6, 123.6 (d, J = 1.5 Hz), 59.3 (d, J = 19.4 Hz). **HRMS-ESI** (m/z) calcd. for $[C_3H_5ClFO_2S]^+$ ($[M+H]^+$): 158.9677, found: 158.9674.

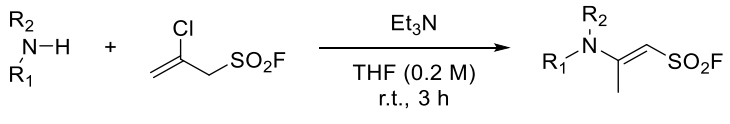
3.2 Preparation of amine substrates (1)[3]



III 1

Compound **1b** was taken as an example to illustrate the preparation process of the substrate: p-methylaniline (0.53 g, 5 mmol) was added to the methanol solution (10 ml) containing sodium methanol (1.71 g, 30 mmol) in drops, and the mixed solution was continuously stirred for 0.5 h. The methanol solution (5 mL) of paraformaldehyde (0.32 g, 10 mmol) was added to the above mixture by drop and stirred for 16 h at room temperature. Sodium borocyanide (0.2 g, 5 mmol) was added to the mixture in proportion, and the reaction was heated and kept reflux for 6 h. The reaction was detected by TLC. After the reaction, the solution was concentrated under vacuum to remove the solvent. Water (50 mL) was added to the residue and the reaction mixture was extracted with ethyl acetate (3×20 mL). The extracts were dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate (10:1) as eluents to give the desired product **1b** as a white solid, 526 mg, 87% yield. The synthesis of amine substrates (**1c-1u**) can be referred to the above process. [4][5] Amine substrates (**1a, 1v, 1w, 1aa-1ad**) were all purchased from commercial sources and used without further purification.

3.3 General procedure for preparation of *N*-ESF (3)

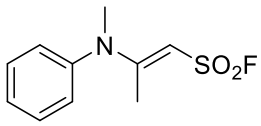


1 CESF, 2 3

An oven-dried reaction tube (20 mL) equipped with a magnetic stirring bar was charged with amines (**1**, 1.0 mmol, 1.0 equiv.), CESF (**2**, 189 mg, 1.2 mmol, 1.2

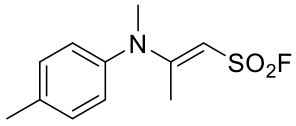
equiv.) and 4.0 mL THF. Then, trimethylamine (122 mg, 1.2 mmol, 1.2 equiv.) dissolved in THF (1.0 mL) was added dropwise to the above solution and the solution slowly became turbid. The mixture was stirred at room temperature for 3 h under an air atmosphere monitored by TLC. After the reaction was completed, water (20 mL) was added to the mixture and the reaction mixture was extracted with ethyl acetate (3×10 mL). The extracts were dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate as eluents to give the desired product **3**.

4. Characterization



3a

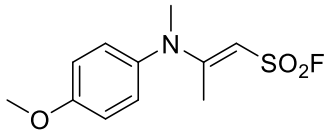
(E)-2-(methyl(phenyl)amino)prop-1-ene-1-sulfonyl fluoride (**3a**). White solid, 219 mg, 96% yield. M.p. 74−76 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.45 (t, J = 7.6 Hz, 2H), 7.38 (t, J = 7.0 Hz, 1H), 7.14 (d, J = 8.5 Hz, 2H), 5.06 (s, 1H), 3.26 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.6, 144.6, 130.3, 128.5, 127.0, 85.7 (d, J = 24.3 Hz), 41.6, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{13}FNO_2S]^+$ ($[M+H]^+$): 230.0646, found: 230.0645.



3b

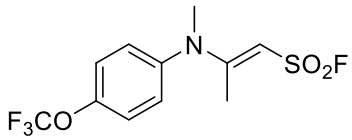
(E)-2-(methyl(p-tolyl)amino)prop-1-ene-1-sulfonyl fluoride (**3b**). White solid, 228 mg, 94% yield. M.p. 81−83 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ

7.24 (d, *J* = 8.0 Hz, 2H), 7.01 (d, *J* = 8.0 Hz, 2H), 5.03 (s, 1H), 3.24 (s, 3H), 2.39 (s, 3H), 2.18 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.8, 142.0, 138.6, 130.8, 126.7, 85.3 (d, *J* = 24.1 Hz), 41.7, 21.2, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_2S]^+$ ($[M+H]^+$): 244.0802, found: 244.0795.



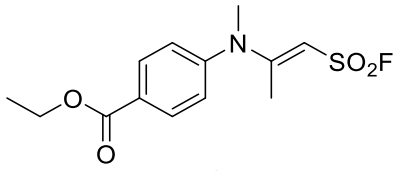
3c

(E)-2-((4-methoxyphenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3c**). White solid, 241 mg, 93% yield. M.p. 69−71 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.04 (d, *J* = 9.0 Hz, 2H), 6.93 (d, *J* = 9.0 Hz, 2H), 5.02 (s, 1H), 3.83 (s, 3H), 3.23 (s, 3H), 2.18 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.9, 159.2, 137.2, 127.9, 115.2, 85.1 (d, *J* = 24.2 Hz), 55.6, 41.7, 17.7. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_3S]^+$ ($[M+H]^+$):260.0751, found: 260.0752.



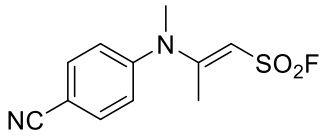
3d

(E)-2-(methyl(4-(trifluoromethoxy)phenyl)amino)prop-1-ene-1-sulfonyl fluoride (**3d**). White solid, 278 mg, 89% yield. M.p. 51−53 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.5 Hz, 2H), 7.20 (d, *J* = 8.5 Hz, 2H), 5.09 (s, 1H), 3.26 (s, 3H), 2.20 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.1 (s, 1F), -58.0 (s, 3F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.3, 148.7 (d, *J* = 2.0 Hz), 142.9, 128.8, 122.7, 120.5 (q, *J* = 258.8 Hz), 87.1 (d, *J* = 24.7 Hz), 41.7, 17.9. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{12}F_4NO_3S]^+$ ($[M+H]^+$): 314.0469, found: 314.0476.



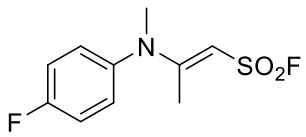
3e

methyl (E)-4-((1-(fluorosulfonyl)prop-1-en-2-yl)(methyl)amino)benzoate (**3e**). White solid, 243 mg, 85% yield. M.p. 84−86 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$). δ 8.13 (d, J = 8.5 Hz, 2H), 7.22 (d, J = 8.5 Hz, 2H), 5.13 (s, 1H), 4.41 (q, J = 7.0 Hz, 2H), 3.28 (s, 3H), 2.20 (s, 3H), 1.41 (t, J = 7.1 Hz, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 165.5, 161.9, 148.3, 131.6, 130.5, 127.1, 87.6 (d, J = 24.8 Hz), 61.6, 41.5, 18.0, 14.4. **HRMS-ESI** (m/z) calcd. for $[C_{13}H_{17}FNO_4S]^+$ ($[M+H]^+$): 302.0857, found: 302.0858.



3f

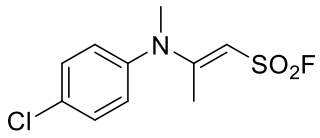
(E)-2-((4-cyanophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3f**). Light yellow solid, 175 mg, 69% yield. M.p. 119−121 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 5:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.78 (d, J = 8.5 Hz, 2H), 7.30 (d, J = 8.5 Hz, 2H), 5.18 (s, 1H), 3.29 (s, 3H), 2.22 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 71.9 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 161.5, 148.3, 134.2, 128.2, 117.7, 112.3, 88.9 (d, J = 25.2 Hz), 41.5, 17.9. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{12}FN_2O_2S]^+$ ($[M+H]^+$): 255.0598, found: 255.0605.



3g

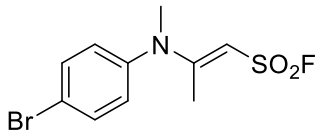
(E)-2-((4-fluorophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3f**). White solid,

212 mg, 86% yield. M.p. 61−63 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.16 – 7.13 (m, 4H), 5.05 (s, 1H), 3.24 (s, 3H), 2.18 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.2 (s, 1F), -112.1 (m, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.8 (d, J = 49.3 Hz), 161.0, 140.6 (d, J =3.5 Hz), 128.9 (d, J = 8.7 Hz), 117.2 (d, J = 23.1 Hz), 86.3 (d, J = 24.4 Hz), 41.7, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{12}F_2NO_2S]^+$ ($[M+H]^+$): 248.0551, found: 248.0545.



3h

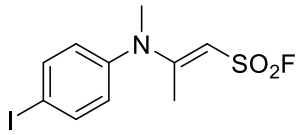
(E)-2-((4-chlorophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3h**). White solid, 236 mg, 90% yield. M.p. 77−79 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.43 (d, J = 8.5 Hz, 2H), 7.09 (d, J = 8.7 Hz, 2H), 5.07 (s, 1H), 3.24 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.1 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.3, 143.0, 134.4, 130.5, 128.5, 86.8 (d, J = 24.6 Hz), 41.6, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{12}ClFNO_2S]^+$ ($[M+H]^+$): 264.0256, found: 264.0259.



3i

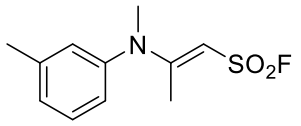
(E)-2-((4-bromophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3i**). Yellow solid, 278 mg, 91% yield. M.p. 96−98 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.58 (d, J = 8.5 Hz, 2H), 7.03 (d, J = 8.5 Hz, 2H), 5.08 (s, 1H), 3.24 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.1 (s, 1F). **^{13}C NMR** (126

MHz, $CDCl_3$) δ 162.2, 143.6, 133.5, 128.8, 122.3, 86.9 (d, J = 24.6 Hz), 41.6, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{12}BrFNO_2S]^+$ ($[M+H]^+$): 307.9751, found: 307.9759.



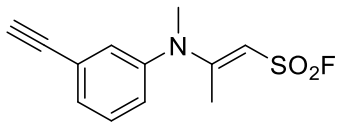
3j

(E)-2-((4-iodophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3j**). Purple solid, 322 mg, 91% yield. M.p. 124−126 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 – 7.77 (m, 2H), 6.91 – 6.88 (m, 2H), 5.08 (s, 1H), 3.23 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.1 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.1, 144.3, 139.5, 129.0, 93.7, 87.0 (d, J = 24.8 Hz), 41.5, 17.9. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{12}FINO_2S]^+$ ($[M+H]^+$): 355.9612, found: 355.9617.



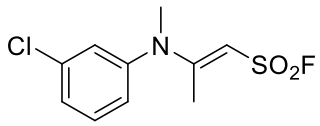
3k

(E)-2-(methyl(m-tolyl)amino)prop-1-ene-1-sulfonyl fluoride (**3k**). White solid, 230 mg, 95% yield. M.p. 84−86 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.32 (t, J = 7.7 Hz, 1H), 7.18 (d, J = 7.6 Hz, 1H), 6.94 – 6.91 (m, 2H), 5.04 (s, 1H), 3.24 (s, 3H), 2.38 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.7, 144.5, 140.5, 130.0, 129.2, 127.5, 123.9, 85.3 (d, J = 24.1 Hz), 41.6, 21.4, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_2S]^+$ ($[M+H]^+$): 244.0802, found: 244.0798.



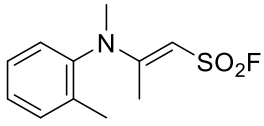
3l

(E)-2-((3-ethynylphenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3l**). White solid, 222 mg, 92% yield. M.p. 88−90 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.48 (d, J = 7.5 Hz, 1H), 7.40 (t, J = 8.0 Hz, 1H), 7.26 (s, 1H), 7.13 (d, J =8.0 Hz, 1H), 5.06 (s, 1H), 3.23 (s, 3H), 3.16 (s, 1H), 2.18 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.2 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.3, 144.6, 132.1, 130.6, 130.4, 127.7, 124.5, 86.6 (d, J = 24.4 Hz), 82.0, 79.3, 41.5, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{12}H_{13}FNO_2S]^+$ ($[M+H]^+$): 254.0646, found: 254.0637.



3m

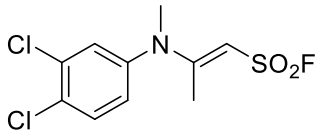
(E)-2-((3-chlorophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3m**). White solid, 236 mg, 90% yield. M.p. 108−110 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.42 – 7.36 (m, 2H), 7.17 (t, J = 2.0 Hz, 1H), 7.07 – 7.04 (m, 1H), 5.09 (s, 1H), 3.25 (s, 3H), 2.20 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.1 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.2, 145.6, 135.7, 131.3, 128.8, 127.5, 125.5, 87.0 (d, J = 24.7 Hz), 41.5, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{12}ClFNO_2S]^+$ ($[M+H]^+$): 264.0256, found: 264.0256.



3n

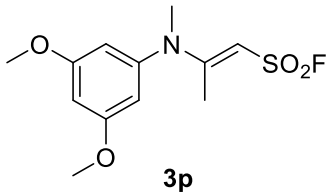
(E)-2-(methyl(o-tolyl)amino)prop-1-ene-1-sulfonyl fluoride (**3n**). White solid, 225 mg,

93% yield. M.p. 73−75 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.32 (t, J = 7.7 Hz, 1H), 7.18 (d, J = 7.6 Hz, 1H), 6.94 – 6.91 (m, 2H), 5.04 (s, 1H), 3.24 (s, 3H), 2.38 (s, 3H), 2.19 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.7, 144.5, 140.5, 130.0, 129.2, 127.5, 123.9, 85.3 (d, J = 24.1 Hz), 41.6, 21.4, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_2S]^+$ ($[M+H]^+$): 244.0802, found: 244.0798.



3o

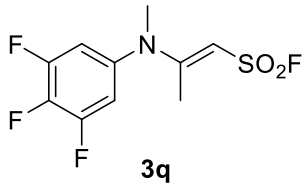
(E)-2-((3,4-dichlorophenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3o**). White solid, 264 mg, 89% yield. M.p. 102−104 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.54 (d, J = 8.5 Hz, 1H), 7.29 (d, J = 2.5 Hz, 1H), 7.03 (dd, J_1 = 8.5 Hz, J_2 = 2.5 Hz, 1H), 5.11 (s, 1H), 3.24 (s, 3H), 2.21 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 161.9, 143.7, 134.2, 133.0, 131.9, 129.3, 126.7, 88.0 (d, J = 24.8 Hz), 41.6, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{11}Cl_2FNO_2S]^+$ ($[M+H]^+$): 297.9866, found: 297.9875.



3p

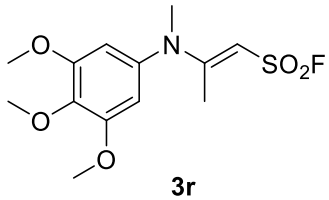
(E)-2-((3,5-dimethoxyphenyl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3p**). White solid, 271 mg, 94% yield. M.p. 141−143 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.45 (t, J = 2.5 Hz, 1H), 6.26 (d, J = 2.5 Hz, 2H), 5.06 (s, 1H), 3.80 (s, 6H), 3.23 (s, 3H), 2.23 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$)

δ 72.2 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.5, 161.9, 146.1, 105.3, 100.3, 85.6 (d, J = 24.2 Hz), 55.7, 41.4, 17.7. **HRMS-ESI** (m/z) calcd. for $[C_{12}H_{17}FNO_4S]^+$ ($[M+H]^+$): 290.0857, found: 290.0863.



3q

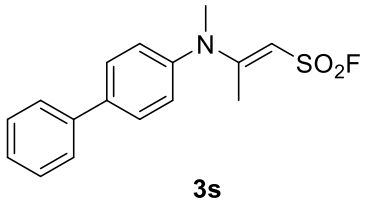
(E)-2-(methyl(3,4,5-trifluorophenyl)amino)prop-1-ene-1-sulfonyl fluoride (**3q**). White solid, 219 mg, 83% yield. M.p. 89−91 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.88 – 6.85 (m, 2H), 5.11 (s, 1H), 3.23 (s, 3H), 2.21 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 71.9 (s, 1F), -130.39 (dd, J_1 = 20.3, J_2 = 7.1 Hz, 2F), -158.52 – -158.62 (m, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 161.8, 151.8 (dq, J_1 = 254.8 Hz, J_2 = 5.04 Hz), 140.0 (dt, J_1 = 255.7 Hz, J_2 = 15.0 Hz), 139.8 – 139.6 (m), 112.5 (dd, J_1 = 16.8 Hz, J_2 = 5.7 Hz), 88.7 (d, J = 25.2 Hz), 41.5, 17.7. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{10}F_4NO_2S]^+$ ($[M+H]^+$):284.0363, found: 284.0359.



3r

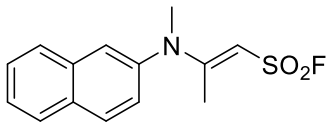
(E)-2-(methyl(3,4,5-trimethoxyphenyl)amino)prop-1-ene-1-sulfonyl fluoride (**3r**). White solid, 303 mg, 95% yield. M.p. 156−158 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.34 (s, 2H), 5.04 (s, 1H), 3.86 (s, 3H), 3.85 (s, 6H), 3.24 (s, 3H), 2.23 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.7, 154.2, 140.1, 138.1, 104.3, 85.5 (d, J = 24.3 Hz), 61.1, 56.5, 41.6, 17.7. **HRMS-ESI** (m/z) calcd. for $[C_{13}H_{19}FNO_5S]^+$ ($[M+H]^+$): 320.0962,

found: 320.0957.



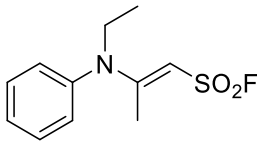
3s

(E)-2-([1,1'-biphenyl]-4-yl(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3s**). White solid, 280 mg, 92% yield. M.p. 131−133 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.66 (d, J = 8.5 Hz, 2H), 7.59 (d, J = 7.0 Hz, 2H), 7.48 (t, J = 8.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 1H), 7.21 (d, J = 8.5 Hz, 2H), 5.11 (s, 1H), 3.30 (s, 3H), 2.25 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.6, 143.6, 141.5, 139.8, 129.1, 128.9, 128.1, 127.4, 127.2, 86.1 (d, J = 24.2 Hz), 41.7, 18.0. **HRMS-ESI** (m/z) calcd. for $[C_{16}H_{17}FNO_2S]^+$ ($[M+H]^+$): 306.0959, found: 306.0964.



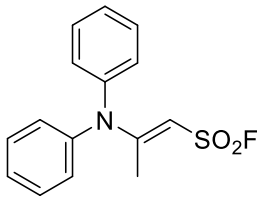
3t

(E)-2-(methyl(naphthalen-2-yl)amino)prop-1-ene-1-sulfonyl fluoride (**3t**). White solid, 253 mg, 91% yield. M.p. 121−123 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.99 – 7.88 (m, 3H), 7.67 (s, 1H), 7.63 – 7.61 (m, 2H), 7.31 – 7.24 (m, 1H), 5.18 (s, 1H), 3.39 (s, 3H), 2.29 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.4 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.7, 141.8, 133.7, 132.6, 130.5, 128.0, 128.0, 127.4, 127.3, 125.7, 124.6, 86.0 (d, J = 24.1 Hz), 41.7, 18.0. **HRMS-ESI** (m/z) calcd. for $[C_{14}H_{15}FNO_2S]^+$ ($[M+H]^+$): 280.0802, found: 280.0798.



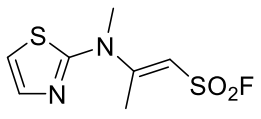
3u

(E)-2-(ethyl(phenyl)amino)prop-1-ene-1-sulfonyl fluoride (**3v**). White solid, 217 mg, 95% yield. M.p. 79−81 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.62 (t, J = 7.5 Hz, 2H), 7.55 (t, J = 7.4 Hz, 1H), 7.27 (d, J = 7.0 Hz, 2H), 5.17 (s, 1H), 3.80 (q, J = 7.0 Hz, 2H), 2.35 (s, 3H), 1.36 (t, J = 7.5 Hz, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.6 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.0, 142.8, 130.3, 128.6, 127.9, 84.8 (d, J = 23.9 Hz), 48.4, 17.7, 12.0. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_2S]^+$ ($[M+H]^+$): 244.0802, found: 244.0792.



3v

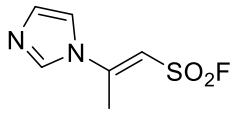
(E)-2-(diphenylamino)prop-1-ene-1-sulfonyl fluoride (**3w**). White solid, 198 mg, 68% yield. M.p. 103−105 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.45 (t, J = 7.5 Hz, 4H), 7.35 (t, J = 7.5 Hz, 2H), 7.27 (d, J = 7.0 Hz, 4H), 5.12 (s, 1H), 2.36 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 71.9 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 163.0, 143.3, 130.3, 128.2, 127.9, 90.9 (d, J = 24.4 Hz), 18.5. **HRMS-ESI** (m/z) calcd. for $[C_{15}H_{15}FNO_2S]^+$ ($[M+H]^+$): 292.0802, found: 292.0811.



3w

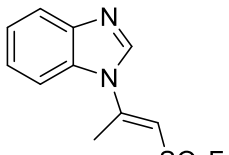
(E)-2-(methyl(thiazol-2-yl)amino)prop-1-ene-1-sulfonyl fluoride (**3w**). Light yellow

solid, 186 mg, 79% yield. M.p. 158−160 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 3:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.60 (d, J = 3.6 Hz, 1H), 7.31 (d, J = 3.6 Hz, 1H), 5.57 (s, 1H), 3.37 (s, 3H), 2.36 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 71.4 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 164.4, 161.3, 140.4, 119.8, 93.1 (d, J = 25.4 Hz), 41.4, 17.8. **HRMS-ESI** (m/z) calcd. for $[C_7H_{10}FN_2O_2S_2]^+$ ($[M+H]^+$): 237.0162, found: 237.0165.



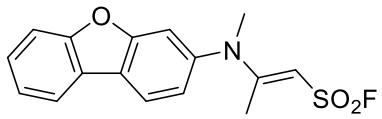
3x

(E)-2-(1H-imidazol-1-yl)prop-1-ene-1-sulfonyl fluoride (**3x**). Light yellow solid, 154 mg, 81% yield. M.p. 135−137 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 5:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.25 (t, J = 1.6 Hz, 1H), 7.21 (d, J = 1.5 Hz, 1H), 6.54 (s, 1H), 2.74 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 67.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 151.1 (d, J = 2.7 Hz), 135.6, 132.5, 116.6, 108.6 (d, J = 29.5 Hz), 17.0. **HRMS-ESI** (m/z) calcd. for $[C_6H_8FN_2O_2S]^+$ ($[M+H]^+$): 191.0285, found: 191.0285.



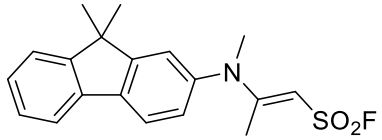
3y

(E)-2-(1H-benzo[d]imidazol-1-yl)prop-1-ene-1-sulfonyl fluoride (**3y**). Light yellow solid, 134 mg, 56% yield. M.p. 158−160 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 5:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.18 (s, 1H), 7.87 (dd, J = 7.6, 1.9 Hz, 1H), 7.67 – 7.64 (m, 1H), 7.49 – 7.40 (m, 2H), 6.76 (s, 1H), 2.90 (s, 3H).**^{19}F NMR** (471 MHz, $CDCl_3$) δ 70.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 151.9 (d, J = 2.4 Hz), 145.1, 140.7, 131.6, 125.7, 125.0, 121.9, 112.4, 110.8 (d, J = 29.2 Hz), 18.5. **HRMS-ESI** (m/z) calcd. for $[C_{10}H_{10}FN_2O_2S]^+$ ($[M+H]^+$): 241.0442, found: 241.0443.



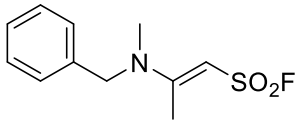
3z

(E)-2-(dibenzo[b,d]furan-3-yl(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3u**). Light yellow solid, 293 mg, 92% yield. M.p. 154−156 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 7:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.99 (dd, J_1 = 13.5 Hz, J_2 = 8.5 Hz, 2H), 7.61 (d, J = 8.5 Hz, 1H), 7.54 – 7.50 (m, 1H), 7.42 – 7.37 (m, 2H), 7.13 (dd, J_1 = 8.5 Hz, J_2 = 2.0 Hz, 1H), 5.14 (s, 1H), 3.34 (s, 3H), 2.24 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.2 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.6, 157.2, 156.5, 143.3, 128.2, 124.6, 123.5, 123.3, 121.9, 121.8, 121.0, 112.1, 110.8, 86.5 (d, J = 24.6 Hz), 42.0, 18.0. **HRMS-ESI** (m/z) calcd. for $[C_{16}H_{15}FNO_3S]^+$ ($[M+H]^+$): 320.0751, found: 320.0755.



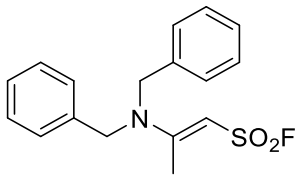
3aa

(E)-2-((9,9-dimethyl-9H-fluoren-2-yl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3t**). Light yellow solid, 314 mg, 91% yield. M.p. 115−117 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.77 – 7.73 (m, 2H), 7.48 – 7.46 (m, 1H), 7.38 – 7.37 (m, 2H), 7.19 (d, J = 2.0 Hz , 1H), 7.10 (dd, J_1 = 8.0 Hz, J_2 = 2.0 Hz, 1H), 5.13 (s, 1H), 3.32 (s, 3H), 2.24 (s, 3H), 1.51 (s, 6H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.4 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.7, 155.8, 153.9, 143.5, 139.5, 137.8, 128.1, 127.4, 125.8, 122.6, 121.3, 121.2, 120.4, 85.5 (d, J = 24.2 Hz), 47.3, 41.9, 27.1, 18.0. **HRMS-ESI** (m/z) calcd. for $[C_{19}H_{21}FNO_2S]^+$ ($[M+H]^+$): 346.1272, found: 346.1265.



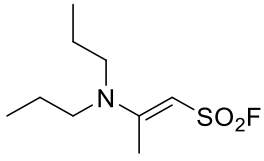
3ab

(E)-2-(benzyl(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3aa**). White solid, 192 mg, 79% yield. M.p. 94−96 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.39 (t, J = 8.0 Hz, 2H), 7.33 (t, J = 7.0 Hz, 1H), 7.11 (d, J = 7.0 Hz, 2H), 5.01 (s, 1H), 4.57 (s, 2H), 2.98 (s, 3H), 2.43 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.8, 129.3, 128.2, 126.3, 84.2 (d, J = 24.2 Hz), 55.9, 39.2, 16.4. **HRMS-ESI** (m/z) calcd. for $[C_{11}H_{15}FNO_2S]^+$ ($[M+H]^+$): 244.0802, found: 244.0812.



3ac

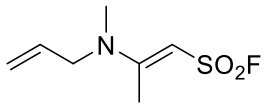
(E)-2-(dibenzylamino)prop-1-ene-1-sulfonyl fluoride (**3ab**). White solid, 277 mg, 87% yield. M.p. 105−107 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.40 (t, J = 8.0 Hz, 4H), 7.34 (t, J = 7.5 Hz, 2H), 7.14 (d, J = 7.1 Hz, 4H), 5.16 (s, 1H), 4.57 (s, 4H), 2.52 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.0 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.9, 134.7, 129.4, 128.2, 126.4, 85.4 (d, J = 24.3 Hz), 54.0, 16.6. **HRMS-ESI** (m/z) calcd. for $[C_{17}H_{19}FNO_2S]^+$ ($[M+H]^+$): 320.1117, found: 320.1115.



3ad

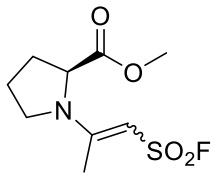
(E)-2-(dipropylamino)prop-1-ene-1-sulfonyl fluoride (**3ac**). White solid, 187 mg, 84%

yield. M.p. 47−49 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.83 (s, 1H), 3.18 (t, J = 7.5 Hz, 4H), 2.34 (s, 3H), 1.66 – 1.59 (m, 4H), 0.93 (t, J = 7.5 Hz, 6H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.1 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 161.5, 82.0 (d, J = 23.7 Hz), 52.9, 16.2, 11.3. **HRMS-ESI** (m/z) calcd. for $[C_9H_{19}FNO_2S]^+$ ($[M+H]^+$): 224.1115, found: 224.1120.



3ae

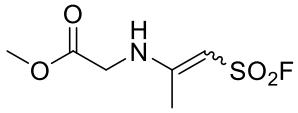
(E)-2-(allyl(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3ad**). White solid, 194 mg, 75% yield. M.p. 46−48 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.79 – 5.72 (m, 1H), 5.27 (d, J = 10.5 Hz, 1H), 5.12 (d, J = 17.0 Hz, 1H), 4.91 (s, 1H), 3.93 (s, 2H), 2.95 (s, 3H), 2.35 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.9 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.6, 131.3, 117.7, 83.4 (d, J = 23.7 Hz), 54.9, 38.8, 16.0. **HRMS-ESI** (m/z) calcd. for $[C_7H_{13}FNO_2S]^+$ ($[M+H]^+$): 194.0646, found: 194.0651.



3af

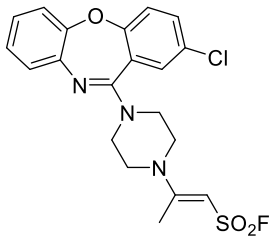
Methyl(Z/E) (1-(fluorosulfonyl)prop-1-en-2-yl)glycinate (**3af**). White solid, 202 mg, 81% yield. M.p. 66−68 °C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, DMSO-d_6) δ 5.06 (s, 2.2H), 4.92 – 4.79 (m, 2.2H), 4.70 (s, 1H), 4.44 (dd, J = 8.9, 2.3 Hz, 1H), 3.71 (d, J = 6.0 Hz, 9.6H), 3.64 – 3.58 (m, 1H), 3.39 – 3.37 (m, 3.21H), 3.29 – 3.24 (m, 2.2H), 2.37 (s, 3H), 2.27 – 2.24 (m, 1H), 2.22 (s, 6.62H), 2.22 – 2.16 (m, 2.25H),

2.16 – 1.76 (m, 10.23H). **^{19}F NMR** (471 MHz, DMSO-d_6) δ 75.2 (s, 1F), 75.1 (s, 1F). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 172.3, 171.4, 162.3, 161.7, 82.3 (d, J = 22.1 Hz), 81.7 (d, J = 22.3 Hz), 61.4, 53.2, 52.9, 49.9, 49.8, 30.4, 30.4, 23.4, 23.2, 17.6, 17.1. **HRMS-ESI** (m/z) calcd. for $[C_9H_{15}FNO_4S]^+$ ($[M+H]^+$): 252.0700, found: 252.0698.



3ag

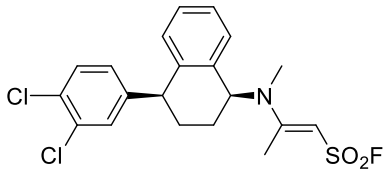
Methyl(Z/E) (1-(fluorosulfonyl)prop-1-en-2-yl) glycinate (**3ag**). White solid, 184 mg, 87% yield. M.p. 41−43 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 5:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, DMSO-d_6) δ 8.24 (t, J = 6.0 Hz, 1H), 7.65 (s, 0.1H), 5.06 (s, 0.1H), 5.04 (s, 1H), 4.21 (d, J = 5.8 Hz, 0.2H), 4.03 (d, J = 6.0 Hz, 2H), 3.71 (s, 0.3H), 3.70 (s, 3H), 2.24 (s, 3H), 2.05 – 1.89 (m, 0.3H). **^{19}F NMR** (471 MHz, DMSO-d_6) δ 75.0 (s, 1F), 73.2 (s, 1F). **^{13}C NMR** (126 MHz, DMSO-d_6) δ 170.4，169.3, 164.1，163.6, 80.2 (d, J = 22.3 Hz), 77.6 (d, J = 20.6 Hz), 52.7, 52.5, 45.1, 44.7, 20.0, 19.1. **HRMS-ESI** (m/z) calcd. for $[C_6H_{11}FNO_4S]^+$ ($[M+H]^+$): 212.0387, found: 212.0381.



3ah

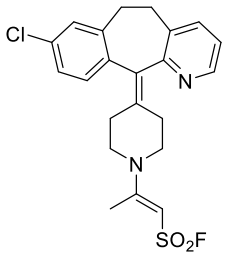
(E)-2-(4-(2-chlorodibenzo[b,f][1,4]oxazepin-11-yl)piperazin-1-yl)prop-1-ene-1-sulfonyl fluoride (**3ah**). White solid, 379 mg, 87% yield. M.p. 185−187 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 3:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.44 – 7.42 (m, 1H), 7.31 (d, J = 2.5 Hz, 1H), 7.22 (d, J = 8.5 Hz, 1H), 7.16 – 7.02 (m, 4H), 5.09 (s, 1H), 3.61 (s, 4H), 3.49 (s, 4H) 2.38 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.0 (s, 1F). **^{13}C NMR** (126 MHz,

$CDCl_3$) δ 162.1, 159.5, 158.3, 151.8, 139.7, 133.2, 130.6, 128.8, 127.2, 126.1, 125.4, 124.5, 123.1, 120.4, 86.4 (d, J = 24.5 Hz), 46.1, 16.6. **HRMS-ESI** (m/z) calcd. for $[C_{20}H_{20}Cl_1FN_3O_3S]^+$ ($[M+H]^+$): 436.0892, found: 436.0892.



3ai

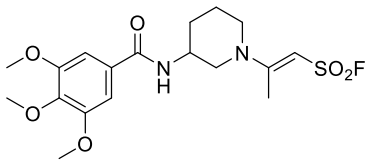
(E)-2-(((1S,4S)-4-(3,4-dichlorophenyl)-1,2,3,4-tetrahydronaphthalen-1-yl)(methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3ai**). White solid, 358 mg, 84% yield. M.p. 176−178 ^oC. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 3:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.38 – 7.27 (m, 3H), 7.10 –7.03 (m, 3H), 6.70 (d, J = 8.5 Hz, 1H), 5.18 – 5.03 (m, 2H), 4.25 (t, J = 4.0 Hz, 1H), 2.64 (s, 3H), 2.53 (s, 3H), 2.34 – 2.28 (m, 1H), 2.13 – 2.10 (m, 1H), 1.85 – 1.77 (m, 1H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.2 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.4, 146.4, 138.1, 135.0, 132.7, 131.5, 130.7, 128.5, 128.2, 128.0, 126.7, 84.6 (d, J = 24.1 Hz), 58.4, 42.7, 34.5, 30.0, 23.0, 16.1. **HRMS-ESI** (m/z) calcd. for $[C_{20}H_{21}Cl_2FNO_2S]^+$ ($[M+H]^+$): 428.0649, found: 428.0645.



3aj

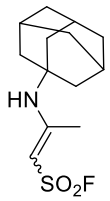
(E)-2-(4-(8-chloro-5,6-dihydro-11H-benzo[5,6]cyclohepta[1,2-b]pyridin-11-ylidene)piperidin-1-yl)prop-1-ene-1-sulfonyl fluoride (**3aj**). White solid, 341 mg, 79% yield. M.p. 159−161 ^oC. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 3:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.39 (dd, J = 3.5, 1.5 Hz, 1H), 7.46 – 7.44 (m, 1H), 7.19 – 7.10 (m, 4H), 4.94 (s, 1H),

3.61 – 3.52 (m, 2H), 3.37 – 3.23 (m, 4H), 2.89 – 2.76 (m, 2H), 2.62 – 2.56 (m, 1H), 2.45 – 2.37 (m, 2H), 2.33 (s, 3H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.4 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 161.4, 156.2, 146.7, 137.9, 137.3, 135.7, 134.4, 133.4, 130.2, 129.1, 126.3, 122.6, 83.9 (d, J = 24.1 Hz), 46.7, 46.6, 46.5, 46.4, 31.6, 31.5, 29.5, 16.5. **HRMS-ESI** (m/z) calcd. for $[C_7H_{13}FNO_2S]^+$ ($[M+H]^+$): 433.1147, found: 433.1147.



3ak

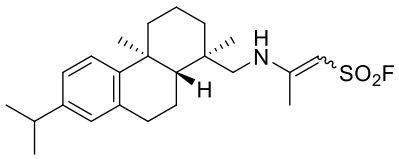
(E)-2-(3-(3,4,5-trimethoxybenzamido)piperidin-1-yl)prop-1-ene-1-sulfonyl fluoride (**3ak**). White solid, 379 mg, 91% yield. M.p. 177−179 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 10:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.0 (s, 2H), 6.29 (d, J = 7.0 Hz, 1H), 5.12 (s, 1H), 4.05 – 4.00 (m, 1H), 3.94 – 3.91 (m, 1H), 3.87 (s, 6H), 3.85 (s, 3H), 3.59 – 3.56 (m, 1H), 3.15 – 3.09 (m, 1H), 2.33 (s, 3H), 2.13 – 2.09 (m, 1H), 1.87 – 1.82 (m, 1H), 1.75 – 1.64 (m, 2H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 73.6 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 167.3, 162.0, 153.3, 141.2, 129.4, 104.5, 84.8 (d, J = 22.9 Hz), 61.0, 56.4, 51.6, 47.7, 46.8, 29.6, 21.1, 16.6. **HRMS-ESI** (m/z) calcd. for $[C_7H_{13}FNO_2S]^+$ ($[M+H]^+$): 417.1490, found: 417.1493.



3al

(Z/E)2-(adamantan-1-ylamino)prop-1-ene-1-sulfonyl fluoride (**3al**). White solid, 196 mg, 72% yield. M.p. 196−198 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 3:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.15 (s, 0.65H), 5.18 (s, 1H), 4.54 (s, 1H), 4.48 (d, J = 3.5 Hz, 0.64H), 2.26

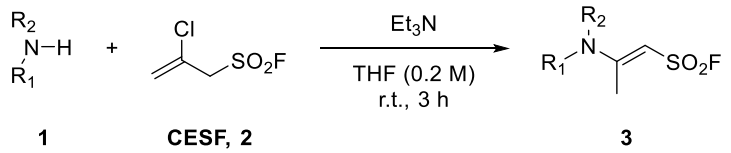
(s, 3H), 2.16 – 2.14 (m, 6.92H), 1.95 – 1.94 (m, 9.91H), 1.74 – 1.65 (m, 11.36H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.4 (s, 1F), 72.3 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.3, 158.5, 83.8 (d, J = 24.1 Hz), 78.2 (d, J = 23.6 Hz), 54.9, 54.0, 43.4, 41.2, 36.1, 36.0, 29.6, 29.4, 22.1, 22.0.**HRMS-ESI** (m/z) calcd. for $[C_{13}H_{21}FNO_2S]^+$ ($[M+H]^+$): 274.1272, found: 274.1272.



3am

(Z/E)2-((((1R,4aS,10aR)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methyl)amino)prop-1-ene-1-sulfonyl fluoride (**3am**). White solid, 341 mg, 84% yield. M.p. 116−118 ^{o}C. Purification by column chromatography on silica gel using petroleum ether / ethyl acetate = 2:1 (v/v) as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.30 (t, J = 6.0 Hz, 2.39H), 7.20 – 7.17 (m, 3.37H), 7.04 – 7.00 (m, 3.37H), 6.94 – 6.90 (m, 3.38H), 4.99 (s, 1H), 4.71 (s, 1H), 4.62 (d, J = 3.5 Hz, 2.35H), 3.25 – 3.21 (m, 2.32H), 3.02 – 2.81 (m, 14.34H), 3.38 – 2.30 (m, 6.58H), 2.01 – 2.00 (m, 7.0H), 1.85 – 1.70 (m, 13.54H), 1.59 – 1.55 (m, 3.4H), 1.52 – 1.48 (m, 1.01 H), 1.47 – 1.39 (m, 6.90 H), 1.27 – 1.22 (m, 34.10H), 1.03 (s, 2.98H), 1.00 (s, 7.06H). **^{19}F NMR** (471 MHz, $CDCl_3$) δ 72.9 (s, 1F), 72.7 (s, 1F). **^{13}C NMR** (126 MHz, $CDCl_3$) δ162.1, 161.4, 146.8, 146.7, 146.2, 145.9, 134.4, 134.3, 127.1, 127.0, 124.4, 124.3, 124.2, 124.2, 82.4 (d, J = 25.6 Hz), 77.78 (d, J = 23.9 Hz), 55.3, 54.6, 46.7, 45.9, 38.3, 38.3, 38.0, 37.7, 37.6, 37.2, 36.5, 36.3, 33.6, 30.2, 29.9, 25.5, 25.3, 24.1, 24.1, 20.5, 19.4, 19.2, 19.1, 18.6, 18.5, 18.1,18.0. **HRMS-ESI** (m/z) calcd. for $[C_7H_{13}FNO_2S]^+$ ($[M+H]^+$): 408.2367, found: 408.2369.

5. Procedure for Scale-up Reaction of *N*-ESF (3)



1 **CESF, 2** **3**

An oven-dried reaction tube (50 mL) equipped with a magnetic stirring bar was charged with amines (**1**, 6.0 mmol, 1.0 equiv.) and CESF (**2**, 1.14 g, 7.2 mmol, 1.2 equiv.), 30.0 mL THF. After stirring evenly, trimethylamine (0.73 g, 7.2 mmol, 1.2 equiv.) was added to the above solution slowly with stirring, and the mixed solution became turbid slowly. The mixture was stirred at room temperature under an air atmosphere for 3 h monitored by TLC. After the reaction was completed, water (50 mL) was added to the mixture and the reaction mixture was extracted with ethyl acetate (3×20 mL). The extracts were dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate as eluents to afford the target product **3**.

6. NOESY of (*E*)-2-(methyl(phenyl)amino)prop-1-ene-1-sulfonyl fluoride (3a)

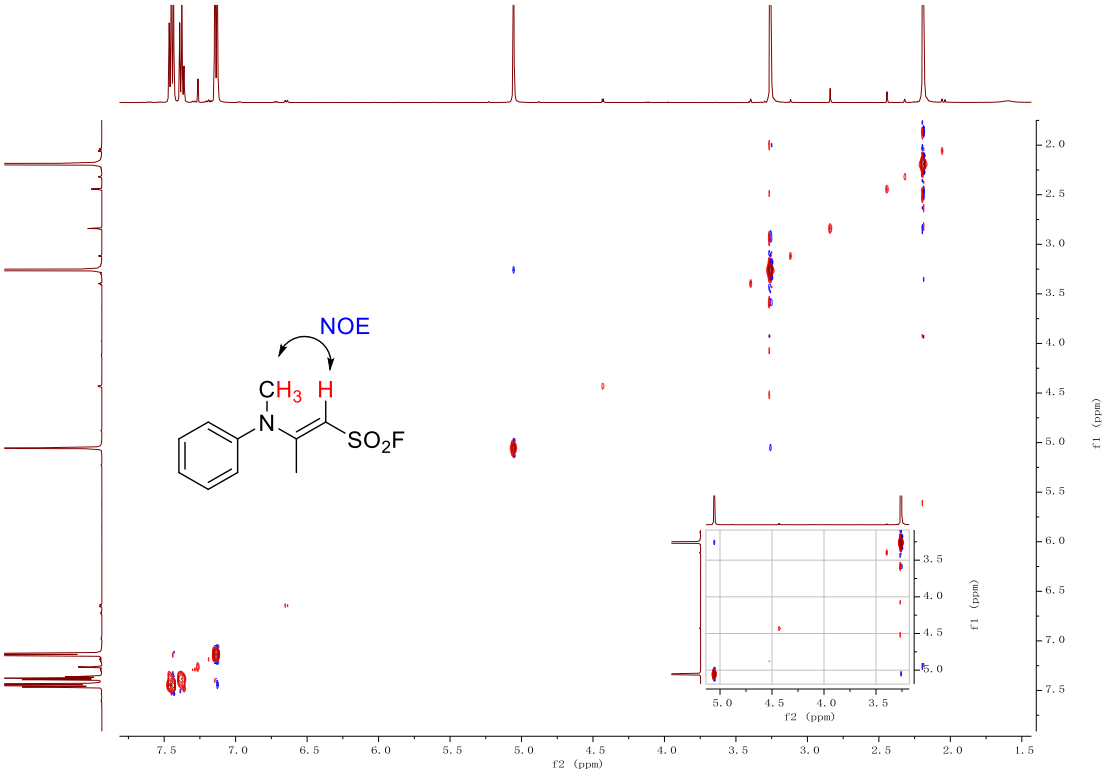


Figure S1 NOESY spectrum of compound **3a** (in CDCl3)

7. References

[1] M. J. Brienne, D. Varech, M. Leclercq, J. Jacques, N. Radembino, M. C. Dessalles, G. Mahuzier, C. Gueyouche, C. Bories, P. Loiseau and P. Gayral, New antifilarial agents. 1. Epoxy sulfonamides and ethynesulfonamides, *J. Med. Chem.*, 1987, **30**, 2232-2239.

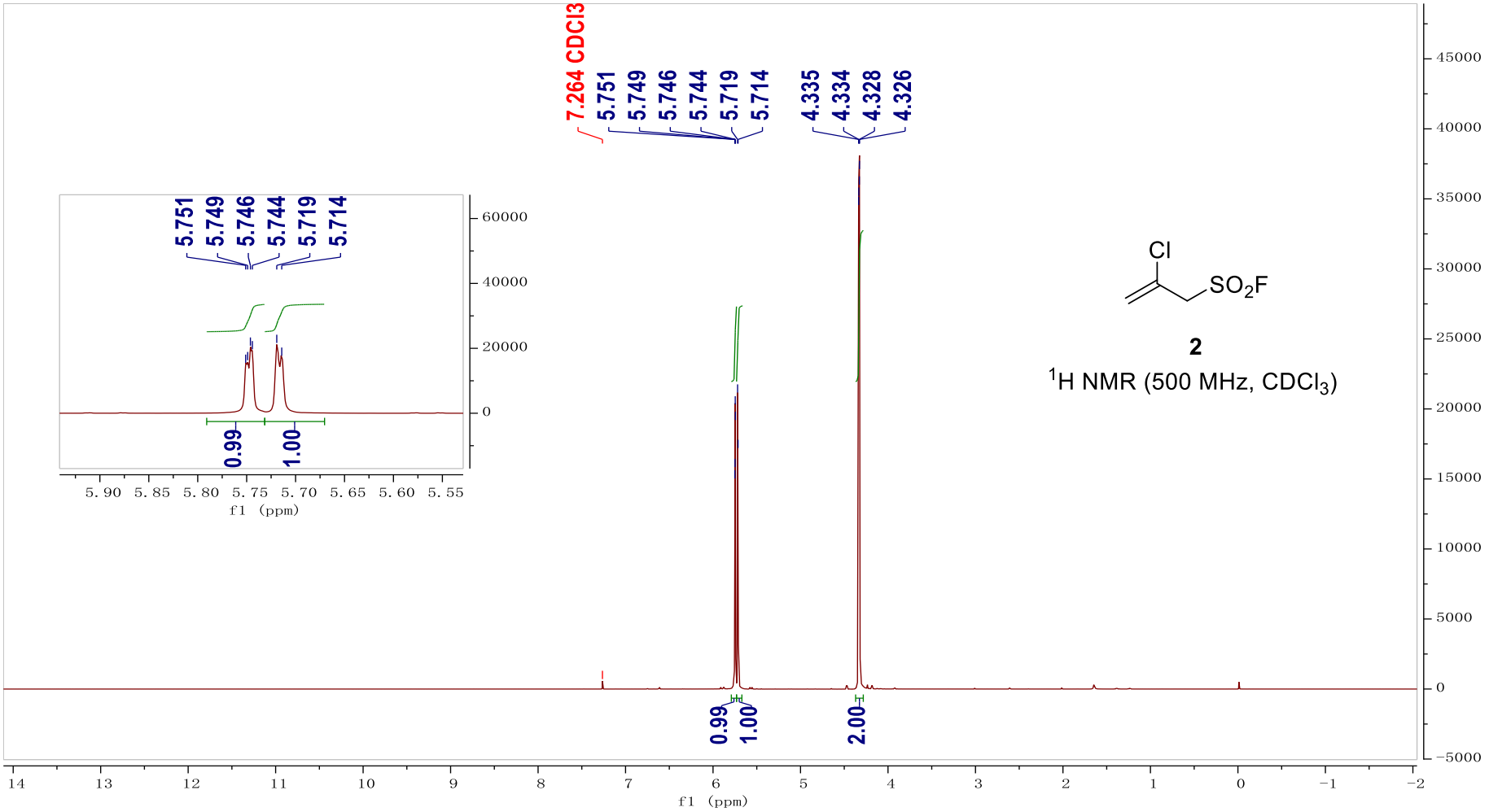
[2] Z.-W. Zhang, S.-M. Wang, W.-Y. Fang, R. Lekkala and H.-L. Qin, Protocol for stereoselective construction of highly functionalized dienyl sulfonyl fluoride warheads, *J. Org. Chem.*, 2020, **85**, 13721-13734.

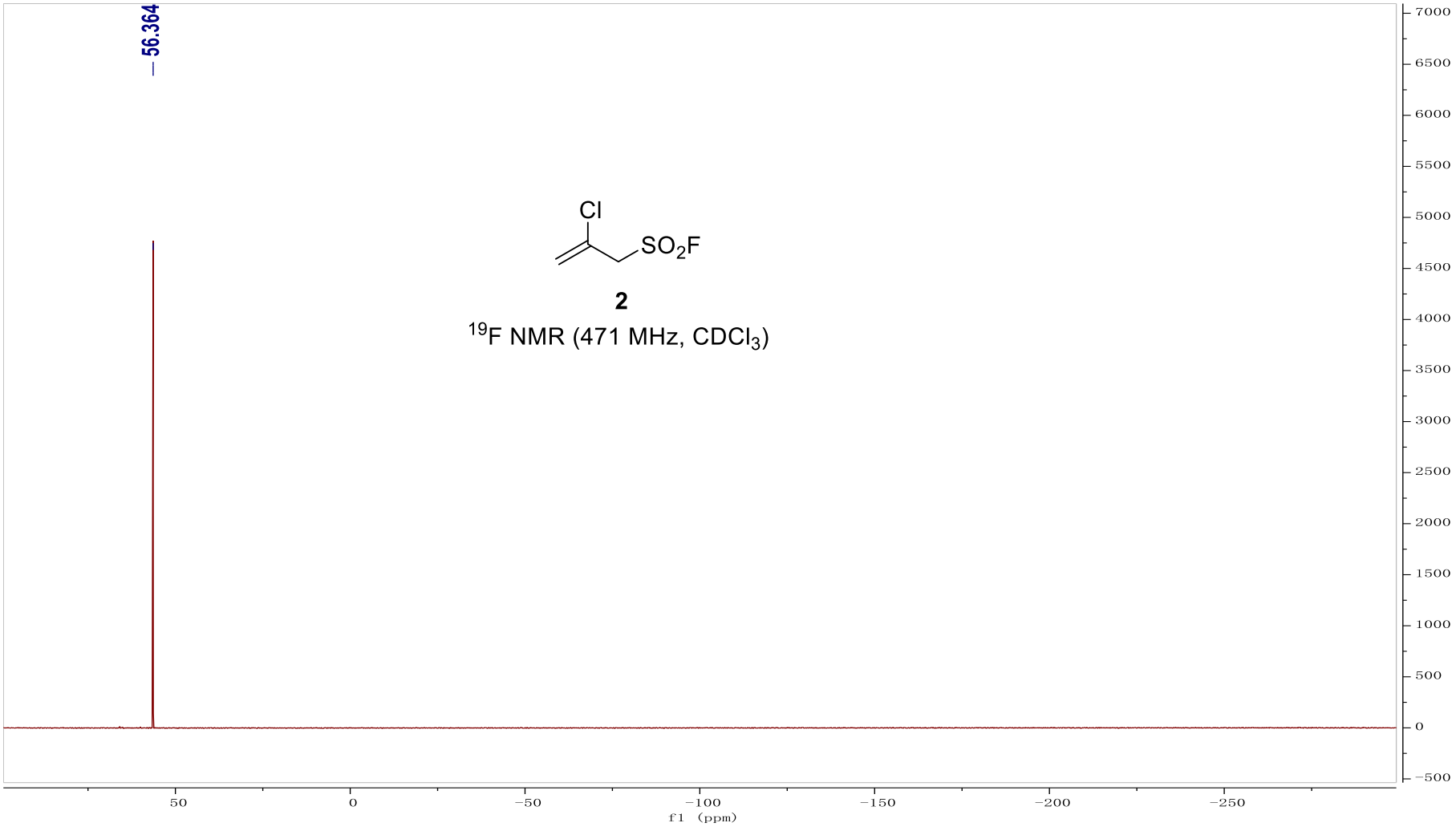
[3] J. Gong, Q. Wan and Q. Kang, Asymmetric [3+2] Cycloaddition Employing N,N′-Cyclic Azomethine Imines Catalyzed by Chiral-at-Metal Rhodium Complex, *Org. Lett.*, 2018, **20**, 3354-3357.

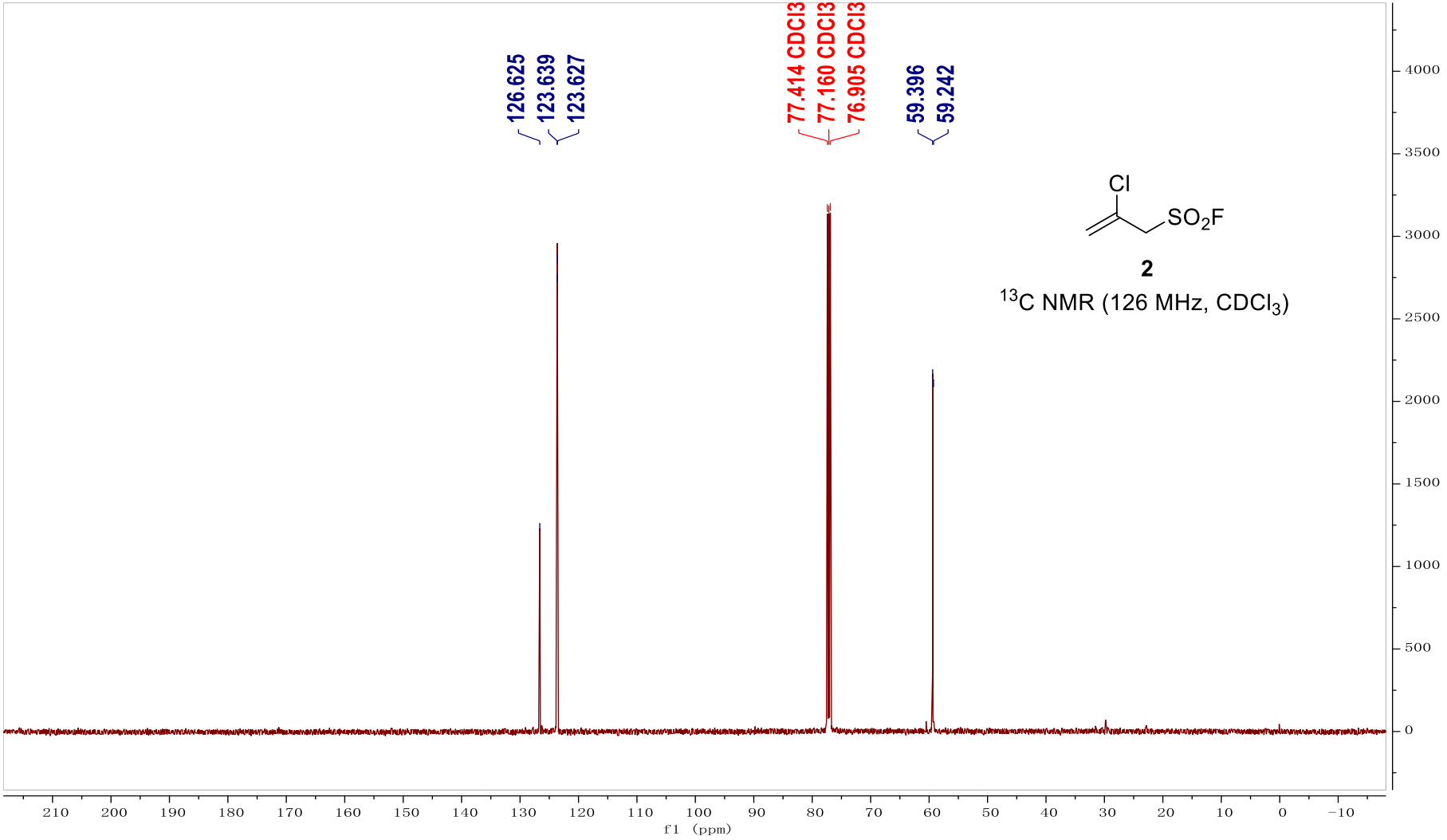
[4] H. Zhang, J. Fan, H. Dong, S. Zhang, W. Xu, J. Wang, P. Gao and X. Peng, Fluorene-derived two-photon fluorescent probes for specific and simultaneous bioimaging of endoplasmic reticulum and lysosomes: group-effect and localization, *J. Mater. Chem. B.*, 2013, **1**, 5450-5455.

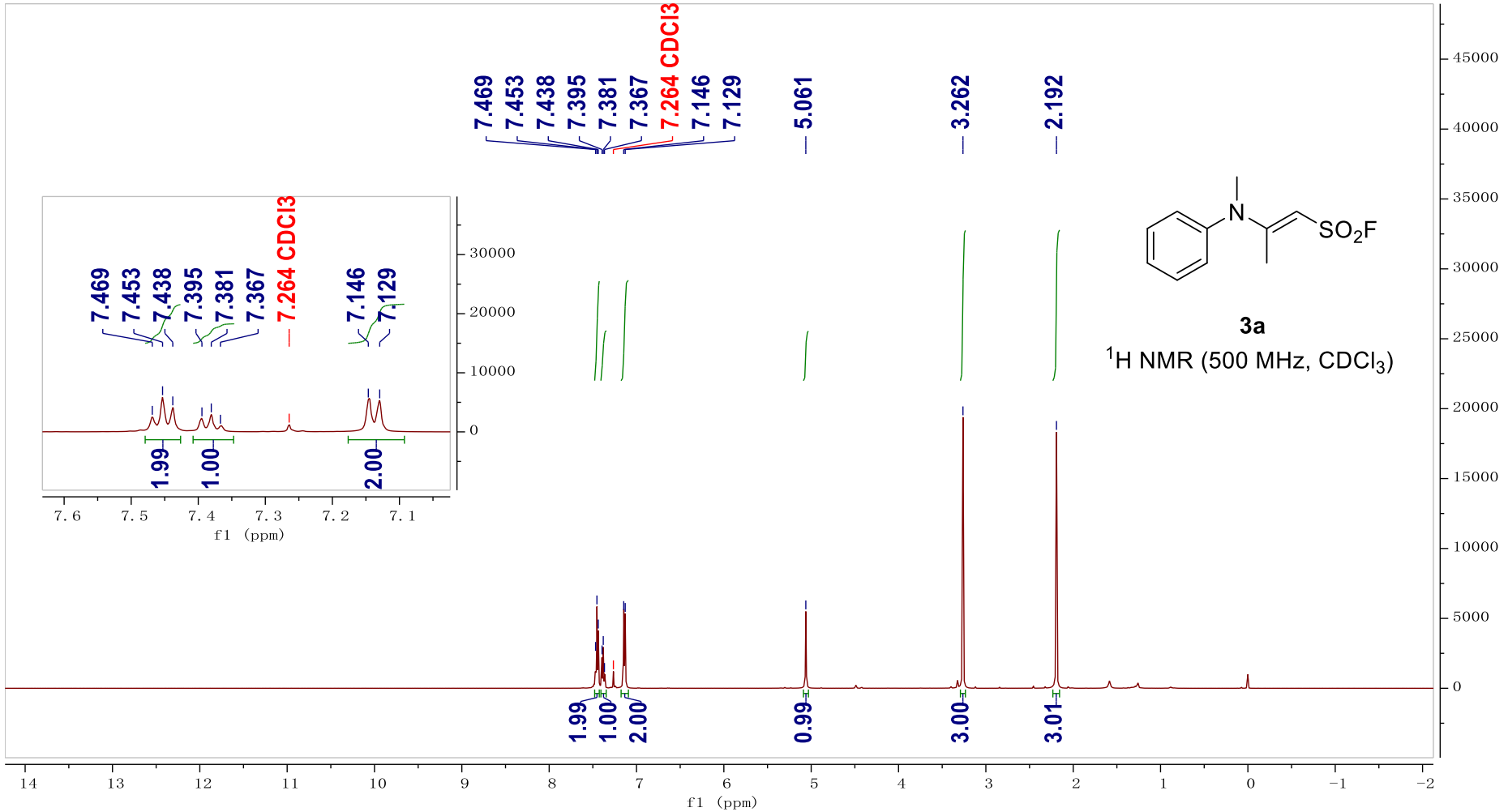
[5] S. Natori, Antibacterial Effect of Lichen Substances and Related Compounds. VII. The Structure-Activity Relationship observed in Compounds related to Dibenzofuran and an Approach to the Elucidation of the Mode of Action, *Pharm. Bull.*, 1957, **5**, 539-560.

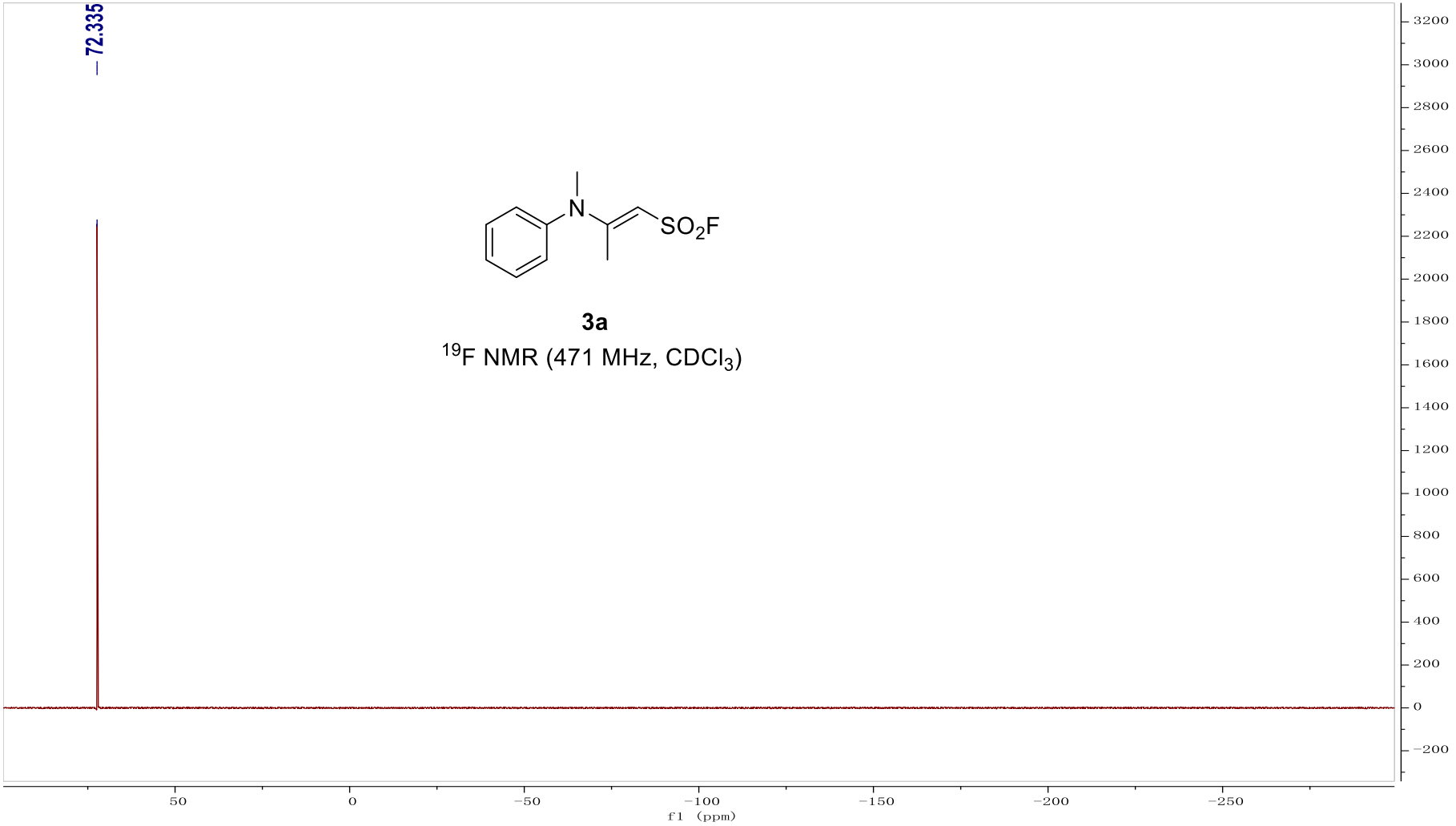
8. NMR Spectra




56.364
Cl
SO2F
2
19F NMR (471 MHz, CDCl3)
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
−500
50
0
−50
−100
−150
−200
−250
f1 (ppm)

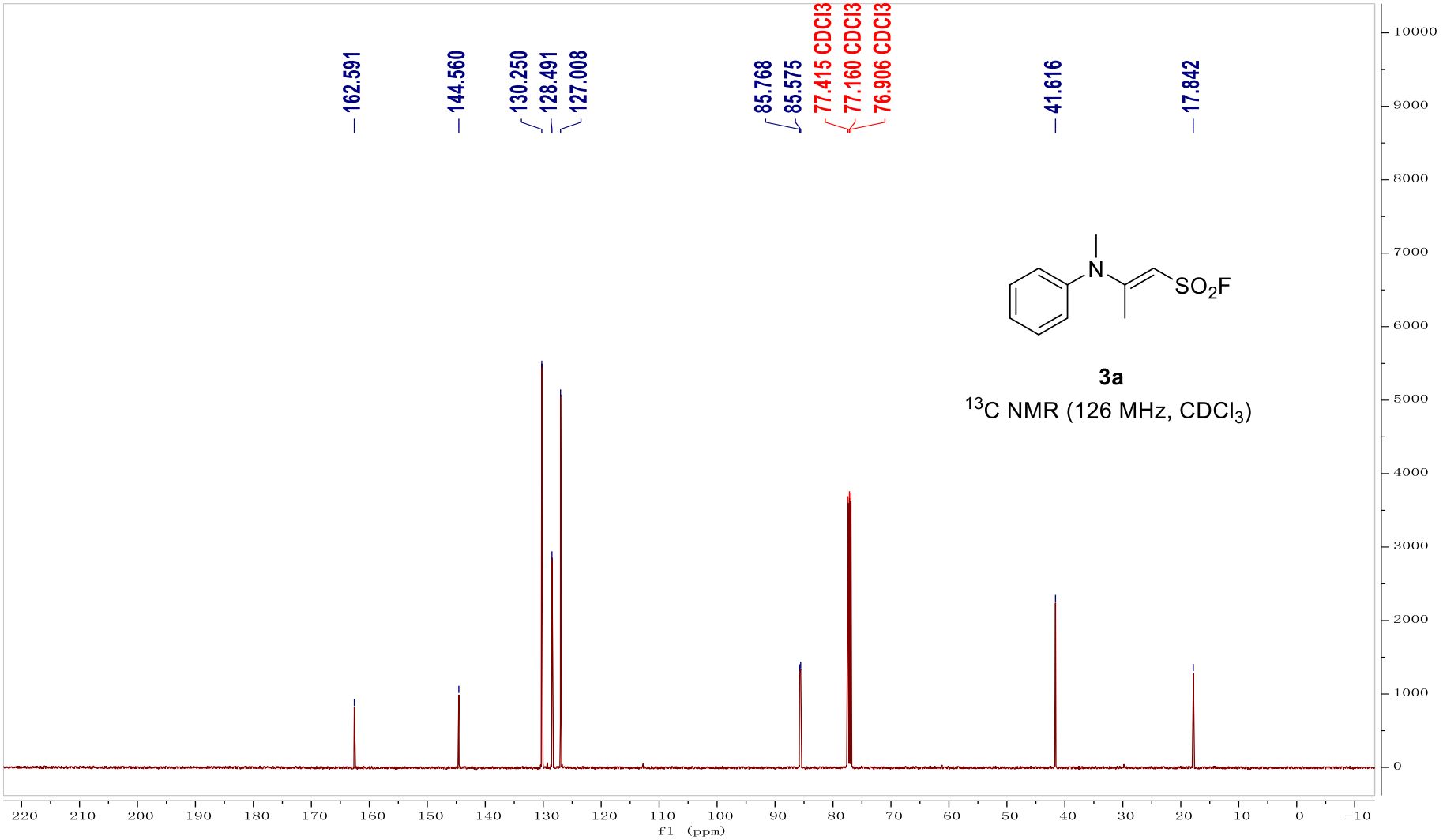

126.625
123.639
123.627
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
59.396
59.242
Cl
SO2F
2
13C NMR (126 MHz, CDCl3)
4000
3500
3000
2500
2000
1500
1000
500
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)

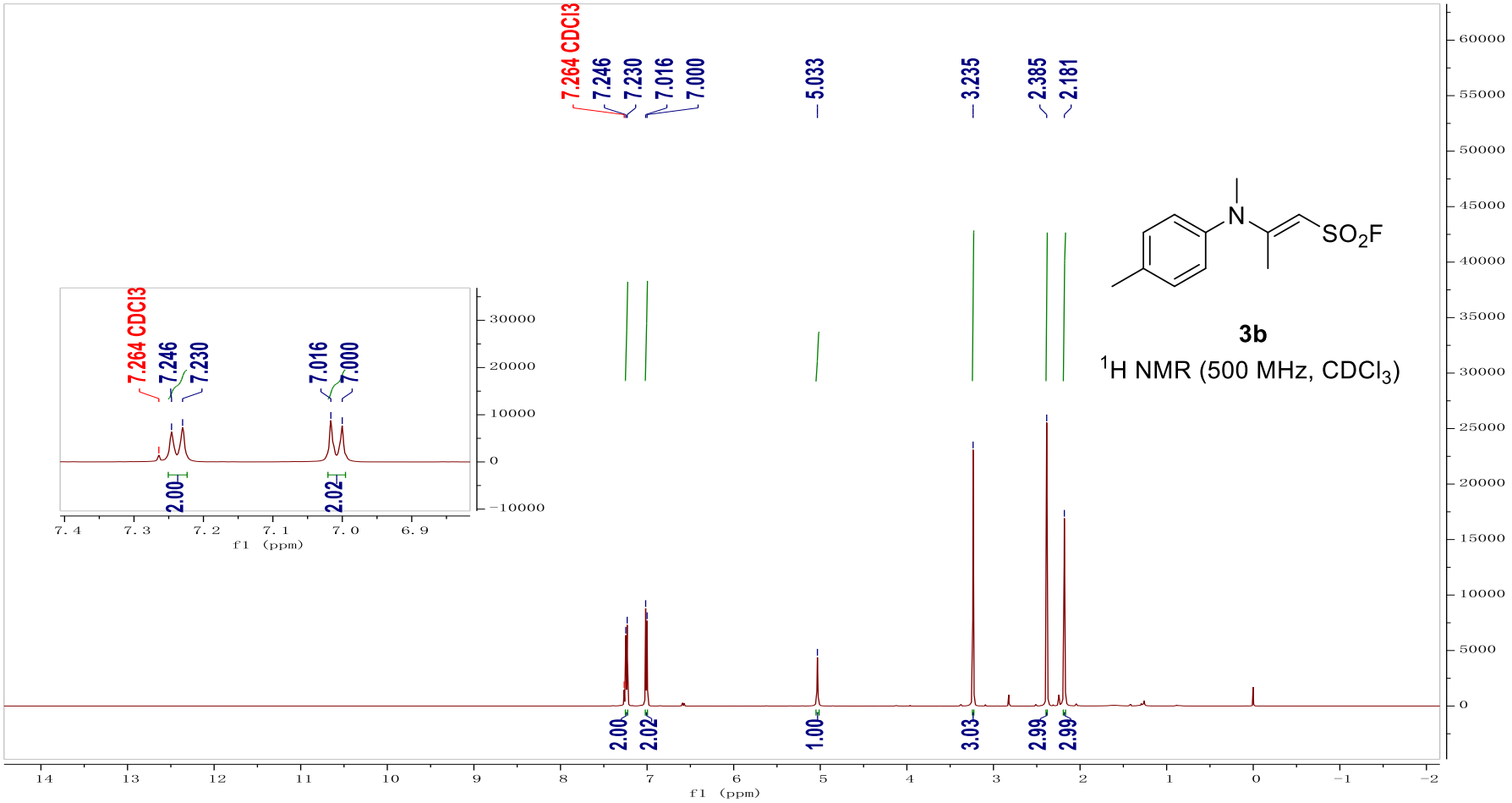

7.469
7.453
7.438
7.395
7.381
7.367
7.264 CDCl3
7.146
7.129
5.061
3.262
2.192
1.99
1.00
2.00
0.99
3.00
3.01
f1 (ppm)
3a
1H NMR (500 MHz, CDCl3)
SO2F
N

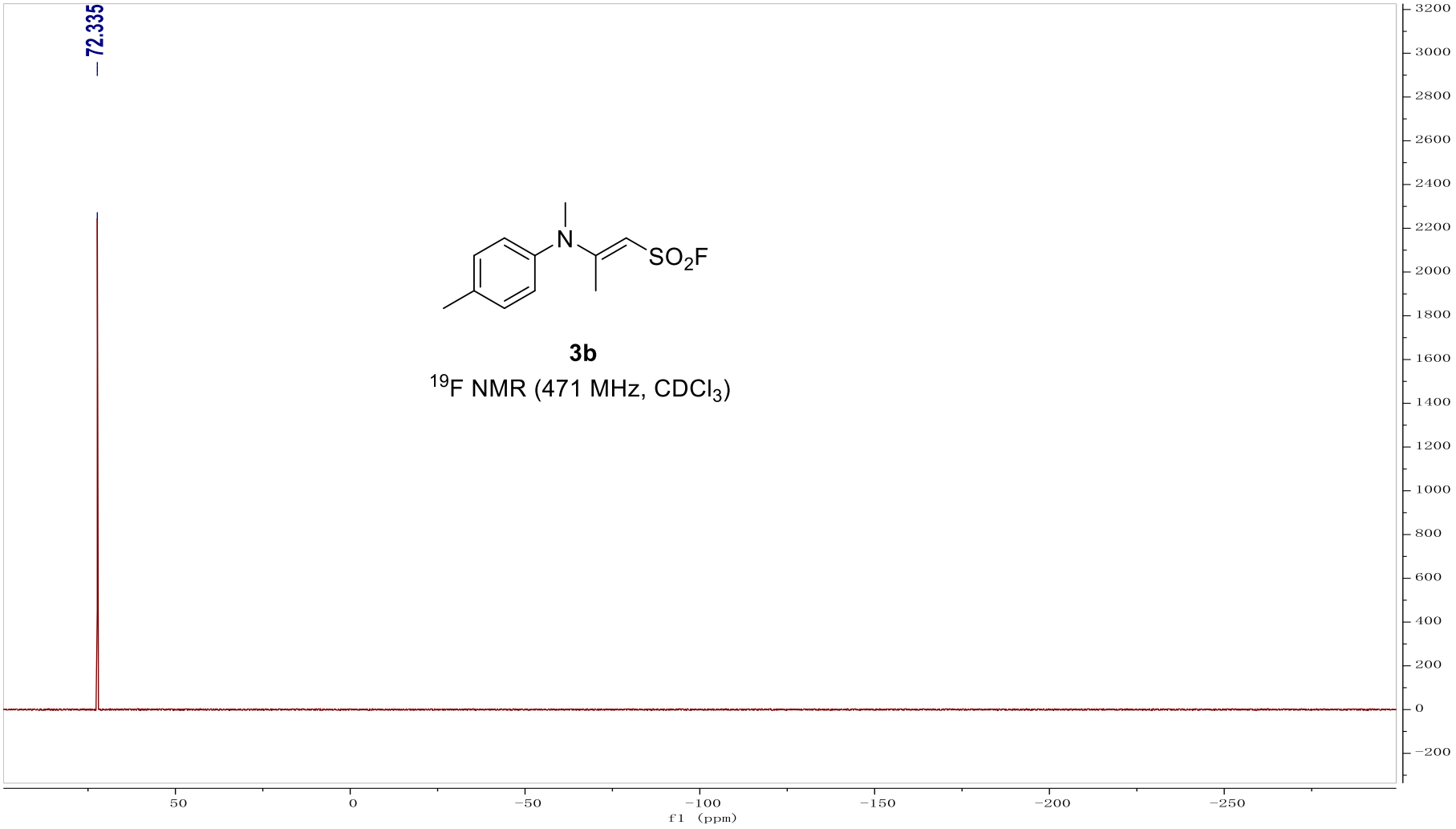


3a

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

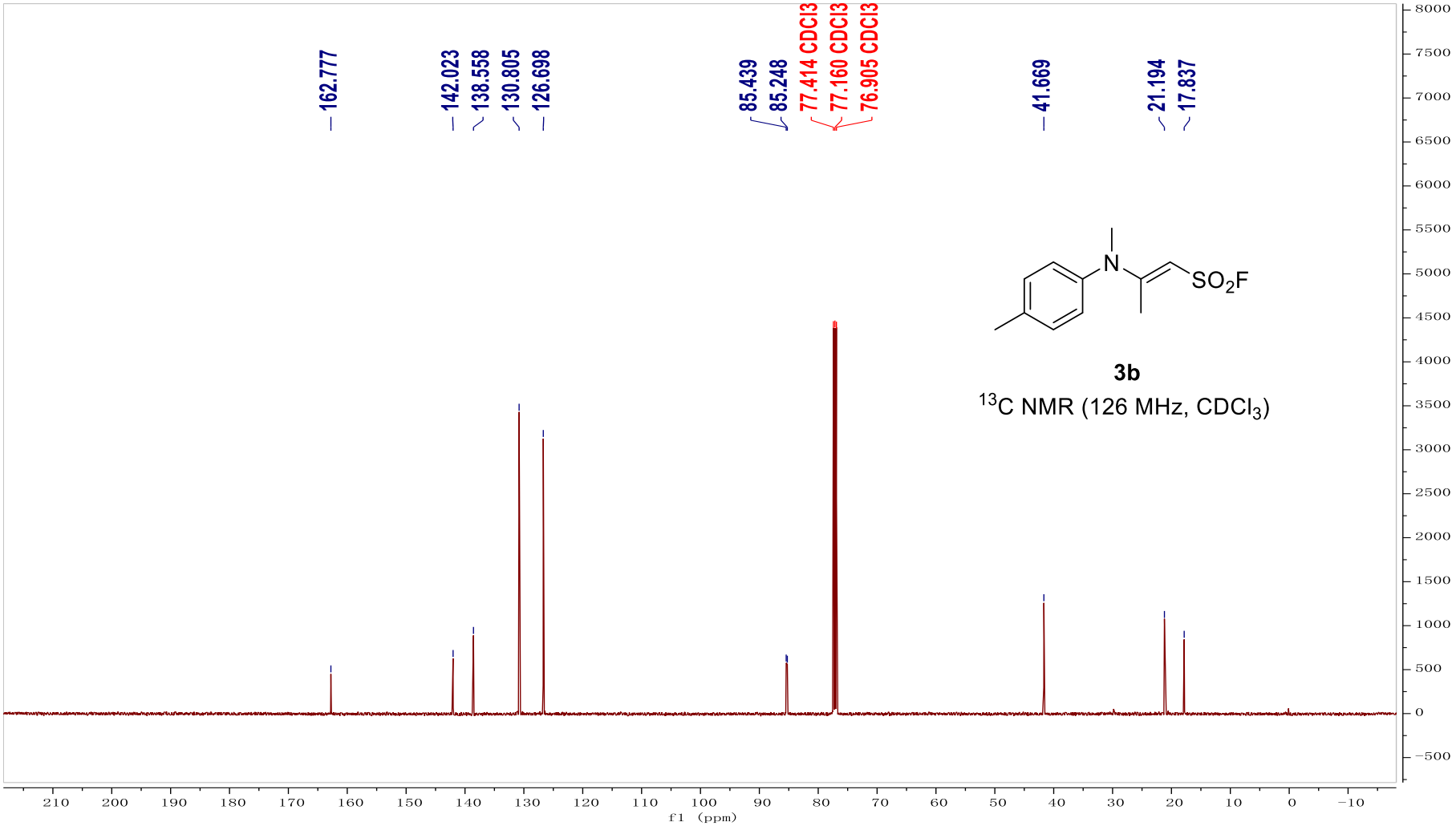

162.591
144.560
130.250
128.491
127.008
85.768
85.575
77.415 CDCl3
77.160 CDCl3
76.906 CDCl3
41.616
17.842
SO2F
3a
13C NMR (126 MHz, CDCl3)
f1 (ppm)

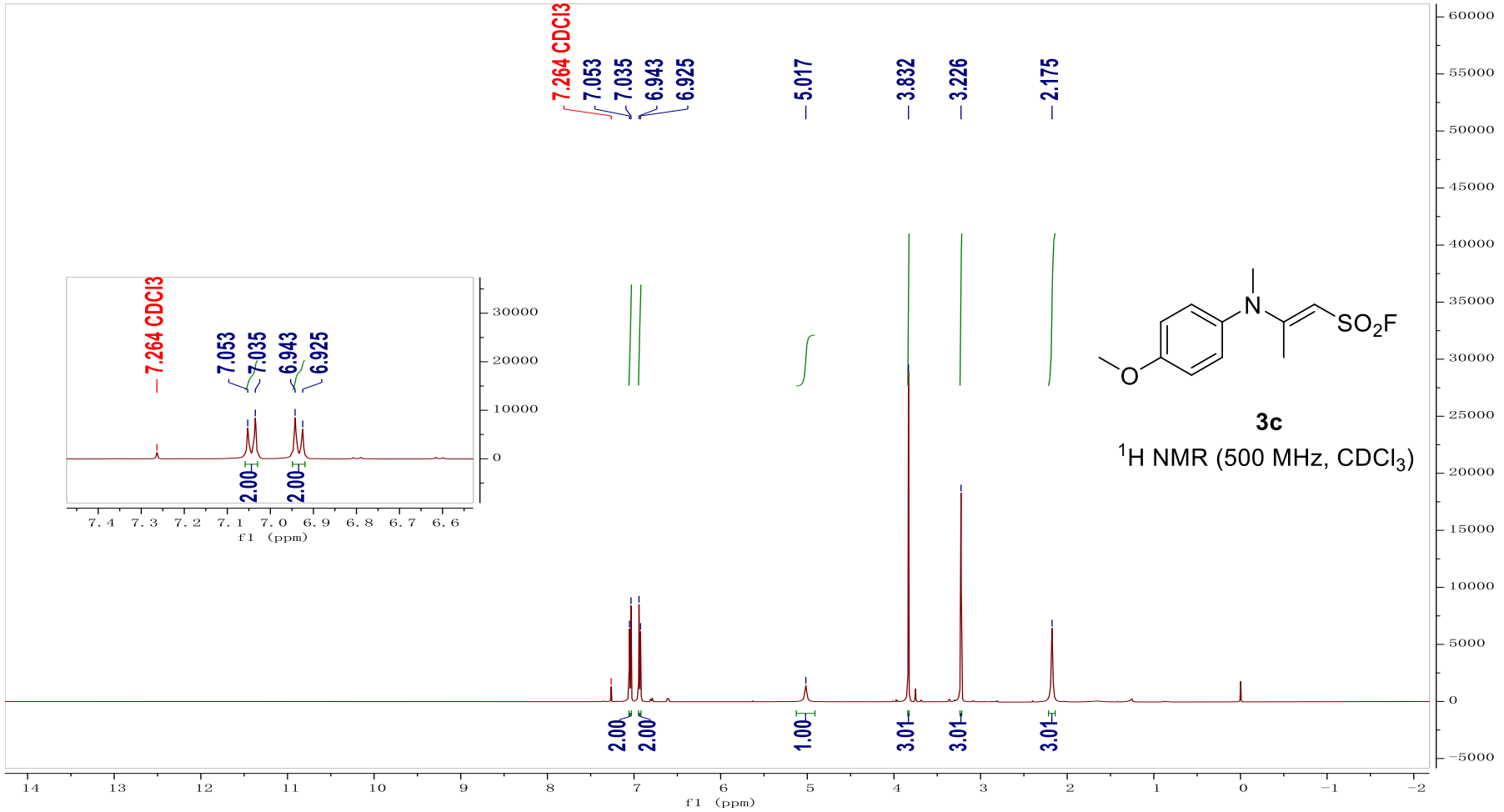

7.264 CDCl3
7.246
7.230
7.016
7.000
5.033
3.235
2.385
2.181
2.00
2.02
1.00
3.03
2.99
2.99
f1 (ppm)
3b
1H NMR (500 MHz, CDCl3)
SO2F

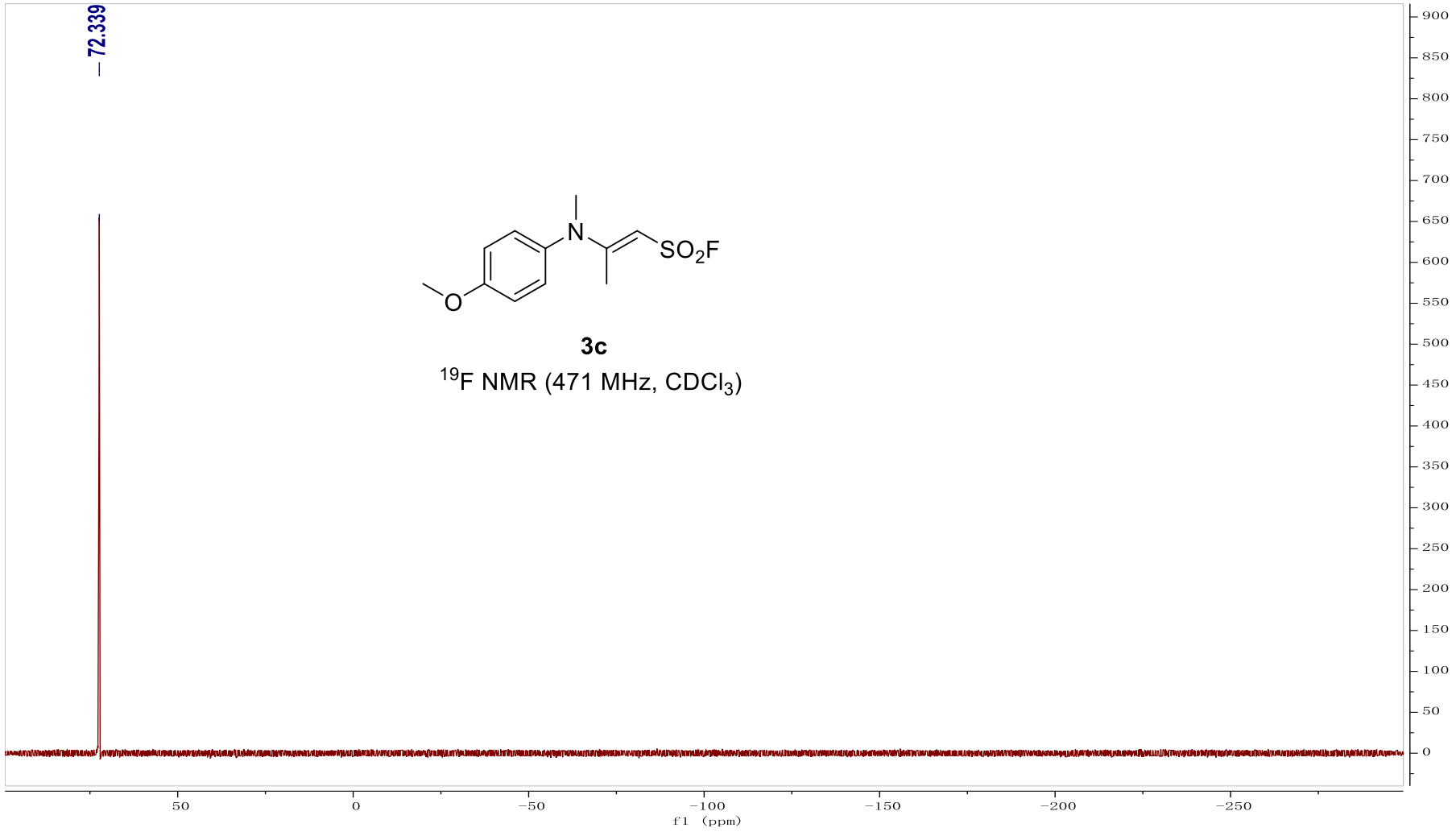


3b

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

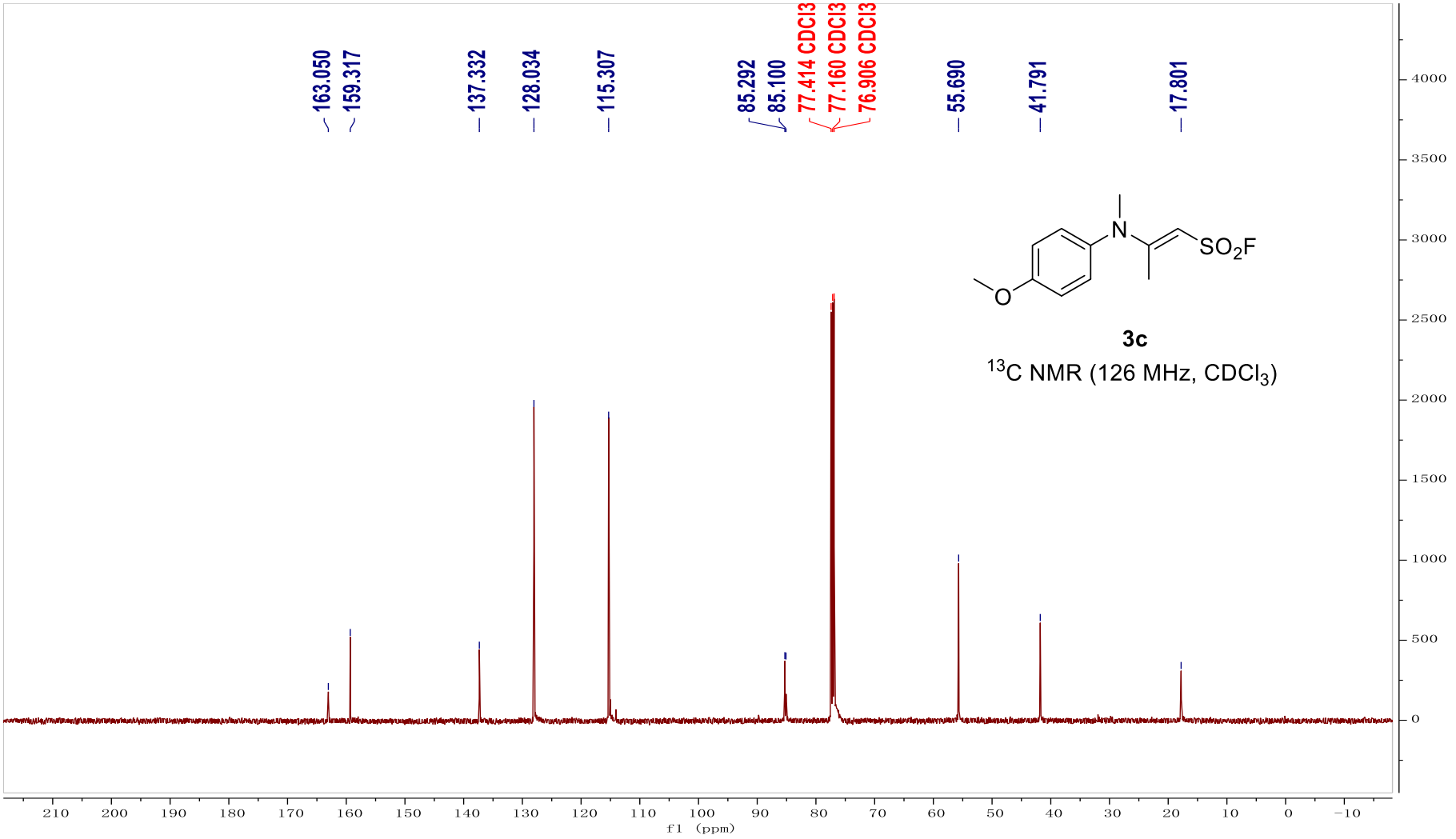

162.777
142.023
138.558
130.805
126.698
85.439
85.248
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
41.669
21.194
17.837
N
SO2F
3b
13C NMR (126 MHz, CDCl3)
f1 (ppm)

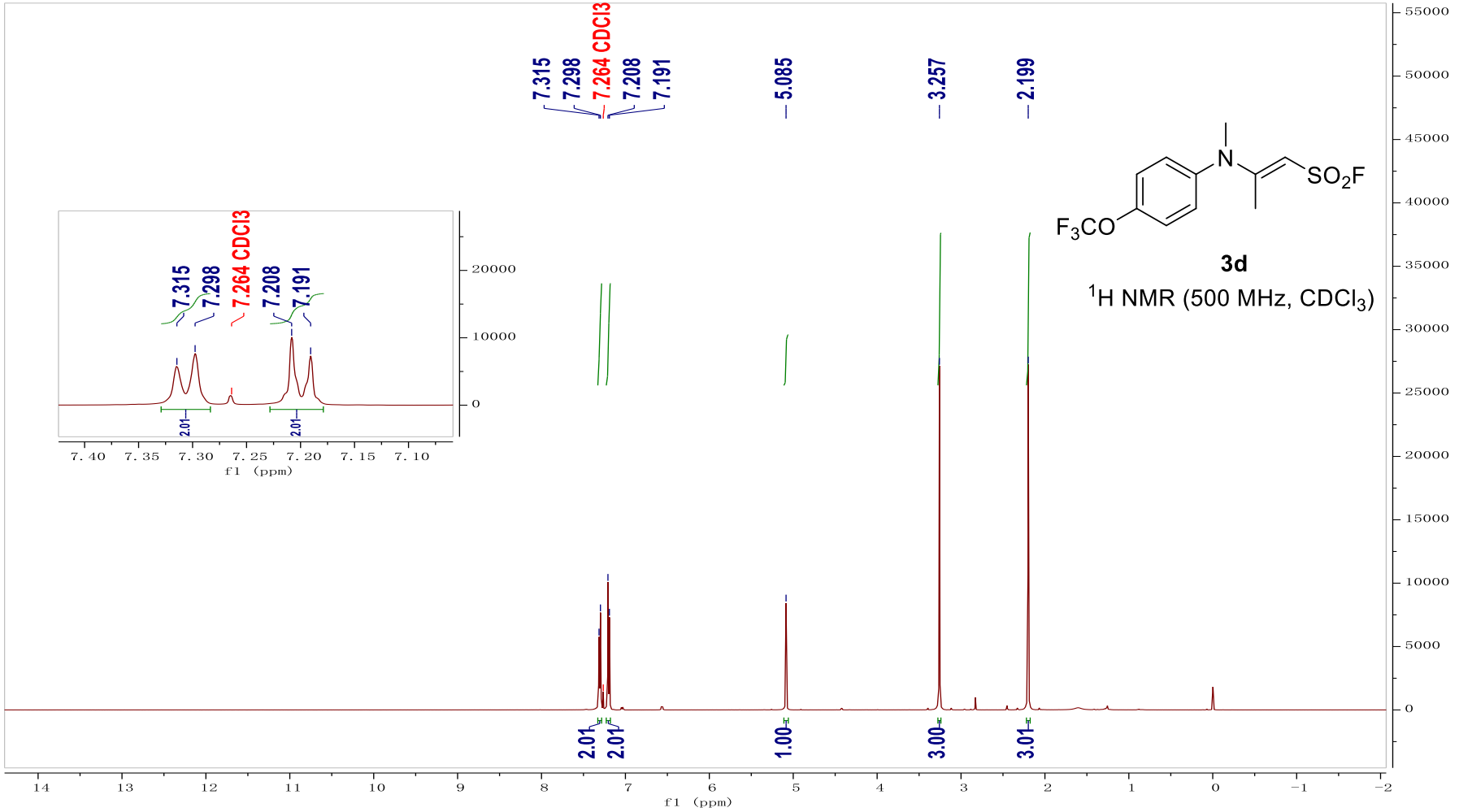

7.264 CDCl3
7.053
7.035
6.943
6.925
5.017
3.832
3.226
2.175
2.00
2.00
1.00
3.01
3.01
3.01
f1 (ppm)
3c
1H NMR (500 MHz, CDCl3)
SO2F
N
O

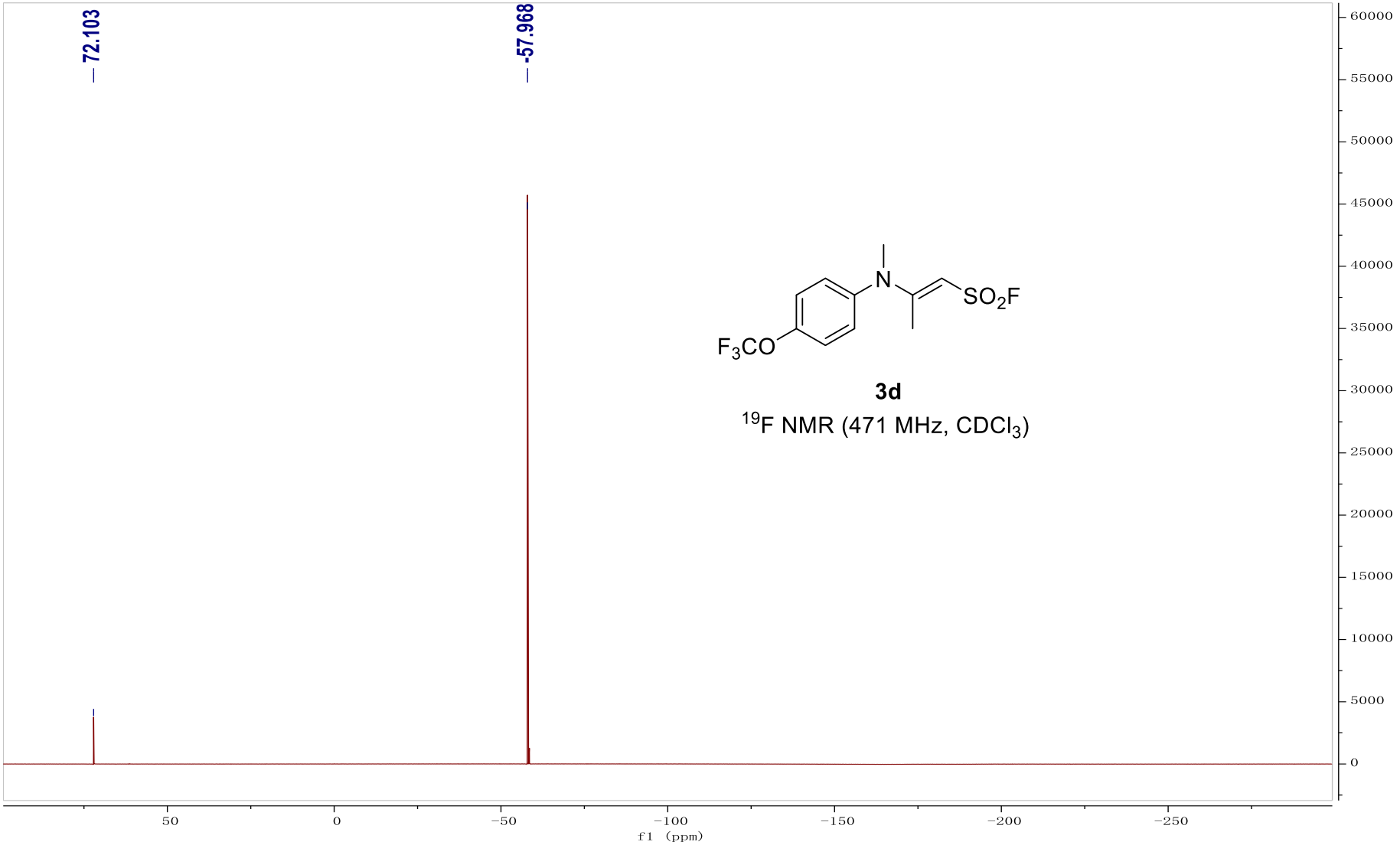


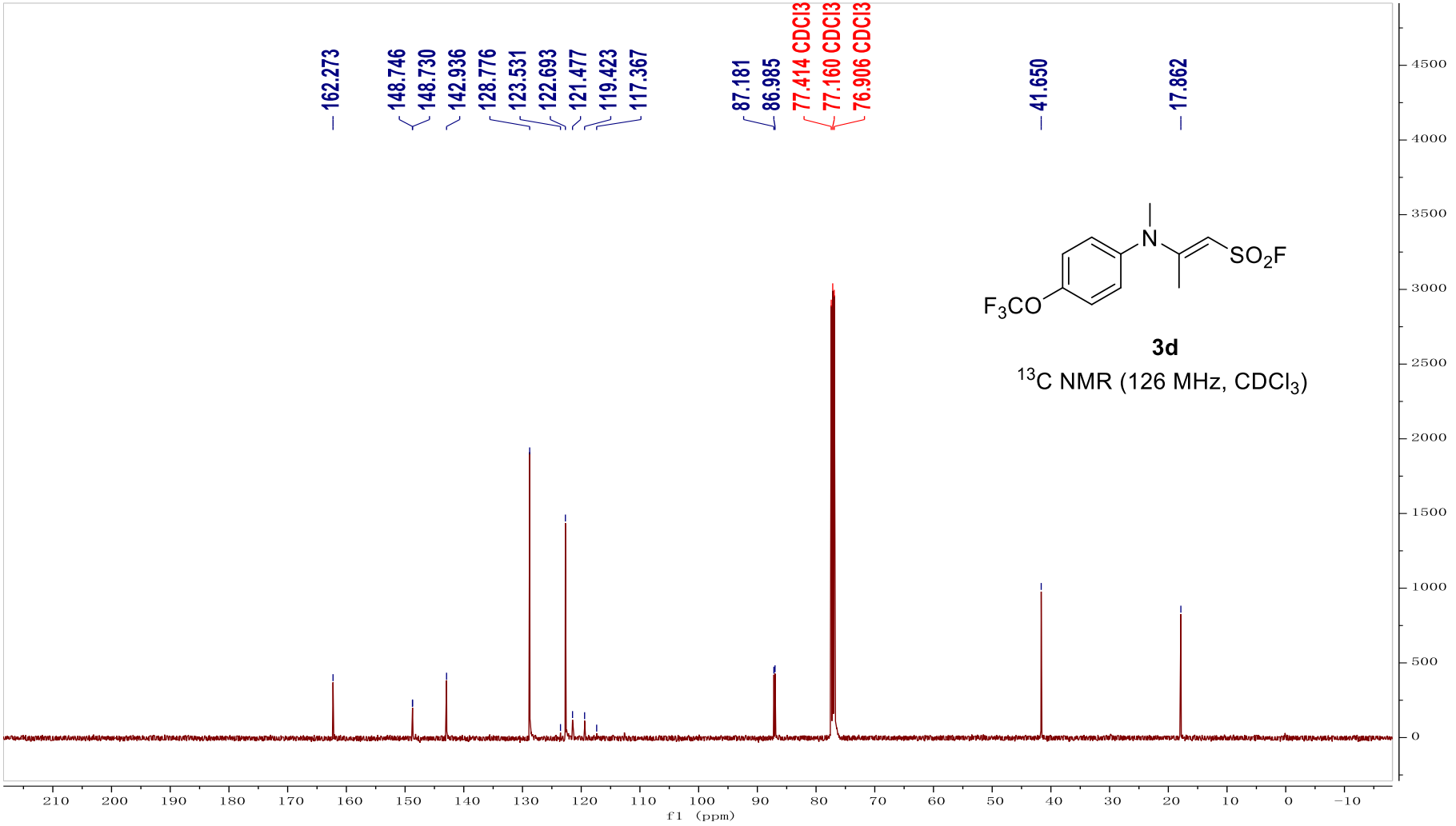
3c

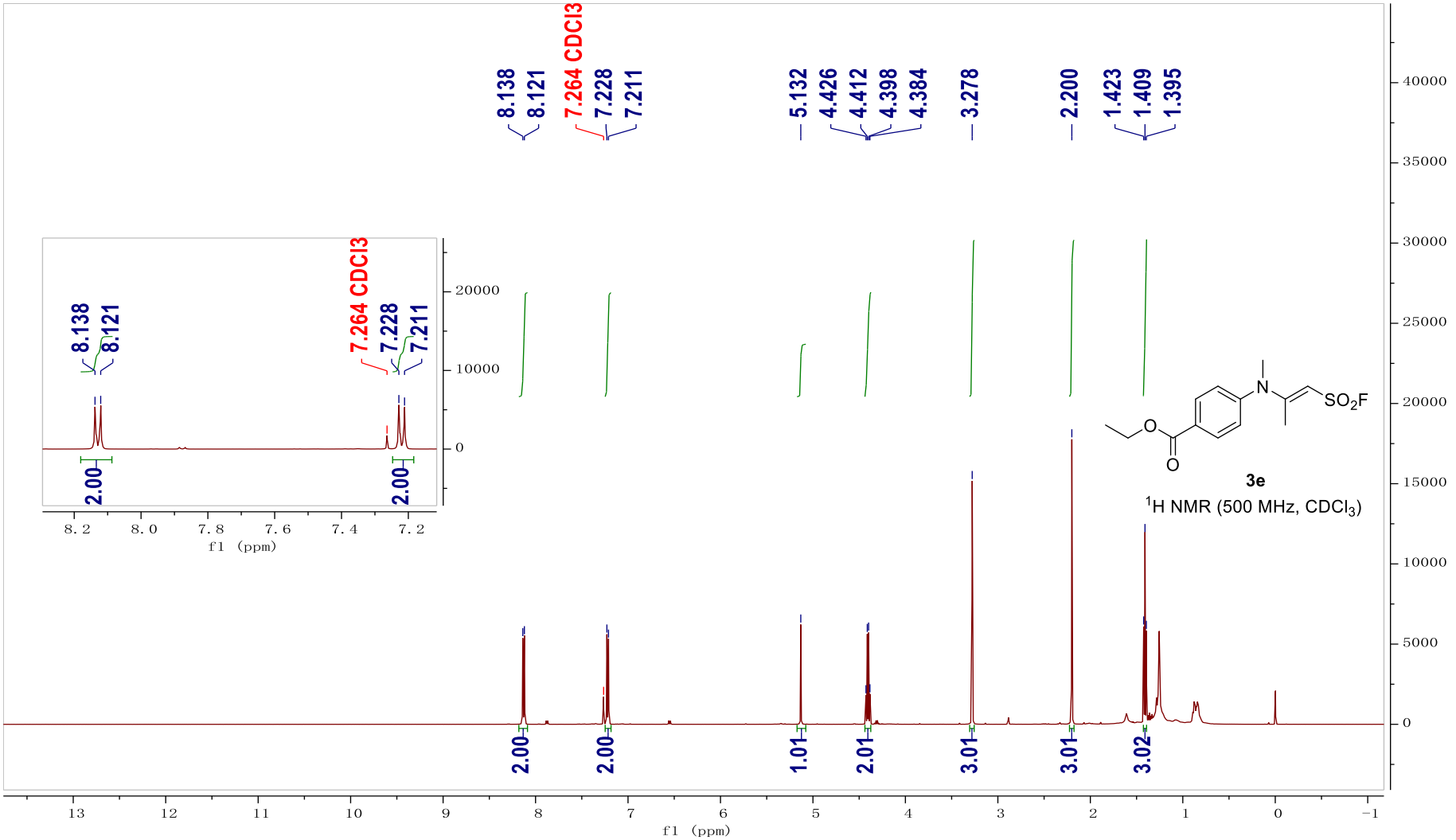
^{19}F NMR (471 MHz, $CDCl_3$)

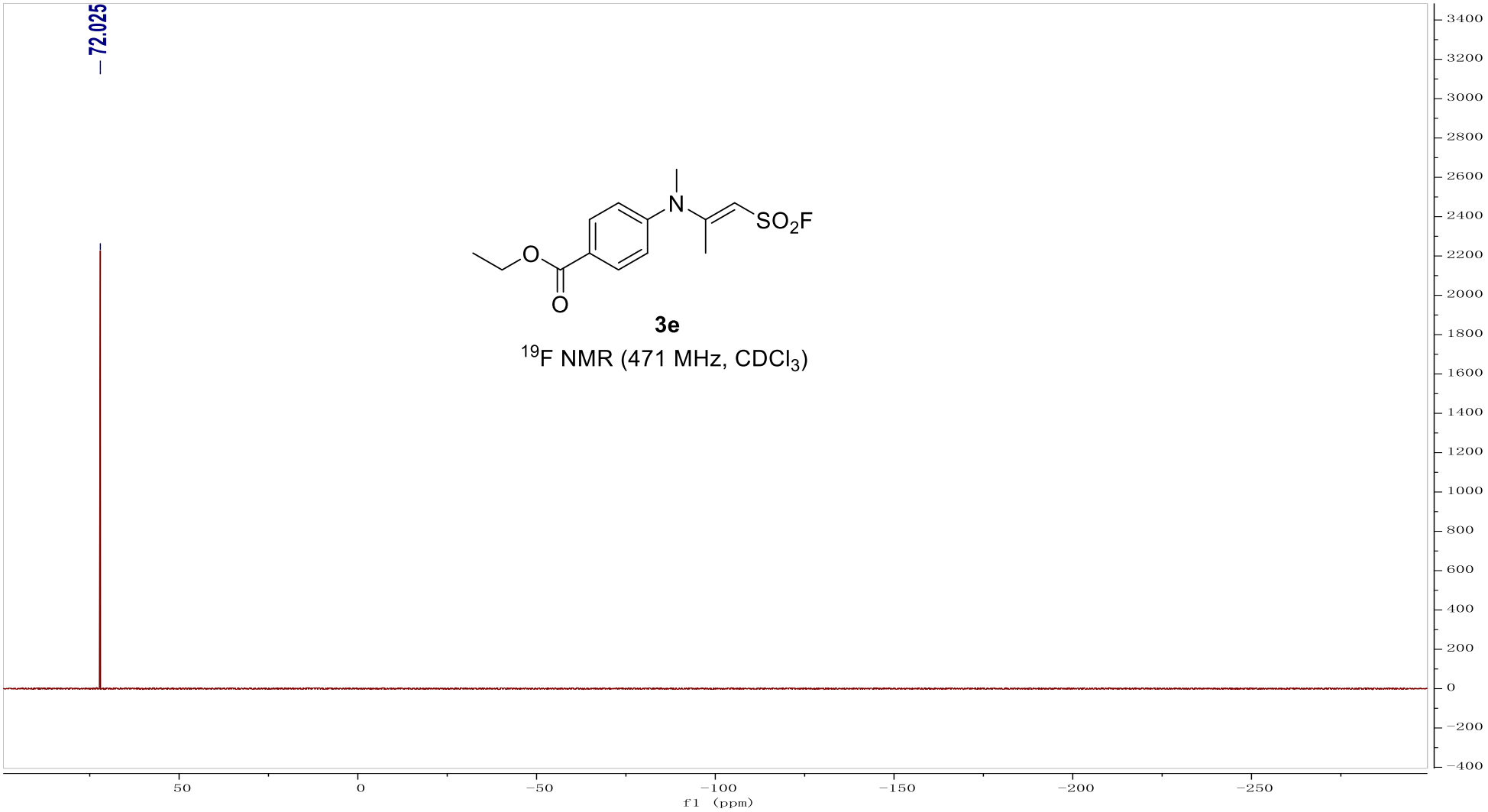

163.050
159.317
137.332
128.034
115.307
85.292
85.100
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
55.690
41.791
17.801
N
SO2F
O
3c
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.315
7.298
7.264 CDCl3
7.208
7.191
5.085
3.257
2.199
2.01
2.01
1.00
3.00
3.01
f1 (ppm)
F3CO
SO2F
3d
1H NMR (500 MHz, CDCl3)


-72.103
-57.968
N
SO2F
F3CO
3d
19F NMR (471 MHz, CDCl3)
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
50
0
−50
−100
−150
−200
−250
f1 (ppm)

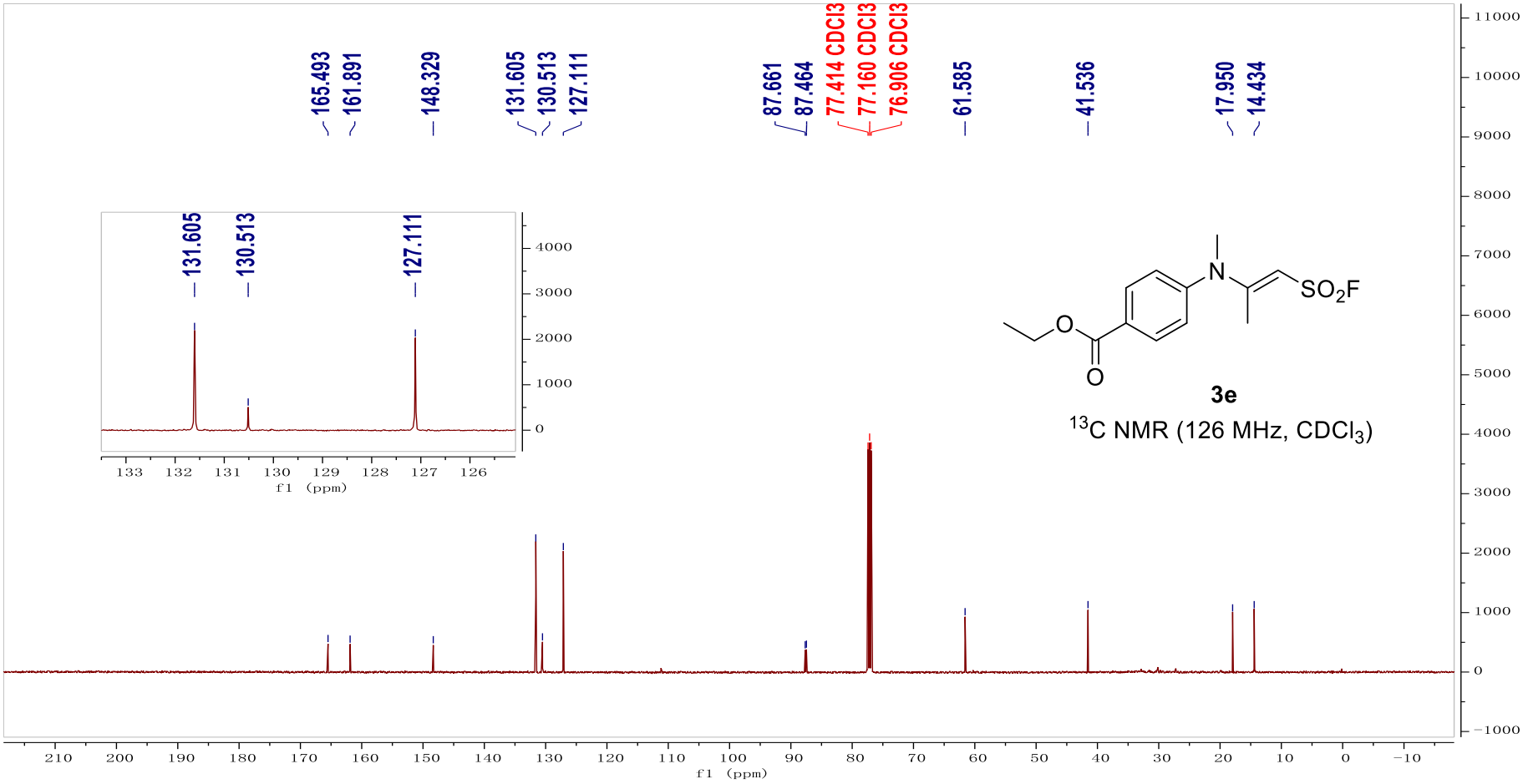

162.273
148.746
148.730
142.936
128.776
123.531
122.693
121.477
119.423
117.367
87.181
86.985
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
41.650
17.862
N
SO2F
F3CO
3d
13C NMR (126 MHz, CDCl3)
f1 (ppm)

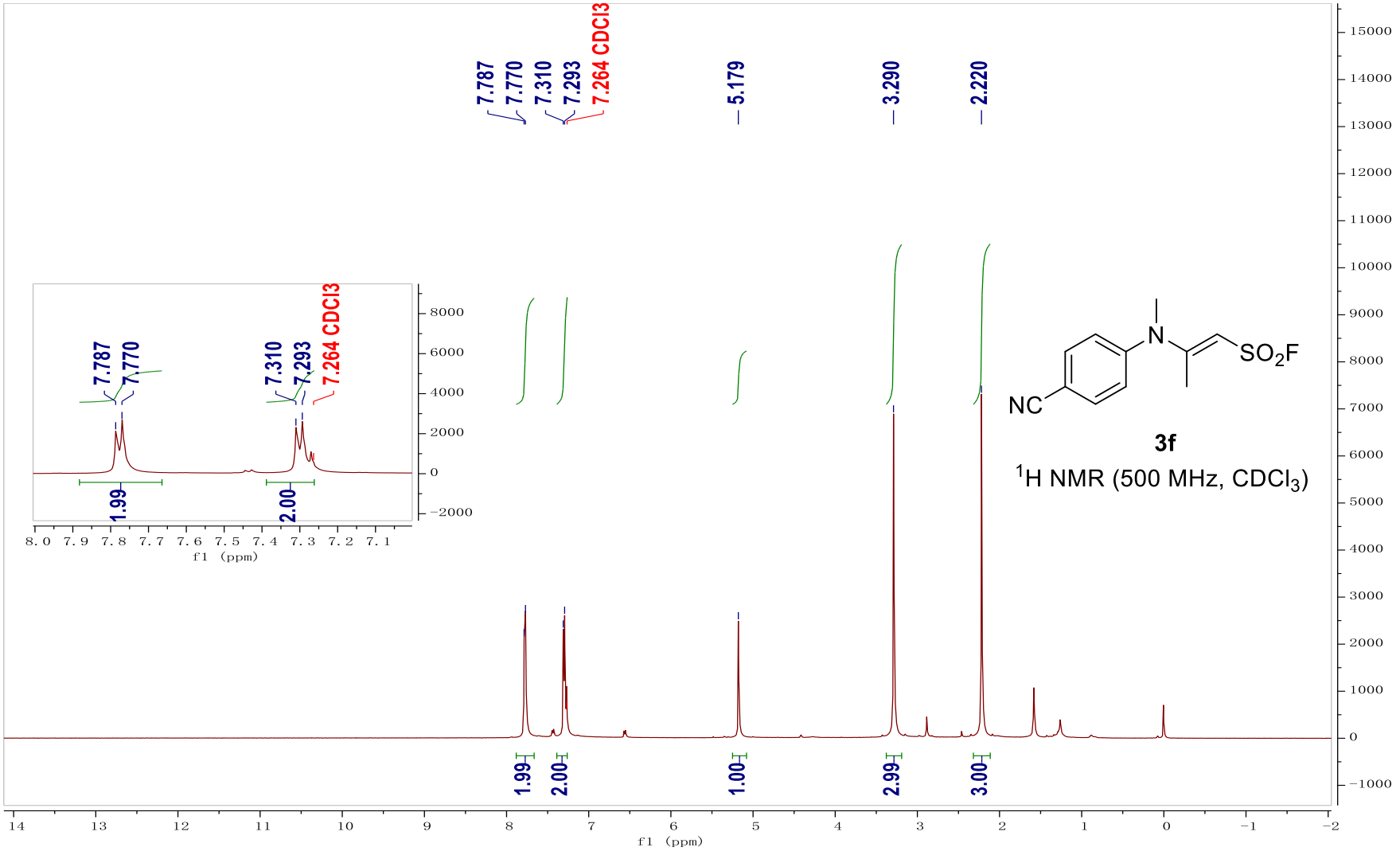

8.138
8.121
7.264 CDCl3
7.228
7.211
5.132
4.426
4.412
4.398
4.384
3.278
2.200
1.423
1.409
1.395
2.00
2.00
1.01
2.01
3.01
3.01
3.02
f1 (ppm)
3e
1H NMR (500 MHz, CDCl3)
SO2F

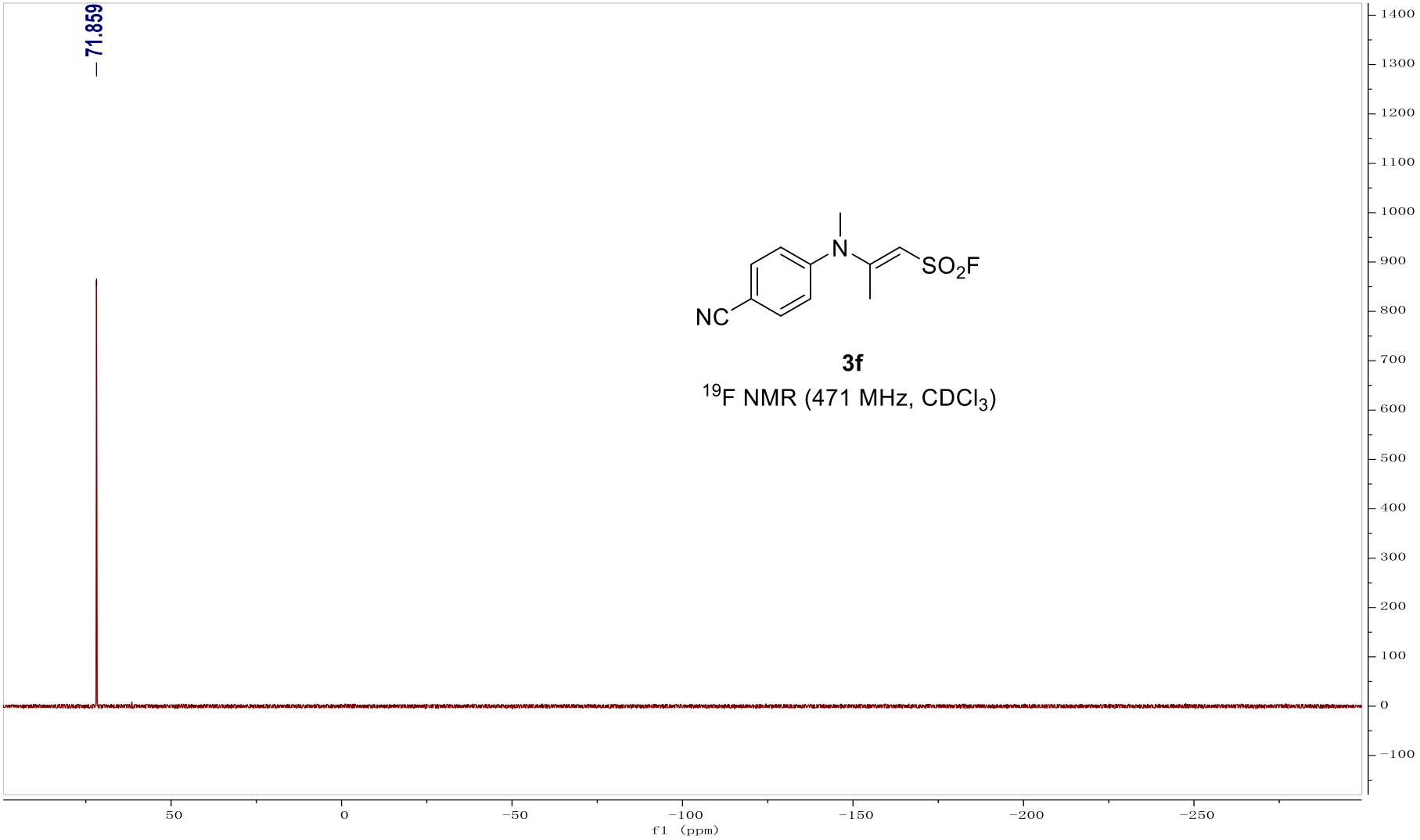


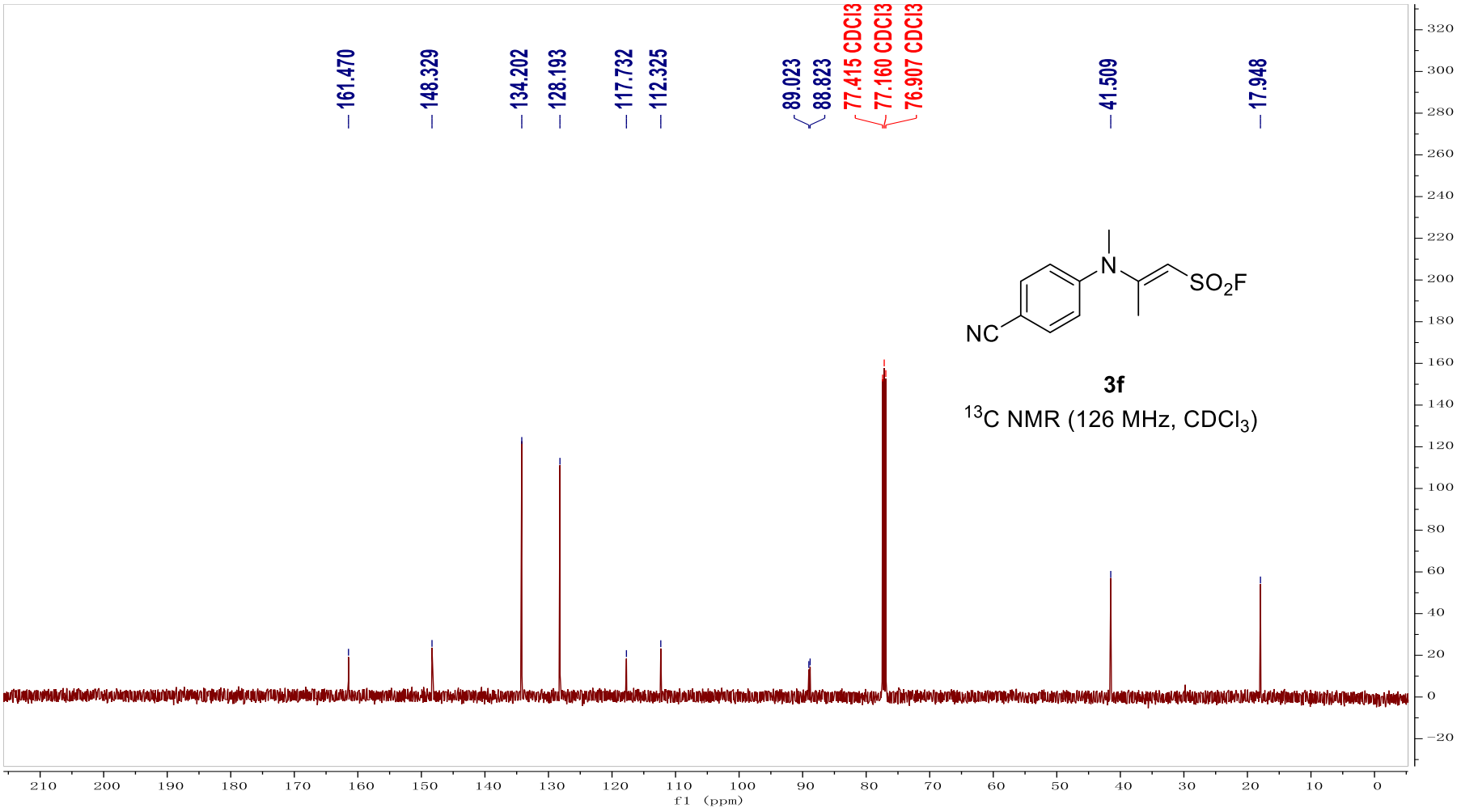
3e

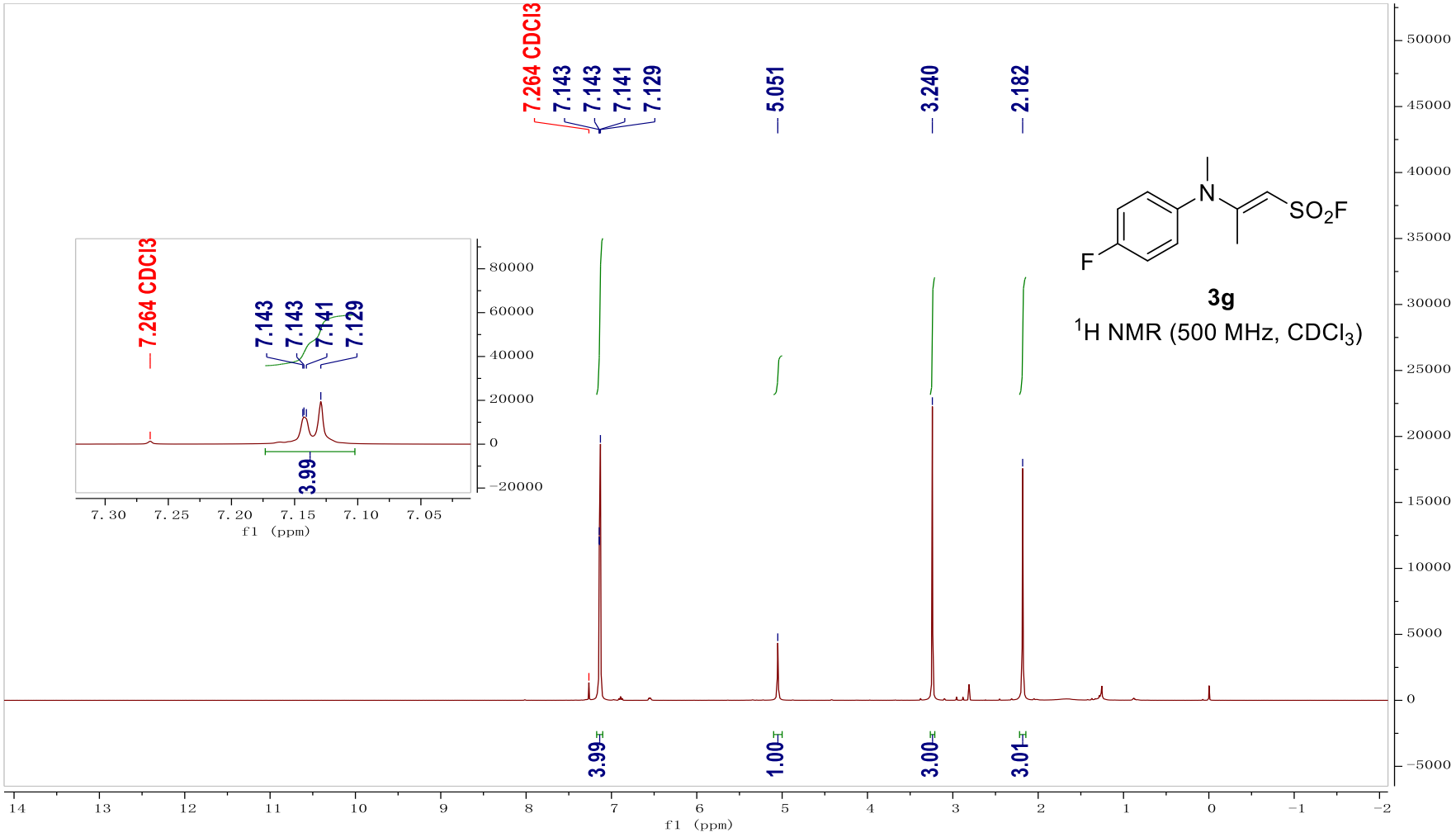
^{19}F NMR (471 MHz, $CDCl_3$)

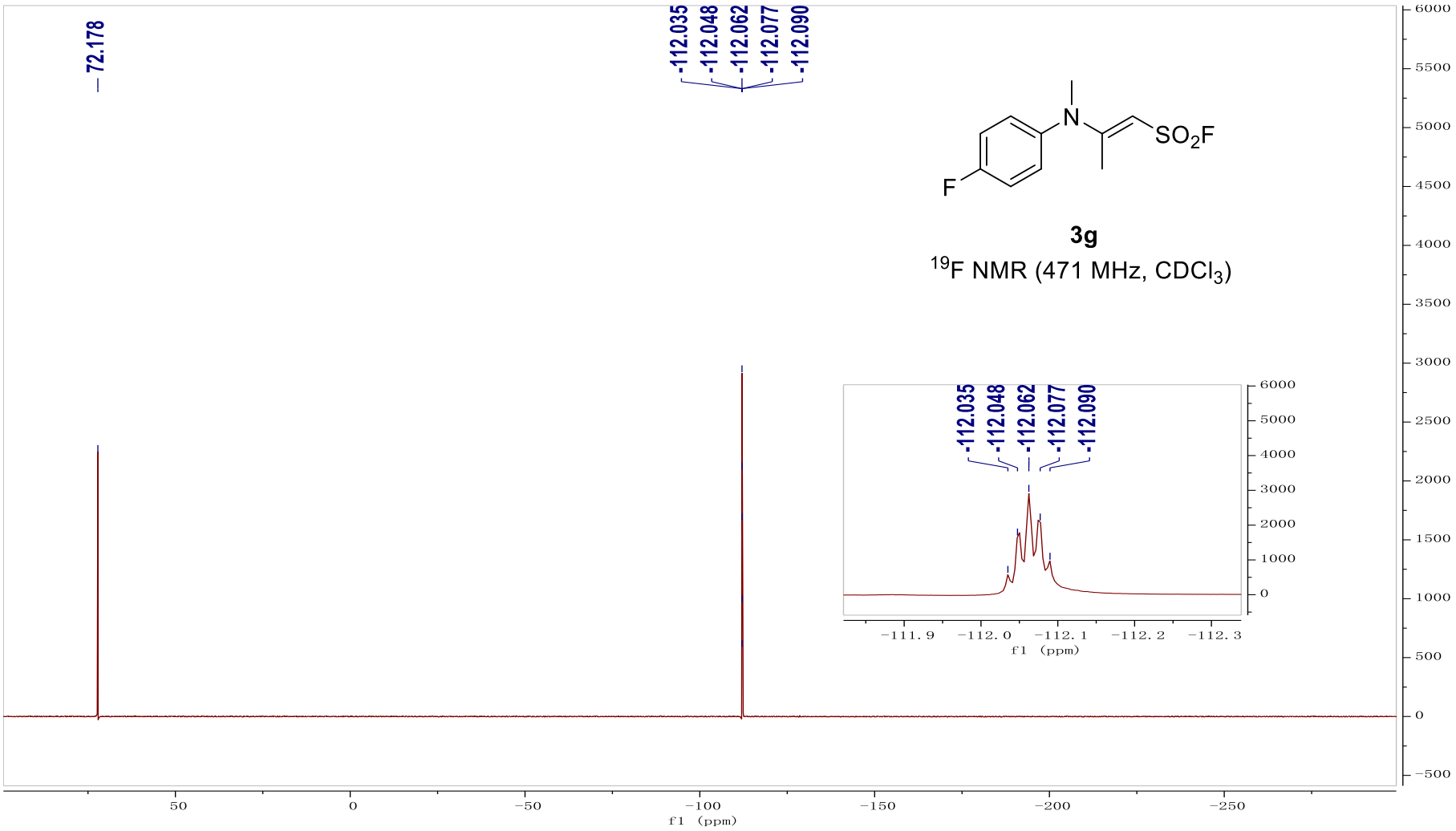

165.493
161.891
148.329
131.605
130.513
127.111
87.661
87.464
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
61.585
41.536
17.950
14.434
f1 (ppm)
N
SO2F
O
O
3e
13C NMR (126 MHz, CDCl3)

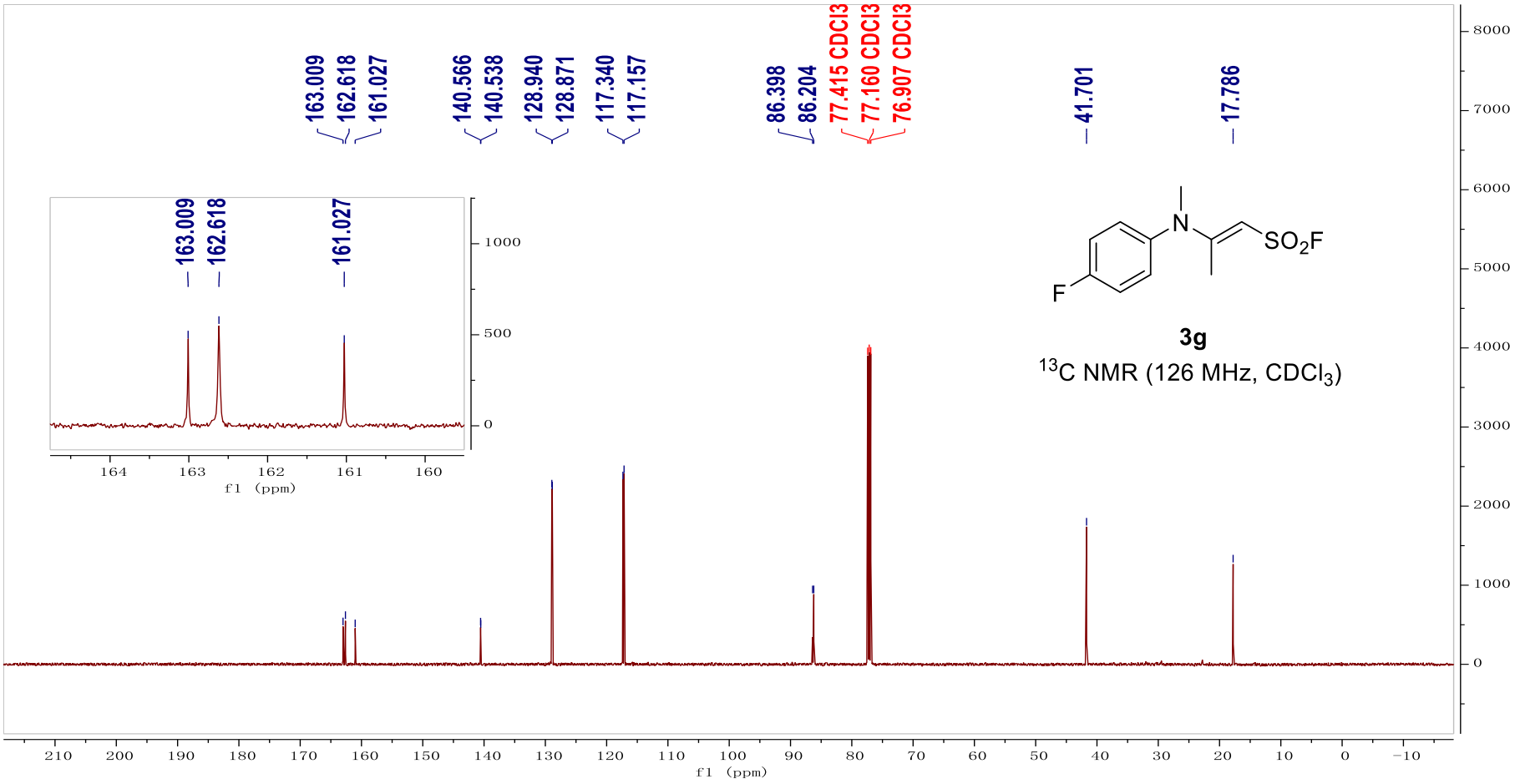

7.787
7.770
7.310
7.293
7.264 CDCl3
5.179
3.290
2.220
1.99
2.00
1.00
2.99
3.00
f1 (ppm)
NC
N
SO2F
3f
1H NMR (500 MHz, CDCl3)

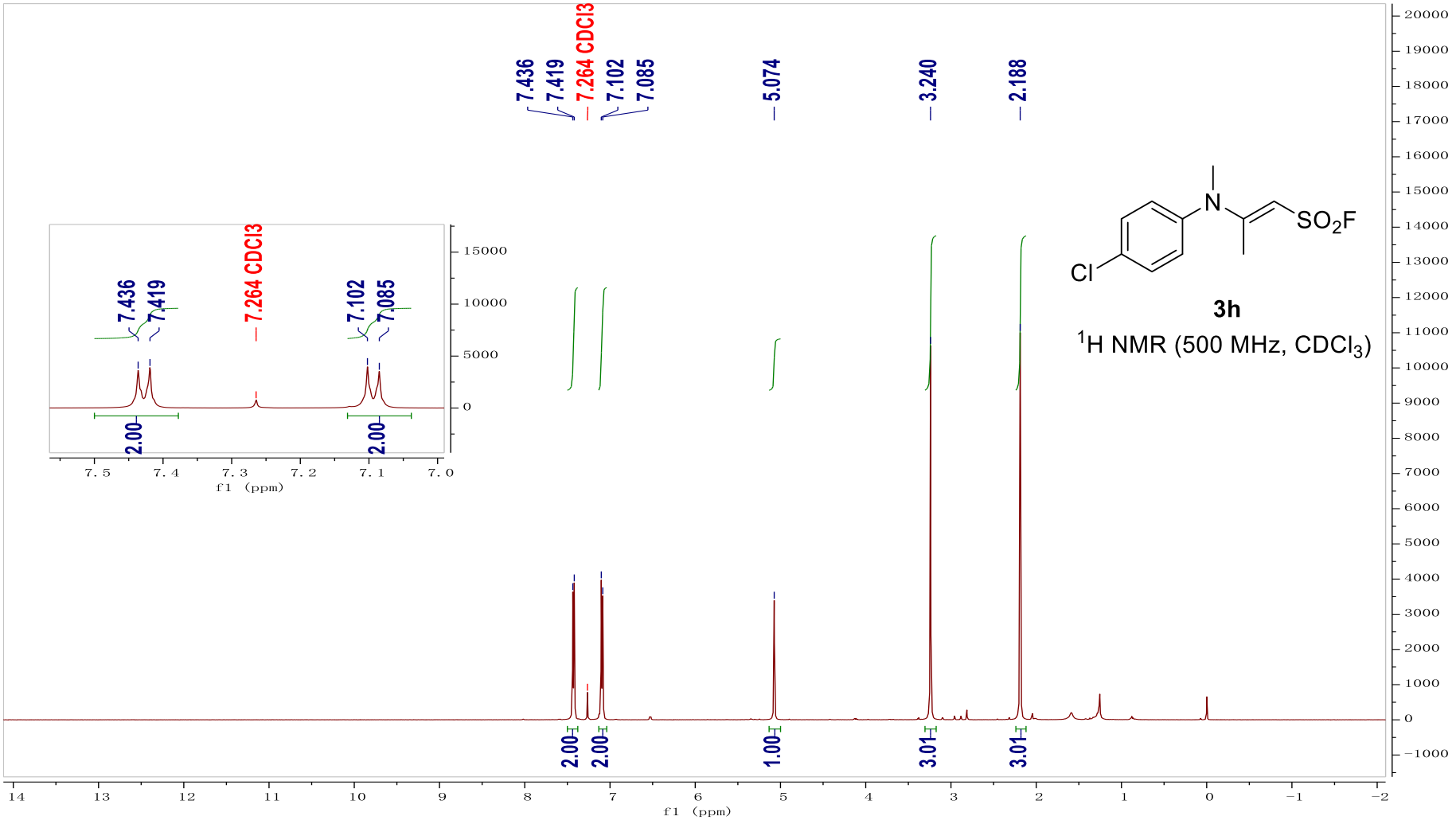

−71.859
N
SO2F
NC
3f
19F NMR (471 MHz, CDCl3)
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
−100
50
0
−50
−100
−150
−200
−250
f1 (ppm)

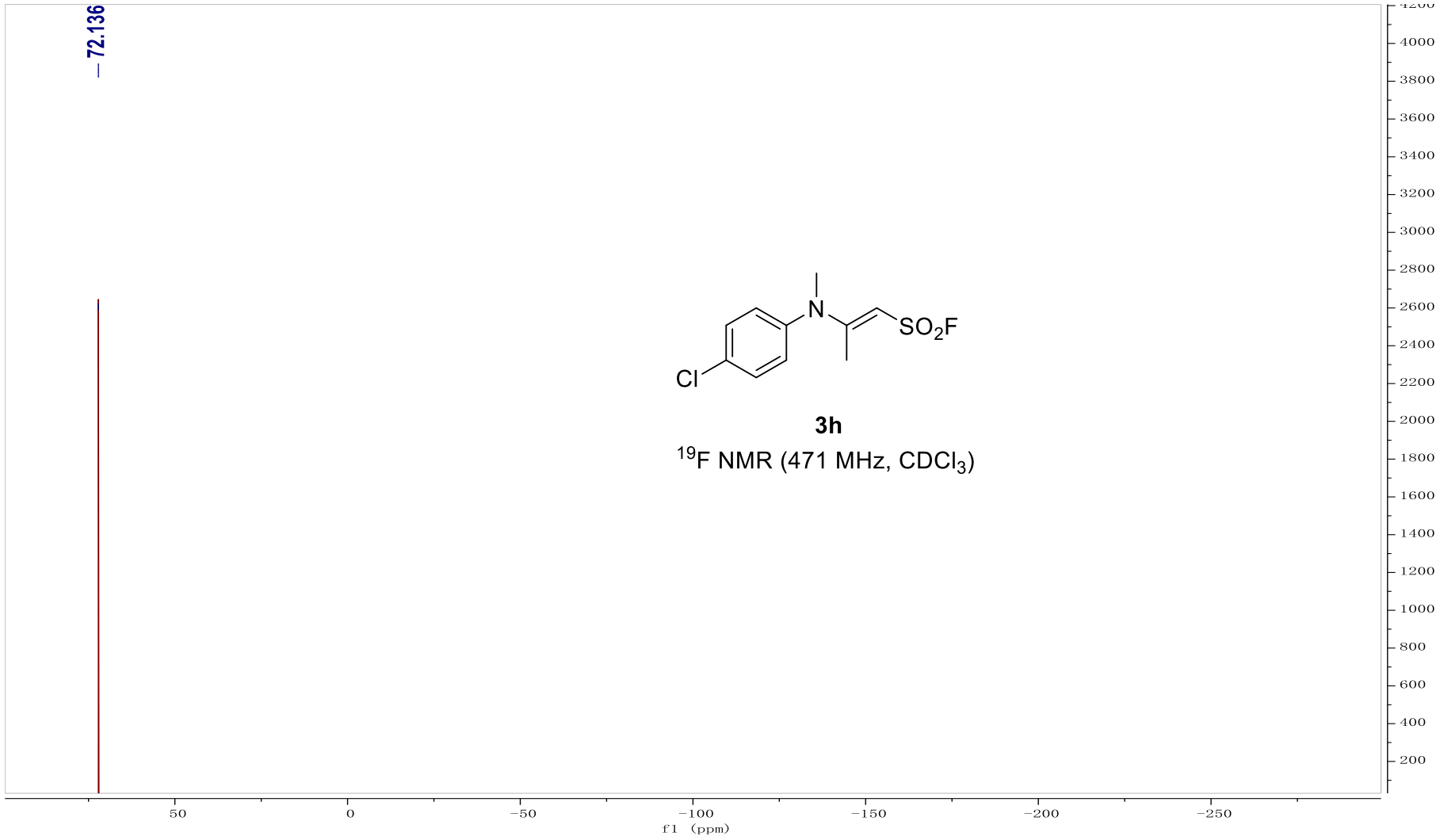

161.470
148.329
134.202
128.193
117.732
112.325
89.023
88.823
77.415 CDCl3
77.160 CDCl3
76.907 CDCl3
41.509
17.948
NC
N
SO2F
3f
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.264 CDCl3
7.143
7.143
7.141
7.129
5.051
3.240
2.182
3.99
1.00
3.00
3.01
f1 (ppm)
3g
1H NMR (500 MHz, CDCl3)


-72.178
-112.035
-112.048
-112.062
-112.077
-112.090
F
N
SO2F
3g
19F NMR (471 MHz, CDCl3)
f1 (ppm)

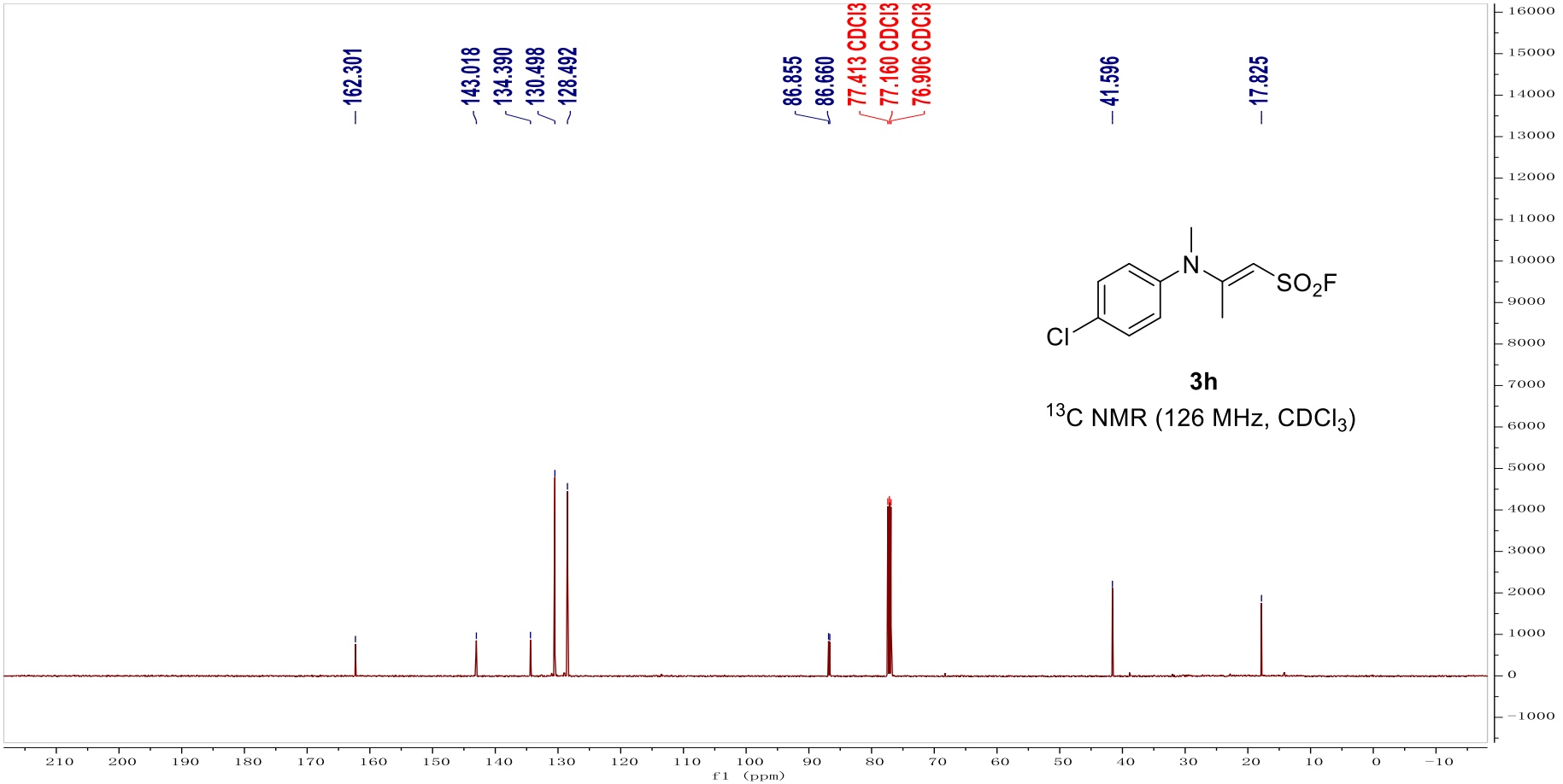

163.009
162.618
161.027
140.566
140.538
128.940
128.871
117.340
117.157
86.398
86.204
77.415 CDCl3
77.160 CDCl3
76.907 CDCl3
41.701
17.786
f1 (ppm)
N
SO2F
F
3g
13C NMR (126 MHz, CDCl3)

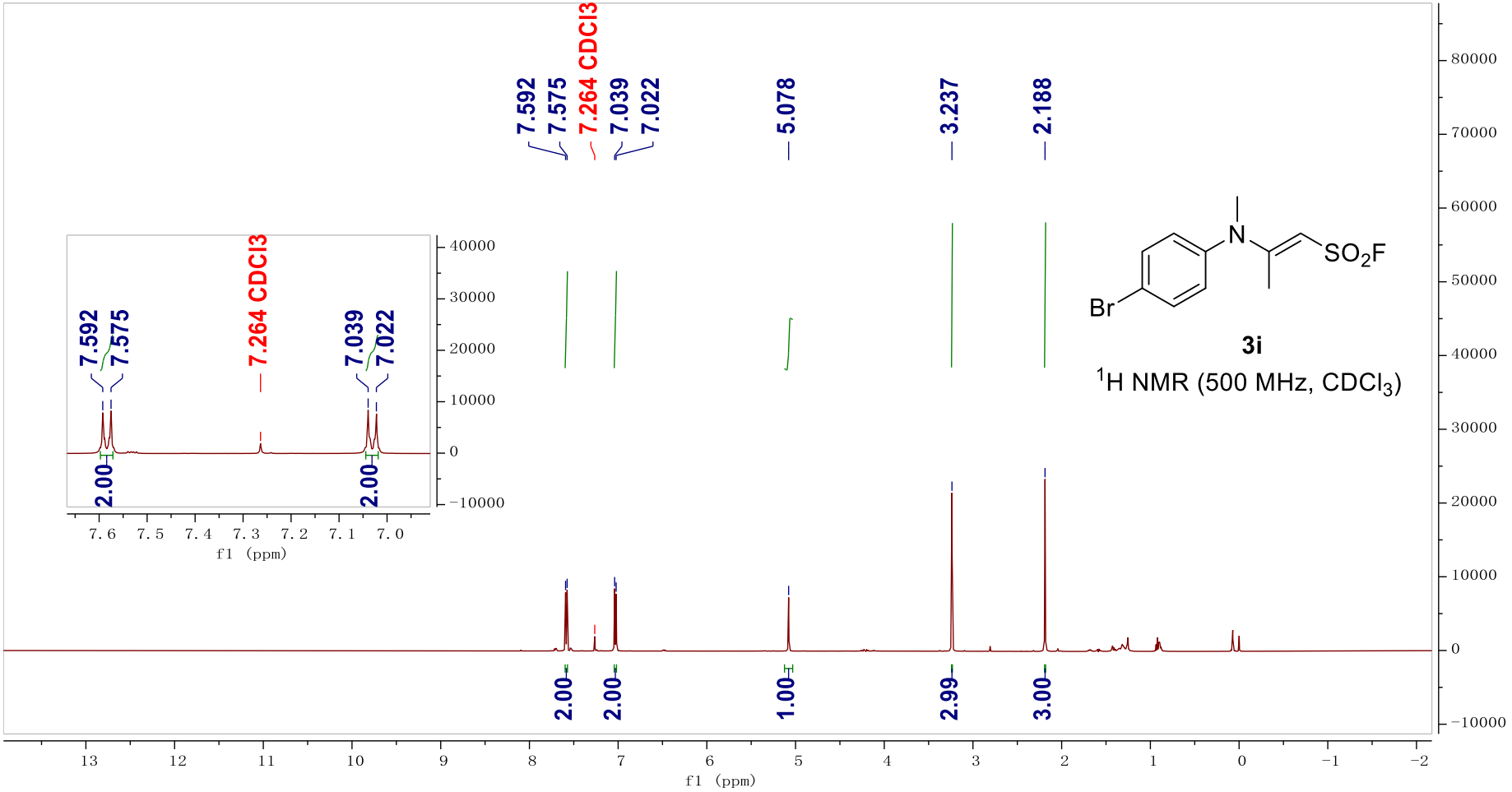

7.436
7.419
7.264 CDCl3
7.102
7.085
5.074
3.240
2.188
2.00
2.00
1.00
3.01
3.01
f1 (ppm)
Cl
N
SO2F
3h
1H NMR (500 MHz, CDCl3)

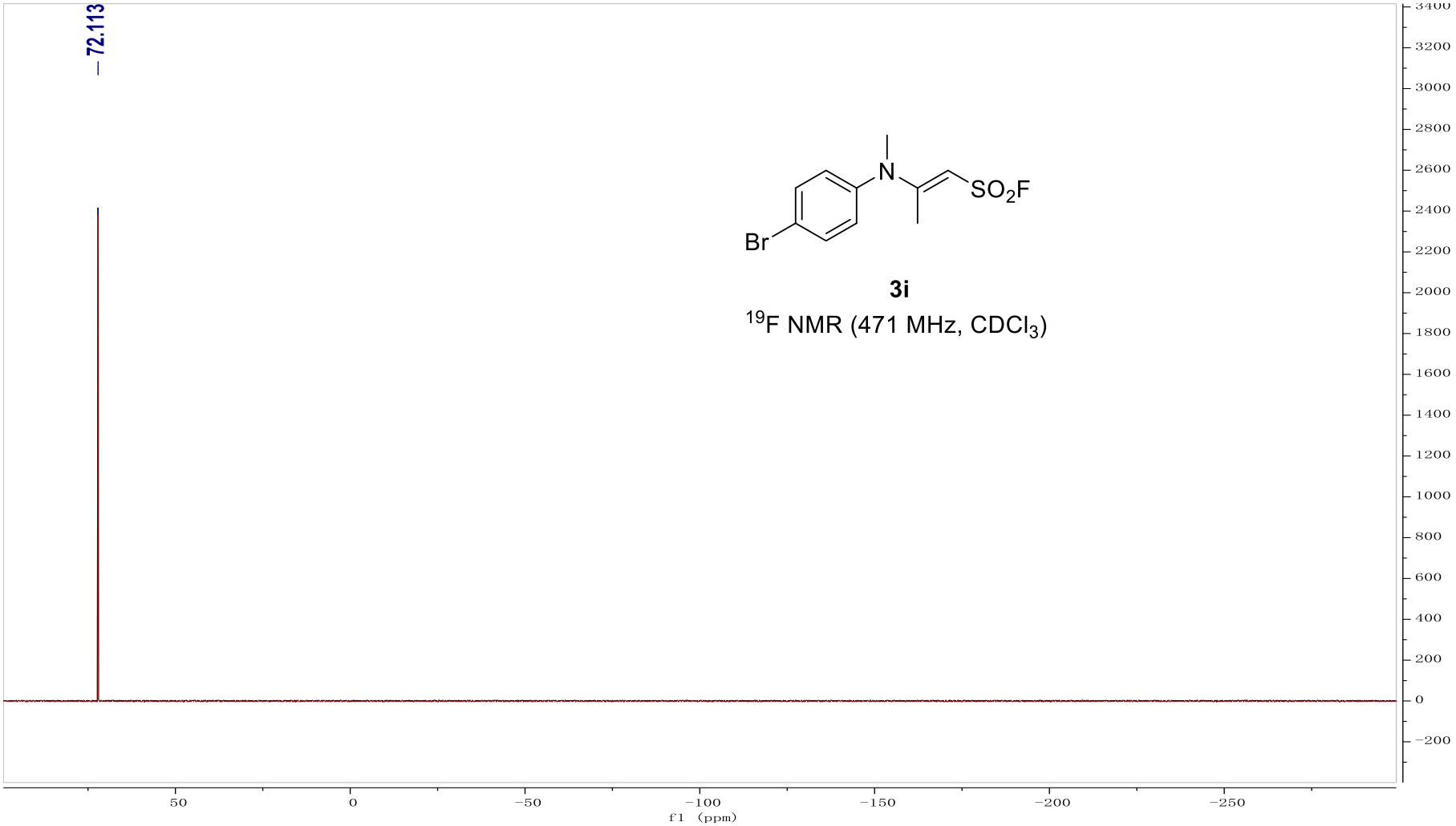


3h

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

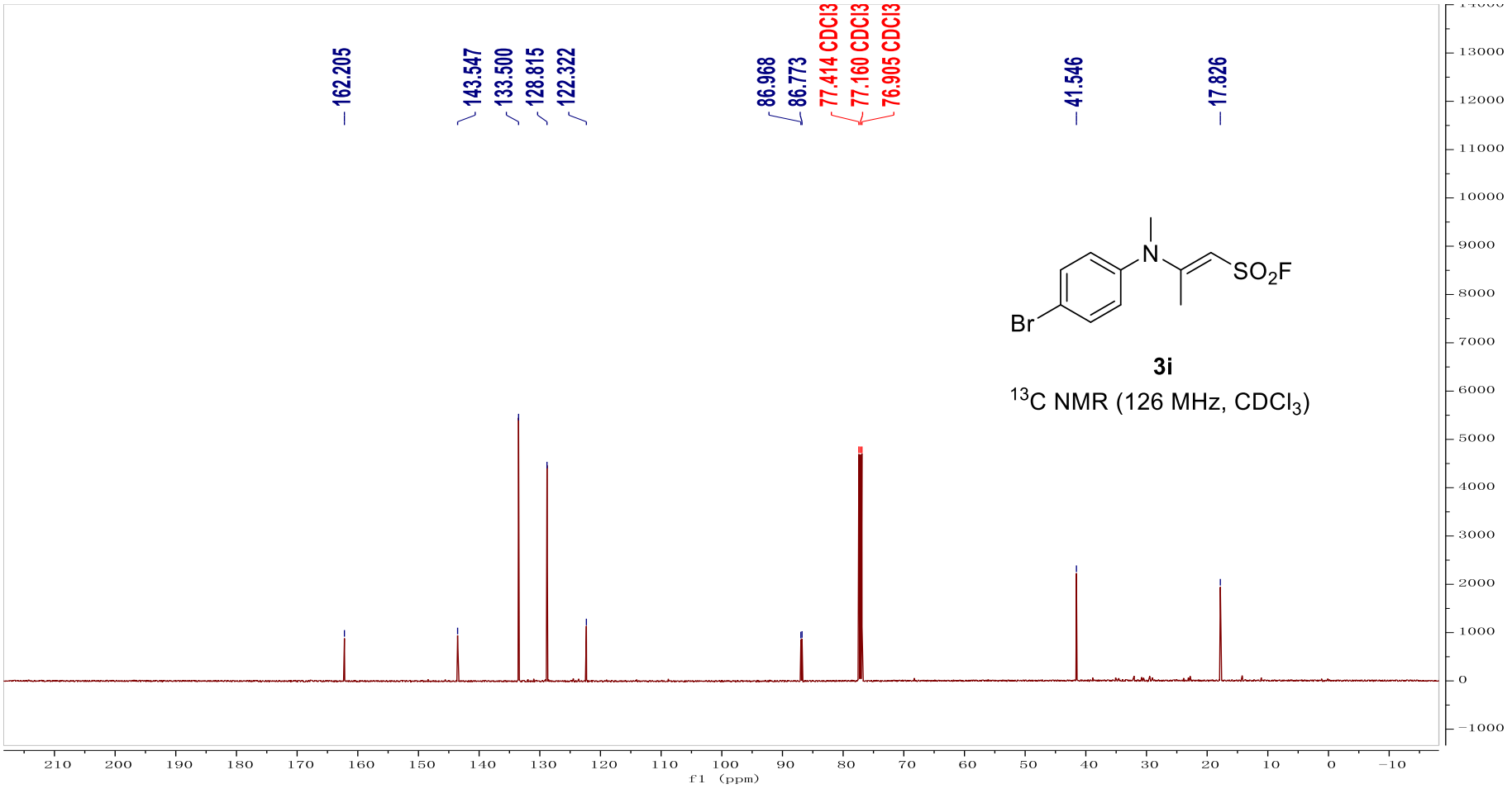

162.301
143.018
134.390
130.498
128.492
86.855
86.660
77.413 CDCl3
77.160 CDCl3
76.906 CDCl3
41.596
17.825
N
SO2F
Cl
3h
13C NMR (126 MHz, CDCl3)
f1 (ppm)

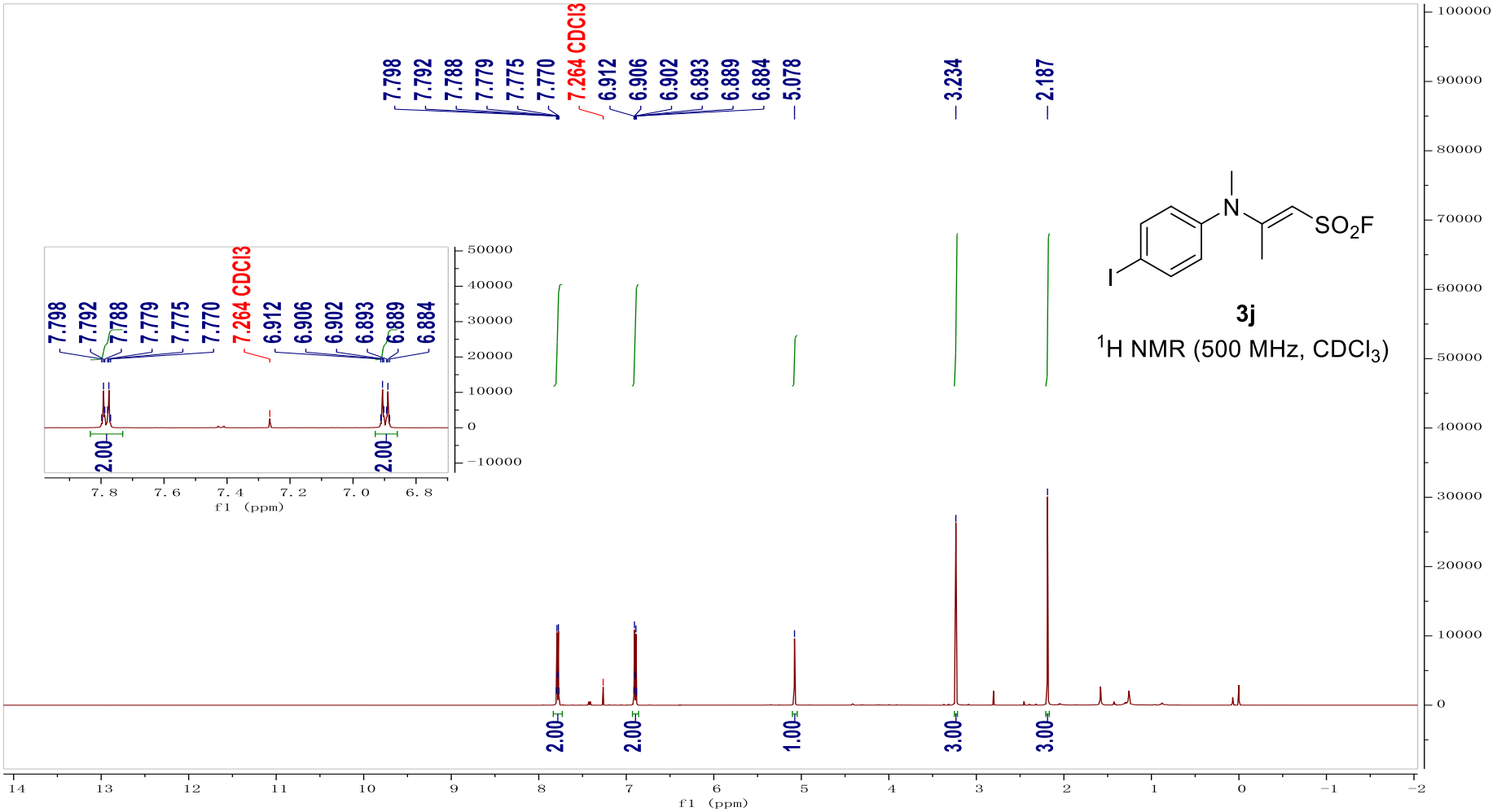

7.592
7.575
7.264 CDCl3
7.039
7.022
5.078
3.237
2.188
2.00
2.00
1.00
2.99
3.00
f1 (ppm)
Br
N
SO2F
3i
1H NMR (500 MHz, CDCl3)

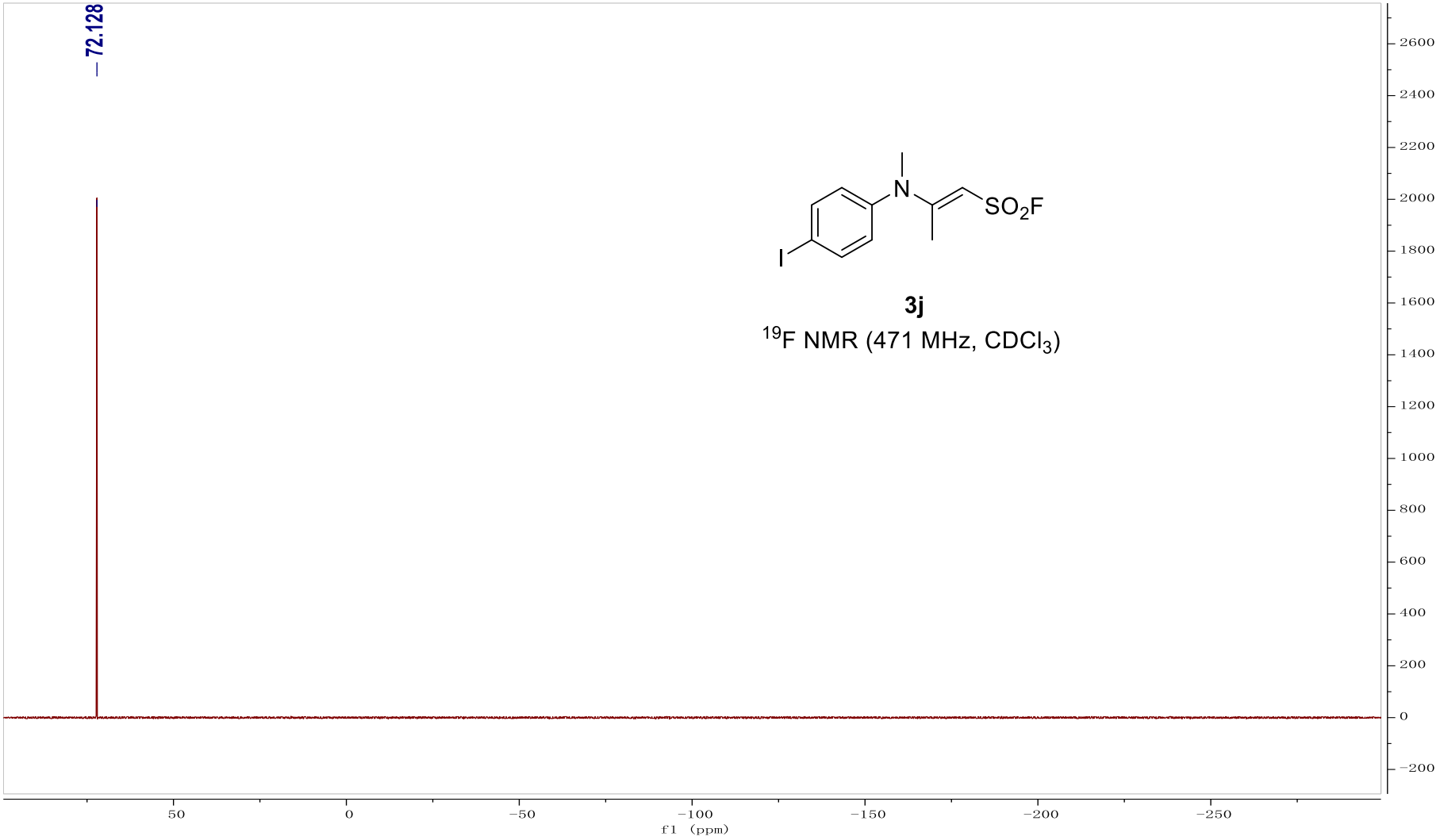


3i

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

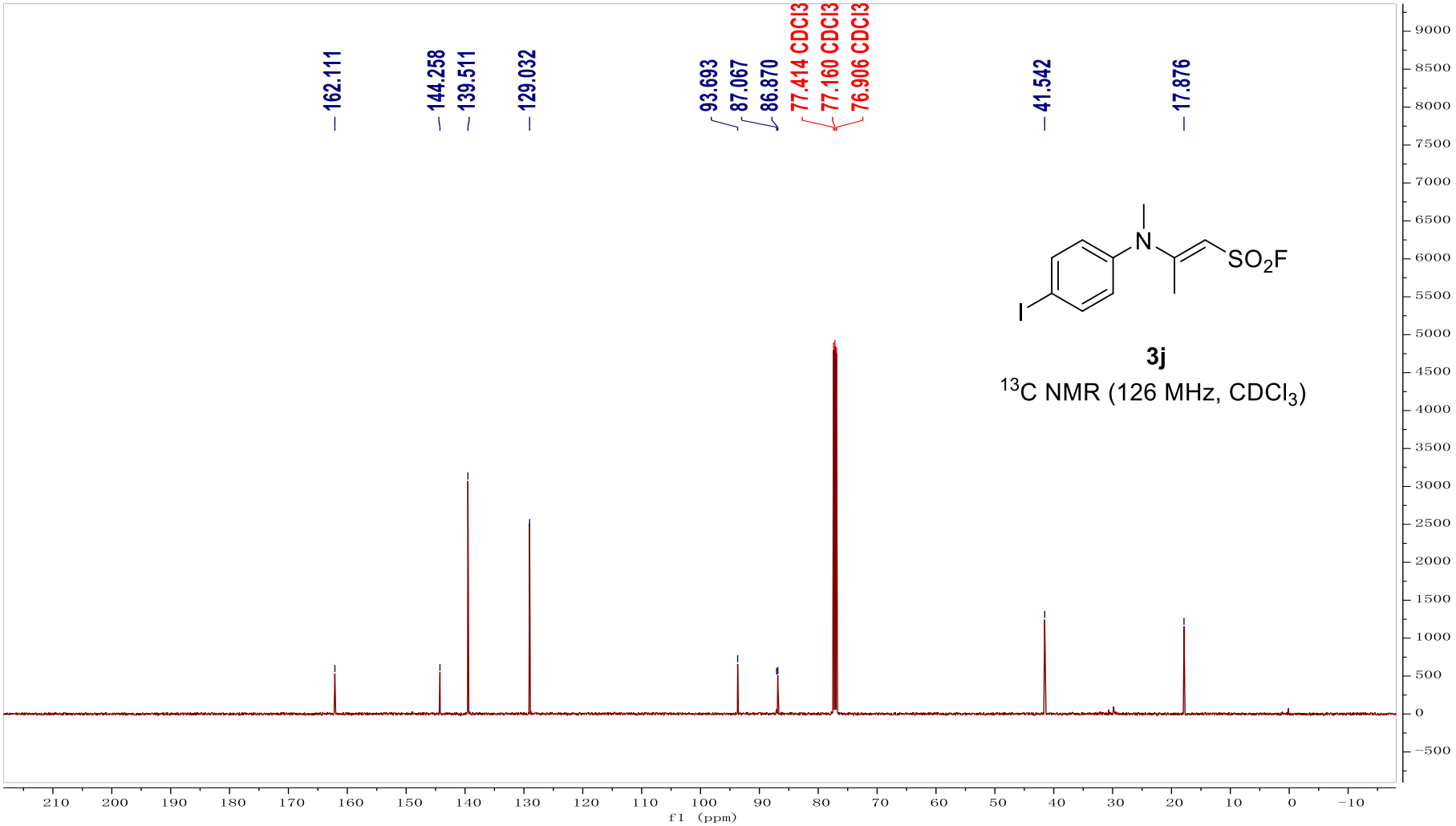

162.205
143.547
133.500
128.815
122.322
86.968
86.773
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
41.546
17.826
N
SO2F
Br
3i
13C NMR (126 MHz, CDCl3)
f1 (ppm)

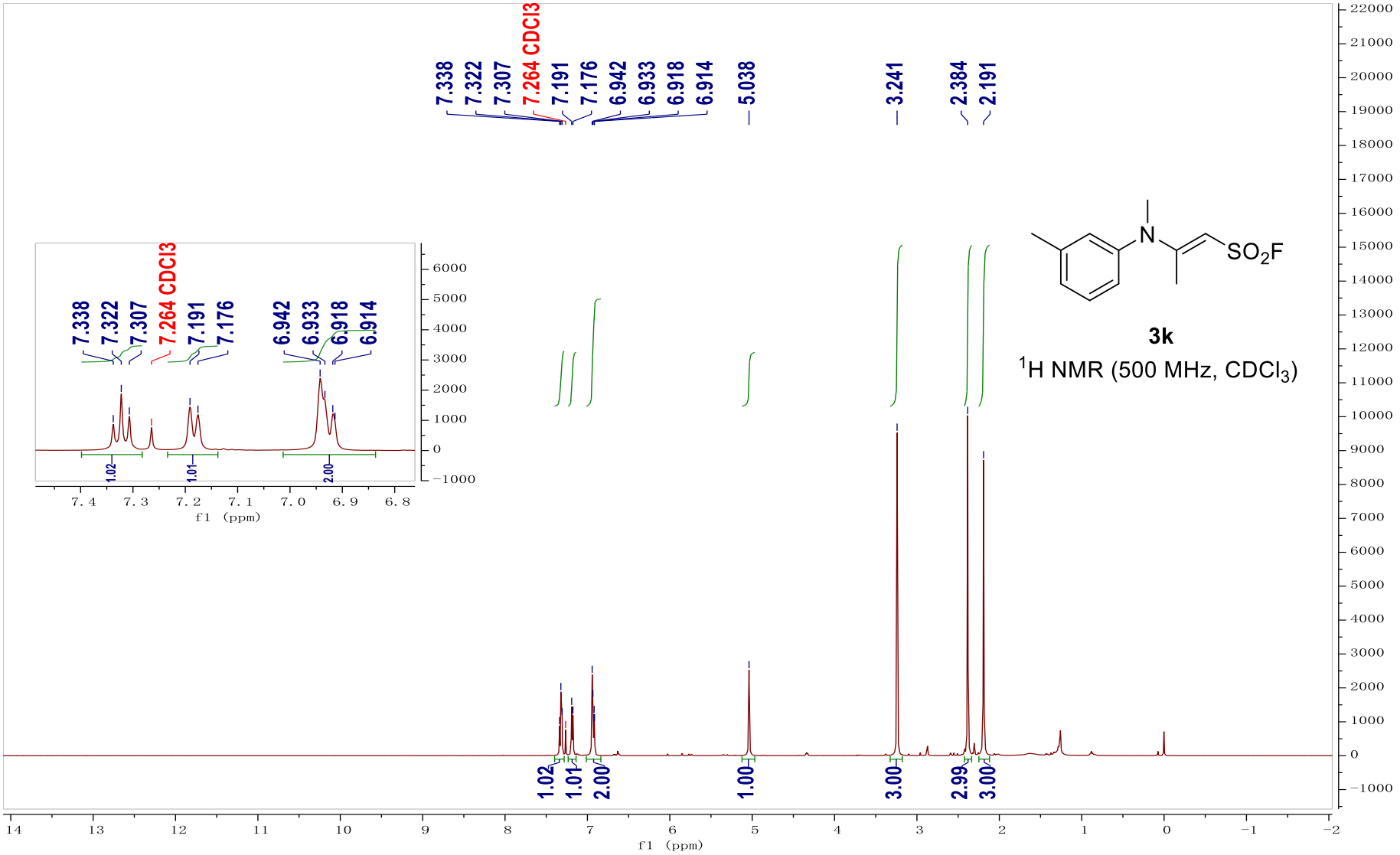

7.798
7.792
7.788
7.779
7.775
7.770
7.264 CDCl3
6.912
6.906
6.902
6.893
6.889
6.884
5.078
3.234
2.187
2.00
2.00
1.00
3.00
3.00
f1 (ppm)
3j
1H NMR (500 MHz, CDCl3)
SO2F
N
I

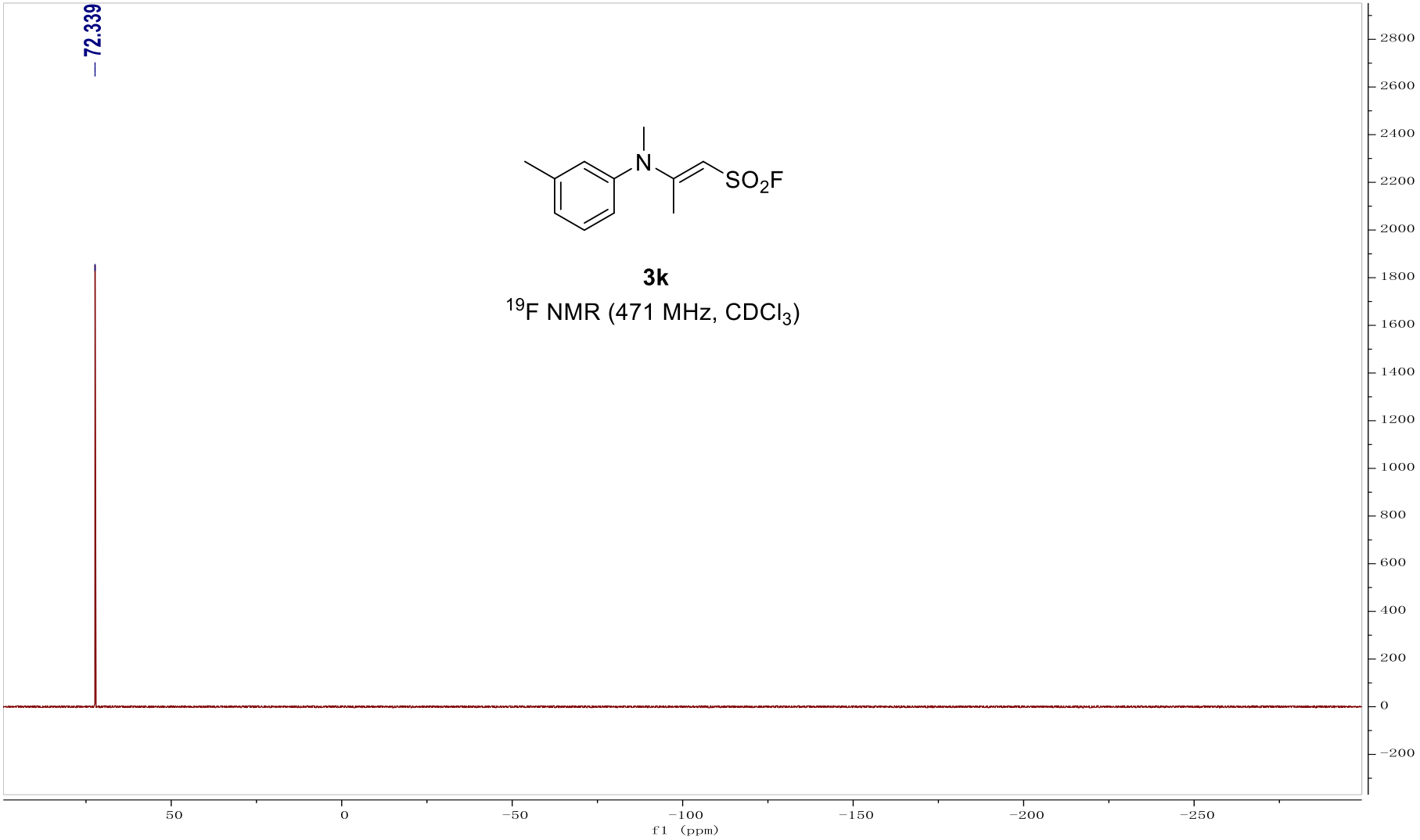


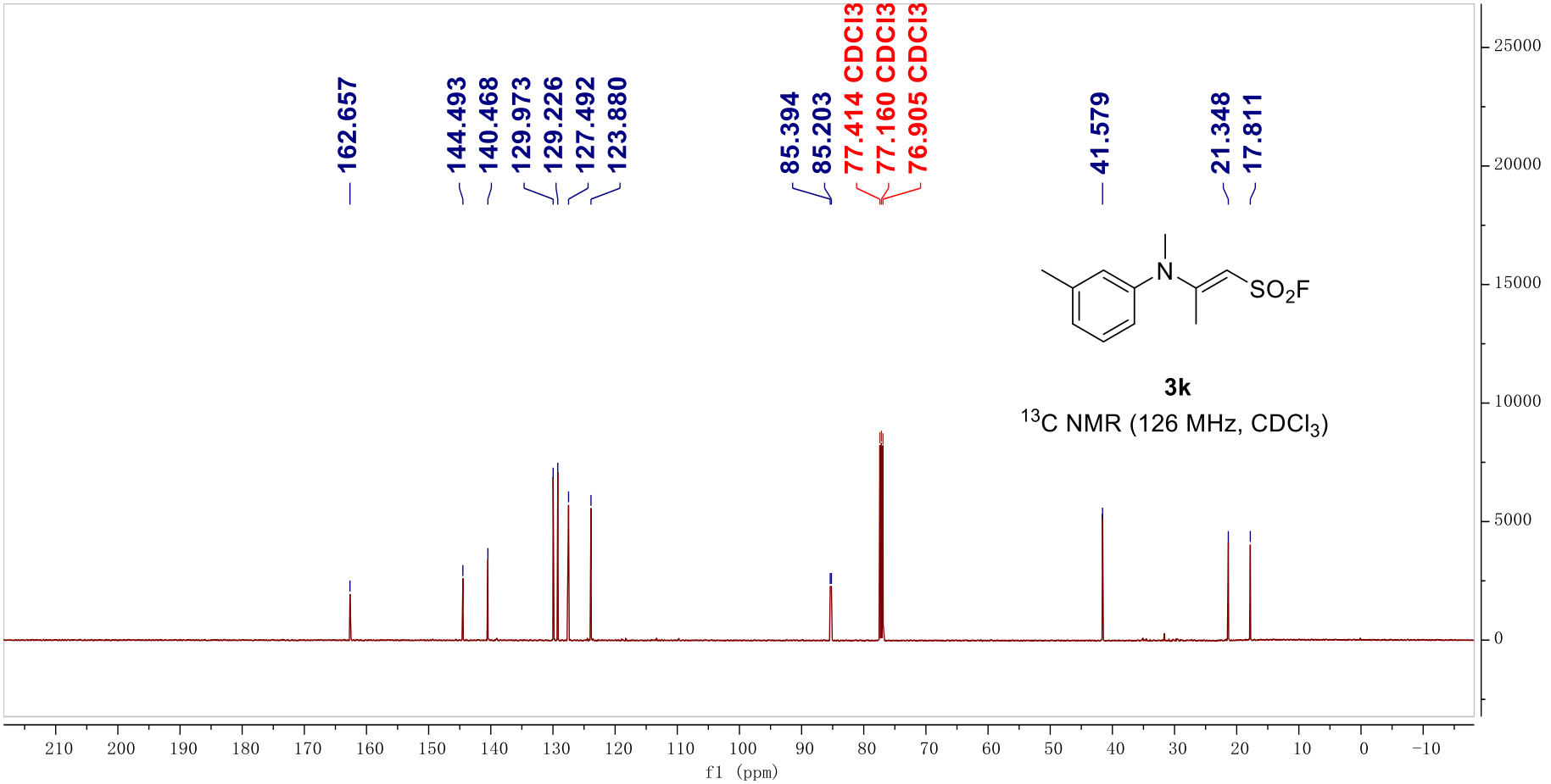
3j

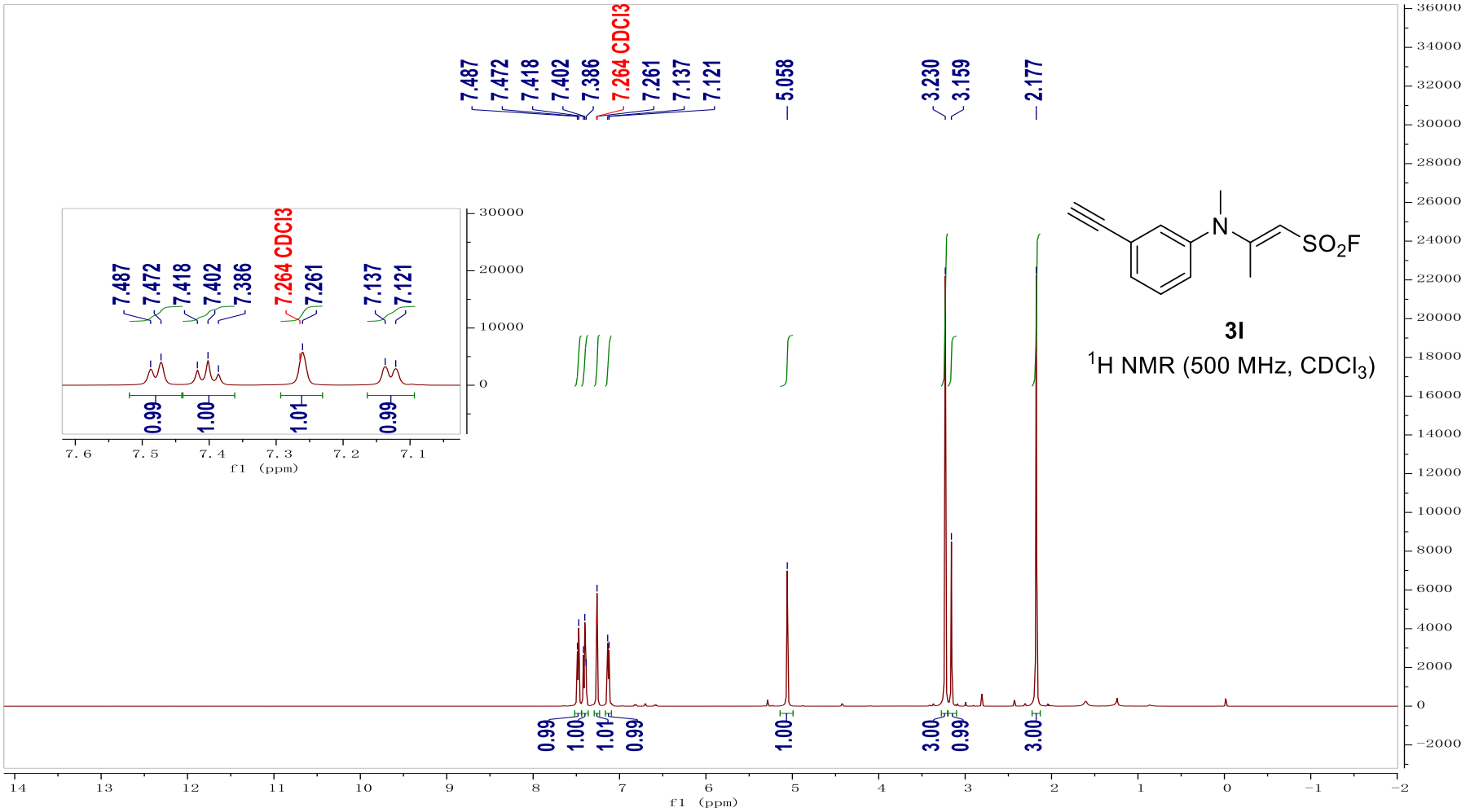
^{19}F NMR (471 MHz, $CDCl_3$)

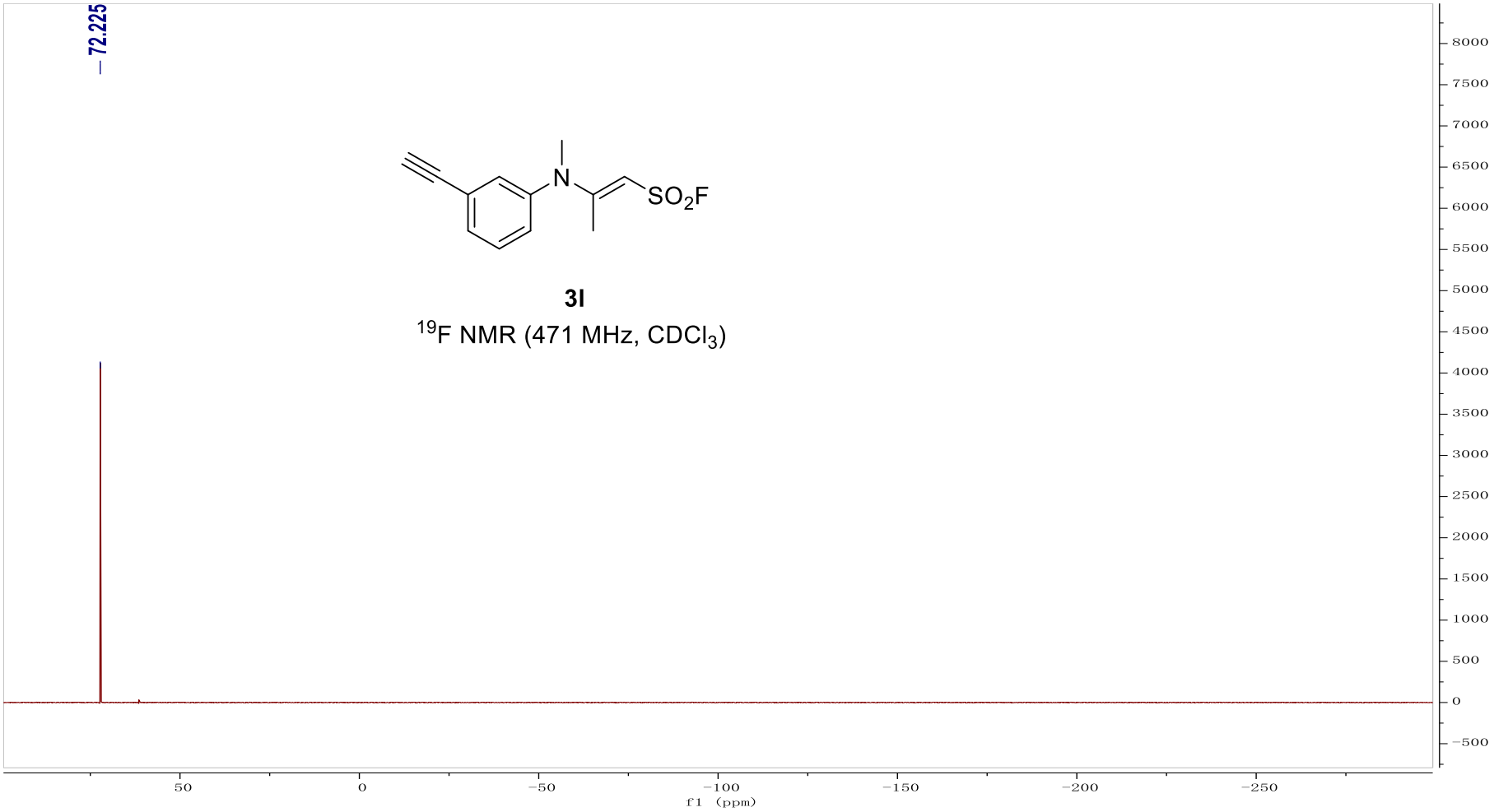

162.111
144.258
139.511
129.032
93.693
87.067
86.870
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
41.542
17.876
N
SO2F
I
3j
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.338
7.322
7.307
7.264 CDCl3
7.191
7.176
6.942
6.933
6.918
6.914
5.038
3.241
2.384
2.191
1.02
1.01
2.00
1.00
3.00
2.99
3.00
f1 (ppm)
3k
1H NMR (500 MHz, CDCl3)
SO2F


−72.339
N
SO2F
3k
19F NMR (471 MHz, CDCl3)
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
−200
50
0
−50
−100
−150
−200
−250
f1 (ppm)

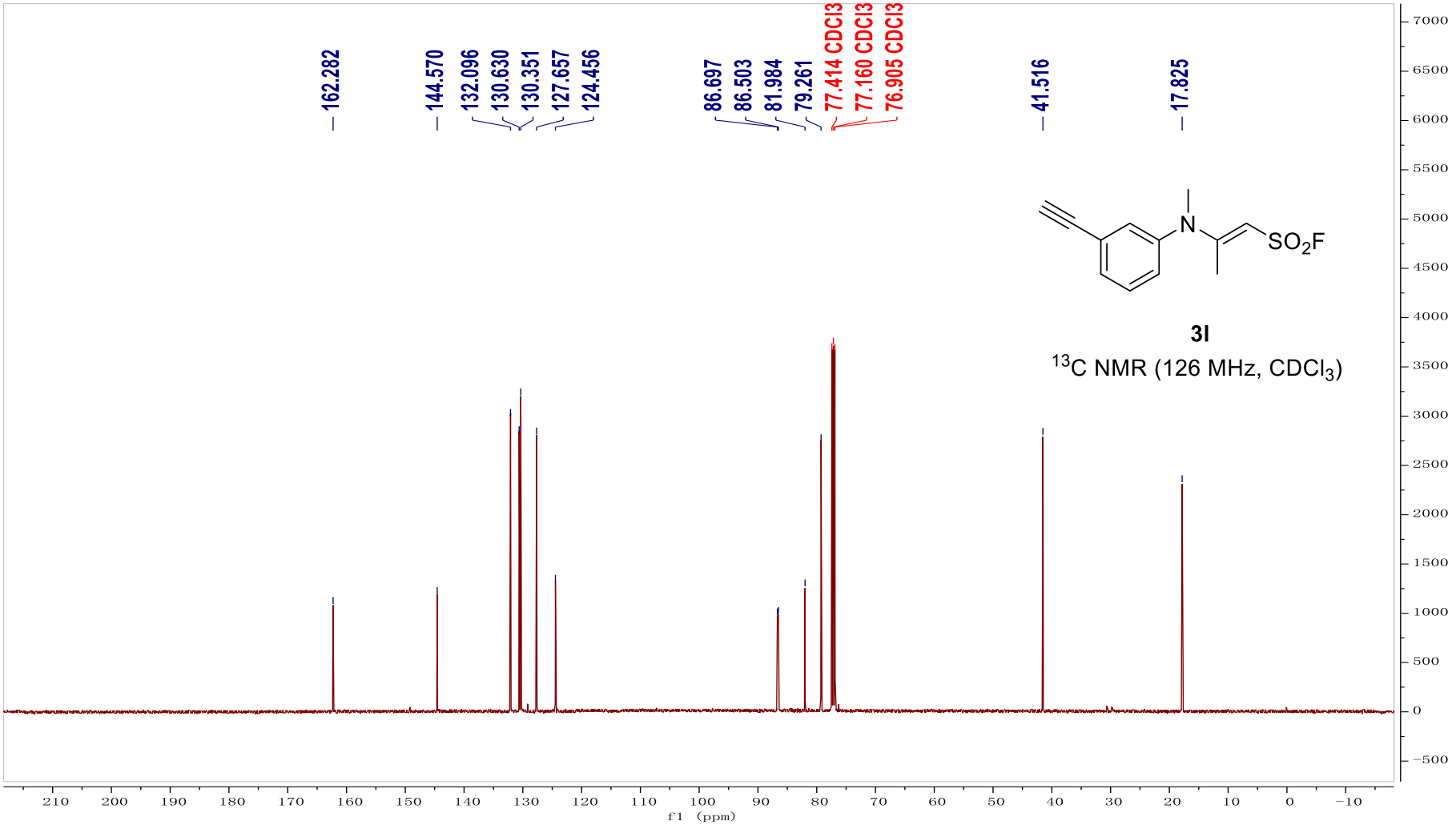

162.657
144.493
140.468
129.973
129.226
127.492
123.880
85.394
85.203
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
41.579
21.348
17.811
N
SO2F
3k
13C NMR (126 MHz, CDCl3)
25000
20000
15000
10000
5000
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)

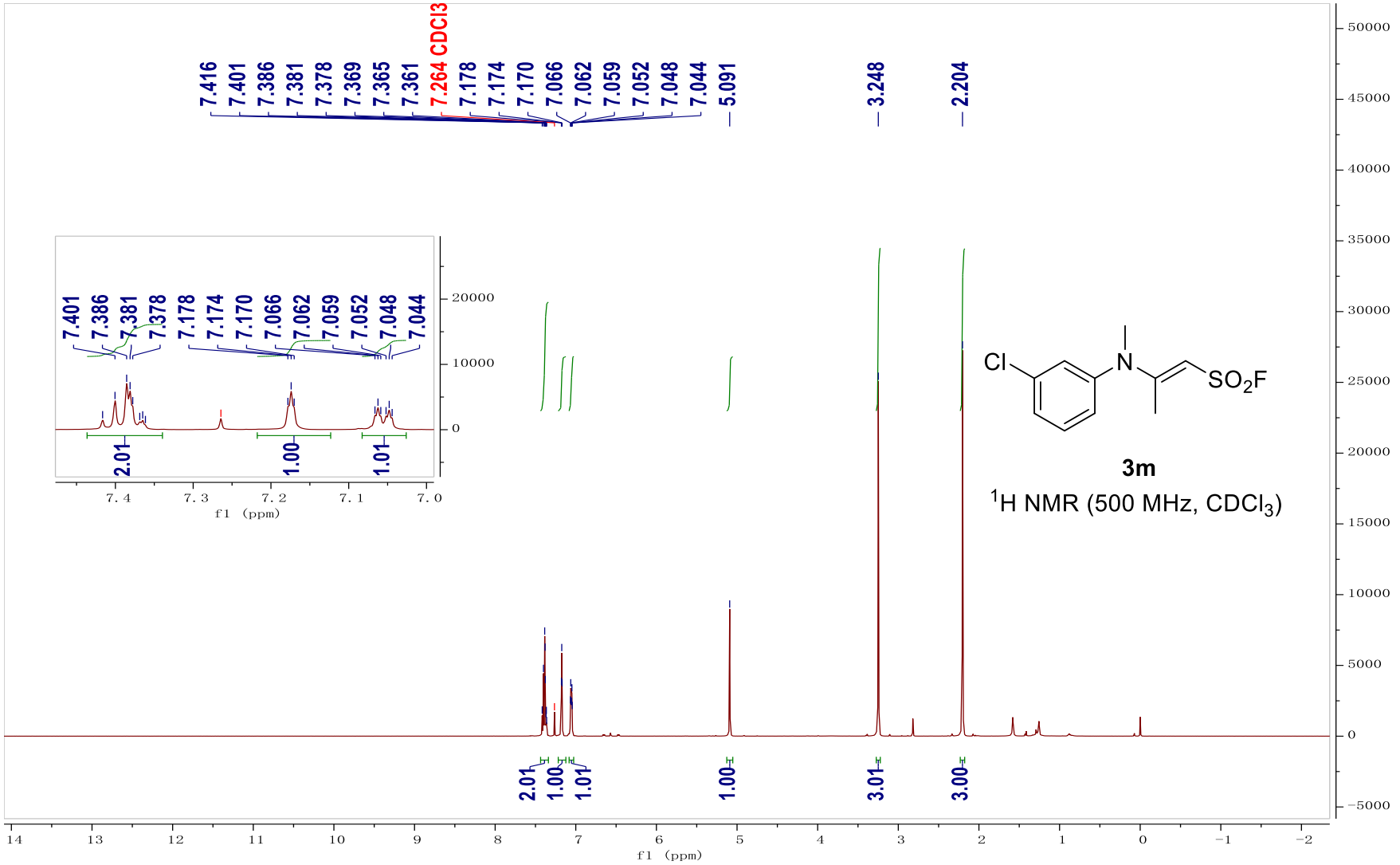

7.487
7.472
7.418
7.402
7.386
7.264 CDCl3
7.261
7.137
7.121
5.058
3.230
3.159
2.177
0.99
1.00
1.01
0.99
1.00
3.00
0.99
3.00
f1 (ppm)
N
SO2F
3l
1H NMR (500 MHz, CDCl3)

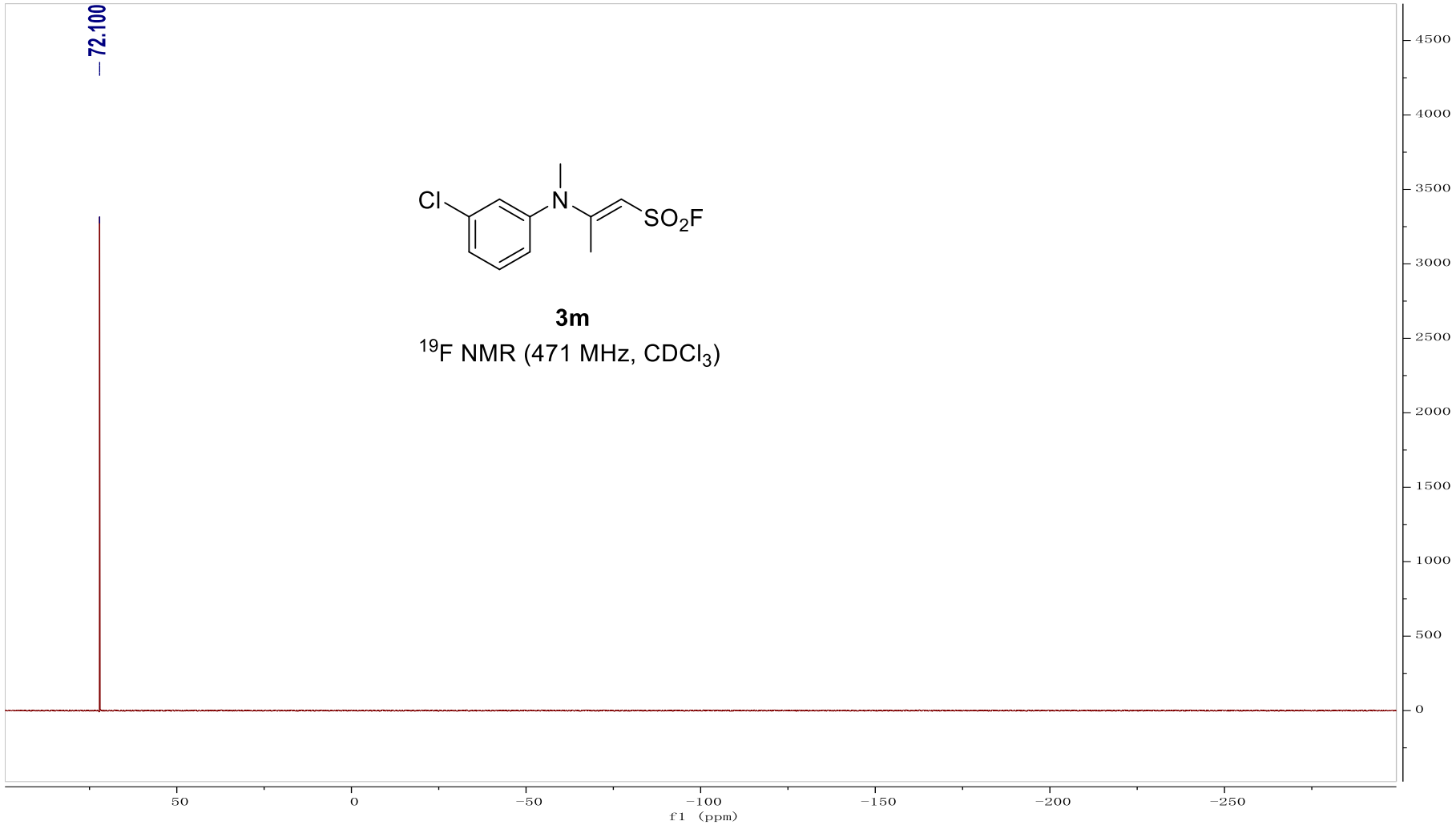


3l

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

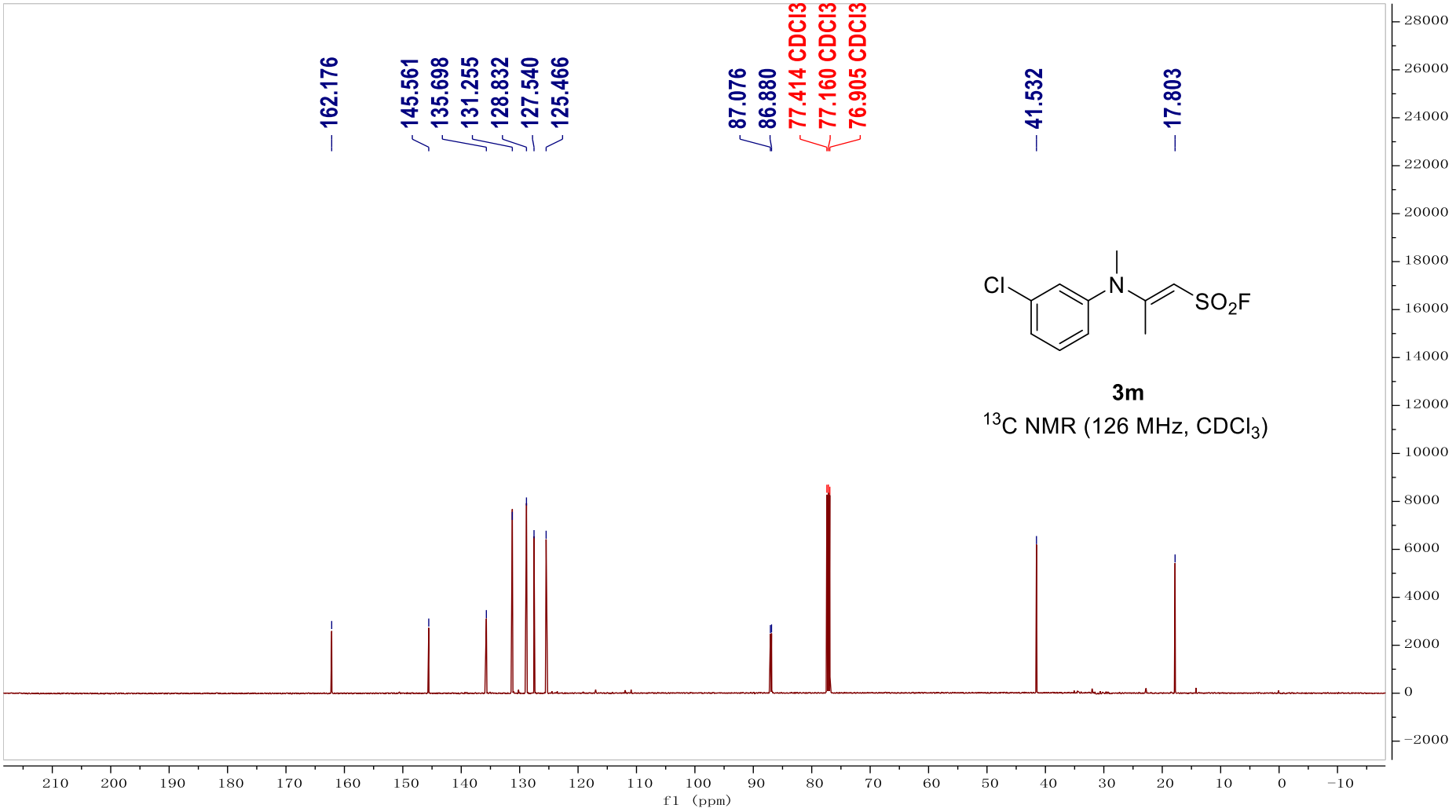

162.282
144.570
132.096
130.630
130.351
127.657
124.456
86.697
86.503
81.984
79.261
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
41.516
17.825
N
SO2F
3l
13C NMR (126 MHz, CDCl3)
f1 (ppm)

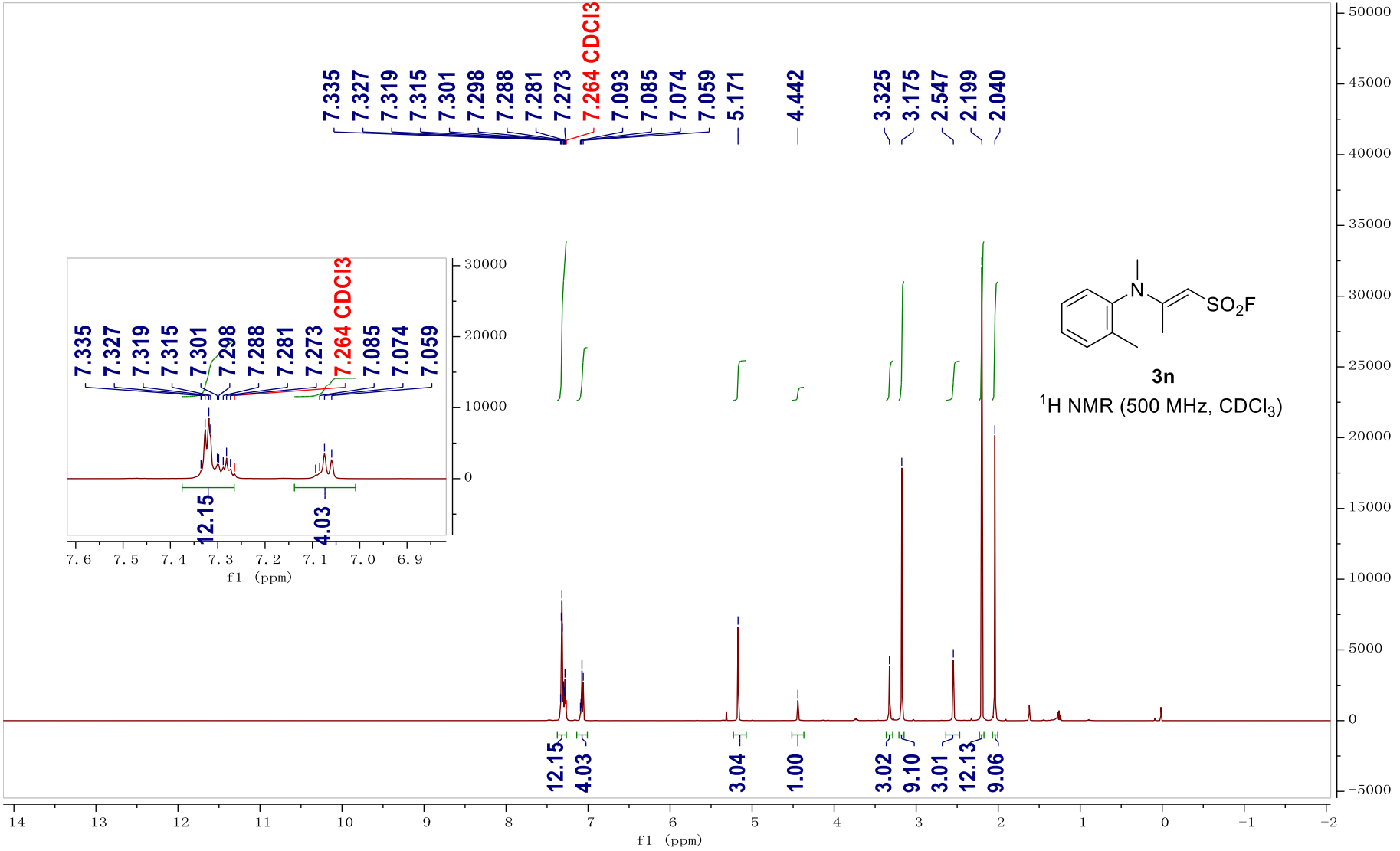

7.416
7.401
7.386
7.381
7.378
7.369
7.365
7.361
7.264 CDCl3
7.178
7.174
7.170
7.066
7.062
7.059
7.052
7.048
7.044
5.091
3.248
2.204
2.01
1.00
1.01
1.00
3.01
3.00
f1 (ppm)
Cl
N
SO2F
3m
1H NMR (500 MHz, CDCl3)

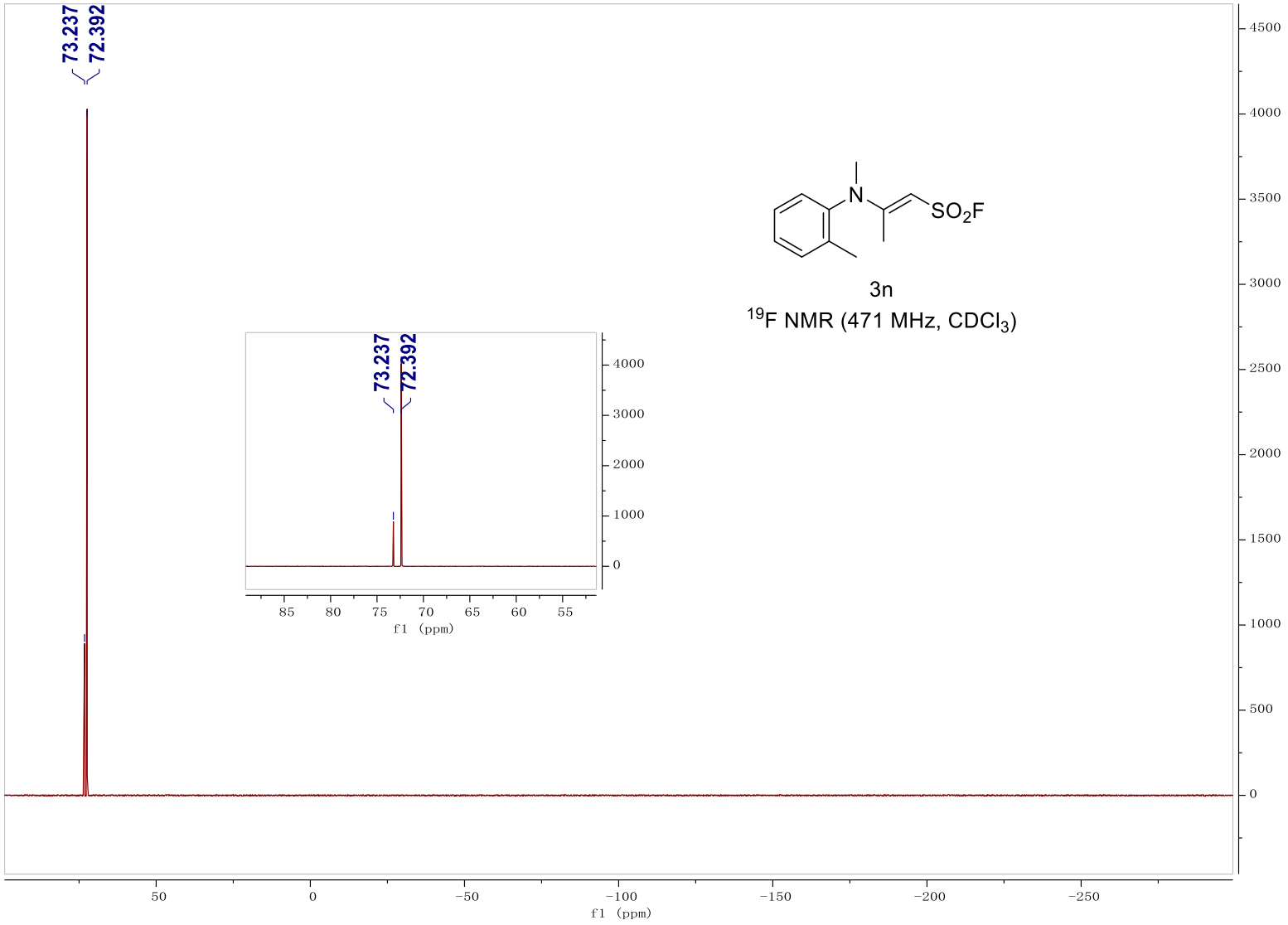


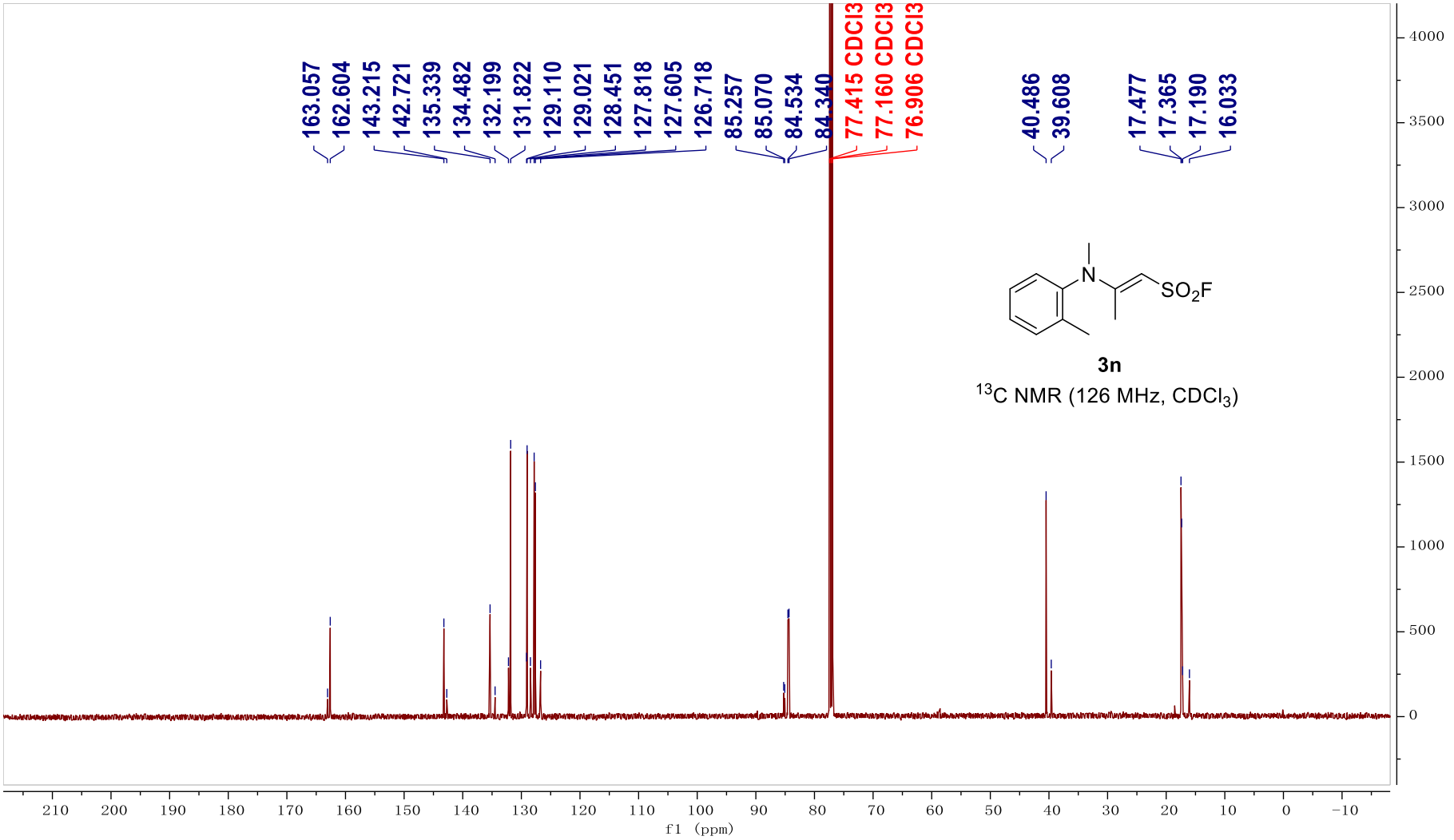
3m

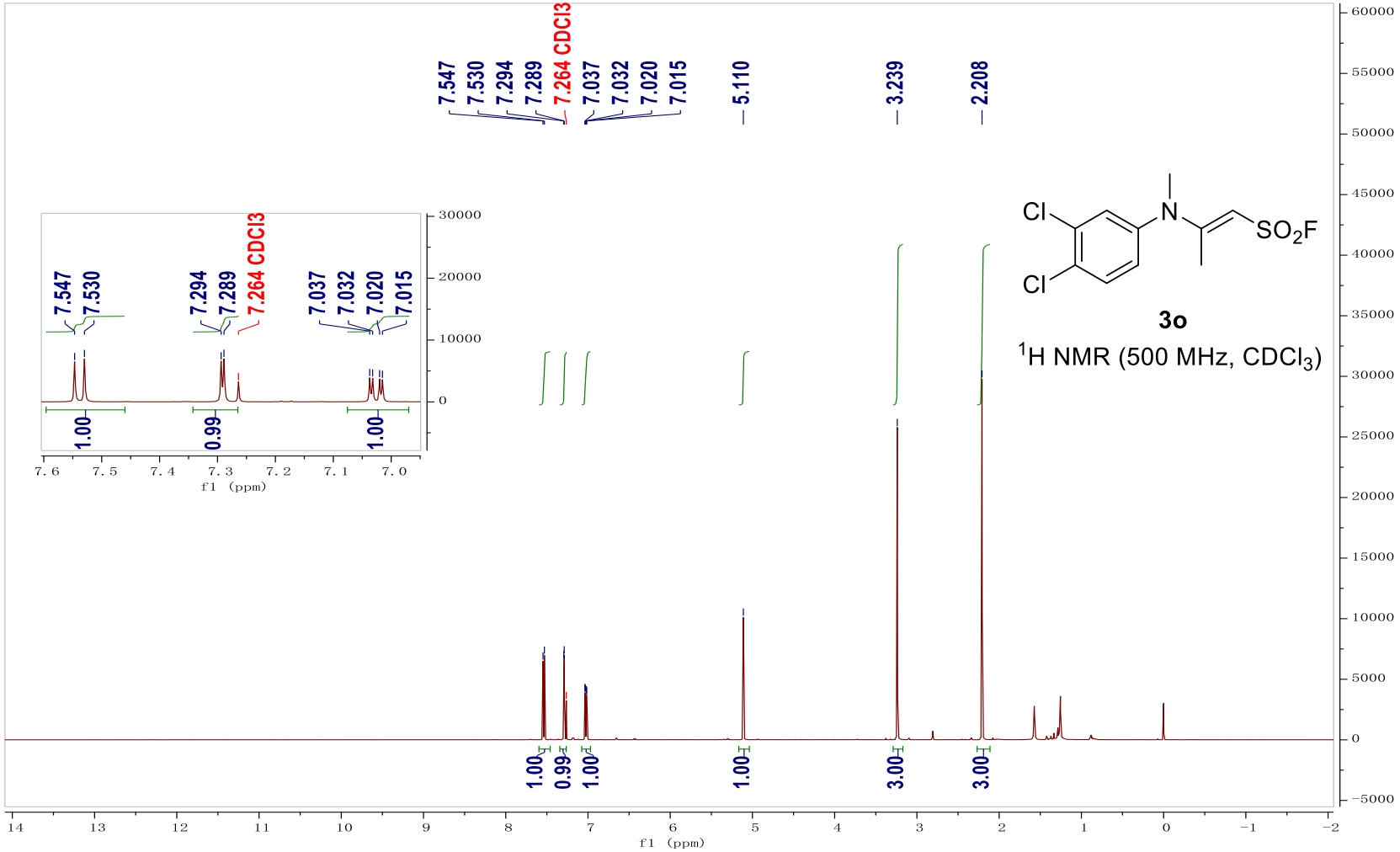
^{19}F NMR (471 MHz, $CDCl_3$)

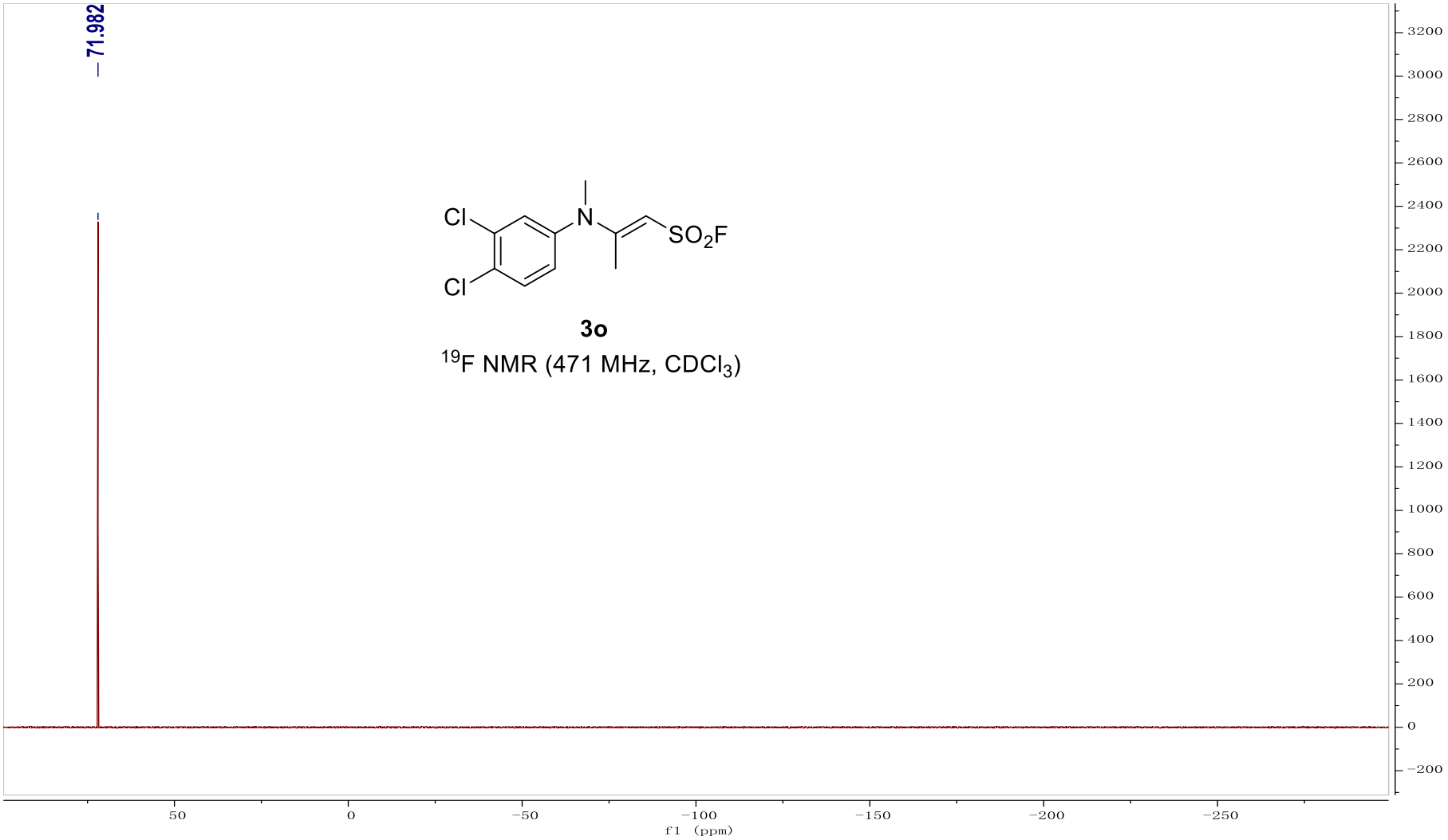

162.176
145.561
135.698
131.255
128.832
127.540
125.466
87.076
86.880
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
41.532
17.803
Cl
N
SO2F
3m
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.335
7.327
7.319
7.315
7.301
7.298
7.288
7.281
7.273
7.264 CDCl3
7.093
7.085
7.074
7.059
5.171
4.442
3.325
3.175
2.547
2.199
2.040
12.15
4.03
3.04
1.00
3.02
9.10
3.01
12.13
9.06
f1 (ppm)
N
SO2F
3n
1H NMR (500 MHz, CDCl3)


73.237
72.392
4500
4000
3500
3000
2500
2000
1500
1000
500
0
50
0
−50
−100
−150
−200
−250
f1 (ppm)
N
SO2F
3n
19F NMR (471 MHz, CDCl3)
73.237
72.392
4000
3000
2000
1000
0
85
80
75
70
65
60
55
f1 (ppm)

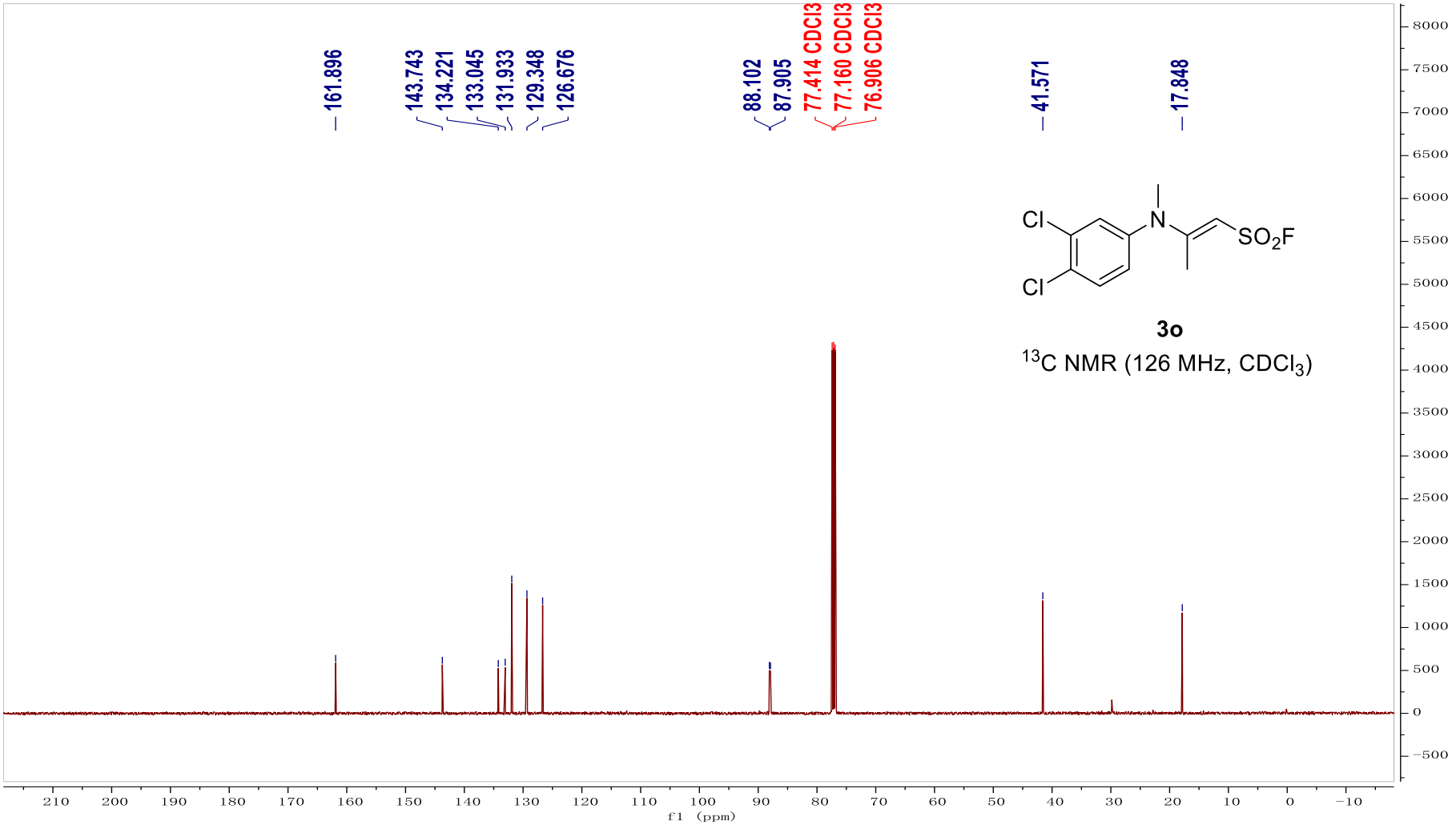

163.057
162.604
143.215
142.721
135.339
134.482
132.199
131.822
129.110
129.021
128.451
127.818
127.605
126.718
85.257
85.070
84.534
84.340
77.415 CDCl3
77.160 CDCl3
76.906 CDCl3
40.486
39.608
17.477
17.365
17.190
16.033
N
SO2F
3n
13C NMR (126 MHz, CDCl3)
f1 (ppm)

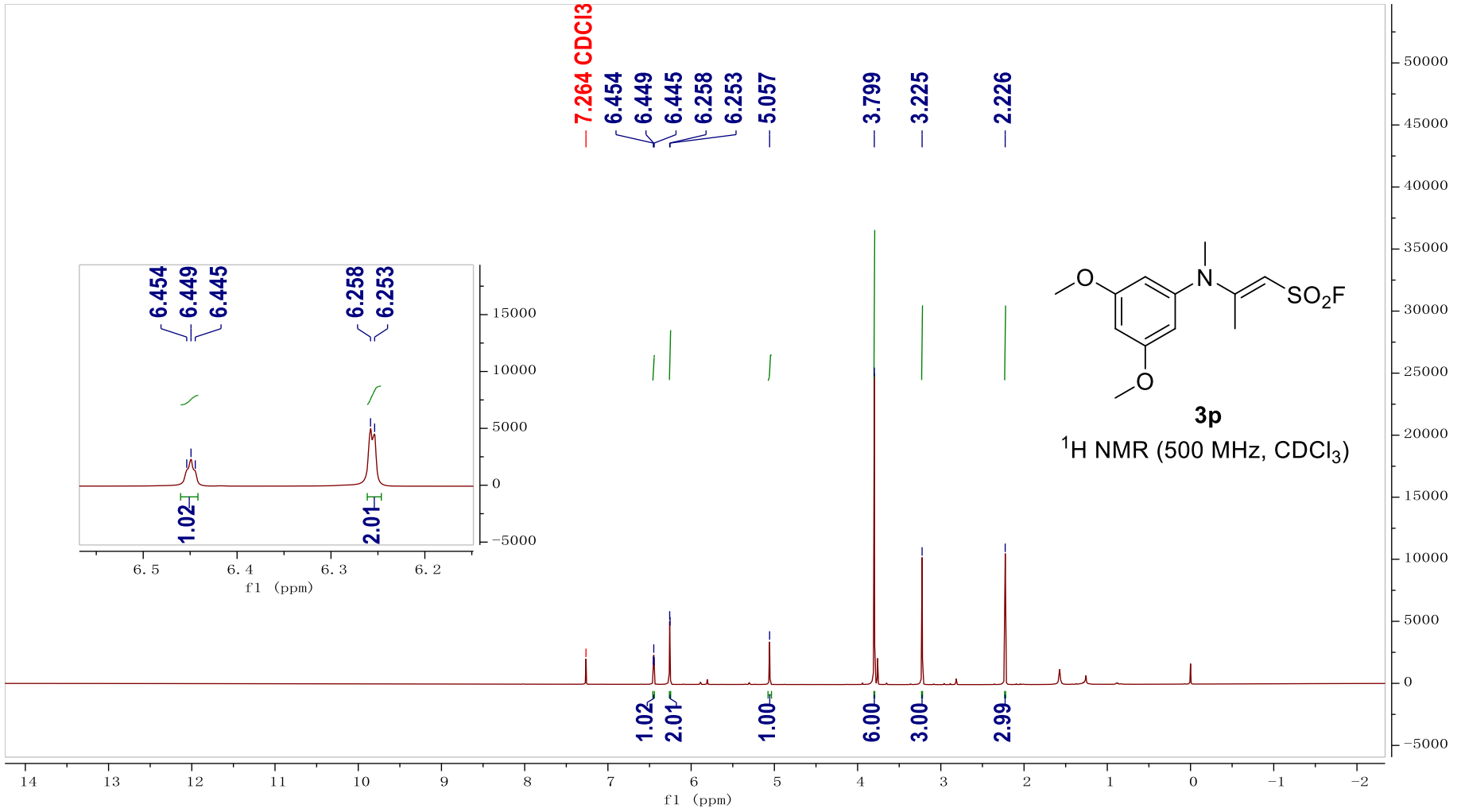

7.547
7.530
7.294
7.289
7.264 CDCl3
7.037
7.032
7.020
7.015
5.110
3.239
2.208
1.00
0.99
1.00
1.00
3.00
3.00
f1 (ppm)
Cl
Cl
N
SO2F
3o
1H NMR (500 MHz, CDCl3)

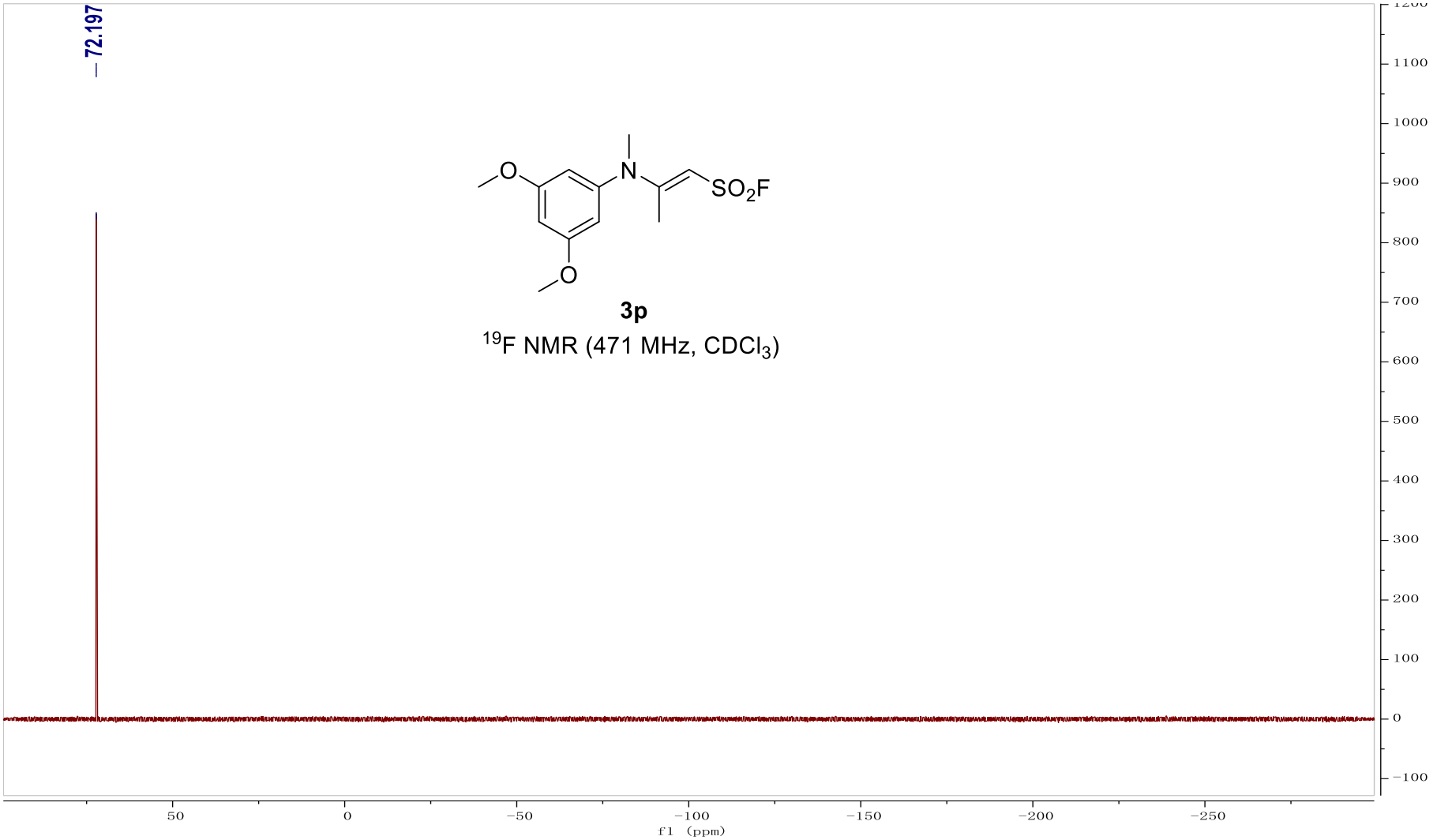


3o

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

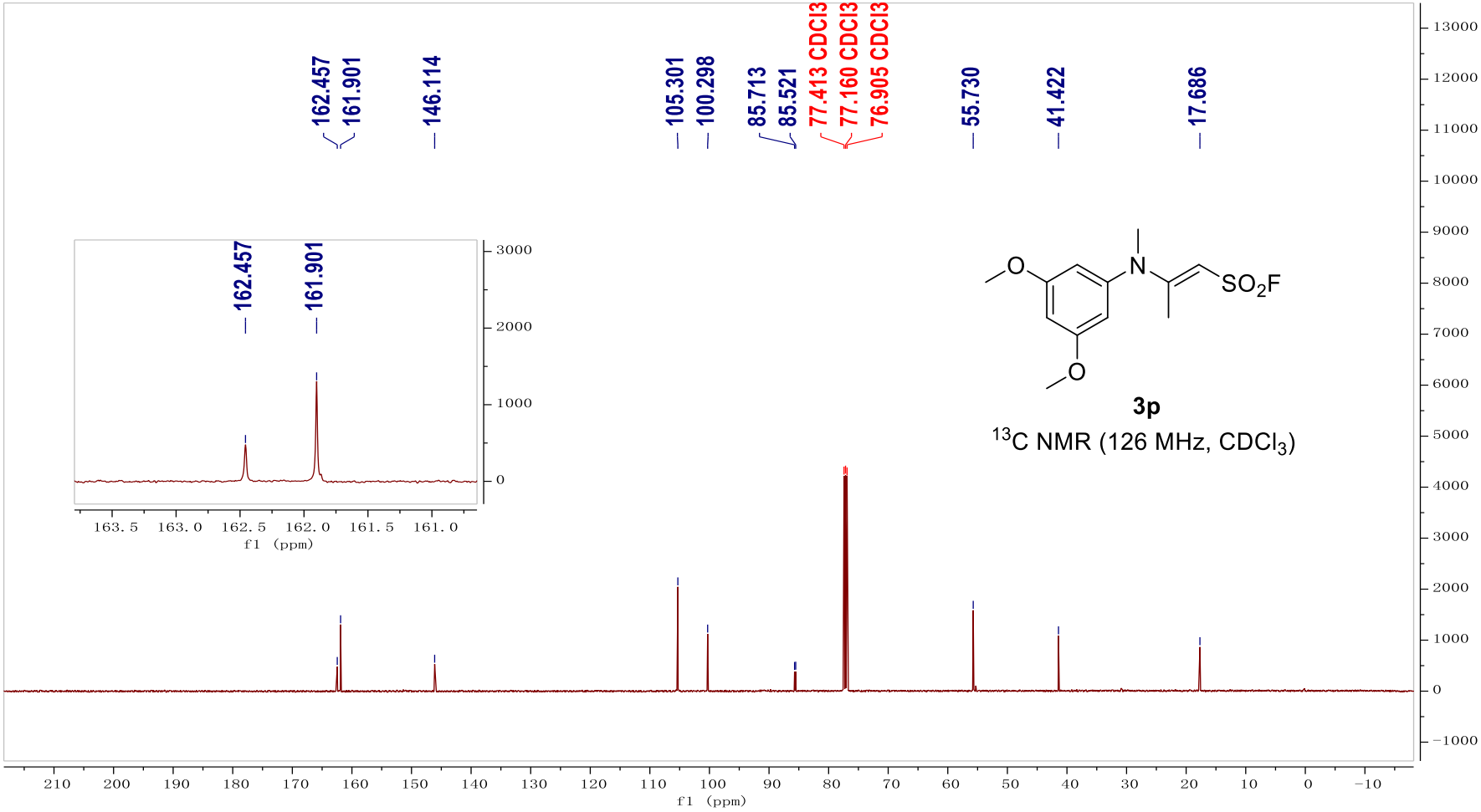

161.896
143.743
134.221
133.045
131.933
129.348
126.676
88.102
87.905
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
41.571
17.848
Cl
Cl
N
SO2F
3o
13C NMR (126 MHz, CDCl3)
f1 (ppm)

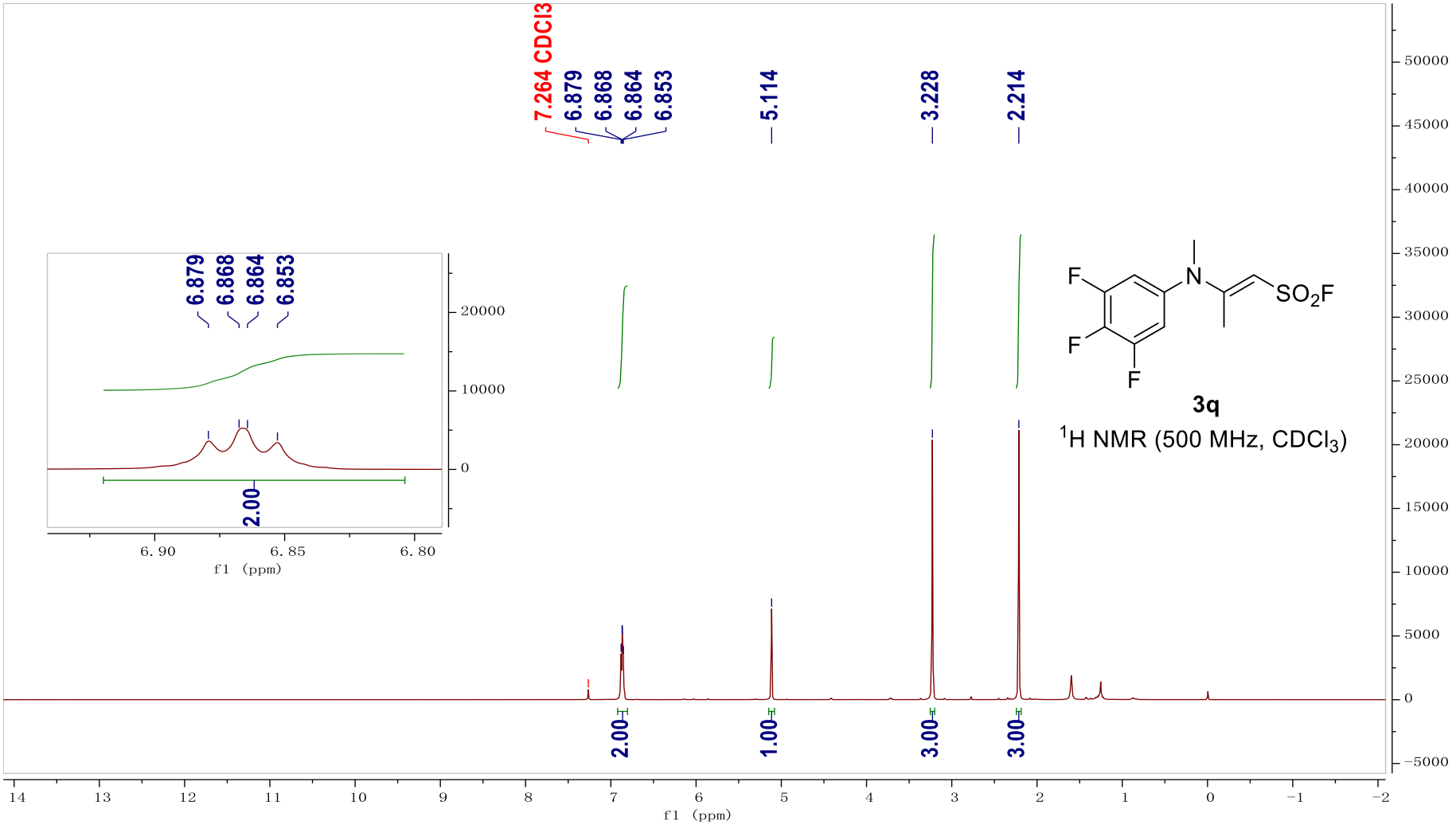

7.264 CDCl3
6.454
6.449
6.445
6.258
6.253
5.057
3.799
3.225
2.226
1.02
2.01
1.00
6.00
3.00
2.99
f1 (ppm)
O
N
SO2F
O
3p
1H NMR (500 MHz, CDCl3)

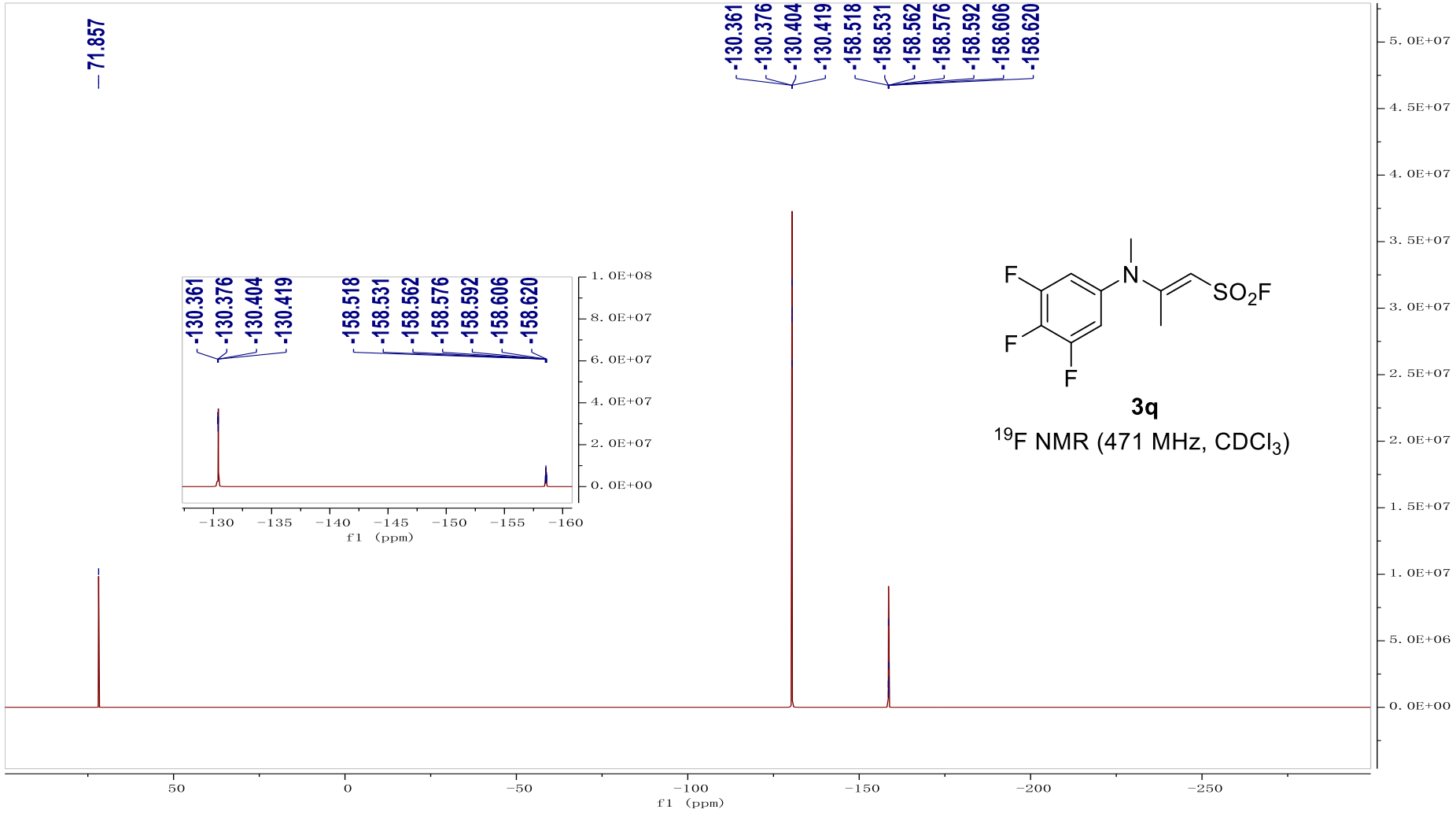


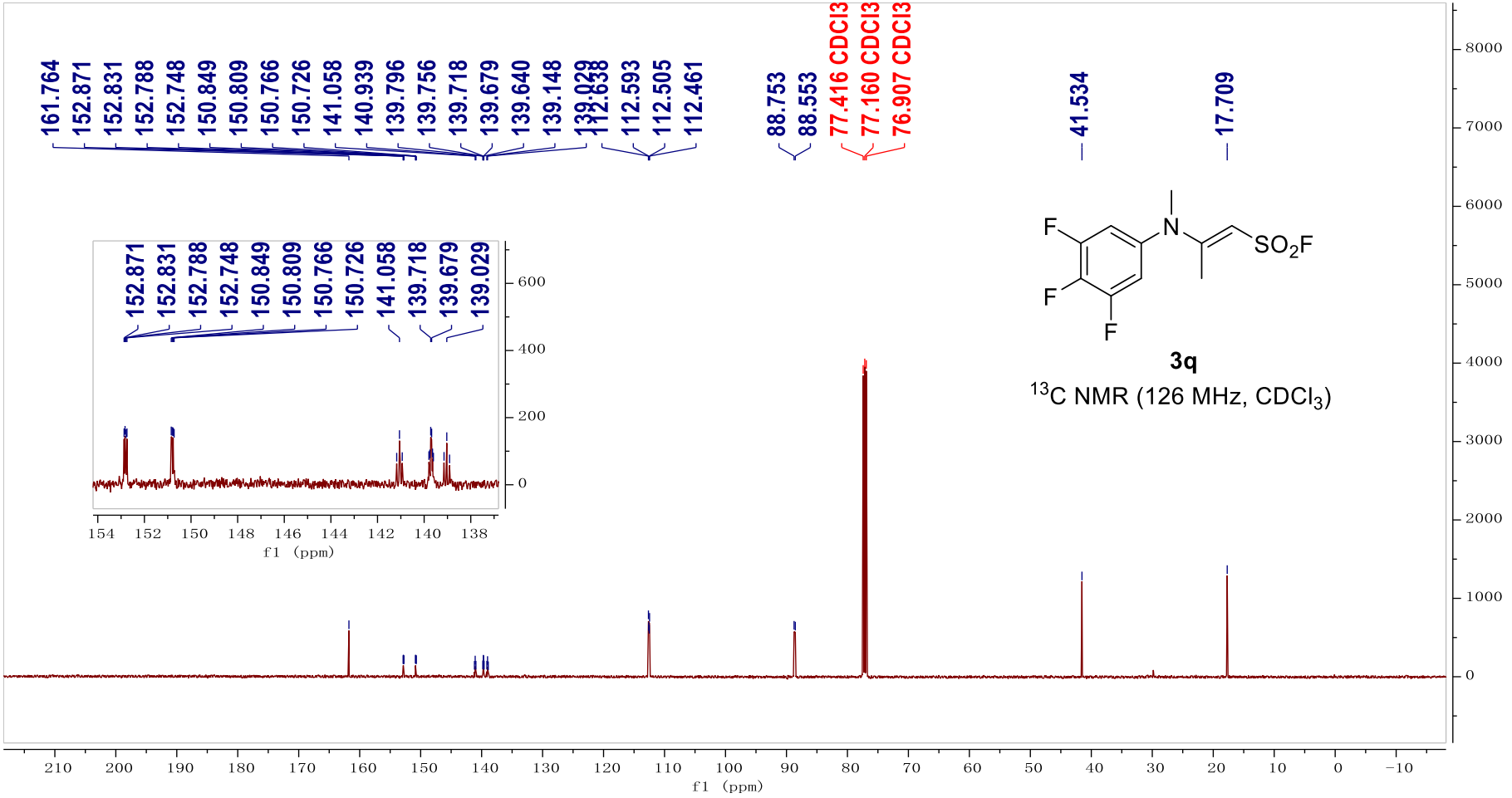
3p

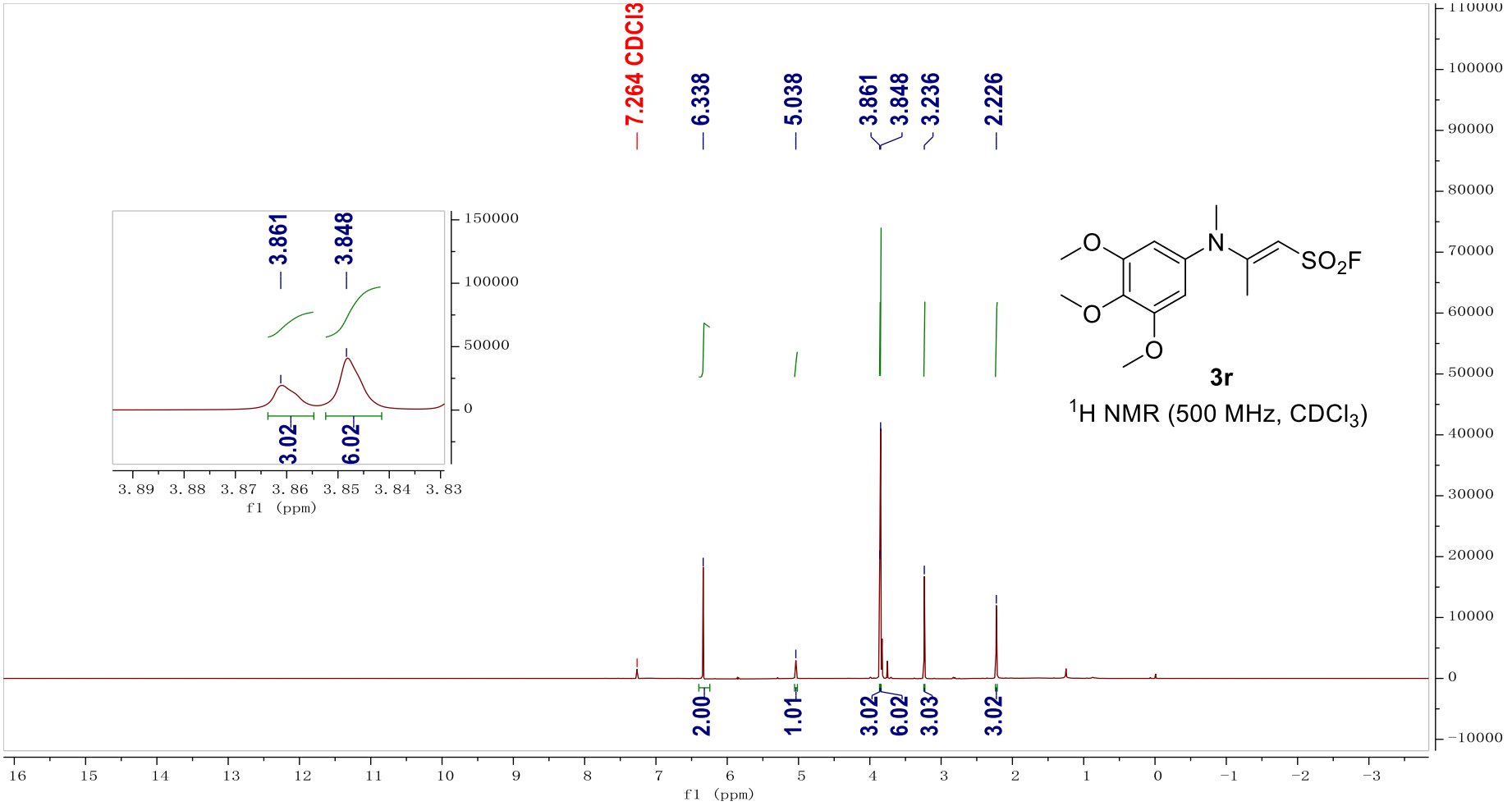
^{19}F NMR (471 MHz, $CDCl_3$)

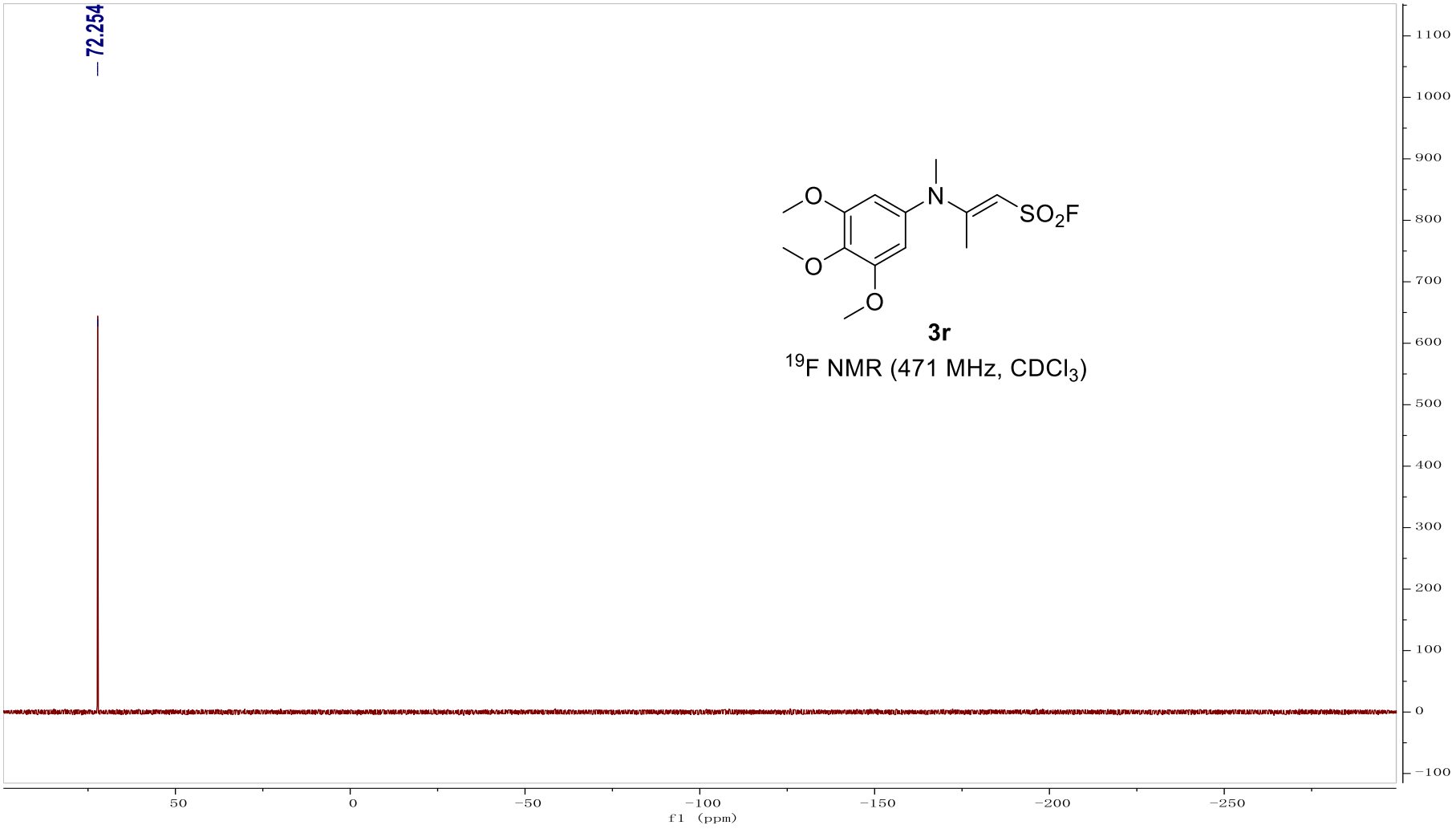

162.457
161.901
146.114
105.301
100.298
85.713
85.521
77.413 CDCl3
77.160 CDCl3
76.905 CDCl3
55.730
41.422
17.686
O
N
SO2F
O
3p
13C NMR (126 MHz, CDCl3)
f1 (ppm)

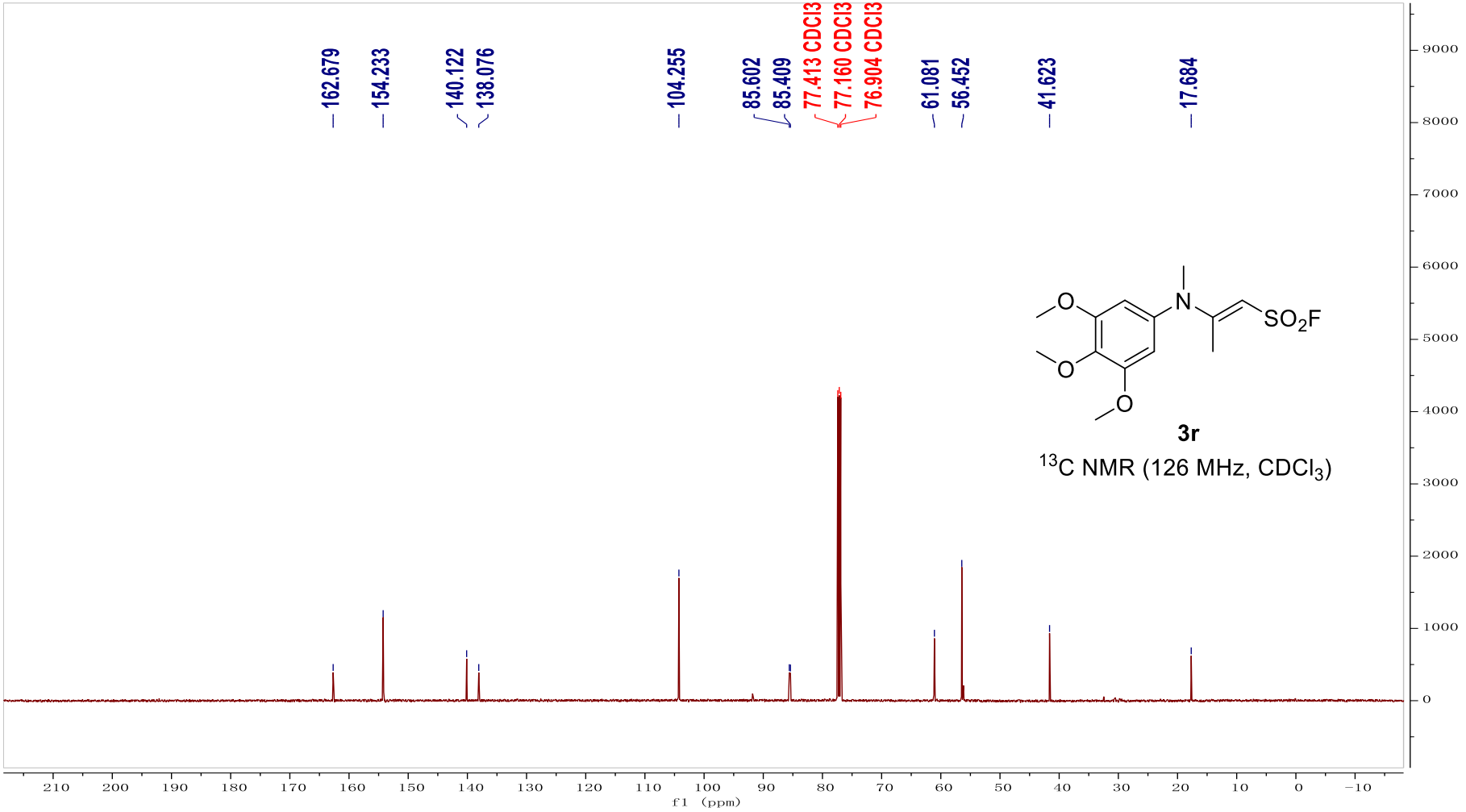

7.264 CDCl3
6.879
6.868
6.864
6.853
5.114
3.228
2.214
2.00
1.00
3.00
3.00
f1 (ppm)
3q
1H NMR (500 MHz, CDCl3)

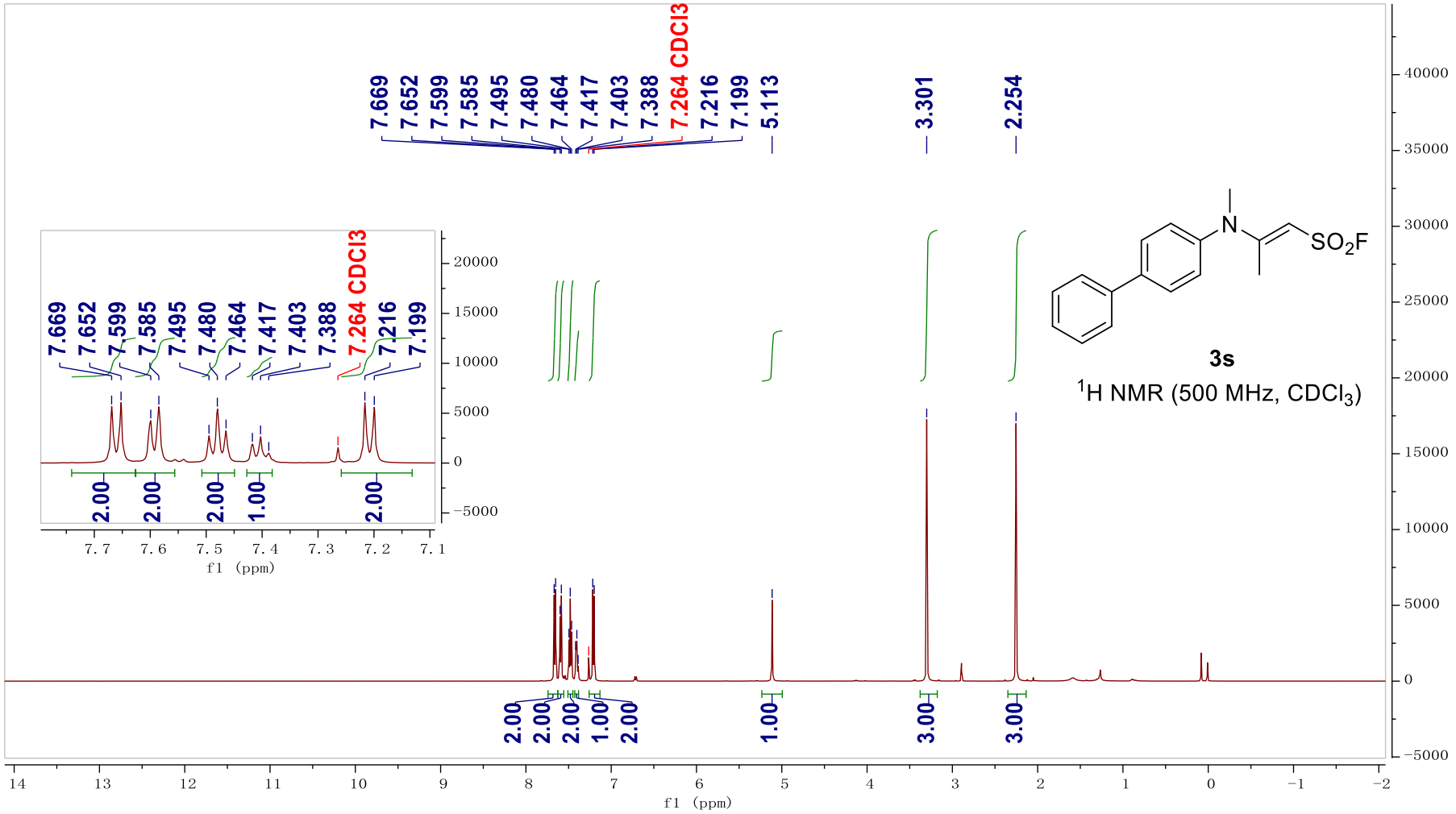

-71.857
-130.361
-130.376
-130.404
-130.419
-158.518
-158.531
-158.562
-158.576
-158.592
-158.606
-158.620
F
F
F
N
SO2F
3q
19F NMR (471 MHz, CDCl3)
f1 (ppm)

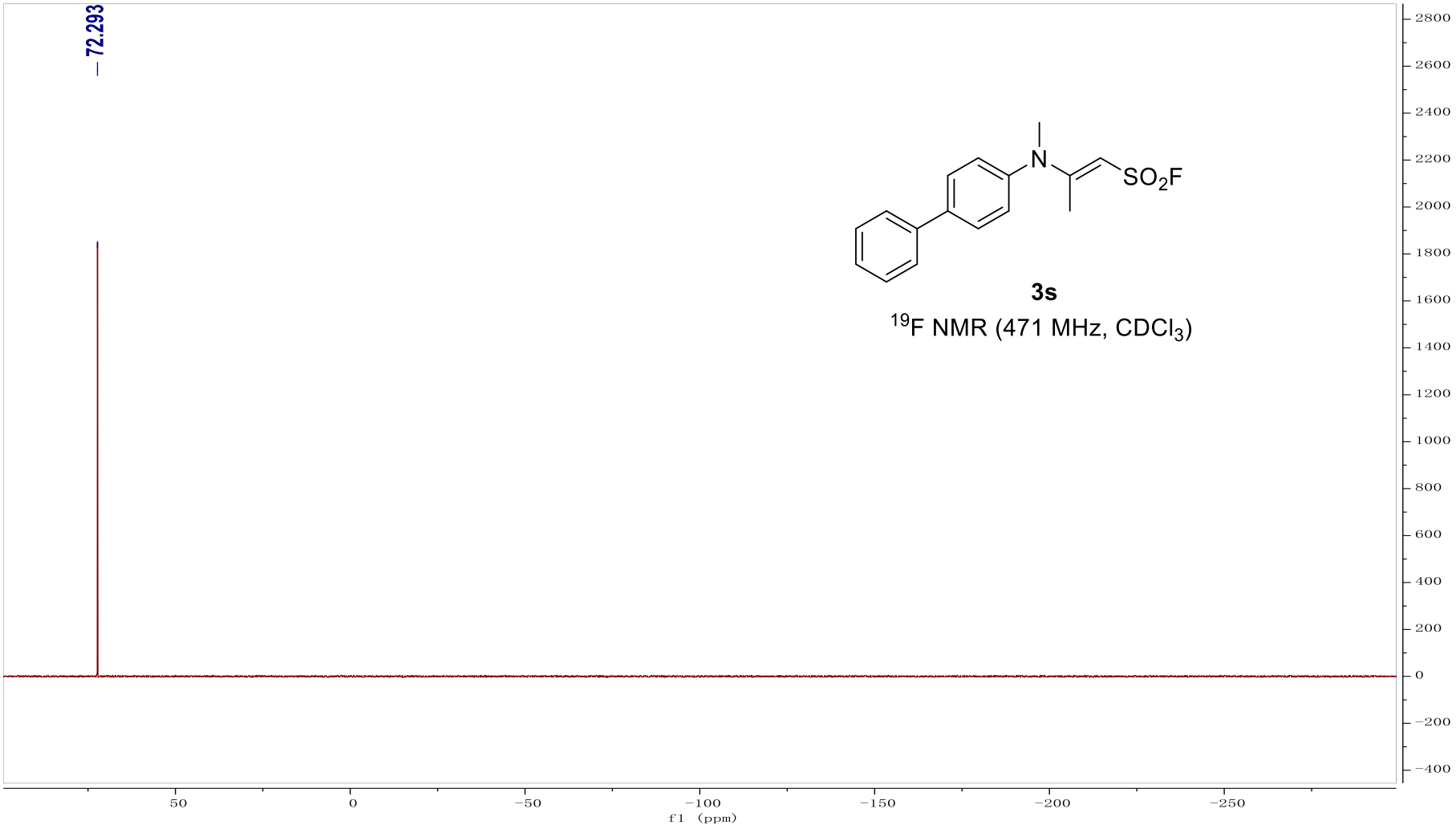

161.764
152.871
152.831
152.788
152.748
150.849
150.809
150.766
150.726
141.058
140.939
139.796
139.756
139.718
139.679
139.640
139.148
139.029
112.638
112.593
112.505
112.461
88.753
88.553
77.416 CDCl3
77.160 CDCl3
76.907 CDCl3
41.534
17.709
F
F
F
N
SO2F
3q
13C NMR (126 MHz, CDCl3)
f1 (ppm)

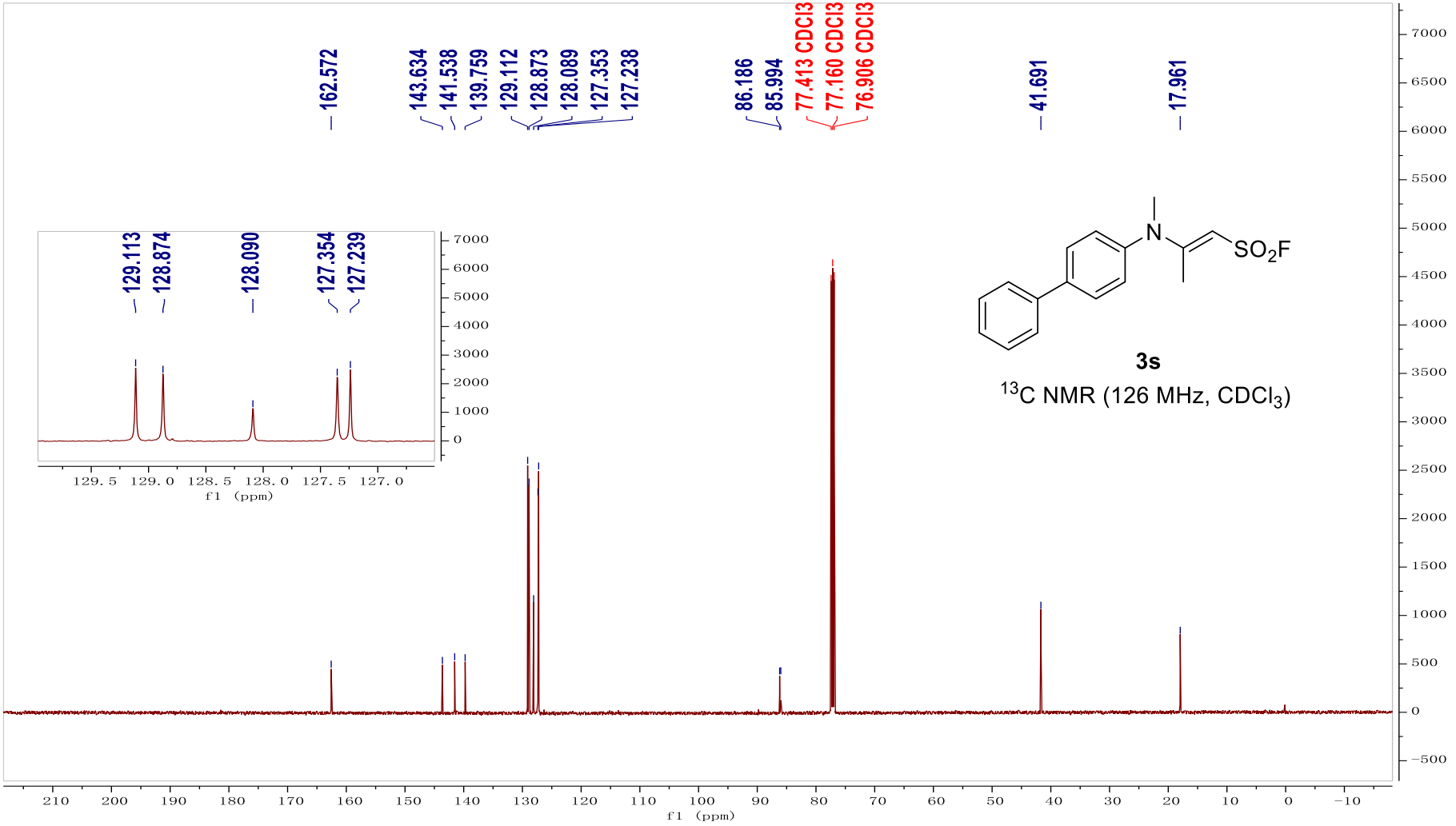

7.264 CDCl3
6.338
5.038
3.861
3.848
3.236
2.226
2.00
1.01
3.02
6.02
3.03
3.02
f1 (ppm)
3.861
3.848
3.02
6.02
3.89 3.88 3.87 3.86 3.85 3.84 3.83
f1 (ppm)
O
O
O
N
SO2F
3r
1H NMR (500 MHz, CDCl3)

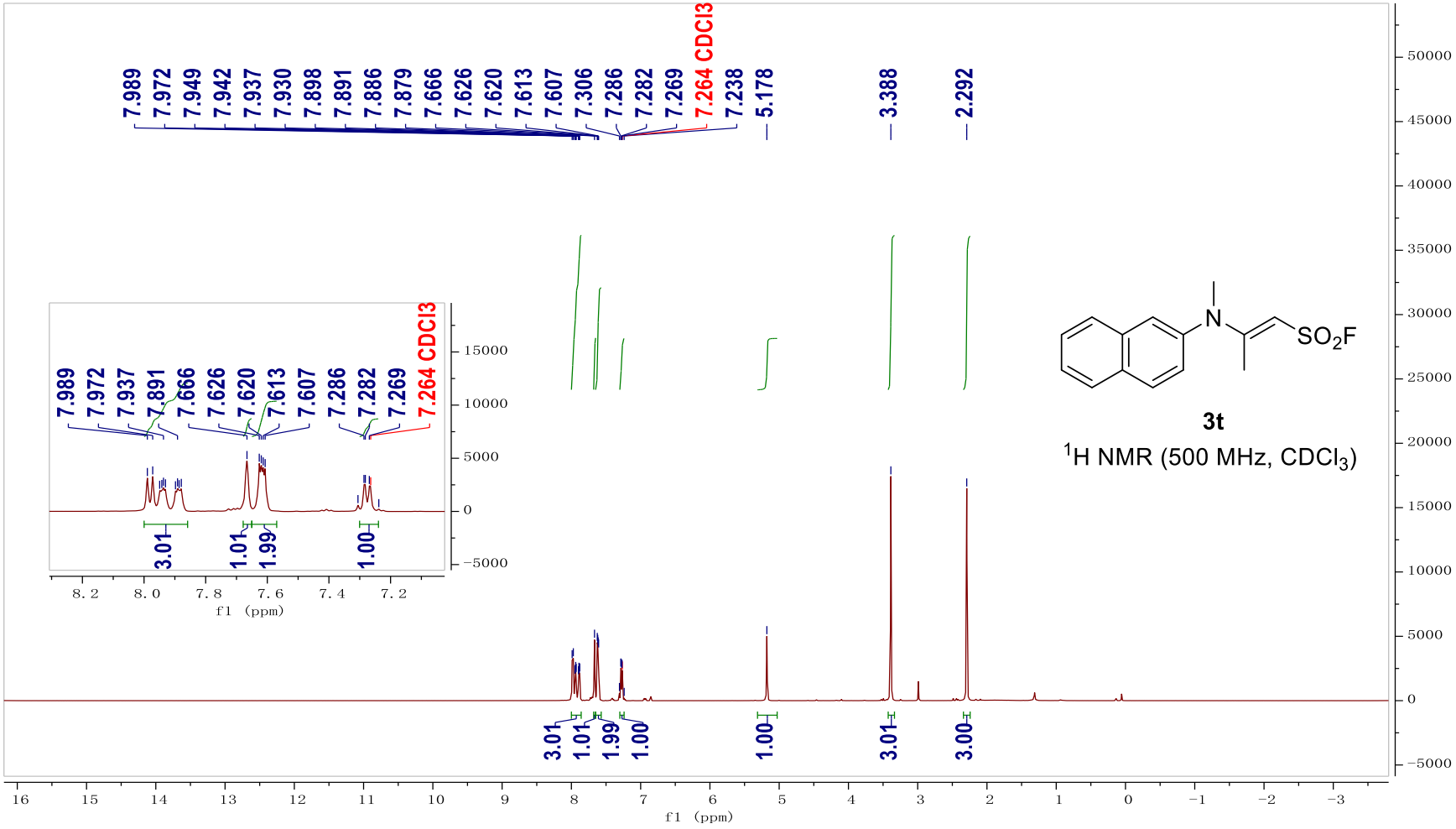

72.254
O
O
O
N
SO2F
3r
19F NMR (471 MHz, CDCl3)
1100
1000
900
800
700
600
500
400
300
200
100
0
−100
50
0
−50
−100
−150
−200
−250
f1 (ppm)

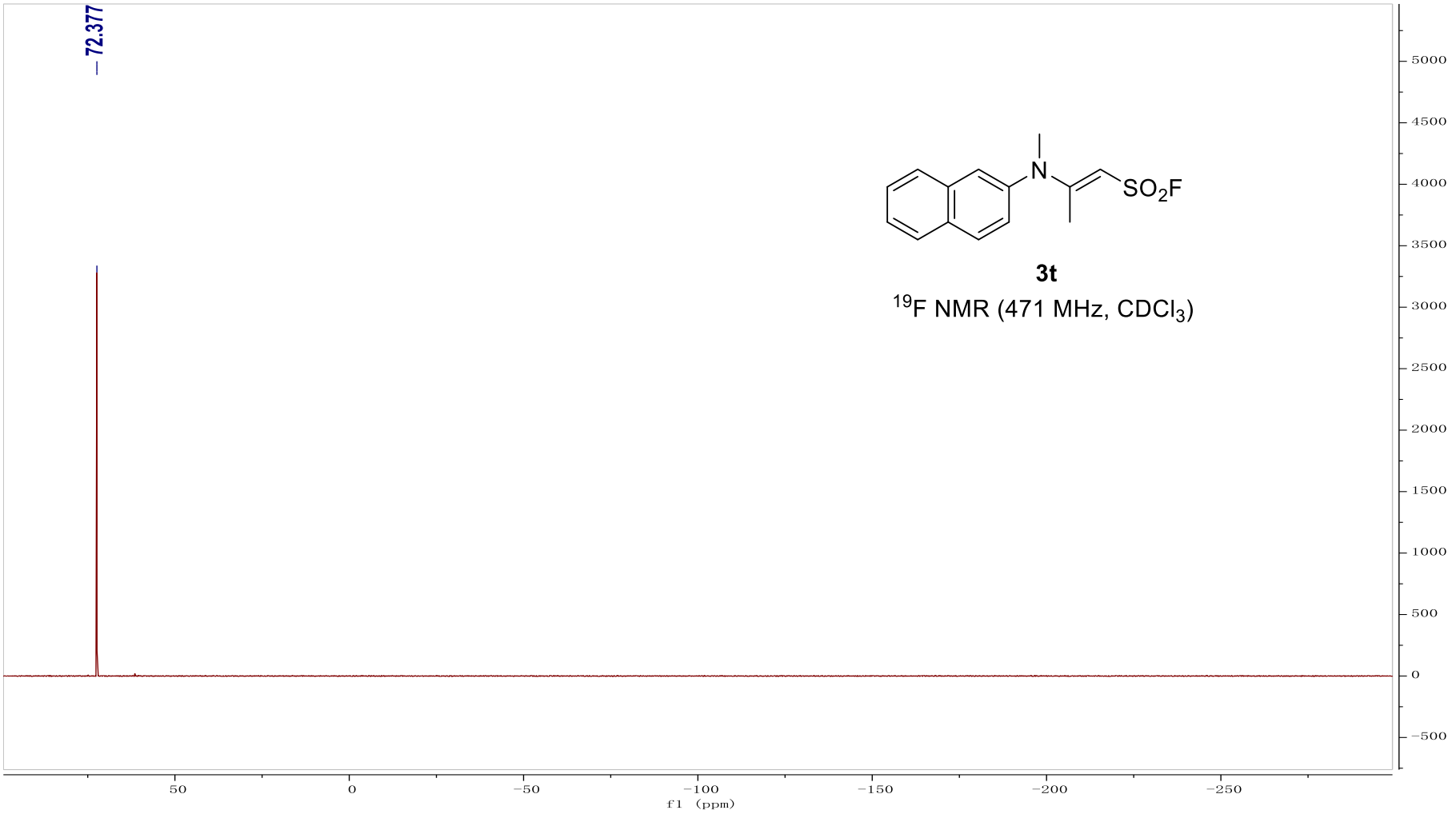

162.679
154.233
140.122
138.076
104.255
85.602
85.409
77.413 CDCl3
77.160 CDCl3
76.904 CDCl3
61.081
56.452
41.623
17.684
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)
O
O
O
N
SO2F
3r
13C NMR (126 MHz, CDCl3)

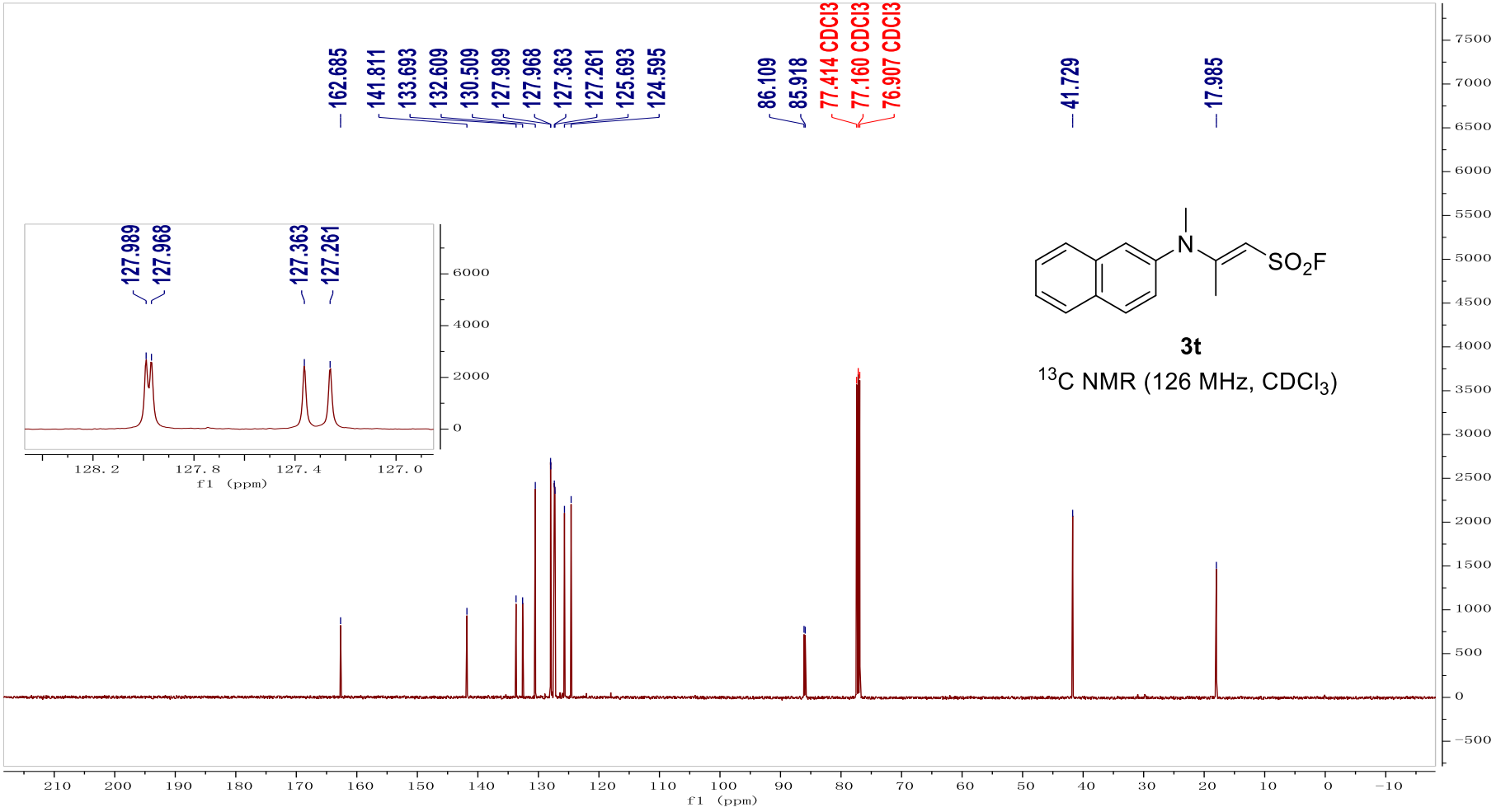

7.669
7.652
7.599
7.585
7.495
7.480
7.464
7.417
7.403
7.388
7.264 CDCl3
7.216
7.199
5.113
3.301
2.254
2.00
2.00
2.00
1.00
2.00
1.00
3.00
3.00
f1 (ppm)
3s
1H NMR (500 MHz, CDCl3)
SO2F
N

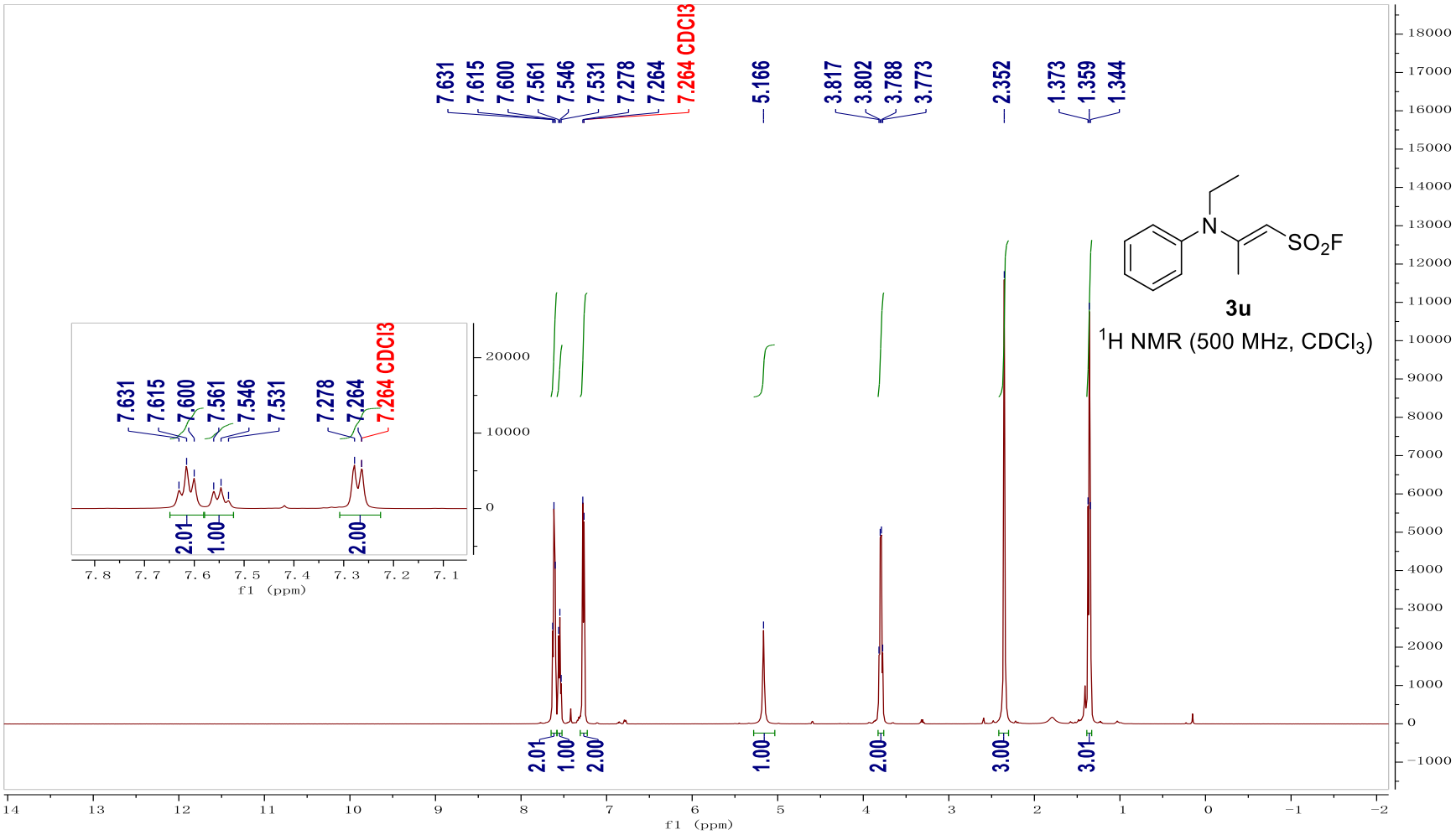

72.293
N
SO2F
3s
19F NMR (471 MHz, CDCl3)
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
−200
−400
50
0
−50
−100
−150
−200
−250
f1 (ppm)

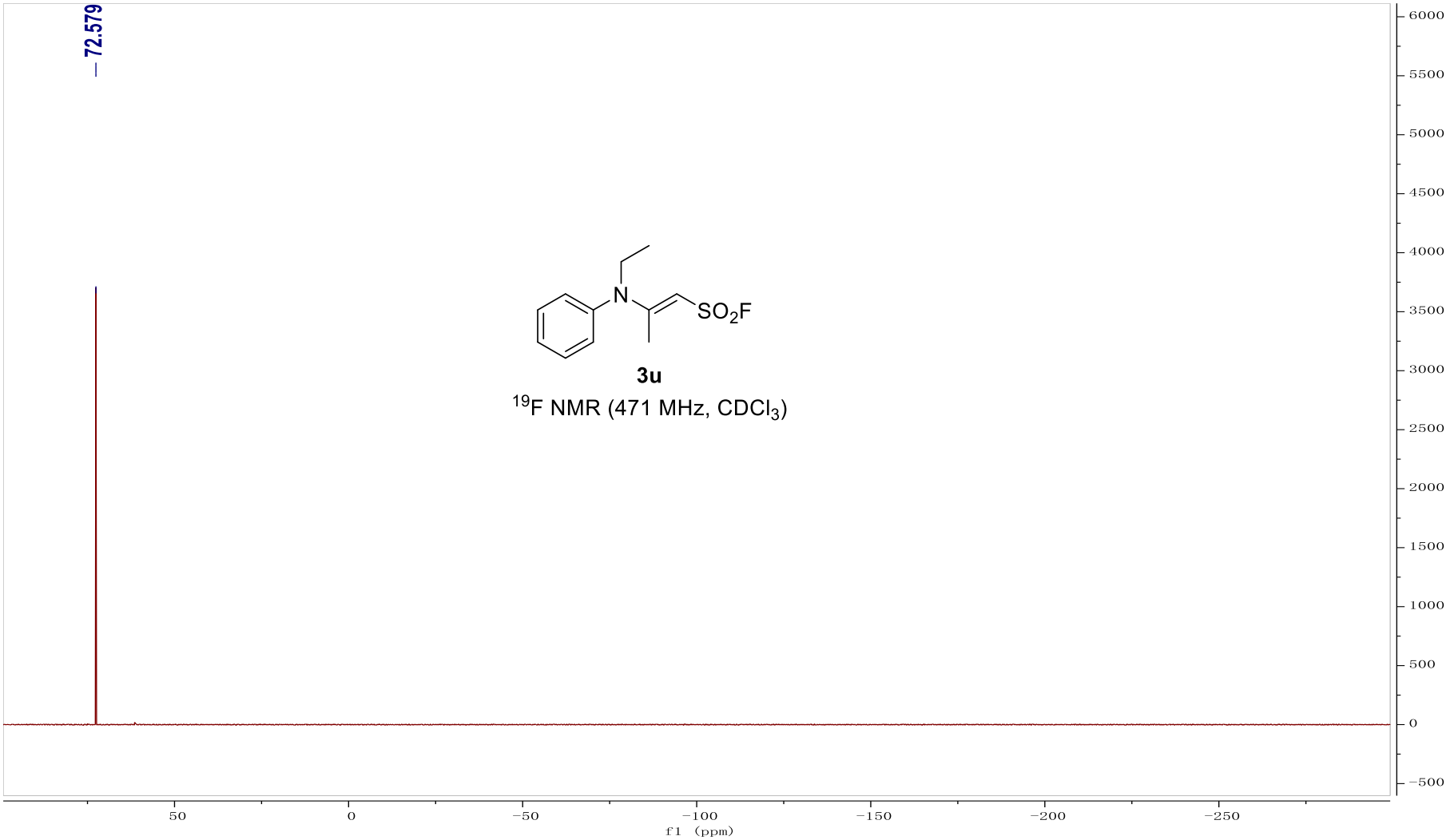

162.572
143.634
141.538
139.759
129.112
128.873
128.089
127.353
127.238
86.186
85.994
77.413 CDCl3
77.160 CDCl3
76.906 CDCl3
41.691
17.961
129.113
128.874
128.090
127.354
127.239
f1 (ppm)
N
SO2F
3s
13C NMR (126 MHz, CDCl3)


7.989
7.972
7.949
7.942
7.937
7.930
7.898
7.891
7.886
7.879
7.666
7.626
7.620
7.613
7.607
7.306
7.286
7.282
7.269
7.264 CDCl3
7.238
5.178
3.388
2.292
3.01
1.01
1.99
1.00
1.00
3.01
3.00
f1 (ppm)
N
SO2F
3t
1H NMR (500 MHz, CDCl3)


−72.377
N
SO2F
3t
19F NMR (471 MHz, CDCl3)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
−500
50
0
−50
−100
−150
−200
−250
f1 (ppm)

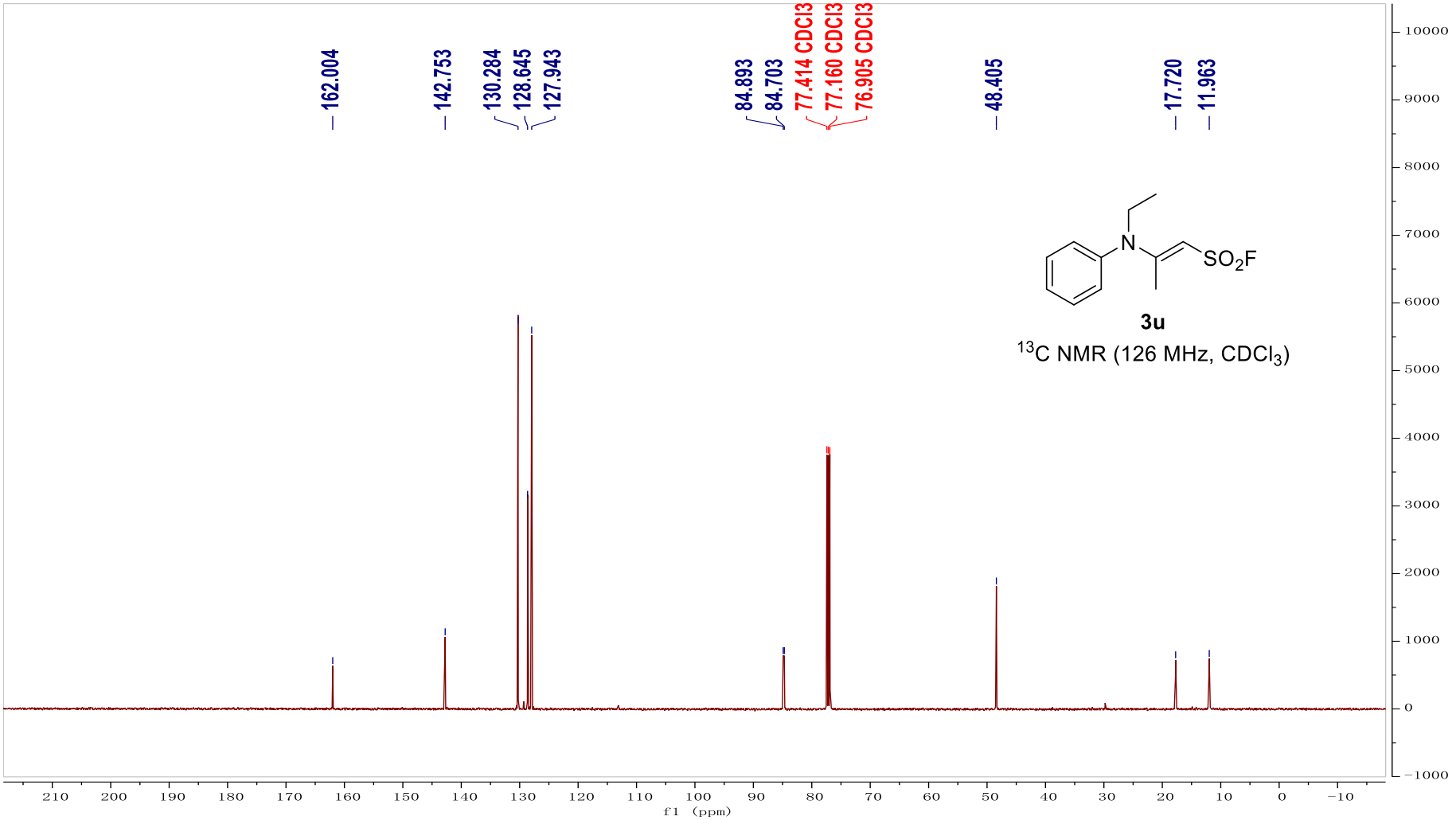

162.685
141.811
133.693
132.609
130.509
127.989
127.968
127.363
127.261
125.693
124.595
86.109
85.918
77.414 CDCl3
77.160 CDCl3
76.907 CDCl3
41.729
17.985
127.989
127.968
127.363
127.261
f1 (ppm)
f1 (ppm)
N
SO2F
3t
13C NMR (126 MHz, CDCl3)

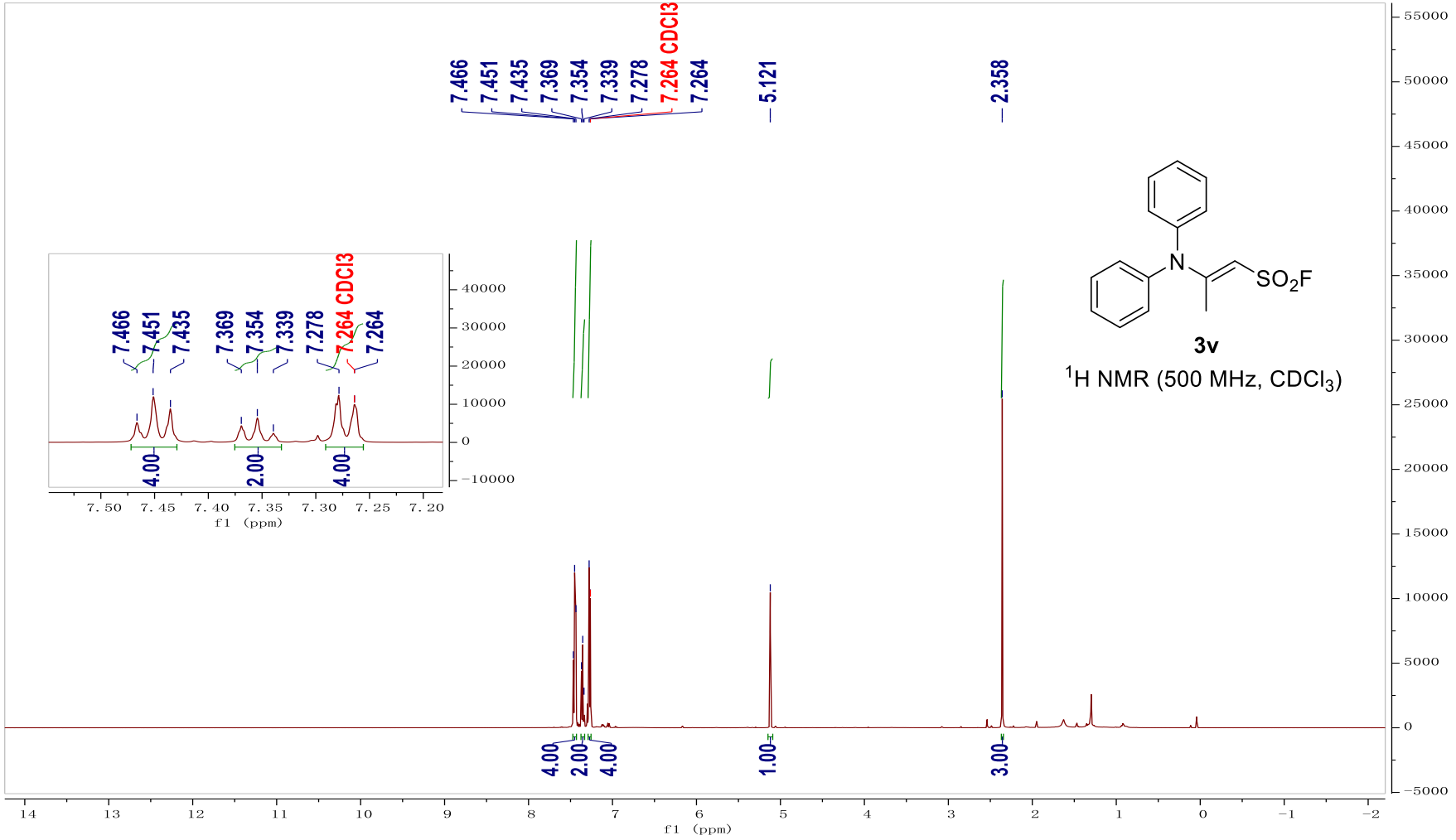

7.631
7.615
7.600
7.561
7.546
7.531
7.278
7.264
7.264 CDCl3
5.166
3.817
3.802
3.788
3.773
2.352
1.373
1.359
1.344
2.01
1.00
2.00
1.00
2.00
3.00
3.01
f1 (ppm)
3u
1H NMR (500 MHz, CDCl3)
SO2F
N

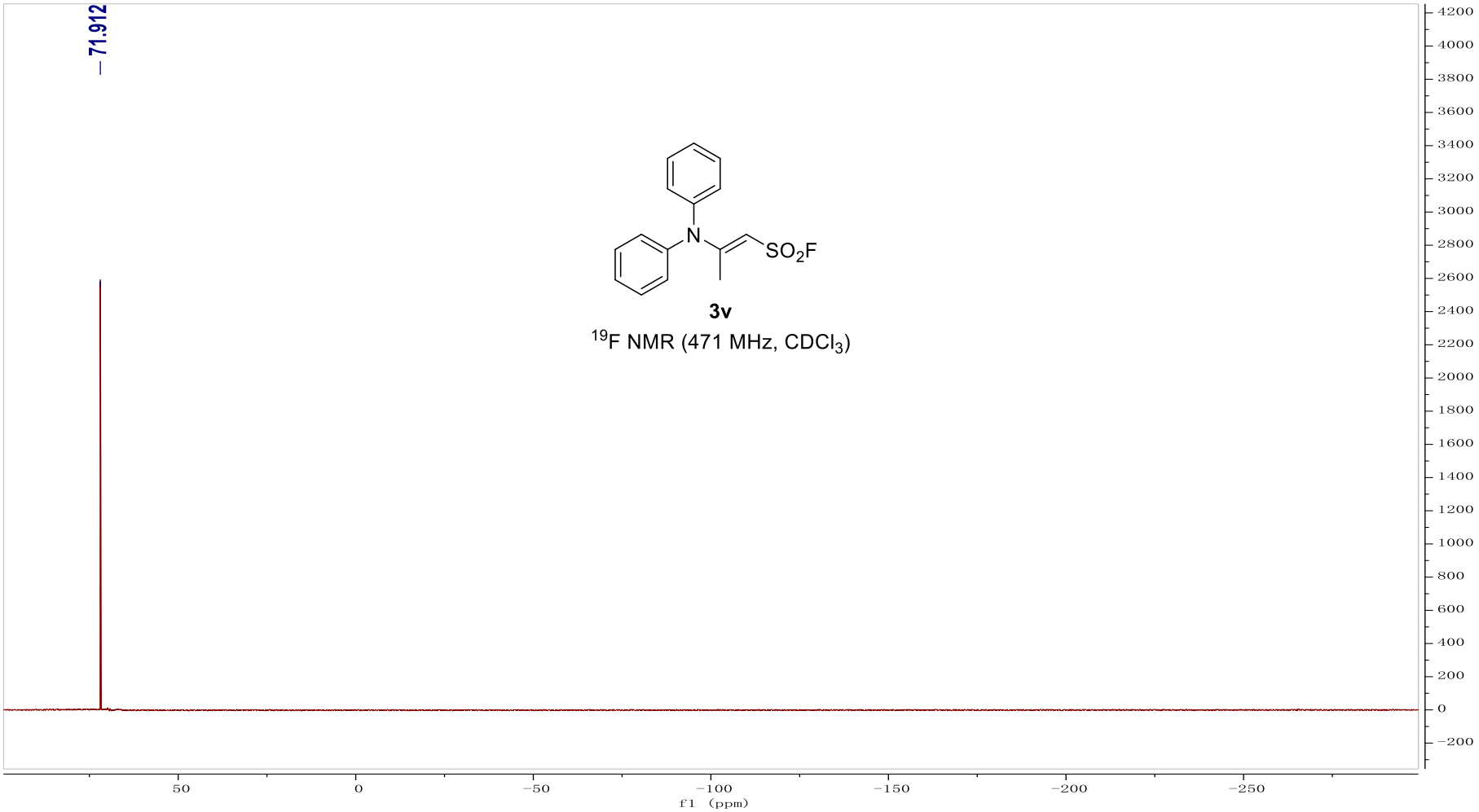


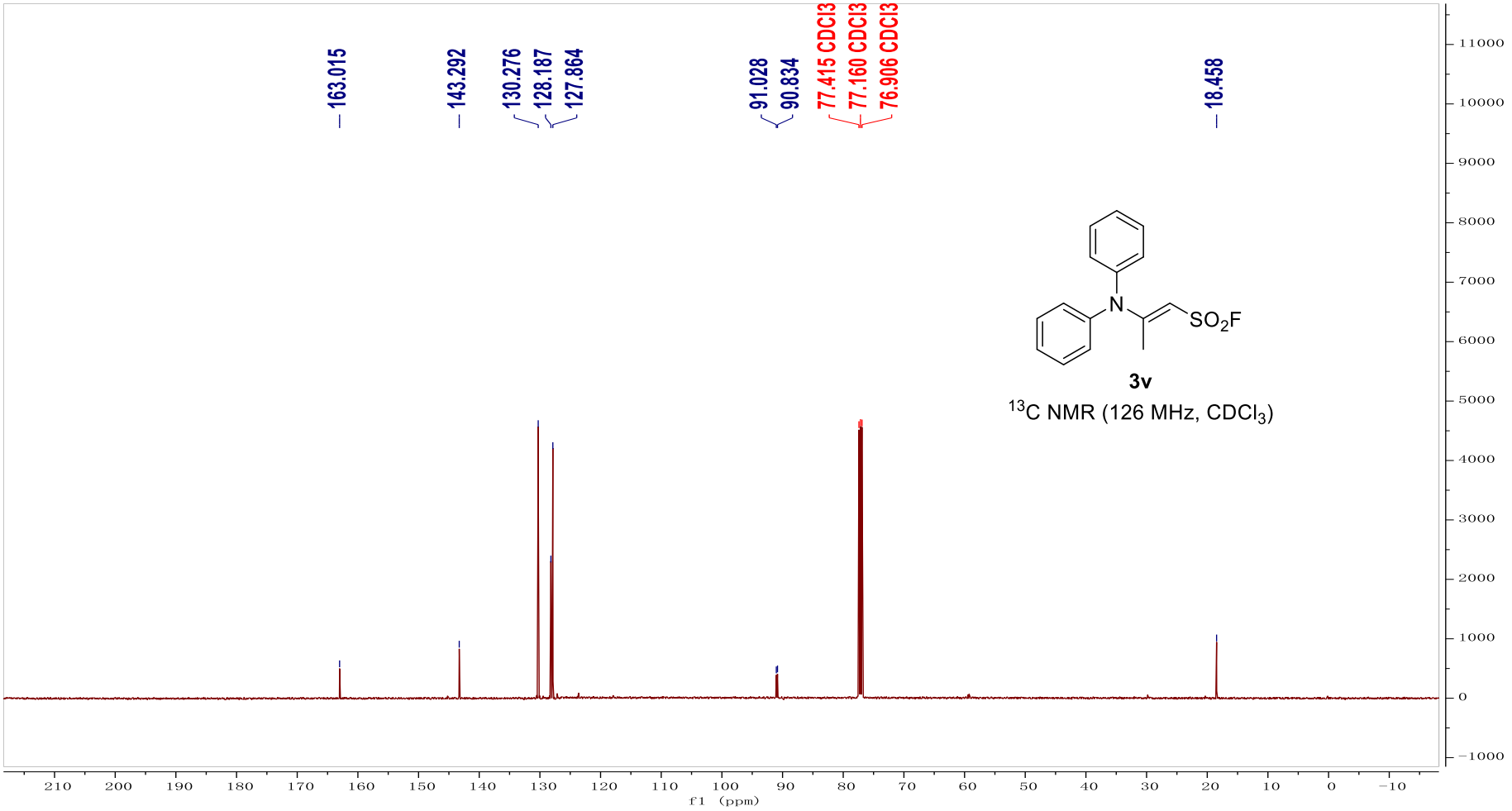
3u

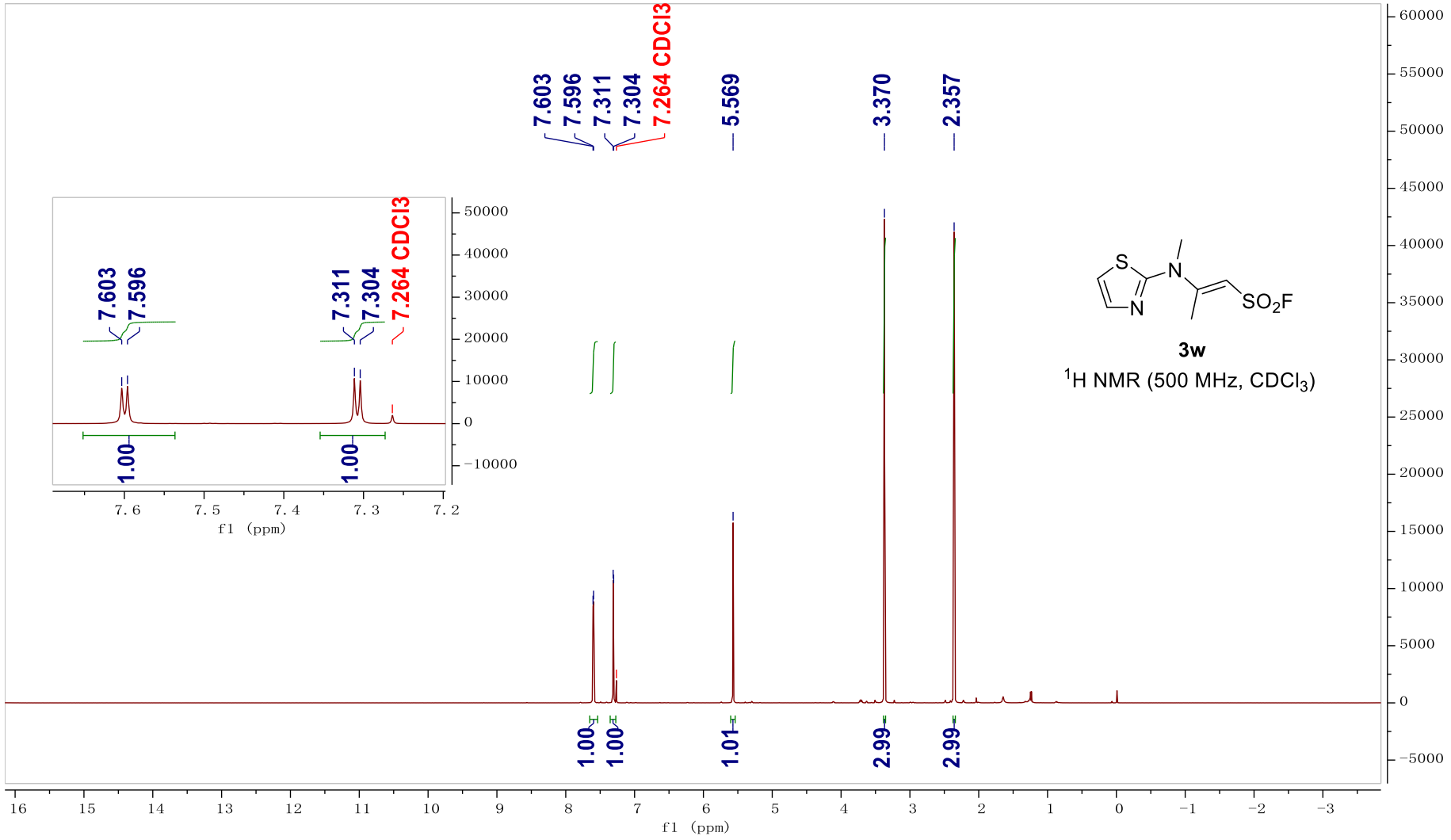
^{19}F NMR (471 MHz, $CDCl_3$)

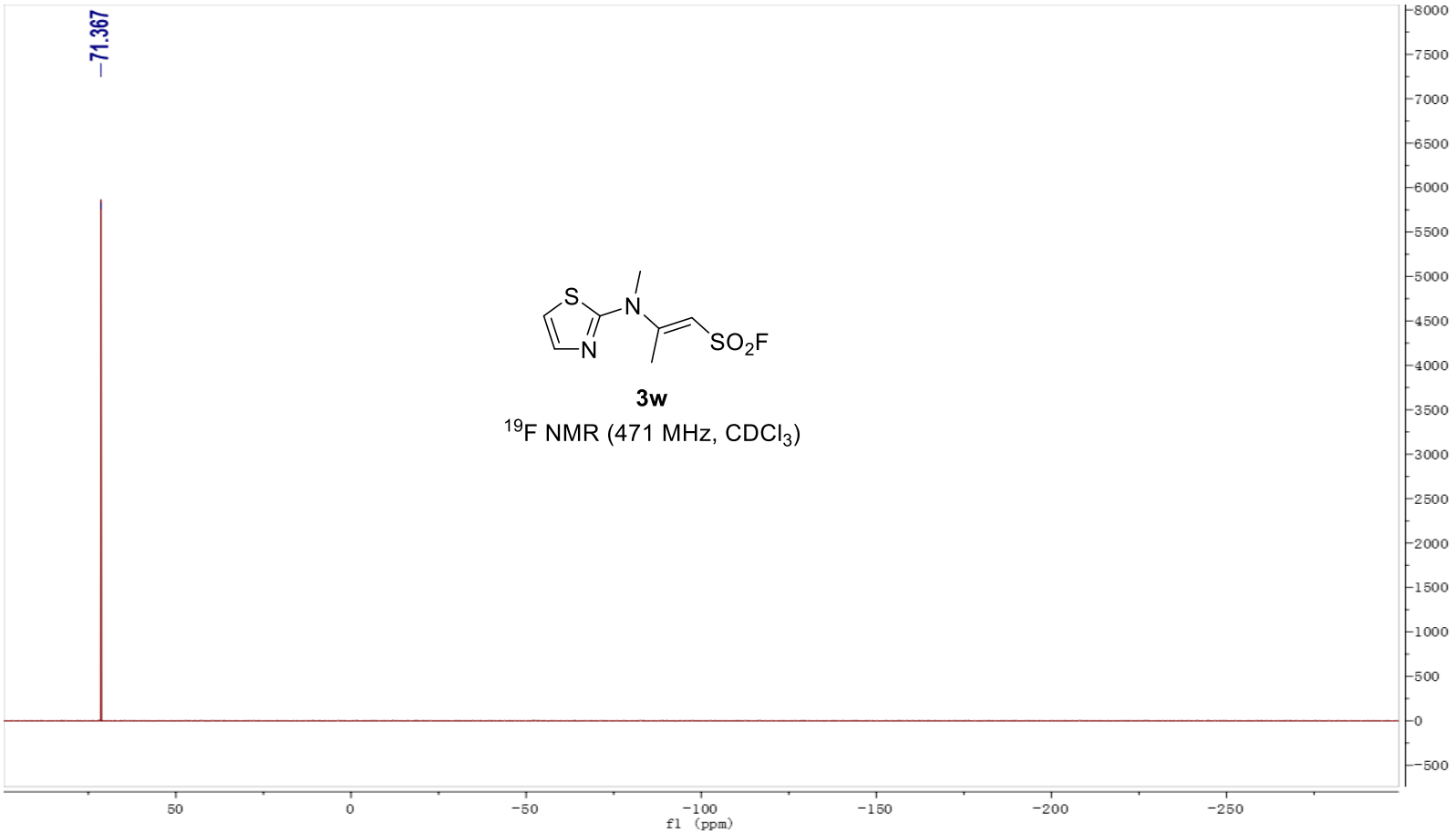

162.004
142.753
130.284
128.645
127.943
84.893
84.703
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
48.405
17.720
11.963
N
SO2F
3u
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.466
7.451
7.435
7.369
7.354
7.339
7.278
7.264 CDCl3
7.264
5.121
2.358
4.00
2.00
4.00
1.00
3.00
f1 (ppm)
N
SO2F
3v
1H NMR (500 MHz, CDCl3)


−71.912
N
SO2F
3v
19F NMR (471 MHz, CDCl3)
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
−200
50
0
−50
−100
−150
−200
−250
f1 (ppm)

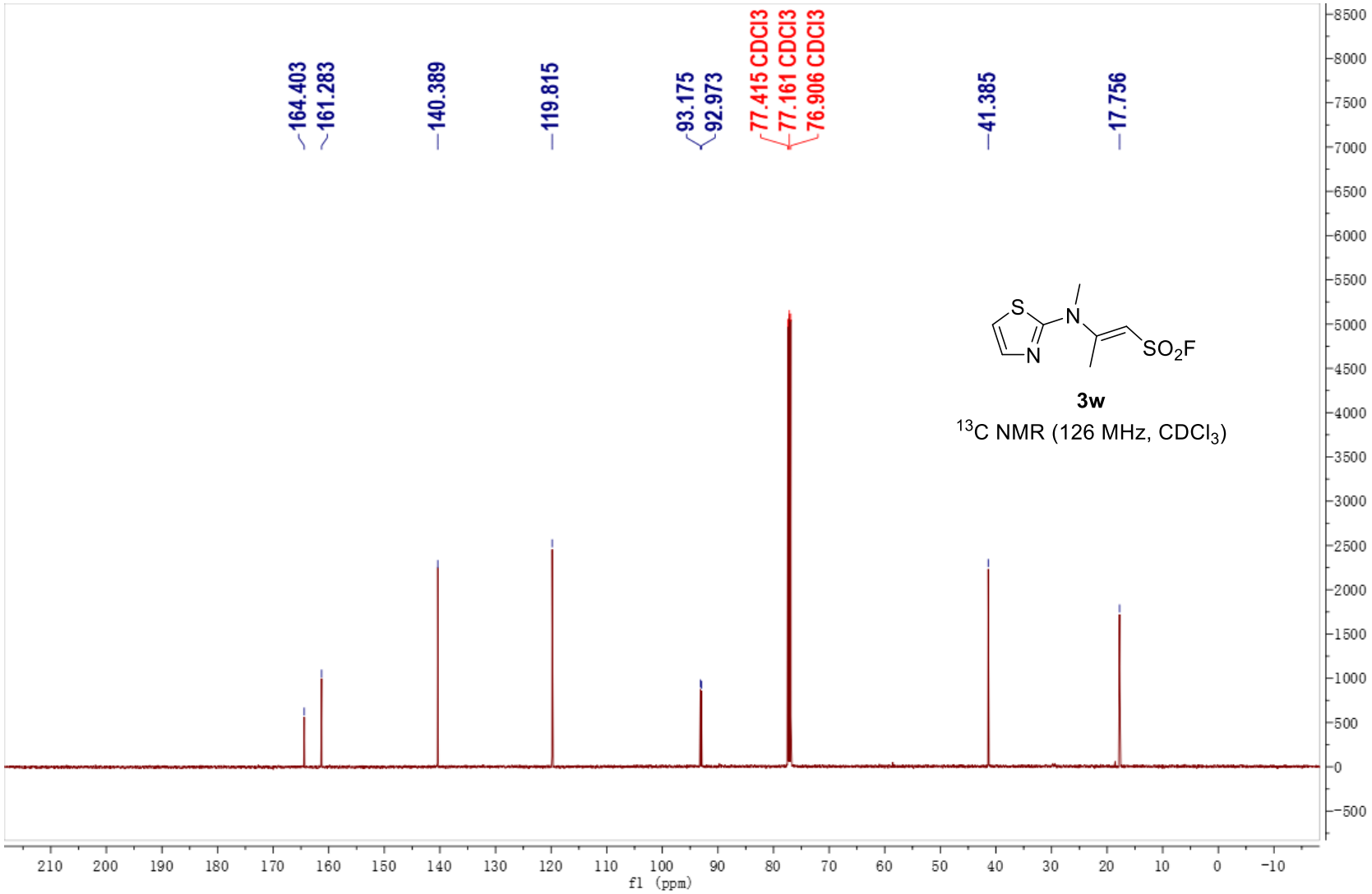

163.015
143.292
130.276
128.187
127.864
91.028
90.834
77.415 CDCl3
77.160 CDCl3
76.906 CDCl3
18.458
N
SO2F
3v
13C NMR (126 MHz, CDCl3)
f1 (ppm)

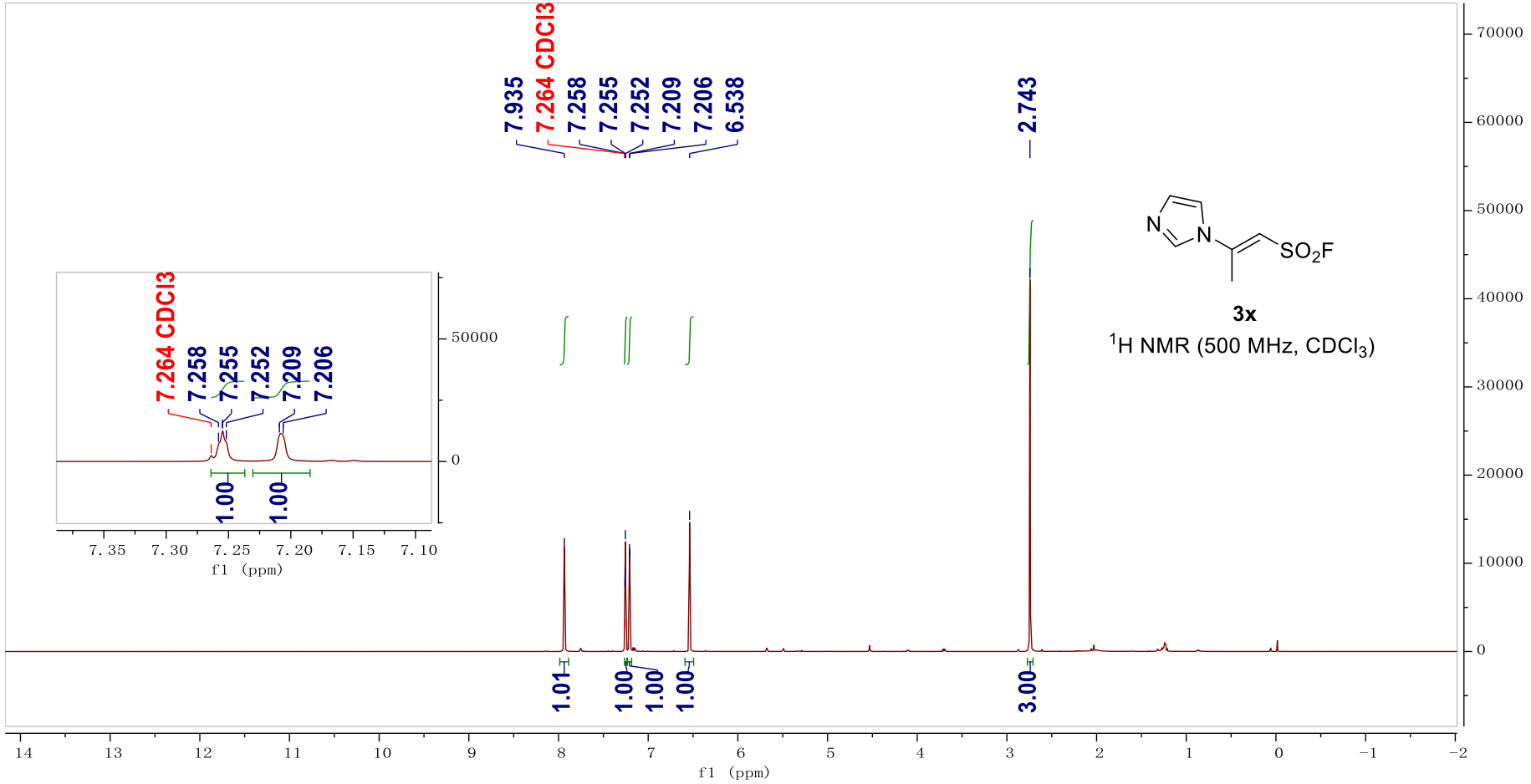

7.603
7.596
7.311
7.304
7.264 CDCl3
5.569
3.370
2.357
1.00
1.00
1.01
2.99
2.99
f1 (ppm)
3w
1H NMR (500 MHz, CDCl3)
SO2F

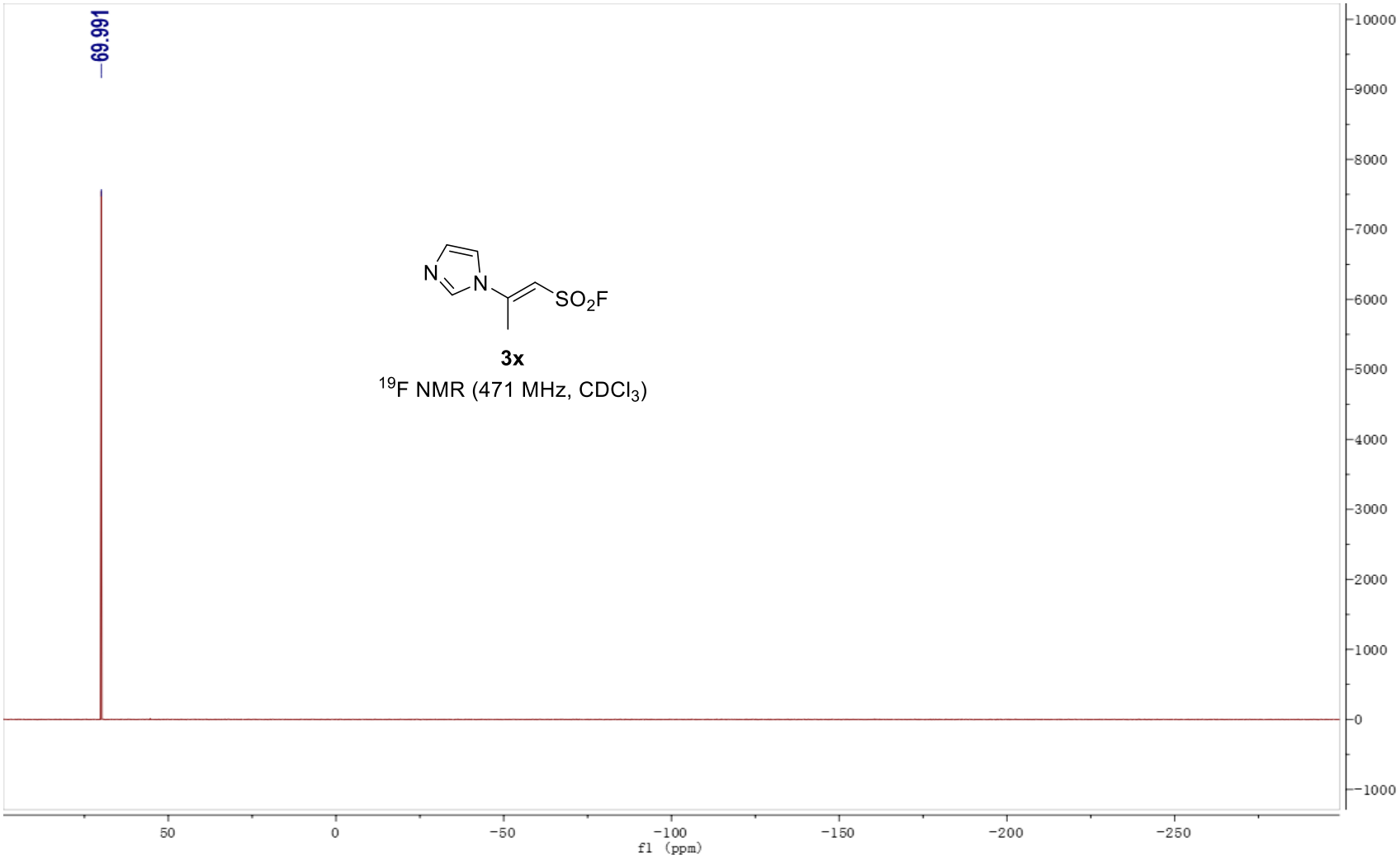


3w

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

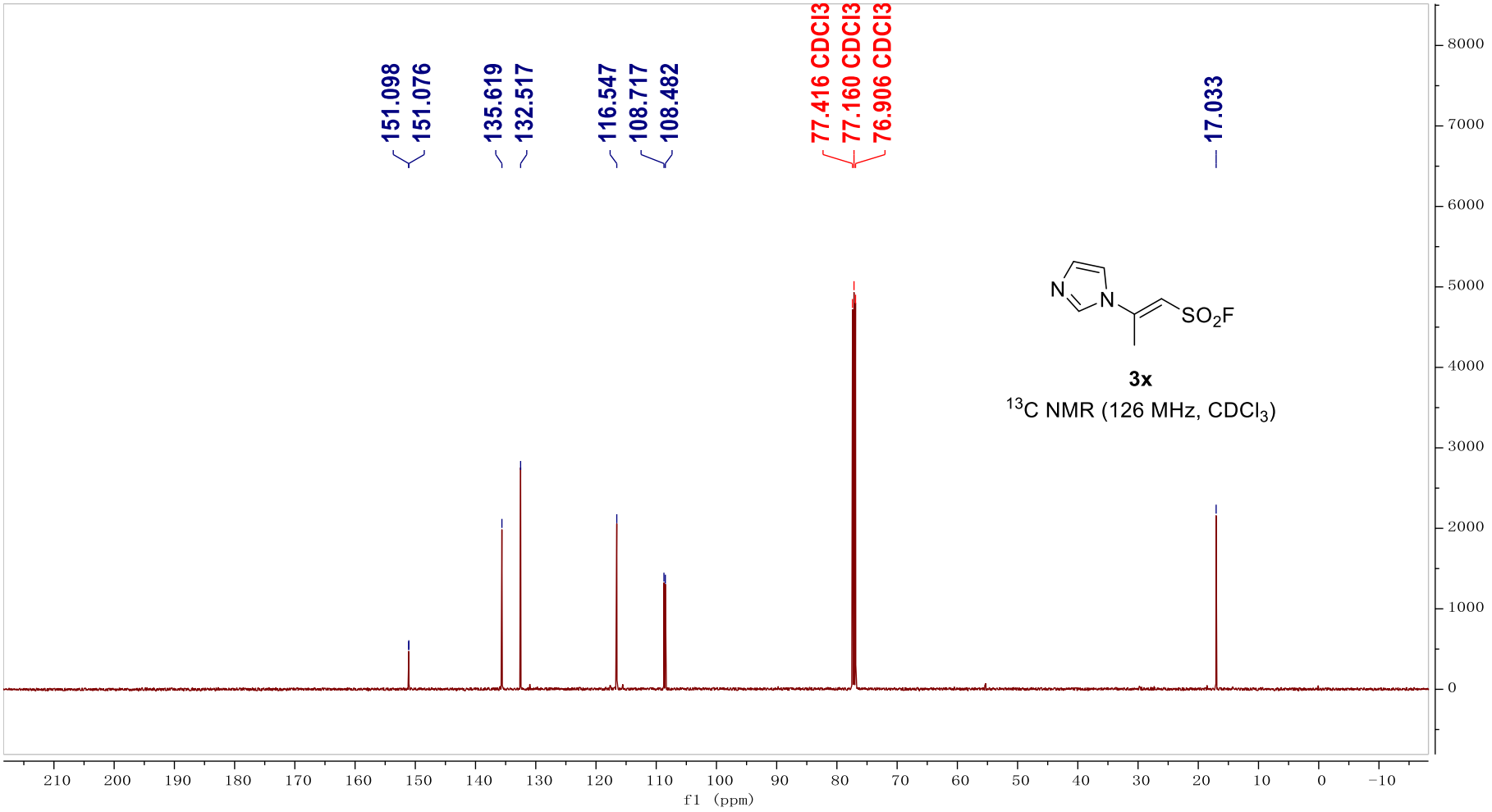

164.403
161.283
140.389
119.815
93.175
92.973
77.415 CDCl3
77.161 CDCl3
76.906 CDCl3
41.385
17.756
S
N
N
SO2F
3w
13C NMR (126 MHz, CDCl3)
f1 (ppm)

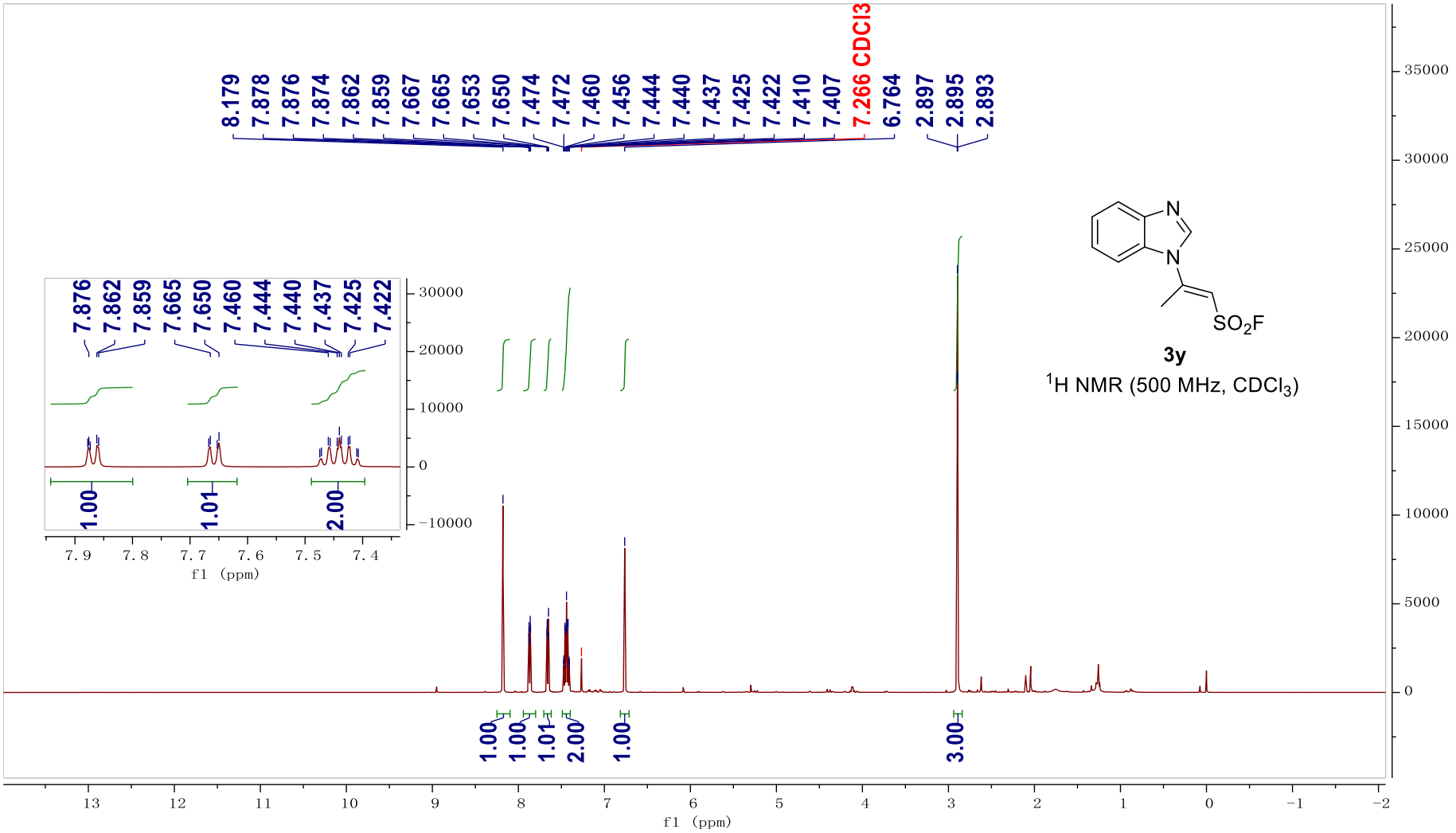

7.935
7.264 CDCl3
7.258
7.255
7.252
7.209
7.206
6.538
2.743
1.01
1.00
1.00
1.00
3.00
f1 (ppm)
7.264 CDCl3
7.258
7.255
7.252
7.209
7.206
1.00
1.00
7.35 7.30 7.25 7.20 7.15 7.10
f1 (ppm)
N
N
SO2F
3x
1H NMR (500 MHz, CDCl3)

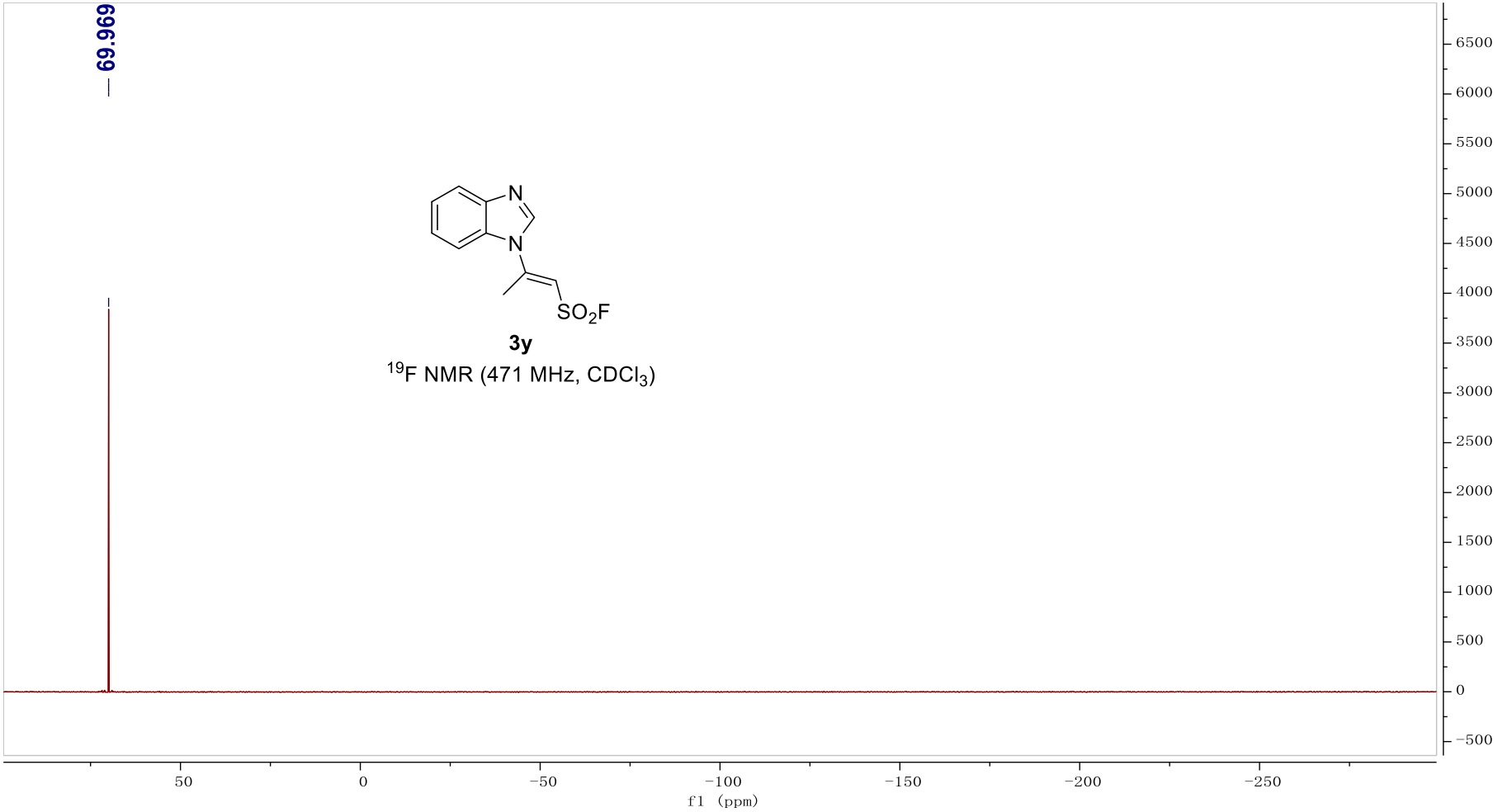


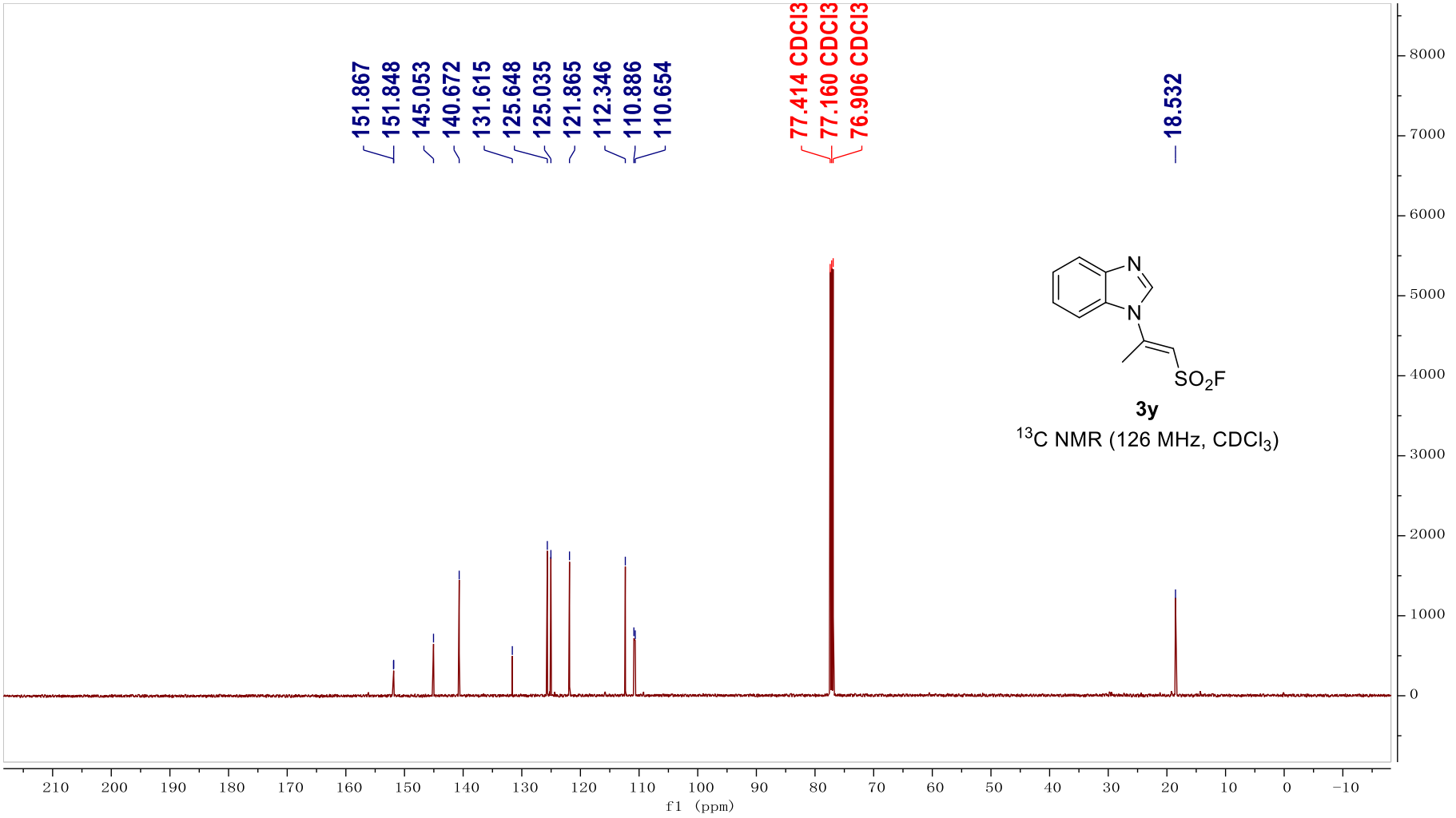
3x

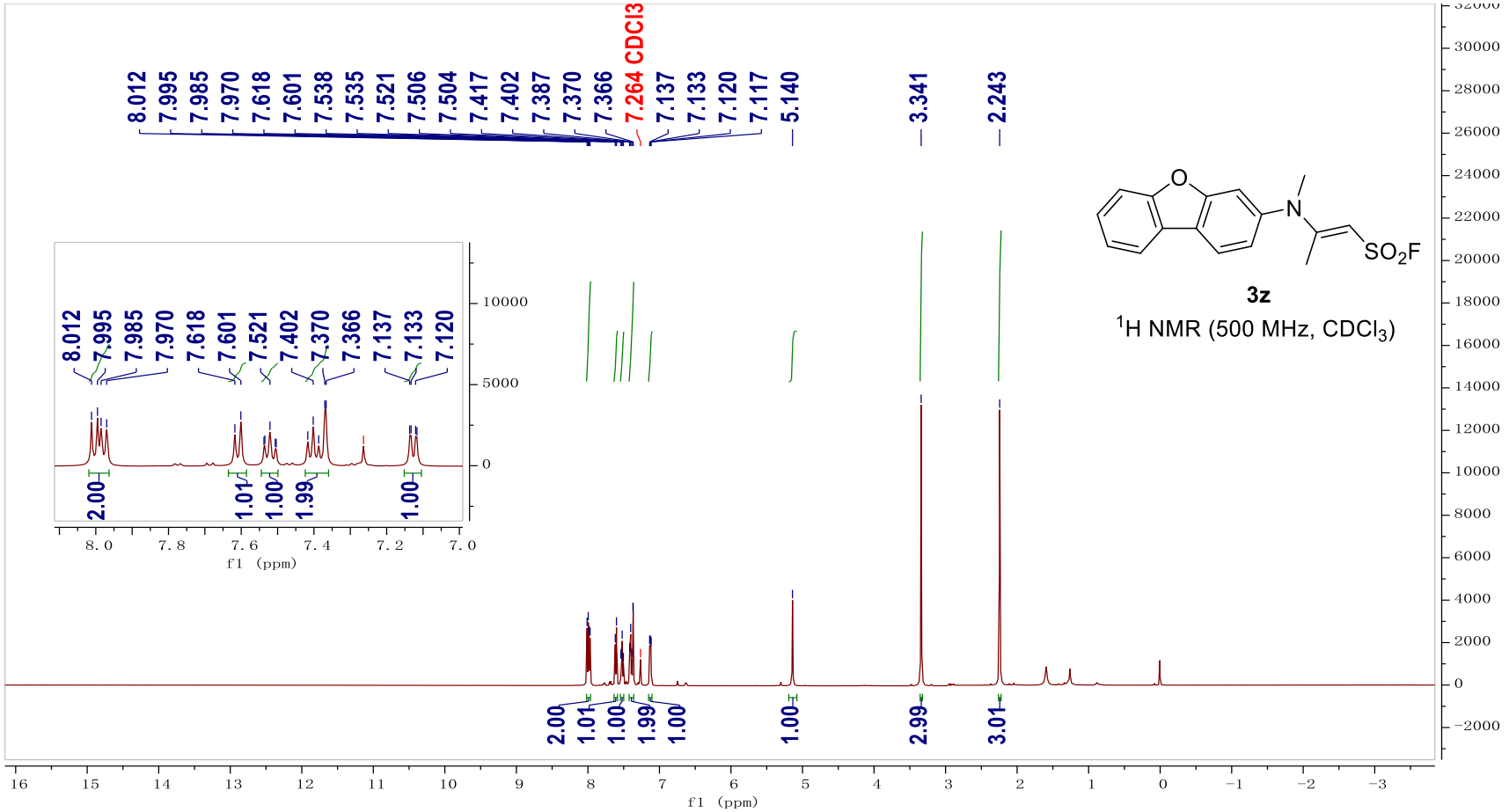
^{19}F NMR (471 MHz, $CDCl_3$)

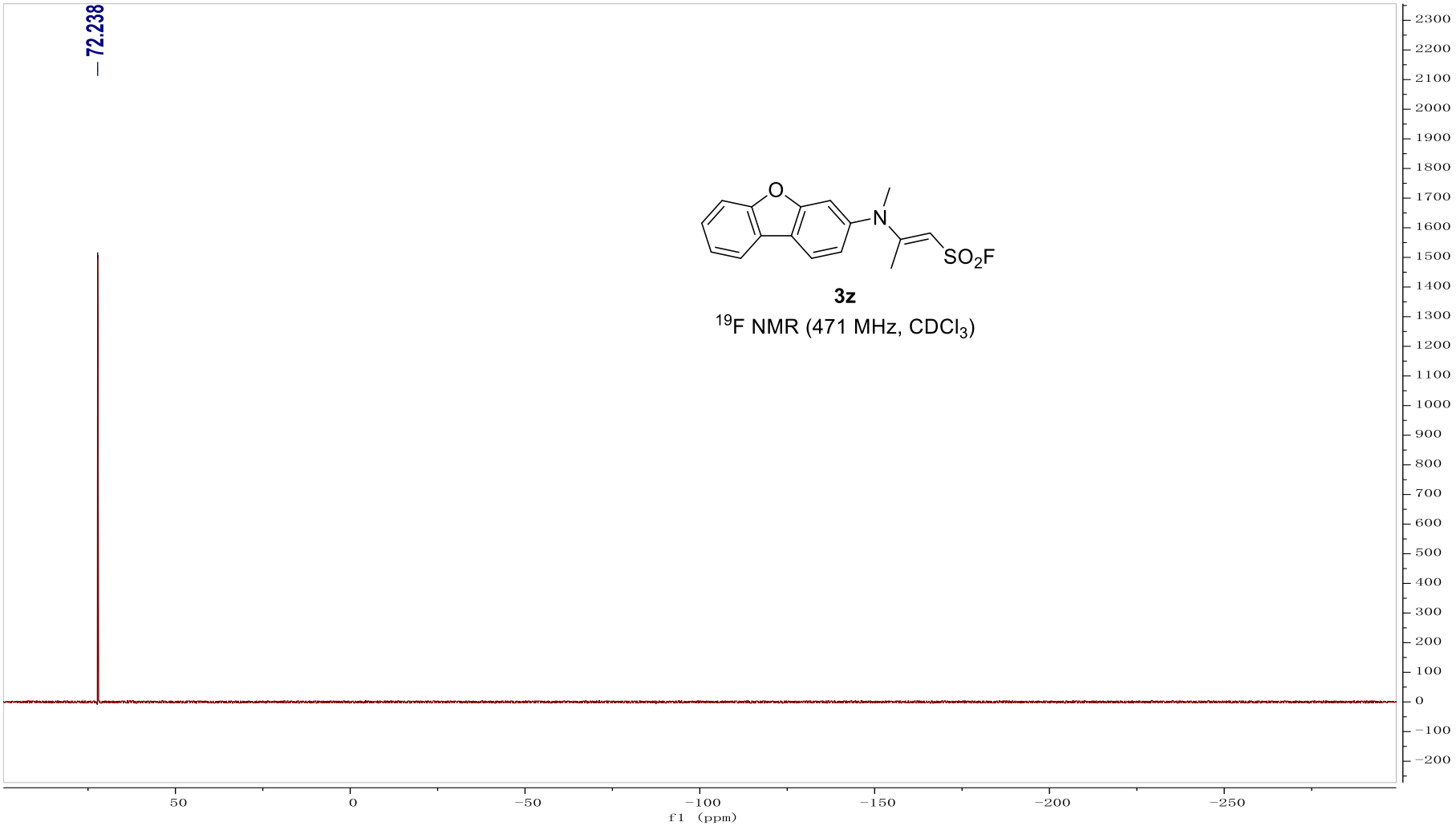

151.098
151.076
135.619
132.517
116.547
108.717
108.482
77.416 CDCl3
77.160 CDCl3
76.906 CDCl3
17.033
N
N
SO2F
3x
13C NMR (126 MHz, CDCl3)
f1 (ppm)

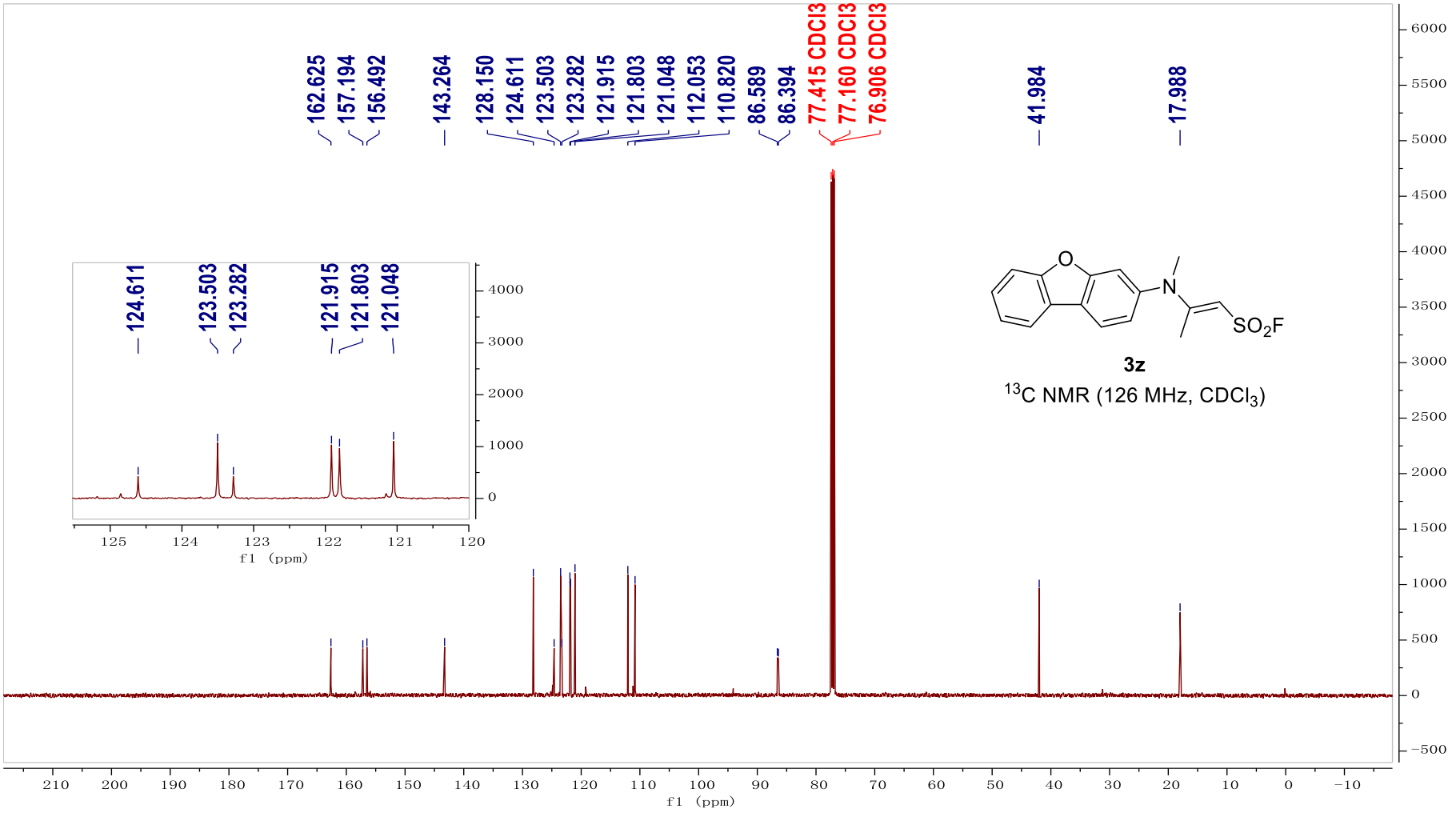

8.179
7.878
7.876
7.874
7.862
7.859
7.667
7.665
7.653
7.650
7.474
7.472
7.460
7.456
7.444
7.440
7.437
7.425
7.422
7.410
7.407
7.266 CDCl3
6.764
2.897
2.895
2.893
1.00
1.00
1.01
2.00
1.00
3.00
f1 (ppm)
3y
1H NMR (500 MHz, CDCl3)
SO2F

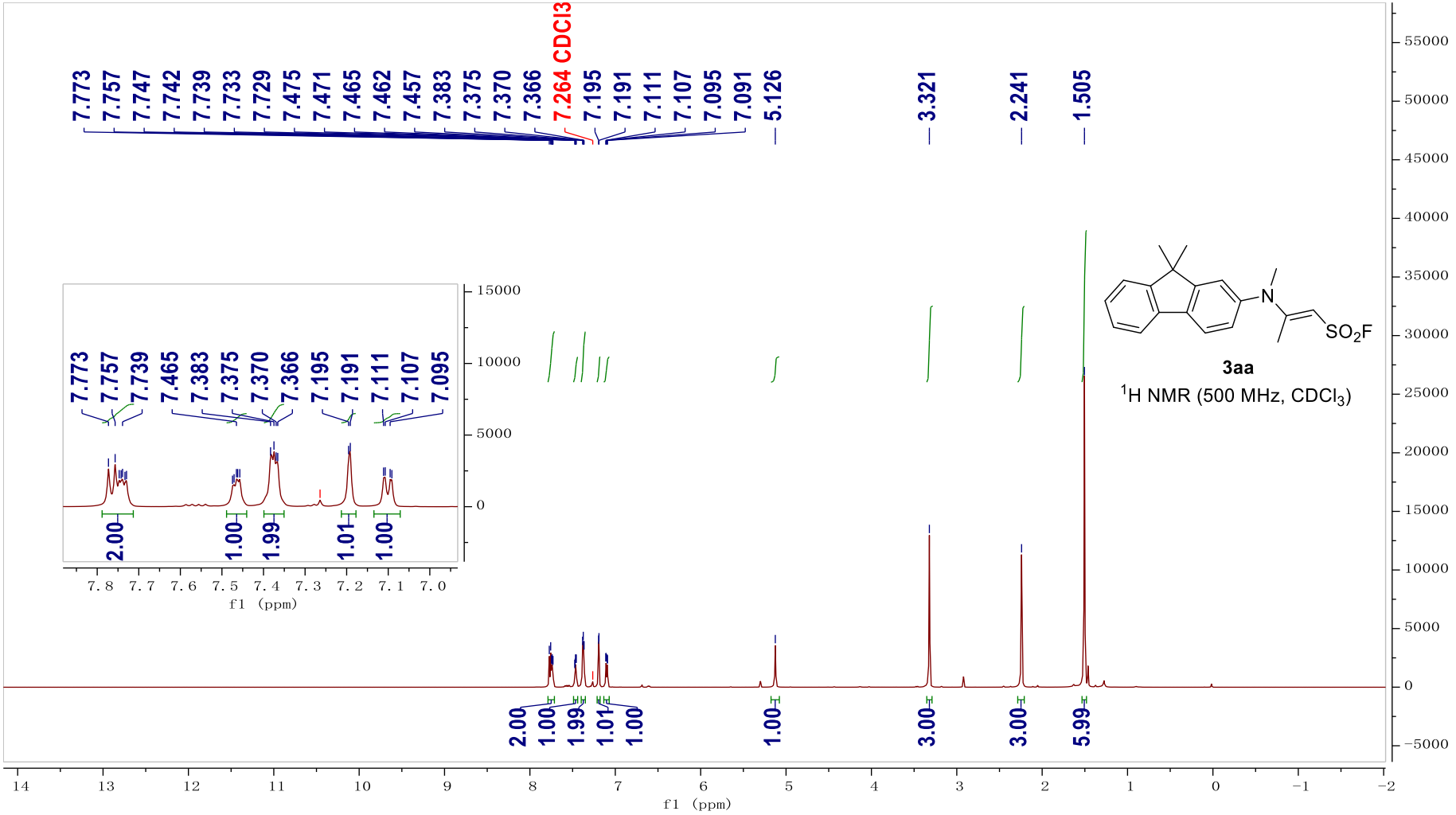

69.969
N
N
SO2F
3y
19F NMR (471 MHz, CDCl3)
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
−500
50
0
−50
−100
−150
−200
−250
f1 (ppm)

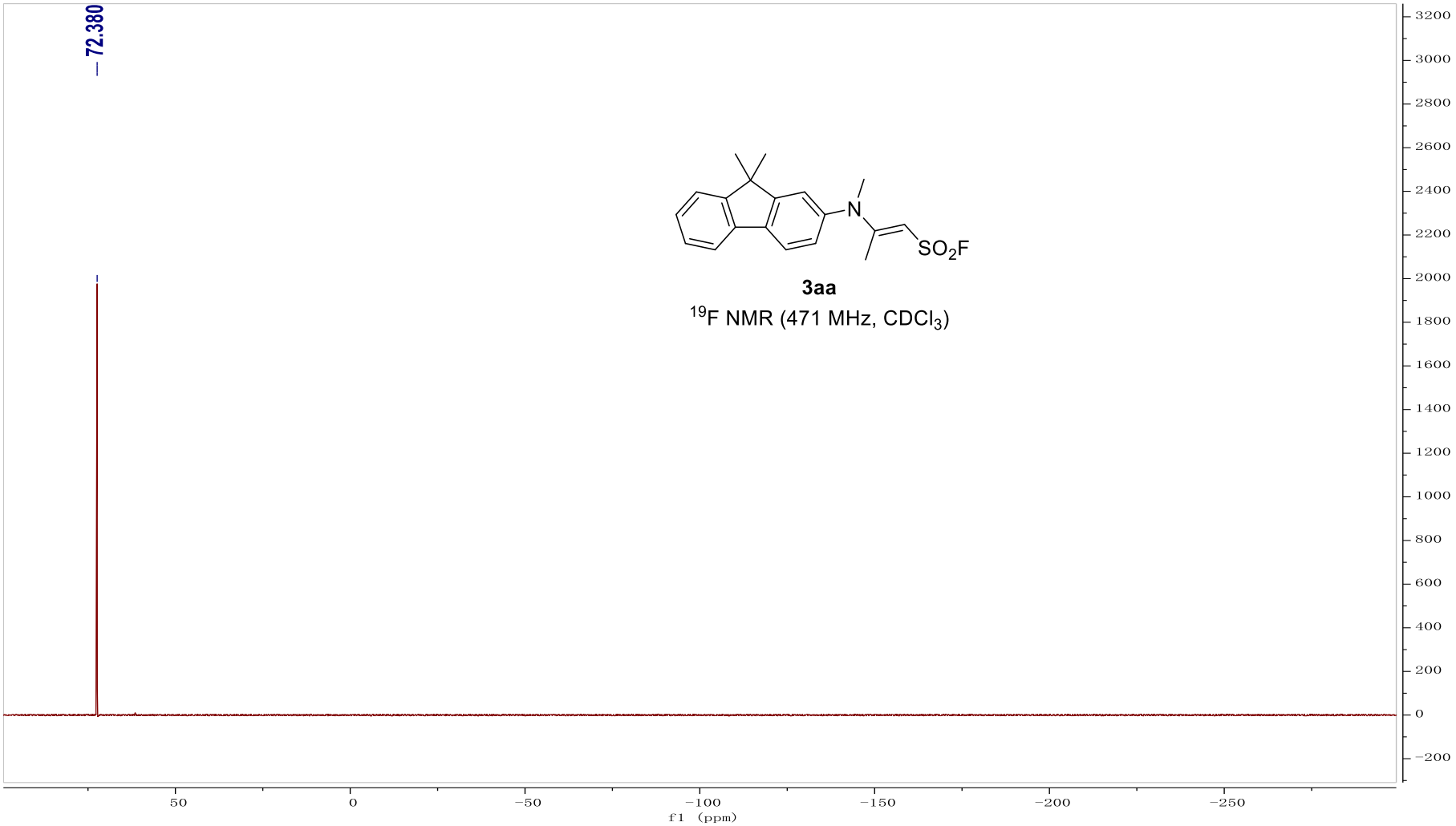

151.867
151.848
145.053
140.672
131.615
125.648
125.035
121.865
112.346
110.886
110.654
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
18.532
N
N
SO2F
3y
13C NMR (126 MHz, CDCl3)
f1 (ppm)


8.012
7.995
7.985
7.970
7.618
7.601
7.538
7.535
7.521
7.506
7.504
7.417
7.402
7.387
7.370
7.366
7.264 CDCl3
7.137
7.133
7.120
7.117
5.140
3.341
2.243
2.00
1.01
1.00
1.99
1.00
1.00
2.99
3.01
f1 (ppm)
O
N
SO2F
3z
1H NMR (500 MHz, CDCl3)


72.238
O
N
SO2F
3z
19F NMR (471 MHz, CDCl3)
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
−100
−200
50
0
−50
−100
−150
−200
−250
f1 (ppm)

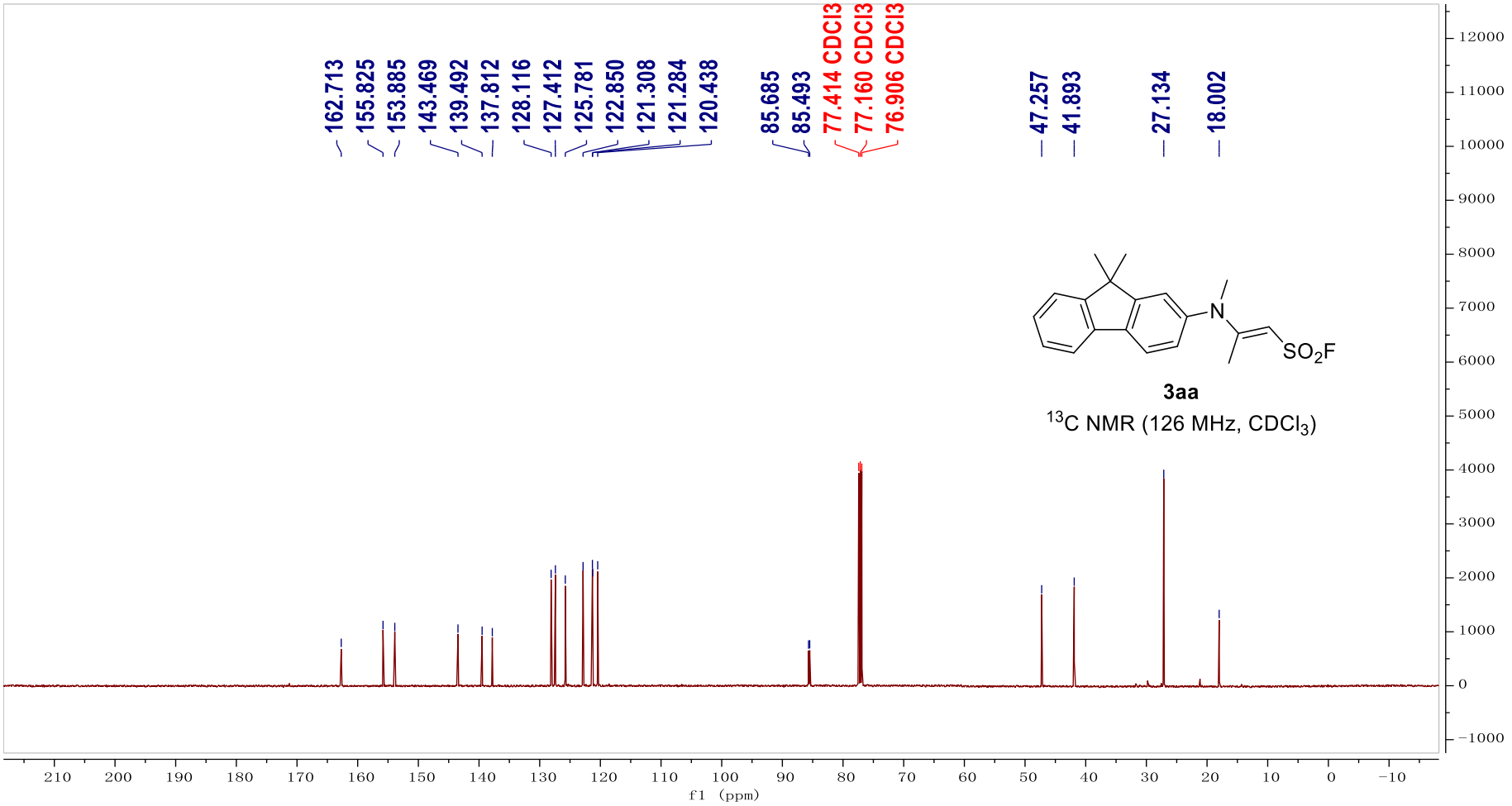

162.625
157.194
156.492
143.264
128.150
124.611
123.503
123.282
121.915
121.803
121.048
112.053
110.820
86.589
86.394
77.415 CDCl3
77.160 CDCl3
76.906 CDCl3
41.984
17.988
O
N
SO2F
3z
13C NMR (126 MHz, CDCl3)
f1 (ppm)

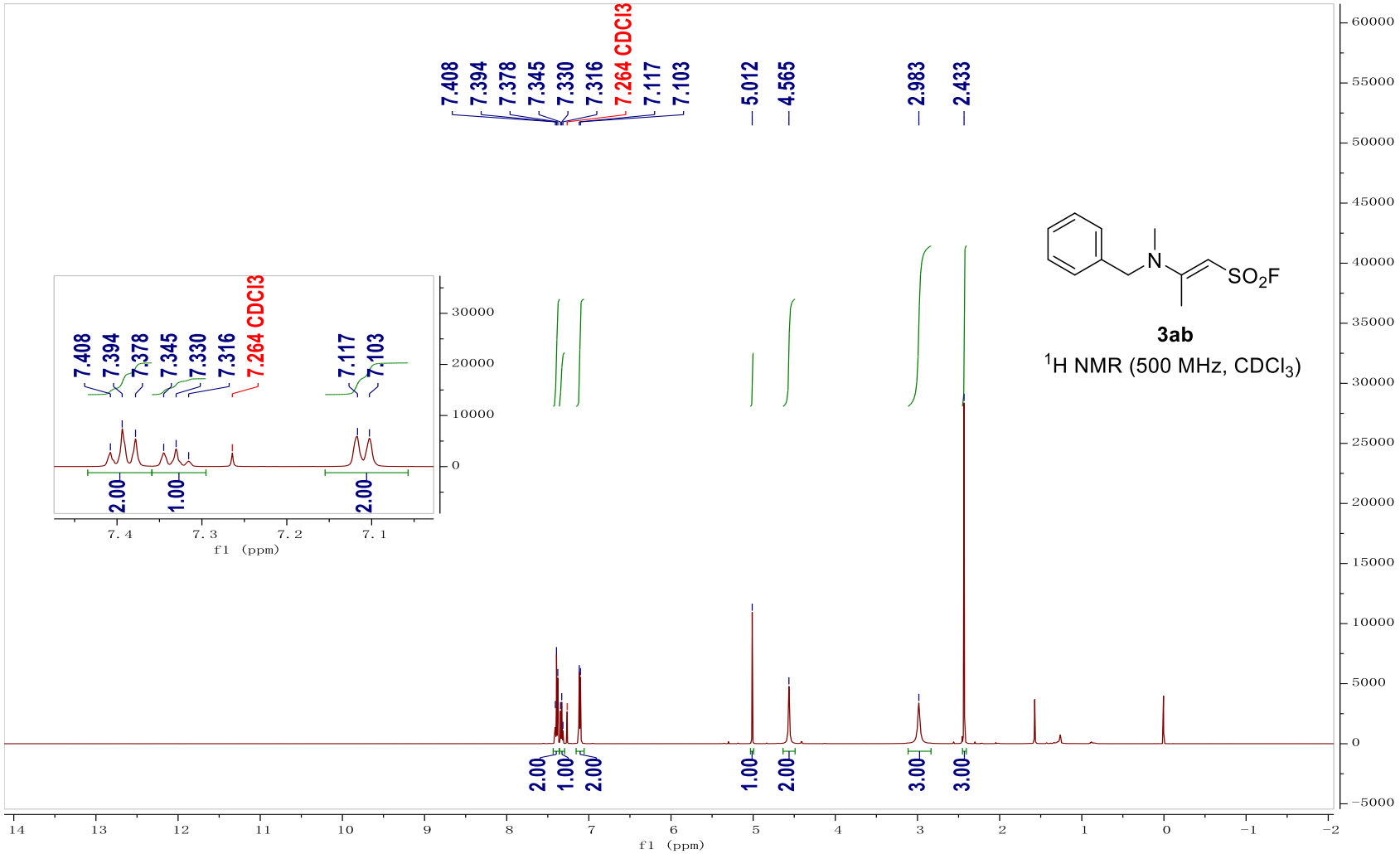

7.773
7.757
7.747
7.742
7.739
7.733
7.729
7.475
7.471
7.465
7.462
7.457
7.383
7.375
7.370
7.366
7.264 CDCl3
7.195
7.191
7.111
7.107
7.095
7.091
5.126
3.321
2.241
1.505
2.00
1.00
1.99
1.01
1.00
1.00
3.00
3.00
5.99
f1 (ppm)
3aa
1H NMR (500 MHz, CDCl3)
SO2F
N

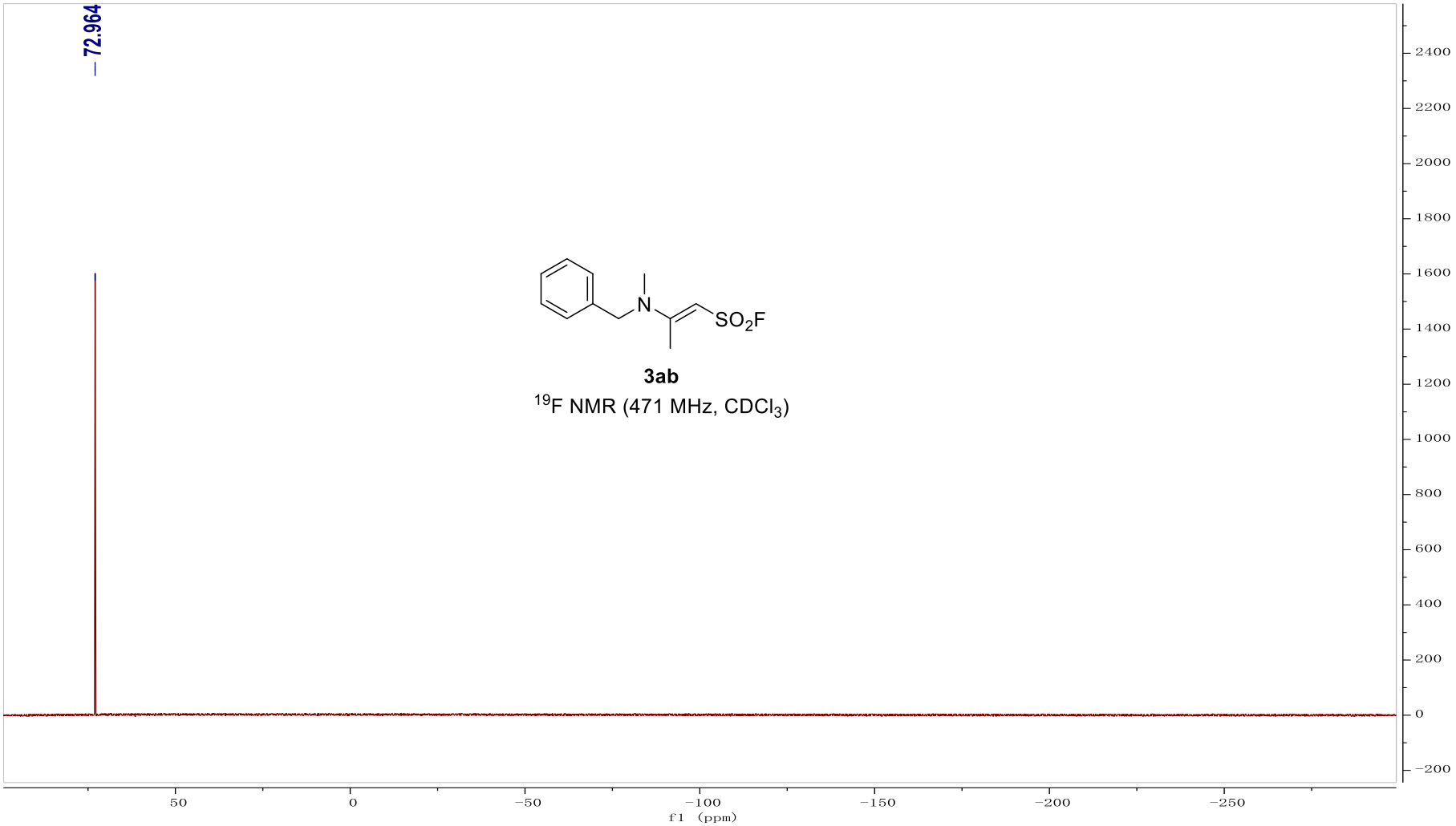


3aa

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

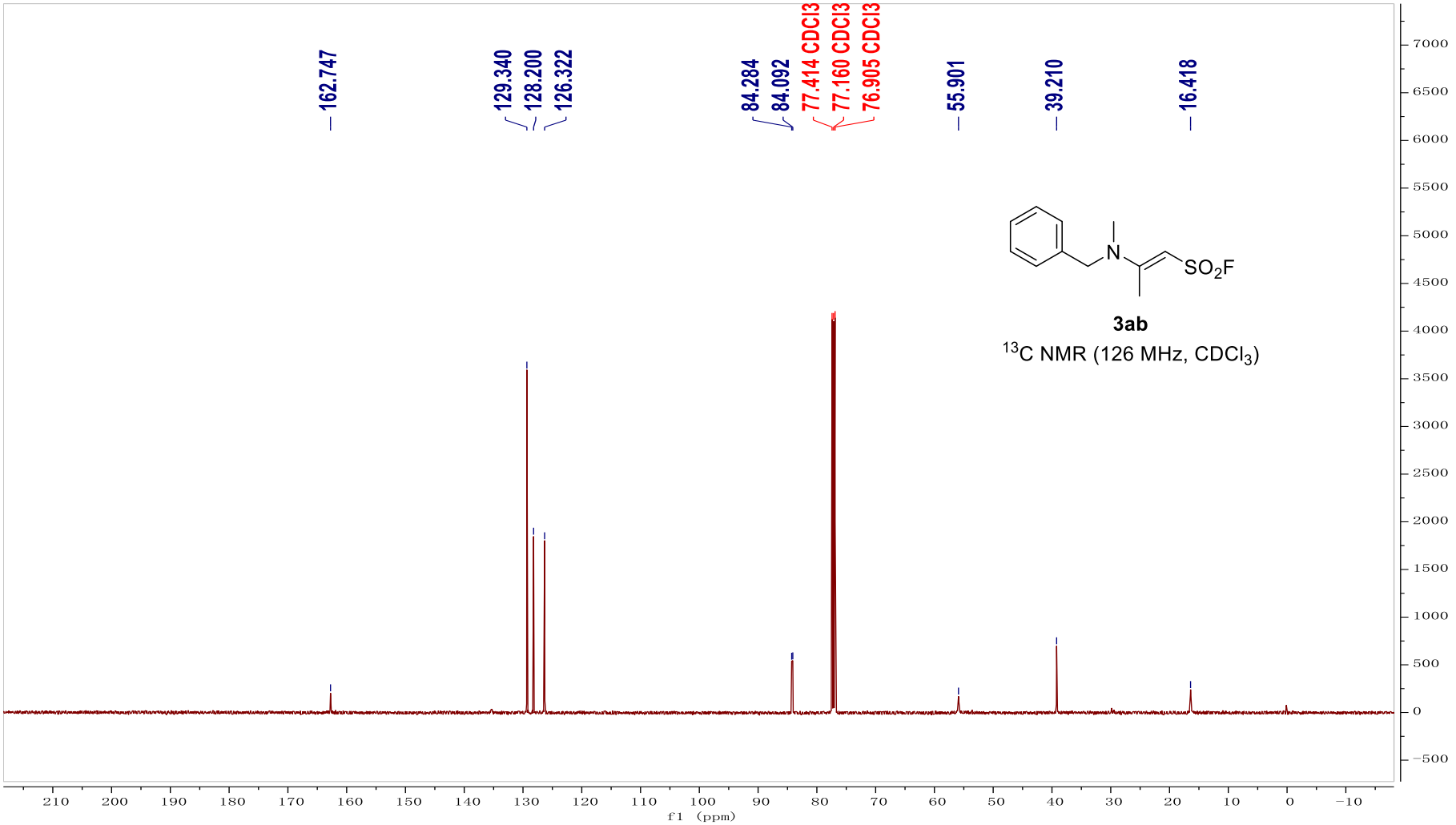

162.713
155.825
153.885
143.469
139.492
137.812
128.116
127.412
125.781
122.850
121.308
121.284
120.438
85.685
85.493
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
47.257
41.893
27.134
18.002
N
SO2F
3aa
13C NMR (126 MHz, CDCl3)
f1 (ppm)

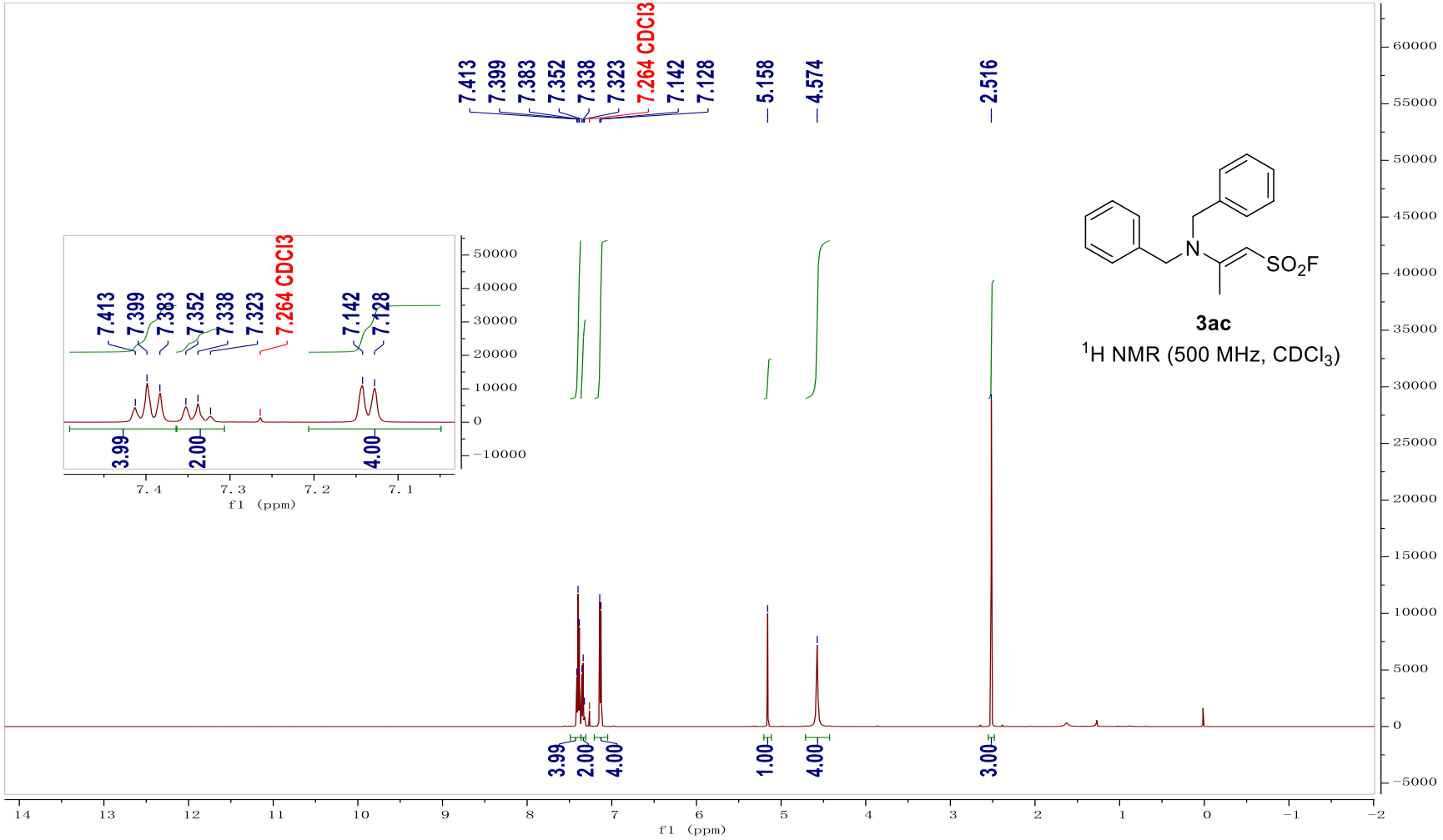

7.408
7.394
7.378
7.345
7.330
7.316
7.264 CDCl3
7.117
7.103
5.012
4.565
2.983
2.433
2.00
1.00
2.00
1.00
2.00
3.00
3.00
f1 (ppm)
SO2F
N
3ab
1H NMR (500 MHz, CDCl3)

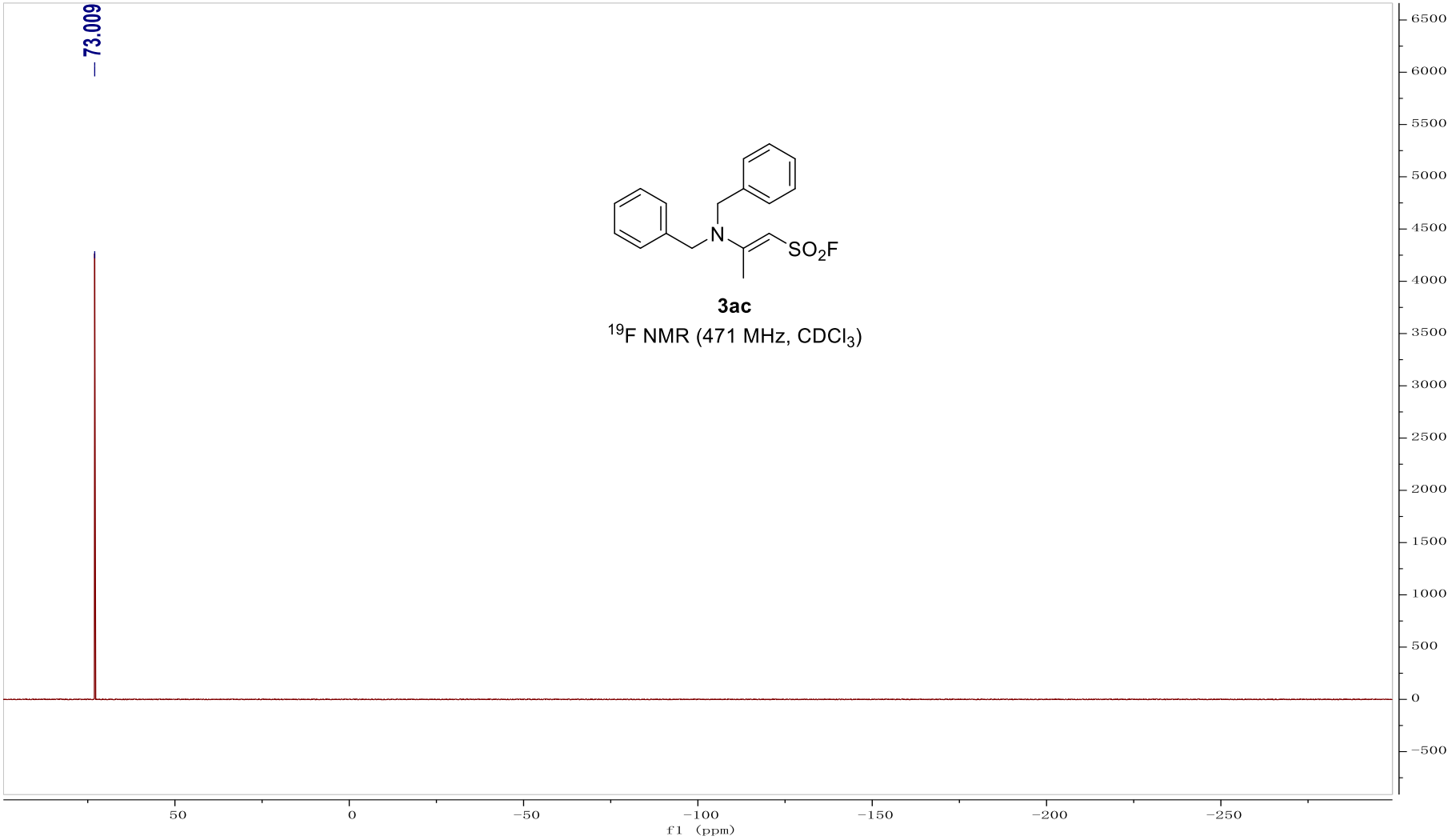


3ab

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

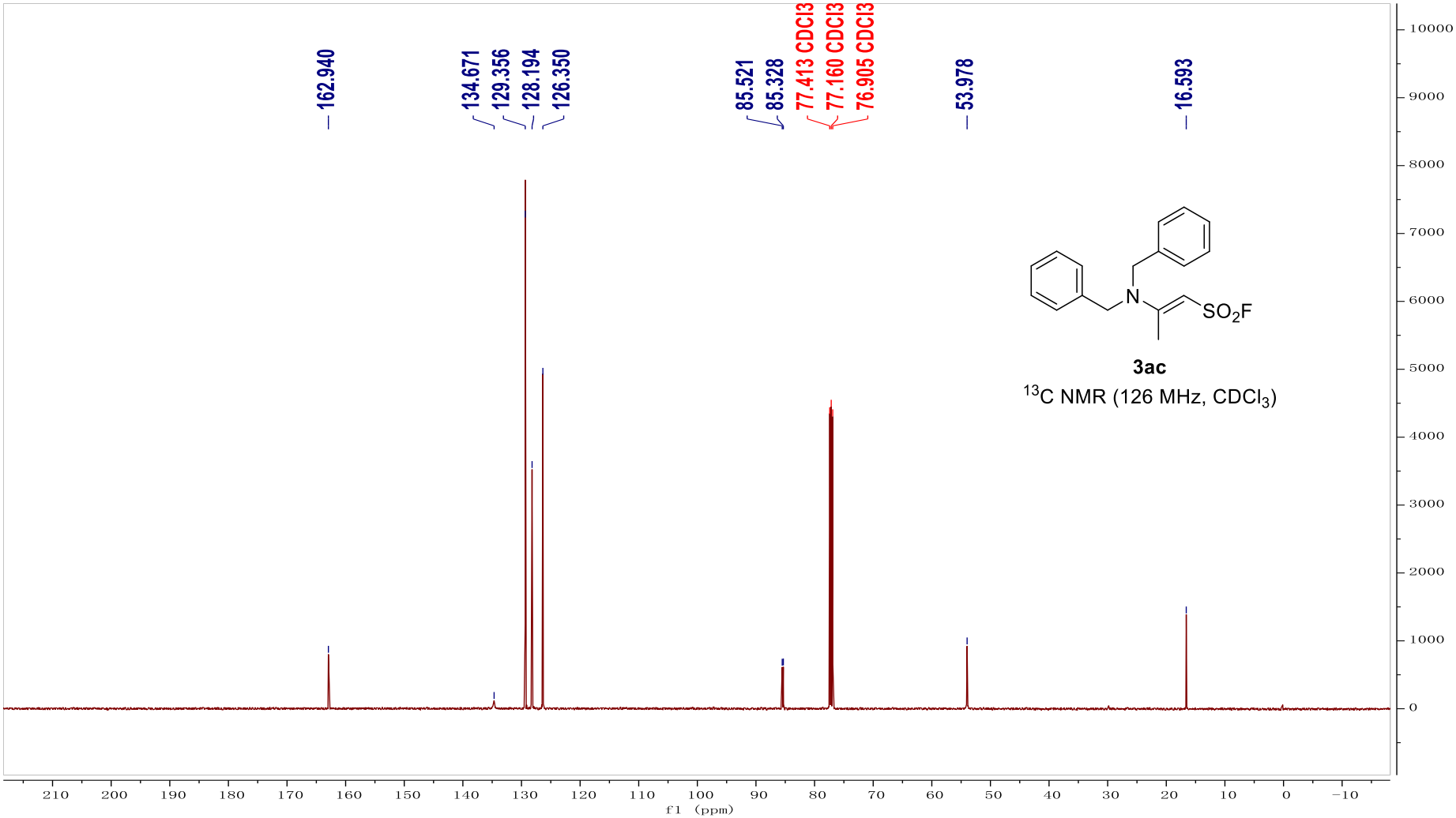

162.747
129.340
128.200
126.322
84.284
84.092
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
55.901
39.210
16.418
N
SO2F
3ab
13C NMR (126 MHz, CDCl3)
f1 (ppm)

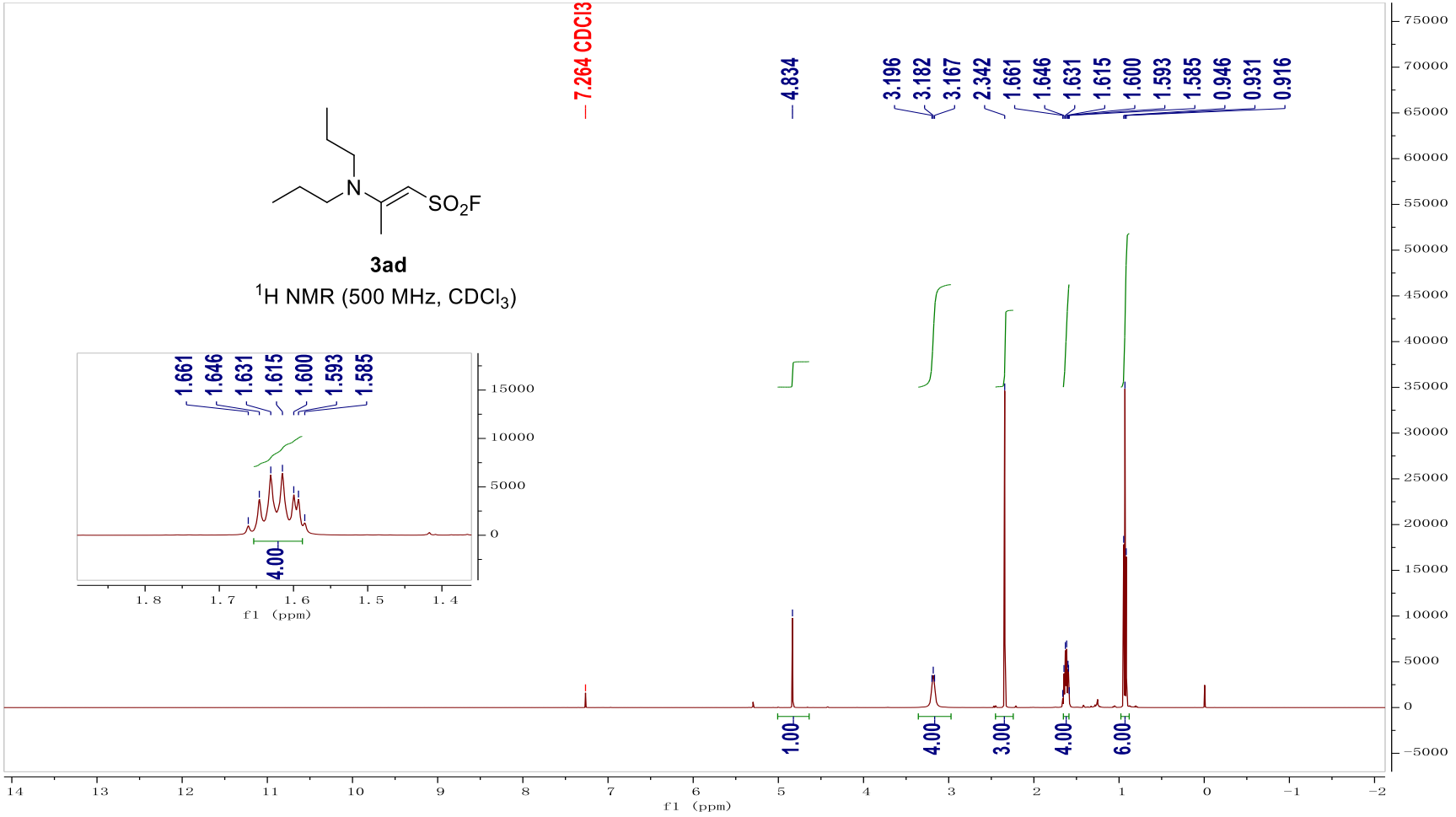

7.413
7.399
7.383
7.352
7.338
7.323
7.264 CDCl3
7.142
7.128
5.158
4.574
2.516
3.99
2.00
4.00
1.00
4.00
3.00
f1 (ppm)
N
SO2F
3ac
1H NMR (500 MHz, CDCl3)

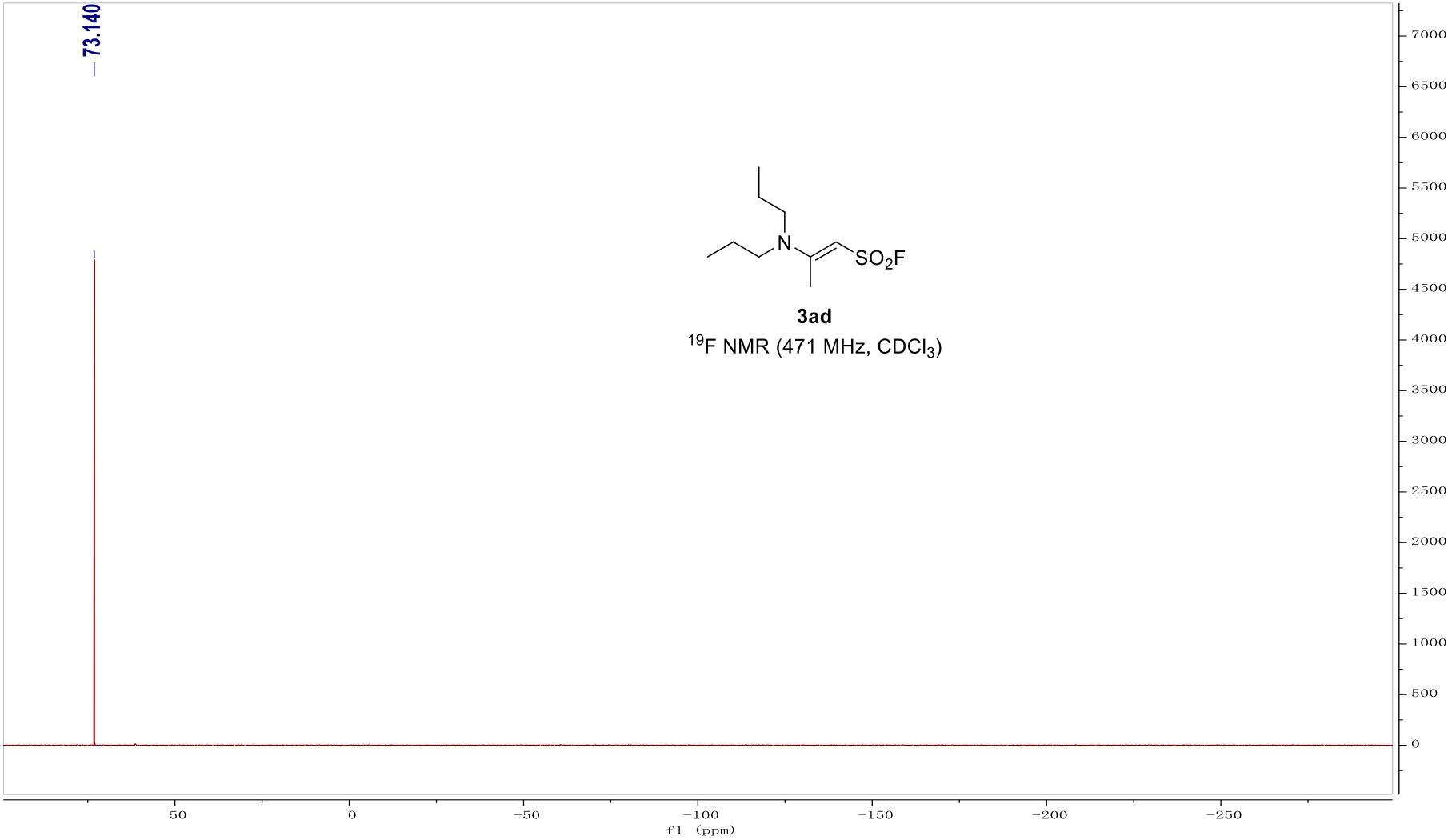


3ac

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

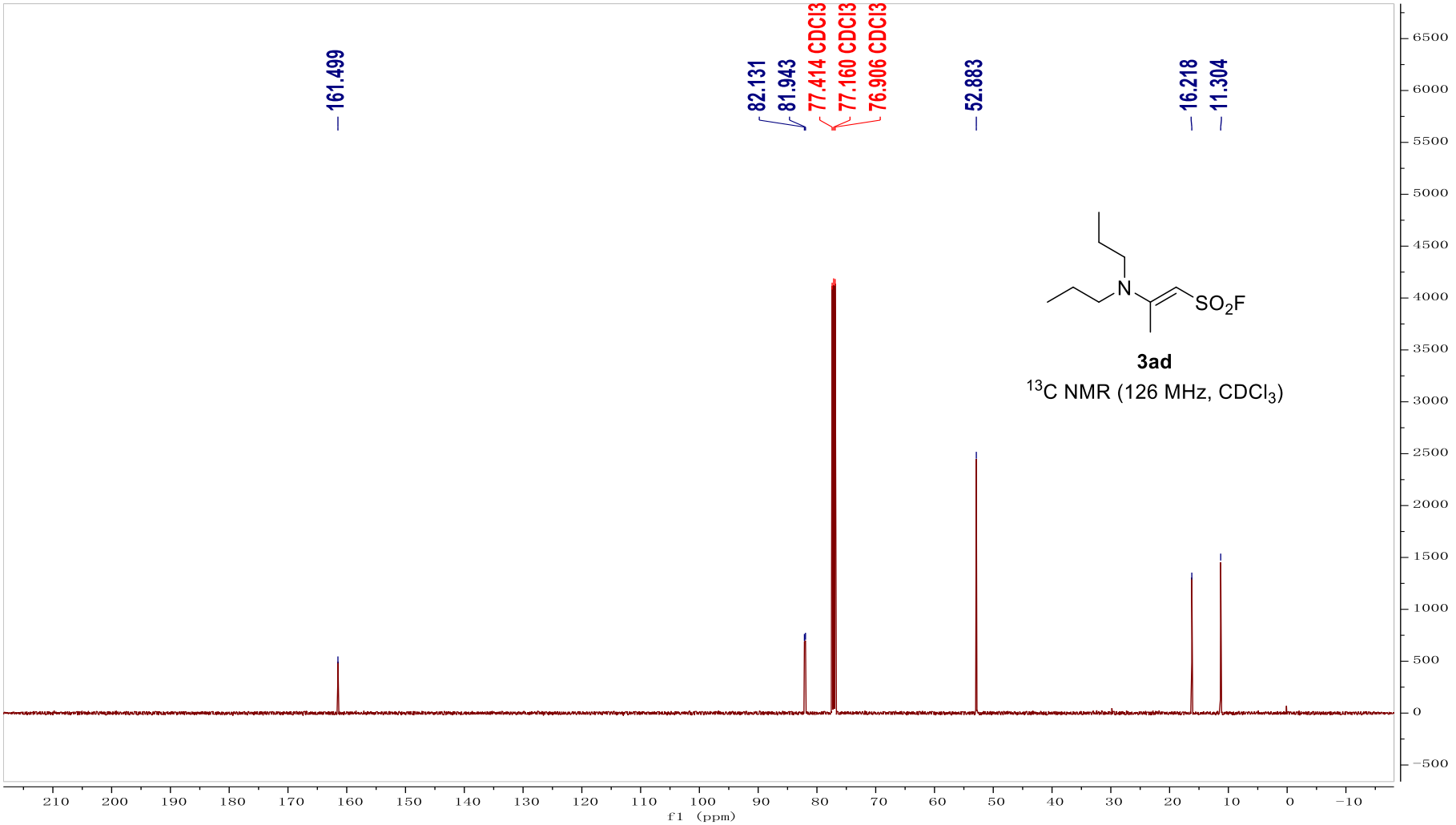

162.940
134.671
129.356
128.194
126.350
85.521
85.328
77.413 CDCl3
77.160 CDCl3
76.905 CDCl3
53.978
16.593
N
SO2F
3ac
13C NMR (126 MHz, CDCl3)
f1 (ppm)

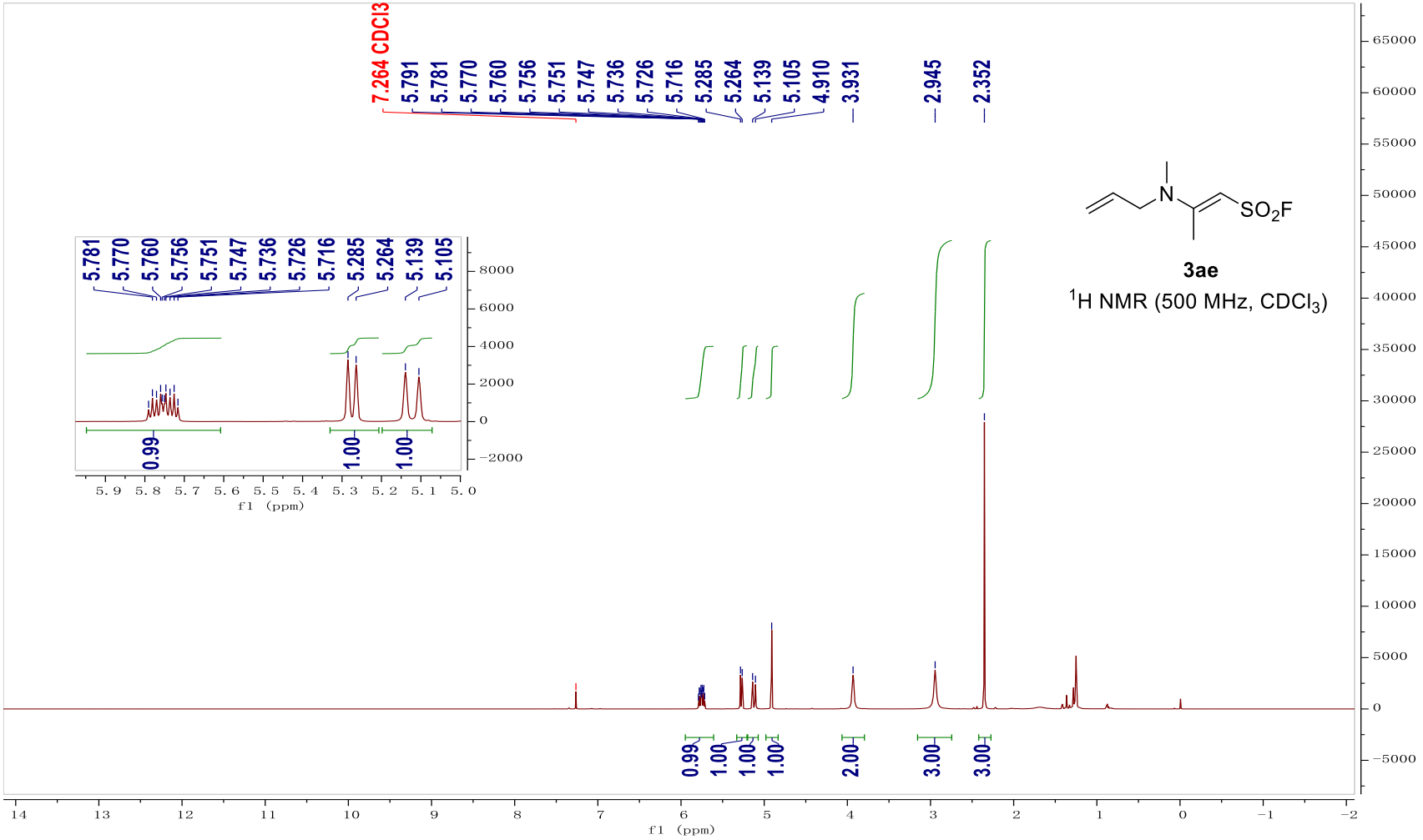

7.264 CDCl3
4.834
3.196
3.182
3.167
2.342
1.661
1.646
1.631
1.615
1.600
1.593
1.585
0.946
0.931
0.916
1.00
4.00
3.00
4.00
6.00
f1 (ppm)
SO2F
N
3ad
1H NMR (500 MHz, CDCl3)
4.00
f1 (ppm)

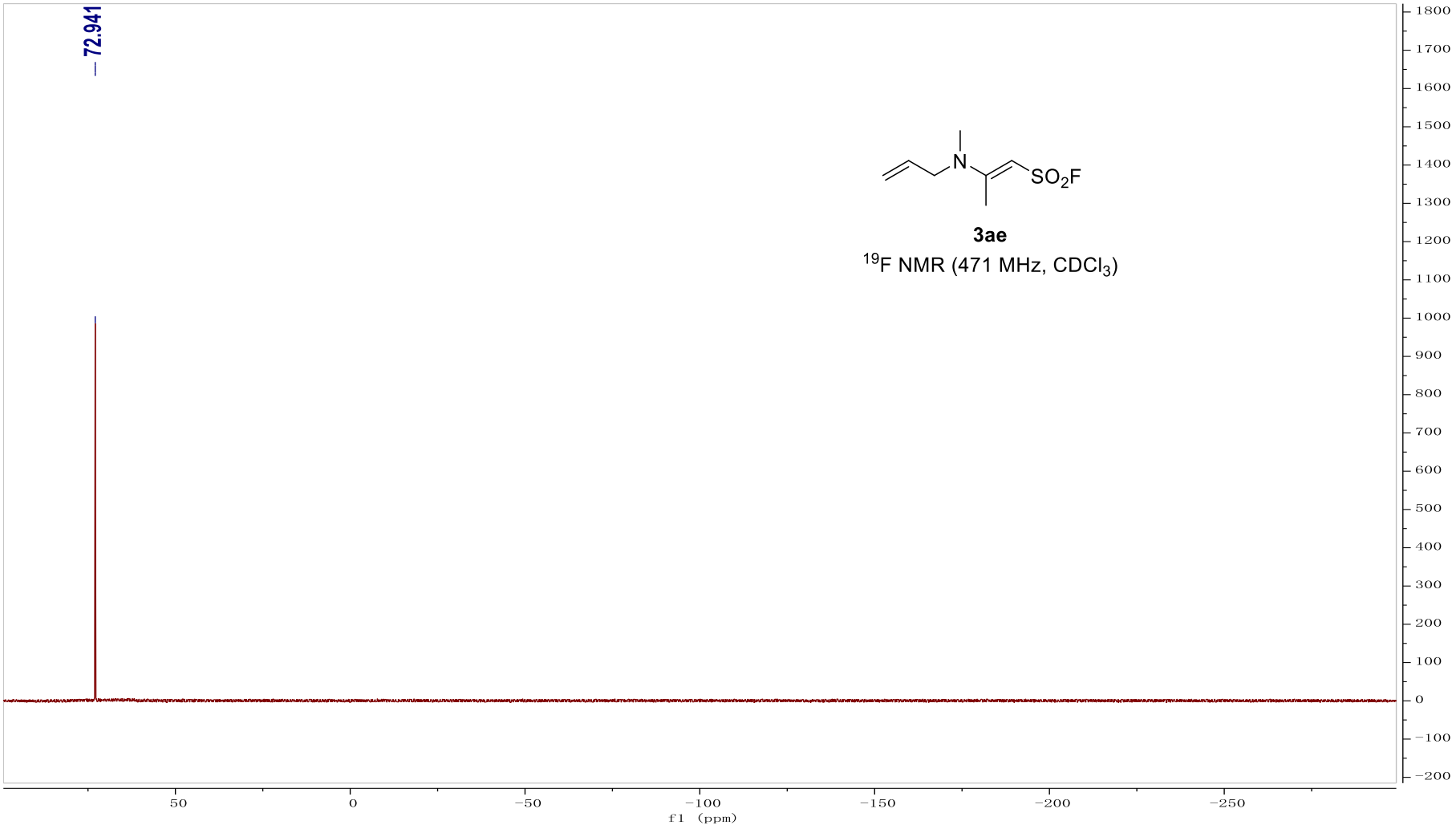


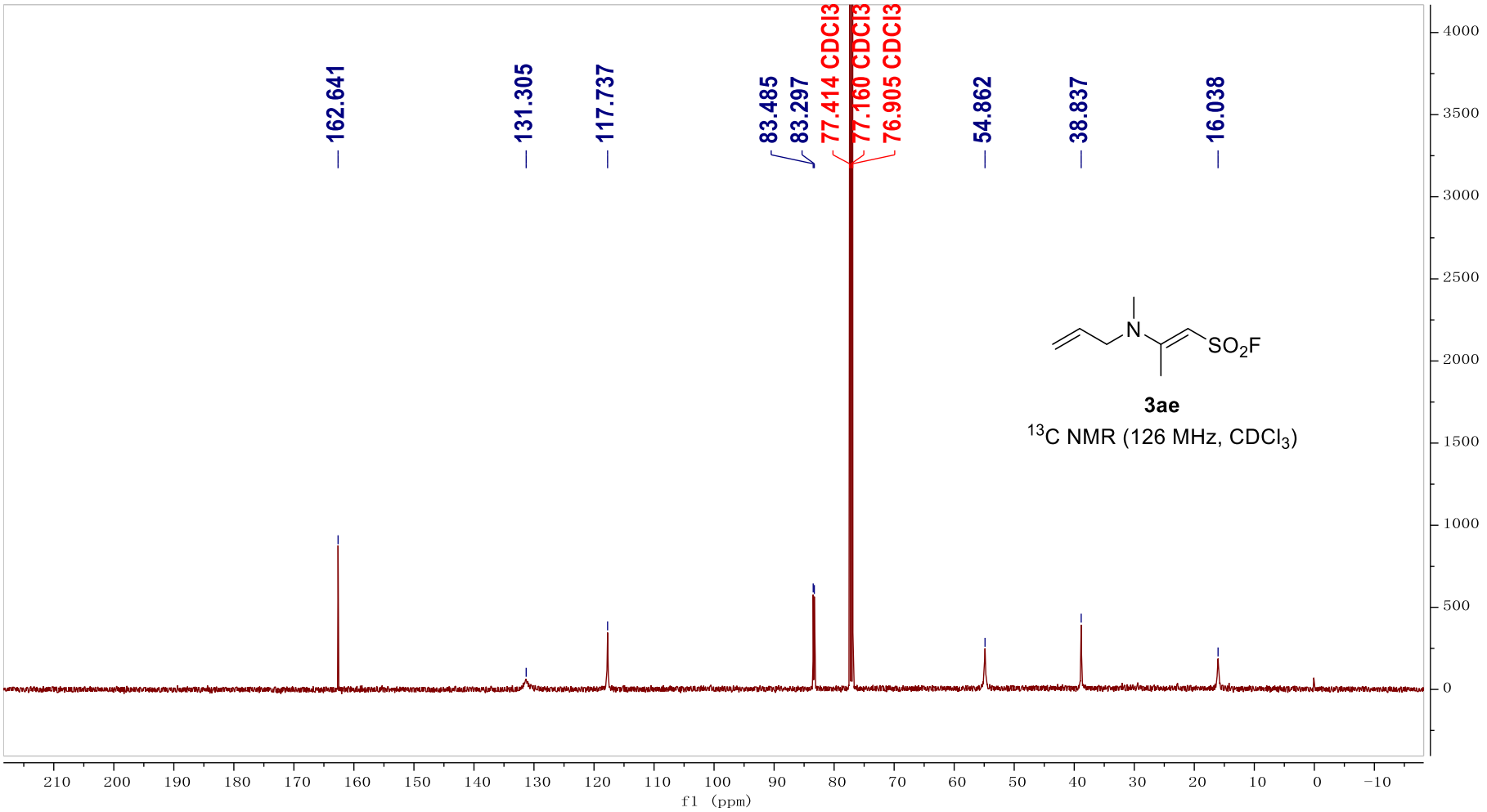
3ad

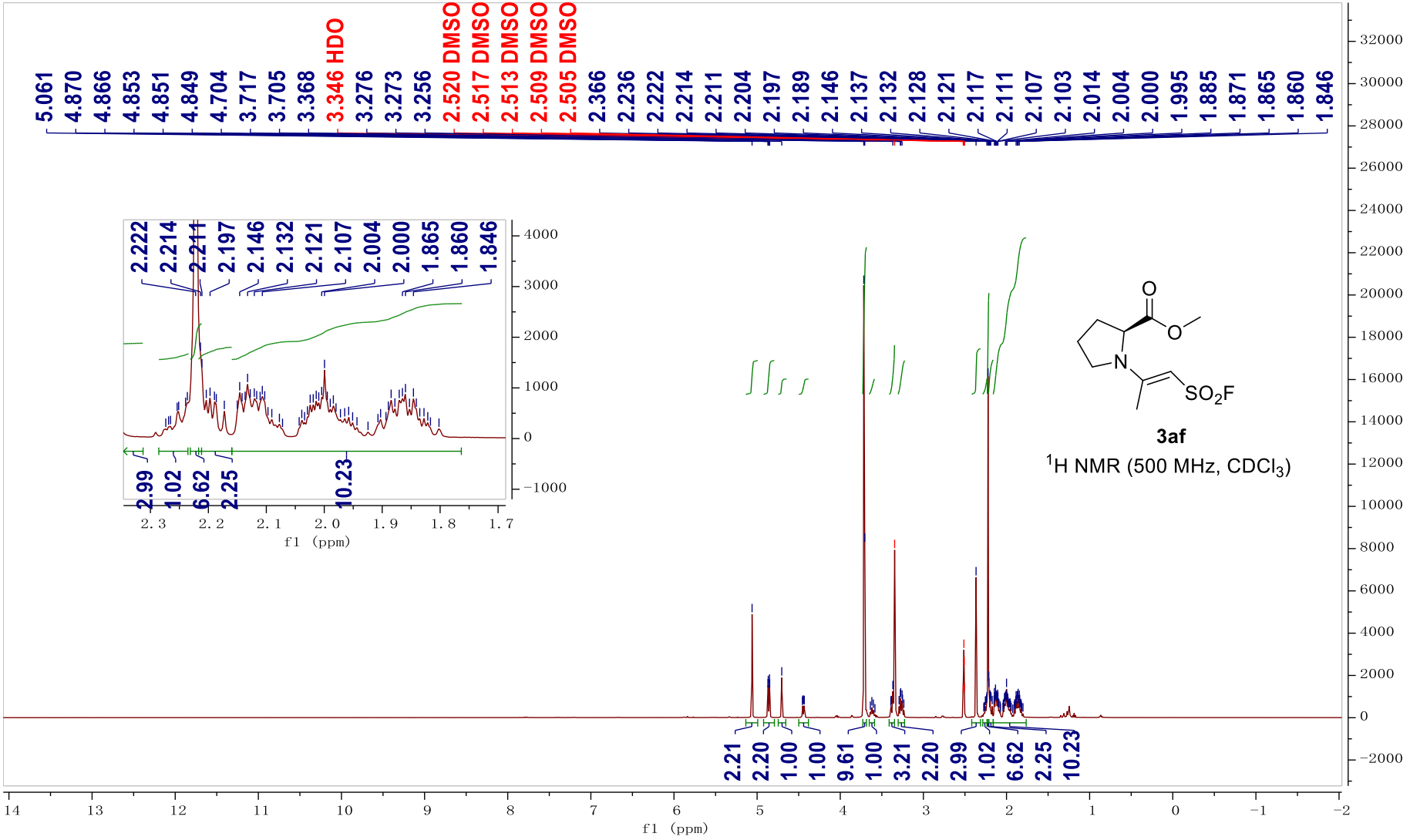
^{19}F NMR (471 MHz, $CDCl_3$)

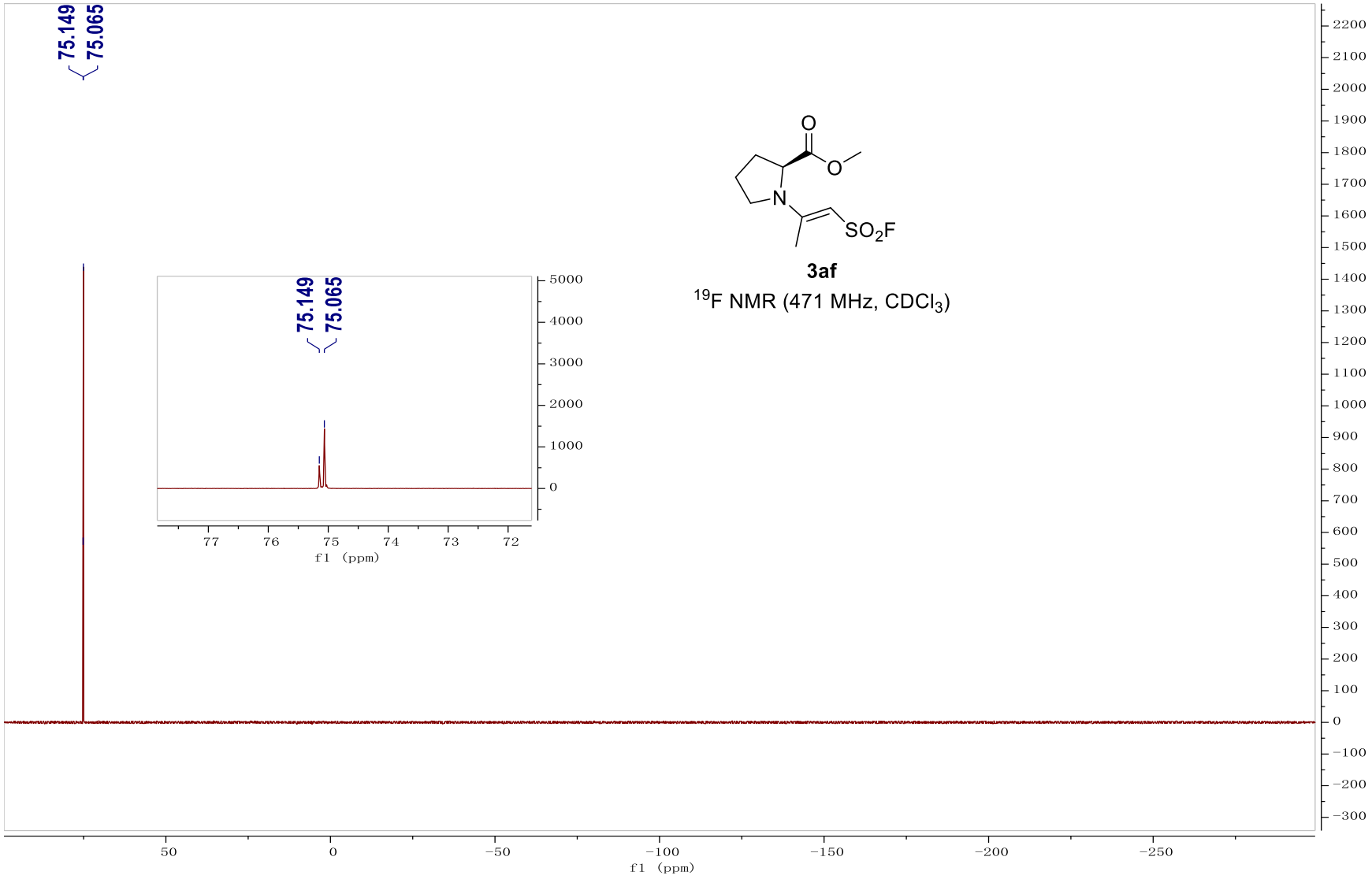

161.499
82.131
81.943
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
52.883
16.218
11.304
N
SO2F
3ad
13C NMR (126 MHz, CDCl3)
f1 (ppm)

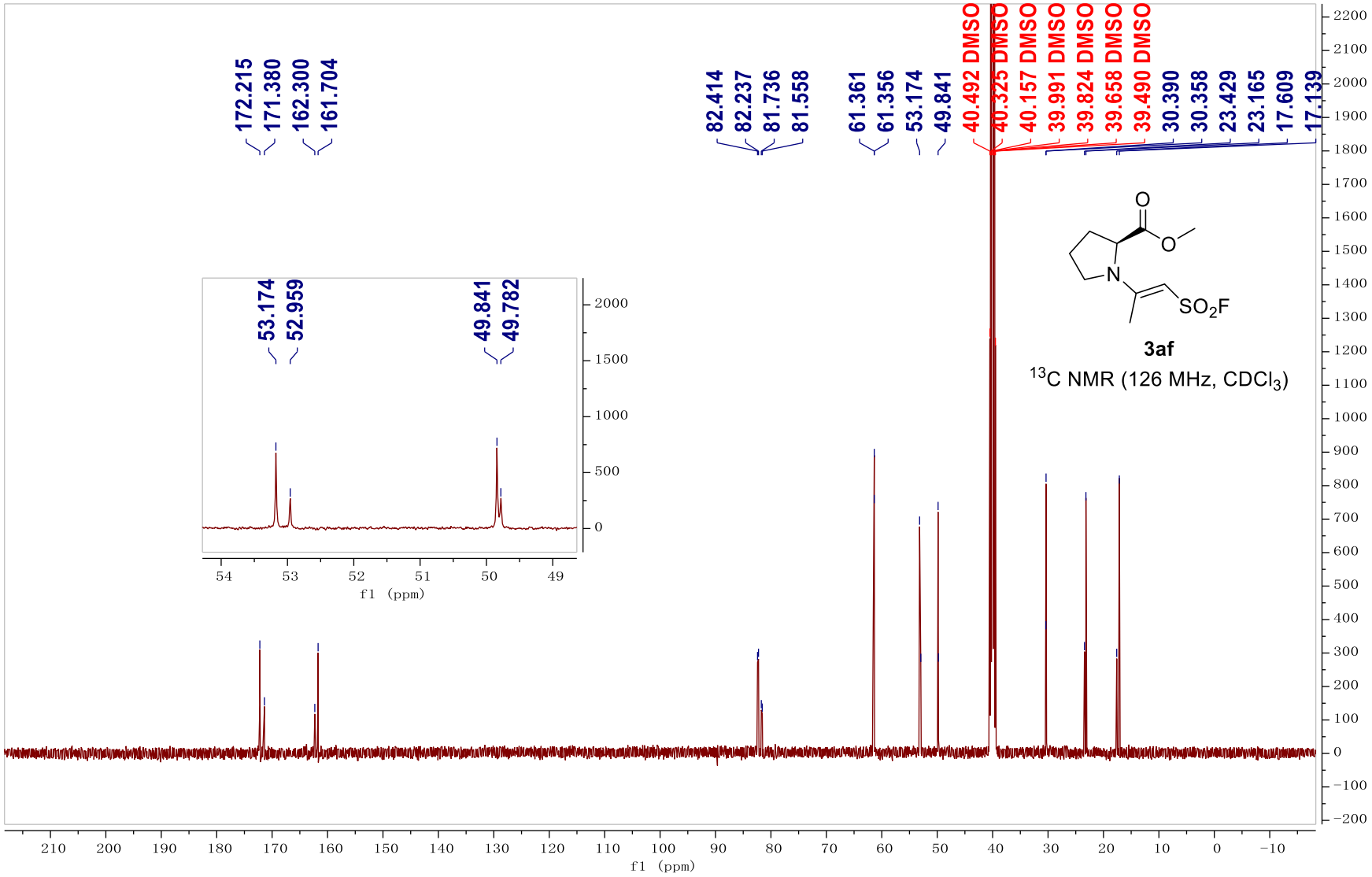

7.264 CDCl3
5.791
5.781
5.770
5.760
5.756
5.751
5.747
5.736
5.726
5.716
5.285
5.264
5.139
5.105
4.910
3.931
2.945
2.352
0.99
1.00
1.00
1.00
2.00
3.00
3.00
f1 (ppm)
N
SO2F
3ae
1H NMR (500 MHz, CDCl3)

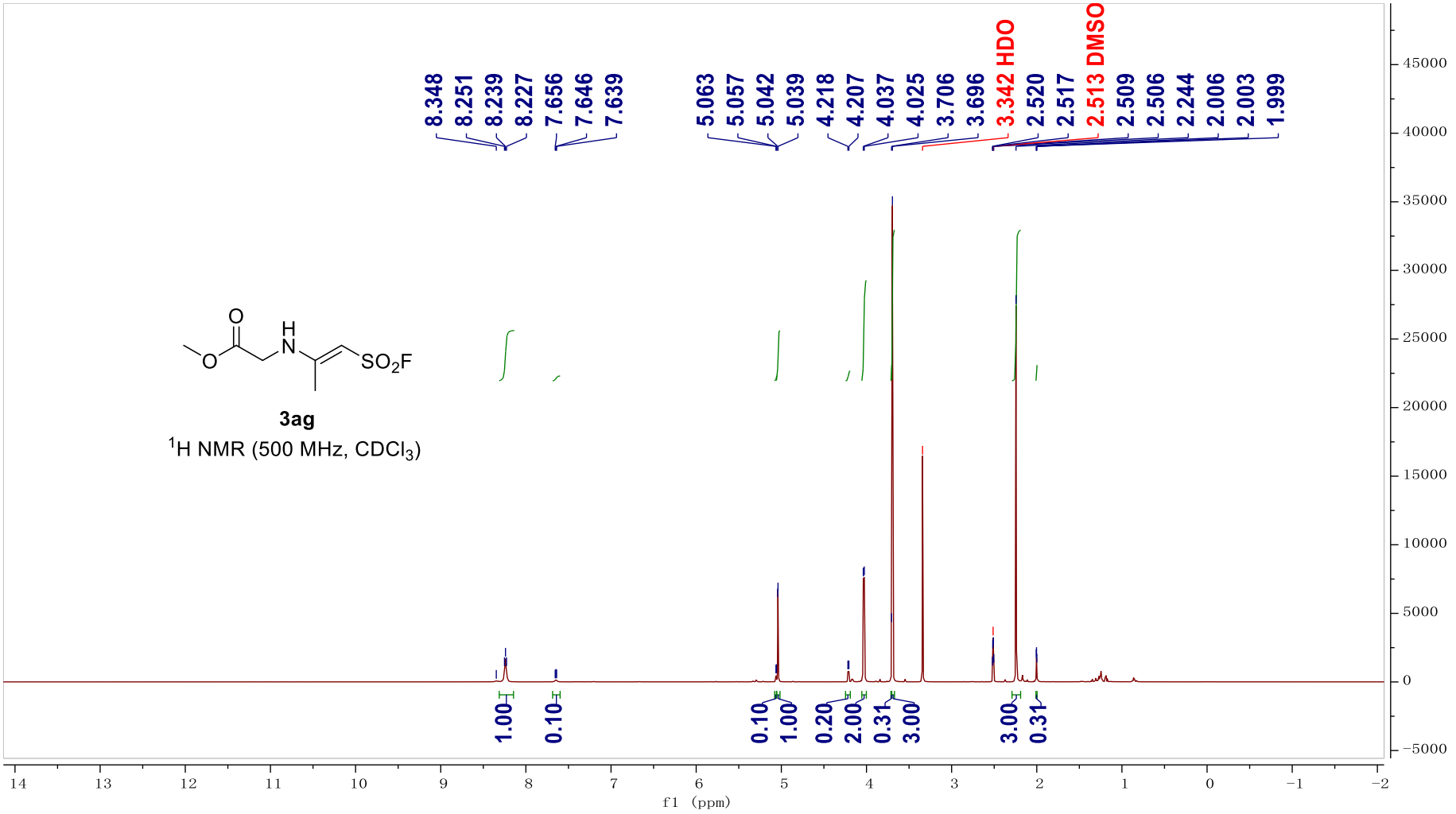

72.941
N
SO2F
3ae
19F NMR (471 MHz, CDCl3)
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
−100
−200
50
0
−50
−100
−150
−200
−250
f1 (ppm)


162.641
131.305
117.737
83.485
83.297
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
54.862
38.837
16.038
4000
3500
3000
2500
2000
1500
1000
500
0
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)
N
SO2F
3ae
13C NMR (126 MHz, CDCl3)


5.061 4.870 4.866 4.853 4.851 4.849 4.704 3.717 3.705 3.368 3.346 HDO 3.276 3.273 3.256 2.520 DMSO 2.517 DMSO 2.513 DMSO 2.509 DMSO 2.505 DMSO 2.366 2.236 2.222 2.214 2.211 2.204 2.197 2.189 2.146 2.137 2.132 2.128 2.121 2.117 2.111 2.107 2.103 2.014 2.004 2.000 1.995 1.885 1.871 1.865 1.860 1.846
2.21 2.20 1.00 1.00 9.61 1.00 3.21 2.20 2.99 1.02 6.62 2.25 10.23
f1 (ppm)
2.222 2.214 2.211 2.197 2.146 2.132 2.121 2.107 2.004 2.000 1.865 1.860 1.846
2.99 1.02 6.62 2.25 10.23
f1 (ppm)
O
O
N
SO2F
3af
1H NMR (500 MHz, CDCl3)

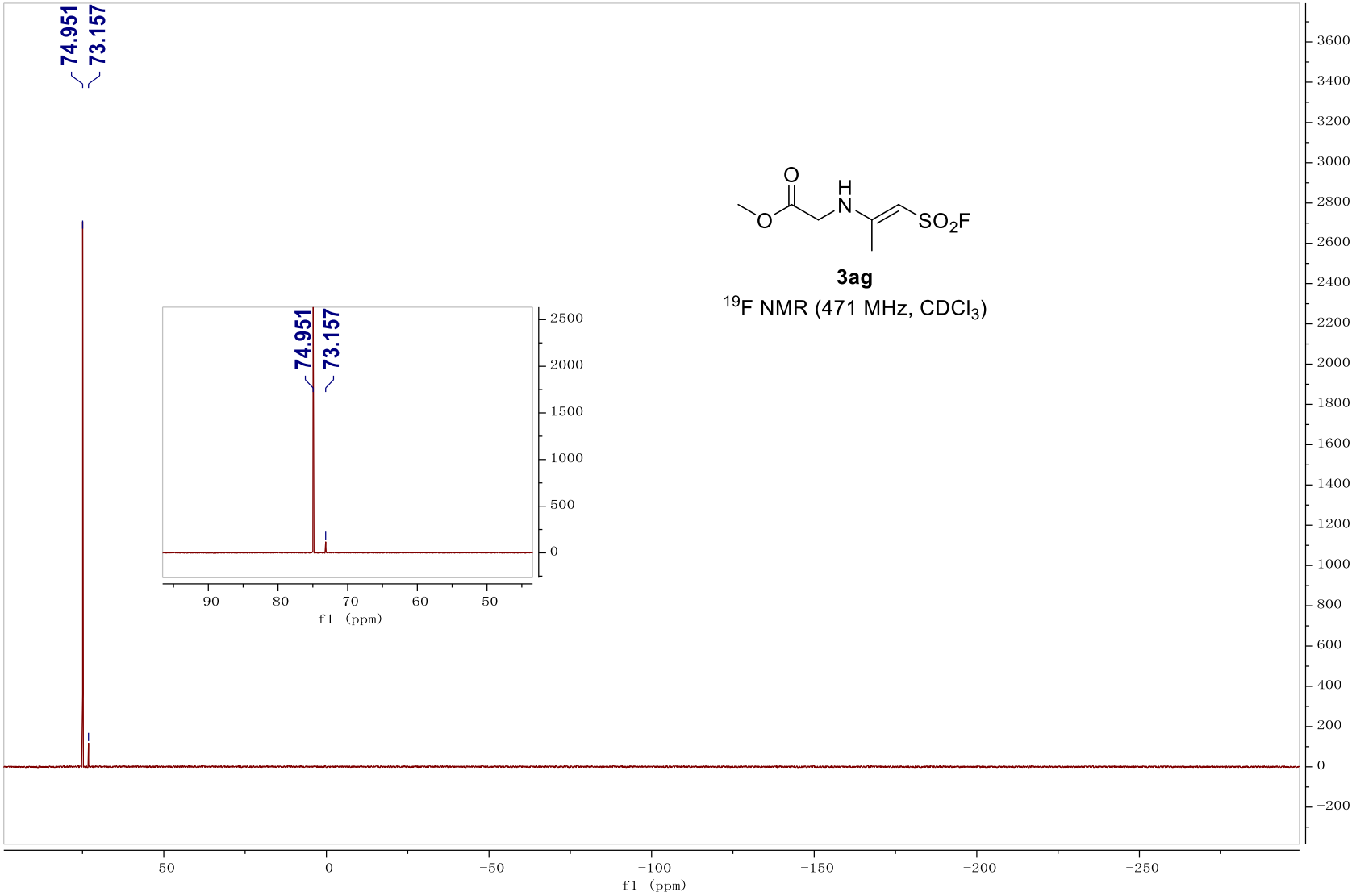

75.149
75.065
O
O
N
SO2F
3af
19F NMR (471 MHz, CDCl3)
f1 (ppm)

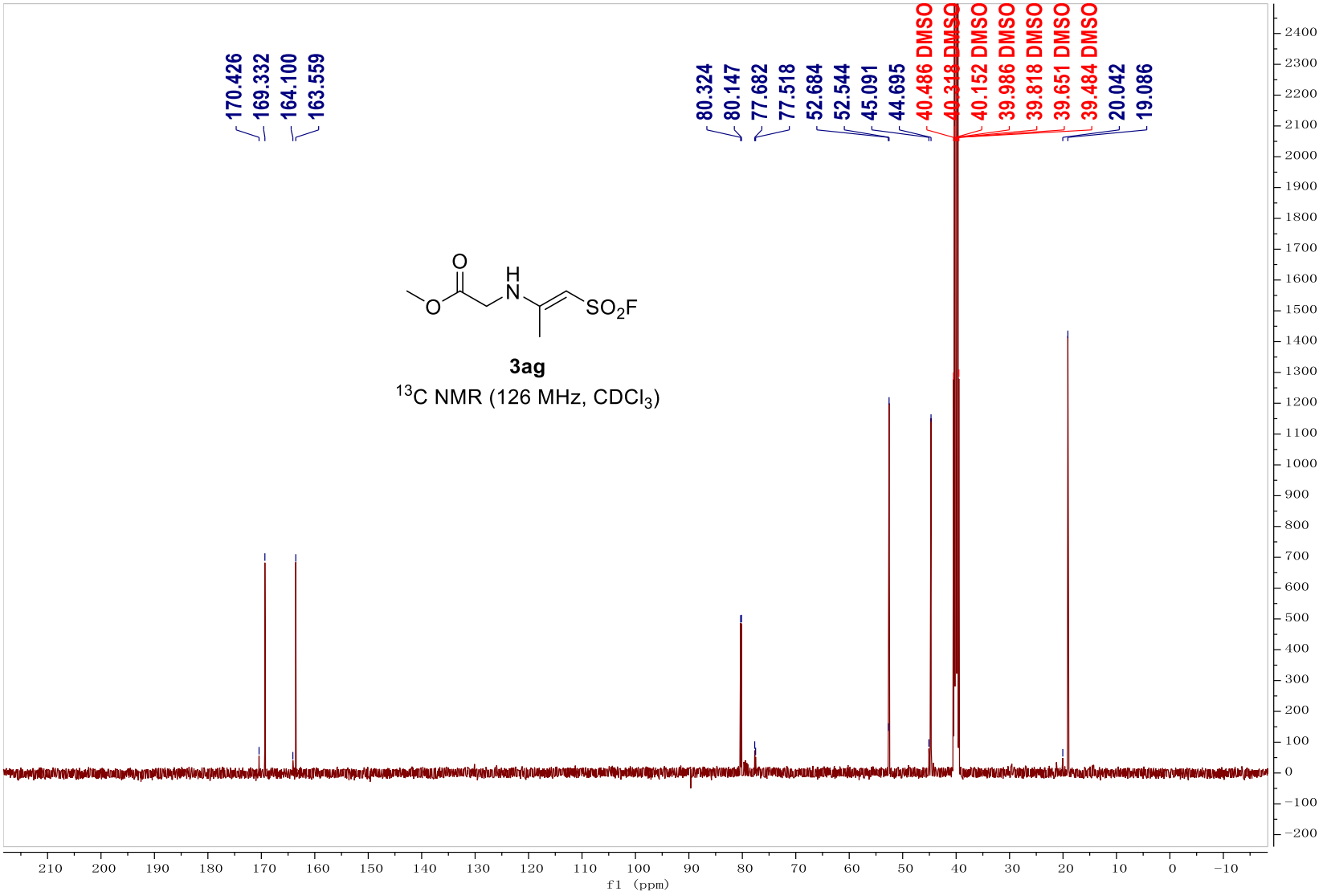

172.215
171.380
162.300
161.704
82.414
82.237
81.736
81.558
61.361
61.356
53.174
49.841
40.492 DMSO
40.325 DMSO
40.157 DMSO
39.991 DMSO
39.824 DMSO
39.658 DMSO
39.490 DMSO
30.390
30.358
23.429
23.165
17.609
17.139
53.174
52.959
49.841
49.782
f1 (ppm)
f1 (ppm)
O
O
N
SO2F
3af
13C NMR (126 MHz, CDCl3)

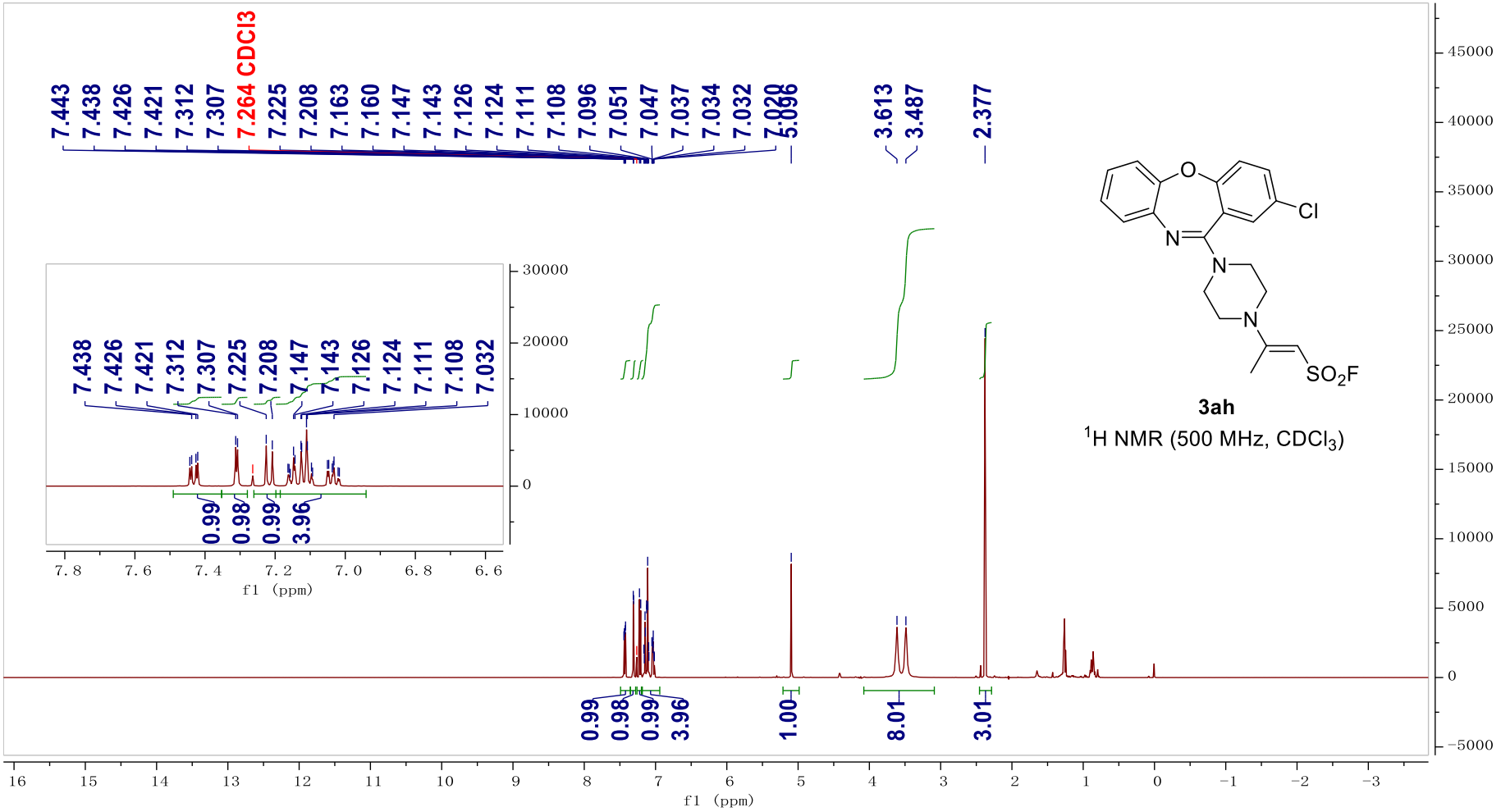


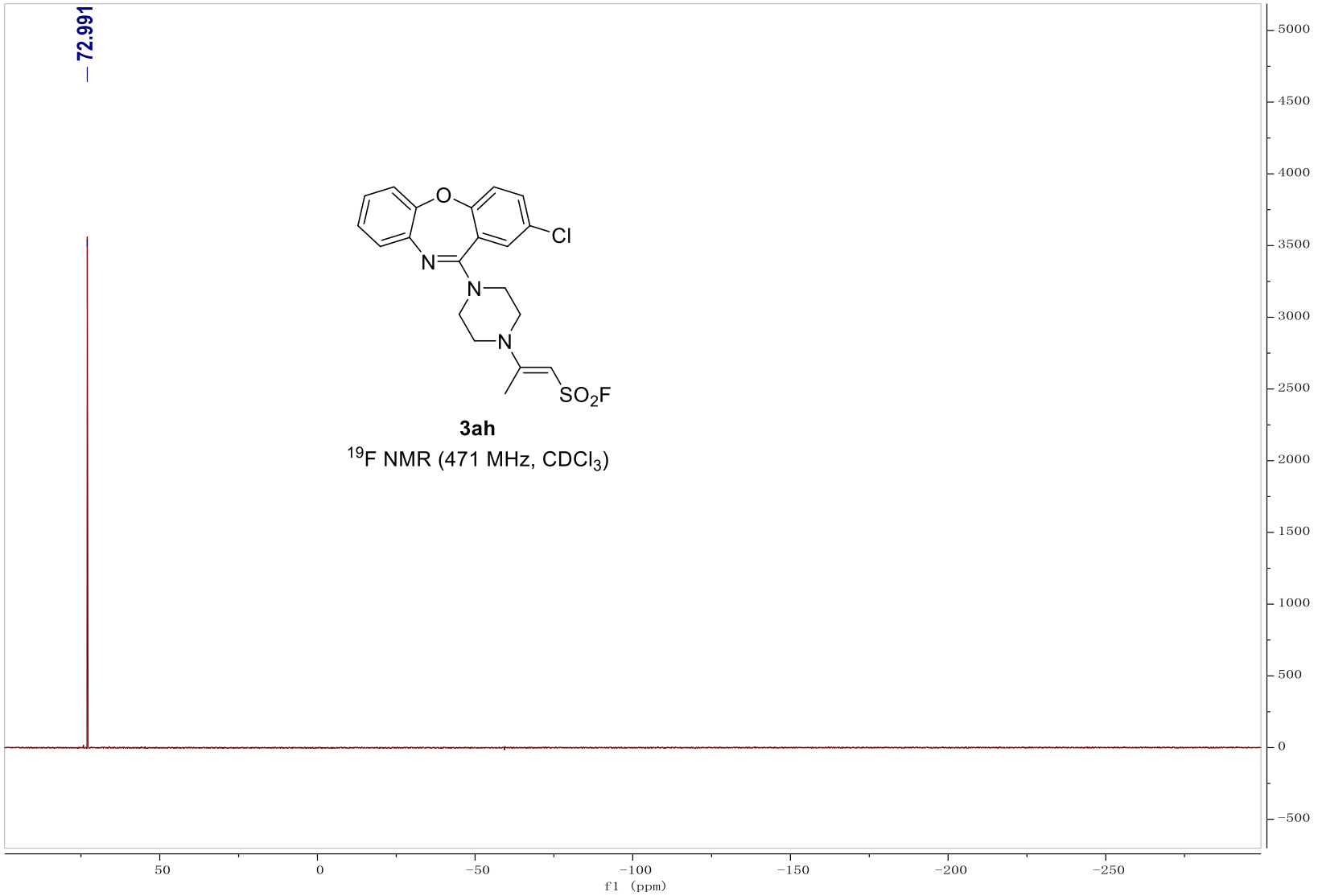
3ag

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


74.951
73.157
O
H
N
O
SO2F
3ag
19F NMR (471 MHz, CDCl3)
f1 (ppm)

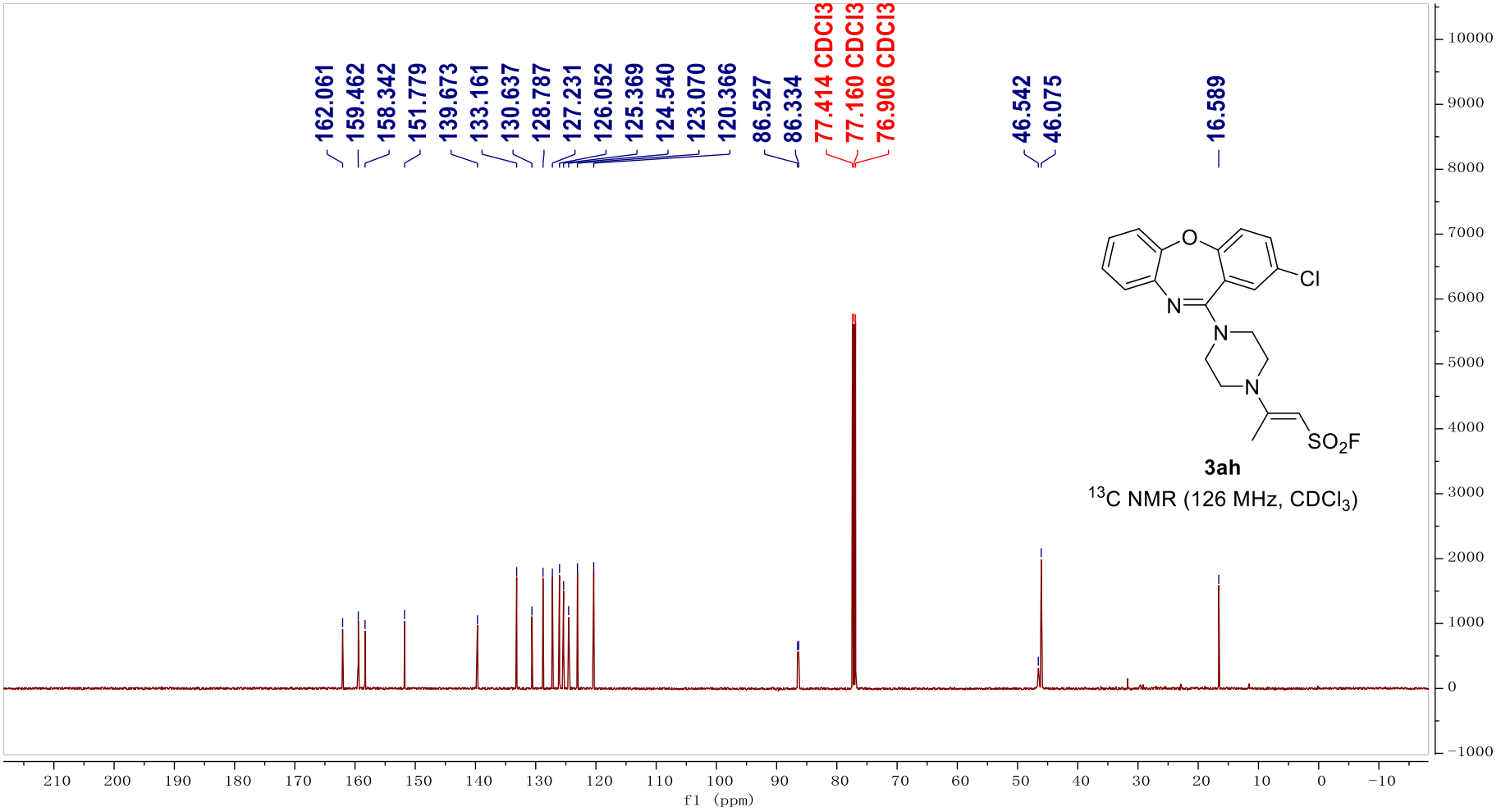

170.426
169.332
164.100
163.559
80.324
80.147
77.682
77.518
52.684
52.544
45.091
44.695
40.486 DMSO
40.318 DMSO
40.152 DMSO
39.986 DMSO
39.818 DMSO
39.651 DMSO
39.484 DMSO
20.042
19.086
O
H
N
O
SO2F
3ag
13C NMR (126 MHz, CDCl3)
f1 (ppm)

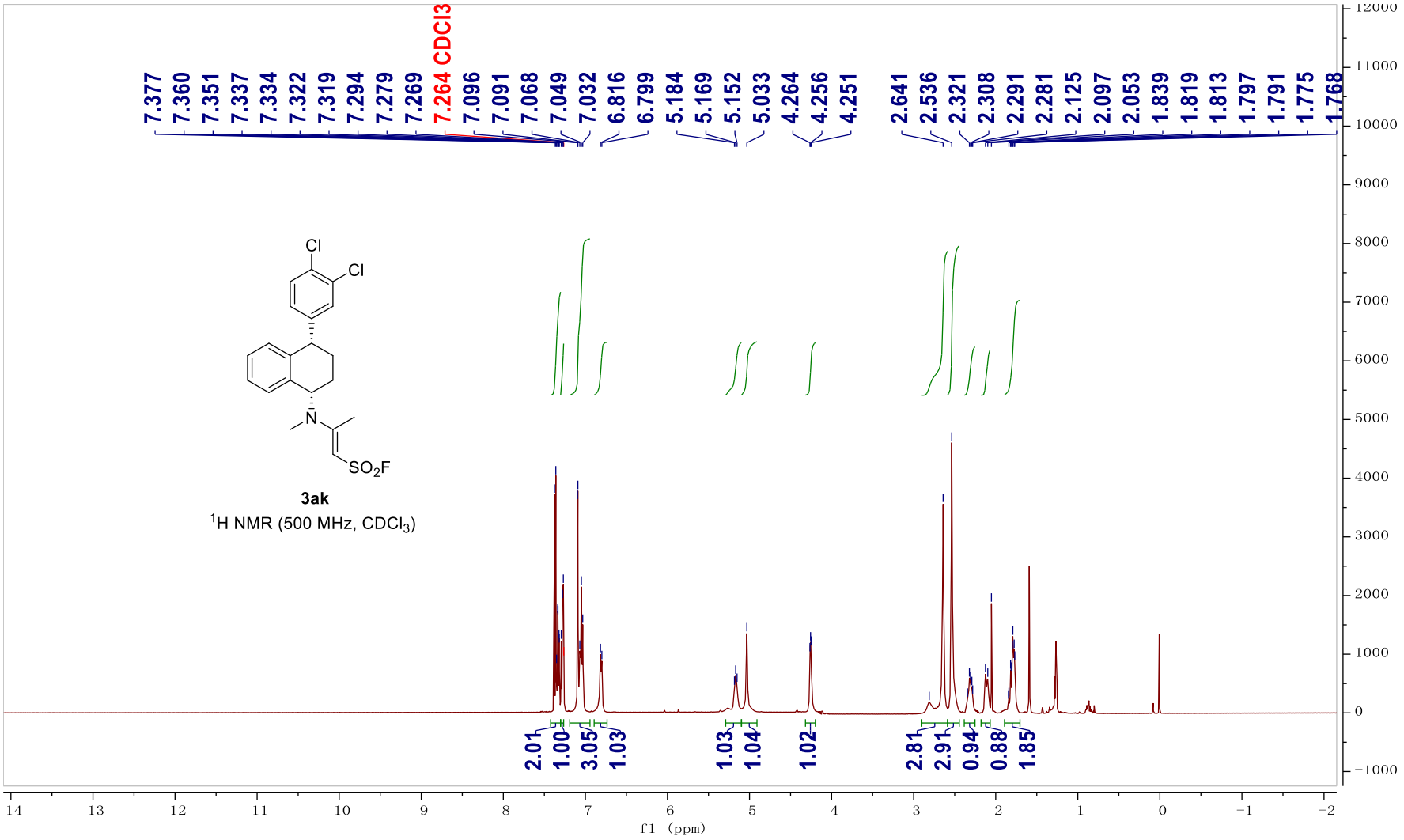

7.443
7.438
7.426
7.421
7.312
7.307
7.264 CDCl3
7.225
7.208
7.163
7.160
7.147
7.143
7.126
7.124
7.111
7.108
7.096
7.051
7.047
7.037
7.034
7.032
3.613
3.487
2.377
0.99
0.98
0.99
3.96
1.00
8.01
3.01
f1 (ppm)
3ah
1H NMR (500 MHz, CDCl3)

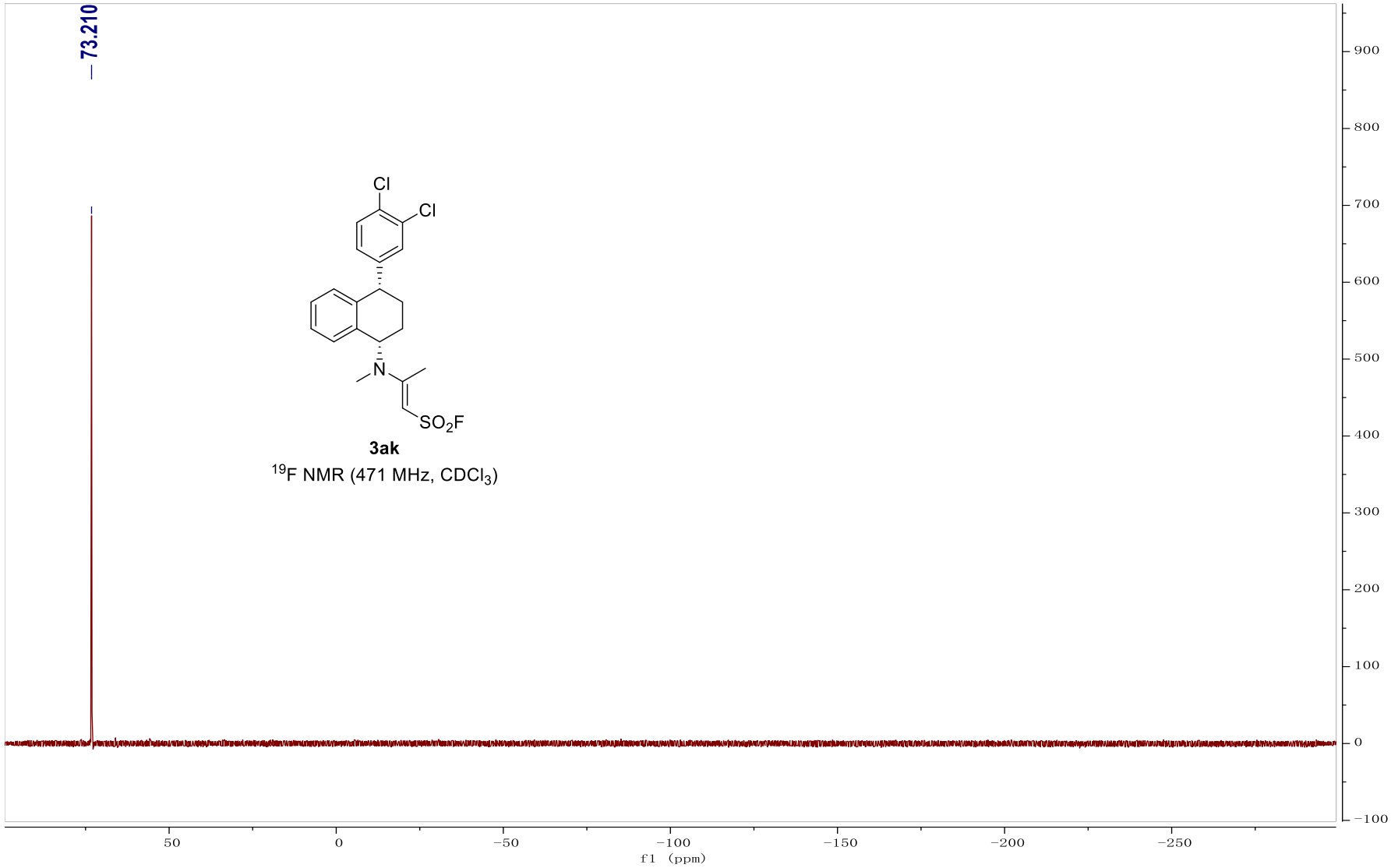


3ah

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

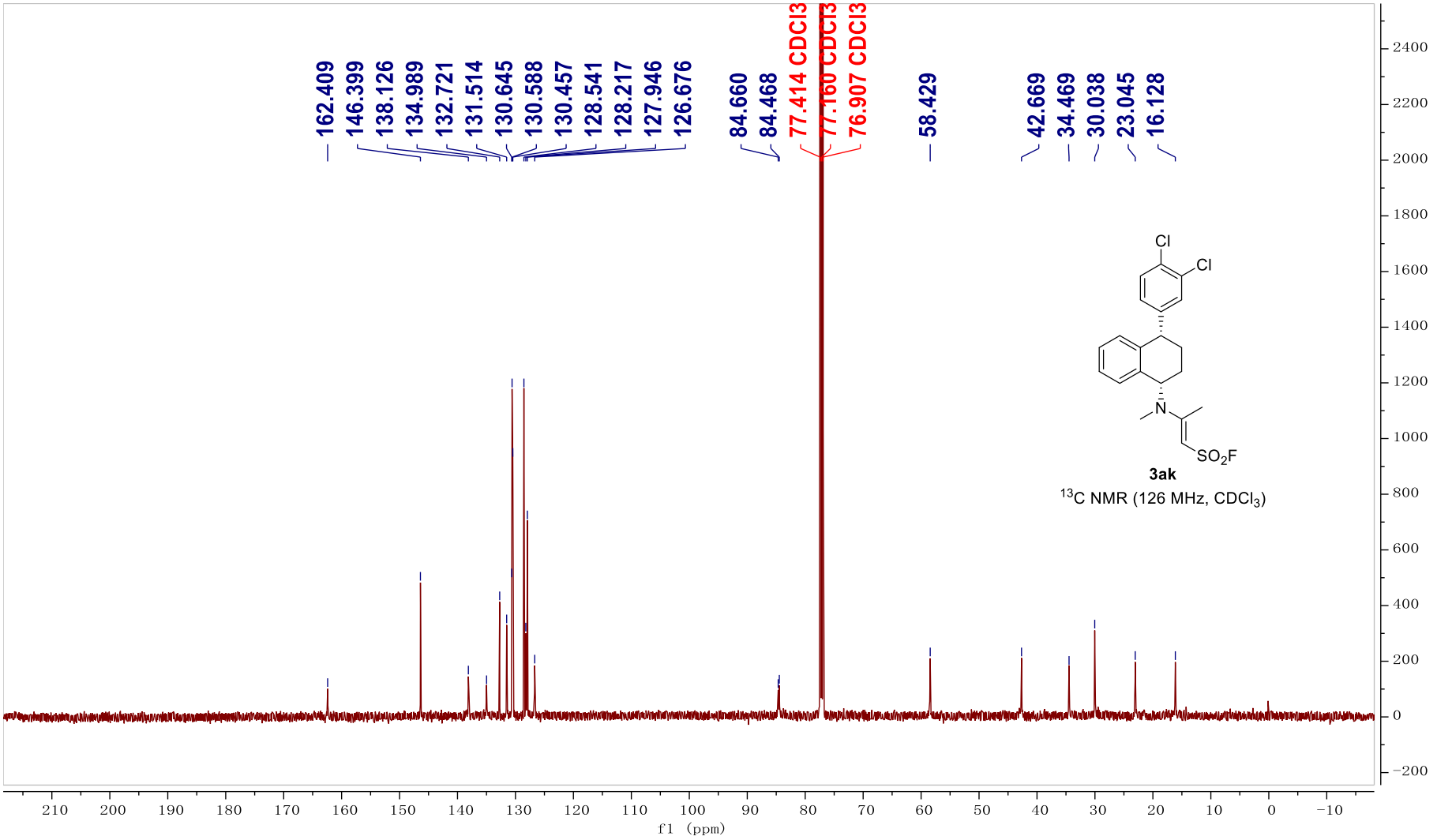

162.061
159.462
158.342
151.779
139.673
133.161
130.637
128.787
127.231
126.052
125.369
124.540
123.070
120.366
86.527
86.334
77.414 CDCl3
77.160 CDCl3
76.906 CDCl3
46.542
46.075
16.589
Cl
O
N
N
N
SO2F
3ah
13C NMR (126 MHz, CDCl3)
f1 (ppm)

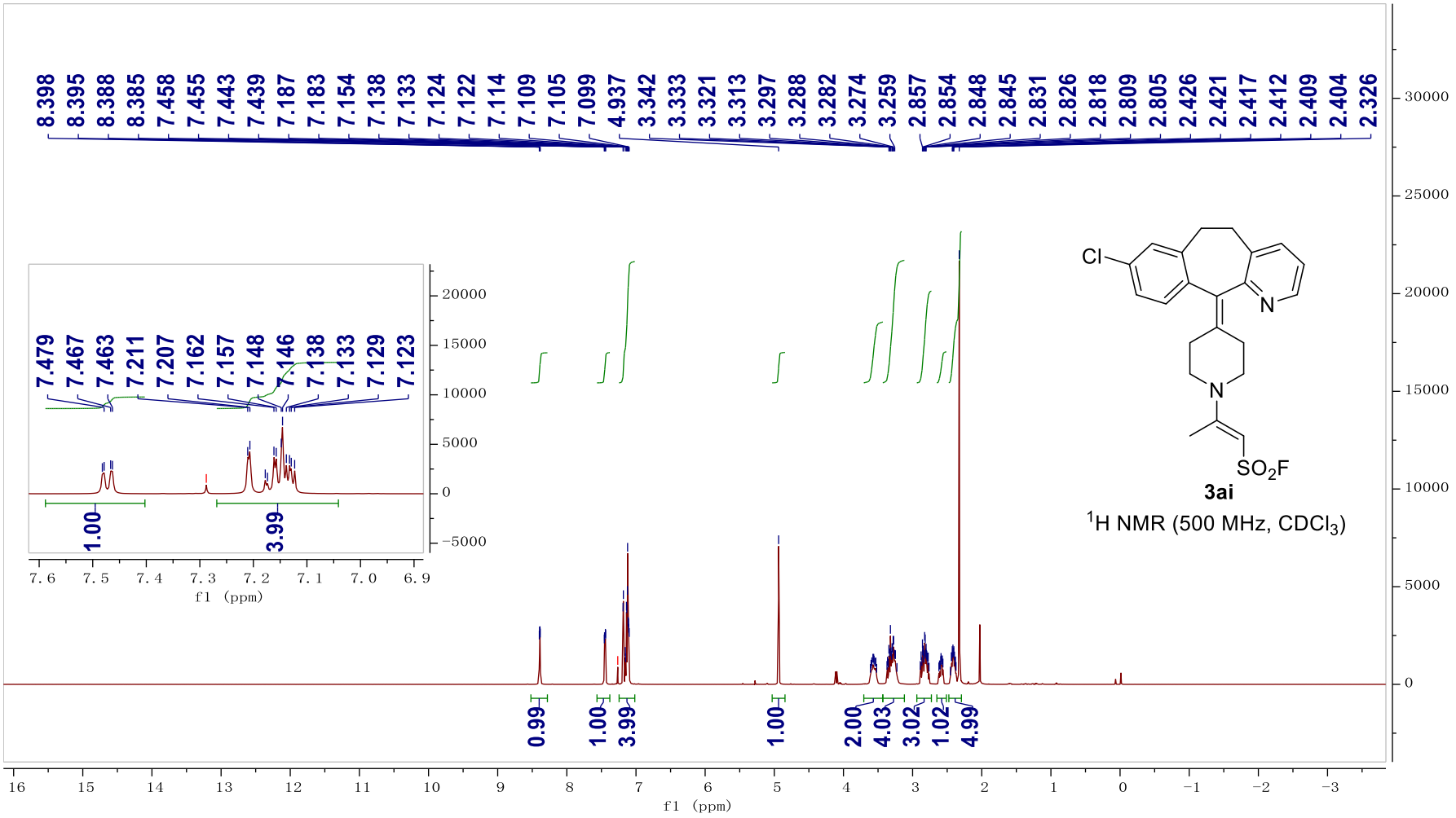

7.377
7.360
7.351
7.337
7.334
7.322
7.319
7.294
7.279
7.269
7.264 CDCl3
7.096
7.091
7.068
7.049
7.032
6.816
6.799
5.184
5.169
5.152
5.033
4.264
4.256
4.251
2.641
2.536
2.321
2.308
2.291
2.281
2.125
2.097
2.053
1.839
1.819
1.813
1.797
1.791
1.775
1.768
Cl
Cl
N
SO2F
3ak
1H NMR (500 MHz, CDCl3)
2.01
1.00
3.05
1.03
1.03
1.04
1.02
2.81
2.91
0.94
0.88
1.85
f1 (ppm)

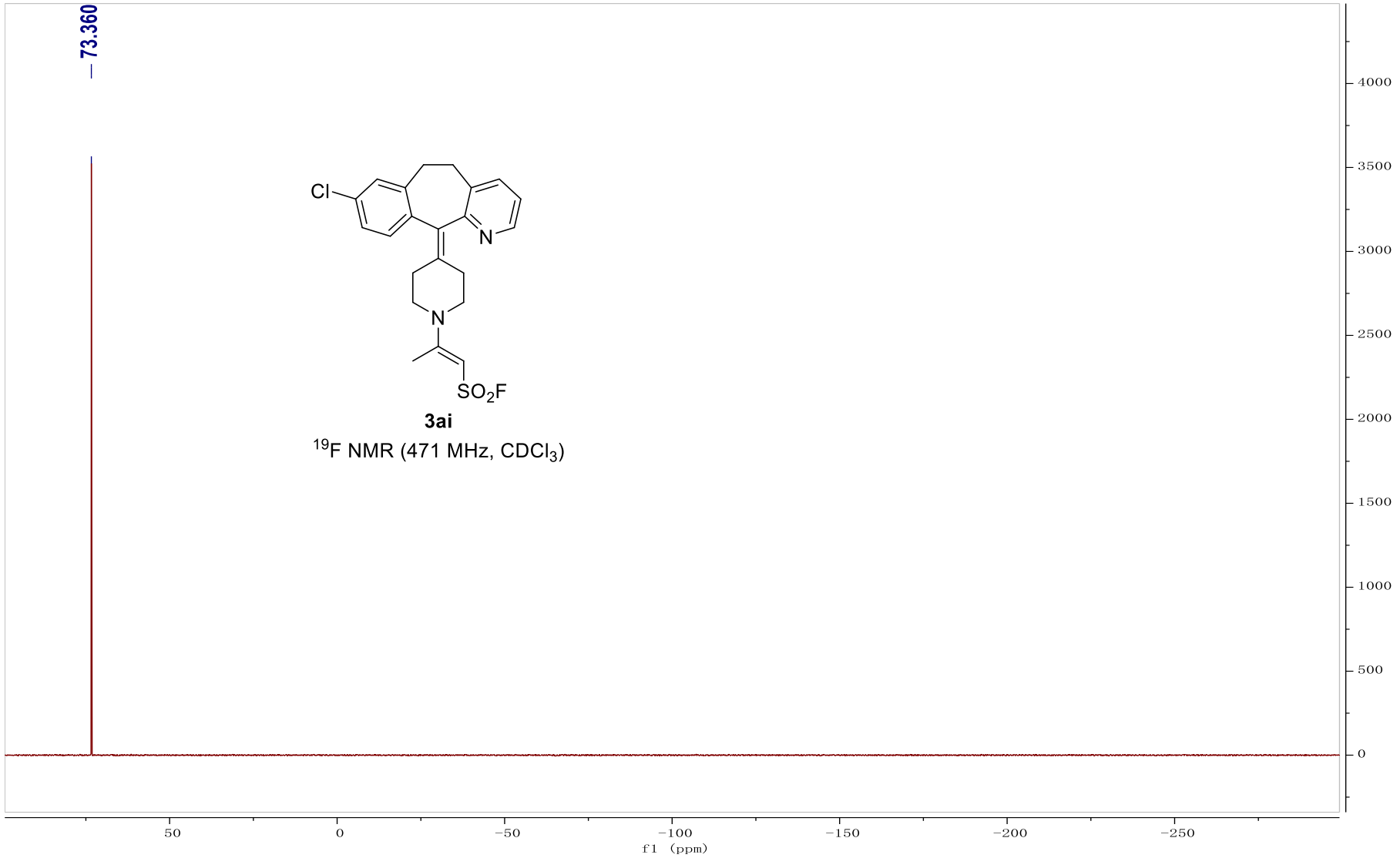


3ak

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

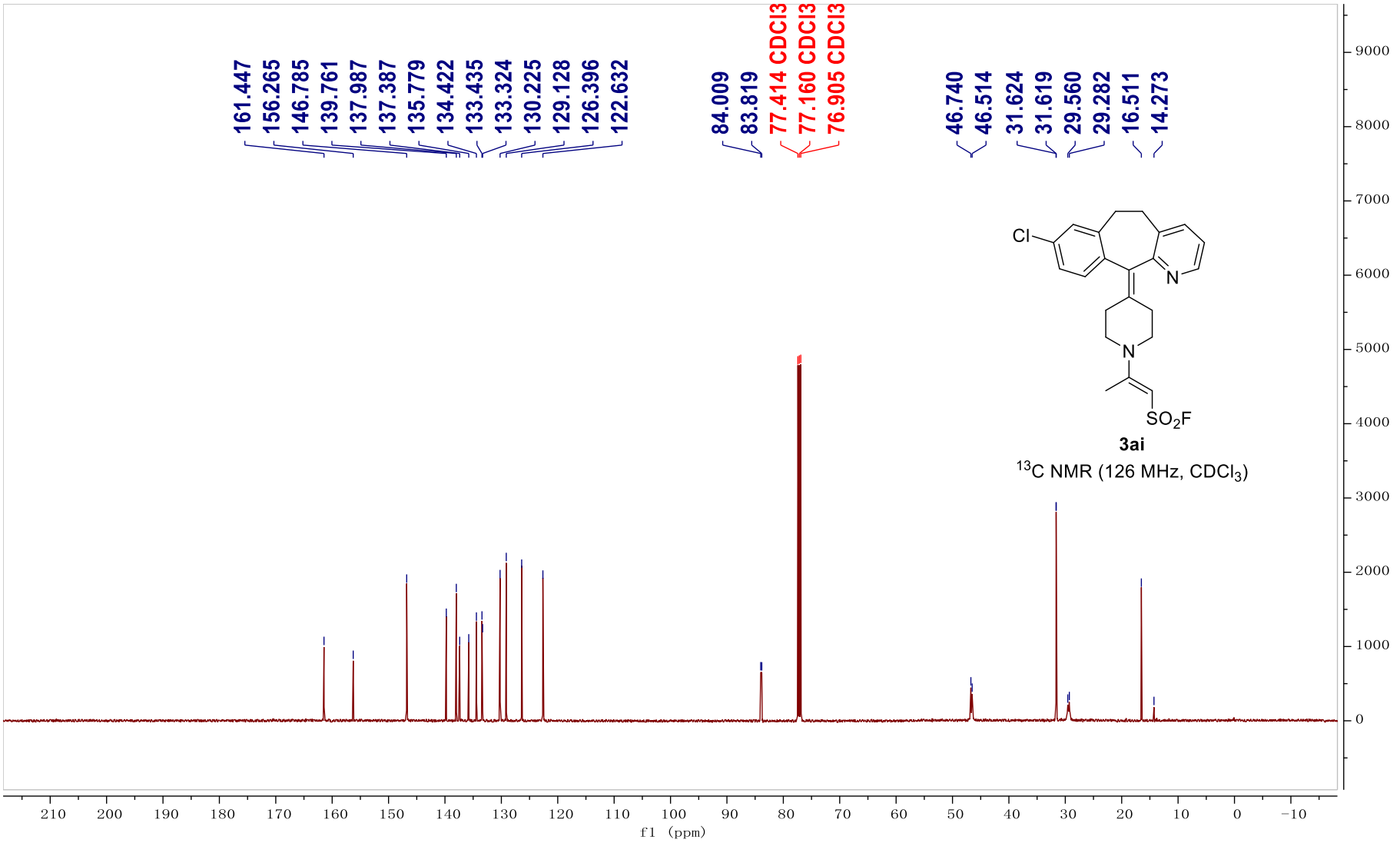

162.409
146.399
138.126
134.989
132.721
131.514
130.645
130.588
130.457
128.541
128.217
127.946
126.676
84.660
84.468
77.414 CDCl3
77.160 CDCl3
76.907 CDCl3
58.429
42.669
34.469
30.038
23.045
16.128
Cl
Cl
N
SO2F
3ak
13C NMR (126 MHz, CDCl3)
f1 (ppm)

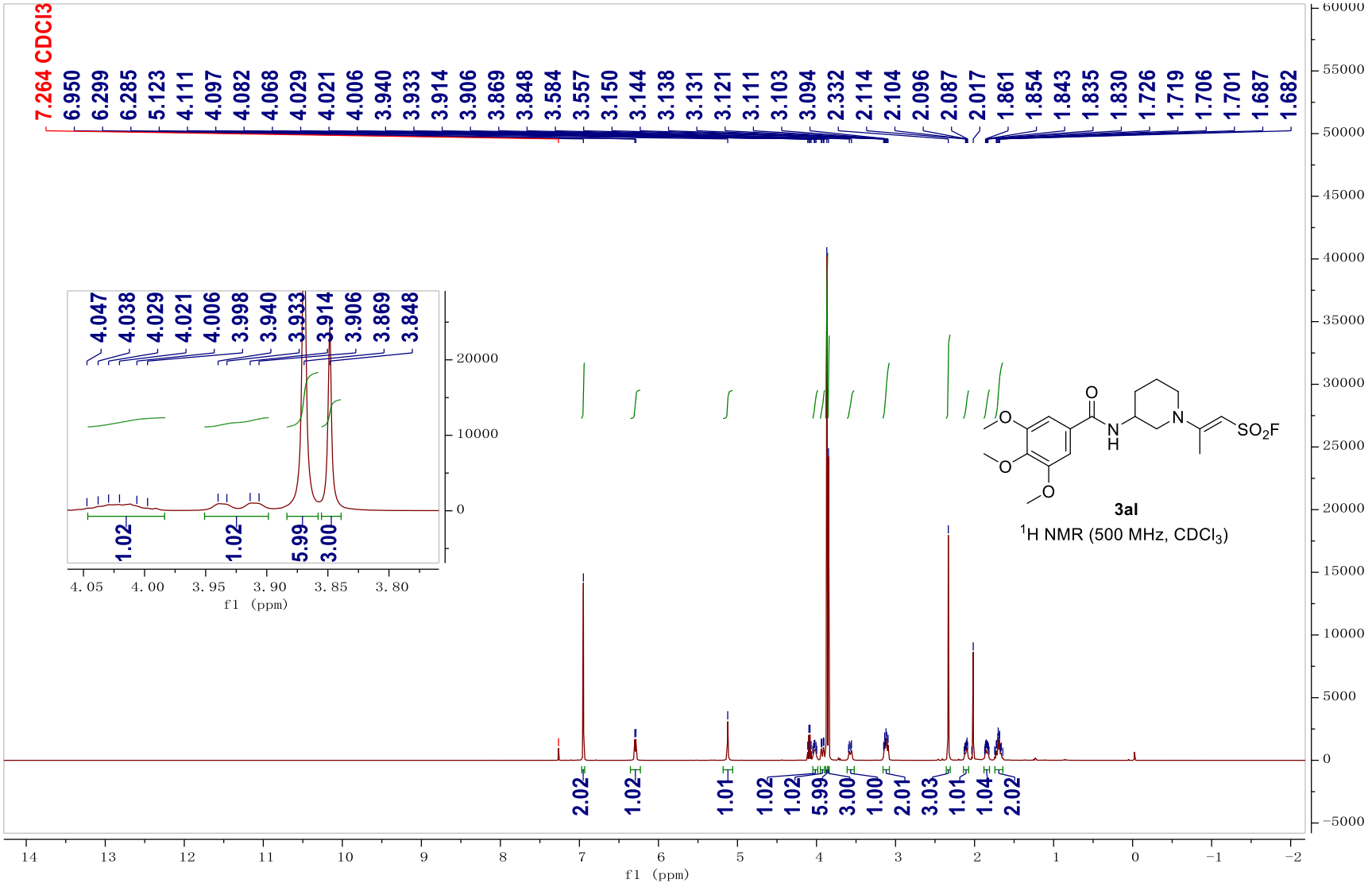

8.398
8.395
8.388
8.385
7.458
7.455
7.443
7.439
7.187
7.183
7.154
7.138
7.133
7.124
7.122
7.114
7.109
7.105
7.099
4.937
3.342
3.333
3.321
3.313
3.297
3.288
3.282
3.274
3.259
2.857
2.854
2.848
2.845
2.831
2.826
2.818
2.809
2.805
2.426
2.421
2.417
2.412
2.409
2.404
2.326
7.479
7.467
7.463
7.211
7.207
7.162
7.157
7.148
7.146
7.138
7.133
7.129
7.123
1.00
3.99
f1 (ppm)
0.99
1.00
3.99
1.00
2.00
4.03
3.02
1.02
4.99
f1 (ppm)
Cl
N
N
SO2F
3ai
1H NMR (500 MHz, CDCl3)

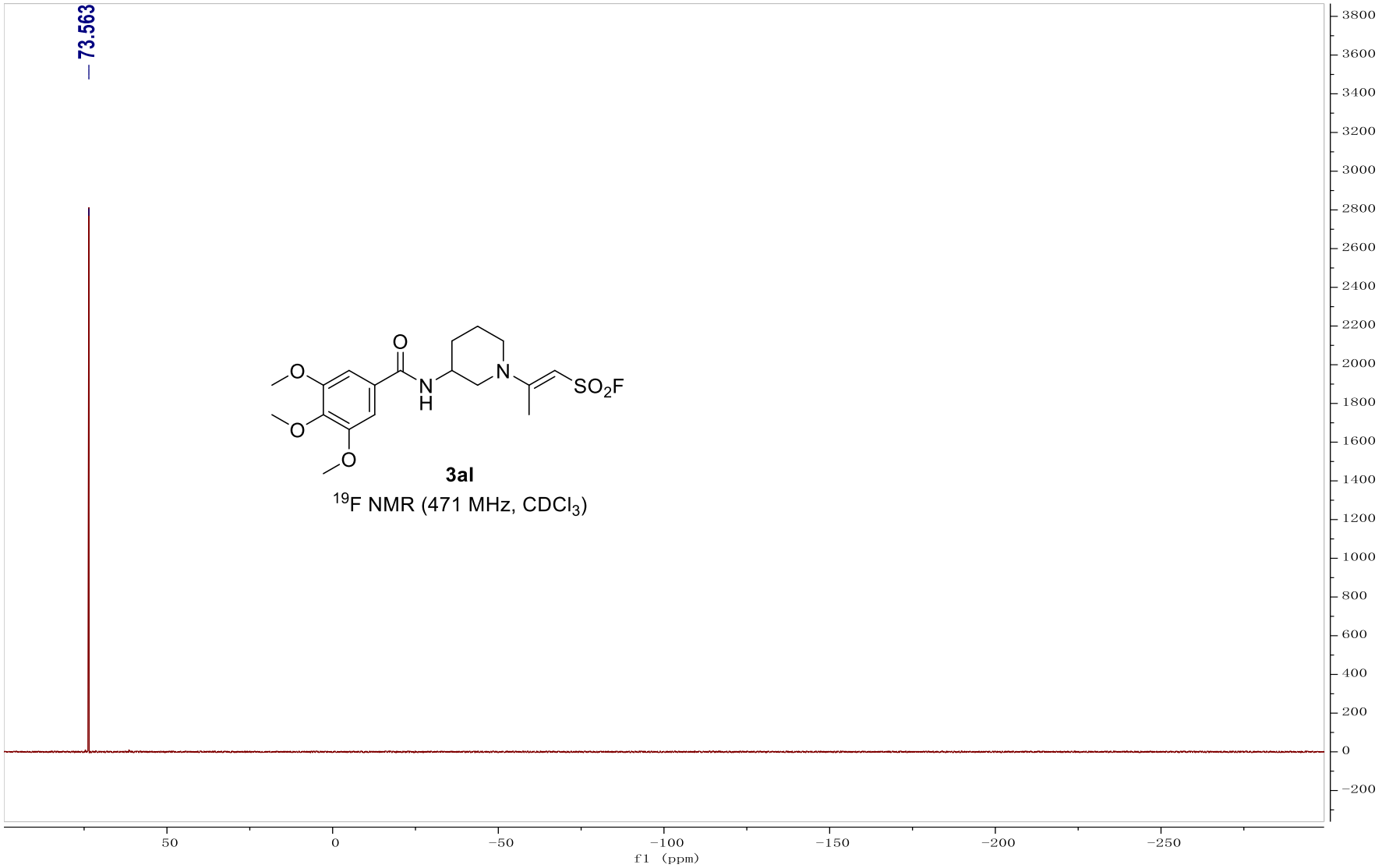


3ai

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

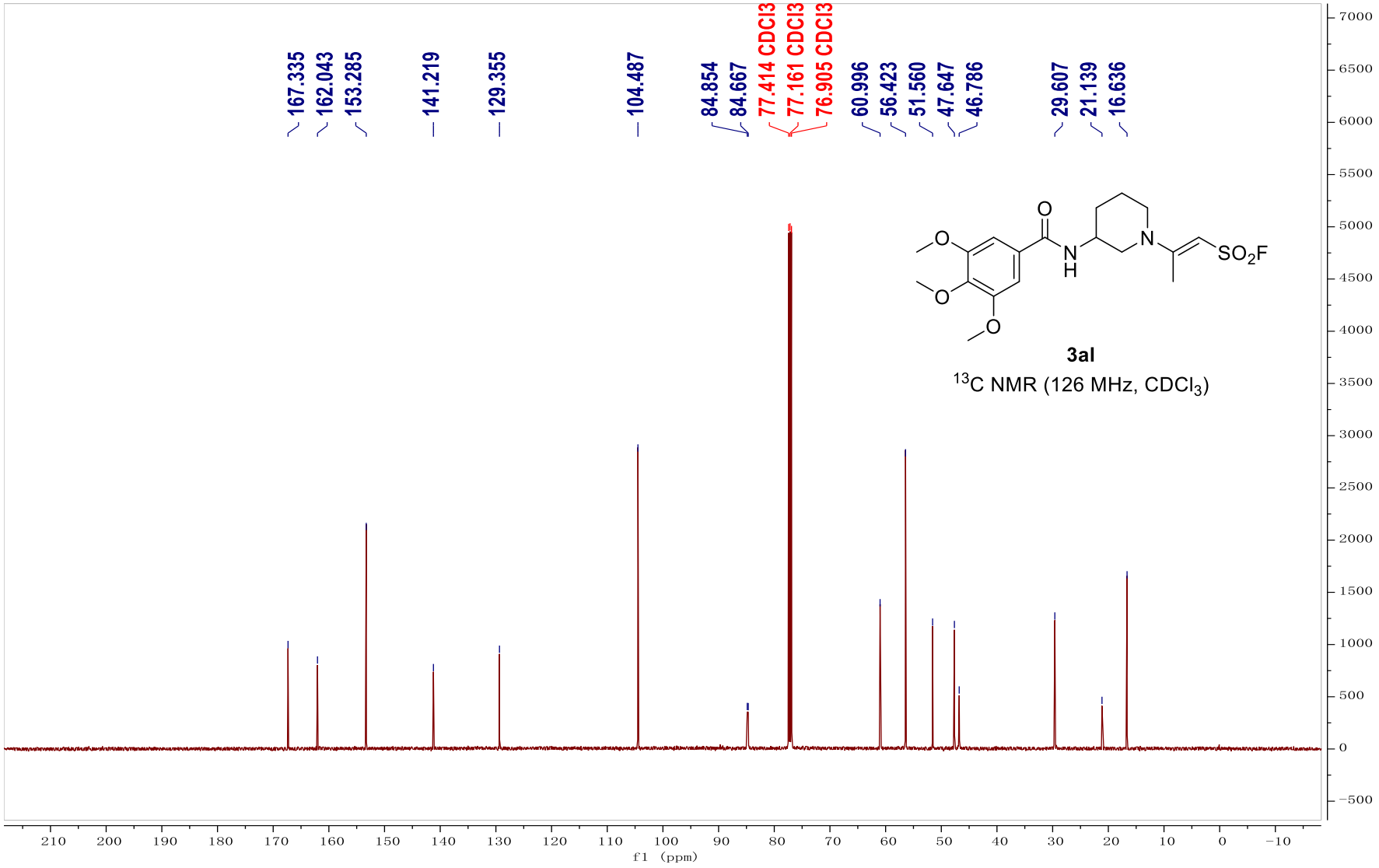

161.447
156.265
146.785
139.761
137.987
137.387
135.779
134.422
133.435
133.324
130.225
129.128
126.396
122.632
84.009
83.819
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
46.740
46.514
31.624
31.619
29.560
29.282
16.511
14.273
Cl
N
N
SO2F
3ai
13C NMR (126 MHz, CDCl3)
f1 (ppm)

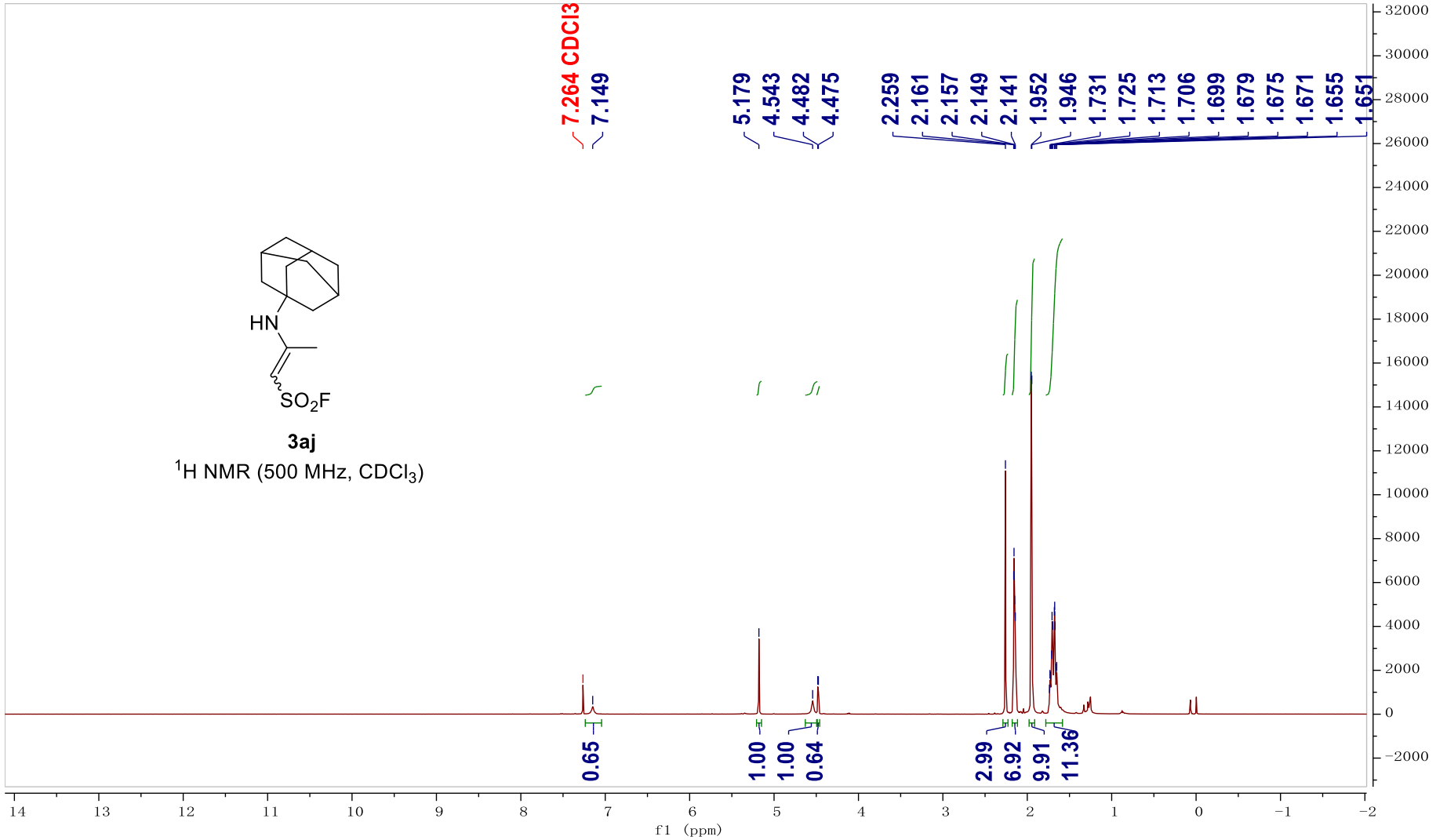

7.264 CDCl3
6.950 6.299 6.285 5.123 4.111 4.097 4.082 4.068 4.029 4.021 4.006 3.940 3.933 3.914 3.906 3.869 3.848 3.584 3.557 3.150 3.144 3.138 3.131 3.121 3.111 3.103 3.094 2.332 2.114 2.104 2.096 2.087 2.017 1.861 1.854 1.843 1.835 1.830 1.726 1.719 1.706 1.701 1.687 1.682
4.047 4.038 4.029 4.021 4.006 3.998 3.940 3.933 3.914 3.906 3.869 3.848
1.02 1.02 5.99 3.00
4.05 4.00 3.95 3.90 3.85 3.80
f1 (ppm)
2.02 1.02 1.01 1.02 1.02 5.99 3.00 1.00 2.01 3.03 1.01 1.04 2.02
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 −1 −2
f1 (ppm)
3al
1H NMR (500 MHz, CDCl3)

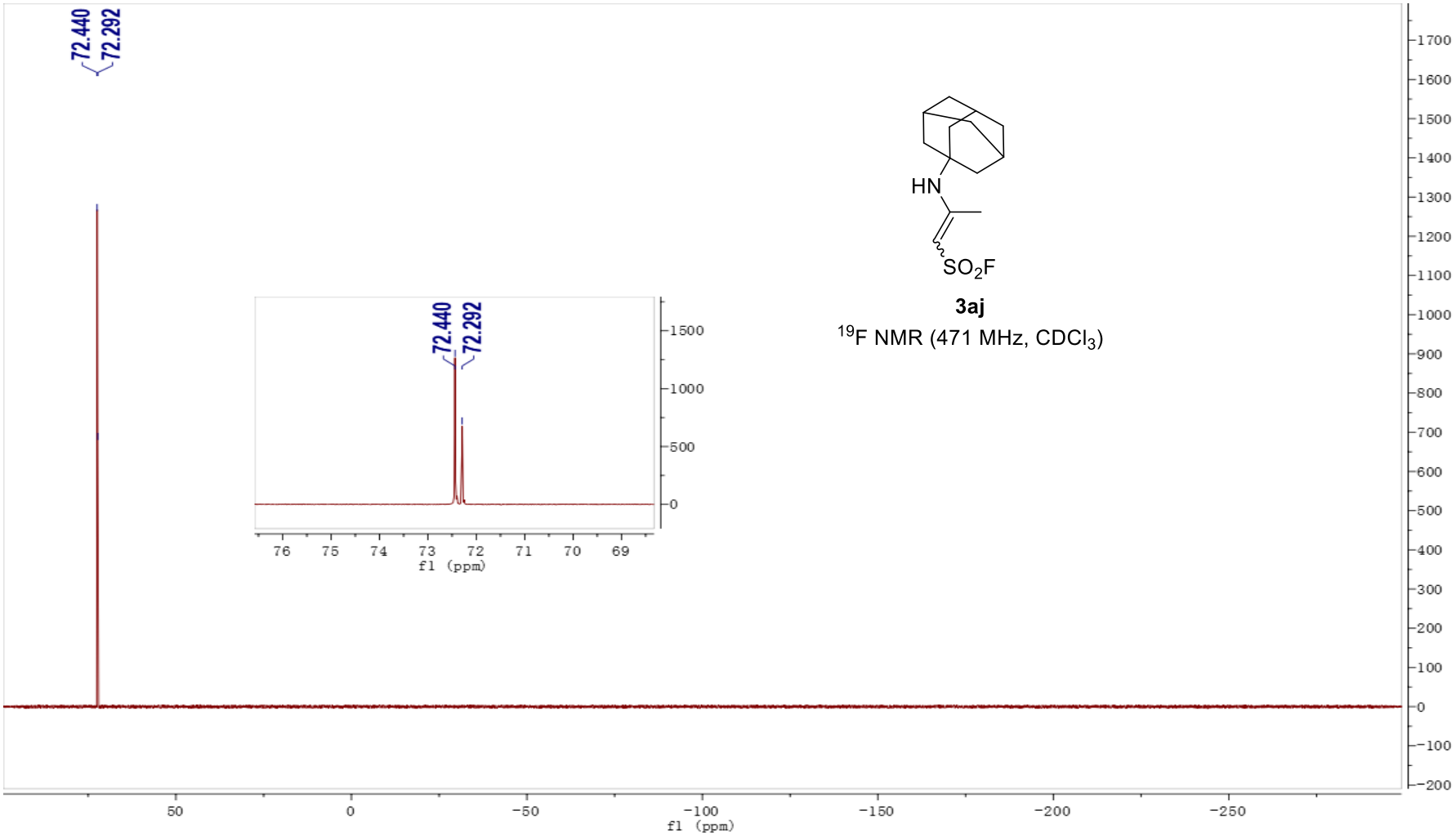


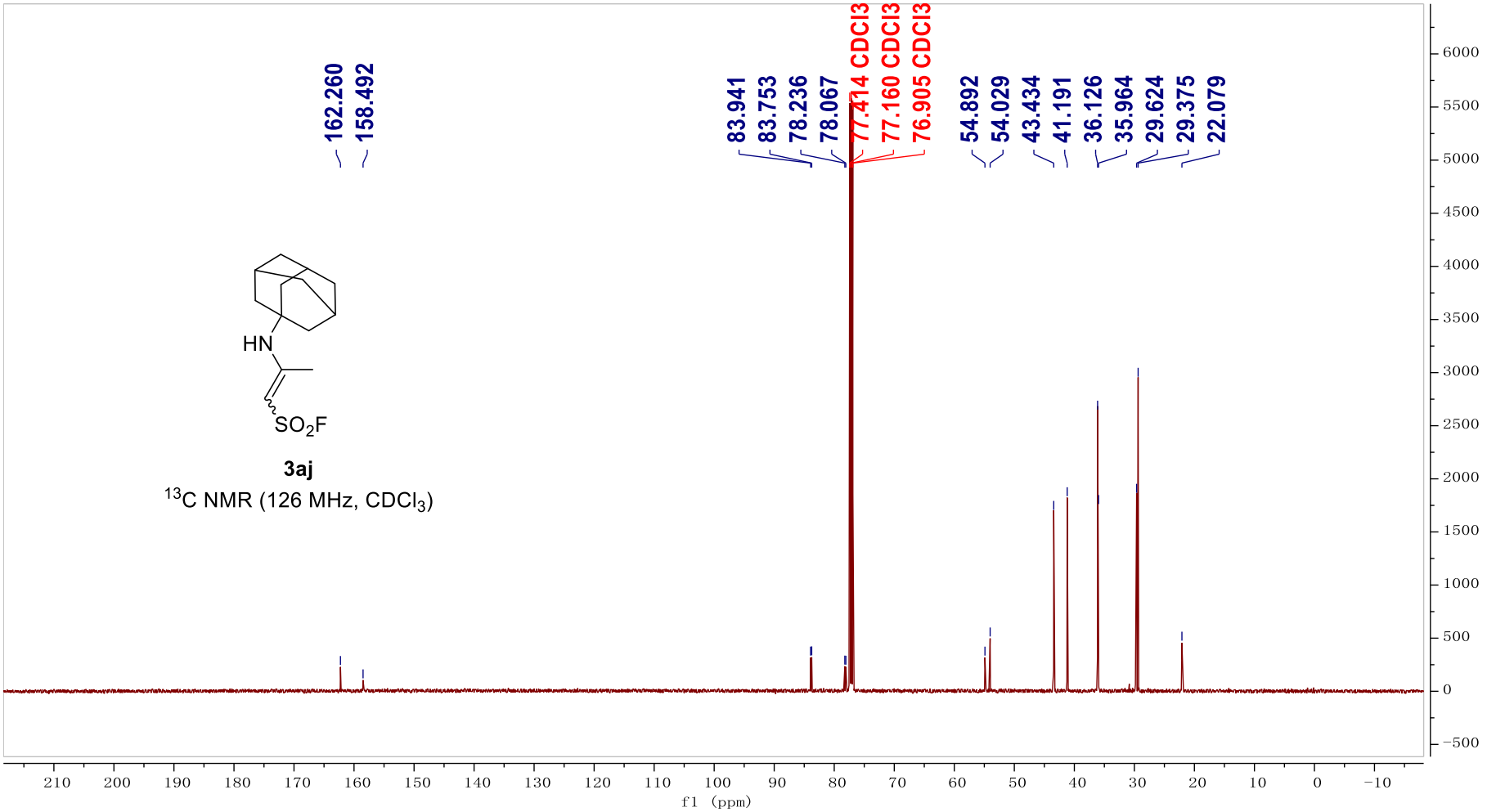
3al

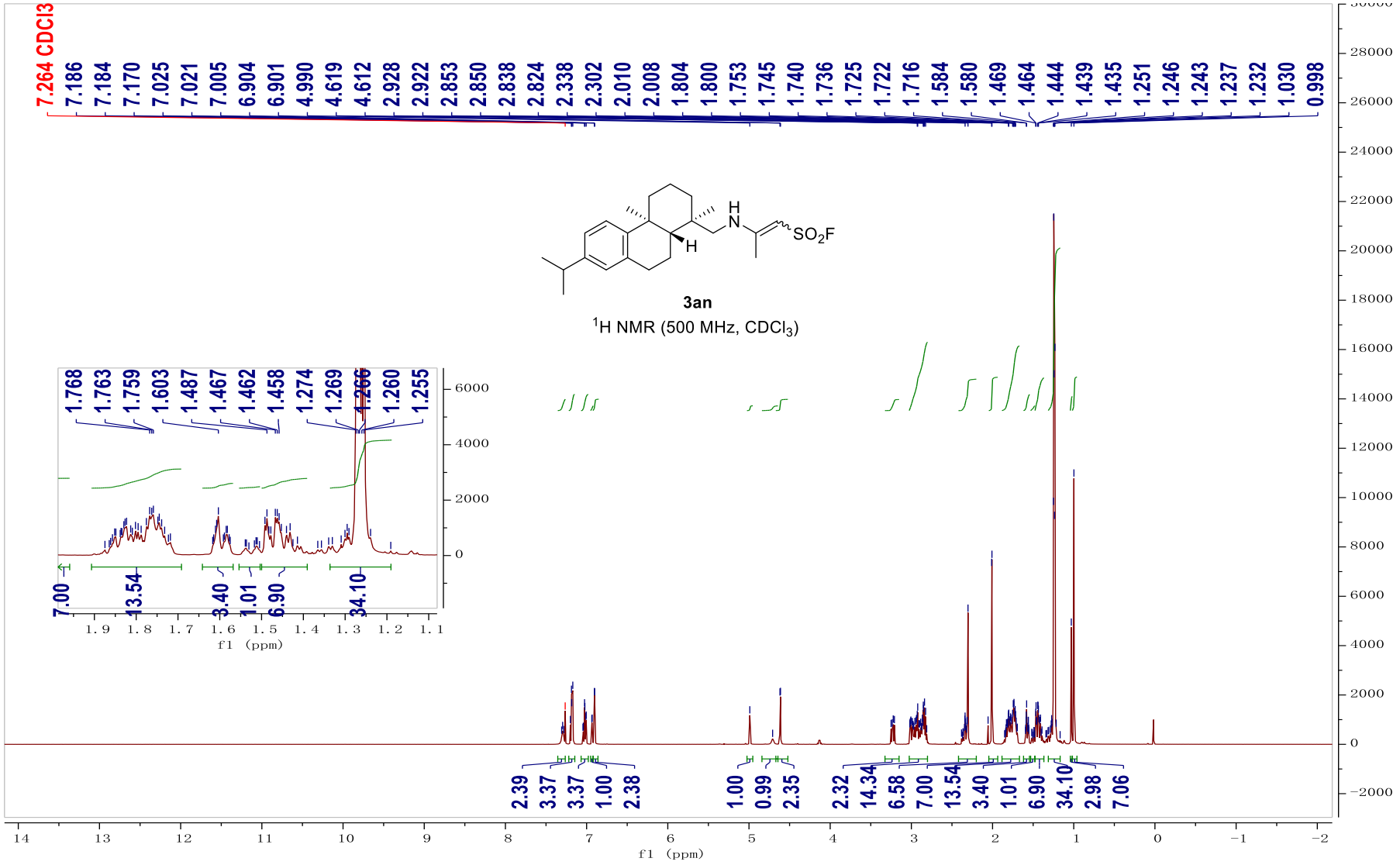
^{19}F NMR (471 MHz, $CDCl_3$)

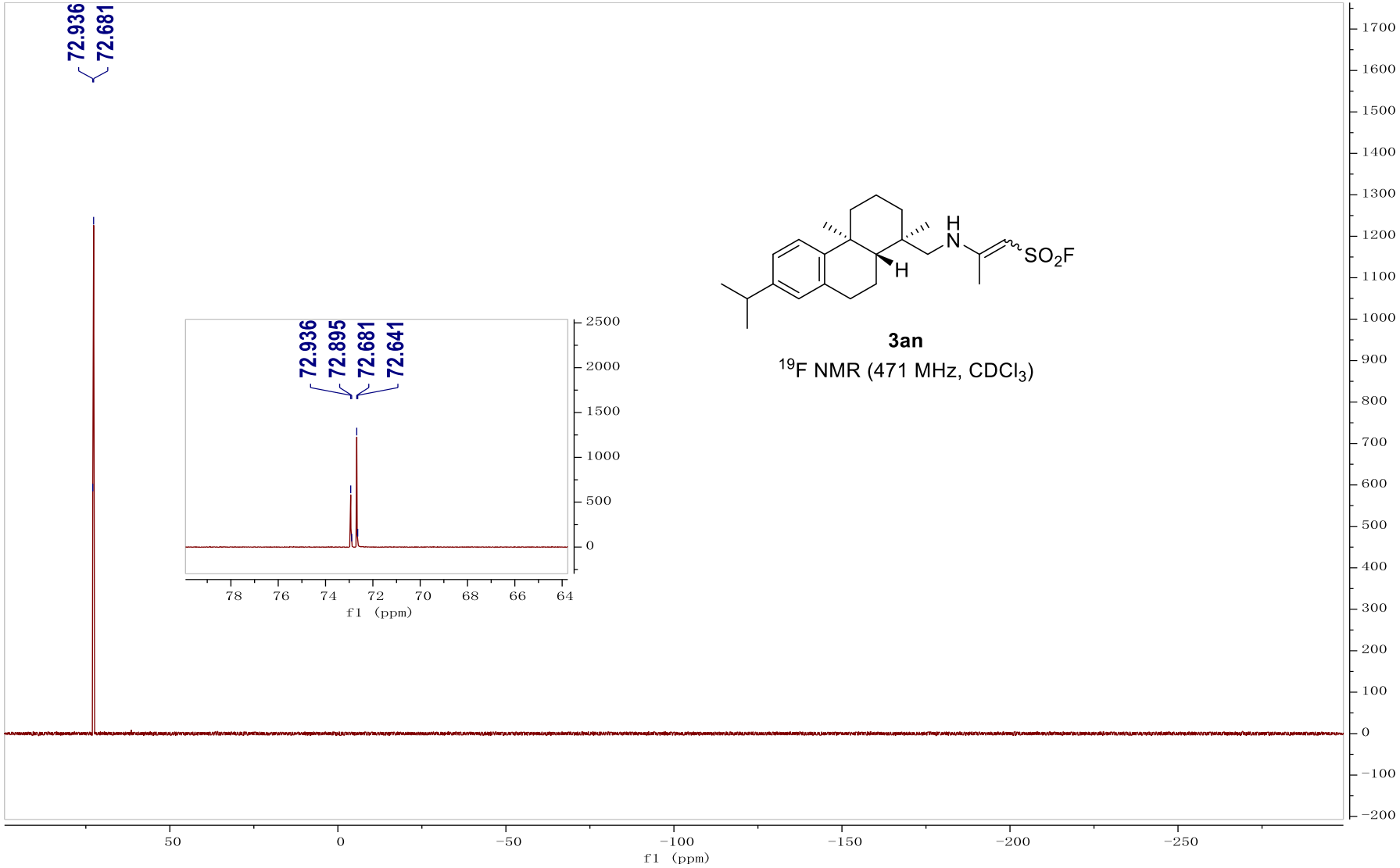

167.335
162.043
153.285
141.219
129.355
104.487
84.854
84.667
77.414 CDCl3
77.161 CDCl3
76.905 CDCl3
60.996
56.423
51.560
47.647
46.786
29.607
21.139
16.636
O
O
O
O
N
H
N
SO2F
3al
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.264 CDCl3
7.149
5.179
4.543
4.482
4.475
2.259
2.161
2.157
2.149
2.141
1.952
1.946
1.731
1.725
1.713
1.706
1.699
1.679
1.675
1.671
1.655
1.651
HN
SO2F
3aj
1H NMR (500 MHz, CDCl3)
0.65
1.00
1.00
0.64
2.99
6.92
9.91
11.36
f1 (ppm)


72.440
72.292
HN
SO2F
3aj
19F NMR (471 MHz, CDCl3)
f1 (ppm)

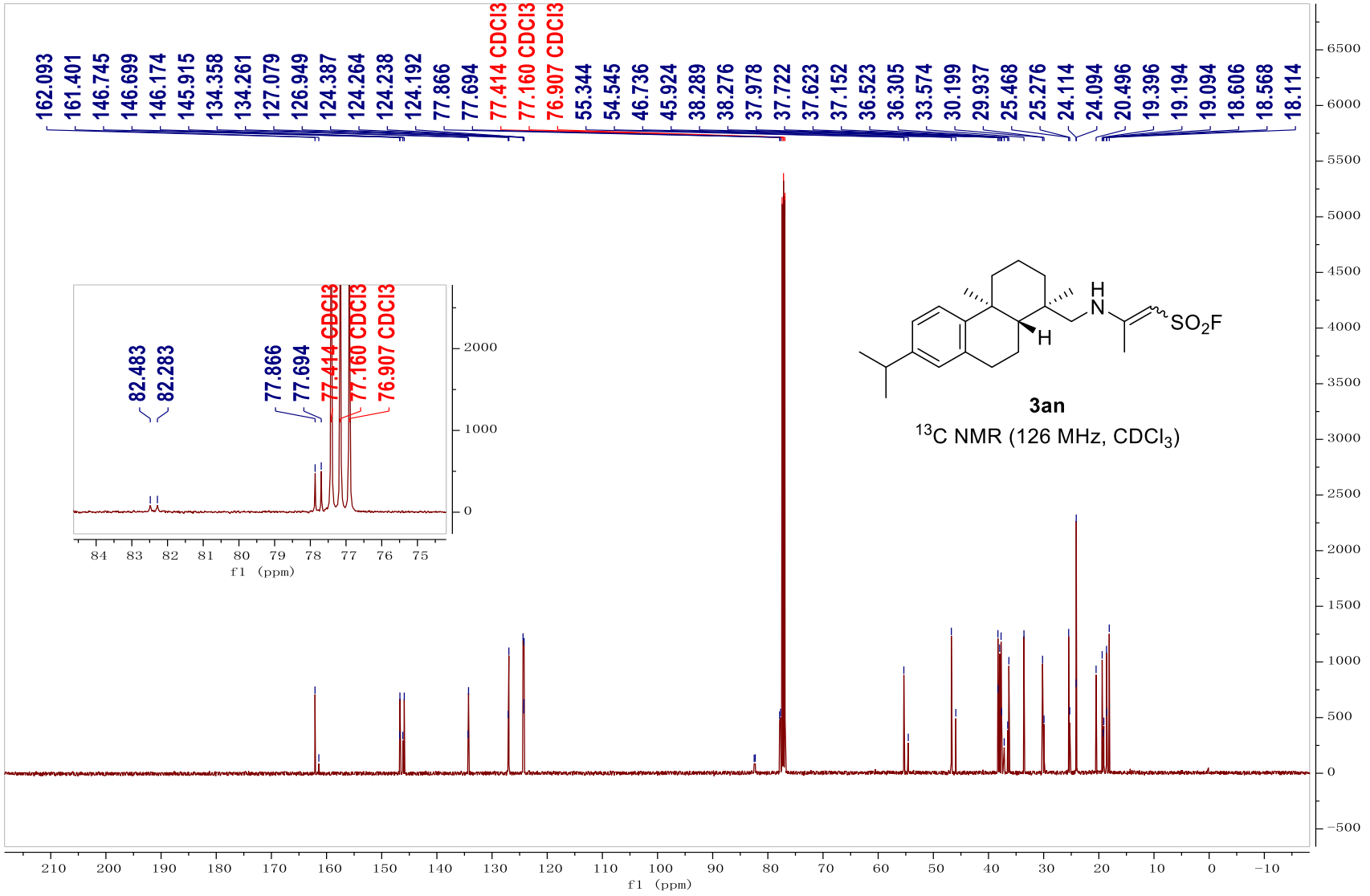

162.260
158.492
83.941
83.753
78.236
78.067
77.414 CDCl3
77.160 CDCl3
76.905 CDCl3
54.892
54.029
43.434
41.191
36.126
35.964
29.624
29.375
22.079
HN
SO2F
3aj
13C NMR (126 MHz, CDCl3)
f1 (ppm)


7.264 CDCl3
7.186
7.184
7.170
7.025
7.021
7.005
6.904
6.901
4.990
4.619
4.612
2.928
2.922
2.853
2.850
2.838
2.824
2.338
2.302
2.010
2.008
1.804
1.800
1.753
1.745
1.740
1.736
1.725
1.722
1.716
1.584
1.580
1.469
1.464
1.444
1.439
1.435
1.251
1.246
1.243
1.237
1.232
1.030
0.998
H
N
SO2F
H
3an
1H NMR (500 MHz, CDCl3)
1.768
1.763
1.759
1.603
1.487
1.467
1.462
1.458
1.274
1.269
1.266
1.260
1.255
7.00
13.54
3.40
1.01
6.90
34.10
f1 (ppm)
2.39
3.37
3.37
1.00
2.38
1.00
0.99
2.35
2.32
14.34
6.58
7.00
13.54
3.40
1.01
6.90
34.10
2.98
7.06
f1 (ppm)



3an

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


162.093
161.401
146.745
146.699
146.174
145.915
134.358
134.261
127.079
126.949
124.387
124.264
124.238
124.192
77.866
77.694
77.414 CDCl3
77.160 CDCl3
76.907 CDCl3
55.344
54.545
46.736
45.924
38.289
38.276
37.978
37.722
37.623
37.152
36.523
36.305
33.574
30.199
29.937
25.468
25.276
24.114
24.094
20.496
19.396
19.194
19.094
18.606
18.568
18.114
82.483
82.283
77.866
77.694
77.414 CDCl3
77.160 CDCl3
76.907 CDCl3
f1 (ppm)
H
N
H
SO2F
3an
13C NMR (126 MHz, CDCl3)
f1 (ppm)