

SUPPORTING INFORMATION

for

Interception Of Benzyne With Thioethers: A Facile Access To Sulfur Ylides In Mild

Conditions

Hua-Dong Xu,^{*,†,‡} Mao-Qiang Cai,[†] Wei-Jie He[†] Wen-Hao Hu[†], and Mei-Hua Shen^{*,‡}

huadongxu@gmail.com

[†] Shanghai Engineering Research Centre of Molecular Therapeutics and New Drug Development, East China Normal University, Shanghai, 200062, China; [‡] School of Pharmaceutical Engineering and Life Science, Changzhou University, Changzhou, Jiangsu Province, 213164, China.

General Information.....	2
Preparation of starting materials.....	2
General procedure.....	2-3
References.....	3
Analytical Data for the Products.....	4-18
NMR spectra for the Products.....	19-90
5-fluoro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one(NOESY) :4af.....	91-92
1-methyl-5-nitro-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one(NOESY):4ag.....	93-94
3'-(4-chlorophenyl)-5-fluoro-1-methylspiro[indoline-3,2'-oxiran]-2-one(NOESY):4ff.....	95-96
5-fluoro-1-methyl-3'-vinylspiro[indoline-3,2'-oxiran]-2-one(NOESY):4gf.....	97-98

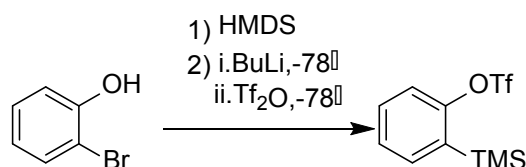
General Information

Unless otherwise stated, all commercial reagents were used without additional purification. CH₃CN was freshly distilled from calcium hydride prior to use. Benzyne precursors *o*-Trialkylsilylaryl triflates and thioethers were prepared according to literature procedures.^{1,2} Isatins were methylated with CH₃I. All reactions were performed under an argon atmosphere in an oven-dried flask. ¹H NMR spectra were recorded on 500 MHz or 400 MHz spectrometer. ¹³C NMR spectra were recorded on 125 MHz or 100 MHz spectrometer. Chemical shifts are reported in ppm with the internal standard tetramethylsilane ($\delta = 0$ ppm) for ¹H NMR and CDCl₃ ($\delta = 77.00$ ppm) for ¹³C NMR. HRMS: (ESI) Mass Spectra were obtained on a IonSpec FT-ICR mass spectrometer.

Preparation of starting materials:

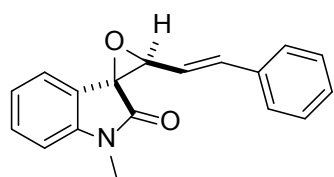
Benzyne precursors *o*-Trialkylsilylaryl triflates and thioethers were prepared according to literature procedures.^{1,2} Isatins were methylated with CH₃I.

Scheme SI 1: Preparation of *o*-Trialkylsilylaryl triflates



General procedure for the on pot synthesis of spiro epoxyoxindole: To a 25 mL flask was introduced *N*-methylisatin (0.25 mmol), thioether (0.38 mmol, 1.5 equiv.), and CsF (0.76 mmol, 3.0 equiv.), The flask was then sealed with a rubber septum, evacuated and backfilled with argon three times. Then anhydrous CH₃CN (10 mL) was syringed. The mixture was stirred vigorously under 40 °C for 5 min before *o*-Trimethylsilylphenyl triflate (1.2 equiv.) was added in one portion, the reaction mixture was stirred at 40°C overnight. Upon the completion of the reaction (monitored by TLC), the volatiles were removed under reduced pressure. Purification by flash column chromatography on silica gel (15% ethyl acetate in petroleum) gave the spiro epoxyoxindole.

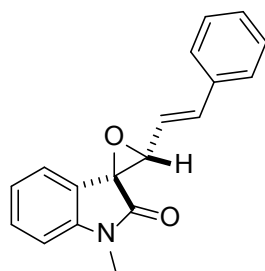
- (1) Peña, D.; Cobas, A.; Pérez, D.; Guitián, E.; *Synthesis*. **2002**, 9, 1454–1458.
- (2) Yu, M.; Xie, Y.; Xie, C.; Zhang, Y. *Org. Lett.* **2012**, 14 (8), 2164–2167.



cis-4aa

1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4aa*):

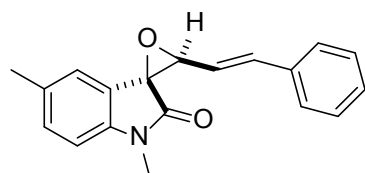
Yellowish solid. mp:138.4-138.8 °C. ¹H NMR (400 MHz, CDCl₃) δ ppm 7.49 (dd, *J* = 8.3, 2.0 Hz, 1H), 7.47 – 7.42 (m, 2H), 7.36 – 7.29 (m, 3H), 7.27 (d, *J* = 2.0 Hz, 2H), 6.92 (d, *J* = 16.2 Hz, 1H), 6.80 (dd, *J* = 19.2, 8.4 Hz, 2H), 4.19 (d, *J* = 8.5 Hz, 1H), 3.25 (s, 3H). ¹³C NMR (100 MHz, CDCl₃) δ ppm 170.5, 143.5, 138.5, 135.7, 132.9, 128.7, 127.0, 125.4, 124.9, 121.2, 115.5, 110.1, 67.4, 61.8, 26.7. HRMS calcd for C₁₈H₁₅NO₂Na [M+Na]⁺ 300.1000, found 300.0990.



trans-4aa

1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4aa*):

Yellowish solid. mp:141.2-143.3 °C. ¹H NMR (400 MHz, CDCl₃) δ ppm 7.50 (dd, *J* = 8.3, 1.9 Hz, 1H), 7.44 – 7.40 (m, 2H), 7.37 (dd, *J* = 7.6, 2.2 Hz, 3H), 7.35 – 7.27 (m, 2H), 7.00 (d, *J* = 16.0 Hz, 1H), 6.79 (d, *J* = 8.3 Hz, 1H), 6.21 (dd, *J* = 16.0, 7.5 Hz, 1H), 4.30 (d, *J* = 7.5 Hz, 1H), 3.26 (s, 3H). ¹³C NMR (100 MHz, CDCl₃) δ ppm 171.3, 144.3, 138.6, 135.4, 132.9, 128.9, 128.8, 127.1, 126.8, 123.5, 120.4, 115.4, 110.3, 65.8, 62.0, 26.8. HRMS: calcd for C₁₈H₁₅NO₂Na [M+Na]⁺: 300.0995, found 300.1019.

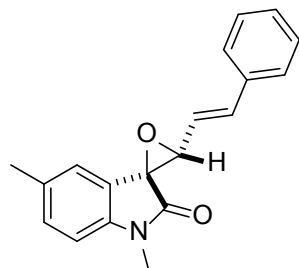


cis-4ab

1,5-dimethyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ab*):

Yellowish semisolid. ¹H NMR (400 MHz, CDCl₃): δ ppm 7.46 (d, *J* = 7.2 Hz, 2H),

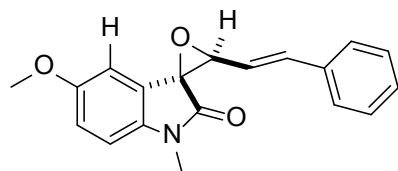
7.34-7.26 (m, 3H), 7.17 (d, $J = 8.0$ Hz, 1H), 6.98 (s, 1H), 6.92-6.82 (m, 2H), 6.79 (d, $J = 8.0$ Hz, 1H), 4.18 (dd, $J = 6.8, 1.2$ Hz, 1H), 3.24 (s, 3H), 2.35 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.1, 142.2, 137.9, 135.9, 132.5, 130.4, 128.6, 128.5, 126.9, 123.3, 122.4, 121.9, 108.5, 67.1, 62.3, 26.6, 21.0. HRMS: calcd for $\text{C}_{19}\text{H}_{17}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 314.1151, found 314.1145.



trans-4ab

1,5-dimethyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ab*):

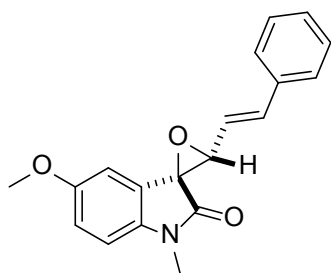
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.42-7.40 (m, 2H), 7.37-7.29 (m, 3H), 7.18 (d, $J = 7.6$ Hz, 1H), 7.07 (s, 1H), 7.00 (d, $J = 16$ Hz, 1H), 6.82 (d, $J = 8.0$ Hz, 1H), 6.31 (dd, $J = 16.0, 7.6$ Hz, 1H), 4.29 (d, $J = 7.6$ Hz, 1H), 3.26 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.8, 143.0, 138.0, 135.7, 132.3, 130.4, 128.8, 128.7, 126.7, 124.8, 121.4, 121.3, 108.7, 65.5, 62.4, 26.7, 21.2. HRMS: calcd for $\text{C}_{19}\text{H}_{17}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 314.1151, found 314.1153.



cis-4ac

5-methoxy-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ac*):

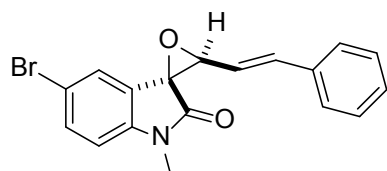
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.46 (d, $J = 7.2$ Hz, 2H), 7.32 (dd, $J = 14.9, 7.4$ Hz, 4H), 6.89 (d, $J = 2.7$ Hz, 2H), 6.87 – 6.75 (m, 2H), 4.17 (d, $J = 7.6$ Hz, 1H), 3.81 (s, 3H), 3.25 (d, $J = 4.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 170.9, 156.4, 138.1, 137.9, 135.8, 128.6, 128.5, 127.0, 124.3, 121.7, 114.9, 109.3, 108.6, 67.3, 62.4, 55.9, 26.7. HRMS: calcd for $\text{C}_{19}\text{H}_{17}\text{NO}_3\text{Na}$ $[\text{M}+\text{Na}]^+$: 330.1106, found 330.1101.



trans-4ac

5-methoxy-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ac*):

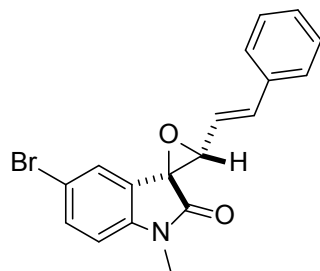
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.41 (d, $J = 7.7$ Hz, 2H), 7.37 – 7.28 (m, 3H), 6.99 (d, $J = 15.9$ Hz, 1H), 6.89 (d, $J = 11.1$ Hz, 2H), 6.82 (d, $J = 8.3$ Hz, 1H), 6.40 – 6.10 (m, 1H), 4.30 (d, $J = 7.3$ Hz, 1H), 3.76 (s, 3H), 3.33 – 3.18 (m, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 171.5, 155.9, 138.7, 137.9, 135.6, 128.8, 128.7, 126.7, 122.6, 120.9, 114.4, 111.6, 109.3, 65.4, 62.5, 55.9, 26.8. HRMS: calcd for $\text{C}_{19}\text{H}_{17}\text{NO}_3\text{Na}$ $[\text{M}+\text{Na}]^+$: 330.1106, found 330.1107.



cis-4ad

5-bromo-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ad*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.72 (s, 1H), 7.58 – 7.41 (m, 4H), 7.33 (s, 2H), 6.92 (d, $J = 16.1$ Hz, 1H), 6.80 (dd, $J = 17.0, 8.1$ Hz, 2H), 4.37 (d, $J = 5.8$ Hz, 1H), 3.25 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 170.4, 150.1, 143.5, 138.5, 135.7, 135.6, 132.9, 132.1, 128.7, 127.0, 121.2, 116.2, 115.5, 110.1, 67.4, 62.7, 61.6, 26.7. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 378.0100; found 378.0103.

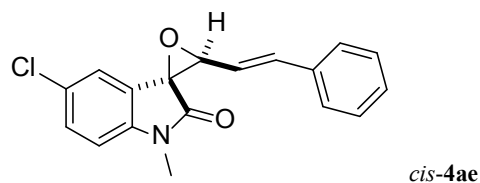


trans-4ad

5-bromo-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ad*):

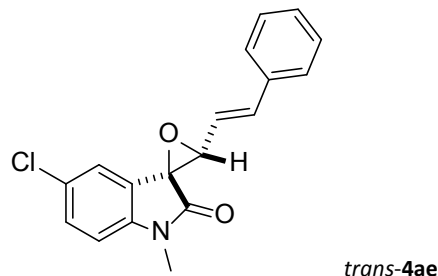
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.51 (d, $J = 8.0$ Hz, 1H),

7.42 (d, $J = 6.5$ Hz, 2H), 7.36 (s, 4H), 7.00 (d, $J = 15.9$ Hz, 1H), 6.80 (d, $J = 8.2$ Hz, 1H), 6.21 (dd, $J = 15.9, 7.1$ Hz, 1H), 4.30 (d, $J = 6.8$ Hz, 1H), 3.27 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 171.3, 144.3, 138.6, 135.4, 132.9, 128.9, 128.8, 127.1, 126.8, 123.5, 120.4, 115.4, 110.3, 65.8, 61.9, 53.2, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 378.0106, found 378.0119.



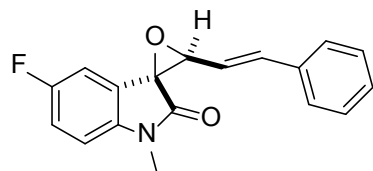
5-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ae*):

Yellowish solid. mp:118.4-119.2 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.38 (d, $J = 7.2$ Hz, 2H), 7.27-7.18 (m, 4H), 7.05 (s, 1H), 6.86 (d, $J = 16.0$ Hz, 1H), 6.76 (dd, $J = 14.8, 7.2$ Hz, 2H), 4.12 (d, 8.4 Hz, 1H), 3.17 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 170.6, 143.0, 138.5, 135.7, 130.0, 128.7, 128.4, 127.0, 125.1, 122.2, 121.2, 109.7, 67.4, 61.9, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 334.0605, found 334.0608.



5-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ae*):

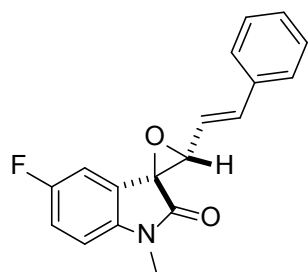
Yellowish solid. mp:123.1-123.8 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.42-7.40 (m, 2H), 7.37-7.30 (m, 3H), 7.17 (d, $J = 7.6$ Hz, 1H), 7.07 (dd, $J = 1.6, 8.0$ Hz, 1H), 7.01 (d, $J = 15.6$ Hz, 1H), 6.93 (d, $J = 1.6$ Hz, 1H), 6.26 (dd, $J = 15.6, 7.2$ Hz, 1H), 4.31 (dd, $J = 7.2, 0.4$ Hz, 1H), 3.27 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.4, 143.8, 138.6, 135.4, 130.0, 128.9, 128.8, 128.2, 126.8, 124.3, 120.4, 109.8, 65.8, 62.1, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 334.0605, found 334.0622.



cis-4af

5-fluoro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4af*):

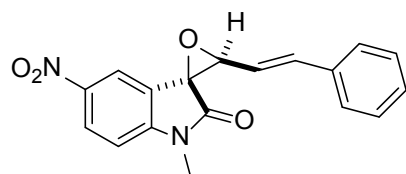
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.37 (d, $J = 7.3$ Hz, 2H), 7.25 – 7.16 (m, 3H), 6.99 (t, $J = 8.8$ Hz, 1H), 6.89 – 6.79 (m, 2H), 6.75 (dd, $J = 15.2$, 8.8 Hz, 2H), 4.09 (d, $J = 8.2$ Hz, 1H), 3.17 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 170.7, 160.5, 158.1, 140.4, 138.4, 135.7, 128.6, 126.9, 125.0 (d, $J = 8.4$ Hz), 121.2, 116.4 (d, $J = 23.6$ Hz), 109.6 (dd, $J = 49.7$, 16.8 Hz), 67.3, 62.1, 26.7. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 318.0901, found 318.0902.



trans-4af

5-fluoro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4af*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ ppm 7.42 (d, $J = 7.6$ Hz, 2H), 7.39 – 7.27 (m, 3H), 7.08 (t, $J = 8.8$ Hz, 1H), 7.04 – 6.95 (m, 2H), 6.84 (dd, $J = 8.4$, 3.9 Hz, 1H), 6.22 (dd, $J = 15.9$, 7.3 Hz, 1H), 4.31 (d, $J = 7.3$ Hz, 1H), 3.27 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 171.7, 160.3, 157.9, 141.4, 138.5, 135.5, 129.0, 129.0, 126.9, 123.2 (d, $J = 8.5$ Hz), 120.6, 116.6 (d, $J = 23.7$ Hz), 112.4, 112.2, 109.6 (d, $J = 8.1$ Hz), 65.8, 62.4, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{NO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 318.0901, found 318.0908.

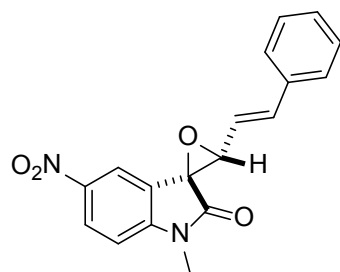


cis-4ag

1-methyl-5-nitro-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ag*):

Yellowish solid. mp: 147.3–148.0 °C. ^1H NMR (400 MHz, CDCl_3) δ ppm 8.33 (d, $J = 8.6$ Hz, 1H), 8.04 (s, 1H), 7.45 (d, $J = 7.2$ Hz, 2H), 7.37 – 7.28 (m, 3H), 7.02 – 6.92

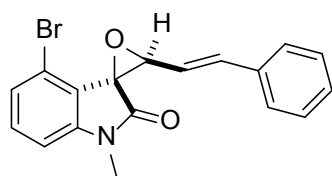
(m, 2H), 6.76 (dd, $J = 16.1, 8.7$ Hz, 1H), 4.32 (d, $J = 8.6$ Hz, 1H), 3.33 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ ppm 171.2, 149.7, 143.6, 139.2, 135.5, 128.9, 128.7, 127.0, 124.4, 120.4, 117.6, 108.4, 67.7, 61.5, 29.7, 27.1. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{N}_2\text{O}_4\text{Na}$ $[\text{M}+\text{Na}]^+$: 345.0846, found 345.0843.



trans-4ag

1-methyl-5-nitro-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ag*):

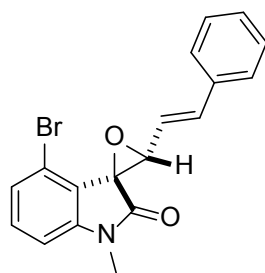
Yellowish semisolid. ^1H NMR (400 MHz, DMSO): δ ppm 8.38 (d, $J = 8.8$ Hz, 1H), 8.24 (s, 1H), 7.58 (d, $J = 7.6$ Hz, 2H), 7.40-7.32 (m, 4H), 7.17 (d, $J = 16$ Hz, 1H), 6.62 (dd, $J = 15.6, 6.8$ Hz, 1H), 4.37 (d, $J = 7.2$ Hz, 1H), 3.28 (s, 3H). ^{13}C NMR (100 MHz, DMSO): δ ppm 171.3, 151.2, 142.7, 138.0, 135.3, 128.7, 128.6, 127.1, 126.9, 121.9, 121.0, 119.0, 109.7, 65.7, 61.4, 27.0. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{N}_2\text{O}_4\text{Na}$ $[\text{M}+\text{Na}]^+$: 345.0846, found 345.0845.



cis-4ah

4-bromo-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ah*):

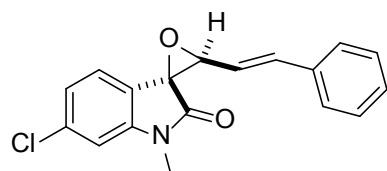
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.47-7.45 (m, 2H), 7.34-7.27 (m, 3H), 7.22-7.17 (m, 2H), 6.98-6.86 (m, 2H), 6.84 (dd, $J = 6.4, 2.4$ Hz, 1H), 5.00 (d, $J = 8.0$ Hz, 1H), 3.24 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 169.5, 145.4, 137.5, 134.9, 130.1, 127.6, 127.5, 126.3, 125.9, 120.1, 119.7, 116.6, 106.7, 62.2, 61.0, 25.7. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 378.0100, found 378.0100.



trans-4ah

4-bromo-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ah*):

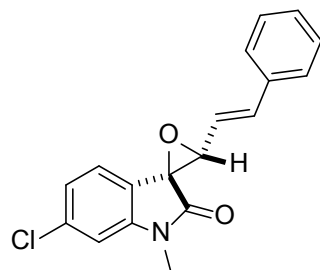
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.41-7.39 (m, 2H), 7.35-7.28 (m, 3H), 7.25-7.20 (m, 2H), 7.08 (dd, $J = 16, 8.8$ Hz, 1H), 6.92-6.86 (m, 2H), 4.22 (d, $J = 9.2$ Hz, 1H), 3.26 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.8, 146.9, 139.0, 135.6, 131.1, 128.7, 128.2, 126.7, 122.8, 120.4, 117.9, 108.0, 69.2, 64.6, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{BrNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 378.0100, found 378.0097.



cis-4ai

6-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ai*):

Yellowish solid. mp:140.7-141.2 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.39 (d, $J = 7.2$ Hz, 2H), 7.27-7.20 (m, 3H), 7.00 (s, 2H), 6.86-6.82 (m, 2H), 6.77 (dd, $J = 16.4, 8.4$ Hz, 1H), 4.12 (d, $J = 8.4$ Hz, 1H), 3.17 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.2, 145.7, 138.3, 136.0, 135.5, 128.6, 126.9, 122.6, 122.5, 121.6, 121.2, 109.5, 67.2, 62.0, 26.7. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 334.0605, found 334.0602.

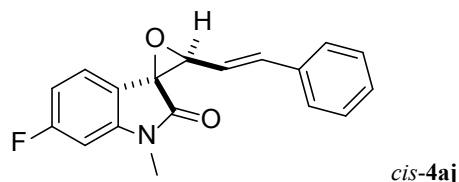


trans-4ai

6-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ai*):

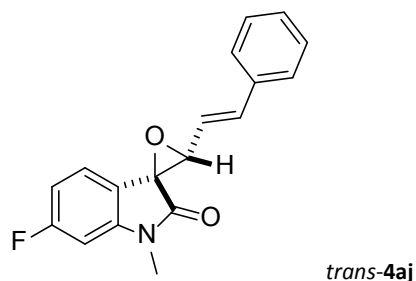
Yellowish solid. mp:138.8-139.6 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.42 (d, $J = 7.2$ Hz, 2H), 7.37-7.31 (m, 3H), 7.17 (d, $J = 8.0$ Hz, 1H), 7.07 (dd, $J = 8.0, 1.6$ Hz, 1H),

7.01 (d, $J = 15.6$ Hz, 1H), 6.93 (d, $J = 1.6$ Hz, 1H), 6.26 (dd, $J = 16.0, 7.2$ Hz, 1H), 4.31 (d, $J = 7.2$ Hz, 1H), 3.27 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 172.0, 146.6, 138.2, 136.4, 135.6, 129.0, 128.9, 126.9, 124.9, 122.7, 120.8, 109.9, 65.6, 62.2, 26.9. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{ClNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 334.0605, found 334.0615.



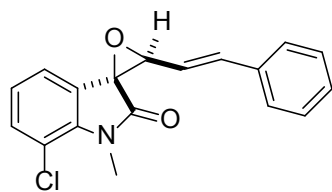
6-fluoro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4aj*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.39 (d, $J = 6.4$ Hz, 2H), 7.28-7.19 (m, 3H), 7.03 (d, $J = 4.0$ Hz, 1H), 6.86 (d, $J = 16.4$ Hz, 1H), 6.72-6.68 (m, 2H), 6.59 (d, $J = 8.8$ Hz, 1H), 4.12 (d, $J = 8.0$ Hz, 1H), 3.18 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ ppm ^{13}C NMR (100 MHz, CDCl_3) δ 171.4, 165.6, 163.2, 146.1, 138.3, 135.8, 130.9, 128.7, 126.9, 123.0 (d, $J = 10.1$ Hz), 121.4, 109.0 (d, $J = 22.7$ Hz), 97.8 (d, $J = 27.8$ Hz), 67.1, 61.9, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 318.0901; found 318.0917.



6-fluoro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4aj*):

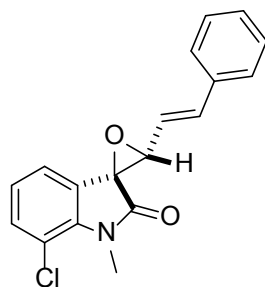
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.35 (d, $J = 6.4$ Hz, 2H), 7.30-7.24 (m, 3H), 7.14 (dd, $J = 7.2, 4.0$ Hz, 1H), 6.94 (d, $J = 16.0$ Hz, 1H), 6.70 (t, $J = 8.4$ Hz, 1H), 6.61 (d, $J = 8.4$ Hz, 1H), 6.20 (dd, $J = 16.0, 6.8$ Hz), 4.23 (d, $J = 6.8$ Hz, 1H), 3.19 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ ppm 172.2, 165.6, 163.2, 147.0, 138.0, 135.5, 128.8, 126.8, 125.3 (d, $J = 10.0$ Hz), 120.8, 116.7, 109.0 (d, $J = 22.7$ Hz), 98.0 (d, $J = 27.8$ Hz), 65.3, 62.0, 26.8. HRMS: calcd for $\text{C}_{18}\text{H}_{14}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 318.0901, found 318.0921.



cis-4ak

7-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4ak*):

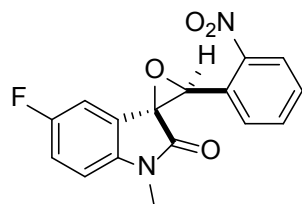
Yellowish solid. mp:146.0-148.0 °C. ¹H NMR (400 MHz, CDCl₃): δ ppm 7.46-7.44 (d, *J* = 8.0 Hz, 2H), 7.35-7.30 (m, 3H), 7.28 (d, *J* = 8.4 Hz, 1H), 7.04-6.98 (m, 2H), 6.93 (d, *J* = 16 Hz, 1H), 6.83 (dd, *J* = 16.4, 8.4 Hz, 1H), 4.16 (d, *J* = 8.4 Hz, 1H), 3.63 (s, 3H). ¹³C NMR (100 MHz, CDCl₃): δ ppm 171.3, 140.2, 138.5, 135.7, 132.4, 128.7, 127.0, 126.2, 123.6, 121.2, 120.0, 116.3, 67.8, 61.7, 29.9. HRMS: calcd for C₁₈H₁₄ClNO₂Na [M+Na]⁺ : 334.0605, found 334.0607.



trans-4ak

7-chloro-1-methyl-3'-((E)-styryl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4ak*):

Yellowish semisolid. ¹H NMR (400 MHz, CDCl₃): δ ppm 7.40 (d, *J* = 6.8 Hz, 2H), 7.36-7.28 (m, 4H), 7.14 (d, *J* = 7.2 Hz, 1H), 7.00-6.96 (m, 2H), 6.26 (dd, *J* = 16.0, 7.6 Hz, 1H), 4.31 (d, *J* = 7.2 Hz, 1H), 3.64 (s, 3H). ¹³C NMR (100 MHz, CDCl₃): δ ppm 172.2, 141.0, 138.4, 135.5, 132.4, 128.8, 126.8, 124.3, 123.4, 122.4, 120.4, 116.5, 66.2, 61.8, 30.2. HRMS: calcd for C₁₈H₁₄ClNO₂Na [M+Na]⁺ : 334.0605, found 334.0615.

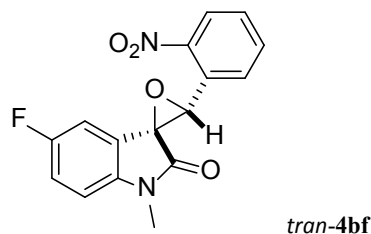


cis-4bf

5-fluoro-1-methyl-3'-(2-nitrophenyl)spiro[indoline-3,2'-oxiran]-2-one (*cis-4bf*):

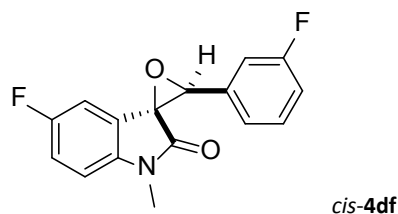
Yellowish semisolid. ¹H NMR (400 MHz, CDCl₃) δ 8.23 (d, *J* = 4.6 Hz, 1H), 8.00 (s, 1H), 7.79 (t, *J* = 7.6 Hz, 1H), 7.56 (t, *J* = 7.8 Hz, 1H), 7.12 (dd, *J* = 12.2, 5.4 Hz, 1H),

7.07 – 7.01 (m, 1H), 6.83 (dd, $J = 8.4, 3.8$ Hz, 1H), 5.06 (s, 1H), 3.11 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): ppm 169.4, 160.6, 158.3, 146.5, 140.8, 133.8, 130.4, 129.7, 124.5, 121.9, 117.0, 116.8, 110.5, 110.2, 109.6, 109.5, 62.3, 65.1, 26.7. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{FN}_2\text{O}_4\text{Na}$ $[\text{M}+\text{Na}]^+$: 337.0601 ,found 337.0617.



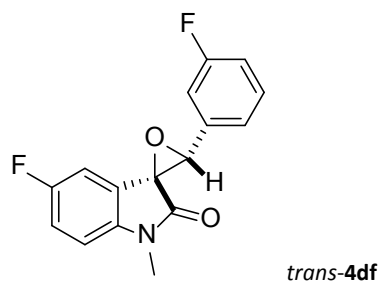
5-fluoro-1-methyl-3'-(2-nitrophenyl)spiro[indoline-3,2'-oxiran]-2-one (*trans-4bf*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3) δ 8.20 (d, $J = 10.7$ Hz, 1H), 8.07 – 8.01 (m, 1H), 7.87 (t, $J = 7.5$ Hz, 1H), 7.65 (t, $J = 7.8$ Hz, 1H), 7.00 – 6.91 (m, 1H), 5.82 – 5.71 (m, 1H), 5.16 (s, 1H), 3.31 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 170.7, 159.7, 157.3, 146.8, 141.5, 134.5, 130.4, 129.5, 125.1, 122.0, 116.9, 116.7, 110.7, 110.4, 109.6, 109.5, 64.4, 61.7, 26.9. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{FN}_2\text{O}_4\text{Na}$ $[\text{M}+\text{Na}]^+$: 337.0601 ,found 337.0617.



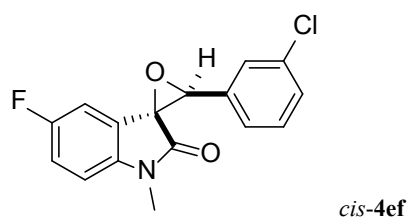
5-fluoro-3'-(3-fluorophenyl)-1-methylspiro[indoline-3,2'-oxiran]-2-one (*cis-4df*):

Yellowish solid. mp:158.0-158.6 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.34 (s, 3H), 7.12-7.03 (m, 2H), 6.97-6.95 (m, 1H), 6.83 (dd, $J = 8.4, 3.6$ Hz, 1H), 4.60 (s, 1H), 3.14 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 169.3, 163.6, 160.8(d, $J = 62.4$ Hz), 158.1, 140.5, 133.9 (d, $J = 7.7$ Hz), 129.3 (d, $J = 8.1$ Hz), 124.9 (d, $J = 8.4$ Hz), 123.1 (d, $J = 2.9$ Hz), 116.3 (dd, $J = 70.8, 22.4$ Hz), 114.7(d, $J = 23.1$ Hz), 109.6 (dd, $J = 53.4, 16.7$ Hz), 66.8, 61.8, 26.6. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{F}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 310.0656 ,found 310.0654 .



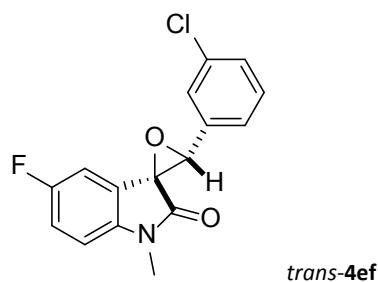
5-fluoro-3'-(3-fluorophenyl)-1-methylspiro[indoline-3,2'-oxiran]-2-one (*trans-4df*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.43 (dd, $J = 13.6, 7.6$ Hz, 1H), 7.24 (d, $J = 7.6$ Hz, 1H), 7.16 (d, $J = 9.2$ Hz, 1H), 7.12 (t, $J = 8.4$ Hz, 1H), 7.02-6.97 (m, 1H), 6.82 (dd, $J = 8.4, 3.6$ Hz, 1H), 6.23 (dd, $J = 8.0, 2.0$ Hz, 1H), 4.80 (s, 1H), 3.29 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.0, 164.1, 161.6, 159.9, 157.5, 141.3, 135.4, 135.3, 130.5 (d, $J = 8.4$ Hz), 122.3 (t, $J = 5.3$ Hz), 116.4 (dd, $J = 58.0, 22.4$ Hz), 113.8 (d, $J = 23.1$ Hz), 111.8 (d, $J = 26.4$ Hz), 109.3 (d, $J = 8.1$ Hz), 64.5 (d, $J = 2.6$ Hz), 61.5, 26.8. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{F}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 310.0656, found 310.0659.



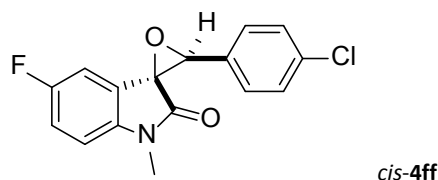
3'-(3-chlorophenyl)-5-fluoro-1-methylspiro[indoline-3,2'-oxiran]-2-one (*cis-4ef*):

Yellowish solid. mp: 179.8-180.5 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.57 (s, 1H), 7.49 (d, $J = 3.2$ Hz, 1H), 7.32 (d, $J = 4.4$ Hz, 2H), 7.12 (td, $J = 8.8, 2.0$ Hz, 1H), 6.97 (dd, $J = 7.2, 2.4$ Hz, 1H), 6.83 (dd, $J = 8.4, 3.6$ Hz, 1H), 4.58 (s, 1H), 3.14 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 169.3, 160.5, 158.1, 140.5, 133.8, 133.4, 129.1 (d, $J = 6.6$ Hz), 127.6, 125.6, 124.8 (d, $J = 8.1$ Hz), 116.7 (d, $J = 23.8$ Hz), 109.9 (d, $J = 25.7$ Hz), 109.4 (d, $J = 8.1$ Hz), 66.7, 61.8, 26.7. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{FCINa}$ $[\text{M}+\text{Na}]^+$: 326.0360, found 326.0352.



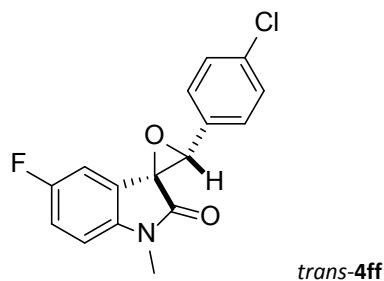
3'-(3-chlorophenyl)-5-fluoro-1-methylspiro[indoline-3,2'-oxiran]-2-one(*trans-4ef*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.44 (s, 1H), 7.38-7.32 (m, 3H), 7.03 (td, $J = 8.8, 2.4$ Hz, 1H), 6.82 (dd, $J = 8.4, 4.0$ Hz, 1H), 6.23 (dd, $J = 8.0, 2.8$ Hz, 1H), 4.78 (s, 1H), 3.29 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.0, 159.9, 157.5, 141.3, 134.8, 130.0, 129.3, 126.8, 124.7, 122.2 (d, $J = 8.8$ Hz), 116.7 (d, $J = 23.5$ Hz), 111.8 (d, $J = 26.4$ Hz), 109.3 (d, $J = 8.1$ Hz), 64.4, 61.5, 26.8. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{FCINa}$ $[\text{M}+\text{Na}]^+$: 326.0360 , found 326.0351 .



3'-(4-chlorophenyl)-5-fluoro-1-methylspiro[indoline-3,2'-oxiran]-2-one (*cis-4ff*):

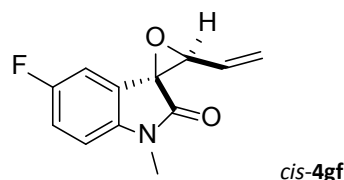
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.54 (d, $J = 8.0$ Hz, 2H), 7.36 (d, $J = 8.0$ Hz, 2H), 7.11 (t, $J = 8.0$ Hz, 1H), 6.97 (d, $J = 6.0$ Hz, 1H), 6.83 (dd, $J = 8.0, 3.2$ Hz, 1H), 4.58 (s, 1H), 3.14 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 169.4, 160.5, 158.1, 140.5 (d, $J = 1.8$ Hz), 134.9, 129.8, 128.9, 128.0, 124.93 (d, $J = 8.1$ Hz), 116.58 (d, $J = 23.5$ Hz), 110.0, 109.37 (d, $J = 7.7$ Hz), 67.0, 61.8, 26.6. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{FCINa}$ $[\text{M}+\text{Na}]^+$: 326.0360, found 326.0368 .



3'-(4-chlorophenyl)-5-fluoro-1-methylspiro[indoline-3,2'-oxiran]-2-one(*trans-4ff*)

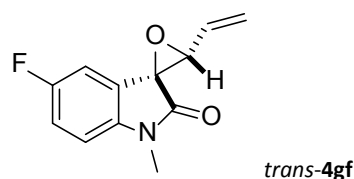
Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.42-7.37 (m, 4H), 7.02 (t, $J = 8.4$ Hz, 1H), 6.81 (dd, $J = 8.4, 4.0$ Hz, 1H), 6.22 (d, $J = 7.6$ Hz, 1H), 4.78 (s, 1H),

3.28 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.1, 159.9, 157.5, 141.2, 135.0, 131.3, 129.0, 128.0, 122.3 (d, $J = 8.8$ Hz), 116.6 (d, $J = 23.8$ Hz), 111.8 (d, $J = 26.4$ Hz), 109.3 (d, $J = 8.1$ Hz), 64.6, 61.5, 26.8. HRMS: calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_2\text{FCINa}$ $[\text{M}+\text{Na}]^+$: 326.0360, found 326.0353.



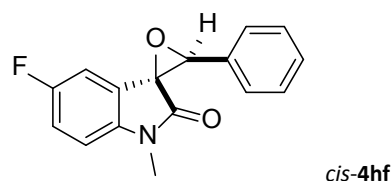
5-fluoro-1-methyl-3'-vinylspiro[indoline-3,2'-oxiran]-2-one (*cis-4gf*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.09 (t, $J = 8.4$ Hz, 1H), 6.88 (d, $J = 0.8$ Hz, 1H), 6.84 (dd, $J = 8.4, 3.6$ Hz, 1H), 6.50-6.41 (m, 1H), 5.69 (d, $J = 17.6$ Hz, 1H), 5.55 (d, $J = 10.4$ Hz, 1H), 4.01 (d, $J = 8.4$ Hz, 1H), 3.25 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 170.7, 160.5, 158.1, 140.4, 130.6, 124.9 (d, $J = 8.4$ Hz), 123.8, 116.4 (d, $J = 23.5$ Hz), 109.9 (d, $J = 25.7$ Hz), 109.4 (d, $J = 8.1$ Hz), 67.0, 61.7, 16.8. HRMS: calcd for $\text{C}_{12}\text{H}_{10}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 242.0593, found 242.0599.



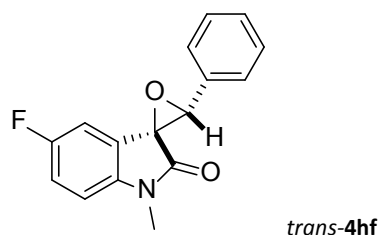
5-fluoro-1-methyl-3'-vinylspiro[indoline-3,2'-oxiran]-2-one (*trans-4gf*):

Yellowish solid. mp: 137.0-137.3 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.12 (t, $J = 8.8$ Hz, 1H), 6.96 (d, $J = 7.6$ Hz, 1H), 6.86 (dd, $J = 8.4, 3.6$ Hz, 1H), 5.98 (ddd, $J = 17.3, 10.4, 7.0$ Hz, 1H), 5.76 (d, $J = 17.2$ Hz, 1H), 5.62 (d, $J = 10.8$ Hz, 1H), 4.16 (d, $J = 6.8$ Hz, 1H), 3.27 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.5, 160.1, 157.7, 141.2, 129.9, 123.6, 122.9, 122.8, 116.4 (d, $J = 23.5$ Hz), 112.3 (d, $J = 26.4$ Hz), 109.4 (d, $J = 8.1$ Hz), 65.2, 61.6, 26.8. HRMS: calcd for $\text{C}_{12}\text{H}_{10}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 242.0593, found 242.0592.



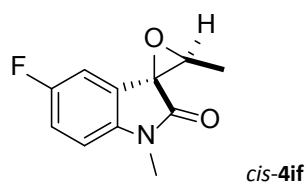
5-fluoro-1-methyl-3'-phenylspiro[indoline-3,2'-oxiran]-2-one (*cis-4hf*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.61 (d, $J = 7.2\text{Hz}$, 2H), 7.42-7.36 (m, 3H), 7.12 (t, $J = 8.4\text{ Hz}$, 1H), 7.00 (d, $J = 7.2\text{ Hz}$, 1H), 6.83-6.81 (m, 1H), 4.64 (s, 1H), 3.15 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 169.6, 160.5, 158.1, 140.5, 131.3, 129.0, 127.6 (d, $J = 30.0\text{ Hz}$), 125.3 (d, $J = 8.4\text{ Hz}$), 116.4 (d, $J = 23.6\text{ Hz}$), 109.9 (d, $J = 25.4\text{ Hz}$), 109.3 (d, $J = 7.9\text{ Hz}$), 67.7, 61.9, 26.6. HRMS: calcd for $\text{C}_{16}\text{H}_{12}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 292.0744, found 292.0764.



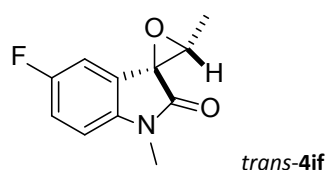
5-fluoro-1-methyl-3'-phenylspiro[indoline-3,2'-oxiran]-2-one (*trans-4hf*):

Yellowish semisolid. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.43-7.40 (m, 5H), 7.00 (t, $J = 8.4\text{ Hz}$, 1H), 6.80-6.78 (m, 1H), 6.22 (d, $J = 8.0\text{ Hz}$, 1H), 4.84 (s, 1H), 3.29 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.4, 159.9, 157.5, 141.2, 132.7, 128.8 (d, $J = 36.2\text{ Hz}$), 122.7 (d, $J = 8.8\text{ Hz}$), 122.7, 122.6, 116.4 (d, $J = 23.8\text{ Hz}$), 111.9 (d, $J = 26.3\text{ Hz}$), 109.1 (d, $J = 8.1\text{ Hz}$), 65.2, 61.5, 26.8. HRMS: calcd for $\text{C}_{16}\text{H}_{12}\text{NO}_2\text{FNa}$ $[\text{M}+\text{Na}]^+$: 292.0750, found 292.0733.



5-fluoro-1,3'-dimethylspiro[indoline-3,2'-oxiran]-2-one (*cis-4if*):

Yellowish solid. mp: 143.5-143.9 °C. ^1H NMR (400 MHz, CDCl_3): δ ppm 7.07 (t, $J = 8.8\text{ Hz}$, 1H), 6.82 (d, $J = 7.6\text{ Hz}$, 2H), 3.71-3.68 (m, 1H), 3.25 (s, 3H), 1.73 (d, $J = 4.0\text{ Hz}$, 3H). ^{13}C NMR (100 MHz, CDCl_3): δ ppm 171.4, 160.5, 158.1, 140.3, 125.88 (d, $J = 8.4\text{ Hz}$), 116.1 (d, $J = 23.8\text{ Hz}$), 109.5 (dd, $J = 61.3, 16.9\text{ Hz}$), 63.4, 59.6, 26.7, 12.2. HRMS: calcd for $\text{C}_{11}\text{H}_{10}\text{FNO}_2\text{Na}$ $[\text{M}+\text{Na}]^+$: 230.0588, found 230.0604.



5-fluoro-1,3'-dimethylspiro[indoline-3,2'-oxiran]-2-one (*trans*-4if):

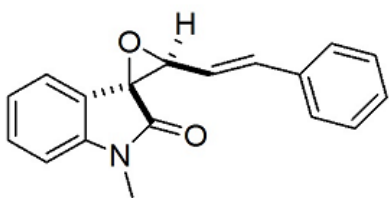
Yellowish semisolid. ¹H NMR (400 MHz, CDCl₃): δ ppm 7.12 (t, *J* = 8.8 Hz, 1H), 6.95 (d, *J* = 7.6 Hz, 1H), 6.88-6.85 (m, 1H), 3.79 (q, *J* = 5.2 Hz, 1H), 3.26 (s, 3H), 1.59 (d, *J* = 5.2 Hz, 3H). ¹³C NMR (100 MHz, CDCl₃): δ ppm 172.3, 160.2, 157.8, 141.3, 123.6 (d, *J* = 8.4 Hz), 116.2 (d, *J* = 23.8 Hz), 112.2 (d, *J* = 25.7 Hz), 109.3 (d, *J* = 8.1 Hz), 61.5, 60.5, 26.7, 13.6. HRMS: calcd for C₁₁H₁₀FNO₂Na [M+Na]⁺ : 230.0588, found 230.0593.

cmq-3214
boss HWH
cmq-3214

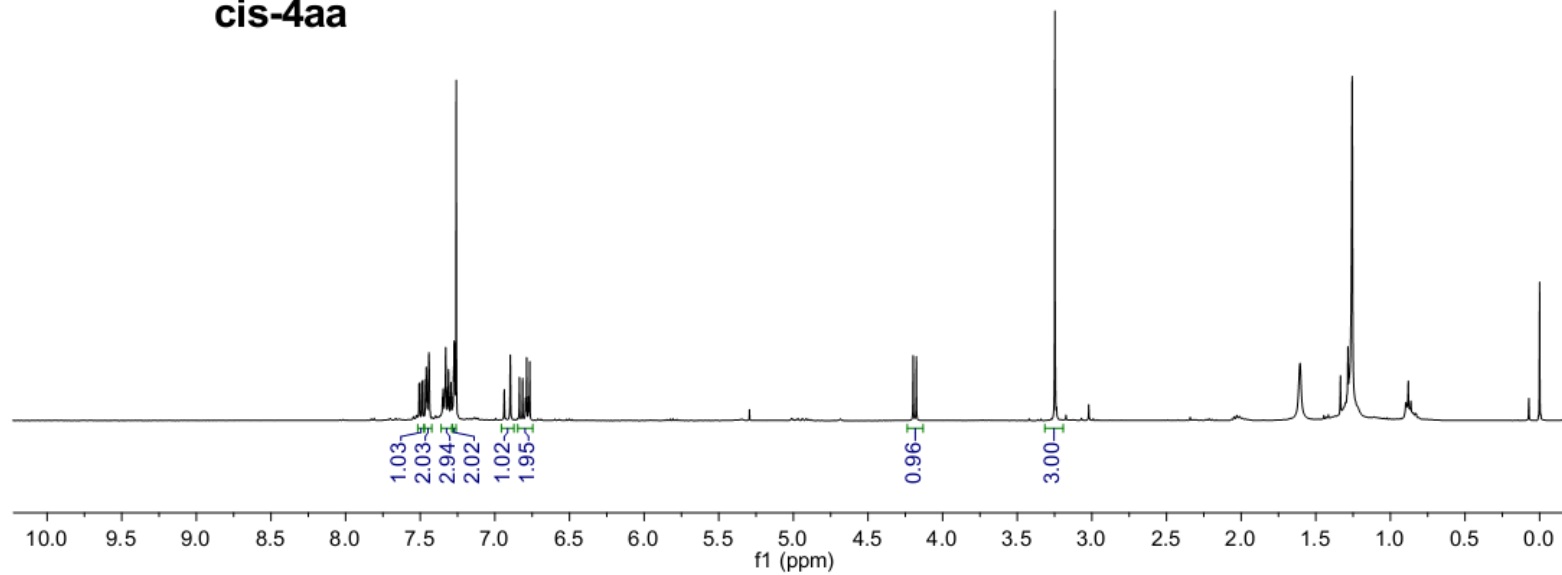
7.507
7.503
7.487
7.482
7.463
7.459
7.442
7.346
7.329
7.325
7.310
7.294
7.273
7.268
7.259
6.937
6.896
6.835
6.814
6.787
6.766

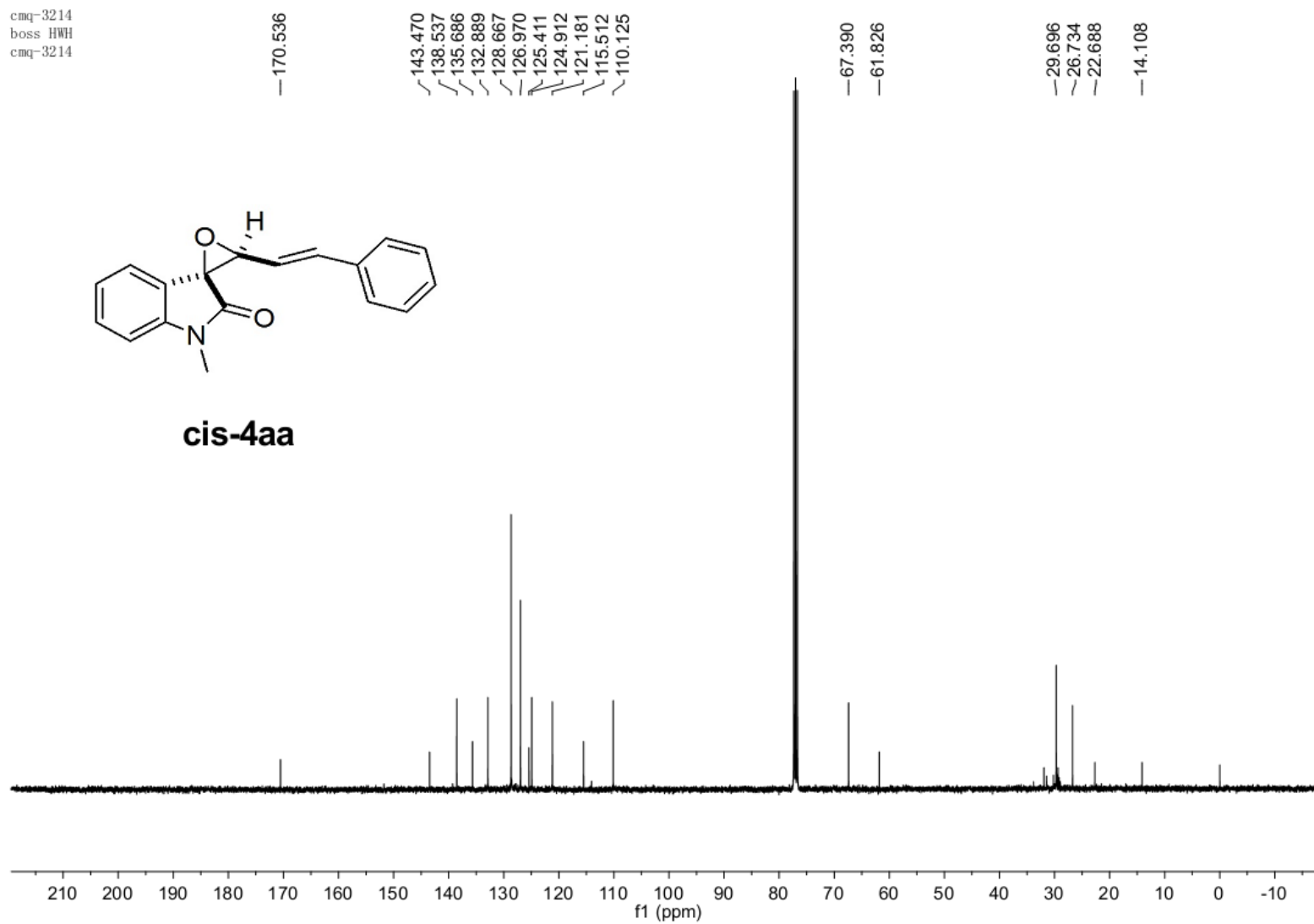
4.197
4.176

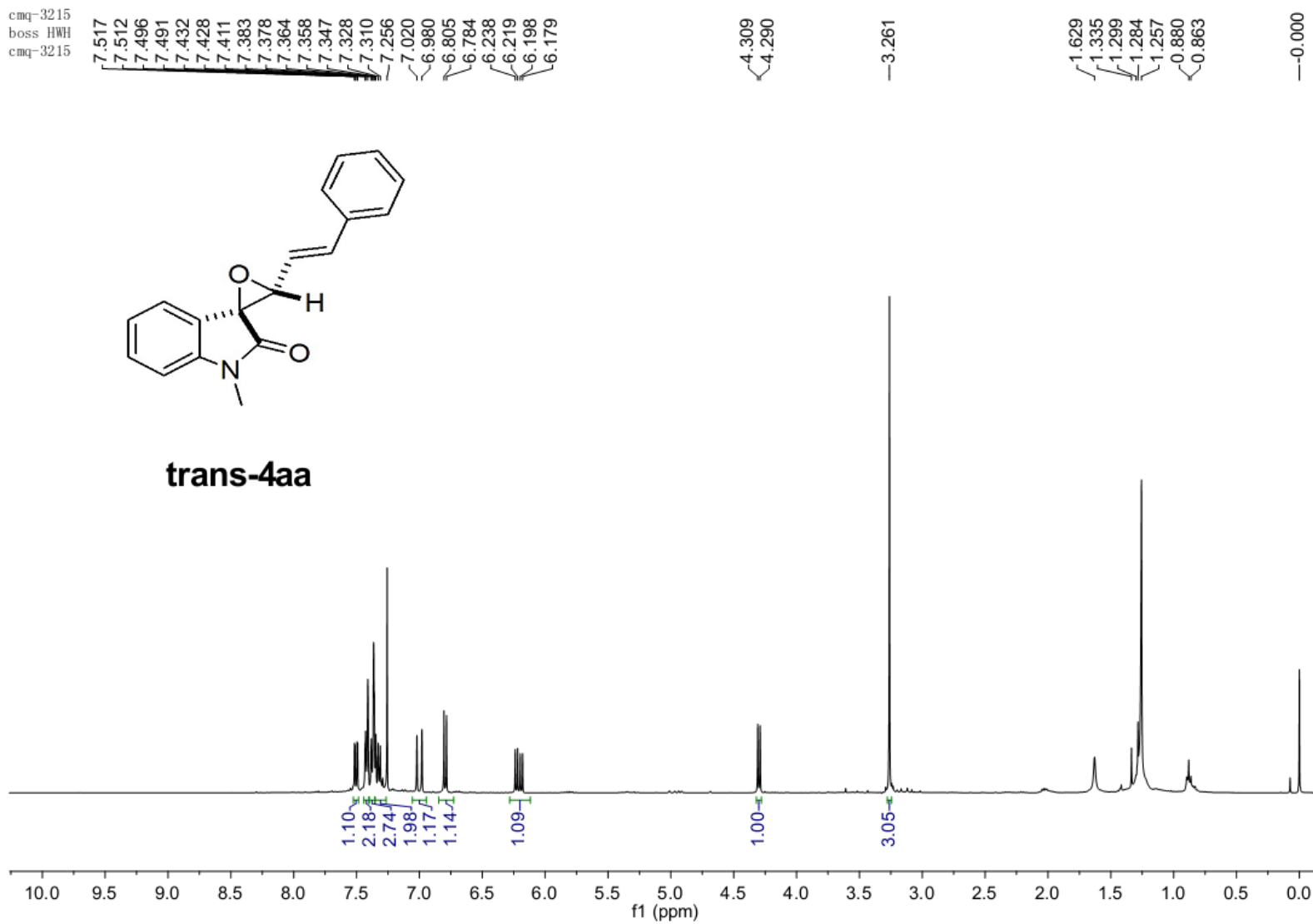
3.248



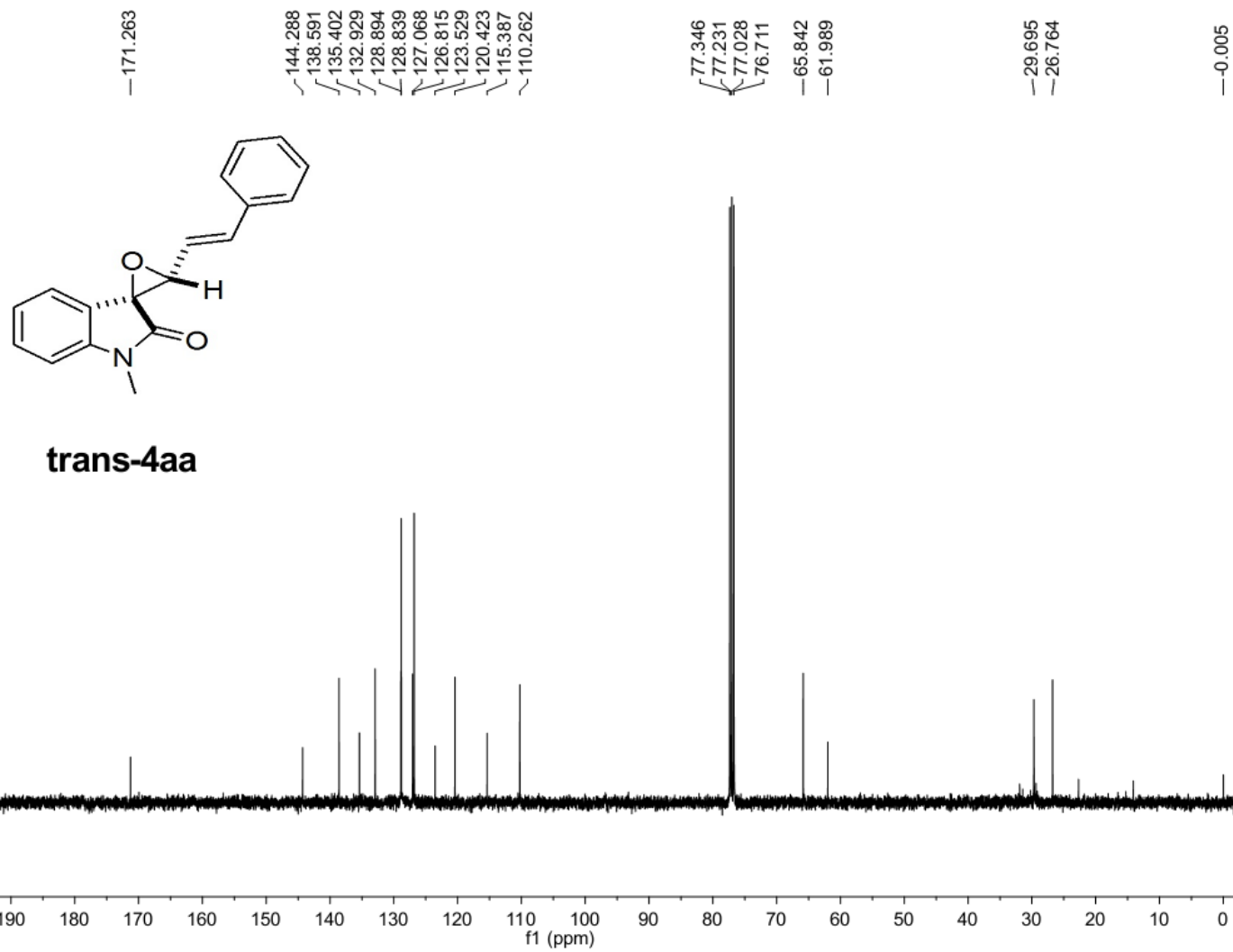
cis-4aa







cmq-3215
boss HWH
cmq-3215



cmq353-2
boss HWH
cmq313-2

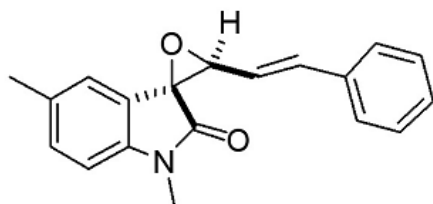
7.460
7.442
7.337
7.319
7.300
7.280
7.268
7.262
7.255
7.174
7.154
6.976
6.920
6.881
6.864
6.823
6.793
6.773

4.184
4.181
4.167
4.164

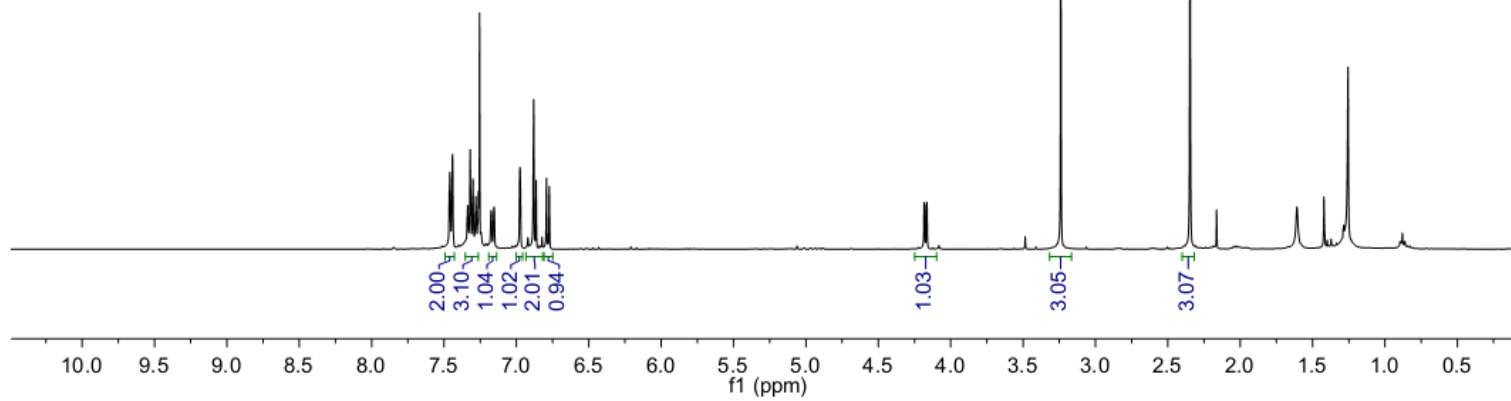
—3.240

—2.347

—1.256



cis-4ab

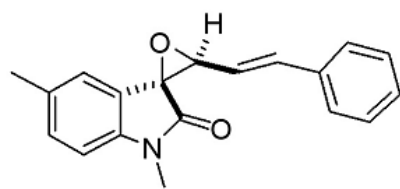


cmq353-2
boss HWH
cmq313-2

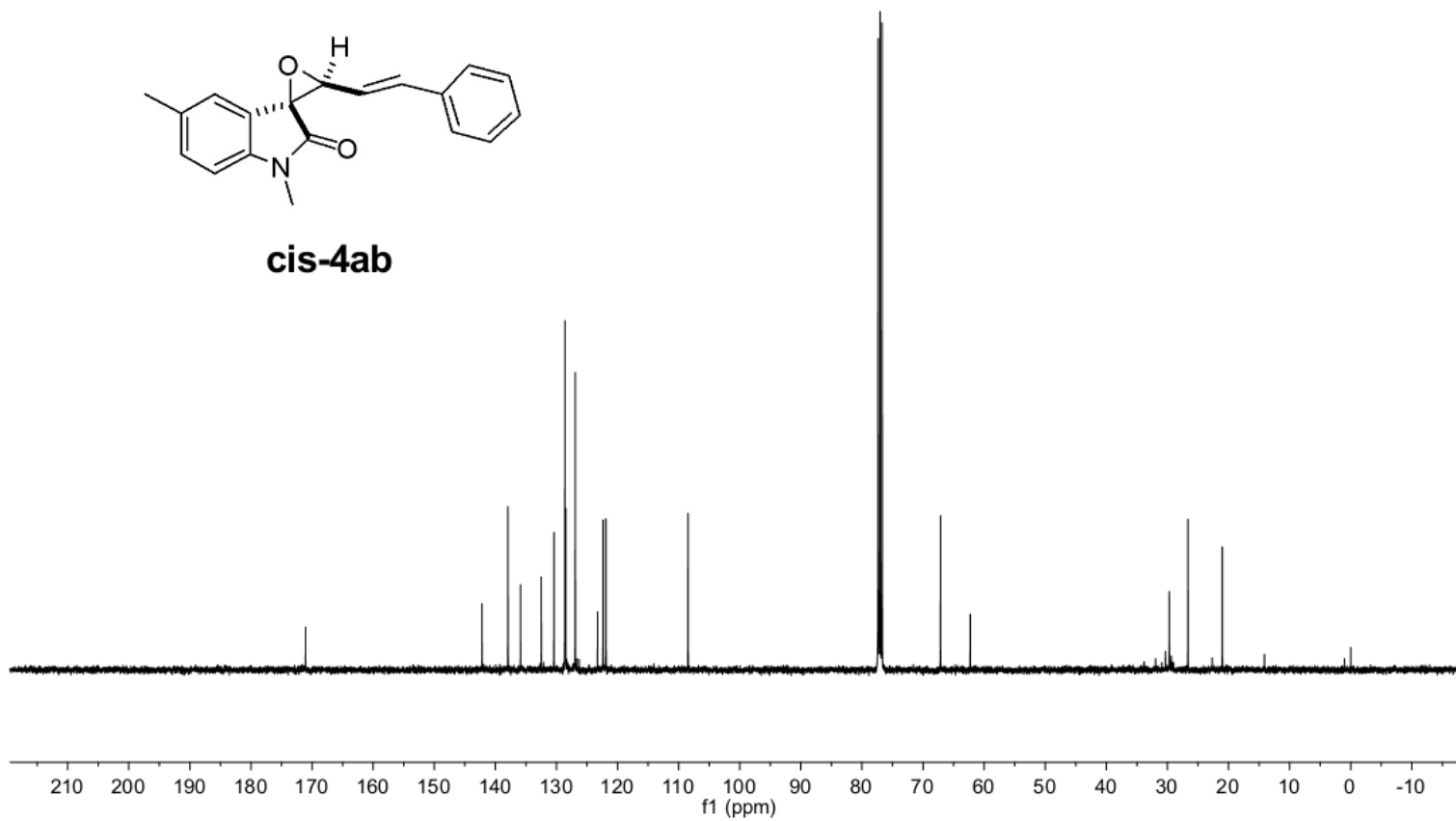
— 171.076
— 142.186
— 137.942
— 135.879
— 132.495
— 130.398
— 128.624
— 128.493
— 126.937
— 123.277
— 122.380
— 121.907
— 108.471

— 77.346
— 77.231
— 77.029
— 76.711
— 67.135
— 62.277

— 29.700
— 26.647
— 21.020



cis-4ab



cmq353-3
boss HWH
cmq313-3

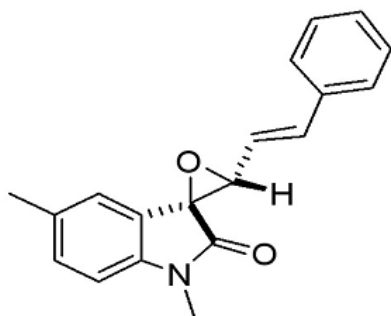
7.423
7.420
7.402
7.370
7.352
7.333
7.312
7.294
7.254
7.184
7.165
7.103
7.003
6.963
6.817
6.797
6.311
6.292
6.271
6.252

4.293
4.274

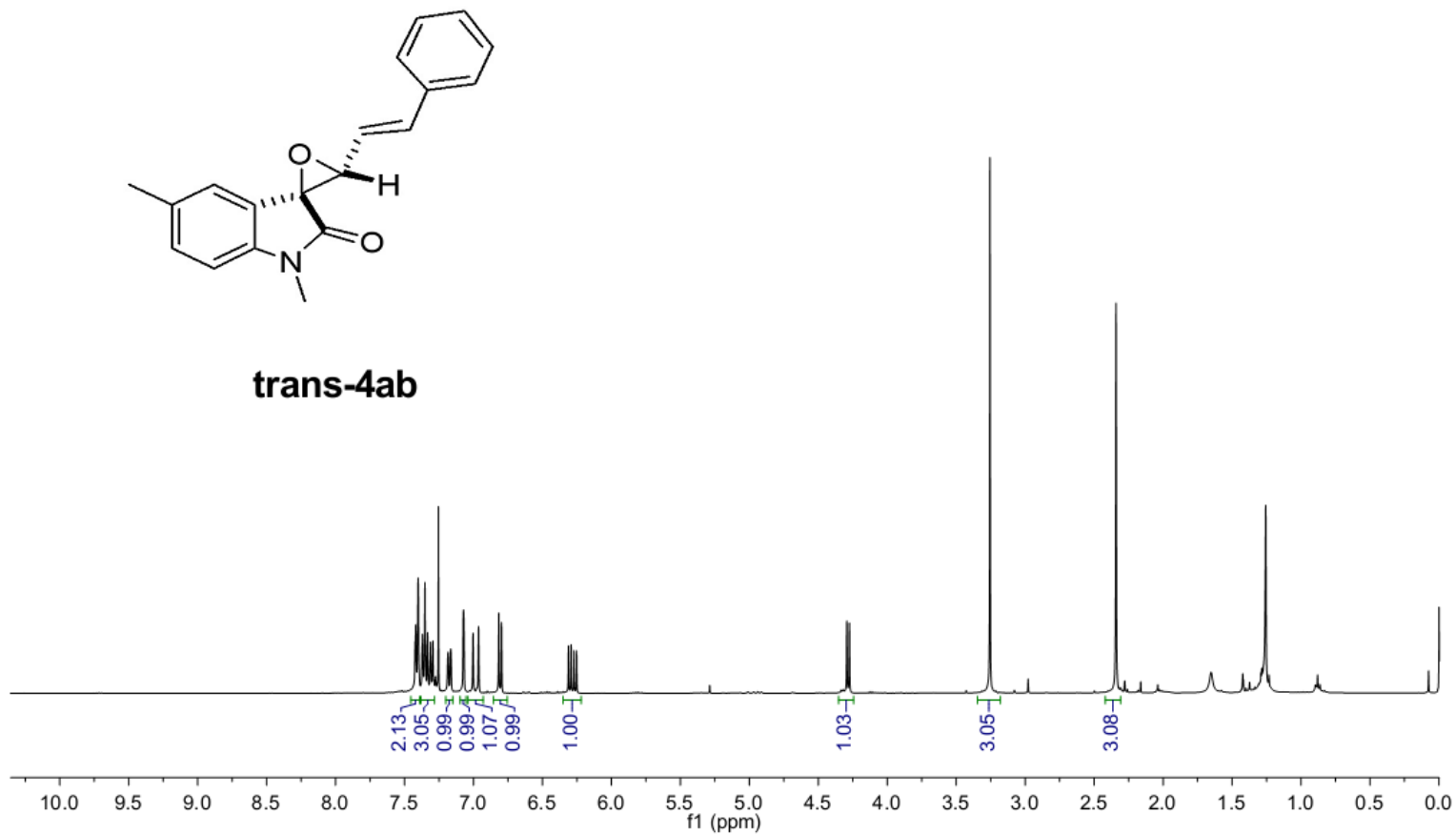
3.255

2.341

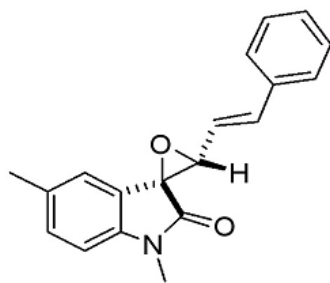
1.256



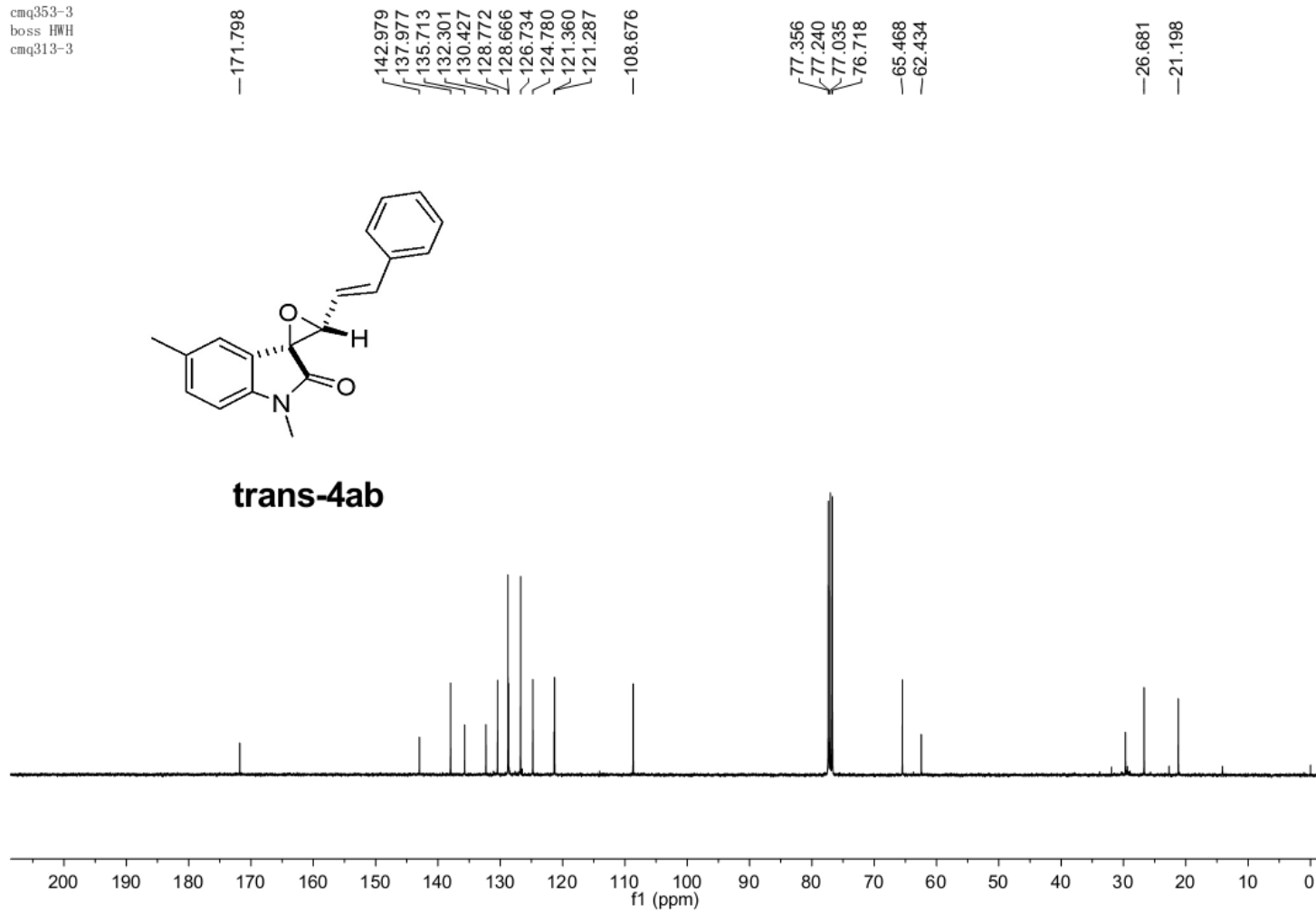
trans-4ab

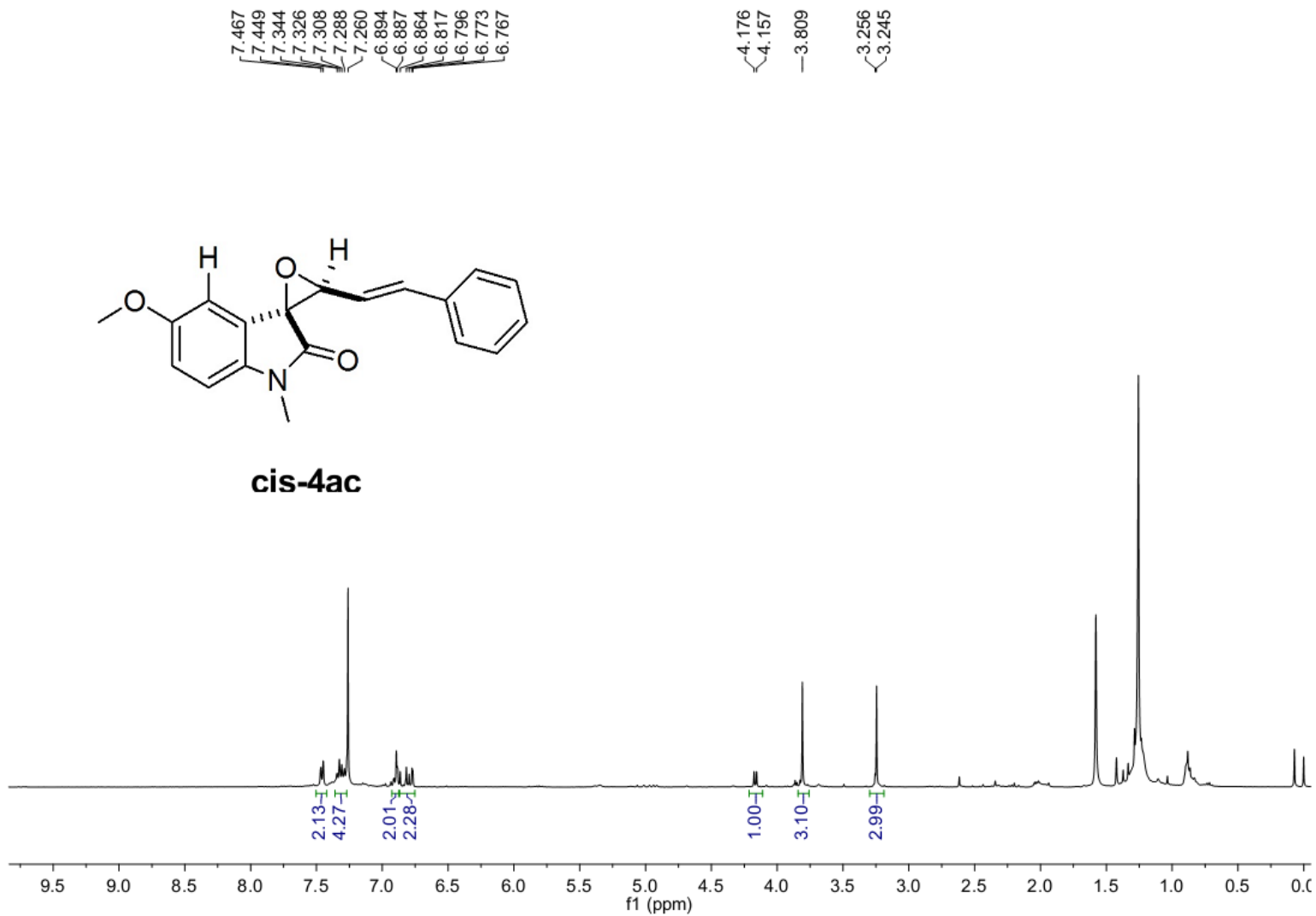


cmq353-3
boss HWH
cmq313-3

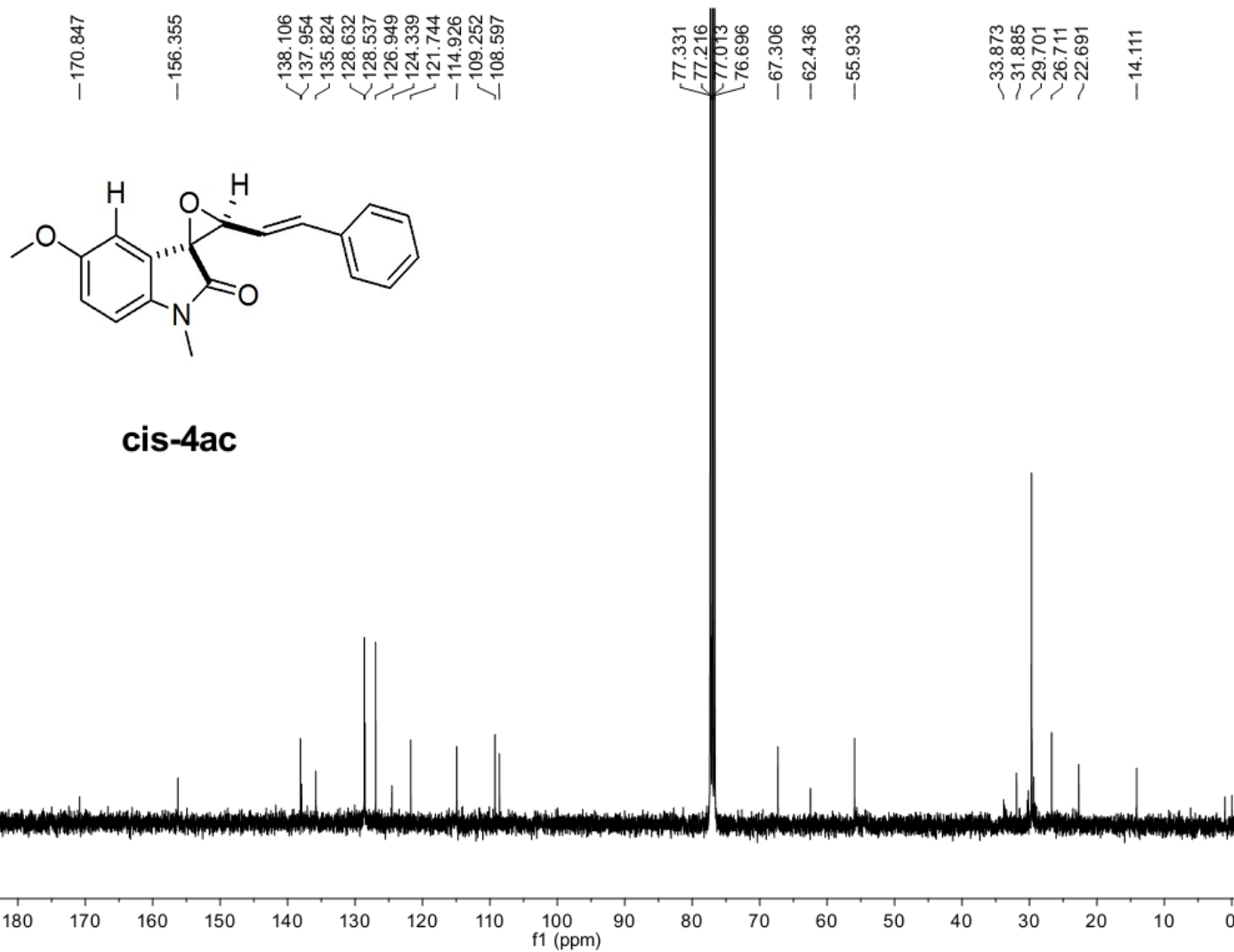


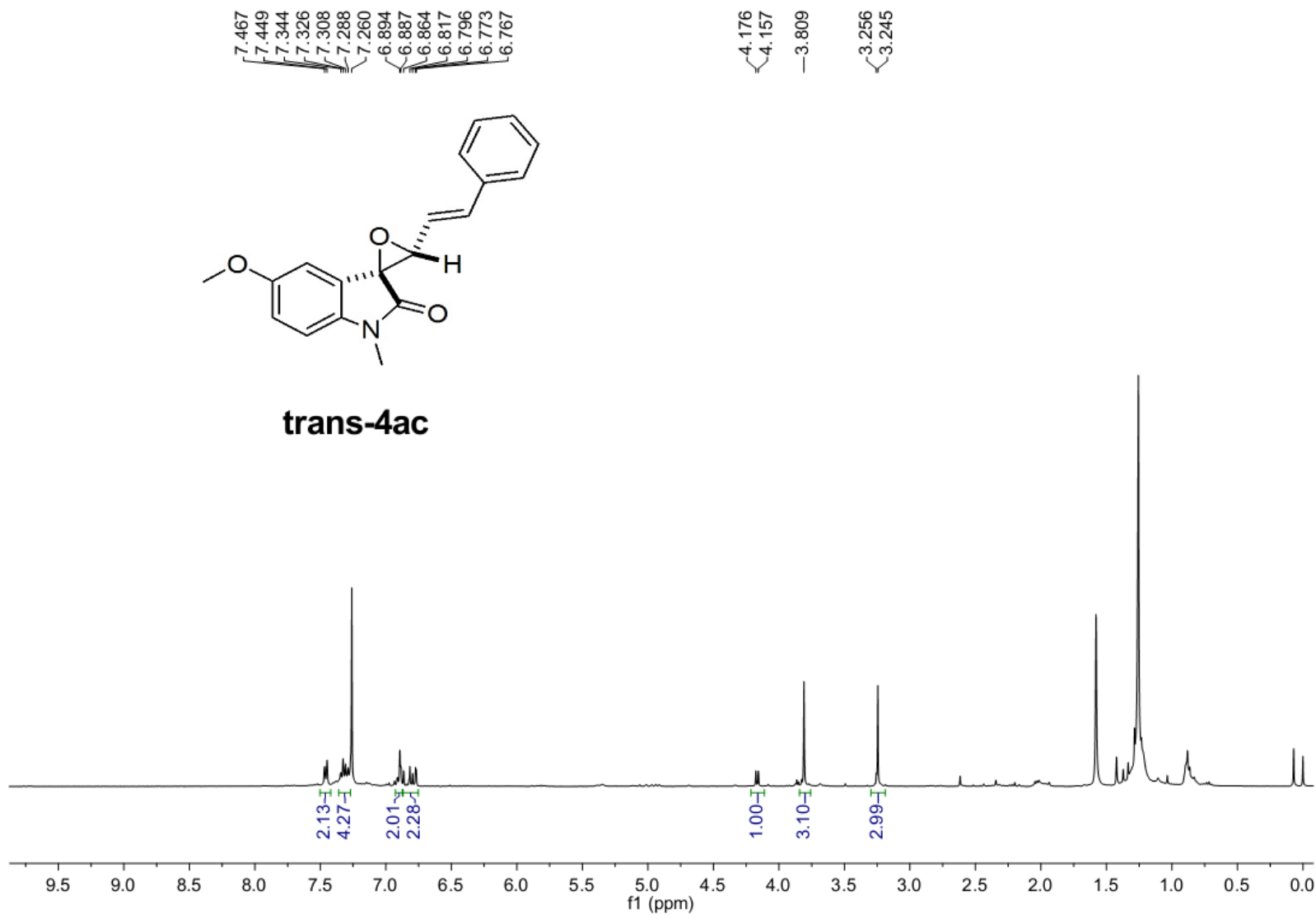
trans-4ab

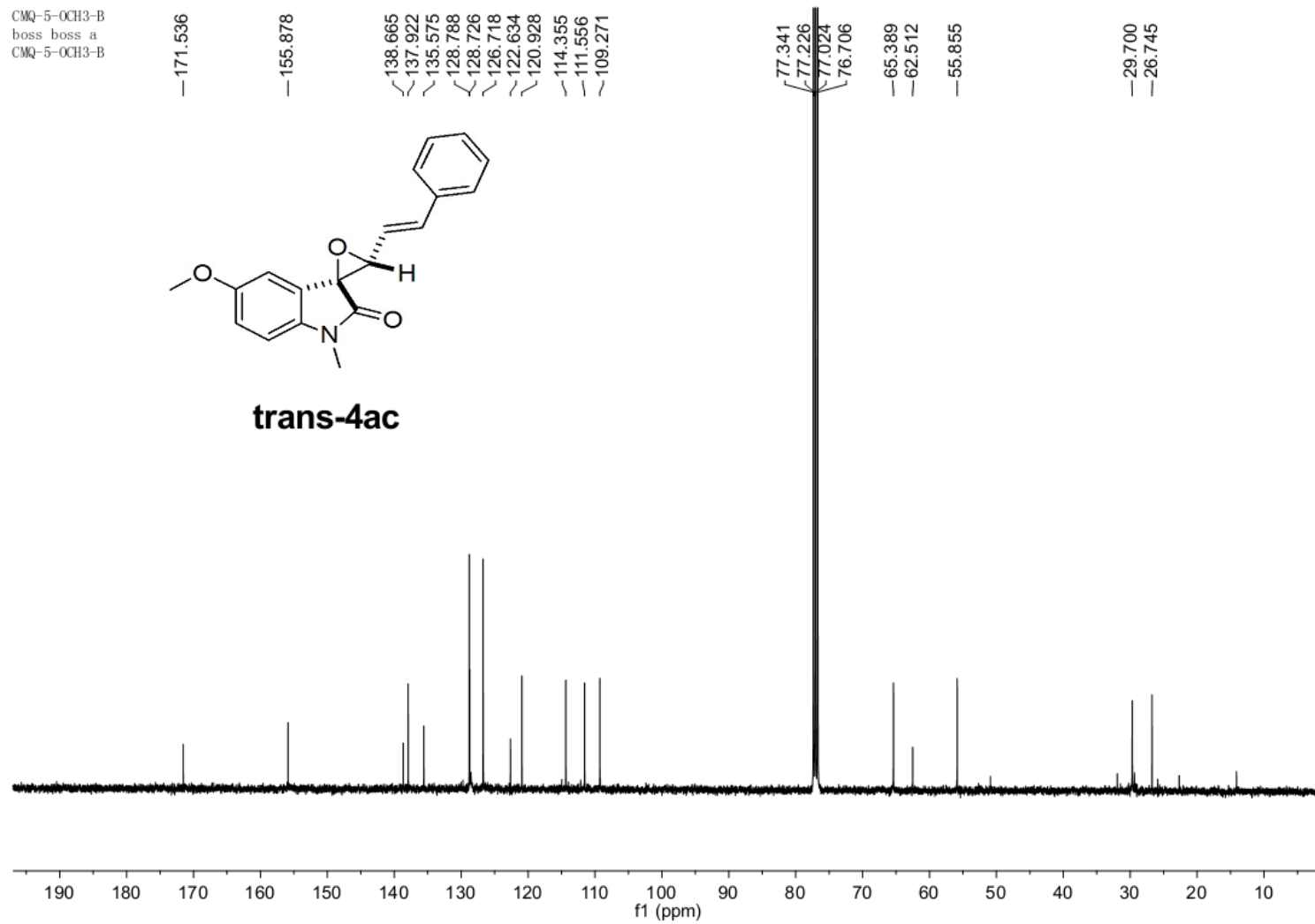




CMQ-5-OCH3-A
boss boss a
CMQ-5-OCH3-A







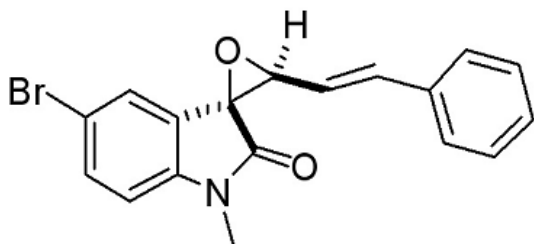
CMQ3412
boss HWH
CMQ3412

7.723
7.510
7.490
7.447
7.331
7.314
7.262
6.940
6.900
6.836
6.815
6.792
6.774

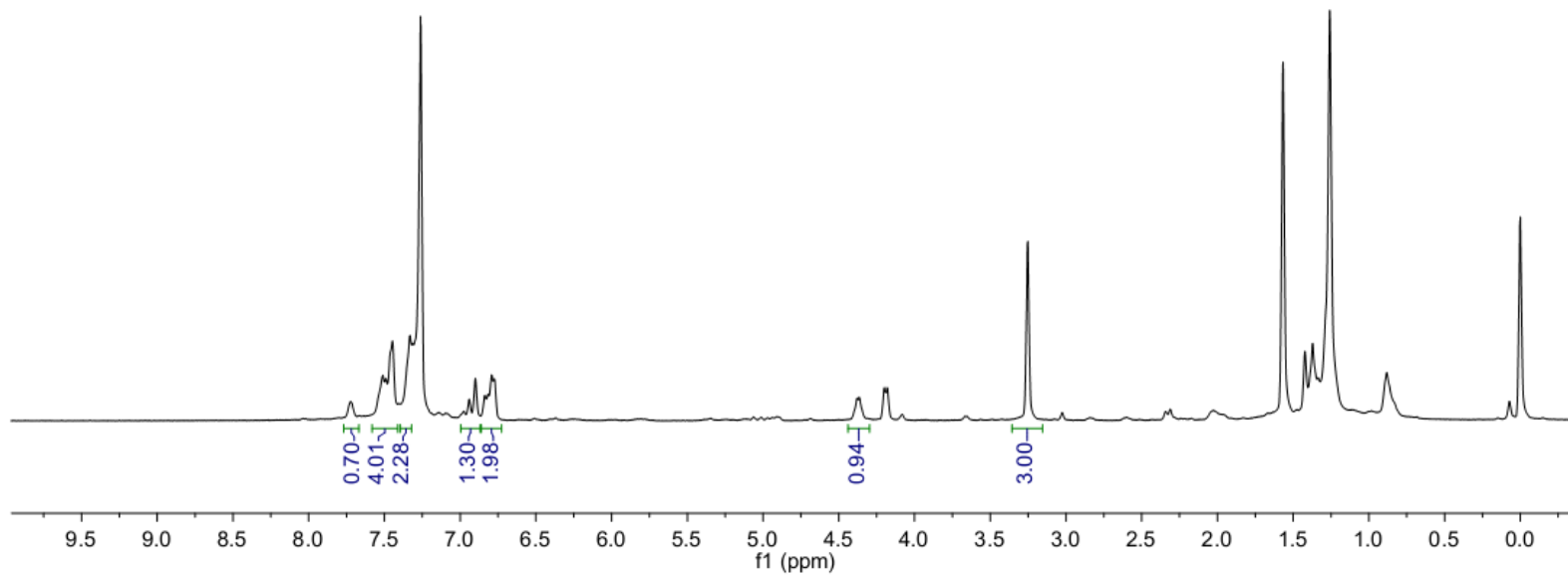
4.379
4.364

3.252

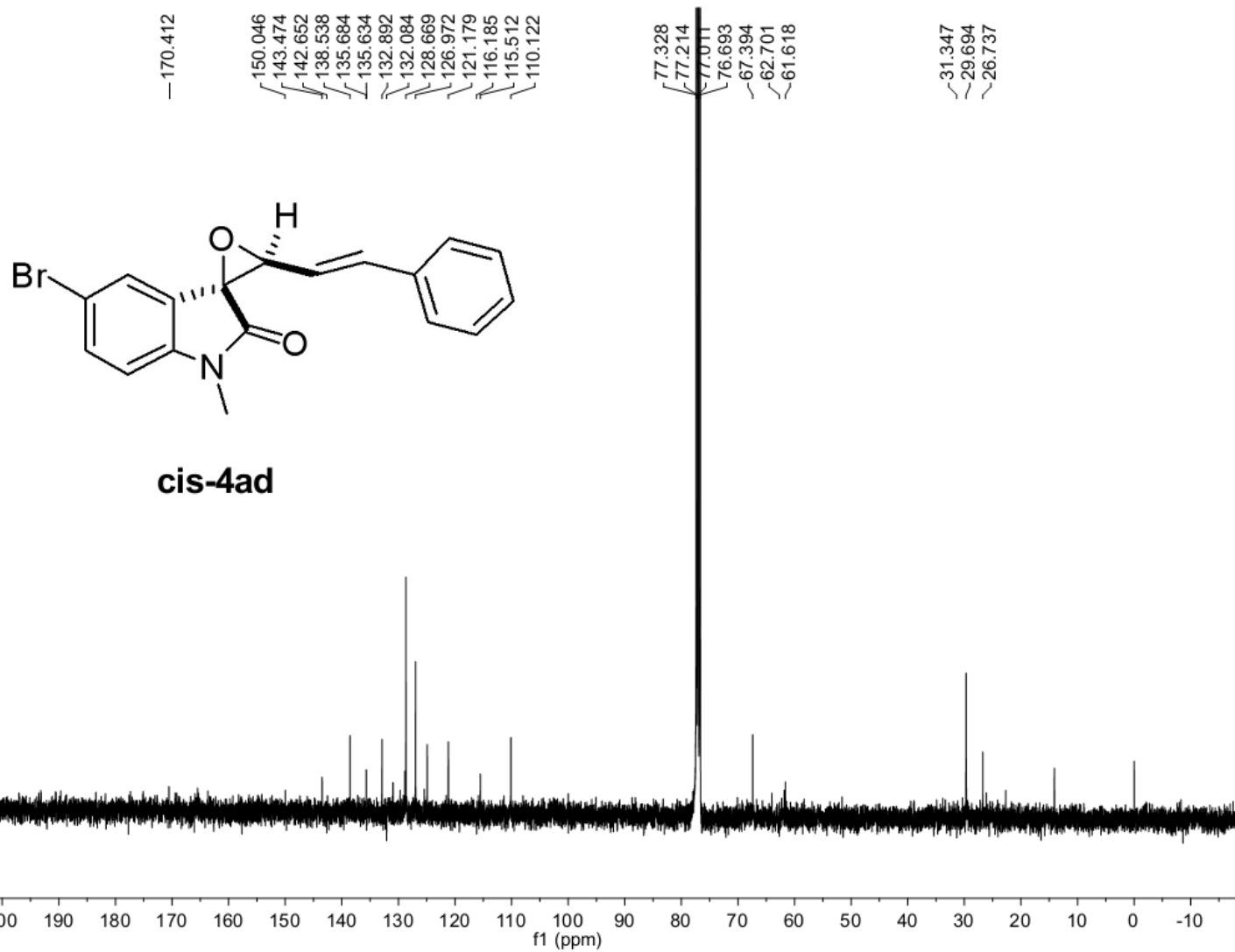
1.567
1.258



cis-4ad



CMQ3412
boss HWH
CMQ3412



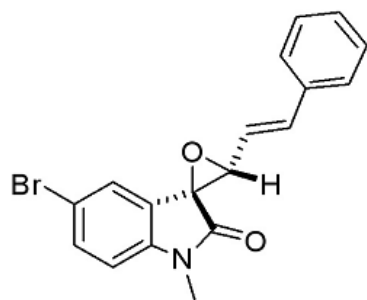
CMQ3413
boss boss hwh
cmq3413

7.520
7.500
7.429
7.413
7.365
7.260
7.024
6.984
6.811
6.790
6.240
6.223
6.201
6.183

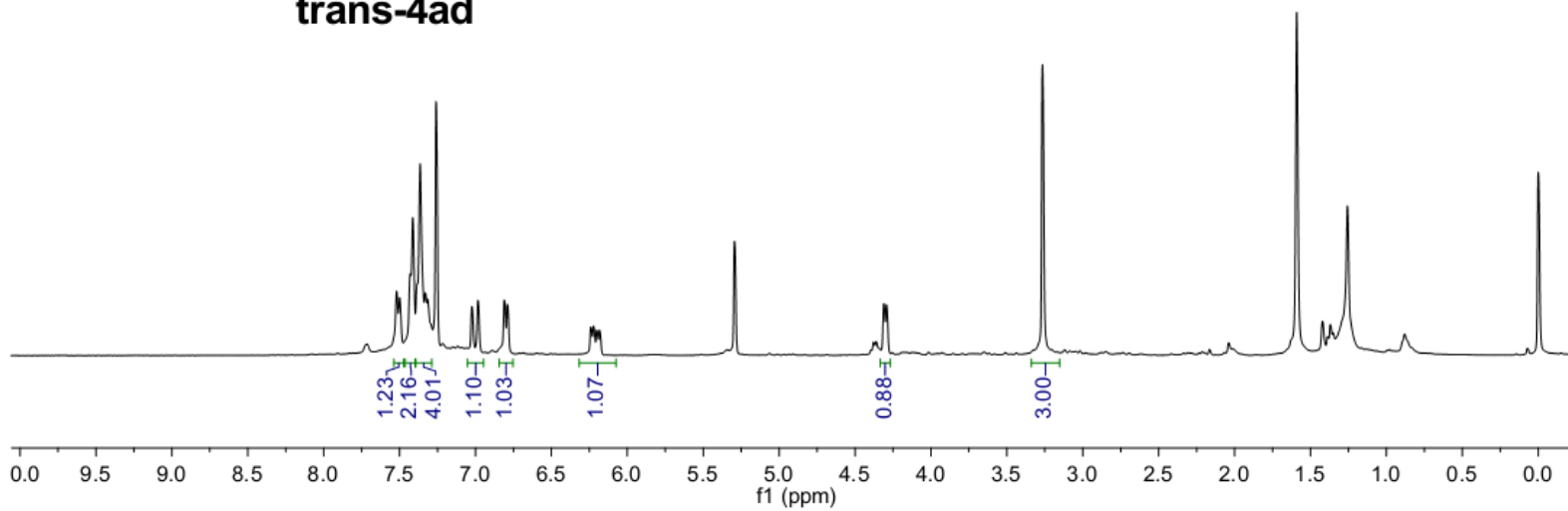
—5.294

4.310
4.293

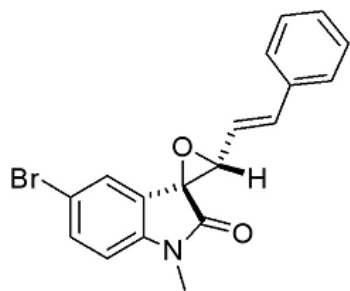
—3.266



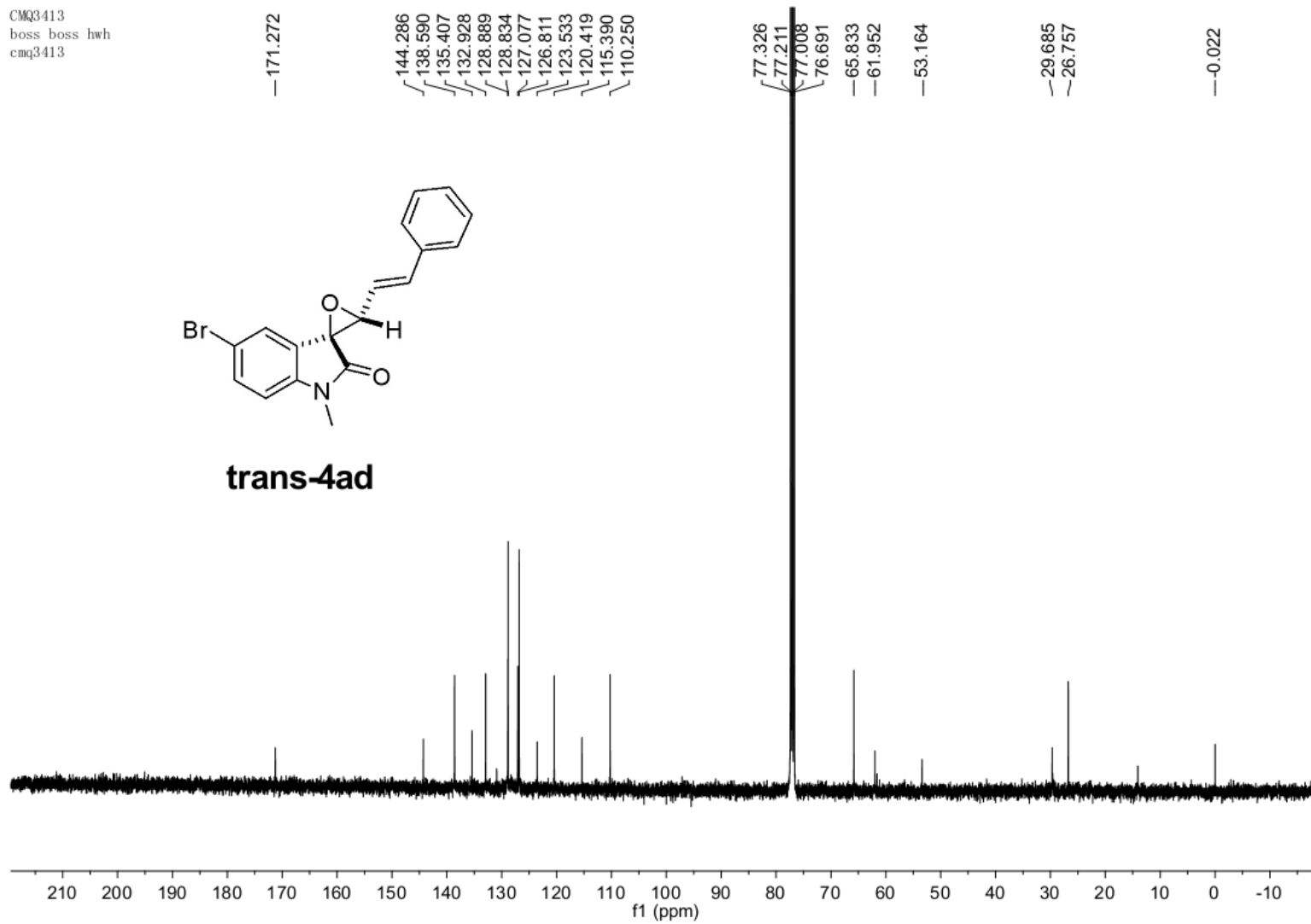
trans-4ad



CMQ3413
boss boss hwh
cmq3413



trans-4ad



cmq-3343
boss HWH
cmq-3342

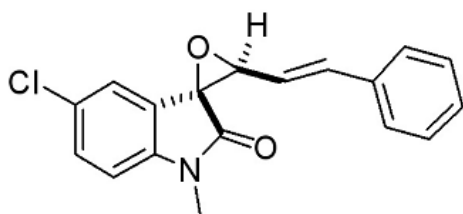
7.381
7.363
7.270
7.250
7.231
7.214
7.198
7.180
7.054
6.858
6.818
6.763
6.745
6.726
6.703
5.972

4.117
4.096

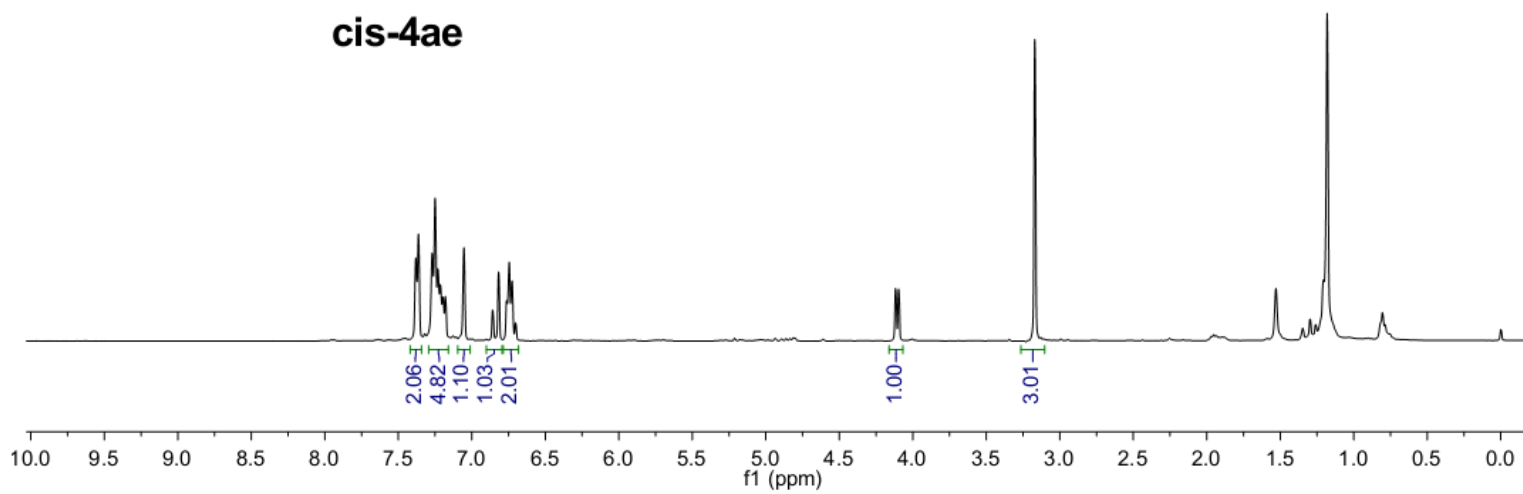
3.170

1.529

1.181



cis-4ae

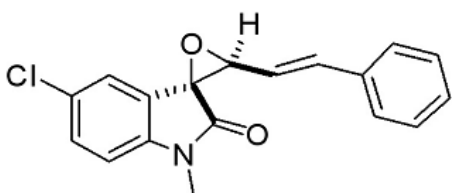


cmq-3342
boss boss a
CMQ-3342 CDCL3 13C

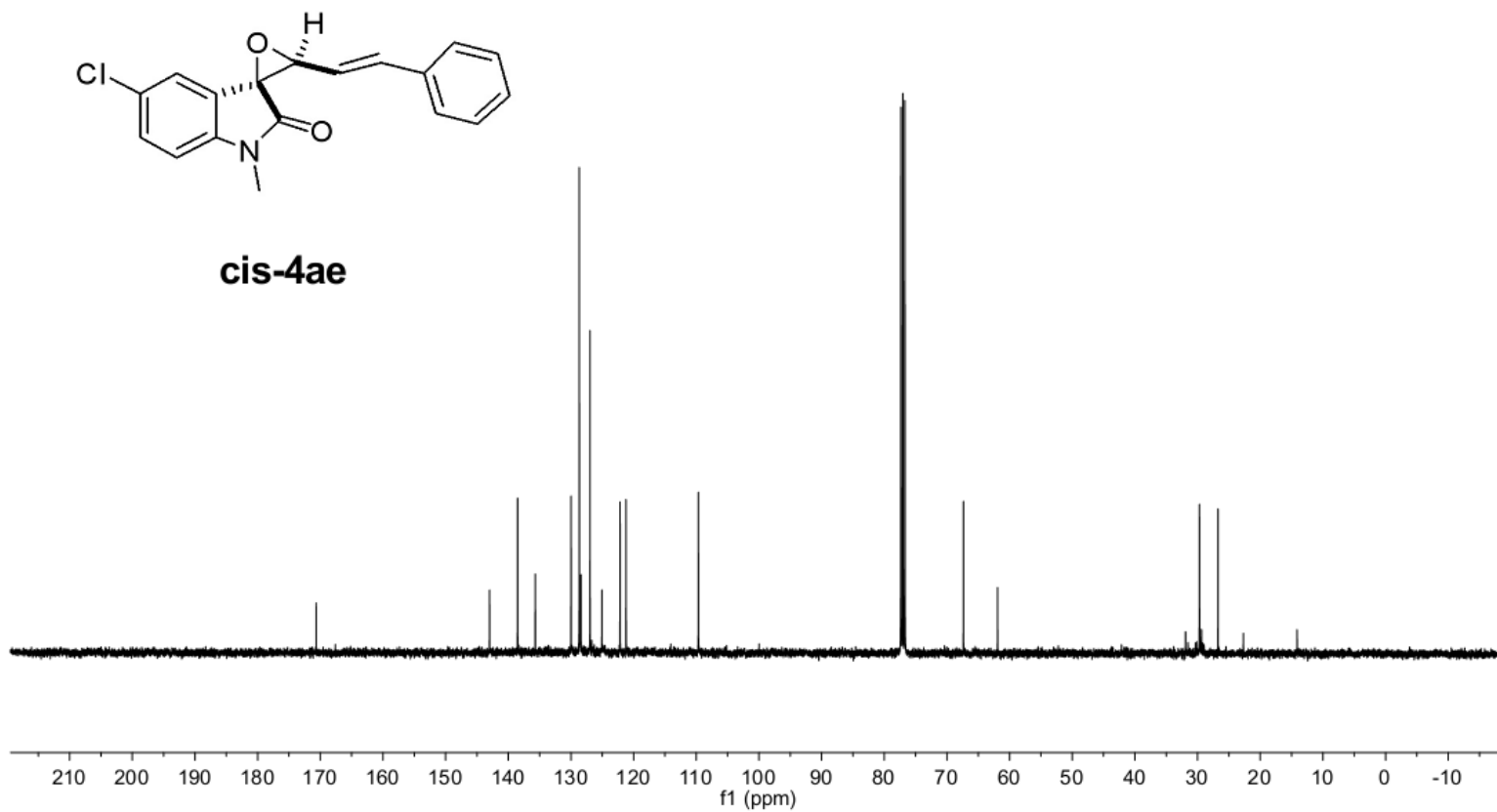
—170.650
142.983
138.517
135.694
129.987
128.666
128.403
126.969
125.070
122.164
121.212
—109.663

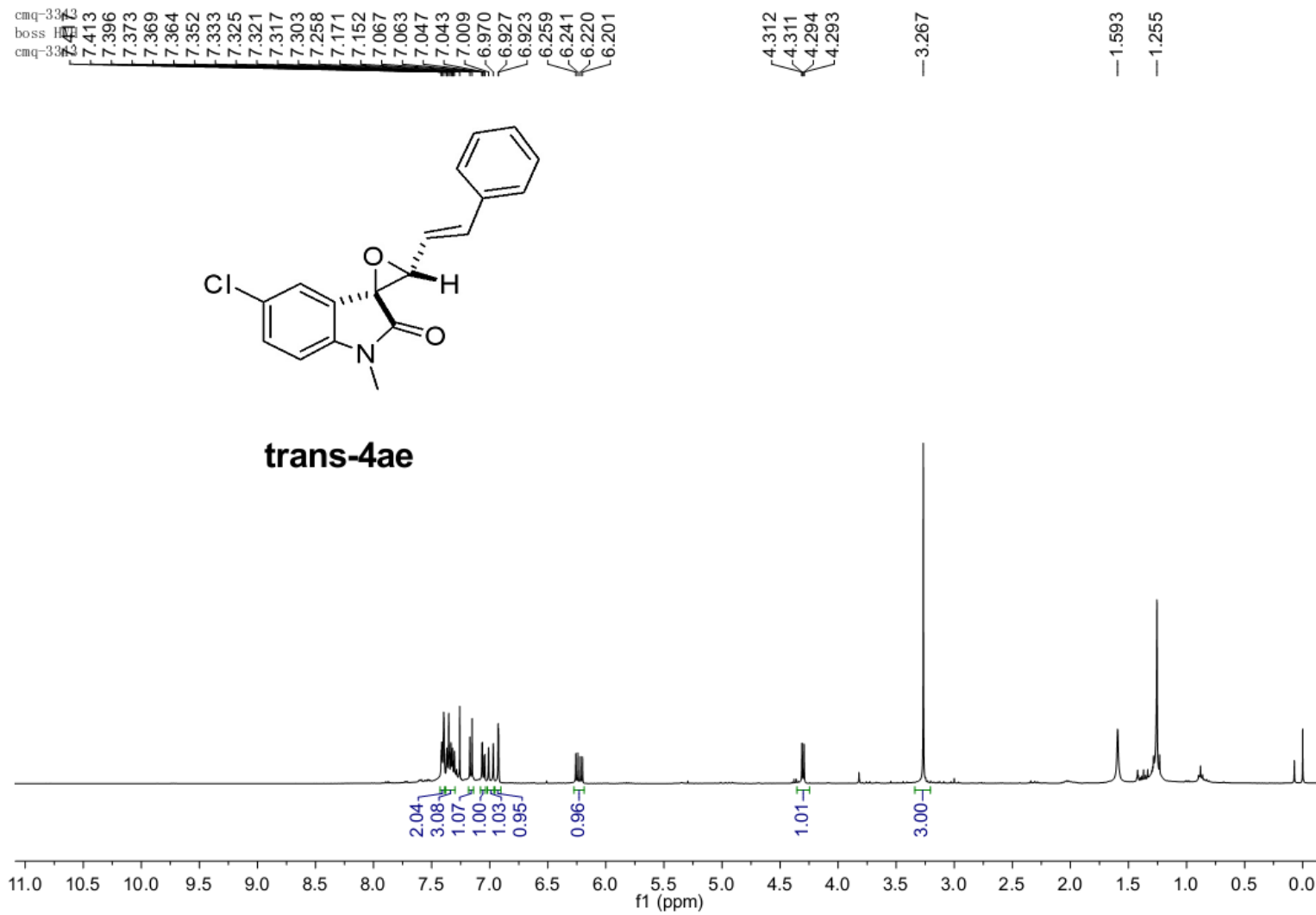
77.349
77.031
76.714
—67.363
—61.920

—29.700
—26.752



cis-4ae





cmq-3343
boss boss a
CMQ-3343 CDCL3 13C

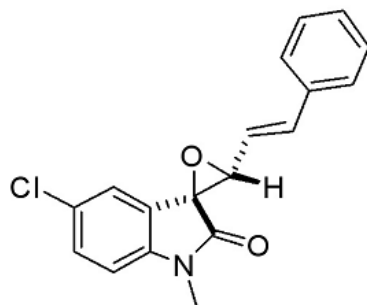
—171.379

143.803
138.553
135.395
130.023
128.898
128.840
128.216
126.816
124.328
123.168
120.427
—109.803

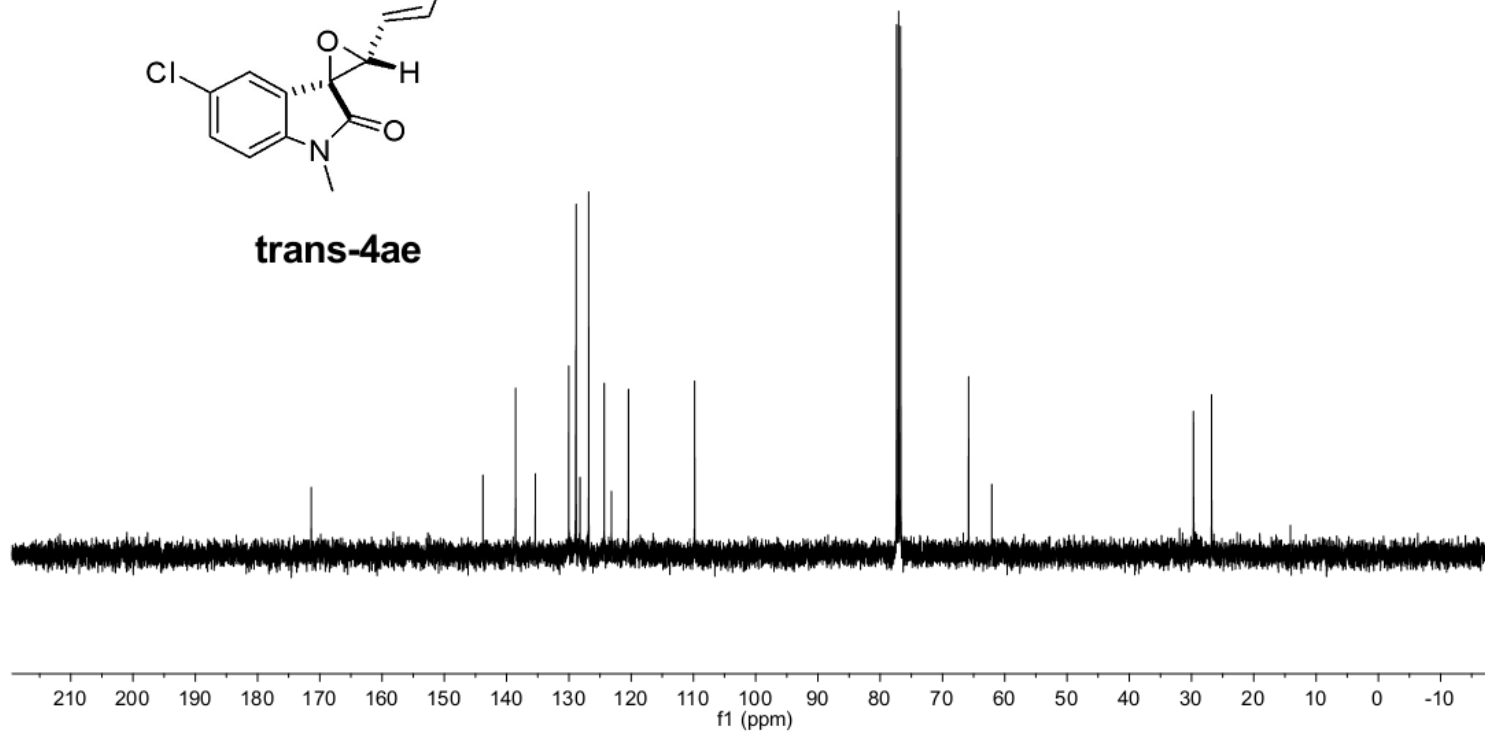
77.361
77.043
76.725

—65.807
—62.080

—29.699
—26.788



trans-4ae



CMQ-3582
boss HWH
CMQ-3582

7.378
7.360
7.260
7.242
7.224
7.208
7.190
7.175
7.009
6.987
6.965
6.856
6.831
6.814
6.776
6.753
6.737
6.716

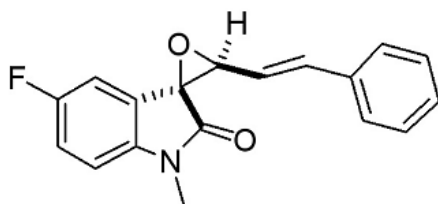
4.097
4.077

3.165

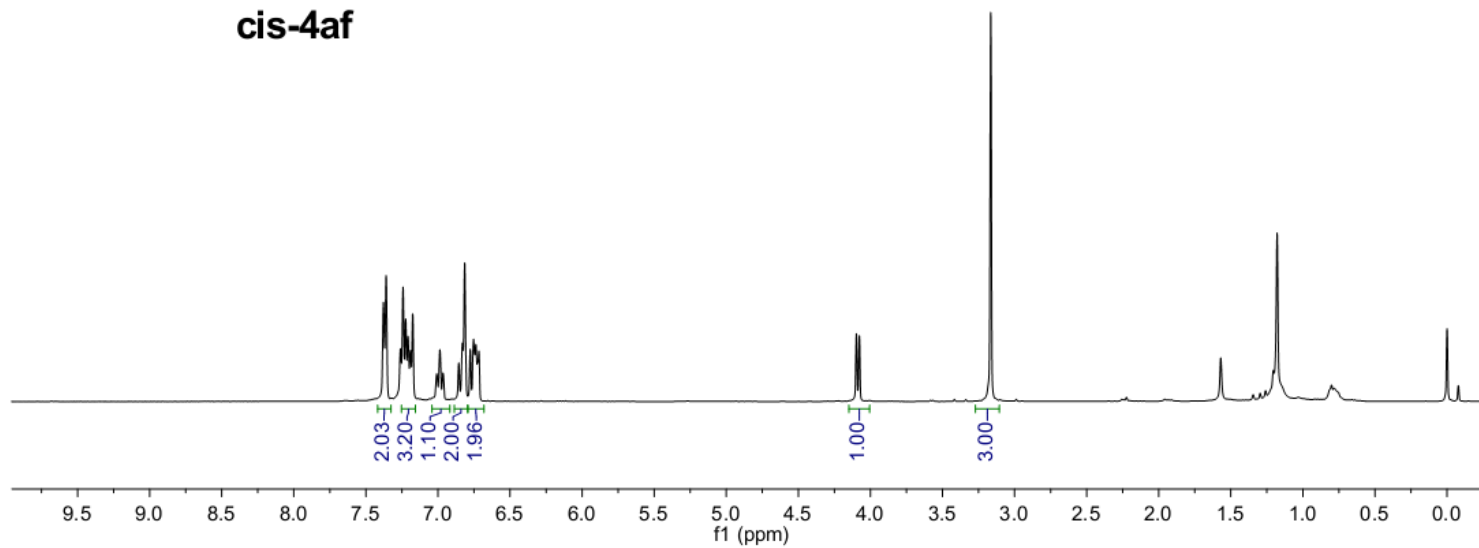
1.570
1.259
1.205
1.179

0.801
0.782

0.000
-0.078

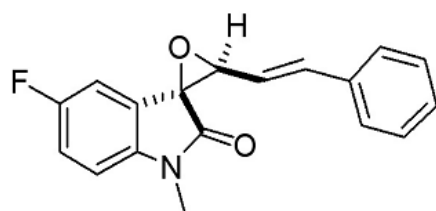


cis-4af

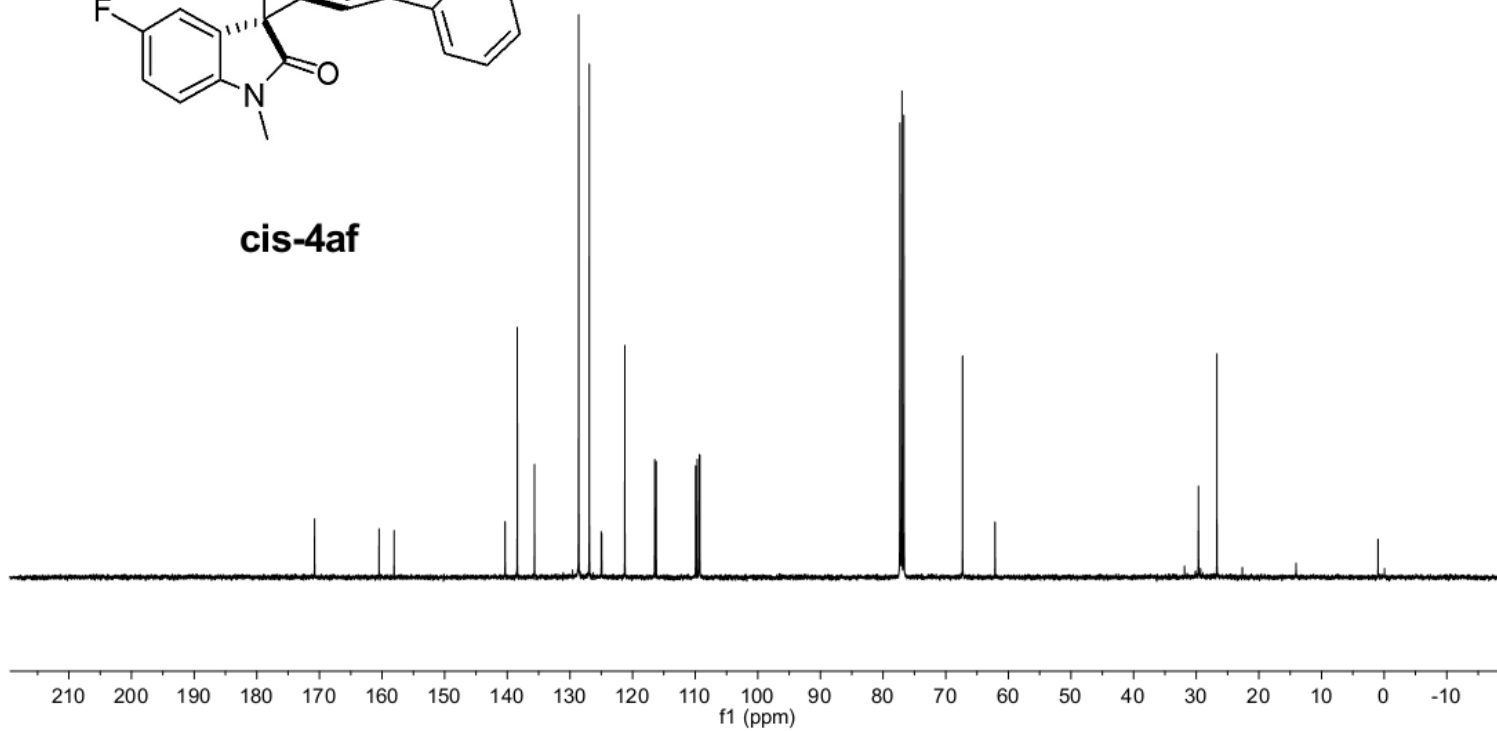


CMQ-3582
boss HWH
CMQ-3582

170.776
160.483
158.077
140.346
138.412
135.659
128.611
126.914
125.010
124.927
121.237
116.466
116.232
109.930
109.676
109.349
109.270
77.316
77.200
76.998
76.680
67.311
62.117
29.654
26.710
15.807
14.069
0.979
0.916



cis-4af



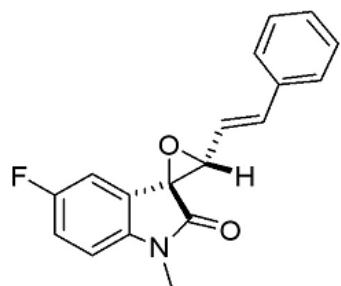
CMQ-3583
boss HWH
CMQ-3583

7.376
7.358
7.340
7.323
7.306
7.257
7.106
7.084
7.062
7.015
6.995
6.976
6.857
6.847
6.836
6.826
6.252
6.234
6.212
6.194

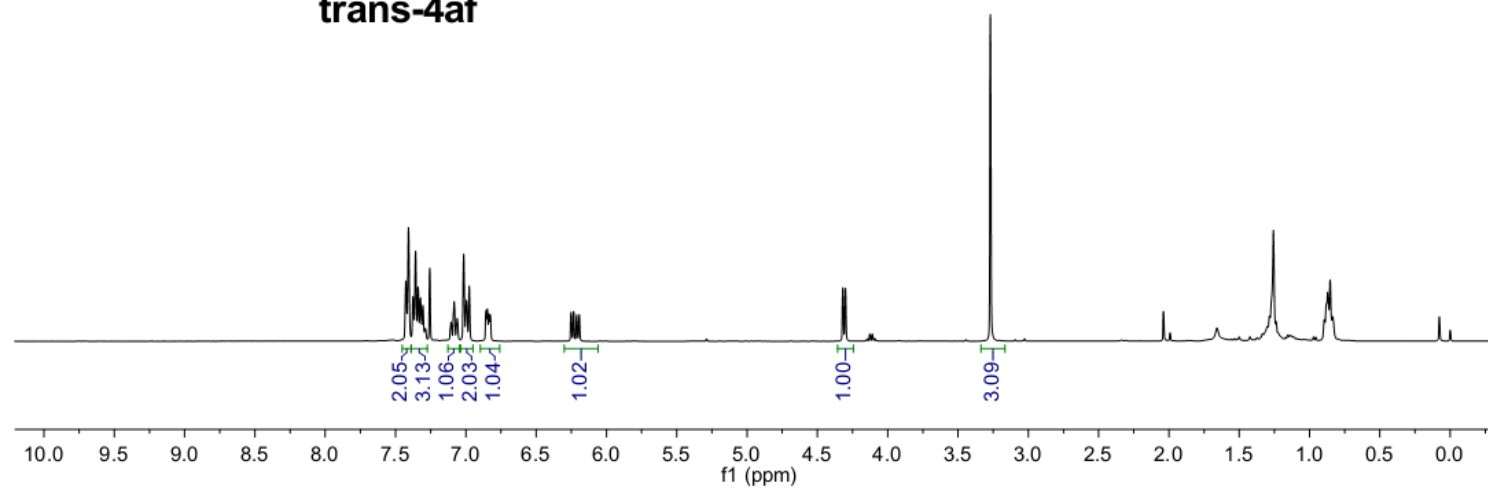
4.319
4.301

3.270

0.077

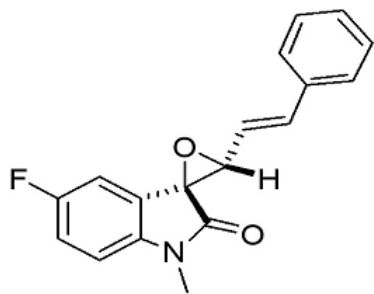


trans-4af

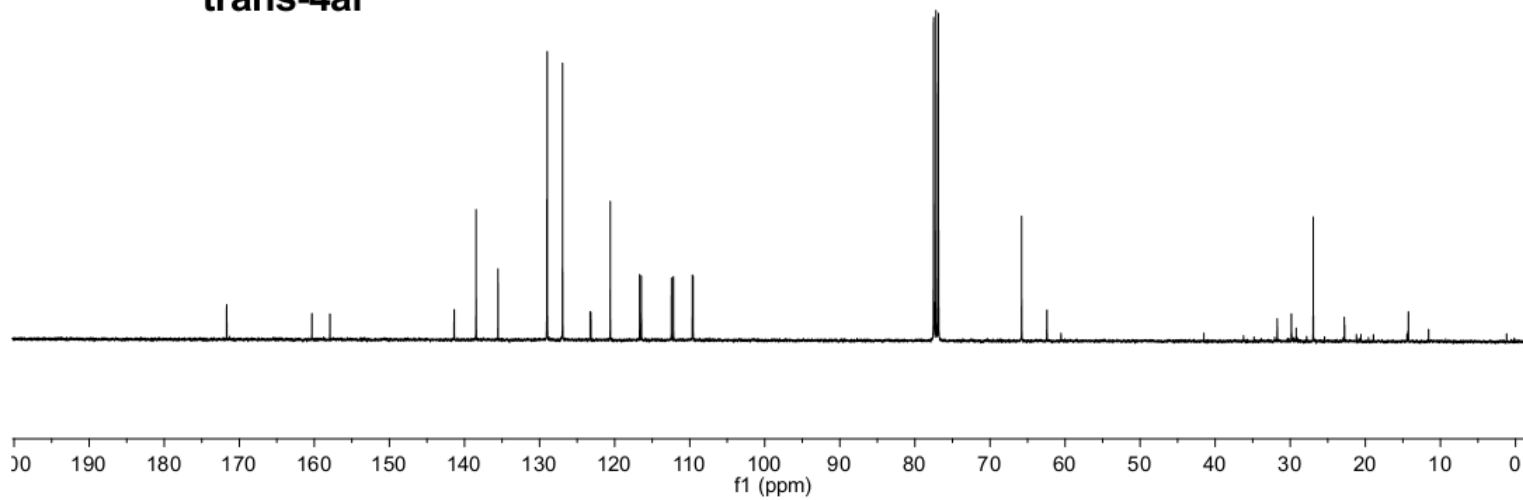


CMQ-3583
boss HWH
CMQ-3583

— 171.681
— 160.330
— 157.928
— 141.387
— 141.368
— 138.461
— 135.536
— 129.036
— 128.984
— 126.938
— 123.256
— 123.172
— 120.586
— 116.676
— 116.441
— 112.432
— 112.174
— 109.641
— 109.560
— 77.510
— 77.395
— 77.192
— 76.874
— 65.789
— 62.427
— 31.609
— 29.851
— 26.765
— 22.842
— 14.264
— 11.446



trans-4af



CMQ-4102
boss HWH
CMQ-4102

8.343
8.322
8.040
7.456
7.438
7.353
7.335
7.316
7.290
7.262
6.995
6.975
6.938
6.795
6.774
6.755
6.733

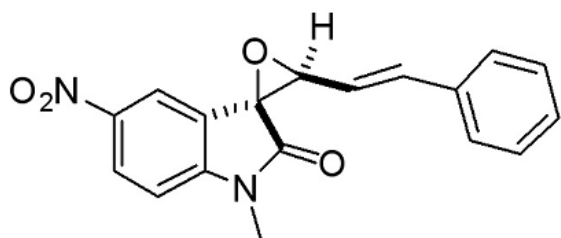
4.333
4.312

3.334

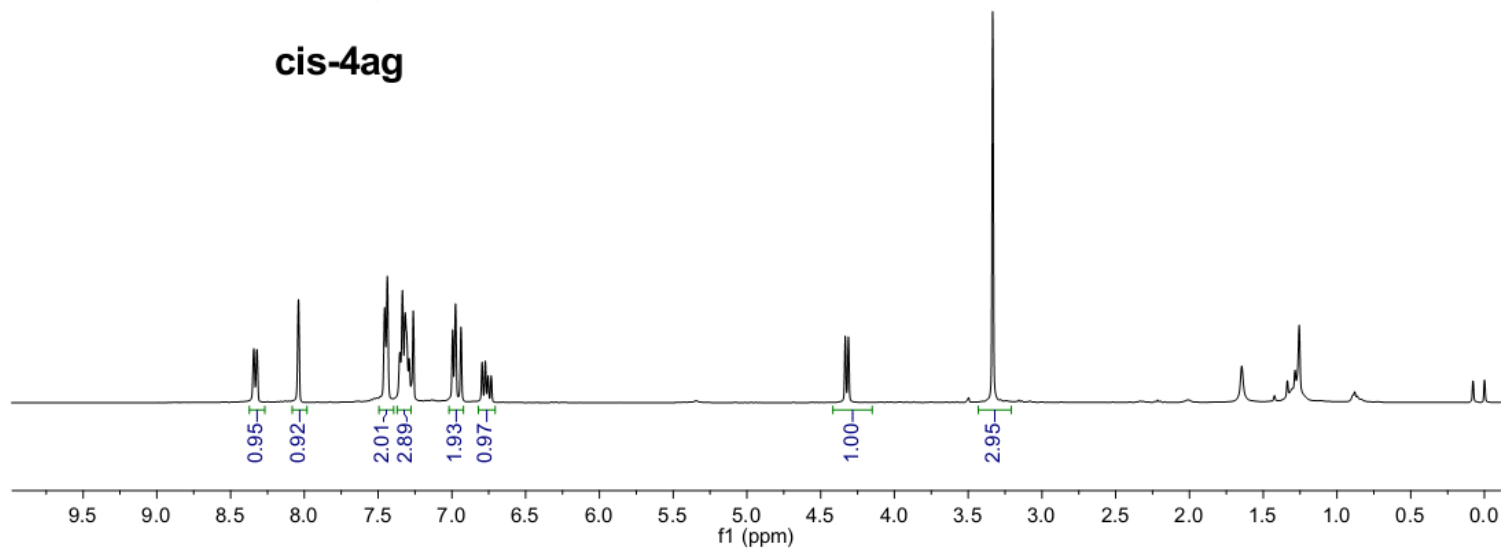
1.646

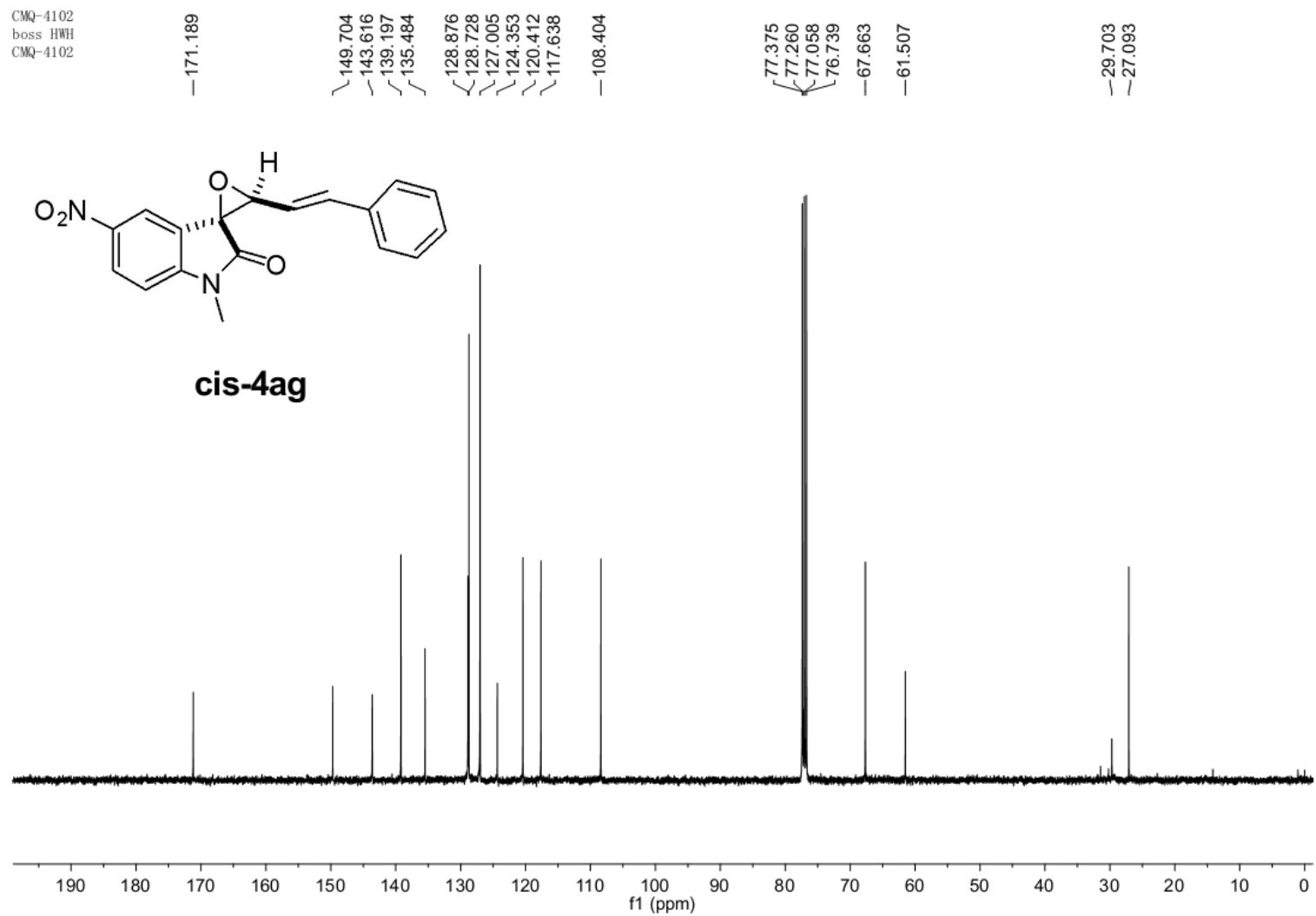
1.256

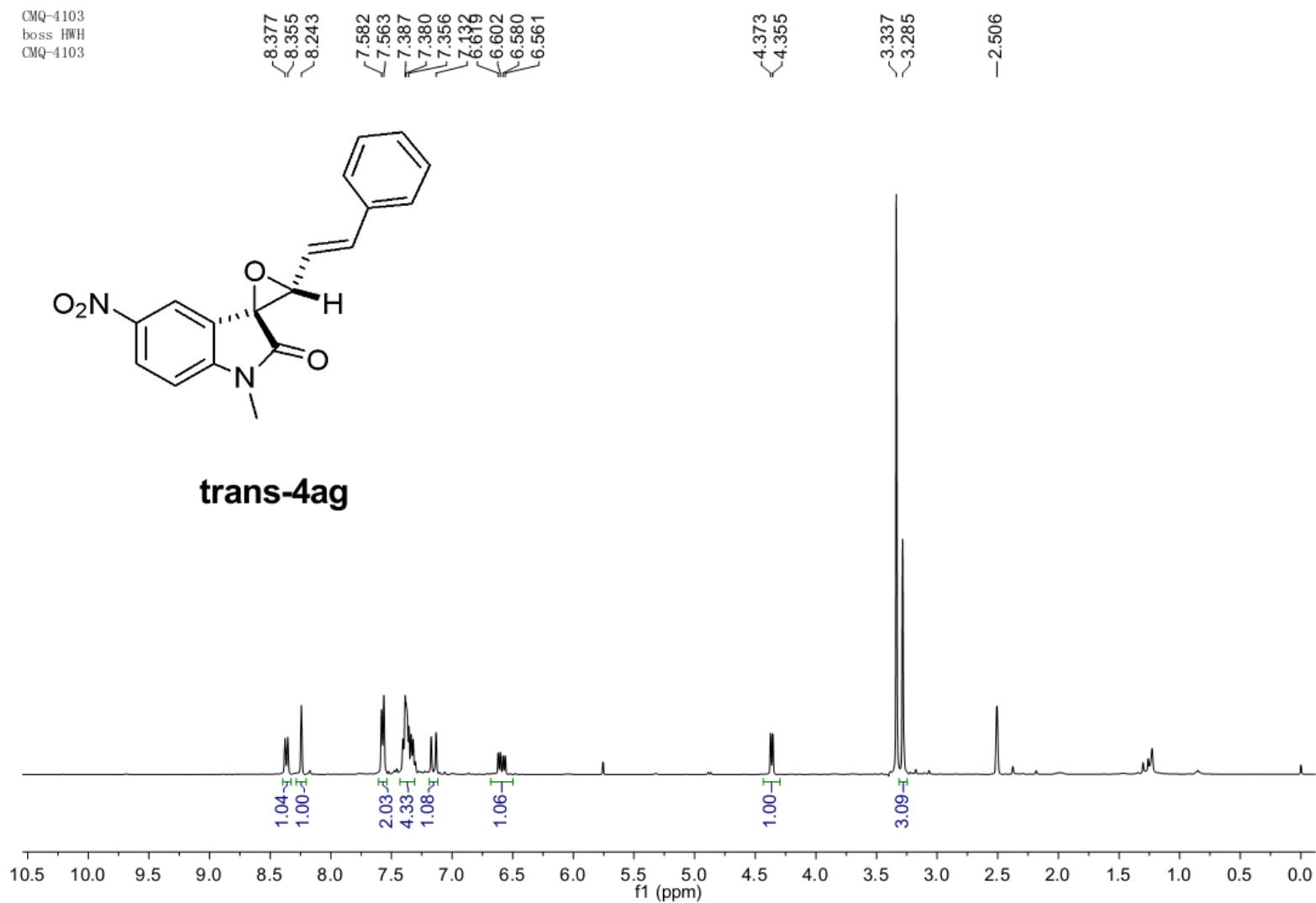
0.078
0.000



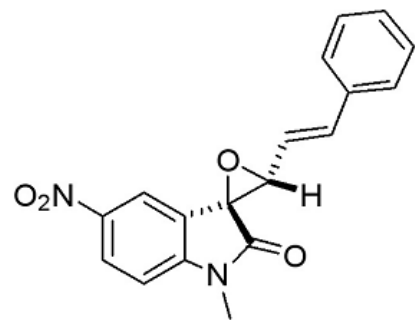
cis-4ag



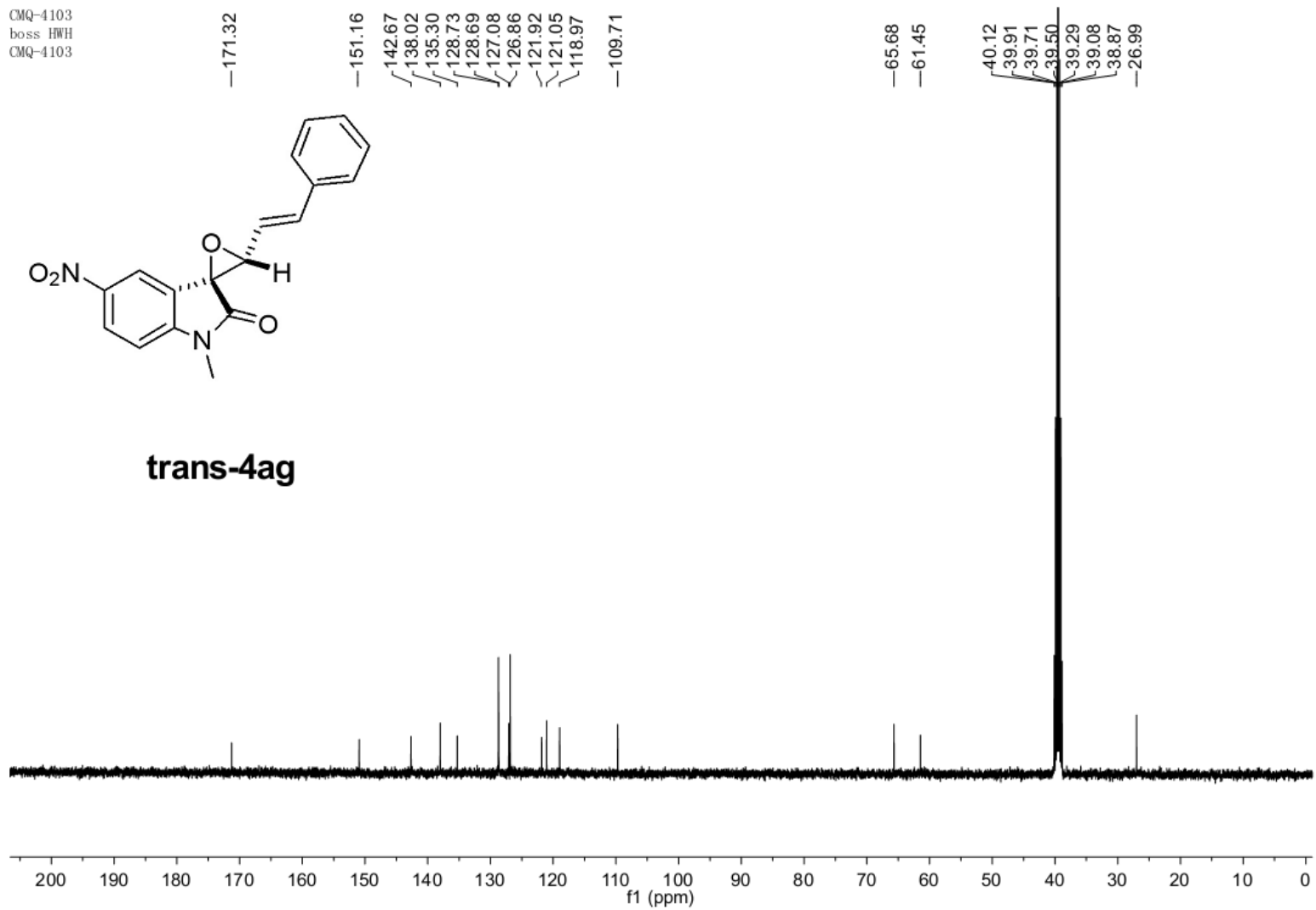


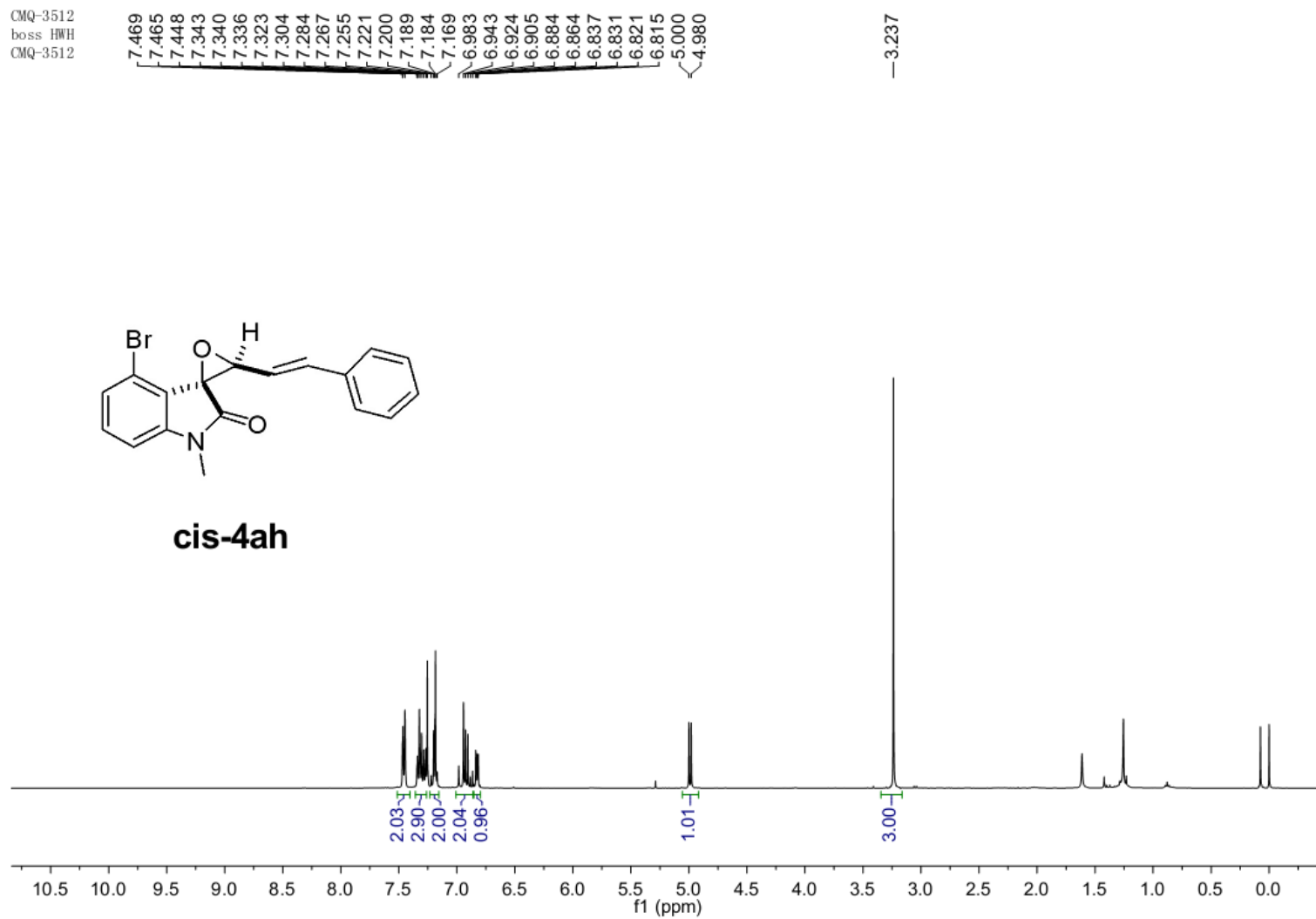


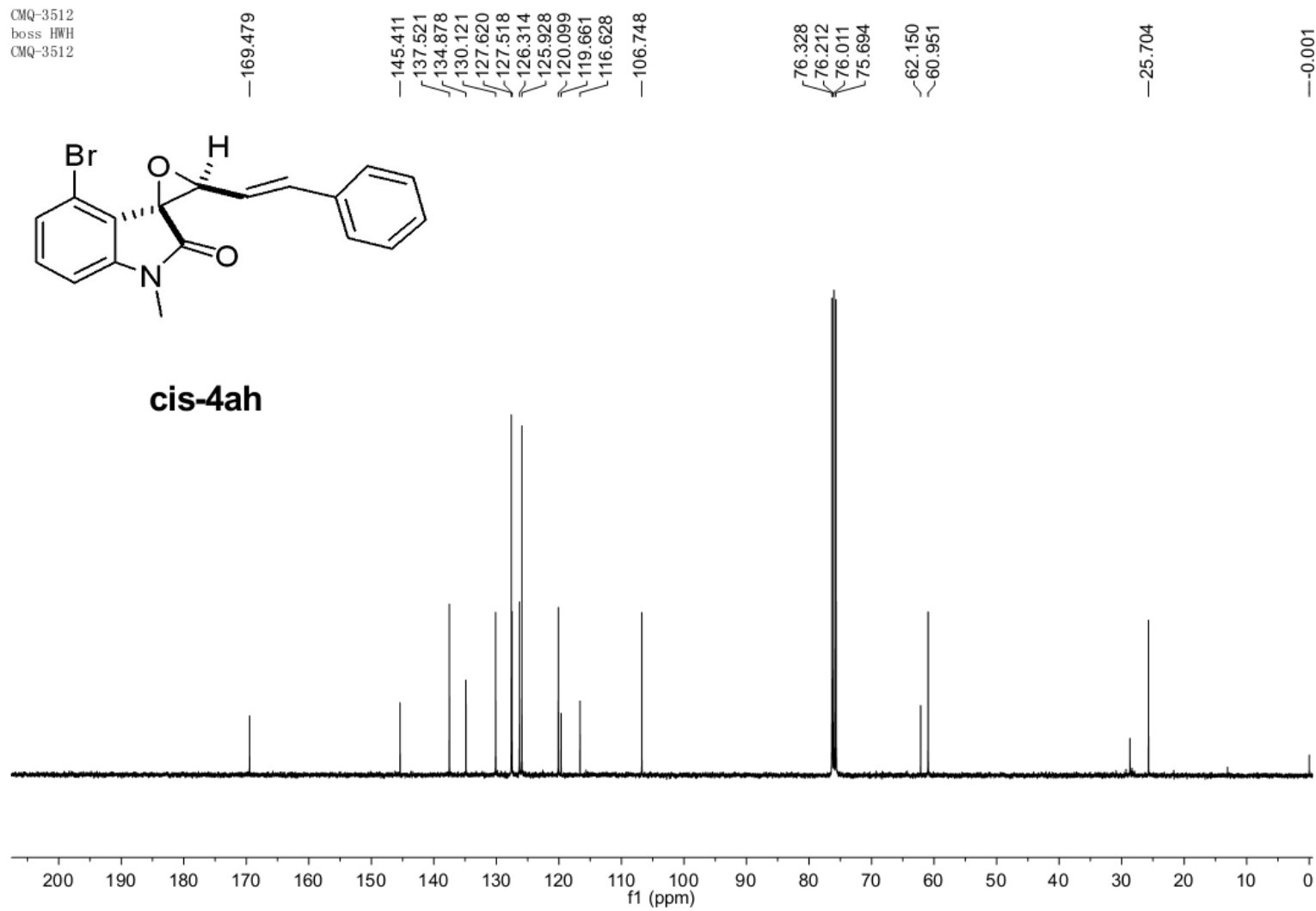
CMQ-4103
boss HWH
CMQ-4103

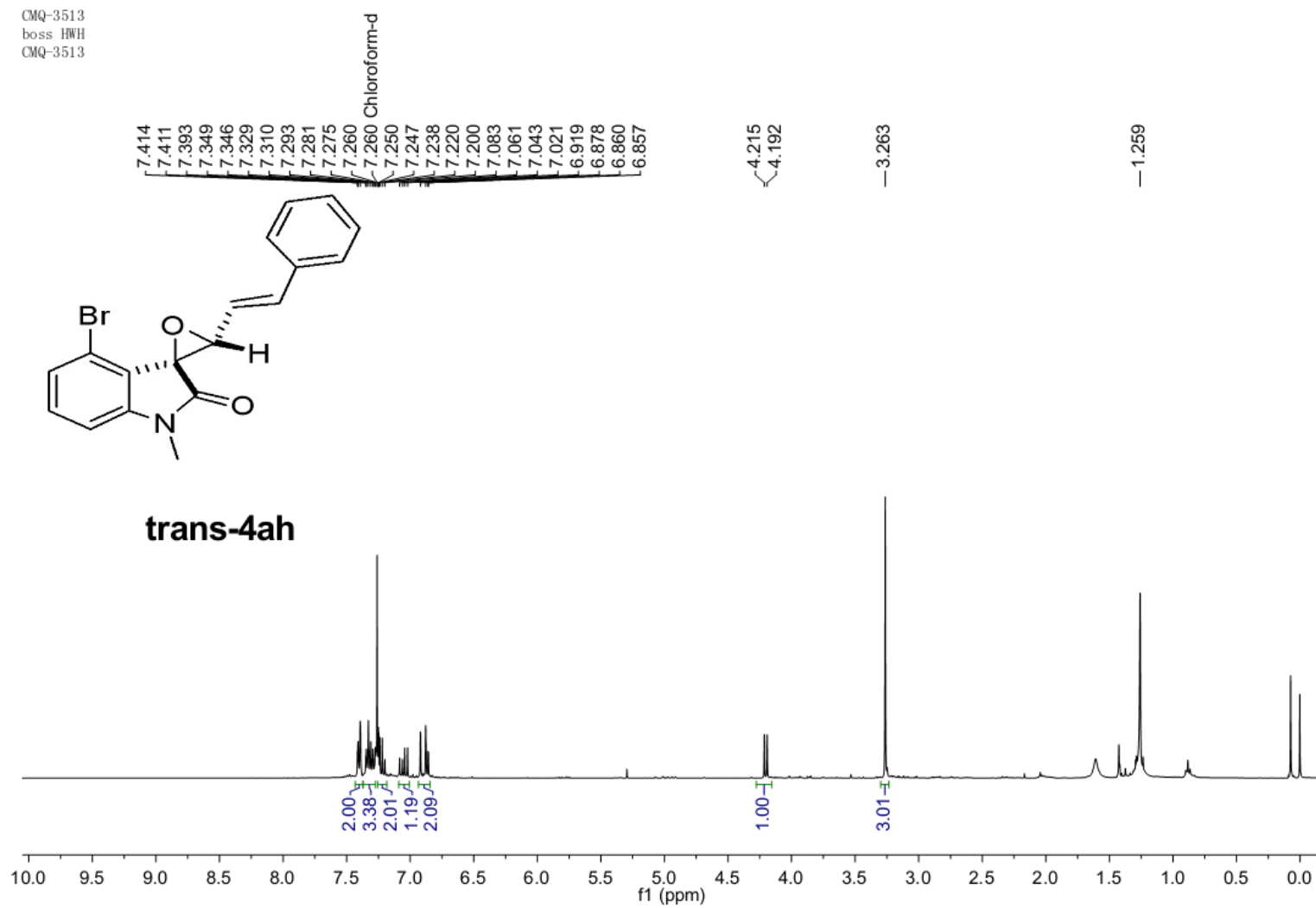


trans-4ag

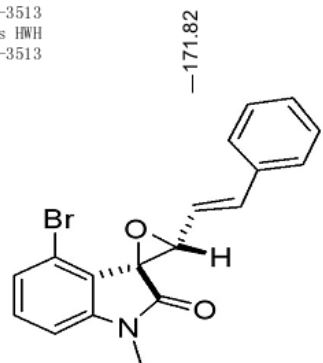




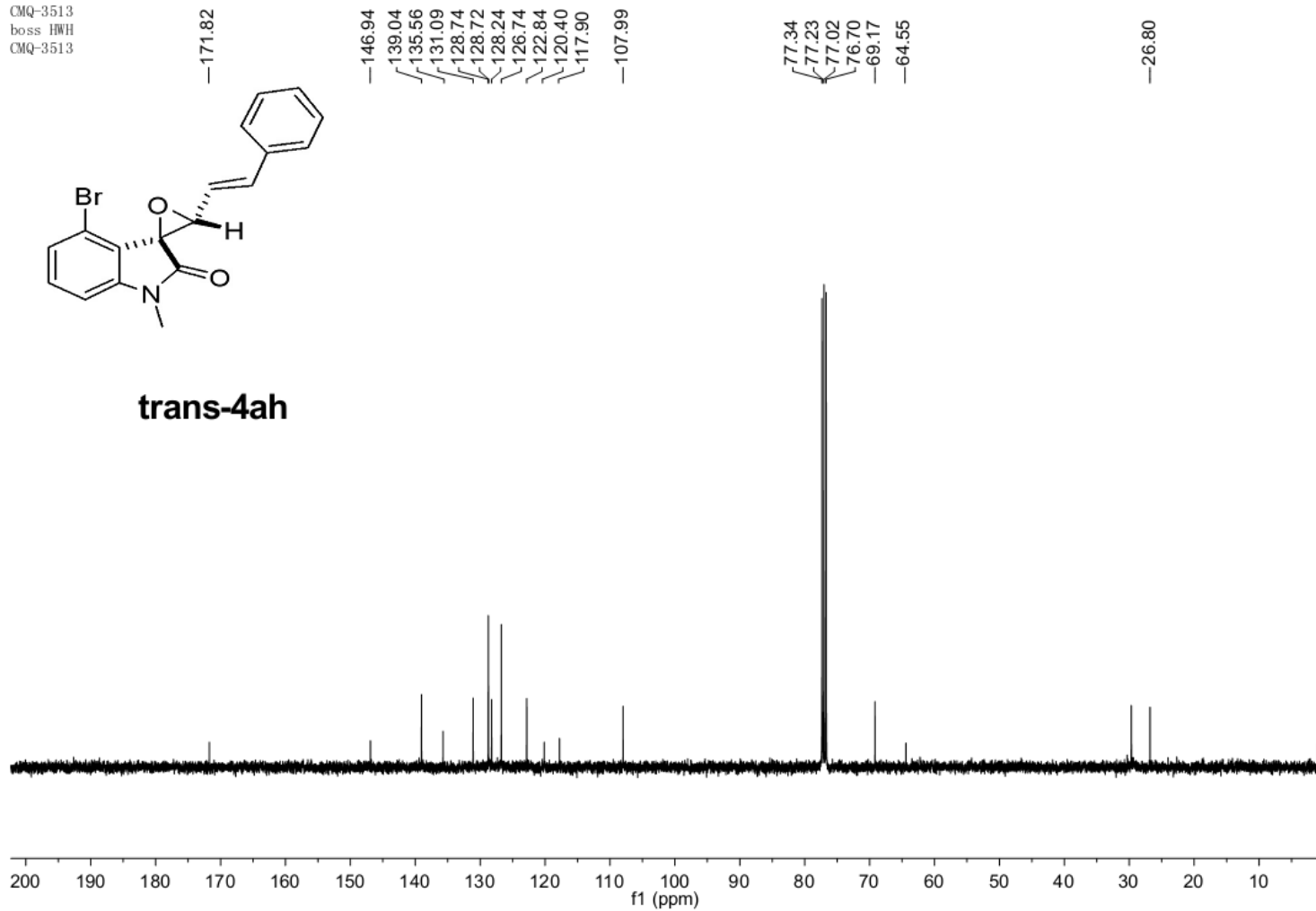




CMQ-3513
boss HWH
CMQ-3513



trans-4ah



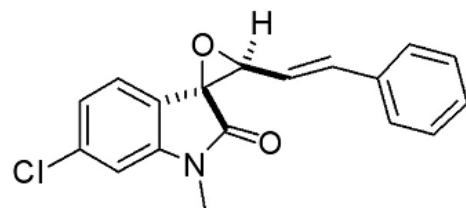
CMQ-3462
boss HWH
CMQ-3462

7.386
7.368
7.273
7.256
7.237
7.220
7.203
7.185
6.996
6.862
6.829
6.823
6.771
6.750
6.730
6.709

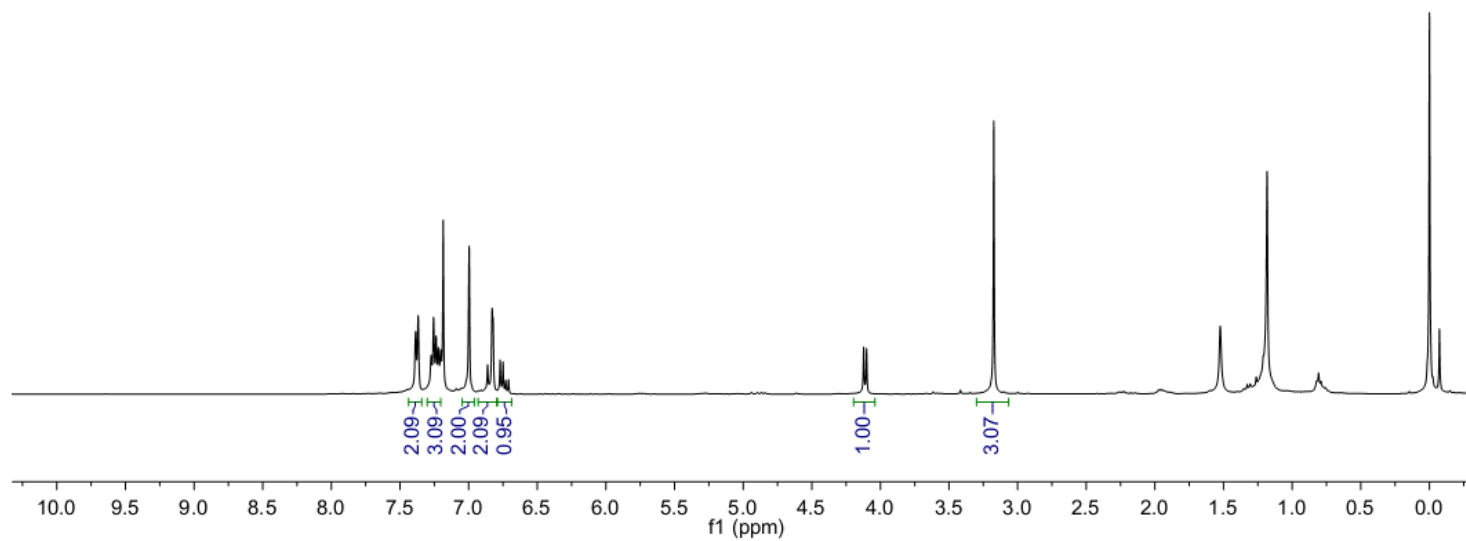
4.122
4.101

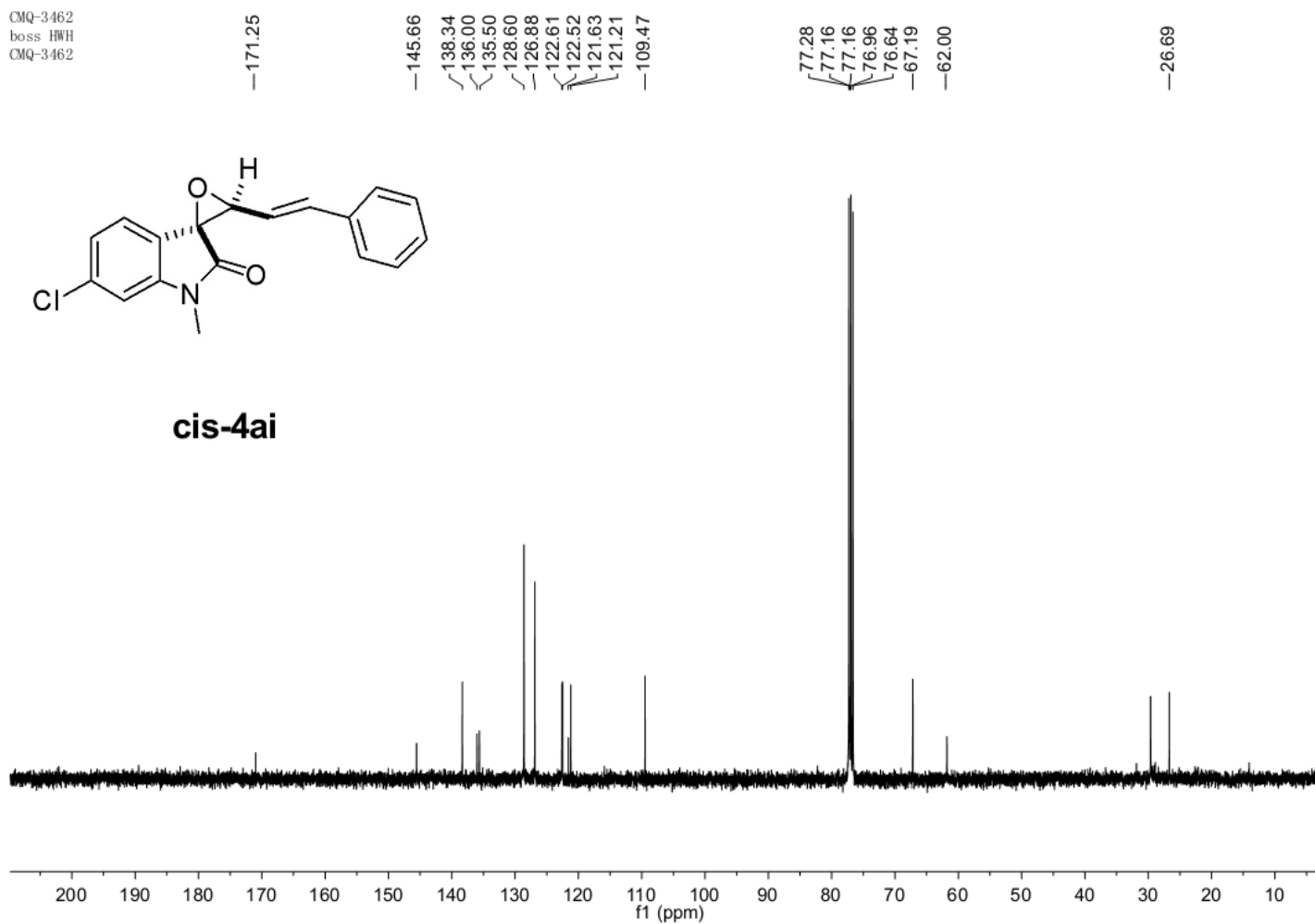
3.174

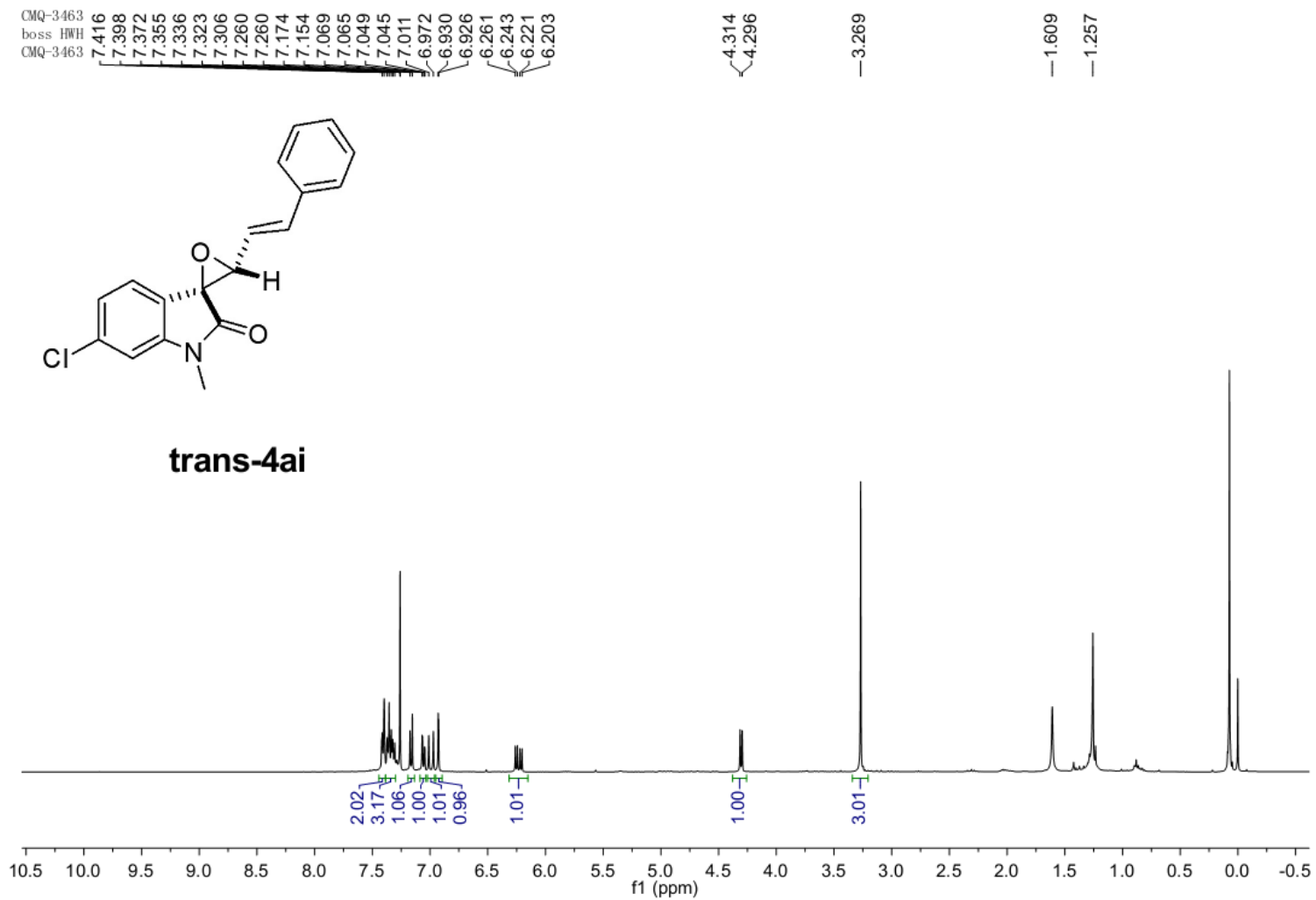
1.524
1.210



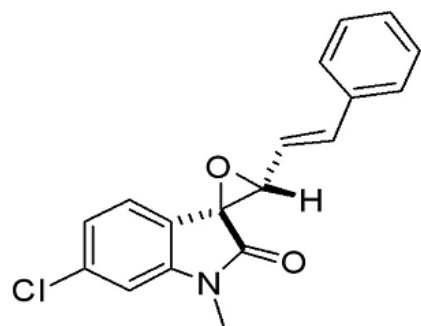
cis-4ai



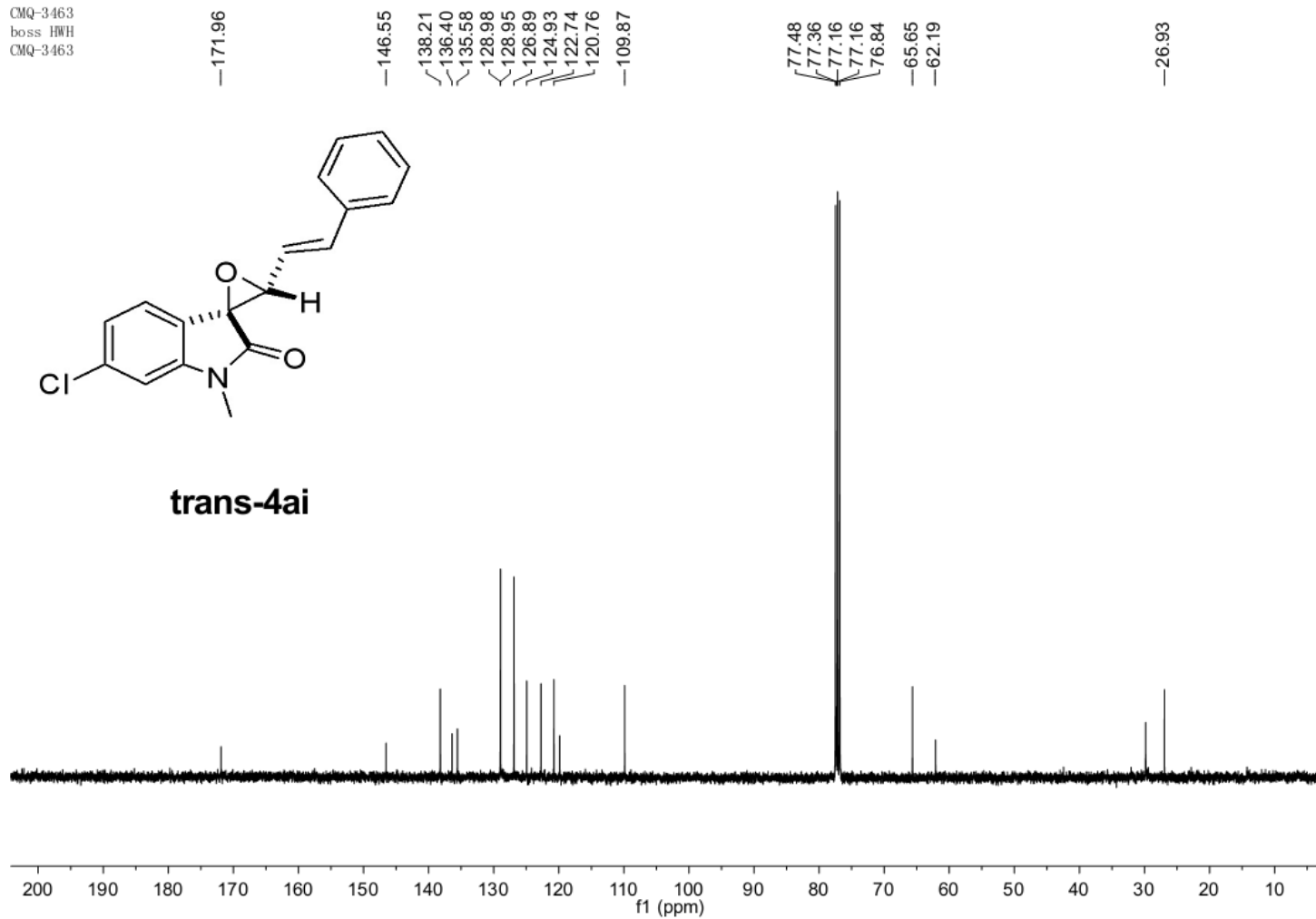




CMQ-3463
boss_HWH
CMQ-3463



trans-4ai

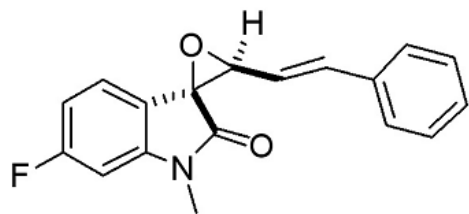


cmg-3402
boss HWH
cmg-3402

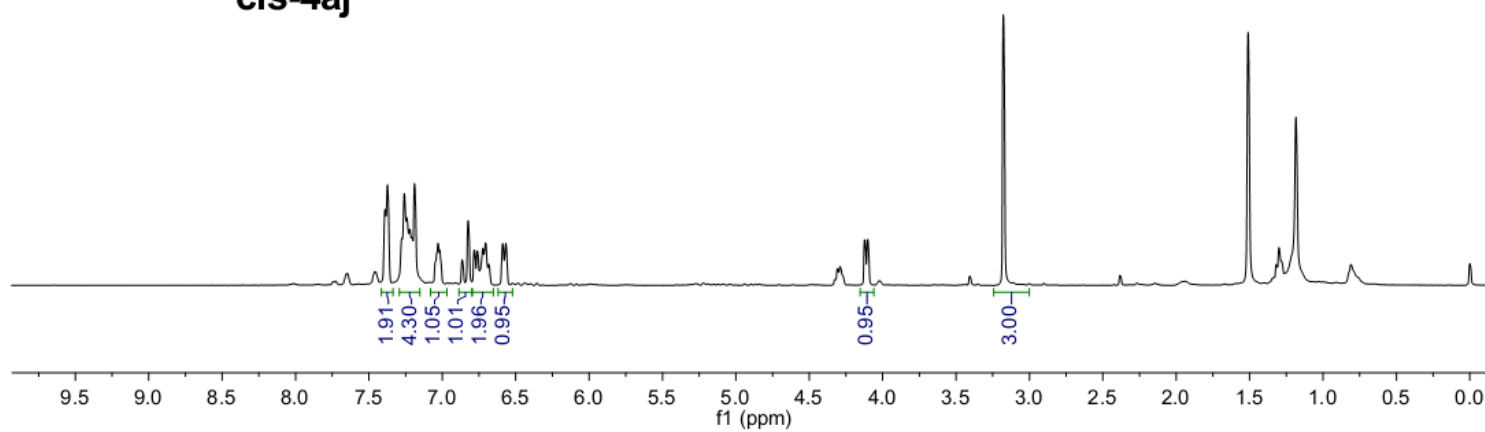
7.390
7.374
7.259
7.242
7.189
7.028
7.018
6.865
6.824
6.783
6.762
6.724
6.705
6.589
6.567

4.123
4.102

3.178

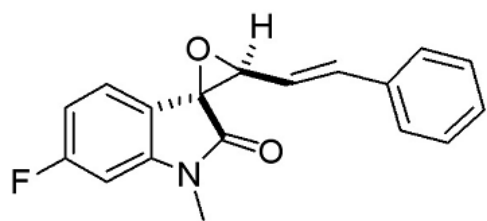


cis-4aj

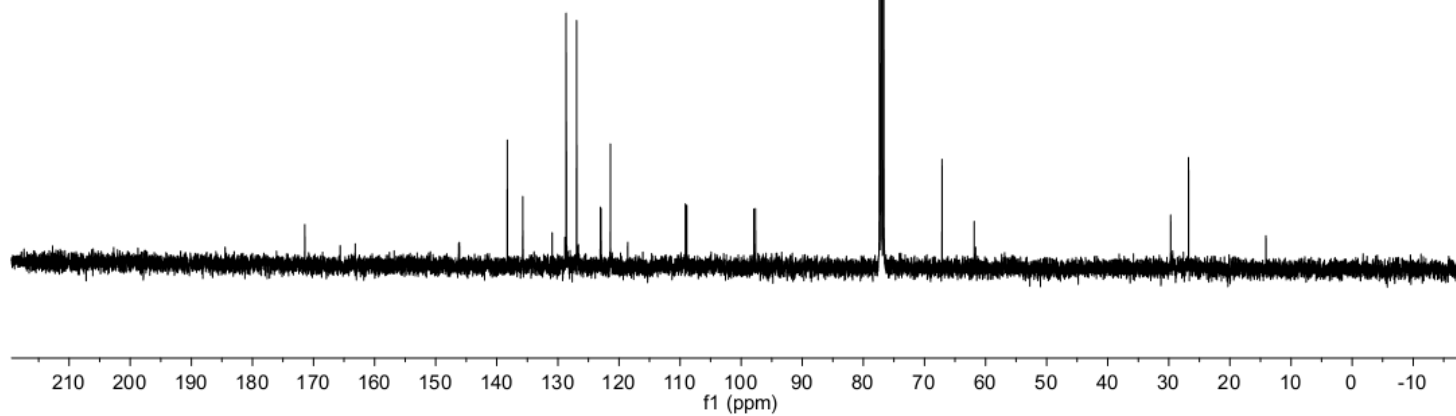


cmg-3402
boss HWH
cmg-3402

— 171.427
— 146.117
— 138.283
— 135.747
— 128.662
— 128.612
— 126.938
— 123.049
— 122.948
— 119.493
— 108.909
— 97.936
— 97.660
77.335
77.049
76.700
— 67.125
— 61.876
— 29.701
— 26.833
— 14.110



cis-4aj

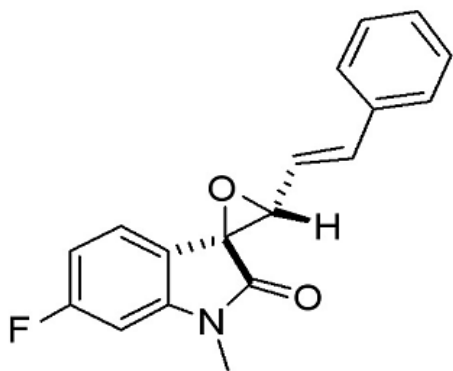


cmg-3403
boss HWH
cmg-3403

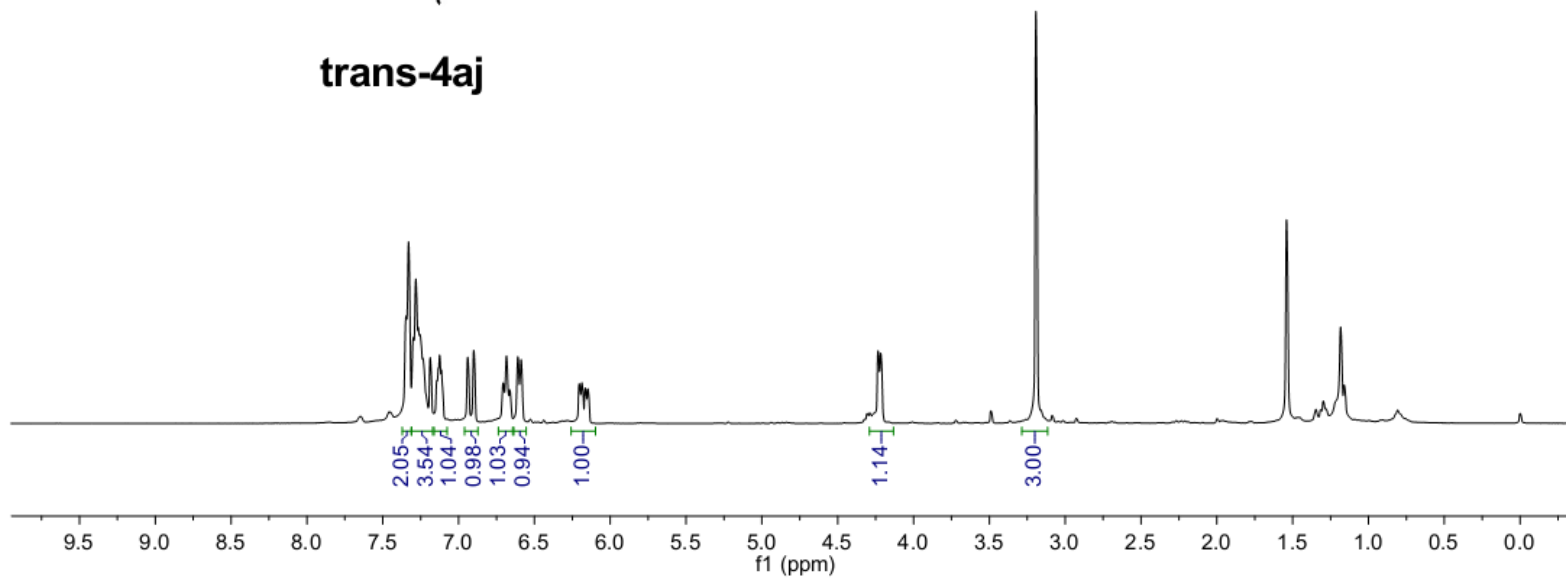
7.346
7.330
7.298
7.282
7.266
7.254
7.235
7.187
7.143
7.133
7.125
7.113
6.940
6.900
6.684
6.609
6.588
6.204
6.187
6.165
6.147

4.234
4.217

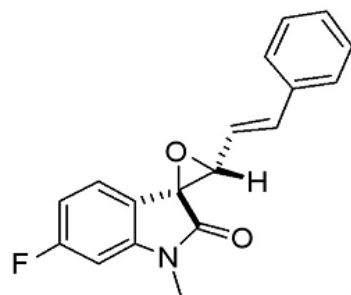
3.193



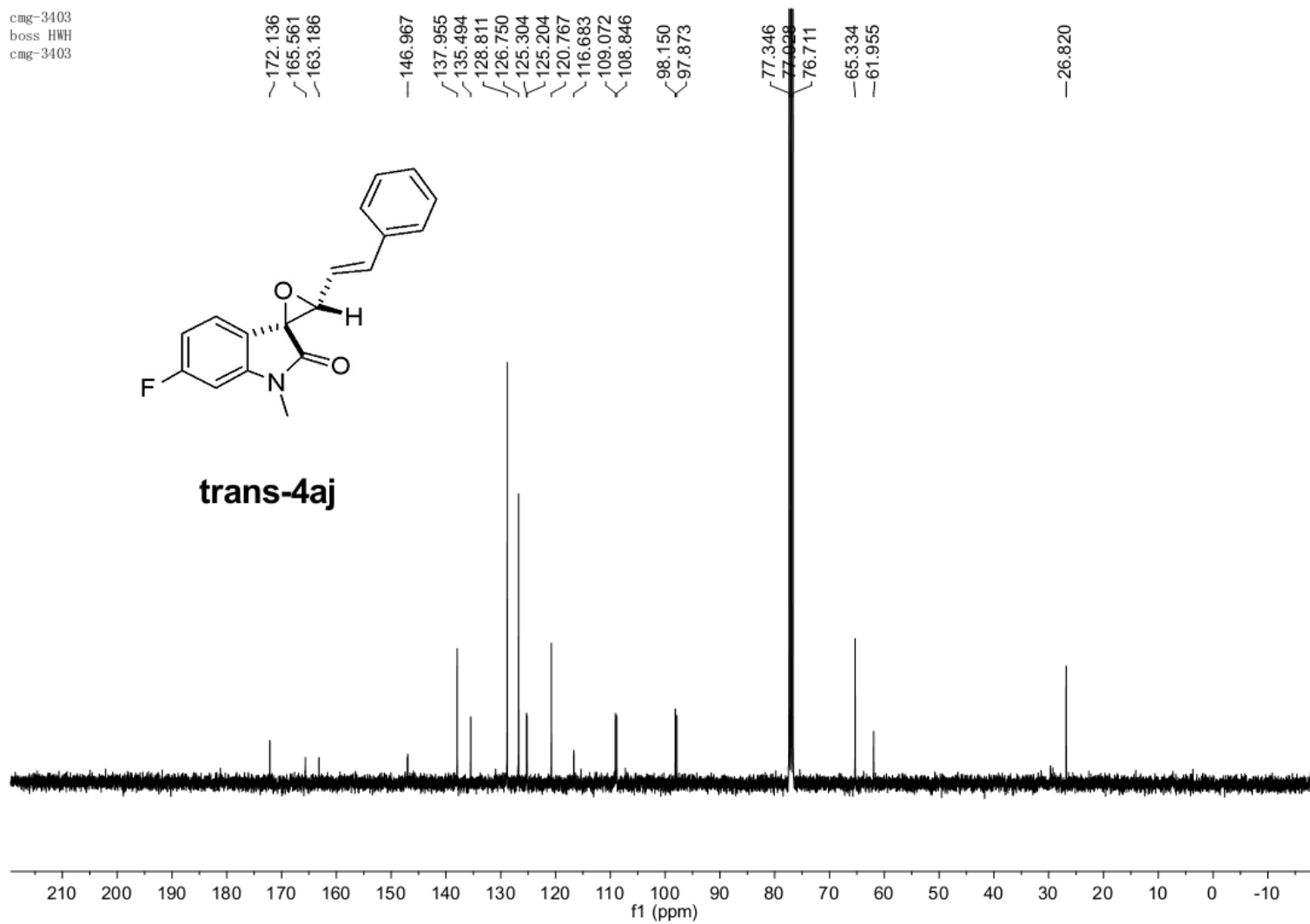
trans-4aj



cmg-3403
boss HWH
cmg-3403



trans-4aj

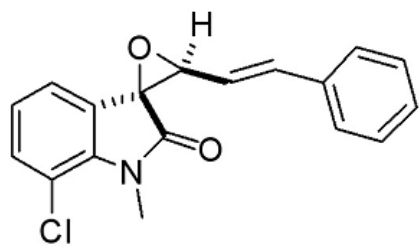


CMQ-3502
boss HWH
CMQ-3502

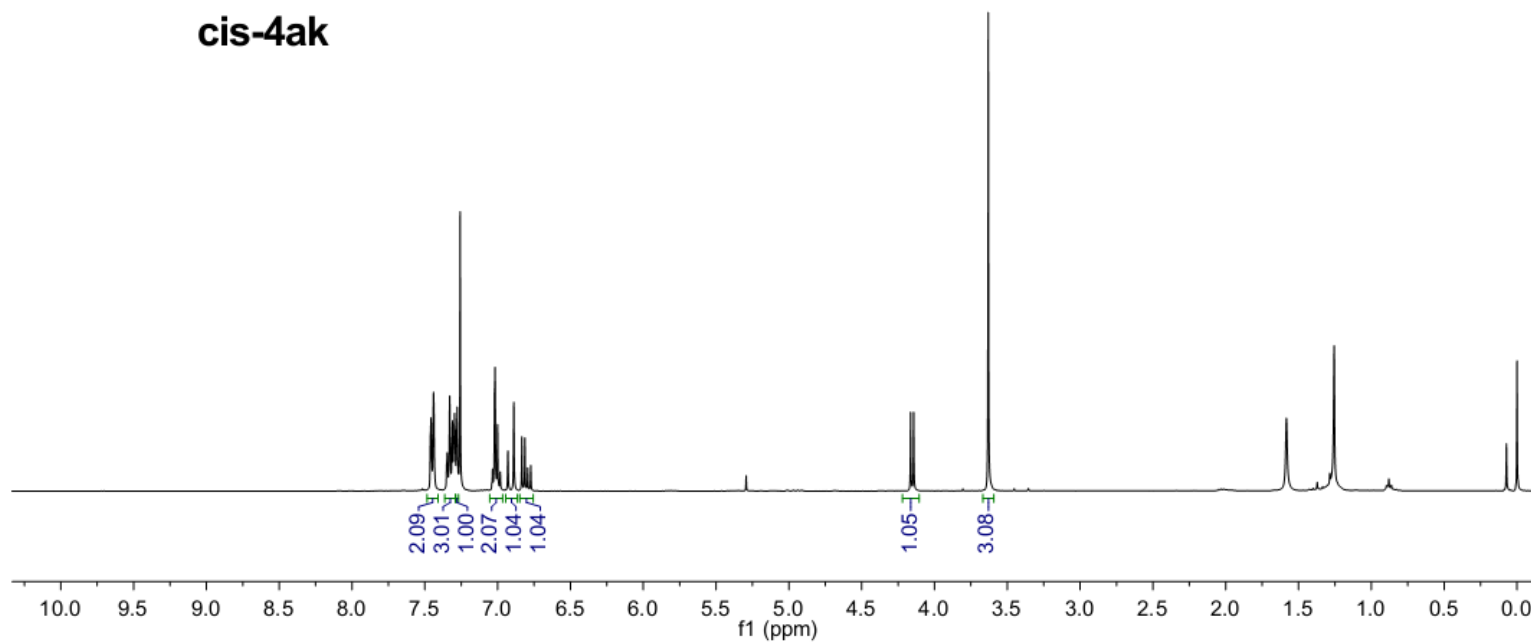
7.458
7.440
7.346
7.329
7.310
7.301
7.296
7.283
7.278
7.257
7.035
7.021
7.018
7.000
6.982
6.929
6.889
6.834
6.813
6.793
6.772

4.164
4.143
—3.631

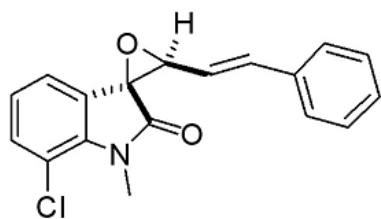
—1.583
—1.285



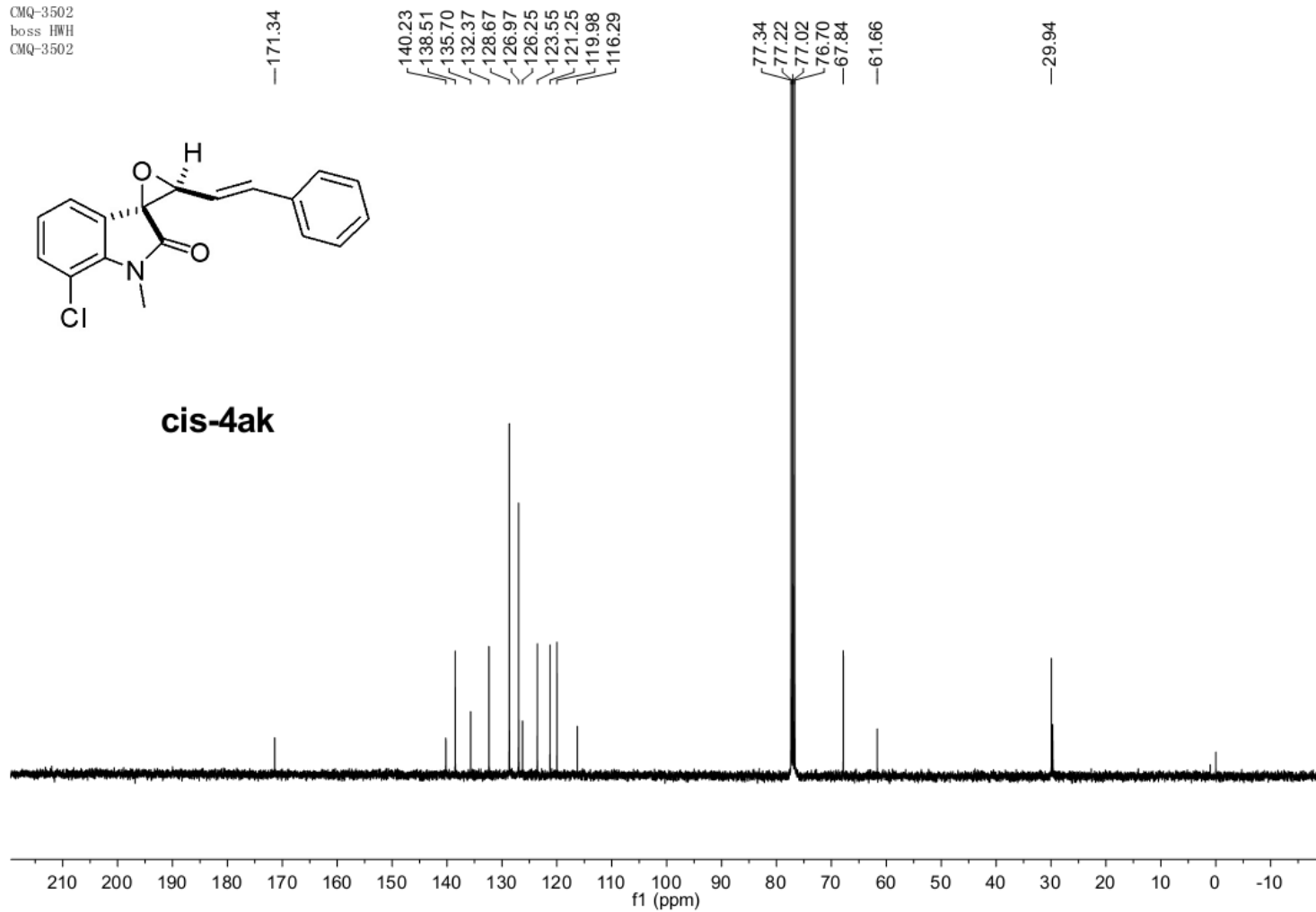
cis-4ak

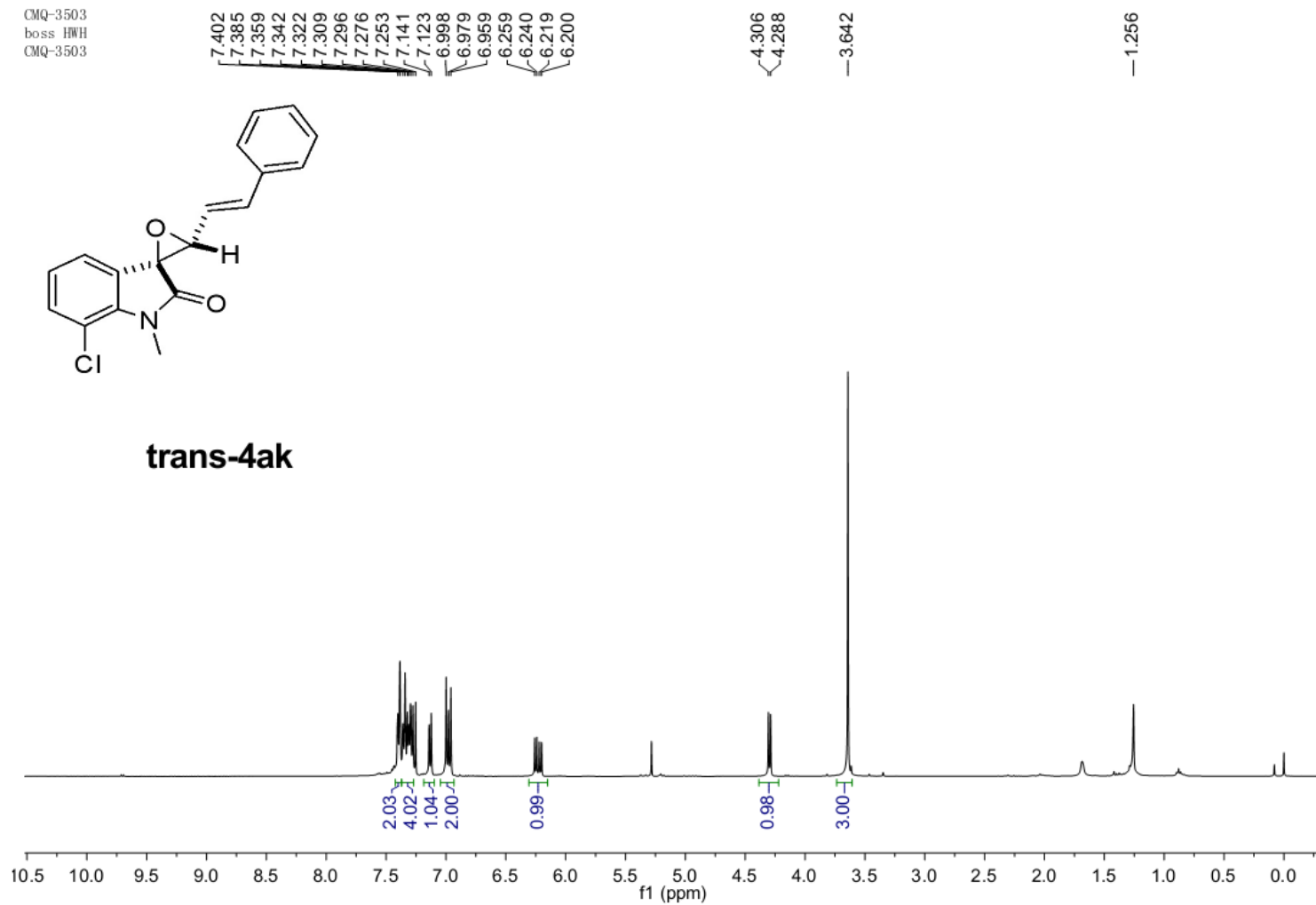


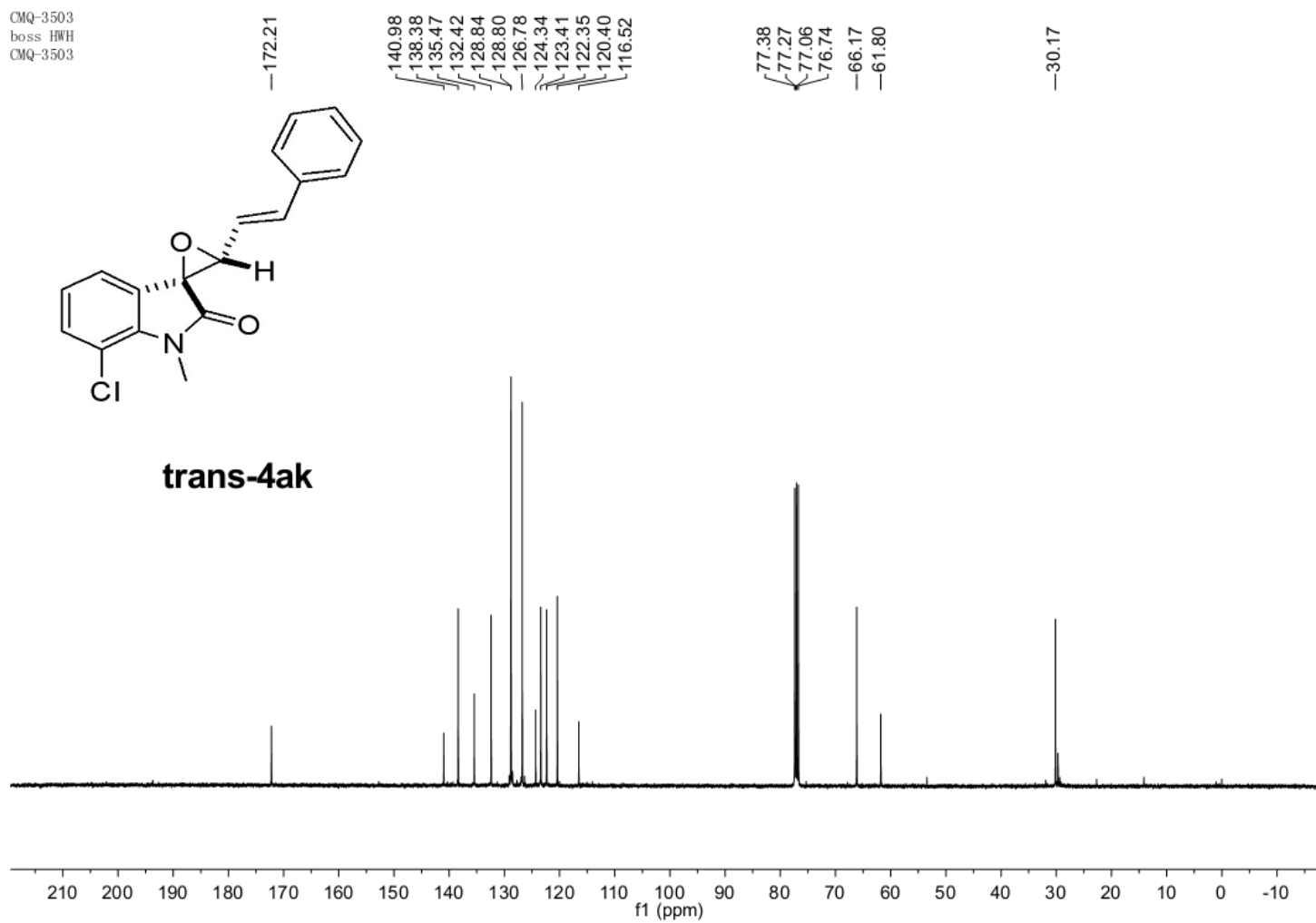
CMQ-3502
boss HWH
CMQ-3502



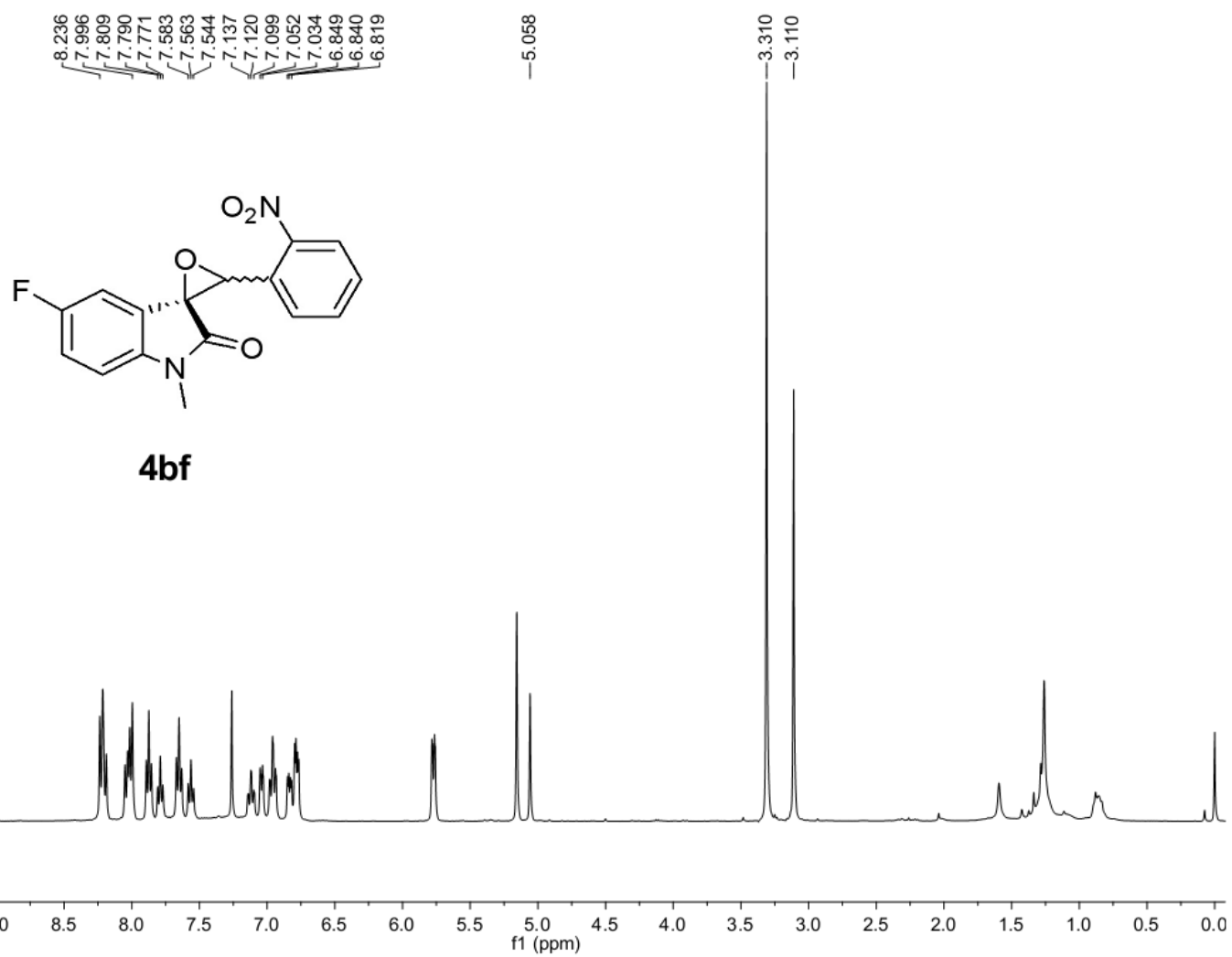
cis-4ak



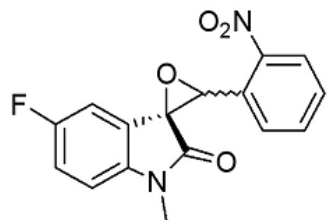




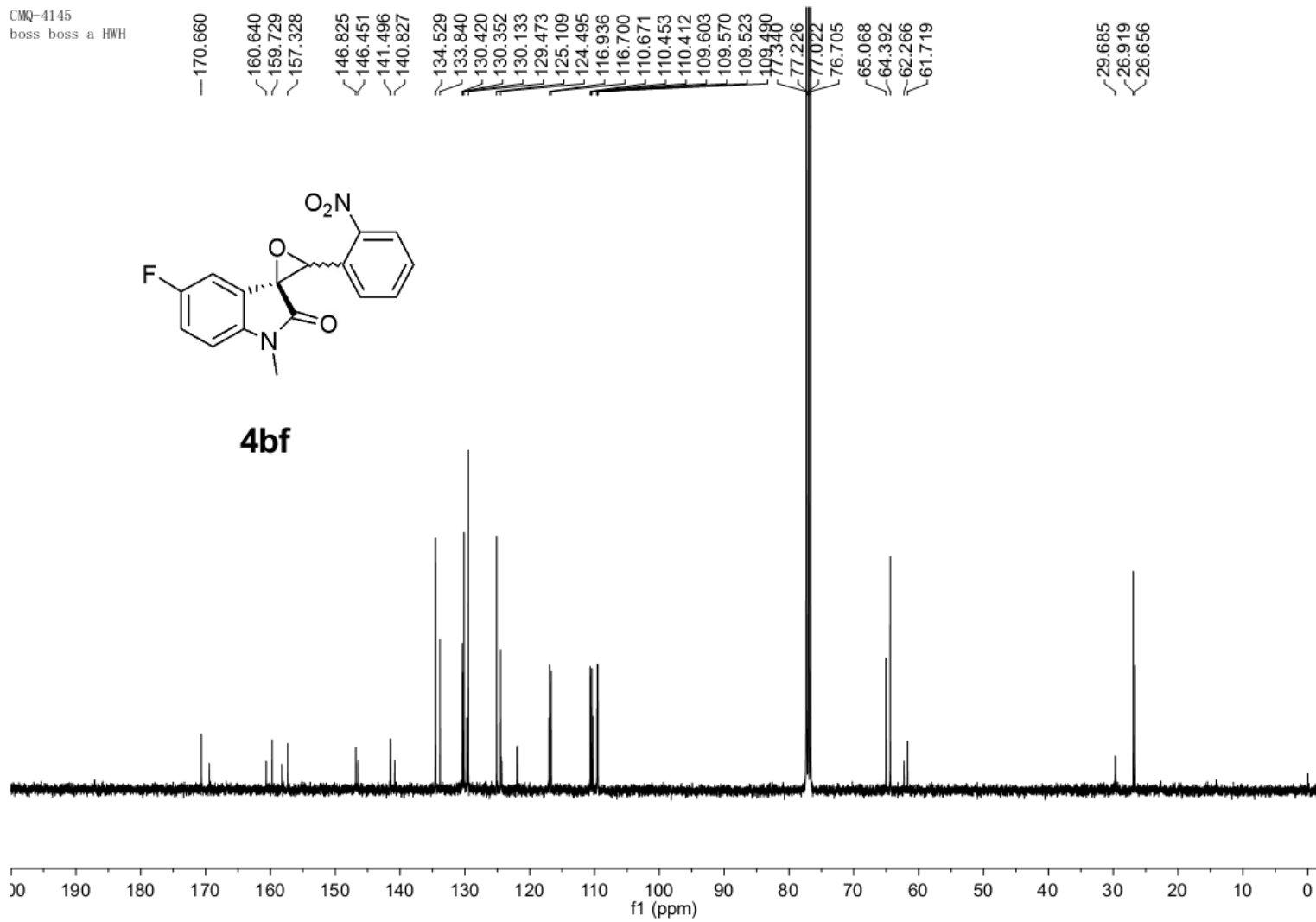
CMQ-4145
boss boss a HWH



CMQ-4145
boss boss a HWH



4bf

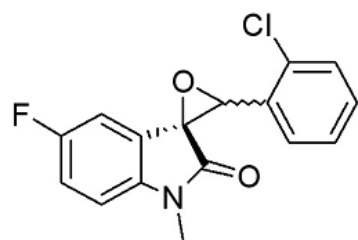


CMQ-4137
boss boss a

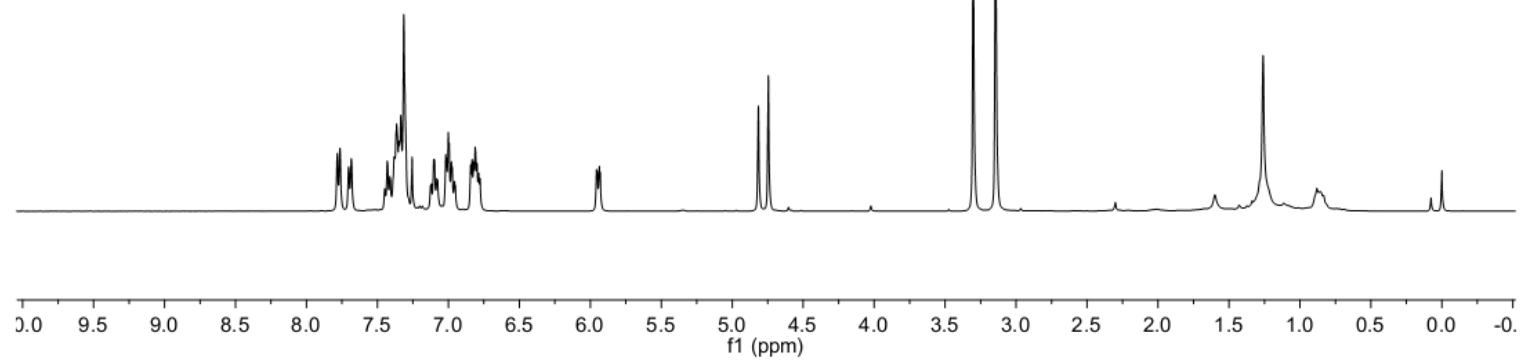
7.783
7.764
7.703
7.684
6.843
6.833
6.822
6.812
6.798
6.787
5.956
5.950
5.936
5.931

4.816
4.746

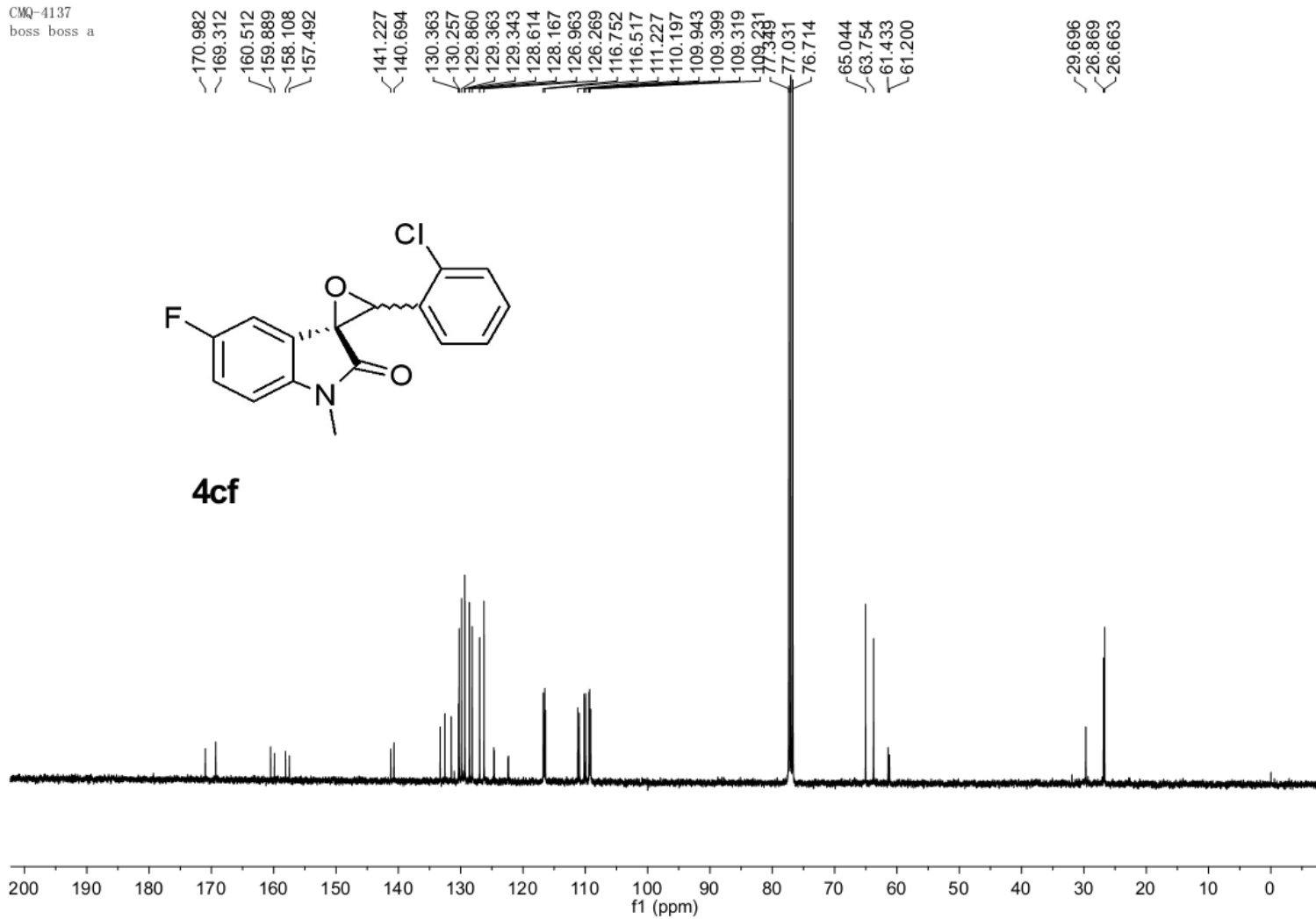
3.301
3.144



4cf



CMQ-4137
boss boss a



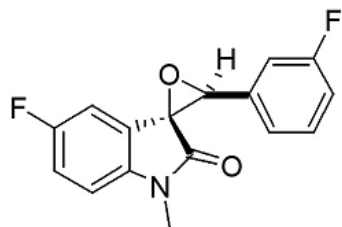
CMQ-41352
boss HWH

7.339
7.250
7.115
7.111
7.093
7.066
7.037
7.032
6.970
6.965
6.952
6.830
6.821
6.809
6.800

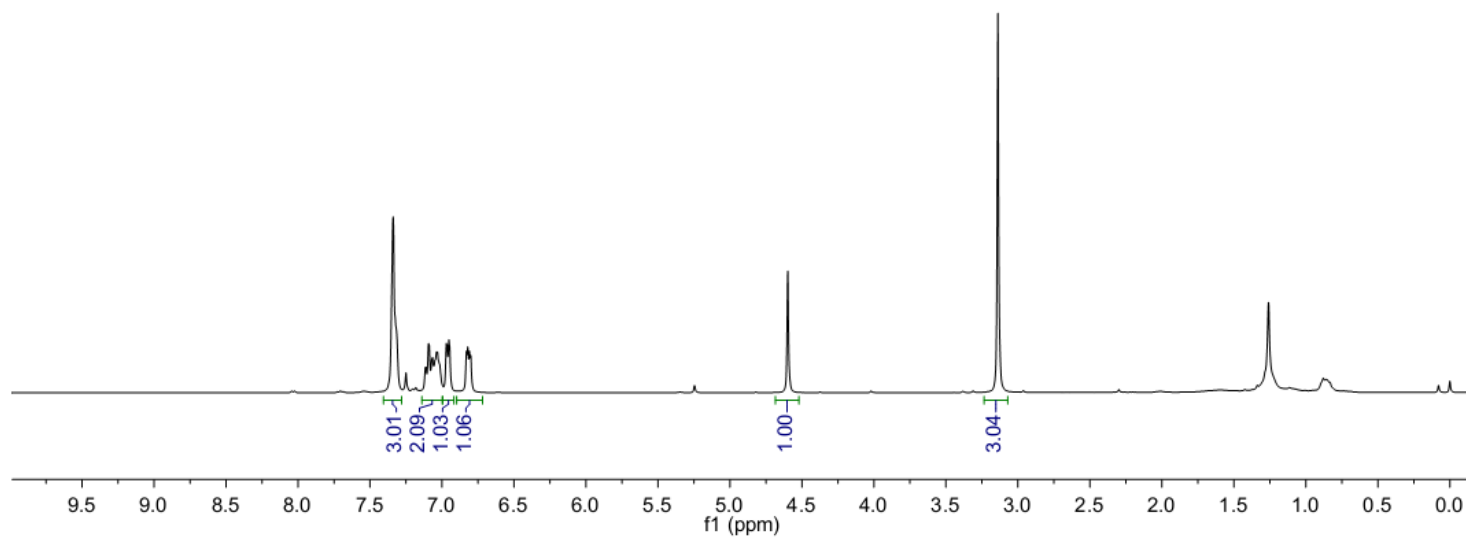
—4.598

—3.139

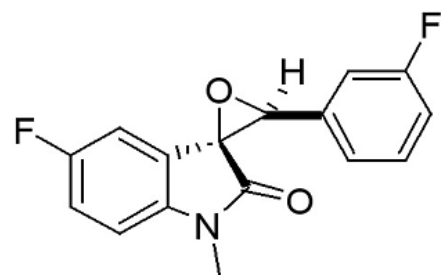
—1.259



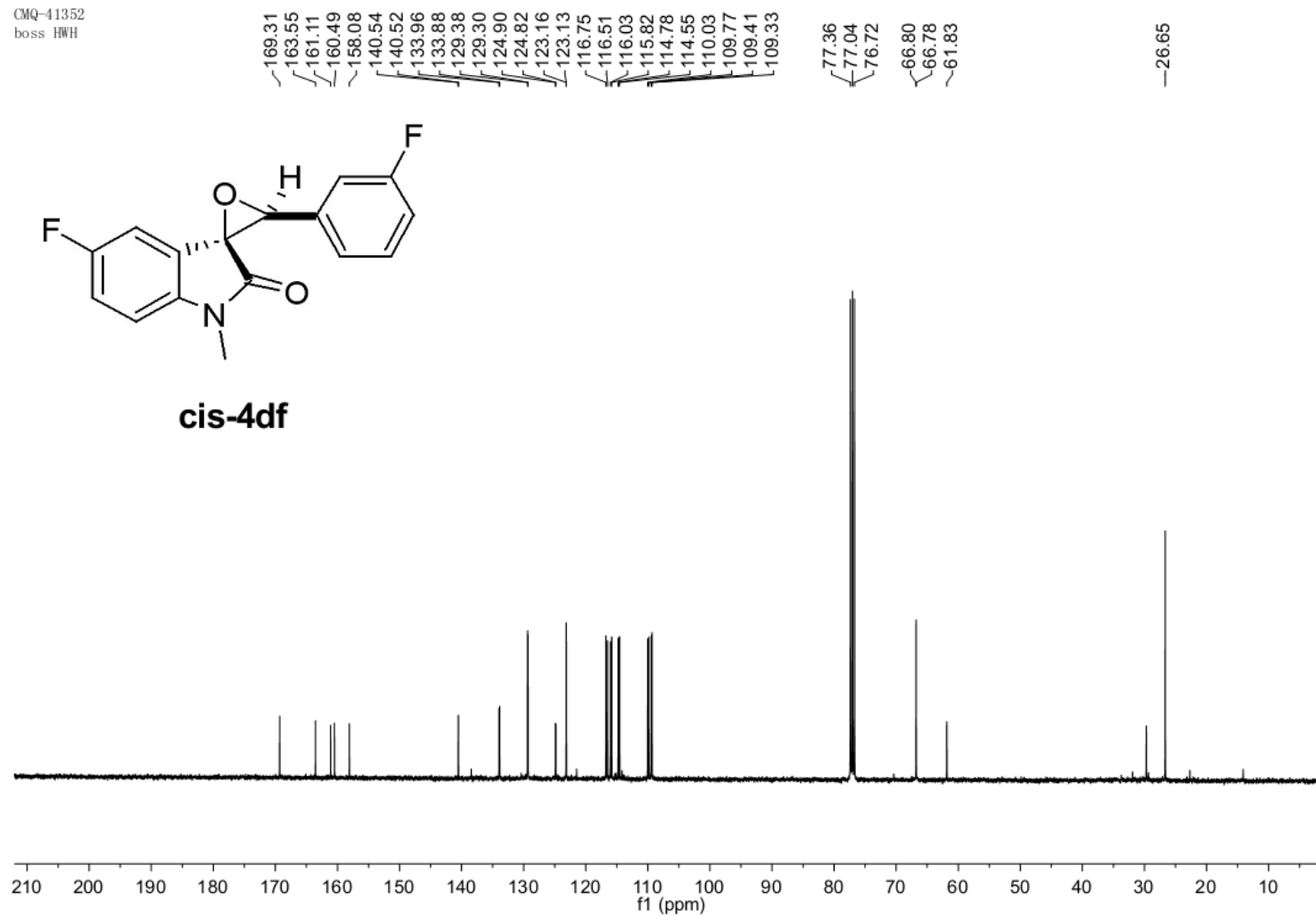
cis-4df

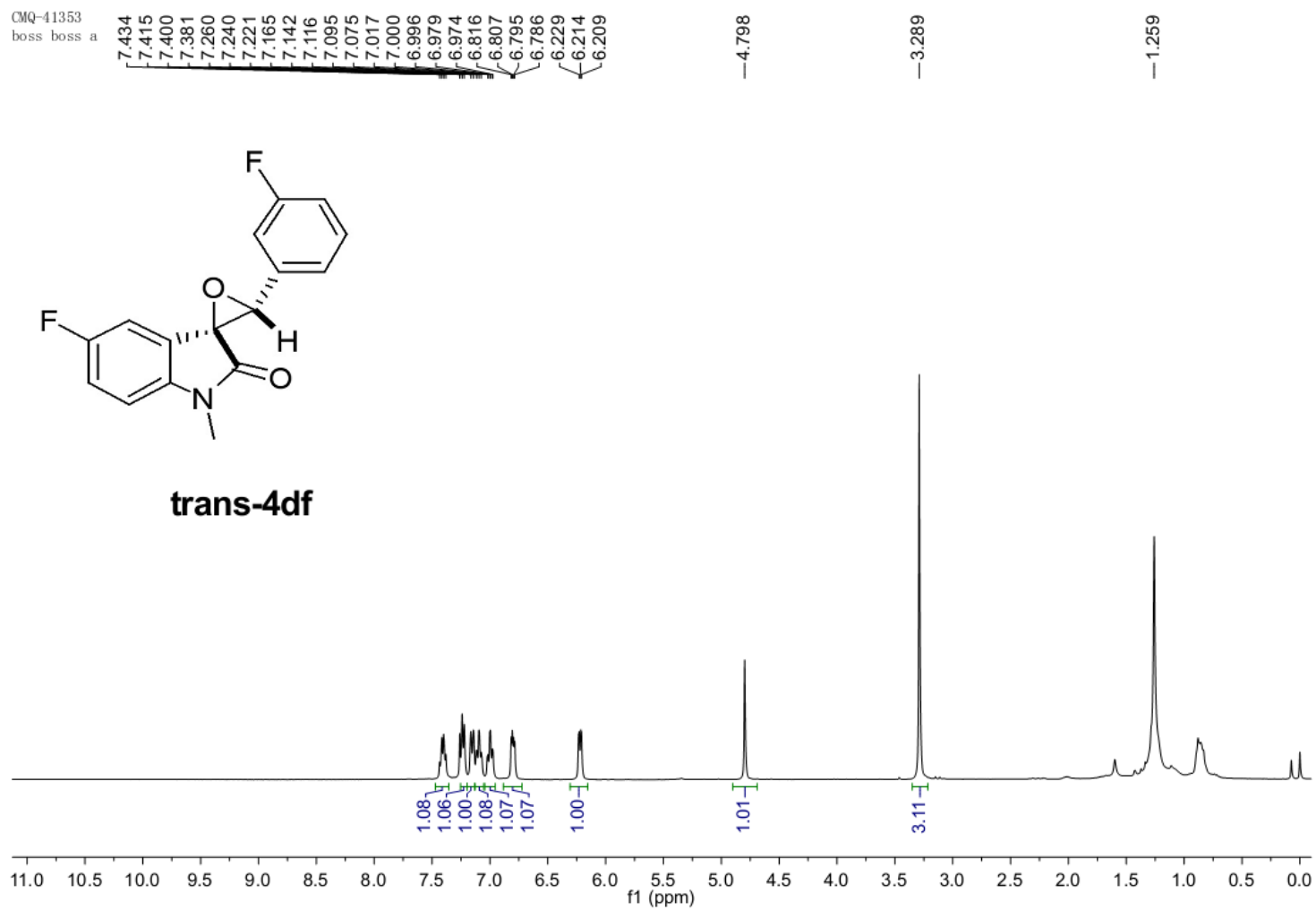


CMQ-41352
boss HWH



cis-4df





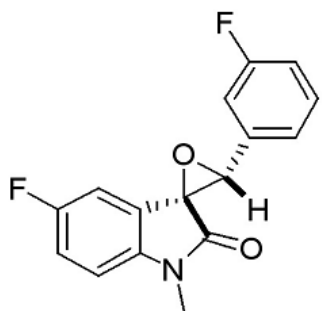
CMQ-41353
boss HWH
CMQ-41353

171.04
164.07
161.60
159.93
157.53

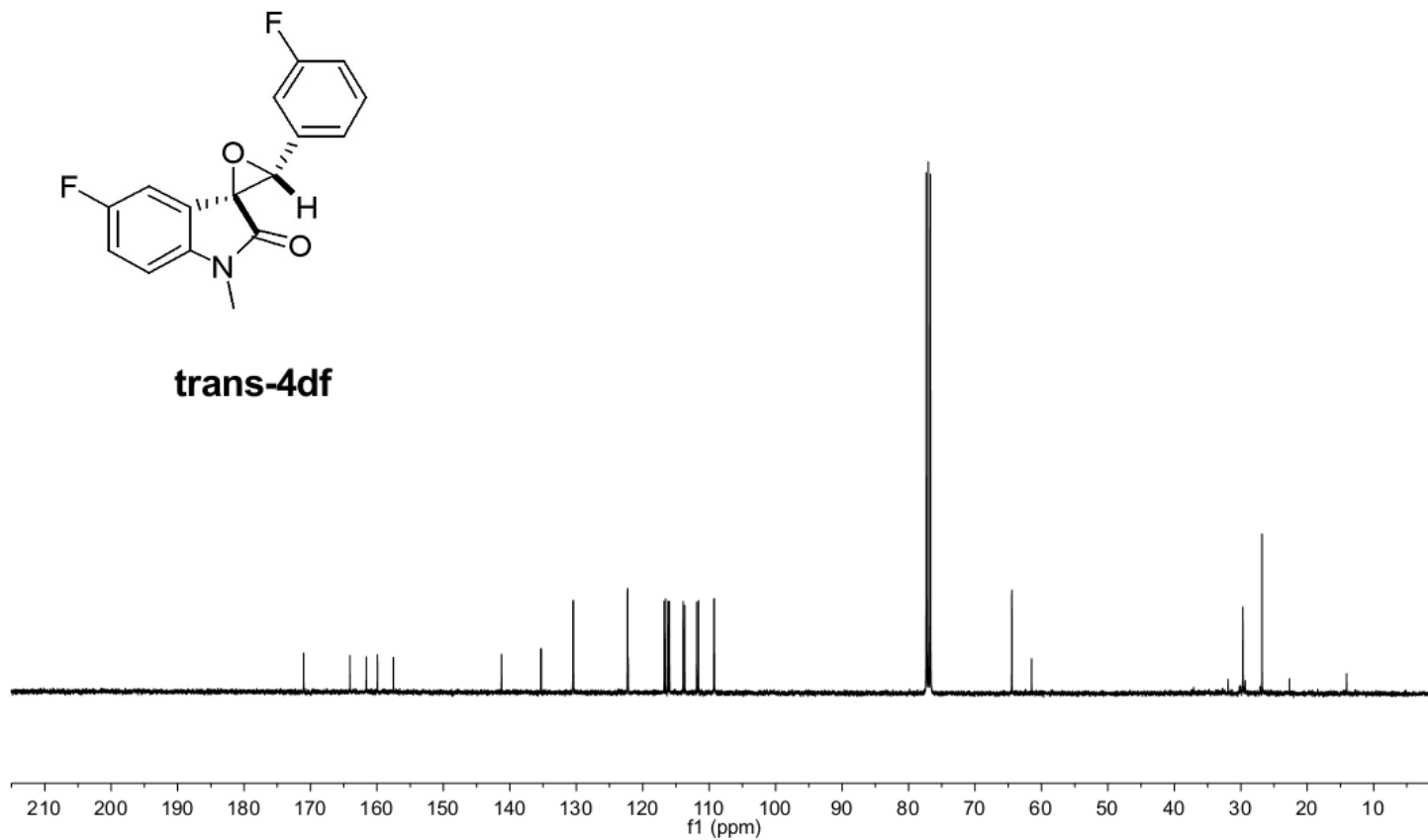
141.26
135.36
135.28
130.52
130.43

122.30
122.27
116.78
116.55
116.19
115.99
113.93
113.70
111.88
111.62
109.31
109.33
77.22
77.02
76.70
64.47
64.44
61.48

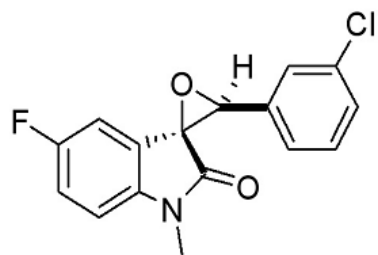
26.80



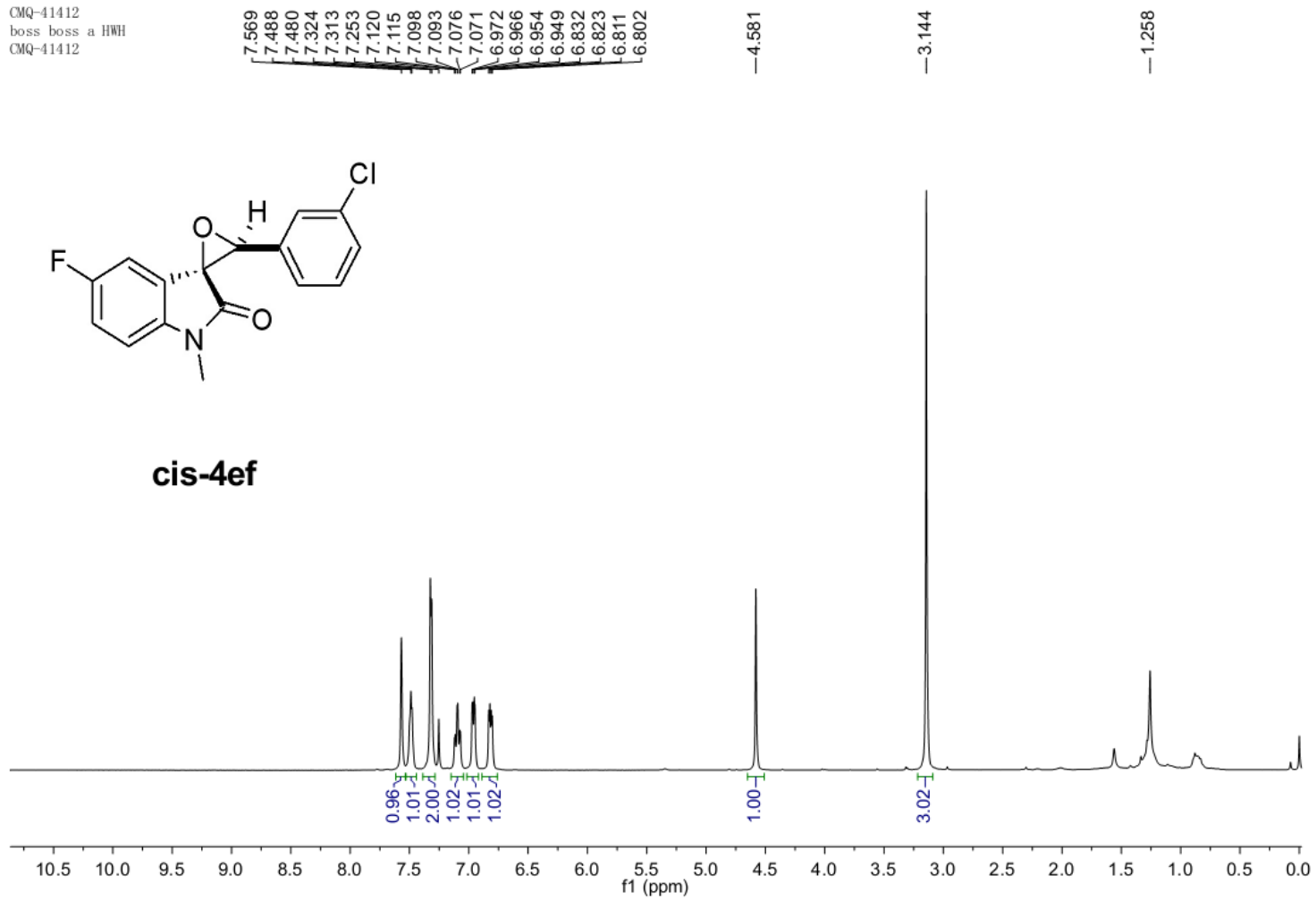
trans-4df



CMQ-41412
boss boss a HWH
CMQ-41412



cis-4ef

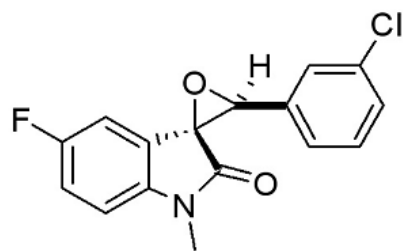


CMQ-41412
boss boss a HWH
CMQ-41412

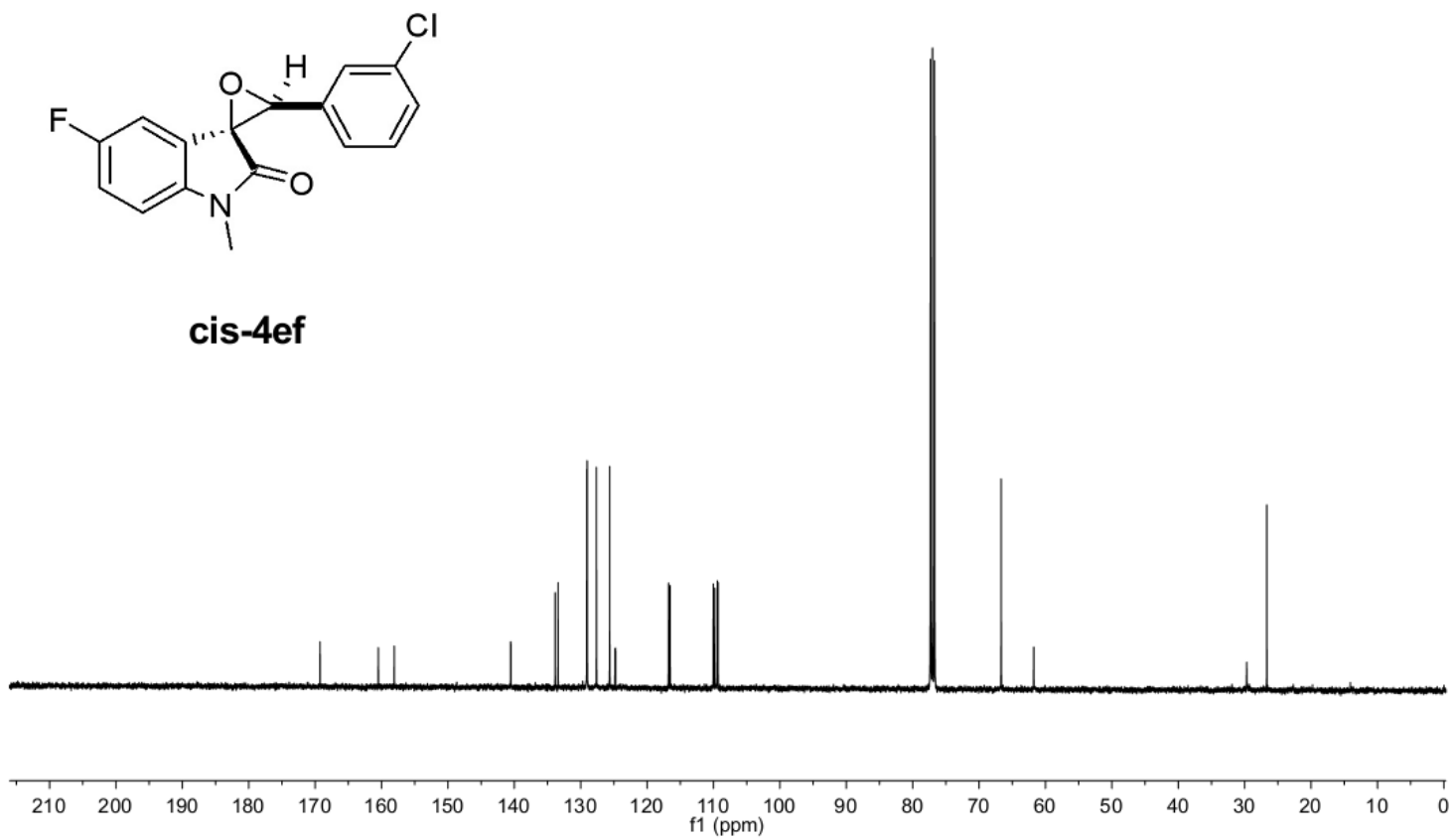
169.27
160.49
158.08
140.54
133.84
133.40
129.09
129.02
127.63
125.64
124.85
124.76
116.77
116.53
110.03
109.78
109.41
109.33

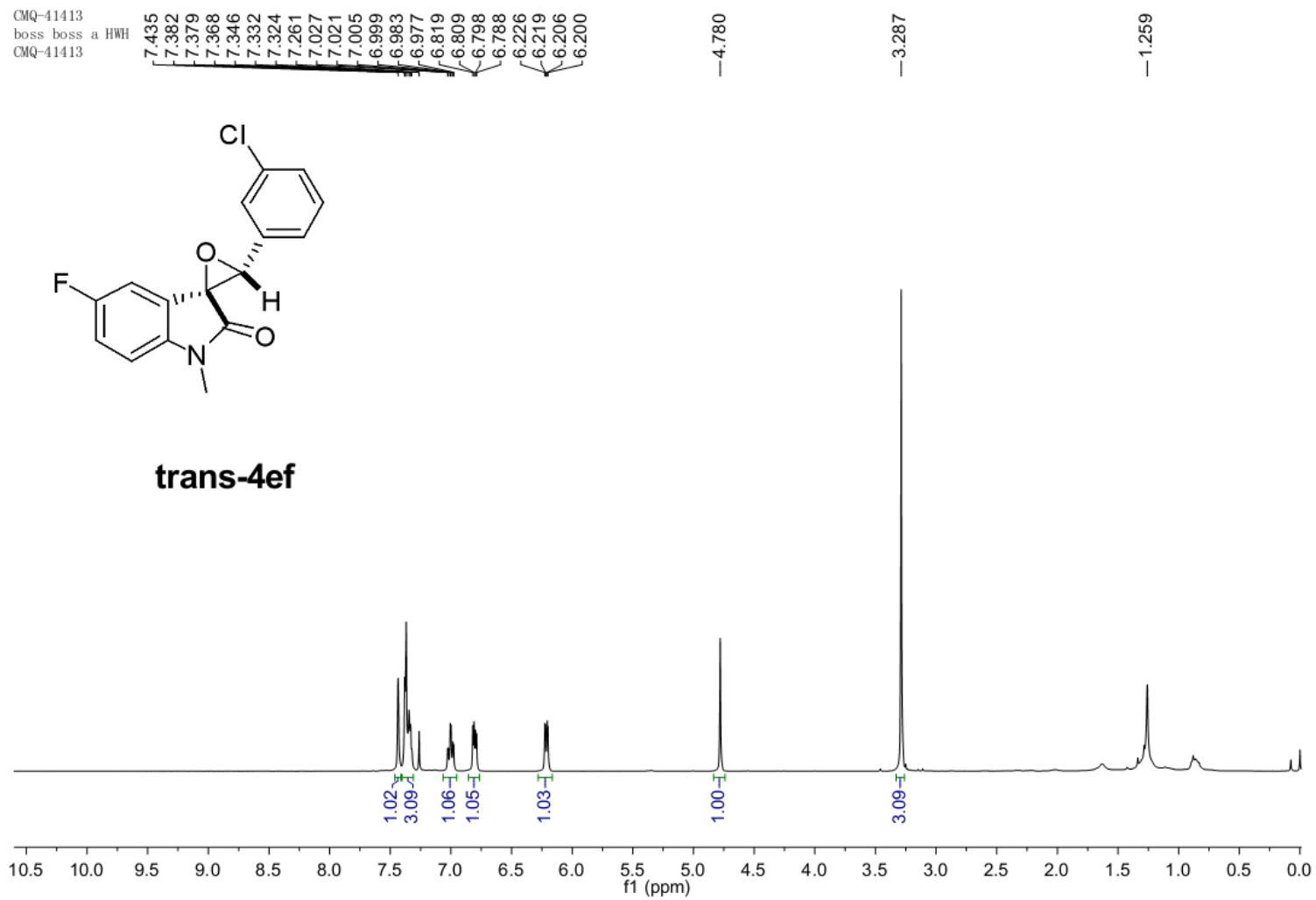
77.34
77.22
77.02
76.70
66.68
61.78

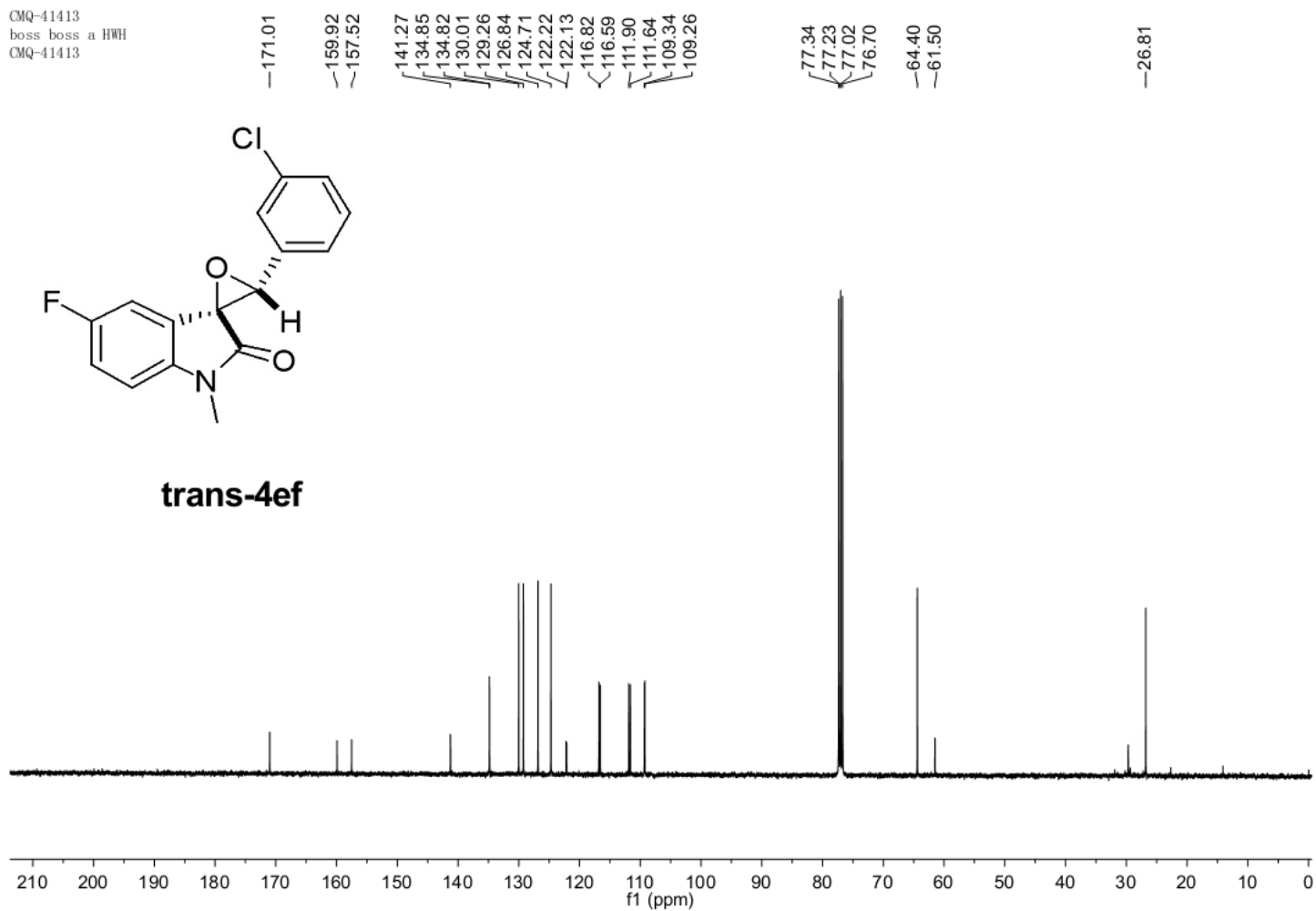
26.67



cis-4ef







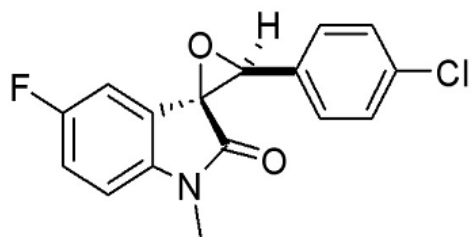
cmq-41432
boss HWH
cmq-41432

7.539
7.519
7.356
7.336
7.250
7.108
7.088
7.068
6.966
6.951
6.826
6.818
6.806
6.798

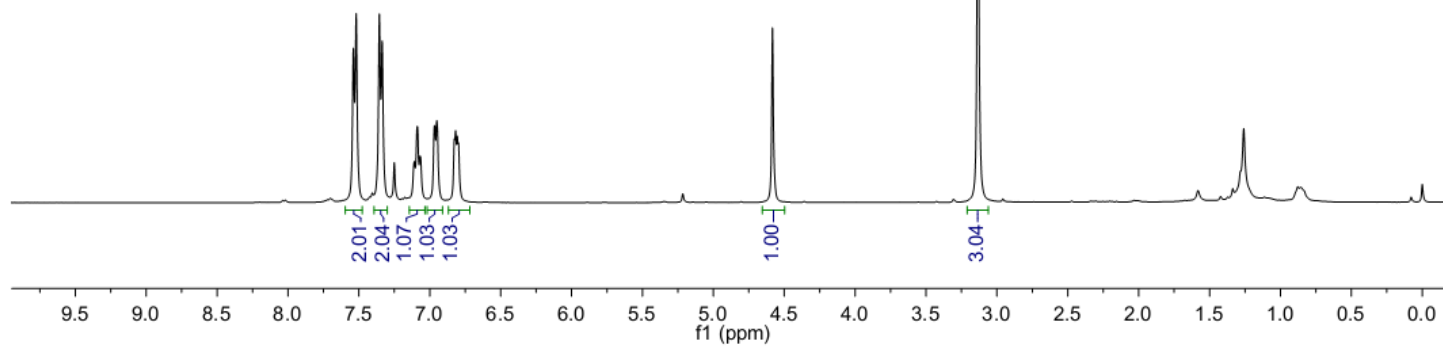
4.583

3.135

1.259

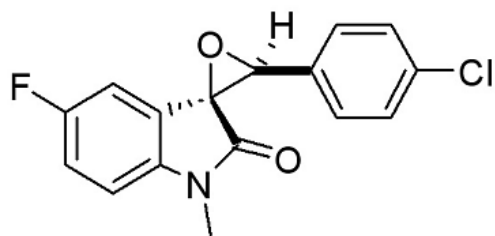


cis-4ff

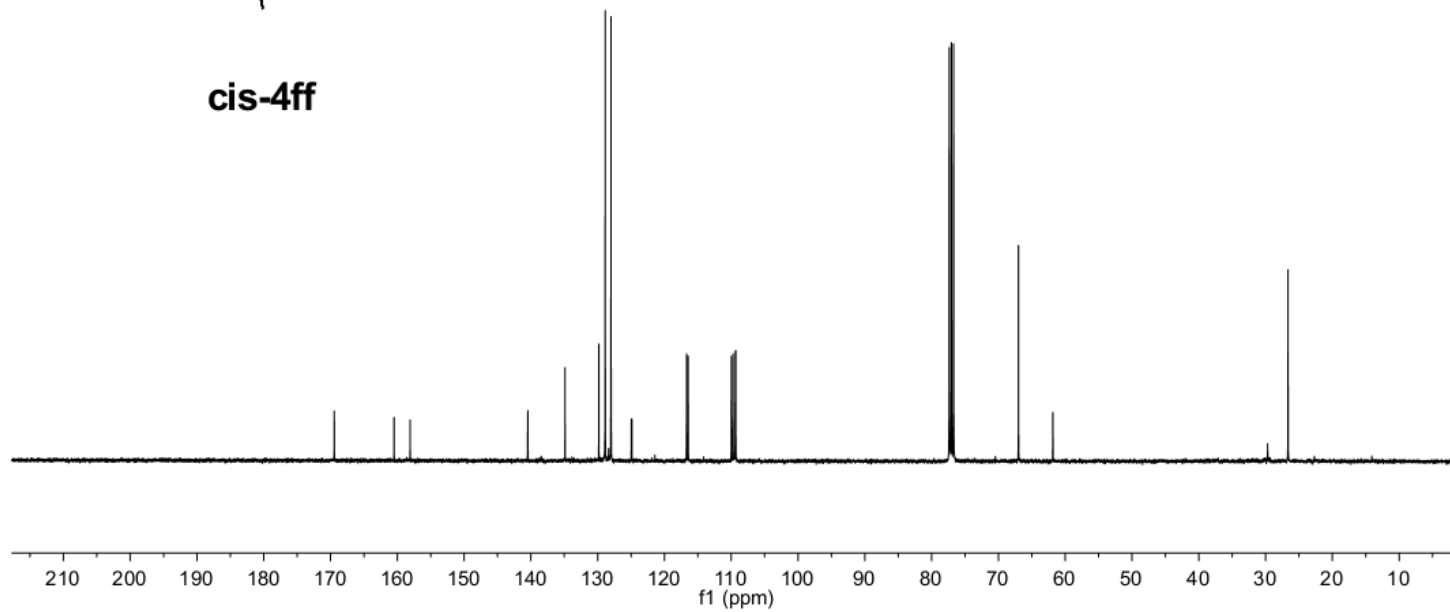


cmq-41432
boss HWH
cmq-41432

—169.44
—160.49
—158.08
140.47
140.45
134.89
129.83
128.88
128.01
124.97
124.89
116.69
116.46
109.99
109.73
109.41
109.33
77.36
77.25
77.04
76.73
—67.00
—61.84
—26.65



cis-4ff



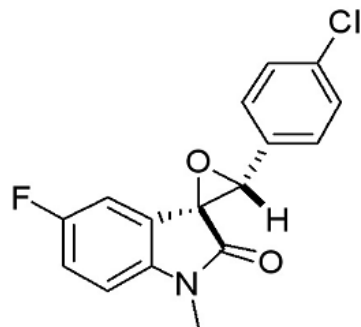
CMQ-41433
boss HWH
CMQ-41433

7.422
7.401
7.389
7.369
7.262
7.021
7.016
7.000
6.978
6.814
6.804
6.793
6.784
6.221
6.202

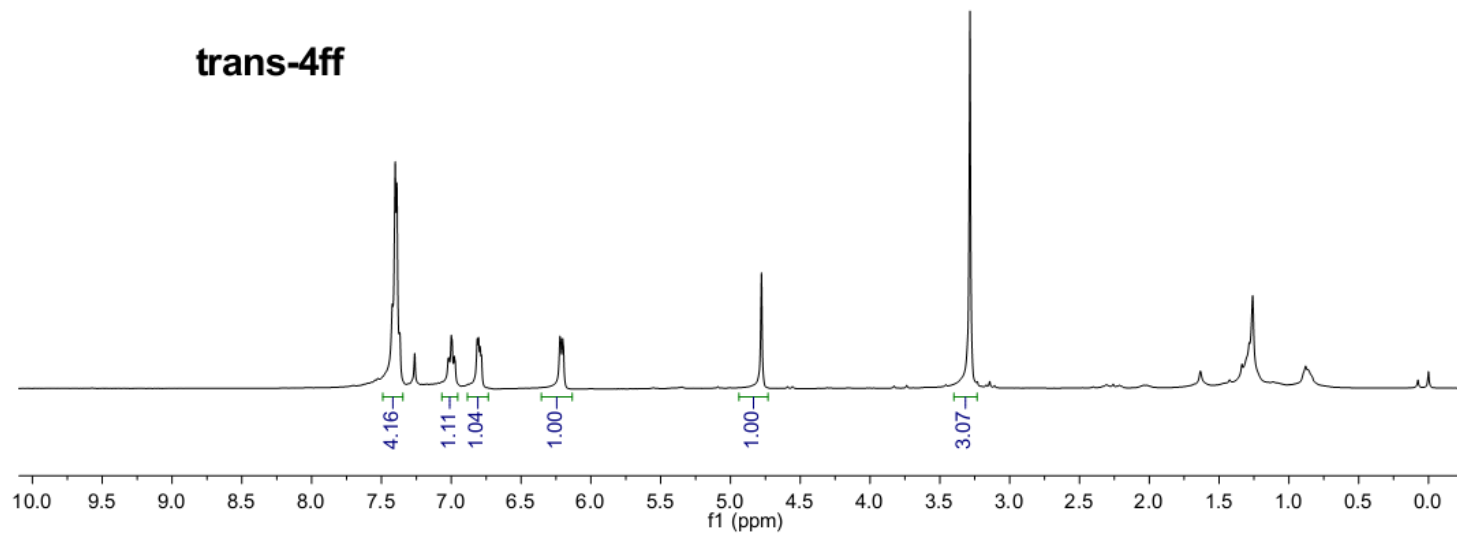
—4.778

—3.284

—1.260



trans-4ff



CMQ-41433
boss HWH
CMQ-41433

—171.10

—159.91

—157.51

—141.23

—134.97

—131.29

—128.96

—128.01

—122.33

—122.24

—116.75

—116.51

—111.88

—111.62

—109.31

—109.23

—77.34

—77.23

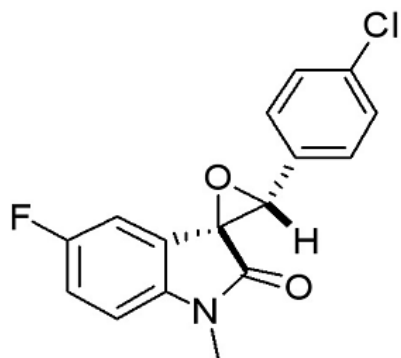
—77.02

—76.71

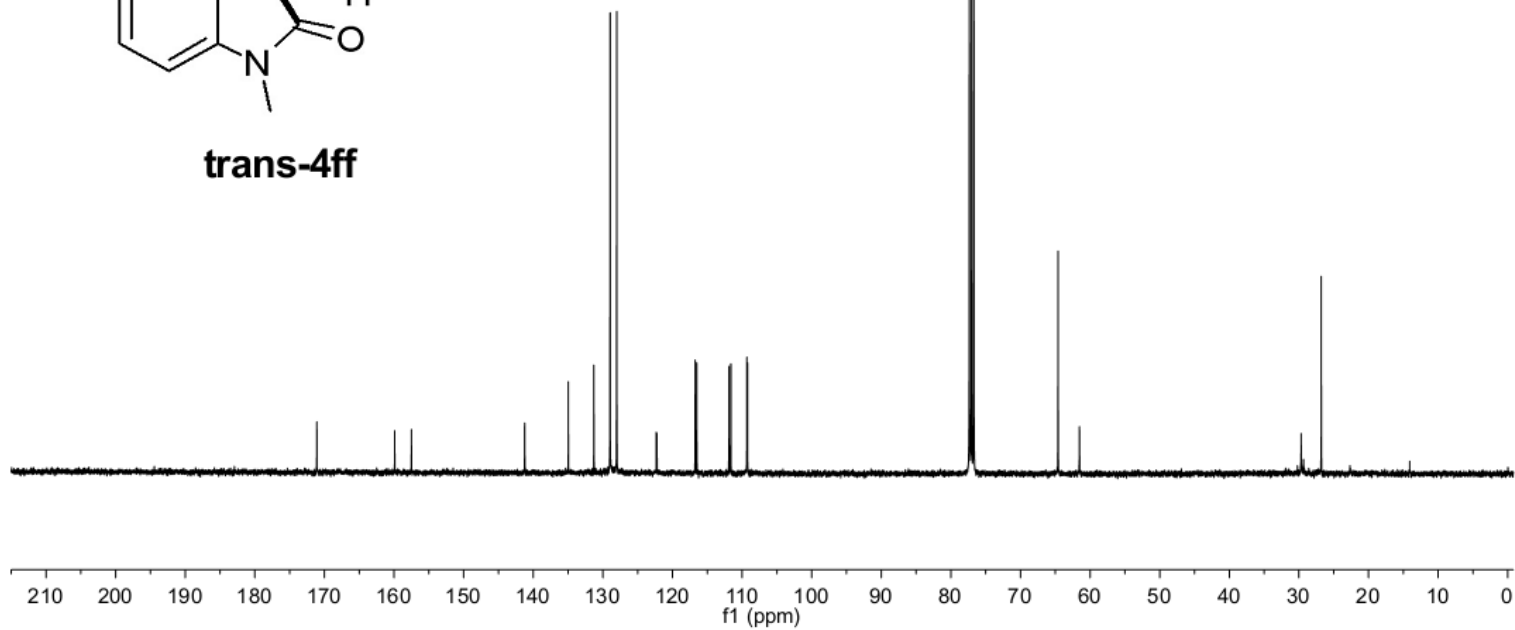
—64.60

—61.54

—26.80

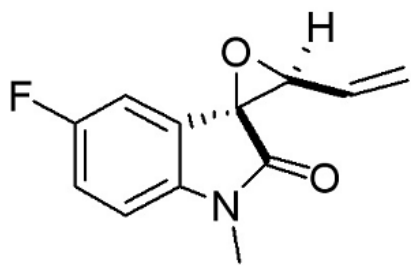


trans-4ff

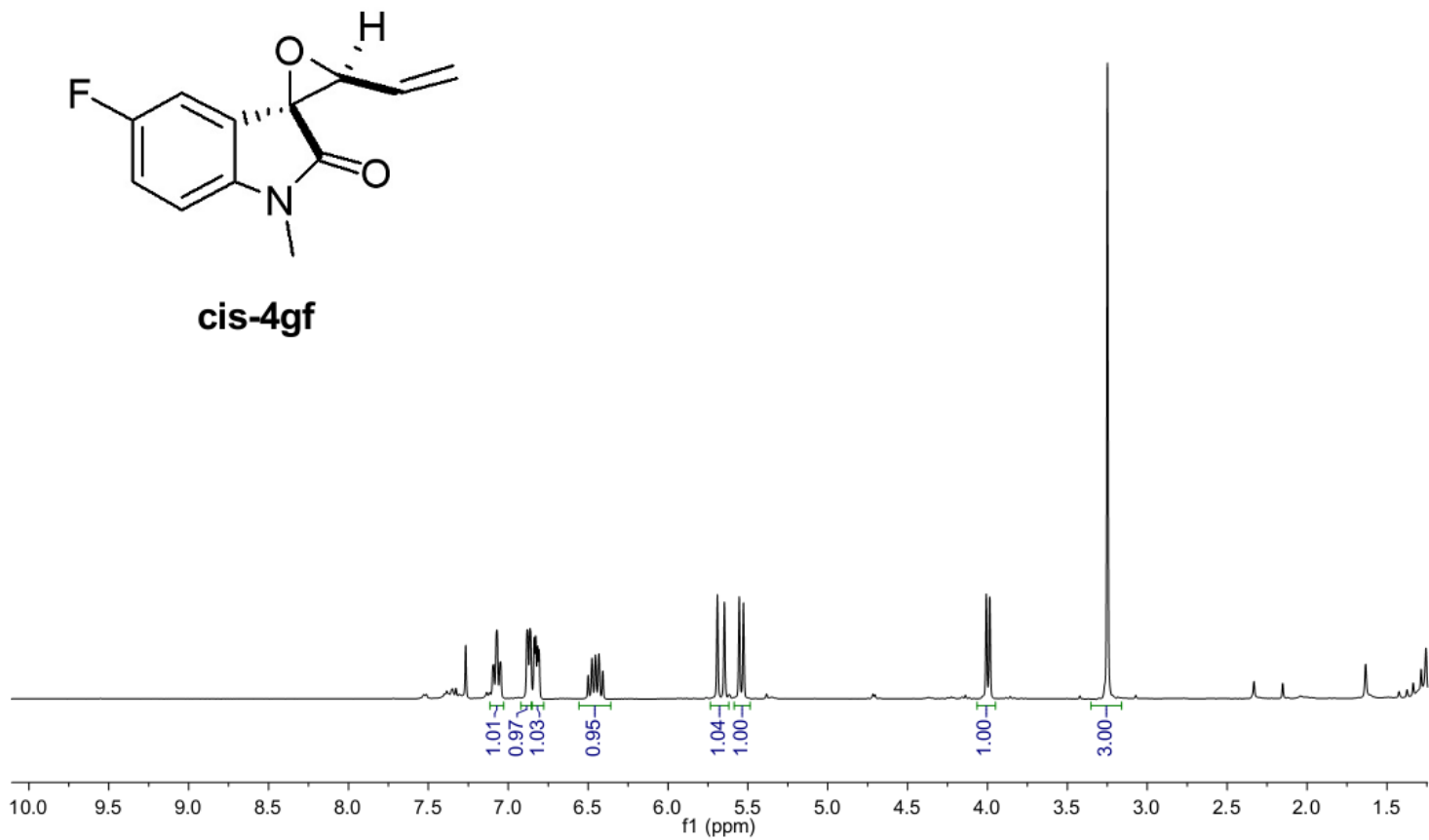


CMQ-4692
boss boss a HWH
CMQ-4692

7.266
7.092
7.071
7.050
7.048
6.881
6.879
6.863
6.837
6.828
6.816
6.807
6.499
6.476
6.454
6.432
6.408
5.691
5.647
5.554
5.528
4.007
3.986
3.249



cis-4gf



CMQ-4692
boss boss a HWH
CMQ-4692

—170.66

—160.50

—158.09

—140.39

—130.58

—124.98

—124.89

—123.83

—116.56

—116.33

—110.01

—109.75

—109.40

—109.32

—77.36

—77.25

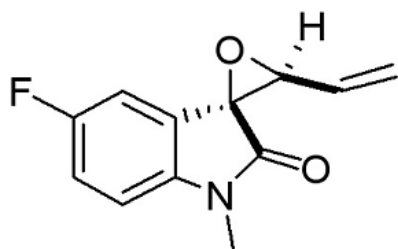
—77.04

—76.73

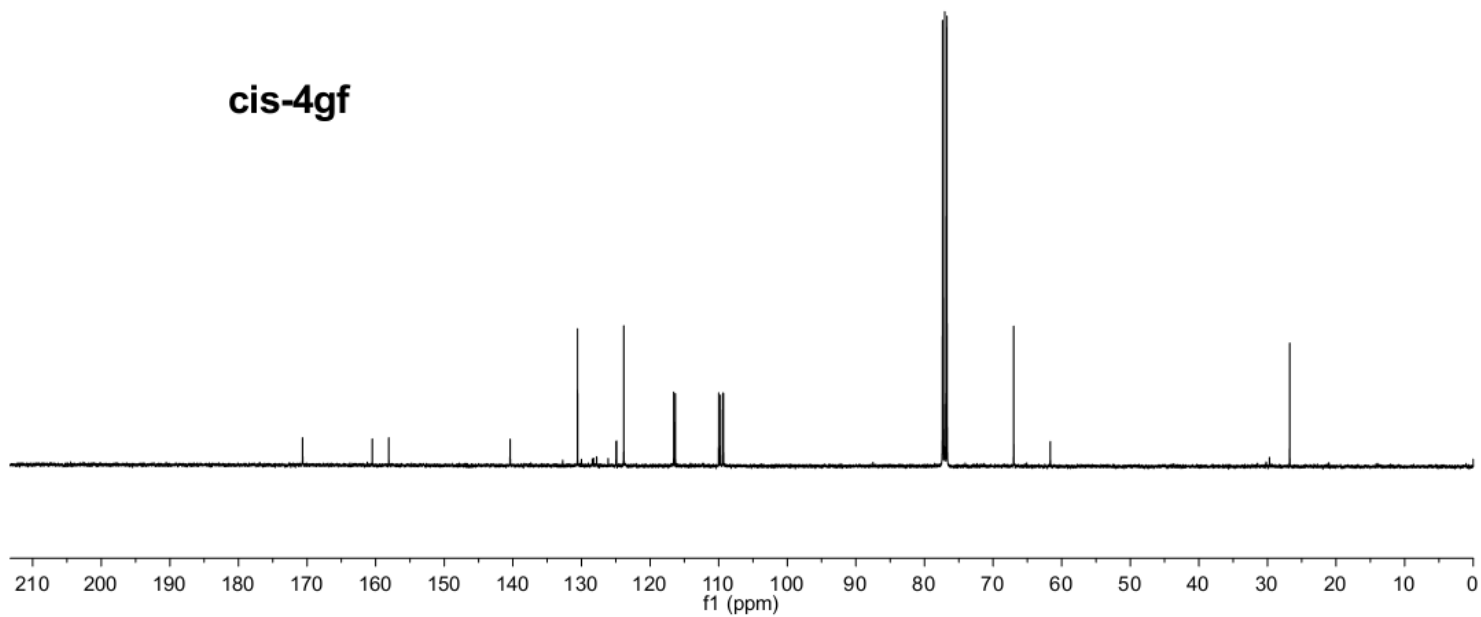
—67.00

—61.66

—26.76

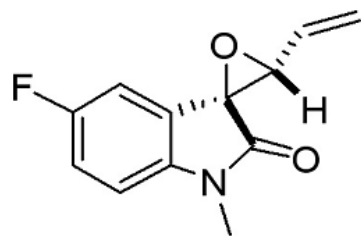


cis-4gf

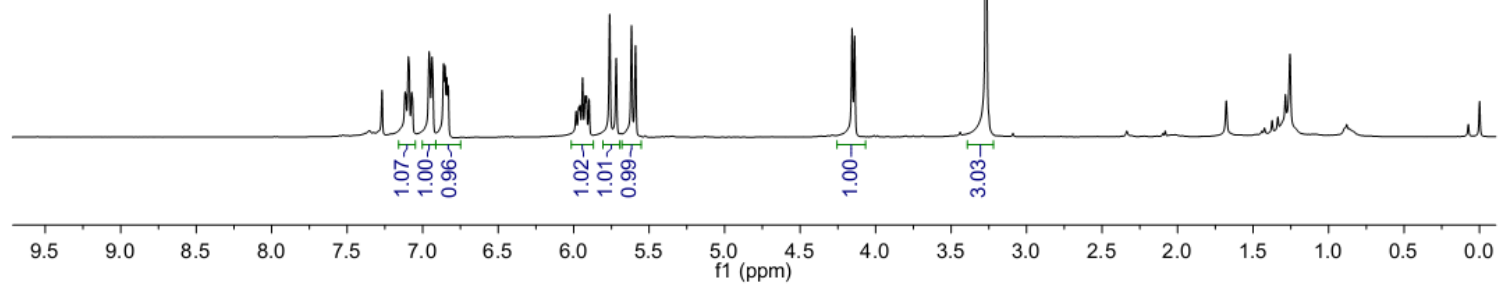


CMQ-4693
boss boss a HWH
CMQ-4693

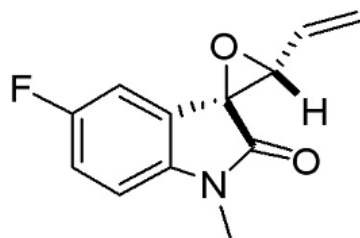
7.269
7.116
7.094
7.072
6.957
6.938
6.861
6.852
6.840
6.831
5.984
5.966
5.958
5.941
5.923
5.915
5.898
5.761
5.718
5.617
5.590
4.156
4.139
3.267



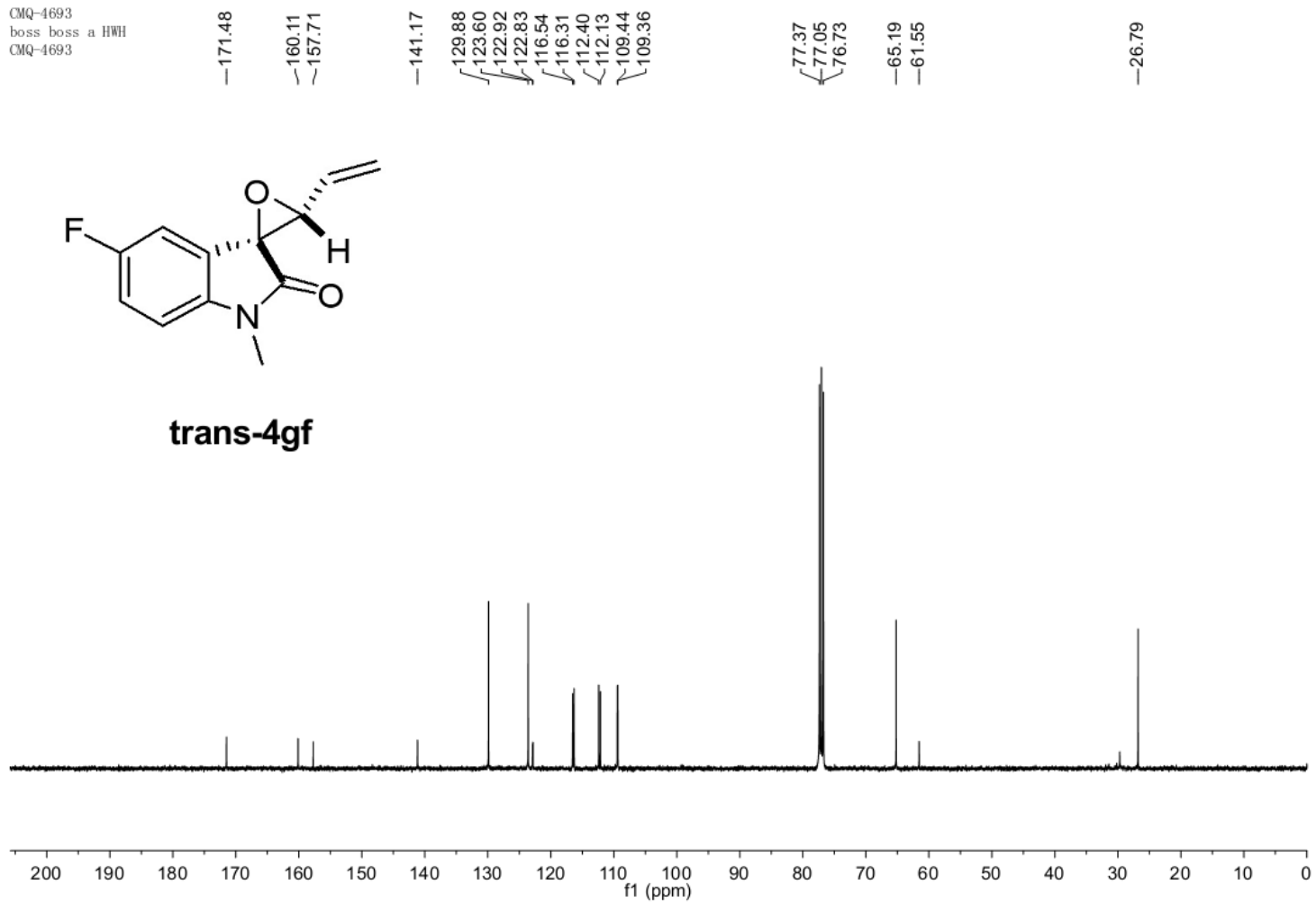
trans-4gf



CMQ-4693
boss boss a HWH
CMQ-4693



trans-4gf

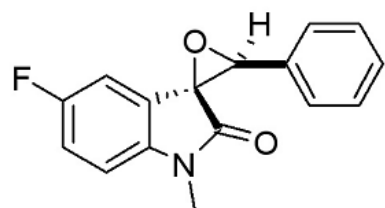


cmq-4302
boss HWH
cmq-4302

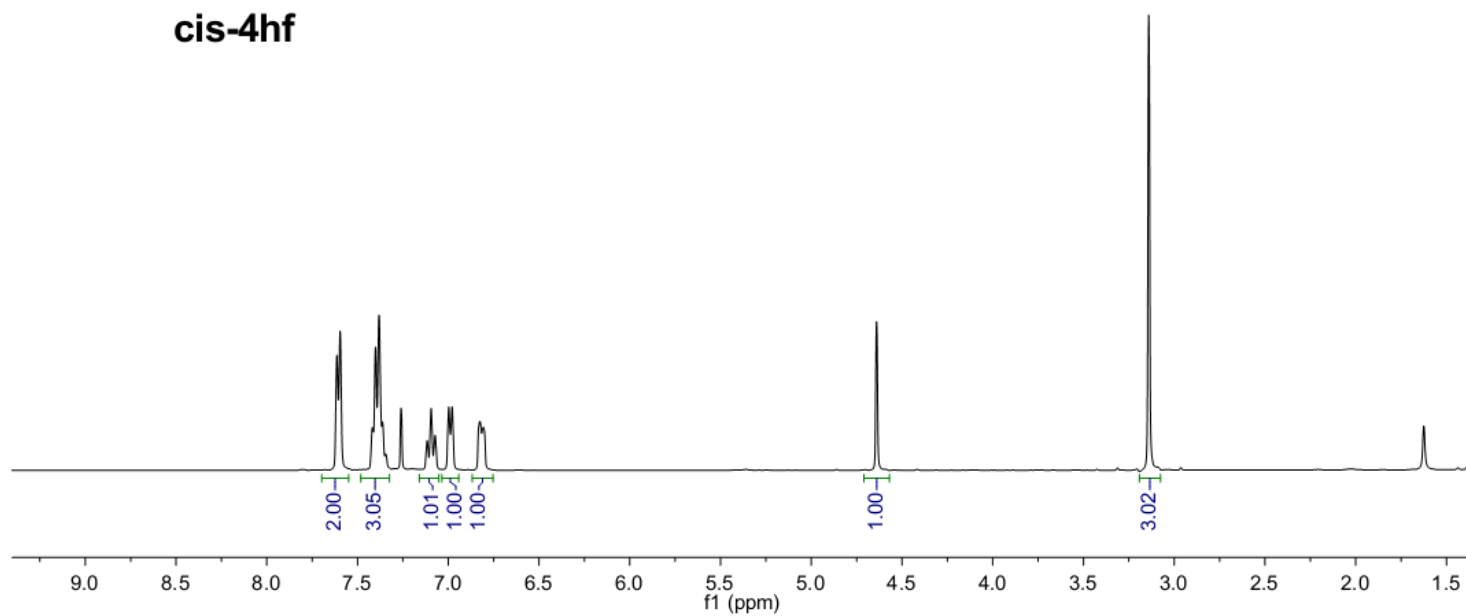
7.614
7.596
7.419
7.401
7.382
7.363
7.260
7.116
7.095
7.072
6.997
6.979
6.827
6.811
6.806

—4.640

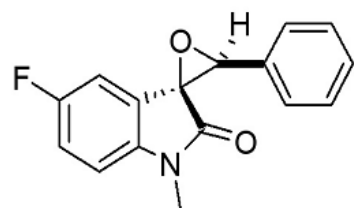
—3.141



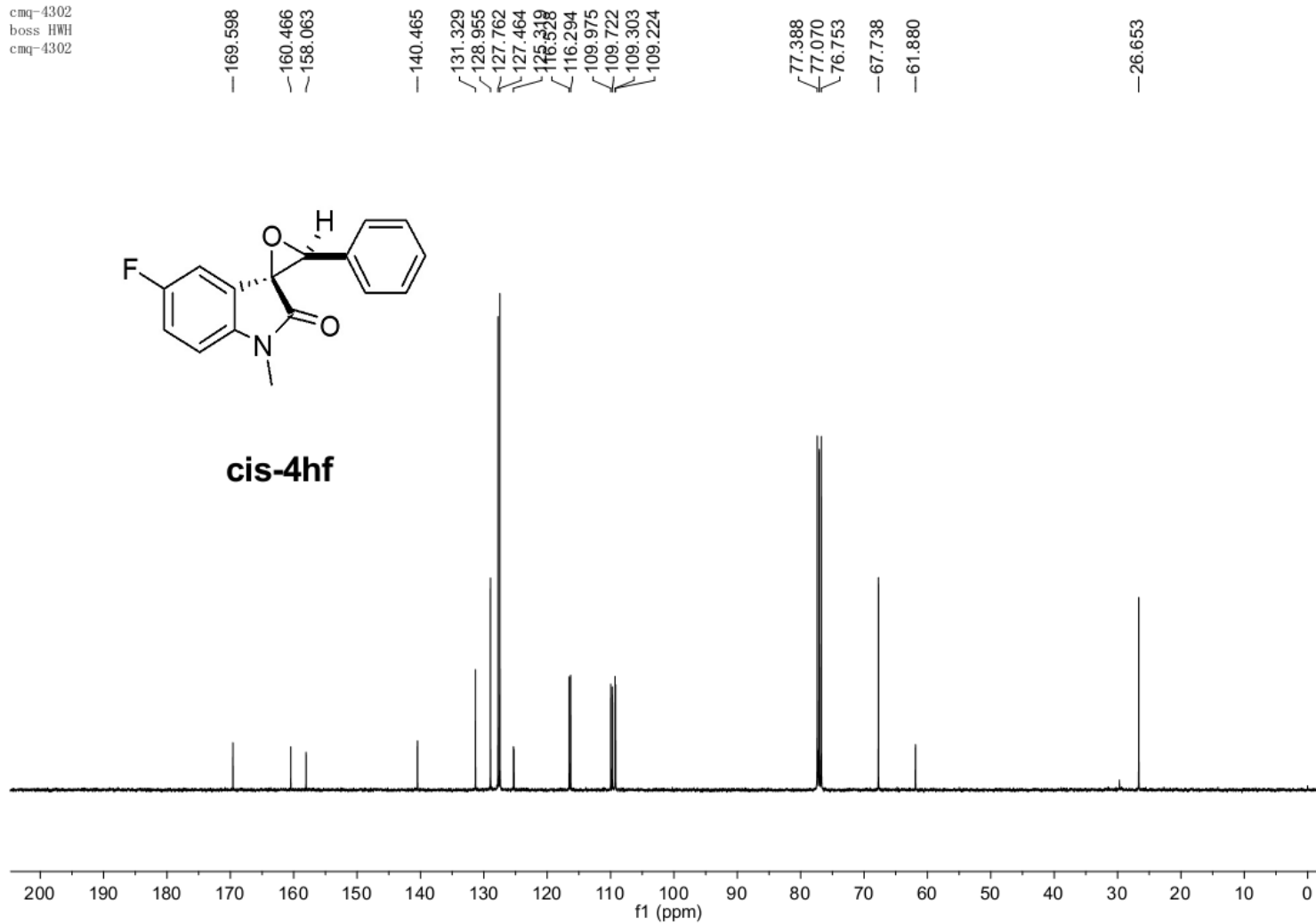
cis-4hf



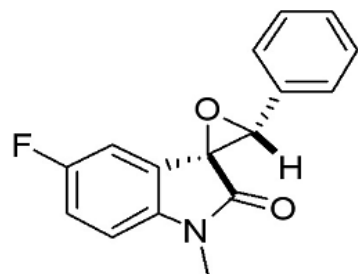
cmq-4302
boss HWH
cmq-4302



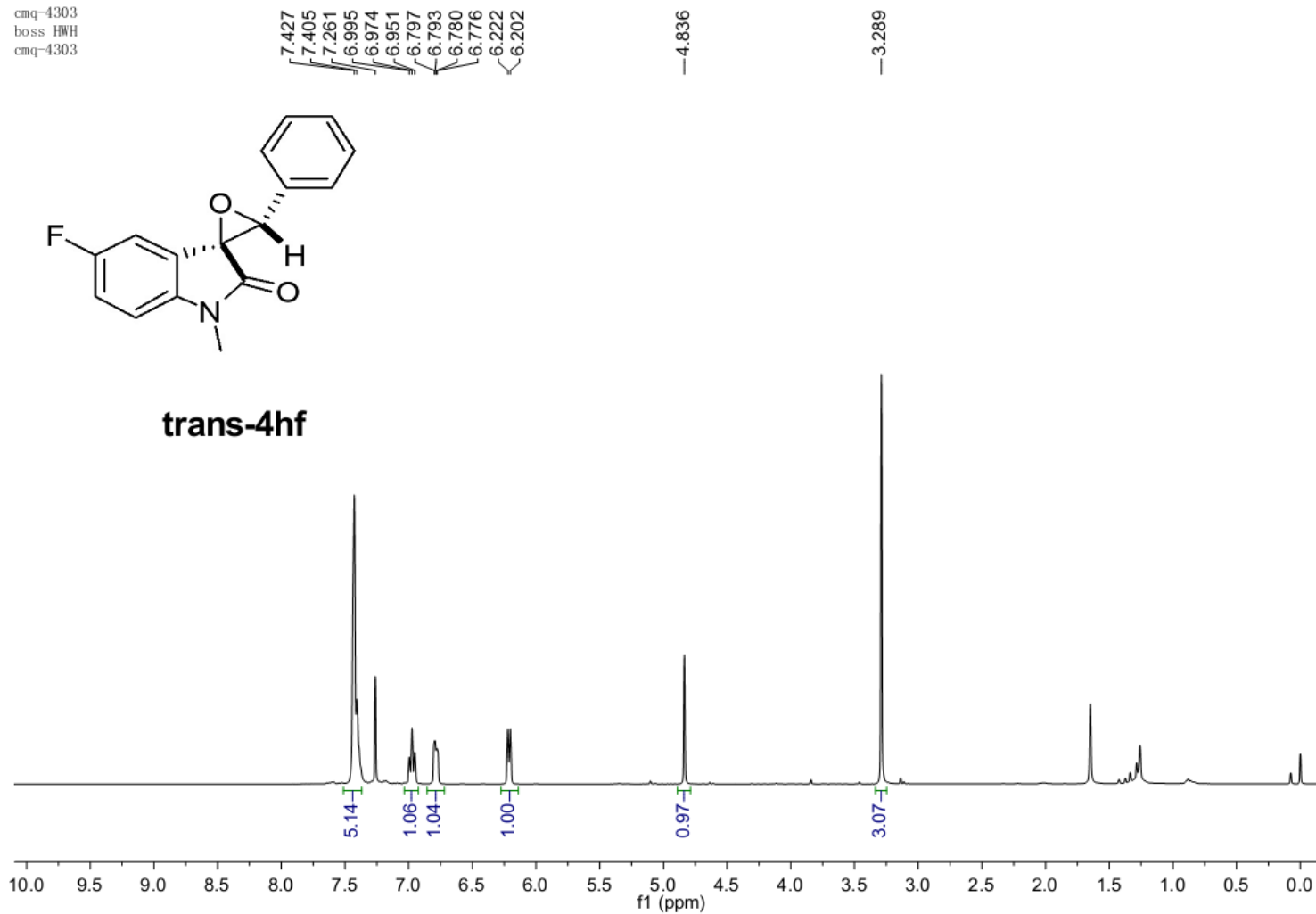
cis-4hf



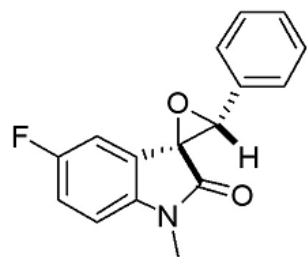
cmq-4303
boss HWH
cmq-4303



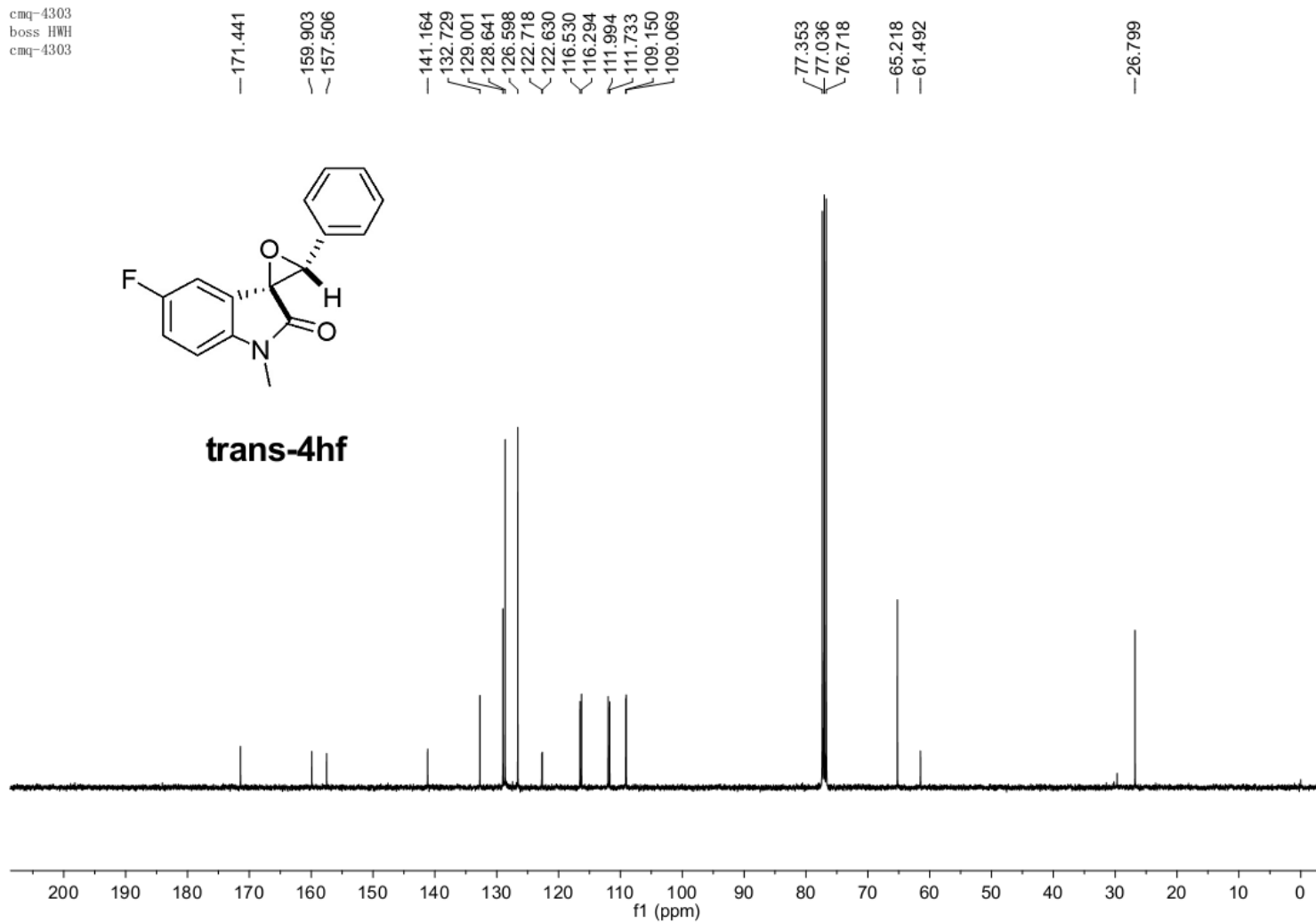
trans-4hf



cmq-4303
boss HWH
cmq-4303



trans-4hf

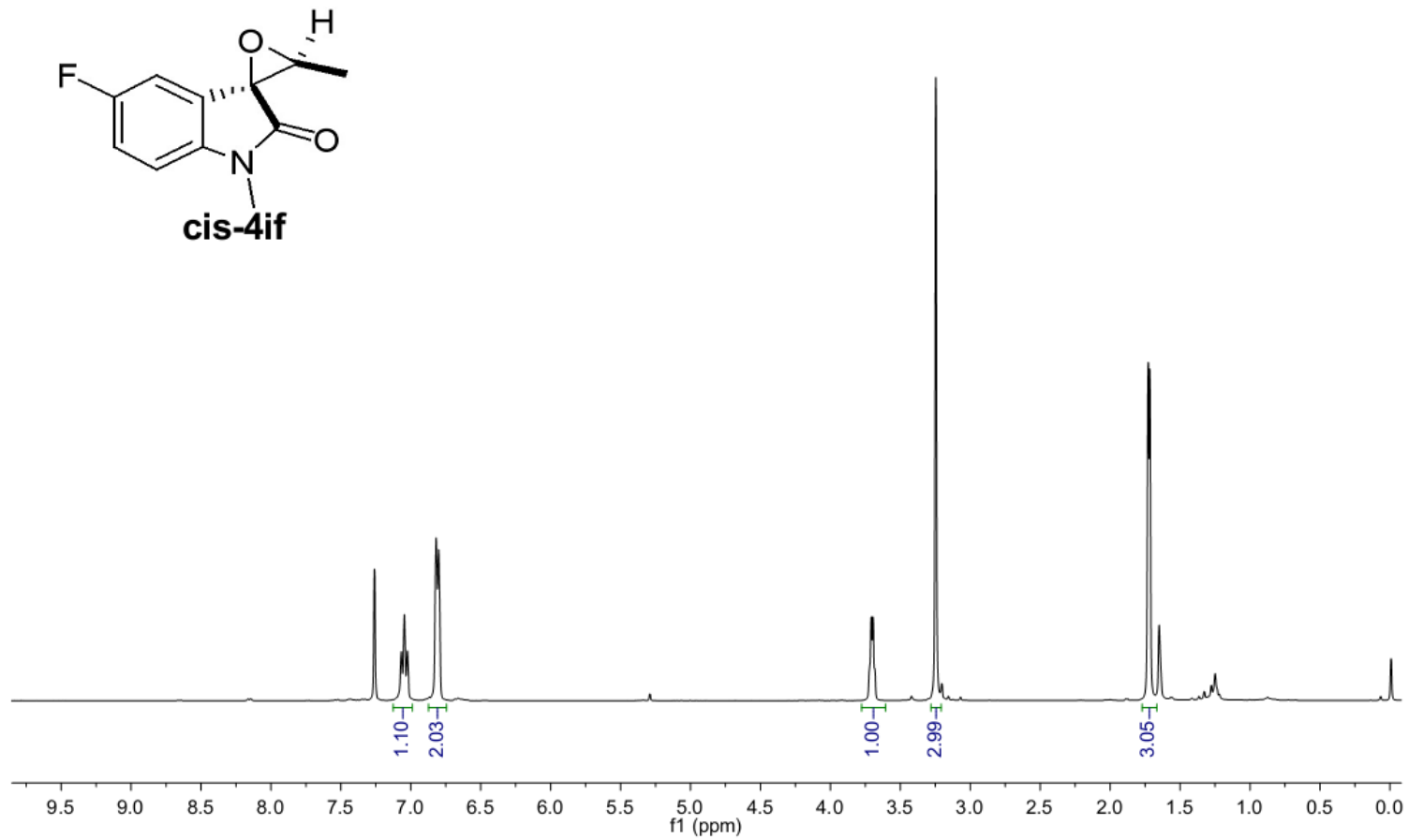
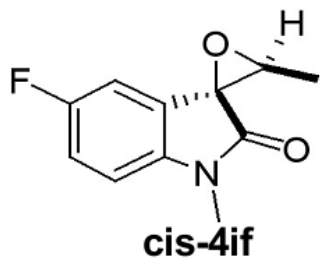


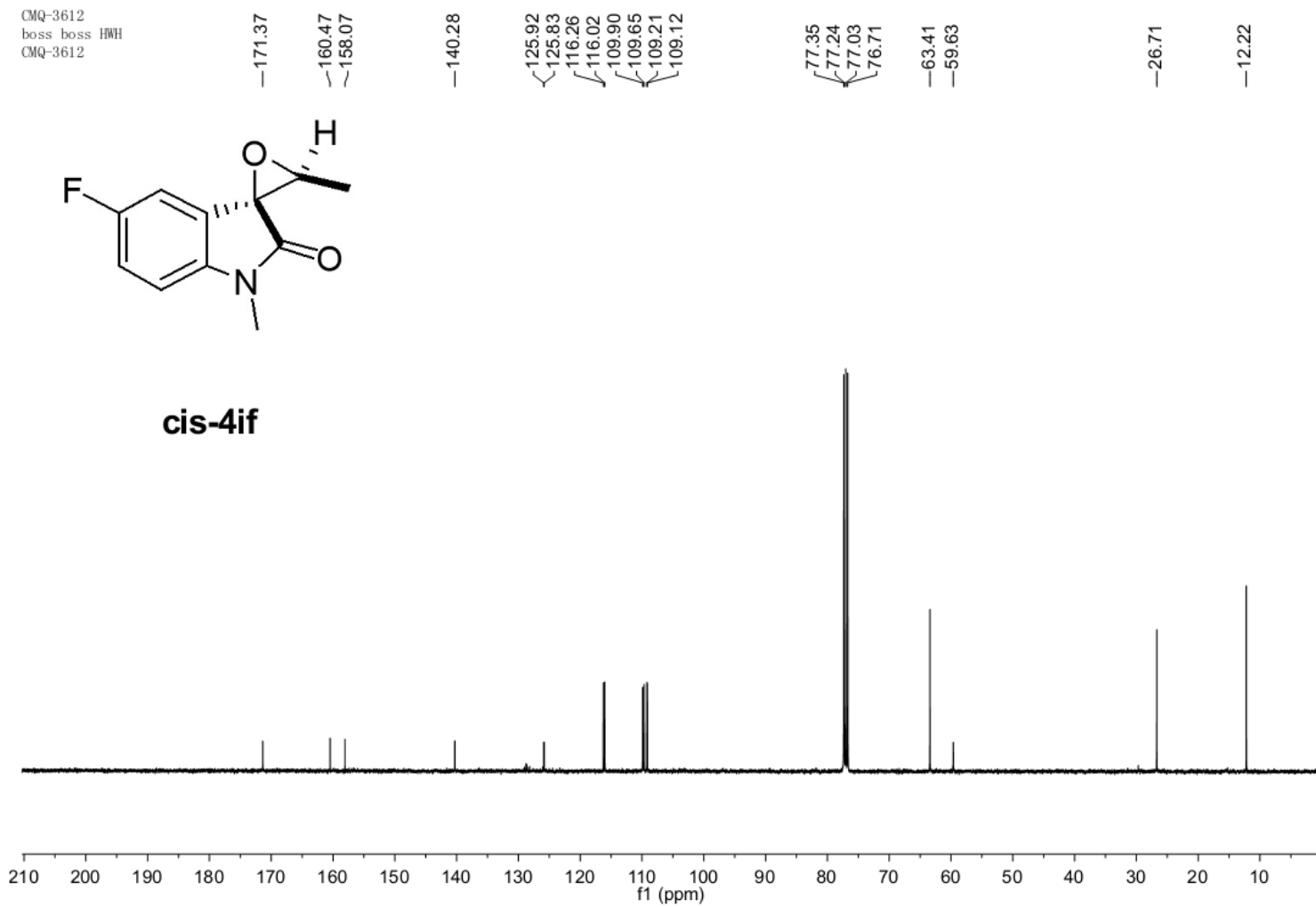
CMQ-3612
boss boss HWH
CMQ-3612

7.260
7.260
7.068
7.046
7.024
6.819
6.800

3.707
3.696
3.685
— 3.247

1.727
1.717
1.649



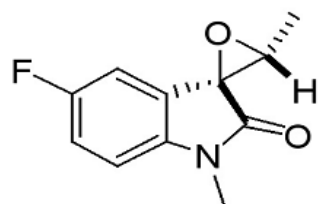


CMQ-3613
boss boss HWH
CMQ-3613

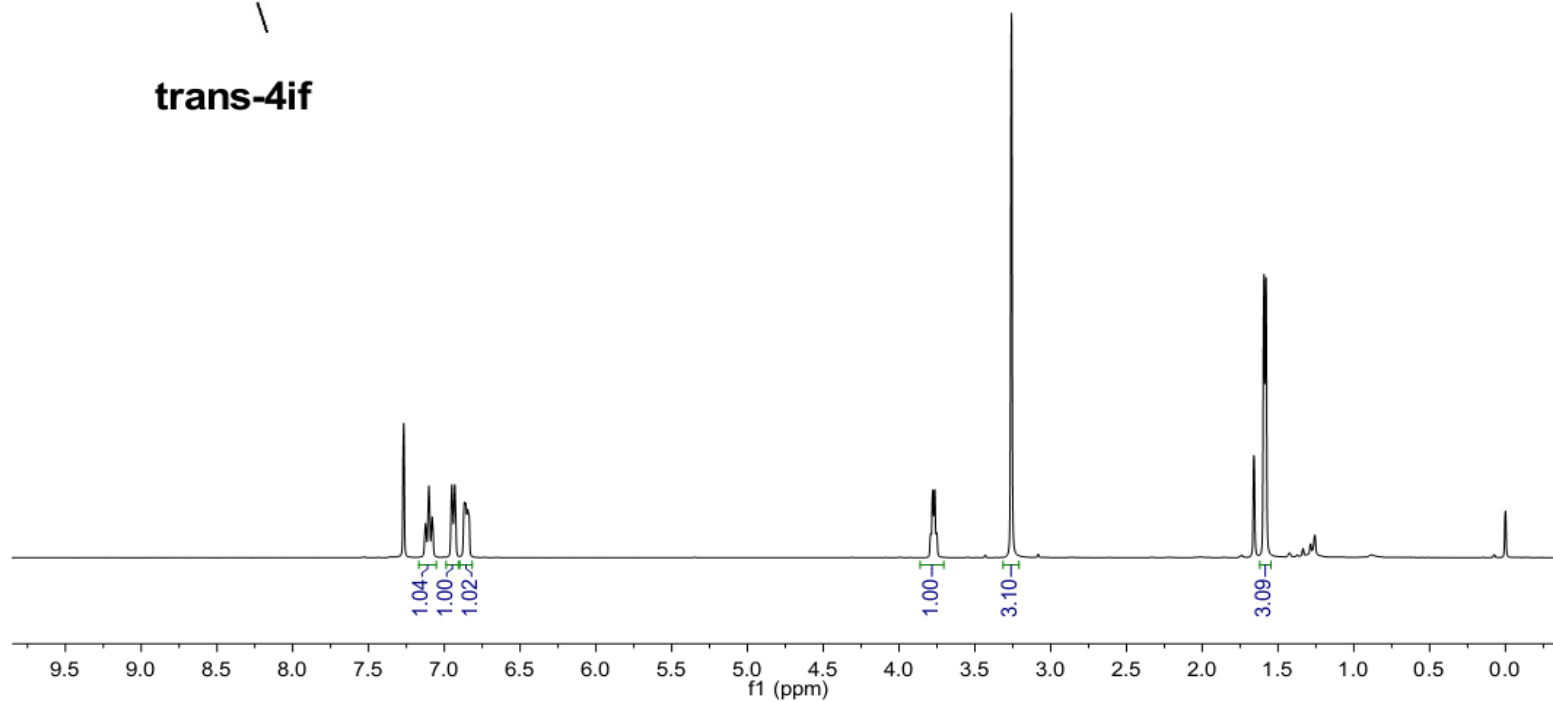
7.268
7.124
7.102
7.080
6.950
6.931
6.867
6.859
6.847

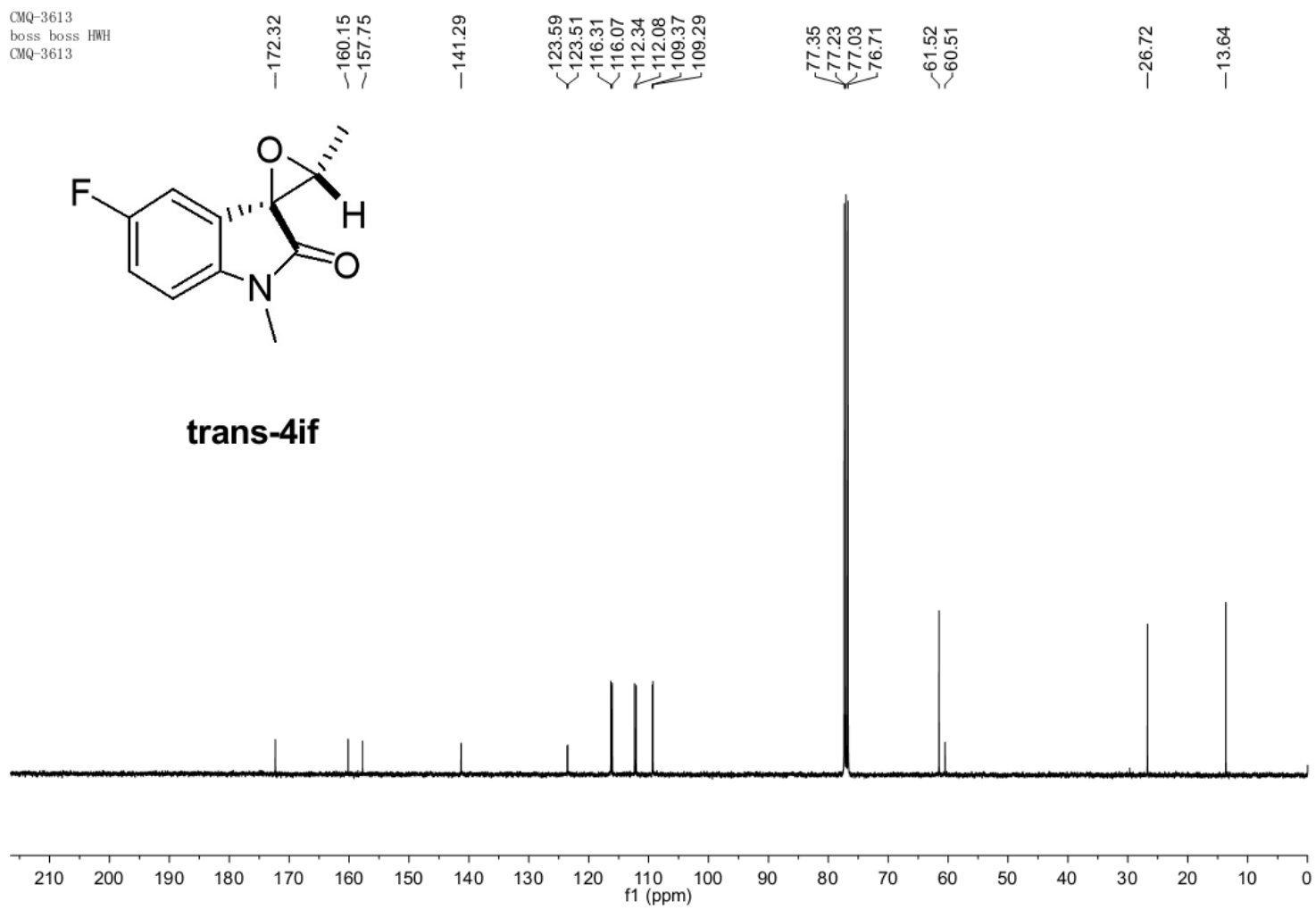
3.791
3.778
3.765
3.752
—
3.259

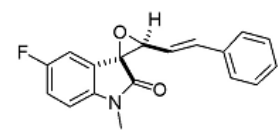
1.659
1.593
1.580



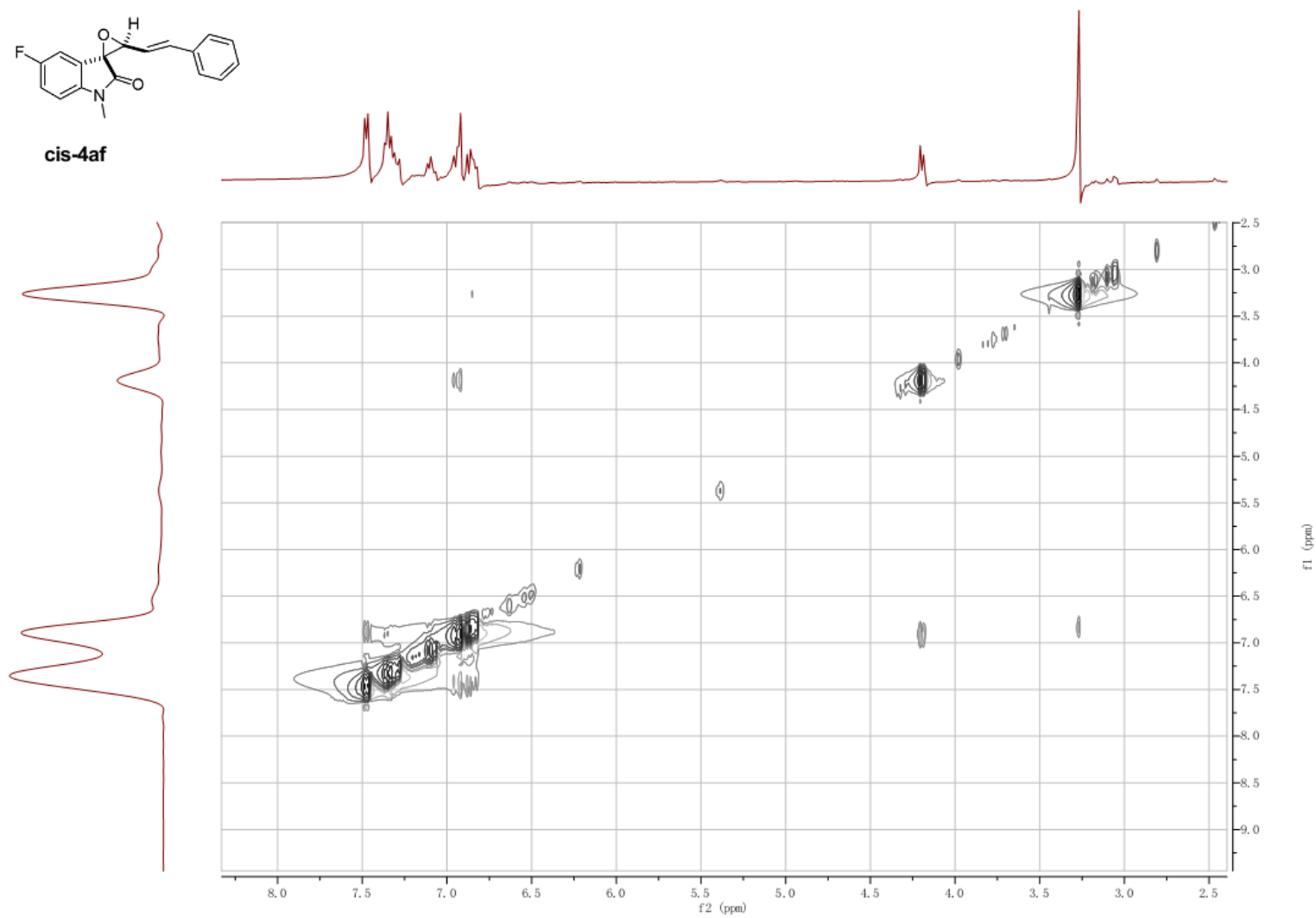
trans-4if

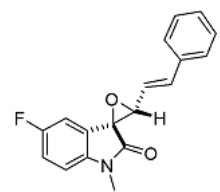




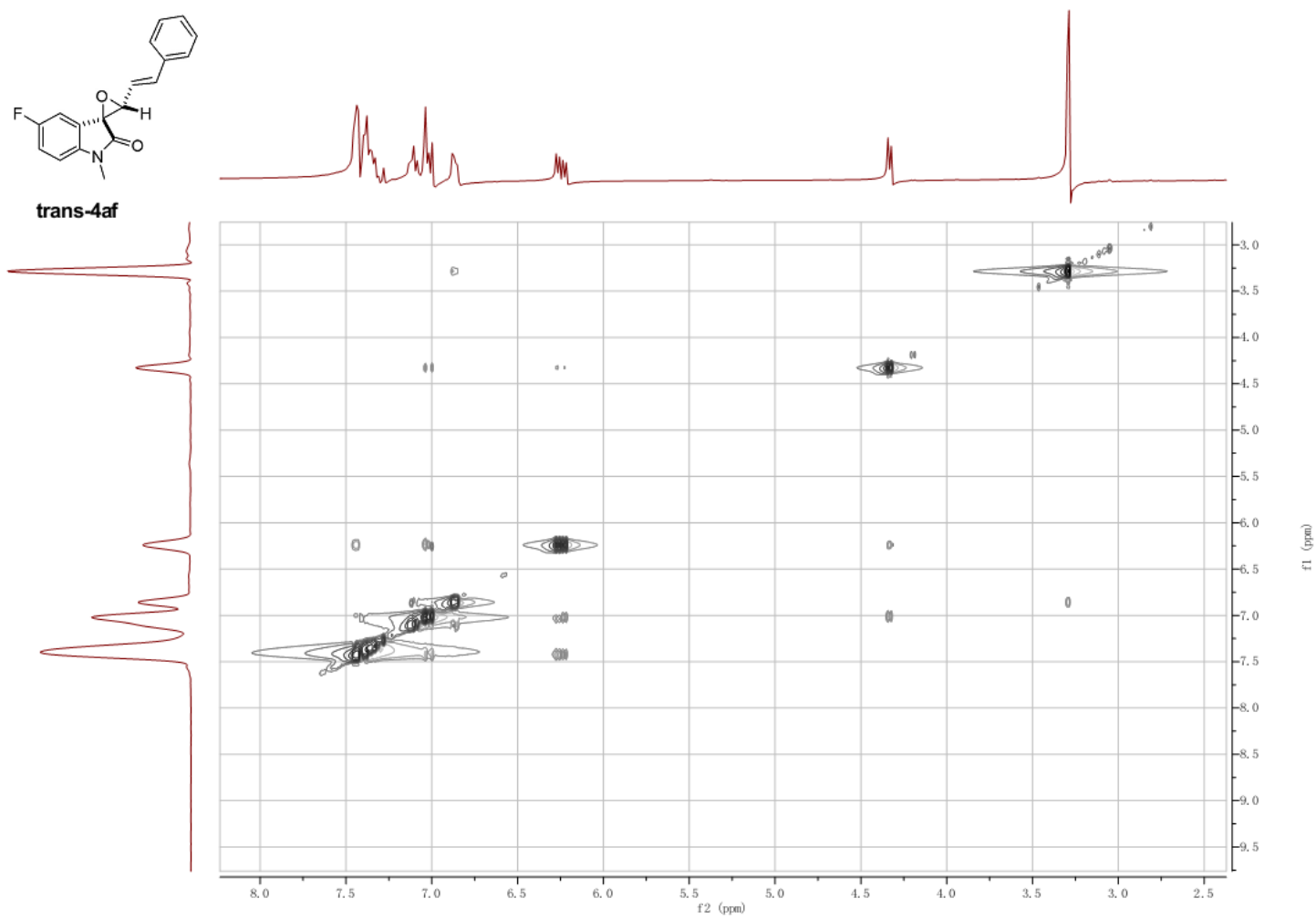


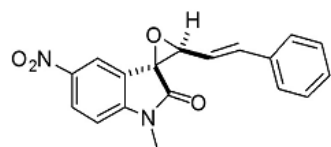
cis-4af



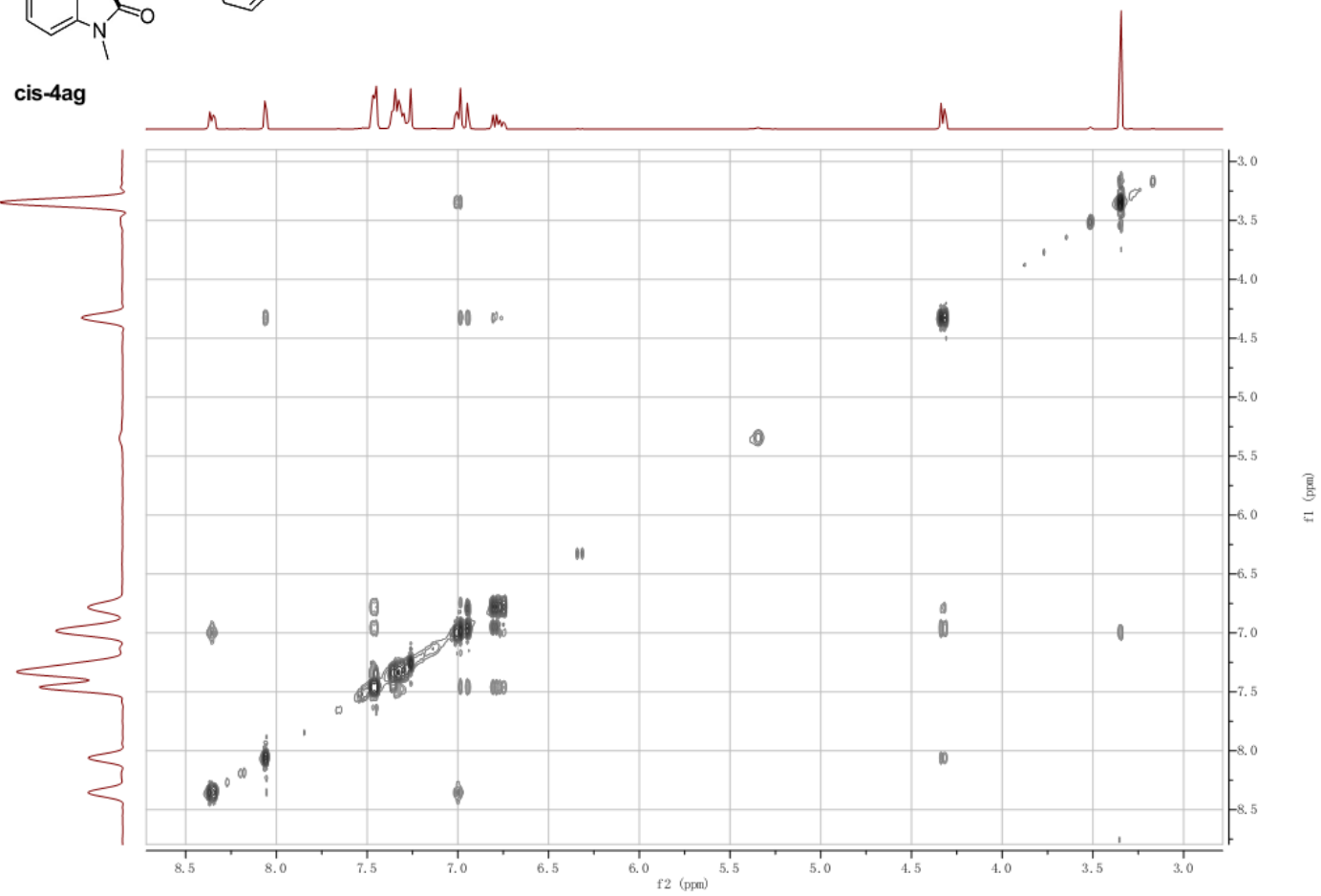


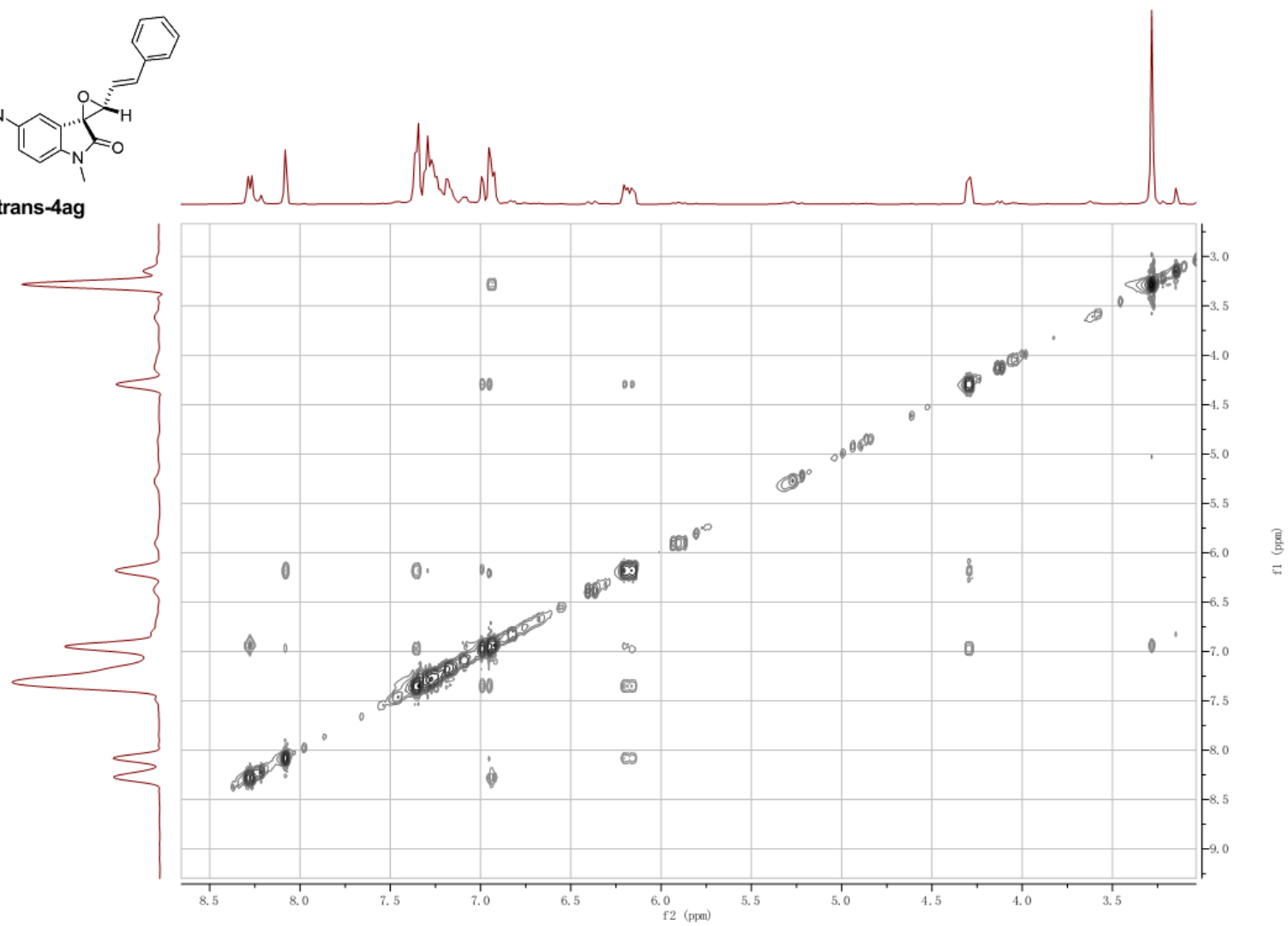
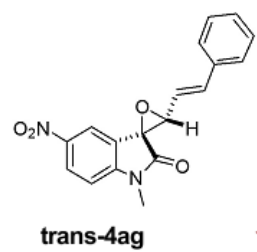
trans-4af

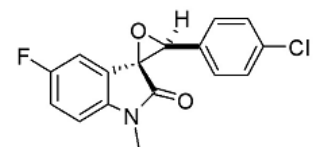




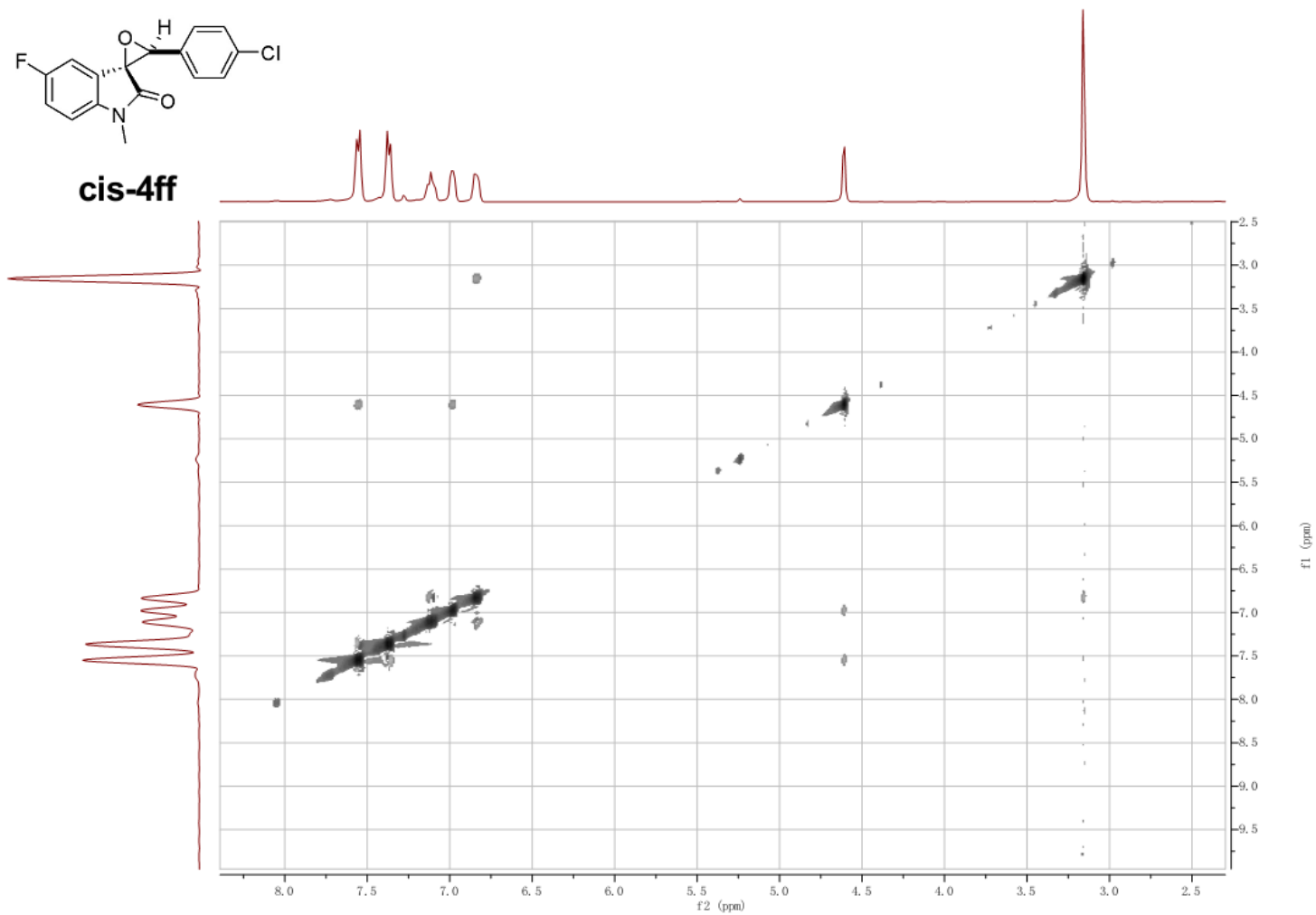
cis-4ag

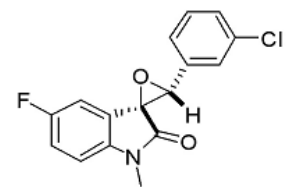




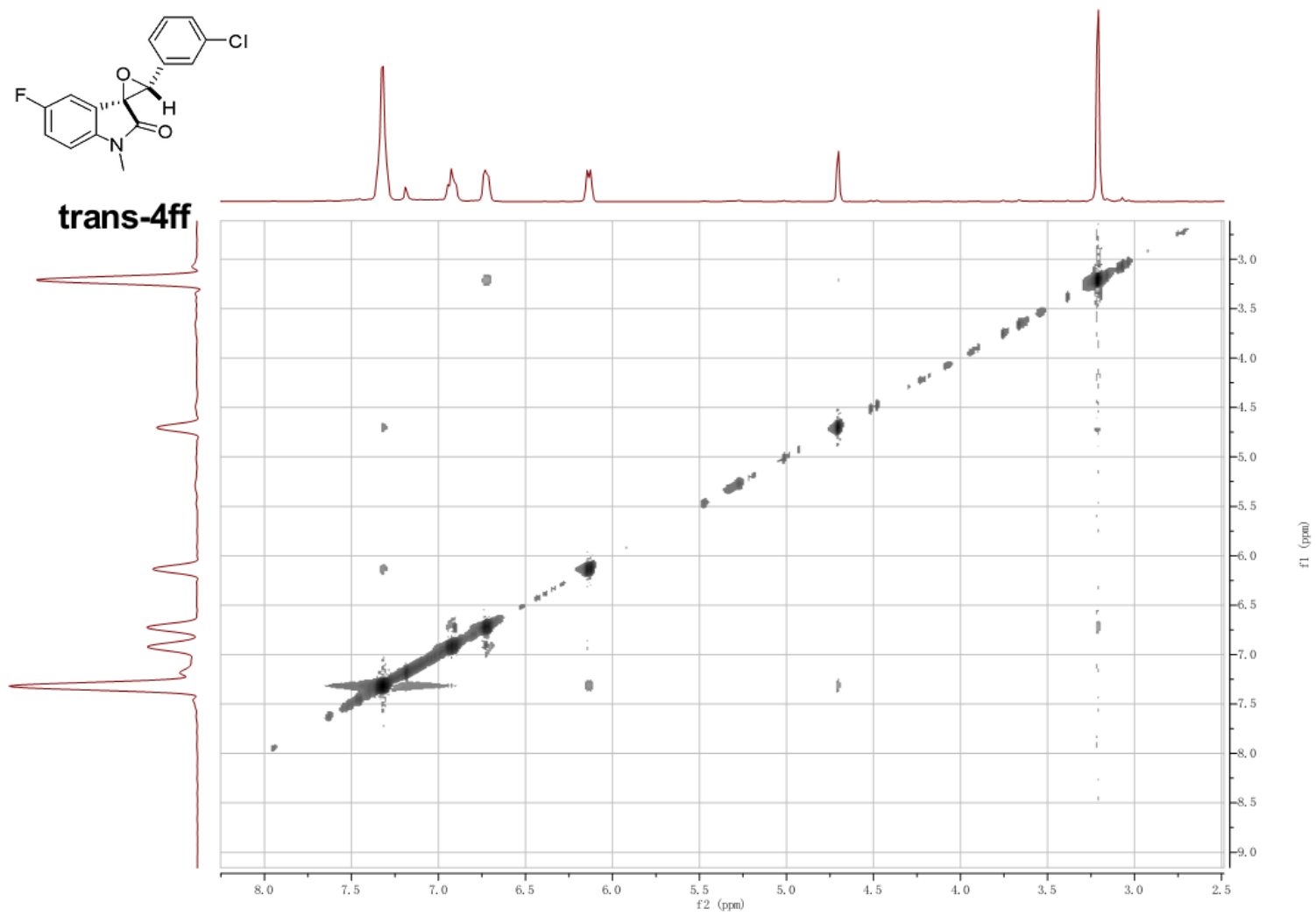


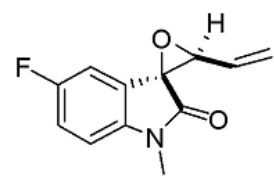
cis-4ff



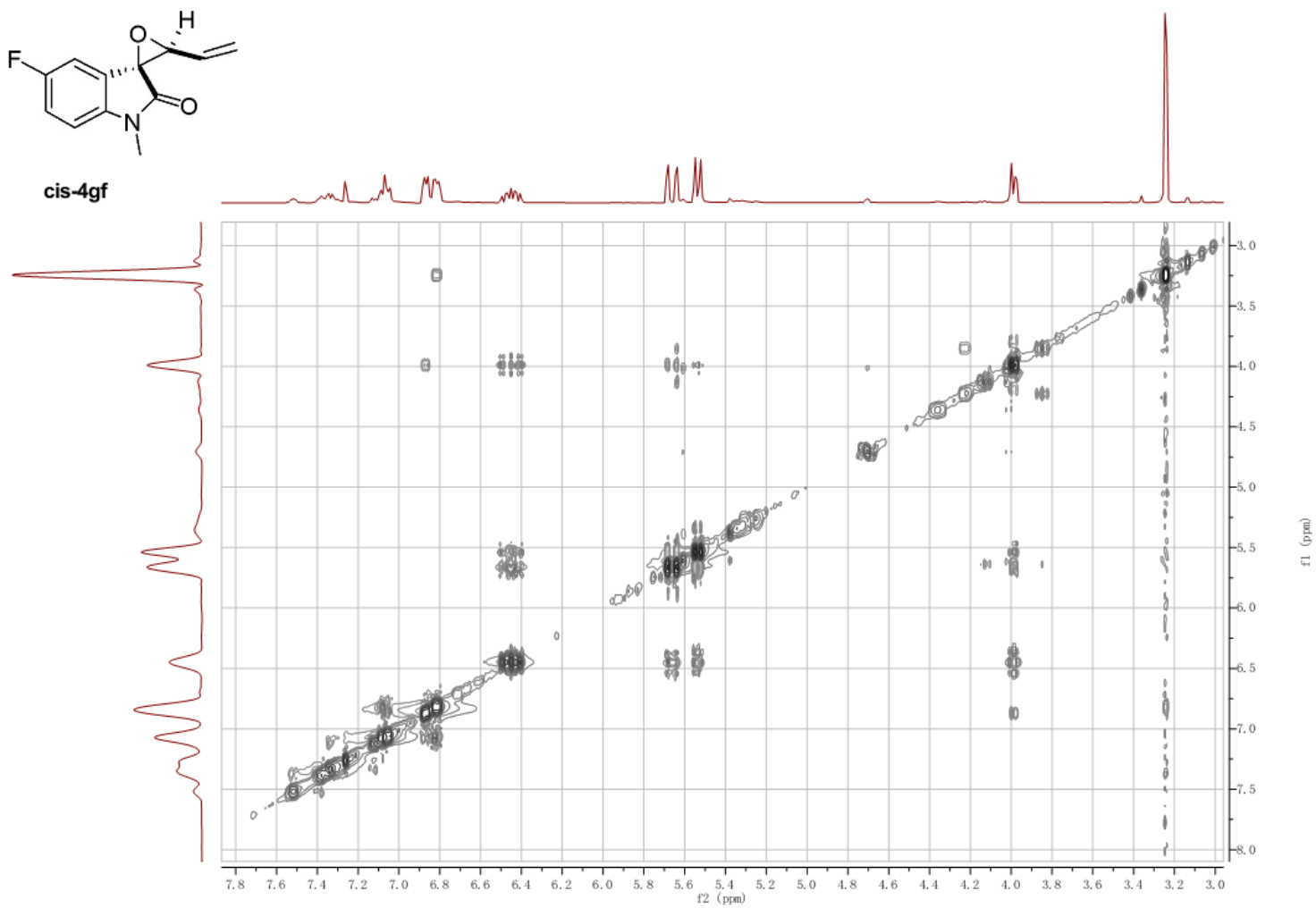


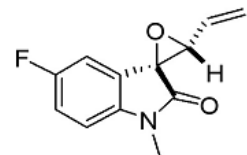
trans-4ff





cis-4gf





trans-4gf

