

**Nickel(II)-Catalyzed Reductive Silylation of Alkenyl Methyl Ethers
for the Synthesis of Alkyl Silanes
(Supporting Information)**

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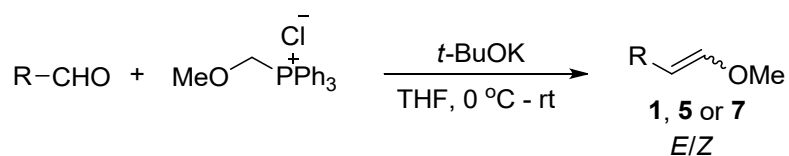
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1. General Information.

Unless otherwise noted, all reactions were performed under an nitrogen atmosphere using flame-dried glassware. Toluene and THF were distilled over Na. 1,4-dioxane was purchased as anhydrous solvent and used directly. All new compounds were fully characterized. NMR-spectra were recorded on Bruker AV-300, ARX-400 MHz or a ARX-600 Associated. ^1H NMR spectra data were reported as δ values in ppm relative to chloroform (δ 7.26), methanol (δ 3.30), or DMSO (δ 2.50) if collected in CDCl_3 , CD_3OD , or DMSO-d^6 . ^{13}C NMR spectra data were reported as δ values in ppm relative to chloroform (δ 77.0) methanol (δ 49.0) or DMSO (δ 39.5) if collected in CDCl_3 (the carbon attached to B was not observed), CD_3OD , DMSO-d^6 . ^1H NMR coupling constants were reported in Hz, and multiplicity was indicated as follows: s (singlet); d (doublet); t (triplet); q (quartet); quint (quintet); m (multiplet); dd (doublet of doublets); ddd (doublet of doublet of doublets); dddd (doublet of doublet of doublet of doublets); dt (doublet of triplets); td (triplet of doublets); ddt (doublet of doublet of triplets); dq (doublet of quartets); app (apparent); br (broad). Mass spectra were conducted at Micromass Q-ToF instrument (ESI) and Agilent Technologies 5973N (EI). All reactions were carried out in flame-dried 25 mL Schlenk tubes with Teflon screw caps under nitrogen. B_2Pin_2 was vacuumized under room temperature for 12 h before use. Unless otherwise noted, materials obtained from commercial suppliers were used without further purification. Compounds **1a-1e**, **1g-1h**, **1j**, **1l-1o**, **1q**, **1s** and **5l**,¹ **1i**, **1r** and **5h**,² **1k**,³ **1t**,⁴ **1v**,⁵ **1w**,⁶ **1x**,⁷ **5b**,⁸ **5f**,⁹ **7a**, **7b**,¹⁰ and **7e**¹¹ were prepared according to literature reports.

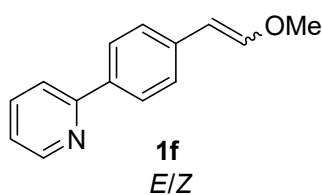
2. General Procedure for Synthesis of Alkenyl Methyl Ethers



To a flame dried flask was added (methoxymethyl)triphenylphosphonium chloride (6.0 mmol, 2.06 g) and *t*-BuOK (6.5 mmol, 0.73 g), the flask was vacuumed and refilled with nitrogen three times and put under the ice bath. 15 mL anhydrous THF was added and the mixture was stirred for 30 min. After that, the solution of aldehyde (5.0 mmol) in THF (5 mL) was added dropwise into the reaction mixture, then the reaction was stirred under room temperature overnight. The reaction was monitored by TLC. After the aldehyde was disappeared, 30 mL water was added and stirred for another 5 min. The aqueous phase

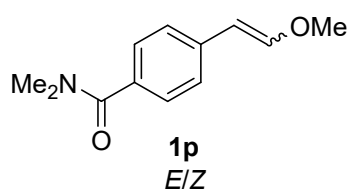
was extracted by ethyl acetate and the combined organic phase was dried over anhydrous sodium sulfate. The mixture was then filtered and the solvent was removed under reduced pressure. Further purification through flash chromatography using petroleum ether and ethyl acetate as the eluent provided the alkenyl methyl ether products as a mixture with both *E* and *Z* isomers.

2-(4-(2-Methoxyvinyl)phenyl)pyridine (**1f**)



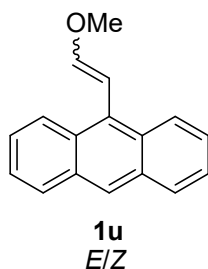
Compound **1f** was prepared from 4-(pyridin-2-yl)benzaldehyde in 91% yield as a pale yellow solid (962 mg). The spectral data were given for the mixture of both (*E*)-**1f** and (*Z*)-**1f** (*E:Z* = 54:46). ¹H NMR (400 MHz, CDCl₃) δ 8.75 – 8.60 (m, 1.81H), 8.01 – 7.86 (m, 3.66H), 7.79 – 7.62 (m, 5.35H), 7.39 – 7.29 (m, 1.94H), 7.24 – 7.09 (m, 2.77H), 6.20 (d, *J* = 7.0 Hz, 0.87H), 5.86 (d, *J* = 13.0 Hz, 1H), 5.28 (d, *J* = 7.1 Hz, 0.86H), 3.82 (s, 2.59H), 3.72 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 157.3, 157.1, 149.58, 149.57, 149.4, 148.6, 137.2, 136.7, 136.65, 136.61, 136.56, 136.4, 128.5, 127.1, 126.6, 125.3, 121.8, 121.7, 120.2, 120.1, 105.2, 104.6, 60.8, 56.6. HRMS *m/z* (ESI) calcd for C₁₄H₁₄NO (*M* + *H*)⁺ 212.1070, found 212.1068.

4-(2-Methoxyvinyl)-*N,N*-dimethylbenzamide (**1p**)



Compound **1p** was prepared from 4-formyl-*N,N*-dimethylbenzamide in 88% yield as a white solid (900 mg). The spectral data were given for the mixture of both (*E*)-**1p** and (*Z*)-**1p** (*E:Z* = 59:41). ¹H NMR (400 MHz, CDCl₃) δ 7.62 – 7.54 (m, 1.42H), 7.38 – 7.30 (m, 3.46H), 7.27 – 7.20 (m, 1.99H), 7.09 (d, *J* = 13.0 Hz, 0.99H), 6.19 (d, *J* = 7.0 Hz, 0.69H), 5.80 (d, *J* = 13.0 Hz, 1H), 5.23 (d, *J* = 7.0 Hz, 0.69H), 3.80 (s, 2.05H), 3.70 (s, 3H), 3.16 – 2.94 (m, 11.10H). ¹³C NMR (101 MHz, CDCl₃) δ 171.7, 171.6, 149.8, 148.9, 137.9, 137.3, 133.2, 133.1, 127.8, 127.7, 127.2, 124.7, 105.0, 104.4, 60.8, 56.6, 39.6, 35.4. HRMS *m/z* (ESI) calcd for C₁₂H₁₆NO₂ (*M* + *H*)⁺ 206.1176, found 206.1178.

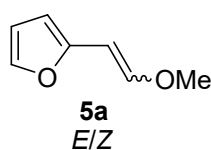
9-(2-Methoxyvinyl)anthracene (**1u**)



Compound **1u** was prepared from anthracene-9-carbaldehyde in 84% yield as a yellow solid (979 mg). The spectral data were given for the mixture of both (*E*)-

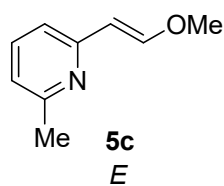
1u and (*Z*)-**1u** (*E:Z* = 56:44). ¹H NMR (400 MHz, CDCl₃) δ 8.46 – 8.36 (m, 3.79H), 8.31 – 8.24 (m, 1.52H), 8.06 – 7.98 (m, 3.52H), 7.56 – 7.45 (m, 7.13H), 6.79 (d, *J* = 13.1 Hz, 0.98H), 6.60 (d, *J* = 6.9 Hz, 0.77H), 6.44 (d, *J* = 13.0 Hz, 1H), 6.02 (d, *J* = 6.9 Hz, 0.77H), 3.95 (s, 3H), 3.64 (s, 2.31H). ¹³C NMR (101 MHz, CDCl₃) δ 152.8, 148.5, 131.5, 131.4, 130.5, 130.1, 129.6, 129.4, 128.6, 128.5, 126.7, 126.2, 126.1, 125.7, 125.1, 125.01, 124.99, 124.9, 101.3, 98.9, 59.9, 56.5. HRMS *m/z* (ESI) calcd for C₁₇H₁₅O (M + H)⁺ 235.1117, found 235.1115.

2-(2-Methoxyvinyl)furan (**5a**)



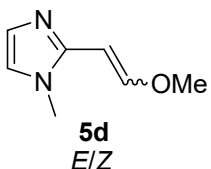
Compound **5a** was prepared from furan-2-carbaldehyde in 74% yield as a colorless oil (455 mg). The spectral data were given for the mixture of both (*E*)-**5a** and (*Z*)-**5a** (*E:Z* = 63:37). Due to the low boil point of compound **5a**, the NMR spectrum contained some petroleum ether signals and it had no effect to the reaction. ¹H NMR (400 MHz, CDCl₃) δ 7.29 (d, *J* = 1.5 Hz, 0.58H), 7.25 (d, *J* = 1.6 Hz, 0.95H), 7.08 (d, *J* = 12.9 Hz, 1.02H), 6.49 (d, *J* = 3.3 Hz, 0.58H), 6.39 (dd, *J* = 3.4, 1.9 Hz, 0.59H), 6.32 (dd, *J* = 3.2, 1.9 Hz, 0.98H), 6.08 (d, *J* = 6.8 Hz, 0.59H), 6.01 (d, *J* = 3.2 Hz, 0.97H), 5.67 (d, *J* = 12.9 Hz, 1H), 5.36 (d, *J* = 6.8 Hz, 0.59H), 3.80 (s, 1.80H), 3.66 (s, 3.07H). ¹³C NMR (101 MHz, CDCl₃) δ 151.6, 150.9, 148.8, 146.2, 140.1, 139.9, 111.3, 111.0, 107.7, 104.0, 96.1, 95.4, 60.7, 56.5. HRMS *m/z* (ESI) calcd for C₇H₉O₂ (M + H)⁺ 125.0597, found 125.0597.

2-(2-Methoxyvinyl)-6-methylpyridine (**5c**)



Compound **5c** was prepared from 6-methylpicolinaldehyde in 80% yield as a colorless oil (593 mg). ¹H NMR (400 MHz, CDCl₃) δ 7.53 (d, *J* = 12.8 Hz, 1H), 7.41 (t, *J* = 7.7 Hz, 1H), 6.88 (dd, *J* = 13.8, 7.7 Hz, 2H), 5.85 (d, *J* = 12.7 Hz, 1H), 3.71 (s, 3H), 2.48 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 157.7, 155.2, 152.7, 136.5, 119.9, 116.8, 105.2, 56.7, 24.5. HRMS *m/z* (ESI) calcd for C₉H₁₂NO (M + H)⁺ 150.0913, found 150.0912.

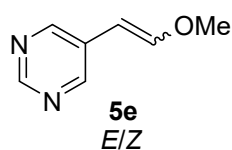
2-(2-Methoxyvinyl)-1-methyl-1*H*-imidazole (**5d**)



Compound **5d** was prepared from 1-methyl-1*H*-imidazole-2-carbaldehyde in 77% yield as a colorless oil (530 mg). The spectral data were given for the mixture

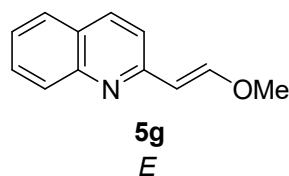
of both (*E*)-**5d** and (*Z*)-**5d** (*E*:*Z* = 51:49). ¹H NMR (400 MHz, CDCl₃) δ 7.54 (s, 0.95H), 7.49 (s, 0.93H), 7.37 (s, 0.97H), 7.19 (s, 0.99H), 6.79 (d, *J* = 13.0 Hz, 0.98H), 5.98 (d, *J* = 6.4 Hz, 0.96H), 5.57 (d, *J* = 13.0 Hz, 1H), 5.16 (d, *J* = 6.4 Hz, 0.96H), 3.84 (s, 2.92H), 3.82 (s, 3.01H), 3.73 (s, 2.93H), 3.59 (s, 3.08H). ¹³C NMR (101 MHz, CDCl₃) δ 147.3, 145.3, 138.5, 136.1, 128.7, 126.1, 117.6, 116.6, 96.2, 94.7, 60.0, 56.2, 38.7, 38.6. HRMS *m/z* (ESI) calcd for C₇H₁₁N₂O (M + H)⁺ 139.0866, found 139.0864.

5-(2-Methoxyvinyl)pyrimidine (**5e**)



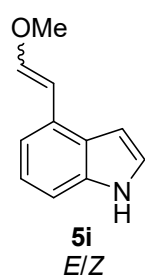
Compound **5e** was prepared from pyrimidine-5-carbaldehyde in 92% yield as a colorless oil (628 mg). The spectral data were given for the mixture of both (*E*)-**5e** and (*Z*)-**5e** (*E*:*Z* = 61:39). ¹H NMR (400 MHz, CDCl₃) δ 8.98 – 8.92 (m, 1.59H), 8.87 (s, 1.26H), 8.59 (s, 1.94H), 7.12 (d, *J* = 13.1 Hz, 1H), 6.35 (d, *J* = 6.8 Hz, 0.65H), 5.65 (d, *J* = 13.1 Hz, 1H), 5.12 (d, *J* = 6.8 Hz, 0.65H), 3.84 (s, 1.94H), 3.73 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 155.8, 155.4, 155.3, 152.8, 151.4, 151.3, 130.5, 130.2, 98.5, 97.8, 61.1, 56.8. HRMS *m/z* (ESI) calcd for C₇H₉N₂O (M + H)⁺ 137.0709, found 137.0708.

2-(2-Methoxyvinyl)quinoline (**5g**)



Compound **5g** was prepared from quinoline-2-carbaldehyde in 82% yield as a colorless oil (759 mg). ¹H NMR (400 MHz, CDCl₃) δ 8.00 – 7.92 (m, 2H), 7.72 – 7.66 (m, 2H), 7.63 (ddd, *J* = 8.5, 6.9, 1.5 Hz, 1H), 7.40 (ddd, *J* = 8.0, 6.9, 1.2 Hz, 1H), 7.29 (d, *J* = 8.6 Hz, 1H), 6.08 (d, *J* = 12.9 Hz, 1H), 3.77 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 156.0, 154.3, 148.0, 136.0, 129.4, 128.4, 127.4, 126.5, 125.1, 118.5, 105.9, 56.8. HRMS *m/z* (ESI) calcd for C₁₂H₁₂NO (M + H)⁺ 186.0913, found 186.0911.

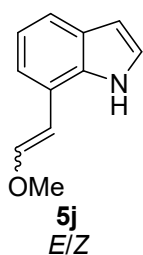
4-(2-Methoxyvinyl)-1*H*-indole (**5i**)



Compound **5i** was prepared from 1*H*-indole-4-carbaldehyde in 73% yield as a pale yellow solid (634 mg). The spectral data were given for the mixture of both (*E*)-**5i** and (*Z*)-**5i** (*E*:*Z* = 43:57). ¹H NMR (400 MHz, CDCl₃) δ 8.25 – 7.95 (m, 1.64H), 7.77 (dd, *J* = 6.4, 1.9 Hz, 0.97H), 7.25 – 7.11 (m, 5.61H), 7.07 (d, *J* = 7.2 Hz, 0.76H), 6.70 – 6.62 (m, 1.74H), 6.30 (d, *J* = 7.0 Hz, 1H), 6.21 (d, *J* = 12.9 Hz, 0.76H), 5.70 (d, *J* = 7.0 Hz,

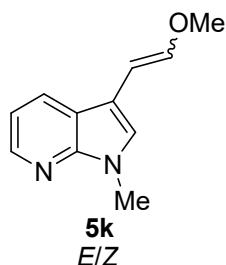
1H), 3.83 (s, 3H), 3.78 (s, 2.31H). ¹³C NMR (101 MHz, CDCl₃) δ 149.3, 148.0, 136.0, 135.7, 128.5, 127.6, 126.3, 125.5, 123.8, 123.4, 122.24, 122.17, 119.5, 115.8, 108.8, 108.7, 103.5, 102.7, 101.1, 101.0, 60.6, 56.5. HRMS m/z (ESI) calcd for C₁₁H₁₂NO (M + H)⁺ 174.0913, found 174.0911.

7-(2-Methoxyvinyl)-1H-indole (5j)



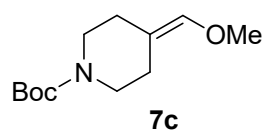
Compound **5j** was prepared from 1H-indole-7-carbaldehyde in 66% yield as a pale yellow solid (570 mg). The spectral data were given for the mixture of both (*E*)-**5j** and (*Z*)-**5j** (*E*:*Z* = 34:66). ¹H NMR (400 MHz, CDCl₃) δ 9.54 (brs, 0.96H), 8.15 (brs, 0.46H), 7.58 – 7.51 (m, 0.93H), 7.51 – 7.45 (m, 0.48H), 7.21 (t, *J* = 2.8 Hz, 1.13H), 7.15 (t, *J* = 2.8 Hz, 0.50H), 7.11 – 7.00 (m, 3.43H), 6.54 (dd, *J* = 3.1, 2.2 Hz, 1.47H), 6.06 (d, *J* = 7.3 Hz, 1H), 6.00 (d, *J* = 12.8 Hz, 0.51H), 5.46 (d, *J* = 7.3 Hz, 1H), 3.82 (s, 3H), 3.73 (s, 1.52H). ¹³C NMR (101 MHz, CDCl₃) δ 149.7, 144.4, 133.6, 133.1, 128.3, 127.9, 124.0, 123.6, 123.1, 120.1, 119.74, 119.69, 119.5, 119.0, 118.9, 118.6, 105.0, 103.1, 102.3, 100.6, 60.6, 56.7. HRMS m/z (ESI) calcd for C₁₁H₁₂NO (M + H)⁺ 174.0913, found 174.0911.

3-(2-Methoxyvinyl)-1-methyl-1H-pyrrolo[2,3-b]pyridine (5k)



Compound **5k** was prepared from 1-methyl-1H-pyrrolo[2,3-b]pyridine-3-carbaldehyde in 85% yield as a yellow solid (796 mg). The spectral data were given for the mixture of both (*E*)-**5k** and (*Z*)-**5k** (*E*:*Z* = 47:53). ¹H NMR (400 MHz, CDCl₃) δ 8.35 – 8.29 (m, 1.79H), 7.98 – 7.92 (m, 1.89H), 7.60 (s, 0.85H), 7.11 – 6.99 (m, 3.72H), 6.16 (d, *J* = 6.5 Hz, 1H), 5.92 (d, *J* = 13.0 Hz, 0.89H), 5.50 (dd, *J* = 6.5, 0.6 Hz, 1H), 3.87 (s, 2.95H), 3.84 (s, 2.65H), 3.82 (s, 3.03H), 3.70 (s, 2.67H). ¹³C NMR (101 MHz, CDCl₃) δ 148.1, 147.4, 147.0, 145.3, 143.0, 142.8, 128.2, 127.8, 127.1, 125.1, 119.3, 118.4, 115.2, 115.1, 109.5, 108.5, 97.3, 96.4, 60.3, 56.4, 31.1, 31.0. HRMS m/z (ESI) calcd for C₁₁H₁₃N₂O (M + H)⁺ 189.1022, found 189.1021.

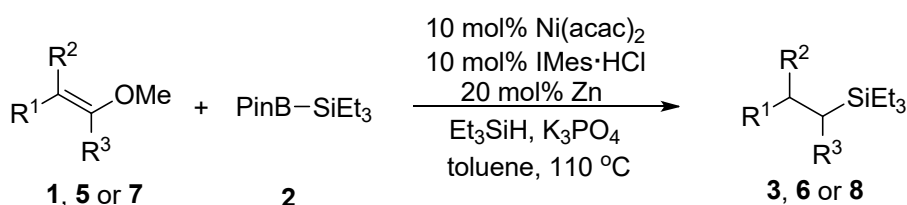
tert-Butyl 4-(methoxymethylene)piperidine-1-carboxylate (7c)



Compound **7c** was prepared from *tert*-butyl 4-oxopiperidine-1-carboxylate in 85% yield as a colorless oil (966 mg). ¹H NMR (400 MHz, CDCl₃) δ 5.82 (s, 1H), 3.53 (s, 3H), 3.34 (d, *J* = 5.2 Hz, 4H), 2.21 (brs, 2H), 2.02 – 1.90 (m, 2H), 1.43 (s, 9H). ¹³C NMR (101 MHz, CDCl₃) δ 154.7, 140.5, 113.5, 79.3, 59.3, 46.0, 44.0, 29.5, 28.4,

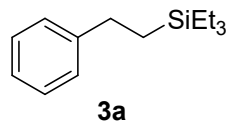
Further purification through flash chromatography using petroleum ether and ethyl acetate as the eluent provided the alkenyl methyl ether product **9** (235 mg, 83%) as a mixture with both *E* and *Z* isomers. The spectral data were given for the mixture of both (*E*)-**9** and (*Z*)-**9** (*E*:*Z* = 57:43). ¹H NMR (400 MHz, CDCl₃) δ 7.65 (d, *J* = 7.9 Hz, 1.47H), 7.43 – 7.26 (m, 5.60H), 7.24 – 7.16 (m, 1.73H), 6.55 (s, 1H), 6.36 (s, 0.74H), 4.39 (s, 2.06H), 4.14 (s, 1.53H), 3.80 – 3.71 (m, 5.32H), 3.38 – 3.30 (m, 5.35H). ¹³C NMR (101 MHz, CDCl₃) δ 148.9, 148.9, 138.4, 136.1, 128.4, 128.0, 127.7, 126.3, 126.2, 125.5, 115.5, 112.5, 73.9, 66.7, 60.6, 60.3, 57.5, 57.0. HRMS *m/z* (ESI) calcd for C₁₁H₁₄NaO₂ (M + H)⁺ 201.0886, found 21.0885.

4. General Procedure for Reductive Silylation of Alkenyl Methyl Ethers



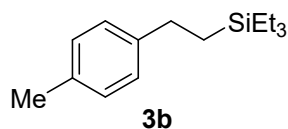
To a flame dried 25 mL Schlenk tube were added Ni(acac)₂ (0.03 mmol, 7.7 mg), IMes·HCl (0.03 mmol, 10.2 mg) and Zn (0.06 mmol, 3.9 mg) and K₃PO₄ (0.45 mmol, 95.4 mg). The tube was vacuumed and refilled with nitrogen three times followed by the addition of anhydrous toluene (1.5 mL). Substrates **1, 5, or 7** (0.3 mmol), **2** (0.6 mmol, 145.2 mg) and HSiEt₃ (0.9 mmol, 104.4 mg) were also added with a syringe under nitrogen atmosphere and the plug is screwed. After that, the reaction was stirred under 110 °C in the heating module for 24-48 h. Then the mixture was cooled to room temperature, the solvents were removed under reduced pressure and the crude product was purified through flash chromatography with petroleum ether and ethyl acetate as the eluent to afford the pure alkyl silane product.

Triethyl(phenethyl)silane (**3a**)



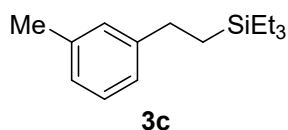
Substrate **1a** (0.3 mmol, 40.2 mg) reacted with **2** for 24 h affording **3a** as a colorless oil (50.3 mg, 76%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.31 – 7.25 (m, 3H), 7.24 – 7.13 (m, 2H), 2.65 – 2.56 (m, 2H), 0.95 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.85 (m, 2H), 0.55 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 145.6, 128.3, 127.7, 125.4, 30.0, 13.6, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₄H₂₅Si (M + H)⁺ 221.1720, found 221.1726. The spectra data are consistent with reports in the literature.¹³

Triethyl(4-methylphenethyl)silane (**3b**)



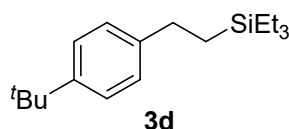
Substrate **1b** (0.3 mmol, 44.4 mg) reacted with **2** for 48 h affording **3b** as a colorless oil (51.3 mg, 73%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.11 (s, 4H), 2.64 – 2.54 (m, 2H), 2.34 (s, 3H), 0.98 (t, J = 7.9 Hz, 9H), 0.92 – 0.85 (m, 2H), 0.57 (q, J = 7.9 Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 142.6, 134.8, 128.9, 127.5, 29.5, 21.0, 13.8, 7.5, 3.2. HRMS m/z (ESI) calcd for $\text{C}_{15}\text{H}_{27}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 235.1877, found 235.1875. The spectra data are consistent with reports in the literature.¹³

Triethyl(3-methylphenethyl)silane (**3c**)



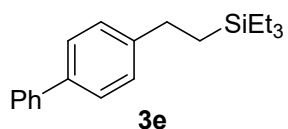
Substrate **1c** (0.3 mmol, 44.4 mg) reacted with **2** for 24 h affording **3c** as a colorless oil (49.4 mg, 70%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.20 (t, J = 7.5 Hz, 1H), 7.09 – 6.97 (m, 3H), 2.65 – 2.56 (m, 2H), 2.37 (s, 3H), 0.99 (t, J = 7.9 Hz, 9H), 0.95 – 0.87 (m, 2H), 0.59 (q, J = 7.9 Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 145.6, 137.8, 128.5, 128.2, 126.2, 124.7, 29.9, 21.4, 13.7, 7.5, 3.2. HRMS m/z (ESI) calcd for $\text{C}_{15}\text{H}_{27}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 235.1877, found 235.1874.

(4-(*tert*-Butyl)phenethyl)triethylsilane (**3d**)



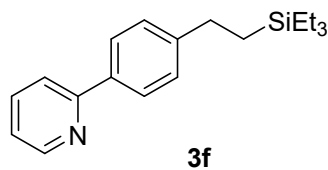
Substrate **1d** (0.3 mmol, 57.0 mg) reacted with **2** for 24 h affording **3d** as a colorless oil (71.1 mg, 86%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.34 (d, J = 8.3 Hz, 2H), 7.18 (d, J = 8.1 Hz, 2H), 2.66 – 2.57 (m, 2H), 1.34 (s, 9H), 0.99 (t, J = 8.0 Hz, 9H), 0.95 – 0.88 (m, 2H), 0.59 (q, J = 7.9 Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 148.2, 142.5, 127.3, 125.1, 34.3, 31.4, 29.4, 13.5, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{18}\text{H}_{33}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 277.2346, found 277.2344.

(2-([1,1'-Biphenyl]-4-yl)ethyl)triethylsilane (**3e**)



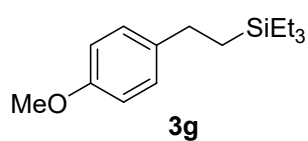
Substrate **1e** (0.3 mmol, 63.0 mg) reacted with **2** for 24 h affording **3e** as a colorless oil (82.5 mg, 93%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.63 – 7.58 (m, 2H), 7.57 – 7.51 (m, 2H), 7.47 – 7.41 (m, 2H), 7.37 – 7.27 (m, 3H), 2.72 – 2.63 (m, 2H), 1.04 – 0.91 (m, 11H), 0.60 (q, J = 7.9 Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 144.8, 141.2, 138.4, 128.7, 128.1, 127.04, 126.97, 126.9, 29.7, 13.6, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{20}\text{H}_{29}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 297.2033, found 297.2029.

2-(4-(2-(Triethylsilyl)ethyl)phenyl)pyridine (**3f**)



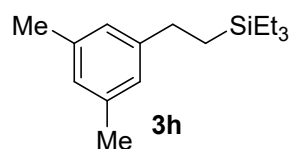
Substrate **1f** (0.3 mmol, 63.3 mg) reacted with **2** for 24 h affording **3f** as a colorless oil (75.9 mg, 85%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 8.68 (dt, *J* = 4.8, 1.4 Hz, 1H), 7.92 (d, *J* = 8.2 Hz, 2H), 7.77 – 7.67 (m, 2H), 7.32 (d, *J* = 8.2 Hz, 2H), 7.19 (ddd, *J* = 5.6, 4.8, 2.8 Hz, 1H), 2.72 – 2.63 (m, 2H), 1.03 – 0.88 (m, 11H), 0.58 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 157.5, 149.5, 146.6, 136.7, 136.6, 128.1, 126.8, 121.7, 120.2, 29.8, 13.5, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₉H₂₈NSi (M + H)⁺ 298.1986, found 298.1983.

Triethyl(4-methoxyphenethyl)silane (**3g**)



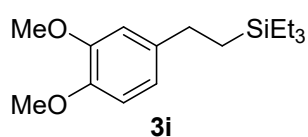
Substrate **1g** (0.3 mmol, 49.2 mg) reacted with **2** for 48 h affording **3g** as a colorless oil (58.3 mg, 78%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.12 (d, *J* = 8.5 Hz, 2H), 6.82 (d, *J* = 8.6 Hz, 2H), 3.79 (s, 3H), 2.60 – 2.52 (m, 2H), 0.95 (t, *J* = 7.9 Hz, 9H), 0.90 – 0.80 (m, 2H), 0.54 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 157.5, 137.7, 128.5, 113.7, 55.3, 29.1, 13.8, 7.5, 3.2. HRMS *m/z* (ESI) calcd for C₁₅H₂₇OSi (M + H)⁺ 251.1826, found 251.1825.

(3,5-Dimethylphenethyl)triethylsilane (**3h**)



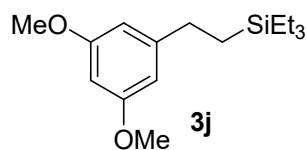
Substrate **1h** (0.3 mmol, 48.6 mg) reacted with **2** for 24 h affording **3h** as a colorless oil (58.2 mg, 78%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 6.90 – 6.82 (m, 3H), 2.64 – 2.51 (m, 2H), 2.33 (s, 6H), 1.00 (t, *J* = 7.9 Hz, 9H), 0.95 – 0.86 (m, 2H), 0.59 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 145.6, 137.7, 127.1, 125.5, 29.8, 21.3, 13.8, 7.5, 3.2. HRMS *m/z* (ESI) calcd for C₁₆H₂₉Si (M + H)⁺ 249.2033, found 249.2037.

(3,4-Dimethoxyphenethyl)triethylsilane (**3i**)



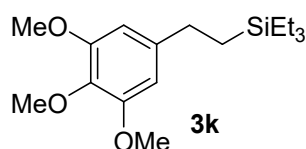
Substrate **1i** (0.3 mmol, 58.2 mg) reacted with **2** for 24 h affording **3i** as a colorless oil (68.8 mg, 82%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 6.82 – 6.71 (m, 3H), 3.89 (s, 3H), 3.86 (s, 3H), 2.62 – 2.52 (m, 2H), 0.96 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.82 (m, 2H), 0.55 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 148.7, 146.9, 138.3, 119.2, 111.14, 111.06, 55.9, 55.8, 29.6, 13.7, 7.5, 3.2. HRMS *m/z* (ESI) calcd for C₁₆H₂₉O₂Si (M + H)⁺ 281.1931, found 281.1930.

(3,5-Dimethoxyphenethyl)triethylsilane (**3j**)



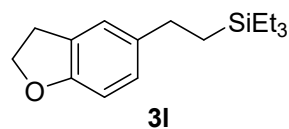
Substrate **1j** (0.3 mmol, 58.2 mg) reacted with **2** for 24 h affording **3j** as a colorless oil (71.2 mg, 85%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 6.37 (d, *J* = 2.3 Hz, 2H), 6.29 (t, *J* = 2.3 Hz, 1H), 3.79 (s, 6H), 2.60 – 2.51 (m, 2H), 0.96 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.84 (m, 2H), 0.55 (q, *J* = 8.0 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 160.7, 148.1, 105.7, 97.4, 55.2, 30.3, 13.4, 7.5, 3.2. HRMS *m/z* (ESI) calcd for C₁₆H₂₉O₂Si (M + H)⁺ 281.1931, found 281.1930.

Triethyl(3,4,5-trimethoxyphenethyl)silane (**3k**)



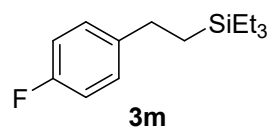
Substrate **1k** (0.3 mmol, 67.2 mg) reacted with **2** for 24 h affording **3k** as a colorless oil (80.1 mg, 86%). Eluent: petroleum ether : ethyl acetate = 20 : 1. ¹H NMR (400 MHz, CDCl₃) δ 6.42 (s, 2H), 3.86 (s, 6H), 3.82 (s, 3H), 2.60 – 2.53 (m, 2H), 0.97 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.83 (m, 2H), 0.56 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 153.0, 141.4, 135.8, 104.5, 60.9, 56.0, 30.4, 13.5, 7.5, 3.2. HRMS *m/z* (ESI) calcd for C₁₇H₃₁O₃Si (M + H)⁺ 311.2037, found 311.2035.

(2-(2,3-Dihydrobenzofuran-5-yl)ethyl)triethylsilane (**3l**)



Substrate **1l** (0.3 mmol, 52.8 mg) reacted with **2** for 48 h affording **3l** as a colorless oil (55.1 mg, 70%). Eluent: petroleum ether : ethyl acetate = 100 : 1. ¹H NMR (400 MHz, CDCl₃) δ 7.05 (s, 1H), 6.93 (d, *J* = 8.1 Hz, 1H), 6.70 (d, *J* = 8.0 Hz, 1H), 4.54 (t, *J* = 8.6 Hz, 2H), 3.18 (t, *J* = 8.6 Hz, 2H), 2.58 – 2.50 (m, 2H), 0.96 (t, *J* = 8.0 Hz, 9H), 0.90 – 0.79 (m, 2H), 0.55 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 157.9, 137.8, 126.9, 126.8, 124.1, 108.8, 71.1, 29.8, 29.4, 14.2, 7.5, 3.3. HRMS *m/z* (ESI) calcd for C₁₆H₂₇O₂Si (M + H)⁺ 263.1826, found 263.1830.

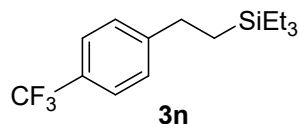
Triethyl(4-fluorophenethyl)silane (**3m**)



Substrate **1m** (0.3 mmol, 45.6 mg) reacted with **2** for 24 h affording **3m** as a colorless oil (50.9 mg, 71%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.15 (dd, *J* = 8.5, 5.6 Hz, 2H), 6.96 (t, *J* = 8.7 Hz, 2H), 2.64 – 2.55 (m, 2H), 0.96 (t, *J* = 7.9 Hz, 9H), 0.90 – 0.82 (m, 2H), 0.55 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 161.0 (d, *J* = 242.7 Hz), 141.1 (d, *J* = 3.2 Hz), 128.9 (d, *J* = 7.7 Hz), 114.9 (d, *J* = 21.0 Hz), 29.3, 13.8, 7.4, 3.2. ¹⁹F NMR (376 MHz, CDCl₃) δ -118.5. HRMS *m/z* (ESI) calcd for C₁₄H₂₄FSi (M + H)⁺

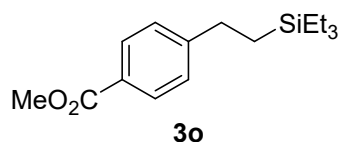
H)⁺ 239.1626, found 239.1632. The spectra data are consistent with reports in the literature.¹³

Triethyl(4-(trifluoromethyl)phenethyl)silane (**3n**)



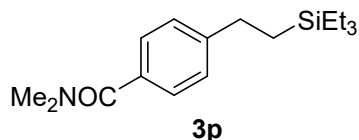
Substrate **1n** (0.3 mmol, 60.6 mg) reacted with **2** for 24 h affording **3n** as a colorless oil (69.0 mg, 80%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.53 (d, *J* = 8.0 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 2.72 – 2.62 (m, 2H), 0.97 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.84 (m, 2H), 0.57 (q, *J* = 8.0 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 149.7 (d, *J* = 1.3 Hz), 128.0, 127.8 (q, *J* = 32.2 Hz), 125.2 (q, *J* = 3.8 Hz), 124.4 (q, *J* = 271.6 Hz), 30.0, 13.5, 7.4, 3.2. ¹⁹F NMR (376 MHz, CDCl₃) δ -62.2. HRMS *m/z* (ESI) calcd for C₁₅H₂₄F₃Si (M + H)⁺ 289.1594, found 289.1582.

Methyl 4-(2-(triethylsilyl)ethyl)benzoate (**3o**)



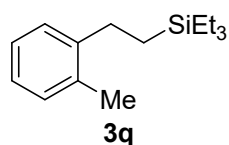
Substrate **1o** (0.3 mmol, 57.6 mg) reacted with **2** for 24 h affording **3o** as a colorless oil (69.1 mg, 83%). Eluent: petroleum ether : ethyl acetate = 100 : 1. ¹H NMR (400 MHz, CDCl₃) δ 7.95 (d, *J* = 8.3 Hz, 2H), 7.26 (d, *J* = 8.2 Hz, 2H), 3.90 (s, 3H), 2.70 – 2.61 (m, 2H), 0.96 (t, *J* = 7.9 Hz, 9H), 0.92 – 0.84 (m, 2H), 0.56 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 167.2, 151.1, 129.7, 127.7, 127.5, 51.9, 30.2, 13.4, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₆H₂₇O₂Si (M + H)⁺ 279.1775, found 279.1771.

N,N-dimethyl-4-(2-(triethylsilyl)ethyl)benzamide (**3p**)



Substrate **1p** (0.3 mmol, 61.5 mg) reacted with **2** for 24 h affording **3p** as a colorless oil (61.5 mg, 70%). Eluent: petroleum ether : ethyl acetate = 20 : 1. ¹H NMR (400 MHz, CDCl₃) δ 7.33 (d, *J* = 8.1 Hz, 2H), 7.21 (d, *J* = 8.1 Hz, 2H), 3.09 (s, 3H), 2.99 (s, 3H), 2.66 – 2.57 (m, 2H), 0.95 (t, *J* = 7.9 Hz, 9H), 0.90 – 0.83 (m, 2H), 0.55 (q, *J* = 8.0 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 171.8, 147.2, 133.4, 127.6, 127.2, 39.6, 35.4, 29.9, 13.5, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₇H₃₀NOSi (M + H)⁺ 292.2091, found 292.2088.

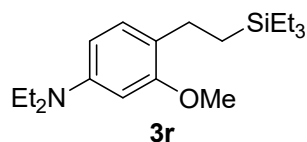
Triethyl(2-methylphenethyl)silane (**3q**)



Substrate **1q** (0.3 mmol, 44.4 mg) reacted with **2** for 48 h affording **3q** as a colorless oil (33.1 mg, 47%). Eluent: petroleum ether. ¹H NMR (400 MHz,

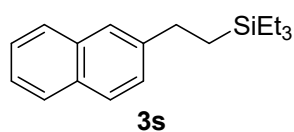
CDCl₃) δ 7.19 – 7.03 (m, 4H), 2.62 – 2.52 (m, 2H), 2.29 (s, 3H), 0.97 (t, J = 7.9 Hz, 9H), 0.86 – 0.77 (m, 2H), 0.58 (q, J = 8.0 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 143.7, 135.2, 130.1, 127.9, 126.0, 125.6, 27.4, 19.1, 12.5, 7.5, 3.3. HRMS m/z (ESI) calcd for C₁₅H₂₇Si (M + H)⁺ 235.1877, found 235.1876.

N,N-diethyl-3-methoxy-4-(2-(triethylsilyl)ethyl)aniline (**3r**)



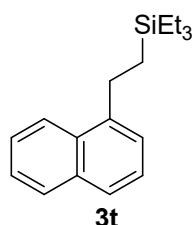
Substrate **1r** (0.3 mmol, 70.5 mg) reacted with **2** for 24 h affording **3r** as a colorless oil (68.5 mg, 71%). Eluent: petroleum ether : ethyl acetate = 20 : 1. ¹H NMR (400 MHz, CDCl₃) δ 7.02 (d, J = 7.9 Hz, 1H), 6.34 – 6.24 (m, 2H), 3.84 (s, 3H), 3.36 (q, J = 7.0 Hz, 4H), 2.62 – 2.46 (m, 2H), 1.19 (t, J = 7.1 Hz, 6H), 1.00 (t, J = 7.9 Hz, 9H), 0.90 – 0.81 (m, 2H), 0.59 (q, J = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 158.0, 147.4, 129.1, 121.6, 104.4, 96.2, 55.1, 44.6, 23.2, 12.6, 12.1, 7.4, 3.3. HRMS m/z (ESI) calcd for C₁₉H₃₆NOSi (M + H)⁺ 322.2561, found 322.2558.

Triethyl(2-(naphthalen-2-yl)ethyl)silane (**3s**)



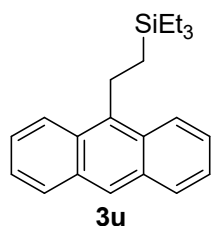
Substrate **1s** (0.3 mmol, 55.2 mg) reacted with **2** for 24 h affording **3s** as a colorless oil (72.8 mg, 90%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.86 – 7.75 (m, 3H), 7.66 (s, 1H), 7.51 – 7.35 (m, 3H), 2.86 – 2.76 (m, 2H), 1.08 – 0.96 (m, 11H), 0.62 (q, J = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 143.1, 133.7, 131.9, 127.8, 127.6, 127.4, 127.0, 125.8, 125.2, 124.9, 30.2, 13.5, 7.5, 3.3. HRMS m/z (ESI) calcd for C₁₈H₂₇Si (M + H)⁺ 271.1877, found 271.1882. The spectra data are consistent with reports in the literature.¹³

Triethyl(2-(naphthalen-1-yl)ethyl)silane (**3t**)



Substrate **1t** (0.3 mmol, 55.2 mg) reacted with **2** for 24 h affording **3t** as a colorless oil (69.0 mg, 85%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 8.04 (d, J = 8.3 Hz, 1H), 7.90 – 7.84 (m, 1H), 7.71 (d, J = 7.9 Hz, 1H), 7.56 – 7.45 (m, 2H), 7.45 – 7.34 (m, 2H), 3.13 – 3.04 (m, 2H), 1.07 – 0.98 (m, 11H), 0.65 (q, J = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 141.7, 133.9, 131.5, 128.8, 126.2, 125.7, 125.6, 125.3, 124.7, 123.6, 27.2, 13.2, 7.5, 3.3. HRMS m/z (ESI) calcd for C₁₈H₂₇Si (M + H)⁺ 271.1877, found 271.1872.

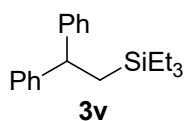
(2-(Anthracen-9-yl)ethyl)triethylsilane (3u)



Substrate **1u** (0.3 mmol, 70.2 mg) reacted with **2** for 24 h affording **3u** as a colorless oil (57.7 mg, 60%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 8.32 (s, 1H), 8.23 (d, $J = 8.8$ Hz, 2H), 8.01 (d, $J = 8.0$ Hz, 2H), 7.56 – 7.42 (m, 4H), 3.65 – 3.53 (m, 2H), 1.16 – 1.03 (m, 11H), 0.75 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 138.2, 131.7, 129.3, 128.7, 125.3, 125.2, 124.8, 124.1, 22.1,

14.2, 7.7, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{22}\text{H}_{29}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 321.2033, found 321.2029.

(2,2-Diphenylethyl)triethylsilane (3v)

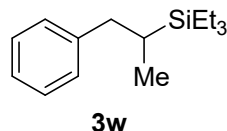


Substrate **1v** (0.3 mmol, 63.0 mg) reacted with **2** for 48 h affording **3v** as a colorless oil (44.4 mg, 50%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.36 – 7.20 (m, 8H), 7.17 – 7.10 (m, 2H), 4.06 (t, $J = 7.9$ Hz, 1H), 1.41 (d, $J = 7.9$ Hz, 3H),

0.82 (t, $J = 7.9$ Hz, 9H), 0.33 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 147.3, 128.3, 127.5, 125.9, 47.1, 19.0, 7.3, 3.4. HRMS m/z (ESI) calcd for $\text{C}_{20}\text{H}_{28}\text{NaSi}$ ($\text{M} + \text{Na}$) $^+$ 319.1852, found 319.1852.

The spectra data are consistent with reports in the literature.¹⁴

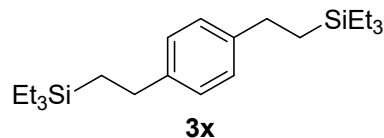
Triethyl(1-phenylpropan-2-yl)silane (3w)



Substrate **1w** (0.3 mmol, 44.4 mg) reacted with **2** for 48 h affording **3w** as a colorless oil (42.6 mg, 61%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.31 – 7.23 (m, 2H), 7.21 – 7.12 (m, 3H), 2.89 (dd, $J = 13.7, 3.4$ Hz,

1H), 2.25 (dd, $J = 13.7, 11.9$ Hz, 1H), 1.16 – 1.04 (m, 1H), 0.99 (t, $J = 7.9$ Hz, 9H), 0.84 (d, $J = 7.4$ Hz, 3H), 0.60 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 142.9, 128.8, 128.0, 125.5, 38.2, 19.2, 13.8, 7.7, 2.2. HRMS m/z (ESI) calcd for $\text{C}_{15}\text{H}_{27}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 235.1877, found 235.1887.

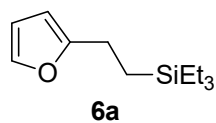
1,4-Bis(2-(triethylsilyl)ethyl)benzene (3x)



Substrate **1x** (0.3 mmol, 57.0 mg) reacted with **2** for 24 h affording **3x** as a colorless oil (88.1 mg, 81%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.15 (s, 4H), 2.65 – 2.56 (m,

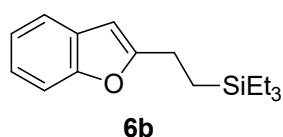
4H), 0.99 (t, $J = 8.0$ Hz, 18H), 0.94 – 0.85 (m, 4H), 0.58 (q, $J = 8.0$ Hz, 12H). ^{13}C NMR (101 MHz, CDCl_3) δ 142.7, 127.6, 29.5, 13.7, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{22}\text{H}_{43}\text{Si}_2$ ($\text{M} + \text{H}$) $^+$ 363.2898, found 363.2893.

Triethyl(2-(furan-2-yl)ethyl)silane (**6a**)



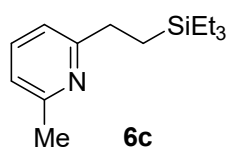
Substrate **5a** (0.3 mmol, 37.2 mg) reacted with **2** for 48 h affording **6a** as a colorless oil (40.4 mg, 64%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.29 (d, $J = 1.0$ Hz, 1H), 6.27 (dd, $J = 3.1, 1.9$ Hz, 1H), 5.98 (dd, $J = 3.1, 1.0$ Hz, 1H), 2.67 – 2.57 (m, 2H), 1.01 – 0.85 (m, 11H), 0.53 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 158.7, 140.5, 110.1, 103.7, 22.3, 9.5, 7.4, 3.1. HRMS m/z (ESI) calcd for $\text{C}_{12}\text{H}_{23}\text{OSi}$ ($\text{M} + \text{H}$) $^+$ 211.1513, found 211.1510.

(2-(Benzofuran-2-yl)ethyl)triethylsilane (**6b**)



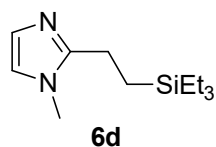
Substrate **5b** (0.3 mmol, 52.2 mg) reacted with **2** for 48 h affording **6b** as a colorless oil (29.0 mg, 37%). Eluent: petroleum ether. ^1H NMR (400 MHz, CDCl_3) δ 7.50 – 7.45 (m, 1H), 7.42 – 7.38 (m, 1H), 7.22 – 7.13 (m, 2H), 6.38 (d, $J = 1.0$ Hz, 1H), 2.81 – 2.72 (m, 2H), 1.05 – 0.91 (m, 11H), 0.57 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 162.0, 154.6, 129.0, 123.0, 122.3, 120.1, 110.6, 100.8, 22.9, 9.4, 7.4, 3.1. HRMS m/z (ESI) calcd for $\text{C}_{16}\text{H}_{25}\text{OSi}$ ($\text{M} + \text{H}$) $^+$ 261.1669, found 261.1670.

2-Methyl-6-(2-(triethylsilyl)ethyl)pyridine (**6c**)



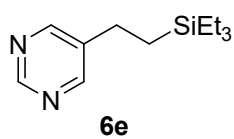
Substrate **5c** (0.3 mmol, 44.7 mg) reacted with **2** for 24 h affording **6c** as a colorless oil (50.7 mg, 72%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ^1H NMR (400 MHz, CDCl_3) δ 7.46 (t, $J = 7.7$ Hz, 1H), 6.98 (d, $J = 7.7$ Hz, 1H), 6.92 (d, $J = 7.6$ Hz, 1H), 2.80 – 2.71 (m, 2H), 2.51 (s, 3H), 1.00 – 0.89 (m, 11H), 0.54 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 164.1, 157.4, 136.5, 120.2, 118.4, 32.6, 24.5, 11.7, 7.4, 3.2. HRMS m/z (ESI) calcd for $\text{C}_{14}\text{H}_{26}\text{NSi}$ ($\text{M} + \text{H}$) $^+$ 236.1829, found 236.1827.

1-Methyl-2-(2-(triethylsilyl)ethyl)-1H-imidazole (**6d**)



Substrate **5d** (0.3 mmol, 41.4 mg) reacted with **2** for 24 h affording **6d** as a colorless oil (41.9 mg, 62%). Eluent: petroleum ether : ethyl acetate = 5 : 1. ^1H NMR (400 MHz, CDCl_3) δ 7.31 (s, 1H), 7.13 (s, 1H), 3.84 (s, 3H), 2.50 – 2.41 (m, 2H), 0.94 (t, $J = 7.9$ Hz, 9H), 0.87 – 0.77 (m, 2H), 0.53 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 138.1, 127.6, 125.3, 38.7, 18.4, 13.0, 7.4, 3.2. HRMS m/z (ESI) calcd for $\text{C}_{12}\text{H}_{25}\text{N}_2\text{Si}$ ($\text{M} + \text{H}$) $^+$ 225.1782, found 225.1778.

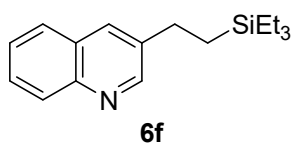
5-(2-(Triethylsilyl)ethyl)pyrimidine (6e)



6e

Substrate **5e** (0.3 mmol, 40.8 mg) reacted with **2** for 24 h affording **6e** as a colorless oil (48.5 mg, 73%). Eluent: petroleum ether : ethyl acetate = 5 : 1. ¹H NMR (400 MHz, CDCl₃) δ 9.03 (s, 1H), 8.57 (s, 2H), 2.63 – 2.55 (m, 2H), 0.94 (t, *J* = 7.9 Hz, 9H), 0.90 – 0.83 (m, 2H), 0.55 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 156.4, 156.1, 138.0, 24.9, 13.1, 7.3, 3.1. HRMS *m/z* (ESI) calcd for C₁₂H₂₃N₂Si (M + H)⁺ 223.1625, found 223.1623.

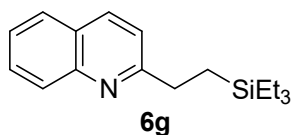
3-(2-(Triethylsilyl)ethyl)quinoline (6f)



6f

Substrate **5f** (0.3 mmol, 55.5 mg) reacted with **2** for 24 h affording **6f** as a colorless oil (52.7 mg, 65%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 8.79 (d, *J* = 2.3 Hz, 1H), 8.07 (d, *J* = 8.4 Hz, 1H), 7.92 (d, *J* = 1.2 Hz, 1H), 7.76 (d, *J* = 8.1 Hz, 1H), 7.64 (ddd, *J* = 8.4, 6.8, 1.5 Hz, 1H), 7.50 (ddd, *J* = 8.1, 6.8, 1.2 Hz, 1H), 2.85 – 2.75 (m, 2H), 1.03 – 0.93 (m, 11H), 0.60 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 151.9, 146.7, 137.9, 133.0, 129.1, 128.3, 128.2, 127.2, 126.4, 27.5, 13.3, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₇H₂₆NSi (M + H)⁺ 272.1829, found 272.1827.

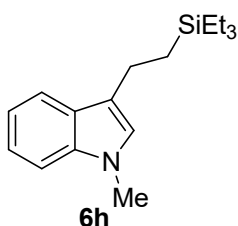
2-(2-(Triethylsilyl)ethyl)quinoline (6g)



6g

Substrate **5g** (0.3 mmol, 55.5 mg) reacted with **2** for 24 h affording **6g** as a colorless oil (62.8 mg, 77%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 8.05 (dd, *J* = 8.3, 5.3 Hz, 2H), 7.76 (dd, *J* = 8.1, 1.4 Hz, 1H), 7.67 (ddd, *J* = 8.4, 6.8, 1.5 Hz, 1H), 7.46 (ddd, *J* = 8.1, 6.9, 1.2 Hz, 1H), 7.33 (d, *J* = 8.5 Hz, 1H), 3.02 – 2.92 (m, 2H), 1.11 – 1.02 (m, 2H), 0.98 (t, *J* = 7.9 Hz, 9H), 0.60 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 165.1, 147.8, 136.3, 129.2, 128.7, 127.4, 126.6, 125.5, 120.7, 33.5, 12.0, 7.4, 3.2. HRMS *m/z* (ESI) calcd for C₁₇H₂₆NSi (M + H)⁺ 272.1829, found 272.1826. The spectra data are consistent with reports in the literature.¹⁵

1-Methyl-3-(2-(triethylsilyl)ethyl)-1*H*-indole (6h)

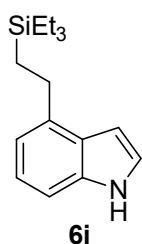


6h

Substrate **5h** (0.3 mmol, 56.1 mg) reacted with **2** for 24 h affording **6h** as a colorless oil (62.4 mg, 76%). Eluent: petroleum ether : ethyl acetate = 100 : 1. ¹H NMR (400 MHz, CDCl₃) δ 7.60 (d, *J* = 7.9 Hz, 1H), 7.29 (d, *J* = 8.2 Hz, 1H),

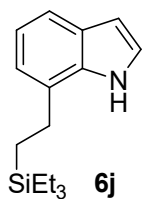
7.22 (t, $J = 7.5$ Hz, 1H), 7.10 (d, $J = 14.8$ Hz, 1H), 6.85 (s, 1H), 3.75 (s, 3H), 2.80 – 2.70 (m, 2H), 1.05 – 0.94 (m, 11H), 0.60 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 137.1, 127.5, 125.3, 121.4, 119.0, 118.7, 118.4, 109.1, 32.5, 19.2, 12.2, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{17}\text{H}_{28}\text{NSi}$ ($\text{M} + \text{H}$) $^+$ 274.1986, found 274.1982.

4-(2-(Triethylsilyl)ethyl)-1H-indole (6i)



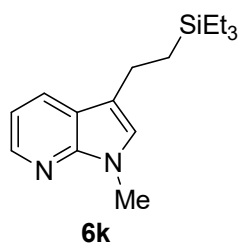
Substrate **5i** (0.3 mmol, 51.9 mg) reacted with **2** for 48 h affording **6i** as a colorless oil (49.1 mg, 63%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ^1H NMR (400 MHz, CDCl_3) δ 8.15 (brs, 1H), 7.25 (d, $J = 8.2$ Hz, 1H), 7.22 – 7.19 (m, 1H), 7.17 – 7.10 (m, 1H), 6.97 (d, $J = 7.1$ Hz, 1H), 6.59 (ddd, $J = 3.2, 2.1, 1.0$ Hz, 1H), 2.95 – 2.86 (m, 2H), 1.08 – 0.94 (m, 11H), 0.61 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 138.0, 135.7, 126.6, 123.4, 122.2, 118.0, 108.6, 100.9, 27.5, 12.8, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{16}\text{H}_{26}\text{NSi}$ ($\text{M} + \text{H}$) $^+$ 260.1829, found 260.1825.

7-(2-(Triethylsilyl)ethyl)-1H-indole (6j)



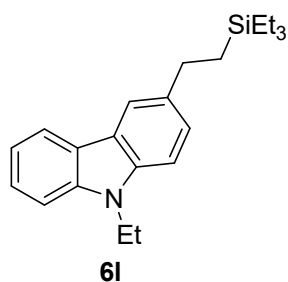
Substrate **5j** (0.3 mmol, 51.9 mg) reacted with **2** for 48 h affording **6j** as a colorless oil (61.9 mg, 76%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ^1H NMR (400 MHz, CDCl_3) δ 8.08 (brs, 1H), 7.50 (dd, $J = 6.6, 2.4$ Hz, 1H), 7.22 (t, $J = 2.8$ Hz, 1H), 7.12 – 7.04 (m, 2H), 6.58 (dd, $J = 3.2, 2.0$ Hz, 1H), 2.90 – 2.80 (m, 2H), 1.10 – 0.90 (m, 11H), 0.61 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 134.4, 127.62, 127.60, 123.6, 120.3, 120.0, 118.4, 103.1, 25.2, 11.2, 7.5, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{16}\text{H}_{26}\text{NSi}$ ($\text{M} + \text{H}$) $^+$ 260.1829, found 260.1827.

1-Methyl-3-(2-(triethylsilyl)ethyl)-1H-pyrrolo[2,3-b]pyridine (6k)



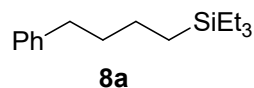
Substrate **5k** (0.3 mmol, 56.4 mg) reacted with **2** for 24 h affording **6k** as a colorless oil (68.5 mg, 83%). Eluent: petroleum ether : ethyl acetate = 20 : 1. ^1H NMR (400 MHz, CDCl_3) δ 8.31 (dd, $J = 4.7, 1.5$ Hz, 1H), 7.87 (dd, $J = 7.8, 1.6$ Hz, 1H), 7.02 (dd, $J = 7.8, 4.7$ Hz, 1H), 6.96 (d, $J = 1.2$ Hz, 1H), 3.83 (s, 3H), 2.77 – 2.68 (m, 3H), 1.02 – 0.92 (m, 11H), 0.58 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 148.1, 142.6, 126.9, 125.2, 119.9, 117.0, 114.5, 30.9, 19.3, 12.0, 7.5, 3.2. HRMS m/z (ESI) calcd for $\text{C}_{16}\text{H}_{27}\text{N}_2\text{Si}$ ($\text{M} + \text{H}$) $^+$ 275.1938, found 275.1935.

9-Ethyl-3-(2-(triethylsilyl)ethyl)-9H-carbazole (**6l**)



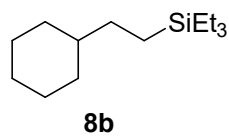
Substrate **5l** (0.3 mmol, 75.3mg) reacted with **2** for 24 h affording **6l** as a colorless oil (85.7 mg, 85%). Eluent: petroleum ether : ethyl acetate = 50 : 1. ¹H NMR (400 MHz, CDCl₃) δ 8.09 (d, *J* = 7.8 Hz, 1H), 7.93 (s, 1H), 7.48 – 7.31 (m, 4H), 7.20 (ddd, *J* = 7.9, 7.0, 1.1 Hz, 1H), 4.36 (q, *J* = 7.2 Hz, 2H), 2.86 – 2.77 (m, 2H), 1.42 (t, *J* = 7.2 Hz, 3H), 1.16 – 0.94 (m, 11H), 0.60 (q, *J* = 7.9 Hz, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 140.1, 138.3, 136.2, 125.7, 125.3, 122.9, 122.8, 120.3, 118.9, 118.4, 108.3, 108.1, 37.5, 30.0, 14.6, 13.8, 7.5, 3.3. HRMS *m/z* (ESI) calcd for C₂₂H₃₂NSi (M + H)⁺ 338.2299, found 338.2293.

Triethyl(4-phenylbutyl)silane (**8a**)



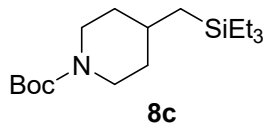
Substrate **7a** (0.3 mmol, 48.6 mg) reacted with **2** for 48 h affording **8a** as a colorless oil (47.8 mg, 64%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.31 – 7.23 (m, 2H), 7.20 – 7.13 (m, 3H), 2.66 – 2.54 (m, 2H), 1.63 (p, *J* = 7.5 Hz, 2H), 1.41 – 1.29 (m, 2H), 0.92 (t, *J* = 8.0 Hz, 9H), 0.59 – 0.44 (m, 8H). ¹³C NMR (101 MHz, CDCl₃) δ 142.9, 128.4, 128.2, 125.5, 35.70, 35.65, 23.6, 11.2, 7.5, 3.3. HRMS *m/z* (ESI) calcd for C₁₆H₂₉Si (M + H)⁺ 249.2033, found 249.2038. The spectra data are consistent with reports in the literature.¹⁶

(2-Cyclohexylethyl)triethylsilane (**8b**)



Substrate **7b** (0.3 mmol, 42.0 mg) reacted with **2** for 48 h affording **8b** as a colorless oil (41.5 mg, 61%). Eluent: petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 1.80 – 1.58 (m, 5H), 1.30 – 1.03 (m, 6H), 0.98 – 0.75 (m, 11H), 0.57 – 0.42 (m, 8H). ¹³C NMR (101 MHz, CDCl₃) δ 41.0, 33.1, 31.3, 26.9, 26.5, 8.1, 7.5, 3.3. HRMS *m/z* (ESI) calcd for C₁₄H₃₁Si (M + H)⁺ 227.2190, found 227.2196. The spectra data are consistent with reports in the literature.¹⁷

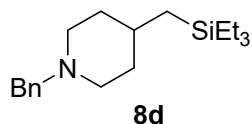
tert-Butyl 4-((triethylsilyl)methyl)piperidine-1-carboxylate (**8c**)



Substrate **7c** (0.3 mmol, 37.8 mg) reacted with **2** for 48 h affording **8c** as a colorless oil (45.2 mg, 48%). Eluent: petroleum ether : ethyl acetate = 40 : 1. ¹H NMR (400 MHz, CDCl₃) δ 4.02 (brs, 2H), 2.66 (t, *J* = 12.5 Hz, 2H),

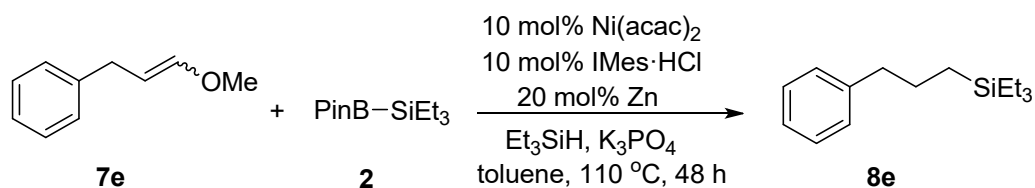
1.70 – 1.55 (m, 3H), 1.45 (s, 9H), 1.18 – 1.04 (m, 2H), 0.92 (t, $J = 7.9$ Hz, 9H), 0.62 – 0.42 (m, 8H). ^{13}C NMR (101 MHz, CDCl_3) δ 154.9, 79.1, 44.2, 35.6, 32.5, 28.5, 19.3, 7.5, 4.1. HRMS m/z (ESI) calcd for $\text{C}_{17}\text{H}_{35}\text{NNaO}_2\text{Si}$ ($\text{M} + \text{H}$) $^+$ 336.2329, found 336.2325.

1-Benzyl-4-((triethylsilyl)methyl)piperidine (**8d**)

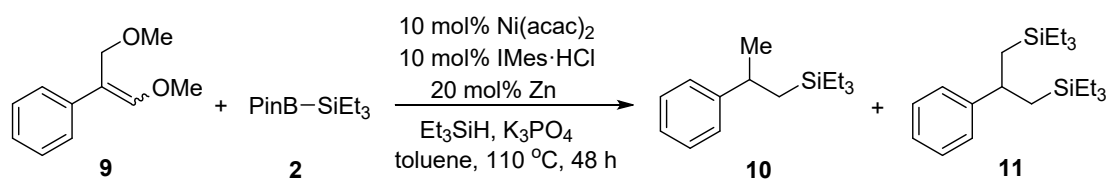


Substrate **7d** (0.3 mmol, 37.8 mg) reacted with **2** for 48 h affording **8d** as a colorless oil (38.3 mg, 42%). Eluent: petroleum ether : ethyl acetate = 20 : 1. ^1H NMR (400 MHz, CDCl_3) δ 7.33 – 7.27 (m, 4H), 7.26 – 7.21 (m, 1H), 3.48 (s, 2H), 2.89 – 2.77 (m, 2H), 1.99 – 1.88 (m, 2H), 1.67 – 1.57 (m, 2H), 1.35 – 1.23 (m, 3H), 0.91 (t, $J = 7.9$ Hz, 9H), 0.56 – 0.44 (m, 8H). ^{13}C NMR (101 MHz, CDCl_3) δ 138.3, 129.3, 128.1, 126.9, 63.5, 54.0, 35.8, 32.2, 19.2, 7.5, 4.1. HRMS m/z (ESI) calcd for $\text{C}_{19}\text{H}_{34}\text{NSi}$ ($\text{M} + \text{H}$) $^+$ 304.2455, found 304.2450.

5. Experimental Procedure for Mechanistic Studies



To a flame dried 25 mL Schlenk tube were added $\text{Ni}(\text{acac})_2$ (0.03 mmol, 7.7 mg), $\text{IMes}\cdot\text{HCl}$ (0.03 mmol, 10.2 mg) and Zn (0.06 mmol, 3.9 mg) and K_3PO_4 (0.45 mmol, 95.4 mg). The tube was vacuumed and refilled with nitrogen three times followed by the addition of anhydrous toluene (1.5 mL). Substrates **7e** (0.3 mmol, 44.4 mg), **2** (0.6 mmol, 145.2 mg) and HSiEt_3 (0.9 mmol, 104.4 mg) were also added with a syringe under nitrogen atmosphere and the plug is screwed. After that, the reaction was stirred under 110 °C in the heating module for 48 h. Then the mixture was cooled to room temperature and was tested by GC-MS. After that, the solvent was removed under reduced pressure and the crude product was purified through flash chromatography with petroleum ether and ethyl acetate as the eluent to afford **8e** as a colorless oil (47.2 mg, 67%). ^1H NMR (400 MHz, CDCl_3) δ 7.32 – 7.23 (m, 2H), 7.23 – 7.12 (m, 3H), 2.62 (t, $J = 7.7$ Hz, 2H), 1.67 – 1.56 (m, 2H), 0.91 (t, $J = 7.9$ Hz, 9H), 0.61 – 0.53 (m, 2H), 0.49 (q, $J = 7.9$ Hz, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 142.8, 128.4, 128.2, 125.6, 40.2, 26.1, 11.3, 7.4, 3.3. HRMS m/z (ESI) calcd for $\text{C}_{16}\text{H}_{29}\text{Si}$ ($\text{M} + \text{H}$) $^+$ 249.2033, found 249.2038. The spectra data are consistent with reports in the literature.¹⁸

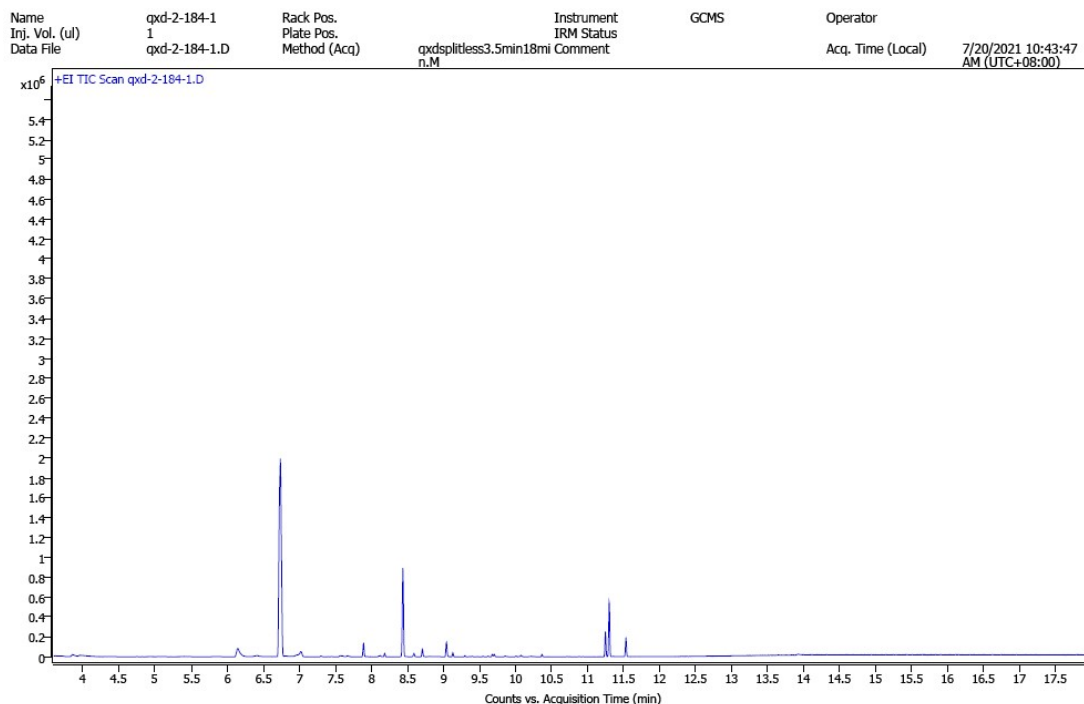


main products detected by GC-MS

To a flame dried 25 mL Schlenk tube were added Ni(acac)₂ (0.03 mmol, 7.7 mg), IMes·HCl (0.03 mmol, 10.2 mg) and Zn (0.06 mmol, 3.9 mg) and K₃PO₄ (0.45 mmol, 95.4 mg). The tube was vacuumed and refilled with nitrogen three times followed by the addition of anhydrous toluene (1.5 mL). Substrates **9** (0.3 mmol, 53.4 mg), **2** (0.6 mmol, 145.2 mg) and HSiEt₃ (0.9 mmol, 104.4 mg) were also added with a syringe under nitrogen atmosphere and the plug is screwed. After that, the reaction was stirred under 110 °C in the heating module for 48 h. Then the mixture was cooled to room temperature and was tested by GC-MS. A little amount of main products **10** and **11** was detected as a result (**10** was synthesized through another reported method¹⁹ and was tested by GC-MS to confirm that our product had exactly the correct structure). Due to the low yield of **10** and **11**, as well as the complexity of the reaction, we didn't go for additional purification.

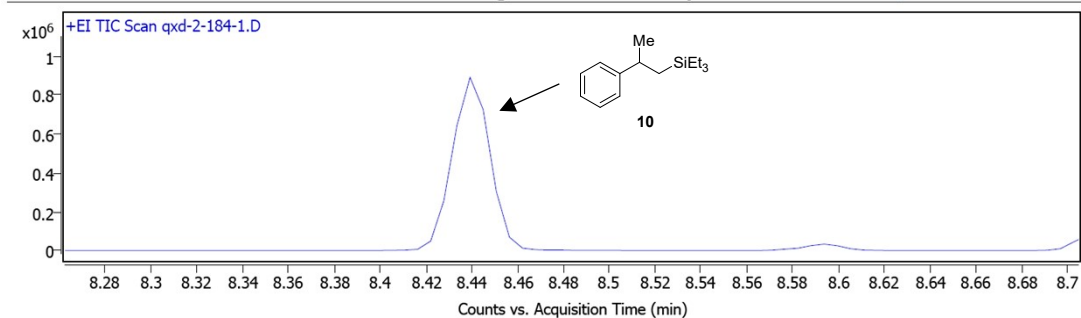
Chromatogram Plot Report

Agilent Future Now



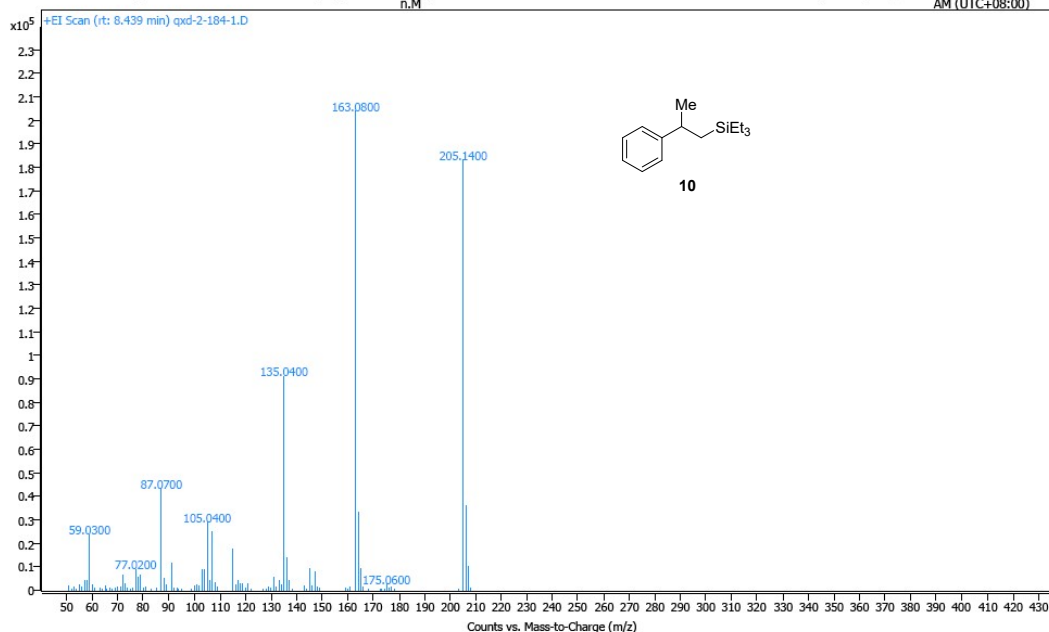
GC-spectrum of the reaction above (without any further purification)

Chromatogram Plot Report



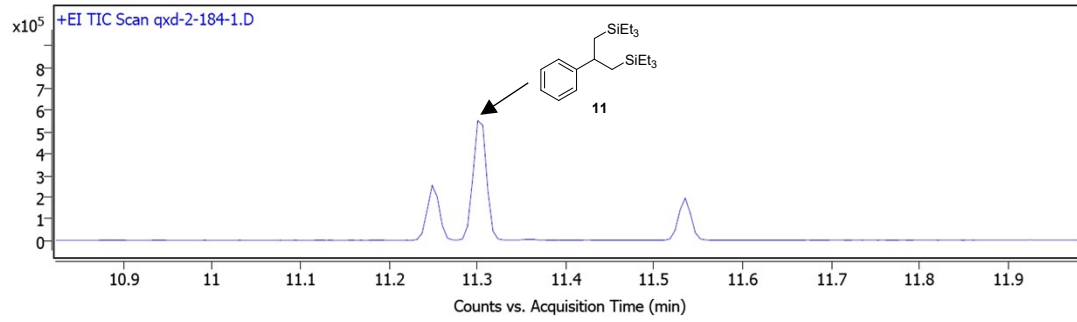
Spectrum Plot Report

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Inj. Vol. (ul)	1	Plate Pos.	IRM Status		
Data File	qxd-2-184-1.D	Method (Acq)	qxdsplitless3.5min18mi n.M	Comment	Acq. Time (Local) 7/20/2021 10:43:47 AM (UTC+08:00)



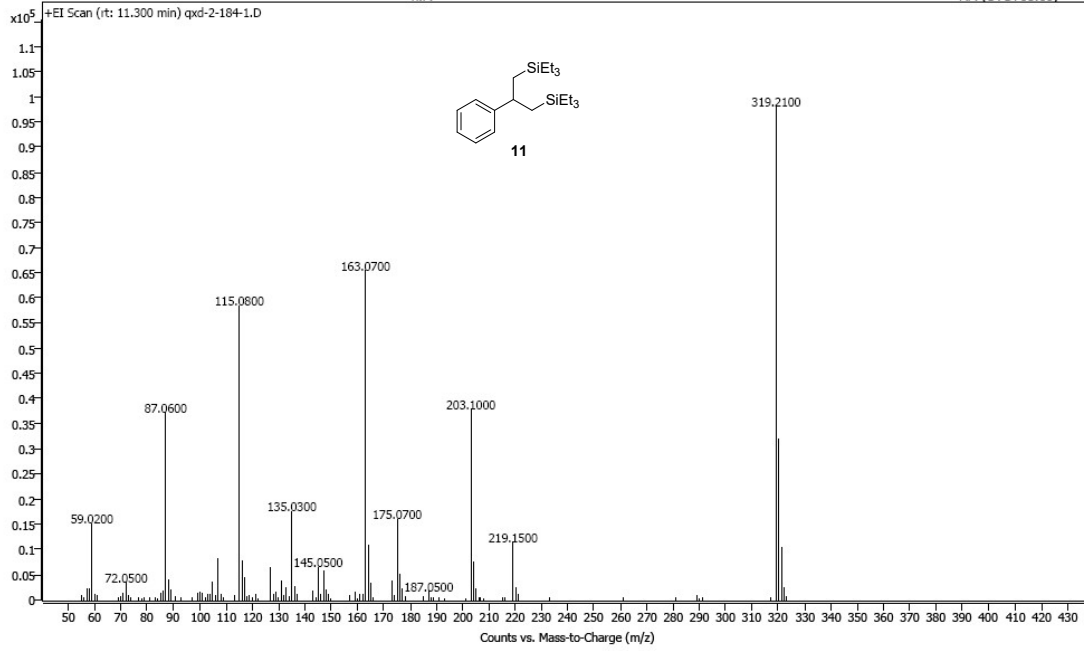
MS-spectrum of compound **10**

Chromatogram Plot Report

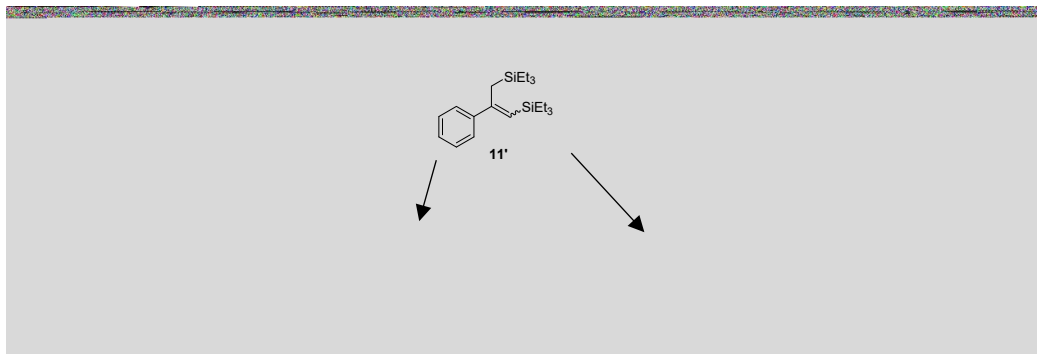


Spectrum Plot Report

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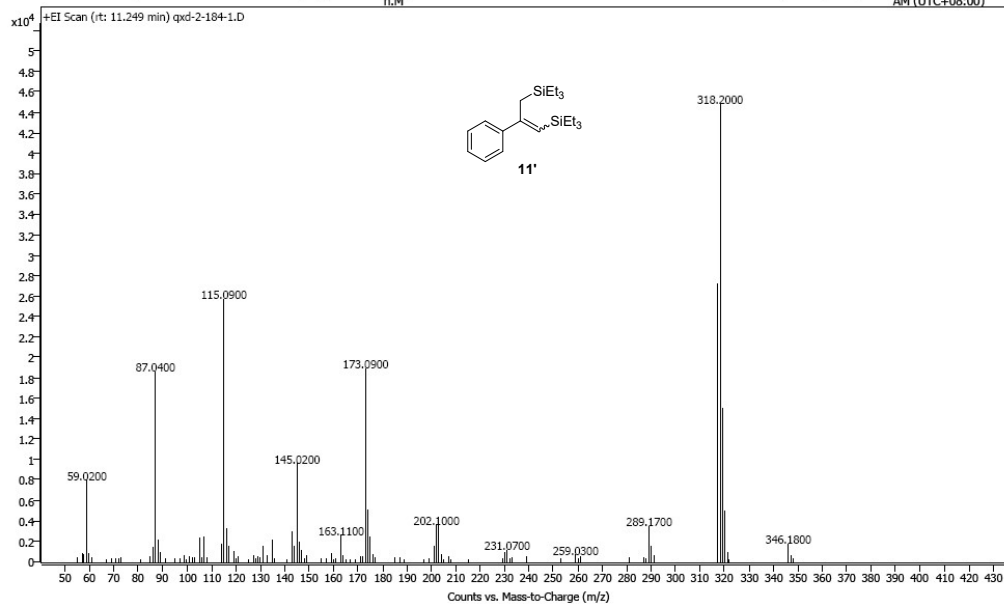
MS-spectrum of compound **11**



Spectrum Plot Report

Agilent Build. Answers

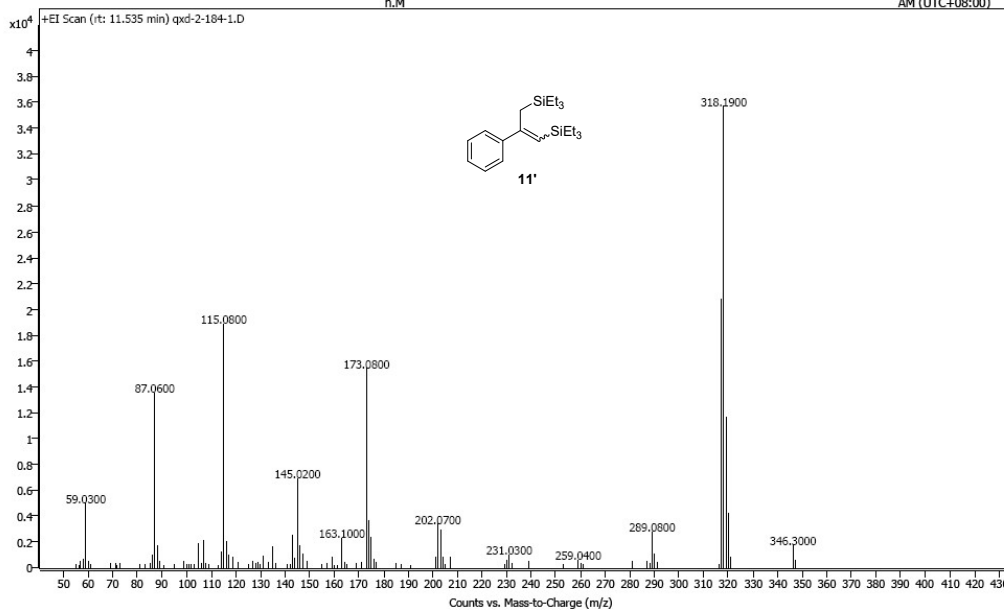
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Spectrum Plot Report

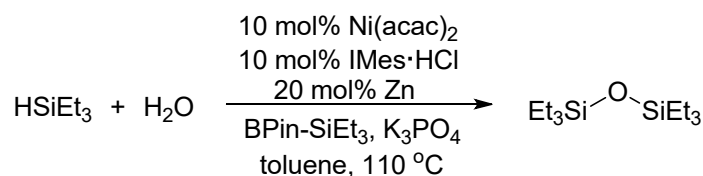
Agilent Build. Answers

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Inj. Vol. (ul)	1	Plate Pos.	IRM Status		
Data File	qxd-2-184-1.D	Method (Acq)	qxdsplitless3.5min18mi	n.M	Acq. Time (Local)
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MS-spectrum of *E/Z* mixture 11'

6. Isolation of Quantification of Disiloxane



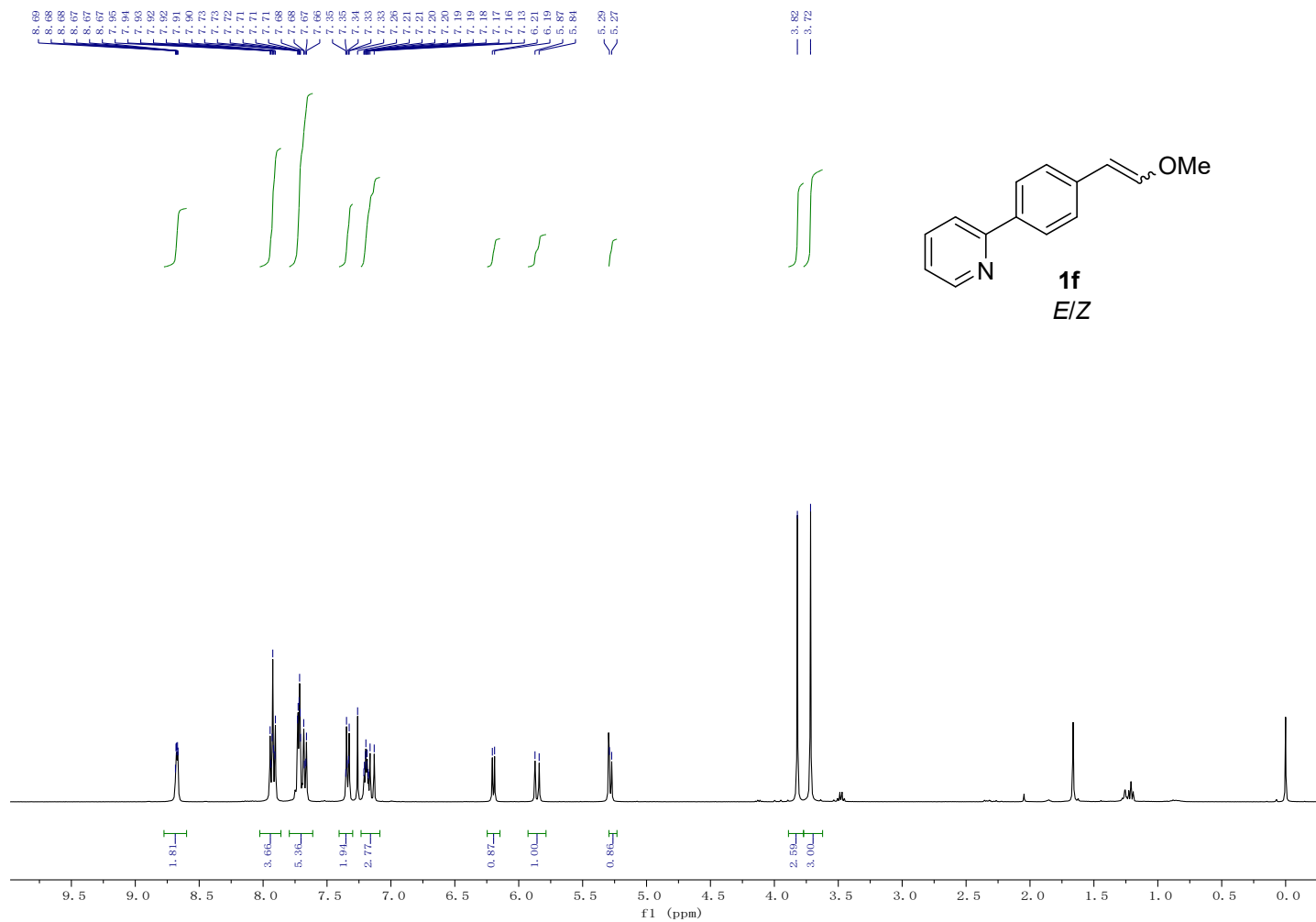
To a flame dried 25 mL Schlenk tube were added Ni(acac)₂ (0.03 mmol, 7.7 mg), IMes·HCl (0.03

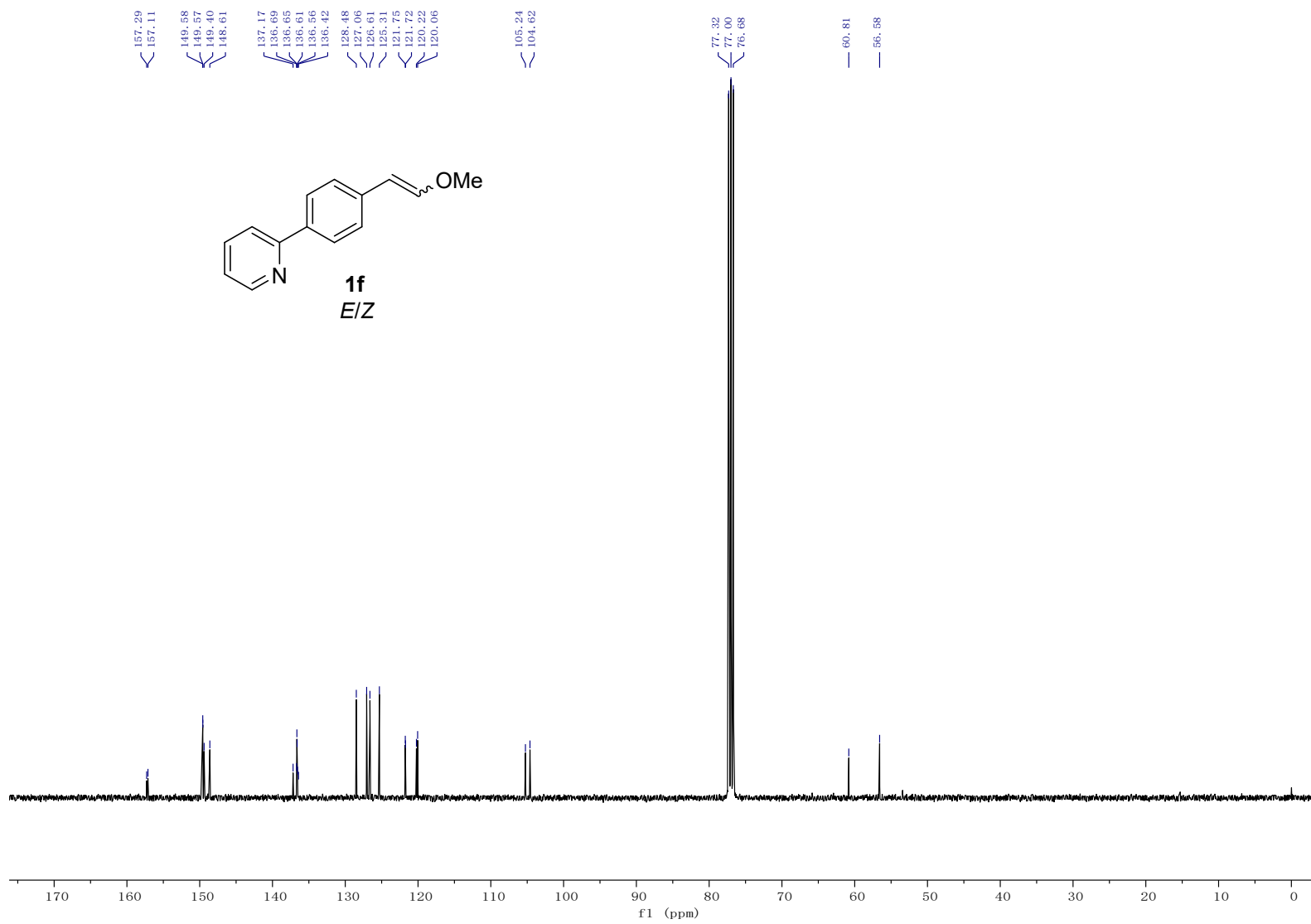
mmol, 10.2 mg) and Zn (0.06 mmol, 3.9 mg) and K₃PO₄ (0.45 mmol, 95.4 mg). The tube was vacuumed and refilled with nitrogen three times followed by the addition of new distilled toluene (1.5 mL). HSiEt₃ (0.3 mmol, 34.8 mg) and H₂O (0.15 mmol, 2.7 mg) were also added with a syringe under nitrogen atmosphere and the plug is screwed. After that, the reaction was stirred under 110 °C in the heating module for 12 h. Then the mixture was cooled to room temperature, the solvents were removed under reduced pressure and the crude product was purified through flash chromatography with petroleum ether as the eluent. Disiloxane was isolated as a colorless oil in 53% yield (19.8 mg).

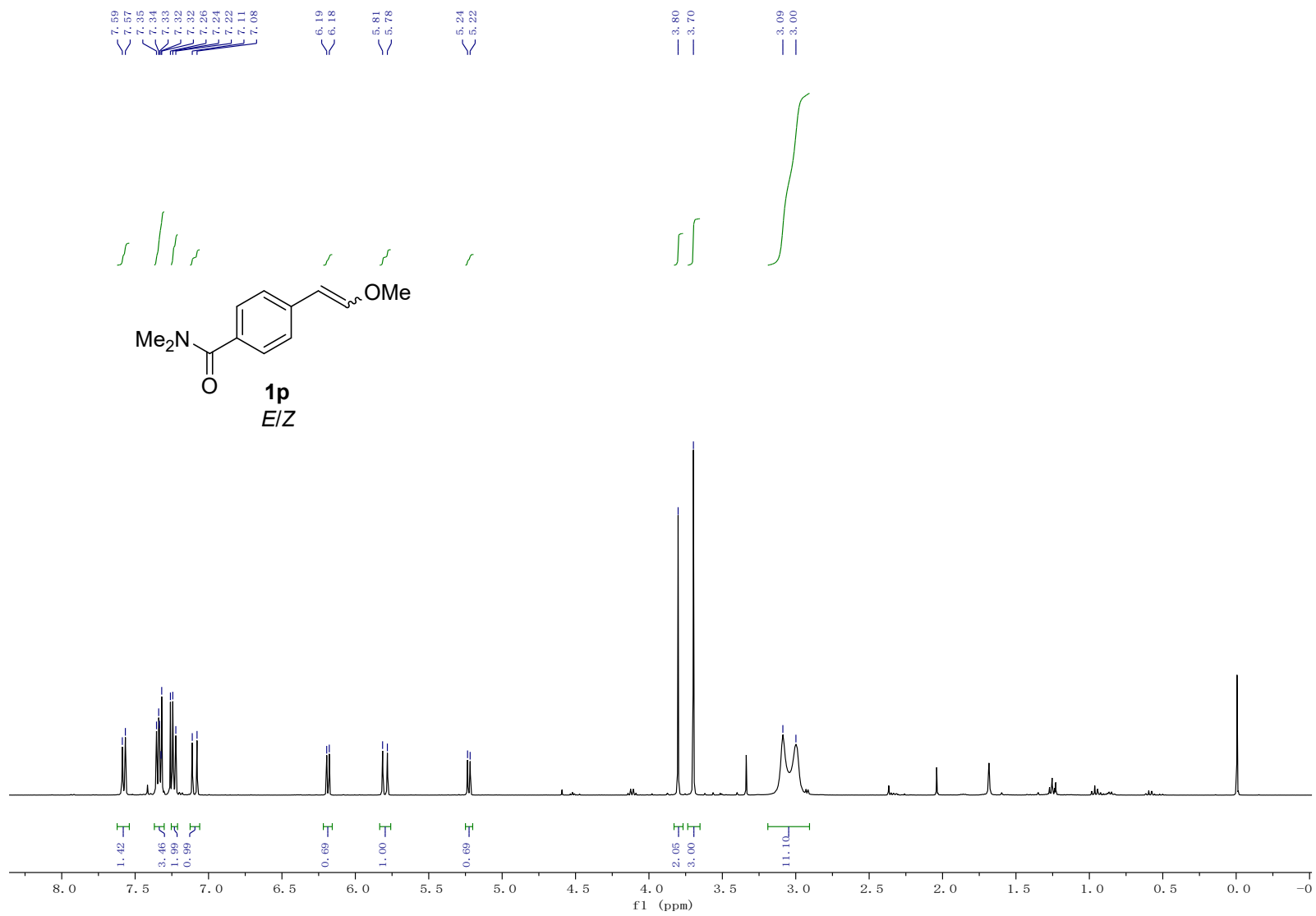
7. References

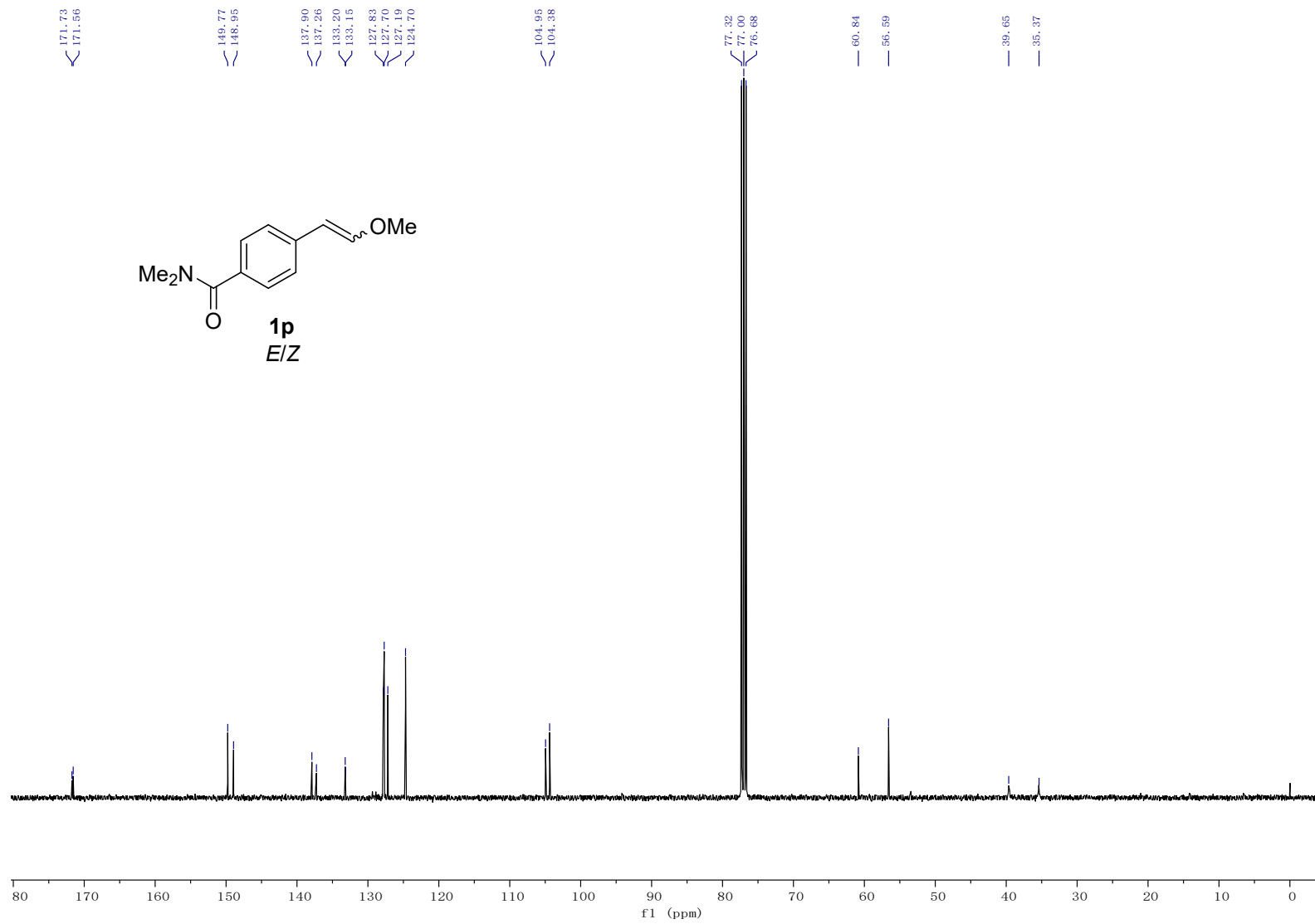
- (1) Qiu, X.; L, Y.; Zhou, L.; Chen, P.; Li, F.; Zhang, Y.; Ling, Y. *Org. Lett.* **2020**, *22*, 6424.
- (2) Hostier, T.; Neouchy, Z.; Ferey, V.; Pardo, D. G.; Cossy, J. *Org. Lett.* **2018**, *20*, 1815.
- (3) Balti, M.; Efrat, M. L.; Leadbeater, N. E. *Tetrahedron Lett.* **2016**, *57*, 1804.
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- (19) Andrews, R. J.; Chitnis, S. S.; Stephan, D. W. *Chem. Commun.* **2019**, *55*, 5599.

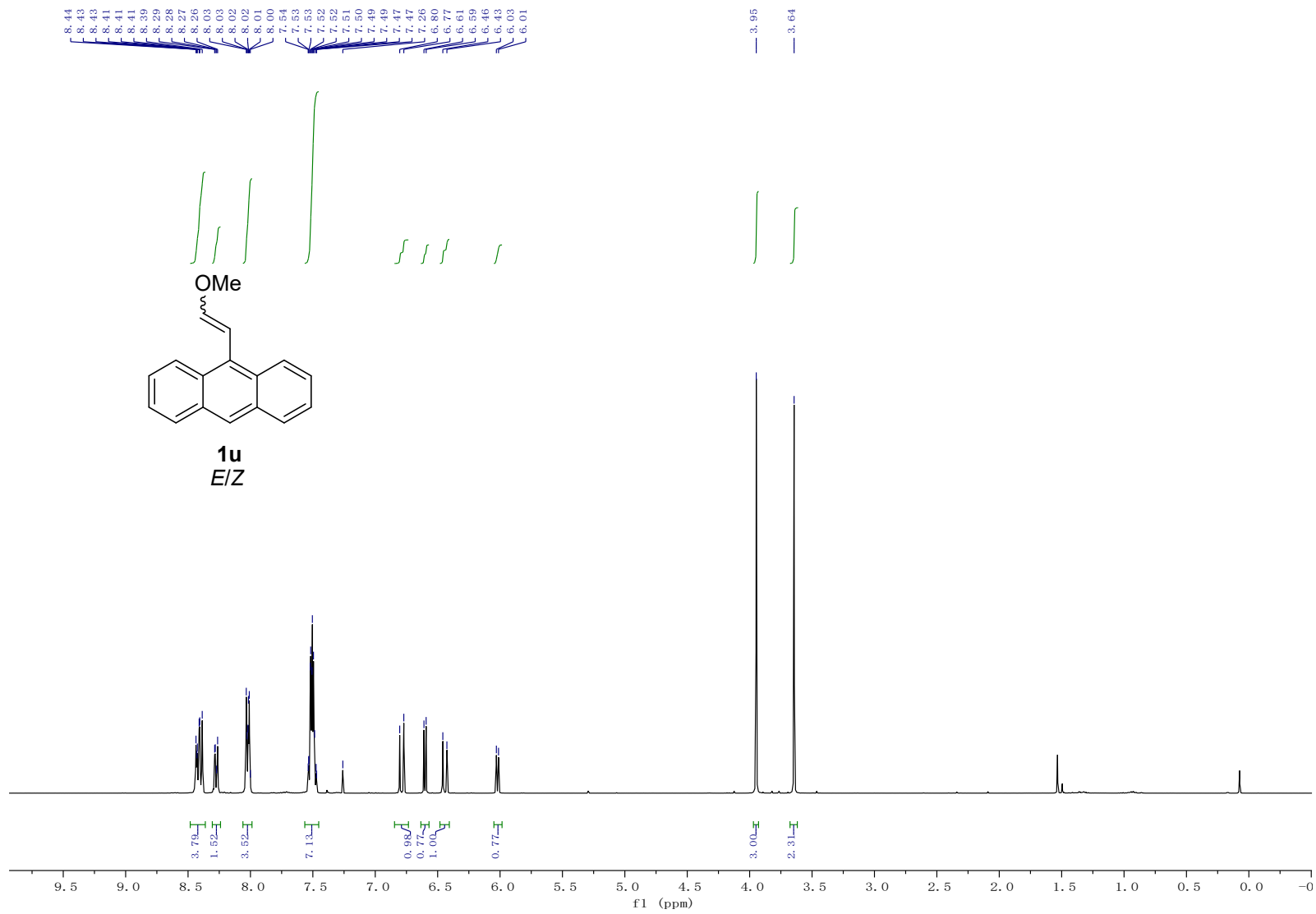
8. Spectral data

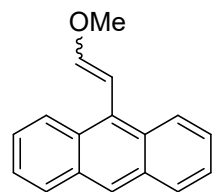




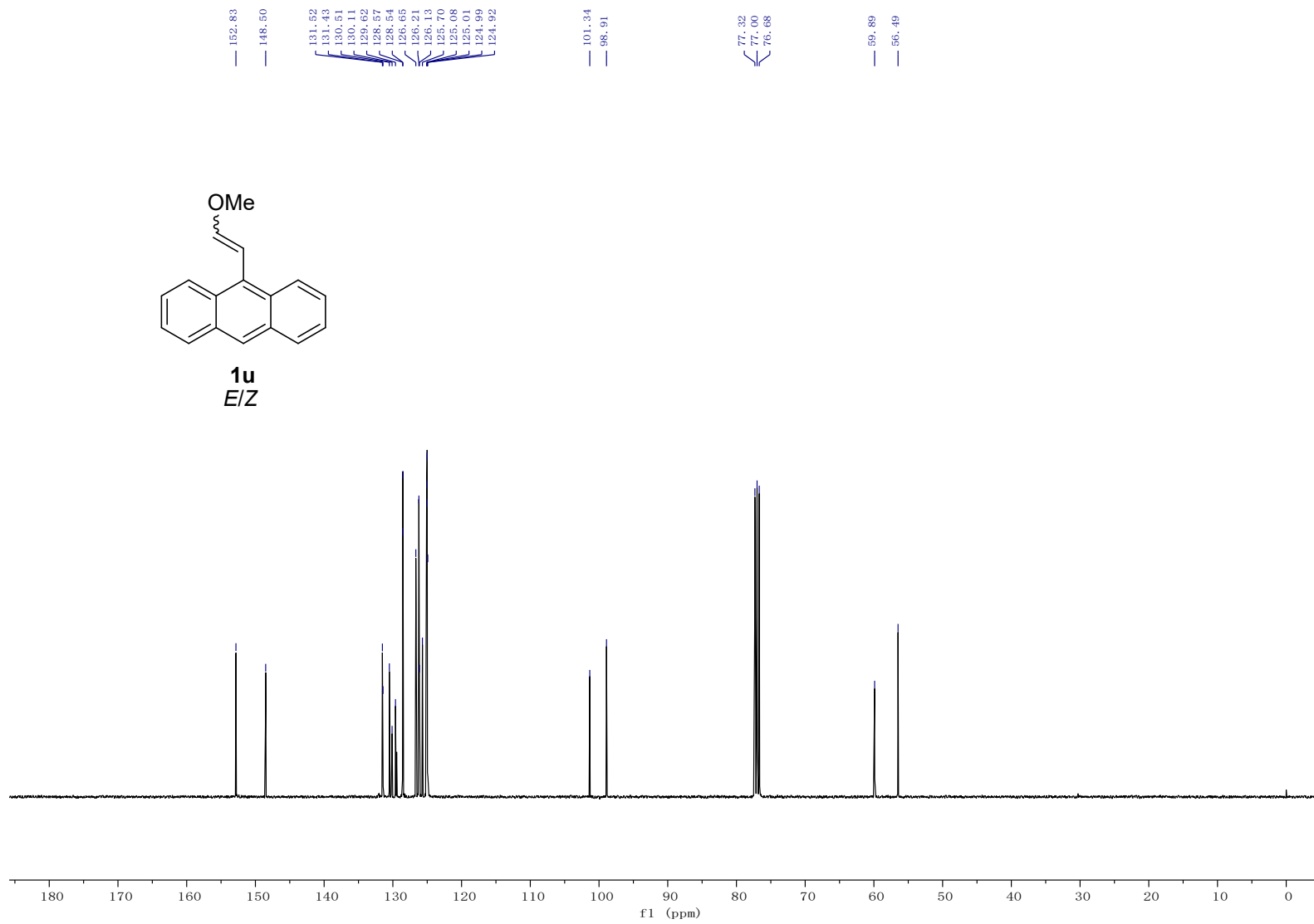


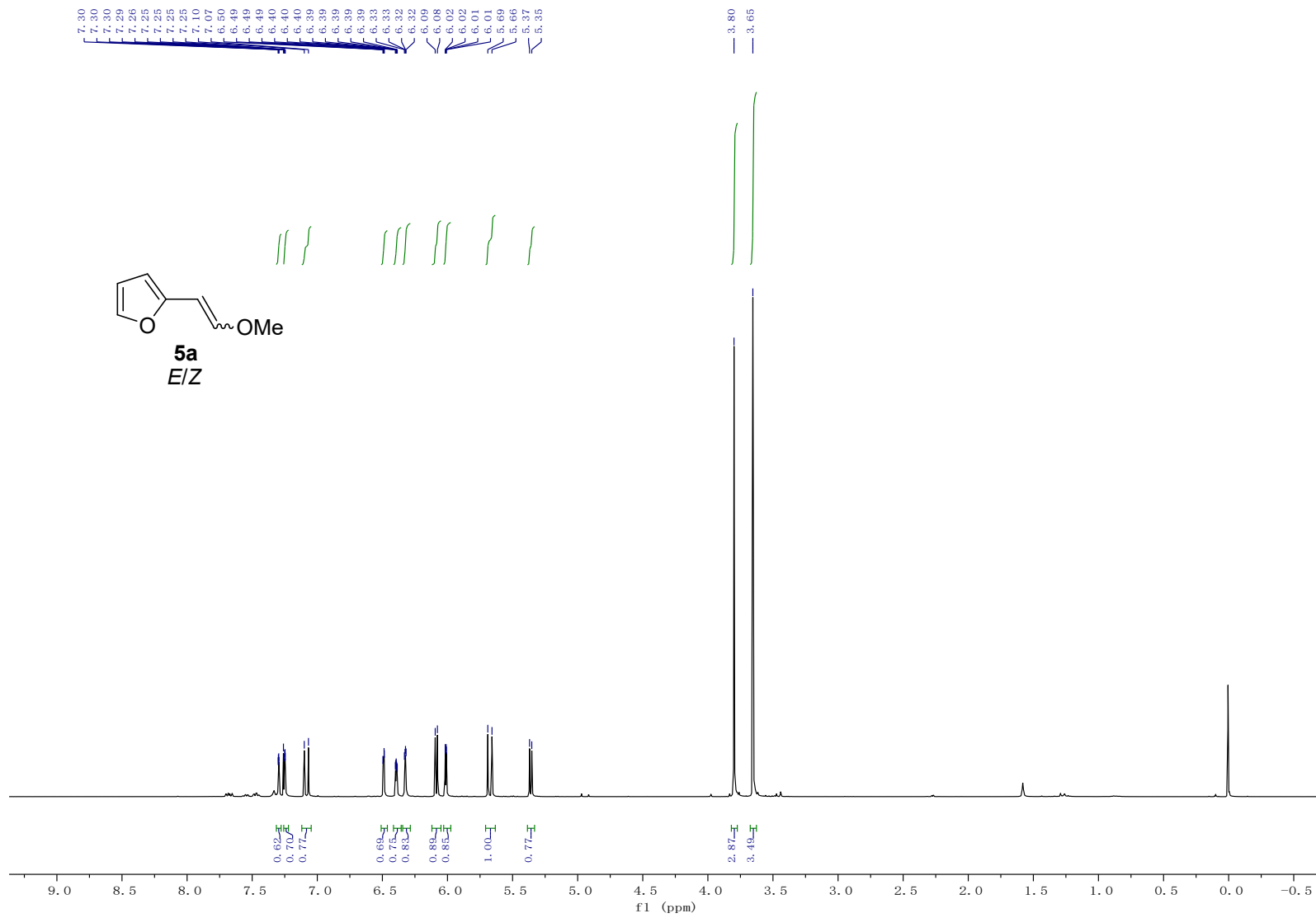






1u
E/Z





151.61
150.85
148.77
146.21

140.09
139.86

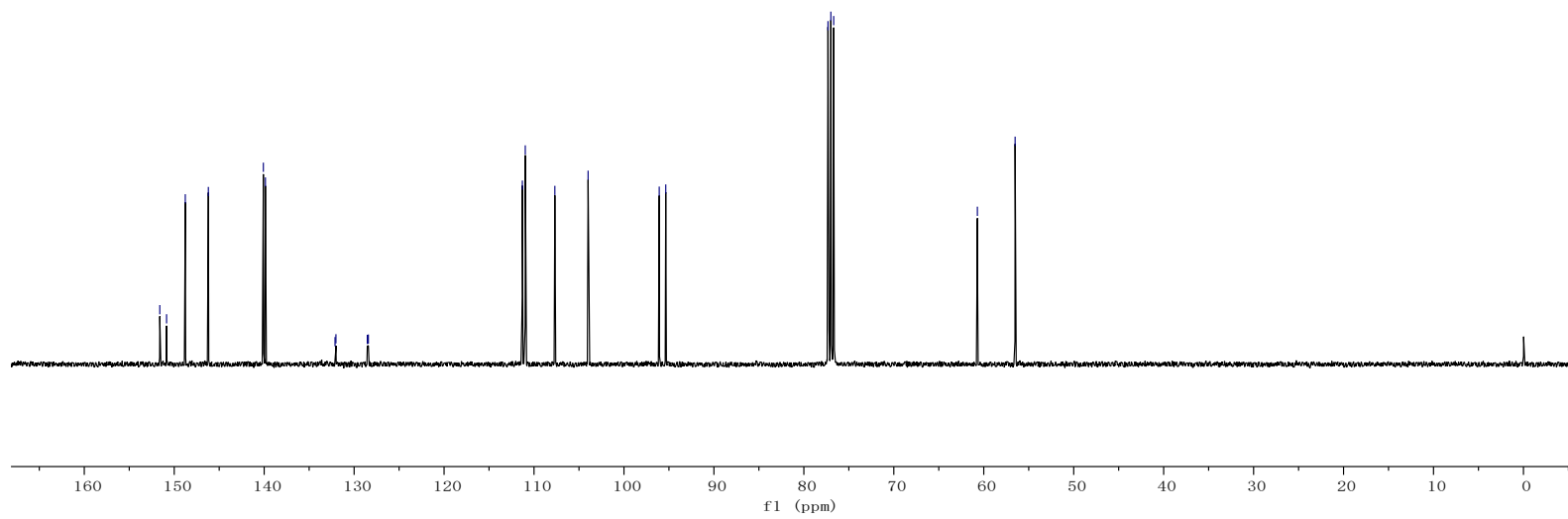
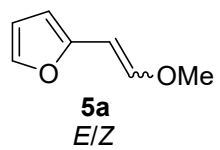
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128.41

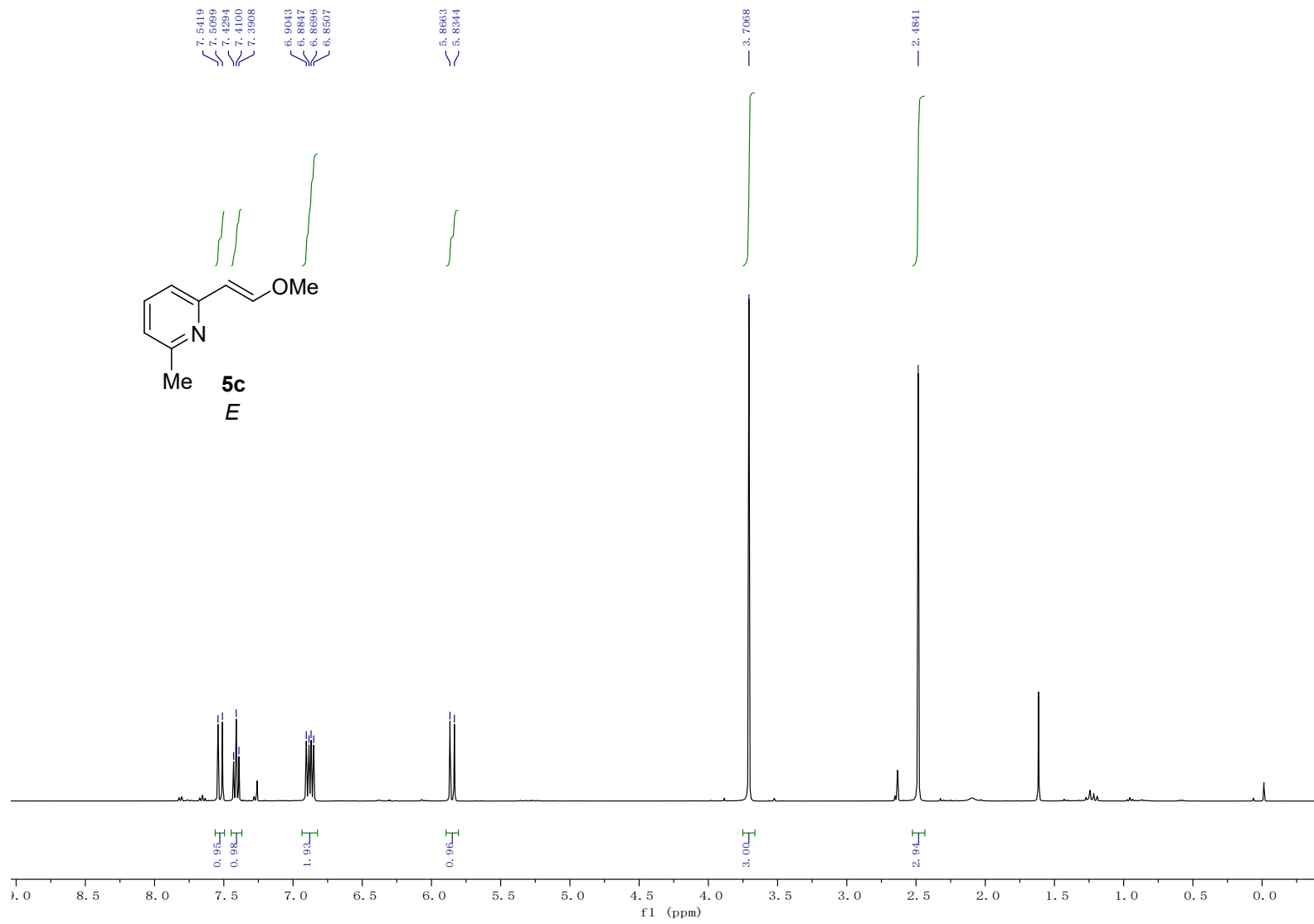
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103.99

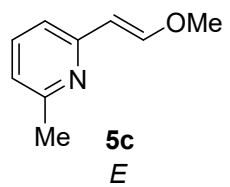
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60.71
56.51







157.74
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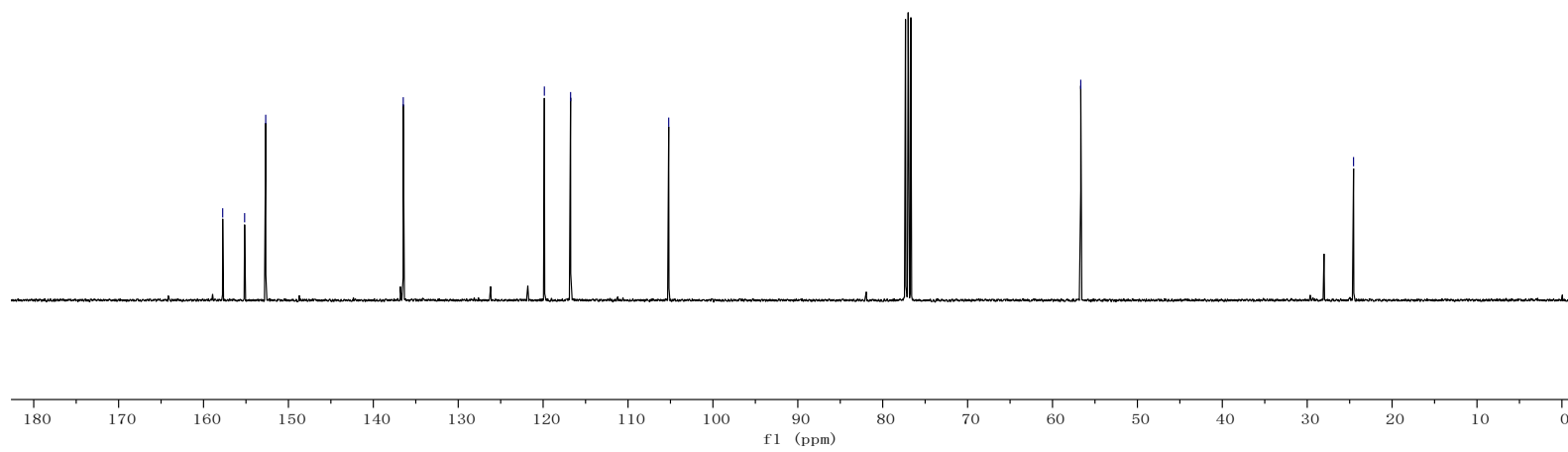
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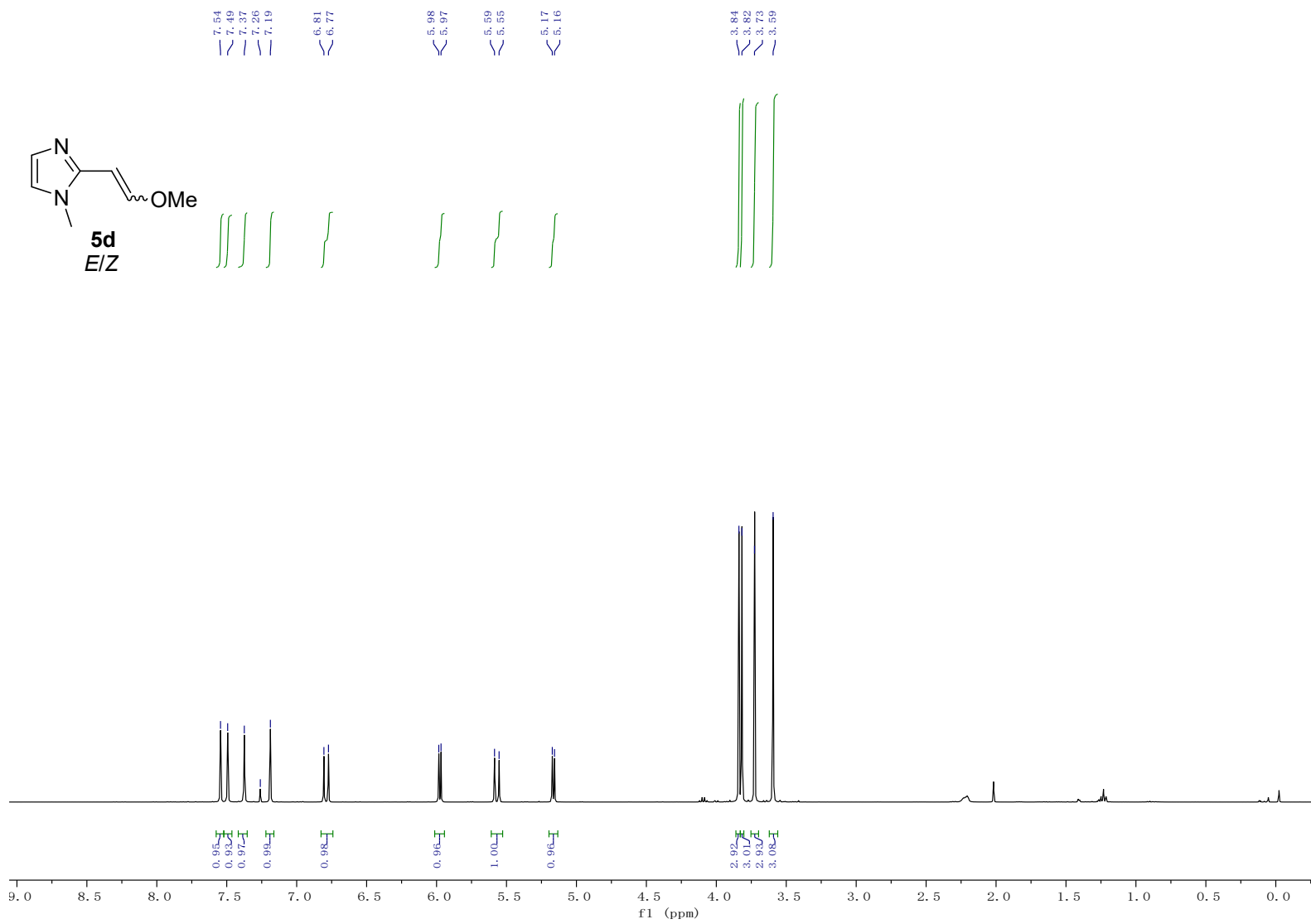
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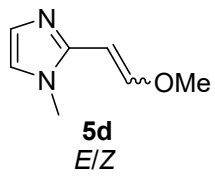
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24.54







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128.66
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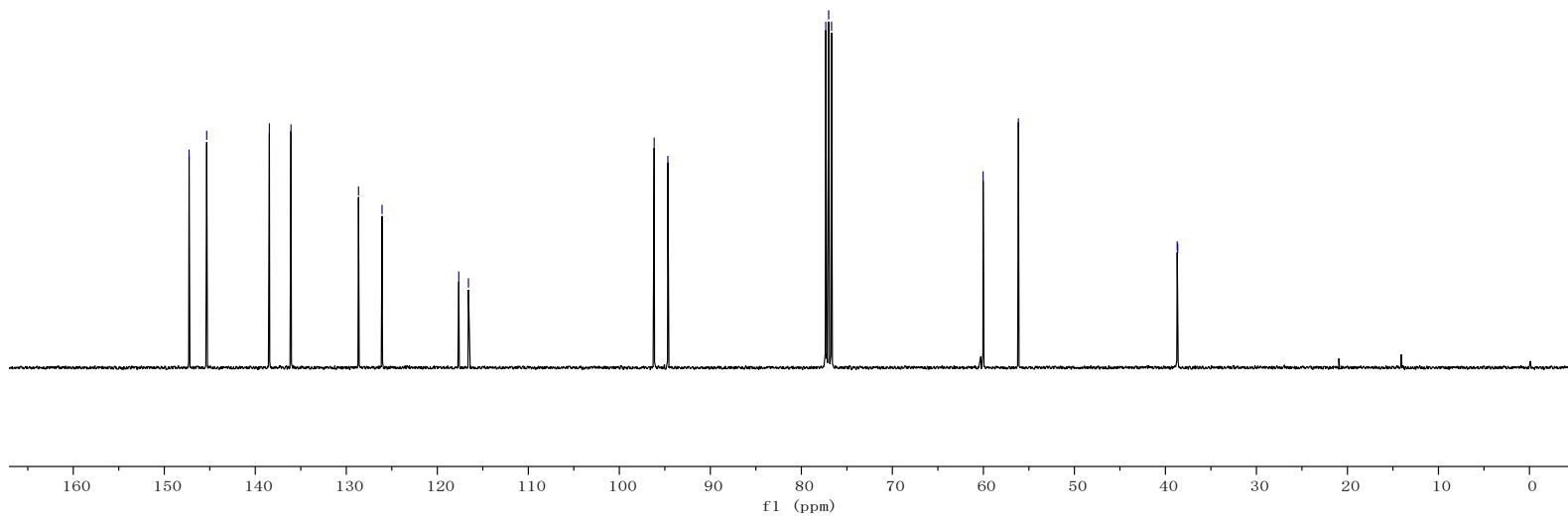
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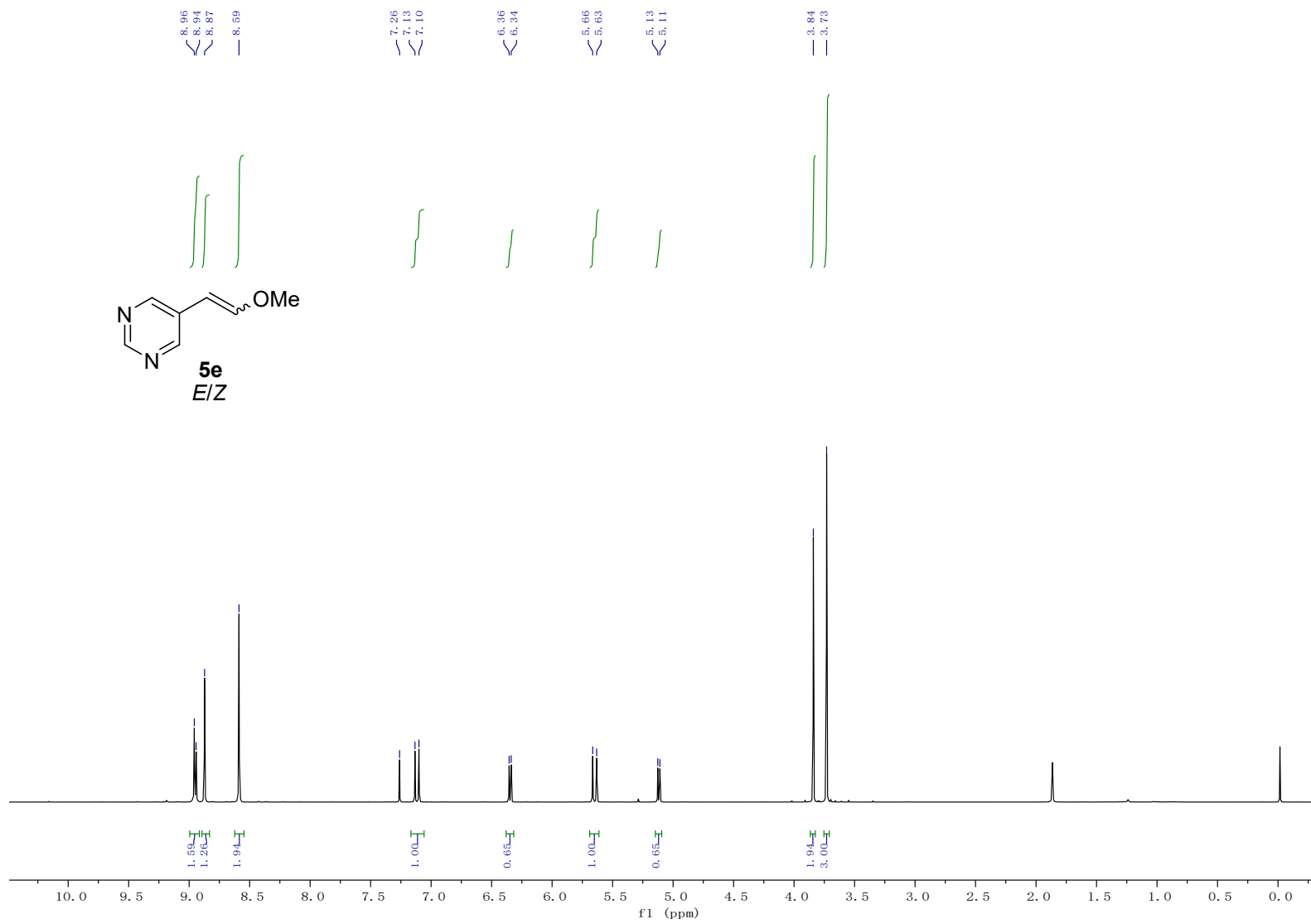
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76.68

60.03
56.15

38.70
38.65





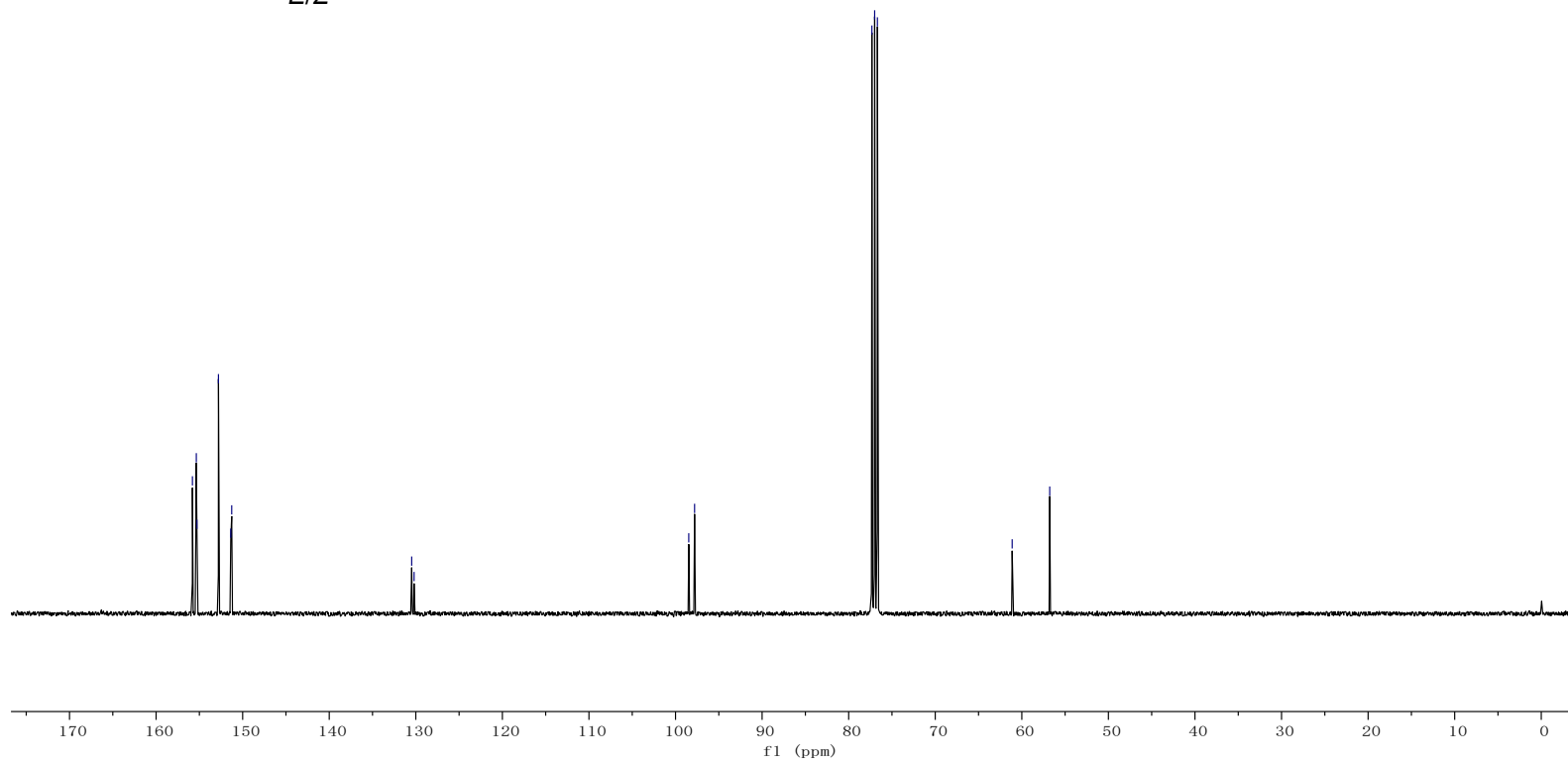
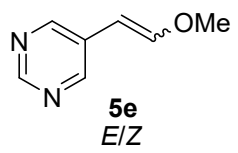
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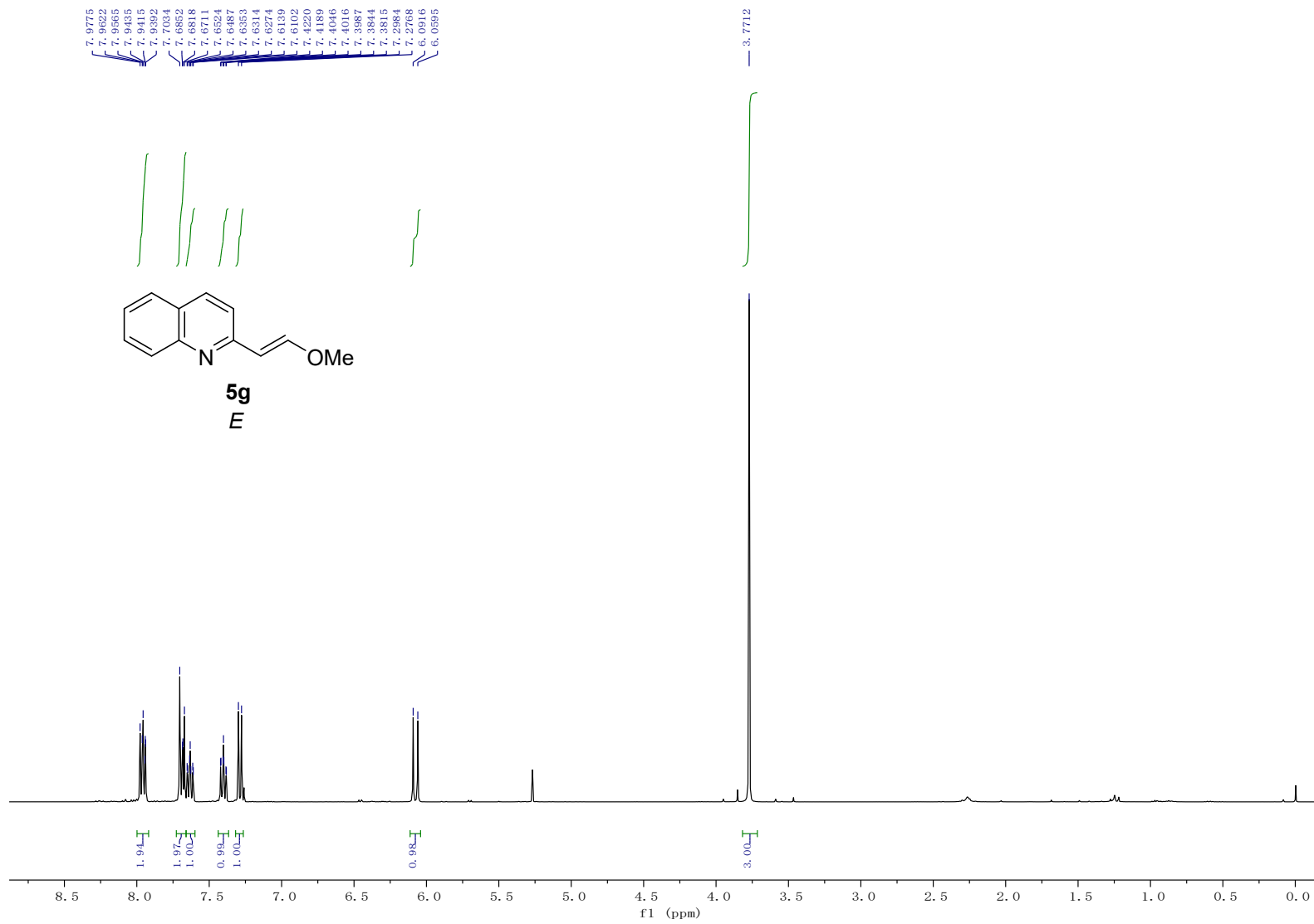
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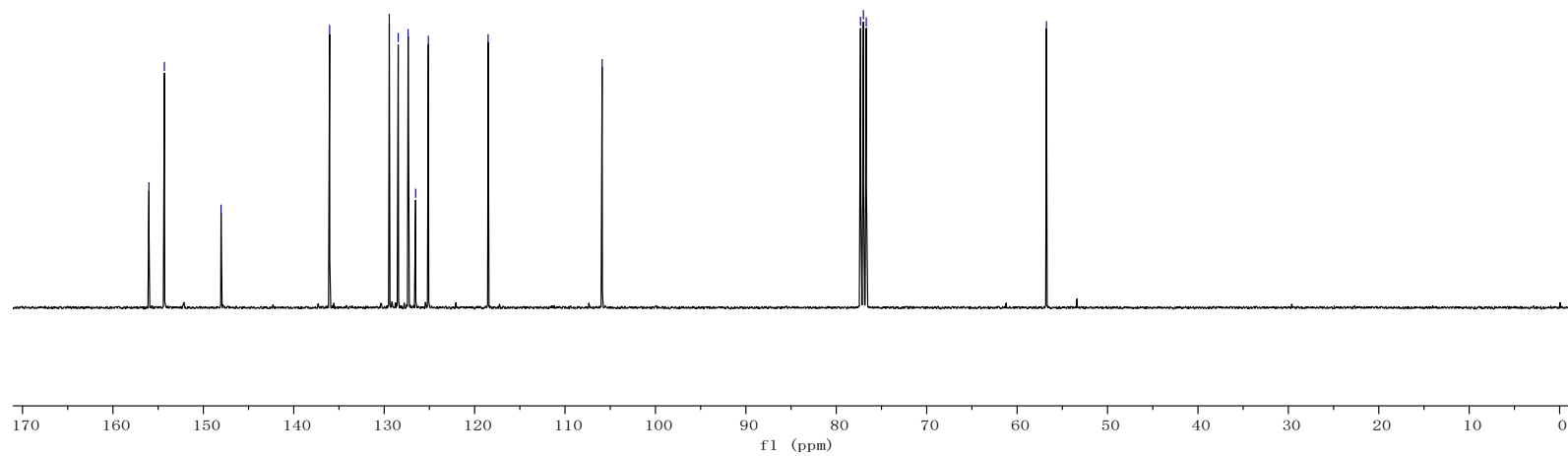
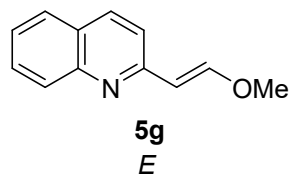
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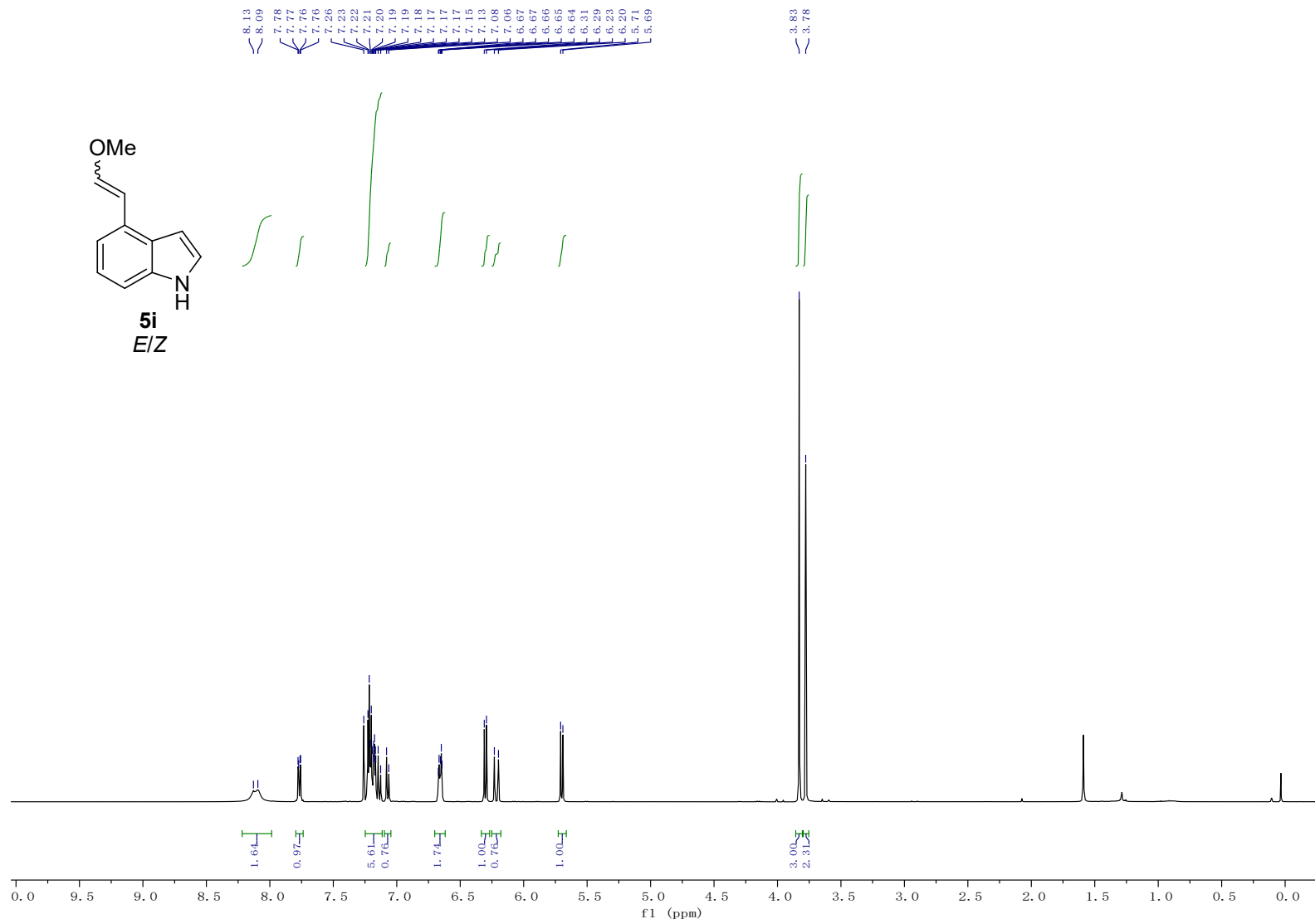
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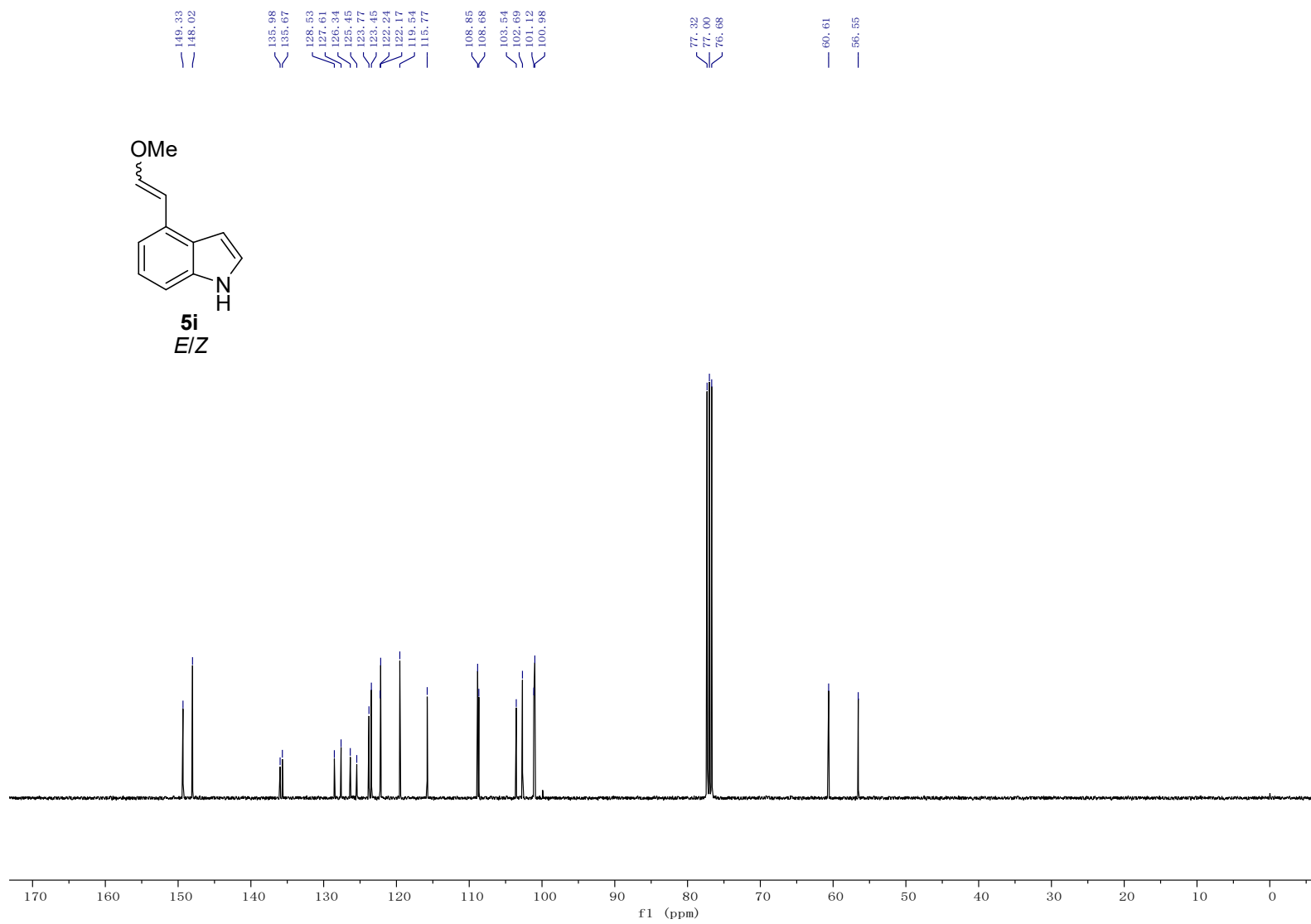
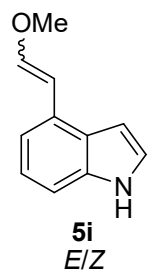


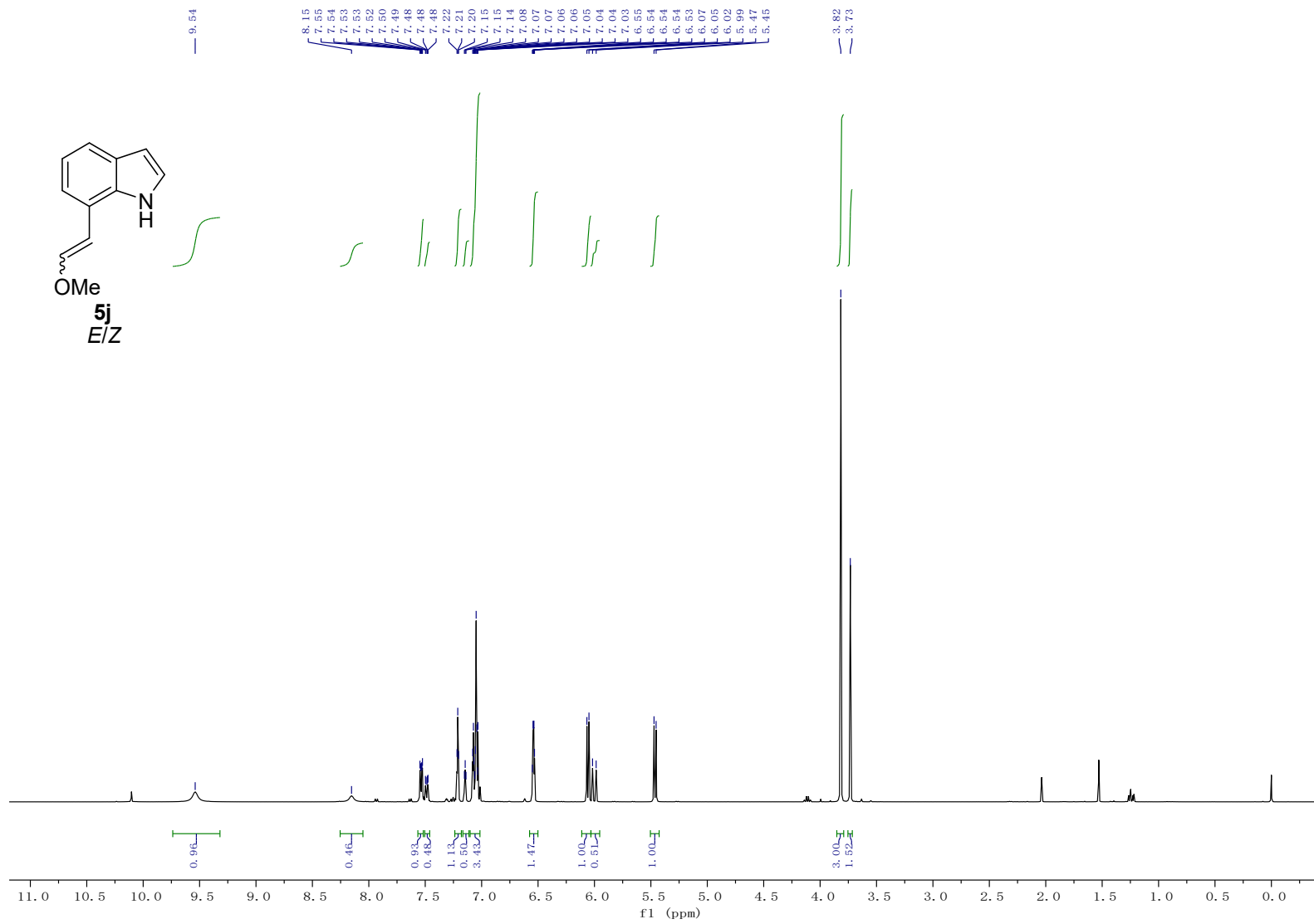


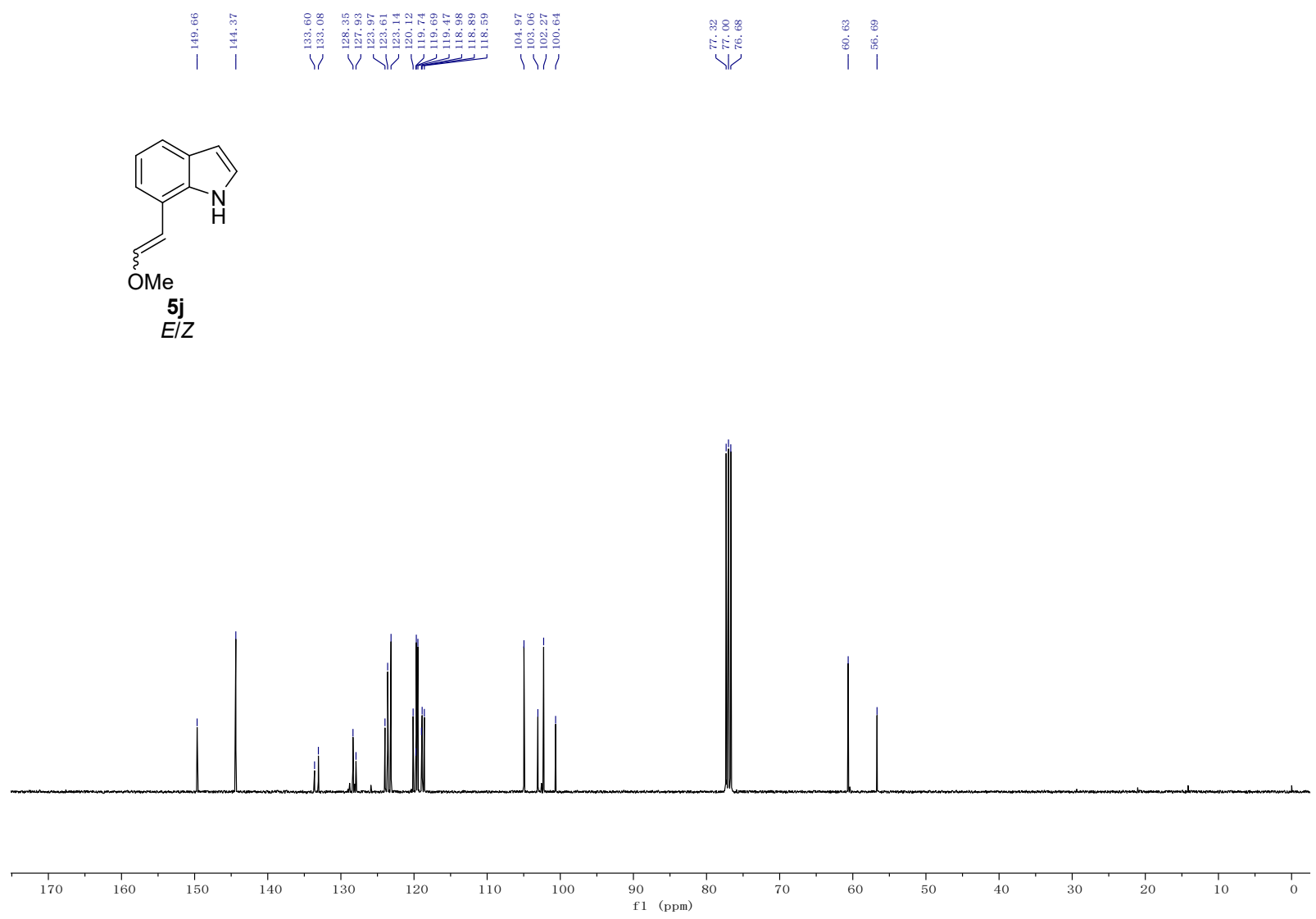
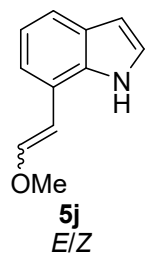
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56.76

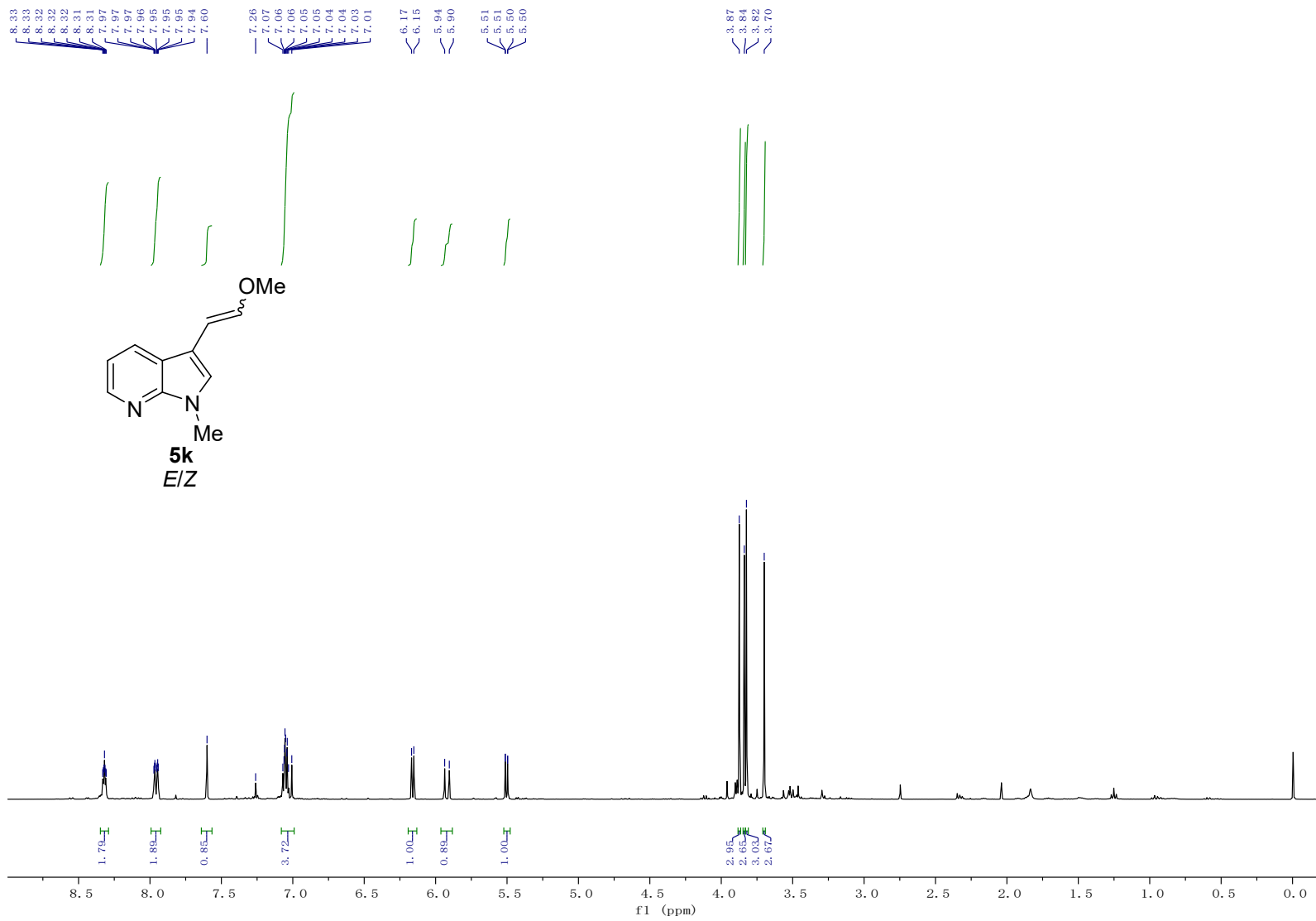












148.13
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147.04
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127.09
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118.40
115.24
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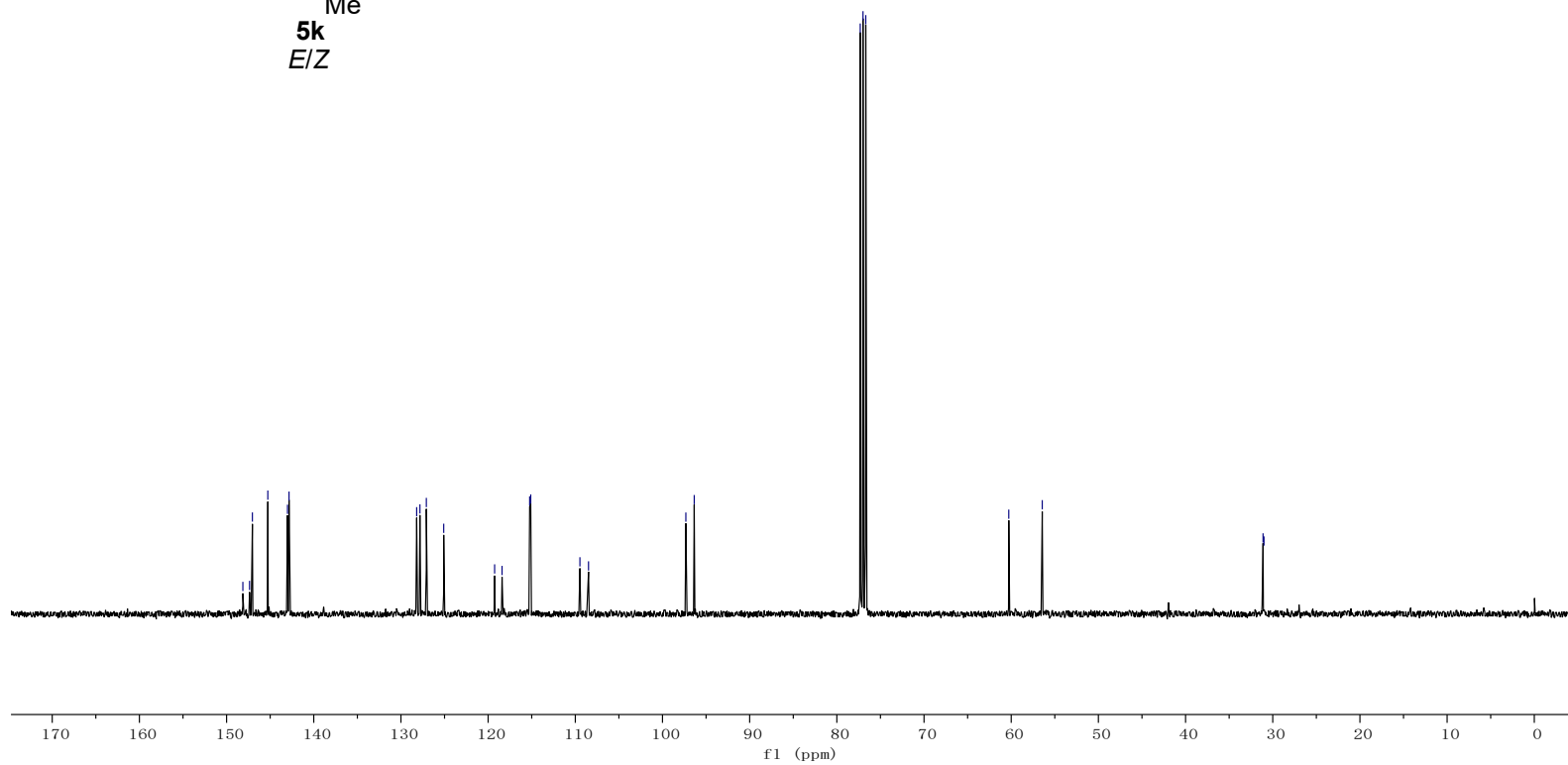
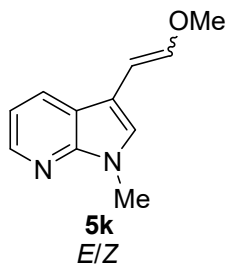
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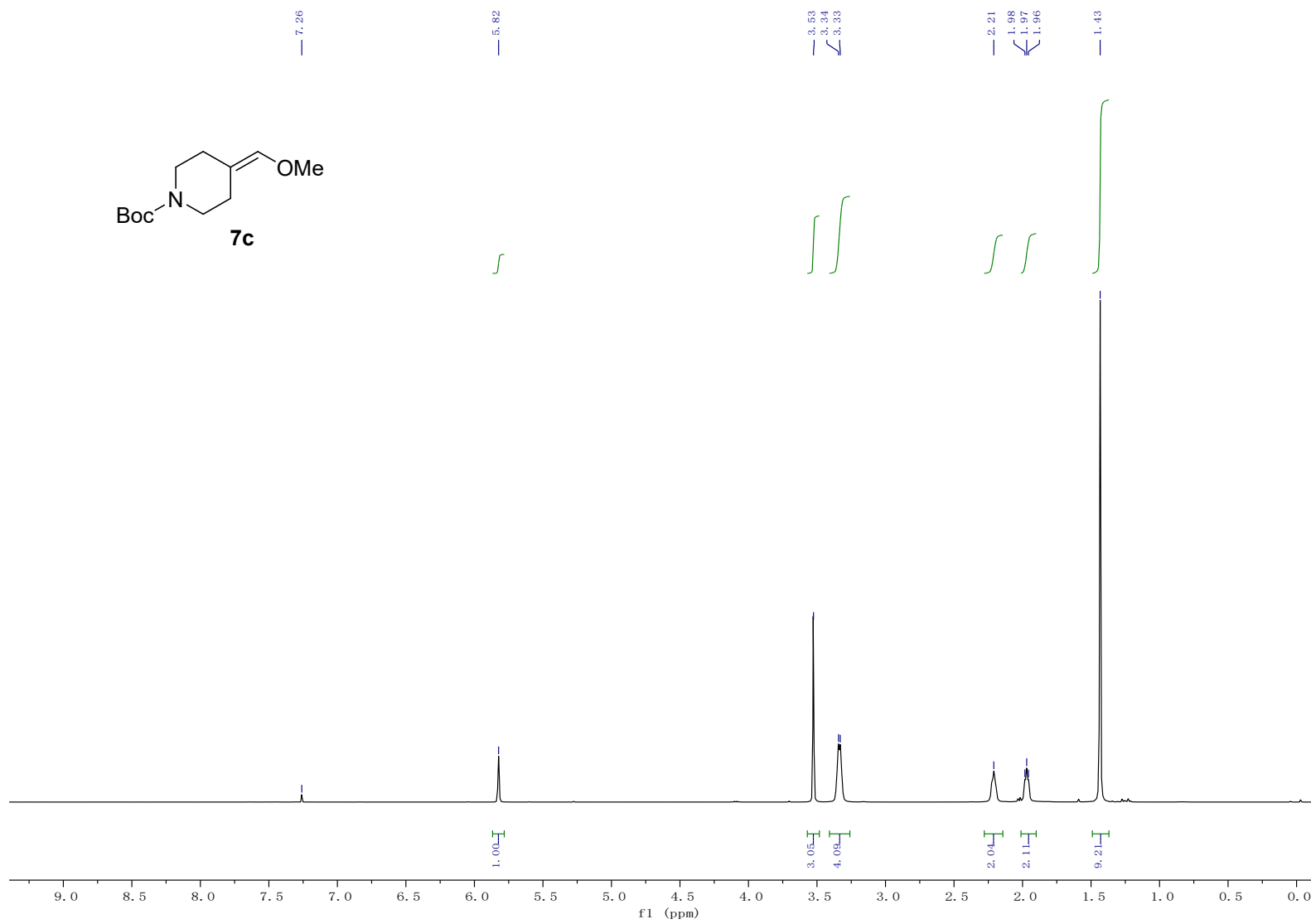
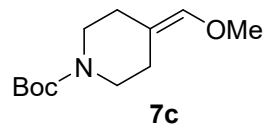
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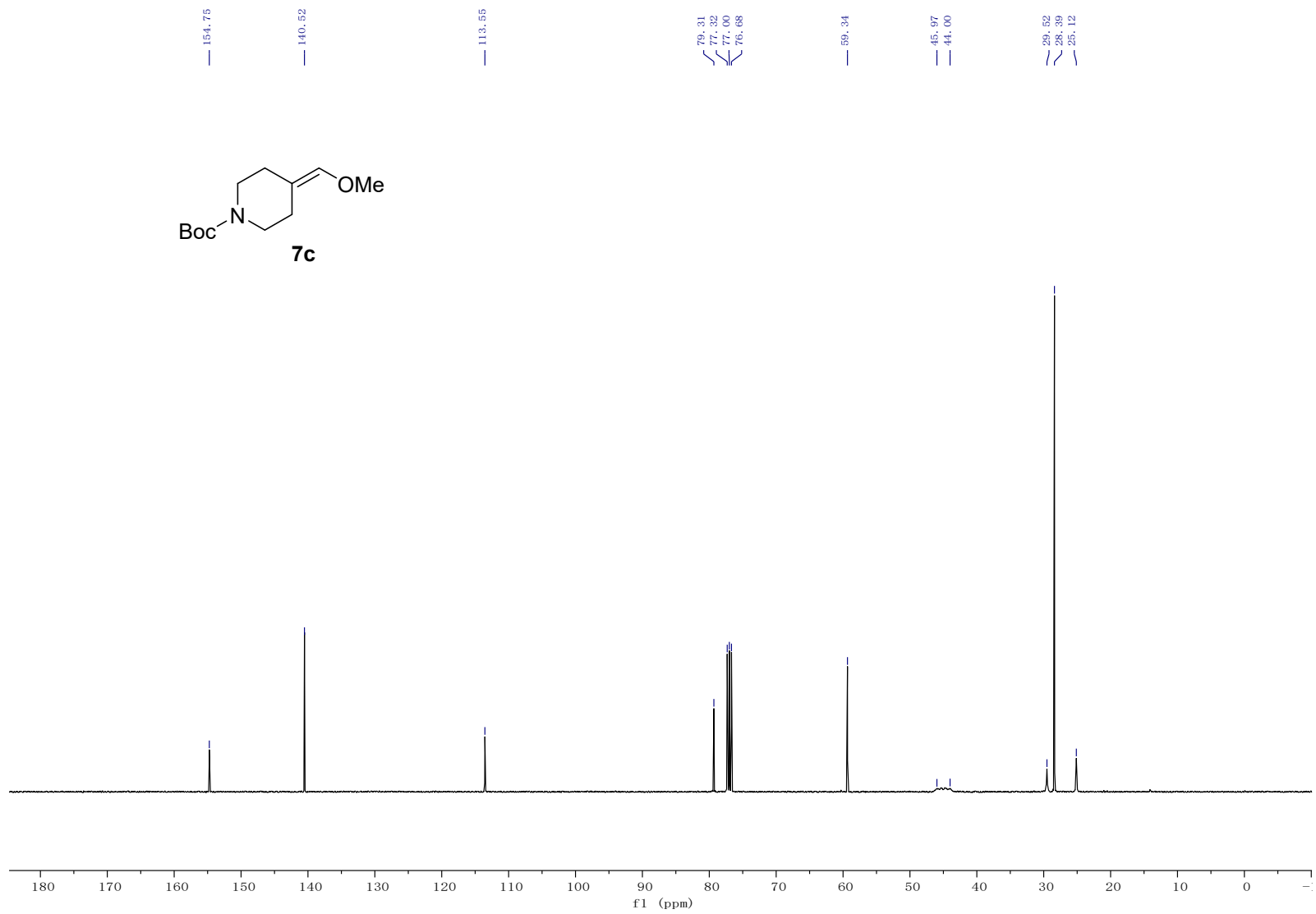
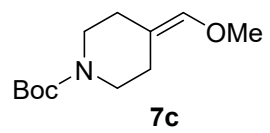
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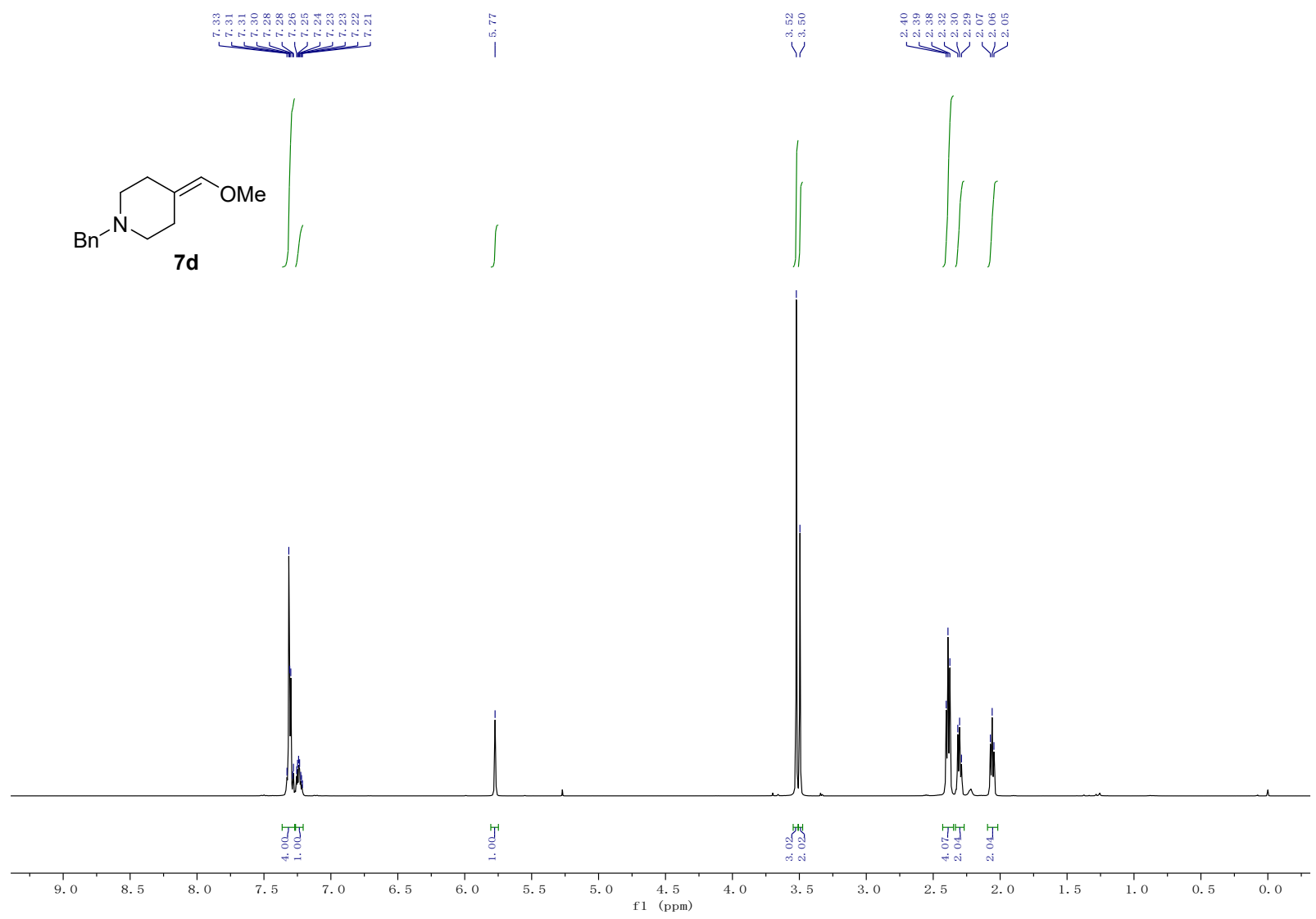
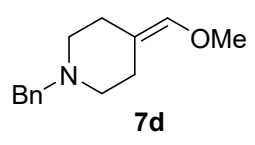
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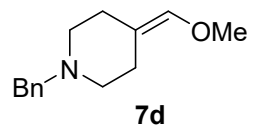
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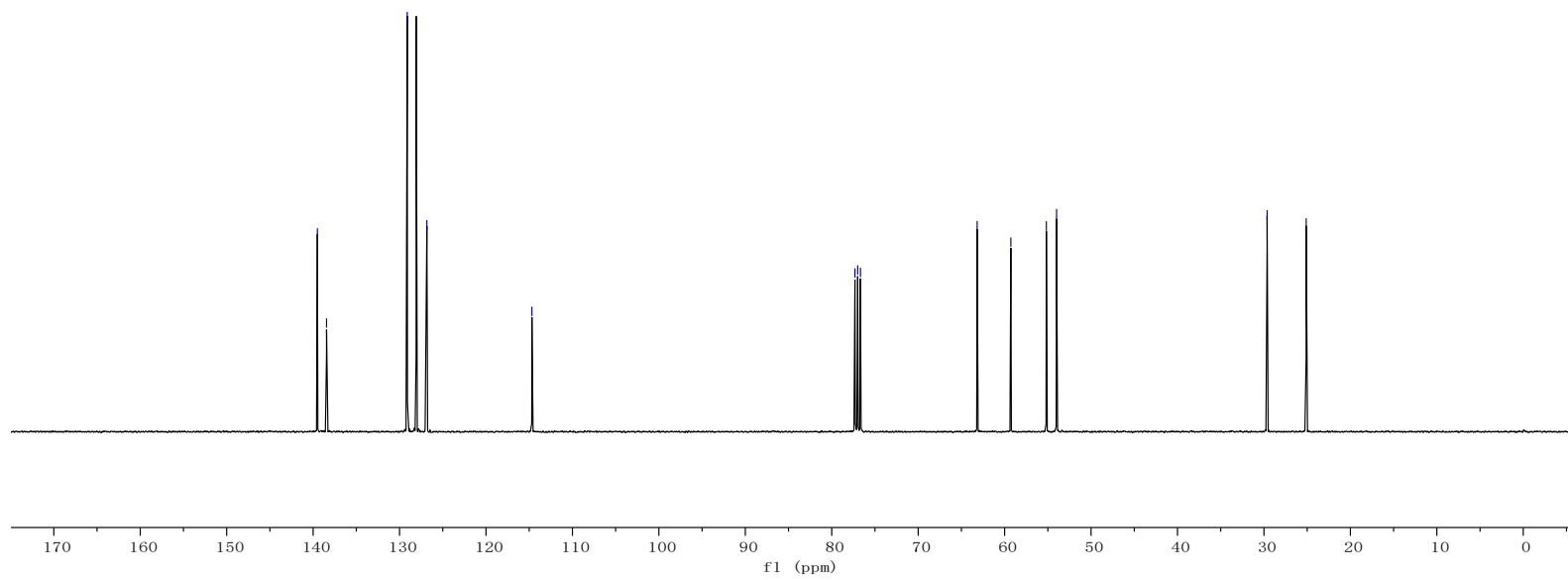
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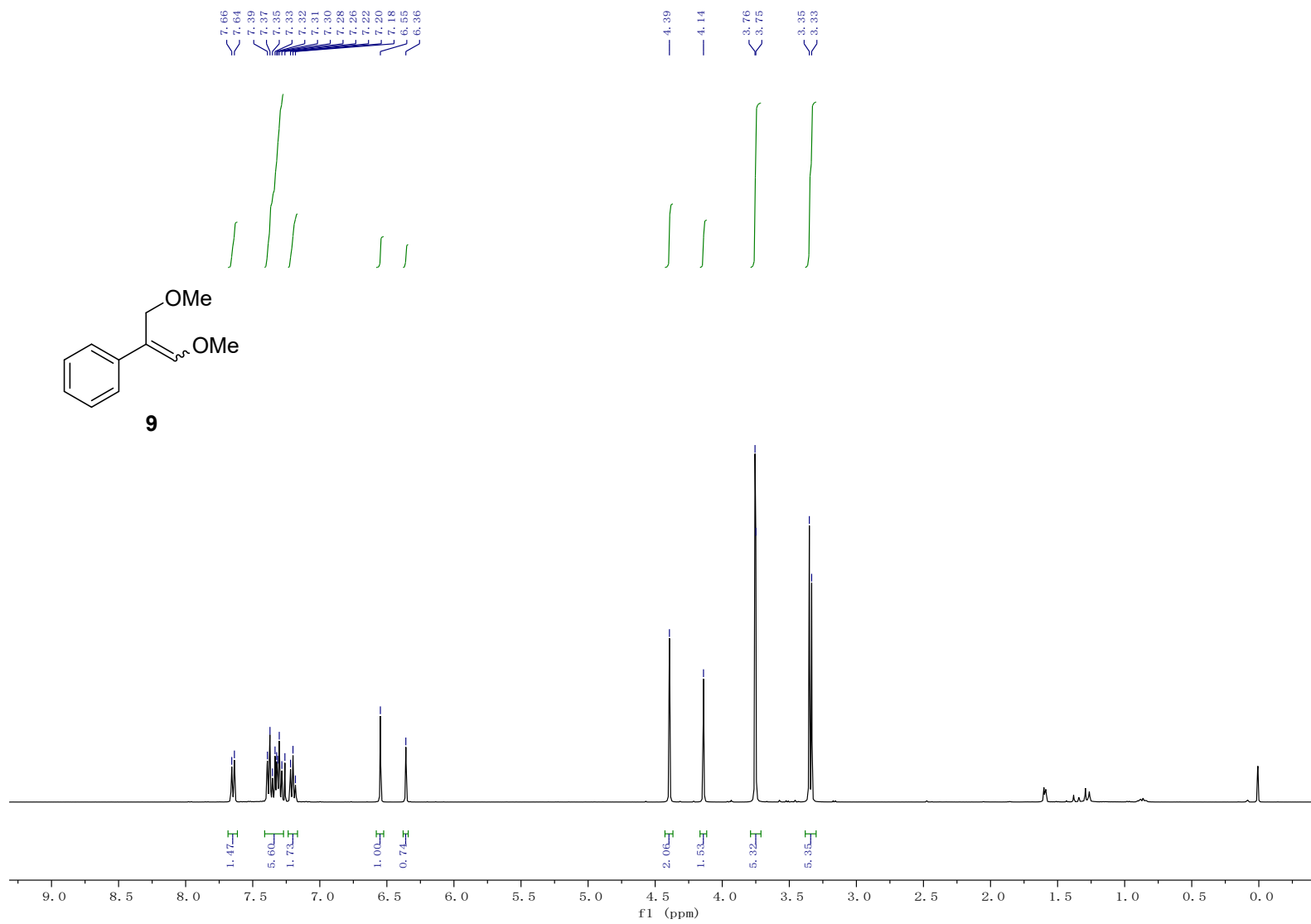
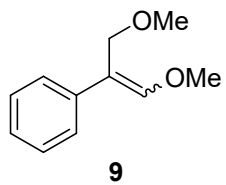
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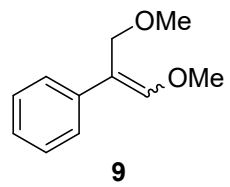
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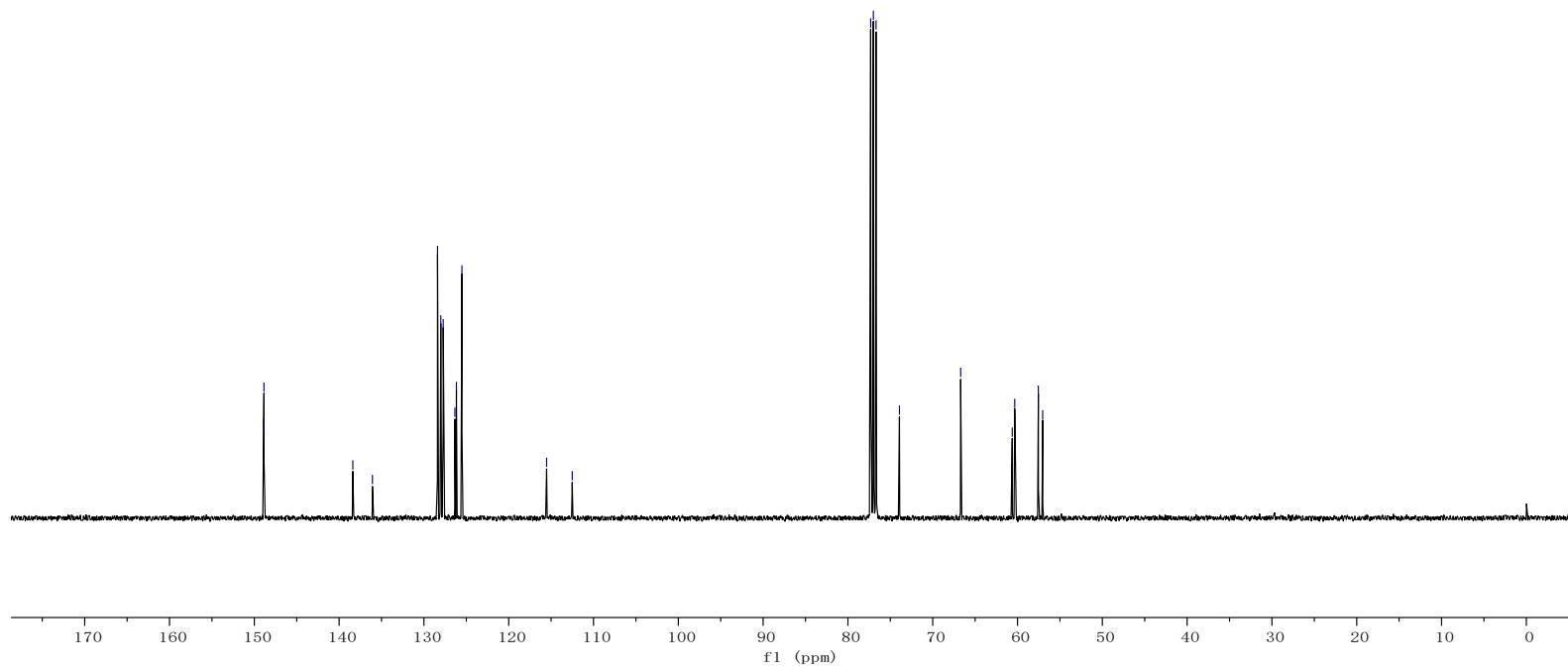
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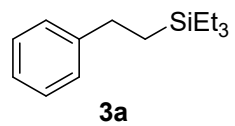
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57.03

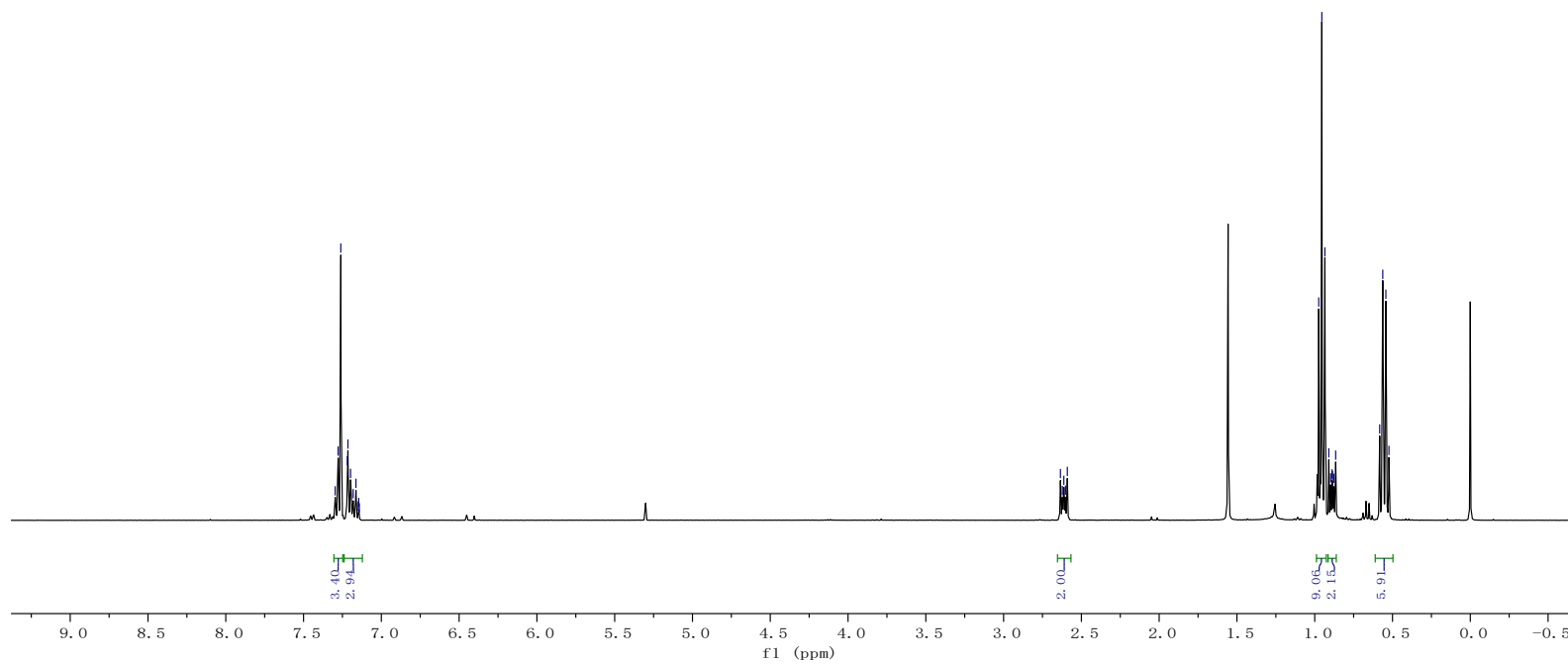


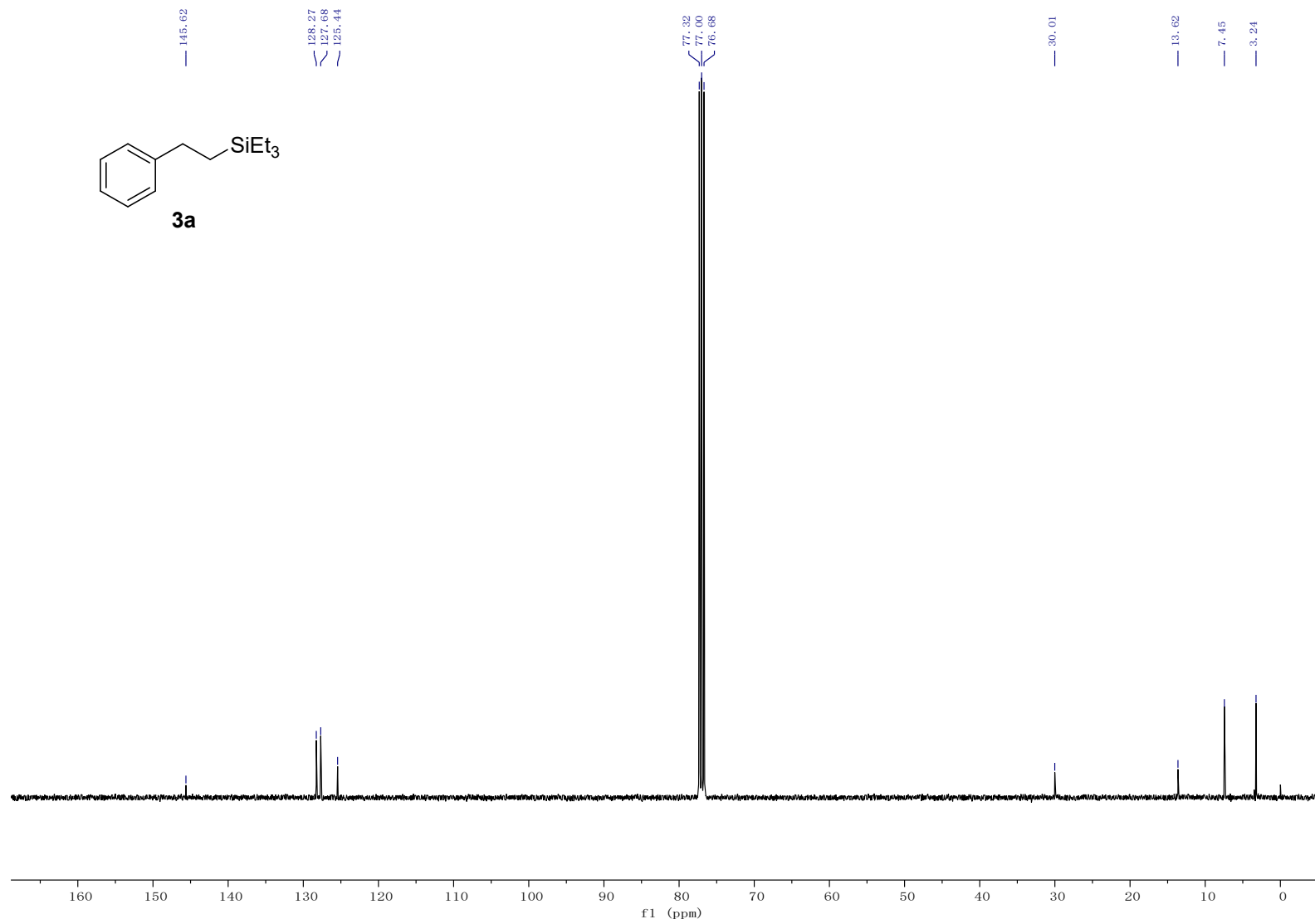
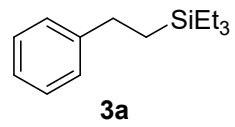


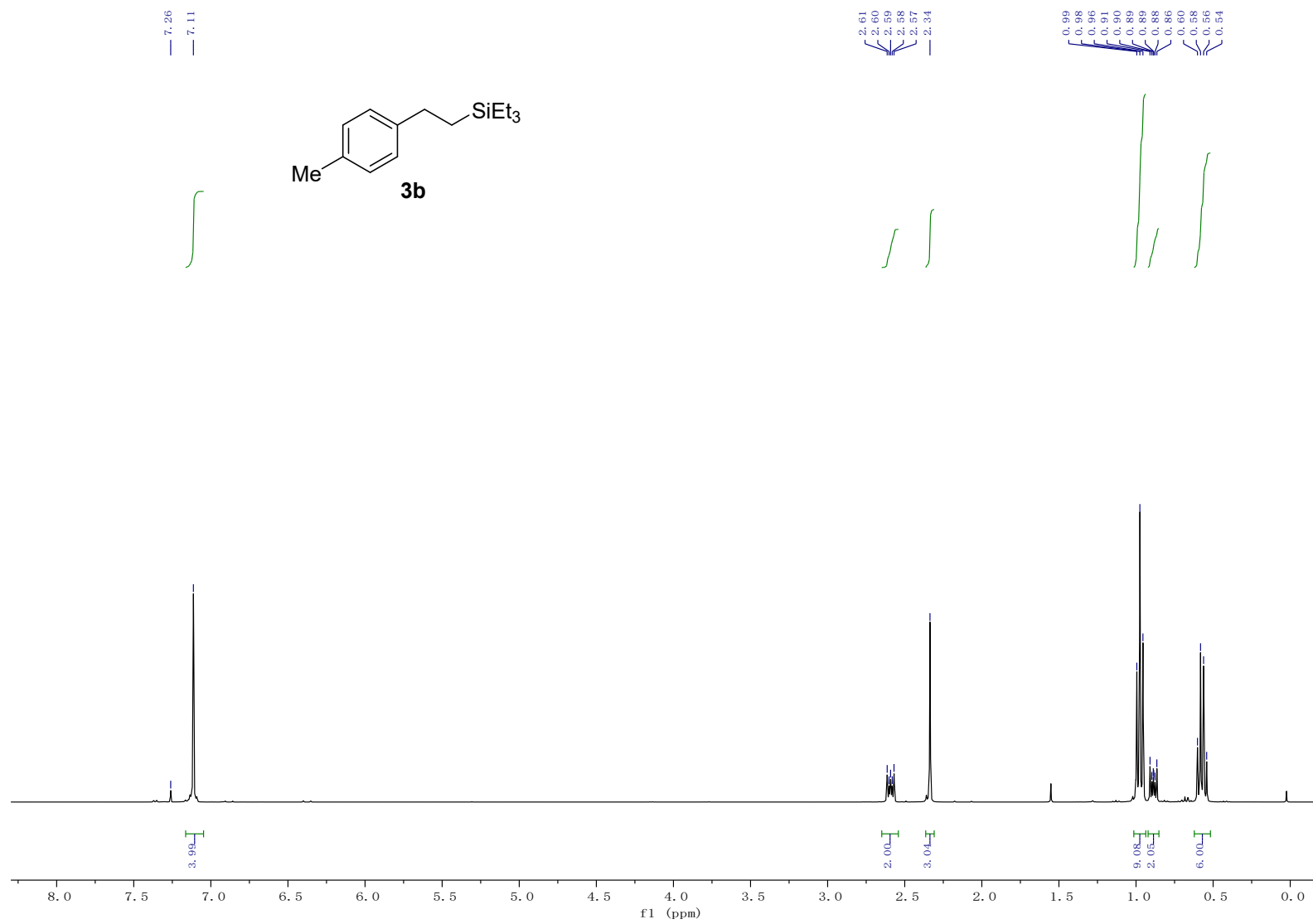
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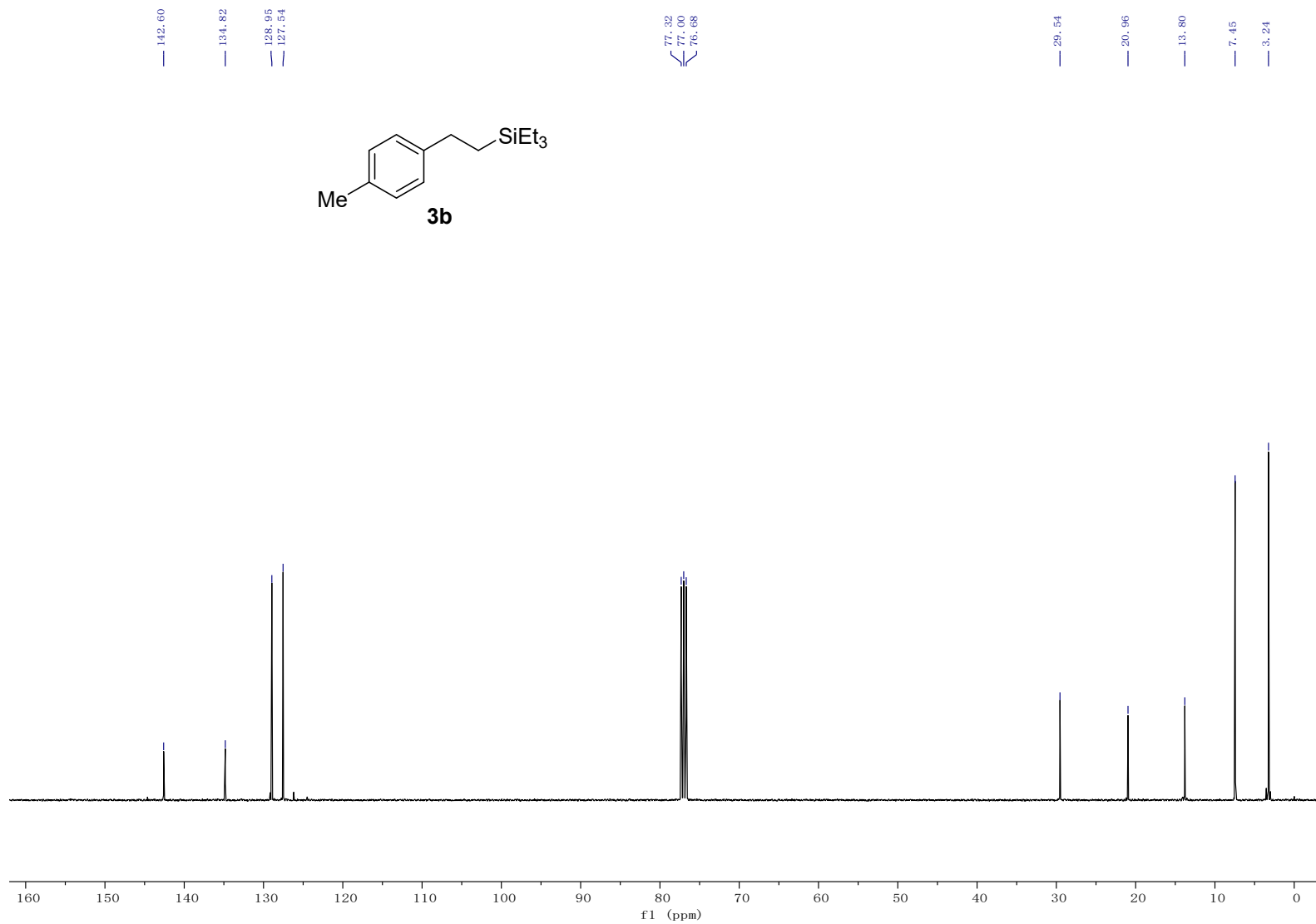
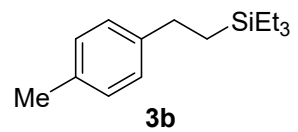
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2.59

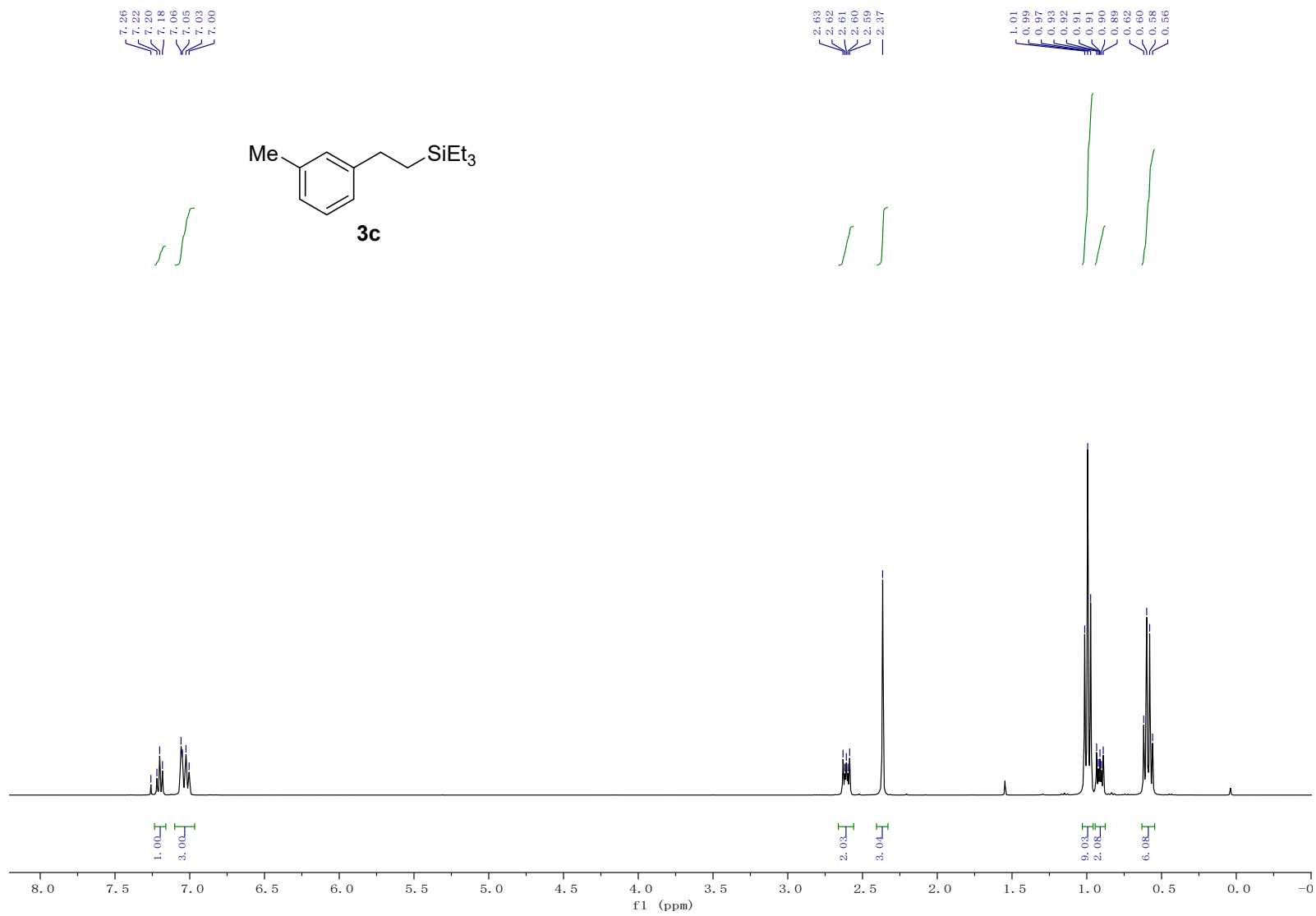
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0.90
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0.88
0.87
0.86
0.85
0.84







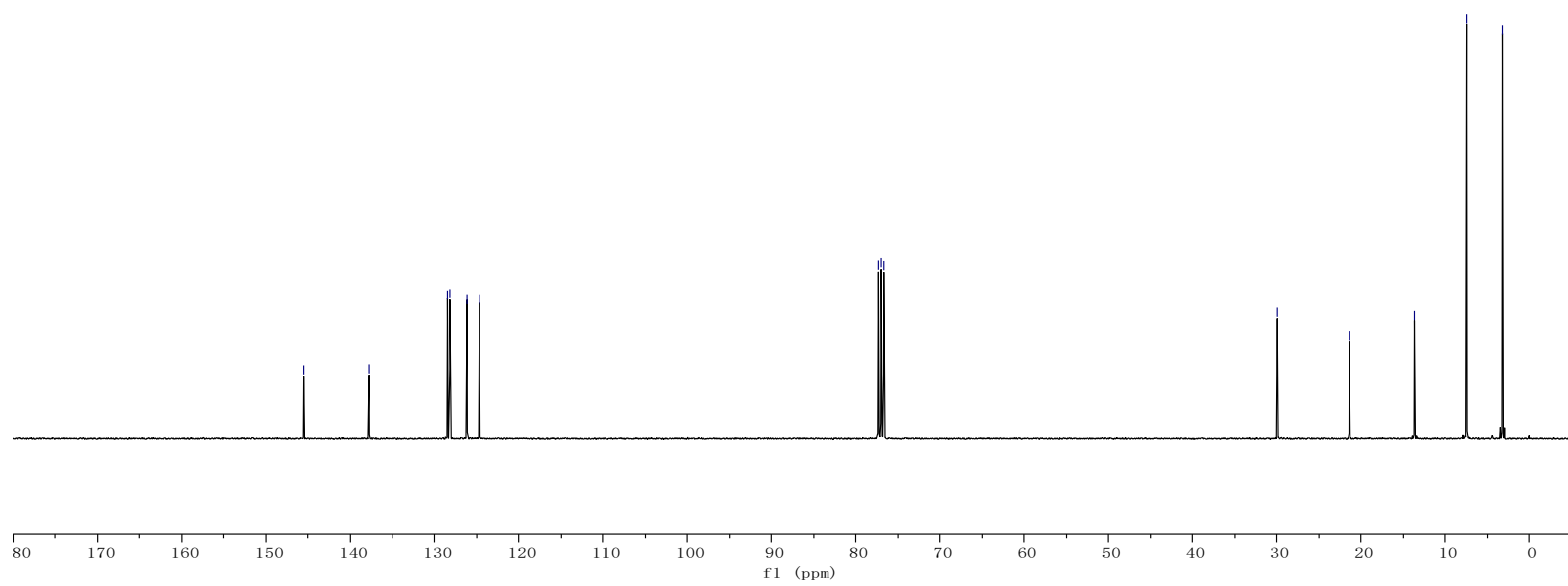
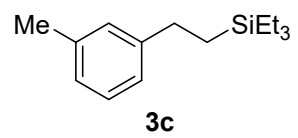


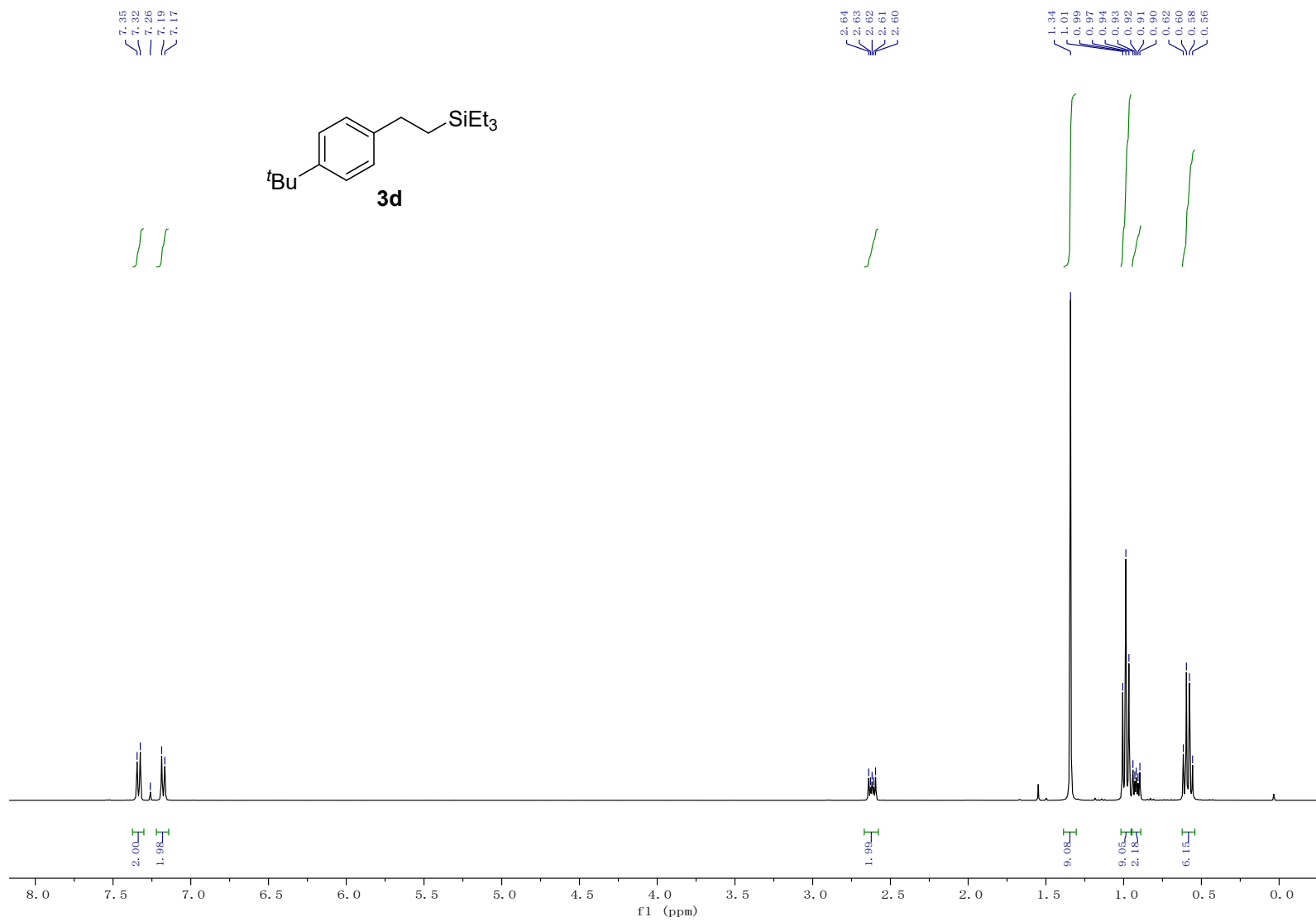


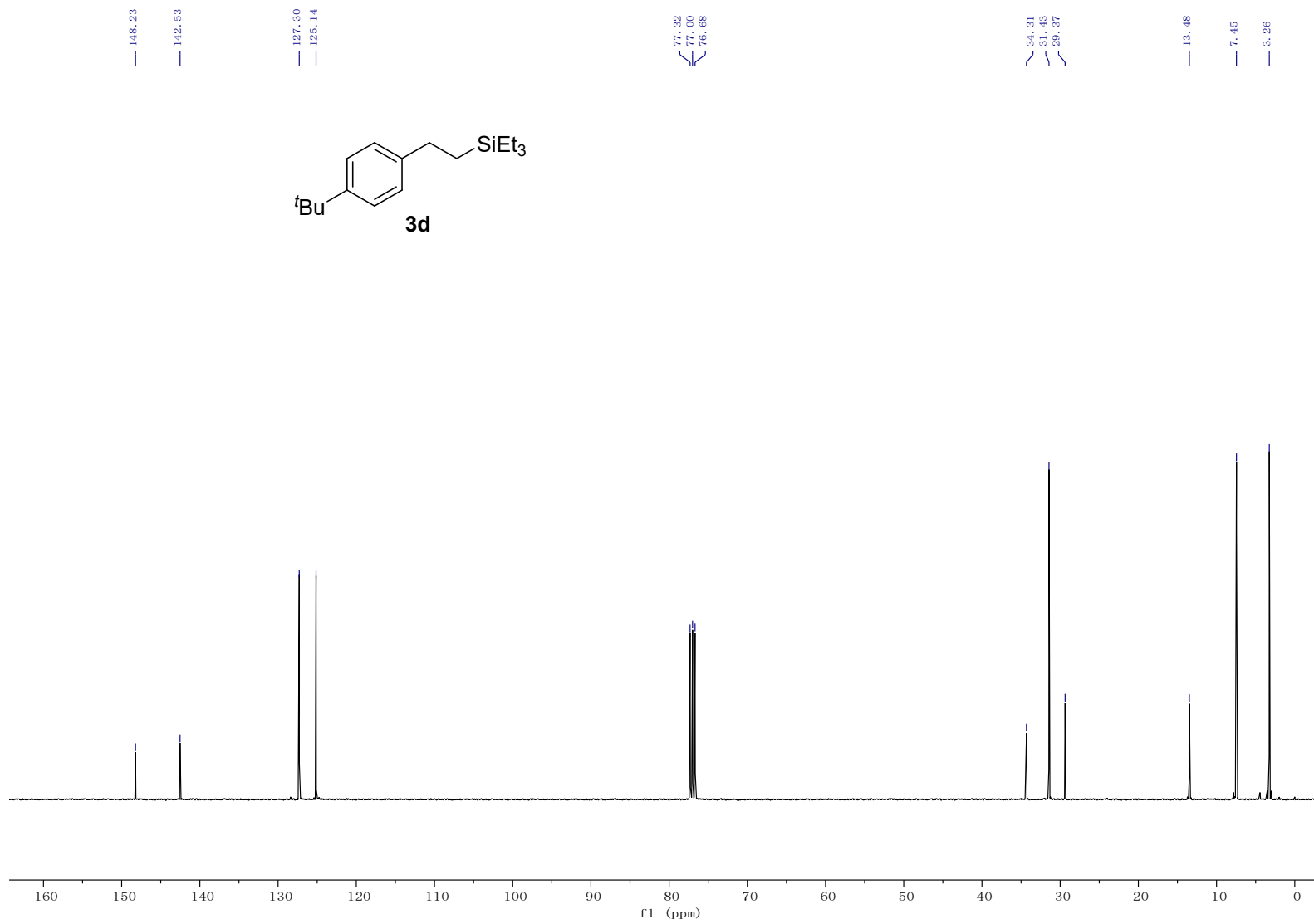
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124.67

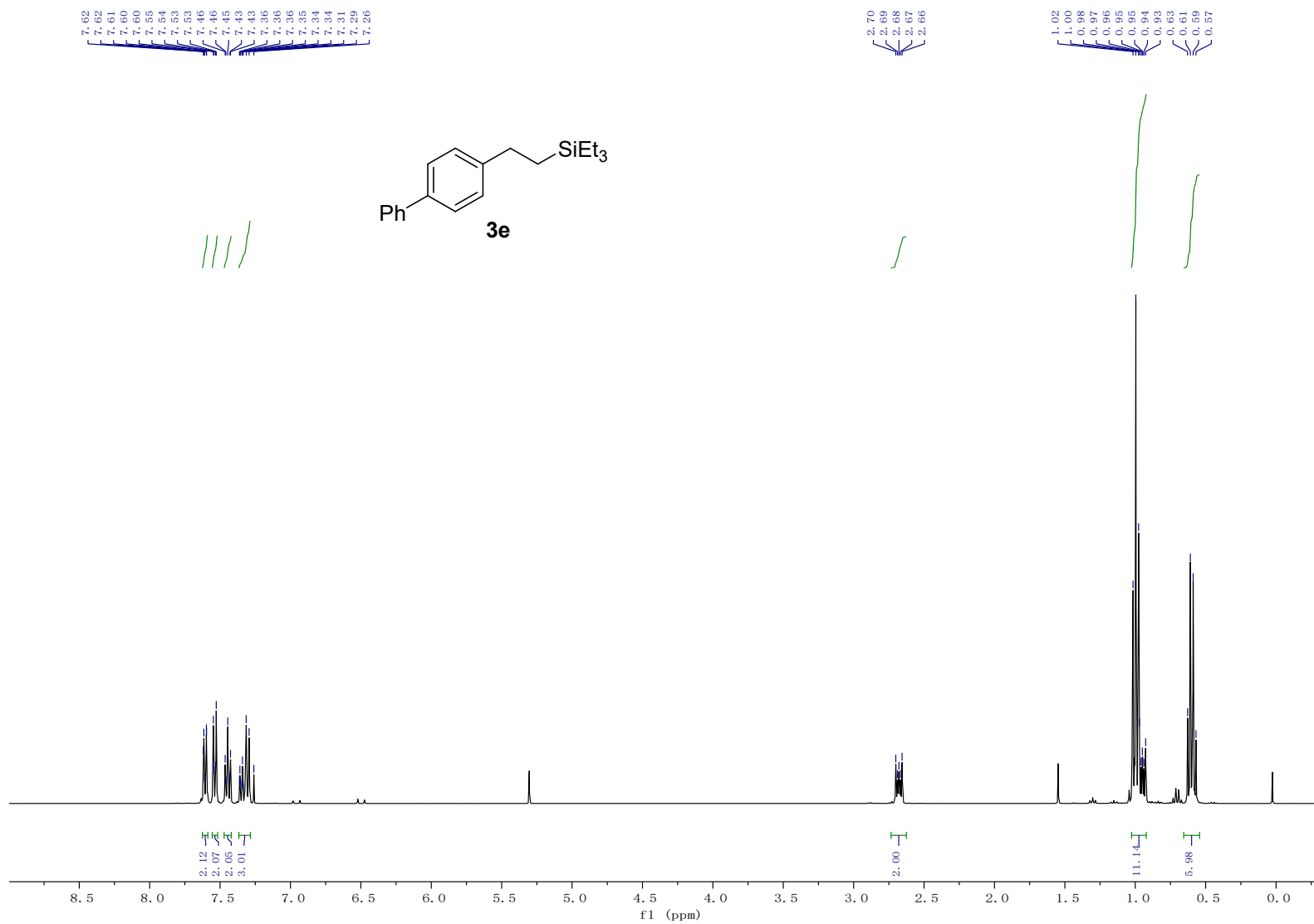
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76.68

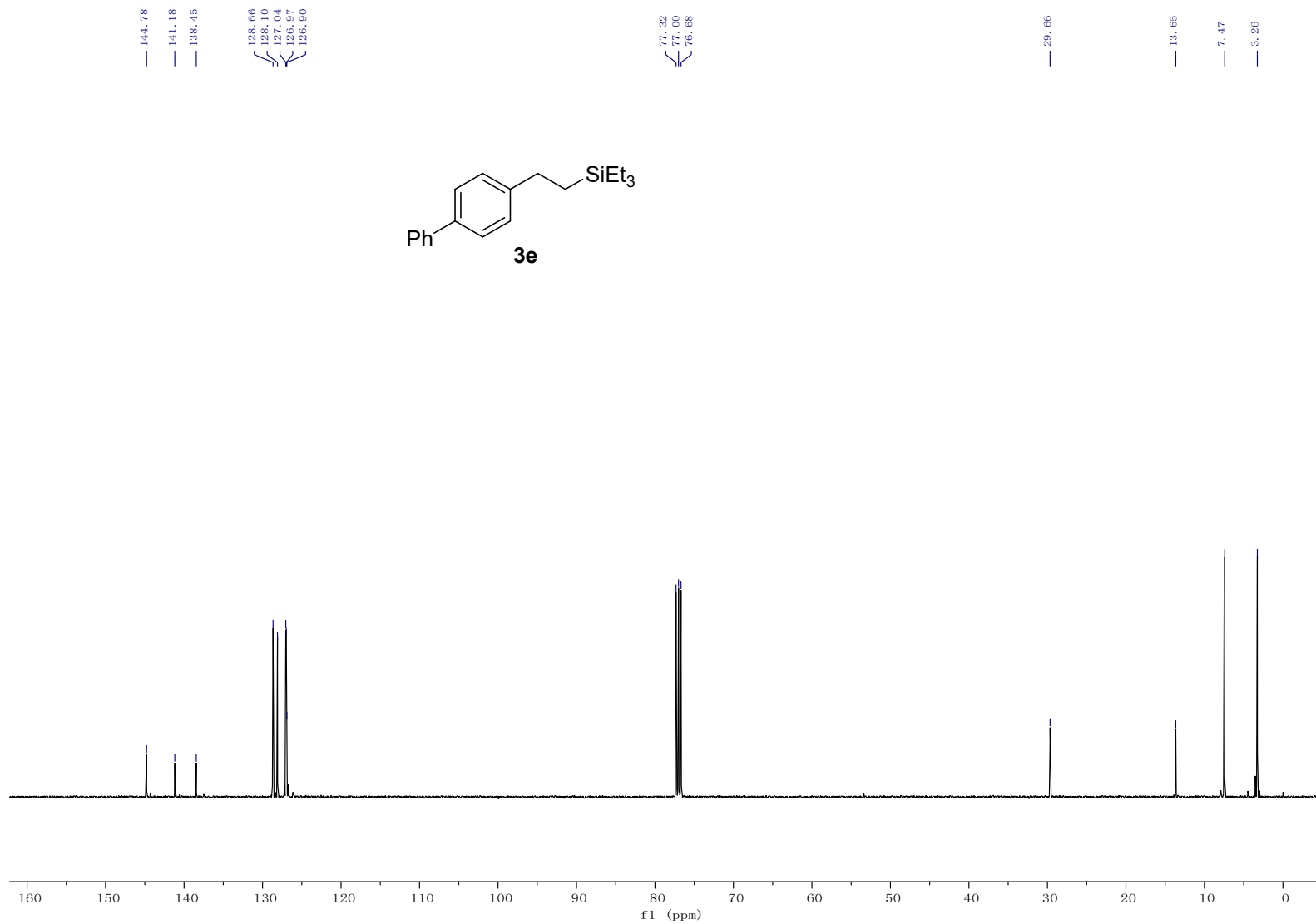
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7.46
3.24

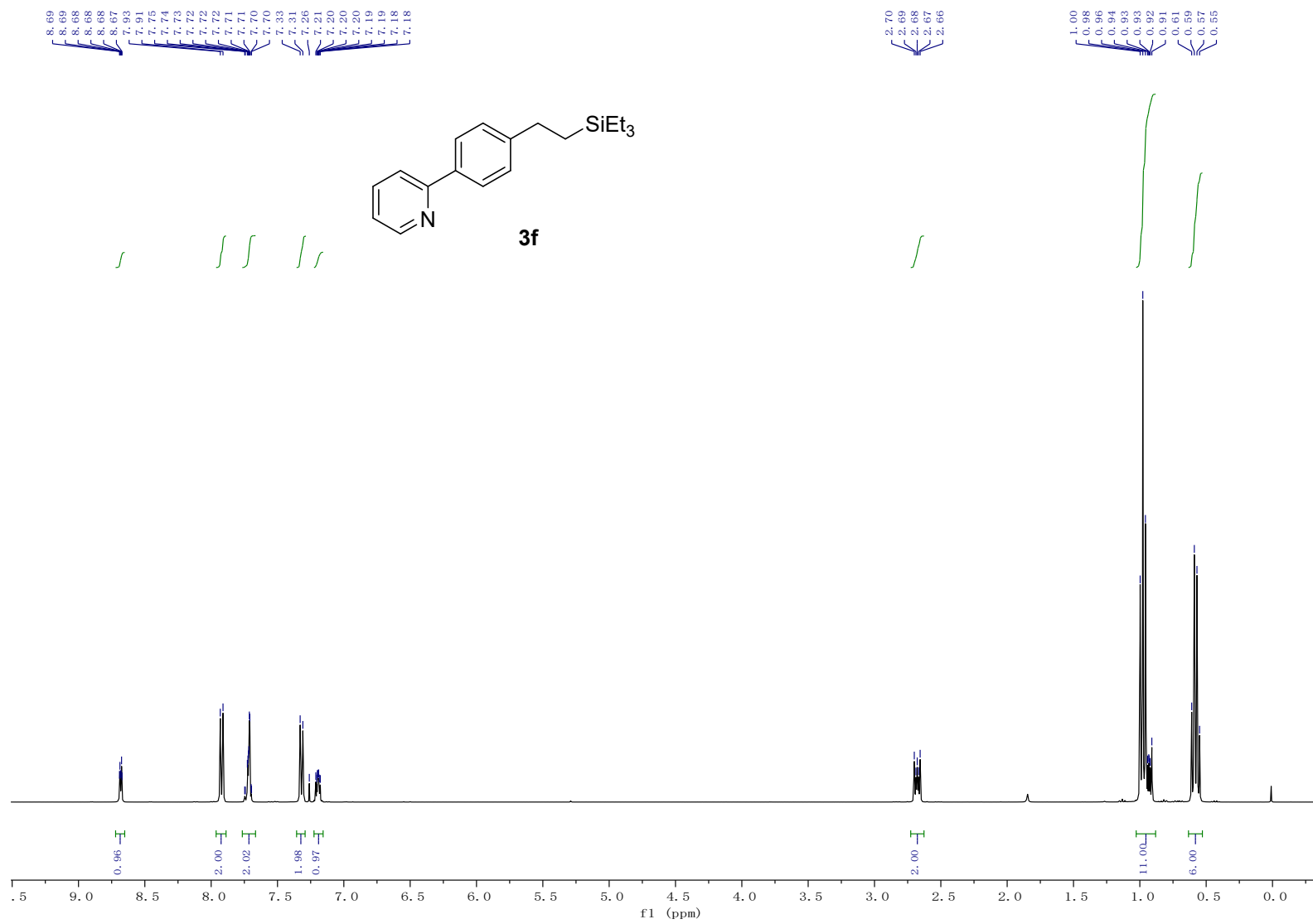


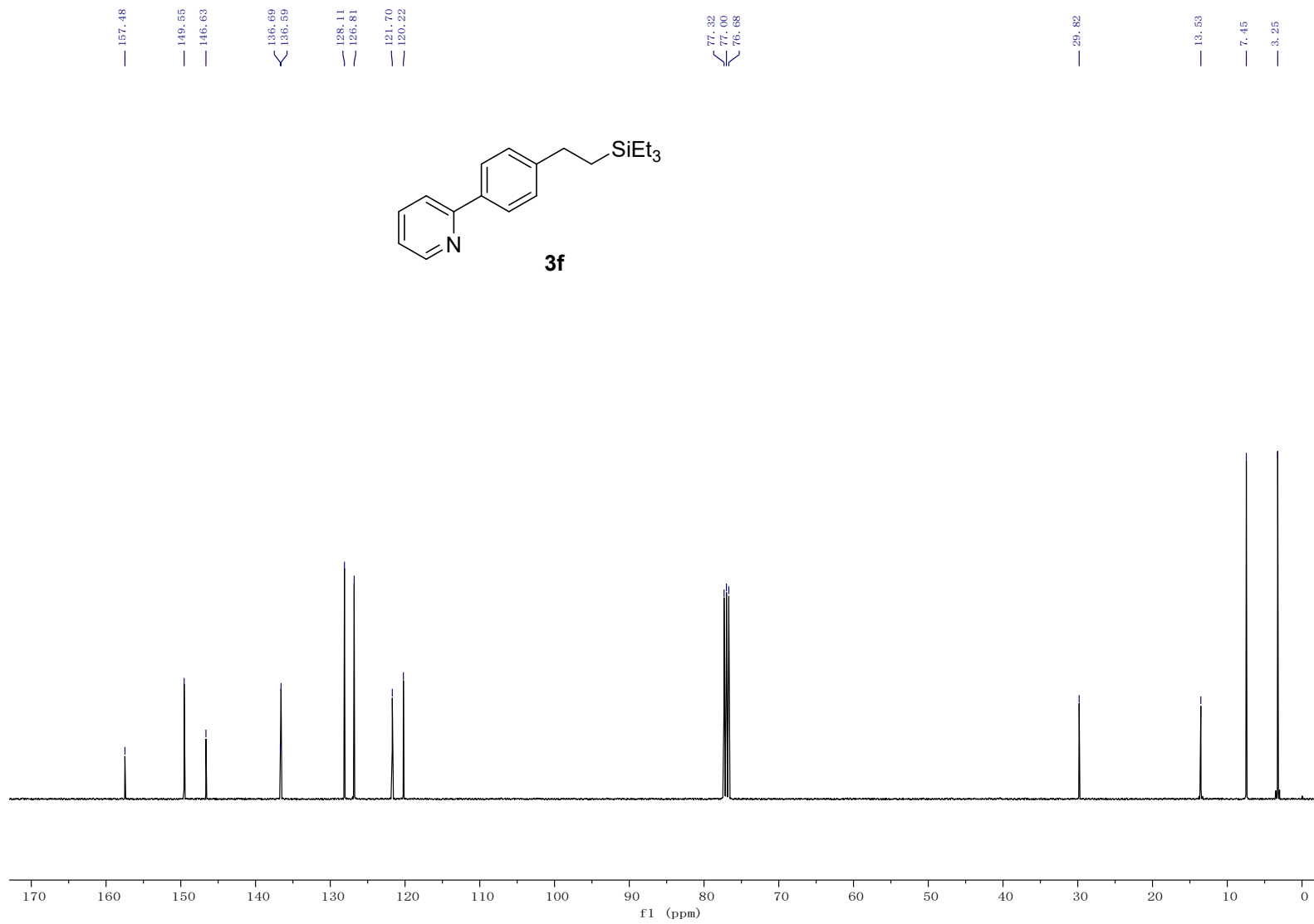


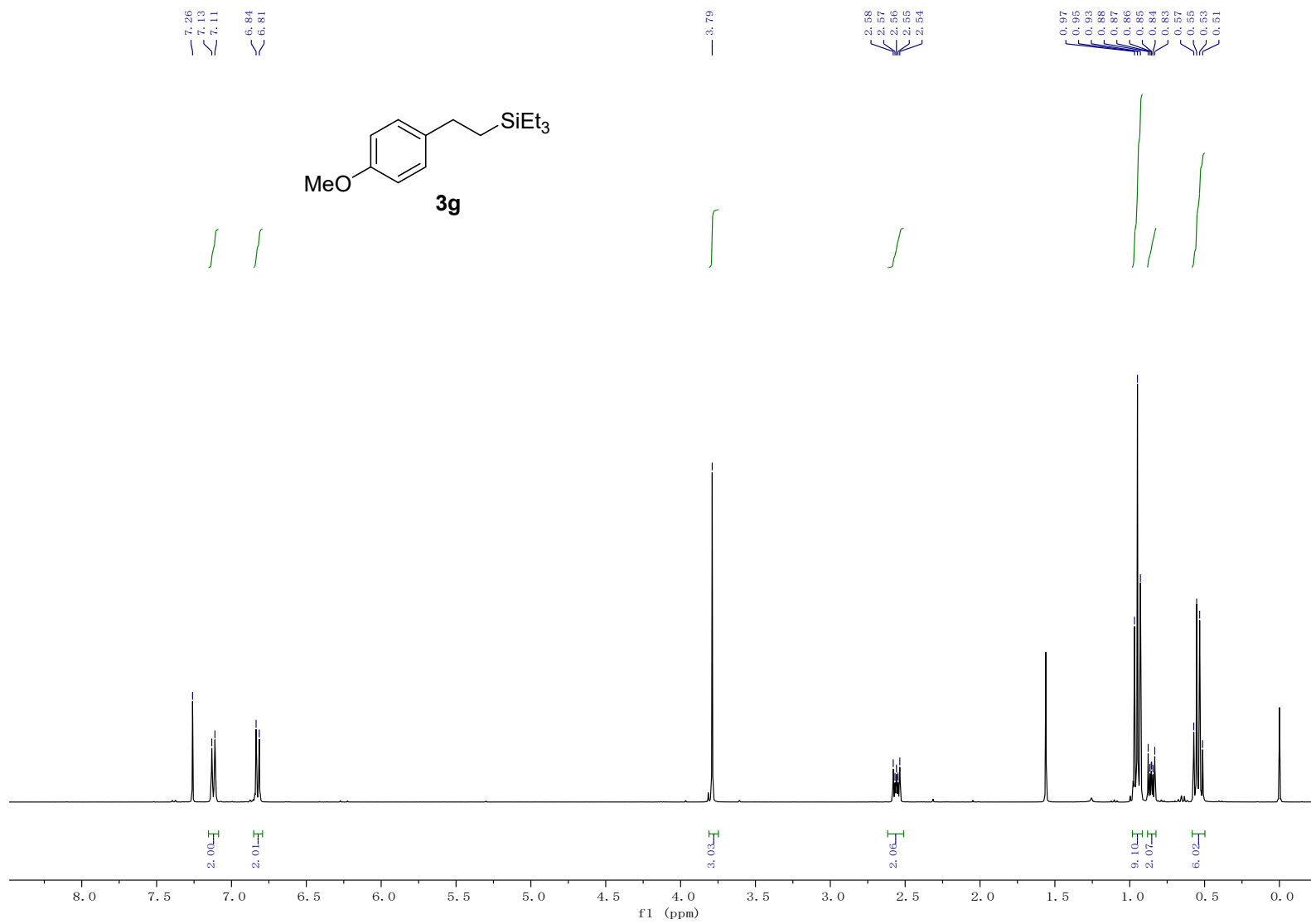


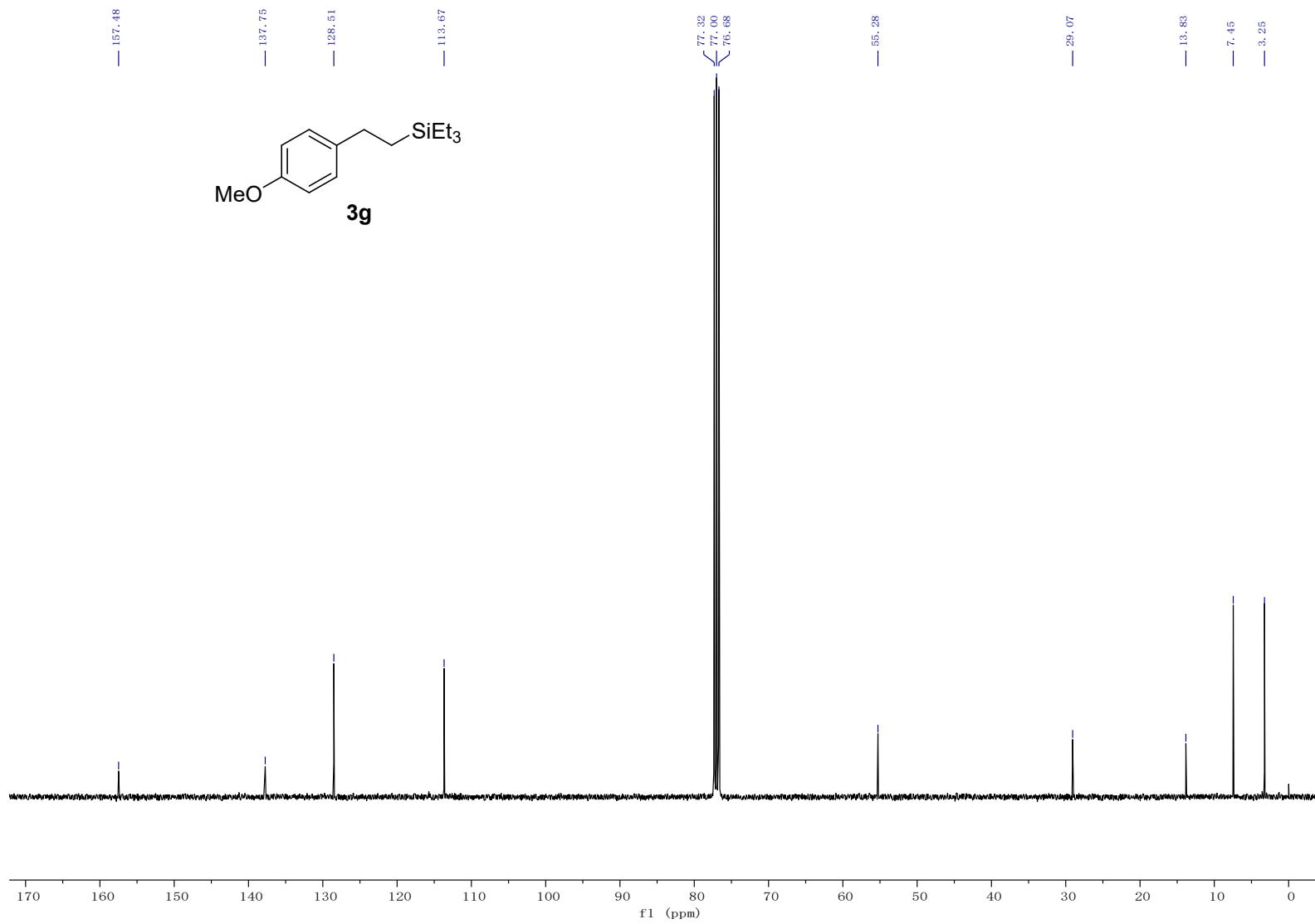


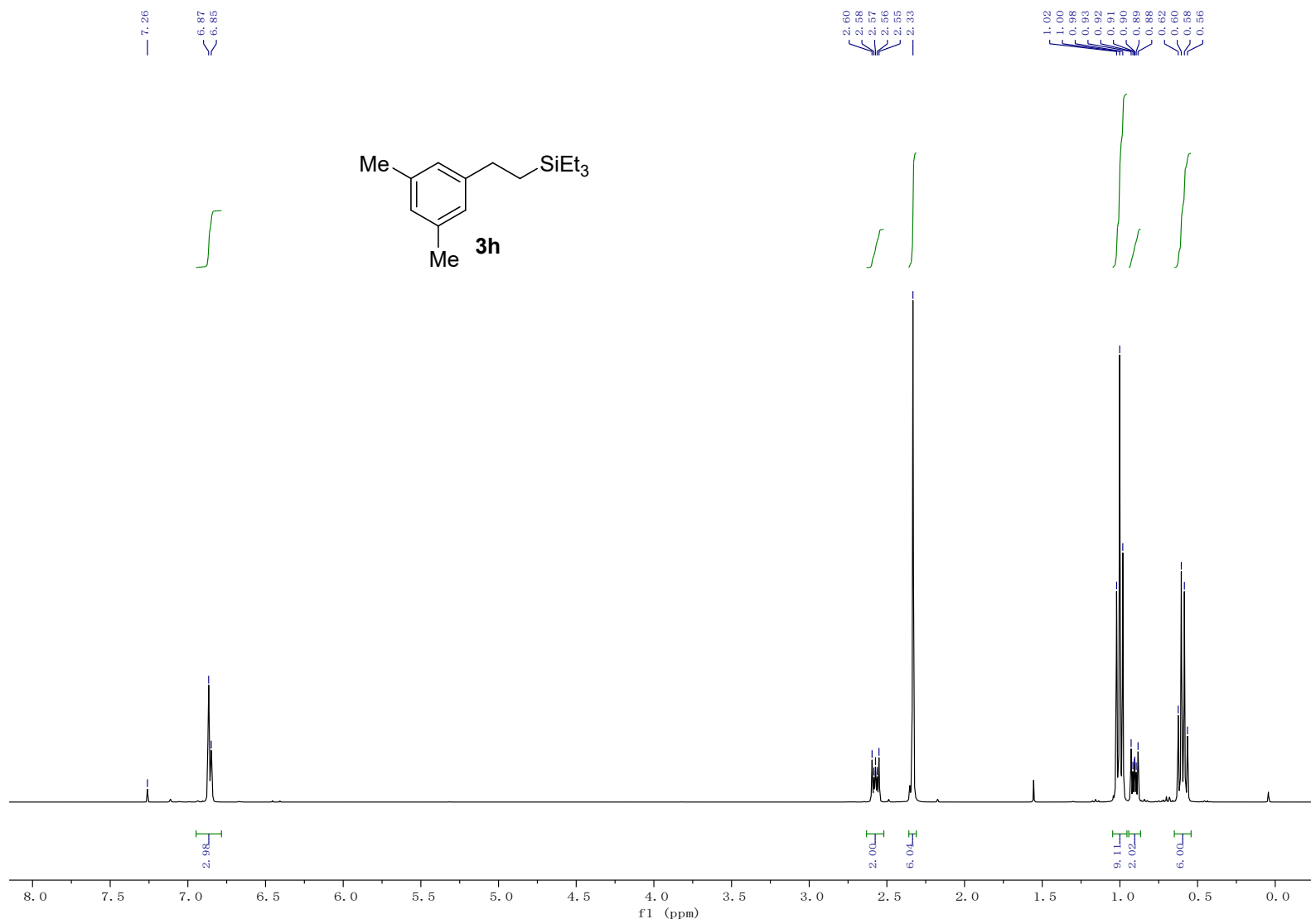


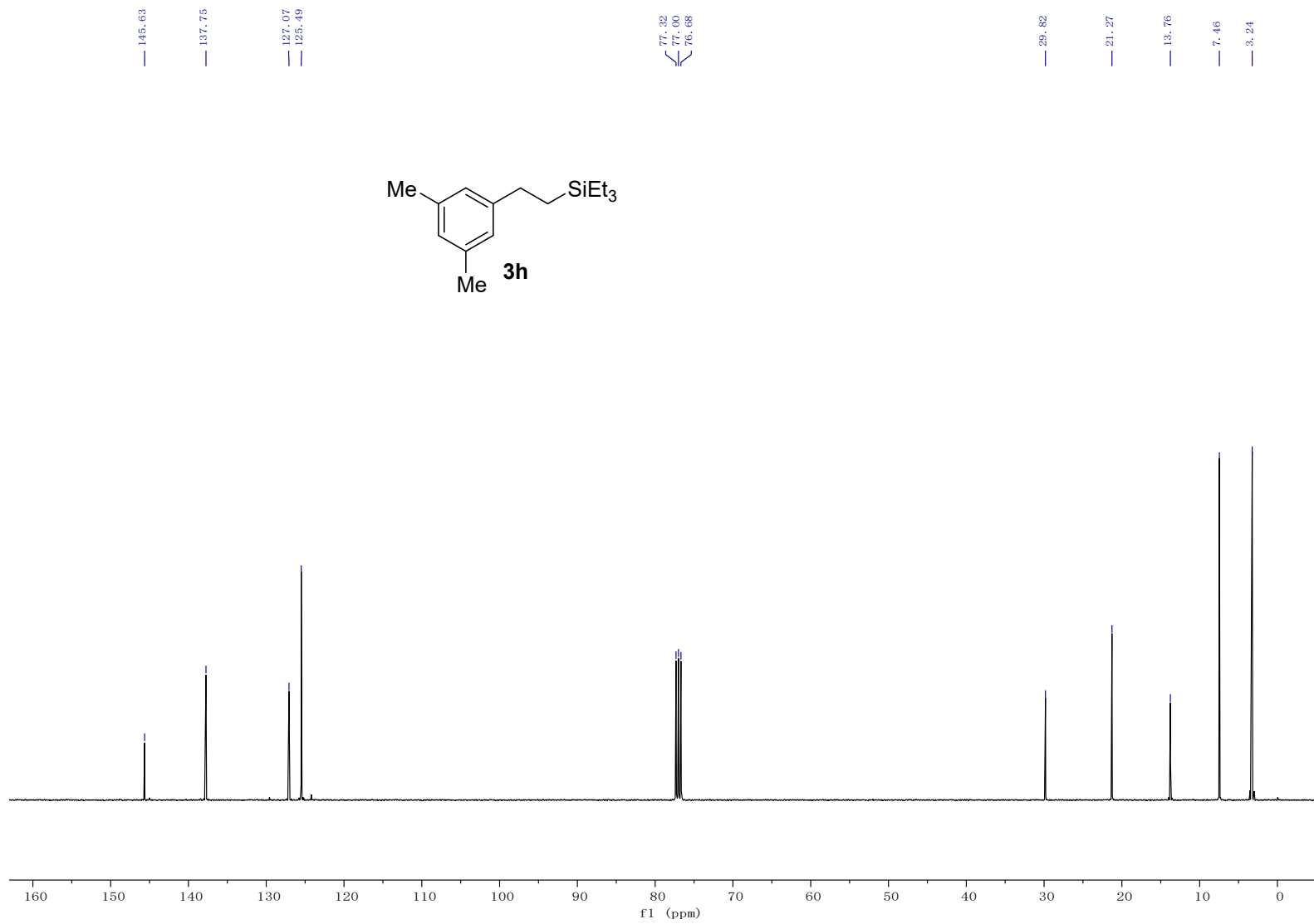


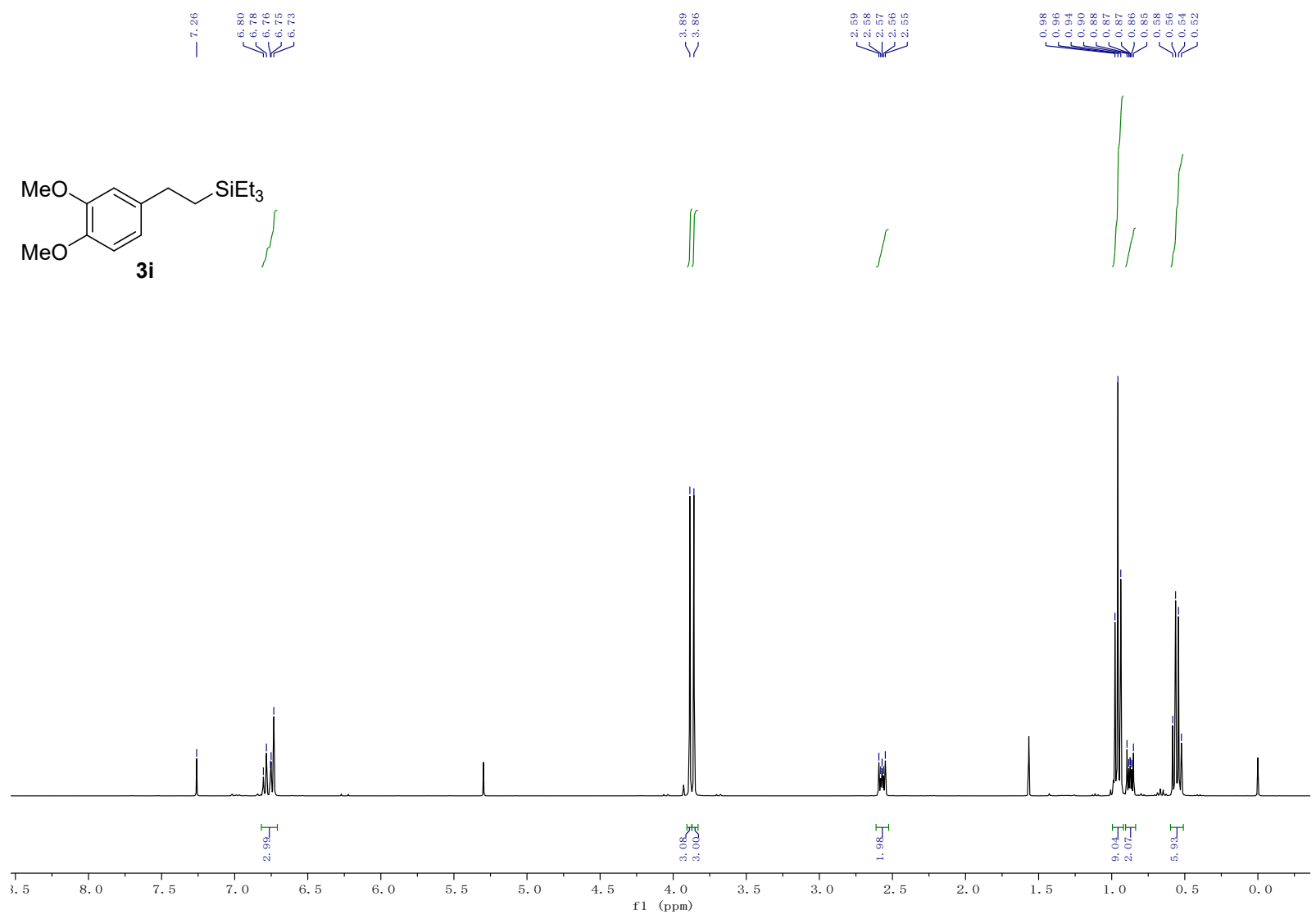
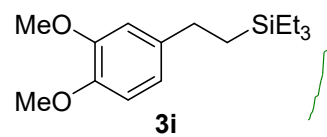


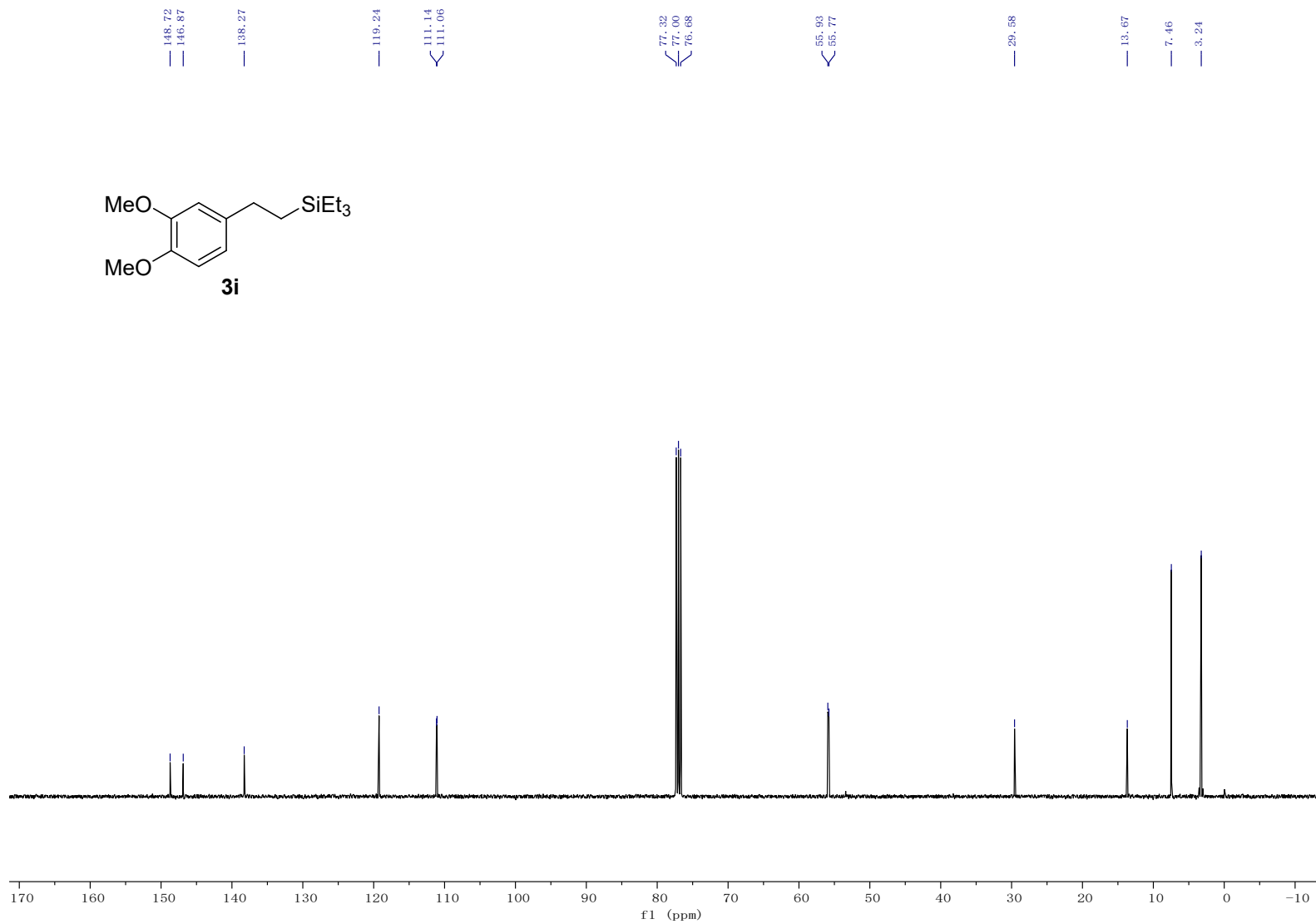
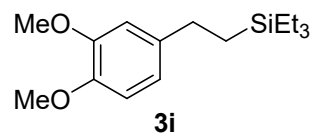


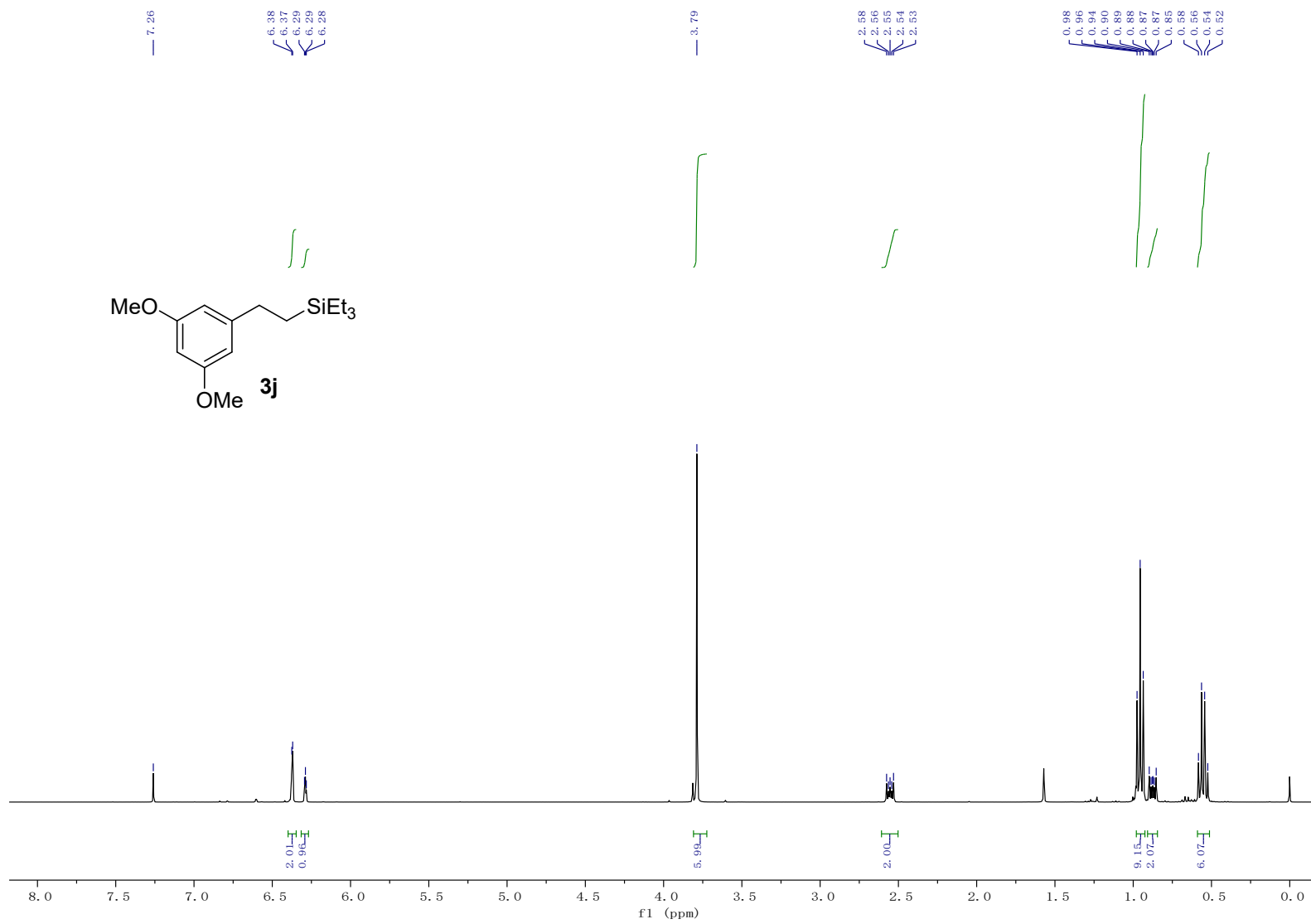


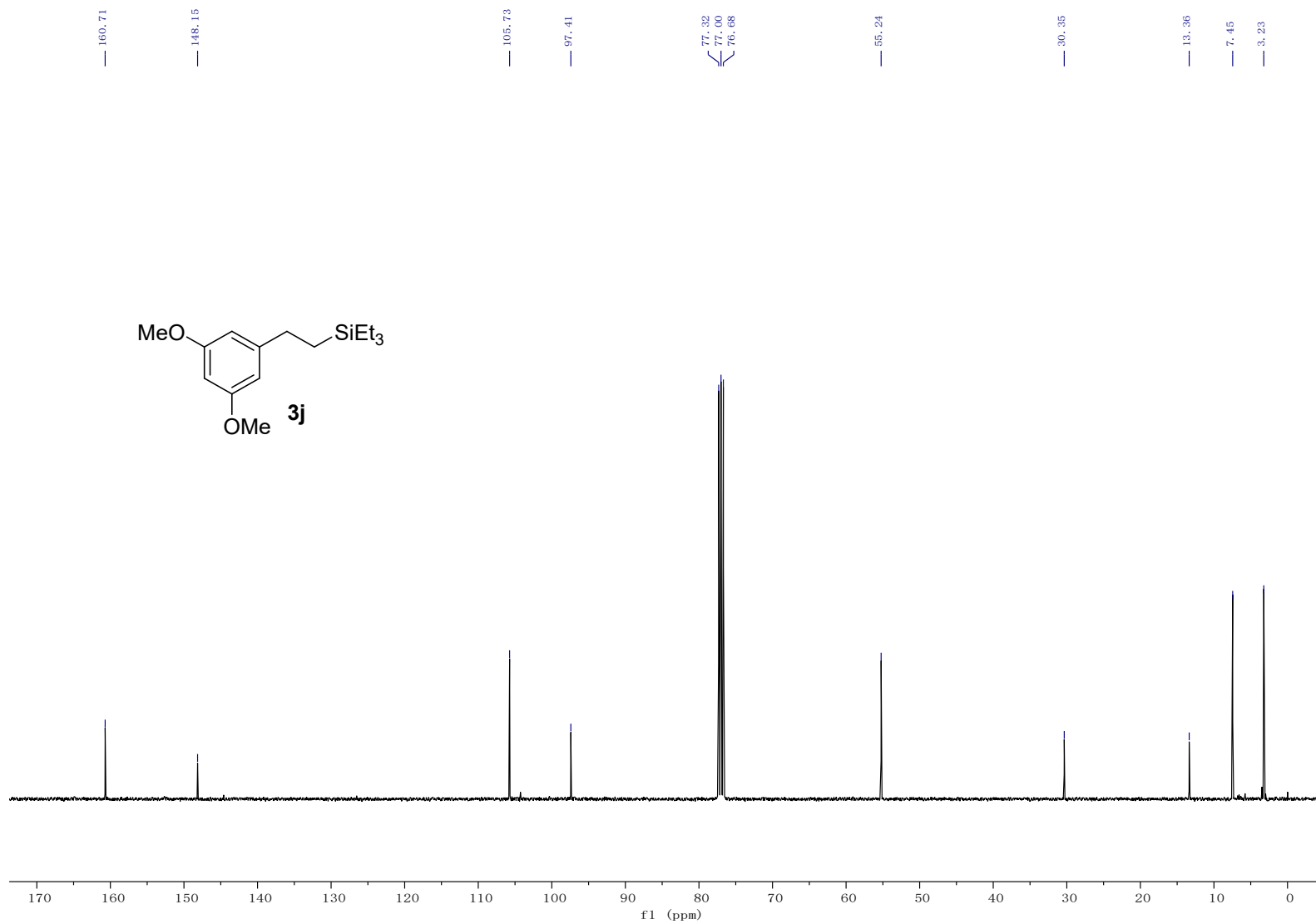
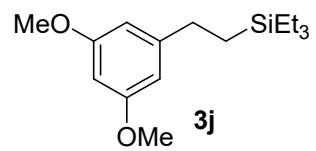


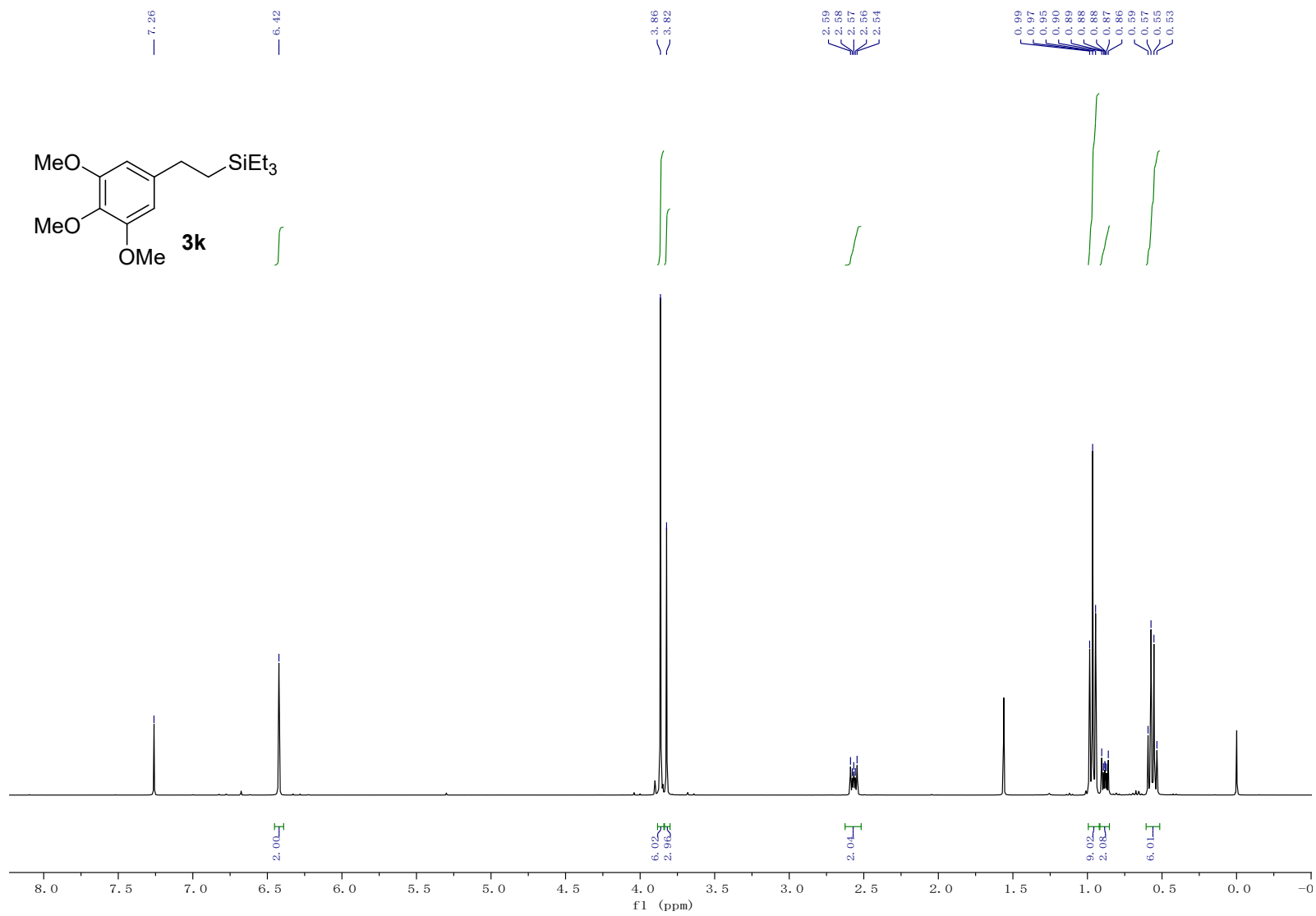


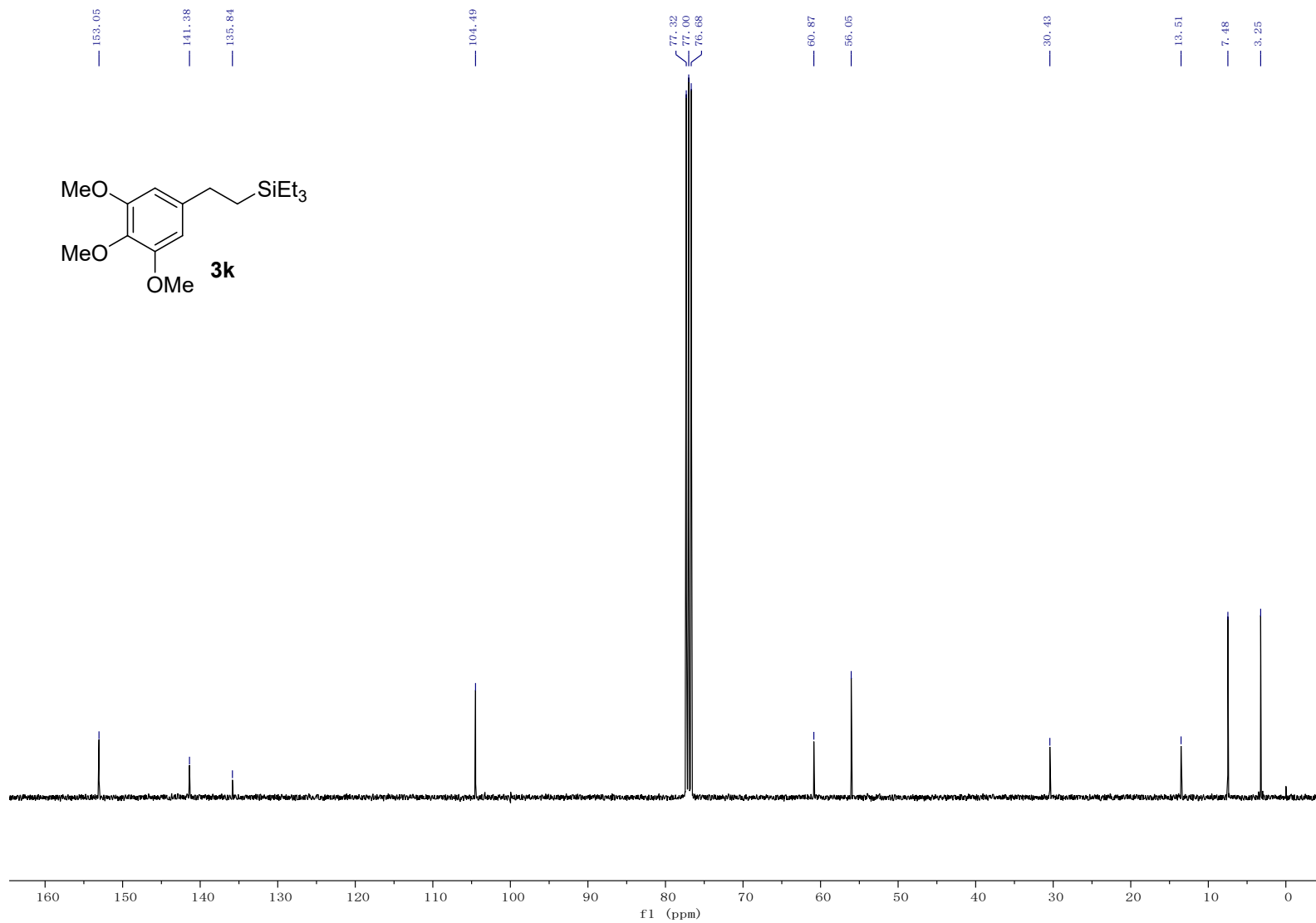
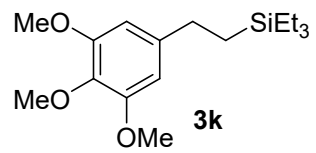


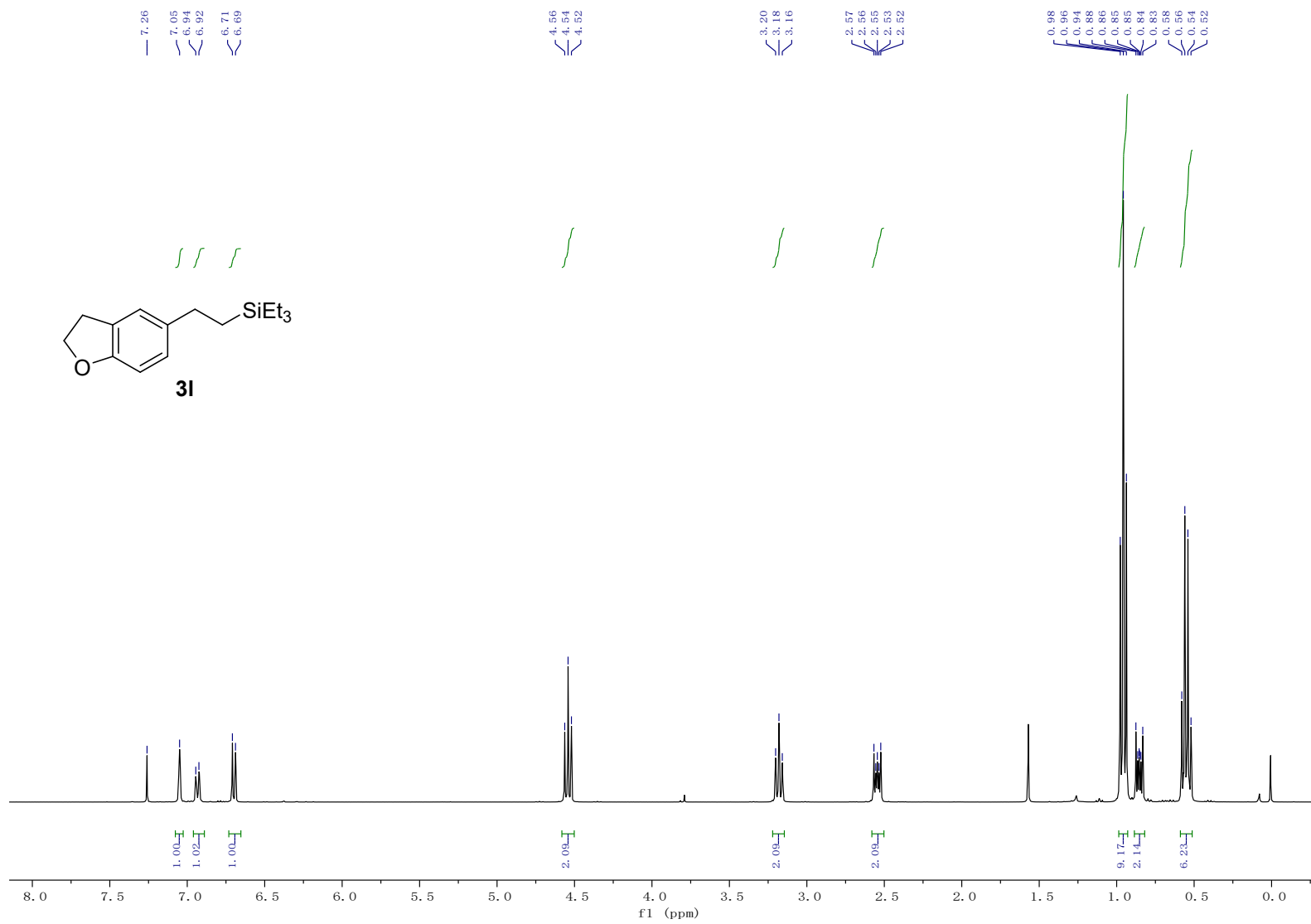


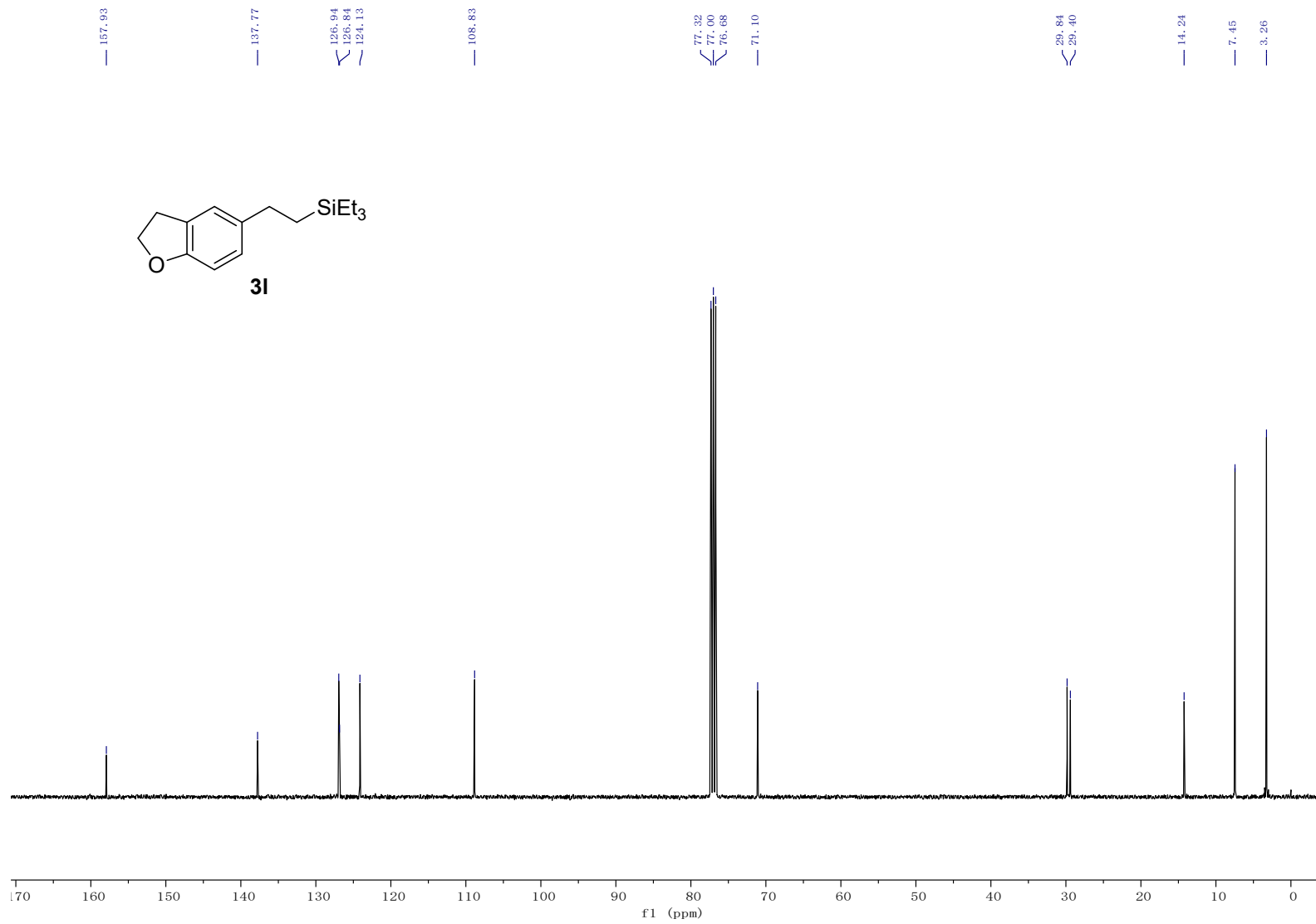
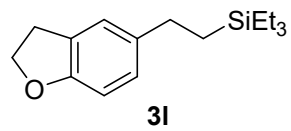


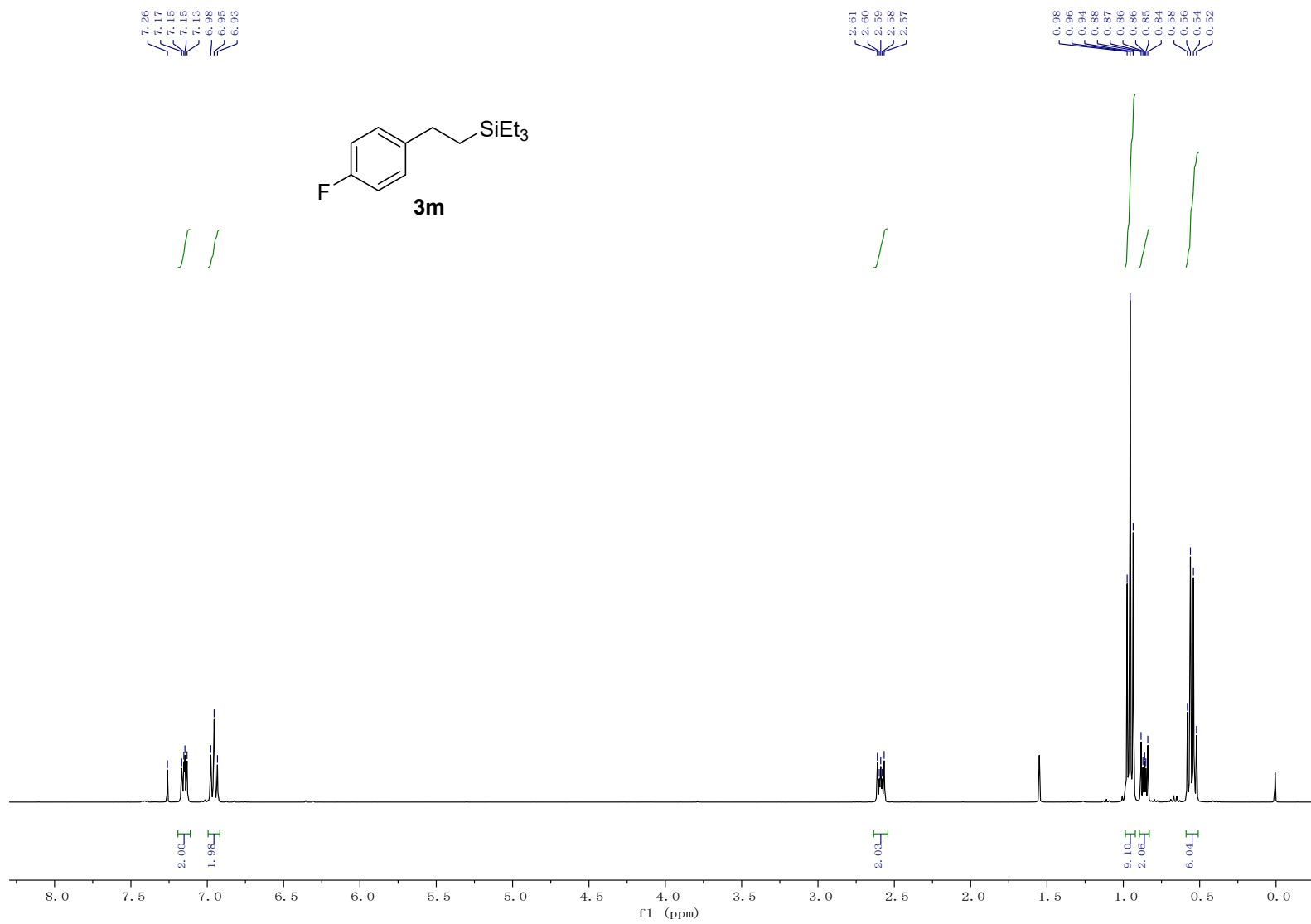


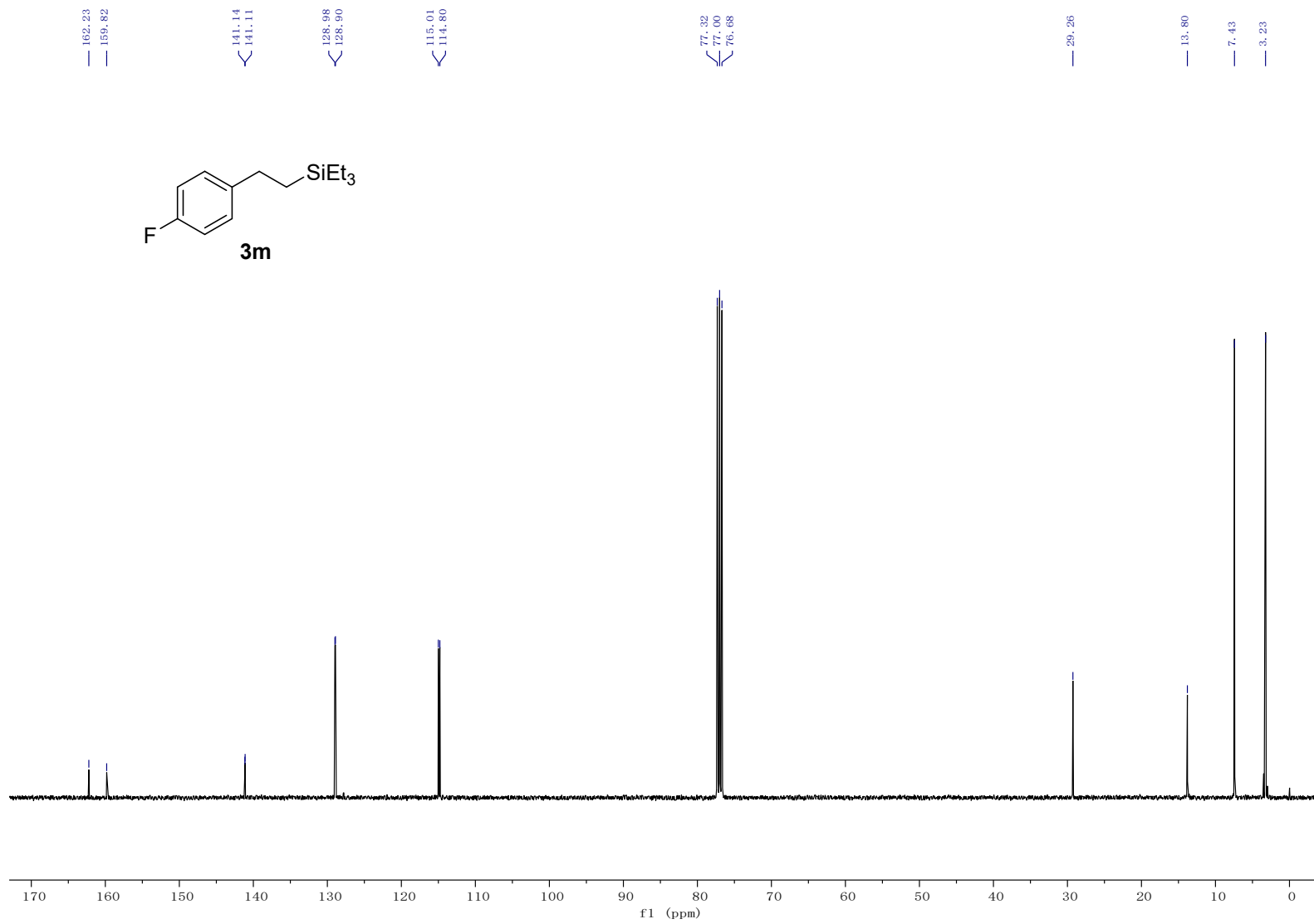
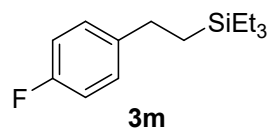


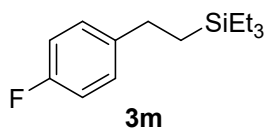




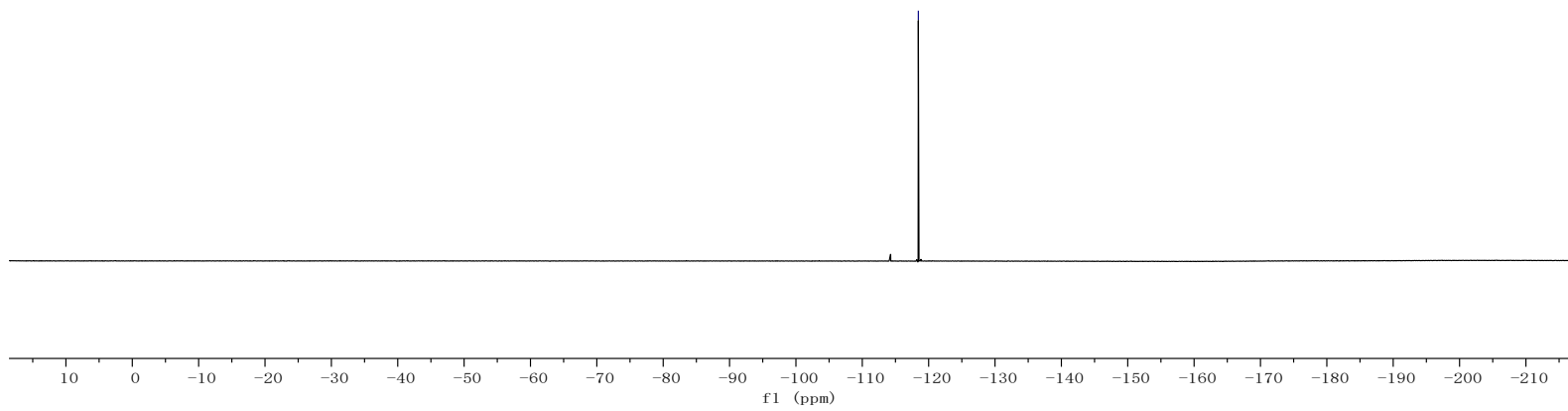


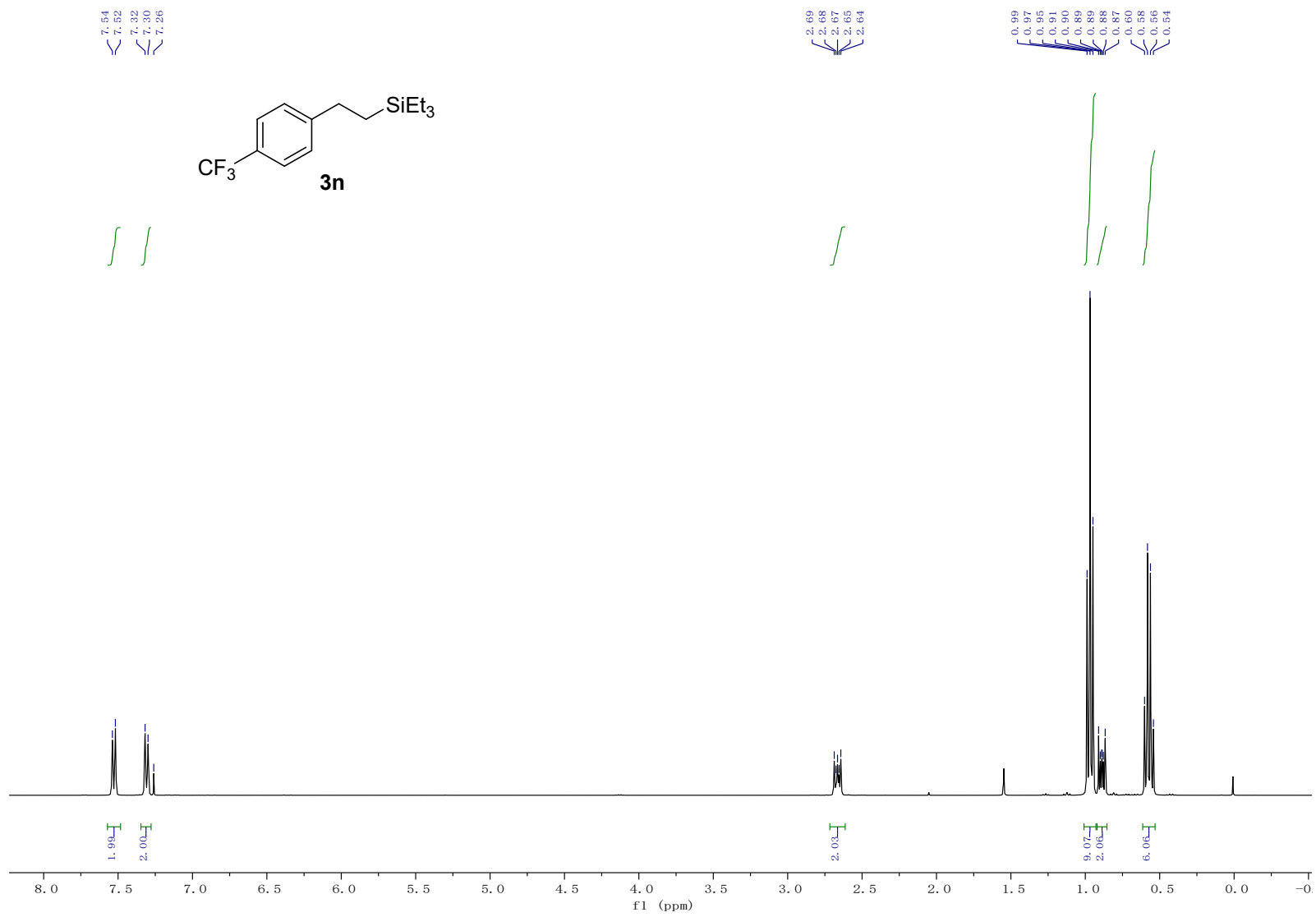


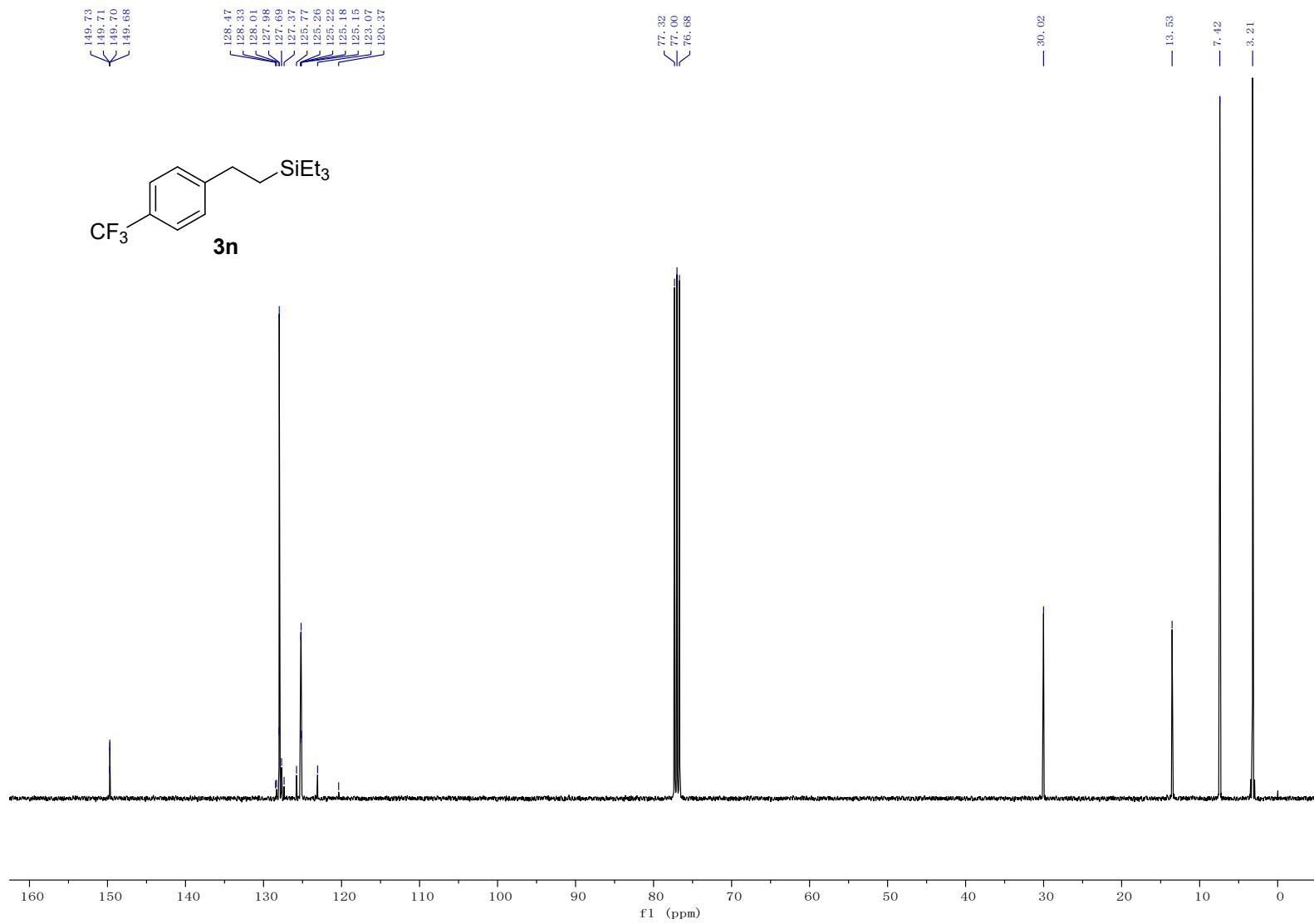


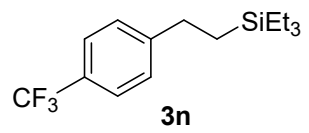


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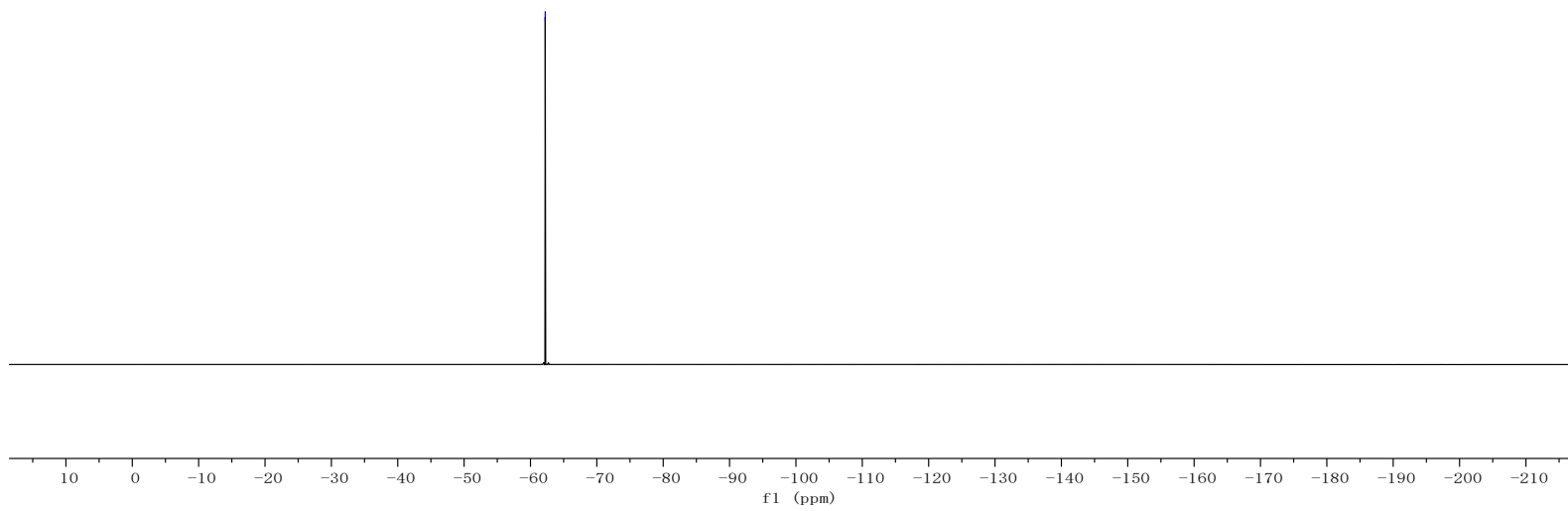


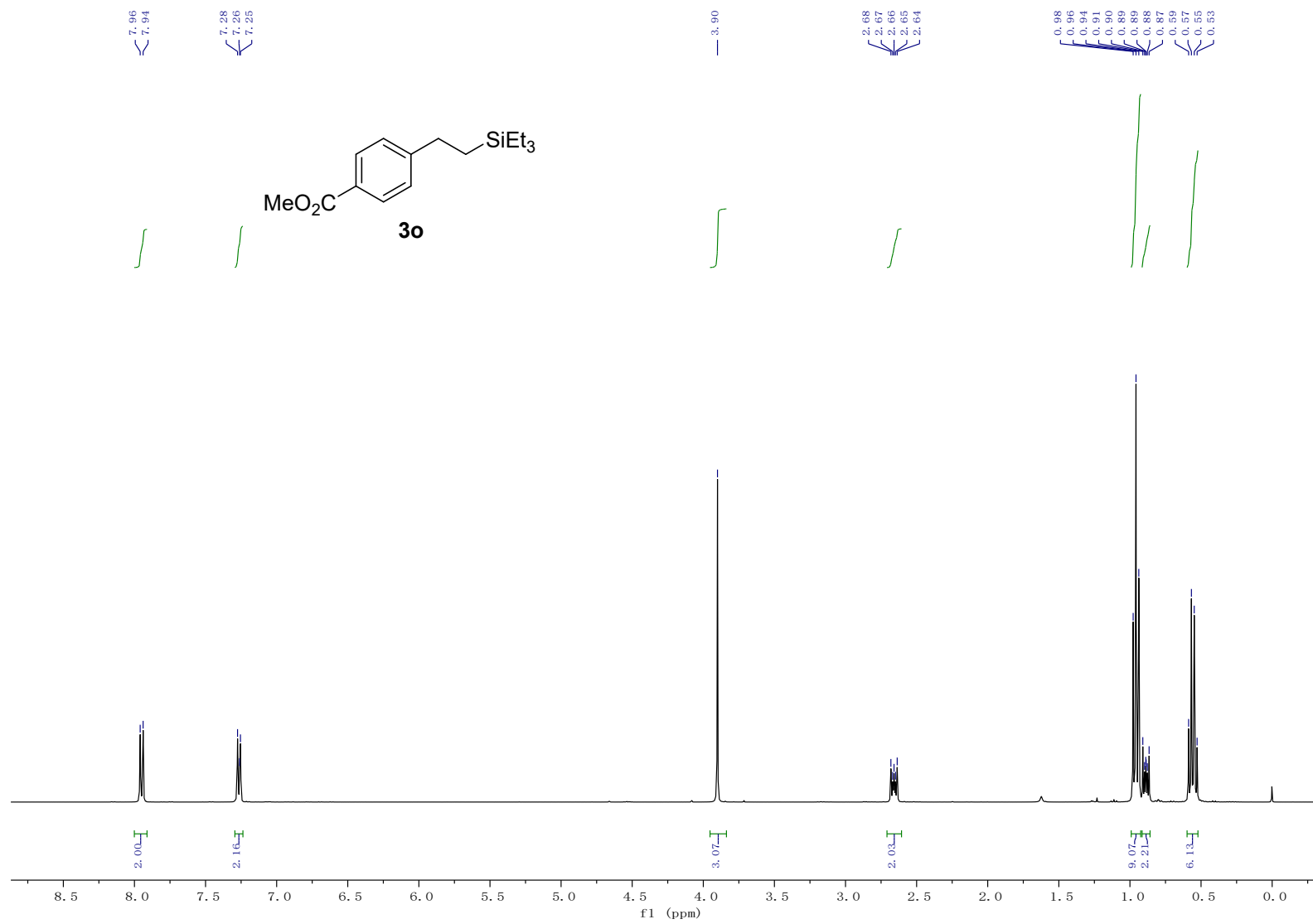


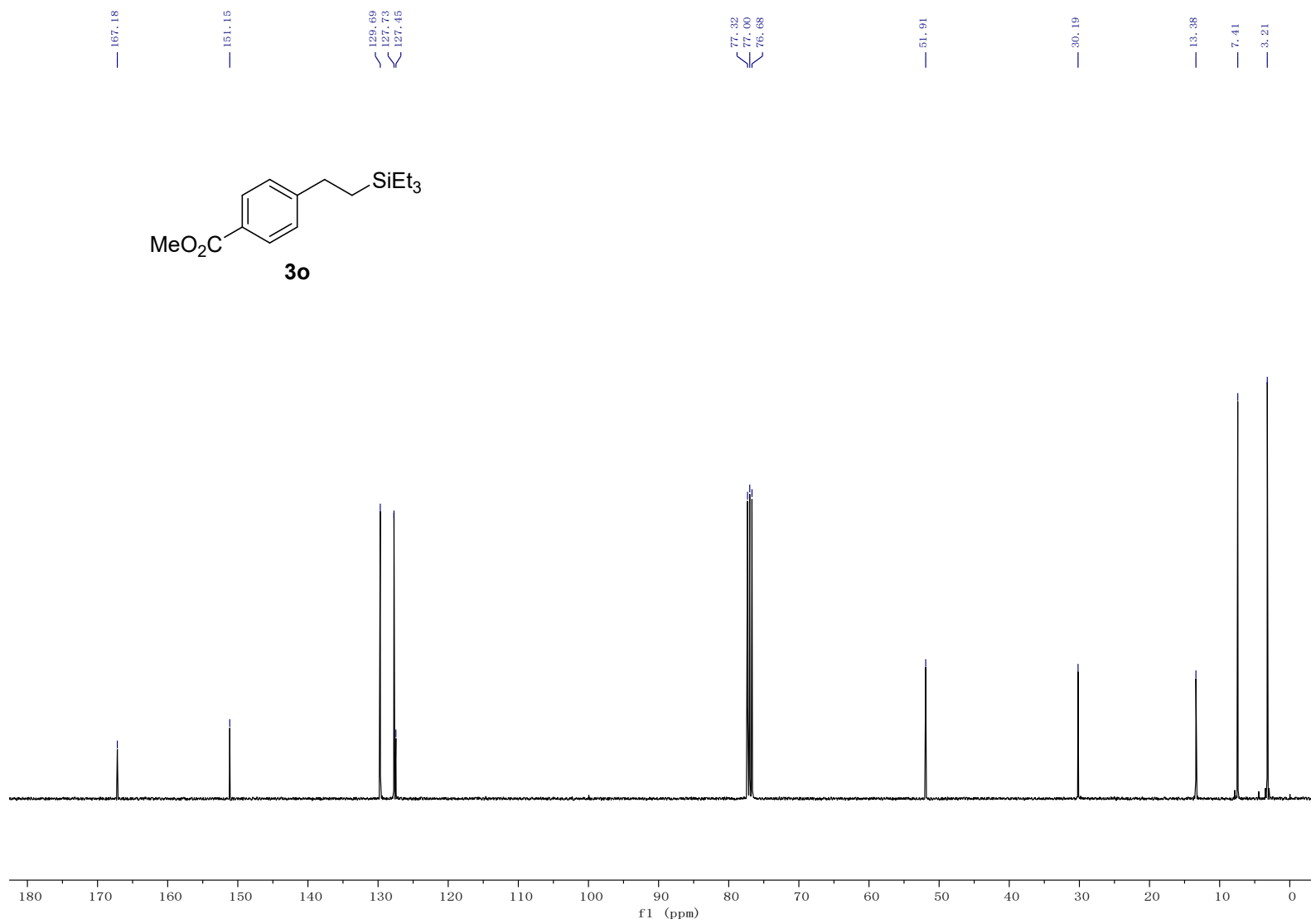
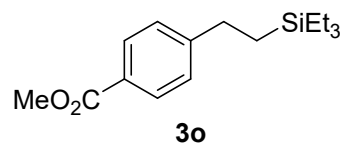


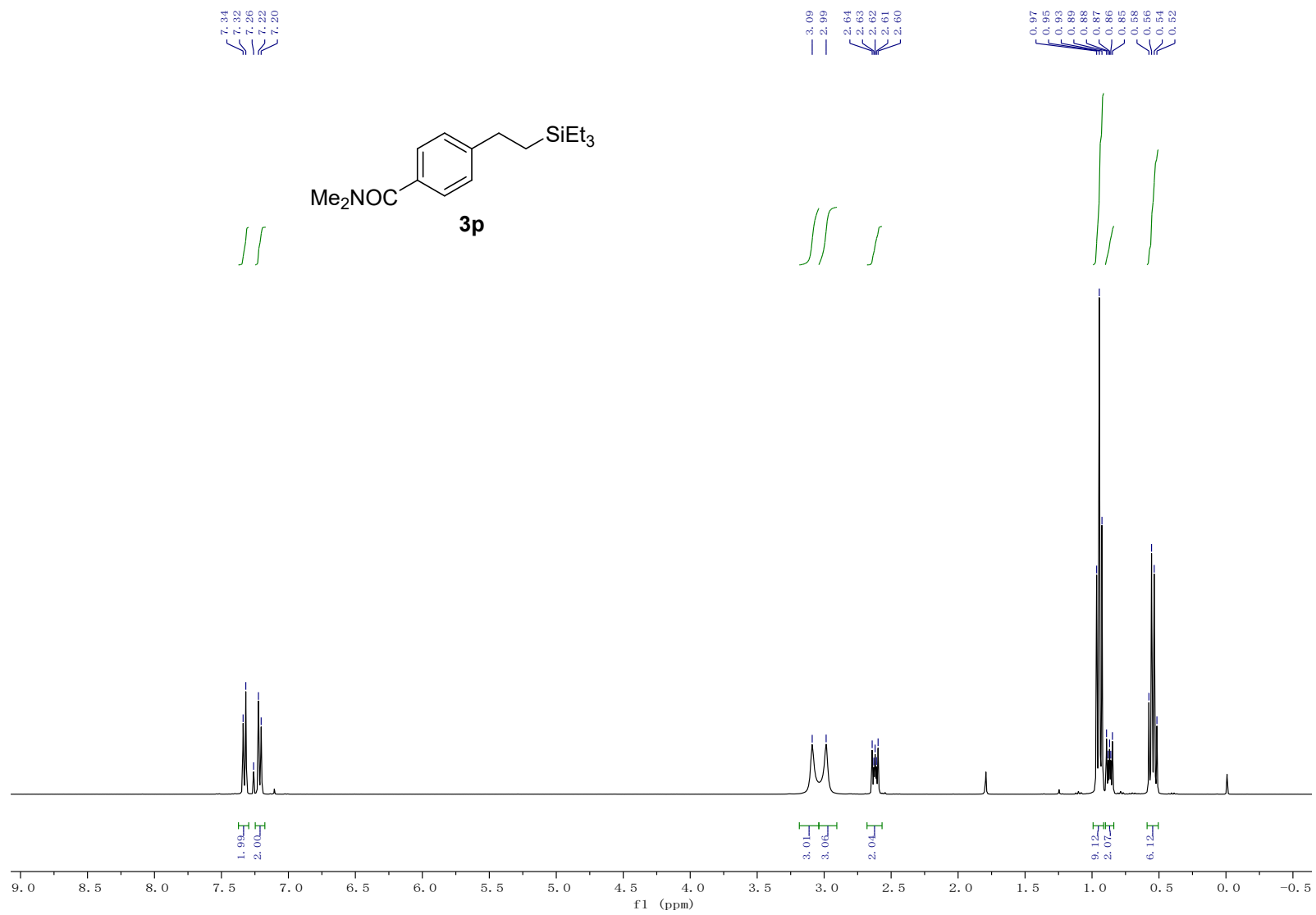


-62.22









171.79

147.23

133.41

127.57

127.21

77.32

77.00

76.68

39.62

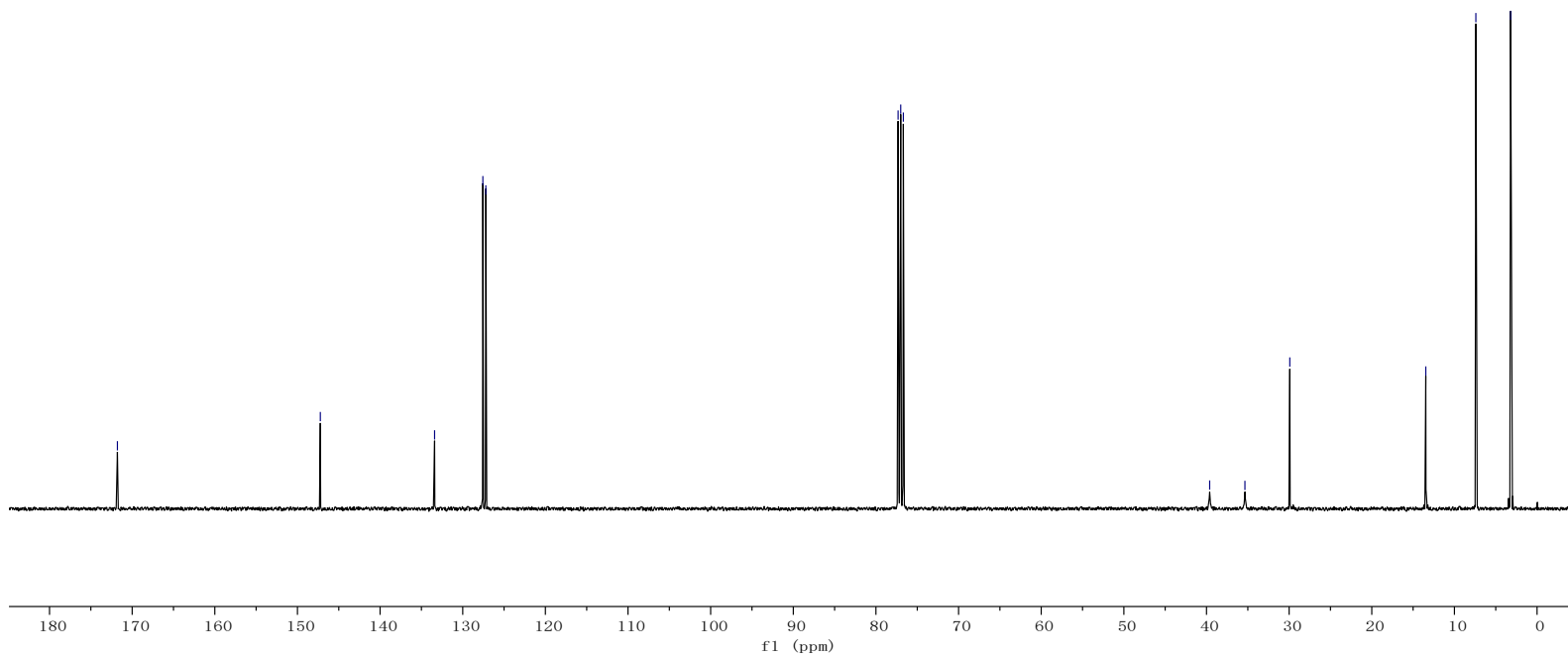
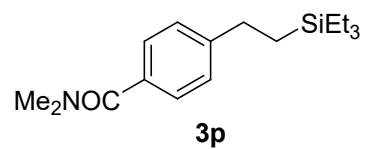
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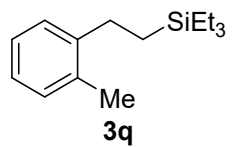
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7.41

3.20

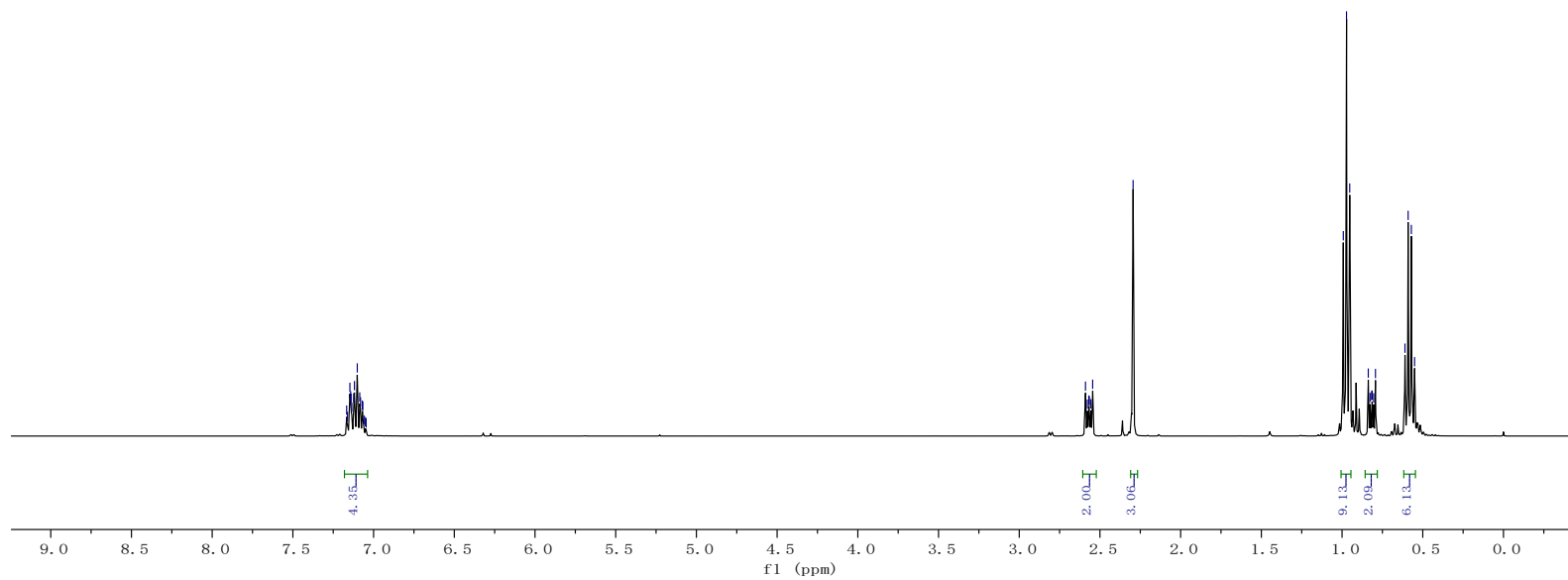


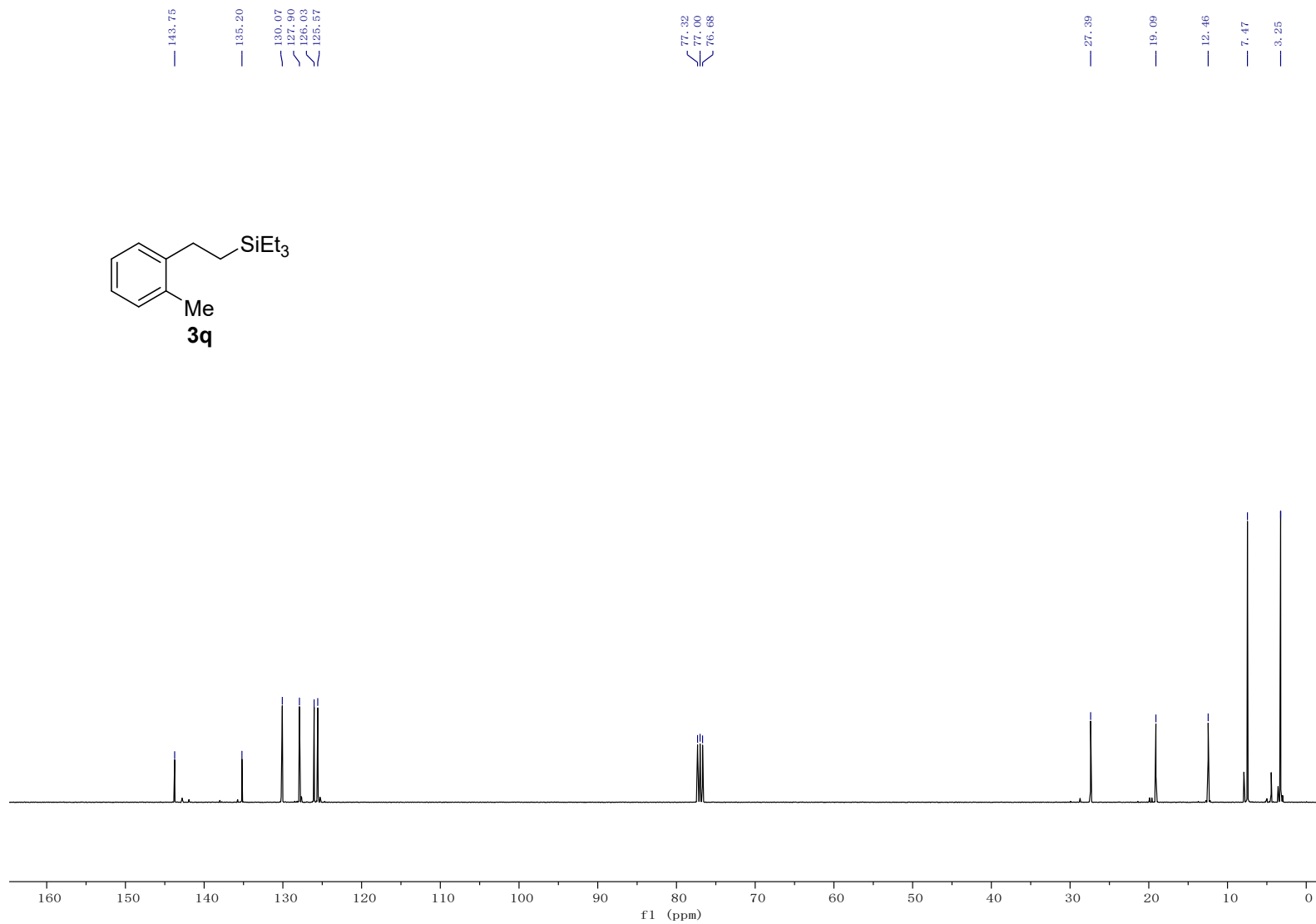
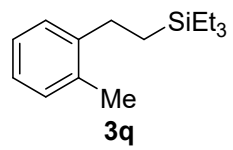


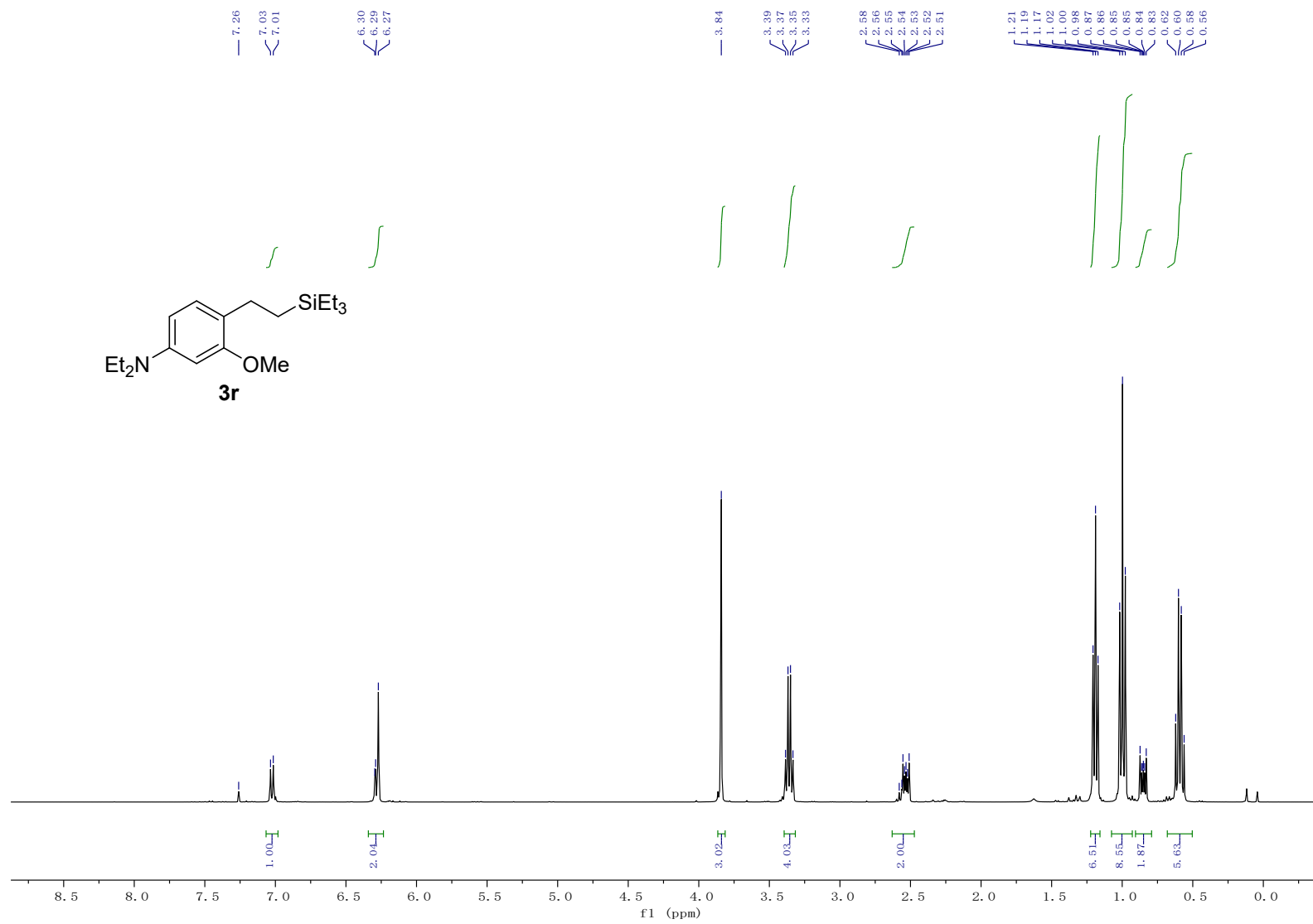
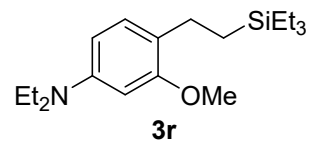
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7.12
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7.10
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7.08
7.07
7.06
7.05
7.05

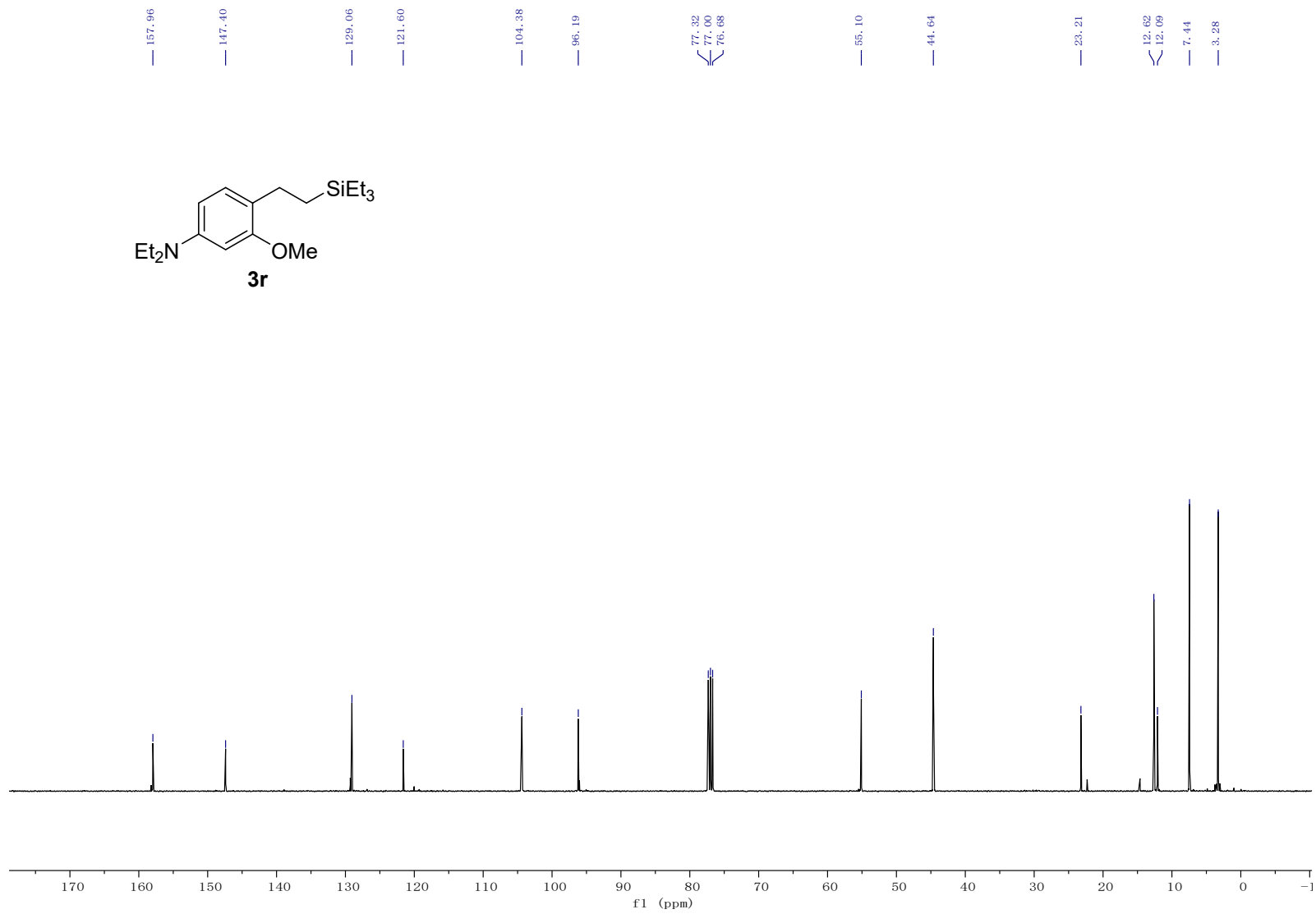
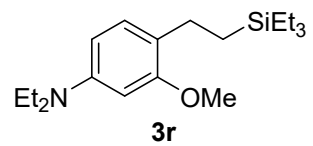
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2.29

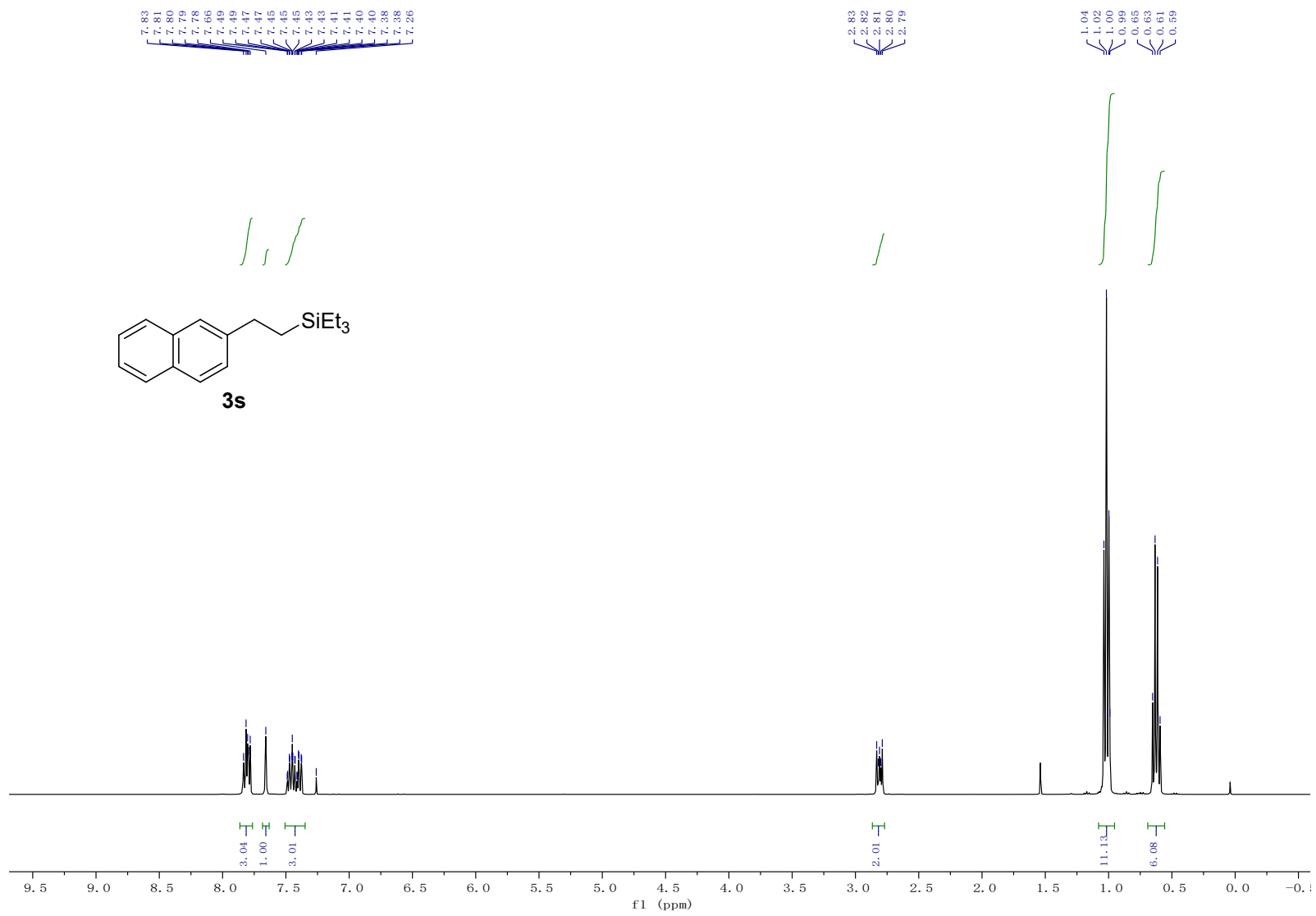
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0.55

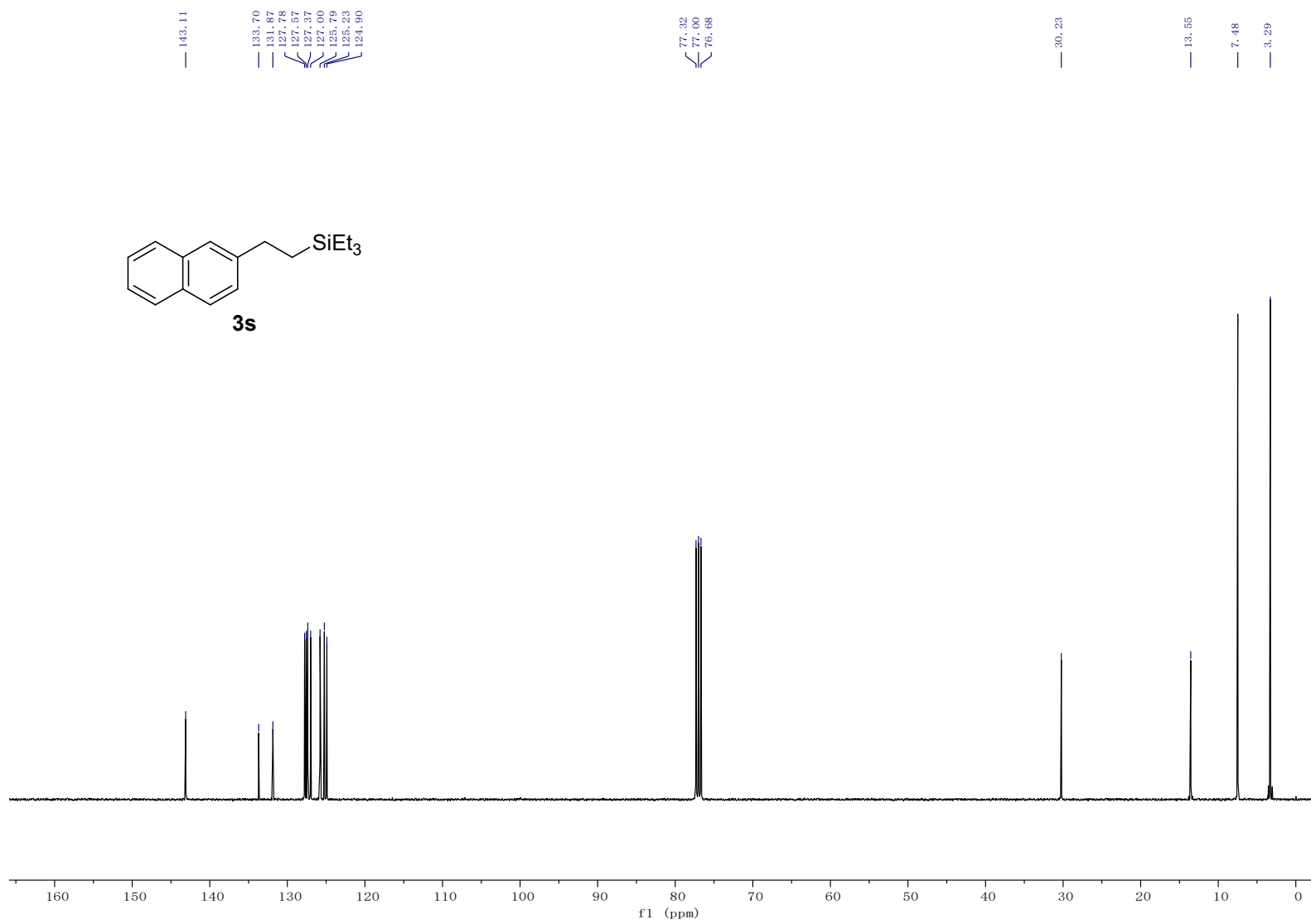
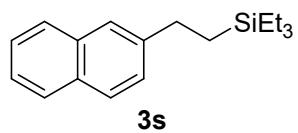


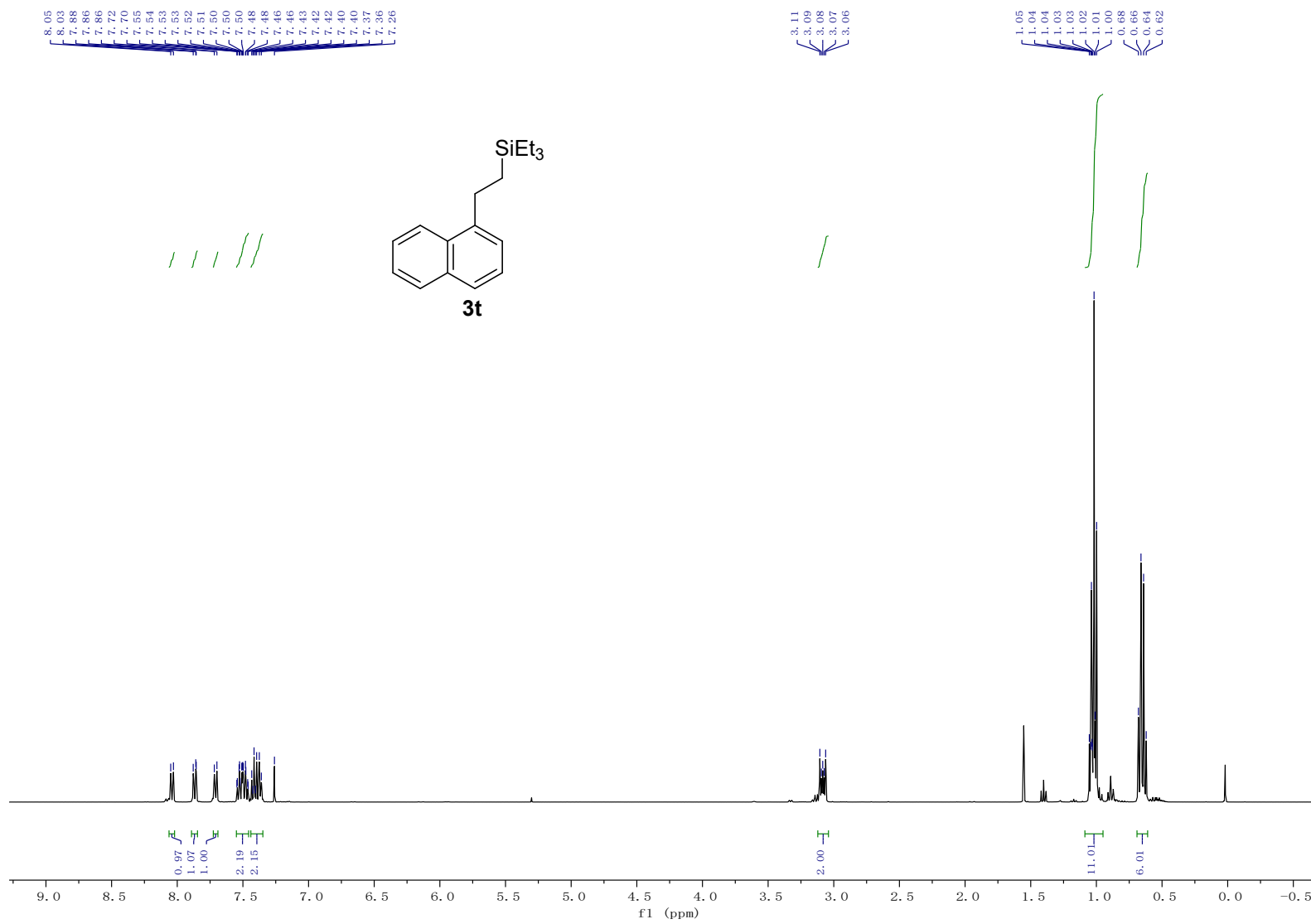


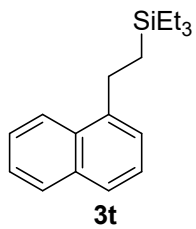












141.70
133.88
131.45
128.78
126.24
125.67
125.61
125.34
124.74
123.63

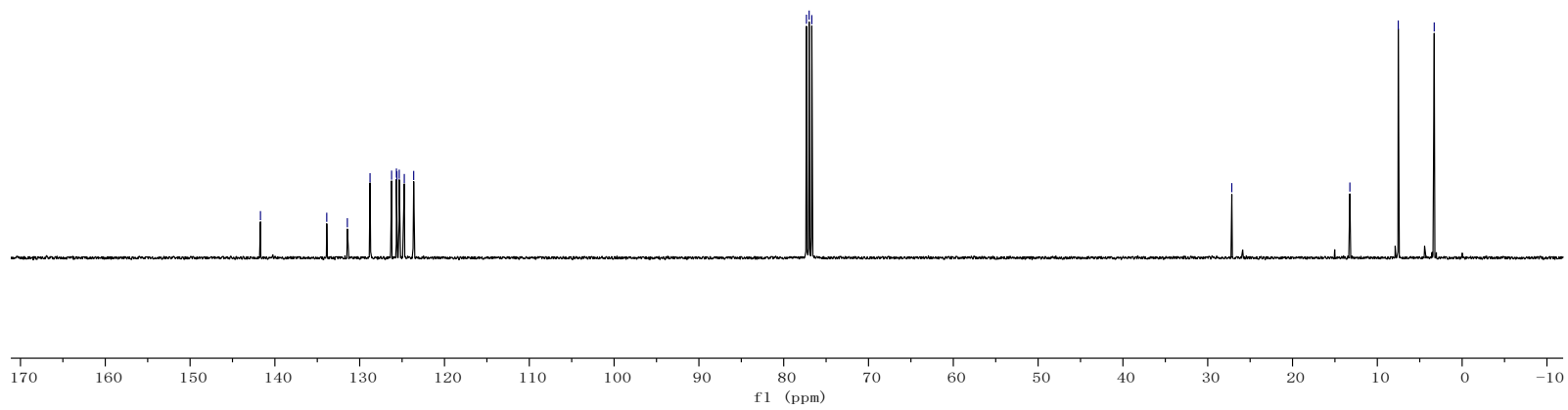
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77.00
76.68

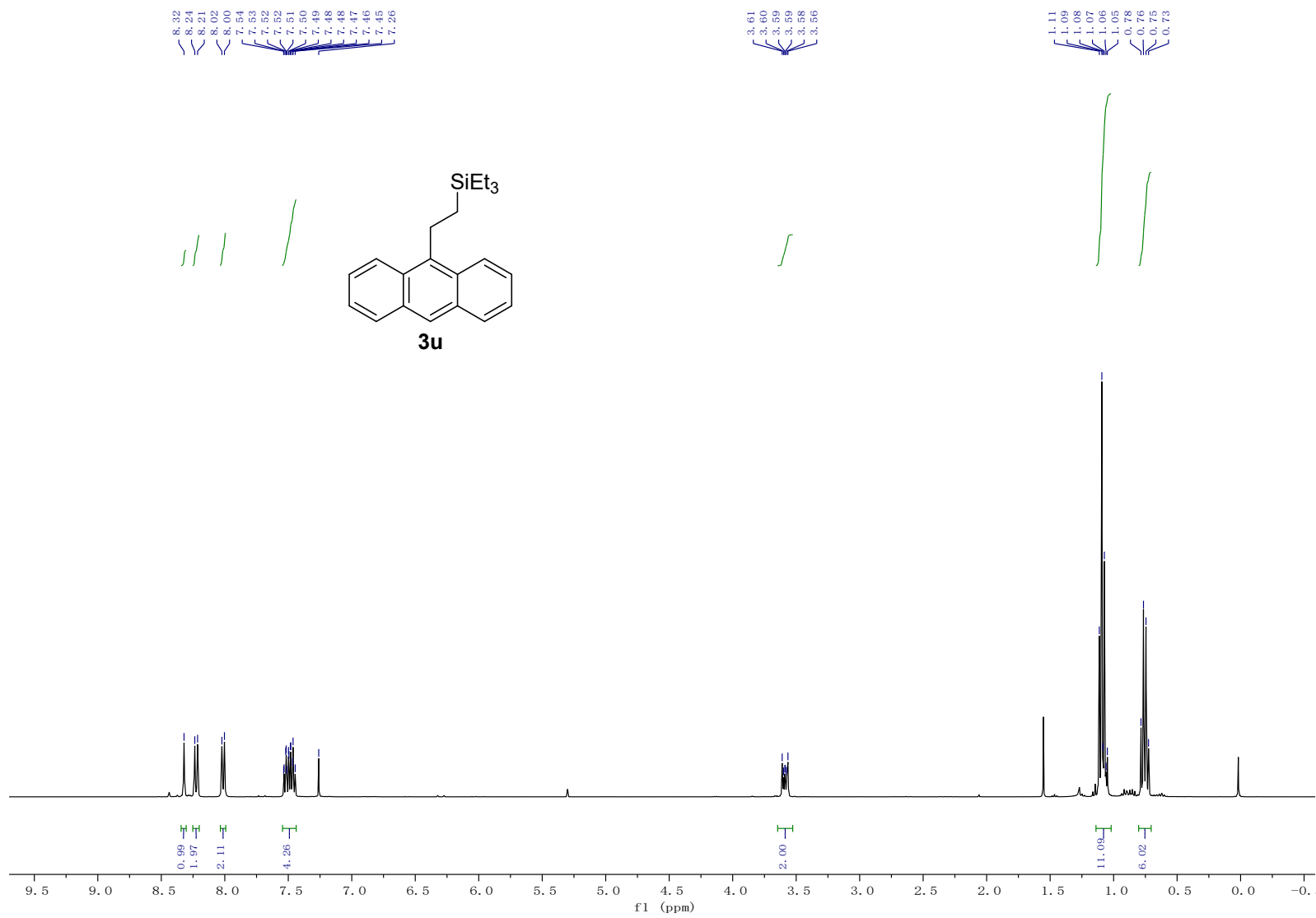
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13.24

7.53

3.29





138.24
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124.76
124.10

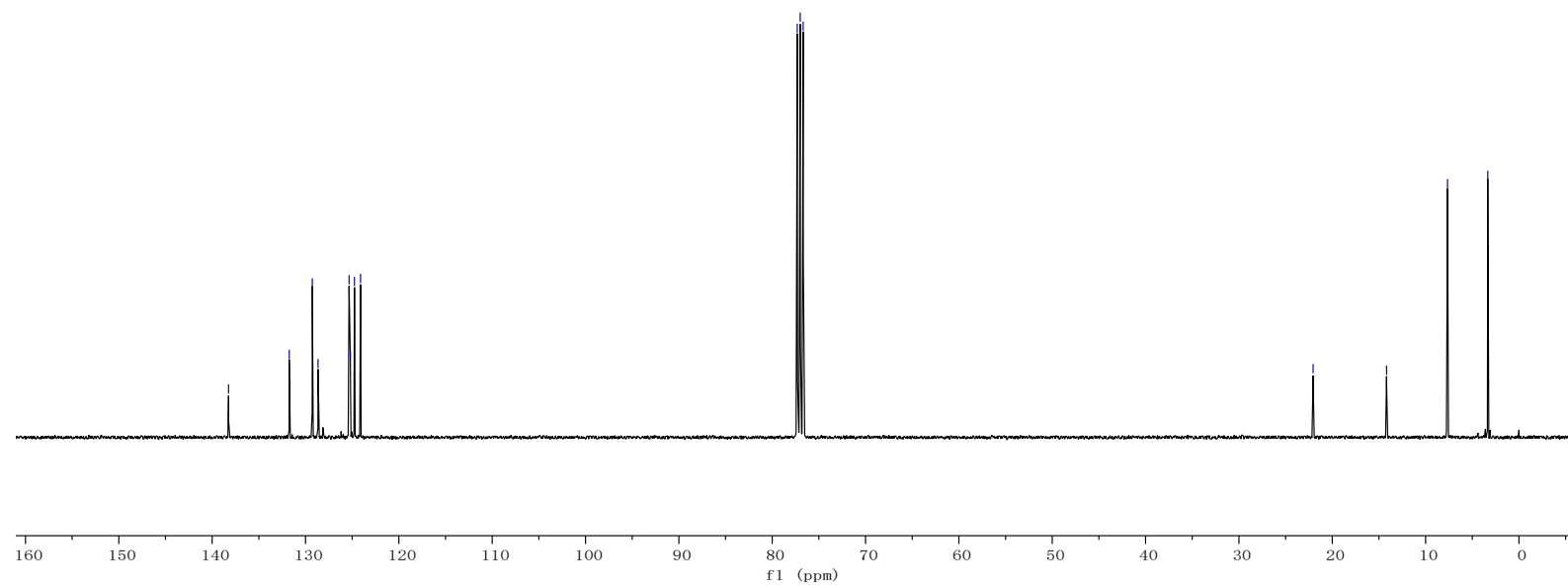
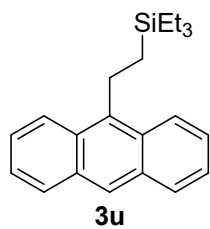
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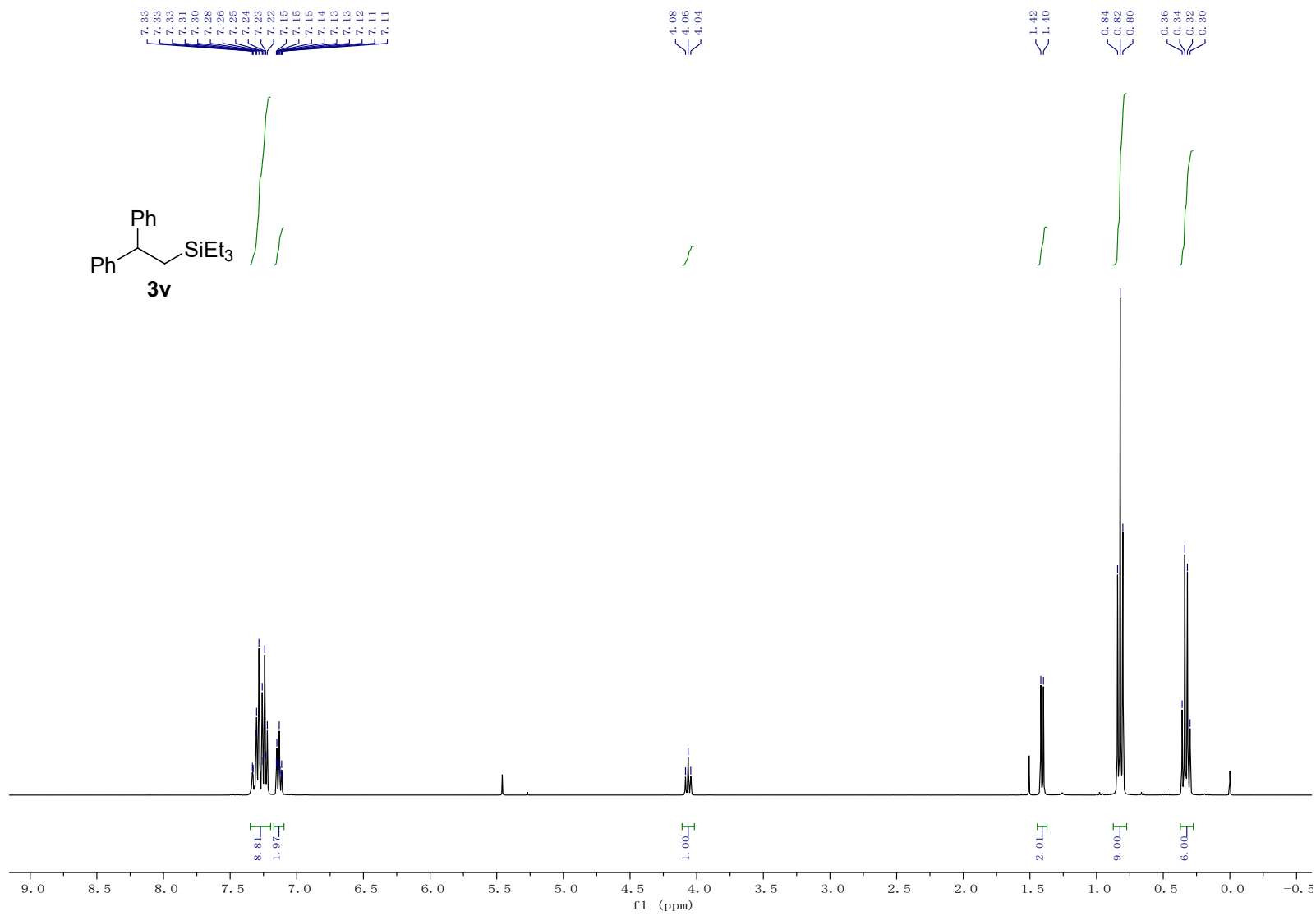
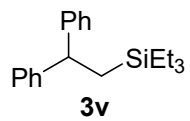
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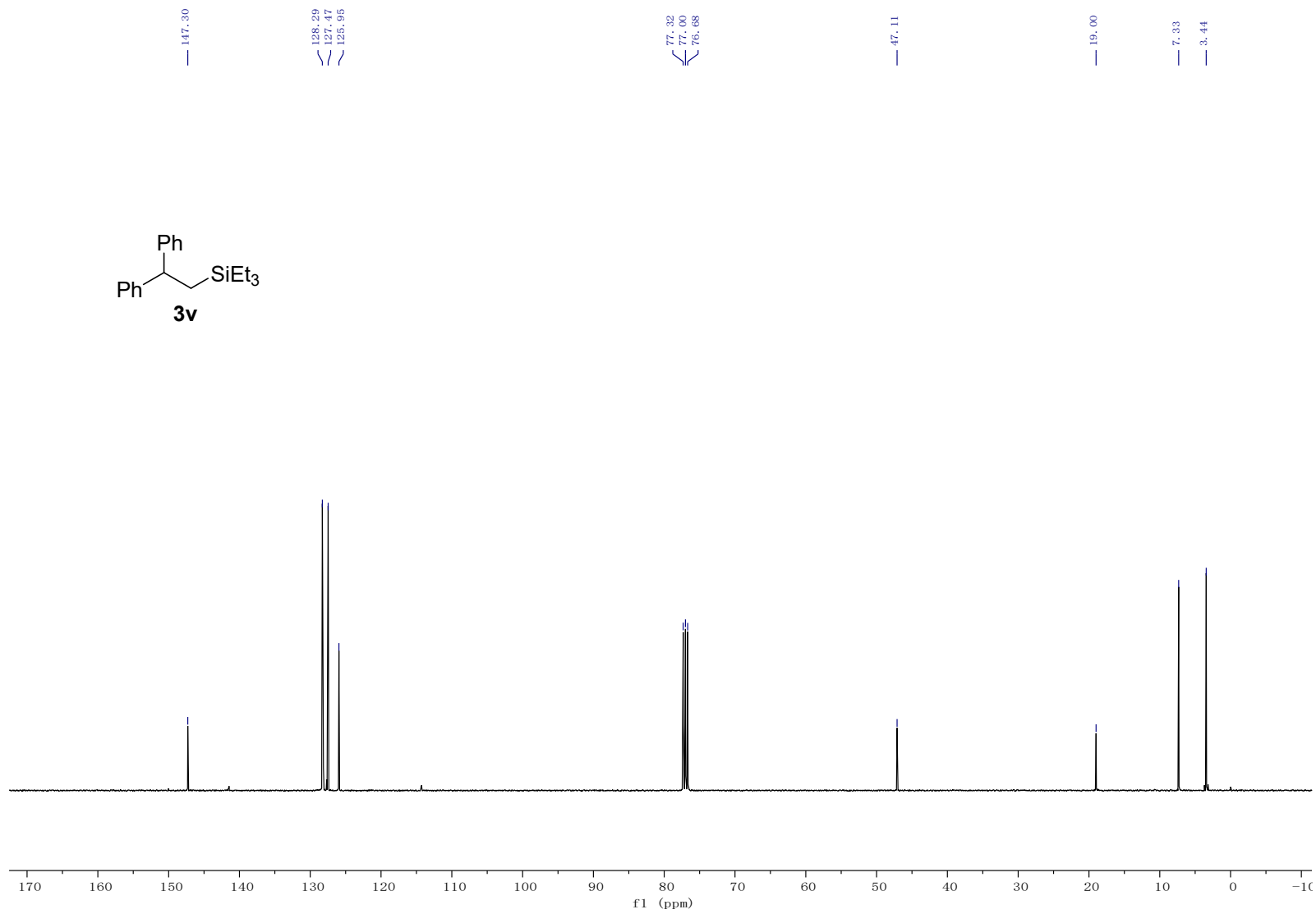
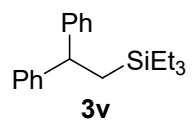
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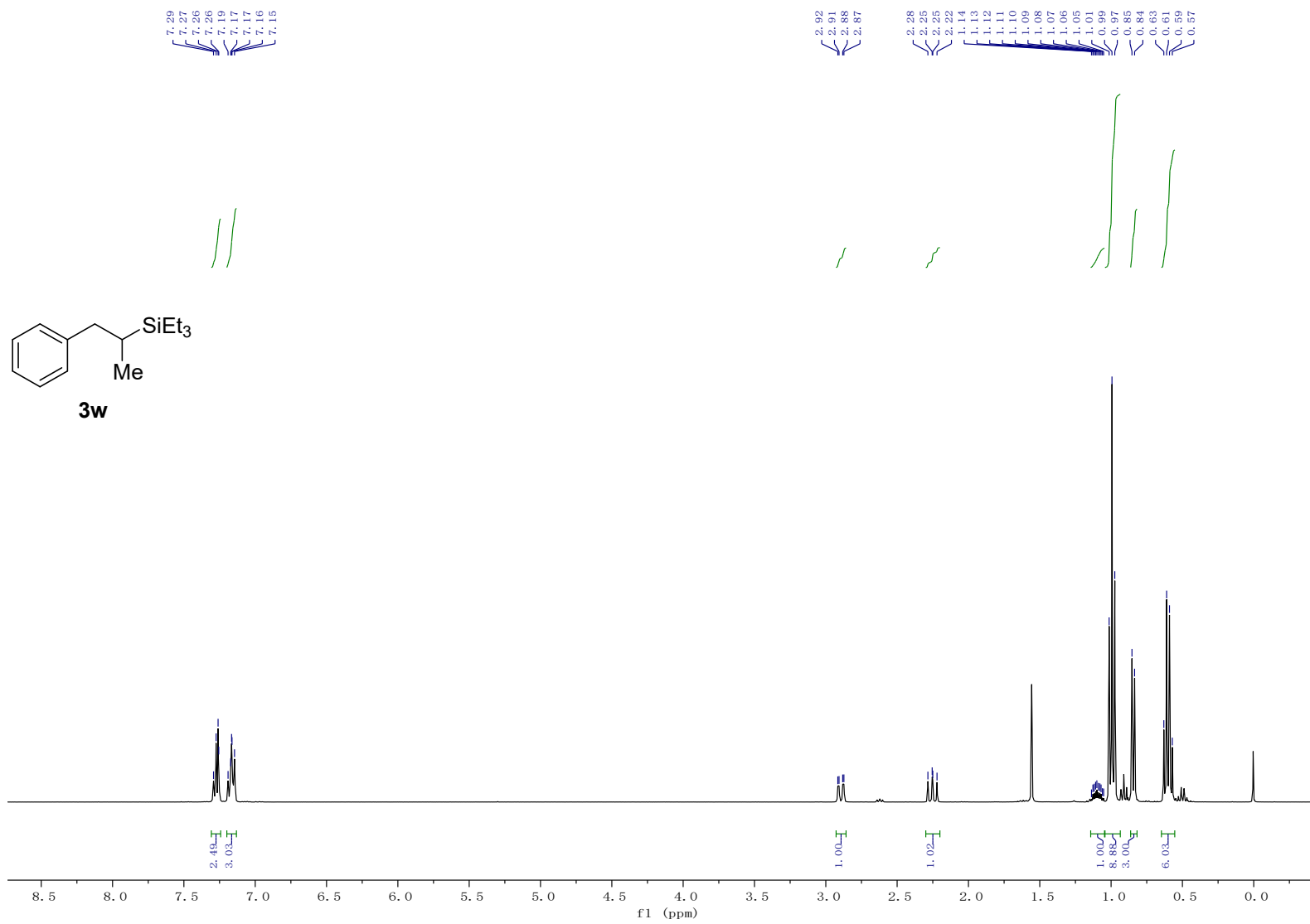
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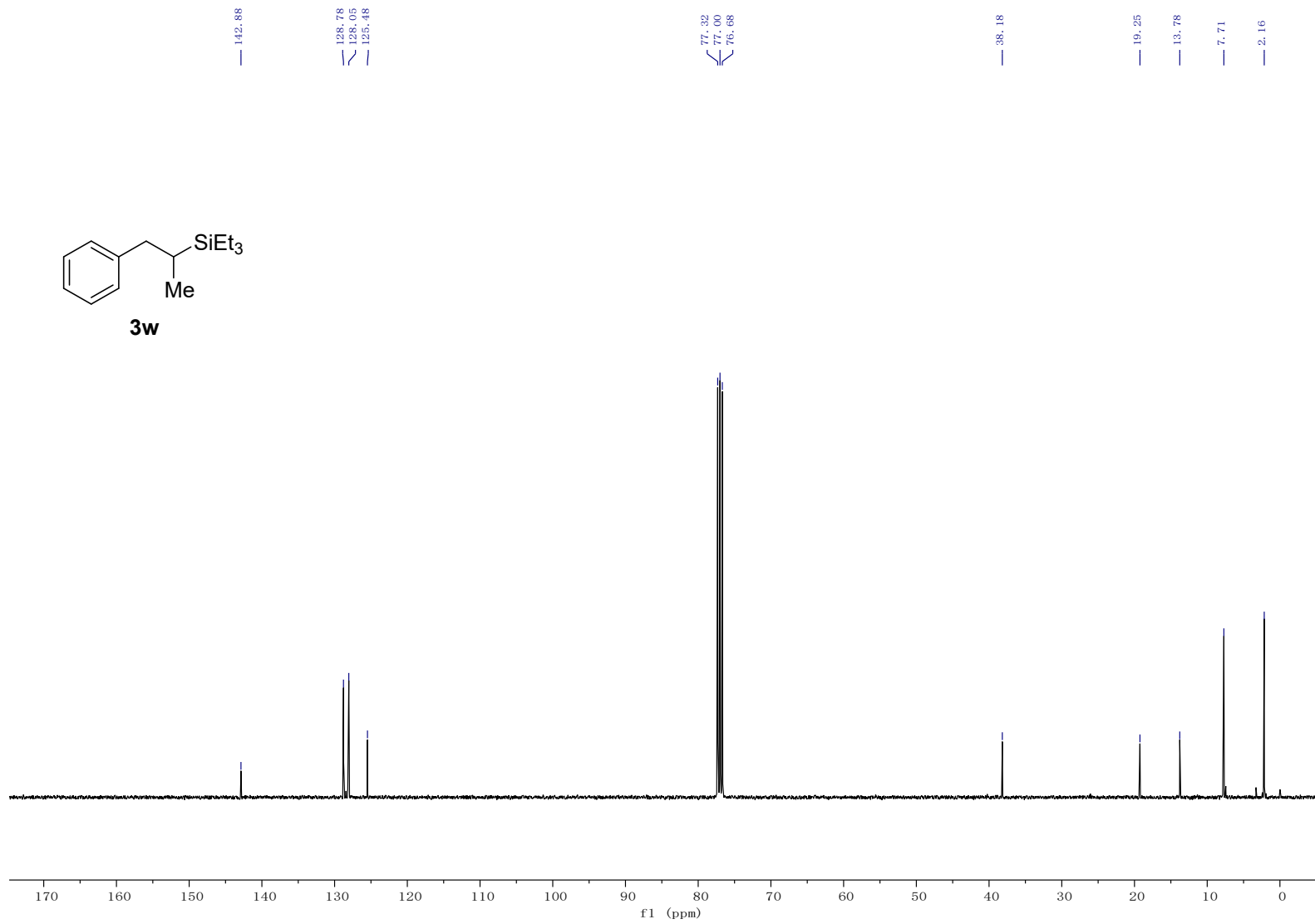
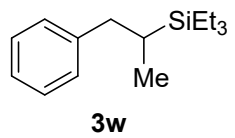
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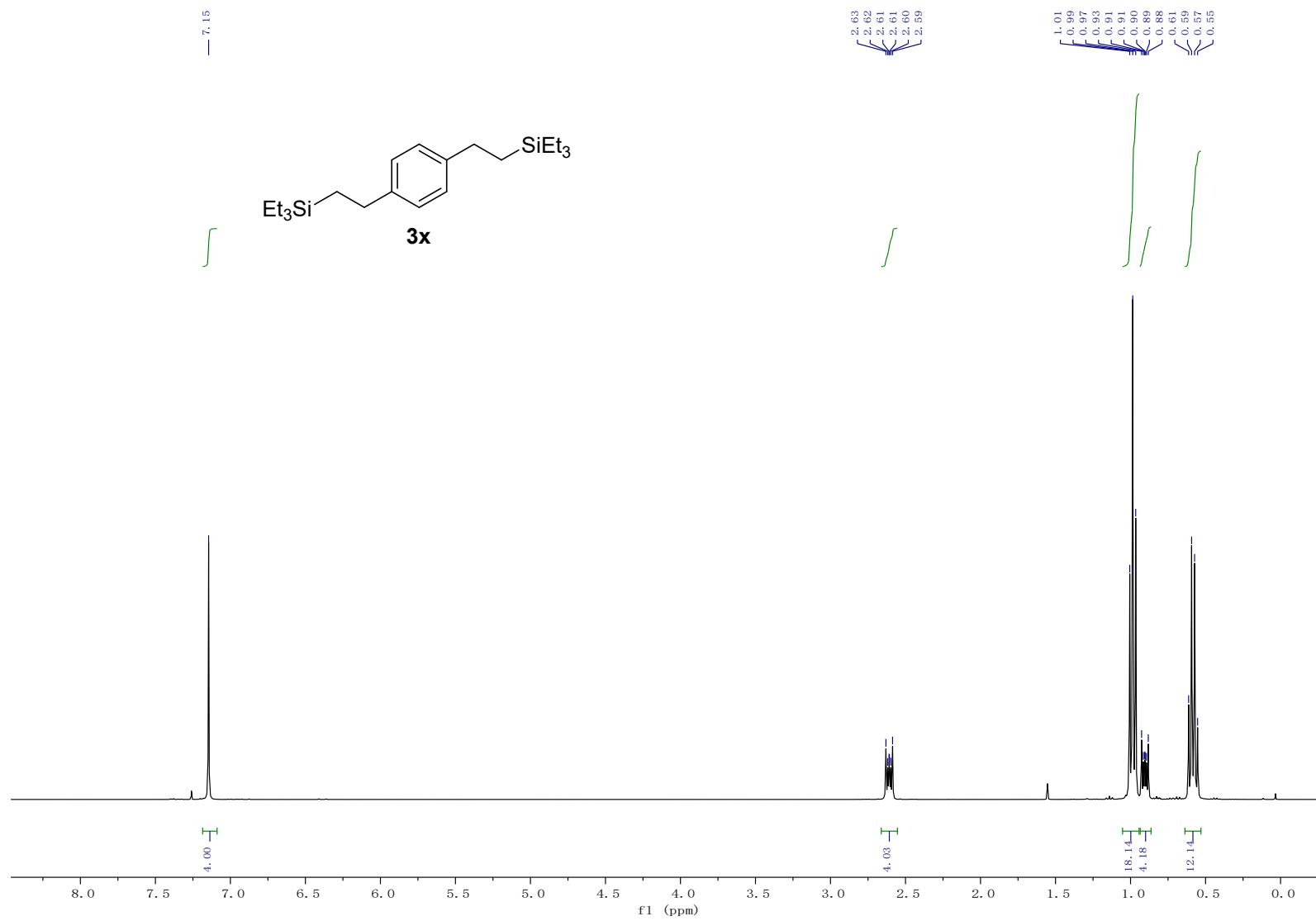


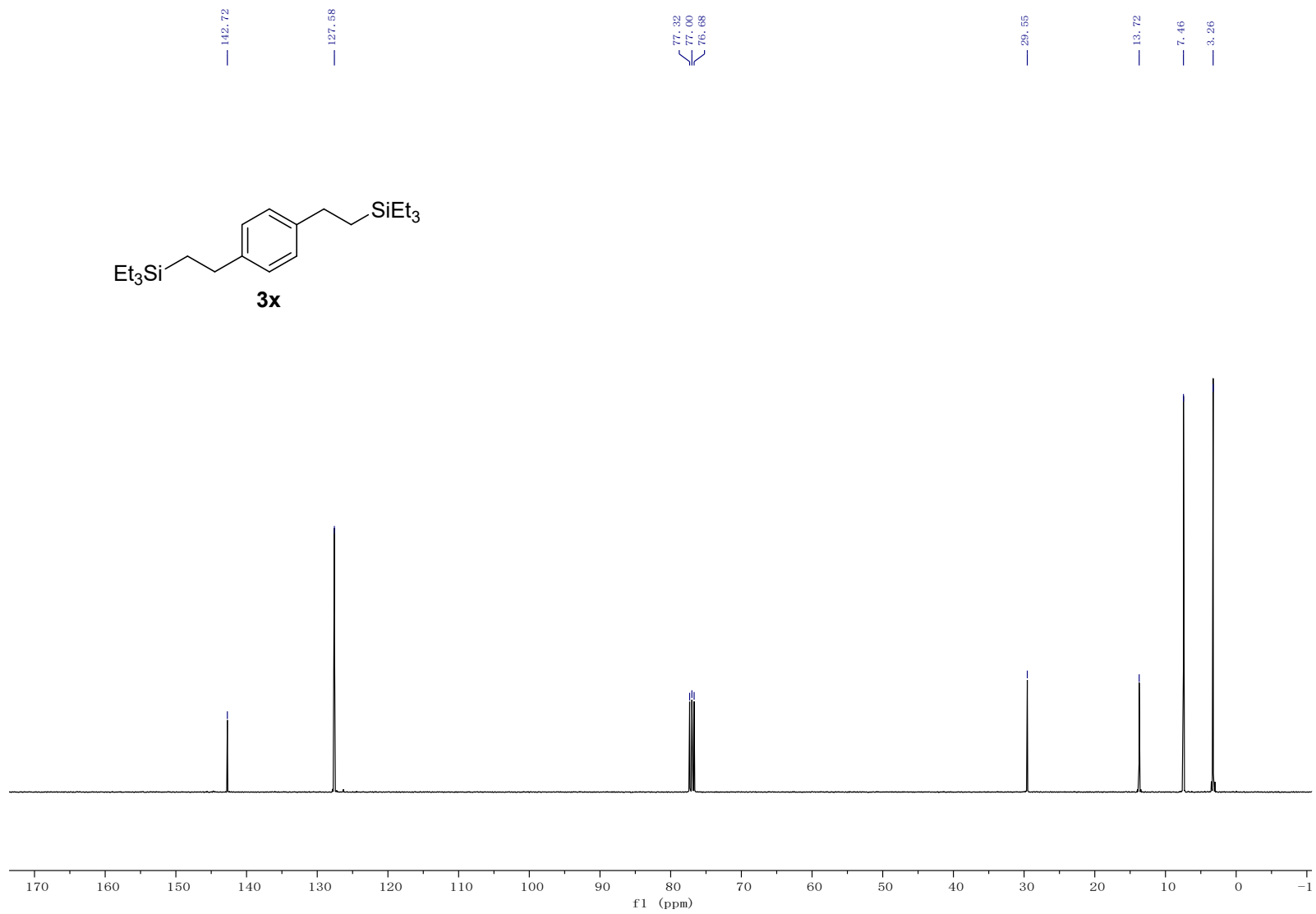
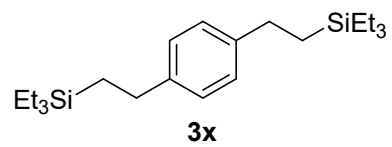


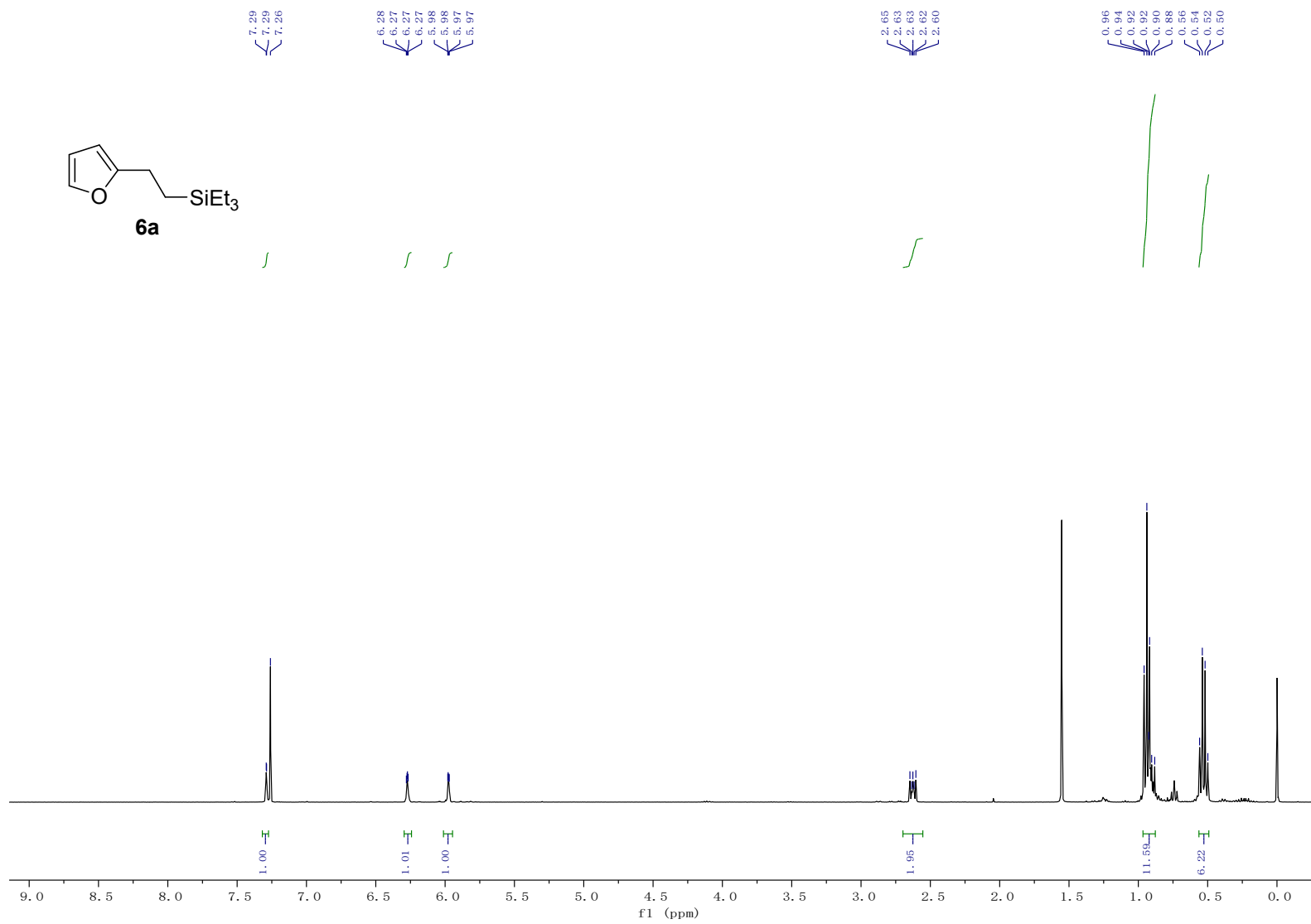
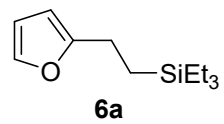


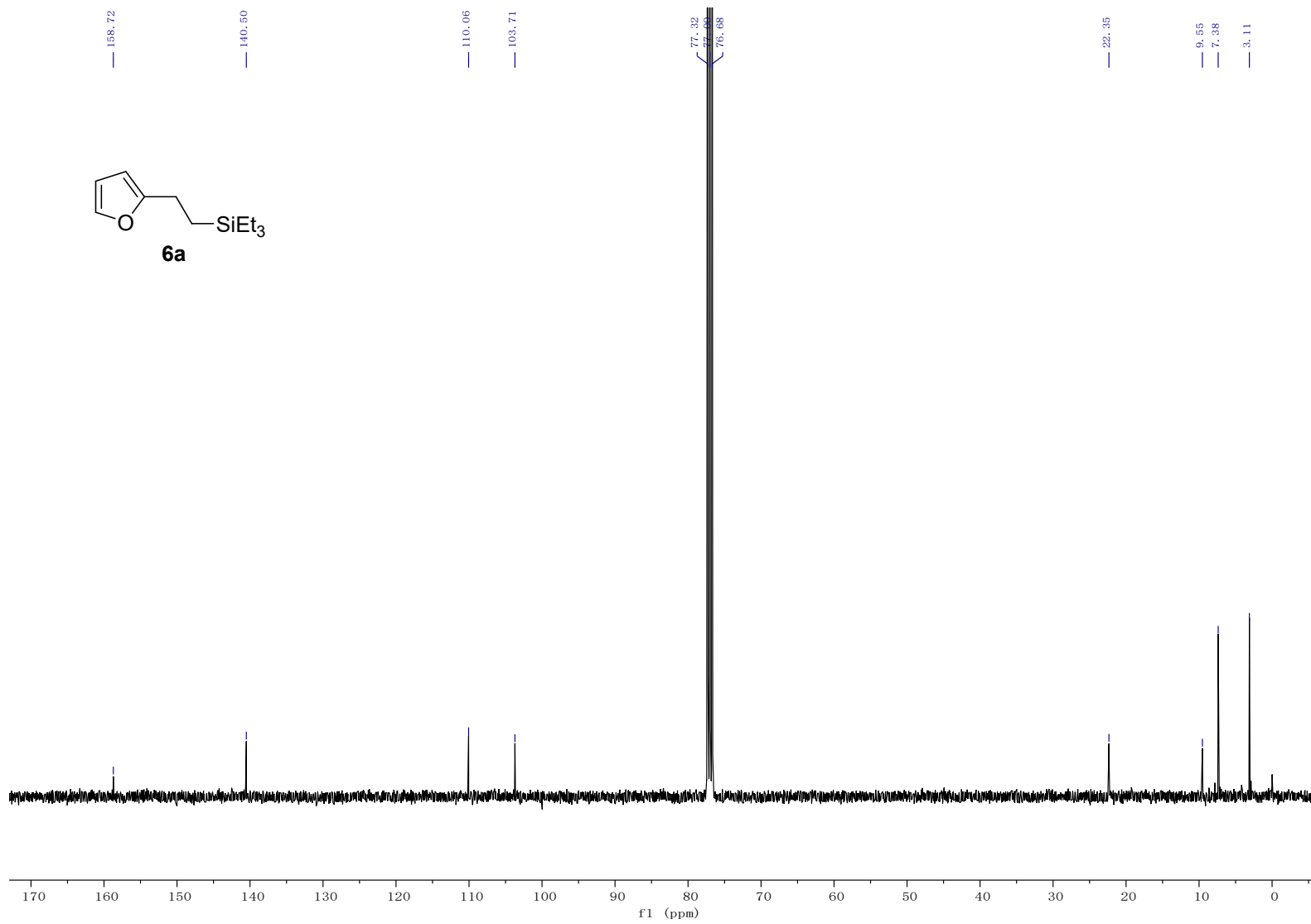
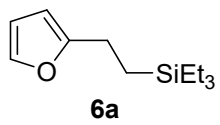


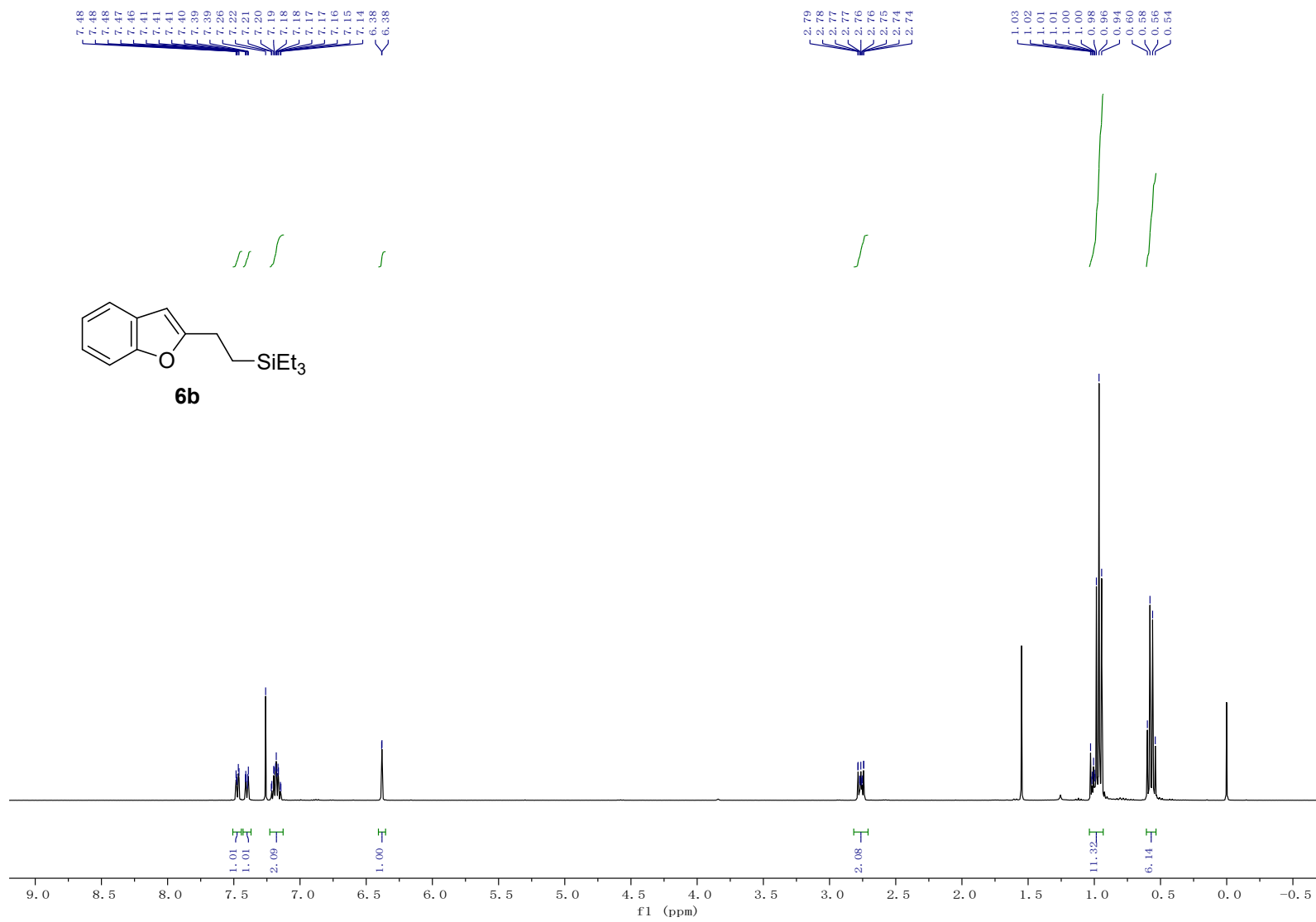


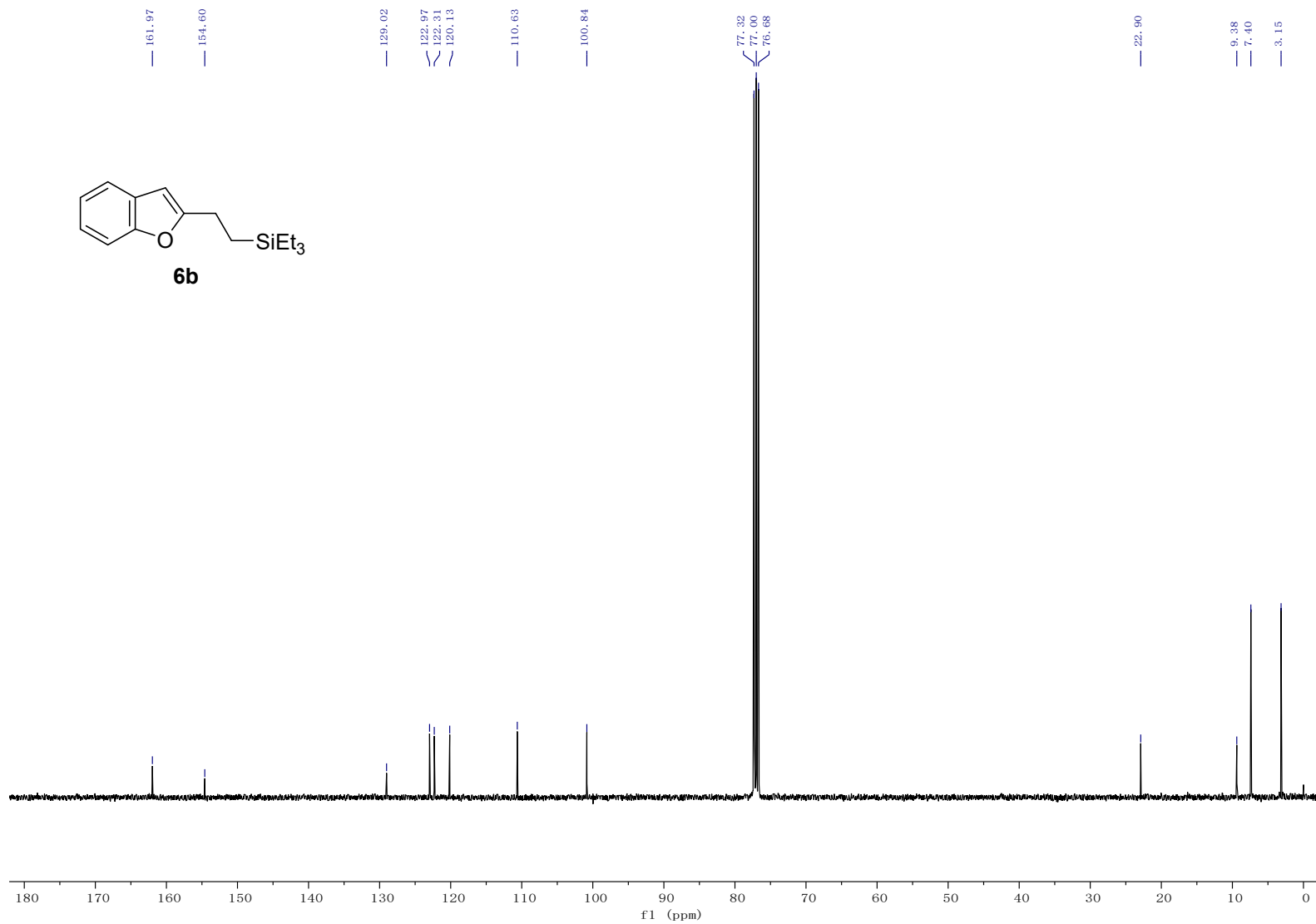
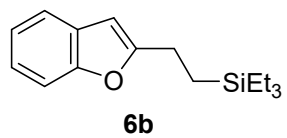


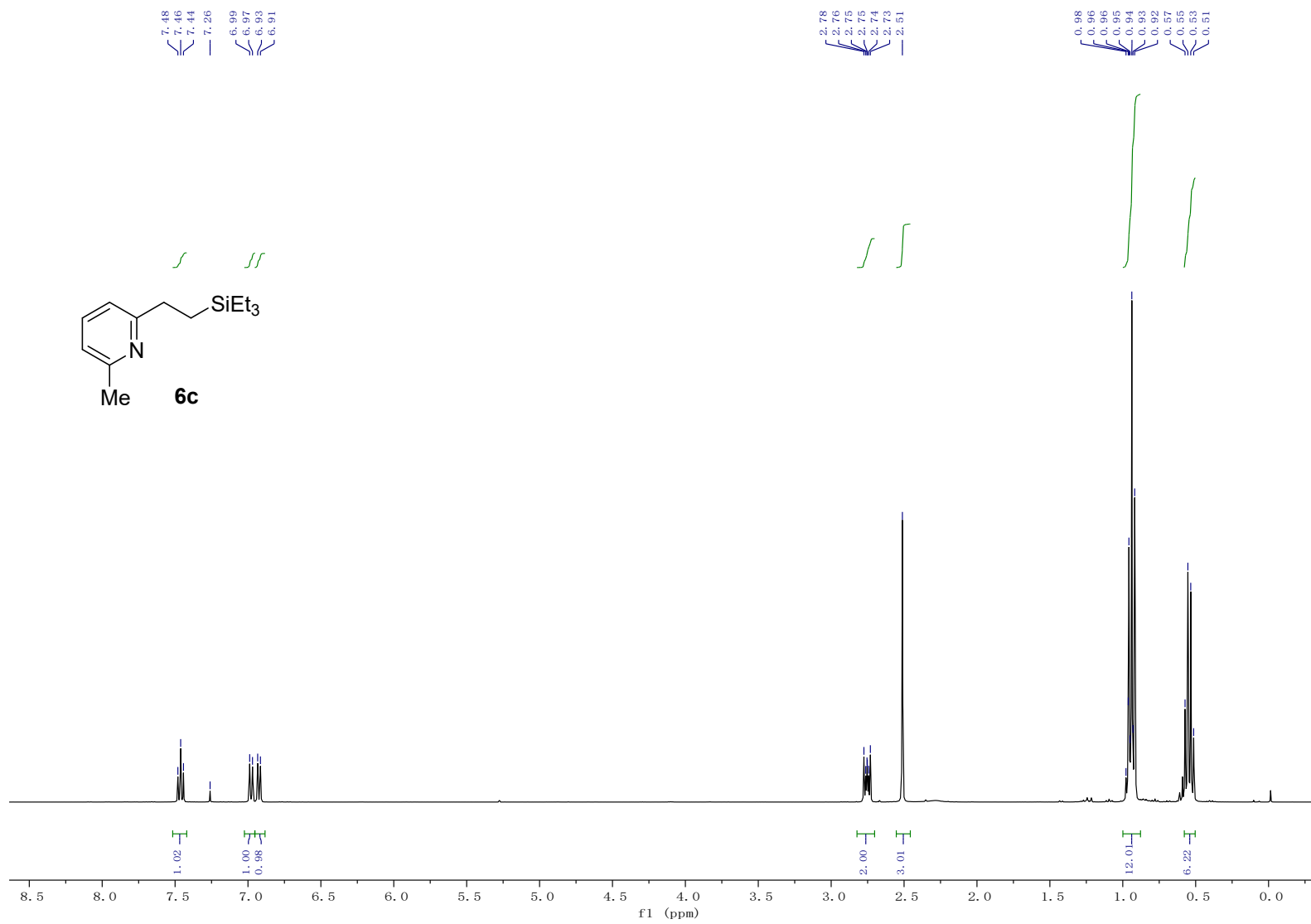


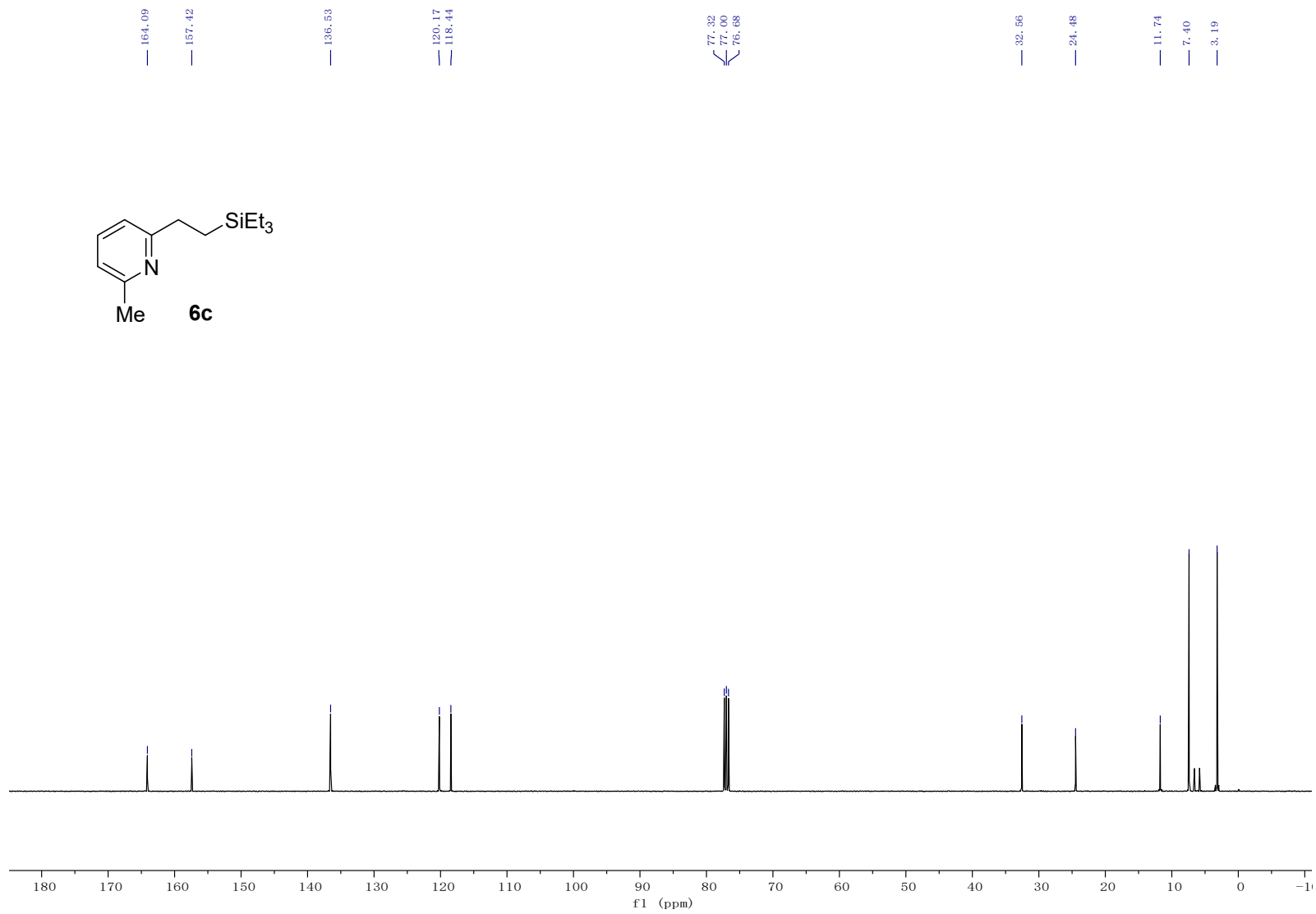
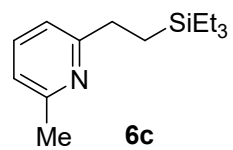


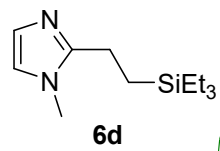










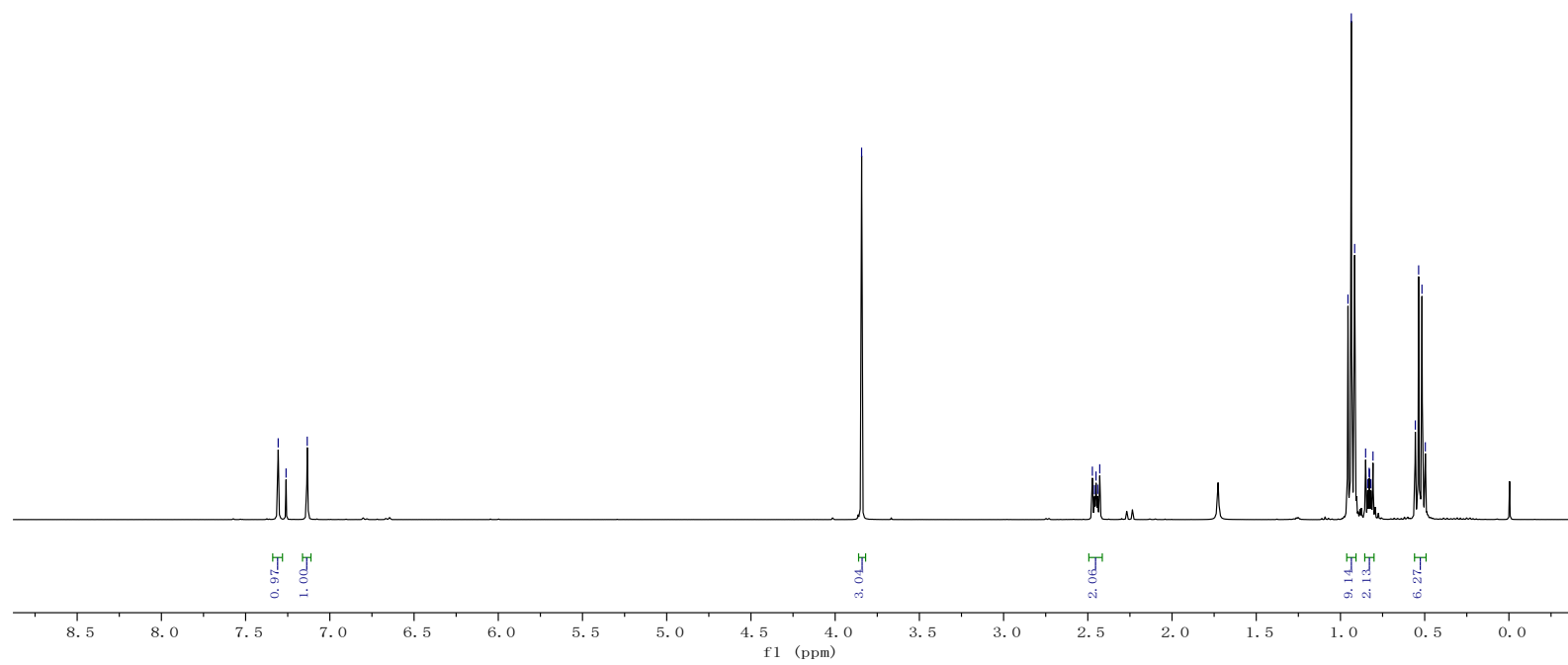


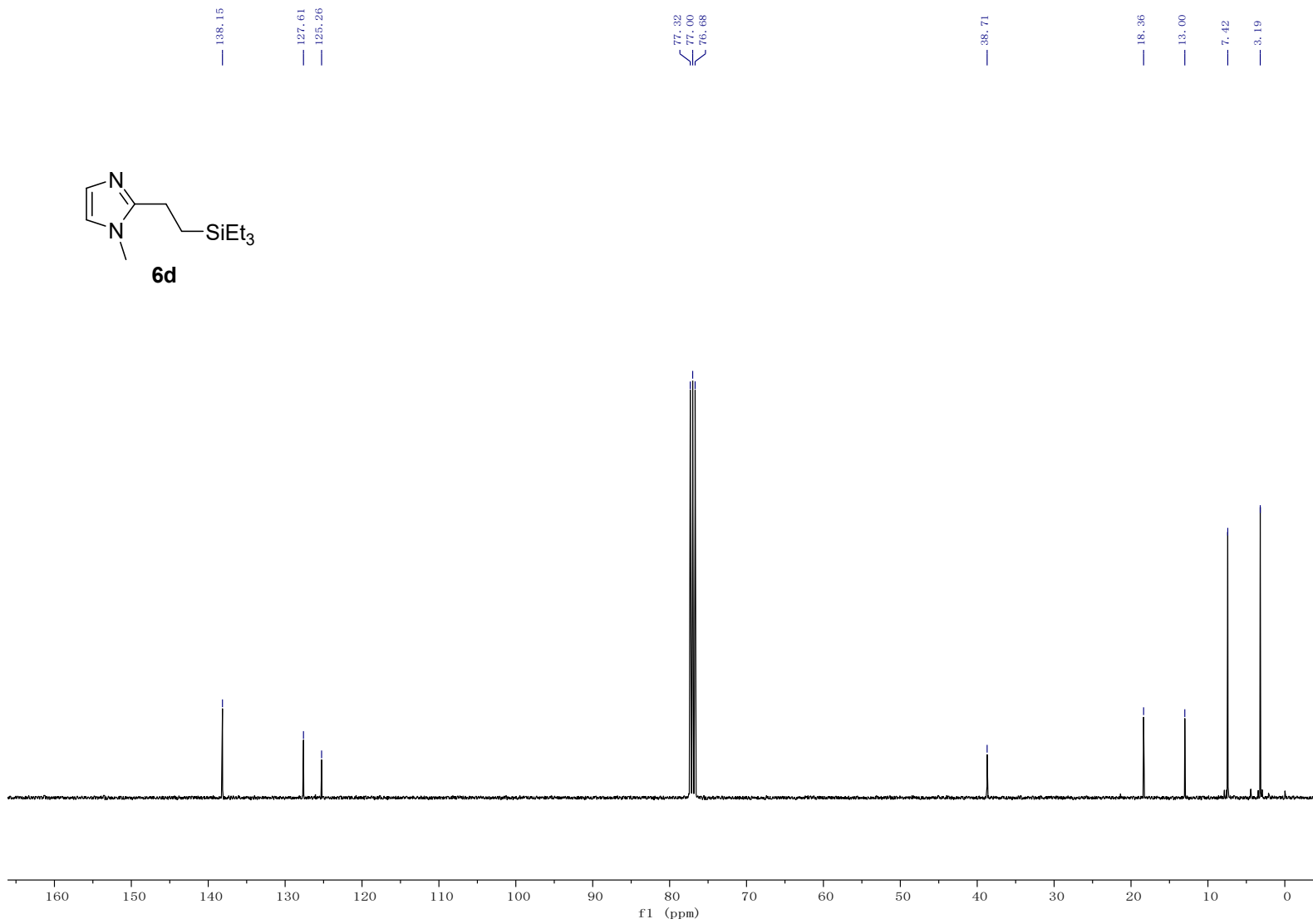
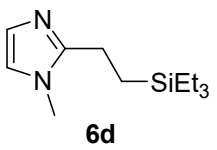
7.31
7.26
7.13

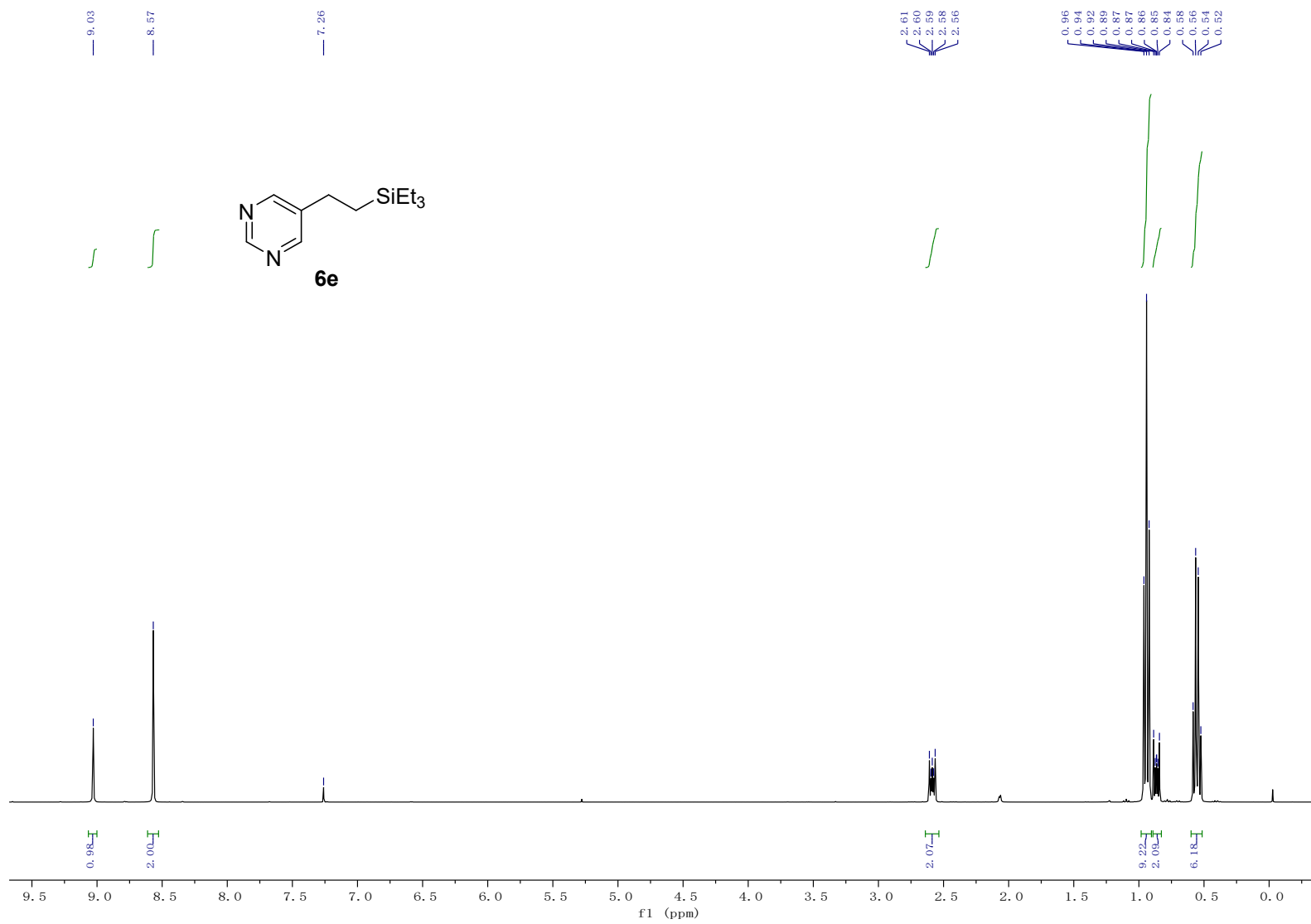
3.84

2.47
2.46
2.45
2.44
2.43

0.96
0.94
0.92
0.85
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0.83
0.82
0.81
0.56
0.54
0.52
0.50







156.43
136.14

137.95

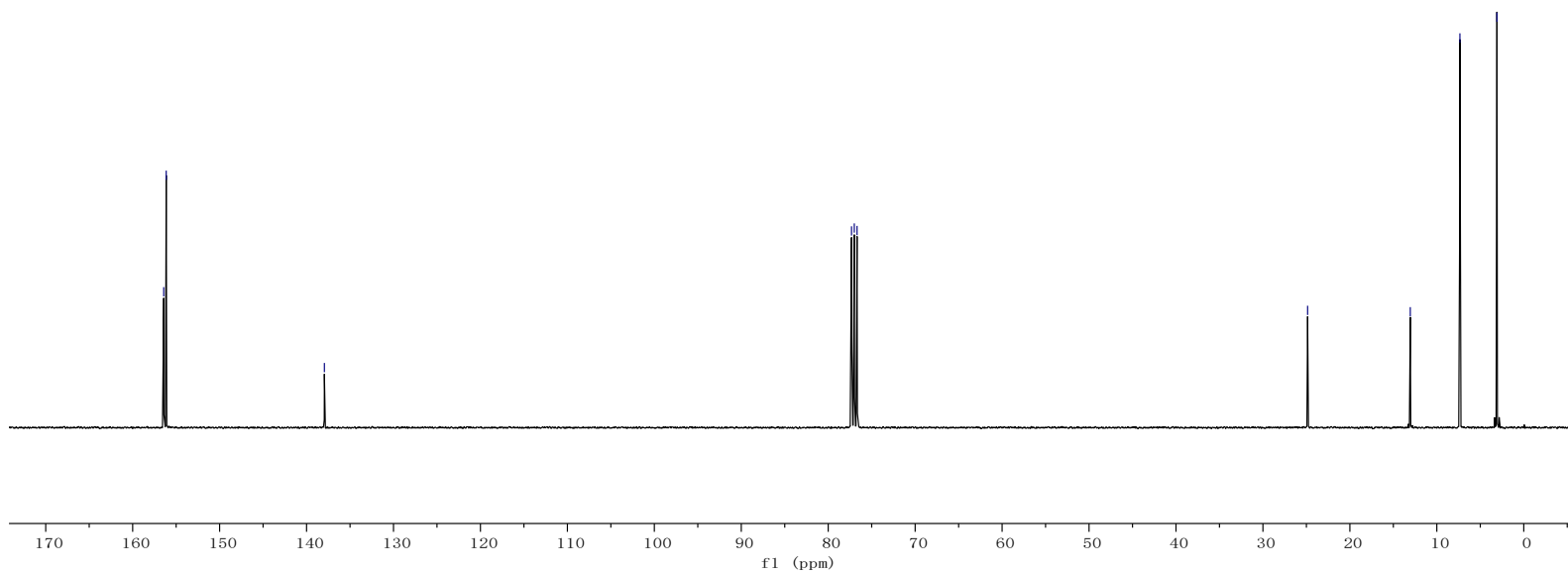
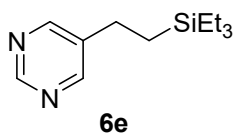
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77.00
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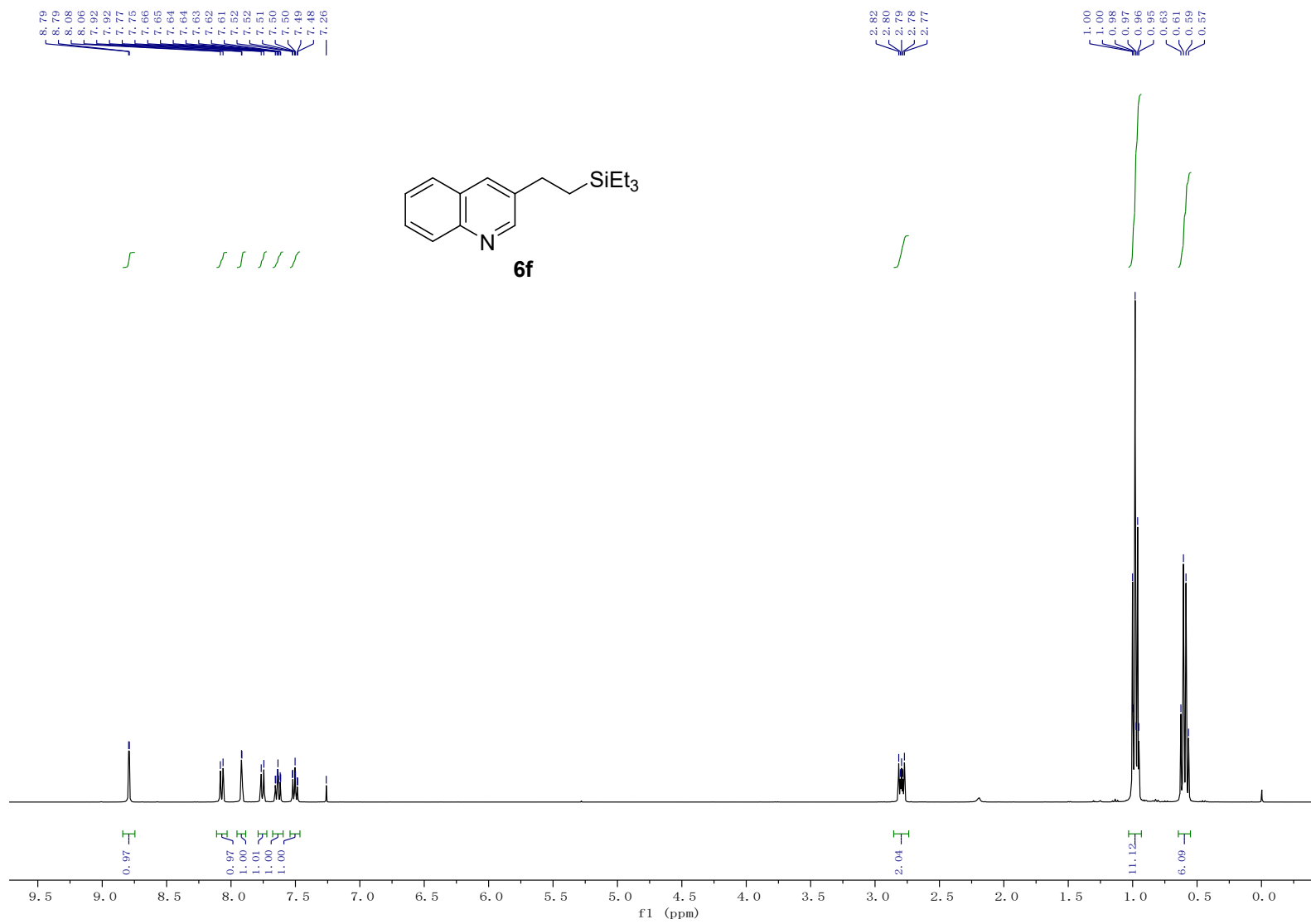
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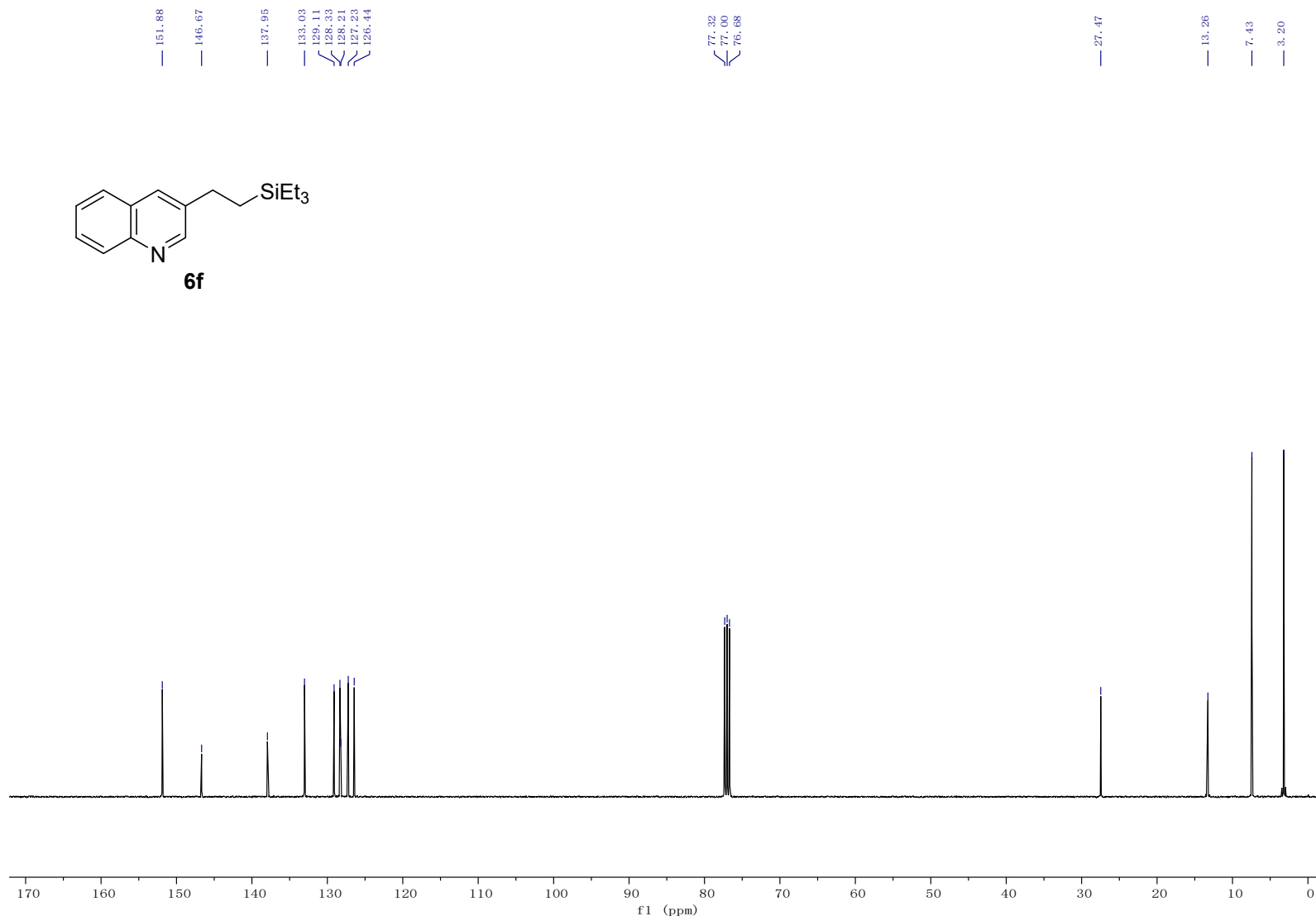
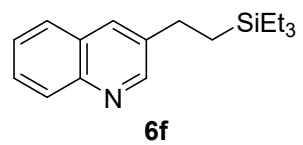
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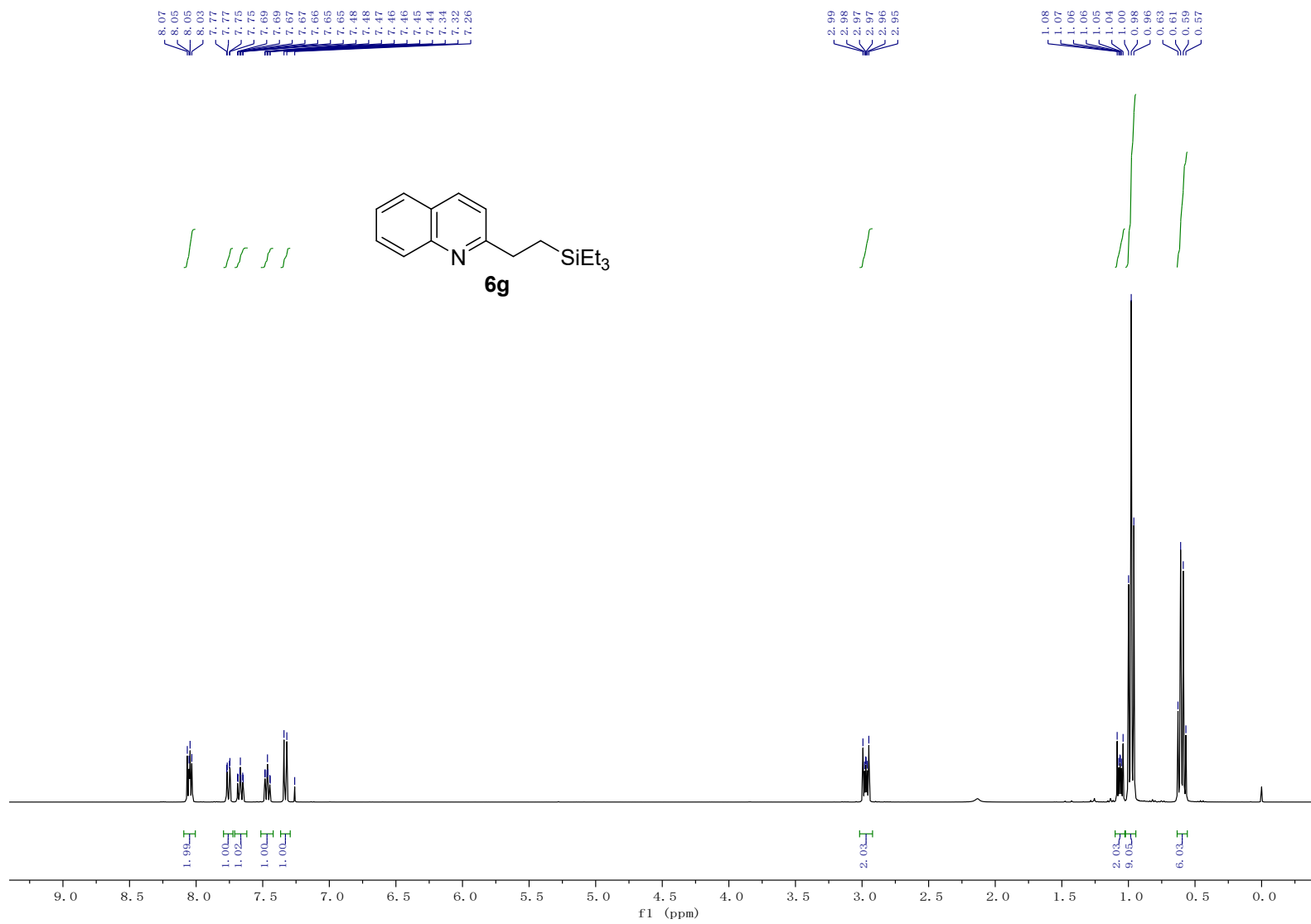
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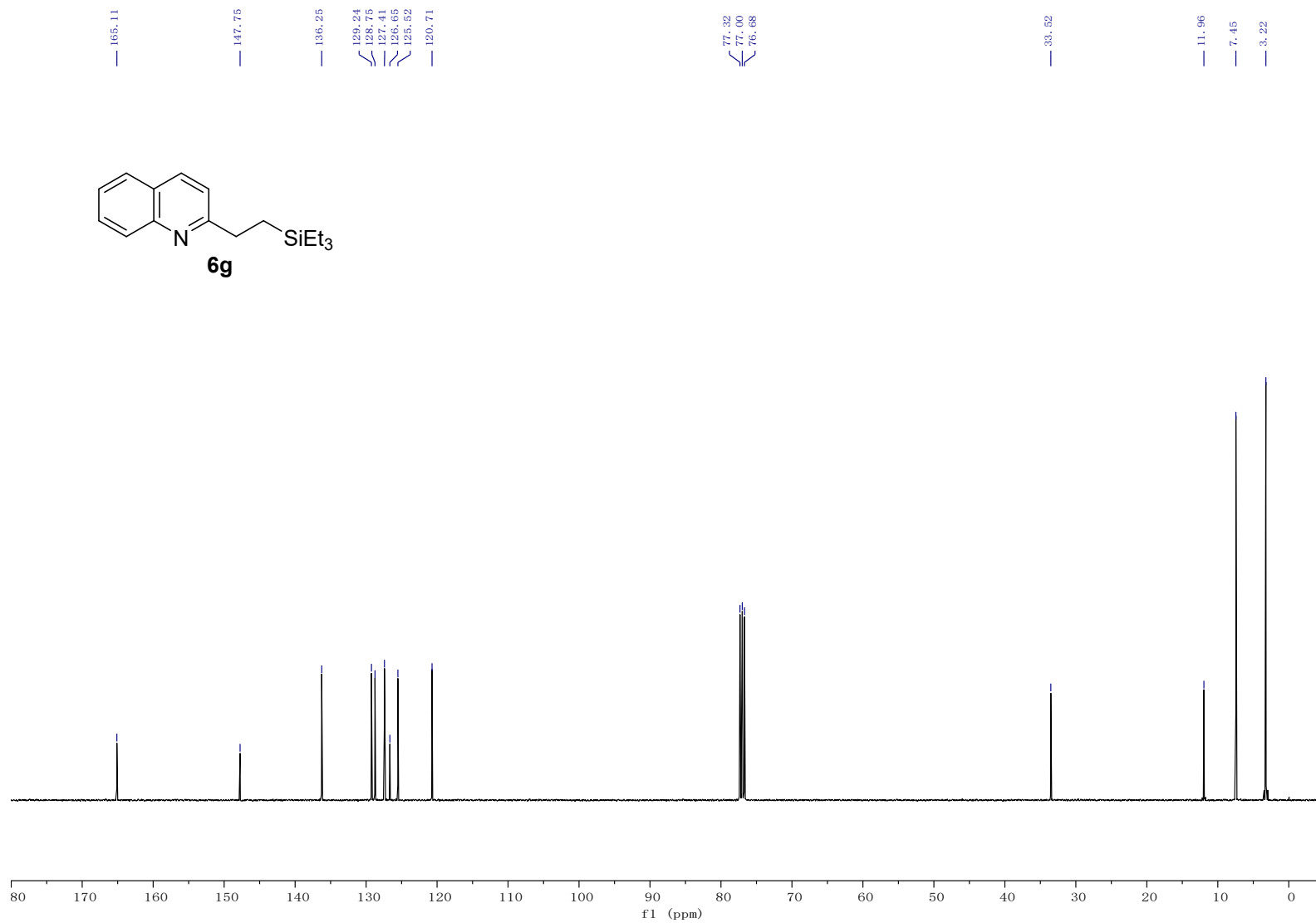
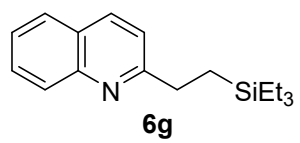
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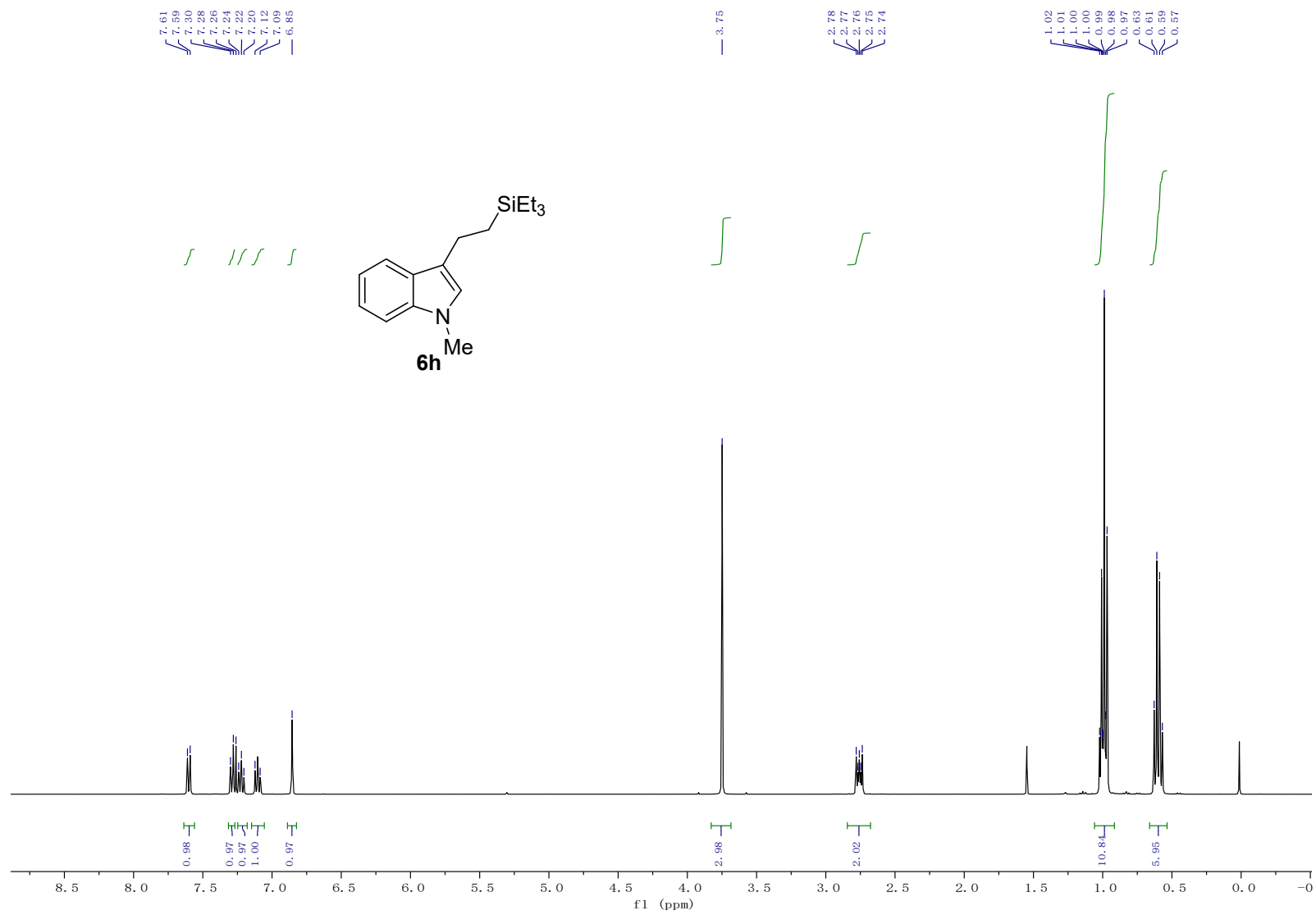


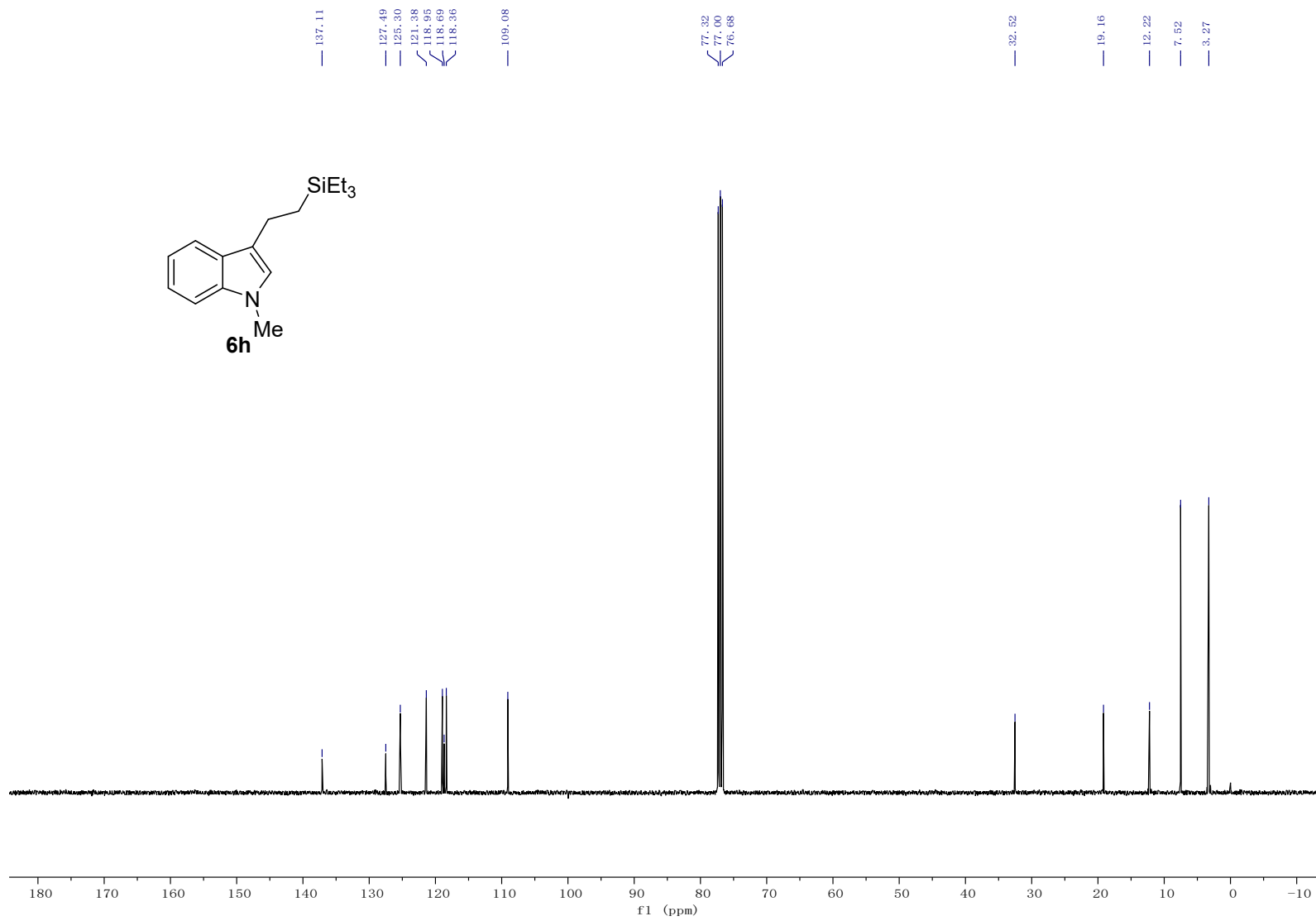
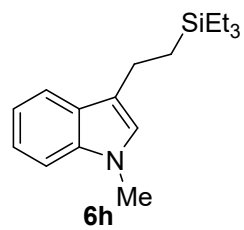


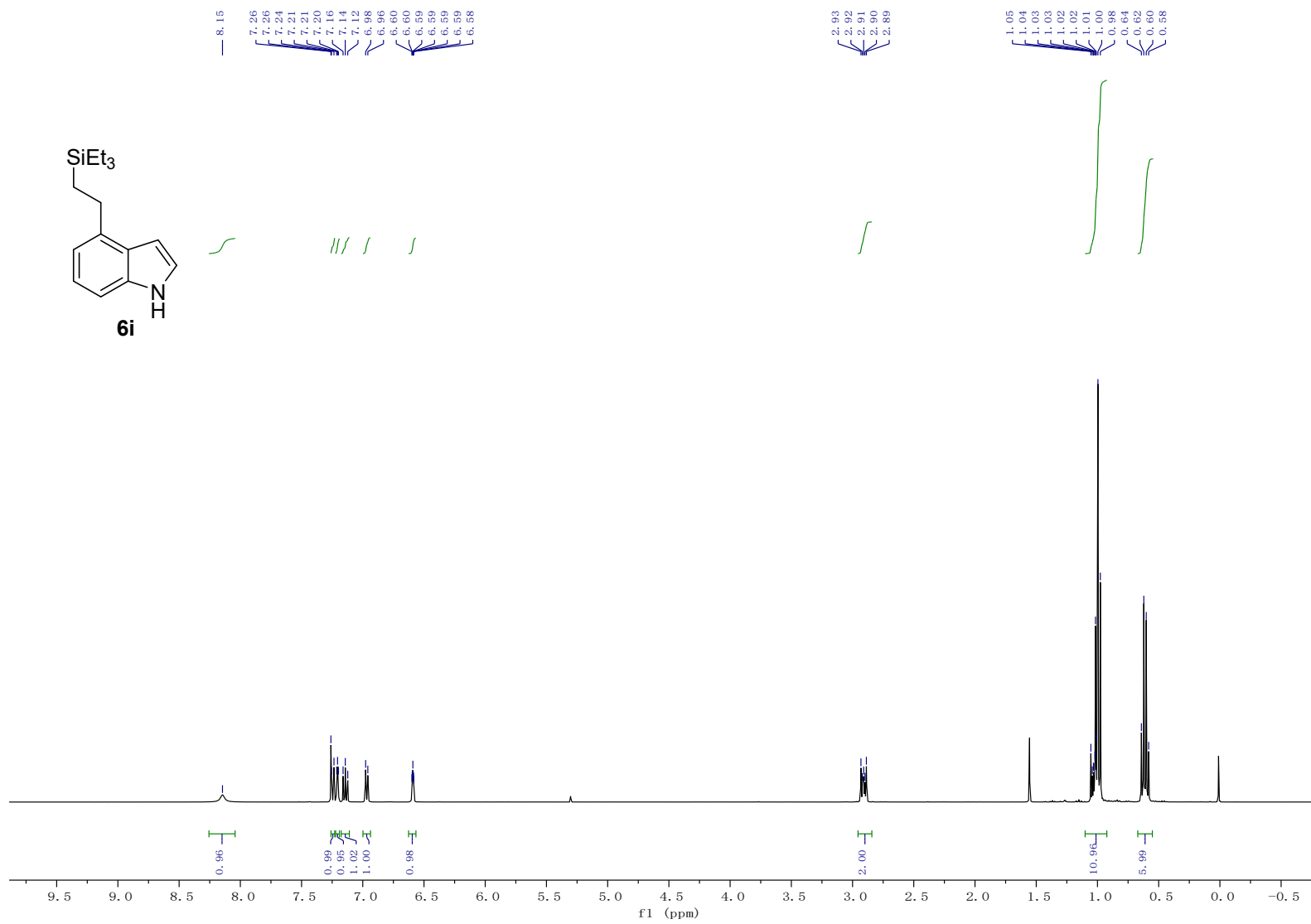


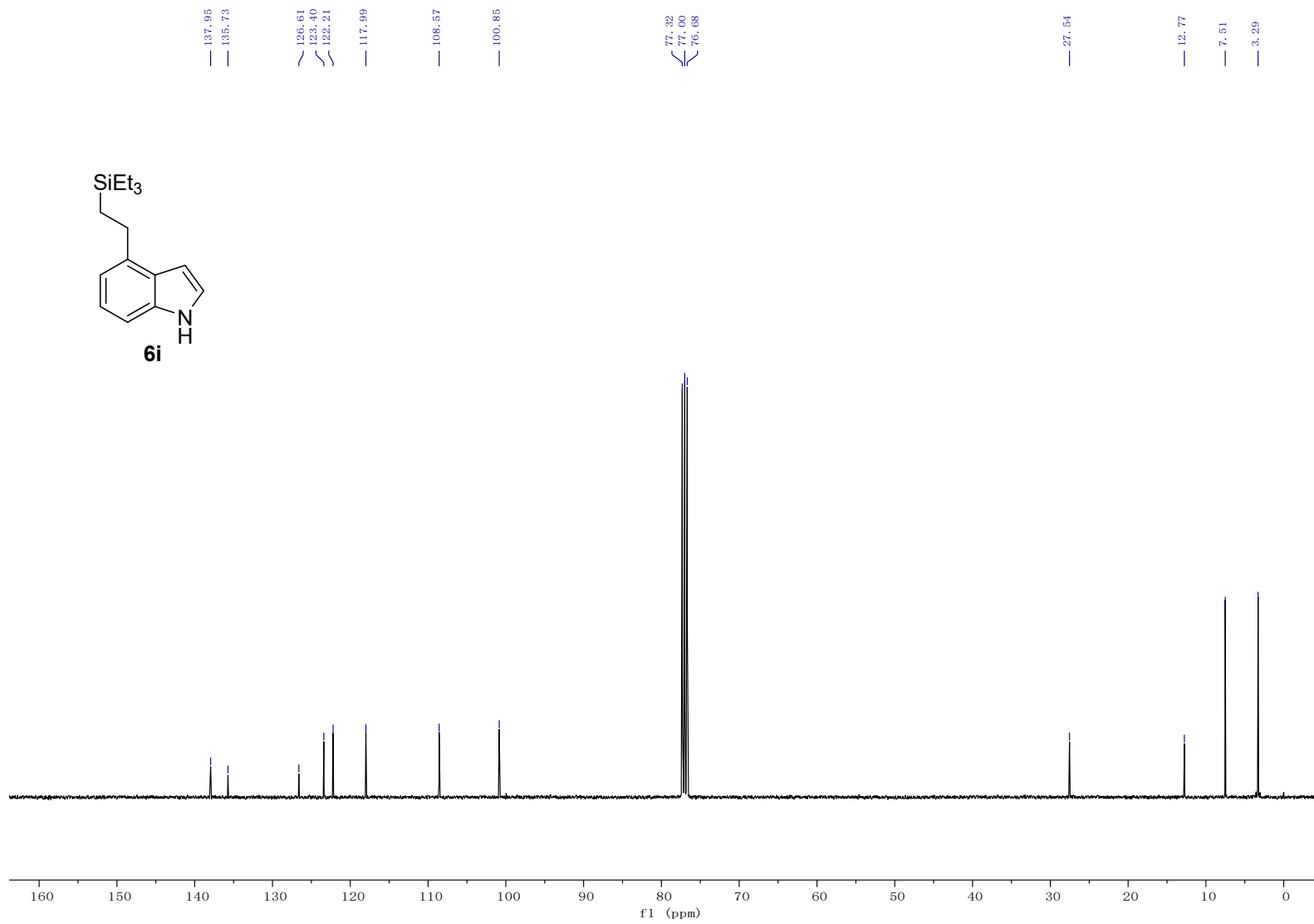
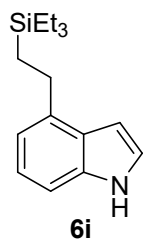


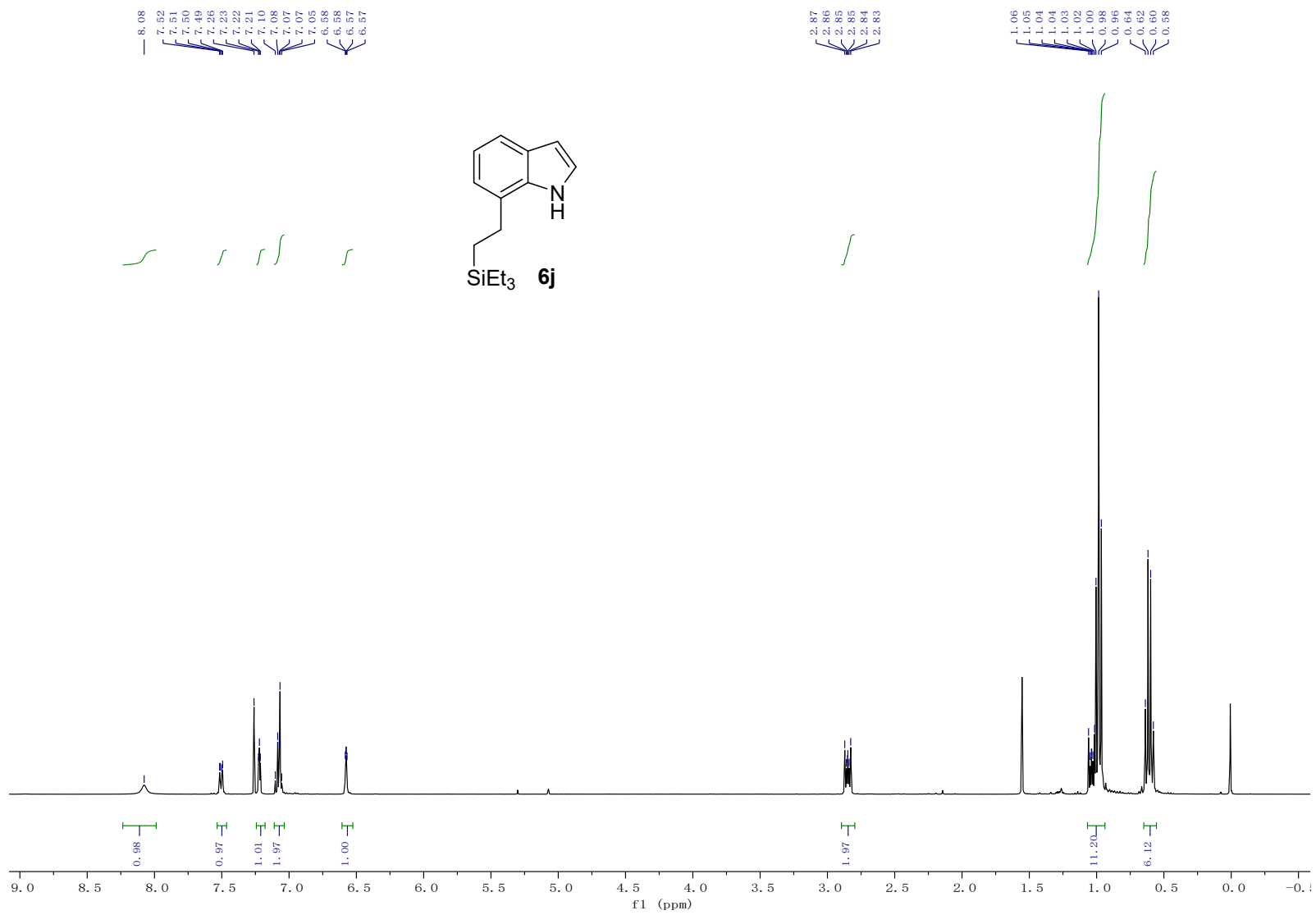


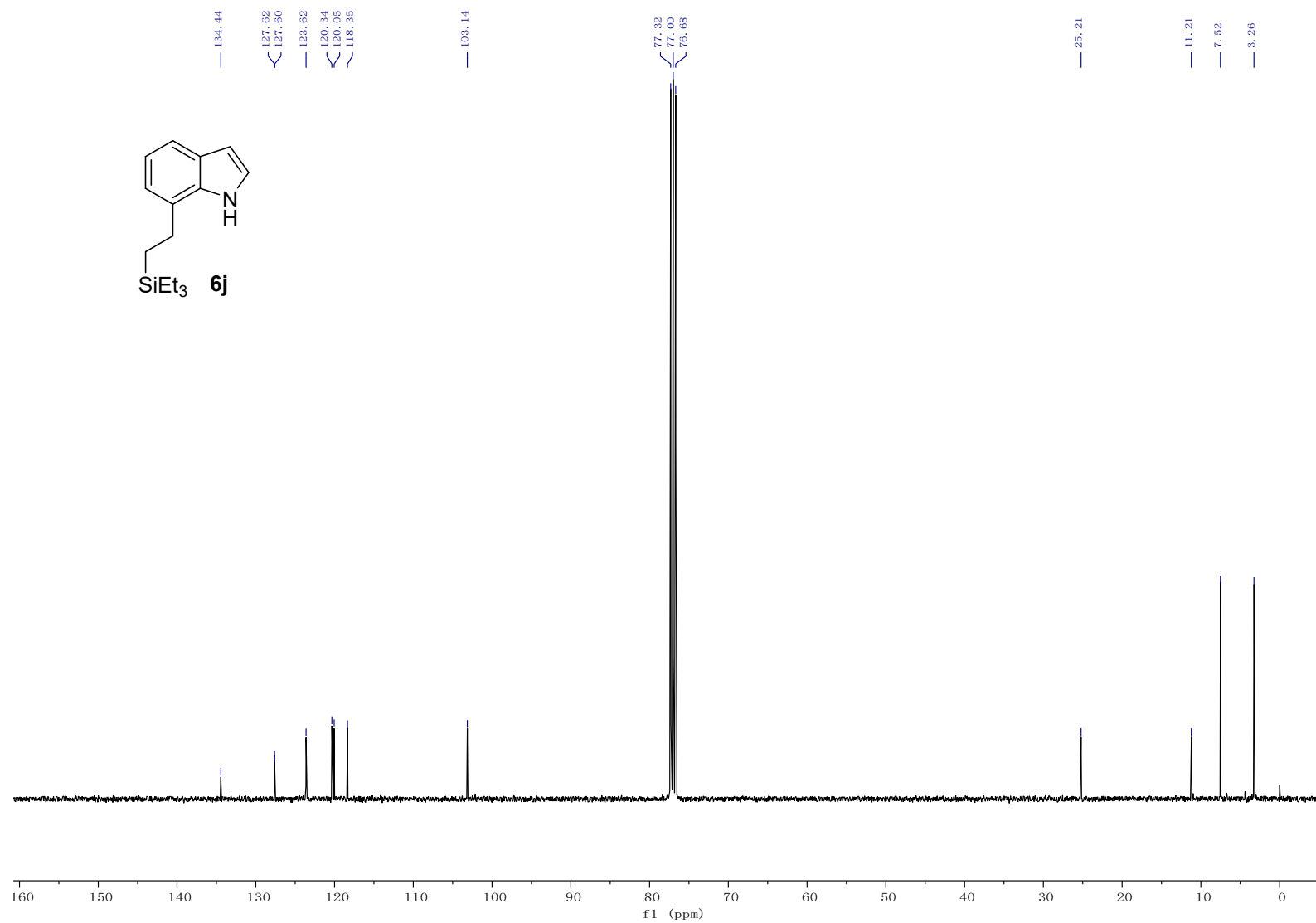
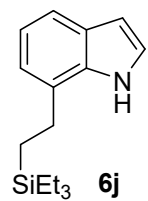


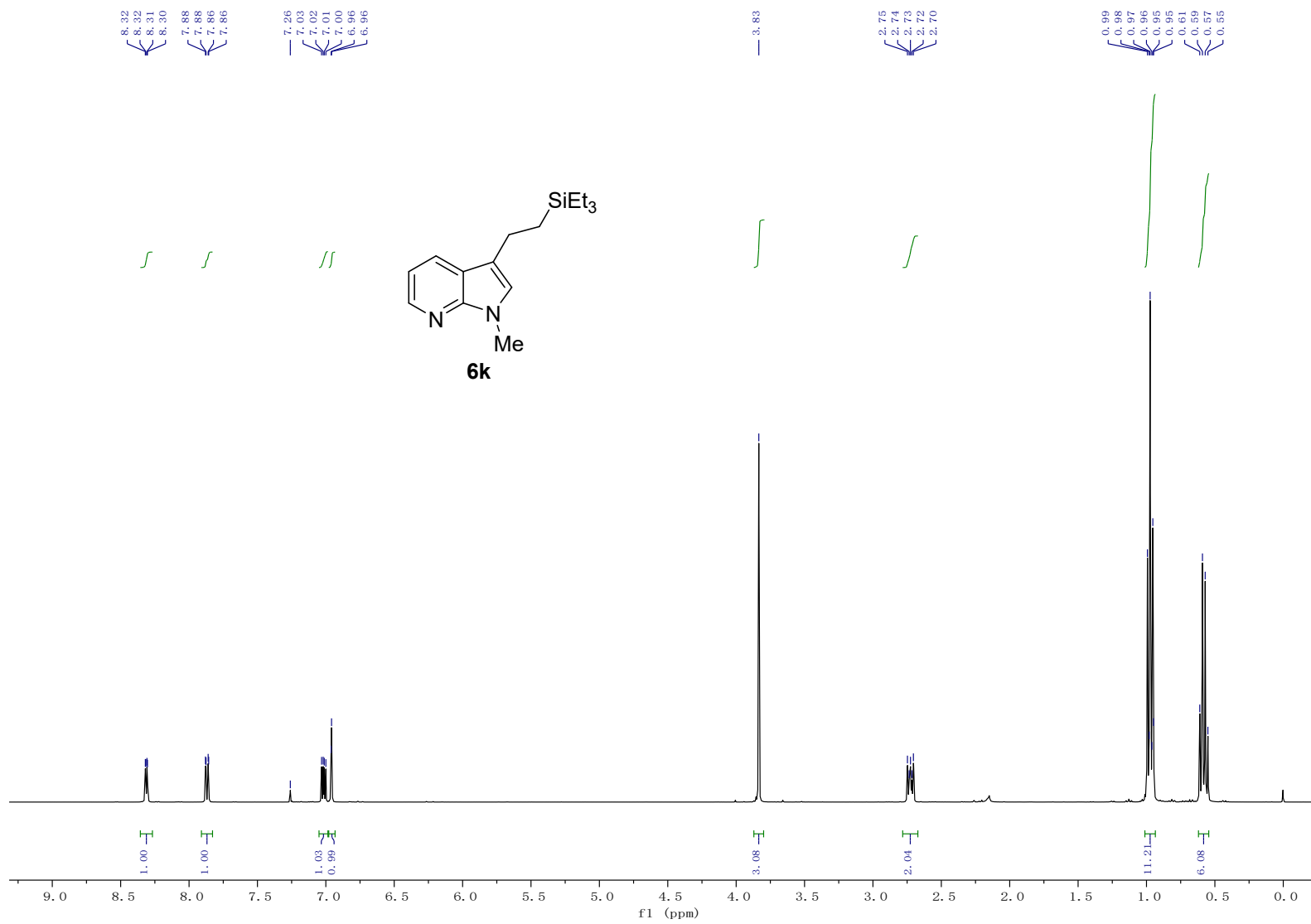


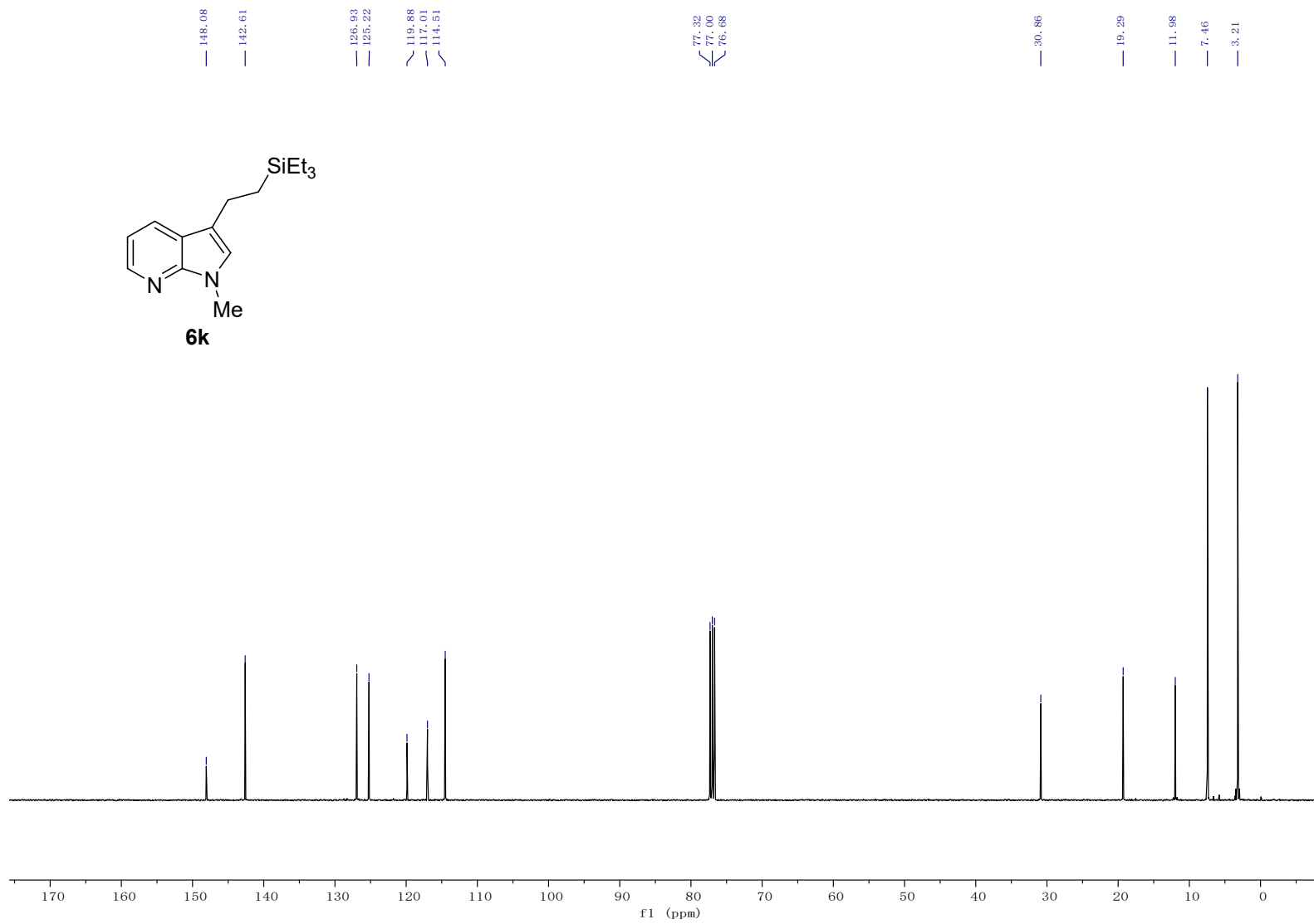
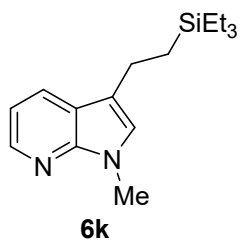


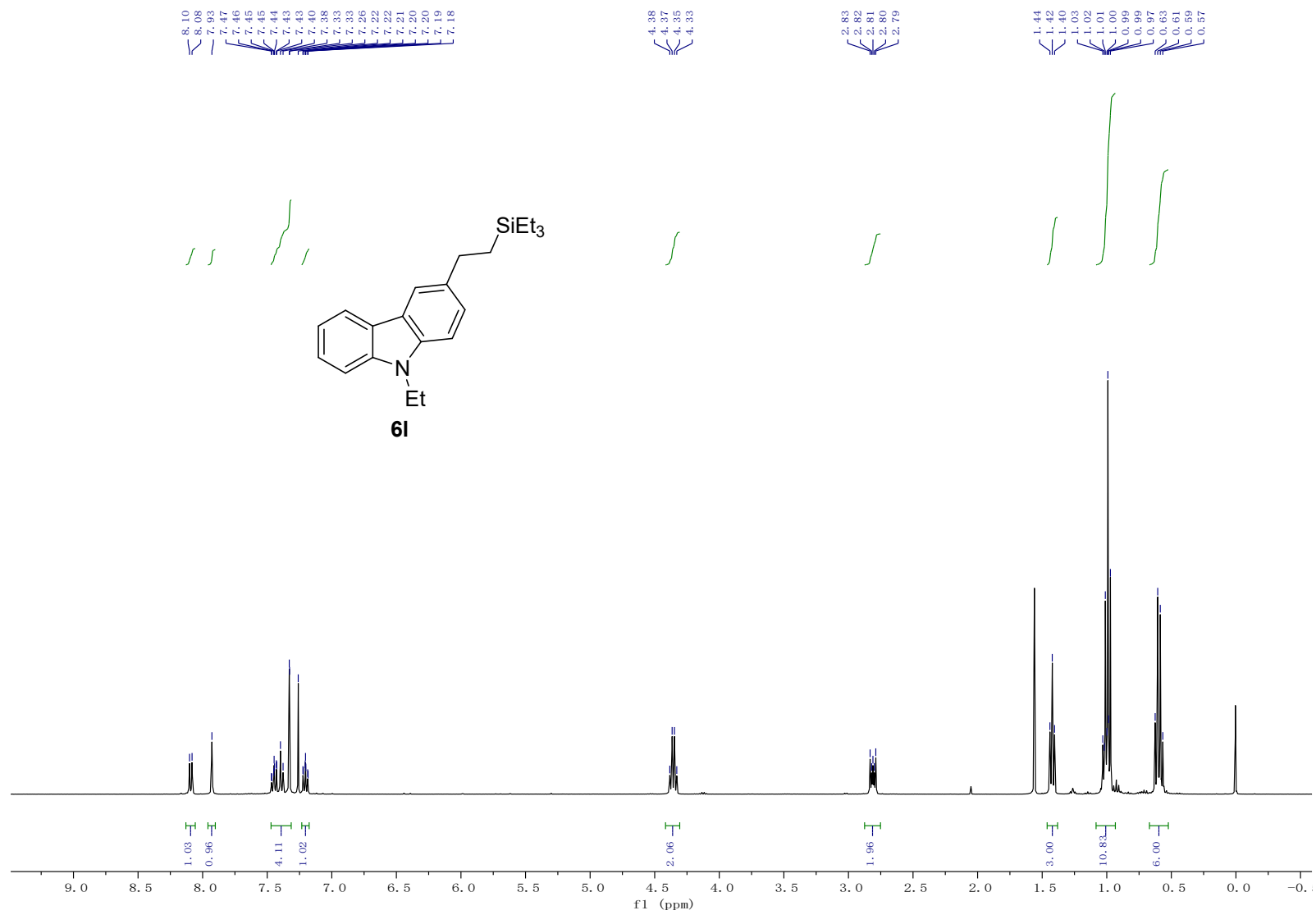


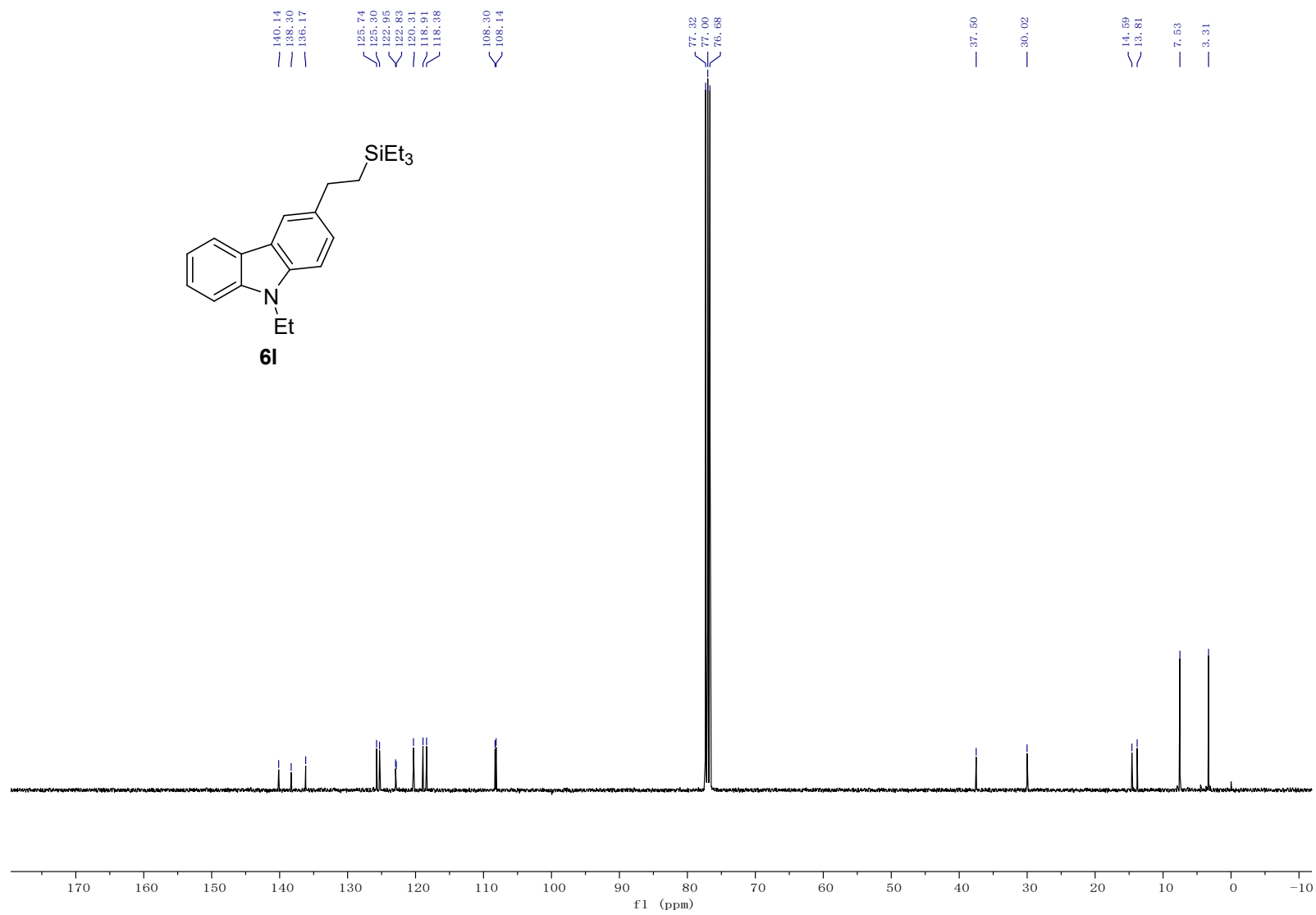
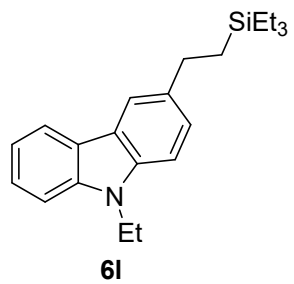


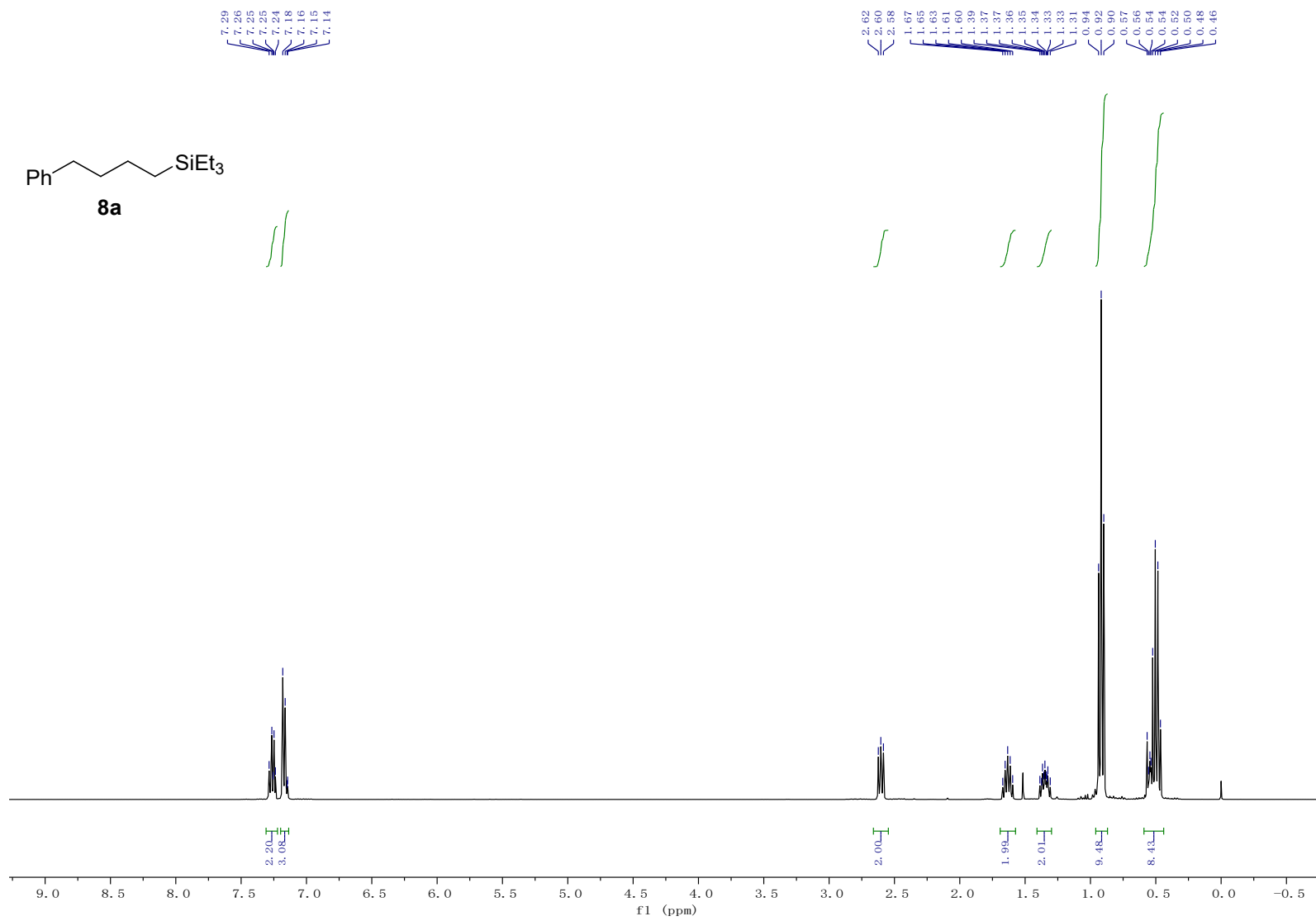


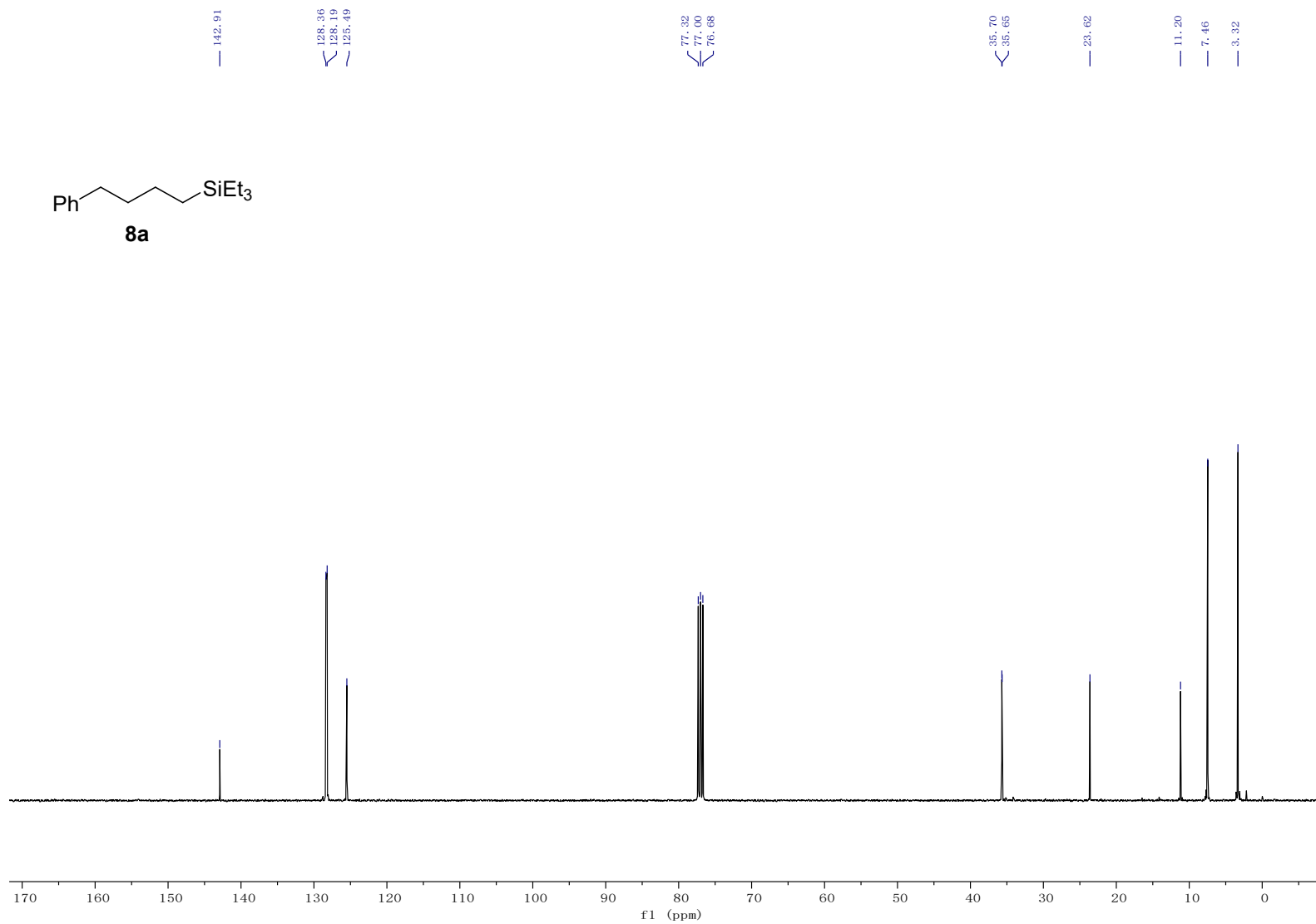
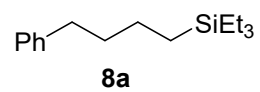


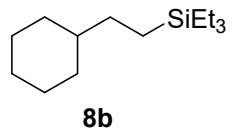




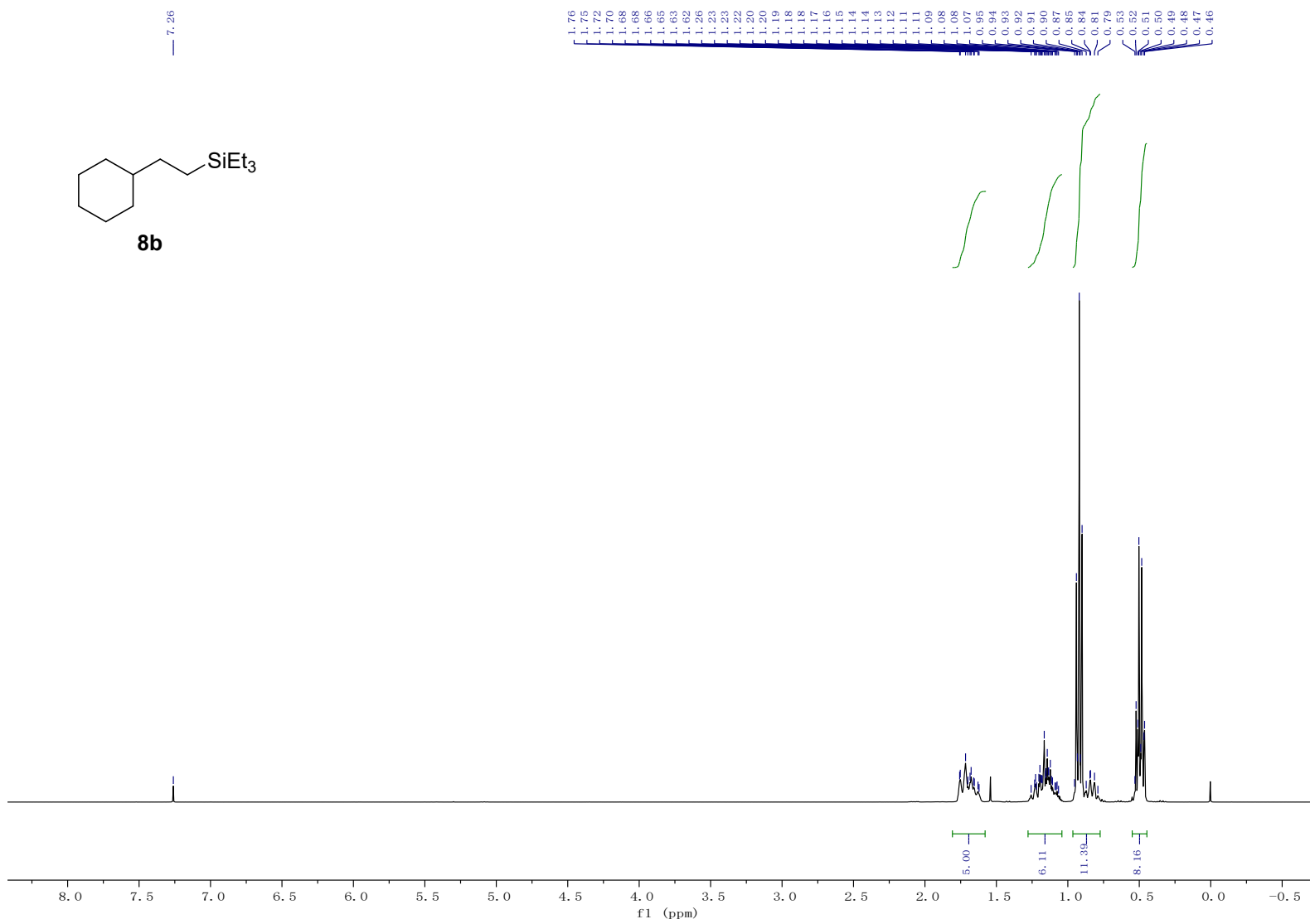


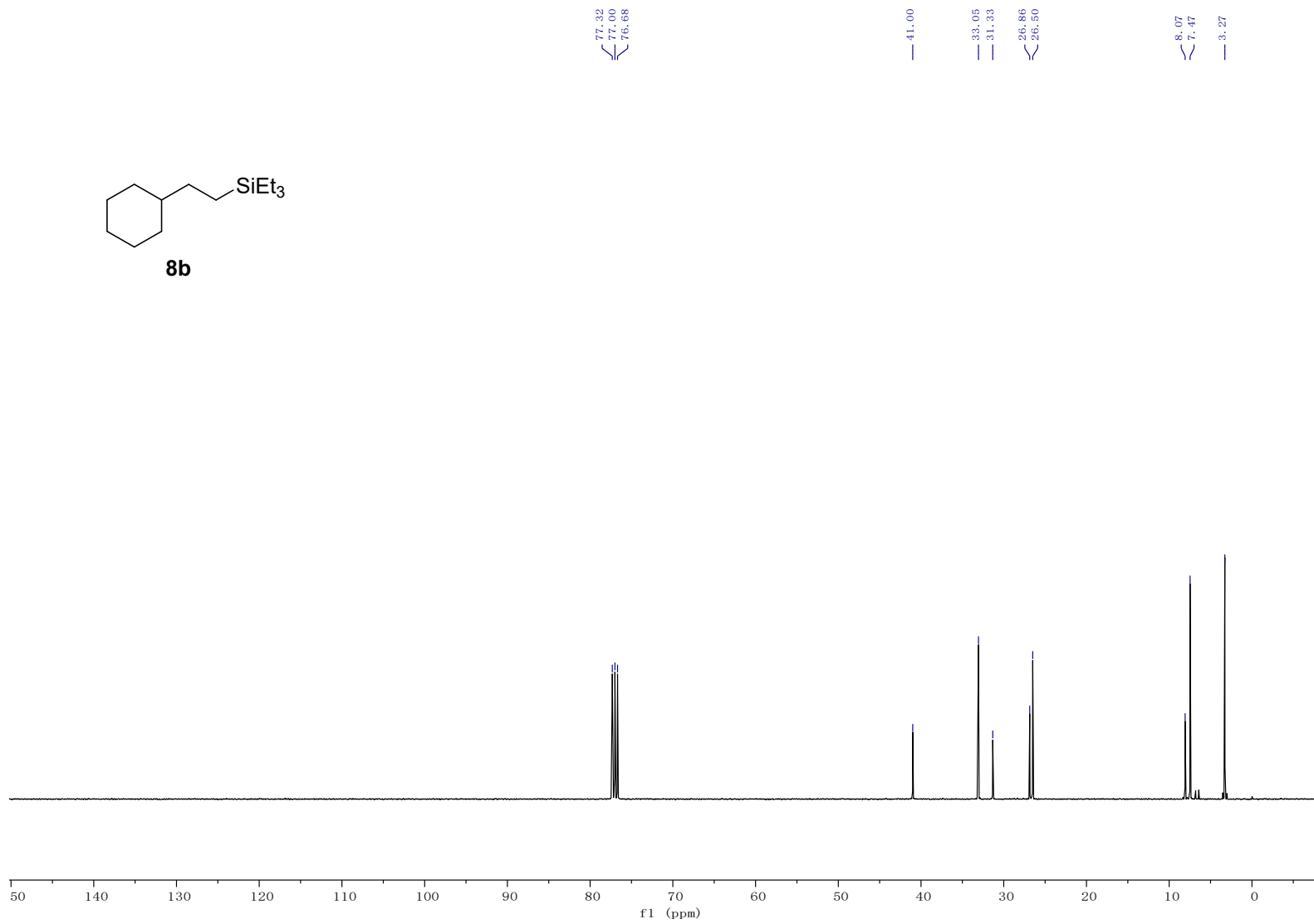
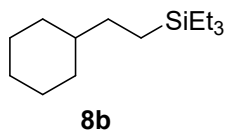


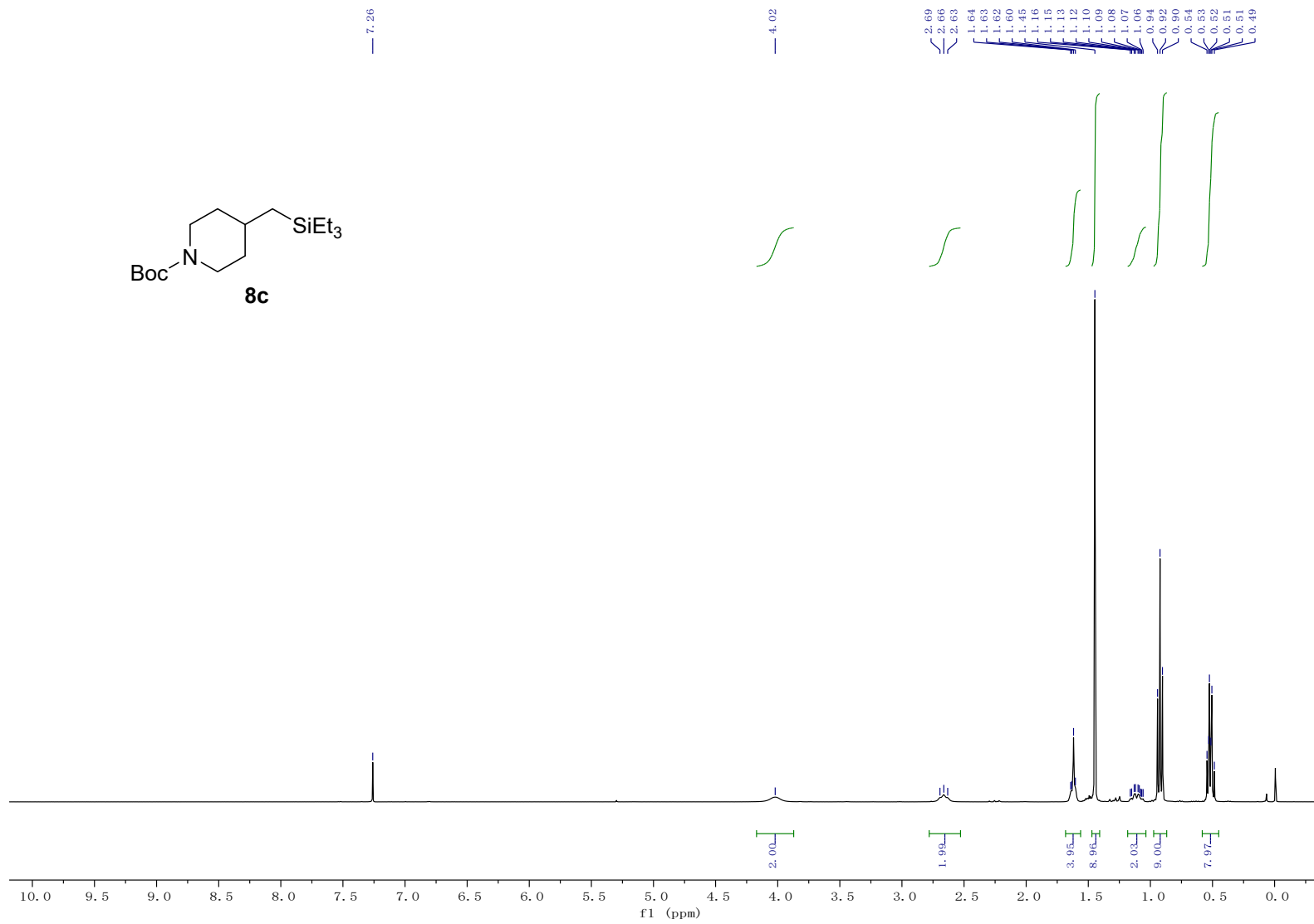
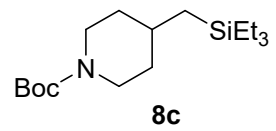


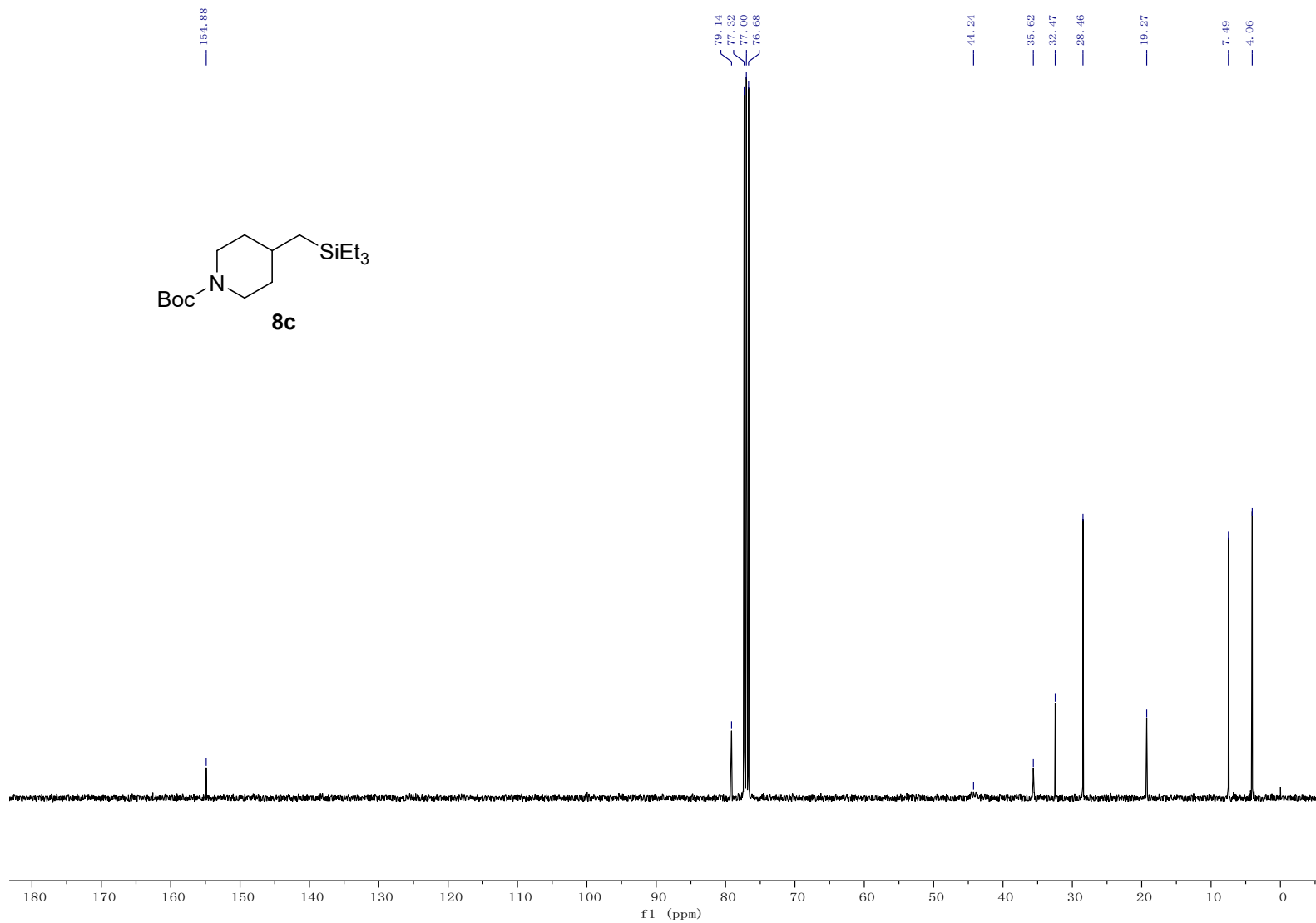
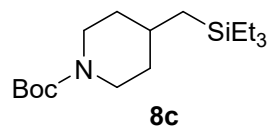


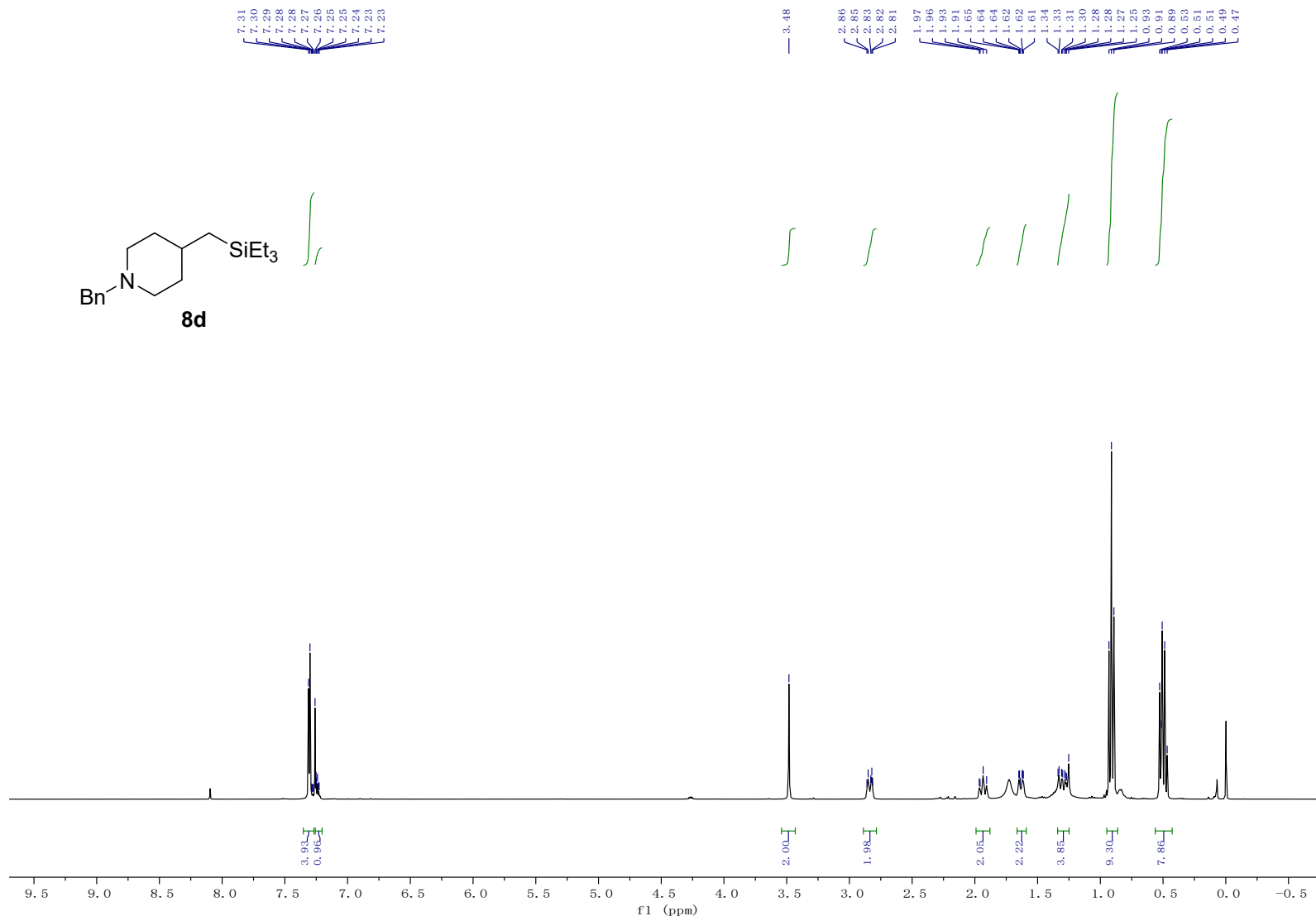
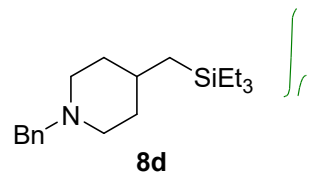
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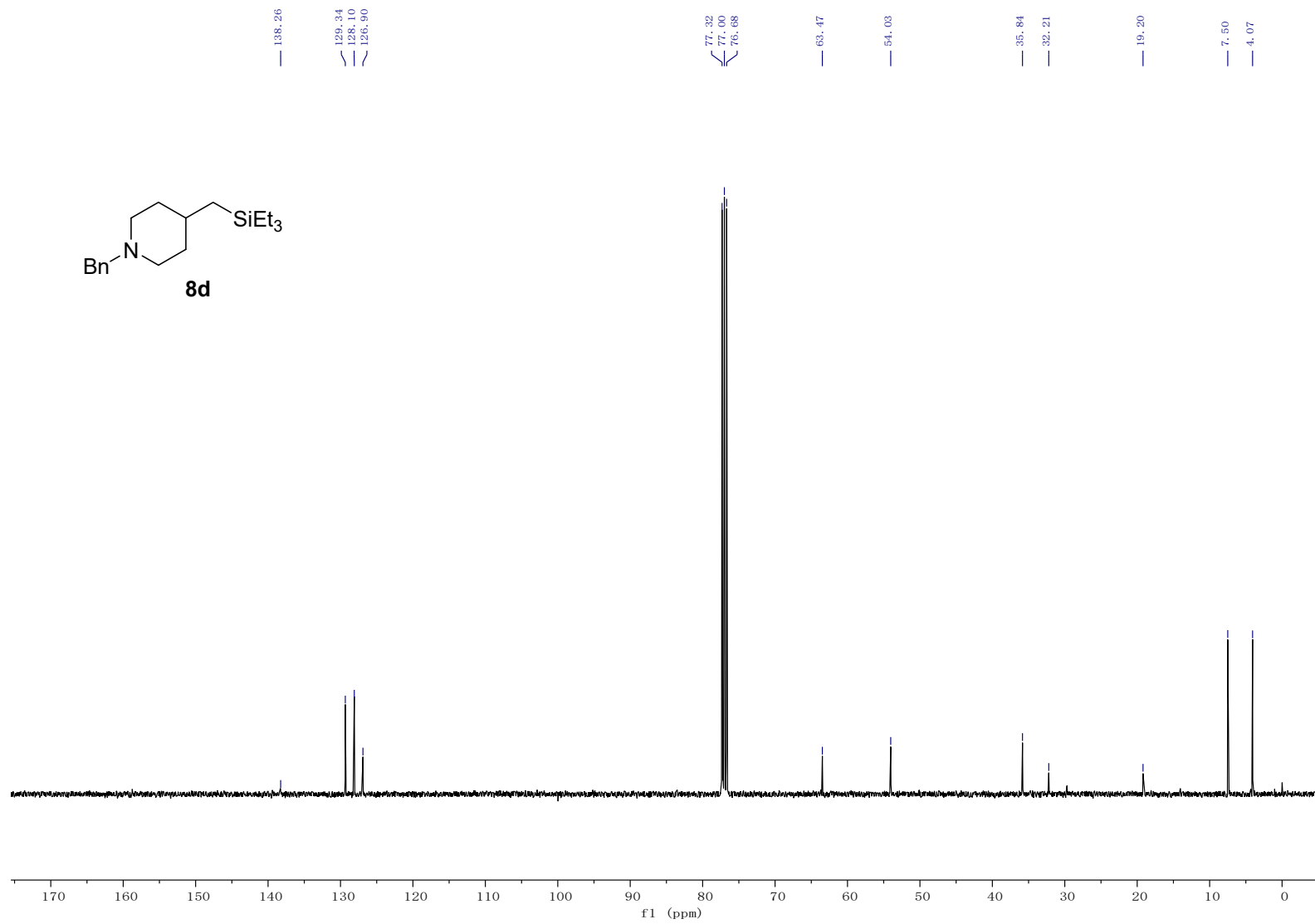
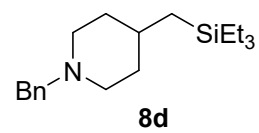


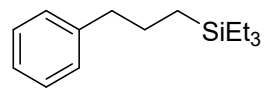












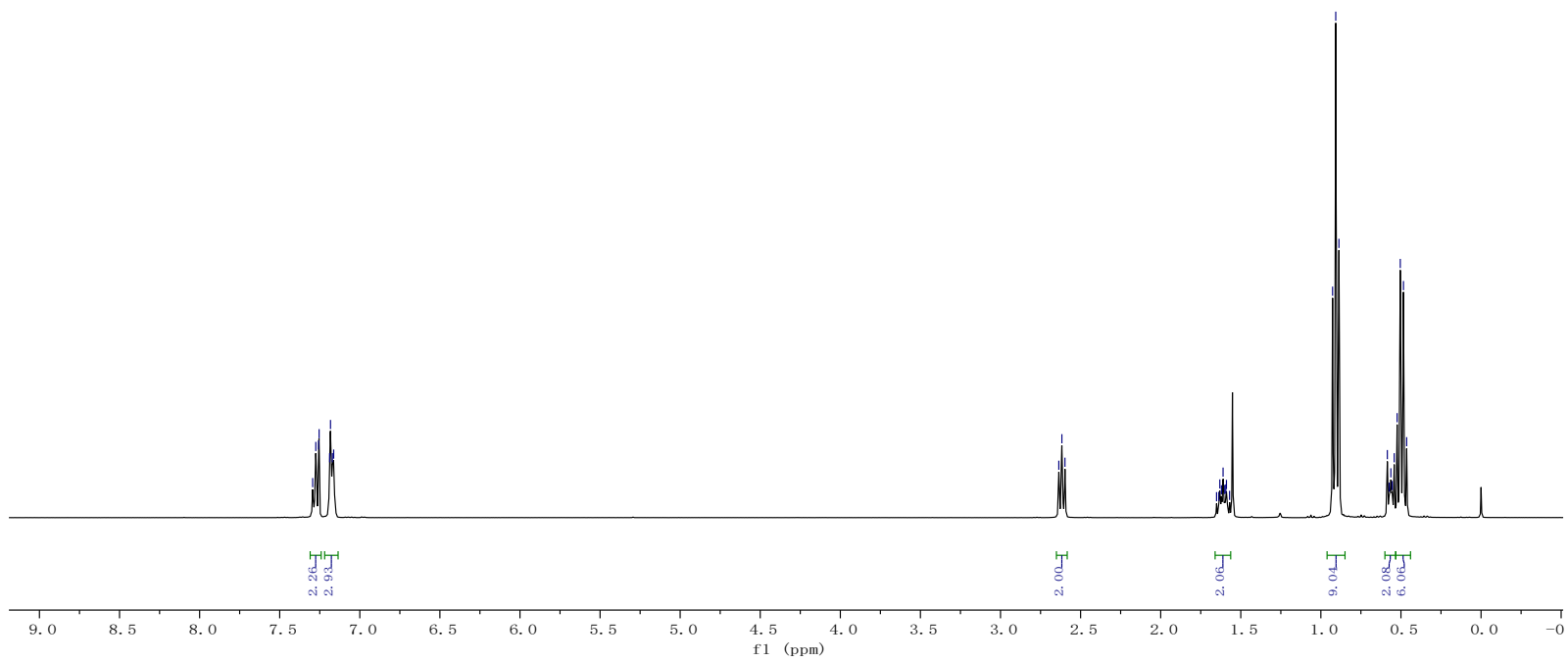
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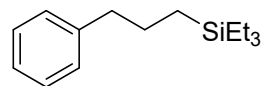
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7.16

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2.62
2.60

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1.62
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1.60
1.59
1.58
1.57

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0.91
0.89
0.87
0.85
0.84
0.83
0.82
0.81
0.80





8e

