

Supplementary Information

Silyl Group-Enhanced Photooxidative C-C Double Bond Cleavage of β -Enaminocarbonyl Substrates: Towards Selective *N*-Formylation of Amines

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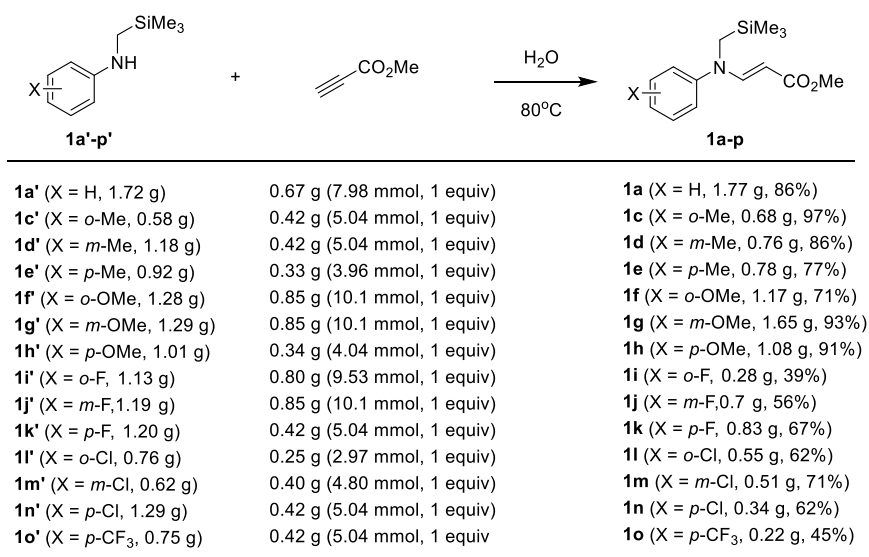
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Experimental

General. The ^1H (300 or 600 MHz) and ^{13}C NMR (75 or 150 MHz) spectra were recorded on CDCl_3 , and chemical shifts were reported in parts per million (δ , ppm) relative to CHCl_3 (7.24 ppm for ^1H and 77.0 ppm for ^{13}C) as an internal standard. High resolution (HRMS) mass spectra were obtained by using an ESI. All starting materials used in the synthetic routes came from commercially available sources. Photochemical reactions were conducted using photochemical apparatus, consisting of a 20 W compact fluorescence lamp (CFL) and a borosilicate glass tube (3 cm (diameter) x 20 cm length). The distance from the light source to the reaction solution was 9 cm.

General procedure for Synthesis of *N*-(trimethylsilyl)methyl substituted β -enamincarbonyl substrates **1a-1o, **3a-3y**, **5a-5f**, **6a-6c**.** The H_2O (11 equiv.) solutions of silyl group-substituted secondary amines (1.2 equiv.) and either methyl propiolate (1 equiv.) or 3-butyne-2-one (1 equiv.) were stirred at 80°C for certain period time, and then the resulting solutions were concentrated in vacuo to give residues that were partitioned between water and Et_2O . The Et_2O layers were dried and concentrated in vacuo to afford residues that were subjected to silica gel column chromatography ($\text{EtOAc}/\text{hexane} = 1:1$ for **1a-1o**, **3a-3y**, **5a-5f**, 1:5 for **6a-6c**) to yield corresponding β -enamincarbonyl substrates.



1a (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.88 (d, J = 12.9 Hz, 1H), 7.28-7.35 (m, 2H), 7.06-7.14 (m, 3H), 4.82 (d, J = 13.2 Hz, 1H), 3.67 (s, 3H), 3.23 (s, 2H), -0.00 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.7, 148.4, 146.4, 129.3, 124.3, 120.6, 88.9, 50.5, 40.8, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{22}\text{NO}_2\text{Si}$ 264.1414; found 264.1414.

1c (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.55 (d, J = 11.4 Hz, 1H), 7.14-7.23 (m, 3H), 7.06-7.11 (m, 1H), 4.68 (d, J = 7.2 Hz, 1H), 3.62 (s, 3H), 3.06 (s, 2H), 2.20 (s, 3H), -0.01 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.9, 152.3, 146.4, 142.4, 134.3, 131.5, 127.3, 126.9, 85.9, 50.4, 42.4, 17.7, -1.5; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{24}\text{NO}_2\text{Si}$ 278.1571; found 278.1570.

1d (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.88 (d, J = 12.9 Hz, 1H), 7.16-7.22 (m, 1H), 6.89-6.93 (m, 3H), 4.80 (d, J = 12.9 Hz, 1H), 3.67 (s, 3H), 3.21 (s, 2H), 2.33 (s, 3H), 0.00 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.9, 148.6, 146.5, 139.3, 129.1, 125.2, 121.4, 117.7, 88.7, 50.6, 40.9, 21.4, -1.3; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_2\text{SiNa}$ 300.1390; found 300.1388.

1e (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.83 (d, J = 12.9 Hz, 1H), 6.99-7.12 (m, 4H), 4.77 (d, J = 12.9 Hz, 1H), 3.66 (s, 3H), 3.19 (s, 2H), 2.29 (s, 3H), -0.01 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.4, 148.4, 143.8, 133.7, 129.5, 120.5, 88.0, 50.1, 40.7, 20.3, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_2\text{SiNa}$ 300.1390; found 300.1388.

1f (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.57 (d, J = 12.9 Hz, 1H), 7.08-7.22 (m, 2H), 6.88-6.93 (m, 2H), 4.71 (s, 1H), 3.80 (s, 3H), 3.62 (s, 3H), 3.12 (s, 2H), -0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.1, 154.1, 152.4, 136.2, 127.8, 127.1, 120.8, 112.0, 85.8, 55.4, 50.4, 41.6, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_3\text{SiNa}$ 316.1339; found 316.1338.

1g (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.89 (d, J = 12.9 Hz, 1H), 7.19-7.23 (m, 1H), 6.70-6.73 (m, 1H), 6.62-6.66 (m, 2H), 4.82 (d, J = 12.9 Hz, 1H), 3.79 (s, 3H), 3.67 (s, 3H), 3.21 (s, 2H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.6, 160.3, 148.1, 147.6, 129.9, 112.7, 109.2, 106.8, 89.1, 55.2, 50.5, 40.7, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_3\text{SiNa}$ 316.1339; found 316.1338.

1h (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.75 (d, $J = 13.2$ Hz, 1H), 7.02-7.08 (m, 2H), 6.81-6.87 (m, 2H), 4.72 (d, $J = 12.9$ Hz, 1H), 3.78 (s, 3H), 3.66 (s, 3H), 3.17 (s, 2H), -0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.5, 156.6, 149.3, 139.6, 122.7, 114.1, 87.1, 55.0, 50.1, 41.6, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{NO}_3\text{SiNa}$ 316.1339; found 316.1336.

1i (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.58 (d, $J = 13.2$ Hz, 1H), 7.05-7.22 (m, 4H), 4.73 (d, $J = 11.1$ Hz, 1H), 3.64 (s, 3H), 3.16 (s, 2H), -0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.6, 156.7 (d, $J_{\text{C-F}} = 248$ Hz), 151.2, 134.4, 127.3 (d, $J_{\text{C-F}} = 53$ Hz), 124.7 (d, $J_{\text{C-F}} = 3.8$ Hz), 116.9 (d, $J_{\text{C-F}} = 20$ Hz), 88.0, 50.5, 42.8, -1.8; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{14}\text{H}_{20}\text{FNO}_2\text{SiNa}$ 304.1140; found 304.1137.

1j (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.88 (d, $J = 12.9$ Hz, 1H), 7.23-7.31 (m, 1H), 6.75-6.91 (m, 3H), 4.88 (d, $J = 13.2$ Hz, 1H), 3.69 (s, 3H), 3.21 (s, 2H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.4, 163.1 (d, $J_{\text{C-F}} = 245$ Hz), 147.8 (d, $J_{\text{C-F}} = 11$ Hz), 147.4, 130.5 (d, $J_{\text{C-F}} = 9$ Hz), 115.4, 110.6 (d, $J_{\text{C-F}} = 21$ Hz), 107.2 (d, $J_{\text{C-F}} = 24$ Hz), 90.5, 50.6, 40.4, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{14}\text{H}_{20}\text{FNO}_2\text{SiNa}$ 304.1140; found 304.1143.

1k (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.76 (d, $J = 13.2$ Hz, 1H), 6.99-7.11 (m, 4H), 4.78 (d, $J = 12.9$ Hz, 1H), 3.67 (s, 3H), 3.19 (s, 2H), -0.01 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 168.7, 158.8 (d, $J_{\text{C-F}} = 243$ Hz), 148.0, 142.2 (d, $J_{\text{C-F}} = 2.3$ Hz), 122.1 (d, $J_{\text{C-F}} = 8.3$ Hz), 115.4 (d, $J_{\text{C-F}} = 23$ Hz), 88.4, 49.6, 40.7, -2.2; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{21}\text{FNO}_2\text{Si}$ 282.1320; found 282.1319.

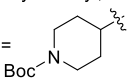
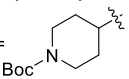
1l (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.52 (d, $J = 13.2$ Hz, 1H), 7.39-7.41 (m, 1H), 7.16-7.25 (m, 3H), 3.62 (s, 3H), 3.14 (s, 2H), -0.03 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.0, 151.4, 143.5, 130.8, 130.5, 128.2, 127.9, 127.5, 87.1, 50.0, 42.3, -2.1; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{21}\text{ClNO}_2\text{Si}$ 298.1025; found 298.1025.

1m (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.86 (d, $J = 13.2$ Hz, 1H), 7.21-7.27 (m, 1H), 6.98-7.11 (m, 3H), 4.88 (d, $J = 13.2$ Hz, 1H), 3.69 (s, 3H), 3.21 (s, 2H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR

(CDCl₃, 150 MHz) δ 169.5, 147.5 (2C), 135.1, 130.3, 124.0, 120.3, 118.2, 90.7, 50.8, 40.6, -1.2; HRMS (ESI) m/z : [M + H]⁺ calcd for C₁₄H₂₁ClNO₂Si 298.1025; found 298.1023.

1n (yellow liquid) : ¹H NMR (CDCl₃, 300 MHz) δ 7.82 (d, J = 12.9 Hz, 1H), 7.26-7.31 (m, 2H), 7.02-7.07 (m, 2H), 4.84 (d, J = 12.9 Hz, 1H), 3.68 (s, 3H), 3.20 (s, 2H), 0.01 (s, 9H); ¹³C{¹H} NMR (CDCl₃, 75 MHz) δ 169.3, 147.7, 144.8, 129.2, 121.4, 89.8, 50.5, 40.6, -1.5; HRMS (ESI) m/z : [M + H]⁺ calcd for C₁₄H₂₁ClNO₂Si 298.1025; found 298.1022.

1o (yellow liquid) : ¹H NMR (CDCl₃, 600 MHz) δ 7.95 (d, J = 26.4 Hz, 1H), 7.57 (d, J = 17.4 Hz, 2H), 7.19 (d, J = 16.8 Hz, 2H), 4.97 (d, J = 26.4 Hz, 1H), 3.70 (s, 3H), 3.26 (s, 2H), 0.04 (s, 9H); ¹³C{¹H} NMR (CDCl₃, 150 MHz) δ 169.4, 148.8, 146.7, 126.6 (q, J_{C-F} = 3.0 Hz), 125.4 (q, J_{C-F} = 33 Hz), 124.0 (d, J_{C-F} = 270 Hz), 119.1, 92.0, 50.9, 40.1, -1.2; HRMS (ESI) m/z : [M + H]⁺ calcd for C₁₅H₂₁F₃NO₂Si 332.1288; found 332.1281.

$\text{R}-\text{NH}-\text{CH}_2-\text{SiMe}_3$ 3a'-y'		H_2O $\xrightarrow{80^\circ\text{C}}$ $\text{R}-\text{N}(\text{CH}_2\text{SiMe}_3)-\text{CH}=\text{CH}-\text{CO}_2\text{Me}$ 3a-y
3a' (R = hexyl, 0.57g)	0.21g (2.52 mmol, 1 equiv)	3a (R = hexyl, 0.64g, 94%)
3b' (R = 2-ethylhexyl, 1.31g)	0.42g (5.04 mmol, 1 equiv)	3b (R = 2-ethylhexyl, 1.5g, 100%)
3c' (R = <i>tert</i> -Bu, 0.48g)	0.21g (2.52 mmol, 1 equiv)	3c (R = <i>tert</i> -Bu, 0.54g, 89%)
3d' (R = MeOCH ₂ CH ₂ , 0.35g)	0.15g (1.82 mmol, 1 equiv)	3d (R = MeOCH ₂ CH ₂ , 0.34g, 76%)
3e' (R = EtO ₂ CCH ₂ , 0.48g)	0.18g (2.13 mmol, 1 equiv)	3e (R = EtO ₂ CCH ₂ , 0.39g, 67%)
3f' (R = EtO ₂ C(Me)CH, 0.61g)	0.21g (2.52 mmol, 1 equiv)	3f (R = EtO ₂ C(Me)CH, 0.71g, 97%)
3g' (R = EtO ₂ C(Bn)CH, 0.76g)	0.19g (2.26 mmol, 1 equiv)	3g (R = EtO ₂ C(Bn)CH, 0.45g, 55%)
3h' (R = EtO ₂ CCH ₂ CH ₂ , 1.23g)	0.42g (5.04 mmol, 1 equiv)	3h (R = EtO ₂ CCH ₂ CH ₂ , 0.91g, 62%)
3i' (R = allyl, 0.87g)	0.42g (5.04 mmol, 1 equiv)	3i (R = allyl, 0.92g, 80%)
3j' (R = cyclohexyl, 0.39g)	0.15g (1.75 mmol, 1 equiv)	3j (R = cyclohexyl, 0.34g, 72%)
3k' (R =  , 0.34g)	0.08g (0.95 mmol, 1 equiv)	3k (R =  , 0.37g, 99%)
3l' (R = 2-pyridylmethyl, 0.36g)	0.13g (1.51 mmol, 1 equiv)	3l (R = 2-pyridylmethyl, 0.35g, 83%)
3m' (R = 3-pyridylmethyl, 0.36g)	0.13g (1.51 mmol, 1 equiv)	3m (R = 3-pyridylmethyl, 0.25g, 60%)
3n' (R = 1-naphthalenylmethyl, 0.74g)	0.21g (2.52 mmol, 1 equiv)	3n (R = 1-naphthalenylmethyl, 0.81g, 98%)
3o' (R = PhCH ₂ , 0.47g)	0.17g (2.04 mmol, 1 equiv)	3o (R = PhCH ₂ , 0.51g, 90%)
3p' (R = <i>p</i> -Me-PhCH ₂ , 0.63g)	0.21g (2.52 mmol, 1 equiv)	3p (R = <i>p</i> -Me-PhCH ₂ , 0.70g, 95%)
3q' (R = <i>p</i> -MeO-PhCH ₂ , 0.68g)	0.21g (2.52 mmol, 1 equiv)	3q (R = <i>p</i> -MeO-PhCH ₂ , 0.70g, 90%)
3r' (R = <i>p</i> -F-PhCH ₂ , 0.26g)	0.08g (1.01 mmol, 1 equiv)	3r (R = <i>p</i> -F-PhCH ₂ , 0.24g, 80%)
3s' (R = <i>p</i> -Cl-PhCH ₂ , 0.28g)	0.08g (1.01 mmol, 1 equiv)	3s (R = <i>p</i> -Cl-PhCH ₂ , 0.24g, 77%)
3t' (R = <i>p</i> -CF ₃ -PhCH ₂ , 0.32g)	0.08g (1.01 mmol, 1 equiv)	3t (R = <i>p</i> -CF ₃ -PhCH ₂ , 0.32g, 91%)
3u' (R = Ph(Me)CH, 0.25g)	0.08g (1.01 mmol, 1 equiv)	3u (R = Ph(Me)CH, 0.28g, 97%)
3v' (R = Ph ₂ CH ₂ , 0.30g)	0.08g (1.01 mmol, 1 equiv)	3v (R = Ph ₂ CH ₂ , 0.28g, 88%)
3w' (R = PhCH ₂ CH ₂ , 0.63g)	0.21g (2.52 mmol, 1 equiv)	3w (R = PhCH ₂ CH ₂ , 0.71g, 96%)
3x' (R = <i>p</i> -MeO-PhCH ₂ CH ₂ , 0.72g)	0.21g (2.52 mmol, 1 equiv)	3x (R = <i>p</i> -MeO-PhCH ₂ CH ₂ , 0.81g, 99%)
3y' (R = <i>p</i> -F-PhCH ₂ CH ₂ , 0.28g)	0.09g (1.02 mmol, 1 equiv)	3y (R = <i>p</i> -F-PhCH ₂ CH ₂ , 0.23g, 72%)

3a (yellow liquid) : ¹H NMR (CDCl₃, 300 MHz) δ 7.42 (d, J = 12.6 Hz, 1H), 4.39 (d, J = 12.9 Hz, 1H), 3.62 (s, 3H), 3.08 (s, 2H), 2.63 (s, 2H), 1.48-1.58 (m, 2H), 1.25-1.29 (m, 6H), 0.86 (t, J = 6.3

Hz, 3H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 151.7, 82.3, 57.3, 50.1, 39.2, 31.3, 28.3, 26.1, 22.4, 13.8, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{14}\text{H}_{29}\text{NO}_2\text{SiNa}$ 294.1860; found 294.1858.

3b (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.40 (d, J = 12.6 Hz, 1H), 4.39 (d, J = 12.9 Hz, 1H), 3.62 (s, 3H), 2.99 (d, J = 7.2 Hz, 2H), 2.62 (s, 2H), 1.59 (s, 2H), 1.16-1.28 (m, 7H), 0.81-0.89 (m, 6H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 152.2, 82.2, 61.1, 50.1, 39.2, 37.4, 30.0, 28.4, 23.4, 22.8, 13.8, 10.4, -1.3; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{33}\text{NO}_2\text{SiNa}$ 322.2173; found 322.2170.

3c (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.85 (s, 1H), 3.64 (s, 3H), 2.67 (s, 2H), 1.29 (s, 9H), 0.10 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.3, 147.7, 83.8, 57.9, 50.1, 36.3, 28.8, -1.0; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{12}\text{H}_{26}\text{NO}_2\text{Si}$ 244.1727; found 244.1726.

3d (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.43 (d, J = 12.9 Hz, 1H), 4.42 (d, J = 12.9 Hz, 1H), 3.62 (s, 3H), 3.47 (t, J = 5.4 Hz, 2H), 3.31 (s, 3H), 3.27 (t, J = 5.7 Hz, 2H), 2.74 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.6, 151.6, 83.0, 70.3, 58.4, 56.4, 49.8, 40.0, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_{23}\text{NO}_3\text{SiNa}$ 268.1339; found 268.1338.

3e (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.38 (d, J = 12.9 Hz, 1H), 4.49 (d, J = 12.9 Hz, 1H), 4.18 (q, J = 7.2 Hz, 2H), 3.81 (s, 2H), 3.63 (s, 3H), 2.75 (s, 2H), 1.26 (t, J = 7.2 Hz, 3H), 0.09 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.5, 168.6, 152.3, 85.1, 61.2, 57.5, 50.2, 41.2, 13.9, -1.9; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{12}\text{H}_{23}\text{NO}_4\text{SiNa}$ 296.1289; found 296.1286.

3f (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.50 (d, J = 12.9 Hz, 1H), 4.52 (d, J = 12.9 Hz, 1H), 4.15 (q, J = 7.2 Hz, 2H), 3.88 (q, J = 7.2 Hz, 1H), 3.63 (s, 3H), 2.63 (q, J = 7.5 Hz, 2H), 1.45 (d, J = 7.2 Hz, 3H), 1.24 (t, J = 7.2 Hz, 3H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.9, 169.5, 149.7, 85.4, 62.2, 61.1, 50.0, 40.4, 15.9, 13.8, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{25}\text{NO}_4\text{SiNa}$ 310.1445; found 310.1441.

3g (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.61 (d, J = 12.9 Hz, 1H), 7.25-7.30 (m, 2H), 7.14-7.23 (m, 3H), 4.51 (d, J = 12.9 Hz, 1H), 4.15 (q, J = 7.2 Hz, 2H), 3.91 (t, J = 8.1 Hz, 1H), 3.65 (s, 3H), 3.01-3.28 (m, 2H), 2.52 (dd, J = 60 Hz, J = 15.6 Hz, 2H), 1.20 (t, J = 7.2 Hz, 3H), -0.01 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.9, 169.6, 149.6, 136.2, 129.0, 128.5, 126.8, 86.1, 68.5, 61.3, 50.3, 42.0, 36.7, 13.9, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{19}\text{H}_{29}\text{NO}_4\text{SiNa}$ 386.1758; found 386.1753.

3h (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.40 (d, J = 12.0 Hz, 1H), 4.44 (d, J = 12.6 Hz, 1H), 4.13 (q, J = 7.2 Hz, 2H), 3.63 (s, 3H), 3.42 (s, 2H), 2.67 (s, 2H), 2.54 (t, J = 7.2 Hz, 2H), 1.24 (t, J = 7.2 Hz, 3H), 0.09 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.6, 169.5, 151.1, 83.6, 60.5, 52.2, 49.9, 39.1, 33.1, 13.8, -1.8; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{25}\text{NO}_4\text{SiNa}$ 310.1445; found 310.1442.

3i (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.45 (d, J = 12.6 Hz, 1H), 5.64-5.77 (m, 1H), 5.11-5.22 (m, 2H), 4.45 (d, J = 12.9 Hz, 1H), 3.71 (d, J = 6.0 Hz, 2H), 3.62 (s, 3H), 2.65 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.6, 151.4, 132.6, 118.0, 83.0, 59.3, 49.8, 38.9, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_{21}\text{NO}_2\text{SiNa}$ 250.1234; found 250.1232.

3j (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.55 (d, J = 12.6 Hz, 1H), 4.39 (d, J = 12.3 Hz, 1H), 3.62 (s, 3H), 2.83 (s, 1H), 2.62 (s, 2H), 1.03-1.84 (m, 10H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 148.7, 82.8, 65.2, 50.1, 39.7, 32.0, 25.7, 25.2, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{28}\text{NO}_2\text{Si}$ 270.1884; found 270.1882.

3k (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.52 (s, 1H), 4.21 (s, 2H), 3.63 (s, 3H), 3.03 (s, 1H), 2.65-2.69 (m, 2H), 2.61 (s, 2H), 1.74-1.76 (m, 2H), 1.55-1.61 (m, 2H), 1.45 (s, 9H), 0.09 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.8, 154.2, 148.6, 84.0, 79.6, 63.5, 50.1, 43.0, 39.2, 30.7, 28.2, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{18}\text{H}_{35}\text{N}_2\text{O}_4\text{Si}$ 371.2361; found 371.2354.

3l (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 8.55 (d, J = 4.8 Hz, 1H), 7.68 (t, J = 6.6 Hz, 1H), 7.60 (d, J = 12.6 Hz, 1H), 7.21 (t, J = 6.6 Hz, 1H), 7.15 (d, J = 7.8 Hz, 1H), 4.54 (d, J = 13.2 Hz,

1H), 4.46 (s, 2H), 3.63 (s, 3H), 2.67 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.7, 156.6, 152.1, 149.4, 136.6, 122.3, 120.8, 84.0, 62.5, 50.0, 39.6, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{23}\text{N}_2\text{O}_2\text{Si}$ 279.1523; found 279.1519.

3m (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 8.55 (d, $J = 4.2$ Hz, 1H), 8.45 (s, 1H), 7.60 (d, $J = 12.6$ Hz, 1H), 7.54 (d, $J = 7.2$ Hz, 1H), 7.30-7.32 (m, 1H), 4.55 (d, $J = 12.6$ Hz, 1H), 4.33 (s, 2H), 3.64 (s, 3H), 2.60 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.7, 151.9, 149.2, 148.7, 134.7, 131.6, 123.5, 84.2, 58.3, 50.2, 39.0, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{23}\text{N}_2\text{O}_2\text{Si}$ 279.1523; found 279.1520.

3n (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.79-7.88 (m, 3H), 7.71 (s, 1H), 7.49-7.54 (m, 2H), 7.42 (t, $J = 7.2$ Hz, 1H), 7.23-7.24 (m, 1H), 4.79 (s, 2H), 3.65 (s, 3H), 2.69 (s, 2H), 0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 152.4, 133.7, 131.2, 128.9, 128.5, 126.5, 125.9, 125.4, 125.2, 122.5, 84.0, 58.7, 50.3, 39.6, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{26}\text{NO}_2\text{Si}$ 328.1727; found 328.1727.

3o (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.63 (d, $J = 12.9$ Hz, 1H), 7.26-7.36 (m, 3H), 7.13-7.17 (m, 2H), 7.52 (d, $J = 12.6$ Hz, 1H), 4.31 (s, 2H), 3.64 (s, 3H), 2.59 (s, 2H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 170.2, 152.4, 136.2, 128.7, 127.8, 127.3, 83.4, 61.1, 50.3, 38.9, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{24}\text{NO}_2\text{Si}$ 278.1571; found 278.1570.

3p (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.62 (d, $J = 12.6$ Hz, 1H), 7.13 (d, $J = 8.1$ Hz, 2H), 7.04 (d, $J = 8.1$ Hz, 2H), 4.51 (d, $J = 12.6$ Hz, 1H), 4.27 (s, 2H), 3.64 (s, 3H), 2.56 (s, 2H), 2.32 (s, 3H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 152.3, 137.6, 133.1, 129.3, 127.3, 83.2, 60.9, 50.3, 38.7, 21.0, -1.3; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{25}\text{NO}_2\text{SiNa}$ 314.1547; found 314.1543.

3q (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.62 (d, $J = 10.2$ Hz, 1H), 7.05-7.10 (m, 2H), 6.83-6.88 (m, 2H), 4.50 (d, $J = 12.0$ Hz, 1H), 4.25 (s, 2H), 3.78 (s, 3H), 3.64 (s, 3H), 2.56 (s, 2H), 0.06

(s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.2, 159.2, 152.2, 128.7, 128.0, 114.0, 83.1, 60.6, 55.1, 50.2, 38.6, -1.3; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{25}\text{NO}_3\text{SiNa}$ 330.1496; found 330.1492.

3r (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.60 (d, $J = 12.9$ Hz, 1H), 7.10-7.15 (m, 2H), 6.98-7.05 (m, 2H), 4.52 (d, $J = 12.9$ Hz, 1H), 4.27 (s, 2H), 3.64 (s, 3H), 2.57 (s, 2H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.0, 162.2 (d, $J_{\text{C-F}} = 245$ Hz), 152.1, 131.9, 128.9, 115.5 (d, $J_{\text{C-F}} = 23$ Hz), 83.6, 60.2, 50.2, 38.8, -1.5; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{22}\text{FNO}_2\text{SiNa}$ 318.1296; found 318.1293.

3s (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.57 (d, $J = 13.2$ Hz, 1H), 7.26 (d, $J = 8.4$ Hz, 2H), 7.06 (d, $J = 8.4$ Hz, 2H), 4.50 (d, $J = 12.6$ Hz, 1H), 4.25 (s, 2H), 3.61 (s, 3H), 2.53 (s, 2H), 0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.0, 152.1, 134.7, 133.6, 128.8, 128.6, 83.9, 60.3, 50.3, 38.9, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{ClNO}_2\text{Si}$ 312.1181; found 312.1179.

3t (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.60 (d, $J = 12.9$ Hz, 1H), 7.58 (d, $J = 8.1$ Hz, 2H), 7.26 (d, $J = 7.8$ Hz, 2H), 4.54 (d, $J = 12.9$ Hz, 1H), 4.36 (s, 2H), 3.64 (s, 3H), 2.61 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.0, 152.2, 140.5, 129.9 (t, $J_{\text{C-F}} = 32$ Hz), 127.4, 125.7, 124.8, 123.0, 84.3, 60.4, 50.4, 39.1, -1.5; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{22}\text{F}_3\text{NO}_2\text{SiNa}$ 368.1264; found 368.1261.

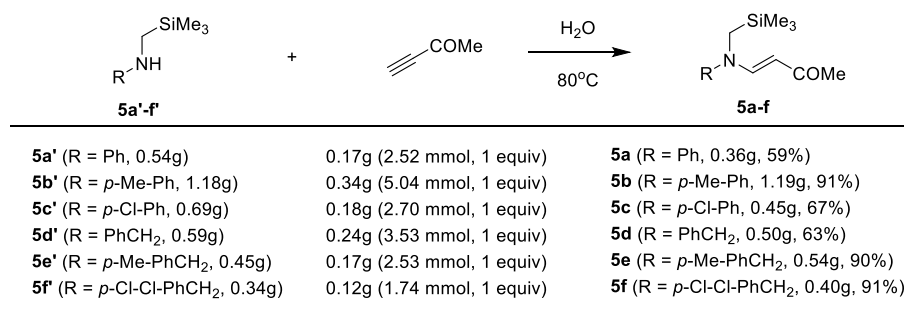
3u (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.81 (d, $J = 12.6$ Hz, 1H), 7.31-7.34 (m, 2H), 7.25-7.28 (m, 1H), 7.17 (d, $J = 7.2$ Hz, 2H), 4.51 (d, $J = 12.0$ Hz, 1H), 4.40 (s, 1H), 3.65 (s, 3H), 2.58 (d, $J = 15.6$ Hz, 1H), 2.41 (d, $J = 16.2$ Hz, 1H), 1.58 (d, $J = 6.6$ Hz, 3H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.4, 149.0, 141.2, 128.7, 127.7, 126.5, 83.6, 64.1, 50.3, 39.4, 20.1, -1.2; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{25}\text{NO}_2\text{SiNa}$ 314.1547; found 314.1544.

3v (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.50 (d, $J = 12.6$ Hz, 1H), 7.27-7.37 (m, 6H), 7.08-7.12 (m, 4H), 5.60 (s, 1H), 4.57 (d, $J = 12.9$ Hz, 1H), 3.58 (s, 3H), 2.72 (s, 2H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.0, 150.3, 138.8, 128.8, 128.7, 128.1, 84.4, 72.7, 50.3, 41.5, -1.2; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{21}\text{H}_{27}\text{NO}_2\text{SiNa}$ 376.1703; found 376.1700.

3w (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.42 (d, J = 12.9 Hz, 1H), 7.26-7.32 (m, 2H), 7.13-7.23 (m, 3H), 4.47 (s, 1H), 3.64 (s, 3H), 3.31 (t, J = 6.9 Hz, 2H), 2.80-2.85 (m, 2H), 2.62 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 169.6, 151.0, 137.6, 128.2 (2C), 126.2, 82.8, 58.4, 49.8, 39.4, 34.7, -1.9; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{25}\text{NO}_2\text{SiNa}$ 314.1547; found 314.1544.

3x (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.41 (d, J = 12.6 Hz, 1H), 7.05 (d, J = 8.4 Hz, 2H), 6.80-6.85 (m, 2H), 4.46 (s, 1H), 3.77 (s, 3H), 3.63 (s, 3H), 3.27 (t, J = 7.2 Hz, 2H), 2.74-2.79 (m, 2H), 2.62 (s, 2H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz) δ 170.0, 158.1, 151.3, 129.8, 129.4, 113.9, 82.9, 58.8, 55.0, 50.1, 39.7, 34.3, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{17}\text{H}_{27}\text{NO}_3\text{SiNa}$ 344.1652; found 344.1648.

3y (yellow liquid) : ^1H NMR (CDCl_3 , 300 MHz) δ 7.39 (d, J = 12.6 Hz, 1H), 7.07-7.11 (m, 2H), 6.94-7.00 (m, 2H), 4.45 (d, J = 12.0 Hz, 1H), 3.63 (s, 3H), 3.29 (t, J = 7.2 Hz, 2H), 2.80 (t, J = 8.1 Hz, 2H), 2.60 (s, 2H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.1, 161.6 (d, $J_{\text{C-F}}$ = 243 Hz), 151.4, 133.7, 130.1 (d, $J_{\text{C-F}}$ = 9.0 Hz), 115.4 (d, $J_{\text{C-F}}$ = 21 Hz), 83.3, 58.8, 50.3, 39.8, 34.4, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{24}\text{FNO}_2\text{SiNa}$ 332.1453; found 332.1448.



5a (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.84 (d, J = 12.6 Hz, 1H), 7.33 (t, J = 7.8 Hz, 2H), 7.14 (t, J = 5.4 Hz, 3H), 5.31 (d, J = 12.6 Hz, 1H), 3.27 (s, 2H), 2.14 (s, 3H), -0.00 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 195.5, 148.5, 146.2, 129.3, 124.9, 121.2, 101.0, 41.3, 27.9, -1.5; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{22}\text{NOSi}$ 248.1465; found 248.1461.

5b (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.81 (d, J = 12.0 Hz, 1H), 7.13 (d, J = 8.4 Hz, 2H), 7.03 (d, J = 8.4 Hz, 2H), 5.28 (d, J = 12.6 Hz, 1H), 3.24 (s, 2H), 2.31 (s, 3H), 2.13 (s, 3H), -0.01

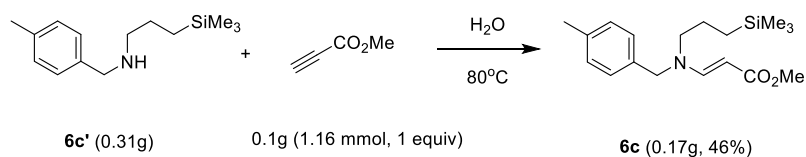
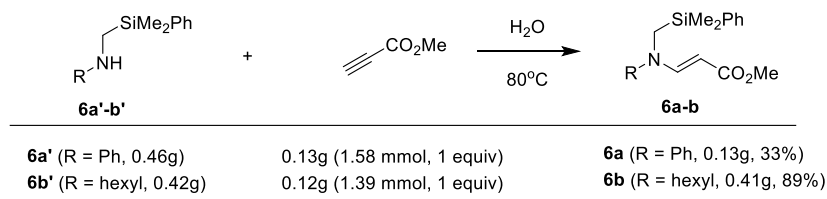
(s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 195.5, 148.9, 144.0, 134.9, 129.9, 121.3, 100.5, 41.3, 27.9, 20.7, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{24}\text{NOSi}$ 262.1622; found 262.1618.

5c (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.99 (s, 1H), 7.34 (d, J = 8.4 Hz, 2H), 7.12 (d, J = 9.0 Hz, 2H), 5.40 (d, J = 11.4 Hz, 1H), 3.31 (s, 2H), 2.20 (s, 3H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 195.6, 147.8, 144.8, 130.1, 129.4, 122.2, 101.5, 41.4, 28.2, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{21}\text{ClNOSi}$ 282.1076; found 282.1074.

5d (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.74 (s, 1H), 7.30-7.35 (m, 3H), 7.16 (d, J = 7.2 Hz, 2H), 5.05 (d, J = 9.6 Hz, 1H), 4.37 (s, 2H), 2.60 (s, 2H), 2.09 (s, 3H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 194.9, 151.9, 135.8, 128.7, 128.0, 127.4, 95.8, 61.4, 53.9, 47.0, 39.2, -1.2; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{24}\text{NOSi}$ 262.1622; found 262.1618.

5e (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.69 (s, 1H), 7.14 (d, J = 7.2 Hz, 2H), 7.04 (d, J = 7.8 Hz, 2H), 5.02 (d, J = 12 Hz, 1H), 4.31 (s, 2H), 2.58 (s, 2H), 2.32 (s, 3H), 2.08 (s, 3H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 194.6, 151.6, 137.6, 132.5, 129.2, 127.3, 95.2, 61.1, 53.4, 46.6, 38.9, 20.8, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{26}\text{NOSi}$ 276.1778; found 276.1775.

5f (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.65 (s, 1H), 7.31 (d, J = 7.2 Hz, 2H), 7.09 (d, J = 8.4 Hz, 2H), 5.05 (d, J = 11.4 Hz, 1H), 4.32 (s, 2H), 2.56 (s, 2H), 2.08 (s, 3H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 194.6, 151.5, 134.2, 133.6, 128.7, 128.5, 96.4, 60.4, 53.1, 46.9, 39.1, -1.4; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{23}\text{ClNOSi}$ 296.1232; found 296.1232.



6a (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.85 (d, J = 13.2 Hz, 1H), 7.23-7.41 (m, 7H), 7.02-7.08 (m, 3H), 4.82 (d, J = 13.2 Hz, 1H), 3.67 (s, 3H), 3.41 (s, 2H), 0.27 (s, 6H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 169.7, 148.6, 146.2, 136.5, 133.4, 129.4, 129.2, 127.9, 124.4, 120.9, 89.1, 50.6, 40.6, -3.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{19}\text{H}_{23}\text{NO}_2\text{SiNa}$ 348.1390; found 348.1387.

6b (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.47-7.49 (m, 2H), 7.34-7.41 (m, 4H), 4.43 (d, J = 12.6 Hz, 1H), 3.63 (s, 3H), 2.91 (s, 2H), 1.59-1.63 (m, 2H), 1.38-1.43 (m, 2H), 1.07-1.25 (m, 6H), 0.83 (t, J = 7.2 Hz, 3H), 0.37 (s, 6H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.1, 151.7, 136.7, 133.3, 129.4, 127.9, 82.6, 56.9, 50.1, 38.8, 31.2, 28.0, 25.9, 22.3, 13.8, -3.2; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{32}\text{NO}_2\text{Si}$ 334.2197; found 334.2196.

6c (yellow liquid) : ^1H NMR (CDCl_3 , 600 MHz) δ 7.59 (d, J = 10.8 Hz, 1H), 7.05-7.12 (m, 4H), 4.62 (d, J = 12.6 Hz, 1H), 4.27 (s, 2H), 3.64 (s, 3H), 3.05 (s, 2H), 2.31 (s, 3H), 1.45 (s, 2H), 0.35 (t, J = 9.0 Hz, 2H), -0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.1, 152.2, 137.1, 133.1, 129.2, 127.1, 83.8, 59.2, 50.8, 50.2, 20.8, 20.0, 13.4, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{18}\text{H}_{29}\text{NO}_2\text{SiNa}$ 342.1860; found 342.1861.

General procedure for MB-sensitized photooxidative C-C double bond cleavage reactions of *N*-(trimethylsilyl)methyl substituted β -enaminocarbonyl substrates. The 5% H_2O -MeCN (v/v) solutions (80 mL) containing β -enaminocarbonyl substrates (0.38 mmol, 4.75 mM) and MB (5 mol %) that were purged with O_2 before and during the irradiation with a 20W compact fluorescent lamp (CFL) for the time periods given below. The photolyzates were concentrated in vacuo to generate residues that were subjected to silica gel column chromatography (EtOAc: hexane = 1: 2-1: 10) to isolate and determine the corresponding photoproducts.

Photoreaction of 1a: A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **2a** (59mg, 75%, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.36 (s, 1H), 7.34-7.40 (m, 2H), 7.22-7.27 (m, 1H), 7.12-7.16 (m, 2H), 3.40 (s, 2H), -0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75

MHz) δ 161.6, 142.4, 129.4, 126.5, 123.6, 36.6, -1.8; HRMS (ESI) m/z : $[M + H]^+$ calcd for $C_{11}H_{18}NOSi$ 208.1152; found 208.1152.

Photoreaction of 1c. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2c** (16mg, 19%, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.11 (s, 1H), 7.19-7.27 (m, 3H), 7.08-7.09 (m, 1H), 3.21 (s, 2H), 2.26 (s, 3H), -0.03 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.5, 141.1, 135.3, 131.6, 128.1 (2C), 126.9, 37.8, 17.9, -1.5; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NOSiNa$ 244.1128; found 244.1123.

Photoreaction of 1d. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2d** (58mg, 69%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.35 (s, 1H), 7.22-7.28 (m, 1H), 6.93-7.07 (m, 3H), 3.38 (s, 2H), 2.36 (s, 3H), -0.06 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 161.6, 142.4, 139.4, 129.2, 127.2, 124.2, 120.6, 36.6, 21.3, -1.8; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NOSiNa$ 244.1128; found 244.1127.

Photoreaction of 1e. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2e** (61mg, 72%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.31 (s, 1H), 7.15-7.18 (m, 2H), 7.01-7.05 (m, 2H), 3.37 (s, 2H), 2.34 (s, 3H), -0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 161.6, 139.8, 136.4, 130.0, 123.6, 36.6, 20.8, -1.8; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NOSiNa$ 244.1128; found 244.1128.

Photoreaction of 1f. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2f** (28mg, 31%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.11 (s, 1H), 7.25-7.31 (m, 1H), 7.09-7.12 (m, 1H), 6.91-6.98 (m, 2H), 3.82 (s, 3H), 3.31 (s, 2H), -0.09 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.9, 155.0, 131.0, 128.8, 128.2, 120.7, 111.9, 55.4, 36.8, -1.9; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NO_2SiNa$ 260.1077; found 260.1076.

Photoreaction 1g. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2g** (44mg, 49%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.38 (s, 1H), 7.28 (d, J = 8.1 Hz, 1H), 6.67-6.80 (m, 3H), 3.80 (s, 3H), 3.37 (s, 2H), -0.05 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz)

δ 161.5, 160.4, 143.7, 130.2, 115.7, 111.5, 109.8, 55.4, 36.6, -1.7; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NO_2SiNa$ 260.1077; found 260.1075.

Photoreaction of 1h. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2h** (55mg, 61%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.25 (s, 1H), 7.04-7.09 (m, 2H), 6.86-6.91 (m, 2H), 3.80 (s, 3H), 3.34 (s, 2H), -0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 161.6, 158.2, 135.3, 125.5, 114.5, 55.4, 37.0, -1.9; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{19}NO_2SiNa$ 260.1077; found 260.1076.

Photoreaction 1i. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 20) to yield **2i** (34mg, 40%, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.20 (d, $J = 2.4$ Hz, 1H), 7.26-7.30 (m, 1H), 7.12-7.20 (m, 3H), 3.36 (s, 2H), -0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.2, 157.5 (d, $J_{C-F} = 248$ Hz), 130.1 (d, $J_{C-F} = 12$ Hz), 128.8 (d, $J_{C-F} = 7.5$ Hz), 127.9, 124.8 (d, $J_{C-F} = 4.5$ Hz), 116.9 (d, $J_{C-F} = 21$ Hz), 37.0, -2.0; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{11}H_{16}FNOSiNa$ 248.0877; found 248.0876.

Photoreaction of 1j. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2j** (47mg, 55%, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.40 (s, 1H), 7.32-7.36 (m, 1H), 6.93-6.97 (m, 2H), 6.87-6.90 (m, 1H), 3.38 (s, 2H), -0.04 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 163.1 (d, $J_{C-F} = 248$ Hz), 161.4, 144.1 (d, $J_{C-F} = 11$ Hz), 130.8 (d, $J_{C-F} = 9$ Hz), 118.8 (d, $J_{C-F} = 3$ Hz), 113.3 (d, $J_{C-F} = 21$ Hz), 110.6 (d, $J_{C-F} = 24$ Hz), 36.6, -1.7; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{11}H_{16}FNOSiNa$ 248.0877; found 248.0876.

Photoreaction of 1k. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2k** (30mg, 35%, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.29 (s, 1H), 7.03-7.16 (m, 4H), 3.36 (s, 2H), -0.06 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 161.5, 161.0 (d, $J_{C-F} = 96$ Hz), 138.6 (d, $J_{C-F} = 3$ Hz), 125.7 (d, $J_{C-F} = 7.5$ Hz), 116.4 (d, $J_{C-F} = 24$ Hz), 37.0, -1.8; HRMS (ESI) m/z : $[M + H]^+$ calcd for $C_{11}H_{17}FNOSi$ 226.1058; found 226.1055.

Photoreaction of 1l. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 20) to yield **2l** (31mg, 34%, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.14 (s, 1H), 7.46-7.48 (m, 1H), 7.22-7.32 (m, 3H), 3.32 (s, 2H), -0.03 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.5, 139.7, 132.2, 130.9, 129.3, 129.1, 127.8, 37.6, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_{16}\text{ClNOSiNa}$ 264.0582; found 264.0586.

Photoreaction of 1m. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2m** (47mg, 51%, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.38 (s, 1H), 7.02-7.34 (m, 4H), 3.37 (s, 2H), -0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 161.3, 143.7, 135.1, 130.5, 126.5, 123.5, 121.4, 36.6, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_{16}\text{ClNOSiNa}$ 264.0582; found 264.0578.

Photoreaction of 1n. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2n** (30mg, 33%, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.33 (s, 1H), 7.33-7.36 (m, 2H), 7.08-7.10 (m, 2H), 3.37 (s, 2H), -0.05 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 161.4, 141.1, 132.1, 129.7, 124.8, 36.7, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{11}\text{H}_{17}\text{ClNOSi}$ 242.0762; found 242.0763.

Photoreaction of 1o. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2o** (40mg, 39%, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.46 (s, 1H), 7.65 (d, J = 8.4 Hz, 2H), 7.27 (d, J = 8.4 Hz, 2H), 3.43 (s, 2H), -0.03 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 161.3, 145.5, 128.2 (q, $J_{\text{C-F}}$ = 33 Hz), 126.8 (q, $J_{\text{C-F}}$ = 3 Hz), 124.9 (d, $J_{\text{C-F}}$ = 81 Hz), 122.8, 36.5, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{12}\text{H}_{17}\text{F}_3\text{NOSi}$ 276.1026; found 276.1025.

Photoreaction of 3a. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4a** (71mg, 86%, 1: 3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.00 (s, 1H), 7.97 (s, 1H), 3.28 (t, J = 7.2 Hz, 2H), 3.17 (t, J = 7.2 Hz, 2H), 2.80 (s, 2H), 2.71 (s, 2H), 1.66 (s, 2H), 1.49-1.54 (m, 2H), 1.21-1.30 (m, 6H), 0.85-0.88 (m, 3H), 0.09 (s, 9H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.2, 161.6, 49.5, 44.7, 38.3, 33.8, 31.5, 31.4, 27.9, 26.6, 26.5, 26.0, 22.5,

22.5, 14.0, 13.9, -1.4, -2.0; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{11}H_{25}NOSiNa$ 238.1598; found 238.1597.

Photoreaction of 3b. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4b** (65mg, 70%, 1: 4 conformers, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.04 (s, 1H), 7.96 (s, 1H), 3.15-3.30 (m, 2H), 3.02-3.05 (m, 2H), 2.78 (s, 2H), 2.69 (s, 2H), 1.59 (s, 2H), 1.18-1.32 (m, 7H), 0.82-0.90 (m, 6H), 0.09 (s, 9H), 0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.5, 161.8, 53.1, 47.8, 38.3, 36.1 (2C), 33.8, 30.2, 29.9, 28.5, 28.4, 23.4, 23.2, 23.0, 22.8, 13.9 (2C), 10.4, 10.3, -1.5, -2.0; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{13}H_{29}NOSiNa$ 266.1911; found 266.1909.

Photoreaction of 3c. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 2) to yield **4c** (45mg, 63%, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.34 (s, 1H), 2.66 (s, 2H), 1.33 (s, 9H), 0.06 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 160.2, 55.2, 32.8, 29.1, -0.9; HRMS (ESI) m/z : $[M + H]^+$ calcd for $C_9H_{22}NOSi$ 188.1465; found 188.1464.

Photoreaction of 3d. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 2) to yield **4d** (47mg, 66%, 1: 2 conformers, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.01 (s, 1H), 8.00 (s, 1H), 3.47-3.52 (m, 2H), 3.43 (t, J = 5.4 Hz, 2H), 3.34 (t, J = 5.4 Hz, 2H), 3.31 (s, 3H), 2.84 (s, 2H), 0.08 (s, 9H), 0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.4, 162.2, 70.2, 69.6, 58.9, 58.7, 49.4, 44.7, 39.7, 34.8, -1.5, -2.1; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_8H_{19}NO_2SiNa$ 212.1077; found 212.1076.

Photoreaction of 3e. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4e** (58mg, 70%, 1: 1 conformers, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.07 (s, 1H), 8.01 (s, 1H), 4.17-4.22 (m, 2H), 4.04 (s, 2H), 3.92 (s, 2H), 2.85 (s, 2H), 2.83 (s, 2H), 1.25-1.29 (m, 3H), 0.10 (s, 9H), 0.07 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 168.8, 168.2, 162.8, 162.4, 61.6, 61.2, 51.1, 46.4, 39.5, 35.8, 14.0, -1.7, -2.2; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_9H_{19}NO_3SiNa$ 240.1026; found 240.1023.

Photoreaction of 3f. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4f** (57mg, 65%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.12 (s, 1H), 8.07 (s, 1H), 4.74 (q, $J = 7.2$ Hz, 1H), 4.13-4.20 (m, 2H), 2.53-2.71 (m, 2H), 1.47 (d, $J = 7.2$ Hz, 3H), 1.39 (d, $J = 7.2$ Hz, 3H), 1.23-1.27 (m, 3H), 0.14 (s, 9H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 171.0, 170.8, 162.4, 162.2, 61.5, 61.1, 56.9, 52.0, 36.1, 34.2, 16.2, 14.0 (2C), 13.9, -1.2, -1.9; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{10}\text{H}_{21}\text{NO}_3\text{SiNa}$ 254.1183; found 254.1181.

Photoreaction of 3g. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4g** (64mg, 55%, 1: 1 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.00 (s, 1H), 7.90 (s, 1H), 7.13-7.29 (m, 5H), 4.74 (q, $J = 4.8$ Hz, 1H), 4.14-4.23 (m, 3H), 3.25-3.37 (m, 2H), 3.00-3.14 (m, 2H), 2.53-2.64 (m, 2H), 2.25 (d, $J = 15.6$ Hz, 2H), 1.23-1.26 (m, 3H), 0.03 (s, 9H), 0.02 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 170.0, 169.9, 162.5, 162.4, 137.0, 136.1, 128.9 (2C), 128.7, 128.4, 127.1, 126.6, 63.4, 61.4, 61.3, 58.7, 37.7, 36.0, 34.6, 34.1, 14.0 (2C), -1.1, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{25}\text{NO}_3\text{SiNa}$ 330.1496; found 330.1494.

Photoreaction of 3h. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4h** (60mg, 69%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.06 (s, 1H), 7.96 (s, 1H), 4.08-4.17 (m, 2H), 3.50-3.59 (m, 2H), 2.78 (s, 2H), 2.77 (s, 2H), 2.51-2.59 (m, 2H), 1.21-1.26 (m, 3H), 0.10 (s, 9H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 171.5, 170.7, 162.3, 161.9, 60.9, 60.6, 45.1, 41.2, 39.1, 33.8, 33.0, 32.0, 14.0, -1.5, -2.2; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{10}\text{H}_{22}\text{NO}_3\text{SiNa}$ 254.1183; found 254.1182.

Photoreaction of 3i. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4i** (42mg, 65%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.05 (s, 1H), 8.03 (s, 1H), 5.61-5.76 (m, 1H), 5.10-5.25 (m, 2H), 3.92-3.94 (m, 2H), 3.77-3.80 (m, 2H), 2.80 (s, 2H), 2.70 (s, 2H), 0.09 (s, 9H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.1, 161.7, 133.1, 132.1, 118.6, 117.9, 52.0, 47.0, 37.8, 34.0, -1.5, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_8\text{H}_{18}\text{NOSi}$ 172.1152; found 172.1150.

Photoreaction of 3j. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4j** (60mg, 74%, 1: 6 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.11 (s, 1H), 8.05 (s, 1H), 4.06-4.17 (m, 1H), 3.09-3.19 (m, 1H), 2.65 (s, 2H), 2.56 (s, 2H), 1.01-1.86 (m, 10H), 0.10 (s, 9H), 0.06 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.3, 161.1, 59.0, 52.2, 33.9, 33.3, 32.1, 29.5, 25.6, 25.4, 25.3, 25.1, -1.3, -1.8; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{11}\text{H}_{24}\text{NOSi}$ 214.1622; found 214.1621.

Photoreaction of 3k. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 1) to yield **4k** (87mg, 73%, 1: 3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.18 (s, 1H), 8.09 (s, 1H), 4.32-4.38 (m, 1H), 4.23 (d, J = 12.6 Hz, 2H), 4.19 (d, J = 13.8 Hz, 2H), 3.35-3.40 (m, 1H), 2.69-2.77 (m, 2H), 2.66 (s, 2H), 2.55 (s, 2H), 1.55-1.72 (m, 4H), 1.45 (s, 9H), 1.44 (s, 9H), 0.12 (s, 9H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.6, 161.3, 154.5, 154.4, 79.9, 79.6, 57.2, 50.4, 43.1, 33.8, 33.2, 31.0, 28.3, -1.1, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{15}\text{H}_{30}\text{N}_2\text{O}_3\text{SiNa}$ 337.1918; found 337.1914.

Photoreaction of 3l. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 1) to yield **4l** (44mg, 52%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.52-8.57 (m, 1H), 8.27 (s, 1H), 8.16 (s, 1H), 7.62-7.70 (m, 1H), 7.15-7.23 (m, 2H), 4.64 (s, 2H), 4.49 (s, 2H), 2.78 (s, 2H), 0.08 (s, 9H), 0.05 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.6, 162.3, 156.3, 149.7, 149.0, 137.0, 136.9, 122.8, 122.5, 122.2, 121.3, 55.1, 50.2, 38.7, 34.7, -1.5, -2.1; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{11}\text{H}_{19}\text{N}_2\text{OSi}$ 223.1261; found 223.1261.

Photoreaction of 3m. A 48 h irradiation and then column chromatography (EtOAc) to yield **4m** (50mg, 59%, 1: 1.3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.55-8.63 (m, 2H), 8.30 (s, 1H), 8.15 (s, 1H), 8.12 (s, 1H), 7.69 (s, 1H), 7.49 (s, 1H), 4.61 (s, 2H), 4.45 (s, 2H), 2.69 (s, 2H), 2.68 (s, 2H), 0.12 (s, 9H), 0.07 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.5, 161.6, 149.6, 149.3, 149.1, 149.0, 136.0, 135.0, 132.0, 131.5, 123.7 (2C), 50.8, 45.7, 37.9, 34.1, -1.5, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{11}\text{H}_{19}\text{N}_2\text{OSi}$ 223.1261; found 223.1261.

Photoreaction of 3n. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4n** (72mg, 70%, 1: 1.5 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.35 (s, 1H), 8.19 (s, 1H), 8.05 (d, J = 8.4 Hz, 1H), 7.80-7.90 (m, 3H), 7.48-7.56 (m, 2H), 7.45 (t, J = 7.2 Hz, 1H), 7.42 (t, J = 6.6 Hz, 1H), 7.32 (d, J = 7.2 Hz, 1H), 7.29 (d, J = 6.6 Hz, 1H), 4.99 (s, 2H), 4.88 (s, 2H), 2.85 (s, 2H), 2.58 (s, 2H), 0.03 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.2, 162.1, 133.8, 133.7, 131.5 (2C), 131.2, 131.1, 129.0, 128.6 (3C), 127.1, 126.6, 126.5, 126.0 (2C), 125.4, 125.2, 125.0, 123.7, 122.2, 50.8, 46.0, 37.2, 34.9, -1.5, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{22}\text{NOSi}$ 272.1465; found 272.1462.

Photoreaction of 3o. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **4o** (65mg, 77%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.26 (s, 1H), 8.15 (s, 1H), 7.15-7.38 (m, 5H), 4.52 (s, 2H), 4.36 (s, 2H), 2.71 (s, 2H), 2.62 (s, 2H), 0.07 (s, 9H), 0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.4, 161.7, 136.2, 135.9, 128.7, 128.5, 128.0, 127.9, 127.4 (2C), 53.3, 47.8, 37.6, 33.9, -1.5, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{12}\text{H}_{20}\text{NOSi}$ 222.1309; found 222.1308.

Photoreaction of 3p. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4p** (58mg, 72%, 1: 3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.24 (s, 1H), 8.13 (s, 1H), 7.04-7.16 (m, 4H), 4.48 (s, 2H), 4.31 (s, 2H), 2.70 (s, 2H), 2.60 (s, 2H), 2.33 (s, 3H), 2.31 (s, 3H), 0.07 (s, 9H), 0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.4, 161.7, 137.8, 137.2, 133.2, 132.8, 129.4, 129.3, 128.1, 127.4, 53.1, 47.6, 37.5, 33.9, 33.8, 21.0, -1.4, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{21}\text{NOSiNa}$ 258.1285; found 258.1282.

Photoreaction of 3q. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4q** (76mg, 80%, 1: 3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.24 (s, 1H), 8.11 (s, 1H), 7.13 (d, J = 8.4 Hz, 2H), 7.08 (d, J = 9.0 Hz, 2H), 6.83-6.88 (m, 4H), 4.45 (s, 2H), 4.29 (s, 2H), 3.79 (s, 3H), 3.78 (s, 3H), 2.69 (s, 2H), 2.59 (s, 2H), 0.07 (s, 9H), 0.04 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.4, 161.6, 159.4, 159.0, 129.5, 128.8, 128.4, 127.8, 114.2, 114.0, 55.3,

52.9, 47.3, 37.5, 33.7, -1.4, -1.9; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{13}H_{21}NO_2SiNa$ 274.1234; found 274.1230.

Photoreaction of 3r. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4r** (70mg, 77%, 1: 2 conformers, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.25 (s, 1H), 8.13 (s, 1H), 7.17-7.19 (m, 2H), 7.13-7.15 (m, 2H), 6.98-7.06 (m, 4H), 4.48 (s, 2H), 4.33 (s, 2H), 2.68 (s, 2H), 2.60 (s, 2H), 0.07 (s, 9H), 0.04 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 163.3, 162.5, 162.2 (d, J_{C-F} = 243 Hz), 161.7, 132.1 (d, J_{C-F} = 3.0 Hz), 131.7, 129.8 (d, J_{C-F} = 7.5 Hz), 129.2 (d, J_{C-F} = 7.5 Hz), 115.8 (d, J_{C-F} = 23 Hz), 115.5 (d, J_{C-F} = 21 Hz), 52.7, 47.3, 37.7, 33.9, -1.4, -2.0; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{12}H_{18}FNOSiNa$ 262.1034; found 262.1032.

Photoreaction of 3s. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4s** (68mg, 70%, 1: 2 conformers, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.24 (s, 1H), 8.13 (s, 1H), 7.26-7.35 (m, 4H), 7.08-7.16 (m, 4H), 4.48 (s, 2H), 4.33 (s, 2H), 2.68 (s, 2H), 2.60 (s, 2H), 0.08 (s, 9H), 0.04 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.4, 161.6, 134.8, 134.4, 133.8, 133.2, 129.4, 128.9, 128.7 (2C), 52.6, 47.3, 37.7, 33.9, -1.5, -2.1; HRMS (ESI) m/z : $[M + H]^+$ calcd for $C_{12}H_{19}ClNOSi$ 256.0919; found 256.0915.

Photoreaction of 3t. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4t** (89mg, 81%, 1: 2 conformers, yellow liquid). 1H NMR ($CDCl_3$, 600 MHz) δ 8.27 (s, 1H), 8.17 (s, 1H), 7.61 (d, J = 7.8 Hz, 2H), 7.57 (d, J = 7.8 Hz, 2H), 7.31 (d, J = 7.8 Hz, 2H), 7.29 (d, J = 7.8 Hz, 2H), 4.57 (s, 2H), 4.43 (s, 2H), 2.70 (s, 2H), 2.63 (s, 2H), 0.09 (s, 9H), 0.05 (s, 9H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 150 MHz) δ 162.5, 161.8, 140.4, 140.2, 130.2 (q, J_{C-F} = 33 Hz), 129.7 (q, J_{C-F} = 33 Hz), 128.1, 127.6, 125.7, 125.5, 124.8, 124.7, 123.0, 122.9, 52.7, 47.6, 37.9, 34.1, -1.6, -2.2; HRMS (ESI) m/z : $[M + Na]^+$ calcd for $C_{13}H_{18}F_3NOSiNa$ 312.1002; found 312.0999.

Photoreaction of 3u. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4u** (59mg, 66%, 1: 4 conformers, yellow liquid). 1H NMR ($CDCl_3$, 300 MHz) δ 8.36 (s, 1H), 8.20 (s, 1H), 7.22-7.38 (m, 5H), 5.86 (q, J = 7.5 Hz, 1H), 4.69 (q, J = 6.9 Hz, 1H), 2.20-2.60 (m,

2H), 1.61 (d, $J = 7.2$ Hz, 3H), 1.48 (d, $J = 7.2$ Hz, 3H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.6, 161.4, 140.2, 139.7, 128.6, 128.4, 127.8, 127.5, 127.4, 126.8, 57.5, 49.5, 33.2, 32.7, 18.9, 15.4, -1.1, -1.7; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{21}\text{NOSiNa}$ 258.1285; found 258.1283.

Photoreaction of 3v. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4v** (62mg, 55%, 1: 8 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 8.38 (s, 1H), 8.12 (s, 1H), 7.28-7.38 (m, 5H), 7.13-7.22 (m, 5H), 5.76 (s, 1H), 2.79 (s, 2H), 2.52 (s, 2H), -0.01 (s, 9H), -0.03 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.9, 162.6, 138.5, 138.1, 129.0, 128.7, 128.6, 128.4, 128.0, 127.5, 67.5, 59.5, 36.1, 35.1, -1.3, -1.6; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{18}\text{H}_{23}\text{NOSiNa}$ 320.1441; found 320.1440.

Photoreaction of 3w. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4w** (63mg, 70%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 300 MHz) δ 7.98 (s, 1H), 7.80 (s, 1H), 7.10-7.32 (m, 5H), 3.49-3.54 (m, 2H), 3.42 (t, $J = 7.2$ Hz, 2H), 2.86 (s, 2H), 2.79-2.85 (m, 2H), 2.64 (s, 2H), 0.09 (s, 9H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.2, 161.6, 138.6, 137.8, 128.8, 128.7, 128.5, 126.8, 126.4, 51.1, 46.7, 39.0, 34.7, 34.0, 33.2, -1.4, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{21}\text{NOSiNa}$ 258.1285; found 258.1284.

Photoreaction of 3x. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **4x** (68mg, 68%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 7.98 (s, 1H), 7.78 (s, 1H), 7.11-7.13 (m, 2H), 7.01-7.03 (m, 2H), 6.81-6.83 (m, 2H), 3.77 (s, 3H), 3.47-3.49 (m, 2H), 3.37 (t, $J = 7.2$ Hz, 2H), 2.85 (s, 2H), 2.74-2.78 (m, 2H), 2.64 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.2, 161.7, 158.4, 158.2, 130.6, 129.7 (2C), 114.2, 113.9, 55.2, 51.3, 46.9, 38.9, 34.0, 33.8, 32.2, -1.4, -2.0; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{14}\text{H}_{23}\text{NO}_2\text{SiNa}$ 288.1390; found 288.1388.

Photoreaction of 3y. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4y** (63mg, 65%, 1: 2 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 7.98 (s, 1H), 7.78 (s, 1H), 7.14-7.17 (m, 2H), 7.05-7.08 (m, 2H), 6.94-6.99 (m, 2H), 3.48-3.50 (m, 2H), 3.39

(t, $J = 6.6$ Hz, 2H), 2.84 (s, 2H), 2.78-2.81 (m, 2H), 2.63 (s, 2H), 0.08 (s, 9H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.1, 161.6 (d, $J_{\text{C-F}} = 243$ Hz), 161.5, 161.4 (d, $J_{\text{C-F}} = 243$ Hz), 134.1 (d, $J_{\text{C-F}} = 3$ Hz), 133.4 (d, $J_{\text{C-F}} = 3$ Hz), 130.0 (d, $J_{\text{C-F}} = 7.5$ Hz), 115.4 (d, $J_{\text{C-F}} = 21$ Hz), 115.2 (d, $J_{\text{C-F}} = 21$ Hz), 50.9, 46.5, 38.8, 33.9, 33.6, 32.1, -1.5, -2.2; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{20}\text{FNOSiNa}$ 276.1190; found 276.1189.

Photoreaction of 5a. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2a** (35mg, 45%, yellow liquid).

Photoreaction of 5b. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2f** (47mg, 56%, yellow liquid).

Photoreaction of 5c. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **2o** (29mg, 32%, yellow liquid).

Photoreaction of 5d. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4o** (37mg, 44%, yellow liquid).

Photoreaction of 5e. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4p** (44mg, 49%, yellow liquid).

Photoreaction of 5f. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 3) to yield **4s** (52mg, 54%, yellow liquid).

Photoreaction of 6a. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 10) to yield **7a** (65mg, 65%, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 8.31 (s, 1H), 7.39-7.41 (m, 2H), 7.27-7.34 (m, 5H), 7.19-7.22 (m, 1H), 6.99-7.01 (m, 2H), 3.59 (s, 2H), 0.23 (s, 6H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 161.6, 142.1, 136.8, 133.6, 129.3, 129.2, 127.7, 126.5, 123.7, 36.1, -3.1; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{19}\text{NOSiNa}$ 292.1128; found 292.1126.

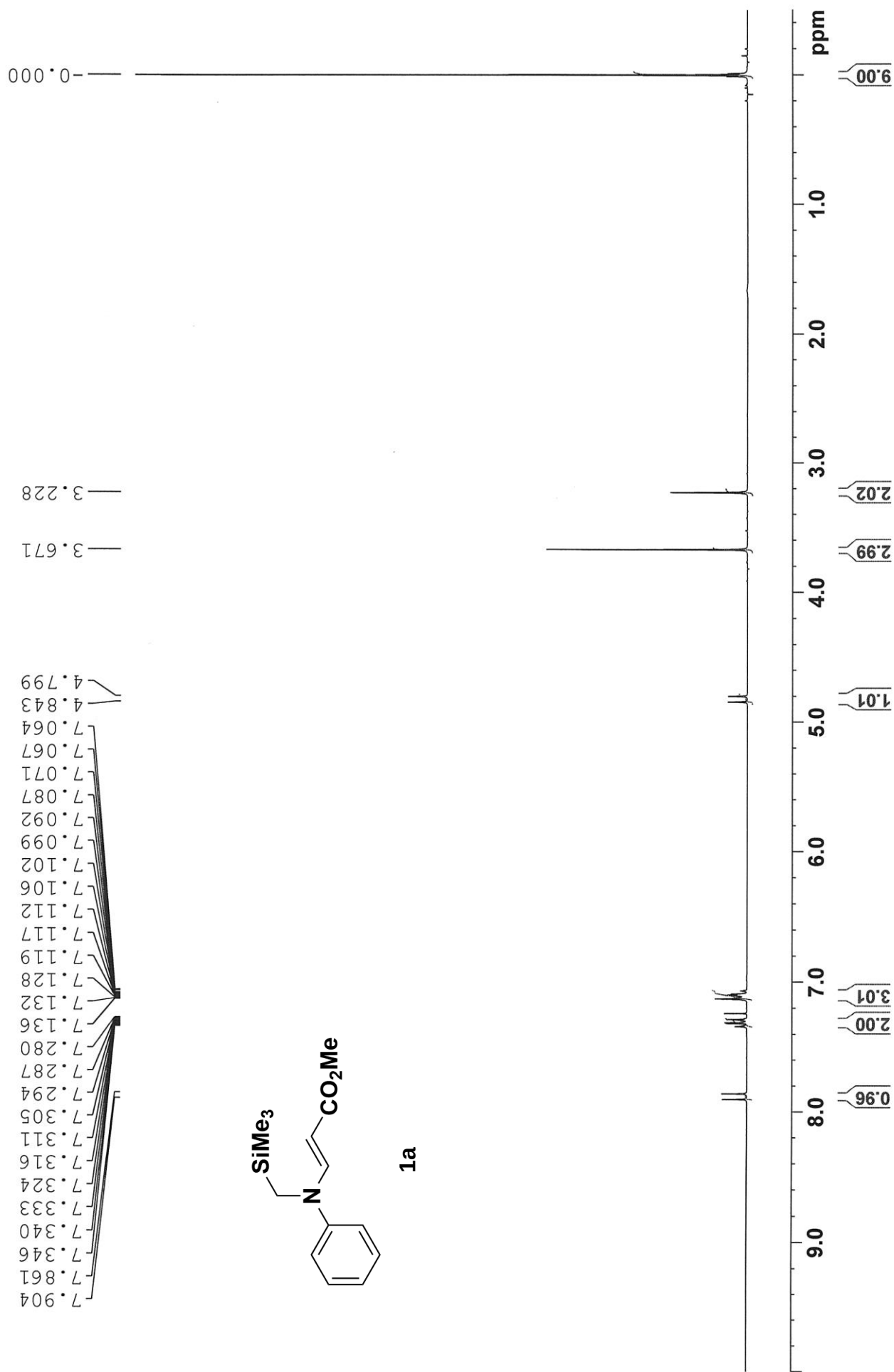
Photoreaction 6b. A 48 h irradiation and then column chromatography (EtOAc: hexane = 1: 5) to yield **7b** (74mg, 70%, 1: 3 conformers, yellow liquid). ^1H NMR (CDCl_3 , 600 MHz) δ 7.98 (s, 1H), 7.93 (s, 1H), 7.33-7.53 (m, 5H), 3.16 (t, $J = 7.2$ Hz, 2H), 3.02 (s, 2H), 2.99 (t, $J = 7.2$ Hz, 2H), 2.92 (s,

2H), 1.07-1.42 (m, 8H), 0.84 (t, $J = 7.2$ Hz, 3H), 0.37 (s, 6H); $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz) δ 162.2, 161.6, 137.6, 136.0, 133.5, 133.4, 129.7, 129.3, 128.1, 127.8, 49.2, 44.5, 37.7, 33.1, 31.4, 31.2, 27.6, 26.4, 26.3, 25.9, 22.4 (2C), 13.9 (2C), -3.2, -3.8; HRMS (ESI) m/z : $[\text{M} + \text{Na}]^+$ calcd for $\text{C}_{16}\text{H}_{27}\text{NOSiNa}$ 300.1754; found 300.1757.

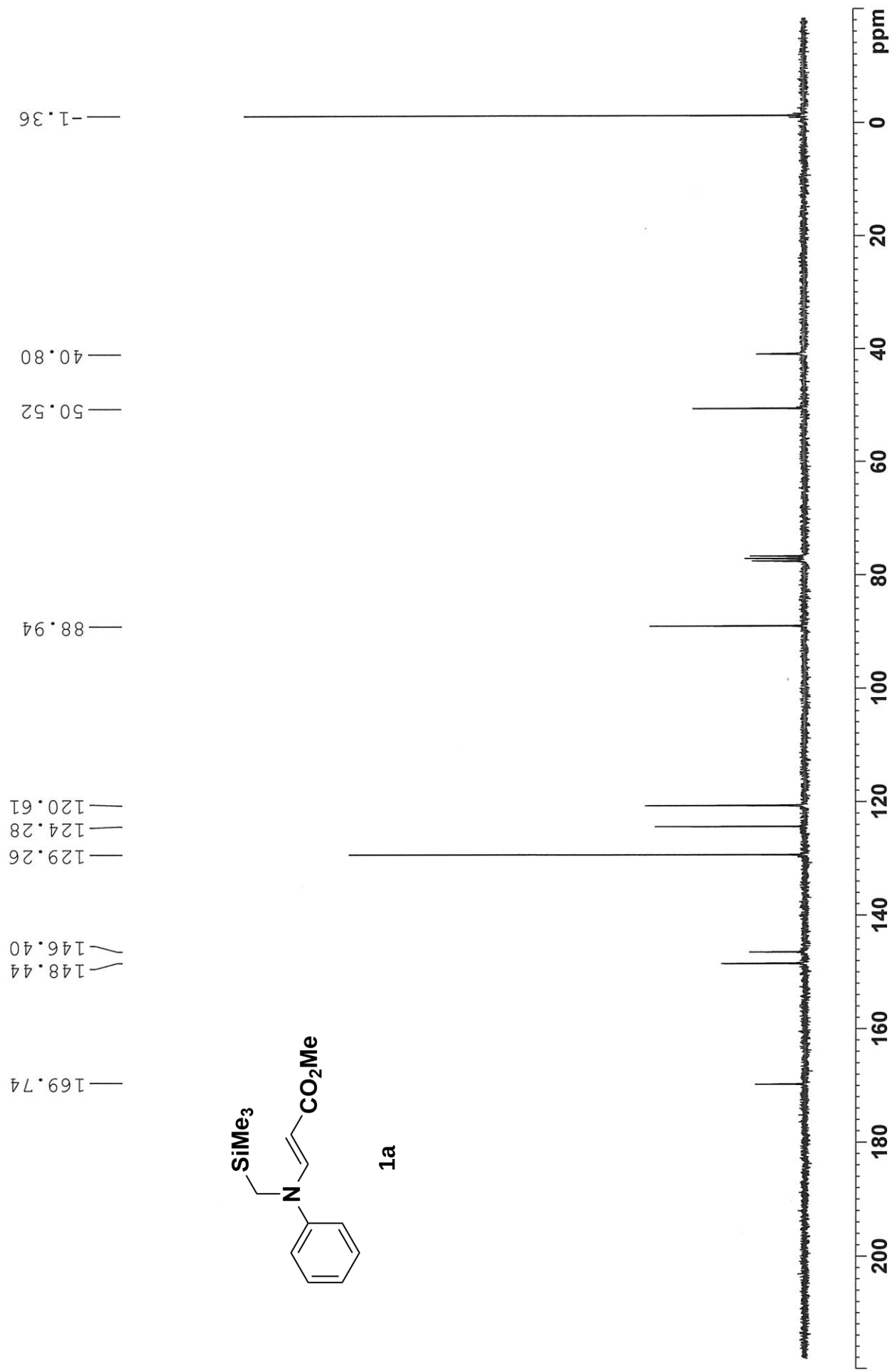
MB-sensitized photooxidative reactions of 1a in the presence of DABCO. The 5% H_2O -MeCN solutions (80 mL) containing β -enaminoester **1a** (0.38 mmol, 4.75 mM) and MB (5 mol %) that were purged with O_2 before and during the irradiation were irradiated for 48 h with a 20W compact fluorescent lamp (CFL) in the presence of DABCO (0, 2.37, 4.75, 9.49, 23.8 mM respectively). The photolyzates were concentrated in vacuo to generate residues that were subjected to silica gel column chromatography (EtOAc: hexane = 1: 8) to isolate and determine the yields of corresponding *N*-formamide **2a**.

MB-sensitized photooxidative reactions of 1a in the presence of methyl phenyl sulfoxide. The 5% H_2O -MeCN solutions (80 mL) containing β -enaminoester **1a** (0.19 mmol, 2.37 mM) and MB (5 mol %) that were purged with O_2 before and during the irradiation were irradiated for 48 h with 20 W compact fluorescent lamp (CFL) in the presence of methyl phenyl sulfoxide (0, 2.37 mM (1 equiv.), and 11.9 mM (5 equiv.)). The photolyzates were concentrated in vacuo to generate residues that were subjected to silica gel column chromatography (EtOAc: hexane = 1: 8) to isolate and determine the yields of corresponding *N*-formamide **2a**.

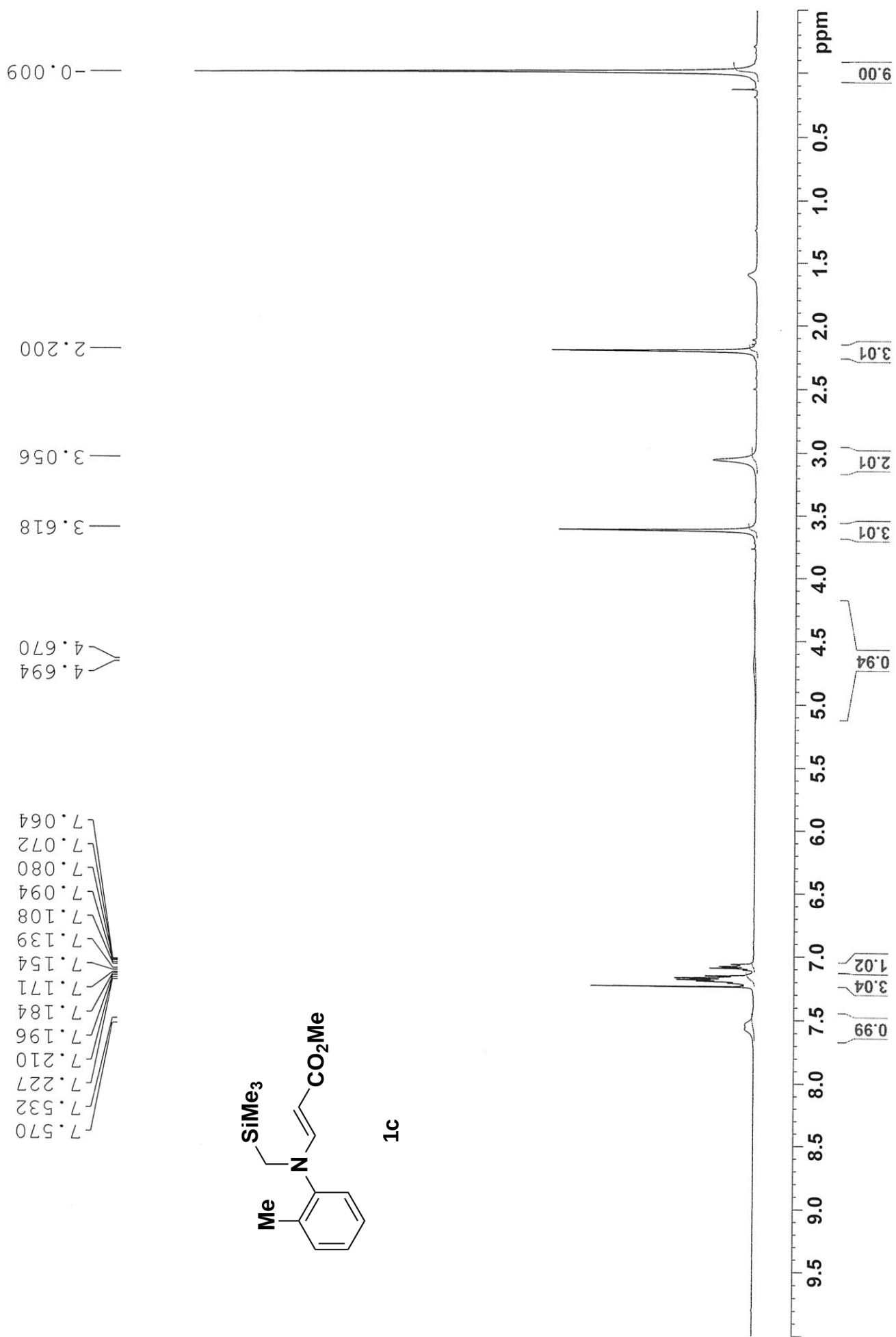
¹H NMR (CDCl₃, 300 MHz)



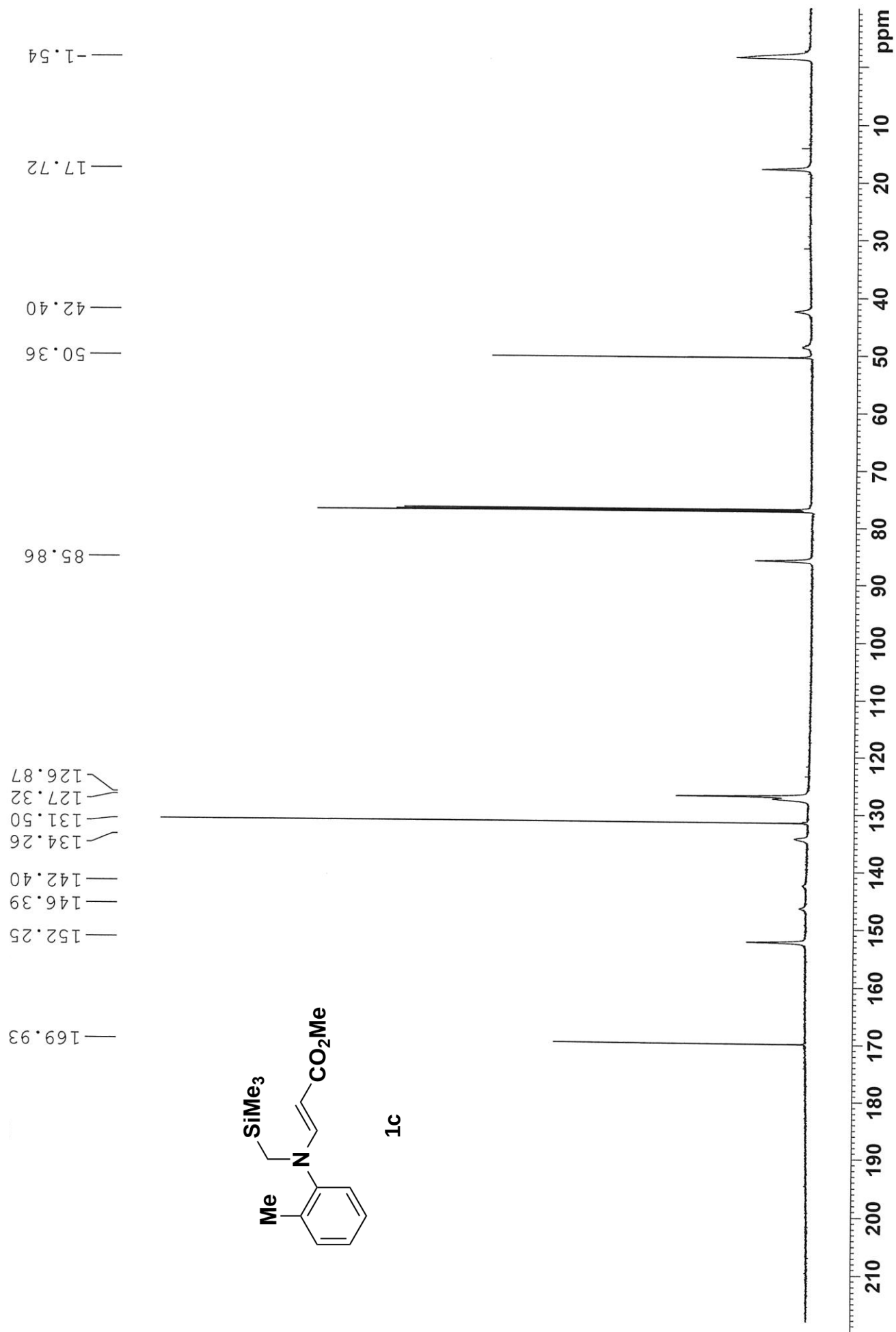
^{13}C { ^1H } NMR (CDCl_3 , 75 MHz)



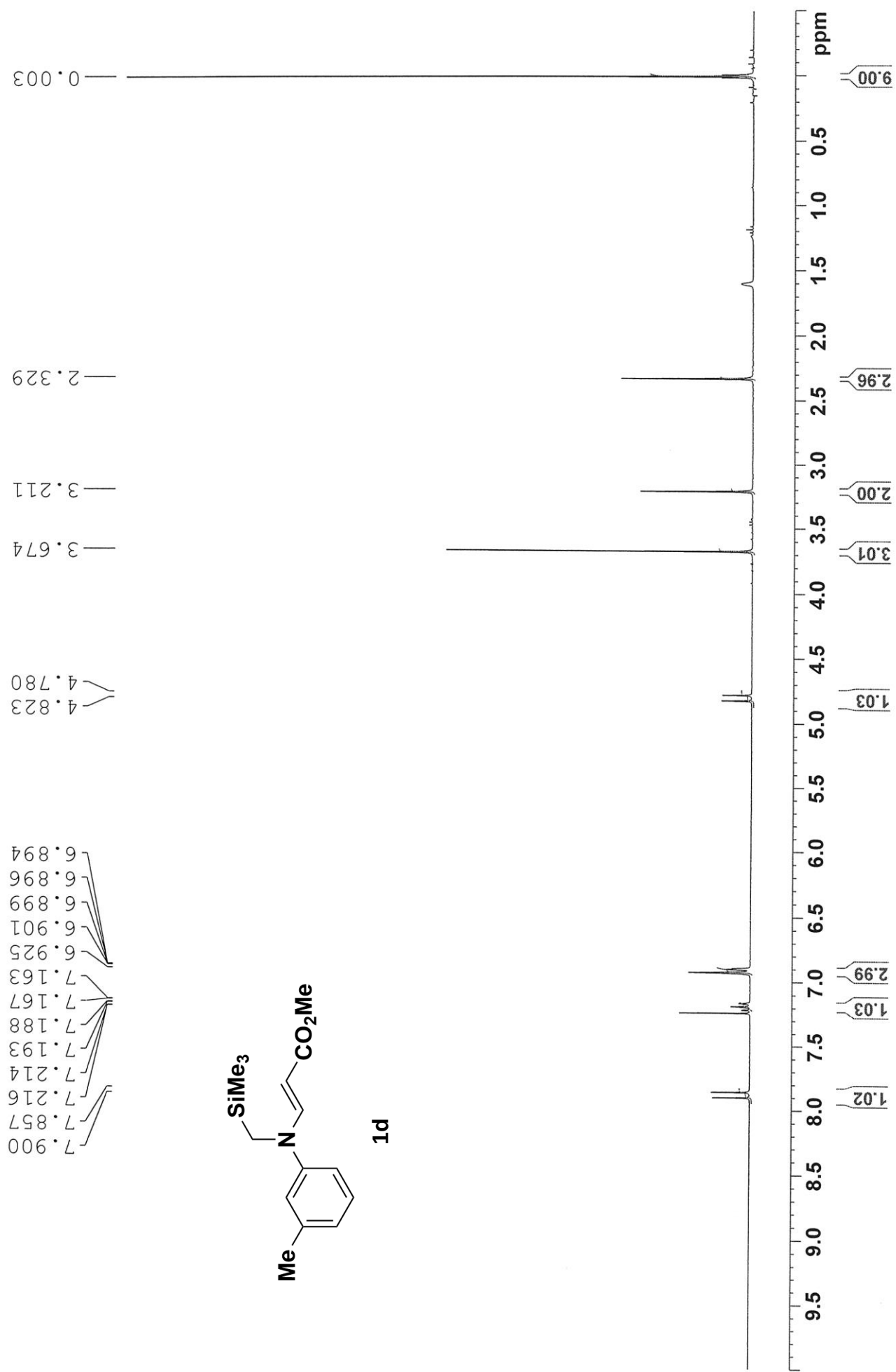
¹H NMR (CDCl₃, 300 MHz)



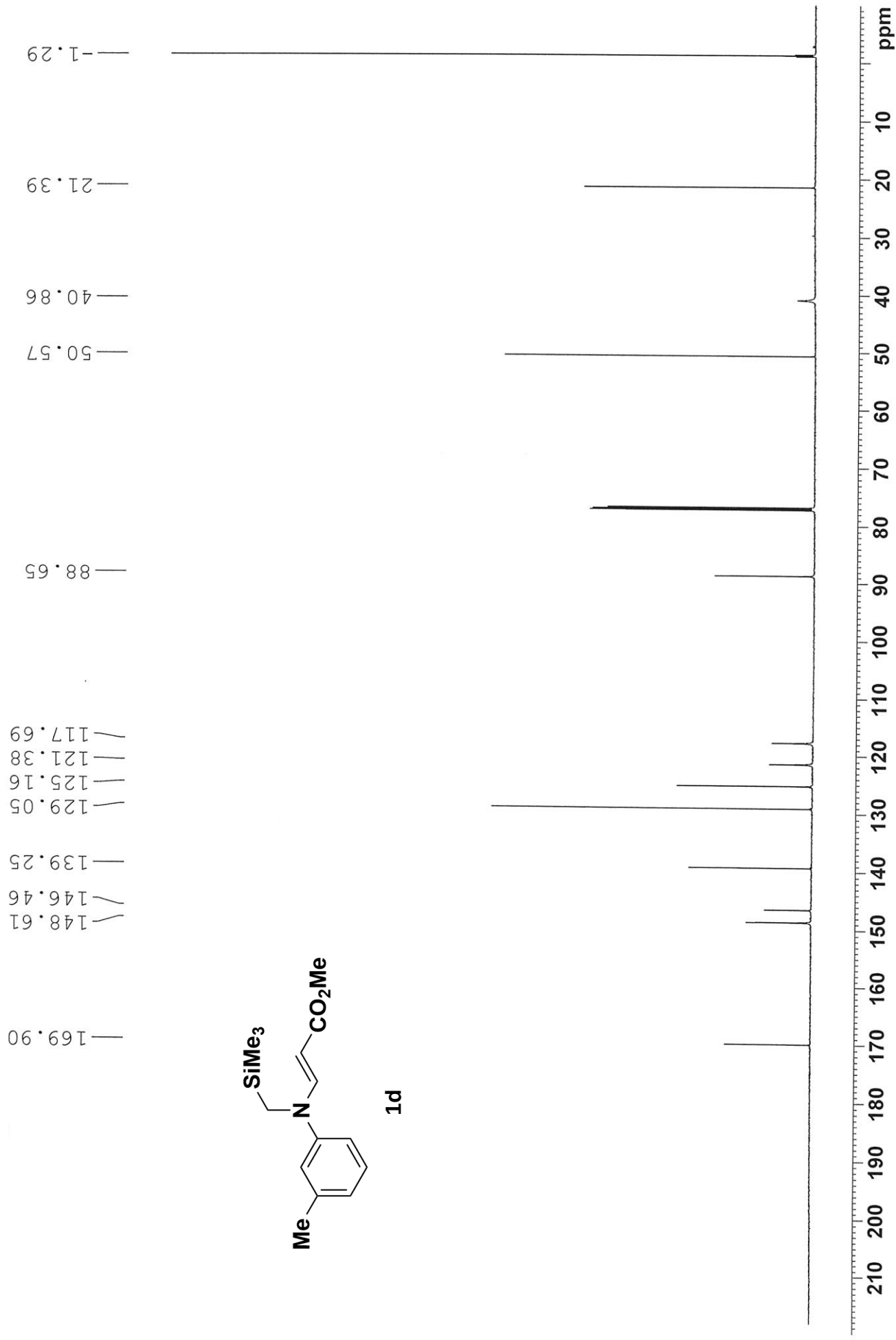
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



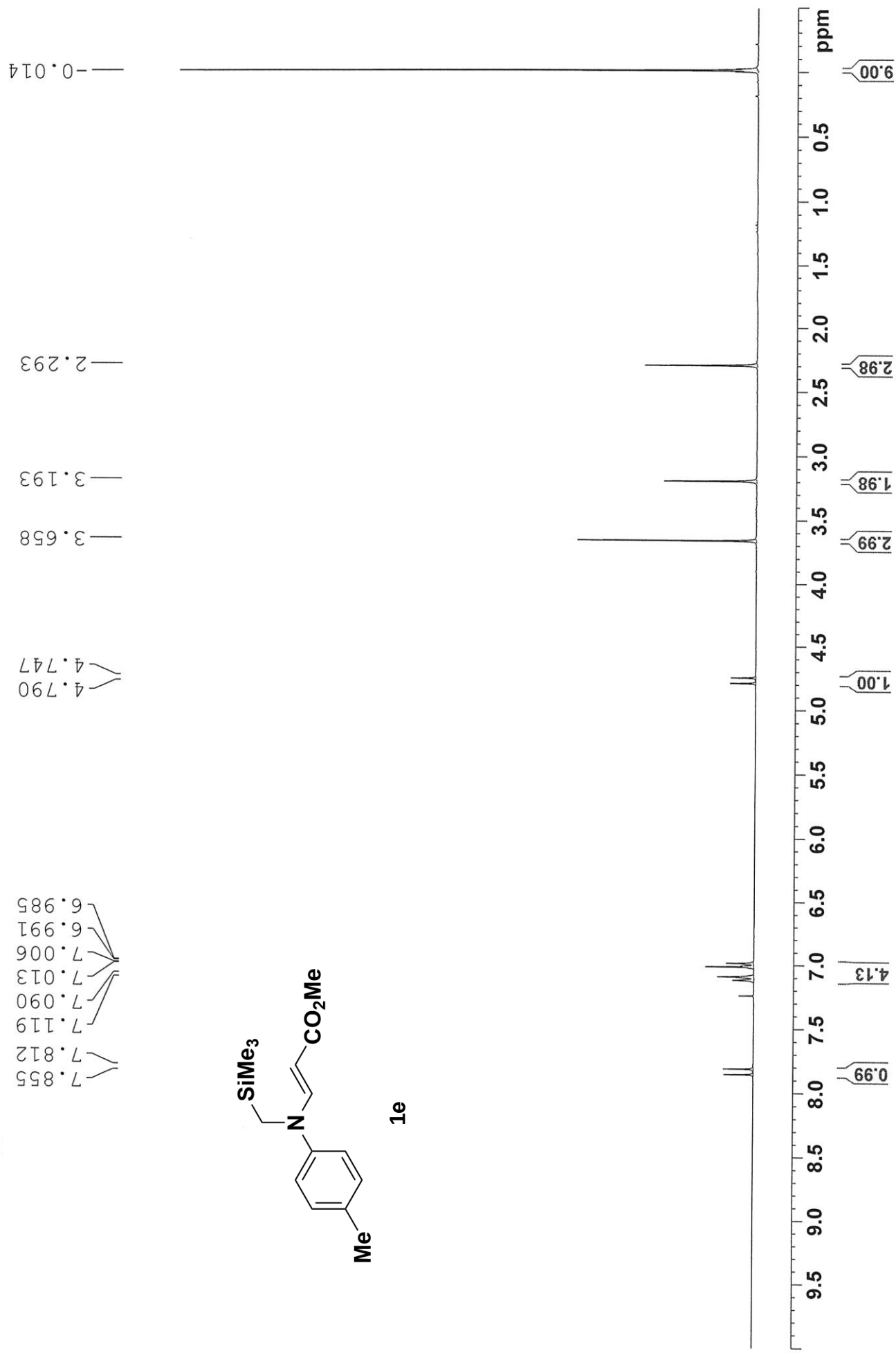
¹H NMR (CDCl₃, 300 MHz)



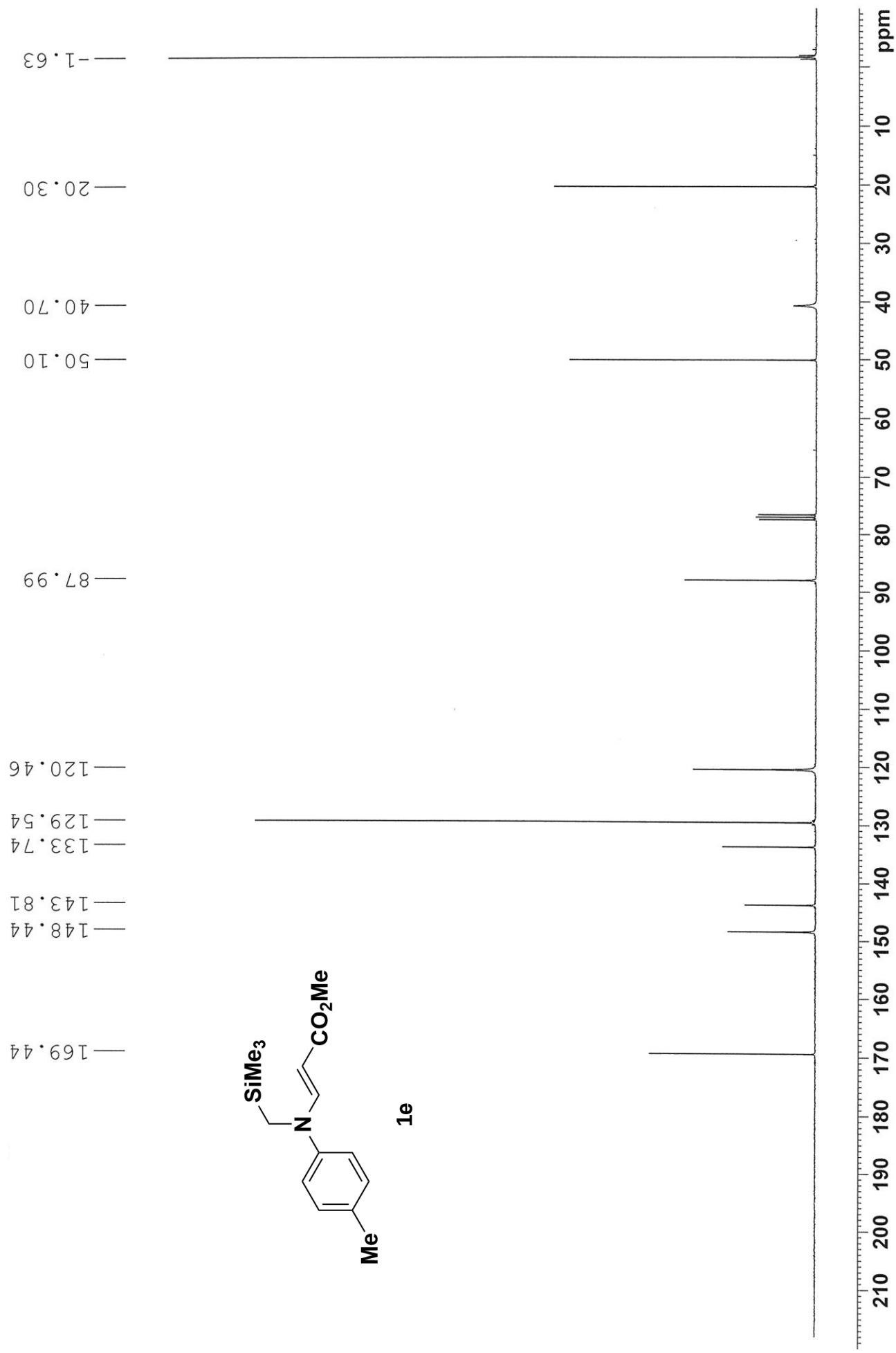
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

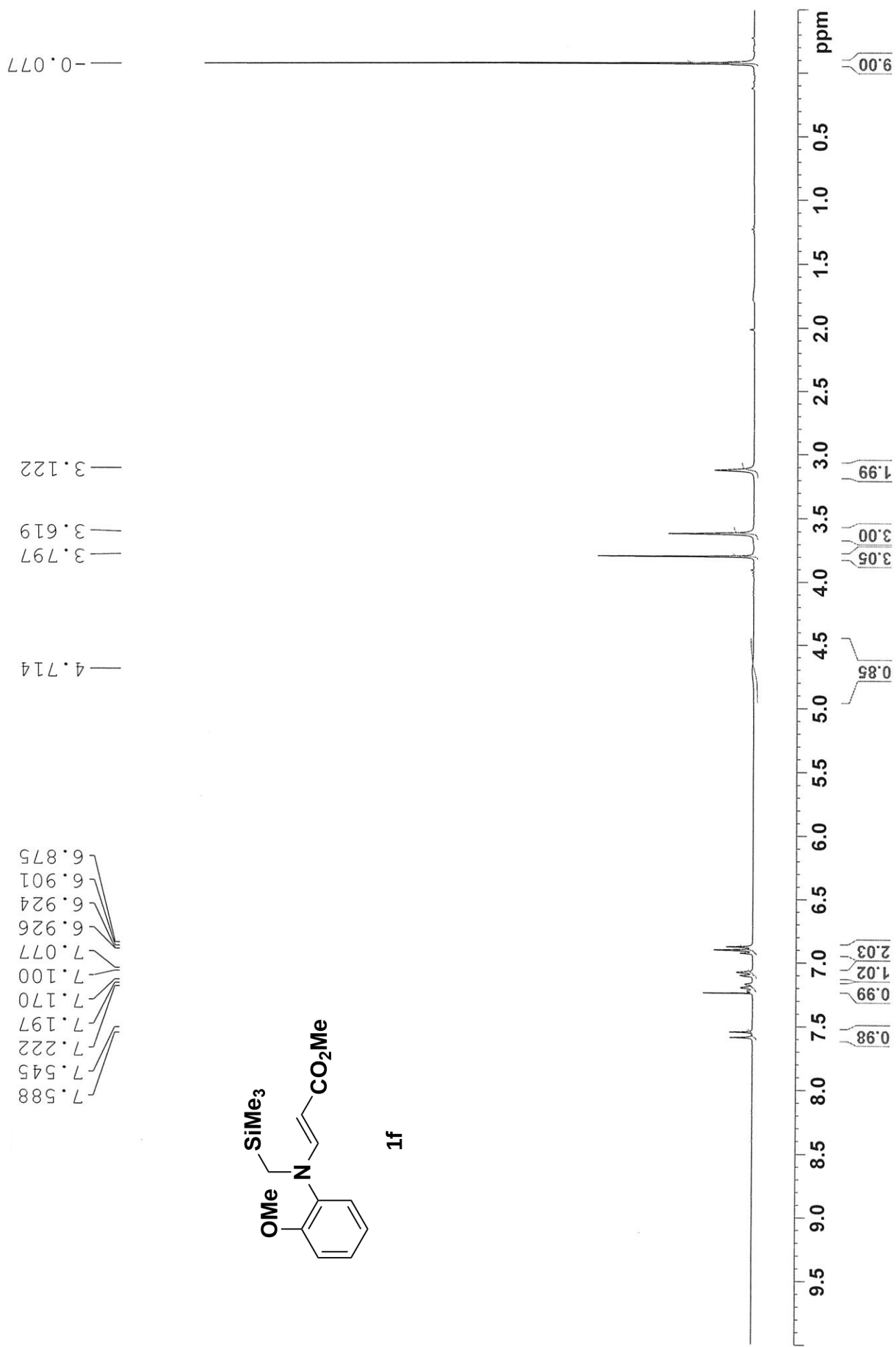


^1H NMR (CDCl_3 , 300 MHz)

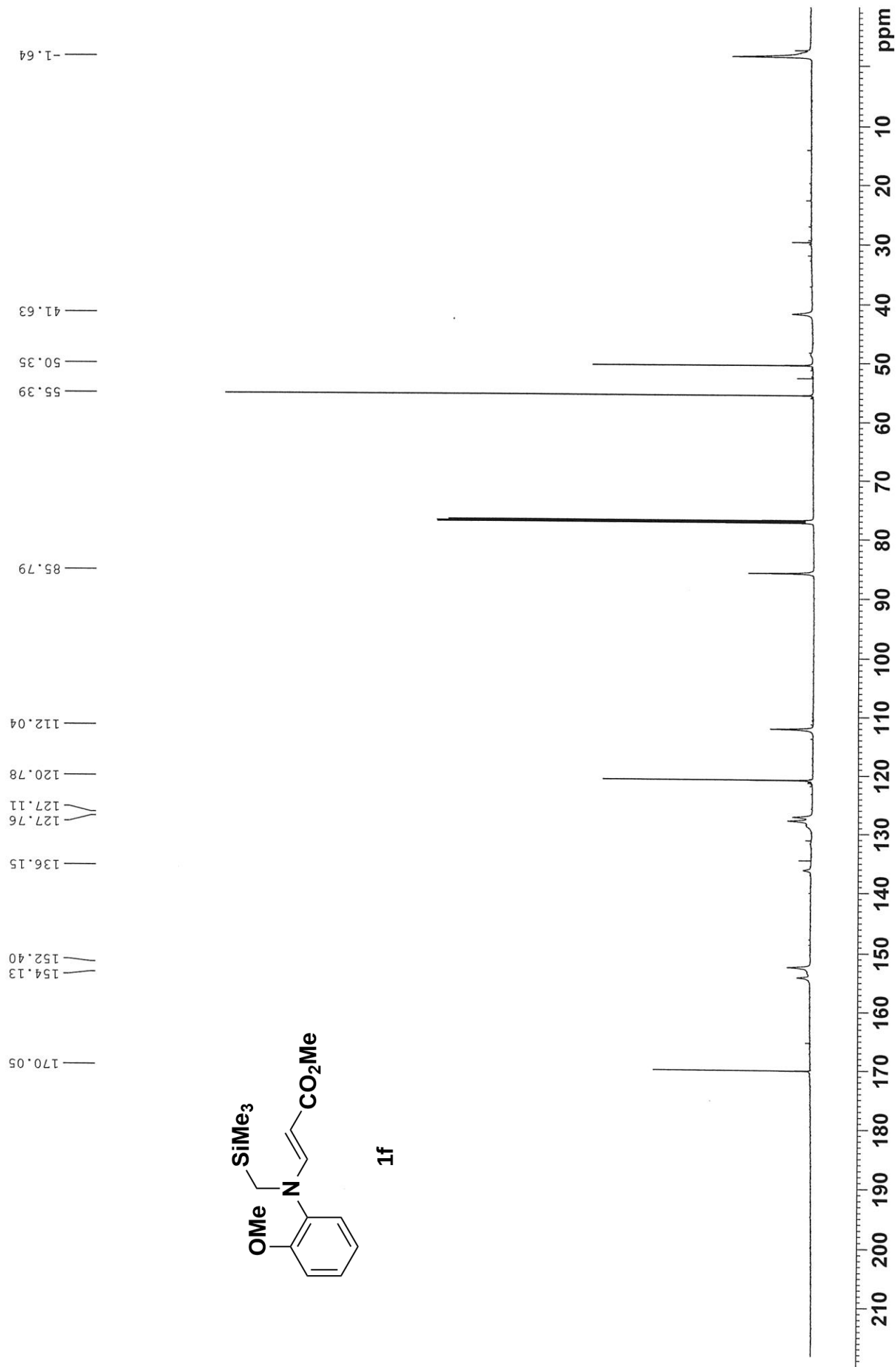


$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)

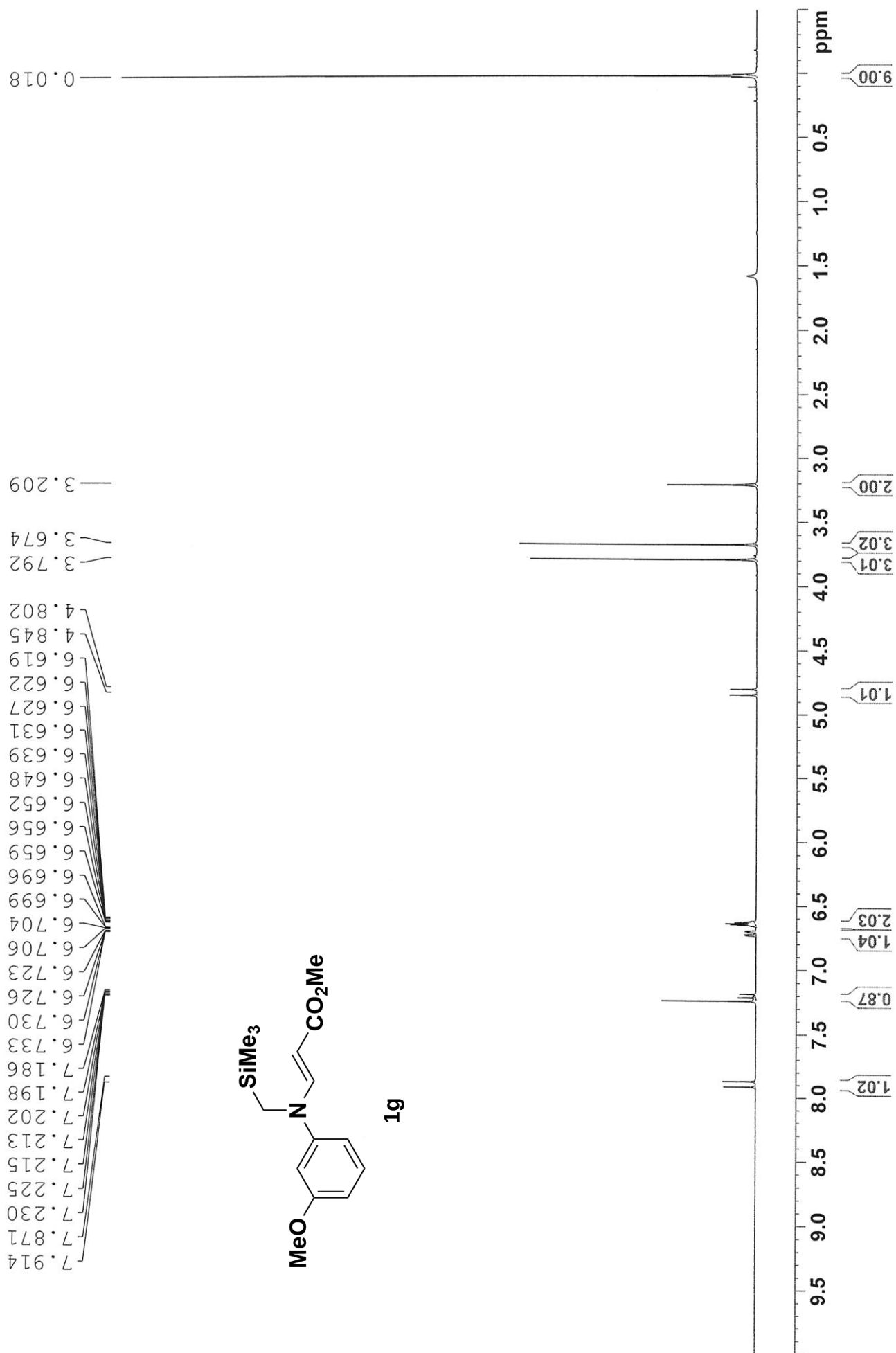


¹H NMR (CDCl₃, 300 MHz)

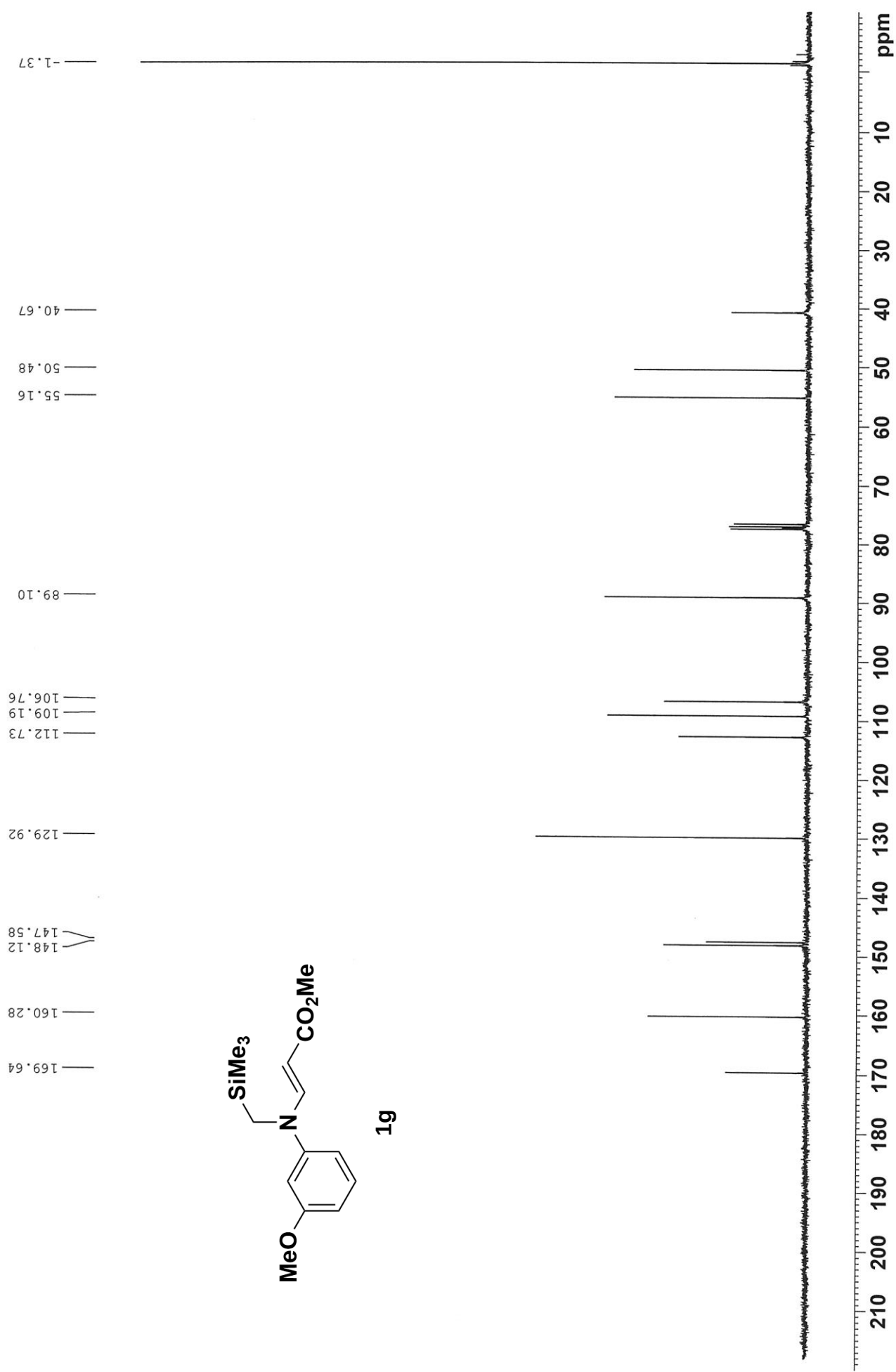
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

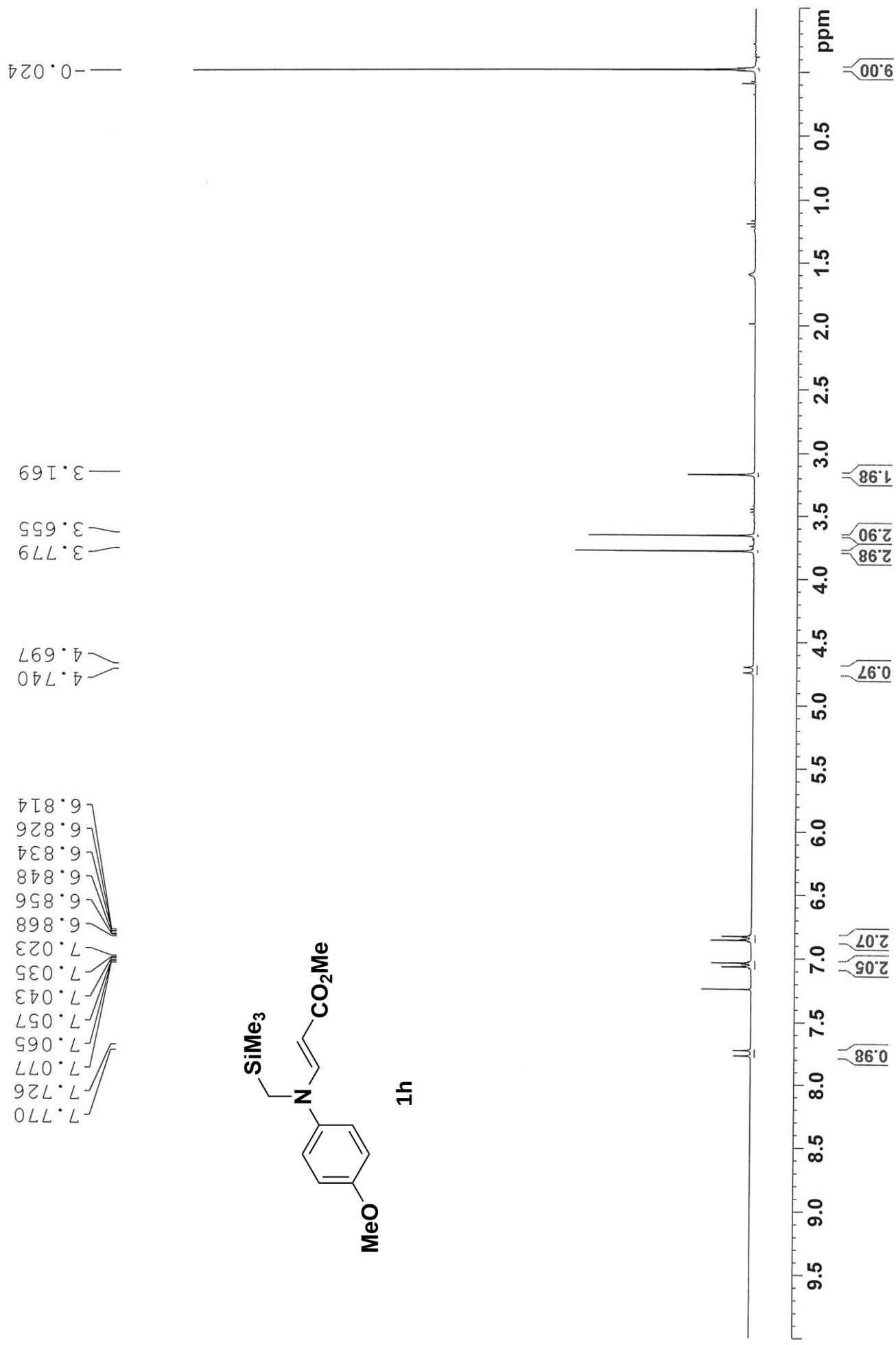


¹H NMR (CDCl₃, 300 MHz)

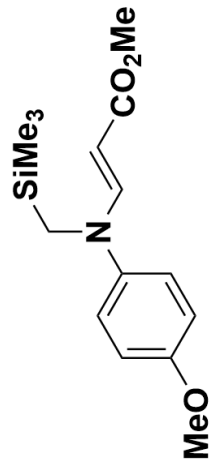


^{13}C { ^1H } NMR (CDCl₃, 75 MHz)

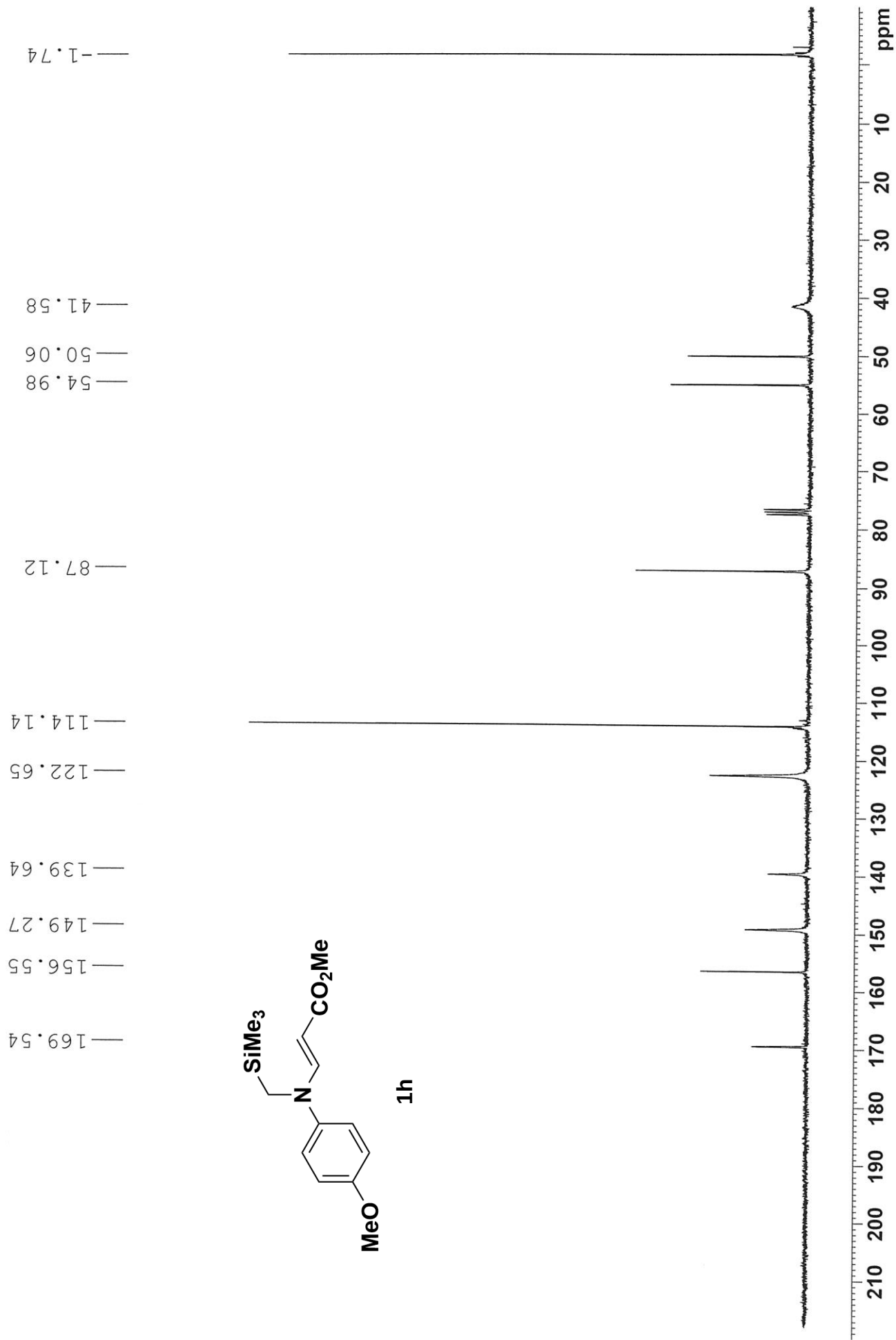


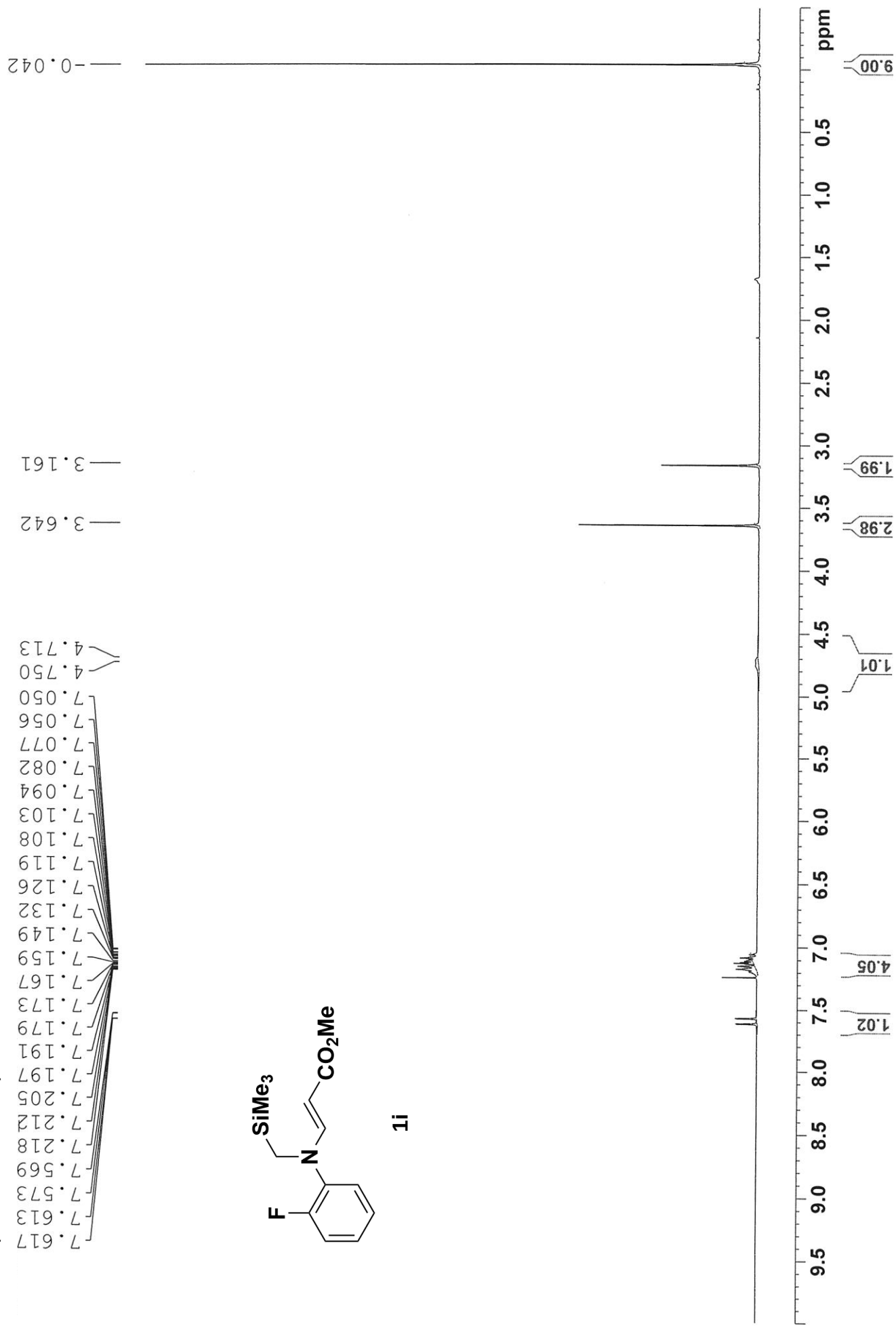
¹H NMR (CDCl₃, 300 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)

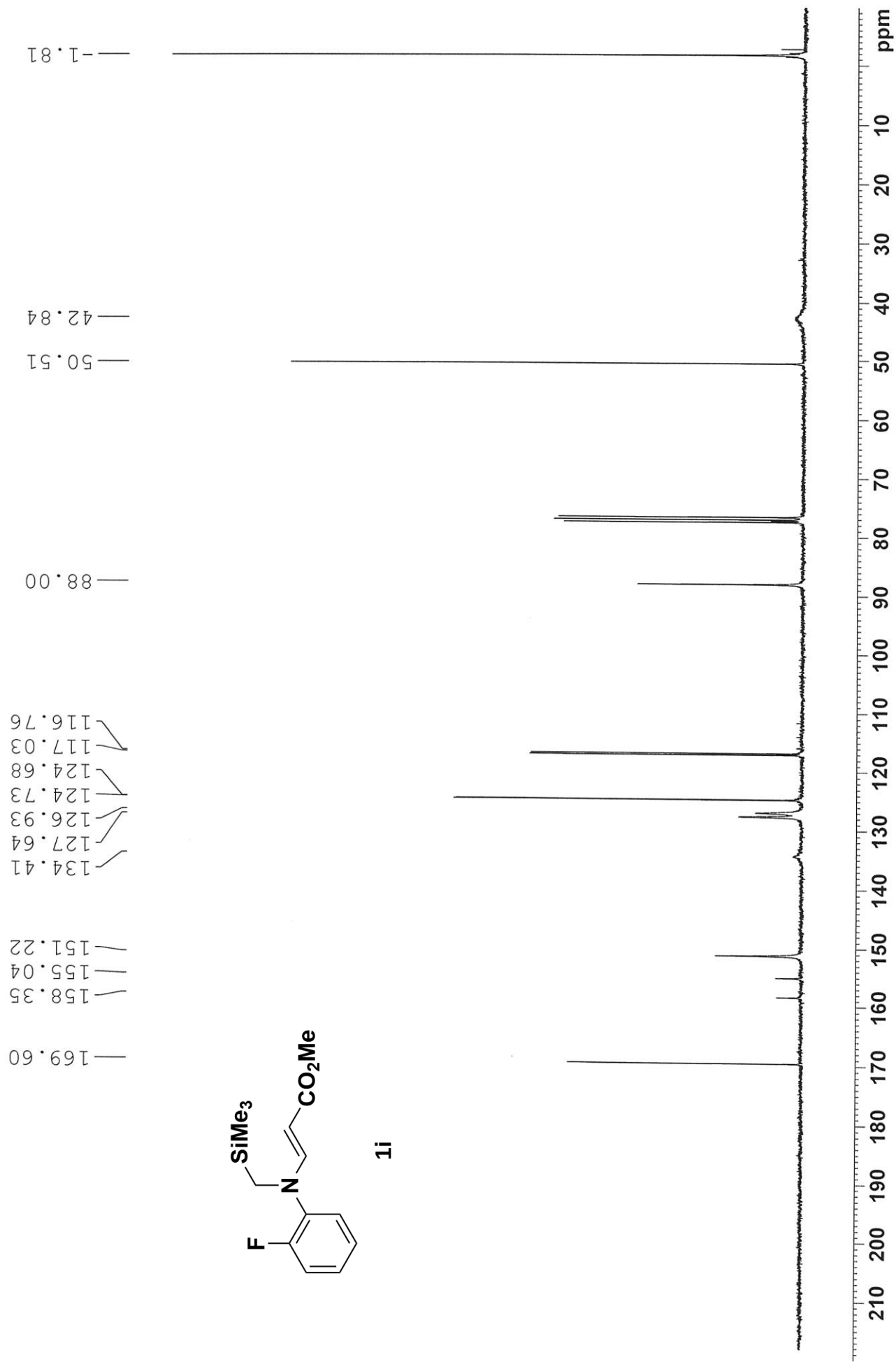


1h

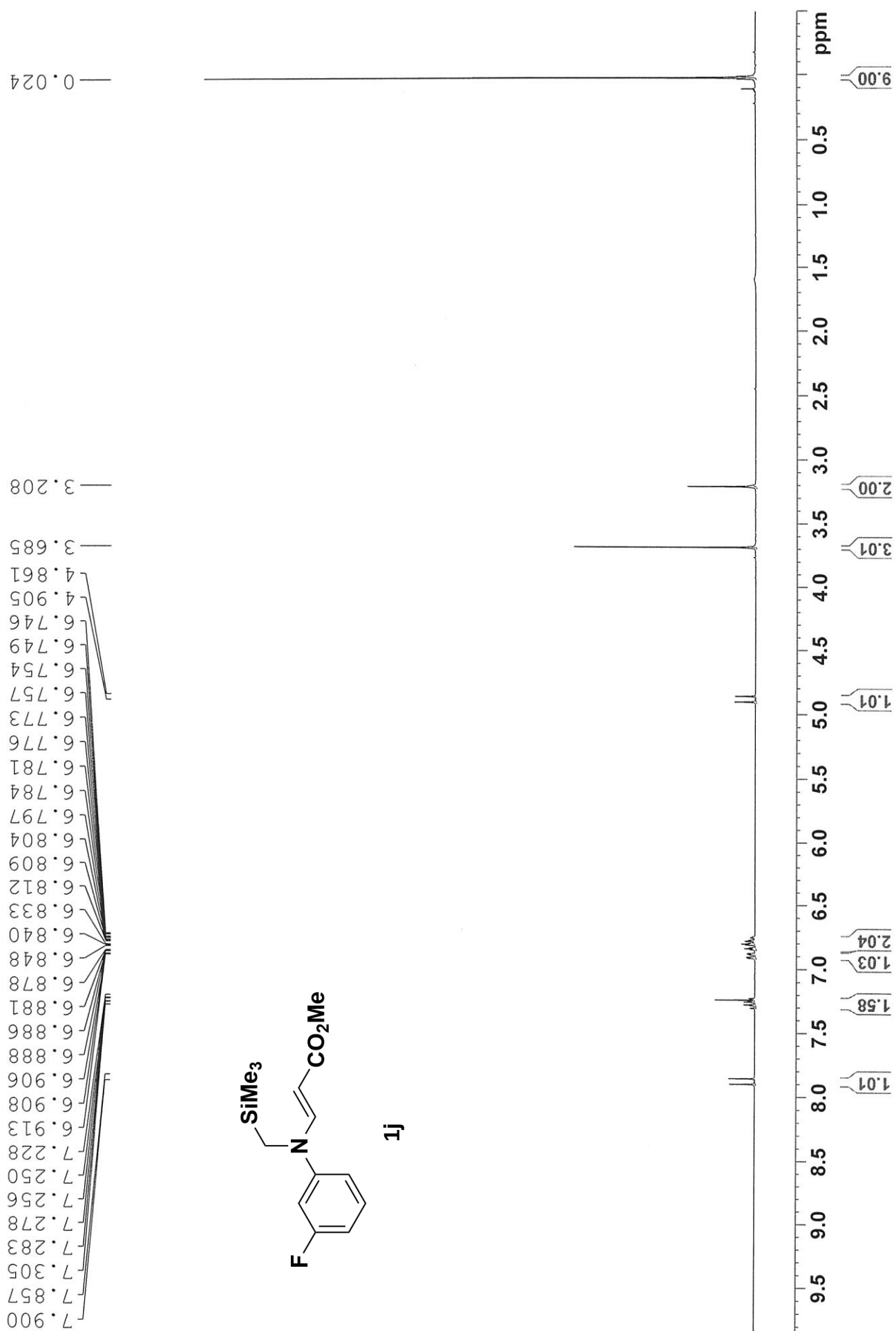


¹H NMR (CDCl₃, 300 MHz)

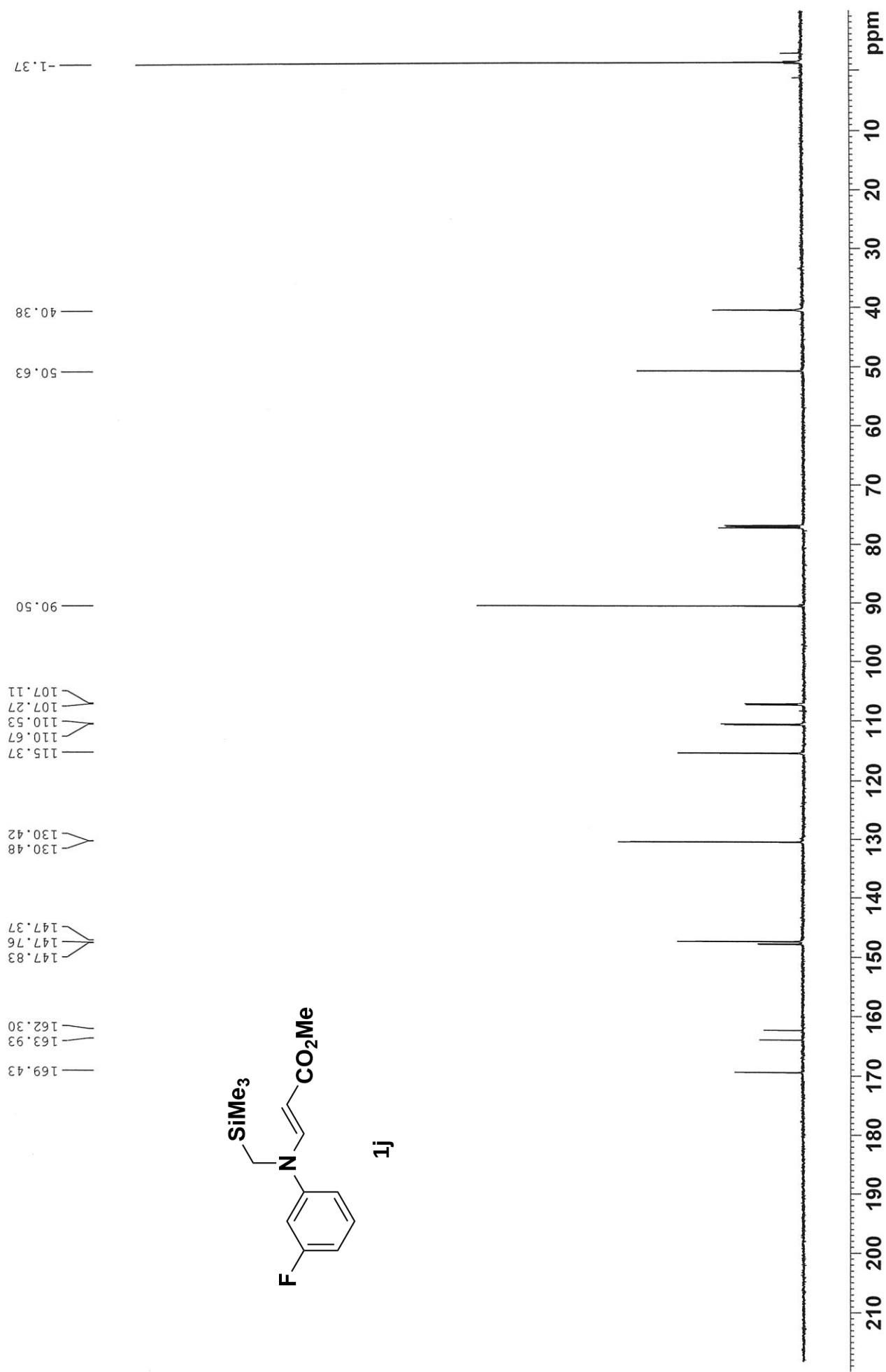
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



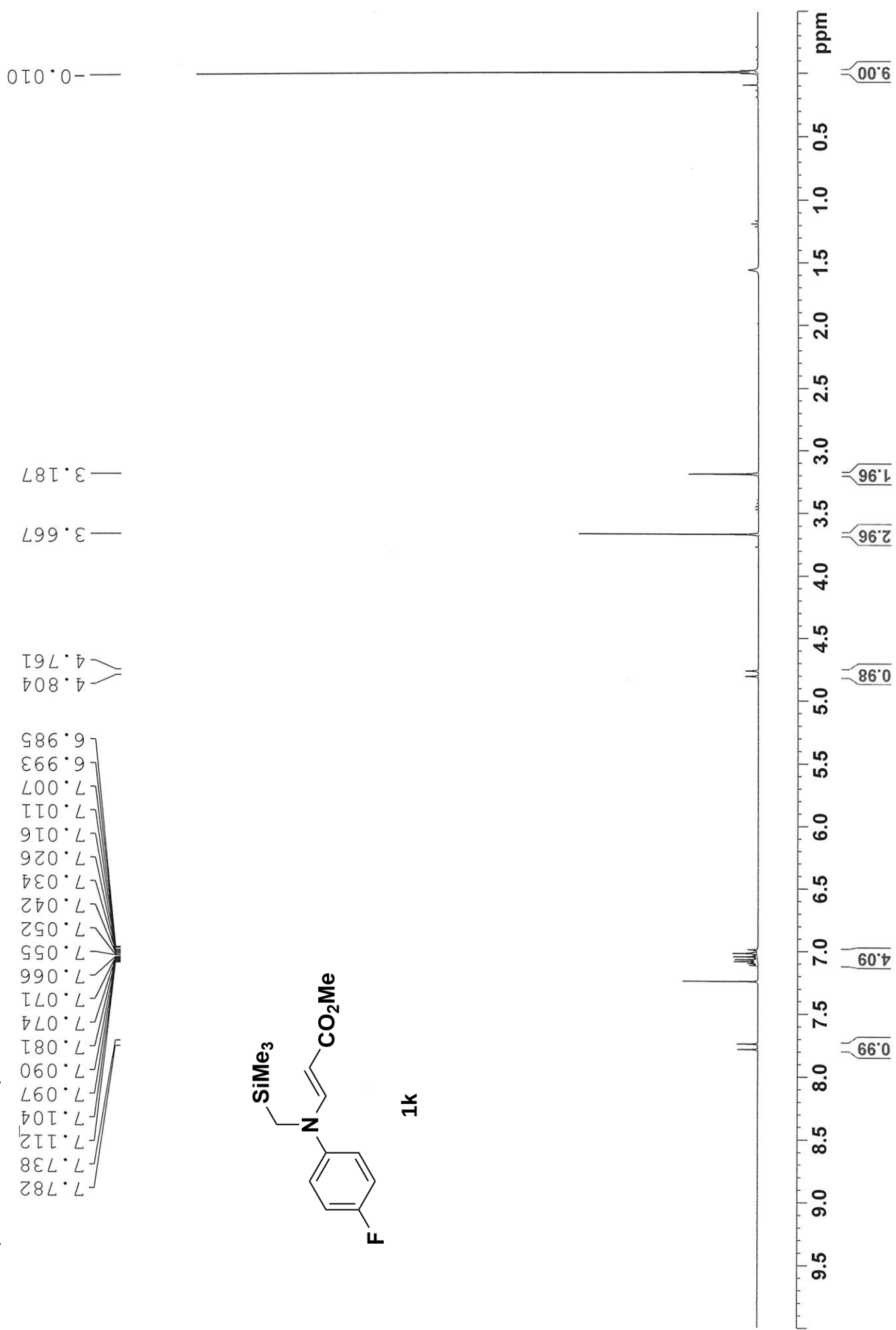
¹H NMR (CDCl₃, 300 MHz)



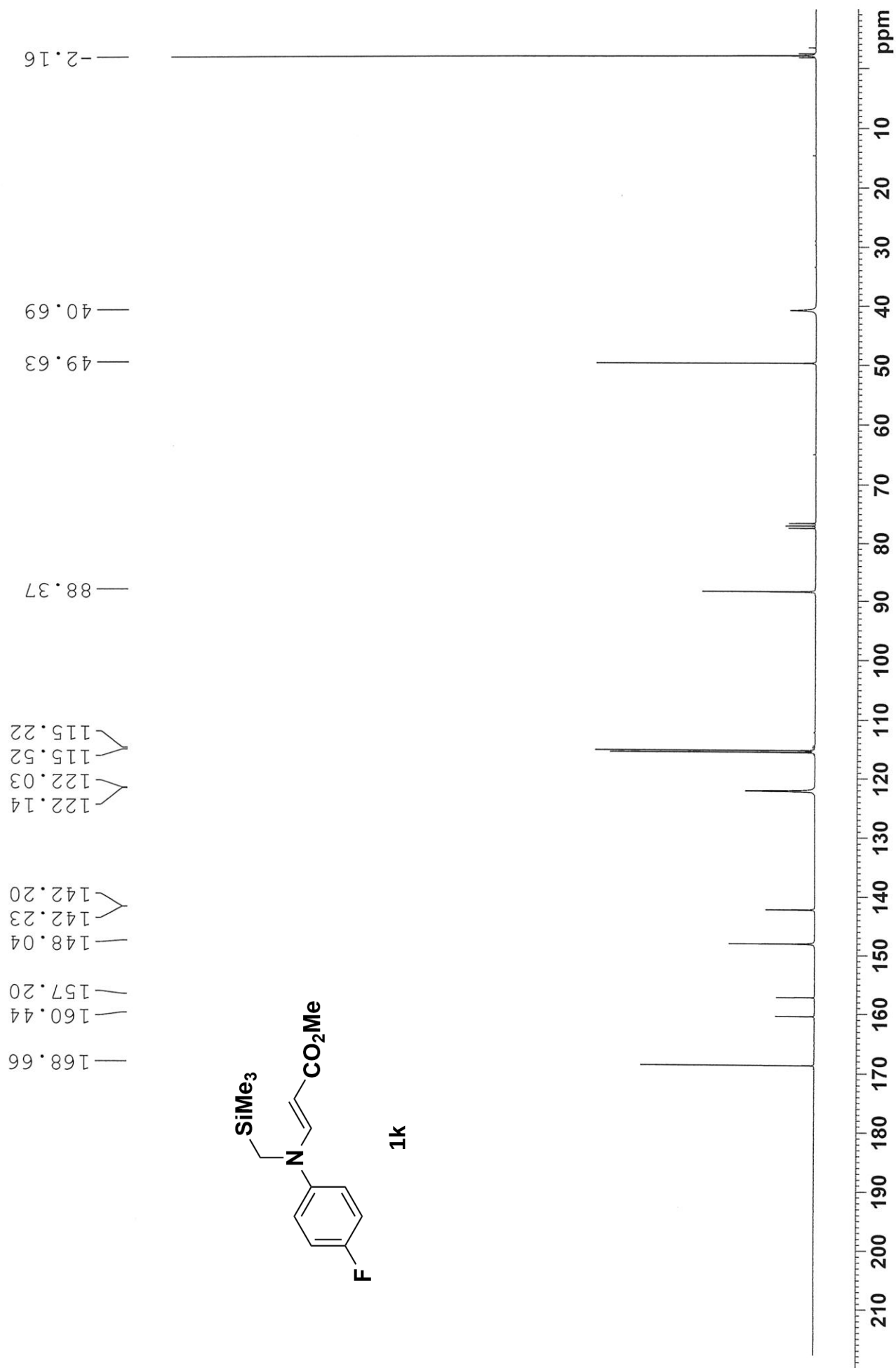
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



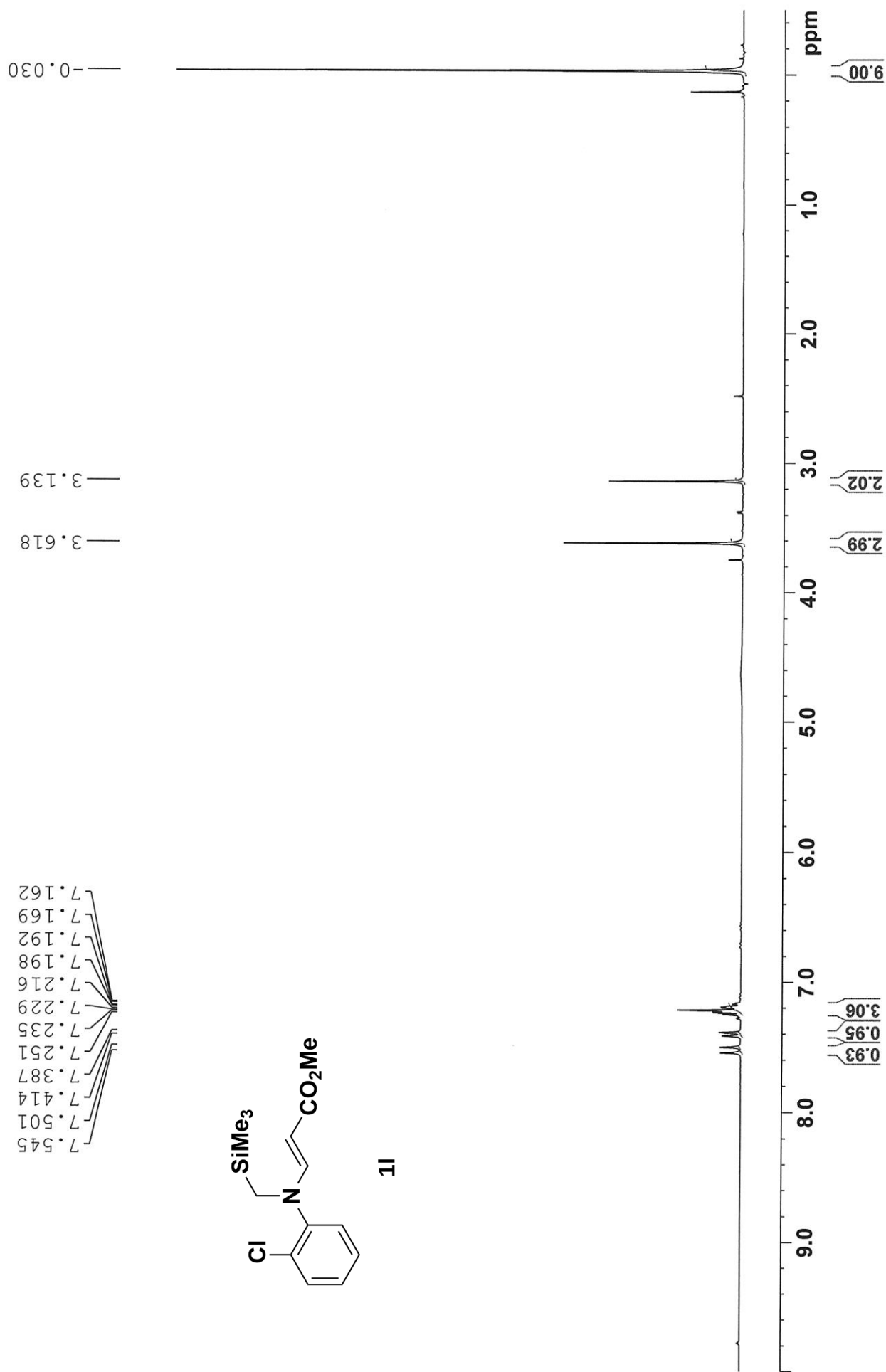
¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)

— 169.01

— 151.39

— 143.51

130.78

130.47

128.21

127.94

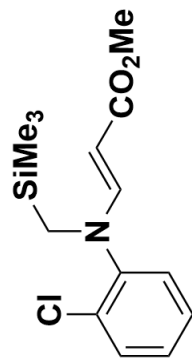
127.45

— 87.13

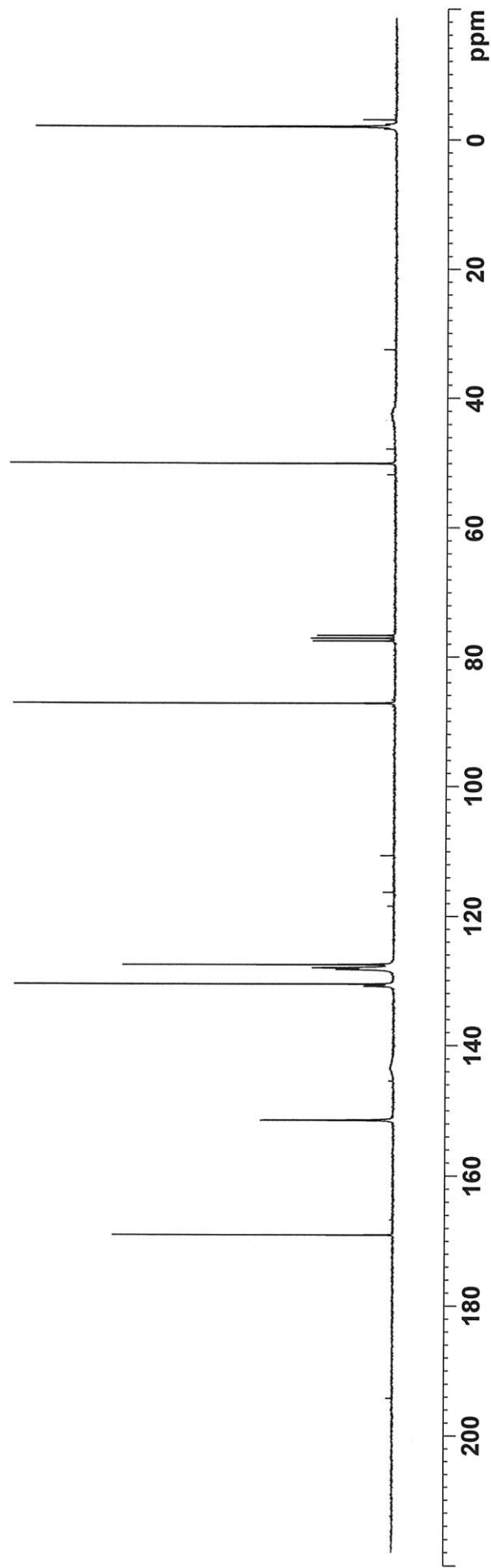
— 49.95

— 42.33

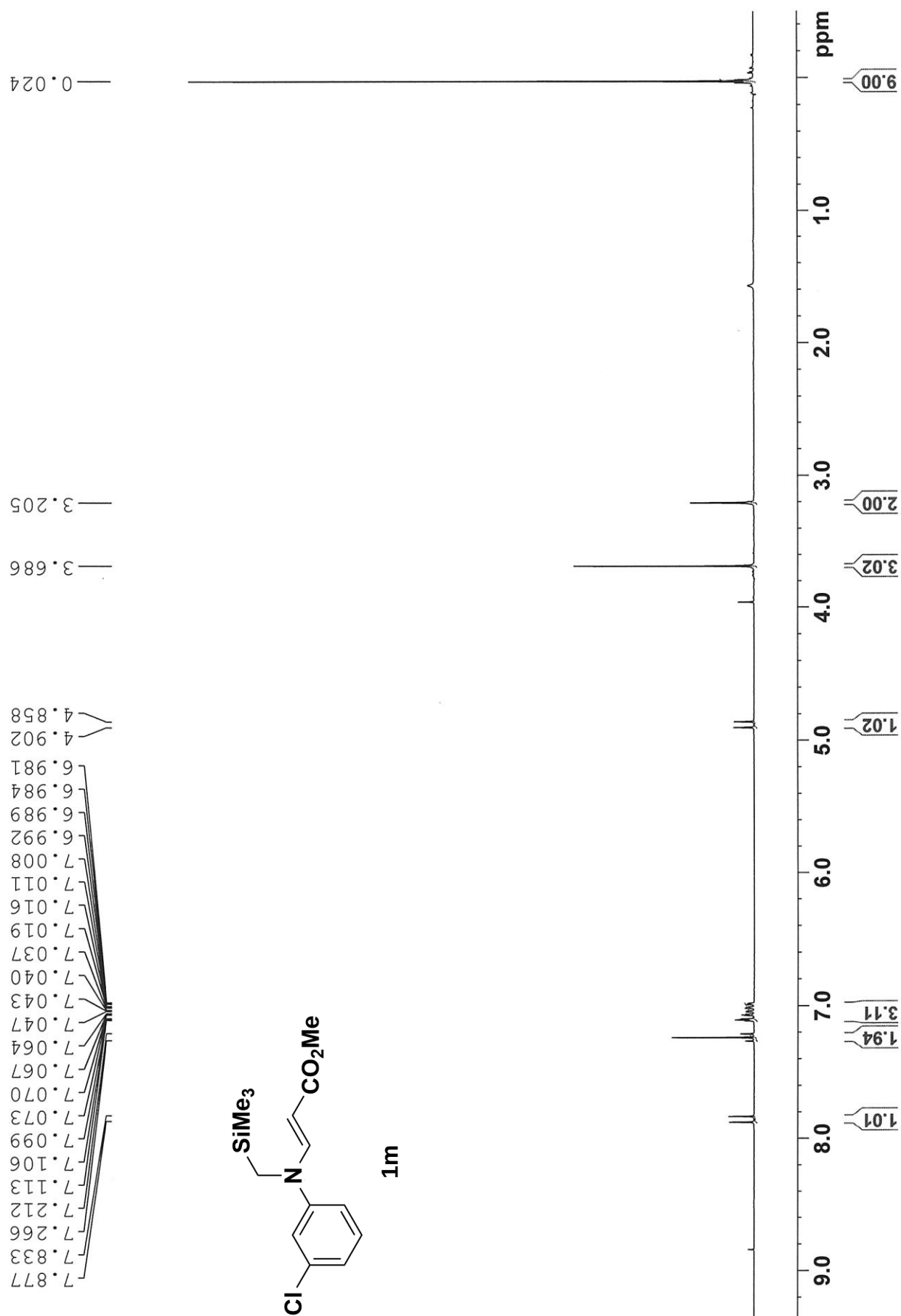
— -2.12



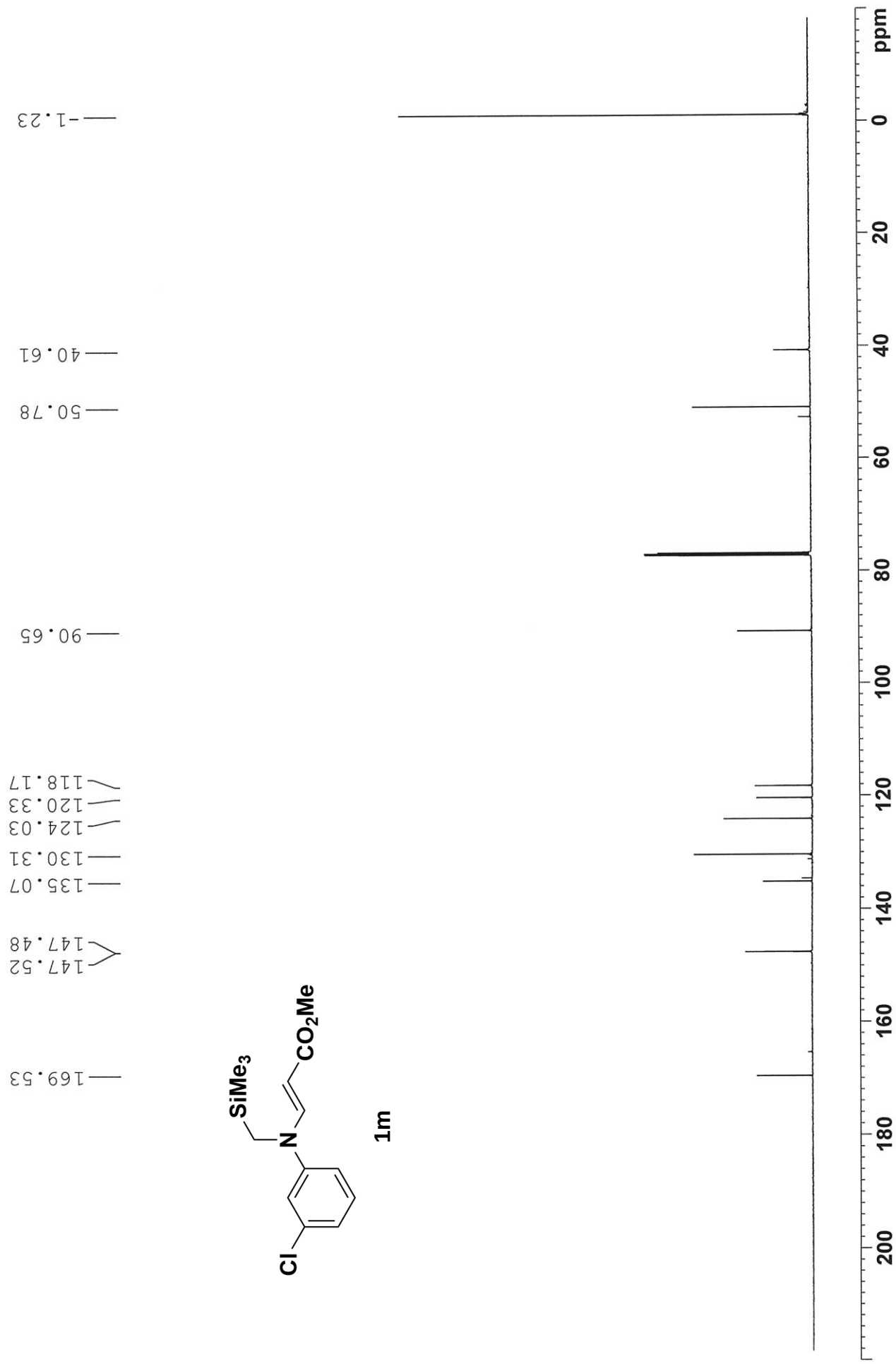
1I

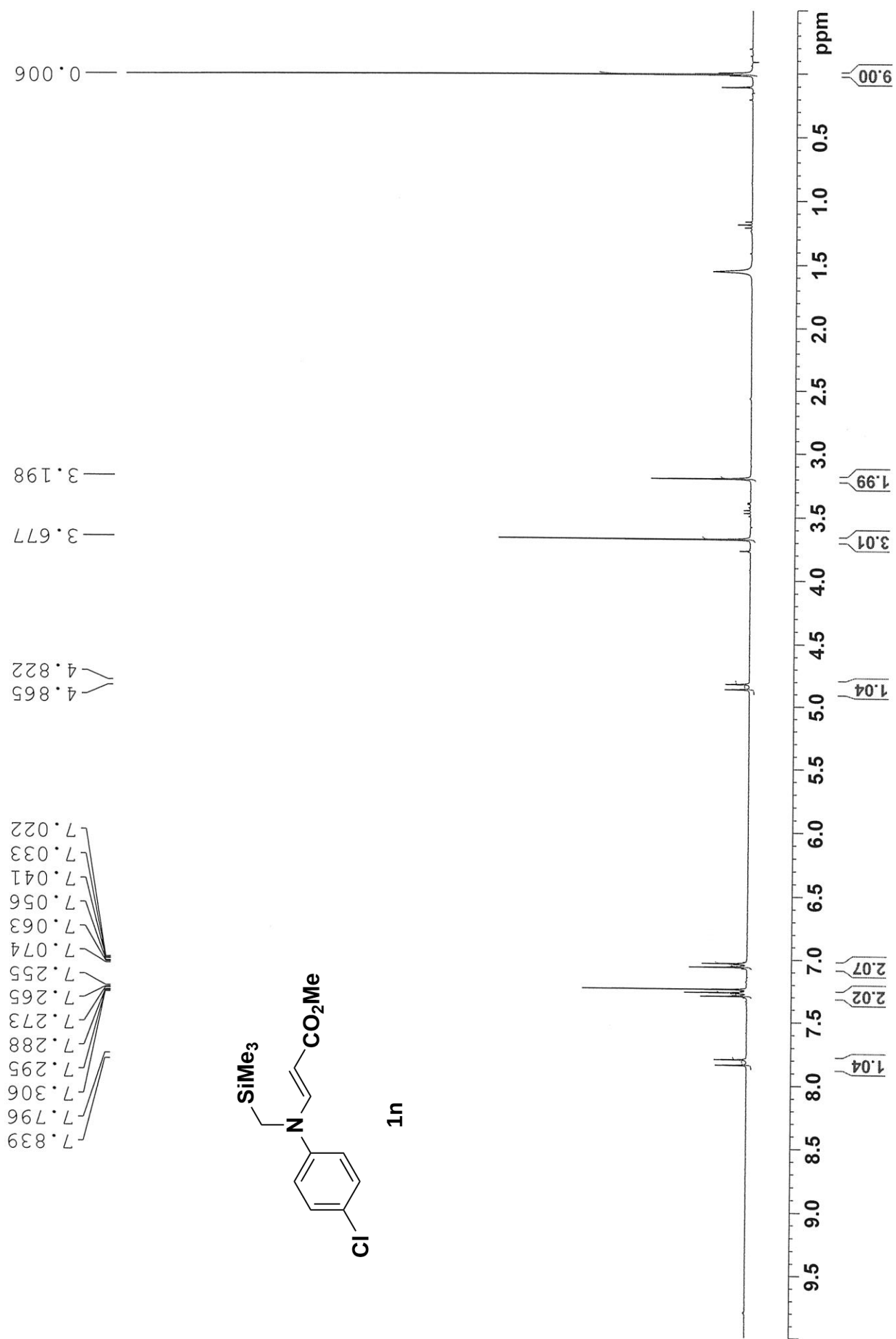


¹H NMR (CDCl₃, 300 MHz)

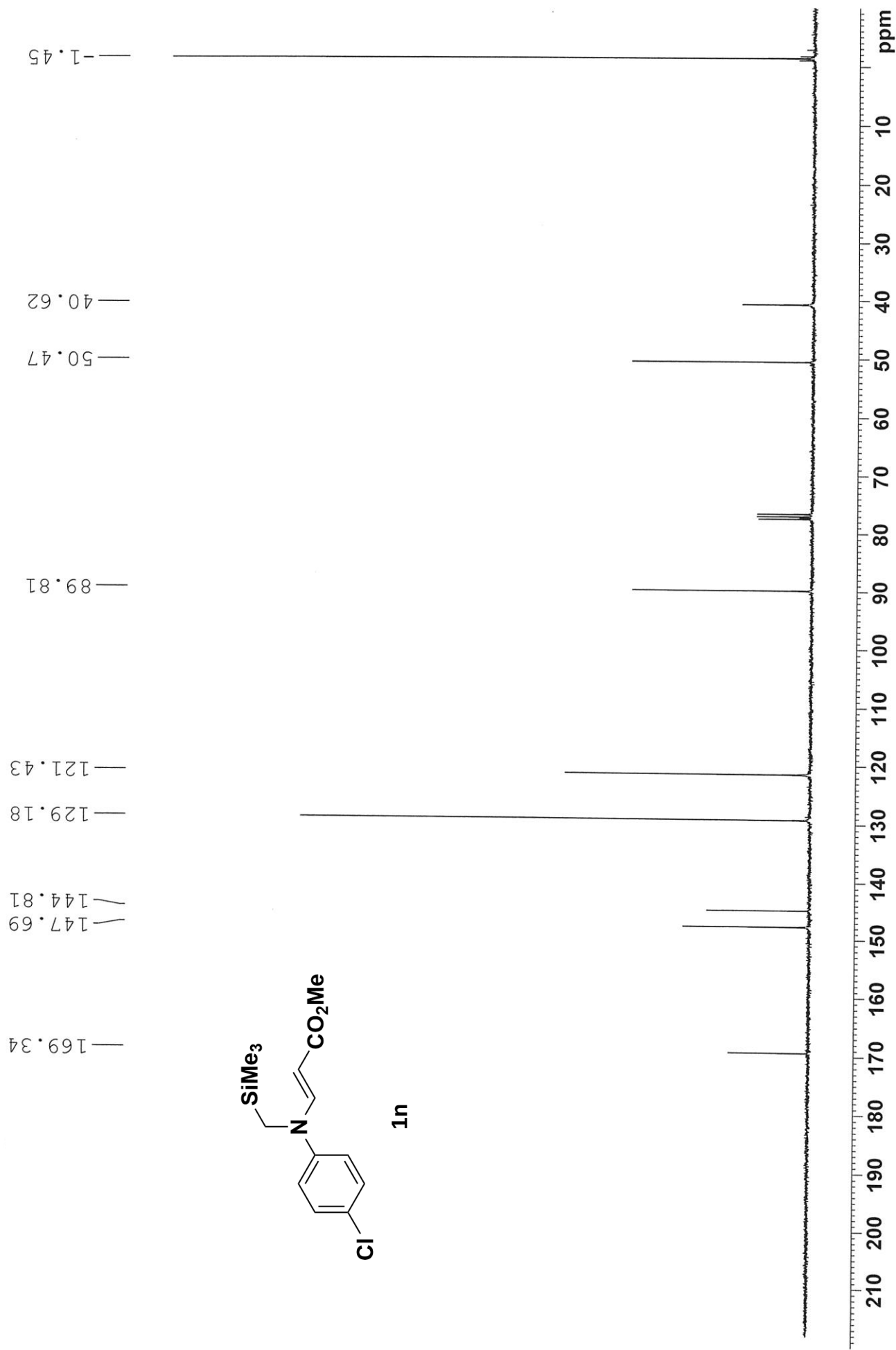


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

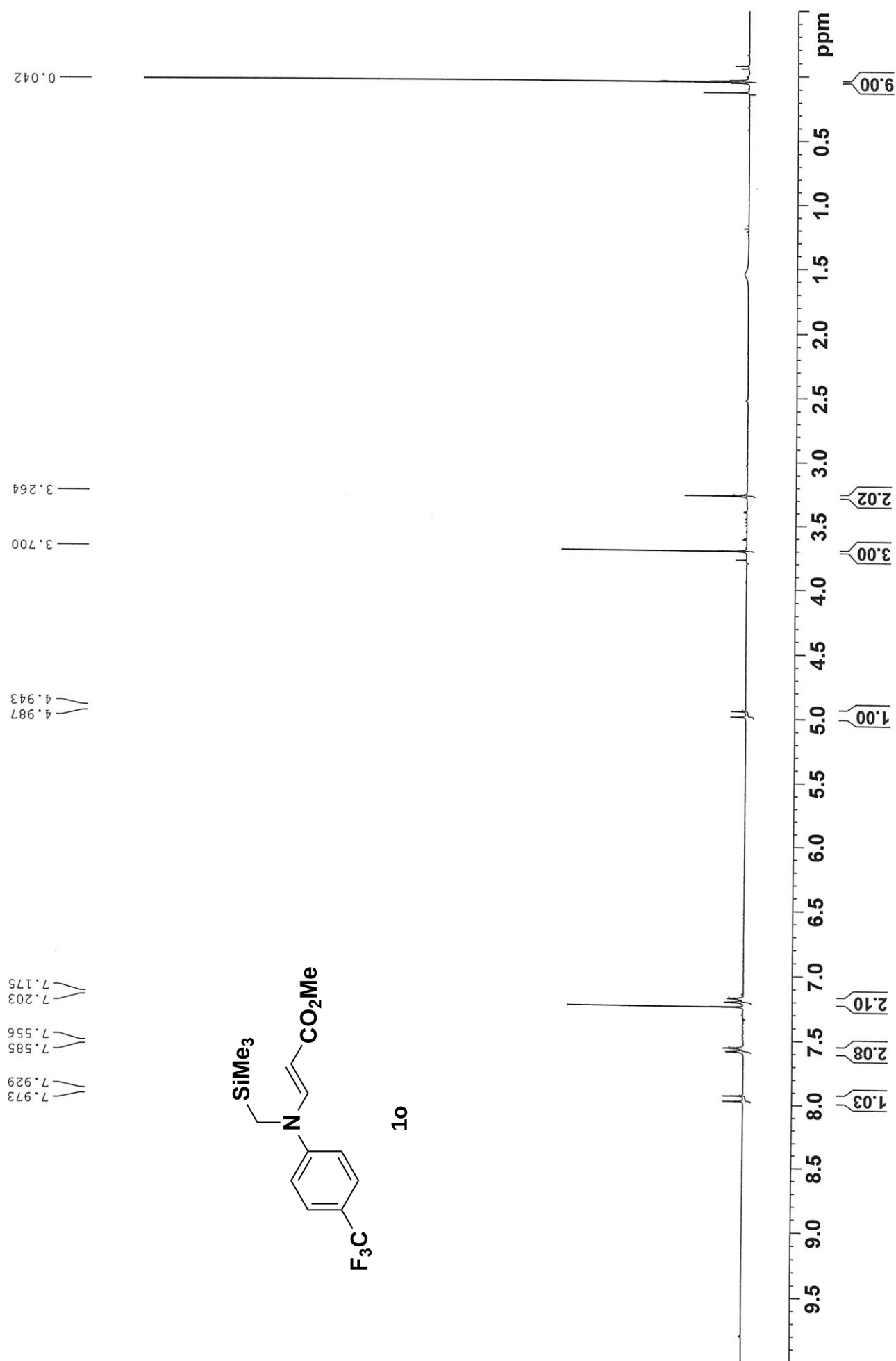




$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

— 169.36

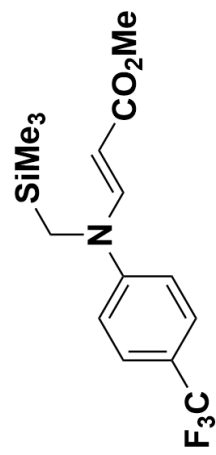
148.84
146.74
126.66
126.64
126.62
126.59
125.71
125.49
125.27
125.05
124.89
123.09
119.11

— 92.01

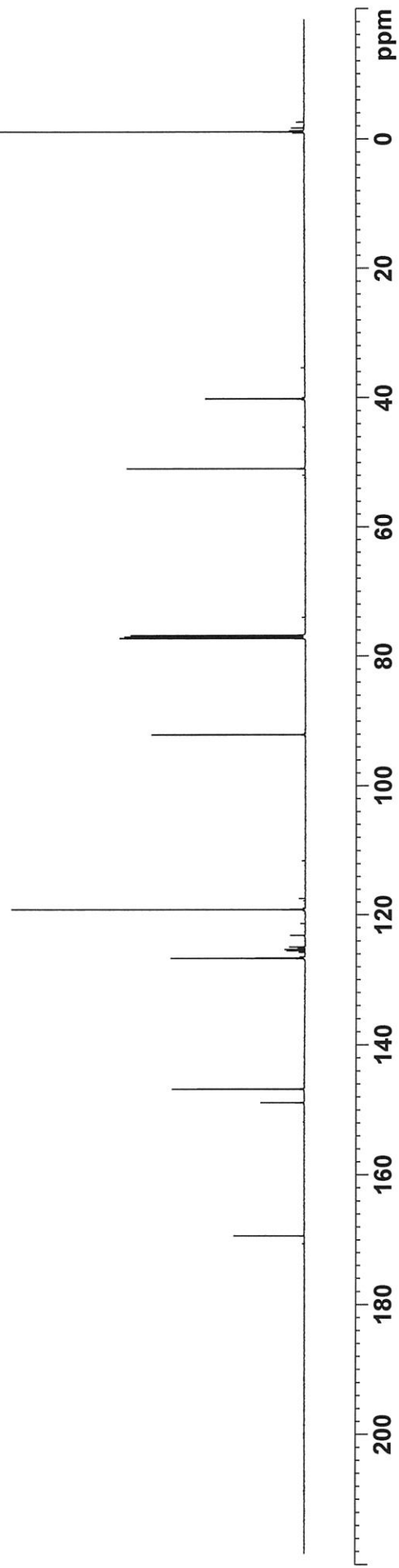
— 50.87

— 40.12

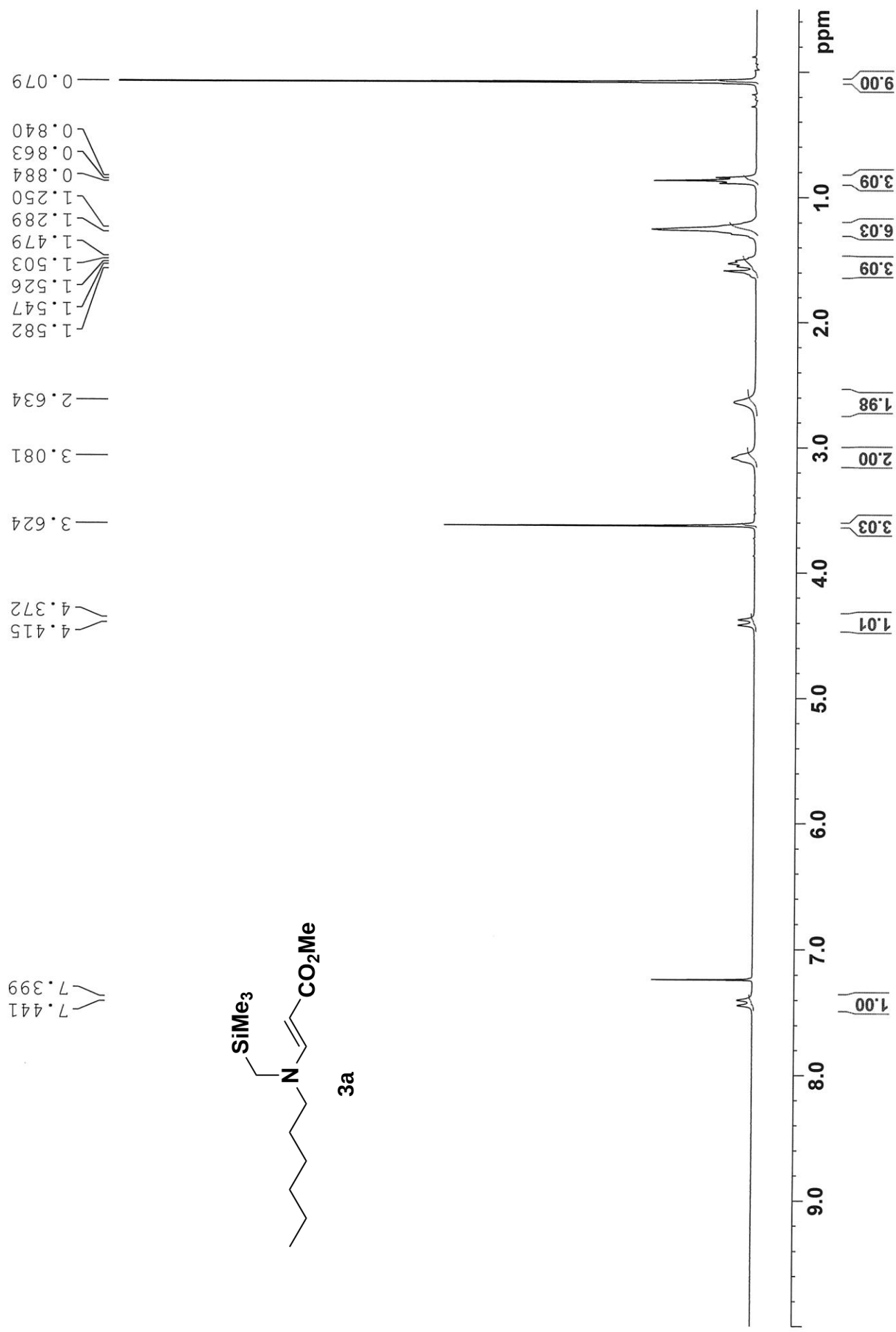
— 1.18



10



^1H NMR (CDCl_3 , 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

170.23
151.72

82.32

57.32

50.12

39.22

31.32

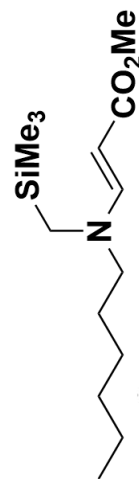
28.27

26.08

22.36

13.81

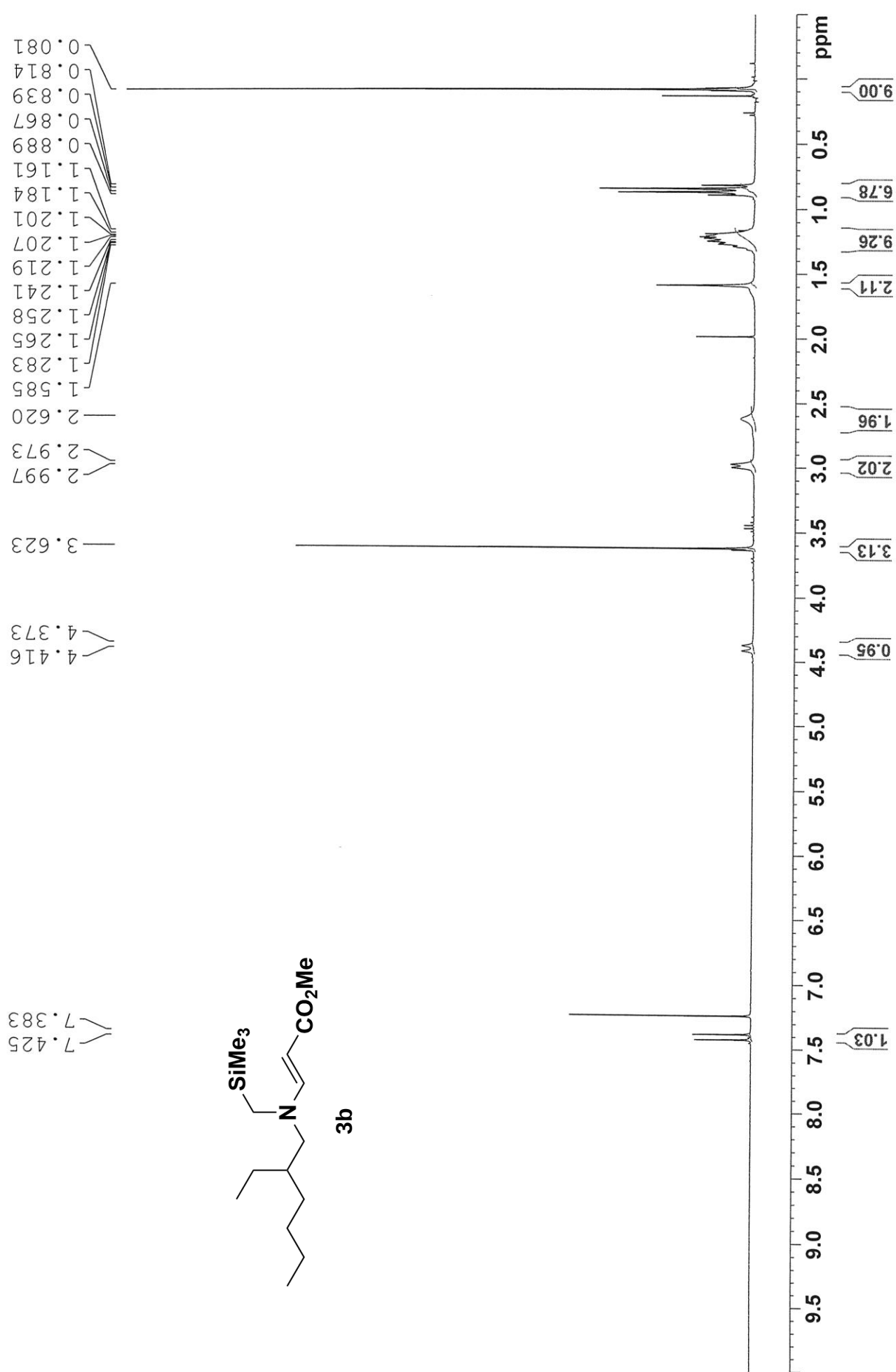
-1.35



3a

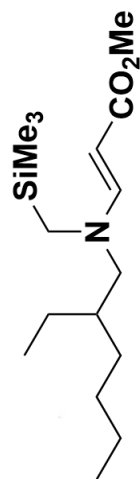


¹H NMR (CDCl₃, 300 MHz)



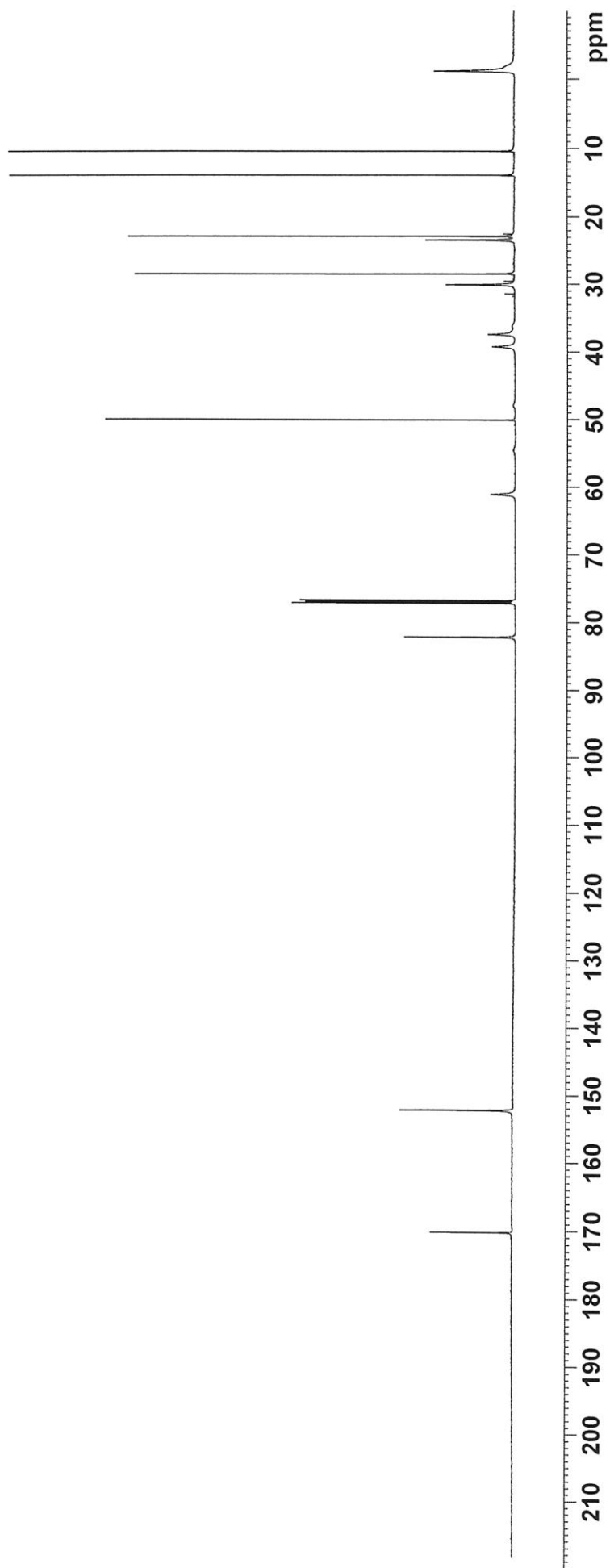
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

— 170.20
— 152.24

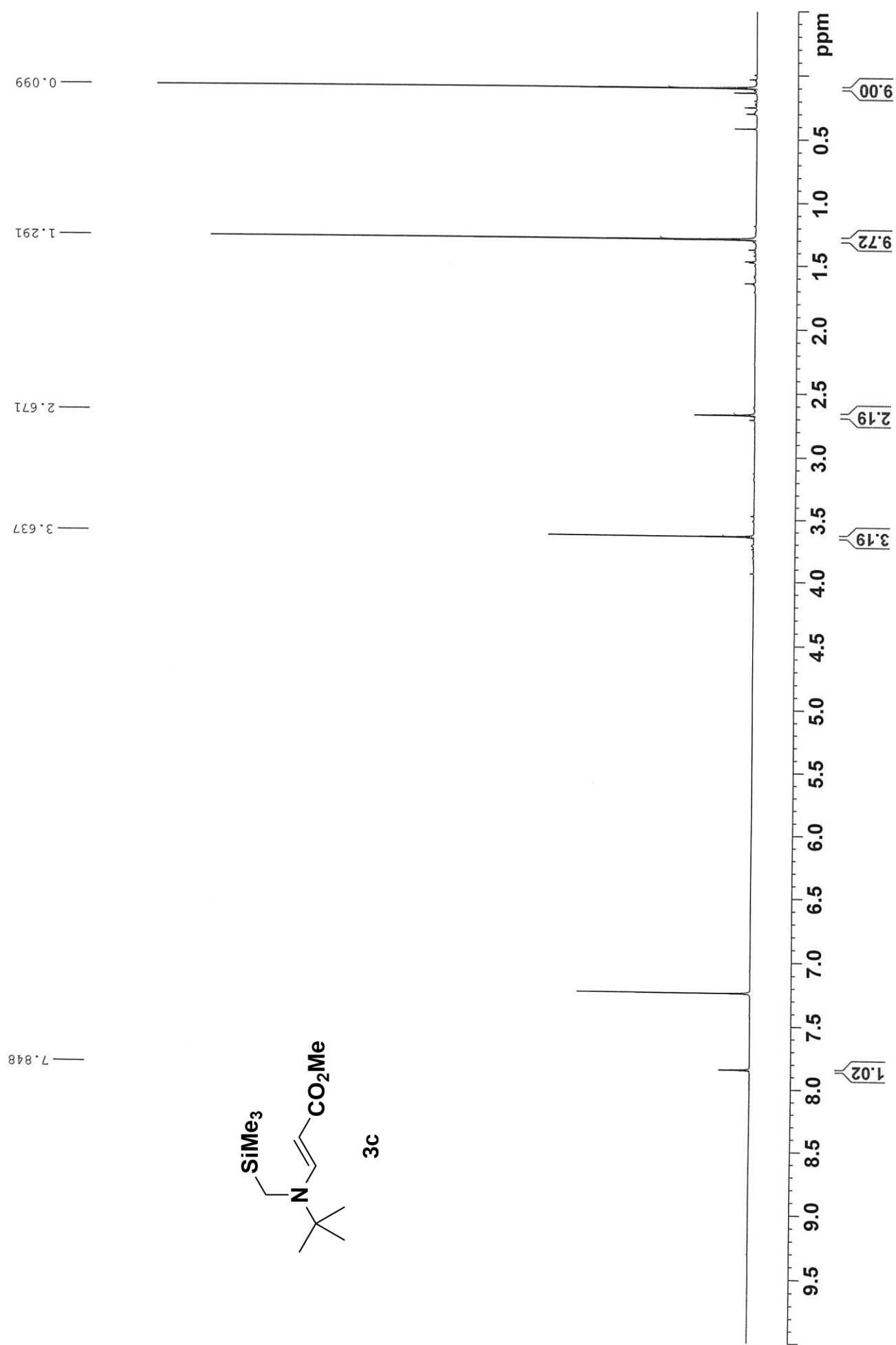


3b

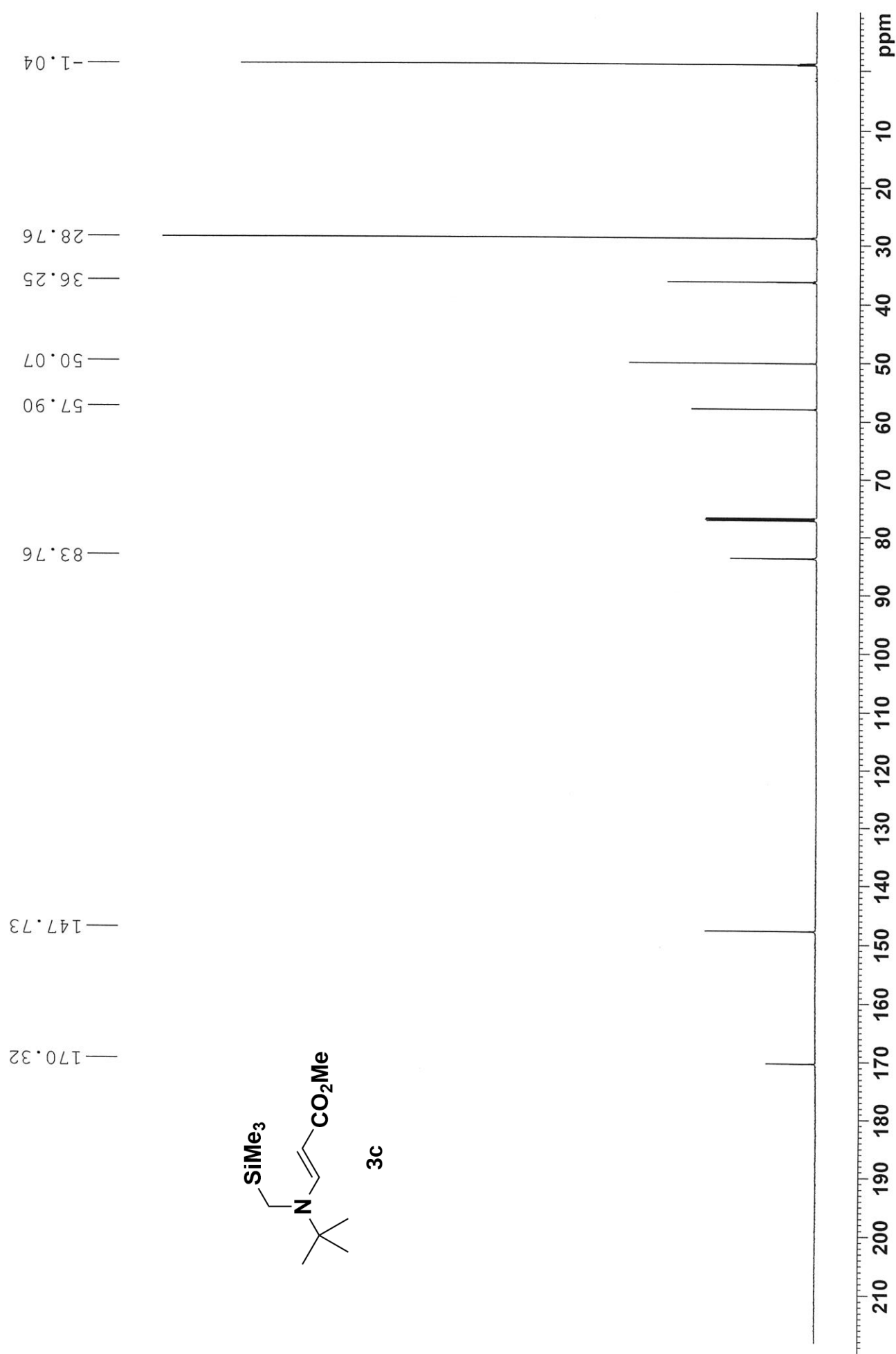
— 82.18
— 61.07
— 50.08
39.19
37.38
30.03
28.39
23.37
22.82
13.84
10.36
— 1.26



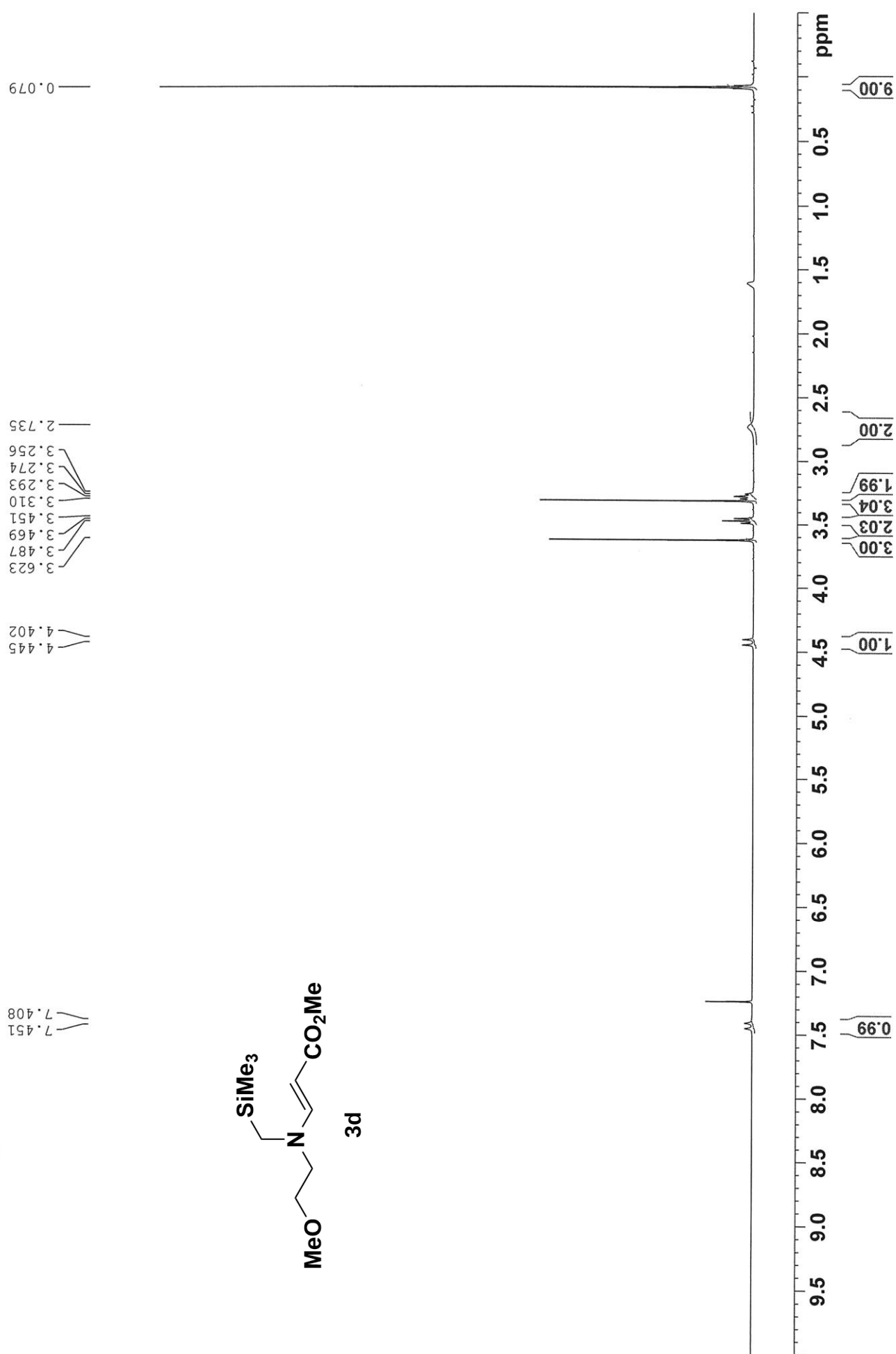
¹H NMR (CDCl₃, 600 MHz)



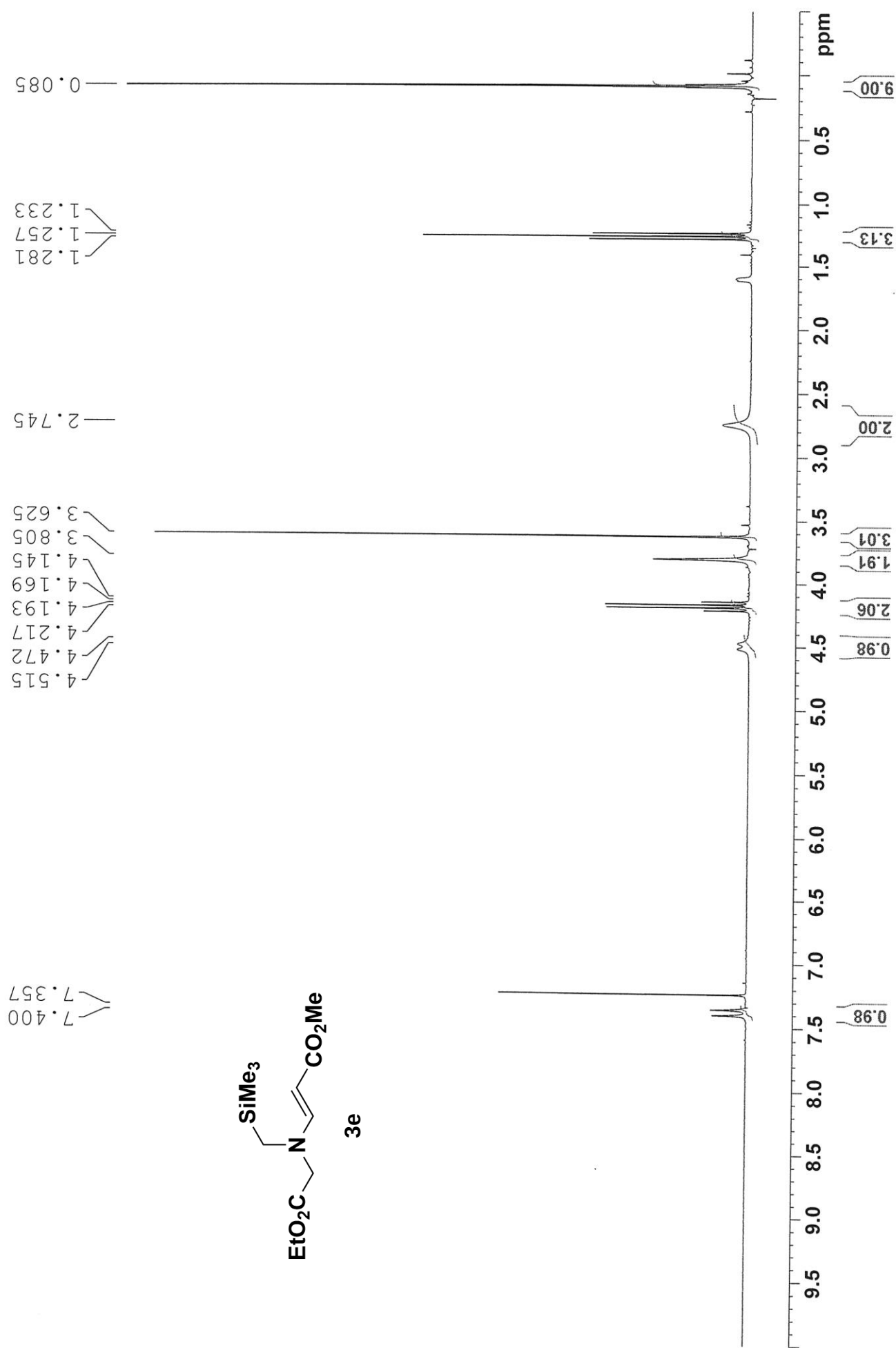
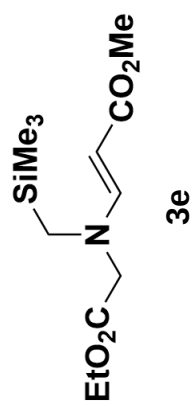
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

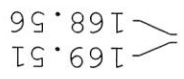


¹H NMR (CDCl₃, 300 MHz)



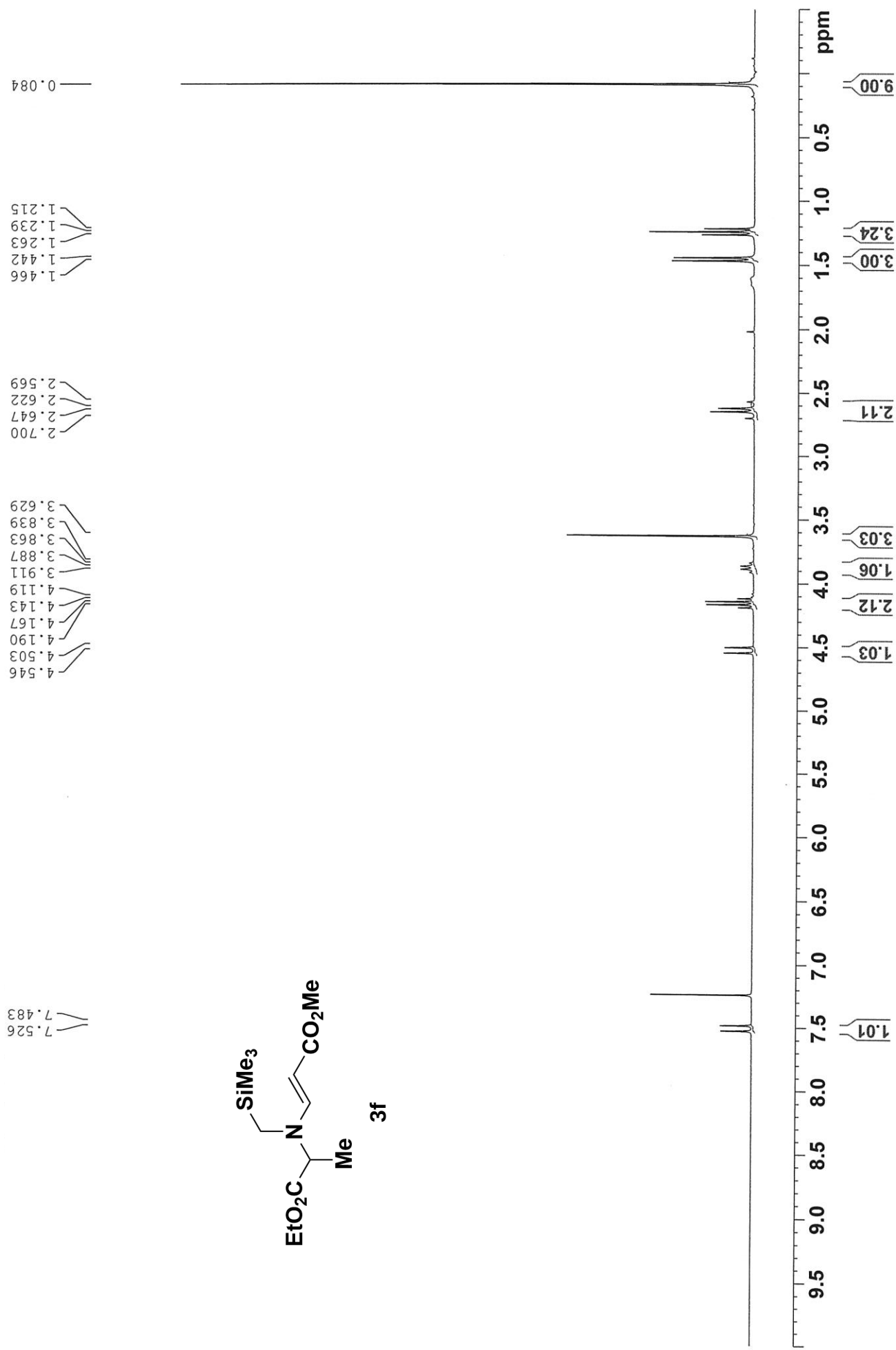
^1H NMR (CDCl_3 , 300 MHz)



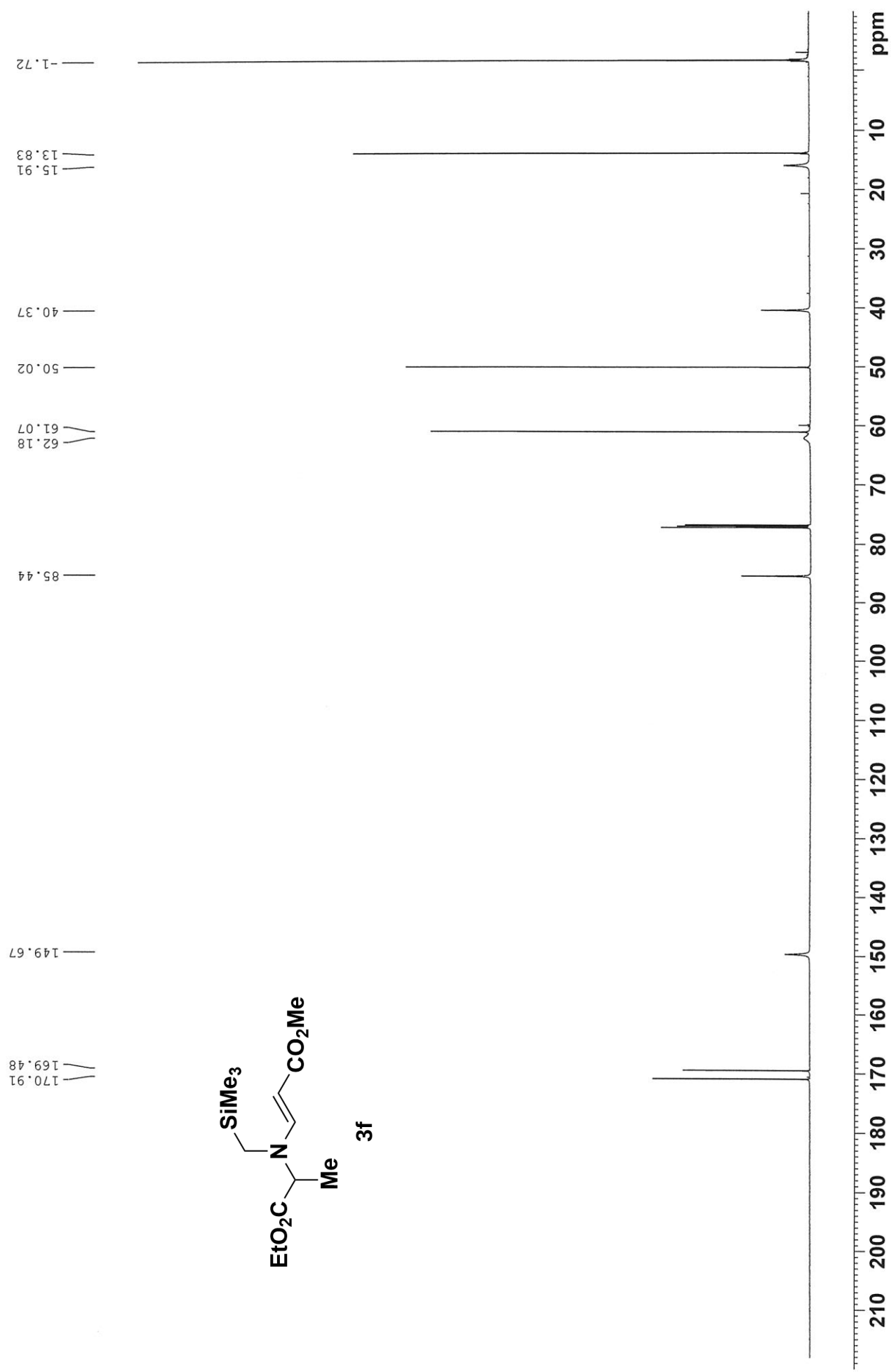
$^{13}\text{C}\{^1\text{H}\}\text{NMR (CDCl}_3, 75\text{ MHz)}$ 

3e

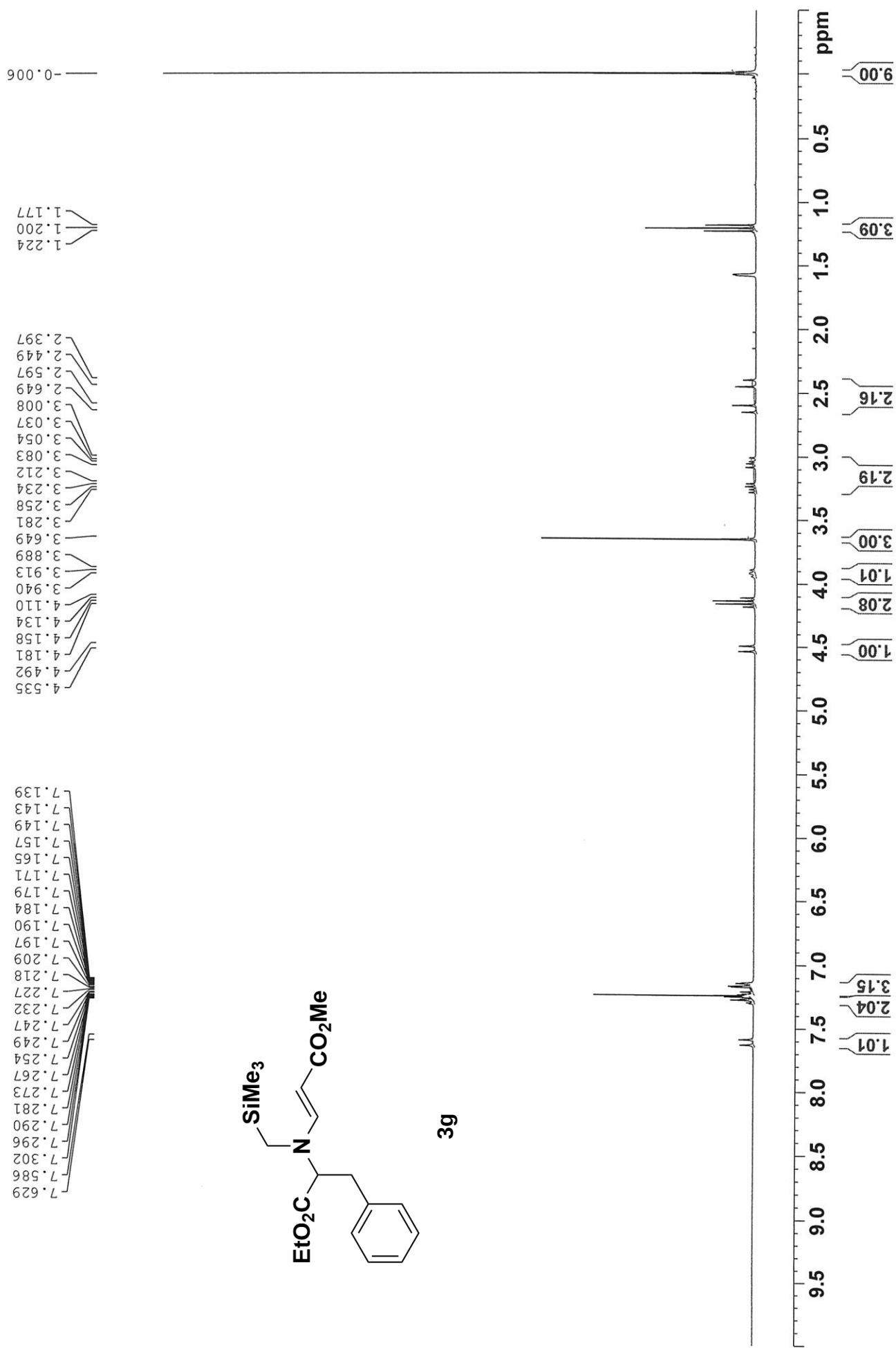
^1H NMR (CDCl_3 , 300 MHz)



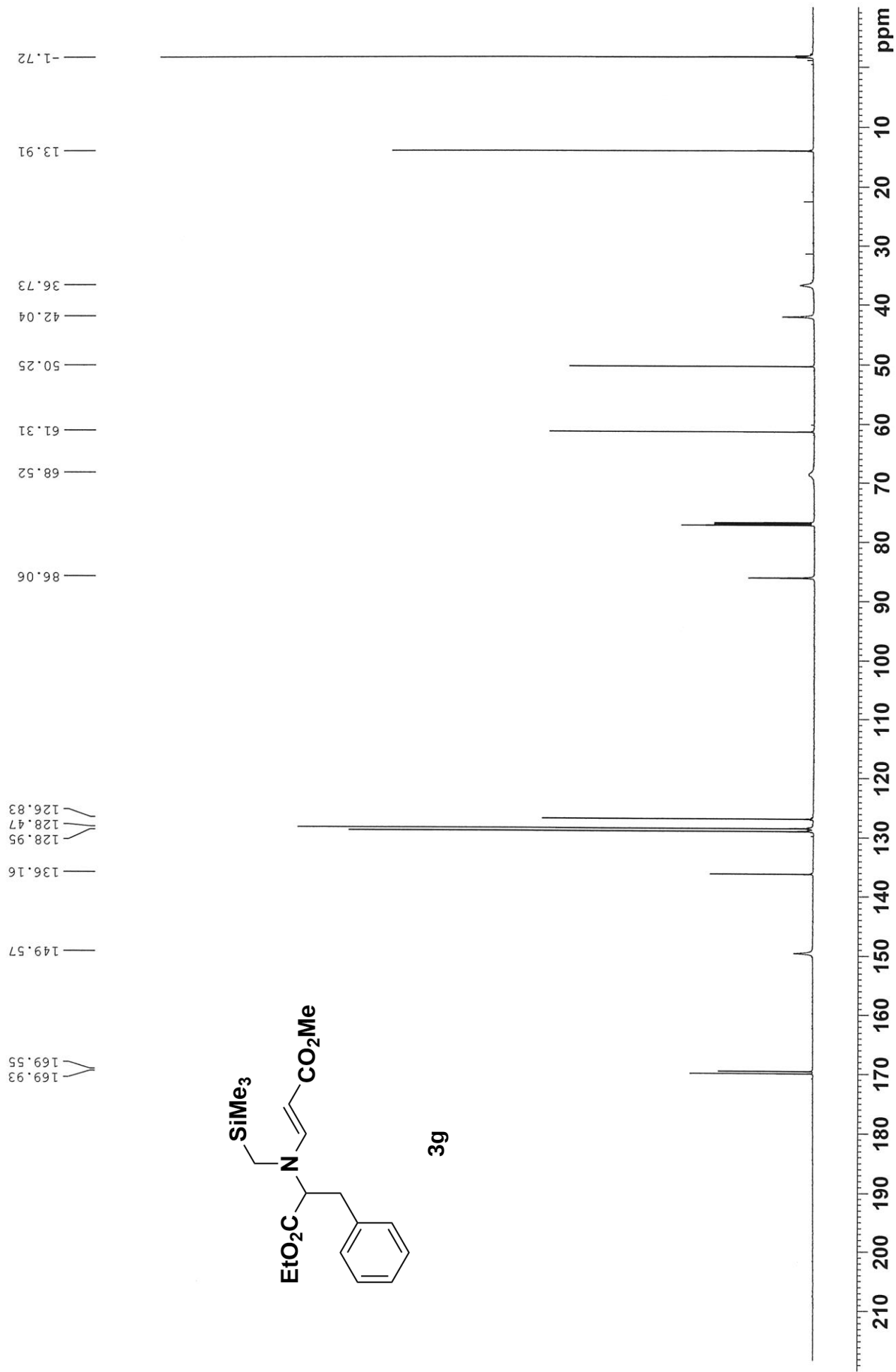
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



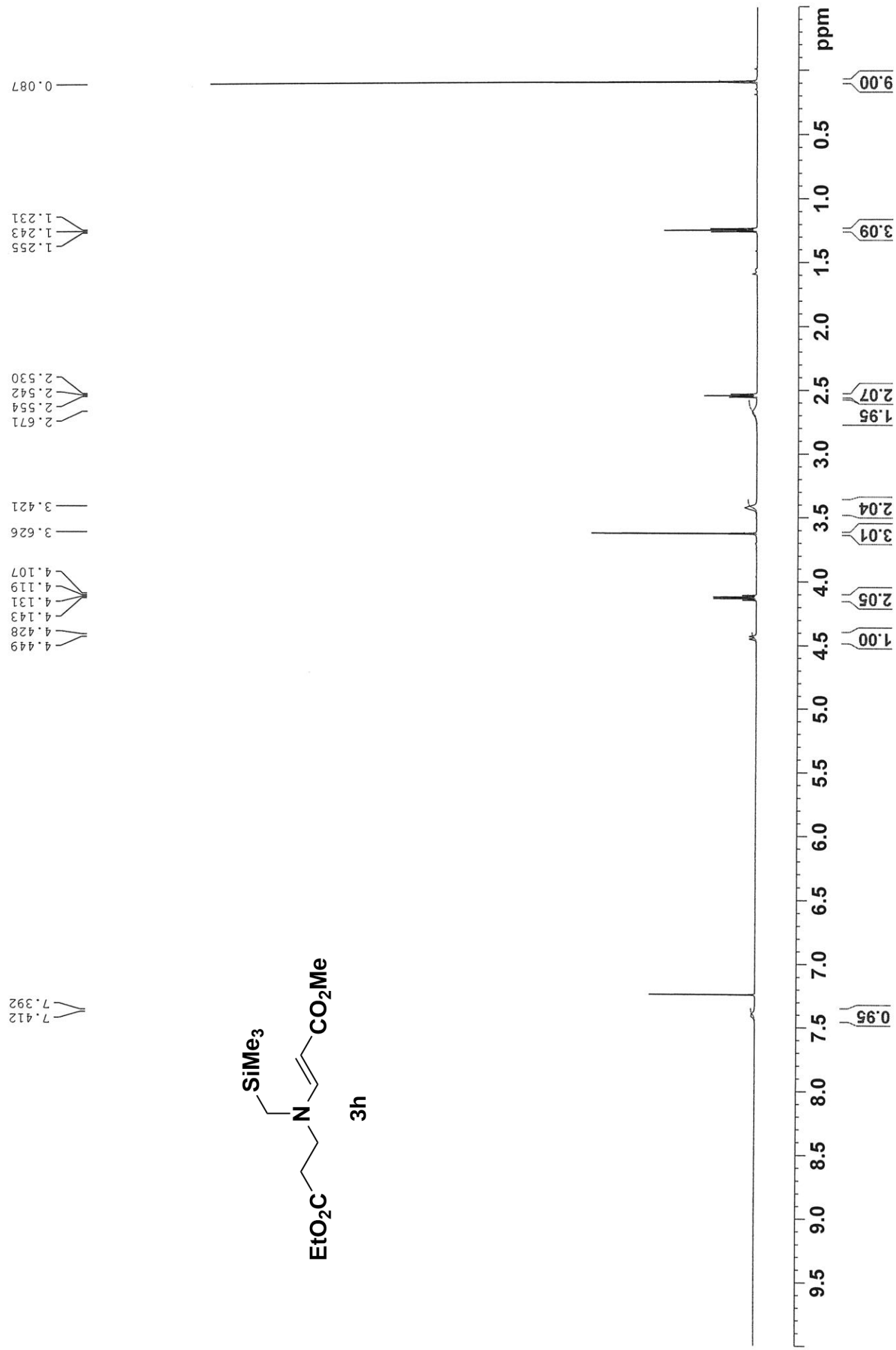
¹H NMR (CDCl₃, 300 MHz)



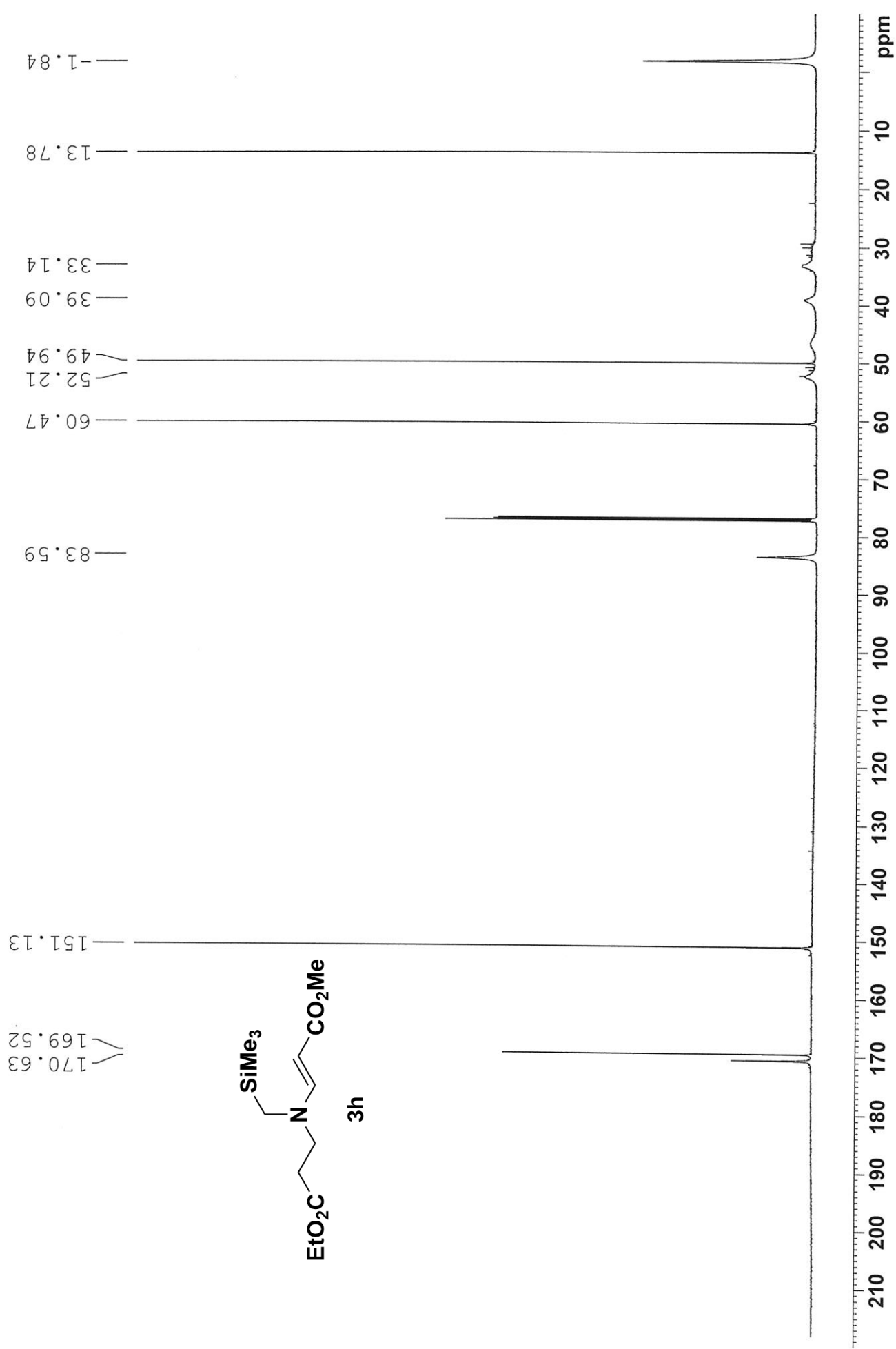
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



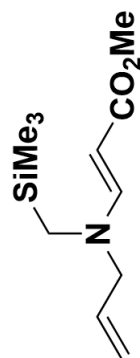
¹H NMR (CDCl₃, 600 MHz)



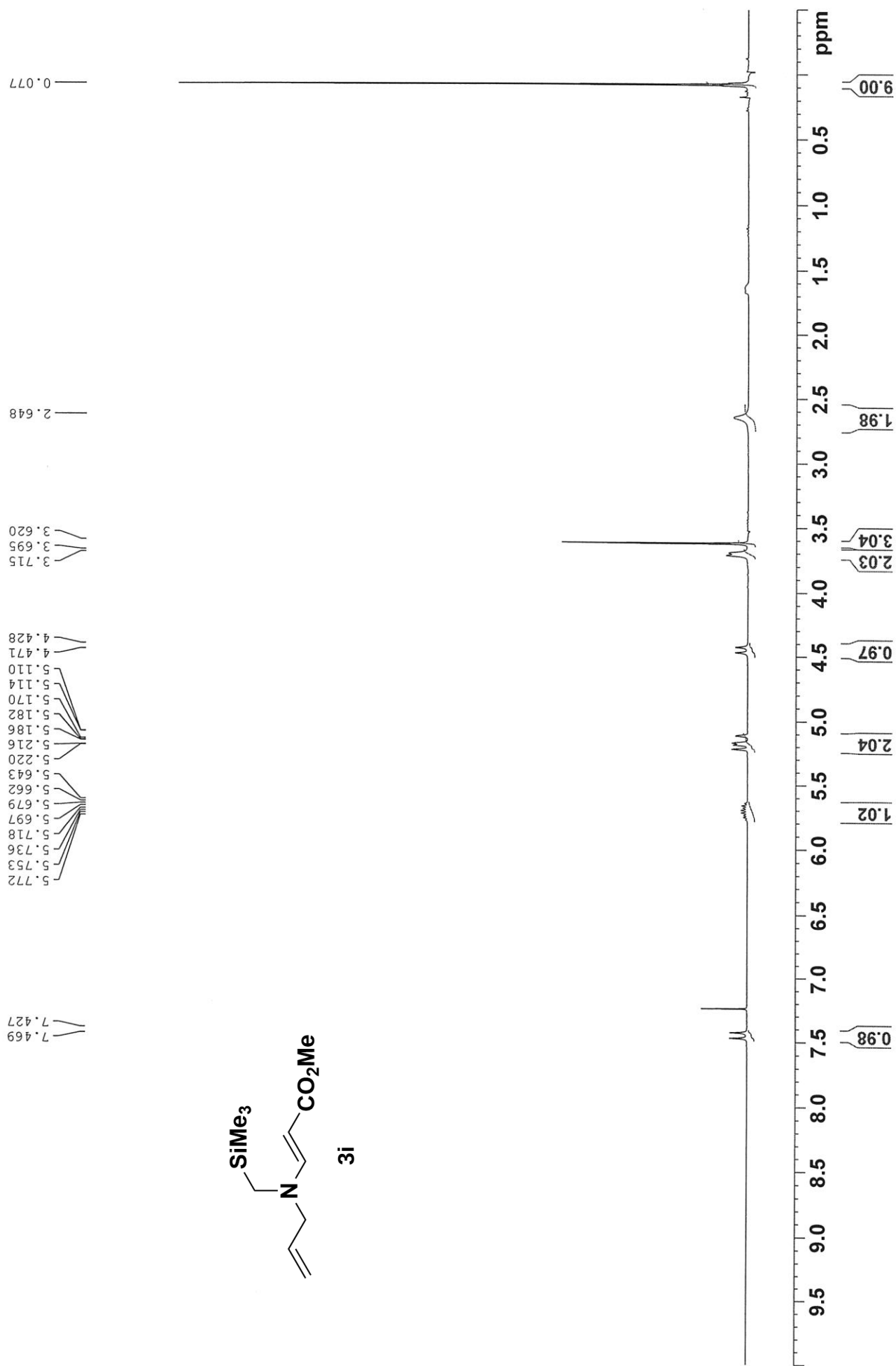
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



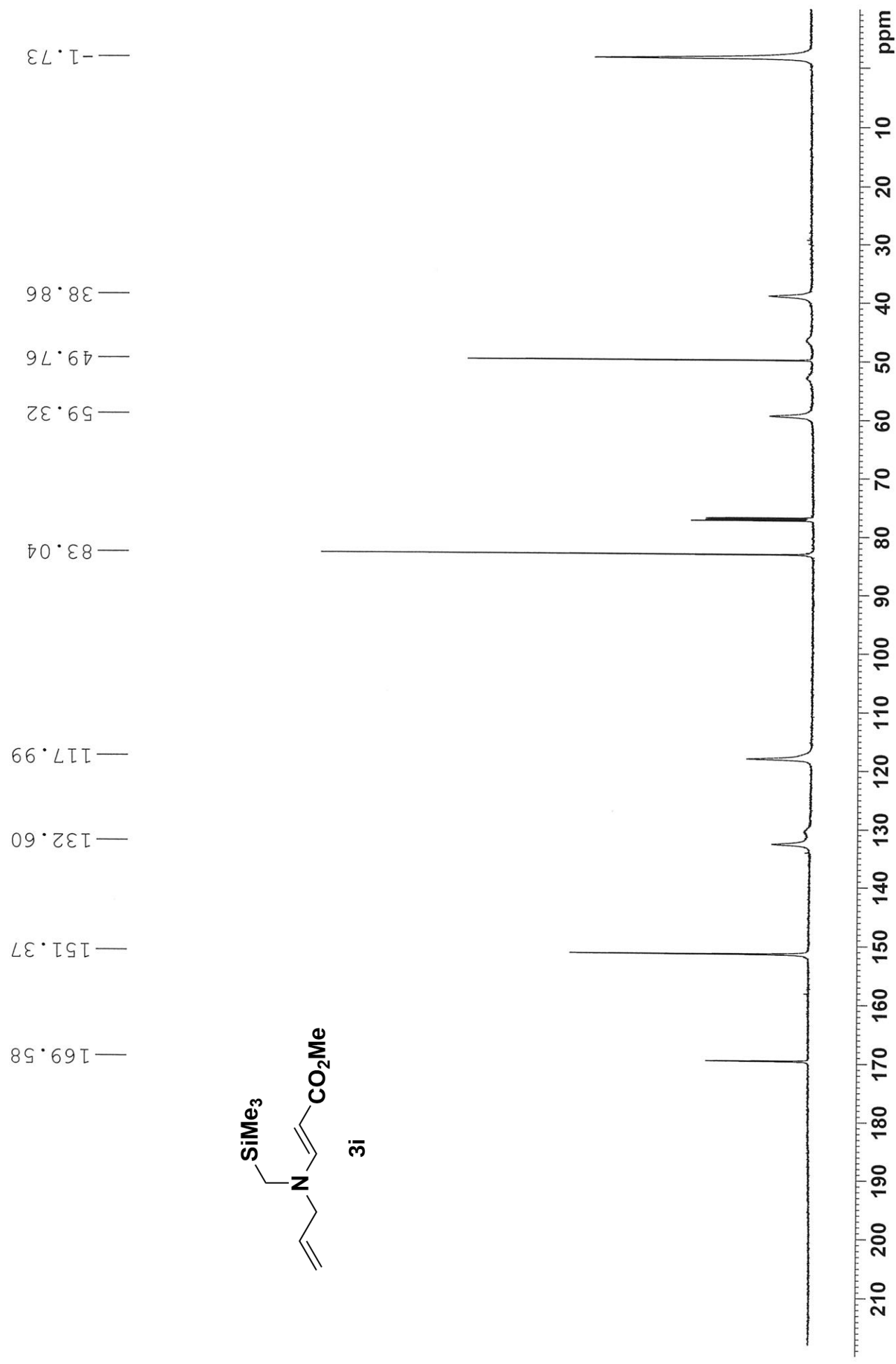
^1H NMR (CDCl_3 , 300 MHz)

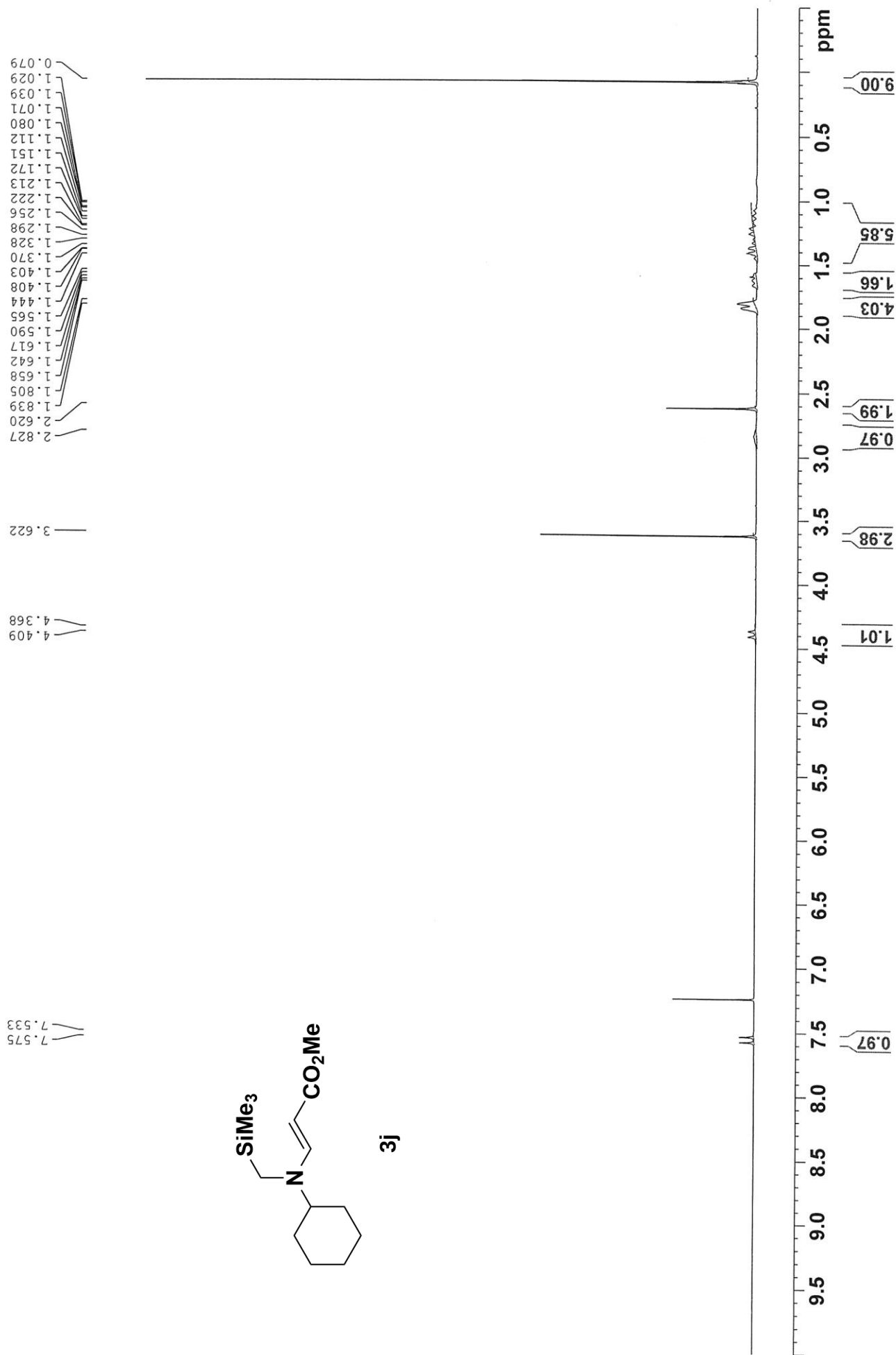


3i

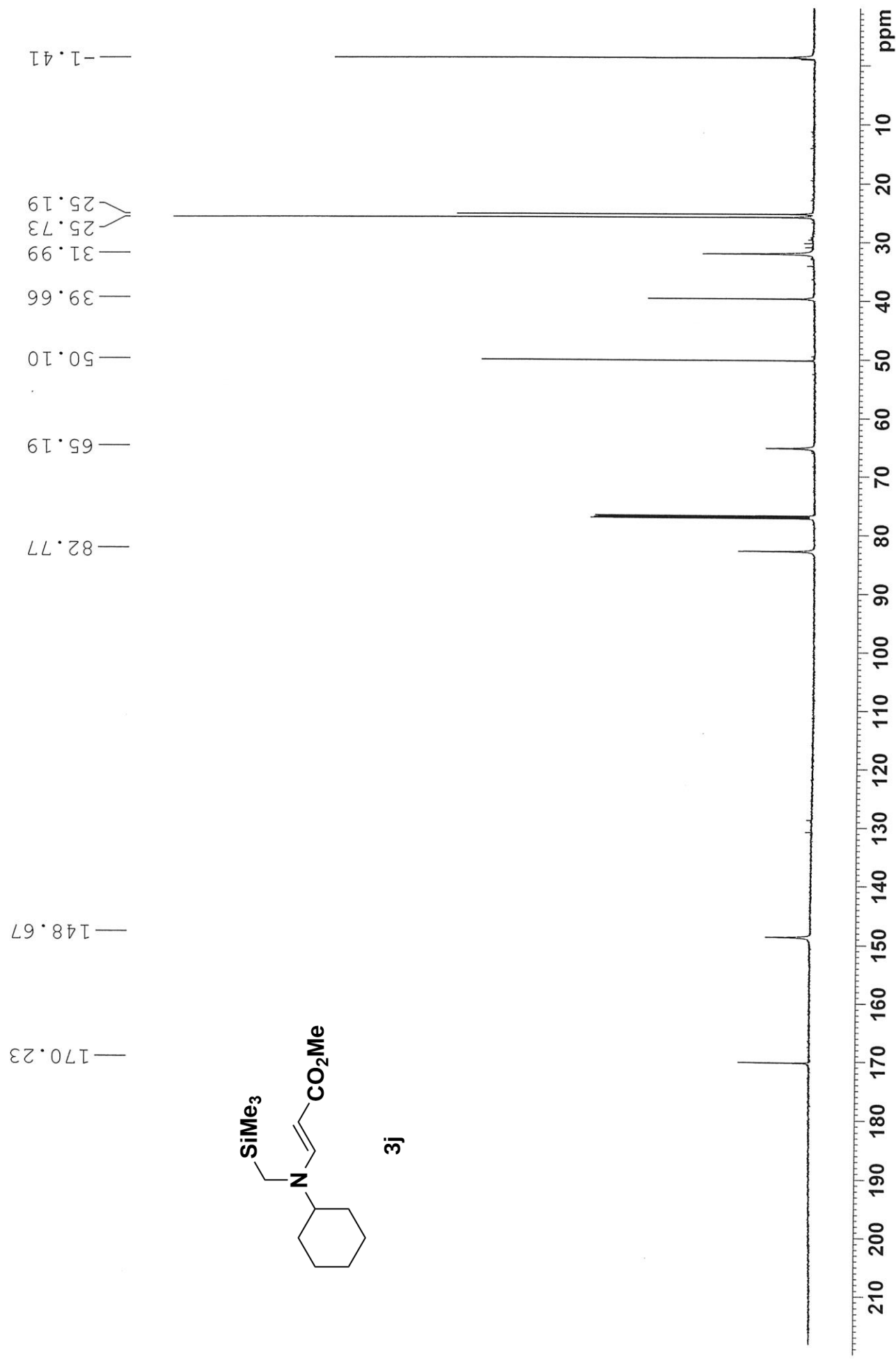


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

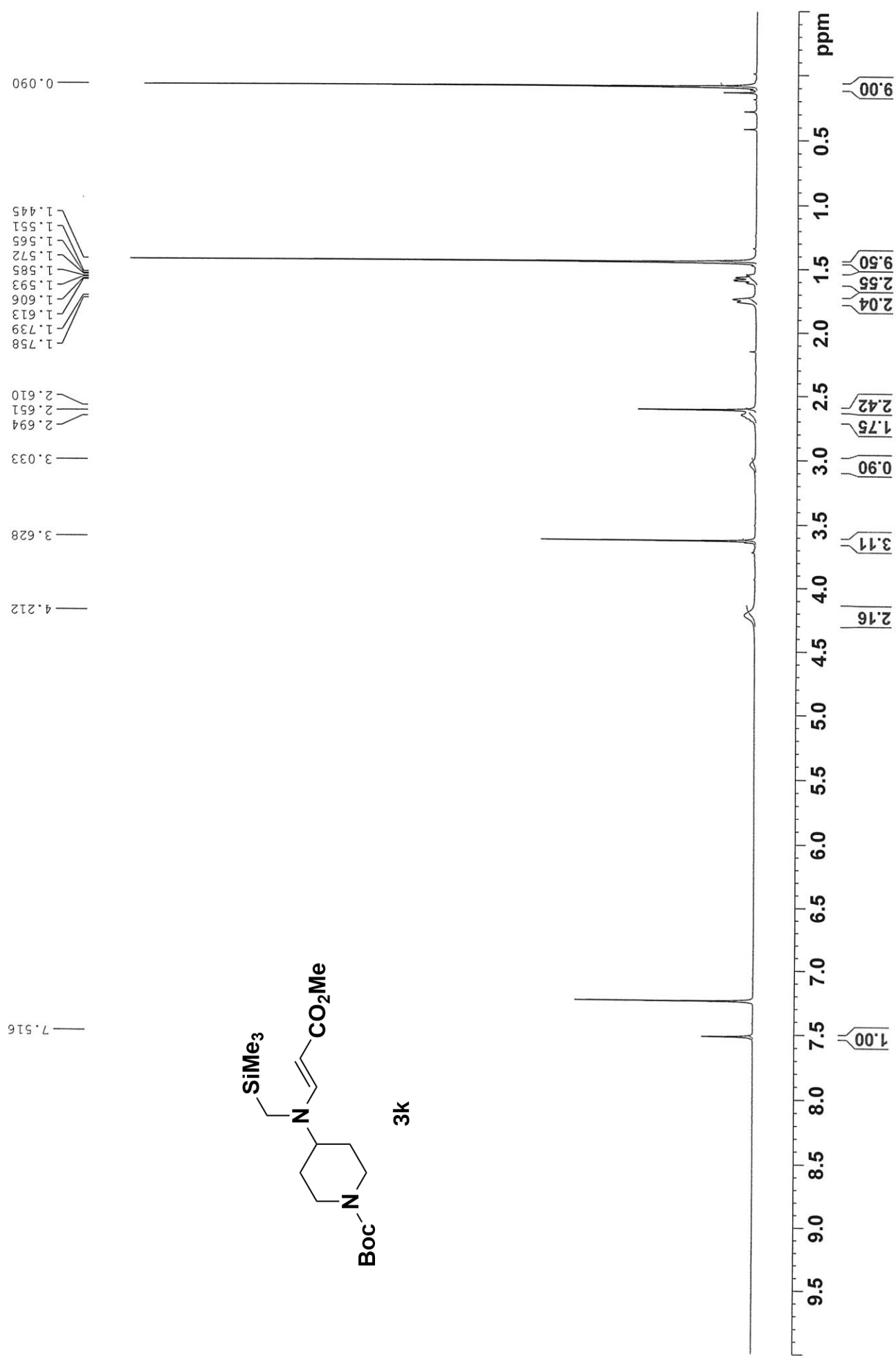


¹H NMR (CDCl₃, 300 MHz)

$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

— 169.84
— 154.19
— 148.63

— 63.46

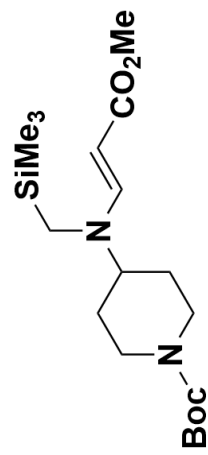
— 83.98
— 79.62

— 50.12

— 42.95
— 39.21

— 30.71
— 28.16

— -1.43



3k



¹H NMR (CDCl₃, 600 MHz)

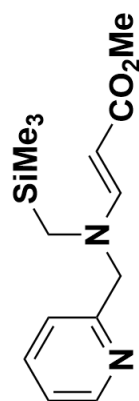
8.556
8.548
7.694
7.683
7.670
7.612
7.591
7.224
7.215
7.204
7.158
7.145

4.552
4.530
4.457

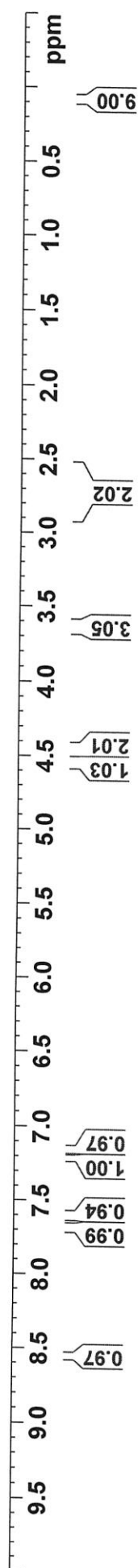
3.633

2.672

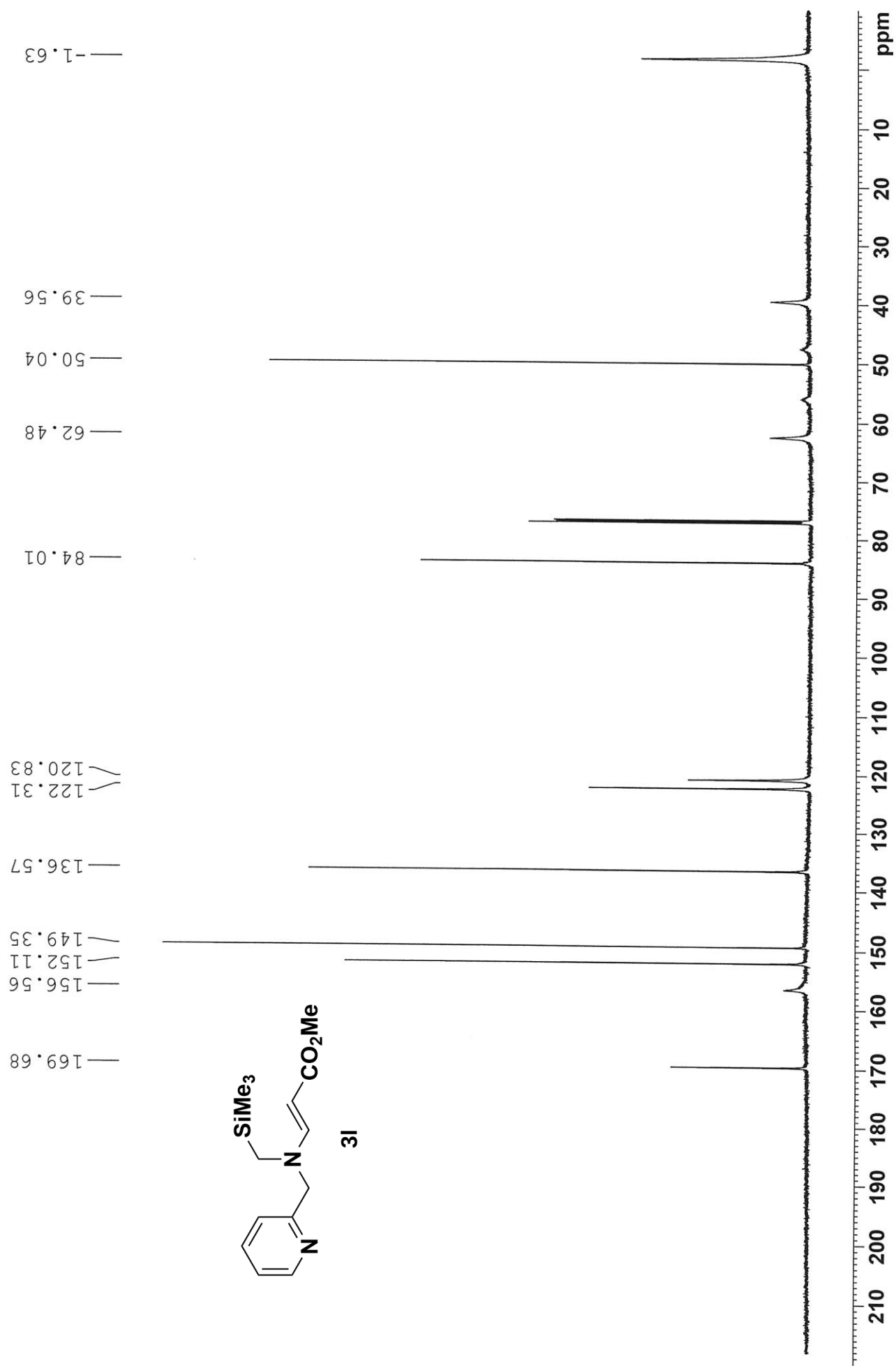
0.080



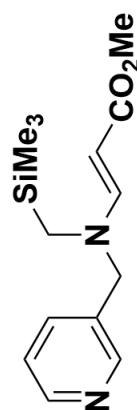
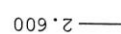
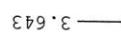
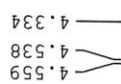
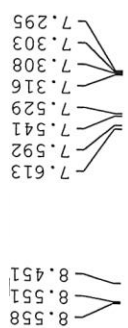
3l



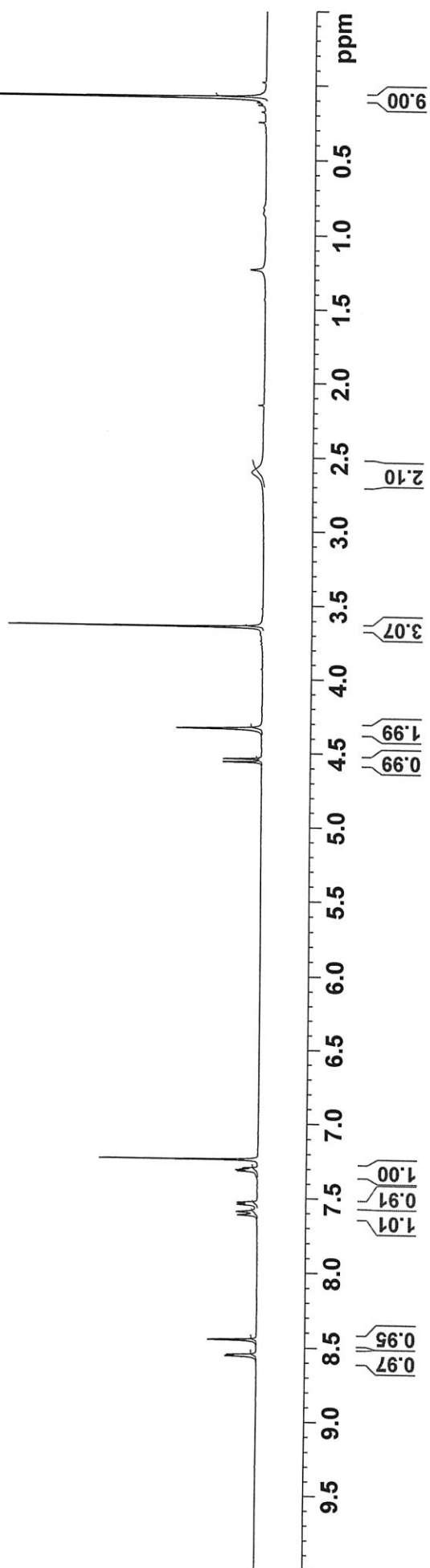
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



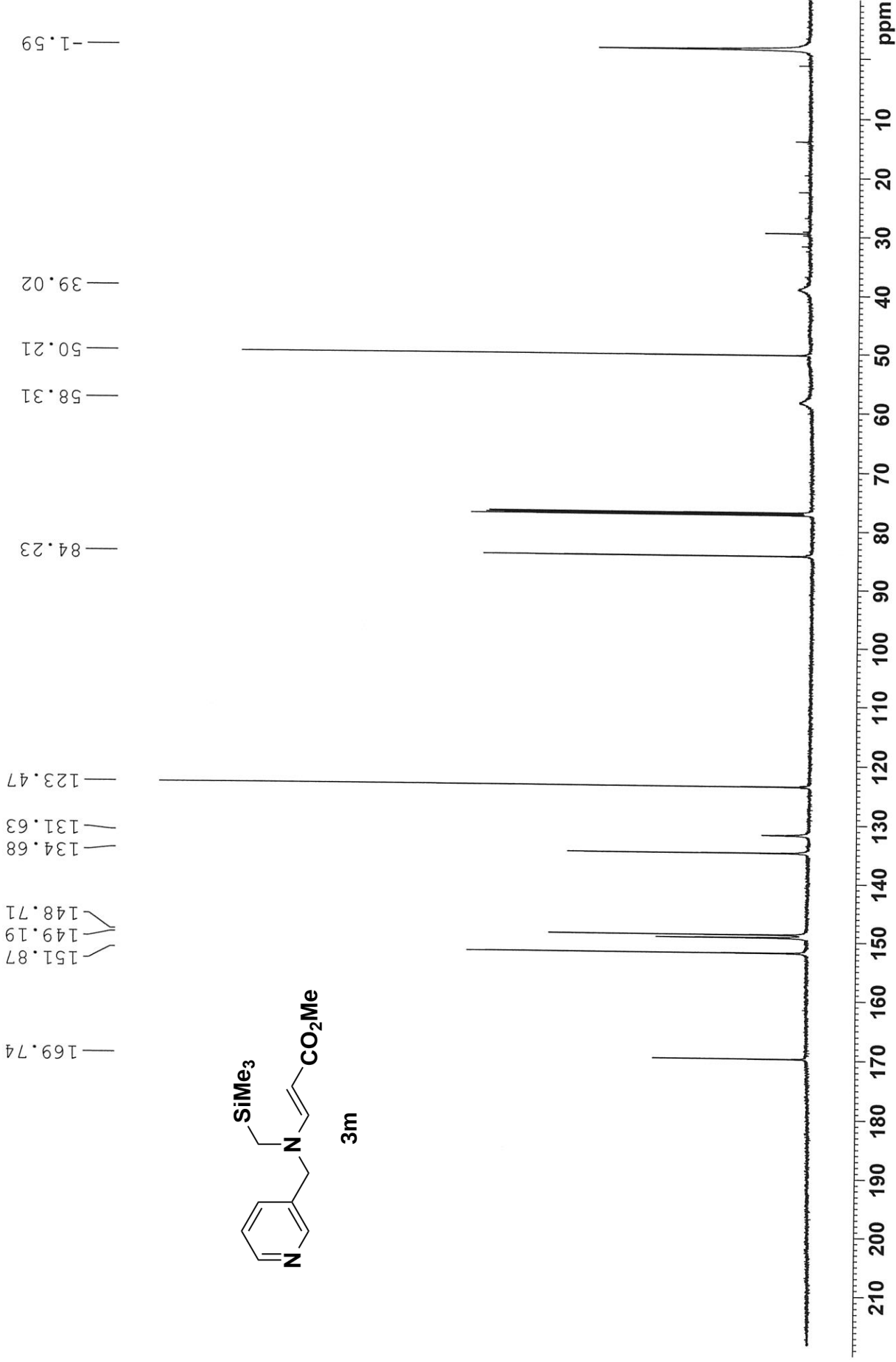
¹H NMR (CDCl₃, 600 MHz)



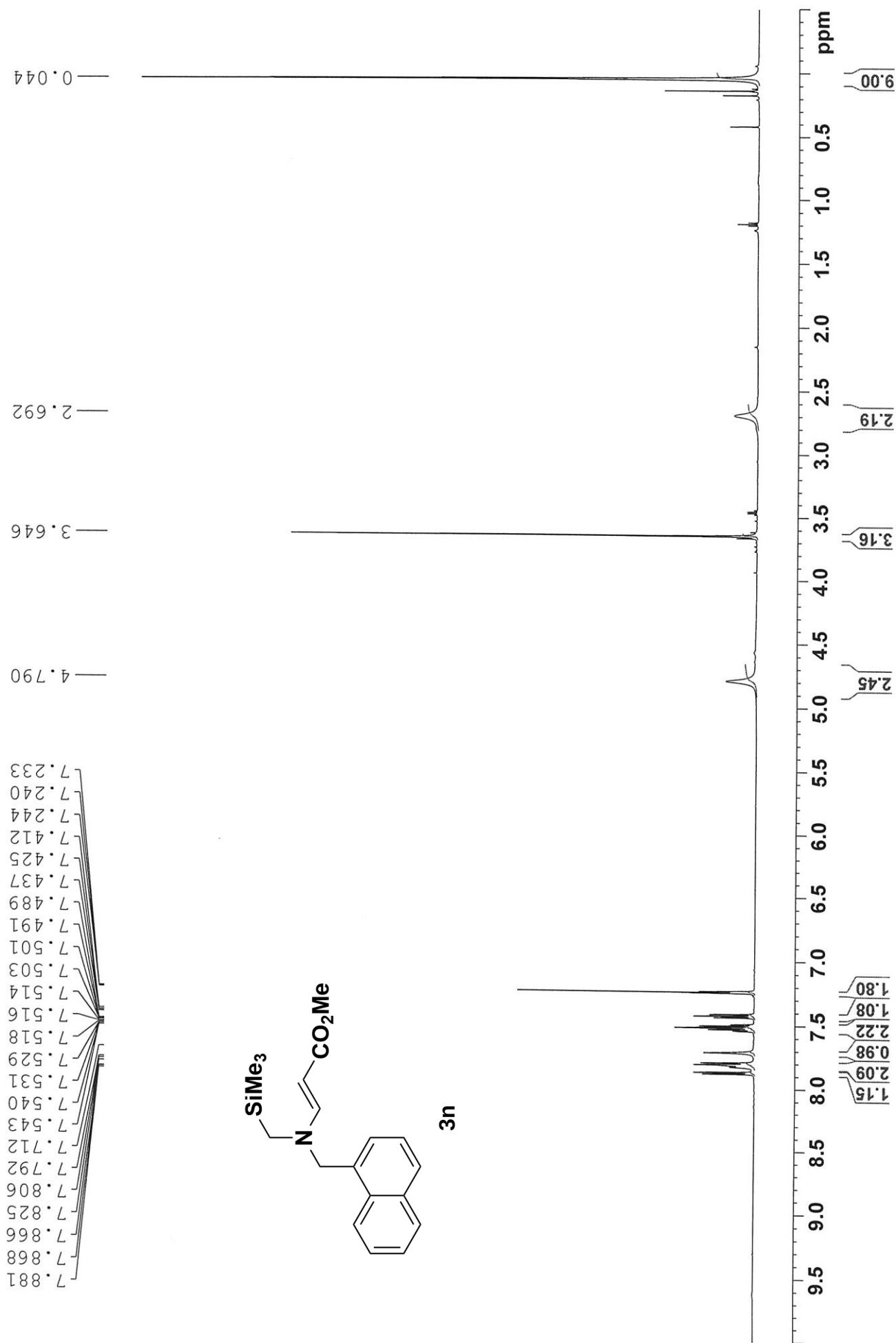
3m



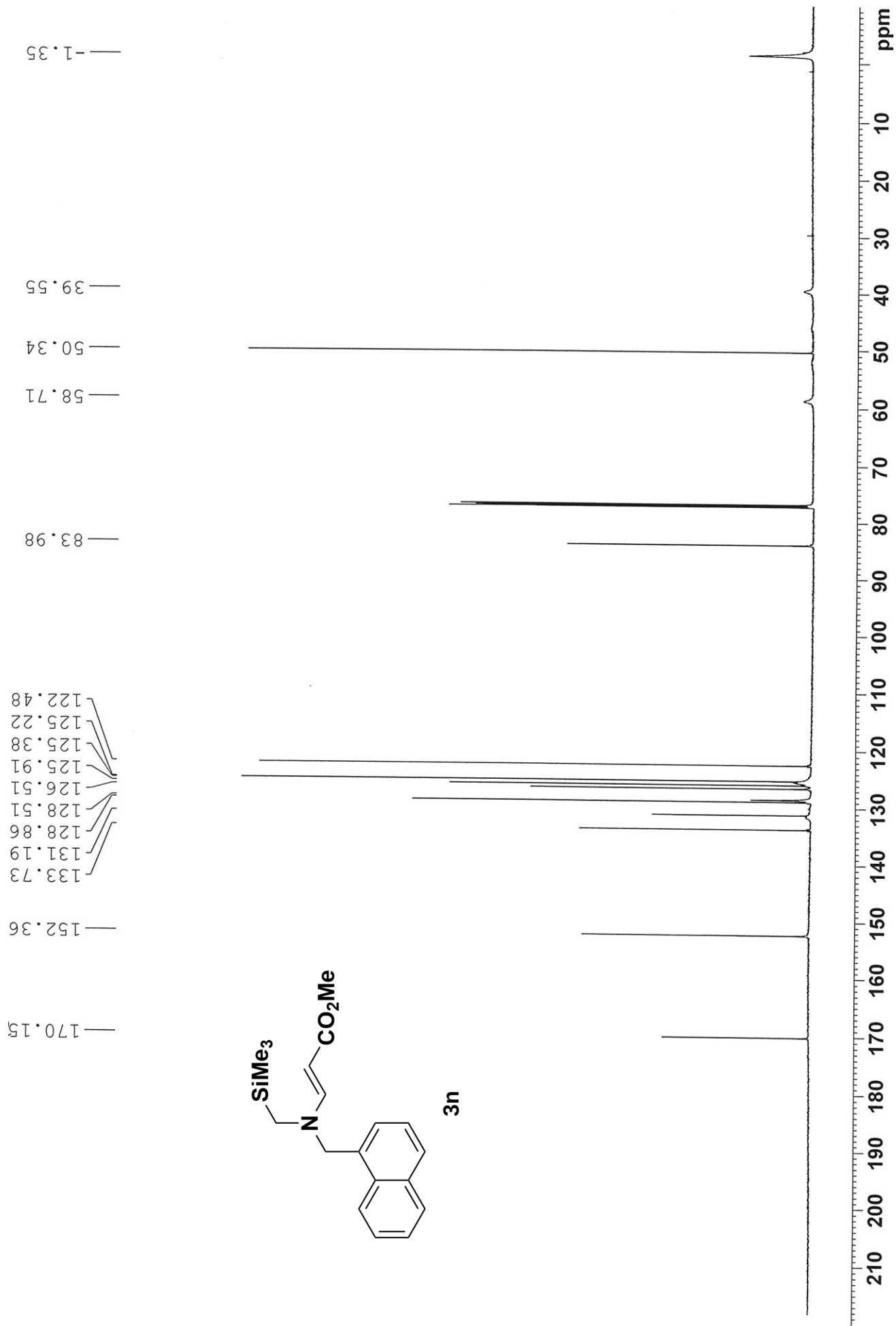
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



^1H NMR (CDCl_3 , 600 MHz)



$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



^1H NMR (CDCl_3 , 300 MHz)

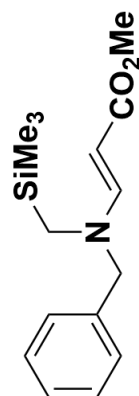
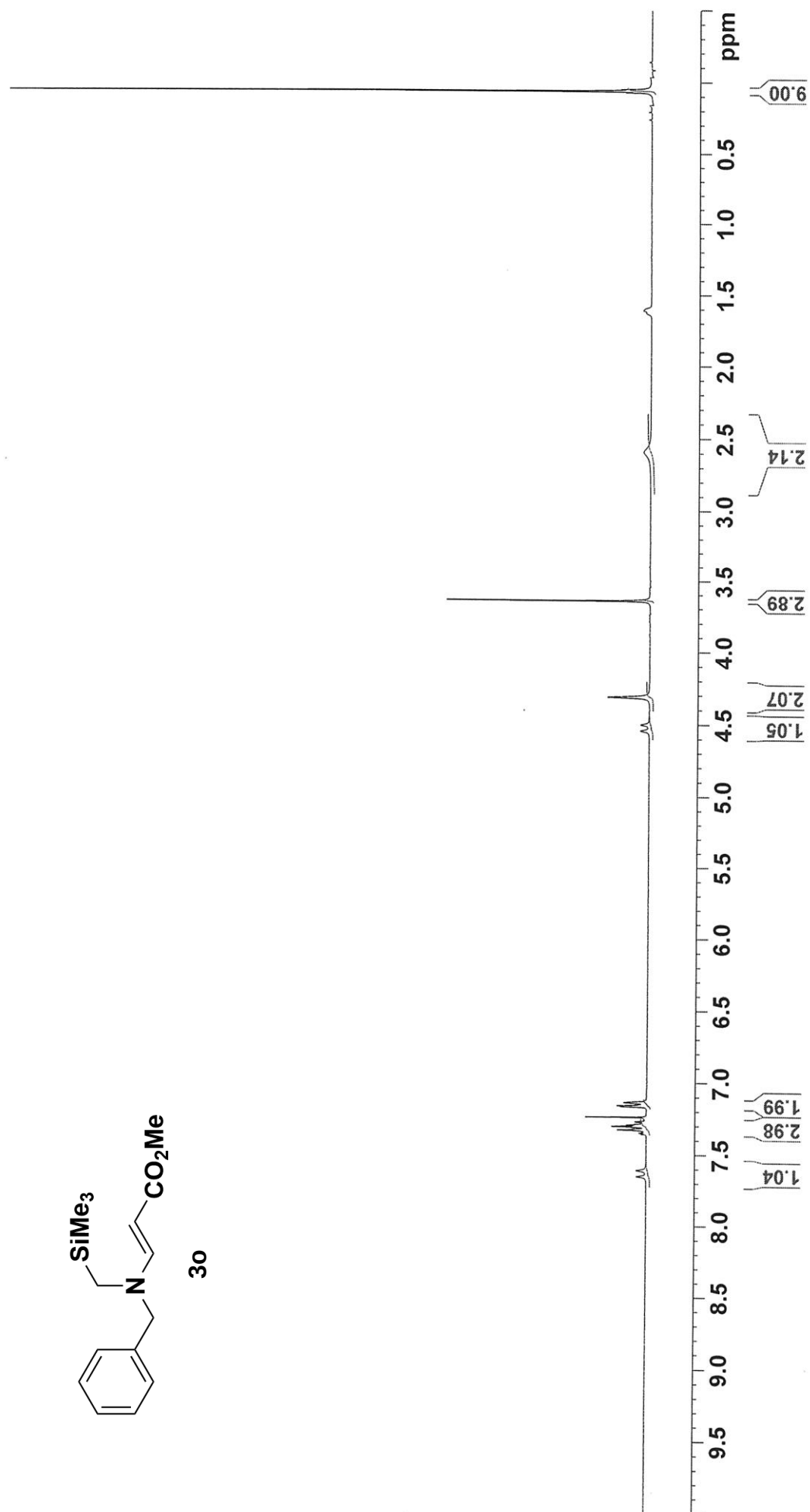
7.652
7.609
7.357
7.349
7.344
7.328
7.323
7.309
7.304
7.294
7.288
7.281
7.271
7.257
7.165
7.160
7.152
7.138
7.125

4.544
4.502
4.313

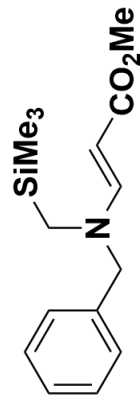
3.641

2.588

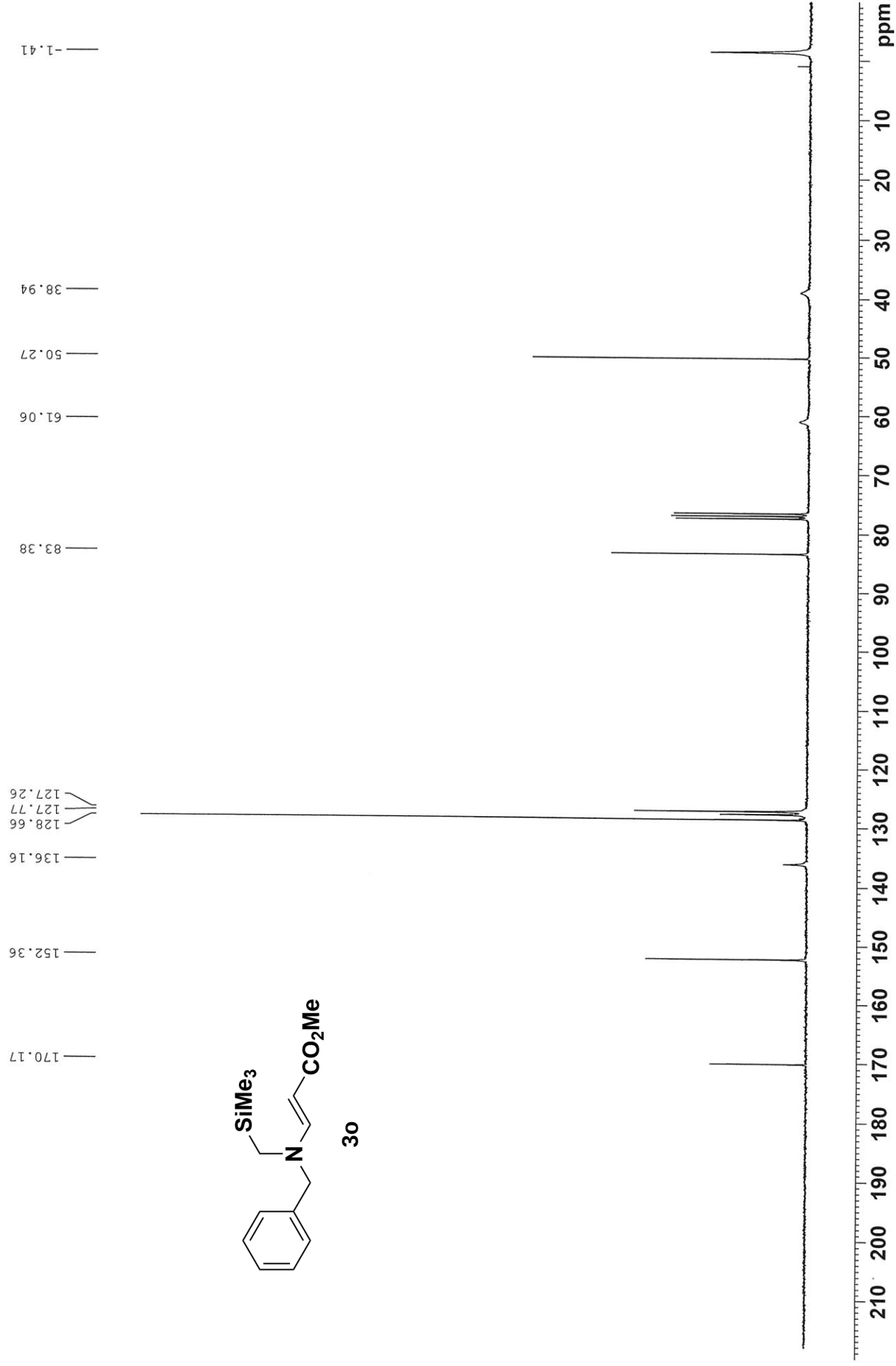
0.061

**30**

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



30



^1H NMR (CDCl_3 , 300 MHz)

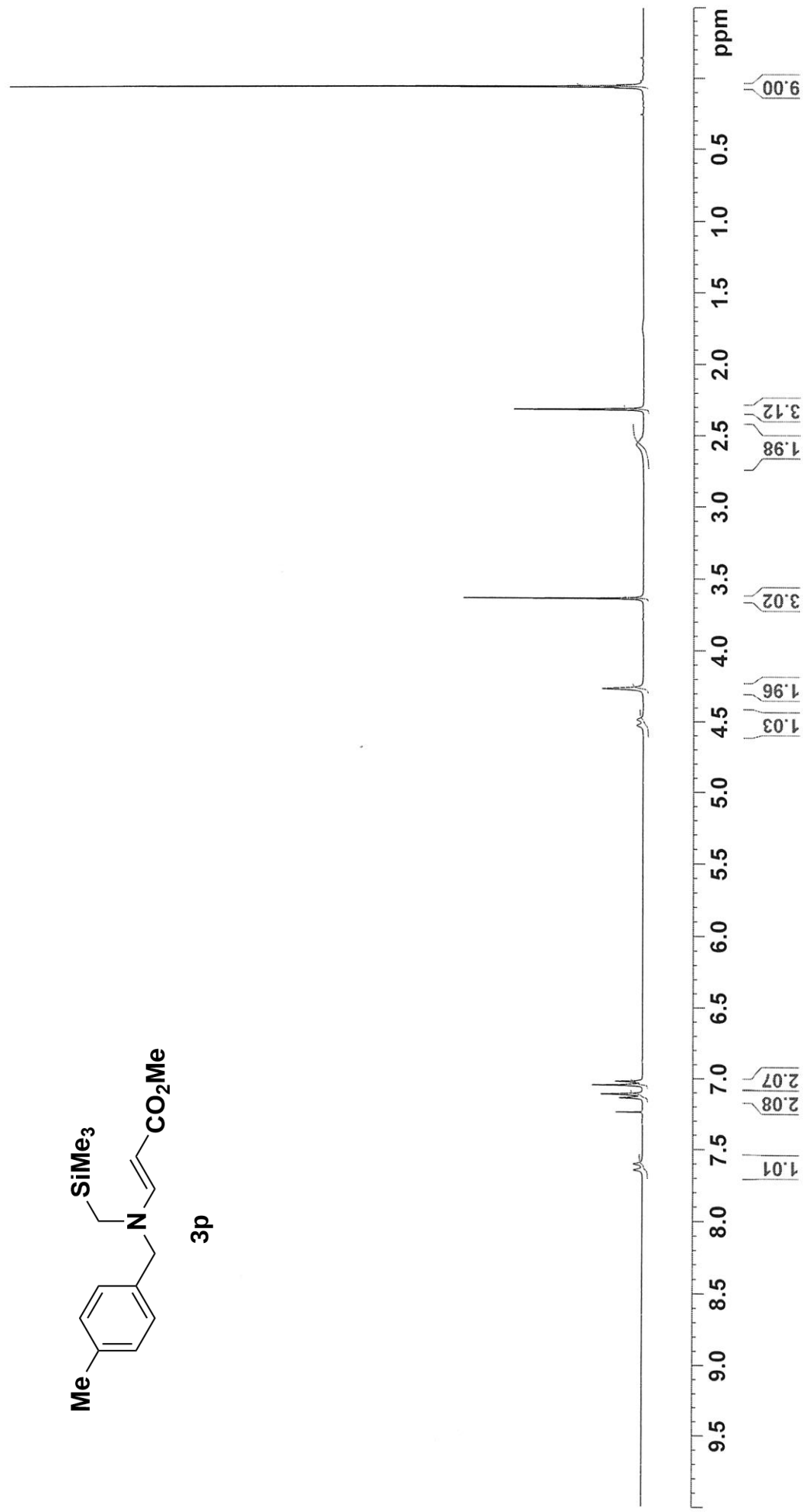
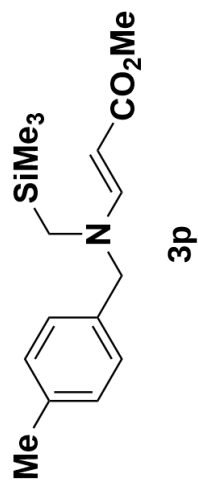
7.644
7.602
7.139
7.112
7.049
7.022

4.527
4.485
4.266

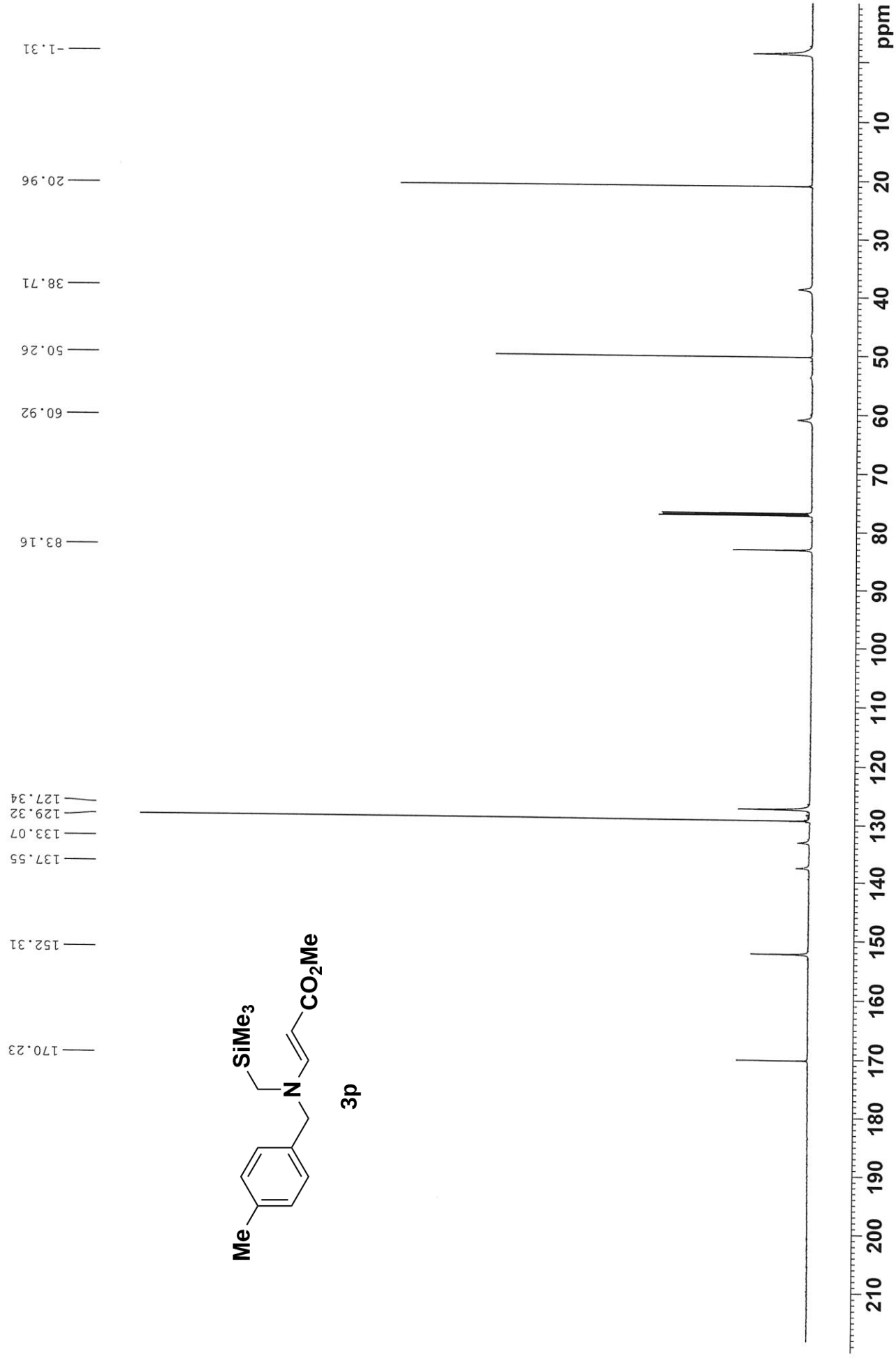
3.636

2.562
2.315

0.057



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)

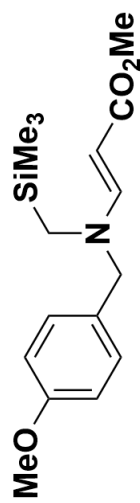
7.637
7.603
7.102
7.092
7.085
7.070
7.063
7.054
6.875
6.865
6.858
6.843
6.836
6.827

4.522
4.482
4.247

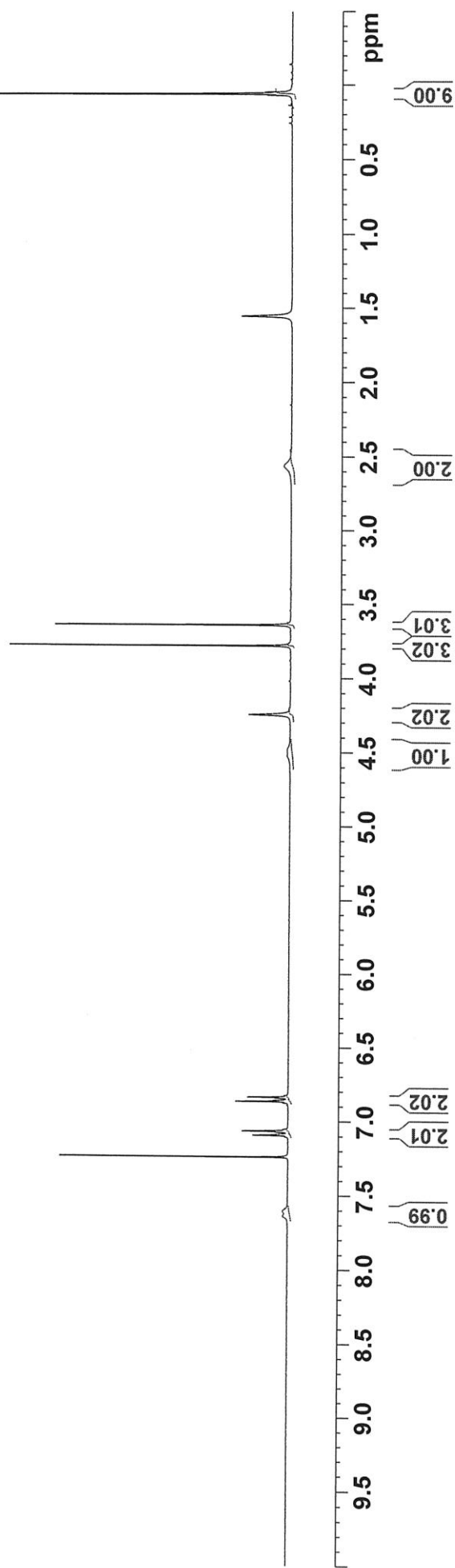
3.782
3.640

2.562

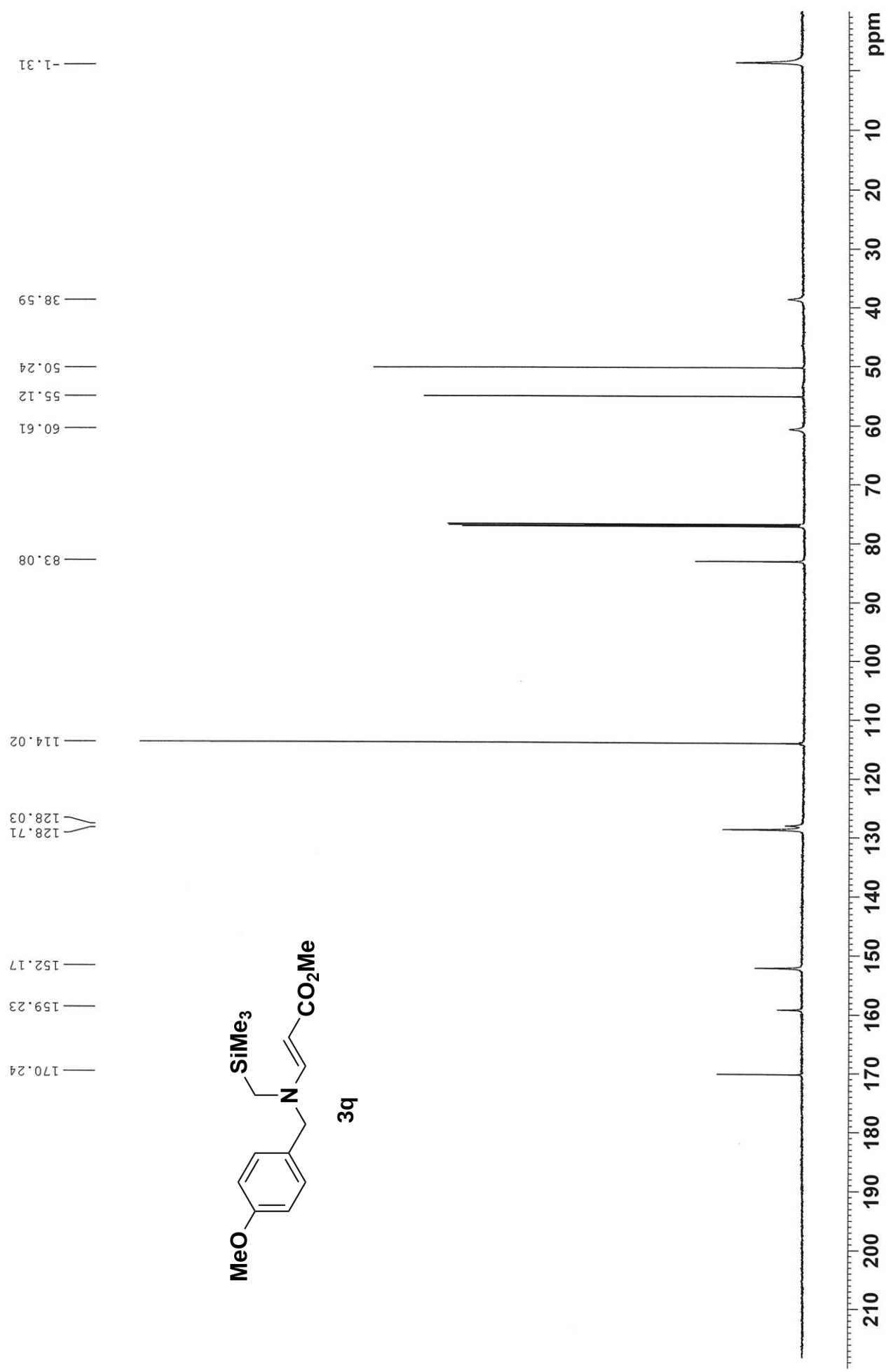
0.058

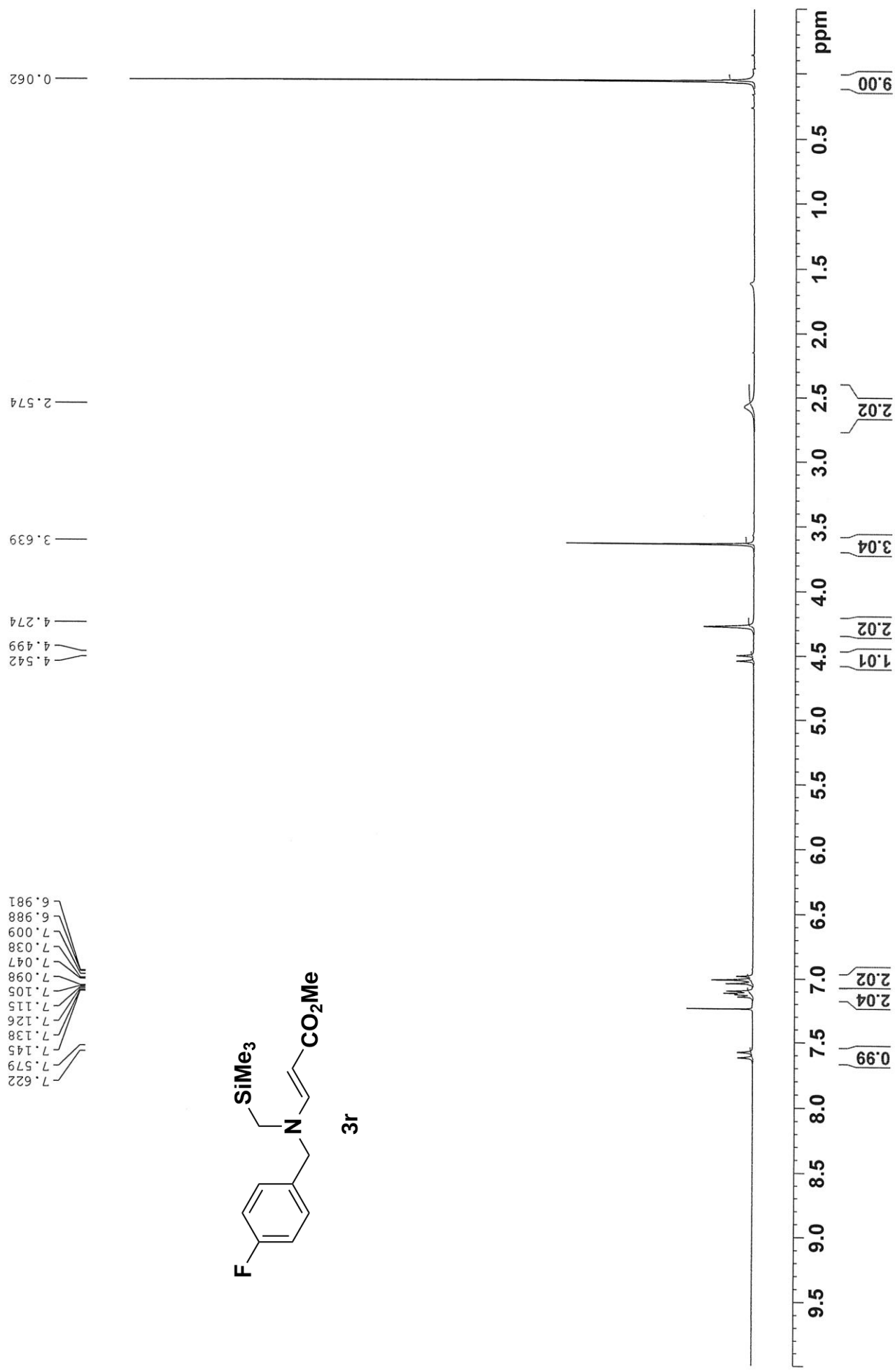


3q

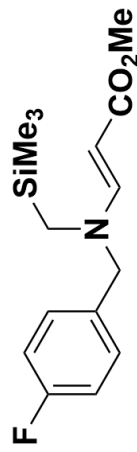


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

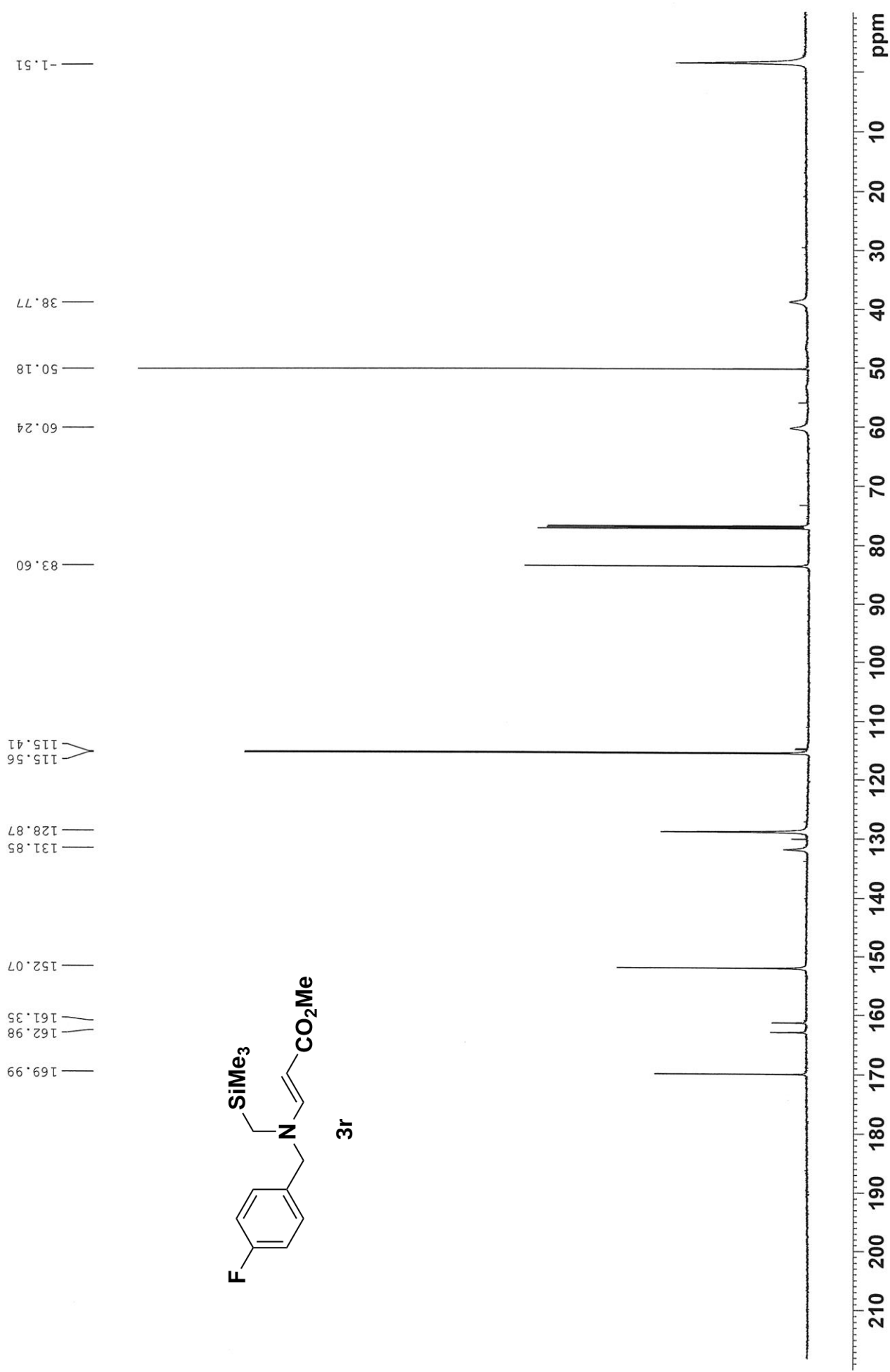


^1H NMR (CDCl_3 , 300 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



3r



^1H NMR (CDCl_3 , 600 MHz)

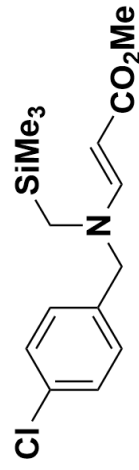
7.580
7.558
7.268
7.254
7.066
7.052

4.509
4.488
4.249

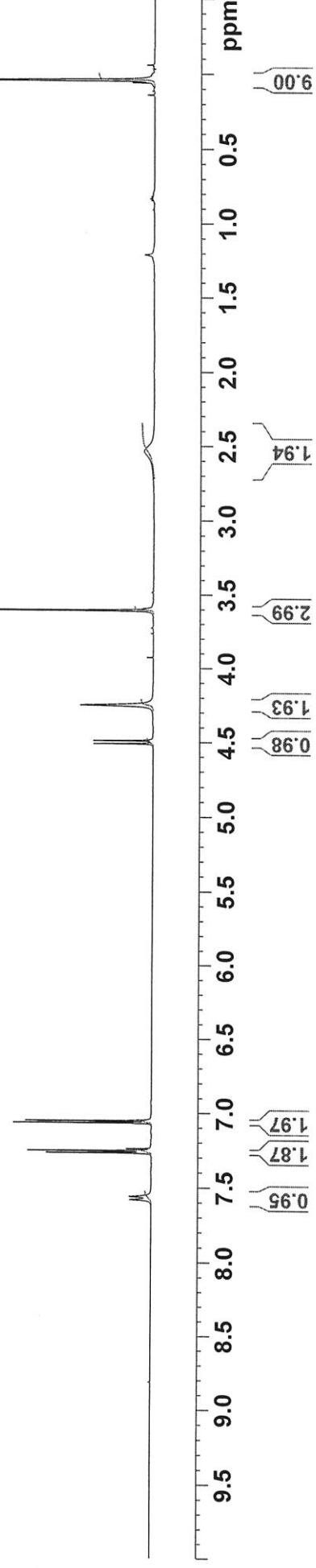
3.607

2.531

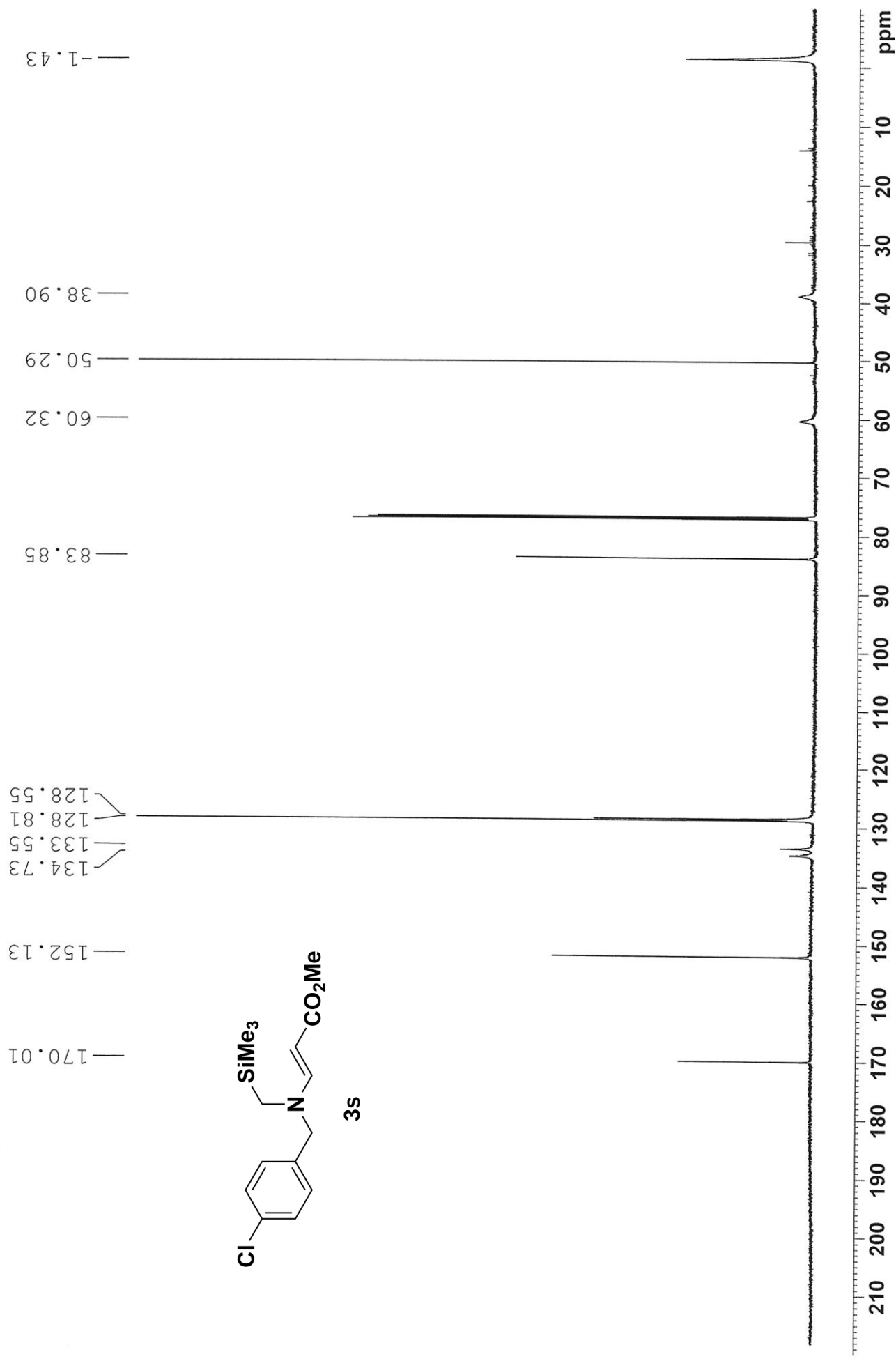
0.040



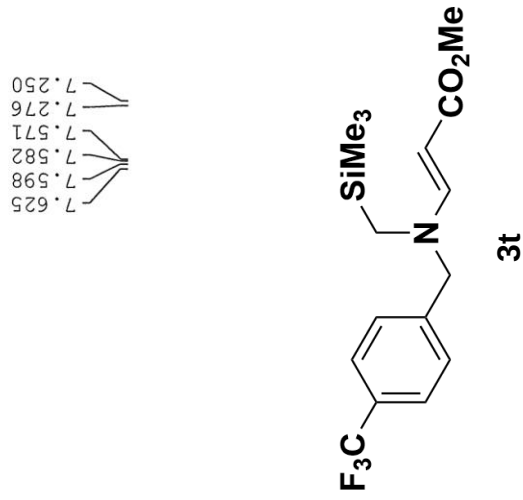
3s



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



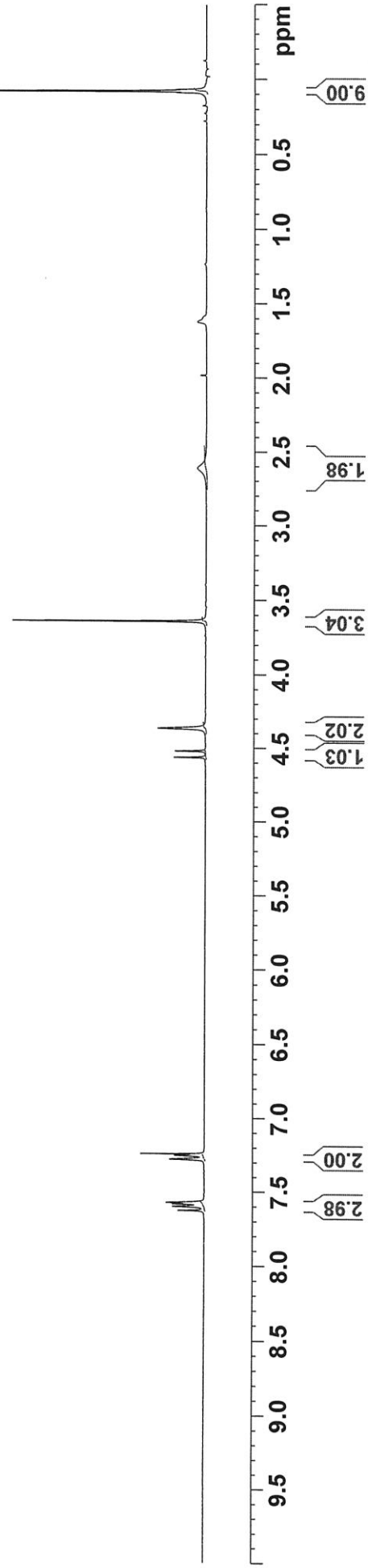
7.625
7.598
7.582
7.571
7.276
7.250

4.563
4.520
4.364

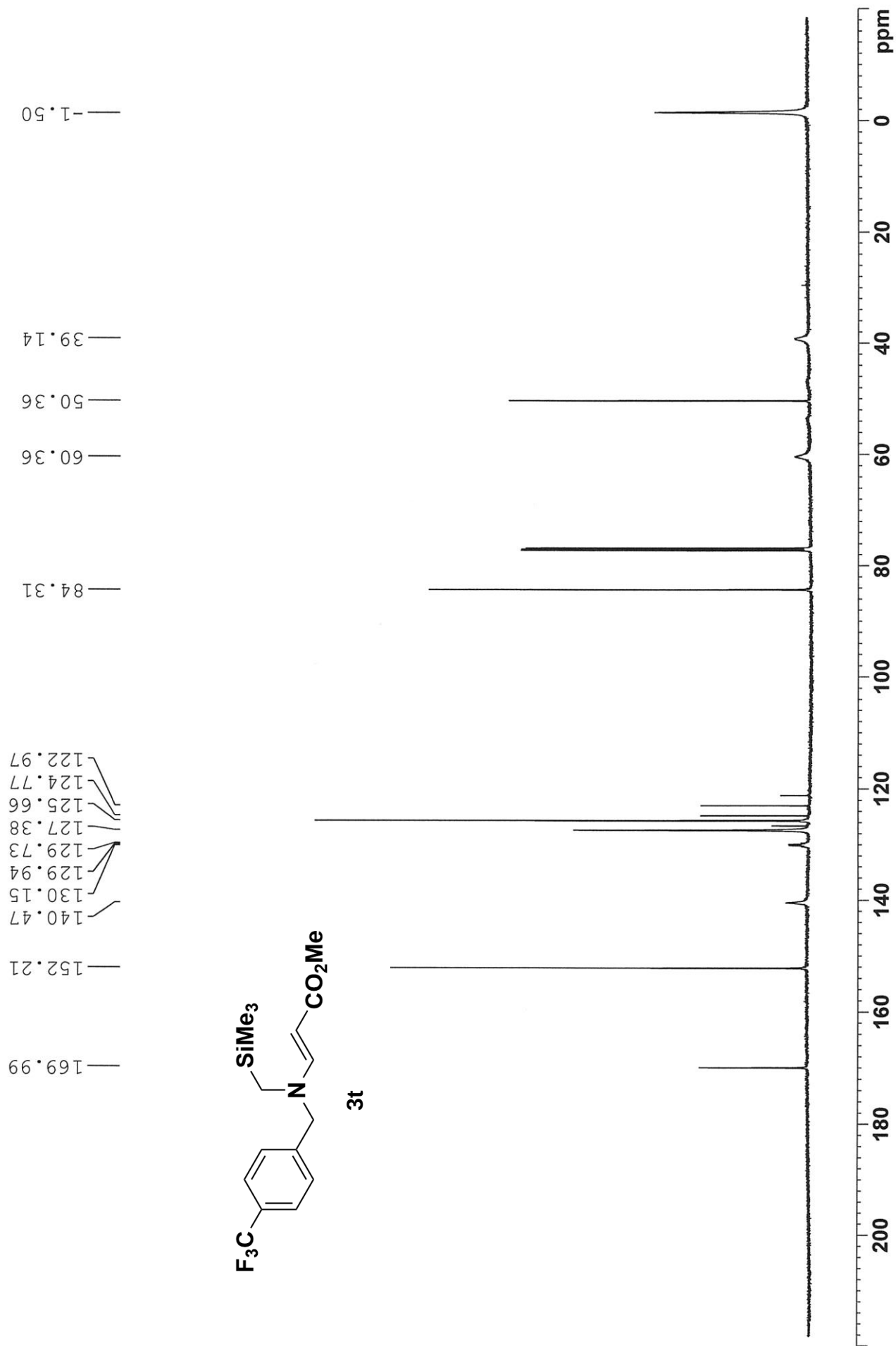
3.641

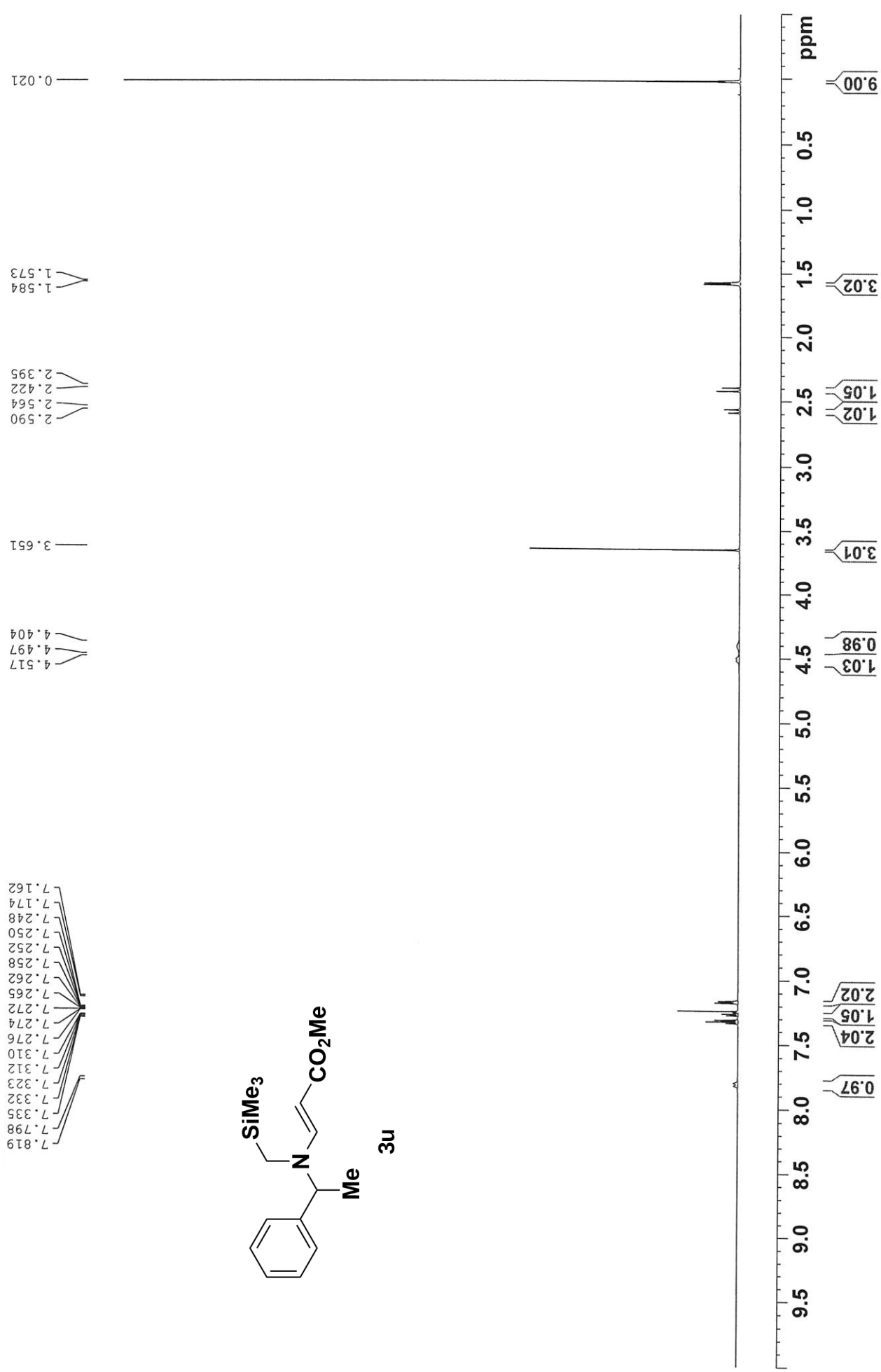
2.611

0.079

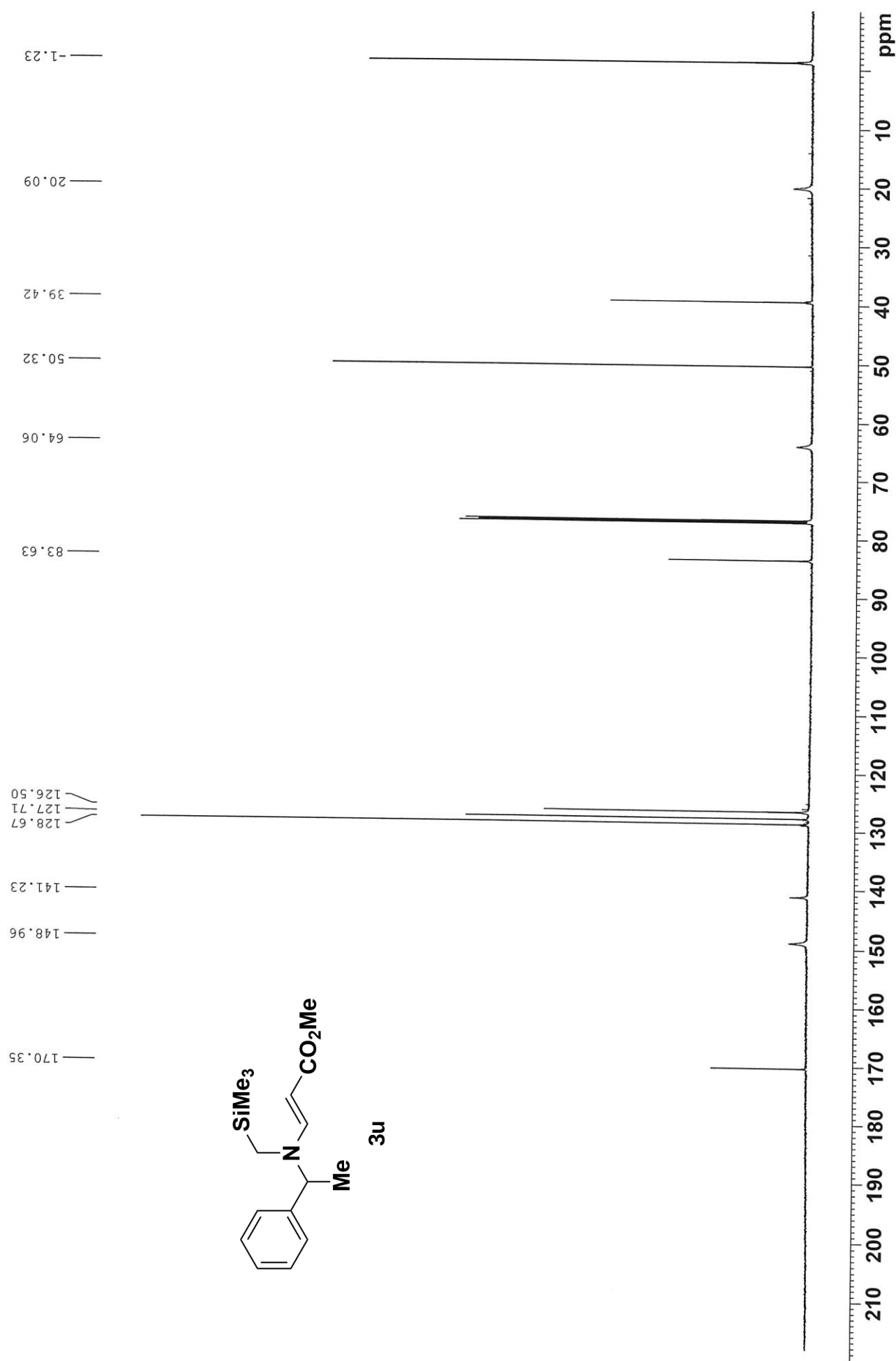


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

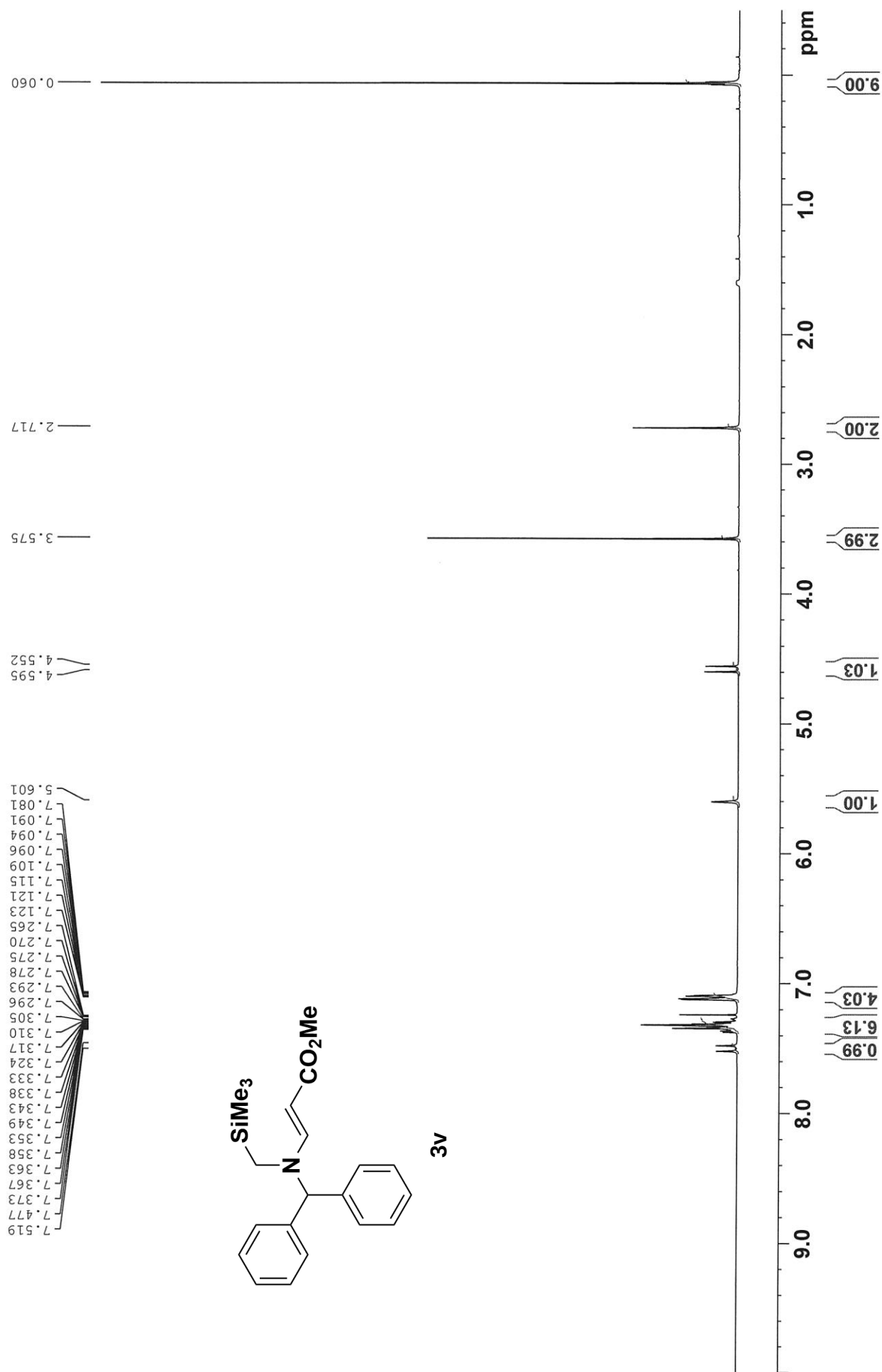


^1H NMR (CDCl_3 , 600 MHz)

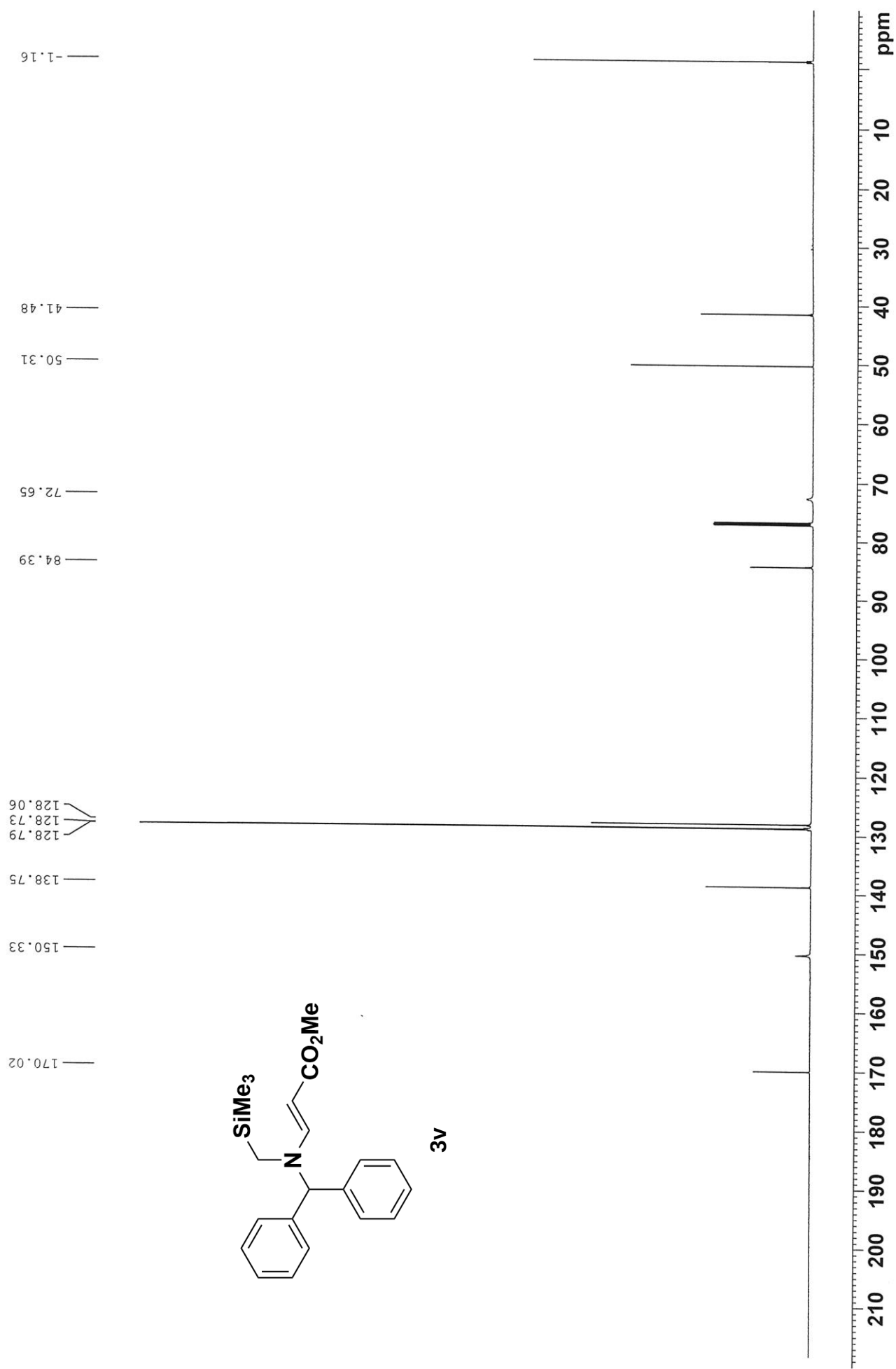
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



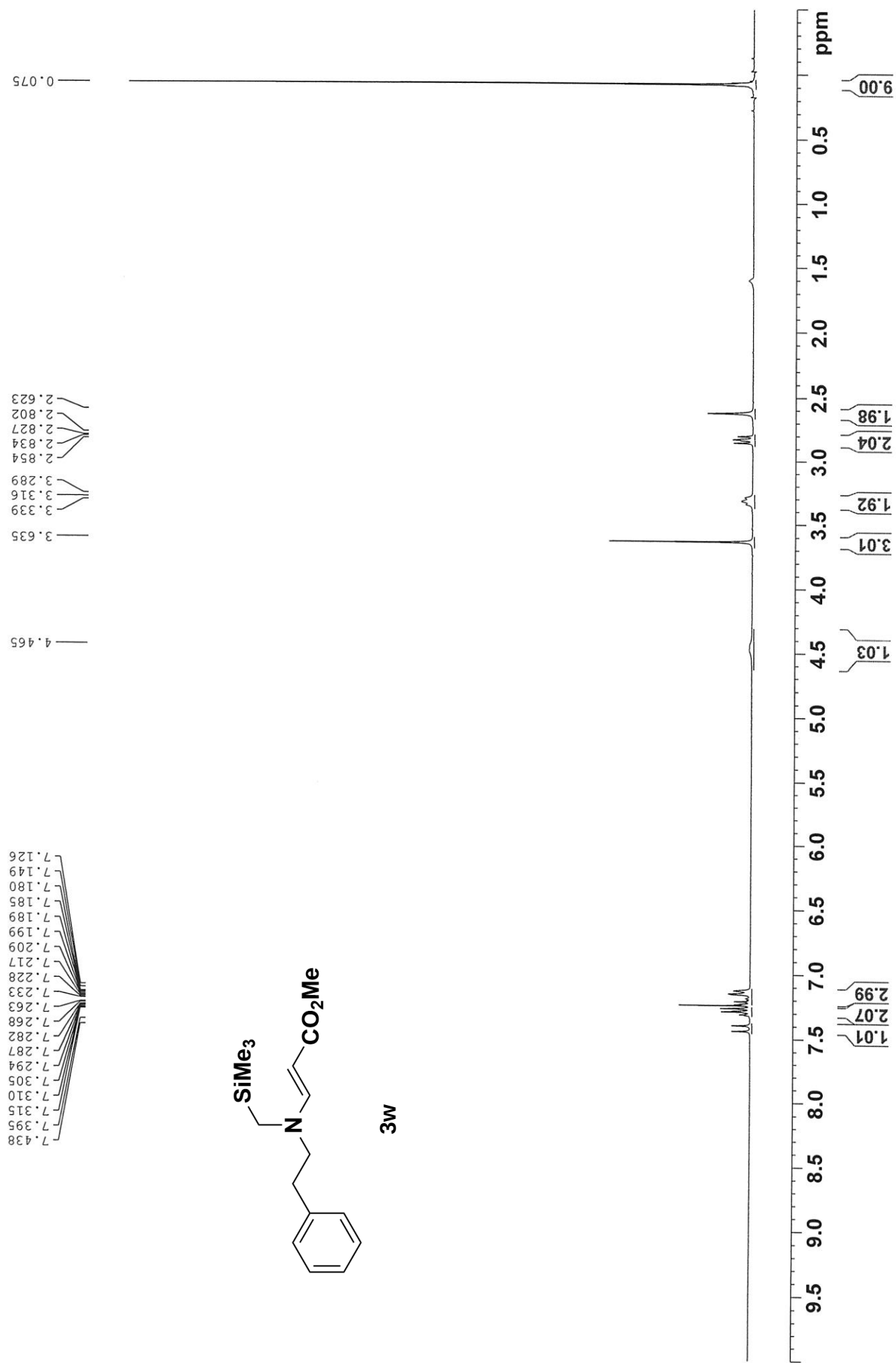
¹H NMR (CDCl₃, 300 MHz)



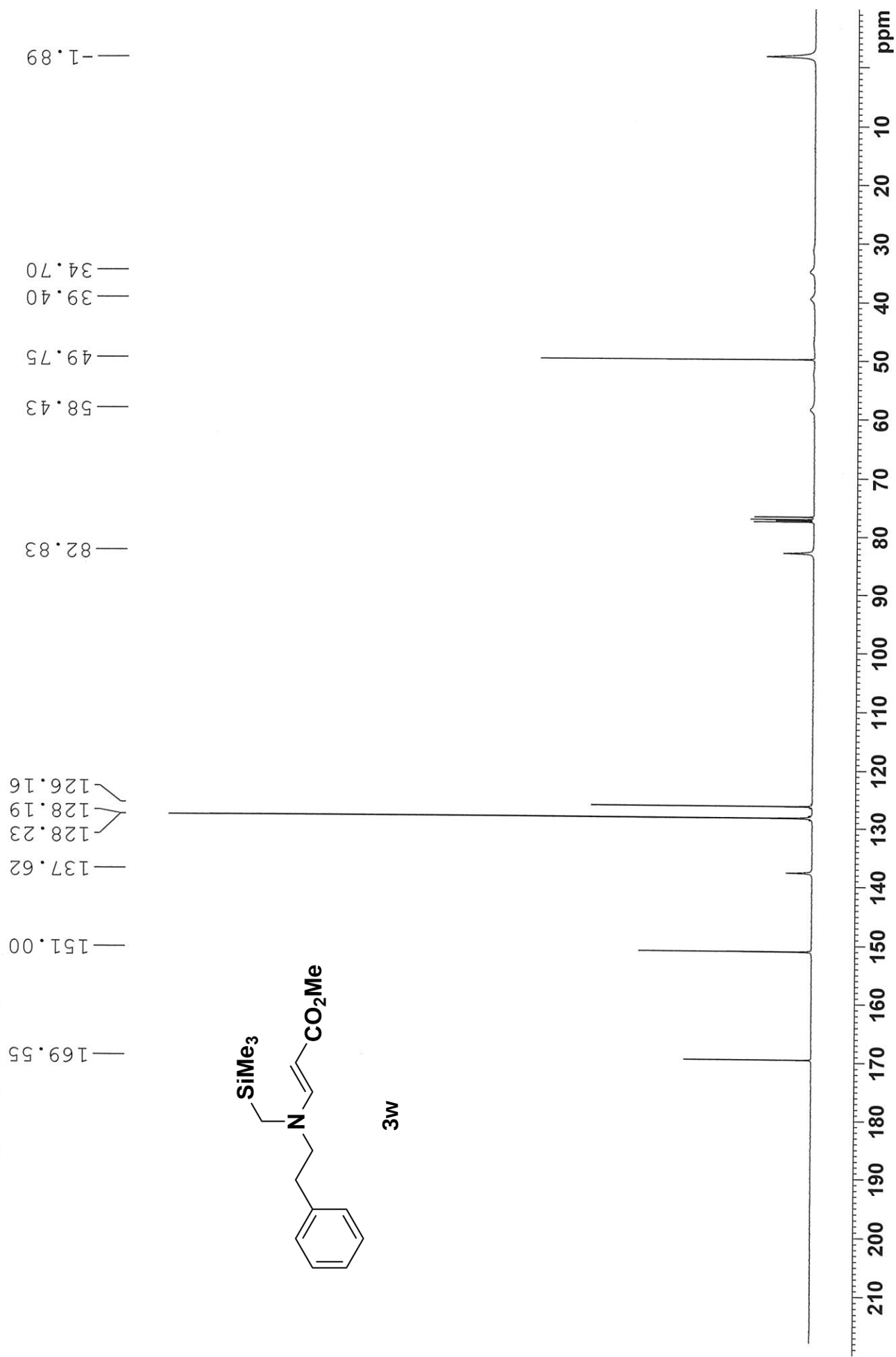
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

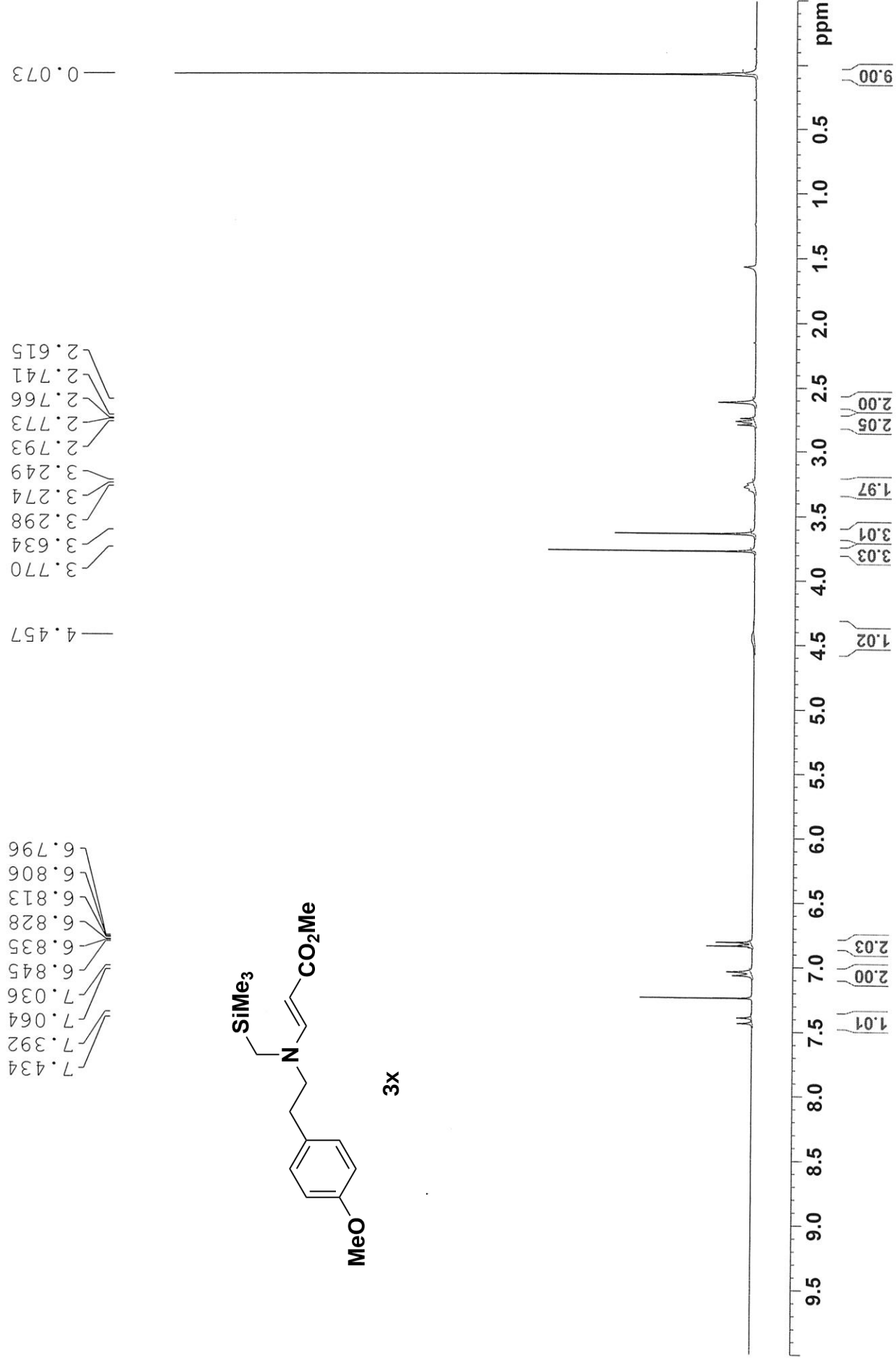


¹H NMR (CDCl₃, 300 MHz)

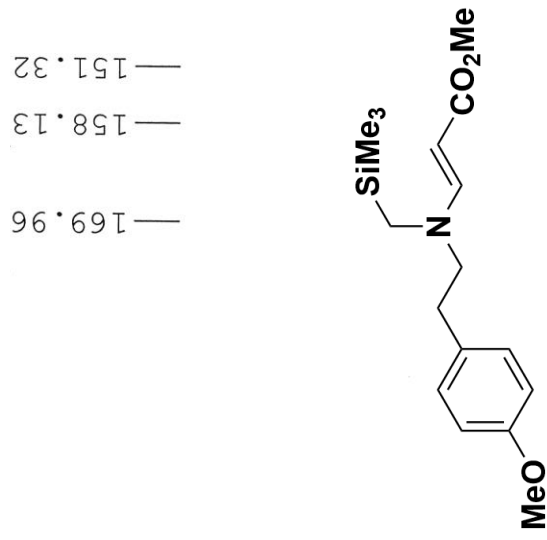


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



¹H NMR (CDCl₃, 300 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 75 MHz)



— 169.96
— 158.13
— 151.32
129.81
129.43
— 113.86

— 82.89

— 58.76
— 54.95
— 50.07
— 39.70
— 34.25

— -1.64

ppm

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

¹H NMR (CDCl₃, 300 MHz)

7.408
7.366
7.112
7.093
7.083
7.065
6.995
6.988
6.974
6.967
6.959
6.945
6.938

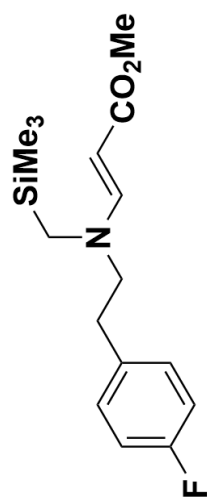
4.468
4.428

3.631

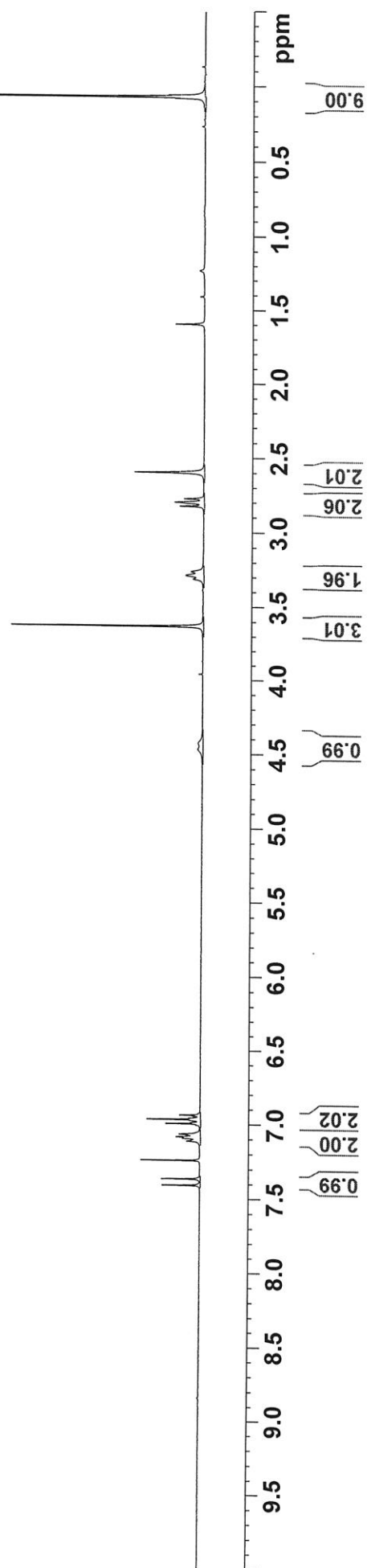
3.311
3.287
3.261

2.825
2.798
2.774
2.597

0.072



3y



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

— 170.08
— 162.42
— 160.80
— 151.39

— 133.66
— 130.10
— 130.04
— 115.50
— 115.36

— 83.31

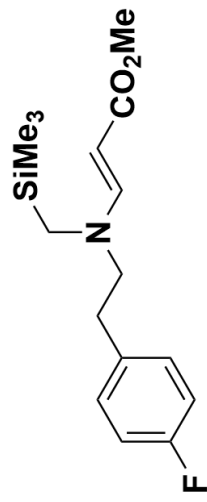
— 58.75

— 50.30

— 39.84

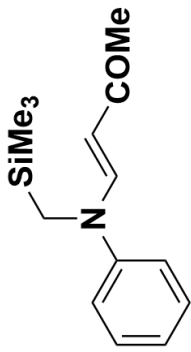
— 34.40

— -1.42

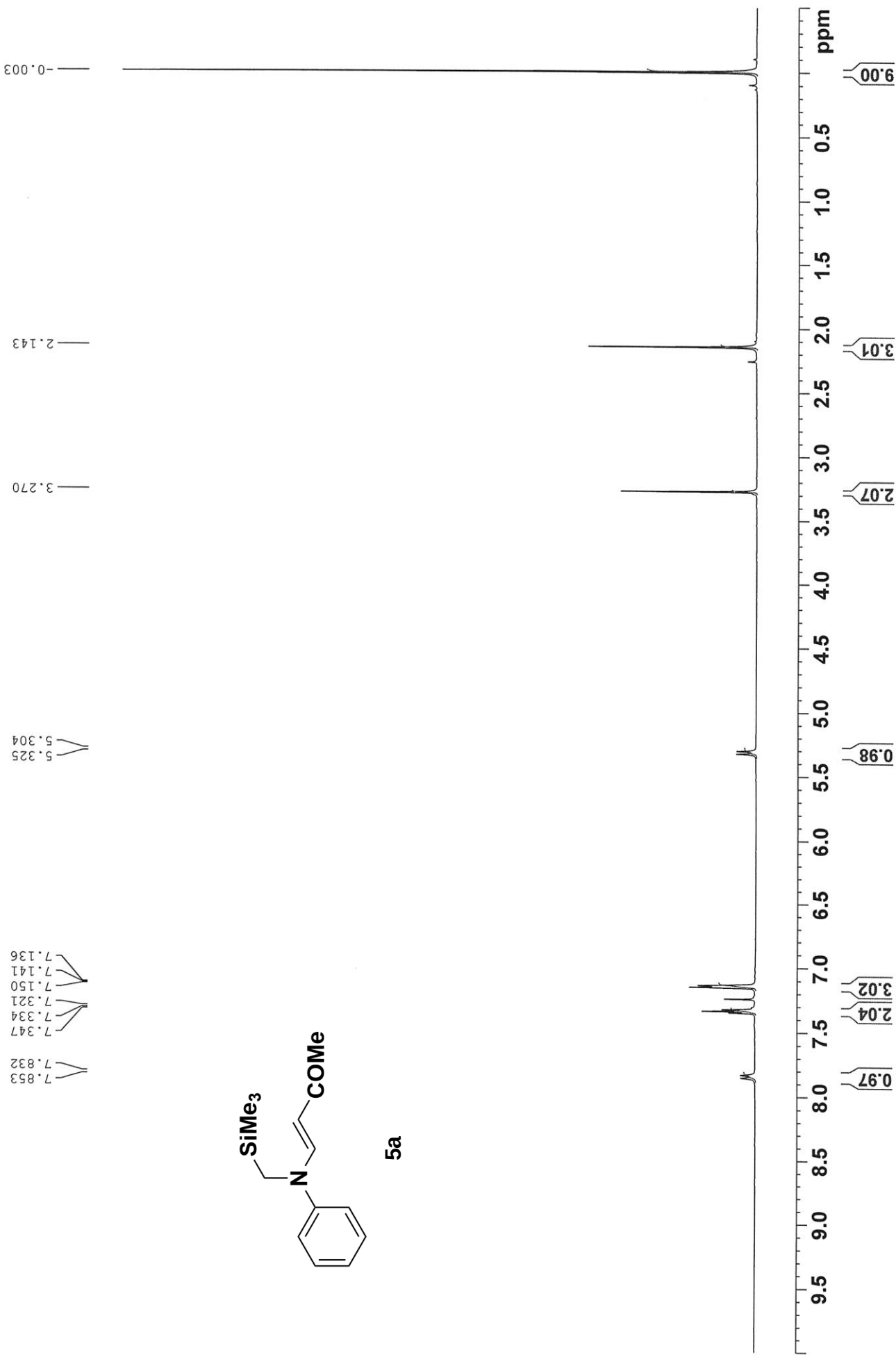


3y

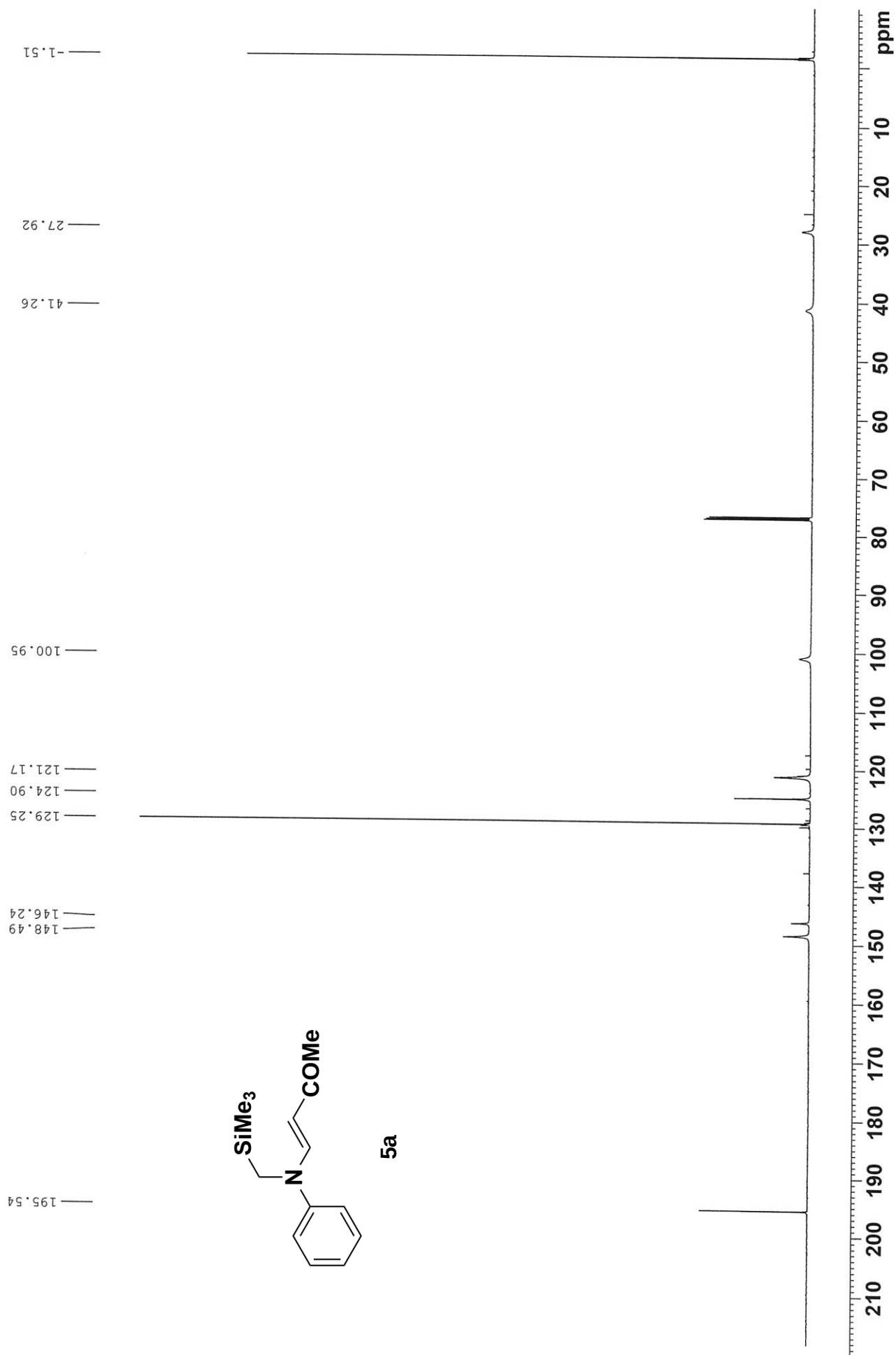


^1H NMR (CDCl_3 , 600 MHz)

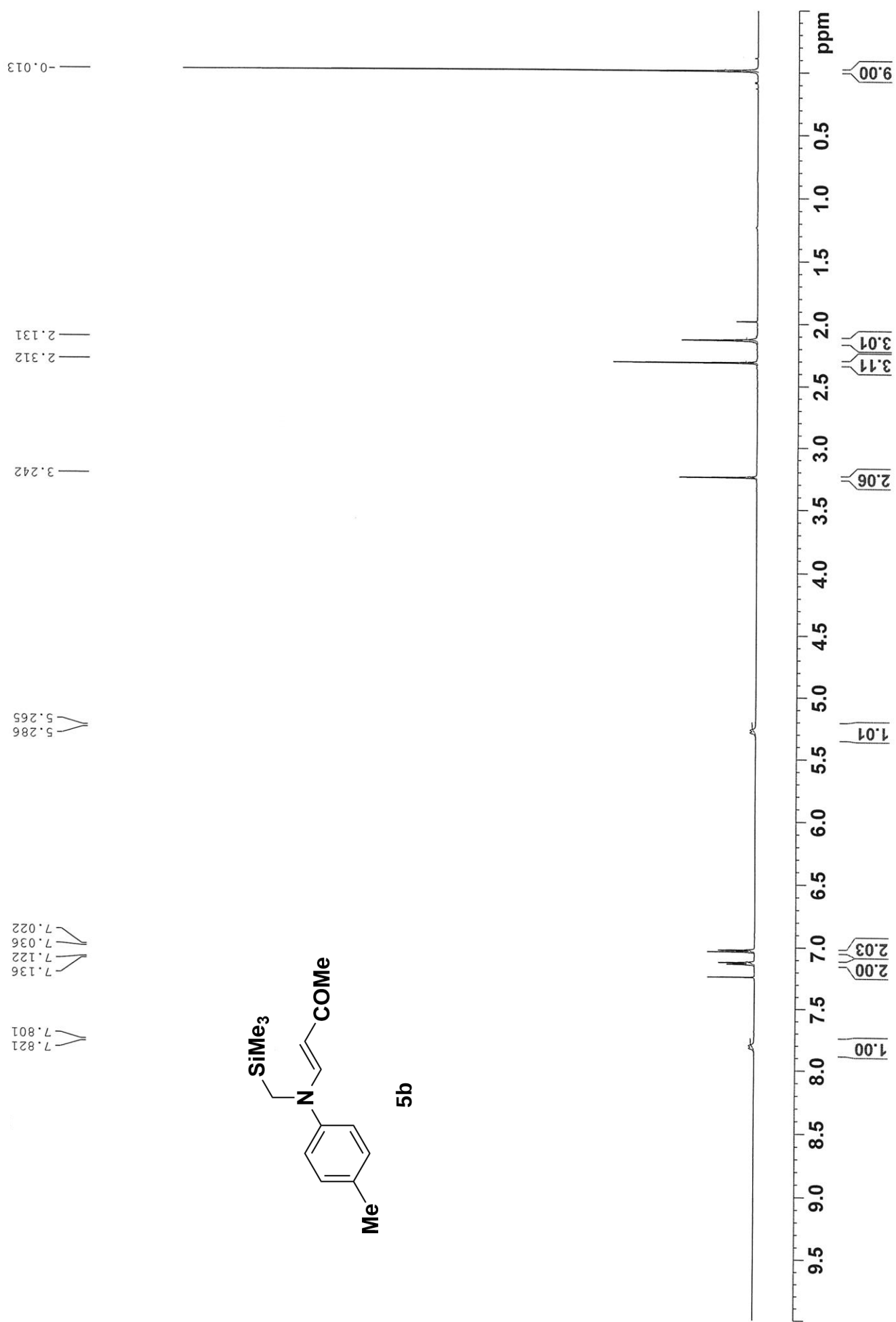
5a



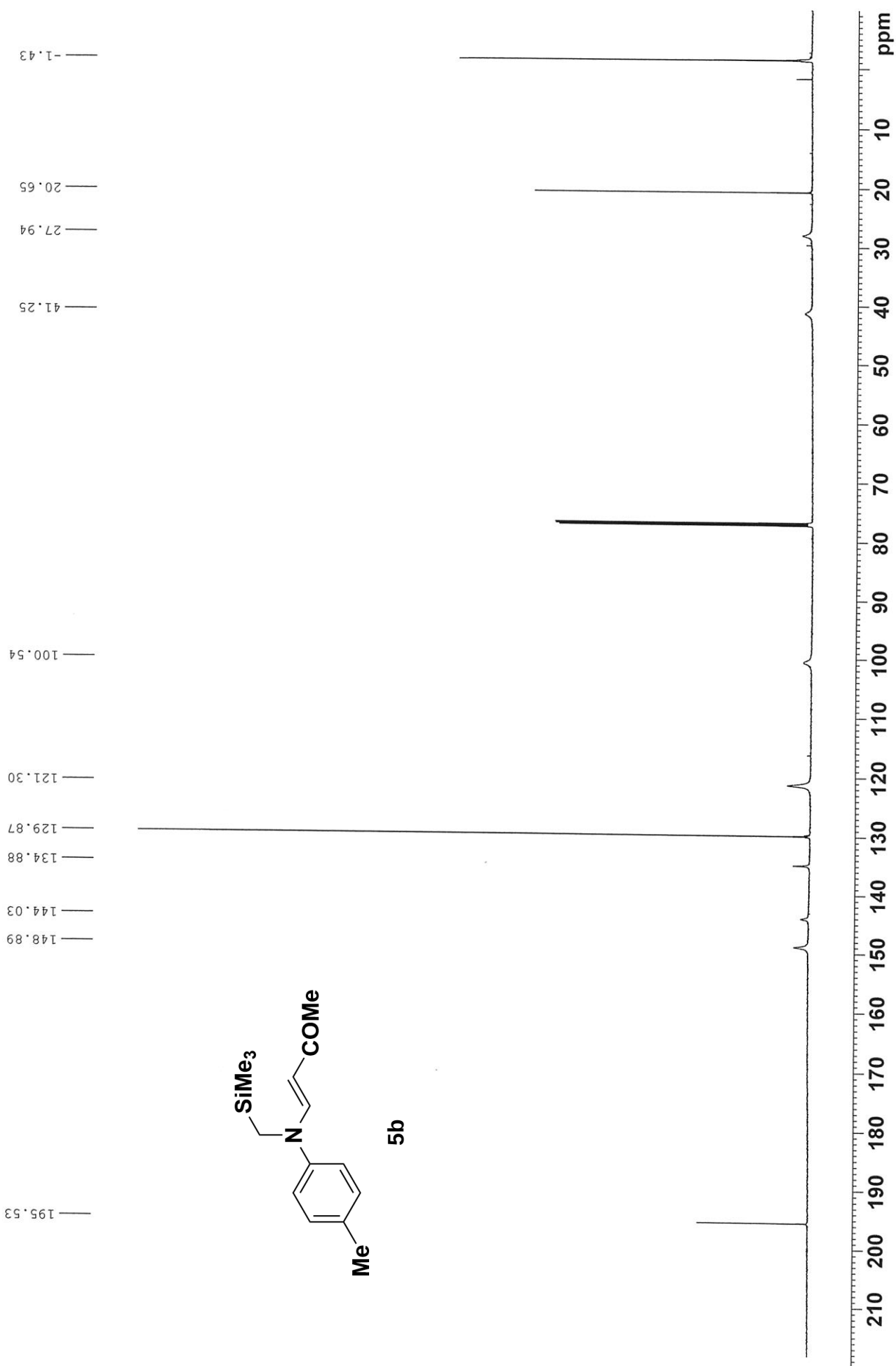
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



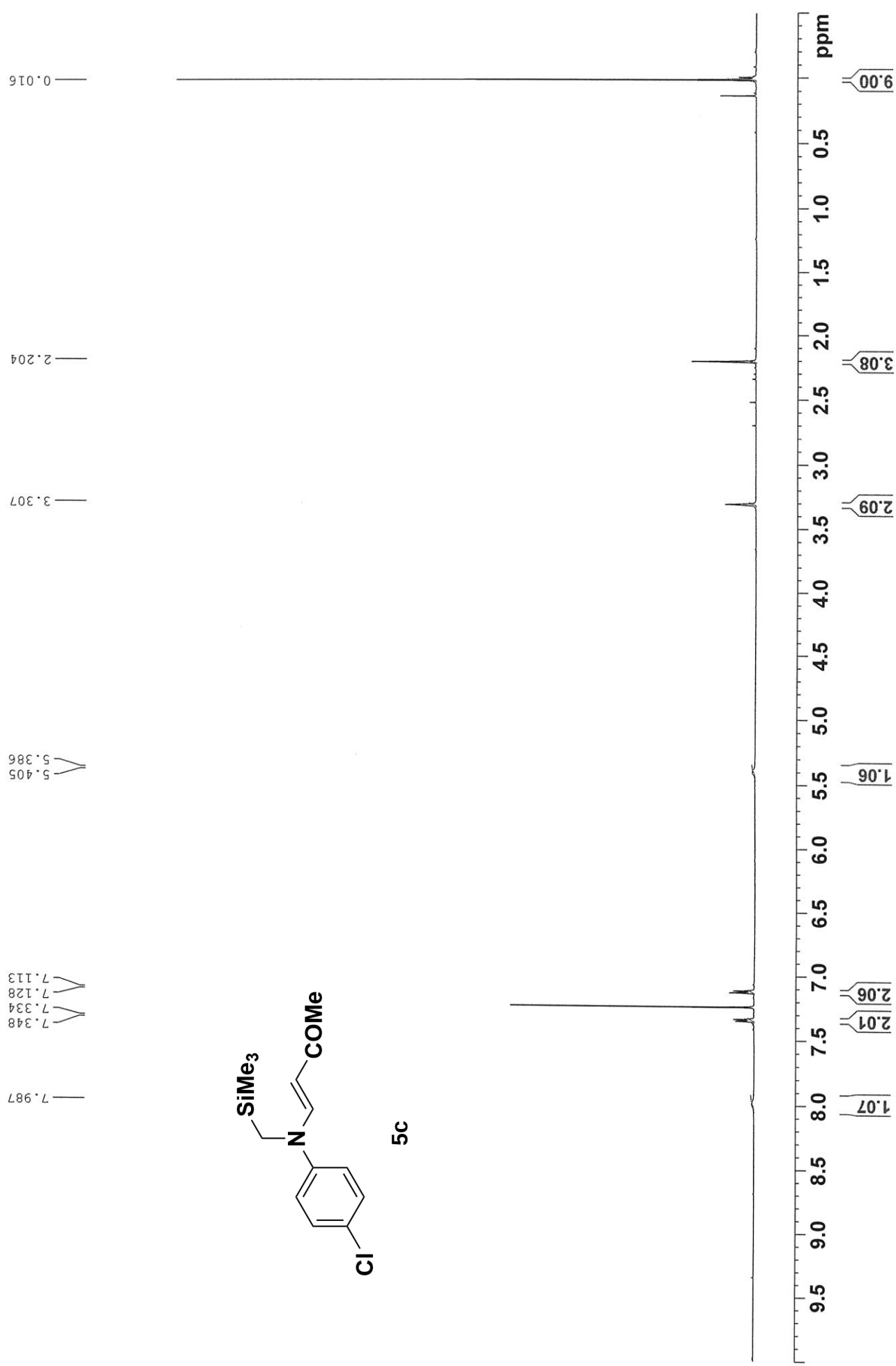
^1H NMR (CDCl_3 , 600 MHz)



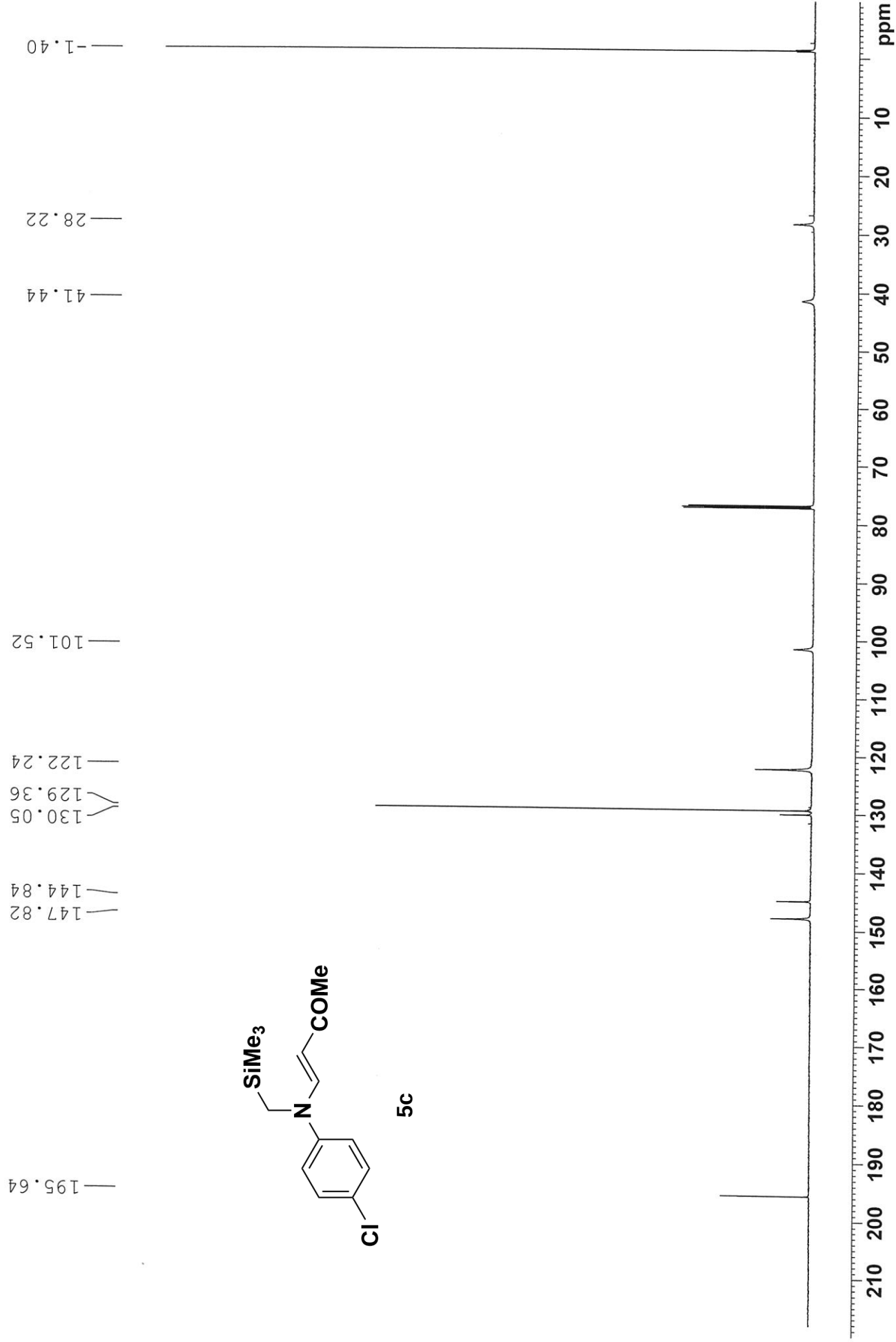
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



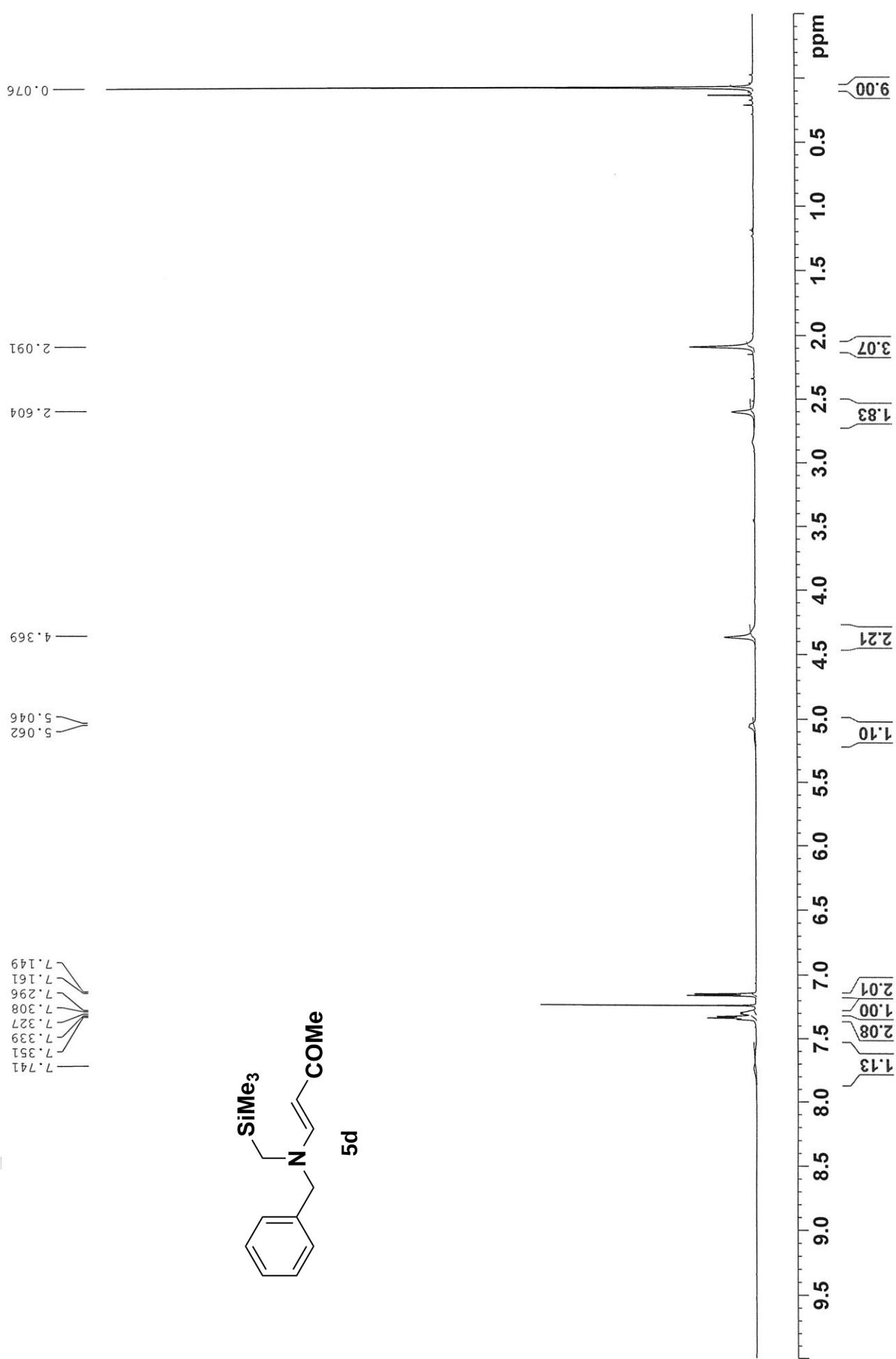
¹H NMR (CDCl₃, 600 MHz)



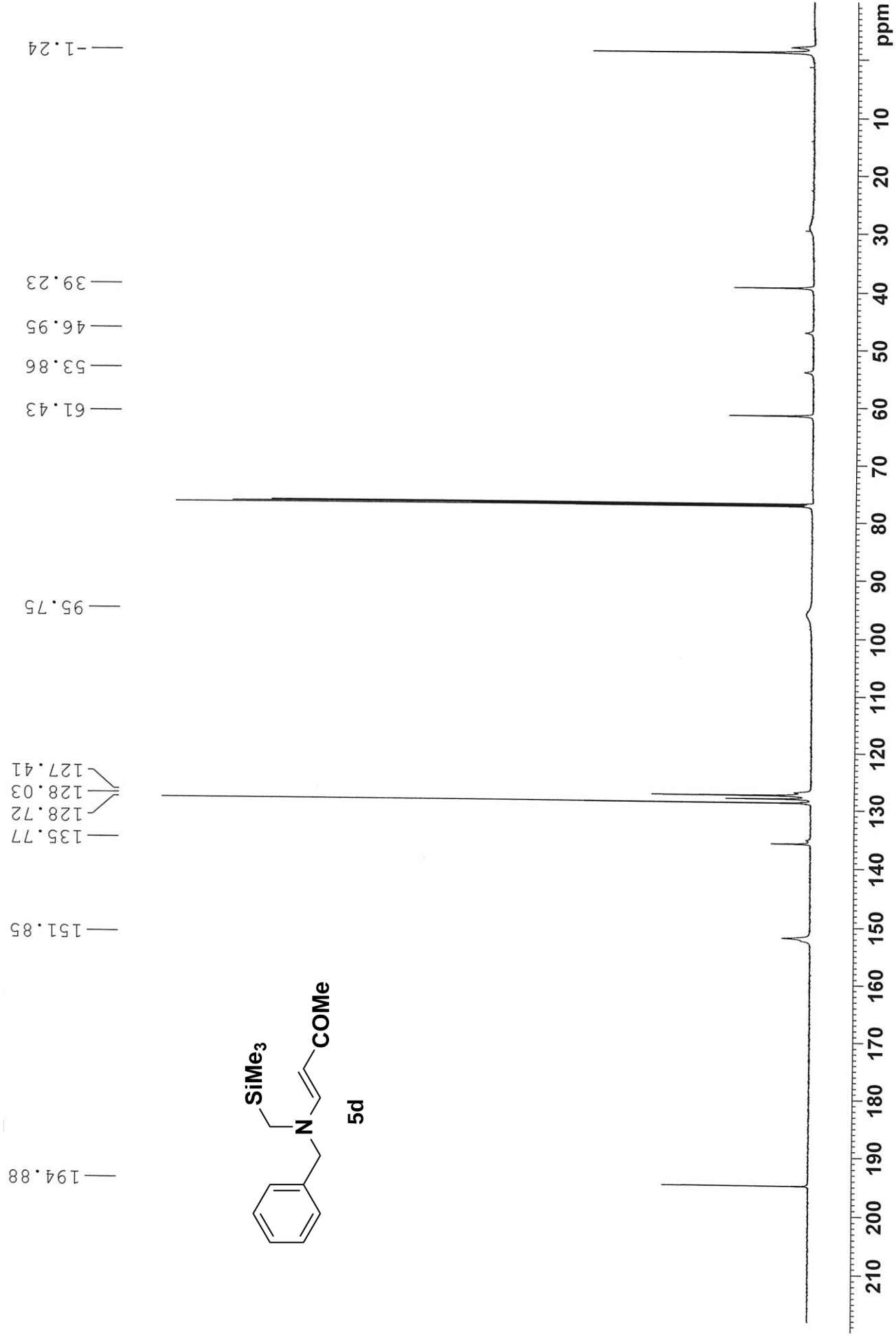
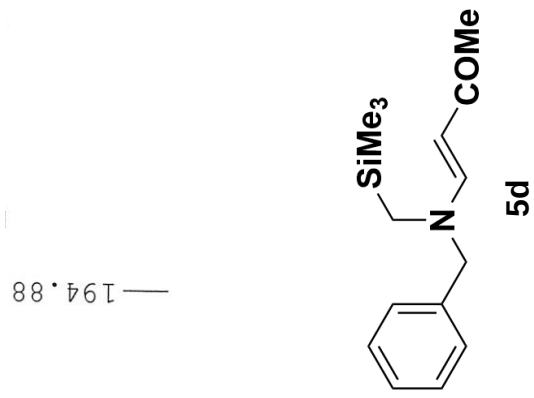
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



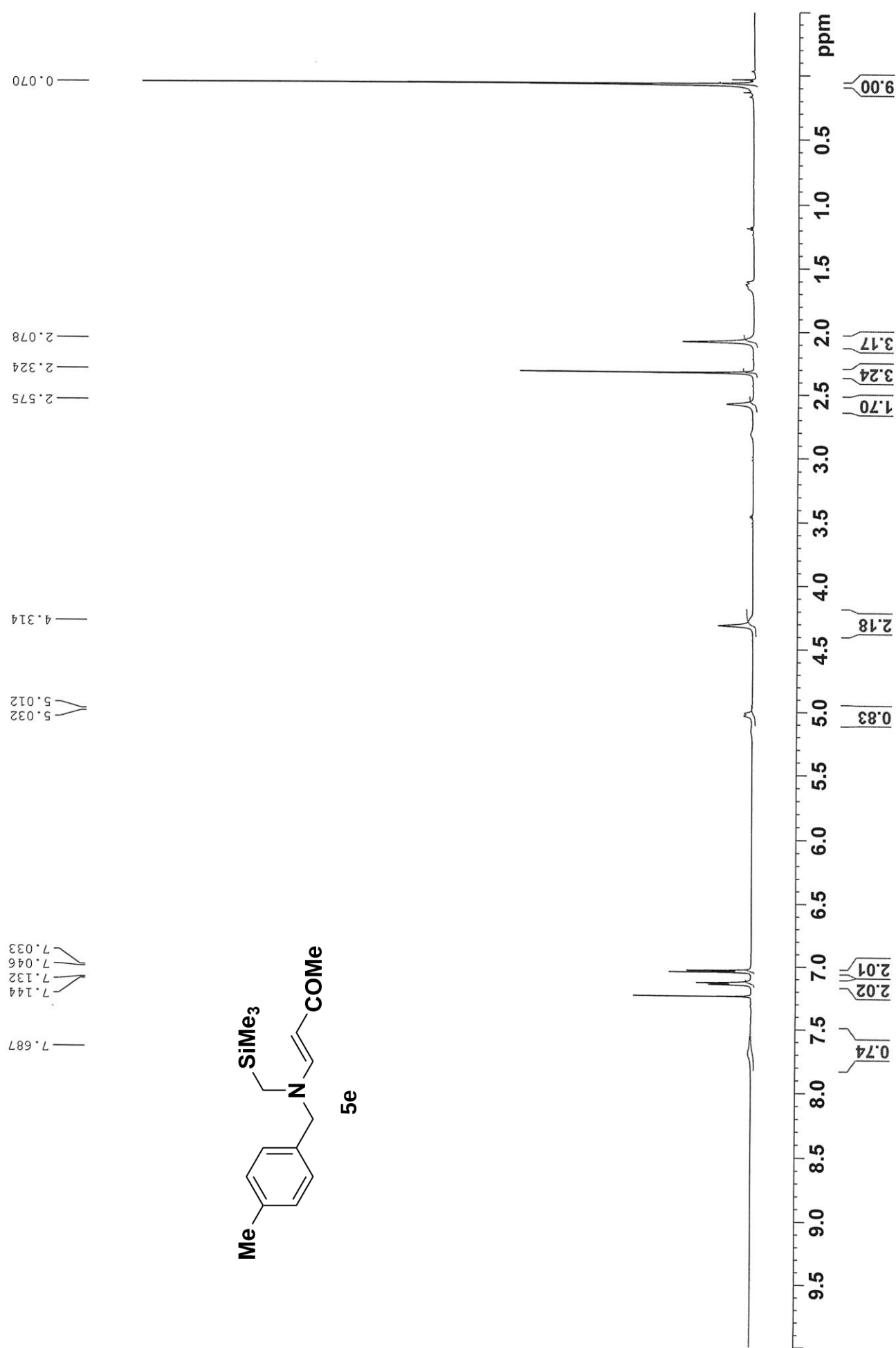
¹H NMR (CDCl₃, 600 MHz)



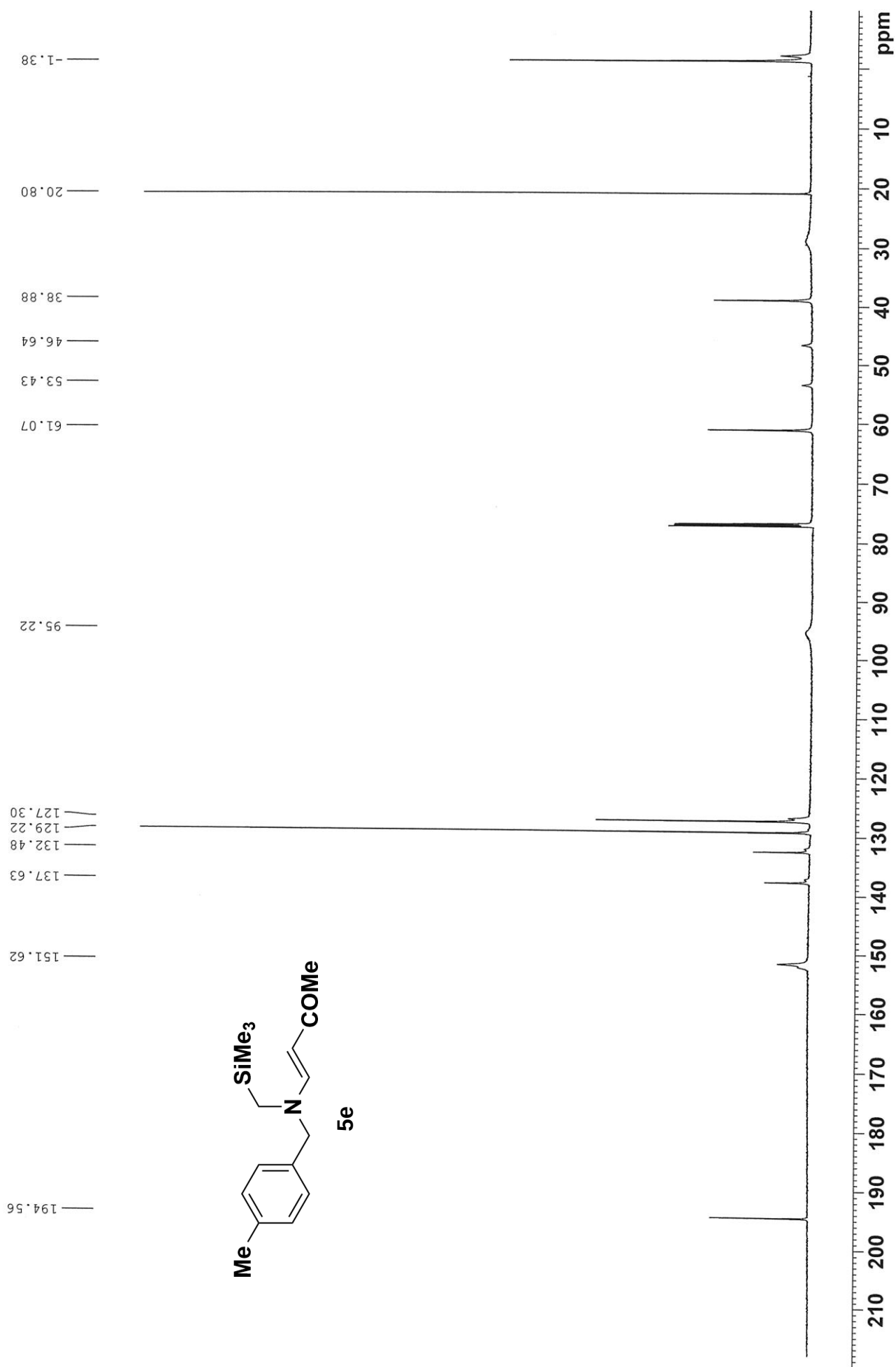
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



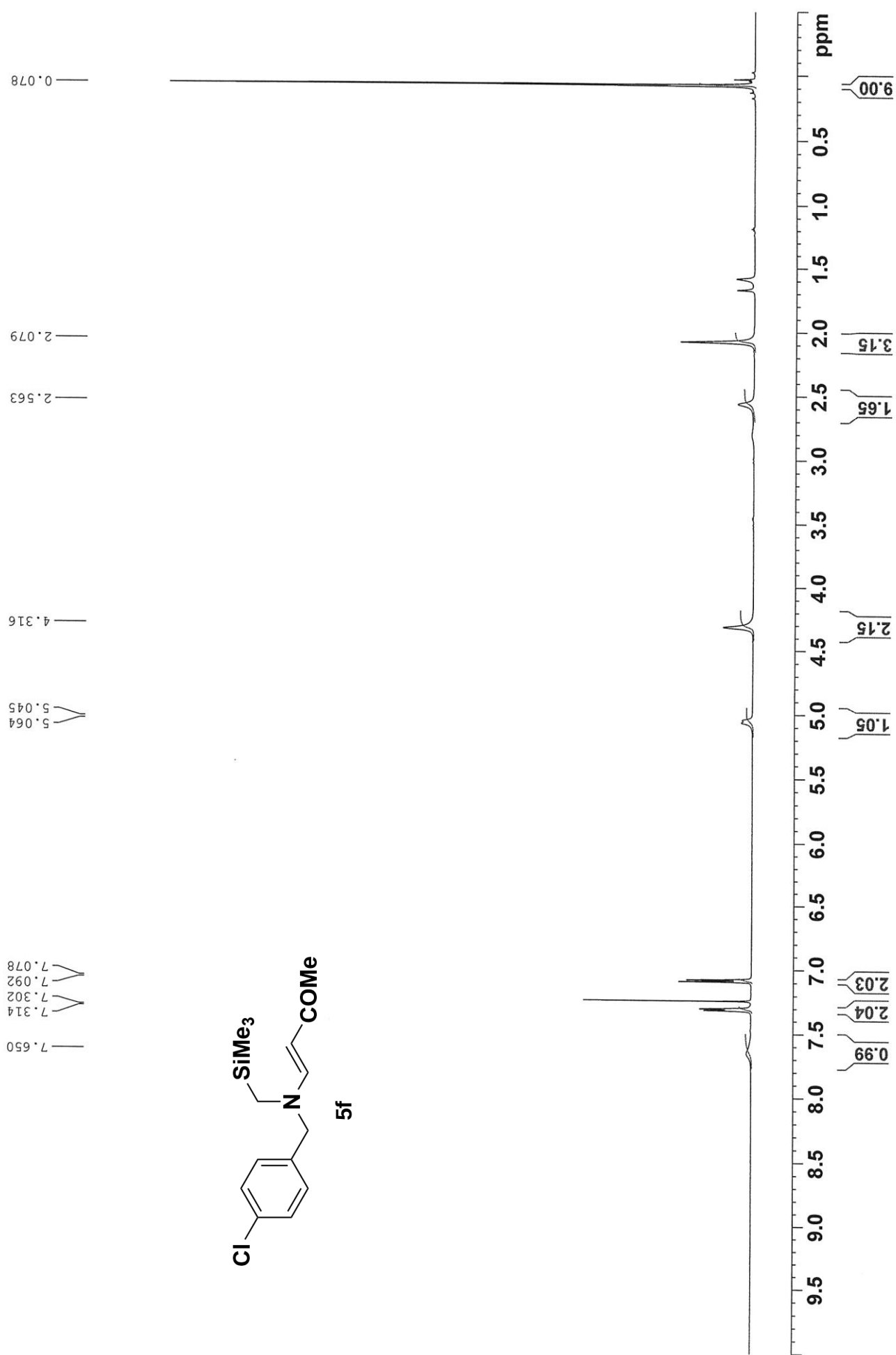
¹H NMR (CDCl₃, 600 MHz)



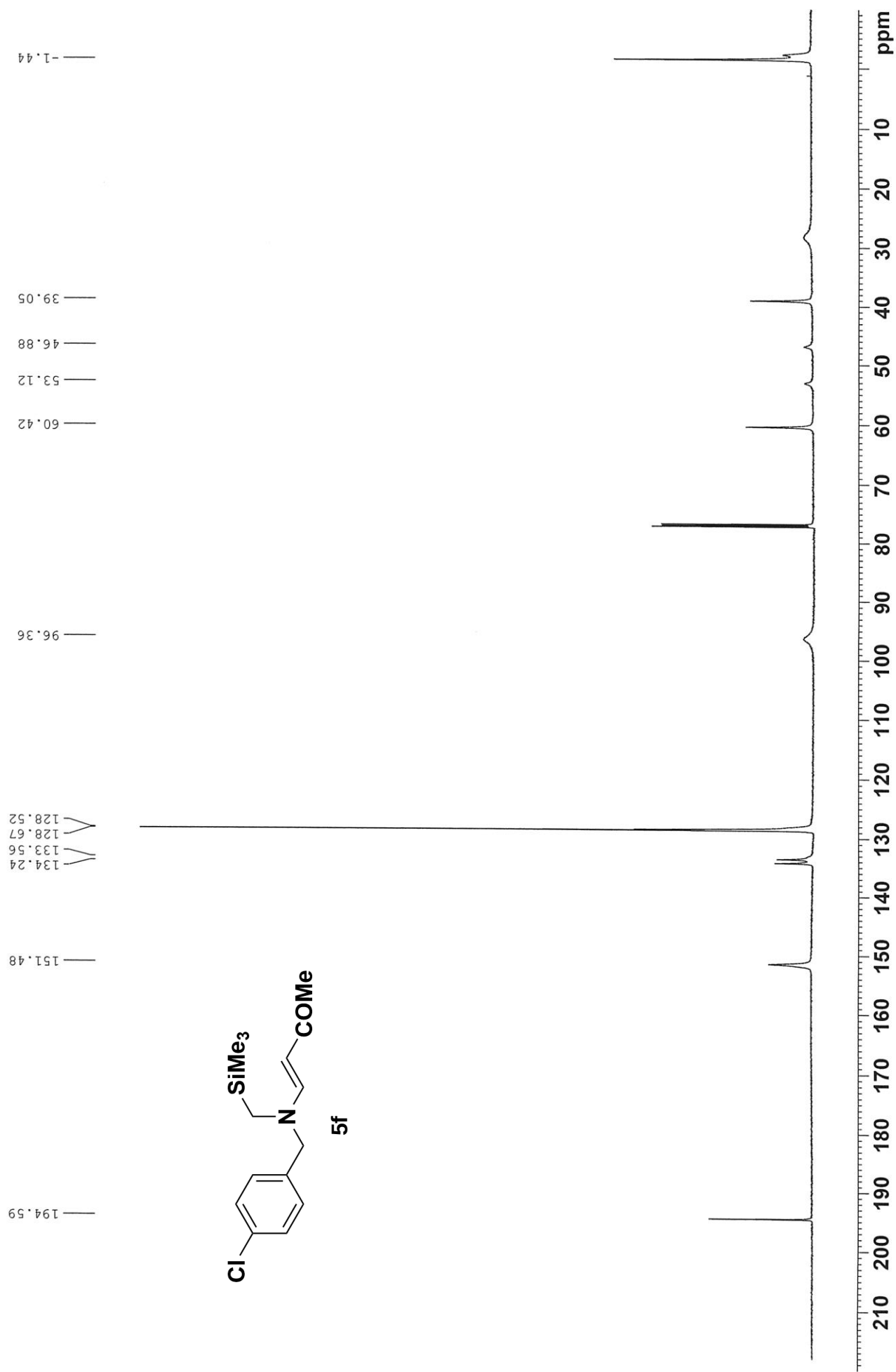
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



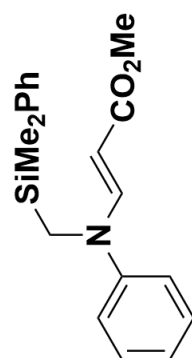
^1H NMR (CDCl_3 , 600 MHz)

7.859, 7.837, 7.413, 7.410, 7.408, 7.403, 7.400, 7.397, 7.364, 7.361, 7.359, 7.354, 7.349, 7.345, 7.340, 7.337, 7.335, 7.321, 7.311, 7.309, 7.300, 7.298, 7.295, 7.260, 7.257, 7.247, 7.246, 7.233, 7.076, 7.074, 7.063, 7.051, 7.049, 7.035, 7.033, 7.021, 7.019

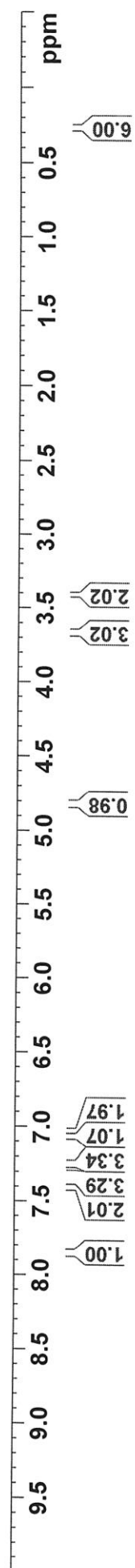
4.828, 4.806

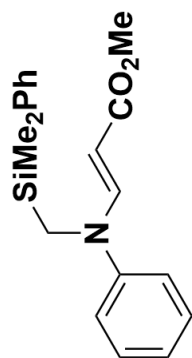
3.666, 3.408

0.268

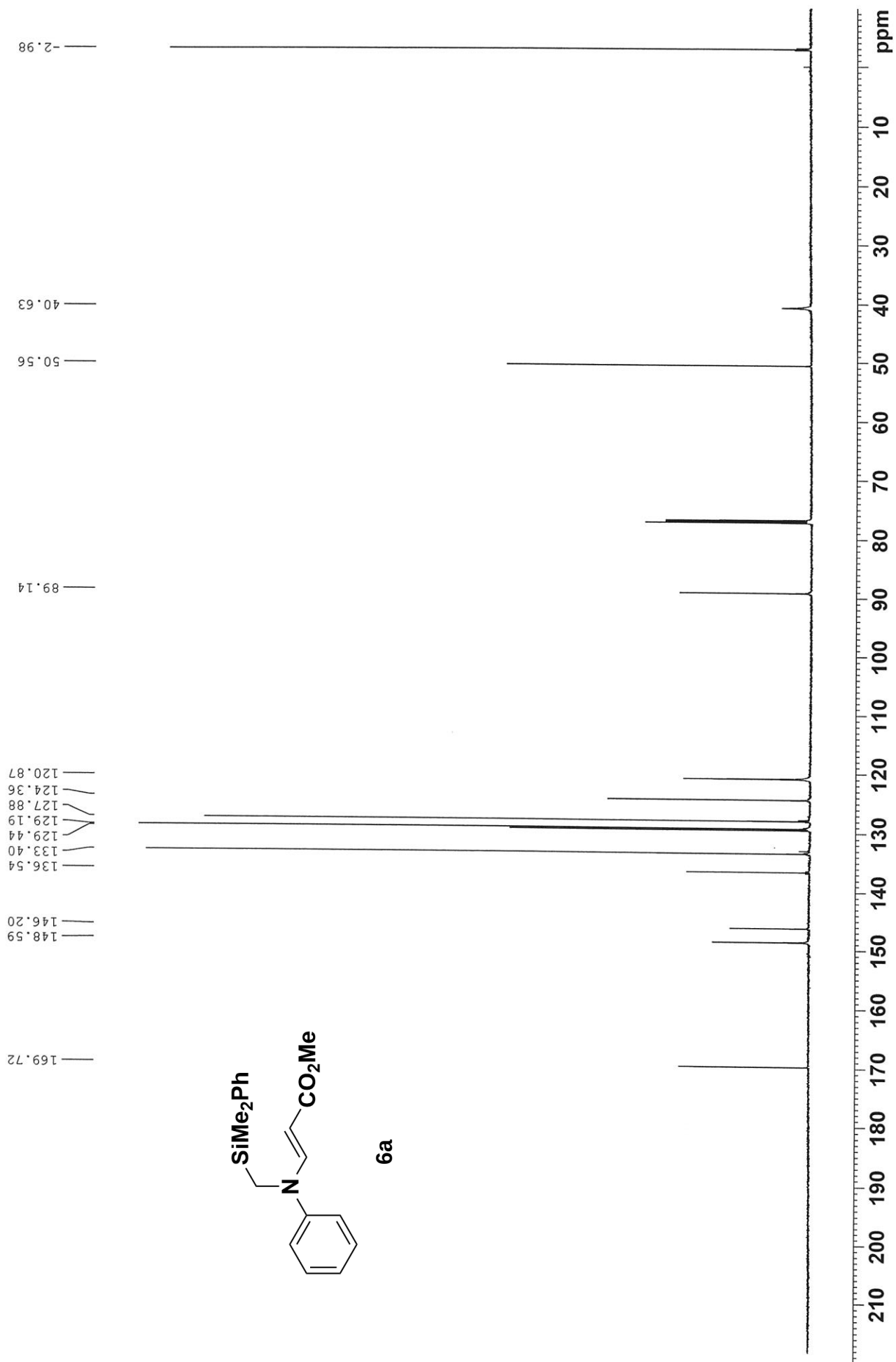


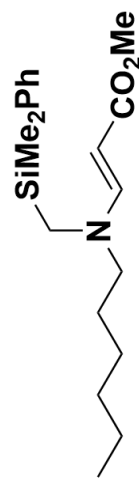
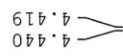
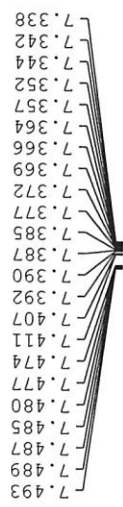
6a



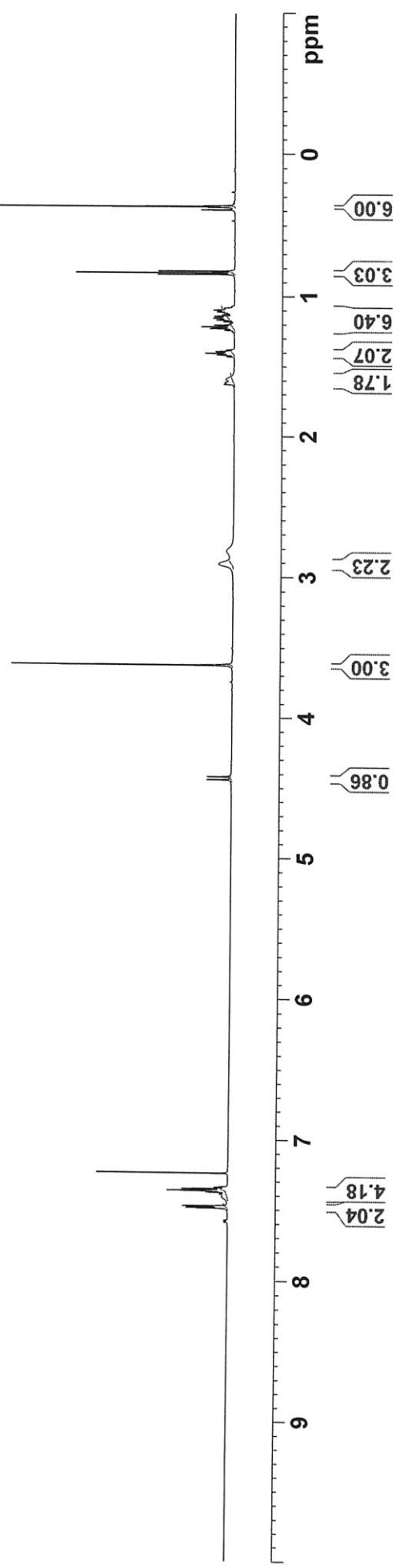
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

6a

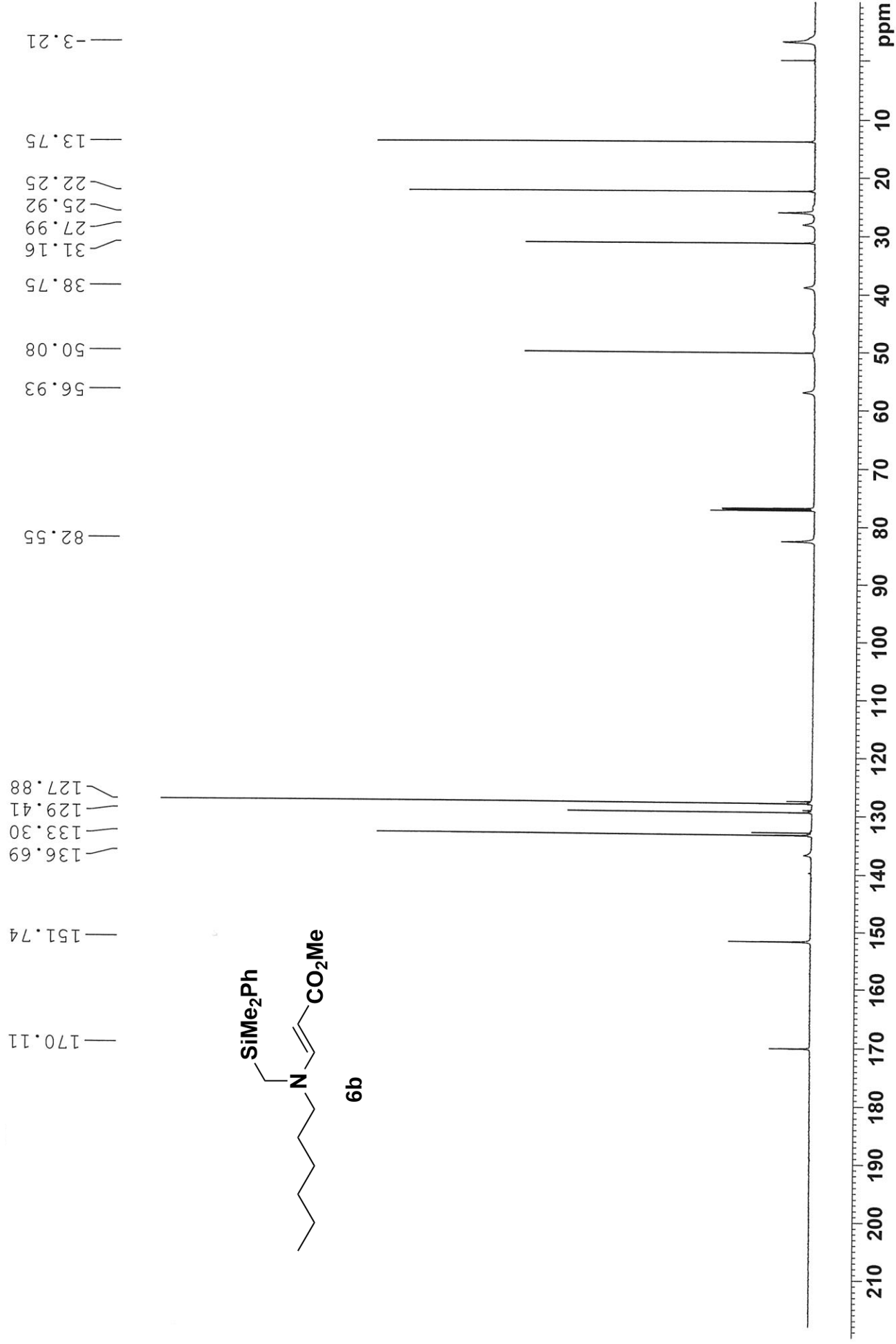


¹H NMR (CDCl₃, 600 MHz)

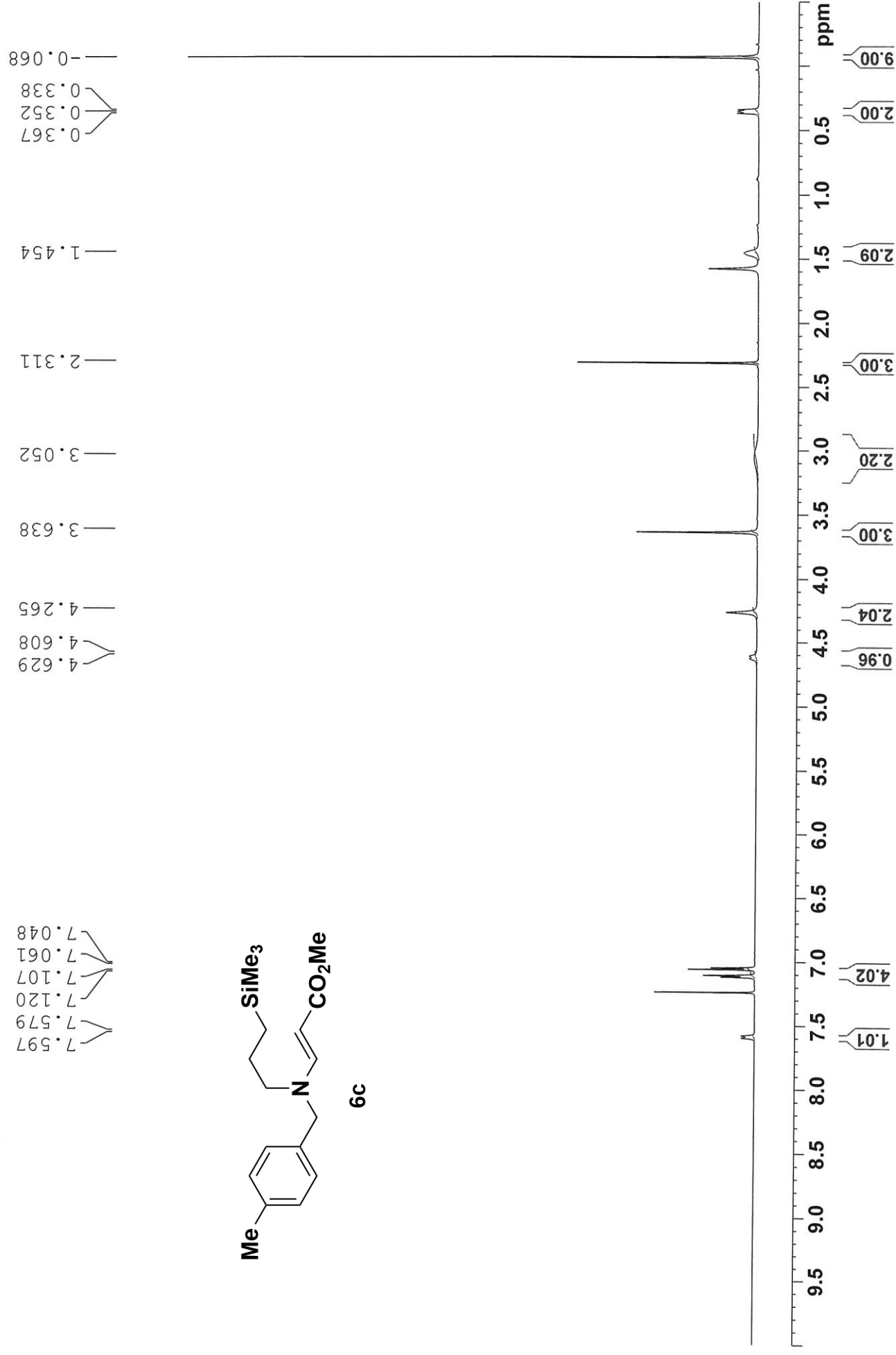
6b



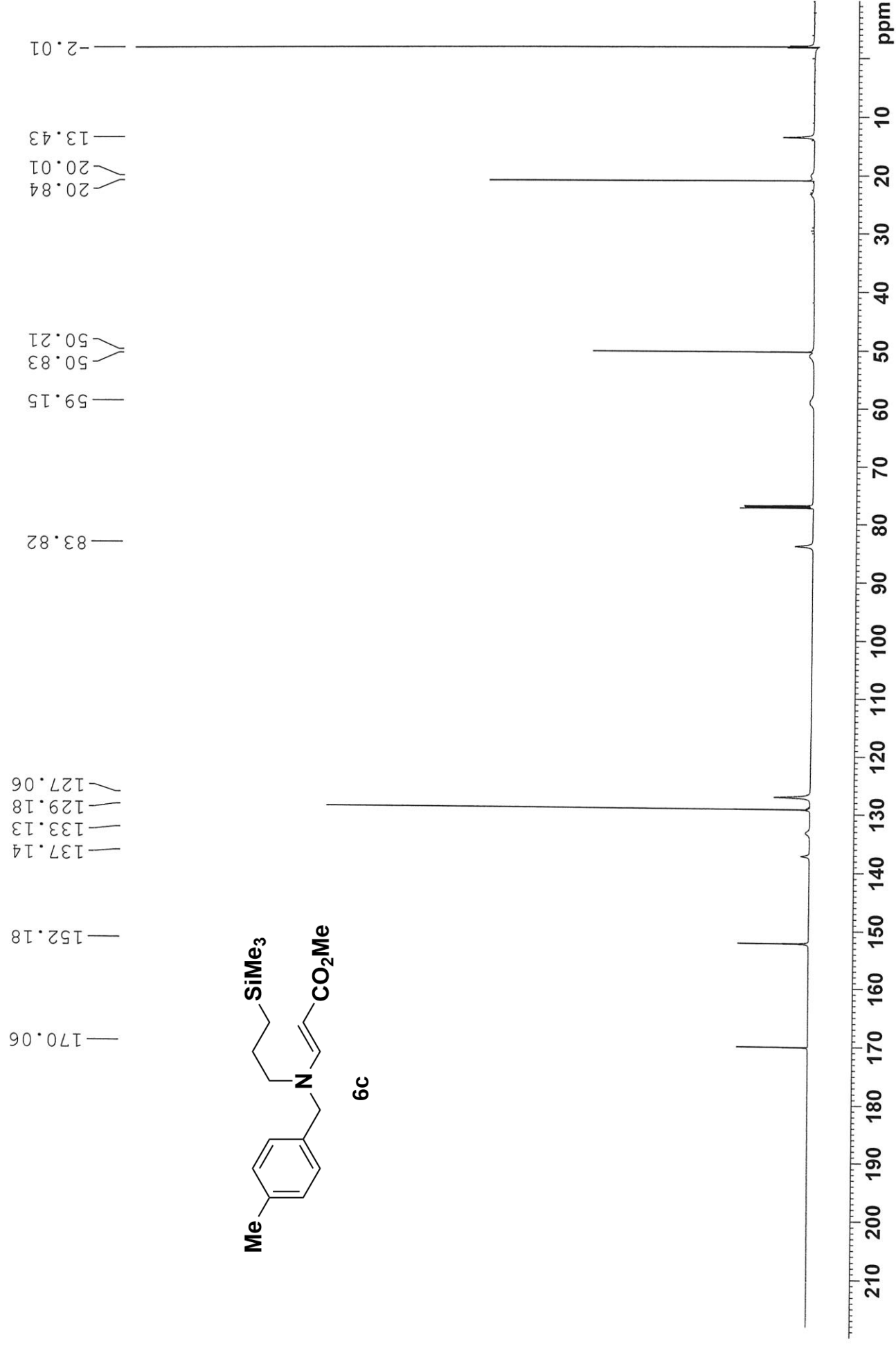
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



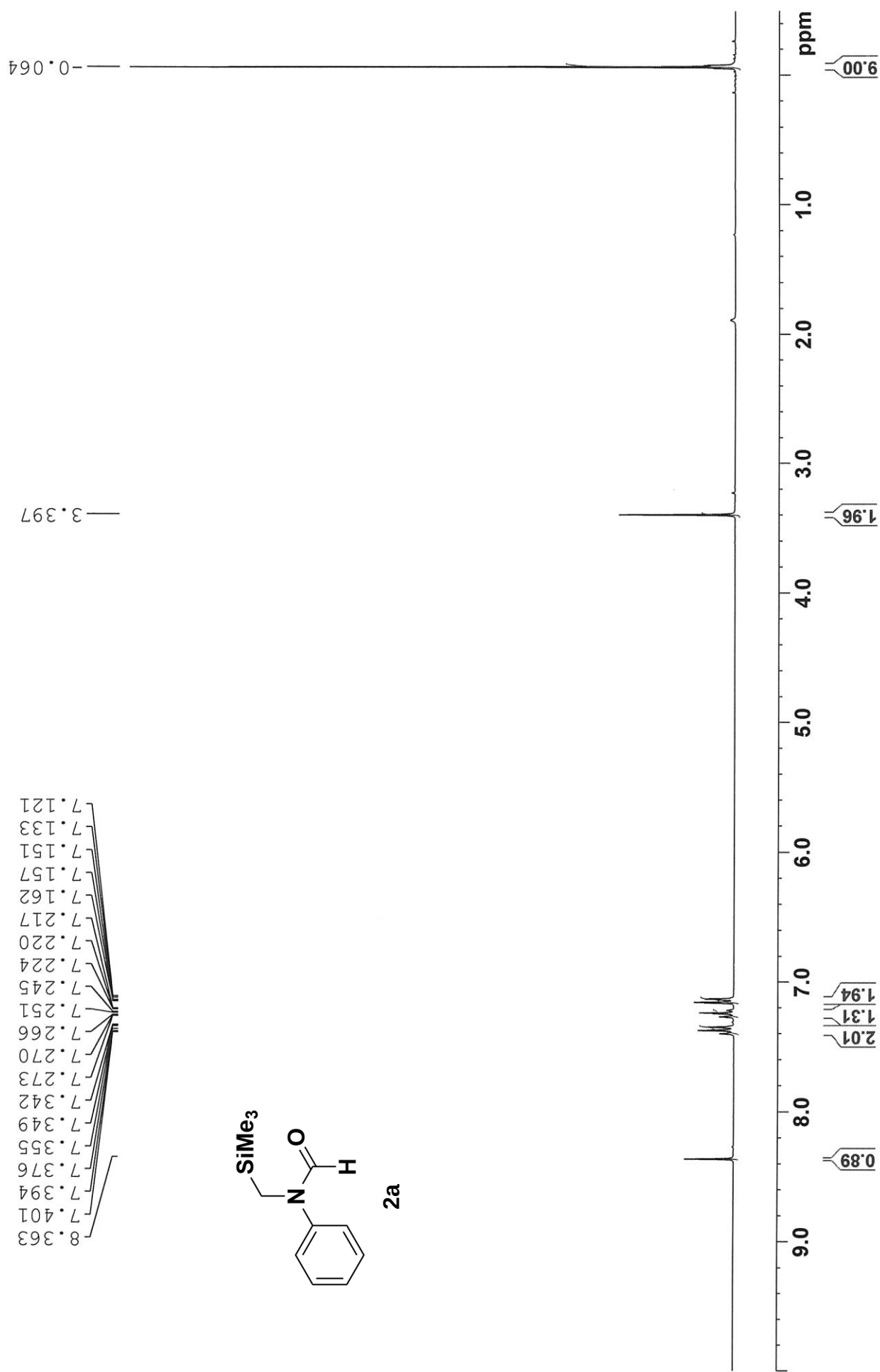
^1H NMR (CDCl_3 , 600 MHz)



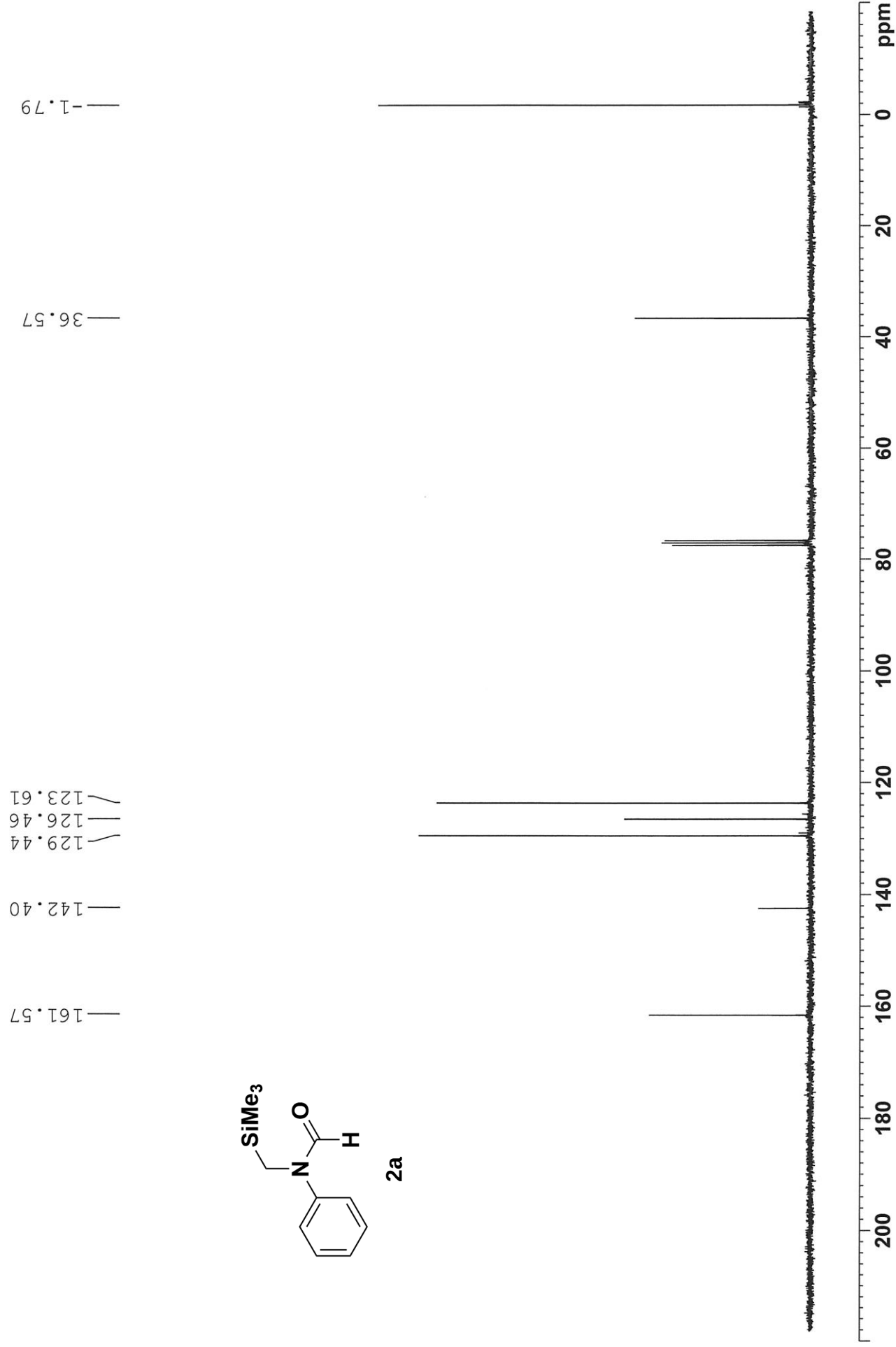
^{13}C { ^1H } NMR (CDCl_3 , 150 MHz)



^1H NMR (CDCl_3 , 300 MHz)



^{13}C { ^1H } NMR (CDCl₃, 75 MHz)



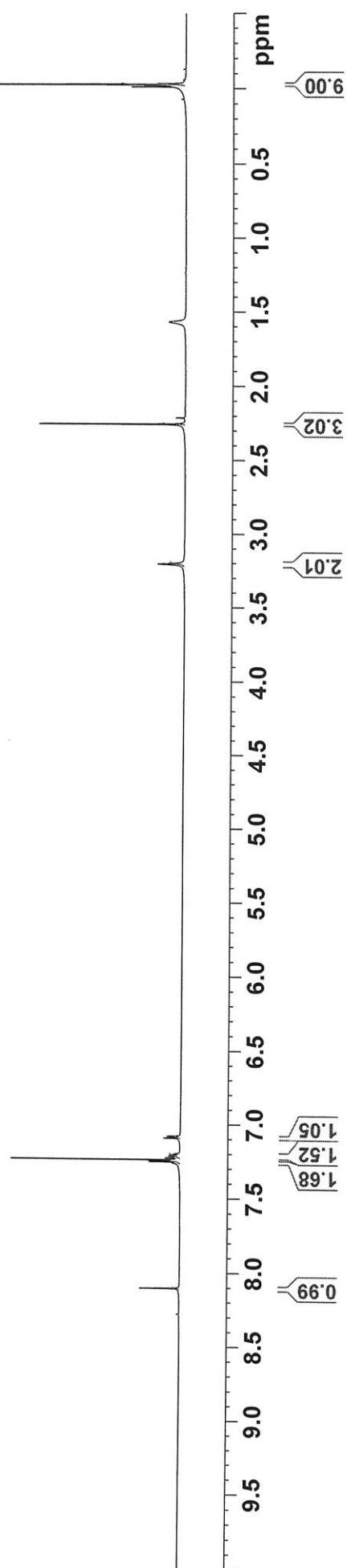
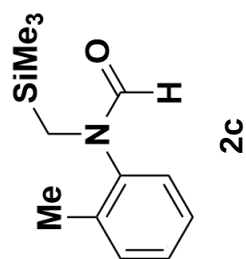
¹H NMR (CDCl₃, 600 MHz)

8.105
7.273
7.266
7.262
7.253
7.250
7.250
7.246
7.230
7.227
7.222
7.221
7.214
7.213
7.210
7.209
7.202
7.198
7.194
7.094
7.082
7.079

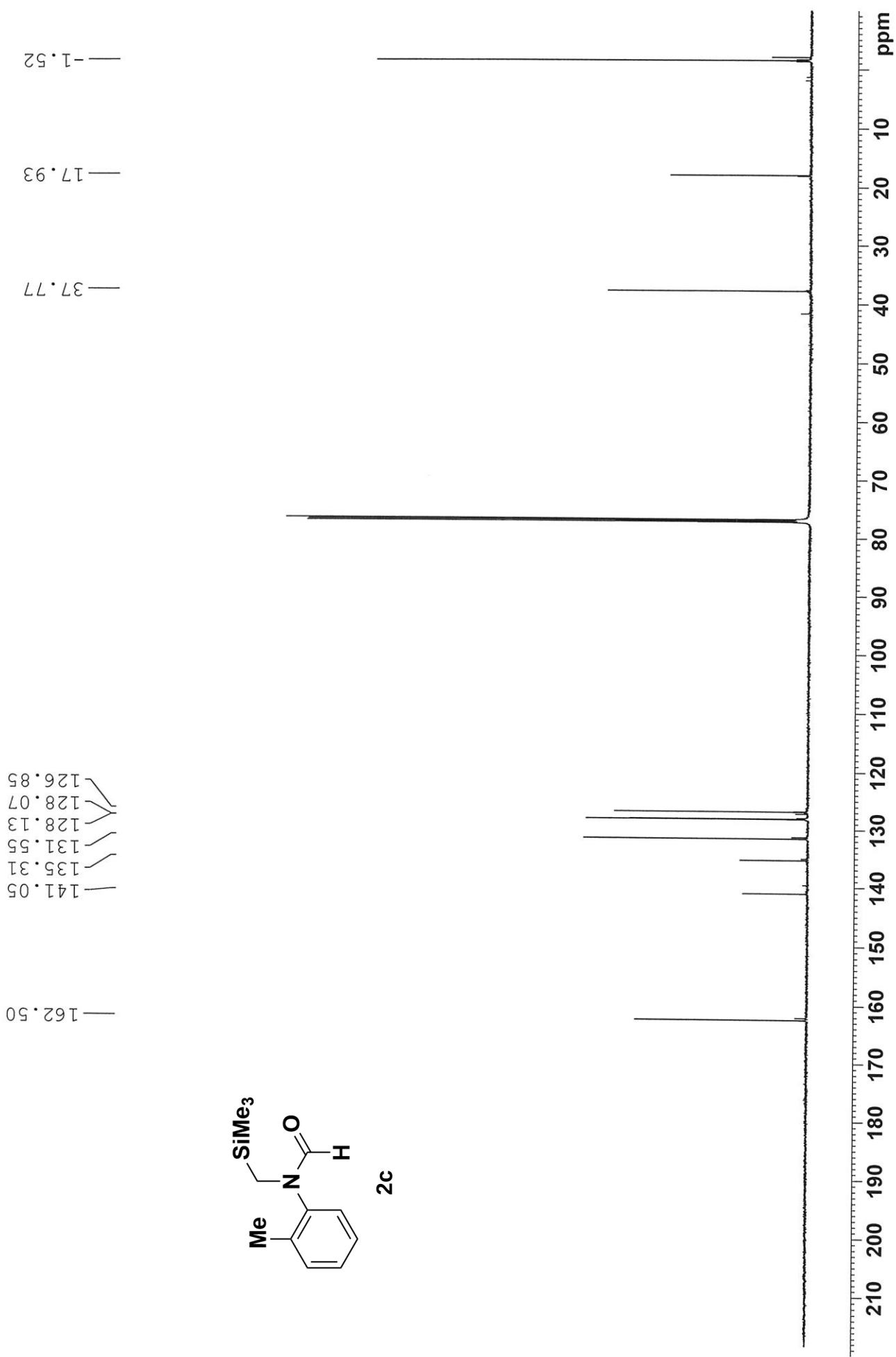
3.206

2.256

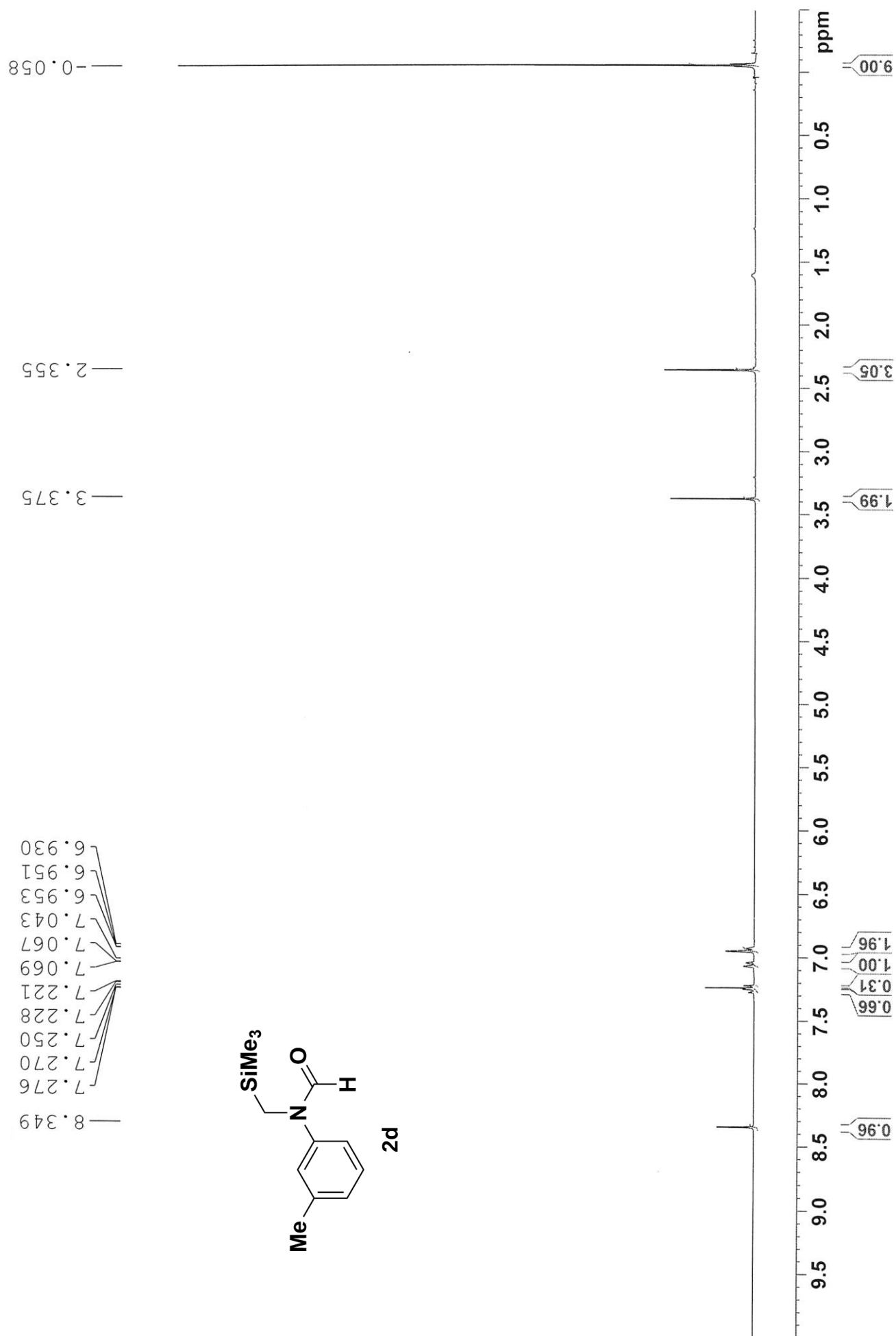
-0.028



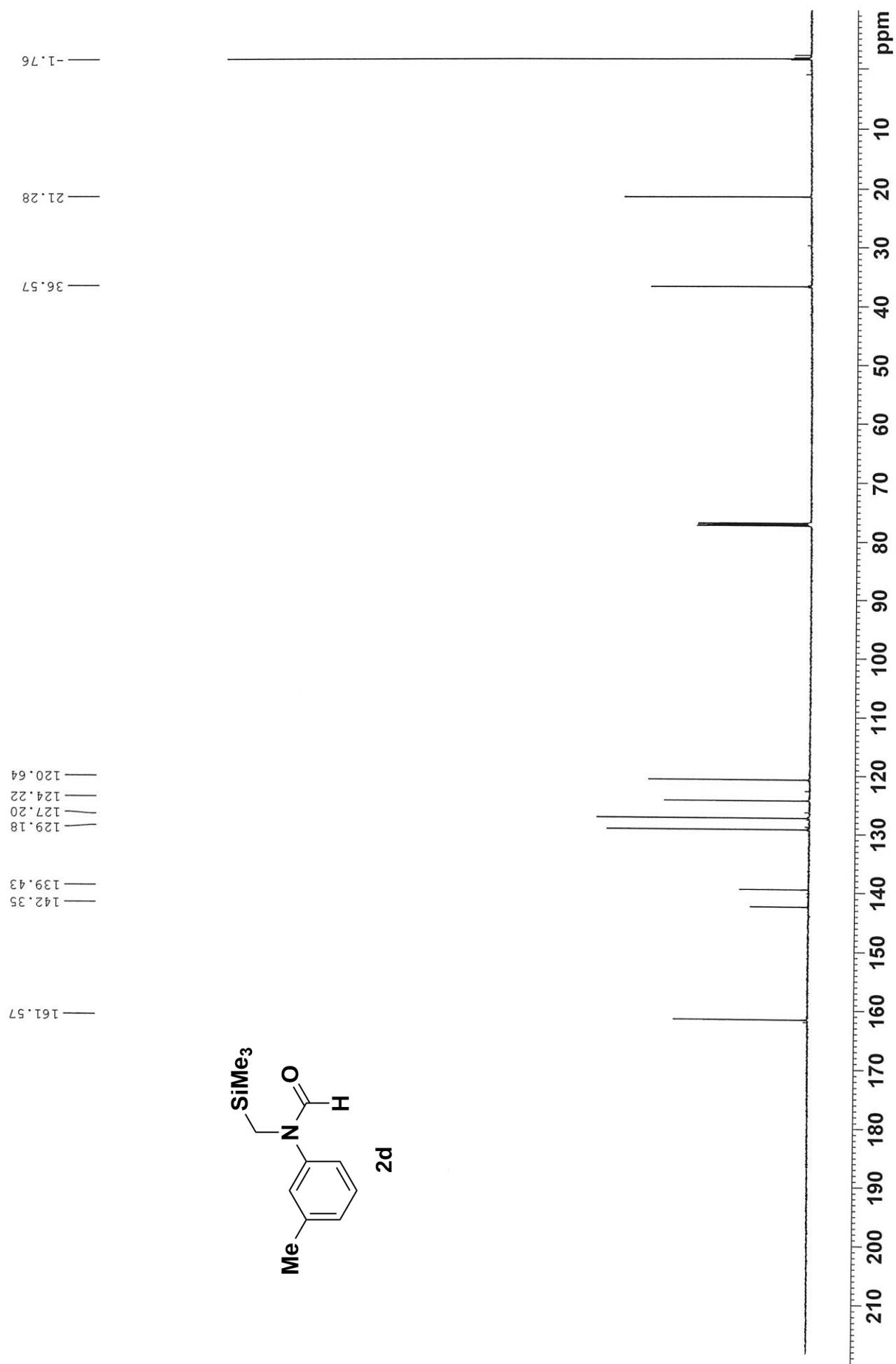
^{13}C { ^1H } NMR (CDCl₃, 150 MHz)



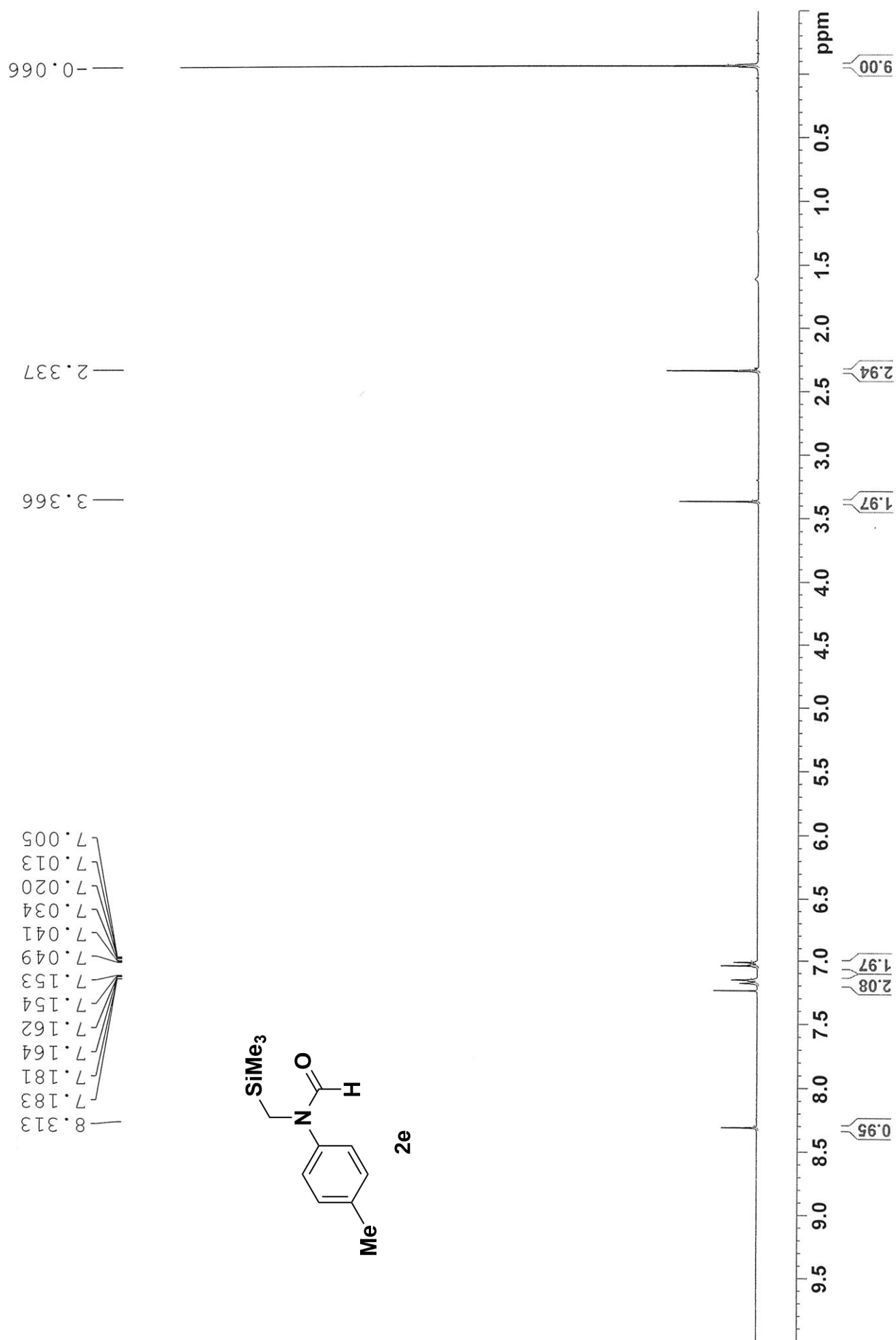
¹H NMR (CDCl₃, 300 MHz)



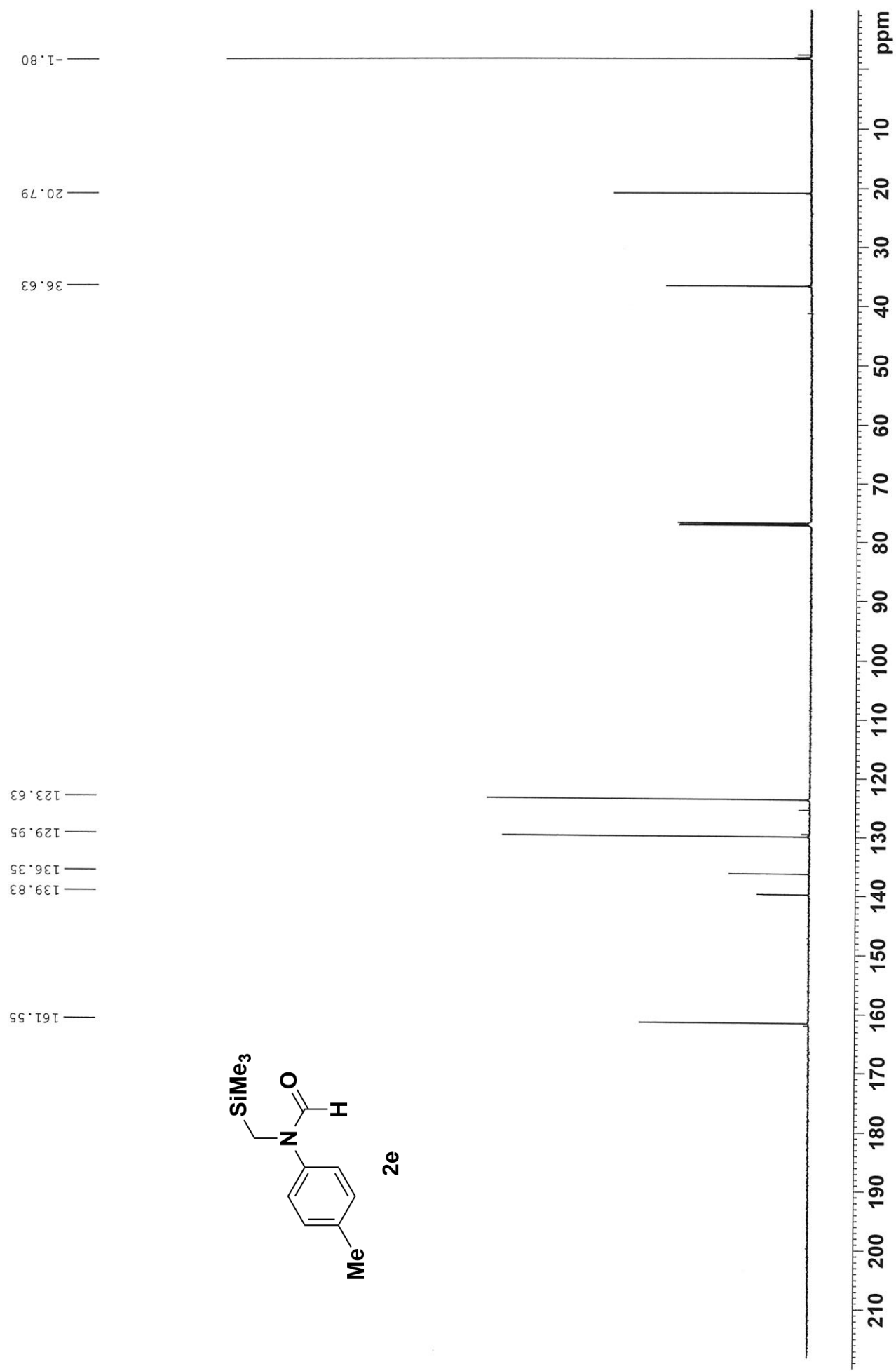
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



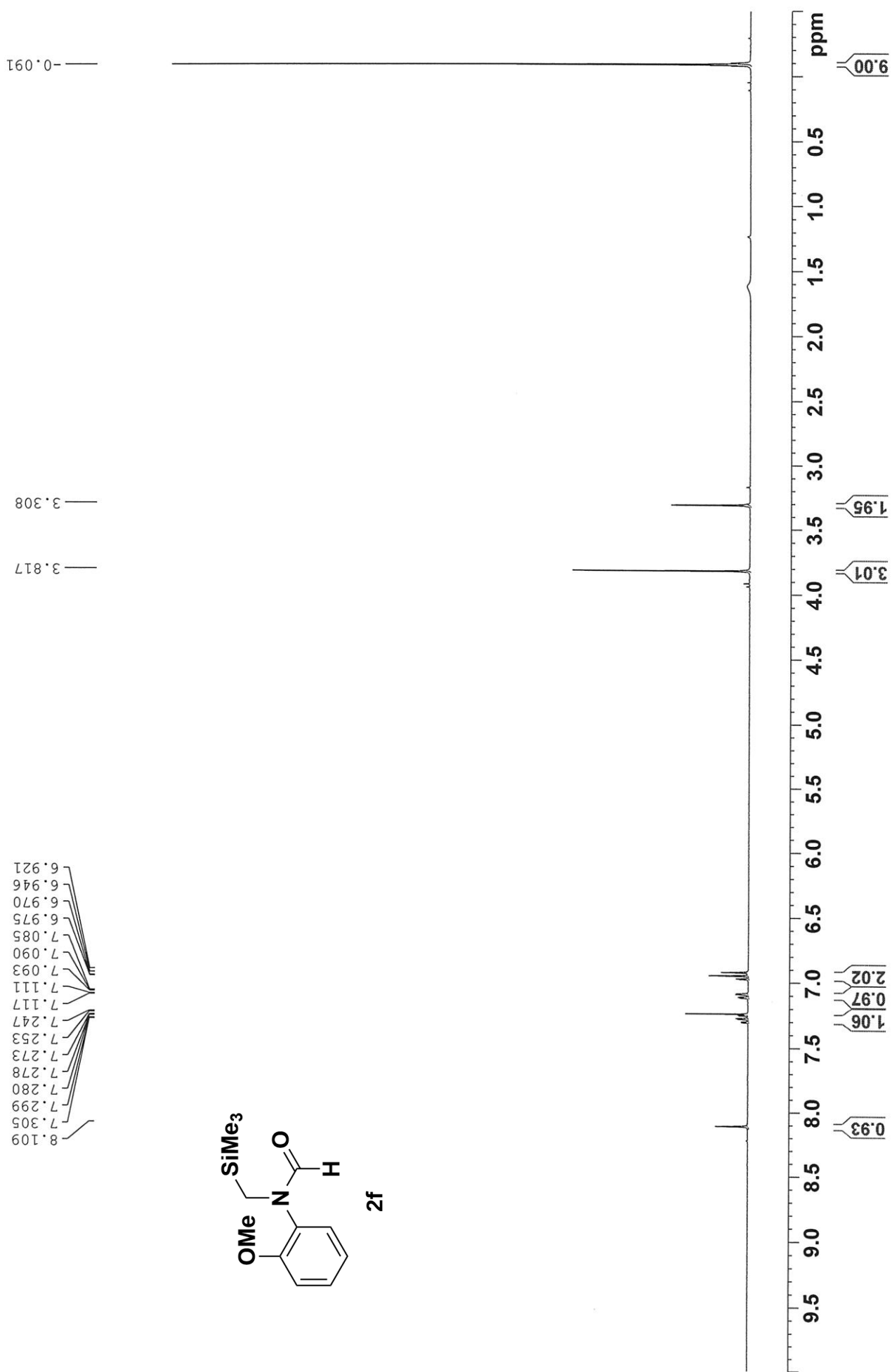
¹H NMR (CDCl₃, 300 MHz)



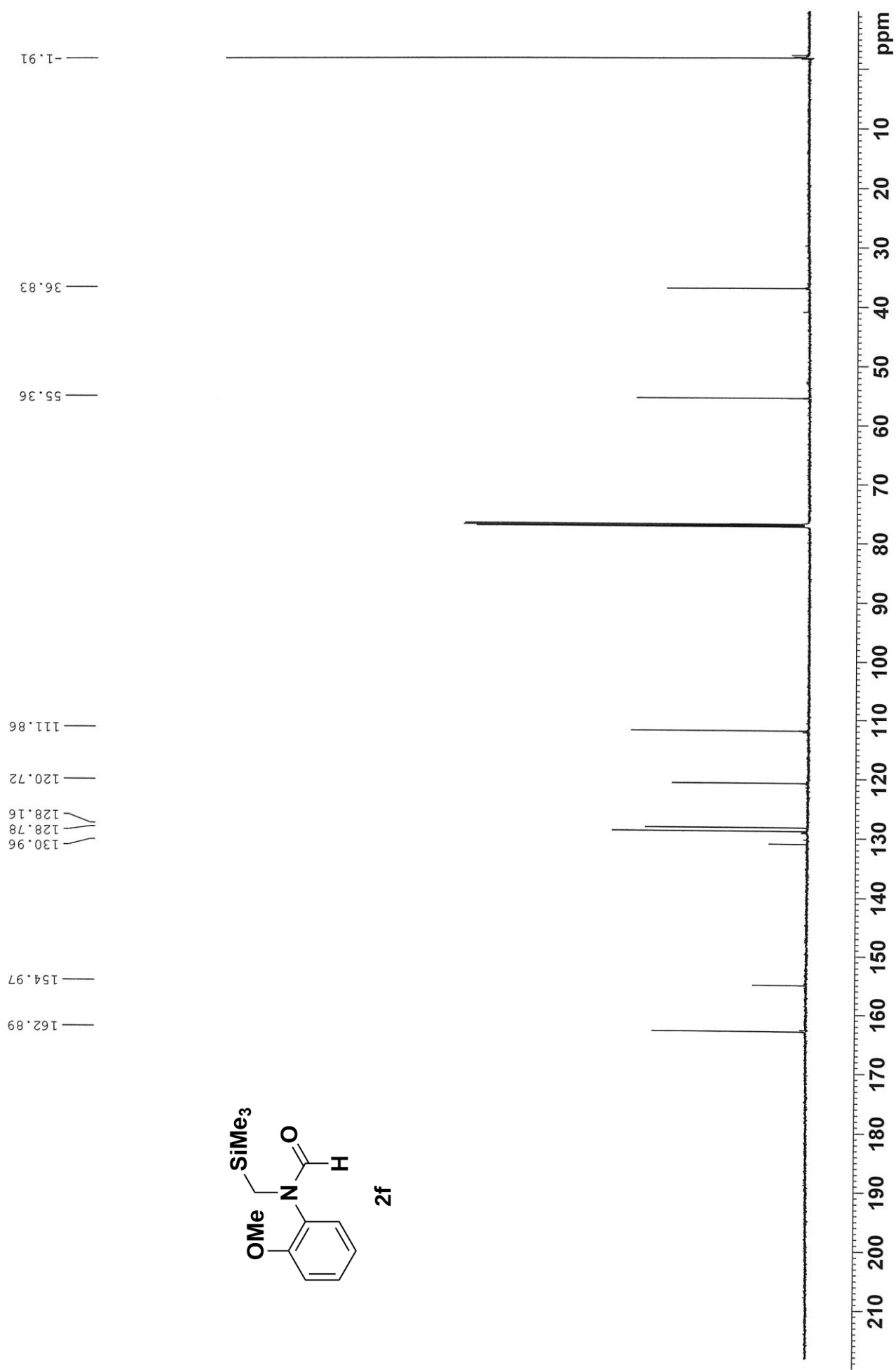
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



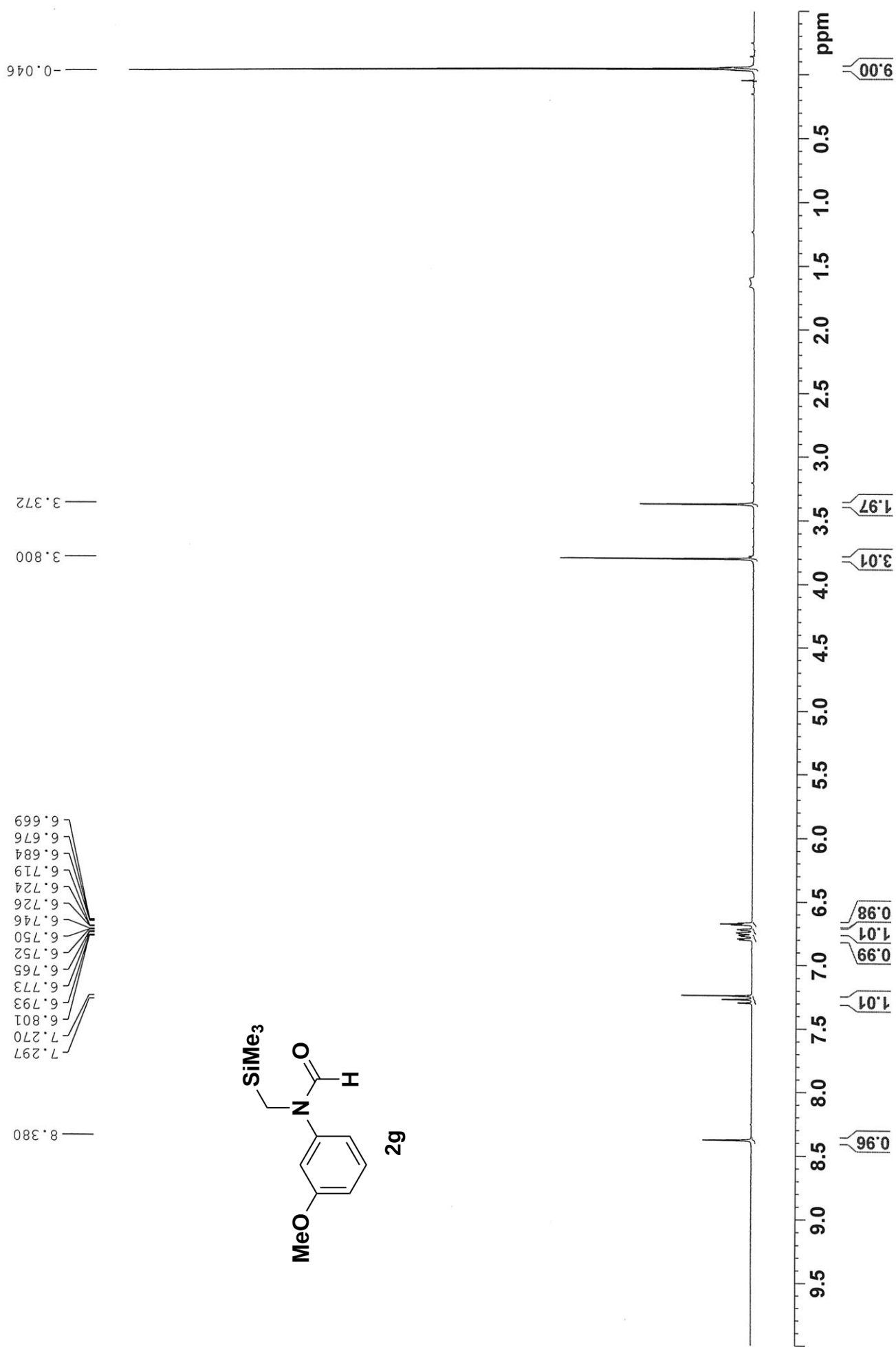
^1H NMR (CDCl_3 , 300 MHz)



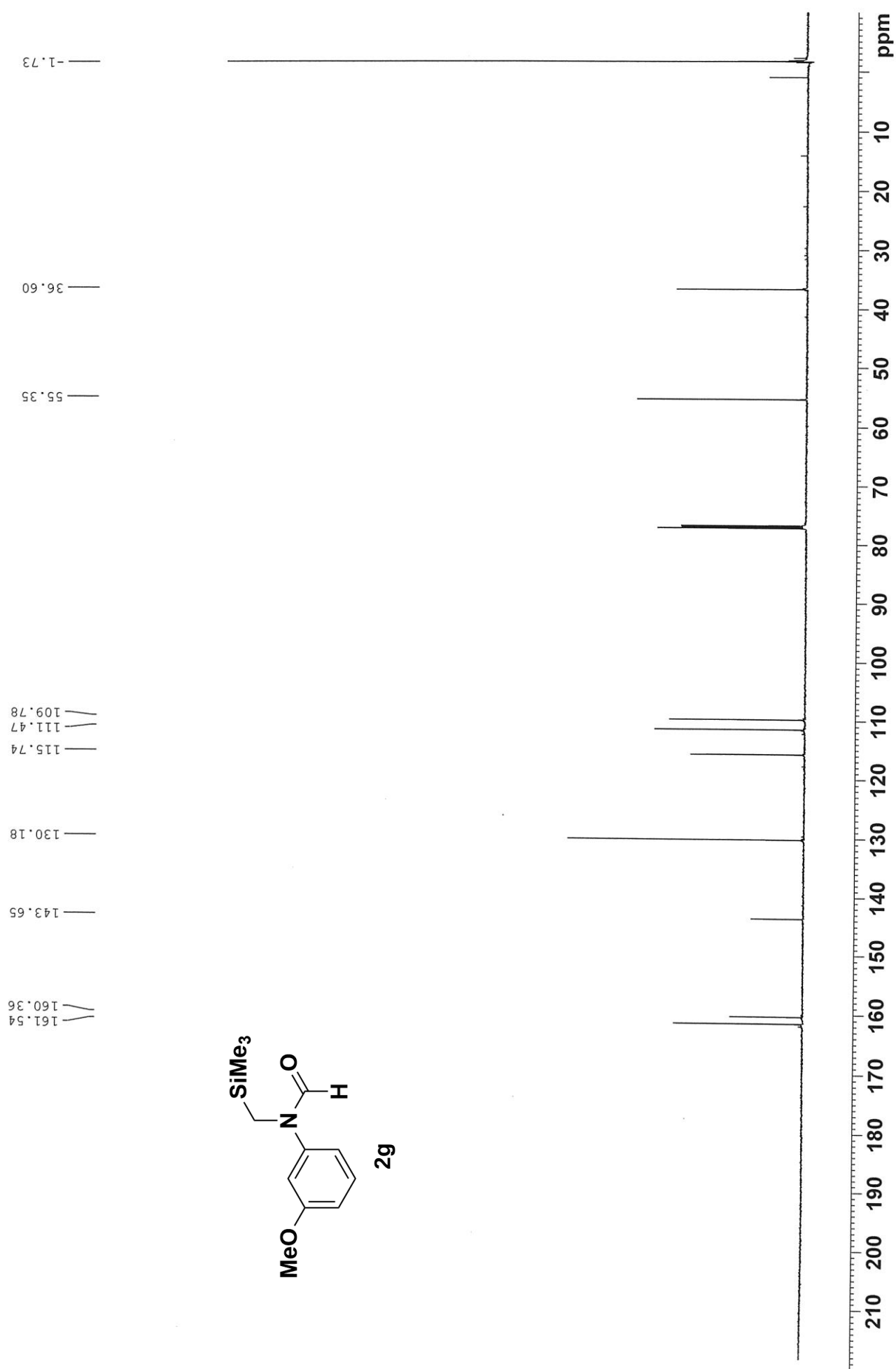
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



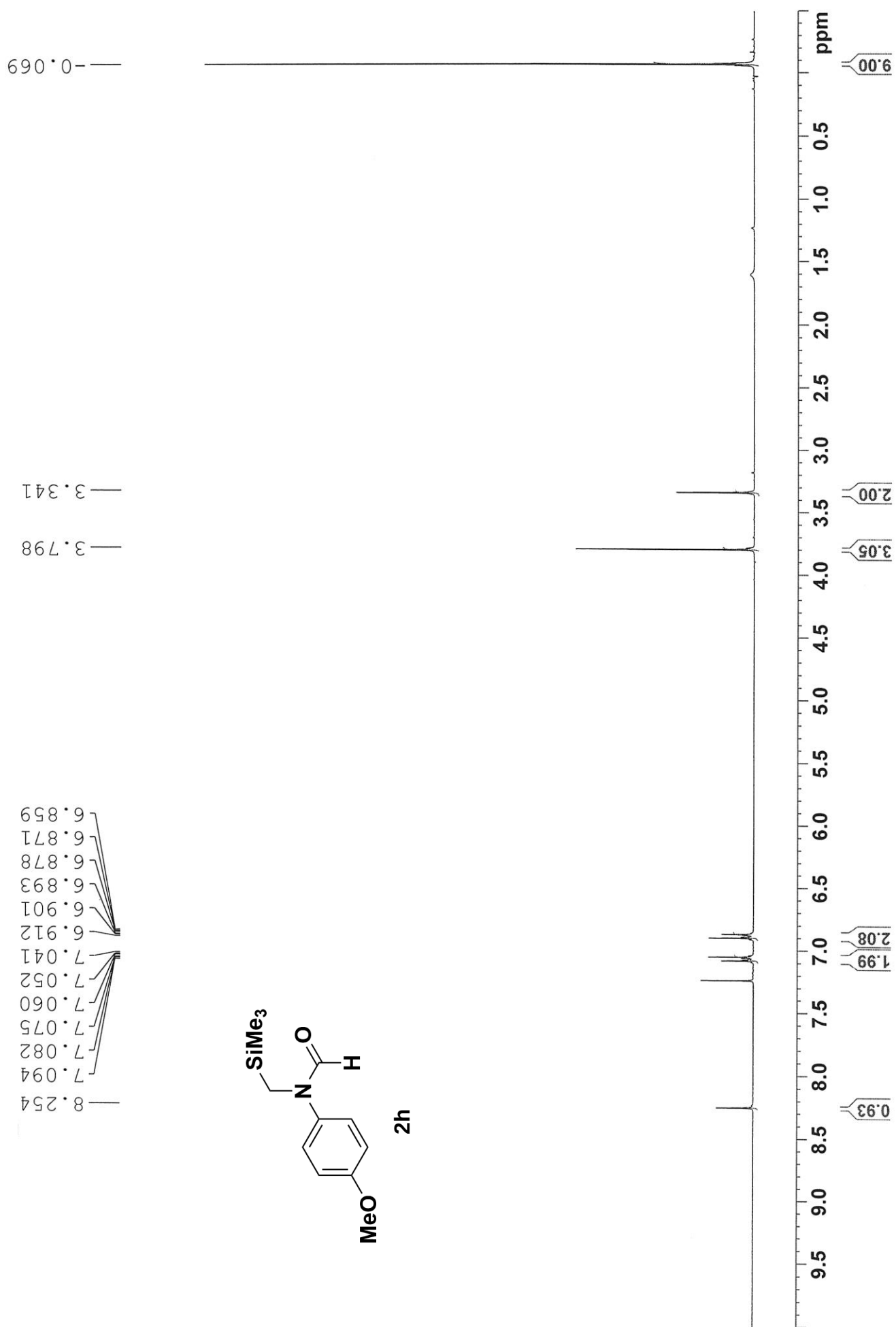
¹H NMR (CDCl₃, 300 MHz)



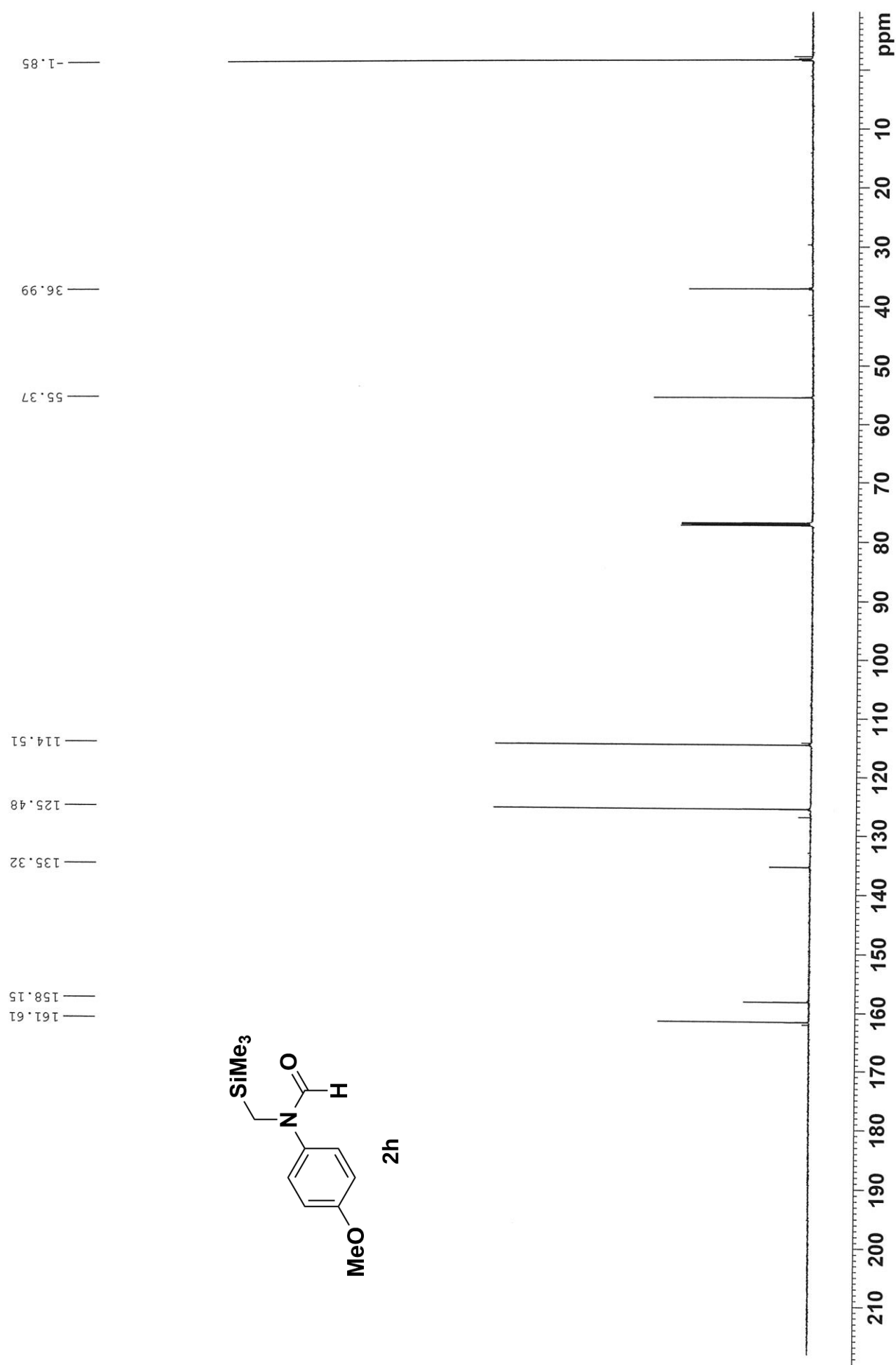
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

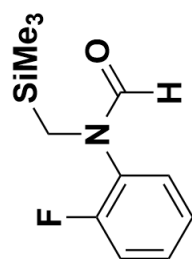


¹H NMR (CDCl₃, 600 MHz)

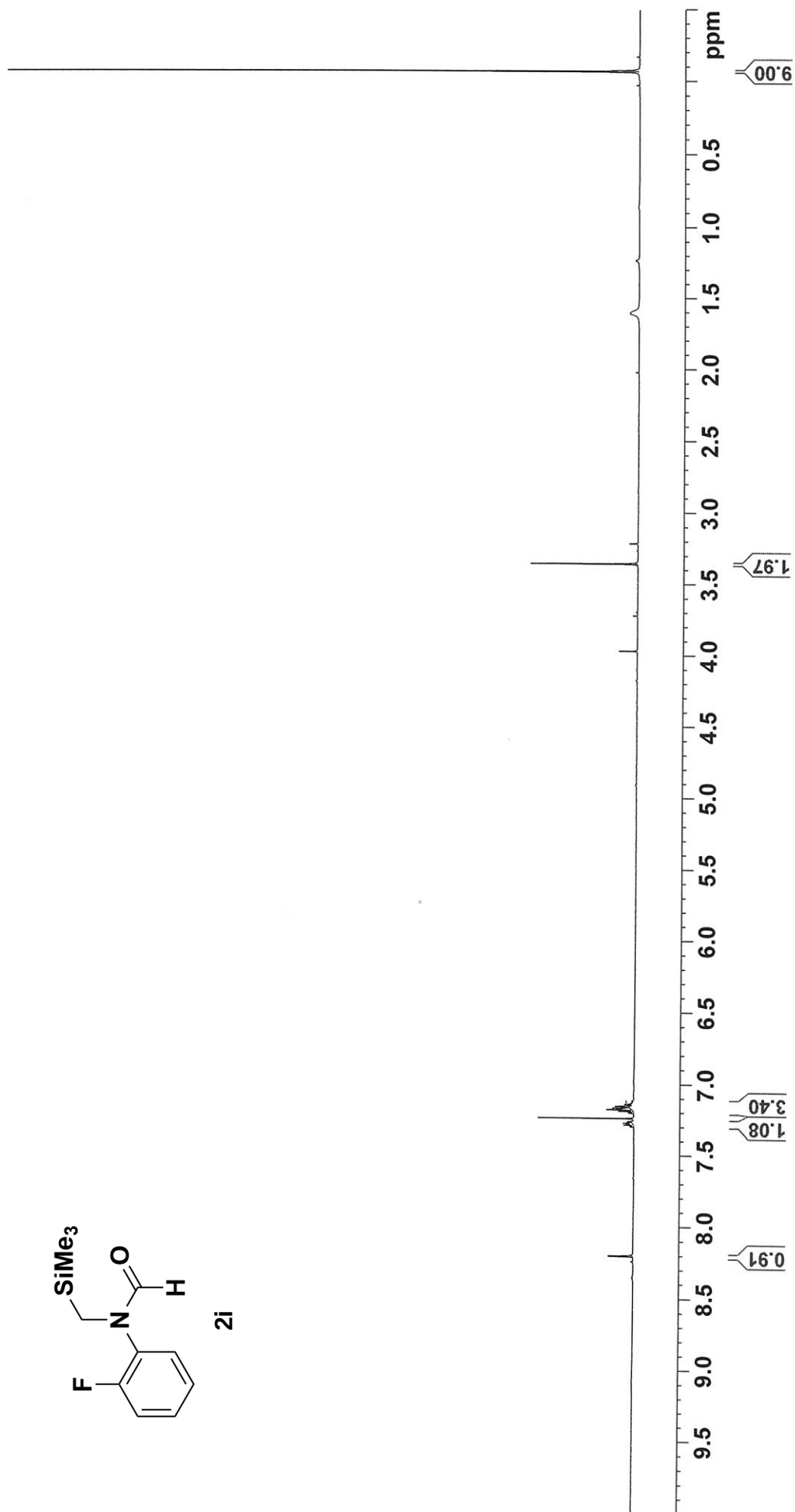
8.203, 8.199, 8.298, 7.295, 7.290, 7.286, 7.284, 7.281, 7.276, 7.275, 7.273, 7.269, 7.266, 7.261, 7.203, 7.199, 7.196, 7.189, 7.186, 7.178, 7.176, 7.172, 7.169, 7.166, 7.164, 7.158, 7.153, 7.144, 7.140, 7.138, 7.129, 7.127, 7.120, 7.115

3.356

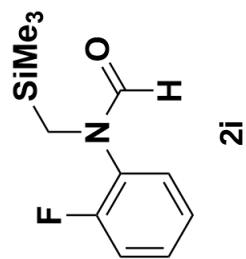
-0.067



2i



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



162.23
 158.29
 156.64
 130.13
 130.05
 128.82
 128.77
 127.85
 124.82
 124.79
 117.00
 116.86

37.01

-2.03

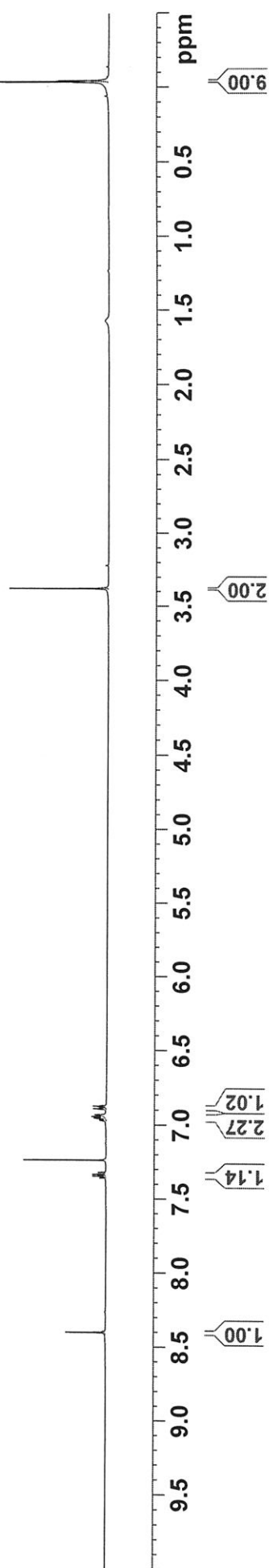
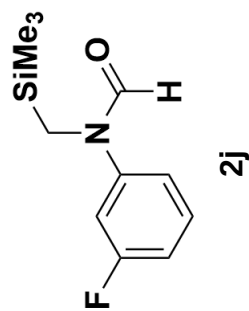


¹H NMR (CDCl₃, 600 MHz)

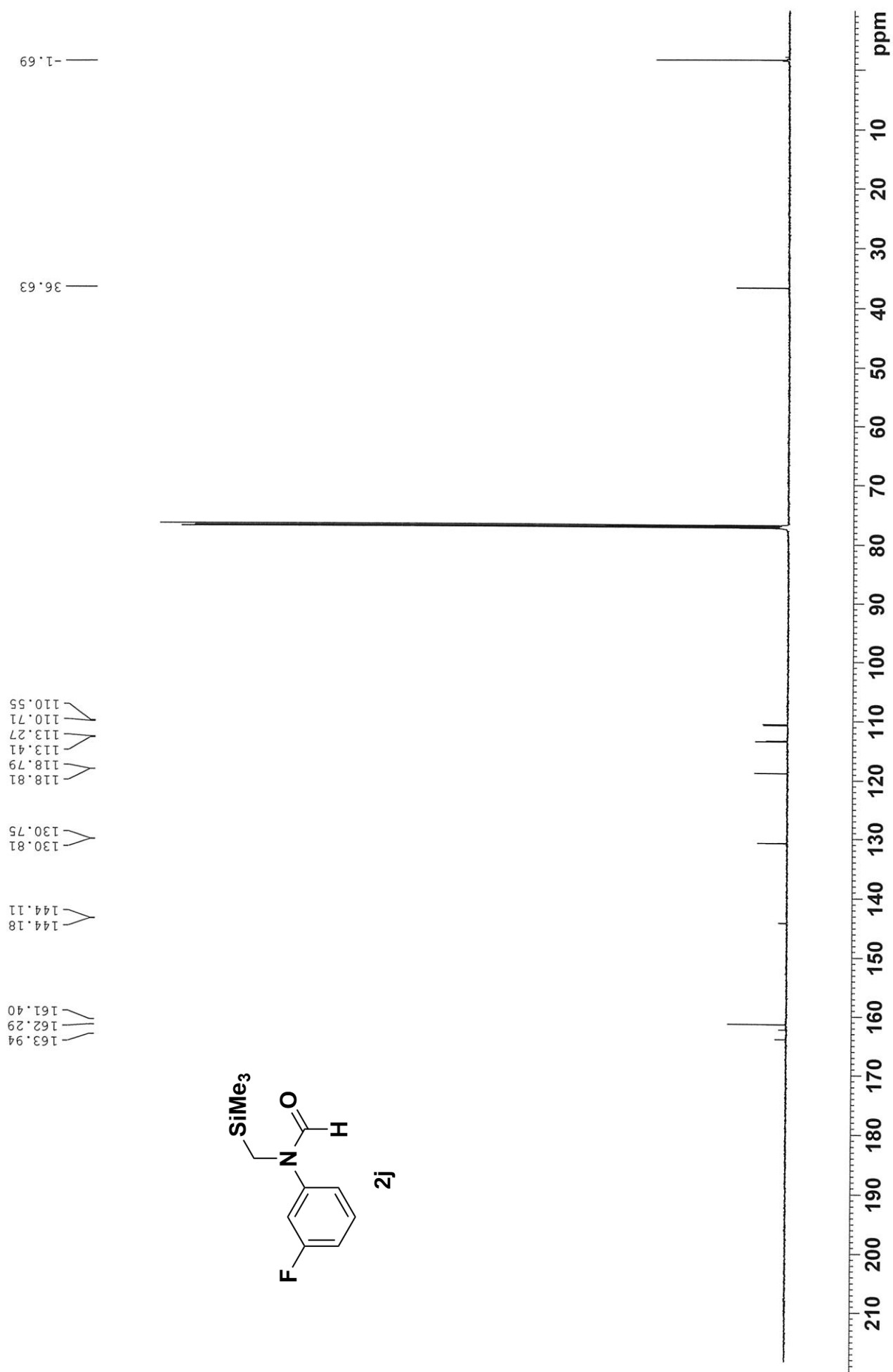
8.404
7.360
7.349
7.346
7.336
7.333
7.322
6.972
6.971
6.968
6.967
6.958
6.957
6.954
6.953
6.949
6.948
6.946
6.945
6.941
6.939
6.936
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6.932
6.931
6.896
6.892
6.888
6.879
6.875
6.871

3.379

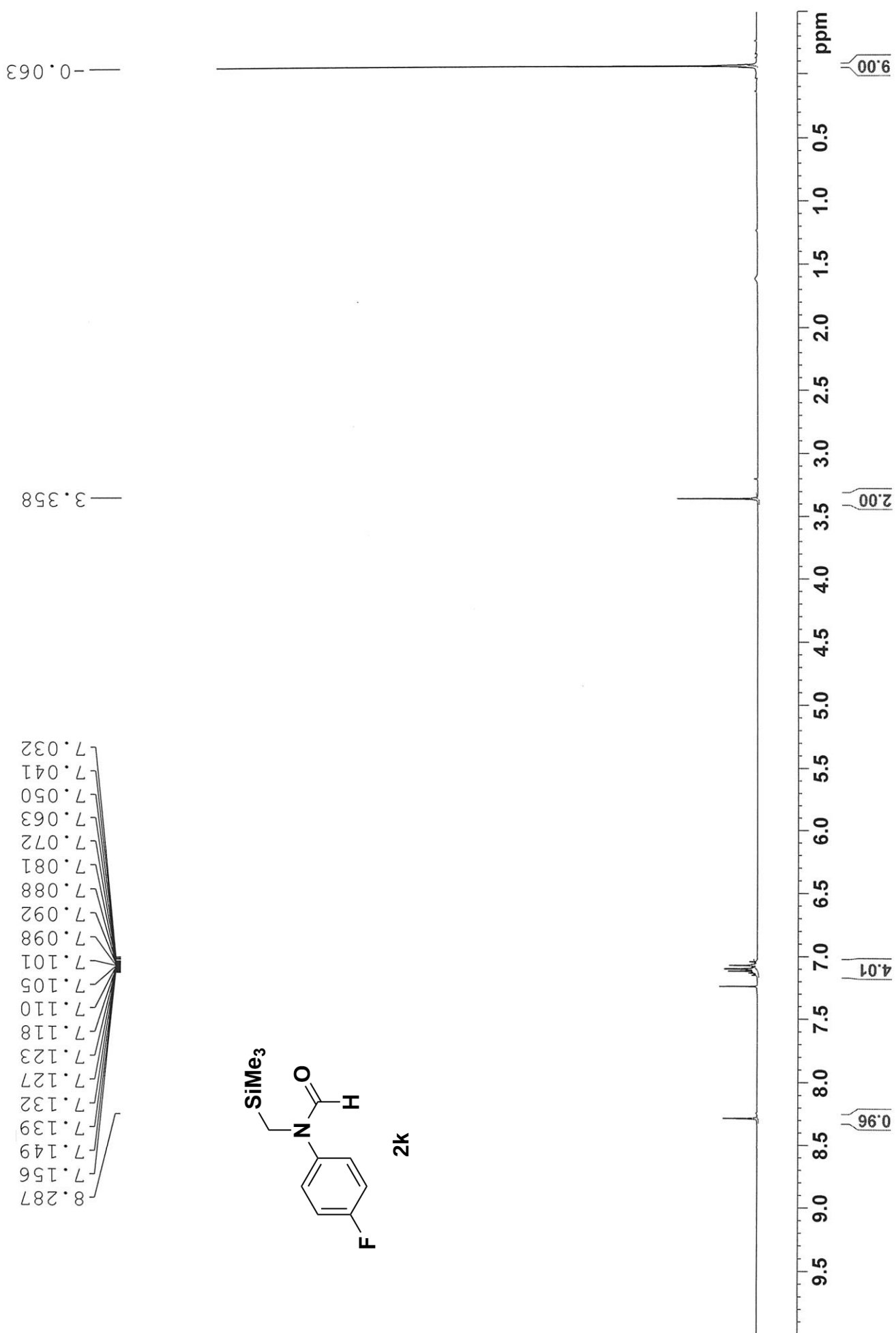
-0.039



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



^{13}C { ^1H } NMR (CDCl₃, 150 MHz)

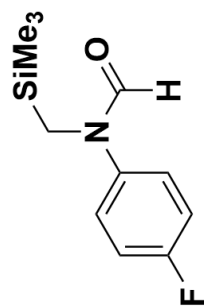
161.81
161.49
160.17

138.58
138.56

125.68
125.63
116.44
116.28

37.04

-1.79



2k

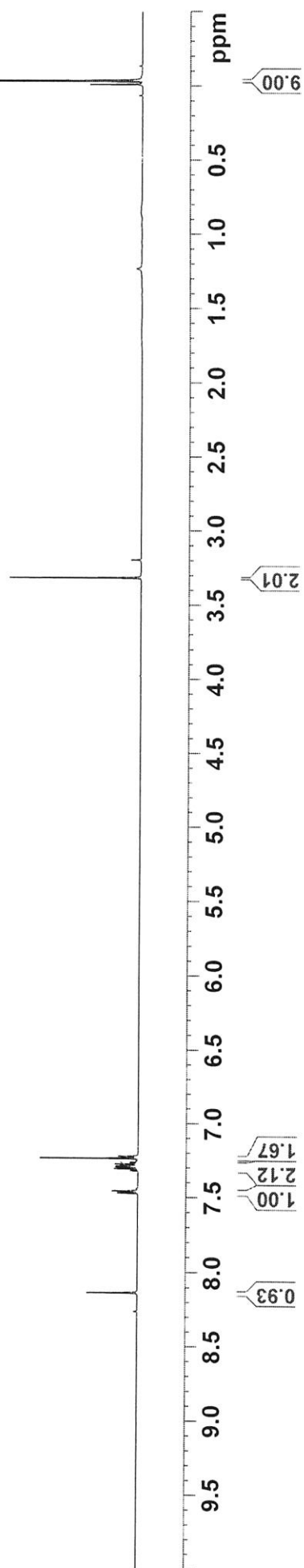
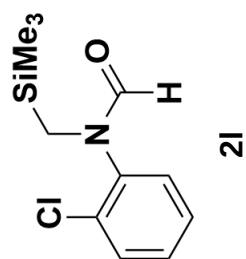


¹H NMR (CDCl₃, 600 MHz)

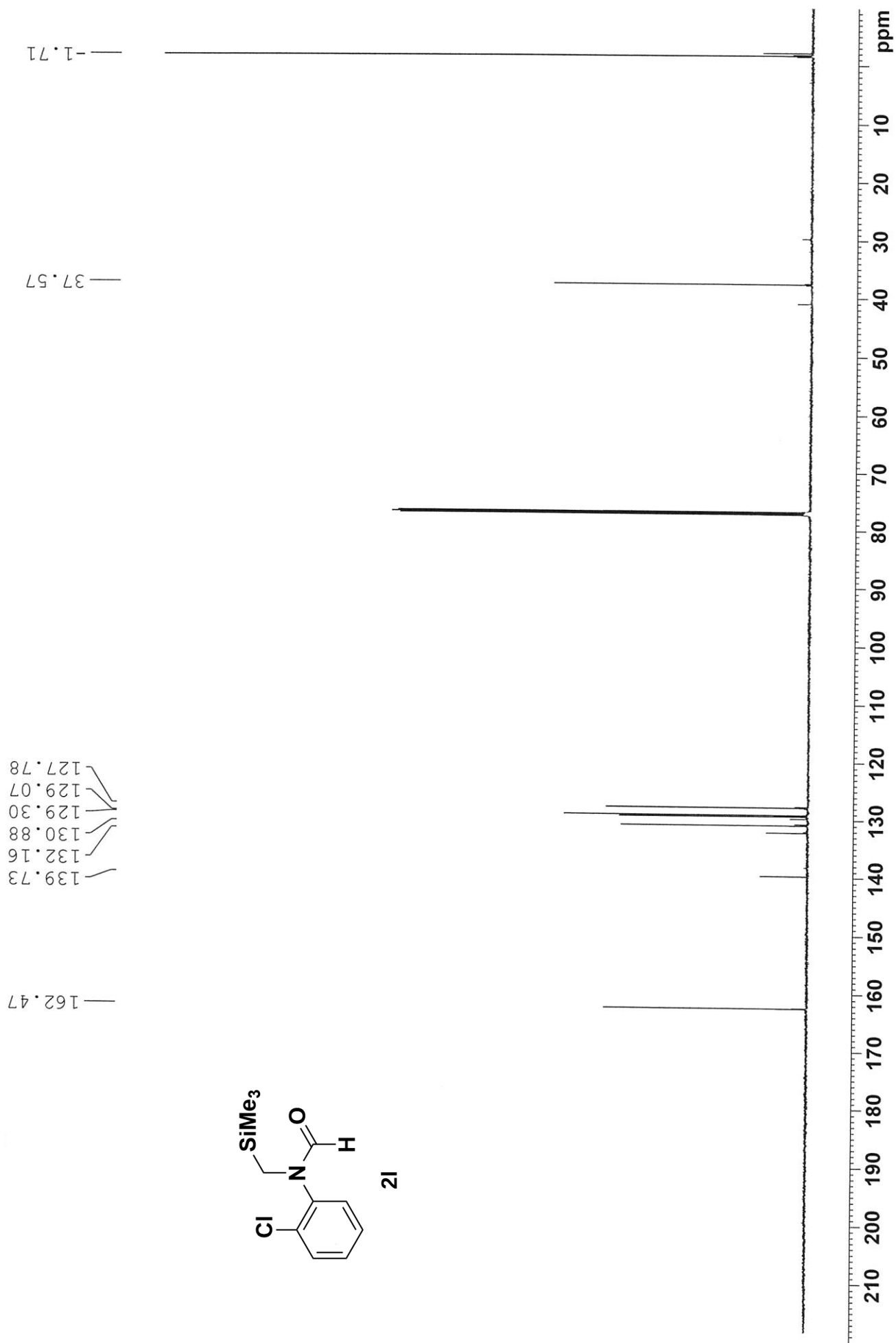
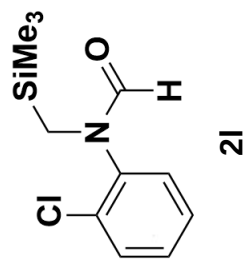
8.138
7.475
7.472
7.462
7.459
7.324
7.321
7.312
7.309
7.299
7.296
7.292
7.289
7.280
7.276
7.267
7.264
7.236
7.227
7.224

3.317

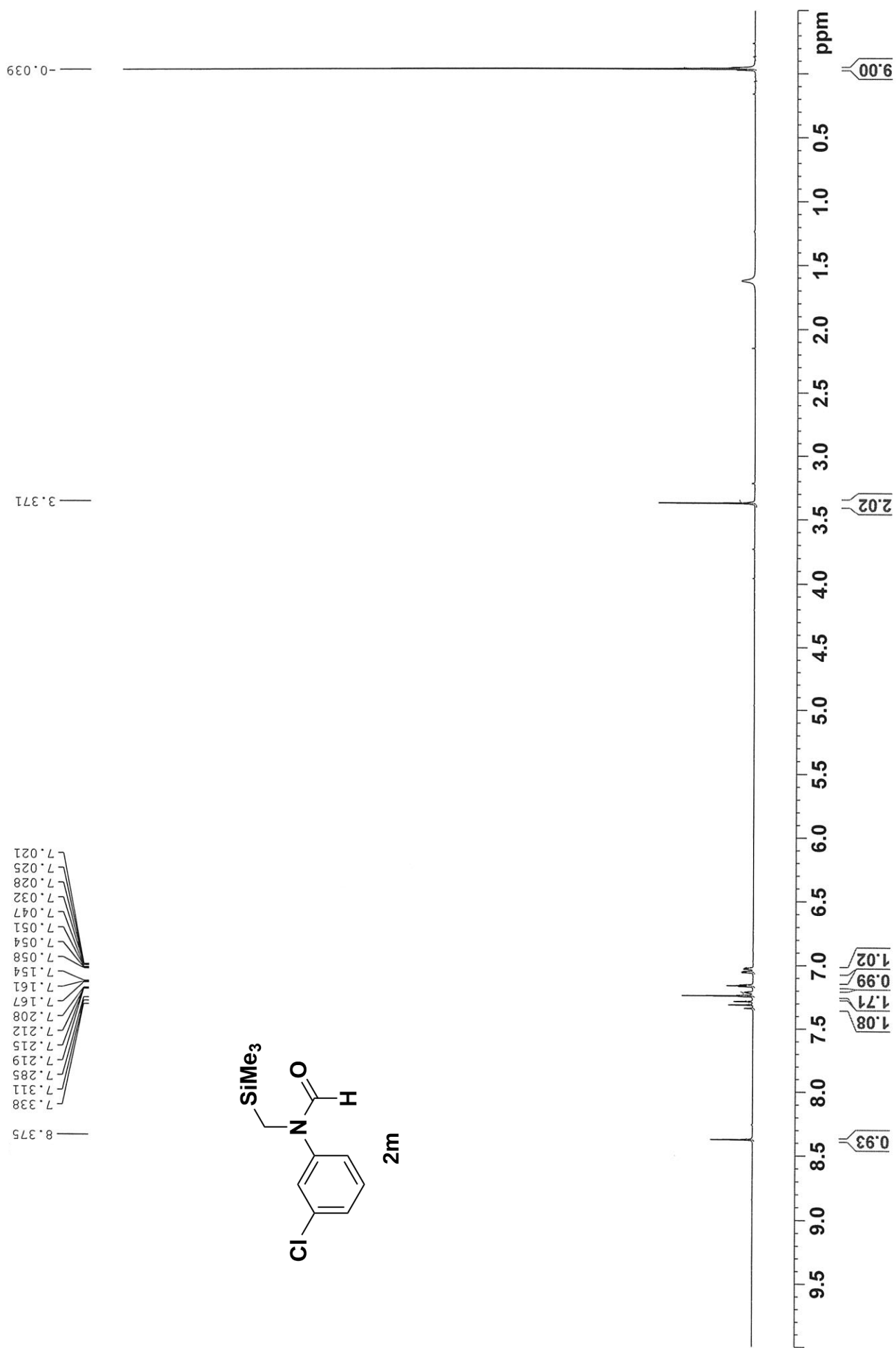
-0.033



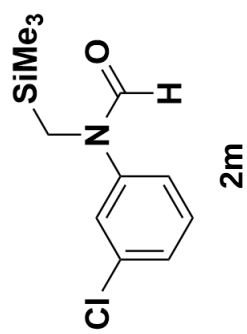
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



161.31

143.71

135.12

130.49

126.50

123.49

121.38

36.62

-1.70

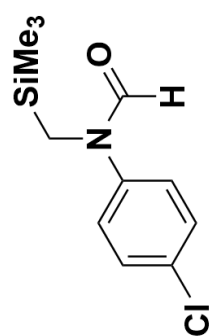


¹H NMR (CDCl₃, 600 MHz)

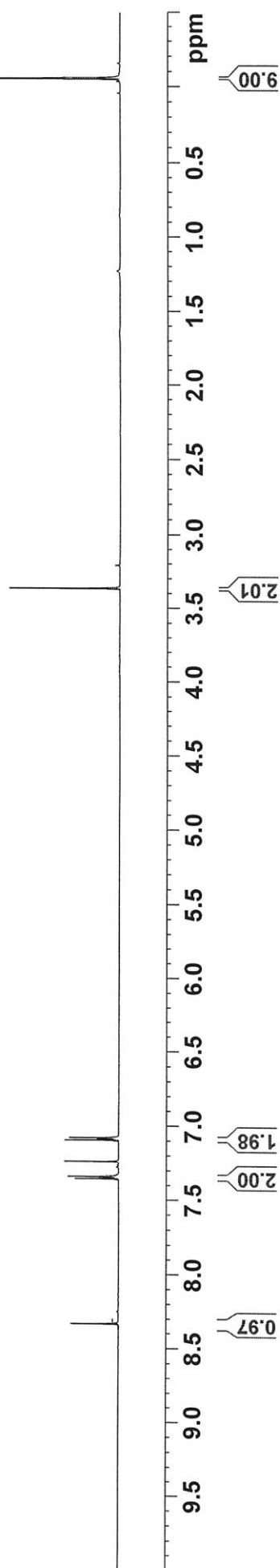
8.334
7.363
7.357
7.354
7.346
7.343
7.338
7.330
7.101
7.096
7.092
7.085
7.081
7.076

3.367

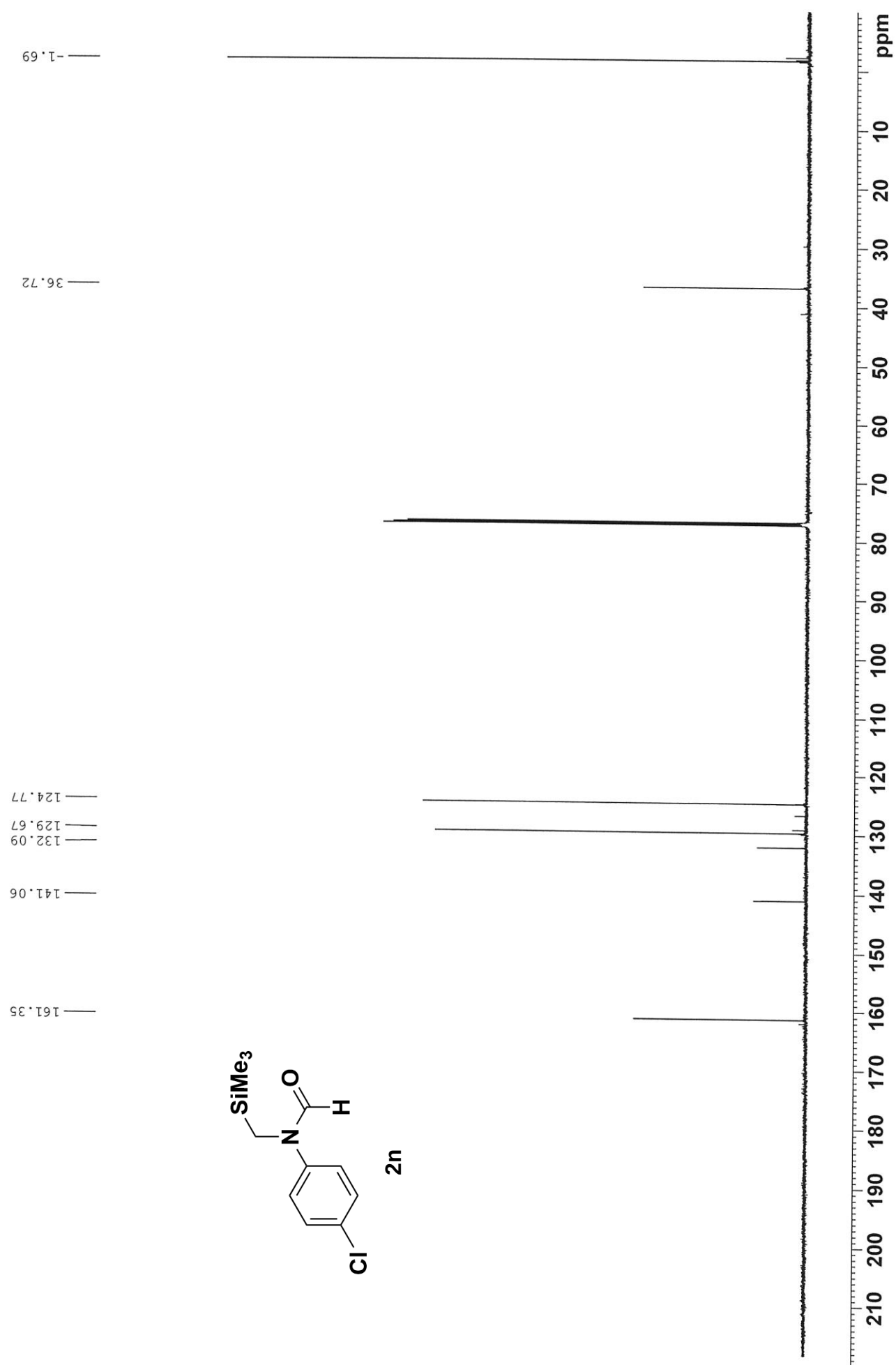
-0.053



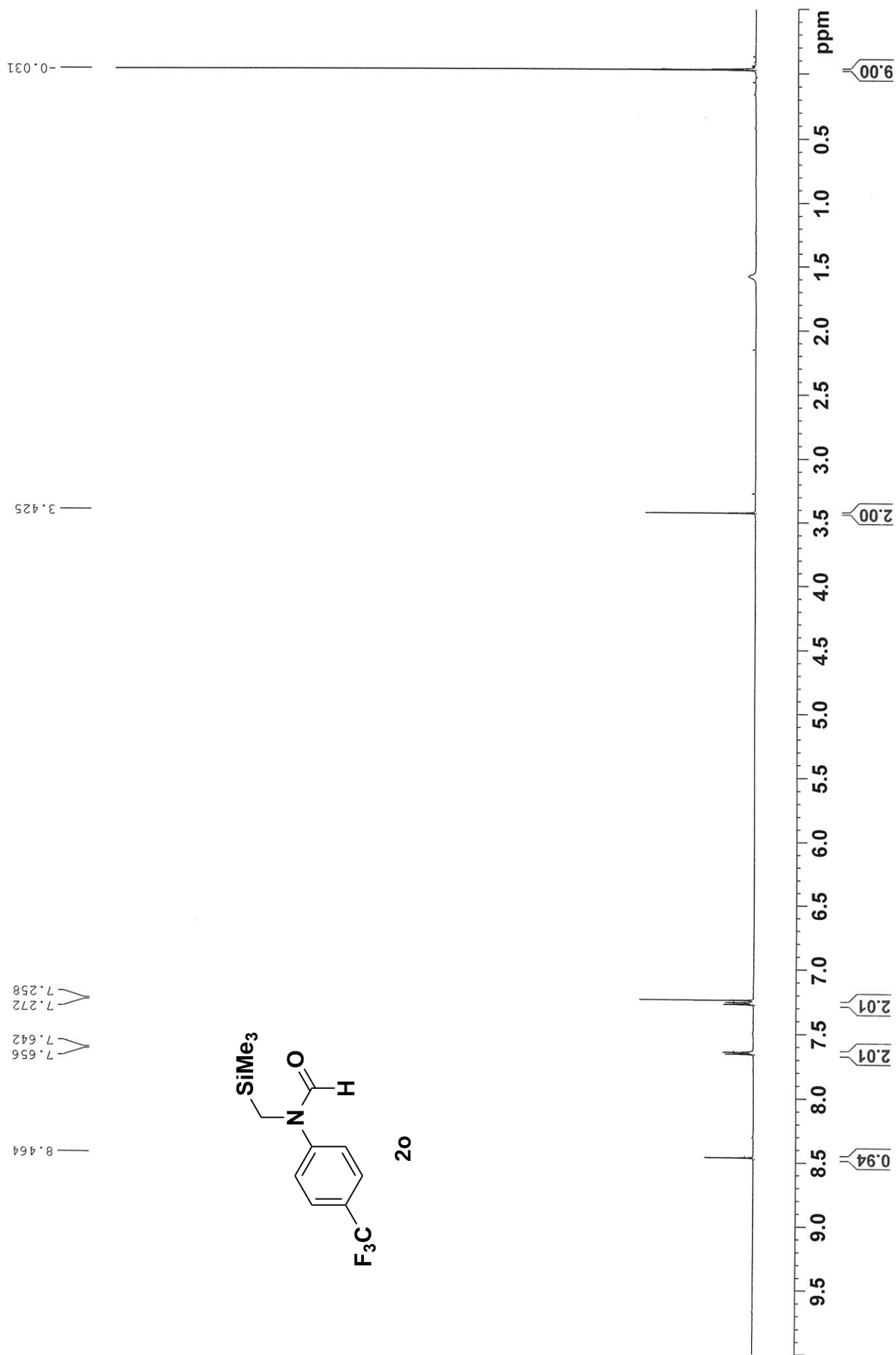
2n



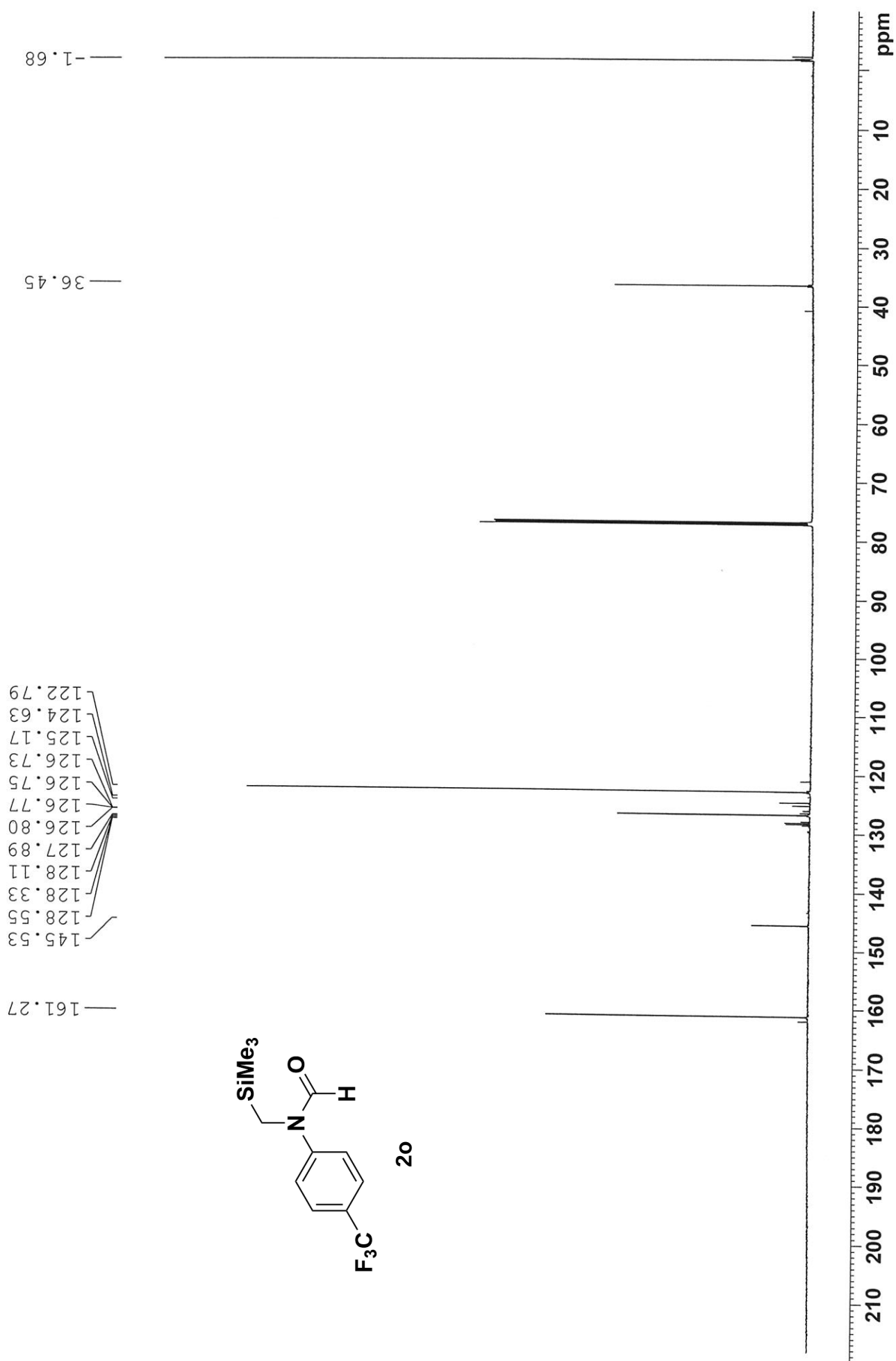
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



^1H NMR (CDCl_3 , 600 MHz)

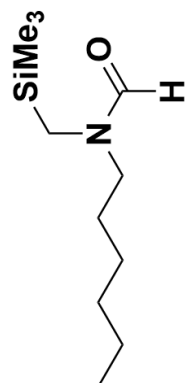


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

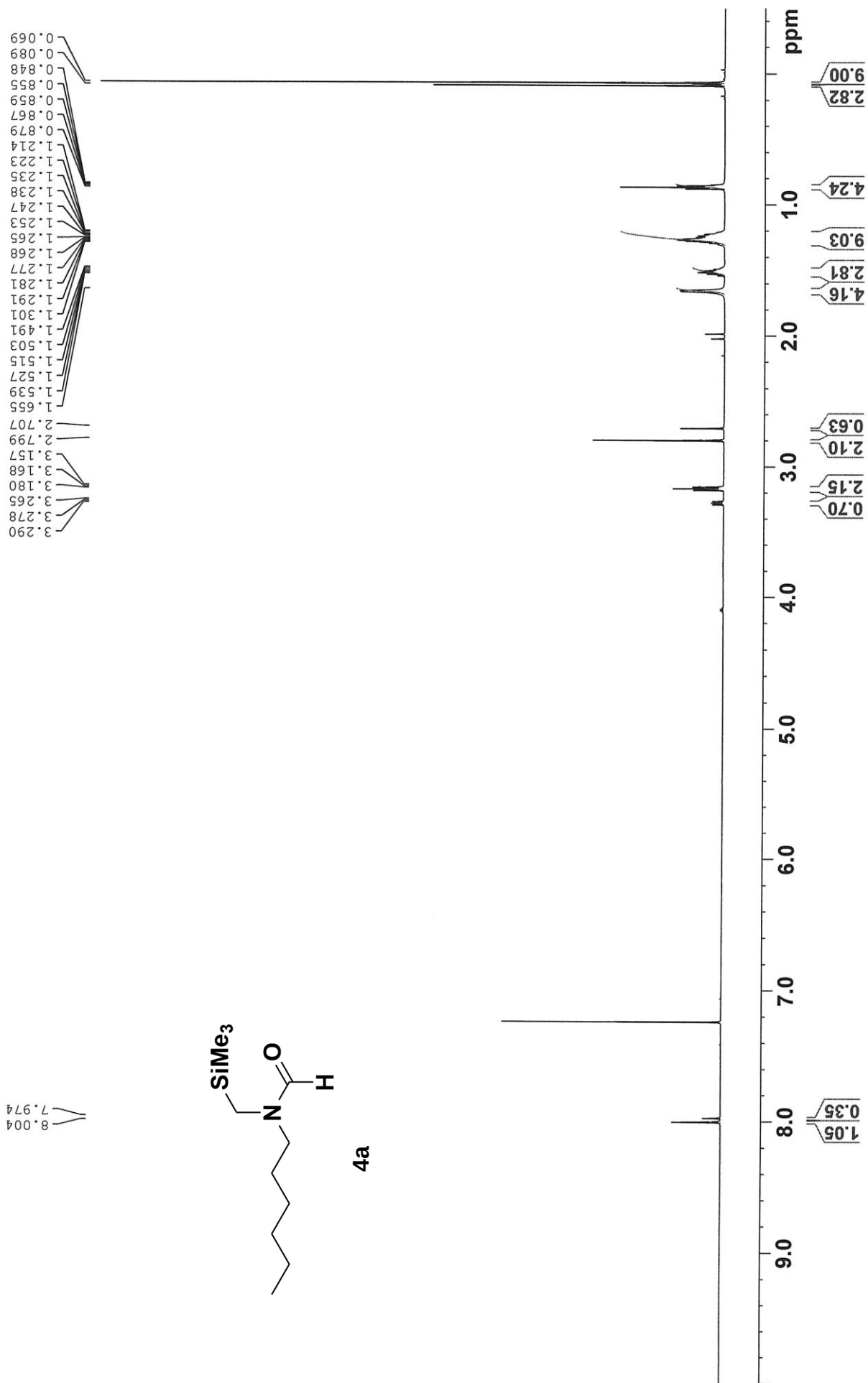


¹H NMR (CDCl₃, 600 MHz)

8.004
7.974

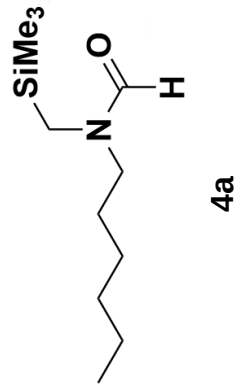


4a



$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

162.23
161.62

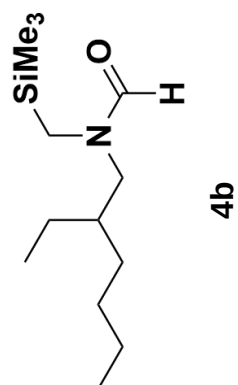


49.47
44.69
38.30
33.75
31.52
31.35
27.89
26.61
26.45
26.04
22.53
22.50
13.98
13.94
-1.43
-2.01

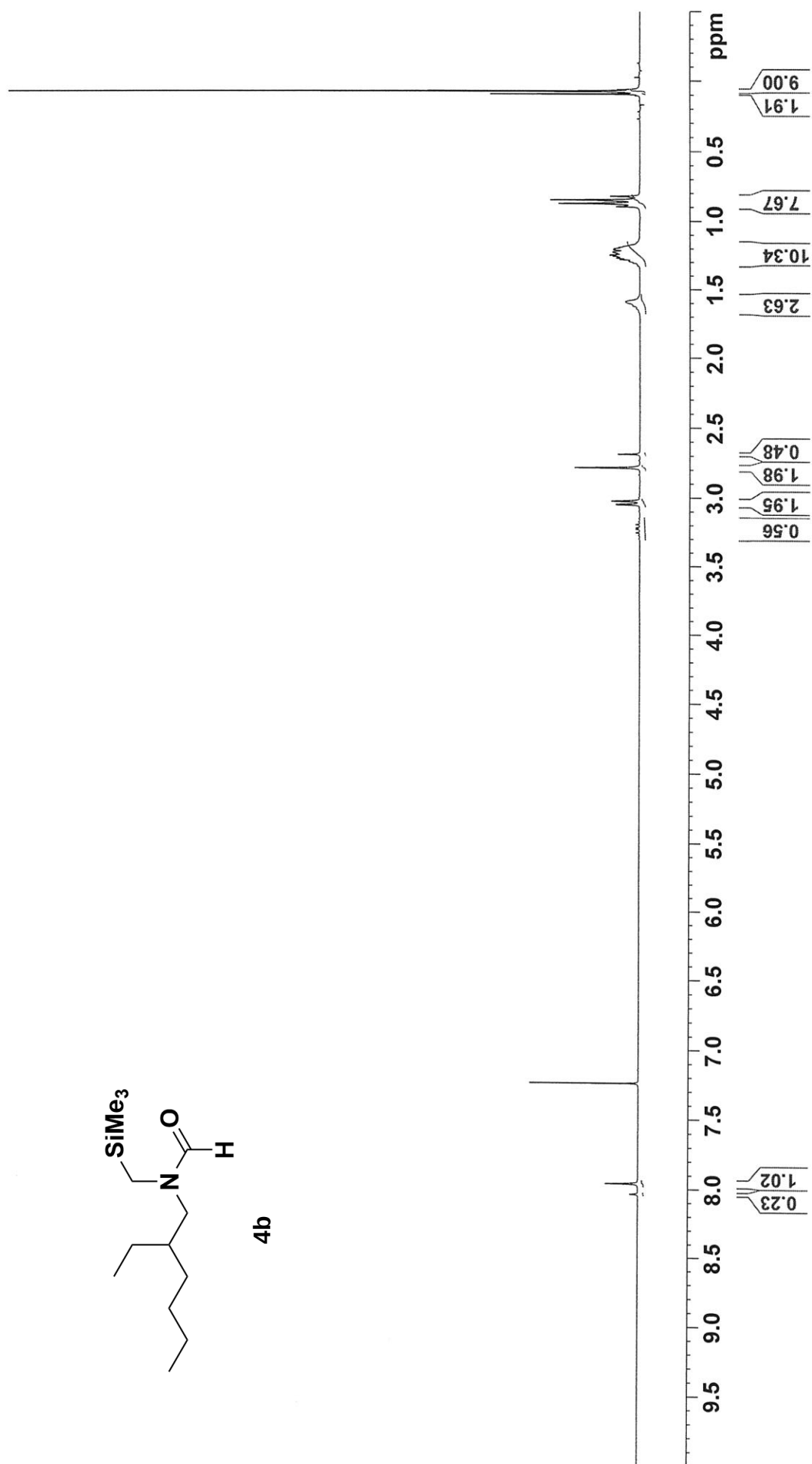


¹H NMR (CDCl₃, 300 MHz)

8.036
7.959

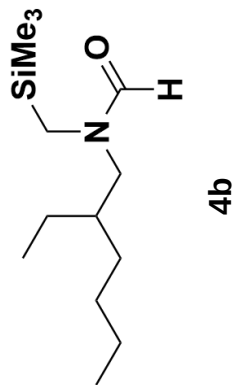


3.298, 3.272, 3.253, 3.227, 3.217, 3.192, 3.172, 3.147, 3.045, 3.022, 2.783, 2.687, 1.589, 1.324, 1.305, 1.292, 1.279, 1.268, 1.260, 1.254, 1.246, 1.235, 1.226, 1.223, 1.206, 1.199, 1.190, 1.183, 0.895, 0.872, 0.846, 0.827, 0.821, 0.092, 0.072

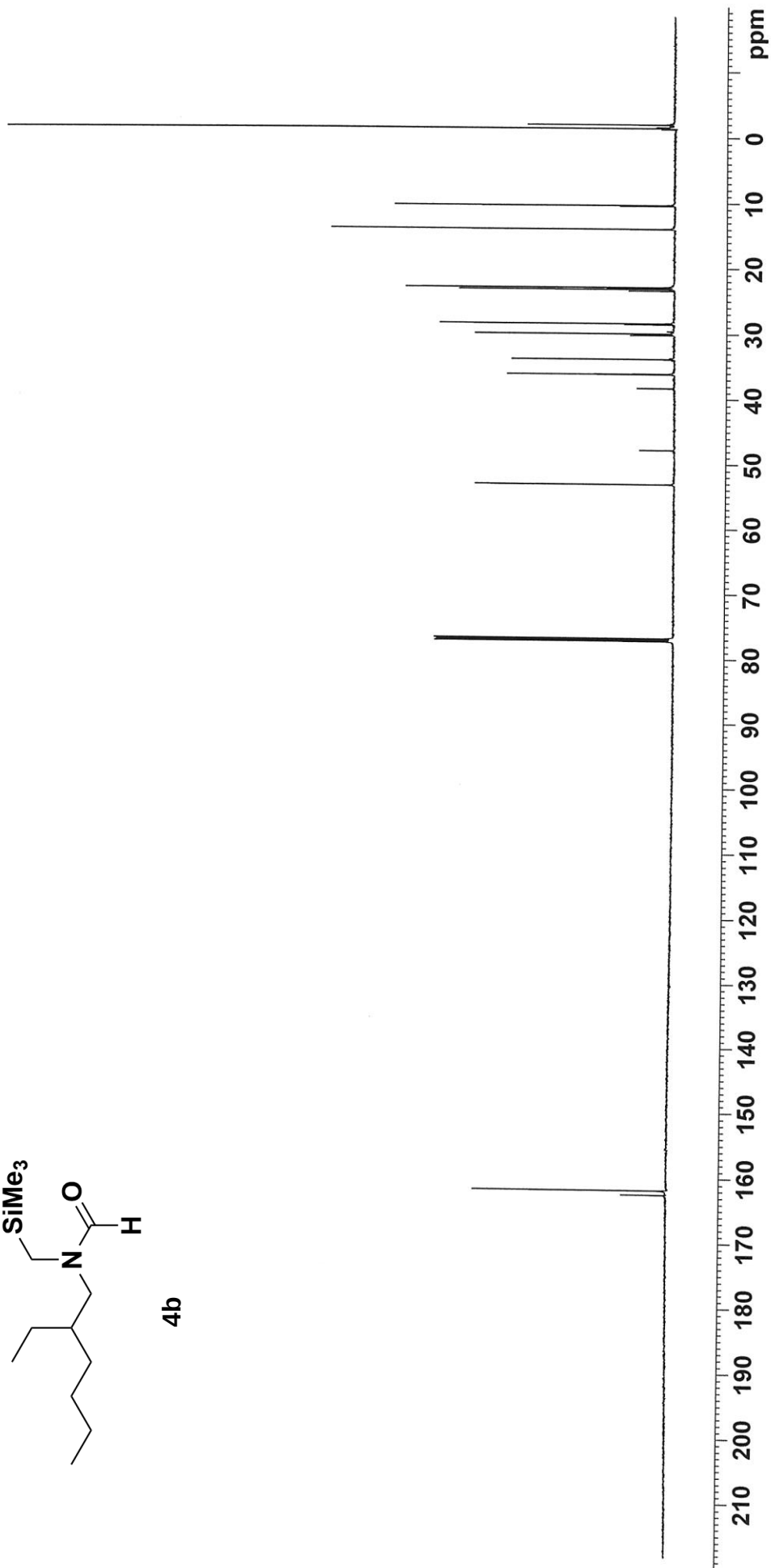


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

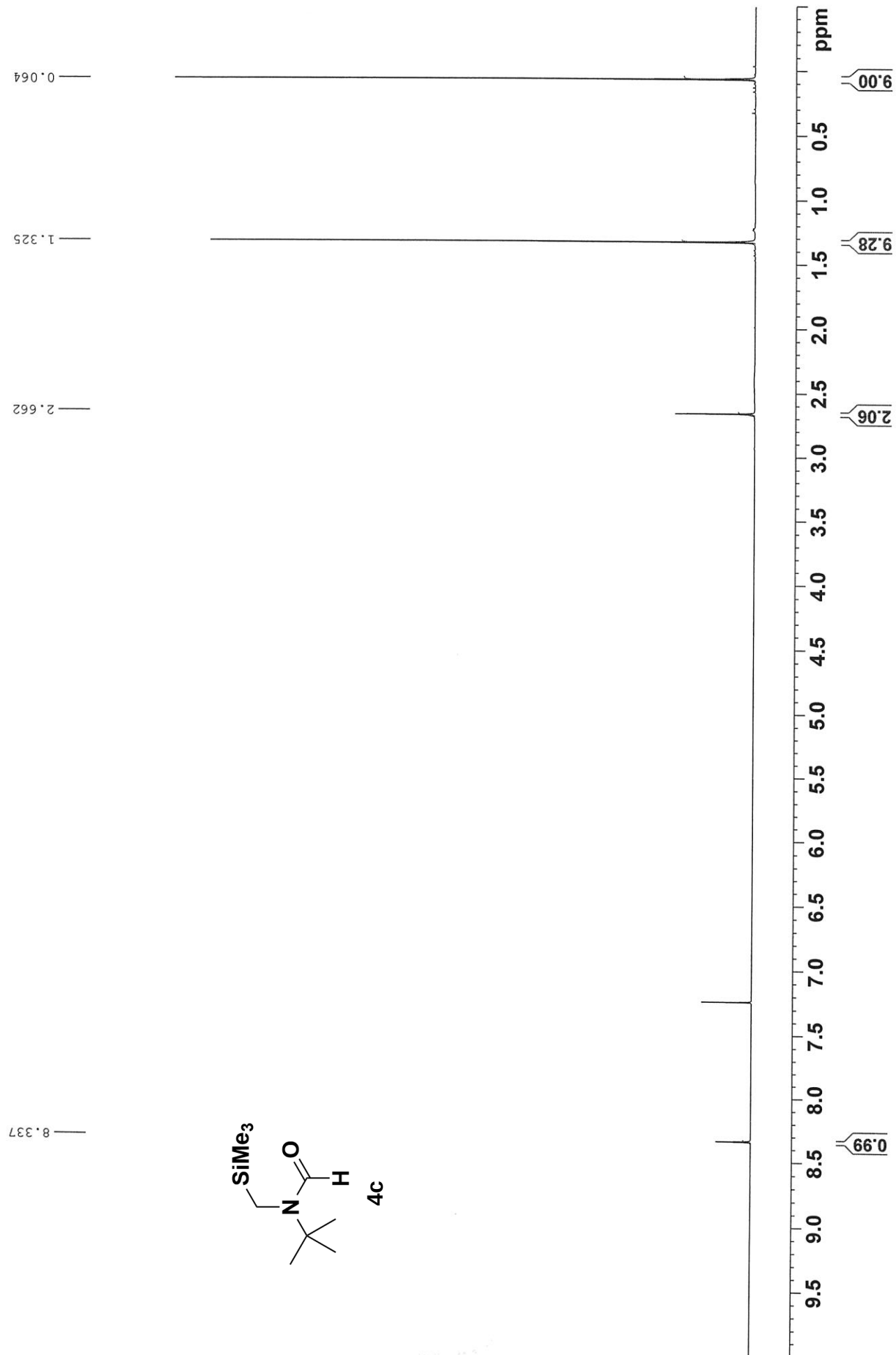
162.50
161.82



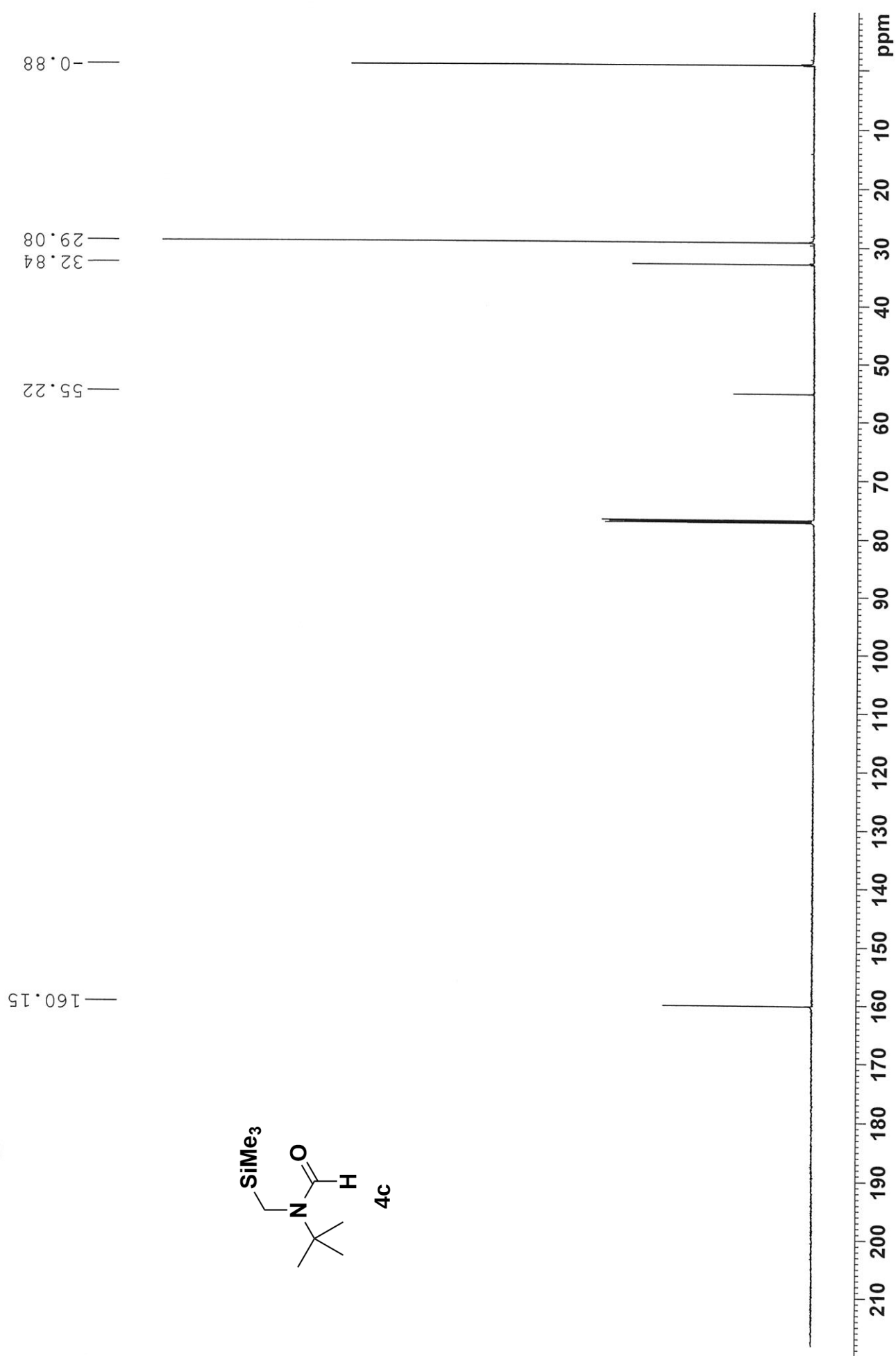
53.10
 47.77
 38.29
 36.12
 36.06
 33.82
 30.16
 29.94
 28.54
 28.40
 23.42
 23.16
 22.95
 22.87
 13.94
 13.91
 10.41
 10.29
 -1.45
 -1.99



^1H NMR (CDCl_3 , 600 MHz)

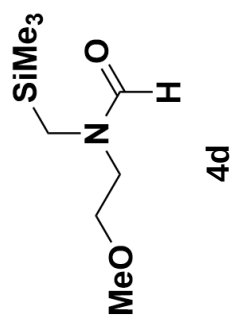


^{13}C { ^1H } NMR (CDCl₃, 150 MHz)



¹H NMR (CDCl₃, 600 MHz)

8.008
7.998



3.515
3.511
3.508
3.502
3.495
3.487
3.479
3.474
3.471
3.467
3.439
3.430
3.422
3.348
3.339
3.330
3.314
3.312
2.844

0.083
0.066

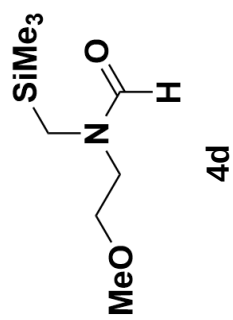
0.97
0.42

1.75
2.14
2.17
4.31
2.96

3.66
9.00

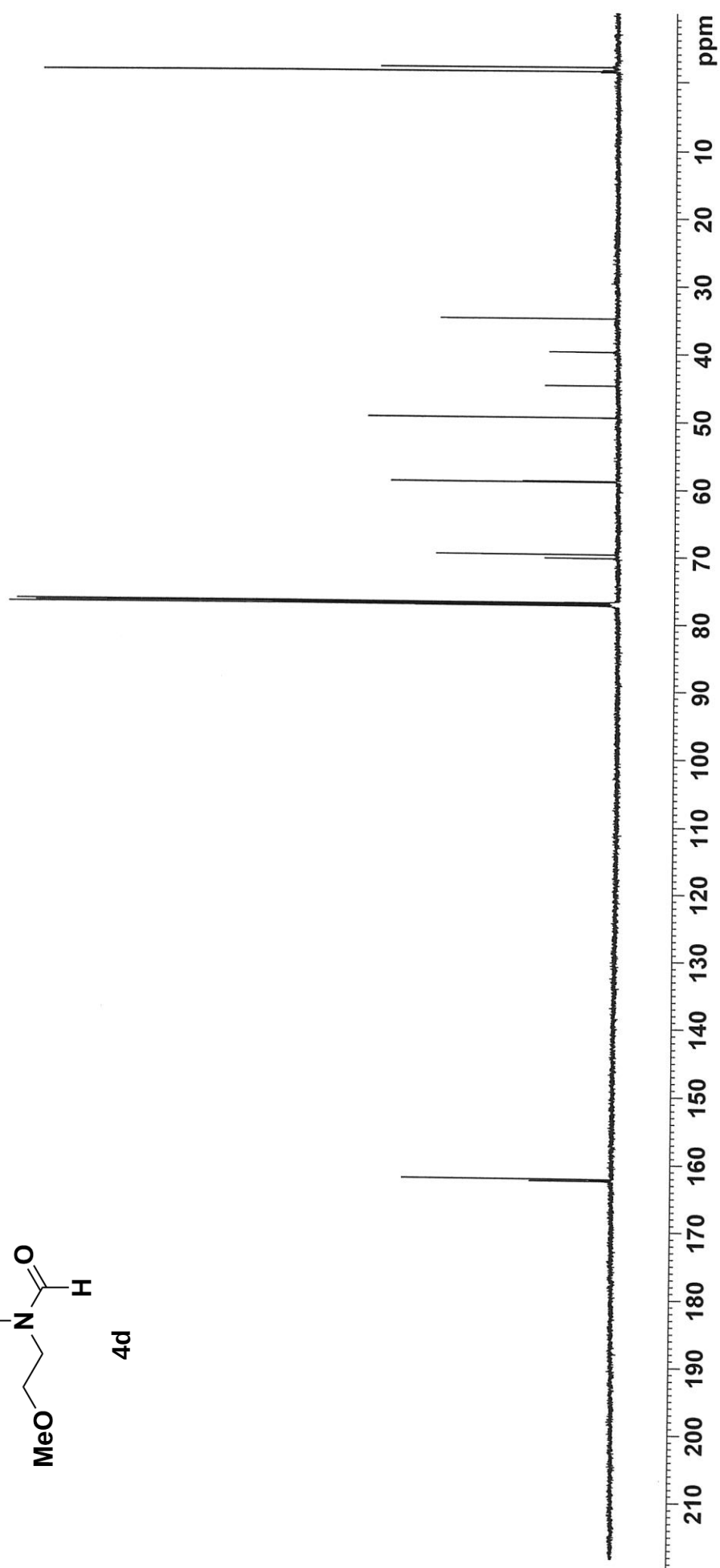
ppm

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



162.42
162.16

70.17
69.63
58.85
58.72
49.37
44.70
39.73
34.78
-1.54
-2.12



¹H NMR (CDCl₃, 600 MHz)

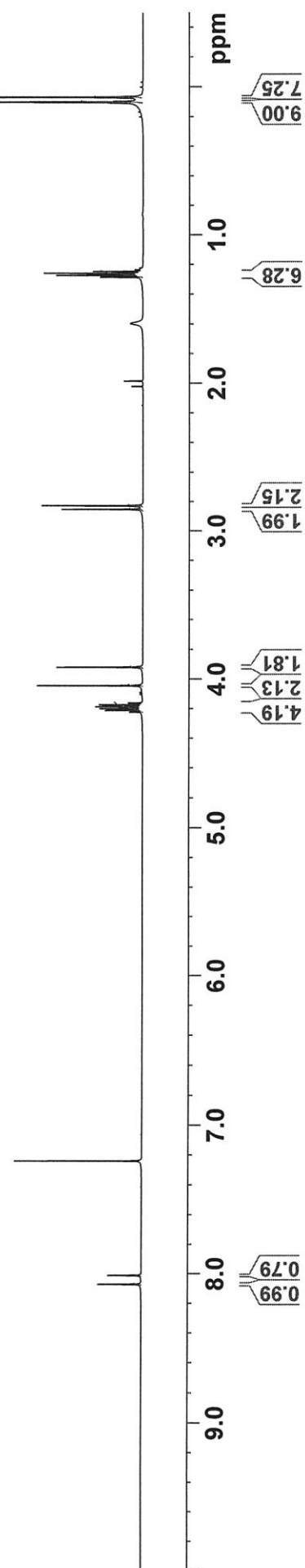
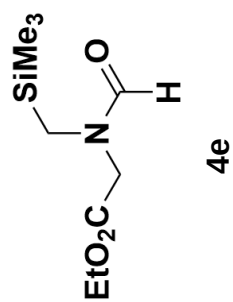
8.072
8.012

4.223
4.211
4.199
4.186
4.174
4.162
4.044
3.919

2.852
2.827

1.285
1.273
1.270
1.261
1.258
1.246

0.101
0.068



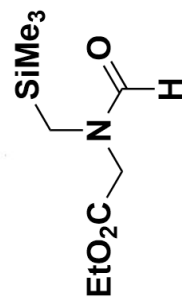
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

168.82
168.21
162.78
162.40

51.08
46.42
39.50
35.76

14.02

-1.68
-2.24

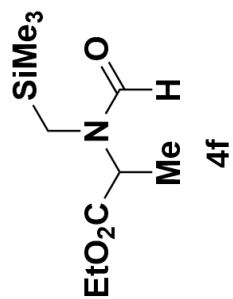


4e



¹H NMR (CDCl₃, 600 MHz)

8.115
8.074

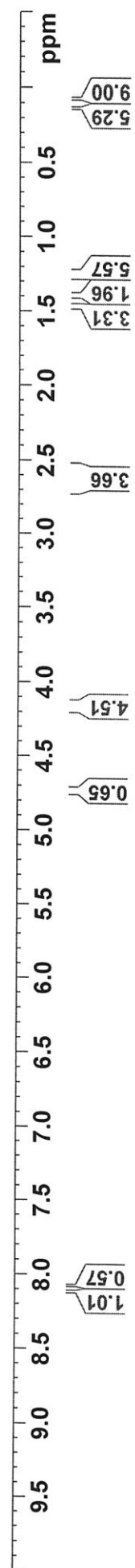


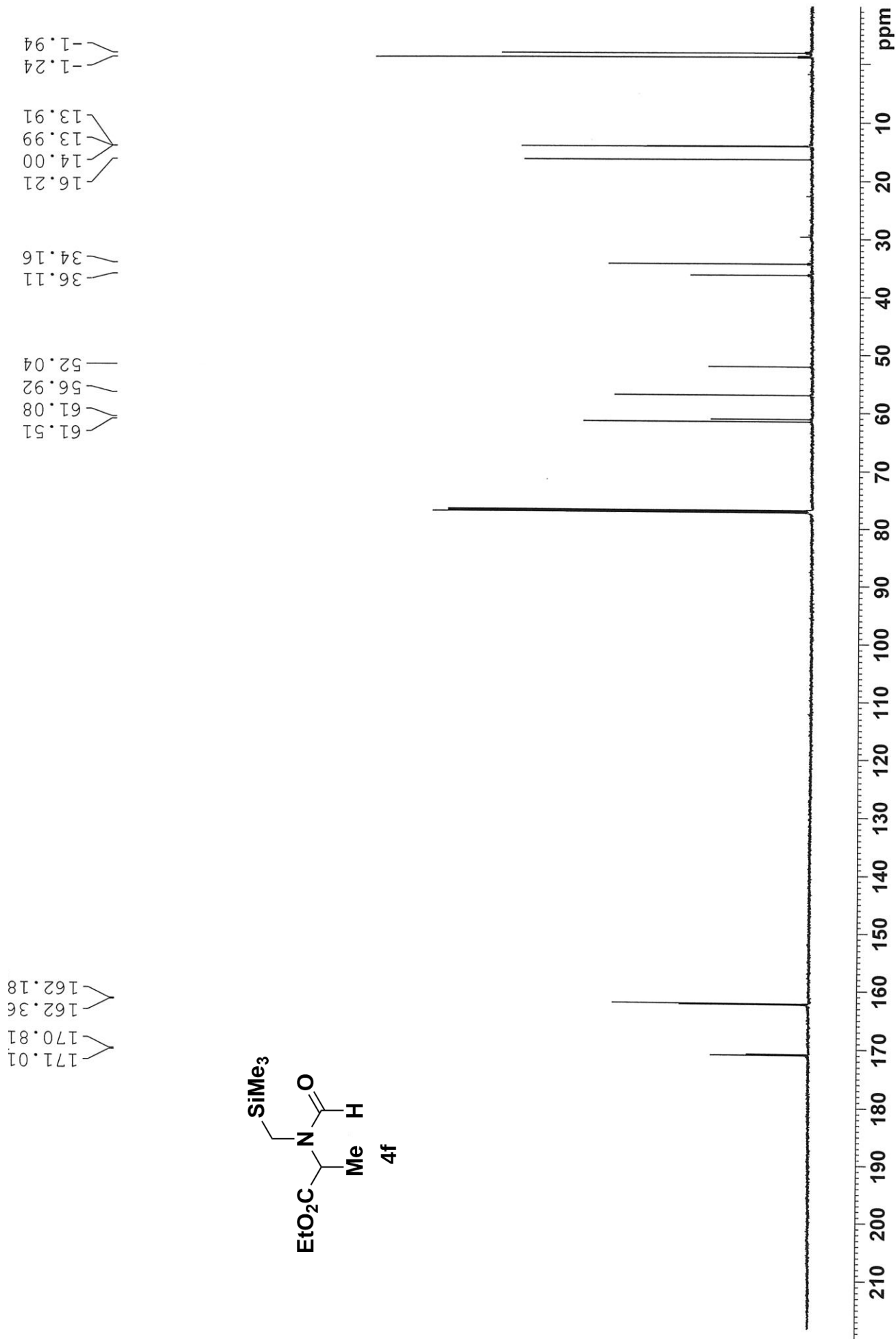
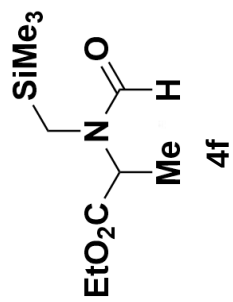
0.136
0.072

1.472
1.460
1.398
1.386
1.270
1.258
1.255
1.246
1.243
1.232

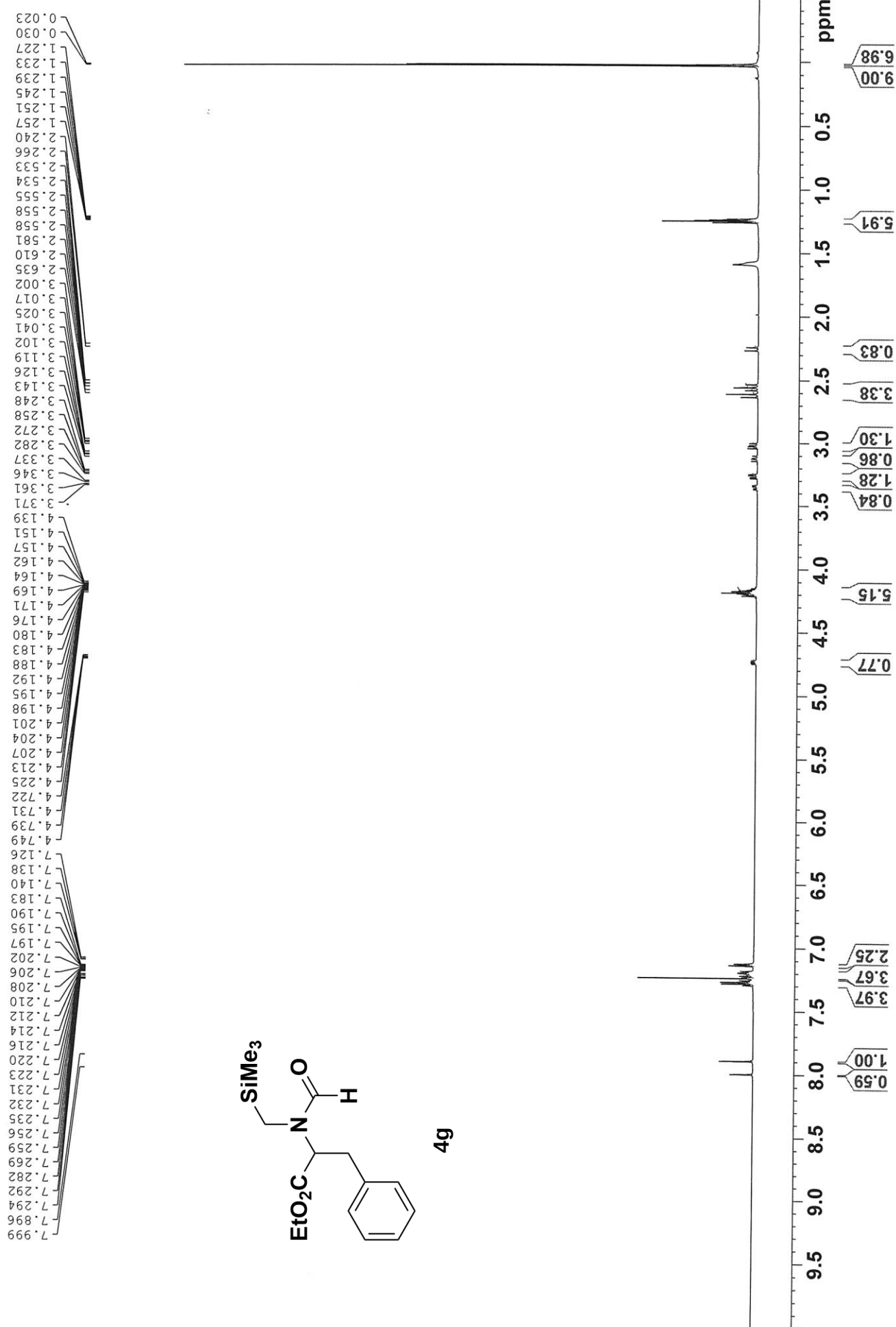
2.713
2.687
2.682
2.657
2.617
2.591
2.558
2.533

4.754
4.742
4.730
4.718
4.195
4.190
4.183
4.177
4.171
4.165
4.159
4.154
4.143
4.131





¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

170.01
169.91
162.48
162.40

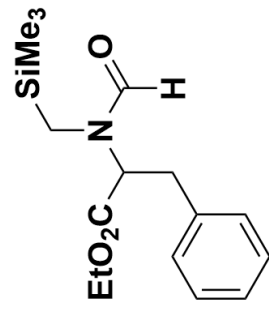
137.00
136.08
128.87
128.85
128.74
128.44
127.08
126.64

63.43
61.64
61.27
58.65

37.73
35.97
34.64
34.11

14.04
14.00

-1.05
-2.00

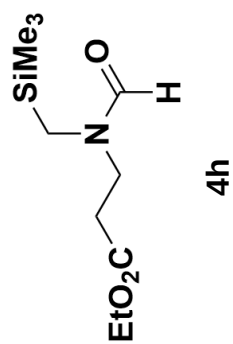


4g



¹H NMR (CDCl₃, 300 MHz)

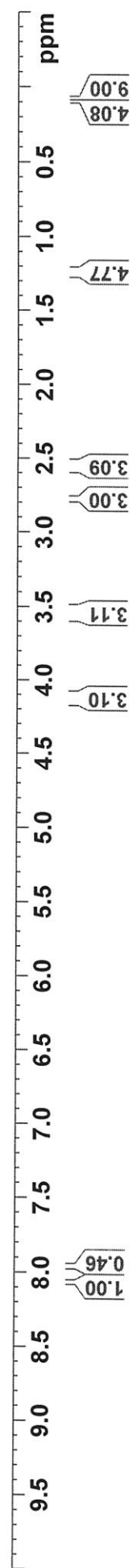
8.063
7.956



0.095
0.073

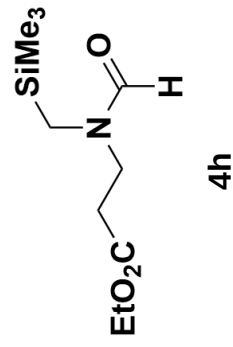
1.263
1.260
1.239
1.236
1.215
1.213

4.166
4.154
4.142
4.131
4.118
4.107
4.094
4.083
3.588
3.565
3.541
3.518
3.496
2.780
2.772
2.590
2.567
2.557
2.543
2.535
2.512



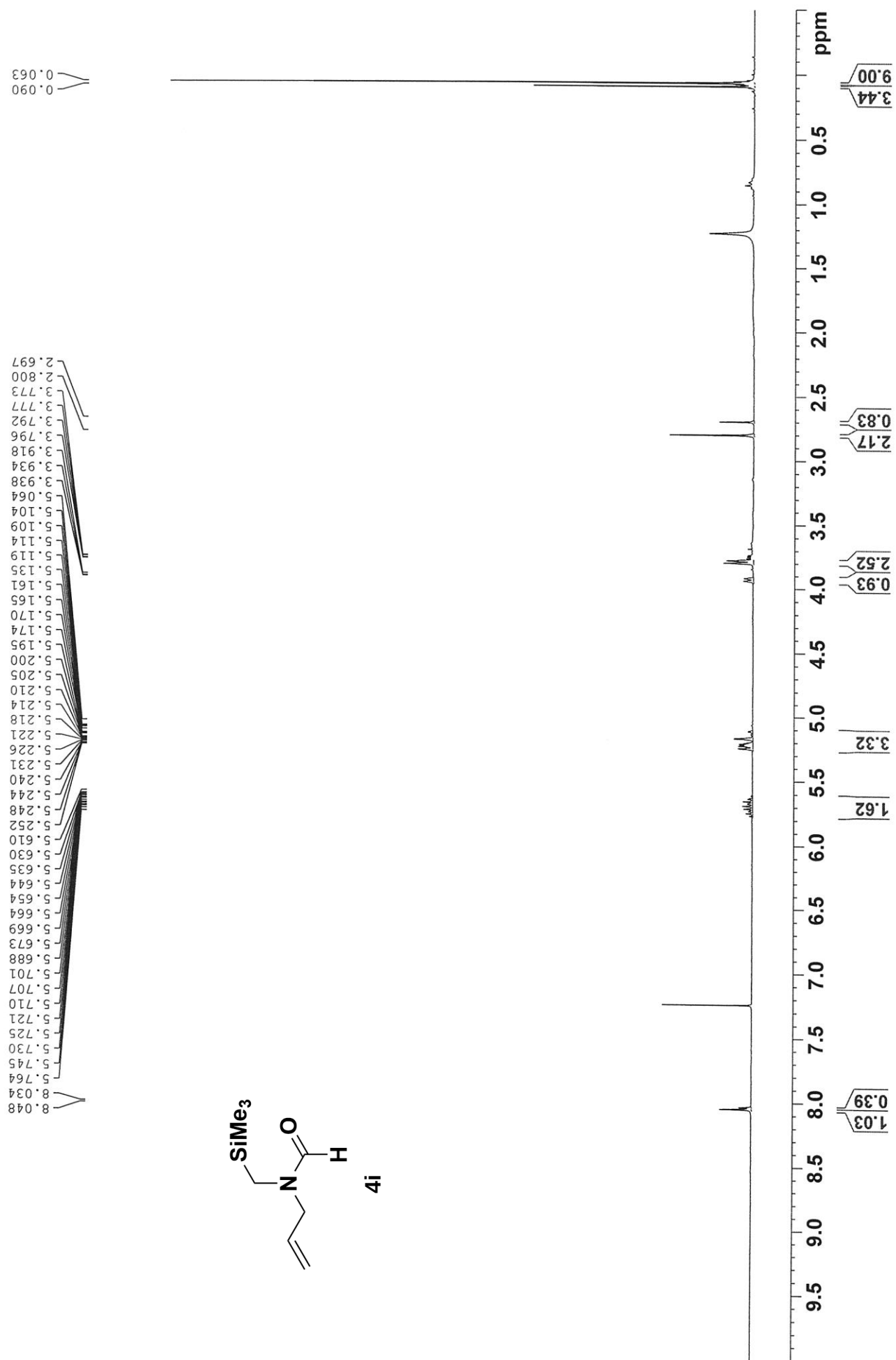
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

171.54
170.66
162.27
161.90

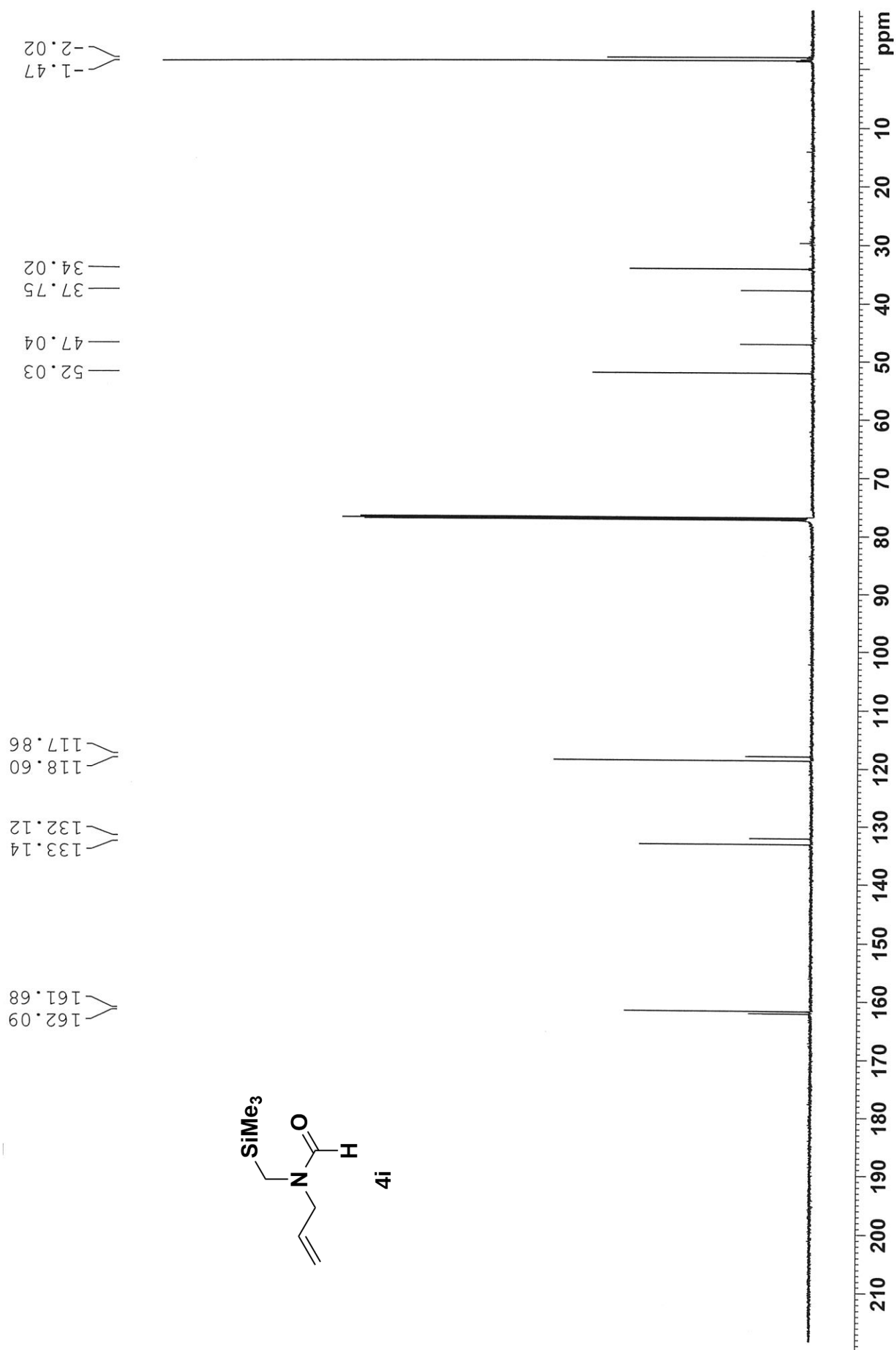


60.85
60.57
45.06
41.23
39.06
33.84
33.04
31.96
14.03
-1.53
-2.22



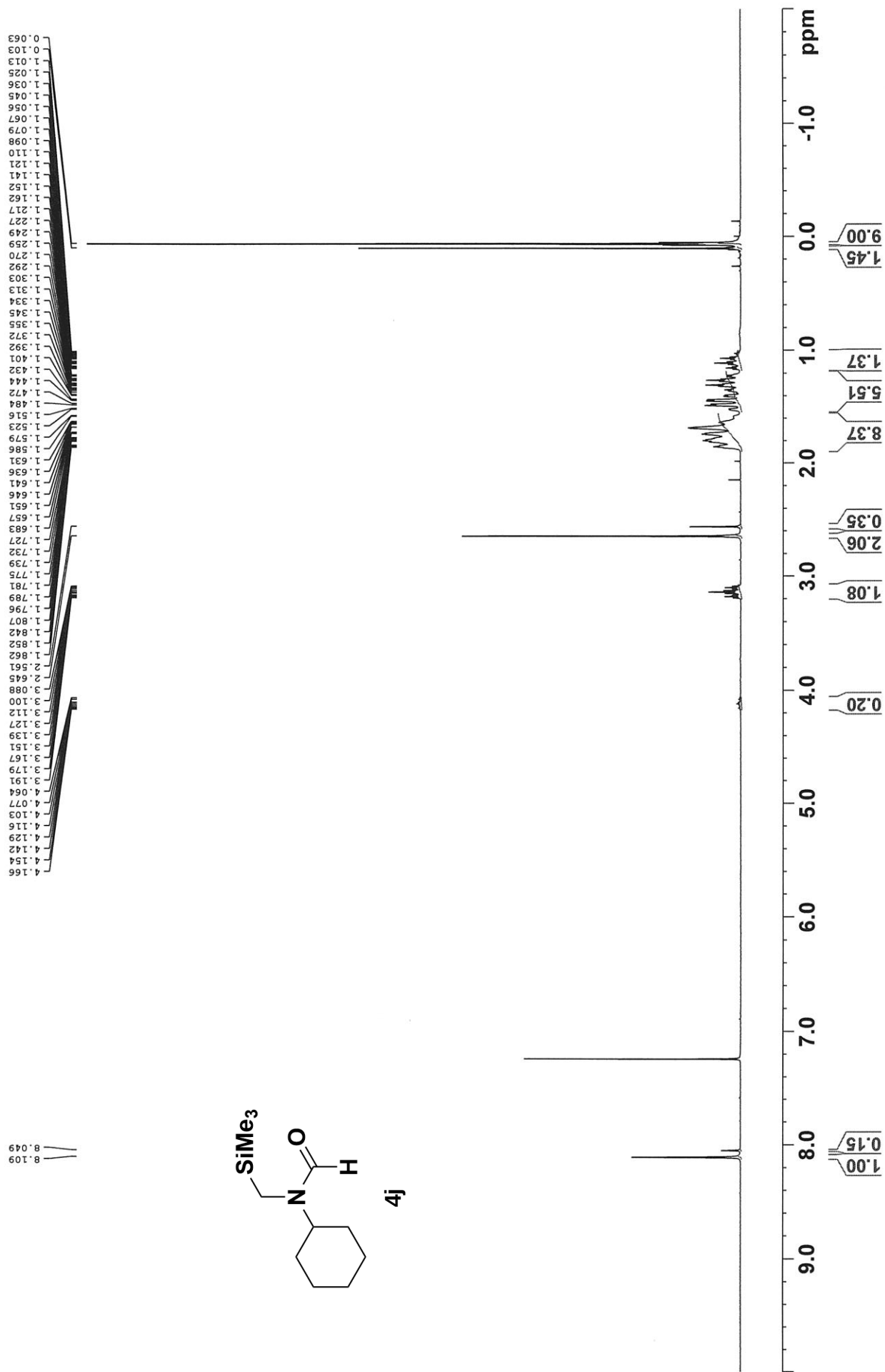
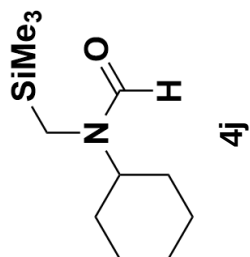


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



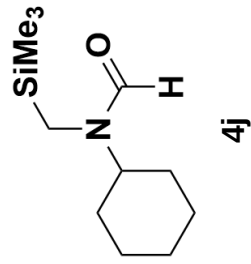
¹H NMR (CDCl₃, 300 MHz)

8.109
8.049



^{13}C { ^1H } NMR (CDCl₃, 150 MHz)

162.32
161.11

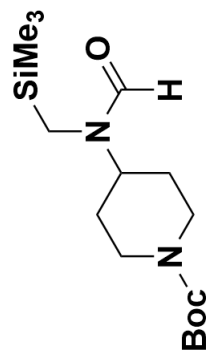


58.97
52.22
33.86
33.27
32.07
29.51
25.61
25.43
25.25
25.05
-1.25
-1.78

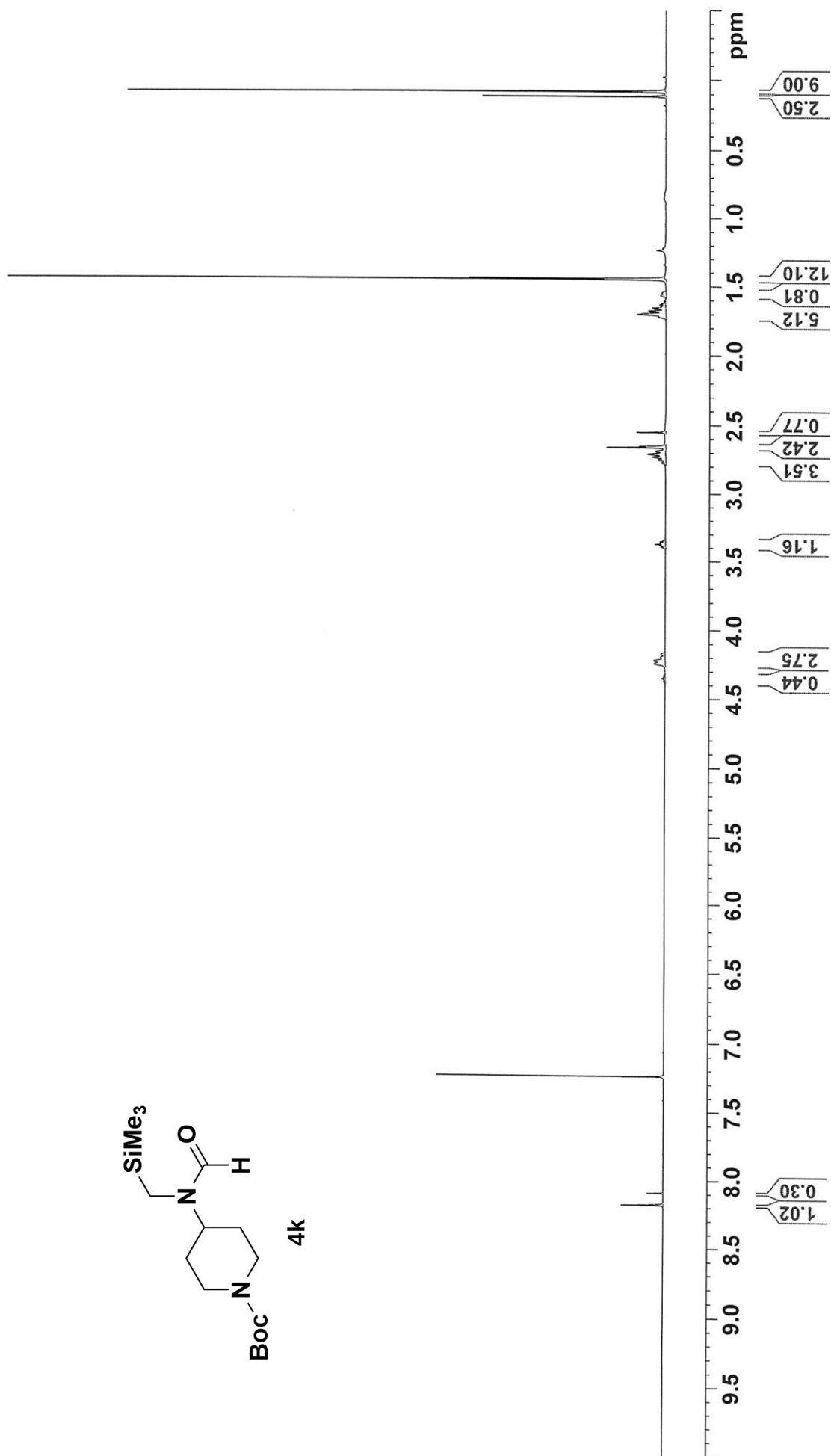


¹H NMR (CDCl₃, 600 MHz)

8.179
8.090



4.377
4.371
4.364
4.357
4.351
4.344
4.337
4.331
4.324
4.242
4.221
4.197
4.174
3.400
3.393
3.381
3.374
3.366
3.362
3.354
3.347
2.773
2.769
2.748
2.727
2.708
2.690
2.685
2.661
2.652
2.550
1.718
1.700
1.694
1.681
1.674
1.653
1.643
1.631
1.623
1.610
1.603
1.562
1.552
1.545
1.448
1.441
0.116
0.081



^{13}C { ^1H } NMR (CDCl₃, 150 MHz)

162.58
161.25
154.48
154.42

79.86
79.58

57.23

50.35

43.07

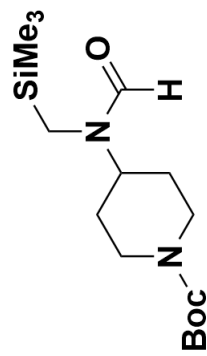
33.78

33.24

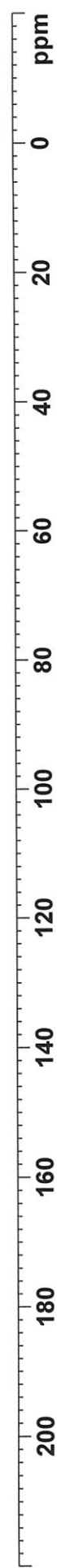
30.95

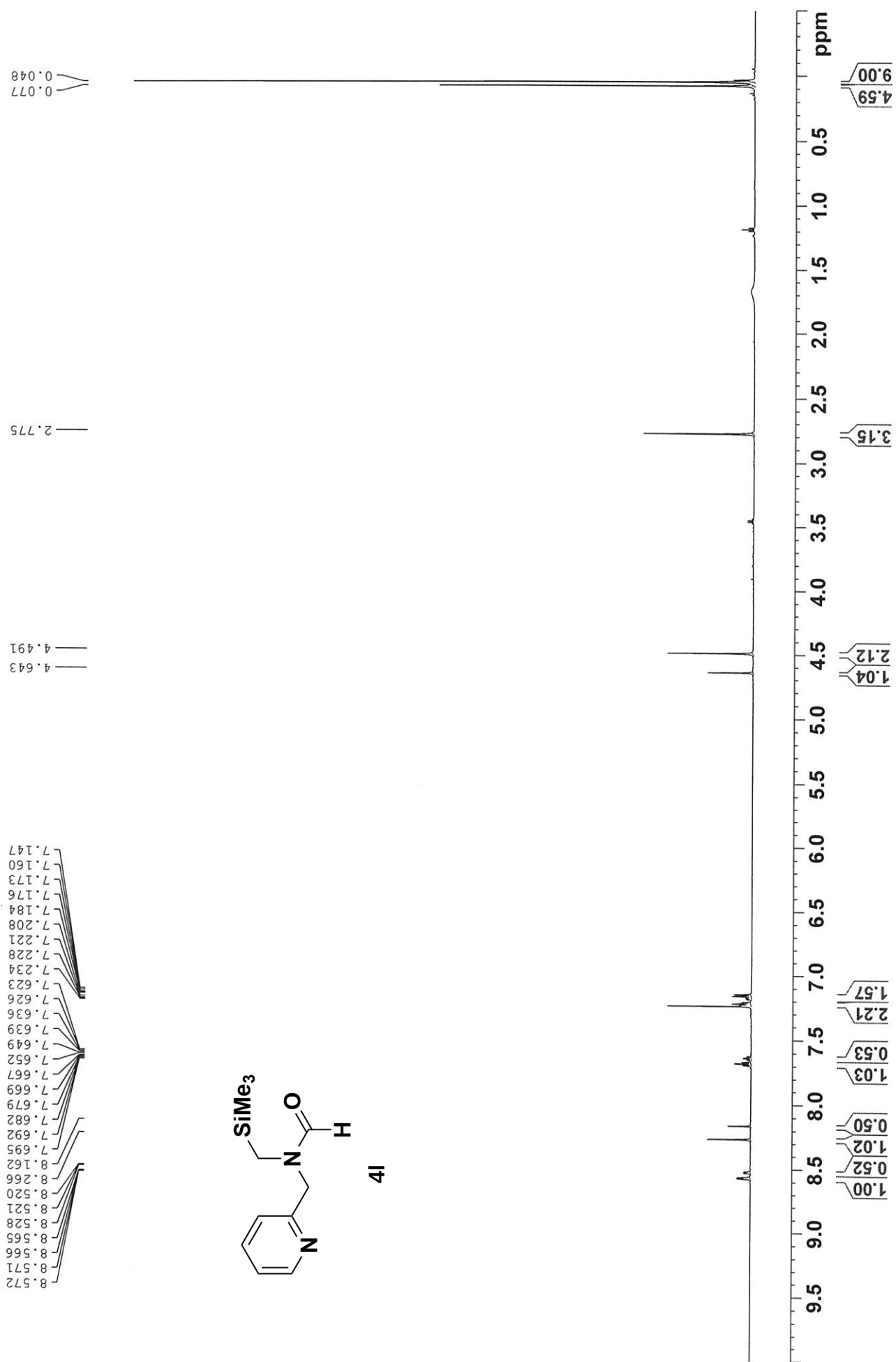
28.29

-1.11
-1.71

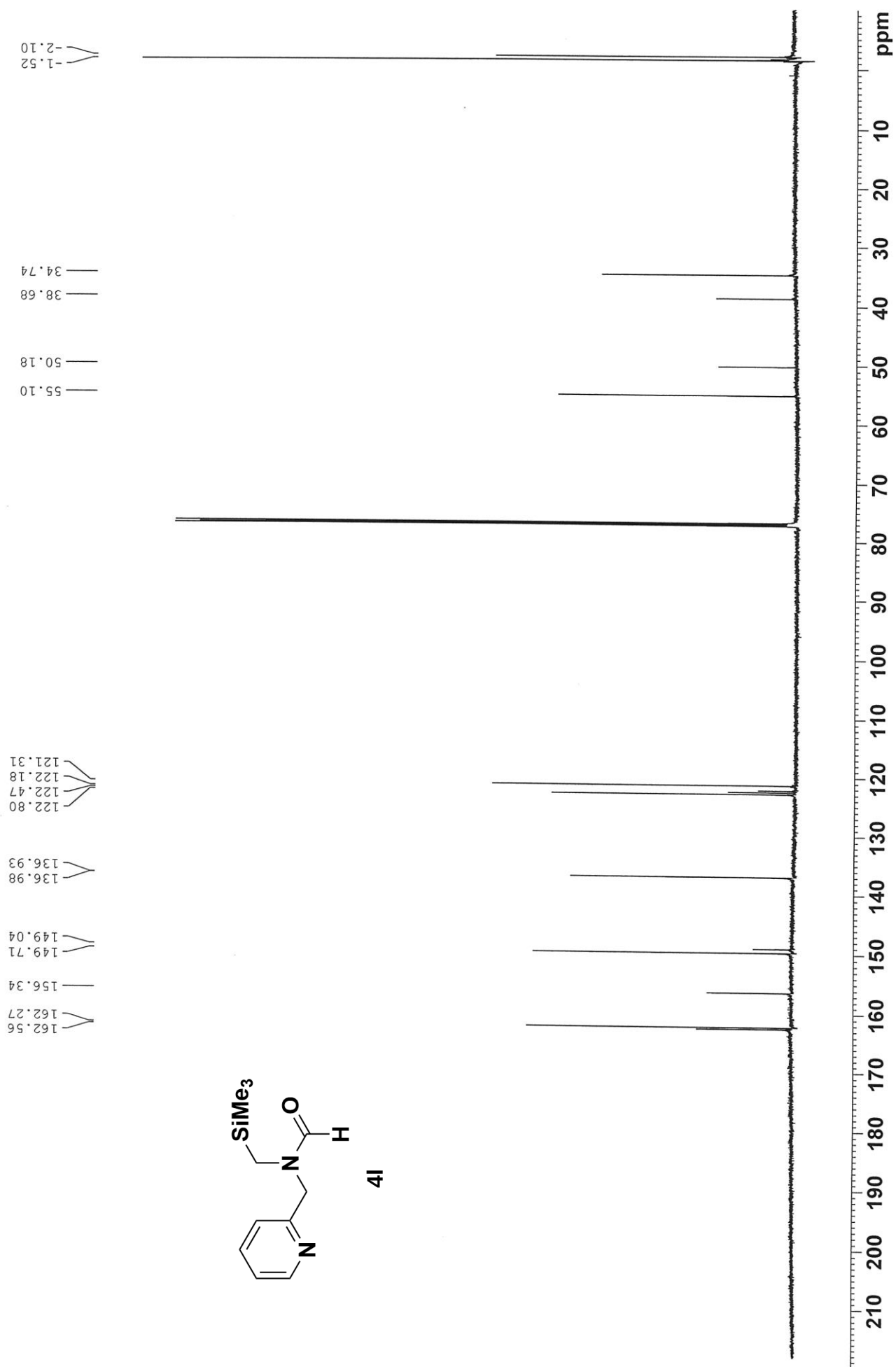
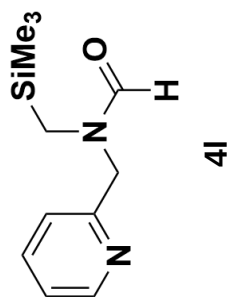


4k

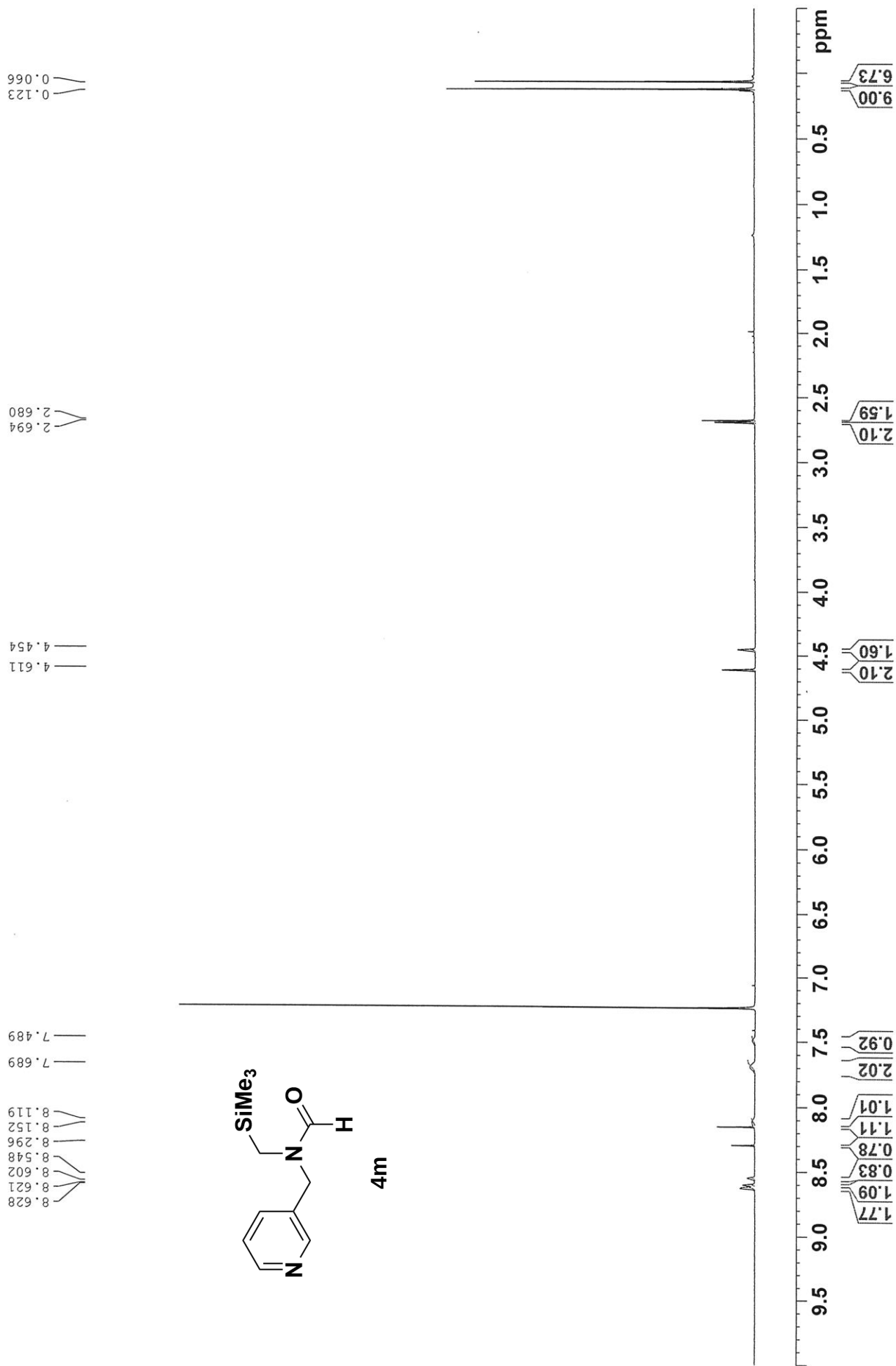


¹H NMR (CDCl₃, 600 MHz)

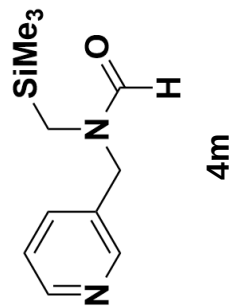
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



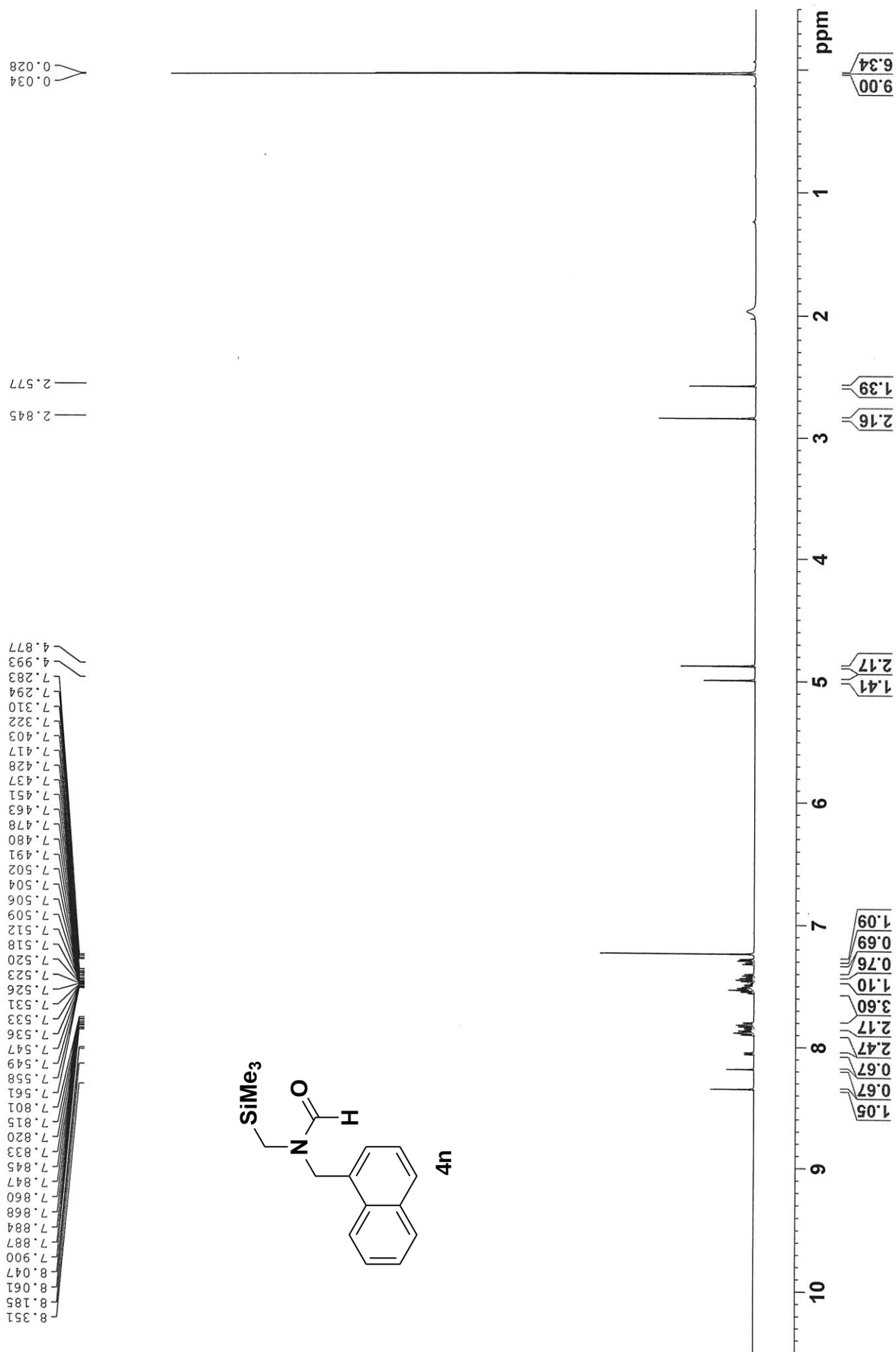
162.50
161.60
149.60
149.30
149.09
149.01
135.97
135.03
132.04
131.53
123.74
123.71

50.84
45.65
37.85
34.06

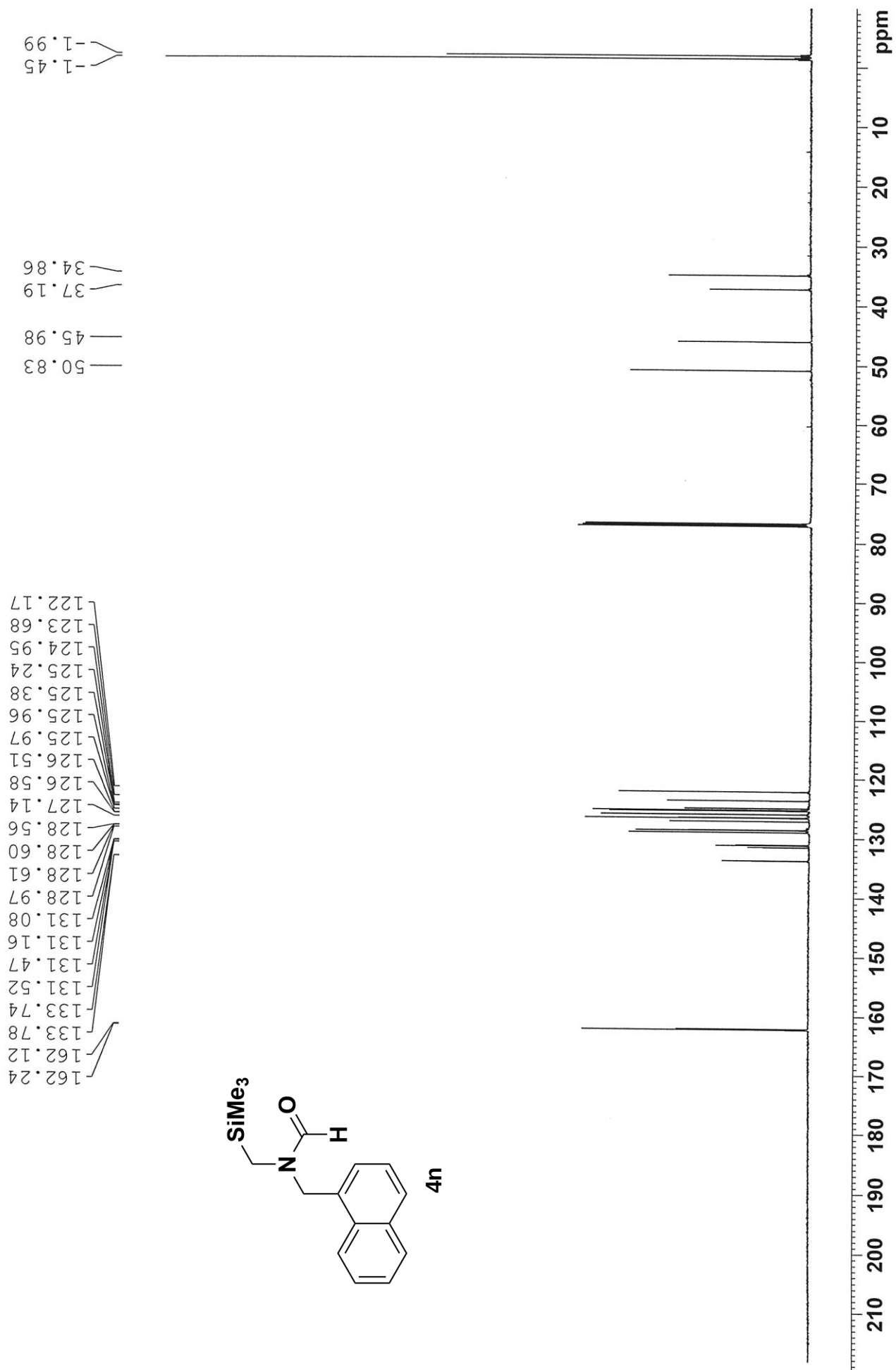
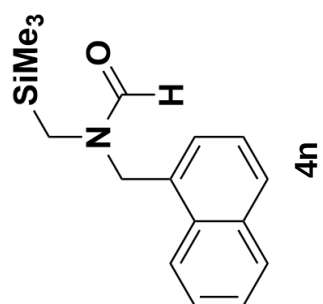
-1.46
-2.01

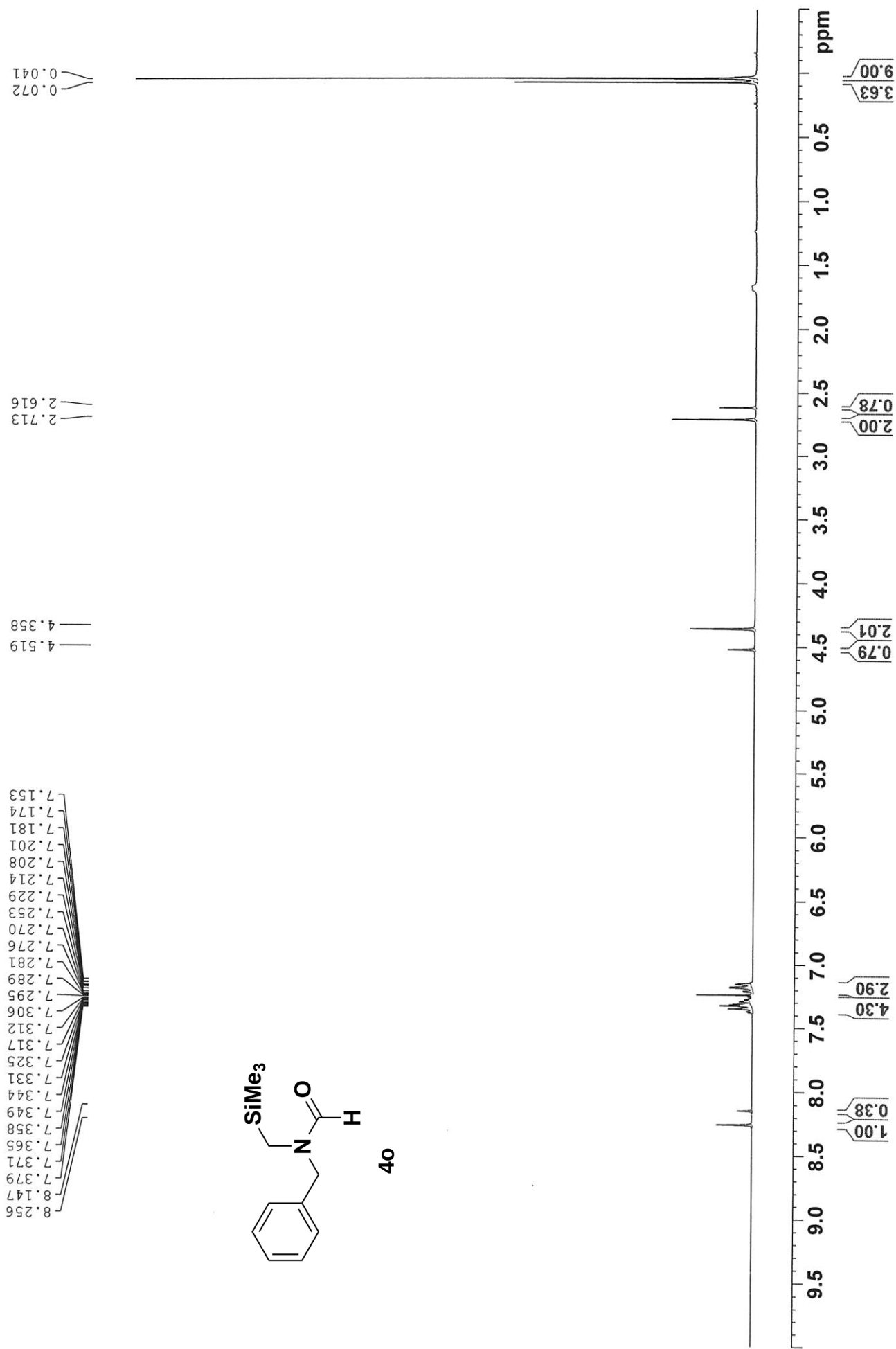
ppm

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

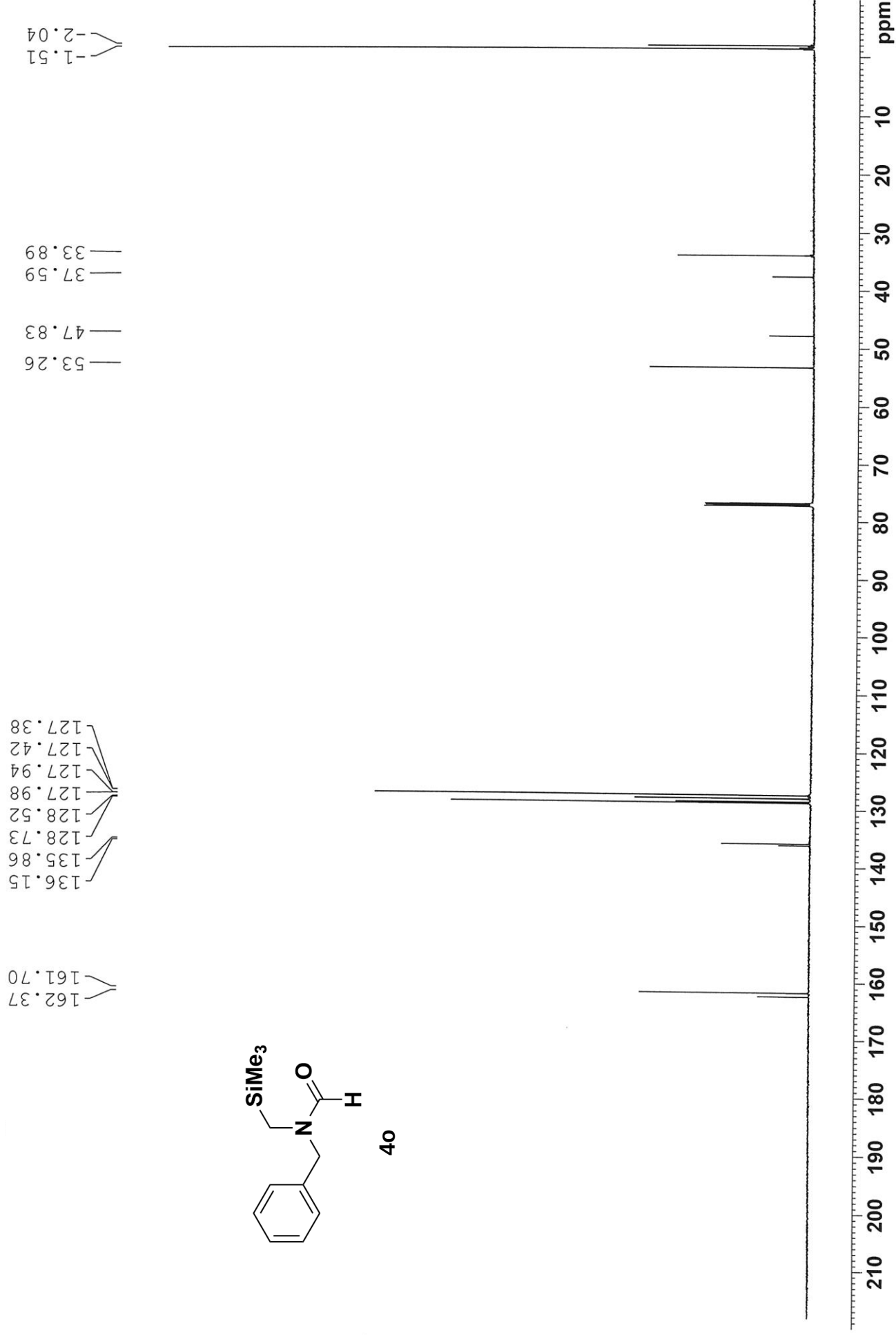
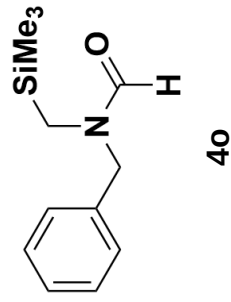
¹H NMR (CDCl₃, 600 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

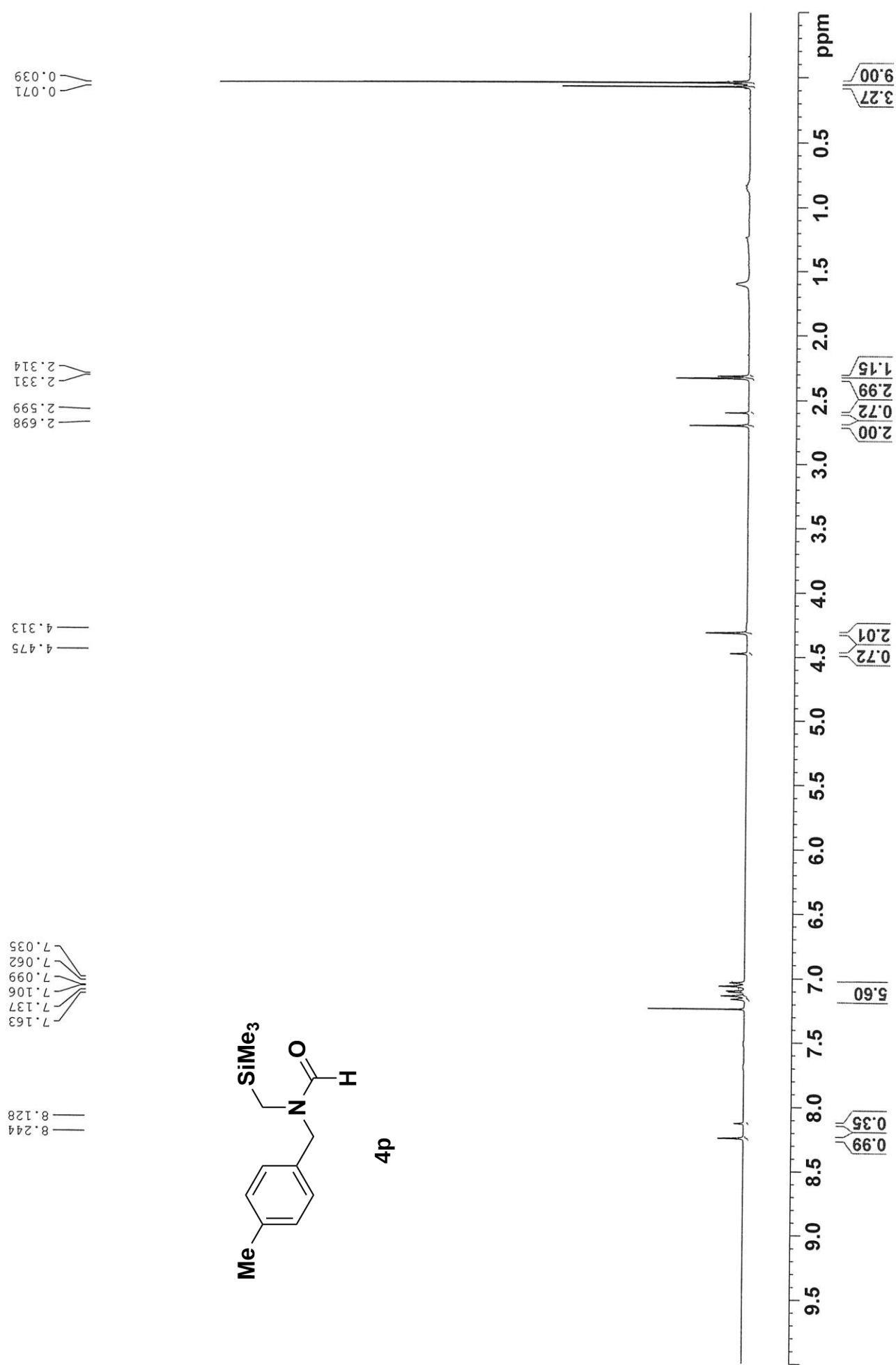


^1H NMR (CDCl_3 , 300 MHz)

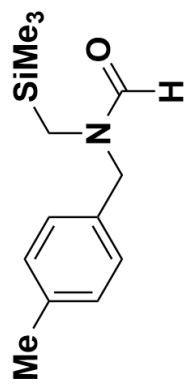
$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



4p

162.40
161.71

137.79
137.17
133.16
132.79
129.44
129.25
128.07
127.43

53.08
47.58

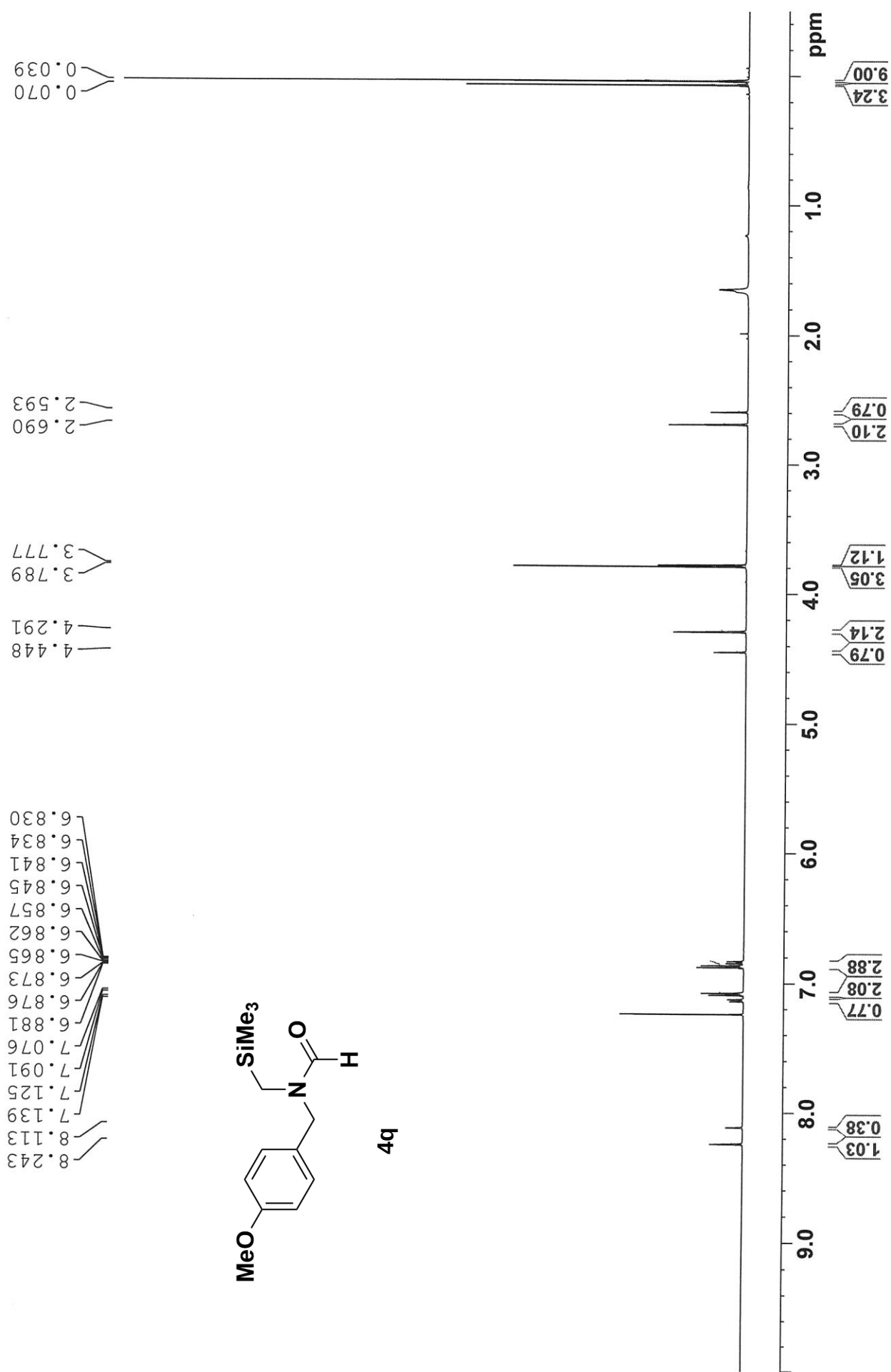
37.52
33.88
33.79

21.03

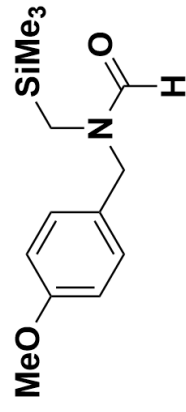
-1.45
-1.97



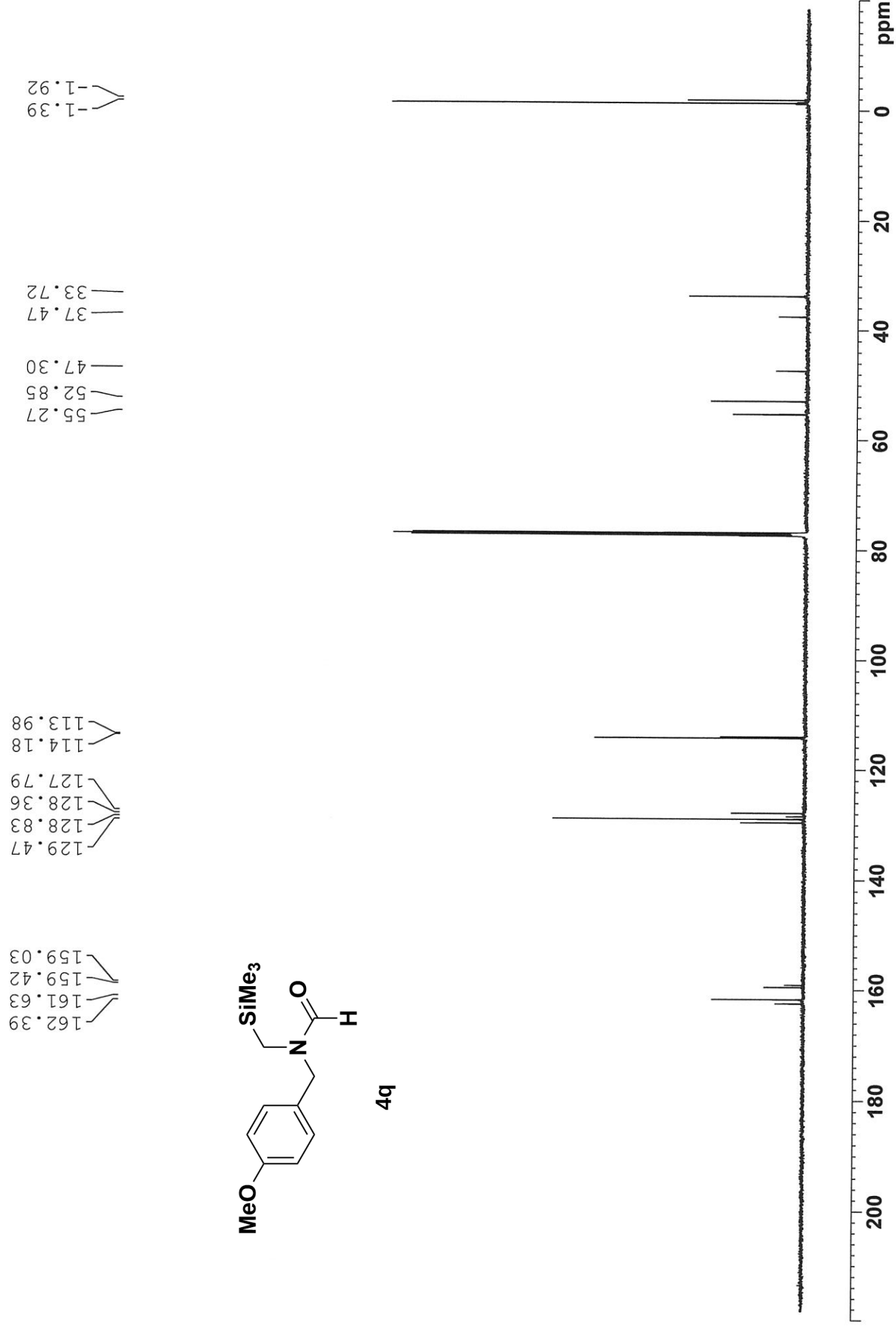
¹H NMR (CDCl₃, 600 MHz)

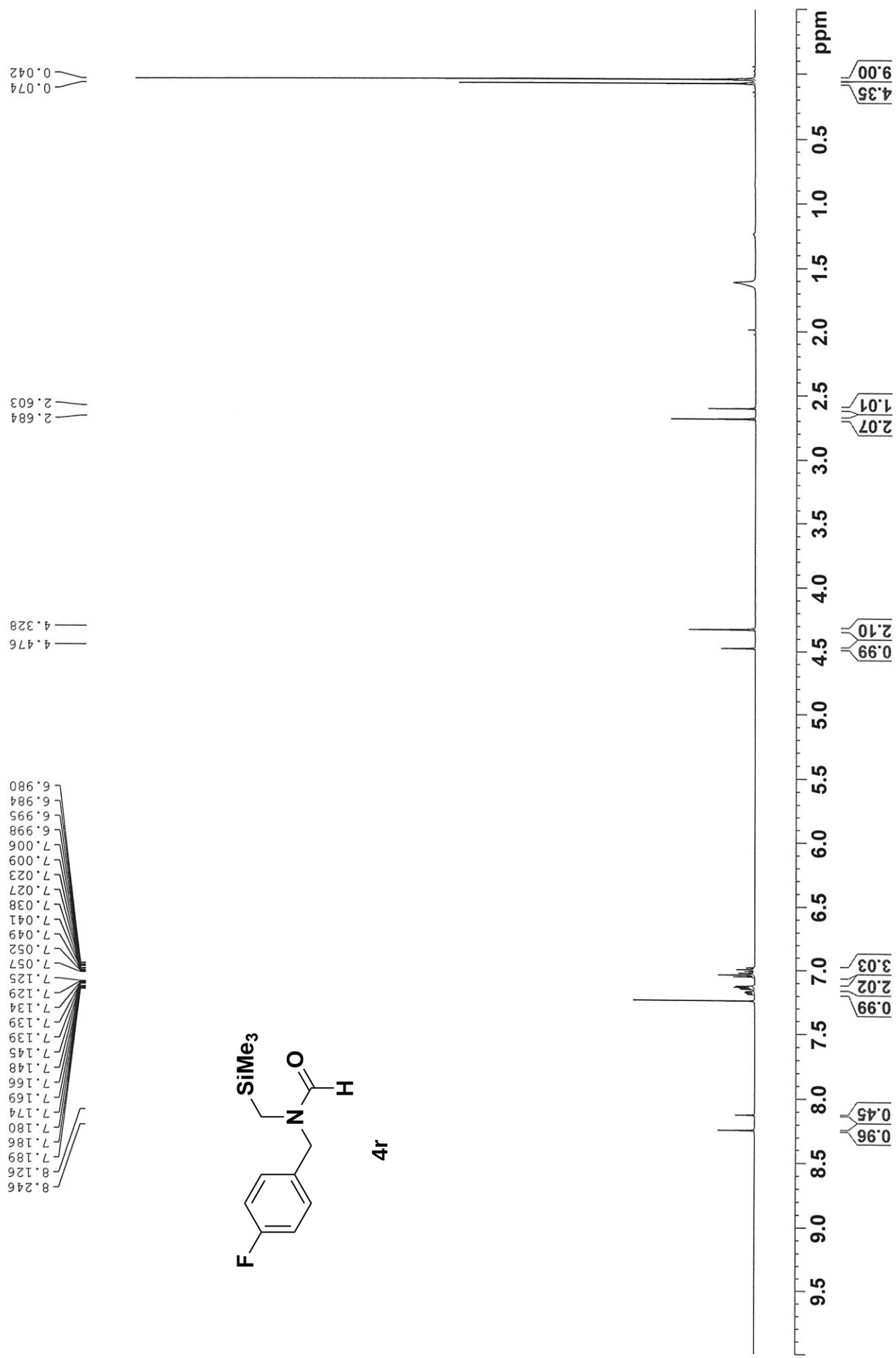


$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

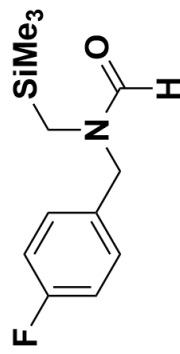


4q



¹H NMR (CDCl₃, 600 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



4r

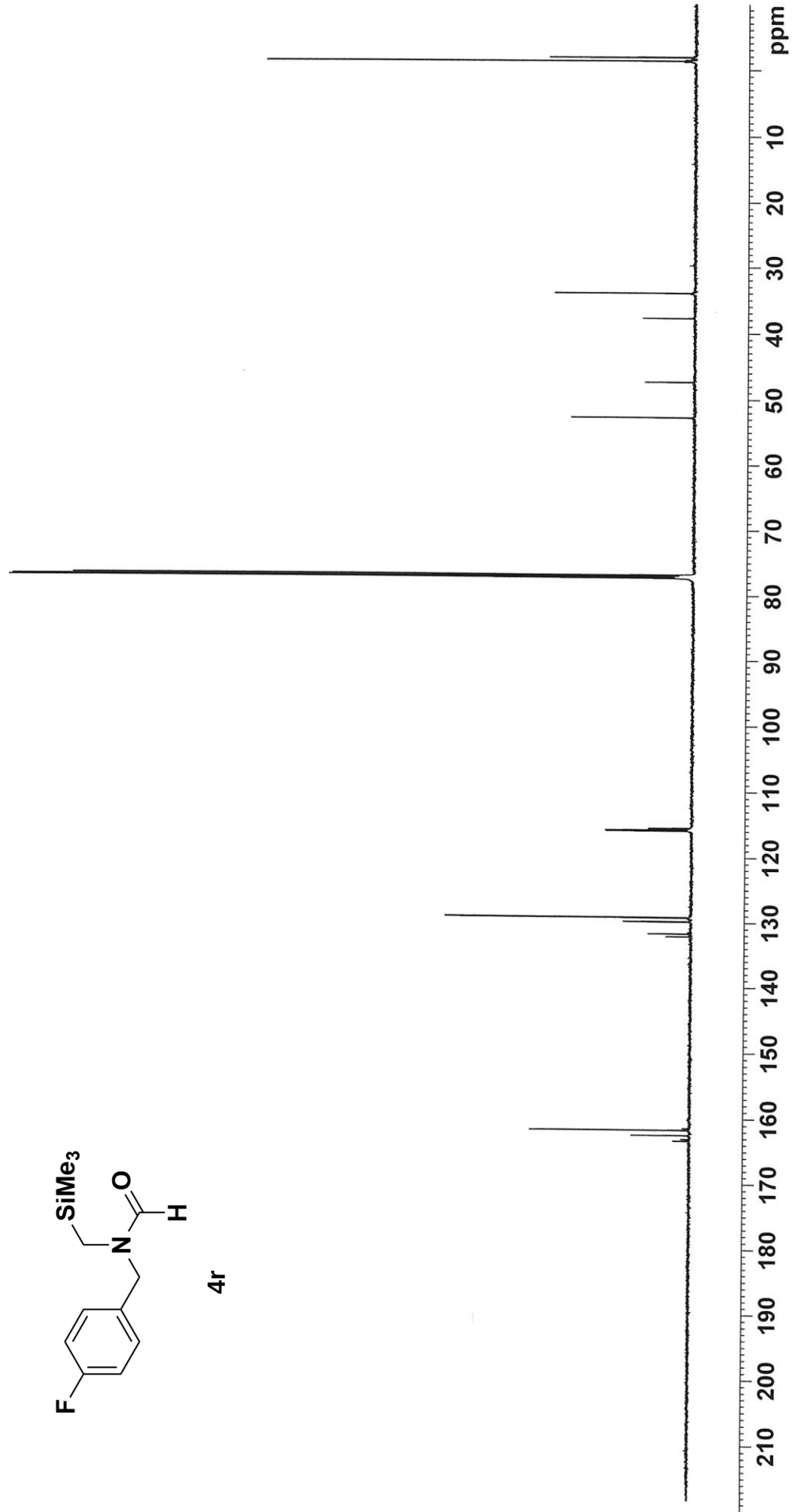
163.30
163.02
162.47
161.69
161.40

132.11
132.09
131.67
129.81
129.76
129.20
129.15
115.86
115.71
115.57
115.43

52.68
47.31

37.69
33.91

-1.41
-1.96



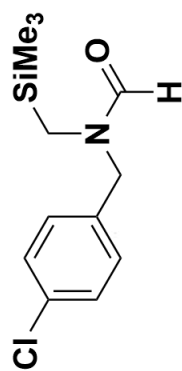
¹H NMR (CDCl₃, 300 MHz)

8.240
8.133
8.133
7.345
7.337
7.331
7.315
7.309
7.309
7.300
7.295
7.289
7.274
7.267
7.259
7.159
7.151
7.145
7.130
7.123
7.114
7.107
7.092
7.085
7.077

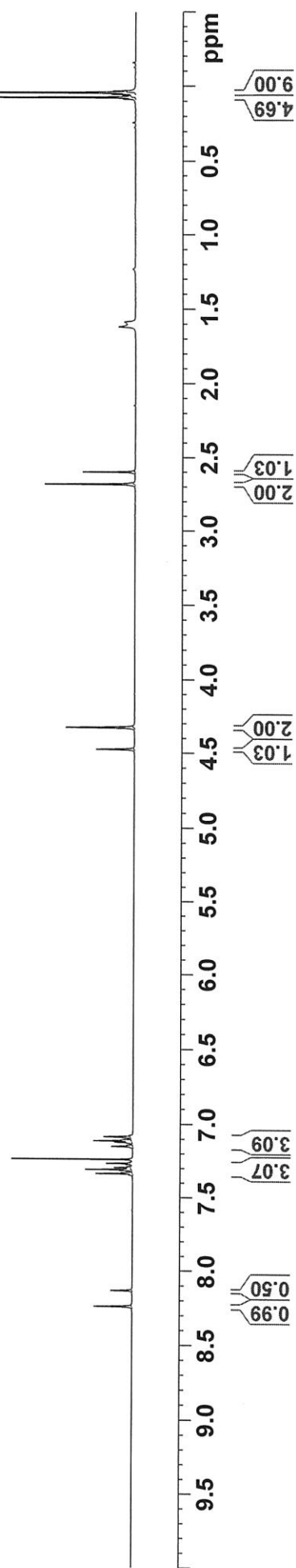
4.476
4.329

2.682
2.600

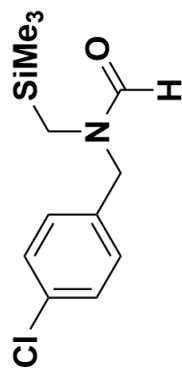
0.075
0.043



4s



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



4s

162.37
161.63

134.76
134.42
133.78
133.22
129.35
128.91
128.72
128.68

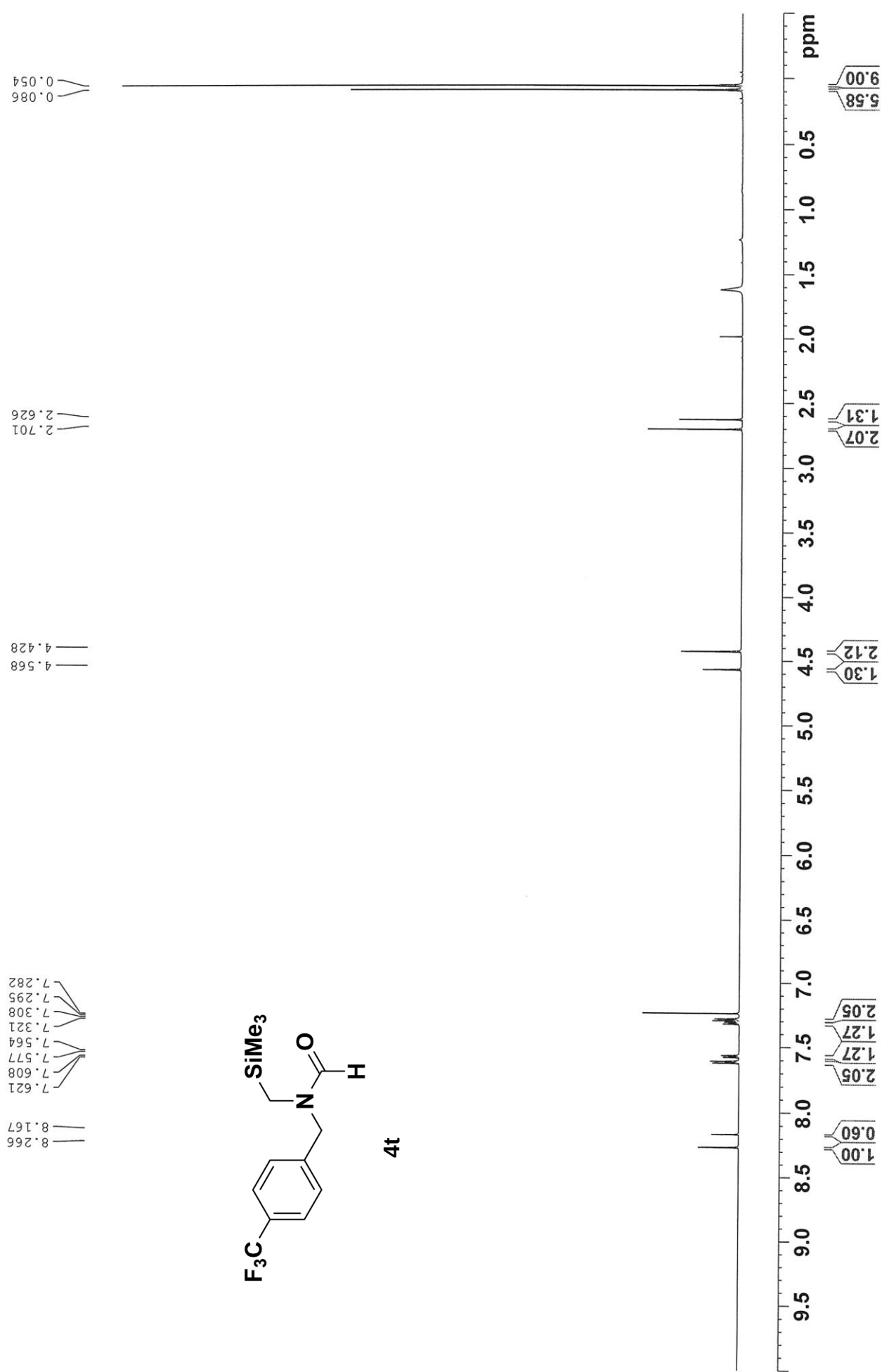
52.59
47.28

37.67
33.89

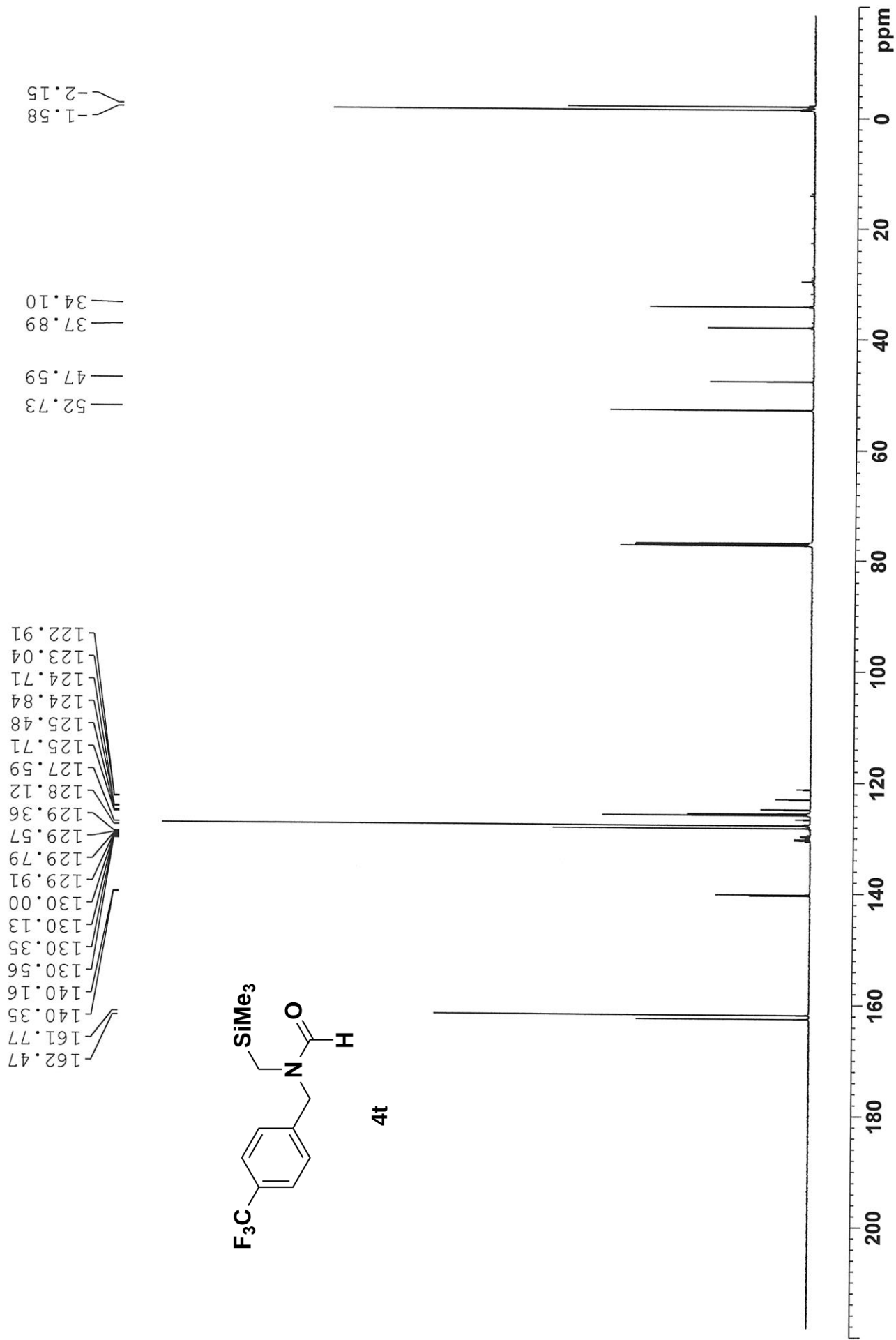
1.50
-2.05



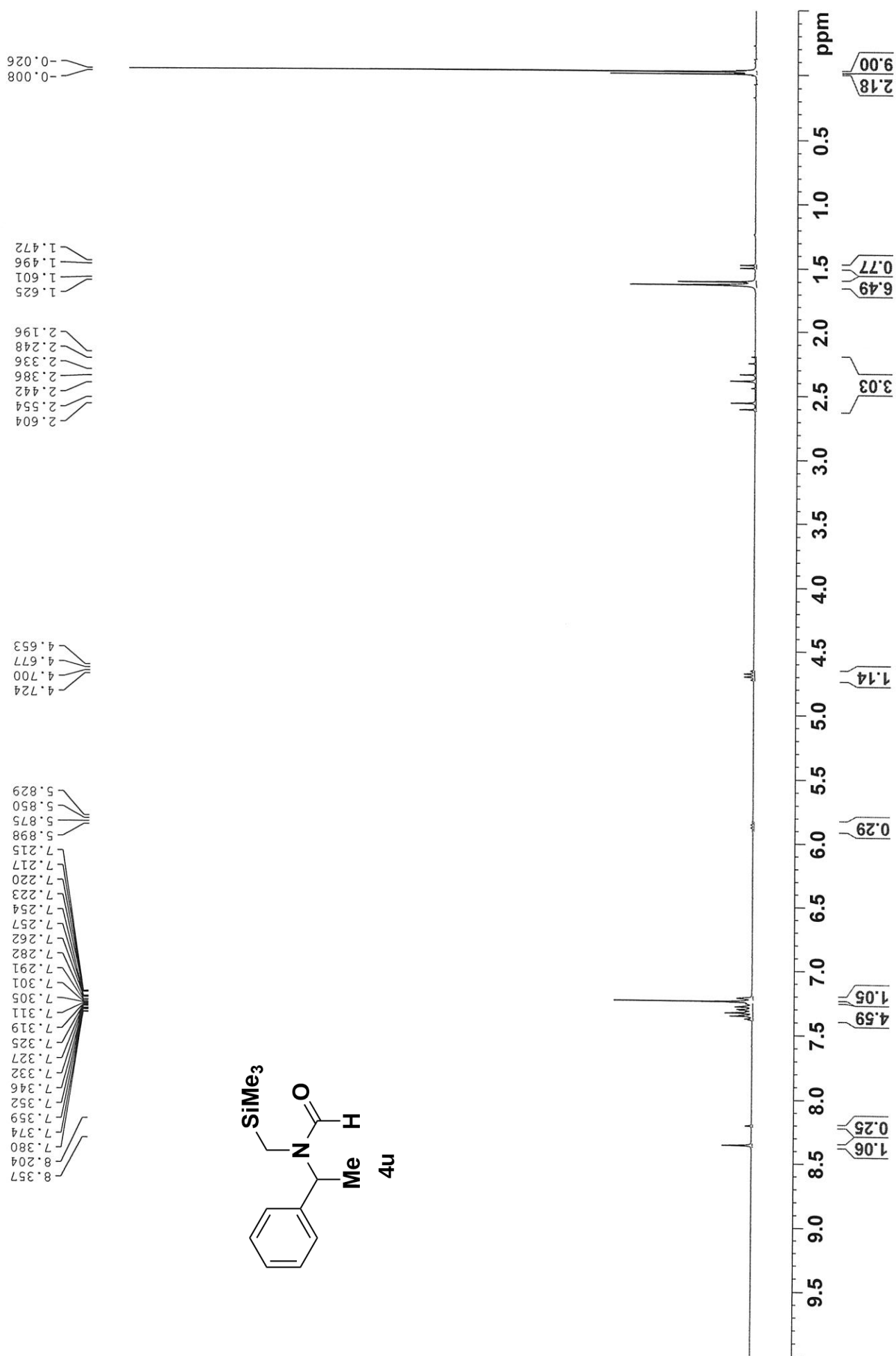
¹H NMR (CDCl₃, 600 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



¹H NMR (CDCl₃, 300 MHz)



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

162.57
161.38

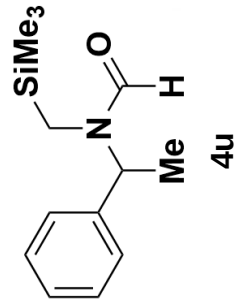
140.16
139.73
128.61
128.35
127.77
127.47
127.38
126.79

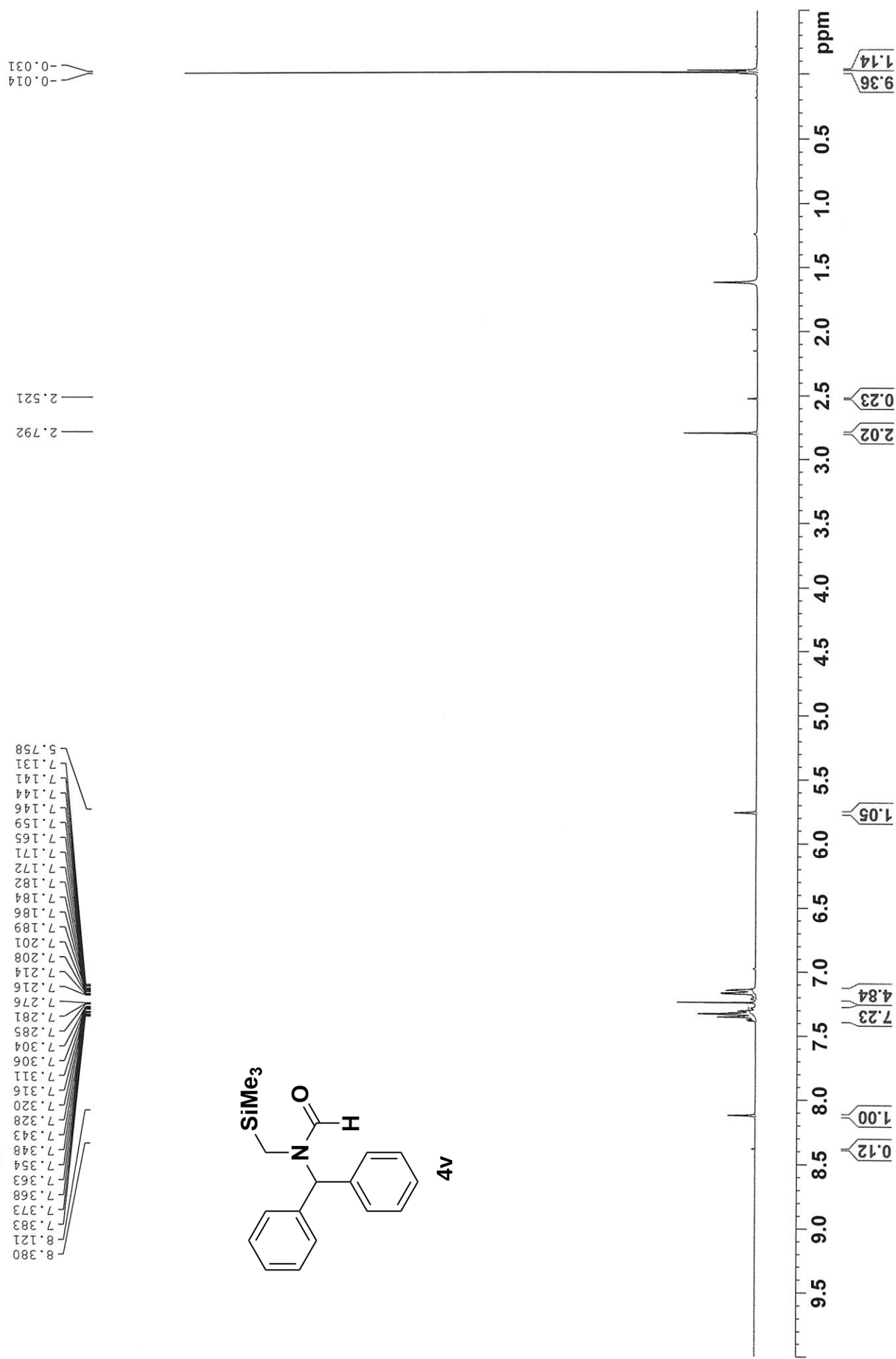
57.53
49.45

33.24
32.67

18.87
15.38

-1.13
-1.72



^1H NMR (CDCl_3 , 300 MHz)

$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

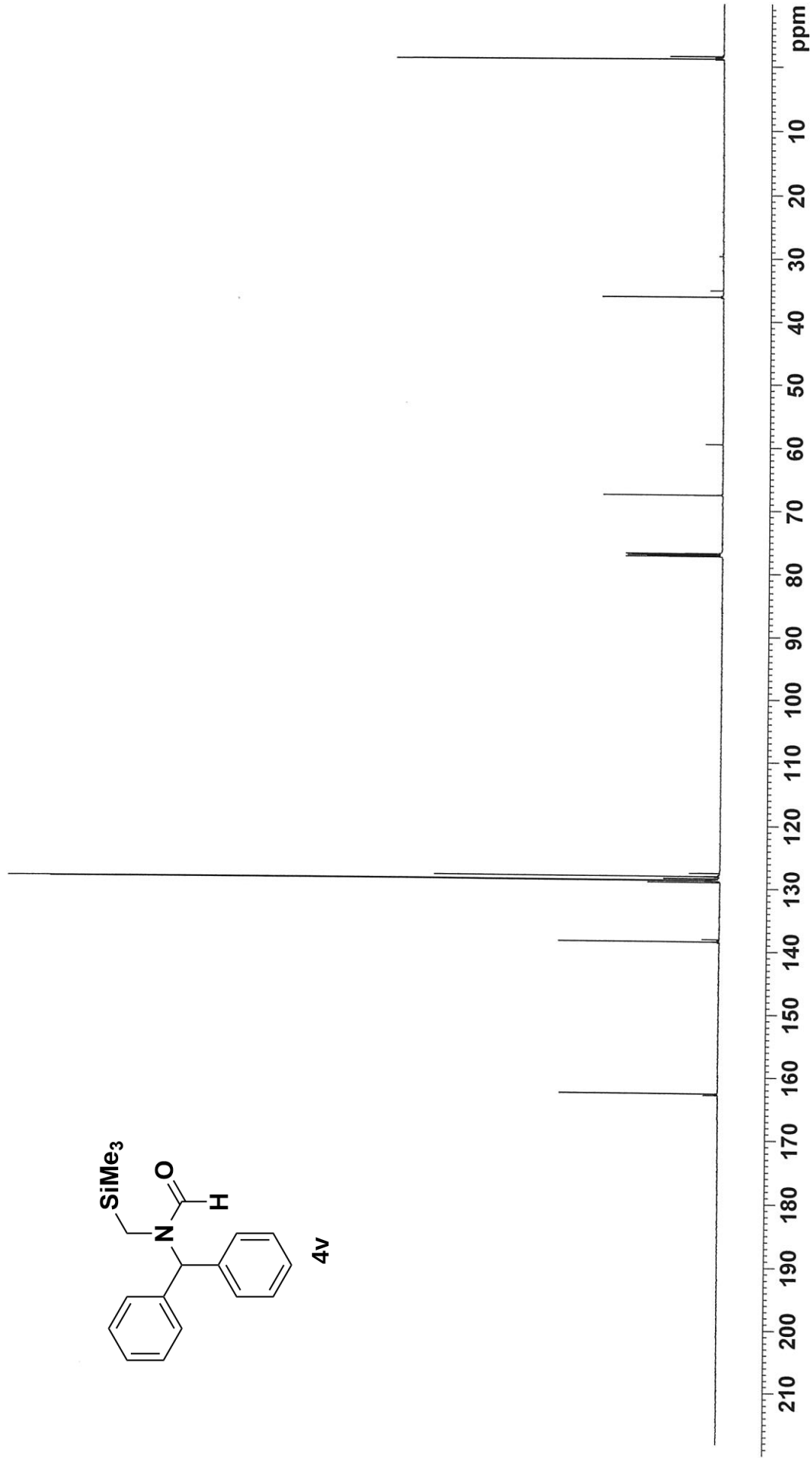
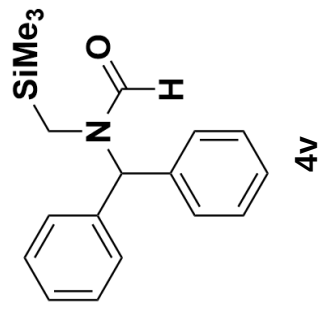
162.88
162.63

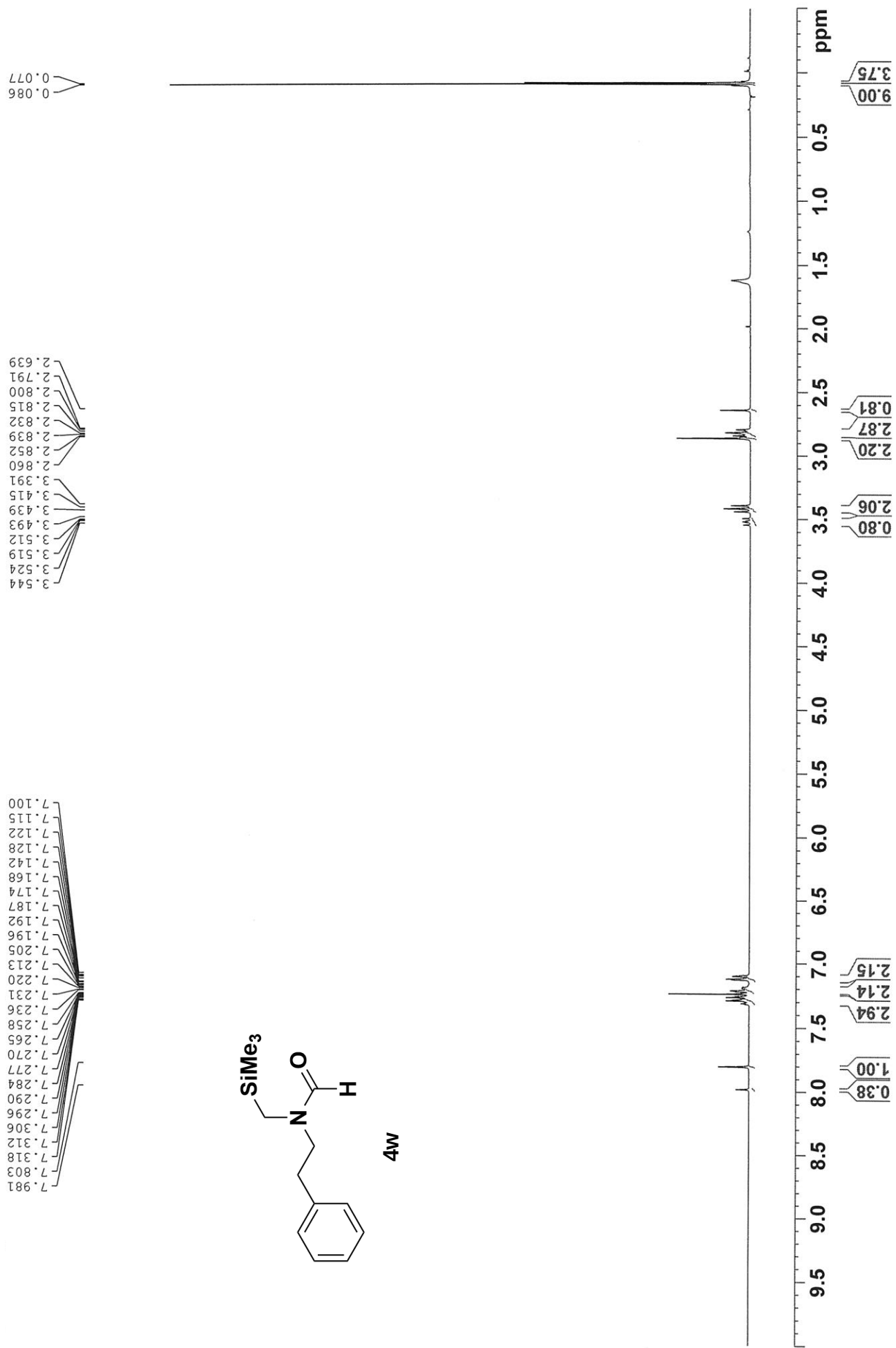
138.45
138.08
128.97
128.70
128.61
128.38
128.01
127.49

67.51
59.48

36.06
35.05

-1.25
-1.60



^1H NMR (CDCl_3 , 300 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

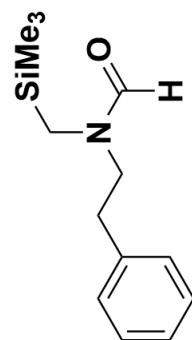
162.23
161.64

138.63
137.77
128.76
128.68
128.53
126.80
126.44

38.96
34.74
34.00
33.16

51.14
46.74

-1.40
-2.01



4w

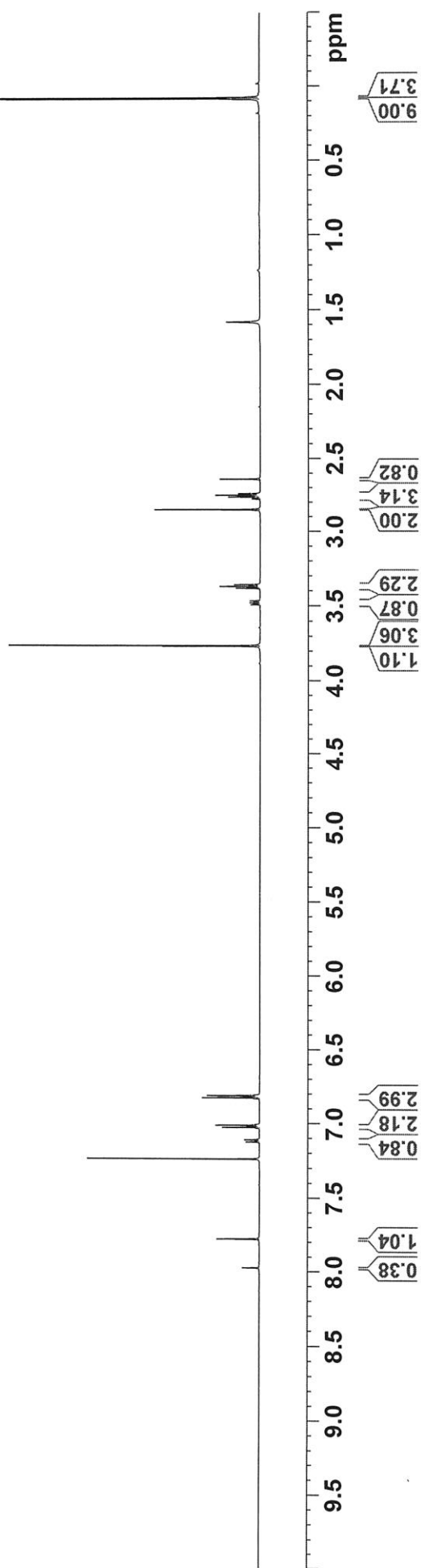
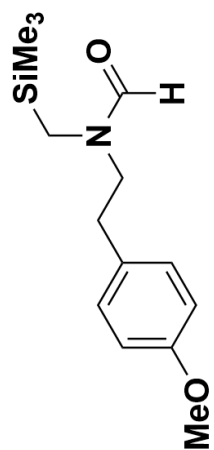


¹H NMR (CDCl₃, 600 MHz)

7.975
7.780
7.130
7.125
7.121
7.114
7.110
7.105
7.032
7.027
7.023
7.016
7.012
7.008
6.832
6.827
6.823
6.816
6.812
6.807

3.768
3.765
3.492
3.482
3.479
3.476
3.466
3.383
3.371
3.359
2.851
2.778
2.765
2.753
2.741
2.641

0.084
0.077



$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

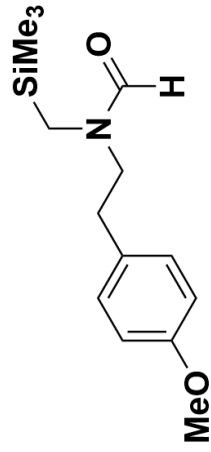
162.21
161.67
158.41
158.20

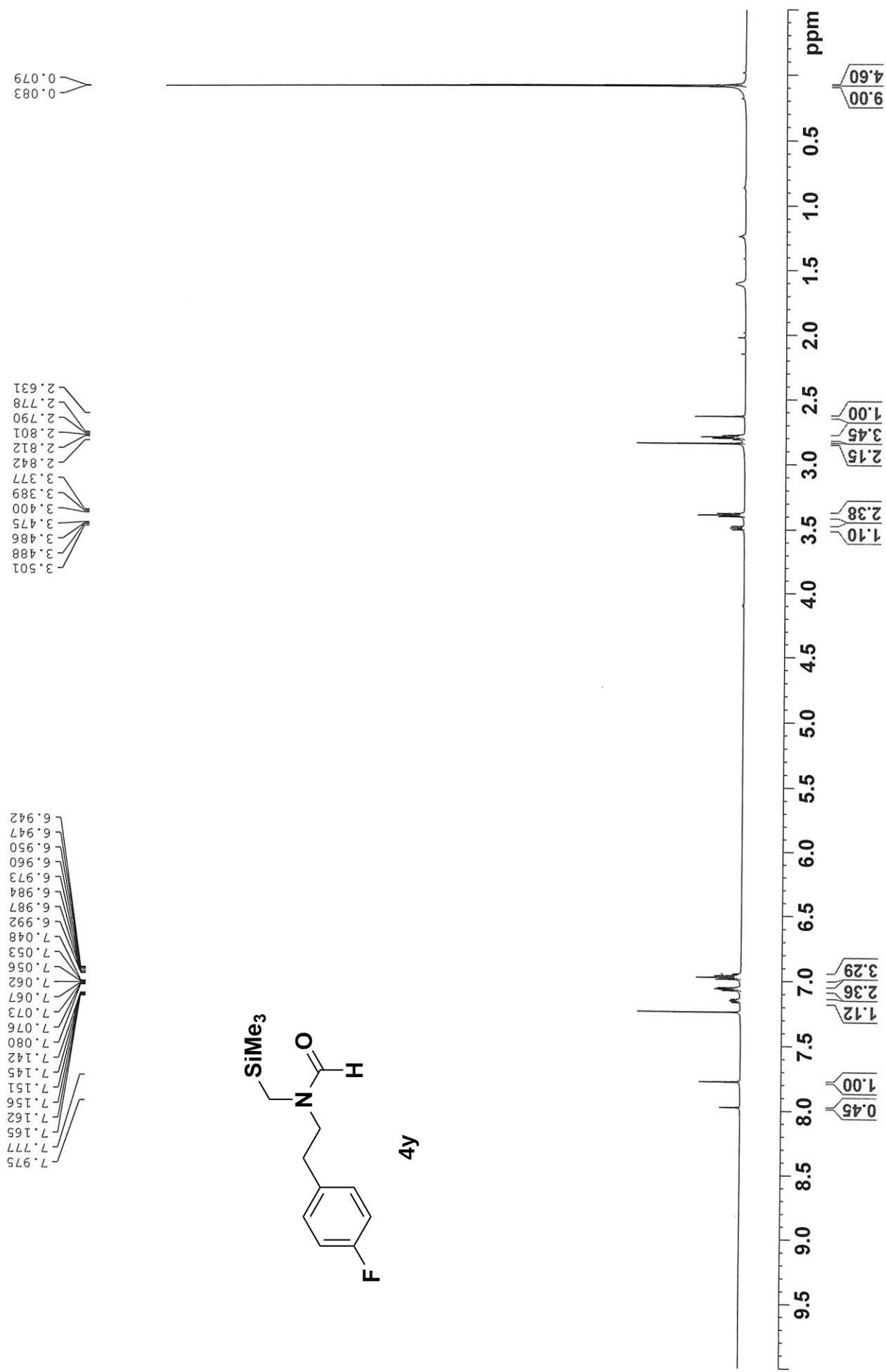
130.63
129.71
129.67

114.16
113.93

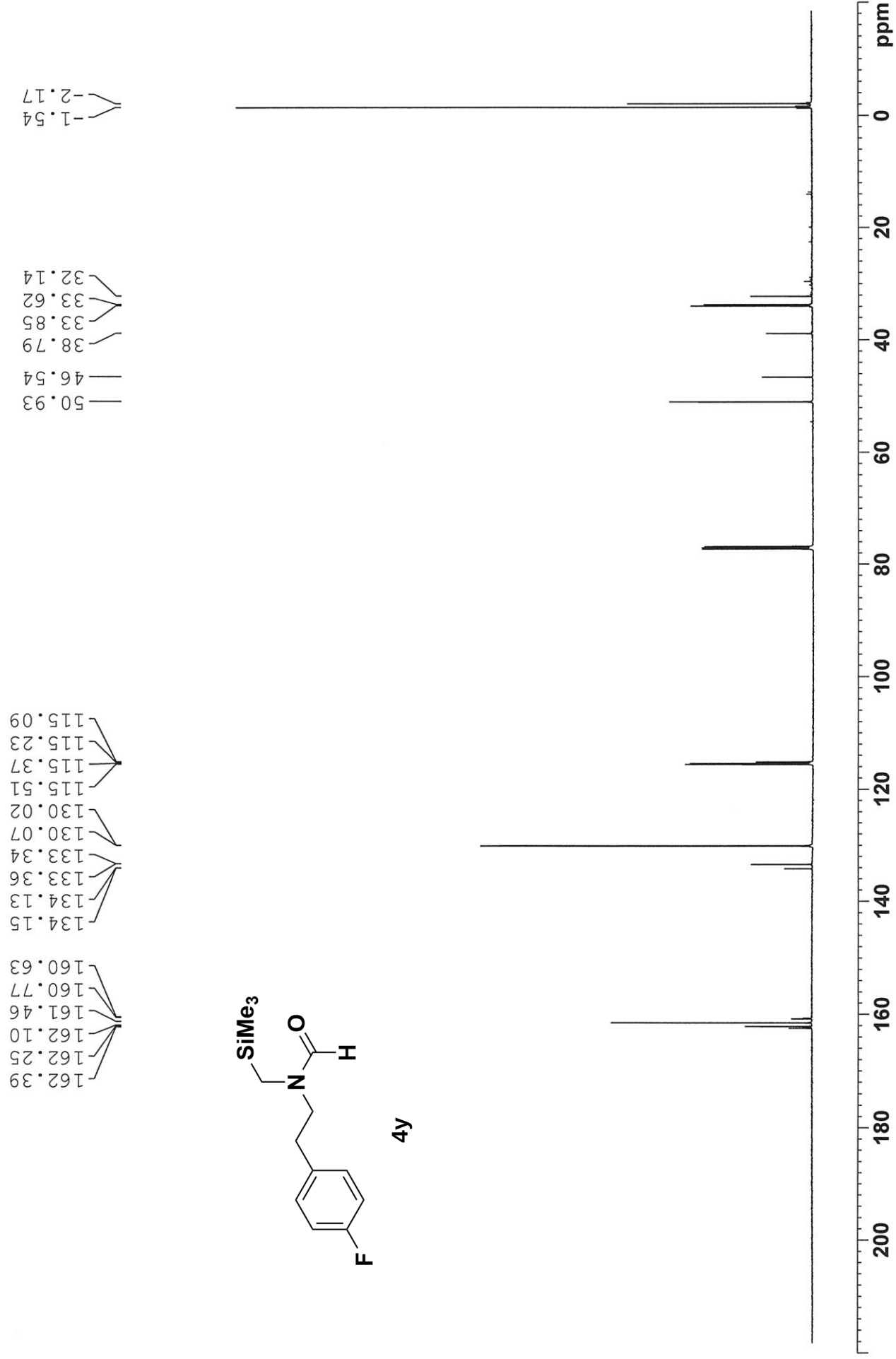
55.22
51.32
46.87
38.94
33.96
33.76
32.23

-1.41
-2.00



^1H NMR (CDCl_3 , 600 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



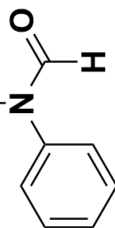
¹H NMR (CDCl₃, 600 MHz)

8.308
7.412
7.410
7.407
7.402
7.399
7.396
7.392
7.337
7.335
7.333
7.328
7.323
7.319
7.313
7.311
7.308
7.306
7.302
7.299
7.293
7.290
7.283
7.281
7.276
7.272
7.270
7.267
7.215
7.213
7.211
7.203
7.201
7.198
7.190
7.188
7.186
7.005
7.003
7.000
6.993
6.991
6.989
6.985

3.592

0.228

SiMe₂Ph



7a

0.97

2.00

5.13

1.09

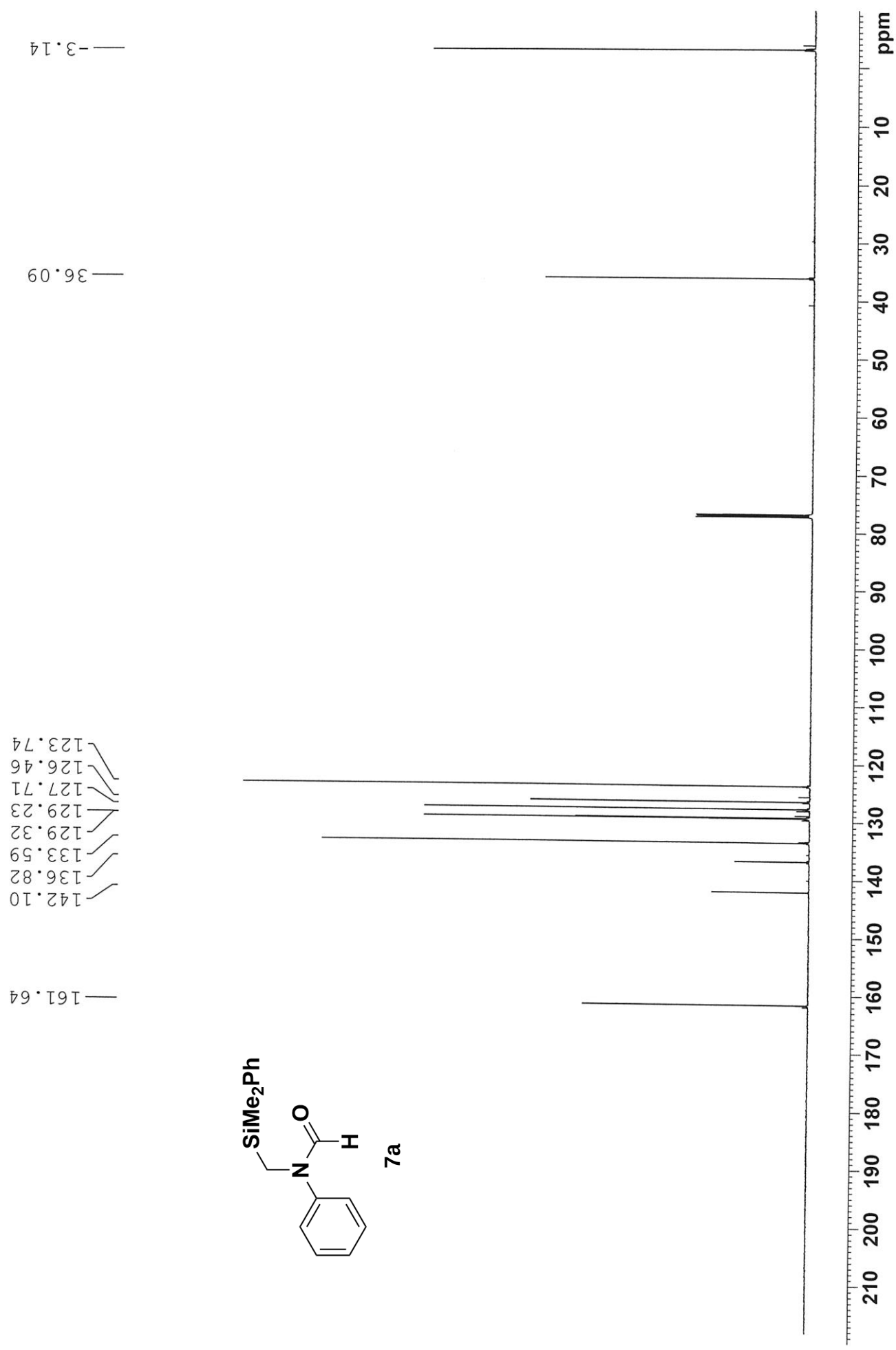
2.01

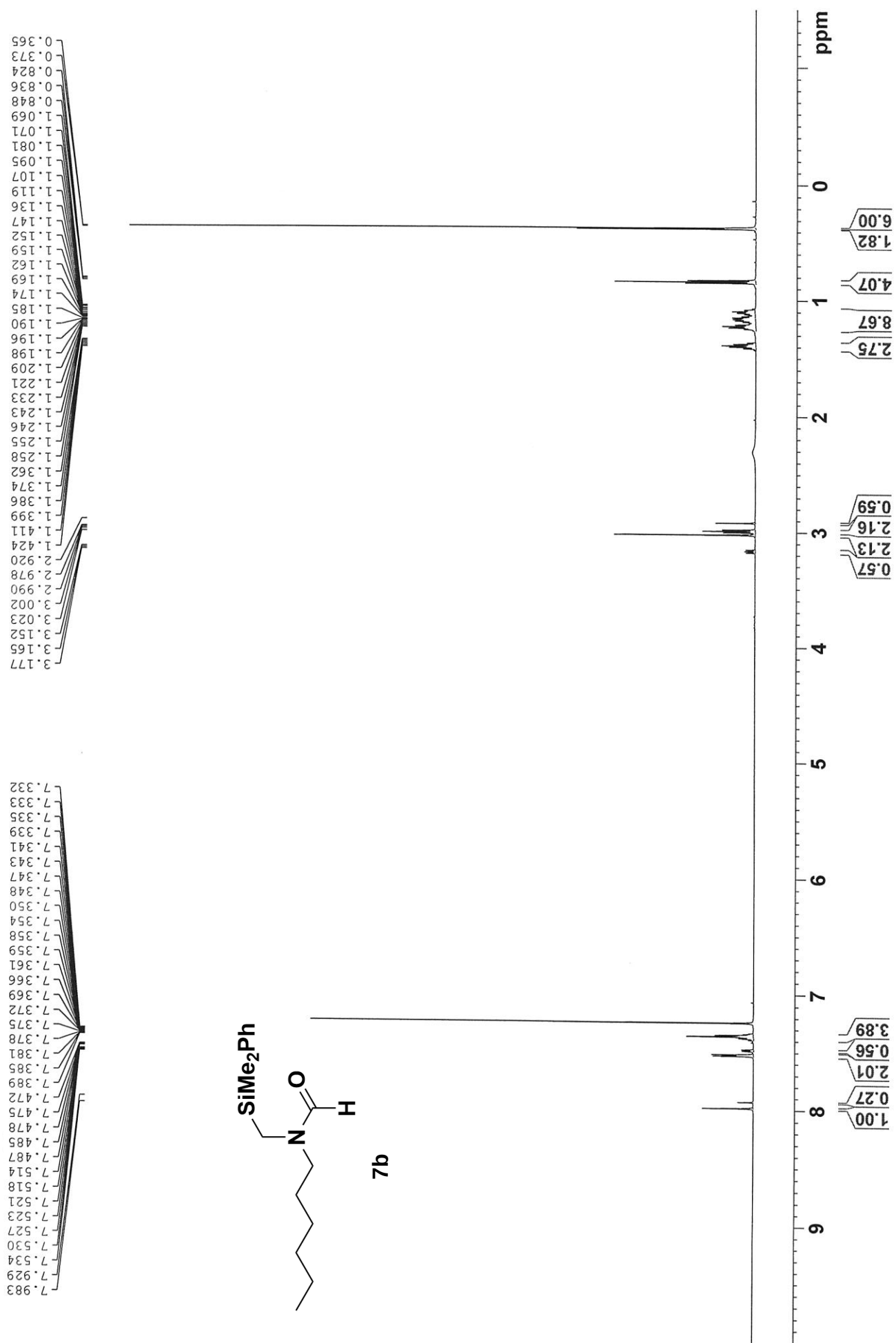
2.02

6.00

ppm

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)



^1H NMR (CDCl_3 , 600 MHz)

$^{13}\text{C} \{^1\text{H}\}$ NMR (CDCl_3 , 150 MHz)

