Supporting Information

Highly sulphated cellulose: A versatile, reusable and selective desilylating agent for deprotection of alcoholic TBDMS ethers

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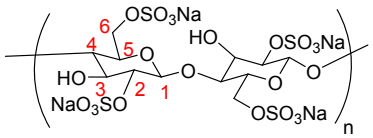
General Information

Solvents were dried by standard procedures. All commercially available alcohols and phenols were purchased from the Sigma Aldrich Company. Thin-layer chromatography was performed on silica gel plates and chromatographic spots were visualized by using UV light and staining with anisaldehyde charring solution. ^{1}H NMR and ^{13}C NMR spectral analyses were recorded on a Varian 400 MHz spectrometer equipped with a Linux workstation running on vNMRj software and the chemical shifts are based on the internal standard TMS peak at δ = 0.00 *ppm* for proton NMR and the $CDCl_3$ peak at δ = 77.23 *ppm* (t) for carbon NMR. For cellulose sulphate sodium both ^{1}H NMR and ^{13}C NMR were recorded in D_2O. IR spectra were obtained on a Thermo Scientific Nicolet iS 50 FT-IR instrument. Silyl ethers were prepared from phenols\alcohols using a standard procedure[1] (TBDMS chloride, imidazole, DCM). TBDMS ethers **3k, 5e, 5f** were synthesized by the Barbier allylation procedure[2]. TBDMS ethers **3a-3j** and **5a-5d** were prepared from commercially available phenols/alcohols. Compound **3l** was prepared by the reduction of methyl 8-(4-chlorophenyl)-1, 4-dioxaspiro[4.5]dec-7-ene-7-carboxylate using lithium aluminum hydride (LAH) as reducing agent to afford **4l**. Compound **4l** was converted to its TBDMS ether by reaction with TBDMS chloride and imidazole in DCM.[1] TBDMS ethers **3a**[3], **3b**[4] **3e**[5], **5a**[5], **5b**[6], **5c**[5] are known compounds **and the** characterization data for these ethers complied with the literature reported data. The desilylated products **4a**[7], **4b**[8], **4c**[9], **4d**,[10] **4e**[11], **4f**[12], **4g**[13], **4h**[14], **4i**,[15] **4j**,[16] **4k**[17], **6a**[6], **6b**[18], **6c**[19], **6d**[20], **6e**[21] are known

compounds, and their characterization data complied with the literature reported data. Characterization data for the new compounds **3c, 3d, 3f, 3g**, **3h, 3i, 3j, 3k, 3l, 4l, 5d, 5e, 5f** and **6f** are provided below.

Characterization data for new compounds



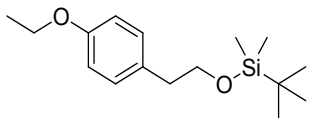
HS-cellulose sulphate sodium salt

HS-Cellulose sulphate (H_2SO_4 method) sodium salt: The compound was obtained as a white solid; ^{1}H-NMR (D_2O, 400 MHz): δ 4.56 (d, J = 16.0 Hz, 1H, H_1), 4.37 (m, 1H, H_6), 4.0-3.49 (m, 3H, H_3, H_6, H_4), 3.36 (s, 1H, H_5) *ppm*; ^{13}C-NMR (D_2O, 100 MHz): δ 104.8 (C-1), 80.7, 77.2, 76.4, 75.4 (C-2 to C-5), 62.3 (C-6) *ppm*. Sulphur combustion analysis calcd for the 2,6-disubstited cellulose sulphate, empirical formula $C_6H_8S_2O_{11}Na_2$: 17.51%. Found: 15.42% (88.06% of theoretical), FT-IR: 3332, 2896, 1427, 1053, 663, 557 cm^{-1}.

NOTE: Sulphur combustion analysis calcd for 2,6-disubstituted cellulose sulphate, empirical formula $C_6H_8S_2O_{11}Na_2$: 17.51%. Found: 15.42% (88.06% of theoretical); sulphur combustion analysis calcd for 6-monosubstituted cellulose sulphate, empirical formula $C_6H_9SO_8Na$: 12.14%. Found: 15.42% (27.01 % greater than theoretical); sulphur combustion analysis calcd for 2,3,6-trisubstituted cellulose sulphate, empirical formula $C_6H_7S_3O_{14}Na_2$: 20.54%. Found: 15.42% (24.92% less than theoretical). These data indicate that the sulphated cellulose product is predominantly the 2,6-disulphated cellulose rather than the 2,3,6-trisubstituted or 6-monosulphated cellulose.

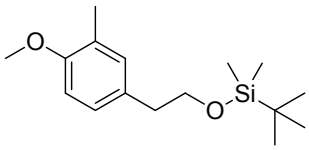
Cellulose sulphate (chlorosulphonic acid method): Sulphur content calcd for the empirical formula $C_6H_7S_3O_{14}Na_3$: 20.54%. Found: 0.42%; sulphur content: 2.04% of theoretical; FT-IR: 3331, 2891, 1315, 1201, 1159, 1023, 895, 558, and 433 cm^{-1}.

Tert-butyl(4-ethoxyphenethoxy)dimethylsilane (3c)



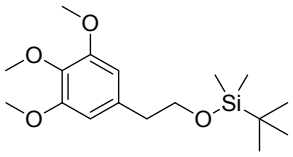
Colourless liquid, Yield: (95%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.15 (d, *J* = 8.0 Hz, 2H, Ar-H), 6.82 (t, *J* = 8.0, 4.0 Hz, 2H. Ar-H), 4.01 (q, *J* = 8.0 Hz, 2H, -OCH_2), 3.76 (t, *J* = 7.43, 7.04 Hz, 2H, -OCH_2), 2.74 (t, *J* = 8.0, 4.0 Hz, 2H, -CH_2), 1.40 (t, *J* = 8.0 Hz, 3H, -CH_3), 0.88 (s, 9H, t-Bu), -0.01 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C-NMR ($CDCl_3$, 100 MHz): δ 157.3, 131.0, 130.0, 114.2, 64.8, 63.3, 38.7, 25.9, 18.3, 14.8, -5.4 *ppm*; ESI-MS *(m/z)*: 281.0447 $(M+H)^+$.

Tert-butyl (4-methoxy-3-methylphenethoxy) dimethylsilane (3d)



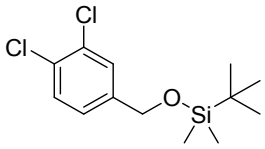
Colourless liquid, Yield: (95%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.00-6.98 (m, 2H, Ar-H), 6.73 (t, *J*= 8.0 Hz, 1H, Ar-H), 3.80 (s, 3H, -OCH_3), 3.75 (t, *J* = 4 Hz, 2H, -OCH_2), 2.74 (t, *J* = 8 Hz, 2H, -CH_2), 2.20 (s, 3H, Ar-CH_3), 0.89 (s, 9H, t-Bu), 0.01 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C-NMR ($CDCl_3$, 100 MHz): δ 156.1, 131.5, 130.6, 127.0, 126.2, 109.7, 64.9, 55.3, 38.7, 25.9, 18.35, 16.1, -5.3 *ppm*; ESI-MS*(m/z)*: 281.0610 $(M+H)^+$, 304.0410 $(M+Na)^+$.

Tert-butyldimethyl (3, 4, 5-trimethoxyphenethoxy)silane (3f)



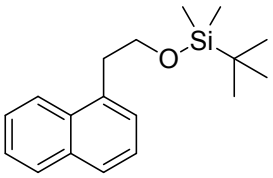
Colourless liquid, Yield: (85%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 6.43 (s, 2H, Ar-H), 3.84 (s, 6H, 2 x -OCH_3), 3.82-3.78 (m, 5H, -OCH_3 and –OCH_2), 2.75 (t, *J* = 8.0 Hz, 4.0 Hz, 2H, CH_2), 0.87 (s, 9H, t-Bu), -0.01 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 152.9, 136.3, 135.1, 106.0, 64.4, 60.7, 55.9, 39.8, 25.8, 18.2, -5.4 *ppm*; ESI-MS *(m/z)*: 327.0410 $(M+H)^+$, 349.0256 $(M+Na)^+$.

Tert-butyl ((3, 4-dichlorobenzyl) oxy)dimethylsilane (3g)



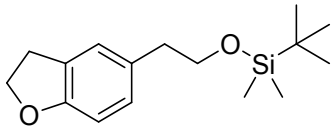
Colourless liquid, Yield: (85%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.42 -7.41 (m, 1H, Ar-H), 7.39 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.16-7.13 (m, 1H, Ar-H), 4.68 (s, 2H, -OCH_2), 0.95 (s, 9H, t-Bu), 0.11 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 141.7, 132.2, 130.6, 130, 127.8, 125.1, 63.6, 25.8, 18.3, -5.3 *ppm*; ESI-MS*(m/z)*: 291.022 $(M+H)^+$.

Tert-butyldimethyl(2-(naphthalen-1-yl)ethoxy)silane (3h)



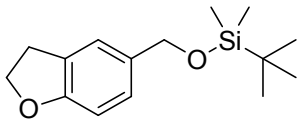
Colourless liquid; Yield: (88%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.09-8.07 (m, 1H, Ar-H), 7.87-7.84 (m, 1H, Ar-H), 7.74 (d, *J* = 8.0 Hz, 1H, Ar-H), 7.54-7.45 (m, 2H, Ar-H), 7.43-7.35 (m, 2H, Ar-H), 3.97-3.93 (m, 2H, $-OCH_2$), 3.33 (t, *J* = 8.0 Hz, 2H, CH_2), 0.88 (s, 9H, t-Bu), -0.03 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 135.0, 133.7, 132.2, 128.6, 127.1, 126.9, 125.7, 125.4, 125.3, 123.8, 63.9, 36.6, 25.9, 18.3, -5.4 *ppm*; ESI-MS*(m/z)*: 287.0406 $(M+H)^+$, 310.294 $(M+Na)^+$.

Tert-butyl (2-(2, 3-dihydrobenzofuran-5-yl)ethoxy)dimethylsilane (3i)



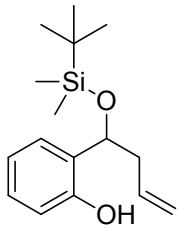
Colourless liquid, Yield: (92%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.04 (s, 1H, Ar-H), 6.94-6.92 (m, 1H, Ar-H), 6.70 (d, *J* = 8.0 Hz, 1H, Ar-H), 4.54 (t, *J* = 8.99, 8.66 Hz, 2H, $-OCH_2$), 3.75 (t, *J* = 8.0 Hz, 2H, $-OCH_2$), 3.17 (t, *J* = 8.6 Hz, 2H, CH_2), 2.75 (t, *J* = 12.0, 8.0 Hz, 7.04 Hz, 2H, CH_2), 0.89 (s, 9H, t-Bu), 0.01 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.4, 130.9, 128.4, 126.7, 125.6, 108.8, 71.1, 64.9, 39.01, 29.7, 25.9, 18.3, -5.3 *ppm*; ESI-MS *(m/z)*: 279.0549 $(M+H)^+$, 301.0227 $(M+Na)^+$.

Tert-butyl ((2, 3-dihydrobenzofuran-5-yl) methoxy)dimethylsilane (3j)



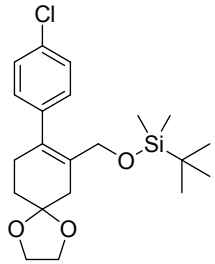
Colourless liquid, Yield: (75%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.17 (s, 1H, Ar-H), 7.06-7.03 (m, 1H, Ar-H), 6.74 (d, *J* = 8.0 Hz, 1H, Ar-H), 4.65 (s, 2H, $-OCH_2$), 4.56 (t, *J* = 8.0 Hz, 2H, $-OCH_2$), 3.20 (t, *J* = 8.0 Hz, 2H, CH_2), 0.94 (s, 9H, t-Bu), 0.10 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.1, 133.4, 126.9, 126.2, 123.2, 108.78 71.2, 65.0, 29.7, 26.0, 18.4, -5.1 *ppm*; ESI-MS *(m/z)*: 287.0778 $(M+Na)^+$.

2-(1-((Tert-butyldimethylsilyl) oxy) but-3-en-1-yl)phenol (3k)



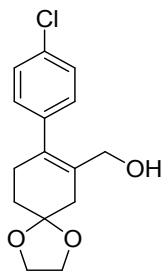
Colourless liquid, Yield: (82%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.18 (s, 1H, Ar-OH), 7.17-7.13 (m, 1H, Ar-H), 6.89-6.85 (m, 2H, Ar-H), 6.81-6.77 (m, 1H, Ar-H), 5.78-5.67 (m, 1H, -OCH), 5.08 (d, *J* = 1.17 Hz, 1H, Vinyl-CH), 5.05-5.03 (m, 1H, Vinyl-CH), 4.76 (dd, *J* = 8.0 Hz, 1H, Vinyl-CH), 2.65-2.45 (m, 2H, Allyl-CH), 0.90 (s, 9H, t-Bu), 0.14 (s, 3H, CH_3-Si), 0.02 (s, 3H, CH_3-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 155.7, 134.1, 128.6, 127.0, 126.8, 119.2, 117.9, 117.1, 77.7, 43.2, 25.6, 18.1, -5.0, -5.1 *ppm*; ESI-MS*(m/z)*: 279.0549 $(M+H)^+$, 301.0227 $(M+Na)^+$.

Tert-Butyl((8-(4-chlorophenyl)-1,4-dioxaspiro[4.5]dec-7-en-7-yl)methoxy)dimethylsilane (3l)



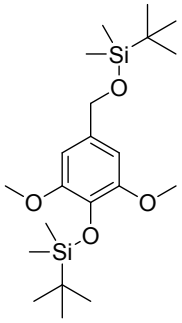
Colourless liquid, Yield: 95%, ^{1}H-NMR ($CDCl_3$, 400MHz): δ 7.28 (t, *J* = 4.0 Hz, 1H, Ar-H), 7.26 (t, *J* = 4.0 Hz, 1H, Ar-H), 7.12 (t, *J* = 4.0 Hz, 1H, Ar-H), 7.10 (t, *J* = 4.0 Hz, 1H, Ar-H), 4.04 – 4.01 (m, 4H, -$(OCH_2)_2$), 3.94 (s, 2H, -OCH_2), 2.48 (dd, *J* = 8.0, 4.0 Hz, 4H, 2x CH_2), 1.86 (t, *J* = 4.0 Hz, 2H, -CH_2), 0.85 (s, 9H, t-Bu), -0.05 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C-NMR ($CDCl_3$, 100 MHz): δ 140.3, 132.6, 132.4, 131.2, 129.6, 128.1, 108.1, 64.4, 63.9, 37.0, 31.4, 31.1, 25.8, 18.2, -5.3 *ppm*; ESI-MS *(m/z)*: 394.9949 $(M+H)^+$, 416.9845 $(M+Na)^+$.

(8-(4-Chlorophenyl)-1,4-dioxaspiro[4.5]dec-7-en-7-yl)methanol (4l)



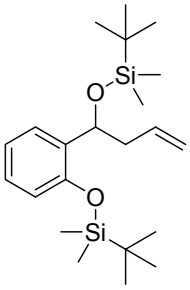
Colourless liquid, Yield: 91%, ^{1}H-NMR ($CDCl_3$, 400MHz): δ 7.29 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.11 (d, *J* = 8.0 Hz, 2H, Ar-H), 4.05-4.01 (m, 4H, -$(OCH_2)_2$), 3.93 (s, 2H, -OCH_2), 2.50 (t, *J* = 12.0, 8Hz, 4H, Allyl-CH_2), 1.87 (t, *J* = 4.0 Hz, 1H, -CH_2) *ppm*; ^{13}C-NMR ($CDCl_3$, 100 MHz): δ 140.0, 134.6, 132.6, 130.7, 129.5, 128.3, 107.9, 64.4, 63.4, 37.0, 31.4, 31.3 *ppm*; ESI-MS *(m/z)*: 281.9937 $(M+2H)^+$, 302.9126 $(M+Na)^+$.

Tert-butyl ((4-((tert-butyldimethylsilyl) oxy)-3, 5-dimethoxybenzyl) oxy)dimethylsilane (5d)



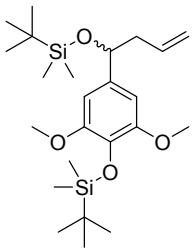
Colourless liquid, Yield: (82%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 6.52 (s, 2H, Ar-CH), 4.66 (s, 2H, -OCH_2), 3.78 (s, 6H, -$(OCH_3)_2$), 1.00 (s, 9H, t-Bu), 0.94 (s, 9H, t-Bu), 0.11 (s, 6H, $CH_3)_2$-Si), 0.09 (s, 6H, $(CH_3)_2$-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 151.4, 133.9, 133.0, 103.1, 65.1, 55.6, 25.9, 25.8, 18.7, 18.4, -4.6, -5.1 *ppm*; ESI-MS *(m/z)*:413.0653 $(M+H)^+$, 435.0308 $(M+Na)^+$.

Tert-butyl (2-(1-((tert-butyldimethylsilyl) oxy) but-3-en-1-yl) phenoxy) dimethylsilane (5e)



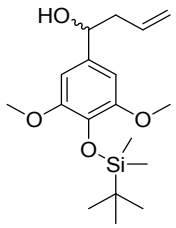
Colourless liquid, Yield: (90%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.48 (dd, *J* = 8.0, 4.0 Hz, 1H, Ar-H), 7.10 (td, *J* = 8.0 Hz, 1H, Ar-H), 6.95 (t, *J* = 8.0 Hz, 1H, Ar-H), 6.77 (d, *J* = 8.0Hz, 1H, Ar-H), 5.94-5.84 (m, 1H, Vinyl-CH), 5.16 (dd, *J* = 4.0 Hz, 1H, Vinyl-CH), 5.05 (dd, *J* = 4.0 Hz, 1H, Vinyl-CH), 5.02 (s, -OCH), 2.47-2.32 (m, 2H, Allyl-CH_2), 1.06 (s, 9H, t-Bu), 0.92 (s, 9H, t-Bu), 0.31 (s, 3H, CH_3-Si), 0.27 (s, 3H, CH_3-Si), 0.05 (s, 3H, CH_3-Si), -0.08 (s, 3H, CH_3-Si) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 151.2, 135.8, 135.7, 127.3, 127.2, 120.8, 117.4, 116.5, 68.7, 43.8, 25.9, 25.8, 18.3, 18.2, -3.8, -4.2, -4.7, -4.9 *ppm*; ESI-MS *(m/z)*: 415.0718 $(M+Na)^+$.

Tert-butyl ((1-(4-((tert-butyldimethylsilyl) oxy)-3, 5-dimethoxyphenyl) but-3-en-1-yl) oxy) dimethylsilane (5f)

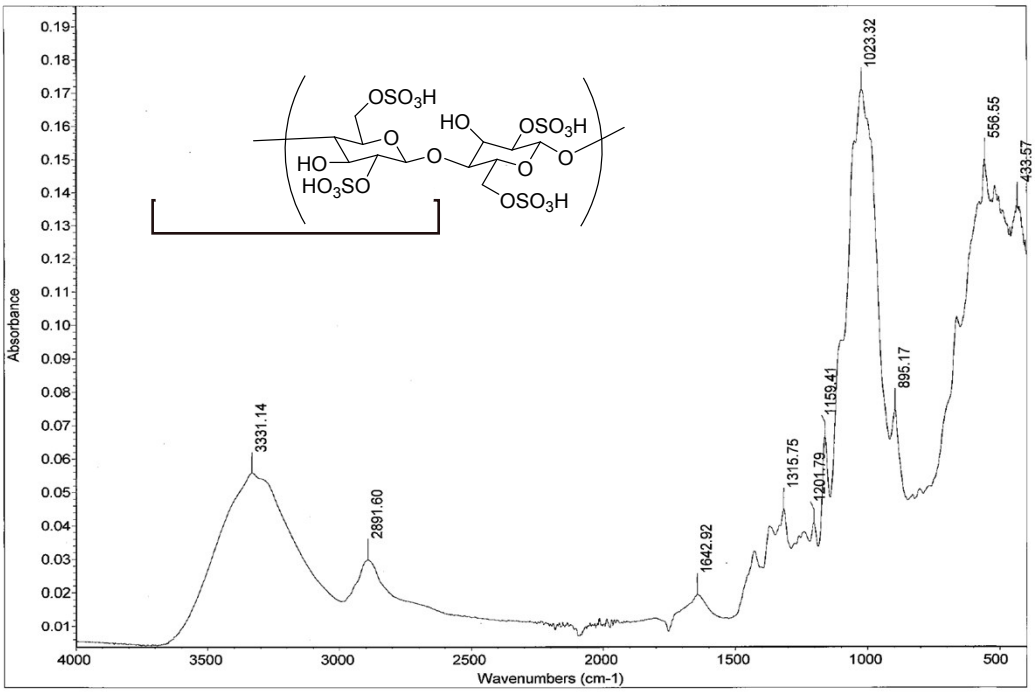


Colourless liquid, Yield: (88%), ^{1}H NMR (400 MHz, $CDCl_3$): δ 6.50 (s, 2H, Ar-H), 5.83-5.74 (m, 1H, -OCH), 5.05-5.00 (m, 2H, Vinyl-CH), 4.57 (dd, *J* = 4.0 Hz, 1H, -OCH), 3.78 (s, 6H, -$(OCH_3)_2$), 2.48-2.33 (m, 2H, Allyl-CH_2), 1.02 (s, 9H, t-Bu), 0.88 (s, 9H, t-Bu), 0.13 (s, 6H, Si-$(CH_3)_2$), 0.02 (s, 3H, Si-CH_3), -0.12 (s, 3H, Si-CH_3) *ppm*; ^{13}C NMR (100 MHz, $CDCl_3$): δ 151.1, 137.9, 135.5, 132.9, 116.5, 102.9, 75.2, 55.6, 44.5, 25.8, 18.7, 18.2, -4.6, -4.69, -4.7, -4.9 *ppm*; ESI-MS *(m/z)*: 475.0574 $(M+Na)^+$.

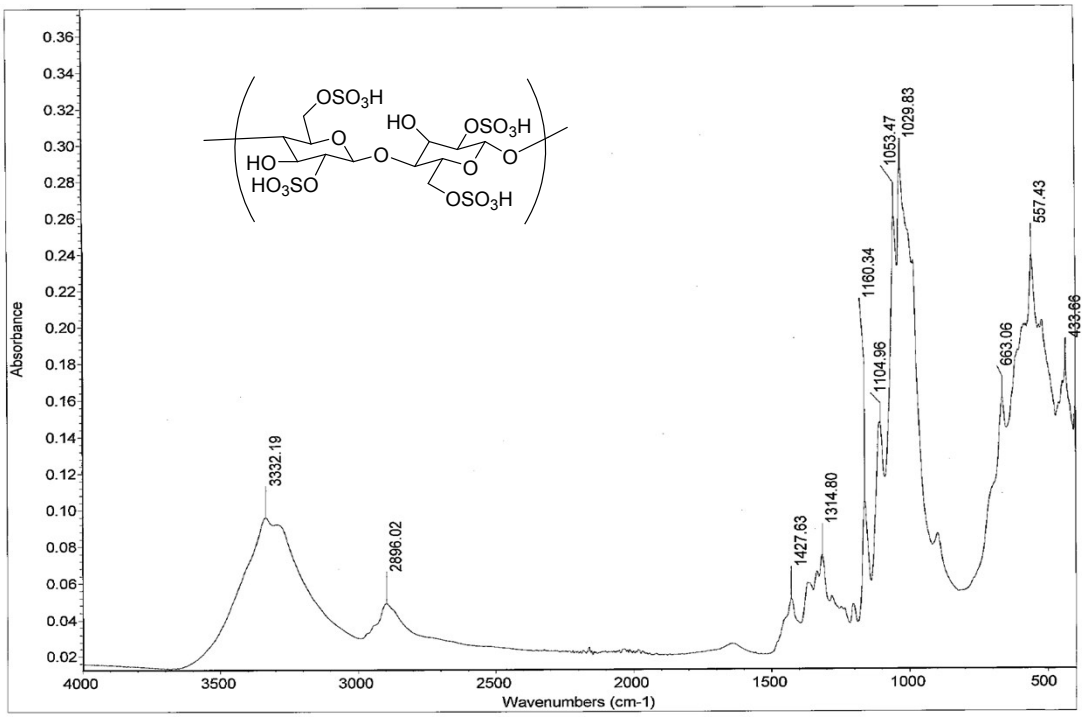
1-(4-((*tert*-Butyldimethylsilyl)oxy)-3,5-dimethoxyphenyl)but-3-en-1-ol (6f)



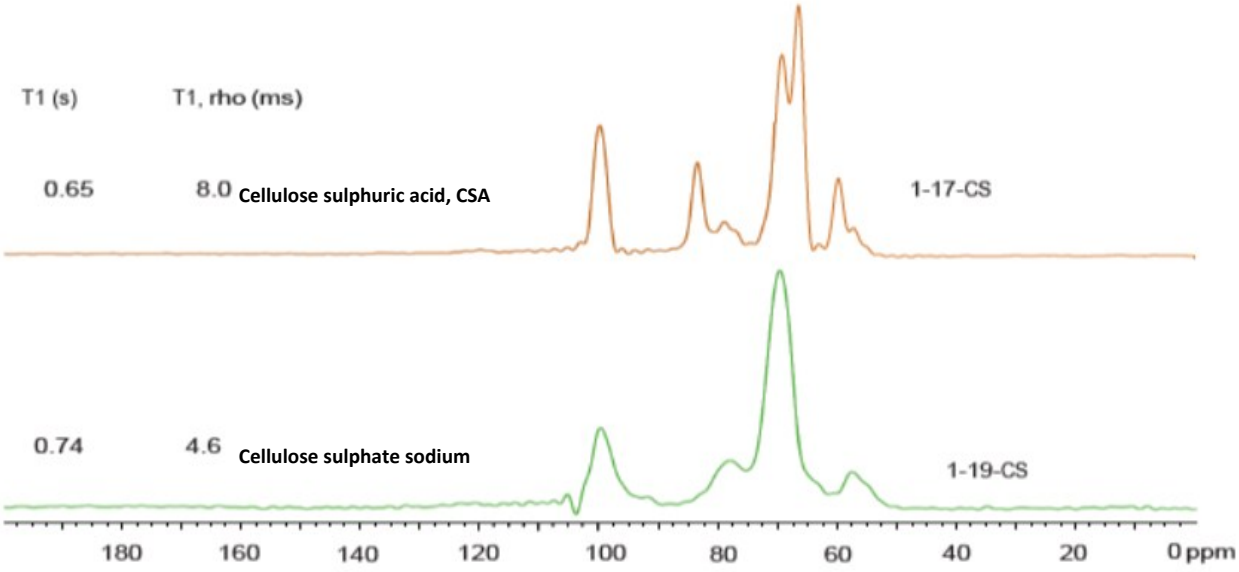
Colourless liquid, Yield: 88%, ^{1}H-NMR ($CDCl_3$, 400MHz): δ 6.55 (s, 2H, Ar-H), 5.86-5.76 (m, 1H, -Vinyl-CH), 5.15 (t, , *J* = 12 Hz, 2H, Vinyl-CH), 4.67-4.63 (m, 1H, -OCH), 3.80 (s, 6H, -$(OCH_3)_2$), 2.48 (dd, *J* = 8.0, 4.0 Hz, 2H, Allyl-CH_2), 1.98 (d, *J* = 4.0 Hz, 1H, -OH), 1.01 (s, 9H, t-Bu), 0.12 (s, 6H, , $(CH_3)_2$-Si) *ppm*; ^{13}C-NMR ($CDCl_3$, 100MHz): δ 151.4, 136.4, 134.6, 133.3, 118.0, 102.7, 73.5, 55.6, 43.8, 25.7, 18.6, -4.6 *ppm*; ESI-MS *(m/z)*: 339. 0476 $(M+H)^+$, 361.8842 $(M+Na)^+$.



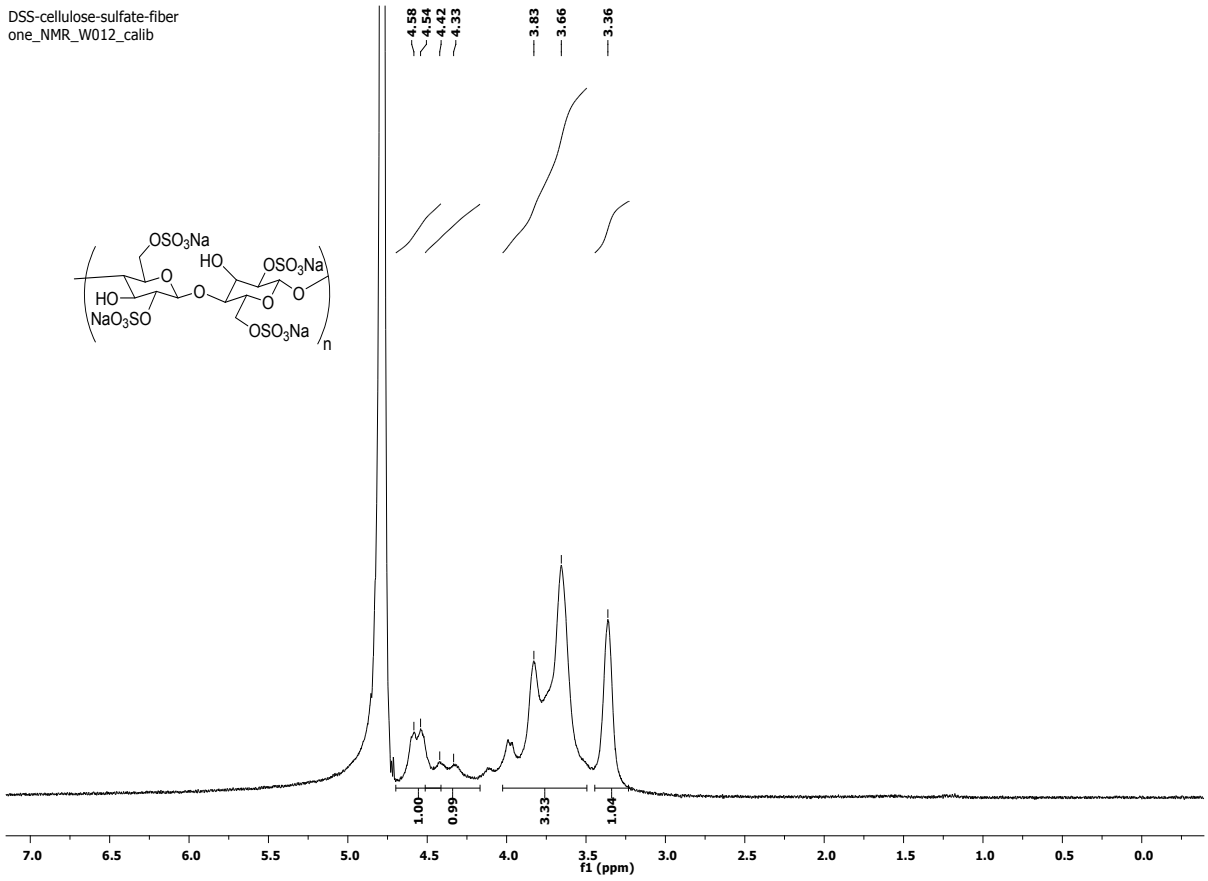
IR spectrum of HS-cellulose sulphate



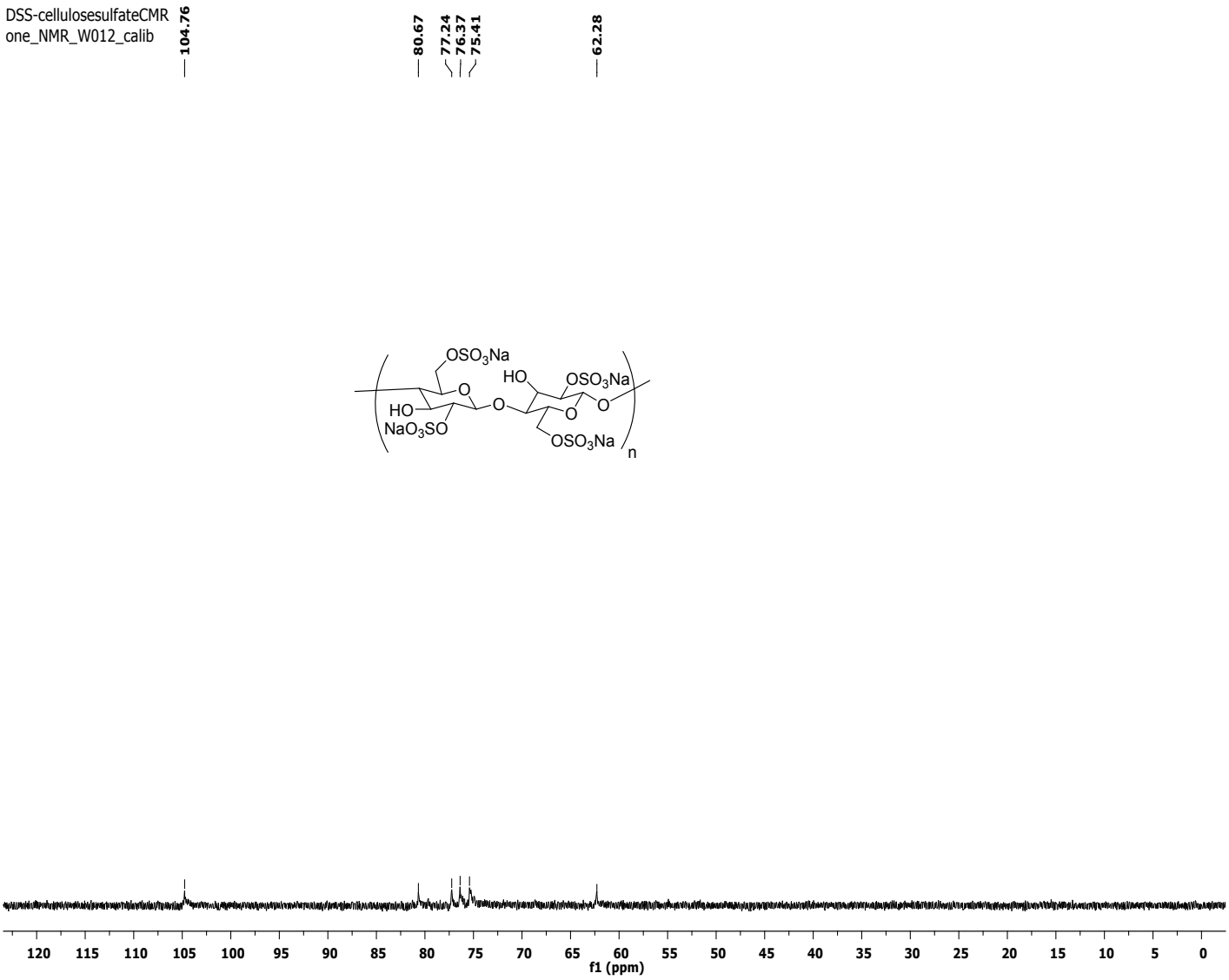
IR spectrum of HS-cellulose sulphate sodium



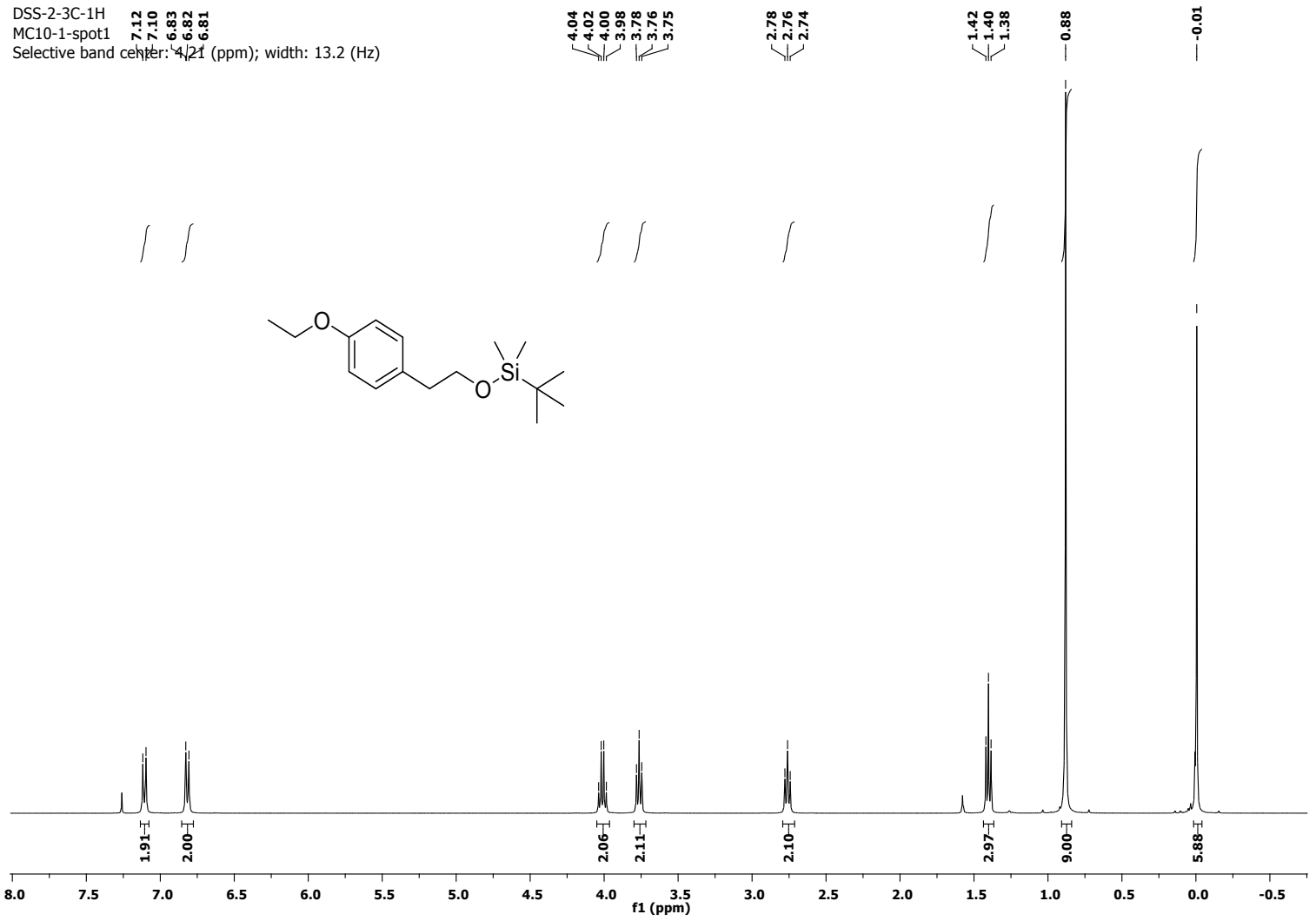
Solid state NMR spectrum of HS-cellulose sulpate sodium



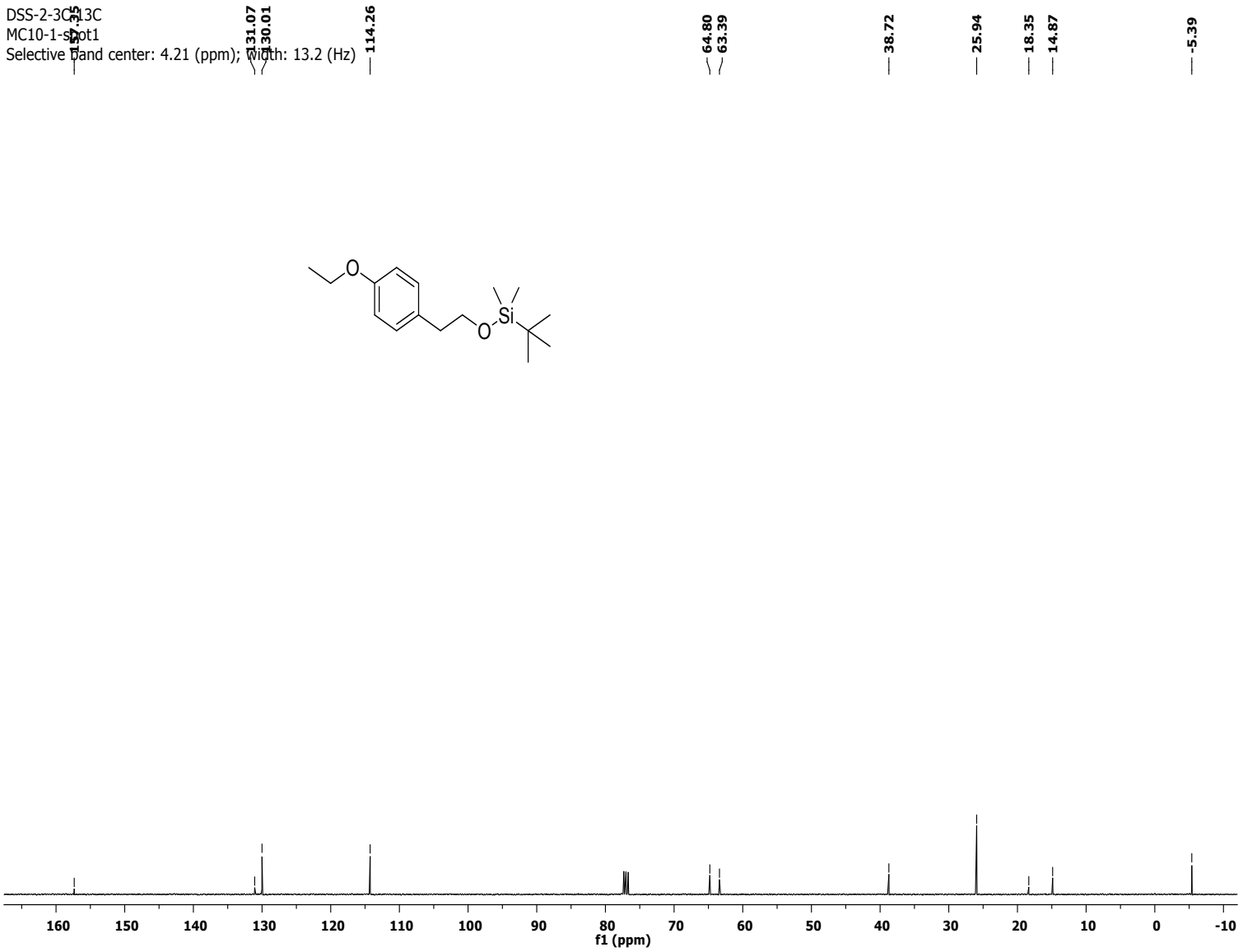
^{1}H NMR spectrum of HS-cellulose sulphate sodium in D_2O



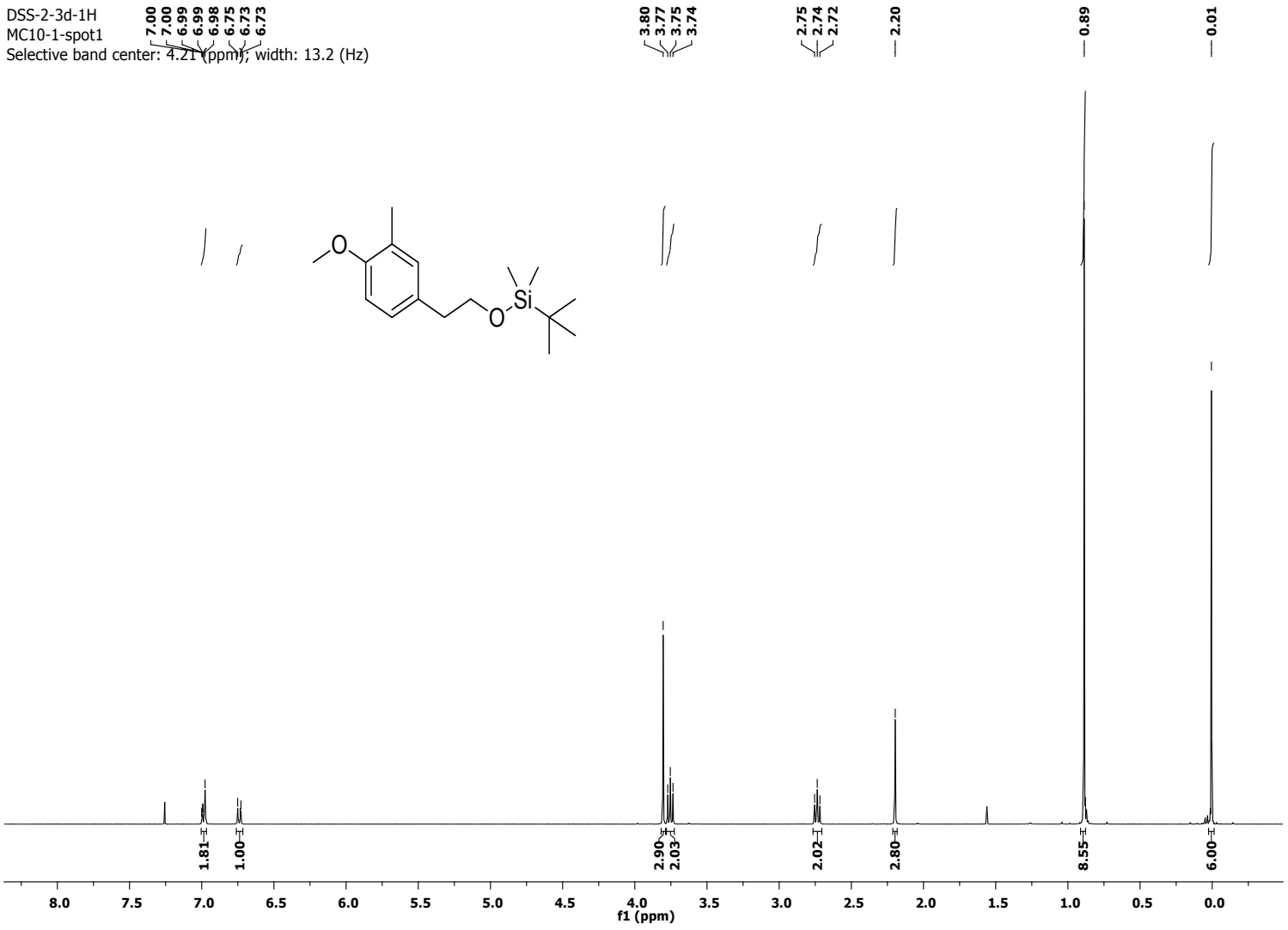
^{13}C NMR spectrum of compound cellulose sulphate sodium in D_2O



^{1}H NMR spectrum of compound 3c in $CDCl_3$



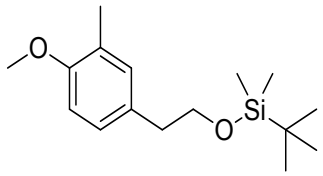
^{13}C NMR spectrum of compound 3c in $CDCl_3$

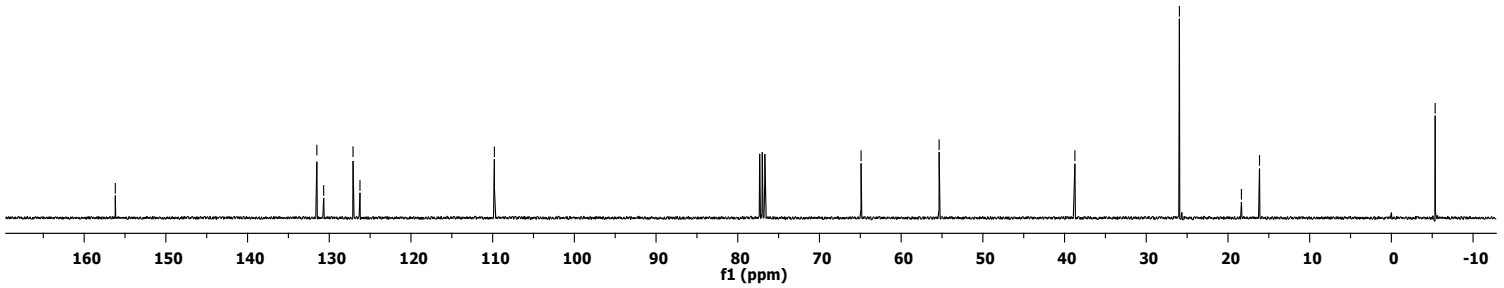


^{1}H NMR spectrum of compound 3d in $CDCl_3$

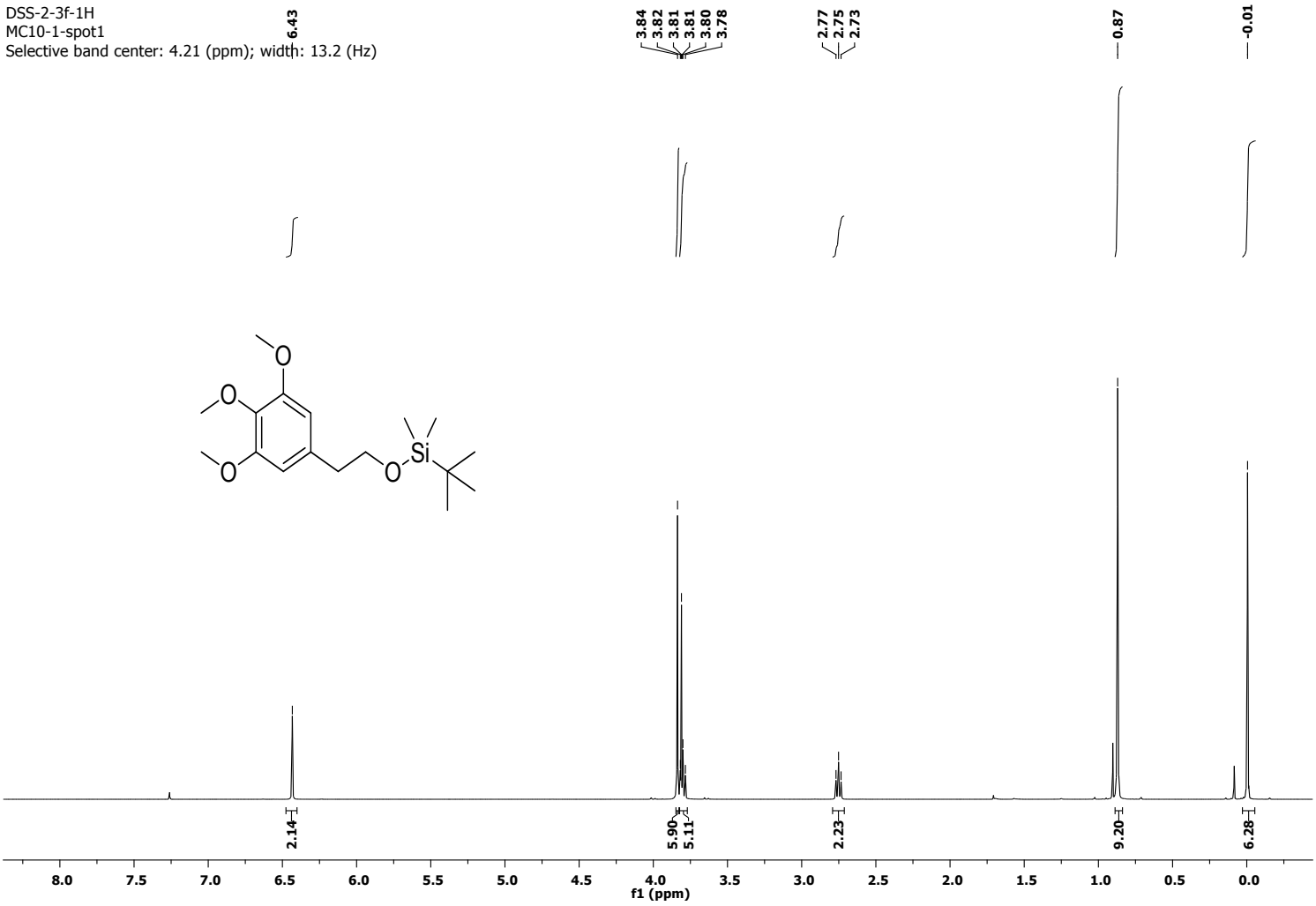
DSS-2-3D-13C
MC10-1-spot1
Selective band center: 4.21 (ppm); width: 13.2 (Hz)

156.49
131.52
130.68
127.09
126.24
109.79
64.91
55.35
38.74
25.94
18.35
16.14
-5.36

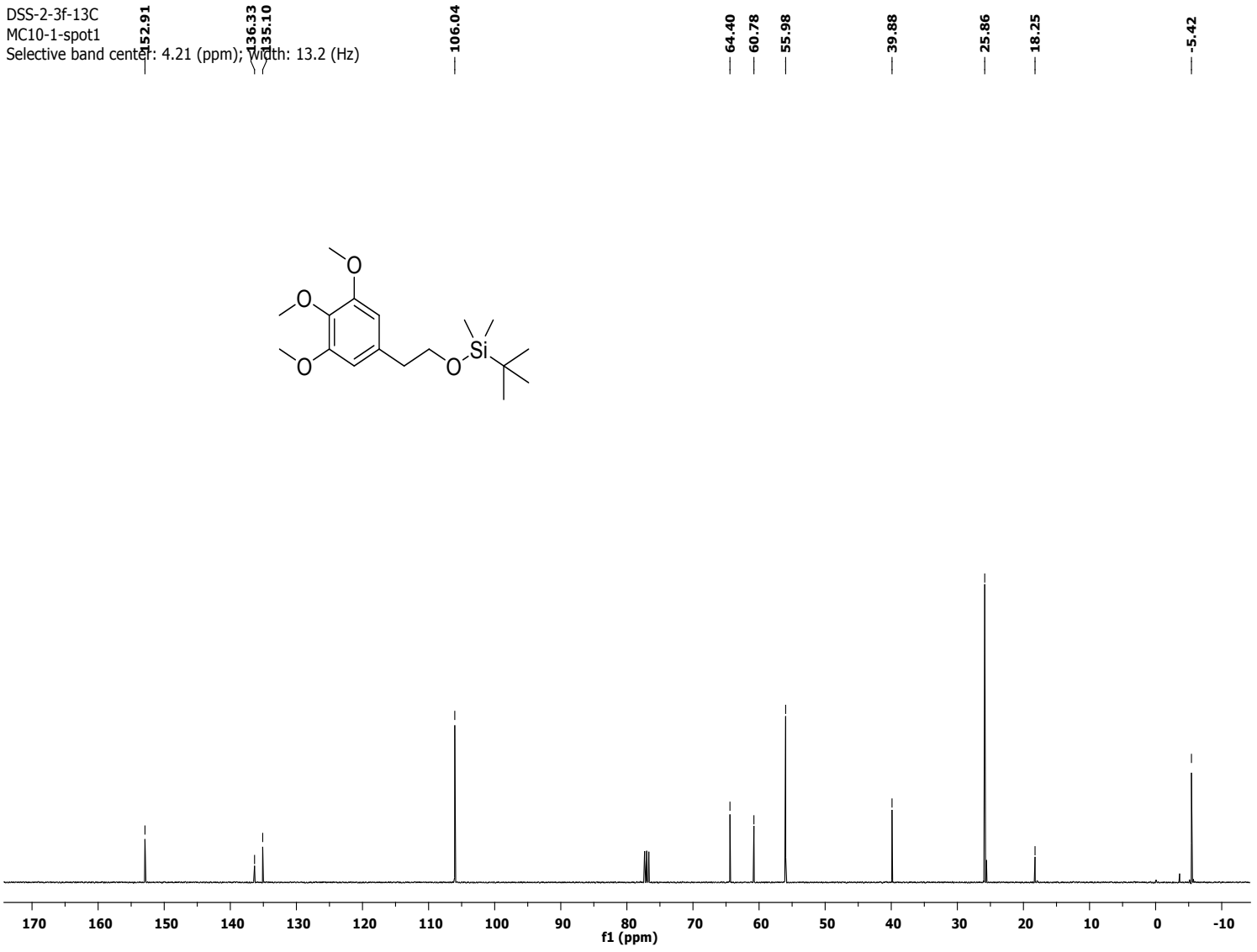




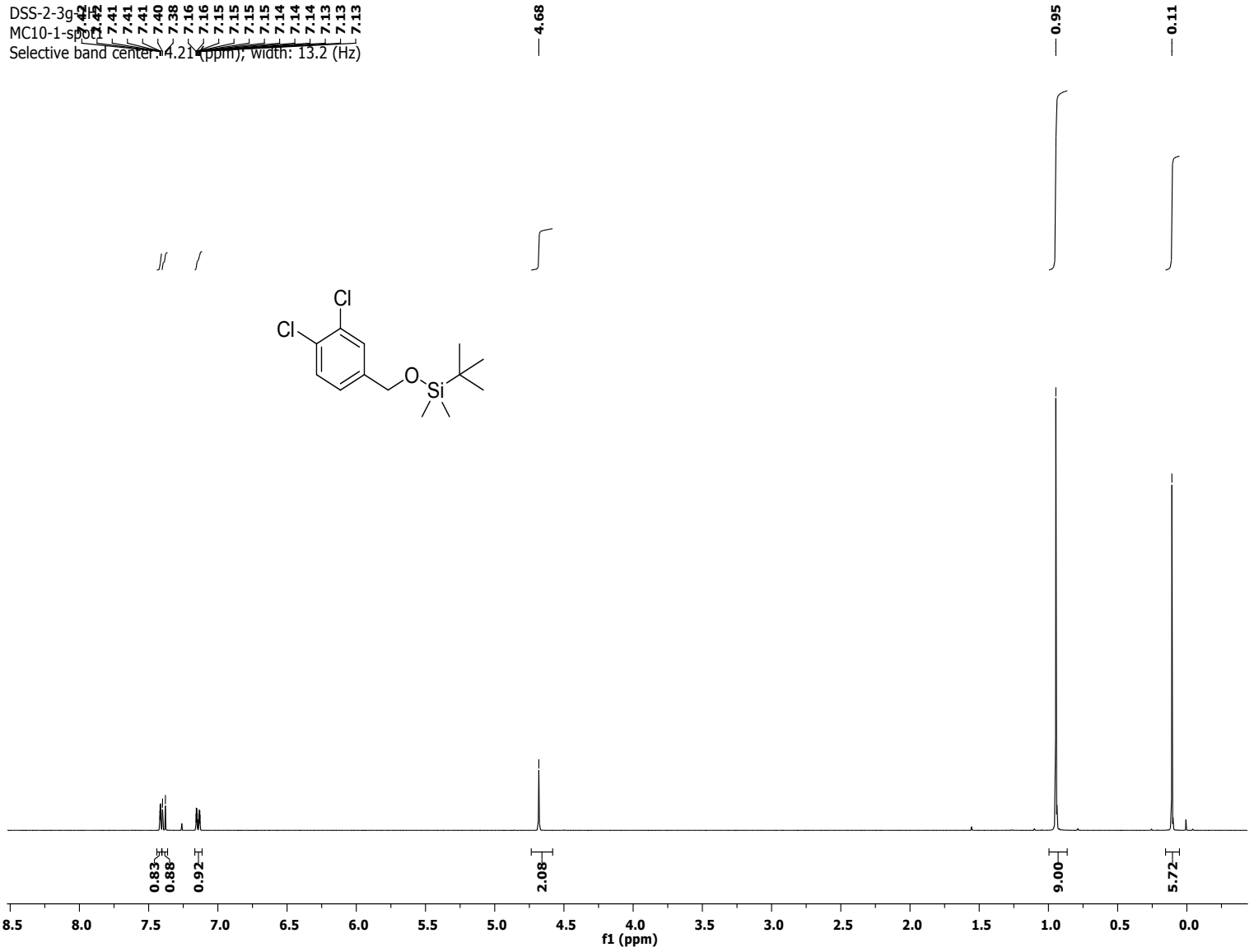
^{13}C NMR spectrum of compound 3d in $CDCl_3$



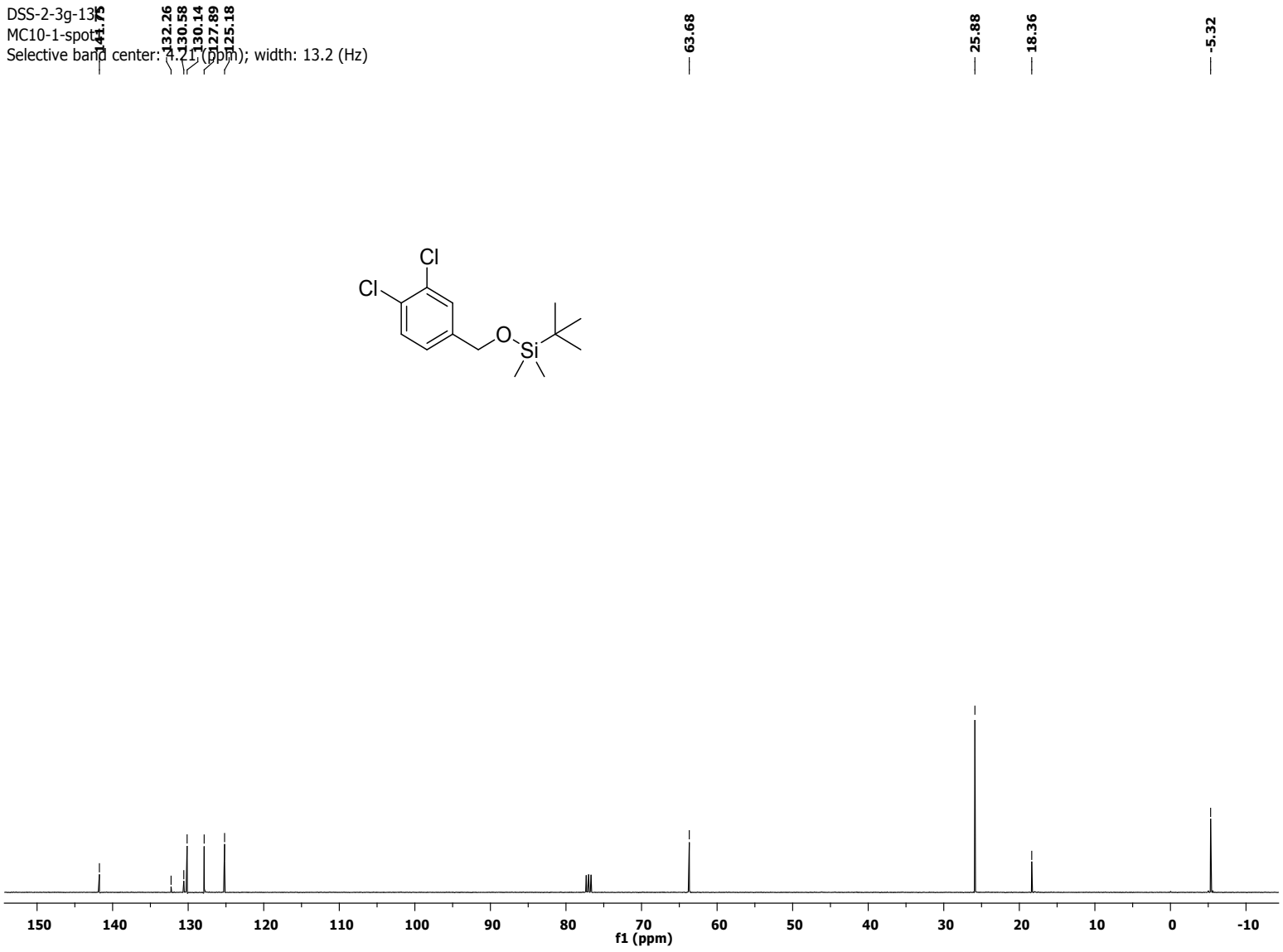
^{1}H NMR spectrum of compound 3f in $CDCl_3$



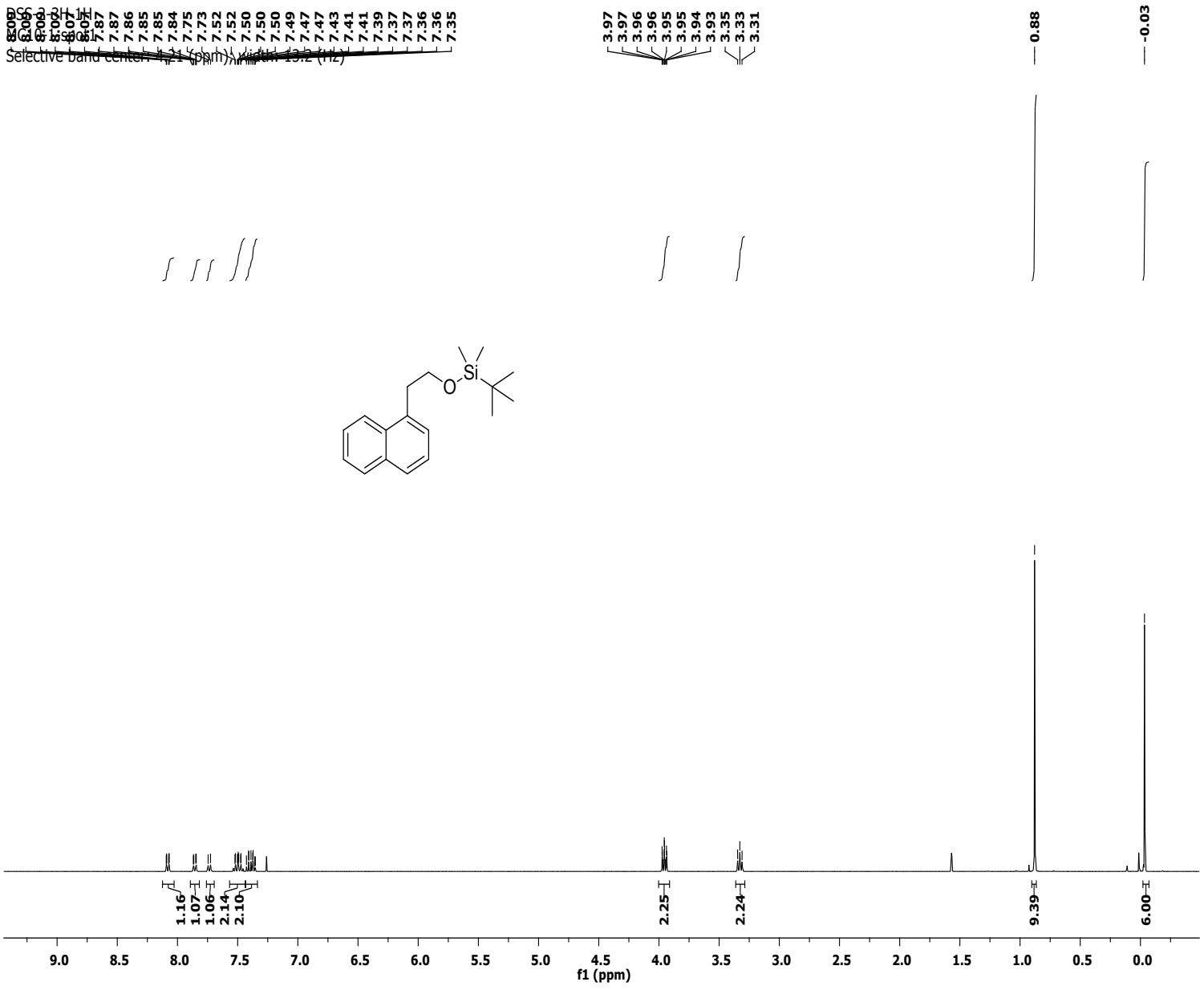
^{13}C NMR spectrum of compound 3f in $CDCl_3$



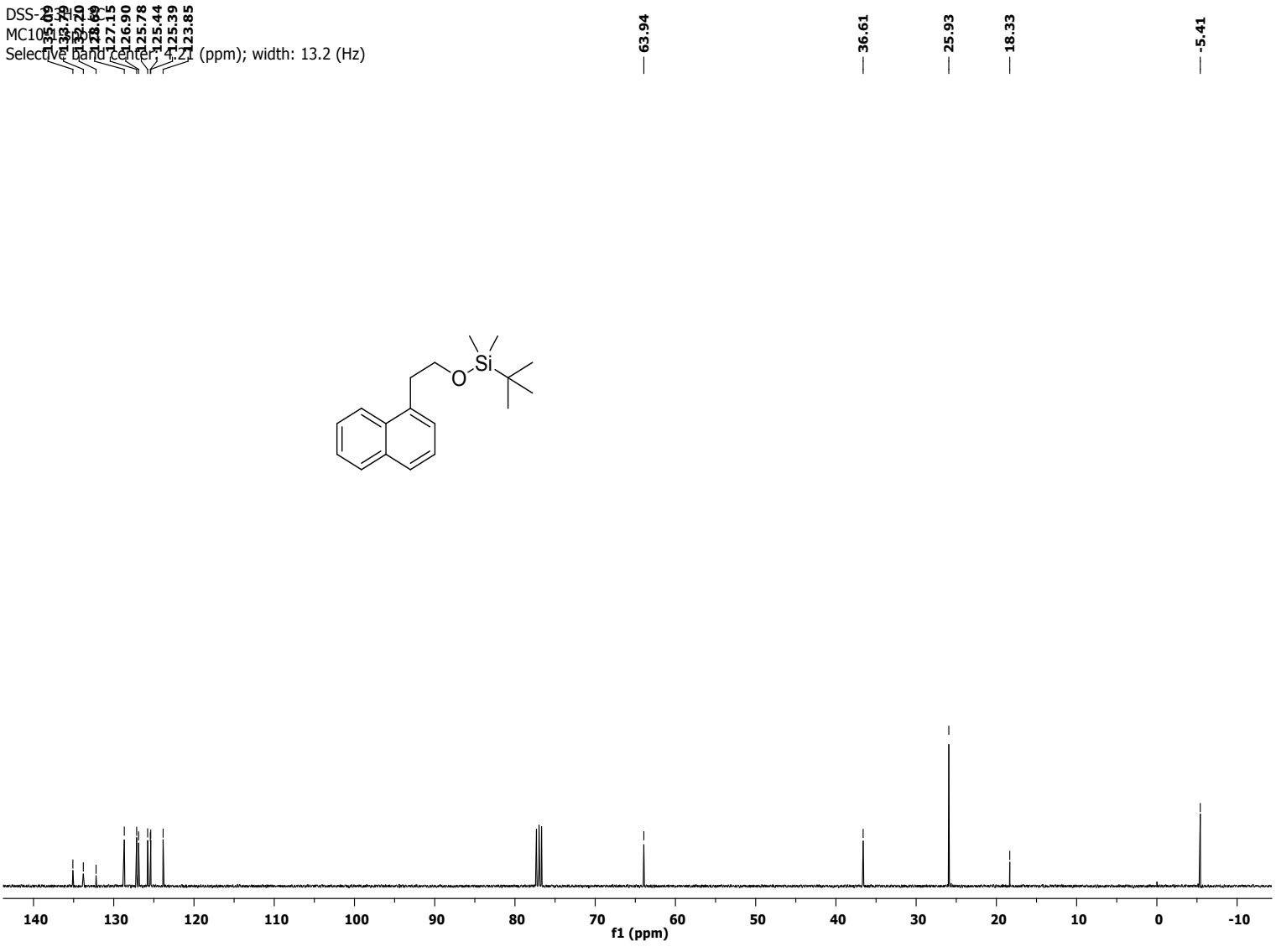
^{1}H NMR spectrum of compound 3g in $CDCl_3$



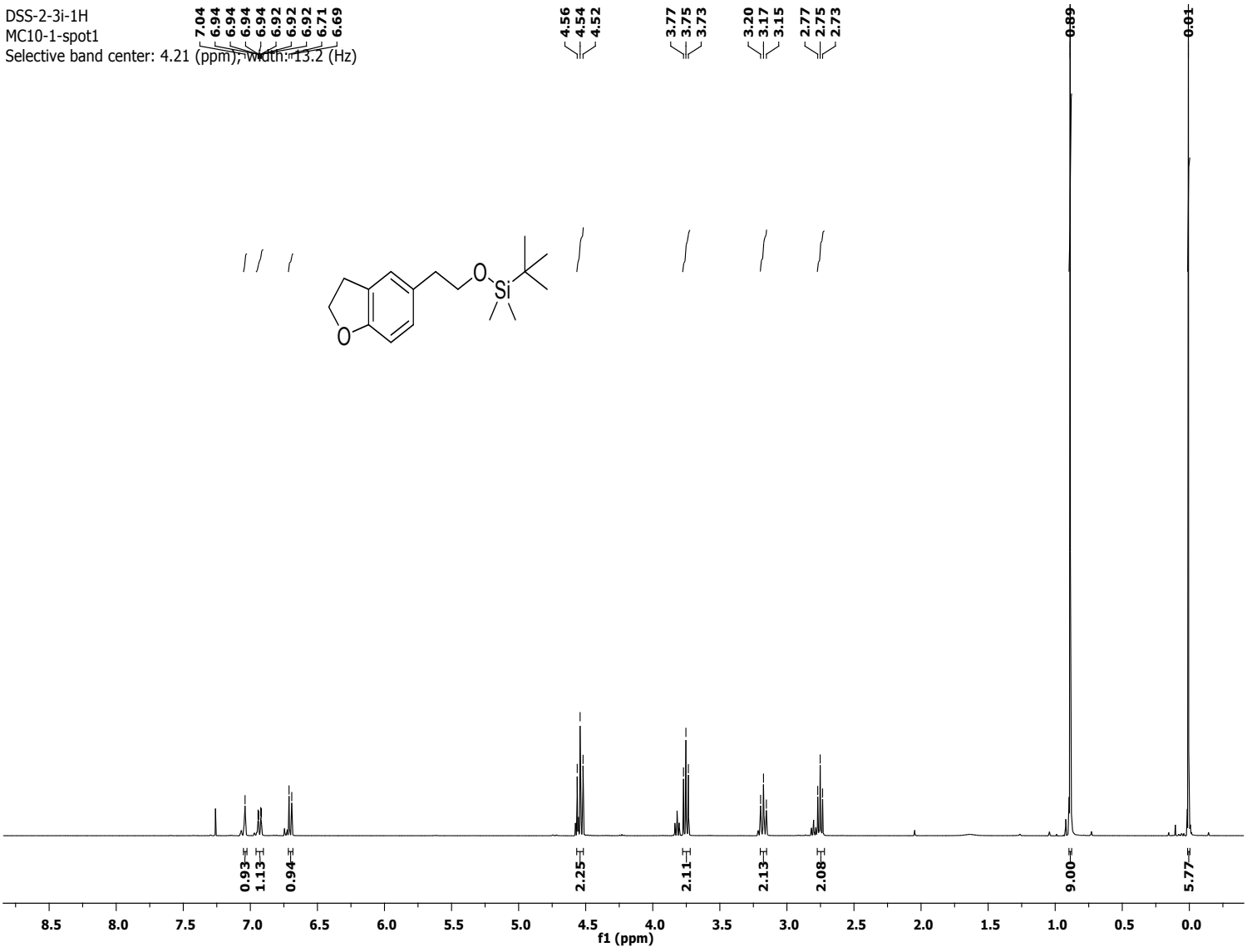
^{13}C NMR spectrum of compound 3g in $CDCl_3$



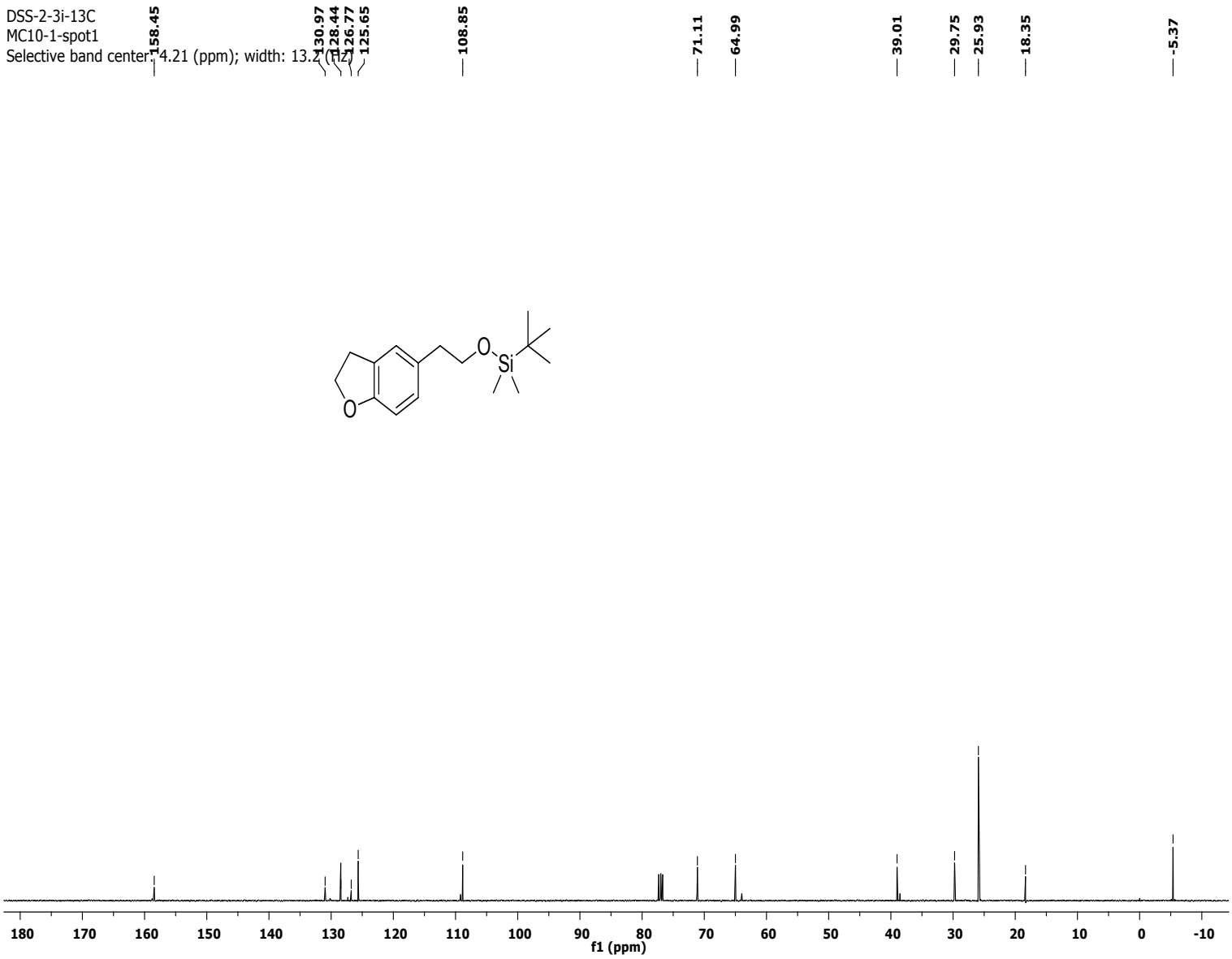
^{1}H NMR spectrum of compound 3h in $CDCl_3$



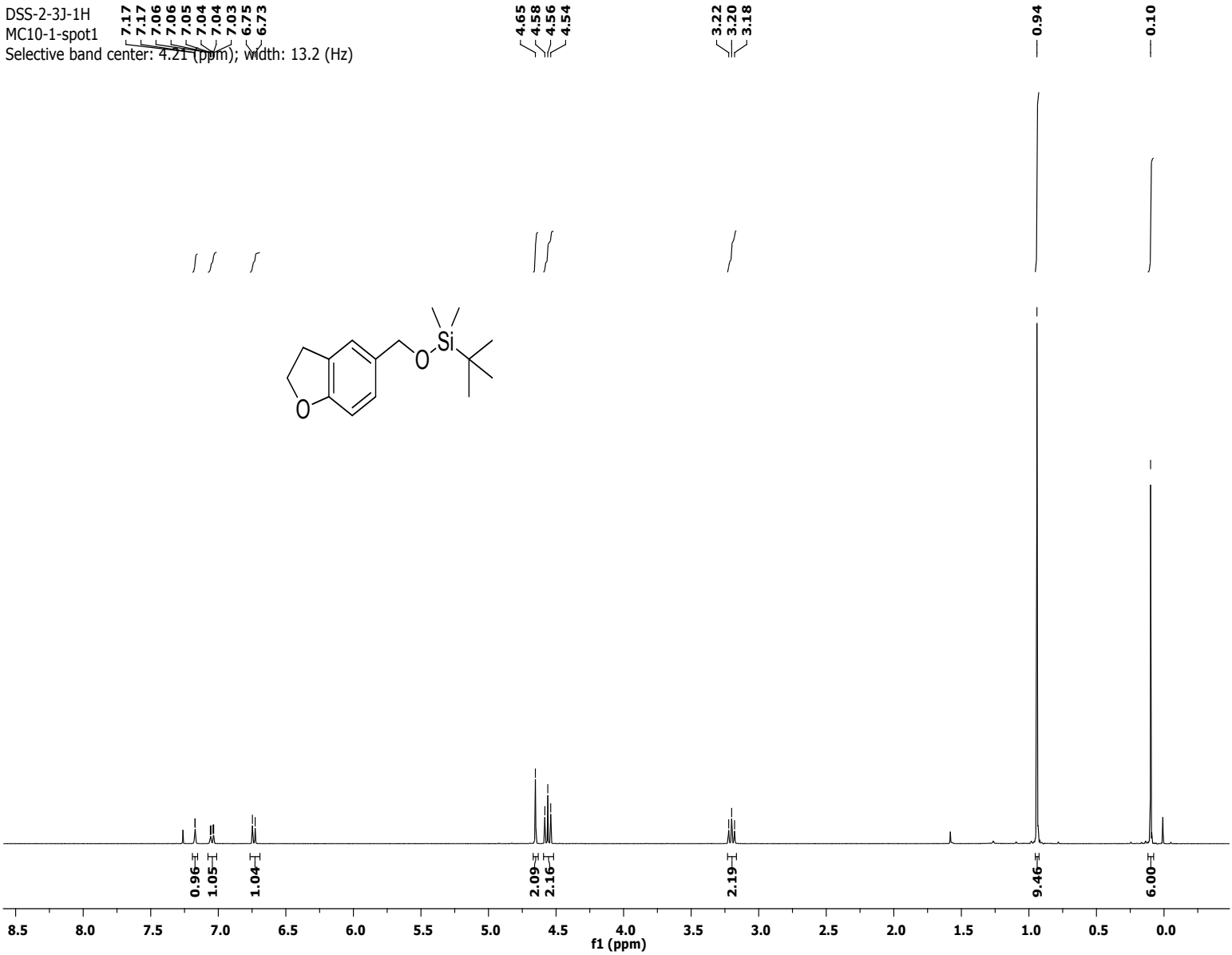
^{13}C NMR spectrum of compound 3h in $CDCl_3$



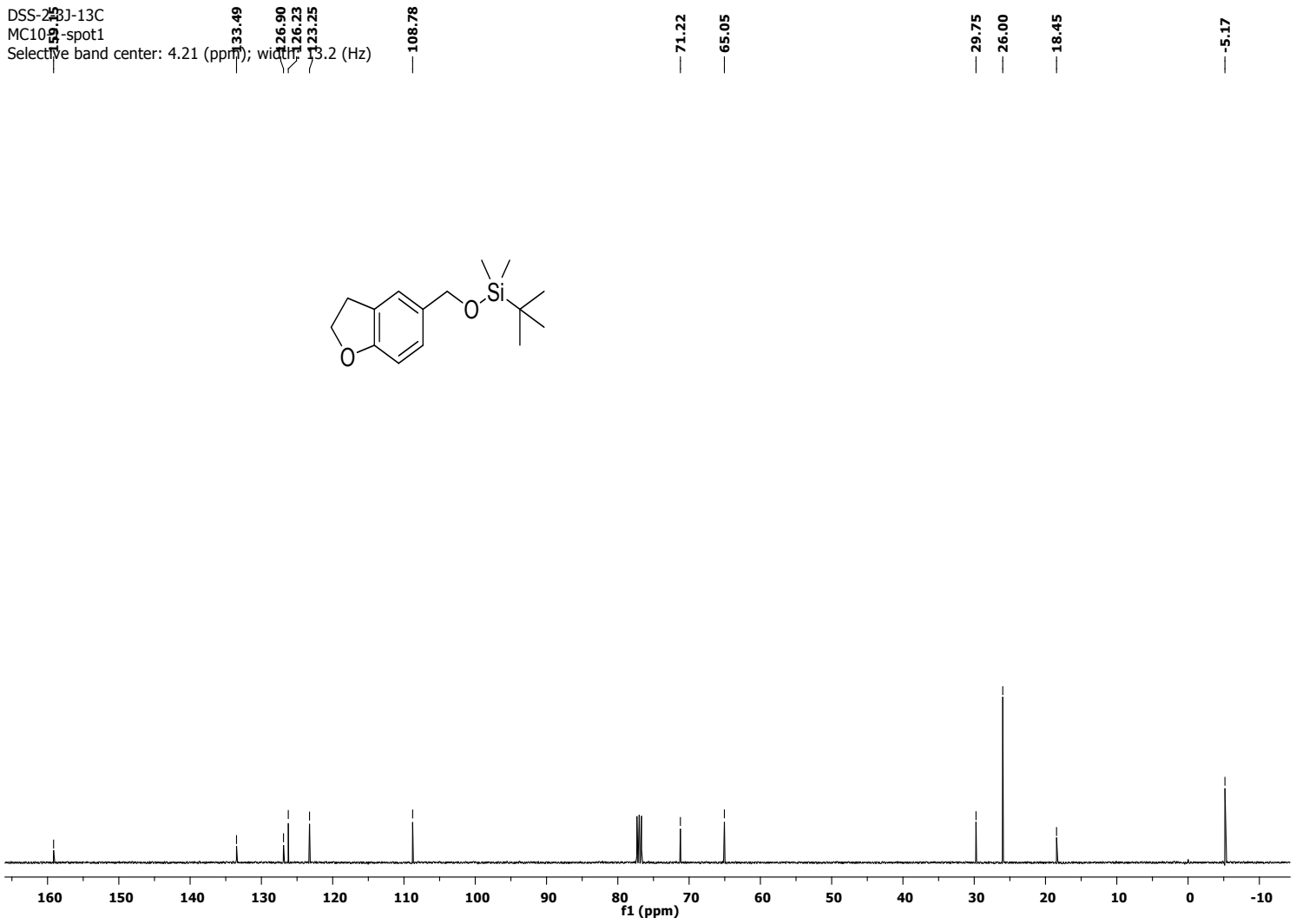
^{1}H NMR spectrum of compound 3i in $CDCl_3$



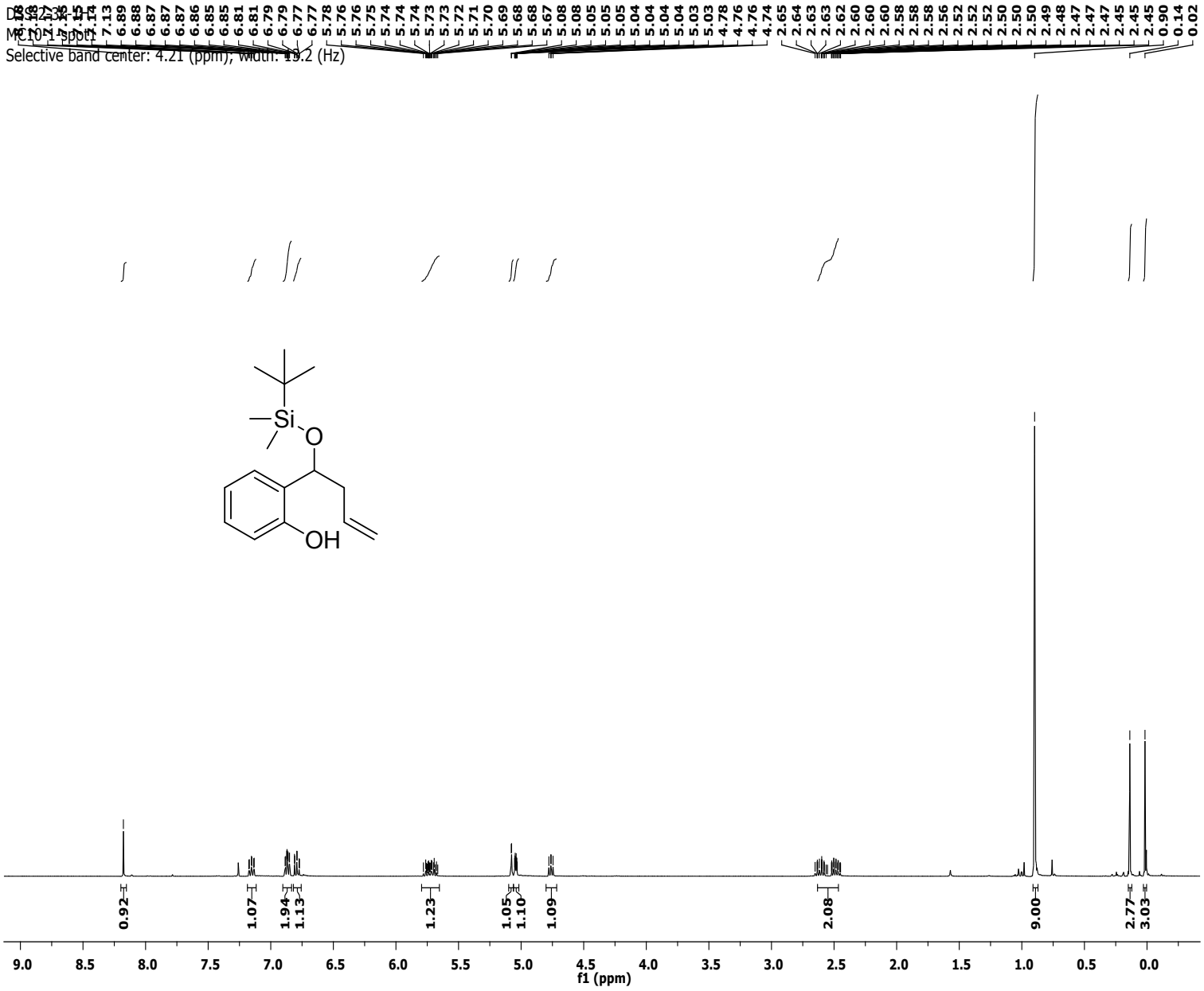
^{13}C NMR spectrum of compound 3i in $CDCl_3$



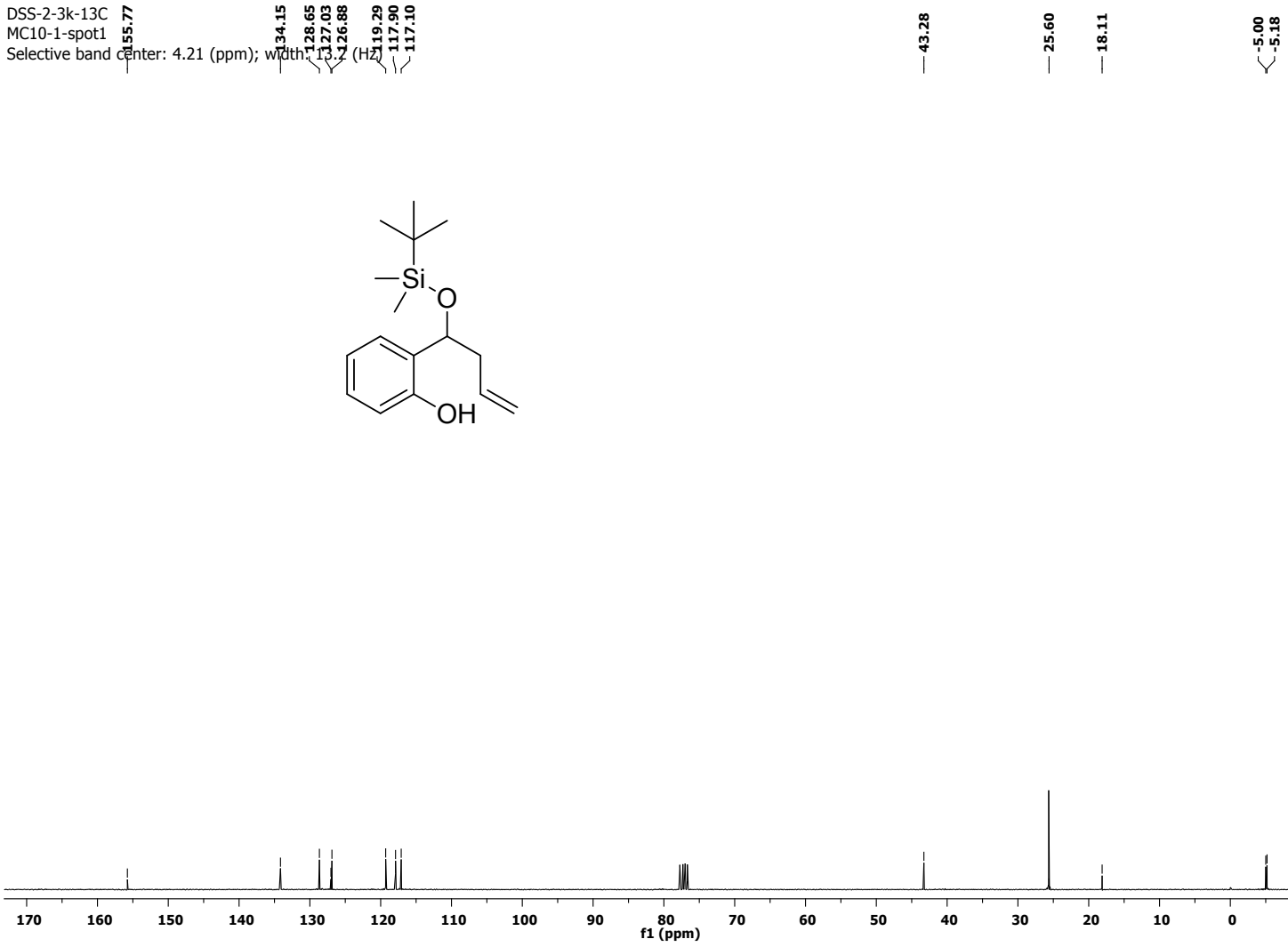
^{1}H NMR spectrum of compound 3j in $CDCl_3$



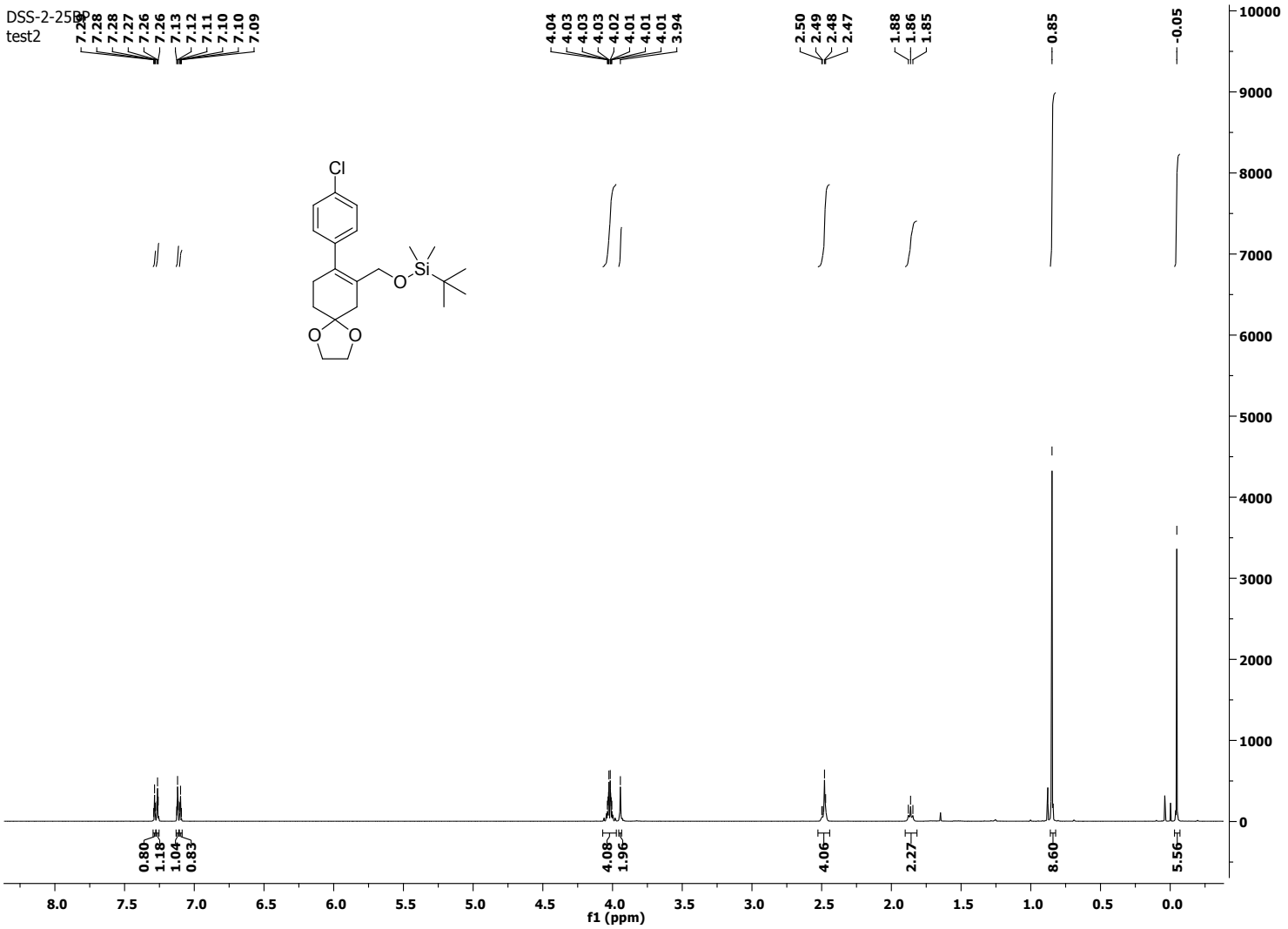
^{13}C NMR spectrum of compound 3j in $CDCl_3$



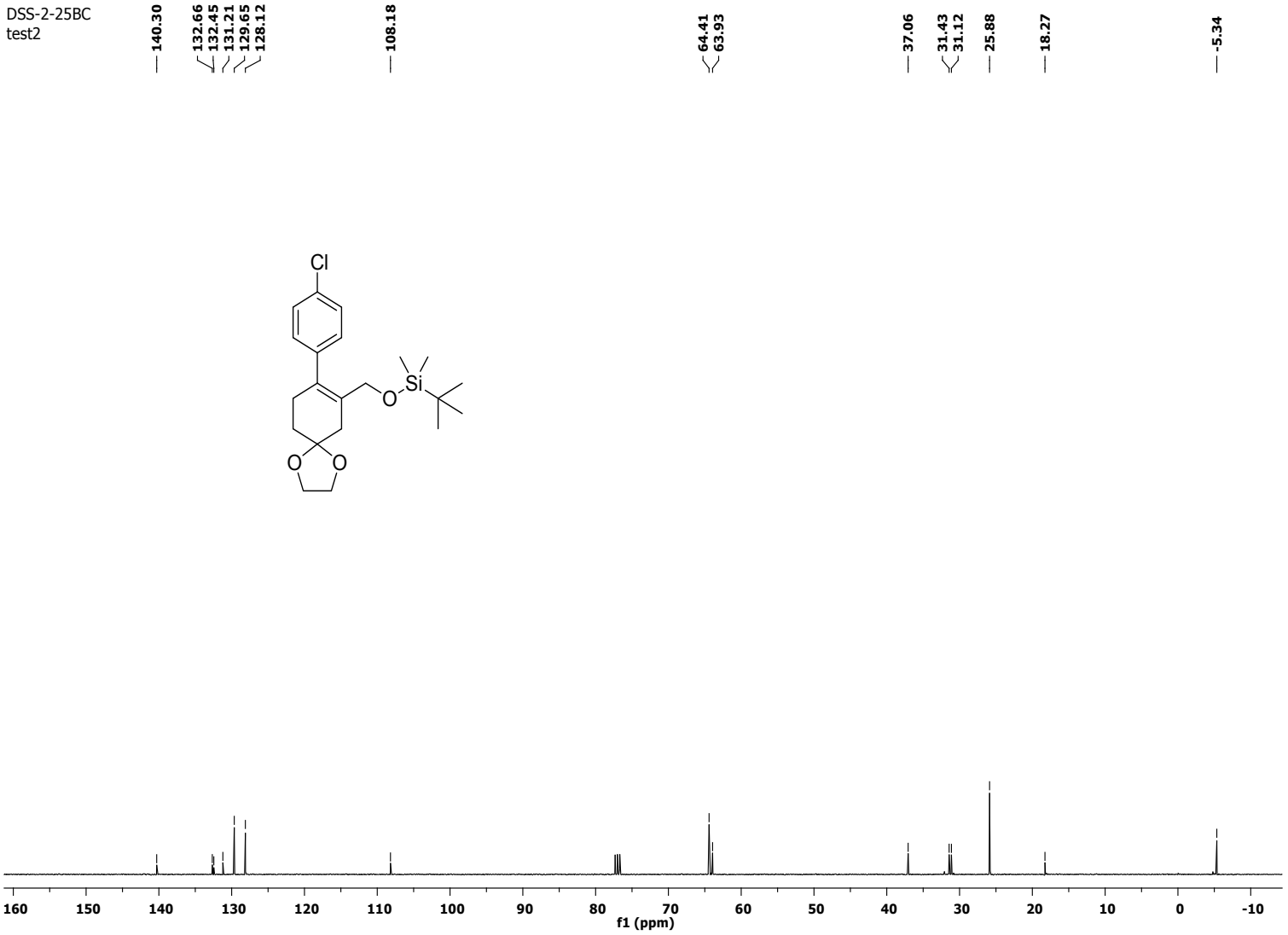
^{1}H NMR spectrum of compound 3k in $CDCl_3$



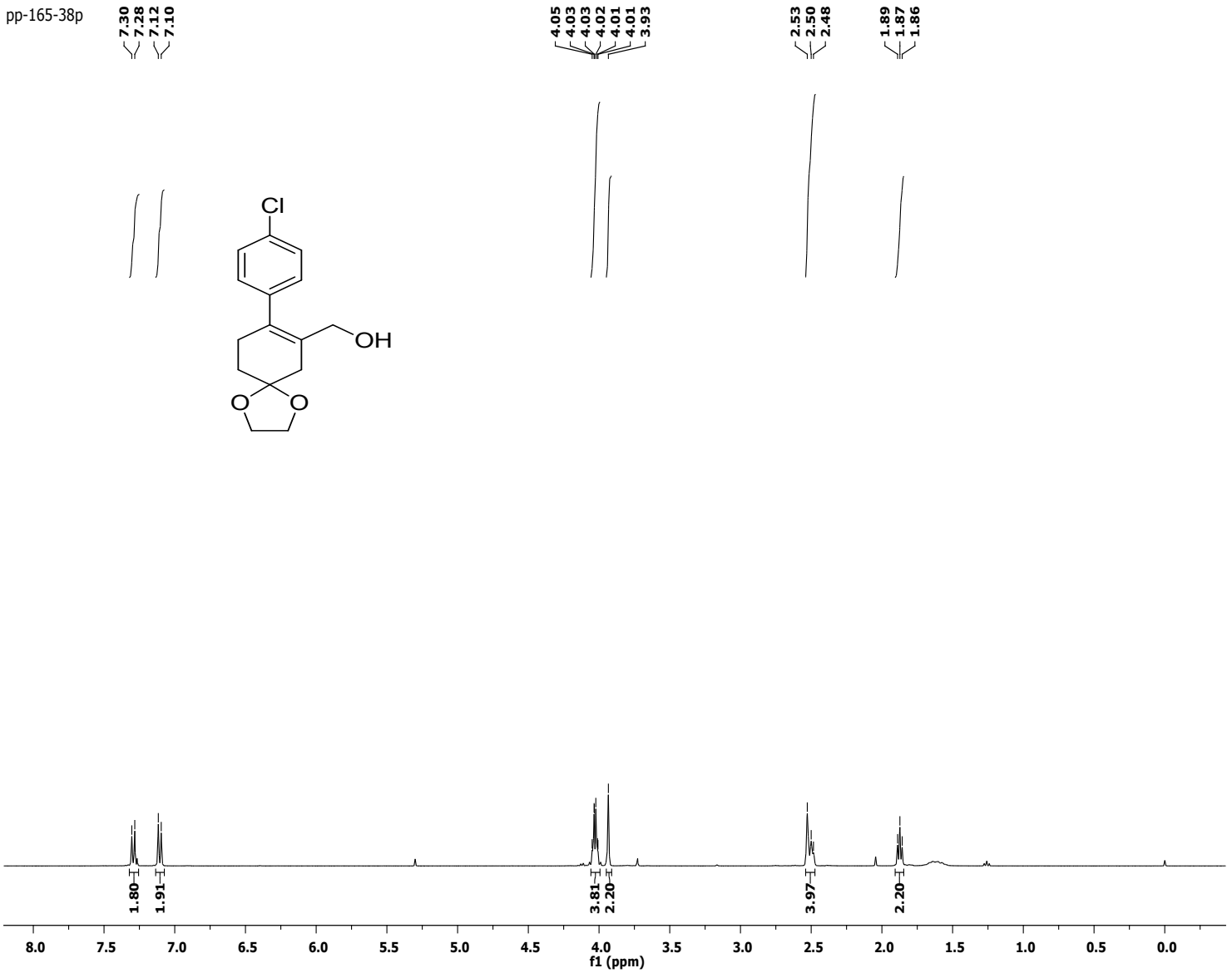
^{13}C NMR spectrum of compound 3k in $CDCl_3$



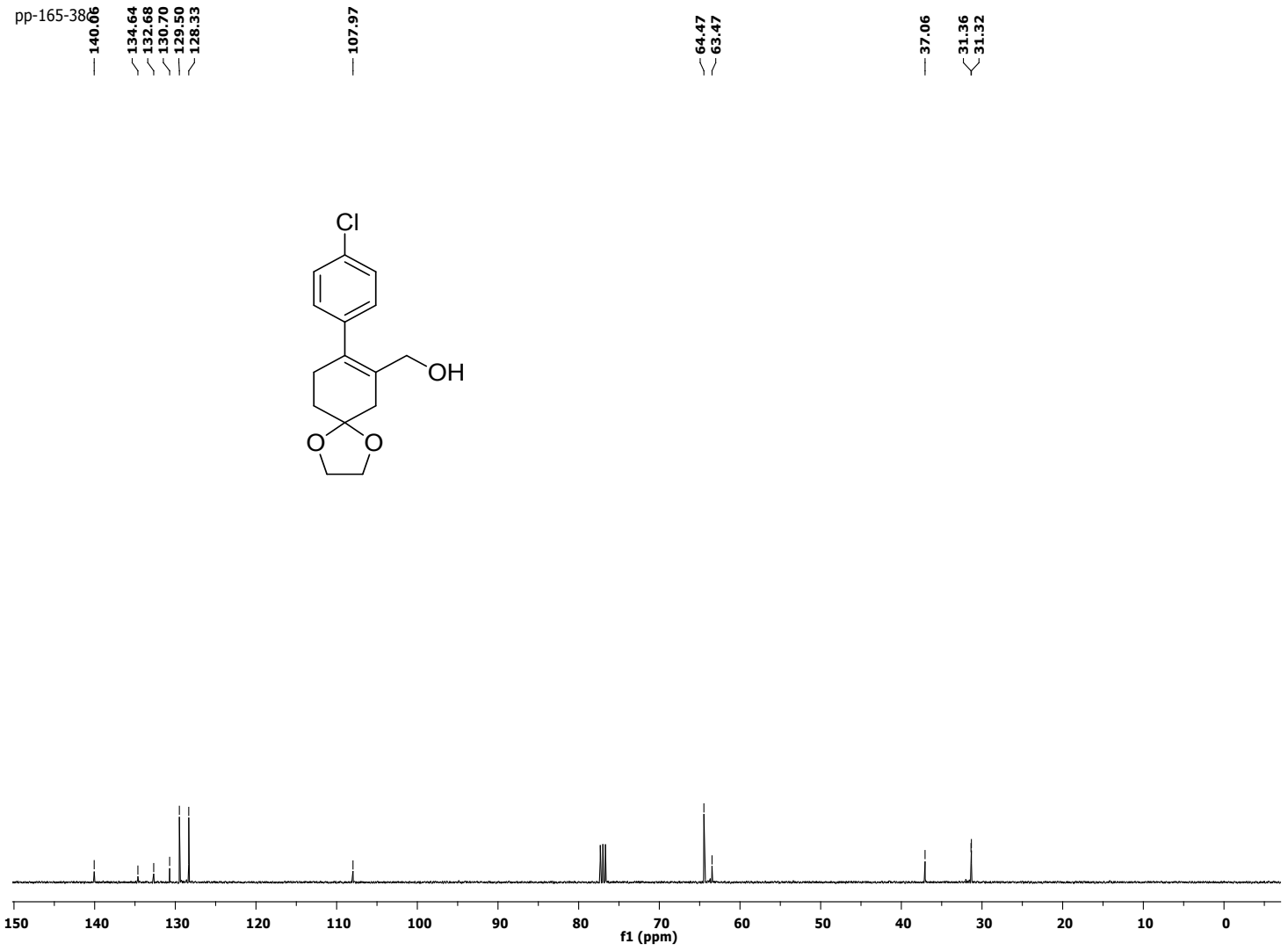
^{1}H NMR spectrum of compound 3l in $CDCl_3$



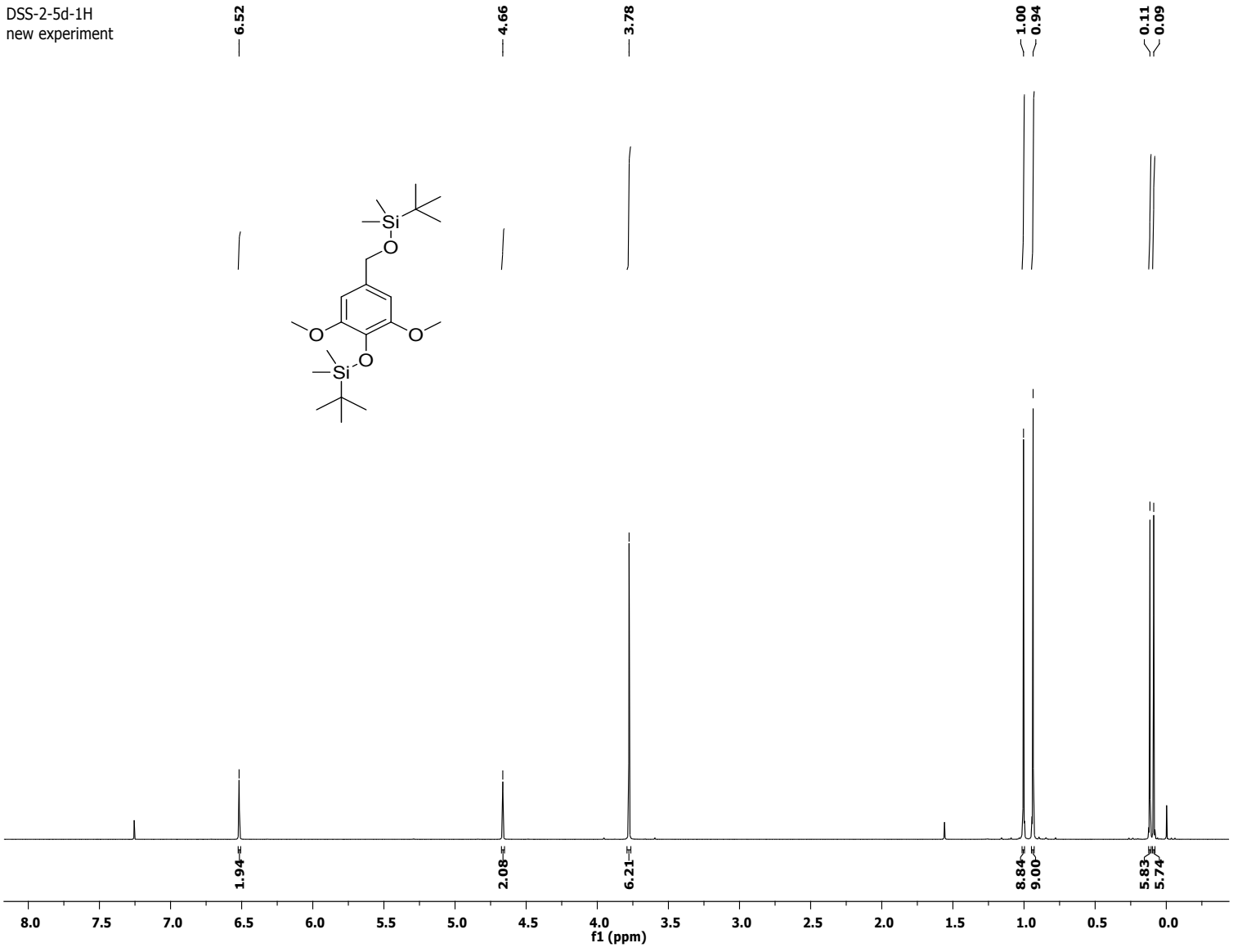
^{13}C NMR spectrum of compound 3l in $CDCl_3$



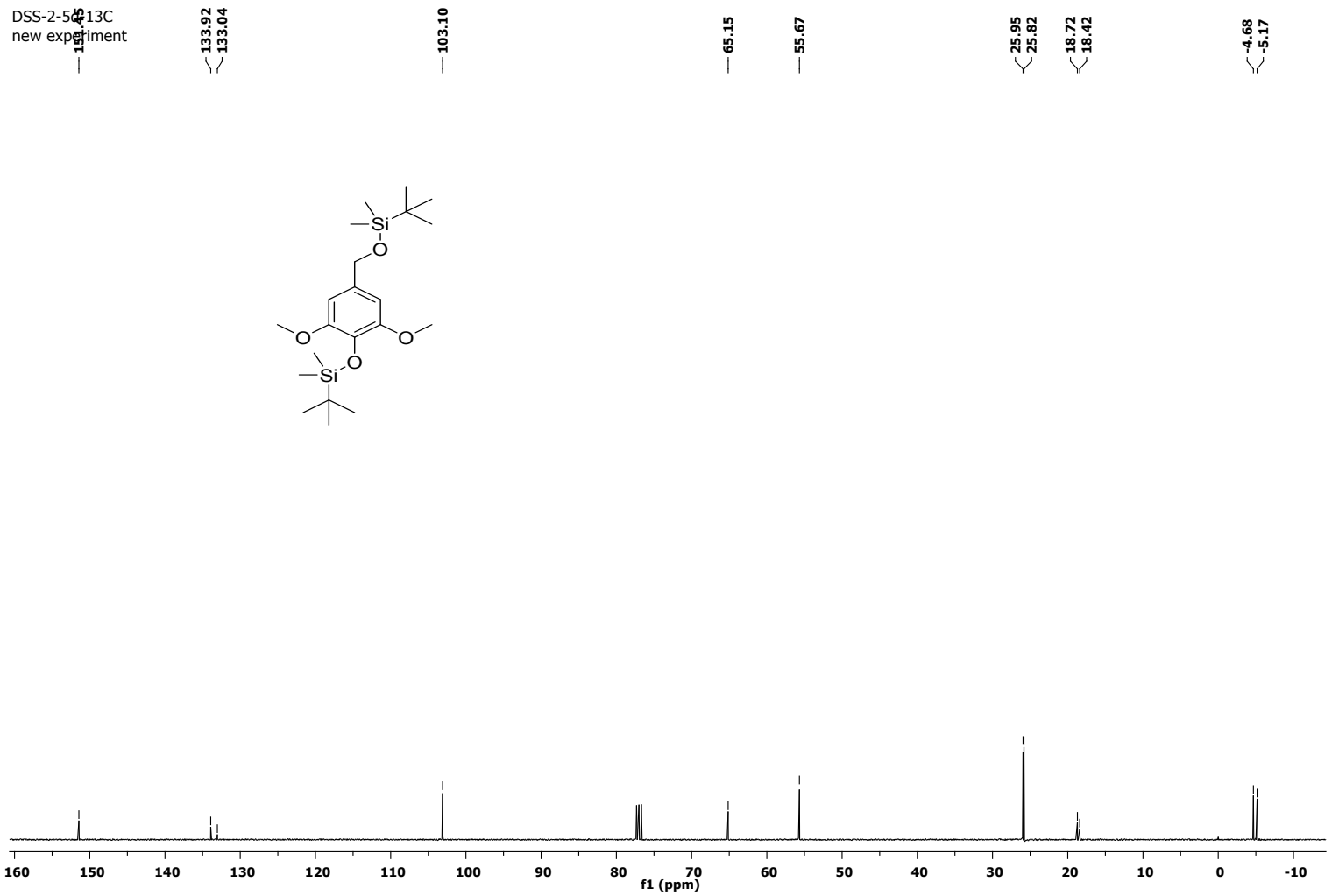
^{1}H NMR spectrum of compound 4l in $CDCl_3$



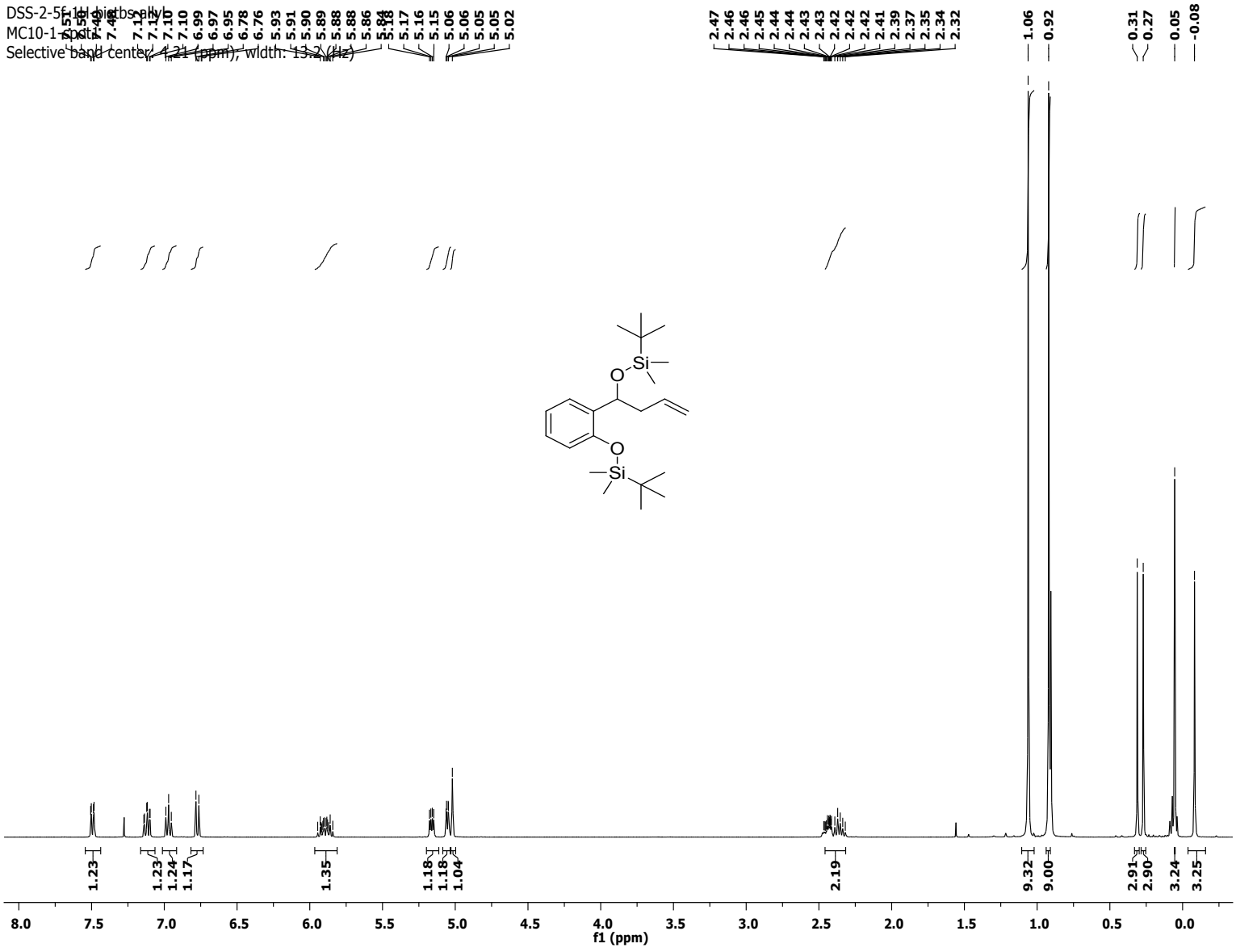
^{13}C NMR spectrum of compound 4l in $CDCl_3$



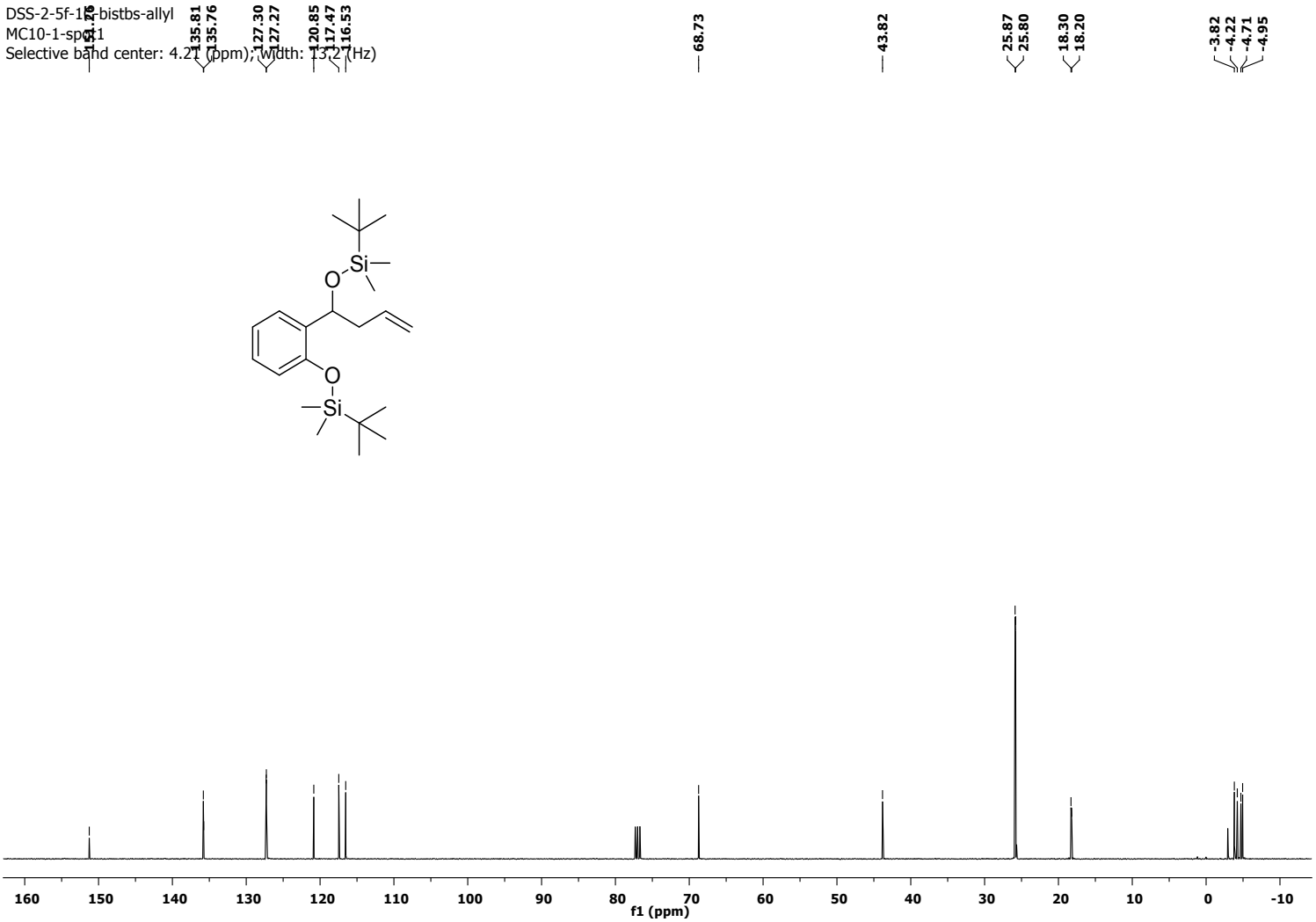
^{1}H NMR spectrum of compound 5d in $CDCl_3$



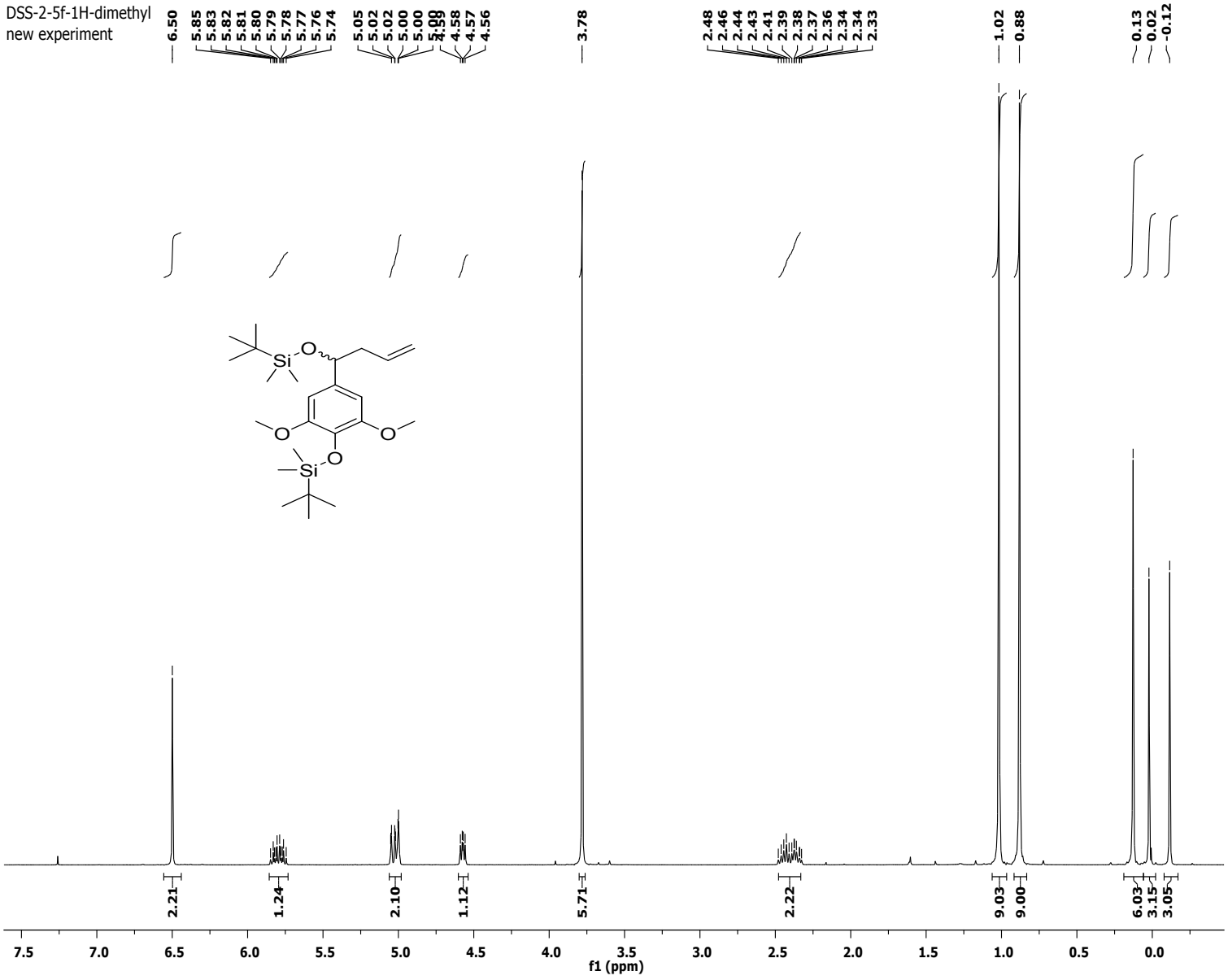
^{13}C NMR spectrum of compound 5d in $CDCl_3$



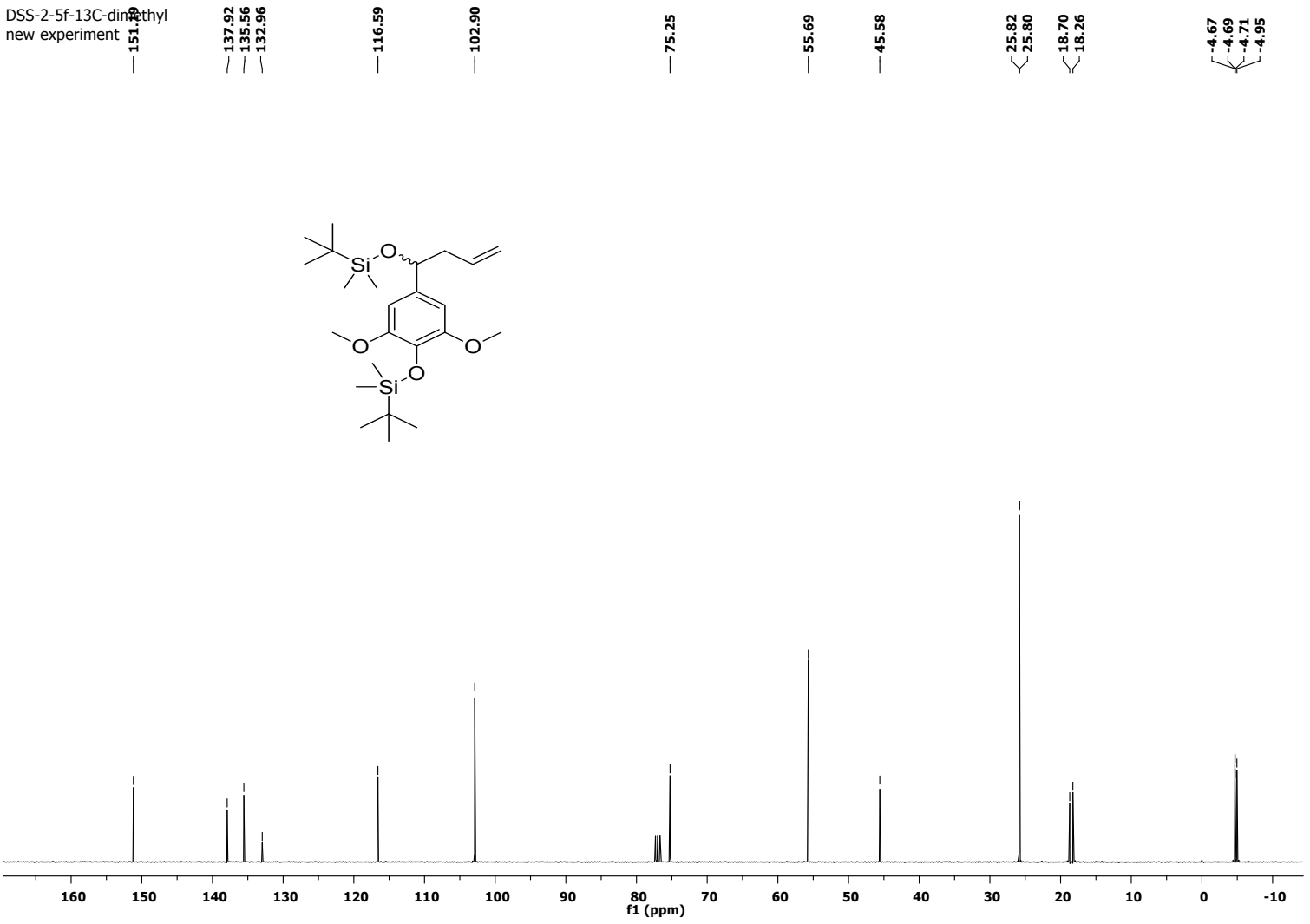
^{1}H NMR spectrum of compound 5e in $CDCl_3$



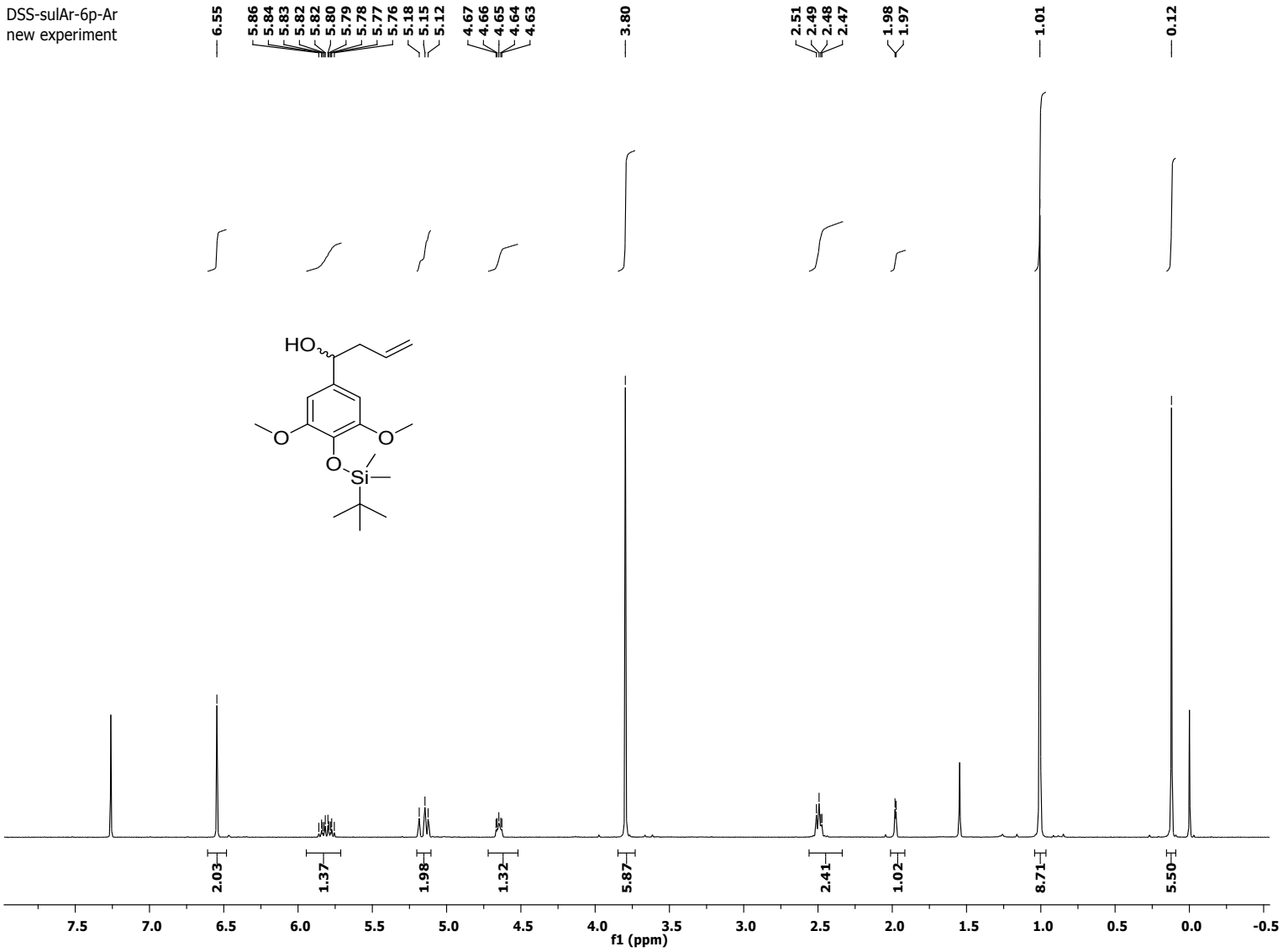
^{13}C NMR spectrum of compound 5e in $CDCl_3$



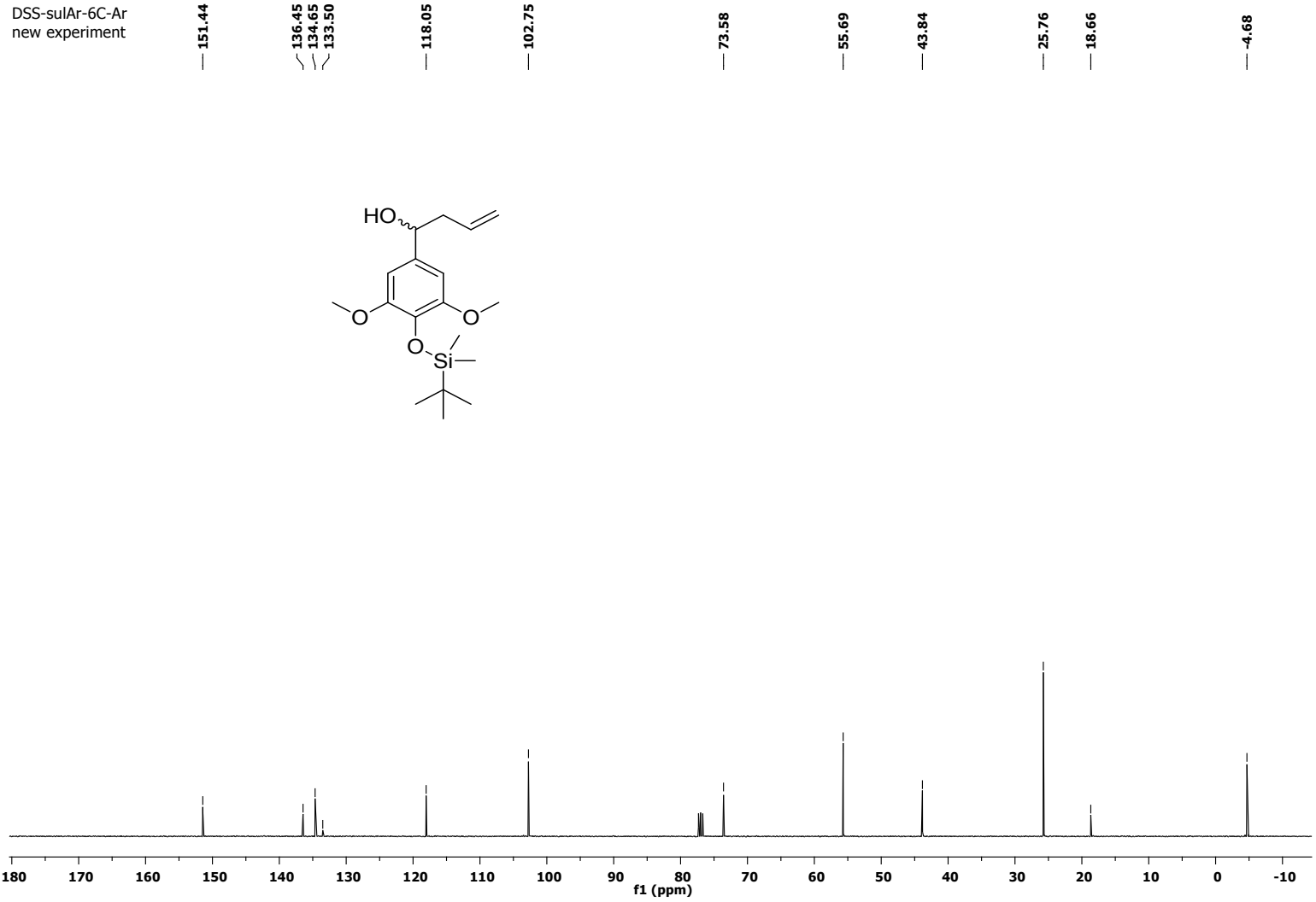
^{1}H NMR spectrum of compound 5f in $CDCl_3$



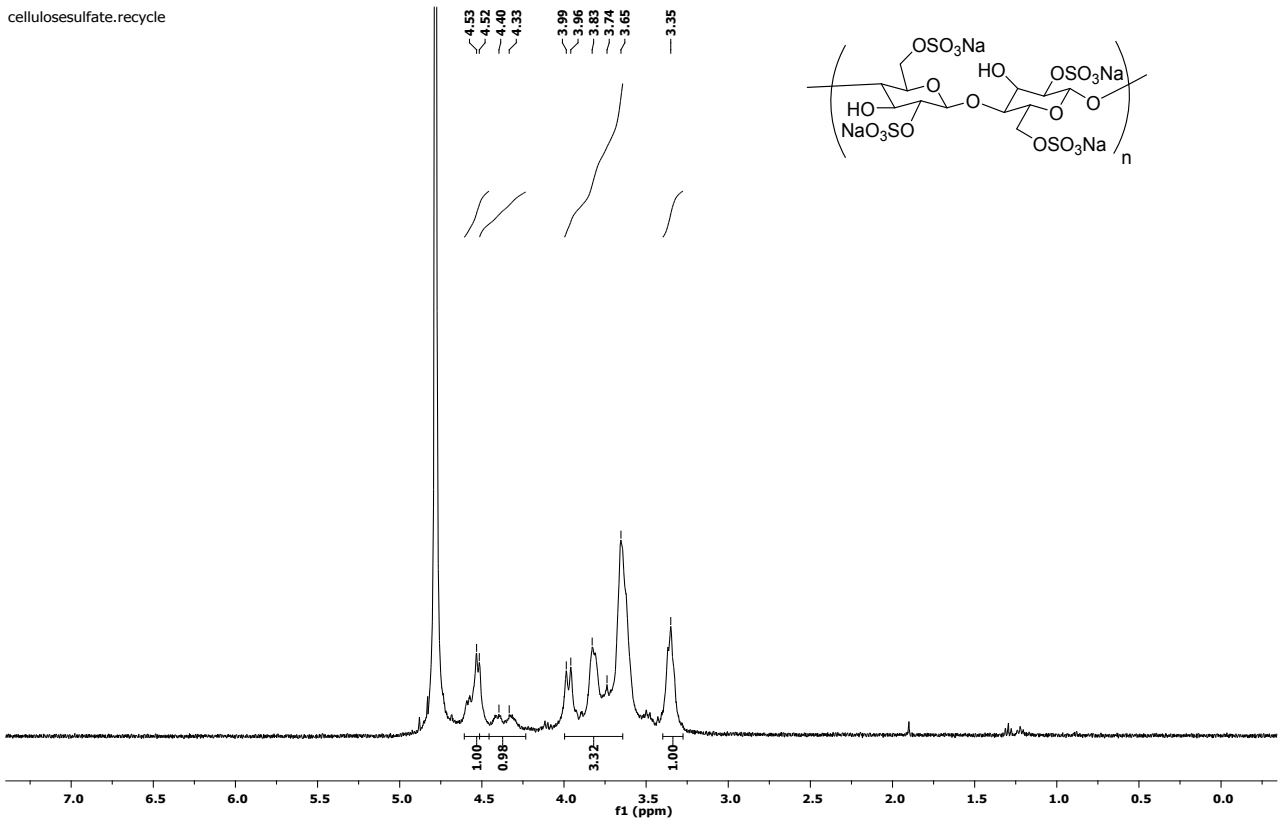
^{13}C NMR spectrum of compound 5f in $CDCl_3$



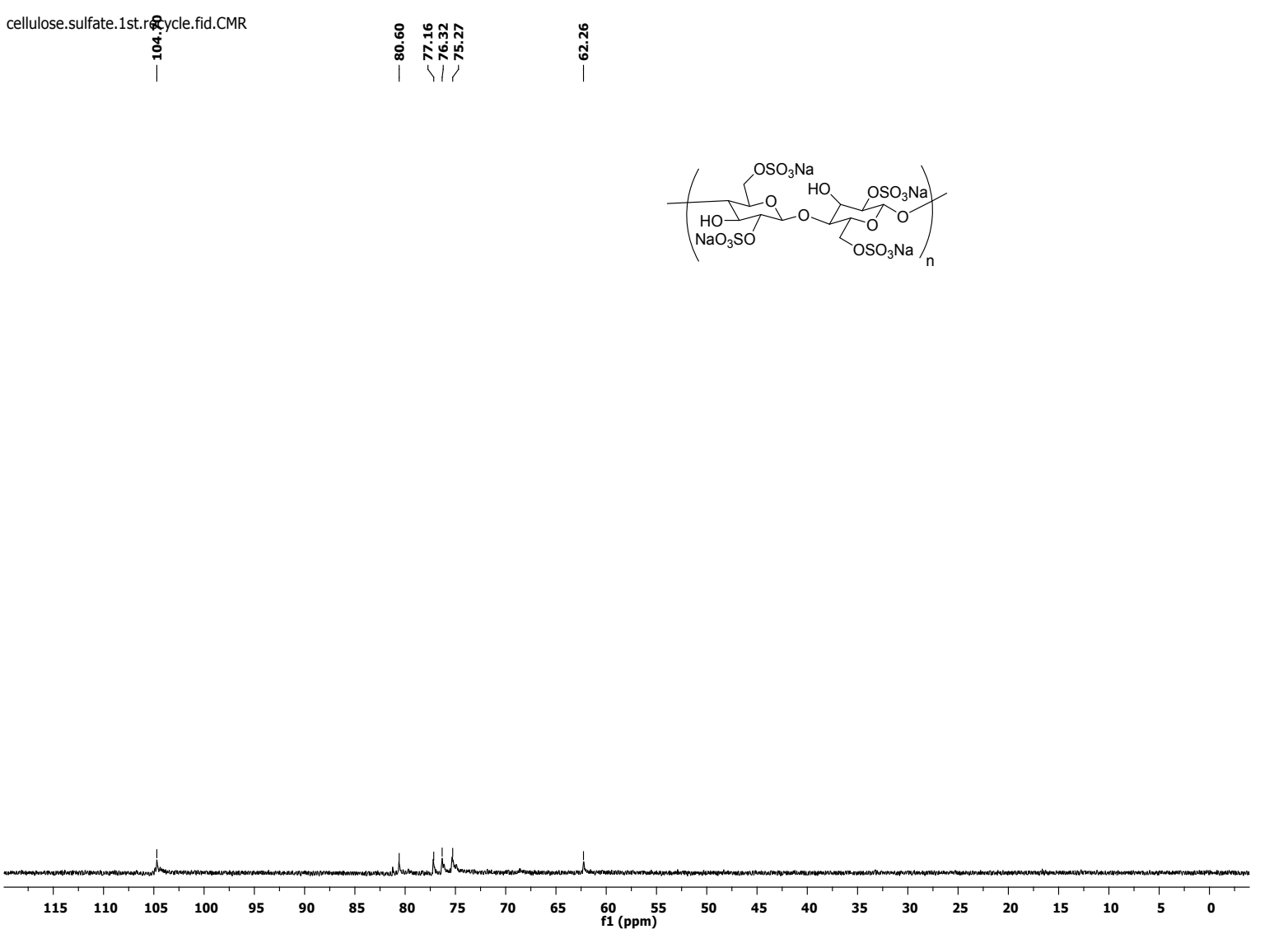
^{1}H NMR spectrum of compound 6f in $CDCl_3$



^{13}C NMR spectrum of compound 6f in $CDCl_3$



^{1}H NMR spectrum of recovered (after 3rd cycle) HS-cellulose sulphate sodium in D_2O



^{13}C NMR spectrum of recovered (after 3rd cycle) HS-cellulose sulphate sodium in D_2O

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