Supporting Information

Diastereoselective Johnson-Corey-Chaykovsky Trifluoroethylidenation

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1. General Information

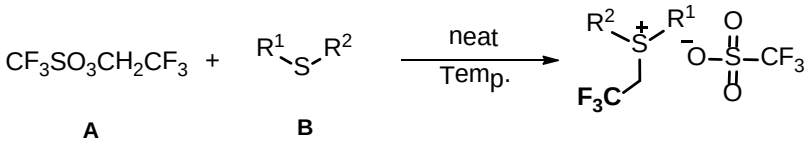
^{1}H, ^{13}C and ^{19}F NMR spectra were detected on a 500 MHz, 400 MHz or 300 MHz NMR spectrometer. Data for ^{1}H NMR, ^{13}C NMR and ^{19}F NMR were recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, coupling constant (s) in Hz). Mass spectra were obtained on GC-MS or LC-MS (ESI). High resolution mass data were recorded on a high resolution mass spectrometer in the EI or ESI mode.

Reagents such as 2,2,2-trifluoroethyl triflate, diphenyl sulfide, TBAF, TBAT and extra dry dichloromethane are commercially available.

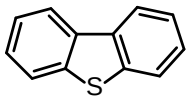
2. Screening Reaction Conditions for the Synthesis of Salt 1

2.1 Screening reaction conditions for the synthesis of salt 1

Table S2.1. Screening reaction conditions for the synthesis of salt **1**

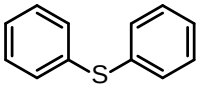


A **B**



B1

B2



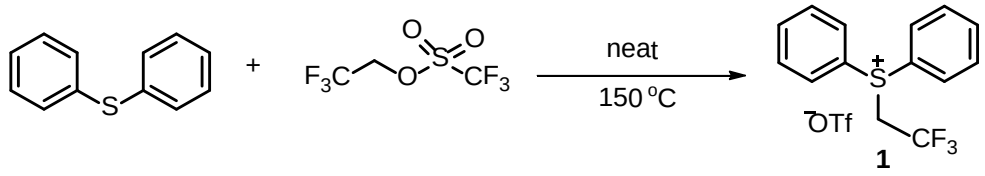
B3

Entry	B	A:B[a]	Temp. (^{o}C)	Yield (%)[b]
1	**B1**	5 : 1	120 ^{o}C	N.R.
2	**B1**	10 : 1	200 ^{o}C	N.R.
3	**B2**	10 : 1	120 ^{o}C	N.R.
4	**B3**	10 : 1	120 ^{o}C	3%
5	**B3**	1 : 5	100 ^{o}C	N.R.
6	**B3**	1 : 5	200 ^{o}C	82%
7	**B3**	1 : 5	150 ^{o}C	80%
8	**B3**	1 : 5	120 ^{o}C	32%

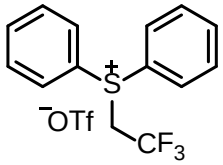
9	**B3**	1:2	150 °C	50%
10	**B3**	1:1.5	150 °C	41%

[a]Molar ratio; [b]Isolated yields.

2.2 Typical Procedure for the Synthesis of 1



The mixture of 2,2,2-trifluoroethyl triflate (4.64 g, 20 mmol, 1.0 equiv.) and diphenyl sulfide (18.6 g, 100 mmol, 5.0 equiv.) in a sealed tube was stirred at 150 °C for 30 hours. After the reaction mixture was cooled to room temperature, diethyl ether (10 mL) was added to precipitate the crude product, which was then washed by dry diethyl ether to give the final product **1** (5.9 g, yield 70%).



1

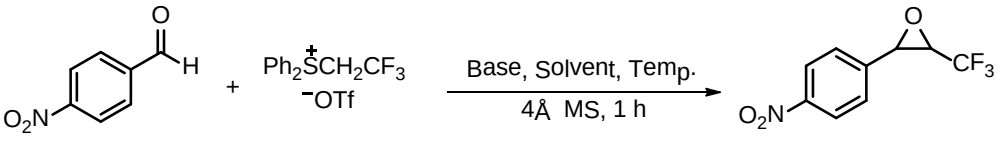
Diphenyl(2,2,2-trifluoroethyl)sulfonium triflate (**1**): White solid. M.P.: 136.6 - 137.8 °C; ^{1}H NMR (400 MHz, acetone-d_6) δ 8.35 (d, *J* = 7.7 Hz, 4H), 7.98 - 7.90 (m, 2H), 7.89 - 7.80 (m, 4H), 5.75 (q, *J* = 8.8 Hz, 2H); ^{19}F NMR (376 MHz, acetone-d_6) δ -61.20 (t, *J* = 8.8 Hz, 3F), -78.95 (s, 3F); ^{13}C NMR (101 MHz, acetone-d_6) δ 135.44 (s), 131.67 (s), 131.07 (s), 124.25 (s), 122.58 (q, *J* = 278.2 Hz), 121.35 (q, *J* = 321.4 Hz), 45.04 (q, *J* = 33.9 Hz); IR (neat) ν = 3096, 3067, 2999, 2937, 1484, 1450, 1415, 1342, 1244, 1155, 1110, 1029, 761, 740, 690, 679, 639, 541, 517, 507, 467 cm^{-1}; HRMS (ESI) Calcd for $C_{14}H_{12}F_3S^+$ [M - OTf]$^+$: 269.0606, Found: 269.0604; Calcd for $CF_3O_3S^-$ [OTf]$^-$: 148.9526, Found: 148.9522.

3. Screening Reaction Conditions for Expoxidation, Cyclopropanation and Airdination

3.1 Screening reaction conditions for expoxidation

Screening bases for the epoxidation of **2a (**4-nitrobenzaldehyde) with reagent **1** in DCM suggested that TBAT was a suitable base (entries 1-7, Table S3.1). The reaction was sensitive to the solvent, and DCM seemed to be a good choice (entries 8-12 vs Entry 5). Lowering the reaction temperature led to a dramatic decrease in the yield (entry 13, Table S3.1), and elevating the temperature improved the yield slightly to 68% (entry 14). The use of excess aldehyde (2 equiv.) was necessary to efficiently trap the unstable ylide intermediate generated in situ, as evidenced by the observation that decreasing the loading of aldehyde resulted in lower yield (entry 15). Increasing the reaction scale and shortening the time had no negative effect on this transformation (entry 16). Under these optimal reaction conditions (entry 16), the substrate scope of epoxidation was investigated.

Table S3.1. Screening reaction conditions for expoxidation[a]



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

TBAF: $^{n}Bu_4N^+F^-$ TBAT: $^{n}Bu_4N^+$ $Ph_3SiF_2^-$

Entry	Base	Solvent	Temp. (^{o}C)	Yield (%)[b]
1	NaF	DCM	r.t.	NR
2	CsF	DCM	r.t.	NR
3[c]	CsF	DCM	r.t.	27
4	TBAF	DCM	r.t.	35
5	TBAT	DCM	r.t.	64
6[d]	$^{i}Pr_2NH$	DCM	r.t.	14
7	Cs_2CO_3	DCM	r.t.	30
8	TBAT	DMF	r.t.	16
9	TBAT	CH_3CN	r.t.	30
10	TBAT	THF	r.t.	13
11	TBAT	Toluene	r.t.	11
12	TBAT	DCE	r.t.	48
13	TBAT	DCM	0 ^{o}C	43

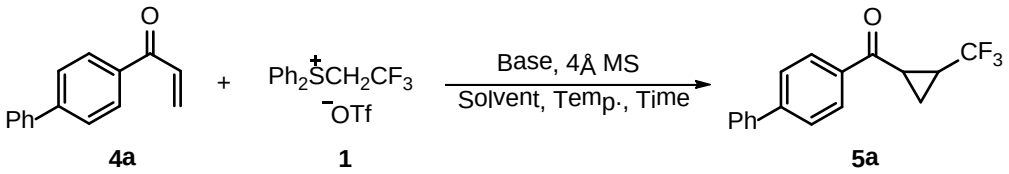
14	TBAT	DCM	Reflux	68
15[e]	TBAT	DCM	r.t.	39
16[f]	TBAT	DCM	Reflux	68

[a]Reaction conditions: **1** (0.1 mmol), **2a** (2 equiv.), base (1.5 equiv.) and 4Å MS (80 mg) in solvent (2 mL) for 1 h. NR: no reaction; [b]Determined by ^{19}F NMR with the use of trifluoromethyl benzene as an internal standard; [c]18-crown-6 (1.5 equiv.) was used as additive; [d]The reaction was run for 4 h; [e]Molar ratio: **1** : **2a** : base = 1: 1.5 :1; [f]Reaction condtions: **1** (0.5 mmol), **2a** (1 mmol), base (0.75 mmol) and 4Å MS (400 mg) in DCM (10 mL) for 20 minutes.

3.2 Screening reaction conditions for cyclopropanation

The investigation of the base (entries 1-10, Table S3.2) for the cyclopropanation of 4'-phenyl-phenyl vinyl ketone **4a** with reagent **1** showed that TBAF or TBAT was suitable (entries 9 and 10). This transformation was not sensitive to the reaction solvent (entries 11-16). Considering the price of the base and the operational convenience of the solvent, TBAF and DCM were chosen as the base and the solvent respectively (entry 9).

Table S3.2. Screening reaction conditions for cyclopropanation[a]



4a **1** **5a**

Entry	Base	Solvent	Time	Ratio [b]	Yield [c]
1	Cs_2CO_3	DCM	1 h	2 : 1 : 1.5	49
2	Na_2CO_3	DCM	1 h	2 : 1 : 1.5	N.R.
3	DBU	DCM	1 h	2 : 1 : 1.5	29
4	Et_3N	DCM	1 h	2 : 1 : 1.5	14
5	KF	DCM	1 h	2 : 1 : 1.5	N.R.
6[d]	KF	DCM	1 h	2 : 1 : 1.5	58
7	CsF	DCM	1 h	2 : 1 : 1.5	10
8	TBAF	DCM	1 h	2 : 1 : 1.5	90
9	TBAF	DCM	2 h	2 : 1 : 1.5	100
10	TBAT	DCM	2 h	2 : 1 : 1.5	100
11	TBAF	DCM	2 h	1 : 1.5 : 1.5	92

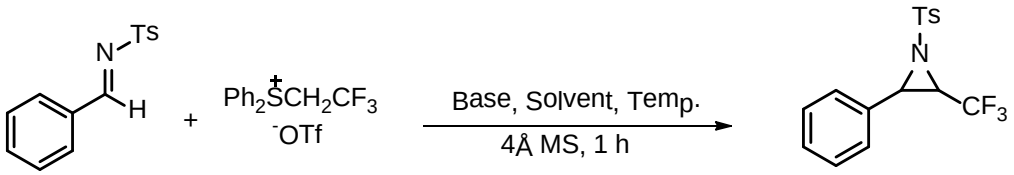
12	TBAF	CH_3CN	2 h	2 : 1 : 1.5	89
13	TBAF	NMP	2 h	2 : 1 : 1.5	83
14	TBAF	DMF	2 h	2 : 1 : 1.5	98
15	TBAF	DMA	2 h	2 : 1 : 1.5	100
16	TBAF	THF	2 h	2 : 1 : 1.5	96
17	TBAF	Dioxane	2 h	2 : 1 : 1.5	98

Notes: [a] Reaction conditions: **1** (0.1 mmol), **4a** (2 equiv.), base (1.5 equiv.) and 4Å MS (80 mg) in solvent (2 mL); [b] Molar ratio: **1** : **4a** : base = 1: 2 :1.5; [c] Determined by ^{19}F NMR with the use of trifluoromethyl benzene as an internal standard. [d] 18-crown-6 (1.5 equiv.) was used as additive.

3.3 Screening reaction conditions for aziridination

Various reaction conditions, including base, solvent and temperature, were examined for aziridination of compound **6a** with reagent **1**. The optimal reaction conditions (entry 1, Table S3.3) were similar with that for cyclopropanation.

Table S3.3. Screening reactions conditions for aziridination[a]



6a **1** **7a**

Entry	Base	Solvent	Ratio[b]	Yield[c]
1	DCM	TBAF	rt.	100%
2	DCM	TBAT	rt.	100%
3	DCM	Et_3N	rt.	89%
4	DCM	DBU	rt.	78%
5	DCM	Cs_2CO_3	rt.	90%
6	DCM	CsF	rt.	62%
7[d]	DCM	KF	rt.	76%
8	THF	TBAF	rt.	95%
9	CH_3CN	TBAF	rt.	76%
10	Dioxane	TBAF	rt.	100%
11	DMF	TBAF	rt.	72%
12	DMSO	TBAF	rt.	84%
13	DMA	TBAF	rt.	76%
14	NMP	TBAF	rt.	86%

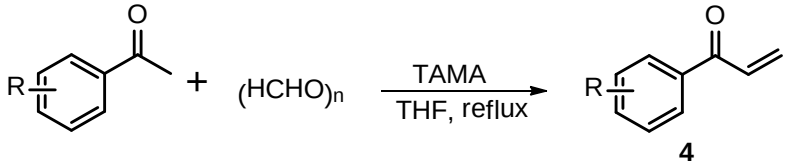
15	DCM	TBAF	0 ^{o}C	100%
16	DCM	TBAF	reflux	94%

[a]Reaction conditions: **1** (0.1 mmol), **6a** (2 equiv.), base (1.5 equiv.) and 4Å MS (80 mg) in solvent (2 mL); [b]Molar ratio: **1** : **6a** : base = 1: 2 :1.5; [c]Determined by ^{19}F NMR with the use of trifluoromethyl benzene as an internal standard. [d]18-crown-6 (1.5 equiv.) was used as additive.

4. Typical Procedure for the Preparation of 4, 6

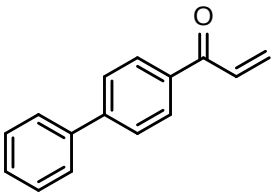
4.1 Procedure for the Preparation of 4

4 were synthesized according to the procedure reported in literature.[1]



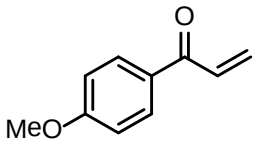
4

Into the solution of paraformaldehyde (7.5g, 250/n mmol, 5.0 equiv.) and *N*-methylanilinium trifluoroacetate (TAMA, 11.05 g, 50 mmol, 1.0 equiv.) in THF (50 mL) was added aryl methyl ketone (50 mmol, 1.0 equiv.) under N_2 atmosphere. The mixture was refluxed for 10 h. After being cooled to room temperature, the solvent was removed by concentration under vacuum. The residue was dissolved in ethyl acetate (100 mL). The organic phase was washed with H_2O (100 mL × 2), HCl solution (1M) and H_2O (100 mL), and then dried over Na_2SO_4. After filtration and concentration, the residue was subjected to flash column chromatography with hexane/ethyl acetate to afford the product **4**.



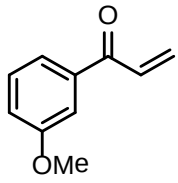
4a

1-([1,1'-Biphenyl]-4-yl)prop-2-en-1-one (**4a**)[2]: 56%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.04 (d, *J* = 7.8 Hz, 2H), 7.71 (d, *J* = 7.8 Hz, 2H), 7.64 (d, *J* = 7.8 Hz, 2H), 7.48 (t, *J* =7.2 Hz, 2H), 7.41 (t, *J* =7.2 Hz, 1H), 7.24 (dd, *J* = 17.1, 10.5 Hz, 1H), 6.48 (dd, *J* = 17.1, 1.5 Hz, 1H), 5.96 (dd, *J* = 10.5, 1.5 Hz, 1H).



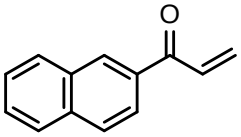
4b

1-(4-Methoxyphenyl)prop-2-en-1-one (**4b**)[1]: 40%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.97 (d, J = 8.6 Hz, 2H), 7.18 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.97 (d, *J* = 8.6 Hz, 2H), 6.43 (d, *J* = 17.1 Hz, 1H), 5.88 (d, *J* = 10.6 Hz, 1H), 3.88 (s, 3H).



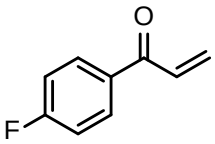
4c

1-(3-Methoxyphenyl)prop-2-en-1-one (**4c**)[1]: 26%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 - 7.39 (m, 2H), 7.31 (t, *J* = 7.8 Hz, 1H), 7.16 - 7.01 (m, 2H), 6.38 (d, *J* = 17.1 Hz, 1H), 5.85 (d, *J* = 10.5 Hz, 1H), 3.78 (s, 3H).



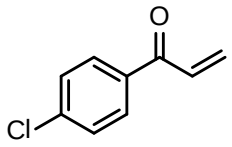
4d

1-(Naphthalen-2-yl)prop-2-en-1-one (**4d**)[1]: 45%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.47 (s, 1H), 8.04 (d, *J* = 8.6 Hz, 1H), 8.00 - 7.85 (m, 3H), 7.67 - 7.51 (m, 2H), 7.33 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.51 (d, *J* = 17.1 Hz, 1H), 5.98 (d, *J* = 10.6 Hz, 1H).



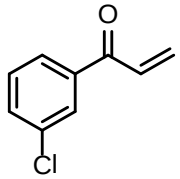
4e

1-(4-Fluorophenyl)prop-2-en-1-one (**4e**)[1]: 37%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.09 - 7.87 (m, 2H), 7.22 - 7.04 (m, 3H), 6.44 (d, *J* = 17.1Hz, 1H), 5.94 (d, *J* = 10.6 Hz, 1H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -105.06 - -105.56 (m, 1F).



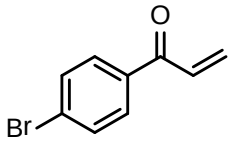
4f

1-(4-Chlorophenyl)prop-2-en-1-one (**4g**)[1]: 72%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.1 Hz, 2H), 7.46 (d, *J* = 8.1 Hz, 2H), 7.12 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.45 (d, *J* = 17.1 Hz, 1H), 5.96 (d, *J* = 10.6 Hz, 1H).



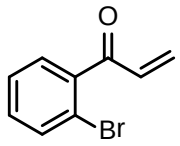
4g

1-(3-Chlorophenyl)prop-2-en-1-one (**4g**)[1]: 44%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.79 (s, 1H), 7.73 - 7.66 (m, 1H), 7.46 - 7.38 (m, 1H), 7.36 - 7.26 (m, 1H), 7.00 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.34 (dd, *J* = 17.1, 1.3 Hz, 1H), 5.85 (dd, *J* = 10.6, 1.3 Hz, 1H).



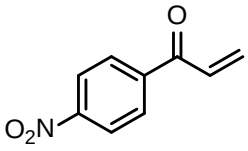
4h

1-(4-Bromophenyl)prop-2-en-1-one (**4h**)[1]: 59%; Colorless liquid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.82 (d, *J* = 8.6 Hz, 2H), 7.63 (d, *J* = 8.6 Hz, 2H), 7.12 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.45 (dd, *J* = 17.1 Hz, 1.5 Hz, 1H), 5.96 (dd, *J* = 10.6 Hz, 1.5 Hz, 1H).



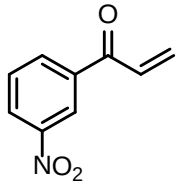
4i

1-(2-Bromophenyl)prop-2-en-1-one (**4i**)[2]: 31%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, *J* = 8.3 Hz, 1H), 7.41 - 7.27 (m, 3H), 6.71 (dd, *J* = 17.5, 10.5 Hz, 1H), 6.09 (d, *J* = 17.5 Hz, 1H), 6.06 (d, *J* = 10.5 Hz, 1H).



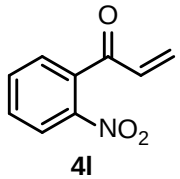
4j

1-(4-Nitrophenyl)prop-2-en-1-one (**4j**)[1]: 27%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.26 (d, *J* = 8.6 Hz, 2H), 8.01 (d, *J* = 8.6 Hz, 2H), 7.06 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.41 (d, *J* = 17.1 Hz, 1H), 6.00 (d, *J* = 10.6 Hz, 1H).



4k

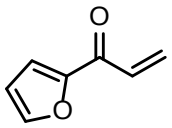
1-(3-Nitrophenyl)prop-2-en-1-one (**4d**)[3]: 31%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.77 (s, 1H), 8.45 (d, *J* = 7.4 Hz, 1H), 8.28 (d, *J* = 7.4 Hz, 1H), 7.71 (t, *J* = 7.4 Hz, 1H), 7.18 (dd, *J* = 17.1, 9.7 Hz, 1H), 6.53 (d, *J* = 17.1 Hz, 1H), 6.08 (d, *J* = 9.7 Hz, 1H).



4l

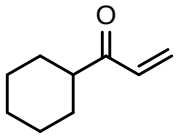
1-(2-Nitrophenyl)prop-2-en-1-one (**4l**)[4]: 52%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 - 7.79 (m, 2H), 7.45 - 7.34 (m, 2H), 7.07 (dd, *J* = 17.1, 10.6 Hz, 1H), 6.40 (dd, *J* = 17.1, 1.6 Hz, 1H), 5.90

(dd, *J* = 10.6, 1.6 Hz, 1H).



4m

1-(Furan-2-yl)prop-2-en-1-one (**4m**)[5]: 29%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 0.9 Hz, 1H), 7.32 - 7.20 (m, 1H), 7.04 (dd, *J* = 17.2, 10.5 Hz, 1H), 6.60 - 6.43 (m, 2H), 5.84 (dd, *J* = 10.5, 1.6 Hz, 1H).



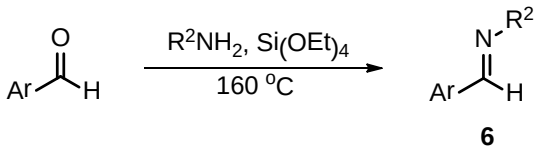
4n

1-Cyclohexylprop-2-en-1-one (**4n**)[5]: 23%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.43 (dd, *J* = 17.5, 10.5 Hz, 1H), 6.25 (dd, *J* = 17.5, 1.2 Hz, 1H), 5.75 (dd, *J* = 10.5, 1.2 Hz, 1H), 2.62 (ddd, *J* = 11.0, 8.7, 2.3 Hz, 1H), 1.86 - 1.78 (m, 4H), 1.69 (d, *J* = 11.6 Hz, 1H), 1.40 - 1.25 (m, 5H).

4.2 Procedure for the Synthesis of 6

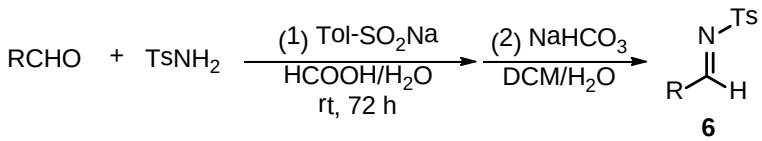
6 were synthesized according to the procedure reported in literature[6].

Method A:



6

Method B:

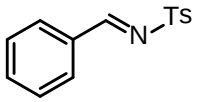


6

Method A[6b, 6c]: Aldehyde (31.5 mmol, 1.05 equiv), sulfonamide (30.0 mmol, 1.0 equiv) and tetraethyl orthosilicate (120 mmol, 25 g, 4.0 equiv) were combined in a flask equipped with a still head and the mixture was stirred at 160°C until no ethanol was produced. After the reaction

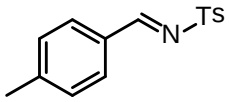
system was cooled to room temperature, ethyl acetate/n-hexane (1:3) was added to precipitate the crude product. After filtration, the solid was washed by ethyl acetate/n-hexane(1:3) followed by ethanol to give the pure product **6a**-**j**, **l**-**m**.

Method B[6a]: Aldehyde (30.0 mmol, 1.0 equiv), sodium *p*-tolylsulfinate (30.0 mmol, 1.0 equiv) and sulfonamide (30 mmol, 1.0 equiv) were mixed in formic acid/H_2O (1:1, 100 mL) and stirred for 72 h at room temperature. The resulting white precipitate was filtered off, washed with H_2O (2 x 30 mL), then pentane (30 mL), and dissolved in CH_2Cl_2 (150 mL). Sat. aq $NaHCO_3$ was added and the solution was well stirred overnight at room temperature. The organic phase was decanted, then washed with brine and dried over Na_2SO_4. Filtered off and the solvent removed under vacuum to yield the corresponding product **6k**.



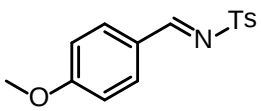
6a

(*E*)-N-Benzylidene-4-methylbenzenesulfonamide (**6a**)[7]: ^{1}H NMR (300 MHz, $CDCl_3$) δ 9.03 (s, 1H), 7.95 - 7.86 (m, 4H), 7.65 - 7.58 (m, 1H), 7.49 (t, *J* = 7.5 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 2.44 (s, 3H).



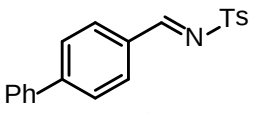
6b

(*E*)-4-Methyl-N-(4-methylbenzylidene)benzenesulfonamide (**6b**)[7]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.97 (s, 1H), 7.86 (d, *J* = 8.1 Hz, 2H), 7.79 (d, *J* = 7.6 Hz, 2H), 7.32 (d, *J* = 7.9 Hz, 2H), 7.26 (d, *J* = 7.8 Hz, 2H), 2.41 (s, 6H).



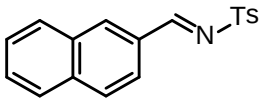
6c

(*E*)-N-(4-Methoxybenzylidene)-4-methylbenzenesulfonamide (**6c**)[7]: ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.94 (s, 1H), 7.94 - 7.83 (m, 4H), 7.33 (d, *J* = 8.3 Hz, 2H), 6.97 (d, *J* = 8.3 Hz, 2H), 3.89 (s, 3H), 2.43 (s, 3H).



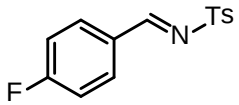
6d

(*E*)-N-([1,1'-Biphenyl]-4-ylmethylene)-4-methylbenzenesulfonamide (**6d**)[8]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.05 (s, 1H), 7.98 (d, *J* = 8.0 Hz, 2H), 7.89 (d, *J* = 8.0 Hz, 2H), 7.70 (d, *J* = 7.9 Hz, 2H), 7.61 (d, *J* = 7.3 Hz, 2H), 7.50 - 7.37 (m, 3H), 7.34 (d, *J* = 7.9 Hz, 2H), 2.43 (s, 3H).



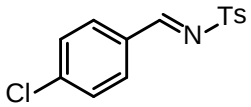
6e

(*E*)-4-Methyl-N-(naphthalen-2-ylmethylene)benzenesulfonamide (**6e**)[9]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.16 (s, 1H), 8.32 (s, 1H), 8.02 (d, *J* = 8.3 Hz, 1H), 7.96 - 7.84 (m, 5H), 7.62 (t, *J* = 7.2 Hz, 1H), 7.56 (t, *J* = 7.6 Hz, 1H), 7.34 (d, *J* = 7.6 Hz, 2H), 2.43 (s, 3H).



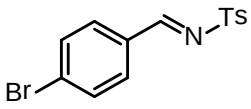
6f

(*E*)-N-(4-Fluorobenzylidene)-4-methylbenzenesulfonamide (**6f**)[9]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.98 (s, 1H), 7.94 (dd, *J* = 8.5, 5.5 Hz, 2H), 7.87 (d, *J* = 8.2 Hz, 2H), 7.33 (d, *J* = 8.2 Hz, 2H), 7.16 (t, *J* = 8.5 Hz, 2H), 2.42 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -101.03 - -101.13 (m, 1F).



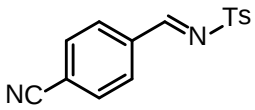
6g

(*E*)-N-(4-Chlorobenzylidene)-4-methylbenzenesulfonamide (**6g**)[10]: ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.99 (s, 1H), 7.94 - 7.81 (m, 4H), 7.46 (d, *J* = 8.3 Hz, 2H), 7.35 (d, *J* = 8.3 Hz, 2H), 2.44 (s, 3H).



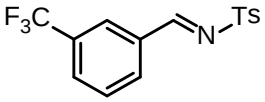
6h

(*E*)-N-(4-Bromobenzylidene)-4-methylbenzenesulfonamide (**6h**)[10]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.95 (s, 1H), 7.86 (d, *J* = 8.2 Hz, 2H), 7.75 (d, *J* = 8.4 Hz, 2H), 7.60 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 2.41 (s, 3H).



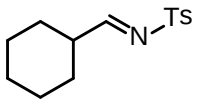
6i

(*E*)-N-(4-Cyanobenzylidene)-4-methylbenzenesulfonamide (**6i**)[7]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.04 (s, 1H), 8.01 (d, *J* = 8.2 Hz, 2H), 7.88 (d, *J* = 8.2 Hz, 2H), 7.76 (d, *J* = 8.2 Hz, 2H), 7.36 (d, *J* = 8.2 Hz, 2H), 2.44 (s, 3H).



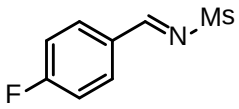
6j

(*E*)-4-Methyl-N-(3-(trifluoromethyl)benzylidene)benzenesulfonamide (**6j**)[11]: ^{1}H NMR (300 MHz, $CDCl_3$) δ 9.08 (s, 1H), 8.20 (s, 1H), 8.10 (d, *J* = 7.8 Hz, 1H), 7.90 (d, *J* = 8.1 Hz, 2H), 7.86 (d, *J* = 8.1 Hz, 1H), 7.65 (t, *J* = 7.8 Hz, 1H), 7.37 (d, *J* = 8.1 Hz, 2H), 2.45 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.04 (s, 3F).



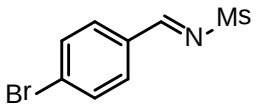
6k

(*E*)-N-(Cyclohexylmethylene)-4-methylbenzenesulfonamide (**6k**)[9]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.77 (d, *J* = 8.2 Hz, 2H), 7.30 (d, *J* = 8.2 Hz, 2H), 2.48 - 2.36 (br s, 4H), 1.91 - 1.80 (m, 5H), 1.76 - 1.70 (m, 2H), 1.68 - 1.62 (m, 1H), 1.36 - 1.12 (m, 5H).



6l

(*E*)-N-(4-Fluorobenzylidene)methanesulfonamide (**6l**)[12]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.98 (s, 1H), 7.98 (dd, *J* = 8.3, 5.5 Hz, 2H), 7.20 (t, *J* = 8.3 Hz, 2H), 3.12 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -99.07 - -101.73 (m).

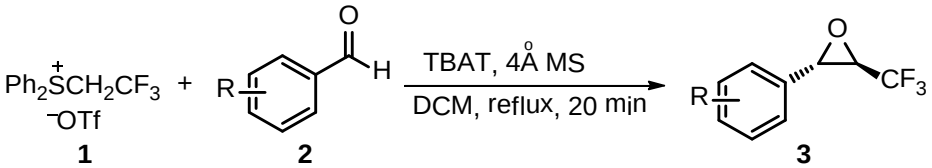


6m

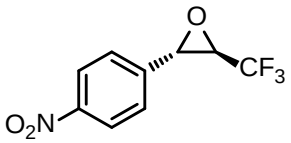
(*E*)-N-(4-Bromobenzylidene)methanesulfonamide (**6m**)[13]: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.97 (s, 1H), 7.80 (d, *J* = 8.4 Hz, 2H), 7.67 (d, *J* = 8.4 Hz, 2H), 3.12 (s, 3H).

5. Procedure for the Synthesis of 3, 5, 7

5.1 Procedure for the Synthesis of 3

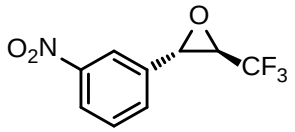


Into the mixture of diphenyl(2,2,2-trifluoroethyl)sulfonium triflate **1** (0.5 mmol, 0.2092 g, 1.0 equiv.), aldehyde **2** (1.0 mmol, 2.0 equiv.), TBAT (0.75 mmol, 0.4048 g, 1.5 equiv.) and 4Å MS (0.4 g) was added dichloromethane(8 mL) under N_2 atmosphere. The resulting mixture was refluxed for 20 min. After filtration, the solvent was removed by concentration under vacuum and the residue was subjected to flash column chromatography with hexane/ethyl acetate (100:1-20:1) as the eluent to afford the final product.



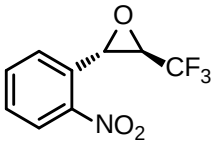
3a

(*2SR,3RS*)-2-(4-Nitrophenyl)-3-(trifluoromethyl)oxirane (**3a**): 61%; White solid. M.P. 55.0-56.1 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.6 Hz, 2H), 7.49 (d, *J* = 8.6 Hz, 2H), 4.25 (s, 1H), 3.57 - 3.44 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.01 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.44 (s), 140.65 (s), 126.72 (s), 123.97 (s), 121.71 (q, *J* = 276.3 Hz), 57.06 (q, *J* = 41.3 Hz), 53.95 (q, *J* = 2.8 Hz); IR (neat) ν = 3087, 2973, 1936, 1608, 1525, 1465, 1351, 1285, 1159, 872, 698 cm^{-1}; HRMS (EI) Calcd for $C_9H_6NO_3F_3$ $[M]^+$: 233.0300, Found: 233.0298.



3b

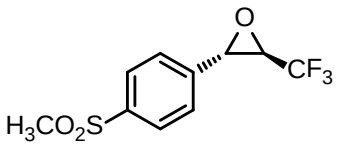
(*2SR,3RS*)-2-(3-Nitrophenyl)-3-(trifluoromethyl)oxirane (**3b**): 50%; Colourless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, *J* = 7.9 Hz, 1H), 8.20 (s, 1H), 7.73 - 7.58 (m, 2H), 4.29 (s, 1H), 3.56 (dq, *J* = 4.6, 1.3 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.01 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.63 (s), 135.88 (s), 131.74 (s), 130.06 (s), 124.24 (s), 121.74 (q, *J* = 276.2 Hz), 120.92 (s), 57.02 (q, *J* = 41.3 Hz), 53.96 (q, *J* = 2.8 Hz); IR (neat) ν = 3095, 1587, 1537, 1488, 1465, 1441, 1354, 1286, 1250, 1207, 1161, 1113, 1097, 1077, 938, 902, 839, 812, 737, 689, 672, 624 cm^{-1}; HRMS (EI): calcd. for $C_9H_6F_3NO_3$ $[M]^+$: 233.0300, Found: 233.0297.



3c

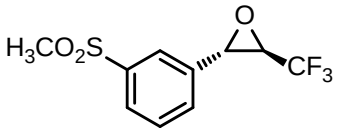
(*2SR,3RS*)-2-(2-Nitrophenyl)-3-(trifluoromethyl)oxirane (**3c**): 62%; Light yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (dd, *J* = 8.2, 0.9 Hz, 1H), 7.78 - 7.68 (m, 1H), 7.64 - 7.52 (m, 2H), 4.75 (d, *J* = 1.9 Hz, 1H), 3.37 (qd, *J* = 4.7, 1.9 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.36 (d, *J* = 4.7 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.26 (s), 134.63 (s), 130.64 (s), 129.76 (s), 127.19 (s), 125.02 (s), 121.85 (q, *J* = 276.1 Hz), 56.21 (q, *J* = 41.4 Hz), 53.79 (q, *J* = 3.3 Hz); IR (neat) ν = 3091, 2864, 1621, 1579, 1533, 1489, 1459, 1445, 1347, 1313, 1282, 1247, 1199, 1166, 1093,

973, 932, 890, 875, 861, 844, 794, 739, 702, 685, 675, 629,571, 503 cm^{-1}; HRMS (EI): calcd. for $C_9H_6F_3NO_3$ $[M]^+$: 233.0300, Found: 233.0298.



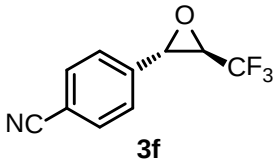
3d

(*2SR,3RS*)-2-(4-(Methylsulfonyl)phenyl)-3-(trifluoromethyl)oxirane (**3d**): 56%; White solid. M.P. 103.5-104.8 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 2H), 7.51 (d, *J* = 8.4 Hz, 2H), 4.22 (d, *J* = 1.7 Hz, 1H), 3.49 (qd, *J* = 4.6, 1.7 Hz, 1H), 3.04 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.02 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.52 (s), 139.75 (s), 127.99 (s), 126.80 (s), 121.76 (q, *J* = 276.2 Hz), 57.09 (q, *J* = 41.3 Hz), 54.10 (q, *J* = 2.8 Hz), 44.43 (s); IR (neat) ν = 3033, 2943, 1607, 1466, 1413, 1354, 1304, 1290, 1252, 1203, 1155, 1119, 1086, 968, 926, 867, 836, 799, 767, 722, 675, 558, 544, 535 cm^{-1}; HRMS (EI): calcd. for $C_{10}H_9F_3O_3S$ $[M]^+$: 266.0224, Found: 266.0225.



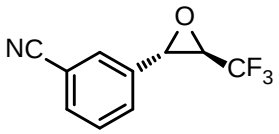
3e

(2*SR*,3*RS*)-2-(3-(Methylsulfonyl)phenyl)-3-(trifluoromethyl)oxirane (**3e**): 49%; White solid. M.P. 68.1-69.3 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 7.98 (dt, *J* = 7.0, 1.8 Hz, 1H), 7.91 (s, 1H), 7.70 - 7.58 (m, 2H), 4.26 (d, *J* = 1.5 Hz, 1H), 3.56 (qd, *J* = 4.6, 1.5 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.02 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.58 (s), 135.64 (s), 131.00 (s), 130.09 (s), 128.20 (s), 124.83 (s), 121.78 (q, *J* = 276.2 Hz), 56.99 (q, *J* = 41.3 Hz), 54.16 (q, *J* = 2.8 Hz), 44.39 (s); IR (neat) ν = 3070, 3039, 2941, 1721, 1473, 1426, 1345, 1320, 1299, 1250, 1211, 1146, 1088, 998, 971, 961, 926, 905, 891, 860, 792, 767, 691, 680, 633, 588, 542, 533, 490 cm^{-1}; HRMS (EI): calcd. for $C_{10}H_6F_3NO$ $[M]^+$: 213.0224, Found: 213.0220.



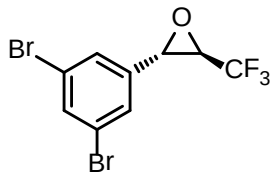
3f

4-((*2SR,3RS*)-3-(Trifluoromethyl)oxiran-2-yl)benzonitrile (**3f**): 56%; White solid. M.P. 53.8 - 54.6 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.5 Hz, 2H), 7.42 (d, *J* = 8.5 Hz, 2H), 4.19 (s, 1H), 3.47 (qd, *J* = 4.7, 1.7 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.03 (d, *J* = 4.7 Hz, 3F); ^{13}C NMR (126 MHz, $CDCl_3$) δ 138.76 (s), 132.61 (s), 126.51 (s), 121.74 (q, *J* = 276.2 Hz), 118.11 (s), 113.25 (s), 57.06 (q, *J* = 41.2 Hz), 54.13 (q, *J* = 2.8 Hz); IR (neat) ν = 3048, 2230, 1615, 1511, 1465, 1352, 1285, 1155, 925, 869, 680 cm^{-1}; HRMS (EI) Calcd for $C_9H_6NO_2F_3$ $[M]^+$: 213.0401, Found: 213.0403.



3g

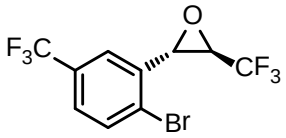
3-((*2SR,3RS*)-3-(Trifluoromethyl)oxiran-2-yl)benzonitrile (**3g**): 50%; White solid. M.P. 49.8-50.3 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 6.7 Hz, 1H), 7.60 (s, 1H), 7.57 - 7.45 (m, 2H), 4.18 (d, 1.5 Hz, 1H), 3.47 (qd, *J* = 4.6, 1.5 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.03 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 135.29 (s), 132.86 (s), 130.05 (s), 129.75 (s), 129.33 (s), 121.70 (q, *J* = 276.2 Hz), 117.94 (s), 113.29 (s), 56.94 (q, *J* = 41.3 Hz), 53.90 (q, *J* = 2.8 Hz); IR (neat) ν = 3093, 2231, 1614, 1588, 1485, 1474, 1425, 1341, 1291, 1252, 1233, 1176, 1142, 1110, 1087, 934, 914, 894, 862, 815, 795, 745, 694, 680, 641, 606, 549, 543, 479 cm^{-1}; HRMS (EI): calcd. for $C_{10}H_6F_3NO$ $[M]^+$: 213.0401, Found: 213.0397.



3h

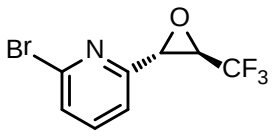
(*2SR,3RS*)-2-(3,5-Dibromophenyl)-3-(trifluoromethyl)oxirane (**3h**): 59%; White solid. M.P. 69.2-70.4 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (t, *J* = 1.4 Hz, 1H), 7.38 (d, *J* = 1.4 Hz, 2H),

4.07 (d, *J* = 1.6 Hz, 1H), 3.44 (qd, *J* = 4.6, 1.6 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -74.04 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 137.53 (s), 135.03 (s), 127.64 (s), 123.52 (s), 121.71 (q, *J* = 276.3 Hz), 56.90 (q, *J* = 41.3 Hz), 53.50 (q, *J* = 2.8 Hz); IR (neat) ν = 3068, 1590, 1560, 1466, 1428, 1414, 1341, 1288, 1202, 1153, 1103, 1078, 991, 930, 914, 890, 884, 867, 857, 816, 745, 696, 670, 650, 528 cm^{-1}; HRMS (EI): calcd. for $C_9H_5Br_2F_3O$ $[M]^+$: 343.8659, Found: 343.8664.



3i

(*2SR,3RS*)-2-(2-Bromo-5-(trifluoromethyl)phenyl)-3-(trifluoromethyl)oxirane (**3i**): 60%; Colourless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.0 Hz, 1H), 7.59 - 7.39 (m, 2H), 4.42 (d, *J* = 1.5 Hz, 1H), 3.38 (qd, *J* = 4.6, 1.5 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.98 (s, 3F), -74.17 (d, *J* = 4.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 134.82 (s), 133.24 (s), 130.66 (q, *J* = 33.4 Hz), 127.01 (q, *J* = 3.6 Hz), 126.18 (d, *J* = 1.5 Hz), 123.45 (q, *J* = 3.8 Hz), 123.41 (q, *J* = 272.4 Hz), 121.76 (q, *J* = 276.1 Hz), 56.46 (q, *J* = 41.5 Hz), 54.63 (q, *J* = 3.0 Hz); IR (neat) ν = 3040, 2920, 1611, 1584, 1484, 1458, 1418, 1347, 1327, 1287, 1264, 1246, 1163, 1135, 1079, 1033, 934, 922, 908, 871, 831, 756, 725, 688, 642, 626 cm^{-1}; HRMS (EI): calcd. for $C_{10}H_5BrF_6O$ $[M]^+$: 333.9428, Found: 333.9427.

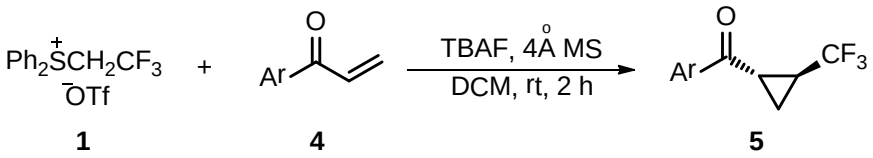


3j

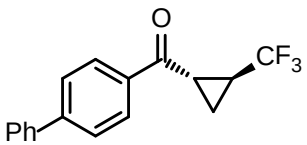
2-Bromo-6-((*2SR,3RS*)-3-(trifluoromethyl)oxiran-2-yl)pyridine (**3j**): 56%; Colourless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 - 7.54 (m, 1H), 7.52 - 7.45 (m, 1H), 7.28 (d, *J* = 7.5 Hz, 1H), 4.22 (d, *J* = 1.4 Hz, 1H), 3.79 (qd, *J* = 4.8, 1.4 Hz, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -73.90 (d, *J* = 4.8 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.25 (s), 142.36 (s), 139.22 (s), 128.79 (s), 121.90 (q, *J* = 276.1 Hz), 120.07 (s), 55.75 (q, *J* = 41.4 Hz), 54.49 (q, *J* = 2.6 Hz); IR (neat) ν =

3050, 2923, 1581, 1557, 1476, 1442, 1405, 1349, 1329, 1275, 1238, 1161, 1124, 1112, 1085, 1071, 988, 927, 892, 860, 820, 793, 736, 699, 682, 632, 598, 536 cm^{-1}; HRMS (EI): calcd. for $C_8H_5BrF_3NO$ $[M]^+$: 266.9507, Found: 266.9506.

5.2 The Procedure for the Synthesis of 5

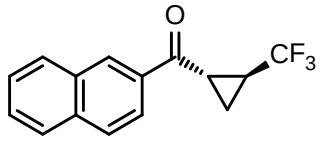


Into the mixture of diphenyl(2,2,2-trifluoroethyl)sulfonium triflate **1** (0.2 mmol, 83.7 mg, 1.0 equiv.), compound **4** (0.4 mmol, 2.0 equiv.) and 4Å MS (160 mg) in dichloromethane(2 mL) was added TBAF (0.3 mmol, 0.3 mL, 1.5 equiv.) dropwise under N_2 atmosphere. The reaction mixture was stirred at room temperature for 2 h. After concentration, the residue was subjected to flash column chromatography with hexane/ethyl acetate (100:1-20:1) as the eluent to afford the final product **5**.



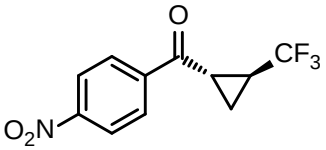
5a

[1,1'-Biphenyl]-4-yl((*1SR,2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5a**): 90%; White solid. M.P.: 108.7-110.3 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, *J* = 7.9 Hz, 2H), 7.72 (d, *J* = 7.9 Hz, 2H), 7.63 (d, *J* = 7.5 Hz, 2H), 7.48 (t, *J* = 7.1 Hz, 2H), 7.41 (t, *J* = 7.1 Hz, 1H), 3.08 - 3.02 (m, 1H), 2.42 - 2.33 (m, 1H), 1.58 - 1.51 (m, 1H), 1.47 - 1.41 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.65 (d, *J* = 6.2 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.79 (s), 146.33 (s), 139.65 (s), 135.39 (s), 128.99 (s), 128.85 (s), 128.39 (s), 127.38 (s), 127.27 (s), 125.24 (q, *J* = 271.1 Hz), 23.82 (q, *J* = 37.8 Hz), 20.08 (q, *J* = 2.0 Hz), 12.50 (q, *J* = 2.6 Hz); IR (neat) ν = 2925, 2361, 1673, 1603, 560, 1509, 1341, 1264, 1150, 1063, 1305, 936, 849, 772, 739 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{13}OF_3$ $[M]^+$: 290.0918, Found: 290.0920.



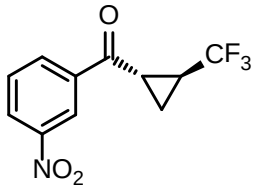
5b

Naphthalen-2-yl((*1SR,2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5b**): 89%; Light yellow solid. M.P.: 42.4-44.4^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 8.04 (d, *J* = 8.8 Hz, 1H), 8.01 (d, *J* = 8.3 Hz, 1H), 7.93 (d, *J* = 8.8 Hz, 1H), 7.90 (d, *J* = 8.3 Hz, 1H), 7.66 - 7.55 (m, 2H), 3.22 - 3.14 (m, 1H), 2.49 - 2.37 (m, 1H), 1.63 - 1.54 (m, 1H), 1.53 - 1.45 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.66 (d, *J* = 6.6 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.22 (s), 135.78 (s), 134.04 (s), 132.44 (s), 130.23 (s), 129.67 (s), 128.83 (s), 128.72 (s), 127.82 (s), 127.01 (s), 125.24 (q, *J* = 271.1 Hz), 123.69 (s), 23.86 (q, *J* = 37.8 Hz), 20.13 (q, *J* = 1.9 Hz), 12.70 (q, *J* = 2.6 Hz); IR (neat) ν = 3059, 2361, 1673, 1628, 1597, 1471, 1357, 1333, 1107, 756 cm^{-1}; HRMS (EI) Calcd for $C_{15}H_{11}OF_3$ [M]$^{+}$: 264.0762, Found: 264.0767.



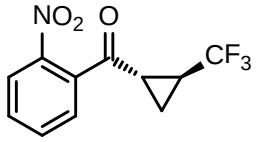
5c

(4-Nitrophenyl)((*1SR, 2SR*)-2-(trifluoromethyl) cyclopropyl) methanone (**5c**): 97%; White solid. M.P.: 57.6-59.1^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (d, *J* = 7.6 Hz, 2H), 8.16 (d, *J* = 7.6 Hz, 2H), 3.02 - 2.98 (m, 1H), 2.54 - 2.31 (m, 1H), 1.65 - 1.55 (m, 1H), 1.55 - 1.50 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.91 (d, *J* = 6.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.11 (s), 150.59 (s), 141.04 (s), 129.26 (s), 124.80 (q, *J* = 271.0 Hz), 123.99 (s), 24.52 (q, *J* = 38.0 Hz), 20.63 (q, *J* = 2.1 Hz), 13.28 (q, *J* = 2.7 Hz); IR (neat) ν = 3113, 1686, 1605, 1529, 1420, 1266, 1221, 1151, 1064, 852,715, 635 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8NO_3F_3$ [M]$^{+}$: 259.0456, Found: 259.0455.



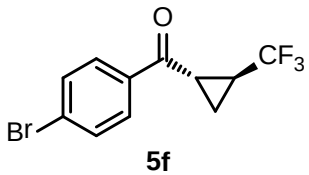
5d

(3-Nitrophenyl)((*1SR, 2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5d**): Quantitative; White solid. M.P.: 29.9-32.0 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.84 (s, 1H), 8.49 (d, *J* = 8.0 Hz, 1H), 8.35 (d, *J* = 8.0 Hz, 1H), 7.84 - 7.69 (m, 1H), 3.17 - 2.98 (m, 1H), 2.54 - 2.36 (m, 1H), 1.74 - 1.51 (m, 2H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.88 (d, *J* = 6.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 194.42 (s), 148.50 (s), 137.85(s), 133.70 (s), 130.11 (s), 127.81 (s), 124.84 (q, *J* = 271.4 Hz), 123.30 (s), 24.35 (q, *J* = 38.1 Hz), 20.32 (q, *J* = 1.3 Hz), 13.35 (q, *J* = 2.0 Hz); IR (neat) ν = 3089, 2360, 1687, 1612, 1536, 1340, 1266, 1224, 1151, 1001, 940, 716 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8NO_3F_3$ $[M]^+$: 259.0456, Found: 259.0461.



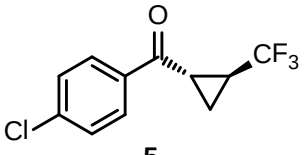
5e

(2-Nitrophenyl)((*1SR, 2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5e**): Quantitative; Yellow liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (d, *J* = 7.5 Hz, 1H), 7.76 (t, *J* = 7.5 Hz, 1H), 7.65 (t, *J* = 7.8 Hz, 1H), 7.47 (d, *J* = 7.8 Hz, 1H), 2.54 - 2.51 (m, 1H), 2.49 - 2.38 (m, 1H), 1.72 - 1.61 (m, 1H), 1.51 - 1.46(m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -67.13 (d, *J* = 6.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.94 (s), 145.93 (s), 137.00 (s), 134.39 (s), 131.25 (s), 127.74 (s), 124.70 (q, *J* = 271.5 Hz), 124.53 (s), 25.18 (q, *J* = 38.1 Hz), 24.30 (q, *J* = 2.1 Hz), 13.78 (q, *J* = 2.6 Hz); IR (neat) ν = 3066, 1701, 1608, 1575, 1477, 1348, 1265, 1152, 945, 753 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8NOF_3$ $[M]^+$: 259.0456, Found: 259.0458.



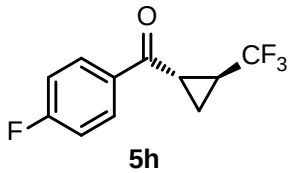
5f

(4-Bromophenyl)((*1SR, 2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5f**): Quantitative; White solid. M.P.: 28.8-29.9 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.4 Hz, 2H), 7.61 (d, *J* = 8.4 Hz, 2H), 2.98 - 2.92 (m, 1H), 2.32 - 2.38 (m, 1H), 1.60 - 1.48(m, 1H), 1.48 - 1.39(m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.83 (d, *J* = 6.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.34 (s), 135.39 (s), 132.10 (s), 129.70 (s), 129.08 (s), 125.03 (q, *J* = 271.2 Hz), 23.97 (q, *J* = 37.9 Hz), 20.00 (q, *J* = 2.1 Hz), 12.69 (q, *J* = 2.7 Hz); IR (neat) ν = 3059, 1681, 1587, 1506, 1397, 1341, 1263, 1150, 1071, 995, 838, 739 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8OF_3Br$ [M]$^{+}$: 291.9711, Found: 291.9713.



5g

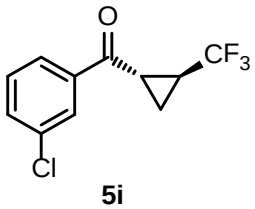
(4-Chlorophenyl)((*1SR, 2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5g**): Quantitative; White solid. M.P.: 25.7-26.1 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.5 Hz, 2H), 7.47 (d, *J* = 8.5 Hz, 2H), 2.97 - 2.93 (m, 1H), 2.56 - 2.19 (m, 1H), 1.56 - 1.49 (m, 1H), 1.47 - 1.39 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.82 (d, *J* = 6.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.19 (s), 140.20 (s), 134.95 (s), 129.64 (s), 129.11 (s), 125.05 (q, *J* = 271.2 Hz), 23.96 (q, *J* = 37.9 Hz), 20.00 (q, *J* = 2.0 Hz), 12.72 (q, *J* = 2.5 Hz); IR (neat) ν = 3061, 2360, 1681, 1592, 1490, 1400, 1344, 1264, 1224, 1151, 1116, 1063, 996, 840, 775 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8OF_3Cl$ [M]$^{+}$: 248.0216, Found: 248.0214; Anal. Calcd. for $C_{11}H_8OF_3Cl$ [M]$^{+}$: C, 53.14;H, 3.24; Found: C, 52.99; H, 3.43.



5h

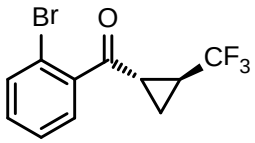
(4-Fluorophenyl)((*1SR,2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5h**): 65%; Colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 - 8.02 (m, 2H), 7.23 - 7.10 (m, 2H), 3.04 - 2.87 (m, 1H), 2.43 - 2.25 (m, 1H), 1.54 - 1.50(m, 1H), 1.45 - 1.40(m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ

-66.84 (d, *J* = 6.5 Hz, 3F), -104.15 - -104.22 (m, 1F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 194.73 (s), 166.08 (d, *J* = 255.9 Hz), 133.13 (d, *J* = 3.0 Hz), 130.91 (d, *J* = 9.5 Hz), 125.09 (q, *J* = 271.2 Hz), 115.94 (d, *J* = 22.0 Hz), 23.84 (q, *J* = 37.8 Hz), 19.96 (q, *J* = 2.1 Hz), 12.53 (q, *J* = 2.7 Hz); IR (neat) ν = 3064, 1681, 1600, 1558, 1509, 1420, 1410, 1343, 1264, 1279, 1157, 1032, 847, 796, 597 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8OF_4$ [M]$^+$: 232.0511, Found: 232.0513.



5i

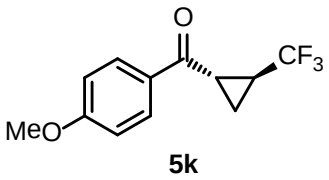
(3-Chlorophenyl)((*1SR,2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5i**): 94%; Colorless liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.88 (d, *J* = 7.7 Hz, 1H), 7.58 (d, *J* = 7.7 Hz, 1H), 7.45 (t, *J* = 7.7 Hz, 1H), 2.99 - 2.94 (m, 1H), 2.59 - 2.14 (m, 1H), 1.57 - 1.49 (m, 1H), 1.49 - 1.40 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.84 (d, *J* = 6.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.18 (s), 138.18 (s), 135.16 (s), 133.51 (s), 130.08 (s), 128.30 (s), 126.34 (s), 124.99 (q, *J* = 271.2 Hz), 24.03 (q, *J* = 37.9 Hz), 20.16 (q, *J* = 2.1 Hz), 12.87 (q, *J* = 2.7 Hz); IR (neat) ν = 3070, 2360, 1683, 1573, 1417, 1340, 1264, 1222, 1150, 1000, 941, 787, 734, 708 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8OF_3Cl$ [M]$^+$: 248.0216, Found: 248.0215.



5j

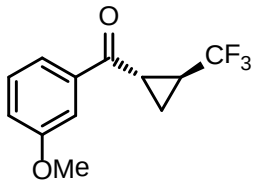
(2-Bromophenyl)((*1SR, 2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5j**): 82%; Yellow liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 7.0 Hz, 1H), 7.46 (d, *J* = 7.1 Hz, 1H), 7.39 (t, *J* = 7.1 Hz, 1H), 7.34 (t, *J* = 7.0 Hz, 1H), 2.90 - 2.85 (m, 1H), 2.45 - 2.39 (m, 1H), 1.62 - 1.54 (m, 1H), 1.49 - 1.44 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.76 (d, *J* = 6.3 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 200.01 (s), 140.72 (s), 133.80 (s), 132.35 (s), 129.32 (s), 127.54 (s), 124.88 (q, *J* = 270.9 Hz), 119.31 (s), 25.37 (q, *J* = 38.2 Hz), 24.24 (q, *J* = 1.4 Hz), 14.20 (q, *J* = 2.3 Hz); IR

(neat) ν = 3059, 1694, 1588, 1565, 1466, 1389, 1263, 1109, 739 cm^{-1}; HRMS (EI) Calcd for $C_{11}H_8OF_3Br$ $[M]^+$: 291.9711, Found: 291.9715.



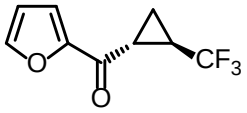
5k

(4-Methoxyphenyl)((*1SR*,*2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5k**): 87%; Colorless liquid. ^1H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.1 Hz, 2H), 6.97 (d, *J* = 8.1 Hz, 2H), 3.88 (s, 3H), 2.99 - 2.94 (m, 1H), 2.32 - 2.27 (m, 1H), 1.49 (m, 1H), 1.38 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.70 (d, *J* = 6.1 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 194.60 (s), 163.95 (s), 130.57 (s), 129.75 (s), 125.27 (q, *J* = 271.0 Hz),113.93 (s), 55.53 (s), 23.50 (q, *J* = 37.8 Hz), 19.66 (q, *J* = 1.8 Hz), 12.18 (q, *J* = 2.7 Hz); IR (neat) ν = 2940, 2843, 1669, 1601, 1576, 1513, 1481, 1345, 1264, 1234, 1149, 1209, 841 cm^{-1}; HRMS (EI) Calcd for $C_{12}H_{11}O_2F_3$ $[M]^+$: 244.0711, Found: 244.0715.



5l

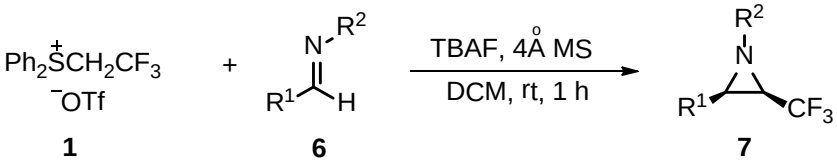
(3-Methoxyphenyl)((*1SR*,*2SR*)-2-(trifluoromethyl)cyclopropyl)methanone (**5l**): 88%; Light yellow liquid. ^1H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 7.5 Hz, 1H), 7.49 (s, 1H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.15 (d, *J* = 7.5 Hz, 1H), 3.85 (s, 3H), 3.12 - 2.80 (m, 1H), 2.37 - 2.31 (m, 1H), 1.52 - 1.49 (m, 1H), 1.46 - 1.36 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.80 (d, *J* = 6.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.15 (s), 159.91 (s), 138.04 (s), 129.74 (s), 125.15 (q, *J* = 271.0 Hz), 120.90 (s), 120.06 (s), 112.41 (s), 55.42 (s), 23.83 (q, *J* = 37.8 Hz), 20.18 (q, *J* = 2.0 Hz), 12.55 (q, *J* = 2.6 Hz); IR (neat) ν = 3058, 2943, 1680, 1598, 1583, 1467, 1432, 1343, 1262, 1151, 1033, 942, 786, 745 cm^{-1}; HRMS (EI) Calcd for $C_{12}H_{11}O_2F_3$ $[M]^+$: 244.0711, Found: 244.0707.



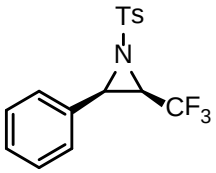
5m

Furan-2-yl((*1RS,2RS*)-2-(trifluoromethyl)cyclopropyl)methanone (**5m**): 88%; White solid. M.P.: 46.5-48.4°C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 1.7 Hz, 1H), 7.31 (d, *J* = 3.4 Hz, 1H), 6.6 (dd, *J* = 3.4, 1.7 Hz, 1H), 3.17 - 2.74 (m, 1H), 2.66 - 2.17 (m, 1H), 1.56 - 1.45 (m, 1H), 1.43 - 1.36 (m, 1H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -66.97 (d, *J* = 6.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 184.77 (s), 152.36 (s), 147.14 (s), 125.03 (q, *J* = 271.1 Hz), 117.86 (s), 112.59 (s), 23.33 (q, *J* = 37.9 Hz), 19.99 (q, *J* = 2.1 Hz), 12.08 (q, *J* = 2.6 Hz); IR (neat) ν = 3138, 2360, 1674, 1572, 1469, 1420, 1345, 1268, 1151, 1086, 1017, 763, 642 cm^{-1}; HRMS (EI) Calcd for $C_9H_7O_2F_3$ [M]$^{+}$: 204.0398, Found: 204.0396.

5.3 The Procedure for The Synthesis of 7

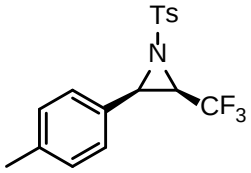


Into the mixture of diphenyl(2,2,2-Trifluoroethyl)sulfonium triflate **1**(1.0 mmol, 0.4184 g, 1.0 equiv.), imine **6** (2.0 mmol, 2.0 equiv.) and 4Å MS (0.8 g) in dichloromethane(10 mL) was added TBAF (1.5 mmol, 1.5 mL, 1.5 equiv.) dropwise under N_2 atmosphere. The reaction mixture was stirred at room temperature for 1 h. After filtration, the solid was washed with DCM (10 mL). The combined organic phase was washed with water, sat. sodium bisulfite and water in sequence and then dried over Na_2SO_4. The solvent was removed by concentration, and the residue was subjected to flash column chromatography with hexane/ethyl acetate (50:1-20:1) as the eluent to afford the final product **7**.



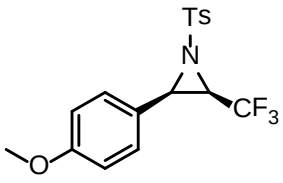
7a

(2*RS*,3*RS*)-2-Phenyl-1-tosyl-3-(trifluoromethyl)aziridine (**7a**): 86%; White solid. M.P. 69.0 - 70.4 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.2 Hz, 2H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.28 (s, 5H), 4.19 (d, *J* = 7.0 Hz, 1H), 3.49 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.45 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.82 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.74 (s), 133.55 (s), 130.08 (s), 128.63 (s), 128.43 (s), 128.28 (s), 127.35 (s), 127.35 (s), 122.21 (q, *J* = 275.7 Hz), 43.51 (q, *J* = 1.1 Hz), 42.55 (q, *J* = 40.2 Hz), 21.77 (s); IR (neat) ν = 3064, 3034, 1698, 1597, 1489, 1458, 1442, 1384, 1347, 1299, 1237, 1181, 1085, 1050, 1013, 954, 933, 923, 825, 805, 787, 700, 663, 605, 545 cm^{-1}; HRMS (ESI) Calcd for $C_{16}H_{15}F_3NO_2S$ $[M+H]^+$: 342.0770, Found: 342.0766.



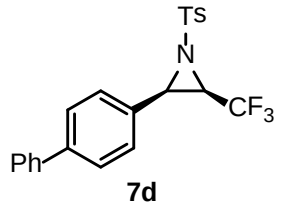
7b

(2*RS*,3*RS*)-2-(*p*-Tolyl)-1-tosyl-3-(trifluoromethyl)aziridine (**7b**): 88%; White solid. M.P. 90.3 - 91.3 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 8.2 Hz, 2H), 7.42 (d, *J* = 8.2 Hz, 2H), 7.20 (d, *J* = 8.2 Hz, 2H), 7.13 (d, *J* = 8.2 Hz, 2H), 4.19 (d, *J* = 7.0 Hz, 1H), 3.51 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.49 (s, 3H), 2.34 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.69 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.66 (s), 138.48 (s), 133.64 (s), 130.04 (s), 129.11 (s), 128.26 (s), 127.22 (s), 127.04 (s), 122.26 (q, *J* = 275.7 Hz), 43.50 (q, *J* = 1.2 Hz), 42.53 (q, *J* = 40.0 Hz), 21.75 (s), 21.19 (s); IR (neat) ν = 3037, 2927, 1598, 1519, 1494, 1435, 1377, 1335, 1292, 1187, 1165, 1150, 1091, 1052, 1041, 945, 910, 880, 814, 777, 683, 666, 609, 558, 539 cm^{-1}; HRMS (ESI) Calcd for $C_{17}H_{17}F_3NO_2S$ $[M+H]^+$: 356.0927, Found: 356.0921.



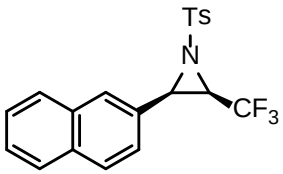
7c

(2*RS*,3*RS*)-2-(4-Methoxyphenyl)-1-tosyl-3-(trifluoromethyl)aziridine (**7c**): 72%; White solid. M.P.: 104.5 - 106.1 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.2 Hz, 2H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.20 (d, *J* = 8.7 Hz, 2H), 6.82 (d, *J* = 8.7 Hz, 2H), 4.14 (d, *J* = 7.0 Hz, 1H), 3.76 (s, 3H), 3.45 (dq, *J* = 7.0, 5.5 Hz, 1H), 2.46 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.69 (d, *J* = 5.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.82 (s), 145.67 (s), 133.67 (s), 130.04 (s), 128.59 (s), 128.24 (s), 122.31 (q, *J* = 276.1 Hz), 121.97 (s), 113.87 (s), 55.21 (s), 43.27 (s), 42.60 (q, *J* = 39.9 Hz), 21.70 (s); IR (neat) ν = 3021, 2968, 2842, 1917, 1614, 1598, 1519, 1495, 1436, 1377, 1339, 1293, 1259, 1188, 1146, 1051, 1032, 936, 877, 838, 806, 778, 681, 665, 577, 549 cm^{-1}; HRMS (ESI) Calcd for $C_{17}H_{16}F_3NNaO_3S$ $[M+Na]^+$: 394.0695, Found: 394.0702.



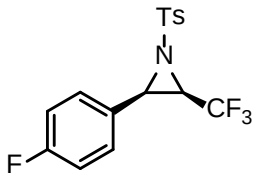
7d

(2*RS*,3*RS*)-2-([1,1'-Biphenyl]-4-yl)-1-tosyl-3-(trifluoromethyl)aziridine (**7d**): 95%; White solid. M.P. 103.9 - 105.1 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.3 Hz, 2H), 7.63 - 7.50 (m, 4H), 7.49 - 7.32 (m, 7H), 4.25 (d, *J* = 7.0 Hz, 1H), 3.56 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.46 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.62 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.77 (s), 141.55 (s), 140.31 (s), 133.62 (s), 130.11 (s), 129.10 (s), 128.85 (s), 128.30 (s), 127.86 (s), 127.63 (s), 127.14 (s), 127.08 (s), 122.30 (q, *J* = 275.7 Hz), 43.42 (q, *J* = 1.8 Hz), 42.70 (q, *J* = 40.1 Hz), 21.74 (s); IR (neat) ν = 3075, 3024, 1597, 1489, 1442, 1353, 1300, 1163, 1087, 1056, 960, 935, 803, 816, 766, 690, 662, 605, 559, 849, 530 cm^{-1}; HRMS (ESI) Calcd for $C_{22}H_{19}F_3NO_2S$ $[M+H]^+$: 418.1083, Found: 418.1079.



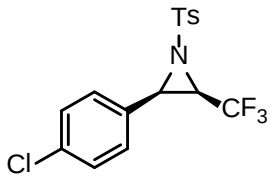
7e

(2*RS*,3*RS*)-2-(Naphthalen-2-yl)-1-tosyl-3-(trifluoromethyl)aziridine (**7e**): 96%; White solid. M.P. 100.6 - 102.2 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.3 Hz, 2H), 7.87 - 7.78 (m, 4H), 7.55 - 7.49 (m, 2H), 7.46 - 7.40 (m, 3H), 4.39 (d, *J* = 7.0 Hz, 1H), 3.61 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.50 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.62 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.80 (s), 133.56 (s), 133.24 (s), 132.90 (s), 130.11 (s), 128.34 (s), 128.31 (s), 127.98 (s), 127.78 (s), 127.51 (s), 126.94 (s), 126.59 (s), 126.53 (s), 124.54 (s), 122.24 (q, *J* = 275.7 Hz), 43.64 (q, *J* = 1.1 Hz), 42.81 (q, *J* = 40.2 Hz), 21.78 (s); IR (neat) ν = 3055, 1599, 1436, 1388, 1338, 1293, 1223, 1171, 1148, 1090, 1055, 974, 941, 906, 842, 820, 776, 761, 684, 661, 559, 544 cm^{-1}; HRMS (ESI) Calcd for $C_{20}H_{17}F_3NO_2S$ $[M+H]^+$: 392.0927, Found: 392.0919.



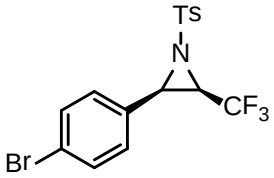
7f

(2*RS*,3*RS*)-2-(4-Fluorophenyl)-1-tosyl-3-(trifluoromethyl)aziridine (**7f**): Quantitative; White solid. M.P.:116.2 - 116.5 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.2 Hz, 2H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.30 - 7.21 (m, 2H), 6.98 (t, *J* = 8.6 Hz, 2H), 4.14 (d, *J* = 7.0 Hz, 1H), 3.45 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.46 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.80 (d, *J* = 5.4 Hz, 3F), -112.64 - -113.03 (m, 1F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.81 (d, *J* = 247.7 Hz), 145.87 (s), 133.42 (s), 130.12 (s), 129.20 (d, *J* = 8.4 Hz), 128.25 (s), 125.92 (d, *J* = 3.2 Hz), 122.15 (q, *J* = 275.6 Hz), 115.53 (d, *J* = 21.9 Hz), 42.75 (s), 42.63 (q, *J* = 40.1 Hz), 21.73 (s); IR (neat) ν = 3037, 1599, 1514, 1452, 1376, 1338, 1282, 1236, 1190, 1170, 1147, 1091, 1058, 952, 905, 885, 831, 817, 784, 750, 703, 682, 669 cm^{-1}; HRMS (ESI) Calcd for $C_{16}H_{14}F_4NO_2S$ $[M+H]^+$: 360.0676, Found: 360.0670.



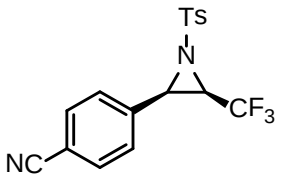
7g

(2*RS*,3*RS*)-2-(4-Chlorophenyl)-1-tosyl-3-(trifluoromethyl)aziridine (**7g**): 89%; White solid. M.P.: 86.8 - 88.4 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 8.2 Hz, 2H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.26 (d, *J* = 8.5 Hz, 2H), 7.21 (d, *J* = 8.5 Hz, 2H), 4.13 (d, *J* = 7.0 Hz, 1H), 3.48 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.45 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.80 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.90 (s), 134.69 (s), 133.38 (s), 130.13 (s), 128.77 (s), 128.72 (s), 128.66 (s), 128.26 (s), 122.08 (q, *J* = 275.7 Hz), 42.72 (s), 42.65 (q, *J* = 40.2 Hz), 21.78 (s); IR (neat) ν = 3032, 1599, 1495, 1437, 1375, 1341, 1293, 1166, 1091, 1053, 1017, 943, 882, 789, 697, 557, 542 cm^{-1}; HRMS (ESI) Calcd for $C_{16}H_{14}ClF_3NO_2S$ $[M+H]^+$: 376.0380, Found: 376.0373.



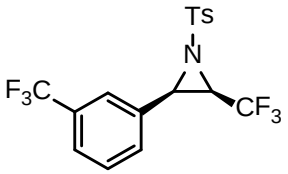
7h

(2*RS*,3*RS*)-2-(4-Bromophenyl)-1-tosyl-3-(trifluoromethyl)aziridine (**7h**): 92%; White solid. M.P. 80.4 - 83.3 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 8.3 Hz, 2H), 7.41 (d, *J* = 8.3 Hz, 2H), 7.37 (d, *J* = 8.2 Hz, 2H), 7.15 (d, *J* = 8.2 Hz, 2H), 4.11 (d, *J* = 7.0 Hz, 1H), 3.48 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.44 (s, 3H)。 ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.77 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.91 (s), 133.39 (s), 131.66 (s), 130.13 (s), 129.23 (s), 129.07 (s), 128.25 (s), 122.85 (s), 122.09 (q, *J* = 275.7 Hz), 42.80 (s), 42.60 (q, *J* = 39.9 Hz), 21.74 (s); IR (neat) ν = 3090, 3030, 1598, 1491, 1437, 1402, 1372, 1335, 1292, 1162, 1090, 1043, 1013, 939, 826, 819, 788, 757, 694, 673, 614, 571, 549, 528 cm^{-1}; HRMS (ESI) Calcd for $C_{16}H_{14}BrF_3NO_2S$ $[M+H]^+$: 419.9875, Found: 419.9872.



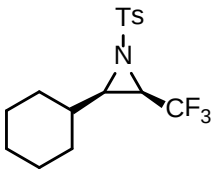
7i

4-((2*RS*,3*RS*)-1-Tosyl-3-(trifluoromethyl)aziridin-2-yl)benzonitrile (**7i**): 94%; White solid. M.P. 135.9 - 136.4 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92 (d, *J* = 8.3 Hz, 2H), 7.62 (d, *J* = 8.2 Hz, 2H), 7.43 (d, *J* = 8.3 Hz, 2H), 7.42 (d, *J* = 8.2 Hz, 2H), 4.21 (d, *J* = 6.0 Hz, 1H), 3.55 (dq, *J* = 7.0, 5.4 Hz, 1H), 2.49 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.94 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.14 (s), 135.45 (s), 133.16 (s), 132.28 (s), 130.21 (s), 128.30 (s), 128.27 (s), 121.89 (q, *J* = 275.7 Hz), 118.20 (s), 112.82 (s), 42.88 (q, *J* = 40.5 Hz), 42.48 (q, *J* = 1.3 Hz), 21.79 (s); IR (neat) ν = 3060, 3042, 2231, 1613, 1598, 1509, 1437, 1374, 1339, 1295, 1190, 1167, 1145, 1089, 1040, 934, 849, 796, 772, 678, 601, 573, 560 cm^{-1}; HRMS (ESI) Calcd for $C_{17}H_{14}F_3N_2O_2S$ $[M+H]^+$: 367.0723, Found: 367.0718.



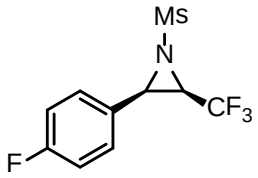
7j

(2*RS*,3*RS*)-1-Tosyl-2-(trifluoromethyl)-3-(3-(trifluoromethyl)phenyl)aziridine (**7j**): 85%; Colourless liquid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 7.6 Hz, 1H), 7.55 - 7.50 (m, 2H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.44 (d, *J* = 8.2 Hz, 2H), 4.23 (d, *J* = 6.9 Hz, 1H), 3.57 (dq, *J* = 6.9, 5.4 Hz, 1H), 2.50 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.87 (s, 3F), -65.87 (d, *J* = 5.4 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.10 (s), 133.20 (s), 131.32 (s), 131.14 (s), 130.81 (s), 130.17 (s), 129.06 (s), 128.30 (s), 125.56 (q, *J* = 3.7 Hz), 124.36 (q, *J* = 3.6 Hz), 123.71 (q, *J* = 272.4 Hz), 122.01 (q, *J* = 275.6 Hz), 42.67 (q, *J* = 40.4 Hz), 42.62 (q, *J* = 0.5 Hz), 21.72 (s); IR (neat) ν = 3033, 1598, 1433, 1379, 1329, 1292, 1230, 1166, 1092, 1074, 955, 916, 814, 771, 743, 701, 679, 543 cm^{-1}; HRMS (ESI) Calcd for $C_{17}H_{14}F_6NO_2S$ $[M+H]^+$: 410.0644, Found: 410.0637.



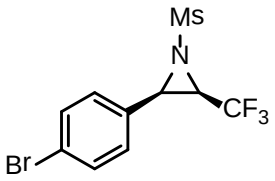
7k

(2*RS*,3*RS*)-2-cyclohexyl-1-tosyl-3-(trifluoromethyl)aziridine (**7k**): 83%; White solid. M.P. 62.5 - 64.1 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 8.2 Hz, 2H), 7.37 (d, *J* = 8.2 Hz, 2H), 3.23 (dq, *J* = 6.9, 6.1 Hz, 1H), 2.76 - 2.69 (m, 1H), 2.46 (s, 3H), 1.78 - 1.62 (m, 5H), 1.50 - 1.38 (m, 1H), 1.28 - 0.99 (m, 5H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.45 (d, *J* = 6.0 Hz, 3F).^{13}C NMR (101 MHz, $CDCl_3$) δ 145.38 (s), 133.70 (s), 129.83 (s), 128.28 (s), 122.97 (q, *J* = 275.1 Hz), 48.05 (s), 41.29 (q, *J* = 40.5 Hz), 35.29 (q, *J* = 1.2 Hz), 31.53 (s), 29.47 (s), 25.89 (s), 25.24 (s), 25.17 (s), 21.68 (s); IR (neat) ν = 3060, 2936, 2852, 1599, 1456, 1408, 1349, 1305, 1283, 1248, 1156, 1119, 1087, 1047, 933, 888, 826, 811, 748, 659, 604, 558, 549, 528 cm^{-1}; HRMS (ESI) Calcd for $C_{16}H_{20}F_3NNaO_2S$ $[M+Na]^+$: 370.1059, Found: 370.1058.



7l

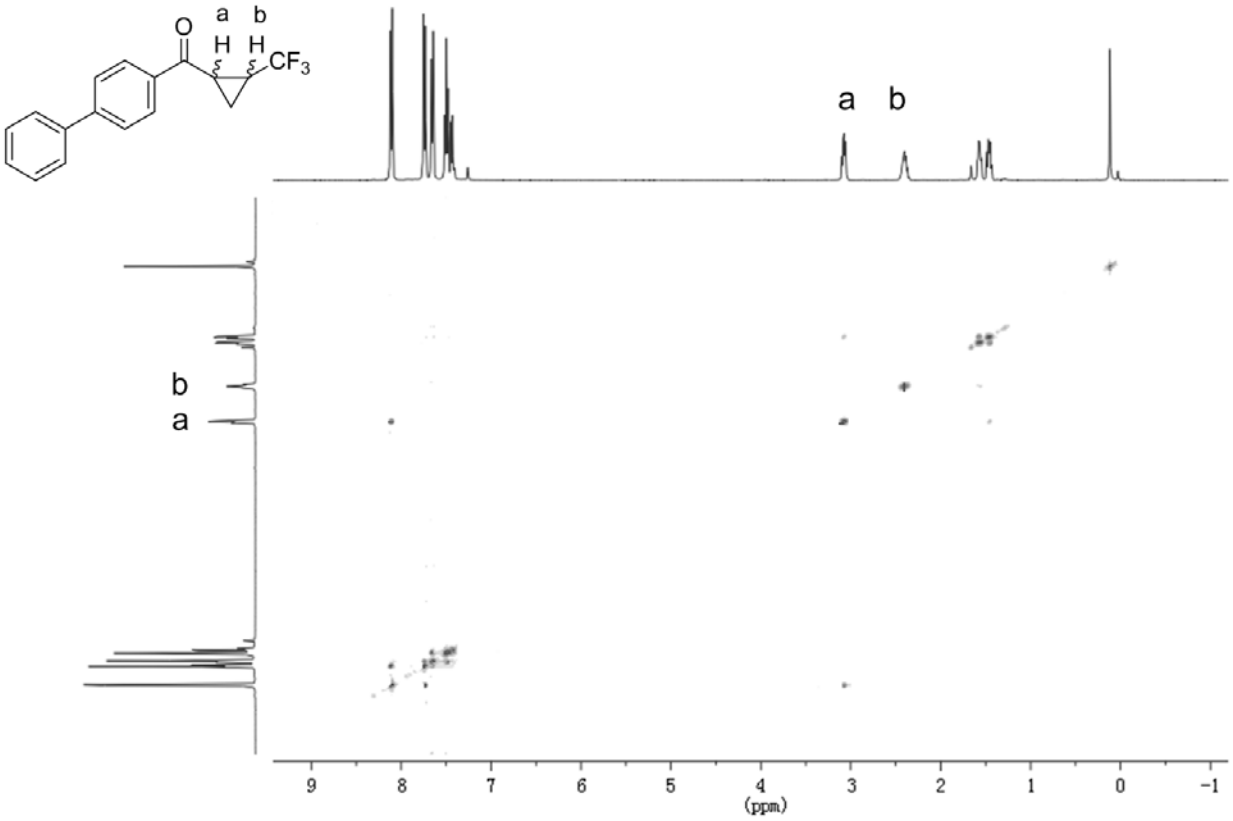
(*2RS,3RS*)-2-(4-fluorophenyl)-1-(methylsulfonyl)-3-(trifluoromethyl)aziridine (**7l**): 90%; White solid. M.P. 76.7 - 78.2 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (dd, *J* = 8.5, 5.4 Hz, 2H), 7.09 - 7.02 (m, 2H), 4.14 (d, *J* = 7.0 Hz, 1H), 3.48 (dq, *J* = 7.0, 5.4 Hz, 1H), 3.23 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.72 (d, *J* = 5.4 Hz, 3F), -111.96 - -113.28 (m, 1F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.93 (d, *J* = 247.9 Hz), 129.24 (d, *J* = 8.5 Hz), 125.67 (d, *J* = 3.2 Hz), 122.22 (q, *J* = 275.4 Hz), 115.65 (d, *J* = 22.0 Hz), 42.77 (q, *J* = 40.1 Hz), 41.97 (q, *J* = 0.9 Hz), 39.60 (s); IR (neat) ν = 3032, 2940, 1609, 1516, 1444, 1380, 1340, 1296, 1238, 1156, 1056, 974, 945, 884, 834, 819, 795, 525, 418 cm^{-1}; HRMS (EI) Calcd for $C_{10}H_9F_4NO_2S$ $[M]^+$: 283.0290, Found: 283.0294.



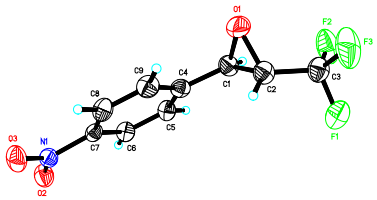
7m

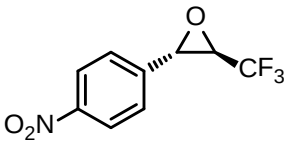
(*2RS,3RS*)-2-(4-bromophenyl)-1-(methylsulfonyl)-3-(trifluoromethyl)aziridine (**7m**): 92%; White solid. M.P. 74.4 - 75.9 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.3 Hz, 2H), 7.27 (d, *J* = 8.3 Hz, 2H), 4.09 (d, *J* = 7.0 Hz, 1H), 3.47 (dq, *J* = 6.8, 5.5 Hz, 1H), 3.22 (s, 3H); ^{19}F NMR (376 MHz, $CDCl_3$) δ -65.75 (d, *J* = 5.5 Hz, 3F); ^{13}C NMR (101 MHz, $CDCl_3$) δ 131.80 (s), 129.09 (s), 128.89 (s), 123.10 (s), 122.13 (q, *J* = 275.5 Hz), 42.85 (q, *J* = 40.2 Hz), 41.97 (q, *J* = 0.9 Hz), 39.72 (s); IR (neat) ν = 3021, 2945, 1492, 1436, 1408, 1331, 1290, 1236, 1182, 1162, 1143, 1049, 1011, 972, 942, 913, 877, 819, 799, 538, 525 cm^{-1}; HRMS (EI) Calcd for $C_{10}H_9BrF_3NO_2S$ $[M]^+$: 342.9489, Found: 342.9490.

6. NOESY Spectrum and Structure Refinement for 5a



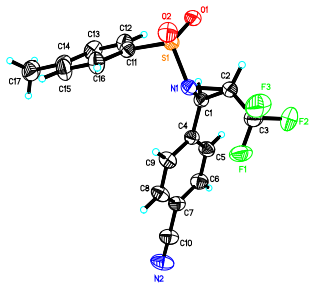
7. X-Ray Diffraction Data and Structure Refinement for 3a, 7i

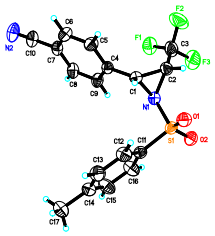


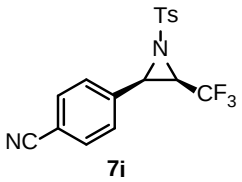


3a

Empirical formula	C9 H6 F3 N O3
Formula weight	233.15
Temperature	293(2) K
Wavelength	0.71073 Å
Crystal system, space group	Orthorhombic, P2(1)2(1)2(1)
Unit cell dimensions	a = 4.8359(6) Å alpha = 90 deg.
	b = 6.4223(8) Å beta = 90 deg.
	c = 30.645(4) Å gamma = 90 deg.
Volume	951.8(2) $Å^3$
Z, Calculated density	4, 1.627 Mg/m^3
Absorption coefficient	0.159 mm^{-1}
F(000)	472
Crystal size	0.311 x 0.167 x 0.086 mm
Theta range for data collection	2.66 to 25.99 deg.
Limiting indices	-5<=h<=5, -7<=k<=5, -35<=l<=37
Reflections collected / unique	5407 / 1850 [R(int) = 0.0309]
Completeness to theta = 25.99	99.7 %
Absorption correction	Empirical
Max. and min. transmission	1.00000 and 0.14145
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	1850 / 6 / 145
Goodness-of-fit on F^2	1.060
Final R indices [I>2sigma(I)]	R1 = 0.0483, wR2 = 0.1313
R indices (all data)	R1 = 0.0559, wR2 = 0.1383
Absolute structure parameter	0.1(15)
Largest diff. peak and hole	0.278 and -0.281 e. $Å^{-3}$







7i

Empirical formula	C17 H13 F3 N2 O2 S	
Formula weight	366.35	
Temperature	293(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	C 2/c	
Unit cell dimensions	a = 17.549(4) Å	α= 90°.
	b = 11.355(2) Å	β= 111.289(4)°.
	c = 18.820(4) Å	γ = 90°.
Volume	3494.2(12) $Å^3$	
Z	8	
Density (calculated)	1.393 Mg/m^3	
Absorption coefficient	0.228 mm^{-1}	
F(000)	1504	
Crystal size	0.211 x 0.166 x 0.123 mm^3	
Theta range for data collection	2.184 to 25.995°.	
Index ranges	-21<=h<=21, -14<=k<=12, -23<=l<=20	
Reflections collected	10399	
Independent reflections	3430 [R(int) = 0.0353]	
Completeness to theta = 25.242°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7457 and 0.6295	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3430 / 36 / 255	
Goodness-of-fit on F^2	1.058	
Final R indices [I>2sigma(I)]	R1 = 0.0465, wR2 = 0.1261	
R indices (all data)	R1 = 0.0579, wR2 = 0.1363	
Extinction coefficient	0.0041(5)	
Largest diff. peak and hole	0.282 and -0.289 $e.Å^{-3}$	

8. References

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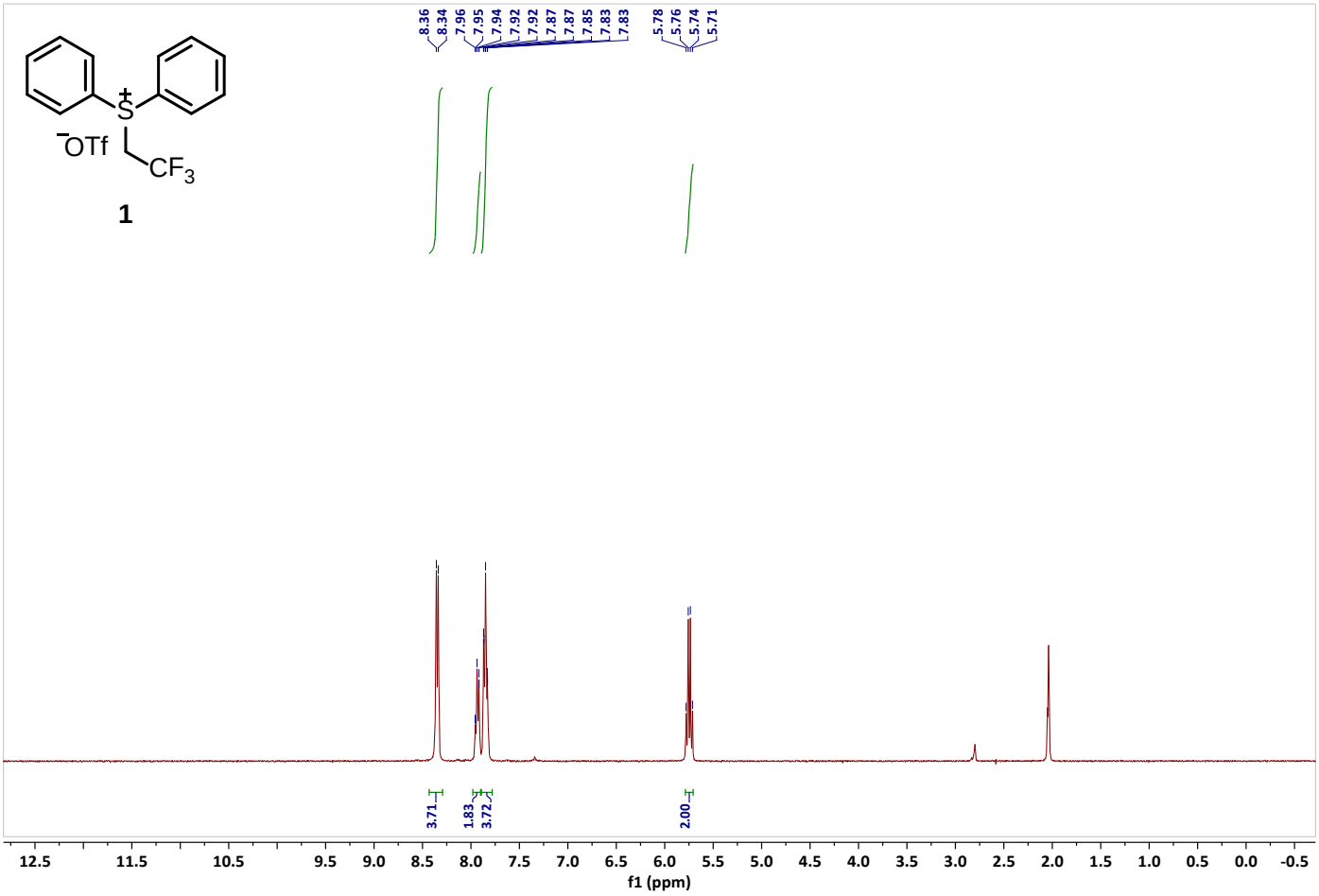
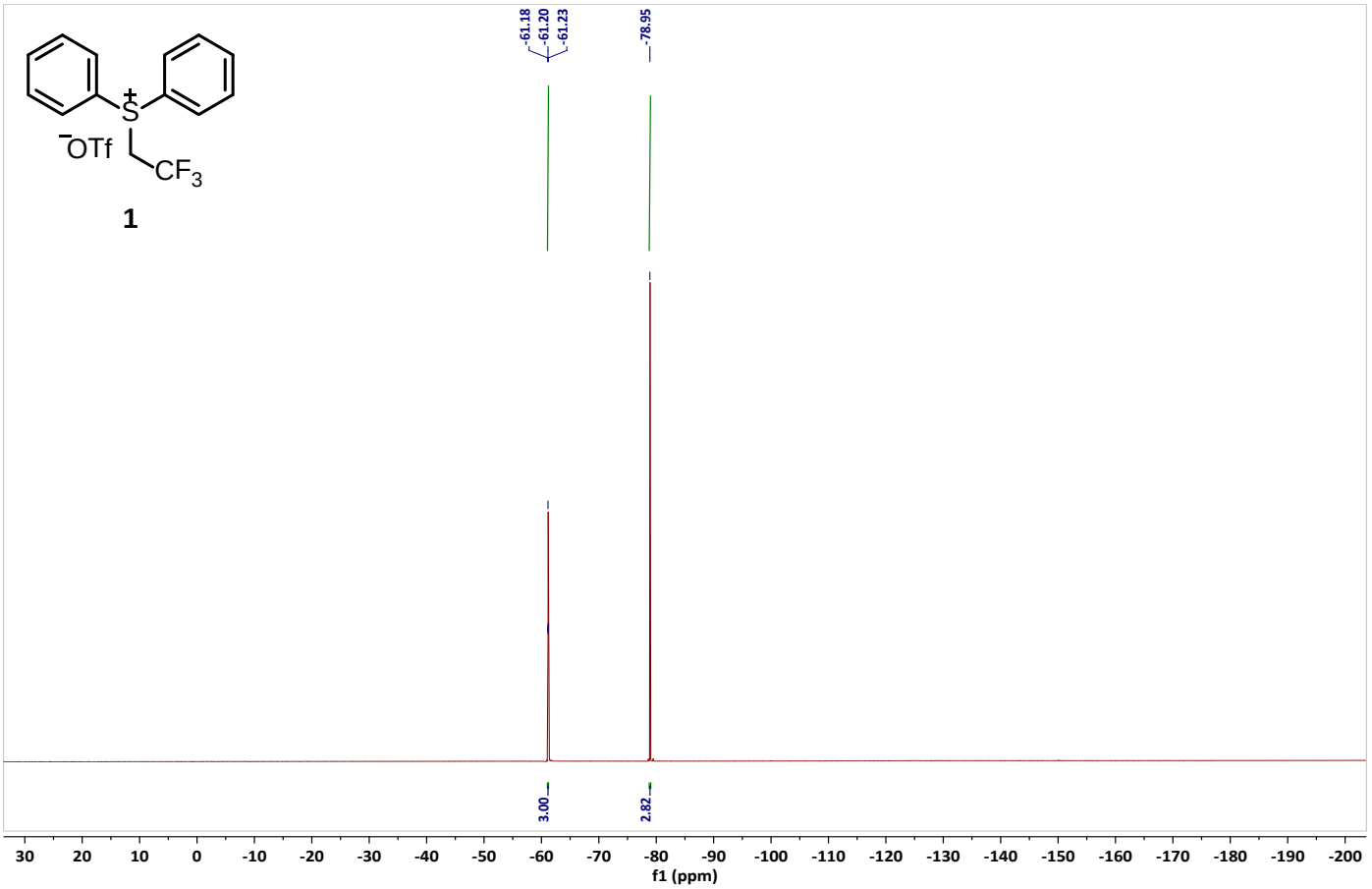
9. Copies of ^{1}H NMR, ^{19}F NMR and ^{13}C NMR Spectra of 1, 3, 5 and 7

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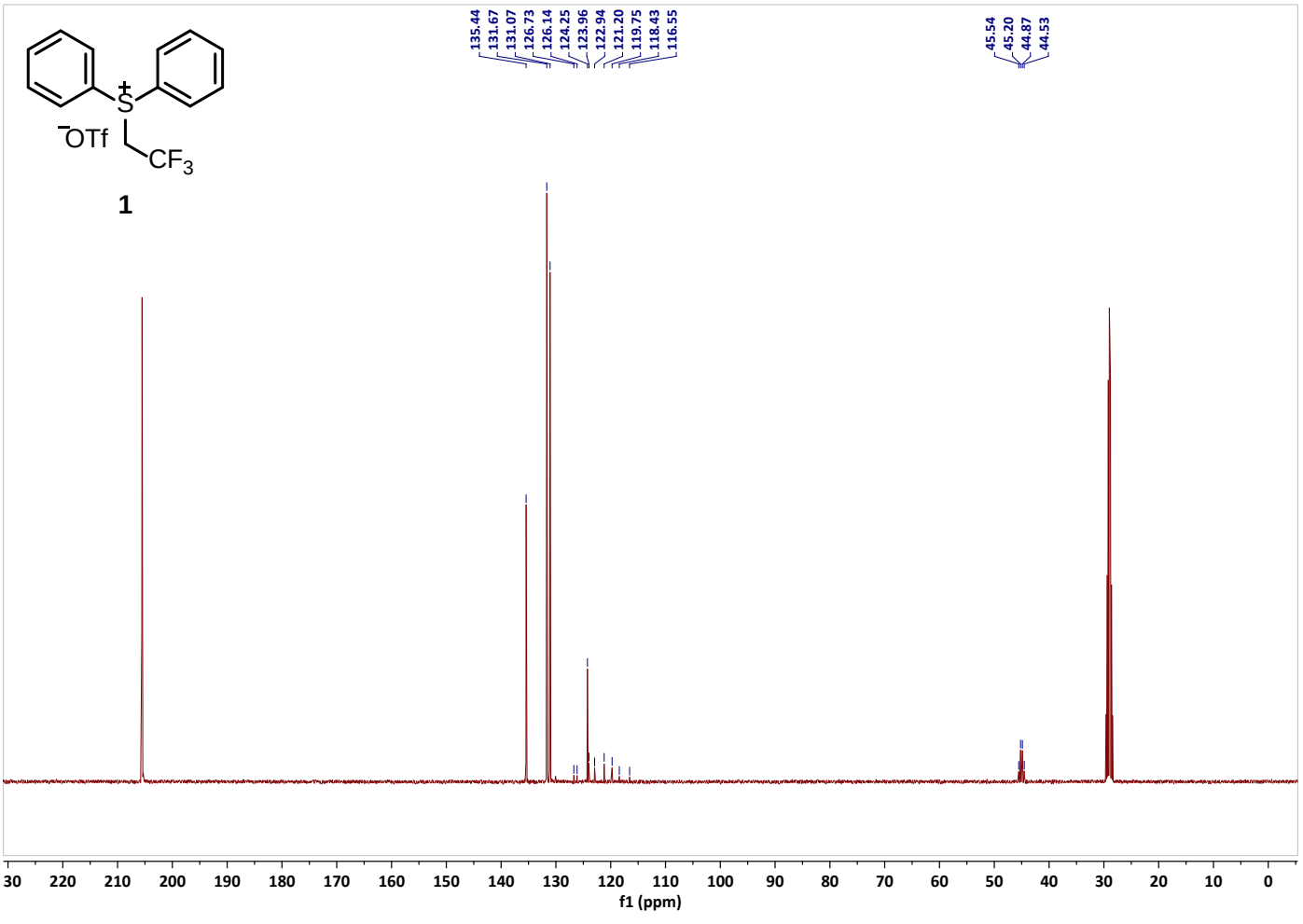
-61.23
-78.95
OTf
CF3
1
3.00
2.82
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)


135.44
131.67
131.07
126.73
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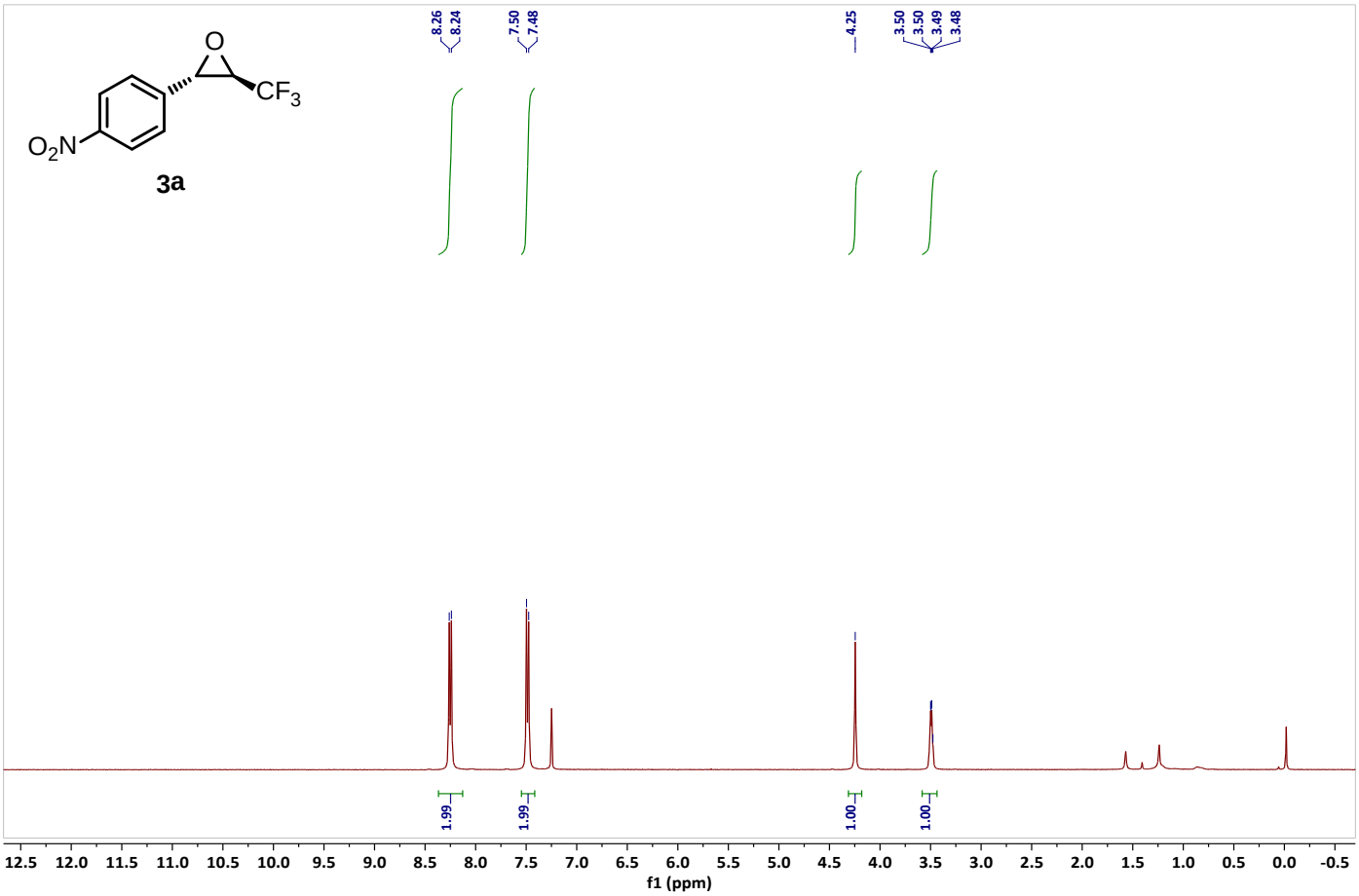
122.94
121.20
119.75
118.43
116.55
45.54
45.20
44.87
44.53
OTf
CF3
1
30 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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CF3
O2N
3a
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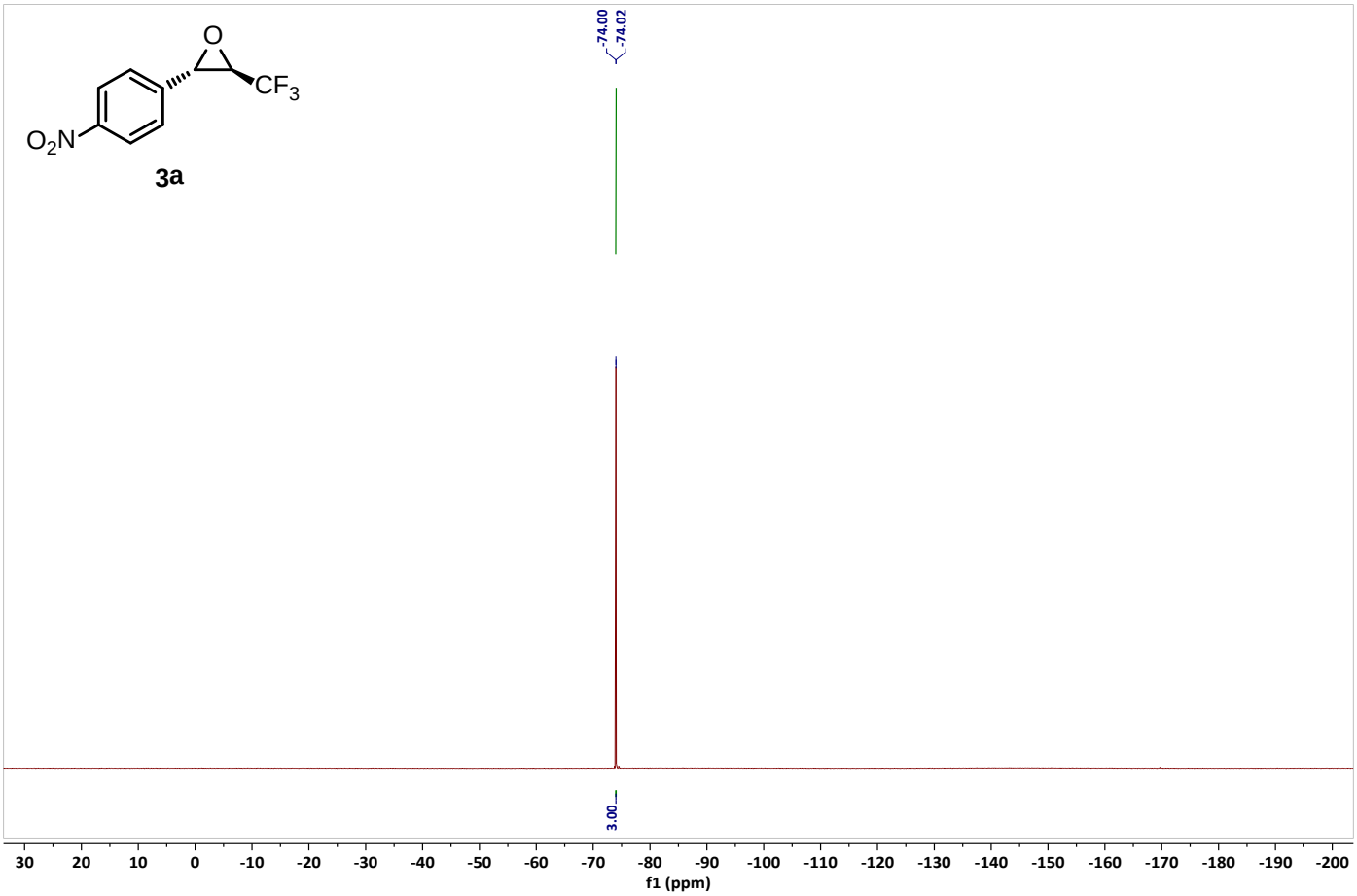
7.48
4.25
3.50
3.50
3.49
3.48
1.99
1.99
1.00
1.00
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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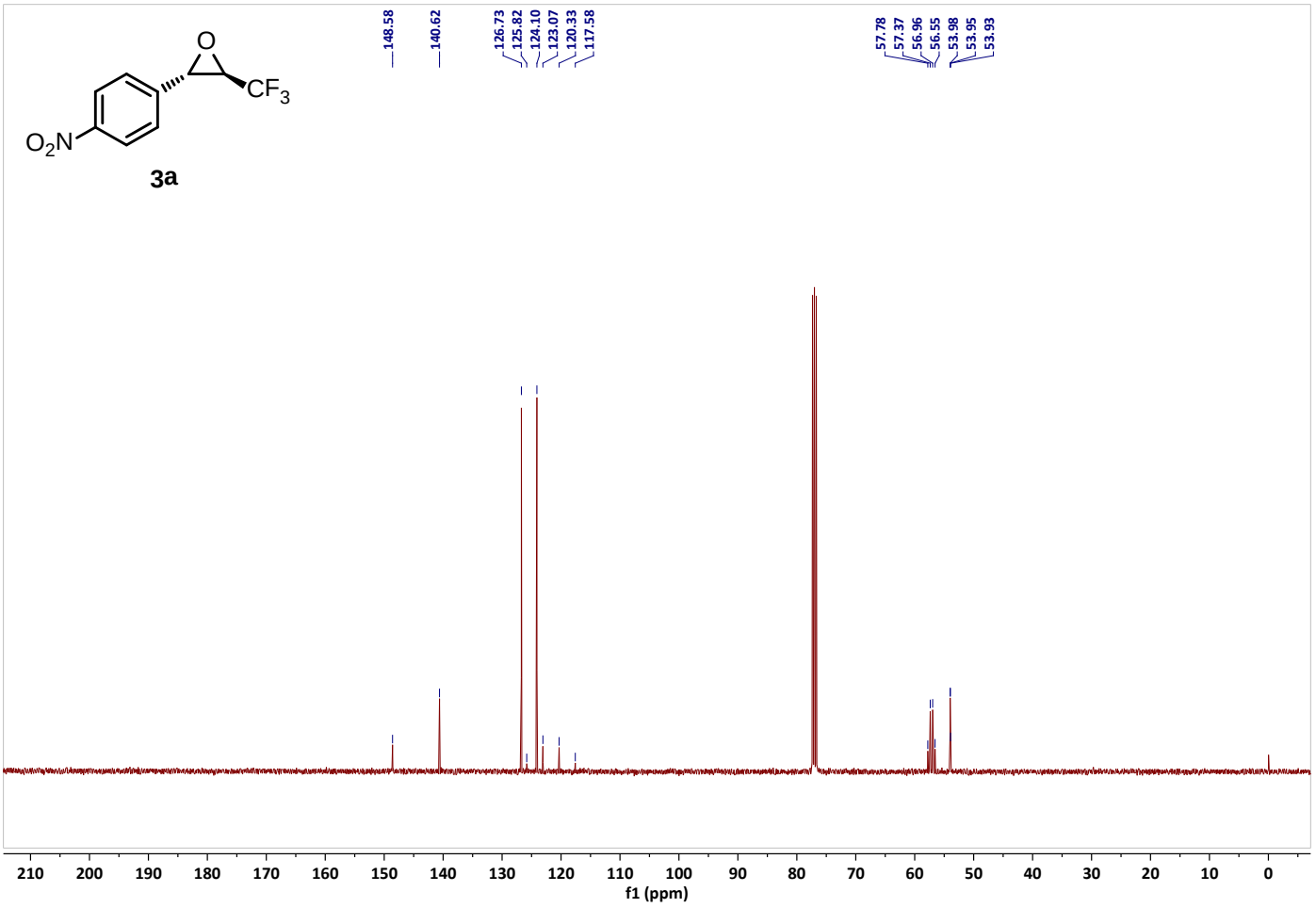
f1 (ppm)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56.96
56.55
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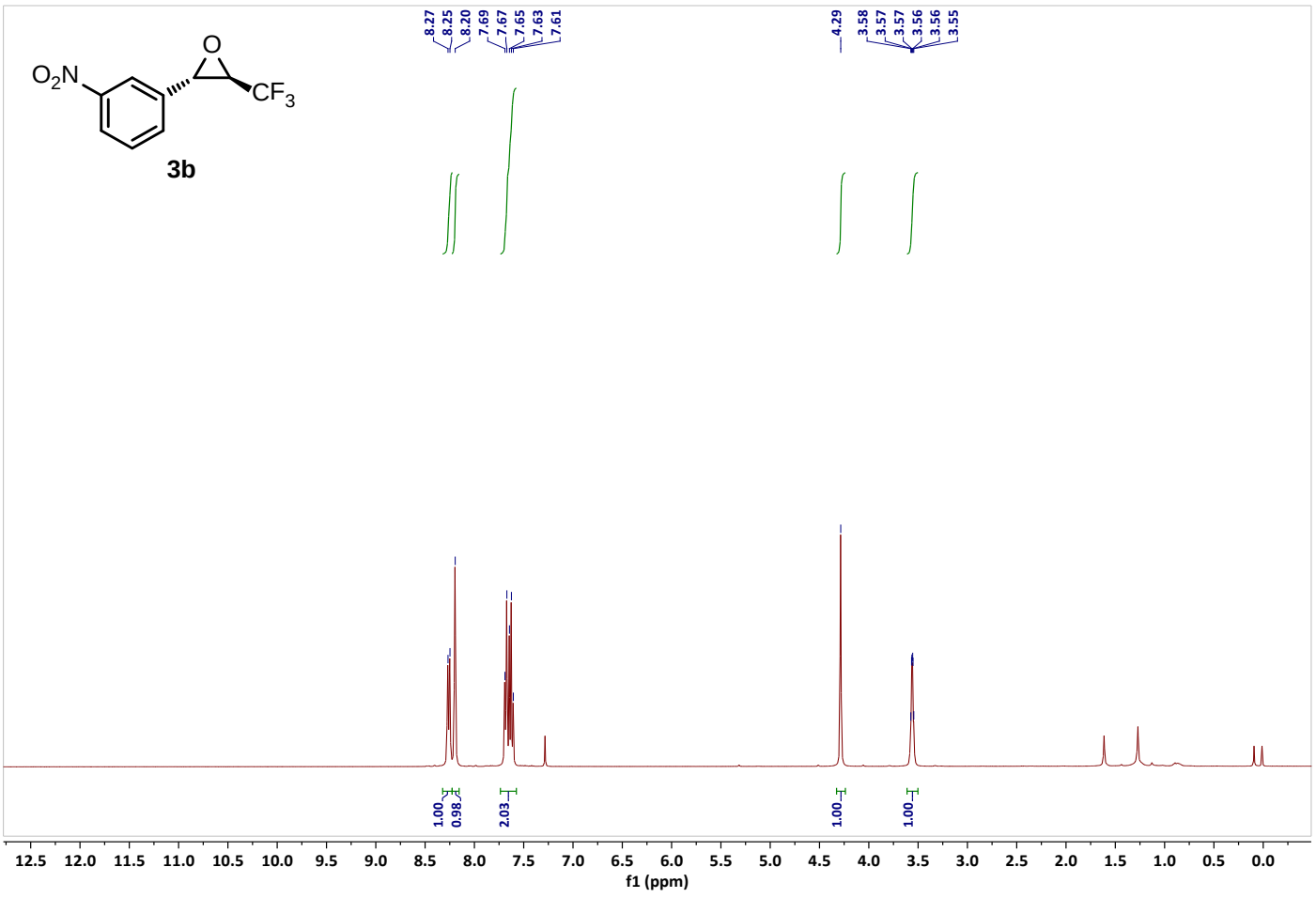
O
CF3
O2N
3a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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3.58
3.57
3.57
3.56
3.56
3.55
O
CF3
O2N
3b
1.00
0.98
2.03
1.00
1.00
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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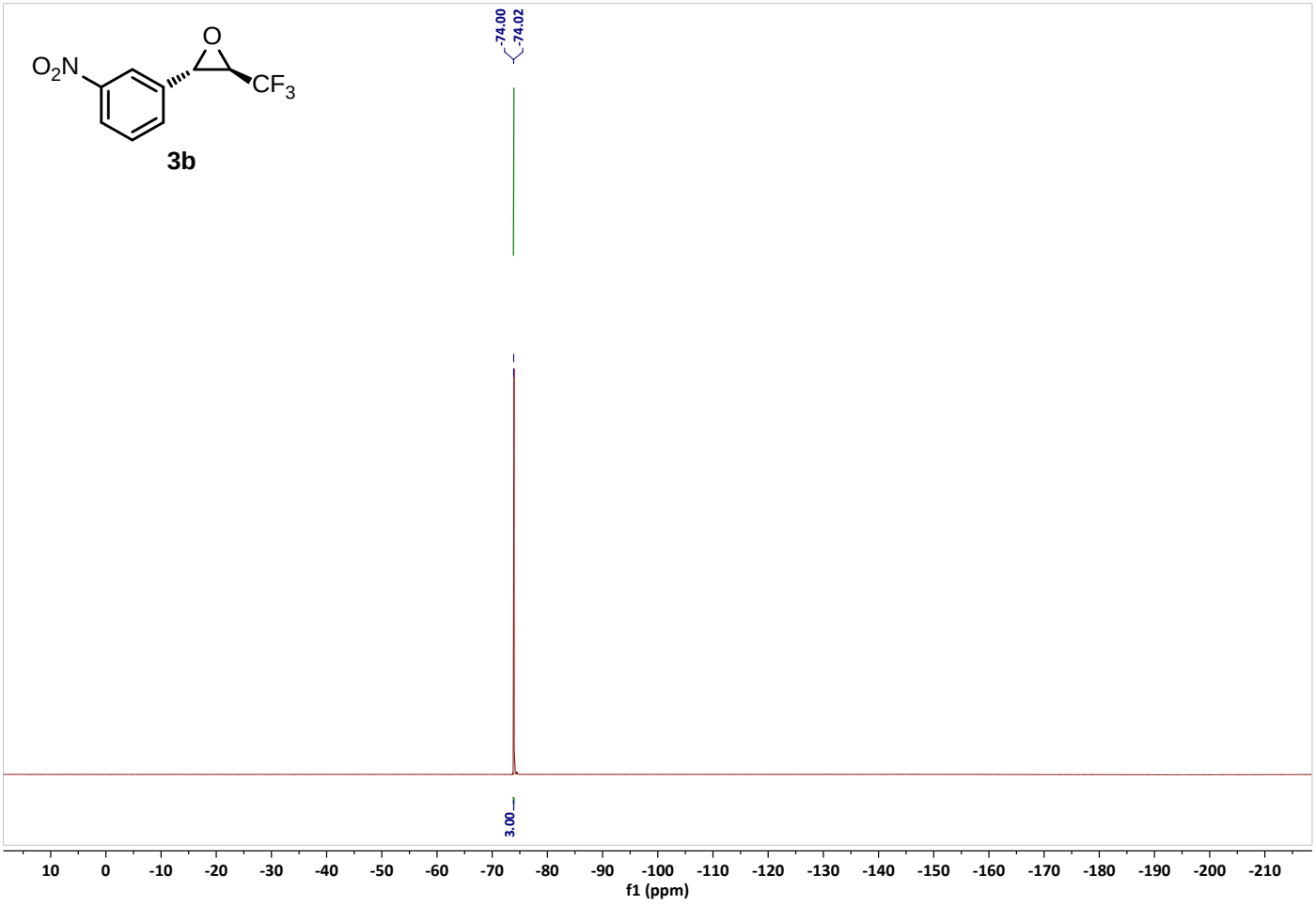
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3.00
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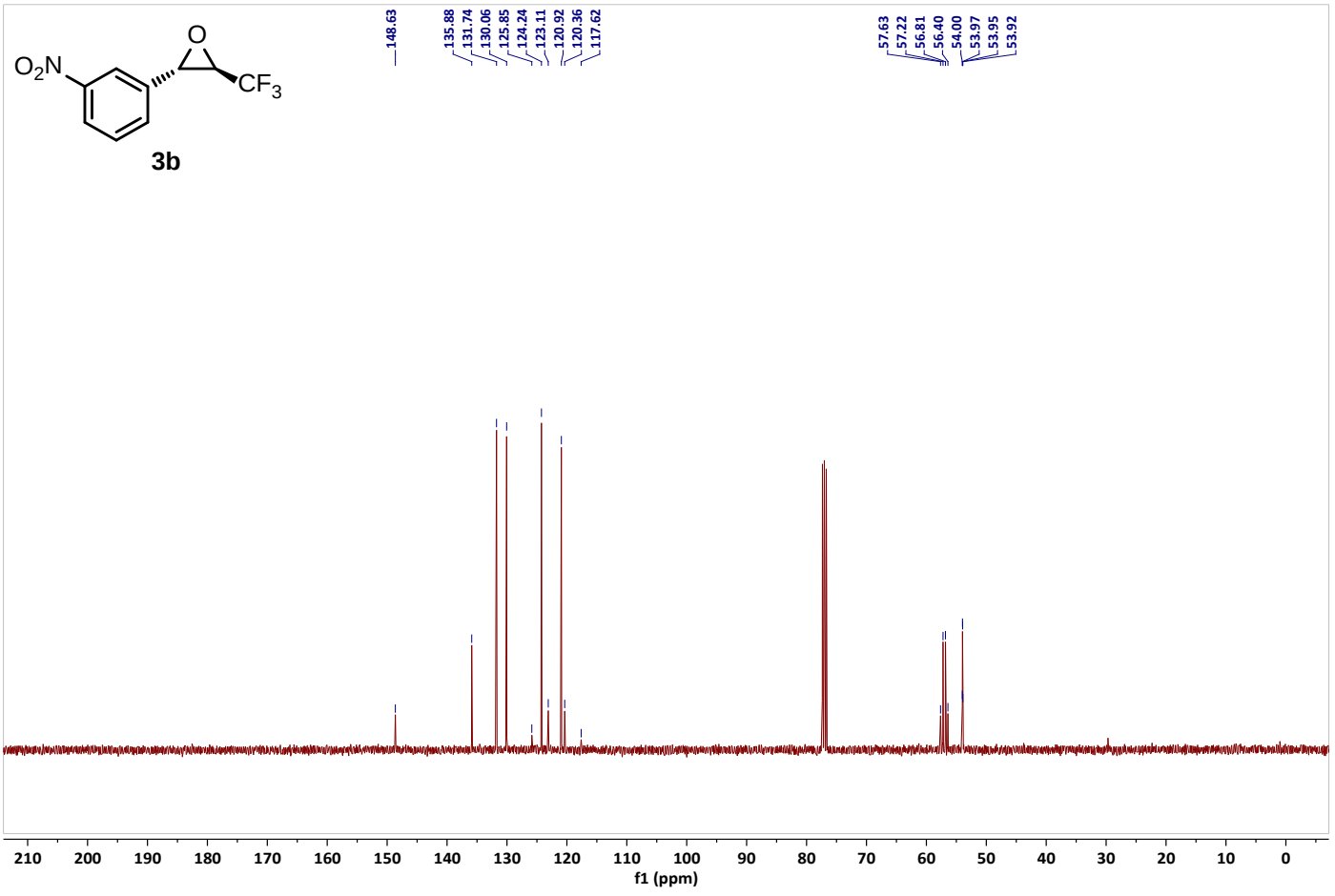
f1 (ppm)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O_2N
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123.11
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57.63
57.22
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53.97
53.95
53.92
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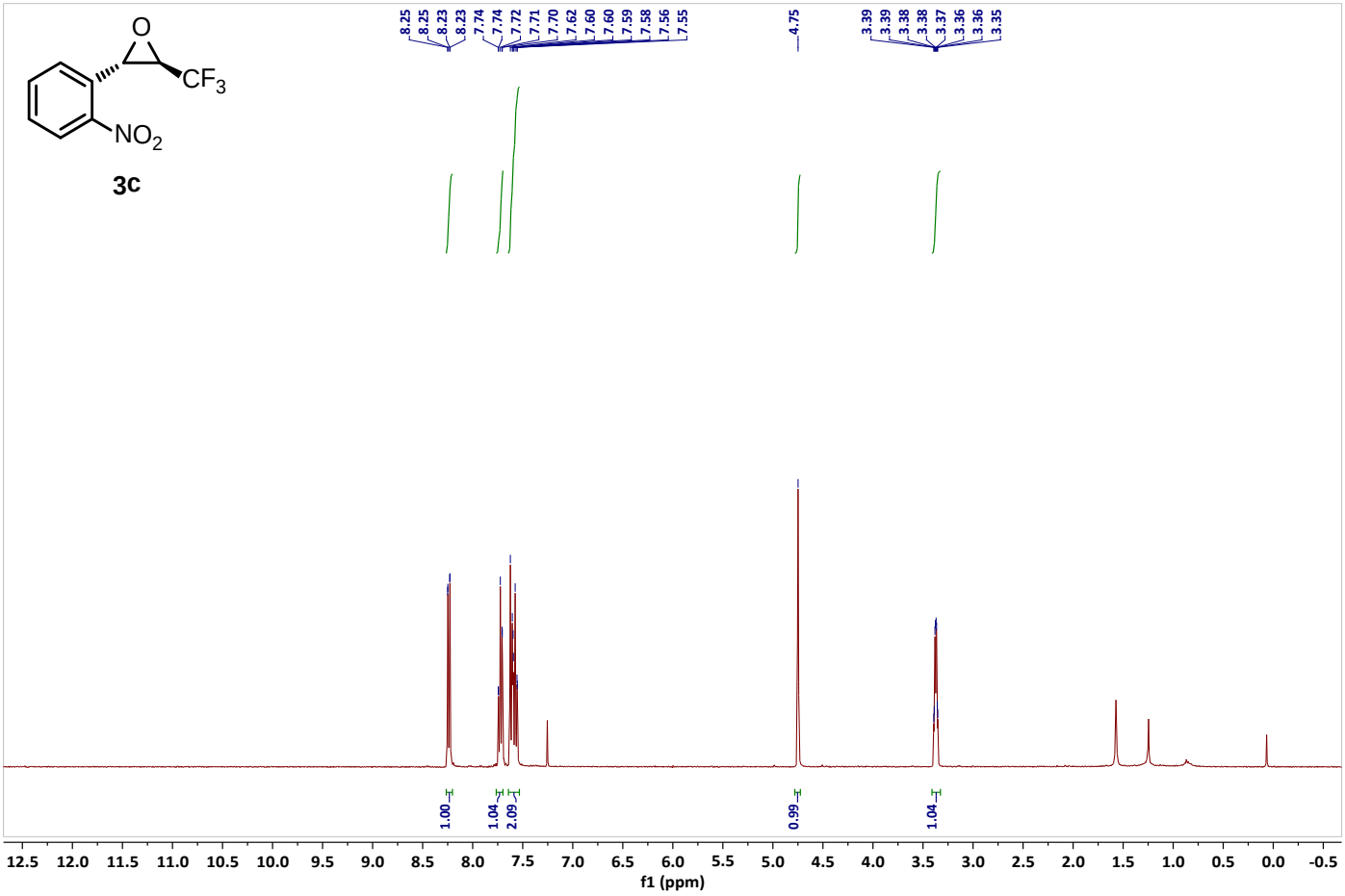
f1 (ppm)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CF3
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4.75
3.39
3.39
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1.04
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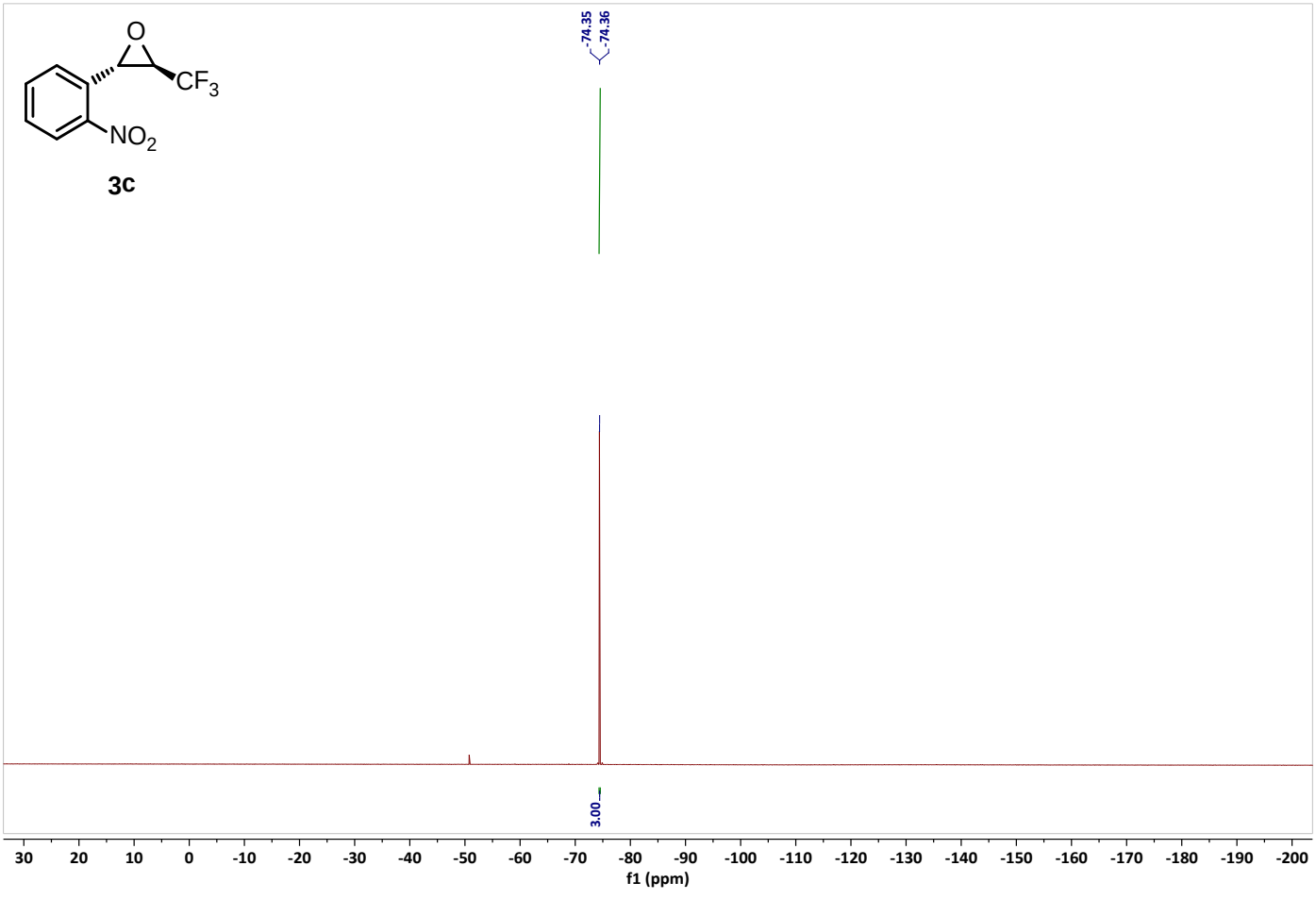
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CF3
NO2
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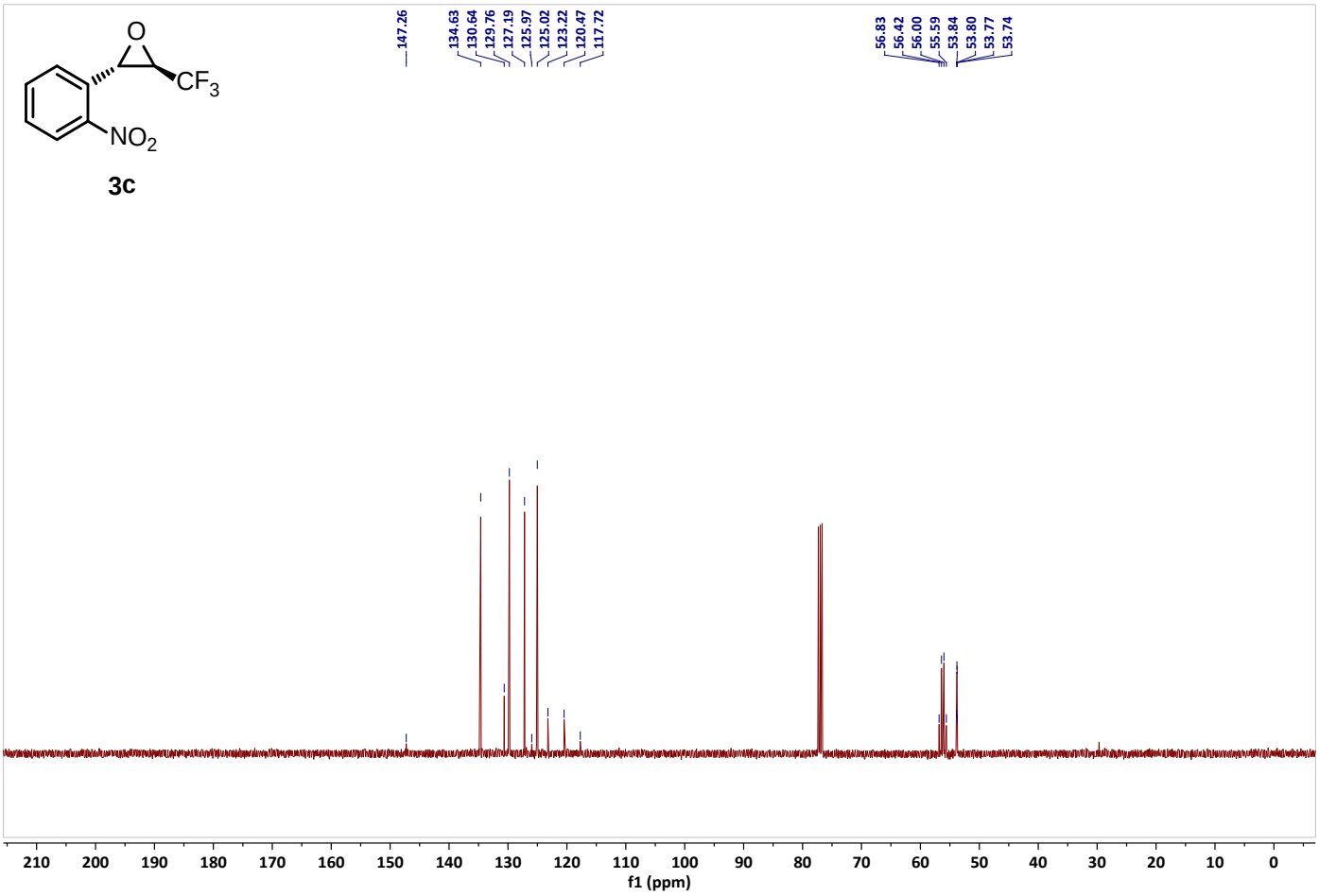
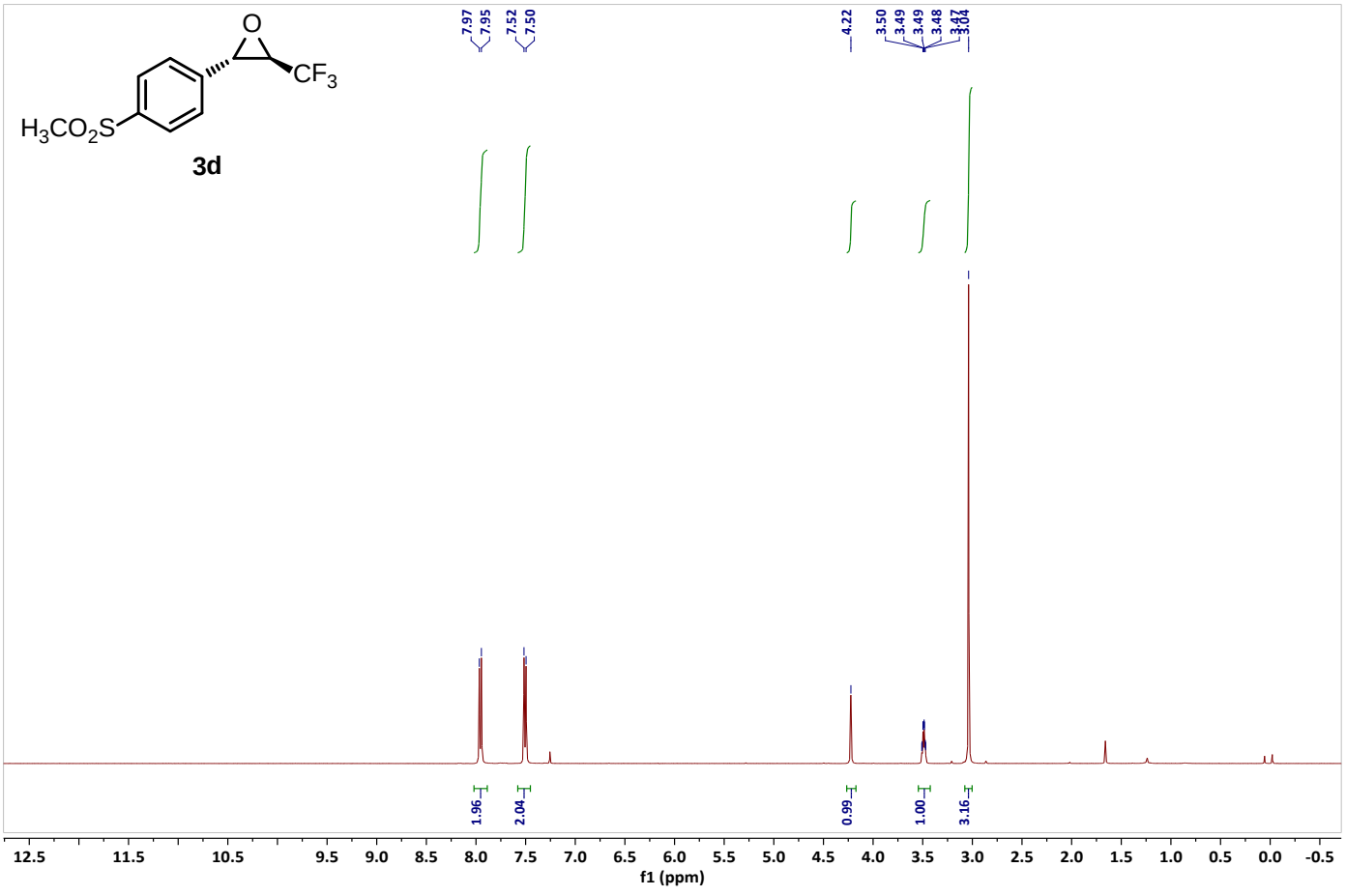
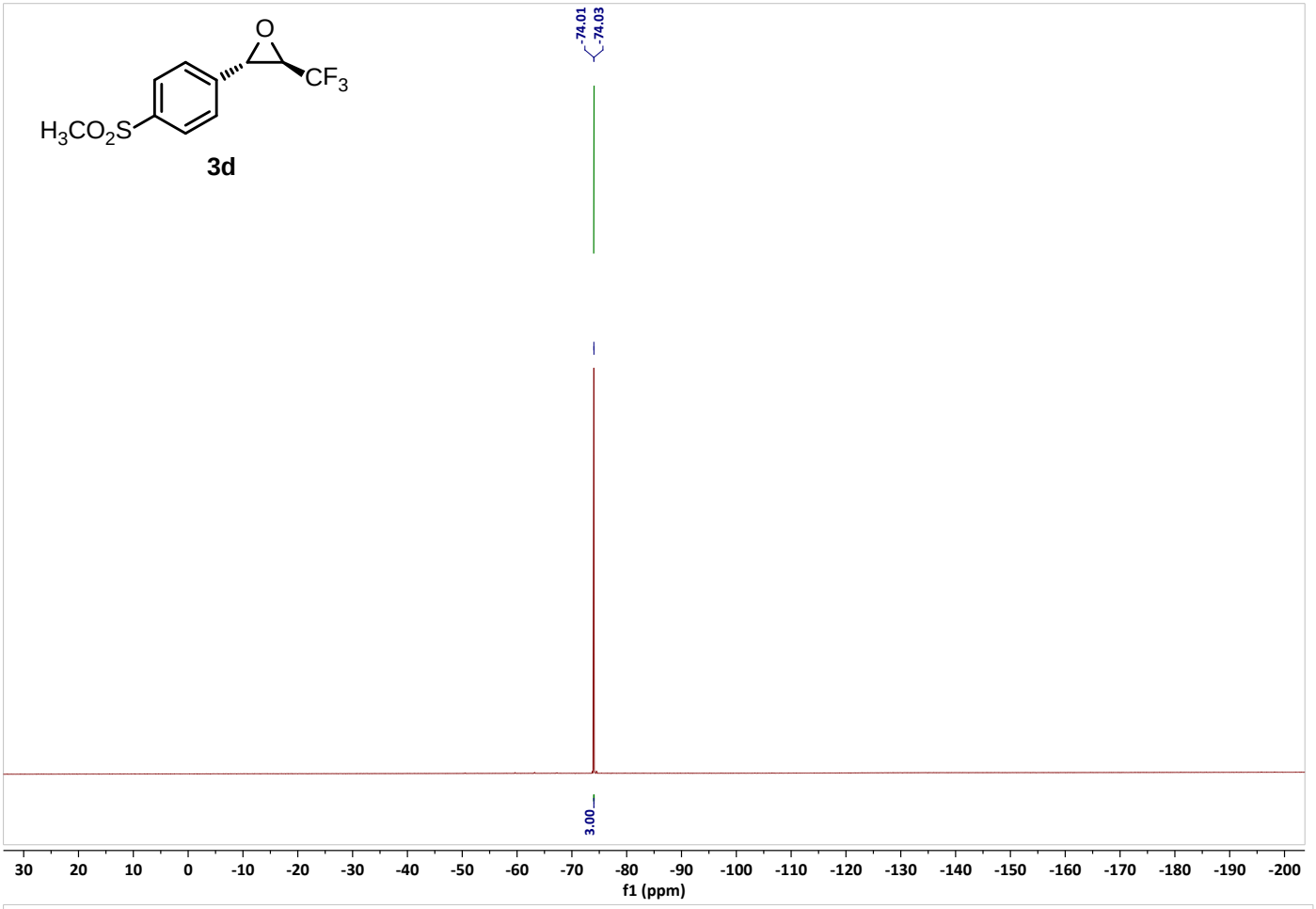
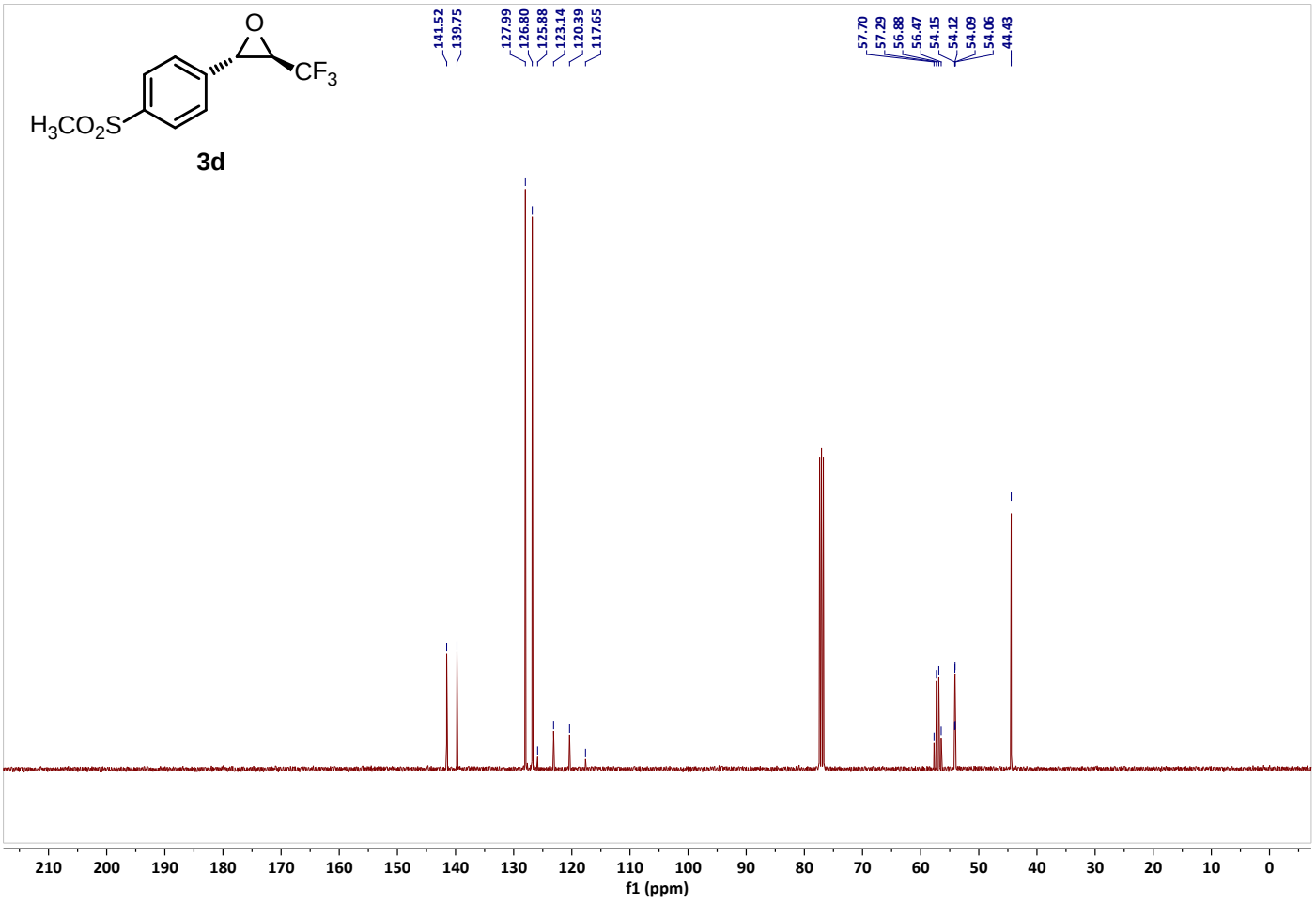
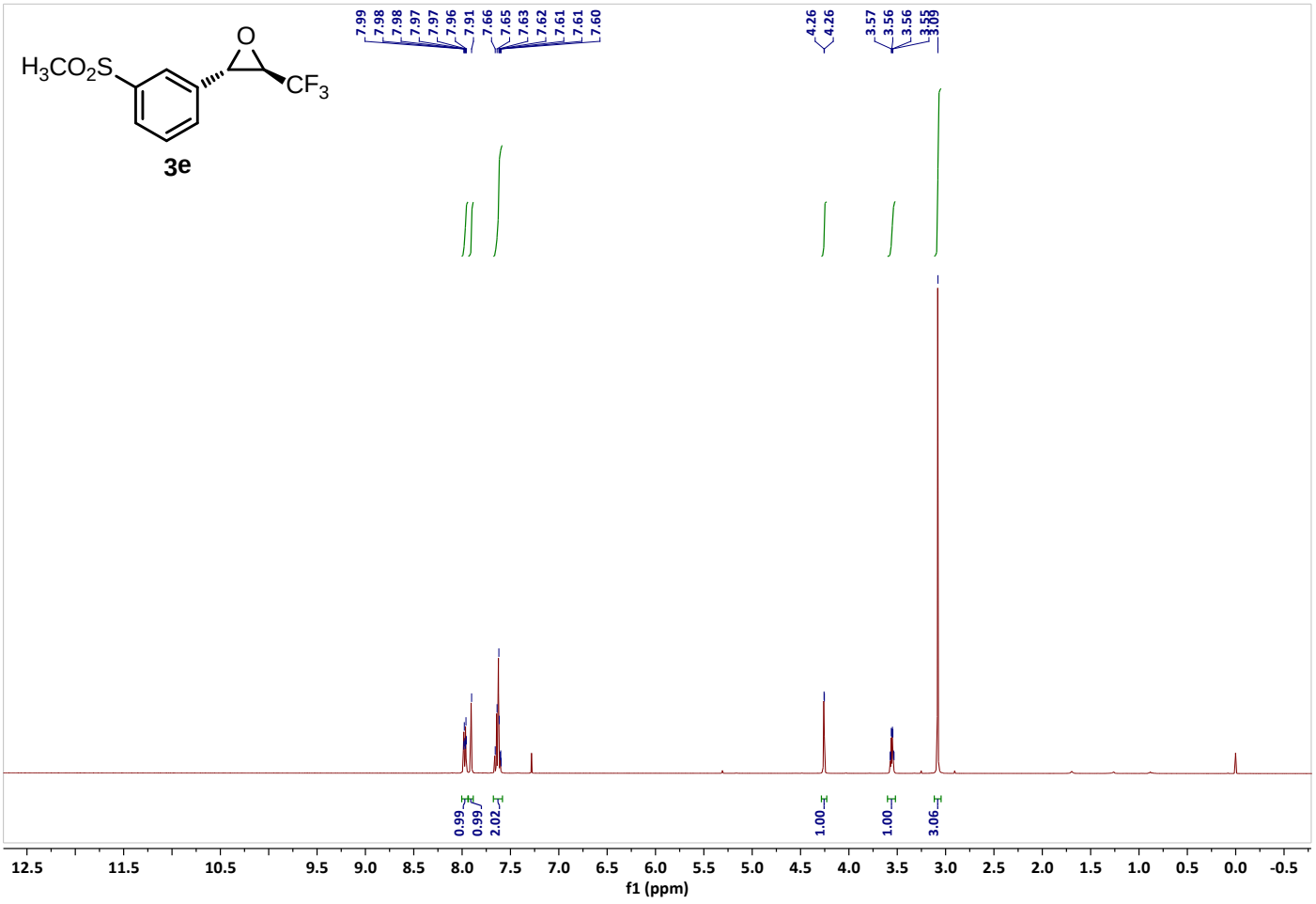
3.00
f1 (ppm)

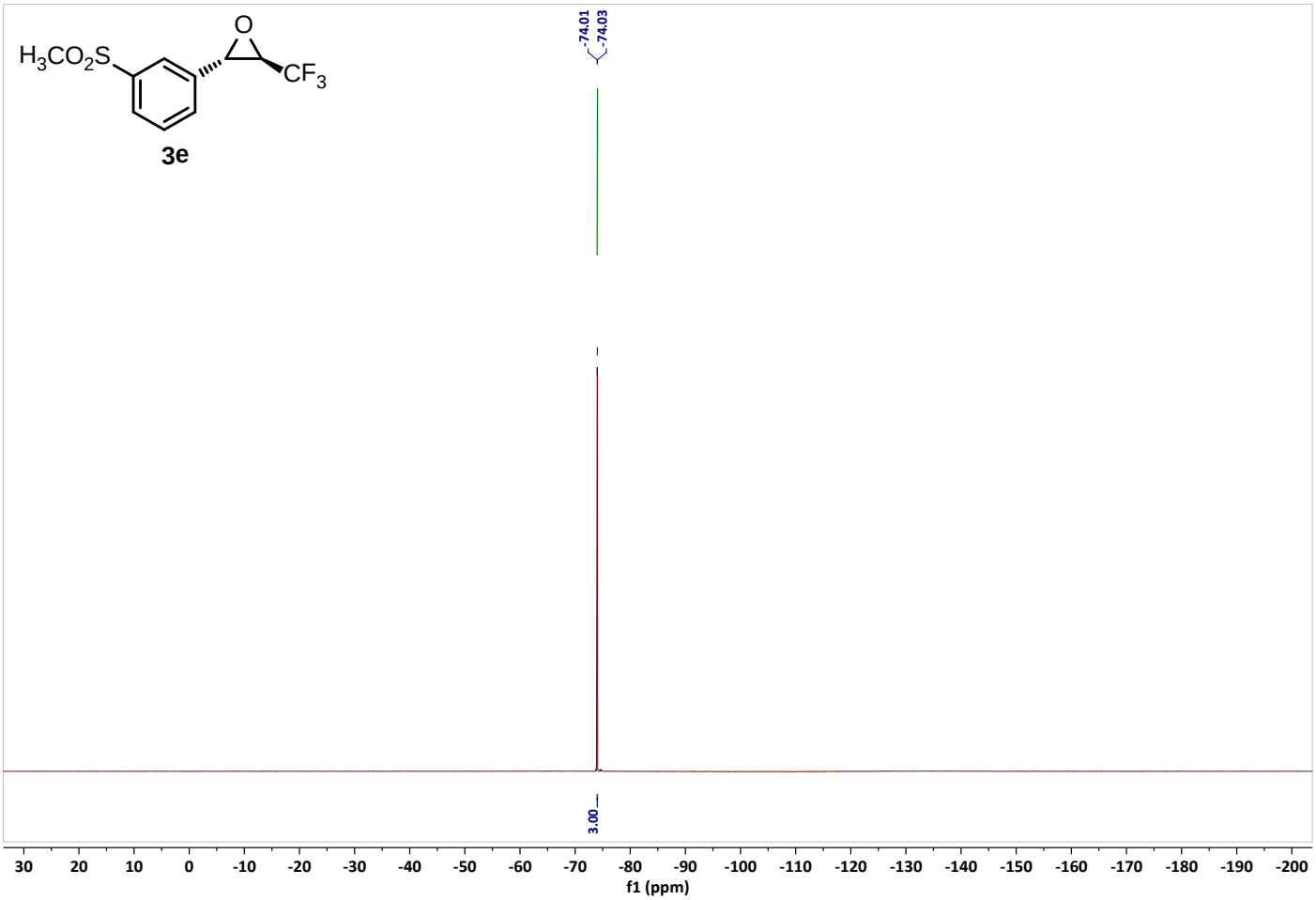

O
CF3
NO2
3c
147.26
134.63
130.64
129.76
127.19
125.97
125.02
123.22
120.47
117.72
56.83
56.42
56.00
55.59
53.84
53.80
53.77
53.74
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

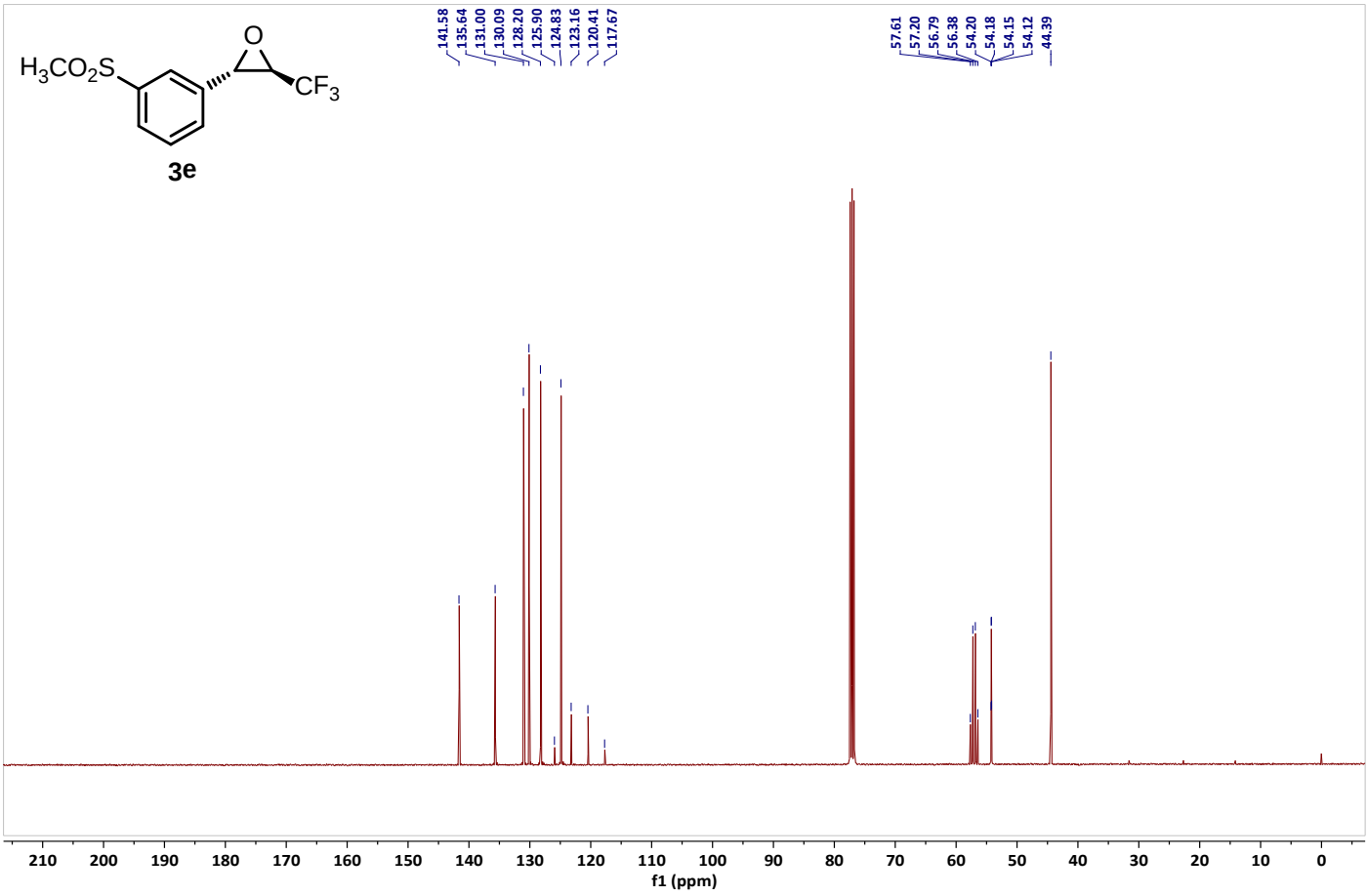

O
CF3
H3CO2S
3d
7.97
7.95
7.52
7.50
4.22
3.50
3.49
3.49
3.48
1.96
2.04
0.99
1.00
3.16
12.5 11.5 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

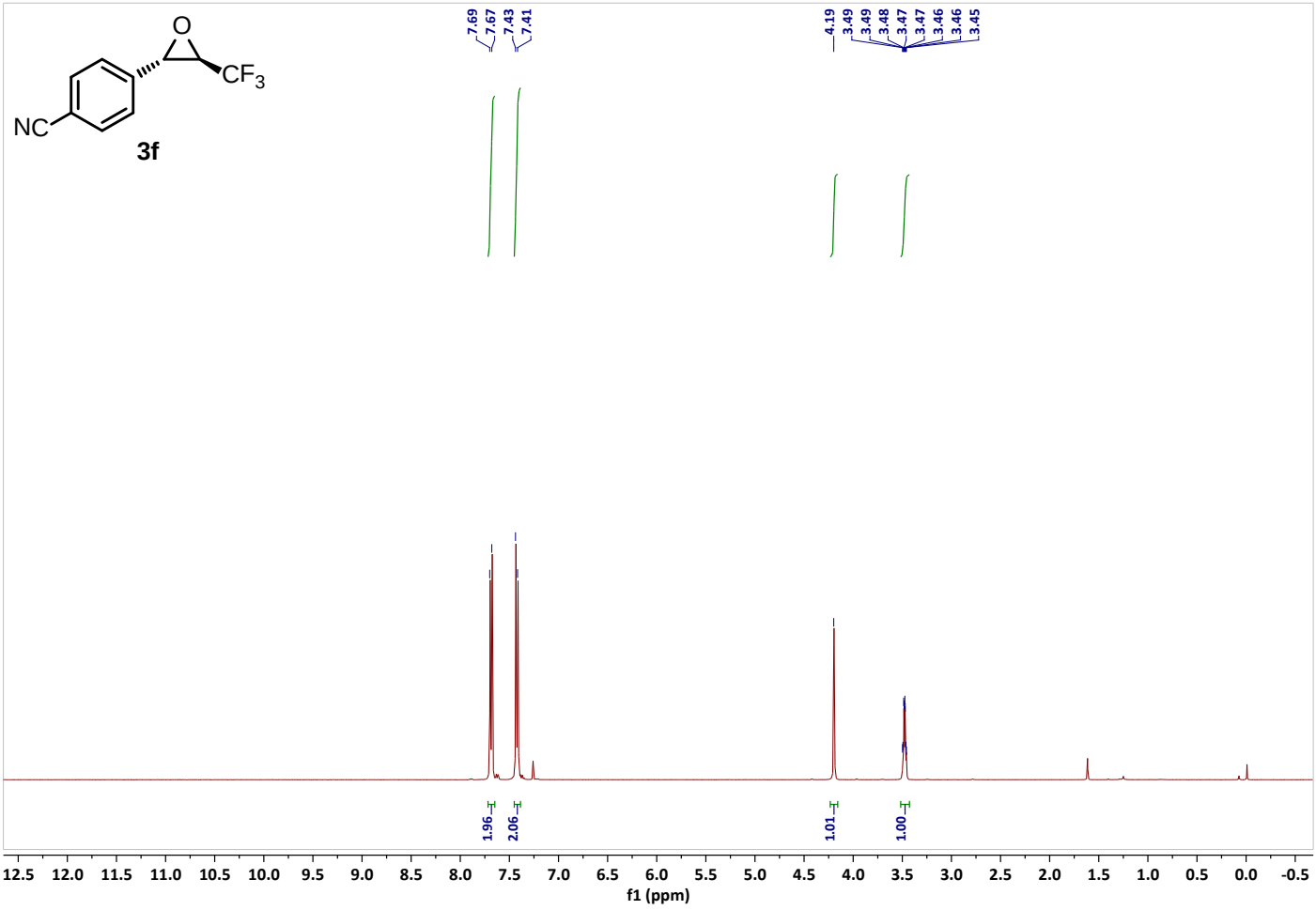

O
CF3
H3CO2S
3d
-74.01
-74.03
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

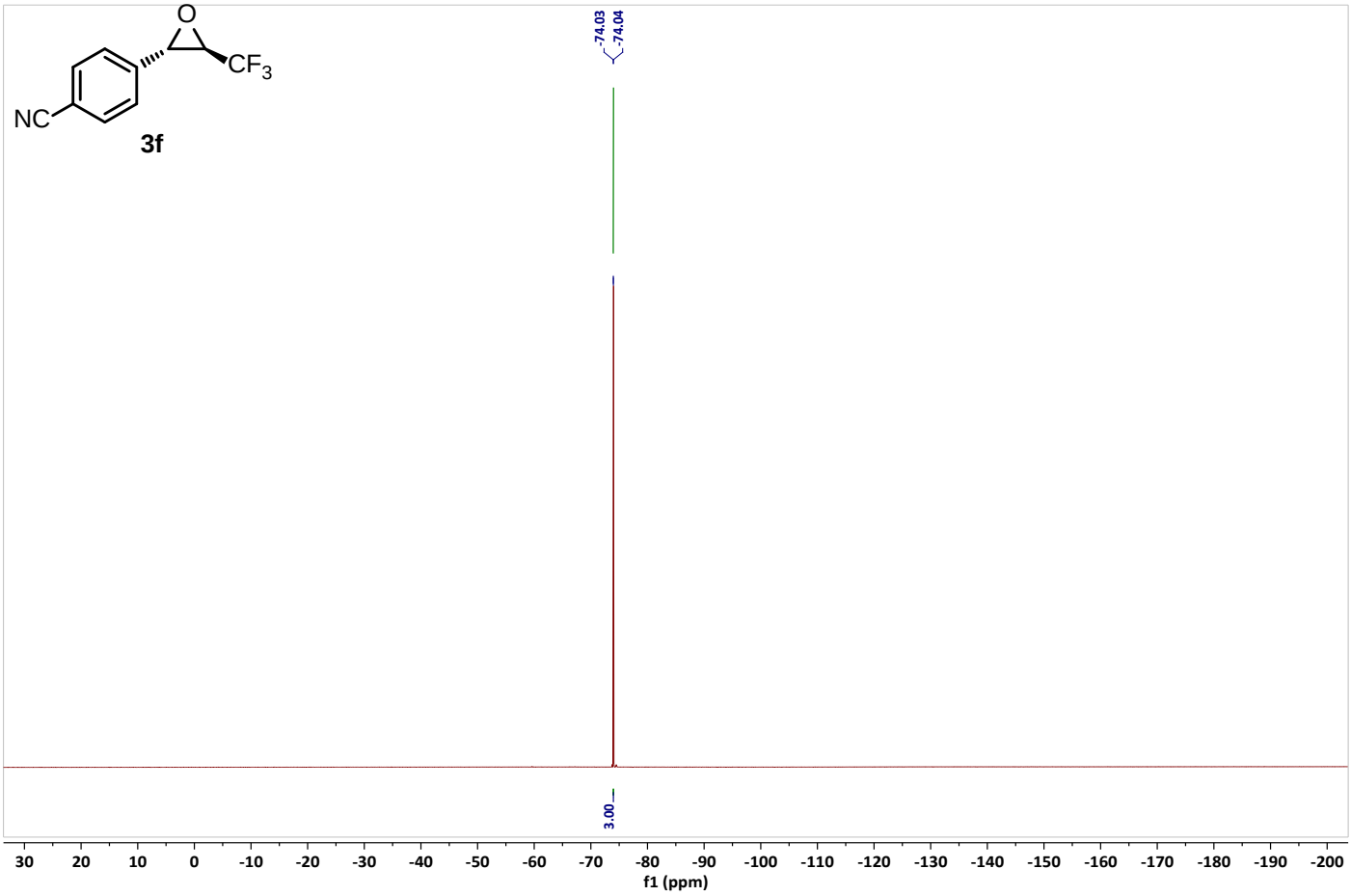

O
CF3
H3CO2S
3d
141.52
139.75
127.99
126.80
125.88
123.14
120.39
117.65
57.70
57.29
56.88
56.47
54.15
54.12
54.09
54.06
44.43
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

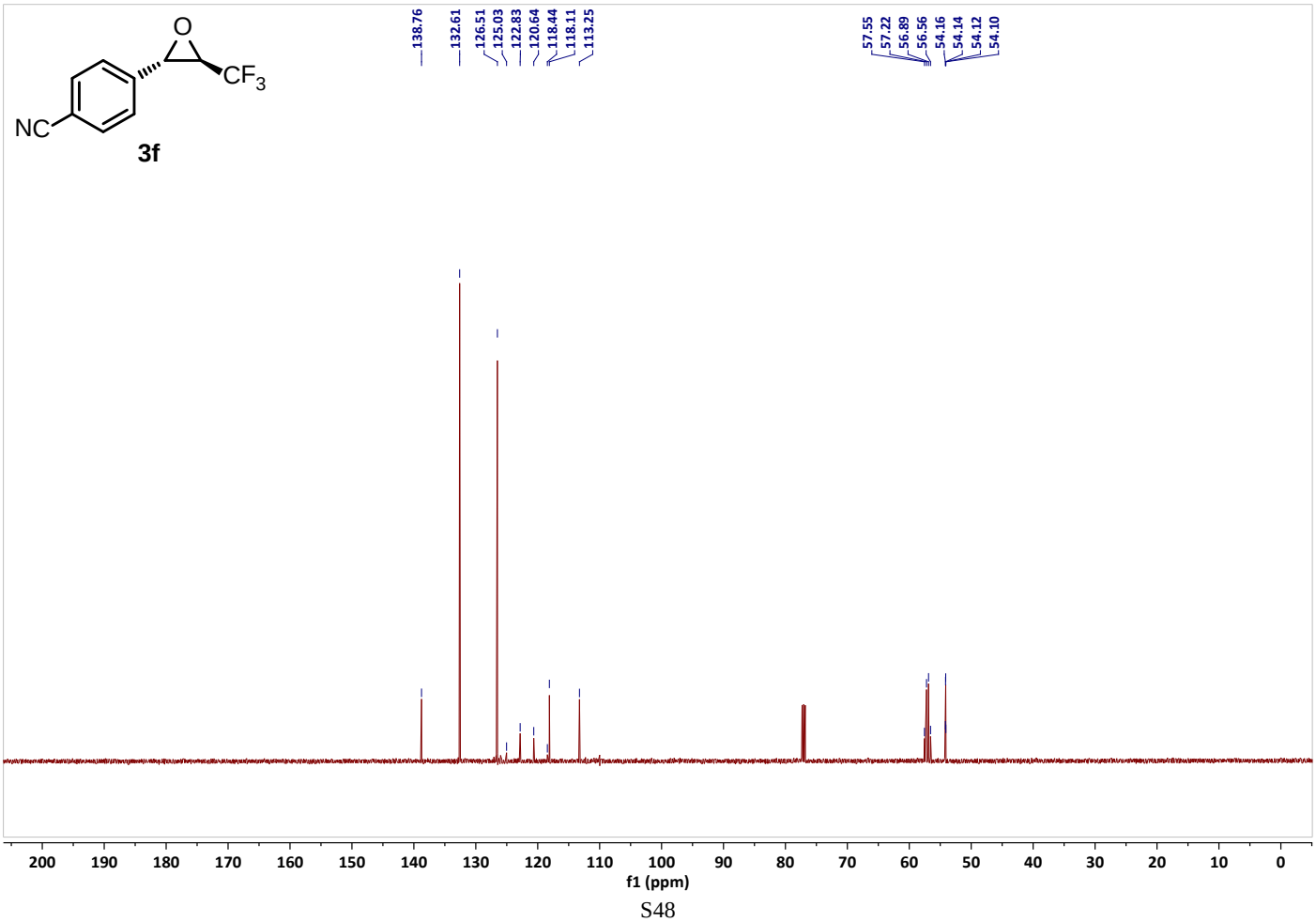

3e
7.99
7.98
7.98
7.97
7.97
7.96
7.91
7.66
7.65
7.63
7.62
7.61
7.61
7.60
4.26
4.26
3.57
3.56
3.56
3.55
3.03
0.99
0.99
2.02
1.00
1.00
3.06
f1 (ppm)

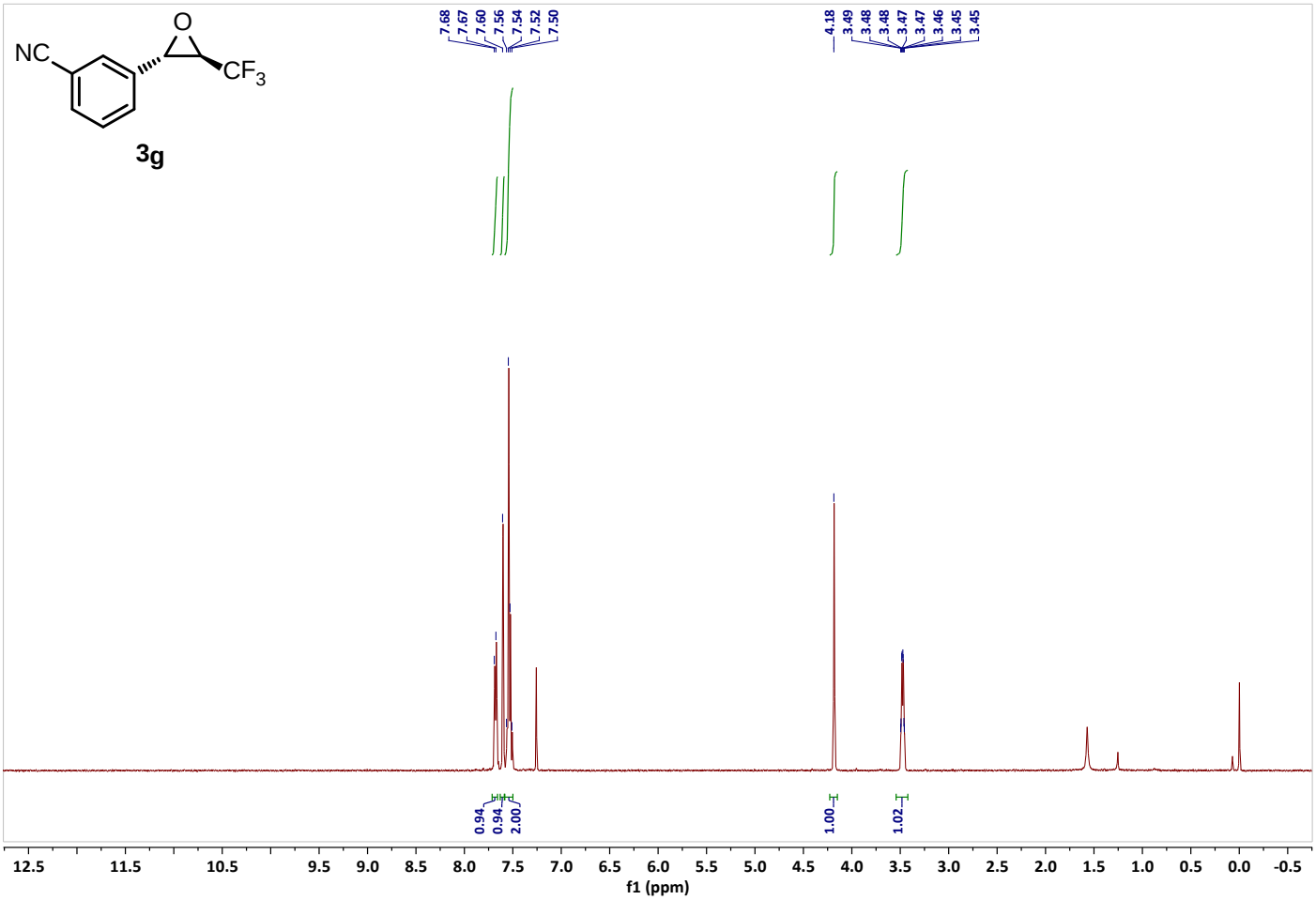

3e
-74.01
-74.03
3.00
f1 (ppm)

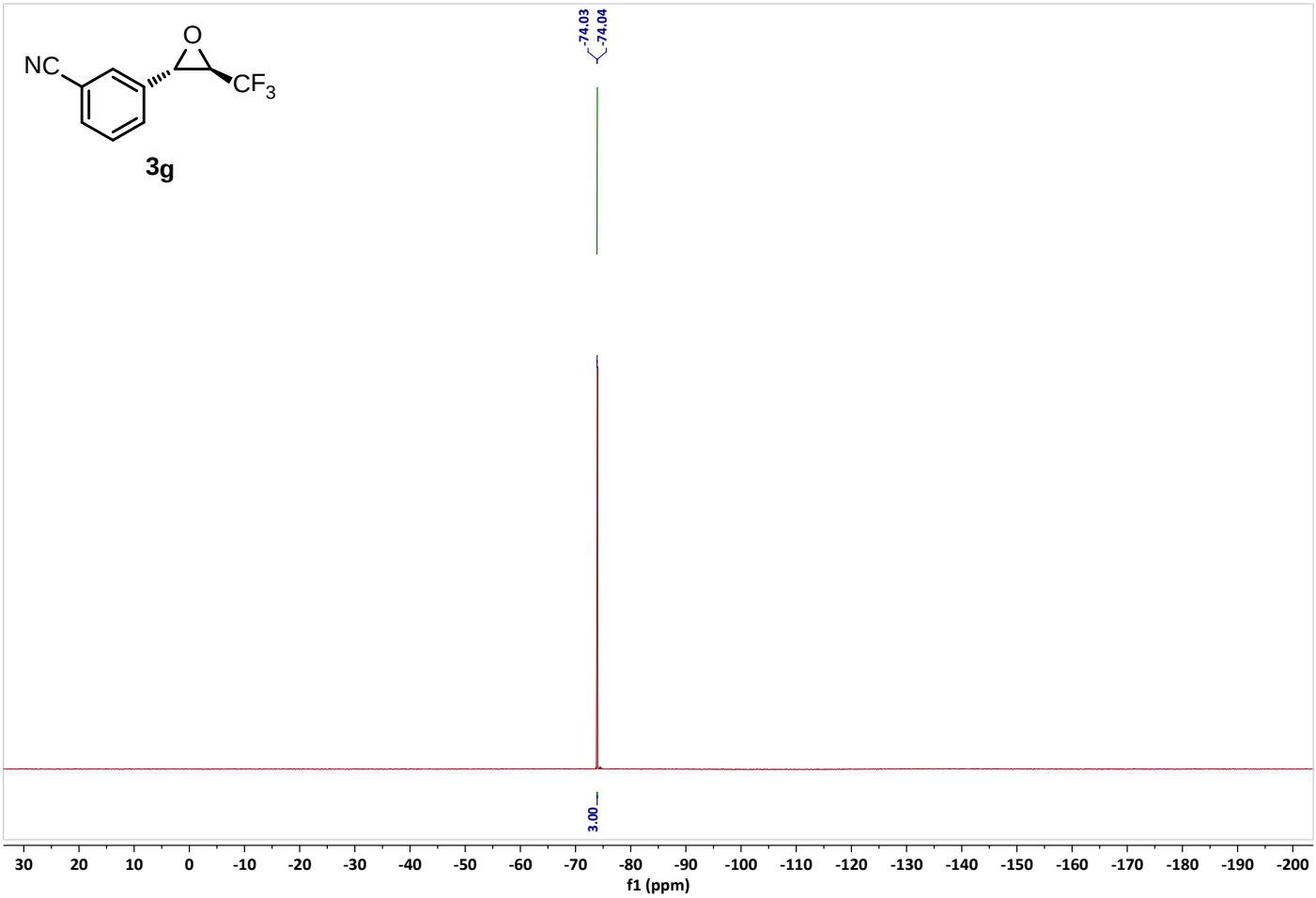

141.58
135.64
131.00
130.09
128.20
125.90
124.83
123.16
120.41
117.67
57.61
57.20
56.79
56.38
54.20
54.18
54.15
54.12
44.39
O
H_3CO_2S
CF_3
3e
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

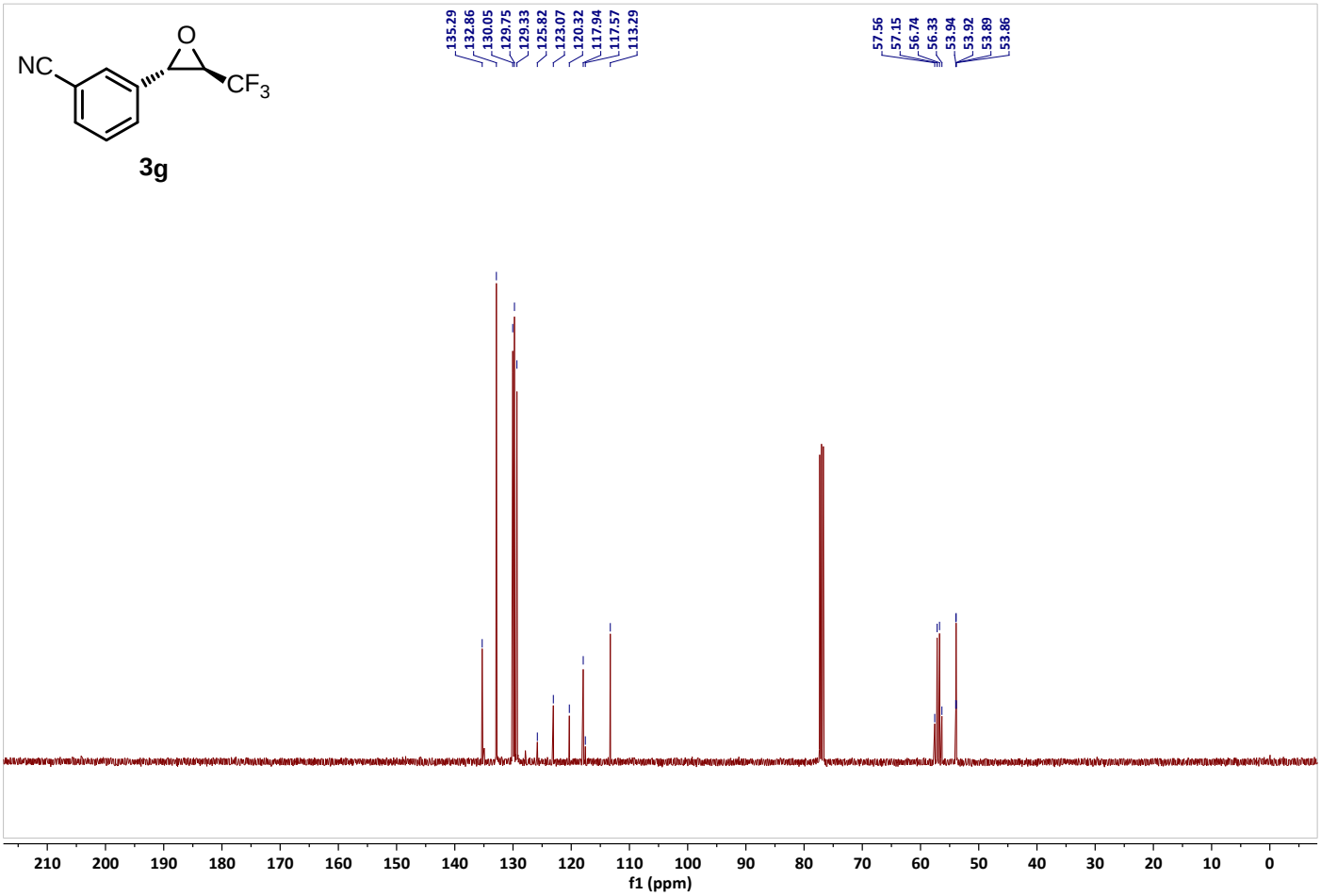

7.69
7.67
7.43
7.41
4.19
3.49
3.49
3.48
3.47
3.47
3.46
3.46
3.45
O
CF_3
NC
3f
1.96
2.06
1.01
1.00
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

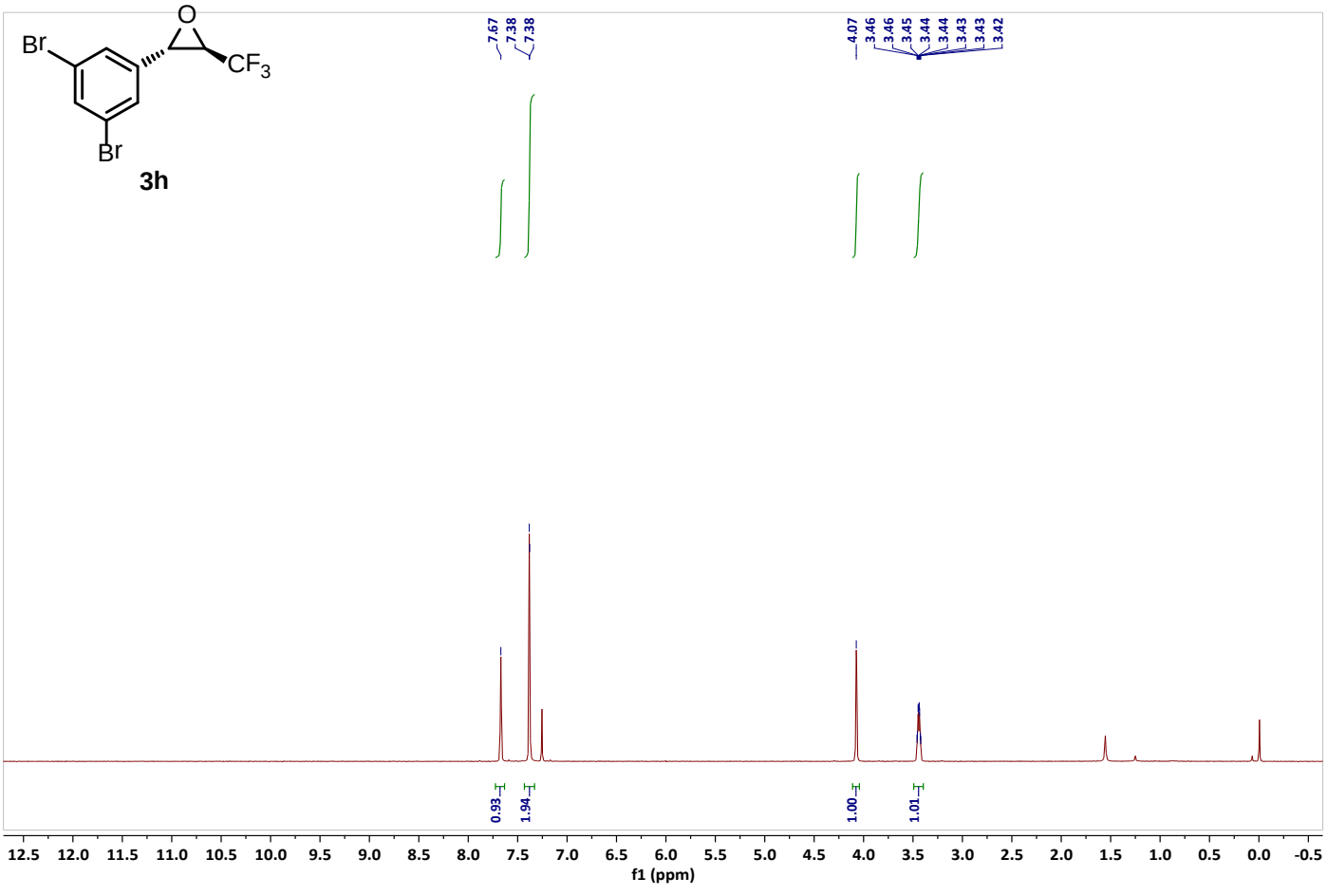

O
CF3
NC
3f
-74.03
-74.04
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

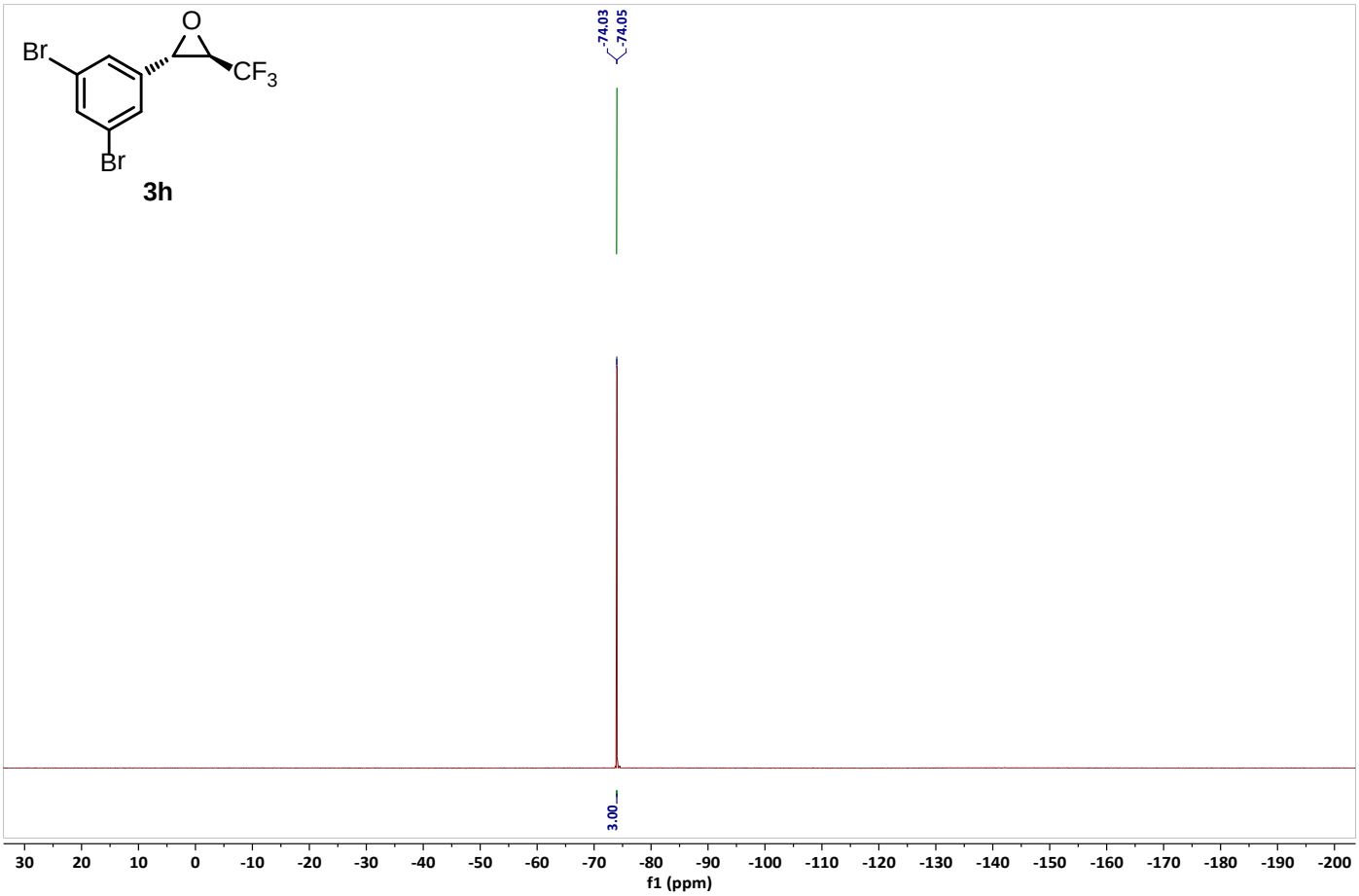

O
CF3
NC
3f
138.76
132.61
126.51
125.03
122.83
120.64
118.44
118.11
113.25
57.55
57.22
56.89
56.56
54.16
54.14
54.12
54.10
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

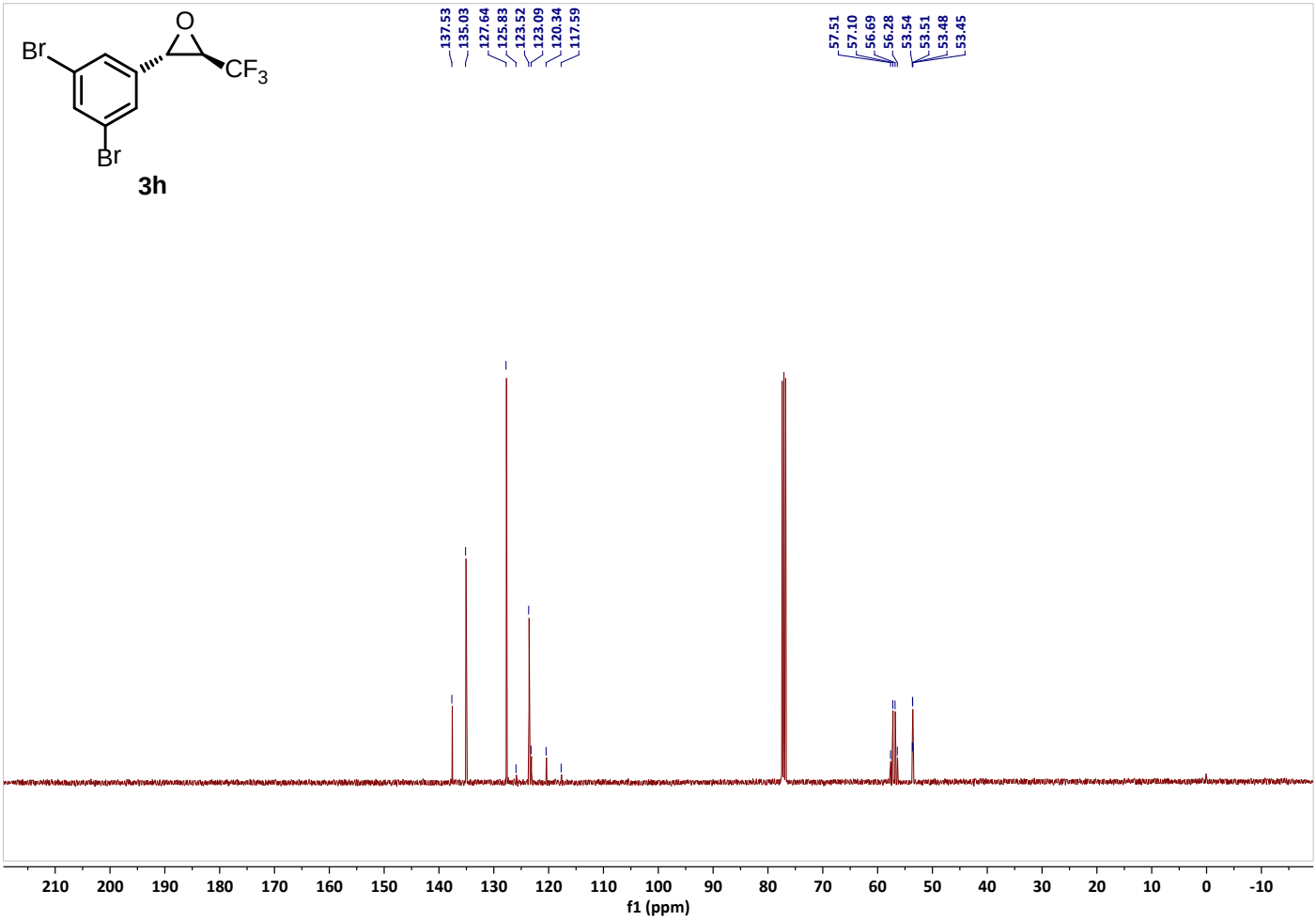

NC
O
CF3
3g
7.68
7.67
7.60
7.56
7.54
7.52
7.50
4.18
3.49
3.48
3.48
3.47
3.47
3.46
3.45
3.45
0.94
0.94
2.00
1.00
1.02
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

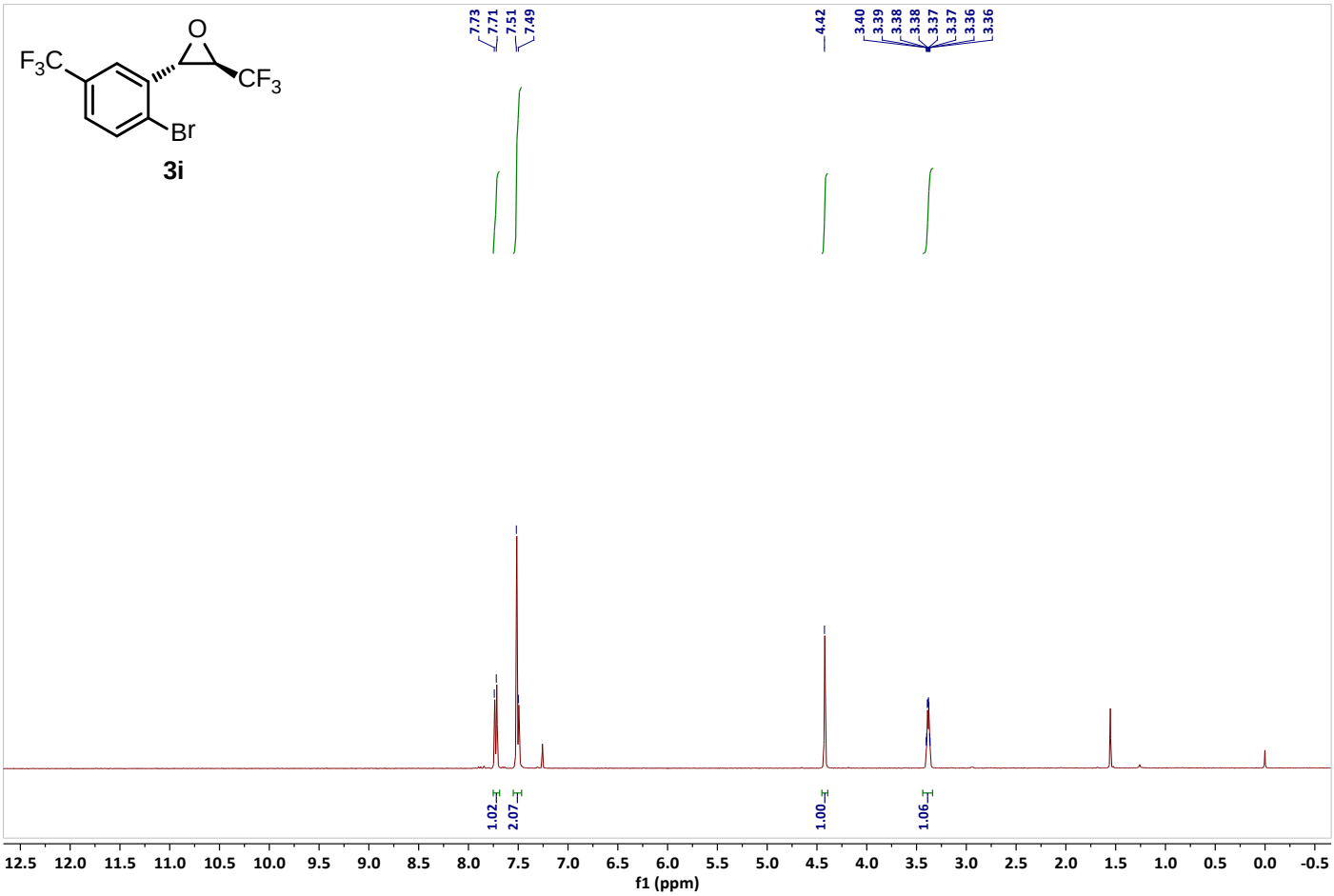

NC
O
CF3
3g
-74.03
-74.04
3.00
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
f1 (ppm)

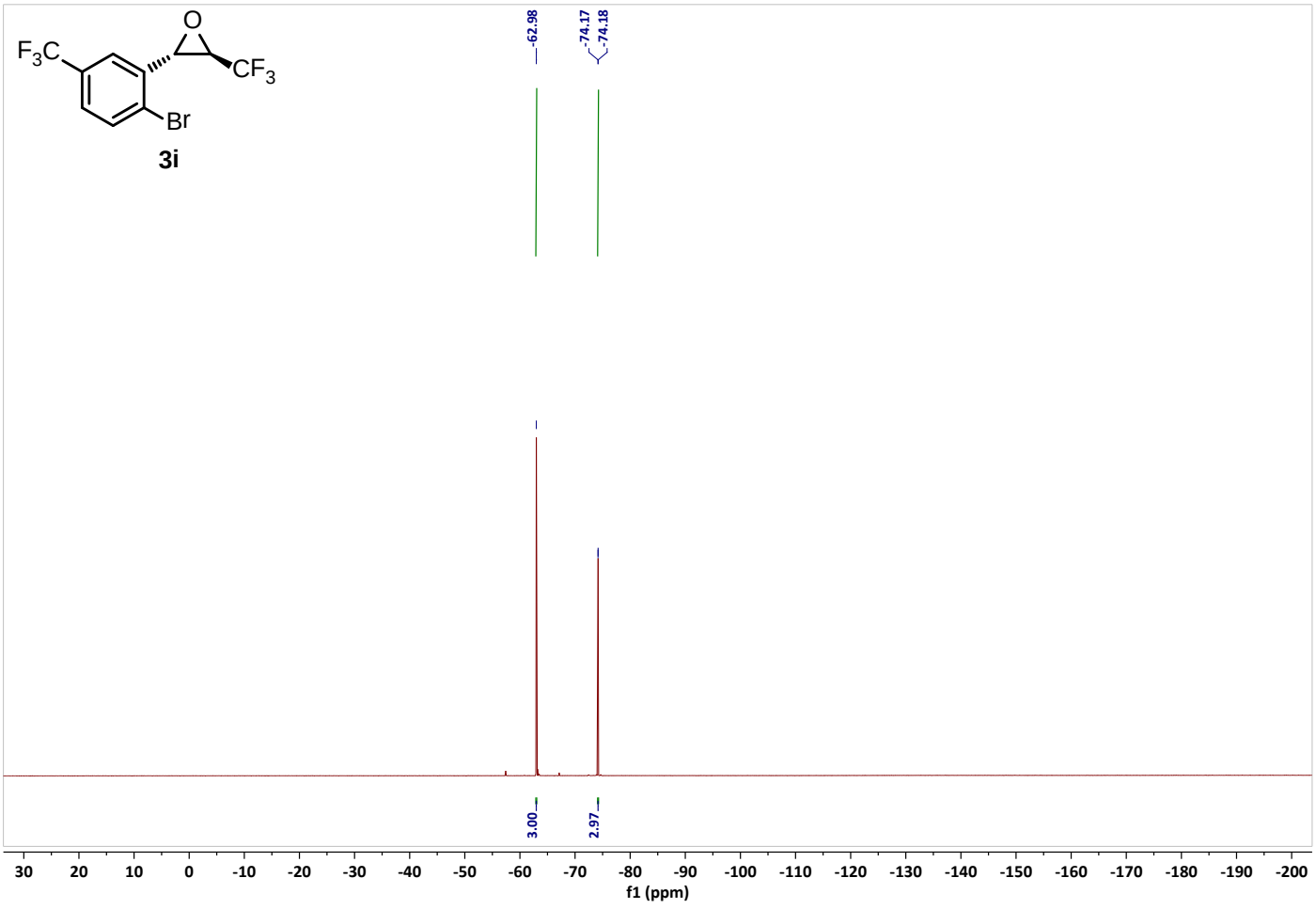

NC
O
CF3
3g
135.29
132.86
130.05
129.75
129.33
125.82
123.07
120.32
117.94
117.57
113.29
57.56
57.15
56.74
56.33
53.94
53.92
53.89
53.86
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

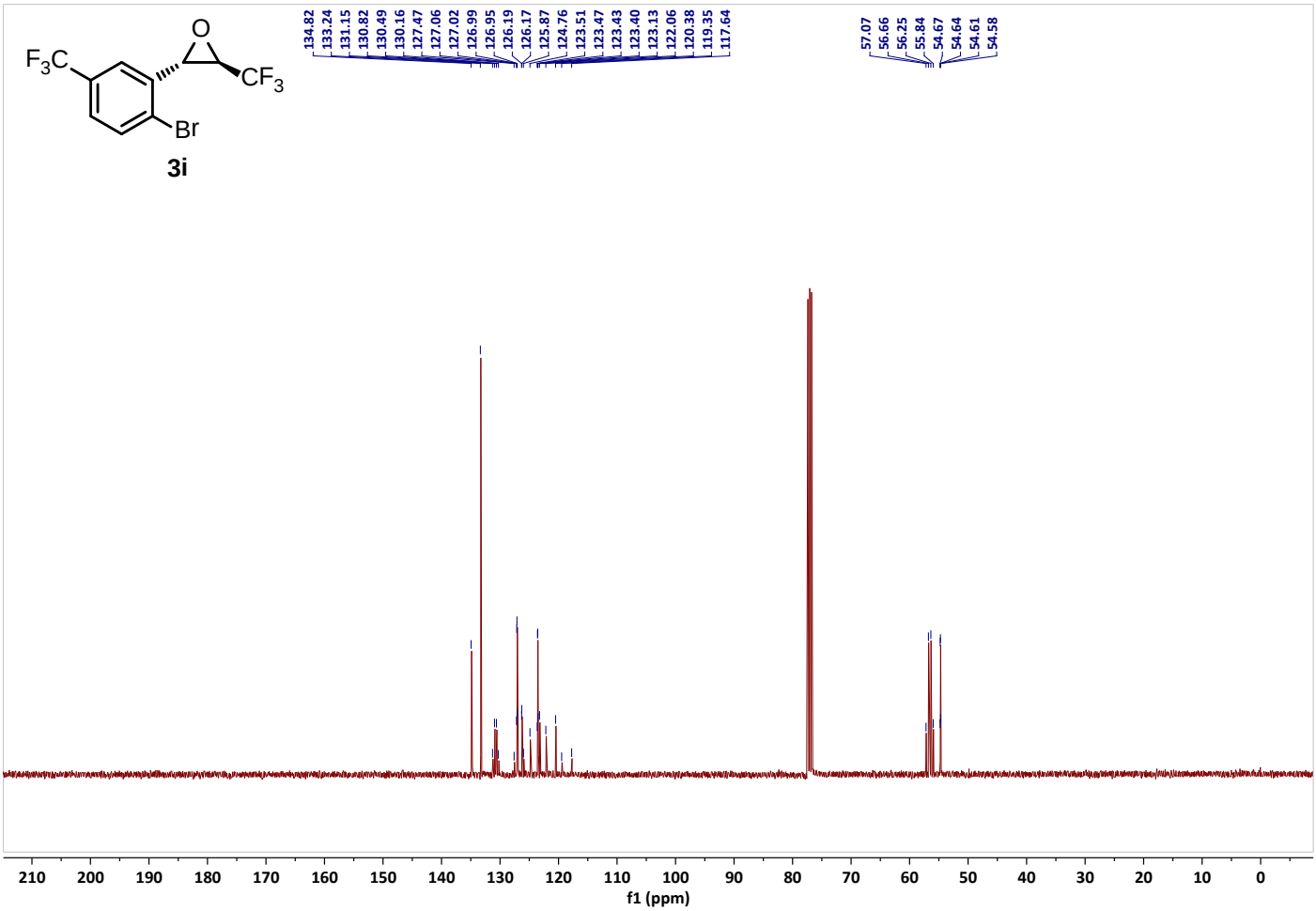

Br
O
CF3
Br
3h
7.67
7.38
7.38
4.07
3.46
3.46
3.45
3.44
3.44
3.43
3.43
3.42
0.93
1.94
1.00
1.01
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

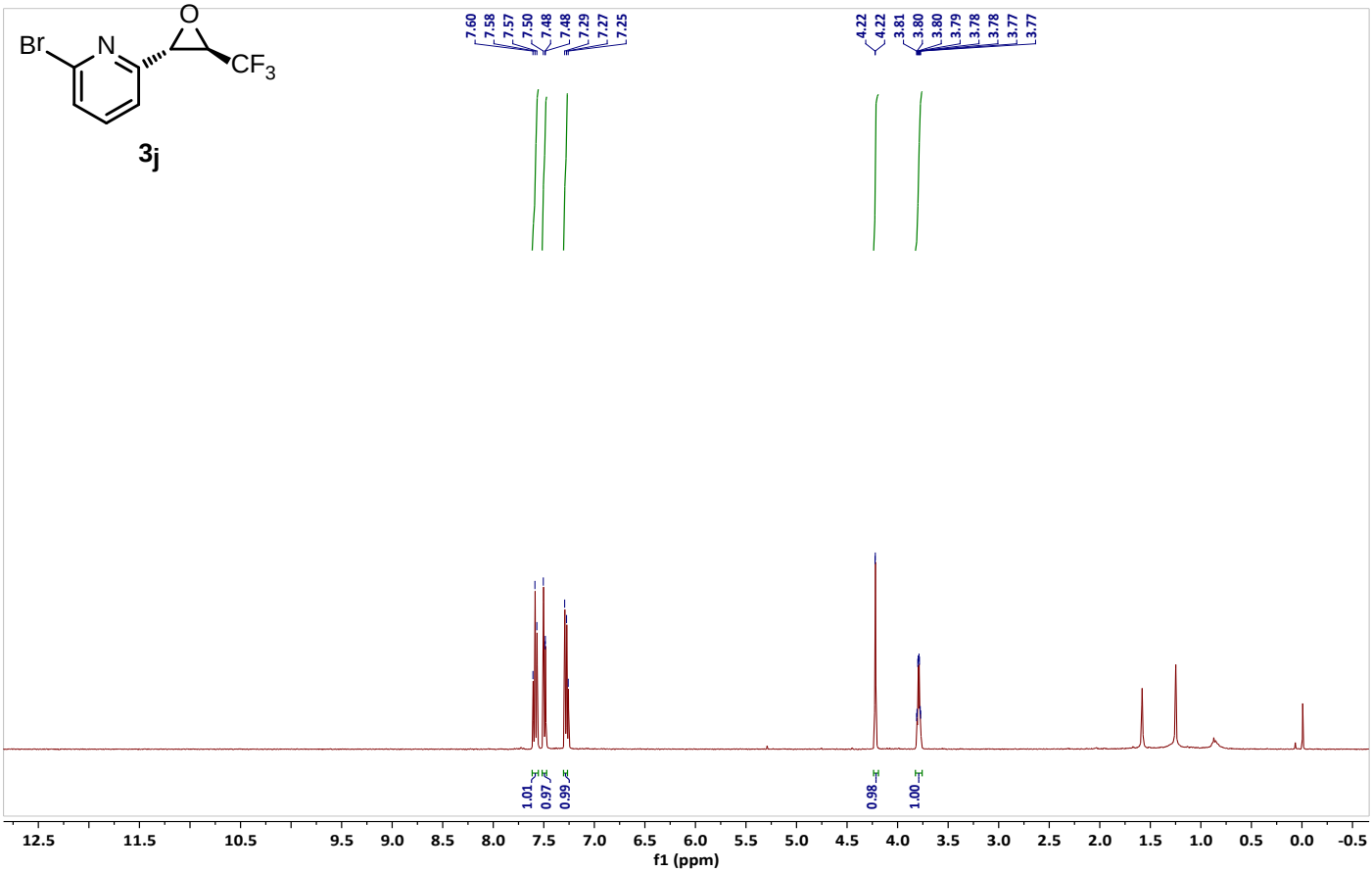

Br
O
CF3
Br
3h
-74.03
-74.05
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

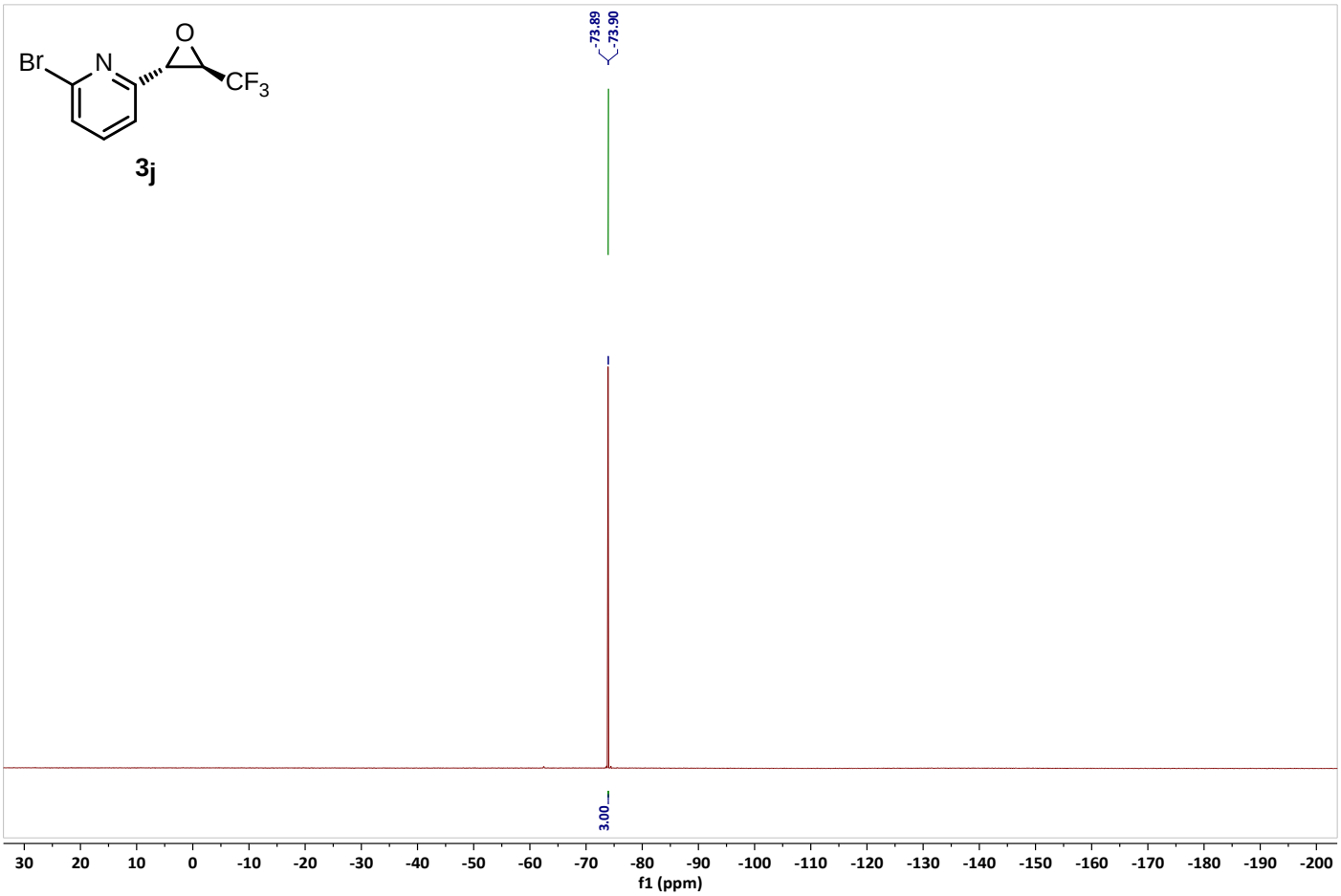

Br
O
CF3
Br
3h
137.53
135.03
127.64
125.83
123.52
123.09
120.34
117.59
57.51
57.10
56.69
56.28
53.54
53.51
53.48
53.45
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

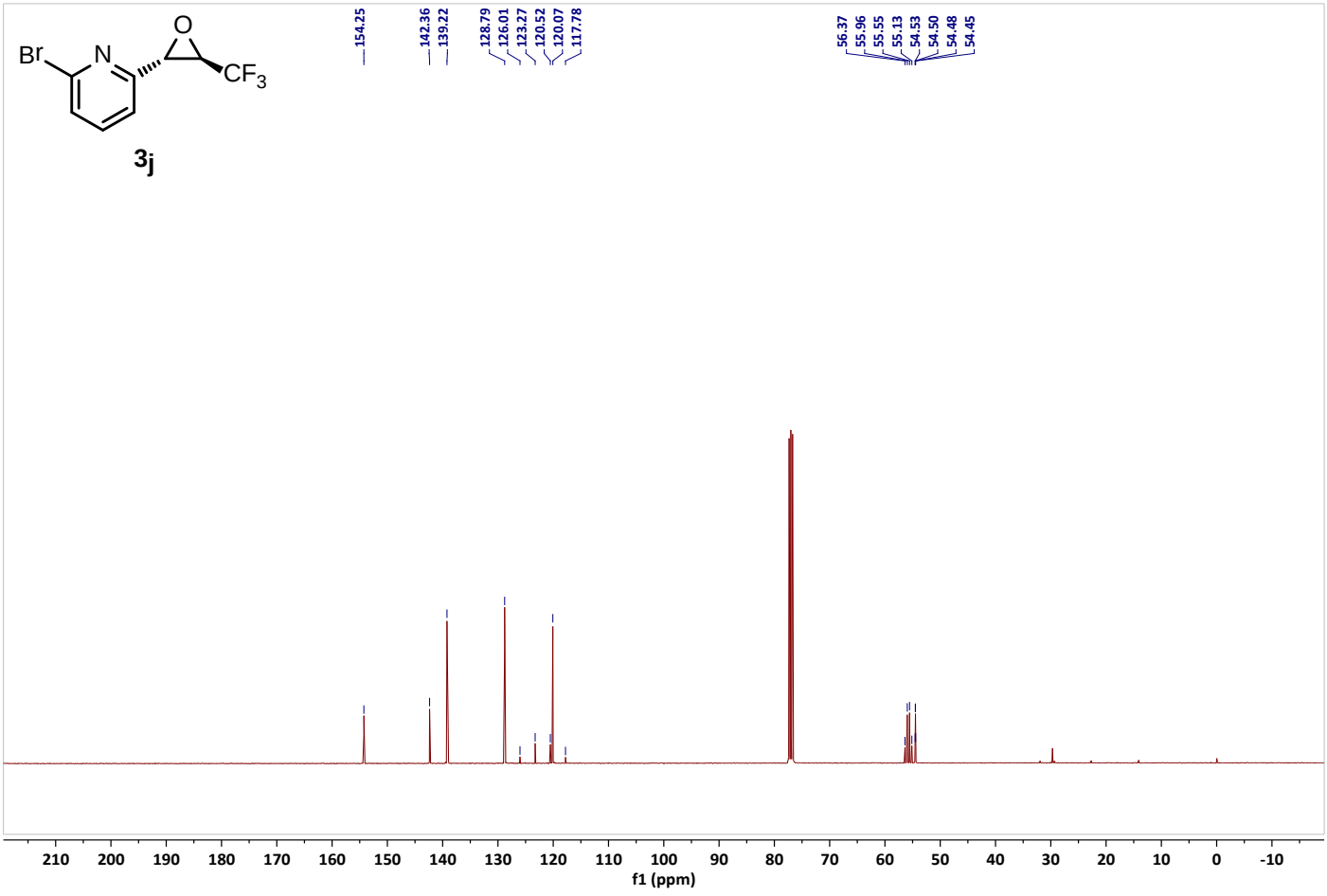

F3C
O
CF3
Br
3i
7.73
7.71
7.51
7.49
4.42
3.40
3.39
3.38
3.38
3.37
3.37
3.36
3.36
1.02
2.07
1.00
1.06
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

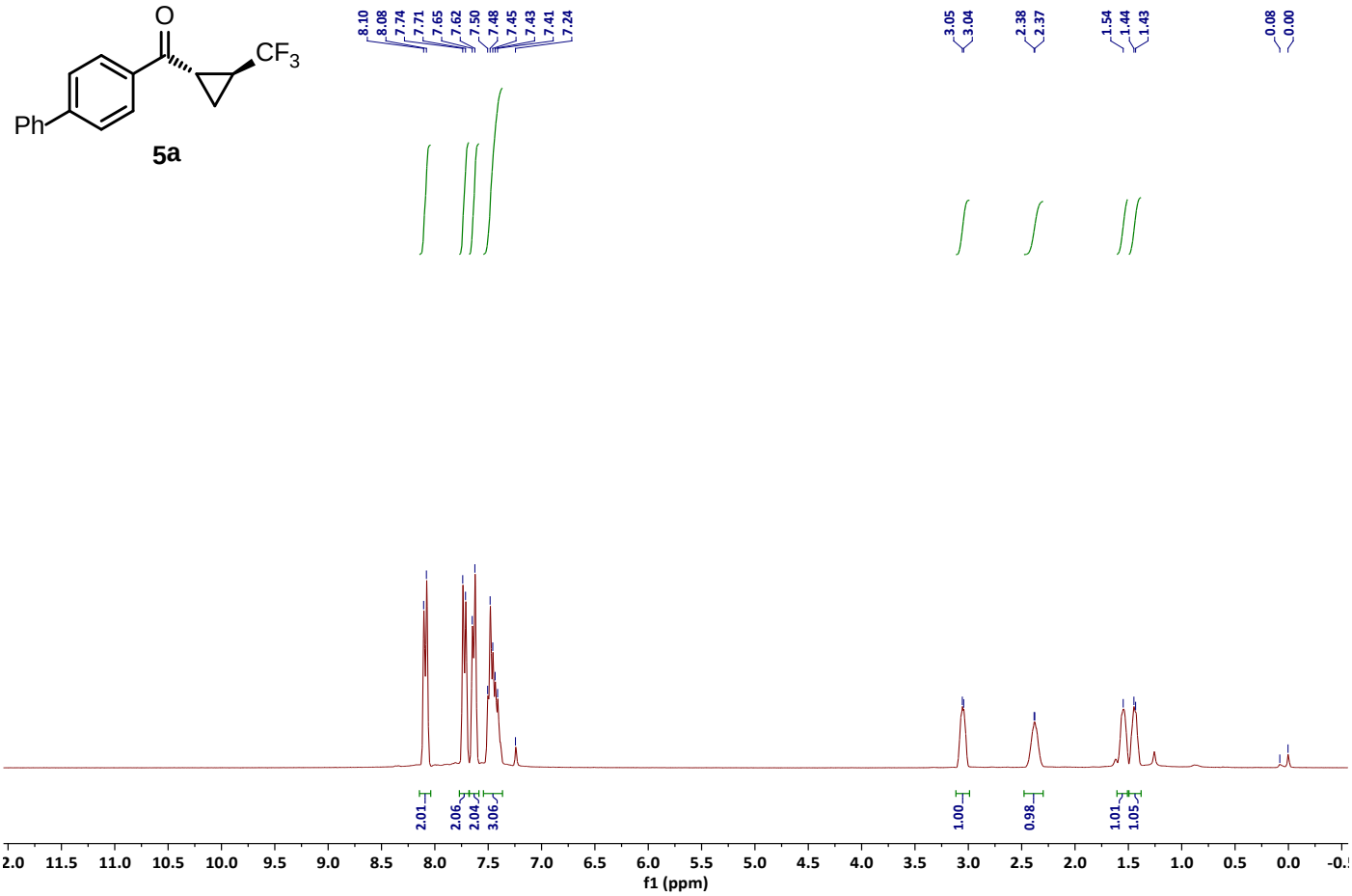

F3C
O
CF3
Br
3i
-62.98
-74.17
-74.18
3.00
2.97
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

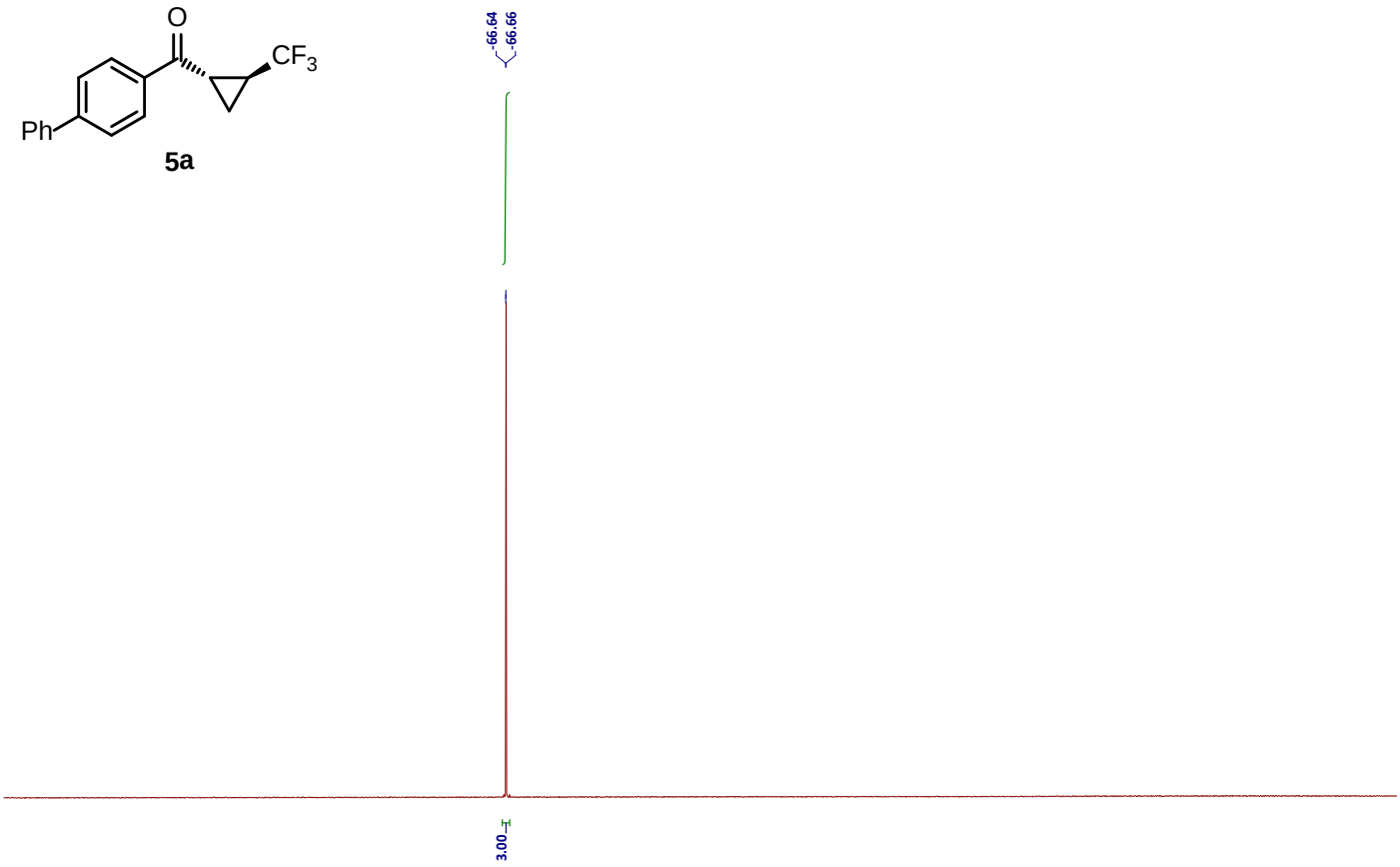

3i
134.82
133.24
131.15
130.82
130.49
130.16
127.47
127.06
127.02
126.99
126.95
126.19
126.17
125.87
124.76
123.51
123.47
123.43
123.40
123.13
122.06
120.38
119.35
117.64
57.07
56.66
56.25
55.84
54.67
54.64
54.61
54.58
f1 (ppm)

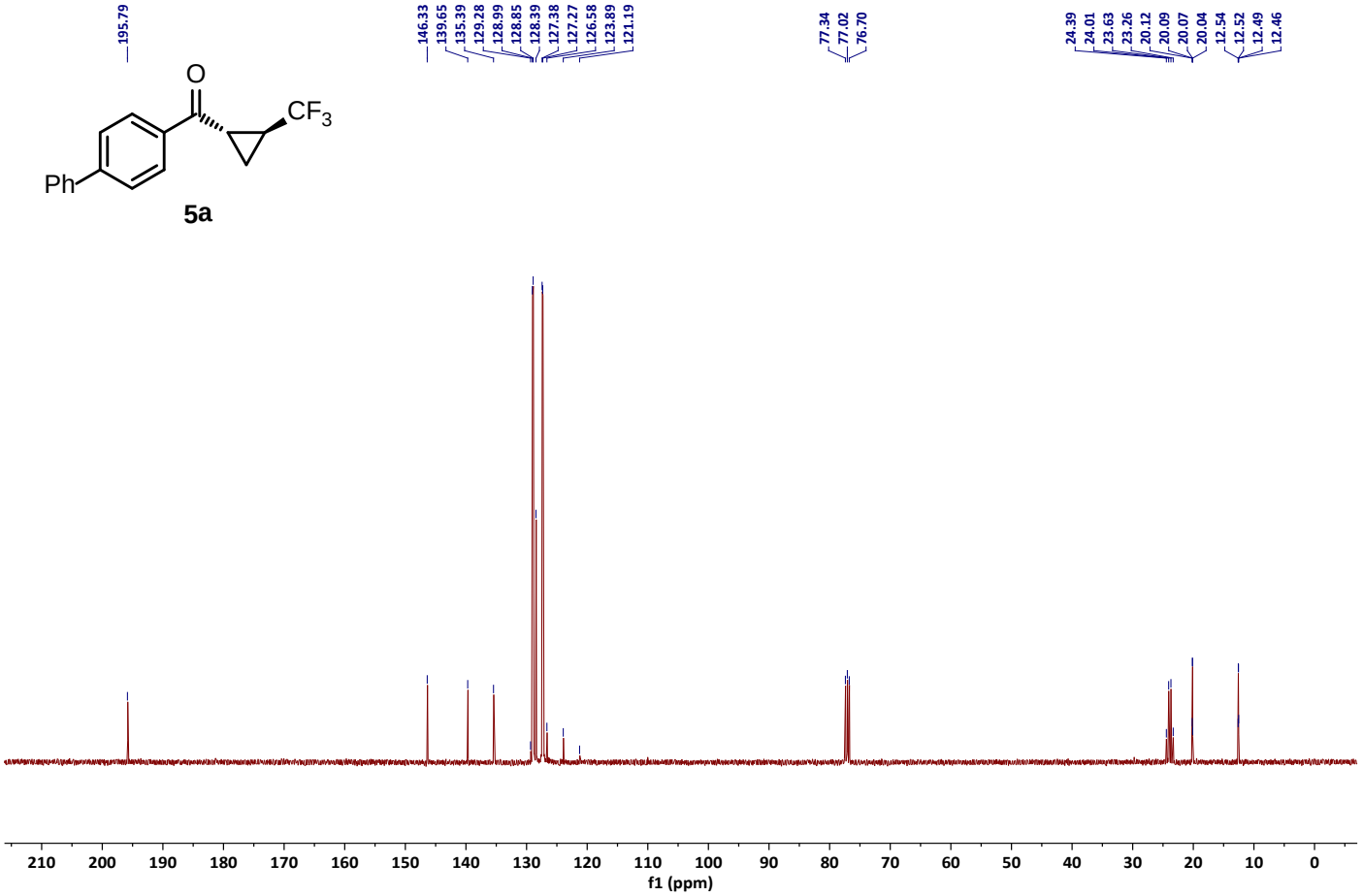

3j
7.60
7.58
7.57
7.50
7.48
7.48
7.29
7.27
7.25
4.22
4.22
3.81
3.80
3.80
3.79
3.78
3.78
3.77
3.77
1.01
0.97
0.99
0.98
1.00
f1 (ppm)

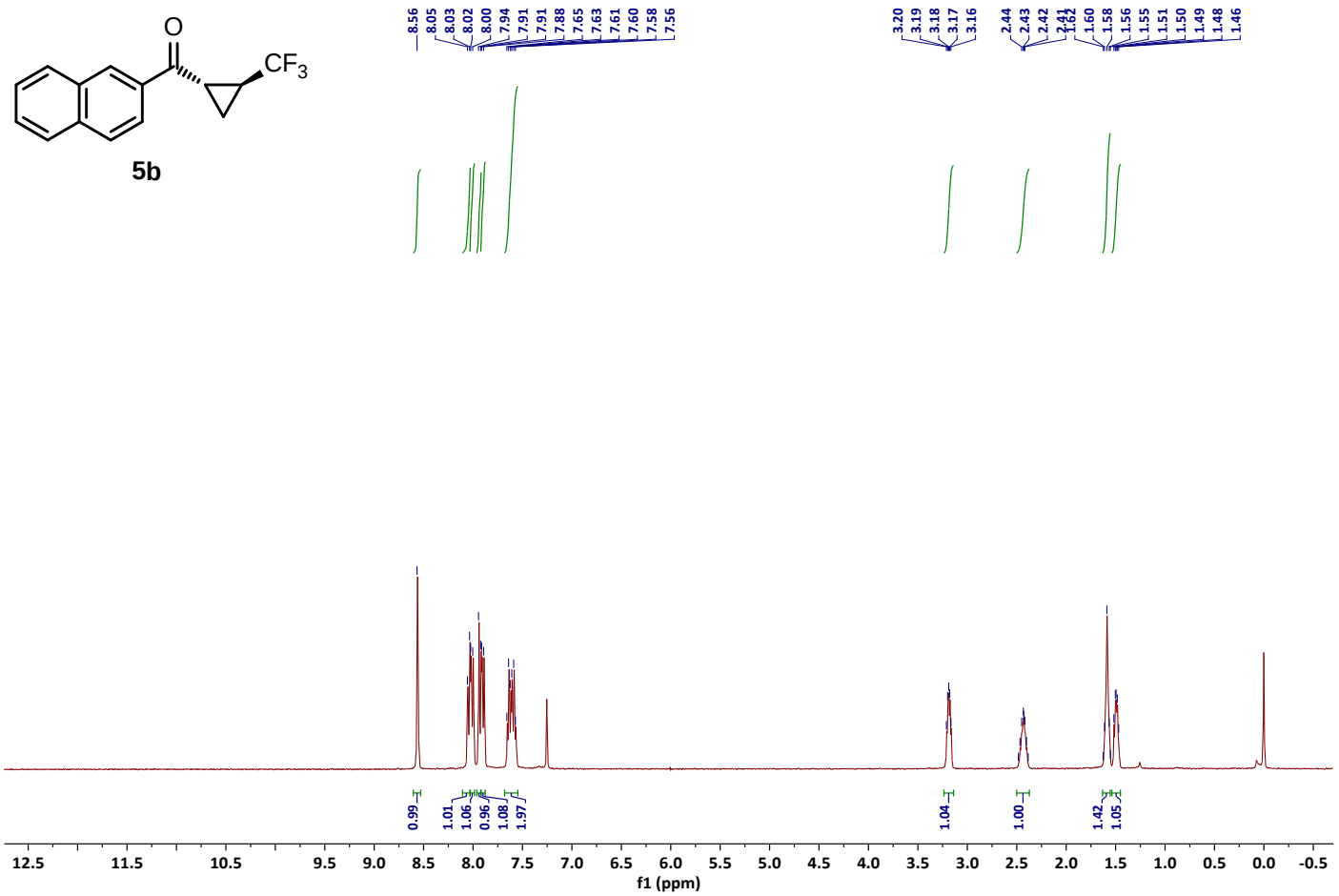

Br
N
O
CF3
3j
-73.89
-73.90
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

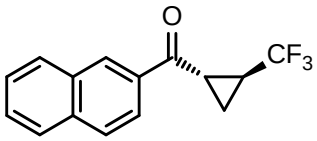

Br
N
O
CF3
3j
154.25
142.36
139.22
128.79
126.01
123.27
120.52
120.07
117.78
56.37
55.96
55.55
55.13
54.53
54.50
54.48
54.45
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


O
CF3
Ph
5a
8.10
8.08
7.74
7.71
7.65
7.62
7.50
7.48
7.45
7.43
7.41
7.24
3.05
3.04
2.38
2.37
1.54
1.44
1.43
0.08
0.00
2.01
2.06
2.04
3.06
1.00
0.98
1.01
1.05
f1 (ppm)


O
CF3
Ph
5a
-66.64
-66.66
3.00
f1 (ppm)


195.79
146.33
139.65
135.39
129.28
128.99
128.85
128.39
127.38
127.27
126.58
123.89
121.19
77.34
77.02
76.70
24.39
24.01
23.63
23.26
20.12
20.09
20.07
20.04
12.54
12.52
12.49
12.46
O
CF3
Ph
5a
f1 (ppm)


8.56
8.05
8.03
8.02
8.00
7.94
7.91
7.91
7.88
7.65
7.63
7.61
7.60
7.58
7.56
3.20
3.19
3.18
3.17
3.16
2.44
2.43
2.42
2.41
1.60
1.58
1.56
1.55
1.51
1.50
1.49
1.48
1.46
O
CF3
5b
0.99
1.01
1.06
0.96
1.08
1.97
1.04
1.00
1.42
1.05
f1 (ppm)


O
CF3

5b

-66.61
-66.63
3.00
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)


196.22
135.78
134.04
132.44
130.23
129.67
129.29
128.83
128.72
127.82
127.01
126.59
123.89
123.69
121.19
77.32
77.00
76.68
24.43
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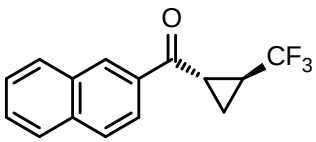
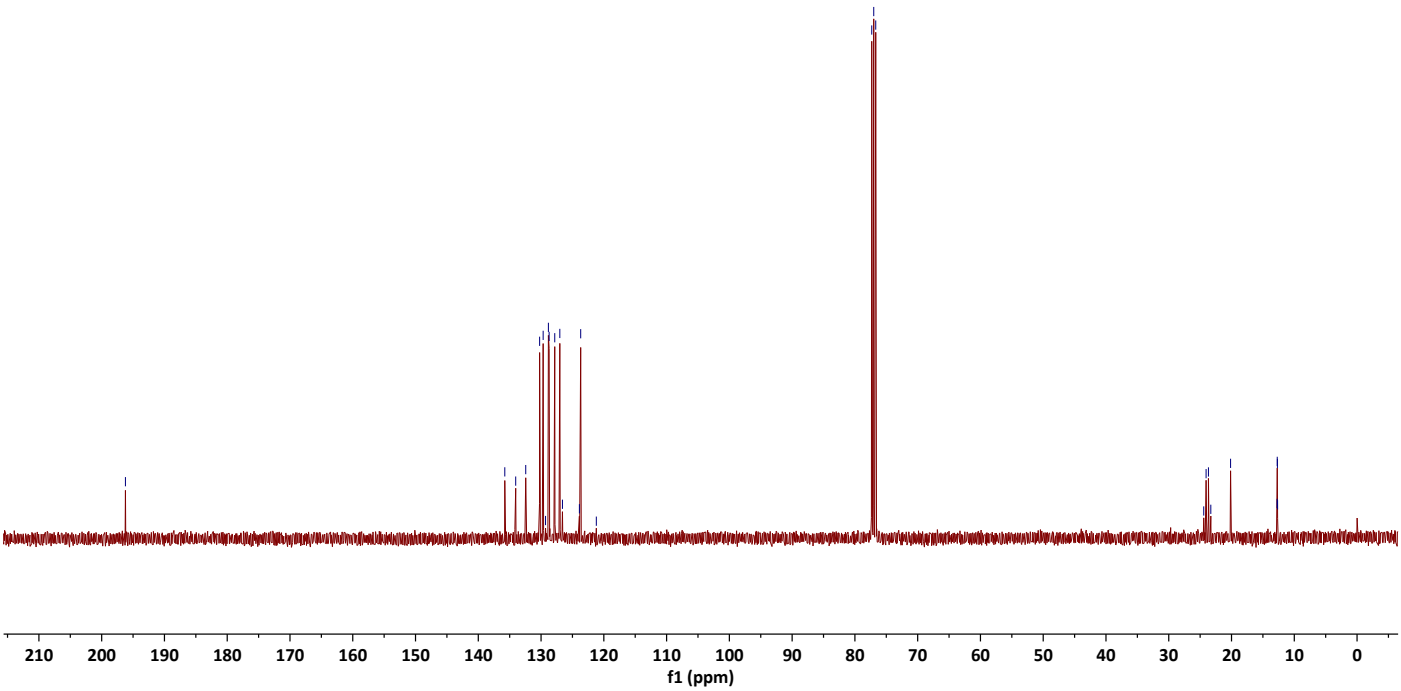
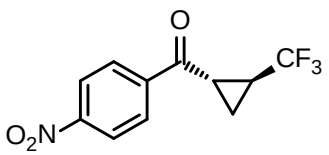
23.67
23.30
20.15
12.74
12.71
12.69
12.66


O
CF3

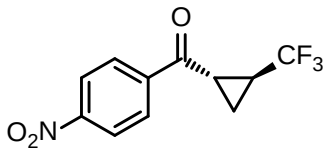
5b


210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


O
CF3
O2N

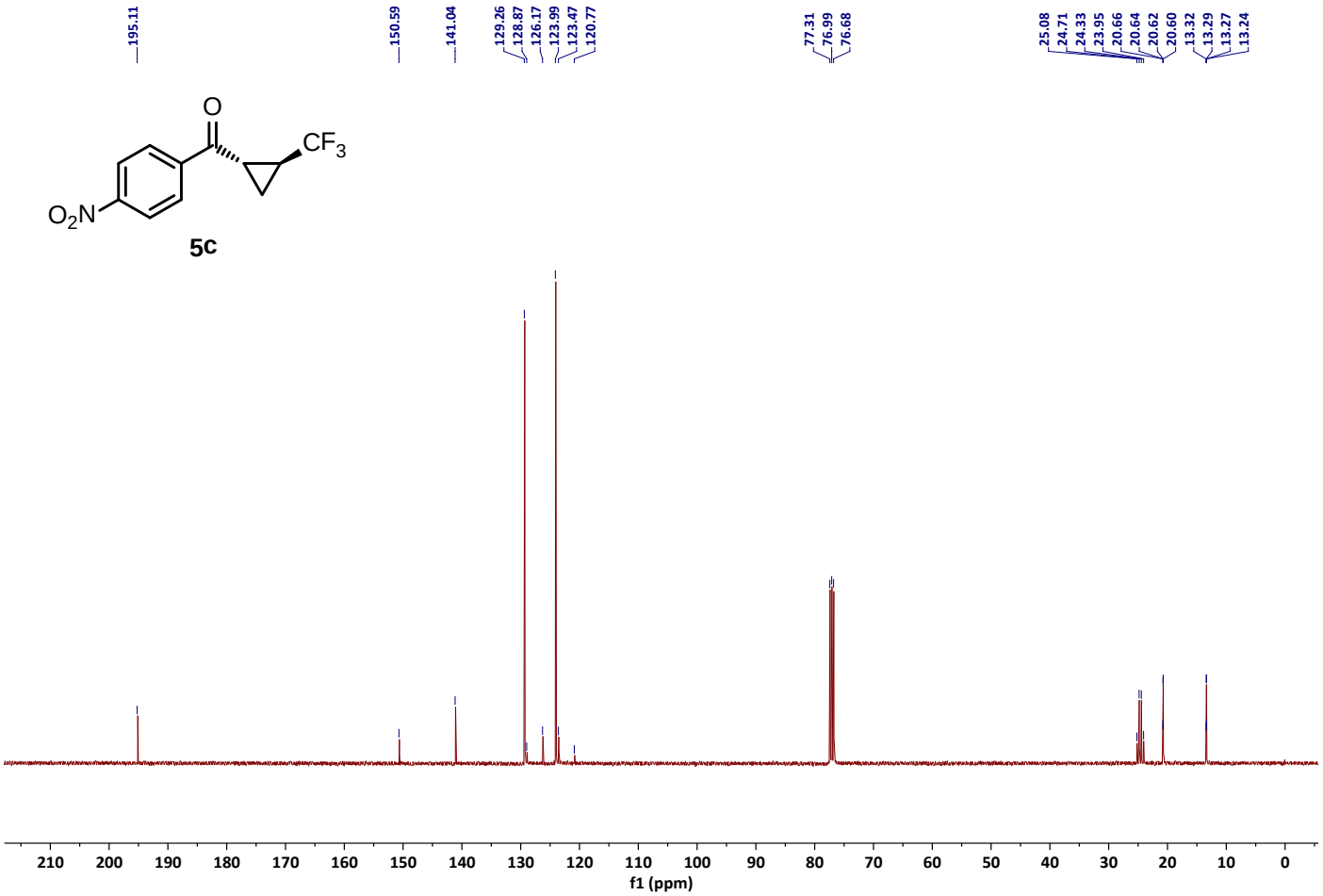
5c

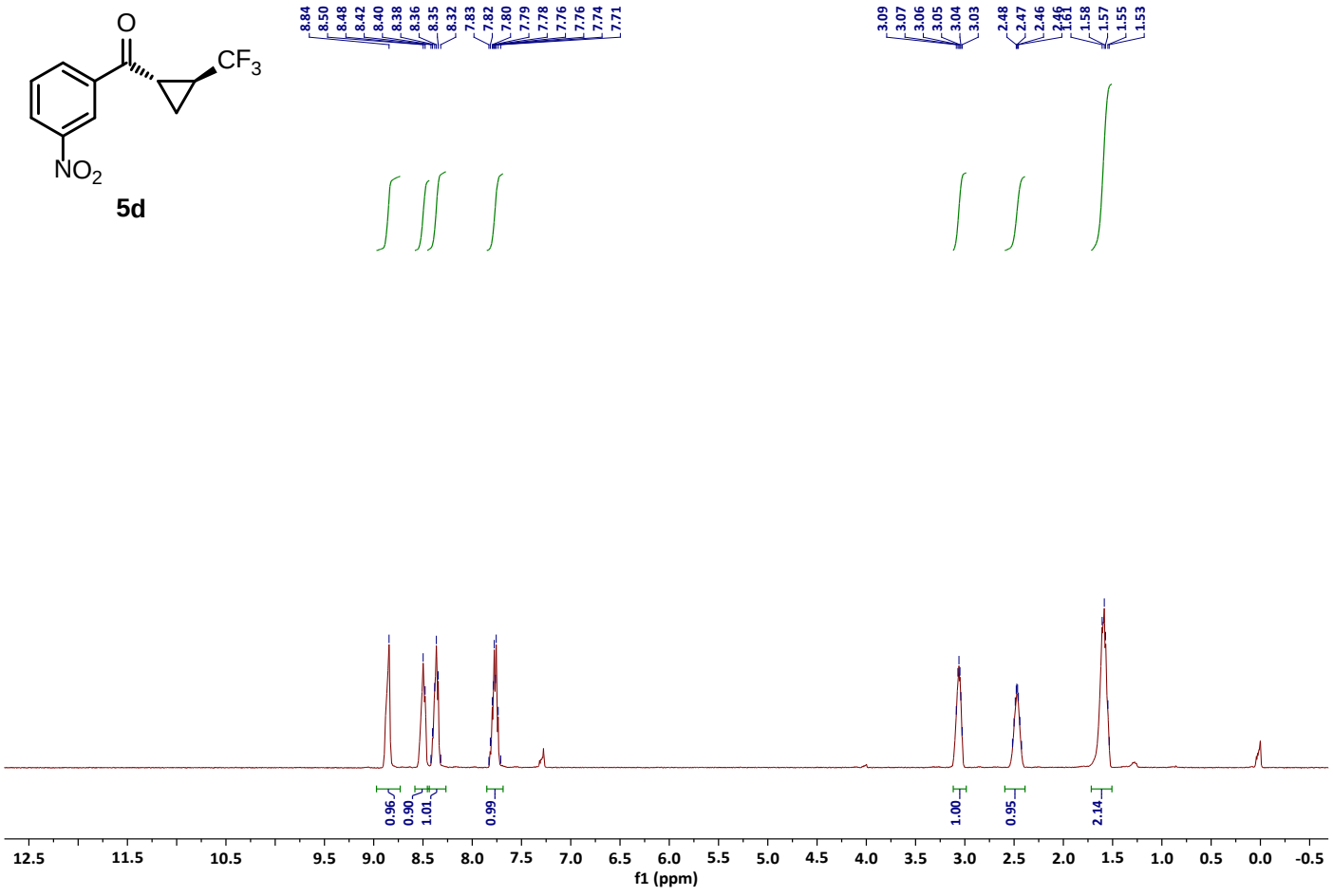
8.36
8.34
8.17
8.15
7.25
7.25
3.02
3.01
3.00
2.99
2.98
2.42
2.41
2.41
1.60
1.59
1.58
1.56
1.55
1.53
1.51
1.50
-0.02
-0.02
1.96
2.01
1.02
1.00
1.19
1.01
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

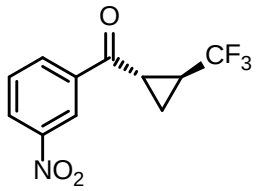

O
CF3
O2N

5c

-66.90
-66.92
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
f1 (ppm)

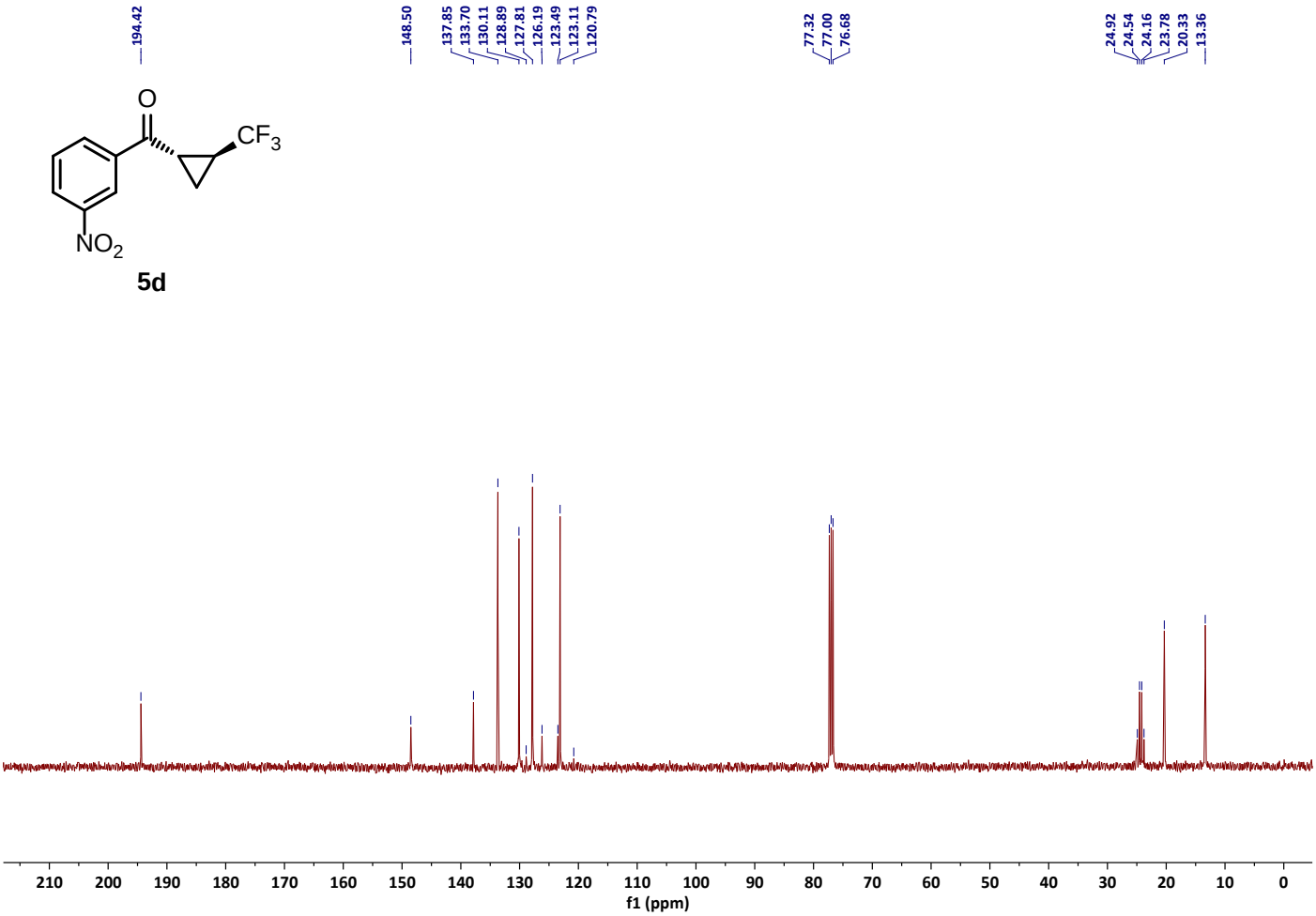

195.11
150.59
141.04
129.26
128.87
126.17
123.99
123.47
120.77
77.31
76.99
76.68
25.08
24.71
24.33
23.95
20.66
20.64
20.62
20.60
13.32
13.29
13.27
13.24
O
CF3
O2N
5c
f1 (ppm)


8.84
8.50
8.48
8.42
8.40
8.38
8.36
8.35
8.32
7.83
7.82
7.80
7.79
7.78
7.76
7.76
7.74
7.71
3.09
3.07
3.06
3.05
3.04
3.03
2.48
2.47
2.46
2.46
1.61
1.58
1.57
1.55
1.53
O
CF3
NO2
5d
0.96
0.90
1.01
0.99
1.00
0.95
2.14
f1 (ppm)

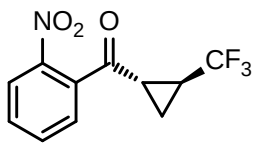

O
CF3
NO2

5d

-66.88
-66.89
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

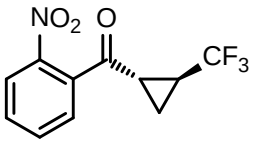

194.42
148.50
137.85
133.70
130.11
128.89
127.81
126.19
123.49
123.11
120.79
77.32
77.00
76.68
24.92
24.54
24.16
23.78
20.33
13.36
O
CF3
NO2
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

5d


NO2
O
CF3

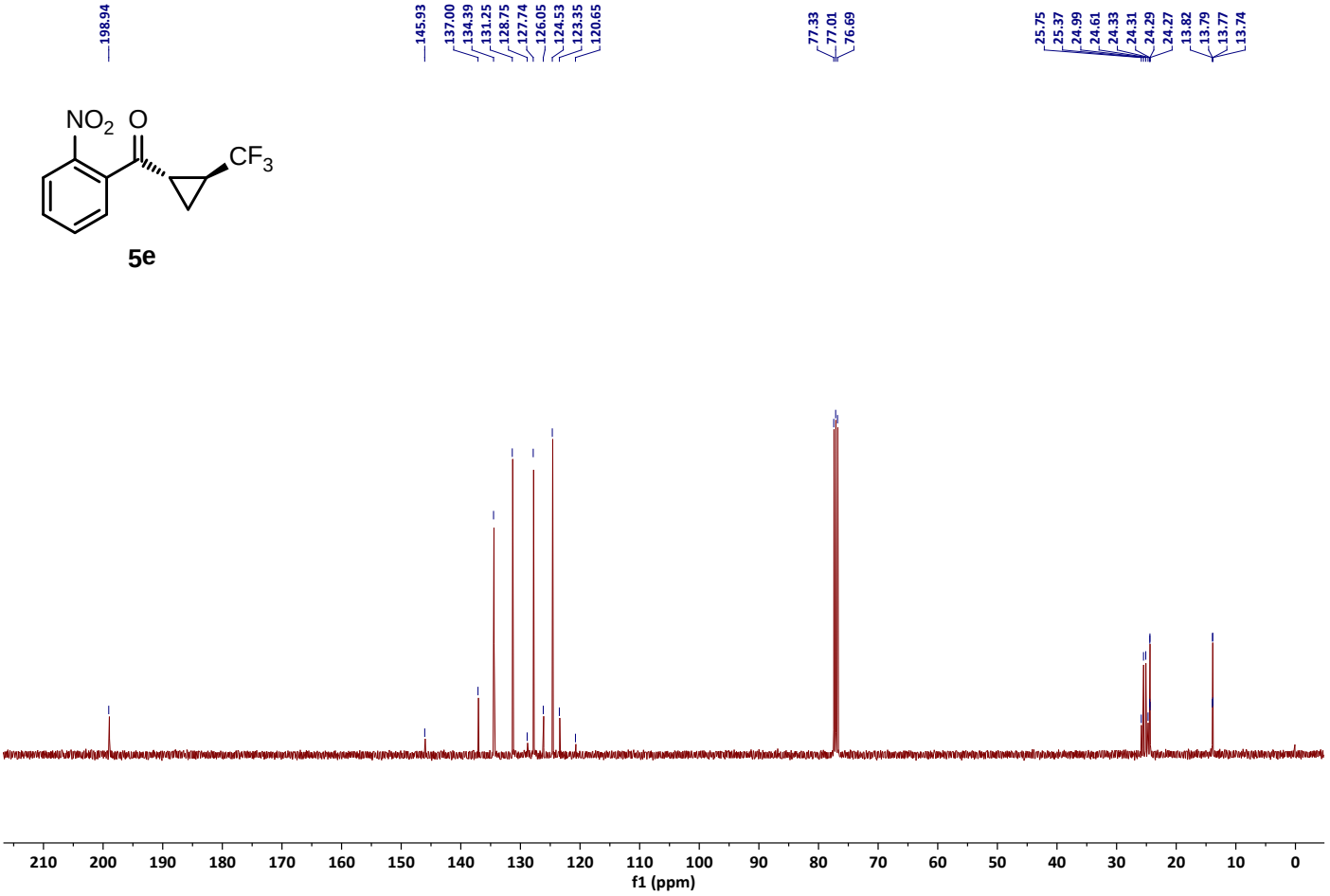
5e

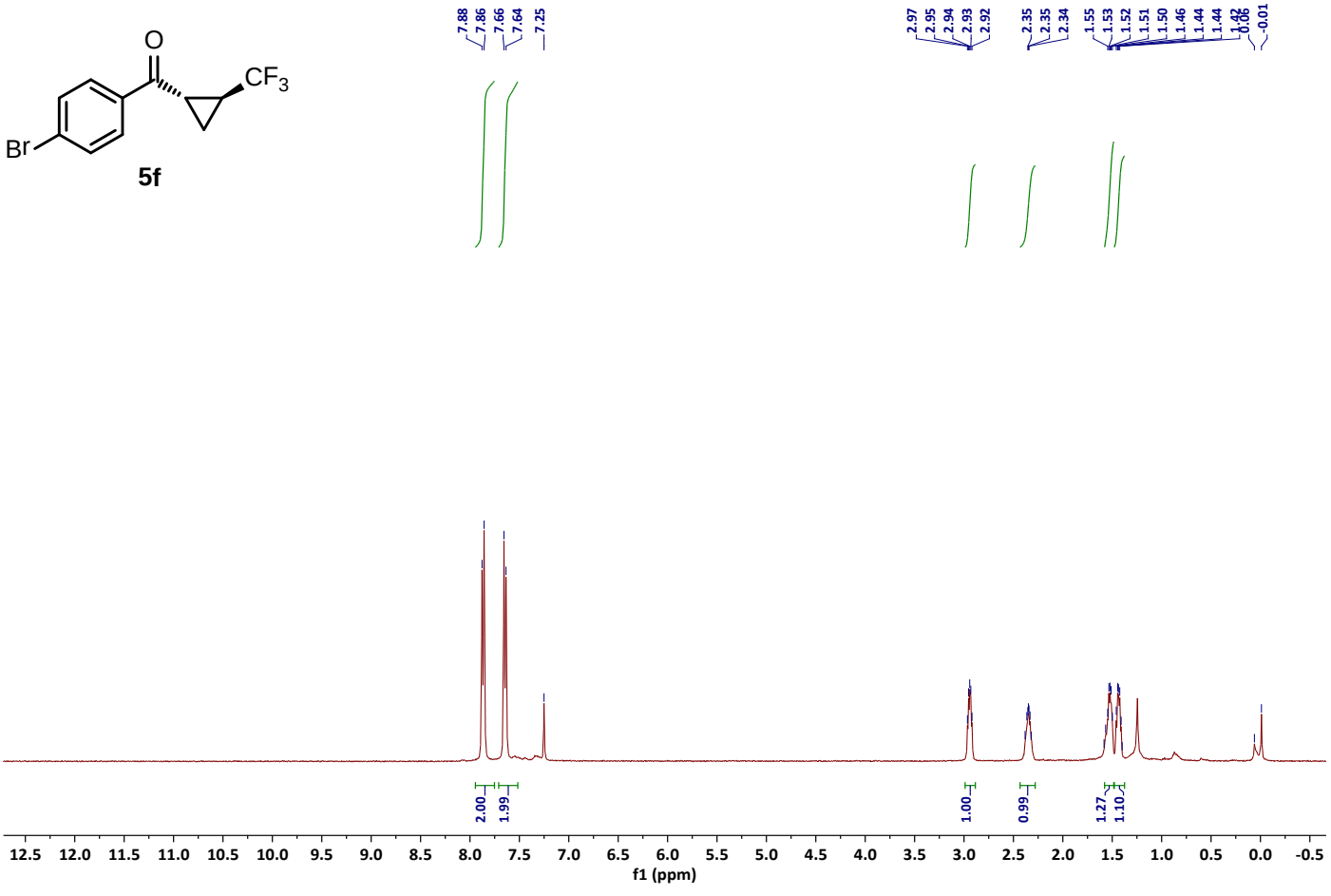
8.15
8.13
7.77
7.76
7.74
7.67
7.65
7.63
7.48
7.46
7.25
2.54
2.53
2.52
2.51
2.49
2.47
2.45
2.45
2.44
2.43
2.42
2.41
2.39
1.69
1.67
1.66
1.65
1.64
1.58
1.51
1.49
1.47
1.46
-0.02
1.01
1.00
1.01
1.02
1.00
0.95
1.11
1.12
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

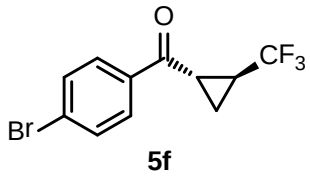

NO2
O
CF3

5e

-67.12
-67.14
3.00
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
f1 (ppm)

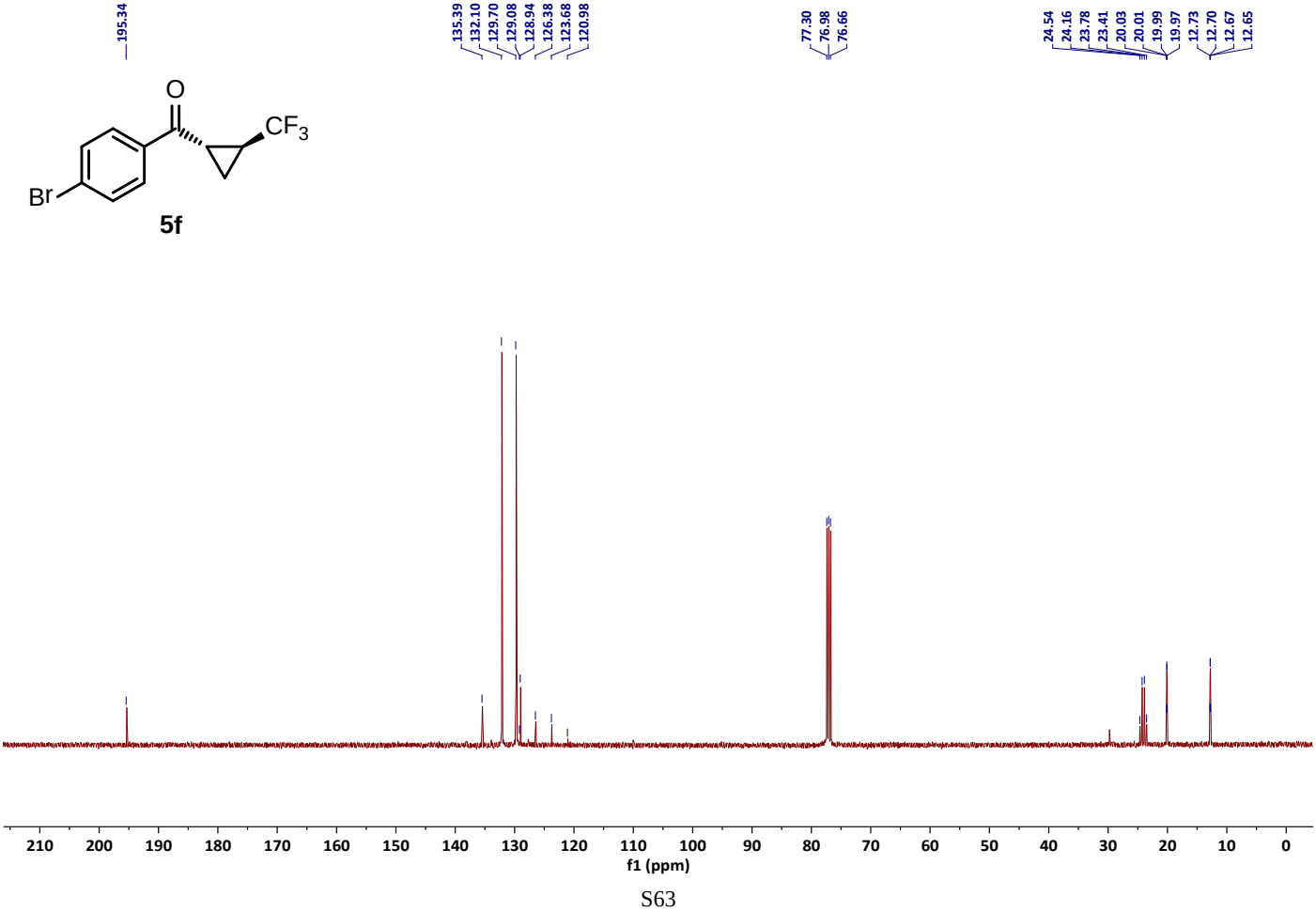

198.94
145.93
137.00
134.39
131.25
128.75
127.74
126.05
124.53
123.35
120.65
77.33
77.01
76.69
25.75
25.37
24.99
24.61
24.33
24.31
24.29
24.27
13.82
13.79
13.77
13.74
NO2
O
CF3
5e
f1 (ppm)


7.88
7.86
7.66
7.64
7.25
2.97
2.95
2.94
2.93
2.92
2.35
2.35
2.34
1.55
1.53
1.52
1.51
1.50
1.46
1.44
1.44
0.06
-0.01
O
CF3
Br
5f
2.00
1.99
1.00
0.99
1.27
1.10
f1 (ppm)


O
CF3
Br

5f

-66.82
-66.84
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)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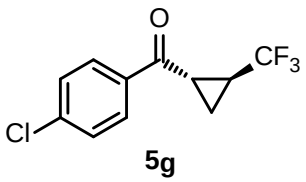
135.39
132.10
129.70
129.08
128.94
126.38
123.68
120.98
77.30
76.98
76.66
24.54
24.16
23.78
23.41
20.03
20.01
19.99
19.97
12.73
12.70
12.67
12.65
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

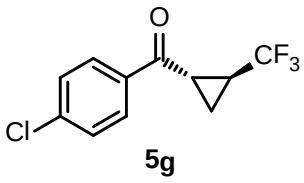
O
CF3
Br

5f


O
CF3
Cl

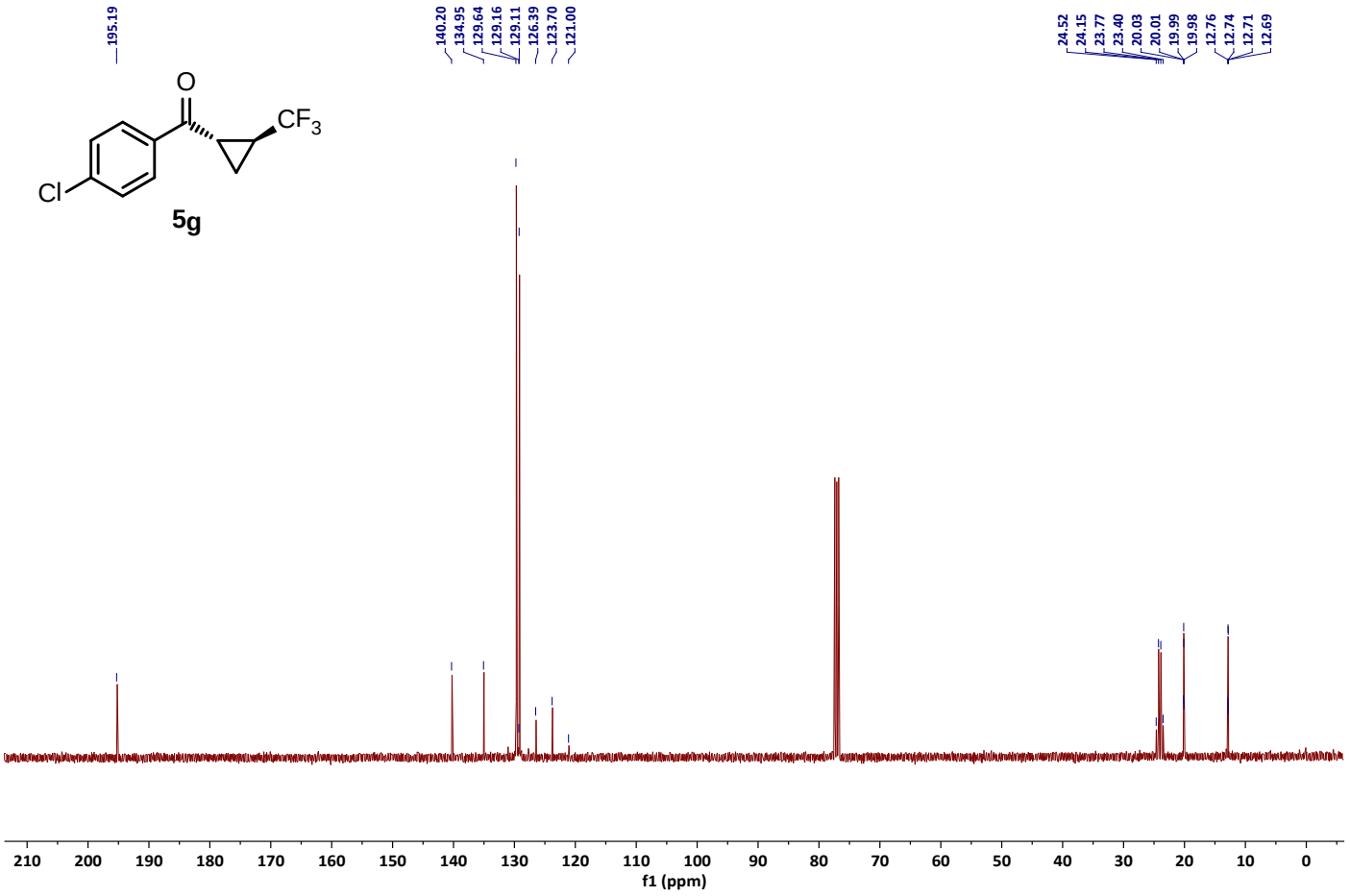
5g

7.96
7.94
7.48
7.46
7.25
2.97
2.96
2.95
2.94
2.93
2.35
2.35
2.34
2.34
1.53
1.52
1.51
1.50
1.46
1.44
1.43
1.42
1.41
1.39
1.99
1.94
1.07
1.00
0.98
0.98
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


O
CF3
Cl

5g

-66.81
-66.83
3.00
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
f1 (ppm)


195.19
140.20
134.95
129.64
129.16
129.11
126.39
123.70
121.00
24.52
24.15
23.77
23.40
20.03
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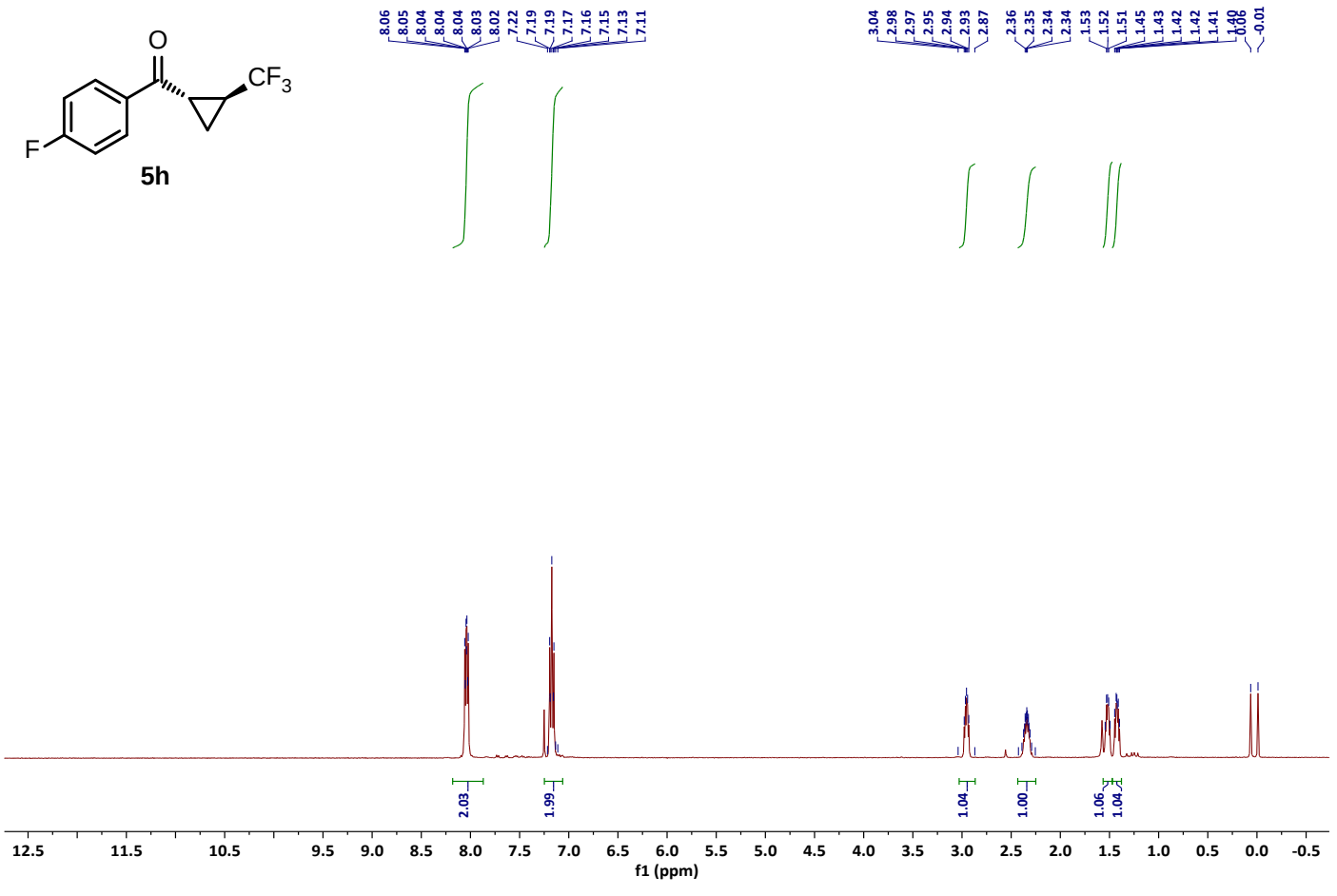
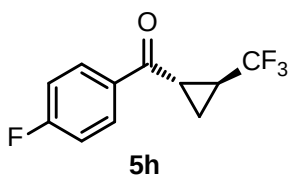
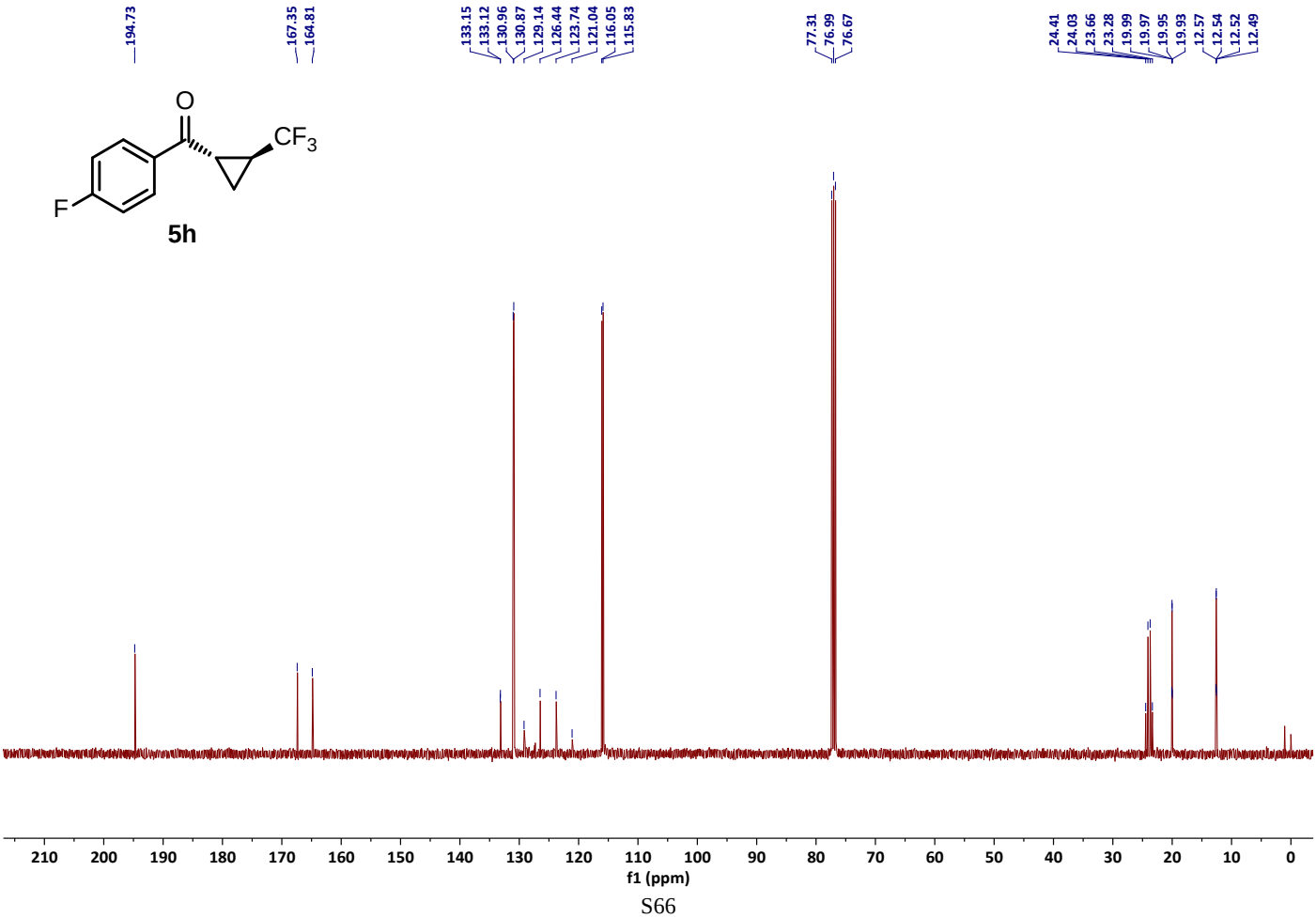
19.98
12.76
12.74
12.71
12.69
O
CF3
Cl
5g
f1 (ppm)


8.06
8.05
8.04
8.04
8.04
8.03
8.02
7.22
7.19
7.19
7.17
7.16
7.15
7.13
7.11
3.04
2.98
2.97
2.95
2.94
2.93
2.87
2.36
2.35
2.34
2.34
1.53
1.52
1.51
1.45
1.43
1.42
1.42
1.41
1.40
0.08
-0.01
O
CF3
F
5h
2.03
1.99
1.04
1.00
1.06
1.04
f1 (ppm)


O
CF3
F

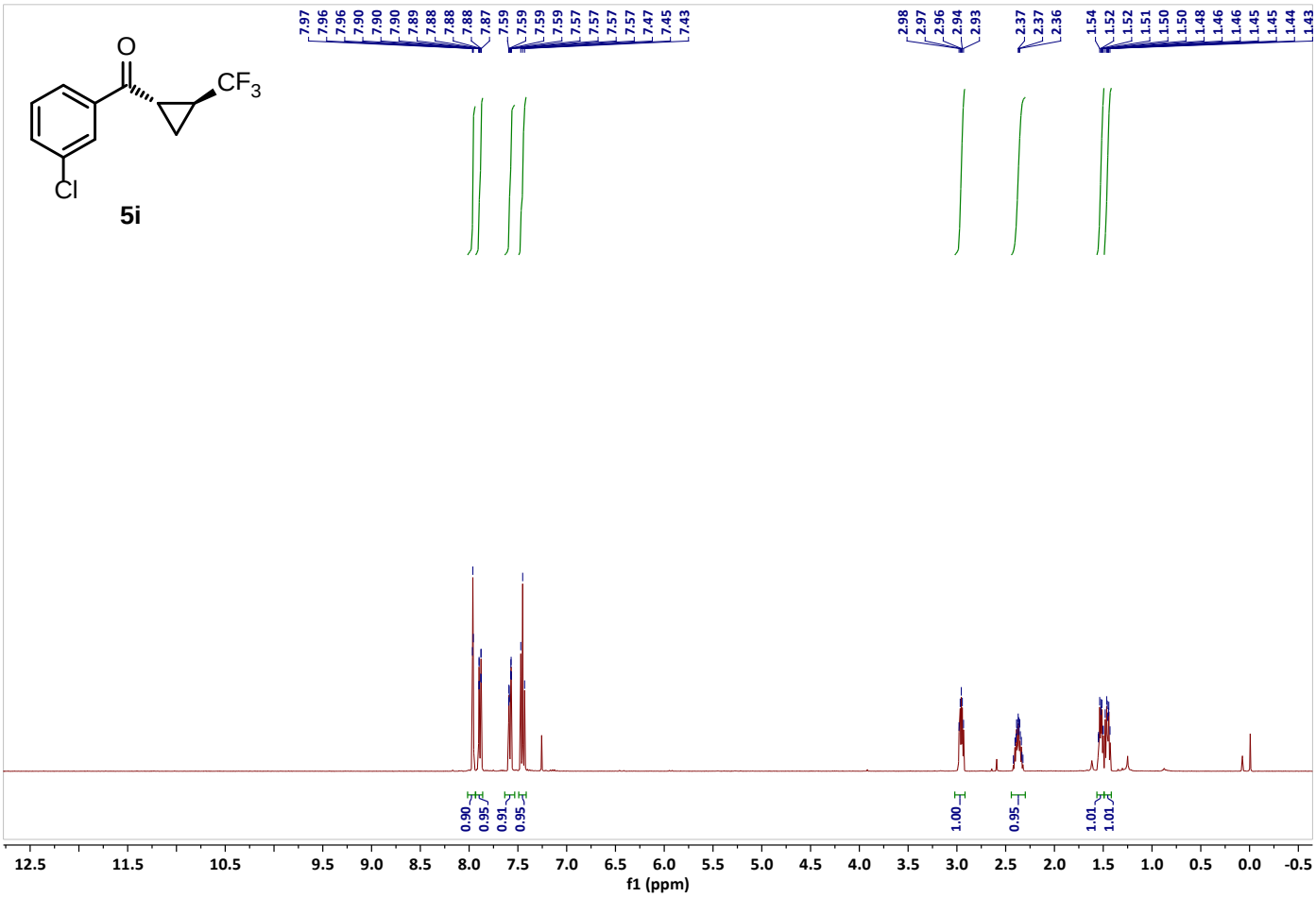
5h

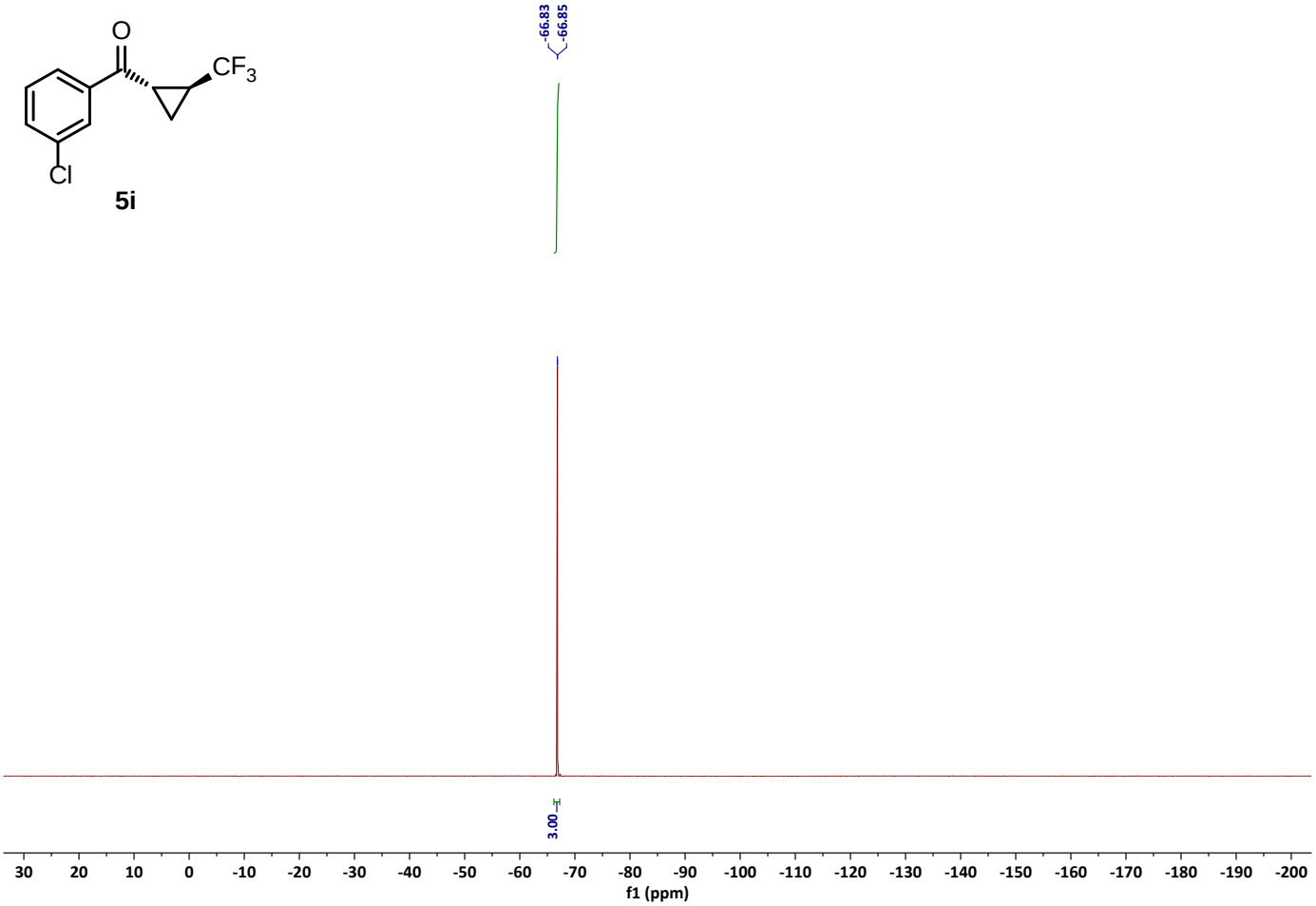
-66.83
-66.85
-104.15
-104.16
-104.17
-104.18
-104.19
-104.20
-104.21
-104.22
3.00
0.96
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

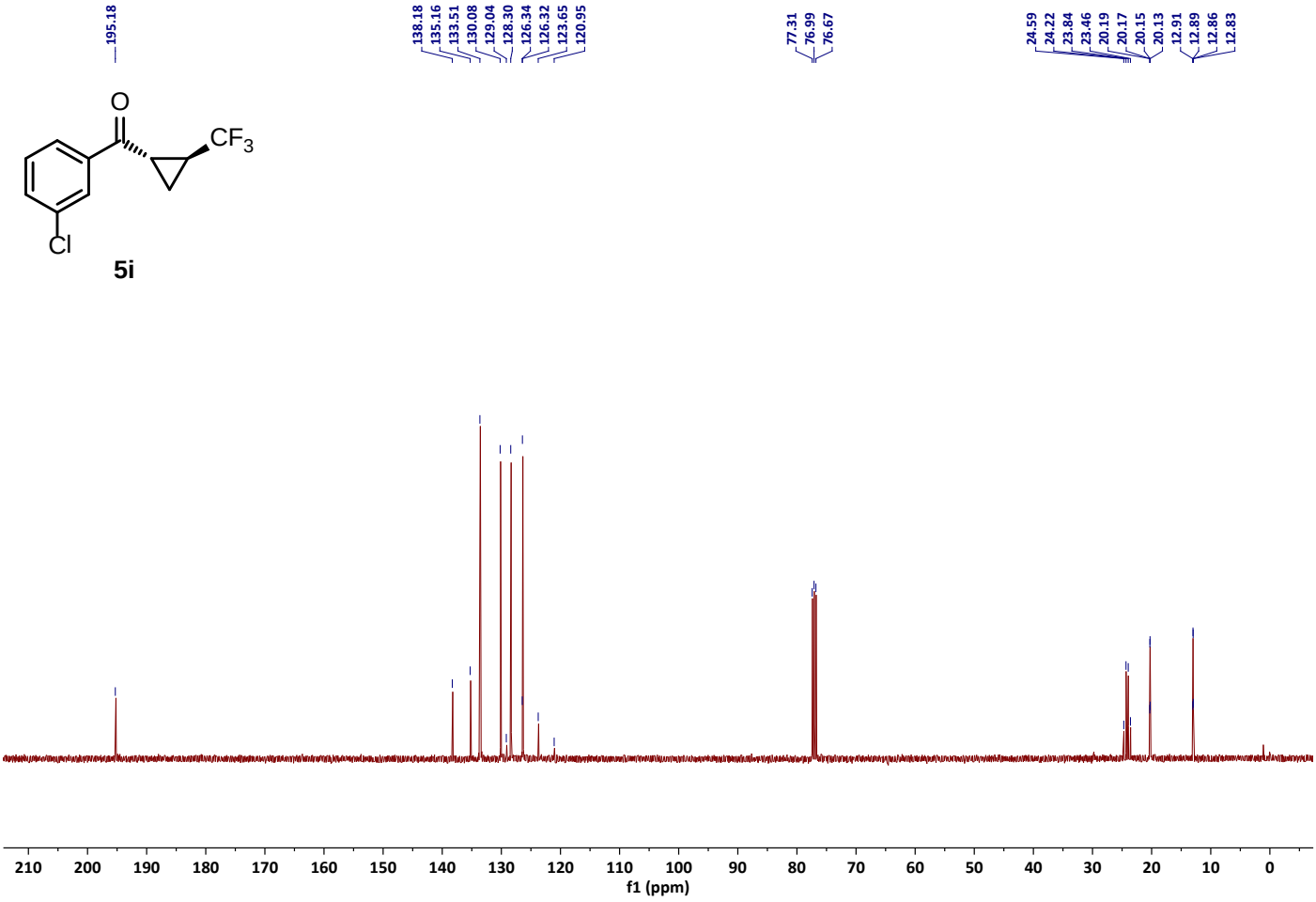

194.73
167.35
164.81
133.15
133.12
130.96
130.87
129.14
126.44
123.74
121.04
116.05
115.83
77.31
76.99
76.67
24.41
24.03
23.66
23.28
19.99
19.97
19.95
19.93
12.57
12.54
12.52
12.49
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

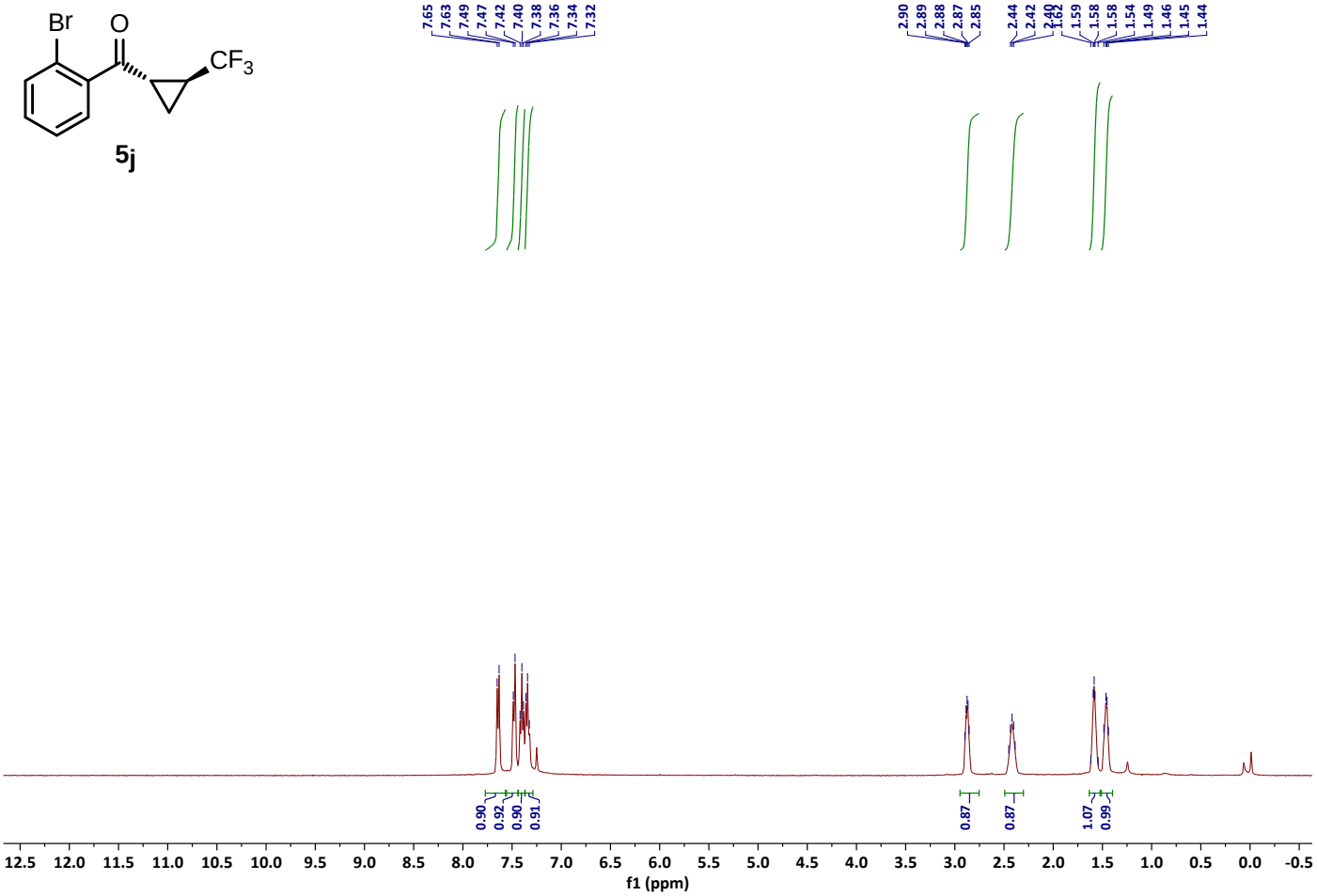
O
CF3
F

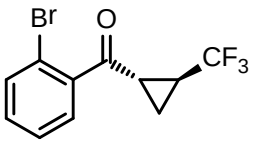
5h


O
CF3
Cl
5i
7.97 7.96 7.96 7.90 7.90 7.90 7.89 7.88 7.88 7.88 7.87 7.59 7.59 7.59 7.57 7.57 7.57 7.57 7.47 7.45 7.43
2.98 2.97 2.96 2.94 2.93
2.37 2.37 2.36
1.54 1.52 1.52 1.51 1.50 1.50 1.48 1.46 1.46 1.45 1.45 1.44 1.43
0.90 0.95 0.91 0.95
1.00
0.95
1.01 1.01
12.5 11.5 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


O
CF3
Cl
5i
-66.83
-66.85
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

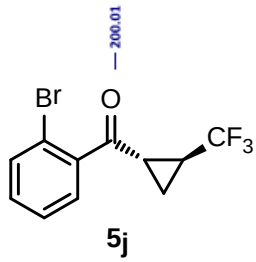

195.18
138.18
135.16
133.51
130.08
129.04
128.30
126.34
126.32
123.65
120.95
77.31
76.99
76.67
24.59
24.22
23.84
23.46
20.19
20.17
20.15
20.13
12.91
12.89
12.86
12.83
O
CF3
Cl
5i
f1 (ppm)


Br
O
CF3
5j
7.65
7.63
7.49
7.47
7.42
7.40
7.38
7.36
7.34
7.32
2.90
2.89
2.88
2.87
2.85
2.44
2.42
2.40
2.02
1.59
1.58
1.58
1.54
1.49
1.46
1.45
1.44
0.90
0.92
0.90
0.91
0.87
0.87
1.07
0.99
f1 (ppm)


Br
O
CF3

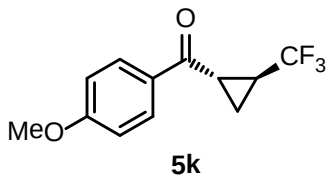
5j

-66.76
-66.77
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)


Br
O
CF3

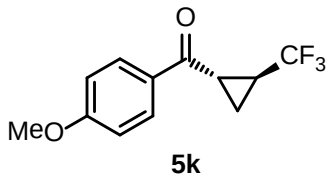
5j

200.01
140.72
133.82
132.37
129.30
129.06
127.53
126.23
123.53
120.84
119.31
77.31
77.00
76.68
25.94
25.56
25.18
24.77
24.22
14.19
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


O
CF3
MeO

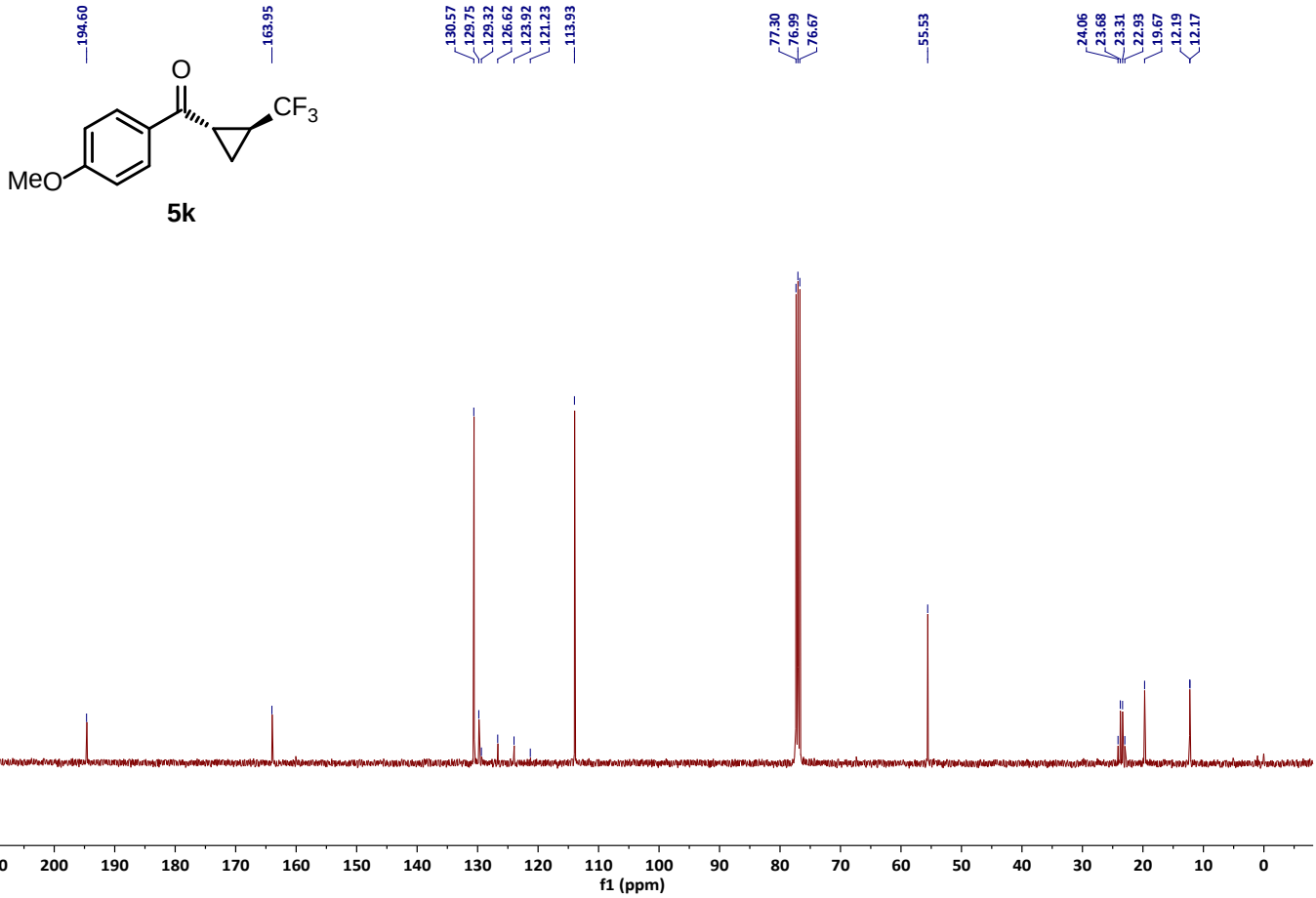
5k

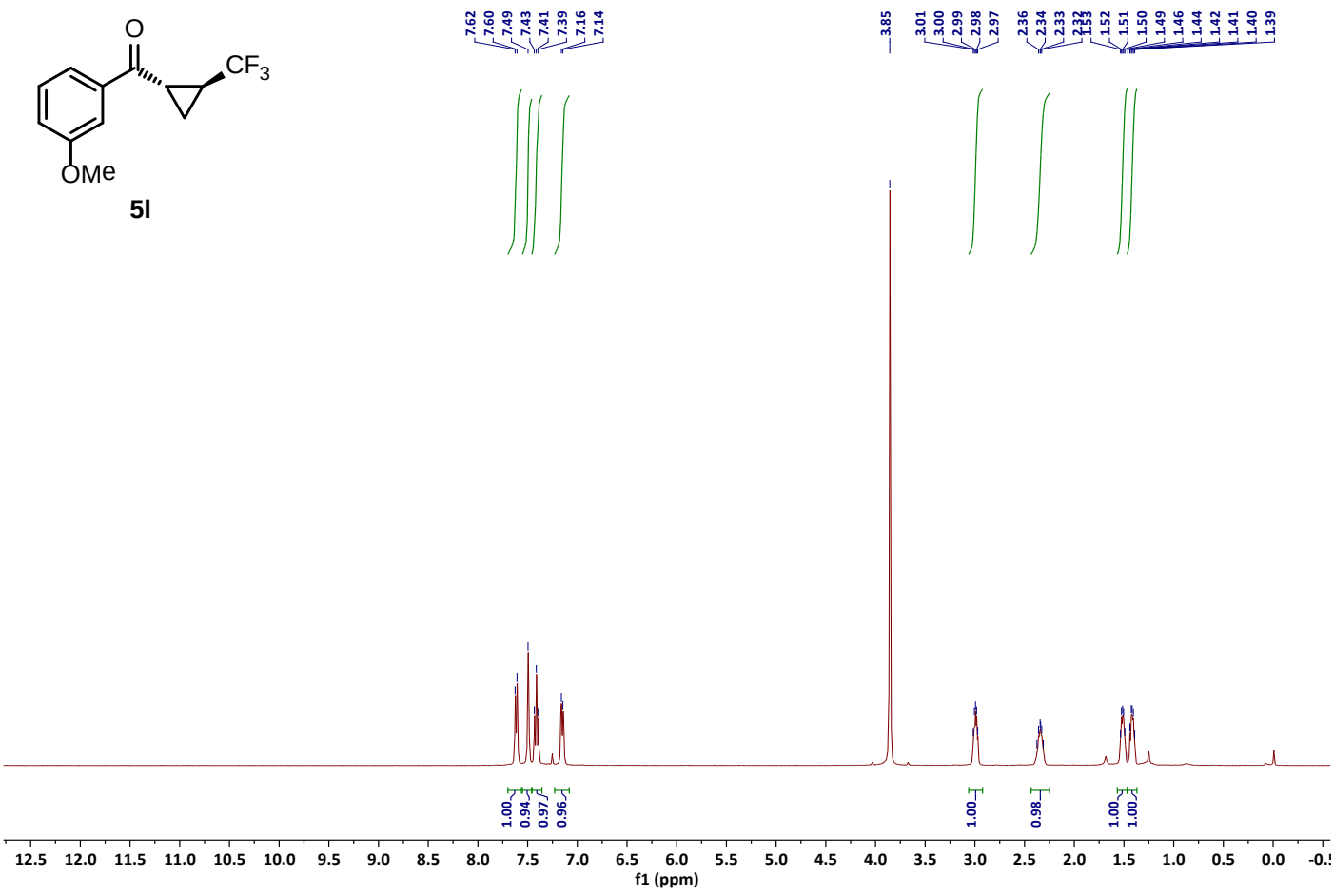
8.01
7.99
6.98
6.96
3.88
2.99
2.98
2.97
2.96
2.95
2.94
2.32
2.32
2.31
1.49
1.49
1.48
1.47
1.40
1.38
1.38
1.36
1.35
1.84
1.83
2.75
0.84
0.80
0.95
0.92
f1 (ppm)

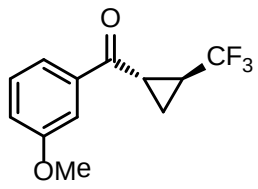

O
CF3
MeO

5k

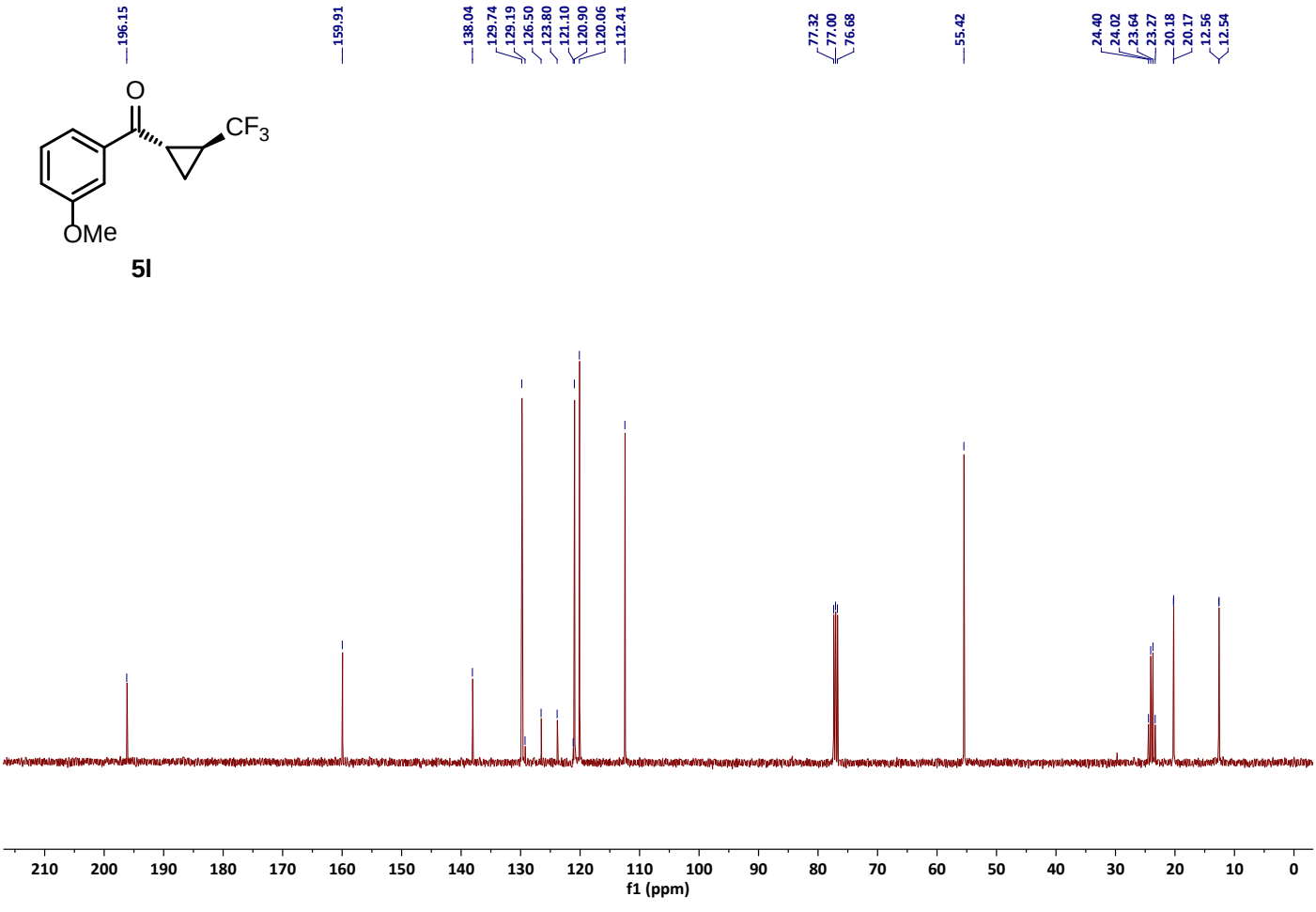
-66.69
-66.71
3.00
f1 (ppm)


194.60
163.95
130.57
129.75
129.32
126.62
123.92
121.23
113.93
77.30
76.99
76.67
55.53
24.06
23.68
23.31
22.93
19.67
12.19
12.17
O
CF3
MeO
5k
f1 (ppm)


7.62
7.60
7.49
7.43
7.41
7.39
7.16
7.14
3.85
3.01
3.00
2.99
2.98
2.97
2.36
2.34
2.33
1.52
1.51
1.50
1.49
1.46
1.44
1.42
1.41
1.40
1.39
O
CF3
OMe
5l
1.00
0.94
0.97
0.96
1.00
0.98
1.00
1.00
f1 (ppm)

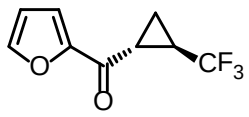


5l



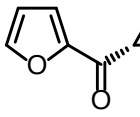
O
CF3
OMe

5l



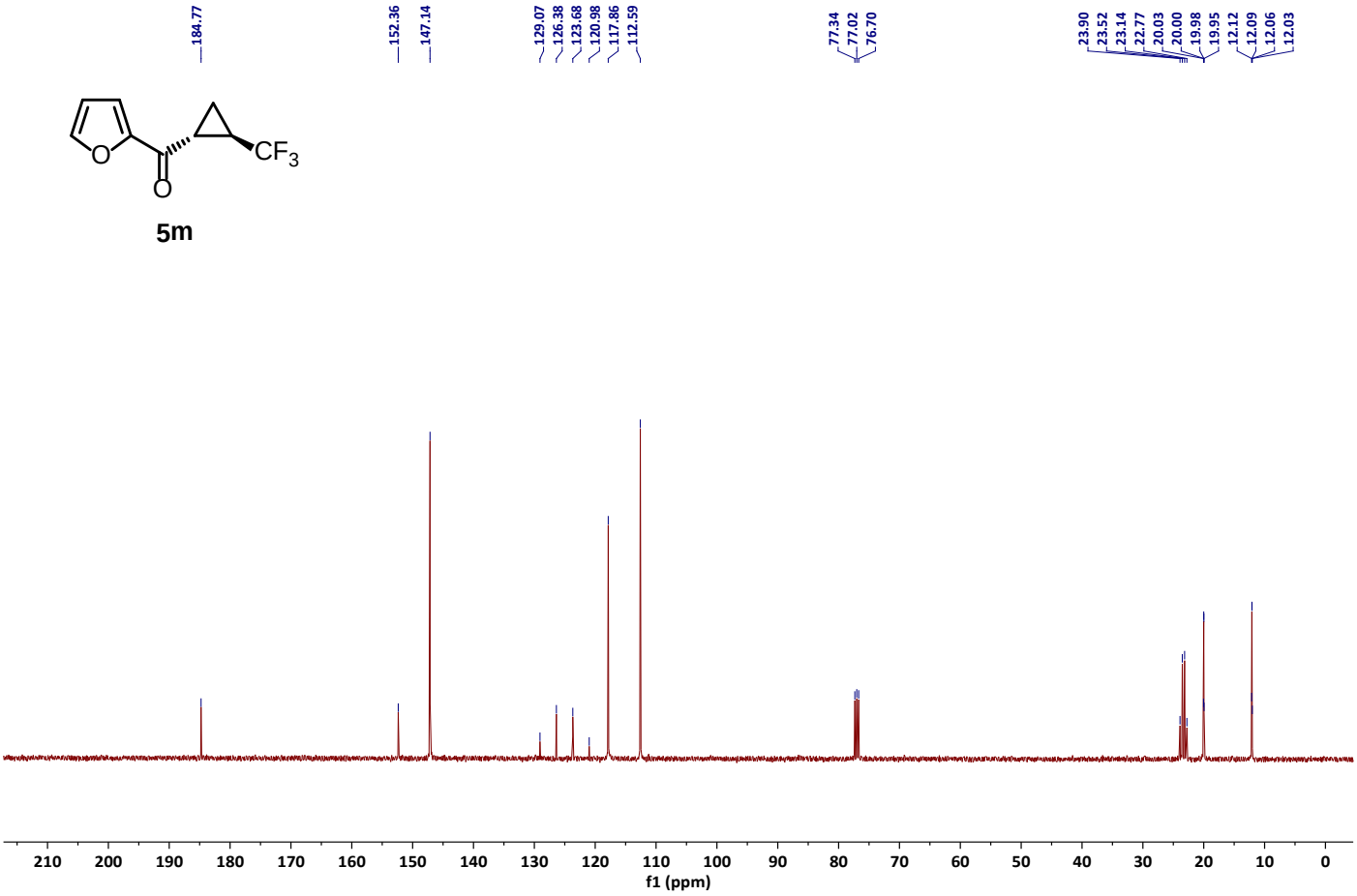
5m

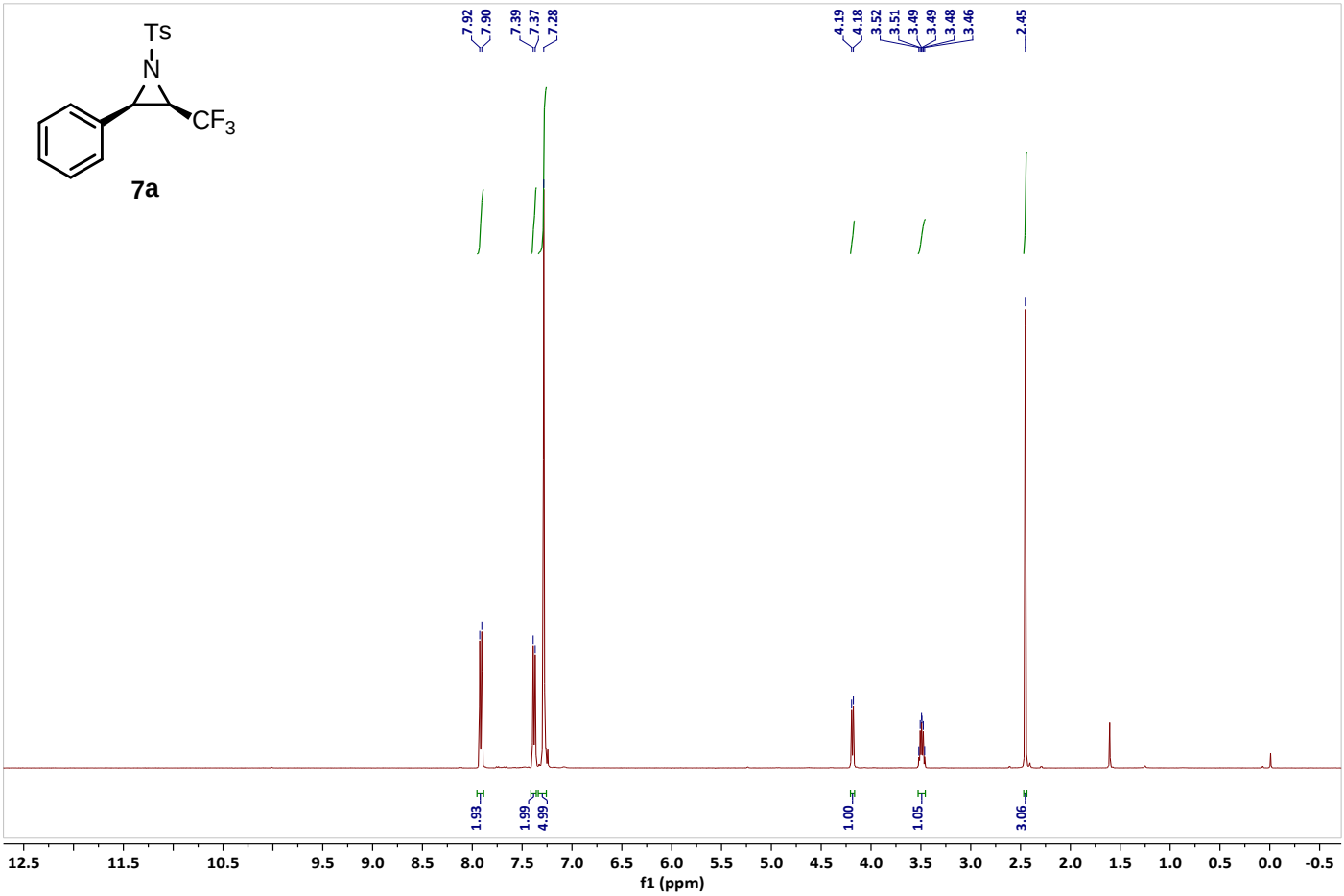
7.67
7.67
7.32
7.31
6.61
6.61
6.60
6.60
2.99
2.97
2.96
2.94
2.93
2.36
2.35
2.34
2.33
1.53
1.52
1.50
1.49
1.47
1.43
1.41
1.40
1.38
0.00
0.97
1.03
0.98
1.00
1.00
1.04
1.02
f1 (ppm)

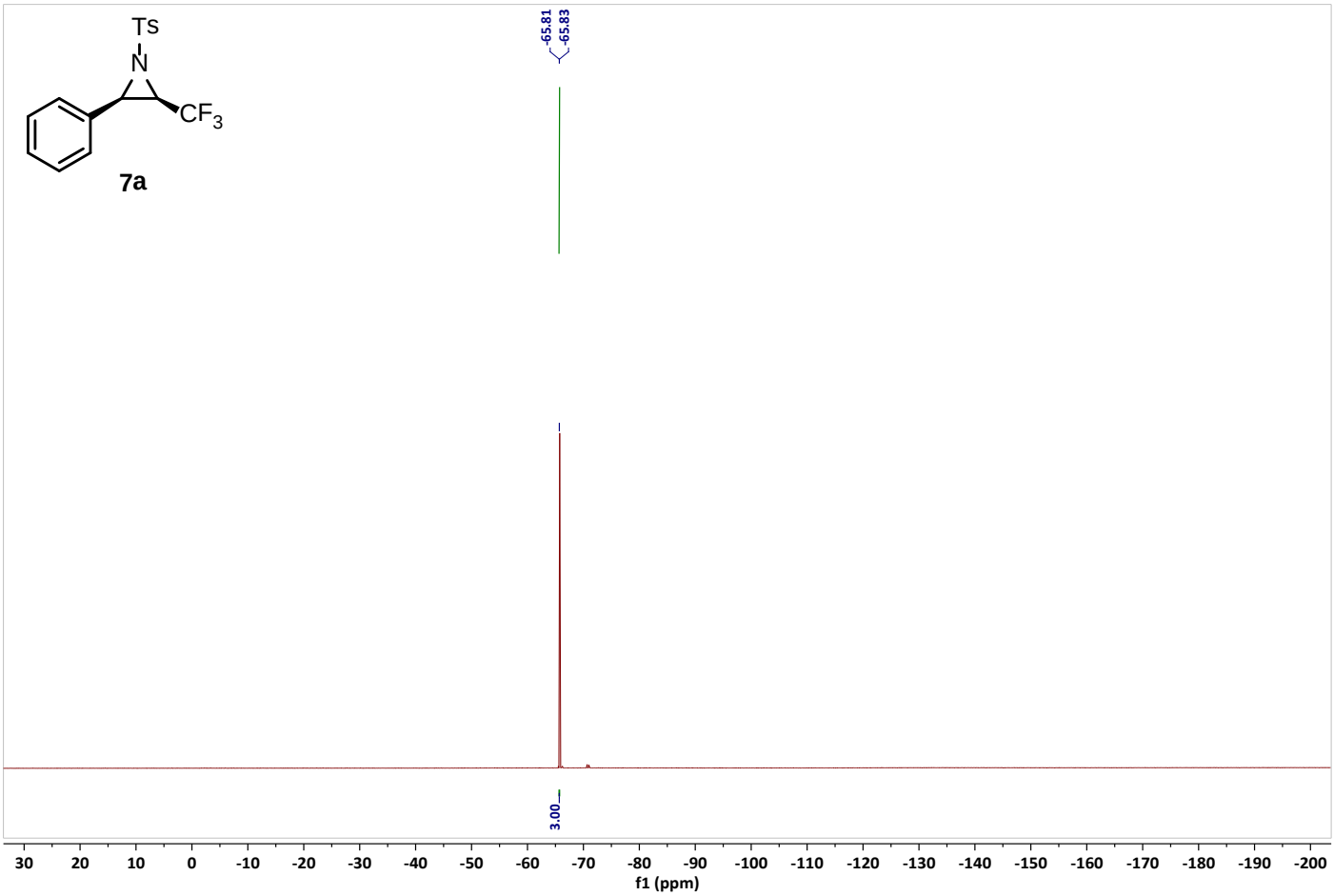


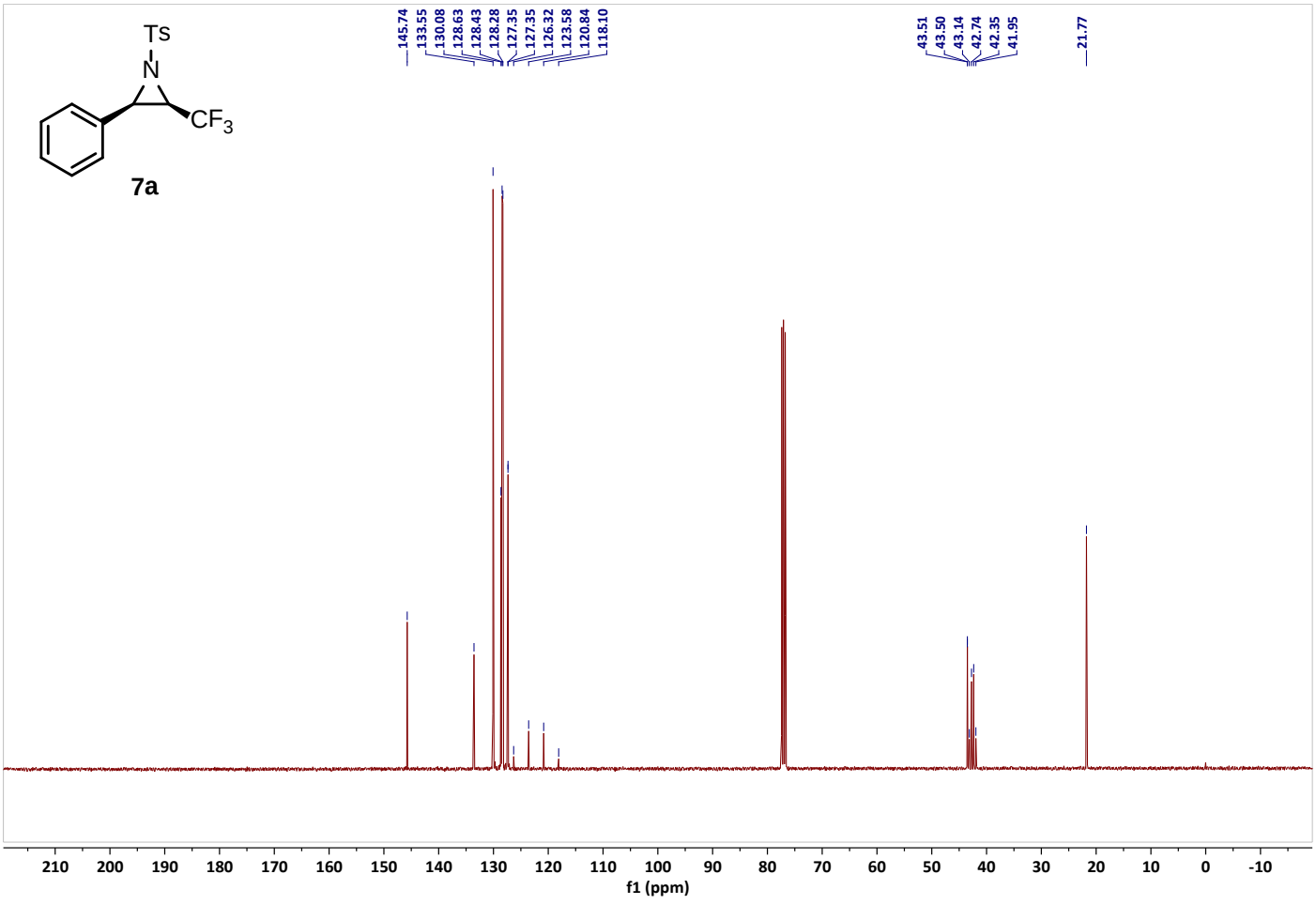
5m

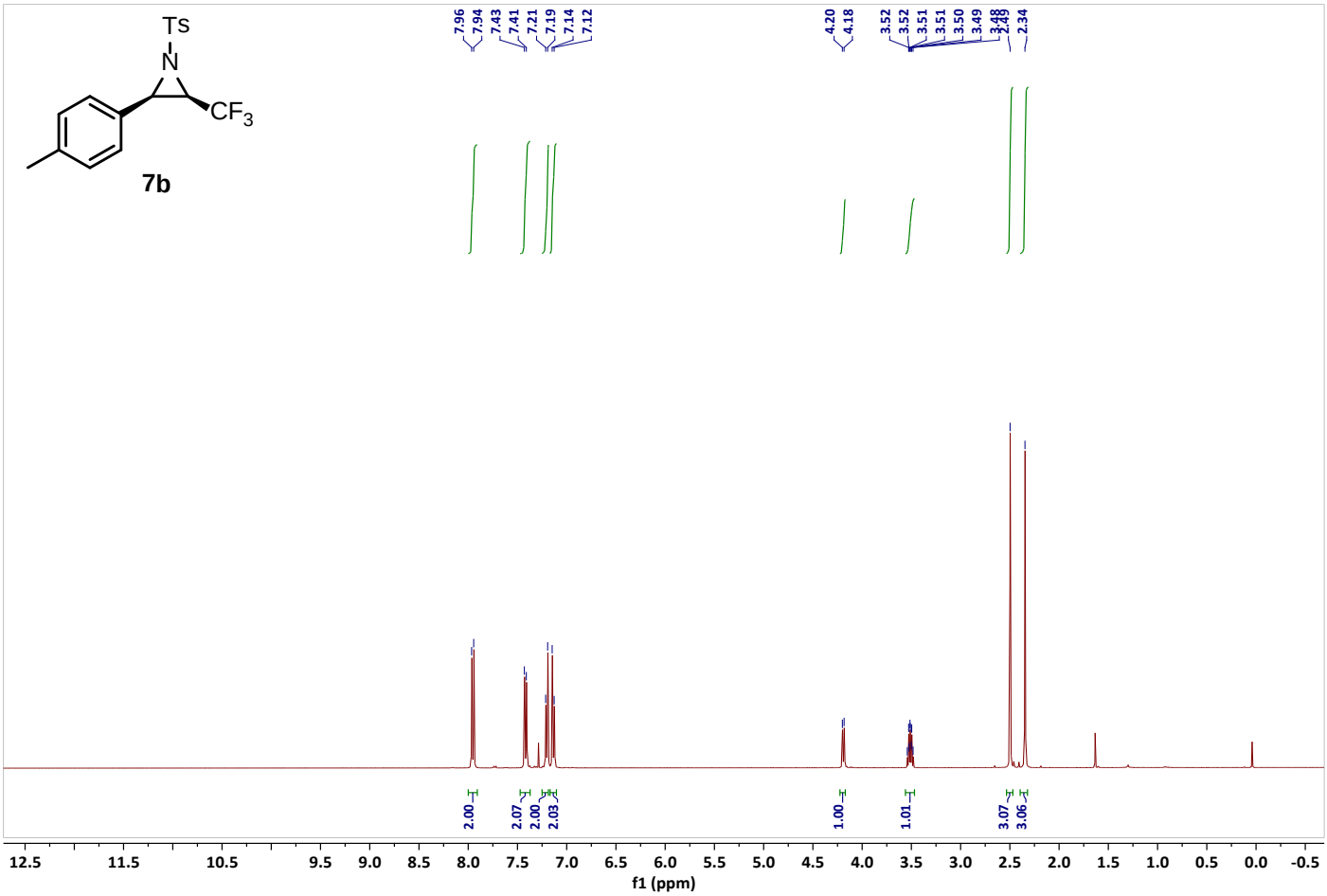
-66.96
-66.98
3.00
f1 (ppm)

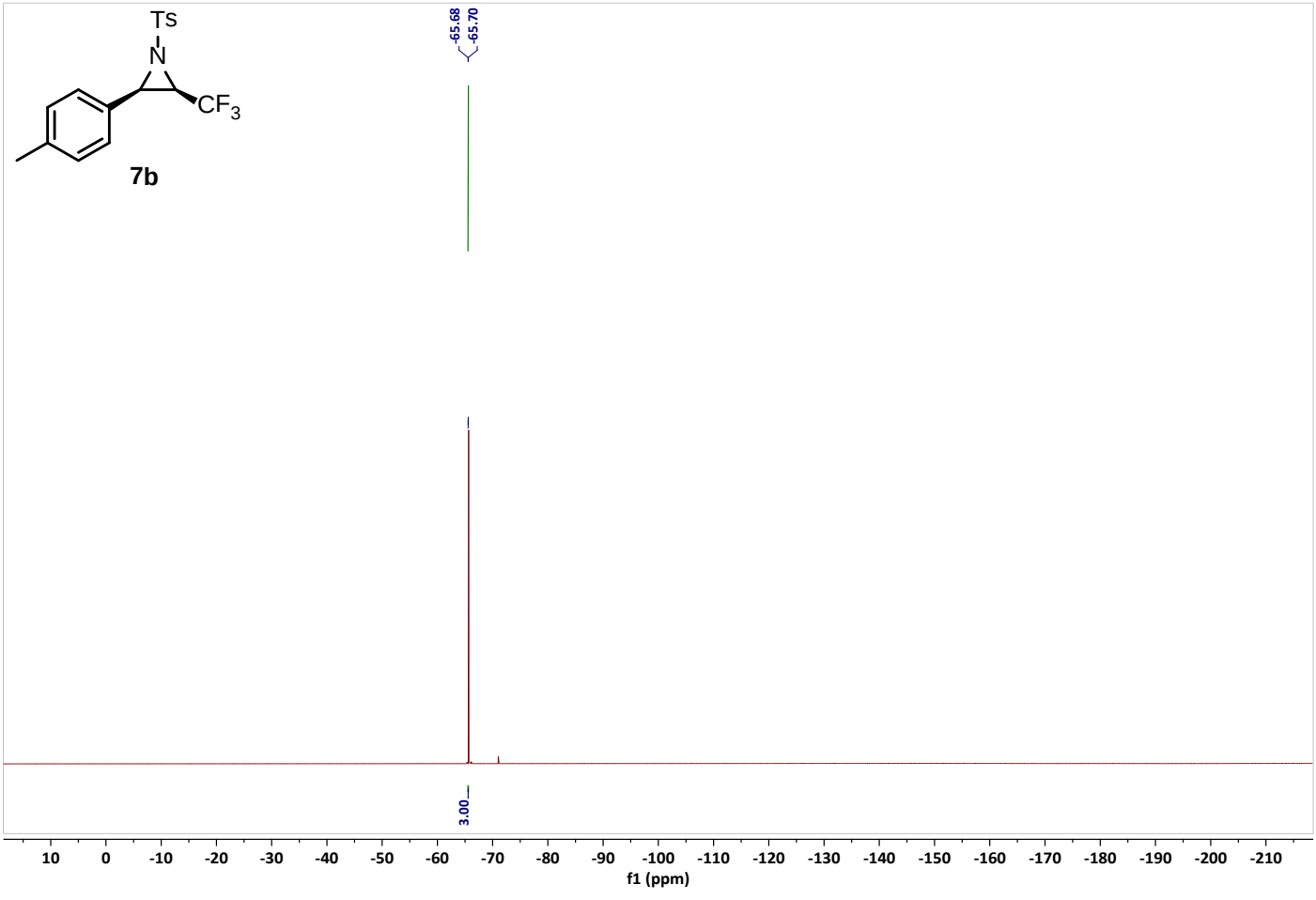

184.77
152.36
147.14
129.07
126.38
123.68
120.98
117.86
112.59
77.34
77.02
76.70
23.90
23.52
23.14
22.77
20.03
20.00
19.98
19.95
12.12
12.09
12.06
12.03
O
O
CF3
5m
f1 (ppm)

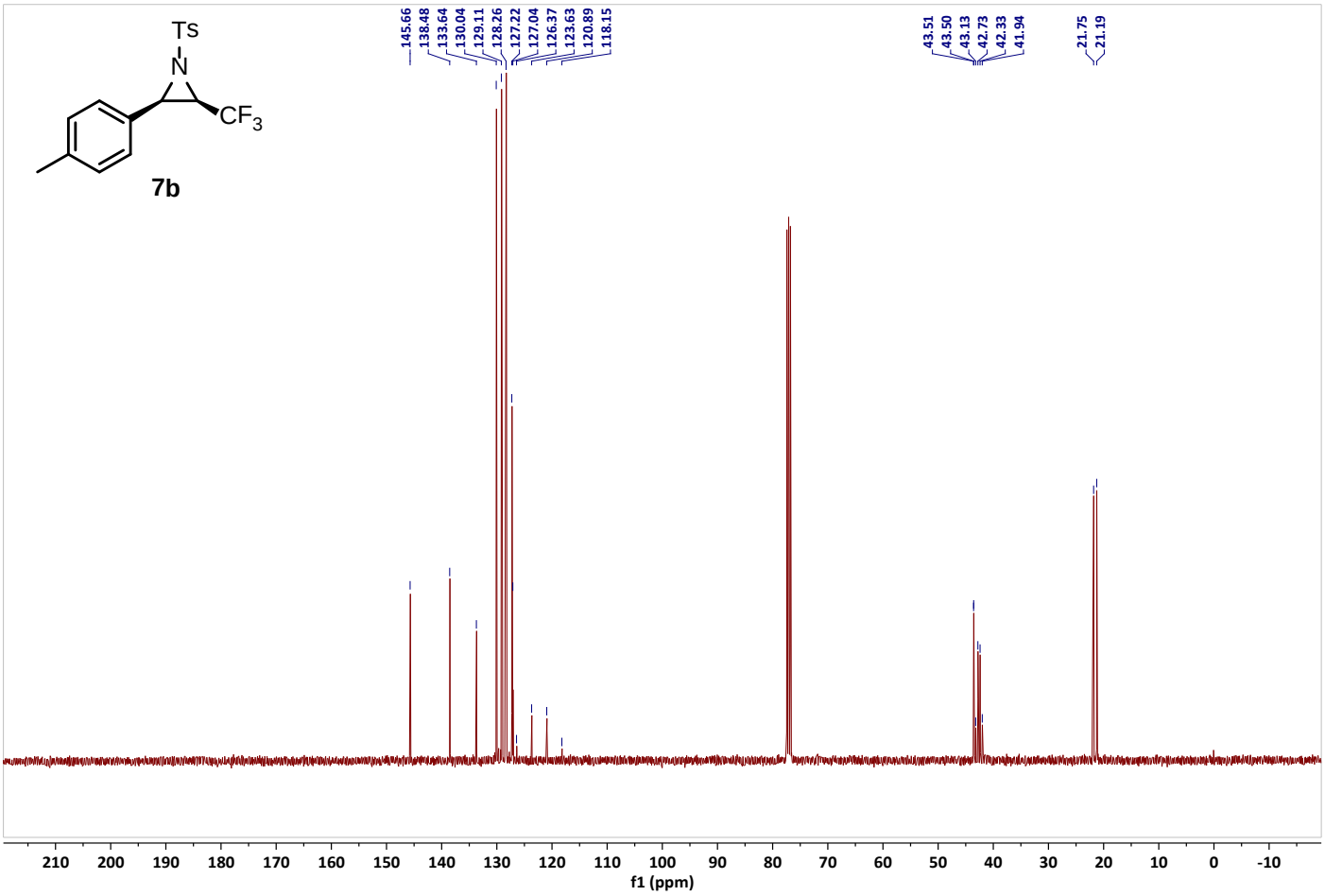

Ts
N
CF3
7a
7.92
7.90
7.39
7.37
7.28
4.19
4.18
3.52
3.51
3.49
3.49
3.48
3.46
2.45
1.93
1.99
4.99
1.00
1.05
3.06
f1 (ppm)

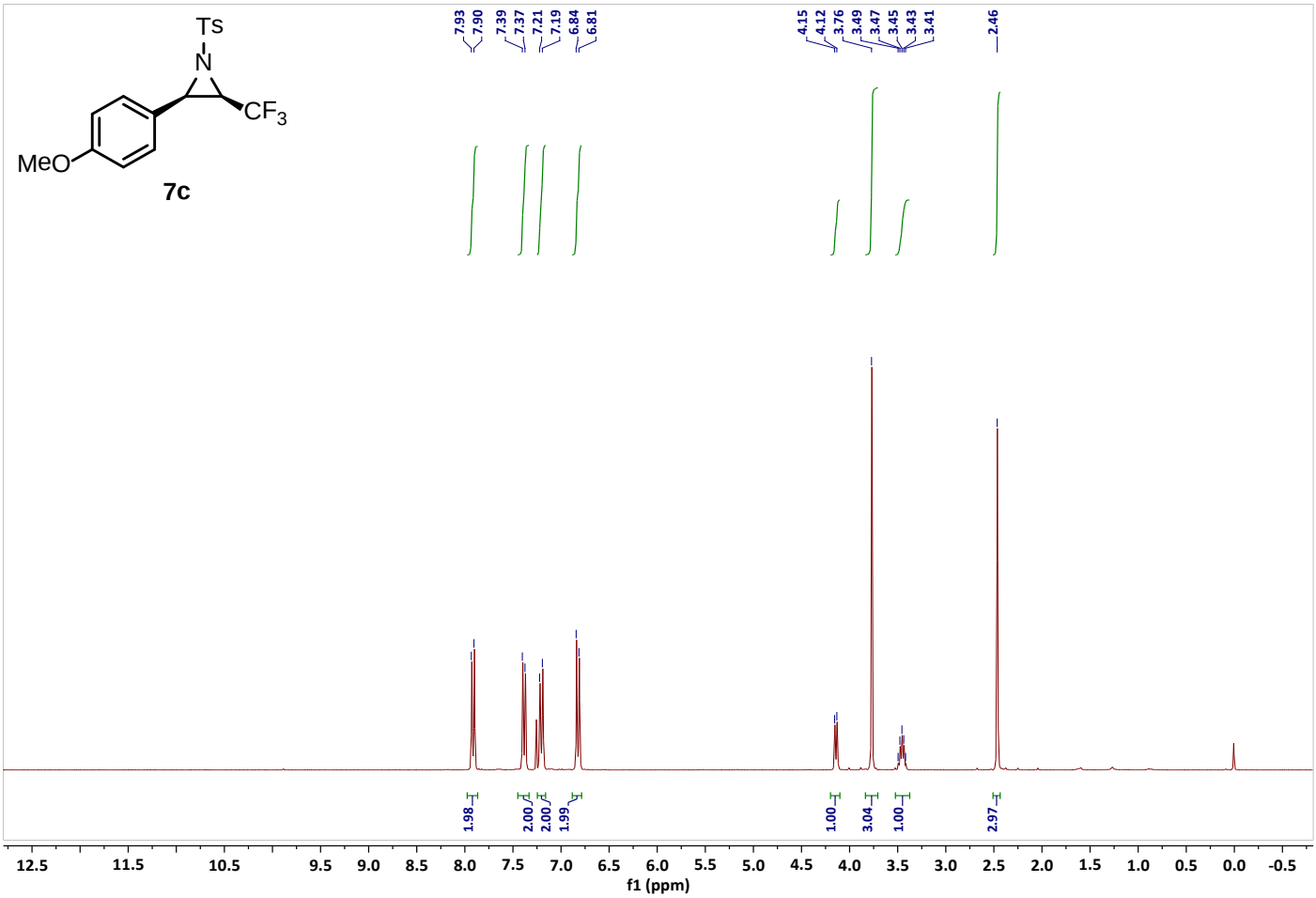

Ts
N
CF3
7a
-65.81
-65.83
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

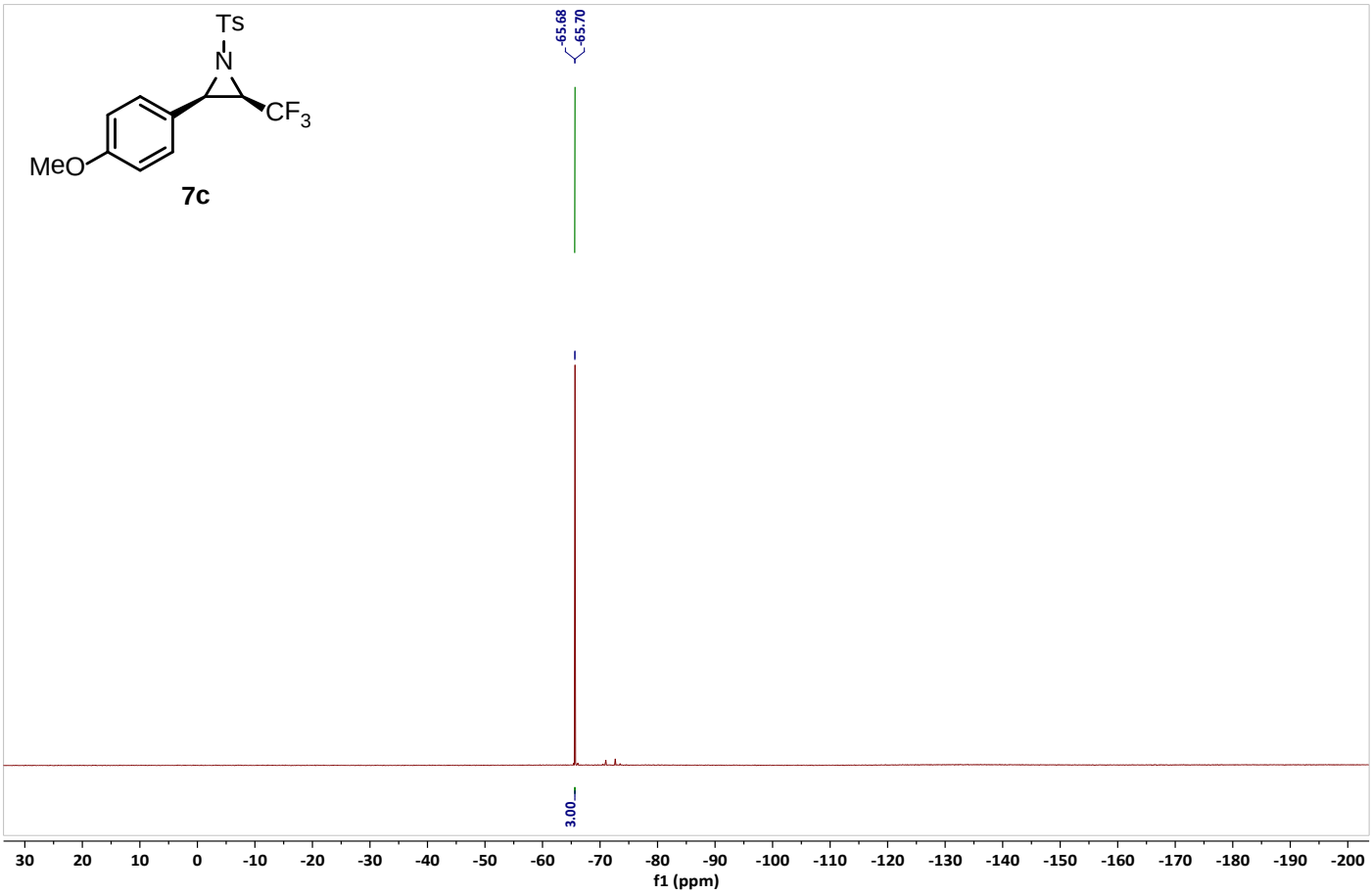

Ts
N
CF3
7a
145.74
133.55
130.08
128.63
128.43
128.28
127.35
127.35
126.32
123.58
120.84
118.10
43.51
43.50
43.14
42.74
42.35
41.95
21.77
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

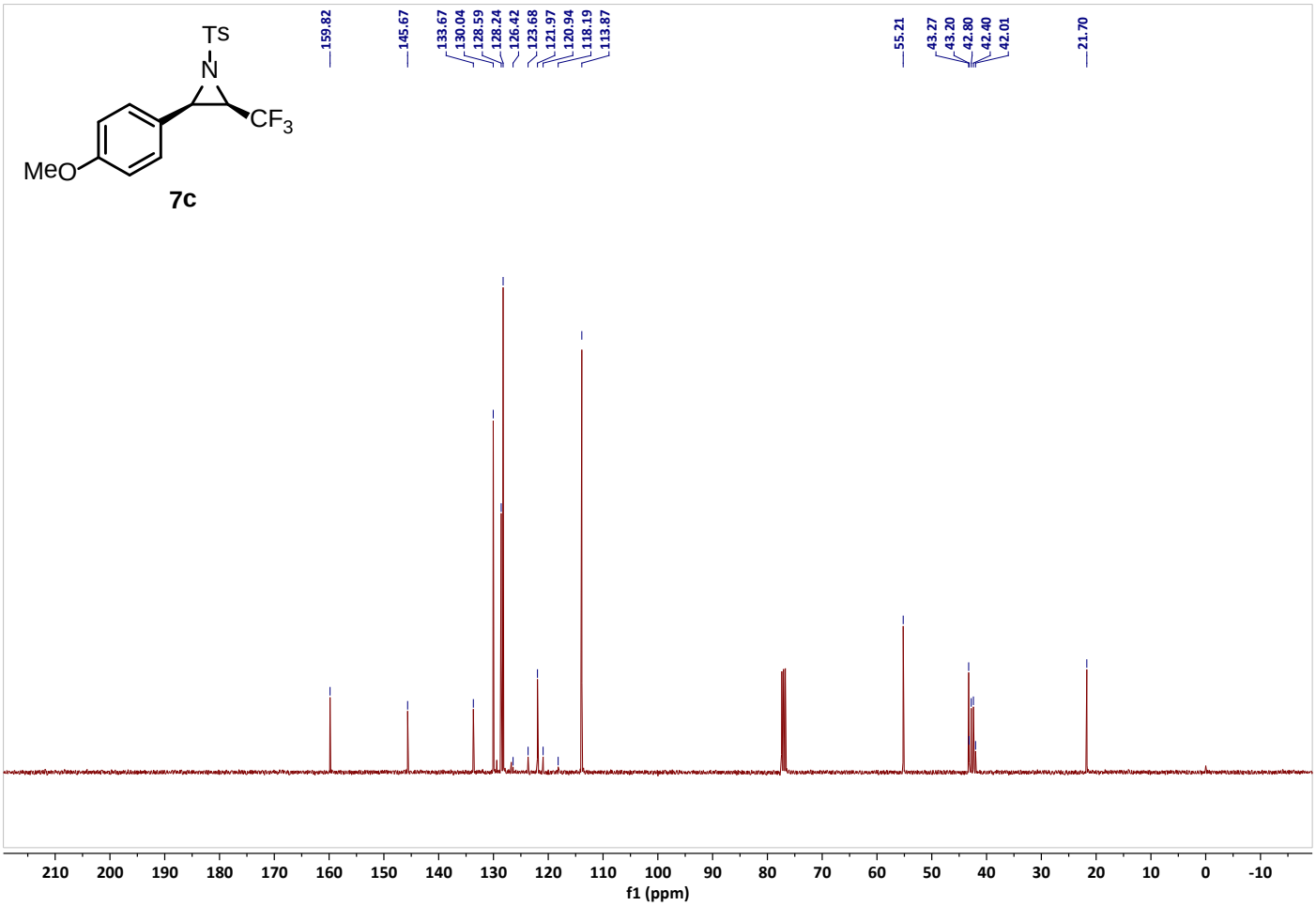

Ts
N
CF3
7b
7.96
7.94
7.43
7.41
7.21
7.19
7.14
7.12
4.20
4.18
3.52
3.52
3.51
3.51
3.50
3.49
3.48
3.48
2.34
2.00
2.07
2.00
2.03
1.00
1.01
3.07
3.06
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

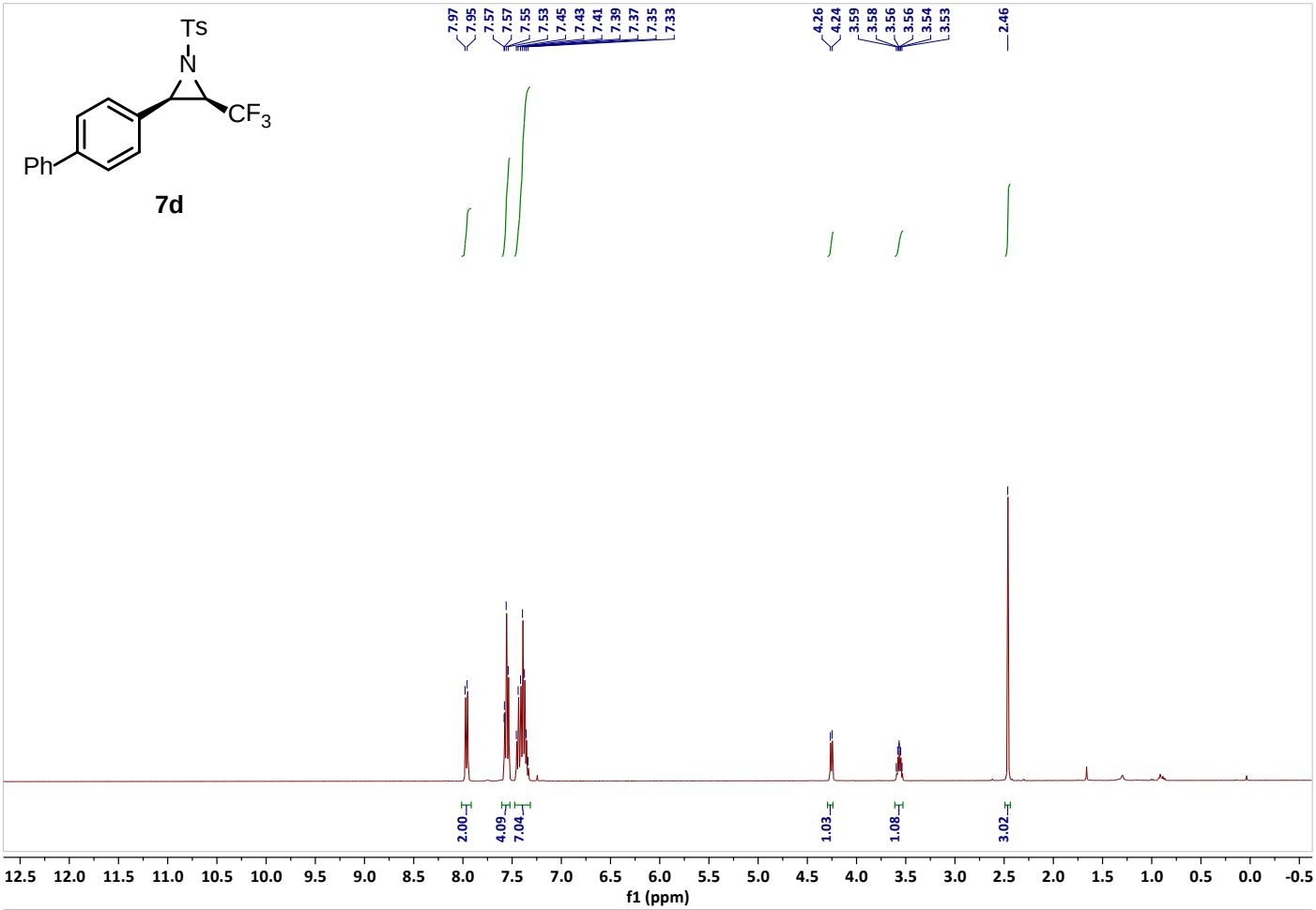

Ts
N
CF3
7b
-65.68
-65.70
3.00
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

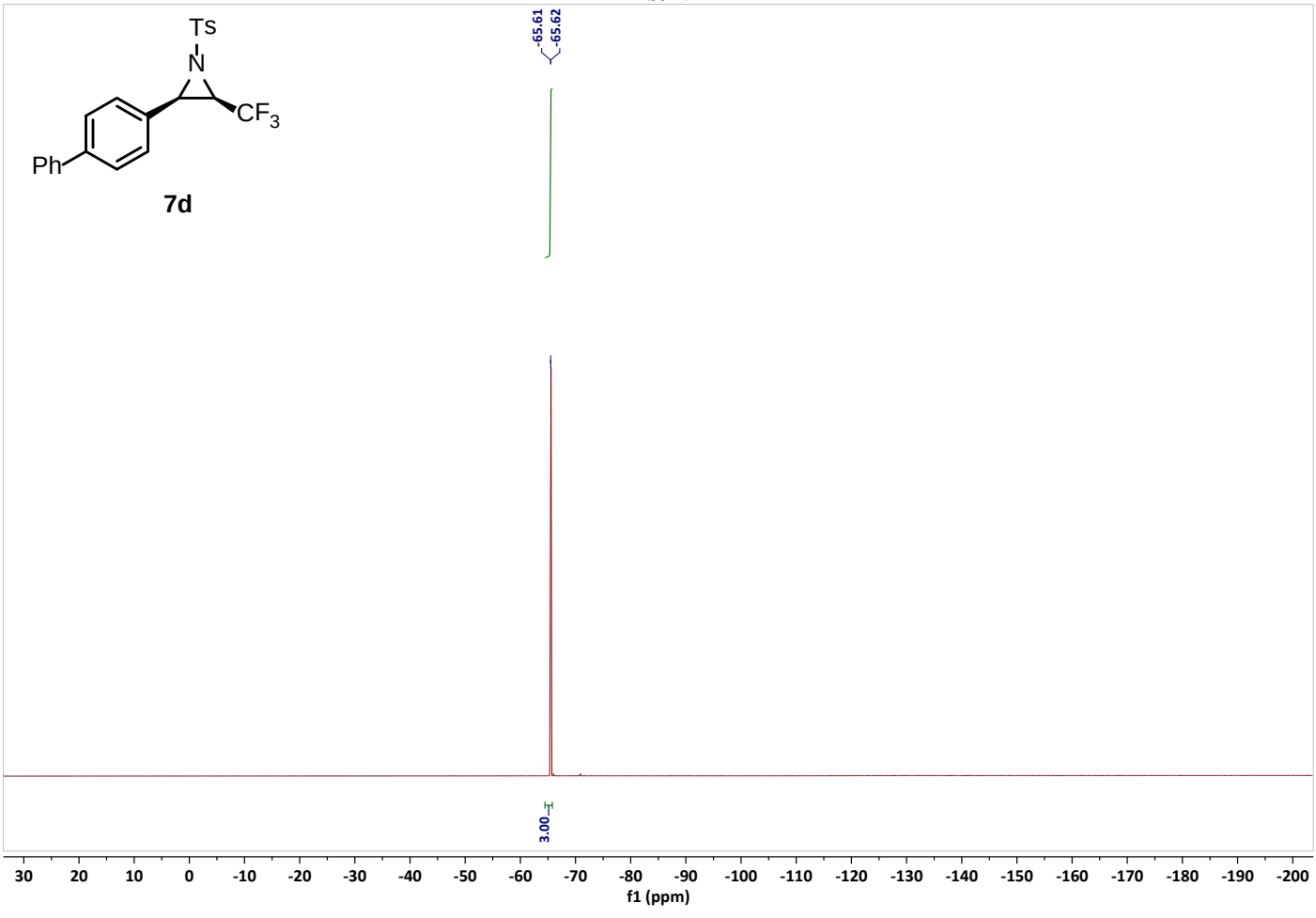

Ts
N
CF3
7b
145.66
138.48
133.64
130.04
129.11
128.26
127.22
127.04
126.37
123.63
120.89
118.15
43.51
43.50
43.13
42.73
42.33
41.94
21.75
21.19
f1 (ppm)

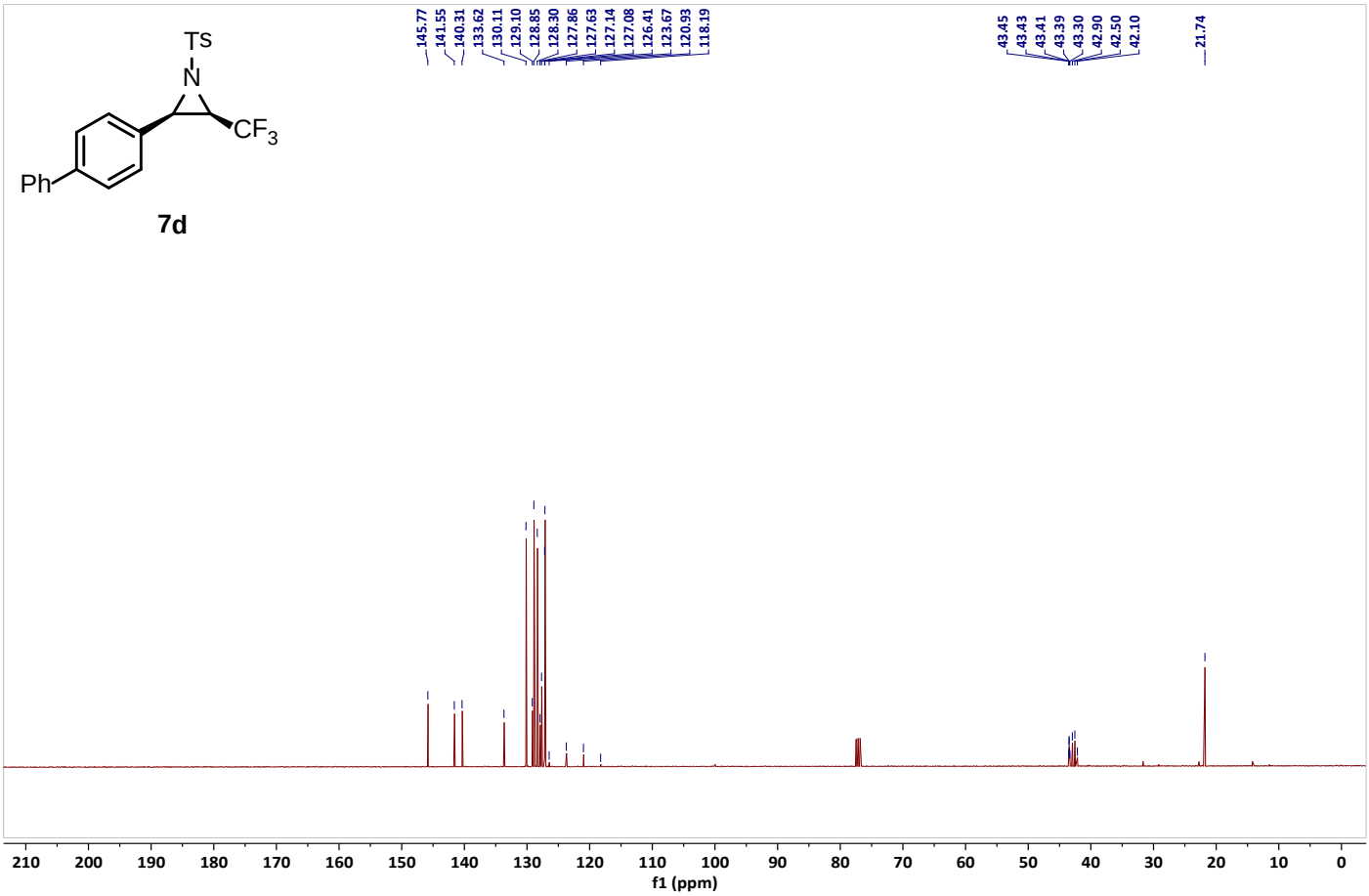

Ts
N
CF3
MeO
7c
7.93
7.90
7.39
7.37
7.21
7.19
6.84
6.81
4.15
4.12
3.76
3.49
3.47
3.45
3.43
3.41
2.46
1.98
2.00
2.00
1.99
1.00
3.04
1.00
2.97
f1 (ppm)

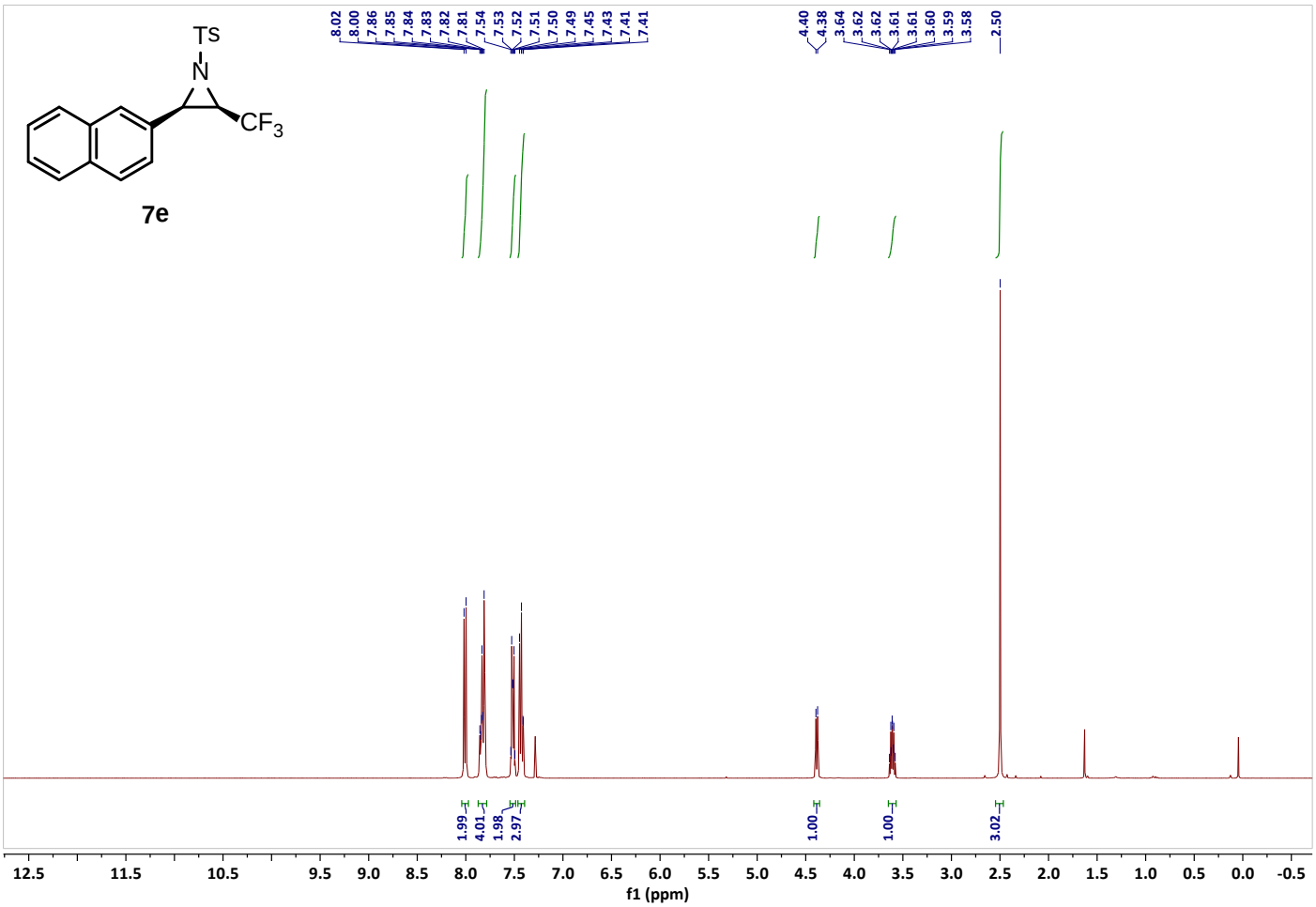

Ts
N
CF3
MeO
7c
-65.68
-65.70
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)


Ts
N
CF3
MeO
7c
159.82
145.67
133.67
130.04
128.59
128.24
126.42
123.68
121.97
120.94
118.19
113.87
55.21
43.27
43.20
42.80
42.40
42.01
21.70
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)


Ts
N
CF3
Ph
7d
7.97
7.95
7.57
7.57
7.55
7.53
7.45
7.43
7.41
7.39
7.37
7.35
7.33
4.26
4.24
3.59
3.58
3.56
3.56
3.54
3.53
2.46
2.00
4.09
7.04
1.03
1.08
3.02
12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


Ts
N
CF3
Ph
7d
-65.61
-65.62
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)


TS
N
CF3
Ph
7d
145.77
141.55
140.31
133.62
130.11
129.10
128.85
128.30
127.86
127.63
127.14
127.08
126.41
123.67
120.93
118.19
43.45
43.43
43.41
43.39
43.30
42.90
42.50
42.10
21.74
f1 (ppm)


TS
N
CF3
7e
8.02
8.00
7.86
7.85
7.84
7.83
7.82
7.81
7.54
7.53
7.52
7.51
7.50
7.49
7.45
7.43
7.41
7.41
4.40
4.38
3.64
3.62
3.62
3.61
3.61
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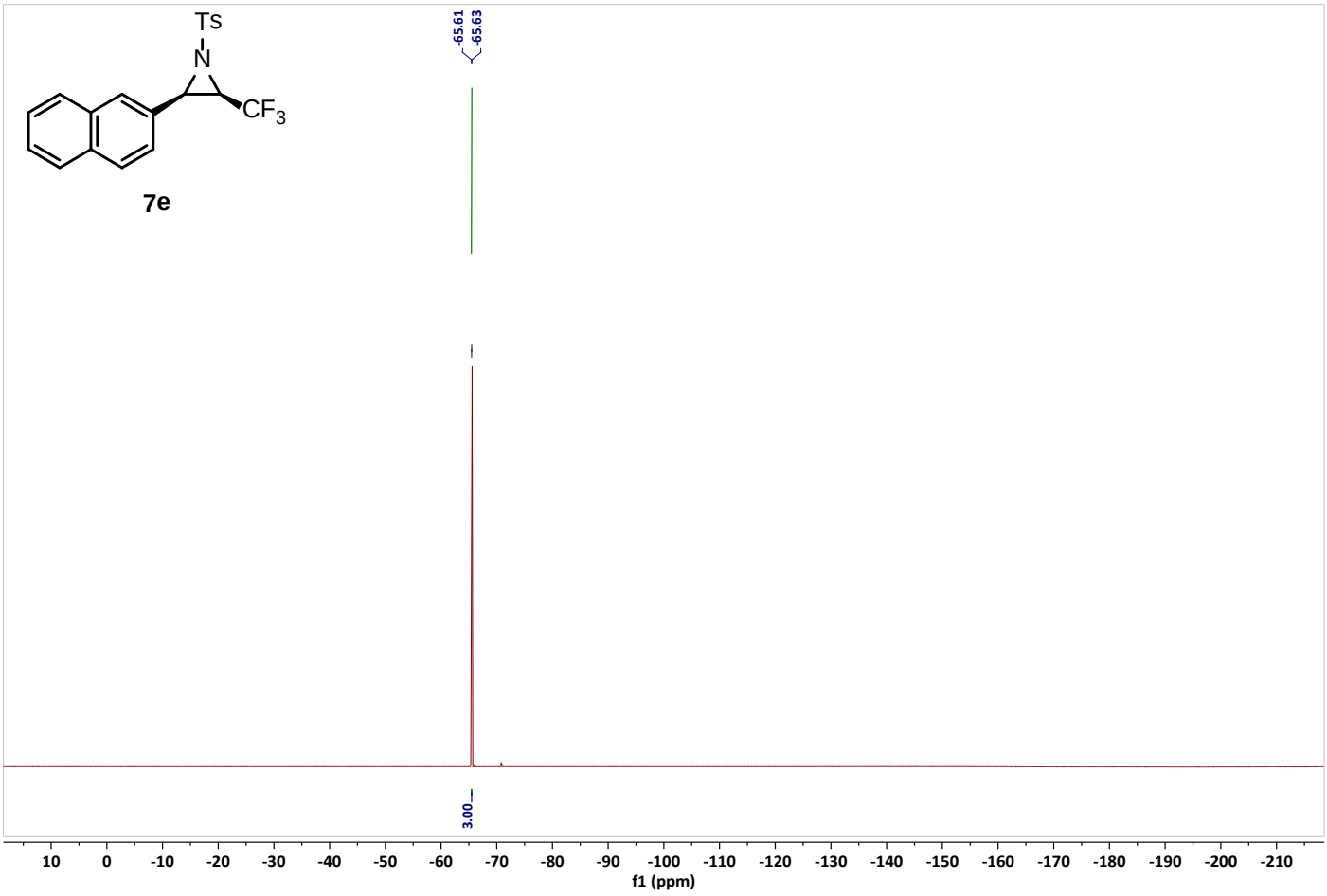
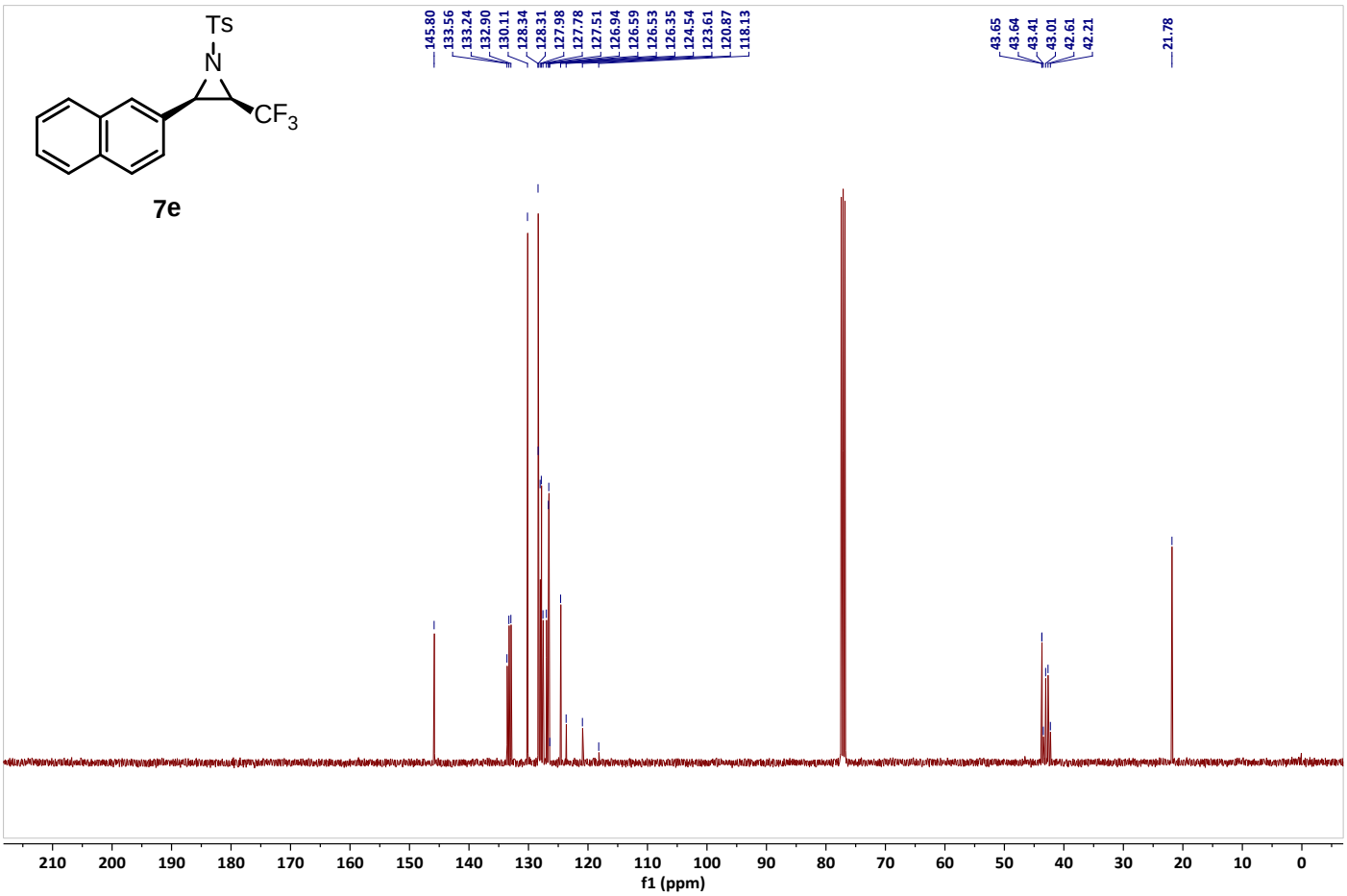
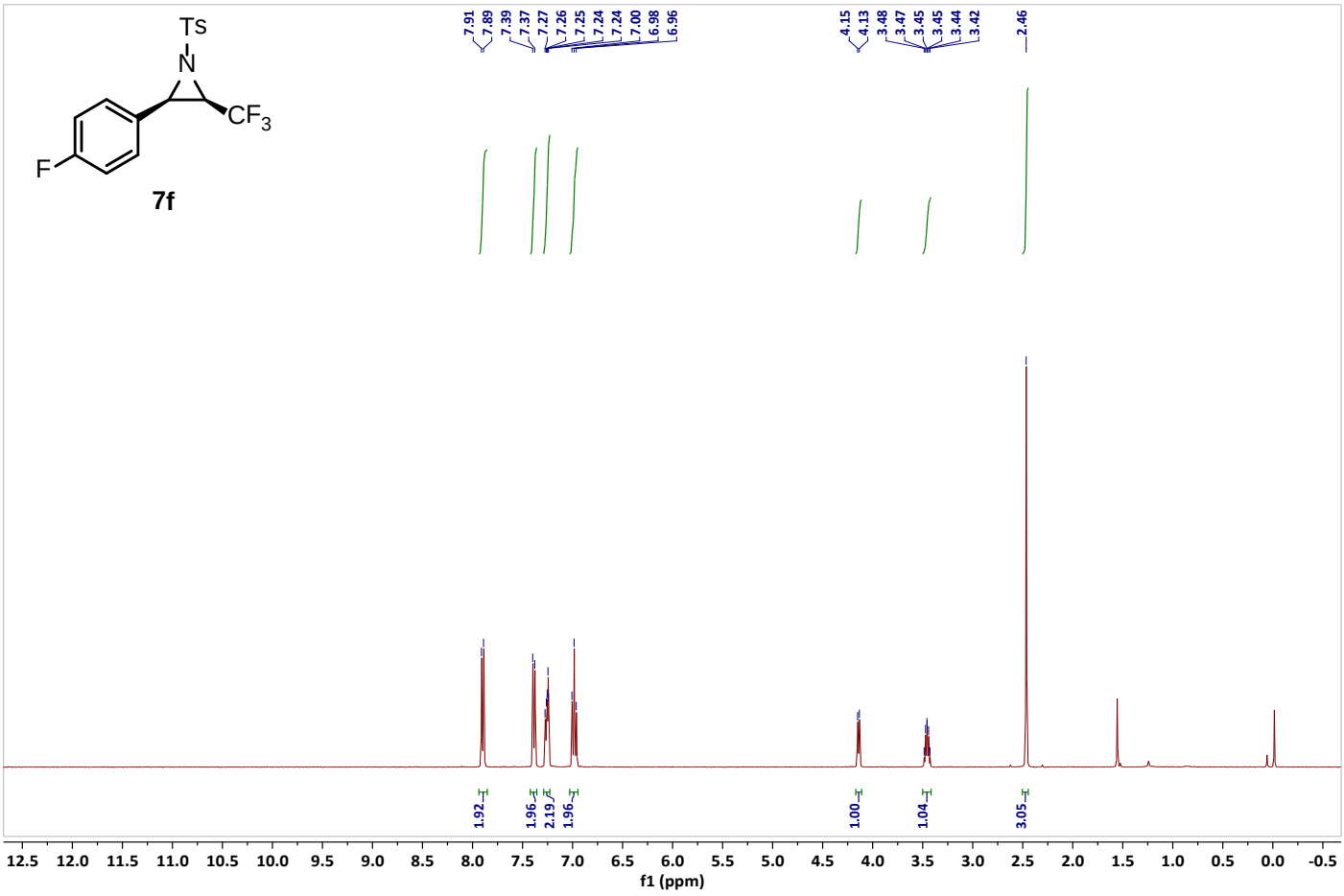
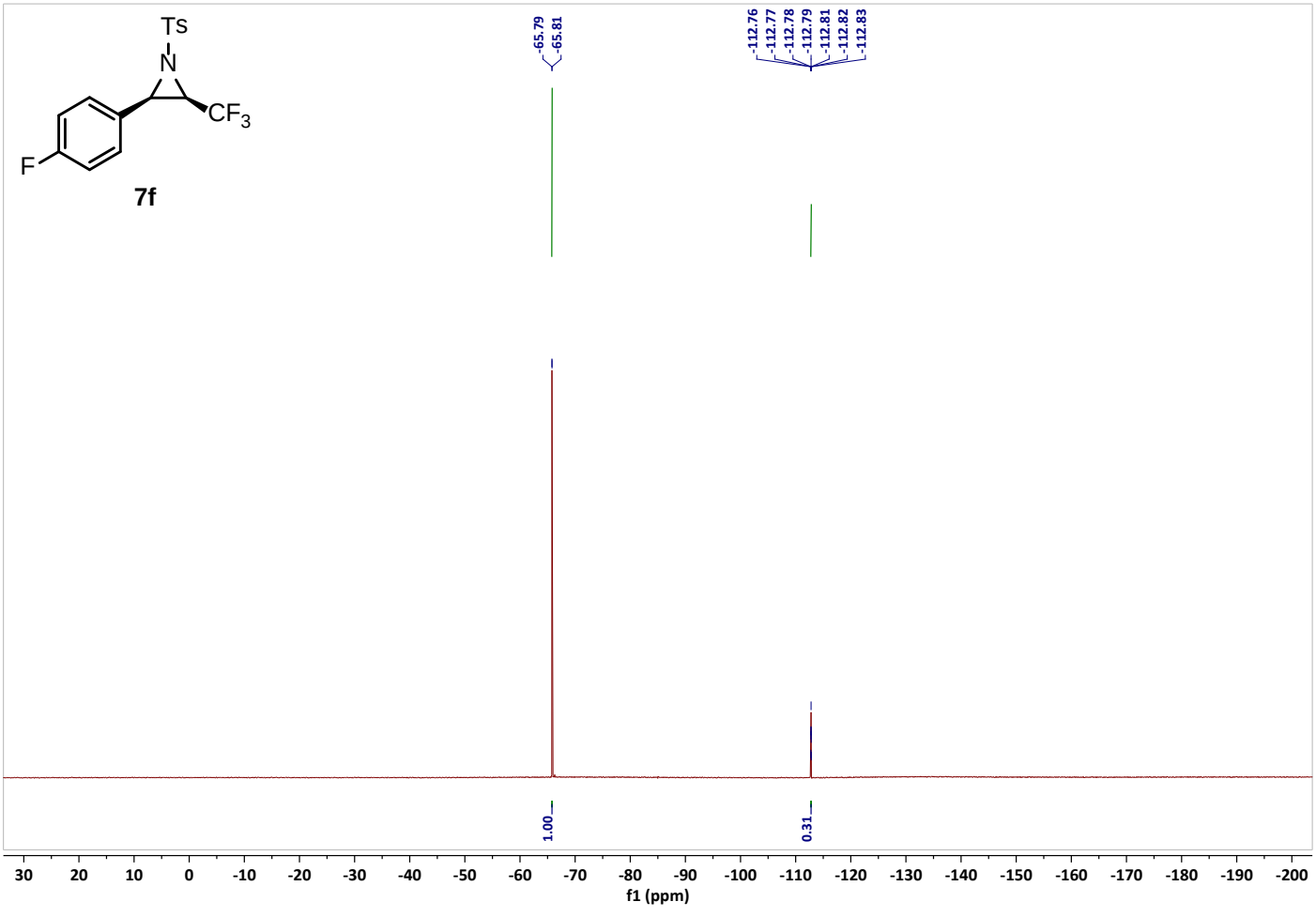
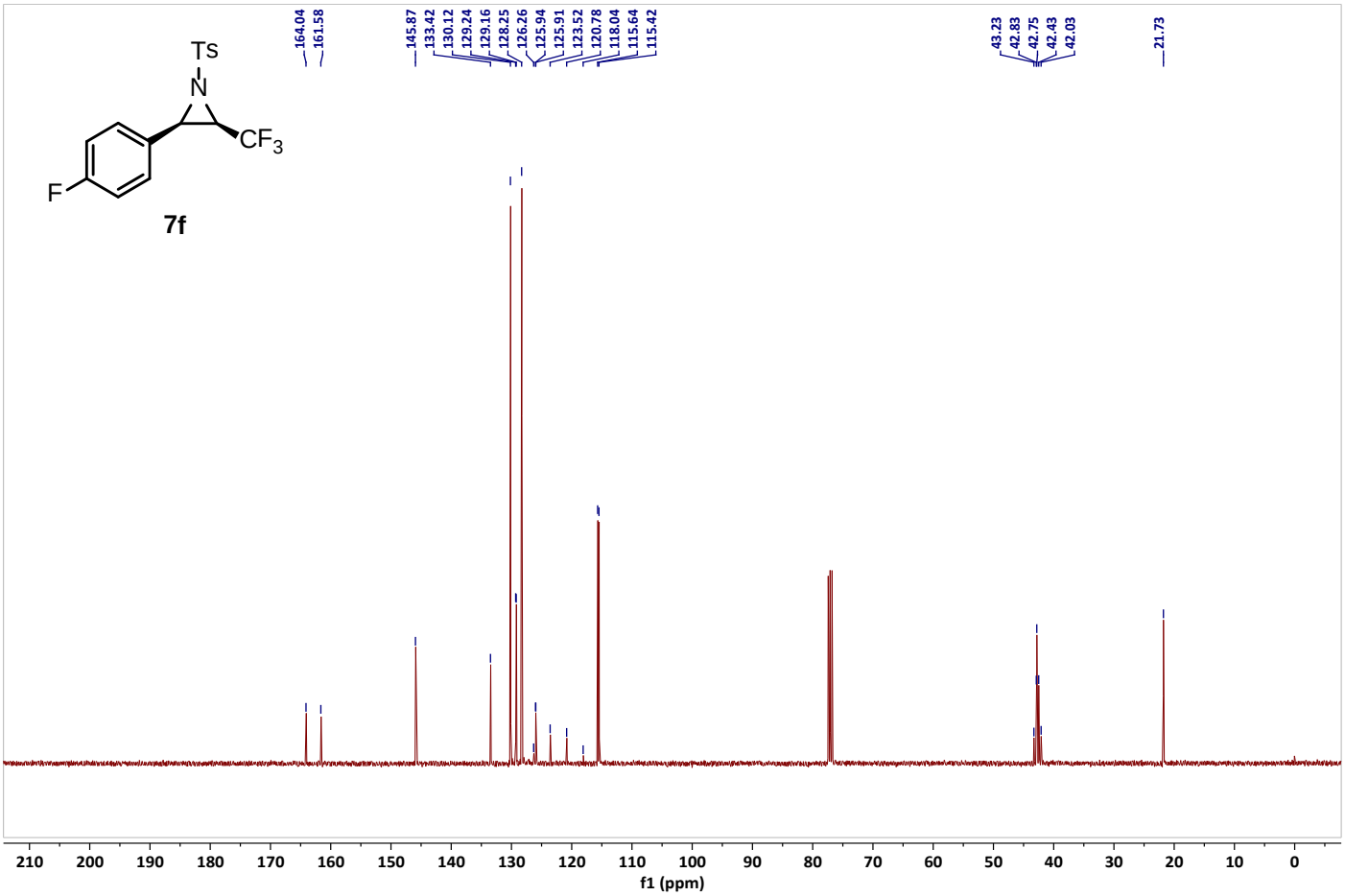
2.97
1.00
1.00
3.02
f1 (ppm)

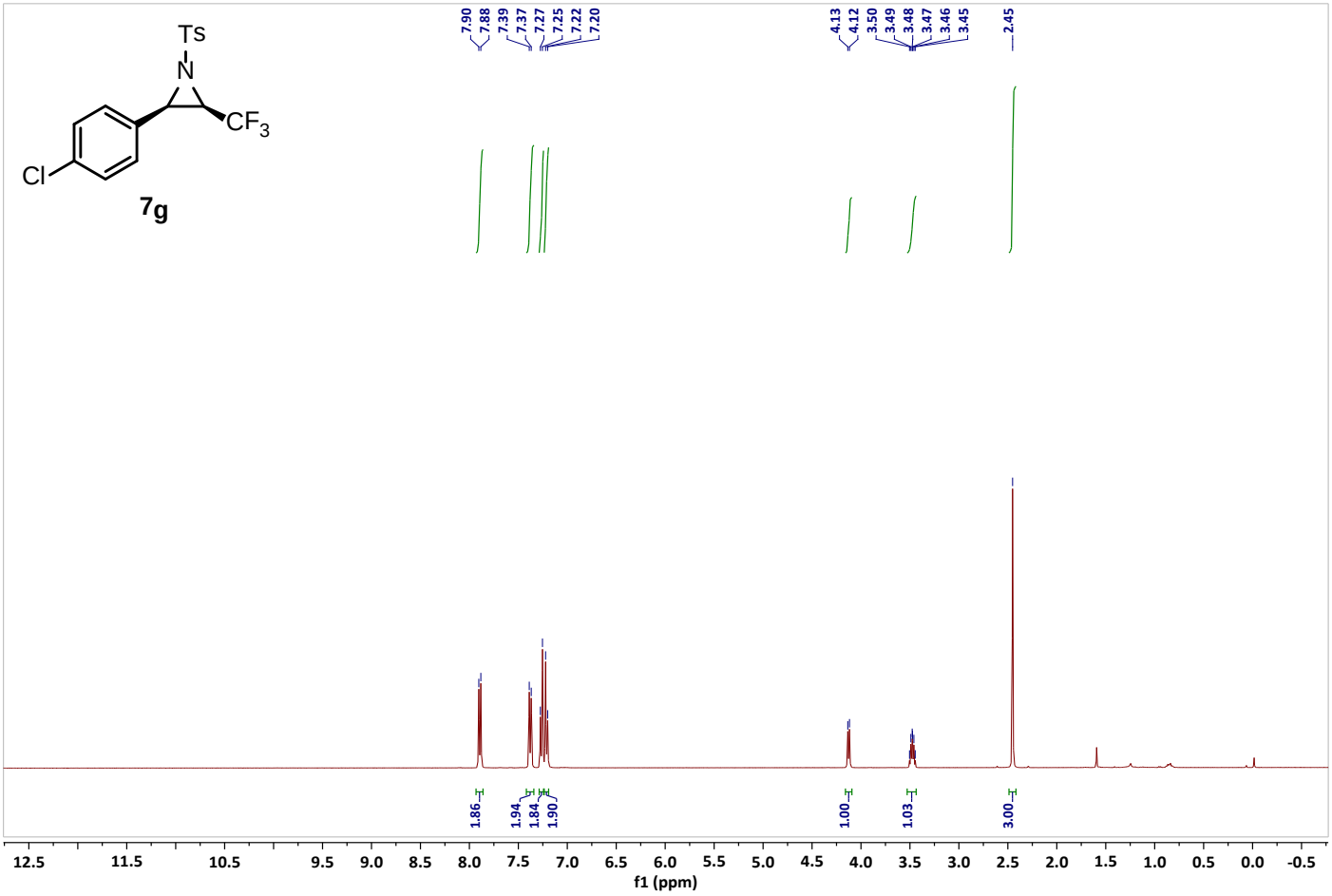

Ts
N
CF3
7e
-65.61
-65.63
3.00
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

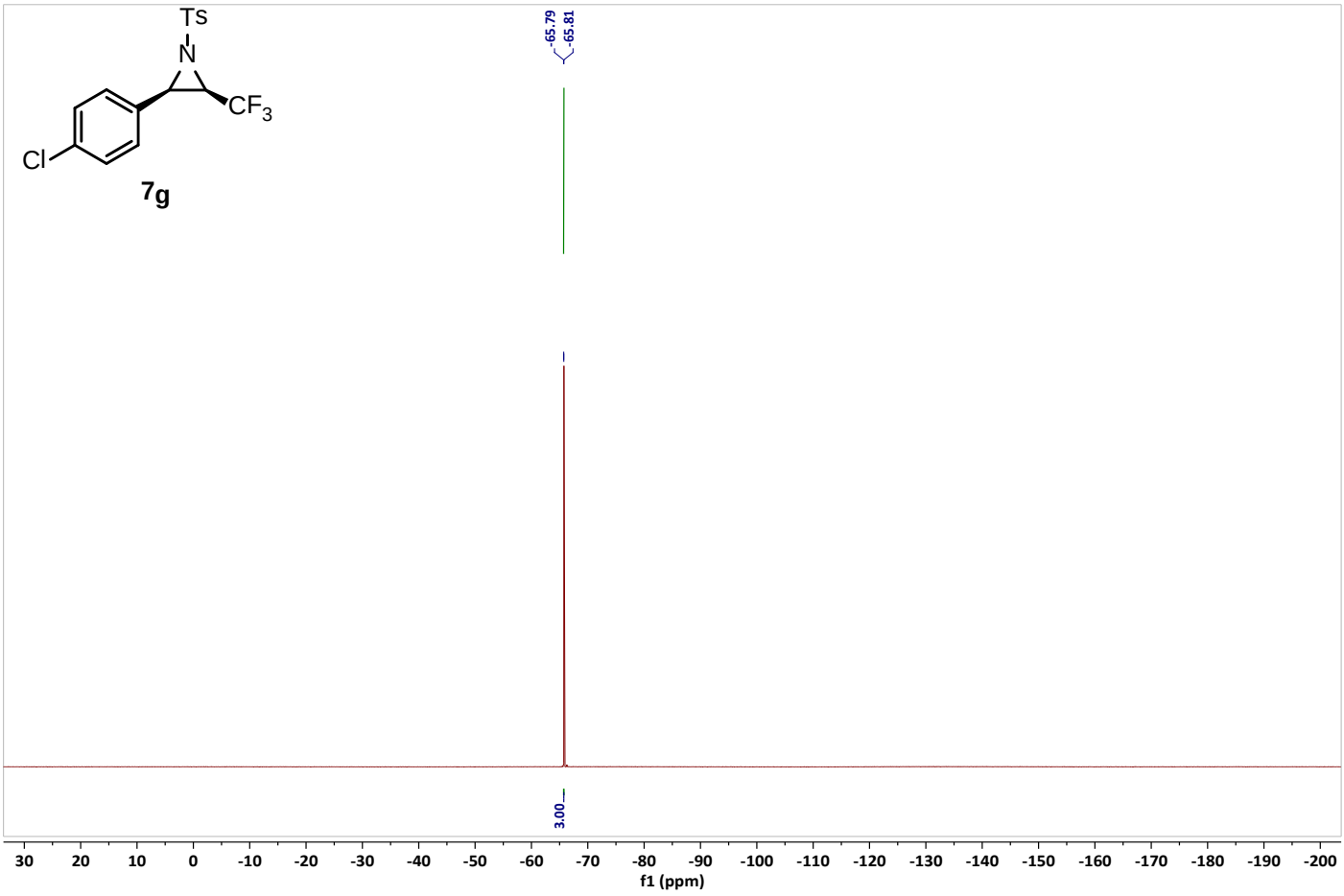

Ts
N
CF3
7e
145.80
133.56
133.24
132.90
130.11
128.34
128.31
127.98
127.78
127.51
126.94
126.59
126.53
126.35
124.54
123.61
120.87
118.13
43.65
43.64
43.41
43.01
42.61
42.21
21.78
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

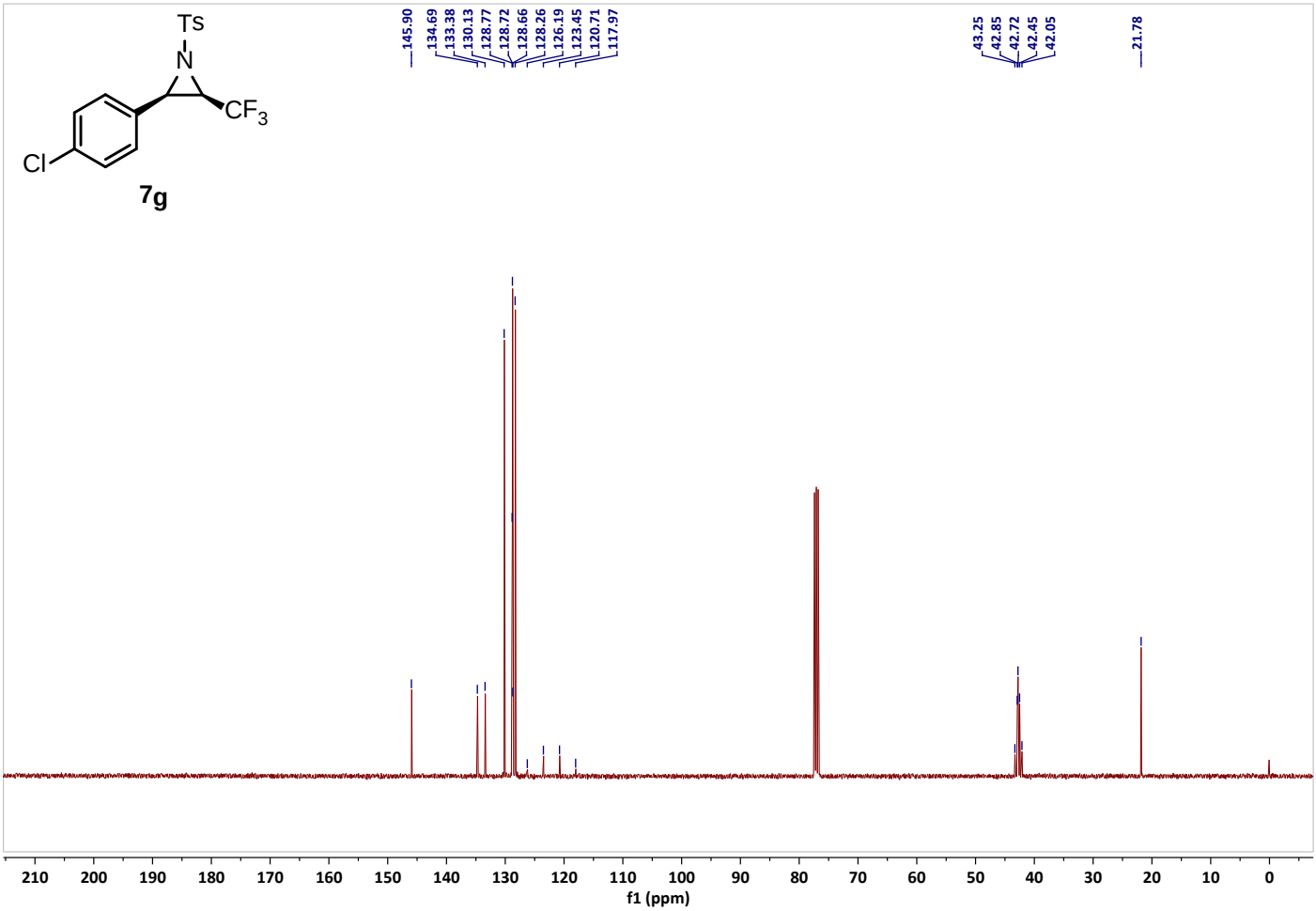

Ts
N
CF3
F
7f
7.91
7.89
7.39
7.37
7.27
7.26
7.25
7.24
7.24
7.00
6.98
6.96
4.15
4.13
3.48
3.47
3.45
3.45
3.44
3.42
2.46
1.92
1.96
2.19
1.96
1.00
1.04
3.05
f1 (ppm)

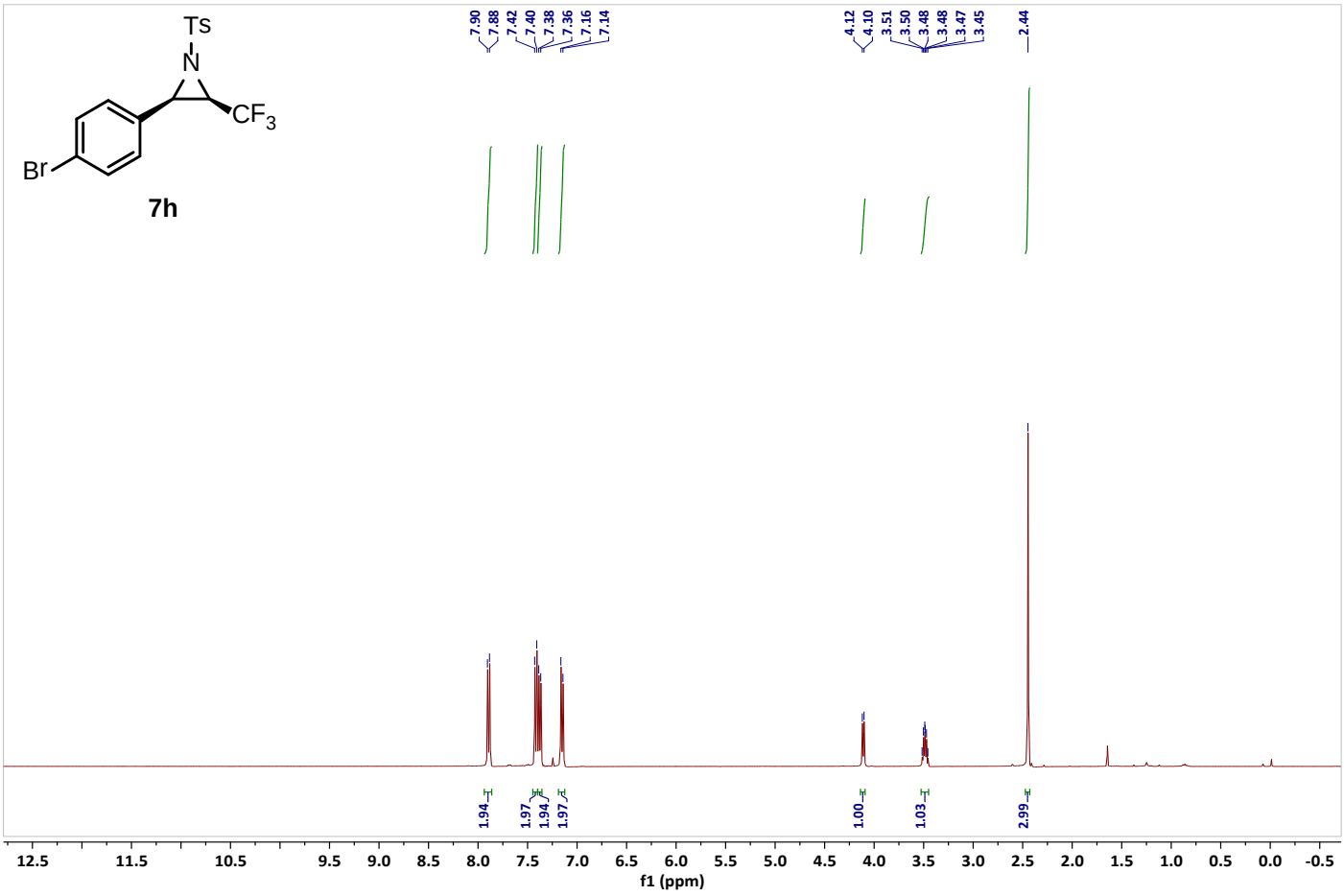

Ts
N
CF3
F
7f
-65.79
-65.81
-112.76
-112.77
-112.78
-112.79
-112.81
-112.82
-112.83
1.00
0.31
f1 (ppm)

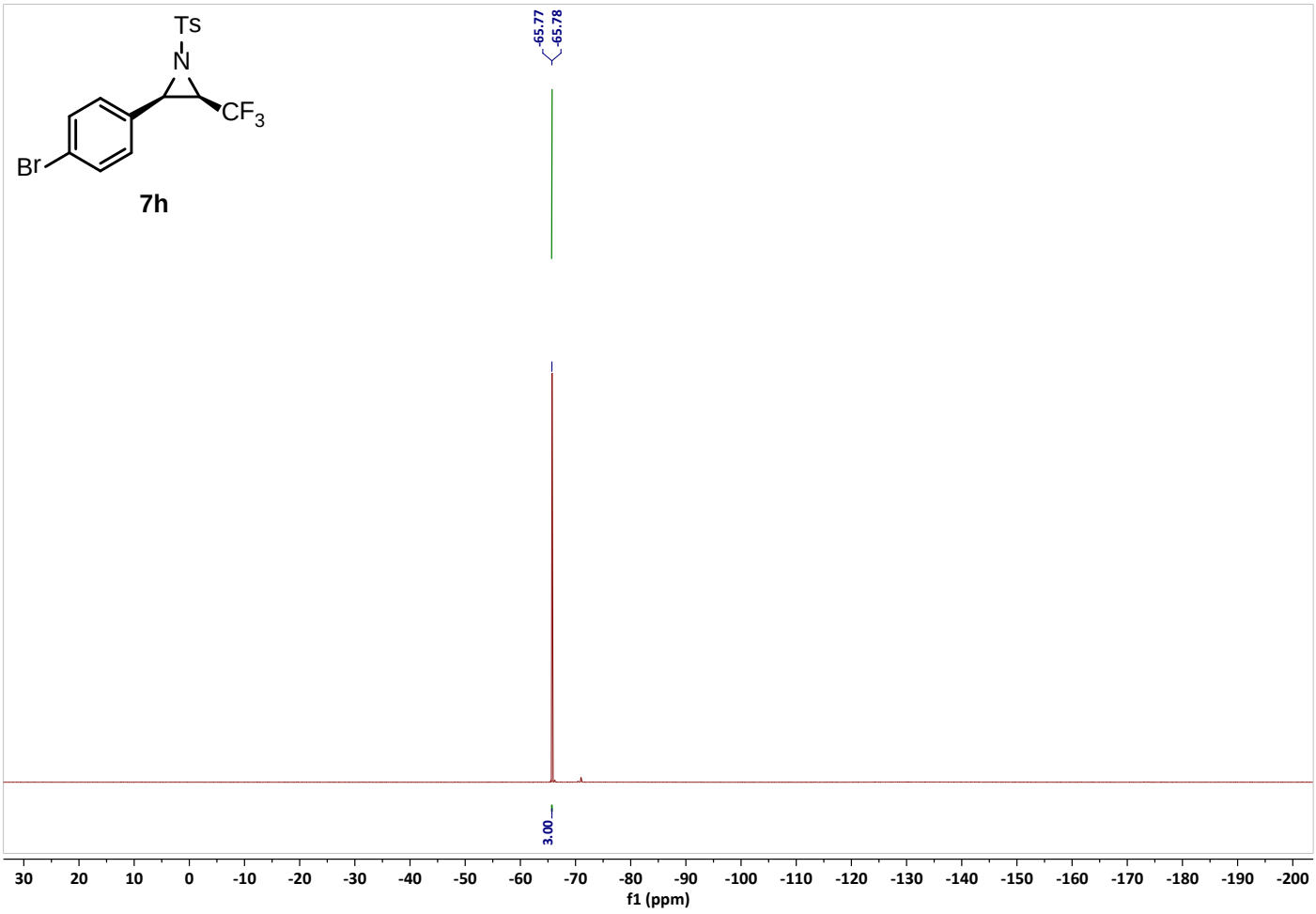

Ts
N
CF3
F
7f
164.04
161.58
145.87
133.42
130.12
129.24
129.16
128.25
126.26
125.94
125.91
123.52
120.78
118.04
115.64
115.42
43.23
42.83
42.75
42.43
42.03
21.73
f1 (ppm)

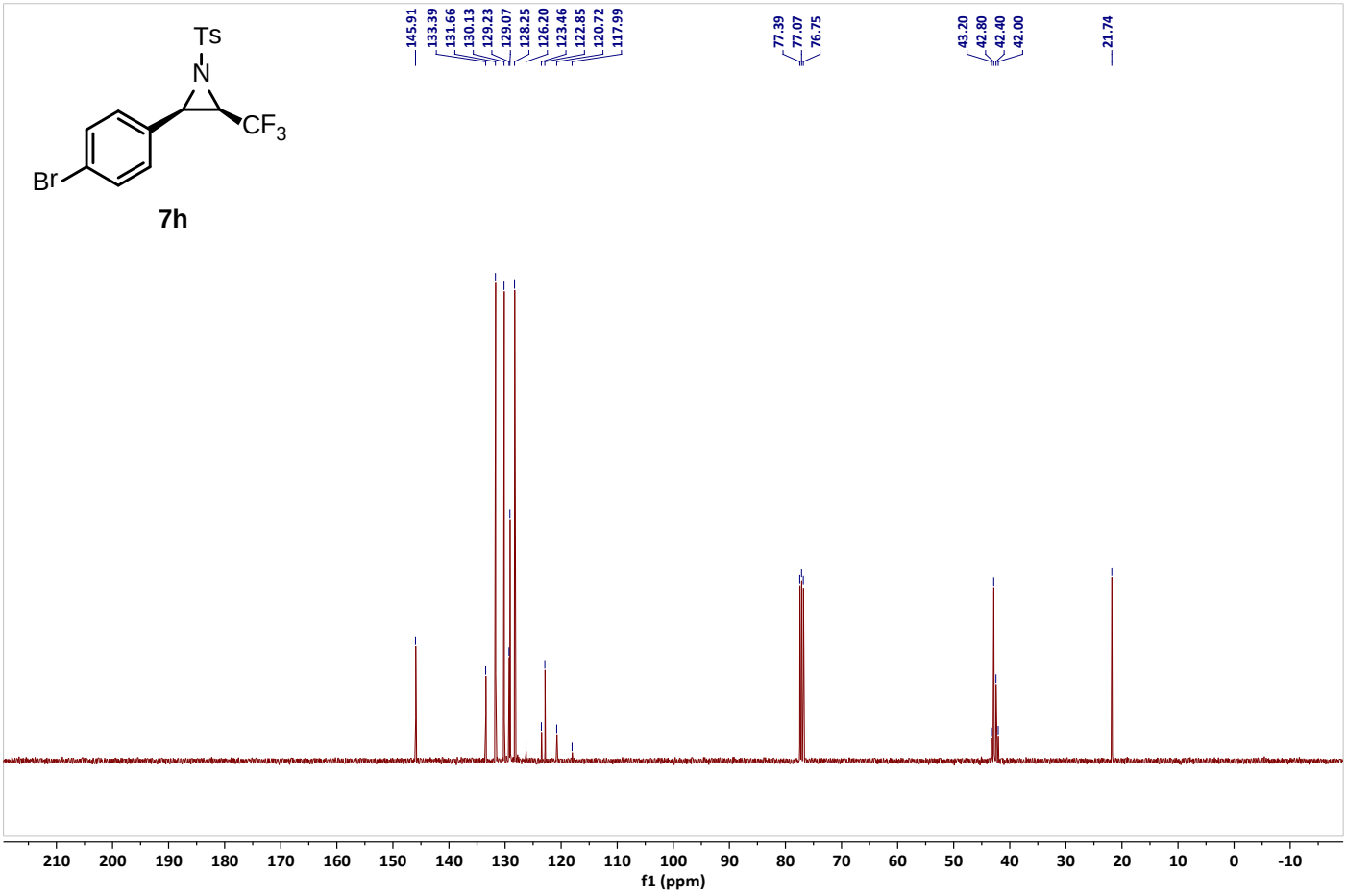

Ts
N
CF3
Cl
7g
7.90
7.88
7.39
7.37
7.27
7.25
7.22
7.20
4.13
4.12
3.50
3.49
3.48
3.47
3.46
3.45
2.45
1.86
1.94
1.84
1.90
1.00
1.03
3.00
f1 (ppm)

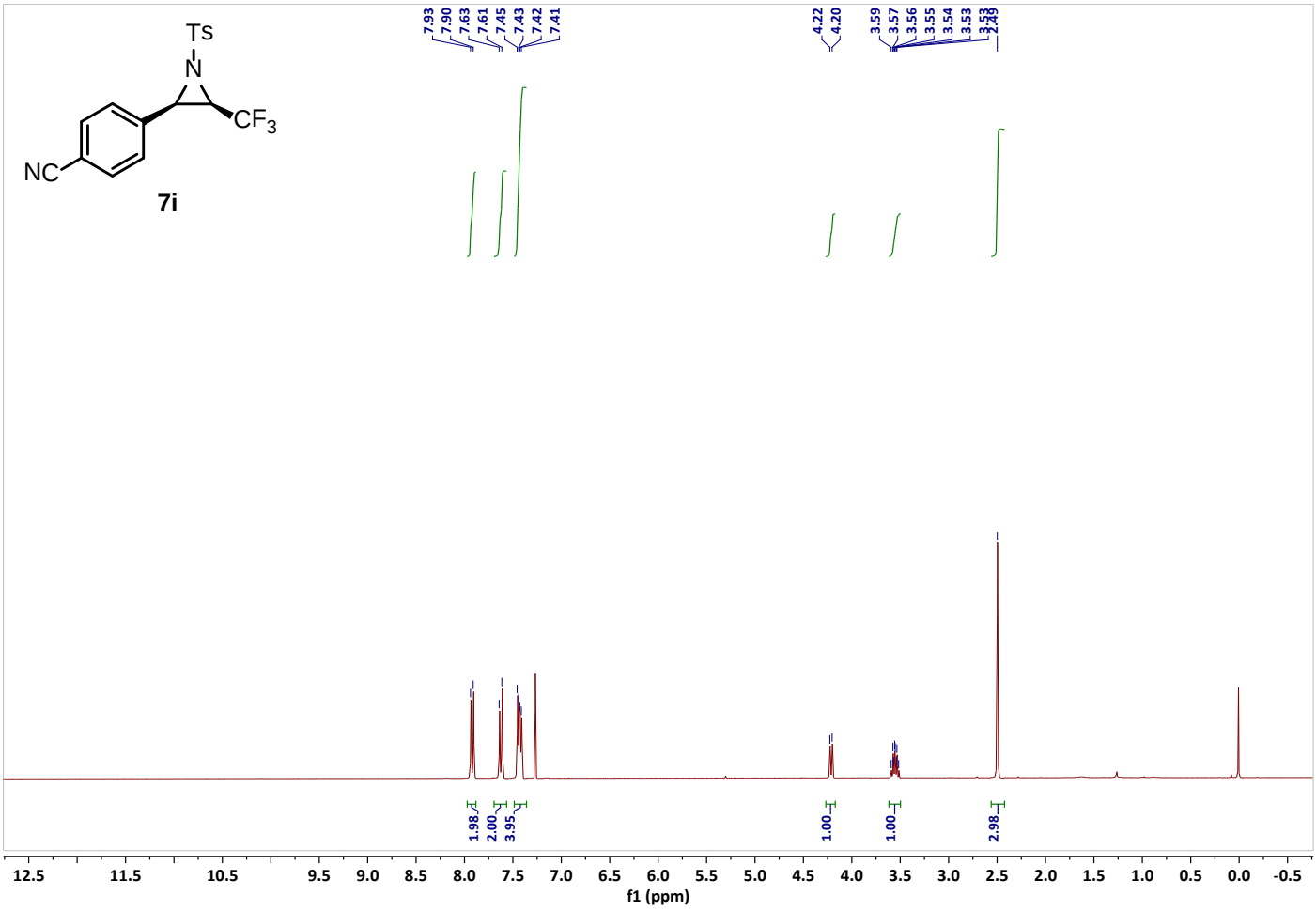

Ts
N
CF3
Cl
7g
-65.79
-65.81
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

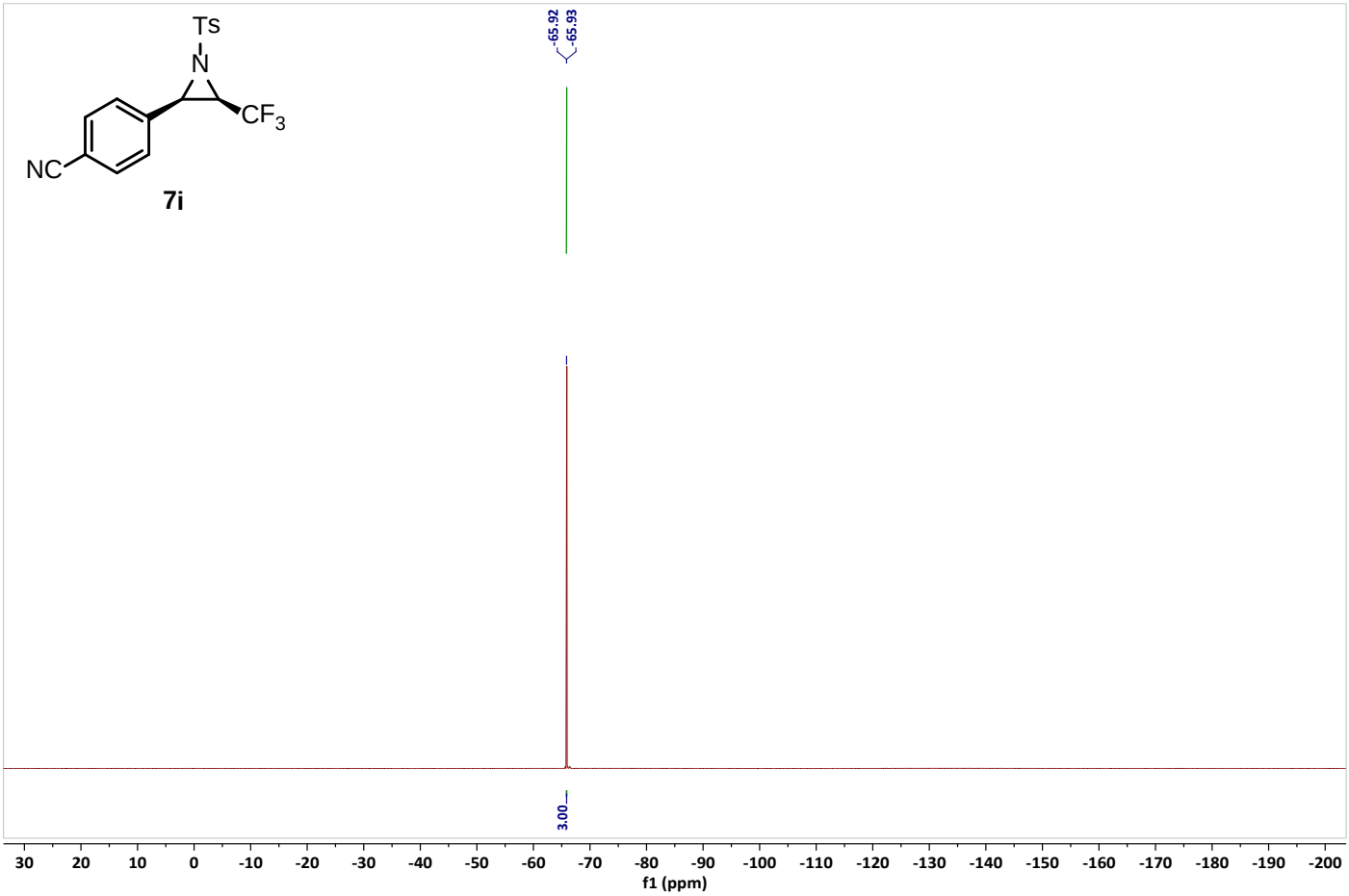

Ts
N
CF3
Cl
7g
145.90
134.69
133.38
130.13
128.77
128.72
128.66
128.26
126.19
123.45
120.71
117.97
43.25
42.85
42.72
42.45
42.05
21.78
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

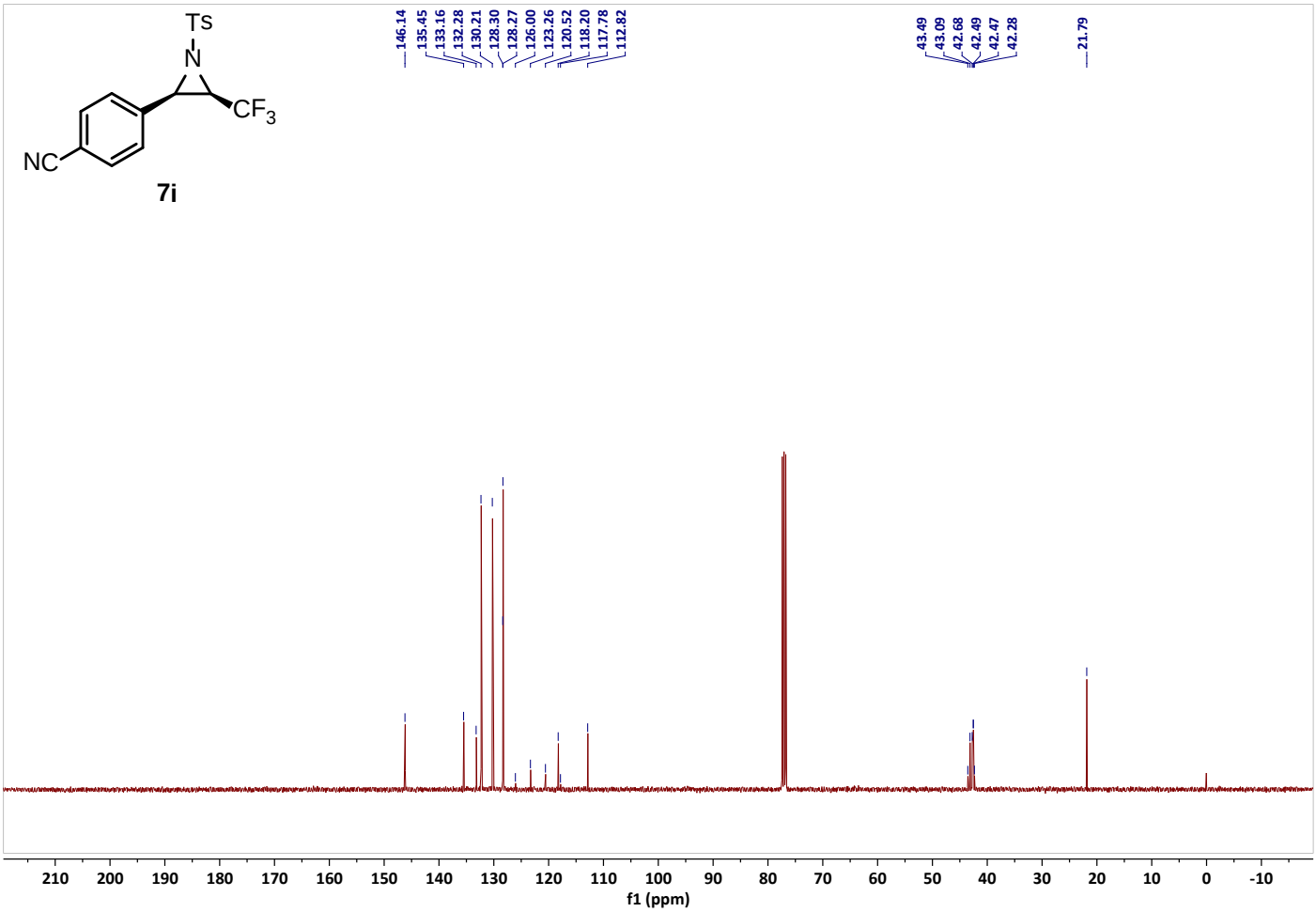

Ts
N
CF3
Br
7h
7.90
7.88
7.42
7.40
7.38
7.36
7.16
7.14
4.12
4.10
3.51
3.50
3.48
3.48
3.47
3.45
2.44
1.94
1.97
1.94
1.97
1.00
1.03
2.99
f1 (ppm)

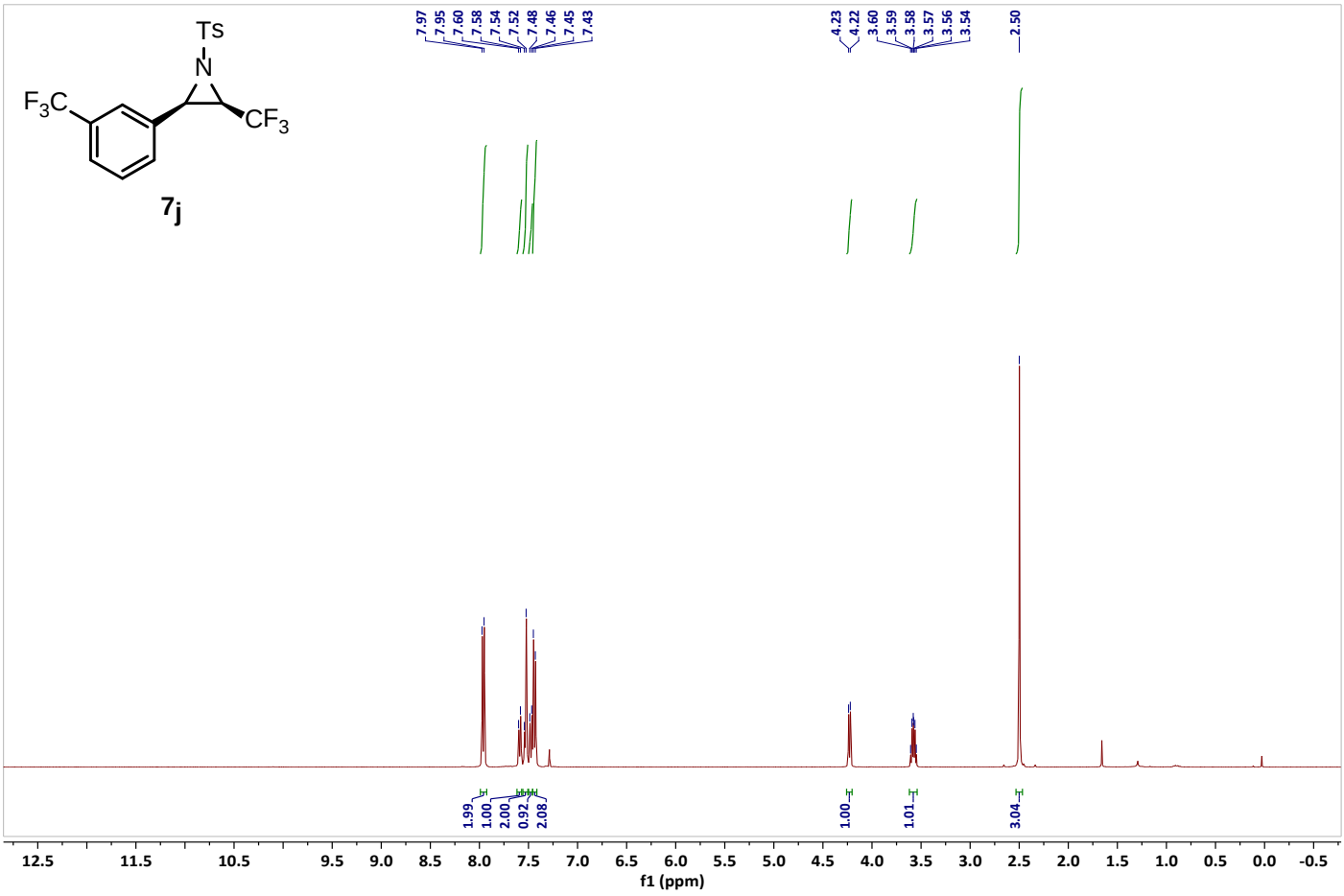

Ts
N
CF3
Br
7h
-65.77
-65.78
3.00
f1 (ppm)

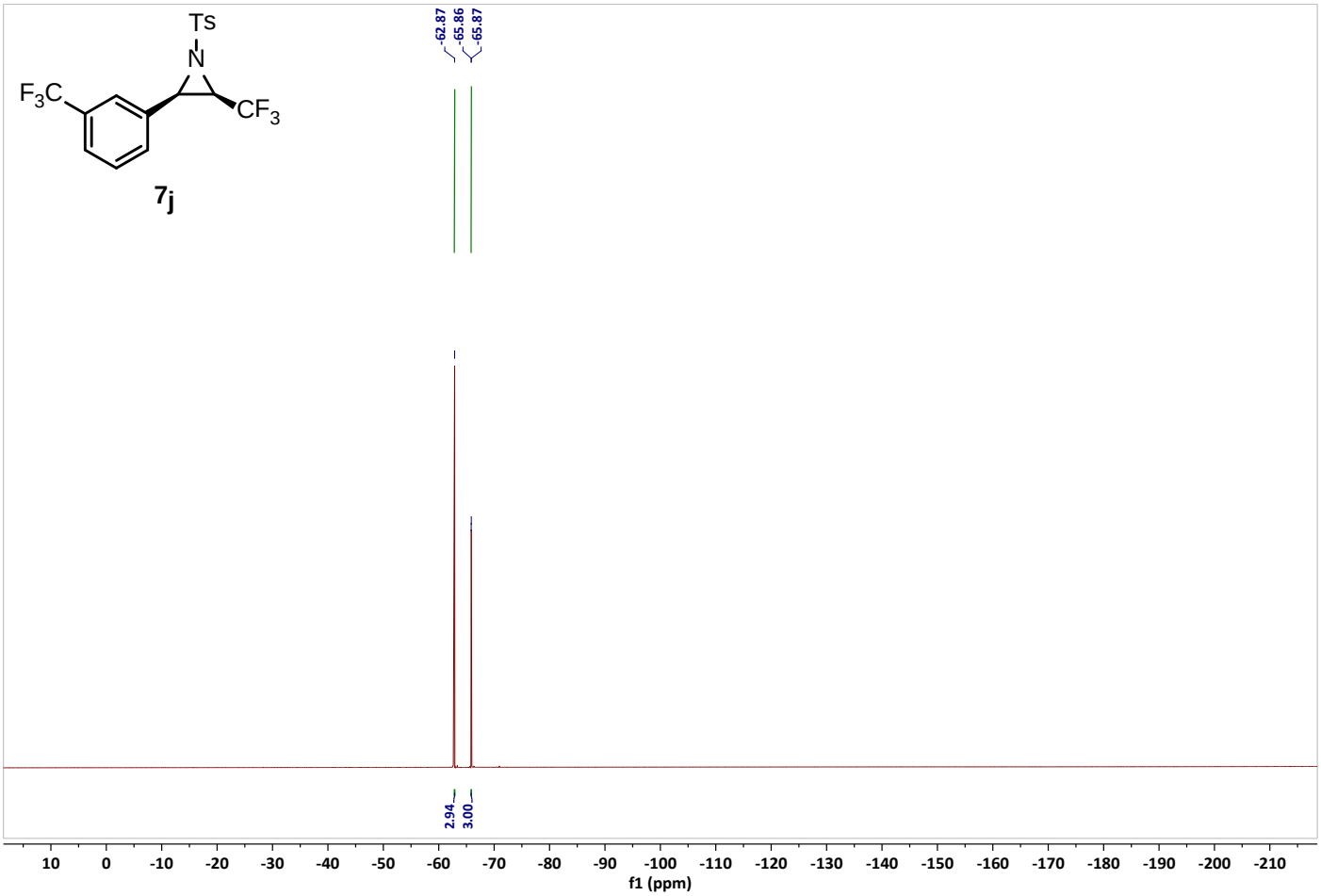

Ts
N
CF3
Br
7h
145.91
133.39
131.66
130.13
129.23
129.07
128.25
126.20
123.46
122.85
120.72
117.99
77.39
77.07
76.75
43.20
42.80
42.40
42.00
21.74
f1 (ppm)

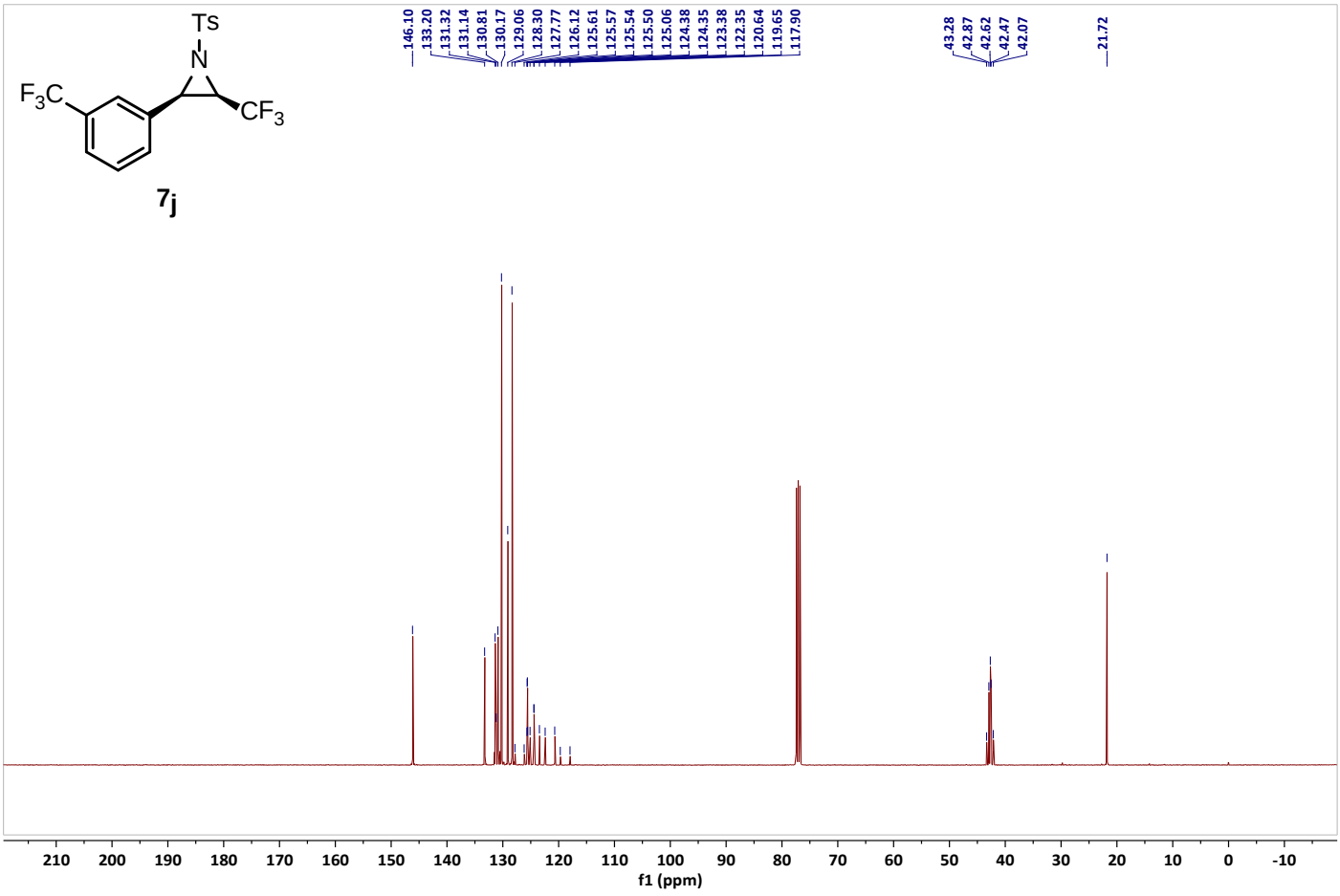

Ts
N
CF3
NC
7i
7.93
7.90
7.63
7.61
7.45
7.43
7.42
7.41
4.22
4.20
3.59
3.57
3.56
3.55
3.54
3.53
2.49
1.98
2.00
3.95
1.00
1.00
2.98
f1 (ppm)

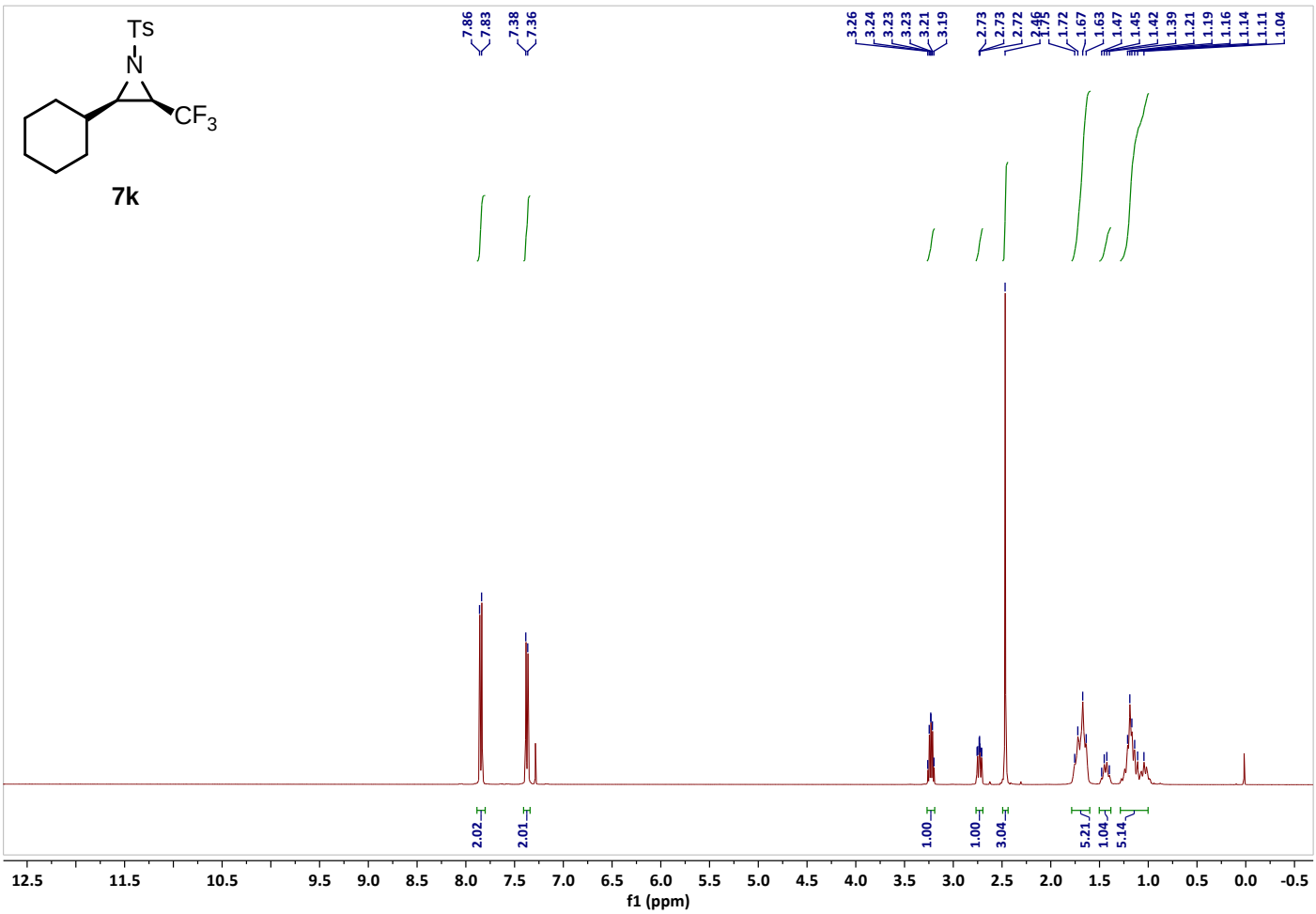

Ts
N
CF3
NC
7i
-65.92
-65.93
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

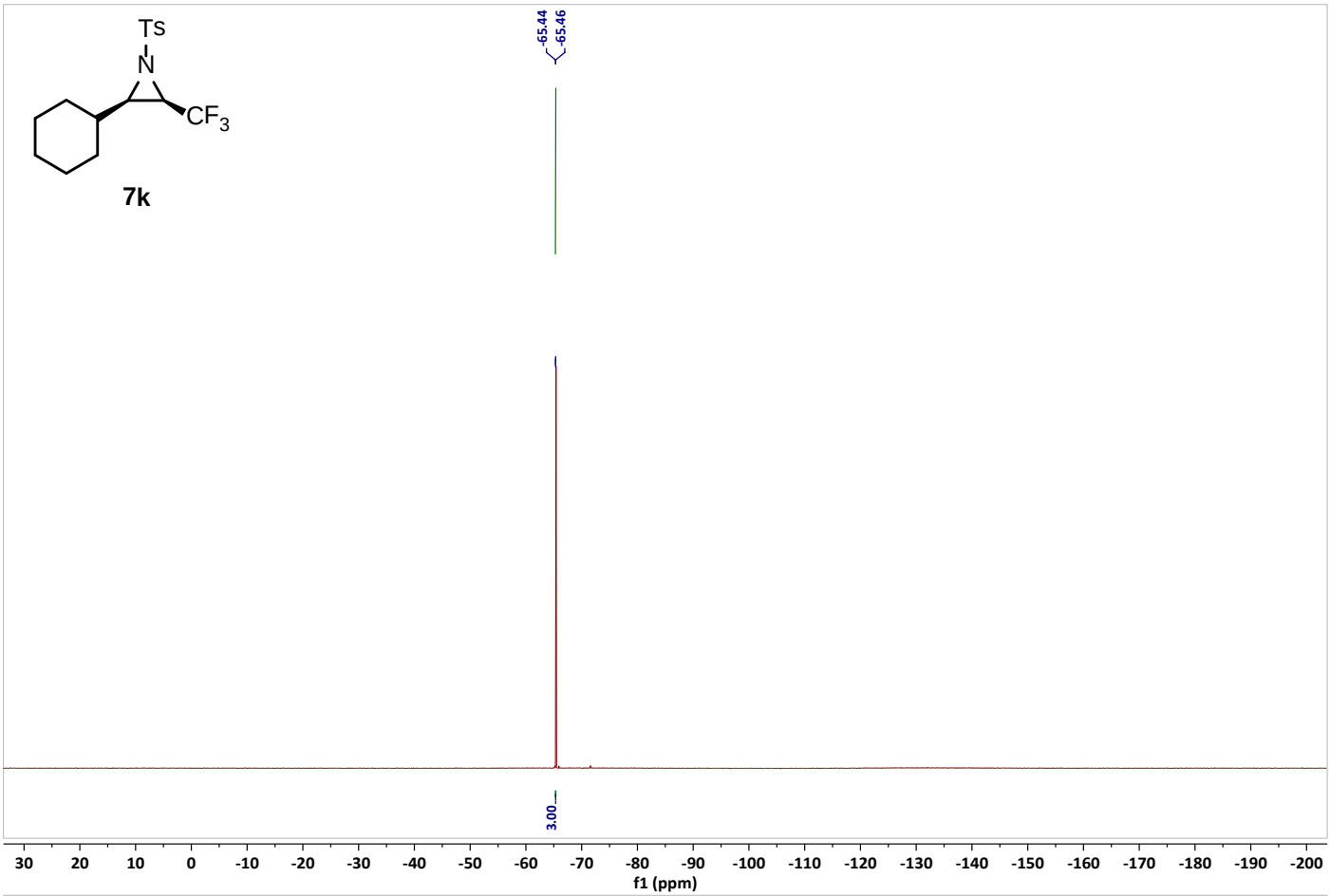

Ts
N
CF3
NC
7i
146.14
135.45
133.16
132.28
130.21
128.30
128.27
126.00
123.26
120.52
118.20
117.78
112.82
43.49
43.09
42.68
42.49
42.47
42.28
21.79
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

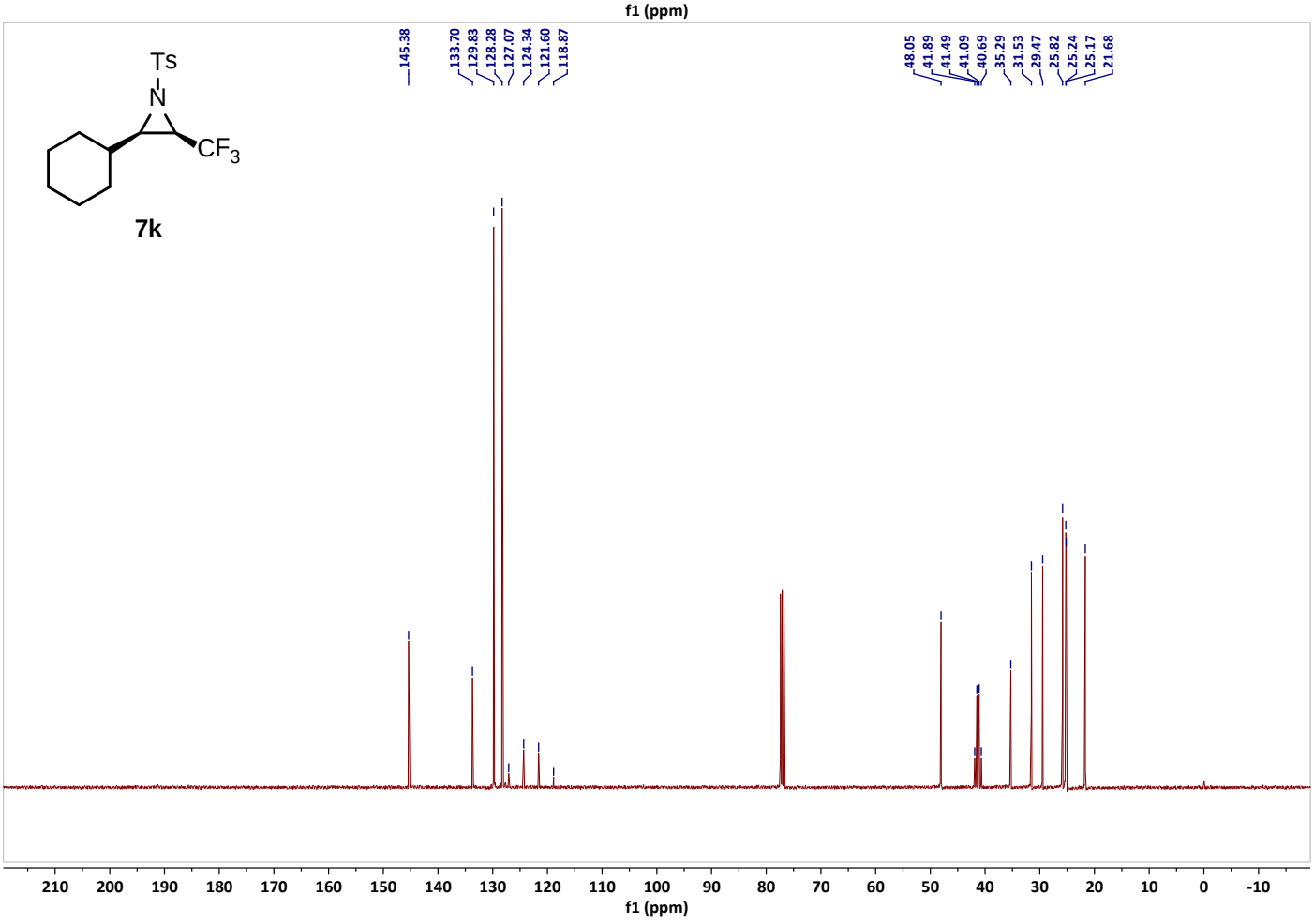

Ts
N
F3C
CF3
7j
7.97
7.95
7.60
7.58
7.54
7.52
7.48
7.46
7.45
7.43
4.23
4.22
3.60
3.59
3.58
3.57
3.56
3.54
2.50
1.99
1.00
2.00
0.92
2.08
1.00
1.01
3.04
f1 (ppm)

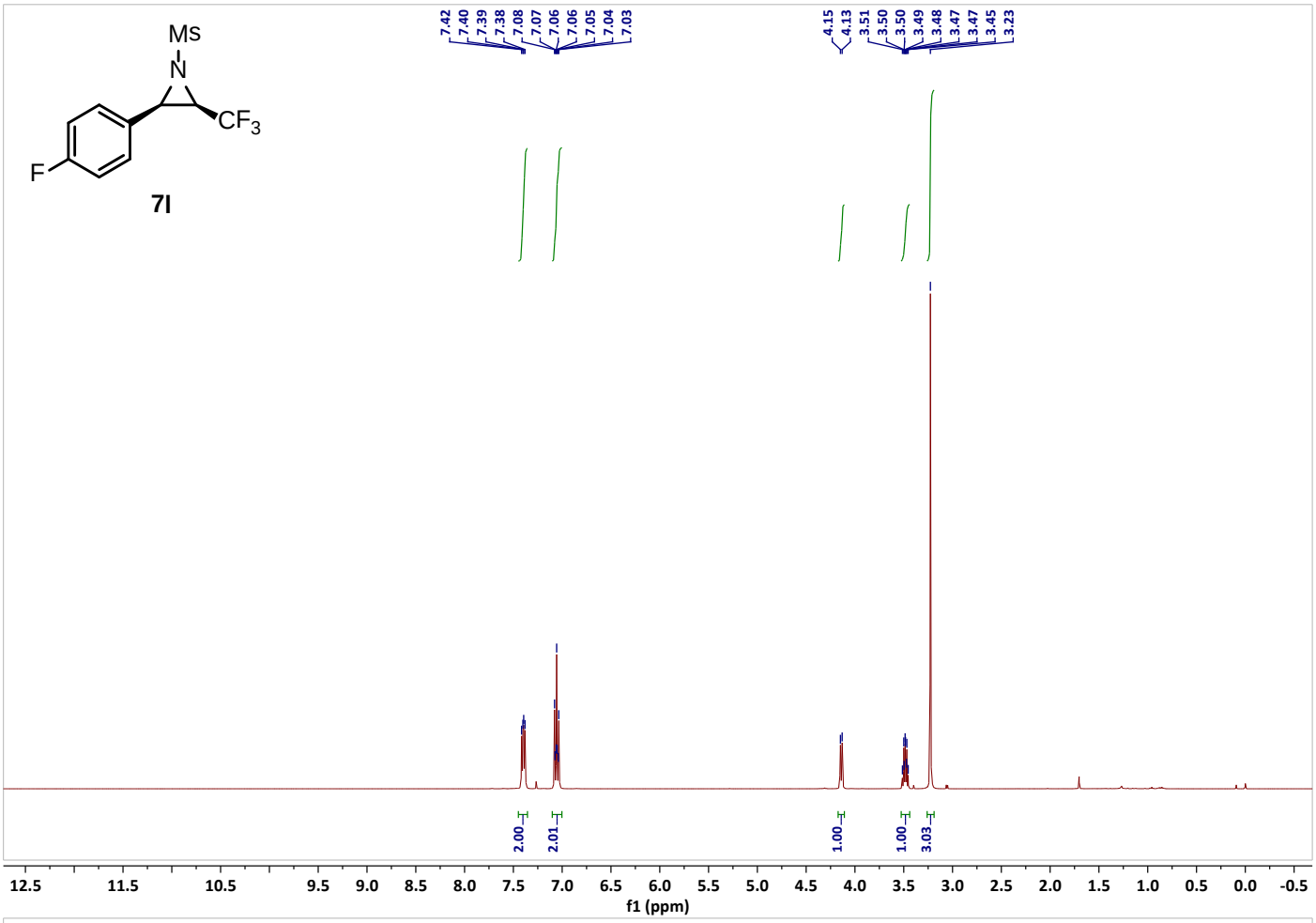

Ts
N
F3C
CF3
7j
-62.87
-65.86
-65.87
2.94
3.00
f1 (ppm)

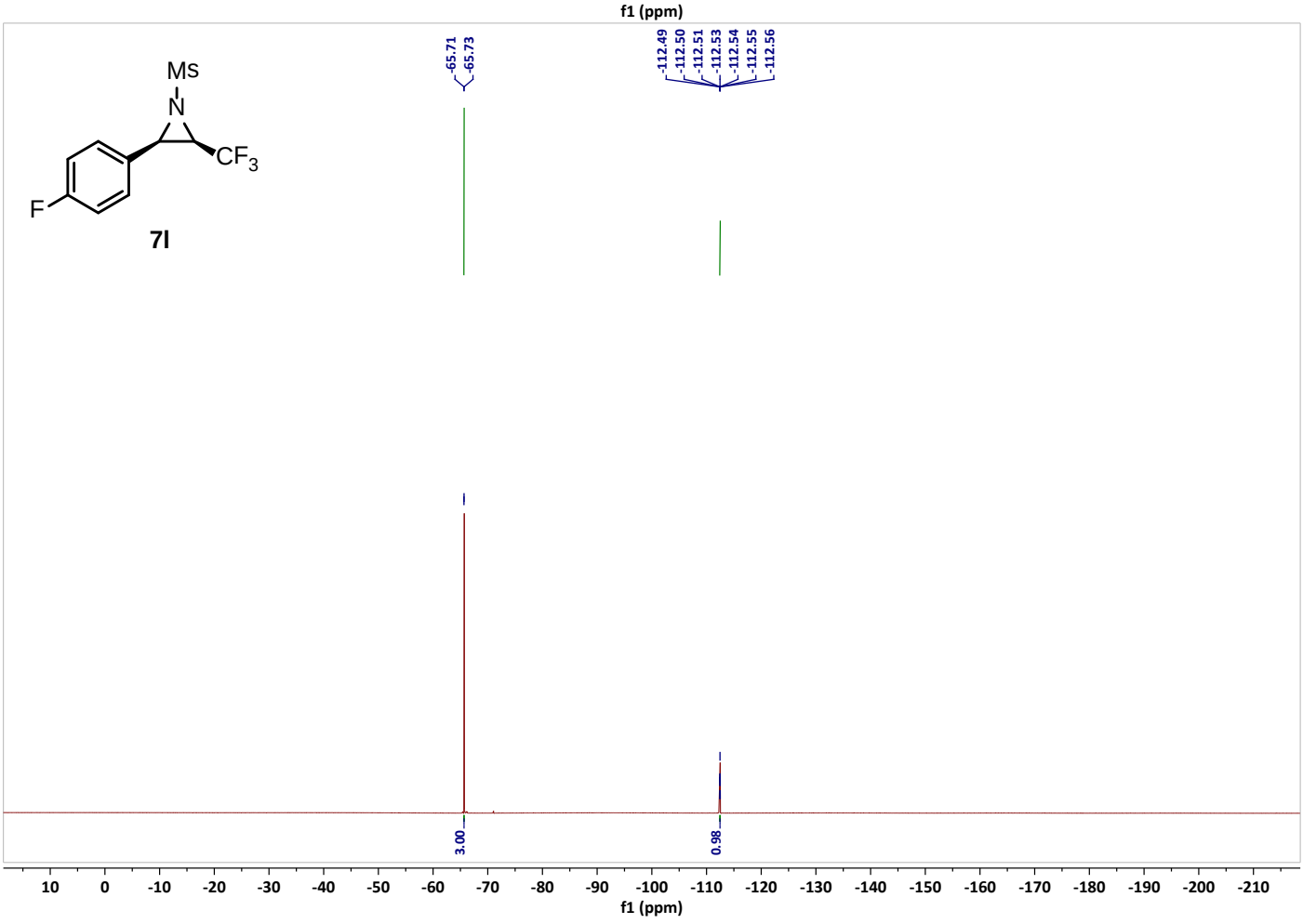

Ts
N
F3C
CF3
7j
146.10
133.20
131.32
131.14
130.81
130.17
129.06
128.30
127.77
126.12
125.61
125.57
125.54
125.50
125.06
124.38
124.35
123.38
122.35
120.64
119.65
117.90
43.28
42.87
42.62
42.47
42.07
21.72
f1 (ppm)

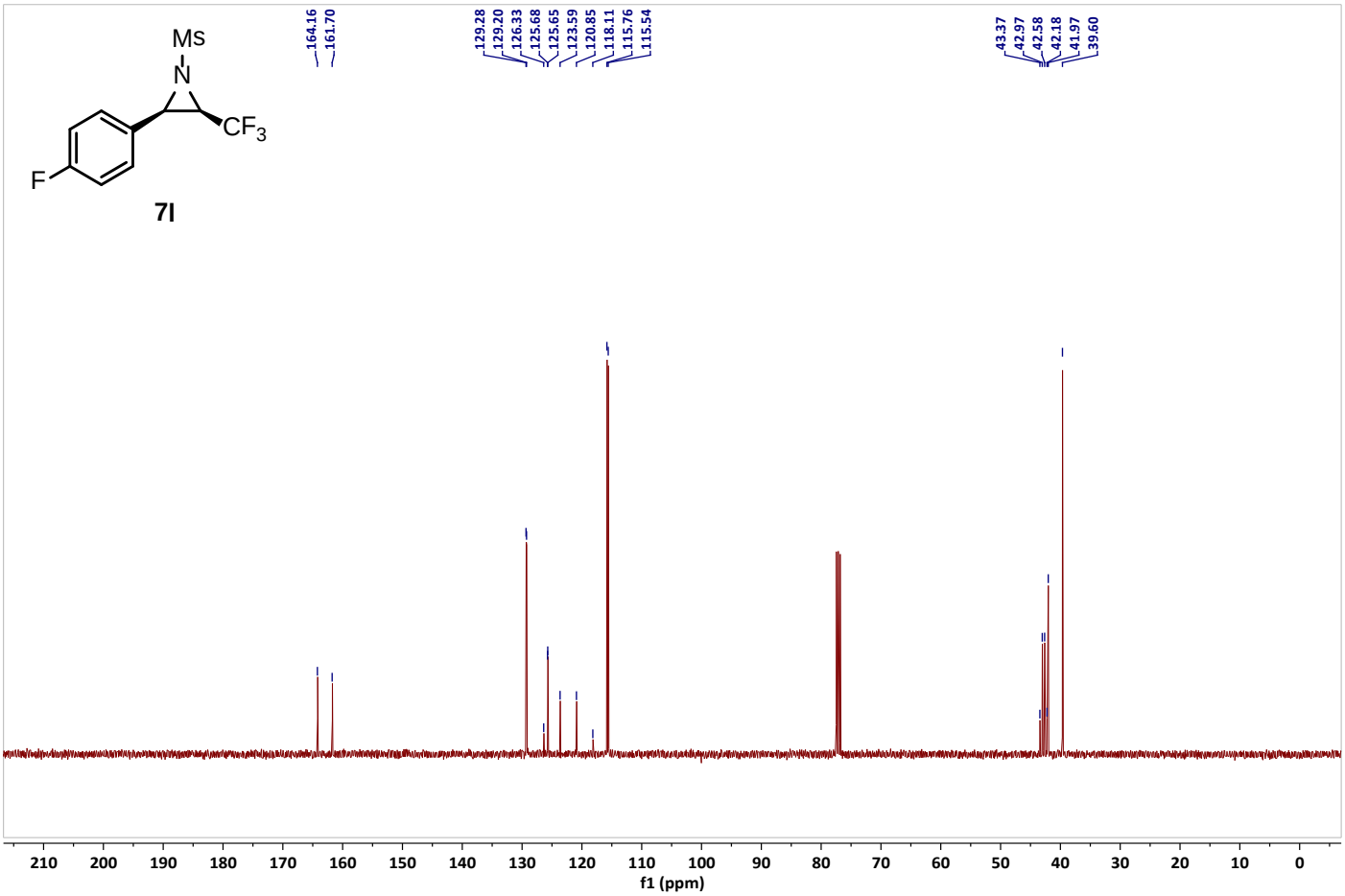

Ts
N
CF3
7k
7.86
7.83
7.38
7.36
3.26
3.24
3.23
3.23
3.21
3.19
2.73
2.73
2.72
1.72
1.67
1.63
1.47
1.45
1.42
1.39
1.21
1.19
1.16
1.14
1.11
1.04
2.02
2.01
1.00
1.00
3.04
5.21
1.04
5.14
f1 (ppm)

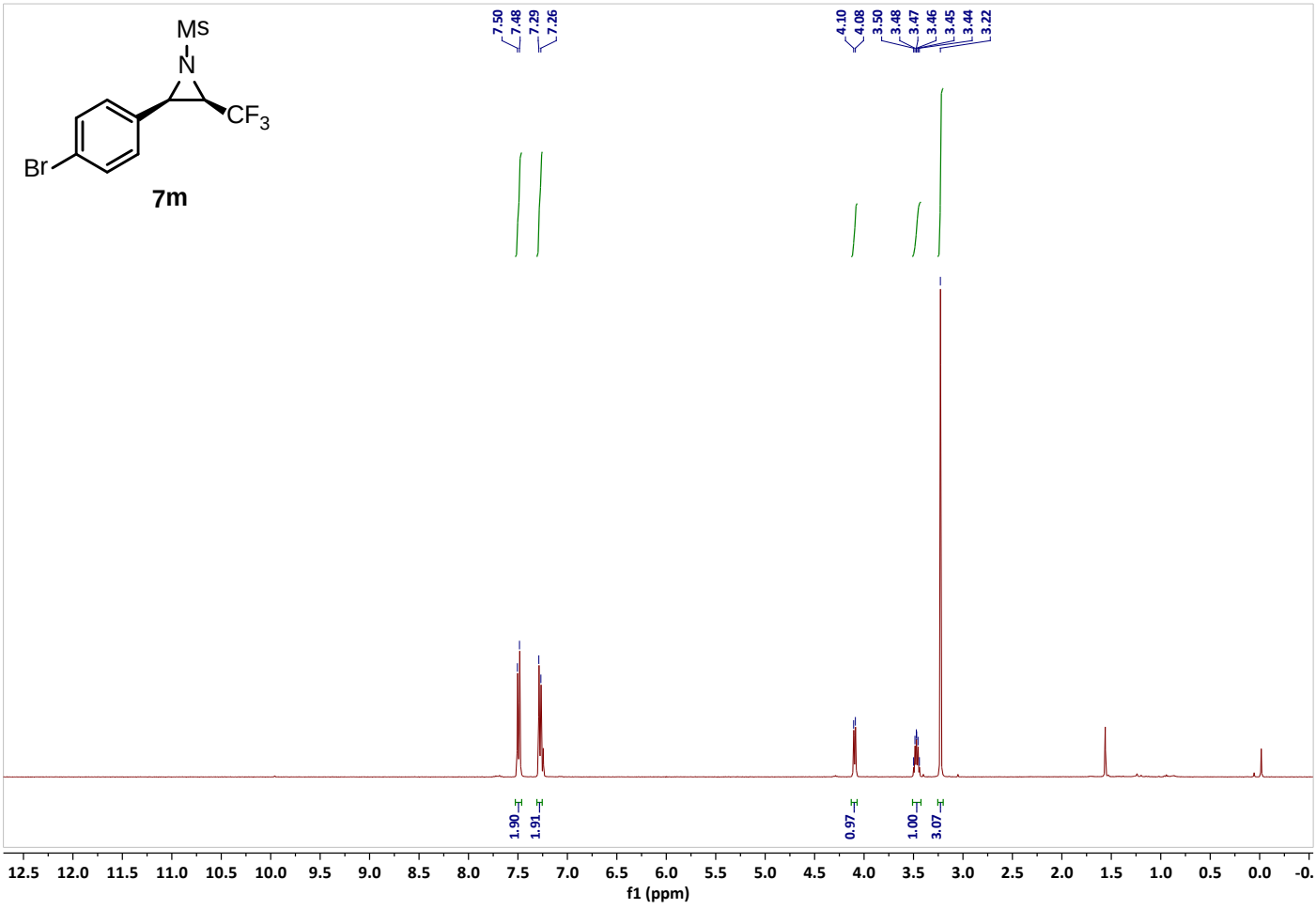

Ts
N
CF3
7k
-65.44
-65.46
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

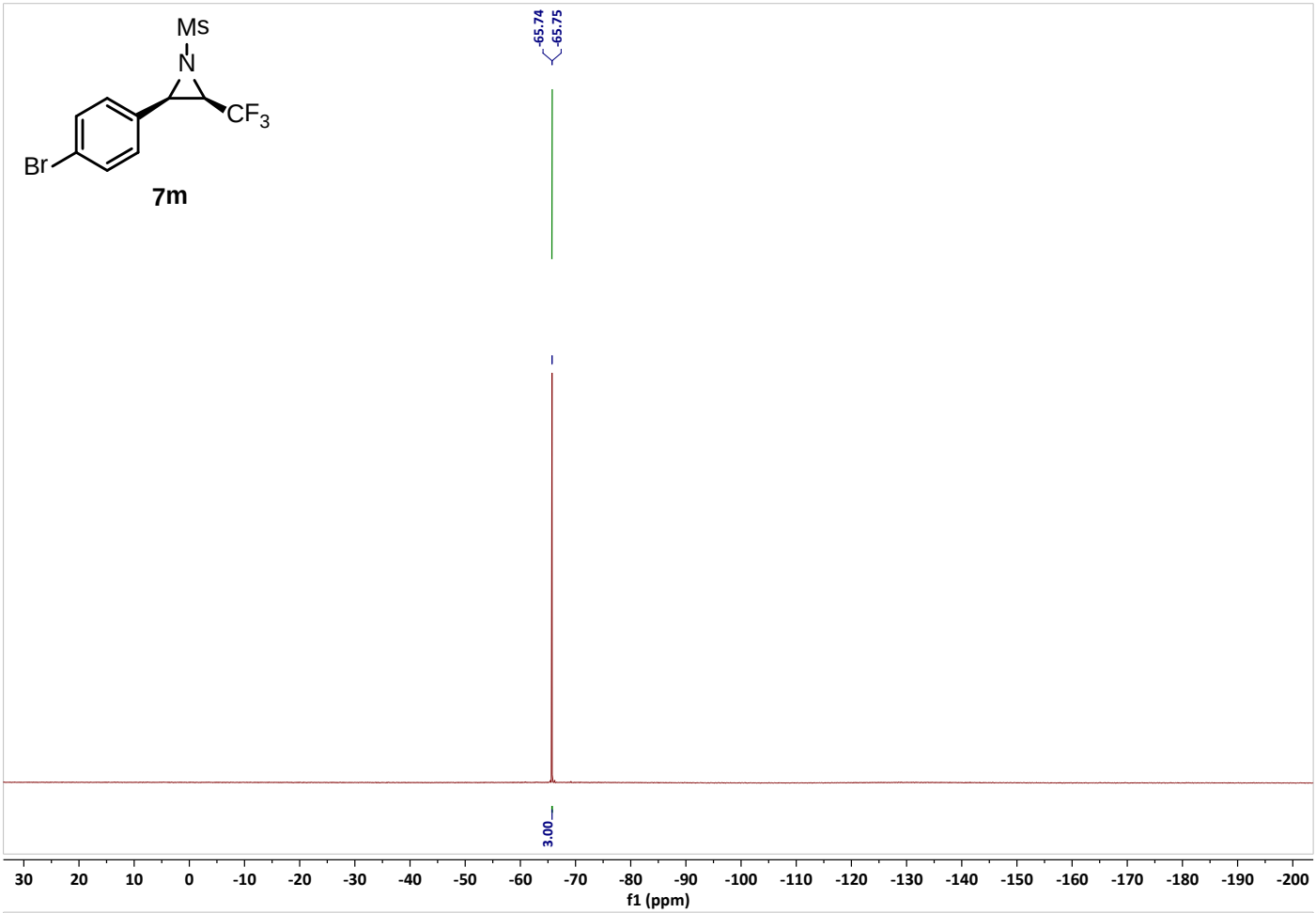

Ts
N
CF3
7k
145.38
133.70
129.83
128.28
127.07
124.34
121.60
118.87
48.05
41.89
41.49
41.09
40.69
35.29
31.53
29.47
25.82
25.24
25.17
21.68
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

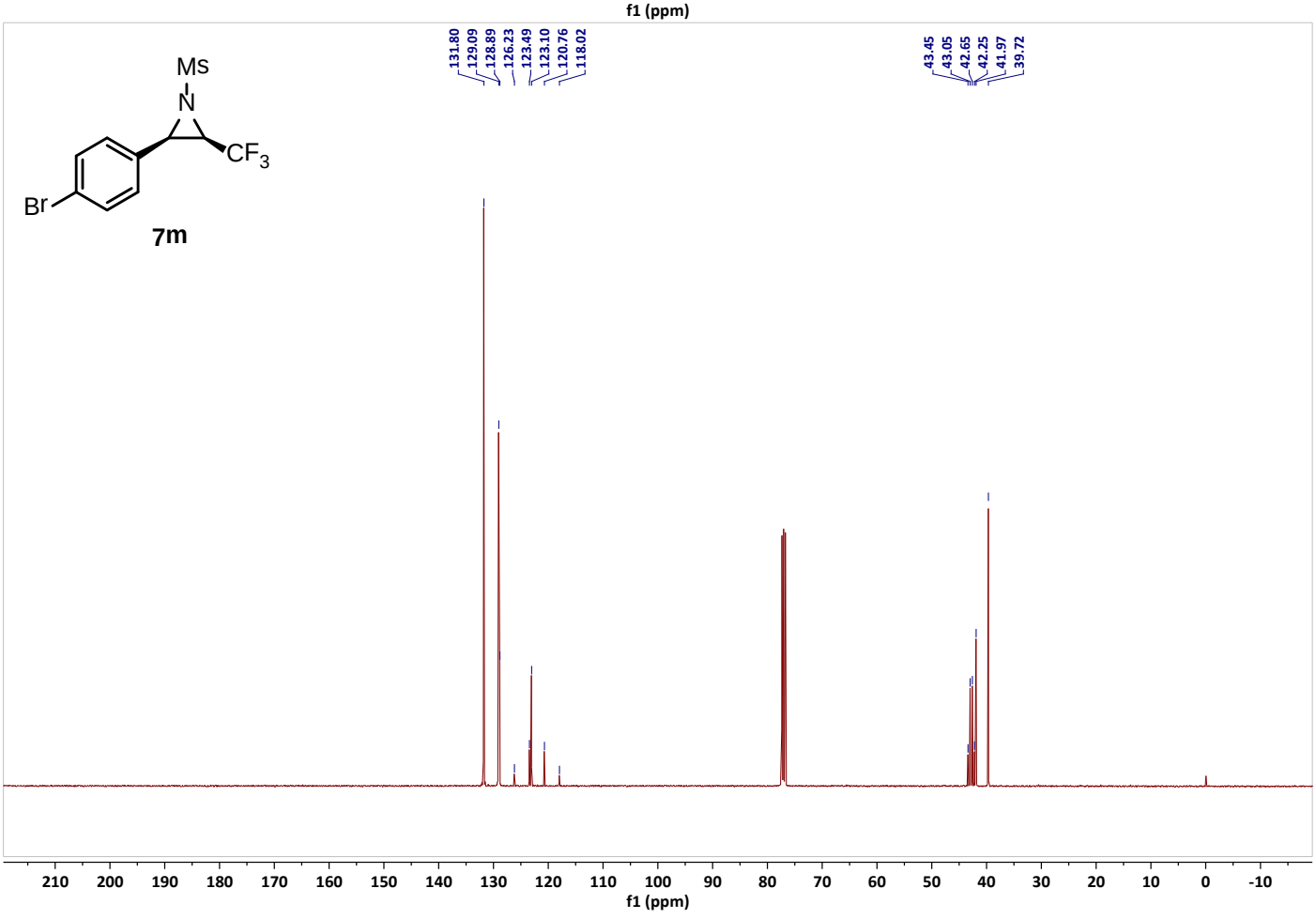

Ms
N
CF3
F
7l
7.42
7.40
7.39
7.38
7.08
7.07
7.06
7.06
7.05
7.04
7.03
4.15
4.13
3.51
3.50
3.50
3.49
3.48
3.47
3.47
3.45
3.23
2.00
2.01
1.00
1.00
3.03
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Ms
N
CF3
F
7l
-65.71
-65.73
-112.49
-112.50
-112.51
-112.53
-112.54
-112.55
-112.56
3.00
0.98
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)


Ms
N
CF3
F
7l
164.16
161.70
129.28
129.20
126.33
125.68
125.65
123.59
120.85
118.11
115.76
115.54
43.37
42.97
42.58
42.18
41.97
39.60
f1 (ppm)


Ms
N
CF3
Br
7m
7.50
7.48
7.29
7.26
4.10
4.08
3.50
3.48
3.47
3.46
3.45
3.44
3.22
1.90
1.91
0.97
1.00
3.07
f1 (ppm)


Ms
N
CF3
Br
7m
-65.74
-65.75
3.00
30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)


Ms
N
CF3
Br
7m
131.80
129.09
128.89
126.23
123.49
123.10
120.76
118.02
43.45
43.05
42.65
42.25
41.97
39.72
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)